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(Sep.,1999)

SanKen

POWER TRANSISTOR ARRAYS

MOS FET ARRAYS

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Ordering

Specify the number of standard minimum packaged units when placing an order.

Standard minimum packaged unit

Package Type / Series	Cardboard Box	Stick	Reel
SLA	50	108	
SMA	120	108	
STA300	100		
STA400	80		
STA500		110	
SDK			1200

Contents

Product index by Part Number

Part Number	Classification	Number of chips	V_{CEO} • V_{DSS} (V)	I_C • I_D (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Package	Page
SDA01	Source driver	4	–60	–1.5	2000		SMD 16-pin	159
SDA05	3–phase motor driver	3	–60	–4	2000		SMD 16-pin	160
SDC01	Sink driver	4	50	2	1000		SMD 16-pin	161
SDC03	Sink driver	4	60±10	1.5	2000		SMD 16-pin	162
SDC04	Sink driver	4	100±15	1.5	2000		SMD 16-pin	163
SDC06	Sink driver	4	30 to 45	2	400		SMD 16-pin	164
SDC07	3–phase motor driver	3	60	4	2000		SMD 16-pin	165
SDH02	Sink driver	4	100	1.5	2000		SMD 16-pin	166
SDH03	H–bridge driver	4	+100/–60	±1.5	2000		SMD 16-pin	168
SDK02	Sink driver	4	60	2		0.24	SMD 16-pin	170
SDK04	Sink driver	4	100	2		0.8	SMD 16-pin	171
SLA4010	Sink driver	4	60±10	4	2000		SIP 12-pin with fin	18
SLA4030	Sink driver	4	100	4	2000		SIP 12-pin with fin	19
SLA4031	Sink driver	4	120	4	2000		SIP 12-pin with fin	20
SLA4041	Sink driver	4	200	3	1000		SIP 12-pin with fin	21
SLA4060	Sink driver	4	120	5	2000		SIP 12-pin with fin	22
SLA4061	Sink driver	4	120	5	2000		SIP 12-pin with fin	23
SLA4070	Source driver	4	–100	–5	1000		SIP 12-pin with fin	24
SLA4071	Source driver	4	–100	–5	2000		SIP 12-pin with fin	25
SLA4310	H–bridge driver	4	±60	±4	80		SIP 12-pin with fin	26
SLA4340	H–bridge driver	4	±60	±4	2000		SIP 12-pin with fin	28
SLA4390	H–bridge driver	4	±100	±5	2000		SIP 12-pin with fin	30
SLA4391	H–bridge driver	4	±100	±5	1000		SIP 12-pin with fin	32
SLA5001	Sink driver	4	100	5		0.3	SIP 12-pin with fin	34
SLA5002	Sink driver	4	100	5		0.3	SIP 12-pin with fin	35
SLA5003	Sink driver	4	200	5		0.9	SIP 12-pin with fin	36
SLA5004	Source driver	4	–60	–5		0.3	SIP 12-pin with fin	37
SLA5005	Source driver	4	–100	–5		0.7	SIP 12-pin with fin	38
SLA5006	Source driver	4	–100	–5		0.7	SIP 12-pin with fin	39
SLA5007	H–bridge driver	4	±60	+5/–4		0.22/0.55	SIP 12-pin with fin	40
SLA5008	H–bridge driver	4	±100	+4/–3		0.6/1.3	SIP 12-pin with fin	42
SLA5009	3–phase motor driver	6	±60	+5/–4		0.22/0.55	SIP 12-pin with fin	44
SLA5010	3–phase motor driver	6	±100	+4/–3		0.6/1.3	SIP 12-pin with fin	46
SLA5011	Sink driver	5	60	5		0.22	SIP 12-pin with fin	48
SLA5012	Source driver	5	–60	–5		0.3	SIP 12-pin with fin	49
SLA5013	H–bridge driver	4	±100	±5		0.3/0.7	SIP 12-pin with fin	50
SLA5015	Source driver	5	–60	–4		0.55	SIP 12-pin with fin	52
SLA5017	3–phase motor driver	6	±60	+5/–4		0.22/0.55	SIP 12-pin with fin	54
SLA5018	H–bridge driver	4	±60	+5/–4		0.22/0.55	SIP 12-pin with fin	56
SLA5021	Sink driver	5	100	5		0.19	SIP 12-pin with fin	58
SLA5022	3–phase motor driver	6	±60	±6	2000	0.22	SIP 12-pin with fin	60
SLA5023	3–phase motor driver	6	±100	±6	2000	0.55	SIP 12-pin with fin	62
SLA5024	Source driver	4	–60	–4		0.55	SIP 12-pin with fin	64
SLA5026	Sink driver	4	100	10		0.175	SIP 12-pin with fin	65
SLA5029	Sink driver	5	60	4		0.45	SIP 12-pin with fin	66
SLA5031	Sink driver	4	60	5		0.3	SIP 12-pin with fin	67
SLA5037	Sink driver	4	100	10		0.08	SIP 12-pin with fin	68
SLA5038	Sink driver	5	150	7		0.2	SIP 12-pin with fin	69
SLA5040	Sink driver	4	100	4		0.6	SIP 12-pin with fin	70
SLA5041	Sink driver	4	200	10		0.175	SIP 12-pin with fin	71
SLA5042	Sink driver	5	100	5		0.185	SIP 12-pin with fin	72
SLA5044	Sink driver	4	250	10		0.25	SIP 12-pin with fin	73
SLA5046	Sink driver	5	200	7		0.35	SIP 12-pin with fin	74
SLA5047	Sink driver	4	150	10		0.085	SIP 12-pin with fin	75
SLA5049	Sink driver	5	250	7		0.5	SIP 12-pin with fin	76
SLA5052	Sink driver	4	150	10		0.115	SIP 12-pin with fin	77
SLA6012	3–phase motor driver	6	±60	±4	2000		SIP 12-pin with fin	78
SLA6020	3–phase motor driver	6	±100	±5	2000		SIP 12-pin with fin	80
SLA6022	3–phase motor driver	6	±80	±5	2000		SIP 12-pin with fin	82
SLA6023	3–phase motor driver	6	±60	±6	2000		SIP 12-pin with fin	84

Part Number	Classification	Number of chips	V_{CEO} • V_{DSS} (V)	I_C • I_D (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Package	Page
SLA6024	3–phase motor driver	6	±60	±8	2000		SIP 12-pin with fin	86
SLA6026	3–phase motor driver	6	±60	±10	2000		SIP 12-pin with fin	88
SLA8001	H–bridge	4	±60	±12	50		SIP 12-pin with fin	90
SMA4020	Source driver	4	–60	–4	2000		SIP 12-pin	92
SMA4021	Source driver	4	–60	–3	2000		SIP 12-pin	93
SMA4030	Sink driver	4	100	3	2000		SIP 12-pin	94
SMA4032	Sink driver	4	100	3	2000		SIP 12-pin	95
SMA4033	Sink driver	4	100	2	2000		SIP 12-pin	96
SMA5101	Sink driver	4	100	4		0.6	SIP 12-pin	97
SMA5102	Sink driver	4	100	4		0.6	SIP 12-pin	98
SMA5103	H–bridge driver	4	±60	+5/–4		0.22/0.55	SIP 12-pin	100
SMA5104	3–phase motor driver	6	±60	+5/–4		0.22/0.55	SIP 12-pin	102
SMA5105	Sink driver	4	100	5		0.3	SIP 12-pin	104
SMA5106	Sink driver	4	100	4		0.55	SIP 12-pin	105
SMA5112	3–phase motor driver	6	250	7		0.5	SIP 12-pin	106
SMA5114	Sink driver	4	60	3		0.25	SIP 12-pin	107
SMA5117	3–phase motor driver	6	250	7		0.25	SIP 12-pin	108
SMA6010	3–phase motor driver	6	±60	±4	2000		SIP 12-pin	110
SMA6014	3–phase motor driver	6	±60	±2	1500/2000		SIP 12-pin	112
SMA6511	Stepper motor driverr with Dual Supply Voltage Switch	5	100±15/–60	1.5/–3	2000		SIP 12-pin	114
SMA6512	Stepper motor driverr with Dual Supply Voltage Switch	5	60±10/–60	1.5/–3	2000		SIP 12-pin	116
STA301A	Sink driver	3	60±10	4	1000		SIP 8-pin	118
STA302A	Source driver	3	–50	–4	1000		SIP 8-pin	119
STA302A	3–phase motor driver	3	–50	–4	1000		SIP 8-pin	119
STA303A	Sink driver	3	100	4	1000		SIP 8-pin	120
STA303A	3–phase motor driver	3	100	4	1000		SIP 8-pin	120
STA304A	3–phase motor driver	3	550	1	200		SIP 8-pin	121
STA305A	3–phase motor driver	3	–550	–1	200		SIP 8-pin	122
STA308A	Source driver	3	–120	–4	2000		SIP 8-pin	123
STA312A	Sink driver	3	60	3	300		SIP 8-pin	124
STA322A	Source driver	3	–50	–3	100		SIP 8-pin	125
STA371A	Sink driver	3	60±10	2	2000		SIP 8-pin	126
STA401A	Sink driver	4	60±10	4	1000		SIP 10-pin	127
STA402A	Source driver	4	–50	–4	1000		SIP 10-pin	128
STA403A	Sink driver	4	100	4	1000		SIP 10-pin	129
STA404A	Sink driver	4	200	3	1000		SIP 10-pin	130
STA406A	Sink driver	4	60±10	6	2000		SIP 10-pin	131
STA408A	Source driver	4	–120	–4	2000		SIP 10-pin	132
STA412A	Sink driver	4	60	3	300		SIP 10-pin	133
STA413A	Sink driver	4	35±5	3	500		SIP 10-pin	134
STA414A	Sink driver	4	100	5	200		SIP 10-pin	135
STA421A	Source driver	4	–60	–3	40		SIP 10-pin	136
STA431A	H–bridge driver	4	±60	±3	40		SIP 10-pin	138
STA434A	H–bridge driver	4	±60	±4	1000		SIP 10-pin	140
STA435A	Sink driver	4	65±15	4	1000		SIP 10-pin	142
STA457C	H–bridge driver	4	±60	±4	2000		SIP 10-pin	144
STA458C	H–bridge driver	4	±30	±5	40		SIP 10-pin	146
STA460C	Sink driver	2	60±10	6	700		SIP 10-pin	148
STA471A	Sink driver	4	60±10	2	2000		SIP 10-pin	149
STA472A	Source driver	4	–60	–2	2000		SIP 10-pin	150
STA473A	Sink driver	4	100	2	2000		SIP 10-pin	151
STA475A	Sink driver	4	100±15	2	2000		SIP 10-pin	152
STA481A	Sink driver	4	60±10	1	2000		SIP 10-pin	153
STA485A	Sink driver	4	100±15	1	2000		SIP 10-pin	154
STA501A	Sink driver	4	60	5		0.2	SIP 10-pin	155
STA504A	Sink driver	4	60	4		0.45	SIP 10-pin	156
STA505A	Sink driver	4	100	3		0.6	SIP 10-pin	157
STA506A	Sink driver	4	100	2		0.8	SIP 10-pin	158

●With built-in avalanche diode between collector and base

Part Number	Number of chips	V_{CEO} (V)	I_C (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Equivalent circuit	Package	Page
STA460C	2	60±10	6	700		1	SIP 10-pin	148
STA371A	3	60±10	2	2000		2	SIP 8-pin	126
STA301A	3	60±10	4	1000		2	SIP 8-pin	118
SDC06	4	30 to 45	2	400		3	SMD 16-pin	164
STA413A	4	35±5	3	500		4	SIP 10-pin	134
STA481A	4	60±10	1	2000		5	SIP 10-pin	153
SDC03	4	60±10	1.5	2000		6	SMD 16-pin	162
STA471A	4	60±10	2	2000		5	SIP 10-pin	149
STA401A	4	60±10	4	1000		5	SIP 10-pin	127
SLA4010	4	60±10	4	2000		6	SIP 12-pin with fin	18
STA406A	4	60±10	6	2000		5	SIP 10-pin	131
STA435A	4	65±15	4	1000		7	SIP 10-pin	142
STA485A	4	100±15	1	2000		5	SIP 10-pin	154
SDC04	4	100±15	1.5	2000		6	SMD 16-pin	163
STA475A	4	100±15	2	2000		5	SIP 10-pin	152

●With built-in flywheel diode

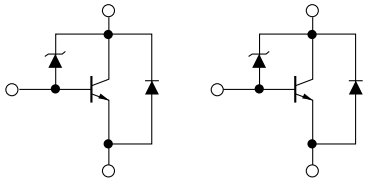
Part Number	Number of chips	V_{CEO} • V_{DSS} (V)	I_C • I_D (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Equivalent circuit	Package	Page
SDK02	4	60	2		0.24	8	SMD 16-pin	170
SMA5114	4	60	3		0.25	9	SIP 12-pin	107
SLA5031	4	60	5		0.3	10	SIP 12-pin with fin	67
SDH02	4	100	1.5	2000		11	SMD 16-pin	166
SMA4033	4	100	2	2000		12	SIP 12-pin	96
SMA4032	4	100	3	2000		12	SIP 12-pin	95
SLA5040	4	100	4		0.6	10	SIP 12-pin with fin	70
SMA5102	4	100	4		0.6	10	SIP 12-pin	98
SMA5106	4	100	4		0.55	10	SIP 12-pin	105
SLA5002	4	100	5		0.3	10	SIP 12-pin with fin	35
SMA5105	4	100	5		0.3	10	SIP 12-pin	104
SLA4031	4	120	4	2000		12	SIP 12-pin with fin	20
SLA4061	4	120	5	2000		12	SIP 12-pin with fin	23
SLA4041	4	200	3	1000		12	SIP 12-pin with fin	21
SLA5003	4	200	5		0.9	10	SIP 12-pin with fin	36

●General purpose

Part Number	Number of chips	V_{CEO} • V_{DSS} (V)	I_C • I_D (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Equivalent circuit	Package	Page
STA312A	3	60	3	300		13	SIP 8-pin	124
STA303A	3	100	4	100		14	SIP 8-pin	120
SDC01	4	50	2	1000		15	SMD 16-pin	161
STA412A	4	60	3	300		17	SIP 10-pin	133
STA504A	4	60	4		0.45	18	SIP 10-pin	156
STA501A	4	60	5		0.2	19	SIP 10-pin	155
STA473A	4	100	2	2000		20	SIP 10-pin	151
STA506A	4	100	2		0.8	19	SIP 10-pin	158
SDK04	4	100	2		0.8	21	SMD 16-pin	171
SMA4030	4	100	3	2000		22	SIP 12-pin	94
STA505A	4	100	3		0.6	21	SIP 10-pin	157
STA403A	4	100	4	1000		20	SIP 10-pin	129
SLA4030	4	100	4	2000		22	SIP 12-pin with fin	19
SMA5101	4	100	4		0.6	21	SIP 12-pin	97
STA414A	4	100	5	200		20	SIP 10-pin	135
SLA5001	4	100	5		0.3	21	SIP 12-pin with fin	34
SLA5037	4	100	10		0.08	21	SIP 12-pin with fin	68
SLA5026	4	100	10		0.175	21	SIP 12-pin with fin	65
SLA4060	4	120	5	2000		22	SIP 12-pin with fin	22
SLA5047	4	150	10		0.085	21	SIP 12-pin with fin	75
SLA5052	4	150	10		0.115	21	SIP 12-pin with fin	77
STA404A	4	200	3	1000		20	SIP 10-pin	130
SLA5041	4	200	10		0.175	21	SIP 12-pin with fin	71
SLA5044	4	250	10		0.25	21	SIP 12-pin with fin	73
SLA5029	5	60	4		0.45	23	SIP 12-pin with fin	66
SLA5011	5	60	5		0.22	23	SIP 12-pin with fin	48
SLA5021	5	100	5		0.19	23	SIP 12-pin with fin	58
SLA5042	5	100	5		0.185	23	SIP 12-pin with fin	72
SLA5038	5	150	7		0.2	23	SIP 12-pin with fin	69
SLA5046	5	200	7		0.35	23	SIP 12-pin with fin	74
SLA5049	5	250	7		0.5	23	SIP 12-pin with fin	76

●Equivalent circuit (Sink driver)

①



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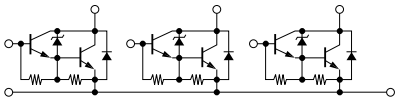

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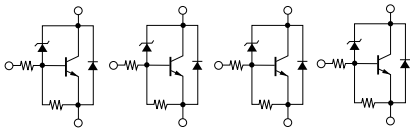

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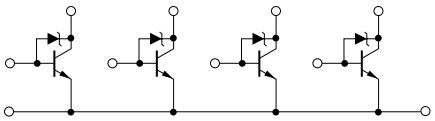

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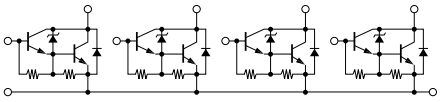

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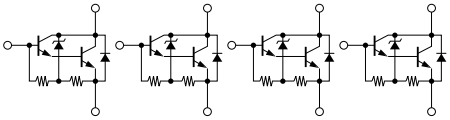

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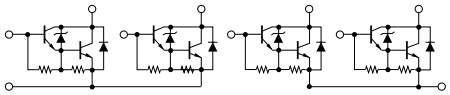

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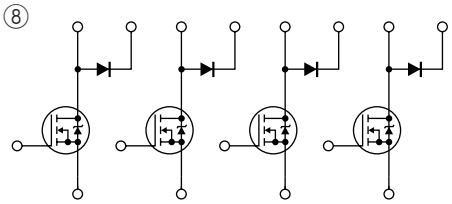

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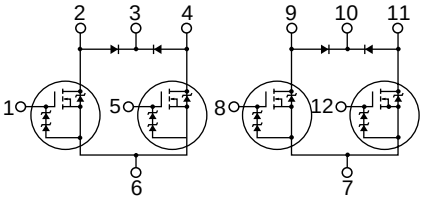

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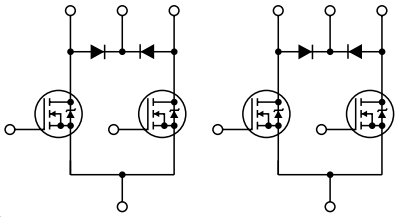

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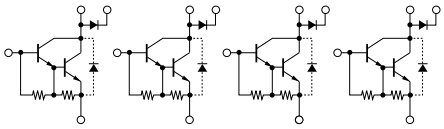

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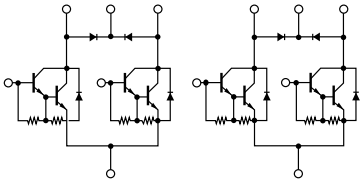

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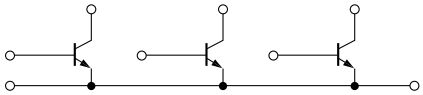

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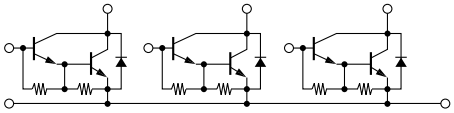

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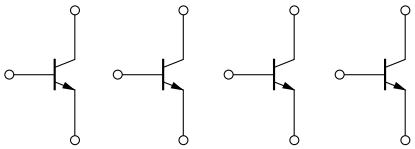

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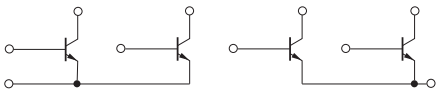

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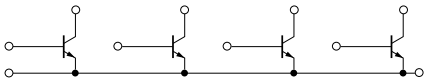

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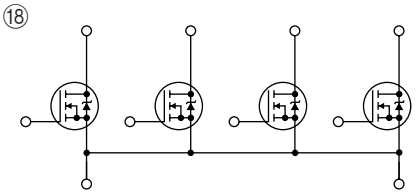

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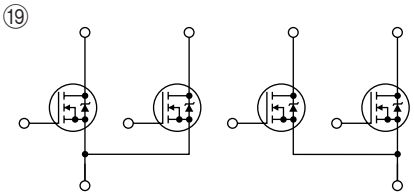

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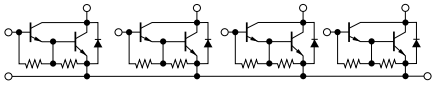

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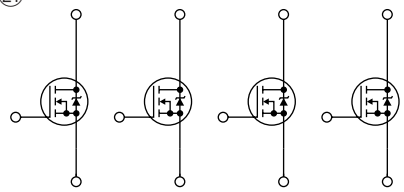

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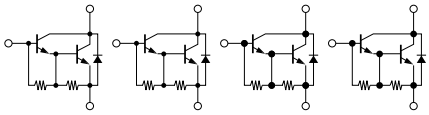

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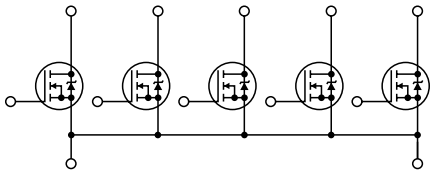


●With built-in flywheel diode

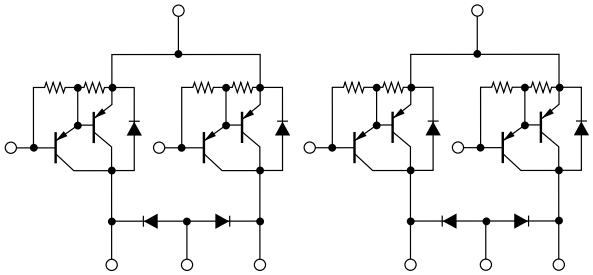
Part Number	Number of chips	V_{CEO} • V_{DSS} (V)	I_C • I_D (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Equivalent circuit	Package	Page
SMA4021	4	–60	–3	2000		1	SIP 12-pin	93
SLA4071	4	–100	–5	2000		1	SIP 12-pin with fin	25
SLA5006	4	–100	–5		0.7	2	SIP 12-pin with fin	39

●General purpose

Part Number	Number of chips	V_{CEO} • V_{DSS} (V)	I_C • I_D (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Equivalent circuit	Package	Page
STA322A	3	–50	–3	100		3	SIP 8-pin	125
STA302A	3	–50	–4	1000		4	SIP 8-pin	119
STA308A	3	–120	–4	2000		4	SIP 8-pin	123
STA402A	4	–50	–4	1000		5	SIP 10-pin	128
SDA01	4	–60	–1.5	2000		6	SMD 16-pin	159
STA472A	4	–60	–2	2000		5	SIP 10-pin	150
STA421A	4	–60	–3	40		7	SIP 10-pin	136
SMA4020	4	–60	–4	2000		6	SIP 12-pin	92
SLA5024	4	–60	–4		0.55	8	SIP 12-pin with fin	64
SLA5004	4	–60	–5		0.3	8	SIP 12-pin with fin	37
SLA4070	4	–100	–5	1000		6	SIP 12-pin with fin	24
SLA5005	4	–100	–5		0.7	8	SIP 12-pin with fin	38
STA408A	4	–120	–4	2000		9	SIP 10-Pin	132
SLA5015	5	–60	–4		0.55	10	SIP 12-pin with fin	52
SLA5012	5	–60	–5		0.3	10	SIP 12-pin with fin	49

●Equivalent circuit (Source driver)

①



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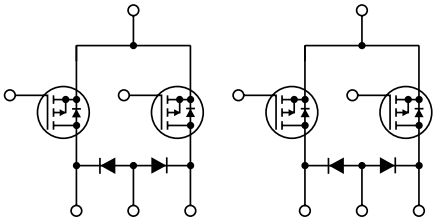

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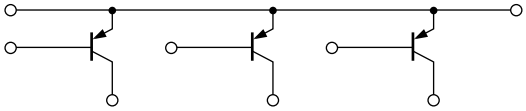

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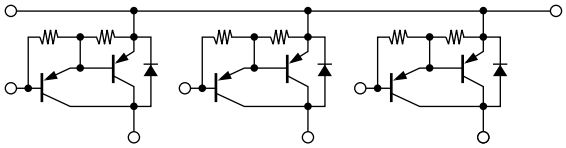

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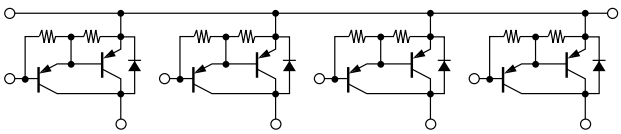

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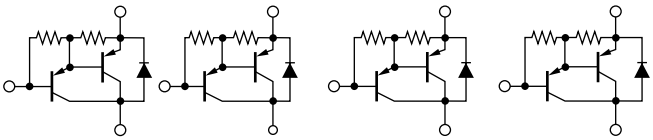

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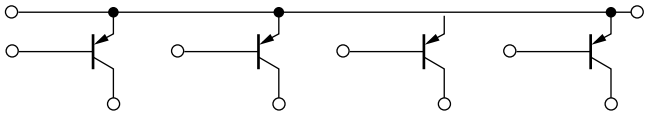

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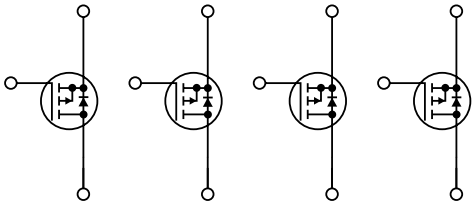

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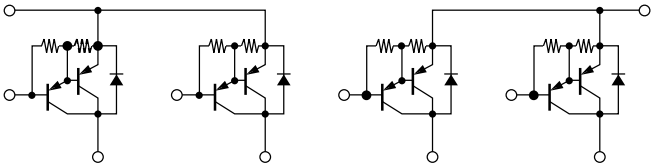

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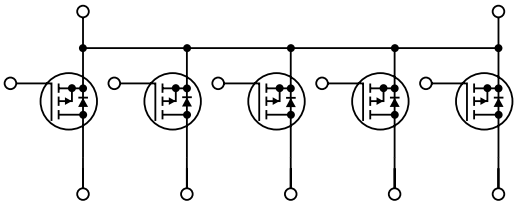

●H-bridge driver

Part Number	Number of chips	V_{CEO} • V_{DSS} (V)	I_C • I_D (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Equivalent circuit	Package	Page
STA458C	4	±30	±5	40		1	SIP 10-pin	146
STA431A	4	±60	±3	40		2	SIP 10-pin	138
STA434A	4	±60	±4	1000		3	SIP 10Pin	140
STA457C	4	±60	±4	2000		4	SIP 10-pin	144
SLA4310	4	±60	±4	80		5	SIP 12-pin with fin	26
SLA4340	4	±60	±4	2000		6	SIP 12-pin with fin	28
SLA5007	4	±60	+5/–4		0.22/0.55	7	SIP 12-pin with fin	40
SLA5018	4	±60	+5/–4		0.22/0.55	7	SIP 12-pin with fin	56
SMA5103	4	±60	+5/–4		0.22/0.55	7	SIP 12-pin	100
SLA8001	4	±60	±12	50		1	SIP 12-pin with fin	90
SDH03	4	±100/–60	±1.5	2000		8	SMD 16-pin	168
SLA5008	4	±100	+4/–3		0.6/1.3	7	SIP 12-pin with fin	42
SLA4390	4	±100	±5	2000		6	SIP 12-pin with fin	30
SLA4391	4	±100	±5	1000		9	SIP 12-pin with fin	32
SLA5013	4	±100	±5		0.3/0.7	7	SIP 12-pin with fin	50

●3-phase motor driver

Part Number	Number of chips	V_{CEO} • V_{DSS} (V)	I_C • I_D (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Equivalent circuit	Package	Page
SDC07	3	60	4	2000		10	SMD 16-pin	165
STA303A	3	100	4	1000		11	SIP 8-pin	120
STA304A	3	550	1	200		12	SIP 8-pin	121
STA302A	3	–50	–4	1000		13	SIP 8-pin	119
SDA05	3	–60	–4	2000		14	SMD 16-pin	160
STA305A	3	–550	–1	200		15	SIP 8-pin	122
SMA6014	6	±60	±2	1500/2000		16	SIP 12-pin	112
SMA6010	6	±60	±4	2000		17	SIP 12-pin	110
SLA6012	6	±60	±4	2000		16	SIP 12-pin with fin	78
SLA5009	6	±60	+5/–4		0.22/0.55	18	SIP 12-pin with fin	44
SLA5017	6	±60	+5/–4		0.22/0.55	18	SIP 12-pin with fin	54
SMA5104	6	±60	+5/–4		0.22/0.55	18	SIP 12-pin	102
SLA6023	6	±60	±6	2000		16	SIP 12-pin with fin	84
SLA5022	6	±60	±6	2000	0.22	19	SIP 12-pin with fin	60
SLA6024	6	±60	±8	2000		16	SIP 12-pin with fin	86
SLA6026	6	±60	±10	2000		16	SIP 12-pin with fin	88
SLA6022	6	±80	±5	2000		16	SIP 12-pin with fin	82
SLA5010	6	±100	+4/–3		0.6/1.3	18	SIP 12-pin with fin	46
SLA6020	6	±100	±5	2000		17	SIP 12-pin with fin	80
SLA5023	6	±100	±6	2000	0.55	19	SIP 12-pin with fin	62
SMA5112	6	250	7		0.5	20	SIP 12-pin	106
SMA5117	6	250	7		0.25	20	SIP 12-pin	108

●Stepper motor driver with dual supply voltage switch

Part Number	Number of chips	V_{CEO} (V)	I_C (A)	h_{FE} (min)	$R_{DS\ (ON)}$ max (Ω)	Equivalent circuit	Package	Page
SMA6511	5	100±15/–60	1.5/–3	2000		21	SIP 12-pin	114
SMA6512	5	60±10/–60	1.5/–3	2000		21	SIP 12-pin	116

●Equivalent circuit (Motor driver)

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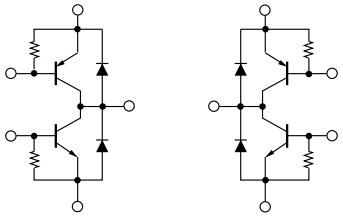

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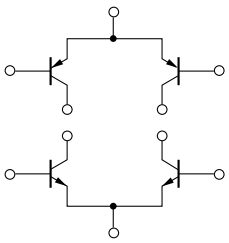

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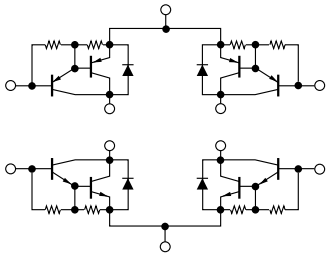

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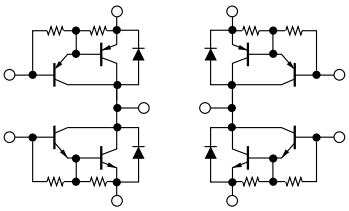

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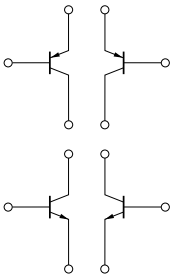

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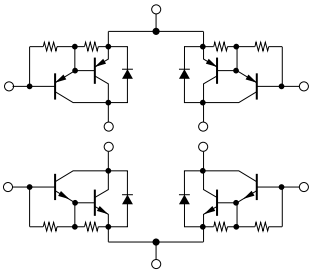

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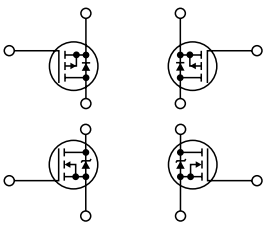

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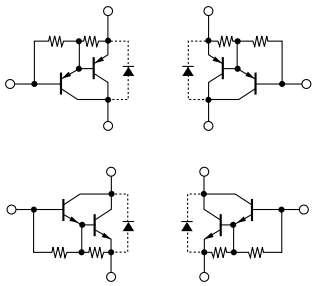

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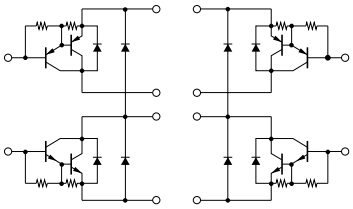

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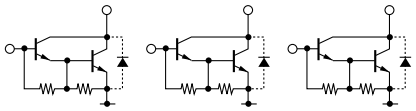

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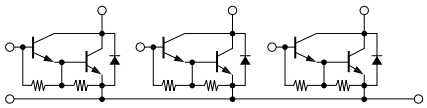

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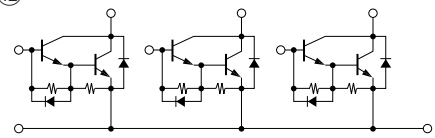

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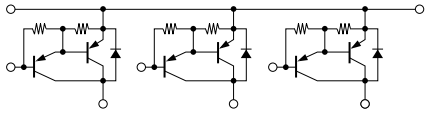

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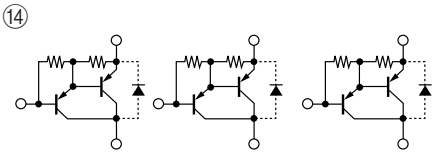

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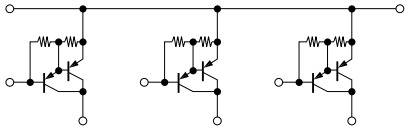

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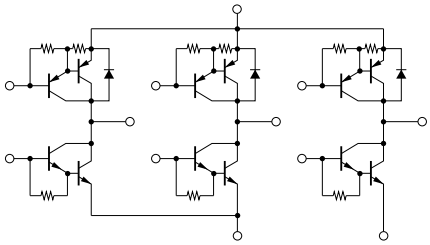

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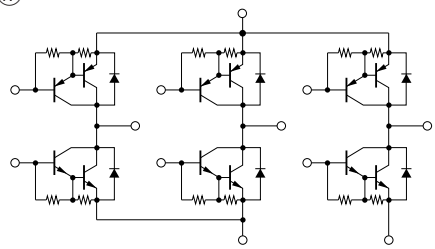

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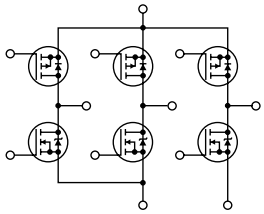

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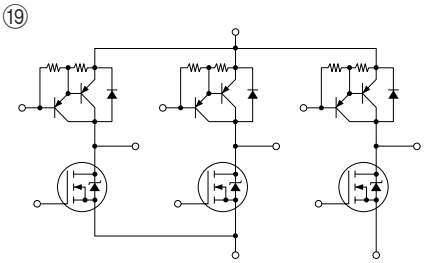

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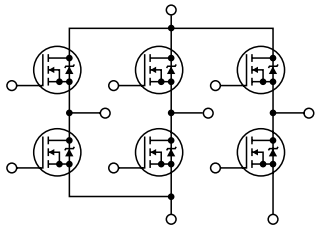

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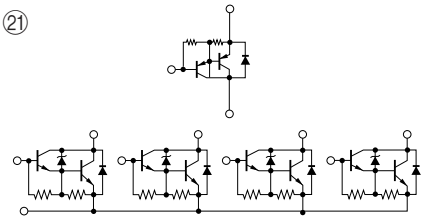
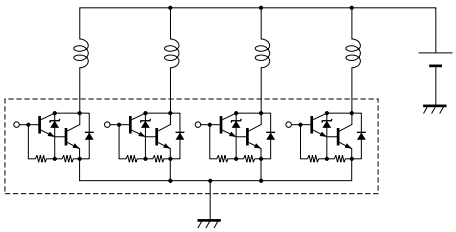
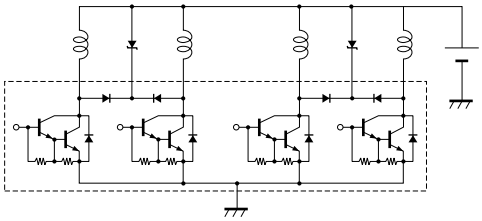
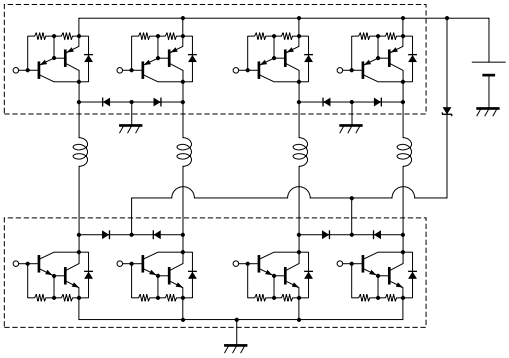
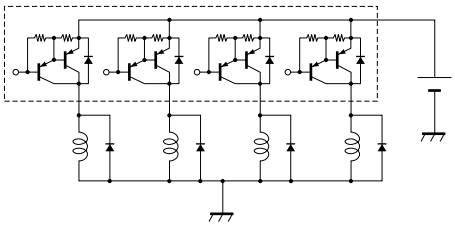
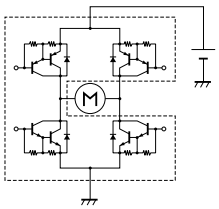
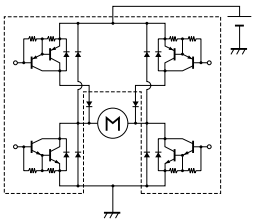
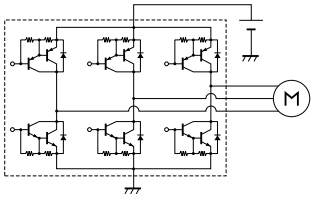
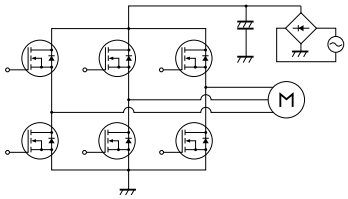
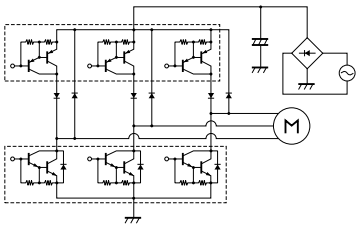
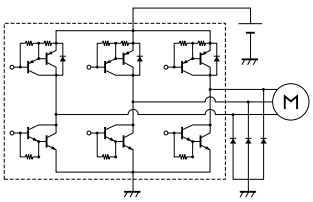
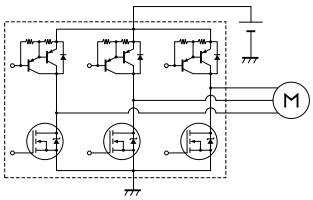
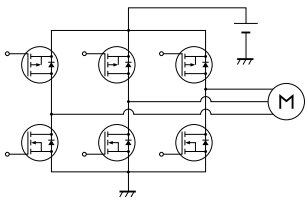
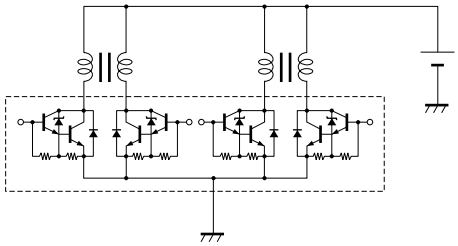
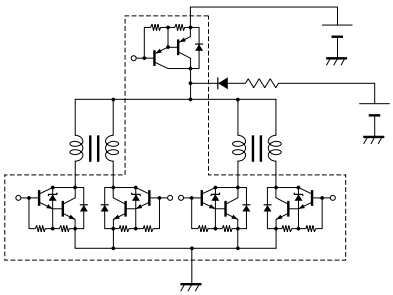
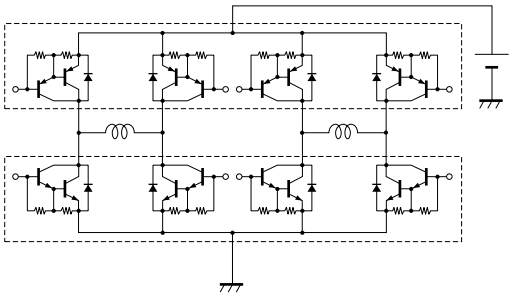


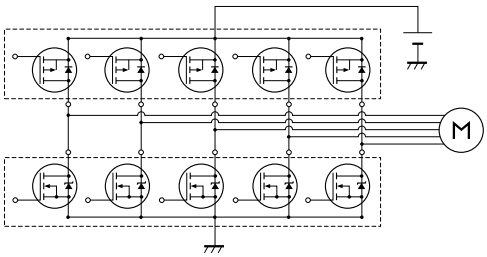
Product index by applications

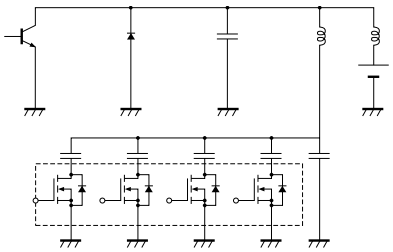
Application	Typical circuit example	Product type		
		Transistor		MOSFET
		Darlington	Single	
●Solenoid ●Relay		STA301A STA371A STA401A STA406A STA435A STA471A STA475A STA481A STA485A STA4010 SDC04 SDC03	STA460C STA413A SDC06	
		SLA4031 SLA4041 SLA4060 SMA4032 SMA4033 SDH02		SLA5002 SLA5003 SLA5031 SLA5040 SMA5102 SMA5105 SMA5106 SMA5114 SDK02
		SLA4071 SMA4021		SLA5006
		STA302A STA308A STA402A STA408A STA472A SLA4070 SMA4020 SDA01	STA322A STA421A	SLA5004 SLA5005 SLA5024

Application		Typical circuit example	Product type		
			Transistor		MOSFET
			Darlington	Single	
●DC motor	Forward-reverse control		STA434A STA457C SLA4340 STA4390 SDH03	STA431A STA458C SLA4310 SLA8001	
	PWM control		SLA4391		SLA5007 SLA5008 SLA5013 SLA5018 SMA5103
●3-phase DC brushless motor			STA302A STA303A SMA6010 SLA6020 SDA05 SDC07		
	100V AC direct drive				SMA5112 SMA5117
	200V AC direct drive		STA304A STA305A		
	PWM control		SLA6012 SLA6022 SLA6023 SLA6024 SLA6026 SMA6014		
			SLA5022 SLA5023		
					SLA5009 SLA5010 SLA5017 SMA5104

Product index by applications

Application		Typical circuit example	Product type		
			Transistor		MOSFET
			Darlington	Single	
●Stepper motor	Constant voltage drive		STA401A STA406A STA435A STA471A STA475A STA481A STA485A SLA4010 SDC04 SDC03	STA460C STA413A SDC06	
	Dual supply voltage drive		SMA6511 SMA6512		
	Bipolar drive		STA473A STA472A STA408A STA404A STA403A STA402A SMA4030 SMA4020 SLA4070 SLA4060 SLA4030 SDA01	STA421A STA414A STA412A SDC01	STA506A STA505A STA504A STA501A SMA5101 SLA5024 SLA5005 SLA5004 SLA5001

Application	Typical circuit example	Product type	
		N–CH	P–CH
●5-phase motor		SLA5011 SLA5029	SLA5012 SLA5015

Application	Typical circuit example	Product type			
		100V	150V	200V	250V
●"S" shape correction switch		SLA5021 SLA5026 SLA5037 SLA5042	SLA5038 SLA5047 SLA5052	SLA5041 SLA5026	SLA5044 SLA5049

Storage, characteristic inspection, and handling precautions

Inappropriate storage, characteristic inspection, or handling may impair the reliability of the device. To ensure high reliability, observe the following precautions:

1. Storage precautions

- It is recommended to store the device at room temperature (between 5 and 35°C) and relative humidity of 40 to 75%. Avoid storing the device in a place where the temperature or humidity is high or changes greatly.
- Store the device in a clean place that is not exposed to direct sunlight, and is free from corrosive or harmful gases.
- If the device is stored for a long time, check the solderability and lead condition before using the device.

2. Precautions on characteristic inspections

When carrying out characteristic inspections on receiving products or other occasions, take care to avoid applying a surge voltage from the measuring equipment and check the terminals of the measuring equipment for a short circuit or wiring errors. Measure the device within the range of its rated values.

3. Silicone Grease

When attaching a heatsink, apply a small amount of silicone evenly to the back of the device and both sides of the insulator to reduce the thermal resistance between the device and heatsink.

Recommended silicone grease

- **G746 SHINETSU SILICONE CO., LTD.**
- **YG6260 TOSHIBA SILICONE CO., LTD.**
- **SC102 DOW CORNING TORAY SILICONE CO., LTD.**

Please select a silicone grease carefully since the oil in some grease can penetrate the product, which will result in an extremely short product life.

4. Screw tightening torque

If screws are not tightened with sufficient torque, this can increase the thermal resistance and reduce the radiation effect. Tightening screws with too great a torque damage the screw thread, deform the heatsink, or twist the device frame until it is damaged. Therefore, tighten screws with a torque between 0.588 and 0.784 N • m (6 to 8 kgf • cm).

5. Soldering temperature

If soldering is necessary, take care to keep the application of heat as brief as possible, and within the following limits:

260±5°C for 10 s max

350°C for 3 s max (soldering iron)

6. Heatsink

A large contact area between the device and the heatsink for effective heat radiation is required. To ensure a large contact area, minimize mounting holes and select a heatsink with a sufficiently smooth surface and that is free from burring or metal debris.

7. Handling precautions to protect power MOSFET arrays from static damage

- When handling the device, physical grounding is necessary. Wear a wrist strap with a 1 MΩ resistor close to the body in the wrist strap to prevent electric shock.
- Use a conductive tablemat or floor mat at the device handling workbench and to ensure grounding.
- When using a curve tracer or other measuring equipment, ground the equipment as well.
- When soldering, ground the bit of the soldering iron and the dip tank to prevent a leakage voltage from damaging the device.
- Store the device in the shipping container or a conductive container or use aluminum foil to protect the device from static electricity.

Avalanche energy capability of MOSFET array

Sanken MOSFETs feature guaranteed avalanche energy capability.

1. What is avalanche energy capability ?

When a MOSFET is used for high-speed switching, the inductive load and wiring inductance may cause a counter electromotive voltage at cutoff that the device cannot withstand.

Avalanche energy capability is the non-clamped ability to withstand damage expressed as energy. As long as the energy applied to the device at cutoff is within the guaranteed avalanche energy capability, the device will not be damaged even if the drain-source voltage exceeds the capability.

For example, a drain-source voltage that is within the guaranteed capability when electrically stationary may exceed the limit at startup or cutoff. Usually, a snubber circuit or similar surge absorbing circuit is used to keep the drain-source voltage within the guaranteed capability. Sanken MOSFETs, however, do not require this kind of protective circuit because the avalanche energy capability is guaranteed. Sanken MOSFETs enable the number of parts to be reduced, saving board area.

* Consult the engineering department of Sanken when planning to use MOSFETs in avalanche mode.

2. EAS calculation method

If the current in an inductive load L is I_{LP} at the moment when the MOSFET is cut off, E_{AS} can be expressed as follows:

$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{LP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}} \quad \cdots\cdots ①$$

*V_{DD} : Supply voltage

If the value of L is not known in an actual circuit, EAS can also be calculated from the actual voltage and current waveforms as follows:

$$E_{AS} = P_S \cdot t \quad \cdots\cdots ②$$

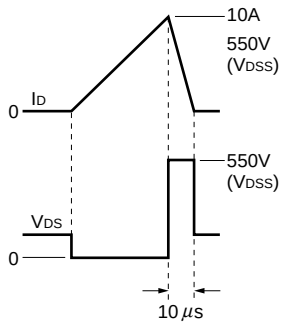
*P_S : Surge power *t : Surge time

The following calculation is used to determine E_{AS} where the voltage and current shown in Fig. A are applied to the MOSFET in a circuit

Integrate the overlapping section of I_D and V_{DS} to calculate $\int I_D \cdot V_{DS} \cdot dt$. When the I_D waveform is triangular, E_{AS} will be as follows:

$$E_{AS} = \frac{1}{2} \cdot 10(A) \cdot 550(V) \cdot 10(\mu s) = 27.5(mJ)$$

Fig. A



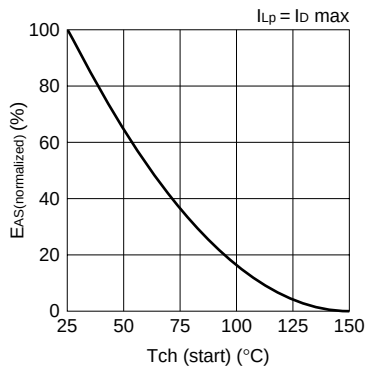
3. Temperature derating for EAS

The E_{AS} value in the specifications is guaranteed when the channel temperature T_{ch} is 25°C. Since the E_{AS} value drops as the channel temperature rises, derating depending on the temperature is necessary.

Fig. B shows the derating curve for single avalanche energy capability. This is the derating curve of E_{AS} and the channel temperature (T_{ch} (start)) immediately before the avalanche occurs in the product, with the E_{AS} value (maximum rating) at 25°C as 100%.

For example, if the product temperature is 50°C, the E_{AS} value is derated to 64% of the value at 25°C.

Fig. B



4. Continuous avalanche energy capability

This section explains the derating method for continuous avalanche.

Considering continuous avalanche as the repetition of a single avalanche, the safe operating area (SOA) is determined using the derating curve shown in Fig. B.

Calculate the energy and T_{ch} (start) of avalanche in the worst condition and determine SOA using the calculated data and the derating curve shown in Fig. B. The temperature rise due to avalanche should not cause the channel temperature to exceed the maximum rating.

The following is an example of determining SOA judgment by calculation when a MOSFET enters a transient avalanche state at power-on then changes to a stationary state

Supposing that the waveform is as shown in Fig. C until the MOSFET changes to the stationary state, calculate the start loss and switching (turn-on/off) loss. To simplify the calculation, the average loss Pa and the last two waveforms are used for approximation. (Fig. D)

First, calculate the channel temperature T_{ch} (τ) at time (τ) where the temperature condition is severest.

If the T_{ch} (τ) value is within the maximum rating, there is no problem as far as the temperature is concerned.

$$T_{ch}(\tau) = T_a + P_a \cdot r_{ch-c}(T_n + T + t_1 + t_2 + t_3) + (P_1 - P_a) \cdot r_{ch-c}(T + t_1 + t_2 + t_3) - (P_1 - P_2) \cdot r_{ch-c}(T + t_2 + t_3) + (P_3 - P_2) \cdot r_{ch-c}(T + t_3) - P_3 \cdot r_{ch-c}(T) + P_4 \cdot r_{ch-c}(t_4 + t_5 + t_6) - (P_4 - P_5) \cdot r_{ch-c}(t_5 + t_6) + (P_6 - P_5) \cdot r_{ch-c}(t_6) \cdots\cdots ③$$

*T_a : Ambient temperature

*$r_{ch\text{-}c}(t)$: Transient thermal resistance at pulse width t

Then calculate the channel temperature T_{ch} (τI) immediately before avalanche.

$$T_{ch}(\tau) = T_a + P_a \cdot r_{ch-c}(T_n + T' + t_1 + t_2 + t_3) + (P_1 - P_a) \cdot r_{ch-c}(T' + t_1 + t_2 + t_3) - (P_1 - P_2) \cdot r_{ch-c}(T' + t_2 + t_3) + (P_3 - P_2) \cdot r_{ch-c}(T' + t_3) - P_3 \cdot r_{ch-c}(T') + P_4 \cdot r_{ch-c}(t_4 + t_5 + t_6) - (P_4 - P_5) \cdot r_{ch-c}(t_5 + t_6) + (P_6 - P_5) \cdot r_{ch-c}(t_6) \cdots\cdots ④$$

This T_{ch} (τ) value becomes T_{ch} (start). If the avalanche energy ($E_{AS} = P_6 \cdot t_6$) is within the value derated from the guaranteed E_{AS} value at the temperature, there is no problem as far as the avalanche energy is concerned.

Fig. C

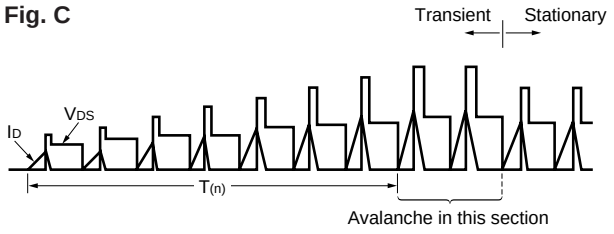
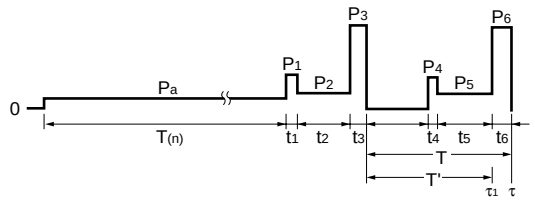
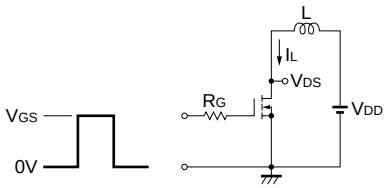


Fig. D



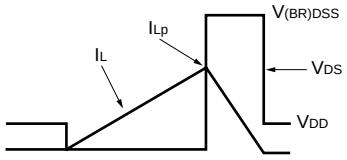
5. Avalanche energy capability measuring method

Fig. E



(a) Measuring circuit

$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{Lp}^2 \cdot \frac{V_{(BR)DSS}}{V_{(BR)DSS} - V_{DD}}$$

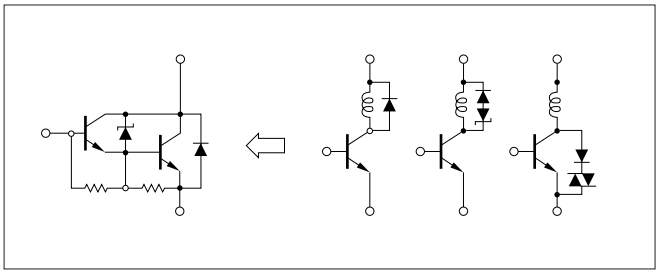


(b) Output waveform

Transistor array with built-in avalanche diode

SLA4010, STA301A, 371A, 401A, 406A, 413A, 435A, 460C, 471A, 475A, 481A, 485A, SDC03, 04, 06

The Darlington transistor chip with a built-in avalanche diode is a planar type monolithic Darlington transistor chip having the equivalent circuit shown in the figure on the right. Surge Voltage can be absorbed by the avalanche diode provided between the collector and the base. This eliminated the need for extra components for absorbing surge caused by counter electromotive force produced by inductive load switch circuits. These Darlington transistor arrays are ideal for relay drive, solenoid drive, and printer wire drive applications.

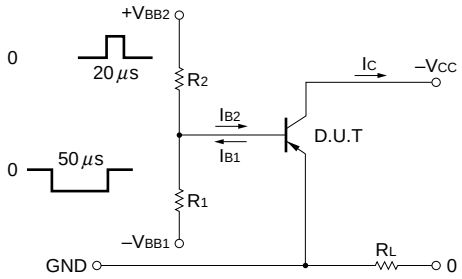


Switching time measurement

1. Transistor array

Fig. 1 PNP

(a) Measuring circuit



(b) Input-output waveform

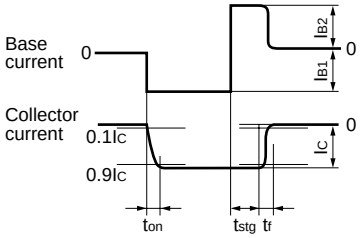
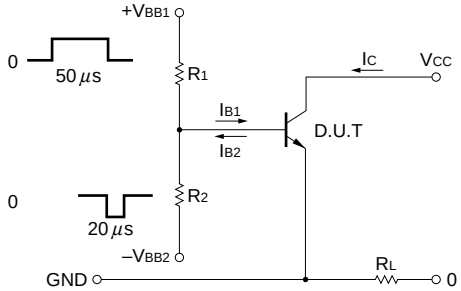
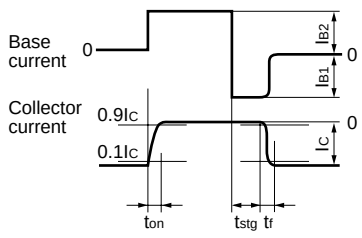


Fig. 2 NPN

(a) Measuring circuit



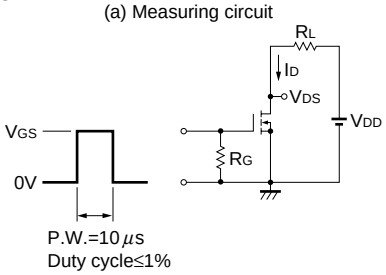
(b) Input-output waveform



2. MOS FET array

Fig. 3 Nch

(a) Measuring circuit



(b) Input-output waveform

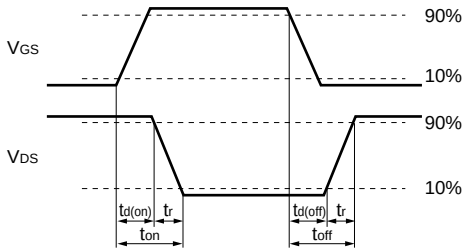
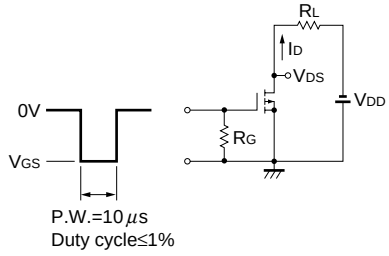
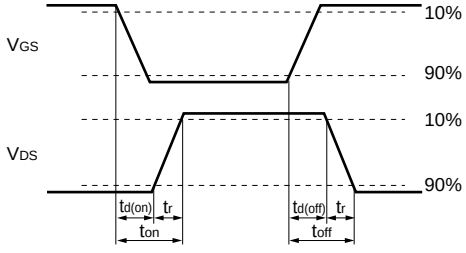


Fig. 4 Pch

(a) Measuring circuit

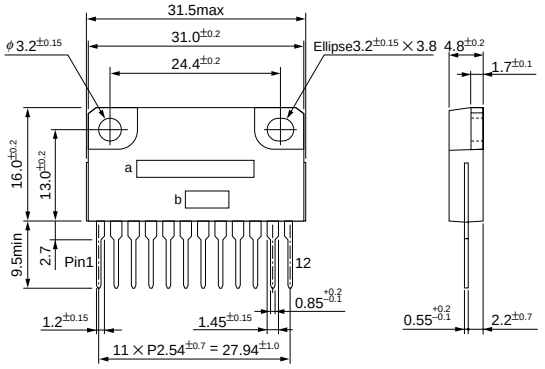


(b) Input-output waveform



External dimensions (unit: mm)

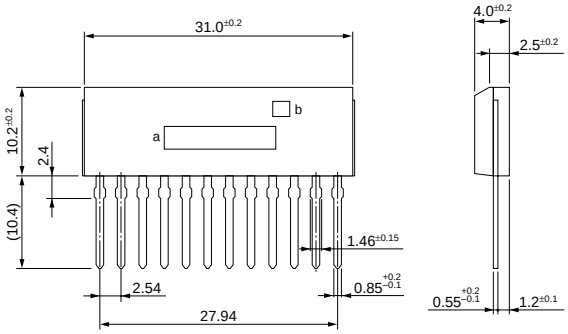
(A) SLA



a. Type No.
b. Lot No.

Weight : Approx. 6.0g

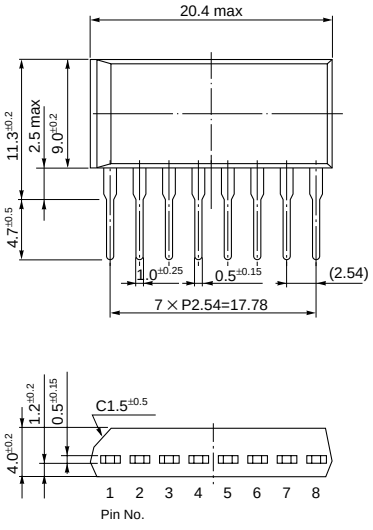
(B) SMA



a. Type No.
b. Lot No.

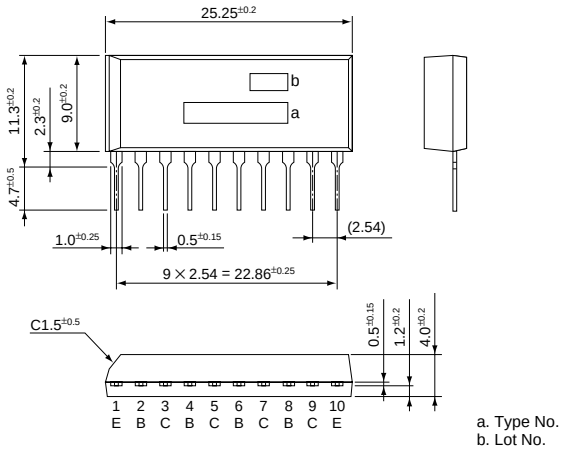
Weight : Approx. 4.0g

(C) STA300



Weight : Approx. 2.0g

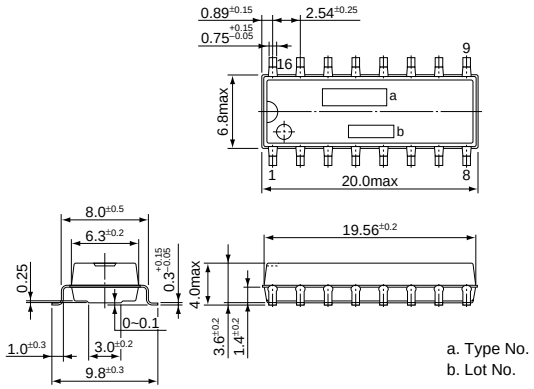
(D) STA400



a. Type No.
b. Lot No.

Weight : Approx. 2.6g

(E) SD



a. Type No.
b. Lot No.

Weight : Approx. 1.05g

SLA4010

NPN Darlington
With built-in avalanche diode

External dimensions Ⓐ ··· SLA

Absolute maximum ratings

(Ta=25°C)

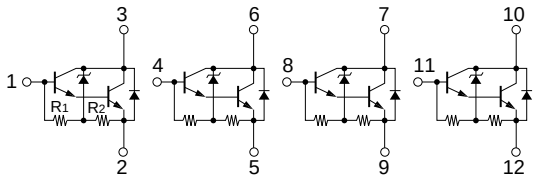
Symbol	Specification	Unit
V_{CBO}	60±10	V
V_{CEO}	60±10	V
V_{EBO}	6	V
I_C	4	A
I_{CP}	6 (PW≤10ms, Du≤50%)	A
I_B	0.5	A
P_T	5 (Ta=25°C)	W
	40 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=50V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	50	60	70	V	I_C=10mA
h_{FE}	2000				V_{CE}=4V, I_C=3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=10mA

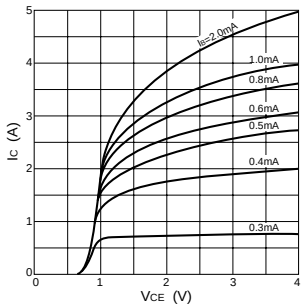
■Equivalent circuit diagram



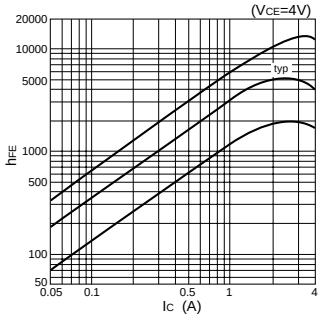
R1: 3kΩ typ R2: 150Ω typ

Characteristic curves

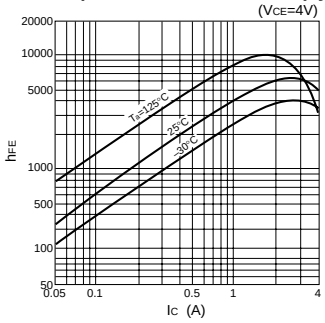
I_C-V_{CE} Characteristics (Typical)



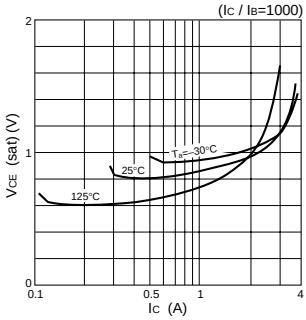
h_{FE}-I_C Characteristics (Typical)



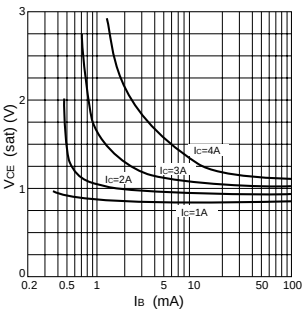
h_{FE}-I_C Temperature Characteristics (Typical)



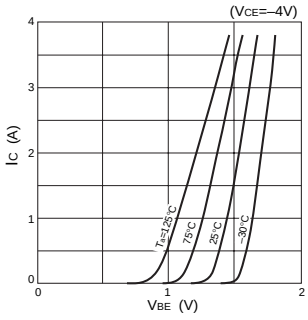
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



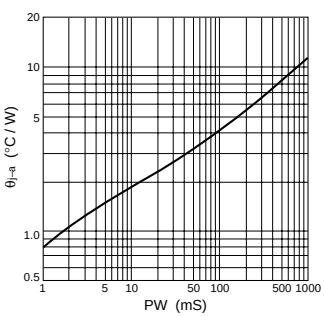
V_{CE}(sat)-I_B Characteristics (Typical)



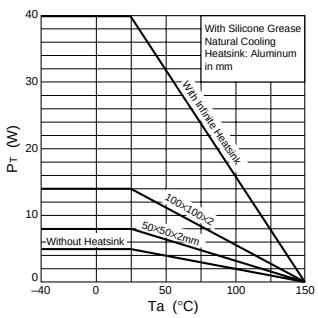
I_C-V_{BE} Temperature Characteristics (Typical)



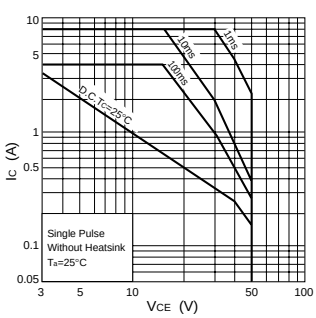
$\theta_{j\text{-}a$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SLA4030

NPN Darlington
General purpose

Absolute maximum ratings

(Ta=25°C)

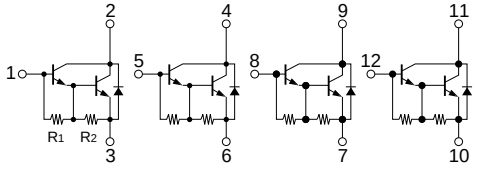
Symbol	Specification	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	4	A
I_{CP}	6 (PW≤1ms, Du≤50%)	A
I_B	0.5	A
P_T	5 (Ta=25°C)	W
	25 (Tc=25°C)	
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
T_j	150	°C
T_{stg}	–40 to +150	°C
$\theta_{j\text{-}c}$	5	°C/W

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	100			V	I_C=10mA
h_{FE}	2000				V_{CE}=4V; I_C=2A
V_{CE}(sat)			1.5	V	I_C=2A, I_B=10mA

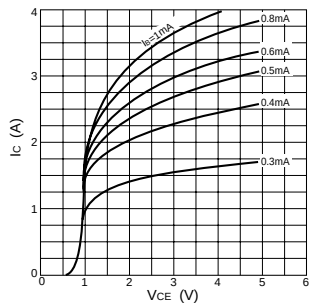
■Equivalent circuit diagram



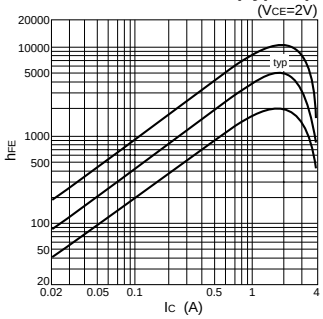
R1: 3kΩ typ R2: 500Ω typ

Characteristic curves

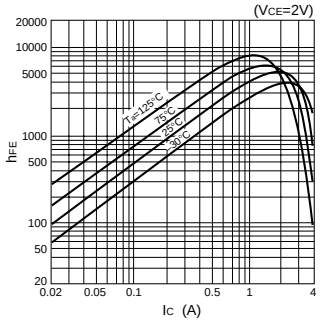
I_C-V_{CE} Characteristics (Typical)



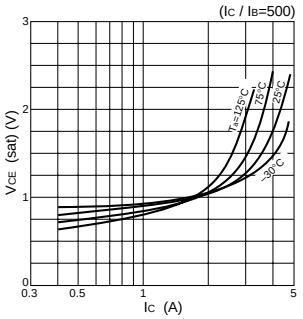
h_{FE}-I_C Characteristics (Typical)



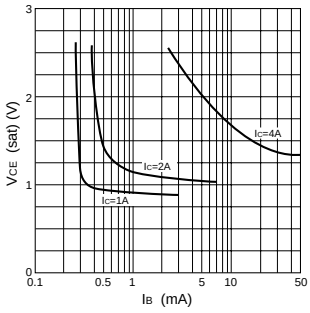
h_{FE}-I_C Temperature Characteristics (Typical)



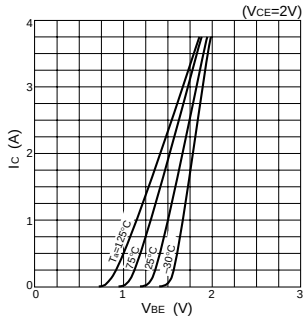
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



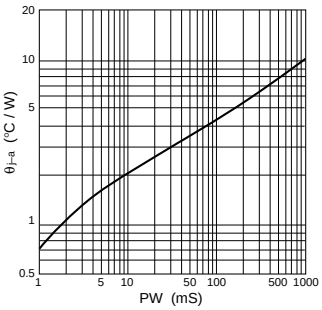
V_{CE}(sat)-I_B Characteristics (Typical)



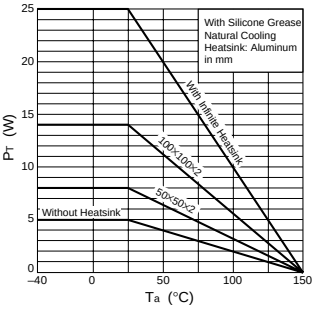
I_C-V_{BE} Temperature Characteristics (Typical)



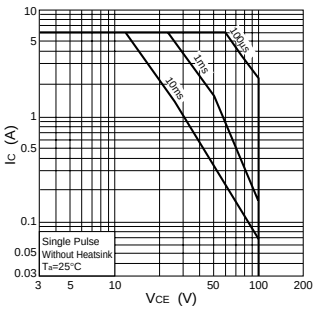
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SLA4031

NPN Darlington
With built-in flywheel diode

External dimensions Ⓐ ··· SLA

Absolute maximum ratings (Ta=25°C)

Symbol	Specification	Unit
V_{CBO}	120	V
V_{CEO}	120	V
V_{EBO}	6	V
I_C	4	A
I_{CP}	6 (PW≤1ms, Du≤50%)	A
I_B	0.5	A
I_F	4 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	6 (PW≤10ms, Single)	A
V_R	120	V
P_T	5 (Ta=25°C)	W
	25 (Tc=25°C)	
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
T_j	150	°C
T_{stg}	–40 to +150	°C
$\theta_{j\text{-}c}$	5	°C/W

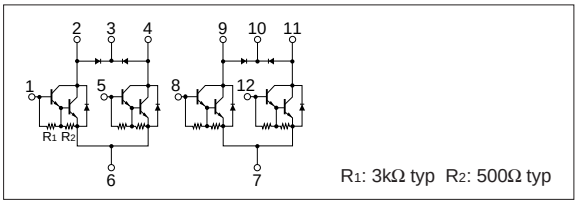
Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	120			V	I_C=25mA
h_{FE}	2000	5000	15000		V_{CE}=2V, I_C=2A
V_{CE} (sat)		1.0	1.5	V	I_C=2A, I_B=2mA
V_{BE} (sat)		1.6	2.0	V	
t_{on}		0.6		μs	V_{CC}≒40V,
t_{stg}		5.0		μs	I_C=2A,
t_f		2.0		μs	I_{B1}=–I_{B2}=10mA

■Diode for flyback voltage absorption (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
V_R	120			V	I_R=10μA
V_F			1.2	V	I_F=1A
I_R			10	μA	V_R=120V
t_{rr}		100		ns	I_F=±100mA

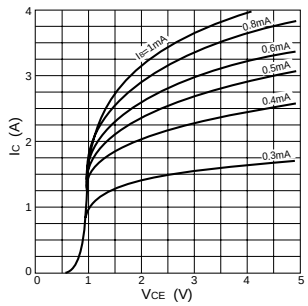
■Equivalent circuit diagram



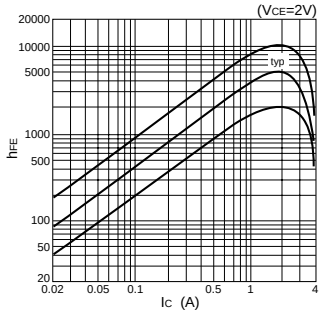
R1: 3kΩ typ R2: 500Ω typ

Characteristic curves

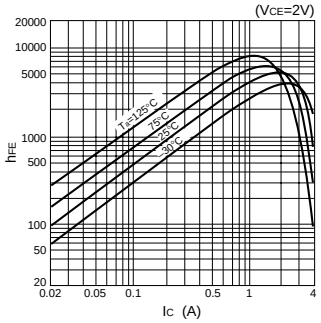
IC-VCE Characteristics (Typical)



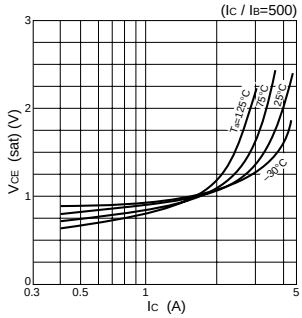
hFE-IC Characteristics (Typical)



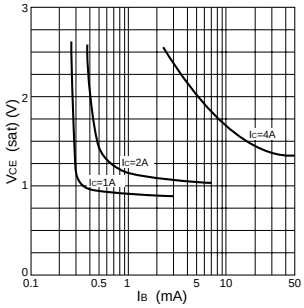
hFE-IC Temperature Characteristics (Typical)



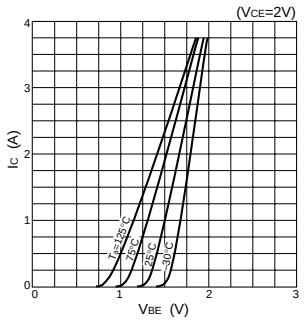
VCE(sat)-IC Temperature Characteristics (Typical)



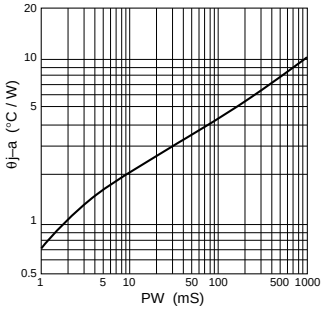
VCE(sat)-IB Characteristics (Typical)



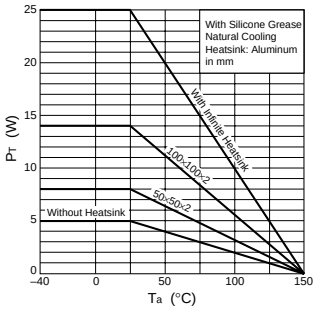
IC-VBE Temperature Characteristics (Typical)



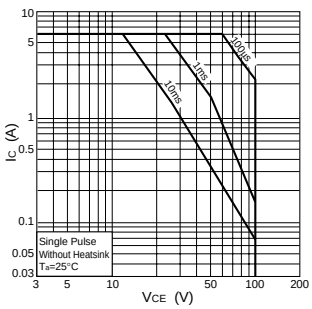
θj-a-PW Characteristics



PT-Ta Characteristics



Safe Operating Area (SOA)



SLA4041

NPN Darlington
With built-in flywheel diode

External dimensions Ⓐ ··· SLA

Absolute maximum ratings (Ta=25°C)

Symbol	Specification	Unit
V_{CBO}	200	V
V_{CEO}	200	V
V_{EBO}	6	V
I_C	3	A
I_{CP}	6 (PW≤10ms, Du≤50%)	A
I_B	0.2	A
I_F	3 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	6 (PW≤10ms, single)	A
V_R	200	V
P_T	5 (Ta=25°C)	W
	25 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

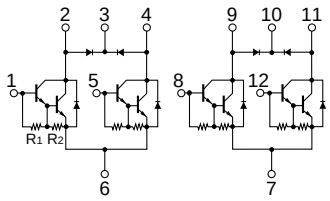
Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			10	μA	V_{CB}=200V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	200			V	I_C=10mA
h_{FE}	1000	6000	15000		V_{CE}=4V, I_C=1.5A
V_{CE}(sat)		1.1	1.5	V	I_C=1.5A, I_B=3mA
V_{BE}(sat)		1.7	2.0	V	
V_{FEC}			1.5	V	I_{FEC}=2.0A

●Diode for flyback voltage absorption (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
V_R	200			V	I_R=10μA
V_F			1.6	V	I_F=1A
I_R			10	μA	V_R=200V
trr		100		ns	I_F=±100mA

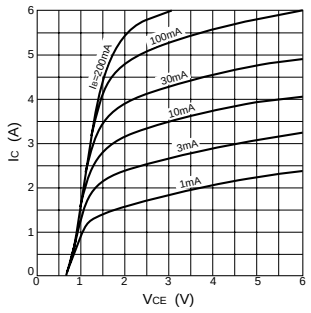
■Equivalent circuit diagram



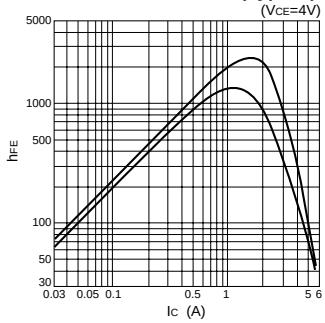
R1: 2kΩ typ R2: 200Ω typ

Characteristic curves

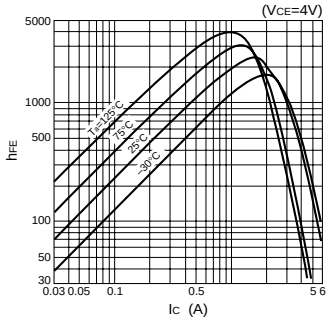
I_C-V_{CE} Characteristics (Typical)



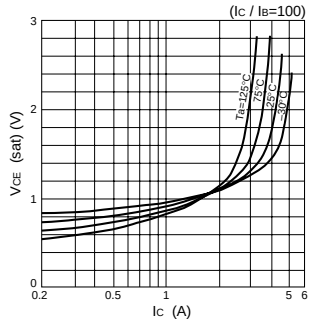
h_{FE}-I_C Characteristics (Typical)



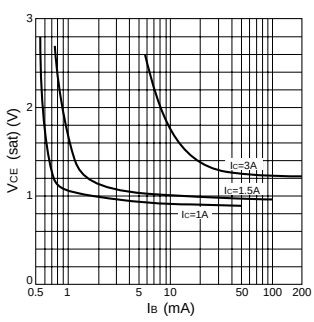
h_{FE}-I_C Temperature Characteristics (Typical)



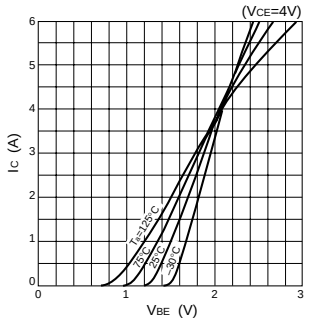
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



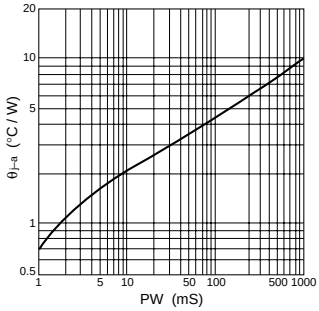
V_{CE}(sat)-I_B Characteristics (Typical)



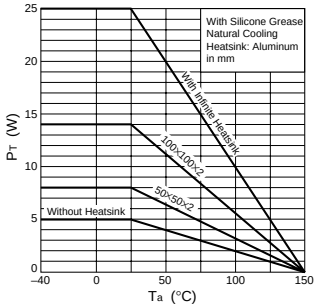
I_C-V_{BE} Temperature Characteristics (Typical)



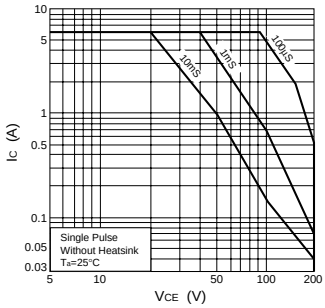
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SLA4060

NPN Darlington
General purpose

Absolute maximum ratings

(Ta=25°C)

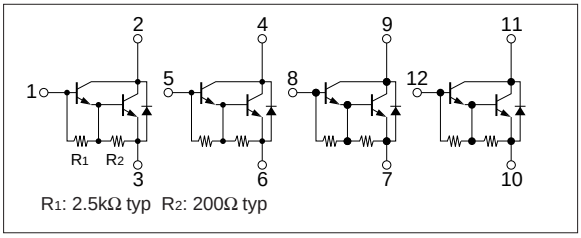
Symbol	Specification	Unit
V_{CBO}	120	V
V_{CEO}	120	V
V_{EBO}	6	V
I_C	5	A
I_{CP}	8 (PW≤1ms, Du≤50%)	A
I_B	0.5	A
P_T	5 (Ta=25°C)	W
	25 (Tc=25°C)	
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
T_j	150	°C
T_{stg}	–40 to +150	°C
$\theta_{j\text{-}c}$	5	°C/W

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	120			V	I_C=25mA
h_{FE}	2000	5000	15000		V_{CE}=2V, I_C=3A
V_{CE}(sat)		1.0	1.5	V	I_C=3A, I_B=3mA
V_{BE}(sat)		1.6	2.0	V	
t_{on}		0.5		μs	V_{CC}≒30V,
t_{stg}		5.5		μs	I_C=3A,
t_f		1.5		μs	I_{B1}=–I_{B2}=3mA

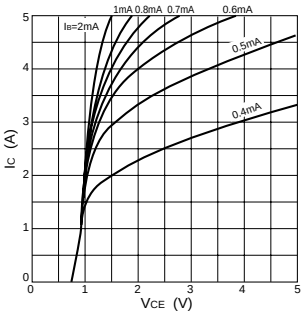
■Equivalent circuit diagram



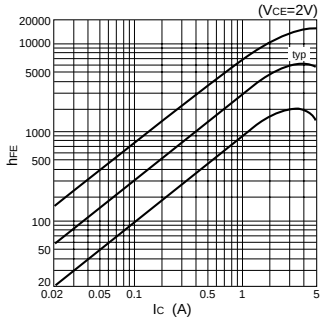
R_1: 2.5kΩ typ R_2: 200Ω typ

Characteristic curves

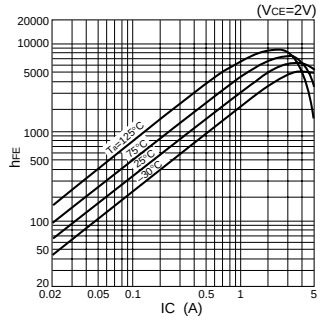
I_C-V_{CE} Characteristics (Typical)



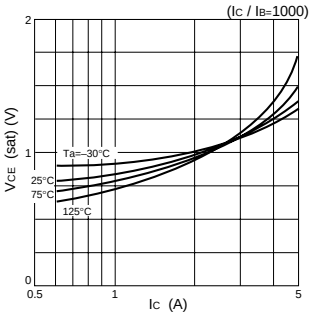
h_{FE}-I_C Characteristics (Typical)



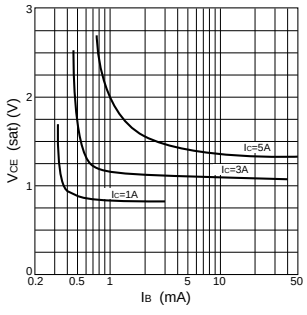
h_{FE}-I_C Temperature Characteristics (Typical)



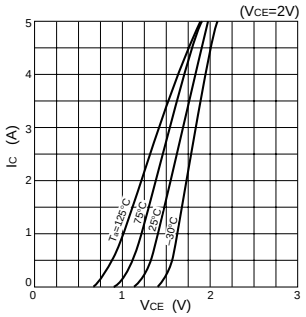
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



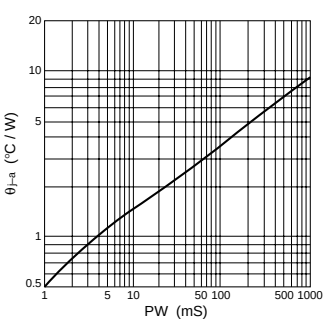
V_{CE}(sat)-I_B Characteristics (Typical)



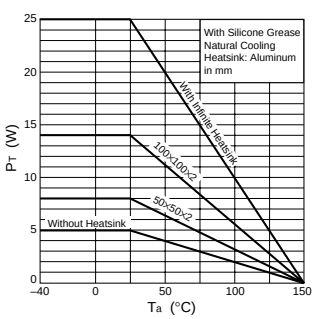
I_C-V_{BE} Temperature Characteristics (Typical)



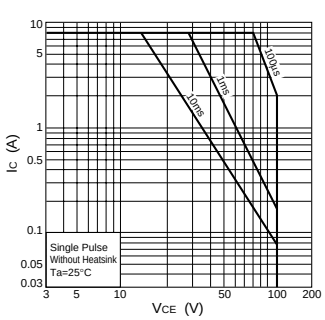
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SLA4061

NPN Darlington
With built-in flywheel diode

External dimensions Ⓐ ··· SLA

Absolute maximum ratings (Ta=25°C)

Symbol	Specification	Unit
V_{CBO}	120	V
V_{CEO}	120	V
V_{EBO}	6	V
I_C	5	A
I_{CP}	8 (PW≤1ms, Du≤50%)	A
I_B	0.5	A
I_F	5 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	8 (PW≤10ms, single)	A
V_R	120	V
P_T	5 (Ta=25°C)	W
	25 (Tc=25°C)	
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
T_j	150	°C
T_{stg}	–40 to +150	°C
$\theta_{j\text{-}c}$	5	°C/W

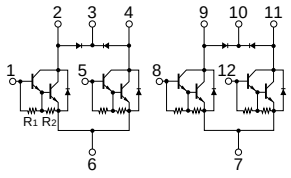
Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	120			V	I_C=25mA
h_{FE}	2000	5000	15000		V_{CE}=2V, I_C=3A
V_{CE}(sat)		1.0	1.5	V	I_C=3A, I_B=3mA
V_{BE}(sat)		1.6	2.0	V	
ton		0.5		μs	V_{CC}≒30V,
tstg		5.5		μs	I_C=3A,
tf		1.5		μs	I_{B1}=–I_{B2}=3mA

●Diode for flyback voltage absorption (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
V_R	120			V	I_R=10μA
V_F			1.2	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F=±100mA

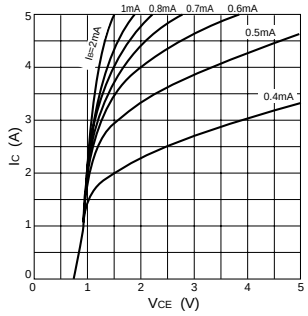
■Equivalent circuit diagram



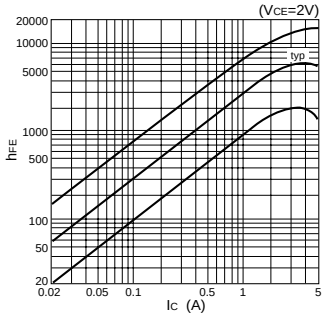
R1: 2.5kΩ typ R2: 200Ω typ

Characteristic curves

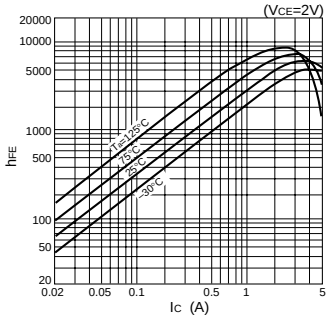
IC-VCE Characteristics (Typical)



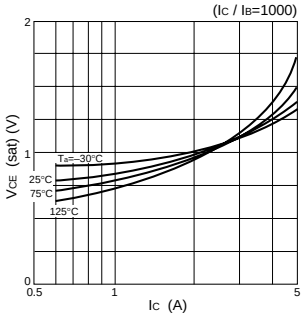
hFE-IC Characteristics (Typical)



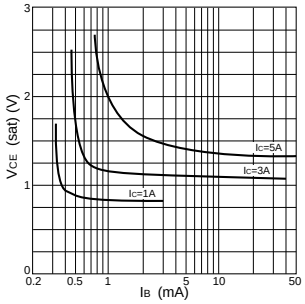
hFE-IC Temperature Characteristics (Typical)



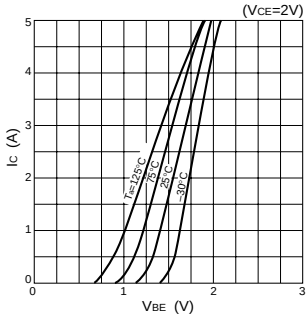
VCE(sat)-IC Temperature Characteristics (Typical)



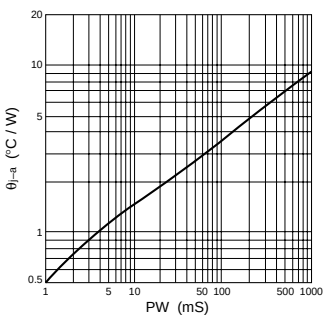
VCE(sat)-IB Characteristics (Typical)



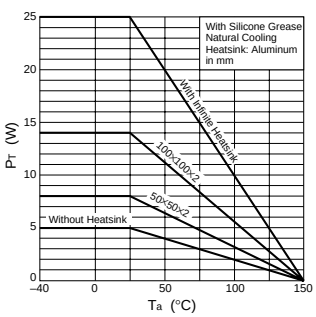
IC-VBE Temperature Characteristics (Typical)



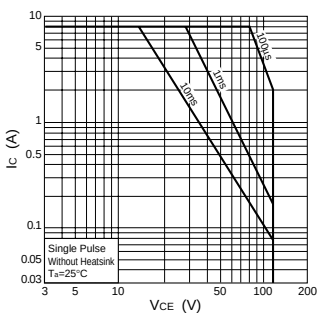
θj-a-PW Characteristics



PT-Ta Characteristics



Safe Operating Area (SOA)



SLA4070

PNP Darlington
General purpose

Absolute maximum ratings

(Ta=25°C)

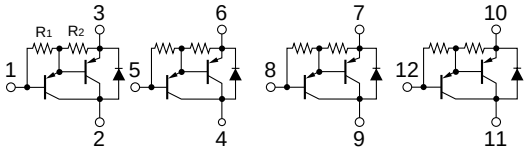
Symbol	Specification	Unit
V_{CBO}	–100	V
V_{CEO}	–100	V
V_{EBO}	–6	V
I_C	–5	A
I_{CP}	–8 (PW≤1ms, Du≤50%)	A
I_B	–0.5	A
P_T	5 (Ta=25°C)	W
	25 (Tc=25°C)	
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
T_j	150	°C
T_{stg}	–40 to +150	°C
$\theta_{j\text{-}c}$	5	°C/W

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–100V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–100			V	I_C=–10mA
h_{FE}	1000	5000	15000		V_{CE}=–2V, I_C=–3A
V_{CE}(sat)		–1.0	–1.5	V	I_C=–3A, I_B=–6mA
V_{BE}(sat)		–1.6	–2.0	V	

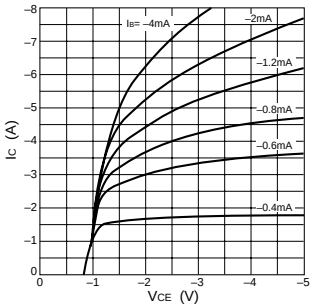
■Equivalent circuit diagram



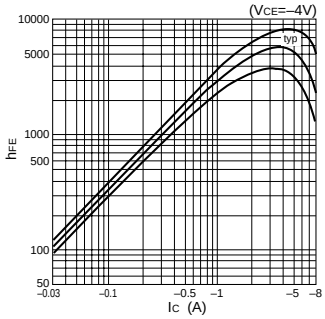
R1: 3kΩ typ R2: 100Ω typ

Characteristic curves

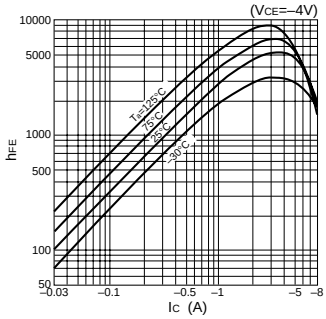
I_C-V_{CE} Characteristics (Typical)



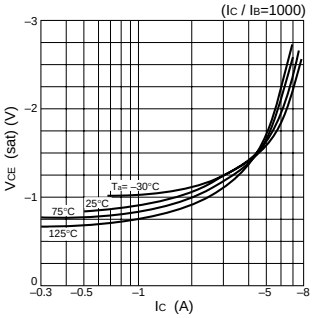
h_{FE}-I_C Characteristics (Typical)



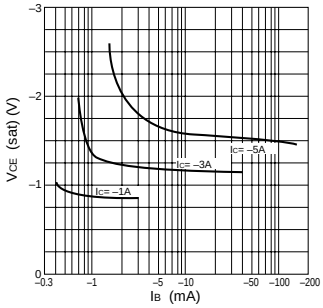
h_{FE}-I_C Temperature Characteristics (Typical)



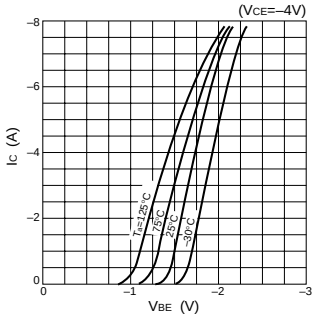
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



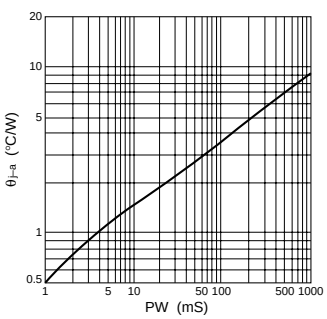
V_{CE}(sat)-I_B Characteristics (Typical)



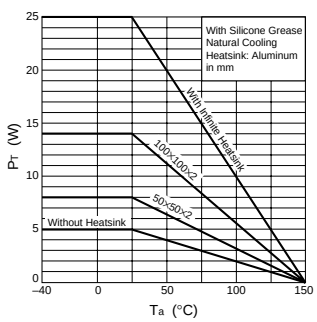
I_C-V_{BE} Temperature Characteristics (Typical)



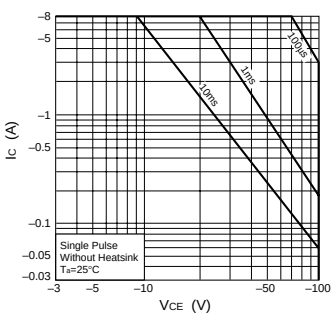
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SLA4071

PNP Darlington
With built-in flywheel diode

External dimensions Ⓐ ··· SLA

Absolute maximum ratings (Ta=25°C)

Symbol	Specification	Unit
V_{CBO}	–100	V
V_{CEO}	–100	V
V_{EBO}	–6	V
I_C	–5	A
I_{CP}	–8 (PW≤1ms, Du≤50%)	A
I_B	–0.5	A
I_F	–5 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	–8 (PW≤10ms, single)	A
V_R	120	V
P_T	5 (Ta=25°C)	W
	25 (Tc=25°)	
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
T_j	150	°C
T_{stg}	–40 to +150	°C
$\theta_{j\text{-}c}$	5	°C/W

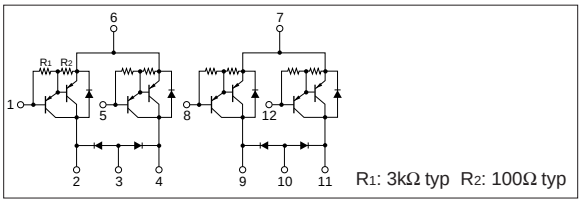
Electrical characteristics (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–100V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–100			V	I_C=–10mA
h_{FE}	2000	5000	15000		V_{CE}=–2V, I_C=–3A
V_{CE}(sat)		–1.0	–1.5	V	I_C=–3A, I_B=–6mA
V_{BE}(sat)		–1.6	–2.0	V	

●Diode for flyback voltage absorption (Ta=25°C)

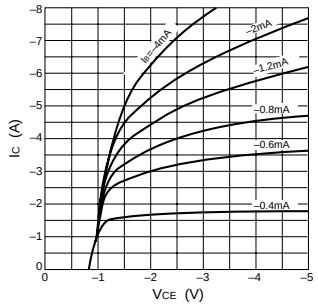
Symbol	Specification			Unit	Conditions
	min	typ	max		
V_R	120			V	I_R=10μA
V_F			1.2	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F=±100mA

■Equivalent circuit diagram

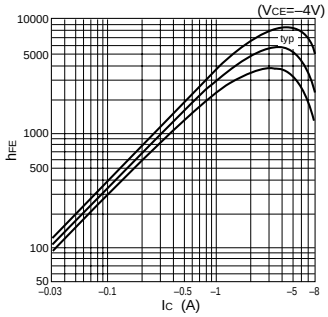


Characteristic curves

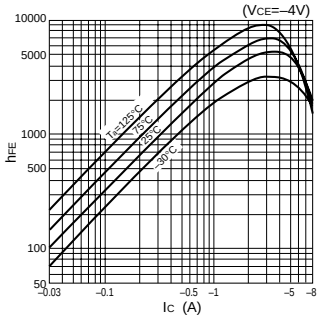
I_C-V_{CE} Characteristics (Typical)



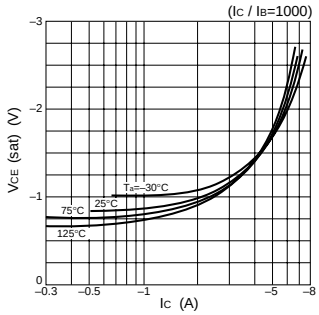
h_{FE}-I_C Characteristics (Typical)



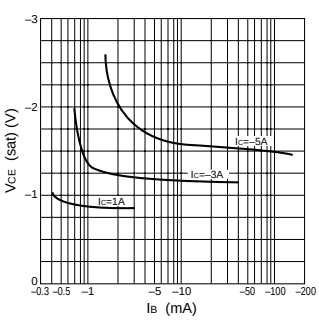
h_{FE}-I_C Temperature Characteristics (Typical)



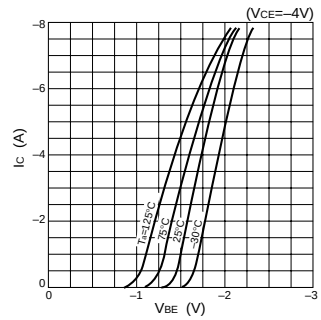
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



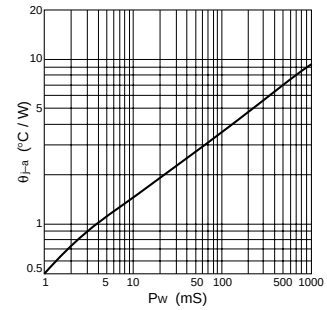
V_{CE}(sat)-I_B Characteristics (Typical)



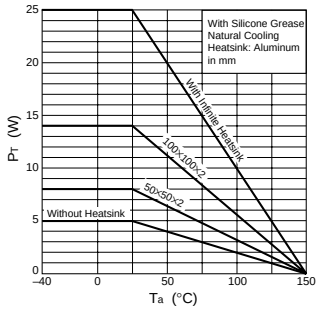
I_C-V_{BE} Temperature Characteristics (Typical)



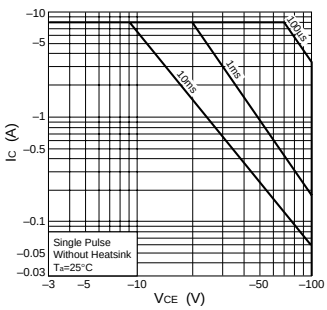
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)

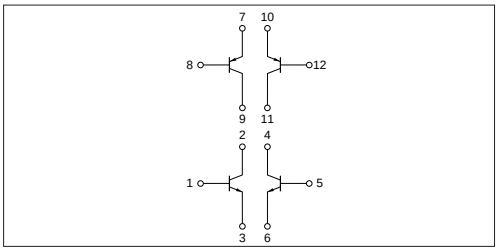


Absolute maximum ratings

(Ta=25°C)

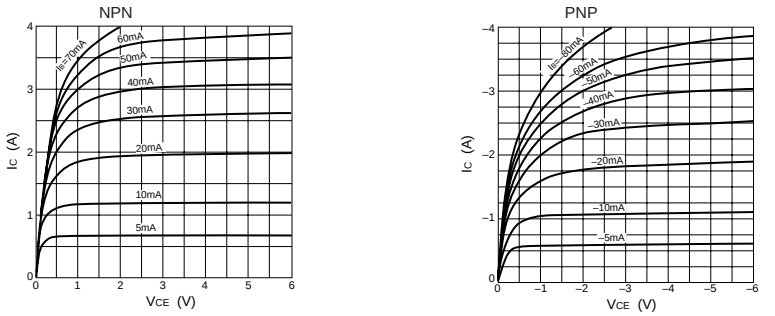
Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	4	–4	A
I_{CP}	6 (PW≤1ms, Du≤50%)	–6 (PW≤1ms, Du≤50%)	A
I_B	1	–1	A
P_T	5 (Ta=25°C)		W
	25 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
$\theta_{j\text{-}c}$	5		°C/W

■Equivalent circuit diagram

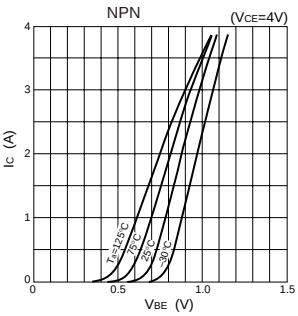


Characteristic curves

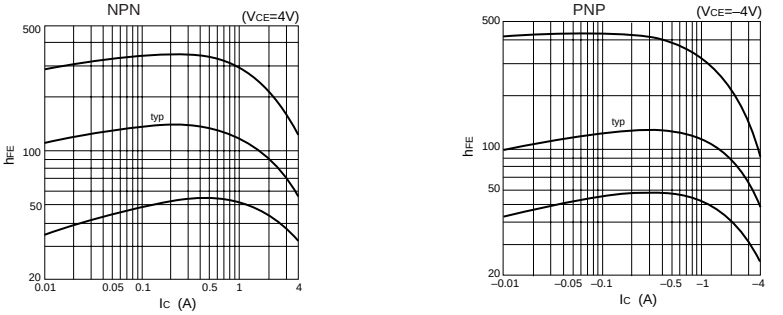
I_C-V_{CE} Characteristics (Typical)

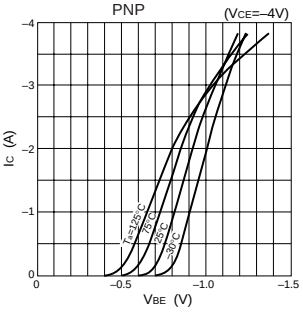


I_C-V_{BE} Temperature Characteristics (Typical)

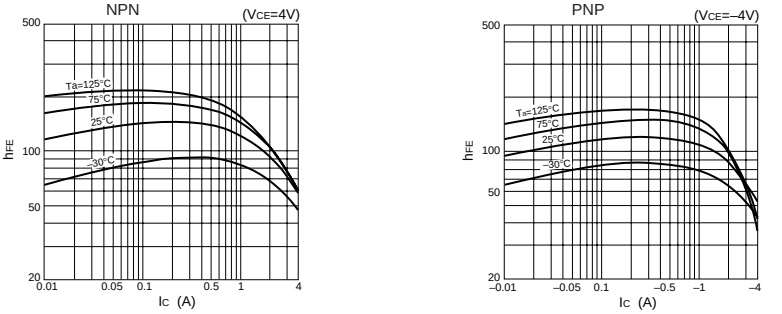


h_{FE}-I_C Characteristics (Typical)





h_{FE}-I_C Temperature Characteristics (Typical)



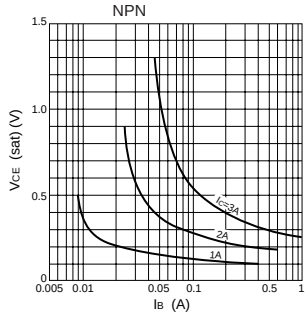
Electrical characteristics

(T_a=25°C)

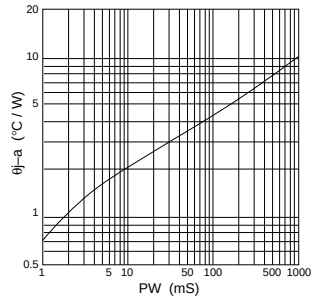
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V			–10	μA	V_{CB}=–60V
I_{EBO}			10	μA	V_{EB}=6V			–10	μA	V_{EB}=–6V
V_{CEO}	60			V	I_C=25mA	–60			V	I_C=–25mA
h_{FE}	80				V_{CE}=4V, I_C=1A	80				V_{CE}=–4V, I_C=–1A
V_{CE}(sat)			0.6	V	I_C=2A, I_B=0.2A			–0.6	V	I_C=–2A, I_B=–0.2A

Characteristic curves

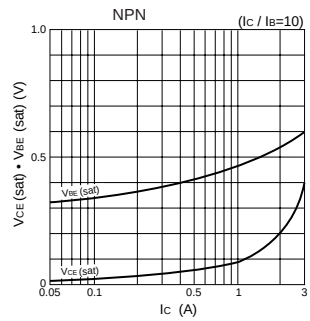
V_{CE}(sat)-I_B Characteristics (Typical)



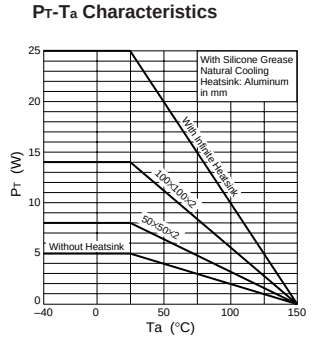
θ_{j-a}-PW Characteristics



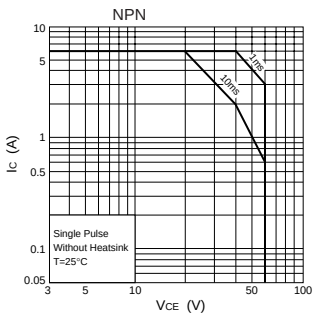
V_{CE}(sat) • V_{BE}(sat)-I_C Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

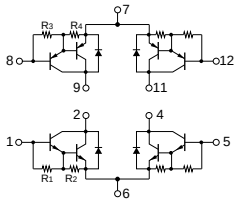


Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	4	–4	A
I_{CP}	6 (PW≤1ms, Du≤50%)	–6 (PW≤1ms, Du≤50%)	A
I_B	0.5	–0.5	A
P_T	5 (Ta=25°C)		W
	25 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
$\theta_{j\text{-}c}$	5		°C/W

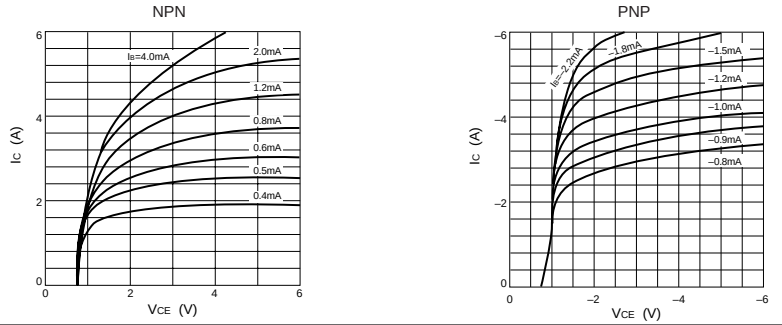
■Equivalent circuit diagram



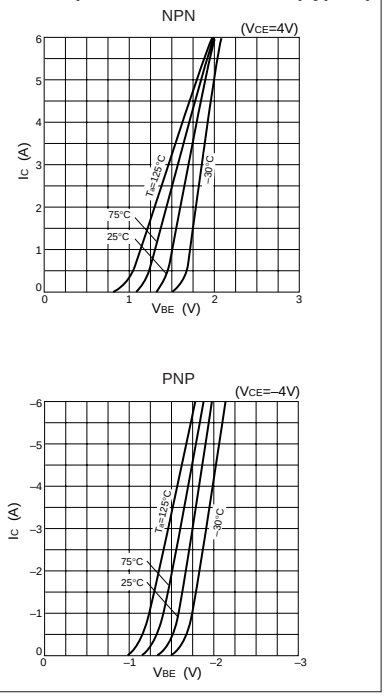
R1: 3kΩ typ R2: 200Ω typ R3: 3kΩ typ R4: 150Ω typ

Characteristic curves

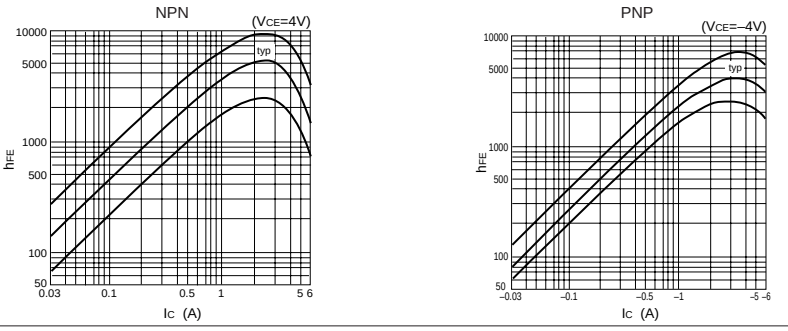
IC-VCE Characteristics (Typical)



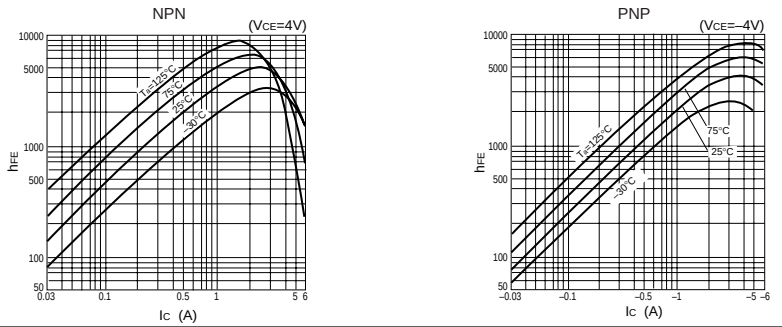
IC-VBE Temperature Characteristics (Typical)



hFE-IC Characteristics (Typical)



hFE-IC Temperature Characteristics (Typical)



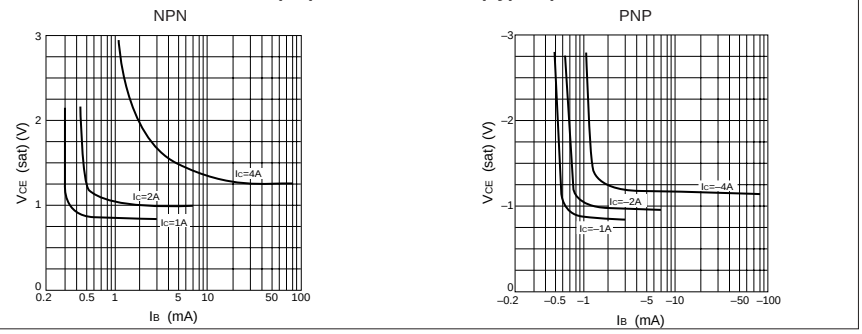
Electrical characteristics

(T_a=25°C)

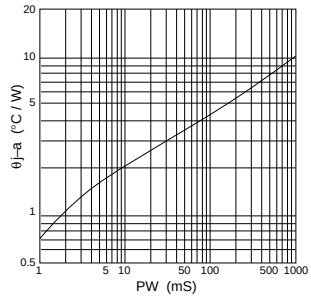
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V			–10	μA	V_{CB}=–60V
I_{EBO}			10	mA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	2000				V_{CE}=4V, I_C=3A	2000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=6mA			–1.5	V	I_C=–3A, I_B=–6mA

Characteristic curves

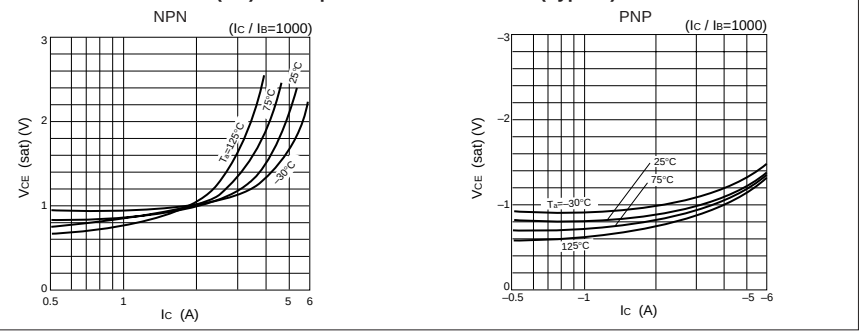
V_{CE}(sat)-I_B Characteristics (Typical)



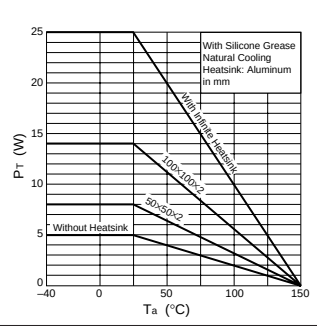
$\theta_{j\text{-}a}$-PW Characteristics



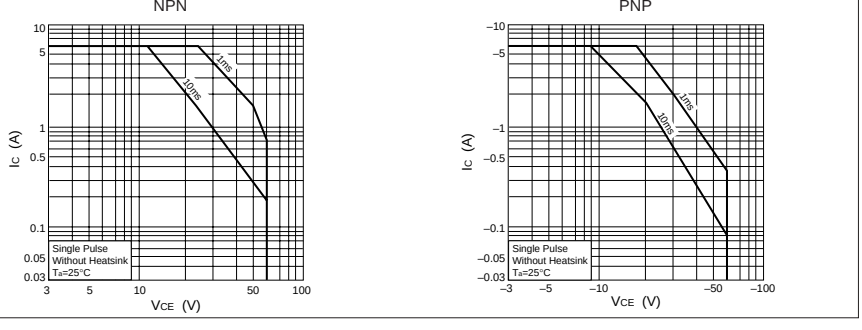
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

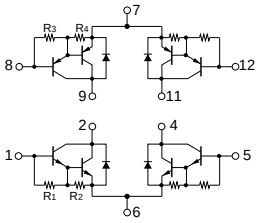


Absolute maximum ratings

(Ta=25°C)

Symbol	Specification		Unit
	NPN	PNP	
V_{CBO}	100	–100	V
V_{CEO}	100	–100	V
V_{EBO}	6	–6	V
I_C	5	–5	A
I_{CP}	8 (PW≤1ms, Du≤50%)	–8 (PW≤1ms, Du≤50%)	A
I_B	0.5	–0.5	A
P_T	5 (Ta=25°C)		W
	25 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	5		°C/W

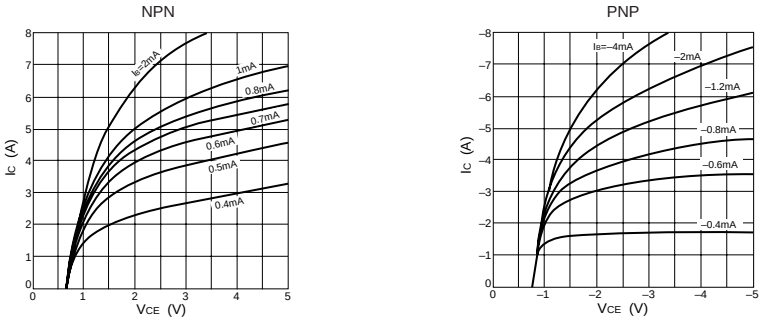
■Equivalent circuit diagram



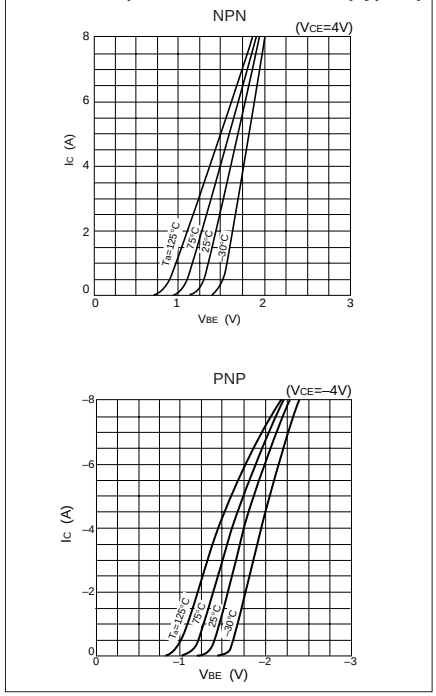
R1: 2.5kΩ typ R2: 200Ω typ R3: 3kΩ typ R4: 100Ω typ

Characteristic curves

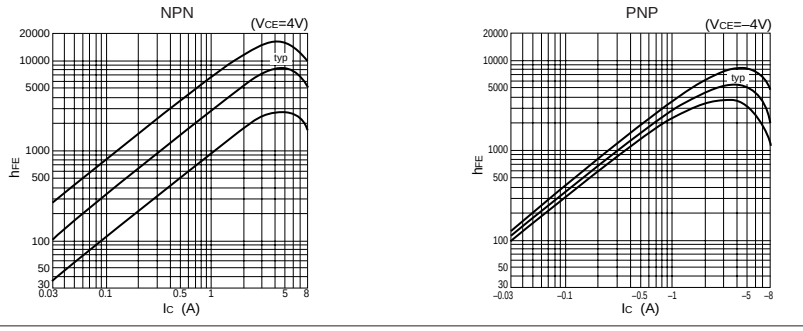
IC-VCE Characteristics (Typical)



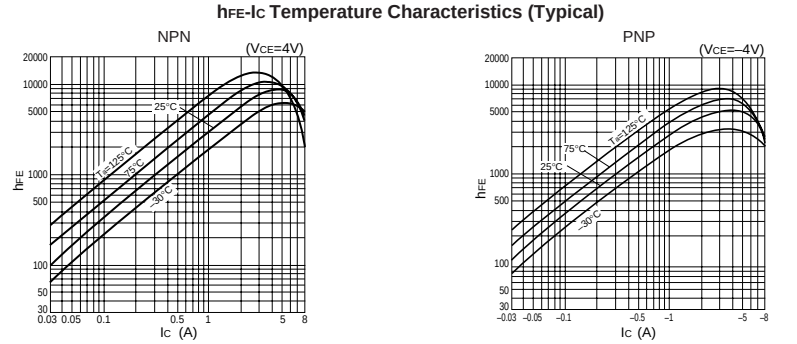
IC-VBE Temperature Characteristics (Typical)



hFE-IC Characteristics (Typical)



hFE-IC Temperature Characteristics (Typical)



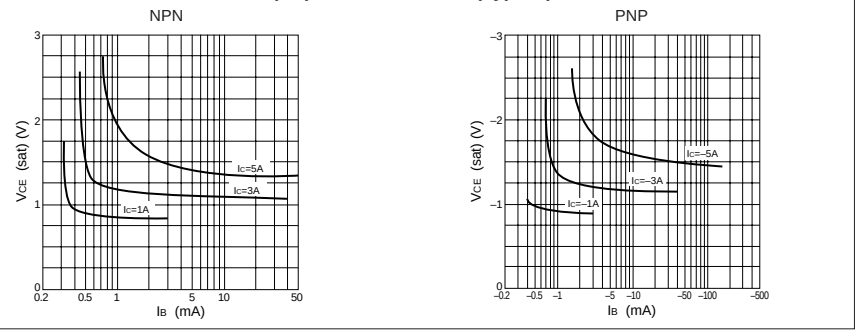
Electrical characteristics

(T_a=25°C)

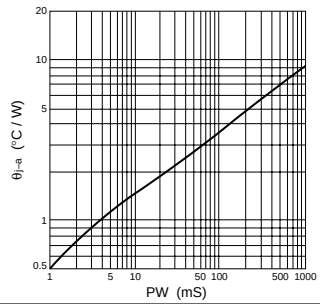
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=100V			–10	μA	V_{CB}=–100V
I_{EBO}			10	mA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	100			V	I_C=10mA	–100			V	I_C=–10mA
h_{FE}	2000				V_{CE}=4V, I_C=3A	2000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=6mA			–1.5	V	I_C=–3A, I_B=–6mA

Characteristic curves

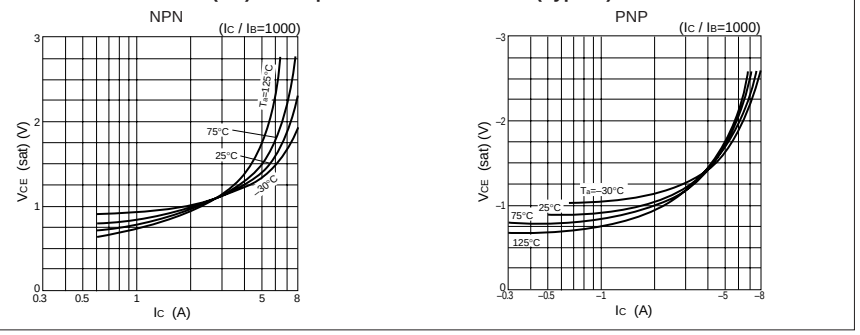
V_{CE}(sat)-I_B Characteristics (Typical)



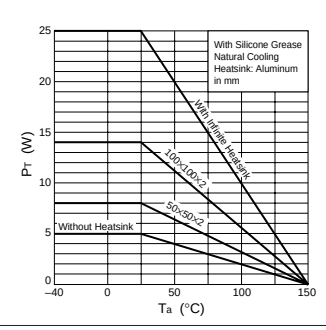
$\theta_{j\text{-}a}$-PW Characteristics



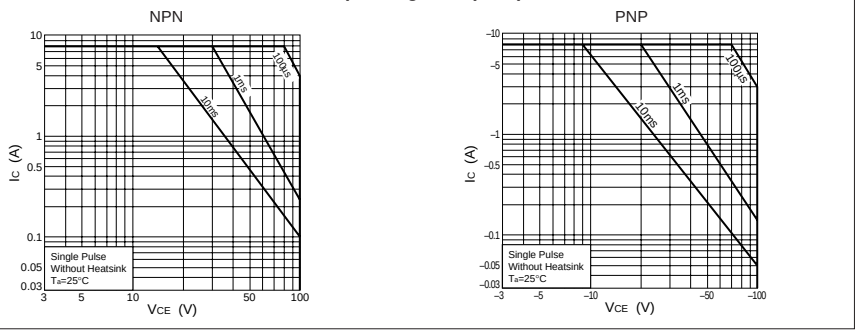
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

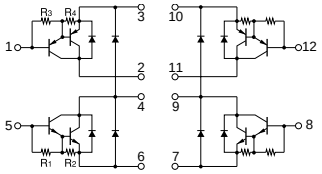


Absolute maximum ratings

(Ta=25°C)

Symbol	Specification		Unit
	NPN	PNP	
V_{CBO}	100	–100	V
V_{CEO}	100	–100	V
V_{EBO}	6	–6	V
I_C	5	–5	A
I_{CP}	8 (PW≤1ms, Du≤50%)	–8 (PW≤1ms, Du≤50%)	A
I_B	0.5	–0.5	A
I_F	5 (PW≤0.5ms, Du≤25%)		A
I_{FSM}	8 (PW≤10ms, single)		A
V_R	120		V
P_T	5 (Ta=25°C)		W
	25 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	5		°C/W

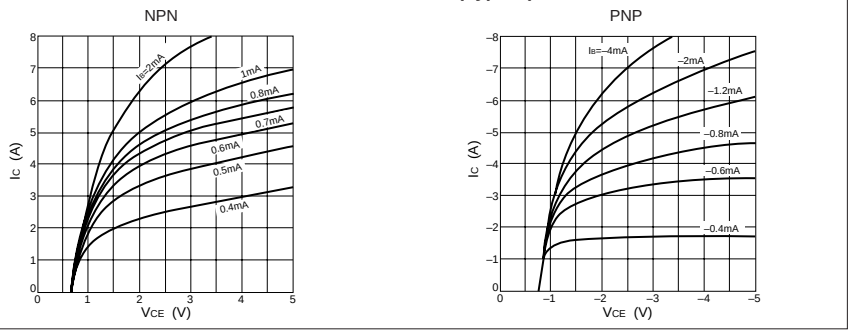
■Equivalent circuit diagram



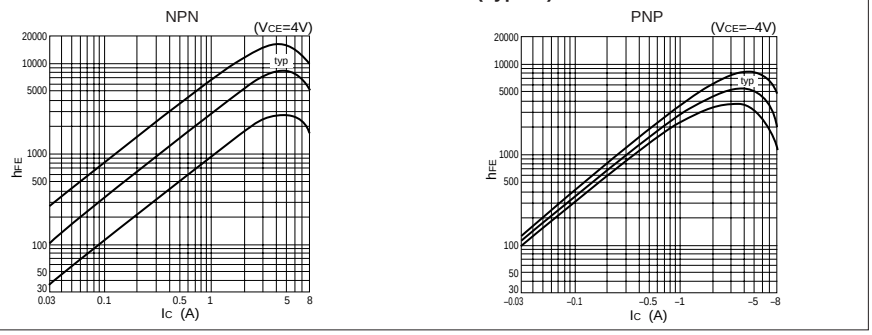
R1: 2.5kΩ typ R2: 200Ω typ R3: 3kΩ typ R4: 100Ω typ

Characteristic curves

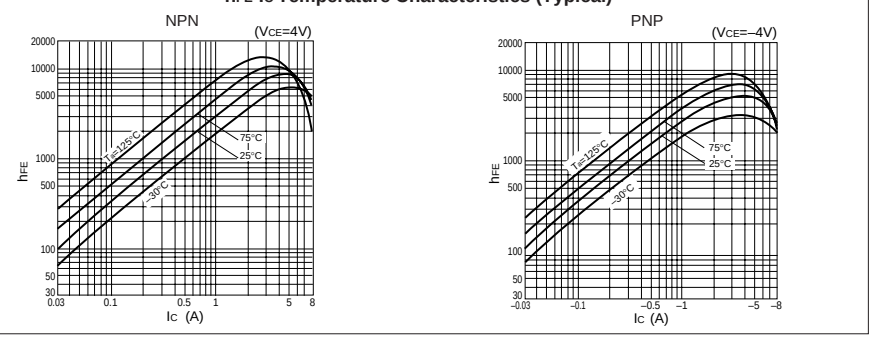
IC-VCE Characteristics (Typical)



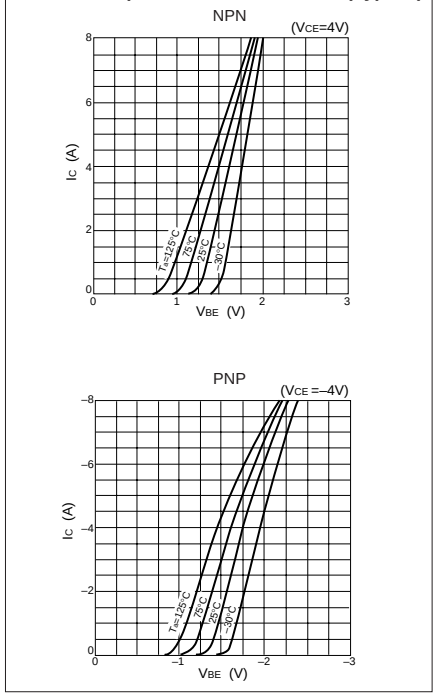
hFE-IC Characteristics (Typical)



hFE-IC Temperature Characteristics (Typical)



IC-VBE Temperature Characteristics (Typical)



Electrical characteristics

(Ta=25°C)

Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=100V			–10	μA	V_{CB}=–100V
I_{EBO}			10	mA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	100			V	I_C=10mA	–100			V	I_C=–10mA
h_{FE}	1000				V_{CE}=4V, I_C=3A	1000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=6mA			–1.5	V	I_C=–3A, I_B=–6mA

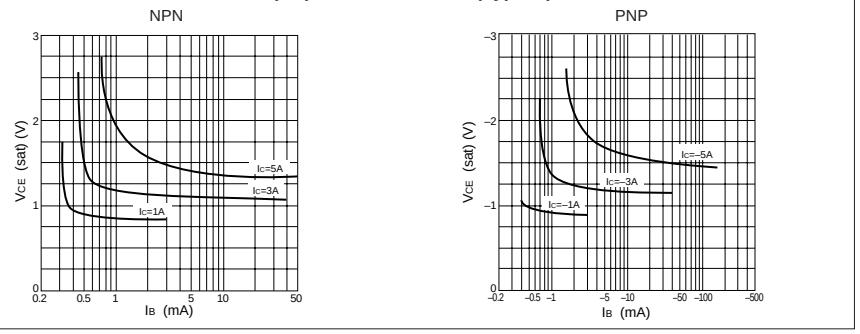
●Diode for flyback voltage absorption

(Ta=25°C)

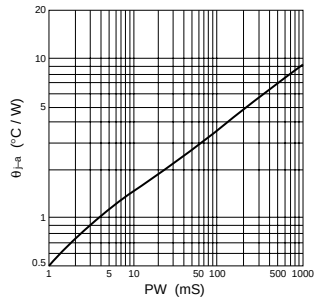
Symbol	Specification			Unit	Conditions
	min	typ	max		
V_R	120			V	I_R=10μA
V_F			1.2	V	I_F=1A
I_R			10	μA	V_R=100V

Characteristic curves

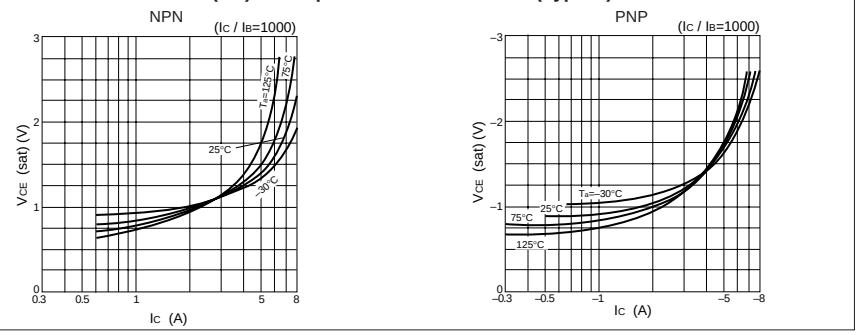
V_{CE}(sat)-I_B Characteristics (Typical)



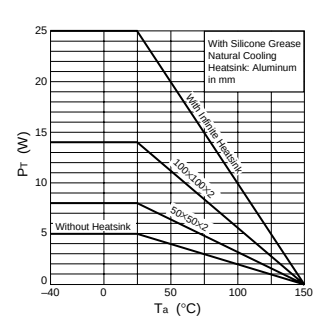
$\theta_{j\text{-}a}$-PW Characteristics



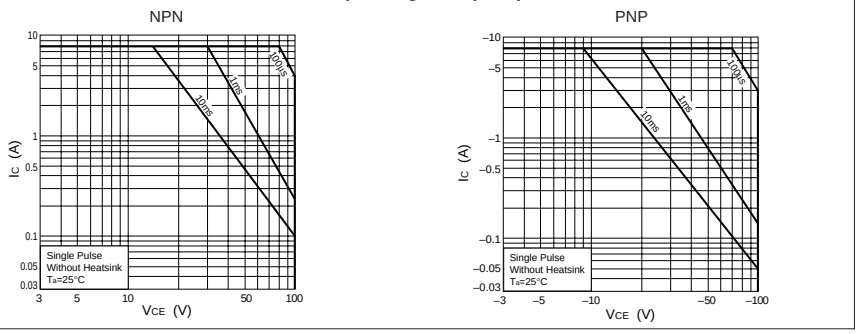
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)



SLA5001

N-channel
General purpose

Absolute maximum ratings (Ta=25°C)

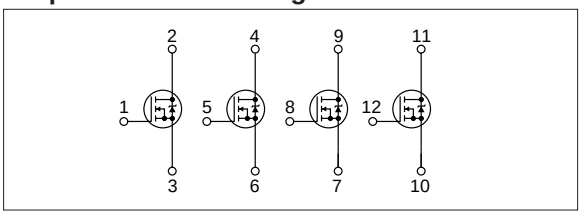
Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±5	A
$I_{D(pulse)}$	±10(PW≤1ms)	A
E_{AS}*	30	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θ_{j-a}	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θ_{j-c}	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	2.4	3.7		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		0.27	0.30	Ω	V_{GS}=10V, I_D=5A
Ciss		350		pF	V_{DS}=25V, f=1.0MHz,
Coss		130		pF	V_{GS}=0V
ton		60		ns	I_D=5A, V_{DD}≒50V, V_{GS}=10V,
toff		40		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.8	V	I_{SD}=5A, V_{GS}=0V
trr		330		ns	I_{SD}=±100mA

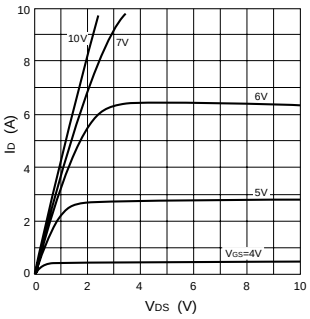
* : V_{DD}=20V, L=10mH, I_D=2.5A, unclamped, see Fig. E on page 15.

■Equivalent circuit diagram

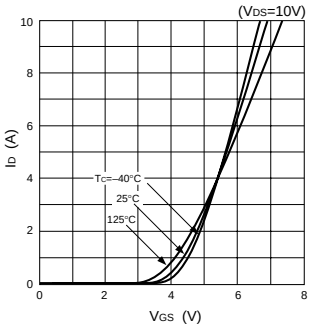


Characteristic curves

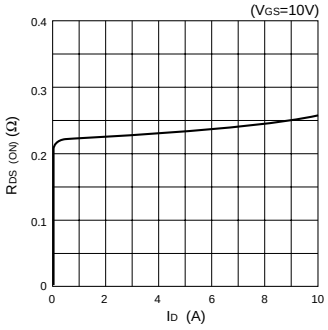
I_D-V_{DS} Characteristics (Typical)



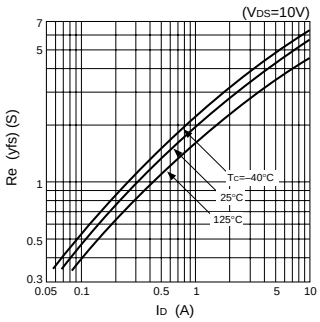
I_D-V_{GS} Characteristics (Typical)



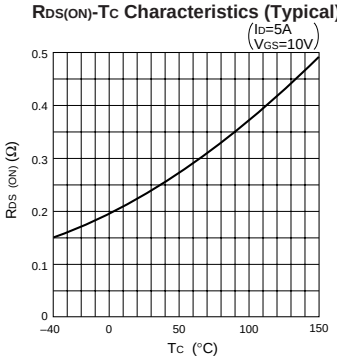
$R_{DS(ON)}$-I_D Characteristics (Typical)



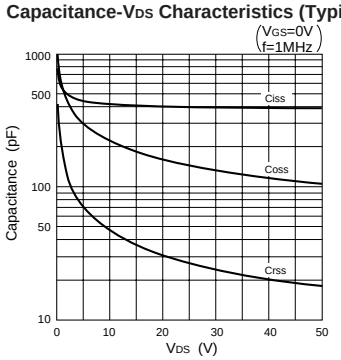
$Re_{(yfs)}$-I_D Characteristics (Typical)



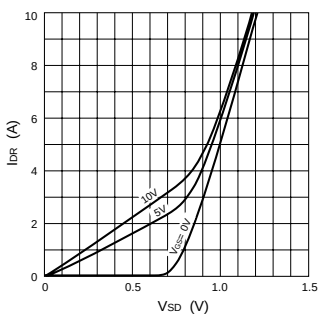
$R_{DS(ON)}$-Tc Characteristics (Typical)



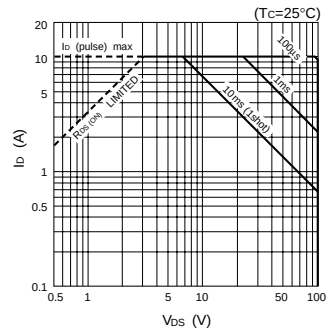
Capacitance-V_{DS} Characteristics (Typical)



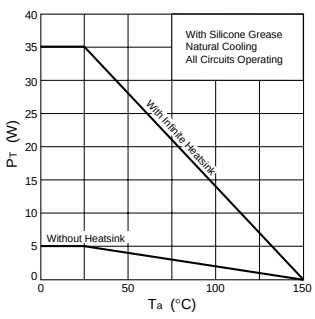
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5002

N-channel
With built-in flywheel diode

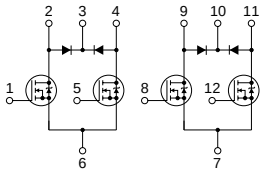
Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±5	A
$I_{D(pulse)}$	±10 (PW≤1ms)	A
E_{AS}*	30	mJ
I_F	5 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	10 (PW≤10ms, Single Pulse)	A
V_R	120	V
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=20V, L=10mH, I_D=2.5A, unclamped, see Fig. E on page 15

■Equivalent circuit diagram



Electrical characteristics

(Ta=25°C)

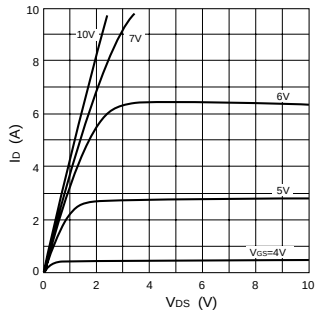
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA
Re(yfs)	2.4	3.7		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		0.27	0.30	Ω	V_{GS}=10V, I_D=5A
Ciss		350		pF	V_{DS}=25V, f=1.0MHz,
Coss		130		pF	V_{GS}=0V
ton		60		ns	I_D=5A, V_{DD}≒50V, V_{GS}=10V,
toff		40		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.8	V	I_{SD}=5A, V_{GS}=0V
trr		330		ns	I_{SD}=±100mA

●Diode for flyback voltage absorption

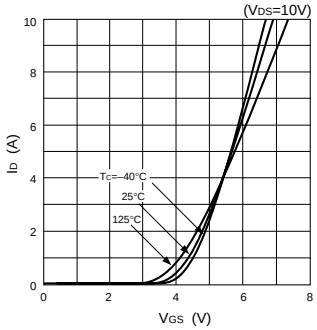
Symbol	Specification			Unit	Conditions
	min	typ	max		
V_R	120			V	I_R=10μA
V_F		1.0	1.2	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F=±100mA

Characteristic curves

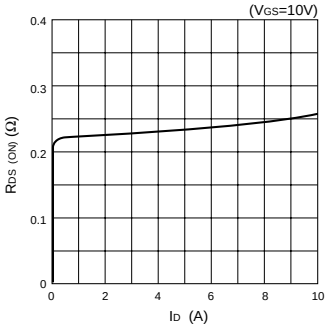
I_D-V_{DS} Characteristics (Typical)



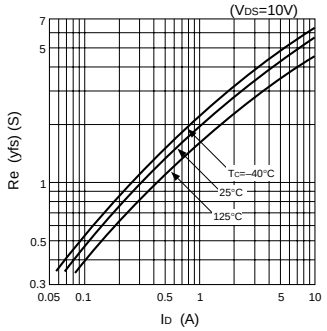
I_D-V_{GS} Characteristics (Typical)



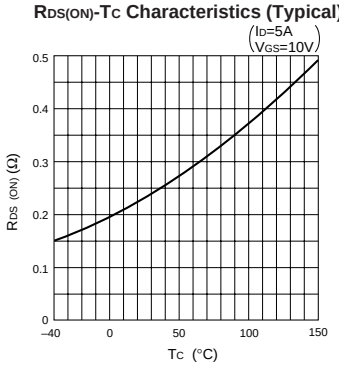
$R_{DS(ON)}$-I_D Characteristics (Typical)



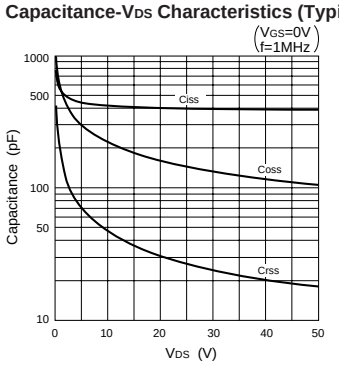
Re(yfs)-I_D Characteristics (Typical)



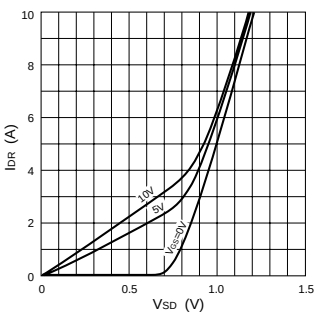
$R_{DS(ON)}$-T_C Characteristics (Typical)



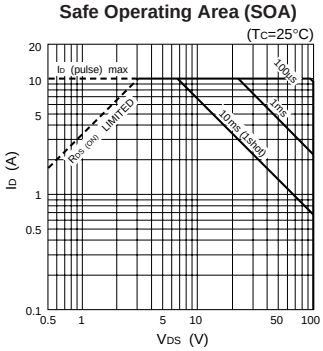
Capacitance-V_{DS} Characteristics (Typical)



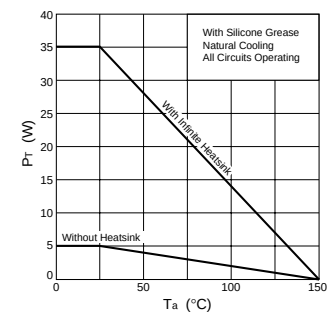
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5003

N-channel
With built-in flywheel diode

External dimensions Ⓐ ··· SLA

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	200	V
V_{GSS}	±20	V
I_D	±5	A
$I_{D(pulse)}$	±10 (PW≤1ms)	A
E_{AS}*	60	mJ
I_F	5(PW≤0.5ms, Du≤25%)	A
I_{FSM}	10(PW≤10ms, Single pulse)	A
V_R	200	V
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=20V, L=10mH, I_D=3.5A, unclamped, see Fig. E on page 15.

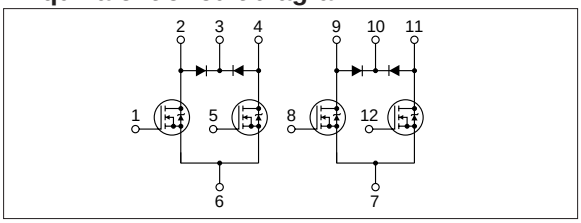
Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
$V_{(BR)DSS}$	200			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V
I_{DSS}			250	μA	V_{DS}=200V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.3	2.5		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		0.67	0.9	Ω	V_{GS}=10V, I_D=5A
Ciss		260		pF	V_{DS}=25V, f=1.0MHz,
Coss		100		pF	V_{GS}=0V
ton		50		ns	I_D=5A, V_{DD}≒100V, V_{GS}=10V,
toff		60		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A, V_{GS}=0V
trr		700		ns	I_{SD}=±100mA

●Diode for flyback voltage absorption (1 circuit)

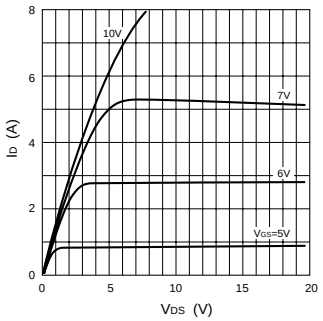
Symbol	Specification min	typ	max	Unit	Conditions
V_R	200			V	I_R=10μA
V_F		1.0	1.2	V	I_F=1A
		1.5	2.0	V	I_F=5A
I_R			10	μA	V_R=200V
trr		100		ns	I_F=±100mA

■Equivalent circuit diagram

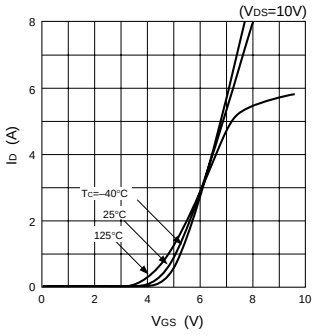


Characteristic curves

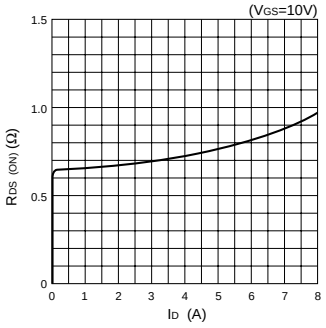
I_D-V_{DS} Characteristics (Typical)



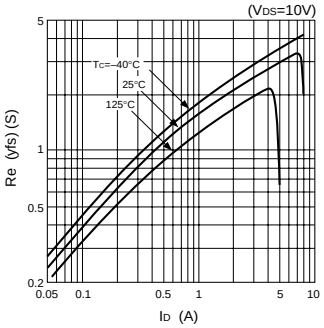
I_D-V_{GS} Characteristics (Typical)



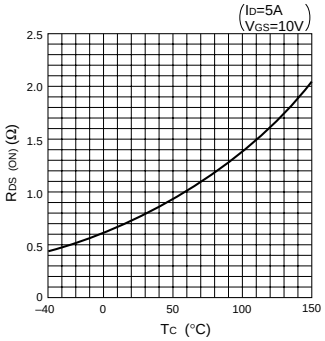
$R_{DS(ON)}$-I_D Characteristics (Typical)



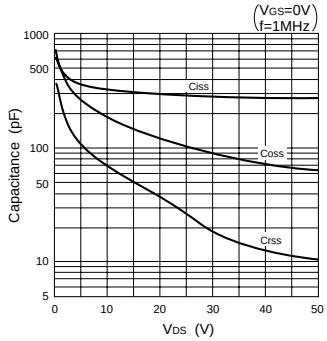
$Re_{(yfs)}$-I_D Characteristics (Typical)



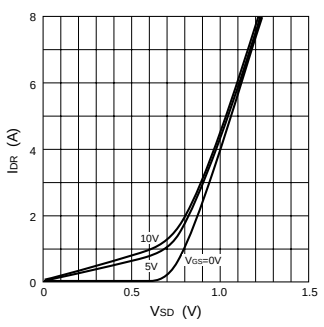
$R_{DS(ON)}$-Tc Characteristics (Typical)



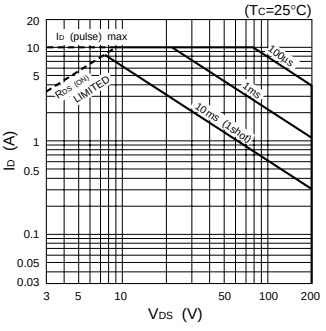
Capacitance-V_{DS} Characteristics (Typical)



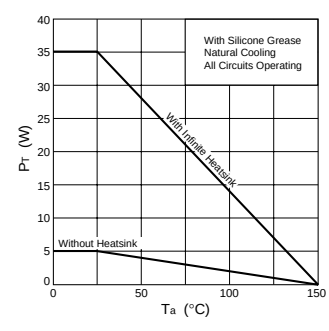
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5004

P-channel
General purpose

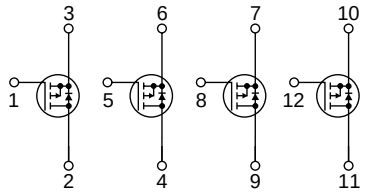
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	–60	V
V_{GSS}	∓20	V
I_D	∓5	A
$I_{D(pulse)}$	∓10 (PW≤1ms)	A
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

Electrical characteristics (Ta=25°C)

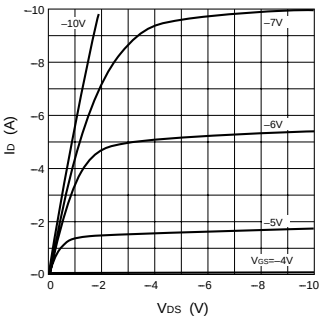
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			∓500	nA	V_{GS}=∓20V
I_{DSS}			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	2.3	3.5		S	V_{DS}=–10V, I_D=–5A
$R_{DS(ON)}$		0.22	0.30	Ω	V_{GS}=–10V, I_D=–5A
Ciss		570		pF	V_{DS}=–25V, f=1.0MHz,
Coss		360		pF	V_{GS}=0V
ton		100		ns	I_D=–5A, V_{DD}≒–30V, V_{GS}=–10V,
toff		60		ns	see Fig. 4 on page 16.
V_{SD}		–4.5	–5.5	V	I_{SD}=–5A
trr		150		ns	I_{SD}= ∓100mA

■Equivalent circuit diagram

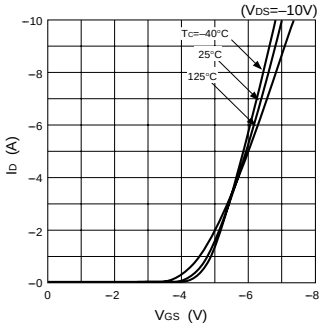


Characteristic curves

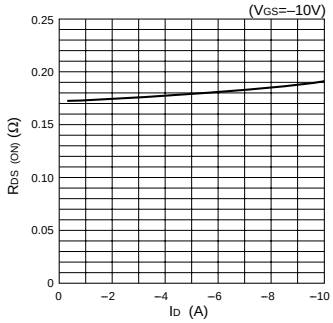
I_D-V_{DS} Characteristics (Typical)



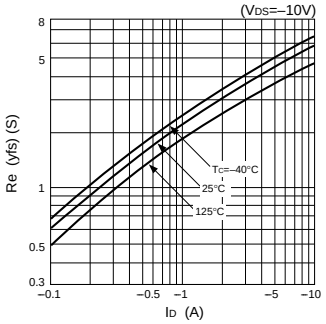
I_D-V_{GS} Characteristics (Typical)



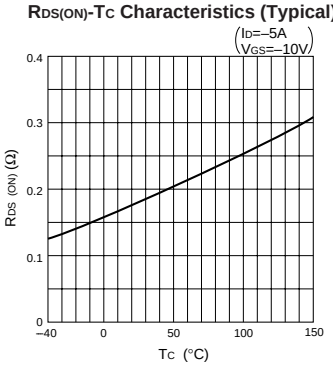
$R_{DS(ON)}$-I_D Characteristics (Typical)



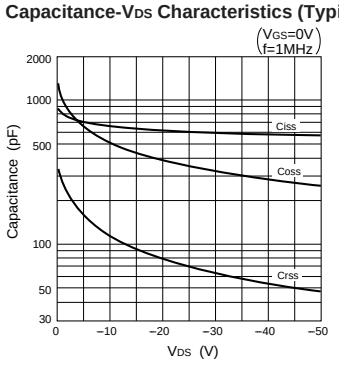
$Re_{(yfs)}$-I_D Characteristics (Typical)



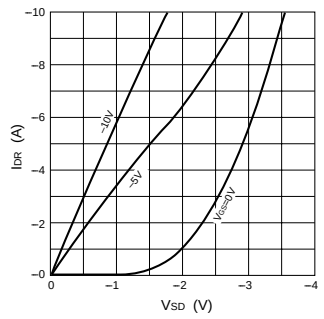
$R_{DS(ON)}$-T_C Characteristics (Typical)



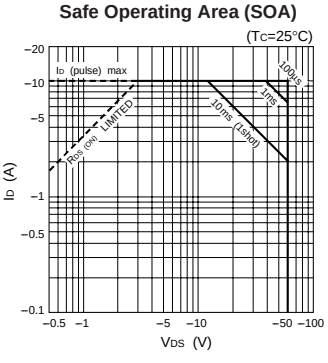
Capacitance-V_{DS} Characteristics (Typical)



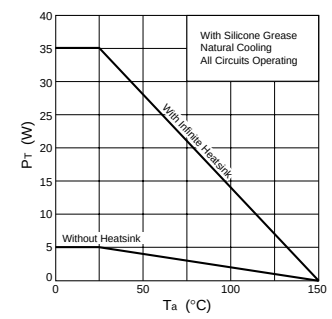
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5005

P-channel
General purpose

Absolute maximum ratings

(Ta=25°C)

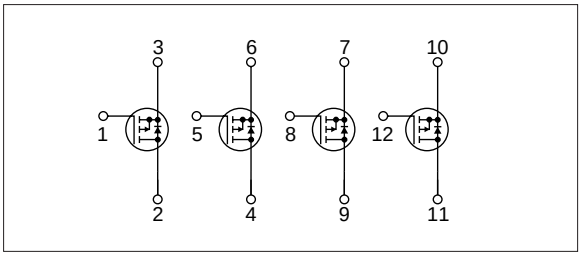
Symbol	Ratings	Unit
V_{DSS}	–100	V
V_{GSS}	∓20	V
I_D	∓5	A
$I_{D(pulse)}$	∓10 (PW≤1ms)	A
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
$\theta_{j\text{-}a}$	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
$\theta_{j\text{-}c}$	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

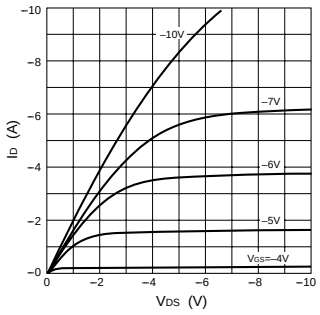
Symbol	Specifications min	typ	max	Unit	Condition
$V_{(BR)DSS}$	–100			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			∓500	nA	V_{GS}=∓20V
I_{DSS}			–250	μA	V_{DS}=–100V, V_{GS}=0V
V_{TH}	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	0.9	2.0		S	V_{DS}=–10V, I_D=–5A
$R_{DS(ON)}$		0.55	0.7	Ω	V_{GS}=–10V, I_D=–5A
Ciss		300		pF	V_{DS}=–25V, f=1.0MHz,
Coss		200		pF	V_{GS}=0V
ton		150		ns	I_D=–5A, V_{DD}≒–50V, V_{GS}=–10V,
toff		200		ns	see Fig. 4 on page 16.
V_{SD}		–4.5	–5.5	V	I_{SD}=–5A, V_{GS}=0V
trr		220		ns	I_{SD}=∓100mA

■Equivalent circuit diagram

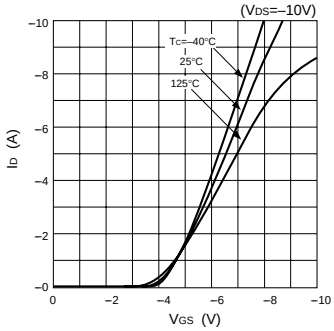


Characteristic curves

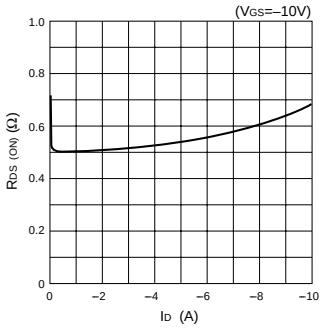
I_D-V_{DS} Characteristics (Typical)



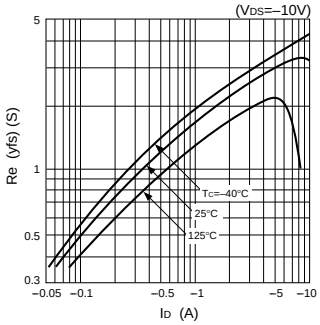
I_D-V_{GS} Characteristics (Typical)



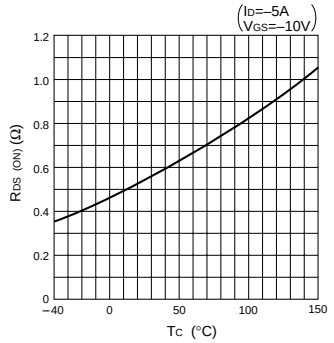
$R_{DS(ON)}$-I_D Characteristics (Typical)



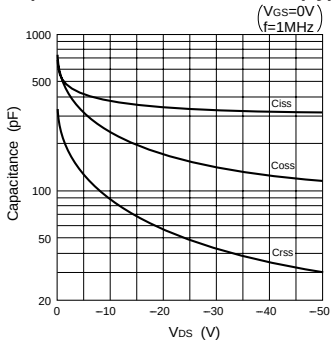
$Re_{(yfs)}$-I_D Characteristics (Typical)



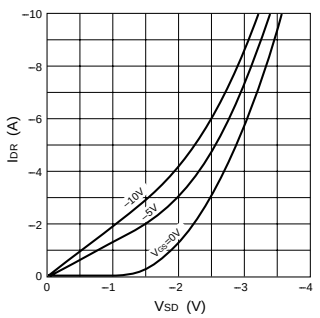
$R_{DS(ON)}$-Tc Characteristics (Typical)



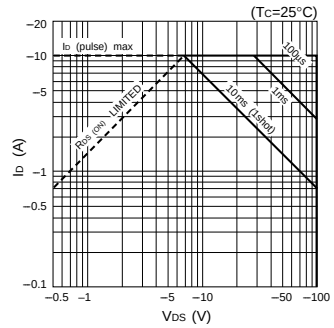
Capacitance-V_{DS} Characteristics (Typical)



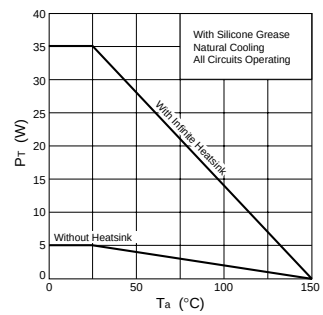
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-Ta Characteristics



SLA5006

P-channel

With built-in flywheel diode

Absolute maximum ratings

(Ta=25°C)

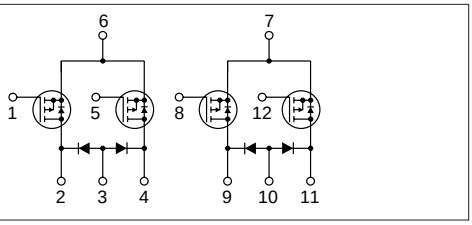
Symbol	Ratings	Unit
V_{DSS}	–100	V
V_{GSS}	∓20	V
I_D	∓5	A
$I_{D(pulse)}$	∓10(PW≤1ms)	A
I_F	5(PW≤0.5ms, Du≤25%)	A
I_{FSM}	10(PW≤10ms, Single pulse)	A
V_R	120	V
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Condition
	min	typ	max		
$V_{(BR)DSS}$	–100			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			∓500	nA	V_{GS}=∓20V
I_{DSS}			–250	μA	V_{DS}=–100V, V_{GS}=0V
V_{TH}	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	0.9	2.0		S	V_{DS}=–10V, I_D=–5A
$R_{DS(ON)}$		0.55	0.7	Ω	V_{GS}=–10V, I_D=–5A
Ciss		300		pF	V_{DS}=–25V, f=1.0MHz,
Coss		200		pF	V_{GS}=0V
ton		150		ns	I_D=–5A, V_{DD}≒–50V, V_{GS}=–10V,
toff		200		ns	see Fig. 4 on page 16.
V_{SD}		–4.5	–5.5	V	I_{SD}=–5A, V_{GS}=0V
trr		220		ns	I_{SD}= ∓100mA

■Equivalent circuit diagram

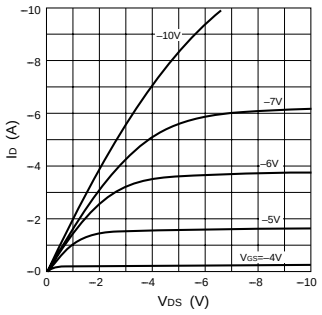


●Diode for flyback voltage absorption

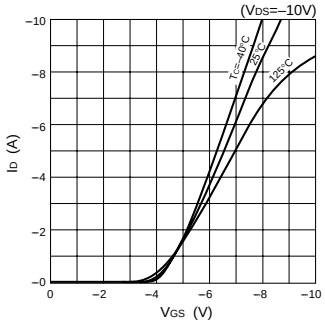
Symbol	Specification			Unit	Condition
	min	typ	max		
V_R	120			V	I_R=10μA
V_F		1.0	1.2	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F= ∓100mA

Characteristic curves

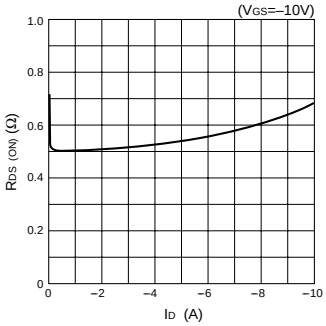
I_D-V_{DS} Characteristics (Typical)



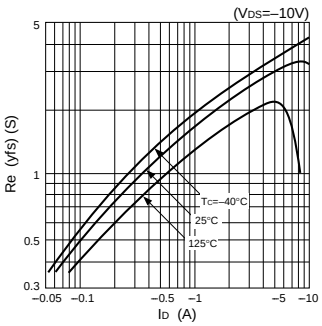
I_D-V_{GS} Characteristics (Typical)



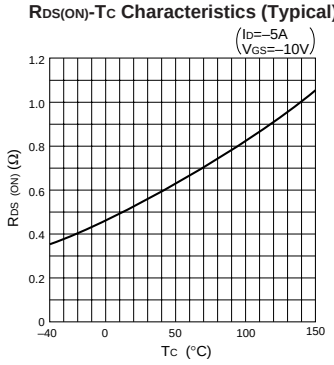
$R_{DS(ON)}$-I_D Characteristics (Typical)



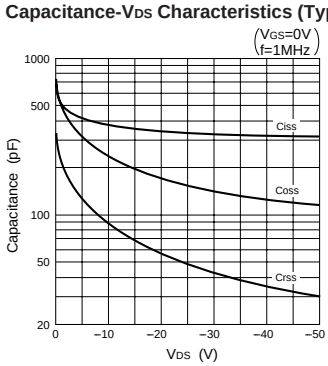
$Re_{(yfs)}$-I_D Characteristics (Typical)



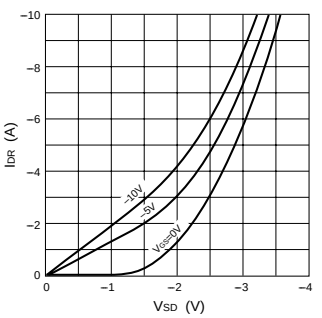
$R_{DS(ON)}$-Tc Characteristics (Typical)



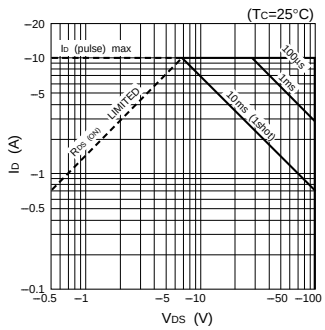
Capacitance-V_{DS} Characteristics (Typical)



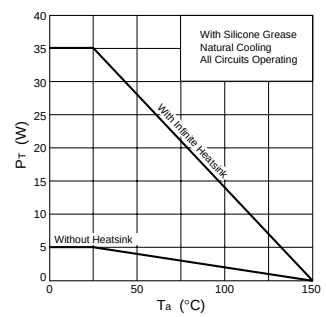
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-Ta Characteristics



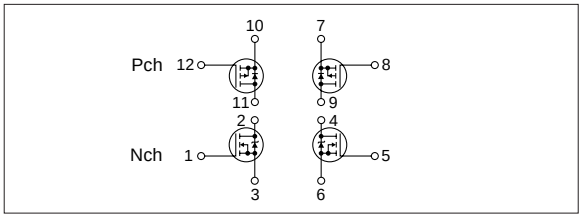
Absolute maximum ratings

(Ta=25°C)

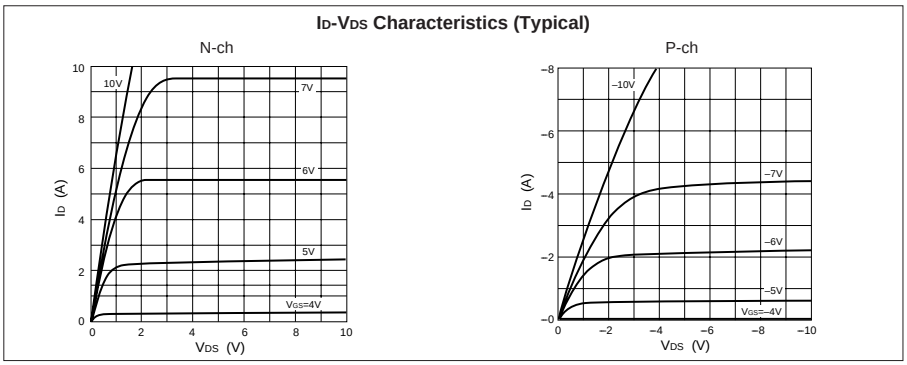
Symbol	Ratigs		Unit
	N channel	P channel	
V_{DSS}	60	–60	V
V_{GSS}	±20	∓20	V
I_D	±5	∓4	A
$I_{D(pulse)}$	±10 (PW≤1ms)	∓8 (PW≤1ms)	A
E_{AS}*	2	—	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)		W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)		W
$\theta_{j\text{-}a}$	25 (Junction-Air, Ta=25°C, with all circuits operating)		°C/W
$\theta_{j\text{-}c}$	3.57 (Junction-Case, Tc=25°C, with all circuits operating)		°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)		Vrms
Tch	150		°C
Tstg	–40 to +150		°C

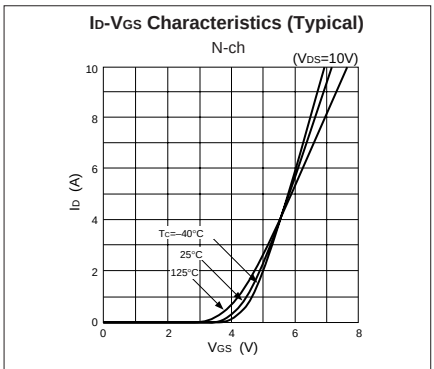
* : V_{DD}=20V, L=1mH, I_D=2A, unclamped, see Fig. E on page 15.

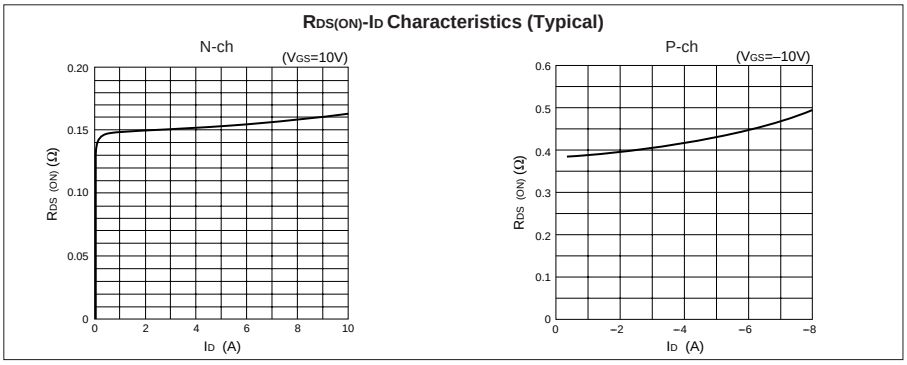
■Equivalent circuit diagram

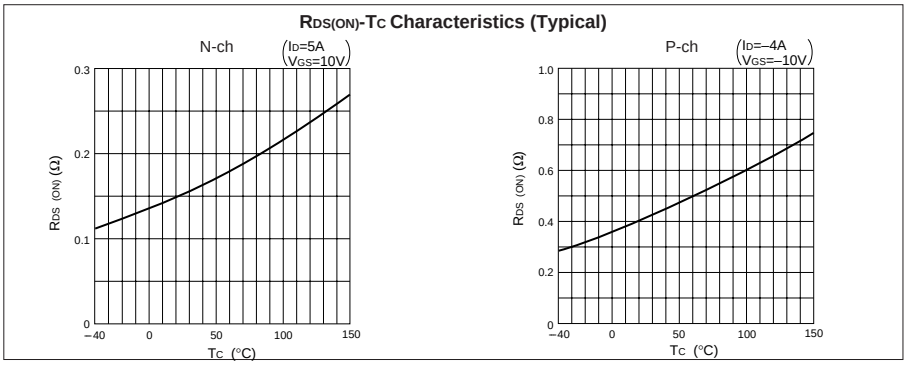


Characteristic curves









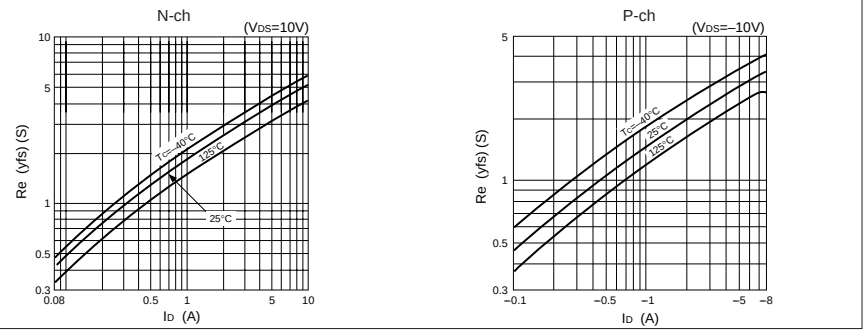
Electrical characteristics

(T_a=25°C)

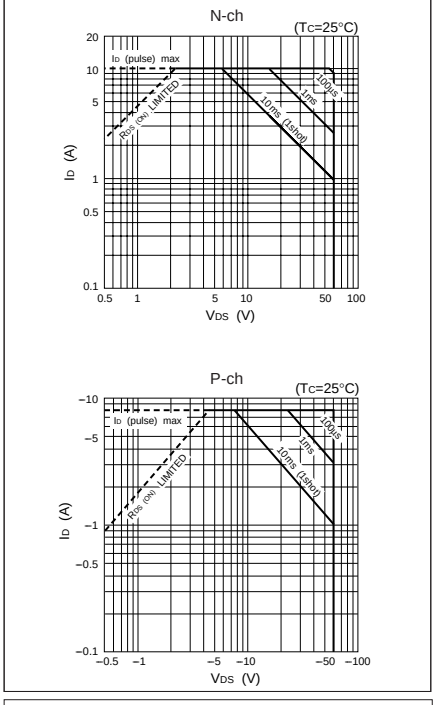
Symbol	N channel					P channel				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V			∓500	nA	V_{GS}=∓20V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	2.2	3.3		S	V_{DS}=10V, I_D=5A	1.6	2.2		S	V_{DS}=–10V, I_D=–4A
$R_{DS(ON)}$		0.17	0.22	Ω	V_{GS}=10V, I_D=5A		0.38	0.55	Ω	V_{GS}=–10V, I_D=–4A
Ciss		300		pF	V_{DS}=25V, f=1.0MHz,		270		pF	V_{DS}=–25V, f=1.0MHz,
Coss		160		pF	V_{GS}=0V		170		pF	V_{GS}=0V
t_{on}		35		ns	I_D=5A, V_{DD}≒30V,V_{GS}=10V		60		ns	I_D=–4A, V_{DD}≒–30V,V_{GS}=10V,
t_{off}		35		ns	see Fig. 3 on page 16.		60		ns	see Fig. 4 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A, V_{GS}=0V		–4.4	–5.5	V	I_{SD}=–4A, V_{GS}=0V
t_{rr}		140		ns	I_{SD}=±100mA		150		ns	I_{SD}= ∓100mA

Characteristic curves

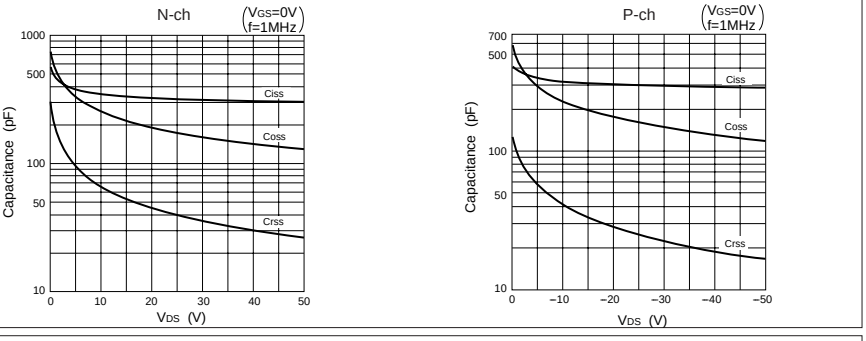
$Re_{(yfs)}$-I_D Characteristics (Typical)



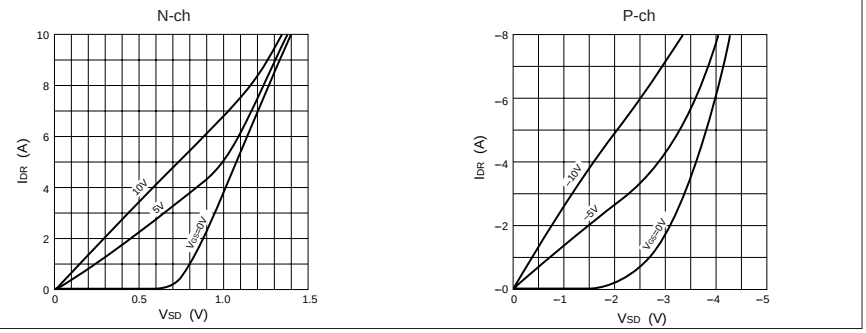
Safe Operating Area (SOA)



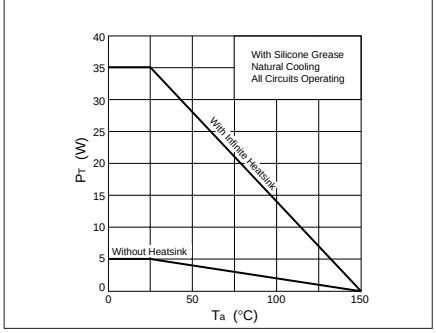
Capacitance-V_{DS} Characteristics (Typical)



I_{DR}-V_{SD} Characteristics (Typical)



P_T-T_a Characteristics



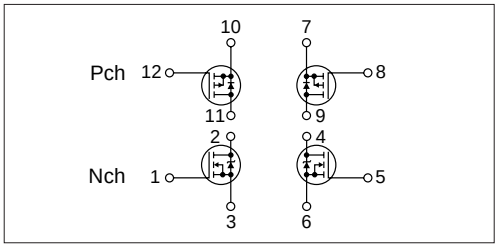
Absolute maximum ratings

(Ta=25°C)

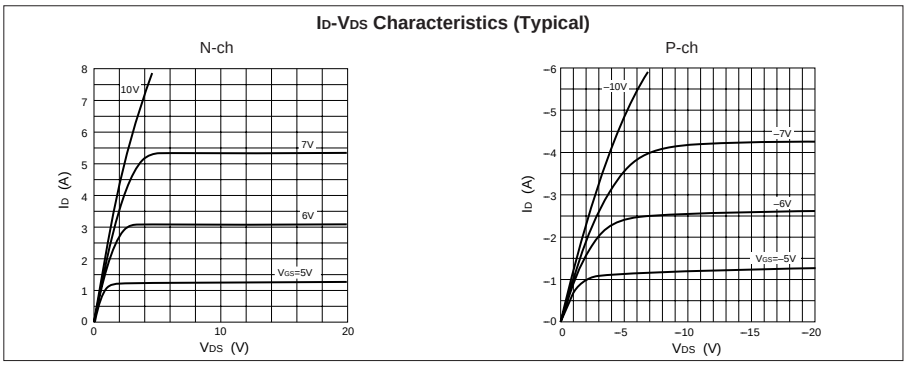
Symbol	Ratings		Unit
	N channel	P channel	
V_{DSS}	100	–100	V
V_{GSS}	±20	∓20	V
I_D	±4	∓3	A
$I_{D(pulse)}$	±8 (PW≤1ms)	∓6 (PW≤1ms)	A
E_{AS}*	15	—	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)		W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)		W
$\theta_{j\text{-}c}$	3.57		°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)		Vrms
Tch	150		°C
Tstg	–40 to +150		°C

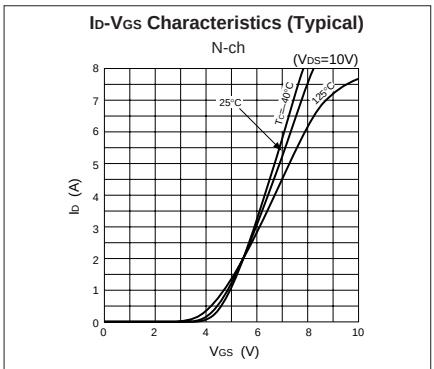
* : V_{DD}=20V, L=1mH, I_D=5A, unclamped, see Fig. E on page 15.

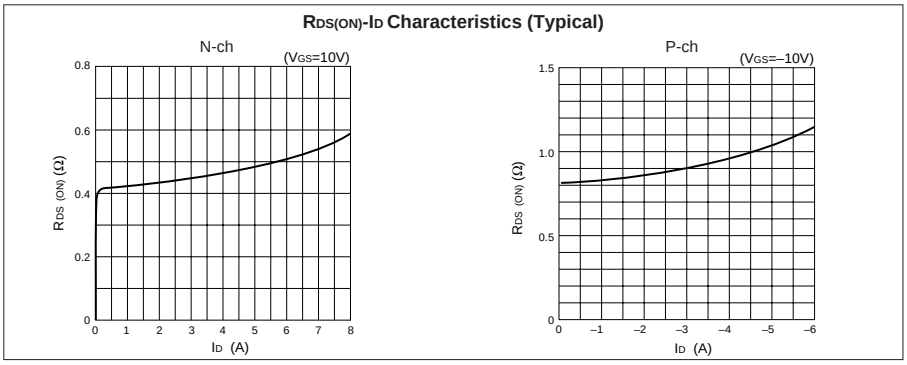
■Equivalent circuit diagram

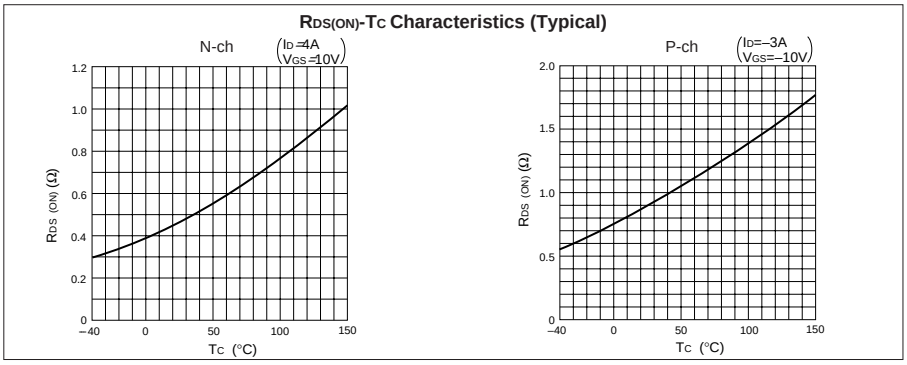


Characteristic curves









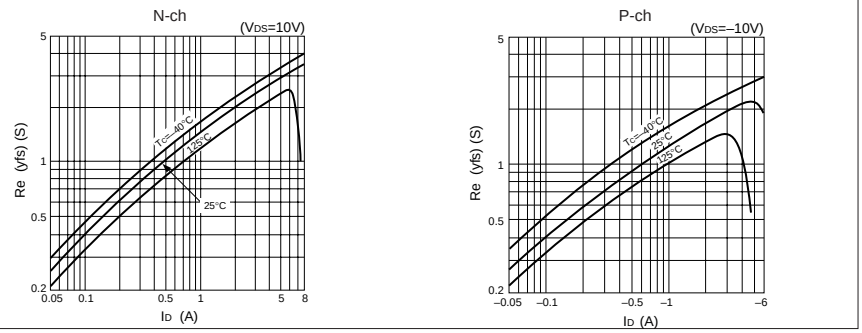
Electrical characteristics

(T_a=25°C)

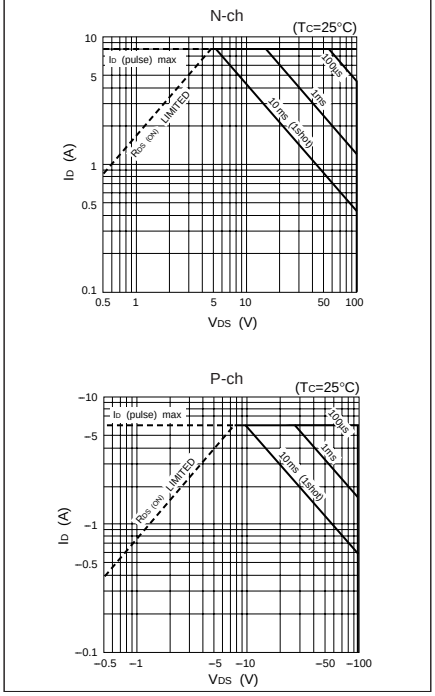
Symbol	N channel					P channel				
	Specifications			Unit	Conditions	Specifications			Unit	Conditions
	min	typ	max			min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V	–100			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V			∓500	nA	V_{GS}=∓20V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V			–250	μA	V_{DS}=–100V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	1.1	1.7		S	V_{DS}=10V, I_D=4A	0.7	1.1		S	V_{DS}=–10V, I_D=–3A
$R_{DS(ON)}$		0.50	0.60	Ω	V_{GS}=10V, I_D=4A		1.1	1.3	Ω	V_{GS}=–10V, I_D=–3A
Ciss		180		pF	V_{DS}=25V, f=1.0MHz,		180		pF	V_{DS}=–25V, f=1.0MHz,
Coss		82		pF	V_{GS}=0V		85		pF	V_{GS}=0V
t_{on}		40		ns	I_D=4A, V_{DD}≒50V, V_{GS}=–10V,		90		ns	I_D=–3A, V_{DD}≒–50V, V_{GS}=–10V,
t_{off}		40		ns	see Fig. 3 on page 16.		80		ns	see Fig. 4 on page 16.
V_{SD}		1.2	2.0	V	I_{SD}=4A		–4.0	–5.5	V	I_{SD}=–3A
t_{rr}		250		ns	I_{SD}=±100mA		250		ns	I_{SD}=∓100mA

Characteristic curves

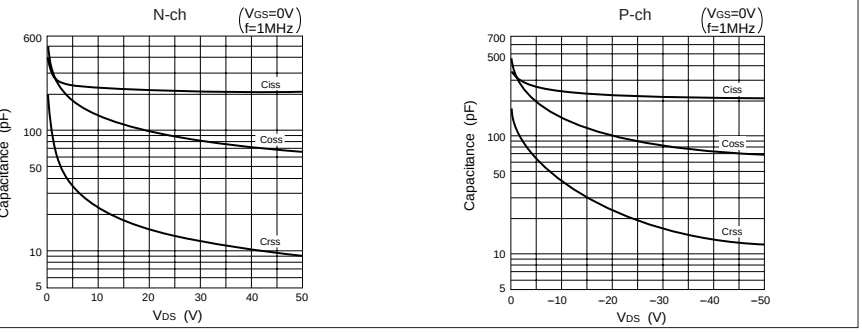
$Re_{(yfs)}$-I_D Characteristics (Typical)



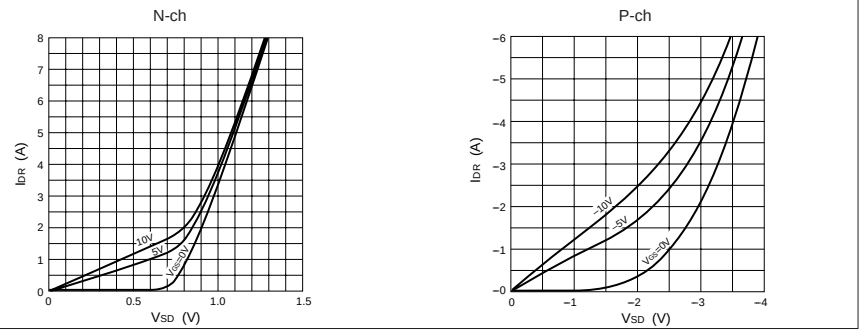
Safe Operating Area (SOA)



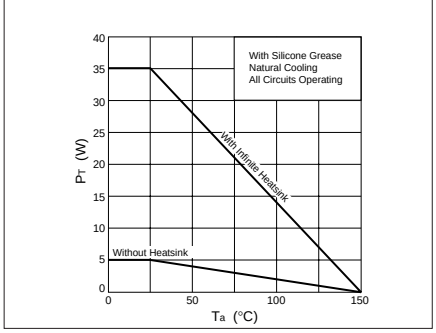
Capacitance-V_{DS} Characteristics (Typical)



I_{DR}-V_{SD} Characteristics (Typical)



P_T-T_a Characteristics



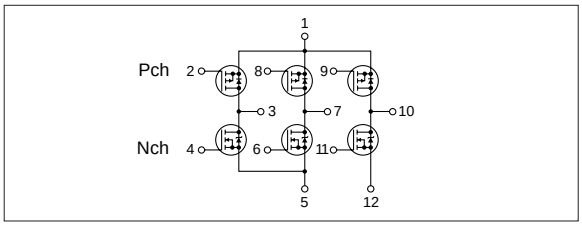
Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	N channel	P channel	
V_{DSS}	60	–60	V
V_{GSS}	±20	∓20	V
I_D	±5	∓4	A
$I_{D(pulse)}$	±10 (PW≤1ms)	∓8 (PW≤1ms)	A
E_{AS}*	2	—	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)		W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)		W
$\theta_{j\text{-}a}$	25 (Junction-Air, Ta=25°C, with all circuits operating)		°C/W
$\theta_{j\text{-}c}$	3.57 (Junction-Case, Tc=25°C, with all circuits operating)		°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)		Vrms
Tch	150		°C
Tstg	–40 to +150		°C

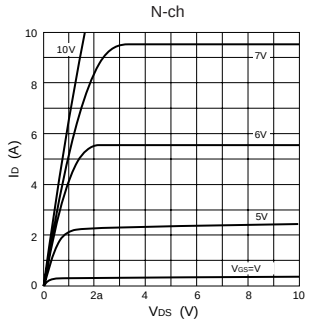
* : V_{DD}=20V, L=1mH, I_D=2A, unclamped, see Fig. E on page 15.

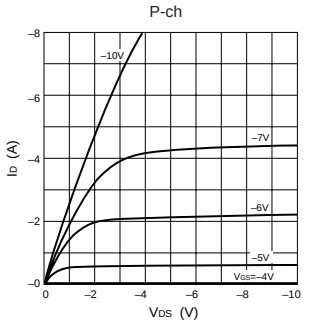
■Equivalent circuit diagram



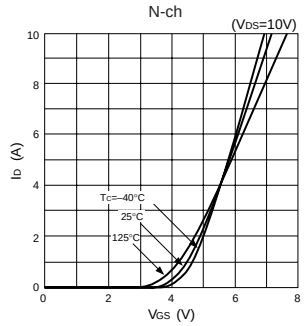
Characteristic curves

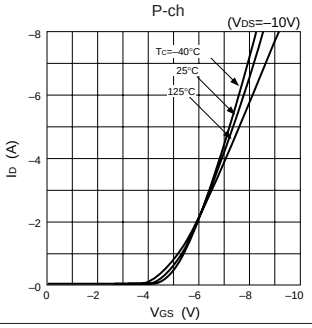
I_D-V_{DS} Characteristics (Typical)



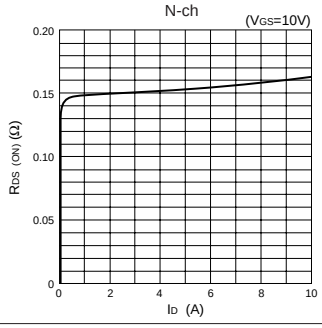


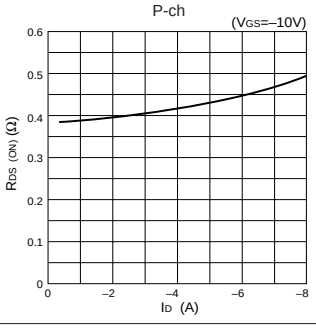
I_D-V_{GS} Characteristics (Typical)



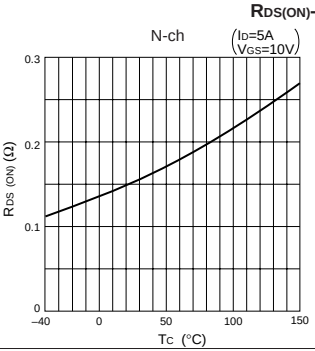


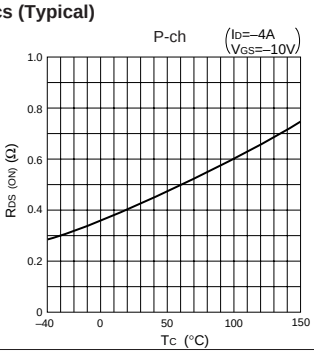
$R_{DS(ON)}$-I_D Characteristics (Typical)





$R_{DS(ON)}$-Tc Characteristics (Typical)





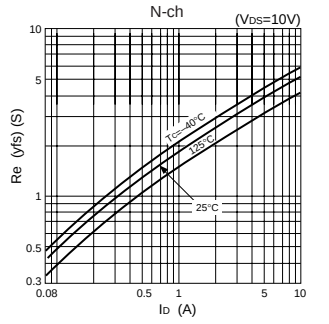
Electrical characteristics

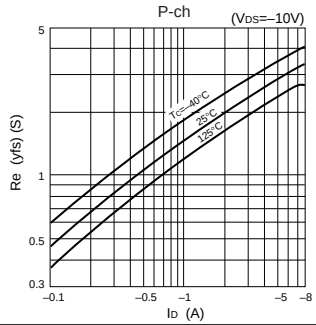
(Ta=25°C)

Symbol	N channel					P channel				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V			∓500	nA	V_{GS}=∓20V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	2.2	3.3		S	V_{DS}=10V, I_D=5A	1.6	2.2		S	V_{DS}=–10V, I_D=–4A
$R_{DS(ON)}$		0.17	0.22	Ω	V_{GS}=10V, I_D=5A		0.38	0.55	Ω	V_{GS}=–10V, I_D=–4A
Ciss		300		pF	V_{DS}=25V, f=1.0MHz,		270		pF	V_{DS}=–25V, f=1.0MHz,
Coss		160		pF	V_{GS}=0V		170		pF	V_{GS}=0V
t_{on}		35		ns	I_D=5A, V_{DD}≒30V, V_{GS}=–10V,		60		ns	I_D=–4A, V_{DD}≒–30V, V_{GS}=–10V,
t_{off}		35		ns	see Fig. 3 on page 16.		60		ns	see Fig. 4 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A, V_{GS}=0V		–4.4	–5.5	V	I_{SD}=–4A, V_{GS}=0V
t_{rr}		140		ns	I_{SD}=±100mA		150		ns	I_{SD}=∓100mA

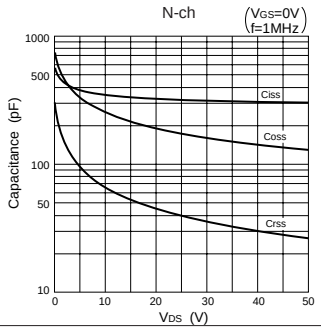
Characteristic curves

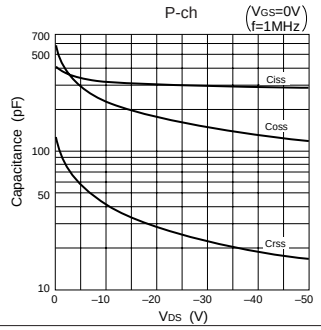
$Re_{(yfs)}$-I_D Characteristics (Typical)



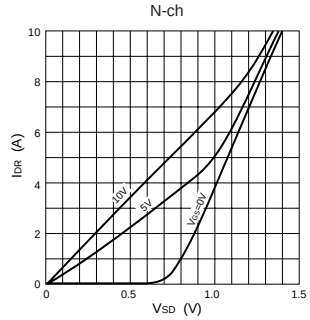


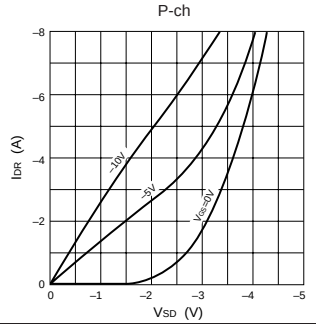
Capacitance-V_{DS} Characteristics (Typical)



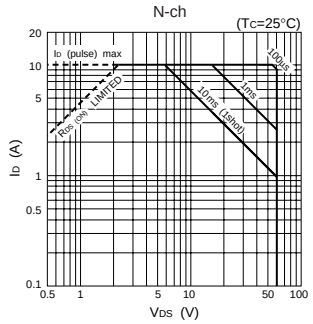


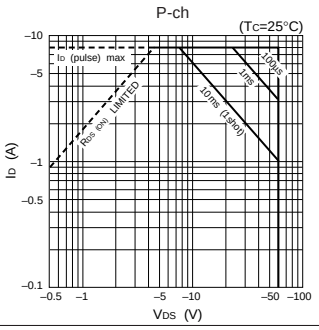
I_{DR}-V_{SD} Characteristics (Typical)



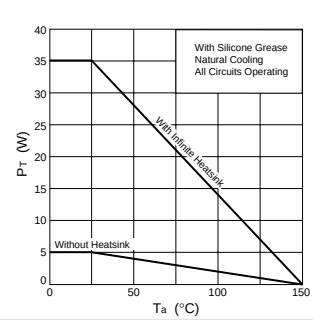


Safe Operating Area (SOA)





P_T-T_a Characteristics



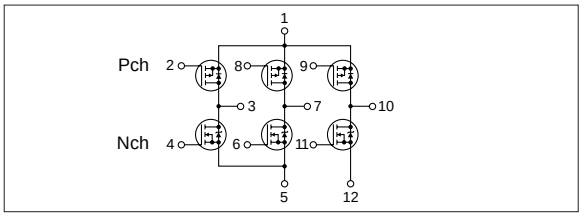
Absolute maximum ratings

(Ta=25°C)

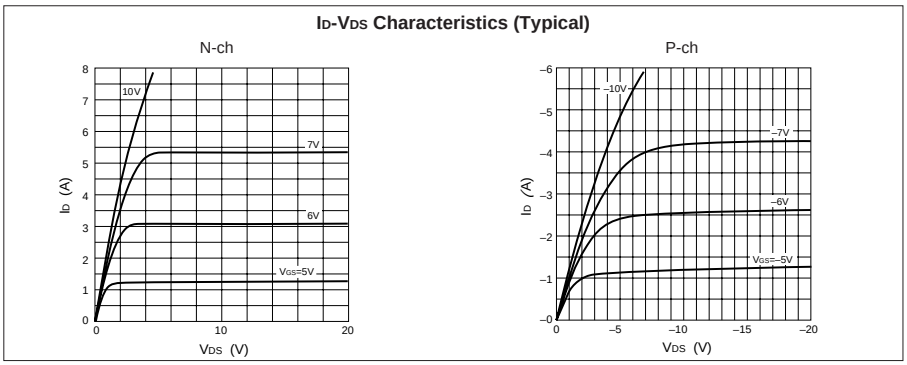
Symbol	Ratings		Unit
	N channel	P channel	
V_{DSS}	100	–100	V
V_{GSS}	±20	∓20	V
I_D	±4	∓3	A
$I_{D(pulse)}$	±8 (PW≤1ms)	∓6 (PW≤1ms)	A
E_{AS}*	16	—	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)		W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)		W
θ_{j-a}	25 (Junction-Air, Ta=25°C, with all circuits operating)		°C/W
θ_{j-c}	3.57 (Junction-Case, Tc=25°C, with all circuits operating)		°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)		Vrms
Tch	150		°C
Tstg	–40 to +150		°C

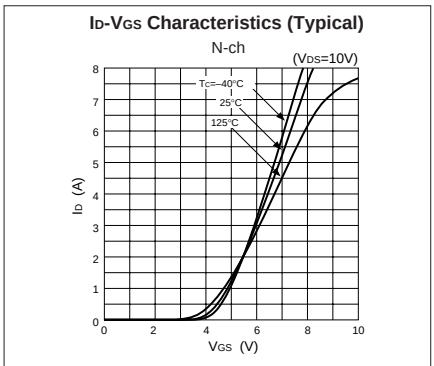
* : V_{DD}=20V, L=1mH, I_D=5A, unclamped, see Fig. E on page 15.

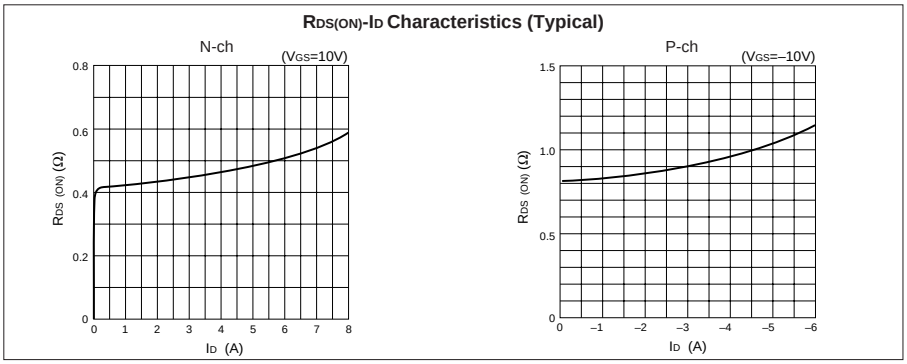
■Equivalent circuit diagram

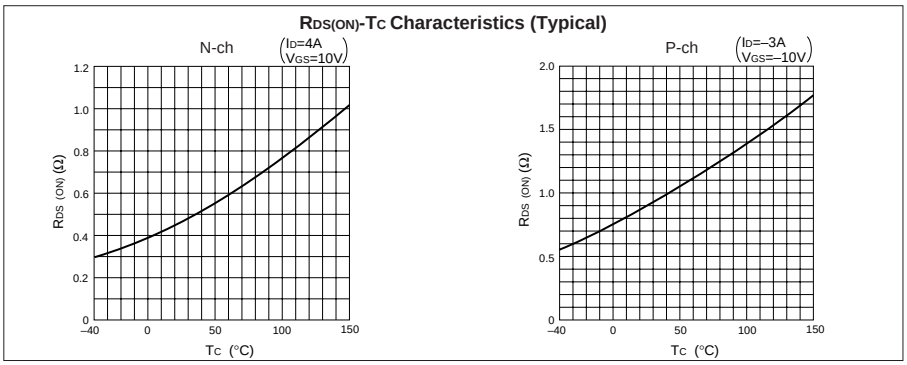


Characteristic curves









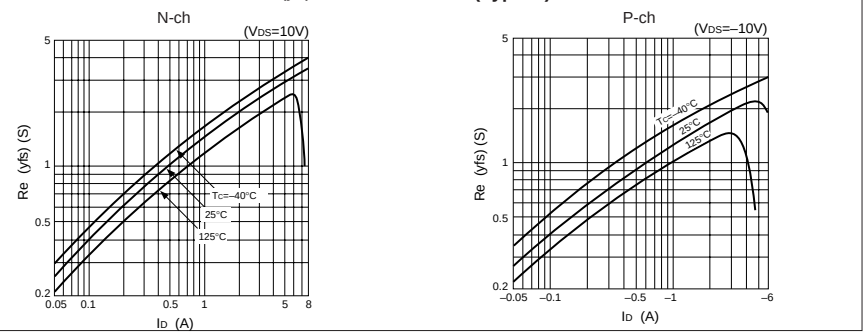
Electrical characteristics

(T_a=25°C)

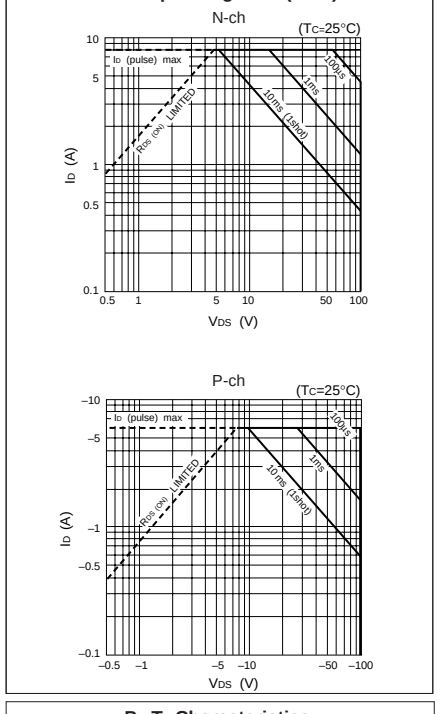
Symbol	N channel					P channel				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V	–100			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V			∓500	nA	V_{GS}=∓20V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V			–250	μA	V_{DS}=–100V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	1.1	1.7		S	V_{DS}=10V, I_D=4A	0.7	1.1		S	V_{DS}=–10V, I_D=–3A
$R_{DS(ON)}$		0.50	0.60	Ω	V_{GS}=10V, I_D=4A		1.1	1.3	Ω	V_{GS}=–10V, I_D=–3A
Ciss		180		pF	V_{DS}=25V, f=1.0MHz,		180		pF	V_{DS}=–25V, f=1.0MHz,
Coss		82		pF	V_{GS}=0V		85		pF	V_{GS}=0V
t_{on}		40		ns	I_D=4A, V_{DD}≒50V, V_{GS}=10V,		90		ns	I_D=–3A, V_{DD}≒–50V, V_{GS}=–10V,
t_{off}		40		ns	see Fig. 3 on page 16.		80		ns	see Fig. 4 on page 16.
V_{SD}		1.2	2.0	V	I_{SD}=4A, V_{GS}=0V		–4.0	–5.5	V	I_{SD}=–3A
t_{rr}		250		ns	I_{SD}=±100mA		250		ns	I_{SD}=∓100mA

Characteristic curves

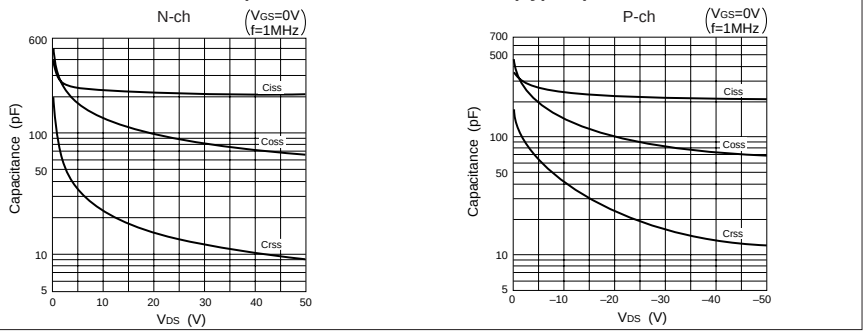
$Re_{(yfs)}$-I_D Characteristics (Typical)



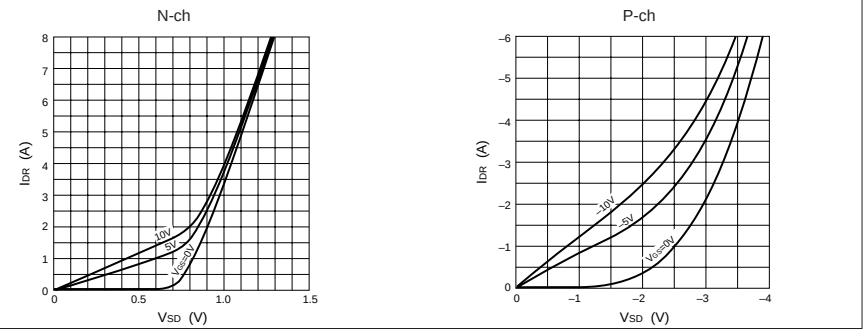
Safe Operating Area (SOA)



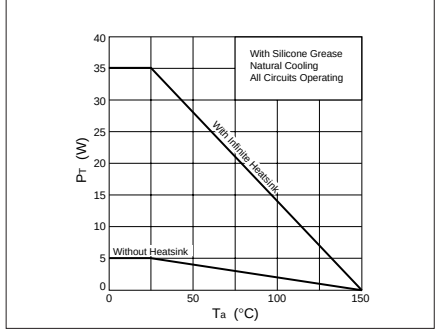
Capacitance-V_{DS} Characteristics (Typical)



I_{DR}-V_{SD} Characteristics (Typical)



P_T-T_a Characteristics



SLA5011

N-channel
General purpose

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	±20	V
I_D	±5	A
$I_{D(pulse)}$	±10(PW≤1ms)	A
E_{AS}*	2	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

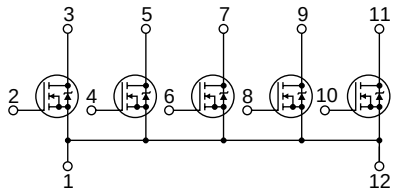
Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA
Re(yfs)	2.2	3.3		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		0.17	0.22	Ω	V_{GS}=10V, I_D=5A
Ciss		300		pF	V_{DS}=25V, f=1.0MHz,
Coss		160		pF	V_{GS}=0V
ton		35		ns	I_D=5A, V_{DD}≒30V, V_{GS}=10V,
toff		35		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A
trr		150		ns	I_{SD}=±100mA

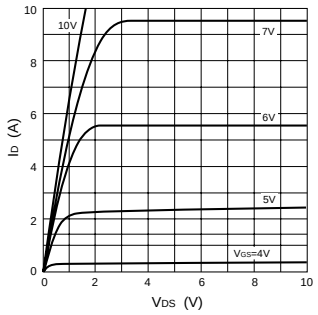
* : V_{DD}=20V, L=1mH, I_D=1.5A, unclamped, see Fig. E on page 15.

■Equivalent circuit diagram

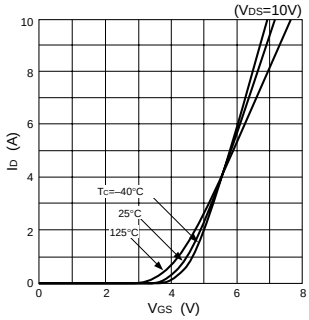


Characteristic curves

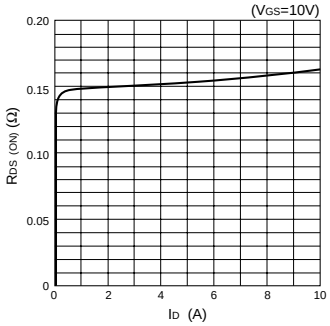
I_D-V_{DS} Characteristics (Typical)



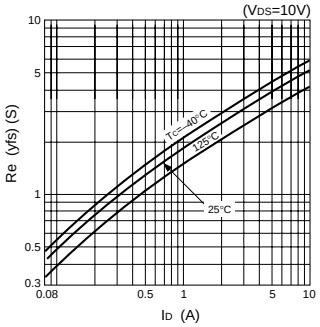
I_D-V_{GS} Characteristics (Typical)



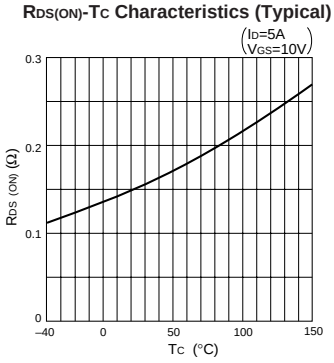
$R_{DS(ON)}$-I_D Characteristics (Typical)



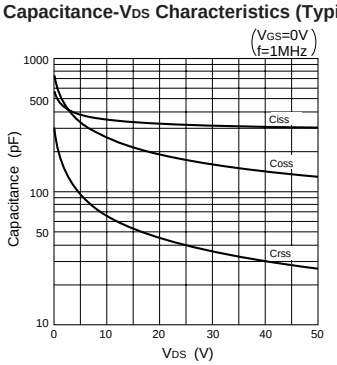
Re(yfs)-I_D Characteristics (Typical)



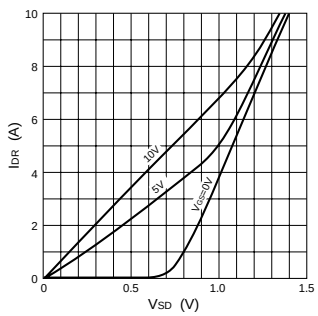
$R_{DS(ON)}$-Tc Characteristics (Typical)



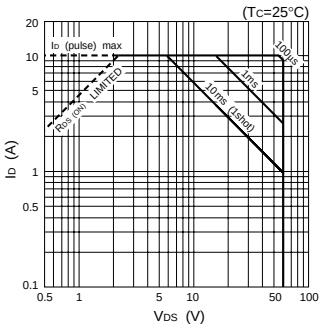
Capacitance-V_{DS} Characteristics (Typical)



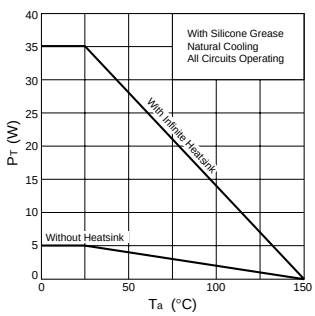
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5012

P-channel

General purpose

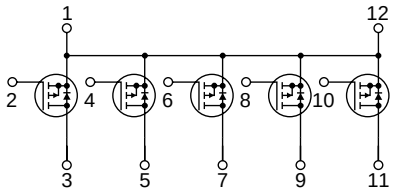
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	–60	V
V_{GSS}	∓20	V
I_D	∓5	A
$I_{D(pulse)}$	∓10 (PW≤1ms)	A
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θ_{j-a}	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θ_{j-c}	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

Electrical characteristics (Ta=25°C)

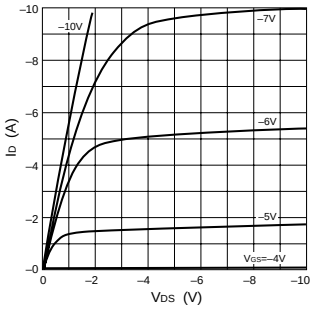
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			∓500	nA	V_{GS}=∓20V
I_{DSS}			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	2.3	3.5		S	V_{DS}=–10V, I_D=–5A
$R_{DS(ON)}$		0.22	0.30	Ω	V_{GS}=–10V, I_D=–5A
Ciss		570		pF	V_{DS}=–25V, f=1.0MHz,
Coss		360		pF	V_{GS}=0V
ton		100		ns	I_D=–5A, V_{DD}≒–30V, V_{GS}=–10V,
toff		60		ns	see Fig. 3 on page 16.
V_{SD}		–4.5	–5.5	V	I_{SD}=–5A
trr		150		ns	I_{SD}=∓100mA

■Equivalent circuit diagram

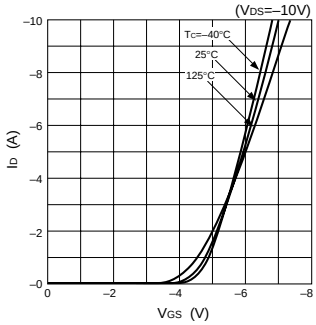


Characteristic curves

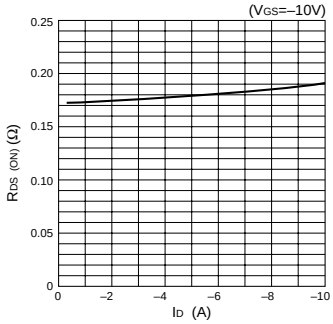
I_D-V_{DS} Characteristics (Typical)



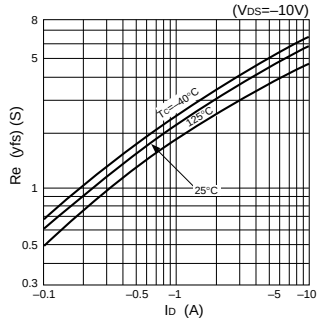
I_D-V_{GS} Characteristics (Typical)



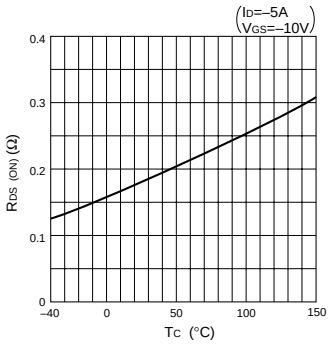
$R_{DS(ON)}$-I_D Characteristics (Typical)



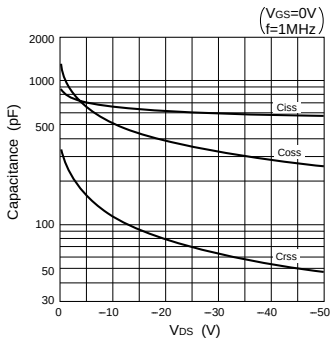
$Re_{(yfs)}$-I_D Characteristics (Typical)



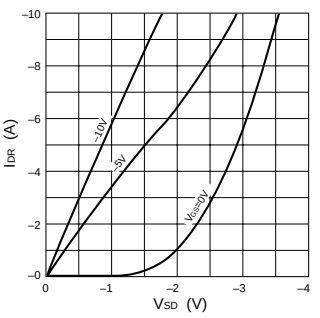
$R_{DS(ON)}$-T_C Characteristics (Typical)



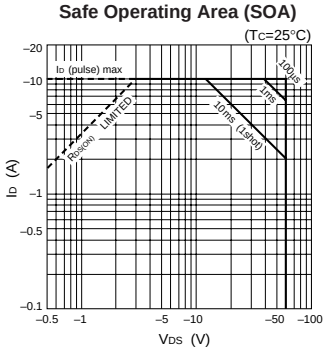
Capacitance-V_{DS} Characteristics (Typical)



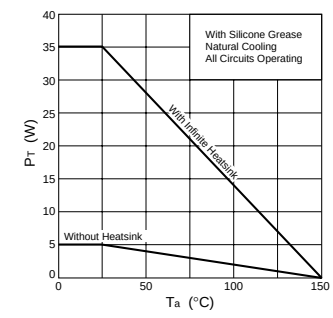
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



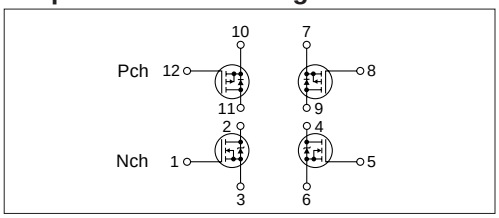
Absolute maximum ratings

(Ta=25°C)

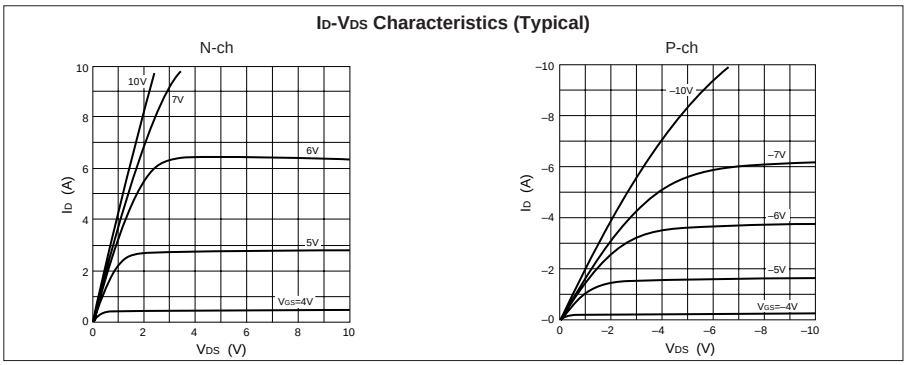
Symbol	Ratings		Unit
	N channel	P channel	
V_{DSS}	100	–100	V
V_{GSS}	±20	∓20	V
I_D	±5	∓5	A
$I_{D(pulse)}$	±10 (PW≤1ms)	∓10 (PW≤1ms)	A
E_{AS}*	30	—	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)		W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)		W
$\theta_{j\text{-}a}$	25 (Junction-Air, Ta=25°C, with all circuits operating)		°C/W
$\theta_{j\text{-}c}$	3.57 (with all circuits operating, Tc=25°C, with all circuits operating)		°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)		Vrms
Tch	150		°C
Tstg	–40 to +150		°C

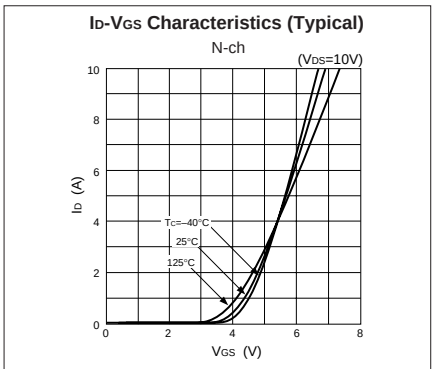
* : V_{DD}=20V, L=10mH, I_D=2.5A, unclamped, see Fig. E on page 15.

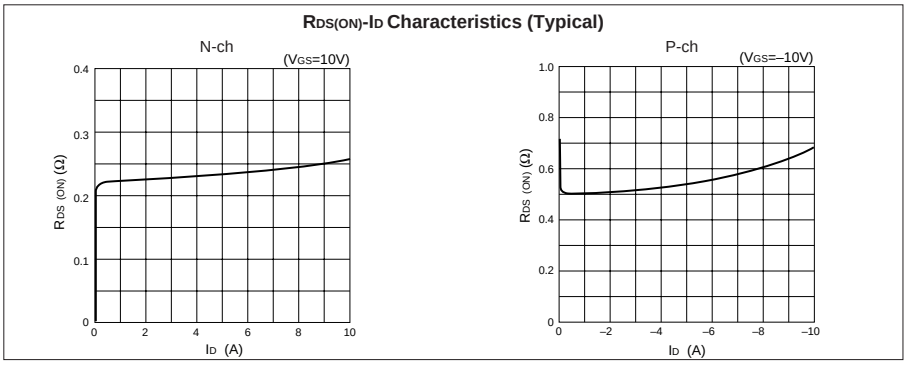
■Equivalent circuit diagram

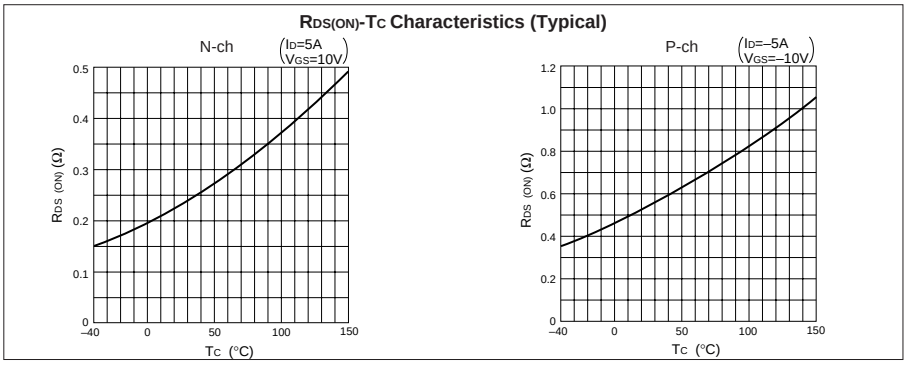


Characteristic curves









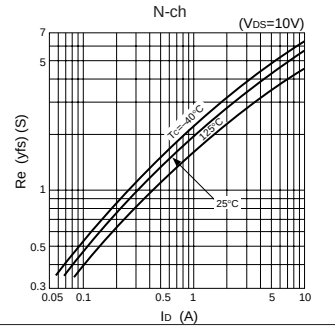
Electrical characteristics

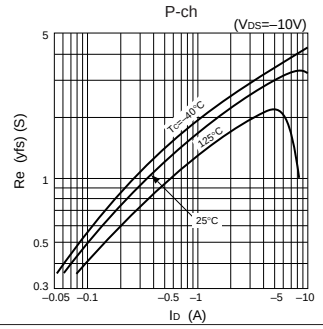
(Ta=25°C)

Symbol	N channel					P channel				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V	–100			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V			∓500	nA	V_{GS}=∓20V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V			–250	μA	V_{DS}=–100V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	2.4	3.7		S	V_{DS}=10V, I_D=5A	0.9	2.0		S	V_{DS}=–10V, I_D=–5A
$R_{DS(ON)}$		0.27	0.30	Ω	V_{GS}=10V, I_D=5A		0.55	0.7	Ω	V_{GS}=–10V, I_D=–5A
Ciss		350		pF	V_{DS}=25V, f=1.0MHz,		300		pF	V_{DS}=–25V, f=1.0MHz,
Coss		130		pF	V_{GS}=0V		200		pF	V_{GS}=0V
t_{on}		60		ns	I_D=5A, V_{DD}≒50V, V_{GS}=10V,		150		ns	I_D=–5A, V_{DD}≒–50V, V_{GS}=–10V,
t_{off}		40		ns	see Fig. 3 on page 16.		200		ns	see Fig. 4 on page 16.
V_{SD}		1.1	1.8	V	I_{SD}=5A, V_{GS}=0V		–4.5	–5.5	V	I_{SD}=–5A, V_{GS}=0V
t_{rr}		330		ns	I_{SD}=±100mA		220		ns	I_{SD}=∓100mA

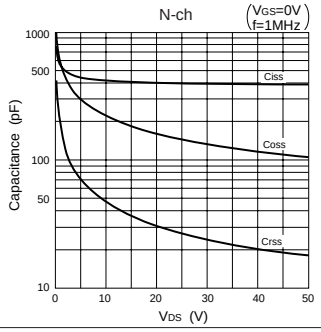
Characteristic curves

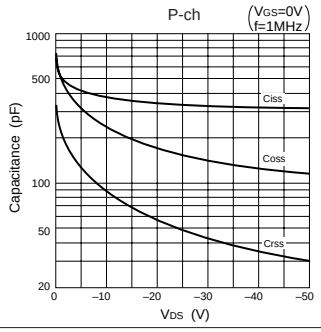
$Re_{(yfs)}$-I_D Characteristics (Typical)



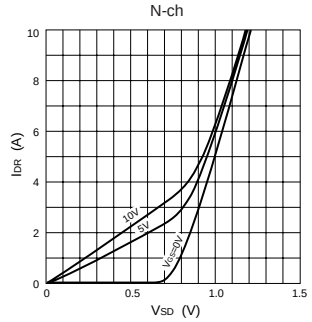


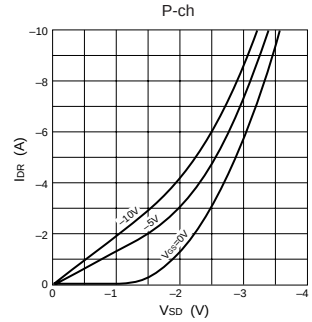
Capacitance-V_{DS} Characteristics (Typical)



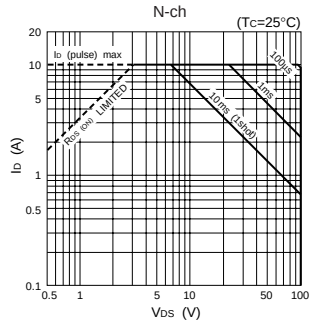


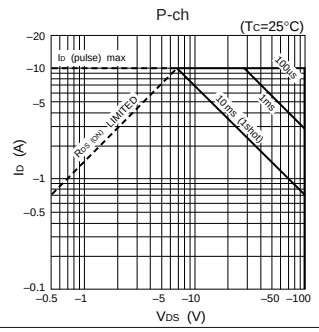
I_{DR}-V_{SD} Characteristics (Typical)



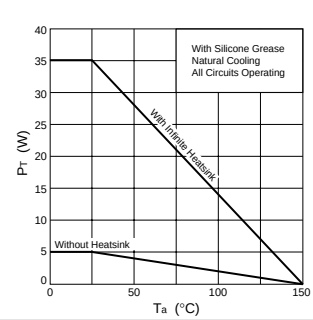


Safe Operating Area (SOA)





P_T-T_a Characteristics



SLA5015

P-channel

General purpose

Absolute maximum ratings

(Ta=25°C)

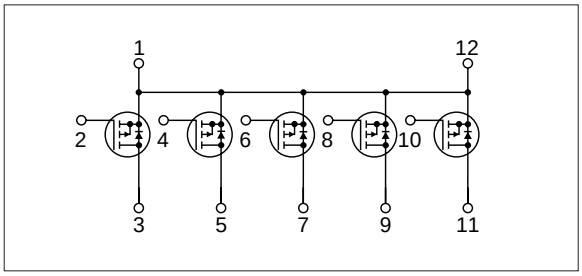
Symbol	Ratings	Unit
V_{DSS}	–60	V
V_{GSS}	∓20	V
I_D	∓4	A
$I_{D(pulse)}$	∓8 (PW≤1ms)	A
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
$\theta_{j\text{-}a}$	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
$\theta_{j\text{-}c}$	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

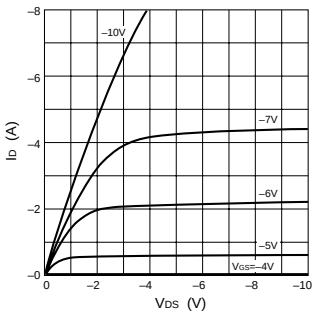
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			∓500	nA	V_{GS}=∓20V
I_{DSS}			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	1.6	2.2		S	V_{DS}=–10V, I_D=–4A
$R_{DS(ON)}$		0.38	0.55	Ω	V_{GS}=–10V, I_D=–4A
Ciss		270		pF	V_{DS}=–25V, f=1.0MHz,
Coss		170		pF	V_{GS}=0V
ton		60		ns	I_D=–4A, V_{DD}≒–30V, V_{GS}=–10V,
toff		60		ns	see Fig. 4 on page 16.
V_{SD}		–4.5	–5.5	V	I_{SD}=–4A
trr		150		ns	I_{SD}=∓100mA

■Equivalent circuit diagram

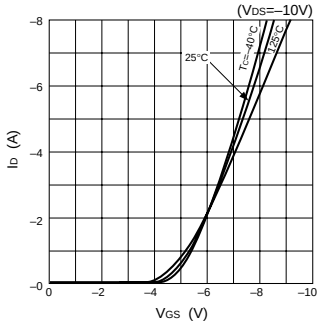


Characteristic curves

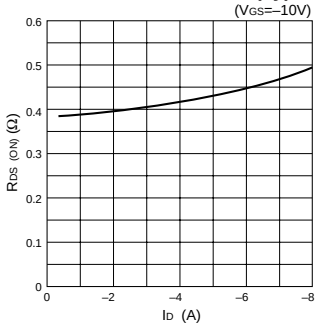
I_D-V_{DS} Characteristics (Typical)



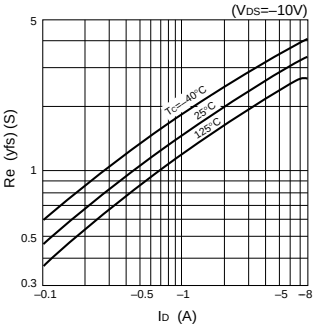
I_D-V_{GS} Characteristics (Typical)



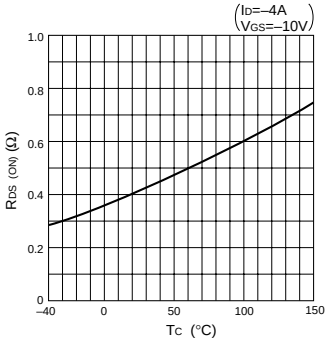
$R_{DS(ON)}$-I_D Characteristics (Typical)



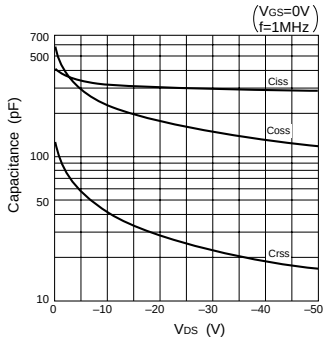
$Re_{(yfs)}$-I_D Characteristics (Typical)



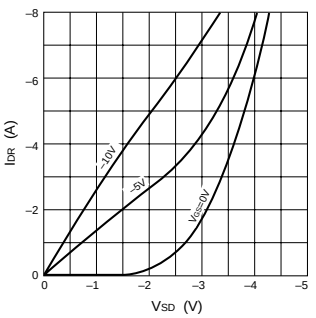
$R_{DS(ON)}$-Tc Characteristics (Typical)



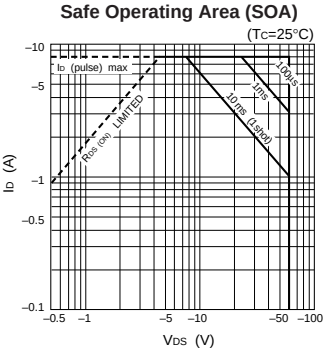
Capacitance-V_{DS} Characteristics (Typical)



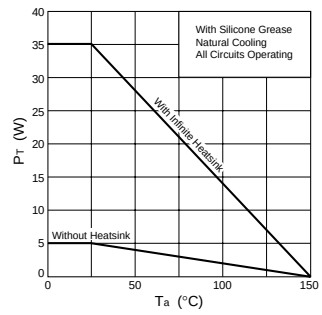
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



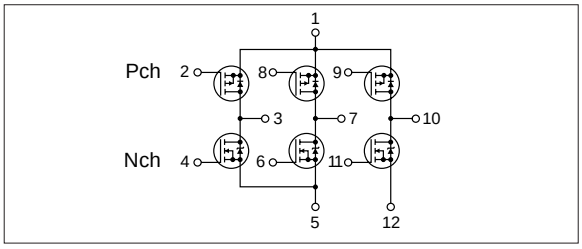
Absolute maximum ratings

(Ta=25°C)

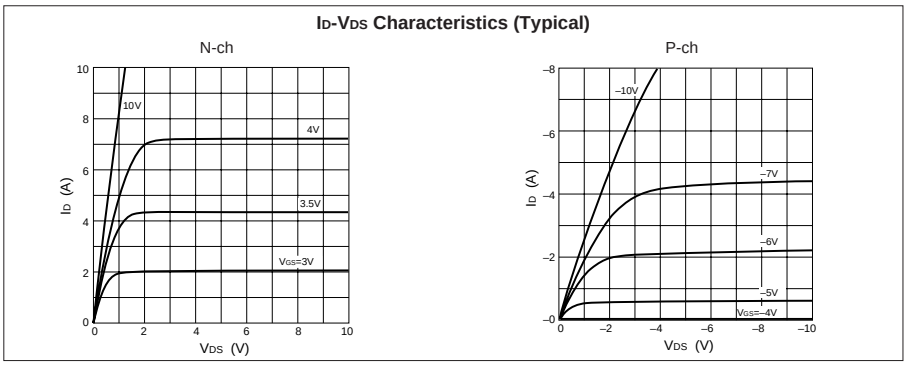
Symbol	Ratings		Unit
	N channel	P channel	
V_{DSS}	60	–60	V
V_{GSS}	±10	∓20	V
I_D	±5	∓4	A
$I_{D(pulse)}$	±10 (PW≤1ms)	∓8 (PW≤1ms)	A
E_{AS}*	2	—	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)		W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)		W
$\theta_{j\text{-}a}$	25 (Junction-Air, Ta=25°C, with all circuits operating)		°C/W
$\theta_{j\text{-}c}$	3.57 (Junction-Case, Tc=25°C, with all circuits operating)		°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)		Vrms
Tch	150		°C
Tstg	–40 to +150		°C

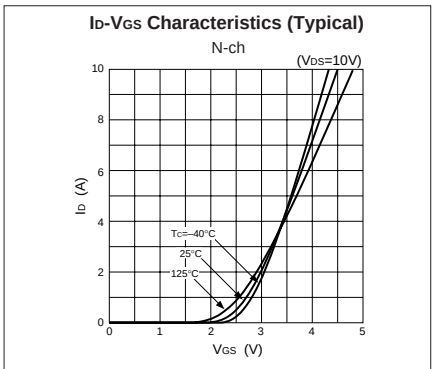
* : V_{DD}=20V, L=1mH, I_D=2A, unclamped, see Fig. E on page 15.

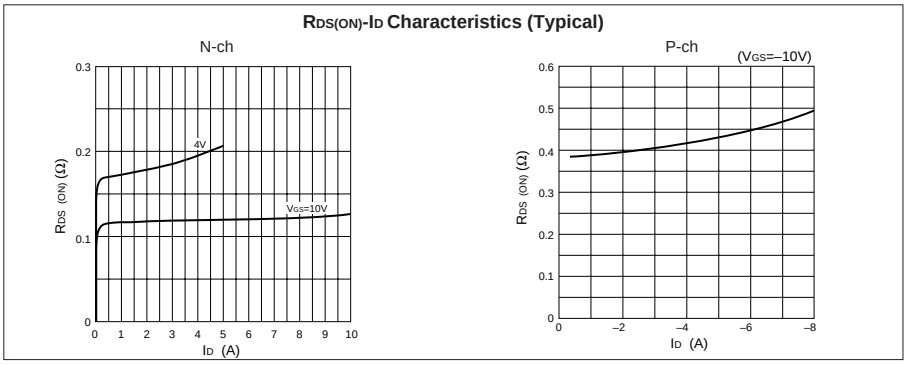
■Equivalent circuit diagram

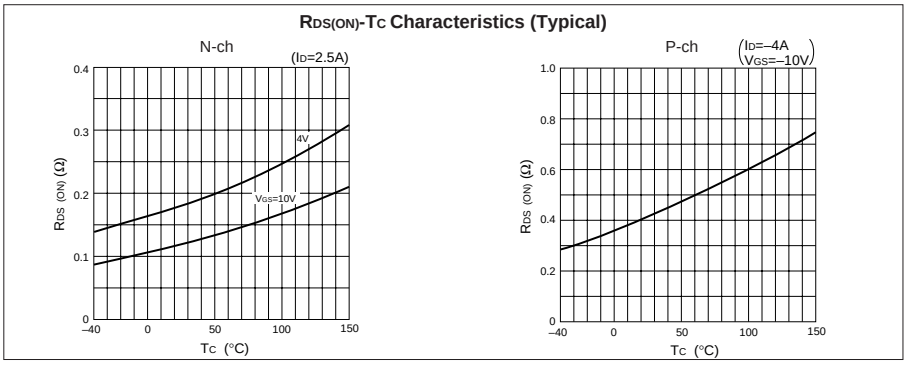


Characteristic curves









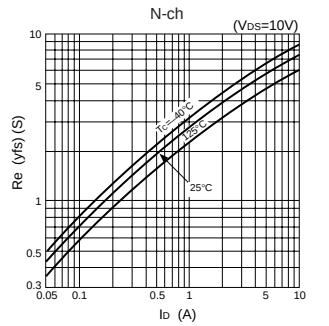
Electrical characteristics

(T_a=25°C)

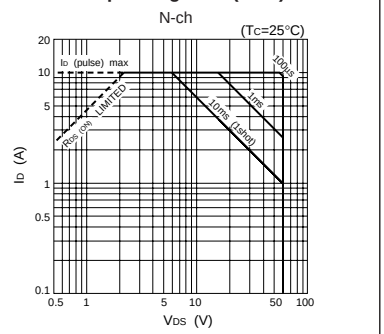
Symbol	N channel					P channel				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V			∓500	nA	V_{GS}=∓20V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	3.1	4.6		S	V_{DS}=10V, I_D=5A	1.6	2.2		S	V_{DS}=–10V, I_D=–4A
$R_{DS(ON)}$		0.17	0.22	Ω	V_{GS}=10V, I_D=5A		0.38	0.55	Ω	V_{GS}=–10V, I_D=–4A
		0.25	0.30	Ω	V_{GS}=4V, I_D=5A					
Ciss		400		pF	V_{DS}=25V, f=1.0MHz,		270		pF	V_{DS}=–25V, f=1.0MHz,
Coss		160		pF	V_{GS}=0V		170		pF	V_{GS}=0V
ton		80		ns	I_D=5A, V_{DD}≒30V, V_{GS}=5V,		60		ns	I_D=–4A, V_{DD}≒–30V, V_{GS}=–10V,
toff		50		ns	see Fig. 3 on page 16.		60		ns	see Fig. 4 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A, V_{GS}=0V		–4.4	–5.5	V	I_{SD}=–4A, V_{GS}=0V
trr		150		ns	I_{SD}=±100mA		150		ns	I_{SD}=∓100mA

Characteristic curves

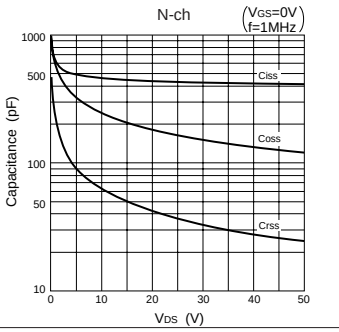
$Re_{(yfs)}$-I_D Characteristics (Typical)



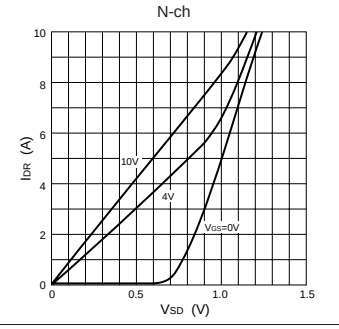
Safe Operating Area (SOA)



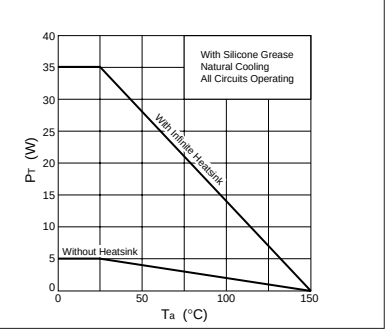
Capacitance-V_{DS} Characteristics (Typical)



I_{DR}-V_{SD} Characteristics (Typical)



P_T-T_a Characteristics



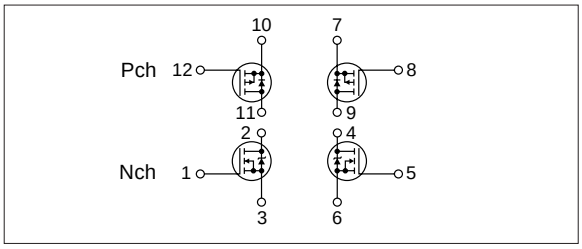
Absolute maximum ratings

(Ta=25°C)

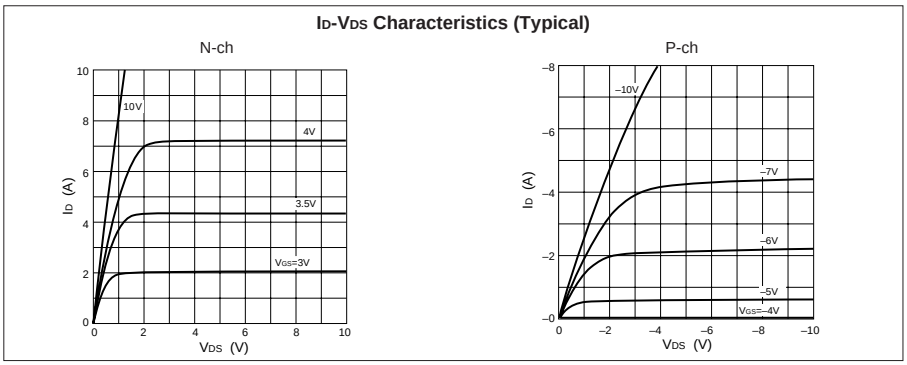
Symbol	Ratings		Unit
	N channel	P channel	
V_{DSS}	60	–60	V
V_{GSS}	±10	∓20	V
I_D	±5	∓4	A
$I_{D(pulse)}$	±10 (PW≤1ms)	∓8 (PW≤1ms)	A
E_{AS}*	2	—	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)		W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)		W
$\theta_{j\text{-}a}$	25 (Junction-Air, Ta=25°C, with all circuits operating)		°C/W
$\theta_{j\text{-}c}$	3.57 (Junction-Case, Tc=25°C, with all circuits operating)		°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)		Vrms
Tch	150		°C
Tstg	–40 to +150		°C

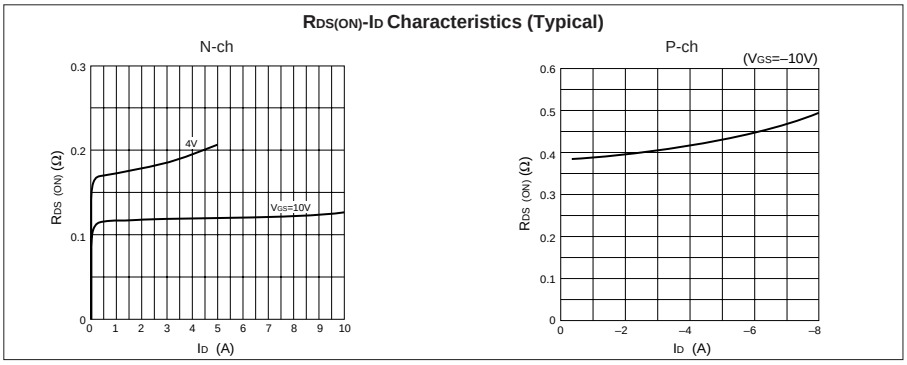
* : V_{DD}=20V, L=1mH, I_D=2A, unclamped, see Fig. E on page 15.

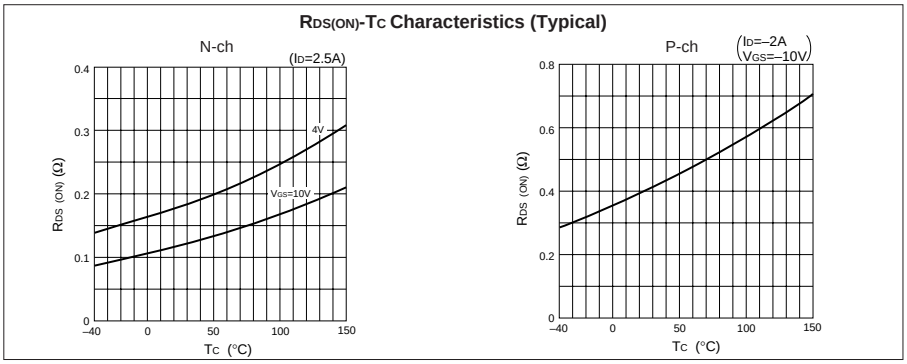
■Equivalent circuit diagram

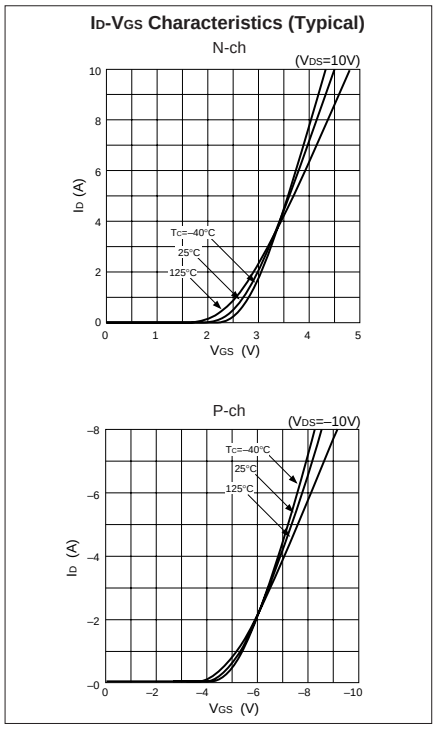


Characteristic curves









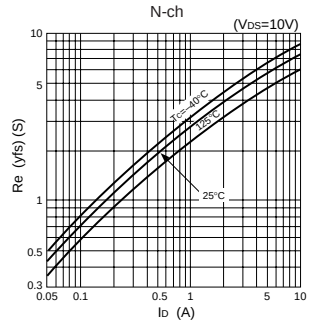
Electrical characteristics

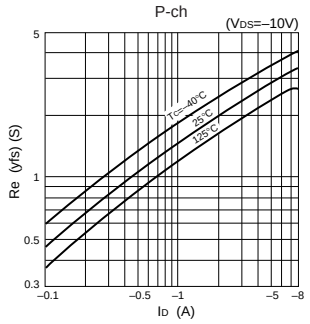
(Ta=25°C)

Symbol	N channel					P channel				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V			∓500	nA	V_{GS}=∓20V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	3.1	4.6		S	V_{DS}=10V, I_D=5A	1.6	2.2		S	V_{DS}=–10V, I_D=–4A
$R_{DS(ON)}$		0.17	0.22	Ω	V_{GS}=10V, I_D=2.5A		0.38	0.55	Ω	V_{GS}=–10V, I_D=–2A
		0.25	0.30	Ω	V_{GS}=4V, I_D=2.5A					
Ciss		400		pF	V_{DS}=25V, f=1.0MHz,		270		pF	V_{DS}=–25V, f=1.0MHz,
Coss		160		pF	V_{GS}=0V		170		pF	V_{GS}=0V
t_{on}		80		ns	I_D=5A, V_{DD}≒30V, V_{GS}=5V,		60		ns	I_D=–4A, V_{DD}≒–30V, V_{GS}=–10V,
t_{off}		50		ns	see Fig. 3 on page 16.		60		ns	see Fig. 4 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A, V_{GS}=0V		–4.4	–5.5	V	I_{SD}=–4A, V_{GS}=0V
t_{rr}		150		ns	I_{SD}=±100mA		150		ns	I_{SD}=∓100mA

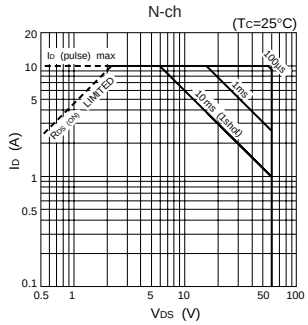
Characteristic curves

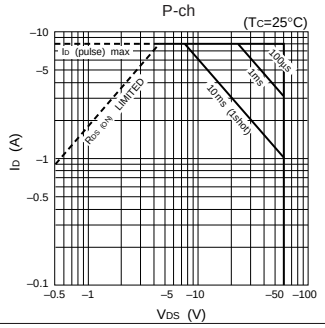
$Re_{(yfs)}$-I_D Characteristics (Typical)



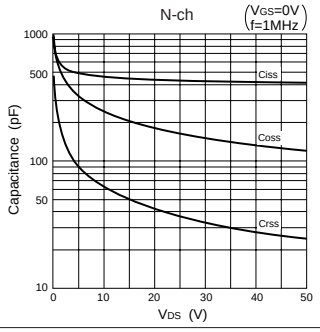


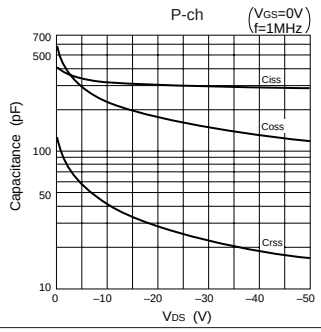
Safe Operating Area (SOA)



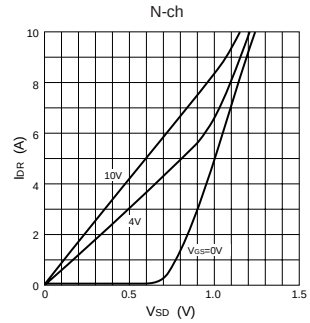


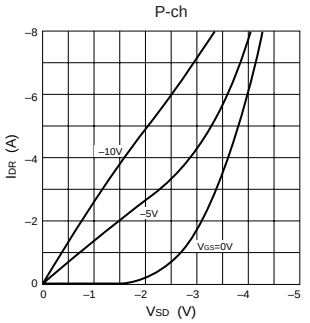
Capacitance-V_{DS} Characteristics (Typical)



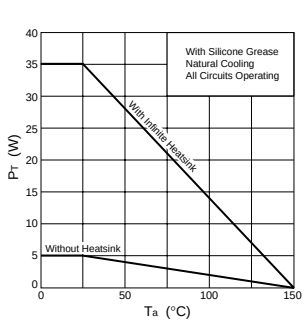


I_{DR}-V_{SD} Characteristics (Typical)





P_T-T_a Characteristics



SLA5021

N-channel
General purpose

External dimensions Ⓐ ··· SLA

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±10	V
I_D	±5	A
$I_{D(pulse)}$	±10 (PW≤1ms)	A
E_{AS}*	60	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

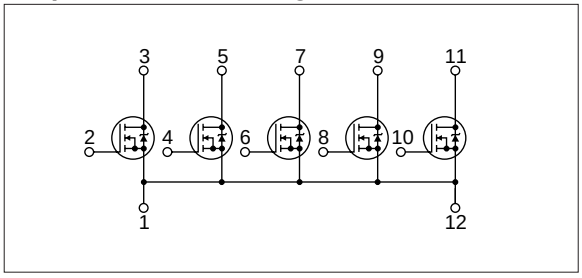
* : V_{DD}=20V, L=10mH, I_D=3A, unclamped, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

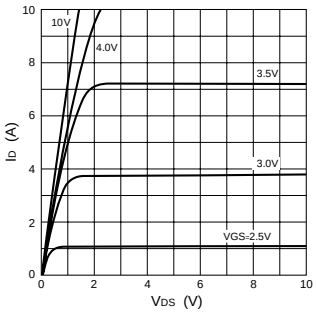
Symbol	Specification			Unit	Conditins
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	4	6		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		0.18	0.19	Ω	V_{GS}=10V, I_D=2.5A
		0.19	0.25	Ω	V_{GS}=4V, I_D=2.5A
Ciss		880		pF	V_{DS}=25V, f=1.0MHz,
Coss		240		pF	V_{GS}=0V
ton		90		ns	I_D=5A, V_{DD}≒50V, V_{GS}=5V,
toff		75		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A, V_{GS}=0V
trr		500		ns	I_{SD}=±100mA

■Equivalent circuit diagram

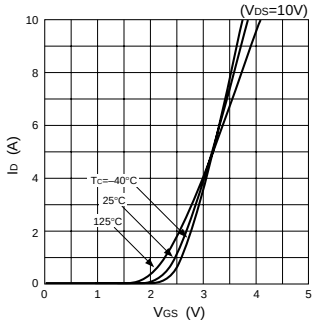


Characteristic curves

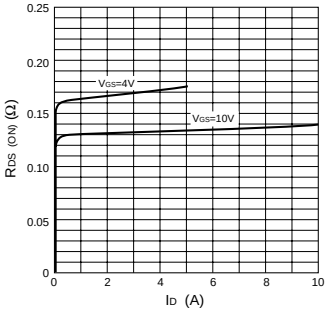
I_D-V_{DS} Characteristics (Typical)



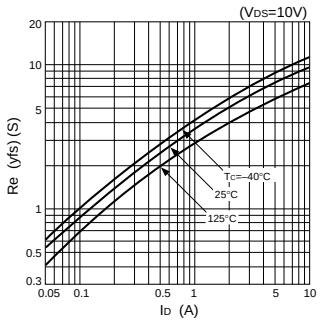
I_D-V_{GS} Characteristics (Typical)



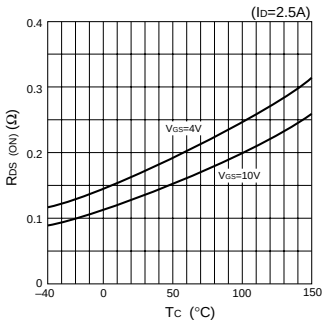
$R_{DS(ON)}$-I_D Characteristics (Typical)



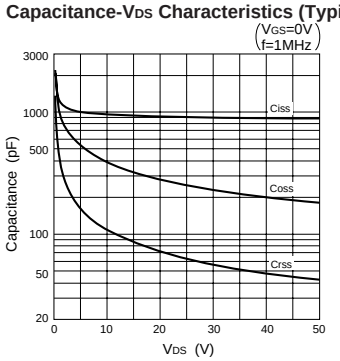
$Re_{(yfs)}$-I_D Characteristics (Typical)



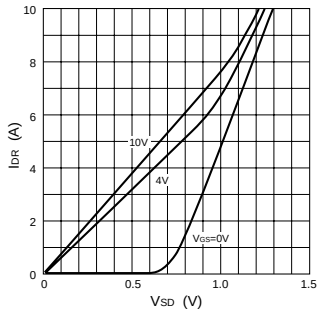
$R_{DS(ON)}$-Tc Characteristics (Typical)



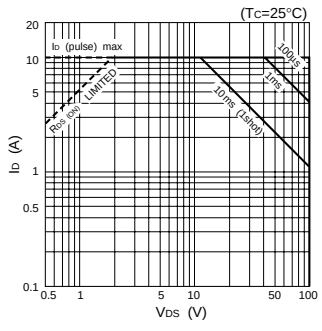
Capacitance-V_{DS} Characteristics (Typical)



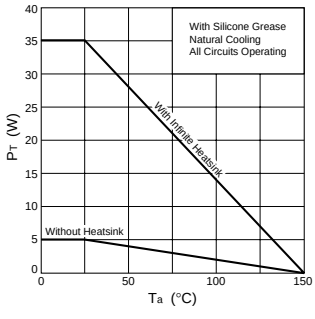
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5022

PNP Darlington + N-channel MOSFET

3-phase motor drive

External dimensions Ⓐ ··· SLA

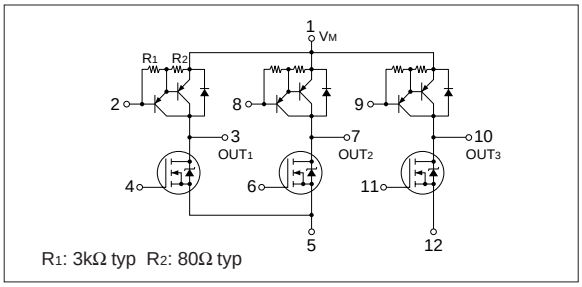
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_M	60	V
I_O	±6 (PW≤100ms)	A
I_{OP}	±10 (PW≤1ms)	A
V_{GSS}	±10	V
I_B	–0.5	A
P_T	5 (T_a=25°C)	W
	35 (T_C=25°C)	
$\theta_{j\text{-}a}$	25	°C/W
$\theta_{j\text{-}c}$	3.57	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Sink : N channel MOSFET) (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
Re(yfs)	3.1	4.6		S	V_{DS}=10V, I_D=4A
$R_{DS(ON)}$		0.17	0.22	W	V_{GS}=10V, I_D=4A
		0.25	0.30		V_{GS}=4V, I_D=4A
Ciss		400		pF	V_{DS}=25V, f=1.0MHz,
Coss		160		pF	V_{GS}=0V
ton		80		ns	I_D=4A, V_{DD}=30V,
toff		50		ns	V_{GS}=5V
V_{SD}		1.1	1.5	V	I_{SD}=4A, V_{GS}=0V
trr		150		ns	I_F=±100mA

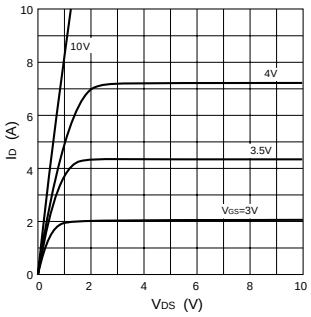
■Equivalent circuit diagram



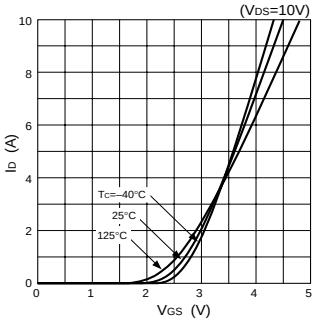
R1: 3kΩ typ R2: 80Ω typ

Characteristic curves (N-channel)

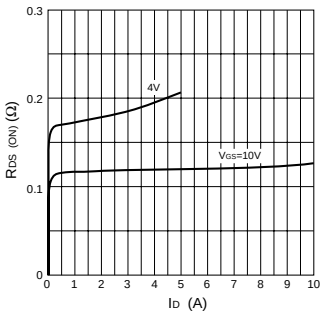
V_{DS}-I_D Characteristics (Typical)



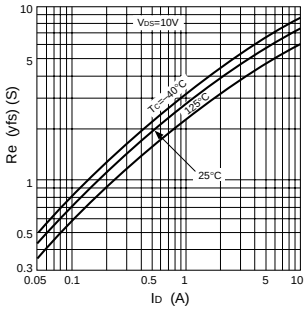
V_{GS}-I_D Temperature Characteristics (Typical)



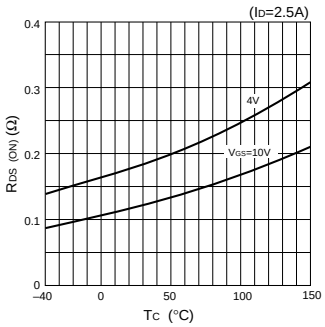
I_{DS}-$R_{DS(ON)}$ Characteristics (Typical)



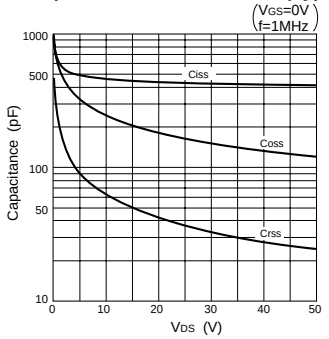
I_D-Re(yfs) Temperature Characteristics (Typical)



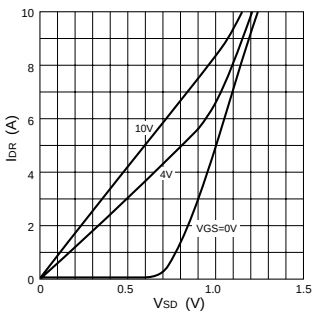
T_C-$R_{DS(ON)}$ Characteristics (Typical)



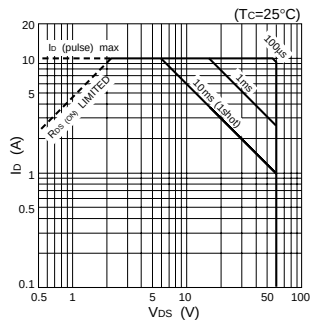
V_{DS}-Cpacitance Characteristics (Typical)



V_{SD}-I_{DR} Characteristics (Typical)



Safe Operating Area (SOA)

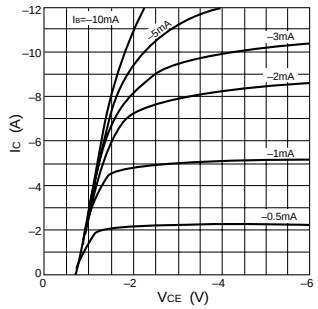


Electrical characteristics (Source: PNP transistor) (Ta=25°C)

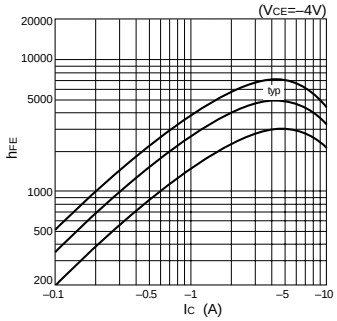
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–60V
I_{EBO}	–1		–5	mA	V_{EB}=–6V
V_{CEO}	–60			V	I_C=–25mA
h_{FE}	2000	5000	12000		V_{CE}=–4V, I_C=–4A
V_{CE}(sat)			–1.5	V	I_C=–4A, I_B=–10mA
V_{BE}(sat)			–2.0	V	
V_{FEC}			2.0	V	I_{FEC}=4A
t_{rr}		1.0		μs	I_F=±0.5A
t_{on}		1.0		μs	V_{CC}≒–25V,
t_{stg}		1.4		μs	I_C=–4A,
t_f		0.6		μs	I_{B1}=–I_{B2}=–10mA
f_T		120		MHz	V_{CE}=–12V, I_E=1A
C_{ob}		150		pF	V_{CB}=–10V, f=1MHz

Characteristic curves (PNP)

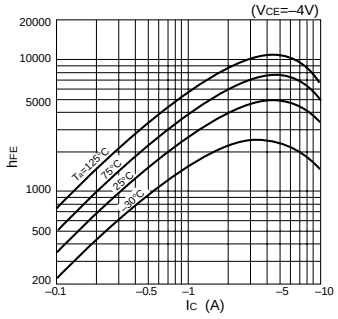
I_C-V_{CE} Characteristics (Typical)



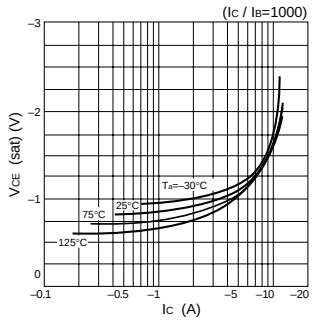
h_{FE}-I_C Characteristics (Typical)



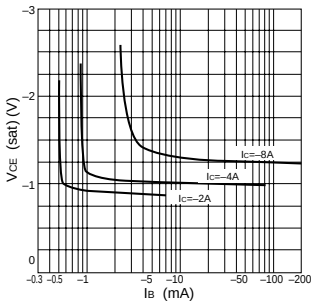
h_{FE}-I_C Temperature Characteristics (Typical)



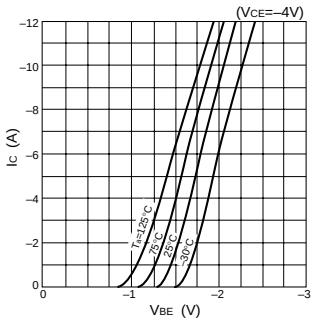
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



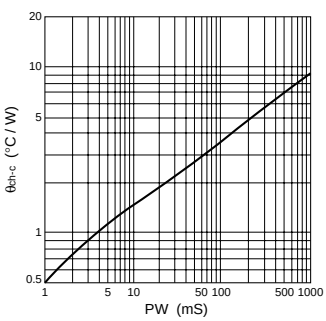
V_{CE}(sat)-I_B Characteristics (Typical)



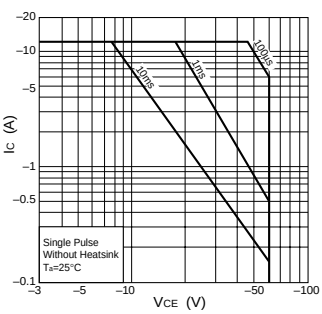
I_C-V_{BE} Temperature Characteristics (Typical)



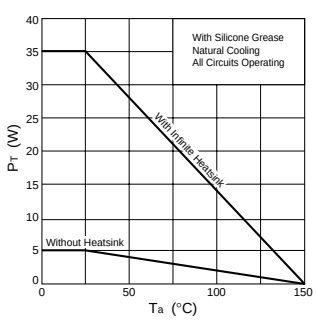
$\theta_{j\text{-}a}$-PW Characteristics



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5023

PNP Darlington + N-channel MOSFET

3-phase motor drive

External dimensions Ⓐ ··· SLA

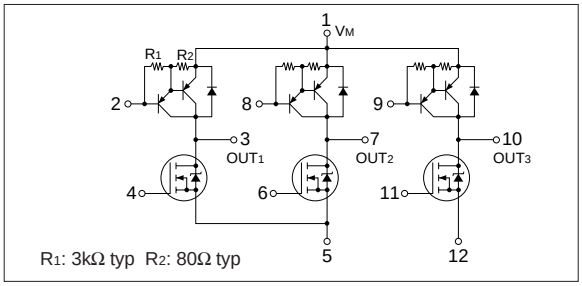
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_M	100	V
I_O	±6 (PW≤100ms)	A
I_{OP}	±8 (PW≤1ms)	A
V_{GSS}	±10	V
I_B	–0.5	A
P_T	5 (Ta=25°C)	W
	35 (Tc=25°C)	
θj-a	25	°C/W
θj-c	3.57	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tj	150	°C
Tstg	–40 to +150	°C

Electrical characteristics (Sink: N-channel MOSFET) (Ta=25°C)

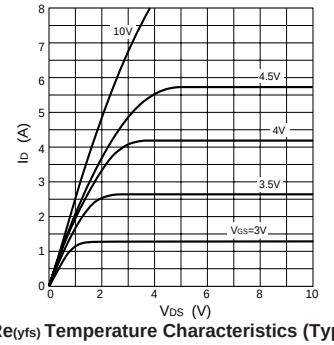
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
Re(yfs)	1.1	1.7		S	V_{DS}=10V, I_D=4A
$R_{DS(ON)}$		0.47	0.55	Ω	V_{GS}=10V, I_D=2A
		0.60	0.78		V_{GS}=4V, I_D=2A
Ciss		230		pF	V_{DS}=25V, f=1.0MHz,
Coss		60		pF	V_{GS}=0V
ton		60		ns	I_D=4A, V_{DD}=50V,
toff		50		ns	V_{GS}=10V
V_{SD}		1.2	2.0	V	I_{SD}=4A, V_{GS}=0V
trr		250		ns	I_F=±100mA

■Equivalent circuit diagram

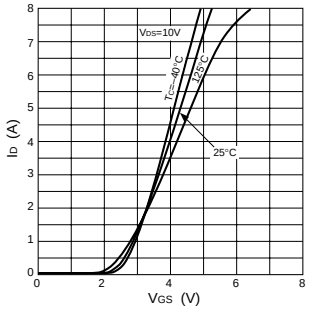


Characteristic curves (N-channel)

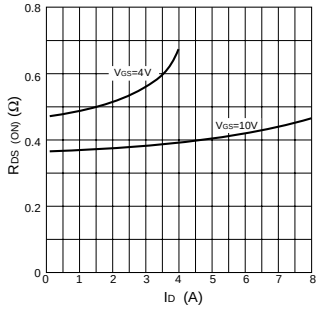
V_{DS}-I_D Characteristics (Typical)



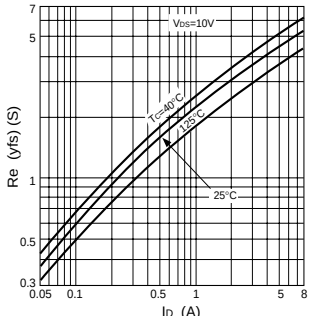
V_{GS}-I_D Temperature Characteristics (Typical)



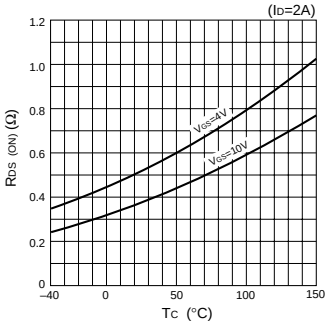
I_{DS}-$R_{DS(ON)}$ Characteristics (Typical)



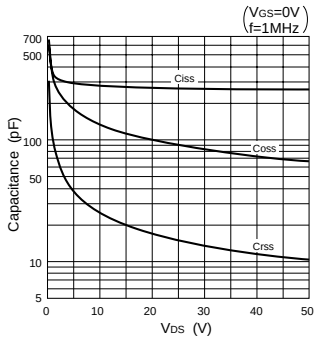
I_D-Re(yfs) Temperature Characteristics (Typical)



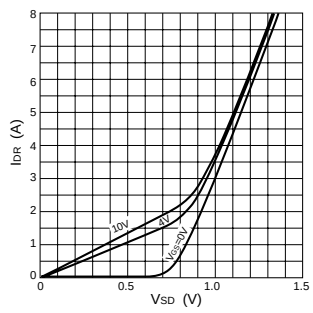
T_C-$R_{DS(ON)}$ Characteristics (Typical)



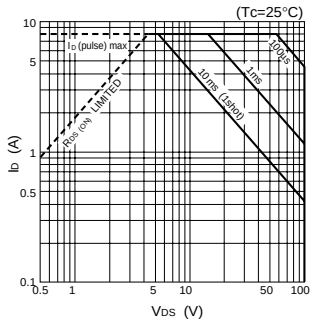
V_{DS}-Cpacitance Characteristics (Typical)



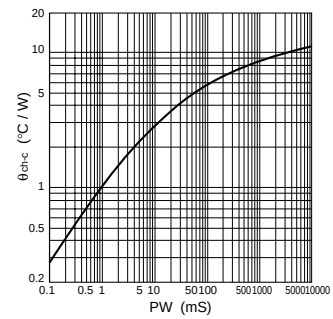
V_{SD}-I_{DR} Characteristics (Typical)



Safe Operating Area (SOA)



$\theta_{ch\text{-}c}$-PW Characteristics

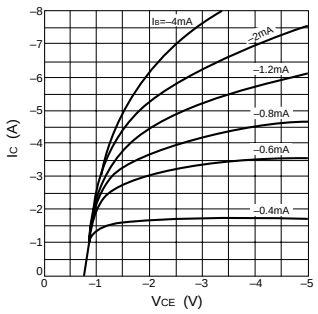


Electrical characteristics (Source: PNP transistor) (Ta=25°C)

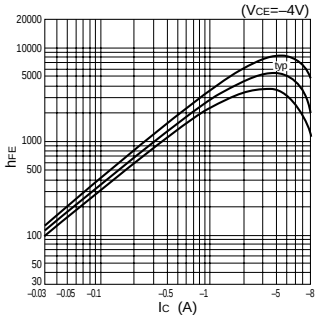
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–100V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–100			V	I_C=–10mA
h_{FE}	2000	5000	12000		V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			–1.5	V	I_C=–3A, I_B=–6mA
V_{BE}(sat)			–2.2	V	
V_{FEC}			1.3	V	I_{FEC}=–1A
t_{rr}		2.0		μs	I_F=±100mA
t_{on}		0.6		μs	V_{CC}≒–30V
t_{stg}		1.6		μs	I_C=–3A
t_f		0.5		μs	I_{B1}=–I_{B2}=–6mA
f_T		90		MHz	V_{CE}=–12V, I_E=1A
C_{ob}		100		pF	V_{CB}=–10V, f=1MHz

Characteristic curves (PNP)

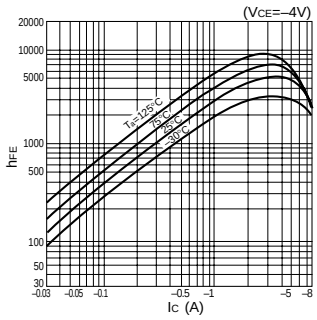
I_C-V_{CE} Characteristics (Typical)



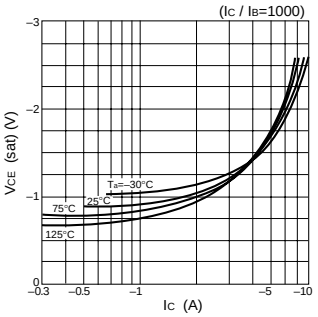
h_{FE}-I_C Characteristics (Typical)



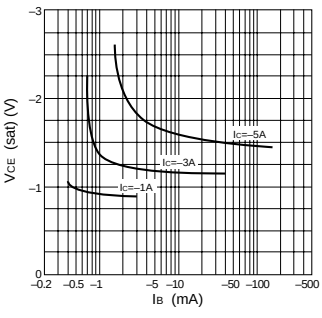
h_{FE}-I_C Temperature Characteristics (Typical)



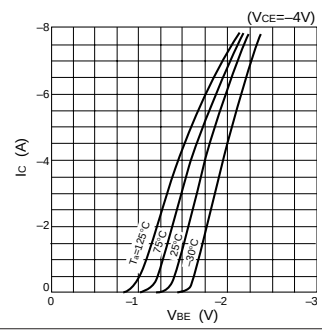
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



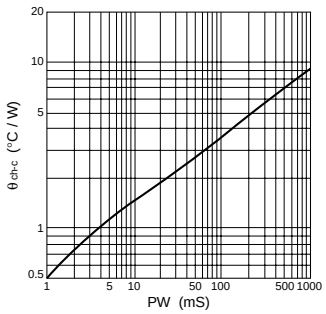
V_{CE}(sat)-I_B Characteristics (Typical)



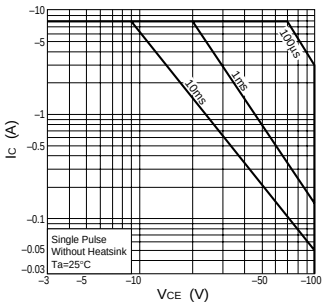
I_C-V_{BE} Temperature Characteristics (Typical)



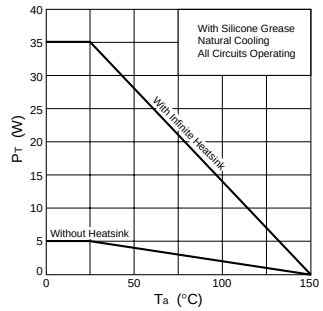
$\theta_{j\text{-}a}$-PW Characteristics



Safe Operating Area (SOA)



P_T-T_a Characteristics



Absolute maximum ratings

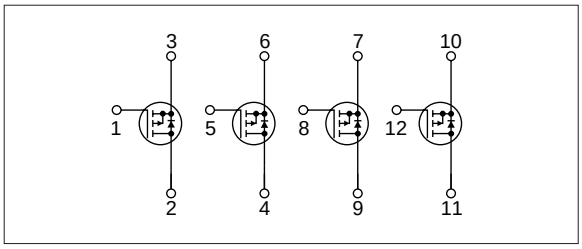
(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	–60	V
V_{GSS}	∓20	V
I_D	∓4	A
$I_{D(pulse)}$	∓8 (PW≤1ms)	A
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θ_{j-a}	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θ_{j-c}	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

(Ta=25°C)

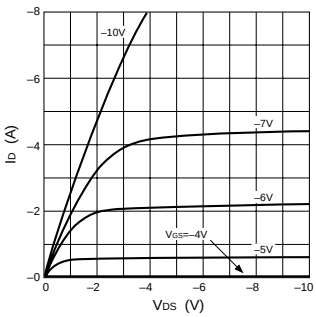
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			∓500	nA	V_{GS}=∓20V
I_{DSS}			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	1.6	2.2		S	V_{DS}=–10V, I_D=–4A
$R_{DS(ON)}$		0.38	0.55	Ω	V_{GS}=–10V, I_D=–4A
Ciss		270		pF	V_{DS}=–25V, f=1.0MHz,
Coss		170		pF	V_{GS}=0V
ton		60		ns	I_D=–4A, V_{DD}≒–30V, V_{GS}=–10V,
toff		60		ns	see Fig. 4 on page 16.
V_{SD}		–4.4	–5.5	V	I_{SD}=–4A
trr		150		ns	I_{SD}=∓100mA

■Equivalent circuit diagram

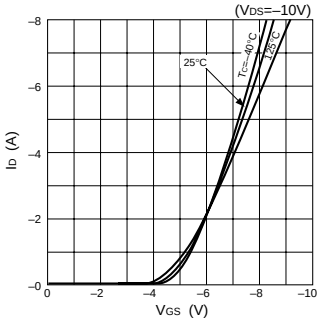


Characteristic curves

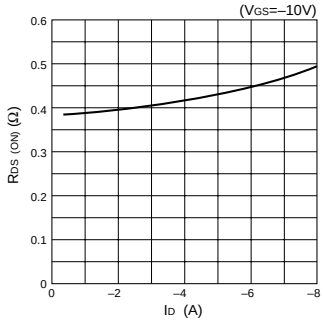
I_D-V_{DS} Characteristics (Typical)



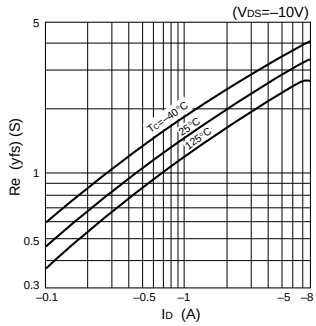
I_D-V_{GS} Characteristics (Typical)



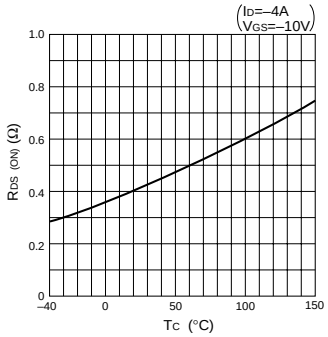
$R_{DS(ON)}$-I_D Characteristics (Typical)



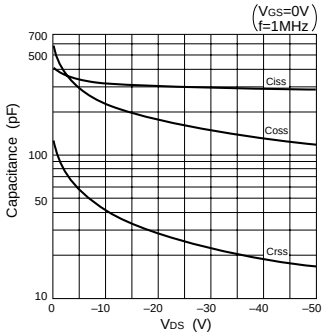
$Re_{(yfs)}$-I_D Characteristics (Typical)



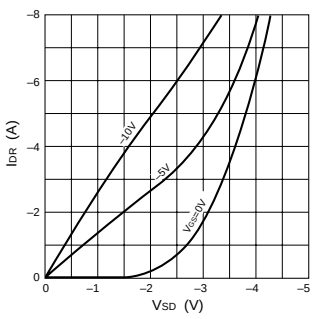
$R_{DS(ON)}$-Tc Characteristics (Typical)



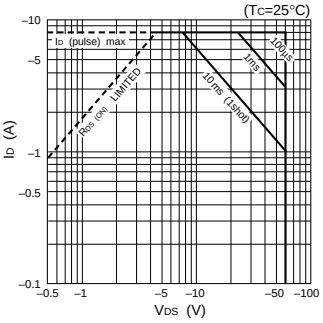
Capacitance-V_{DS} Characteristics (Typical)



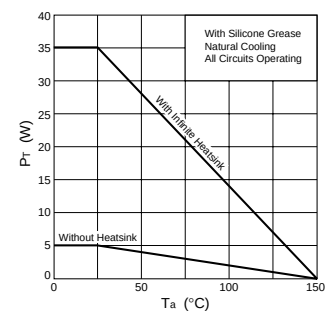
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5026

N-channel
General purpose

Absolute maximum ratings (Ta=25°C)

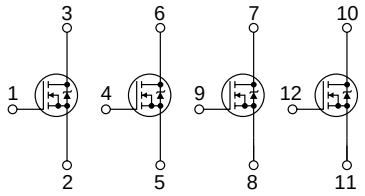
Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±10	A
$I_{D(pulse)}$	±40 (PW≤1ms)	A
E_{AS}*	70	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=25V, L=4.2mH, I_D=5A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics (Ta=25°C)

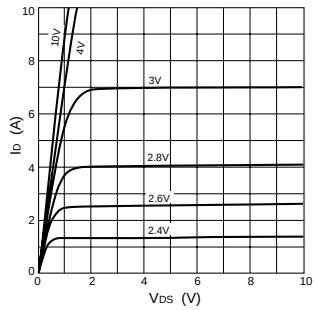
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
Re(yfs)	7	10		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		110	175	mΩ	V_{GS}=10V, I_D=5A
		140	220	mΩ	V_{GS}=4V, I_D=5A
Ciss		740		pF	V_{DS}=10V, f=1.0MHz,
Coss		240		pF	V_{GS}=0V
td(on)		20		ns	I_D=5A,
tr		45		ns	V_{DD}≒50V,
td(off)		60		ns	R_L=10Ω, V_{GS}=5V,
tf		20		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.4	V	I_{SD}=10A, V_{GS}=0V
trr		180		ns	I_{SD}=±100mA

■Equivalent circuit diagram

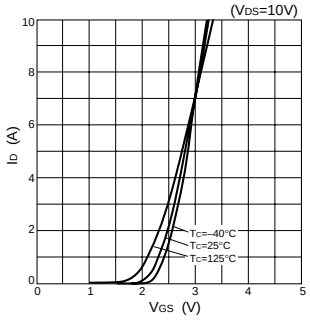


Characteristic curves

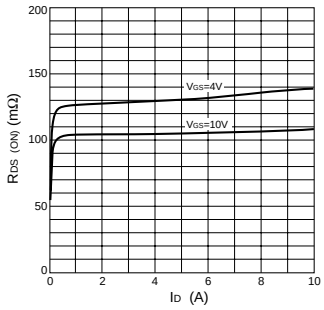
I_D-V_{DS} Characteristics (Typical)



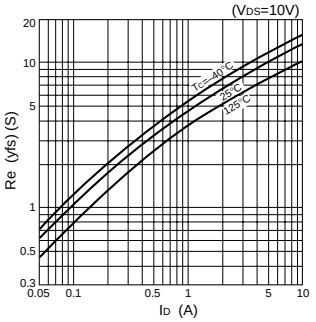
I_D-V_{GS} Characteristics (Typical)



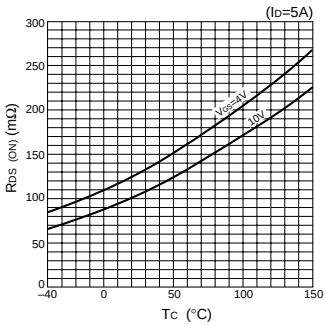
$R_{DS(ON)}$-I_D Characteristics (Typical)



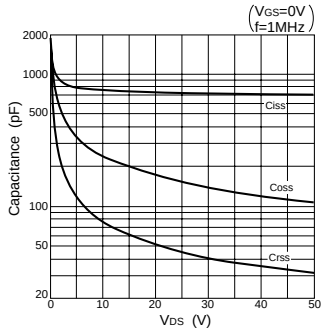
Re(yfs)-I_D Characteristics (Typical)



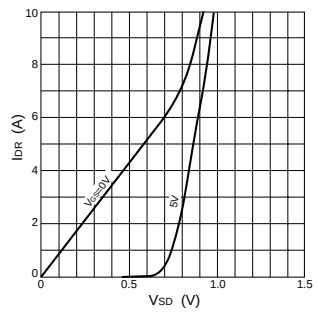
$R_{DS(ON)}$-T_C Characteristics (Typical)



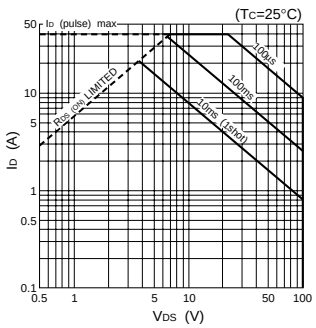
Capacitance-V_{DS} Characteristics (Typical)



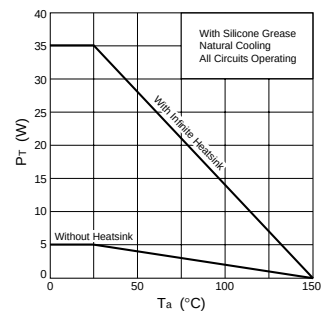
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



Absolute maximum ratings

(Ta=25°C)

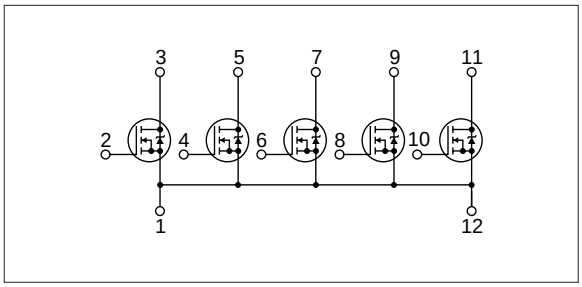
Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	±20	V
I_D	±4	A
$I_{D(pulse)}$	±8 (PW≤1ms)	A
E_{AS}*	1	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=20V, L=1mH, I_D=1.2A, unclamped, see Fig. E on page 15.

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=60V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA
Re(yfs)	1.5	2.4		S	V_{DS}=10V, I_D=4A
$R_{DS(ON)}$		0.33	0.45	Ω	V_{GS}=10V, I_D=4A
Ciss		120		pF	V_{DS}=25V, f=1.0MHz,
Coss		60		pF	V_{GS}=0V
ton		115		ns	I_D=4A, V_{DD}≒30V, V_{GS}=10V,
toff		35		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=4A
trr		100		ns	I_{SD}=±100mA

■Equivalent circuit diagram



Characteristic curves

SLA5031

N-channel
With built-in flywheel diode

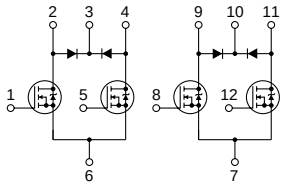
External dimensions Ⓐ ··· SLA

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	±10	V
I_D	±5	A
$I_{D(pulse)}$	±10 (PW≤1ms)	A
E_{AS}*	2	mJ
I_F	5 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	10 (PW≤10ms, Single pulse)	A
V_R	120	V
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=20V, L=1mH, I_D=1.7A, unclamped, see Fig. E on page 15.

■Equivalent circuit diagram



Electrical characteristics (Ta=25°C)

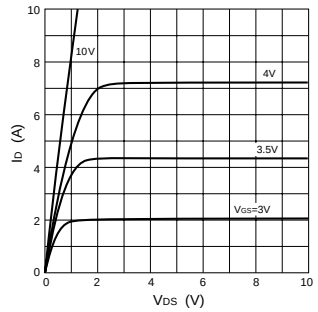
Symbol	Specification min	typ	max	Unit	Conditions
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	3.1	4.6		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		0.17	0.22	Ω	V_{GS}=10V, I_D=2.5A
		0.25	0.30	Ω	V_{GS}=4V, I_D=2.5A
Ciss		400		pF	V_{DS}=25V, f=1.0MHz,
Coss		160		pF	V_{GS}=0V
ton		80		ns	I_D=5A, V_{DD}≒30V, V_{GS}=5V,
toff		50		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A, V_{GS}=0V
trr		150		ns	I_{SD}=±100mA

●Diode for flyback voltage absorption

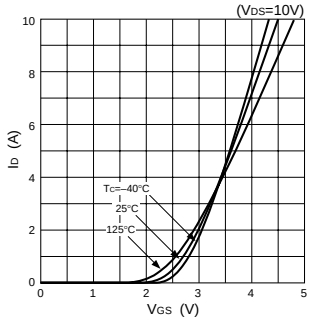
Symbol	Speciication min	typ	max	Unit	Conditions
V_R	120			V	I_R=10μA
V_F		1.0	1.2	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F=±100mA

Characteristic curves

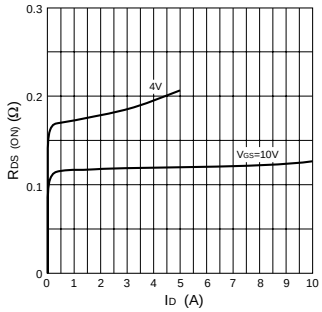
I_D-V_{DS} Characteristics (Typical)



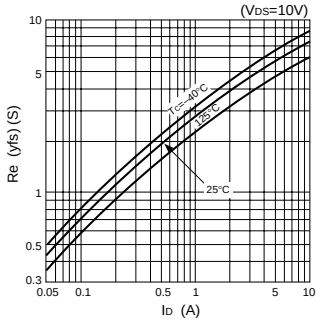
I_D-V_{GS} Characteristics (Typical)



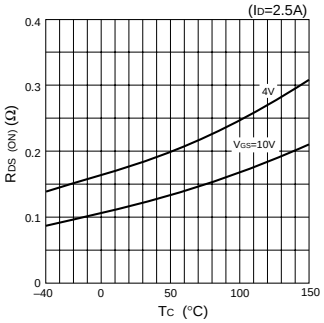
$R_{DS(ON)}$-I_D Characteristics (Typical)



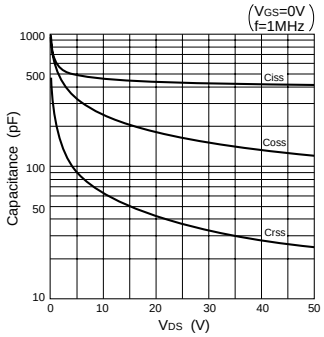
$Re_{(yfs)}$-I_D Characteristics (Typical)



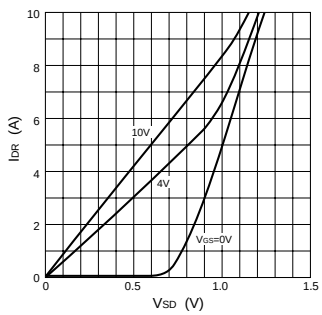
$R_{DS(ON)}$-T_C Characteristics (Typical)



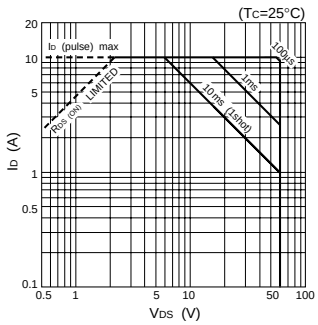
Capacitance-V_{DS} Characteristics (Typical)



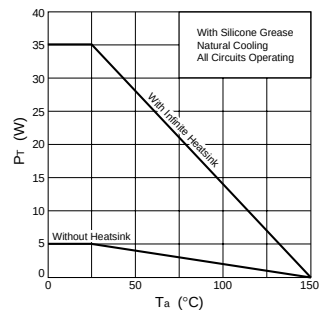
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5037

N-channel
General purpose

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±10	A
$I_{D(pulse)}$	±40 (PW≤1ms)	A
E_{AS}*	200	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	40 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.13 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

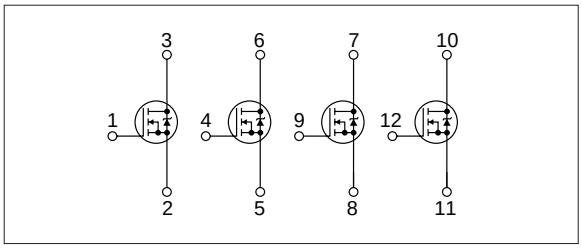
* : V_{DD}=25V, L=3mH, I_D=10A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

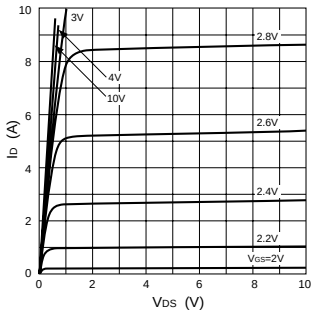
Symbol	Specifications			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
Re(yfs)	8	13		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		60	80	mΩ	V_{GS}=10V, I_D=5A
		75	95	mΩ	V_{GS}=4V, I_D=5A
Ciss		1630		pF	V_{DS}=10V, f=1.0MHz,
Coss		480		pF	V_{GS}=0V
td(on)		30		ns	I_D=5A,
tr		45		ns	V_{DD}≒50V,
td(off)		100		ns	R_L=10Ω, V_{GS}=5V,
tf		40		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=10A, V_{GS}=0V
trr		300		ns	I_{SD}=±100mA

■Equivalent circuit diagram

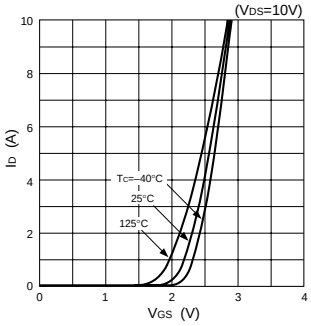


Characteristic curves

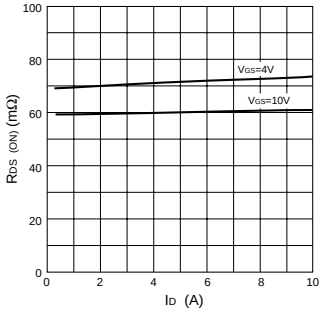
I_D-V_{DS} Characteristics (Typical)



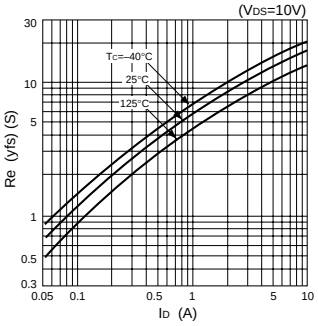
I_D-V_{GS} Characteristics (Typical)



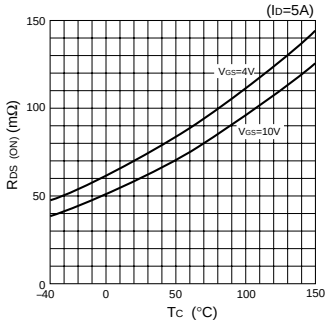
$R_{DS(ON)}$-I_D Characteristics (Typical)



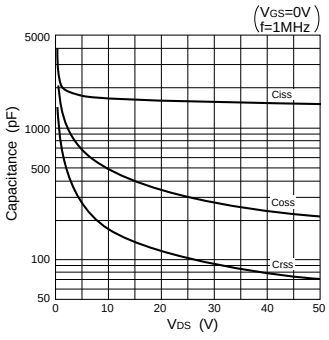
Re(yfs)-I_D Characteristics (Typical)



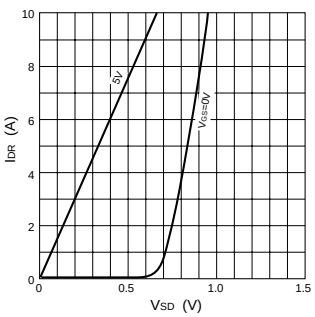
$R_{DS(ON)}$-T_C Characteristics (Typical)



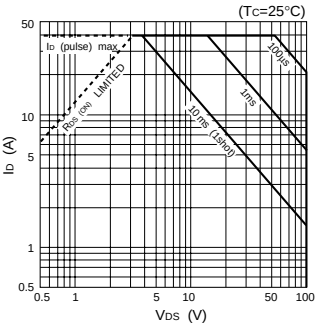
Capacitance-V_{DS} Characteristics (Typical)



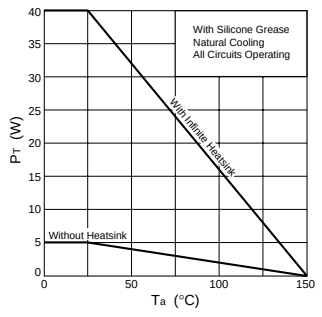
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5038

N-channel

General purpose

External dimensions Ⓐ ··· SLA

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	150	V
V_{GSS}	±20	V
I_D	±7	A
$I_{D(pulse)}$	±15 (PW≤1ms)	A
E_{AS}*	100	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj–a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj–c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

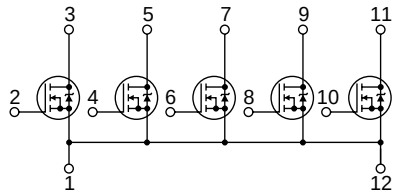
* : V_{DD}=25V, L=3.5mH, I_D=7A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

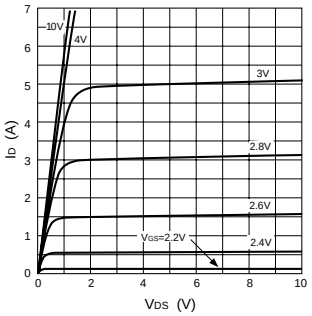
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	150			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=150V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	6	8.5		S	V_{DS}=10V, I_D=3.5A
$R_{DS(ON)}$		150	200	mΩ	V_{GS}=10V, I_D=3.5A
		180	230	mΩ	V_{GS}=4V, I_D=3.5A
Ciss		930		pF	V_{DS}=10V, f=1.0MHz,
Coss		230		pF	V_{GS}=0V
$t_{d(on)}$		25		ns	I_D=3.5A,
t_r		35		ns	V_{DD}≒70V,
$t_{d(off)}$		70		ns	R_L=20Ω, V_{GS}=5V,
t_f		30		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=7A, V_{GS}=0V
t_{rr}		350		ns	I_{SD}=±100mA

■Equivalent circuit diagram

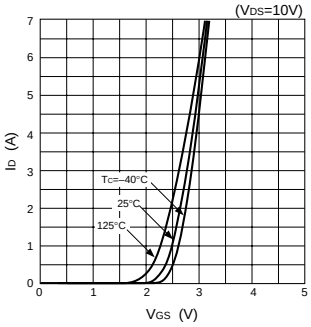


Characteristic curves

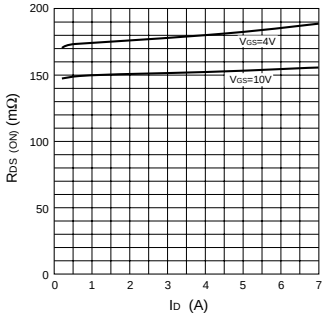
I_D-V_{DS} Characteristics (Typical)



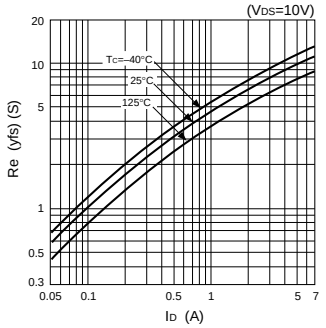
I_D-V_{GS} Characteristics (Typical)



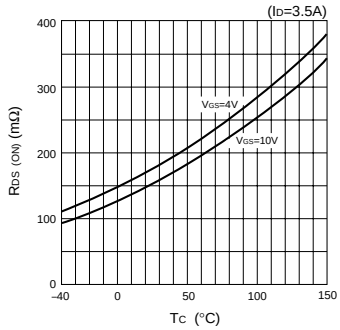
$R_{DS(ON)}$-I_D Characteristics (Typical)



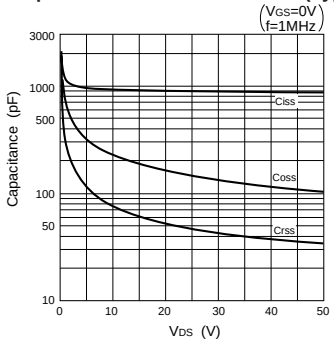
$Re_{(yfs)}$-I_D Characteristics (Typical)



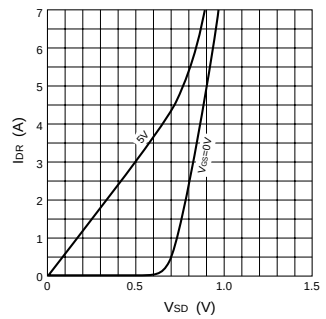
$R_{DS(ON)}$-T_C Characteristics (Typical)



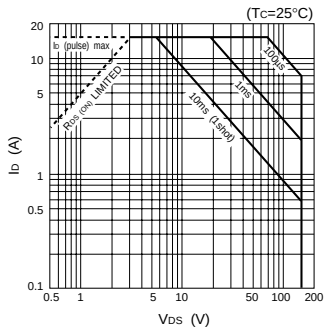
Capacitance-V_{DS} Characteristics (Typical)



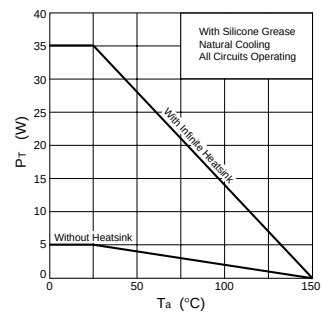
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5040

N-channel

With built-in flywheel diode

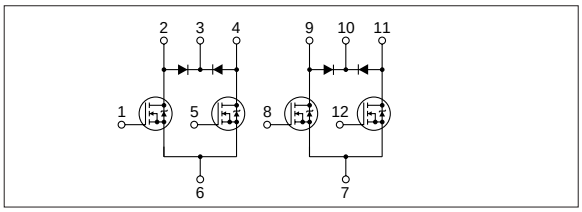
Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±4	A
$I_{D(pulse)}$	±8 (PW≤1ms)	A
E_{AS}*	16	mJ
I_F	4 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	8 (PW≤10ms, Single pulse)	A
V_R	120	V
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
$\theta_{j\text{-}a}$	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
$\theta_{j\text{-}c}$	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=20V, L=1mH, I_D=5A, unclamped, see Fig. E on page 15.

■Equivalent circuit diagram



Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.1	1.7		S	V_{DS}=10V, I_D=4A
$R_{DS(ON)}$		0.50	0.60	Ω	V_{GS}=10V, I_D=4A
Ciss		180		pF	V_{DS}=25V, f=1.0MHz,
Coss		82		pF	V_{GS}=0V
t_{on}		40		ns	I_D=4A, V_{DD}=50V, V_{GS}=10V,
t_{off}		40		ns	see Fig. 3 on page 16.
V_{SD}		1.2	2.0	V	I_{SD}=4A, V_{GS}=0V
t_{rr}		250		ns	I_{SD}=±100mA

●Diode for flyback voltage absorption

Symbol	Specification			Unit	Conditions
	min	typ	max		
V_R	120			V	I_R=10μA
V_F		1.0	1.2	V	I_F=1A
I_R			10	μA	V_R=120V
t_{rr}		100		ns	I_F=±100mA

Characteristic curves

SLA5041

N-channel
General purpose

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	200	V
V_{GSS}	±20	V
I_D	±10	A
$I_{D(pulse)}$	±40 (PW≤1ms, Du≤1%)	A
E_{AS}*	120	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	40 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.13 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

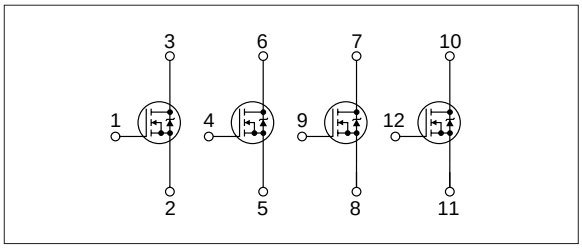
* : V_{DD}=25V, L=2.1mH, I_D=10A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

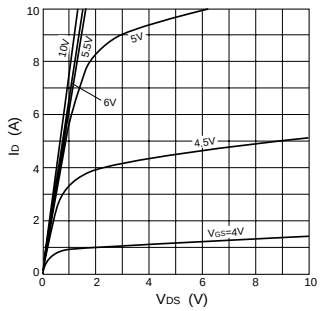
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	200			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=200V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=1mA
$Re_{(yfs)}$	5.0	8.5		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		130	175	mΩ	V_{GS}=10V, I_D=5A
Ciss		850		pF	V_{DS}=10V, f=1.0MHz,
Coss		550		pF	V_{GS}=0V
$td_{(on)}$		20		ns	I_D=5A,
tr		25		ns	V_{DD}≒100V,
$td_{(off)}$		70		ns	R_L=20Ω, V_{GS}=10V,
tf		70		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=10A, V_{GS}=0V
trr		500		ns	I_{SD}=±100mA

■Equivalent circuit diagram

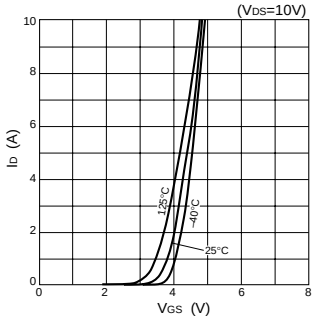


Characteristic curves

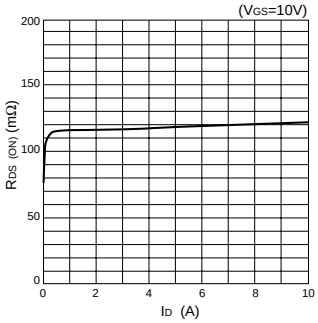
I_D-V_{DS} Characteristics (Typical)



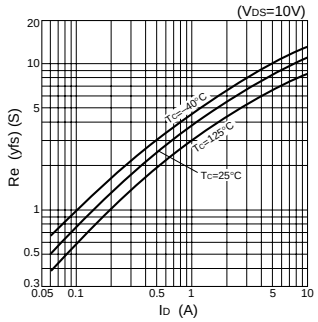
I_D-V_{GS} Characteristics (Typical)



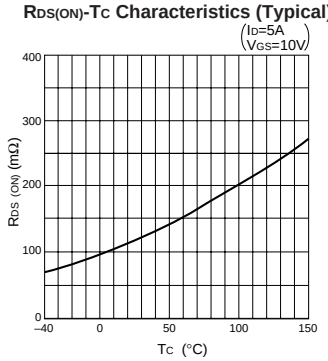
$R_{DS(ON)}$-I_D Characteristics (Typical)



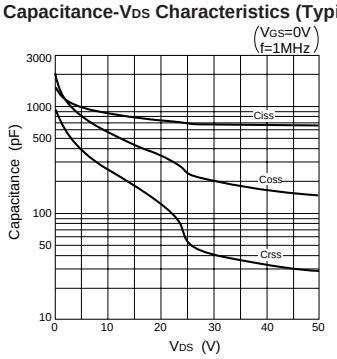
$Re_{(yfs)}$-I_D Characteristics (Typical)



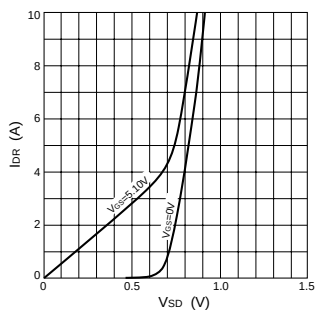
$R_{DS(ON)}$-T_C Characteristics (Typical)



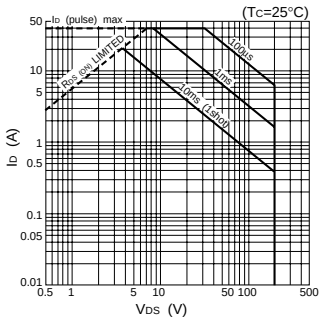
Capacitance-V_{DS} Characteristics (Typical)



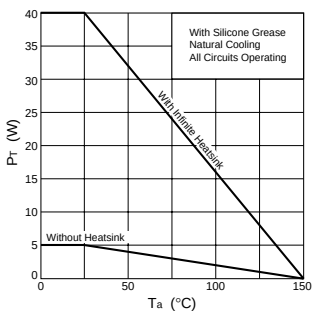
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5042

N-channel
General purpose

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±5	A
$I_{D(pulse)}$	±10 (PW≤1ms, Du≤1%)	A
E_{AS}*	70	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θj–a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj–c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

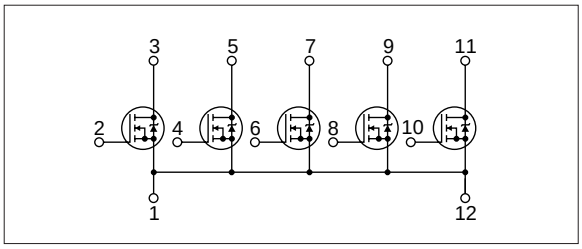
* : V_{DD}=25V, L=4.2mH, I_D=5A, unclamped, R_G=50Ω,see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

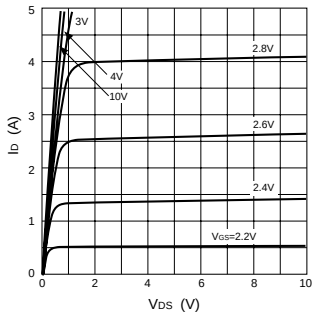
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
Re(yfs)	4	6		S	V_{DS}=10V, I_D=2.5A
$R_{DS(ON)}$		130	185	mΩ	V_{GS}=10V, I_D=2.5A
		155	230	mΩ	V_{GS}=4V, I_D=2.5A
Ciss		740		pF	V_{DS}=10V, f=1.0MHz,
Coss		240		pF	V_{GS}=0V
td(on)		20		ns	I_D=2.5A,
tr		30		ns	V_{DD}≒50V,
td(off)		60		ns	R_L=20Ω, V_{GS}=5V,
tf		20		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.4	V	I_{SD}=5A, V_{GS}=0V
trr		180		ns	I_{SD}=±100mA

■Equivalent circuit diagram

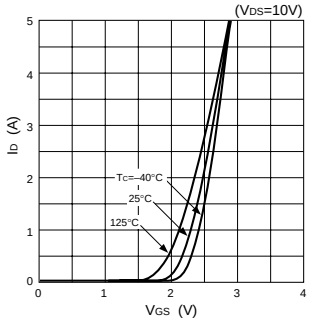


Characteristic curves

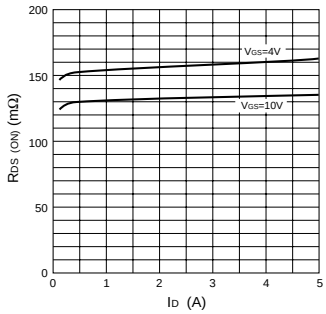
I_D-V_{DS} Characteristics (Typical)



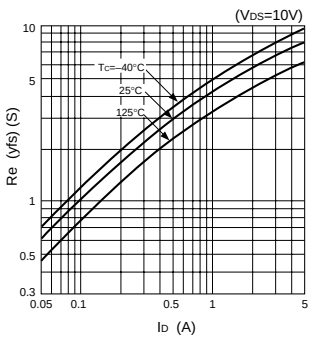
I_D-V_{GS} Characteristics (Typical)



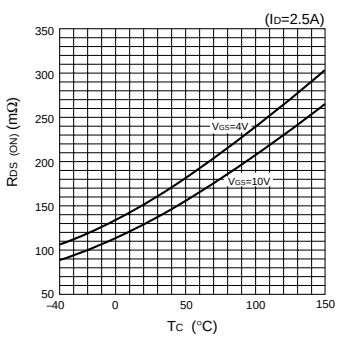
$R_{DS(ON)}$-I_D Characteristics (Typical)



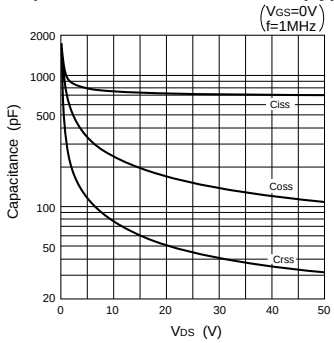
Re(yfs)-I_D Characteristics (Typical)



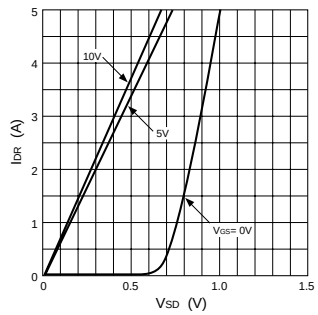
$R_{DS(ON)}$-T_C Characteristics (Typical)



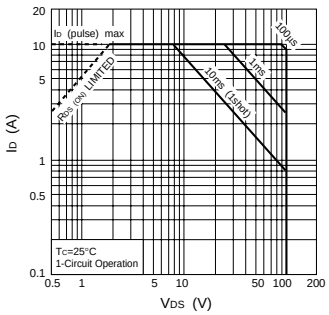
Capacitance-V_{DS} Characteristics (Typical)



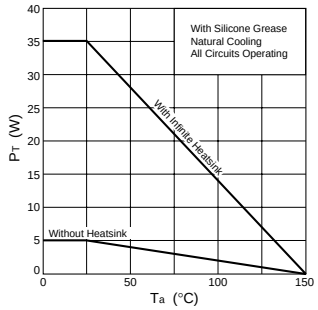
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5044

N-channel
General purpose

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	250	V
V_{GSS}	±20	V
I_D	±10	A
$I_{D(pulse)}$	±40 (PW≤1ms, Du≤1%)	A
E_{AS}*	120	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	40 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.13 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

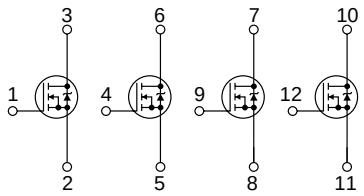
* : V_{DD}=25V, L=2.2mH, I_D=10A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

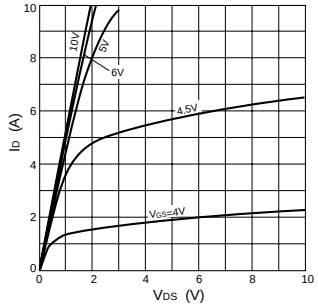
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	250			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=250V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=1mA
$Re_{(yfs)}$	5.0	8.5		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		200	250	mΩ	V_{GS}=10V, I_D=5A
Ciss		850		pF	V_{DS}=10V, f=1.0MHz,
Coss		550		pF	V_{GS}=0V
$t_{d(on)}$		20		ns	I_D=5A,
t_r		25		ns	V_{DD}≒100V,
$t_{d(off)}$		70		ns	R_L=20Ω, V_{GS}=10V,
t_f		70		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=10A, V_{GS}=0V
t_{rr}		700		ns	I_{SD}=±100mA

■Equivalent circuit diagram

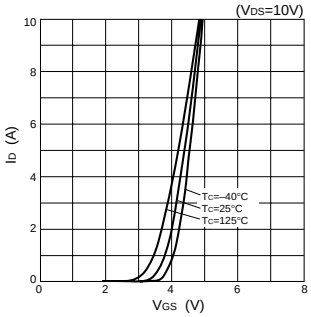


Characteristic curves

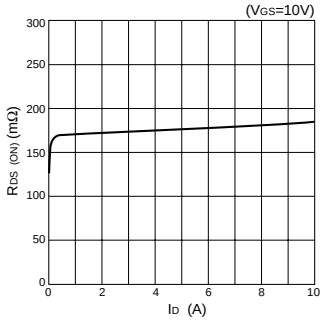
I_D-V_{DS} Characteristics (Typical)



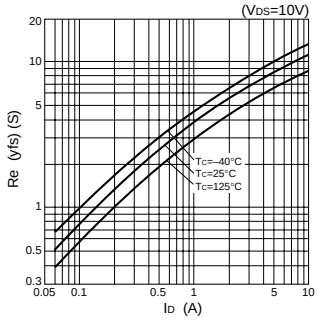
I_D-V_{GS} Characteristics (Typical)



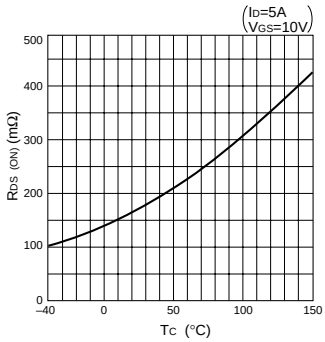
$R_{DS(ON)}$-I_D Characteristics (Typical)



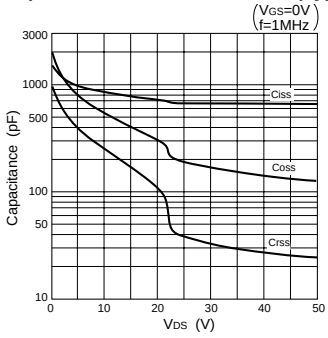
$Re_{(yfs)}$-I_D Characteristics (Typical)



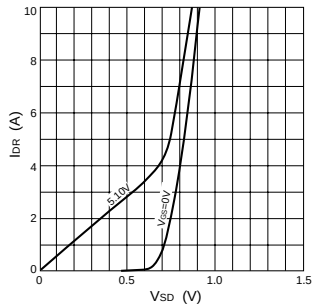
$R_{DS(ON)}$-T_C Characteristics (Typical)



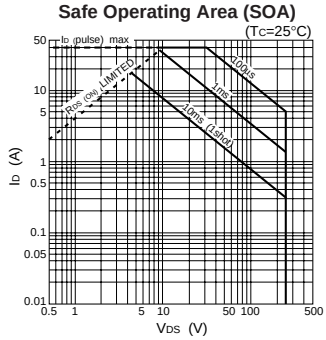
Capacitance-V_{DS} Characteristics (Typical)



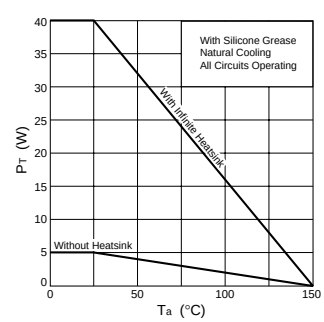
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5046

N-channel
General purpose

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	200	V
V_{GSS}	±20	V
I_D	±7	A
$I_{D(pulse)}$	±15 (PW≤1ms, Du≤1%)	A
E_{AS}*	55	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

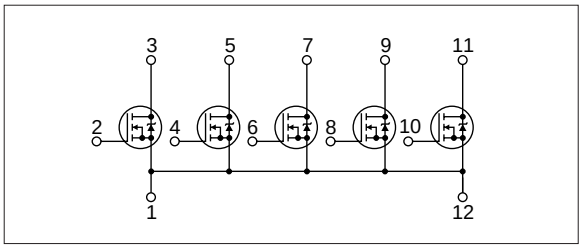
* : V_{DD}=25V, L=2.0mH, I_D=7A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

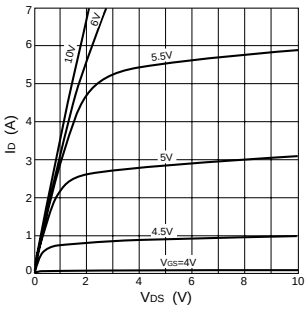
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	200			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=200V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=1mA
Re(yfs)	2.5	5.0		S	V_{DS}=10V, I_D=3.5A
$R_{DS(ON)}$		270	350	mΩ	V_{GS}=10V, I_D=3.5A
Ciss		450		pF	V_{DS}=10V,
Coss		280		pF	f=1.0MHz,
Crss		120		pF	V_{GS}=0V
td(on)		20		ns	I_D=3.5A,
tr		30		ns	V_D≒100V,
td(off)		55		ns	R_L=28.6Ω, V_{GS}=10V,
tf		75		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=7A, V_{GS}=0V
trr		450		ns	I_{SD}=±100mA

■Equivalent circuit diagram

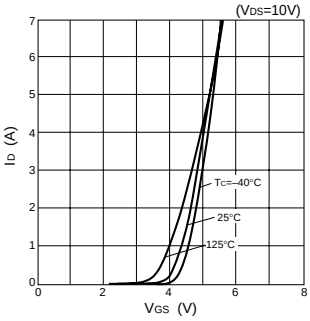


Characteristic curves

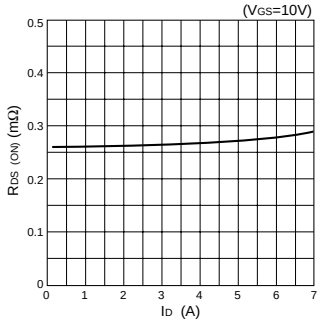
I_D-V_{DS} Characteristics (Typical)



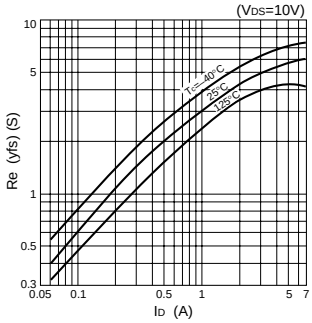
I_D-V_{GS} Characteristics (Typical)



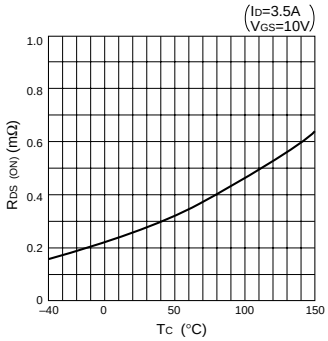
$R_{DS(ON)}$-I_D Characteristics (Typical)



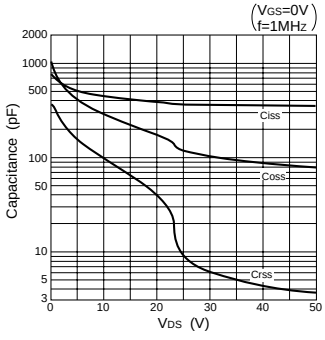
Re(yfs)-I_D Characteristics (Typical)



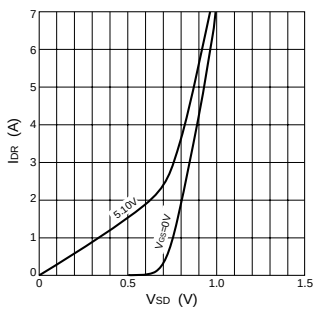
$R_{DS(ON)}$-T_C Characteristics (Typical)



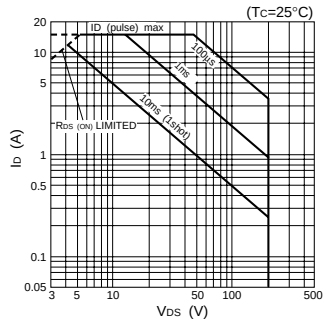
Capacitance-V_{DS} Characteristics (Typical)



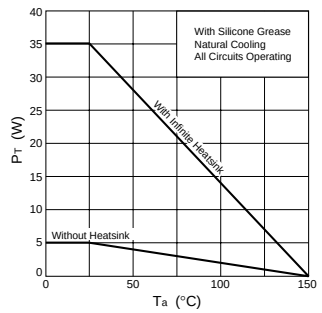
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5047

N-channel
General purpose

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	150	V
V_{GSS}	±20	V
I_D	±10	A
$I_{D(pulse)}$	±40 (PW≤1ms, Du≤1%)	A
E_{AS}*	280	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	40 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.13 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

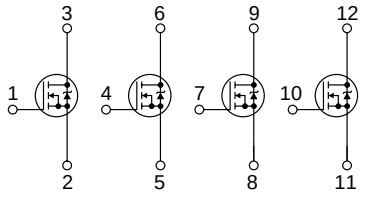
* : V_{DD}=25V, L=4.7mH, I_D=10A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

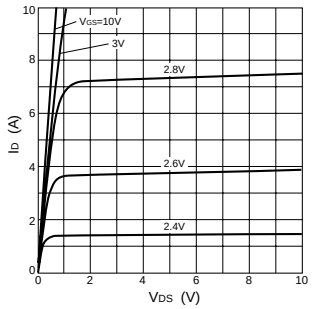
Symbol	Specification			Unit	Specification
	min	typ	max		
$V_{(BR)DSS}$	150			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=150V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	10	15		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		70	85	mΩ	V_{GS}=10V, I_D=5A
		80	100	mΩ	V_{GS}=4V, I_D=5A
Ciss		2000		pF	V_{DS}=10V, f=1.0MHz,
Coss		470		pF	V_{GS}=0V
$t_{d(on)}$		35		ns	I_D=5A,
tr		40		ns	V_{DD}≒70V,
$t_{d(off)}$		150		ns	R_L=14Ω, V_{GS}=5V,
tf		50		ns	see Fig. 3 on page 16.
V_{SD}		0.9	1.5	V	I_{SD}=10A, V_{GS}=0V
trr		500		ns	I_{SD}=±100mA

■Equivalent circuit diagram

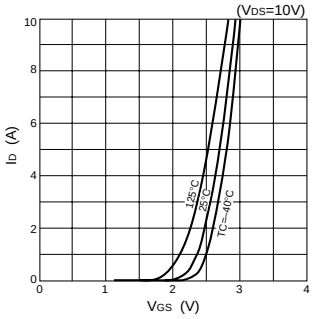


Characteristic curves

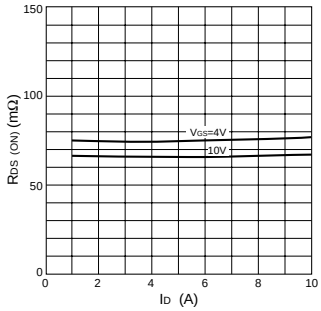
I_D-V_{DS} Characteristics (Typical)



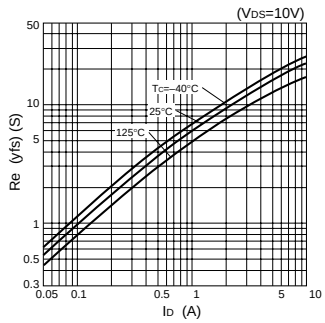
I_D-V_{GS} Characteristics (Typical)



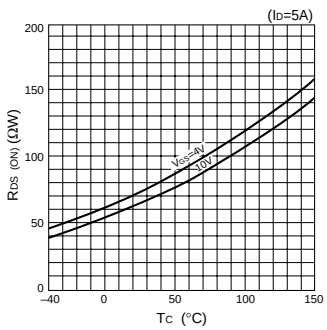
$R_{DS(ON)}$-I_D Characteristics (Typical)



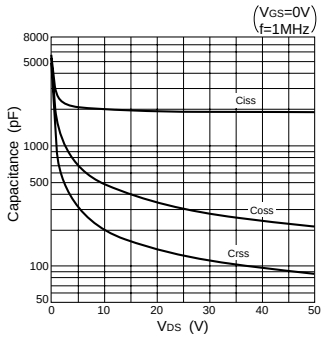
$Re_{(yfs)}$-I_D Characteristics (Typical)



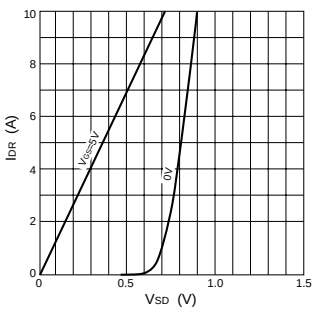
$R_{DS(ON)}$-T_C Characteristics (Typical)



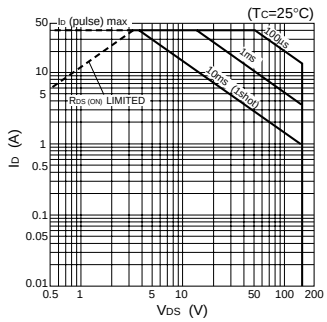
Capacitance-V_{DS} Characteristics (Typical)



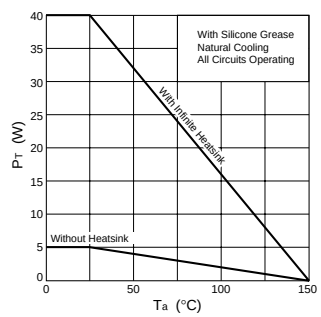
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5049

N-channel
General purpose

External dimensions Ⓐ ··· SLA

Absolute maximum ratings (Ta=25°C)

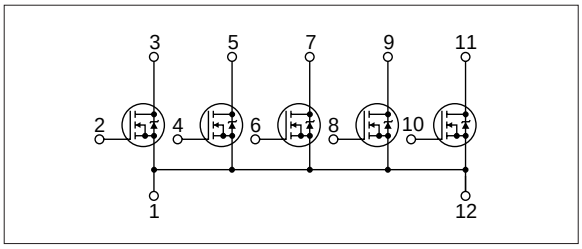
Symbol	Ratings	Unit
V_{DSS}	250	V
V_{GSS}	±20	V
I_D	±7	A
$I_{D(pulse)}$	±15 (PW≤1ms, Du≤1%)	A
E_{AS}*	55	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=25V, L=2.0mH, I_D=7A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics (Ta=25°C)

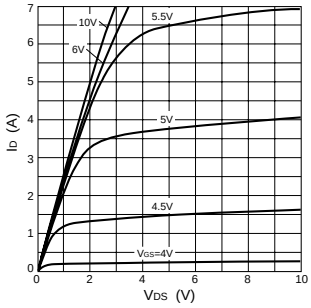
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	250			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=250V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=1mA
Re(yfs)	2.5	5.0		S	V_{DS}=10V, I_D=3.5A
$R_{DS(ON)}$		400	500	mΩ	V_{GS}=10V, I_D=3.5A
Ciss		450		pF	V_{DS}=10V, f=1.0MHz,
Coss		280		pF	V_{GS}=0V
td(on)		20		ns	I_D=3.5A,
tr		30		ns	V_{DD}≒100V,
td(off)		55		ns	R_L=28.6Ω, V_{GS}=10V,
tf		75		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=7A, V_{GS}=0V
trr		600		ns	I_{SD}=±100mA

■Equivalent circuit diagram

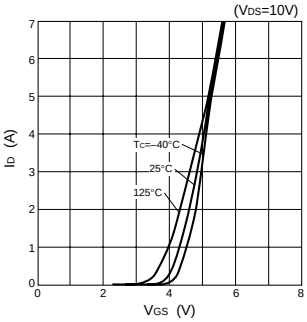


Characteristic curves

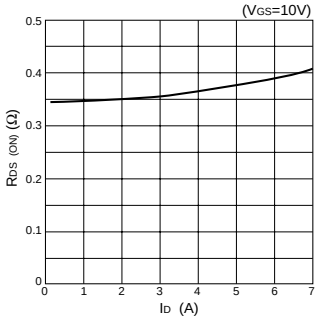
I_D-V_{DS} Characteristics (Typical)



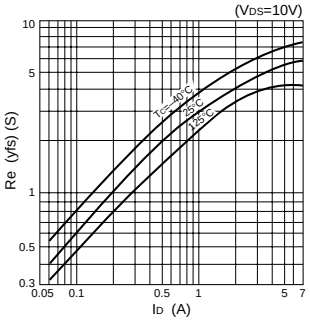
I_D-V_{GS} Characteristics (Typical)



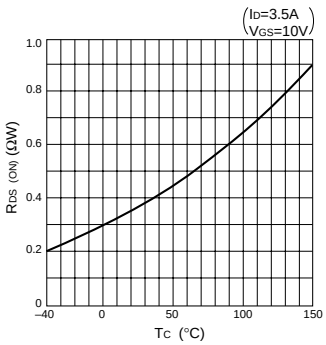
$R_{DS(ON)}$-I_D Characteristics (Typical)



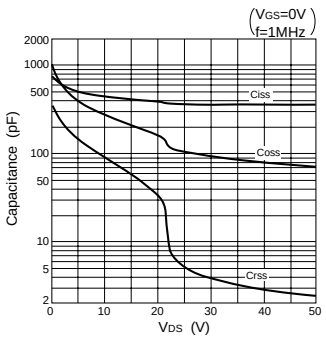
Re(yfs)-I_D Characteristics (Typical)



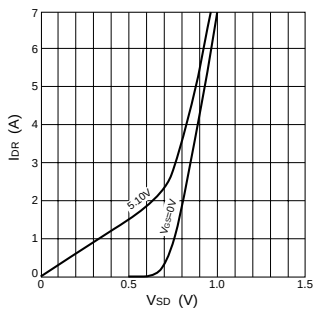
$R_{DS(ON)}$-T_C Characteristics (Typical)



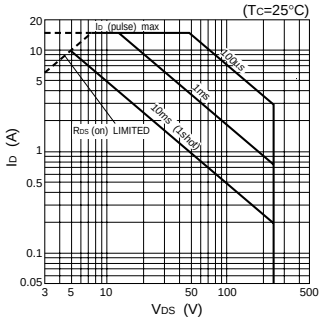
Capacitance-V_{DS} Characteristics (Typical)



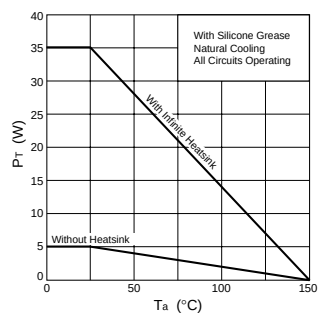
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SLA5052

N-channel

General purpose

External dimensions Ⓐ ··· SLA

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	150	V
V_{GSS}	±20	V
I_D	±10	A
$I_{D(pulse)}$	±40 (PW≤1ms, Du≤1%)	A
E_{AS}*	160	mJ
P_T	5 (Ta=25°C, with all circuits operating, without heatsink)	W
	40 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj–a	25 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj–c	3.13 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
V_{ISO}	1000 (Between fin and lead pin, AC)	Vrms
Tch	150	°C
Tstg	–40 to +150	°C

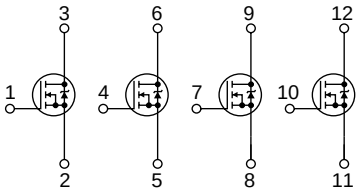
* : V_{DD}=25V, L=2.7mH, I_D=10A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

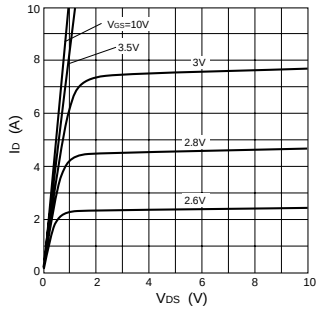
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	150			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=150V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	8	13.5		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		90	115	mΩ	V_{GS}=10V, I_D=5A
		105	130	mΩ	V_{GS}=4V, I_D=5A
Ciss		1500		pF	V_{DS}=10V, f=1.0MHz,
Coss		360		pF	V_{GS}=0V
$t_{d(on)}$		30		ns	I_D=5A,
t_r		35		ns	V_{DD}≒70V,
$t_{d(off)}$		100		ns	R_L=14Ω, V_{GS}=5V,
t_f		40		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=10A, V_{GS}=0V
t_{rr}		420		ns	I_{SD}=±100mA

■Equivalent circuit diagram

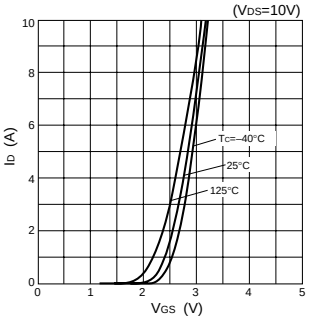


Characteristic curves

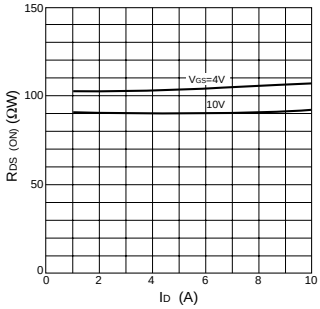
I_D-V_{DS} Characteristics (Typical)



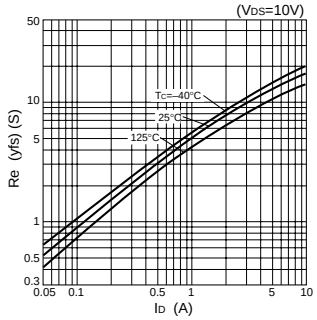
I_D-V_{GS} Characteristics (Typical)



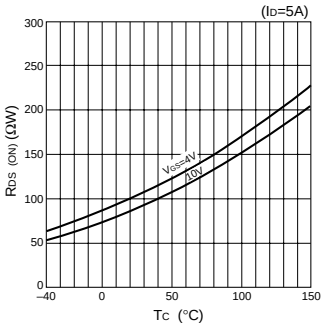
$R_{DS(ON)}$-I_D Characteristics (Typical)



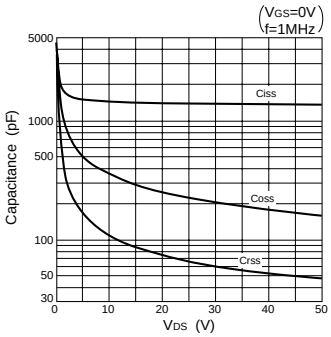
$Re_{(yfs)}$-I_D Characteristics (Typical)



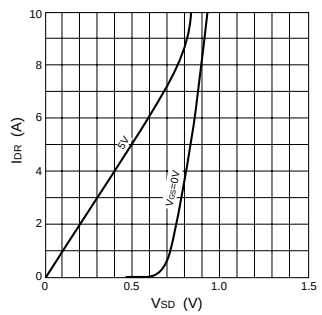
$R_{DS(ON)}$-T_C Characteristics (Typical)



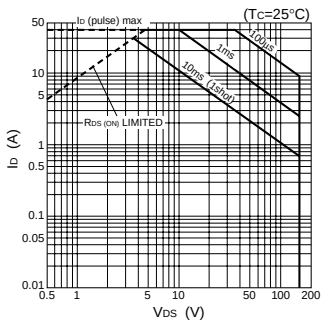
Capacitance-V_{DS} Characteristics (Typical)



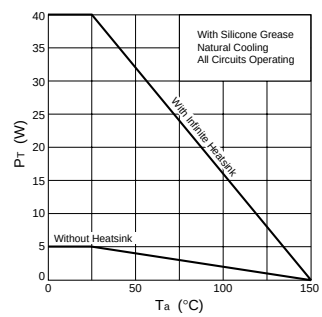
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics

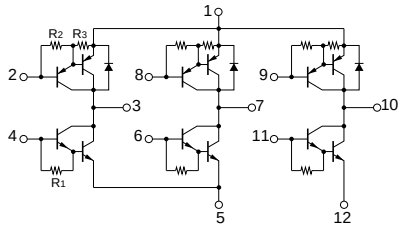


Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	4	–4	A
I_B	0.5	–0.5	A
P_T	5 (Ta=25°C)		W
	25 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	5		°C/W

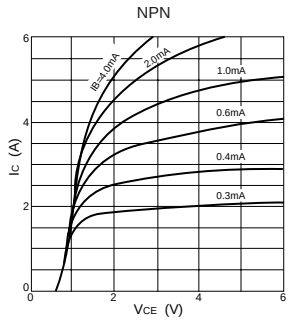
■Equivalent circuit diagram

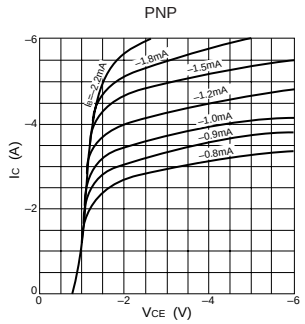


R1: 3kΩ typ R2: 2kΩ typ R3: 150Ω typ

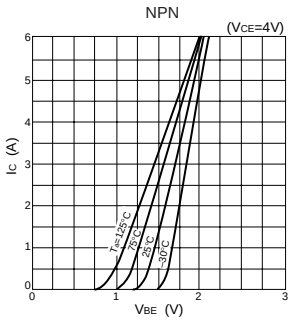
Characteristic curves

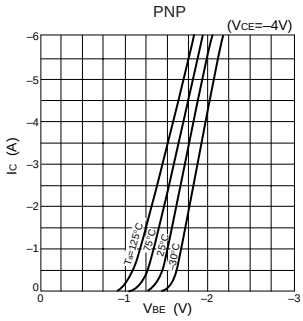
IC-VCE Characteristics (Typical)



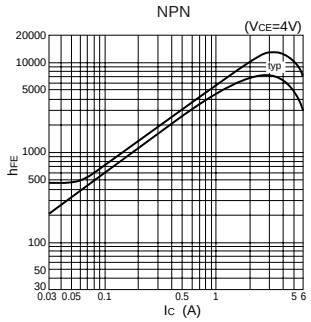


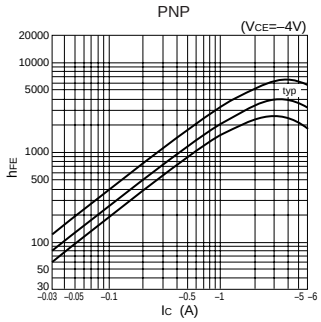
IC-VBE Temperature Characteristics (Typical)



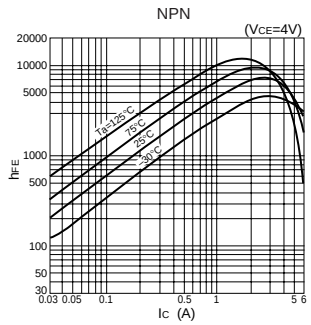


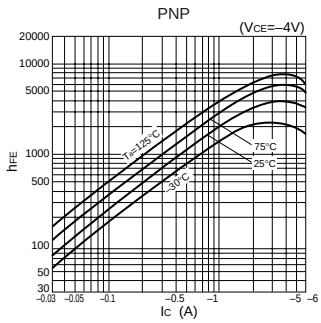
hFE-IC Characteristics (Typical)





hFE-IC Temperature Characteristics (Typical)





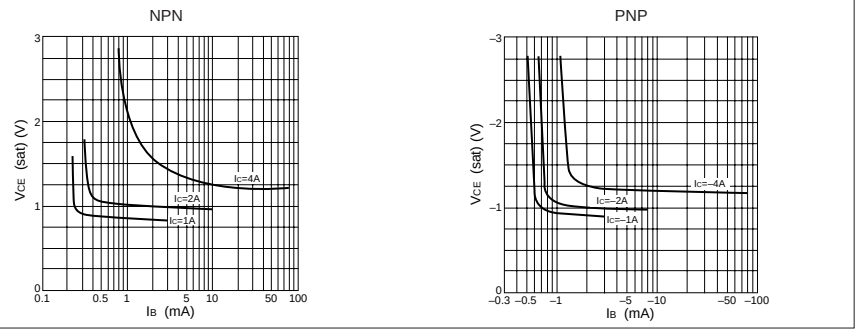
Electrical characteristics

(T_a=25°C)

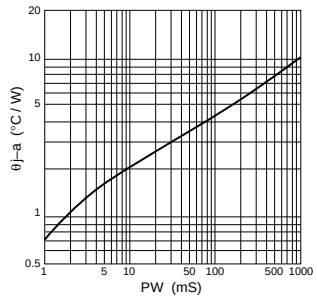
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V			–10	μA	V_{CB}=–60V
I_{EBO}			10	μA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	2000				V_{CE}=4V, I_C=3A	2000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=6mA			–1.5	V	I_C=–3A, I_B=–6mA

Characteristic curves

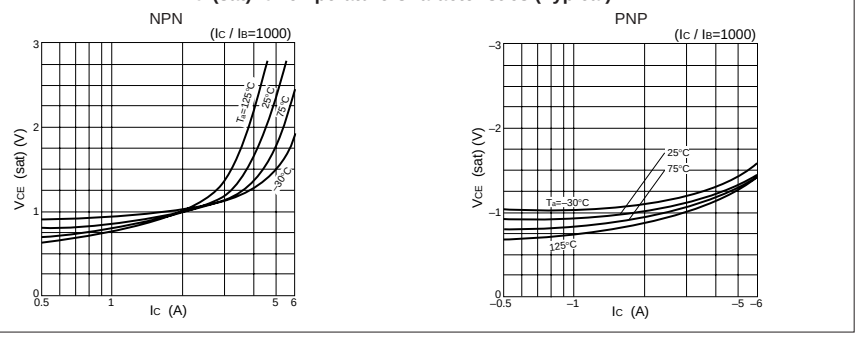
V_{CE}(sat)-I_B Characteristics (Typical)



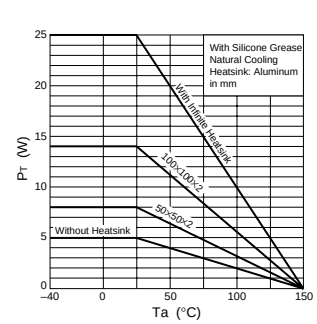
$\theta_{j\text{-}a}$-PW Characteristics



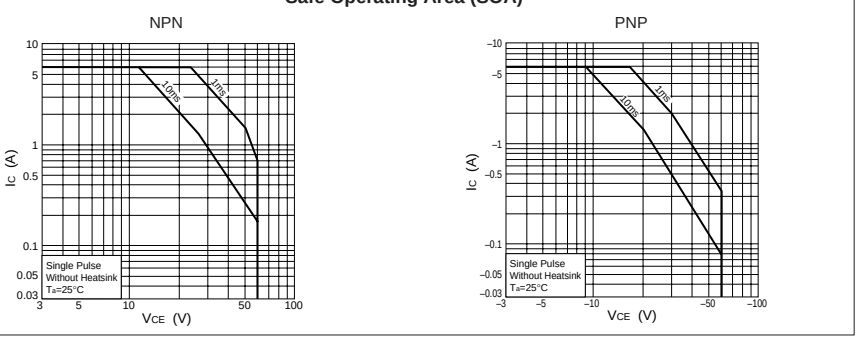
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

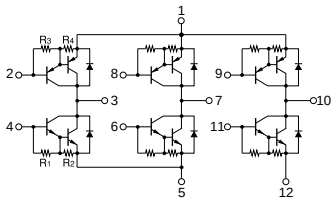


Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	100	–100	V
V_{CEO}	100	–100	V
V_{EBO}	6	–6	V
I_C	5	–5	A
I_{CP}	8 (PW≤1ms, Du≤50%)	–8 (PW≤1ms, Du≤50%)	A
I_B	0.5	–0.5	A
P_T	5 (Ta=25°C)		W
	25 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	5		°C/W

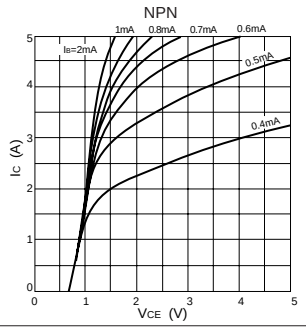
■Equivalent circuit diagram

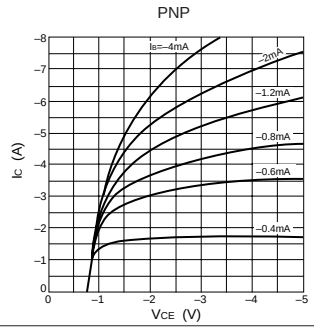


R1: 2.5kΩ typ R2: 200Ω typ R3: 3kΩ typ R4: 100Ω typ

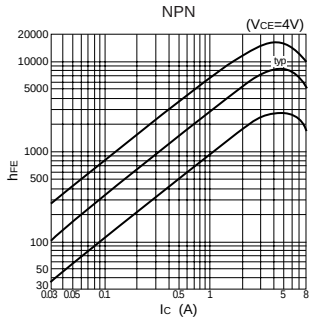
Characteristic curves

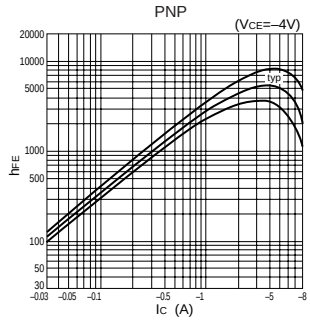
IC-VCE Characteristics (Typical)



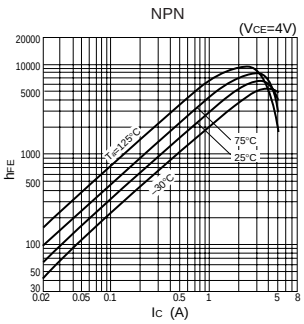


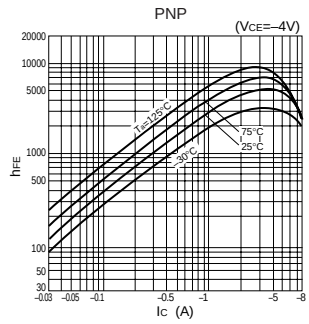
hFE-IC Characteristics (Typical)



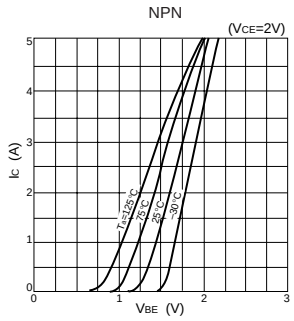


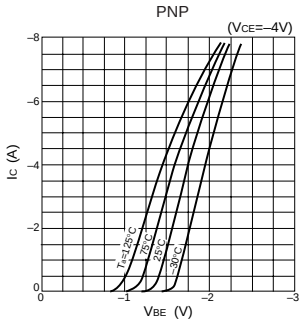
hFE-IC Temperature Characteristics (Typical)





IC-VBE Temperature Characteristics (Typical)





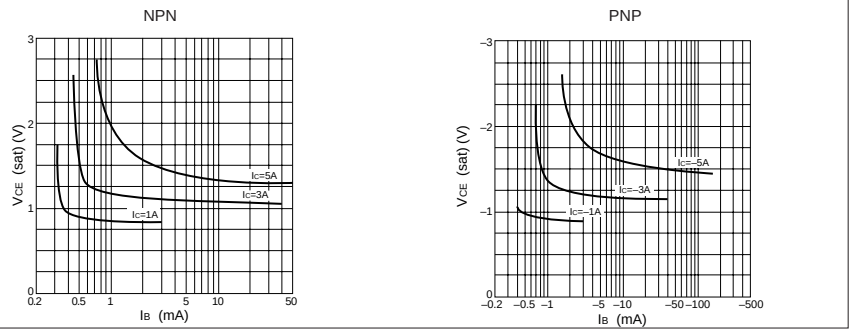
Electrical characteristics

(T_a=25°C)

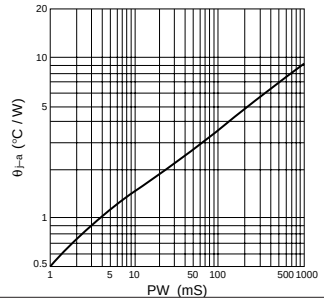
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=100V			–10	μA	V_{CB}=–100V
I_{EBO}			10	mA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	100			V	I_C=10mA	–100			V	I_C=–10mA
h_{FE}	2000				V_{CE}=4V, I_C=3A	2000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=6mA			–1.5	V	I_C=–3A, I_B=–6mA

Characteristic curves

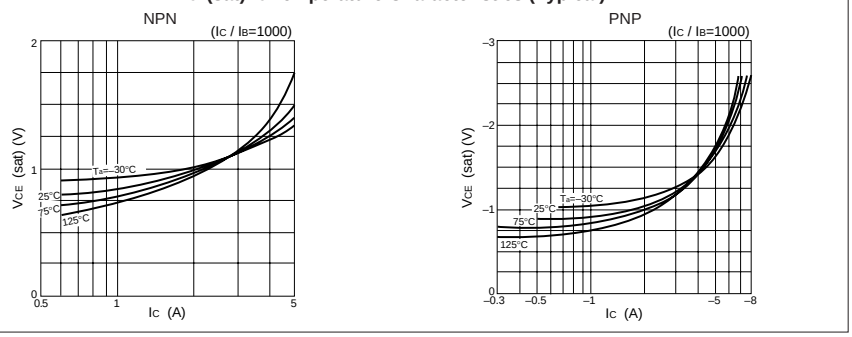
V_{CE}(sat)-I_B Characteristics (Typical)



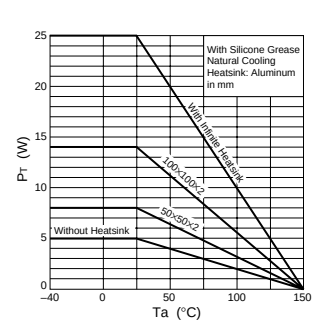
$\theta_{j\text{-}a}$-PW Characteristics



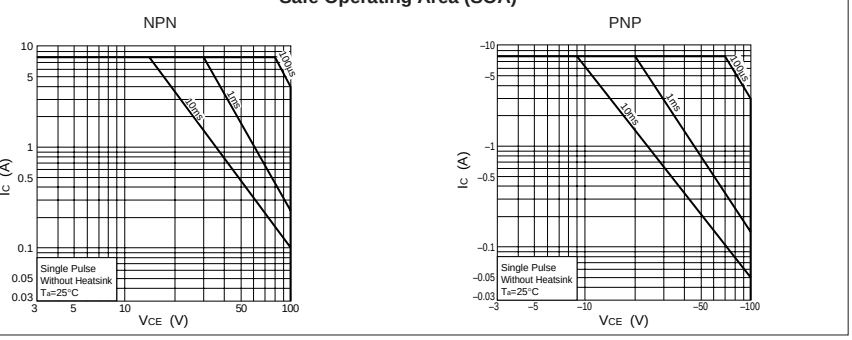
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

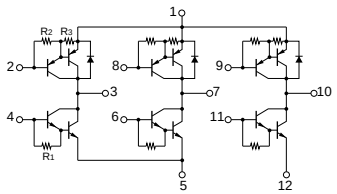


Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	100	–100	V
V_{CEO}	80	–100	V
V_{EBO}	6	–6	V
I_C	5	–5	A
I_B	0.5	–0.5	A
P_T	5 (Ta=25°C)		W
	25 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	5		°C/W

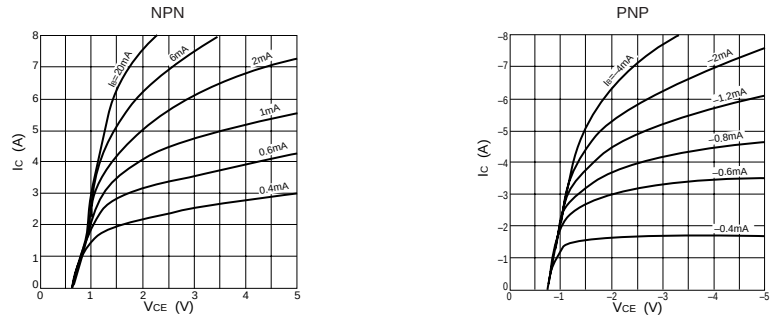
■Equivalent circuit diagram



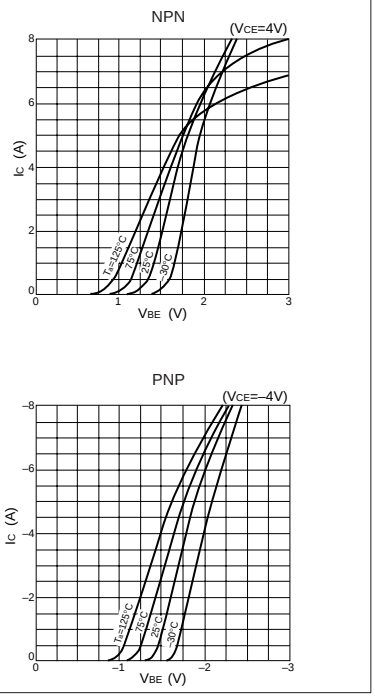
R_1: 2.5kΩ typ R_2: 2.5kΩ typ R_3: 200Ω typ

Characteristic curves

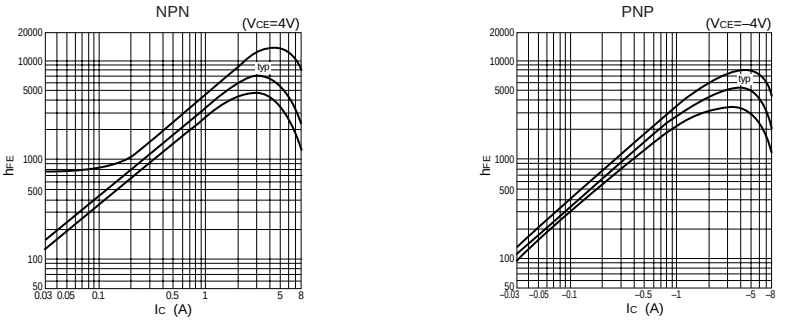
I_C-V_{CE} Characteristics (Typical)



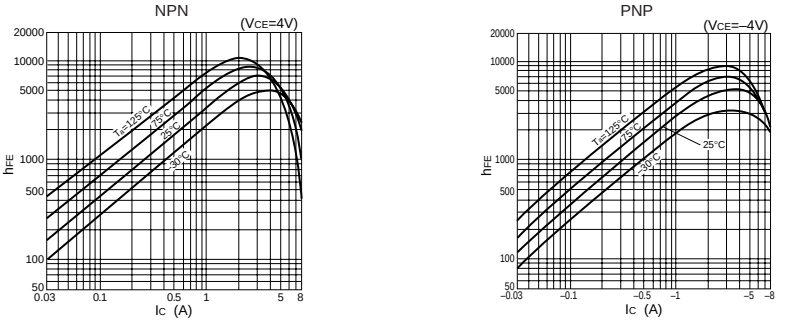
I_C-V_{BE} Temperature Characteristics (Typical)



h_{FE}-I_C Characteristics (Typical)



h_{FE}-I_C Temperature Characteristics (Typical)



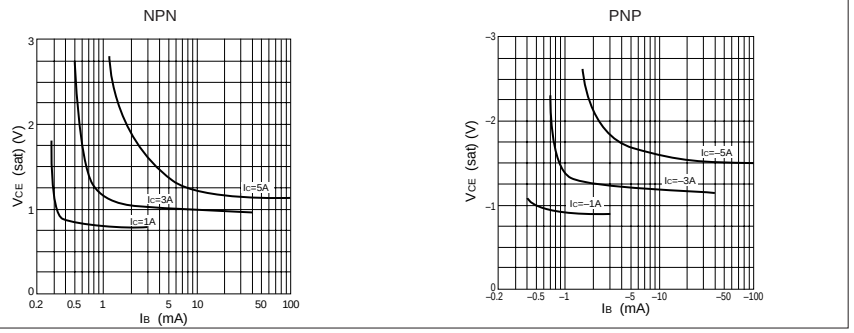
Electrical characteristics

(T_a=25°C)

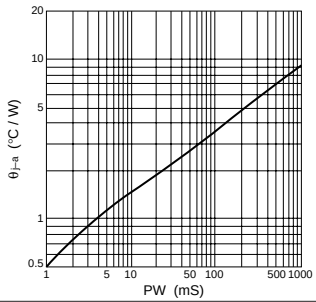
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=100V			–10	μA	V_{CB}=–100V
I_{EBO}			10	μA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	80			V	I_C=10mA	–100			V	I_C=–10mA
h_{FE}	2000				V_{CE}=4V, I_C=3A	2000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=6mA			–1.5	V	I_C=–3A, I_B=–6mA
V_{FEC}				V				1.3	V	I_{FEC}=1A
t_{rr}				μs			2.0		μs	I_{FEC}=±100mA

Characteristic curves

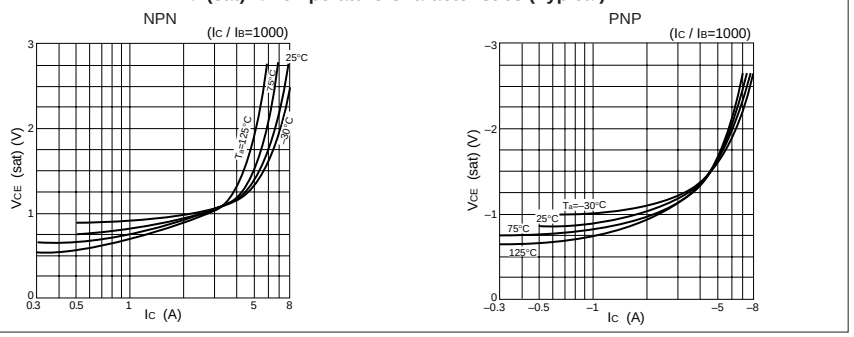
V_{CE}(sat)-I_B Characteristics (Typical)



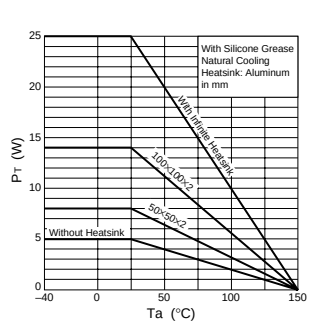
$\theta_{j\text{-}a}$-PW Characteristics



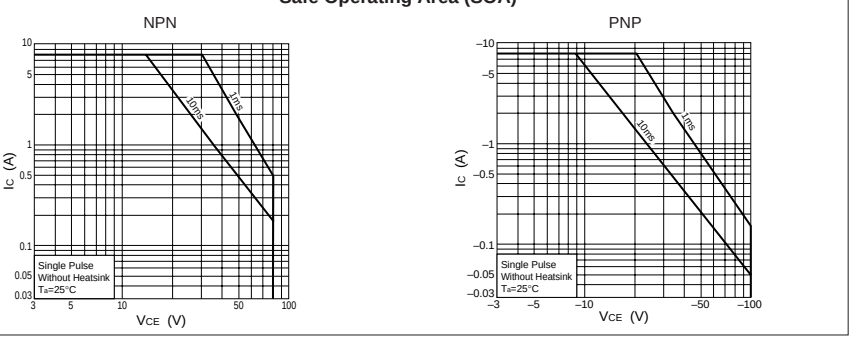
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

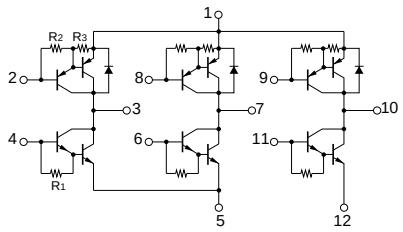


Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	6	–6	A
I_{CP}	12 (PW≤1ms, Du≤50%)	–12 (PW≤1ms, Du≤50%)	A
I_B	0.5	–0.5	A
P_T	5 (Ta=25°C)		W
	25 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
$\theta_{j\text{-}c}$	5		°C/W

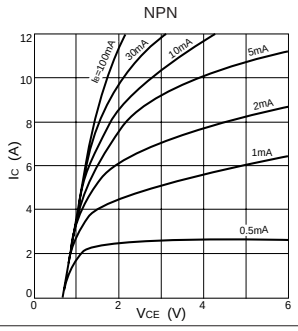
■Equivalent circuit diagram

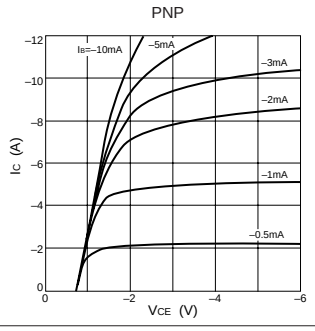


R1: 2kΩ typ R2: 3kΩ typ R3: 80Ω typ

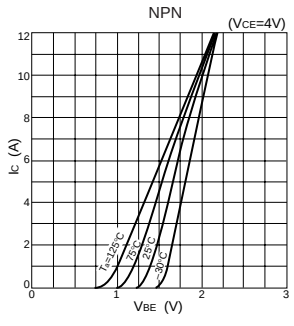
Characteristic curves

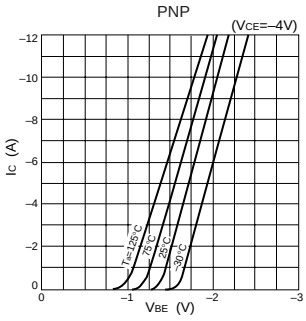
IC-VCE Characteristics (Typical)



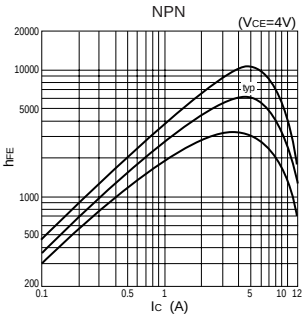


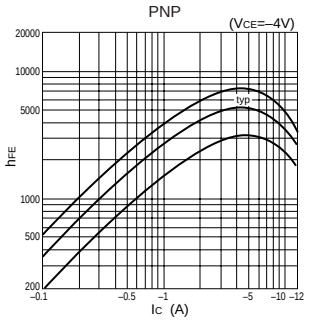
IC-VBE Temperature Characteristics (Typical)



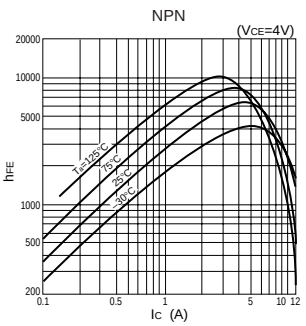


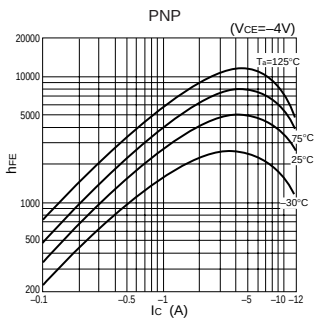
hFE-IC Characteristics (Typical)





hFE-IC Temperature Characteristics (Typical)





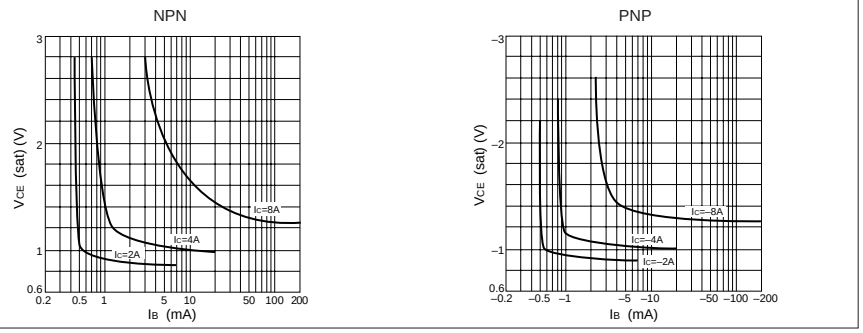
Electrical characteristics

(T_a=25°C)

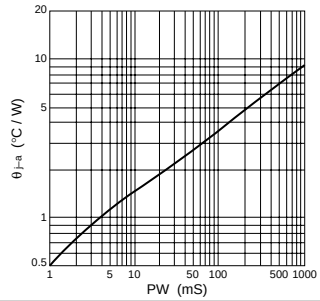
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V			–10	μA	V_{CB}=–60V
I_{EBO}			10	μA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=25mA	–60			V	I_C=–25mA
h_{FE}	2000	5000	12000		V_{CE}=4V, I_C=5A	2000	5000	12000		V_{CE}=–4V, I_C=–5A
V_{CE}(sat)			1.5	V	I_C=5A, I_B=10mA			–1.5	V	I_C=–5A, I_B=–10mA
V_{BE}(sat)			2.0	V				–2.0	V	
V_{FEC}				V				2.0	V	I_{FEC}=5A
t_{rr}				μs			1.0		μs	I_{FEC}=±0.5A
t_{on}		0.8		μs	V_{CC}≒25V,		1.0		μs	V_{CC}≒–25V,
t_{stg}		6.0		μs	I_C=5A,		1.4		μs	I_C=–5A,
t_f		2.0		μs	I_{B1}=–I_{B2}=10mA		0.6		μs	I_{B1}=–I_{B2}=–10mA
f_T		80		MHz	V_{CE}=12V, I_E=–1A		120		MHz	V_{CE}=–12V, I_E=1A
C_{ob}		100		pF	V_{CB}=10V, f=1MHz		150		pF	V_{CB}=–10V, f=1MHz

Characteristic curves

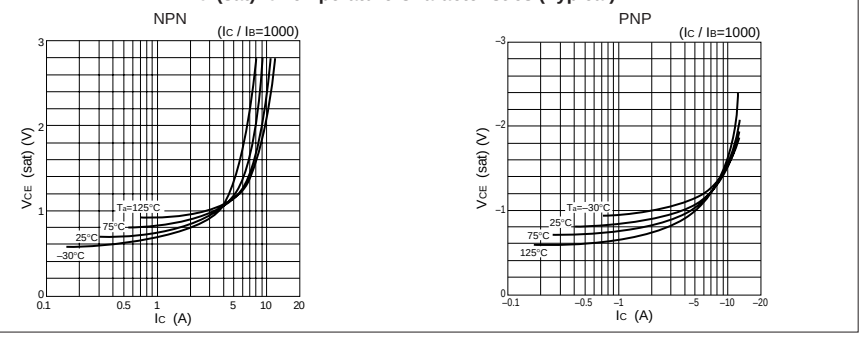
V_{CE}(sat)-I_B Characteristics (Typical)



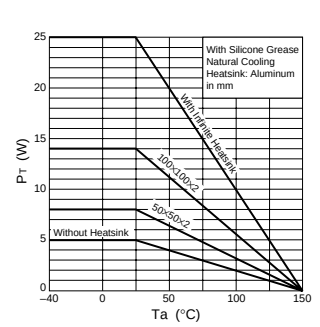
$\theta_{j\text{-}a}$-PW Characteristics



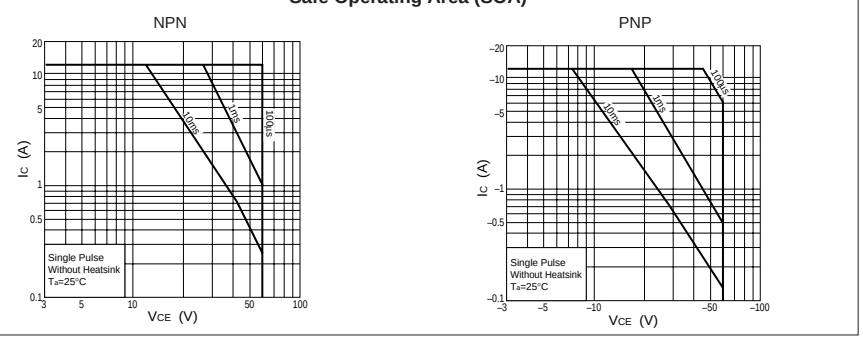
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

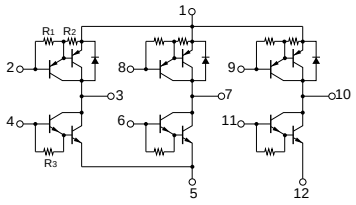


Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	8	–8	A
I_{CP}	12 (PW≤1ms, Du≤50%)	–12 (PW≤1ms, Du≤50%)	A
I_{FEC}	—	–8	A
I_{FECP}	—	–12	A
I_B	0.5	–0.5	A
P_T	5 (Ta=25°C)		W
	25 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	5		°C/W

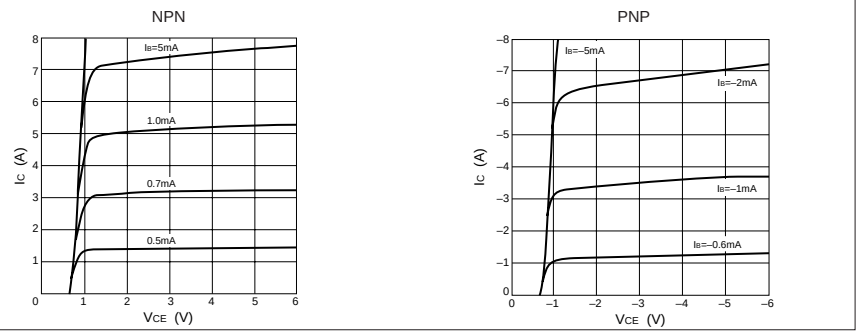
■Equivalent circuit diagram



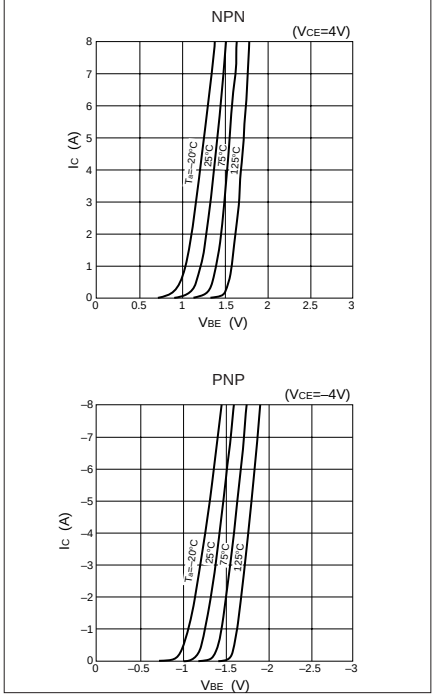
R1: 2kΩ typ R2: 80Ω typ R3: 2kΩ typ

Characteristic curves

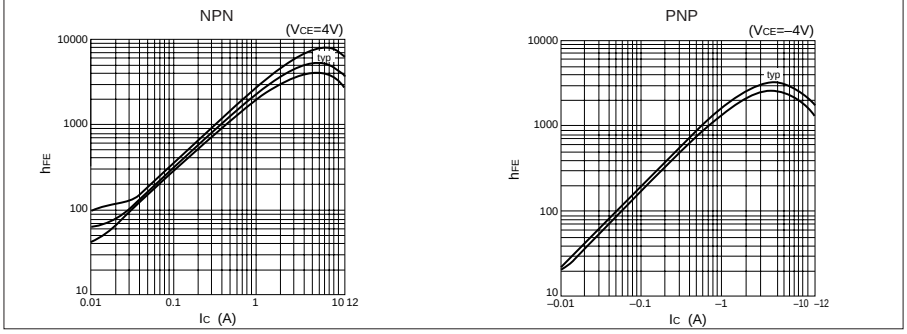
IC-VCE Characteristics (Typical)



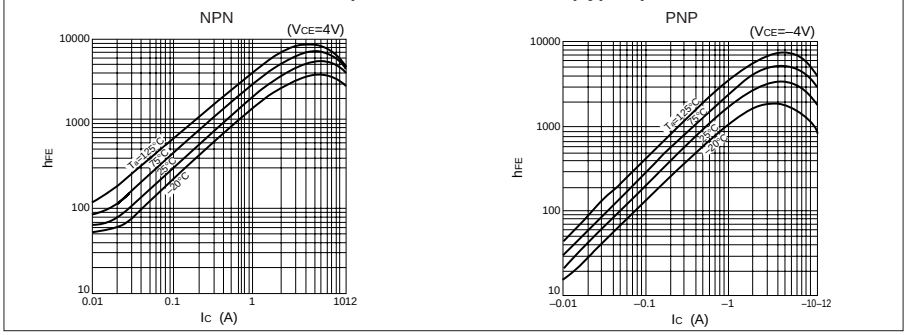
IC-VBE Temperature Characteristics (Typical)



hFE-IC Characteristics (Typical)



hFE-IC Temperature Characteristics (Typical)



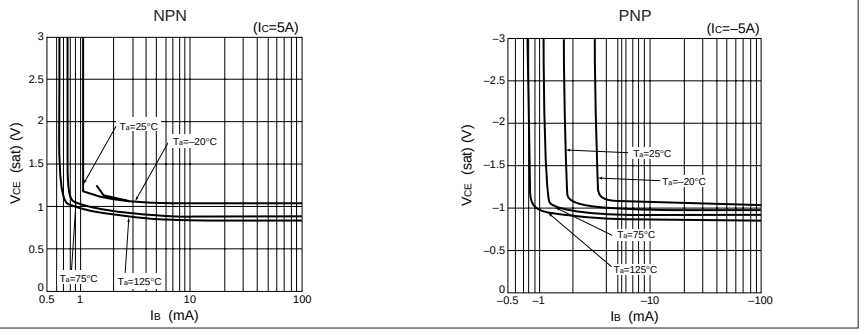
Electrical characteristics

(T_a=25°C)

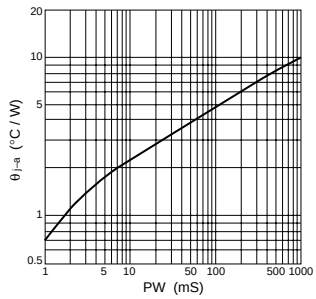
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V			–10	μA	V_{CB}=–60V
I_{EBO}			10	μA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	2000	5000	12000		V_{CE}=4V, I_C=5A	2000	5000	12000		V_{CE}=–4V, I_C=–5A
V_{CE}(sat)			1.5	V	I_C=5A, I_B=10mA			–1.5	V	I_C=–5A, I_B=–10mA
V_{BE}(sat)			2.0	V				–2.0	V	
V_{FEC}		—		V				2.0	V	I_{FEC}=5A
t_{rr}		—		μs			1.0		μs	I_{FEC}=±0.5A
t_{on}		0.5		μs	V_{CC}≒25V,		0.5		μs	V_{CC}≒–25V,
t_{stg}		2.0		μs	I_C=5A,		1.4		μs	I_C=–5A,
t_f		1.2		μs	I_{B1}=–I_{B2}=10mA		0.6		μs	I_{B1}=–I_{B2}=–10mA
f_T		50		MHz	V_{CE}=12V, I_E=–1A		100		MHz	V_{CE}=–12V, I_E=1A
C_{ob}		100		pF	V_{CB}=10V, f=1MHz		130		pF	V_{CB}=–10V, f=1MHz

Characteristic curves

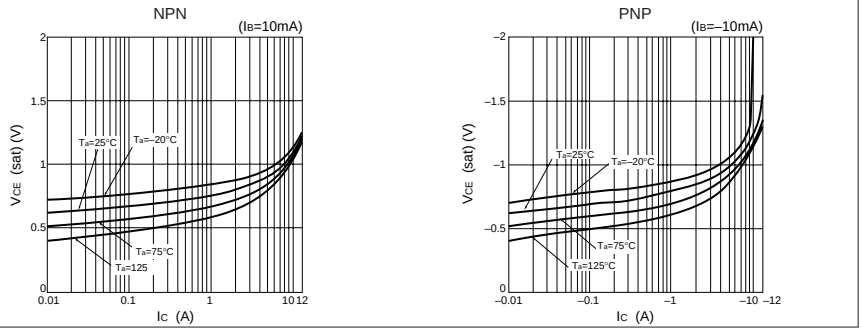
V_{CE}(sat)-I_B Temperature Characteristics (Typical)



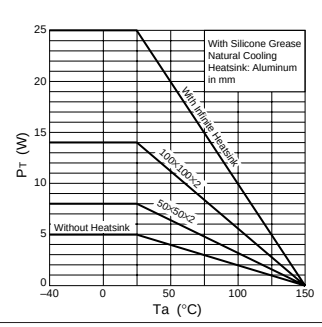
$\theta_{j\text{-}a}$-PW Characteristics



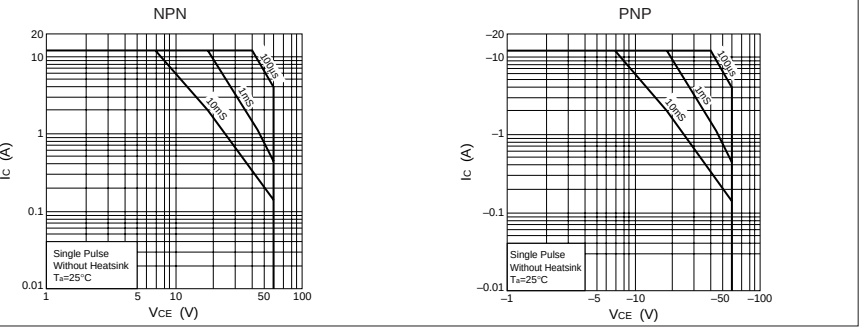
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

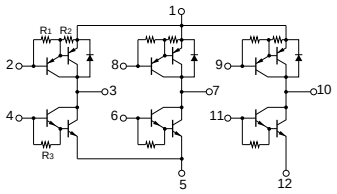


Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	10	–10	A
I_{CP}	15 (PW≤1ms, Du≤50%)	–15 (PW≤1ms, Du≤50%)	A
I_{FEC}	—	–10	A
I_{FECP}	—	–15	A
I_B	0.5	–0.5	A
P_T	5 (Ta=25°C)		W
	35 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	3.57		°C/W

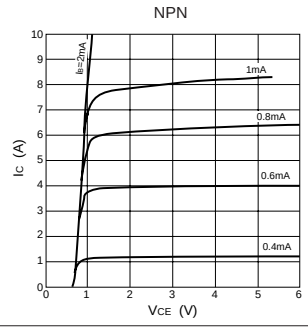
■Equivalent circuit diagram

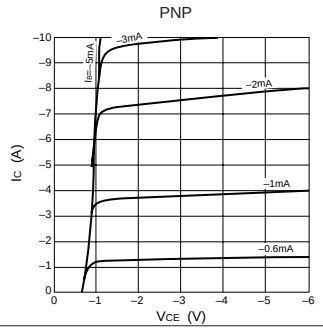


R1: 2kΩ typ R2: 80Ω typ R3: 2kΩ typ

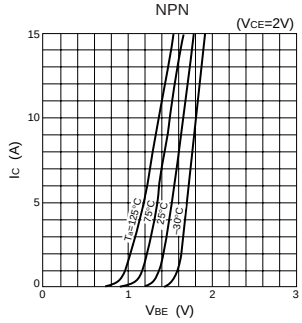
Characteristic curves

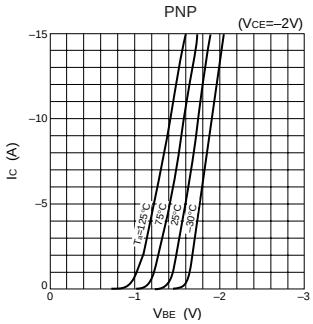
IC-VCE Characteristics (Typical)



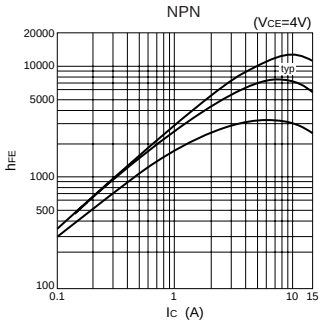


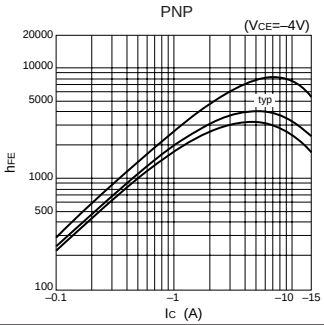
IC-VBE Temperature Characteristics (Typical)



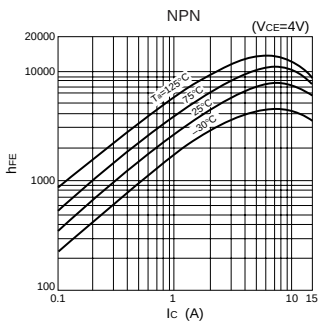


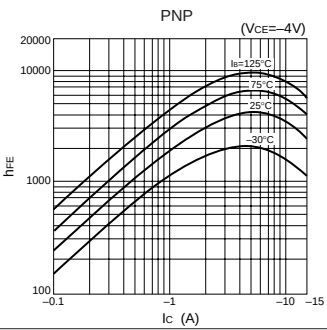
hFE-IC Characteristics (Typical)





hFE-IC Temperature Characteristics (Typical)





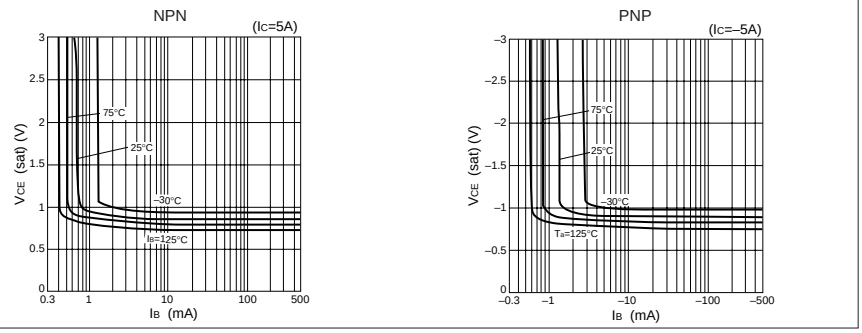
Electrical characteristics

(T_a=25°C)

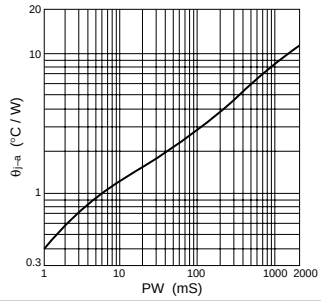
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V			–10	μA	V_{CB}=–60V
I_{EBO}			10	μA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	2000	5000	12000		V_{CE}=4V, I_C=6A	2000	5000	12000		V_{CE}=–4V, I_C=–6A
V_{CE}(sat)			1.5	V	I_C=6A, I_B=12mA			–1.5	V	I_C=–6A, I_B=–12mA
V_{BE}(sat)			2.0	V				–2.0	V	
V_{FEC}		–		V				2.0	V	I_{FEC}=–6A
t_{rr}		–		μs			4.0		μs	I_{FEC}=±0.5A
t_{on}		0.6		μs	V_{CC}≒24V,		0.7		μs	V_{CC}≒–24V,
t_{stg}		2.0		μs	I_C=6A,		1.2		μs	I_C=–6A,
t_f		1.5		μs	I_{B1}=–I_{B2}=12mA		0.7		μs	I_{B1}=–I_{B2}=–12mA
f_T		50		MHz	V_{CE}=12V, I_E=–1A		50		MHz	V_{CE}=–12V, I_E=1A
C_{ob}		100		pF	V_{CB}=10V, f=1MHz		180		pF	V_{CB}=–10V, f=1MHz

Characteristic curves

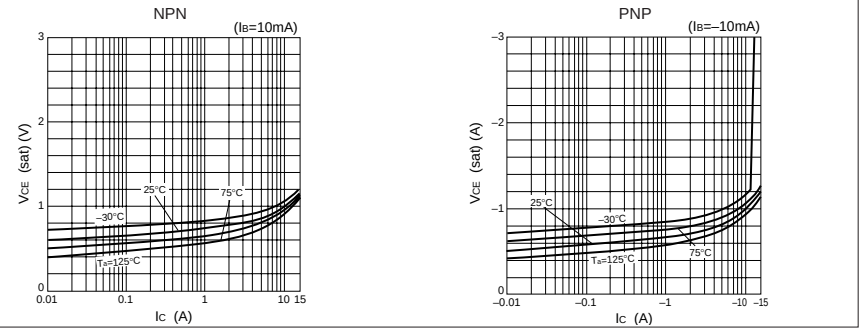
V_{CE}(sat)-I_B Temperature Characteristics (Typical)



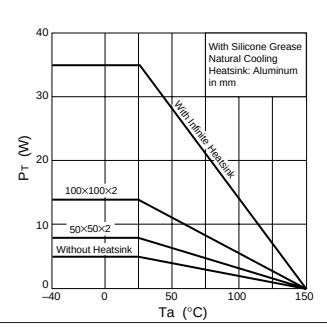
$\theta_{j\text{-}a}$-PW Characteristics



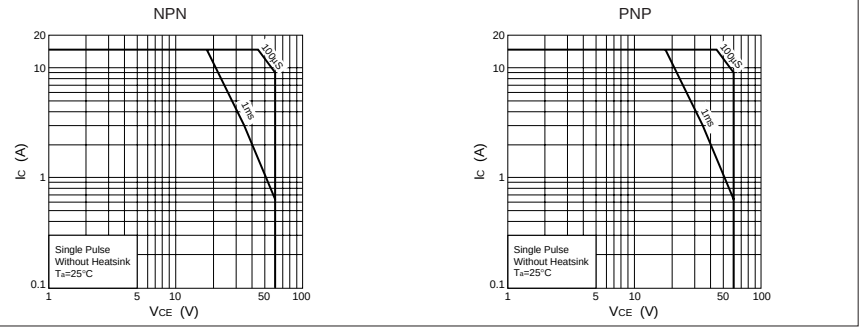
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

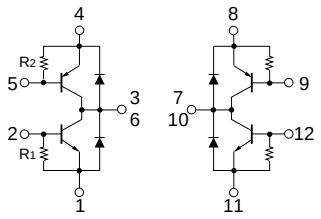


Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	12	–12	A
I_B	3	–3	A
P_T	5 (Ta=25°C)		W
	40 (Tc=25°C)		
V_{ISO}	1000 (Between fin and lead pin, AC)		V_{rms}
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	3.12		°C/W

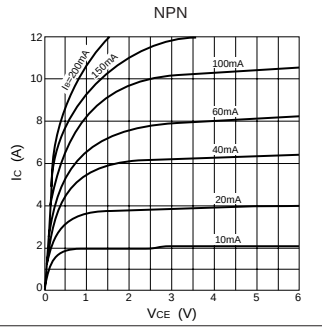
■Equivalent circuit diagram

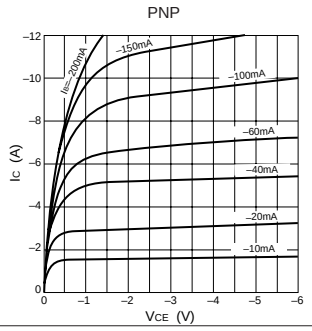


R1: 500kΩ typ R2: 350Ω typ

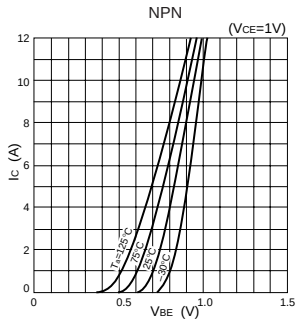
Characteristic curves

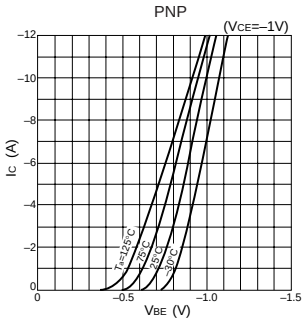
IC-VCE Characteristics (Typical)



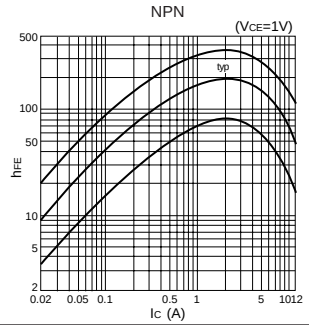


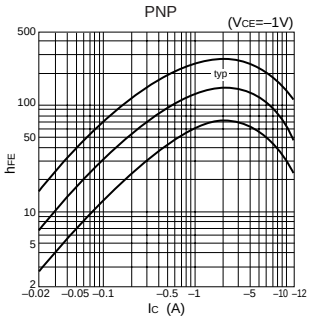
IC-VBE Temperature Characteristics (Typical)



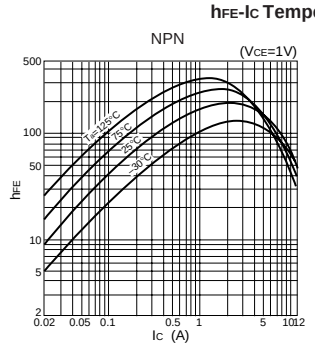


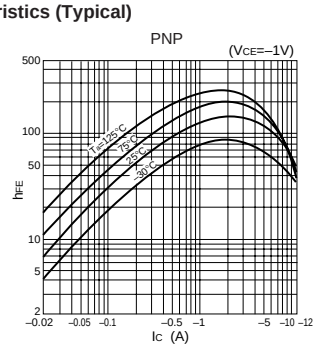
hFE-IC Characteristics (Typical)





hFE-IC Temperature Characteristics (Typical)





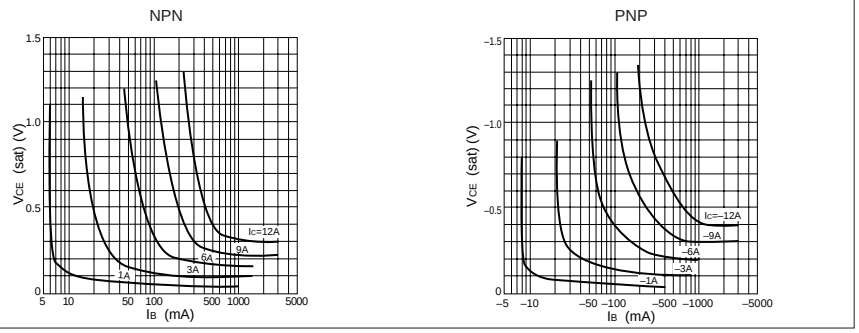
Electrical characteristics

(T_a=25°C)

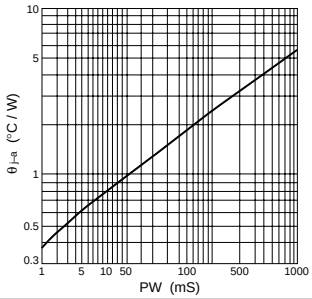
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			100	μA	V_{CB}=60V			–100	μA	V_{CB}=–60V
I_{EBO}			60	mA	V_{EB}=6V			–60	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=25mA	–60			V	I_C=–25mA
h_{FE}	50				V_{CE}=1V, I_C=6A	50				V_{CE}=–1V, I_C=–6A
V_{CE}(sat)			0.35	V	I_C=6A, I_B=0.3A			–0.35	V	I_C=–6A, I_B=–0.3A
V_{FEC}			2.5	V	I_{FEC}=10A			2.5	V	I_{FEC}=10A

Characteristic curves

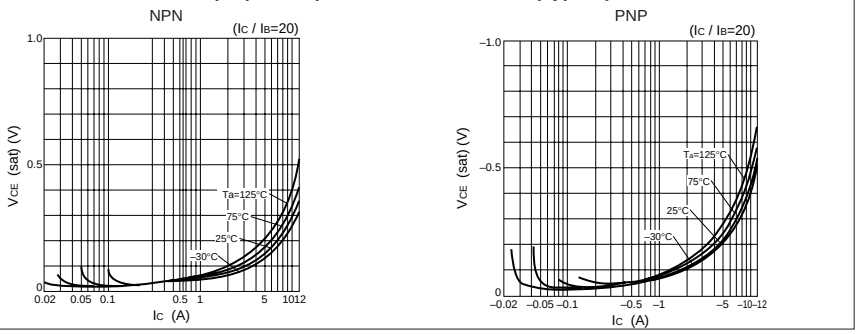
V_{CE}(sat)-I_B Characteristics (Typical)



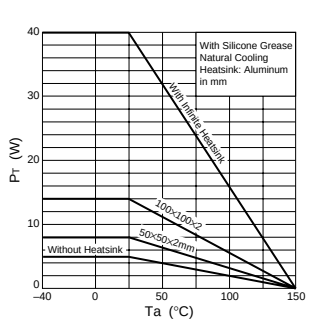
$\theta_{j\text{-}a}$-PW Characteristics



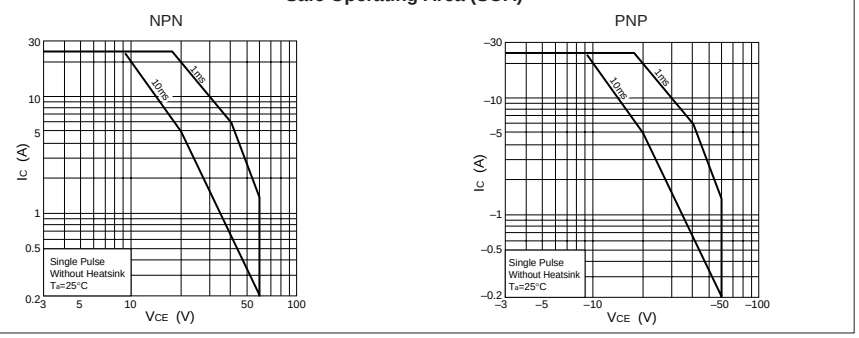
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)



SMA4020

PNP Darlington
General purpose

External dimensions Ⓑ ··· SMA

Absolute maximum ratings

(Ta=25°C)

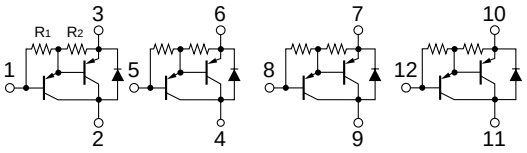
Symbol	Ratings	Unit
V_{CBO}	–60	V
V_{CEO}	–60	V
V_{EBO}	–6	V
I_C	–4	A
I_B	–1	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
Tj	150	°C
Tstg	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–60V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–60			V	I_C=–10mA
h_{FE}	2000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			–1.5	V	I_C=–3A, I_B=–6mA

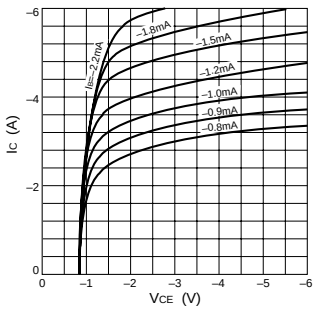
■Equivalent circuit diagram



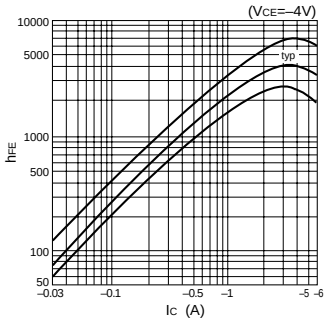
R1: 2kΩ typ R2: 150Ω typ

Characteristic curves

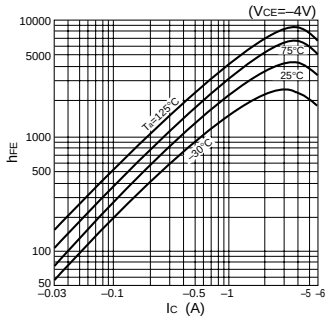
I_C-V_{CE} Characteristics (Typical)



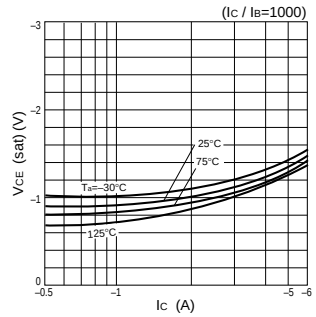
h_{FE}-I_C Characteristics (Typical)



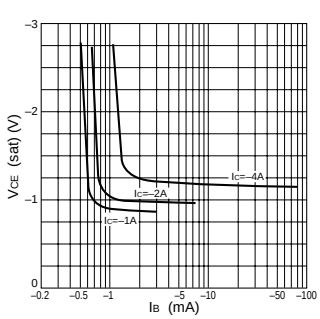
h_{FE}-I_C Temperature Characteristics (Typical)



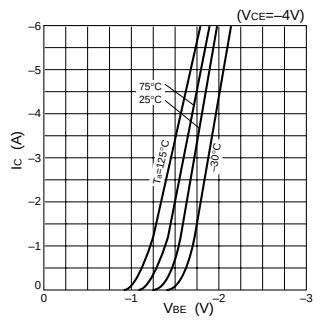
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



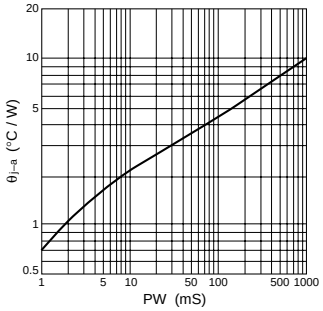
V_{CE}(sat)-I_B Characteristics (Typical)



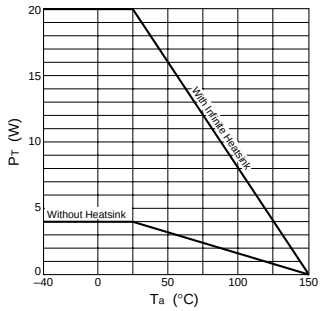
I_C-V_{BE} Temperature Characteristics (Typical)



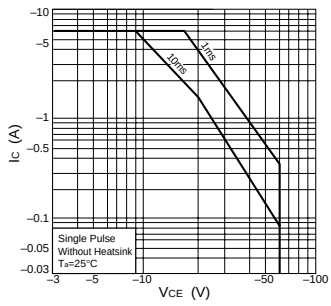
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SMA4021

PNP Darlington
With built-in flywheel diode

External dimensions Ⓑ ··· SMA

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	–60	V
V_{CEO}	–60	V
V_{EBO}	–6	V
I_C	–3	A
I_{CP}	–6 (PW≤1ms, Du≤50%)	A
I_B	–0.5	A
I_F	–6 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	–8 (PW≤10ms, Single pulse)	A
V_R	100	V
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

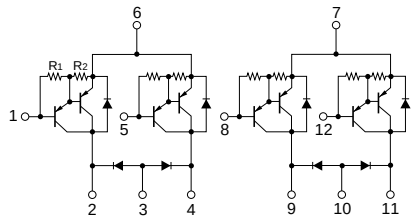
Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			–10	μA	V_{CB}=–60V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–60			V	I_C=–10mA
h_{FE}	2000	5000	12000		V_{CE}=–4V, I_C=–2A
V_{CE}(sat)			–1.5	V	I_C=–2A, I_B=–4mA
V_{BE}(sat)			–2.0	V	

●Diode for flyback voltage absorption (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
V_R	100			V	I_R=10μA
V_F			1.2	V	I_F=1A
I_R			10	μA	V_R=100V
trr		100		ns	I_F=±100mA

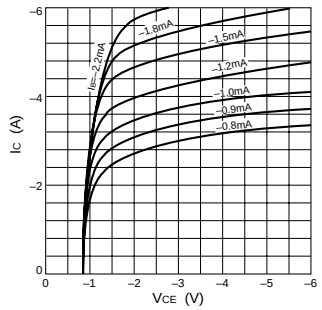
■Equivalent circuit diagram



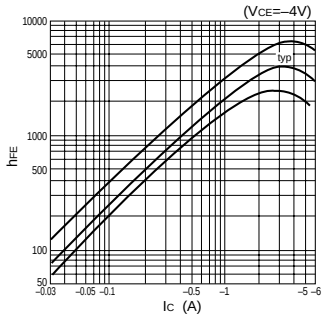
R1: 2kΩ typ R2: 150Ω typ

Characteristic curves

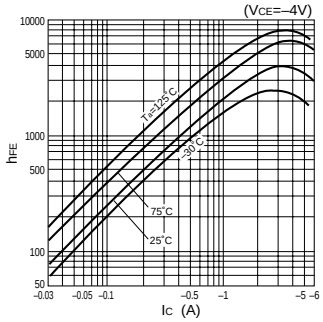
I_C-V_{CE} Characteristics (Typical)



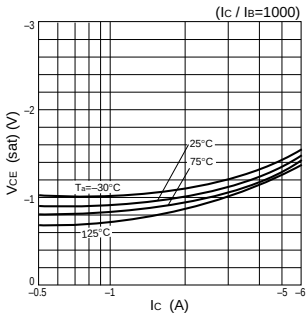
h_{FE}-I_C Characteristics (Typical)



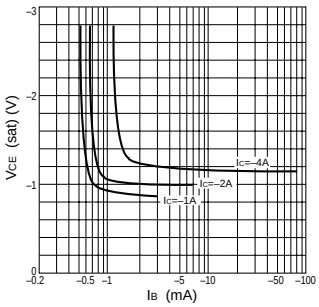
h_{FE}-I_C Temperature Characteristics (Typical)



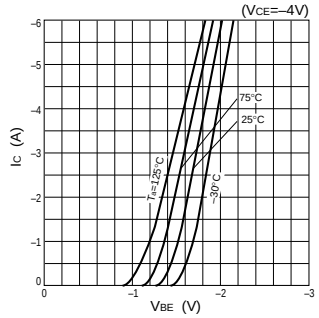
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



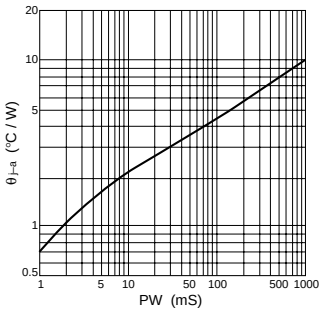
V_{CE}(sat)-I_B Characteristics (Typical)



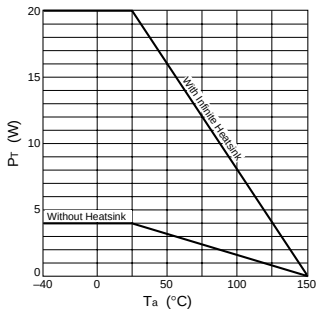
I_C-V_{BE} Temperature Characteristics (Typical)



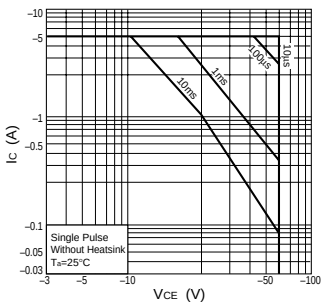
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SMA4030

PNP Darlington
General purpose

External dimensions Ⓑ ··· SMA

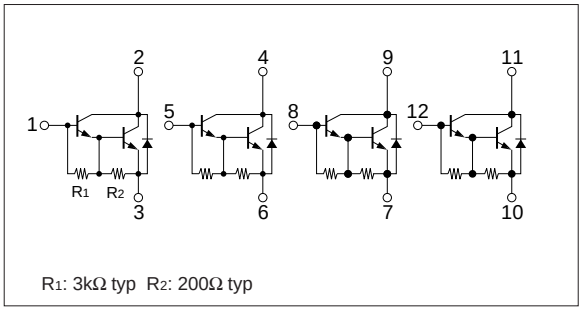
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	3	A
I_{CP}	5 (PW≤1ms, Du≤50%)	A
I_B	0.2	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	100			V	I_C=25mA
h_{FE}	2000	6000	15000		V_{CE}=4V, I_C=1.5A
V_{CE}(sat)		1.1	1.5	V	I_C=1.5A, I_B=3mA
V_{BE}(sat)		1.7	2.0	V	
t_{on}		0.5		μs	V_{CC}≒30V
t_{stg}		2.2		μs	I_C=1.5A
t_f		0.9		μs	I_{B1}=–I_{B2}=3mA
f_T		40		MHz	V_{CE}=12V, I_E=–0.5A
C_{ob}		30		pF	V_{CB}=10V, f=1MHz

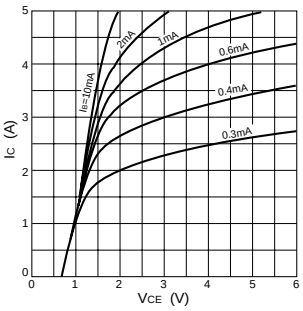
■Equivalent circuit diagram



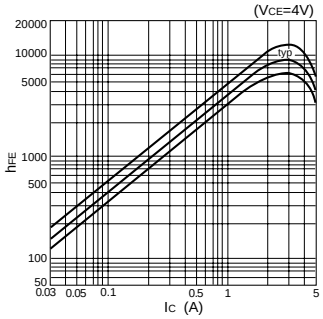
R1: 3kΩ typ R2: 200Ω typ

Characteristic curves

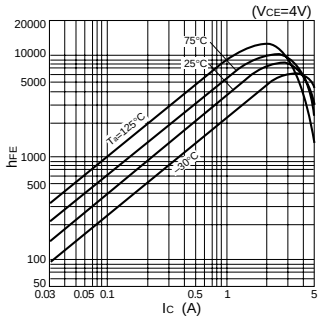
I_C-V_{CE} Characteristics (Typical)



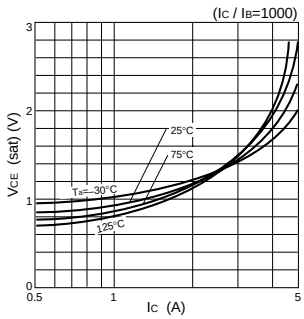
h_{FE}-I_C Characteristics (Typical)



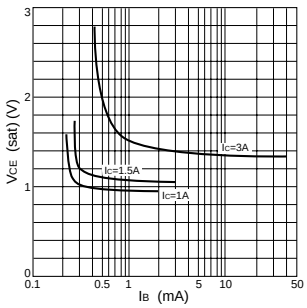
h_{FE}-I_C Temperature Characteristics (Typical)



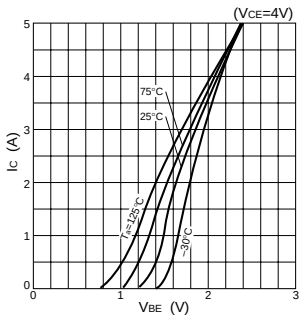
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



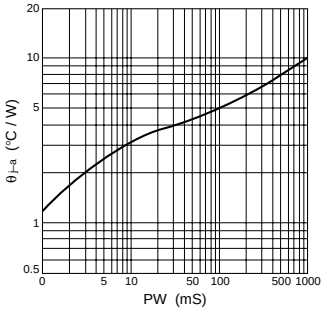
V_{CE}(sat)-I_B Characteristics (Typical)



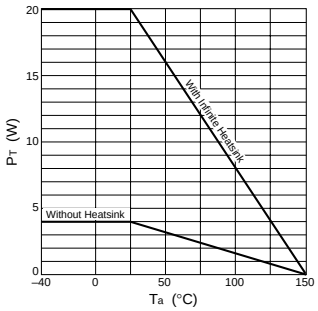
I_C-V_{BE} Temperature Characteristics (Typical)



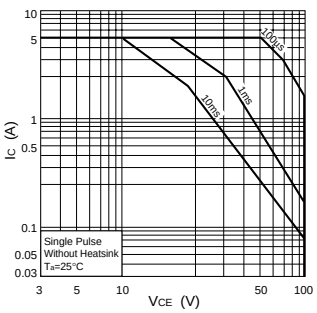
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SMA4032

NPN Darlington
With built-in flywheel diode

External dimensions Ⓑ ··· SMA

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	3	A
I_{CP}	5 (PW≤1ms, Du≤50%)	A
I_B	0.2	A
I_F	3 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	5 (PW≤10ms, Single pulse)	A
V_R	120	V
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

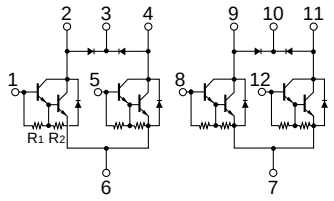
Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	100			V	I_C=25mA
h_{FE}	2000	6000	15000		V_{CE}=4V, I_C=1.5A
V_{CE}(sat)		1.1	1.5	V	I_C=1.5A, I_B=3mA
V_{BE}(sat)		1.7	2.0	V	
ton		0.5		μs	V_{CC}≒30V,
tstg		2.2		μs	I_C=1.5A,
tf		0.9		μs	I_{B1}=–I_{B2}=3mA
f_T		40		MHz	V_{CE}=12V, I_E=–0.5A
Cob		30		pF	V_{CB}=10V, f=1MHz

●Diode for flyback voltage absorption (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
V_R	120			V	I_R=10μA
V_F			1.6	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F=±100mA

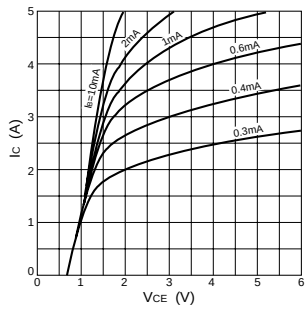
■Equivalent circuit diagram



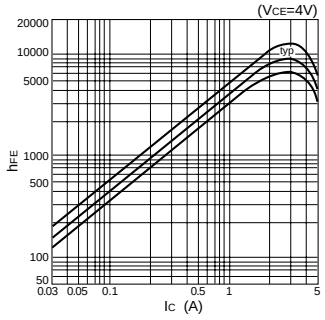
R1: 3kΩ typ R2: 200Ω typ

Characteristic curves

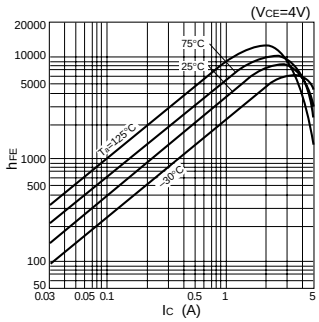
IC-VCE Characteristics (Typical)



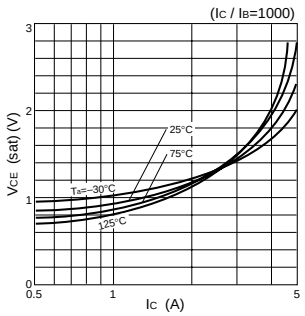
hFE-IC Characteristics (Typical)



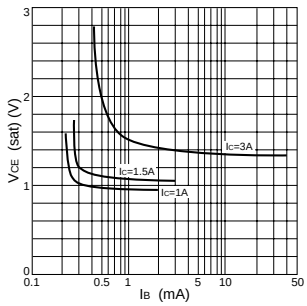
hFE-IC Temperature Characteristics (Typical)



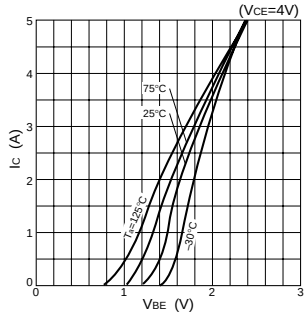
VCE(sat)-IC Temperature Characteristics (Typical)



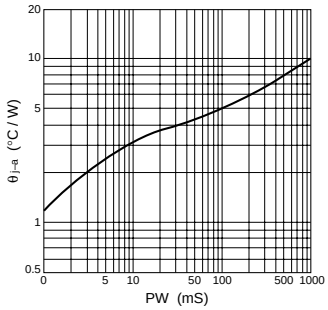
VCE(sat)-IB Characteristics (Typical)



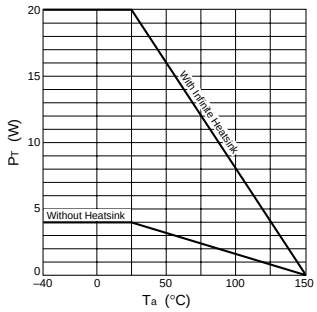
IC-VBE Temperature Characteristics (Typical)



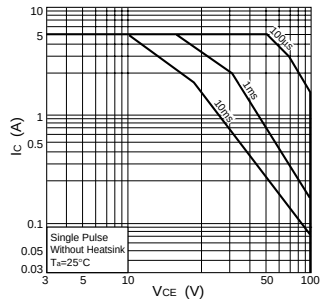
θj-a-PW Characteristics



PT-Ta Characteristics



Safe Operating Area (SOA)



SMA4033

NPN Darlington
With built-in flywheel diode

External dimensions Ⓑ ··· SMA

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	2	A
I_{CP}	4 (PW≤1ms, Du≤50%)	A
I_B	0.2	A
I_F	2 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	4 (PW≤10ms, Single pulse)	A
V_R	120	V
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

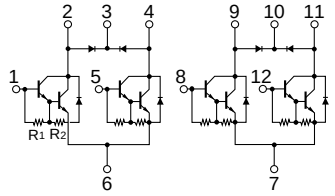
Electrical characteristics (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	100			V	I_C=25mA
h_{FE}	2000	6000	15000		V_{CE}=4V, I_C=1A
V_{CE}(sat)		1.1	1.5	V	I_C=1A, I_B=2mA
V_{BE}(sat)		1.7	2.0	V	

●Diode for flyback voltage absorption (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
V_R	120			V	I_R=10μA
V_F			1.8	V	I_F=1A
I_R			10	μA	V_R=120V
t_{rr}		100		ns	I_F=±100mA

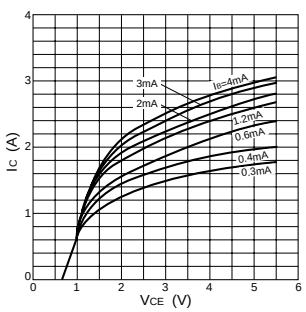
■Equivalent circuit diagram



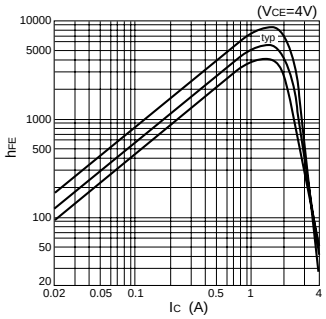
R1: 4kΩ typ R2: 150Ω typ

Characteristic curves

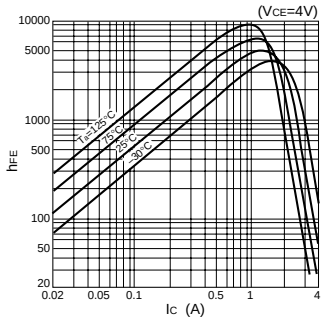
I_C-V_{CE} Characteristics (Typical)



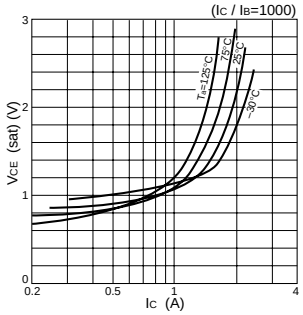
h_{FE}-I_C Characteristics (Typical)



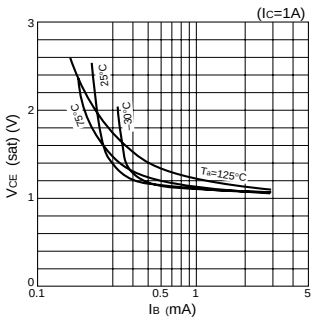
h_{FE}-I_C Temperature Characteristics (Typical)



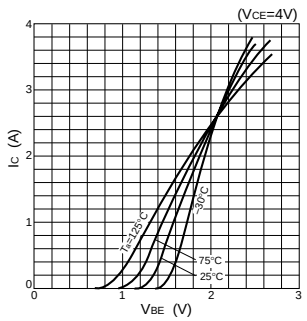
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



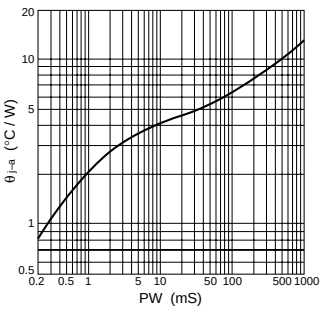
V_{CE}(sat)-I_B Characteristics (Typical)



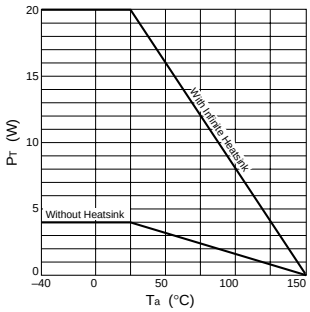
I_C-V_{BE} Temperature Characteristics (Typical)



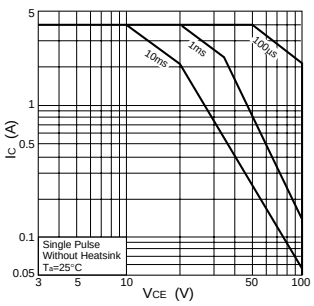
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SMA5101

N-channel
General purpose

External dimensions Ⓑ ··· SMA

Absolute maximum ratings

(Ta=25°C)

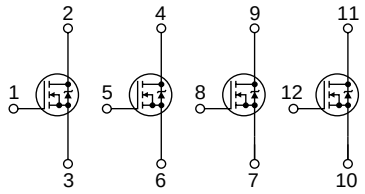
Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±4	A
$I_{D(pulse)}$	±8 (PW≤1ms)	A
E_{AS}*	16	mJ
P_T	4 (Ta=25°C, with all circuits operating, without heatsink)	W
	28 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj–a	31.2 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj–c	4.46 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=20V, L=1mH, I_D=5A, unclamped, see Fig. E on page 15.

(Ta=25°C)

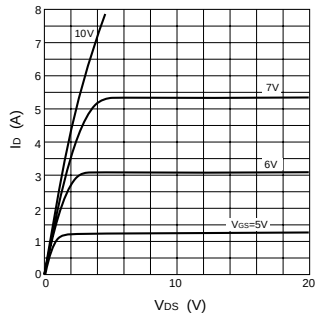
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.1	1.7		S	V_{DS}=10V, I_D=4A
$R_{DS(ON)}$		0.50	0.60	Ω	V_{GS}=10V, I_D=4A
Ciss		180		pF	V_{DS}=25V, f=1.0MHz,
Coss		82		pF	V_{GS}=0V
ton		40		ns	I_D=4A, V_{DD}≒50V, V_{GS}=10V,
toff		40		ns	see Fig. 3 on page 16.
V_{SD}		1.2	2.0	V	I_{SD}=4A, V_{GS}=0V
trr		250		ns	I_{SD}=±100mA

■Equivalent circuit diagram

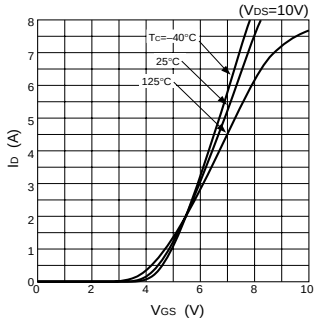


Characteristic curves

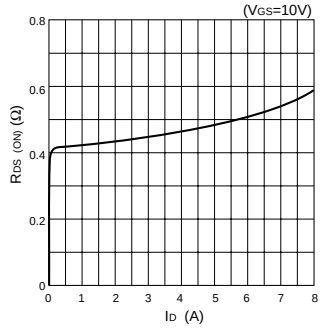
I_D-V_{DS} Characteristics (Typical)



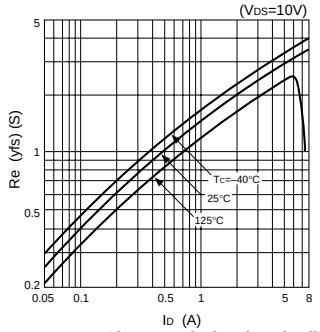
I_D-V_{GS} Characteristics (Typical)



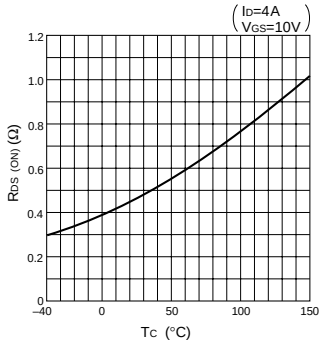
$R_{DS(ON)}$-I_D Characteristics (Typical)



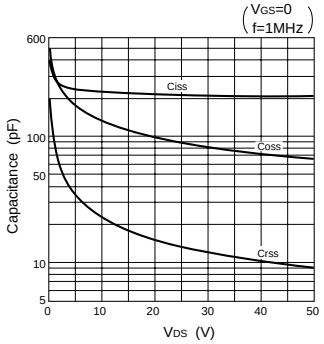
$Re_{(yfs)}$-I_D Characteristics (Typical)



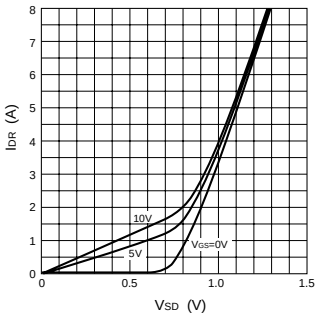
$R_{DS(ON)}$-T_C Characteristics (Typical)



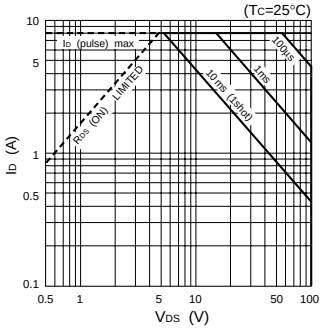
Capacitance-V_{DS} Characteristics (Typical)



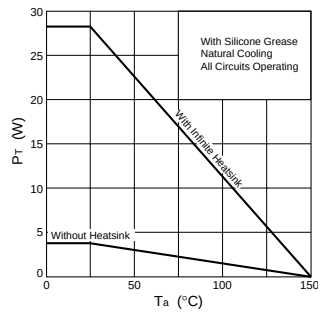
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SMA5102

N-channel
With built-in flywheel diode

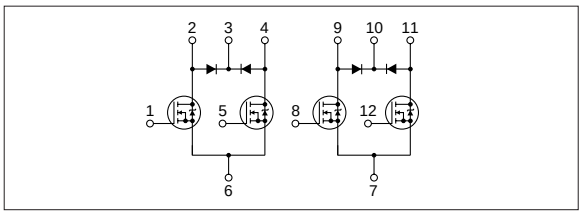
External dimensions Ⓑ ··· SMA

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Uni
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±4	A
$I_{D(pulse)}$	±8 (PW≤1ms)	A
E_{AS}*	16	mJ
I_F	4 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	8 (PW≤10ms, Single pulse)	A
V_R	120	V
P_T	4 (Ta=25°C, with all circuits operating, without heatsink)	W
	28 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θ_{j-a}	31.2 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θ_{j-c}	4.46 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=20V, L=1mH, I_D=5A, unclamped, see Fig. E on page 15.



Electrical characteristics

(Ta=25°C)

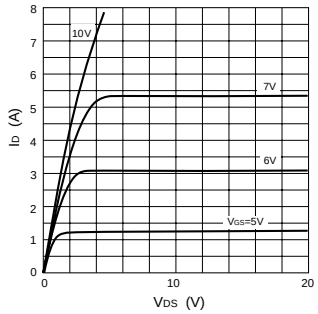
Symbol	Specification min	typ	max	Unit	Conditions
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.1	1.7		S	V_{DS}=10V, I_D=4A
$R_{DS(ON)}$		0.50	0.60	Ω	V_{GS}=10V, I_D=4A
Ciss		180		pF	V_{DS}=25V, f=1.0MHz,
Coss		82		pF	V_{GS}=0V
ton		40		ns	I_D=4A, V_{DD}≒50V, V_{GS}=10V,
toff		40		ns	see Fig. 3 on page 16.
V_{SD}		1.2	2.0	V	I_{SD}=4A, V_{GS}=0V
trr		250		ns	I_{SD}=±100mA

●Diode for flyback voltage absorption

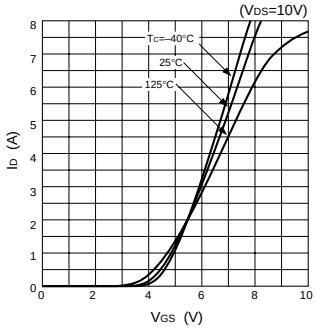
Symbol	Specification min	typ	max	Unit	Conditions
V_R	120			V	I_R=10μA
V_F		1.0	1.2	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F=±100mA

Characteristic curves

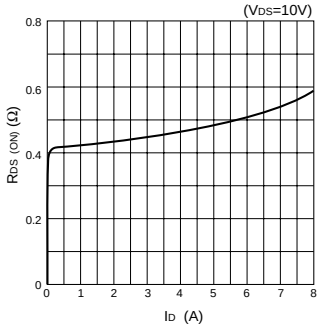
I_D-V_{DS} Characteristics (Typical)



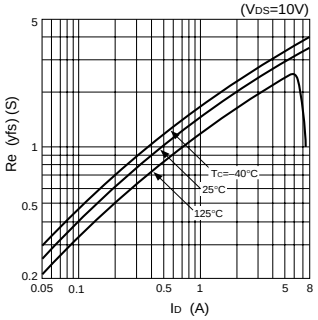
I_D-V_{GS} Characteristics (Typical)



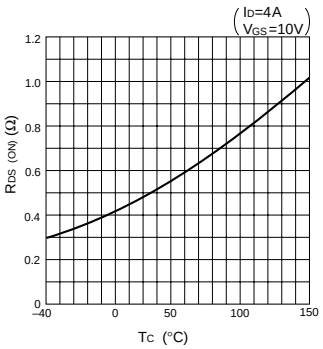
$R_{DS(ON)}$-I_D Characteristics (Typical)



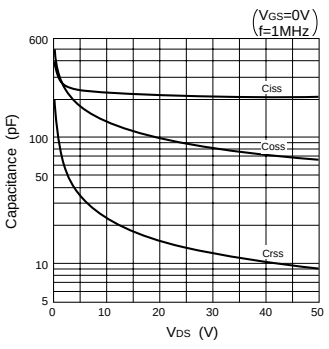
$Re_{(yfs)}$-I_D Characteristics (Typical)



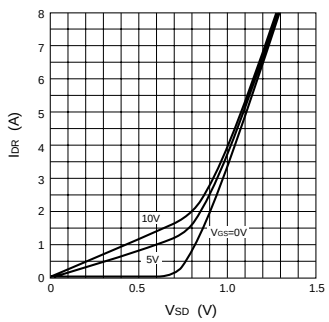
$R_{DS(ON)}$-T_C Characteristics (Typical)



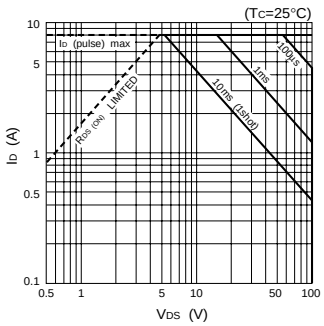
Capacitance-V_{DS} Characteristics (Typical)



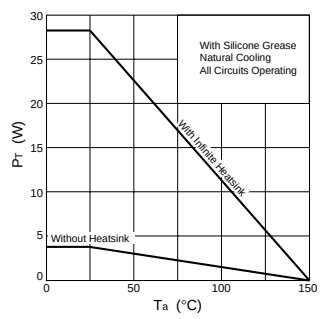
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SMA5103

N-channel + P-channel
H-bridge

External dimensions Ⓑ ··· SMA

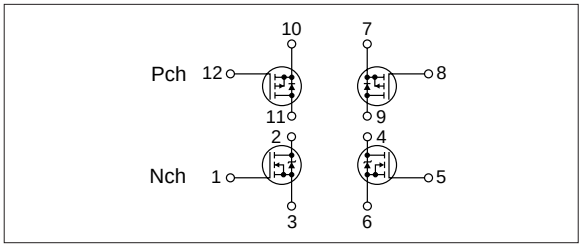
Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	N channel	P channel	
V_{DSS}	60	–60	V
V_{GSS}	±20	∓20	V
I_D	±5	∓4	A
$I_{D(pulse)}$	±10 (PW≤1ms)	∓8 (PW≤1ms)	A
E_{AS}*	2	—	mJ
P_T	4 (Ta=25°C, with all circuits operating, without heatsink)		W
	28 (Tc=25°C,with all circuits operating, with infinite heatsink)		W
θ_{j-a}	31.2 (Junction-Air, Ta=25°C, with all circuits operating)		°C/W
θ_{j-c}	4.46 (Junction-Case, Tc=25°C, with all circuits operating)		°C/W
Tch	150		°C
Tstg	–40 to +150		°C

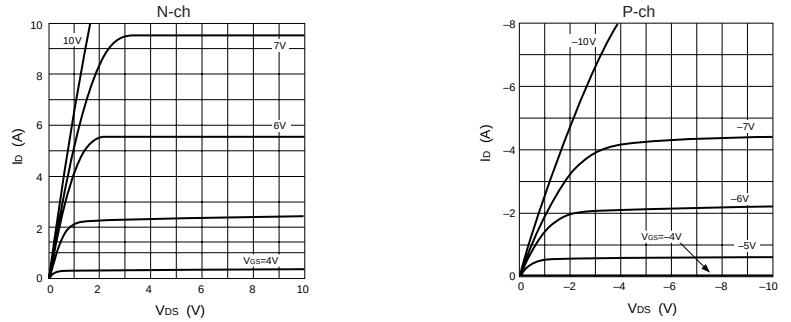
* : V_{DD}=20V, L=1mH, I_D=2A, unclamped, see Fig. E on page 15.

■Equivalent circuit diagram

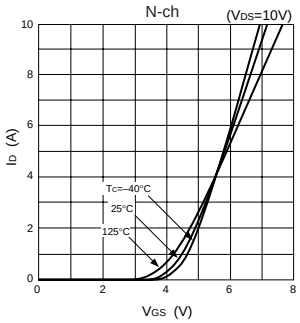


Characteristic curves

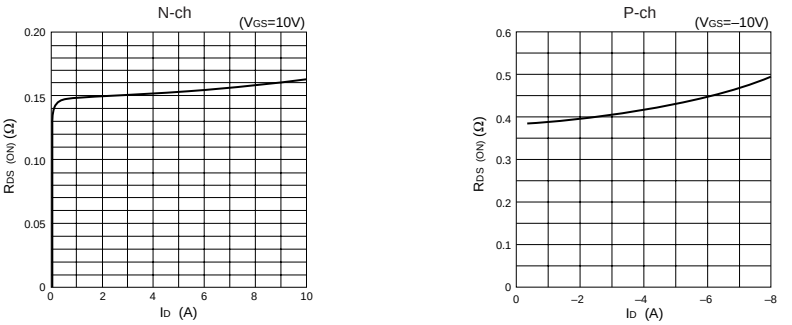
I_D-V_{DS} Characteristics (Typical)



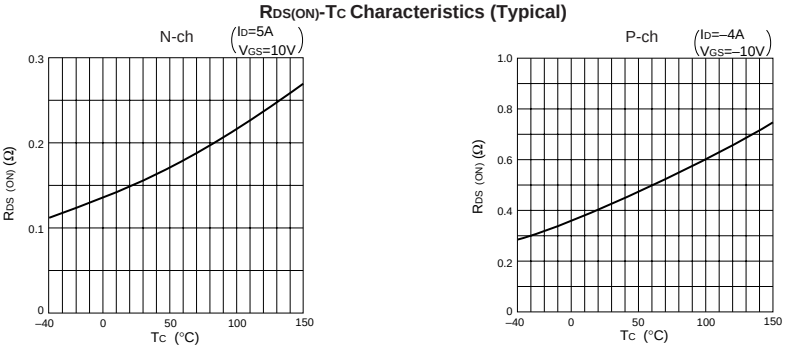
I_D-V_{GS} Characteristics (Typical)



$R_{DS(ON)}$-I_D Characteristics (Typical)



$R_{DS(ON)}$-T_C Characteristics (Typical)



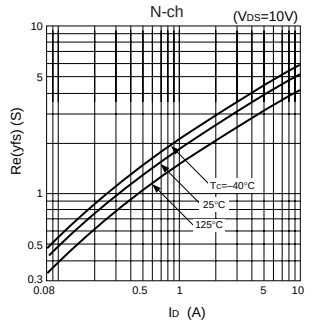
Electrical characteristics

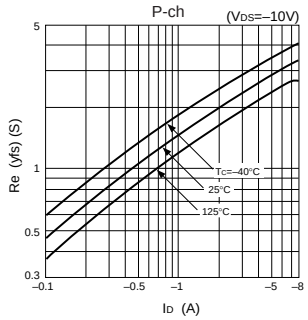
(Ta=25°C)

Symbol	N channel					P channel				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V			∓500	nA	V_{GS}=∓20V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	2.2	3.3		S	V_{DS}=10V, I_D=5A	1.6	2.2		S	V_{DS}=–10V, I_D=–4A
$R_{DS(ON)}$		0.17	0.22	Ω	V_{GS}=10V, I_D=5A		0.38	0.55	Ω	V_{GS}=–10V, I_D=–4A
Ciss		300		pF	V_{DS}=25V, f=1.0MHz,		270		pF	V_{DS}=–25V, f=1.0MHz,
Coss		160		pF	V_{GS}=0V		170		pF	V_{GS}=0V
t_{on}		35		ns	I_D=5A, V_{DD}≒30V, V_{GS}=10V,		60		ns	I_D=–4A, V_{DD}≒–30V, V_{GS}=–10V,
t_{off}		35		ns	see Fig. 3 on page 16.		60		ns	see Fig. 4 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A, V_{GS}=0V		–4.4	–5.5	V	I_{SD}=–4A, V_{GS}=0V
t_{rr}		140		ns	I_{SD}=±100mA		150		ns	I_{SD}=∓100mA

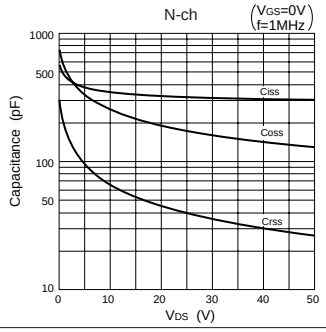
Characteristic curves

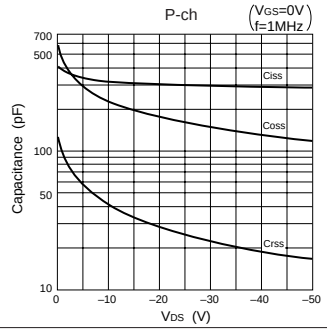
$Re_{(yfs)}$-I_D Characteristics (Typical)



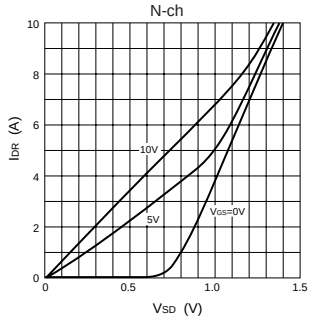


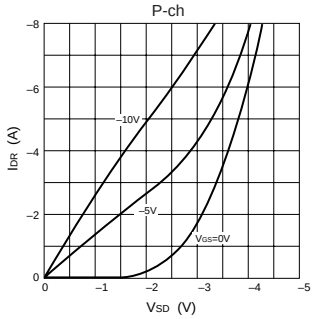
Capacitance-V_{DS} Characteristics (Typical)



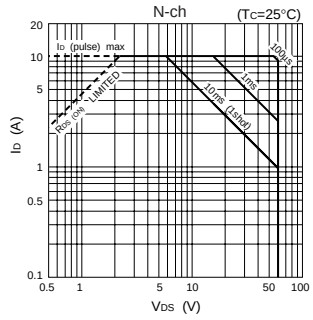


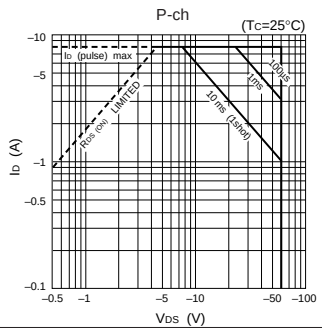
I_{DR}-V_{SD} Characteristics (Typical)



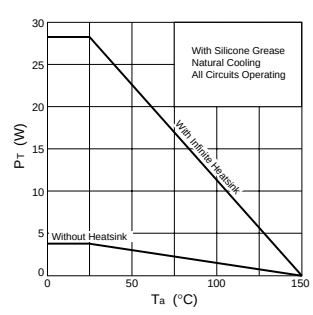


Safe Operating Area (SOA)





P_T-T_a Characteristics



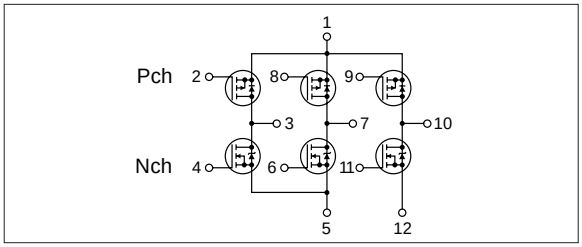
Absolute maximum ratings

(Ta=25°C)

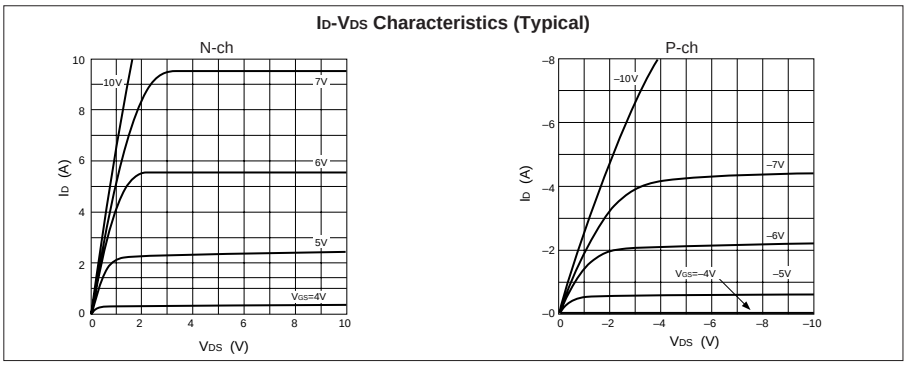
Symbol	Ratings		Unit
	N channel	P channel	
V_{DSS}	60	–60	V
V_{GSS}	±20	∓20	V
I_D	±5	∓4	A
$I_{D(pulse)}$	±10 (PW≤1ms)	∓8 (PW≤1ms)	A
E_{AS}*	2	—	mJ
P_T	4 (Ta=25°C, with all circuits operating, without heatsink)		W
	28 (Tc=25°C,with all circuits operating, with infinite heatsink)		W
$\theta_{j\text{-}a}$	31.2 (Junction-Air, Ta=25°C, with all circuits operating)		°C/W
$\theta_{j\text{-}c}$	4.46 (Junction-Case, Tc=25°C, with all circuits operating)		°C/W
Tch	150		°C
Tstg	–40 to +150		°C

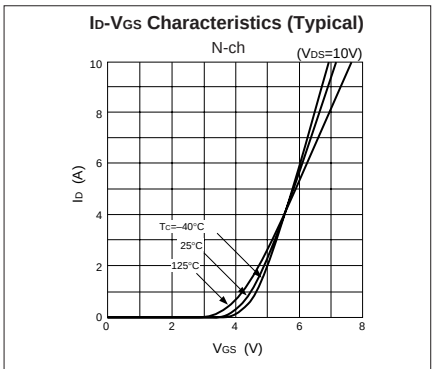
* : V_{DD}=20V, L=1mH, I_D=2A, unclamped, see Fig. E on page 15.

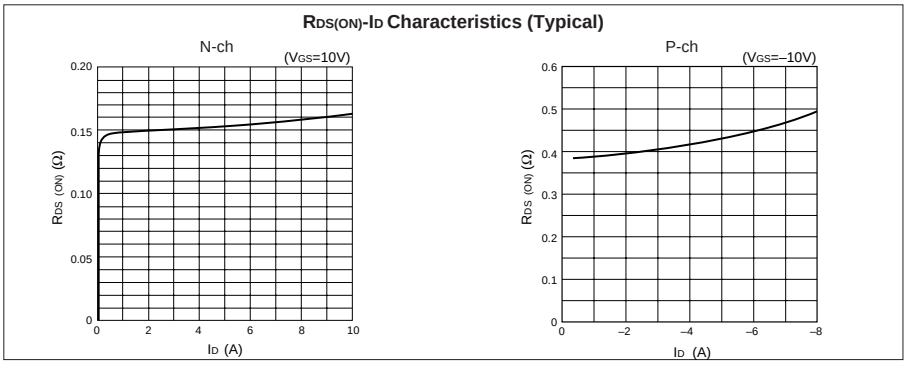
■Equivalent circuit diagram

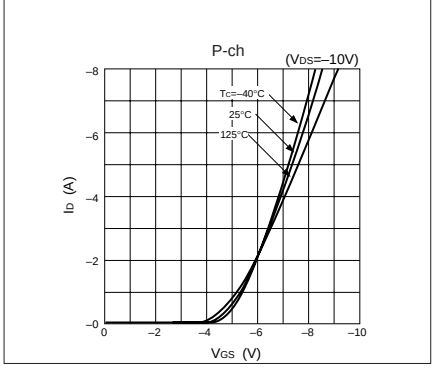


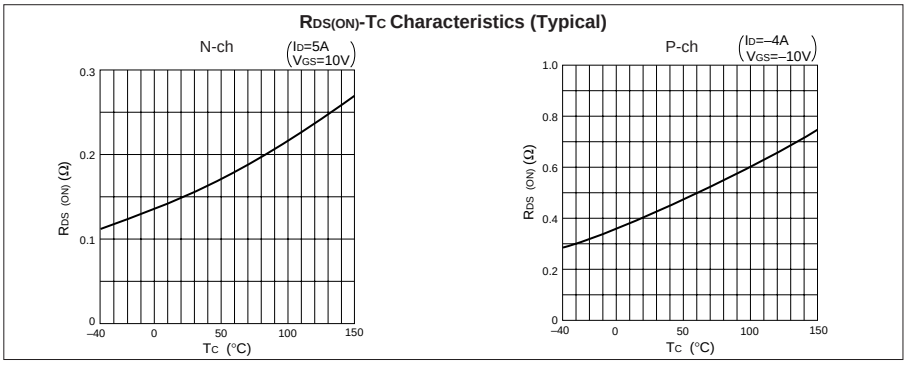
Characteristic curves











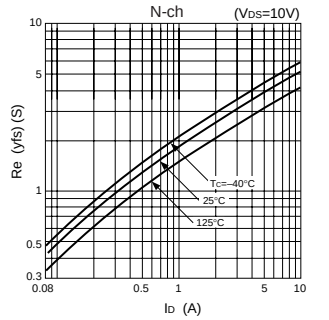
Electrical characteristics

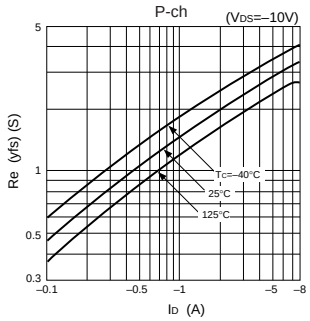
(T_a=25°C)

Symbol	N channel					P channel				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V	–60			V	I_D=–250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±20V			∓500	nA	V_{GS}=∓20V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V			–250	μA	V_{DS}=–60V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA	–2.0		–4.0	V	V_{DS}=–10V, I_D=–250μA
$Re_{(yfs)}$	2.2	3.3		S	V_{DS}=10V, I_D=5A	1.6	2.2		S	V_{DS}=–10V, I_D=–4A
$R_{DS(ON)}$		0.17	0.22	Ω	V_{GS}=10V, I_D=5A		0.38	0.55	Ω	V_{GS}=–10V, I_D=–4A
Ciss		300		pF	V_{DS}=25V, f=1.0MHz,		270		pF	V_{DS}=–25V, f=1.0MHz,
Coss		160		pF	V_{GS}=0V		170		pF	V_{GS}=0V
t_{on}		35		ns	I_D=5A, V_{DD}≒30V, V_{GS}=10V,		60		ns	I_D=–4A, V_{DD}≒–30V, V_{GS}=–10V,
t_{off}		35		ns	see Fig. 3 on page 16.		60		ns	see Fig. 4 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=5A, V_{GS}=0V		–4.4	–5.5	V	I_{SD}=–4A, V_{GS}=0V
t_{rr}		140		ns	I_{SD}=±100mA		150		ns	I_{SD}=∓100mA

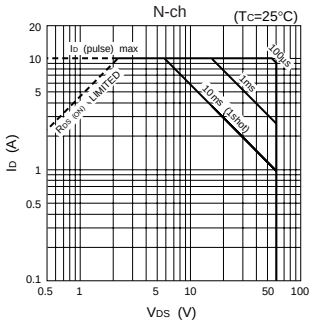
Characteristic curves

$Re_{(yfs)}$-I_D Characteristics (Typical)

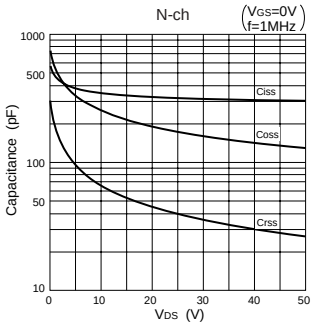


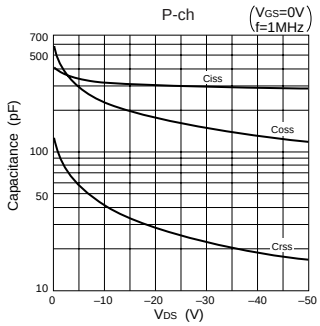


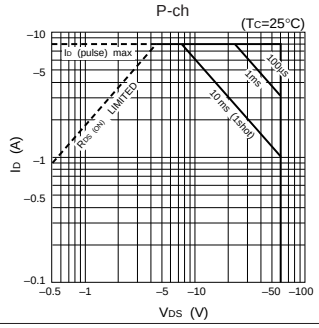
Safe Operating Area (SOA)



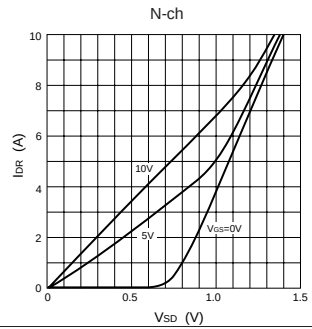
Capacitance-V_{DS} Characteristics (Typical)

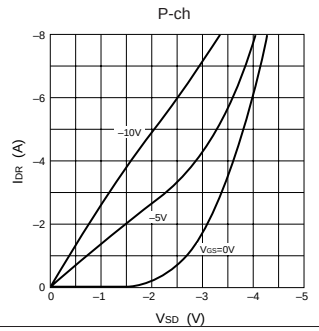




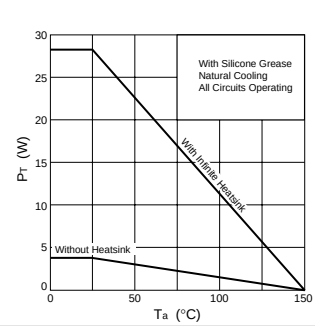


I_{DR}-V_{SD} Characteristics (Typical)





P_T-T_a Characteristics



SMA5105

N-channel
With built-in flywheel diode

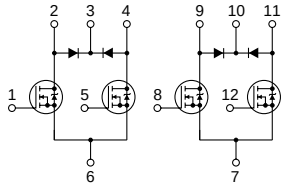
External dimensions Ⓑ ··· SMA

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±10	V
I_D	±5	A
$I_{D(pulse)}$	±10 (PW≤1ms)	A
E_{AS}*	32	mJ
I_F	5 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	10 (PW≤10ms, Single pulse)	A
V_R	120	V
P_T	4 (Ta=25°C, with all circuits operating, without heatsink)	W
	28 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj–a	31.2 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj–c	4.46 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=20V, L=2mH, I_D=5A, unclamped, see Fig. E on page 15.

■Equivalent circuit diagram



Electrical characteristics (Ta=25°C)

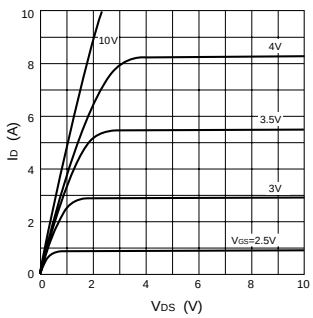
Symbol	Specification min	typ	max	Unit	Conditions
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	3.1	4.5		S	V_{DS}=10V, I_D=5A
$R_{DS(ON)}$		0.27	0.30	Ω	V_{GS}=10V, I_D=2.5A
		0.38	0.41	Ω	V_{GS}=4V, I_D=2.5A
Ciss		470		pF	V_{DS}=25V, f=1.0MHz,
Coss		130		pF	V_{GS}=0V
ton		70		ns	I_D=5A, V_{DD}≒50V, V_{GS}=5V,
toff		50		ns	see Fig. 3 on page 16.
V_{SD}		1.2	2.0	V	I_{SD}=5A, V_{GS}=0V
trr		330		ns	I_{SD}=±100mA

●Diode for flyback voltage absorption (1 circuit)

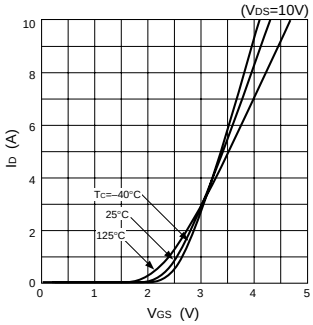
Symbol	Specification min	typ	max	Unit	Conditions
V_R	120			V	I_R=10μA
V_F		1.0	1.2	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F=±100mA

Characteristic curves

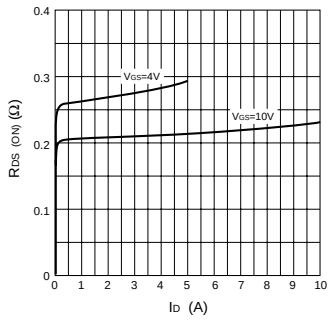
I_D-V_{DS} Characteristics (Typical)



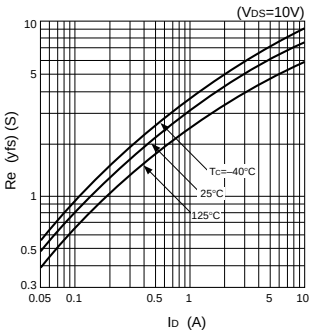
I_D-V_{GS} Characteristics (Typical)



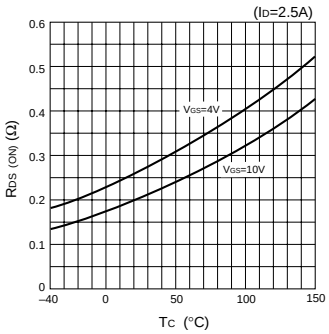
$R_{DS(ON)}$-I_D Characteristics (Typical)



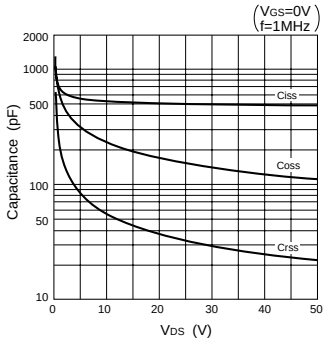
$Re_{(yfs)}$-I_D Characteristics (Typical)



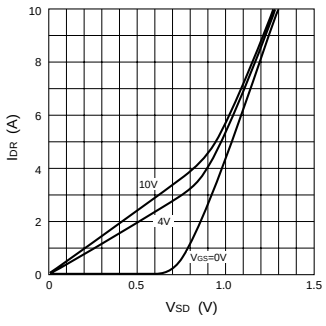
$R_{DS(ON)}$-T_C Characteristics (Typical)



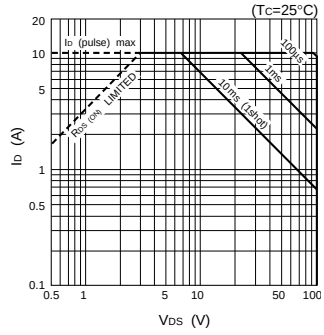
Capacitance-V_{DS} Characteristics (Typical)



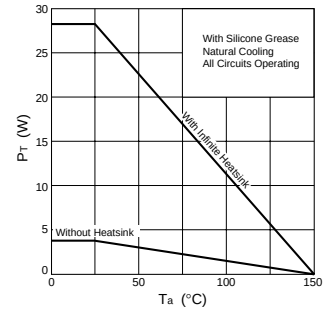
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SMA5106

N-channel
With built-in flywheel diode

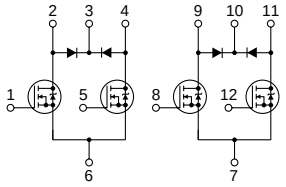
External dimensions Ⓑ ··· SMA

Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±10	V
I_D	±4	A
$I_{D(pulse)}$	±8 (PW≤1ms)	A
E_{AS}*	16	mJ
I_F	4 (PW≤0.5ms, Du≤25%)	A
I_{FSM}	8 (PW≤10ms, Single pulse)	A
V_R	120	V
P_T	4 (Ta=25°C, with all circuits operating, without heatsink)	W
	28 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θj–a	31.2 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj–c	4.46 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=20V, L=1mH, I_D=5A, unclamped, see Fig. E on page 15.

■Equivalent circuit diagram



Electrical characteristics (Ta=25°C)

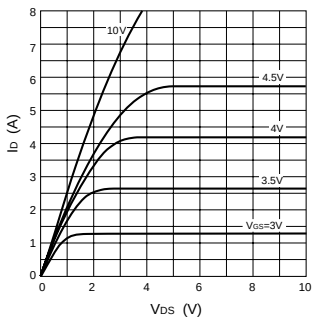
Symbol	Specification min	typ	max	Unit	Conditions
$V_{(BR)DSS}$	100			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V
I_{DSS}			250	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.1	1.7		S	V_{DS}=10V, I_D=4A
$R_{DS(ON)}$		0.47	0.55	Ω	V_{GS}=10V, I_D=2A
		0.60	0.78	Ω	V_{GS}=4V, I_D=2A
Ciss		230		pF	V_{DS}=25V, f=1.0MHz,
Coss		60		pF	V_{GS}=0V
ton		60		ns	I_D=4A, V_{DD}≒50V, V_{GS}=10V,
toff		50		ns	see Fig. 3 on page 16.
V_{SD}		1.2	2.0	V	I_{SD}=4A, V_{GS}=0V
trr		250		ns	I_{SD}=±100mA

●Diode for flyback voltage absorption

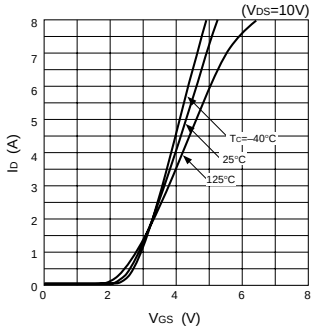
Symbol	Specification min	typ	max	Unit	Conditions
V_R	120			V	I_R=10μA
V_F		1.0	1.2	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F=±100mA

Characteristic curves

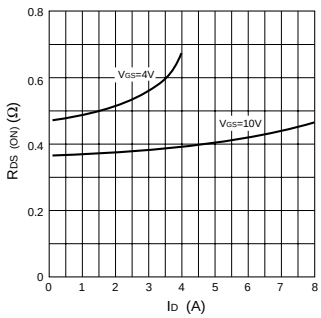
I_D-V_{DS} Characteristics (Typical)



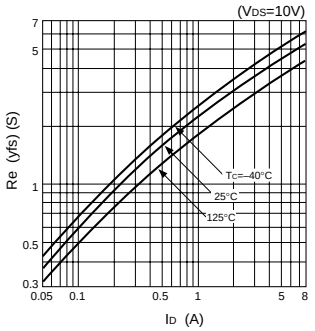
I_D-V_{GS} Characteristics (Typical)



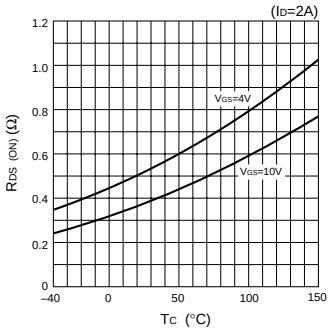
$R_{DS(ON)}$-I_D Characteristics (Typical)



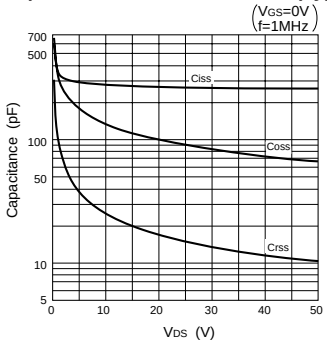
$Re_{(yfs)}$-I_D Characteristics (Typical)



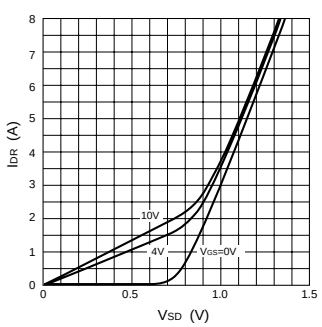
$R_{DS(ON)}$-T_C Characteristics (Typical)



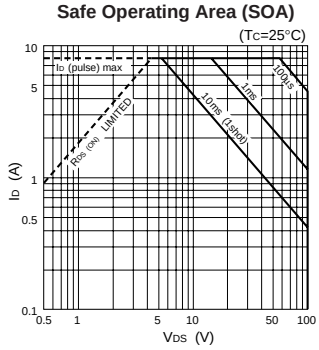
Capacitance-V_{DS} Characteristics (Typical)



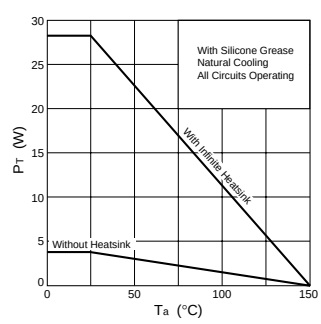
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SMA5112

N-channel

3-phase DC motor 100V AC direct drive

External dimensions Ⓑ ··· SMA

Absolute maximum ratings (Ta=25°C)

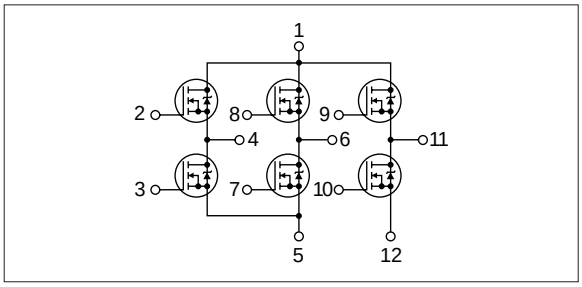
Symbol	Ratings	Unit
V_{DSS}	250	V
V_{GSS}	±20	V
I_D	±7	A
$I_{D(pulse)}$	±15 (PW≤1ms, Du≤1%)	A
E_{AS}*	55	mJ
P_T	4 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C, with all circuits operating, with infinite heatsink)	W
θj-a	31.2 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj-c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=25V, L=2.0mH, I_D=7A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics (Ta=25°C)

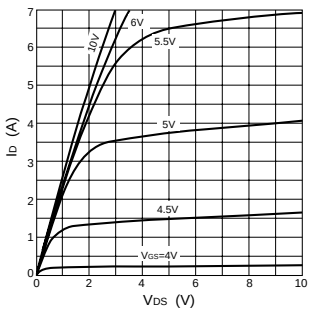
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	250			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=250V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=1mA
Re(yfs)	2.5	5.0		S	V_{DS}=10V, I_D=3.5A
$R_{DS(ON)}$		0.4	0.5	Ω	V_{GS}=10V, I_D=3.5A
Ciss		450		pF	V_{DS}=10V, f=1.0MHz,
Coss		280		pF	V_{GS}=0V
td(on)		20		ns	I_D=3.5A,
tr		30		ns	V_{DD}≒100V,
td(off)		55		ns	R_L=28.6Ω, V_{GS}=10V,
tf		75		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=7A, V_{GS}=0V
trr		600		ns	I_{SD}=±100mA

■Equivalent circuit diagram

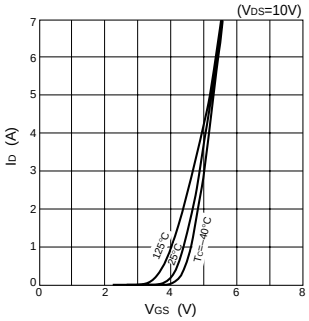


Characteristic curves

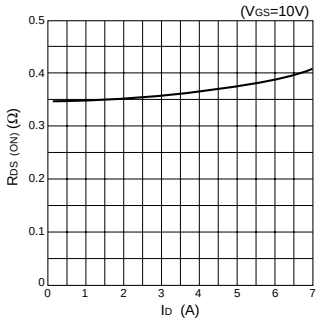
I_D-V_{DS} Characteristics (Typical)



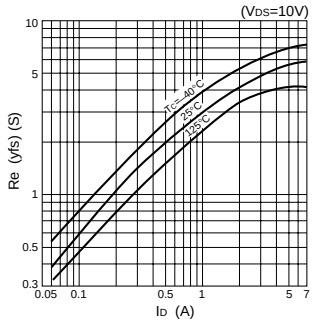
I_D-V_{GS} Characteristics (Typical)



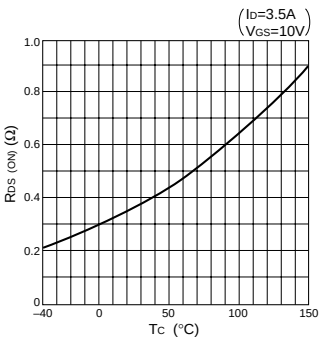
$R_{DS(ON)}$-I_D Characteristics (Typical)



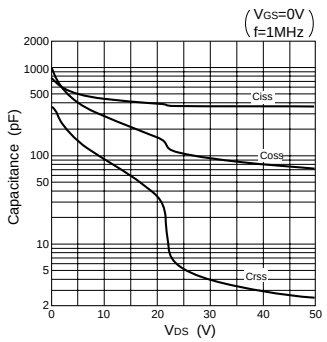
Re(yfs)-I_D Characteristics (Typical)



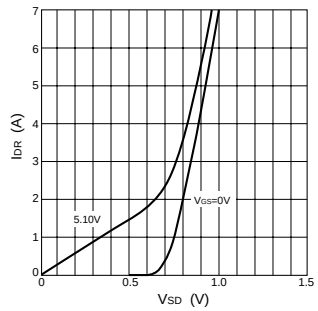
$R_{DS(ON)}$-T_C Characteristics (Typical)



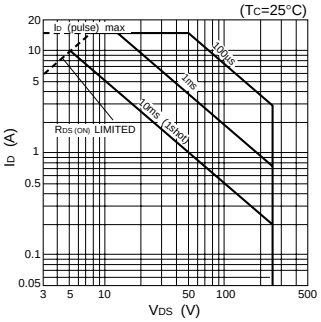
Capacitance-V_{DS} Characteristics (Typical)



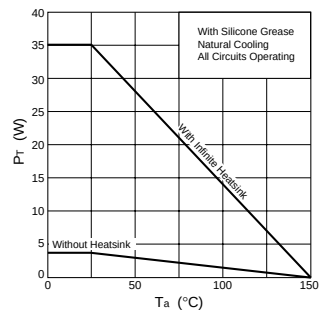
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SMA5114

N-channel

With built-in flywheel diode

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	±20	V
I_D	±3	A
$I_{D(pulse)}$	±6 (PW≤1ms, Du≤1%)	A
E_{AS}*	6.8	mJ
I_{AS}	3	A
P_T	4 (Ta=25°C, with all circuits operating, without heatsink)	W
	28 ((Tc=25°C,with all circuits operating, with infinite heatsink)	W
θj–a	31.2 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj–c	4.46 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
Tch	150	°C
Tstg	–40 to +150	°C

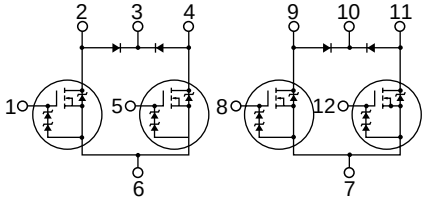
* : V_{DD}=20V, L=1mH, I_L=3A, unclamped, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±10	μA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=60V, V_{GS}=0V
V_{TH}	1.0		2.5	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.0	2.3		S	V_{DS}=10V, I_D=1.0A
$R_{DS(ON)}$		0.20	0.25	Ω	V_{GS}=10V, I_D=1.0A
		0.25	0.30	Ω	V_{GS}=4V, I_D=1.0A
Ciss		170		pF	V_{DS}=10V,
Coss		130		pF	f=1.0MHz,
Crss		20		pF	V_{GS}=0V
$td_{(on)}$		80		ns	I_D=1A,
tr		170		ns	V_{DD}≒30V,
$td_{(off)}$		330		ns	R_L=30Ω, V_{GS}=5V,
tf		150		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=3A, V_{GS}=0V
trr		80		ns	I_{SD}=±100mA

■Equivalent circuit diagram

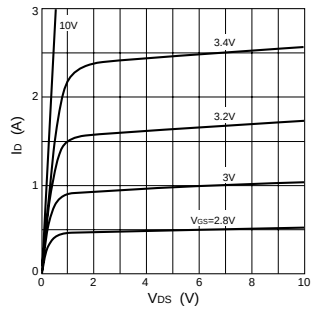


●Diode for flyback voltage absorption

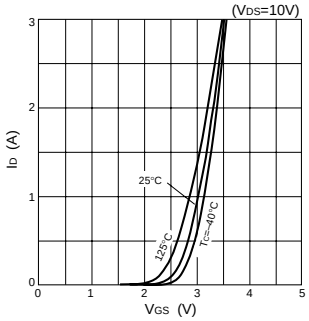
Symbol	Specification			Unit	Conditions
	min	typ	max		
V_R	120			V	I_R=10μA
V_F		1.0	1.2	V	I_F=1A
I_R			10	μA	V_R=120V
trr		100		ns	I_F=±100mA

Characteristic curves

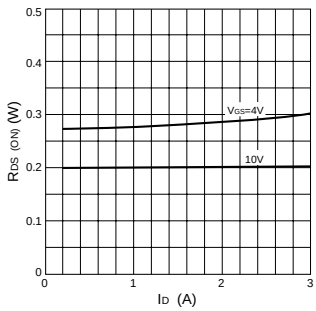
I_D-V_{DS} Characteristics (Typical)



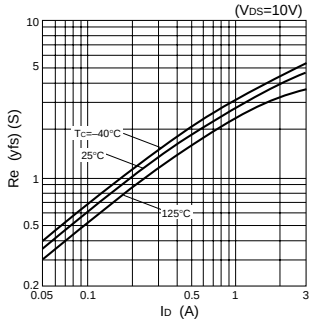
I_D-V_{GS} Characteristics (Typical)



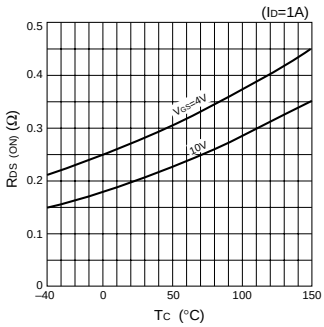
$R_{DS(ON)}$-I_D Characteristics (Typical)



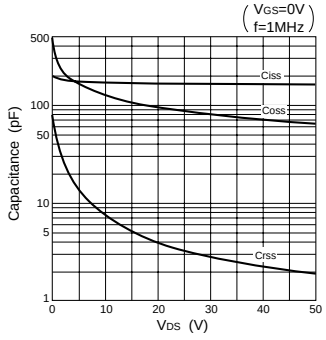
$Re_{(yfs)}$-I_D Characteristics (Typical)



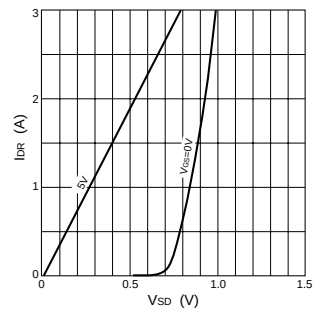
$R_{DS(ON)}$-T_C Characteristics (Typical)



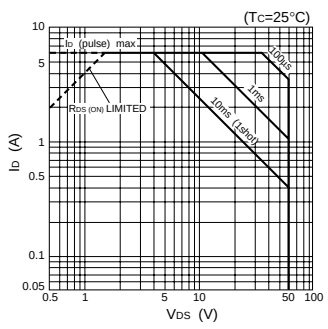
Capacitance-V_{DS} Characteristics (Typical)



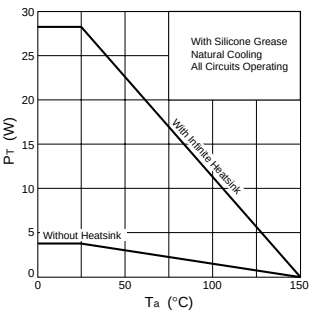
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SMA5117

N-channel

3-phase DC motor 100V AC direct drive

External dimensions Ⓑ ··· SMA

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	250	V
V_{GSS}	±20	V
I_D	±7	A
$I_{D(pulse)}$	±15 (PW≤1ms, Du≤1%)	A
E_{AS}*	120	mJ
P_T	4 (Ta=25°C, with all circuits operating, without heatsink)	W
	35 (Tc=25°C,with all circuits operating, with infinite heatsink)	W
θj–a	31.2 (Junction-Air, Ta=25°C, with all circuits operating)	°C/W
θj–c	3.57 (Junction-Case, Tc=25°C, with all circuits operating)	°C/W
Tch	150	°C
Tstg	–40 to +150	°C

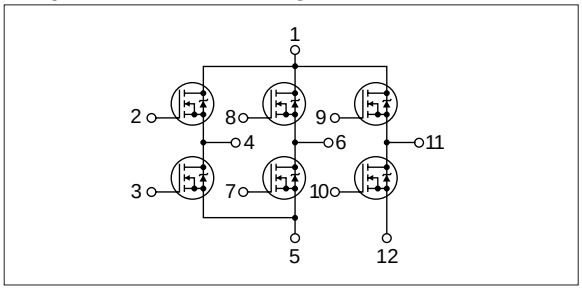
* : V_{DD}=25V, L=4.4mH, I_D=7A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics

(Ta=25°C)

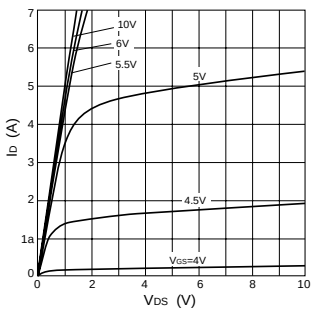
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	250			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=250V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=1mA
$Re_{(yfs)}$	4.5	6.5		S	V_{DS}=10V, I_D=3.5A
$R_{DS(ON)}$		0.2	0.25	Ω	V_{GS}=10V, I_D=3.5A
Ciss		850		pF	V_{DS}=10V,
Coss		550		pF	f=1.0MHz,
Crss		250		pF	V_{GS}=0V
$td_{(on)}$		20		ns	I_D=3.5A,
tr		25		ns	V_{DD}≒100V,
$td_{(off)}$		90		ns	R_L=28.6Ω, V_{GS}=10V,
tf		70		ns	see Fig. 3 on page 16.
V_{SD}		1.1	1.5	V	I_{SD}=7A, V_{GS}=0V
trr		85		ns	I_{SD}=3.5A, V_{GS}=0V, di/dt=100A/μs

■Equivalent circuit diagram

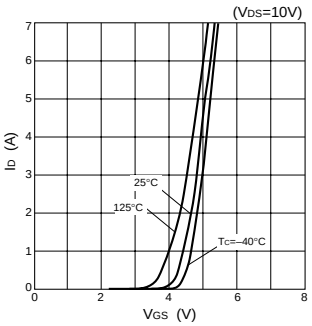


Characteristic curves

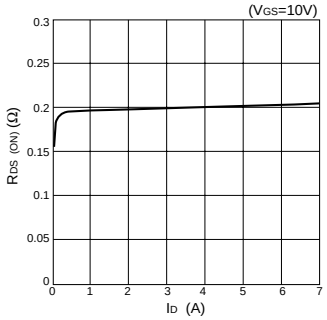
I_D-V_{DS} Characteristics (Typical)



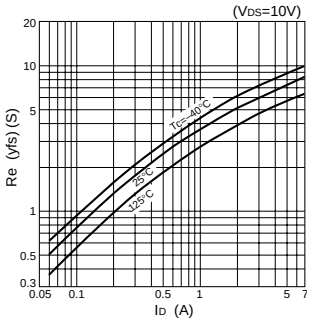
I_D-V_{GS} Characteristics (Typical)



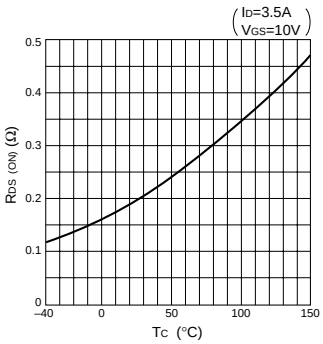
$R_{DS(ON)}$-I_D Characteristics (Typical)



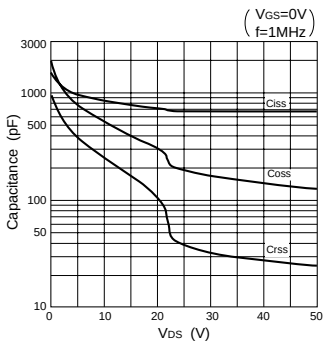
$Re_{(yfs)}$-I_D Characteristics (Typical)



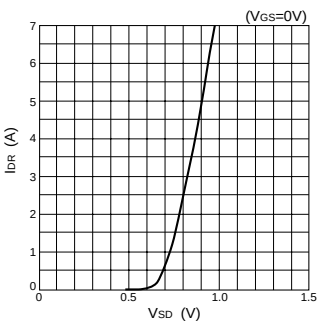
$R_{DS(ON)}$-T_C Characteristics (Typical)



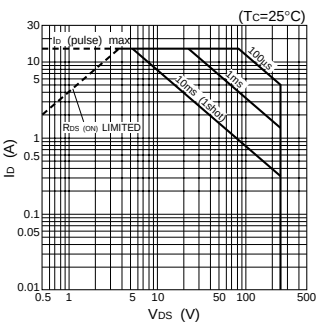
Capacitance-V_{DS} Characteristics (Typical)



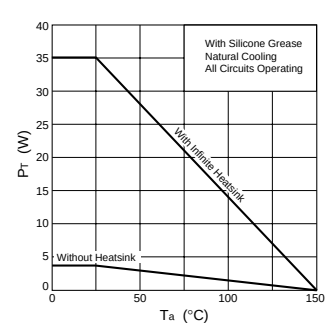
I_{DR}-V_{SD} Characteristics (Typical)



Safe Operating Area (SOA)



P_T-T_a Characteristics



SMA6010

PNP + NPN Darlington
3-phase motor drive

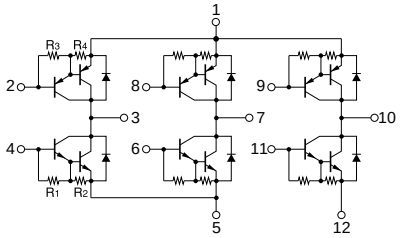
External dimensions Ⓑ ··· SMA

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	4	–4	A
I_{CP}	6 (PW≤1ms, Du≤50%)	–6 (PW≤1ms, Du≤50%)	A
I_B	0.5	–0.5	A
P_T	4 (Ta=25°C)		W
	20 (Tc=25°C)		
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	6.25		°C/W

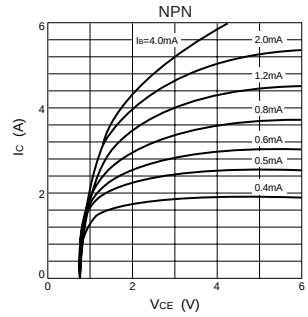
■Equivalent circuit diagram

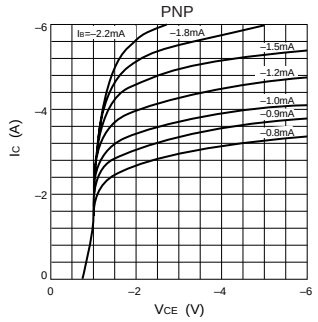


R1: 3kΩ typ R2: 200Ω typ R3: 2kΩ typ R4: 150Ω typ

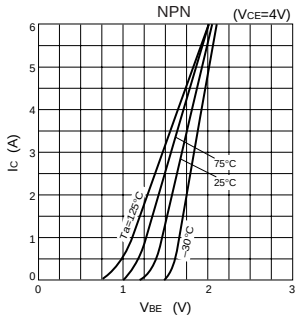
Characteristic curves

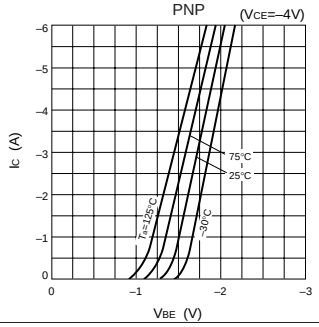
IC-VCE Characteristics (Typical)



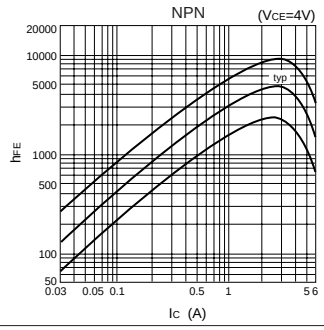


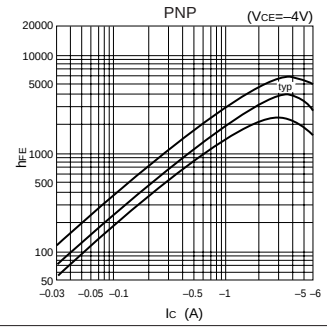
IC-VBE Temperature Characteristics (Typical)



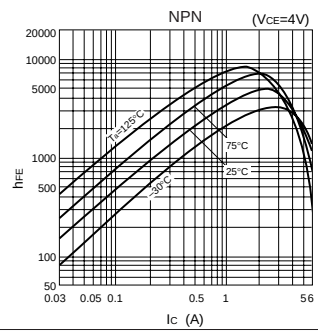


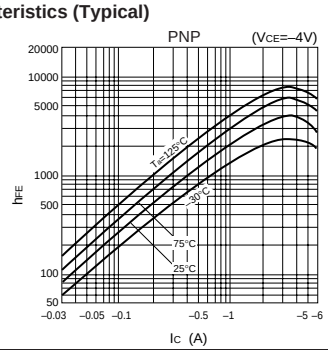
hFE-IC Characteristics (Typical)





hFE-IC Temperature Characteristics (Typical)





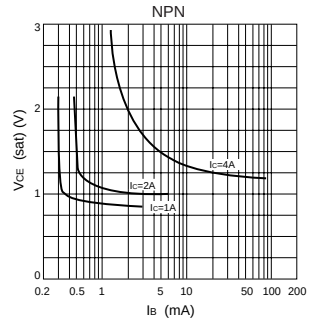
Electrical characteristics

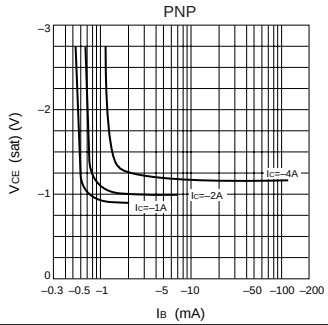
(T_a=25°C)

Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V			–10	μA	V_{CB}=–60V
I_{EBO}			10	mA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=10mA	–60			V	I_C=–20mA
h_{FE}	2000	5000	12000		V_{CE}=4V, I_C=3A	2000	5000	12000		V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=6mA			–1.5	V	I_C=–3A, I_B=–6mA
V_{BE}(sat)			2.0	V				–2.0	V	
V_{FEC}			1.8	V	I_{FEC}=1A			–1.8	V	I_{FEC}=–1A
t_{on}		1.0		μs	V_{CC}≒30V,		0.4		μs	V_{CC}≒–30V,
t_{stg}		4.0		μs	I_C=3A,		0.8		μs	I_C=–3A,
t_f		1.5		μs	I_{B1}=–I_{B2}=10mA		0.6		μs	I_{B1}=–I_{B2}=–10mA
f_T		75		MHz	V_{CE}=12V, I_E=–0.1A		200		MHz	V_{CE}=–12V, I_E=0.2A
C_{ob}		50		pF	V_{CB}=10V, f=1MHz		75		pF	V_{CB}=–10V, f=1MHz

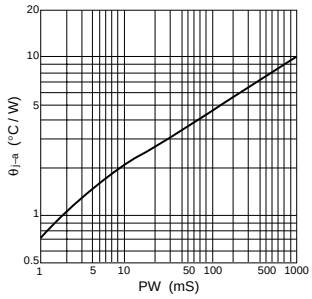
Characteristic curves

V_{CE}(sat)-I_B Characteristics (Typical)

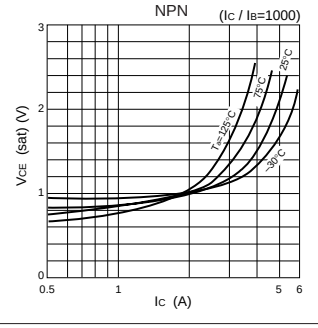


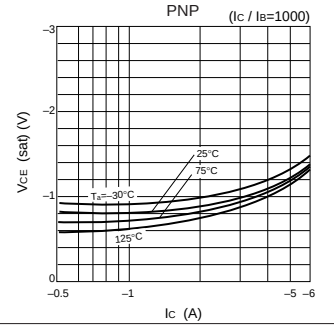


$\theta_{j\text{-}a}$-PW Characteristics

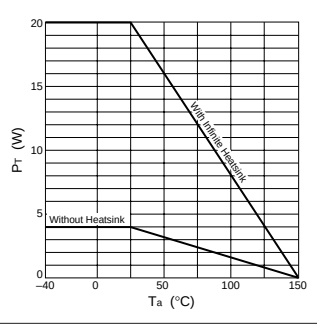


V_{CE}(sat)-I_C Temperature Characteristics (Typical)

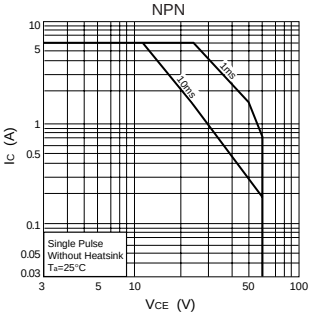


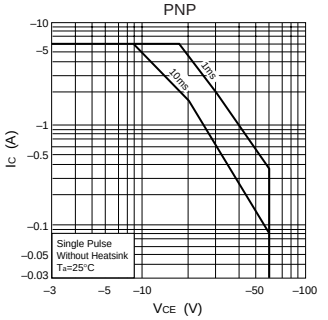


P_T-T_a Characteristics



Safe Operating Area (SOA)





SMA6014

PNP + NPN Darlington
3-phase motor drive

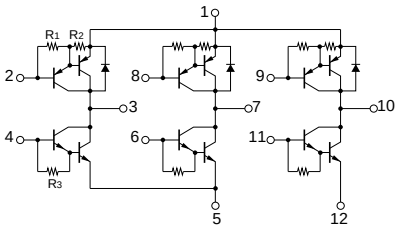
External dimensions Ⓑ ··· SMA

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	2	–2	A
I_{CP}	3 (PW≤1ms, Du≤50%)	–3 (PW≤1ms, Du≤50%)	A
I_B	0.5	–0.5	A
P_T	4 (Ta=25°C)		W
	20 (Tc=25°C)		
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-c}	6.25		°C/W

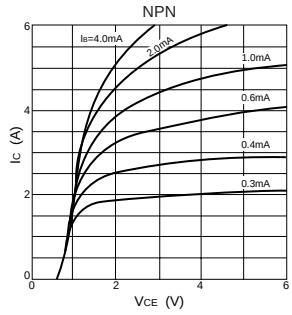
■Equivalent circuit diagram

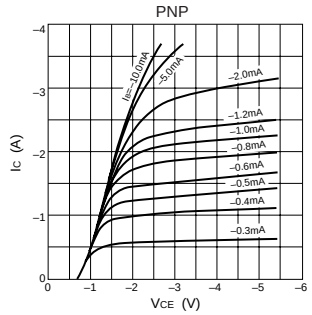


R1: 4kΩ typ R2: 100Ω typ R3: 3kΩ typ

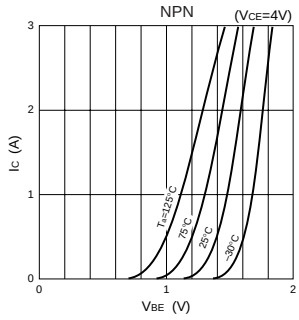
Characteristic curves

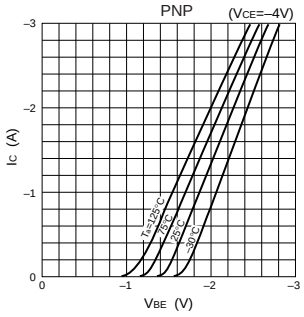
IC-VCE Characteristics (Typical)



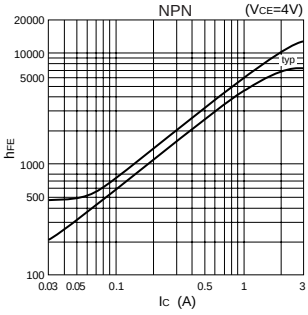


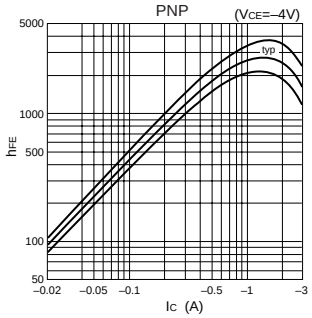
IC-VBE Temperature Characteristics (Typical)



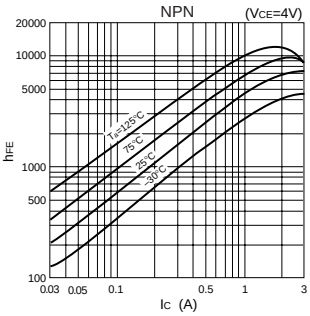


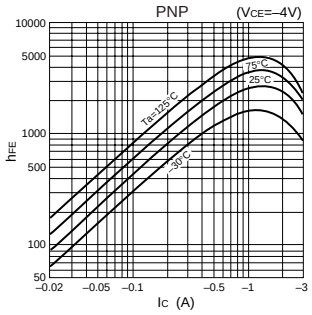
hFE-IC Characteristics (Typical)





hFE-IC Temperature Characteristics (Typical)





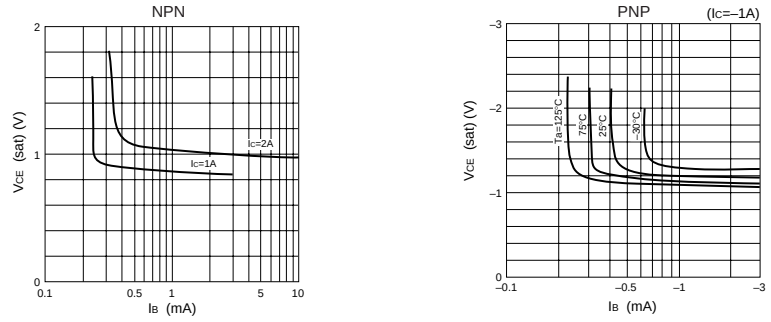
Electrical characteristics

(T_a=25°C)

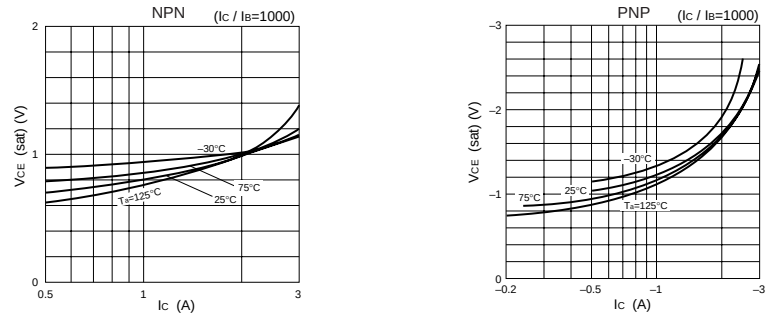
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V			–10	μA	V_{CB}=–60V
I_{EBO}			10	μA	V_{EB}=6V			–5	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	1500	4000	10000		V_{CE}=4V, I_C=1A	2000	4000	10000		V_{CE}=–4V, I_C=–1A
V_{CE}(sat)			1.5	V	I_C=1A, I_B=2mA			–1.5	V	I_C=–1A, I_B=–2mA
V_{BE}(sat)			2.2	V				–2.2	V	
V_{FEC}		—		V				–1.8	V	I_{FEC}=–1A
t_{rr}		—		μs			3.0		μs	I_{FEC}=±100mA
t_{on}		0.7		μs	V_{CC}≒30V,		0.4		μs	V_{CC}≒–30V,
t_{stg}		5.0		μs	I_C=1A,		1.0		μs	I_C=–1A,
t_f		3.0		μs	I_{B1}=–I_{B2}=2mA		0.4		μs	I_{B1}=–I_{B2}=–2mA
f_T		20		MHz	V_{CE}=12V, I_E=–1A		100		MHz	V_{CE}=–12V, I_E=0.1A
C_{ob}		45		pF	V_{CB}=10V, f=1MHz		30		pF	V_{CB}=–10V, f=1MHz

Characteristic curves

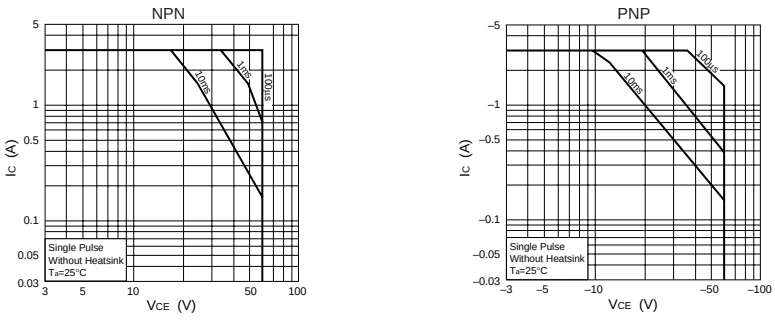
V_{CE}(sat)-I_B Characteristics (Typical)



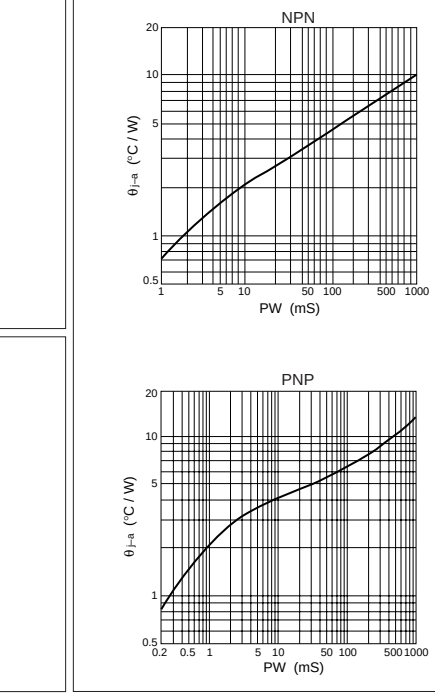
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



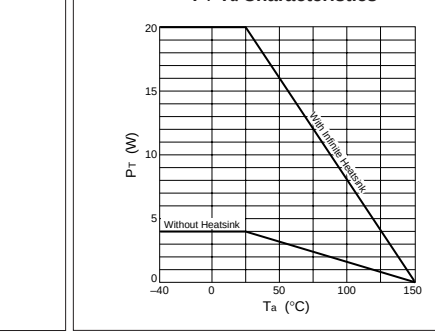
Safe Operating Area (SOA)



$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



SMA6511

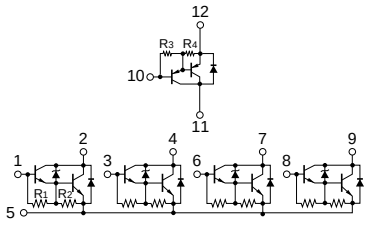
PNP + NPN Darlington
Stepper motor driver with dual supply voltage switch

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	100±15	–60	V
V_{CEO}	100±15	–60	V
V_{EBO}	6	–6	V
I_{CP}	1.5	–3	A
I_B	0.5	–0.5	A
P_T	4 (Ta=25°C)		W
	20 (Tc=25°C)		
T_j	150		°C
T_{stg}	–40 to +150		°C

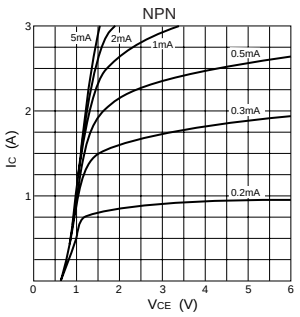
■Equivalent circuit diagram

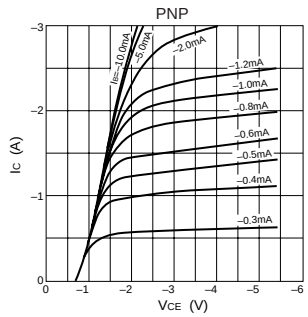


R_1: 3.5kΩ typ R_2: 200Ω typ R_3: 4kΩ typ R_4: 100Ω typ

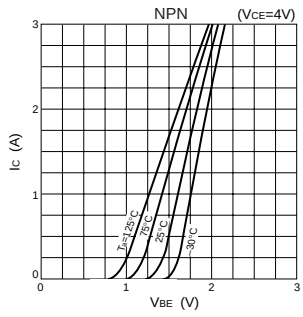
Characteristic curves

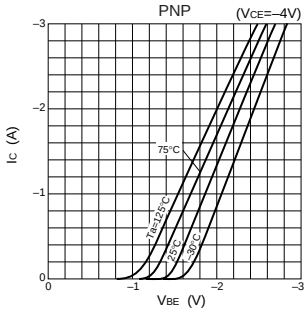
I_C-V_{CE} Characteristics (Typical)



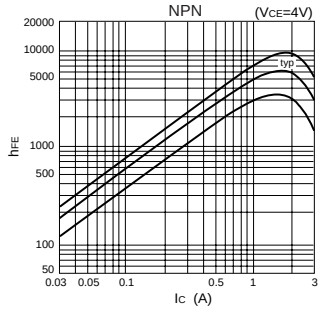


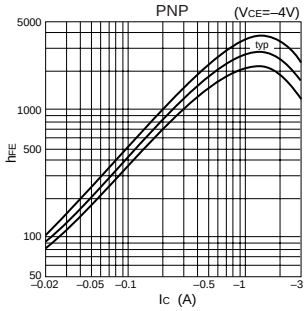
I_C-V_{BE} Temperature Characteristics (Typical)



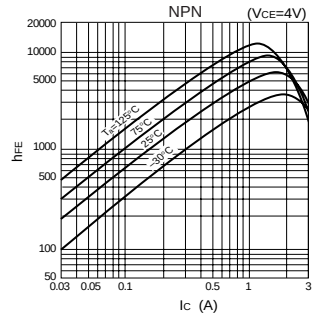


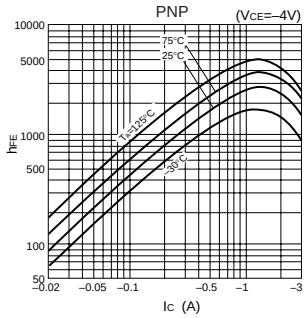
h_{FE}-I_C Characteristics (Typical)





h_{FE}-I_C Temperature Characteristics (Typical)





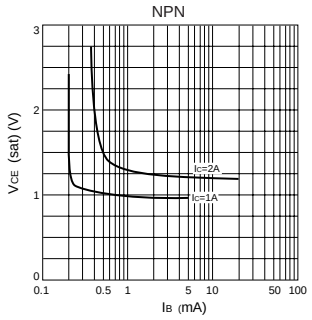
Electrical characteristics

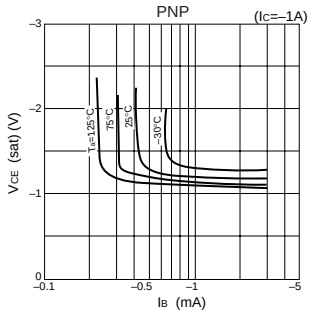
(T_a=25°C)

Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=85V			–10	μA	V_{CB}=–60V
I_{EBO}			5	mA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	85	100	115	V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	2000				V_{CE}=4V, I_C=1A	2000				V_{CE}=–4V, I_C=–1A
V_{CE}(sat)			1.5	V	I_C=1A, I_B=2mA			–1.5	V	I_C=–1A, I_B=–2mA

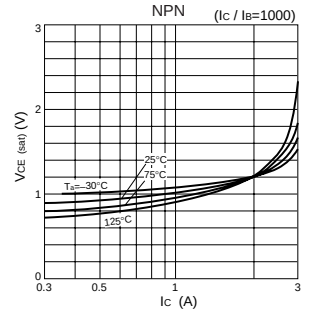
Characteristic curves

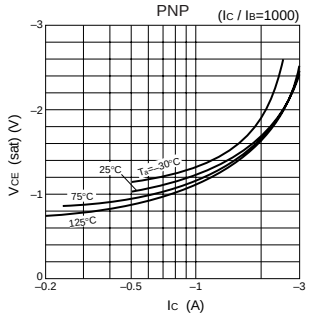
V_{CE}(sat)-I_B Characteristics (Typical)



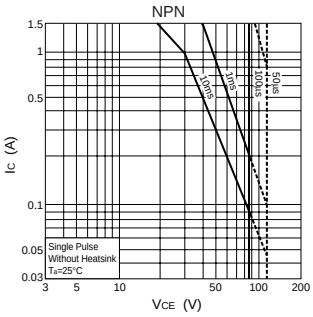


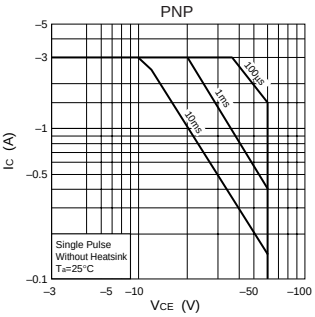
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



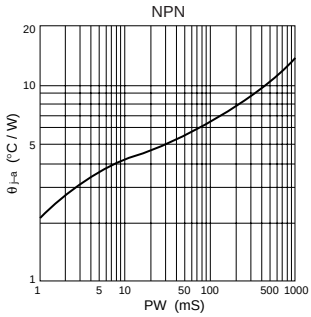


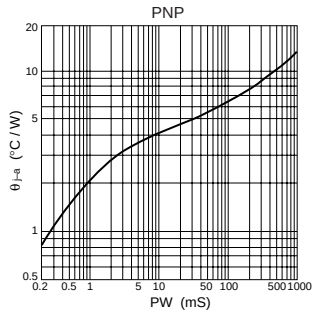
Safe Operating Area (SOA)



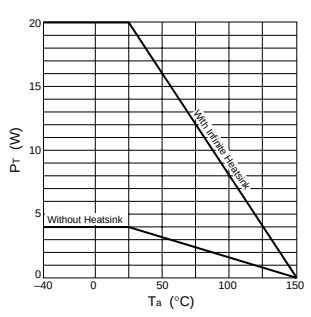


$\theta_{j\text{-}a}$-PW Characteristics





P_T-T_a Characteristics



SMA6512

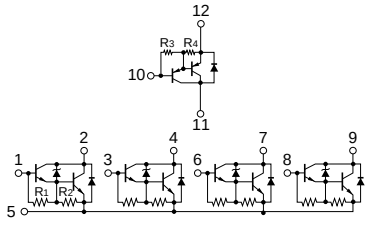
PNP + NPN Darlington
Stepper motor driver with dual supply voltage switch

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60±10	–60	V
V_{CEO}	60±10	–60	V
V_{EBO}	6	–6	V
I_{CP}	1.5	–3	A
I_B	0.5	–0.5	A
P_T	4 (Ta=25°C)		W
	20 (Tc=25°C)		
T_j	150		°C
T_{stg}	–40 to +150		°C

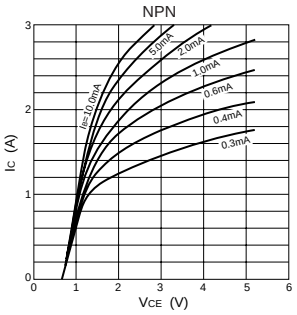
■Equivalent circuit diagram

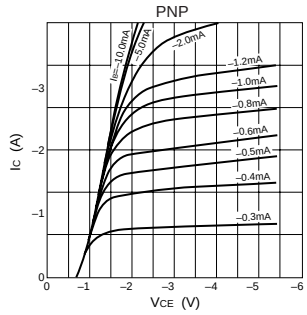


R_1: 4kΩ typ R_2: 150Ω typ R_3: 4kΩ typ R_4: 100Ω typ

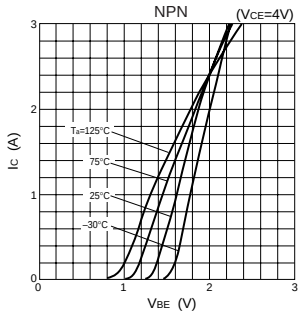
Characteristic curves

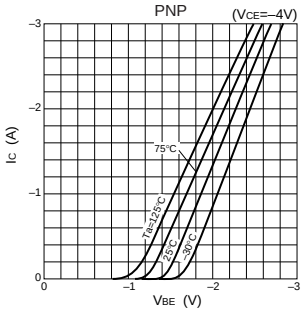
I_C-V_{CE} Characteristics (Typical)



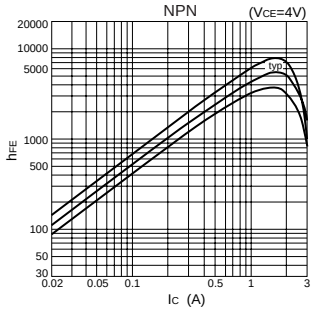


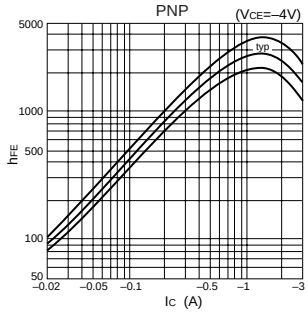
I_C-V_{BE} Temperature Characteristics (Typical)



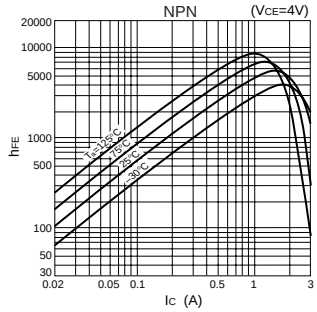


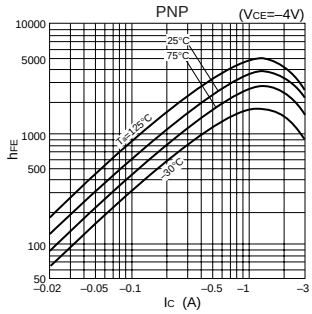
h_{FE}-I_C Characteristics (Typical)





h_{FE}-I_C Temperature Characteristics (Typical)





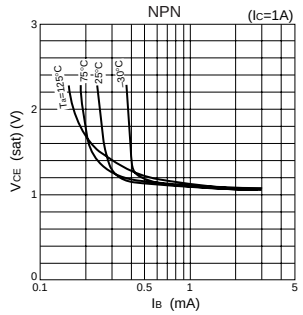
Electrical characteristics

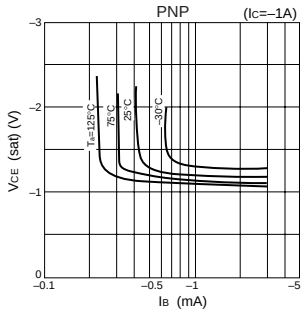
(T_a=25°C)

Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=50V			–10	μA	V_{CB}=–60V
I_{EBO}			5	mA	V_{EB}=6V			–5	mA	V_{EB}=–6V
V_{CEO}	50	60	70	V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	2000				V_{CE}=4V, I_C=1A	2000				V_{CE}=–4V, I_C=–1A
V_{CE}(sat)			1.5	V	I_C=1A, I_B=2mA			–1.5	V	I_C=–1A, I_B=–2mA

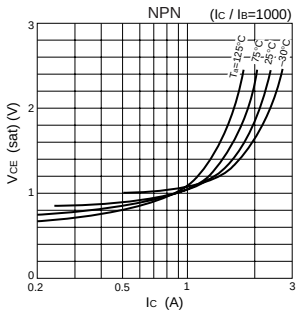
Characteristic curves

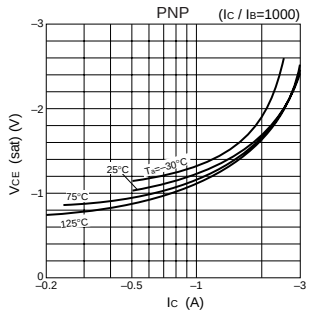
V_{CE}(sat)-I_B Temperature Characteristics (Typical)



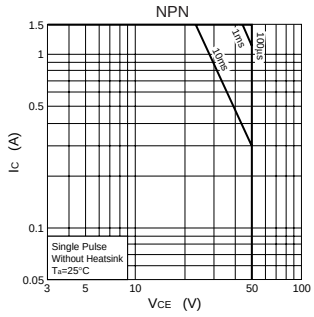


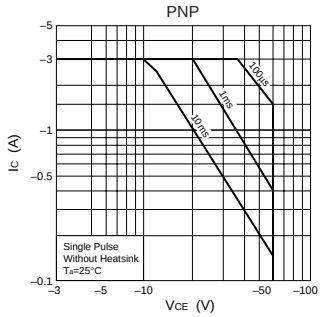
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



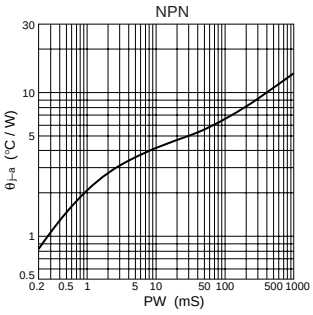


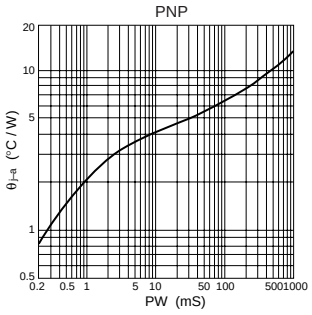
Safe Operating Area (SOA)



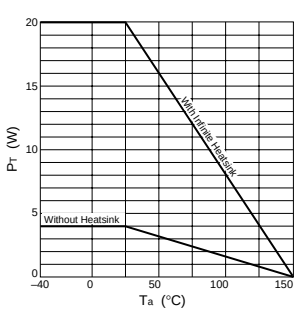


$\theta_{j\text{-}a}$-PW Characteristics





P_T-T_a Characteristics



STA301A

NPN Darlington
With built-in avalanche diode

External dimensions Ⓒ···STA300

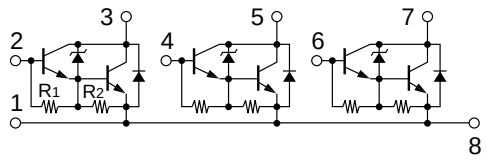
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	60±10	V
V_{CEO}	60±10	V
V_{EBO}	6	V
I_C	4	A
I_{CP}	8 (PW≤10ms, Du≤50%)	A
P_T	3 (Ta=25°C)	W
	15 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			100	μA	V_{CB}=50V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	50	60	70	V	I_C=10mA
h_{FE}	1000				V_{CE}=4V, I_C=3A
V_{CE}(sat)			2.0	V	I_C=3A, I_B=10mA
ton		1.0		μs	V_{CC}≒30V,
tstg		4.0		μs	I_C=3A,
tf		1.5		μs	I_{B1}=–I_{B2}=10mA

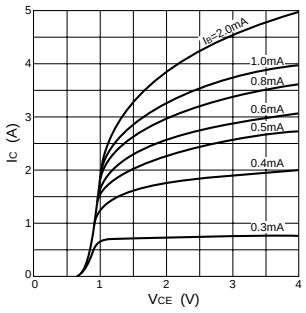
■Equivalent circuit diagram



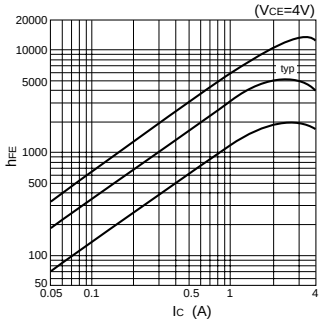
R1: 3kΩ typ R2: 150Ω typ

Characteristic curves

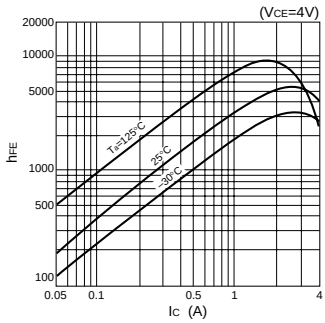
I_C-V_{CE} Characteristics (Typical)



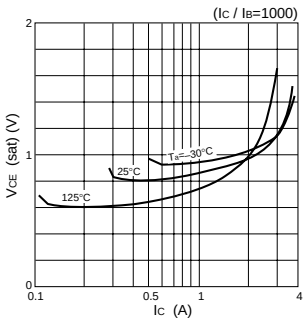
h_{FE}-I_C Characteristics (Typical)



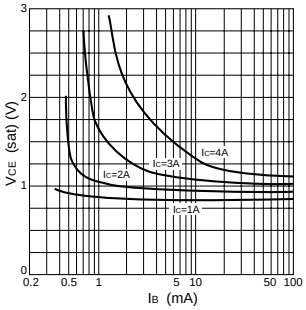
h_{FE}-I_C Temperature Characteristics (Typical)



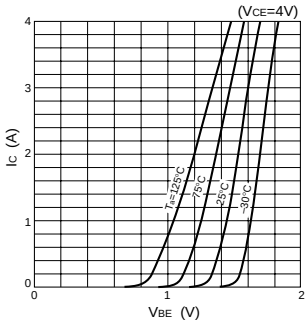
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



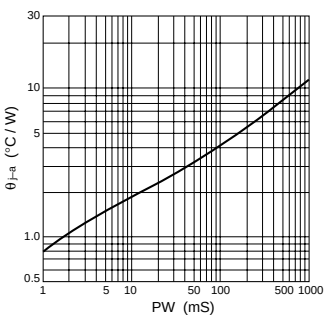
V_{CE}(sat)-I_B Characteristics (Typical)



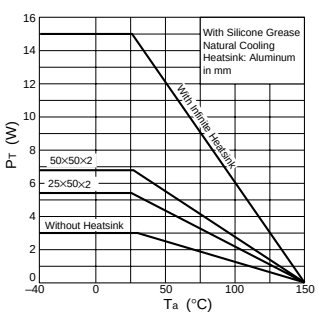
I_C-V_{BE} Temperature Characteristics (Typical)



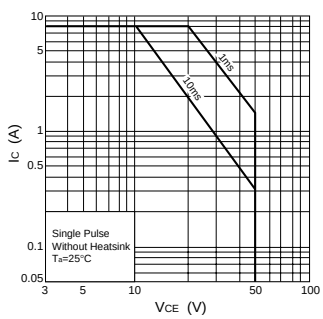
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA302A

PNP Darlington

General purpose/3-phase motor drive

External dimensions Ⓒ ··· STA300

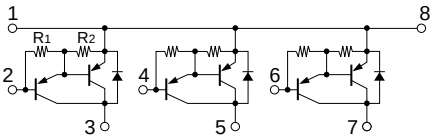
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	–50	V
V_{CEO}	–50	V
V_{EBO}	–6	V
I_C	–4	A
I_{CP}	–8 (PW≤10ms, Du≤50%)	A
P_T	3 (Ta=25°C)	W
	15 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–100	μA	V_{CB}=–50V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–50			V	I_C=–10mA
h_{FE}	1000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			–2.0	V	I_C=–3A, I_B=–10mA
ton		0.4		μs	V_{CC}≒–30V,
tstg		0.8		μs	I_C=–3A,
tf		0.6		μs	I_{B1}=–I_{B2}=–10mA

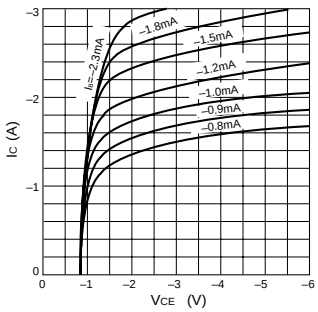
■Equivalent circuit diagram



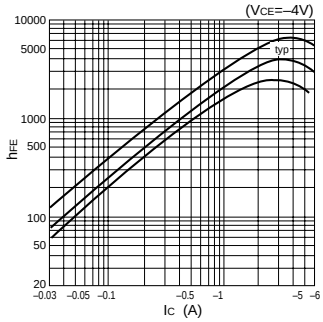
R1: 2kΩ typ R2: 150Ω typ

Characteristic curves

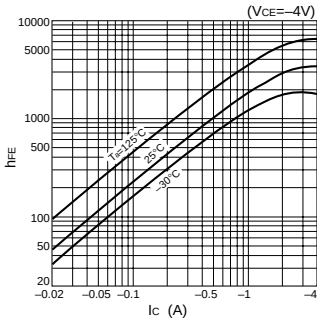
I_C-V_{CE} Characteristics (Typical)



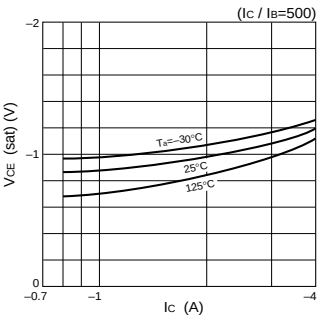
h_{FE}-I_C Characteristics (Typical)



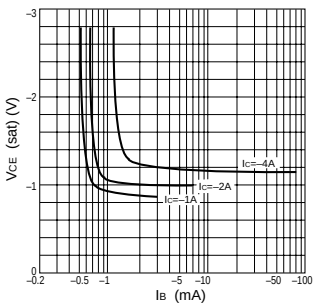
h_{FE}-I_C Temperature Characteristics (Typical)



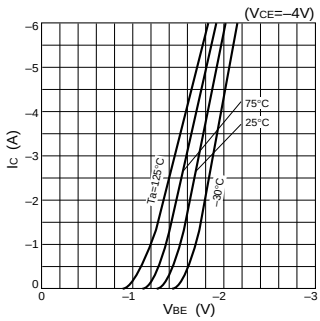
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



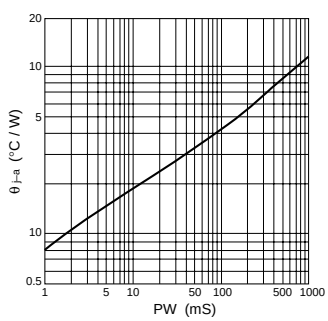
V_{CE}(sat)-I_B Characteristics (Typical)



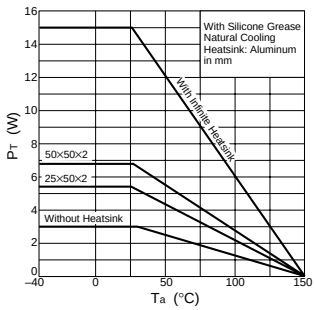
I_C-V_{BE} Temperature Characteristics (Typical)



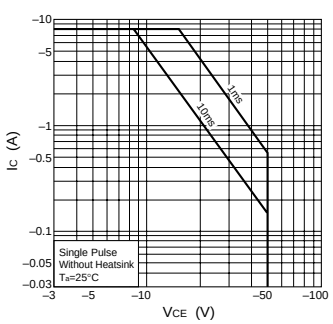
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA303A

NPN Darlington

General purpose/3-phase motor drive

External dimensions Ⓒ···STA300

Absolute maximum ratings

(Ta=25°C)

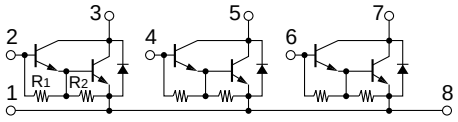
Symbol	Ratings	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	4	A
I_{CP}	8 (PW≤10ms, Du≤50%)	A
P_T	3 (Ta=25°C)	W
	15 (Tc=25°C)	
Tj	150	°C
Tstg	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			100	μA	V_{CB}=120V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	100			V	I_C=10mA
h_{FE}	1000				V_{CE}=4V, I_C=2A
V_{CE}(sat)			2.0	V	I_C=2A, I_B=10mA
ton		0.8		μs	V_{CC}≒40V,
tstg		5.0		μs	I_C=2A,
tf		2.0		μs	I_{B1}=–I_{B2}=10mA

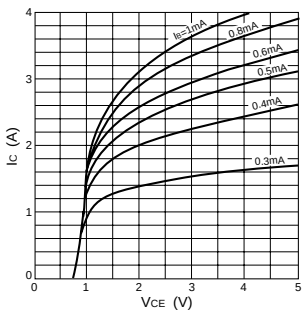
■Equivalent circuit diagram



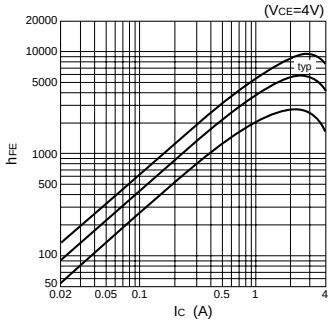
R1: 3kΩ typ R2: 500Ω typ

Characteristic curves

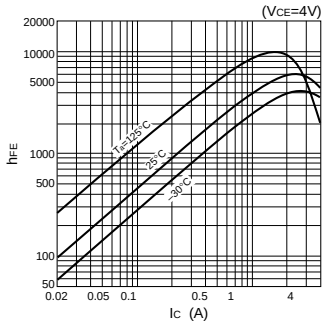
I_C-V_{CE} Characteristics (Typical)



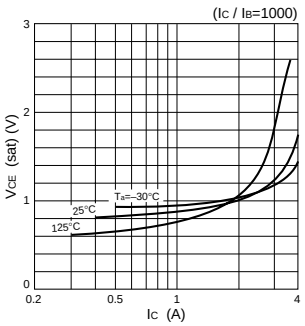
h_{FE}-I_C Characteristics (Typical)



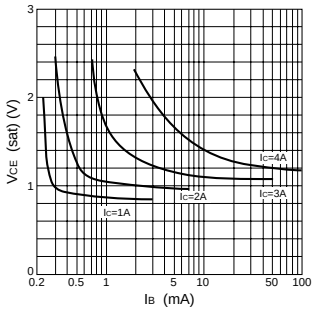
h_{FE}-I_C Temperature Characteristics (Typical)



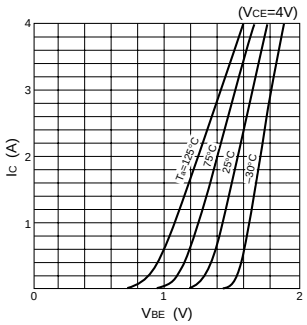
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



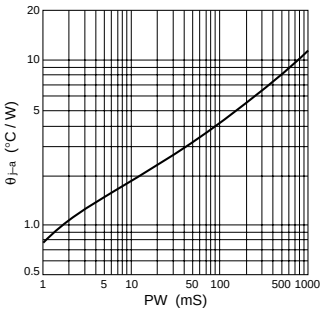
V_{CE}(sat)-I_B Characteristics (Typical)



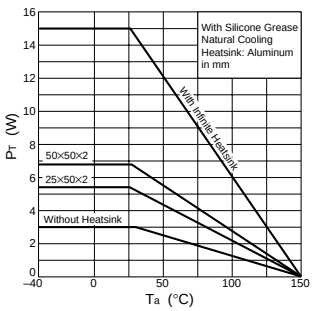
I_C-V_{BE} Temperature Characteristics (Typical)



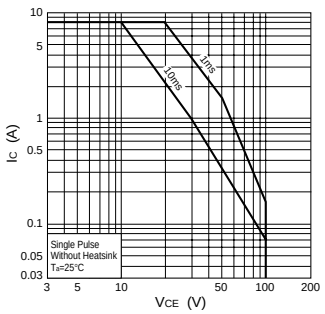
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA304A

NPN Darlington
3-phase motor drive

External dimensions Ⓒ···STA300

Absolute maximum ratings

(Ta=25°C)

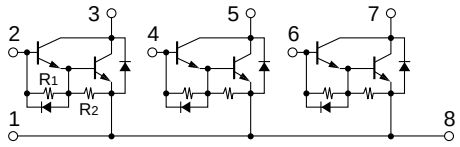
Symbol	Ratings	Unit
V_{CBO}	550	V
V_{CEO}	550	V
V_{EBO}	6	V
I_C	1	A
I_{CP}	2 (PW≤1ms, Du≤25%)	A
I_B	0.5	A
P_T	3 (Ta=25°C)	W
	15 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			100	μA	V_{CB}=550V
I_{EBO}		75	150	mA	V_{EB}=6V
V_{CEO}	550			V	I_C=100μA
h_{FE}	200	400	1000		V_{CE}=4V, I_C=500mA
V_{CE}(sat)		1.0	1.5	V	I_C=500mA, I_B=10mA
V_{BE}(sat)		1.5	2.2	V	
V_{FEC}		1.1	1.5	V	I_{FEC}=1A
ton		0.5		μs	V_{CC}≒200V,
tstg		3.5		μs	I_C=500mA,
tf		0.7		μs	I_{B1}=–I_{B2}=10mA
f_T		15		MHz	V_{CE}=12V, I_E=–0.2A
Cob		35		pF	V_{CB}=10V, f=1MHz

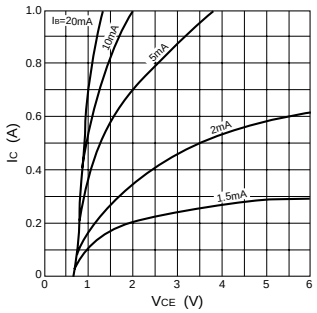
■Equivalent circuit diagram



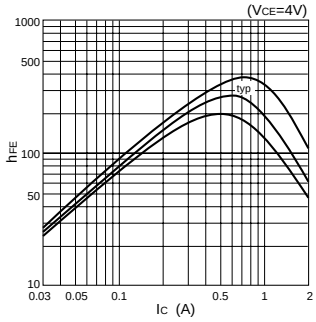
R1: 500Ω typ R2: 70Ω typ

Characteristic curves

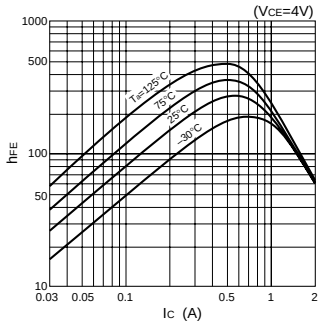
IC-VCE Characteristics (Typical)



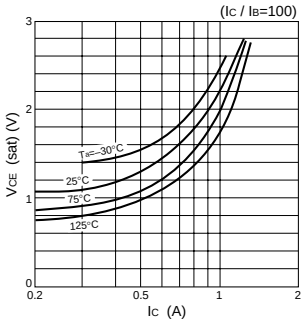
hFE-IC Characteristics (Typical)



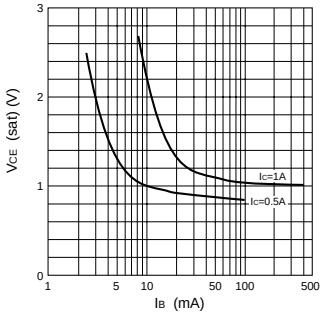
hFE-IC Temperature Characteristics (Typical)



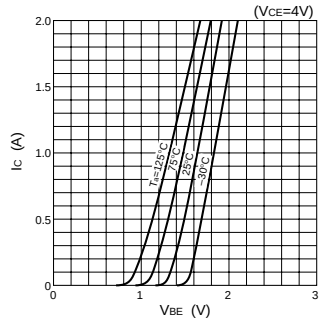
VCE(sat)-IC Temperature Characteristics (Typical)



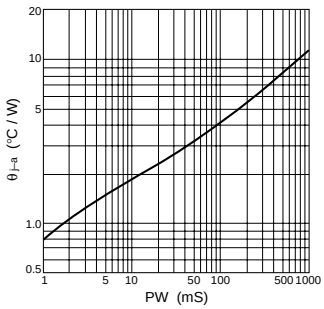
VCE(sat)-IB Characteristics (Typical)



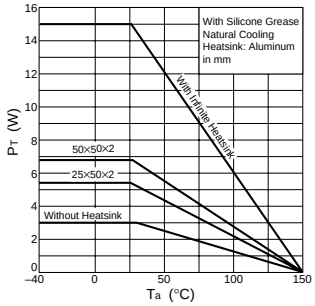
IC-VBE Temperature Characteristics (Typical)



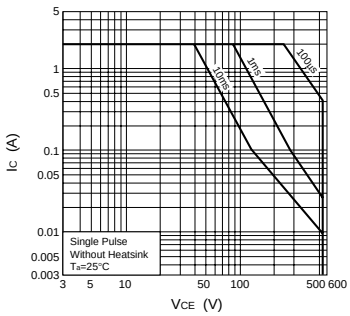
θj-a-PW Characteristics



PT-Ta Characteristics



Safe Operating Area (SOA)



STA305A

PNP Darlington
3-phase motor drive

External dimensions Ⓒ ··· STA300

Absolute maximum ratings

(Ta=25°C)

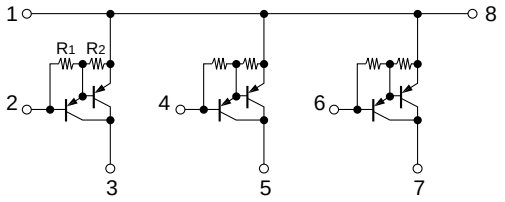
Symbol	Ratings	Unit
V_{CBO}	–550	V
V_{CEO}	–550	V
V_{EBO}	–6	V
I_C	–1	A
I_{CP}	–2 (PW≤1ms, Du≤25%)	A
I_B	–0.5	A
P_T	3 (Ta=25°C)	W
	15 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–100	μA	V_{CB}=–550V
I_{EBO}		–10	–20	mA	V_{EB}=–6V
V_{CEO}	–550			V	I_C=–100μA
h_{FE}	200	400	1000		V_{CE}=–4V, I_C=–500mA
V_{CE}(sat)		–1.0	–1.5	V	I_C=–500mA, I_B=–10mA
V_{BE}(sat)		–1.6	–2.2	V	
ton		0.7		μs	V_{CC}≒–200V,
tstg		13.0		μs	I_C=–500mA,
tf		2.5		μs	I_{B1}=–I_{B2}=–10mA
f_T		15		MHz	V_{CE}=–12V, I_E=0.2A
Cob		48		pF	V_{CB}=–10V, f=1MHz

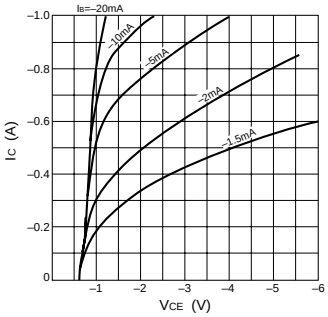
■Equivalent circuit diagram



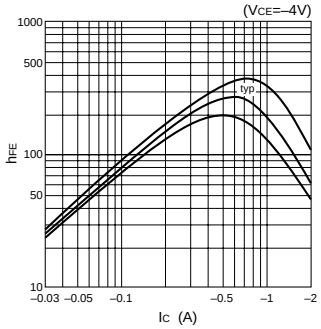
R1: 500Ω typ R2: 70Ω typ

Characteristic curves

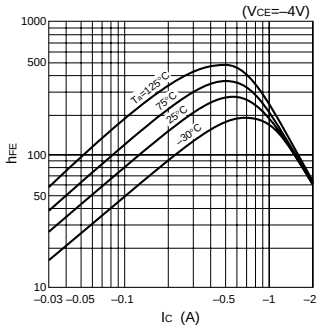
I_C-V_{CE} Characteristics (Typical)



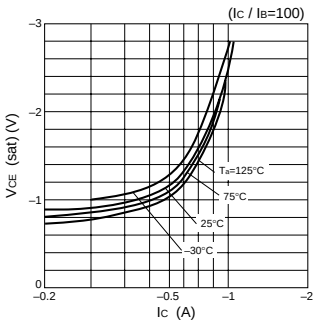
h_{FE}-I_C Characteristics (Typical)



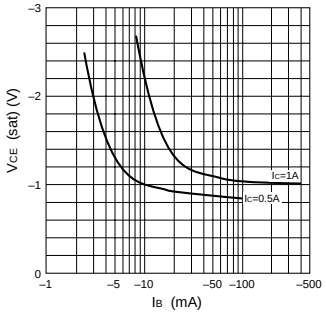
h_{FE}-I_C Temperature Characteristics (Typical)



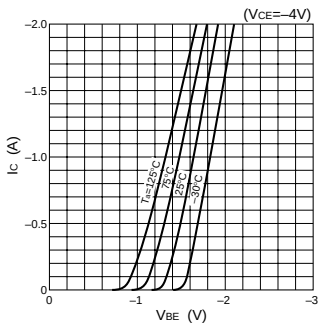
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



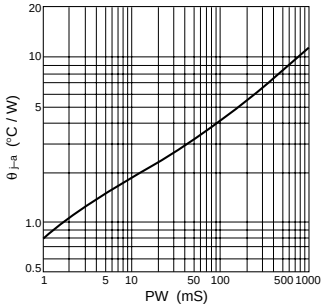
V_{CE}(sat)-I_B Characteristics (Typical)



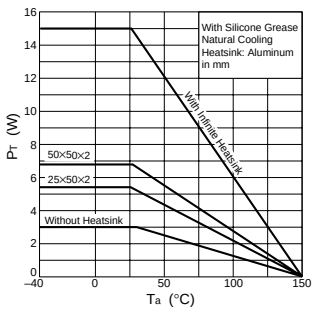
I_C-V_{BE} Temperature Characteristics (Typical)



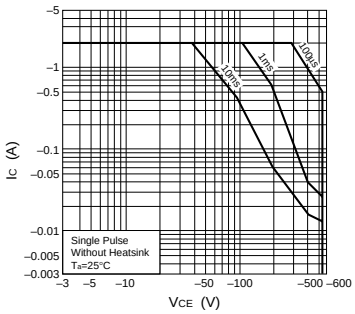
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA308A

PNP Darlington
General purpose

External dimensions Ⓒ ··· STA300

Absolute maximum ratings

(Ta=25°C)

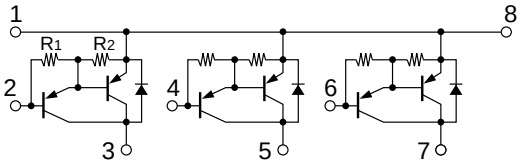
Symbol	Ratings	Unit
V_{CBO}	–120	V
V_{CEO}	–120	V
V_{EBO}	–6	V
I_C	–4	A
I_B	–1	A
P_T	3 (Ta=25°C)	W
	15 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–120V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–120			V	I_C=–10mA
h_{FE}	2000				V_{CE}=–4V, I_C=–2A
V_{CE}(sat)			–1.5	V	I_C=–2A, I_B=–4mA
V_{BE}(sat)			–2.5	V	

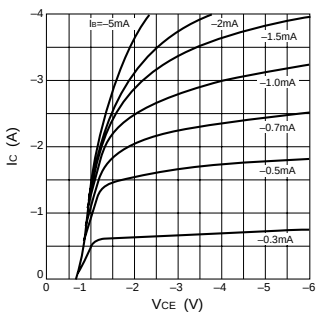
■Equivalent circuit diagram



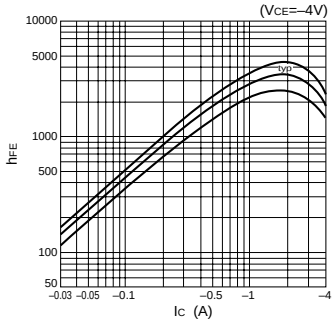
R1: 5kΩ typ R2: 100Ω typ

Characteristic curves

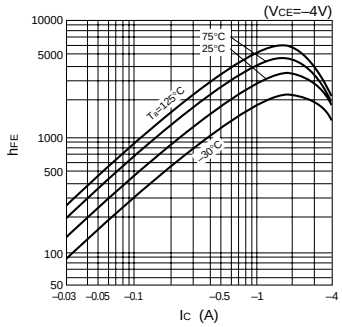
I_C-V_{CE} Characteristics (Typical)



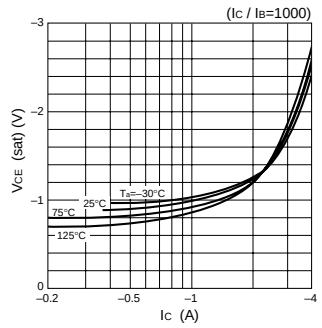
h_{FE}-I_C Characteristics (Typical)



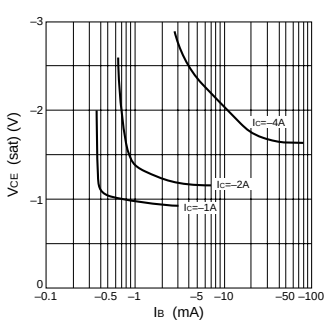
h_{FE}-I_C Temperature Characteristics (Typical)



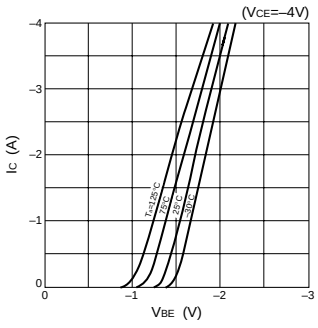
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



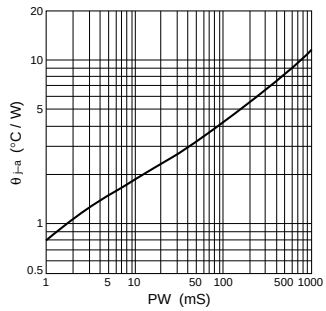
V_{CE}(sat)-I_B Characteristics (Typical)



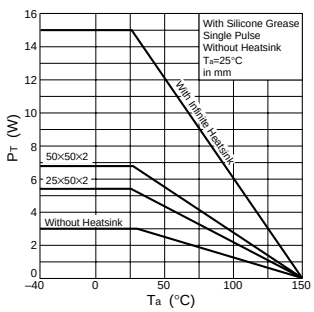
I_C-V_{BE} Temperature Characteristics (Typical)



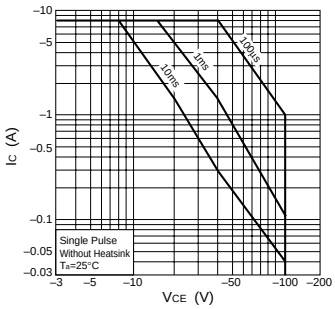
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA312A

NPN

General purpose

External dimensions Ⓒ ··· STA300

Absolute maximum ratings

(Ta=25°C)

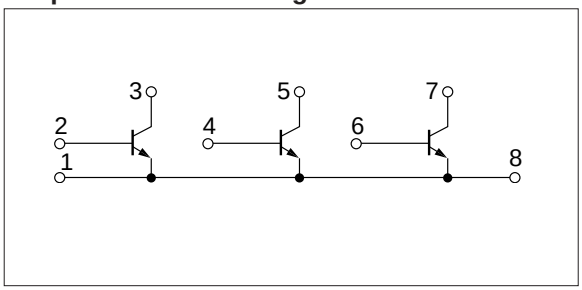
Symbol	Ratings	Unit
V_{CBO}	60	V
V_{CEO}	60	V
V_{EBO}	6	V
I_C	3	A
I_{CP}	6 (PW≤10ms, Du≤50%)	A
P_T	3 (Ta=25°C)	W
	15 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

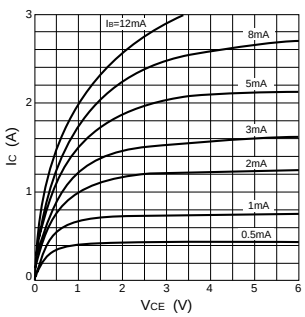
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			100	μA	V_{CB}=60V
I_{EBO}			100	μA	V_{EB}=6V
V_{CEO}	60			V	I_C=25mA
h_{FE}	300				V_{CE}=4V, I_C=0.5A
V_{CE}(sat)			1.0	V	I_C=1A, I_B=10mA
ton		0.8		μs	V_{CC}≒20V,
tstg		3.0		μs	I_C=1A,
tf		1.2		μs	I_{B1}=15mA, I_{B2}=–30mA

■Equivalent circuit diagram

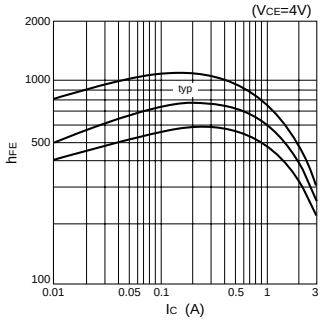


Characteristic curves

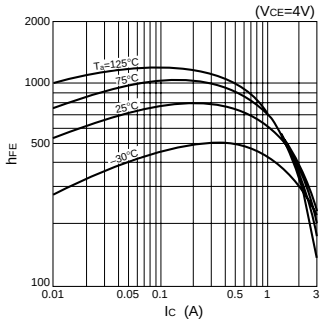
I_C-V_{CE} Characteristics (Typical)



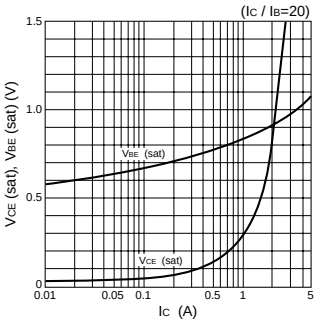
h_{FE}-I_C Characteristics (Typical)



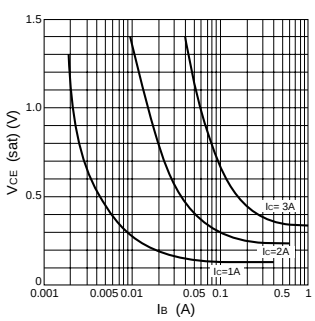
h_{FE}-I_C Temperature Characteristics (Typical)



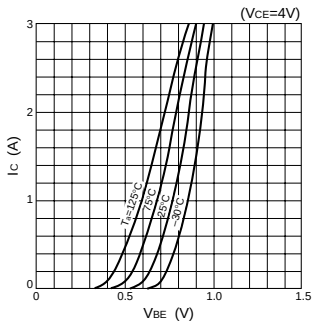
V_{CE}(sat), V_{BE}(sat)-I_C Characteristics (Typical)



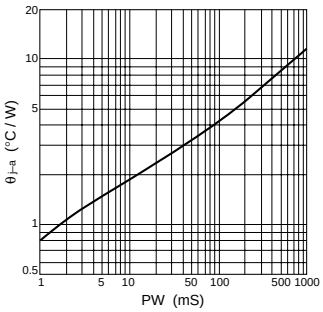
V_{CE}(sat)-I_B Characteristics (Typical)



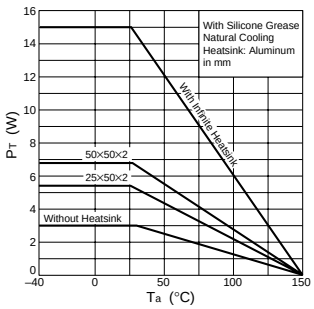
I_C-V_{BE} Temperature Characteristics (Typical)



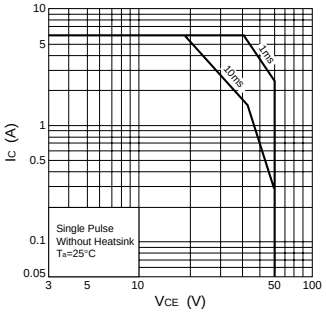
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA322A

PNP

General purpose

External dimensions Ⓒ ··· STA300

Absolute maximum ratings

(Ta=25°C)

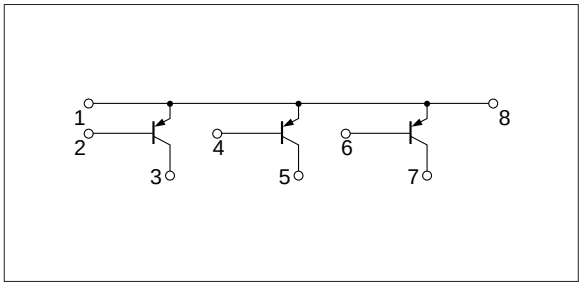
Symbol	Ratings	Unit
V_{CBO}	–50	V
V_{CEO}	–50	V
V_{EBO}	–5	V
I_C	–3	A
I_{CP}	–5 (PW≤1ms, Du≤50%)	A
I_B	–1	A
P_T	3 (Ta=25°C)	W
	15 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

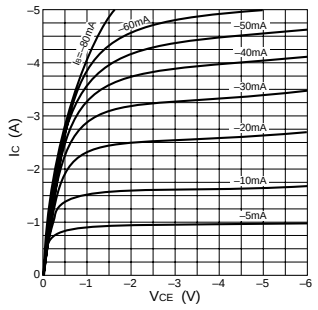
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–50V
I_{EBO}			–10	μA	V_{EB}=–8V
V_{CEO}	–50			V	I_C=–25mA
h_{FE}	100		350		V_{CE}=–4V, I_C=–1A
V_{CE}(sat)			–1.0	V	I_C=–2A, I_B=–40mA
V_{BE}(sat)			–1.5	V	

■Equivalent circuit diagram

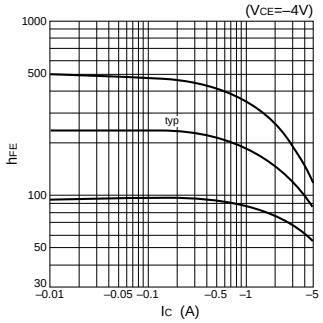


Characteristic curves

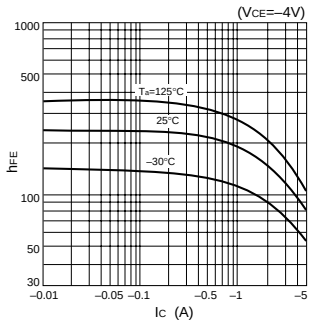
I_C-V_{CE} Characteristics (Typical)



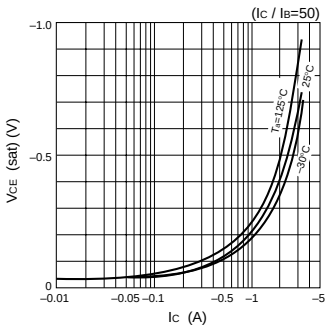
h_{FE}-I_C Characteristics (Typical)



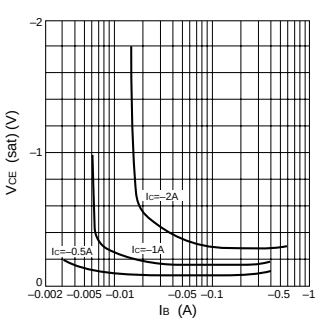
h_{FE}-I_C Temperature Characteristics (Typical)



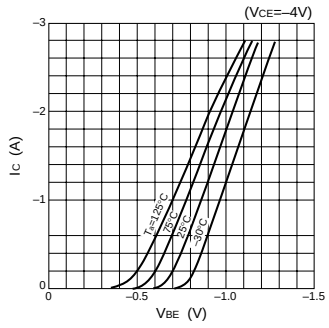
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



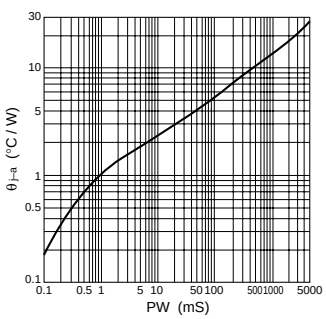
V_{CE}(sat)-I_B Characteristics (Typical)



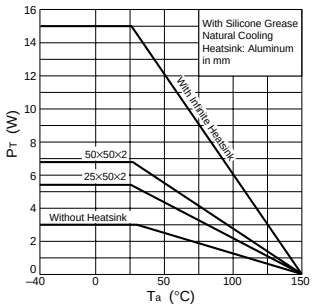
I_C-V_{BE} Temperature Characteristics (Typical)



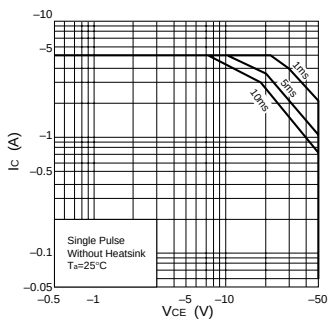
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA371A

NPN Darlington
With built-in avalanche diode

External dimensions Ⓒ ··· STA300

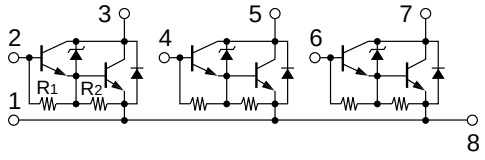
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	60±10	V
V_{CEO}	60±10	V
V_{EBO}	6	V
I_C	2	A
I_{CP}	4 (PW≤1ms, Du≤25%)	A
I_B	0.5	A
P_T	3 (Ta=25°C)	W
	15 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			10	μA	V_{CB}=50V
I_{EBO}			5	mA	V_{EB}=6V
V_{CEO}	50	60	70	V	I_C=10mA
h_{FE}	2000	5000	12000		V_{CE}=4V, I_C=1A
V_{CE}(sat)		1.1	1.5	V	I_C=1A, I_B=2mA
V_{BE}(sat)		1.8	2.2	V	
V_{FEC}		1.3	1.8	V	I_{FEC}=1A
t_{on}		0.5		μs	V_{CC}≒30V,
t_{stg}		4.0		μs	I_C=1A,
t_f		1.0		μs	I_{B1}=–I_{B2}=2mA
f_T		50		MHz	V_{CE}=12V, I_E=–0.1A
C_{ob}		25		pF	V_{CB}=10V, f=1MHz

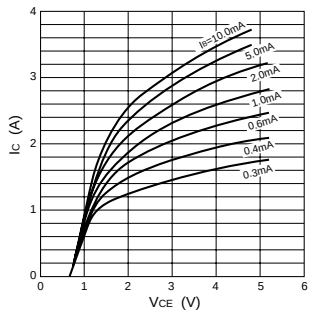
■Equivalent circuit diagram



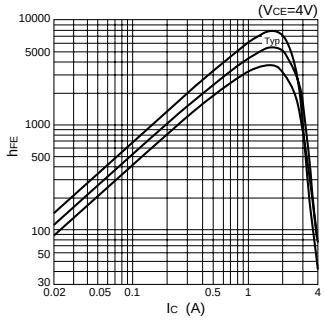
R1: 3.5kΩ typ R2: 200Ω typ

Characteristic curves

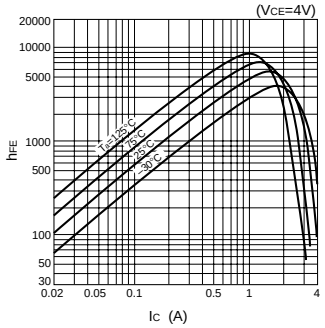
I_C-V_{CE} Characteristics (Typical)



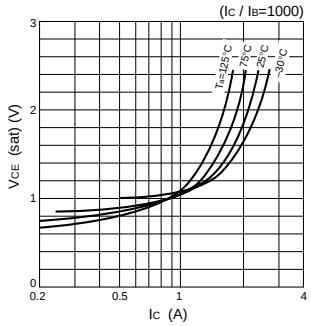
h_{FE}-I_C Characteristics (Typical)



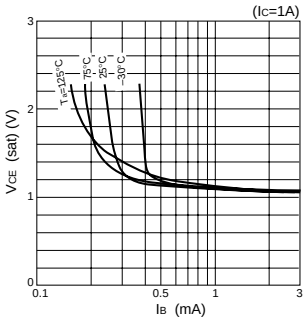
h_{FE}-I_C Temperature Characteristics (Typical)



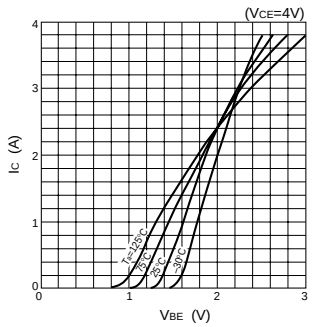
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



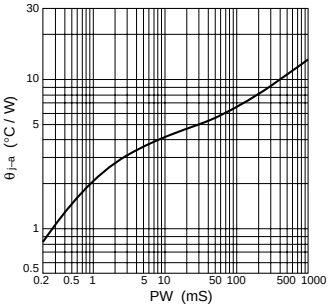
V_{CE}(sat)-I_B Temperature Characteristics (Typical)



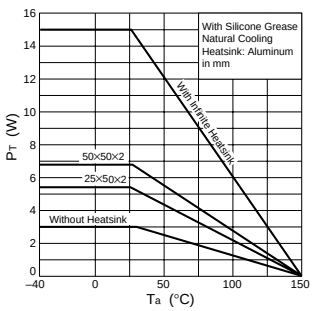
I_C-V_{BE} Temperature Characteristics (Typical)



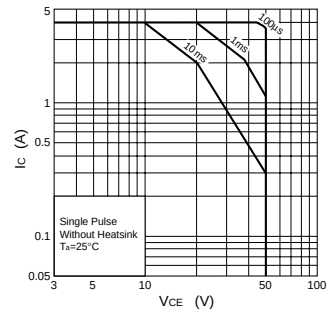
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA401A

NPN Darlington
With built-in avalanche diode

External dimensions Ⓓ ⋯ STA400

Absolute maximum ratings

(Ta=25°C)

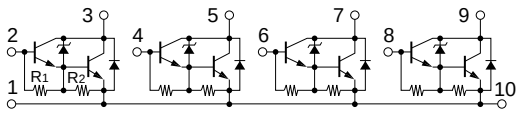
Symbol	Ratings	Unit
V_{CBO}	60±10	V
V_{CEO}	60±10	V
V_{EBO}	6	V
I_C	4	A
I_{CP}	8 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			100	μA	V_{CB}=50V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	50	60	70	V	I_C=10mA
h_{FE}	1000				V_{CE}=4V, I_C=3A
V_{CE}(sat)			2.0	V	I_C=3A, I_B=10mA
ton		1.0		μs	V_{CC}≒30V,
tstg		4.0		μs	I_C=3A,
tf		1.5		μs	I_{B1}=–I_{B2}=10mA

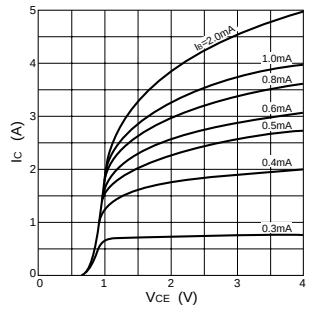
■Equivalent circuit diagram



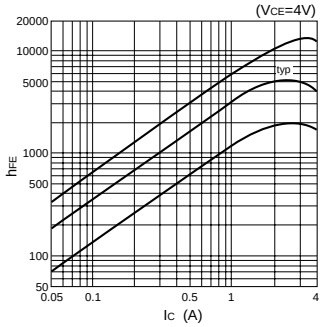
R1: 3kΩ typ R2: 150Ω typ

Characteristic curves

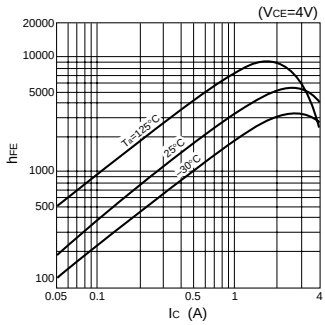
I_C-V_{CE} Characteristics (Typical)



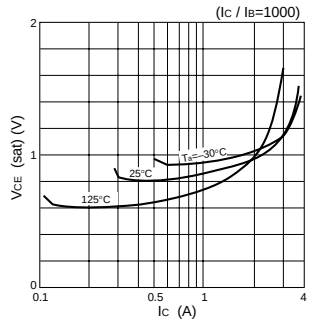
h_{FE}-I_C Characteristics (Typical)



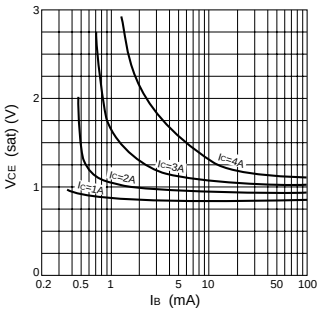
h_{FE}-I_C Temperature Characteristics (Typical)



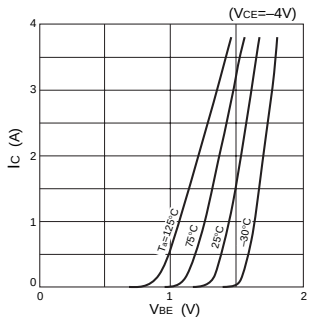
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



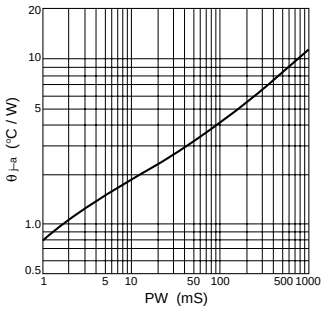
V_{CE}(sat)-I_B Characteristics (Typical)



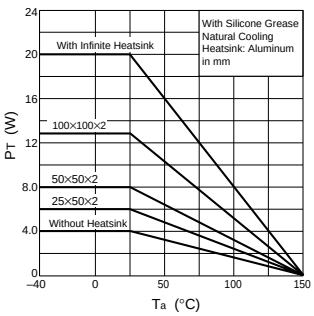
I_C-V_{BE} Temperature Characteristics (Typical)



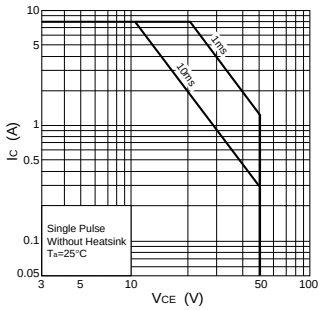
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA402A

PNP Darlington
General purpose

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

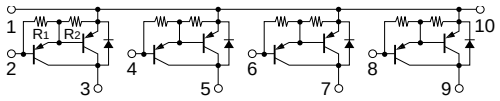
Symbol	Ratings	Unit
V_{CBO}	–50	V
V_{CEO}	–50	V
V_{EBO}	–6	V
I_C	–4	A
I_{CP}	–8 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–100	μA	V_{CB}=–50V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–50			V	I_C=–10mA
h_{FE}	1000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			–2.0	V	I_C=–3A, I_B=–10mA
ton		0.4		μs	V_{CC}≒–30V,
tstg		0.8		μs	I_C=–3A,
tf		0.6		μs	I_{B1}=–I_{B2}=–10mA

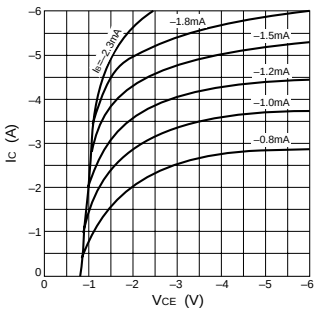
■Equivalent circuit diagram



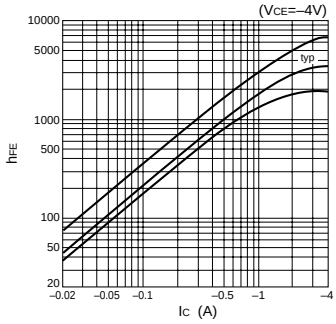
R1: 2kΩ typ R2: 150Ω typ

Characteristic curves

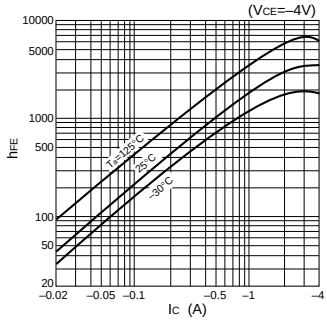
I_C-V_{CE} Characteristics (Typical)



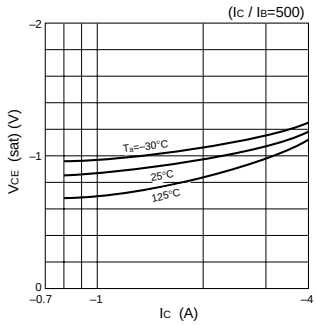
h_{FE}-I_C Characteristics (Typical)



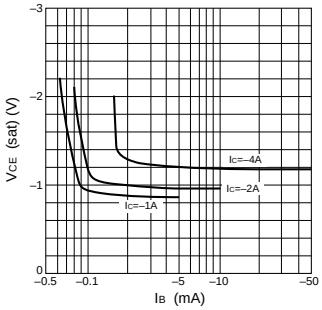
h_{FE}-I_C Temperature Characteristics (Typical)



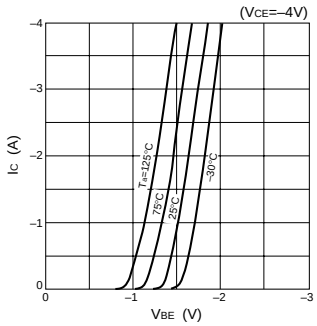
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



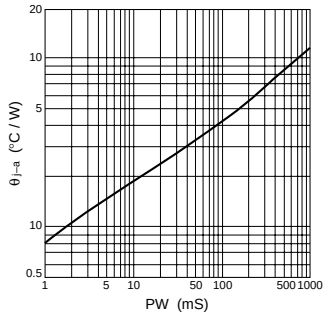
V_{CE}(sat)-I_B Characteristics (Typical)



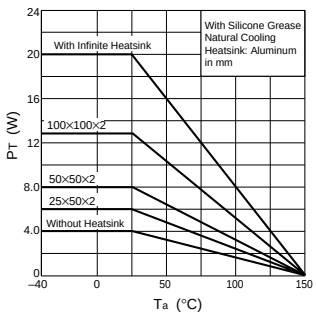
I_C-V_{BE} Temperature Characteristics (Typical)



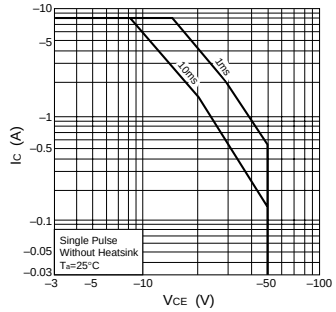
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA403A

NPN Darlington
General purpose

External dimensions Ⓓ ⋯ STA400

Absolute maximum ratings

(Ta=25°C)

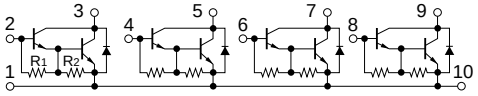
Symbol	Ratings	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	4	A
I_{CP}	8 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			100	μA	V_{CB}=120V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	100			V	I_C=10mA
h_{FE}	1000				V_{CE}=4V, I_C=2A
V_{CE}(sat)			2.0	V	I_C=2A, I_B=10mA
ton		0.6		μs	V_{CC}≒40V,
tstg		5.0		μs	I_C=2A,
tf		2.0		μs	I_{B1}=–I_{B2}=10mA

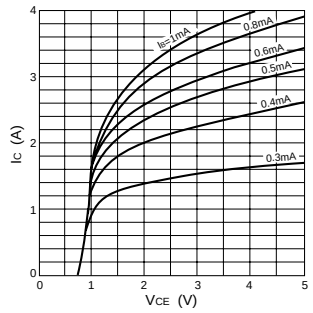
■Equivalent circuit diagram



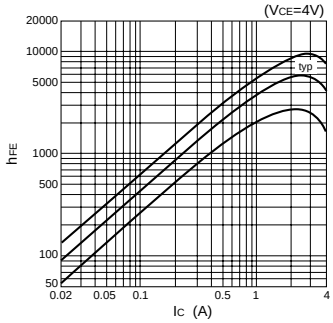
R1: 3kΩ typ R2: 500Ω typ

Characteristic curves

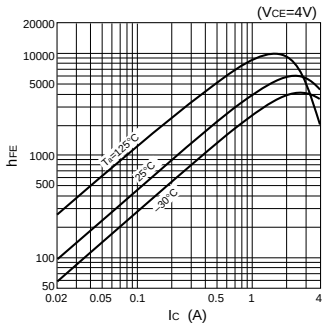
I_C-V_{CE} Characteristics (Typical)



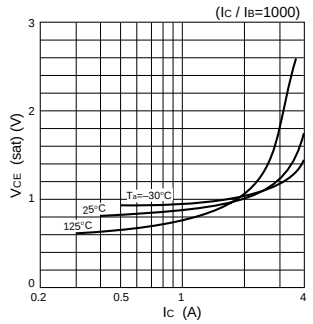
h_{FE}-I_C Characteristics (Typical)



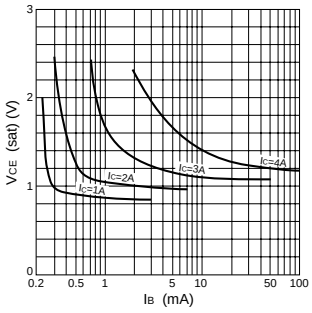
h_{FE}-I_C Temperature Characteristics (Typical)



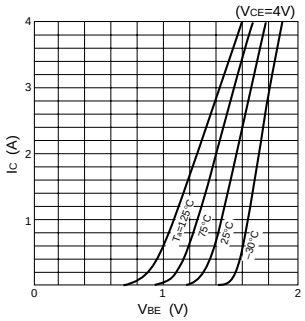
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



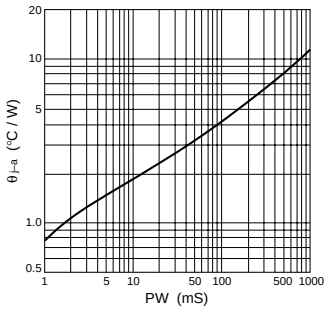
V_{CE}(sat)-I_B Characteristics (Typical)



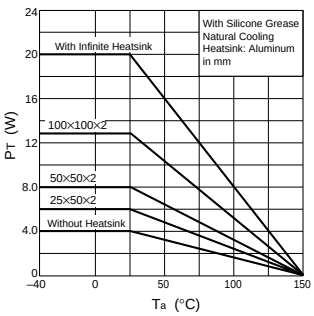
I_C-V_{BE} Temperature Characteristics (Typical)



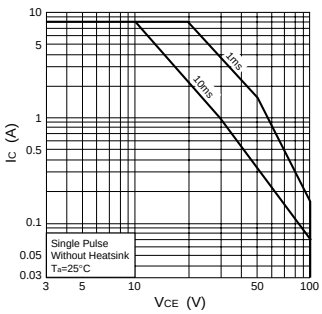
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA404A

NPN Darlington
General purpose

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

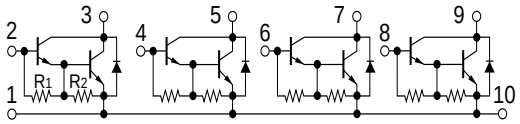
Symbol	Ratings	Unit
V_{CBO}	200	V
V_{CEO}	200	V
V_{EBO}	6	V
I_C	3	A
I_{CP}	6 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			100	μA	V_{CB}=200V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	200			V	I_C=10mA
h_{FE}	1000				V_{CE}=4V, I_C=1A
V_{CE}(sat)			2.0	V	I_C=1A, I_B=1.5mA

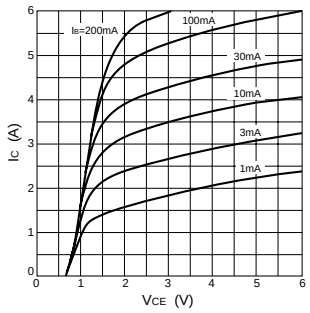
■Equivalent circuit diagram



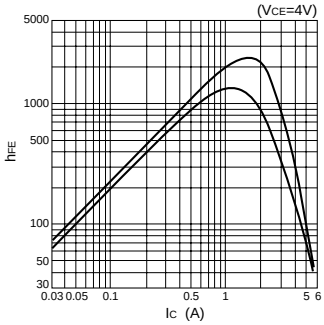
R1: 2kΩ typ R2: 200Ω typ

Characteristic curves

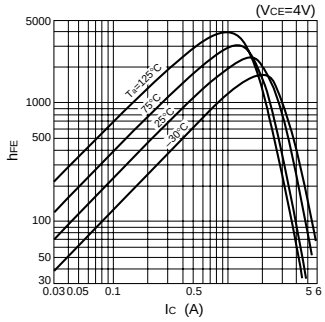
I_C-V_{CE} Characteristics (Typical)



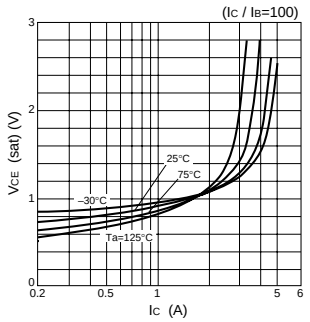
h_{FE}-I_C Characteristics (Typical)



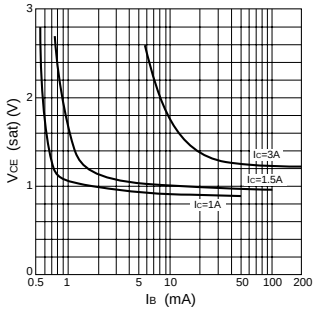
h_{FE}-I_C Temperature Characteristics (Typical)



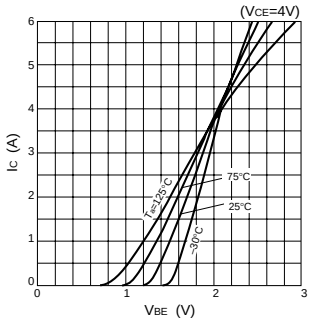
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



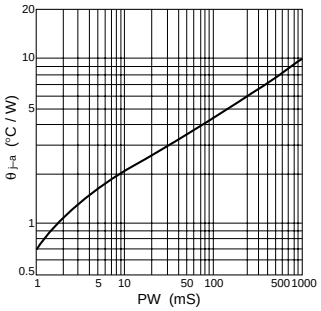
V_{CE}(sat)-I_B Characteristics (Typical)



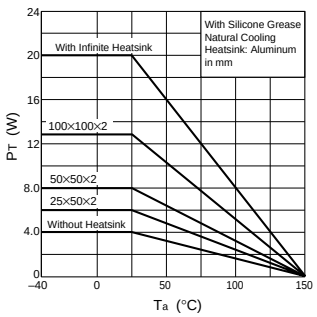
I_C-V_{BE} Temperature Characteristics (Typical)



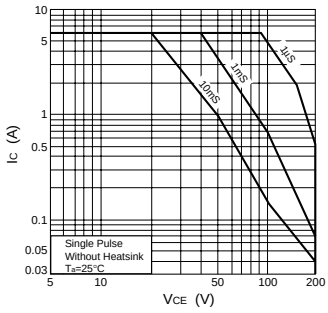
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA406A

NPN Darlington
With built-in avalanche diode

External dimensions Ⓓ ··· STA400

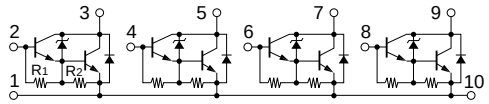
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	60±10	V
V_{CEO}	60±10	V
V_{EBO}	6	V
I_C	6	A
I_B	1	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=50V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	50	60	70	V	I_C=50mA
h_{FE}	2000		15000		V_{CE}=2V, I_C=3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=10mA
V_{BE}(sat)			2.0	V	
$E_{S/B}$	200			mJ	V_{CC}≒20V, L=10mH, I_C=6.4A

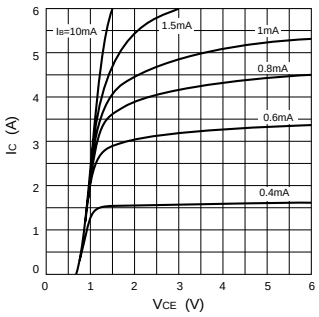
■Equivalent circuit diagram



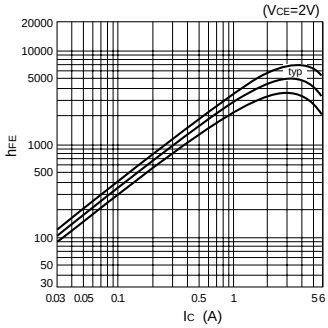
R1: 3kΩ typ R2: 150Ω typ

Characteristic curves

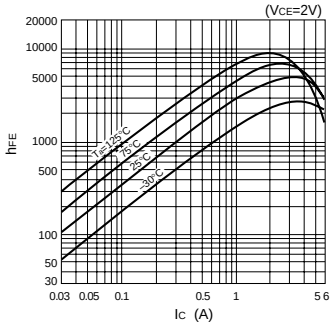
I_C-V_{CE} Characteristics (Typical)



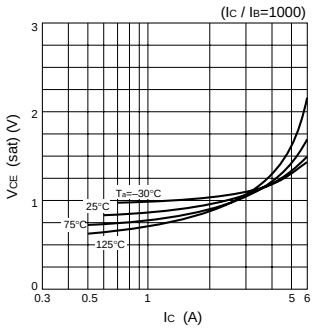
h_{FE}-I_C Characteristics (Typical)



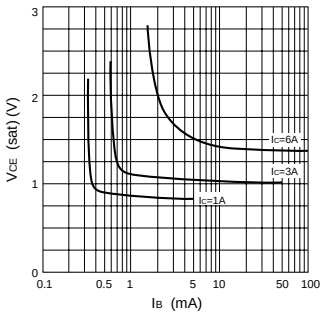
h_{FE}-I_C Temperature Characteristics (Typical)



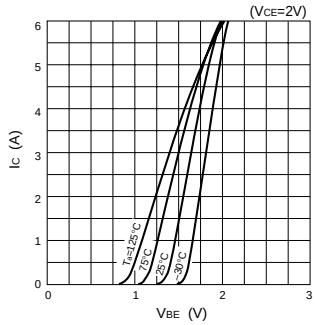
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



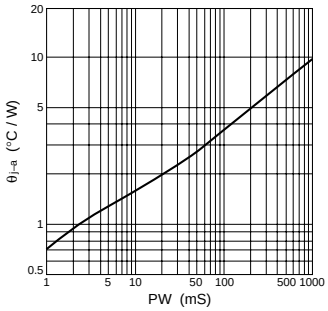
V_{CE}(sat)-I_B Characteristics (Typical)



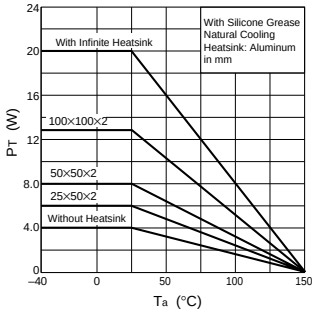
I_C-V_{BE} Temperature Characteristics (Typical)



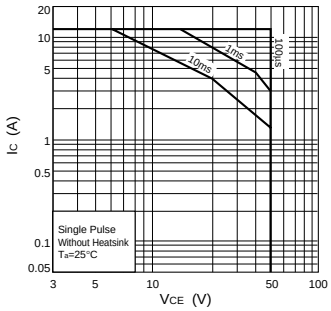
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA408A

PNP Darlington
General purpose

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

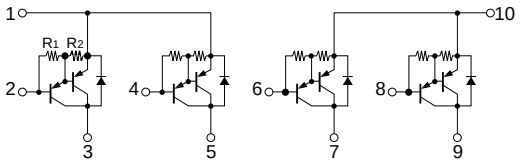
Symbol	Ratings	Unit
V_{CBO}	–120	V
V_{CEO}	–120	V
V_{EBO}	–6	V
I_C	–4	A
I_B	–1	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–120V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–120			V	I_C=–10mA
h_{FE}	2000				V_{CE}=–4V, I_C=–2A
V_{CE}(sat)			–1.5	V	I_C=–2A, I_B=–4mA
V_{BE}(sat)			–2.5	V	

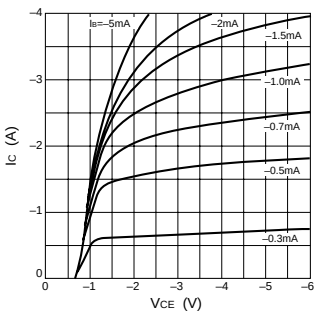
■Equivalent circuit diagram



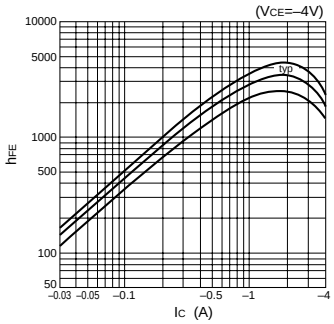
R1: 5kΩ typ R2: 100Ω typ

Characteristic curves

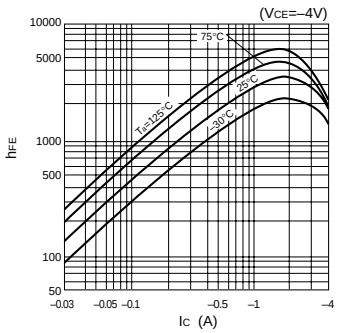
I_C-V_{CE} Characteristics (Typical)



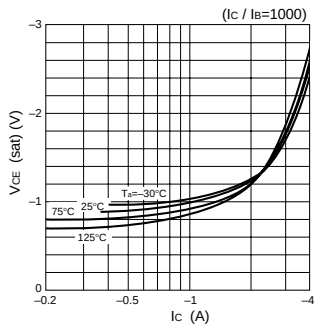
h_{FE}-I_C Characteristics (Typical)



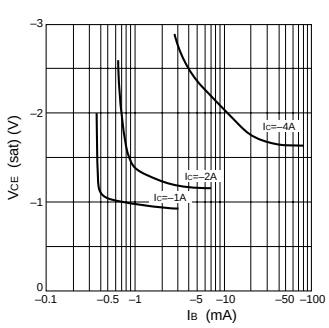
h_{FE}-I_C Temperature Characteristics (Typical)



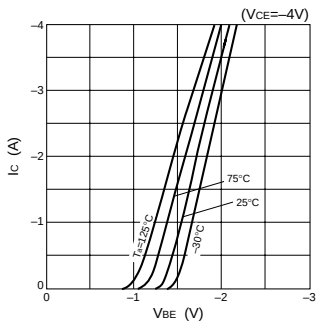
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



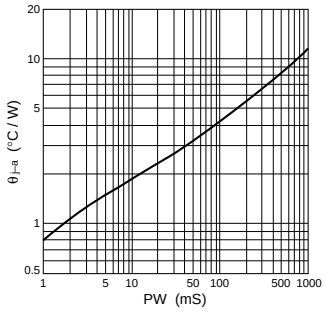
V_{CE}(sat)-I_B Characteristics (Typical)



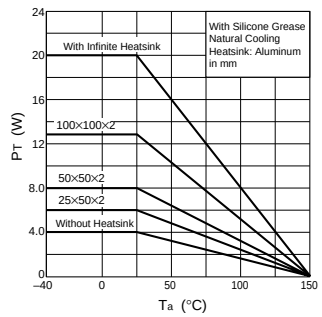
I_C-V_{BE} Temperature Characteristics (Typical)



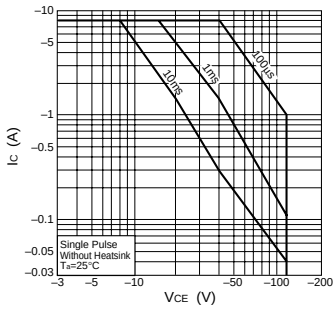
$\theta_{j\text{-}a$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA412A

NPN

General purpose

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

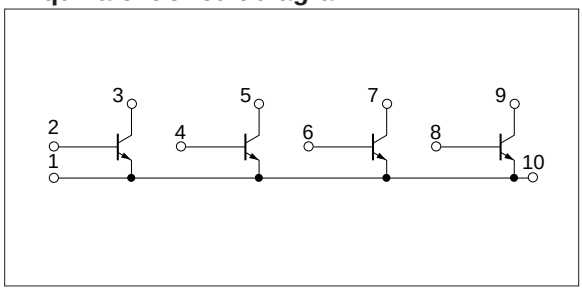
Symbol	Ratings	Unit
V_{CBO}	60	V
V_{CEO}	60	V
V_{EBO}	6	V
I_C	3	A
I_{CP}	6 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

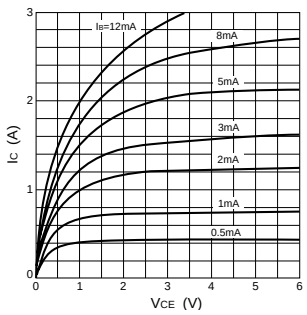
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			100	μA	V_{CB}=60V
I_{EBO}			100	μA	V_{EB}=6V
V_{CEO}	60			V	I_C=25mA
h_{FE}	300				V_{CE}=4V, I_C=0.5A
V_{CE}(sat)			1.0	V	I_C=1A, I_B=10mA
ton		0.8		μs	V_{CC}≒20V,
tstg		3.0		μs	I_C=1A,
tf		1.2		μs	I_{B1}=15mA, I_{B2}=–30mA

■Equivalent circuit diagram

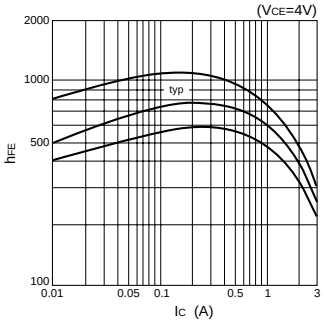


Characteristic curves

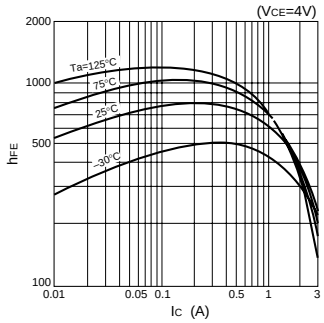
I_C-V_{CE} Characteristics (Typical)



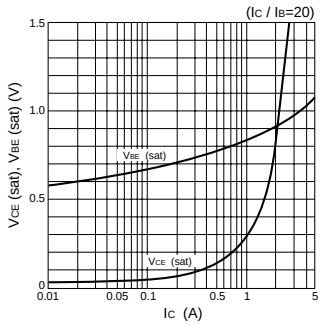
h_{FE}-I_C Characteristics (Typical)



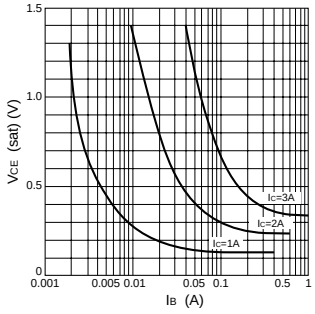
h_{FE}-I_C Temperature Characteristics (Typical)



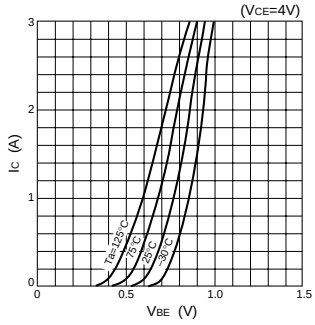
V_{CE}(sat), V_{BE}(sat)-I_C Characteristics (Typical)



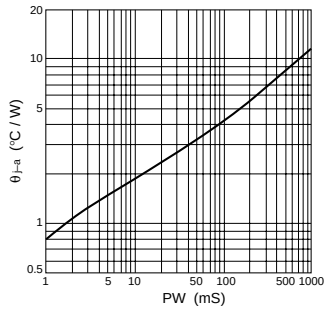
V_{CE}(sat)-I_B Characteristics (Typical)



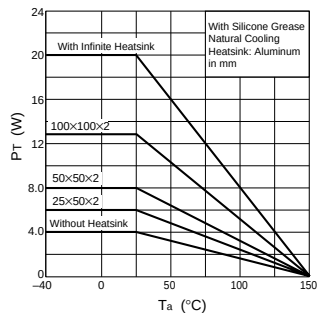
I_C-V_{BE} Temperature Characteristics (Typical)



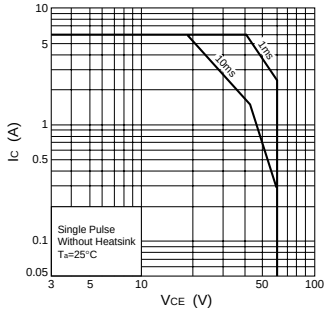
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA413A

NPN

With built-in avalanche diode

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

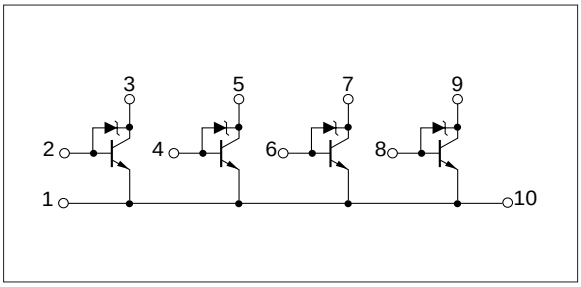
Symbol	Ratings	Unit
V_{CBO}	35±5	V
V_{CEO}	35±5	V
V_{EBO}	6	V
I_C	3	A
I_B	1	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

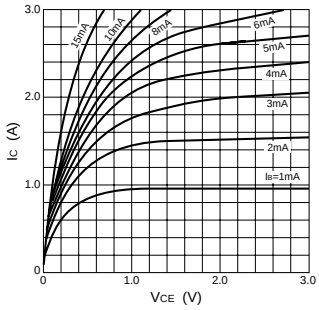
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=30V
I_{EBO}			10	μA	V_{EB}=6V
V_{CEO}	30		40	V	I_C=25mA
h_{FE}	500				V_{CE}=4V, I_C=0.5A
V_{CE}(sat)			0.5	V	I_C=1A, I_B=5mA

■Equivalent circuit diagram

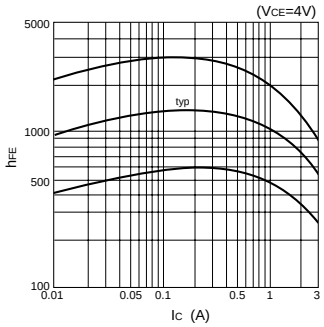


Characteristic curves

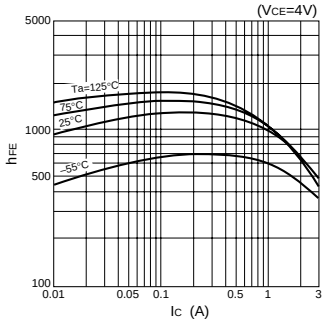
I_C-V_{CE} Characteristics (Typical)



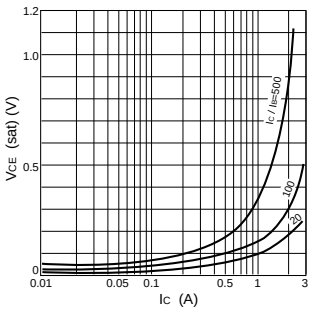
h_{FE}-I_C Characteristics (Typical)



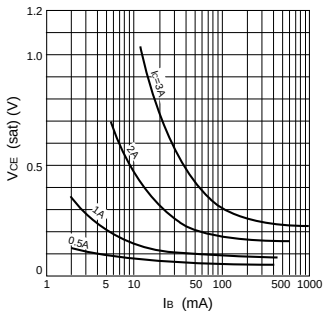
h_{FE}-I_C Temperature Characteristics (Typical)



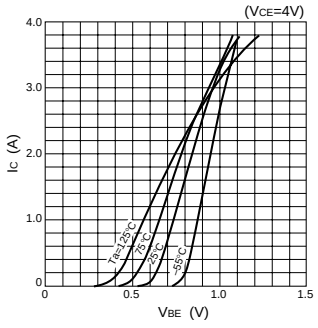
V_{CE}(sat)-I_C Characteristics (Typical)



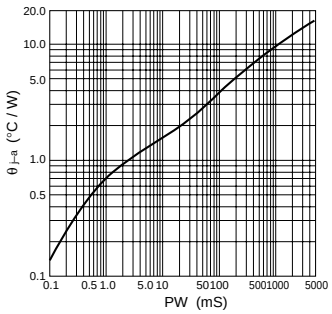
V_{CE}(sat)-I_B Characteristics (Typical)



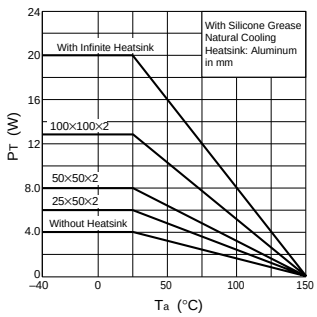
I_C-V_{BE} Temperature Characteristics (Typical)



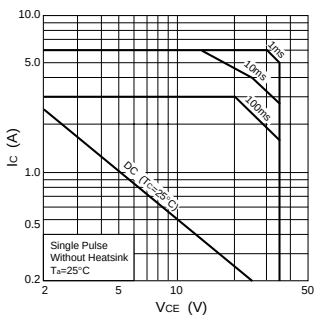
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA414A

NPN
General purpose

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

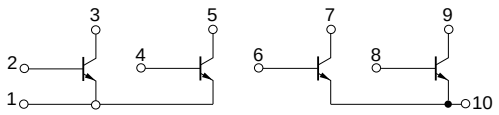
Symbol	Ratings	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	5	A
I_{CP}	8 (PW≤1ms, Du≤25%)	A
I_B	1	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

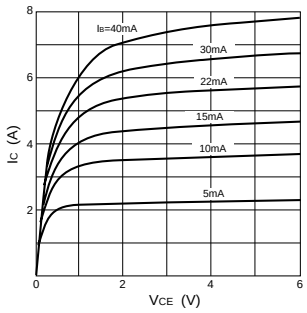
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			10	μA	V_{EB}=6V
V_{CER}	100			V	I_{CER}=100μA, R_{BE}=1kΩ
h_{FE}	200	400	1000		V_{CE}=1V, I_C=2A
V_{CE}(sat)		0.25	0.5	V	I_C=2A, I_B=10mA
V_{BE}(sat)		0.9	1.3	V	

■Equivalent circuit diagram

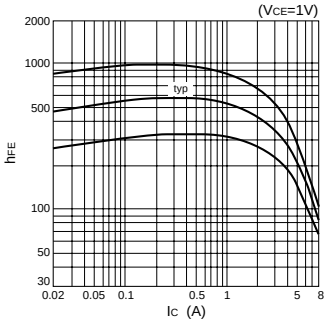


Characteristic curves

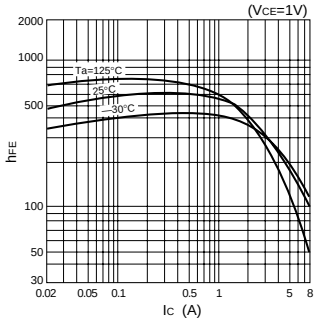
I_C-V_{CE} Characteristics (Typical)



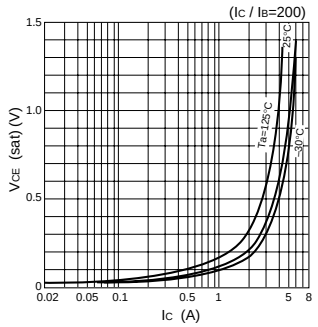
h_{FE}-I_C Characteristics (Typical)



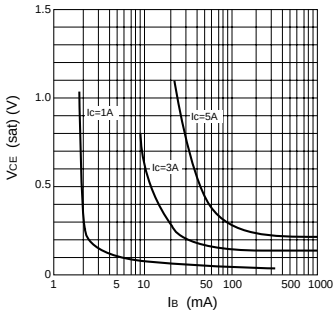
h_{FE}-I_C Temperature Characteristics (Typical)



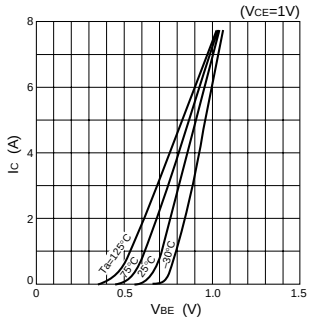
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



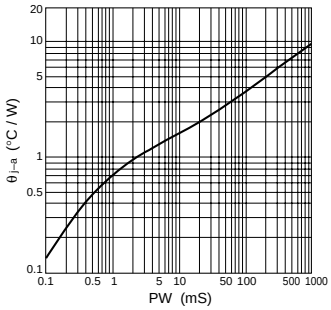
V_{CE}(sat)-I_B Characteristics (Typical)



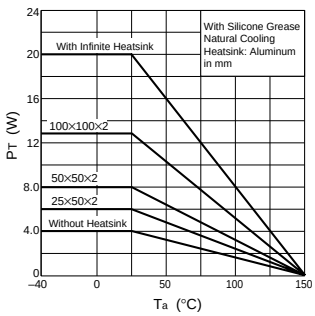
I_C-V_{BE} Temperature Characteristics (Typical)



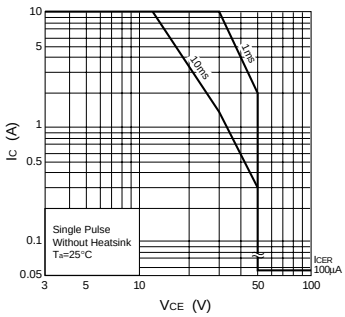
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA421A

PNP

General purpose

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

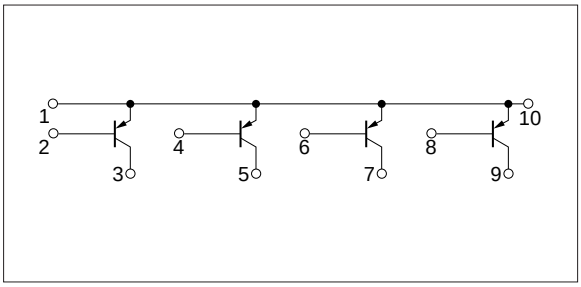
Symbol	Ratings	Unit
V_{CBO}	–60	V
V_{CEO}	–60	V
V_{EBO}	–6	V
I_C	–3	A
I_{CP}	–6 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

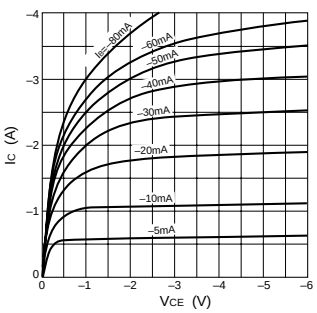
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–100	μA	V_{CB}=–60V
I_{EBO}			–100	μA	V_{EB}=–6V
V_{CEO}	–60			V	I_C=–25mA
h_{FE}	40				V_{CE}=–4V, I_C=–1A
V_{CE}(sat)			–1.0	V	I_C=–2A, I_B=–0.2A
ton		0.25		μs	V_{CC}≒–12V,
tstg		0.75		μs	I_C=–2A,
tf		0.25		μs	I_{B1}=–I_{B2}=–0.2A

■Equivalent circuit diagram

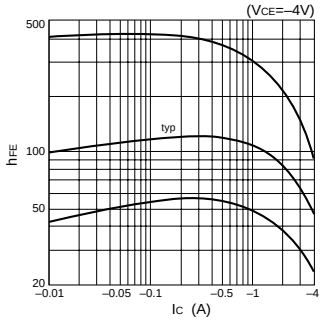


Characteristic curves

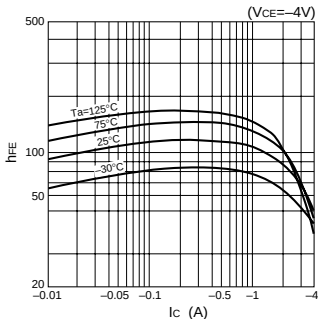
I_C-V_{CE} Characteristics (Typical)



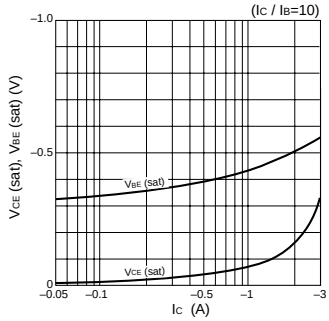
h_{FE}-I_C Characteristics (Typical)



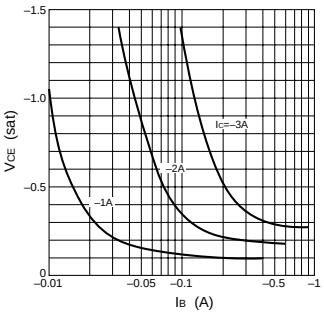
h_{FE}-I_C Temperature Characteristics (Typical)



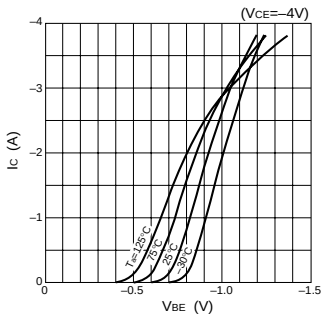
V_{CE}(sat), V_{BE}(sat)-I_C Characteristics (Typical)



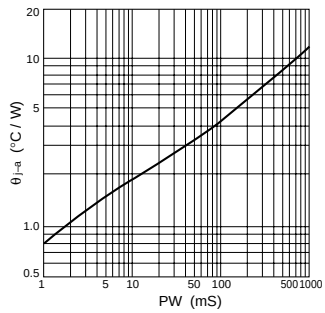
V_{CE}(sat)-I_B Characteristics (Typical)



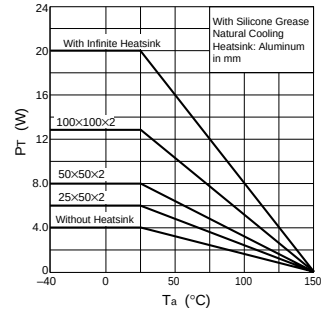
I_C-V_{BE} Temperature Characteristics (Typical)



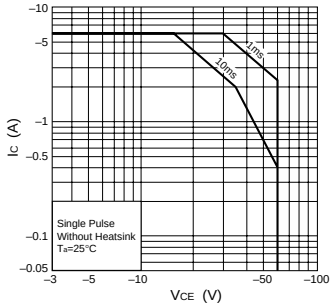
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)

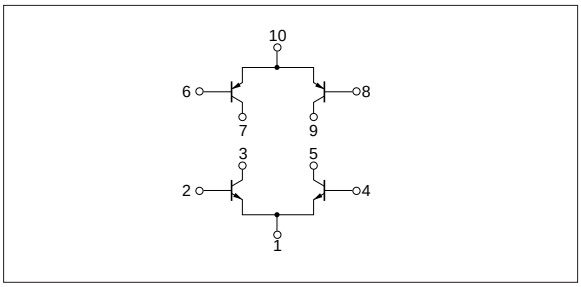


Absolute maximum ratings

(Ta=25°C)

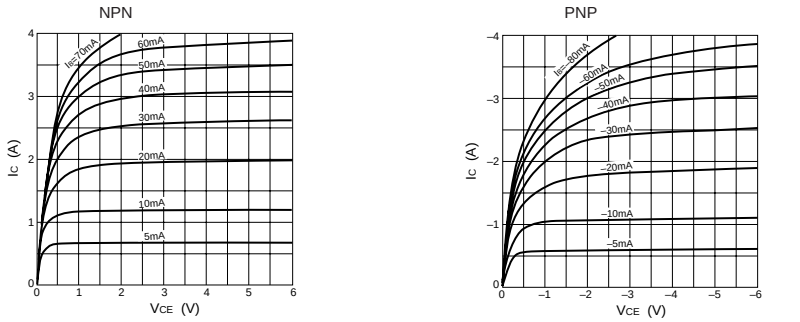
Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	3	–3	A
I_{CP}	6 (PW≤10ms, Du≤50%)	–6 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)		W
	20 (Tc=25°C)		
T_j	150		°C
T_{stg}	–40 to +150		°C

■Equivalent circuit diagram

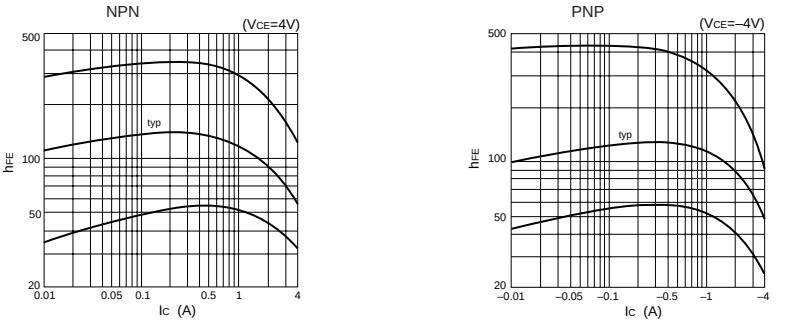


Characteristic curves

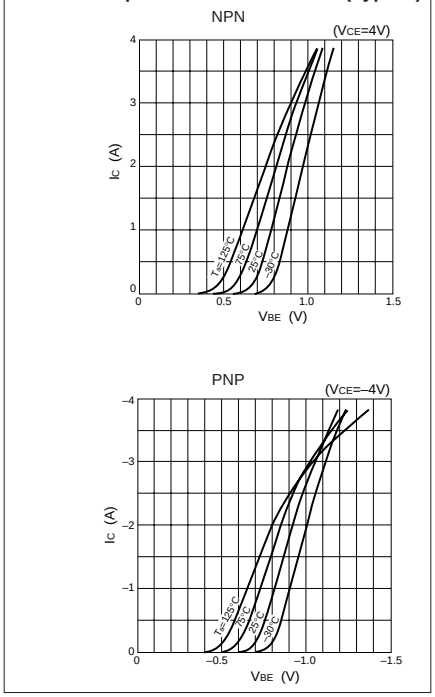
I_C-V_{CE} Characteristics (Typical)



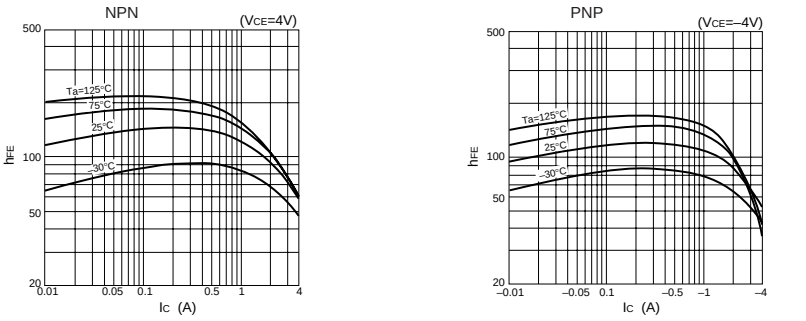
h_{FE}-I_C Characteristics (Typical)



I_C-V_{BE} Temperature Characteristics (Typical)



h_{FE}-I_C Temperature Characteristics (Typical)



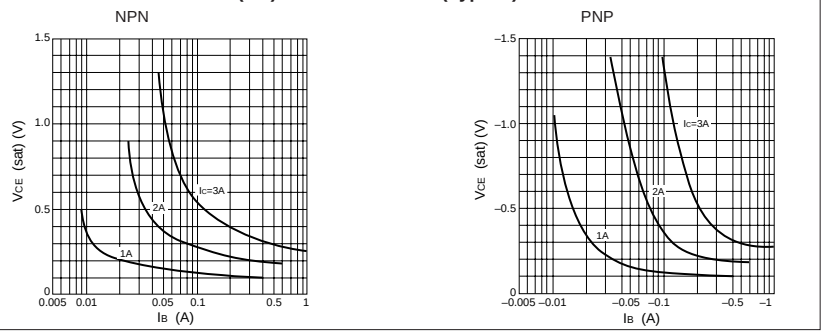
Electrical characteristics

(T_a=25°C)

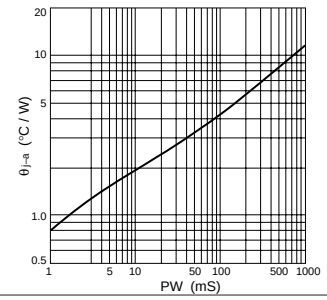
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			100	μA	V_{CB}=60V			–100	μA	V_{CB}=–60V
I_{EBO}			100	μA	V_{EB}=6V			–100	μA	V_{EB}=–6V
V_{CEO}	60			V	I_C=25mA	–60			V	I_C=–25mA
h_{FE}	40				V_{CE}=4V, I_C=1A	40				V_{CE}=–4V, I_C=–1A
V_{CE}(sat)			1.0	V	I_C=2A, I_B=0.2A			–1.0	V	I_C=–2A, I_B=–0.2A
ton		0.2		μs	V_{CC}≒12V,		0.25		μs	V_{CC}≒–12V,
tstg		1.0		μs	I_C=2A,		0.75		μs	I_C=–2A,
tf		0.3		μs	I_{B1}=–I_{B2}=0.2A		0.25		μs	I_{B1}=–I_{B2}=–0.2A

Characteristic curves

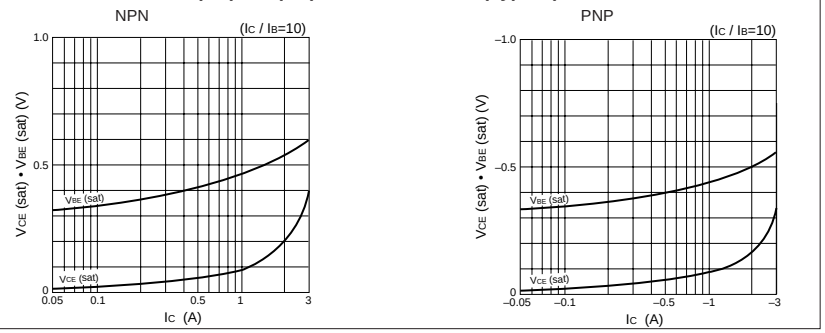
V_{CE}(sat)-I_B Characteristics (Typical)



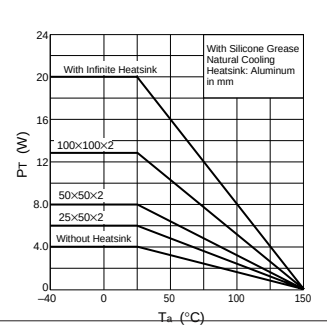
$\theta_{j\text{-}a$-PW Characteristics



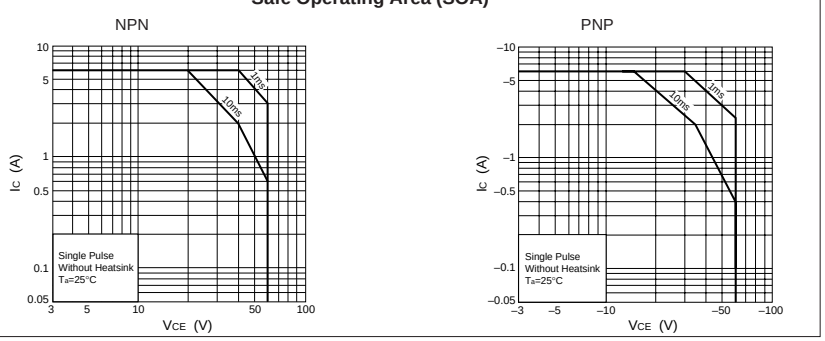
V_{CE}(sat), V_{BE}(sat)-I_C Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

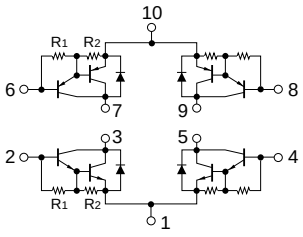


Absolute maximum ratings

(Ta=25°C)

Symbol	Specification		Unit
	NPN	PNP	
V_{CBO}	80	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	4	–4	A
I_{CP}	8 (PW≤10ms, Du≤50%)	–8 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)		W
	20 (Tc=25°C)		
T_j	150		°C
T_{stg}	–40 to +150		°C

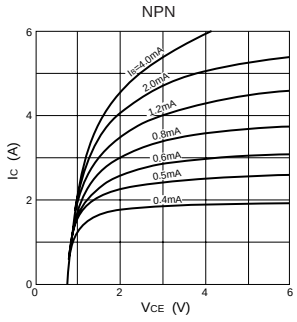
■Equivalent circuit diagram



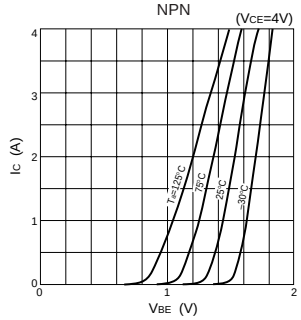
R_1: 2kΩ typ R_2: 150Ω typ R_3: 3kΩ typ R_4: 200Ω typ

Characteristic curves

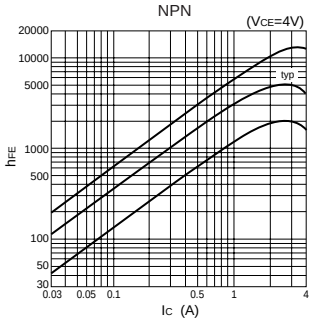
I_C-V_{CE} Characteristics (Typical)



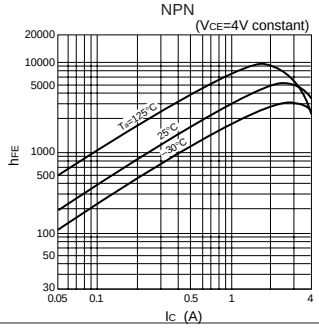
I_C-V_{BE} Temperature Characteristics (Typical)



h_{FE}-I_C Characteristics (Typical)



h_{FE}-I_C Temperature Characteristics (Typical)



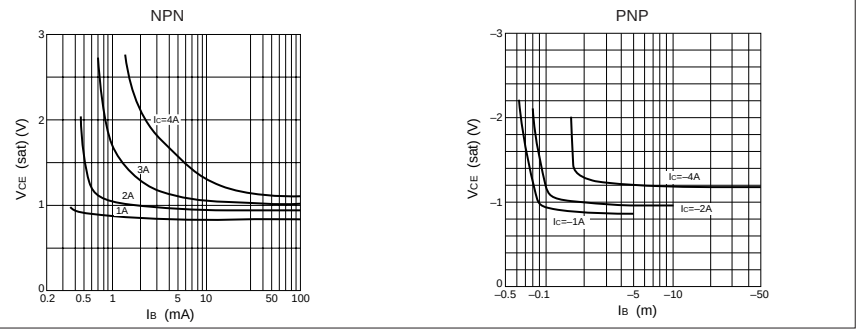
Electrical characteristics

(T_a=25°C)

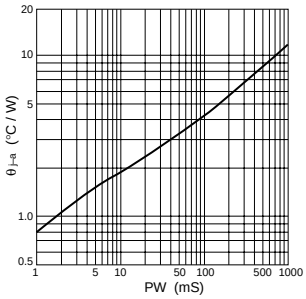
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			100	μA	V_{CB}=80V			–100	μA	V_{CB}=–60V
I_{EBO}			10	mA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	1000				V_{CE}=4V, I_C=3A	1000				V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			2.0	V	I_C=3A, I_B=10mA			–2.0	V	I_C=–2A, I_B=–10mA
t_{on}		1.0		μs	V_{CC}≒30V,		0.4		μs	V_{CC}≒–30V,
t_{stg}		4.0		μs	I_C=3A,		0.8		μs	I_C=–3A,
t_f		1.5		μs	I_{B1}=–I_{B2}=10mA		0.6		μs	I_{B1}=–I_{B2}=–10mA

Characteristic curves

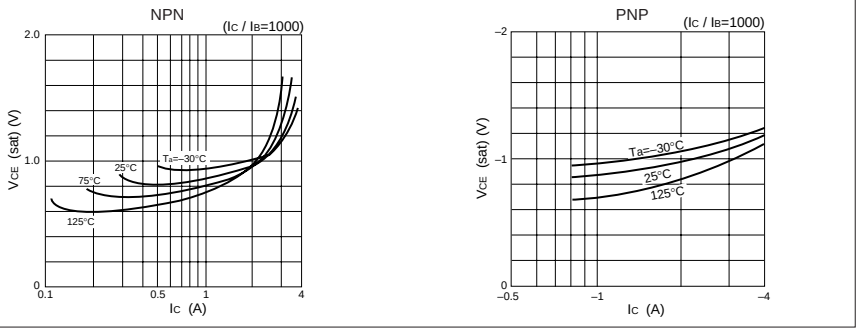
V_{CE}(sat)-I_B Characteristics (Typical)



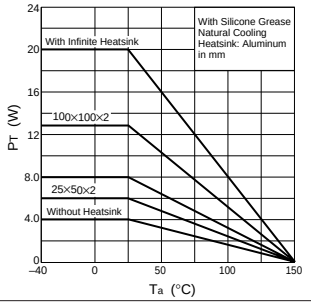
$\theta_{j\text{-}a}$-PW Characteristics



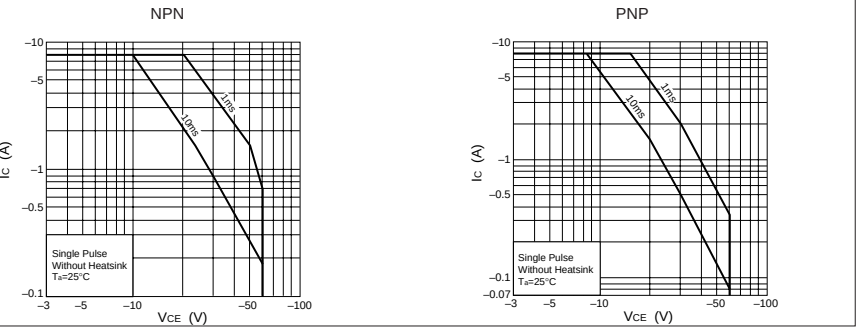
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA435A

NPN Darlington
With built-in avalanche diode

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

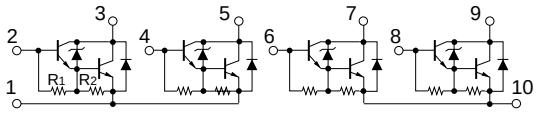
Symbol	Ratings	Unit
V_{CBO}	65±15	V
V_{CEO}	65±15	V
V_{EBO}	6	V
I_C	4	A
I_{CP}	8 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			100	μA	V_{CB}=50V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	50	65	80	V	I_C=10mA
h_{FE}	1000				V_{CE}=4V, I_C=3A
V_{CE}(sat)			2.0	V	I_C=3A, I_B=10mA
ton		1.0		μs	V_{CC}≒30V,
tstg		4.0		μs	I_C=3A,
tf		1.5		μs	I_{B1}=–I_{B2}=10mA

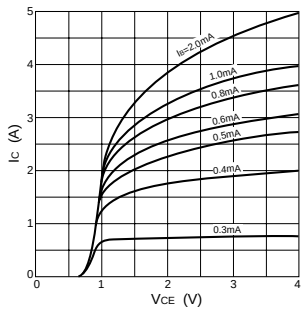
■Equivalent circuit diagram



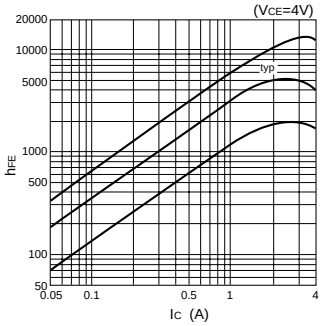
R1: 3kΩ typ R2: 150Ω typ

Characteristic curves

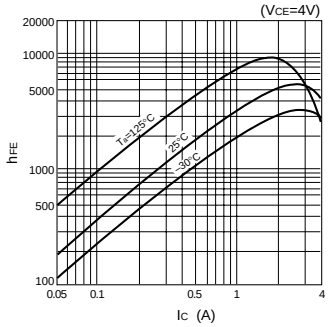
I_C-V_{CE} Characteristics (Typical)



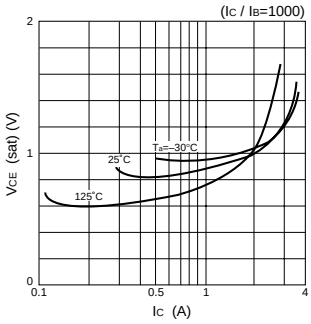
h_{FE}-I_C Characteristics (Typical)



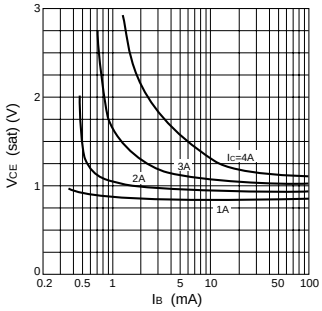
h_{FE}-I_C Temperature Characteristics (Typical)



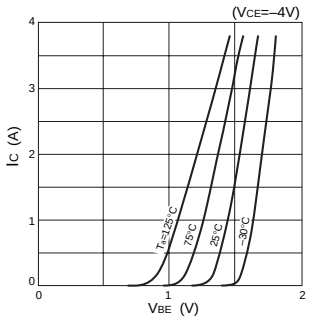
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



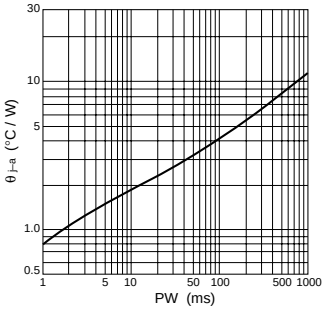
V_{CE}(sat)-I_B Characteristics (Typical)



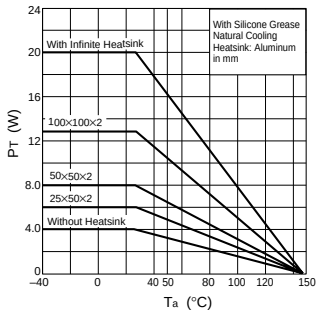
I_C-V_{BE} Temperature Characteristics (Typical)



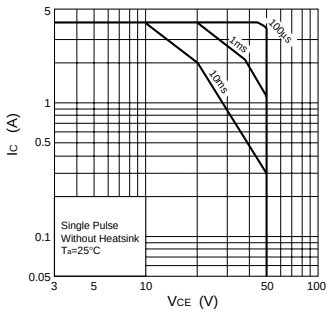
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA457C

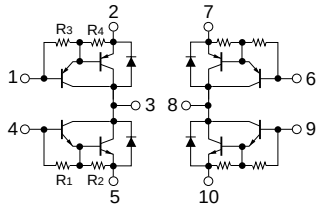
PNP + NPN Darlington
H-bridge

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–60	V
V_{CEO}	60	–60	V
V_{EBO}	6	–6	V
I_C	4	–4	A
I_{CP}	8 (PW≤10ms, Du≤50%)	–8 (PW≤10ms, Du≤50%)	A
P_T	4 (Ta=25°C)		W
	20 (Tc=25°C)		
T_j	150		°C
T_{stg}	–40 to +150		°C

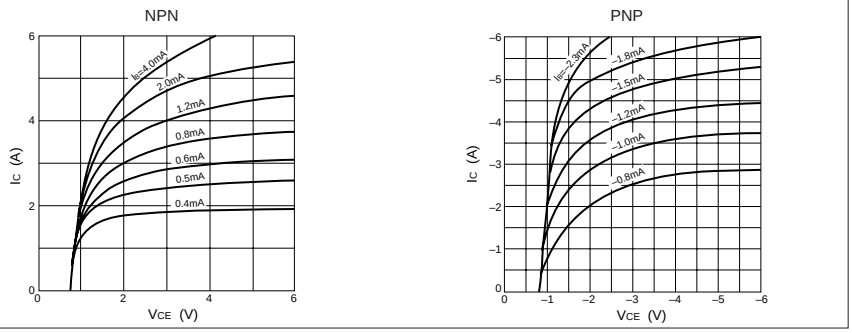
■Equivalent circuit diagram



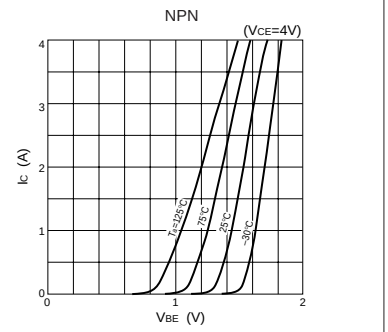
R_1: 3kΩ typ R_2: 200Ω typ R_3: 2kΩ typ R_4: 150Ω typ

Characteristic curves

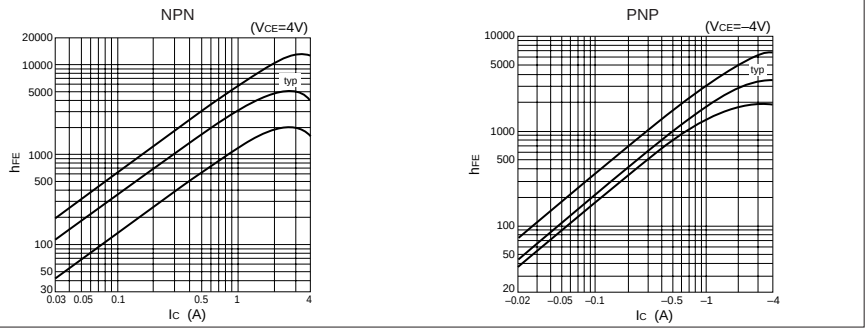
I_C-V_{CE} Characteristics (Typical)



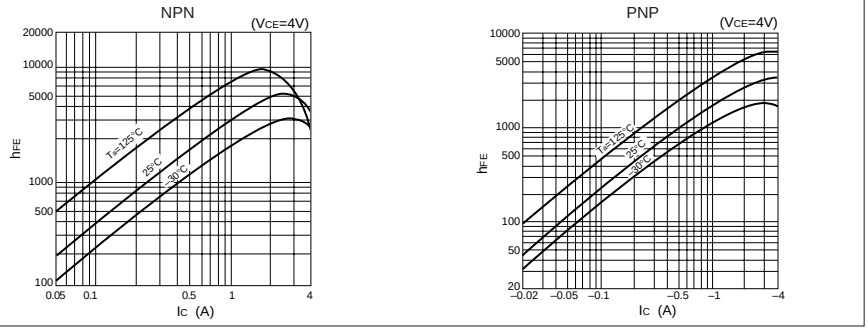
I_C-V_{BE} Temperature Characteristics (Typical)



h_{FE}-I_C Characteristics (Typical)



h_{FE}-I_C Temperature Characteristics (Typical)



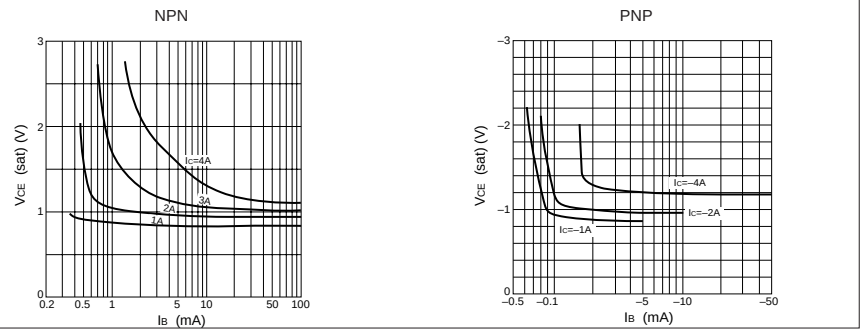
Electrical characteristics

(T_a=25°C)

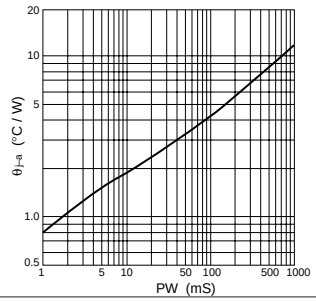
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V			–10	μA	V_{CB}=–60V
I_{EBO}			10	mA	V_{EB}=6V			–10	mA	V_{EB}=–6V
V_{CEO}	60			V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	2000				V_{CE}=4V, I_C=2A	2000				V_{CE}=–4V, I_C=–2A
V_{CE}(sat)			1.5	V	I_C=2A, I_B=4mA			–1.5	V	I_C=–2A, I_B=–4mA
V_{BE}(sat)			2.0	V				–2.0	V	
V_{FEC}			1.6	V	I_{FEC}=2A			–1.6	V	I_{FEC}=–2A

Characteristic curves

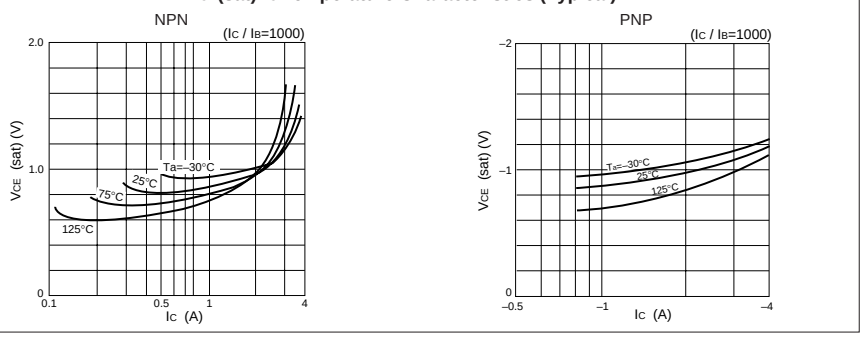
V_{CE}(sat)-I_B Characteristics (Typical)



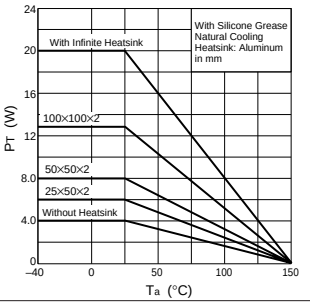
$\theta_{j\text{-}a}$-PW Characteristics



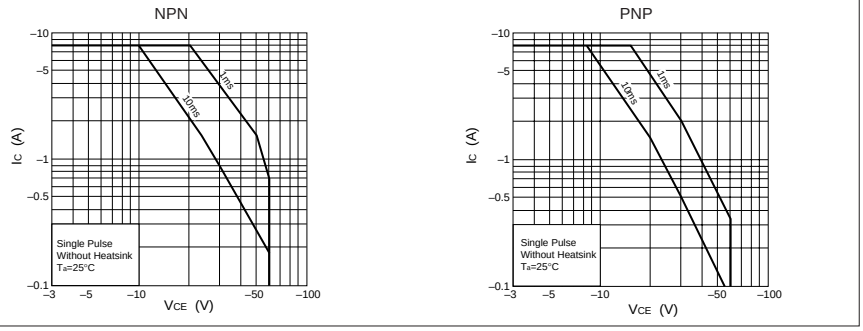
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)

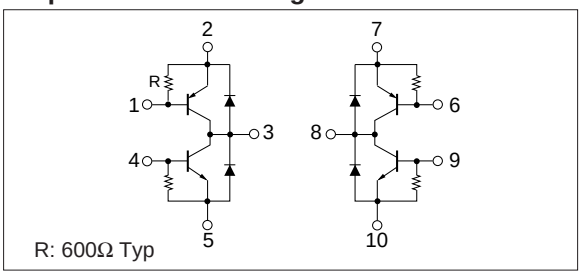


Absolute maximum ratings

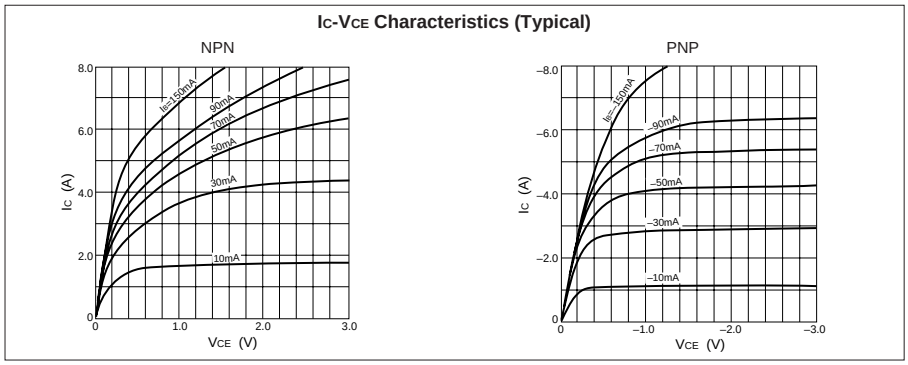
(Ta=25°C)

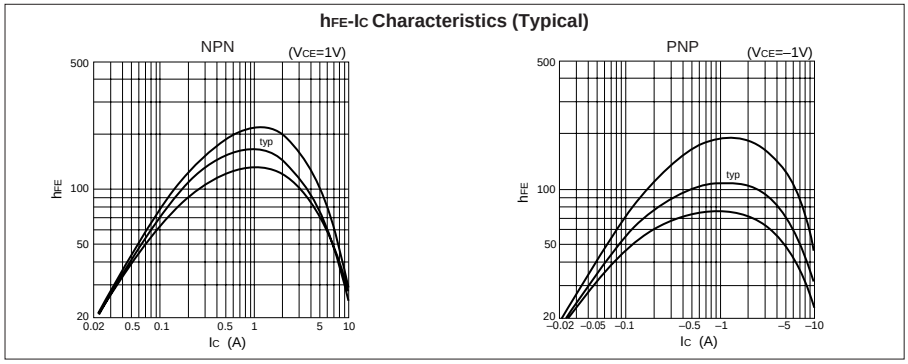
Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	50	–50	V
V_{CEO}	30	–30	V
V_{EBO}	6	–6	V
I_C	5	–5	A
I_{CP}	10(PW≤10ms, Du≤50%)	–10(PW≤10ms, Du≤50%)	A
I_B	1	–1	A
P_T	4 (Ta=25°C)		W
	20 (Tc=25°C)		
T_j	150		°C
T_{stg}	–40 to +50		°C
T_{FSM}	20 (Single half-cycle sinewave)		A

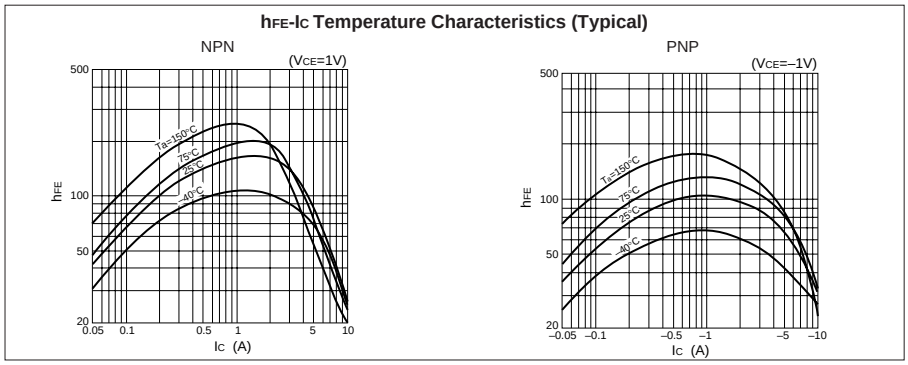
■Equivalent circuit diagram

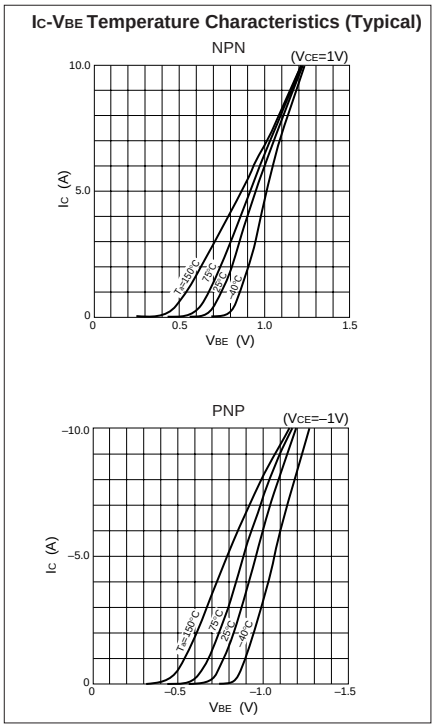


Characteristic curves









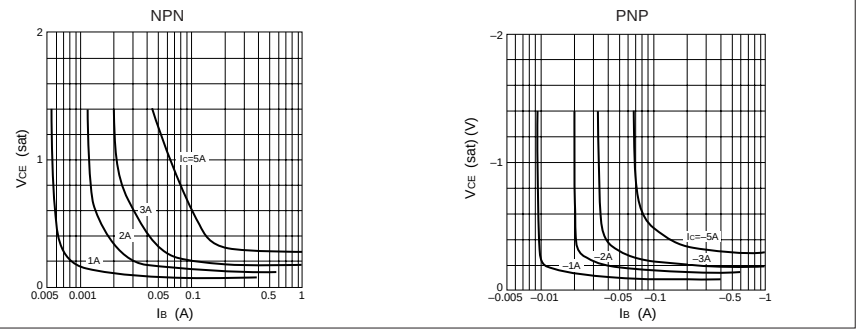
Electrical characteristics

(T_a=25°C)

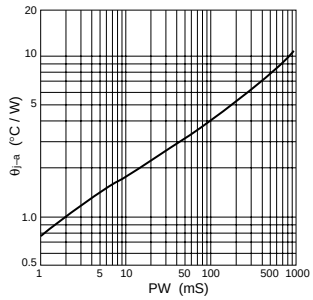
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=50V			–10	μA	V_{CB}=–50V
I_{EBO}			20	mA	V_{EB}=6V			–20	mA	V_{EB}=–6V
V_{CEO}	30			V	I_C=25mA	–30			V	I_C=–25mA
h_{FE}	70				V_{CE}=1V, I_C=1A	70				V_{CE}=–1V, I_C=–1A
	40				V_{CE}=1V, I_C=4A	40				V_{CE}=–1V, I_C=–4A
V_{CE}(sat)			0.5	V	I_C=3A, I_B=0.1A			–0.5	V	I_C=–3A, I_B=–0.1A
t_{on}		0.3		μs	V_{CC}≒12V,		0.3		μs	V_{CC}≒–12V,
t_{stg}		0.5		μs	I_C=3A,		0.5		μs	I_C=–3A,
t_f		0.1		μs	I_{B1}=–I_{B2}=100mA		0.1		μs	I_{B1}=–I_{B2}=–100mA
t_{rr}		2.0		μs	I_F=I_R=100mA		2.0		μs	I_F=I_R=100mA

Characteristic curves

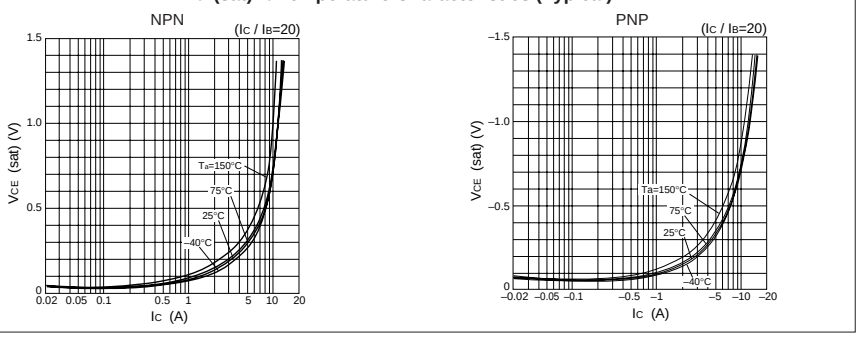
V_{CE}(sat)-I_B Characteristics (Typical)



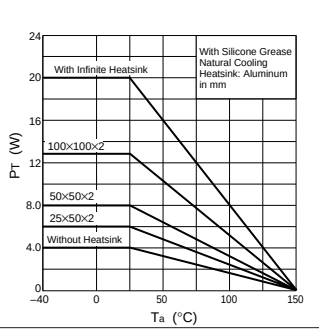
$\theta_{j\text{-}a}$-PW Characteristics



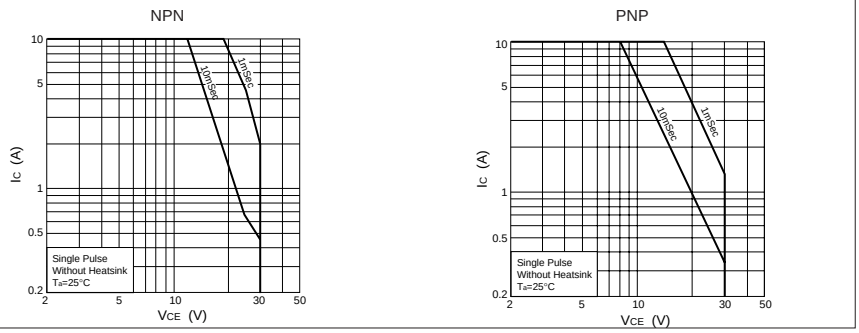
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA460C

NPN Darlington
With built-in avalanche diode

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

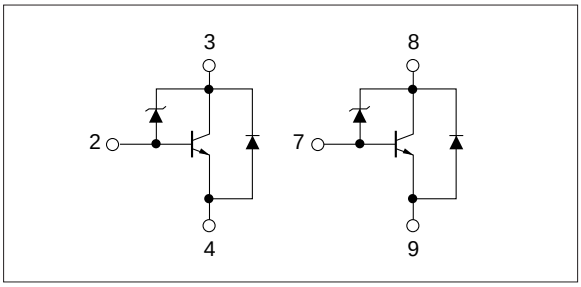
Symbol	Ratings	Unit
V_{CBO}	60±10	V
V_{CEO}	60±10	V
V_{EBO}	6	V
I_C	±6	A
I_{CP}	±10 (PW≤1ms, Du≤50%)	A
P_T	3.2 (Ta=25°C)	W
	18 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

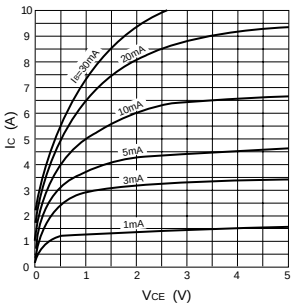
Symbol	Specification			Ratings	Unit
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=50V
I_{EBO}			10	μA	V_{EB}=6V
V_{CEO}	50	60	70	V	I_C=50mA
h_{FE}	700	1500	3000		V_{CE}=1V, I_C=1A
V_{CE}(sat)		0.09	0.15	V	I_C=1.5A, I_B=15mA
V_{FEC}		1.25	1.5	V	I_{FEC}=6A
$E_{S/B}$	200			mJ	L=10mH, Single pulse

■Equivalent circuit diagram

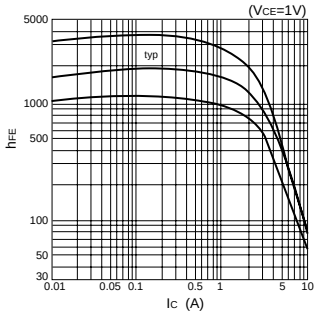


Characteristic curves

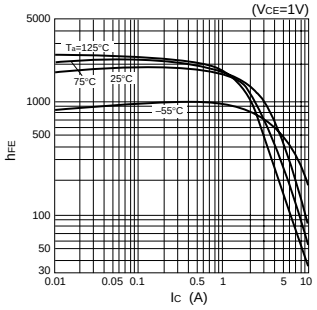
I_C-V_{CE} Characteristics (Typical)



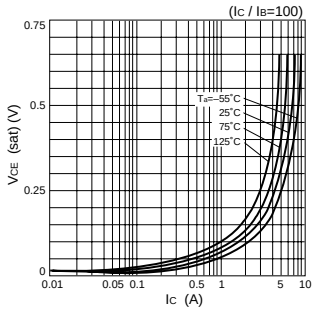
h_{FE}-I_C Characteristics (Typical)



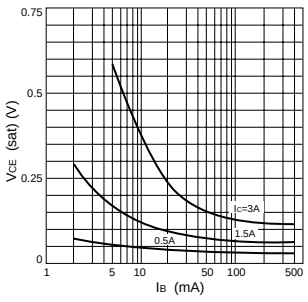
h_{FE}-I_C Temperature Characteristics (Typical)



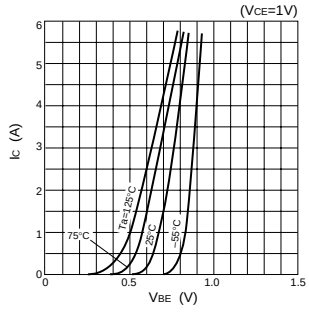
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



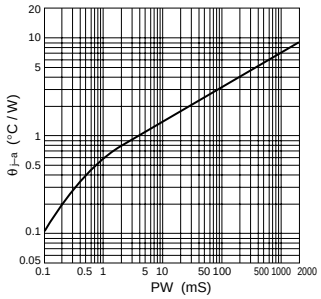
V_{CE}(sat)-I_B Characteristics (Typical)



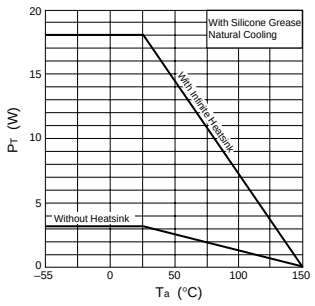
I_C-V_{BE} Temperature Characteristics (Typical)



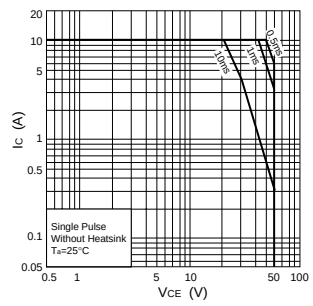
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA471A

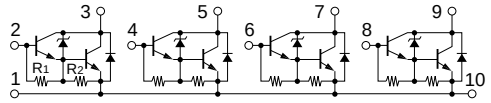
NPN Darlington
With built-in avalanche diode

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	60±10	V
V_{CEO}	60±10	V
V_{EBO}	6	V
I_C	2	A
I_{CP}	4 (PW≤1ms, Du≤25%)	A
I_B	0.5	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C



R1: 3.5kΩ typ R2: 200Ω typ

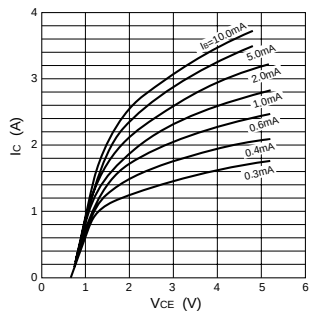
Electrical characteristics

(Ta=25°C)

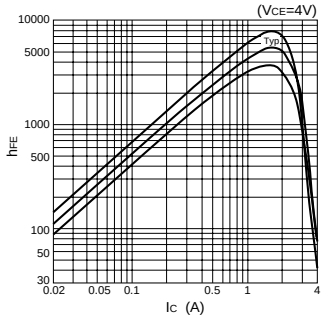
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=50V
I_{EBO}			5	mA	V_{EB}=6V
V_{CEO}	50	60	70	V	I_C=10mA
h_{FE}	2000	5000	10000		V_{CE}=4V, I_C=1A
V_{CE}(sat)		1.1	1.5	V	I_C=1A, I_B=2mA
V_{BE}(sat)		1.8	2.2	V	
V_{FEC}		1.3	1.8	V	I_{FEC}=1A
ton		0.5		μs	V_{CC}≒30V,
tstg		4.0		μs	I_C=1A,
tf		1.0		μs	I_{B1}=–I_{B2}=2mA
f_T		50		MHz	V_{CE}=12V, I_E=–0.1A
Cob		25		pF	V_{CB}=10V, f=1MHz

Characteristic curves

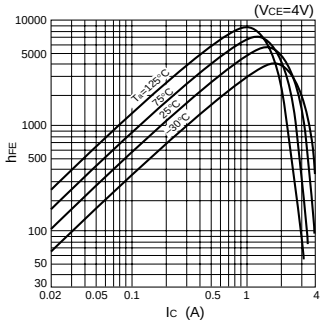
I_C-V_{CE} Characteristics (Typical)



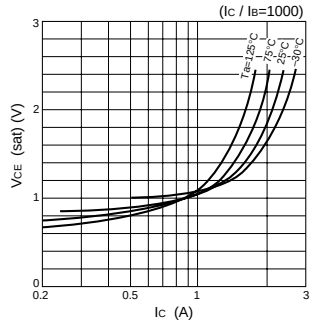
h_{FE}-I_C Characteristics (Typical)



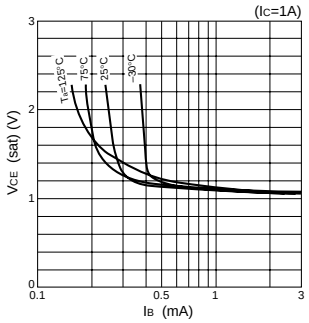
h_{FE}-I_C Temperature Characteristics (Typical)



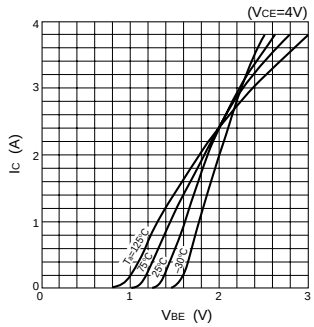
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



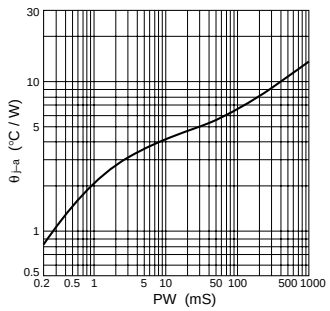
V_{CE}(sat)-I_B Temperature Characteristics (Typical)



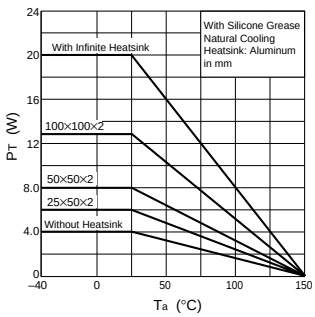
I_C-V_{BE} Temperature Characteristics (Typical)



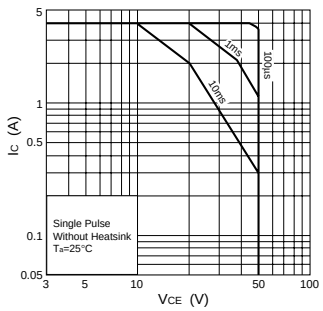
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA472A

PNP Darlington
General purpose

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

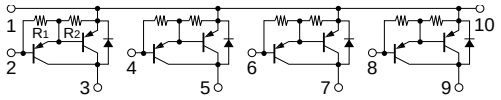
Symbol	Ratings	Unit
V_{CBO}	–60	V
V_{CEO}	–60	V
V_{EBO}	–6	V
I_C	–2	A
I_{CP}	–4 (PW≤1ms, Du≤25%)	A
I_B	–0.5	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–60V
I_{EBO}			–5	mA	V_{EB}=–6V
V_{CEO}	–60			V	I_C=–10mA
h_{FE}	2000	4000	10000		V_{CE}=–4V, I_C=–1A
V_{CE}(sat)		–1.2	–1.5	V	I_C=–1A, I_B=–2mA
V_{BE}(sat)		–1.9	–2.2	V	
V_{FEC}		–1.3	–1.8	V	I_{FEC}=–1A
t_{on}		0.4		μs	V_{CC}≒–30V,
t_{stg}		1.0		μs	I_C=–1A,
t_f		0.4		μs	I_{B1}=–I_{B2}=–2mA
f_T		100		MHz	V_{CE}=12V, I_E=–0.1A
C_{ob}		30		pF	V_{CB}=10V, f=1MHz

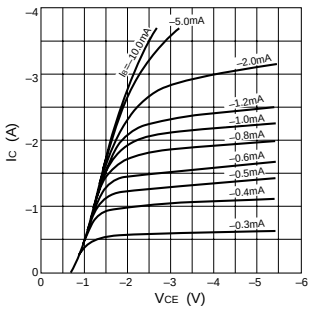
■Equivalent circuit diagram



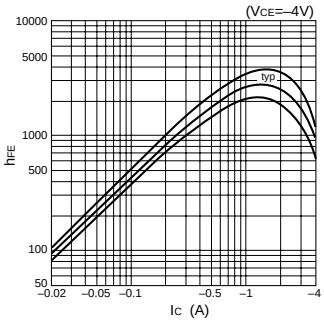
R1: 4kΩ typ R2: 100Ω typ

Characteristic curves

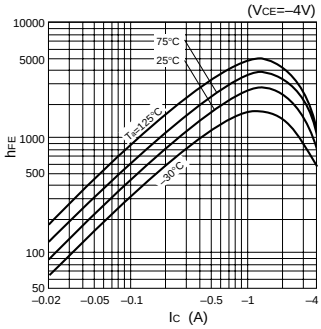
I_C-V_{CE} Characteristics (Typical)



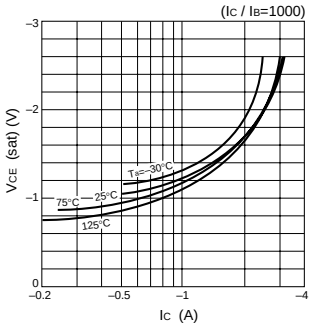
h_{FE}-I_C Characteristics (Typical)



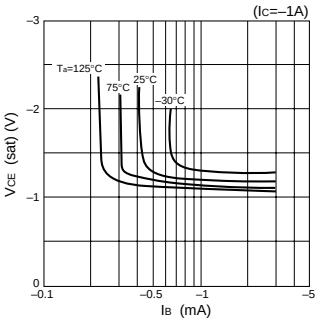
h_{FE}-I_C Temperature Characteristics (Typical)



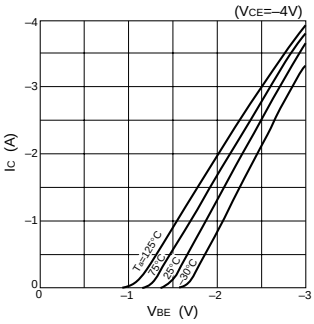
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



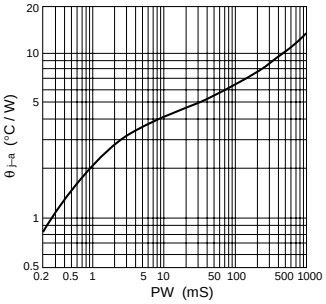
V_{CE}(sat)-I_B Temperature Characteristics (Typical)



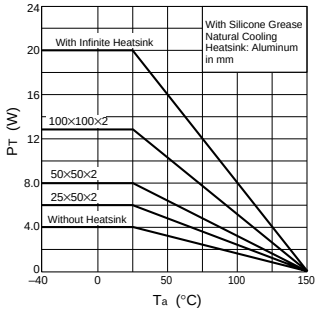
I_C-V_{BE} Temperature Characteristics (Typical)



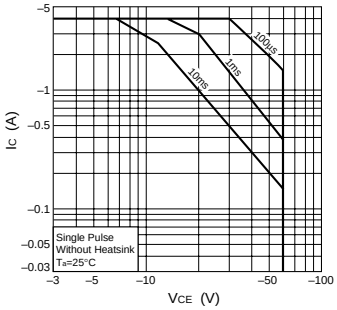
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA473A

NPN Darlington
General purpose

External dimensions Ⓓ ⋯ STA400

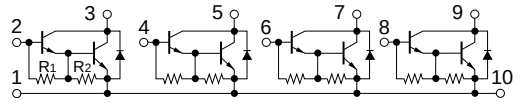
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	2	A
I_{CP}	4 (PW≤1ms, Du≤25%)	A
I_B	0.5	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			5	mA	V_{EB}=6V
V_{CEO}	100			V	I_C=10mA
h_{FE}	2000	5000	12000		V_{CE}=4V, I_C=1A
V_{CE}(sat)		1.1	1.5	V	I_C=1A, I_B=2mA
V_{BE}(sat)		1.8	2.2	V	
V_{FEC}		1.3	1.8	V	I_{FEC}=1A
ton		0.5		μs	V_{CC}≒30V,
tstg		4.5		μs	I_C=1A,
tf		1.2		μs	I_{B1}=–I_{B2}=2mA
f_T		50		MHz	V_{CE}=12V, I_E=–0.1A
Cob		20		pF	V_{CB}=10V, f=1MHz

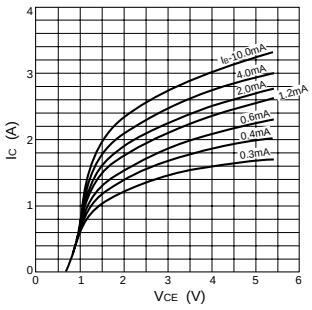
■Equivalent circuit diagram



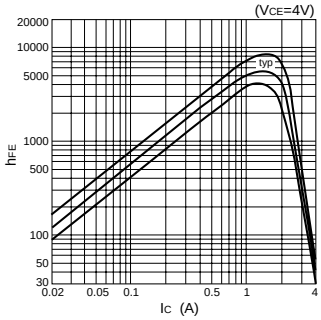
R1: 4kΩ Typ R2: 150Ω Typ

Characteristic curves

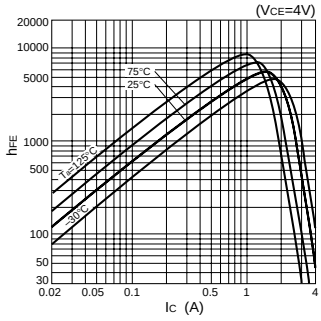
I_C-V_{CE} Characteristics (Typical)



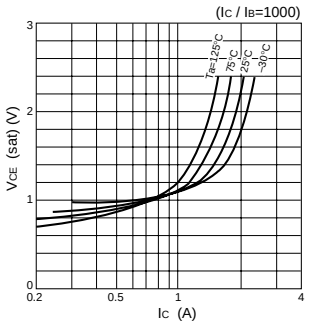
h_{FE}-I_C Characteristics (Typical)



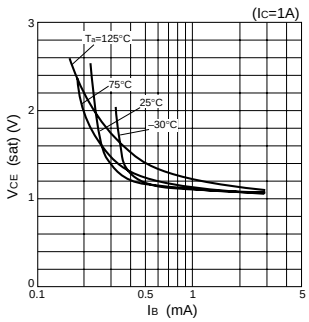
h_{FE}-I_C Temperature Characteristics (Typical)



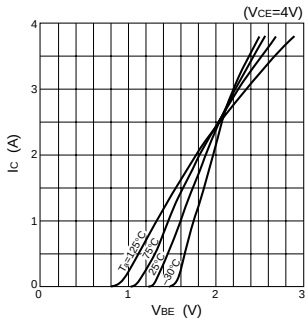
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



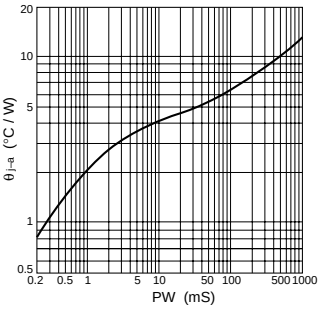
V_{CE}(sat)-I_B Temperature Characteristics (Typical)



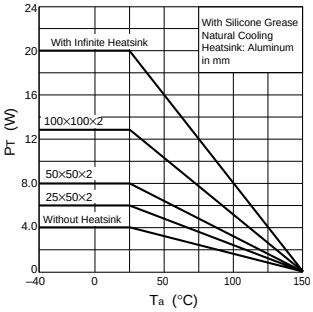
I_C-V_{BE} Temperature Characteristics (Typical)



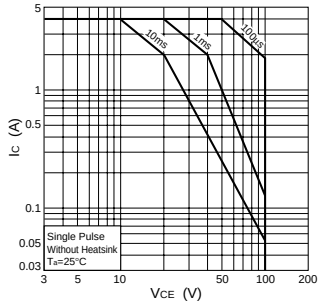
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



STA475A

NPN Darlington
With built-in avalanche diode

External dimensions Ⓓ ··· STA400

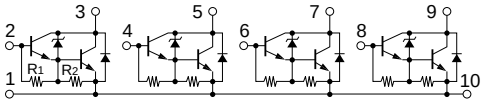
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	100±15	V
V_{CEO}	100±15	V
V_{EBO}	6	V
I_C	2	A
I_{CP}	4 (PW≤1ms, Du≤25%)	A
I_B	0.5	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			10	μA	V_{CB}=85V
I_{EBO}			5	mA	V_{EB}=6V
V_{CEO}	85	100	115	V	I_C=10mA
h_{FE}	2000	5000	12000		V_{CE}=4V, I_C=1A
V_{CE}(sat)			1.5	V	I_C=1A, I_B=2mA
V_{BE}(sat)			2.2	V	
V_{FEC}			1.8	V	I_{FEC}=1A
t_{on}		0.6		μs	V_{CC}≒30V,
t_{stg}		3.0		μs	I_C=1A,
t_f		1.0		μs	I_{B1}=–I_{B2}=2mA

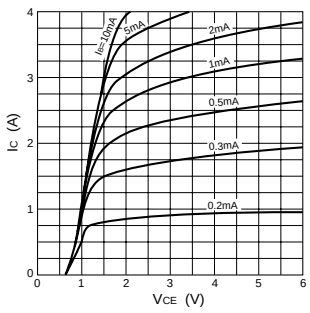
■Equivalent circuit diagram



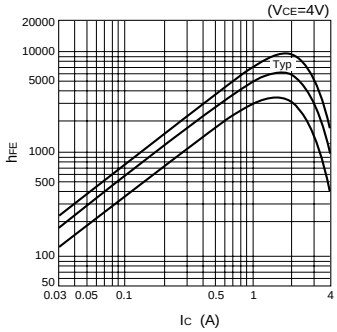
R1: 4kΩ typ R2: 150Ω typ

Characteristic curves

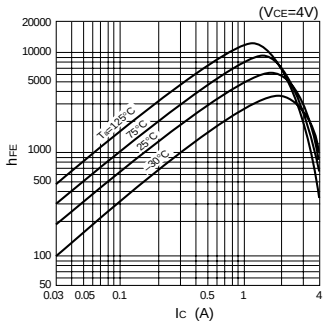
IC-VCE Characteristics (Typical)



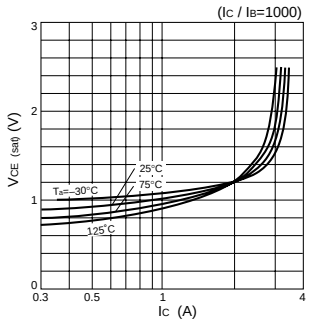
hFE-IC Characteristics (Typical)



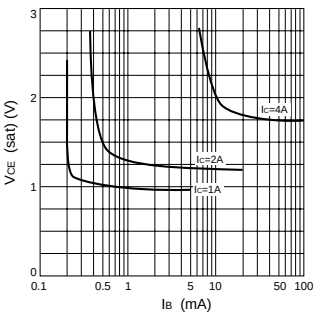
hFE-IC Temperature Characteristics (Typical)



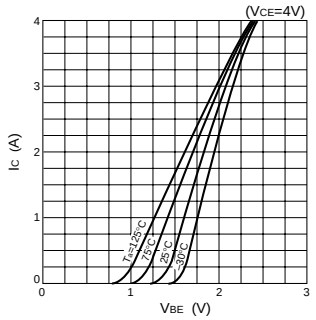
VCE(sat)-IC Temperature Characteristics (Typical)



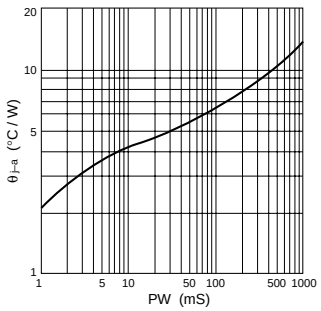
VCE(sat)-IB Characteristics (Typical)



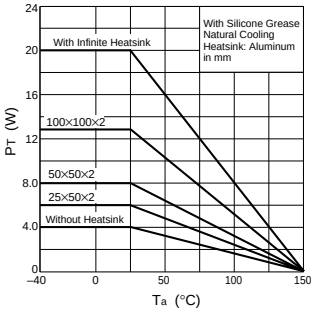
IC-VBE Temperature Characteristics (Typical)



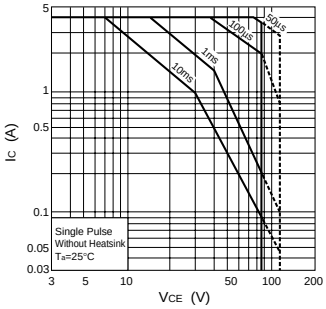
θj-a-PW Characteristics



PT-Ta Characteristics



Safe Operating Area (SOA)



STA481A

NPN Darlington
With built-in avalanche diode

External dimensions Ⓓ ··· STA400

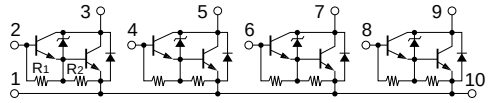
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	60±10	V
V_{CEO}	60±10	V
V_{EBO}	6	V
I_C	1	A
I_{CP}	2.5 (PW≤1ms, Du≤25%)	A
I_B	0.5	A
P_T	4 (Ta=25°C)	W
	16 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			10	μA	V_{CB}=50V
I_{EBO}			3	mA	V_{EB}=6V
V_{CEO}	50	60	70	V	I_C=1mA
h_{FE}	2000	5000	10000		V_{CE}=4V, I_C=0.5A
V_{CE}(sat)		1.0	1.5	V	I_C=0.5A, I_B=1mA
V_{BE}(sat)		1.6	2.2	V	
V_{FEC}		1.4	1.8	V	I_{FEC}=0.5A
ton		0.5		μs	V_{CC}≒30V,
tstg		2.5		μs	I_C=0.5A,
tf		1.0		μs	I_{B1}=–I_{B2}=1mA
f_T		50		MHz	V_{CE}=12V, I_E=–0.1A
Cob		14		pF	V_{CB}=10V, f=1MHz

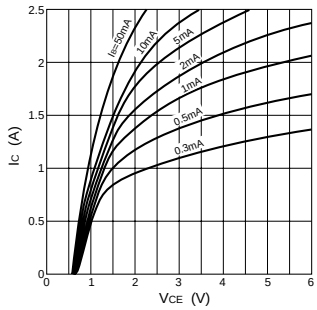
■Equivalent circuit diagram



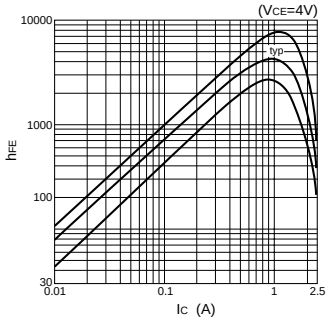
R1: 6kΩ typ R2: 400Ω typ

Characteristic curves

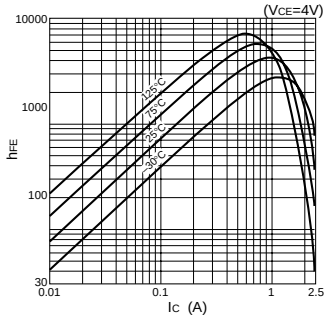
IC-VCE Characteristics (Typical)



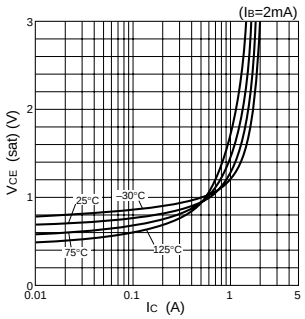
hFE-IC Characteristics (Typical)



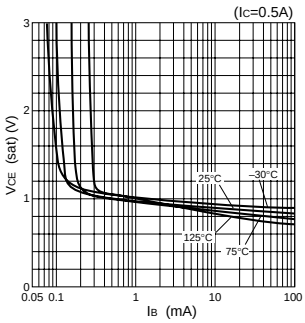
hFE-IC Temperature Characteristics (Typical)



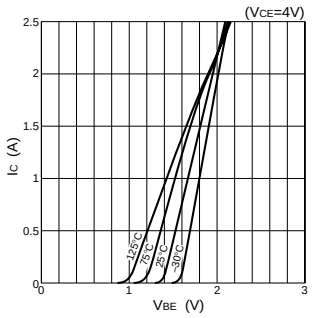
VCE(sat)-IC Temperature Characteristics (Typical)



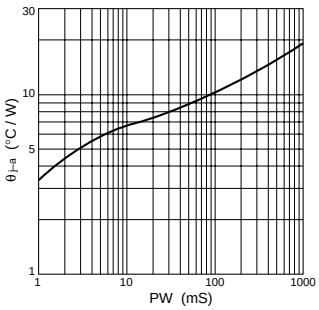
VCE(sat)-IB Temperature Characteristics (Typical)



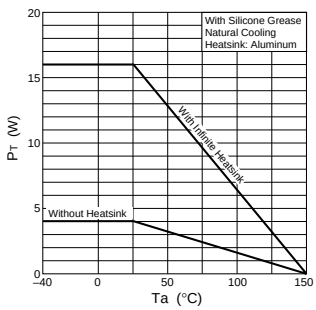
IC-VBE Temperature Characteristics (Typical)



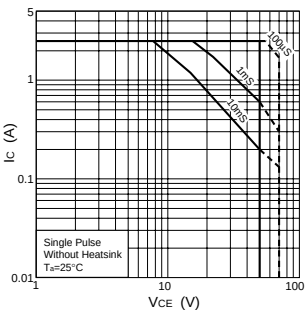
θj-a-PW Characteristics



PT-Ta Characteristics



Safe Operating Area (SOA)



STA485A

NPN Darlington
With built-in avalanche diode

External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

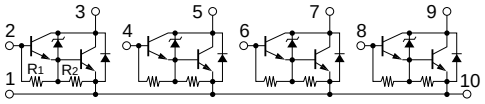
Symbol	Ratings	Unit
V_{CBO}	100±15	V
V_{CEO}	100±15	V
V_{EBO}	6	V
I_C	1	A
I_{CP}	2.5 (PW≤1ms, Du≤25%)	A
I_B	0.5	A
P_T	4 (Ta=25°C)	W
	16 (Tc=25°C)	
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

ymbol	Specification min	typ	max	Unit	Conditions
I_{CBO}			10	μA	V_{CB}=85V
I_{EBO}			3	mA	V_{EB}=6V
V_{CEO}	85	100	115	V	I_C=1mA
h_{FE}	2000	5000	10000		V_{CE}=4V, I_C=0.5A
V_{CE}(sat)		1.0	1.5	V	I_C=0.5A, I_B=1mA
V_{BE}(sat)		1.6	2.2	V	
V_{FEC}		1.4	1.8	V	I_{FEC}=0.5A
ton		0.5		μs	V_{CC}≒30V,
tstg		2.5		μs	I_C=0.5A,
tf		1.0		μs	I_{B1}=–I_{B2}=1mA
f_T		50		MHz	V_{CE}=12V, I_E=–0.1A
Cob		14		pF	V_{CE}=10V, f=1MHz

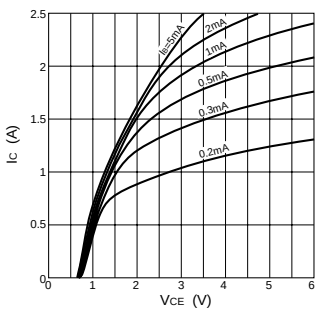
■Equivalent circuit diagram



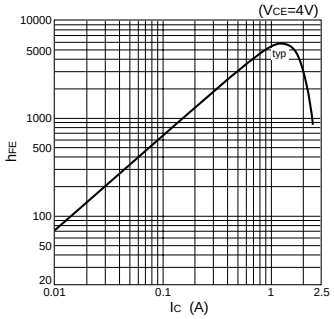
R1: 5kΩ typ R2: 400Ω typ

Characteristic curves

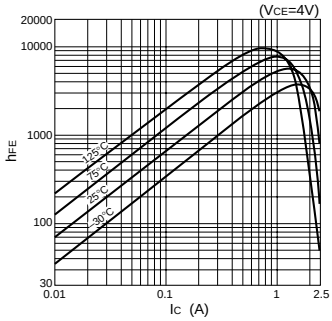
IC-VCE Characteristics (Typical)



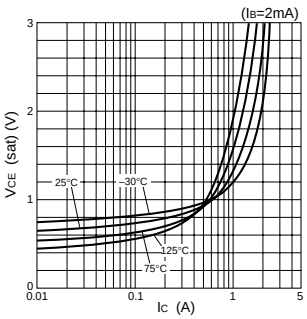
hFE-IC Characteristics (Typical)



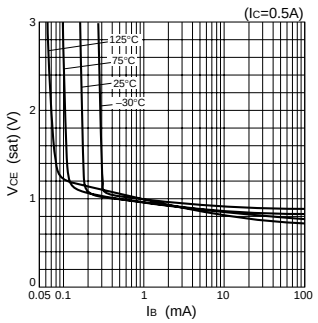
hFE-IC Temperature Characteristics (Typical)



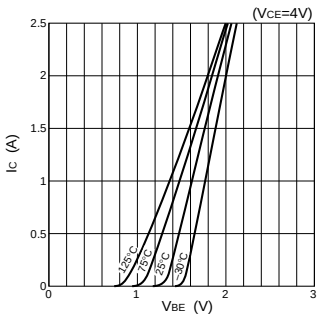
VCE(sat)-IC Temperature Characteristics (Typical)



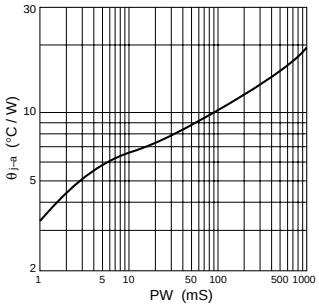
VCE(sat)-IB Temperature Characteristics (Typical)



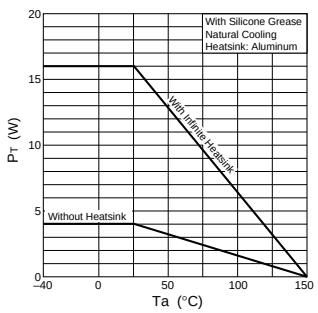
IC-VBE Temperature Characteristics (Typical)



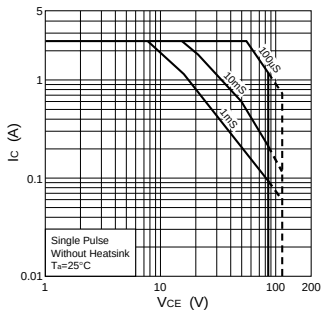
θj-a-PW Characteristics



PT-Ta Characteristics



Safe Operating Area (SOA)



STA501A

N-channel

General purpose

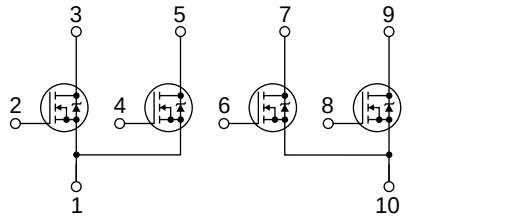
External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	±10	V
I_D	±5	A
$I_{D(pulse)}$	±20 (PW≤100μs, Du≤1%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	W
Tch	150	°C
Tstg	–40 to +150	°C

■Equivalent circuit diagram



Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	2.0			S	V_{DS}=10V, I_D=2.5A
$R_{DS(ON)}$		0.15	0.20	Ω	V_{GS}=10V, I_D=2.5A
		0.23	0.28	Ω	V_{GS}=4V, I_D=2.5A
Ciss		400		pF	V_{DS}=25V,
Coss		160		pF	f=1.0MHz,
Crss		35		pF	V_{GS}=0V
$t_{d(on)}$		20		ns	I_D=2.5A,
t_r		25		ns	V_{DD}≒30V,
$t_{d(off)}$		40		ns	R_L=12Ω,
t_f		20		ns	V_{GS}=5V, see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=5A, V_{GS}=0V
t_{rr}		150		ns	I_{SD}=±100mA

Characteristic curves

Absolute maximum ratings

(Ta=25°C)

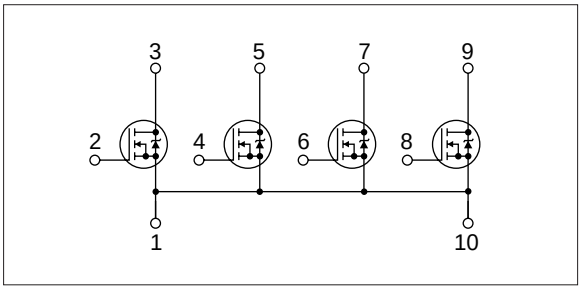
Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	±20	V
I_D	±4	A
$I_{D(pulse)}$	±8 (PW≤100μs, Du≤1%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	W
Tch	150	°C
Tstg	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=60V, V_{GS}=0V
V_{TH}	2.0		4.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.2			S	V_{DS}=10V, I_D=2A
$R_{DS(ON)}$		0.33	0.45	Ω	V_{GS}=10V, I_D=2A
Ciss		120		pF	V_{DS}=25V,
Coss		60		pF	f=1.0MHz,
Crss		14		pF	V_{GS}=0V
V_{SD}		1.1	1.5	V	I_{SD}=4A, V_{GS}=0V
trr		100		ns	I_{SD}=±100mA

■Equivalent circuit diagram



Characteristic curves

STA505A

N-channel

General purpose

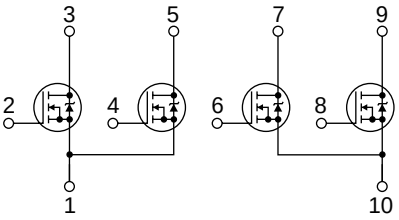
External dimensions Ⓓ ··· STA400

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±3	A
$I_{D(pulse)}$	±12 (PW≤100μs, Du≤1%)	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	W
Tch	150	°C
Tstg	–40 to +150	°C

■Equivalent circuit diagram



Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	2.0		3.0	S	V_{DS}=10V, I_D=1.5A
$R_{DS(ON)}$		0.35	0.50	Ω	V_{GS}=10V, I_D=1.5A
		0.40	0.60	Ω	V_{GS}=4V, I_D=1.5A
Ciss		240		pF	V_{DS}=25V,
Coss		60		pF	f=1.0MHz,
Crss		12		pF	V_{GS}=0V
V_{SD}		1.0	1.5	V	I_{SD}=3A, V_{GS}=0V
trr		150		ns	I_{SD}=±100mA

Characteristic curves

STA506A

N-channel
General purpose

External dimensions Ⓓ ··· STA400

Absolute maximum ratings (Ta=25°C)

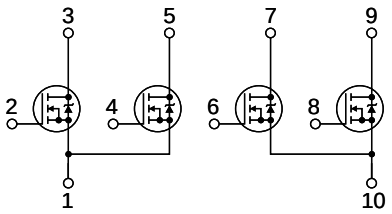
Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±2	A
$I_{D(pulse)}$	±5 (PW≤100μs, Du≤1%)	A
E_{AS}*	5.6	mJ
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	W
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=25V, L=2.2mH, I_L=2A, unclamped, R_G=50Ω, see Fig. E on page 15.

Electrical characteristics (Ta=25°C)

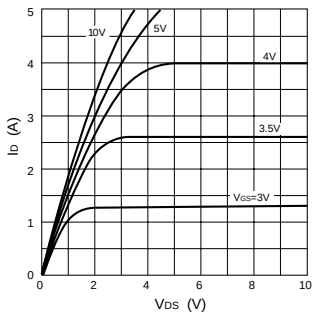
Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.5	2.0		S	V_{DS}=10V, I_D=1A
$R_{DS(ON)}$		0.55	0.80	Ω	V_{GS}=10V, I_D=1A
		0.70	0.95	Ω	V_{GS}=4V, I_D=1A
Ciss		150		pF	V_{DS}=25V,
Coss		45		pF	f=1.0MHz,
Crss		9		pF	V_{GS}=0V
$td_{(on)}$		15		ns	I_D=1A,
tr		30		ns	V_{DD}≒50V,
$td_{(off)}$		40		ns	R_L=50Ω,
tf		30		ns	V_{GS}=5V, see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=2A, V_{GS}=0V
trr		160		ns	I_{SD}=±100mA

■Equivalent circuit diagram

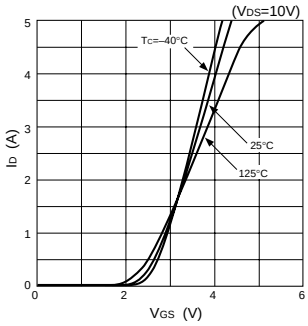


Characteristic curves

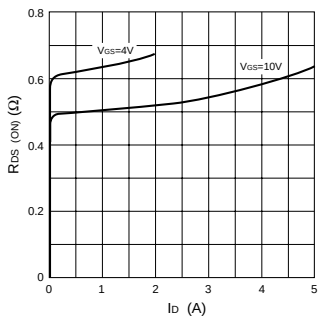
I_D-V_{DS} Characteristics (Typical)



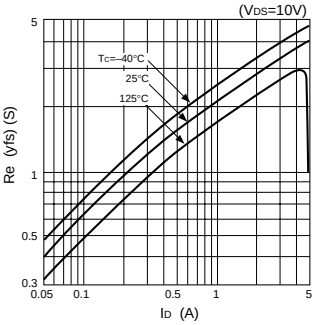
I_D-V_{GS} Characteristics (Typical)



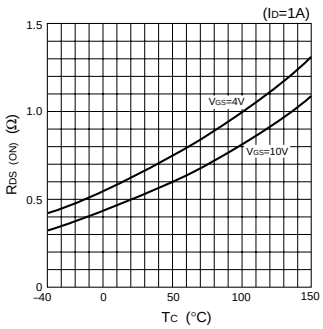
$R_{DS(ON)}$-I_D Characteristics (Typical)



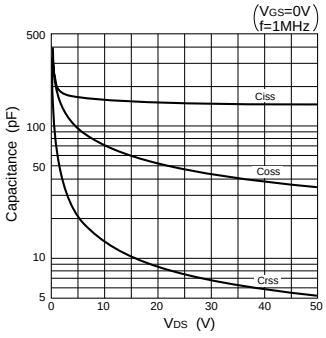
$Re_{(yfs)}$-I_D Characteristics (Typical)



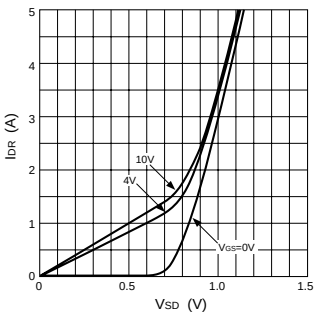
$R_{DS(ON)}$-T_C Characteristics (Typical)



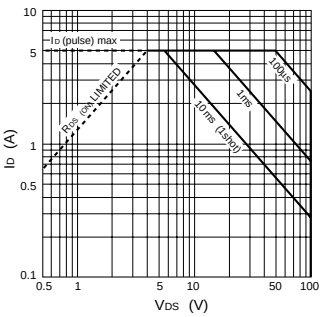
Capacitance-V_{DS} Characteristics (Typical)



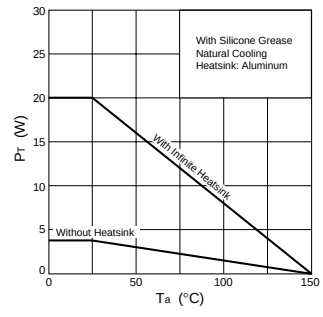
I_{DR}-V_{SD} Characteristics (Typical)



P_T-Ta Characteristics



Safe Operating Area (SOA)



SDA01

PNP Darlington
General purpose

External dimensions (E) ··· SD

Absolute maximum ratings

(Ta=25°C)

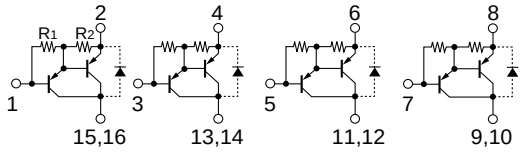
Symbol	Ratings	Unit
V_{CBO}	–60	V
V_{CEO}	–60	V
V_{EBO}	–6	V
I_C	–1.5	A
I_{CP}	–2.5 (PW≤1ms, Du≤10%)	A
I_B	–0.1	A
P_T	3 (Ta=25°C)	W
T_j	150	°C
T_{stg}	–40 to +150	°C
θ_{j-a}	41.6	°C/W

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–60V
I_{EBO}			–3	mA	V_{EB}=–6V
V_{CEO}	–60			V	I_C=–10mA
h_{FE}	2000		12000		V_{CE}=–4V, I_C=–1A
V_{CE}(sat)			–1.4	V	I_C=–1A, I_B=–2mA
V_{BE}(sat)			–2.2	V	

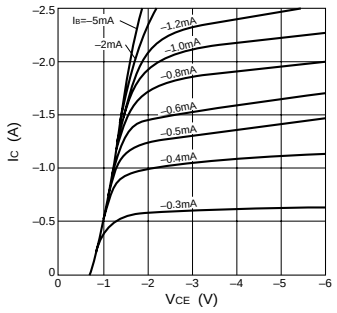
■Equivalent circuit diagram



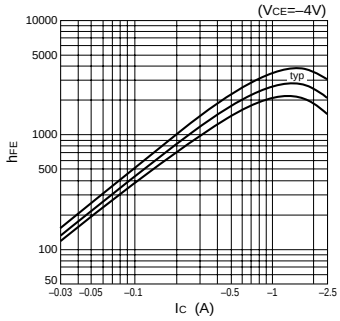
R1: 4kΩ typ R2: 100Ω typ

Characteristic curves

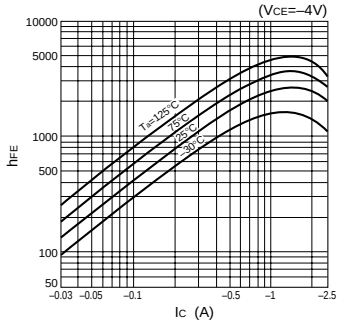
I_C-V_{CE} Characteristics (Typical)



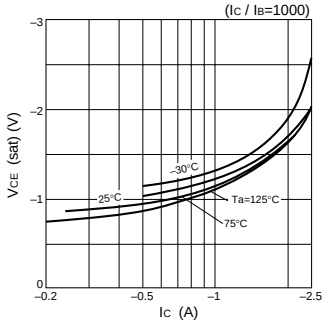
h_{FE}-I_C Characteristics (Typical)



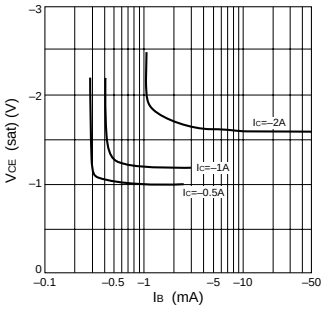
h_{FE}-I_C Temperature Characteristics (Typical)



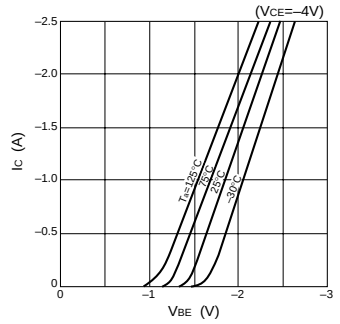
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



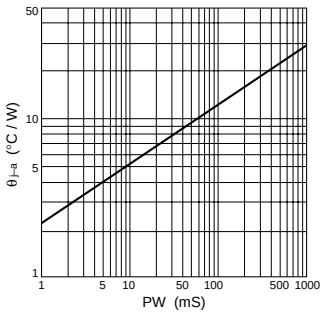
V_{CE}(sat)-I_B Characteristics (Typical)



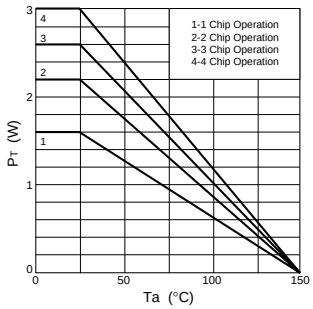
I_C-V_{BE} Temperature Characteristics (Typical)



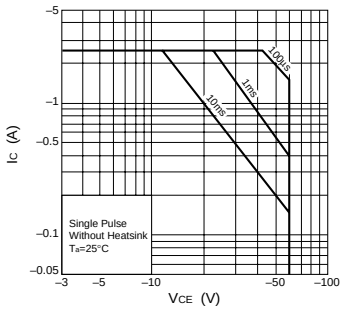
θ_{j-a}-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SDA05

PNP Darlington
3-phase motor drive

External dimensions Ⓔ ··· SD

Absolute maximum ratings

(Ta=25°C)

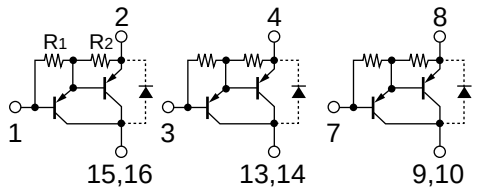
Symbol	Ratings	Unit
V_{CBO}	–60	V
V_{CEO}	–60	V
V_{EBO}	–6	V
I_C	–4	A
I_{CP}	–6 (PW≤1ms, Du≤50%)	A
I_B	–0.5	A
P_T	2.6 (Ta=25°C)	W
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			–10	μA	V_{CB}=–60V
I_{EBO}			–10	mA	V_{EB}=–6V
V_{CEO}	–60			V	I_C=–10mA
h_{FE}	2000		12000		V_{CE}=–4V, I_C=–3A
V_{CE}(sat)			–1.5	V	I_C=–3A, I_B=–6mA
V_{BE}(sat)			–2.0	V	
V_{FEC}			1.8	V	I_{FEC}=1A
ton		0.4		μs	V_{CC}≒–30V,
tstg		0.8		μs	I_C=–3A,
tf		0.6		μs	I_{B1}=–I_{B2}=–10mA
f_T		200		MHz	V_{CE}=–12V, I_E=0.2A
Cob		75		pF	V_{CB}=–10V, f=1MHz

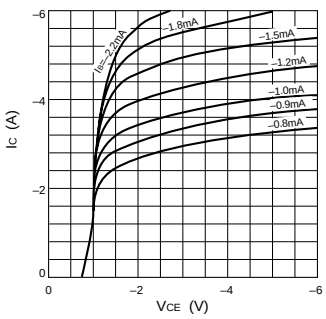
■Equivalent circuit diagram



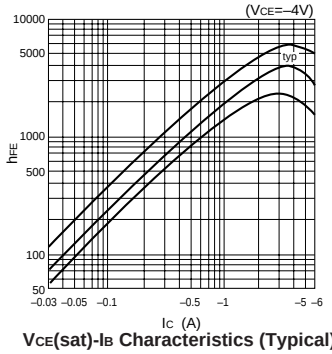
R1: 2kΩ typ R2: 150Ω typ *5, 6, 11, 12 pin is NC

Characteristic curves

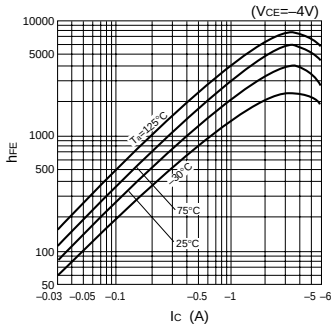
I_C-V_{CE} Characteristics (Typical)



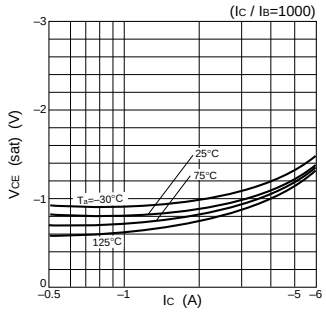
h_{FE}-I_C Characteristics (Typical)



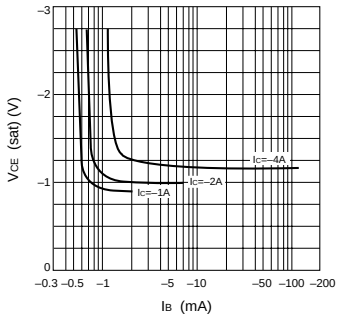
h_{FE}-I_C Temperature Characteristics (Typical)



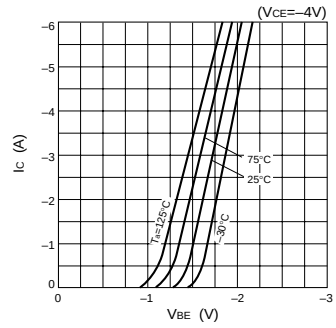
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



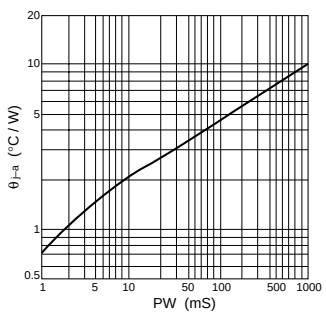
V_{CE}(sat)-I_B Characteristics (Typical)



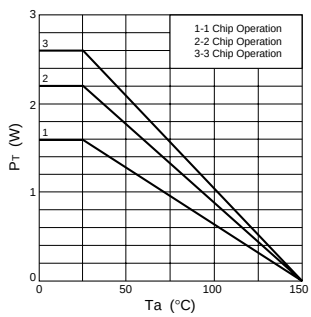
I_C-V_{BE} Temperature Characteristics (Typical)



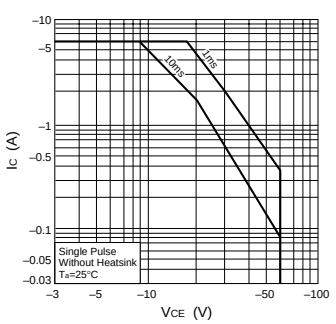
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SDC01

NPN

General purpose

External dimensions Ⓔ ··· SD

Absolute maximum ratings

(Ta=25°C)

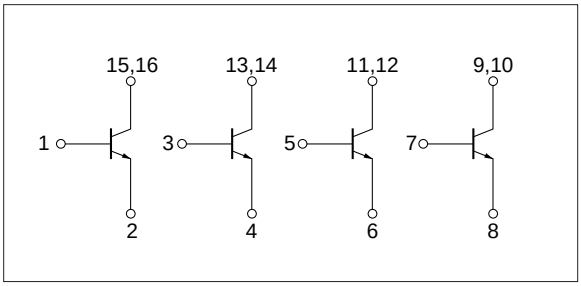
Symbol	Ratings	Unit
V_{CBO}	80	V
V_{CEO}	50	V
V_{EBO}	6	V
I_C	2	A
I_{CP}	3 (PW≤1ms, Du≤10%)	A
I_B	0.5	A
P_T	3 (Ta=25°C)	W
T_j	150	°C
T_{stg}	–40 to +150	°C
θ_{j-a}	41.6	°C/W

Electrical characteristics

(Ta=25°C)

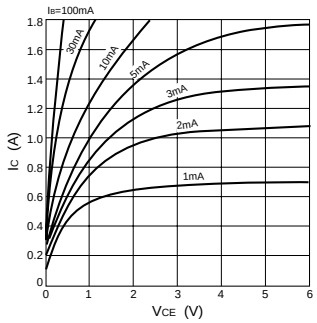
Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=80V
I_{CES}			100	μA	V_{CES}=50V
I_{EBO}			10	μA	V_{EB}=6V
V_{CEO}	50			V	I_C=10mA
h_{FE}	500		2000		V_{CE}=4V, I_C=0.5A
V_{CE}(sat)			0.4	V	I_C=0.5A, I_B=5mA
V_{BE}(sat)			1.1	V	
f_T		40		MHz	V_{CE}=12V, I_E=–0.1A

■Equivalent circuit diagram

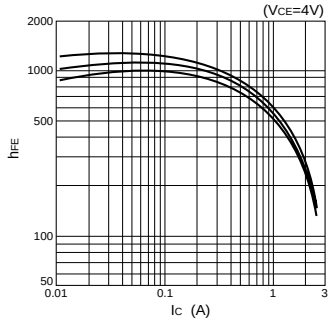


Characteristic curves

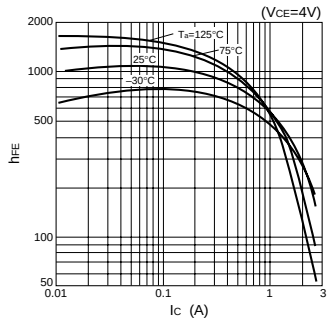
I_C-V_{CE} Characteristics (Typical)



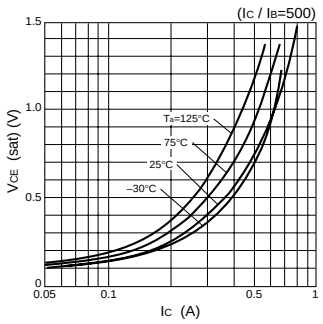
h_{FE}-I_C Characteristics (Typical)



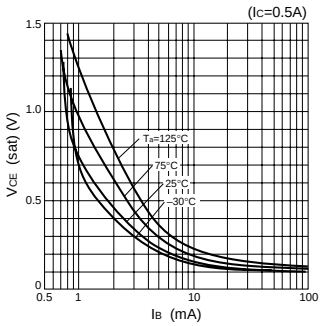
h_{FE}-I_C Temperature Characteristics (Typical)



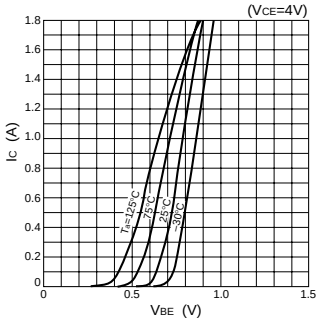
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



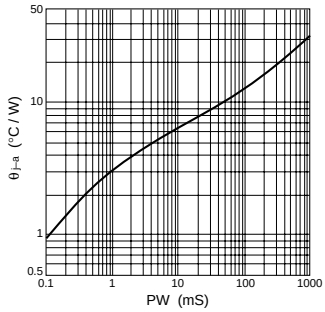
V_{CE}(sat)-I_B Temperature Characteristics (Typical)



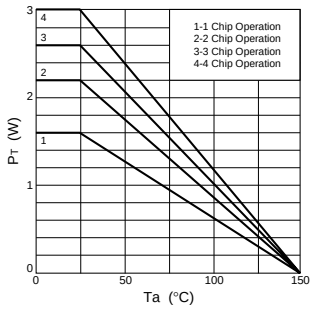
I_C-V_{BE} Temperature Characteristics (Typical)



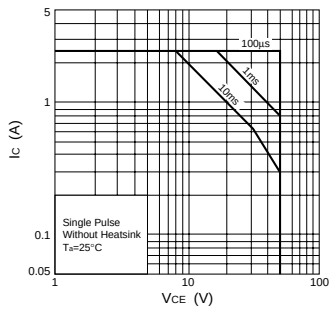
θ_{j-a}-PW Characteristics



P_T-Ta Characteristics



Safe Operating Area (SOA)



SDC03

NPN Darlington
With built-in avalanche diode

External dimensions Ⓔ ··· SD

Absolute maximum ratings

(Ta=25°C)

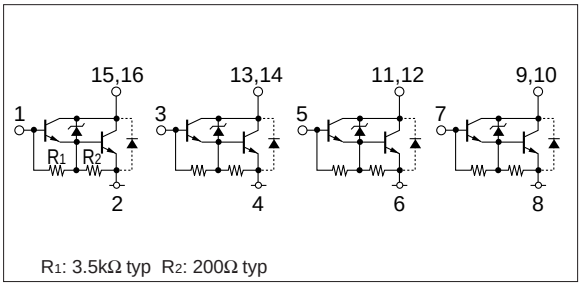
Symbol	Ratings	Unit
V_{CBO}	60±10	V
V_{CEO}	60±10	V
V_{EBO}	6	V
I_C	1.5	A
I_{CP}	2.5 (PW≤1ms, Du≤10%)	A
I_B	0.1	A
P_T	3 (Ta=25°C)	W
T_j	150	°C
T_{stg}	–40 to +150	°C
θ_{j-a}	41.6	°C/W

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=50V
I_{EBO}	1.1		3.5	mA	V_{EB}=6V
V_{CEO}	50	60	70	V	I_C=10mA
h_{FE}	2000	5000	12000		V_{CE}=4V, I_C=1A
V_{CE}(sat)		1.2	1.4	V	I_C=1A, I_B=2mA
V_{BE}(sat)		1.8	2.2	V	
V_{FEC}		1.3	1.8	V	I_{FEC}=1A
t_{on}		0.5		μs	V_{CC}≒30V,
t_{stg}		4.0		μs	I_C=1A,
t_f		1.0		μs	I_{B1}=–I_{B2}=2mA
f_T		50		MHz	V_{CE}=12V, I_E=–0.1A
C_{ob}		25		pF	V_{CB}=10V, f=1MHz

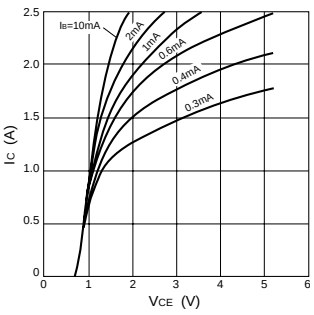
■Equivalent circuit diagram



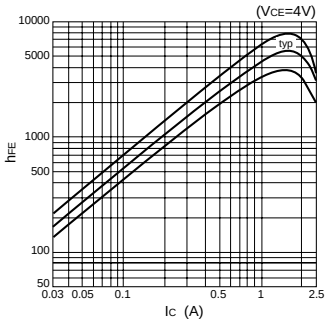
R1: 3.5kΩ typ R2: 200Ω typ

Characteristic curves

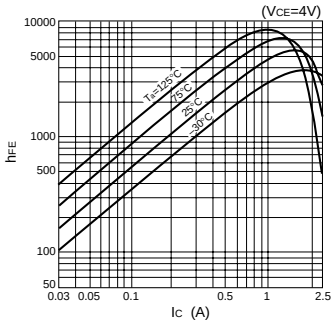
I_C-V_{CE} Characteristics (Typical)



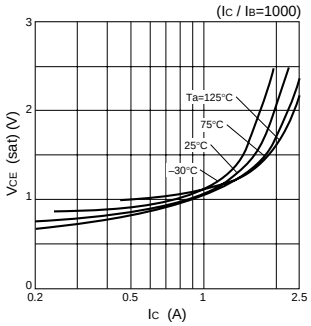
h_{FE}-I_C Characteristics (Typical)



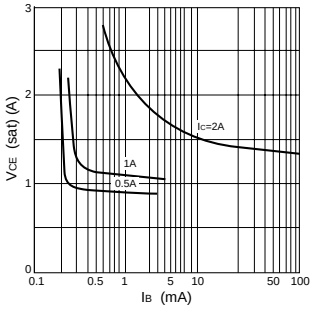
h_{FE}-I_C Temperature Characteristics (Typical)



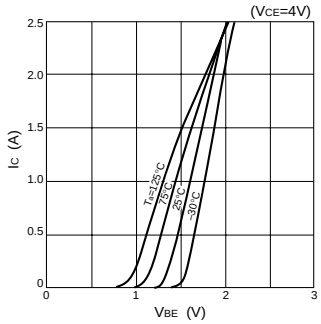
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



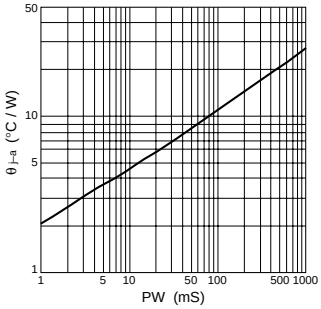
V_{CE}(sat)-I_B Characteristics (Typical)



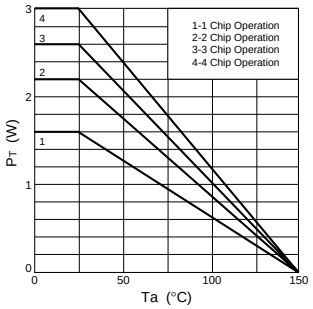
I_C-V_{BE} Temperature Characteristics (Typical)



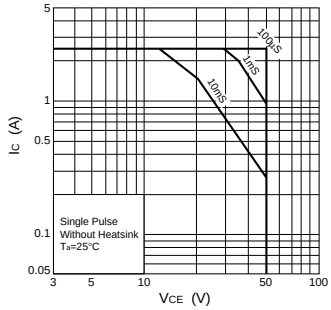
θ_{j-a}-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SDC04

NPN Darlington
With built-in avalanche diode

External dimensions Ⓔ ··· SD

Absolute maximum ratings

(Ta=25°C)

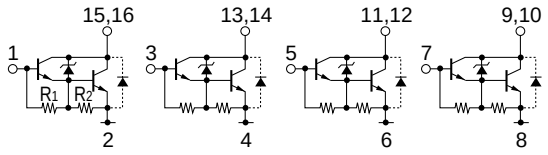
Symbol	Ratings	Unit
V_{CBO}	100±15	V
V_{CEO}	100±15	V
V_{EBO}	6	V
I_C	1.5	A
I_{CP}	2.5 (PW≤1ms, Du≤10%)	A
I_B	0.1	A
P_T	3 (Ta=25°C)	W
T_j	150	°C
T_{stg}	–40 to +150	°C
θ_{j-a}	41.6	°C/W

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=85V
I_{EBO}	1		3	mA	V_{EB}=6V
V_{CEO}	85	100	115	V	I_C=10mA
h_{FE}	2000	5000	12000		V_{CE}=4V, I_C=1A
V_{CE}(sat)		1.0	1.3	V	I_C=1A, I_B=2mA
V_{BE}(sat)		1.7	2.2	V	
V_{FEC}		1.2	1.8	V	I_{FEC}=1A
ton		0.6		μs	V_{CC}≒30V,
tstg		3.0		μs	I_C=1A,
tf		1.0		μs	I_{B1}=–I_{B2}=2mA
f_T		30		MHz	V_{CE}=12V, I_E=–0.1A
Cob		20		pF	V_{CB}=10V, f=1MHz

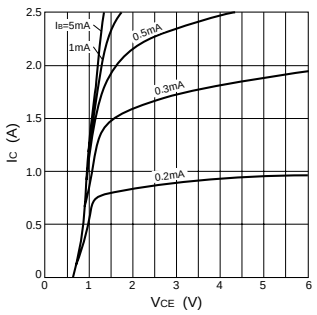
■Equivalent circuit diagram



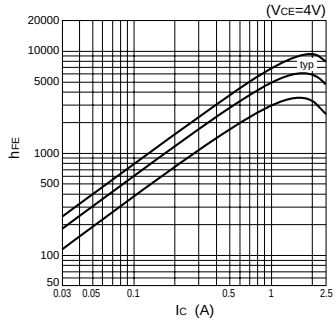
R1: 4kΩ typ R2: 150Ω typ

Characteristic curves

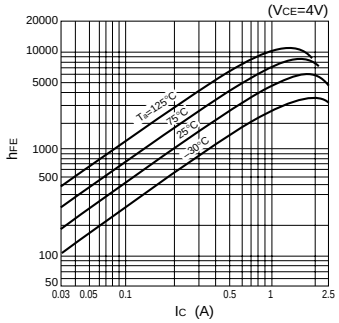
I_C-V_{CE} Characteristics (Typical)



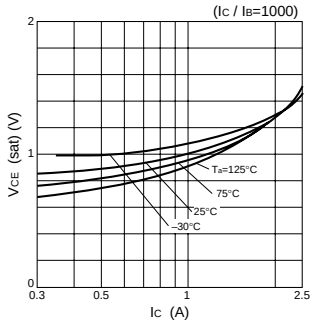
h_{FE}-I_C Characteristics (Typical)



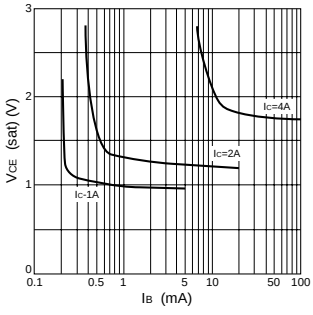
h_{FE}-I_C Temperature Characteristics (Typical)



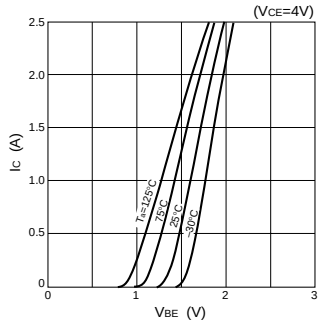
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



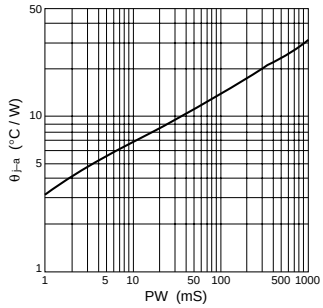
V_{CE}(sat)-I_B Characteristics (Typical)



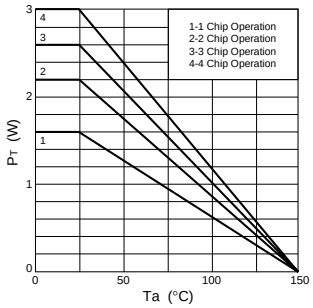
I_C-V_{BE} Temperature Characteristics (Typical)



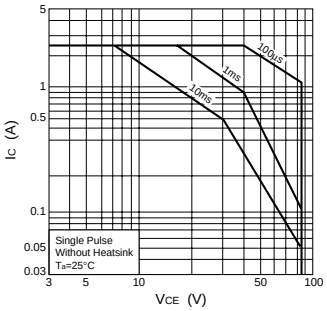
θ_{j-a}-PW Characteristics



P_T-Ta Characteristics



Safe Operating Area (SOA)



SDC06

NPN

With built-in avalanche diode

External dimensions Ⓔ ··· SD

Absolute maximum ratings

(Ta=25°C)

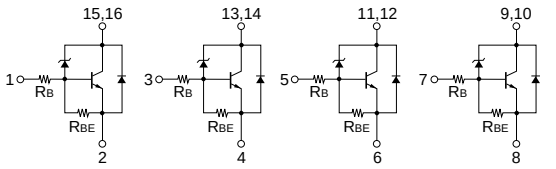
Symbol	Ratings	Unit
V_{CBO}	30 to 45	V
V_{CEO}	30 to 45	V
V_{EBO}	6	V
I_C	2	A
I_{CP}	3 (PW≤1ms, Du≤10%)	A
I_B	30	mA
P_T	3 (Ta=25°C)	W
T_j	150	°C
T_{stg}	–40 to +150	°C
θ_{j-a}	41.6	°C/W

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=30V
I_{EBO}	1.2		2.8	mA	V_{EB}=6V
V_{CEO}	30		45	V	I_C=10mA
h_{FE}	400	700	2000		V_{CE}=4V, I_C=0.5A
V_{CE}(sat)			0.2	V	I_C=0.5A, I_B=5mA
			0.6	V	I_C=1A, I_B=5mA
V_{FEC}			2.0	V	I_{FEC}=1A
t_{on}		1.2		μs	V_{CC}≒10V,
t_{stg}		18.0		μs	I_C=0.5A,
t_f		3.6		μs	I_{B1}=5mA, I_{B2}=0A
f_T		20		MHz	V_{CE}=12V, I_E=–0.2A
C_{ob}		50		pF	V_{CB}=10V, f=1MHz
$E_{S/B}$	40			mJ	L=10mH, Single pulse

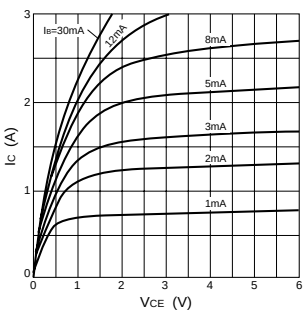
■Equivalent circuit diagram



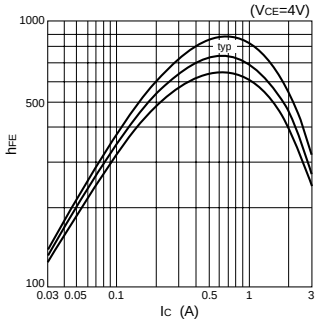
RB: 800Ω typ RBE: 2kΩ typ

Characteristic curves

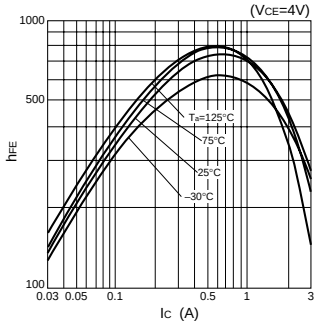
I_C-V_{CE} Characteristics (Typical)



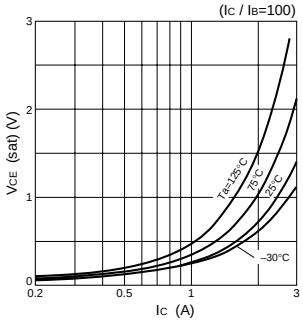
h_{FE}-I_C Characteristics (Typical)



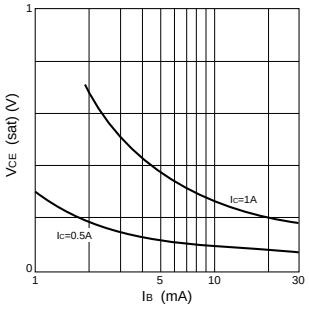
h_{FE}-I_C Temperature Characteristics (Typical)



V_{CE}(sat)-I_C Temperature Characteristics (Typical)

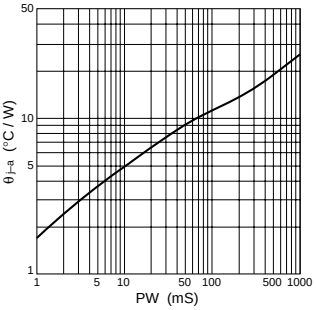


V_{CE}(sat)-I_B Characteristics (Typical)

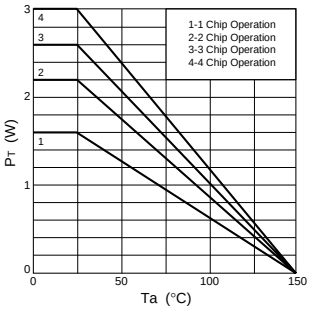


I_C-V_{BE} Temperature Characteristics (Typical)

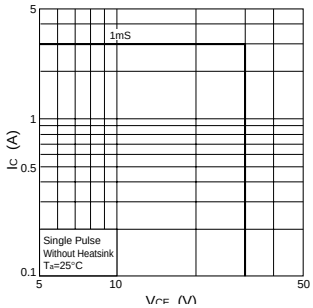
θ_{j-a}-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)



SDC07

NPN Darlington

3-phase motor drive

External dimensions Ⓔ ··· SD

Absolute maximum ratings

(Ta=25°C)

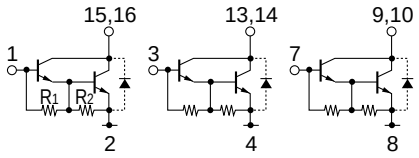
Symbol	Ratings	Unit
V_{CBO}	60	V
V_{CEO}	60	V
V_{EBO}	6	V
I_C	4	A
I_{CP}	6 (PW≤1ms, Du≤50%)	A
I_B	0.5	A
P_T	2.6 (Ta=25°C)	W
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=60V
I_{EBO}			10	mA	V_{EB}=6V
V_{CEO}	60			V	I_C=10mA
h_{FE}	2000		12000		V_{CE}=4V, I_C=3A
V_{CE}(sat)			1.5	V	I_C=3A, I_B=6mA
V_{BE}(sat)			2.0	V	
V_{FEC}			1.8	V	I_{FEC}=1A
ton		1.0		μs	V_{CC}≒30V,
tstg		4.0		μs	I_C=3A,
tf		1.5		μs	I_{B1}=–I_{B2}=10mA
f_T		75		MHz	V_{CE}=12V, I_E=–0.1A
Cob		50		pF	V_{CB}=10V, f=1MHz

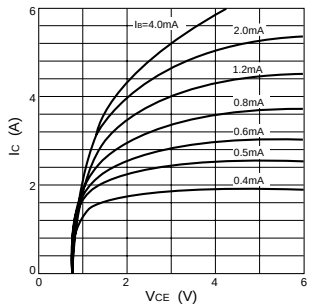
■Equivalent circuit diagram



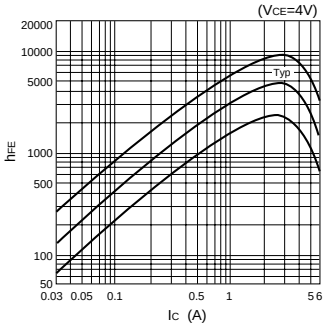
R1: 3kΩ typ R2: 200Ω typ *5, 6, 11, 12 pin is NC

Characteristic curves

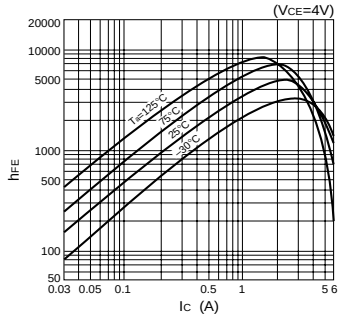
I_C-V_{CE} Characteristics (Typical)



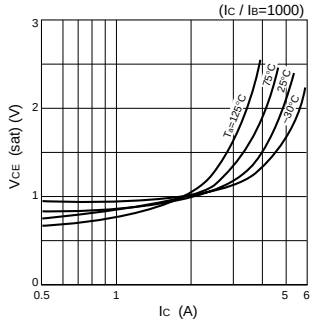
h_{FE}-I_C Characteristics (Typical)



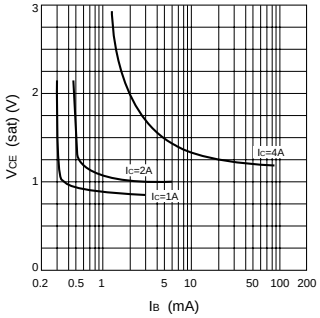
h_{FE}-I_C Temperature Characteristics (Typical)



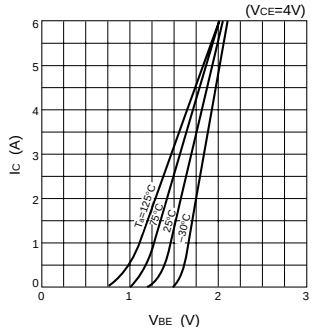
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



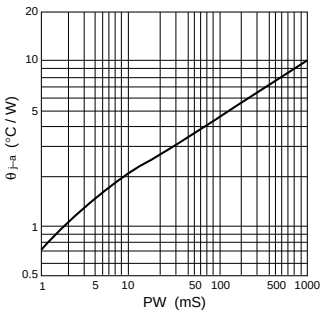
V_{CE}(sat)-I_B Characteristics (Typical)



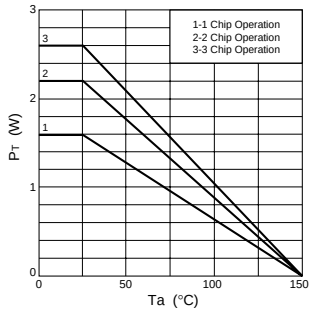
I_C-V_{BE} Temperature Characteristics (Typical)



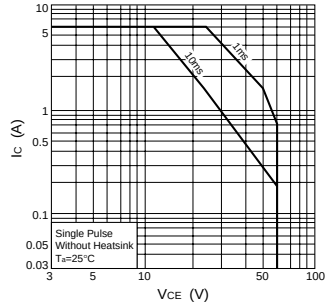
$\theta_{j\text{-}a}$-PW Characteristics



P_T-Ta Characteristics



Safe Operating Area (SOA)



SDH02

NPN Darlington
With built-in flywheel diode

External dimensions Ⓔ ··· SD

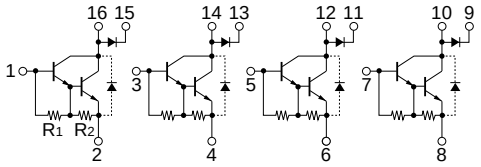
Absolute maximum ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	1.5	A
I_{CP}	2.5 (PW≤1ms, Du≤10%)	A
I_B	0.2	A
I_F	1.5	A
I_{FSM}	2.5 (PW≤0.5ms, Du≤10%)	A
V_R	120	V
P_T	3 (Ta=25°C)	W
T_j	150	°C
T_{stg}	–40 to +150	°C

Electrical characteristics (Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
I_{CBO}			10	μA	V_{CB}=120V
I_{EBO}			3	mA	V_{EB}=6V
V_{CEO}	100			V	I_C=10mA
h_{FE}	2000	6000	12000		V_{CE}=4V, I_C=1A
V_{CE}(sat)		1.1	1.3	V	I_C=1A, I_B=2mA
V_{BE}(sat)		1.7	2.2	V	
t_{on}		0.5		μs	V_{CC}≒30V,
t_{stg}		4.5		μs	I_C=1A,
t_f		1.2		μs	I_{B1}=–I_{B2}=2mA
f_T		50		MHz	V_{CE}=12V, I_E=–0.1A
C_{ob}		20		pF	V_{CB}=10V, f=1MHz

■Equivalent circuit diagram



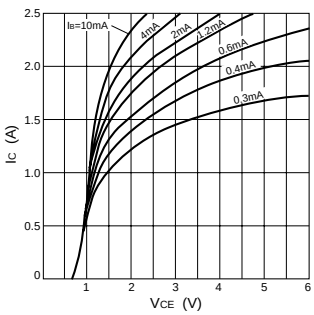
R1: 2.5kΩ typ R2: 200Ω typ

●Diode for flyback voltage absorption (Ta=25°C)

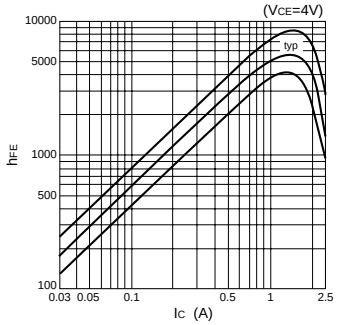
Symbol	Specification			Unit	Conditions
	min	typ	max		
V_R	120			V	I_R=10μA
V_F			1.6	V	I_F=1A
I_R			10	μA	V_R=120V
t_{rr}		100		ns	I_F=±100mA

Characteristic curves

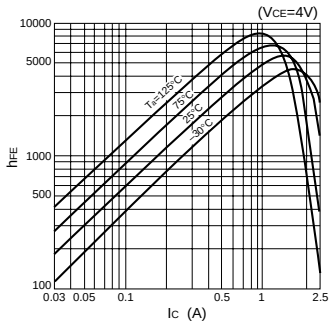
I_C-V_{CE} Characteristics (Typical)



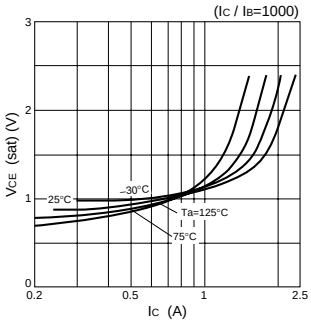
h_{FE}-I_C Characteristics (Typical)



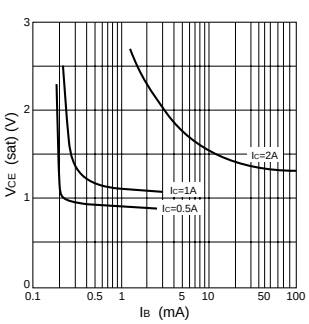
h_{FE}-I_C Temperature Characteristics (Typical)



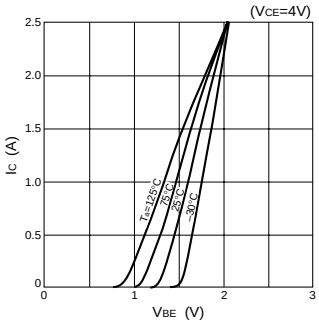
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



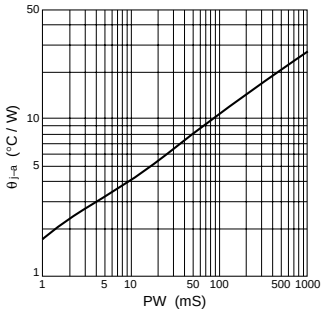
V_{CE}(sat)-I_B Characteristics (Typical)



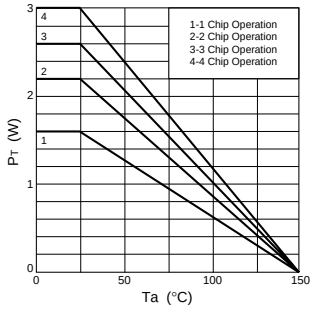
I_C-V_{BE} Temperature Characteristics (Typical)



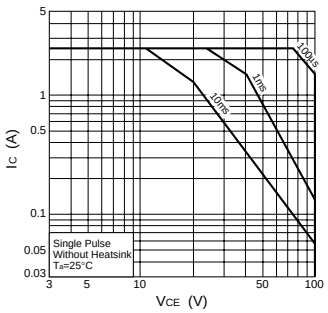
$\theta_{j\text{-}a}$-PW Characteristics



P_T-T_a Characteristics



Safe Operating Area (SOA)

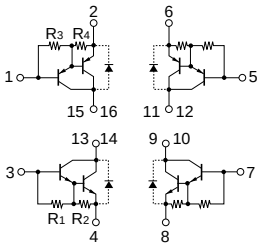


Absolute maximum ratings

(Ta=25°C)

Symbol	Specification		Unit
	NPN	PNP	
V_{CBO}	100	–60	V
V_{CEO}	100	–60	V
V_{EBO}	6	–6	V
I_C	1.5	–1.5	A
I_{CP}	2.5 (PW≤1ms, Du≤100%)	–2.5 (PW≤1ms, Du≤10%)	A
I_B	0.1	–0.1	A
P_T	3 (Ta=25°C)		W
T_j	150		°C
T_{stg}	–40 to +150		°C
θ_{j-a}	41.6		°C/W

■Equivalent circuit diagram

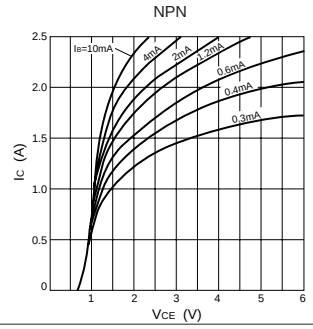


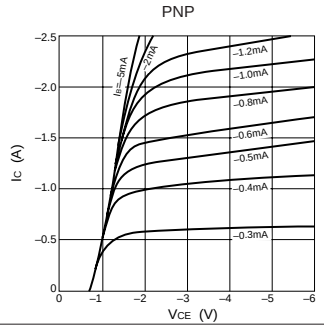
R3: 4kΩ typ
R4: 100Ω typ

R1: 4kΩ typ
R2: 200Ω typ

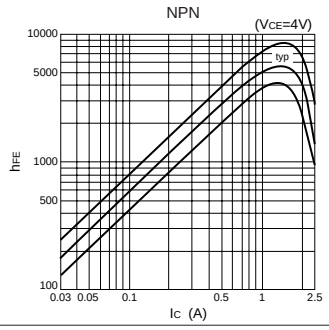
Characteristic curves

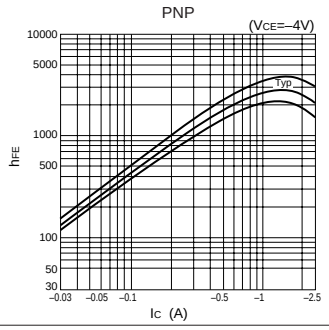
IC-VCE Characteristics (Typical)



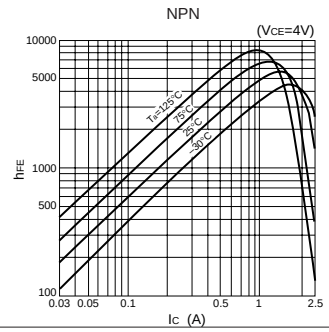


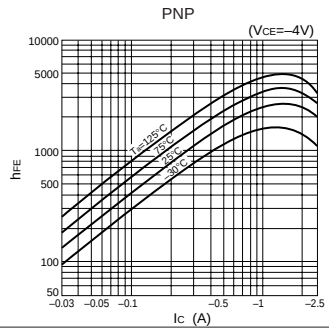
hFE-IC Characteristics (Typical)



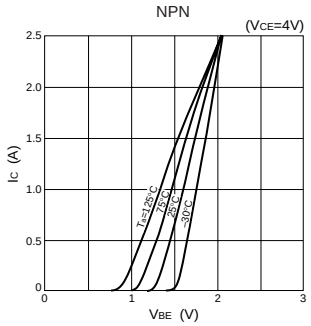


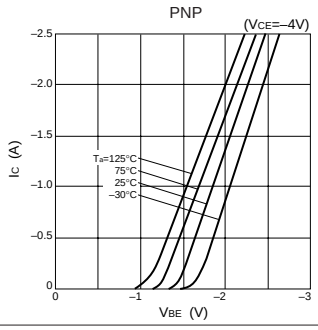
hFE-IC Temperature Characteristics (Typical)





IC-VBE Temperature Characteristics (Typical)





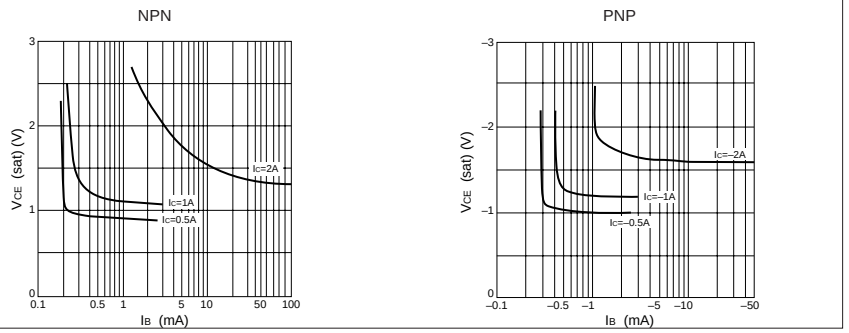
Electrical characteristics

(Ta=25°C)

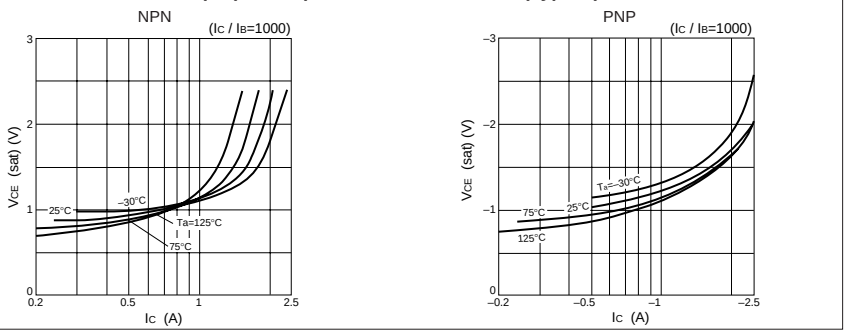
Symbol	NPN					PNP				
	Specification			Unit	Conditions	Specification			Unit	Conditions
	min	typ	max			min	typ	max		
I_{CBO}			10	μA	V_{CB}=100V			–10	μA	V_{CB}=–60V
I_{EBO}			3	mA	V_{EB}=6V			–3	mA	V_{EB}=–6V
V_{CEO}	100			V	I_C=10mA	–60			V	I_C=–10mA
h_{FE}	2000		12000		V_{CE}=4V, I_C=1A	2000		12000		V_{CE}=–4V, I_C=–1A
V_{CE}(sat)			1.3	V	I_C=1A, I_B=2mA			–1.4	V	I_C=–1A, I_B=–2mA
V_{BE}(sat)			2.2	V				–2.2	V	

Characteristic curves

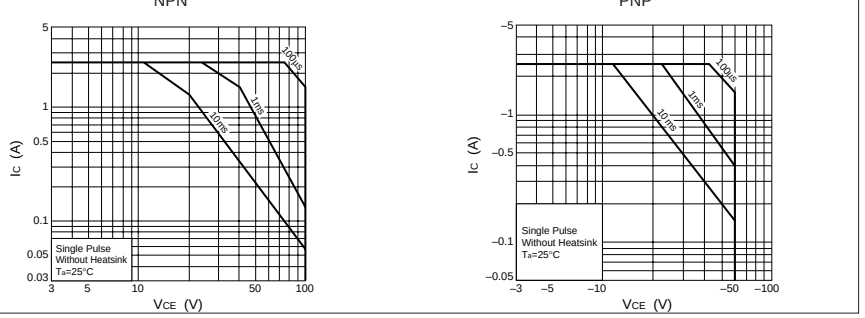
V_{CE}(sat)-I_B Characteristics (Typical)



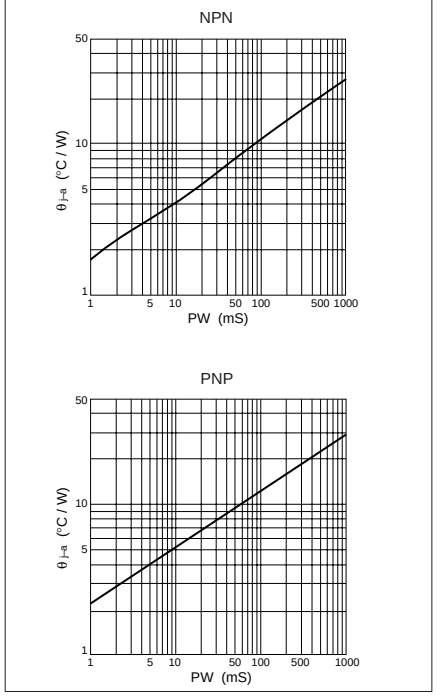
V_{CE}(sat)-I_C Temperature Characteristics (Typical)



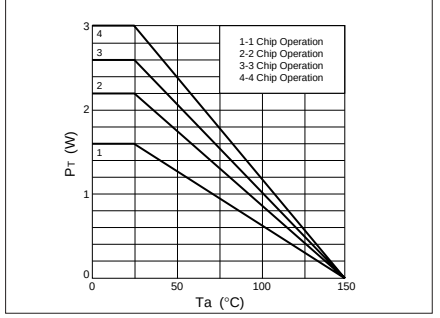
Safe Operating Area (SOA)



$\theta_{j\text{-}a}$-PW Characteristics



P_T-Ta Characteristics



SDK02

N-channel
With built-in flywheel diode

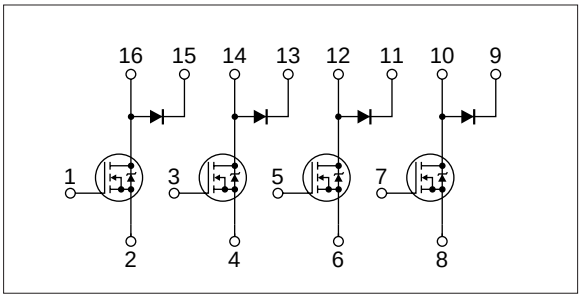
External dimensions Ⓔ ··· SD

Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	±10	V
I_D	±2	A
$I_{D(pulse)}$	±3 (PW≤100μs, Du≤1%)	A
I_F	1.5	A
I_{FSM}	2.5 (PW≤0.5ms, Du≤10%)	A
V_R	120	V
P_T	3 (Ta=25°C, 4-circuit operation)	W
Tch	150	°C
Tstg	–40 to +150	°C

■Equivalent circuit diagram



Electrical characteristics

(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	60			V	I_D=250μA, V_{GS}=0V
I_{GSS}			±500	nA	V_{GS}=±10V
I_{DSS}			250	μA	V_{DS}=60V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.2			S	V_{DS}=10V, I_D=1.0A
$R_{DS(ON)}$		0.19	0.24	Ω	V_{GS}=10V, I_D=1.0A
		0.25	0.30	Ω	V_{GS}=4V, I_D=1.0A
Ciss		400		pF	V_{DS}=25V,
Coss		160		pF	f=1.0MHz,
Crss		35		pF	V_{GS}=0V
V_{SD}		1.0	1.5	V	I_{SD}=2A, V_{GS}=0V
trr		150		ns	I_{SD}=±100mA

●Diode for flyback voltage absorption

Symbol	Specification			Unit	Conditions
	min	typ	max		
V_R	120			V	I_R=10μA
V_F			1.6	V	I_F=1A
I_R			100	Ω	V_R=120V
trr		100		ns	I_F=±100mA

Characteristic curves

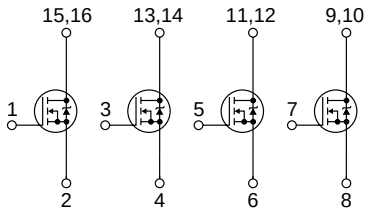
Absolute maximum ratings

(Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	100	V
V_{GSS}	±20	V
I_D	±2	A
$I_{D(pulse)}$	±5 (PW≤100μs, Du≤1%)	A
E_{AS}*	2.7	mJ
P_T	3 (Ta=25°C, 4-circuit operation)	W
Tch	150	°C
Tstg	–40 to +150	°C

* : V_{DD}=25V, L=1mH, I_L=2A, unclamped, R_G=50Ω, see Fig. E on page 15.

■Equivalent circuit diagram



(Ta=25°C)

Symbol	Specification			Unit	Conditions
	min	typ	max		
$V_{(BR)DSS}$	100			V	I_D=100μA, V_{GS}=0V
I_{GSS}			±100	nA	V_{GS}=±20V
I_{DSS}			100	μA	V_{DS}=100V, V_{GS}=0V
V_{TH}	1.0		2.0	V	V_{DS}=10V, I_D=250μA
$Re_{(yfs)}$	1.5			S	V_{DS}=10V, I_D=1.0A
$R_{DS(ON)}$		0.60	0.80	Ω	V_{GS}=10V, I_D=1.0A
		0.75	0.95	Ω	V_{GS}=4V, I_D=1.0A
Ciss		160		pF	V_{DS}=25V,
Coss		40		pF	f=1.0MHz,
Crss		10		pF	V_{GS}=0V
$t_{d(on)}$		7		ns	I_D=1A, V_{DD}≒50V,
t_r		20		ns	R_L=50Ω,
$t_{d(off)}$		35		ns	V_{GS}=10V,
t_f		30		ns	see Fig. 3 on page 16.
V_{SD}		1.0	1.5	V	I_{SD}=2A, V_{GS}=0V
t_{rr}		140		ns	I_{SD}=±100mA

Characteristic curves

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