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SanKen

DEVICES for AUTOMOTIVE

SANKEN ELECTRIC CO.,LTD.

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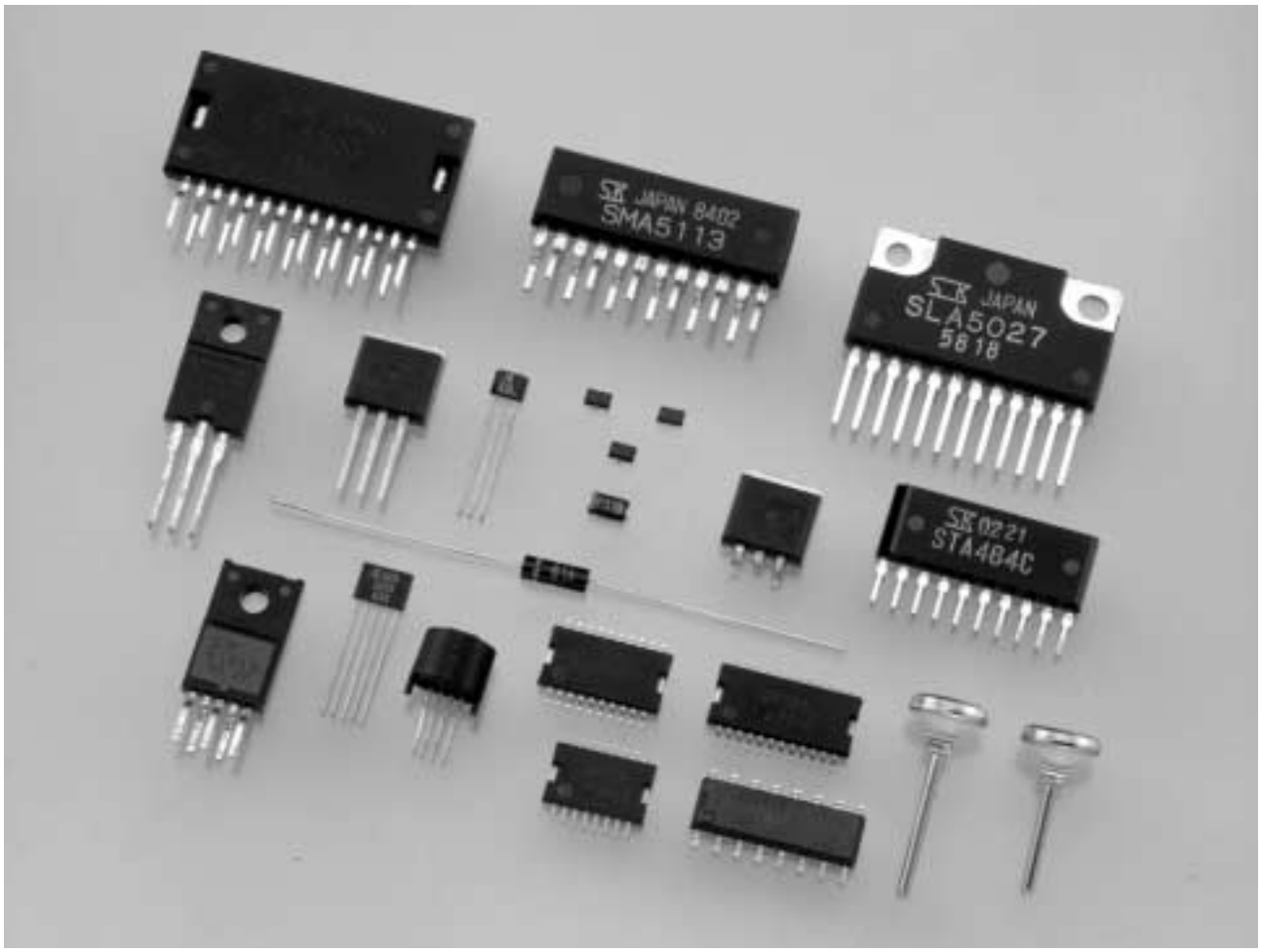
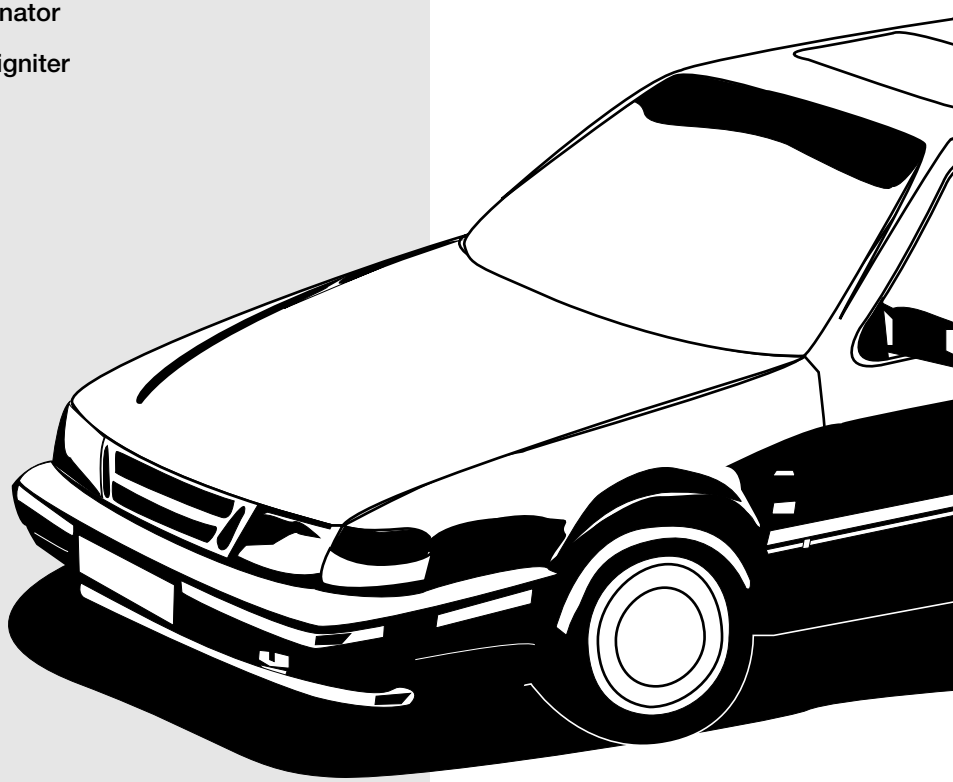
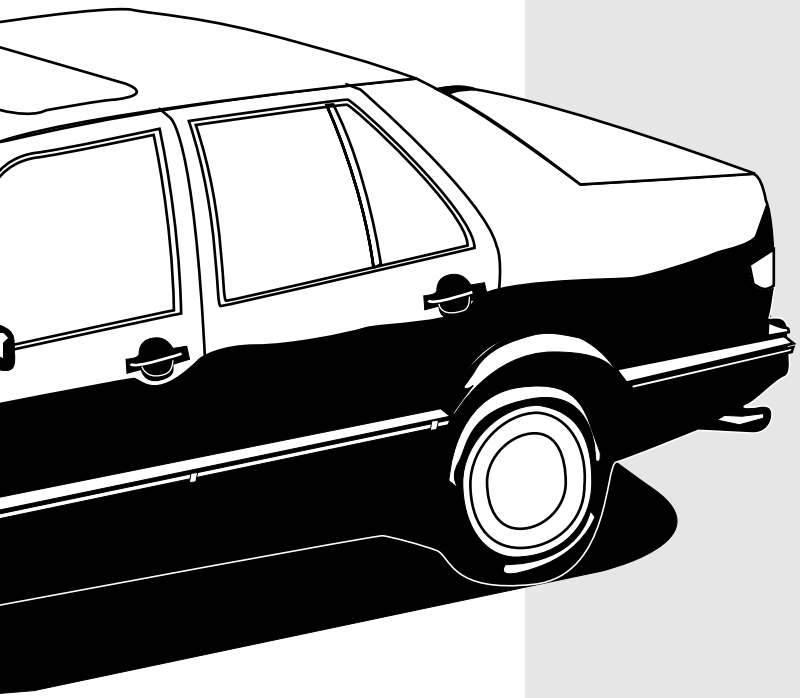

JAPAN 8402
SMA5113
JAPAN
SLA5027
5818
0221
STA484C

Product Groups

- Regulator
- High-side power switch
- Low-side power switch
- Motor driver IC
- Hall-Effect IC
- Custom IC
- Transistor
- MOS FET
- Rectifier Diode for alternator
- High-voltage diode for igniter
- Power Zener diode
- General-purpose diode
- LED (visible & infrared)



Applications



[Power Train Control]

- Engine
  - Fuel injection
  - Ignition control
  - Air ratio control
  - Emission purification control
  - Idling control
  - Knocking and EGR control
  - Variable valve timing control
- Transmission
  - Fully electronic control
  - CVT control
- Alternator

[Carbody Control and Safety]

- 4WD
- 4WS
- ABS
- Power steering
- Auto cruising
- Traction control
- Stability control
- Airbag
- HID Head Lamp

[Compartment Equipment]

- Automatic air conditioner
- Power window
- Keyless entry
- Panel, Multi-media
  - Meter display
  - Car audio
  - Navigation
  - VICS

Contents

Application Note for Regulator ICs

■ Temperature and Reliability

Reliability of an IC is generally heavily dependent on operating temperature. Heat radiation must be fully considered, and an ample margin should be given to the radiating area in designing heatsinks. When mounting ICs on heatsinks, always apply silicone grease and firmly tighten. Air convection should actively be used in actual heat dissipation. The reliability of capacitors and coils, the peripheral components, is also closely related to temperature. A high operating temperature may reduce the service life. Exceeding the allowable temperature may cause coils to be burned or capacitors to be damaged. Make sure that output smoothing coils and input/output capacitors do not exceed their allowable temperature limit in operation. We recommend, in particular, to provide an ample margin for the ratings of coils to minimize heat generation.

■ Power Dissipation (P_D)

1. Dropper Type

$$P_D = I_O \bullet [V_{IN}\,(mean) - V_O]$$

2. Switching Type

$$P_D = V_O \bullet I_O \left(\frac{100}{\eta_\chi} - 1\right) - V_F \bullet I_O \left(1 - \frac{V_O}{V_{IN}}\right)$$

Efficiency η_χ depends on input/output conditions.

Refer to the efficiency characteristics.

V_O : Output voltage η_χ : Efficiency

V_{IN}: Input voltage V_F : Diode forward voltage

I_O : Output current

■ Heatsink Design

The maximum junction temperature Tj (max) and the maximum case temperature Tc (max) given in the absolute maximum ratings are specific to each product type and must be strictly met. Thus, heatsink design must be performed in consideration of the condition of use which affects the maximum power dissipation P_D (max) and the maximum ambient temperature Ta (max). To facilitate heatsink design, the relationship between these two parameters is presented in the Ta-P_D characteristic graphs. Heatsink design must be performed in the following steps:

1. Obtain the maximum ambient temperature Ta (max) (within the set).
2. Obtain the maximum power dissipation P_D (max).
3. Identify the intersection on the Ta-P_D characteristic graph and obtain the size of the heatsink to be used.

The size of a heatsink has been obtained. In actual applications, a 10 to 20% derating factor is generally used. Moreover, the heat dissipation capacity of a heatsink is heavily dependent on how it is mounted. It is therefore important and recommended to measure the heatsink and case temperature in actual operating environments. The Ta-P_D characteristics are provided for each product type for reference purposes.

■ Setting DC Input Voltage

Observe the following precautions when setting the DC input voltage:

- $V_{IN\,(min)}$ must be at least the set output voltage plus dropout voltage for the dropper type. It must be at least the recommended lowest input voltage for the switching type.
- $V_{IN\,(max)}$ must not exceed the DC input voltage of the electrical characteristics.

■ Screw Torque

Screw torque should be between 0.588 to 0.686 [N • m] (6.0 to 7.0 [kgf • cm]).

■ Recommended silicone grease

Volatile type silicone grease may produce cracks after elapse of long term, resulting in reducing heat radiation effect.
Silicone grease with low consistency (hard grease) may cause cracks in the mold resin when screwing the product to a heatsink.

Type	Suppliers
G746	Shin-Etsu Chemical Co., Ltd.
YG6260	GE Toshiba Silicones Co., Ltd.
SC102	Dow Corning Toray Silicone Co., Ltd.

■ Others

This product may not be connected in parallel.
The switching type may not be used for current boosting and stepping up voltage.

Dropper Type Regulator ICs [With Output ON/OFF Control] SI-3001S

Features

- Output current of 1.0A
- 5-terminal type <output on/off control, variable output voltage (rise only)>
- Voltage accuracy of ±2%
- Low dropout voltage ≦1V at I_O ≦1.0A, ≦0.5V at I_O≦0.4A
- Built-in overcurrent, overvoltage and thermal protection circuits
- Withstands external electromagnetic noises
- TO220 equivalent full-mold package

Absolute Maximum Ratings

(Ta = 25°C)

Parameter	Symbol	Ratings	Unit	Conditions
DC Input Voltage	V_{IN}	35	V	
Output Control Terminal Voltage	V_C	V_{IN}	V	
Output Current	I_O	1.0 *1	A	
Power Dissipation	P_{D1}	18	W	With infinite heatsink
	P_{D2}	1.5	W	Stand-alone without heatsink
Junction Temperature	Tj	−40 to +125	°C	
Operating Temperature	T_{OP}	−40 to +100	°C	
Storage Temperature	Tstg	−40 to +125	°C	
Junction to Case Thermal Resistance	θ_{j-c}	5.5	°C/W	
Junction to Ambient-Air Thermal Resistance	θ_{j-a}	66.7	°C/W	Stand-alone without heatsink

Electrical Characteristics

(Tj = 25°C, V_{IN} = 14V unless otherwise specified)

Parameter			Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Input Voltage			V_{IN}	6 *2		30 *1	V	
Output Voltage			V_O	4.90	5.00	5.10	V	V_{IN} = 12 to 16V, I_O = 0.4A
Dropout Voltage			V_{DIF}			0.5	V	I_O ≦ 0.4A
						1.0	V	I_O ≦ 1.0A
Line Regulation			$\Delta V_{O\ LINE}$			30	mV	I_O = 0.4A, V_{IN} = 6 to 16V
Load Regulation			$\Delta V_{O\ LOAD}$			100	mV	I_O = 0 to 0.4A
Output Voltage Temperature Coefficient			$\Delta V_O/\Delta T$		±0.5		mV/°C	I_O = 5mA, Ta = −10 to +100°C
Ripple Rejection			R_{REJ}		54		dB	f = 100 to 120Hz
Quiescent Circuit Current			Iq		3	10	mA	I_O = 0A
Overcurrent Protection Starting Current			I_{S1}	1.2 *3			A	
Vc Terminal	Control Voltage	Output ON	$V_{C,\ IH}$	2.0 *4			V	
		Output OFF	$V_{C,\ IL}$			0.8	V	
	Control Current	Output ON	$I_{C,\ IH}$			20	μA	V_C = 2.7V
		Output OFF	$I_{C,\ IL}$			−0.3	mA	V_C = 0.4V

Notes:

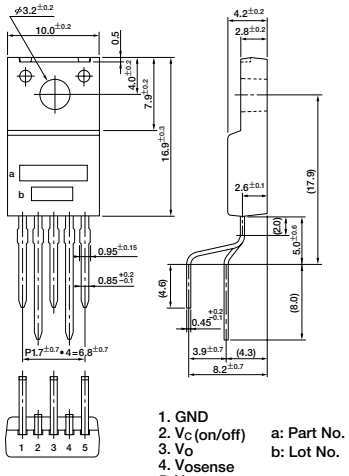
*1. Since $P_D(max) = (V_{IN} - V_O) \cdot I_O = 18(W)$, $V_{IN}(max)$ and $I_O(max)$ may be limited depending on operating conditions. Refer to the Ta-P_D curve to compute the corresponding values.

*2. Refer to the dropout voltage.

*3. I_{S1} rating shall be the point at which the output voltage V_O (V_{IN} = 14V, Io = 0.4A) drops to −5%.

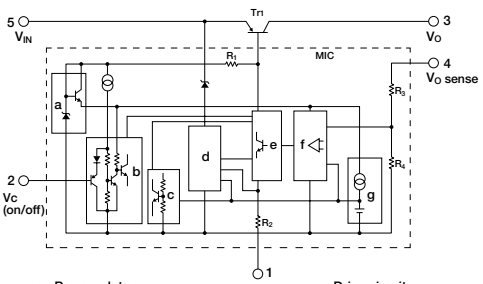
*4. The output control terminal Vc is pulled up inside the IC. Each input level can be directly driven with LS-TTL ICs. Thus, LS-TTL direct driving is also possible.

External Dimensions (unit: mm)

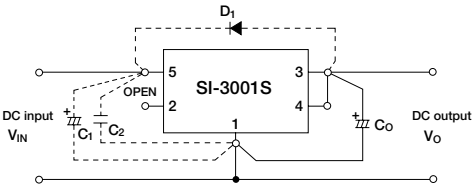


(Forming No. 1101)

Equivalent Circuit Diagram



Standard Circuit Diagram



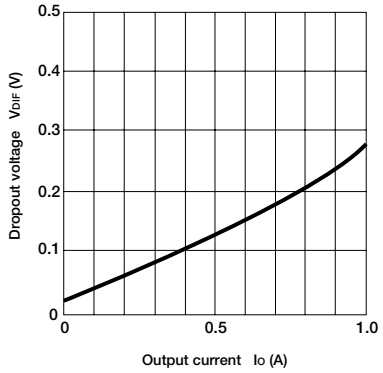
Co : Output capacitor (47 to 100μF, 50V)

C_1, C_2 : Input capacitors (C_1: approx. 47μF, C_2: approx. 0.33μF). These are required for inductive input lines or long wiring. Tantalum capacitors are recommended for C_1 and Co, especially at low temperatures.

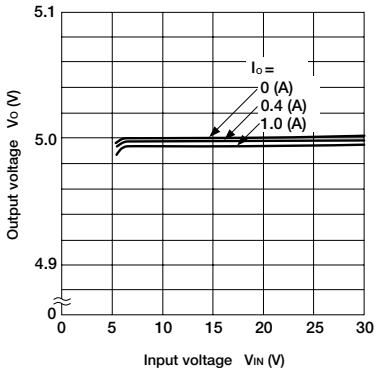
D_1 : Protection diode. Required as protection against reverse biasing between input and output. (Recommended diode: Sanken EU2Z.)

Electrical Characteristics

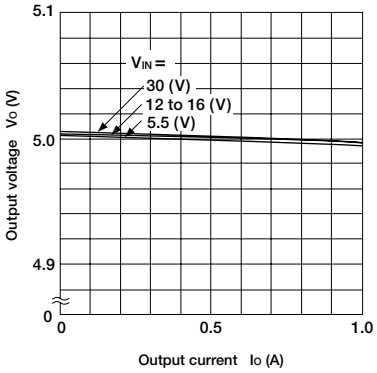
■ I_O vs V_{DIF} Characteristicsc



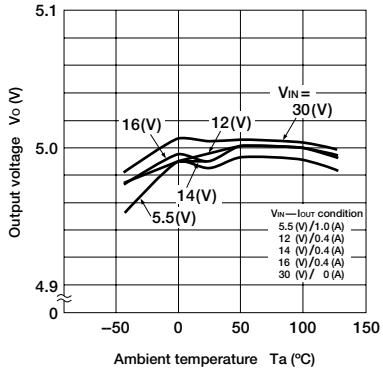
■ Line Regulation



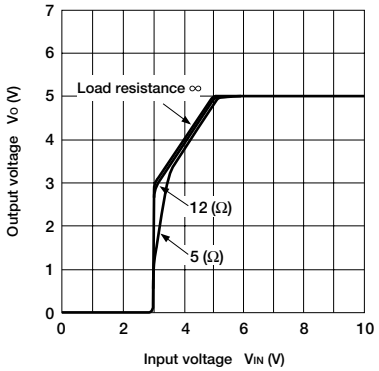
■ Load Regulation



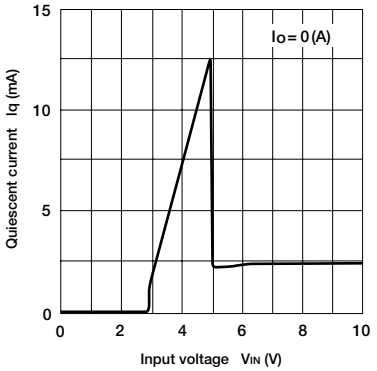
■ Output Voltage Temperature Characteristics



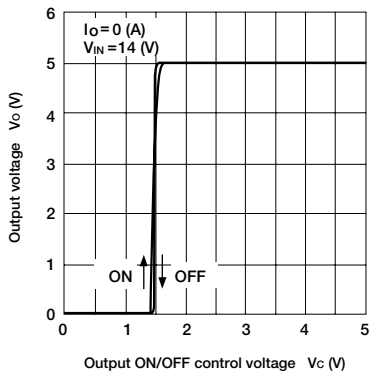
■ Rise Characteristics



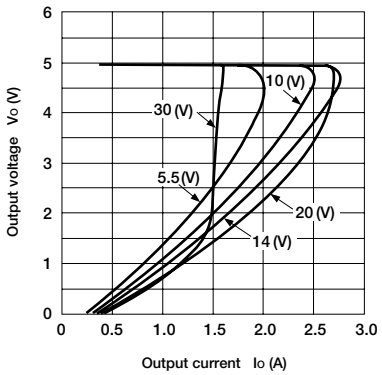
■ Quiescent Circuit Current



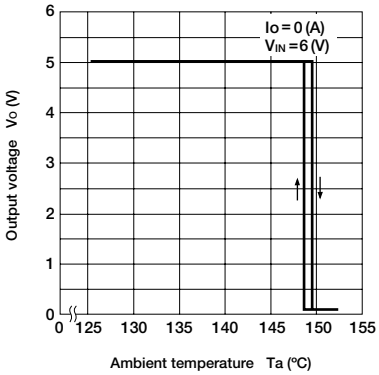
■ ON/OFF Control Characteristics



■ Overcurrent Protection Characteristics

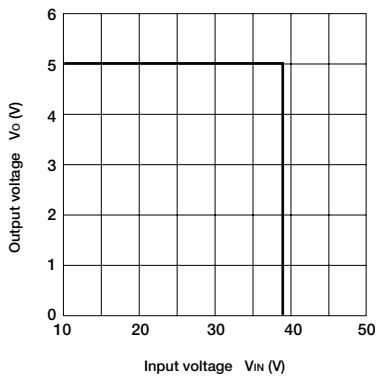


■ Thermal Protection Characteristics

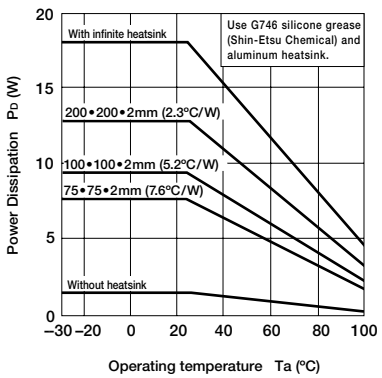


Note on Thermal Protection Characteristics:
The thermal protection circuit is intended for protection against heat during instantaneous short-circuiting. Its operation, including reliability, is not guaranteed for short-circuiting over an extended period of time.

■ Overvoltage Protection Characteristics



■ Ta—P_D Characteristics



Dropper Type Regulator ICs [3-terminal] SI-3003S

Features

- 3-terminal IC regulator with 0.8A output current
- Voltage accuracy of ±2%
- Low Dropout voltage ≦0.5V at I_O≦0.5A, ≦1V at I_O≦0.8A
- Built-in dropping type overcurrent, overvoltage and thermal protection circuits
- TO220 equivalent full-mold package

Absolute Maximum Ratings

(Ta=25ºC)

Parameter	Symbol	Ratings	Unit	Conditions
DC input voltage	V_{IN}	35	V	
Output current	I_O	0.8 *2	A	
Power Dissipation	P_{D1}	22	W	With infinite heatsink
	P_{D2}	1.8	W	Stand-alone without heatsink
Junction temperature	Tj	−40 to +150	ºC	
Operating temperature	T_{OP}	−40 to +100	ºC	
Storage temperature	Tstg	−40 to +150	ºC	
Junction to case thermal resistance	$\theta_{j\text{-}c}$	5.5	ºC/W	
Junction to ambient-air thermal resistance	$\theta_{j\text{-}a}$	66.7	ºC/W	Stand-alone without heatsink

Electrical Characteristics

(Tj=25ºC, V_{IN}=14V, I_O=0.5A unless otherwise specified)

Parameter	Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Input voltage	V_{IN}	6*2		30*1	V	
Output voltage	V_O	4.90	5.00	5.10	V	
Dropout voltage	V_{DIF}			0.5	V	I_O≦0.5A
				1.0	V	I_O≦0.8A
Line regulation	$\Delta V_{O\ LINE}$			30	mV	V_{IN}=8 to 16V
Load regulation	$\Delta V_{O\ LOAD}$			100	mV	I_O=0 to 0.5A
Ripple rejection	R_{REJ}		54		dB	f=100 to 120Hz
Quiescent circuit current	Iq		3	10	mA	I_O=0A
Overcurrent protection starting current	I_{S1}	0.9*3			A	

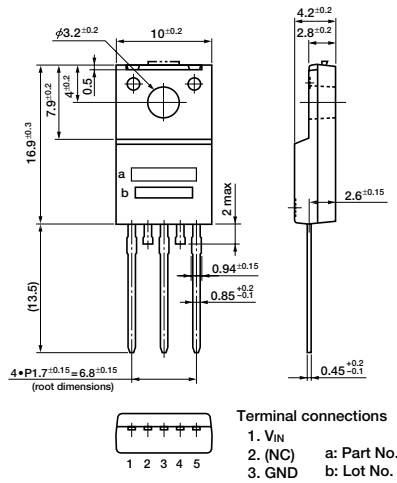
Notes:

*1. Since $P_{D(max)} = (V_{IN}-V_O) \bullet I_O$=22(W), $V_{IN(max)}$ and $I_{O(max)}$ may be limited depending on operating conditions. Refer to the Ta—P_D curve to compute the corresponding values.

*2. Refer to the dropout voltage.

*3. IS1 rating shall be the point at which the output voltage V_O (V_{IN}=14V, I_O=0.5A) drops to −5%.

External Dimensions (unit: mm)

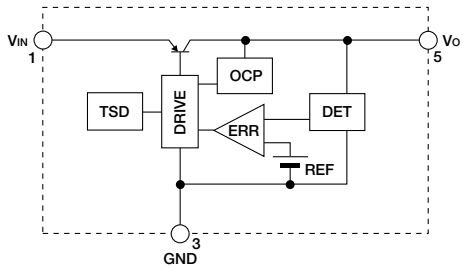


Terminal connections
1. V_{IN}
2. (NC)
3. GND
4. (NC)
5. V_O

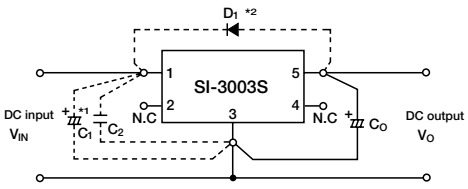
a: Part No.
b: Lot No.

(Forming No. 1115)

Equivalent Circuit Diagram



Standard Circuit Diagram



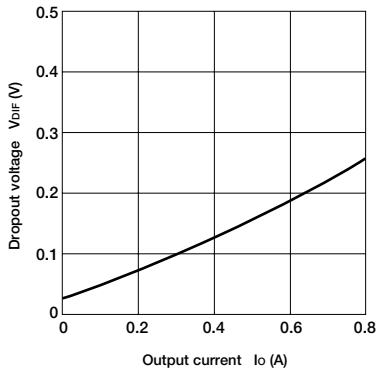
Co : Output capacitor (47 to 100μF, 50V)

*1 C_1, C_2: Input capacitors (C_1: approx. 47μF, C_2: approx. 0.33μF). These are required for inductive input lines or long wiring. Tantalum capacitors are recommended for C_1 and Co, especially at low temperatures.

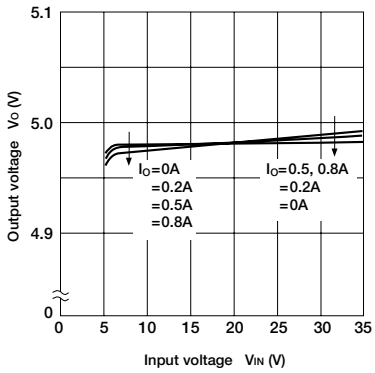
*2 D_1 : Protection diode. Required as protection against reverse biasing between input and output. (Recommended diode: Sanken EU2Z.)

Electrical Characteristics

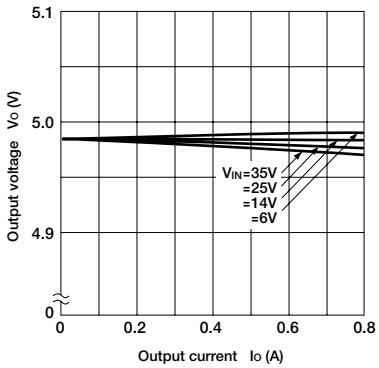
■ I_O vs V_{DIF} Characteristics



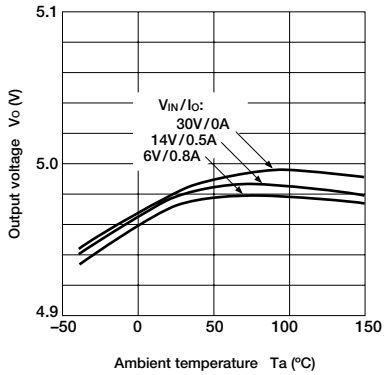
■ Line Regulation



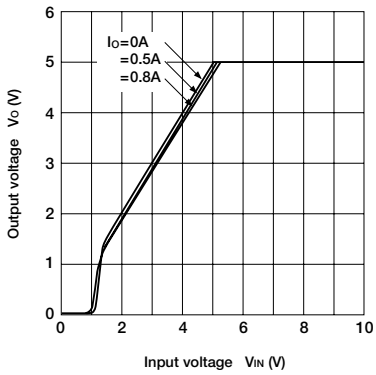
■ Load Regulation



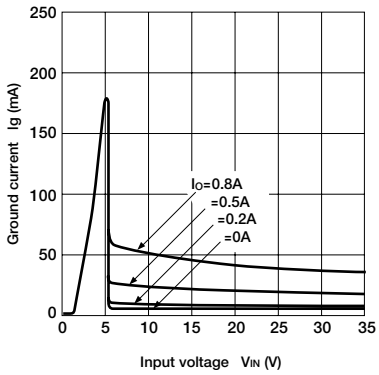
■ Output Voltage Temperature Characteristics



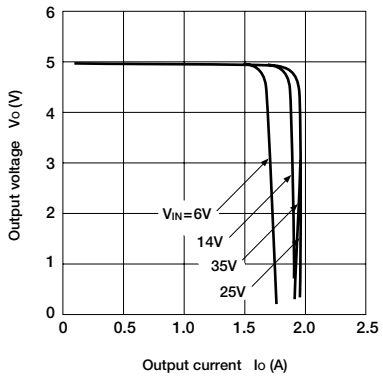
■ Rise Characteristics



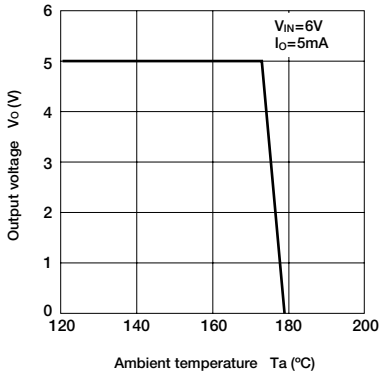
■ Circuit Current



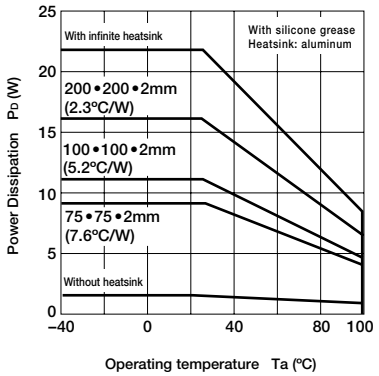
■ Overcurrent Protection Characteristics



■ Thermal Protection Characteristics



■ Ta—P_D Characteristics



Note on Thermal Protection Characteristics:
The thermal protection circuit is intended for protection against heat during instantaneous short-circuiting. Its operation, including reliability, is not guaranteed for short-circuiting over an extended period of time.

Dropper Type Regulator ICs [2-output] SI-3101S

Features

- Single input dual output <sub output (5V/0.07A), main output (5V/0.4A)>
- Main output can be externally turned ON/OFF (with ignition switch, etc.) <most suitable as memory backup power supply>
- Low standby current (≦0.8mA)
- Low dropout voltage ≦1V
- Built-in dropping type overcurrent, overvoltage and thermal protection circuits
- TO220 equivalent 5-terminal full-mold package

Absolute Maximum Ratings

(Ta=25ºC)

Parameter		Symbol	Ratings	Unit	Conditions
DC input voltage		V_{IN}	40	V	
Battery reverse connection		V_{INB}	−13 *6	V	One minute
Output control terminal voltage		V_C	V_{IN}	V	
Output current	CH1	I_{O1}	0.07 *1	A	
	CH2	I_{O2}	0.4 *1	A	
Power Dissipation		P_{D1}	18	W	With infinite heatsink
		P_{D2}	1.5	W	Stand-alone without heatsink
Junction Temperature		Tj	−40 to +125	ºC	
Operating temperature		T_{OP}	−40 to +115	ºC	
Storage temperature		Tstg	−40 to +125	ºC	
Junction to case thermal resistance		θ_{j-c}	5.5	ºC/W	
Junction to ambient-air thermal resistance		θ_{j-a}	66.7	ºC/W	Stand-alone without heatsink

Electrical Characteristics

(Tj=25ºC, V_{IN}=14V unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Input voltage		V_{IN}	6 *2		35 *1	V	
Output voltage	CH1	V_{O1}	4.80	5.00	5.20	V	I_O=0.05A
	CH2	V_{O2}	4.80	5.00	5.20	V	I_O=0.3A
Channel-channel voltage difference (V_{O1}—V_{O2})		ΔV_O	−0.1		0.1	V	I_{O1}=0 to 0.05A I_{O2}=0 to 0.3A
Dropout voltage	CH1	V_{DIF1}			1.0	V	I_{O1}≦0.05A
	CH2	V_{DIF2}			1.0	V	I_{O2}≦0.4A
Line regulation	CH1	$\Delta V_{O\ LINE1}$		10	30	mV	V_{IN}=6 to 18V, I_O=0.05A
	CH2	$\Delta V_{O\ LINE2}$		10	30	mV	V_{IN}=6 to 18V, I_O=0.3A
Load regulation	CH1	$\Delta V_{O\ LOAD1}$		30	70	mV	I_{O1}=0 to 0.05A
	CH2	$\Delta V_{O\ LOAD2}$		40	70	mV	I_{O2}=0 to 0.3A
Ripple rejection	CH1	R_{REJ1}		54		dB	f=100 to 120Hz
	CH2	R_{REJ2}		54		dB	f=100 to 120Hz
Quiescent circuit current		Iq			0.8	mA	I_{O1}=0A, V_C=0V
Overcurrent protection starting current	CH1	$I_{(S1)\,1}$	0.1 *3			A	
	CH2	$I_{(S1)\,2}$	0.5 *3			A	
Output control voltage	Output ON	V_{CH}	4.2	4.5	4.8	V	
	Output OFF	V_{CL}	3.2	3.5	3.8	V	
Output control current	Output ON	I_{CH}			100	μA	V_C=4.8V
	Output OFF	I_{CL}	−100			μA	V_C=3.2V
Overvoltage protection starting voltage		V_{OVP}	35 *4			V	
Thermal protection starting temperature		T_{TSD}	130 *5			ºC	

Notes:

*1. Since $P_D(max) = (V_{IN}-V_O) \cdot I_{O1} + (V_{IN}-V_{O2}) \cdot I_{O2} = 18$ (W), $V_{IN}(max)$, $I_{O1}(max)$ and $I_{O2}(max)$ may be limited depending on operating conditions. Refer to the Ta—P_D curve to compute the corresponding values.

*2. Refer to the dropout voltage.

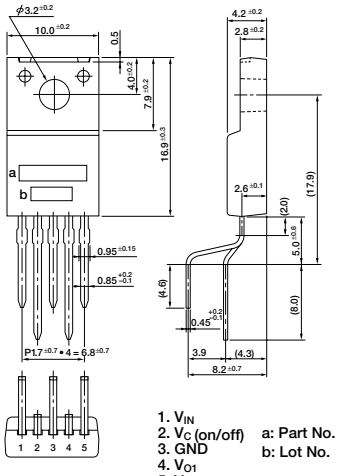
*3. I_{S1} rating shall be the point at which the output voltage V_{O1} or V_{O2} (V_{IN}=14V, I_{O1}=0.05A or I_{O2}=0.3A) drops to −5%.

*4. Overvoltage protection circuit is built only in CH2 (V_{O2} side).

*5. The indicated temperatures are junction temperatures.

*6. All terminals, except V_{IN} and GND, are open.

External Dimensions (unit: mm)

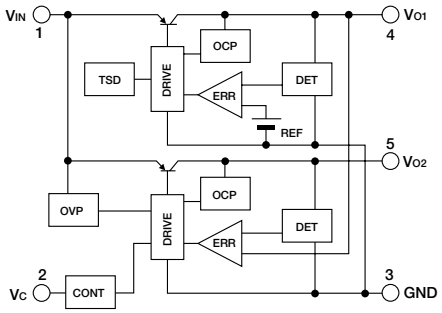


1. V_{IN}
2. V_C (on/off)
3. GND
4. V_{O1}
5. V_{O2}

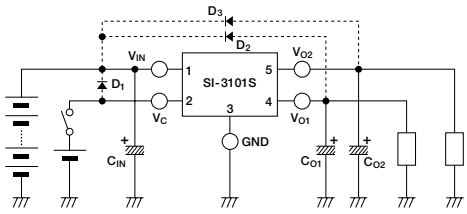
a: Part No.
b: Lot No.

(Forming No. 1101)

Equivalent Circuit Diagram



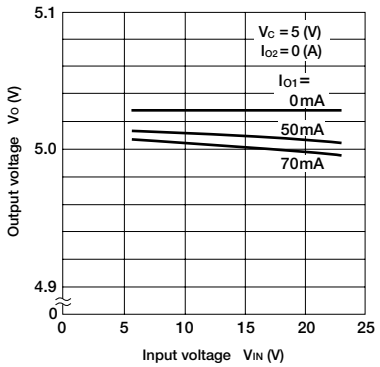
Standard Circuit Diagram



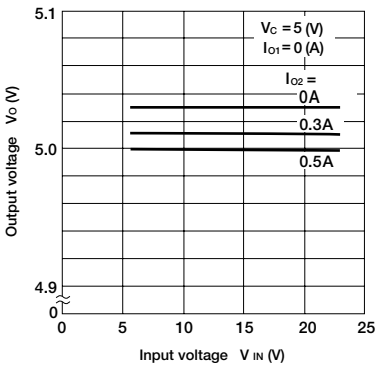
C_{O1} : Output capacitor (47 to 100μF, 50V)
C_{O2} : Output capacitor (47 to 100μF, 50V)
*1 C_{IN} : Input capacitors (approx. 47μF).
Tantalum capacitors are recommended for C_{O1}, C_{O2} and C_{IN}, especially at low temperatures.
*2 D_1, D_2, D_3 : Protection diode.
Required as protection against reverse biasing between input and output.
(Recommended diode: Sanken EU2Z.)

Electrical Characteristics

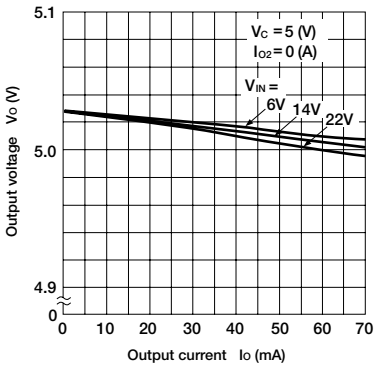
■ Line Regulation (1)



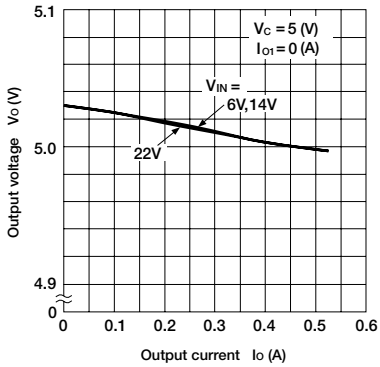
■ Line Regulation (2)



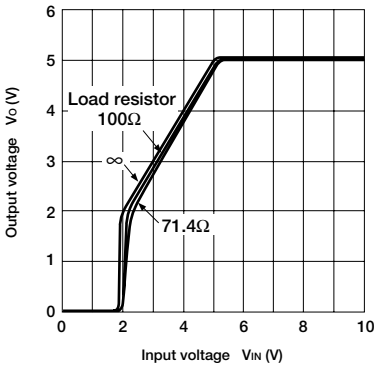
■ Load Regulation (1)



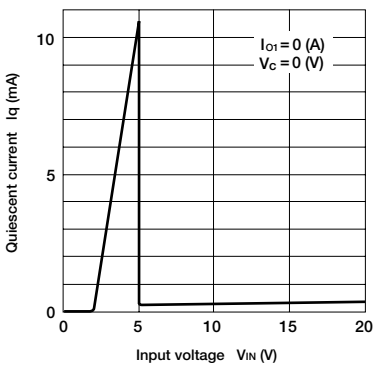
■ Load Regulation (2)



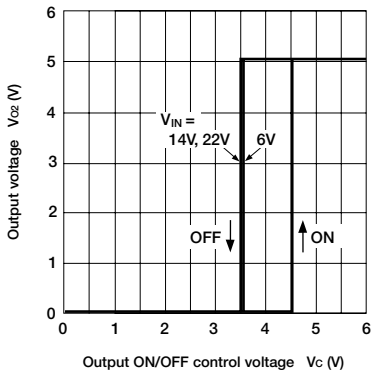
■ Rise Characteristics



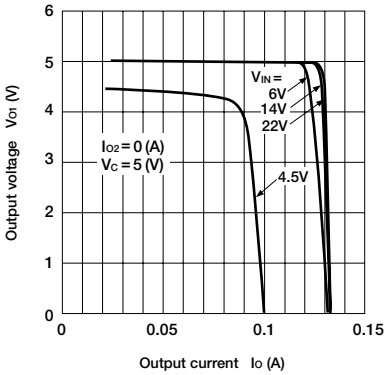
■ Quiescent Circuit Current



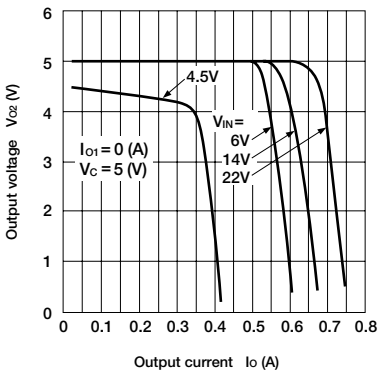
■ ON/OFF Control Characteristics



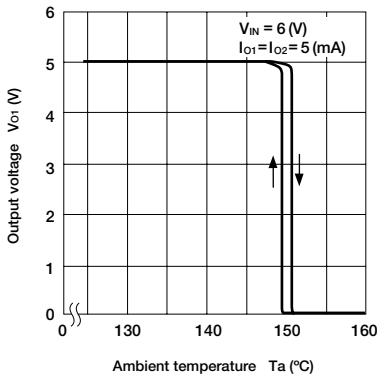
■ Overcurrent Protection Characteristics (1)



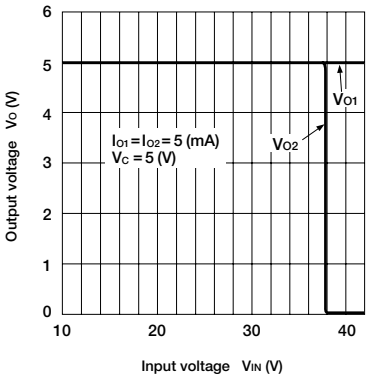
■ Overcurrent Protection Characteristics (2)



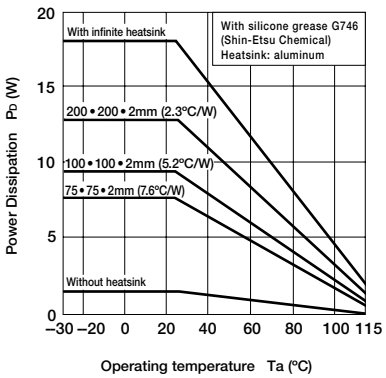
■ Thermal Protection Characteristics



■ Overvoltage Protection Characteristics



■ Ta—P_D Characteristics



Note on Thermal Protection Characteristics:
The thermal protection circuit is intended for protection against heat during instantaneous short-circuiting. Its operation, including reliability, is not guaranteed for short-circuiting over an extended period of time.

Features

- Single input dual output <sub output (5V/0.04A), main output (5V/0.1A)>
- Main output can be externally turned ON/OFF (with ignition switch, etc.) <most suitable as memory backup power supply>
- Low standby current (≦0.8mA)
- Low dropout voltage ≦1V
- Built-in dropping type overcurrent, overvoltage and thermal protection circuits
- TO220 equivalent 5-terminal full-mold miniature package

Absolute Maximum Ratings

(Ta=25ºC)

Parameter		Symbol	Ratings	Unit	Conditions
DC input voltage		V_{IN}	35	V	
Battery reverse connection		V_{INB}	–13 *6	V	One minute
Output control terminal voltage		V_C	V_{IN}	V	
Output current	CH1	I_{O1}	0.04 *1	A	
	CH2	I_{O2}	0.1 *1	A	
Power Dissipation		P_{D1}	22	W	With infinite heatsink
		P_{D2}	1.8	W	Stand-alone without heatsink
Junction temperature		Tj	–40 to +150	ºC	
Operating temperature		T_{OP}	–40 to +105	ºC	
Storage temperature		Tstg	–40 to +150	ºC	
Junction to case thermal resistance		θ_{j-c}	5.5	ºC/W	
Junction to ambient-air thermal resistance		θ_{j-a}	66.7	ºC/W	Stand-alone without heatsink

Electrical Characteristics

(Tj=25ºC, V_{IN}=14V unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Input voltage		V_{IN}	6 *2		30 *1	V	
Output voltage	CH1	V_{O1}	4.80	5.00	5.20	V	I_O=0.04A
	CH2	V_{O2}	4.80	5.00	5.20	V	I_O=0.1A
Channel-channel voltage difference (V_{O1}—V_{O2})		ΔV_O	–0.1		0.1	V	I_{O1}=0 to 0.04A I_{O2}=0 to 0.1A
Dropout voltage	CH1	V_{DIF1}			1.0	V	I_{O1}≦0.04A
	CH2	V_{DIF2}			1.0	V	I_{O2}≦0.1A
Line regulation	CH1	$\Delta V_{O\ LINE1}$		10	50	mV	V_{IN}=6 to 30V, I_O=0.04A
	CH2	$\Delta V_{O\ LINE2}$		10	50	mV	V_{IN}=6 to 30V, I_O=0.1A
Load regulation	CH1	$\Delta V_{O\ LOAD1}$		30	70	mV	I_{O1}=0 to 0.04A
	CH2	$\Delta V_{O\ LOAD2}$		40	70	mV	I_{O2}=0 to 0.1A
Ripple rejection	CH1	R_{REJ1}		54		dB	f=100 to 120Hz
	CH2	R_{REJ2}		54		dB	f=100 to 120Hz
Quiescent circuit current		Iq			0.8	mA	I_{O1}=0A, V_C=0V
Overcurrent protection starting current	CH1	$I_{(S1)\,1}$	0.06 *3			A	
	CH2	$I_{(S1)\,2}$	0.15 *3			A	
Output control voltage	Output ON	V_{CH}	4.2	4.5	4.8	V	
	Output OFF	V_{CL}	3.2	3.5	3.8	V	
Output control current	Output ON	I_{CH}			100	μA	V_C=4.8V
	Output OFF	I_{CL}	–100			μA	V_C=3.2V
Overvoltage protection starting voltage		V_{OVP}	30 *4			V	
Thermal protection starting temperature		T_{TSD}	151 *5			ºC	

Notes:

*1. Since $P_{D(max)} = (V_{IN}-V_O) \bullet I_{O1} + (V_{IN}-V_{O2}) \bullet I_{O2} = 22$ (W), $V_{IN\,(max)}$, $I_{O1(max)}$ and $I_{O2(max)}$ may be limited depending on operating conditions. Refer to the Ta—P_D curve to compute the corresponding values.

*2. Refer to the dropout voltage.

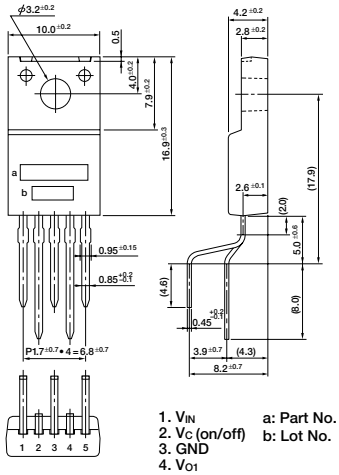
*3. I_{S1} rating shall be the point at which the output voltage V_{O1} or V_{O2} (V_{IN}=14V, I_{O1}=0.04A or I_{O2}=0.1A) drops to –5%.

*4. Overvoltage protection circuit is built only in CH2 (V_{O2} side).

*5. The indicated temperatures are junction temperatures.

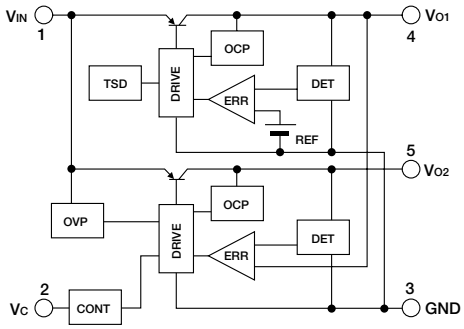
*6. All terminals, except V_{IN} and GND, are open.

External Dimensions (unit: mm)

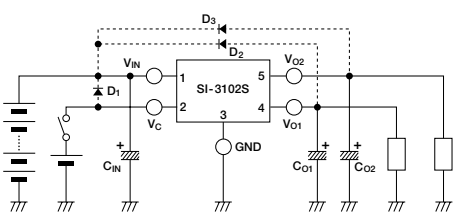


(Forming No. 1101)

Equivalent Circuit Diagram



Standard Circuit Diagram



C_{O1} : Output capacitor (47 to 100μF, 50V)

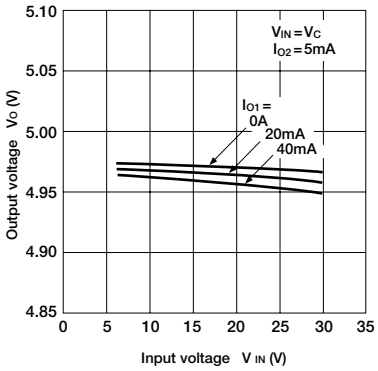
C_{O2} : Output capacitor (47 to 100μF, 50V)

*1 C_{IN} : Input capacitors (approx. 47μF).
Tantalum capacitors are recommended, for C_{O1}, C_{O2} and C_{IN}, especially at low temperatures.

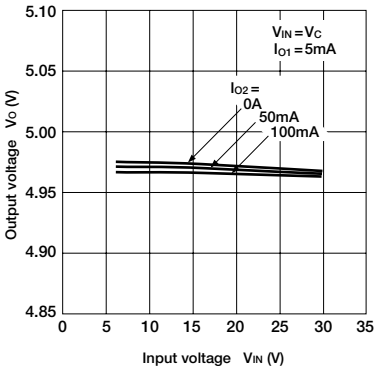
*2 D_1, D_2, D_3 : Protection diode.
Required as protection against reverse biasing between input and output.
(Recommended diode: Sanken EU2Z.)

Electrical Characteristics

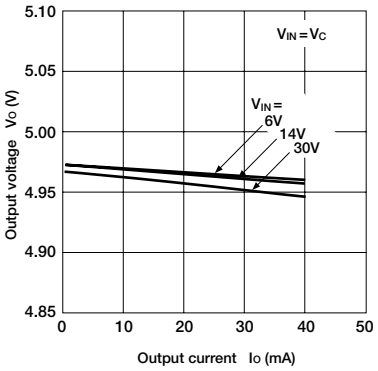
■ Line Regulation (1)



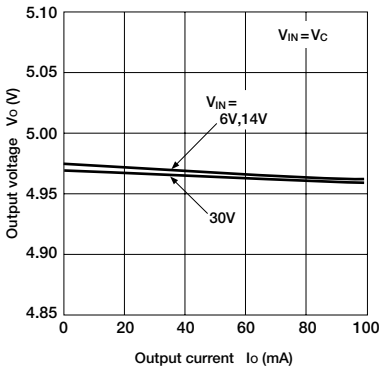
■ Line Regulation (2)



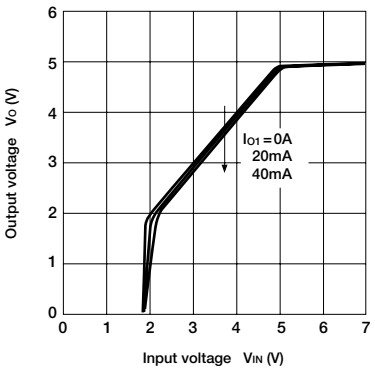
■ Load Regulation (1)



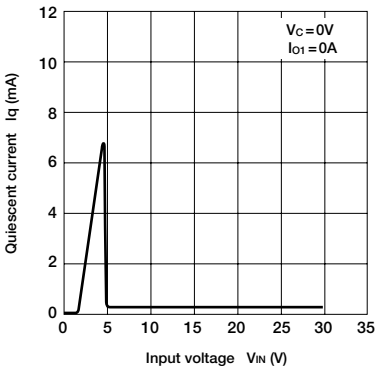
■ Load Regulation (2)



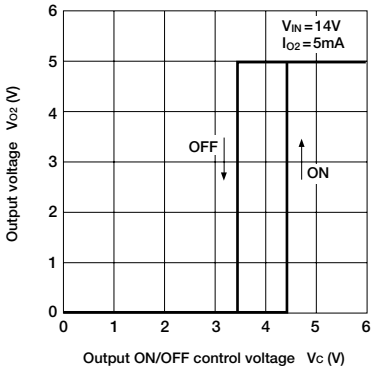
■ Rise Characteristics



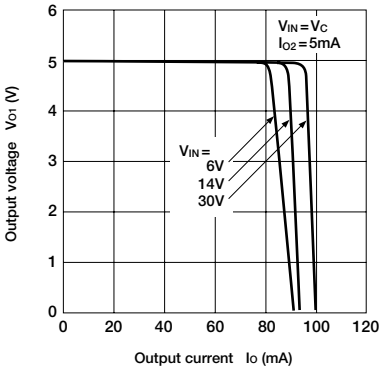
■ Quiescent Circuit Current



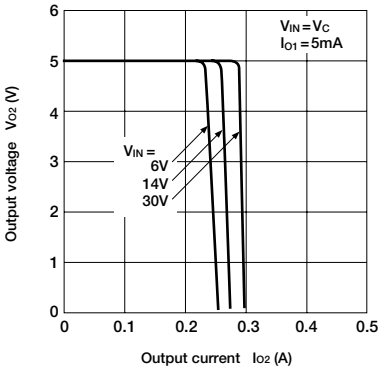
■ ON/OFF Control Characteristics



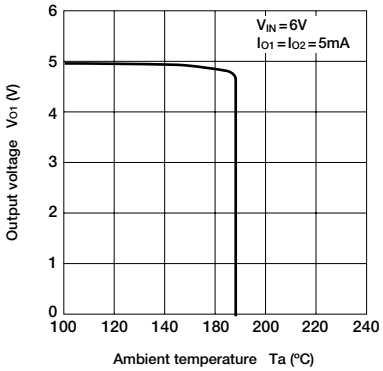
■ Overcurrent Protection Characteristics (1)



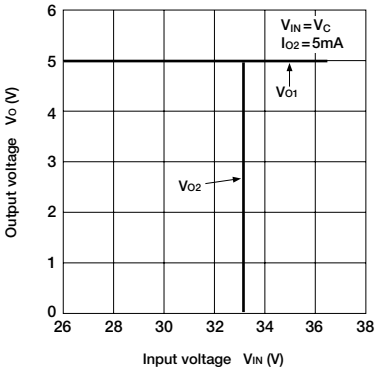
■ Overcurrent Protection Characteristics (2)



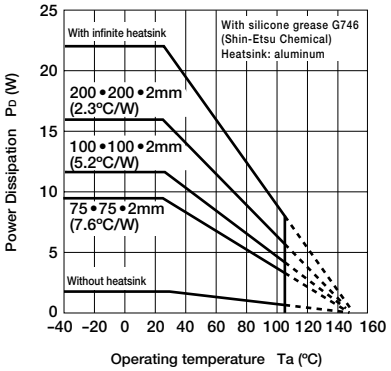
■ Thermal Protection Characteristics



■ Overvoltage Protection Characteristics



■ Ta—PD Characteristics



Note on Thermal Protection Characteristics:
The thermal protection circuit is intended for protection against heat during instantaneous short-circuiting. Its operation, including reliability, is not guaranteed for short-circuiting over an extended period of time.

Switching Type Regulator ICs SI-3201S

Features

- Output current of 3A (Ta = 25ºC, V_{IN} = 8 to 18V)
- High efficiency of 82% (V_{IN} = 14V, I_O = 2A)
- Requires 5 external components only
- Built-in reference oscillator (60kHz)
- Phase internally corrected
- Output voltage internally corrected
- Built-in overcurrent and thermal protection circuits
- Built-in soft start circuit

Absolute Maximum Ratings

(Ta=25ºC)

Parameter	Symbol	Ratings	Unit	Conditions
Input voltage	V_{IN}	35	V	
Output voltage	I_O	3	A	
SW_{OUT} terminal voltage	V_{SWOUT}	–1	V	
Power Dissipation	P_{D1}	22	W	With infinite heatsink
	P_{D2}	1.8	W	Stand-alone
Junction temperature	Tj	–40 to +150	ºC	
Storage temperature	Tstg	–40 to +125	ºC	
Junction to case thermal resistance	$\theta_{j\text{-}c}$	5.5	ºC/W	
Junction to ambient-air thermal resistance	$\theta_{j\text{-}a}$	66.7	ºC/W	

Recommended Operating Conditions

Parameter	Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Input voltage	V_{IN}	8		18	V	
Output current	I_O	0.5		3	A	
Operating temperature	Top	–40		+85	ºC	Ta—P_D characteristics

Electrical Characteristics

(V_{IN} = 14V, I_{OUT} = 2A, Tj = 25ºC unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Output voltage		V_O	4.80	5.00	5.20	V	
Line regulation		$\Delta V_{O\ LINE}$			100	mV	V_{IN} = 8 to 18V
Load regulation		$\Delta V_{O\ LOAD}$			50	mV	I_O = 0.5 to 3A
Efficiency *1		η		82		%	
Oscillation frequency		f_{OSC}	50	60	70	kHz	
Quiescent circuit current		Iq		5	10	mA	I_O = 0A
Overcurrent protection starting current		I_S	3.1			A	*2
Soft start terminal *3	Low level voltage	V_{SSL}			0.2	V	
	Source current when low	I_{SSL}	15	25	35	μA	V_{SSL} = 0.2V
	Discharge resistance	R_{DIS}		200		kΩ	V_{IN} = 0V

Notes:

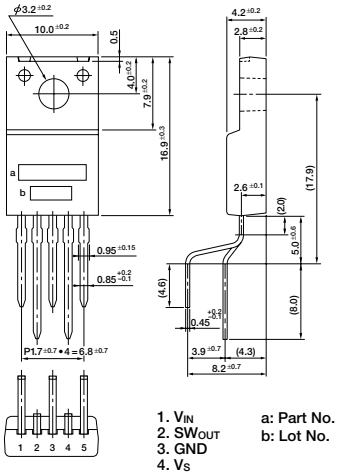
*1. Efficiency is calculated by the following equation:

$$\eta = \frac{V_O \bullet I_O}{V_{IN} \bullet I_{IN}} \bullet 100\ (\%)$$

*2. A dropping-type overcurrent protection circuit is built in the IC.

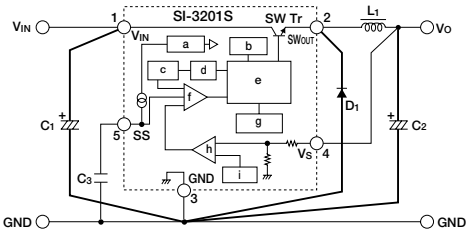
*3. An external voltage may not be applied to the soft start terminal. As shown in the diagram to the right, use this IC in the soft start mode with a capacitor or in the open-collector drive mode with a transistor. Leave the soft start terminal open when not using it since it is already pulled up in the IC.

External Dimensions (unit: mm)



(Forming No. 1101)

Standard Circuit Diagram

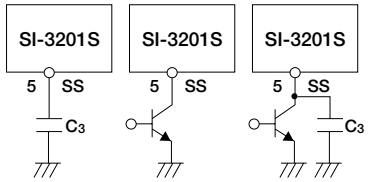


C_1: 1000μF
C_2: 1000μF
L_1: 250μH
D_1: RK46 (Sanken)

a: Internal power supply
b: Thermal protection
c: Reference oscillator
d: Reset
e: Latch & driver
f: Comparator
g: Overcurrent protection
h: Error amplifier
i: Reference voltage

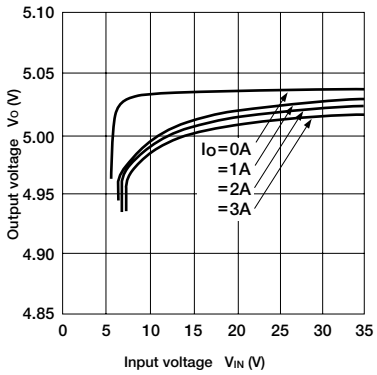
Cautions:

(1) A high-ripple current flows through C_1 and C_2. Use high-ripple type 1000μF or higher capacitors with low internal resistance. Refer to the respective data books for more information on reliability and electrical characteristics of the capacitor.
(2) C_3 is a capacitor used for soft start.
(3) L_1 should be a choke coil with a low core loss for switching power supplies.
(4) Use a Schottky barrier diode for D_1 and make sure that the reverse voltage applied to the 2nd terminal (SW_{OUT} terminal) is within the maximum ratings (–1V). If you use a fast-recovery diode, the recovery voltage and the ON forward voltage may cause a reversed-bias voltage exceeding the maximum ratings to be applied to the 2nd terminal (SW_{OUT} terminal). Applying a reversed-bias voltage exceeding the maximum rating to the 2nd terminal (SW_{OUT} terminal) may damage the IC.
(5) The 4th terminal (V_S) is an output voltage detection terminal. Since this terminal has a high impedance, connect it to the positive (+) terminal of C_2 via the shortest possible route.
(6) Leave the 5th terminal (soft start terminal) open when not using it. It is pulled up internally.
(7) To ensure optimum operating environment, connect the high-frequency current line with minimum wiring length.

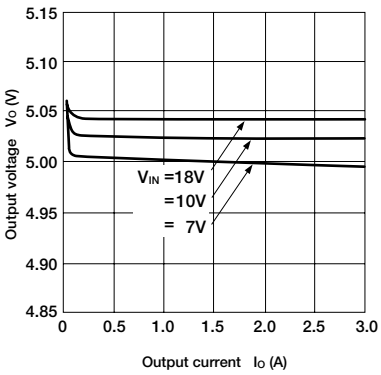


Electrical Characteristics

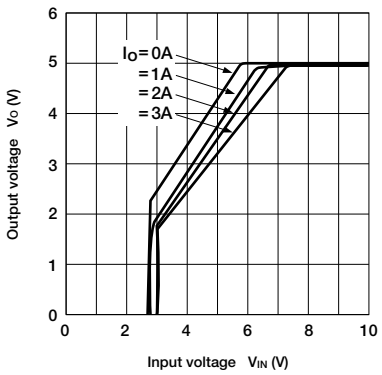
■ Line Regulation



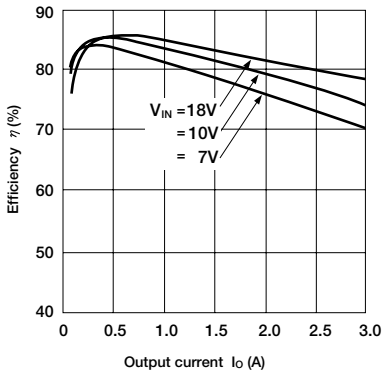
■ Load Regulation



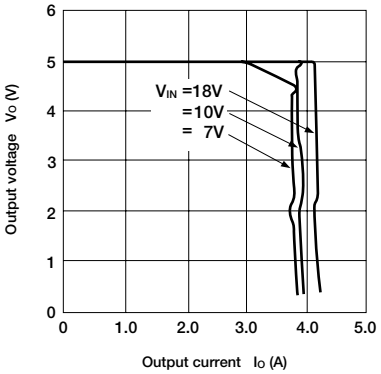
■ Rise Characteristics



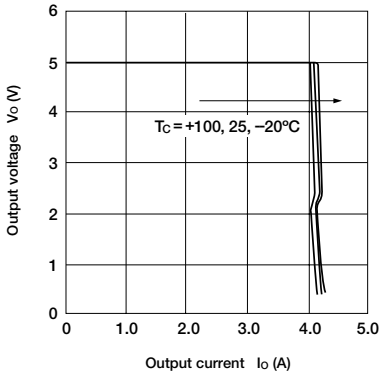
■ Efficiency Curve



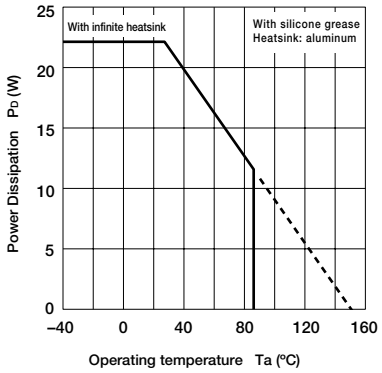
■ Overcurrent Protection Characteristics



■ Overcurrent Protection Temperature Characteristics



■ Ta—PD Characteristics



Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- Low saturation PNP transistor use
- Allows direct driving using LS-TTL and C-MOS logic levels
- Built-in overcurrent and thermal protection circuits
- Built-in protection against reverse connection of power supply
- TO220 equivalent full-mold package not require insulation mica

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	40	V	
Input terminal voltage	V_{IN}	–0.3 to V_B	V	
DIAG terminal voltage	V_{DIAG}	6	V	
Collector-emitter voltage	V_{CE}	40	V	
Output current	I_O	1.8	A	
Power Dissipation	P_{D1}	18	W	With infinite heatsink (Tc=25°C)
	P_{D2}	1.5	W	Stand-alone without heatsink (Tc=25°C)
Junction temperature	Tj	–40 to +125	°C	
Operating temperature	T_{OP}	–40 to +100	°C	
Storage temperature	Tstg	–40 to +125	°C	

Electrical Characteristics

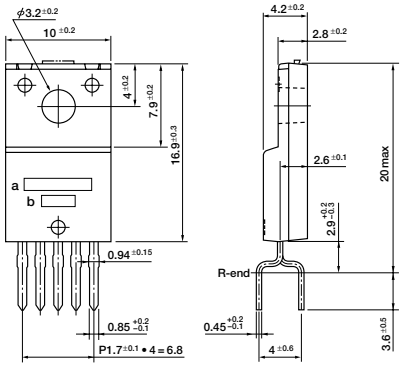
(Ta=25°C unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		V_{Bopr}	6.0		30	V	
Quiescent circuit current		Iq		5	12	mA	V_{Bopr}=14V, V_{IN}=0V
Saturation voltage of output transistor		$V_{CE\ (sat)}$			0.5	V	I_O≦1.0A, V_{Bopr}=6 to 16V
					1.0	V	I_O≦1.8A, V_{Bopr}=6 to 16V
Output leak current		I_O, leak			2	mA	V_{CEO}=16V
Input voltage	Output ON	V_{IH}	2.0		V_B	V	V_{Bopr}=6 to 16V
	Output OFF	V_{IL}	–0.3		0.8	V	V_{Bopr}=6 to 16V
Input current	Output ON	I_{IH}			1	mA	V_{IN}=5V
	Output OFF	I_{IL}	–0.1			mA	V_{IN}=0V
Overcurrent protection starting current		I_S	1.9			A	V_{Bopr}=14V, V_O=V_{Bopr}–1.5V
Thermal protection starting temperature		T_{TSD}	125	145		°C	
Open load detection resistor		Ropen			30	kΩ	V_{Bopr}=6 to 16V
Output transfer time		T_{ON}		8	30	μs	V_{Bopr}=14V, I_O=1A
		T_{OFF}		15	30	μs	V_{Bopr}=14V, I_O=1A
DIAG output voltage		V_{DH}	4.5		6	V	V_{CC}=6V
		V_{DL}			0.3	V	V_{CC}=6V, I_{DD}=2mA
DIAG output transfer time		T_{PLH}			30	μs	V_{Bopr}=14V, I_O=1A
		T_{PHL}			30	μs	V_{Bopr}=14V, I_O=1A
Minimum load inductance		L	1			mH	

Note:

* The rule of protection against reverse connection of power supply is V_B = –13V, one minute (all terminals except, V_B and GND, are open).

External Dimensions (unit: mm)

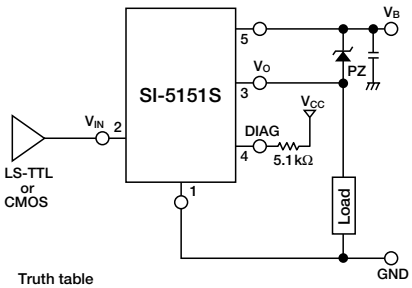


1. GND
2. V_{IN}
3. V_O
4. DIAG
5. V_B

a: Part No.
b: Lot No.

(Forming No. 1123)

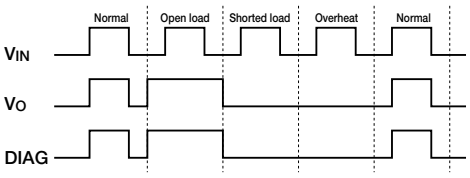
Standard Circuit Diagram



Truth table

V_{IN}	V_O
H	H
L	L

Diagnostic Function

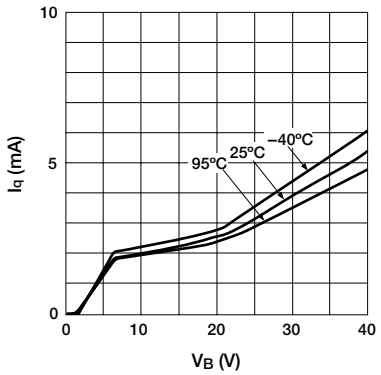


Mode	V_{IN}	V_O	DIAG
Normal	L H	L H	L H
Open load	L H	H H	H H
Shorted load	L H	L L	L L
Overheat	L H	L L	L L

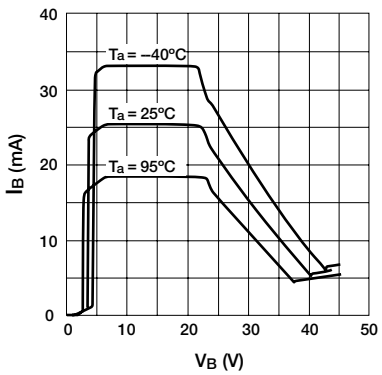
● DIAG output will be undetermined when a voltage exceeding 25V is applied to V_B terminal.

Electrical Characteristics

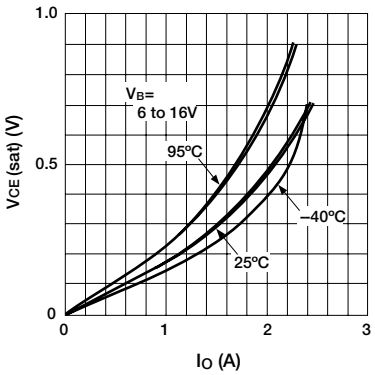
■ Quiescent Circuit Current



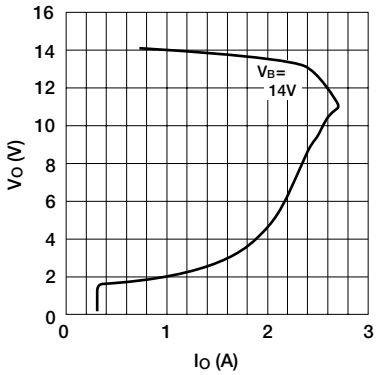
■ Circuit Current



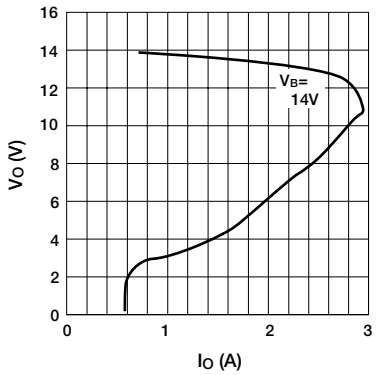
■ Saturation Voltage of Output Transistor



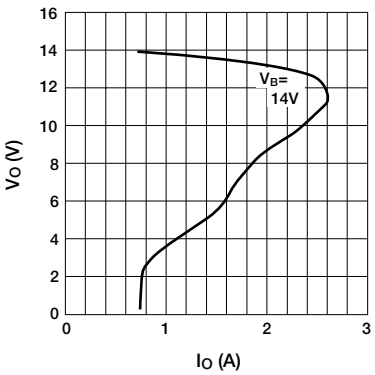
■ Overcurrent Protection Characteristics (Ta= –40°C)



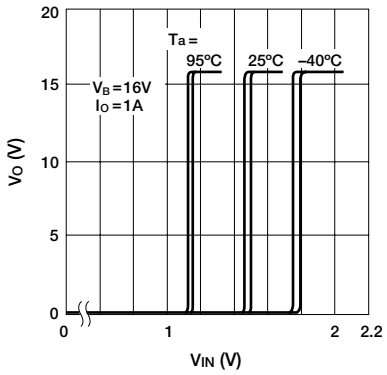
■ Overcurrent Protection Characteristics (Ta=25°C)



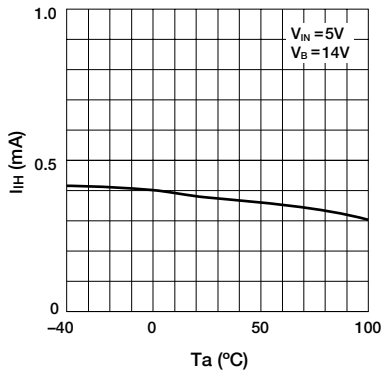
■ Overcurrent Protection Characteristics (Ta=100°C)



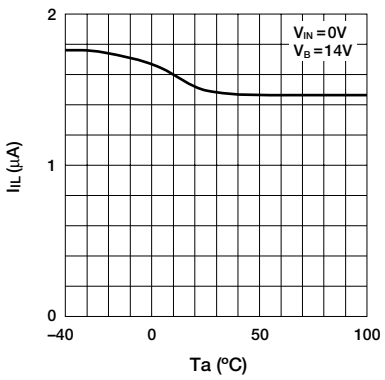
■ Threshold input voltage



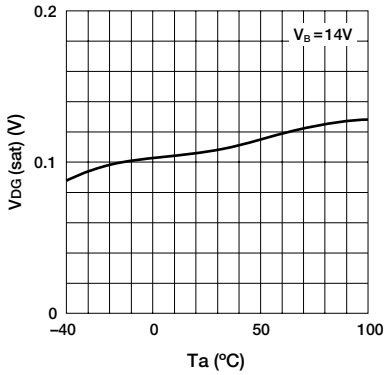
■ Input Current (Output ON)



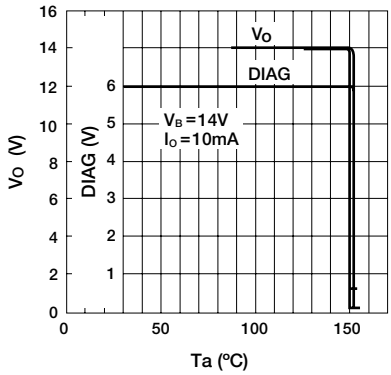
■ Input Current (Output OFF)



■ Saturation Voltage of DIAG Output



■ Thermal Protection Characteristics



High-side Power Switch ICs [With Diagnostic Function] SI-5152S

Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- Low saturation PNP transistor use
- Allows direct driving using LS-TTL and C-MOS logic levels
- Built-in overcurrent and thermal protection circuits
- Built-in protection against reverse connection of power supply
- Tj = 150°C guaranteed
- TO220 equivalent full-mold package not require insulation mica

Absolute Maximum Ratings

(Ta = 25°C)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	40	V	
Input terminal voltage	V_{IN}	–0.3 to V_B	V	
DIAG terminal voltage	V_{DIAG}	6	V	
Collector-emitter voltage	V_{CE}	40	V	
Output current	I_O	1.8	A	
Power Dissipation	P_{D1}	22	W	With infinite heatsink (Tc=25°C)
	P_{D2}	1.8	W	Stand-alone without heatsink
Junction temperature	Tj	–40 to +150	°C	
Operating temperature	T_{OP}	–40 to +100	°C	
Storage temperature	Tstg	–40 to +150	°C	

Electrical Characteristics

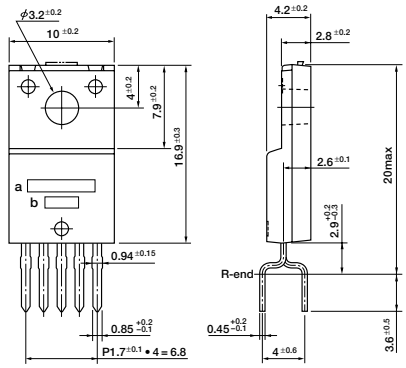
(Ta=25°C unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		V_{Bopr}	6.0		30	V	
Quiescent circuit current		Iq		5	12	mA	V_{Bopr}=14V, V_{IN}=0V
Saturation voltage of output transistor		$V_{CE\ (sat)}$			0.5	V	I_O≦1.0A, V_{Bopr}=6 to 16V
					1.0	V	I_O≦1.8A, V_{Bopr}=6 to 16V
Output leak current		$I_{O,\ leak}$			2	mA	V_{CEO}=16V, V_{IN}=0V
Input voltage	Output ON	V_{IH}	2.0		V_B	V	V_{Bopr}=6 to 16V
	Output OFF	V_{IL}	–0.3		0.8	V	V_{Bopr}=6 to 16V
Input current	Output ON	I_{IH}			1	mA	V_{IN}=5V
	Output OFF	I_{IL}	–0.1			mA	V_{IN}=0V
Overcurrent protection starting current		I_S	1.9			A	V_{Bopr}=14V, V_O=V_{Bopr}–1.5V
Thermal protection starting temperature		T_{TSD}	150			°C	V_{Bopr}≧6V
Open load detection resistor		Ropen			30	kΩ	V_{Bopr}=6 to 16V
Output transfer time		T_{ON}		8	30	μs	V_{Bopr}=14V, I_O=1A
		T_{OFF}		15	30	μs	V_{Bopr}=14V, I_O=1A
DIAG output leak current		I_{DIAG}			100	μA	V_{CC}=6V, V_{Bopr}=6 to 16V
Saturation voltage of DIAG output		V_{DL}			0.3	V	V_{CC}=6V, V_{Bopr}=6 to 16V, I_{DO}=2mA
DIAG output transfer time		T_{PLH}			30	μs	V_{Bopr}=14V, I_O=1A
		T_{PHL}			30	μs	V_{Bopr}=14V, I_O=1A
Minimum load inductance		L	1			mH	

Note:

* The rule of protection against reverse connection of power supply is V_B = –13V, one minute (all terminals except, V_B and GND, are open).

External Dimensions (unit: mm)

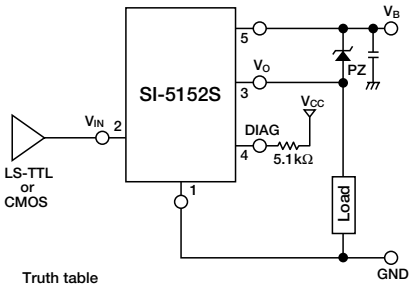


1. GND
2. V_{IN}
3. V_O
4. DIAG
5. V_B

a: Part No.
b: Lot No.

(Forming No. 1123)

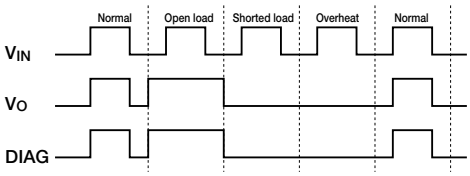
Standard Circuit Diagram



Truth table

V_{IN}	V_O
H	H
L	L

Diagnostic Function

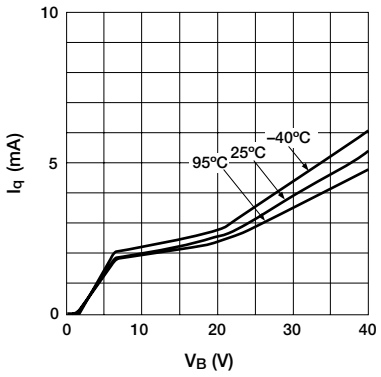


Mode	V_{IN}	V_O	DIAG
Normal	L H	L H	L H
Open load	L H	H H	H H
Shorted load	L H	L L	L L
Overheat	L H	L L	L L

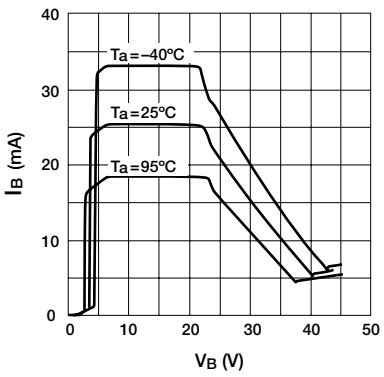
● DIAG output will be undetermined when a voltage exceeding 25V is applied to V_B terminal.

Electrical Characteristics

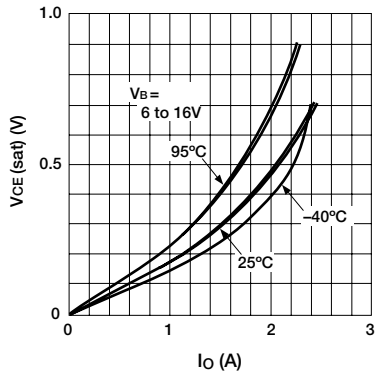
■ Quiescent Circuit Current



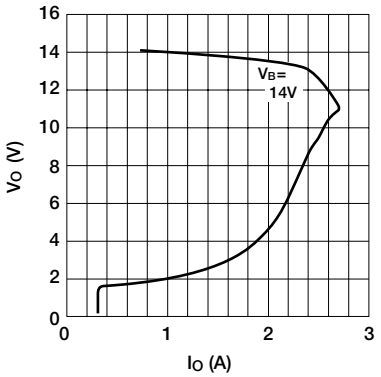
■ Circuit Current



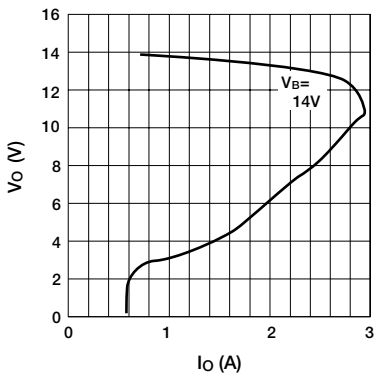
■ Saturation Voltage of Output Transistor



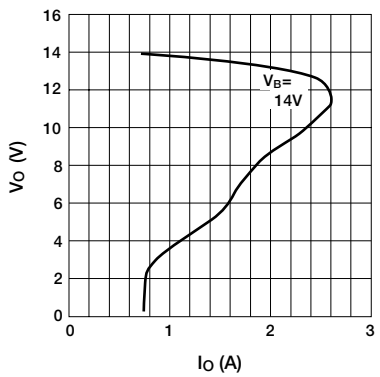
■ Overcurrent Protection Characteristics (Ta = –40ºC)



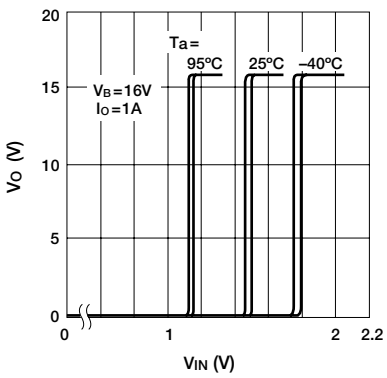
■ Overcurrent Protection Characteristics (Ta=25ºC)



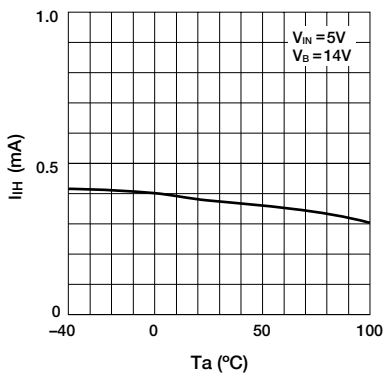
■ Overcurrent Protection Characteristics (Ta=100ºC)



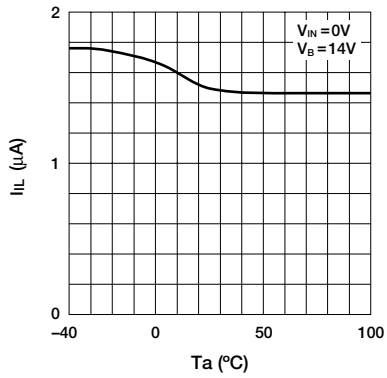
■ Threshold input voltage



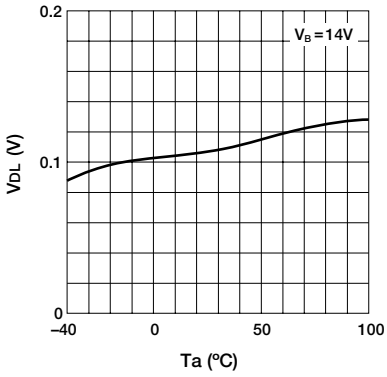
■ Input Current (Output ON)



■ Input Current (Output OFF)



■ Saturation Voltage of DIAG Output



Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- Low saturation PNP transistor use
- Allows direct driving using LS-TTL and C-MOS logic levels
- Built-in overcurrent and thermal protection circuits
- Built-in protection against reverse connection of power supply
- Tj = 150°C guaranteed
- TO220 equivalent full-mold package not require insulation mica

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	–13 to +40	V	
Input terminal voltage	V_{IN}	–0.3 to V_B	V	
DIAG terminal voltage	V_{DIAG}	6	V	
Collector-emitter voltage	V_{CE}	40	V	
Output current	I_O	2.5	A	
Power dissipation	P_{D1}	22	W	With infinite heatsink (Tc=25°C)
	P_{D2}	1.8	W	Stand-alone without heatsink
Junction temperature	Tj	–40 to +150	°C	
Operating temperature	T_{OP}	–40 to +100	°C	
Storage temperature	Tstg	–40 to +150	°C	

Electrical Characteristics

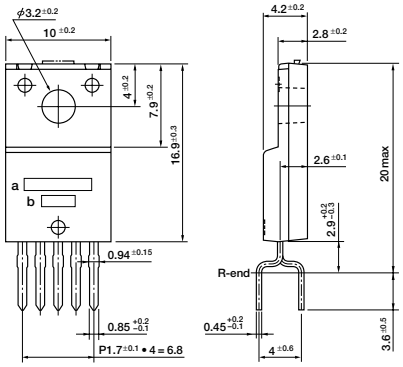
(Ta=25°C unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		V_{Bopr}	6.0		30	V	
Quiescent circuit current		Iq		5	12	mA	V_{Bopr}=14V, V_{IN}=0V
Saturation voltage of output transistor		$V_{CE\ (sat)}$			0.3	V	$I_O \leqq$1.0A, V_{Bopr}=6 to 16V
					0.72	V	$I_O \leqq$2.5A, V_{Bopr}=6 to 16V
Output leak current		I_O, leak			2	mA	V_{CEO}=16V, V_{IN}=0V
Input voltage	Output ON	V_{IH}	2.0		V_B	V	V_{Bopr}=6 to 16V
	Output OFF	V_{IL}	–0.3		0.8	V	V_{Bopr}=6 to 16V
Input current	Output ON	I_{IH}			1	mA	V_{IN}=5V
	Output OFF	I_{IL}	–0.1			mA	V_{IN}=0V
Overcurrent protection starting current		I_S	2.6			A	V_{Bopr}=14V, V_O=V_{Bopr} –1.5V
Thermal protection starting temperature		T_{TSD}	150			°C	$V_{Bopr} \geqq$6V
Open load detection resistor		Ropen			30	kΩ	V_{Bopr}=6 to 16V
Output transfer time		T_{ON}		8	30	µs	V_{Bopr}=14V, I_O=1A
		T_{OFF}		15	30	µs	V_{Bopr}=14V, I_O=1A
DIAG output voltage		V_{DH}	4.5		6	V	V_{CC}=6V, V_{Bopr}=6 to 16V
		V_{DL}			0.3	V	V_{CC}=6V, V_{Bopr}=6 to 16V, I_{DO}=2mA
DIAG output transfer time		T_{PLH}			30	µs	V_{Bopr}=14V, I_O=1A
		T_{PHL}			30	µs	V_{Bopr}=14V, I_O=1A
Minimum load inductance		L	1			mH	

Note:

* The rule of protection against reverse connection of power supply is V_B= –13V, one minute (all terminals except, V_B and GND, are open).

External Dimensions (unit: mm)

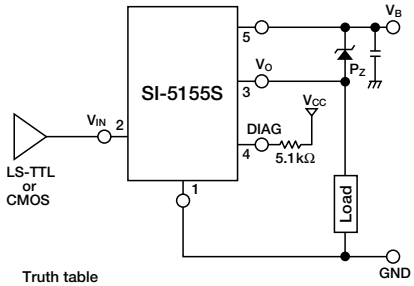


1. GND
2. V_{IN}
3. V_O
4. DIAG
5. V_B

a: Part No.
b: Lot No.

(Forming No. 1123)

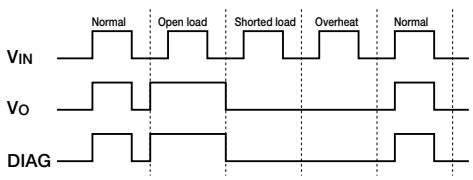
Standard Circuit Diagram



Truth table

V_{IN}	V_O
H	H
L	L

Diagnostic Function

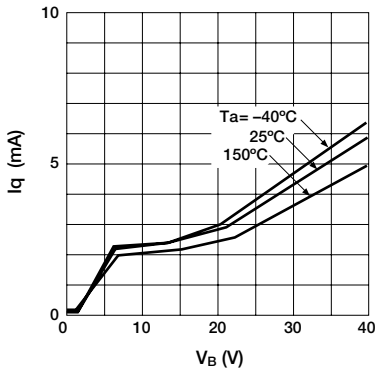


Mode	V_{IN}	V_O	DIAG
Normal	L H	L H	L H
Open load	L H	H H	H H
Shorted load	L H	L L	L L
Overheat	L H	L L	L L

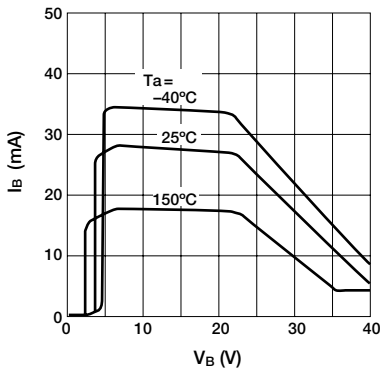
- DIAG output will be undetermined when a voltage exceeding 25V is applied to V_B terminal.

Electrical Characteristics

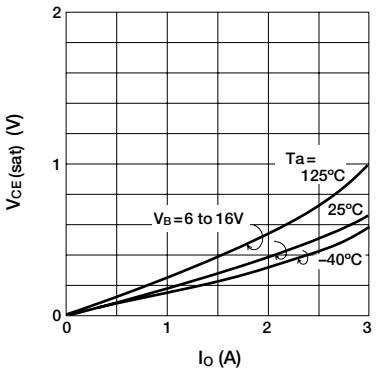
■ Quiescent Circuit Current



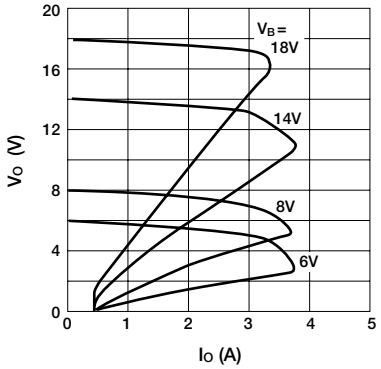
■ Circuit Current



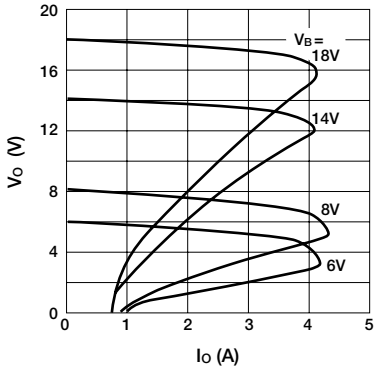
■ Saturation Voltage of Output Transistor



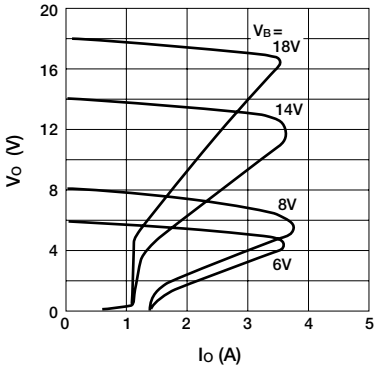
■ Overcurrent Protection Characteristics (Ta=–40ºC)



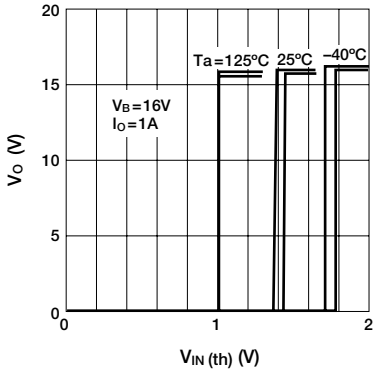
■ Overcurrent Protection Characteristics (Ta=25ºC)



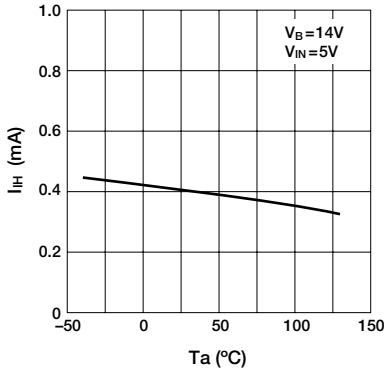
■ Overcurrent Protection Characteristics (Ta=125ºC)



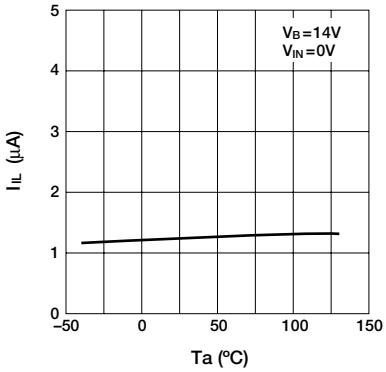
■ Threshold input voltage



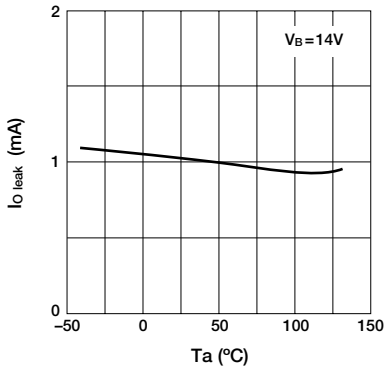
■ Input Current (Output ON)



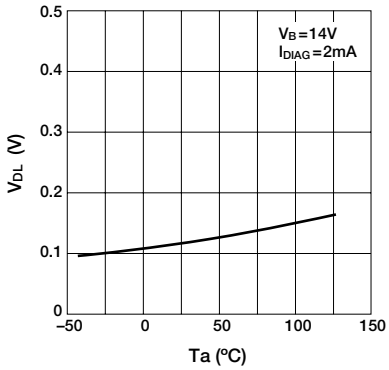
■ Input Current (Output OFF)



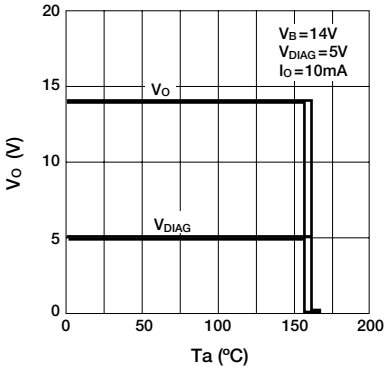
■ Output Terminal Leak Current



■ Saturation Voltage of DIAG Output



■ Thermal Protection Characteristics



Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- Low saturation PNP transistor use
- Allows direct driving using LS-TTL and C-MOS logic levels
- Built-in overcurrent and thermal protection circuits
- Built-in protection against reverse connection of power supply
- Tj = 150°C guaranteed
- Built-in Zener diode
- TO220 equivalent full-mold package not require insulation mica

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	–13 to +40	V	
Input terminal voltage	V_{IN}	–0.3 to V_B	V	
DIAG terminal voltage	V_{DIAG}	6	V	
Collector-emitter voltage	V_{CE}	V_B—V_Z	V	Refer to "Surge clamp voltage" in Electrical Characteristics
Output current	I_O	2.04	A	
Power Dissipation	P_{D1}	22	W	With infinite heatsink (Tc=25°C)
	P_{D2}	1.8	W	Stand-alone without heatsink
Junction temperature	Tj	–40 to +150	°C	
Operating temperature	T_{OP}	–40 to +100	°C	
Storage temperature	Tstg	–40 to +150	°C	

Electrical Characteristics

(Ta=25°C unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		V_{Bopr}	6.0		30	V	
Quiescent circuit current		Iq		5	12	mA	V_{Bopr}=14V, V_{IN}=0V
Saturation voltage of output transistor		$V_{CE\,(sat)}$			0.47	V	I_O≅2.05A, V_{Bopr}=6 to 16V
Output leak current		I_O, leak			2	mA	V_{CEO}=16V, V_{IN}=0V
Input voltage	Output ON	V_{IH}	2.0		V_B	V	V_{Bopr}=6 to 16V
	Output OFF	V_{IL}	–0.3		0.8	V	V_{Bopr}=6 to 16V
Input current	Output ON	I_{IH}			1	mA	V_{IN}=5V
	Output OFF	I_{IL}	–0.1			mA	V_{IN}=0V
Overcurrent protection starting current		I_S	2.05			A	V_{Bopr}=14V, V_O=V_{Bopr}–1.5V
Thermal protection starting temperature		T_{TSD}	150			°C	V_{Bopr}≧6V
Open load detection resistor		Ropen			30	kΩ	V_{Bopr}=6 to 16V
Output transfer time		T_{ON}		8	30	μs	V_{Bopr}=14V, I_O=1A
		T_{OFF}		15	30	μs	V_{Bopr}=14V, I_O=1A
DIAG output voltage		V_{DH}	4.5		6	V	V_{CC}=6V, V_{Bopr}=6 to 16V
		V_{DL}			0.3	V	V_{CC}=6V, V_{Bopr}=6 to 16V, I_{DO}=2mA
DIAG output transfer time		T_{PLH}			30	μs	V_{Bopr}=14V, I_O=1A
		T_{PHL}			30	μs	V_{Bopr}=14V, I_O=1A
Minimum load inductance		L	1			mH	
Surge clamp voltage	*1	V_Z	28	34	40	V	I_C=5mA

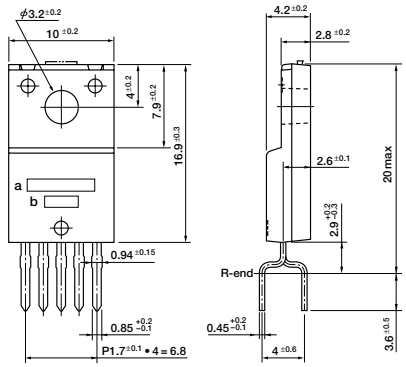
Note:

*1. The Zener diode for surge clamping has an energy capability of 140 mJ (single pulse).

* The rule of protection against reverse connection of power supply is V_B = –13V, one minute.

* This driver is exclusively used for ON/OFF control.

External Dimensions (unit: mm)

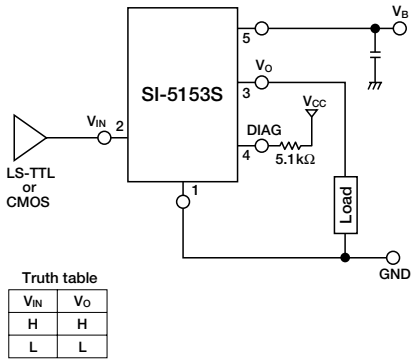


1. GND
2. V_{IN}
3. V_O
4. DIAG
5. V_B

a: Part No.
b: Lot No.

(Forming No. 1123)

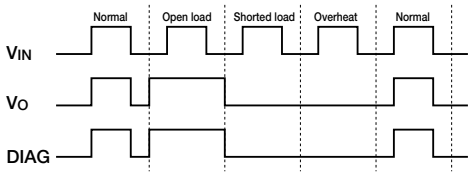
Standard Circuit Diagram



Truth table

V_{IN}	V_O
H	H
L	L

Diagnostic Function

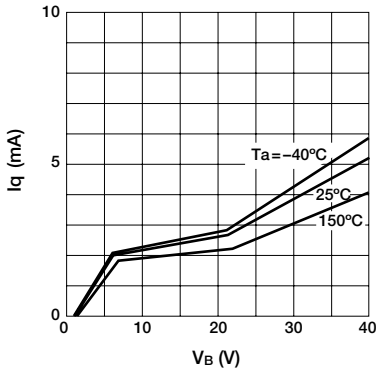


Mode	V_{IN}	V_O	DIAG
Normal	L H	L H	L H
Open load	L H	H H	H H
Shorted load	L H	L L	L L
Overheat	L H	L L	L L

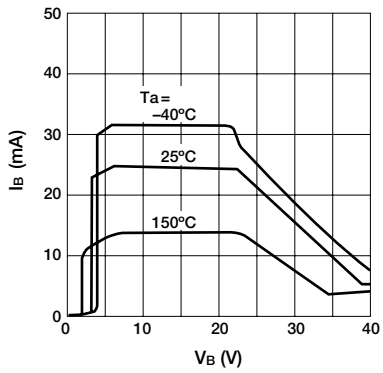
● DIAG output will be undetermined when a voltage exceeding 25V is applied to V_B terminal.

Electrical Characteristics

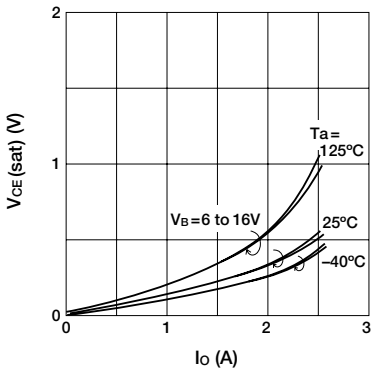
■ Quiescent Circuit Current



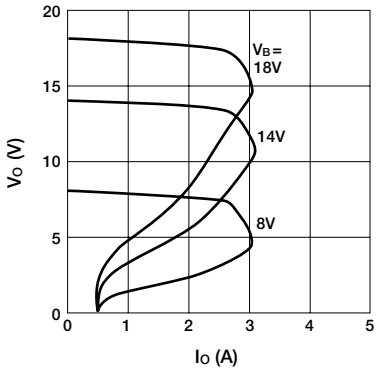
■ Circuit Current



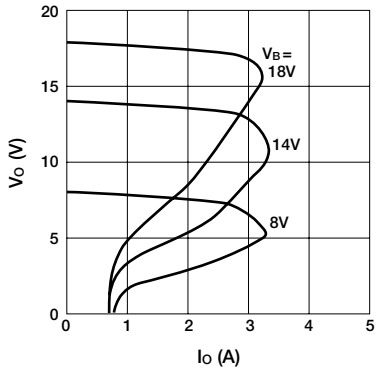
■ Saturation Voltage of Output Transistor



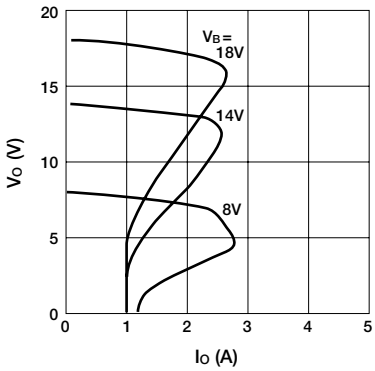
■ Overcurrent Protection Characteristics (Ta=–40°C)



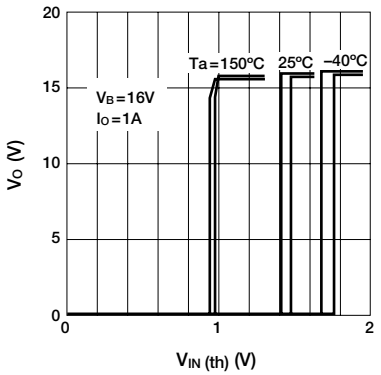
■ Overcurrent Protection Characteristics (Ta=25°C)



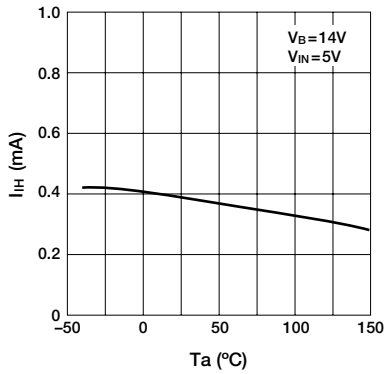
■ Overcurrent Protection Characteristics (Ta=125°C)



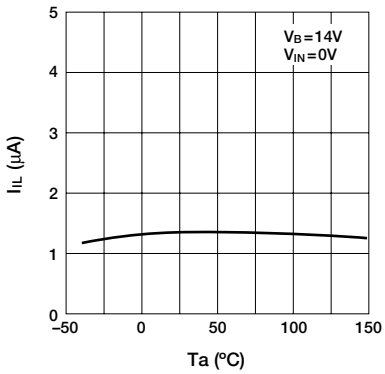
■ Threshold Characteristics of Input Voltage



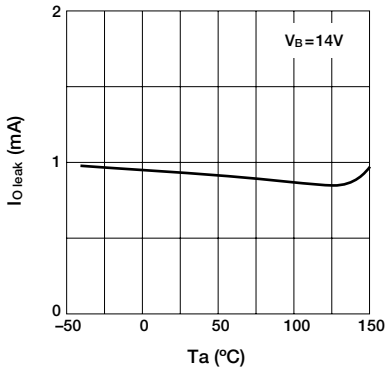
■ Input Current (Output ON)



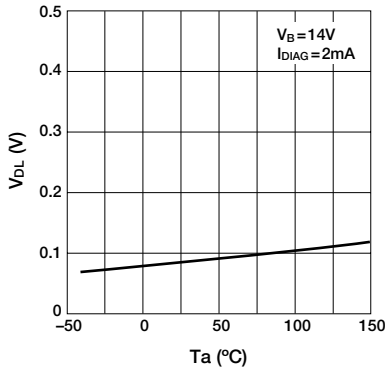
■ Input Current (Output OFF)



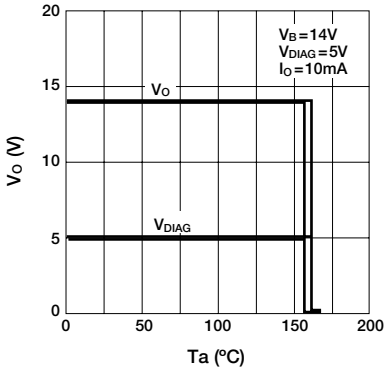
■ Output Terminal Leak Current



■ Saturation Voltage of DIAG Output



■ Thermal Protection Characteristics



Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- Low saturation PNP transistor use
- Allows direct driving using LS-TTL and C-MOS logic levels
- Built-in overcurrent and thermal protection circuits
- Built-in protection against reverse connection of power supply
- Tj = 150°C guaranteed
- Built-in Zener diode
- TO220 equivalent full-mold package not require insulation mica

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	–13 to +40	V	
Input terminal voltage	V_{IN}	–0.3 to V_B	V	
DIAG terminal voltage	V_{DIAG}	6	V	
Collector-emitter voltage	V_{CE}	V_B –V_Z	V	Refer to "Surge clamp voltage" in Electrical Characteristics
Output current	I_O	2.5	A	
Power Dissipation	P_{D1}	22	W	With infinite heatsink (Tc=25°C)
	P_{D2}	1.8	W	Stand-alone without heatsink
Junction temperature	Tj	–40 to +150	°C	
Operating temperature	T_{OP}	–40 to +100	°C	
Storage temperature	Tstg	–40 to +150	°C	

Electrical Characteristics

(Ta=25°C unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		V_{Bopr}	6.0		30	V	
Quiescent circuit current		Iq		5	12	mA	V_{Bopr}=14V, V_{IN}=0V
Saturation voltage of output transistor		$V_{CE(sat)}$			0.3	V	I_O≦1.0A, V_{Bopr}=6 to 16V
					0.72	V	I_O≦2.5A, V_{Bopr}=6 to 16V
Output leak current		$I_{O,leak}$			2	mA	V_{CEO}=16V, V_{IN}=0V
Input voltage	Output ON	V_{IH}	2.0		V_B	V	V_{Bopr}=6 to 16V
	Output OFF	V_{IL}	–0.3		0.8	V	V_{Bopr}=6 to 16V
Input current	Output ON	I_{IH}			1	mA	V_{IN}=5V
	Output OFF	I_{IL}	–0.1			mA	V_{IN}=0V
Overcurrent protection starting current		I_S	2.6			A	V_{Bopr}=14V, V_O=V_{Bopr}–1.5V
Thermal protection starting temperature		T_{TSD}	150			°C	V_{Bopr}≧6V
Open load detection resistor		Ropen			30	kΩ	V_{Bopr}=6 to 16V
Output transfer time		T_{ON}		8	30	μs	V_{Bopr}=14V, I_O=1A
		T_{OFF}		15	30	μs	V_{Bopr}=14V, I_O=1A
DIAG output voltage		V_{DH}	4.5		6	V	V_{CC}=6V, V_{Bopr}=6 to 16V
		V_{DL}			0.3	V	V_{CC}=6V, V_{Bopr}=6 to 16V, I_{DO}=2mA
DIAG output transfer time		T_{PLH}			30	μs	V_{Bopr}=14V, I_O=1A
		T_{PHL}			30	μs	V_{Bopr}=14V, I_O=1A
Minimum load inductance		L	1			mH	
Surge clamp voltage	*1	V_Z	28	34	40	V	I_C=5mA

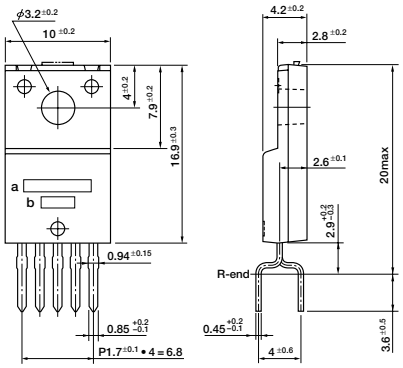
Note:

*1. The Zener diode for surge clamping has an energy capability of 200 mJ (single pulse).

* The rule of protection against reverse connection of power supply is V_B=–13V, one minute.

* This driver is exclusively used for ON/OFF control.

External Dimensions (unit: mm)

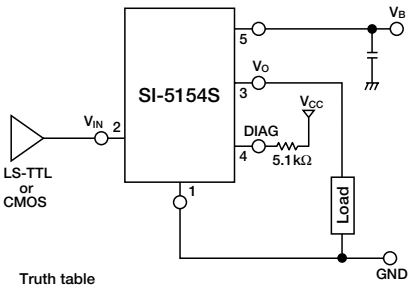


1. GND
2. V_{IN}
3. V_O
4. DIAG
5. V_B

a: Part No.
b: Lot No.

(Forming No. 1123)

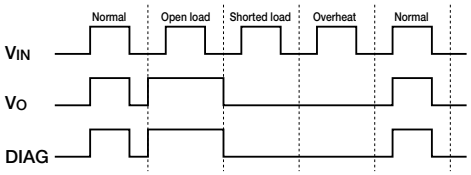
Standard Circuit Diagram



Truth table

V_{IN}	V_O
H	H
L	L

Diagnostic Function

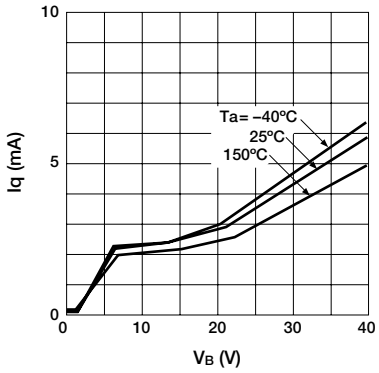


Mode	V_{IN}	V_O	DIAG
Normal	L H	L H	L H
Open load	L H	H H	H H
Shorted load	L H	L L	L L
Overheat	L H	L L	L L

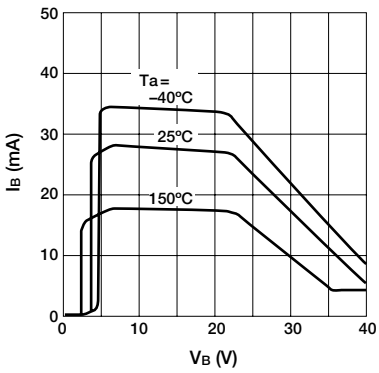
● DIAG output will be undetermined when a voltage exceeding 25V is applied to V_B terminal.

Electrical Characteristics

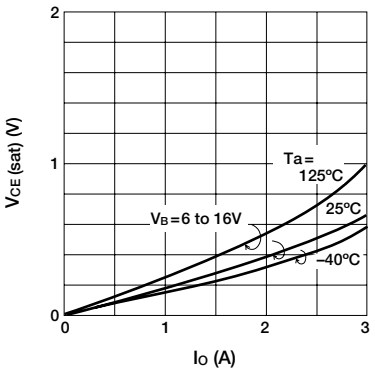
■ Quiescent Circuit Current



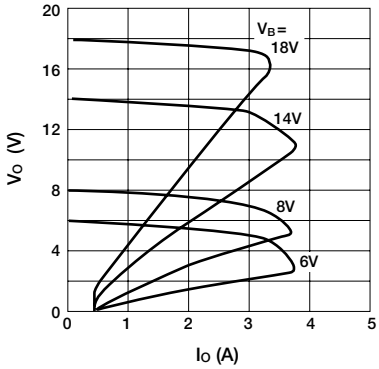
■ Circuit Current



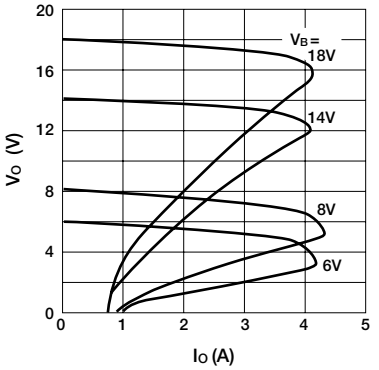
■ Saturation Voltage of Output Transistor



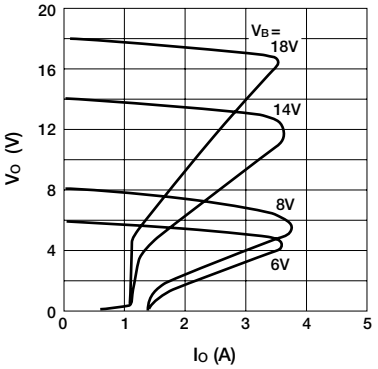
■ Overcurrent Protection Characteristics (Ta= −40ºC)



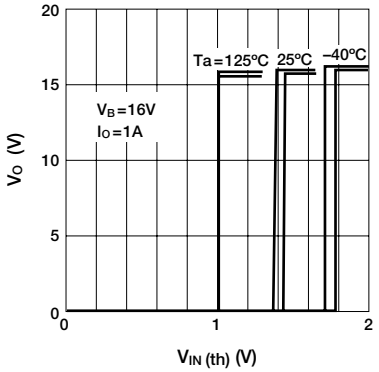
■ Overcurrent Protection Characteristics (Ta=25ºC)



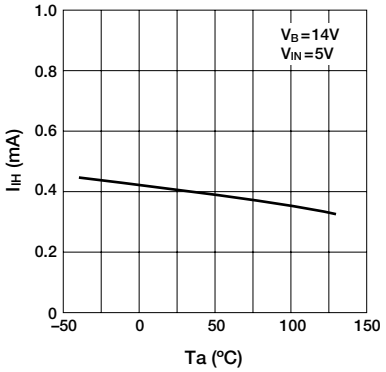
■ Overcurrent Protection Characteristics (Ta=125ºC)



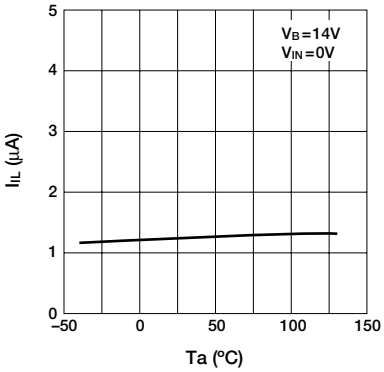
■ Threshold input voltage



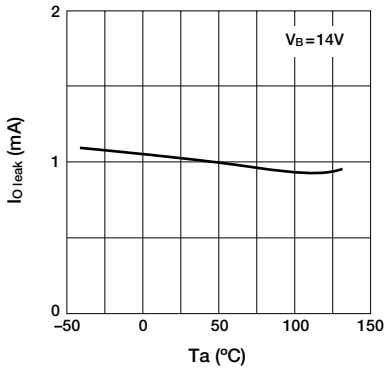
■ Input Current (Output ON)



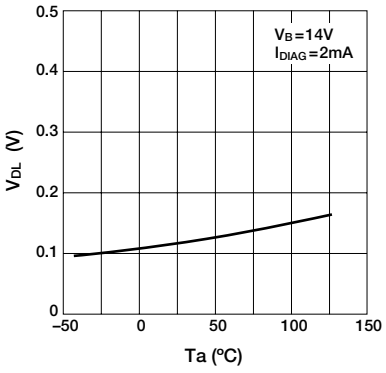
■ Input Current (Output OFF)



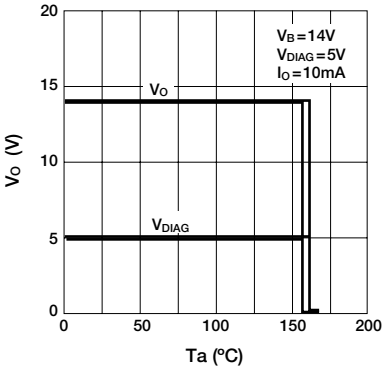
■ Output Terminal Leak Current



■ Saturation Voltage of DIAG Output



■ Thermal Protection Characteristics



High-side Power Switch ICs [Surface-mount 2-circuits] SDH04

Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- Low saturation PNP transistor use
- Allows direct driving using LS-TTL and C-MOS logic levels
- Built-in overcurrent protection circuits
- Built-in protection against reverse connection of power supply
- Tj = 150°C guaranteed
- Surface-mount full-mold package

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	–13 to +40	V	
Drive terminal applied voltage	V_D	–0.3 to V_B	V	
Input terminal voltage	V_{IN}	–0.3 to +7.0	V	
DIAG output applied voltage	V_{DIAG}	–0.3 to +7.0	V	
DIAG output source current	I_{DIAG}	3	mA	
Voltage across power supply and drive terminal	V_{B-D}	V_B –0.4	V	
Output current	I_O	1.5	A	
Power dissipation	P_D	2.6	W	Without heatsink, all circuits operating
Junction temperature	Tj	–40 to +150	°C	
Operating temperature	T_{OP}	–40 to +100	°C	
Storage temperature	Tstg	–40 to +150	°C	

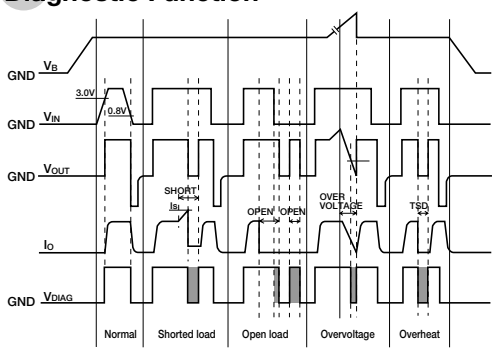
Electrical Characteristics

(V_{Bopr}=14V, Ta=25°C unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		V_{Bopr}	6.0		16	V	
Quiescent circuit current		Iq		5	12	mA	Lo output
Threshold input voltage		V_{IN}th	0.8		3.0	V	
Input current	Hi output	I_{IN}			1.0	mA	V_{IN}=5V
	Lo output	I_{IN}	0		100	μA	V_{IN}=0V
Saturation voltage of output transistor		$V_{CE\ (sat)}$			0.5	V	I_O≦1.0A, V_{Bopr}=6 to 16V
Output terminal sink current		$I_{O\ (off)}$			2.0	mA	V_O=0V, V_{IN}=0V
Saturation voltage of DIAG output		V_{DL}			0.3	V	I_{DIAG}=3mA
Leak current of DIAG output		I_{DGH}			100	μA	V_{DIAG}=5V
Open load detection resistor		Ropen	1		30	kΩ	
Overcurrent protection starting current		I_S	1.6			A	V_O=V_{Bopr} –1.9V
Output transfer time		T_{ON}		8	30	μs	I_O=1A
		T_{OFF}		15	30	μs	I_O=1A
DIAG output transfer time		T_{PLH}		10	30	μs	I_O=1A
		T_{PHL}		15	30	μs	I_O=1A

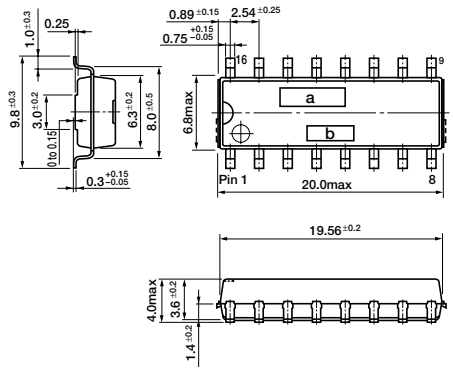
Note: * The rule of protection against reverse connection of power supply is V_B= –13V, one minute (all terminals except, V_B and GND, are open).

Diagnostic Function



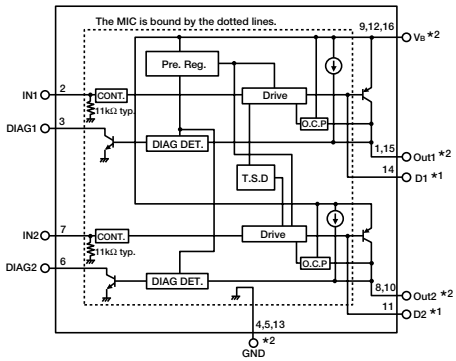
ERROR SIGNAL for CPU

External Dimensions (unit: mm) SMD-16A



a: Part No.
b: Lot No.

Equivalent Circuit Diagram

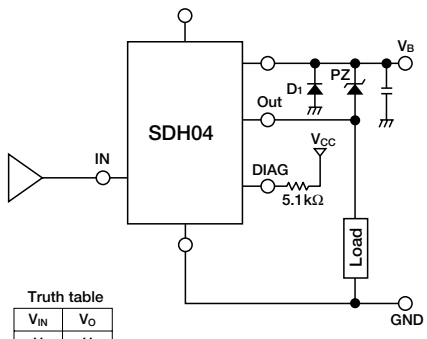


[Abbreviations]
Drive: Drive circuit
CONT: ON/OFF circuit
Pre.Reg: Pre-regulator
DIAG.DET.: Diagnostic circuit
O.C.P.: Overcurrent protection
T.S.D.: Thermal protection

*1. The base terminal (D terminal) is connected to the output transistor base. It is also connected to the control monolithic IC. Do not, therefore, apply an external voltage in operation.

*2. SDH04 have two or three terminals of the same function (V_B, Out1, Out2, GND). The terminals of the same function must be shorted at a pattern near the product.

Standard Circuit Diagram



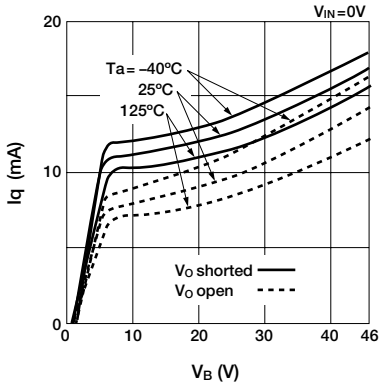
Truth table

V_{IN}	V_O
H	H
L	L

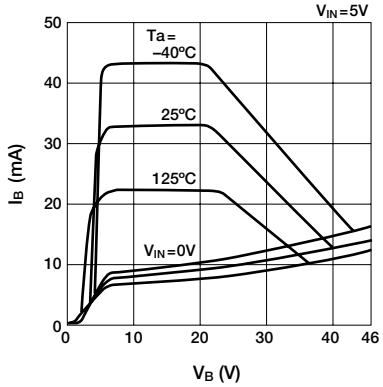
Note 1: A pull-down resistor (11 kΩ typ.) is connected to the IN terminal. V_{OUT} turns "L" when a high impedance is connected to the IN terminal in series.

Electrical Characteristics

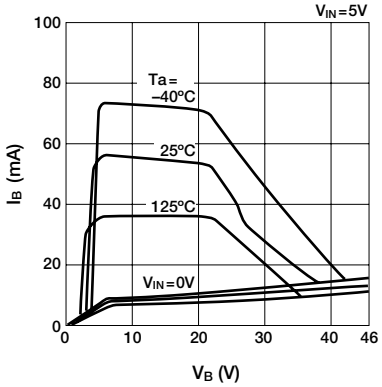
■ Quiescent Circuit Current (dual circuit)



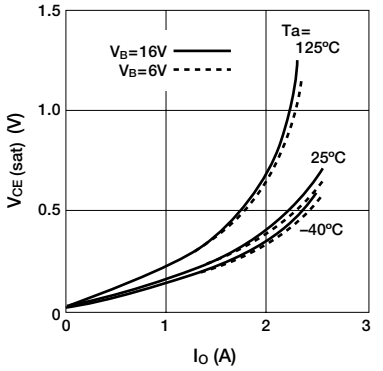
■ Circuit Current (single circuit)



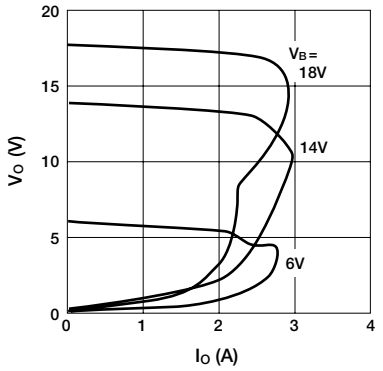
■ Circuit Current (dual circuit)



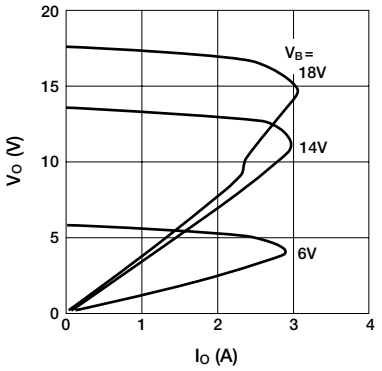
■ Saturation Voltage of Output Transistor



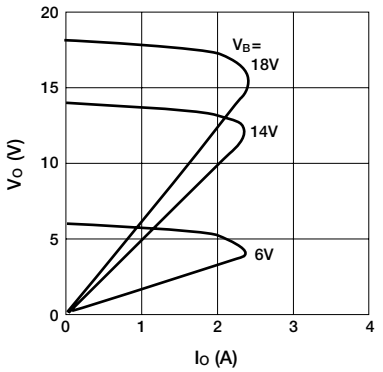
■ Overcurrent Protection Characteristics (Ta=–40ºC)



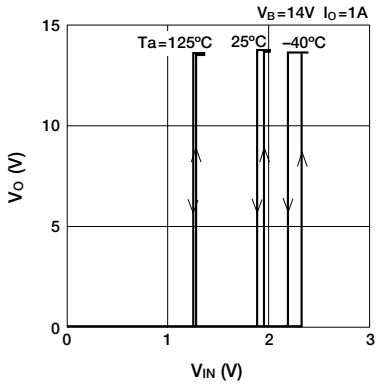
■ Overcurrent Protection Characteristics (Ta=25ºC)



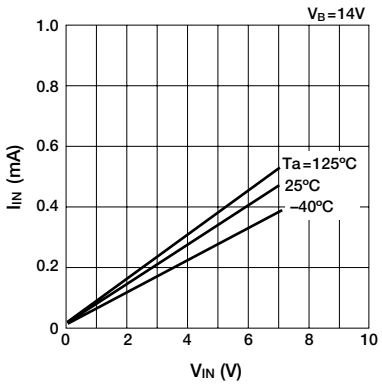
■ Overcurrent Protection Characteristics (Ta=125ºC)



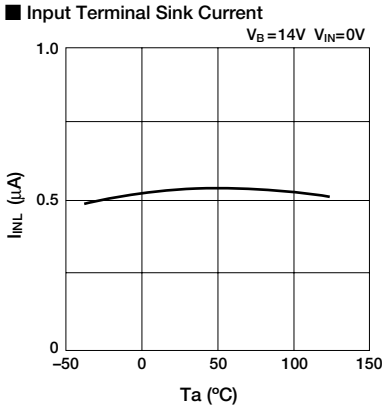
■ Threshold Characteristics of Input Voltage



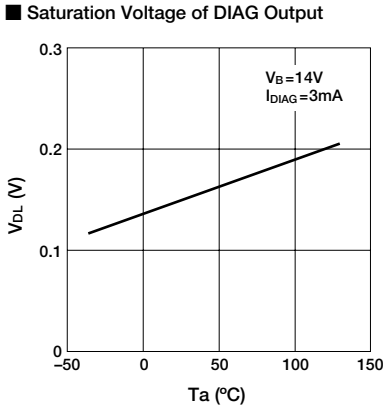
■ Input Terminal Source Current



■ Input Terminal Sink Current



■ Saturation Voltage of DIAG Output



Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- DMOS 2ch output
- Allows ON/OFF using C-MOS logic level
- Built-in overcurrent and thermal protection circuits

Absolute Maximum Ratings

(Ta=25ºC)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	35	V	
Input terminal voltage	V_{IN}	–0.3 to 7	V	
Input terminal current	I_{IN}	5	mA	
DG terminal voltage	V_{DG}	–0.3 to 7	V	
DG terminal current	I_{DG}	5	mA	
Drain to source voltage	V_{DS}	V_B–45	V	
Output current	I_O	1.8	A	
Power dissipation	P_D	2	W	Ta=25ºC
Source to drain Di forward current	I_F	0.8	A	
Channel temperature	Tch	150	ºC	
Operating temperature	T_{OP}	–40 to +105	ºC	
Storage temperature	Tstg	–40 to +150	ºC	

Electrical Characteristics

(V_B=14V, Ta=25ºC unless otherwise specified)

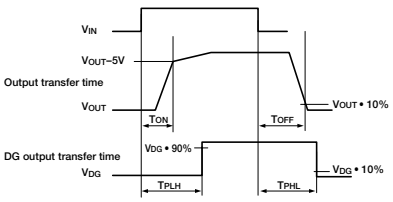
Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		$V_{B\ (opr)}$	5.5		35	V	
Quiescent circuit current		Iq			1	mA	V_{IN}=0V, V_{OUT}=0V
Output ON resistance		$R_{DS\ (ON)}$			200	mΩ	I_O=1A
					300	mΩ	I_O=1A, Ta=80ºC
Output leak current		I_O, leak		50	100	µA	V_{OUT}=0V
Input threshold voltage	Output ON	V_{IHth}	1.4	2.0	3.0	V	Ta= –40 to +105ºC
	Output OFF	V_{ILth}	1.0	1.8		V	Ta= –40 to +105ºC
Inpup current	Output ON	I_{IH}		70	200	µA	V_{IN}=5V
	Output OFF	I_{IL}			12	µA	V_{IN}=0V
Overcurrent protection starting current		I_S	1.9	3		A	V_{OUT}=V_O–1.5V
Internal current limit		I_{Lim}		5		A	V_{OUT}=0V
Thermal shutdown operating temperature		T_{TSD}	155	165		ºC	
Load open detection threshold voltage		Vopen	1.5	3	4.5	V	
Output transfer time *1		T_{ON}		70	140	µs	R_L=14Ω, V_O=–5V
		T_{OFF}		35	90	µs	R_L=14Ω, V_O•10%
DG leak current		I_{DG}			20	µA	V_{DG}=5.5V
Low level DG output voltage		V_{DGL}		0.15	0.5	V	I_{DG}=1.6mA
DG output transfer time *1		T_{PLH}		70	140	µs	
		T_{PHL}		45	120	µs	

Note: *1. Transient time is showed Wave Form below.

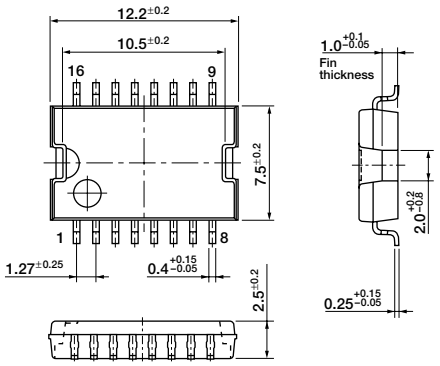
Recommended Operating Conditions (for one channel)

Parameter	Ratings min	Ratings max	Unit
Power supply voltage	5.5	16	V
V_{IH}	4	5.5	V
V_{IL}	–0.3	0.9	V
I_O		1	A
R_{IN}	10	20	kΩ
R_{DG}	10	20	kΩ

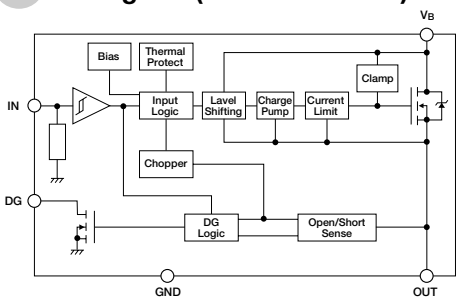
Wave Form



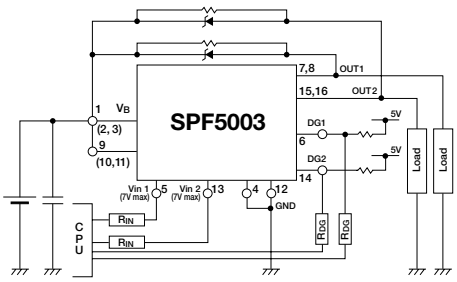
External Dimensions (unit: mm)



Block Diagram (for one channel)

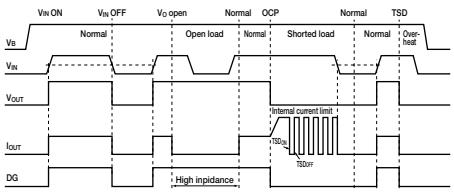


Standard Connection Diagram



* R_{IN} and R_{DG} are needed to protect CPU and SPF5003 in case of reverse connection of V_B terminal.
* Make V_B of 1Pin and 9Pin short from the fin to be plated by solder.

Timing Chart



Mode	V_{IN}	DG	V_O
Normal	H L	H L	H L
Open load	H L	H H	H H
Shorted load	H L	L L	L (Limiting) L
Overheat	H L	L L	L L

Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- DMOS 2ch output
- Allows ON/OFF using C-MOS logic level
- Built-in overcurrent and thermal protection circuits

Absolute Maximum Ratings

(Ta=25ºC)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	35	V	
Input terminal voltage	V_{IN}	–0.3 to 7	V	
Input terminal current	I_{IN}	5	mA	
DG terminal voltage	V_{DG}	–0.3 to 7	V	
DG terminal current	I_{DG}	5	mA	
Drain to source voltage	V_{DS}	V_B–45	V	
Output current	I_O	2.5	A	
Power dissipation	P_D	2.7	W	Ta=25ºC
Source to drain Di forward current	I_F	0.8	A	
Channel temperature	Tch	150	ºC	
Operating temperature	T_{OP}	–40 to +105	ºC	
Storage temperature	Tstg	–40 to +150	ºC	

Electrical Characteristics

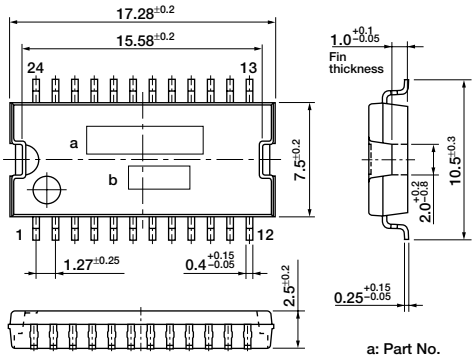
(V_B=14V, Ta=25ºC unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		$V_{B\ (opr)}$	5.5		35	V	
Quiescent circuit current		Iq			1	mA	V_{IN}=0V, V_{OUT}=0V
Output ON resistance		$R_{DS\ (ON)}$			150	mΩ	I_O=2A
					250	mΩ	I_O=1A, Ta=80ºC
Output leak current		I_O, leak		50		µA	V_{OUT}=0V
Input voltage	Output ON	V_{IH}		2.0	3.0	V	Ta= –40 to +105ºC
	Output OFF	V_{IL}	1.0	1.8		V	Ta= –40 to +105ºC
Inpup current	Output ON	I_{IH}		70		µA	V_{IN}=5V
Overcurrent protection starting current		I_S	2.6			A	V_{OUT}=V_O–1.5V
Internal current limit		I_{Lim}		10		A	V_{OUT}=0V
Thermal shutdown operating temperature		T_{TSD}	155	165		ºC	
Load open detection threshold voltage		Vopen		3		V	
Output transfer time		T_{ON}		165		µs	
		T_{OFF}		60		µs	
DG leak current		I_{DG}			20	µA	V_{DG}=5.5V
Low level DG output voltage		V_{DGL}		0.15		V	I_{DG}=1.6mA
DG output transfer time		T_{PLH}		70		µs	
		T_{PHL}		45		µs	

Recommended Operating Conditions (for one channel)

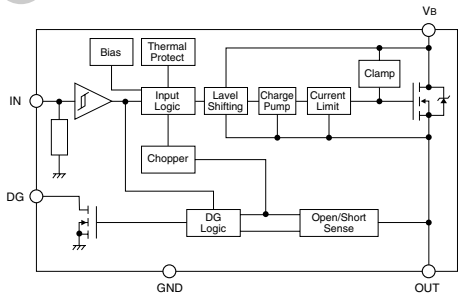
Parameter	Ratings min	Ratings max	Unit
Power supply voltage	5.5	16	V
V_{IH}	4	5.5	V
V_{IL}	–0.3	0.9	V
I_O		1.15	A
R_{IN}	10	20	kΩ
R_{DG}	10	20	kΩ

External Dimensions (unit: mm)

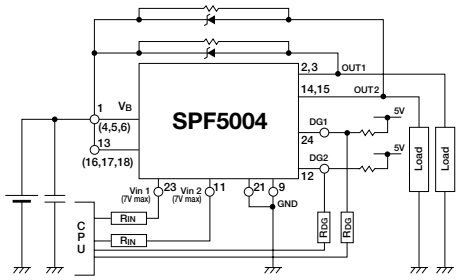


a: Part No.
b: Lot No.

Block Diagram (for one channel)

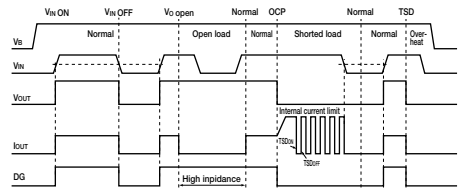


Standard Connection Diagram



* Make V_B of 4Pin, 5Pin, 6Pin, 16Pin, 17Pin and 18Pin short from the fin to be plated by solder.

Timing Chart



Mode	V_{IN}	DG	V_O
Normal	H L	H L	H L
Open load	H L	H H	H H
Shorted load	H L	L L	L (Limiting) L
Overheat	H L	L L	L L

High-side Power Switch ICs [3-circuits] SLA2501M

Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- Low saturation PNP transistor use ($V_{CE\ (sat)} \leqq 0.2V$)
- Allows direct driving using LS-TTL and C-MOS logic levels
- Built-in Zener diode in transistor eliminates the need of (or simplifies) external surge absorption circuit
- Built-in independent overcurrent and thermal protection circuit in each circuit
- Built-in protection against reverse connection of power supply
- Tj = 150°C guaranteed

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	–13 to +40	V	
Drive terminal applied voltage	V_D	–0.3 to V_B	V	
Input terminal voltage	V_{IN}	–0.3 to +7.0	V	
DIAG output applied voltage	V_{DIAG}	–0.3 to +7.0	V	
DIAG output source current	I_{DIAG}	–3	mA	
Voltage across power supply and output terminal	V_{B-O}	V_B–34	V	
Voltage across power supply and drive terminal	V_{B-D}	–0.4	V	
Output current	I_O	1.5	A	
Output reverse current	I_O	–1.8	A	
Electrostatic resistance	$E_{S/A}$	±250	V	C=200pF, R=0Ω
Power Dissipation	P_D	4.8	W	Stand-alone without heatsink, all circuits operating
Junction temperature	Tj	–40 to +150	°C	
Operating temperature	T_{OP}	–40 to +115	°C	
Storage temperature	Tstg	–50 to +150	°C	

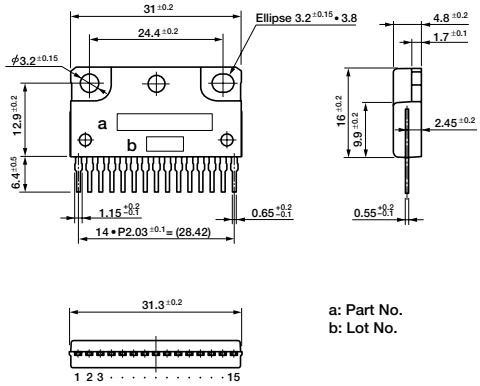
Electrical Characteristics

(V_{Bopr}=14V, Tj= –40 to +150°C unless otherwise specified)

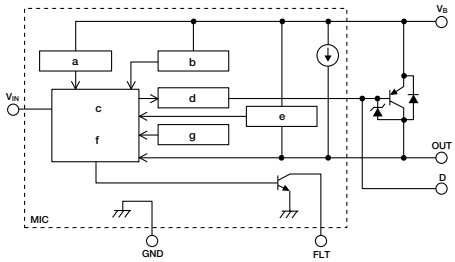
Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		V_{Bopr}	6.0		16	V	
Quiescent circuit current (per circuit)		Iq		0.8	1.6	mA	Lo output
Circuit current (per circuit)		I_B		19.3		mA	Tj=25°C
Threshold input voltage		V_{IN}th	0.8		3.0	V	
Input voltage	Hi output	V_{IN}	3.7			V	
	Lo output	V_{IN}			1.5	V	
Input current	Hi output	I_{IN}			–1.0	mA	V_{IN}=5V
	Lo output	I_{IN}	100			µA	V_{IN}=0V
Saturation voltage of output transistor		$V_{CE\ (sat)}$			0.2	V	$I_O \leqq 1.2A$, V_{Bopr}=6 to 16V
		$V_{CE\ (sat)}$		1.0		V	$I_O \leqq 1.5A$, V_{Bopr}=6 to 16V
Output terminal sink current		$I_{O\ (off)}$		2.5	5	mA	Tj=25°C, V_{CEO}=14V
Surge clamp voltage		V_{B-O}	29	34	39	V	Tj=25°C, I_C=10mA
			28	34	40	V	I_C=5mA
Saturation voltage of DIAG output		V_{DL}			0.4	V	I_{DGH}=–2mA, V_{Bopr}=6 to 16V
Leak current of DIAG output		I_{DGH}			–100	µA	V_{CC}=7V
Open load detection resistor		Ropen	5.5			kΩ	
Overcurrent protection starting current		I_S	1.6			A	$V_O=V_{Bopr}$–1.5V
Thermal protection starting temperature		T_{TSD}				°C	$V_{Bopr} \geqq 6V$
Output transfer time		T_{ON}			30	µs	I_O=1A
		T_{OFF}			100	µs	I_O=1A
DIAG output transfer time		T_{PLH}			30	µs	I_O=1A
		T_{PHL}			100	µs	I_O=1A
Minimum load inductance		Lo	1.0			mH	
Maximum ON duty		$D_{(ON)}$	0		60	%	

Note:
* The Zener diode has an energy capability of 200 mJ (single pulse).
* A start failure may occur if a short OFF signal of 10 ms or below is input in the V_{IN} terminal.

External Dimensions (unit: mm)

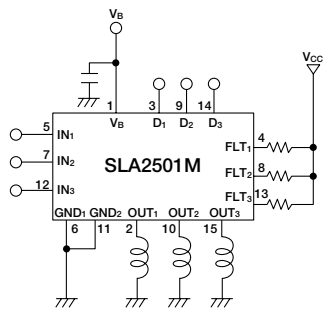


Equivalent Circuit Diagram

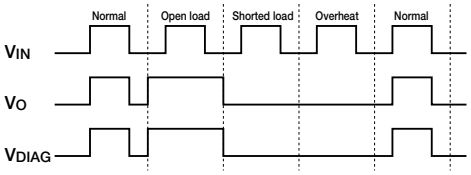


a: Pre-regulator
b: Overvoltage protection circuit
c: Control circuit
d: Driver circuit
e: Overcurrent protection circuit
f: Diagnostic circuit
g: Thermal protection circuit

Standard Circuit Diagram

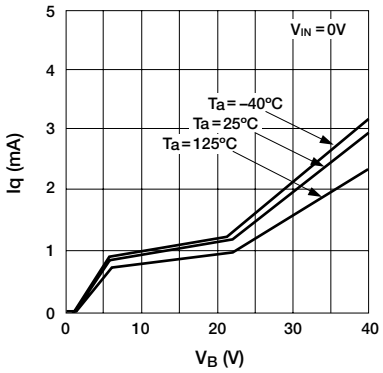


Diagnostic Function

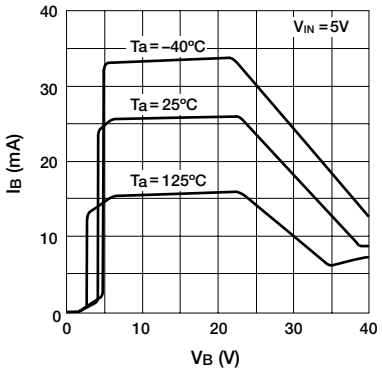


Electrical Characteristics

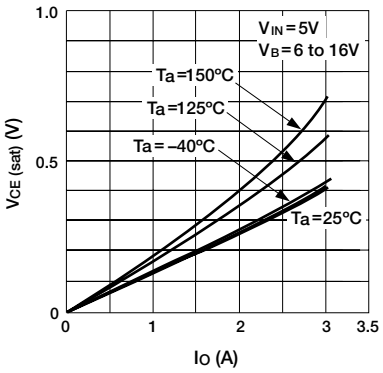
■ Quiescent Circuit Current (single circuit)



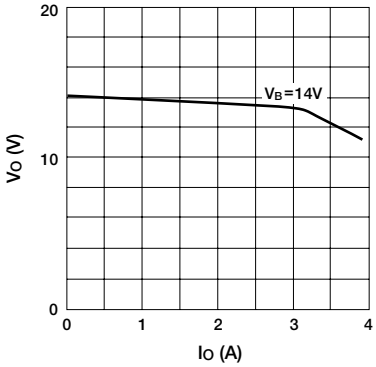
■ Circuit Current (single circuit)



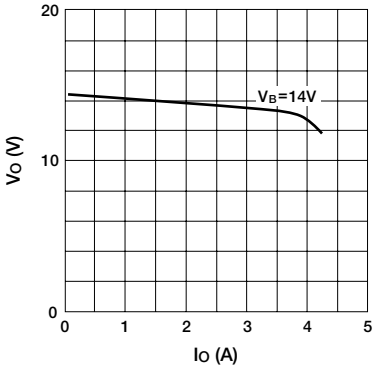
■ Saturation Voltage of Output Transistor



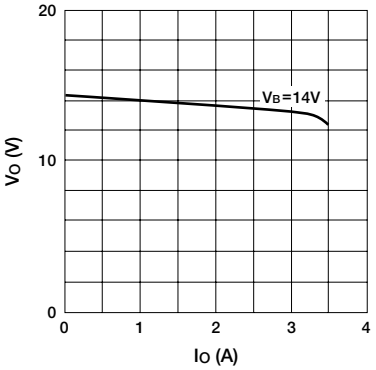
■ Overcurrent Protection Characteristics (Ta = –40°C)



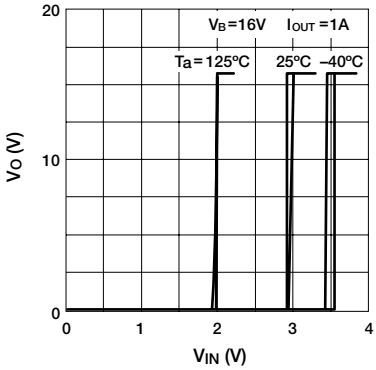
■ Overcurrent Protection Characteristics (Ta = 25°C)



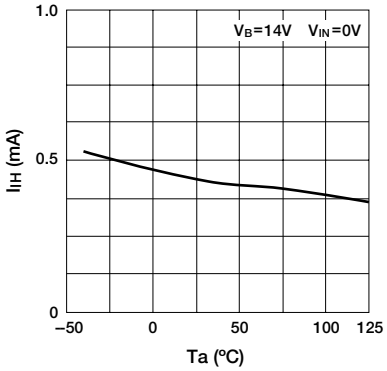
■ Overcurrent Protection Characteristics (Ta = 125°C)



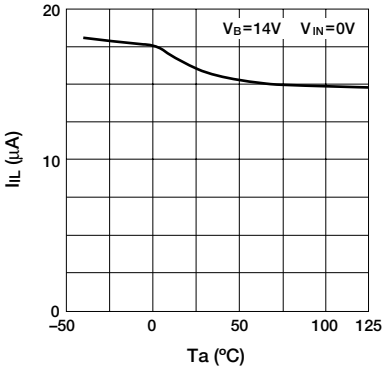
■ Threshold Input Voltage



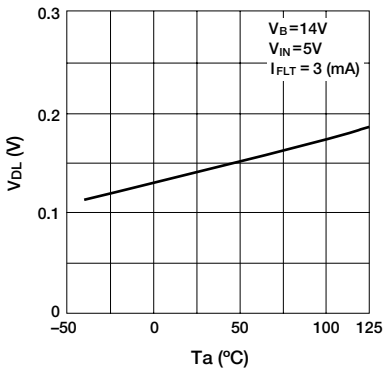
■ Input Current (Output ON)



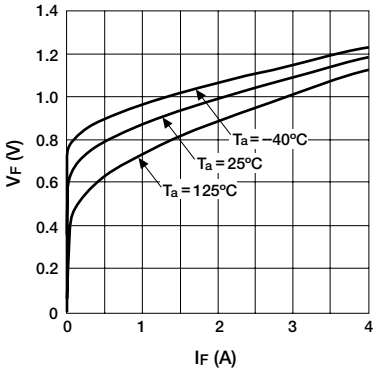
■ Input Current (Output OFF)



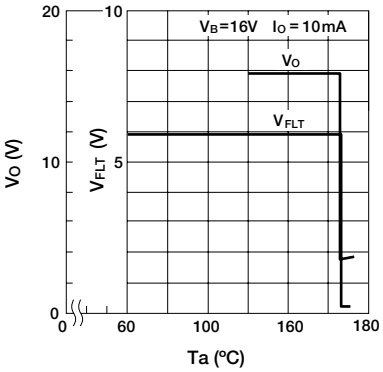
■ Saturation Voltage of DIAG Output



■ Output Reverse Current



■ Thermal Protection



Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- DMOS 3ch output
- Allows ON/OFF using C-MOS logic level
- Built-in overcurrent and thermal protection circuits

Absolute Maximum Ratings

(Ta=25ºC)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	35	V	
Input terminal voltage	V_{IN}	–0.3 to 7	V	
Input terminal current	I_{IN}	5	mA	
DG terminal voltage	V_{DG}	–0.3 to 7	V	
DG terminal current	I_{DG}	5	mA	
Drain to source voltage	V_{DS}	V_B–45	V	
Output current	I_O	1.8	A	
Power dissipation	P_D	2.7	W	Ta=25ºC, all circuit operating
Source to drain Di forward current	I_F	0.8	A	
Channel temperature	Tch	150	ºC	
Operating temperature	T_{OP}	–40 to +105	ºC	
Storage temperature	Tstg	–40 to +150	ºC	

Electrical Characteristics

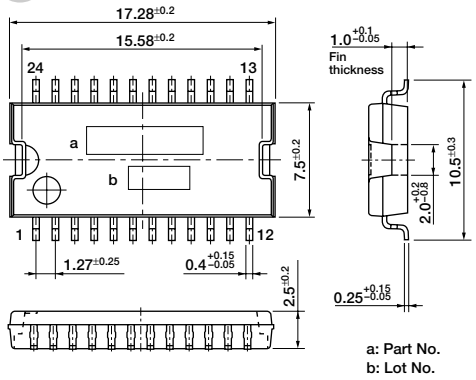
(V_B=14V, Ta=25ºC unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		$V_{B\ (opr)}$	5.5		35	V	
Quiescent circuit current		Iq			1	mA	V_{IN}=0V, V_{OUT}=0V
Output ON resistance		$R_{DS\ (ON)}$			200	mΩ	I_O=1A
					350	mΩ	I_O=1A, Ta=80ºC
Output leak current		I_O, leak		50	100	µA	V_{OUT}=0V
Input threshold voltage	Output ON	V_{IHth}	1.4	2.0	3.0	V	Ta= –40 to +105ºC
	Output OFF	V_{ILth}	1.0	1.8		V	Ta= –40 to +105ºC
Inpup current	Output ON	I_{IH}		70	200	µA	V_{IN}=5V
	Output OFF	I_{IL}			12	µA	V_{IN}=0V
Overcurrent protection starting current		I_S	1.9	3		A	V_{OUT}=V_O–1.5V
Internal current limit		I_{Lim}		5		A	V_{OUT}=0V
Thermal shutdown operating temperature		T_{TSD}	155	165		ºC	
Load open detection threshold voltage		Vopen	1.5	3	4.5	V	
Output transfer time		T_{ON}		70	140	µs	R_L=14Ω, V_{OUT}=V_B–5V
		T_{OFF}		35	90	µs	R_L=14Ω, V_B •10%
DG leak current		I_{DG}			20	µA	V_{DG}=5.5V
Low level DG output voltage		V_{DGL}		0.15	0.5	V	I_{DG}=1.6mA
DG output transfer time		T_{PLH}		70	140	µs	
		T_{PHL}		45	120	µs	

Recommended Operating Conditions (for one channel)

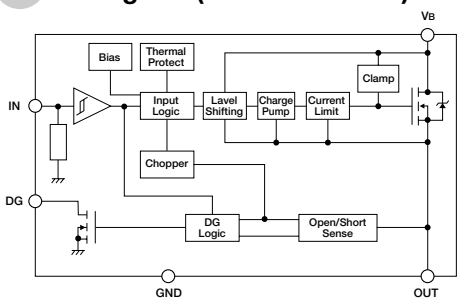
Parameter	Ratings min	Ratings max	Unit
Power supply voltage	5.5	16	V
V_{IH}	4	5.5	V
V_{IL}	–0.3	0.9	V
I_O		1	A
R_{IN}	10	20	kΩ
R_{DG}	10	20	kΩ

External Dimensions (unit: mm)

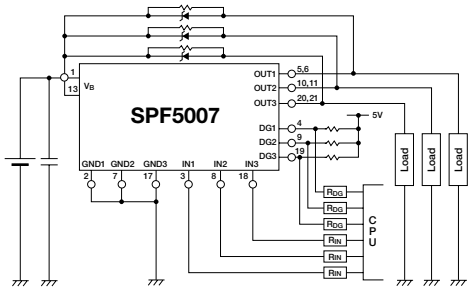


a: Part No.
b: Lot No.

Block Diagram (for one channel)

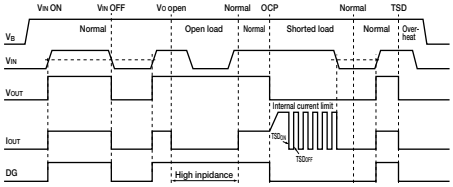


Standard Connection Diagram



* RIN and RDG are needed to protect CPU and SPF5007 in case of reverse connection of VB terminal.
* Make VB of 1Pin and 13Pin short from the fin to be plated by solder.

Timing Chart



Mode	V_{IN}	DG	V_O
Normal	H L	H L	H L
Open load	H L	H H	H H
Shorted load	H L	L L	L (Limiting) L
Overheat	H L	L L	L L

High-side Power Switch ICs [4-circuits] SLA2502M

Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- Low saturation PNP transistor use ($V_{CE\ (sat)} \leqq 0.5V$)
- Allows direct driving using LS-TTL and C-MOS logic levels
- Built-in overcurrent protection circuits
- Built-in protection against reverse connection of power supply
- Tj = 150ºC guaranteed

Absolute Maximum Ratings

(Ta=25ºC)

Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	–13 to +40	V	
Input terminal voltage	V_{IN}	–0.3 to +7.0	V	
DIAG output applied voltage	V_{DIAG}	–0.3 to +7.0	V	
DIAG output source current	I_{DIAG}	3	mA	
Output current	I_O	1.2	A	
Power Dissipation	P_D	4.8	W	Stand-alone operation without heatsink; all circuits operating
Junction temperature	Tj	–40 to +150	ºC	
Operating temperature	T_{OP}	–40 to +100	ºC	
Storage temperature	Tstg	–50 to +150	ºC	

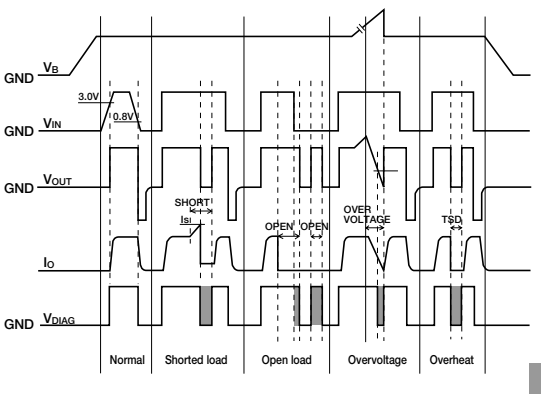
Electrical Characteristics

(V_{Bopr} =14V, Ta=25ºC unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Operating power supply voltage		V_{Bopr}	6.0		16	V	
Quiescent circuit current (per circuit)		Iq		5	12	mA	V_{IN}=0V
Threshold input voltage		V_{IN}th	0.8		3.0	V	
Input current	Hi output	I_{IN}			1.0	mA	V_{IN}=5V
	Lo output	I_{IN}	0		100	µA	V_{IN}=0V
Saturation voltage of output transistor		$V_{CE\ (sat)}$			0.5	V	$I_O \leqq 1.0A$, V_{Bopr}=6 to 16V
Output terminal sink current		$I_{O\ (off)}$			2.0	mA	V_O=0V, V_{IN}=0V
Saturation voltage of DIAG output		V_{DL}			0.3	V	I_{DIAG}=3mA
Leak current of DIAG output		I_{DGH}			100	µA	V_{DIAG}=5V
Open load detection resistor		Ropen			30	kΩ	
Overcurrent protection starting current		I_S	1.6			A	V_O=V_{Bopr}–1.9V
Output transfer time		T_{ON}		8	30	µs	I_O=1A
		T_{OFF}		15	30	µs	I_O=1A
DIAG output transfer time		T_{PLH}		10	30	µs	I_O=1A
		T_{PHL}		15	30	µs	I_O=1A

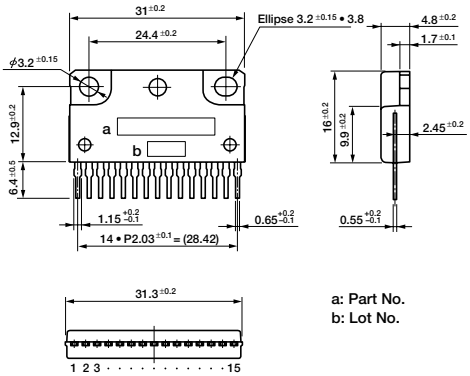
Note: * The rule of protection against reverse connection of power supply is V_B= –13V, one minute (all terminals except V_B and GND should be open).

Diagnostic Function



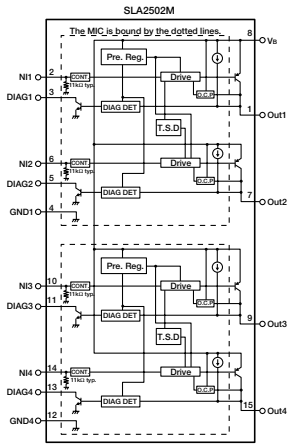
ERROR SIGNAL for CPU

External Dimensions (unit: mm)



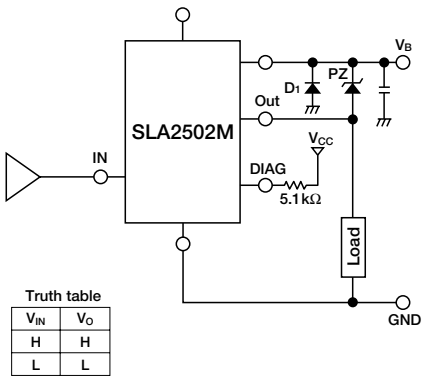
a: Part No.
b: Lot No.

Equivalent Circuit Diagram



[Abbreviations]
Drive: Drive circuit
CONT: ON/OFF circuit
Pre.Reg: Pre-regulator
DIAG.DET.: Diagnostic circuit
O.C.P.: Overcurrent protection
T.S.D.: Thermal protection

Standard Circuit Diagram



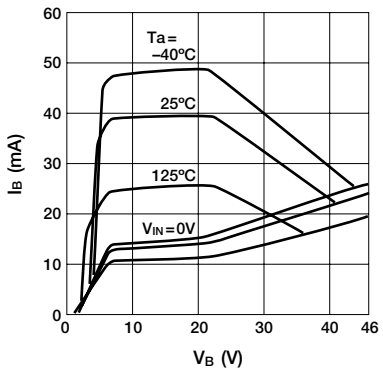
Truth table

V_{IN}	V_O
H	H
L	L

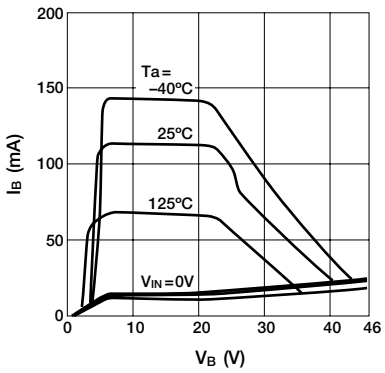
Note 1: A pull-down resistor (11kΩ typ.) is connected to the IN terminal. V_{OUT} turns "L" when a high impedance is connected to the IN terminal in series.
Note 2: Grounds GND1 and GND2 are not wired internally. They must be shorted at a pattern near the product.

Electrical Characteristics

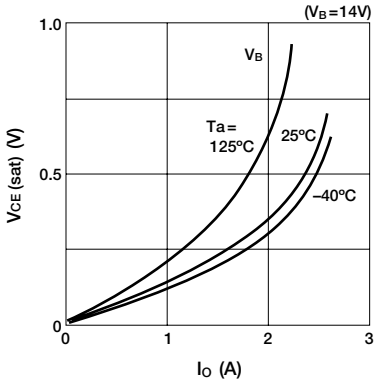
■ Circuit Current (single circuit)



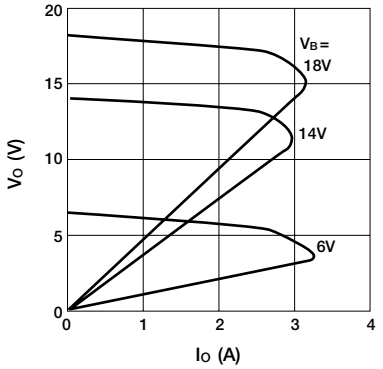
■ Circuit Current (4 circuits)



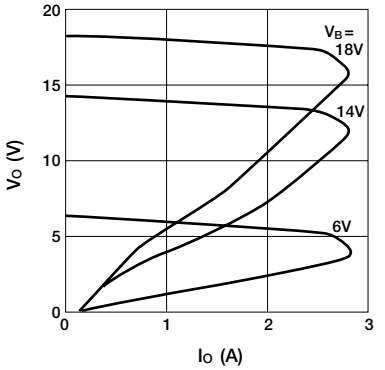
■ Saturation Voltage of Output Transistor



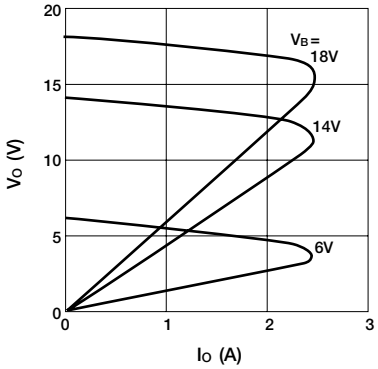
■ Overcurrent Protection Characteristics (Ta=–40°C)



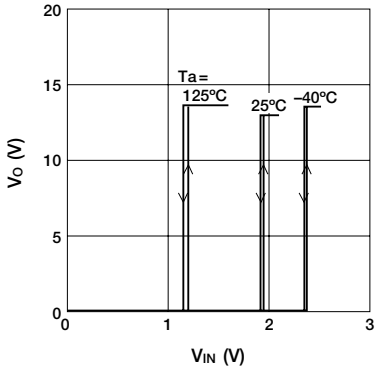
■ Overcurrent Protection Characteristics (Ta=25°C)



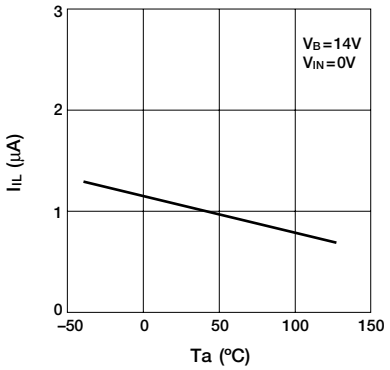
■ Overcurrent Protection Characteristics (Ta=125°C)



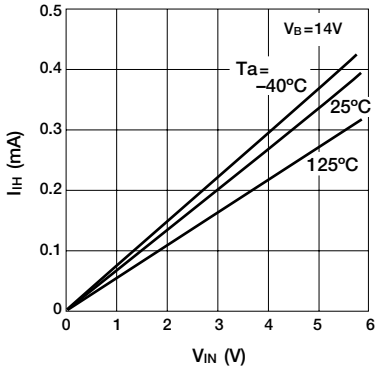
■ Threshold Input Voltage



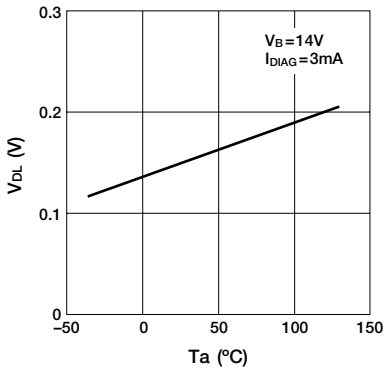
■ Input Current (Output OFF)



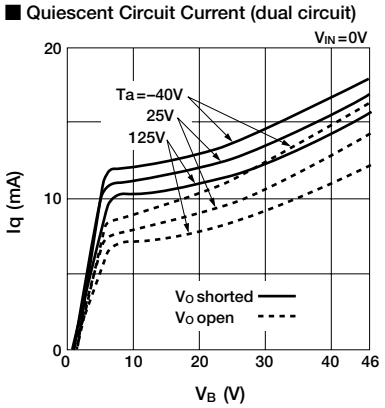
■ Input Current (Output Hi)



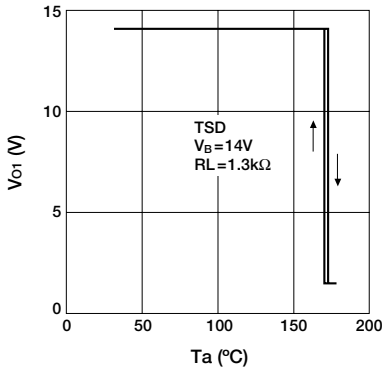
■ Saturation Voltage of DIAG Output



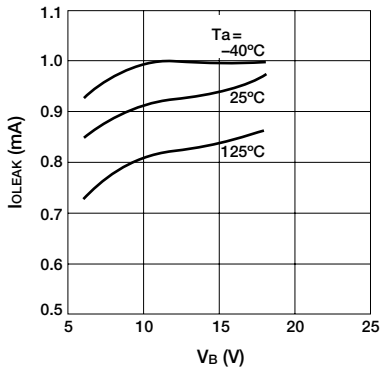
■ Quiescent Circuit Current (dual circuit)



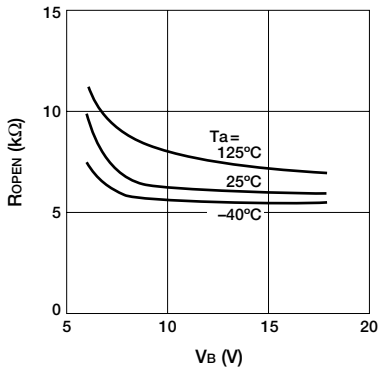
■ Thermal Protection Characteristics



■ Output Terminal Leak Current (V_O=0V)



■ Open Load Detection Resistor



Low-side Switch ICs [Surface-mount 4-circuits] SPF5002A

Features

- DMOS 4ch output
- Allows ON/OFF using C-MOS logic level
- Built-in overcurrent, overvoltage and thermal protection circuits

Absolute Maximum Ratings

(Ta=25°C)

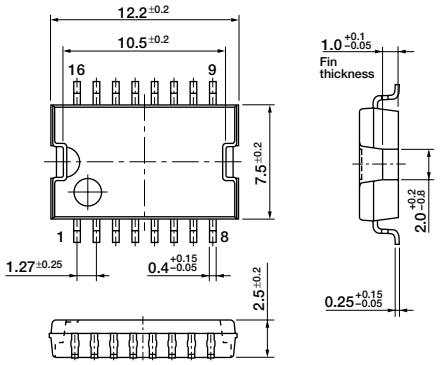
Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	40	V	
Output terminal voltage	V_{OUT}	37	V	
Input terminal voltage	V_{IN}	–0.5 to +7.5	V	
Output current	I_O	1.8	A	
Power Dissipation	P_D	2	W	
Storage temperature	Tstg	–40 to +150	°C	
Channel temperature	Tch	150	°C	
Output avalanche capability	E_{AV}	50	mJ	Single pulse

Electrical Characteristics

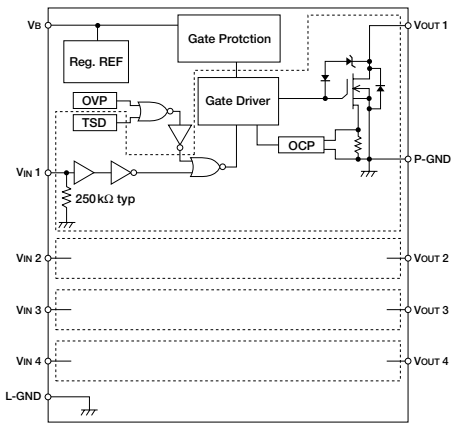
(V_B=14V, Ta=25°C unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Power supply voltage		V_{Bopr}	5.5		25	V	
Quiescent circuit current		Iq		5	7	mA	V_{IN}=0V (all inputs)
Operating circuit current		I_{CC}		8	12	mA	V_{IN}=5V (all inputs)
Input voltage	Hi output	V_{IN}	3.5		5.5	V	I_O=1A
	Lo output	V_{IN}	–0.5		1.5	V	
Input current	Hi output	I_{IN}			50	μA	V_{IN}=5V
	Lo output	I_{IN}			30	μA	V_{IN}=0V
Output ON resistance		$R_{DS(ON)}$		0.4	0.6	Ω	
				0.5	0.7	Ω	V_B=5.5V
Output clamp voltage		$V_{OUT(clamp)}$	41	50	55	V	I_O=1A
Output leak current		I_{OH}			10	μA	V_O=37V
Forward voltage of output stage diode		V_F			1.6	V	I_F=0.5A
Overvoltage protection starting voltage		$V_{B(ovp)}$	25		40	V	
Thermal protection starting temperature		T_{TSD}	151	165		°C	
Overcurrent protection starting current		I_S	1.1			A	
Output transfer time		T_{ON}			12	μs	R_L=14Ω, I_O=1A
		T_{OFF}			8	μs	R_L=14Ω, I_O=1A
Output rise time		T_r			5	μs	R_L=14Ω, I_O=1A
Output fall time		T_f			10	μs	R_L=14Ω, I_O=1A

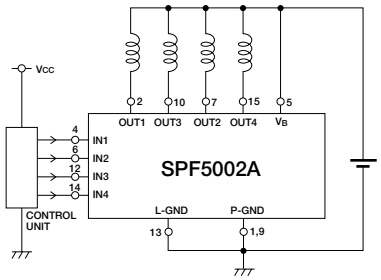
External Dimensions (unit: mm)



Equivalent Circuit Diagram



Circuit Example

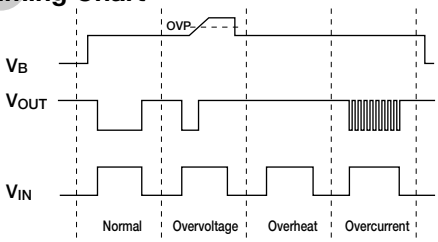


Use L-GND and P-GND being connected.

Truth table

V_{IN}	V_O
H	L
L	H

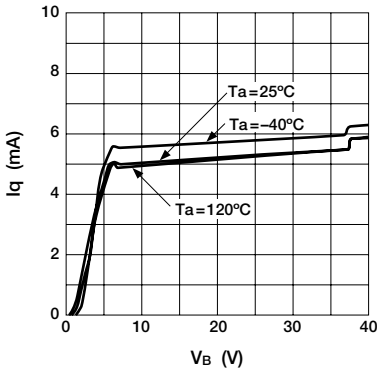
Timing Chart



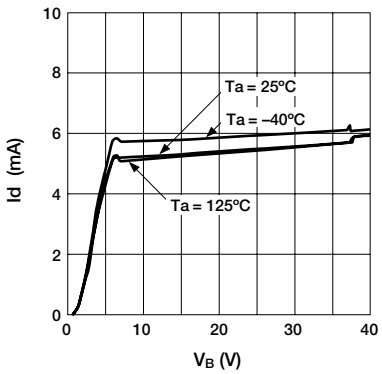
* Self-excited frequency is used in the overcurrent protection.

Electrical Characteristics

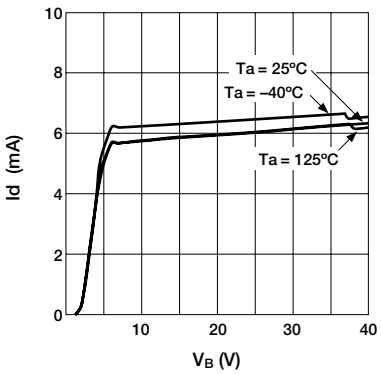
■ Quiescent Circuit Current



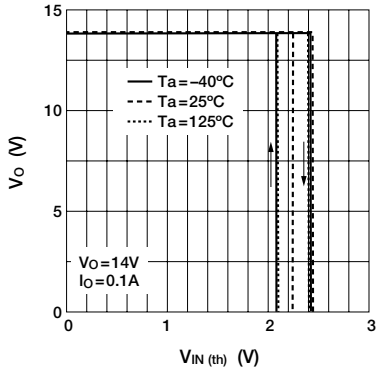
■ Circuit Current (single circuit)



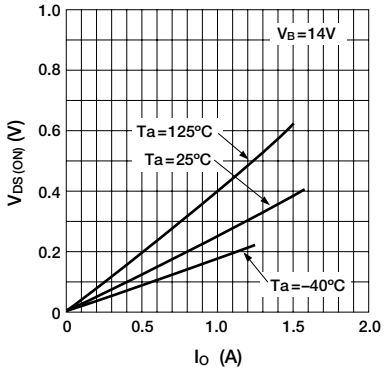
■ Circuit Current (4 circuits)



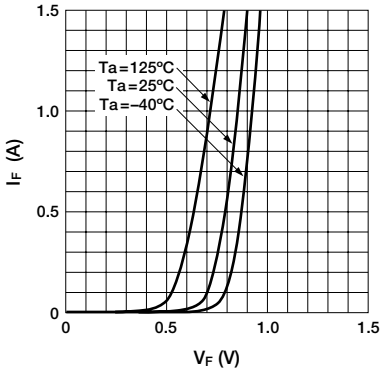
■ Threshold Input Voltage



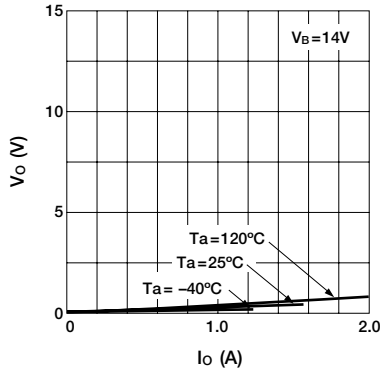
■ Output ON Voltage



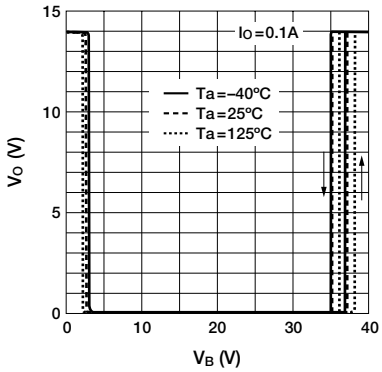
■ Forward Voltage of Output Stage Diode



■ Overcurrent Protection Characteristics



■ Overvoltage Protection Starting Voltage



Features

- DMOS 4ch output
- Allows ON/OFF using C-MOS logic level
- Built-in over current and thermal protection circuit and diagnostic function to detect open load
- Built-in output status signals (over current, over heat and open load)

Absolute Maximum Ratings

(Ta=25ºC)

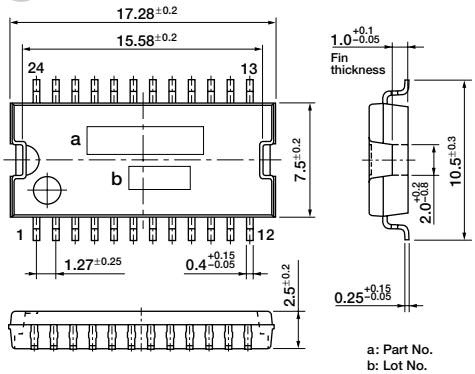
Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_B	40	V	
Output terminal voltage (DC)	V_{OUT}	50	V	
Output terminal voltage (pulse)	V_{OUT}	Output clamping (max 70V)	V	
Output current (DC)	I_{OUT}	±2.9	A	
Output current (pulse)	I_{OUT}	Over current protection starting current	A	
Input terminal voltage	$V_{(IN, SEL, B/U)}$	–0.5 to +6.5	V	
Diag output source current	V_{DIAG}	6.5	V	
Diag output voltage	I_{DIAG}	5	mA	
Power Dissipation	P_D	2.8	W	
Storage temperature	Tstg	–40 to +150	ºC	
Channel temperature	Tch	150	ºC	
Output avalanche capability	E_{AV}	80	mJ	Single pulse

Electrical Characteristics

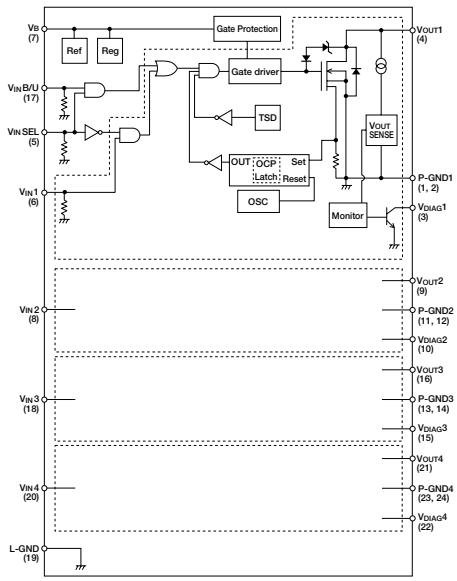
(V_B =14V, Ta= 25ºC unless otherwise specified)

Parameter	Symbol	Ratings			Unit	Conditions
		min	typ	max		
Power supply voltage	$V_{B\ (opr)}$	5.5		40	V	
Quiescent circuit current	I_q		9	12	mA	V_B=14V, V_{IN}=0V
Operating circuit current	I_d		12	15	mA	V_B=14V, V_{IN}=5V (all inputs)
Input voltage (1 to 4, SEL, B/U)	$V_{IN\ (H)}$	3.5		6.5	V	V_B=14V, V_O=1A
	$V_{IN\ (L)}$	–0.5		1.5	V	V_B=14V
Input current (single circuit) (1 to 4, SEL, B/U)	$I_{IN\ (H)}$			200	µA	V_B=14V, V_{IN}=5V
	$I_{IN\ (L)}$			30	µA	V_B=14V, V_{IN}=0V
Output ON resistance	$R_{DS\ (ON)}$			0.18	Ω	V_B=14V, I_O=1A
Output clamp voltage	$V_{OUT\ (clamp)}$	60	65	70	V	V_B=14V, I_O=1A
Output leak current	I_{OH}			50	µA	V_B=14V, V_O=50V
Forward voltage of output stage diode	V_F			1.5	V	I_F=1A
Output moniter threshold voltage	$V_{th}M$			2	V	V_B=14V
DIAG output voltage	$V_{DIAG\ (H)}$	6.4		6.5	V	V_B=14V, V_{DIAG}=6.5V
	$V_{DIAG\ (L)}$			0.5	V	V_B=14V, I_{DIAG}=5mA
DIAG output leak current	I_{DH}			10	µA	V_B=14V, V_{DIAG}=6.5V
Thermal shutdown operating temperature	T_{TSD}	151	165		ºC	V_B=14V
Overcurrent protection starting current	I_S	3.0			A	V_B=14V
Output transfer time	T_{ON}			12	µs	V_B=14V, R_L=14Ω, I_O=1A
	T_{OFF}			8	µs	V_B=14V, R_L=14Ω, I_O=1A
Output rise time	T_r			5	µs	V_B=14V, R_L=14Ω, I_O=1A
Output fall time	T_f			10	µs	V_B=14V, R_L=14Ω, I_O=1A
DIAG output transfer time	t_{DON}			12	µs	V_B=14V, R_L=14Ω, I_O=1A
	t_{DOFF}			8	µs	V_B=14V, R_L=14Ω, I_O=1A

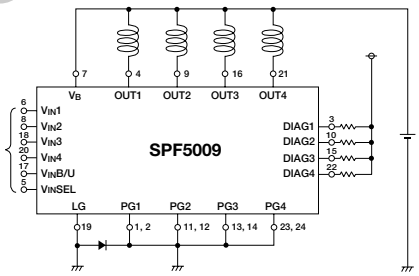
External Dimensions (unit: mm)



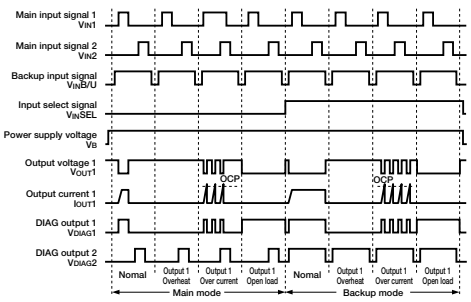
Equivalent Circuit Diagram



Circuit Example



Timing Chart



Features

- Output monitor circuit (DIAG)
- DMOS 4ch output
- Allows ON/OFF using C-MOS logic level
- Built-in overcurrent, overvoltage and thermal protection circuits

Absolute Maximum Ratings

(Ta=25ºC)

Parameter	Symbol	Ratings	Unit	Conditions
DC input voltage	V_B	40	V	
	V_{CC}	7.5	V	
Output voltage	V_O	40 (DC)	V	*1
Logic input voltage	V_{IN}	–0.5 to +7.5	V	
Output current	I_O	Self Limited	A	
Diag output voltage	V_{DIAG}	0 to V_{CC}	V	
Power Dissipation	P_D	2.8 to 5	W	*2
Storage temperature	Tstg	–40 to +150	ºC	
Channel temperature	Tch	150	ºC	
Output avalanche capability	E_{AV}	100	mJ	Single pulse

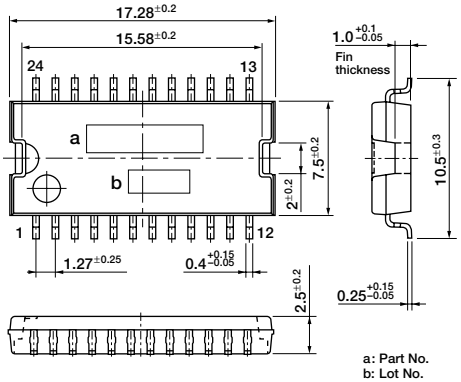
*1. At the clamping operation, refer to the section of $V_{OUT\ (clamp)}$ in electrical characteristics
*2. Changes by the patern of mounted substrate

Electrical Characteristics

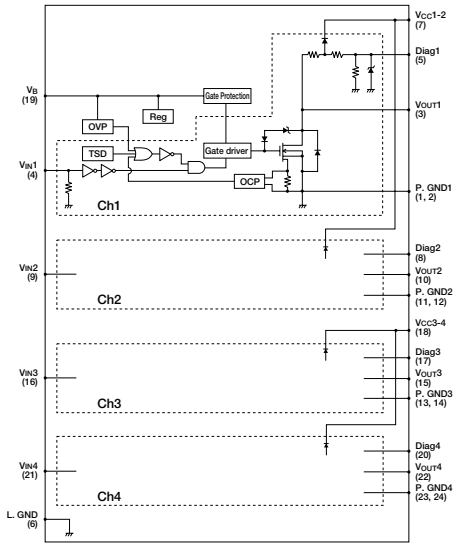
(V_B =14V, Ta=25ºC unless otherwise specified)

Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Power supply voltage		$V_{B\ (opr)}$	5.5		40	V	
		$V_{CC\ (opr)}$	4.5		5.5	V	
Quiescent circuit current		Iq		4	6	mA	V_B=14V, V_{IN}=0V
Operating circuit current		Id		8	12	mA	V_B=14V, V_{IN}=5V
Input voltage	Hi output	V_{IN}	3.5		5.5	V	V_B=14V, V_O=1A
	Lo output	V_{IN}	–0.5		1.5	V	V_B=14V
Input current	Hi output	I_{IN}			50	µA	V_B=14V, V_{IN}=5V
	Lo output	I_{IN}			–30	µA	V_B=14V, I_O 1A
Output ON resistance		$R_{DS\ (ON)}$			0.3	Ω	V_B=14V, I_O=1A, Ta=125ºC
					0.2	Ω	V_B=14V, I_O=1A, Ta=25ºC
Output clamp voltage		$V_{OUT\ (clamp)}$	45	50	55	V	V_B=14V, I_O=1A
Output leak current		I_OH			2.8	mA	V_B=14V, V_{CC}=5V, V_{IN}=0V, V_O=40V, Ta=25ºC
					900	µA	V_B=14V, V_{CC}=5V, V_{IN}=0V, V_O=14V, Ta=25ºC
Forward voltage of output stage diode		V_F			1.6	V	I_F=1A
Overvoltage protection starting voltage		$V_{B\ (ovp)}$	25		40	V	
Overvoltage protection hysteresis voltage		$V_{B\ (ovp•hys)}$		8		V	
Thermal shutdown operating temperature		T_{TSD}	151	165		ºC	V_B=14V
Overcurrent protection operating current		I_S	6			A	V_B=14V, Ta=–40ºC
			6			A	V_B=14V, Ta=25ºC
			5			A	V_B=14V, Ta=125ºC
Output transfer time		T_{ON}			12	µs	V_B=14V, R_L=14Ω, I_O=1A
		T_{OFF}			8	µs	
Output rise time		T_r			5	µs	
Output fall time		T_f			10	µs	
Output-diag voltage ratio		$r_{a\ (DIAG)}$	0.195	0.2	0.205		V_B=14V, V_O=1 to 14V, Rdiag=500kΩ
Diag output clamping voltage		$V_{DIAG\ (clamp)}$			4.85	V	V_B=14V, V_{CC}=5V, V_O=40V

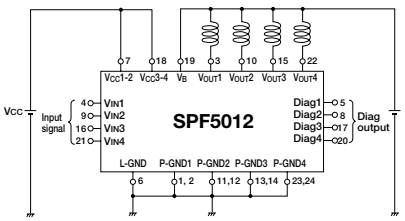
External Dimensions (unit: mm)



Equivalent Circuit Diagram



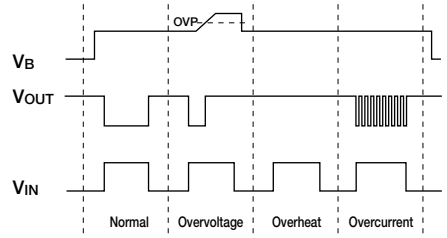
Circuit Example



Truth table

V_{IN}	V_O
H	L
L	H

Timing Chart



* Self-excited frequency is used in the overcurrent protection.

Stepper-motor Driver ICs SLA4708M

Features

- High output breakdown voltage of 50V
- Affluent output current of 1.5A
- Built-in overcurrent, overvoltage and thermal protection circuits
- Low standby current of 50μA

Absolute Maximum Ratings

(Ta=25°C)

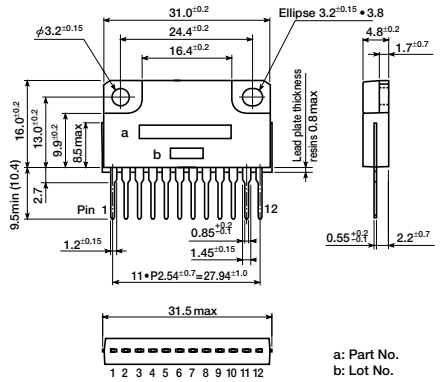
Parameter	Symbol	Ratings	Unit	Conditions
Power supply voltage	V_S	35	V	
Breakdown voltage	V_O	50	V	
Input voltage	V_{IN}	–0.3 to +7	V	
Output current	$I_{O, AVE}$	1.5	A	
Diagnostic output sink current	I_{DIAG}	10	mA	
Diagnostic output withstand voltage	$I_{DIAG. H}$	7	V	
Operating temperature	Top	–40 to +85	°C	
Storage temperature	Tstg	–40 to +150	°C	
Power Dissipation	P_D	3.5 (Ta=25°C)	W	Without heatsink

Electrical Characteristics

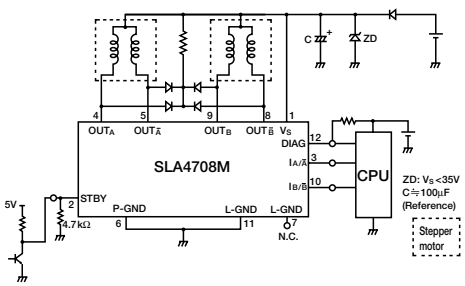
(V_S=12V, Ta=25°C)

Parameter	Symbol	Ratings			Unit	Conditions
		min	typ	max		
Input voltage ($I_{A/\overline{A}}$, $I_{B/\overline{B}}$ standby)	V_{IL}			0.8	V	
	V_{IH}	2.4			V	
Input current	I_{IL}			–0.8	mA	V_{IN}=0.4V
	I_{IH}			50	μA	V_{IN}=2.4V
Output saturation voltage	$V_{O.STA}$			1.3	V	I_O=1A, Ta=25°C
	$V_{O.STA}$			1.5	V	I_O=1.5A, Ta=25°C
Output leak current	$I_{O.LEAK}$			100	μA	V_O=16V
Overcurrent detection	I_{SD}	1.8			A	
Overvoltage detection	V_{SD}	27.5			V	
Saturation voltage of diagnostic output	$V_{DIAG.L}$			0.3	V	I_{DIAG}=5mA
Standby current	I_{STB}		50		μA	V_S=12V

External Dimensions (unit: mm)

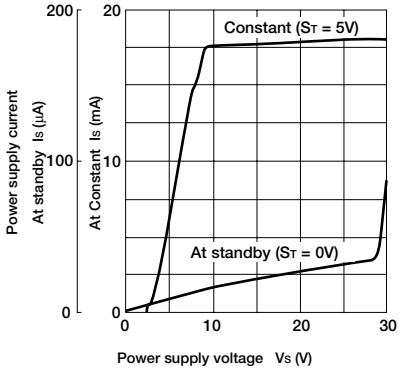


Standard Circuit Diagram

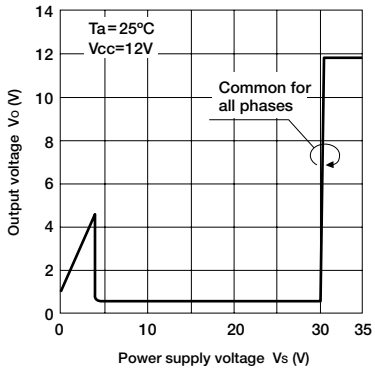


Electrical Characteristics

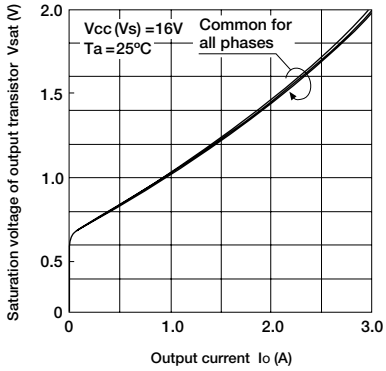
■ Power Supply Current Characteristics



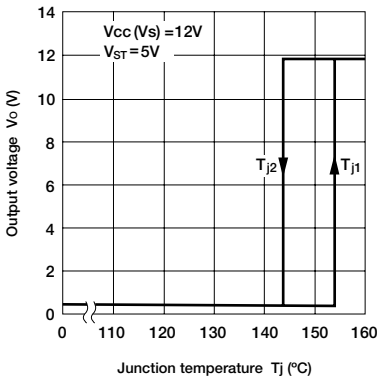
■ Overvoltage Protection Characteristics



■ Saturation Voltage of Output Transistor Characteristics



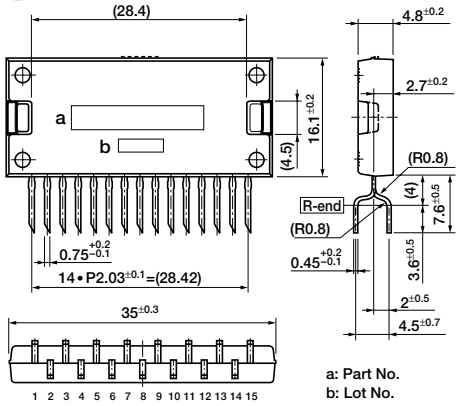
■ Thermal Protection Characteristics



Features

- P-ch MOS for high side and N-ch MOS for low side in one package
- Enable to drive DC±5V
- Possible to drive a motor at the LS-TTL, C-MOS Logic level
- Guarantee Tj=Tch=150°C
- Built-in over current protection and thermal shut down circuits
- Built-in diagnosis function to monitor and signal the state of each protection circuits
- Built-in vertical current prevention circuits (Dead time is defined internally.)
- No insulator required for Sanken's original package (SPM package)

External Dimensions (unit: mm)



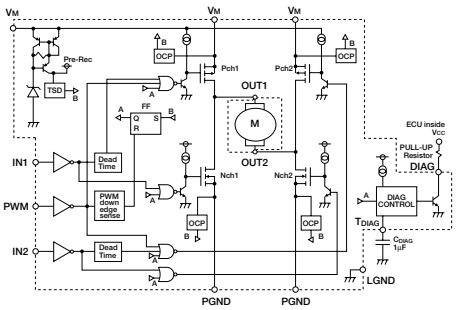
Absolute Maximum Ratings

(Ta=25ºC)

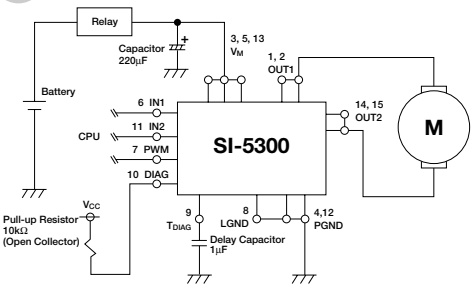
Parameter	Symbol	Ratings	Unit	Conditions
Motor supply voltage	V_M	40	V	
Input terminal voltage	IN1	–0.3 to 7	V	
	IN2	–0.3 to 7	V	
	PWM	–0.3 to 7	V	
Output current	I_O	±5	A	
	$I_{O\ (p\text{-}p)}$	±17	A	P_W≦1ms, Duty≦50%
PWM control frequency	f_{PWM}	20	kHz	Duty=20% to 80%
Forward • reverse rotation switch frequency*	f_{CW}	500	Hz	
Operating temperature	T_{OP}	–40 to +85	ºC	
Junction and channel temperature	Tj, Tch	–40 to +150	ºC	
Storage temperature	Tstg	–40 to +150	ºC	
Thermal resistance	θj-c	3.7	ºC/W	
	θj-a	35	ºC/W	
Power dissipation	P_{D1}	3.6	W	Without heatsink
	P_{D2}	33.7	W	With infinite heatsink

Note: * The dead time for the length current prevention in positive and the reversing switch is set by internal control IC. The set point in internal IC at the dead time is 20μs (typical). Please take into account the dead time and consider the load conditions when you use the IC.

Equivalent Circuit



Standard Connection Diagram



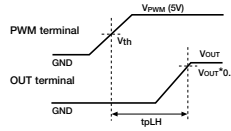
Electrical Characteristics

(Unless, otherwise specified, Tj=Tch=25°C, V_M=14V, I_O=3A)

Parameter	Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Motor supply voltage	V_{IN}	6		18	V	V_M=24V (2 min.)
Output saturation voltage	V, V_M-V_O			0.8	V	I_O=3A
	V, V_O-PG			0.3	V	I_O=3A
Output leakage current	I_L, L			100	μA	V_M=40V
	I_L, H			100	μA	V_M=40V
Output transmission time	tpLH			10 *2	μs	V_{PWM}: L→H (Vth=2.5V typ)
	tpHL			15 *3	μs	V_{PWM}: H→L (Vth=2.5V typ)
	tpHL-tpLH			10	μs	
Forward voltage characteristic of diode between drain and source	V_F•L		0.8		V	I_O=3A
			1.0		V	I_O=10A
	V_F•H		0.8		V	I_O=3A
			1.0		V	I_O=10A
Static circuit current	IM1		22		mA	Stop mode
	IM2		22		mA	Forward and reverse mode
	IM3		16		mA	Brake mode
Input terminal voltage	V_{IN}, H	3.0			V	$V_{IN}1=V_{IN}2=V_{PWM}$
	V_{IN}, L			2.0	V	$V_{IN}1=V_{IN}2=V_{PWM}$
Input terminal current	I_{IN}, L	–100			μA	$V_{IN}1=V_{IN}2=V_{PWM}$=0V
	I_{IN}, H			200	μA	$V_{IN}1=V_{IN}2=V_{PWM}$=5V
OPC start current	I_{OCP}	16			A	*1
DIAG output pulse width	t_{DIAG}	20			ms	C=1μF (typ)
DIAG terminal voltage	V_D•L			0.3	V	ID•SINK=1mA *4

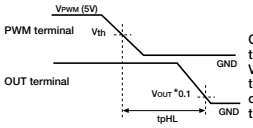
Note:
*1: The standard value of I_{OCP} is assumed to be a value by which the output of each Power MOS FET cuts off. When the protection circuit of OCP and TSD operates, Power MOS FETs keeps cutoff. When a signal (5V: H → 0V: L) is input to the terminal PWM, the cutoff operation will be released. Moreover, three minutes (Ta=25ºC, f_{PWM}=10kHz, V_M=14V) are assumed to be max at the overcurrent state continuance time in the V_M operation and the ground of output terminal (OUT1, OUT2). It is not the one to assure the operation including reliability in the state that the short-circuit continues for a long time.

*2: Output transmission time (tpLH)



Output transmission time tpLH is time from Vth (2.5V typ) of the terminal of PWM to output (V_{OUT} *0.9) of the output terminal.

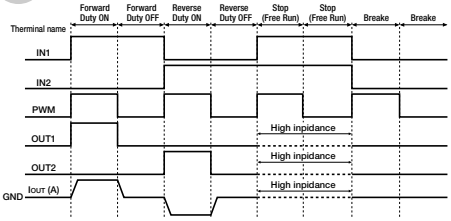
*3: Output transmission time (tpHL)

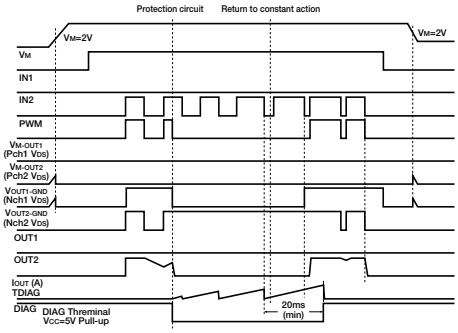


Output transmission time tpHL is time from Vth (2.5V typ) of the terminal of PWM to output (V_{OUT} *0.1) of the output terminal.

*4: DIAG signal output terminal is an open collector output. Use a pull-up resistor when connecting it to a logic circuit.

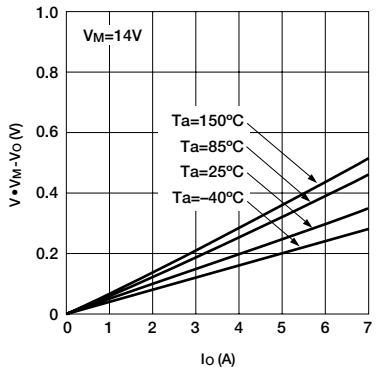
Timing Chart



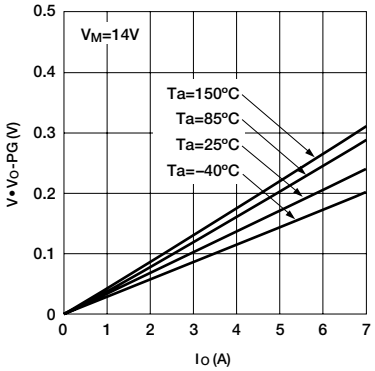


Electrical Characteristics

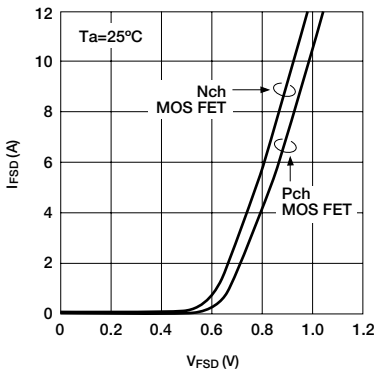
■ Output saturation voltage (Pch)



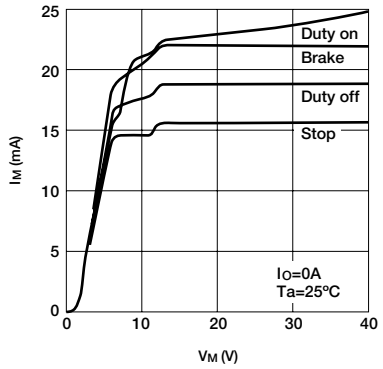
■ Output saturation voltage (Nch)



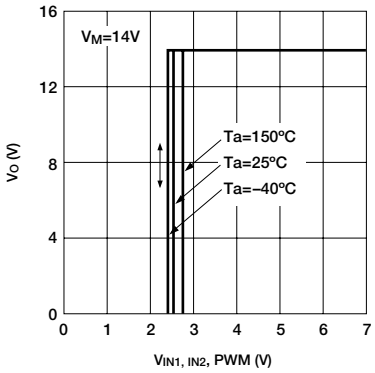
■ Forward voltage of Diode between drain and source



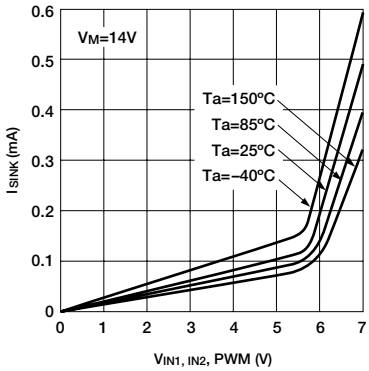
■ Quiescent circuit current



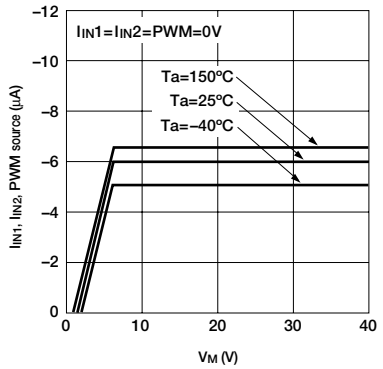
■ Voltage of input terminal (Threshold voltage)



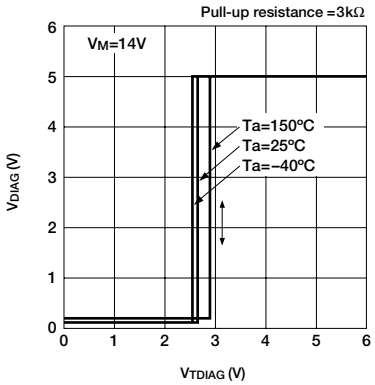
■ Current of input terminal (SINK current)



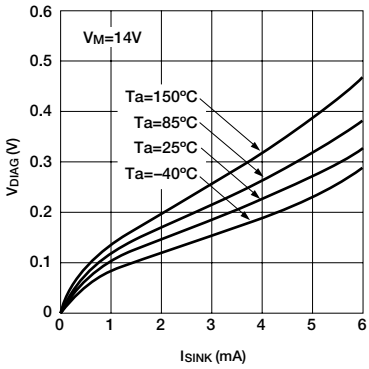
■ Current of input terminal (Source current)



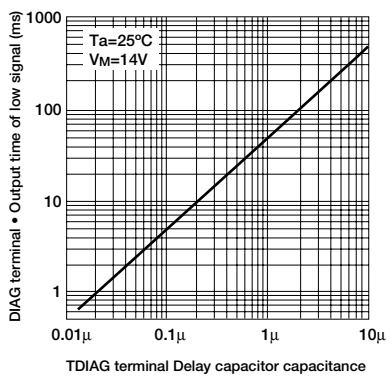
■ VTDIAG – VDIAG Characteristics



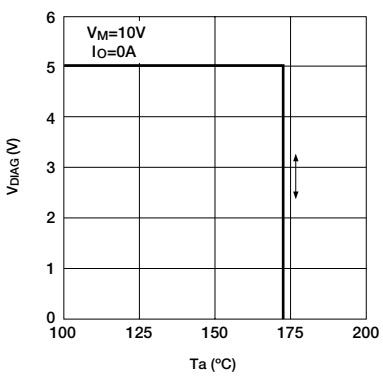
■ DIAG terminal • Saturation voltage



■ DIAG terminal • Output pulse width

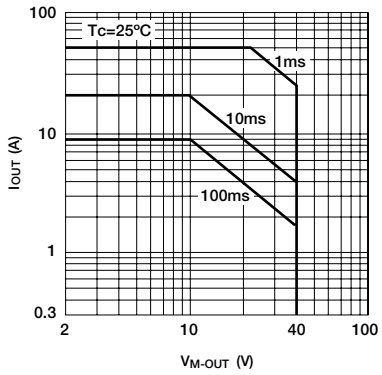


■ Thermal shut down protection

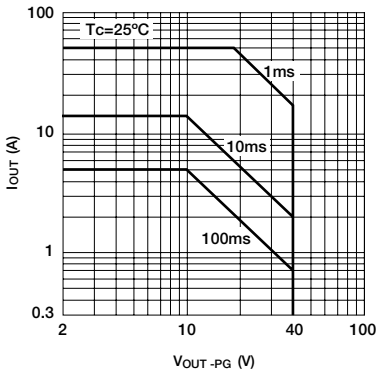


Electrical Characteristics

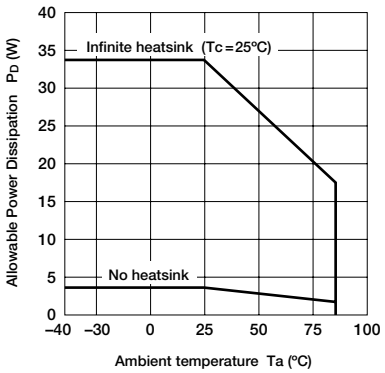
■ Pch MOS FET Safe Operating Area (SOA)



■ Nch MOS FET Safe Operating Area (SOA)



■ PD—Ta Characteristics



High Voltage Full Bridge Drive IC SLA2402M

Features

- One Package Full Bridge Driver Consisted of High Voltage IC and Power MOS FETs (4 pieces)
- High Voltage Driver which accepts direct connection to the input signal line
- External components such as high voltage diodes and capacitors are not required

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Power source voltage *	V_M	500	V	
Input voltage	V_{IN}	15	V	
Output voltage	V_O	500	V	
Output current	I_O	15	A	$P_W \leqq 250\mu s$
Power dissipation	P_D	5 (Ta=25°C)	W	Without heatsink
Storage temperature	Tstg	–40 to +125	°C	
Operation temperature	Topr	–40 to +105	°C	

* Power GND (D terminal) to -HV (-HV terminal) voltage.

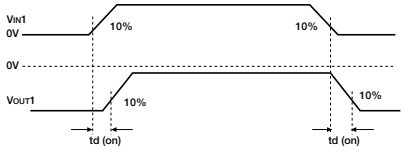
Electrical Characteristics

Parameter	Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Power MOS FET output breakdown voltage	BV_{OUT}	500			V	I_O=100μA
Power MOS FET output leakage voltage	$I_{OUT\ (off)}$			100	μA	V_O=500V
High-side Power MOS FET output on-state voltage	$V_{OUT\ (on)}1$	0.28	0.4	0.52	V	I_O=0.4A, V_{IN}=10V
	$V_{OUT\ (on)}2$	1.4	2.0	2.6	V	I_O=2A, V_{IN}=10V
Low-side Power MOS FET output on-state voltage	$V_{OUT\ (on)}1$	0.28	0.4	0.52	V	I_O=0.4A, V_{GL}=10V
	$V_{OUT\ (on)}2$	1.4	2.0	2.6	V	I_O=2A, V_{GL}=10V
Quiescent circuit current	$I_{CC}1$			3.0	mA	V_{CC}=4.5 to 15V
	$I_{CC}2$			4.0	mA	V_{CC}=10V, V_M=400V
Operating circuit current	$I_{CC}3$			4.0	mA	V_{CC}=10V, V_M=400V
Input voltage (High level)	V_{IH}	0.8V_{CC}			V	V_{CC}=4.5 to 15V
Input voltage (Low level)	V_{IL}			0.2V_{CC}	V	V_{CC}=4.5 to 15V
Delay time *	$t_{d\ (on)}$		1.4		μs	V_{CC}=10A, V_{IN}=10V, V_M=85A, I_O=0.41A
	$t_{d\ (off)}$		3.3		μs	
	Δt			2.5	μs	
Operating voltage	V_{CC}			15	V	–40 to +105°C

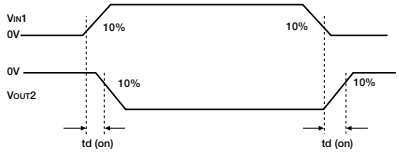
* About delay time

Signal input waveform vs output waveform

① Highside switch turn-on, turn-off

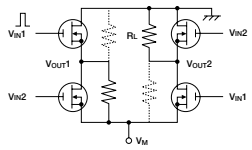


② Lowside switch turn-on, turn-off



* Δt: Δt=td (on) – td (off)

Measurement Circuit



Conditions

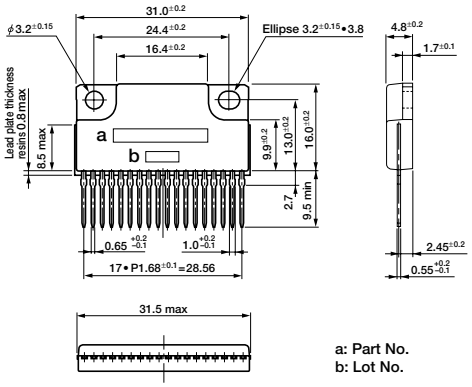
V_{CC}=10V, V_{IN}=10V (pulse)

V_M=85V

I_O=0.41A (R_L=207Ω)

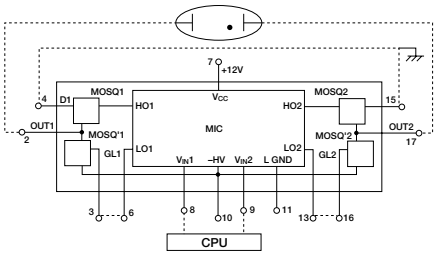
* When pulse signal is inputted to V_{IN1}, R_L on solid line is ON and dotted line R_L is off.
On the contrary, when pulse signal is inputted to V_{IN2}, R_L on dotted line is ON and dotted line R_L is off.

External Dimensions (unit: mm)



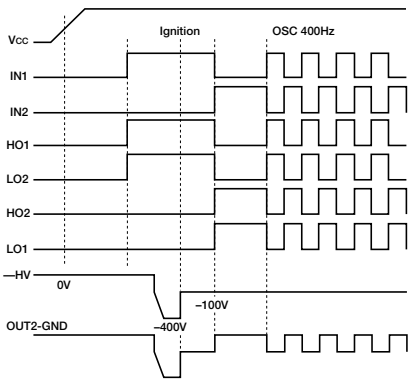
a: Part No.
b: Lot No.

Block Diagram



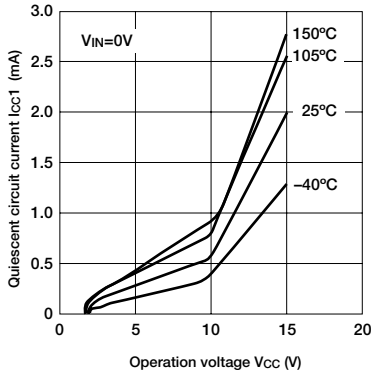
* Dotted Line: Outside Connection

Timing Chart

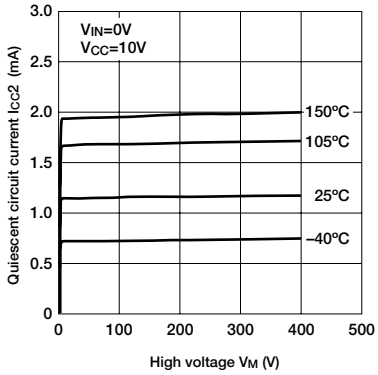


Electrical Characteristics

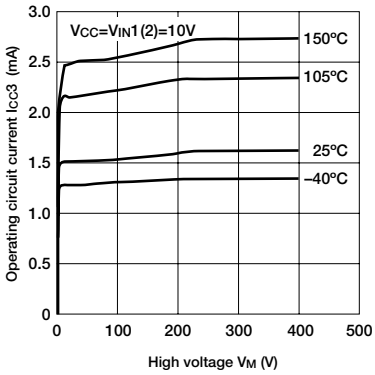
■ Quiescent circuit current



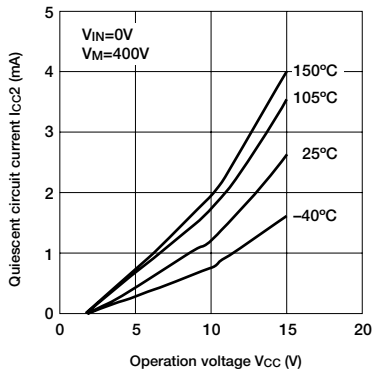
■ Quiescent circuit current supplied high voltage



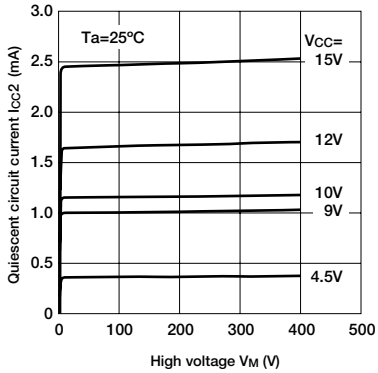
■ Operating circuit current



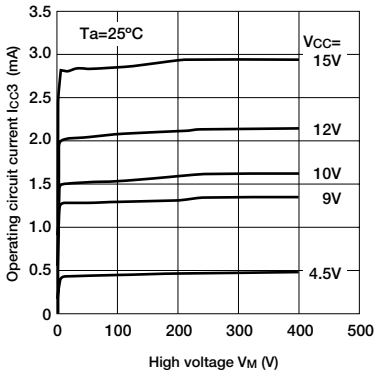
■ Quiescent circuit current supplied high voltage



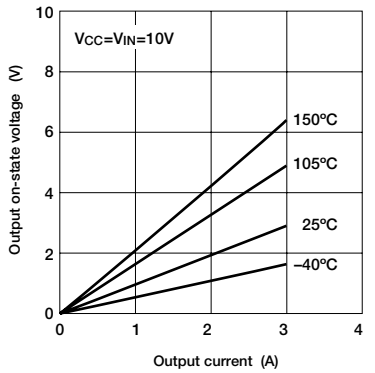
■ Quiescent circuit current



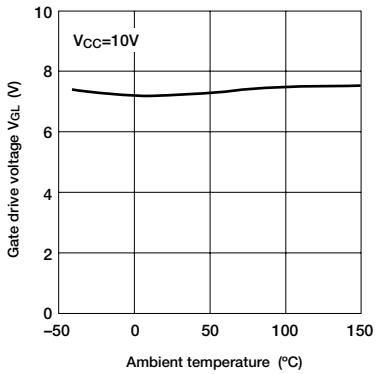
■ Operating circuit current



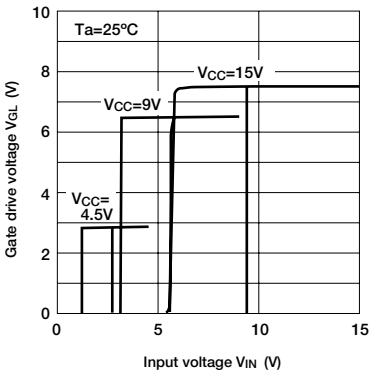
■ Output on-state voltage



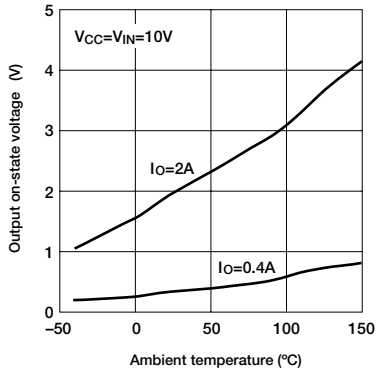
■ Gate drive voltage



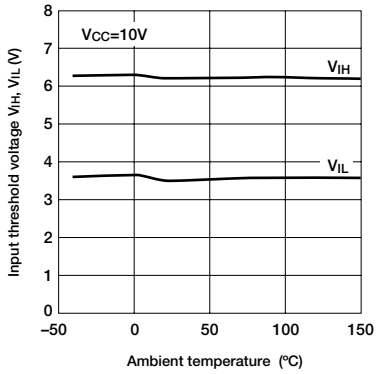
■ Gate drive voltage



■ Output on-state voltage

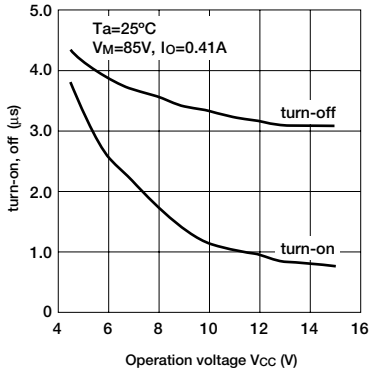


■ Input threshold voltage

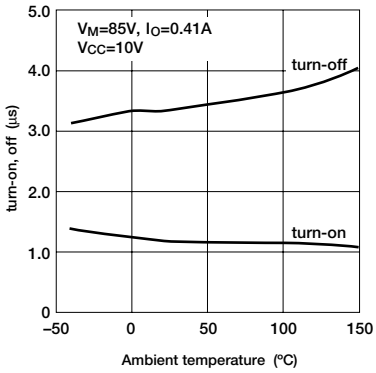


Electrical Characteristics

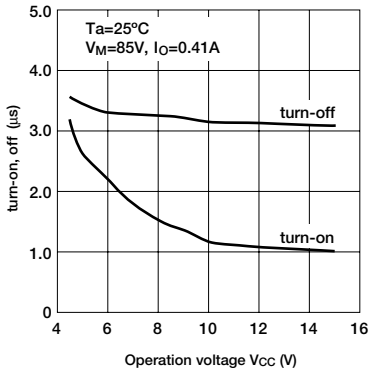
■ High side switch turn-on, off



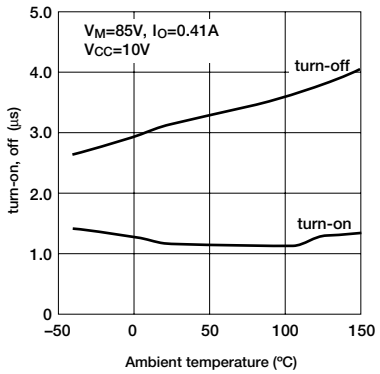
■ High side switch turn-on, off



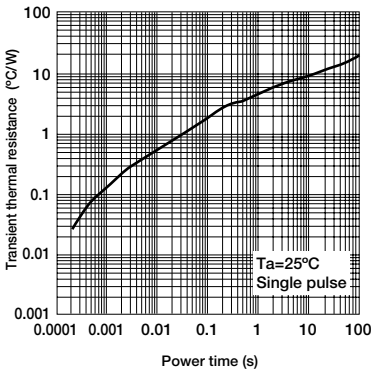
■ Low side switch turn-on, off



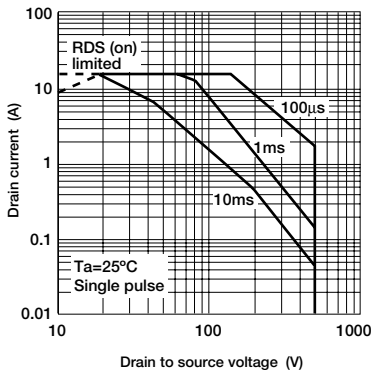
■ Low side switch turn-on, off



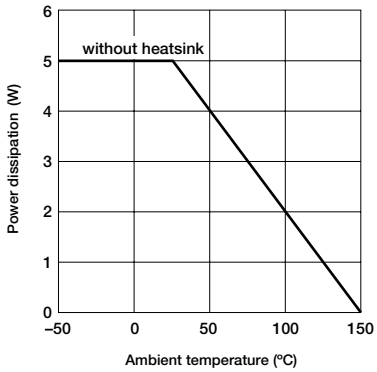
■ Transient thermal resistance characteristics



■ Safe operating area (Power MOS FET)



■ Power derating curve



High Voltage Full Bridge Drive IC SLA2403M

Features

- One Package Full Bridge Driver Consisted of High Voltage IC and Power MOS FETs (4 pieces)
- High Voltage Driver which accepts direct connection to the input signal line
- External components such as high voltage diodes and capacitors are not required

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Power source voltage *	V_M	500	V	
Input voltage	V_{IN}	15	V	
Output voltage	V_O	500	V	
Output current	I_O	7	A	Tc=25°C
	$I_{O\ (peak)}$	15	A	$P_W \leqq 250\mu s$
Power dissipation	P_D	5 (Ta=25°C)	W	Without heatsink
		40 (Tc=25°C)	W	With infinite heatsink
Storage temperature	Tstg	–40 to +125	°C	
Operation temperature	Topr	–40 to +125	°C	
Junction temperature	Tj	150	°C	

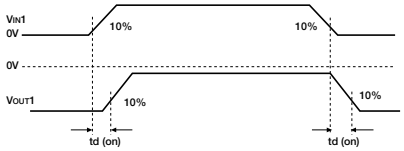
* Power GND (D terminal) to -HV (-HV terminal) voltage.

Electrical Characteristics

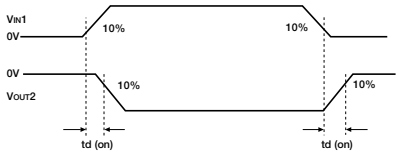
Parameter	Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Power MOS FET output breakdown voltage	BV_{OUT}	500			V	I_O=100μA
Power MOS FET output leakage voltage	$I_{OUT\ (off)}$			100	μA	V_O=500V
High-side Power MOS FET output on-state voltage	$V_{OUT\ (on)}$	0.18	0.26	0.34	V	I_O=0.4A, V_{IN}=10V
Lowside Power MOS FET output on-state voltage	$V_{OUT\ (on)}$	0.18	0.26	0.34	V	I_O=0.4A, V_{GL}=10V
Quiescent circuit current	I_{CC} 1			3.0	mA	V_{CC}=6 to 15V
	I_{CC} 2			4.0	mA	V_{CC}=10V, V_M=400V
Operating circuit current	I_{CC} 3			4.0	mA	V_{CC}=10V, V_M=400V
Input voltage (High level)	V_{IH}	$0.8V_{CC}$			V	V_{CC}=6 to 15V
Input voltage (Low level)	V_{IL}			$0.2V_{CC}$	V	V_{CC}=6 to 15V
Delay time *	$t_{d\ (on)}$		2.0		μs	V_{CC}=10A, V_{IN}=10V, V_M=85V, I_O=0.41A
	$t_{d\ (off)}$		3.0		μs	
Operating voltage	V_{CC}	6		15	V	–40 to +125°C

* About delay time
Signal input waveform vs output waveform

① Highside switch turn-on, turn-off

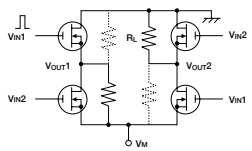


② Lowside switch turn-on, turn-off



* Δt: Δt = td (on) – td (off)

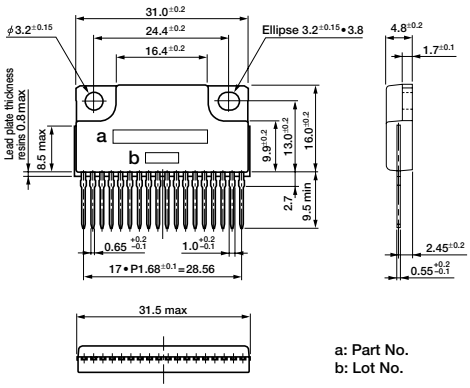
Measurement Circuit



Conditions
V_{CC}=10V, V_{IN}=10V (pulse)
V_M=85V
I_O=0.41A (R_L=207Ω)

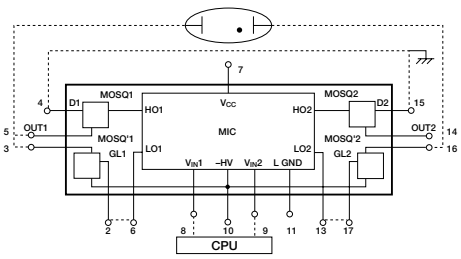
* When pulse signal is inputted to V_{IN1}, R_L on solid line is ON and dotted line R_L is off.
On the contrary, when pulse signal is inputted to V_{IN2}, R_L on dotted line is ON and dotted line R_L is off.

External Dimensions (unit: mm)



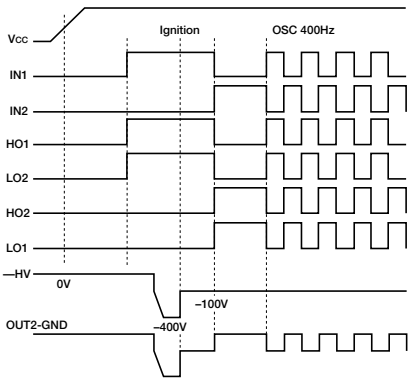
a: Part No.
b: Lot No.

Block Diagram



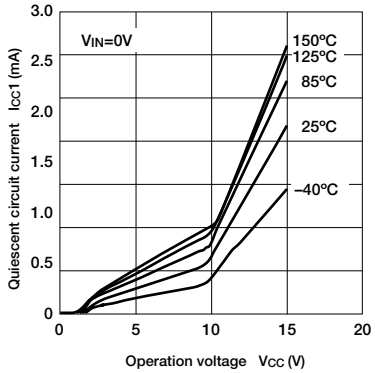
* Dotted Line: Outside Connection

Timing Chart

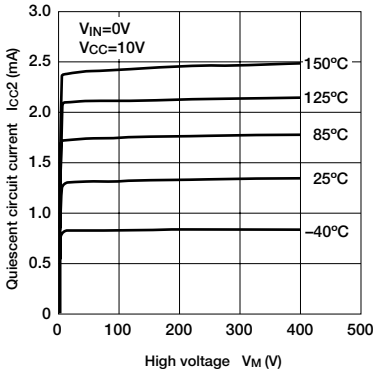


Electrical Characteristics

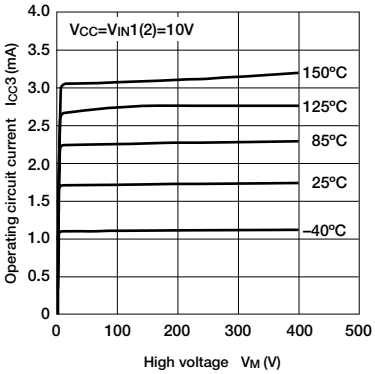
■ Quiescent circuit current



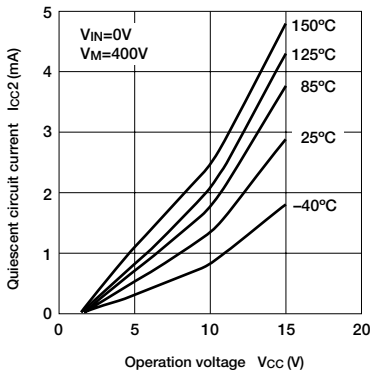
■ Quiescent circuit current supplied high voltage



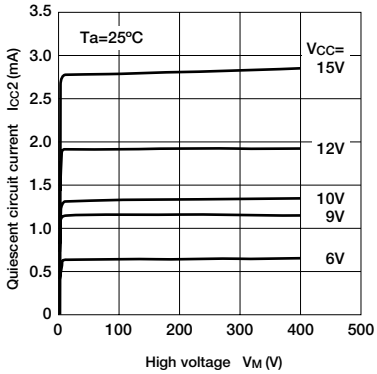
■ Operating circuit current



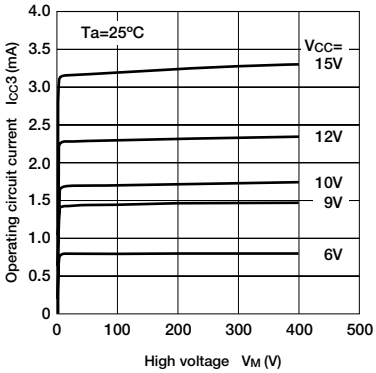
■ Quiescent circuit current supplied high voltage



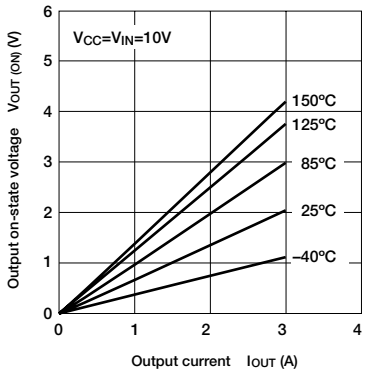
■ Quiescent circuit current supplied high voltage



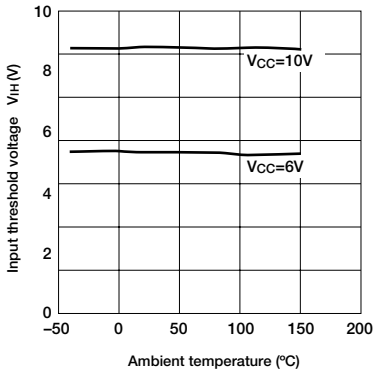
■ Operating circuit current



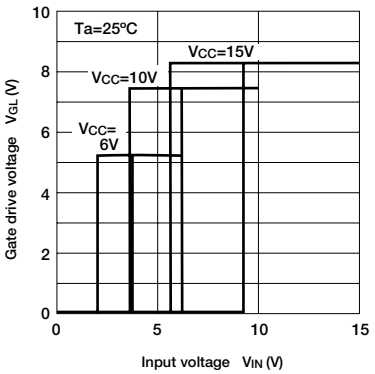
■ Output on-state voltage



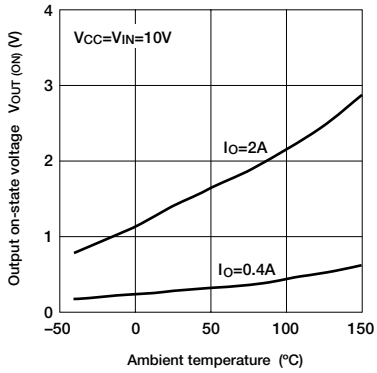
■ Input threshold voltage



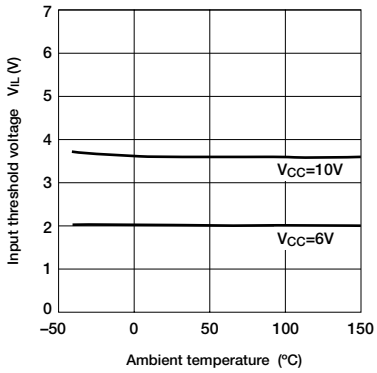
■ Gate drive voltage



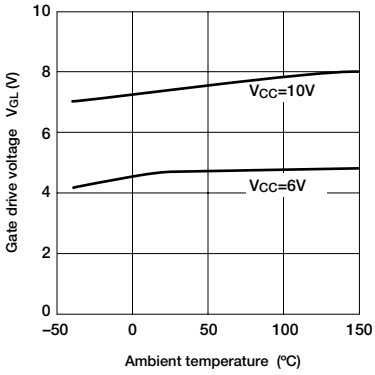
■ Output on-state voltage



■ Input threshold voltage

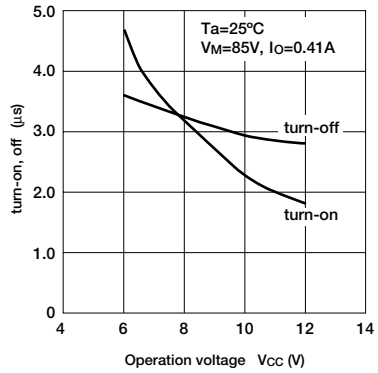


■ Gate drive voltage

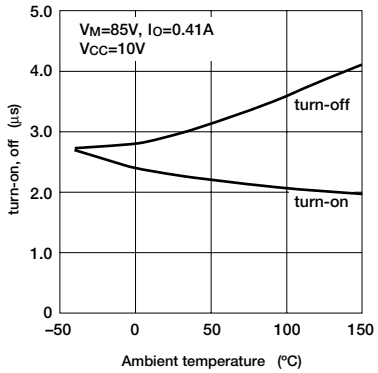


Electrical Characteristics

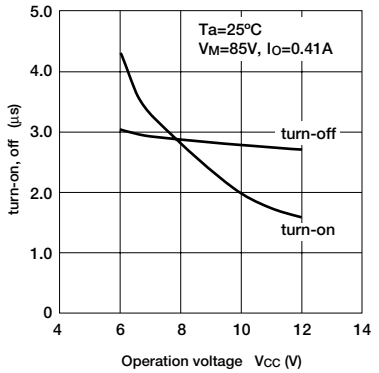
■ High side switch turn-on, off



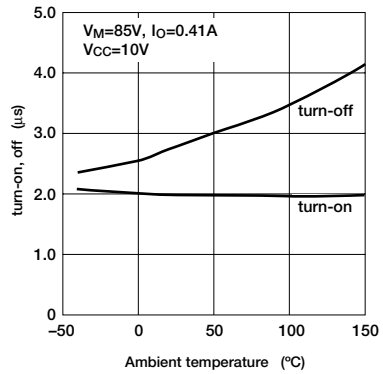
■ High side switch turn-on, off



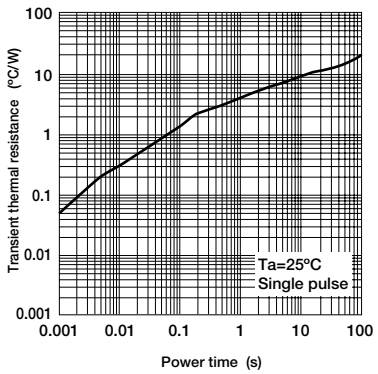
■ Low side switch turn-on, off



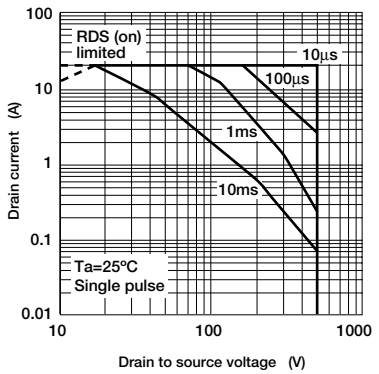
■ Low side switch turn-on, off



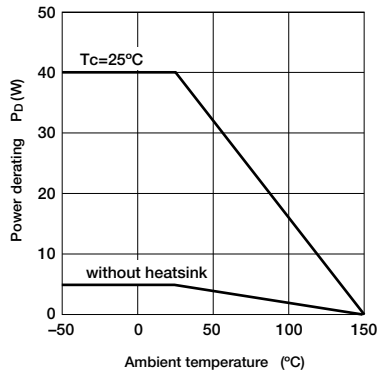
■ Transient thermal resistance characteristics



■ Safe operating area (Power MOS FET)



■ Power derating curve



Unipolar Switch

Temperature Range (°C)	Magnetic Characteristics [mT] (Ta=25°C)			Package	Part No.	Remarks	External Dimensions
	B_{OP} (max)	B_{RP} (min)	B_{HYS} (min)				
–40 to +150	45	12.5	7	UA / LT	A3121L✻		1, 2
	40	14	7	UA / LT	A3122L✻		1, 2
	44	18	7	UA / LT	A3123L✻		1, 2
	16	1	2	UA / LT	A3141L✻	High-Sensitive	1, 2
	23	7.5	3	UA / LT	A3142L✻	High-Sensitive	1, 2
	34	16.5	3	UA / LT	A3143L✻	High-Sensitive	1, 2
	35	5	2	UA / LT	A3144L✻	High-Sensitive	1, 2
	5	0.5	1 (typ)	UA / LT / LH	A3240L✻	Ultra-High-Sensitive, Chopper-Stabilized	1, 2, 3
	Programmable	B_{OP}—B_{HYS}	0.5	UA / LT	A3250L✻	Programmable, Chopper-Stabilized	1, 2

Suffix '✻' is package option

Bipolar Switch

Temperature Range (°C)	Magnetic Characteristics [mT] (Ta=25°C)			Package	Part No.	Remarks	External Dimensions
	B_{OP} (max)	B_{RP} (min)	B_{HYS} (min)				
–40 to +150	5	–5	1	UA / LT	A3134L✻	High-Sensitive	1, 2
–40 to +125	9.5	–9.5	3	UA / LT	UGS3132✻		1, 2
	7.5	–7.5	3	UA / LT	UGS3133✻		1, 2

Suffix '✻' is package option

Bipolar Latch

Temperature Range (°C)	Magnetic Characteristics [mT] (Ta=25°C)			Package	Part No.	Remarks	External Dimensions
	B_{OP} (max)	B_{RP} (min)	B_{HYS} (min)				
–40 to +150	27	–27	34	UA / LT	A3185L✻		1, 2
	15	–15	10	UA / LT	A3187L✻		1, 2
	18	–18	20	UA / LT	A3188L✻		1, 2
	23	–23	10	UA / LT	A3189L✻		1, 2
	4	–4	4.5 (typ)	UA / LT / LH	A3280L✻	Chopper-Stabilized	1, 2, 3
	9	–9	10 (typ)	UA / LT / LH	A3281L✻	Chopper-Stabilized	1, 2, 3
	18	–18	30 (typ)	UA / LT / LH	A3283L✻	Chopper-Stabilized	1, 2, 3

Suffix '✻' is package option

Gear Tooth Sensor

Temperature Range (°C)	Magnetic Characteristics [mT]			Part No.	External Dimensions
	B_{OP} (max)	B_{RP} (min)	B_{HYS} (min)		
–40 to +150	10	–10	2	UGS3059KA	4
	3.5	–3.5	1	UGS3060KA	4

Ratiometric, Linear Sensors

Temperature Range (°C)	Magnetic Characteristics [mT]	Part No.	Remarks	External Dimensions
	Sense			
–40 to +150	50mV / mT	A3515LUA	Chopper-Stabilized	1
	25mV / mT	A3516LUA	Chopper-Stabilized	1

Subassembly

Part No.	Application	External Dimensions
ATS610LSA	Large-tooth, gear-position sensing-crank angle, cam angle	5
ATS611LSB	Fine-pitch, large air gap, gear speed sensing-transmission speed ABS	6
ATS612LSB	Large / small-tooth gear-position sensing-crank angle, transmission speed, cam angle	6

External Dimensions (unit: mm)

Figure 1 (UA)

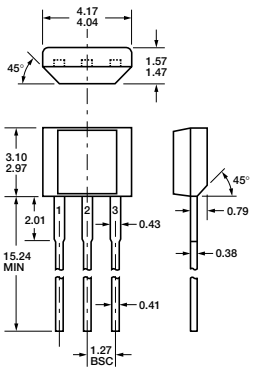


Figure 2 (LT)

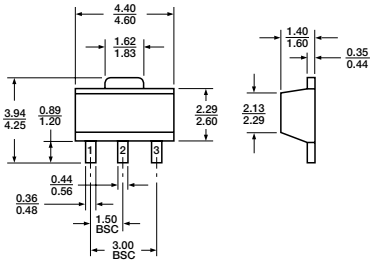


Figure 3 (LH)

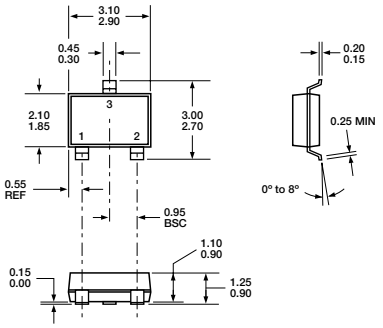


Figure 4 (KA)

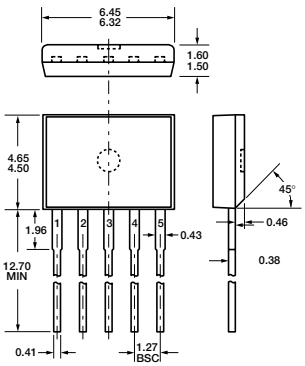


Figure 5 (SA)

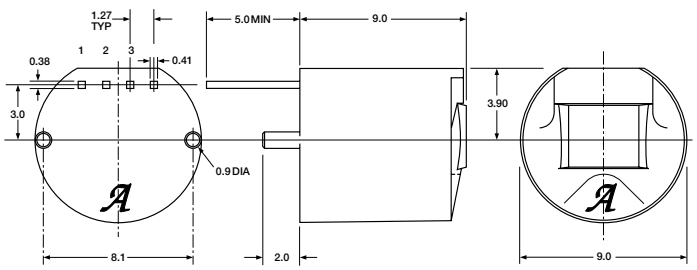
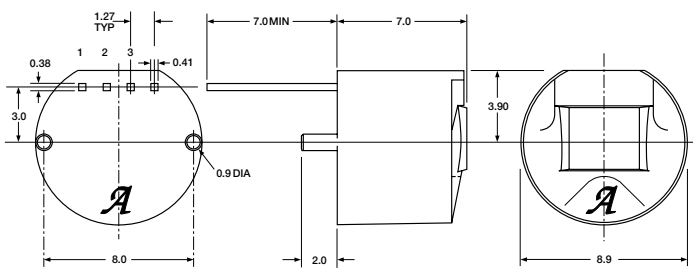


Figure 6 (SB)



Custom IC

■ Various processing technologies of BIP, BiCMOS, CMOS and BCD can be used for the semiconductor chips.
■ Meets detailed user needs, especially power ICs. A wide range of general-purpose ICs is also available.
■ Employs a monolithic chip with flip-chip construction for increased reliability making it ideal for car electronic devices.
■ Also available in hybrid ICs with transfer mold construction, multi-chip IC configuration and power monolithic IC configuration.

Features

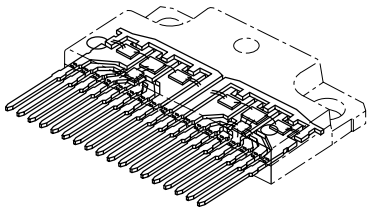
- All semiconductor chips used are manufactured by Sanken.
- Main product lineup consists of power ICs produced out of many years' experience of Sanken.
- Uses monolithic chips with flip-chip construction.
- Mainly available in miniature transfer-mold packages.

Examples of Custom Hybrid IC Products

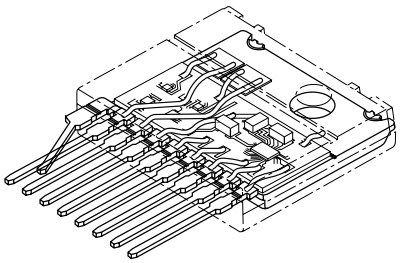
- Regulators for alternators
- Igniters
- Power supply for microcomputer system
- Power steering control IC
- Motor and actuator driver
- Others

Examples of Sanken Automotive Hybrid ICs

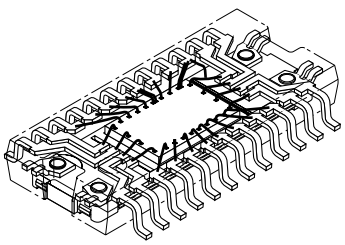
Lead frame type multi-chip power IC →
- One-chip power IC



Lead frame type power hybrid IC with ceramic substrate →
- High-output high-breakdown voltage IC
- Simplified integration of custom circuits
- Distribution of unit functions (Actuators may be built in the device)

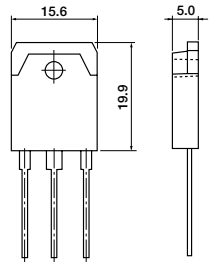


Surface-mount power IC

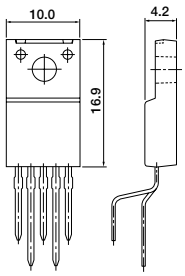


External Dimensions (unit: mm)

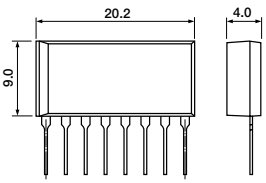
MT-100



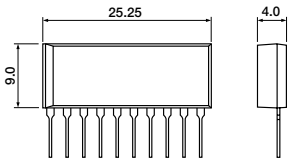
FM205



STA 8pin



STA 10pin



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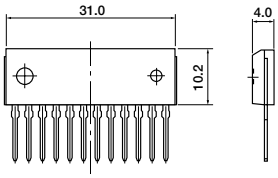

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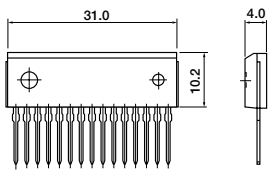
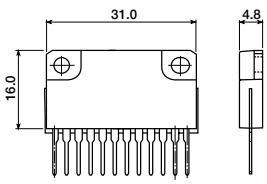


SLA12pin



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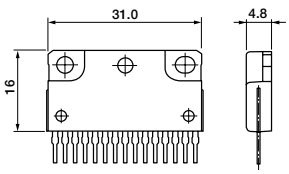

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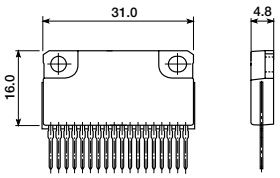
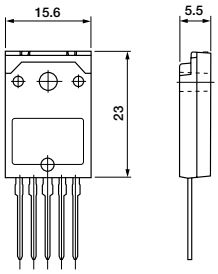
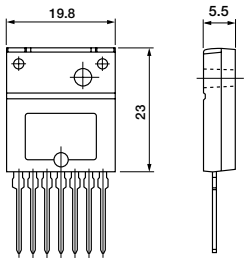


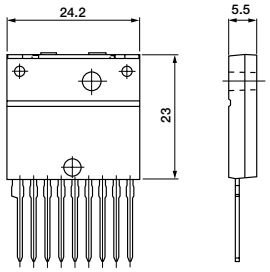
3GR-F



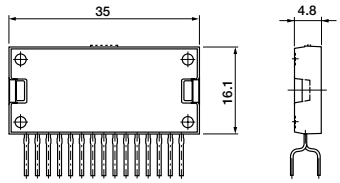
3GR-M



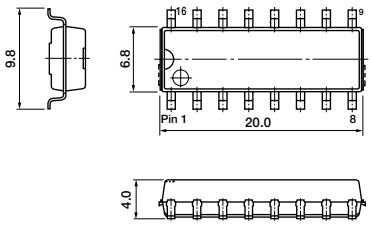
STR-S



SPM



SMD16pin



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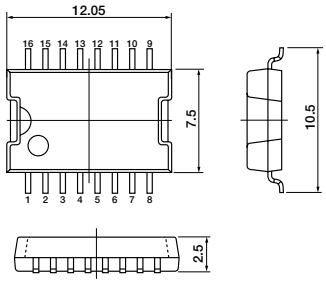
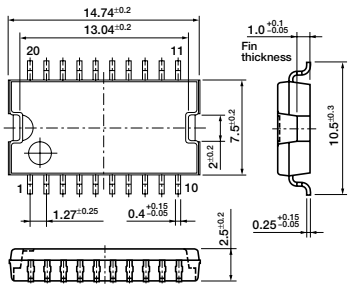
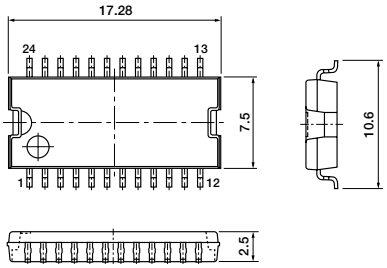


SPF20pin



SPF24pin



Index by Application

Index by Load

Load Current	Part No.	Chip	Avalanche Diode	Single Package		Multi-chip Package					Remarks
				TO220F	TO220S	SPF (Surface-mount)	SD (Surface-mount)	STA	SMA	SLA	
Approx. 0.5A	2SA1488A	Single		25W							
	2SC3851	Single		25W							
	2SC3852	Single		25W							
	STA315A	Single • 3	35V					13.5W			Es/b=50mJ
	STA335A	Single • 2	35V					12W			Es/b=150mJ
	STA415A	Single • 4	35V					18W			Es/b=50mJ
	STA509A	MOS • 4	52V					20W			Es/b=40mJ
	SDK06	MOS • 4	52V				3W				Es/b=40mJ
Approx. 1.2A	2SA1488	Single		25W							
	2SC3851	Single		25W							
	2SC4153	Single		30W							V_{CEO}=120V
	MN611S	Single	115V		60W						Es/b=45mJ
	SPF0001	Single • 2				2.5W					Es/b=45mJ
	SDA03	Single • 4					3W				
	SDA04	Single • 2					2.5W				
	SDC09	Single • 2	65V				2.8W				Es/b=80mJ
	SDK08	MOS • 4					3W				
	SDK09	MOS					3W				
	STA461C	Single • 2	65V					18W			Es/b=80mJ
	STA463C	Single • 2	115V					18W			Es/b=45mJ
	STA464C	Single • 4						4W			Es/b=80mJ
	STA508A	MOS • 4						20W			
	SMA5113	MOS • 4							35W		V_{DSS}=450V
Approx. 3A	2SA1567	Single		35W							
	2SD2382	Single	65V	30W							Es/b=200mJ
	2SK2701	MOS		35W							V_{DSS}=450V
	FP812	Single		35W							
	FN812	Single		35W							
	SLA8004	Single • 4								40W	
Approx. 5A	2SA1568	Single		35W							
	2SC4024	Single		35W							
	2SC4065	Single		35W							
	2SD2141	Darlington	380V	35W							Es/b=210mJ
	2SD2633	Darlington		35W							
	MN638S	Darlington	380V		60W						
	SLA5027	MOS • 4								40W	
10A and over	FKV460	MOS		40W							$R_{DS(ON)}$=9mΩ max
	FKV560	MOS		40W							$R_{DS(ON)}$=11mΩ max
	FKV660	MOS		40W							$R_{DS(ON)}$=14mΩ max
	FKV460S	MOS			60W						$R_{DS(ON)}$=9mΩ max
	FKV560S	MOS			60W						$R_{DS(ON)}$=11mΩ max
	FKV660S	MOS			60W						$R_{DS(ON)}$=14mΩ max

Power Transistor 2SA1488/1488A

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings		Unit
	2SA1488	2SA1488A	
V_{CBO}	–60	–80	V
V_{CEO}	–60	–80	V
V_{EBO}	–6		V
I_C	–4		A
I_B	–1		A
P_C	25 (T_C = 25°C)		W
Tj	150		°C
Tstg	–55 to +150		°C

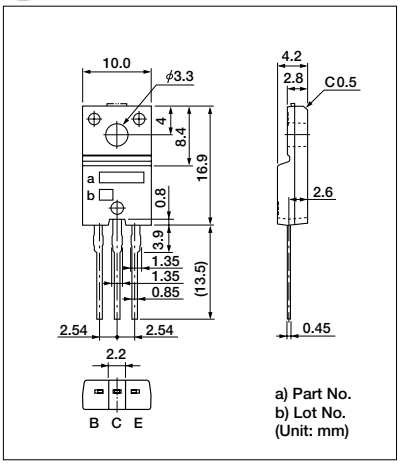
Electrical Characteristics (Ta = 25°C)

Symbol	Test Conditions	Ratings		Unit
		2SA1488	2SA1488A	
I_{CBO}		–100max	–100max	μA
	V_{CB} =	–60	–80	V
I_{EBO}	V_{EB} = –6V	–100max		μA
$V_{(BR)\ CEO}$	I_C = –25mA	–60min	–80min	V
h_{FE}	V_{CE} = –4V, I_C = –1A	40min		
$V_{CE\ (sat)}$	I_C = –2A, I_B = –0.2A	–0.5max		V
f_T	V_{CE} = –12V, I_E = –0.2A	15typ		MHz
C_{OB}	V_{CB} = –10V, f = 1MHz	90typ		pF

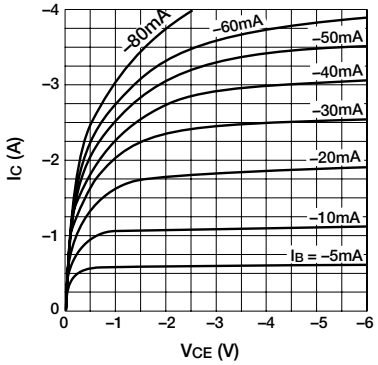
Typical Switching Characteristics (common emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
–12	6	–2	–10	5	–200	200	0.25typ	0.75typ	0.25typ

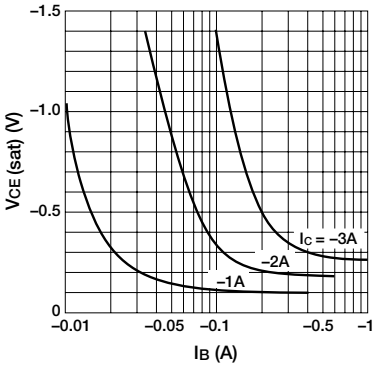
External Dimensions TO220F (full-mold)



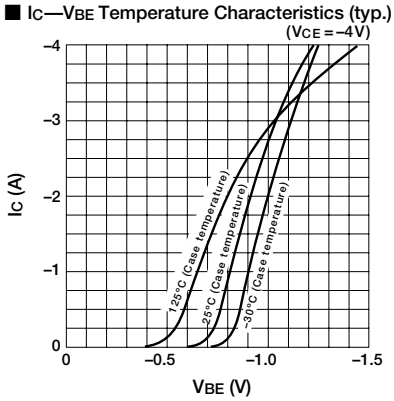
■ I_C—V_{CE} Characteristics (typ.)



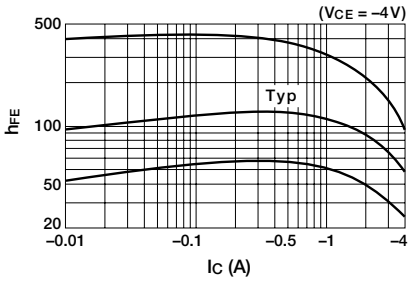
■ $V_{CE\ (sat)}$—I_B Characteristics (typ.)



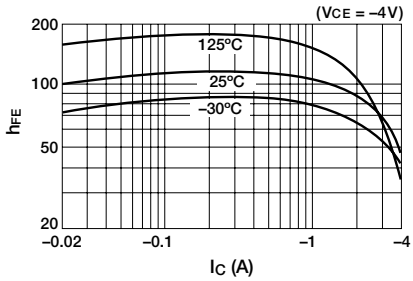
■ I_C—V_{BE} Temperature Characteristics (typ.)



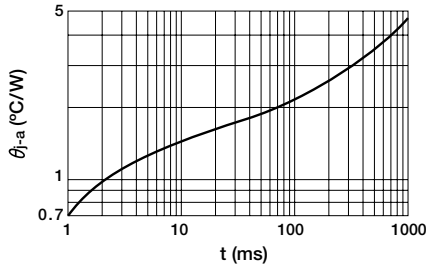
■ h_{FE}—I_C Characteristics (typ.)



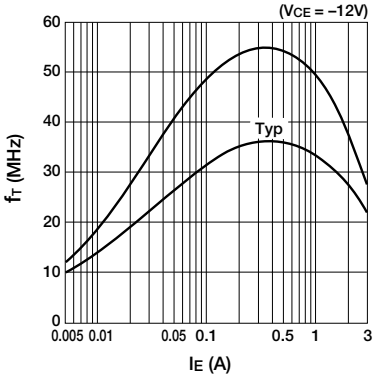
■ h_{FE}—I_C Temperature Characteristics (typ.)



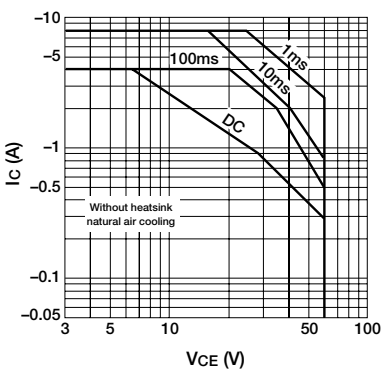
■ $\theta_{j\text{-}a}$—t Characteristics



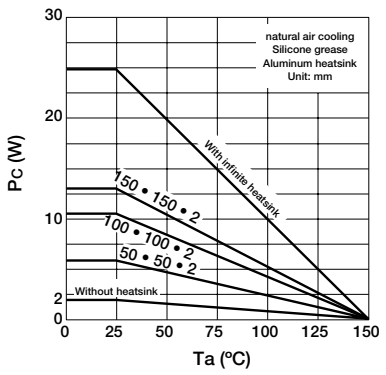
■ f_T—I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C—Ta Derating



Power Transistor 2SA1567

Absolute Maximum Ratings (Ta = 25°C)

Symbol	Ratings	Unit
V_{CBO}	–50	V
V_{CEO}	–50	V
V_{EBO}	–6	V
I_C	–12	A
I_B	–3	A
P_C	35 (T_C = 25°C)	W
Tj	150	°C
Tstg	–55 to +150	°C

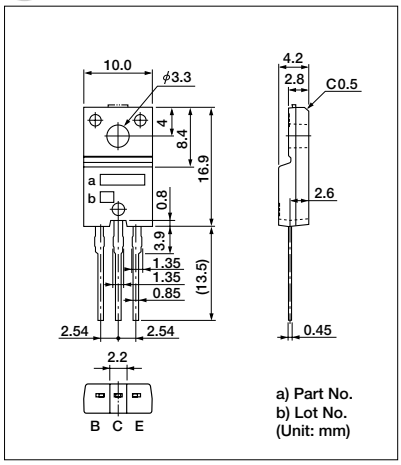
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = –50V	–100max	μA
I_{EBO}	V_{EB} = –6V	–100max	μA
$V_{(BR)\ CEO}$	I_C = –25mA	–50min	V
h_{FE}	V_{CE} = –1V, I_C = –6A	50min	
$V_{CE\ (sat)}$	I_C = –6A, I_B = –0.3A	–0.35max	V
f_T	V_{CE} = –12V, I_E = –0.5A	40typ	MHz
C_{OB}	V_{CB} = –10V, f = 1MHz	330typ	pF

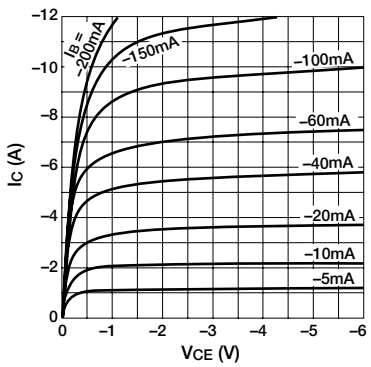
Typical Switching Characteristics (common emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
–24	4	–6	–10	5	–120	120	0.4typ	0.4typ	0.2typ

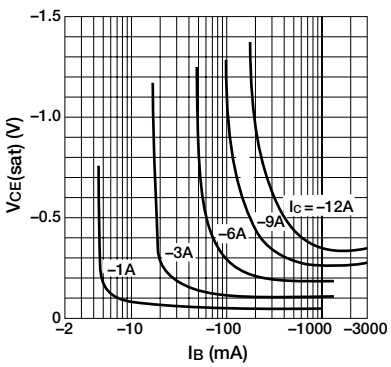
External Dimensions TO220F (full-mold)



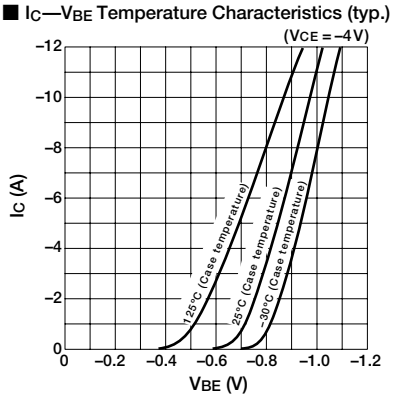
■ I_C—V_{CE} Characteristics (typ.)



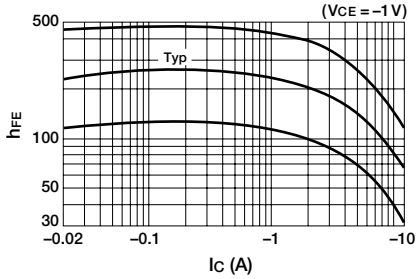
■ $V_{CE\ (sat)}$—I_B Characteristics (typ.)



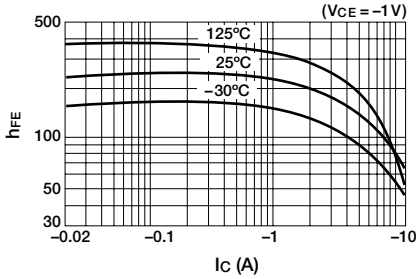
■ I_C—V_{BE} Temperature Characteristics (typ.)



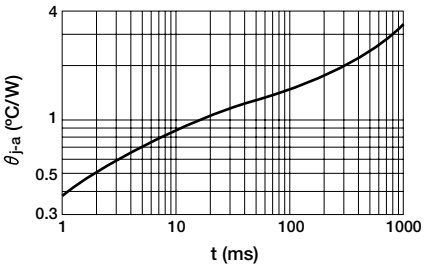
■ h_{FE}—I_C Characteristics (typ.)



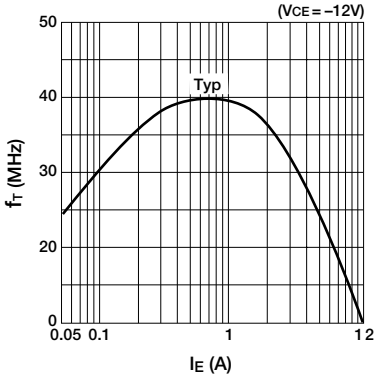
■ h_{FE}—I_C Temperature Characteristics (typ.)



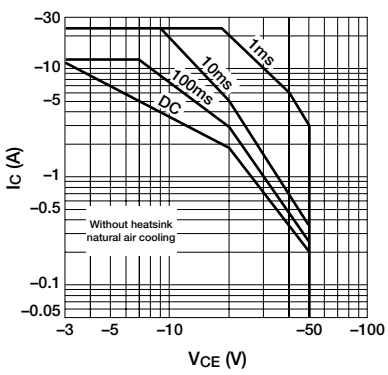
■ $\theta_{j\text{-}a}$—t Characteristics



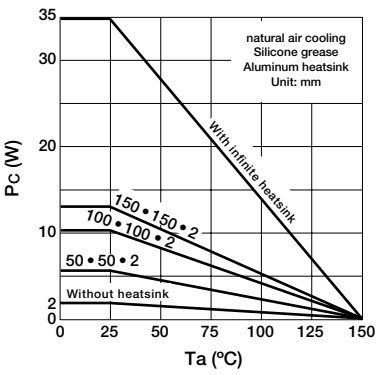
■ f_T—I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C—Ta Derating



Power Transistor 2SA1568

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	−60	V
V_{CEO}	−60	V
V_{EBO}	−6	V
I_C	∓12	A
I_B	−3	A
P_C	35 (T_C=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

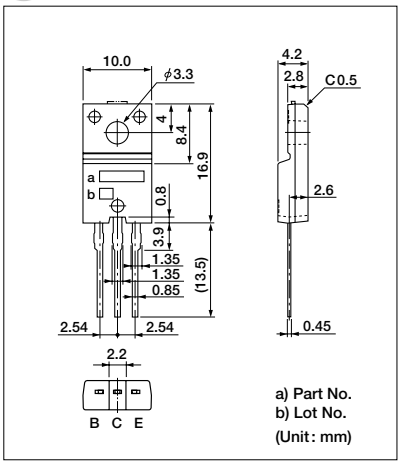
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = −60V	−100max	μA
I_{EBO}	V_{EB} = −6V	−60max	mA
$V_{(BR)\ CEO}$	I_C = −25mA	−60min	V
h_{FE}	V_{CE} = −1V, I_C = −6A	50min	
$V_{CE\ (sat)}$	I_C = −6A, I_B = −0.3A	−0.35max	V
V_{FEC}	I_{ECO} = −10A	−2.5max	V
f_T	V_{CE} = −12V, I_E = 0.5A	40typ	MHz
C_{OB}	V_{CB} = −10V, f = 1MHz	330typ	pF

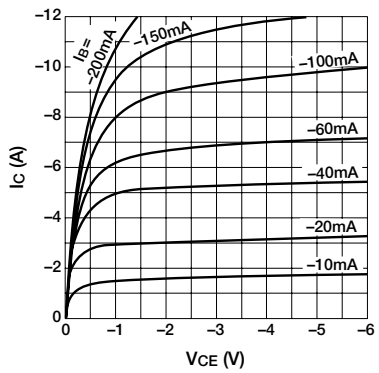
Typical Switching Characteristics (common emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
−24	4	−6	−10	5	−120	120	0.4typ	0.4typ	0.2typ

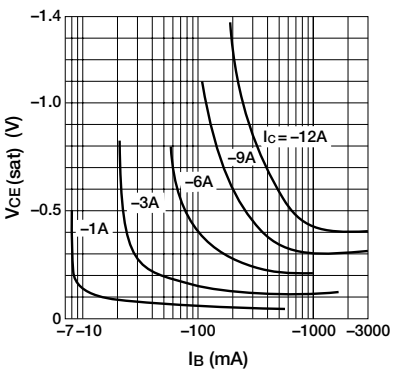
External Dimensions TO220F (full-mold)



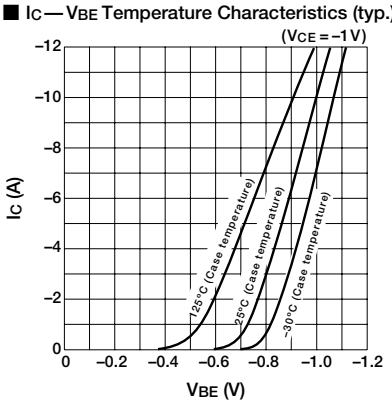
■ I_C — V_{CE} Characteristics (typ.)



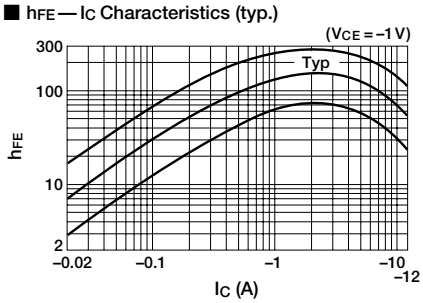
■ $V_{CE\ (sat)}$ — I_B Characteristics (typ.)



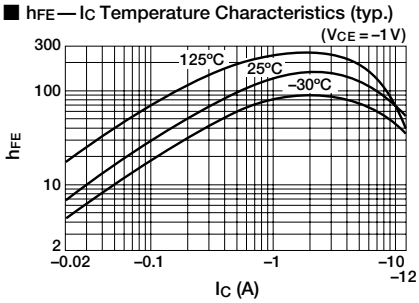
■ I_C — V_{BE} Temperature Characteristics (typ.)



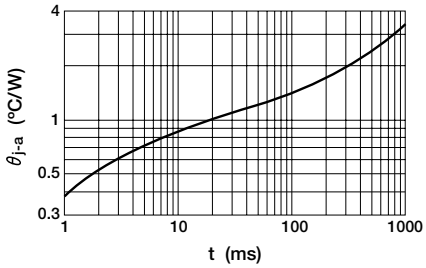
■ h_{FE} — I_C Characteristics (typ.)



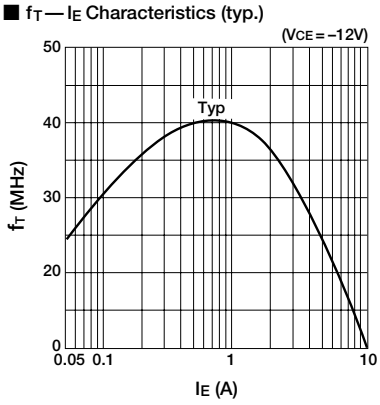
■ h_{FE} — I_C Temperature Characteristics (typ.)



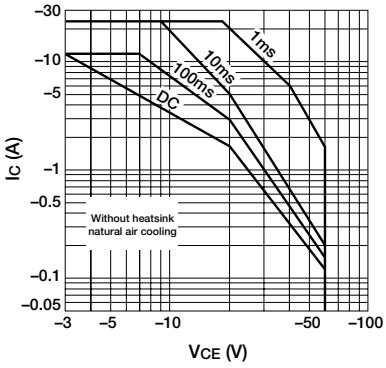
■ $\theta_{j\text{-}a}$ — t Characteristics



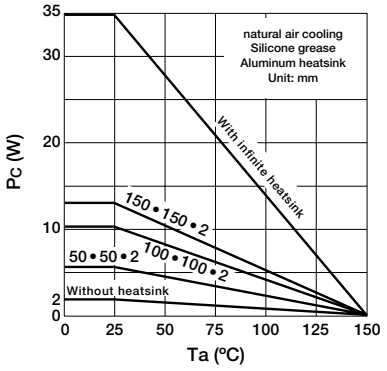
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor 2SC3851

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	80	V
V_{CEO}	60	V
V_{EBO}	6	V
I_C	4	A
I_B	1	A
P_C	25 (Tc=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

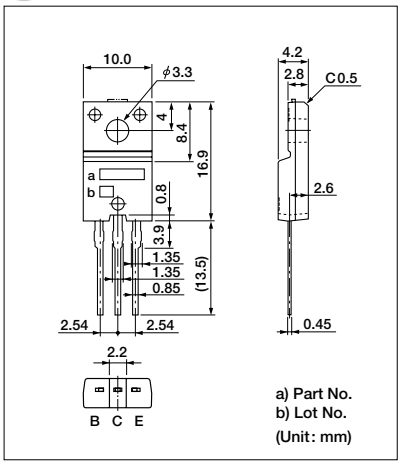
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 80V	100max	μA
I_{EBO}	V_{EB} = 6V	100max	μA
$V_{(BR)\ CEO}$	I_C = 25mA	60min	V
h_{FE}	V_{CE} = 4V, I_C = 1A	40 to 320	
$V_{CE\ (sat)}$	I_C = 2A, I_B = 0.2A	0.5max	V
f_T	V_{CE} = 12V, I_E = −0.2A	15typ	MHz
C_{OB}	V_{CB} = 10V, f = 1MHz	60typ	pF

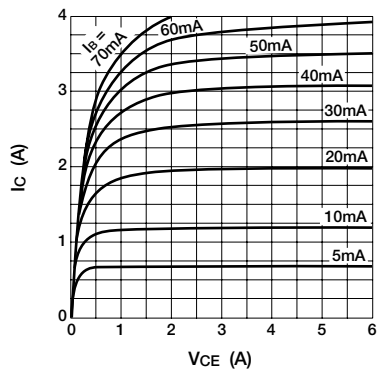
Typical Switching Characteristics (common emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
12	6	2	10	−5	200	−200	0.2typ	1typ	0.3typ

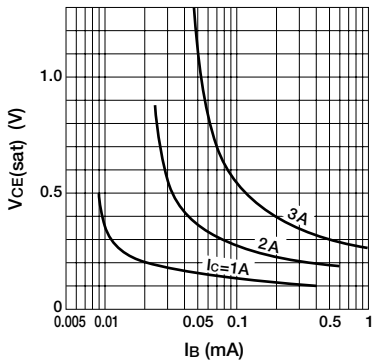
External Dimensions TO220F (full-mold)



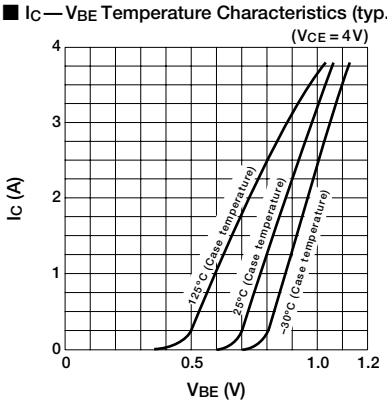
■ I_C — V_{CE} Characteristics (typ.)



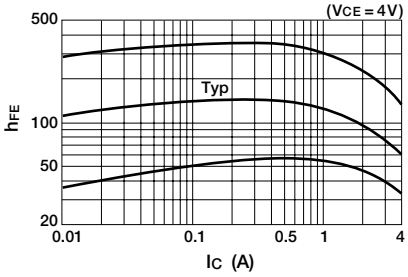
■ $V_{CE\ (sat)}$ — I_B Characteristics (typ.)



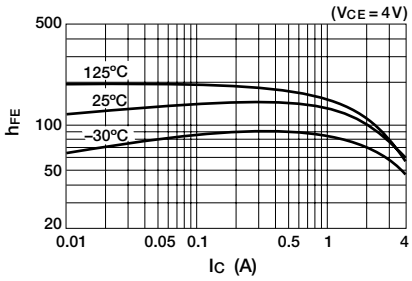
■ I_C — V_{BE} Temperature Characteristics (typ.)



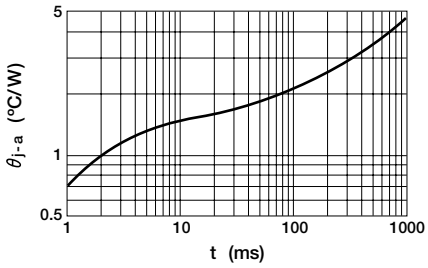
■ h_{FE} — I_C Characteristics (typ.)



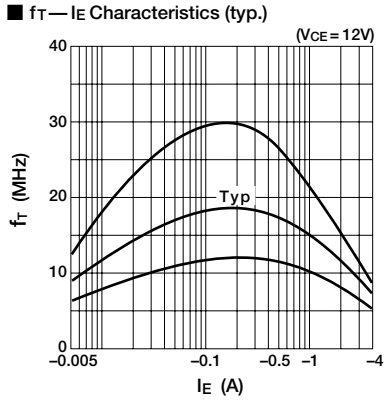
■ h_{FE} — I_C Temperature Characteristics (typ.)



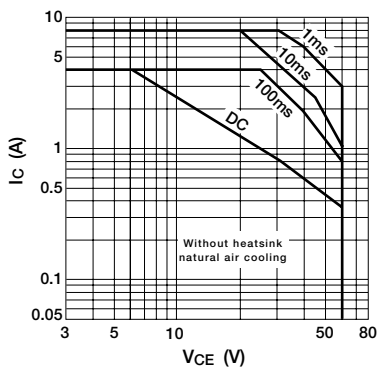
■ $\theta_{j\text{-}a}$ — t Characteristics



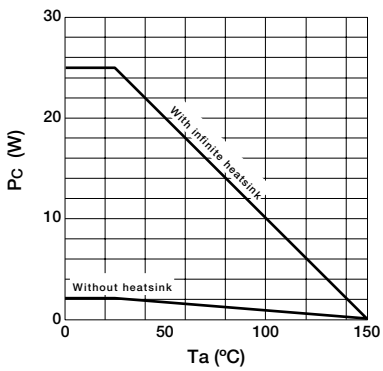
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor 2SC3852

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	80	V
V_{CEO}	60	V
V_{EBO}	6	V
I_C	3	A
I_B	1	A
P_C	25 (Tc=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

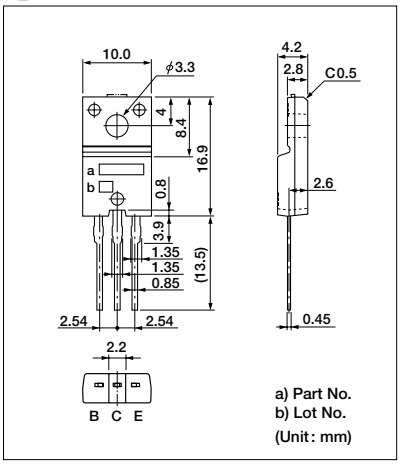
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 80V	10max	μA
I_{EBO}	V_{EB} = 6V	100max	μA
$V_{(BR)\ CEO}$	I_C = 25mA	60min	V
h_{FE}	V_{CE} = 4V, I_C = 0.5A	500min	
$V_{CE\ (sat)}$	I_C = 2A, I_B = 50mA	0.5max	V
f_T	V_{CE} = 12V, I_E = −0.2A	15typ	MHz
C_{OB}	V_{CB} = 10V, f = 1MHz	50typ	pF

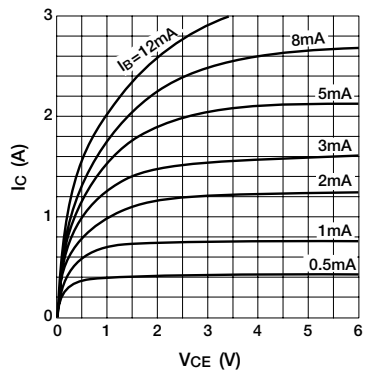
Typical Switching Characteristics (common emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
20	20	1.0	10	−5	15	−30	0.8typ	3.0typ	1.2typ

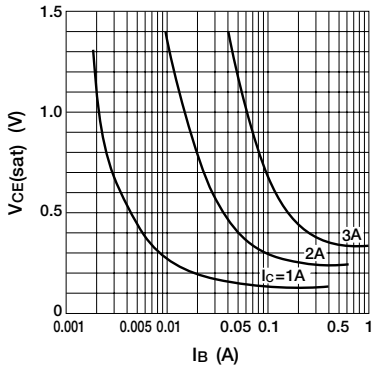
External Dimensions TO220F (full-mold)



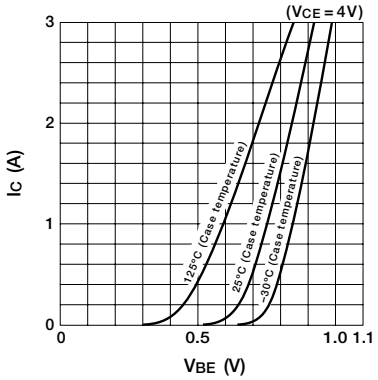
■ I_C — V_{CE} Characteristics (typ.)



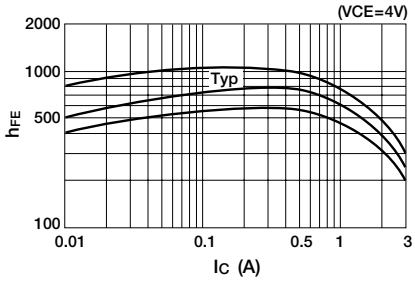
■ $V_{CE\ (sat)}$ — I_B Characteristics (typ.)



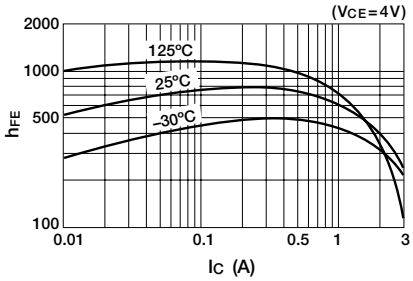
■ I_C — V_{BE} Temperature Characteristics (typ.)



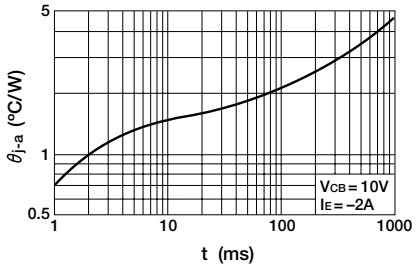
■ h_{FE} — I_C Characteristics (typ.)



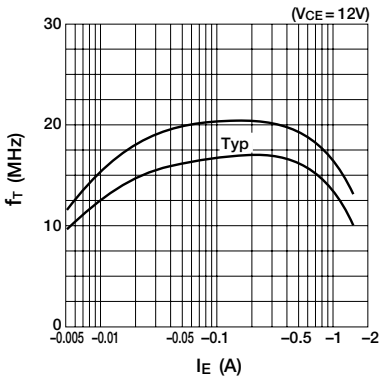
■ h_{FE} — I_C Temperature Characteristics (typ.)



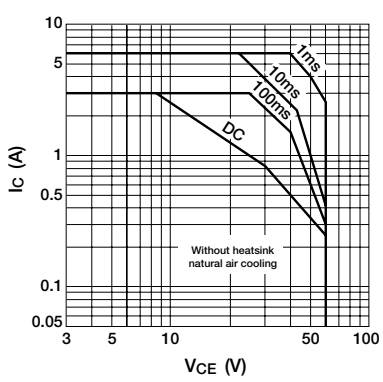
■ $\theta_{j\text{-}a}$ — t Characteristics



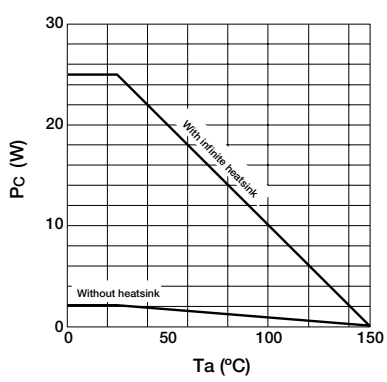
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor 2SC4024

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	100	V
V_{CEO}	50	V
V_{EBO}	15	V
I_C	10	A
I_B	3	A
P_C	35 (Tc=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

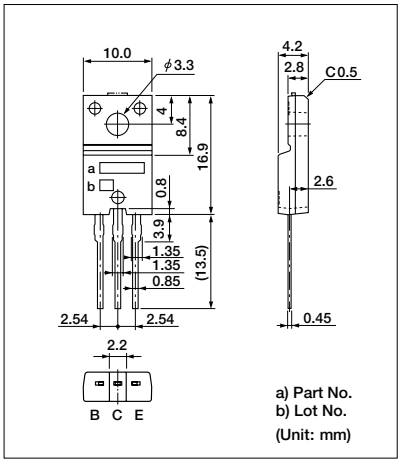
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 100V	10max	μA
I_{EBO}	V_{EB} = 15V	10max	μA
$V_{(BR)\ CEO}$	I_C = 25mA	50min	V
h_{FE}	V_{CE} = 4V, I_C = 1A	300 to 1600	
V_{CE} (sat)	I_C = 5A, I_B = 0.1A	0.5max	V
f_T	V_{CB} = 12V, I_E = −0.5A	24typ	MHz
C_{OB}	V_{CB} = 10V, f = 1MHz	150typ	pF

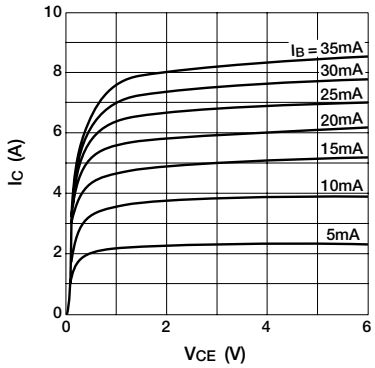
Typical Switching Characteristics (common emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	I_{B1} (A)	I_{B2} (A)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
20	4	5	0.1	−0.1	0.5typ	2.0typ	0.5typ

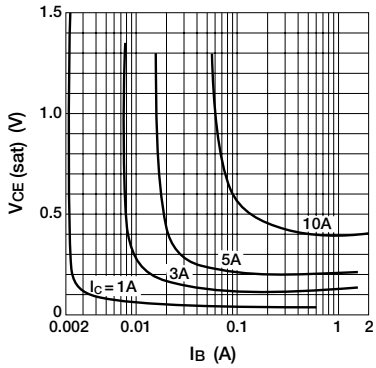
External Dimensions TO220F (full-mold)



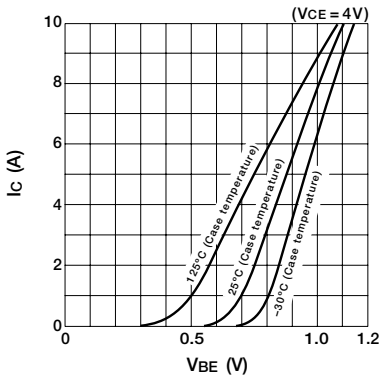
■ I_C — V_{CE} Characteristics (typ.)



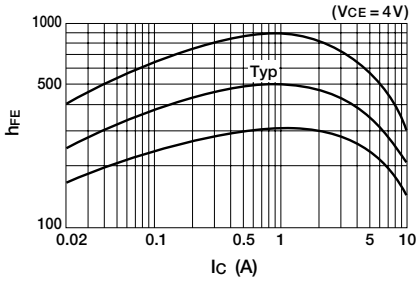
■ V_{CE} (sat) — I_B Characteristics (typ.)



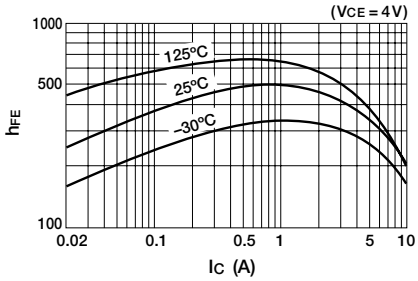
■ I_C — V_{BE} Temperature Characteristics (typ.)



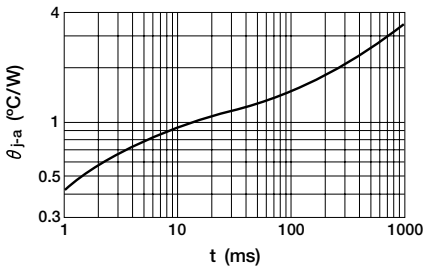
■ h_{FE} — I_C Characteristics (typ.)



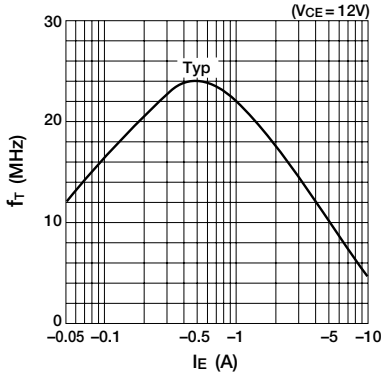
■ h_{FE} — I_C Temperature Characteristics (typ.)



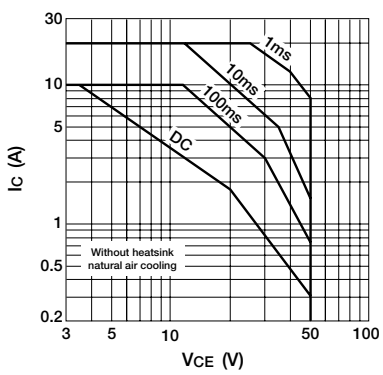
■ $\theta_{j\text{-}a}$ — t Characteristics



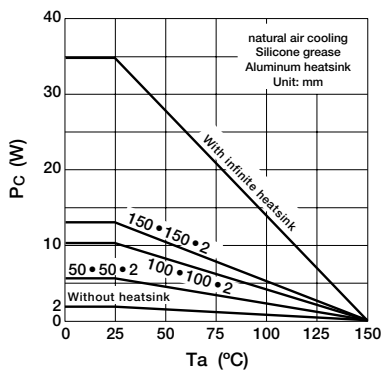
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor 2SC4065

Absolute Maximum Ratings (Ta=25ºC)

Symbol	Ratings	Unit
V_{CBO}	60	V
V_{CEO}	60	V
V_{EBO}	6	V
I_C	±12	A
I_B	3	A
P_C	35 (Tc=25ºC)	W
Tj	150	ºC
Tstg	–55 to +150	ºC

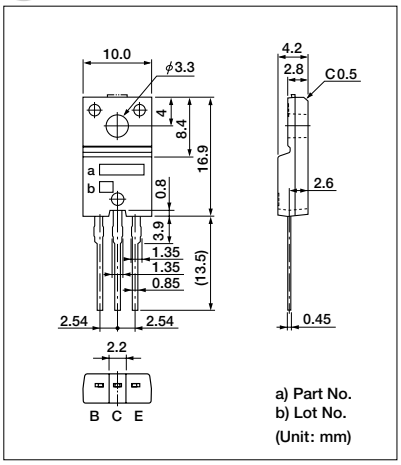
Electrical Characteristics (Ta=25ºC)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 60V	100max	μA
I_{EBO}	V_{EB} = 6V	60max	mA
$V_{(BR)\ CEO}$	I_C = 25mA	60min	V
h_{FE}	V_{CE} = 1V, I_C = 6A	50min	
$V_{CE\ (sat)}$	I_C = 6A, I_B = 1.3A	0.35max	V
V_{FEC}	V_{ECO} = 10A	2.5max	V
f_T	V_{CE} = 12V, I_E = –0.5A	24typ	MHz
C_{OB}	V_{CB} = 10V, f = 1MHz	180typ	pF

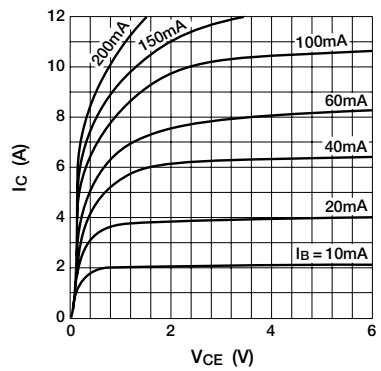
Typical Switching Characteristics (common emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (A)	I_{B2} (A)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
24	4	6	10	–5	0.12	–0.12	0.6typ	1.4typ	0.4typ

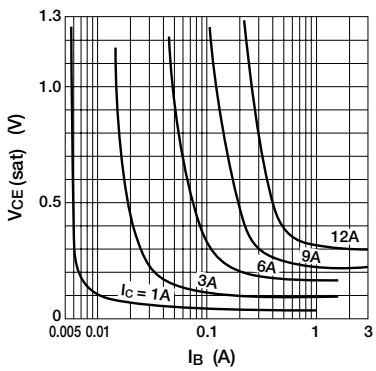
External Dimensions TO220F (full-mold)



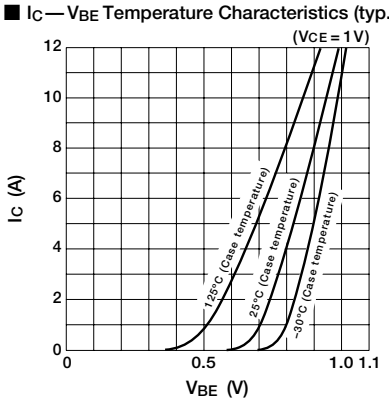
■ I_C — V_{CE} Characteristics (typ.)



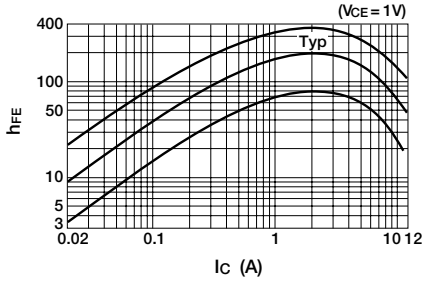
■ $V_{CE\ (sat)}$ — I_B Characteristics (typ.)



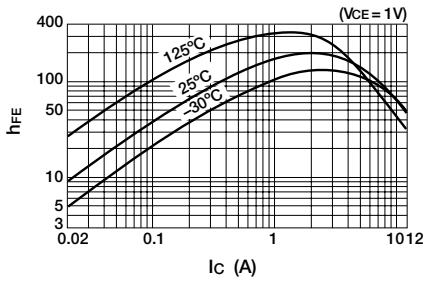
■ I_C — V_{BE} Temperature Characteristics (typ.)



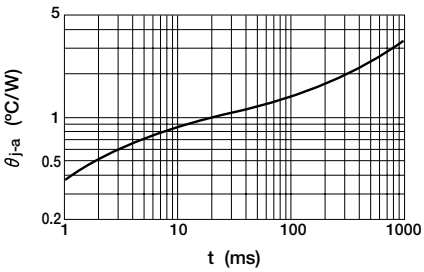
■ h_{FE} — I_C Characteristics (typ.)



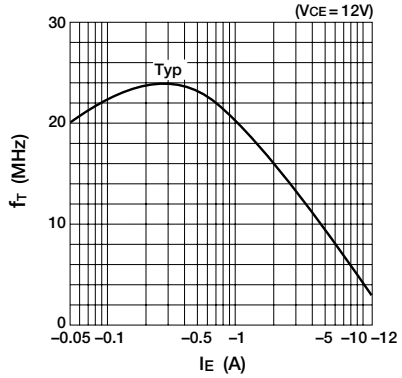
■ h_{FE} — I_C Temperature Characteristics (typ.)



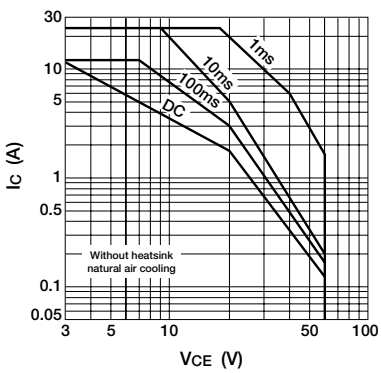
■ $\theta_{j\text{-}a}$ — t Characteristics



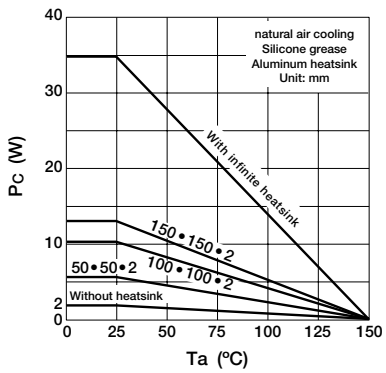
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor 2SC4153

Absolute Maximum Ratings (Ta=25ºC)

Symbol	Ratings	Unit
V_{CBO}	200	V
V_{CEO}	120	V
V_{EBO}	8	V
I_C	7 (pulse 14)	A
I_B	3	A
P_C	30 (Tc=25ºC)	W
Tj	150	ºC
Tstg	–55 to +150	ºC

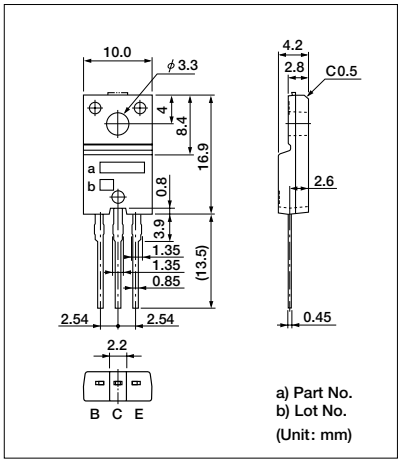
Electrical Characteristics (Ta=25ºC)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 200V	100max	μA
I_{EBO}	V_{EB} = 8V	100max	μA
$V_{(BR)\ CEO}$	I_C = 50mA	120min	V
h_{FE}	V_{CE} = 4V, I_C = 3A	70 to 220	
$V_{CE\ (sat)}$	I_C = 3A, I_B = 0.3A	0.5max	V
$V_{BE\ (sat)}$	I_C = 3A, I_B = 0.3A	1.2max	V
f_T	V_{CE} = 12V, I_E = –0.5A	30typ	MHz
C_{OB}	V_{CB} = 10V, f = 1MHz	110typ	pF

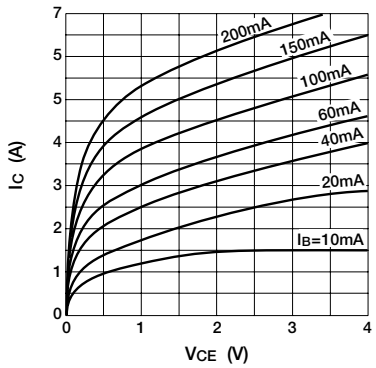
Typical Switching Characteristics (common emitter)

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (A)	I_{B2} (A)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
50	16.7	3	10	–5	0.3	–0.6	0.5max	3max	0.5max

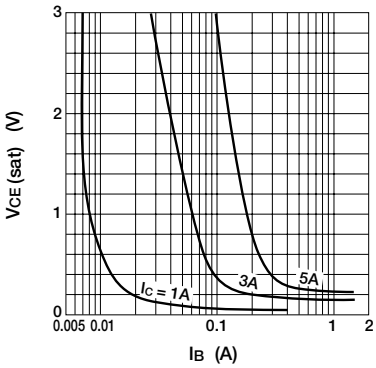
External Dimensions TO220F (full-mold)



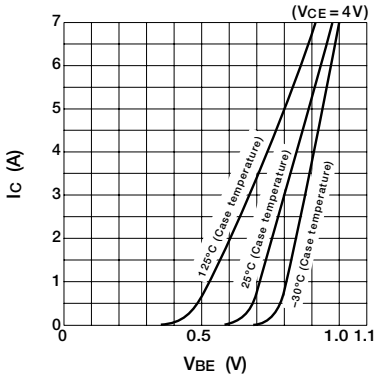
■ I_C — V_{CE} Characteristics (typ.)



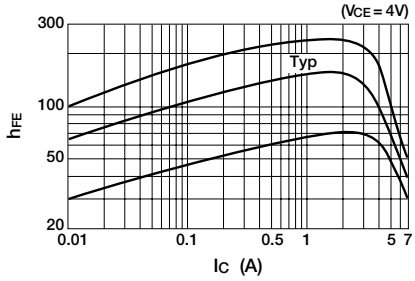
■ $V_{CE\ (sat)}$ — I_B Characteristics (typ.)



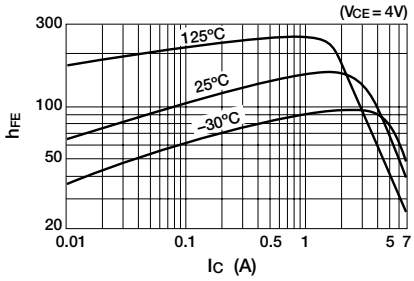
■ I_C — V_{BE} Temperature Characteristics (typ.)



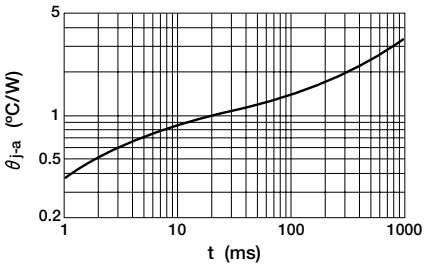
■ h_{FE} — I_C Characteristics (typ.)



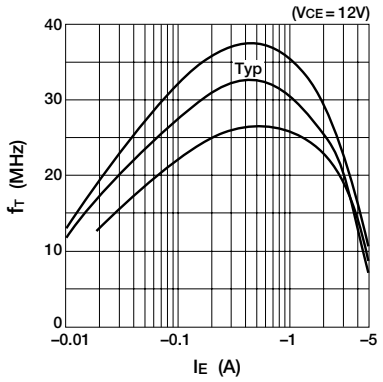
■ h_{FE} — I_C Temperature Characteristics (typ.)



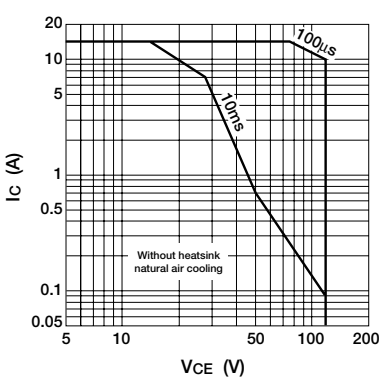
■ $\theta_{j\text{-}a}$ — t Characteristics



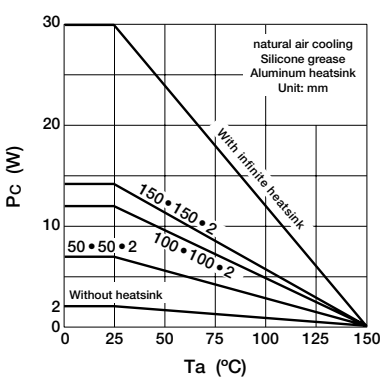
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor 2SD2141

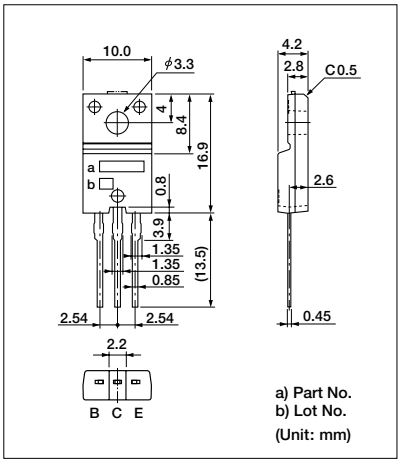
Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	380±50	V
V_{CEO}	380±50	V
V_{EBO}	6	V
I_C	6 (pulse 10)	A
I_B	1	A
P_C	35 (Tc=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

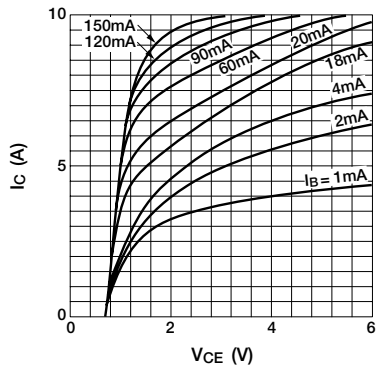
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 330V	10max	μA
I_{EBO}	V_{EB} = 6V	20max	μA
$V_{(BR)\ CEO}$	I_C = 25mA	330 to 430	V
h_{FE}	V_{CE} = 2V, I_C = 3A	1500min	
$V_{CE\ (sat)}$	I_C = 4A, I_B = 20mA	1.5max	V

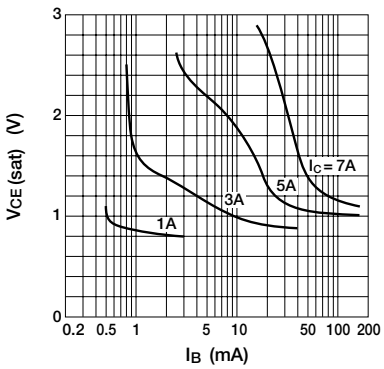
External Dimensions TO220F (full-mold)



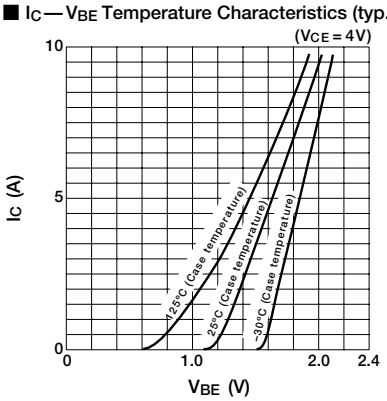
■ I_C — V_{CE} Characteristics (typ.)



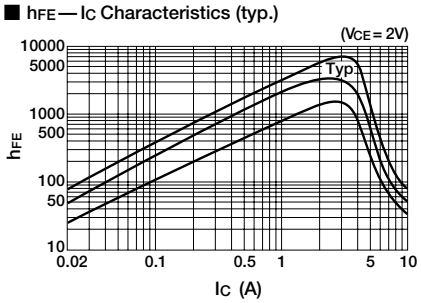
■ $V_{CE\ (sat)}$ — I_B Characteristics (typ.)



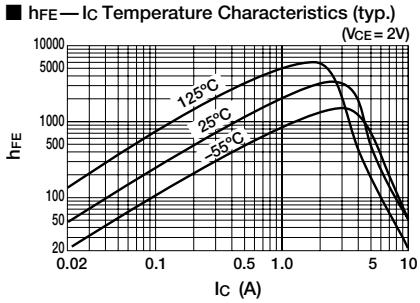
■ I_C — V_{BE} Temperature Characteristics (typ.)



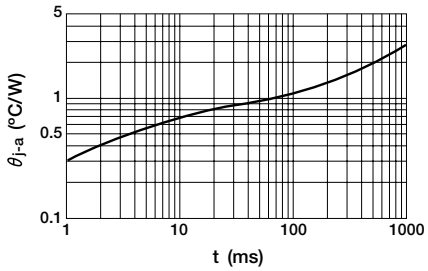
■ h_{FE} — I_C Characteristics (typ.)



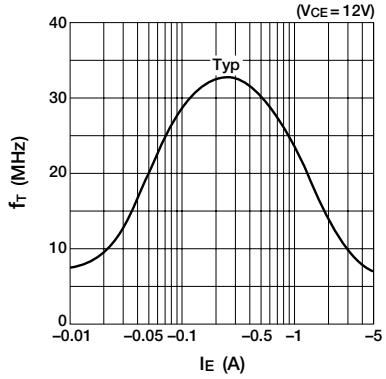
■ h_{FE} — I_C Temperature Characteristics (typ.)



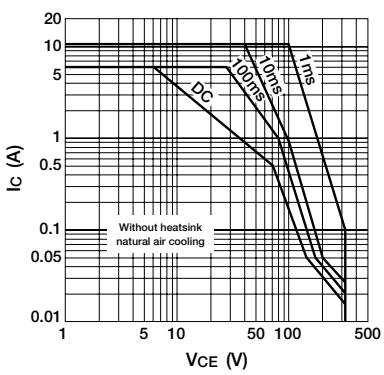
■ $\theta_{j\text{-}a}$ — t Characteristics



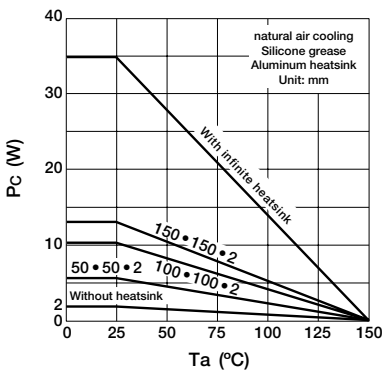
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor 2SD2382

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	65±5	V
V_{CEO}	65±5	V
V_{EBO}	6	V
I_C	±6 (pulse ±10)	A
I_B	1	A
P_C	30 (Tc=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

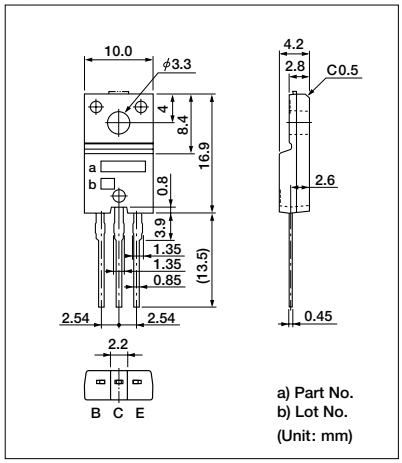
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 60V	10max	μA
I_{EBO}	V_{EB} = 6V	10max	μA
V_{CEO}	I_C = 50mA	60 to 70	V
h_{FE}	V_{CE} = 1V, I_C = 1A	700 to 3000	
V_{CE} (sat)	I_C = 1.5A, I_B = 15mA	0.15max	V
V_{FEC}	I_{FEC} = 6A	1.5max	V
Es/b	L = 10mH, single pulse	200min	mJ

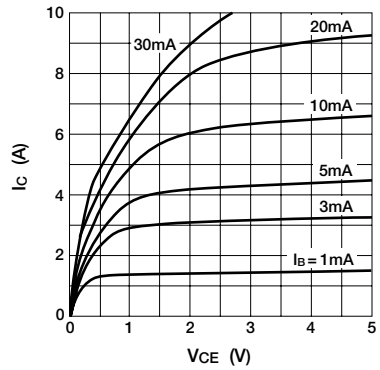
Typical Switching Characteristics

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
12	12	1	10	−5	30	−30	0.25	0.8	0.35

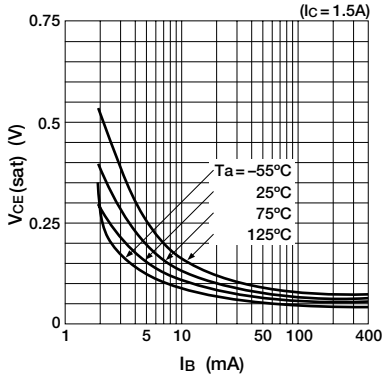
External Dimensions TO220F (full-mold)



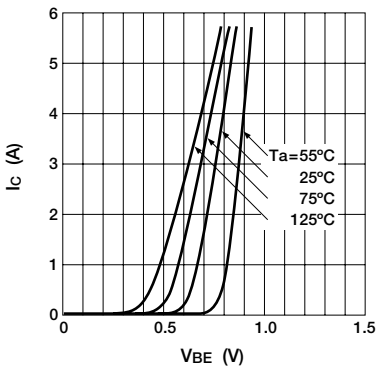
■ I_C — V_{CE} Characteristics (typ.)



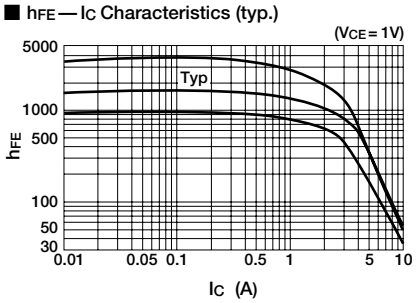
■ V_{CE} (sat) — I_B Temperature Characteristics (typ.)



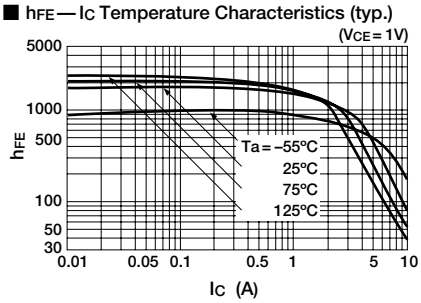
■ I_C — V_{BE} Temperature Characteristics (typ.)



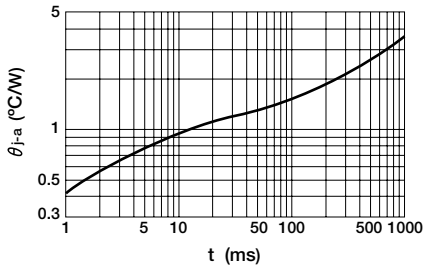
■ h_{FE} — I_C Characteristics (typ.)



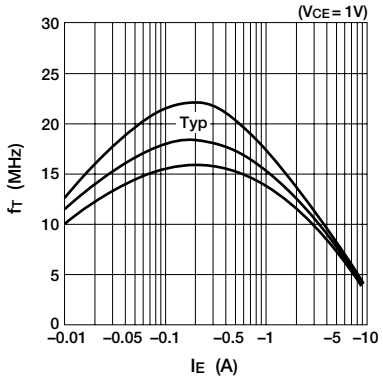
■ h_{FE} — I_C Temperature Characteristics (typ.)



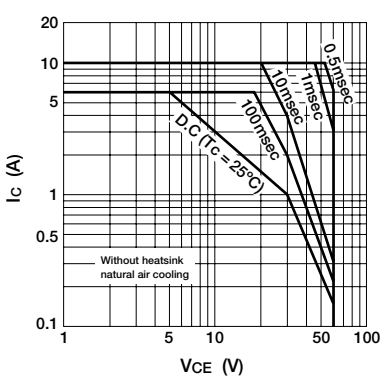
■ $\theta_{j\text{-}a}$ — t Characteristics



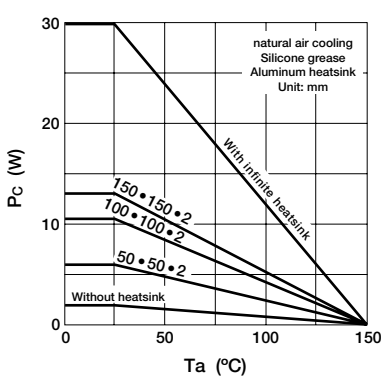
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor 2SD2633

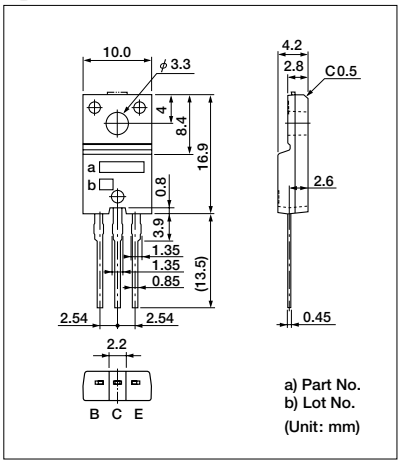
Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	200	V
V_{CEO}	150	V
V_{EBO}	6	V
I_C	8	A
I_B	1	A
P_C	35 (T_C=25°C)	W
	2 (T_a=25°C, No Fin)	
Tj	150	°C
Tstg	−55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB}=200V	100max	μA
I_{EBO}	V_{EB}=6V	10max	mA
V_{CEO}	I_C=50mA	150min	V
h_{FE}	V_{CE}=2V, I_C=6A	2000min	
V_{CE} (sat)	I_C=6A, I_B=6mA	1.5max	V
V_{BE} (sat)	I_C=6A, I_B=6mA	2.0max	V

External Dimensions TO220F (full-mold)



a) Part No.
b) Lot No.
(Unit: mm)

Power Transistor FN812

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	120	V
V_{CEO}	100	V
V_{EBO}	6	V
I_C	8 (pulse 12)	A
I_B	3	A
P_C	35 (Tc=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

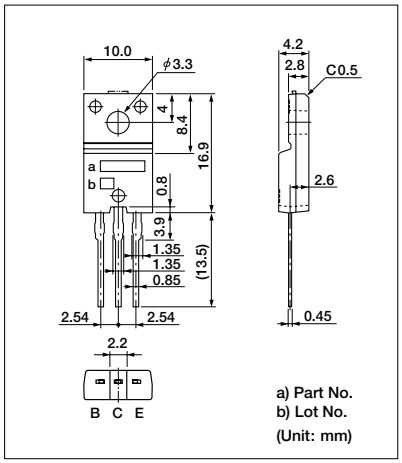
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 120V	10max	μA
I_{EBO}	V_{EB} = 6V	10max	μA
V_{CEO}	I_C = 50mA	100min	V
h_{FE}	V_{CE} = 4V, I_C = 3A	70min	
V_{CE} (sat)	I_C = 4A, I_B = 0.4A	0.3max	V

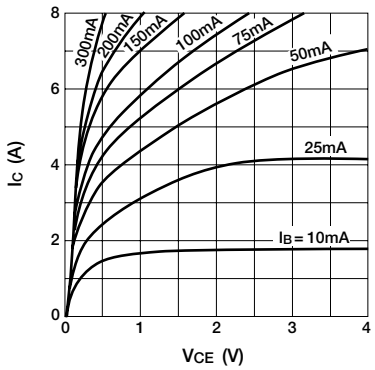
Typical Switching Characteristics

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
12	4	3	10	−5	30	−30	1.0	2.0	0.5

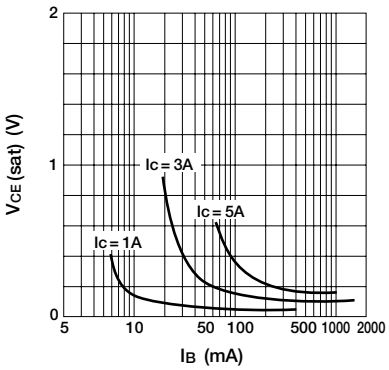
External Dimensions TO220F (full-mold)



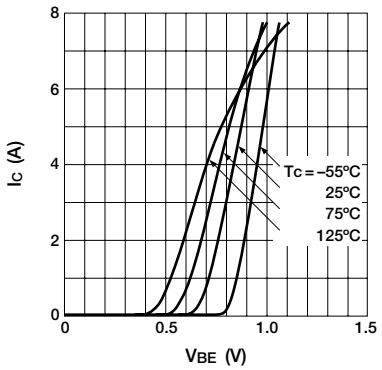
■ I_C — V_{CE} Characteristics (typ.)



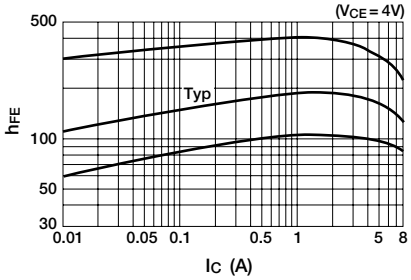
■ V_{CE} (sat) — I_B Characteristics (typ.)



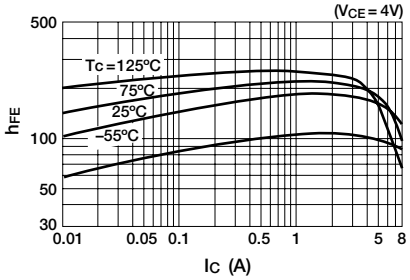
■ I_C — V_{BE} Temperature Characteristics (typ.)



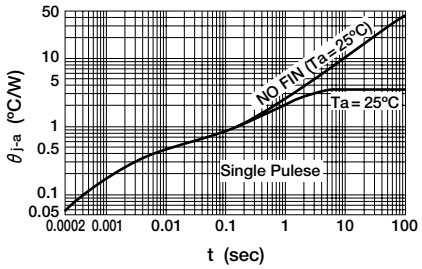
■ h_{FE} — I_C Characteristics (typ.)



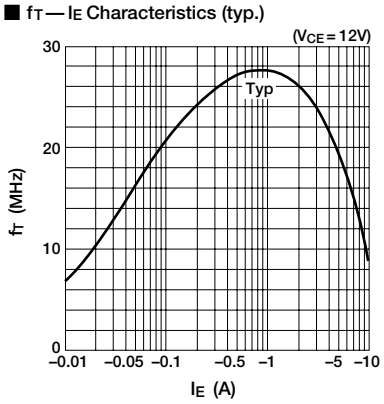
■ h_{FE} — I_C Temperature Characteristics (typ.)



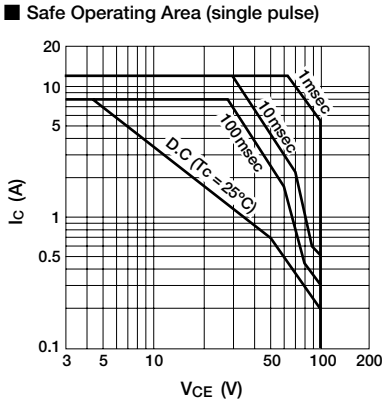
■ $\theta_{j\text{-}a}$ — t Characteristics



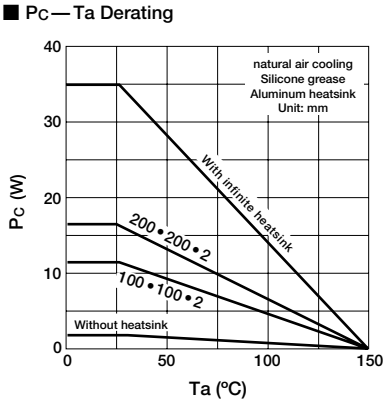
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor FP812

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	–120	V
V_{CEO}	–120	V
V_{EBO}	–6	V
I_C	–8 (pulse –12)	A
I_B	–3	A
P_C	35 (Tc=25°C)	W
Tj	150	°C
Tstg	–55 to +150	°C

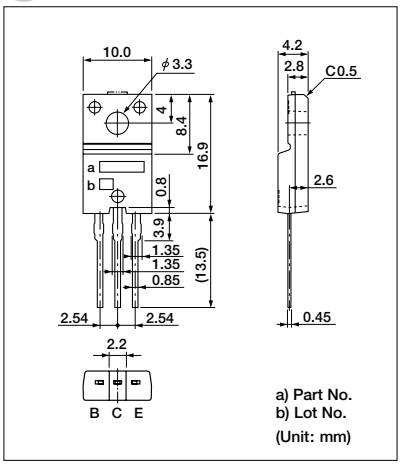
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = –120V	10max	μA
I_{EBO}	V_{EB} = –6V	10max	μA
V_{CEO}	I_C = –50mA	–120min	V
h_{FE}	V_{CE} = –4V, I_C = –3A	70min	
V_{CE} (sat)	I_C = –3A, I_B = –0.3A	–0.3max	V

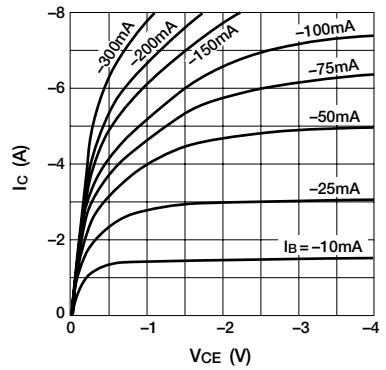
Typical Switching Characteristics

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
–12	4	–3	–10	5	–30	30	2.5	0.4	0.6

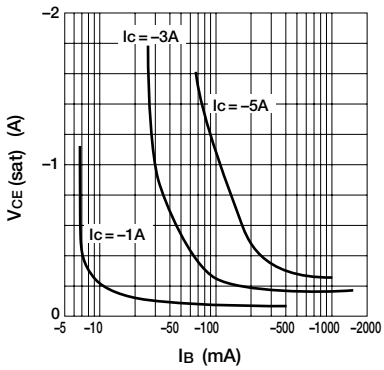
External Dimensions TO220F (full-mold)



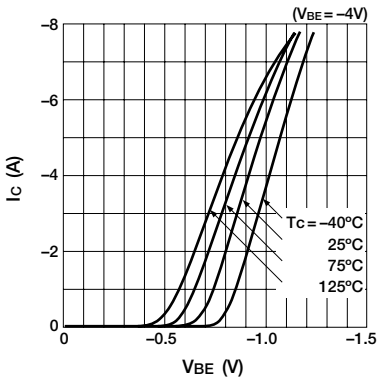
■ I_C — V_{CE} Characteristics (typ.)



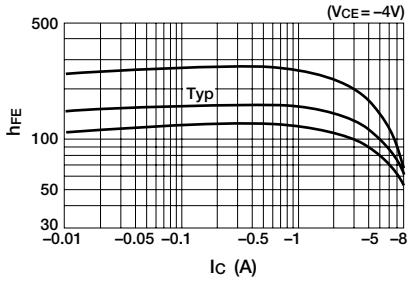
■ V_{CE} (sat) — I_B Characteristics (typ.)



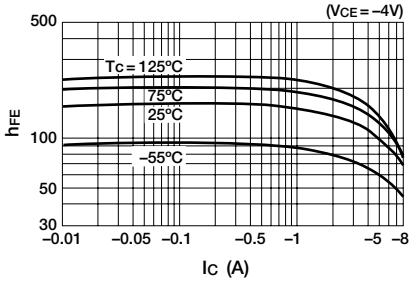
■ I_C — V_{BE} Temperature Characteristics (typ.)



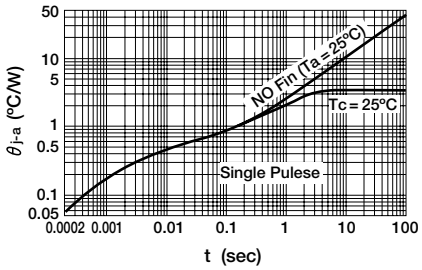
■ h_{FE} — I_C Characteristics (typ.)



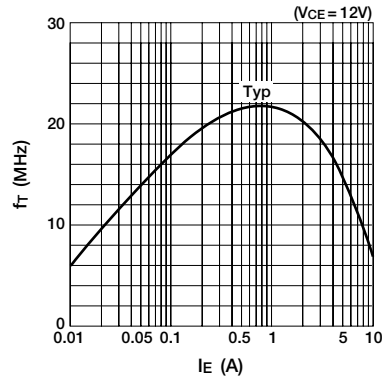
■ h_{FE} — I_C Temperature Characteristics (typ.)



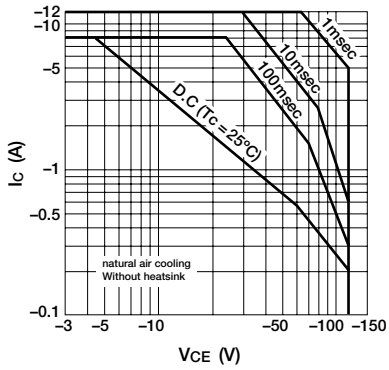
■ $\theta_{j\text{-}a}$ — t Characteristics



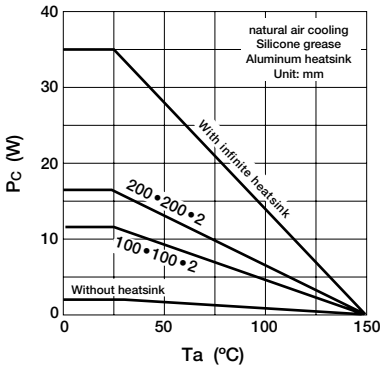
■ f_T — I_E Characteristics (typ.)



■ Safe Operating Area (single pulse)



■ P_C — Ta Derating



Power Transistor MN611S

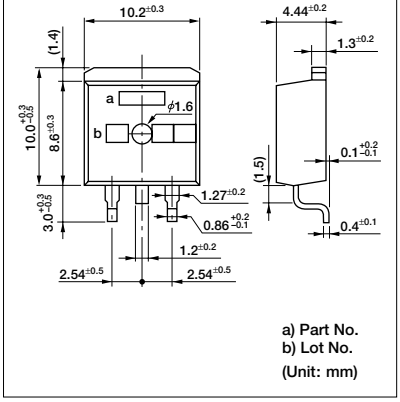
Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	115±10	V
V_{CEO}	115±10	V
V_{EBO}	6	V
I_C	±6 (pulse ±10)	A
I_B	1	A
P_C	50 (Tc=25°C)	W
	1.2 (Ta=25°C, No Fin)	
Tj	150	°C
Tstg	−55 to +150	°C

Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings			Unit
		min	typ	max	
I_{CBO}	V_{CB}=105V			10	μA
I_{EBO}	V_{EB}=6V			10	μA
V_{CEO}	I_C=50mA	105	115	125	V
h_{FE}	V_{CE}=1V, I_C=1A	400	800	1500	
V_{CE} (sat)	I_C=1.2A, I_B=12mA		0.08	0.12	V
V_{FEC}	I_{FEC}=6A		1.25	1.5	V
$E_{S/B}$	L=10mA	45			mJ

External Dimensions TO220S



a) Part No.
b) Lot No.
(Unit: mm)

Power Transistor MN638S

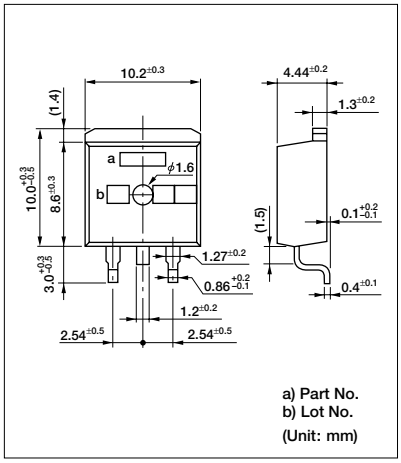
Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	380±50	V
V_{CEO}	380±50	V
V_{EBO}	6	V
I_C	6 (pulse 10)	A
I_B	1	A
P_C	60 (T_C=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

Electrical Characteristics (Ta=25°C)

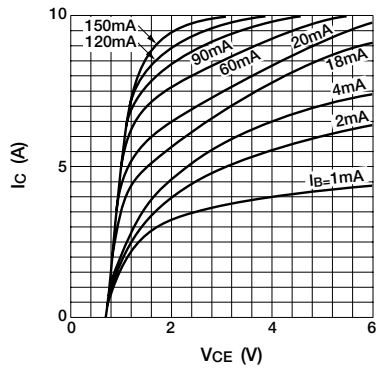
Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB}=330V	10max	μA
I_{EBO}	V_{EB}=6V	20max	mA
$V_{(BR)\,CEO}$	I_C=25mA	330 to 430	V
h_{FE}	V_{CE}=2V, I_C=3A	1500min	
$V_{CE\,(sat)}$	I_C=4A, I_B=20mA	1.5max	V

External Dimensions TO220S

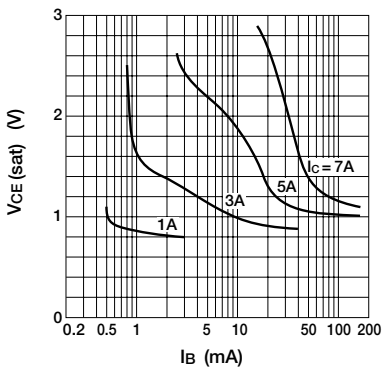


a) Part No.
b) Lot No.
(Unit: mm)

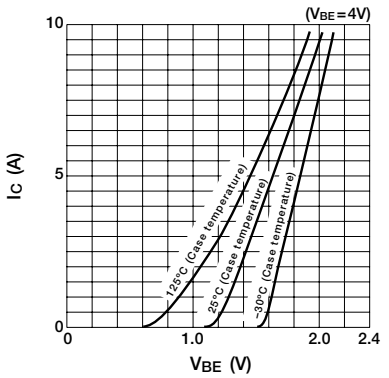
■ I_C — V_{CE} Characteristics (typ.)



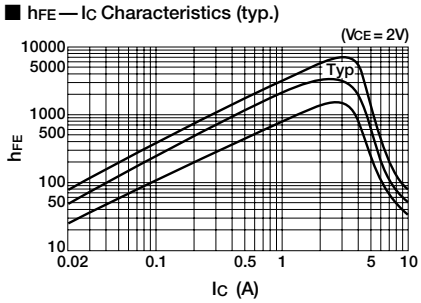
■ $V_{CE\,(sat)}$ — I_B Characteristics (typ.)



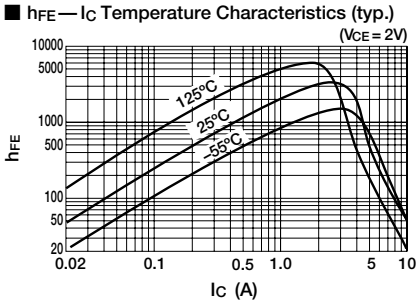
■ I_C — V_{BE} Temperature Characteristics (typ.)



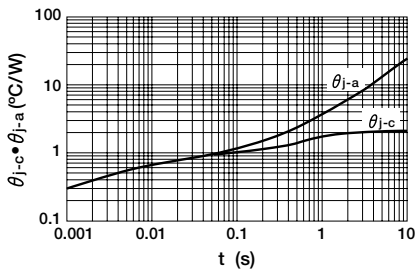
■ h_{FE} — I_C Characteristics (typ.)



■ h_{FE} — I_C Temperature Characteristics (typ.)



■ $\theta_{j\text{-}c} \bullet \theta_{j\text{-}a}$ — t Characteristics



Power Transistor Array STA315A

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	35±5	V
V_{CEO}	36±5	V
V_{EBO}	6	V
I_C	2 (pulse 3*)	A
I_B	30	mA
P_T	3 (Ta=25°C)	W
	13.5 (Tc=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

* $P_W \leqq 1$ms, Duty ≦ 25%

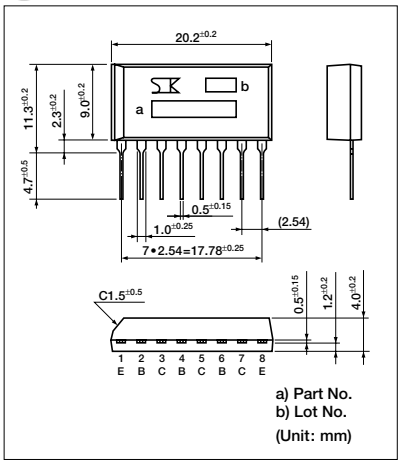
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 30V	10max	μA
I_{EBO}	V_{EB} = 6V	2.7max	mA
V_{CEO}	I_C = 25mA	31 to 41	V
h_{FE}	V_{CE} = 4V, I_C = 0.7A	400min	
V_{CE} (sat)	I_C = 0.5A, I_B = 5mA	0.2max	V
	I_C = 1A, I_B = 5mA	0.5max	V
V_{FEC}	I_{FEC} = 2A	2.5max	V
R_B		800±120	Ω
R_{BE}		2.0±0.4	kΩ
Es/b	L = 10mH, single pulse	50min	mJ

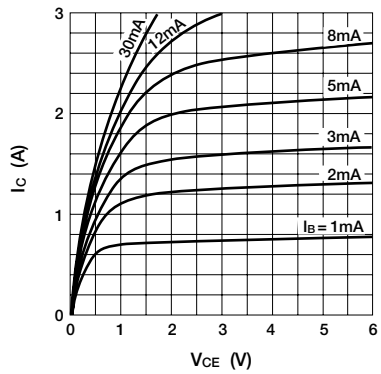
Typical Switching Characteristics

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
12	12	1	10	−5	5	0	1.0	8.5	2.5

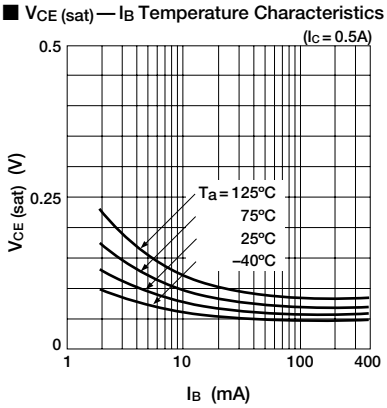
External Dimensions STA3 (LF400A)



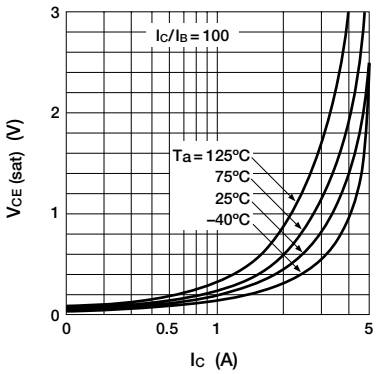
■ I_C — V_{CE} Characteristics (typ.)



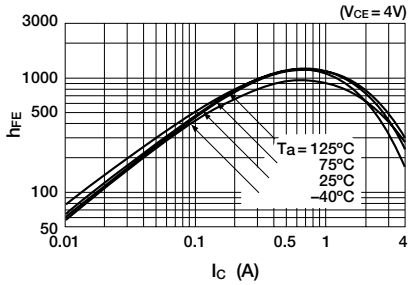
■ V_{CE} (sat) — I_B Temperature Characteristics



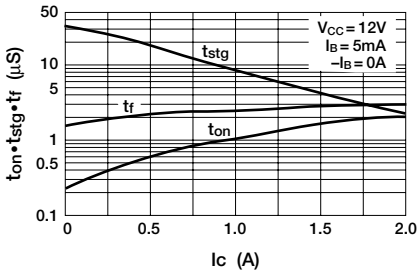
■ V_{CE} (sat) — I_C Temperature Characteristics



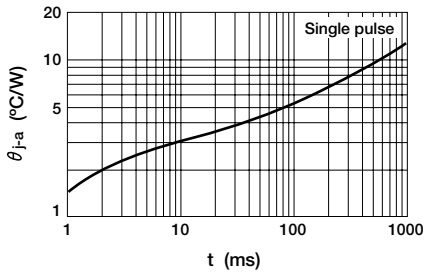
■ h_{FE} — I_C Temperature Characteristics



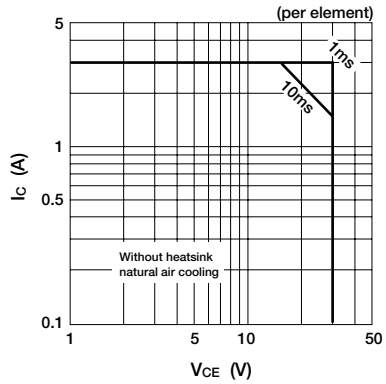
■ $t_{on} \cdot t_{stg} \cdot t_f$ — I_C Characteristics (typ.)



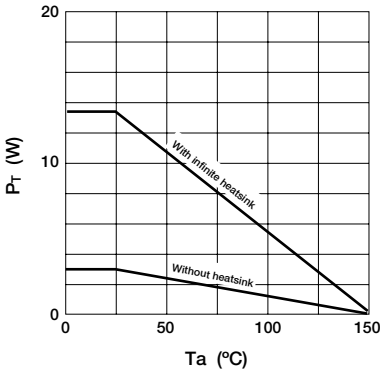
■ $\theta_{j\text{-}a}$ — t Characteristics



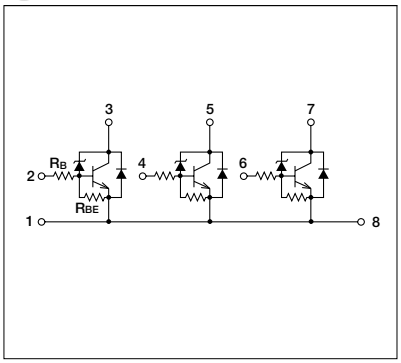
■ Safe Operating Area (single pulse)



■ P_T — Ta Derating



Equivalent Circuit Diagram



Power Transistor Array STA335A

Absolute Maximum Ratings (Ta=25ºC)

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	2.5 (Ta=25ºC)	W
	12 (Tc=25ºC)	W
Tj	150	ºC
Tstg	−55 to +150	ºC

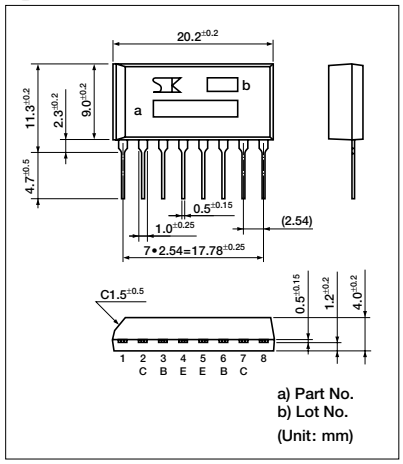
Electrical Characteristics (Ta=25ºC)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 30V	10max	μA
I_{EBO}	V_{EB} = 6V	10max	μA
V_{CEO}	I_C = 25mA	35±5	V
h_{FE}	V_{CE} = 4V, I_C = 0.5A	500min	
V_{CE}(sat)	I_C = 1A, I_B = 5mA	0.5max	V
Es/b	L = 10mH, single pulse	150min	mJ

Typical Switching Characteristics

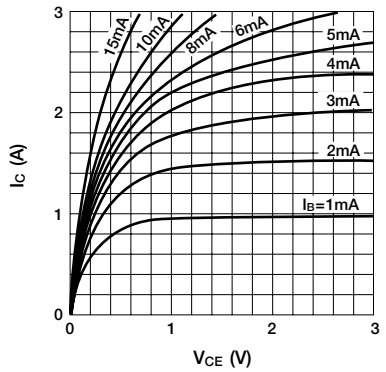
V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
12	12	1	10	−5	5	5	1.3	4.7	1.2

External Dimensions STA3 (LF400A)

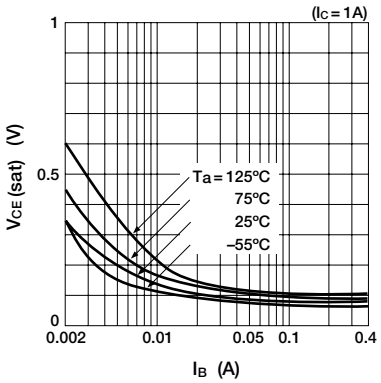


a) Part No.
b) Lot No.
(Unit: mm)

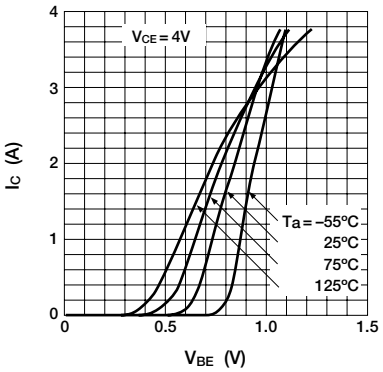
■ I_C — V_{CE} Characteristics (typ.)



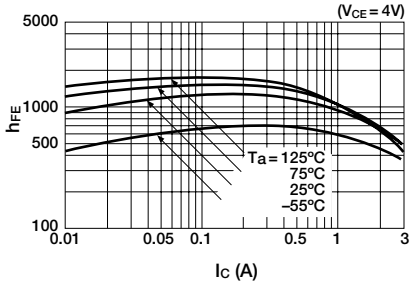
■ V_{CE} (sat) — I_B Temperature Characteristics



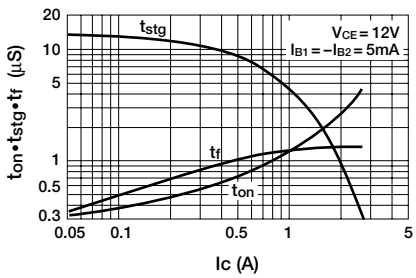
■ I_C — V_{BE} Temperature Characteristics (typ.)



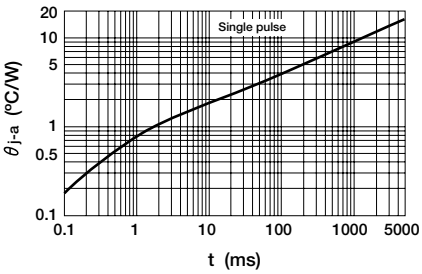
■ h_{FE} — I_C Temperature Characteristics (typ.)



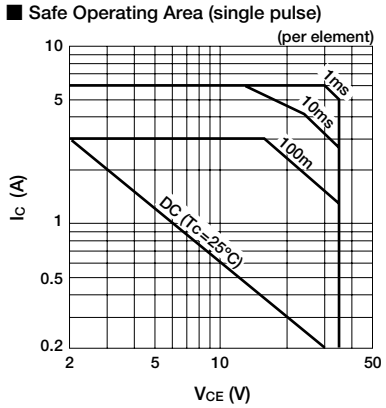
■ t_{on}•t_{stg}•t_f — I_C Characteristics (typ.)



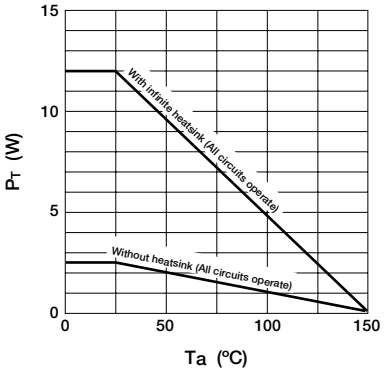
■ $\theta_{j\text{-}a}$ — t Characteristics



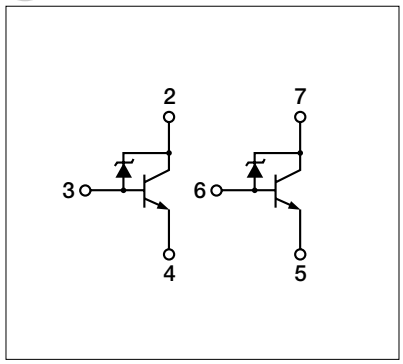
■ Safe Operating Area (single pulse)



■ P_T — Ta Derating



Equivalent Circuit Diagram



Power Transistor Array STA415A

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	35±5	V
V_{CEO}	36±5	V
V_{EBO}	6	V
I_C	2 (pulse 3*)	A
I_B	30	mA
P_T	4 (Ta = 25°C)	W
	18 (Tc = 25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

* $P_W \leqq 1$ms, Duty ≦ 25%

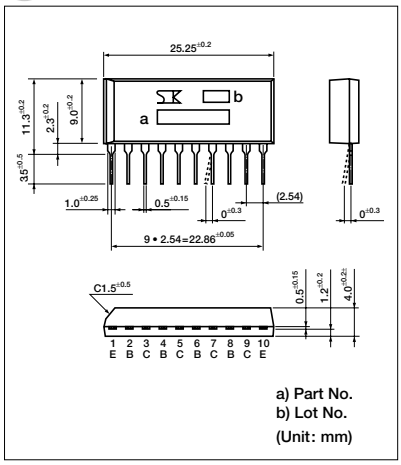
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 30V	10max	μA
I_{EBO}	V_{EB} = 6V	2.7max	mA
V_{CEO}	I_C = 25mA	31 to 41	V
h_{FE}	V_{CE} = 4V, I_C = 0.7A	400min	
V_{CE} (sat)	I_C = 0.5A, I_B = 5mA	0.2max	V
	I_C = 1A, I_B = 5mA	0.5max	V
V_{FEC}	I_{FEC} = 2A	2.5max	V
R_B		800±120	Ω
R_{BE}		2.0±0.4	kΩ
Es/b	L = 10mH, single pulse	50min	mJ

Typical Switching Characteristics

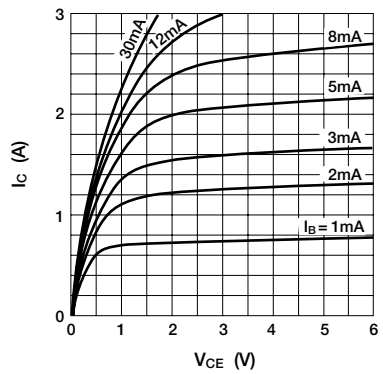
V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
12	12	1	10	−5	5	0	1.0	8.5	2.5

External Dimensions STA4 (LF412)

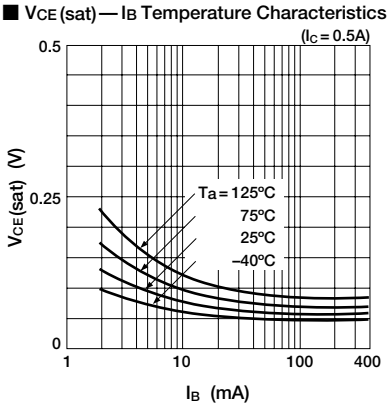


a) Part No.
b) Lot No.
(Unit: mm)

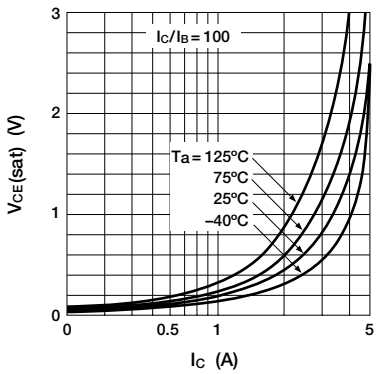
■ I_C — V_{CE} Characteristics (typ.)



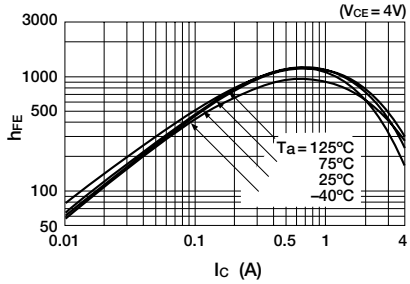
■ V_{CE} (sat) — I_B Temperature Characteristics



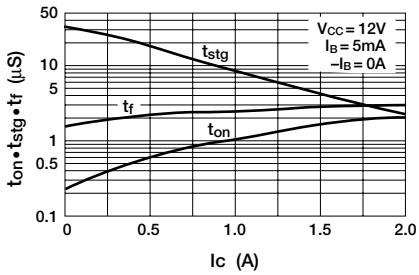
■ V_{CE} (sat) — I_C Temperature Characteristics



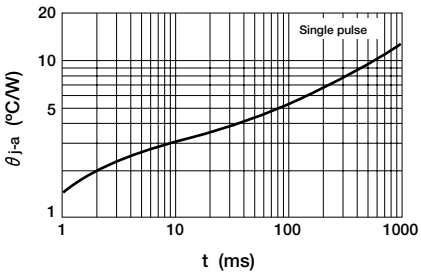
■ h_{FE} — I_C Temperature Characteristics



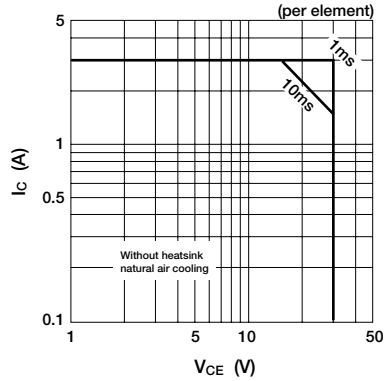
■ $t_{on} \cdot t_{stg} \cdot t_f$ — I_C Characteristics (typ.)



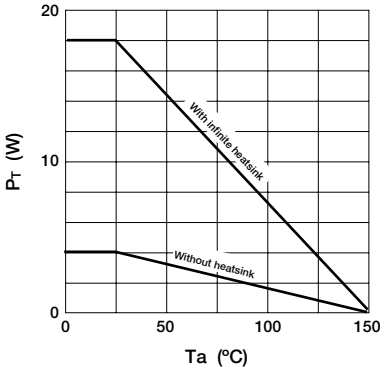
■ $\theta_{j\text{-}a}$ — t Characteristics



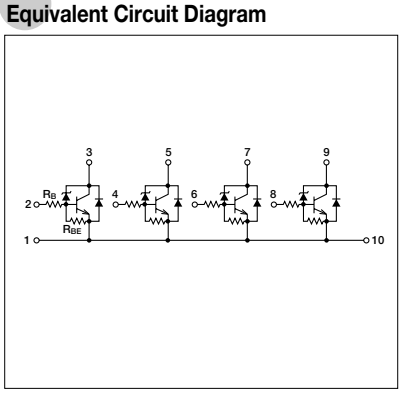
■ Safe Operating Area (single pulse)



■ P_T — Ta Derating



Equivalent Circuit Diagram



Power Transistor Array STA461C

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	65±5	V
V_{CEO}	65±5	V
V_{EBO}	6	V
I_C	±6 (pulse ±10)	A
I_B	1	A
P_T	3.2 (Ta = 25°C)	W
	18 (Tc = 25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

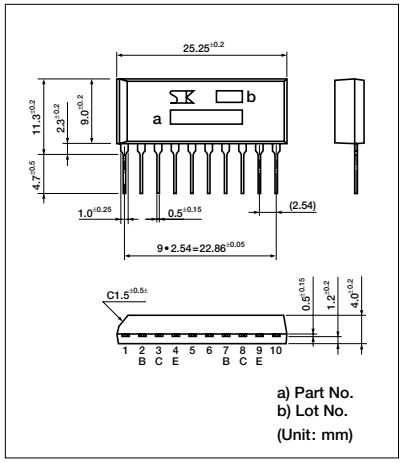
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 60V	10max	μA
I_{EBO}	V_{EB} = 6V	10max	μA
V_{CEO}	I_C = 50mA	60 to 70	V
h_{FE}	V_{CE} = 1V, I_C = 1A	400 to 1500	
V_{CE} (sat)	I_C = 1.5A, I_B = 15mA	0.15max	V
V_{FEC}	I_{FEC} = 6A	1.5max	V
Es/b	L = 10mH, single pulse	80min	mJ

Typical Switching Characteristics

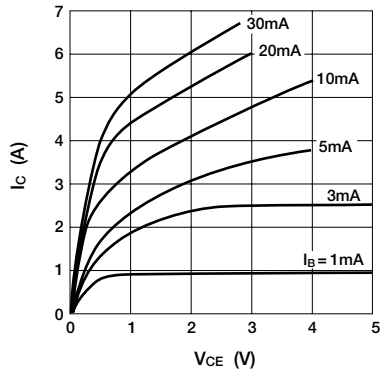
V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
12	12	1	10	−5	30	−30	0.2	3.9	0.2

External Dimensions STA4 (LF400B)

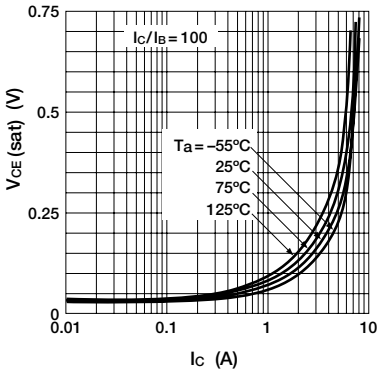


a) Part No.
b) Lot No.
(Unit: mm)

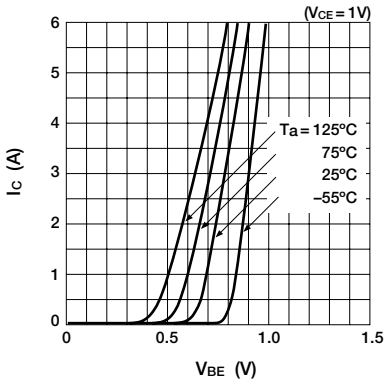
■ I_C — V_{CE} Characteristics (typ.)



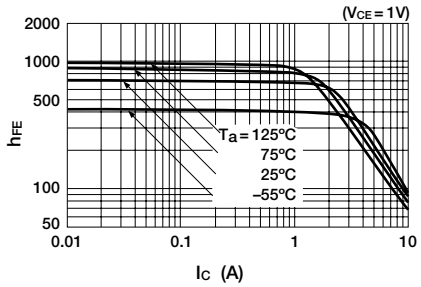
■ V_{CE} (sat) — I_C Temperature Characteristics (typ.)



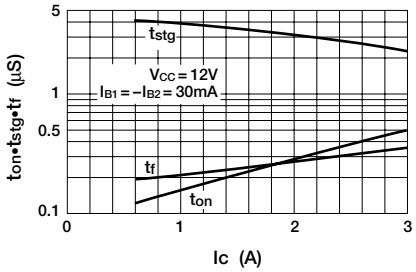
■ I_C — V_{BE} Temperature Characteristics (typ.)



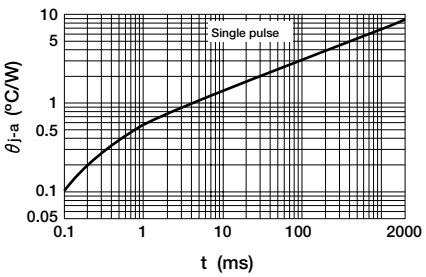
■ h_{FE} — I_C Temperature Characteristics (typ.)



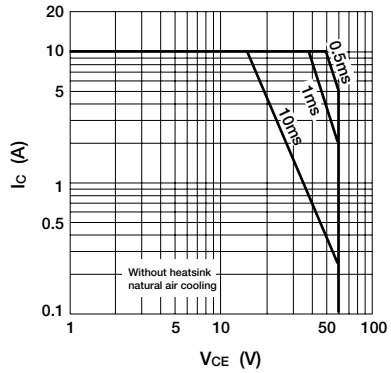
■ t_{on}•t_{stg}•t_f — I_C Characteristics



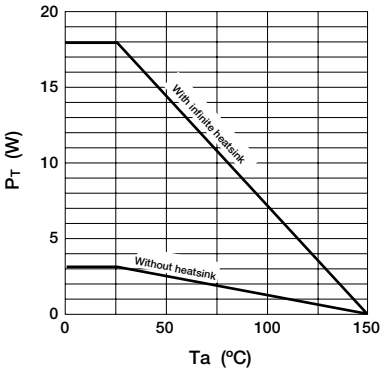
■ $\theta_{j\text{-}a}$ — t Characteristics



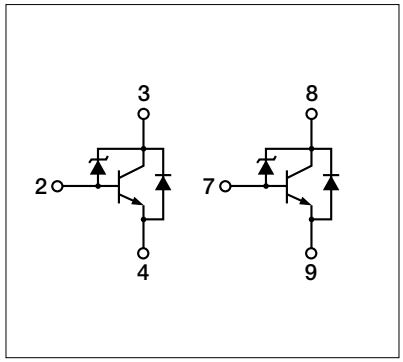
■ Safe Operating Area (single pulse)



■ P_T — Ta Derating



Equivalent Circuit Diagram



Power Transistor Array STA463C

Absolute Maximum Ratings (Ta=25ºC)

Symbol	Ratings	Unit
V_{CBO}	115±10	V
V_{CEO}	115±10	V
V_{EBO}	6	V
I_C	±6 (pulse ±10)	A
I_B	1	A
P_T	3.2 (Ta=250ºC)	W
	18 (Tc=25ºC)	W
Tj	150	ºC
Tstg	−55 to +150	ºC

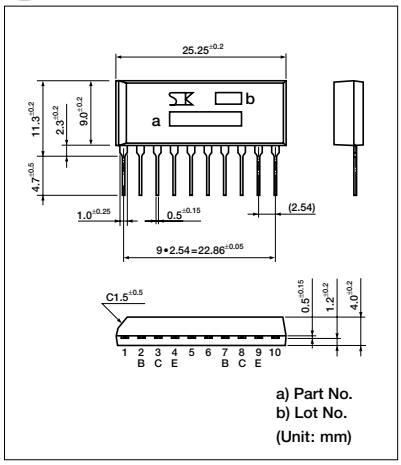
Electrical Characteristics (Ta=25ºC)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = 105V	10max	μA
I_{EBO}	V_{EB} = 6V	10max	μA
V_{CEO}	I_C = 50mA	105 to 125	V
h_{FE}	V_{CE} = 1V, I_C = 1A	400 to 1500	
V_{CE} (sat)	I_C = 1.2A, I_B = 12mA	0.12max	V
V_{FEC}	I_{FEC} = 6A	1.5max	V
Es/b	L = 10mH, single pulse	45min	mJ

Typical Switching Characteristics

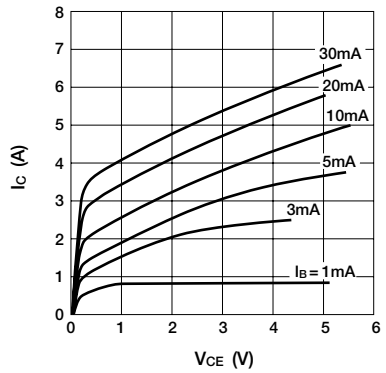
V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
12	12	1	10	−5	30	−30	0.2	5.7	0.4

External Dimensions STA4 (LF400B)

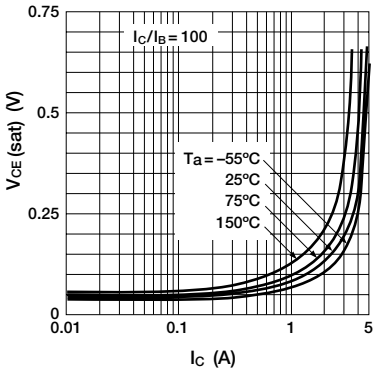


a) Part No.
b) Lot No.
(Unit: mm)

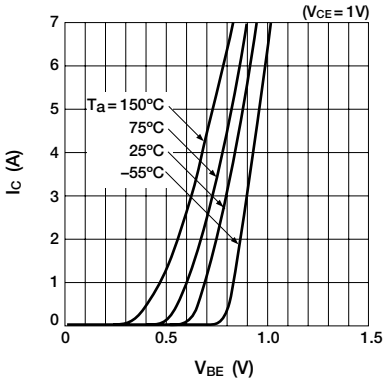
■ I_C — V_{CE} Characteristics (typ.)



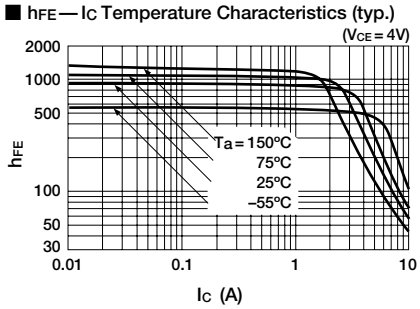
■ V_{CE} (sat) — I_C Temperature Characteristics (typ.)



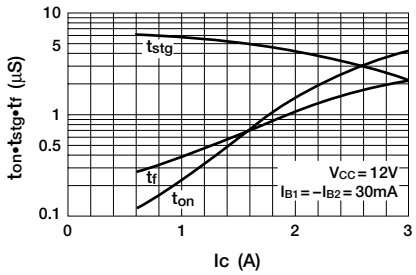
■ I_C — V_{BE} Temperature Characteristics (typ.)



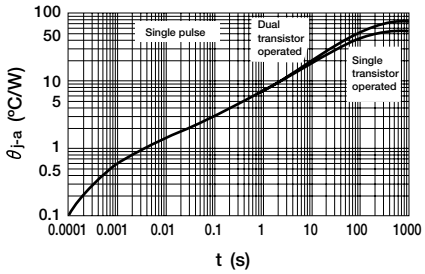
■ h_{FE} — I_C Temperature Characteristics (typ.)



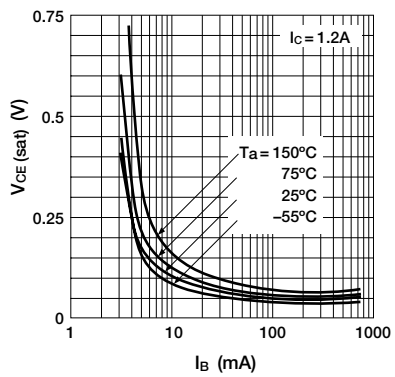
■ t_{on}•t_{stg}•t_f — I_C Characteristics



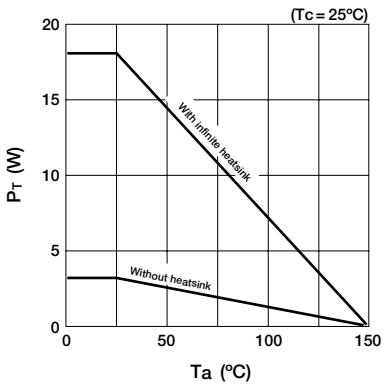
■ $\theta_{j\text{-}a}$ — t Characteristics



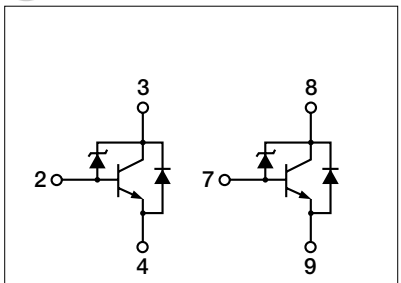
■ V_{CE} (sat) — I_B Temperature Characteristics (typ.)



■ P_T — Ta Derating



Equivalent Circuit Diagram



Power Transistor Array STA464C

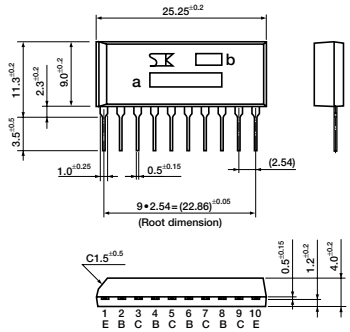
Absolute Maximum Ratings (Ta=25ºC)

Symbol	Ratings	Unit
V_{CBO}	65±5	V
V_{CEO}	65±5	V
V_{EBO}	6	V
I_C	6 (pulse 10)	A
I_B	1	A
P_C	20 (Tc=25ºC)	W
	4 (Ta=25ºC)	
Tj	150	ºC
Tstg	−55 to +150	ºC

Electrical Characteristics (Ta=25ºC)

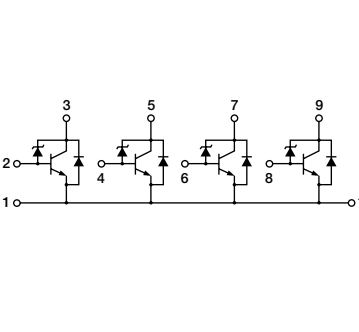
Symbol	Test Conditions	Ratings			Unit
		min	typ	max	
I_{CBO}	V_{CB}=60V			10	μA
I_{EBO}	V_{EB}=6V			10	μA
V_{CEO}	I_C=50mA	60	65	70	V
h_{FE}	V_{CE}=1V, I_C=1A	400	800	1500	
V_{CE} (sat)	I_C=1.5A, I_B=15mA		0.09	0.15	V
V_{FEC}	I_{FEC}=6A		1.25	1.5	V
Es/b	L=10mH	80			mJ

External Dimensions STA4



a) Part No.
b) Lot No.
(Unit: mm)

Equivalent Circuit Diagram



Power Transistor Array SLA8004

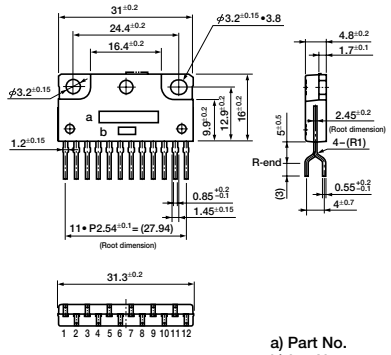
Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings		Unit
	NPN	PNP	
V_{CBO}	60	–55	V
V_{CEO}	60	–55	V
V_{EBO}	6	–6	V
I_C	12	–12	A
I_B	3	–3	A
P_T	5 (Tc=25°C, No Fin)		W
	40 (Tc=25°C)		W
Tj	150		°C
Tstg	–55 to +150		°C

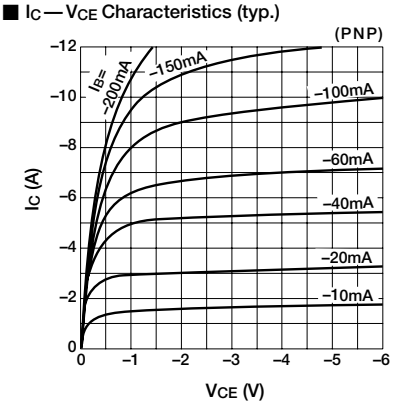
Electrical Characteristics (Ta=25°C)

Symbol	NPN		PNP		Unit
	Test Conditions	Ratings	Test Conditions	Ratings	
I_{CBO}	V_{CB} = 60V	100max	V_{CB} = –55V	–100max	μA
I_{EBO}	V_{EB} = 6V	60max	V_{EB} = –6V	–60max	mA
V_{CEO}	I_C = 25mA	60min	I_C = –25mA	–55min	V
h_{FE}	V_{CE} = 1V, I_C = 3A	150min	V_{CE} = –1V, I_C = –3A	80min	
V_{CE} (sat)	I_C = 6A, I_B = 0.3A	0.35max	I_C = –6A, I_B = –0.3A	–0.35max	V
V_{FEC}	I_{FEC} = 10A	2.5max	I_{FEC} = 10A	2.5max	V

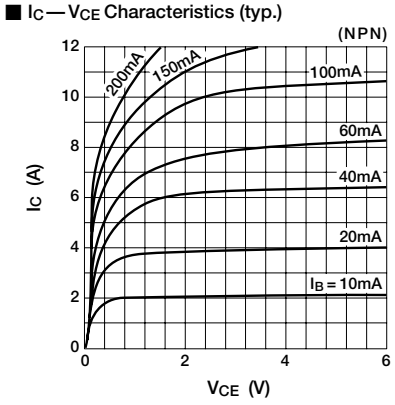
External Dimensions SLA (LF817)



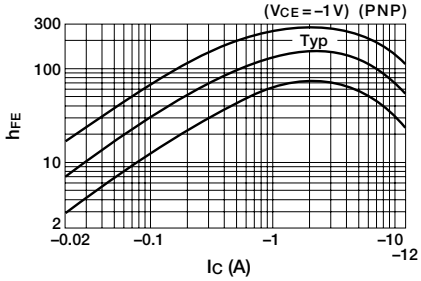
■ I_C — V_{CE} Characteristics (typ.)



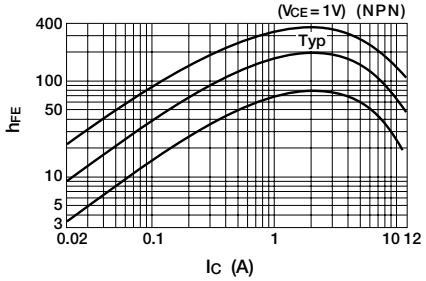
■ I_C — V_{CE} Characteristics (typ.)



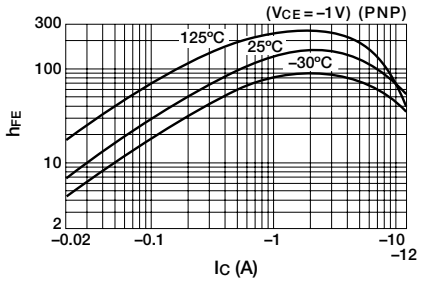
■ h_{FE} — I_C Characteristics (typ.)



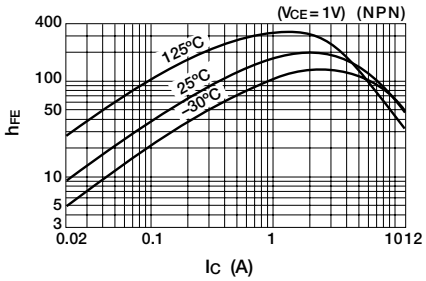
■ h_{FE} — I_C Characteristics (typ.)



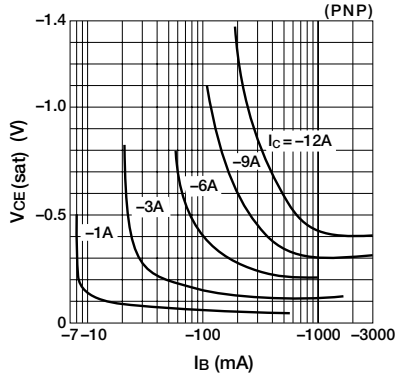
■ h_{FE} — I_C Temperature Characteristics (typ.)



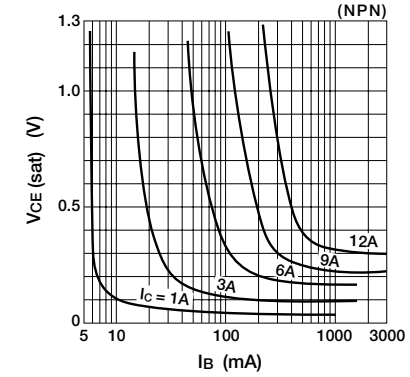
■ h_{FE} — I_C Temperature Characteristics (typ.)



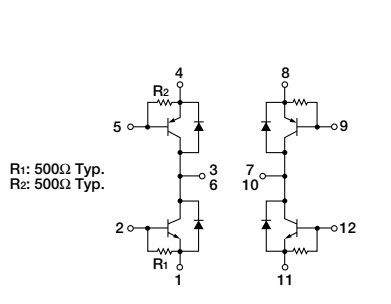
■ V_{CE} (sat) — I_B Characteristics (typ.)



■ V_{CE} (sat) — I_B Characteristics (typ.)



Equivalent Circuit Diagram



Surface-mount Power Transistor Array SDA03

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	–60	V
V_{CEO}	–60	V
V_{EBO}	–6	V
I_C	–6 (pulse –12)	A
I_B	–1	A
P_T	3 (No Fin)	W
Tj	150	°C
Tstg	–55 to +150	°C

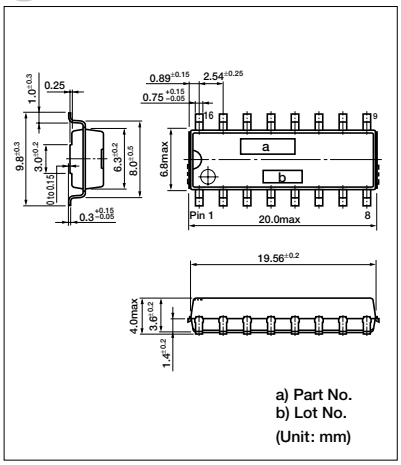
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = –60V	–10max	μA
I_{EBO}	V_{EB} = –6V	–10max	μA
V_{CEO}	I_C = –25mA	–60min	V
h_{FE}	V_{CE} = –4V, I_C = –2A	100min	
V_{CE} (sat)	I_C = –2A, I_B = –0.1A	–0.4max	V

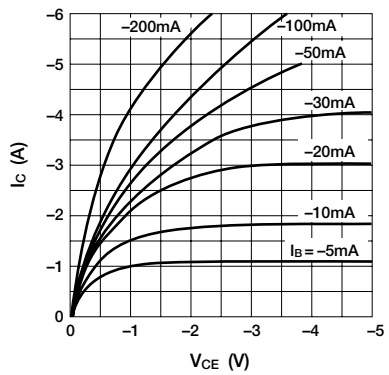
Typical Switching Characteristics

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
–12	12	–1	–10	5	–50	50	0.4	1.75	0.22

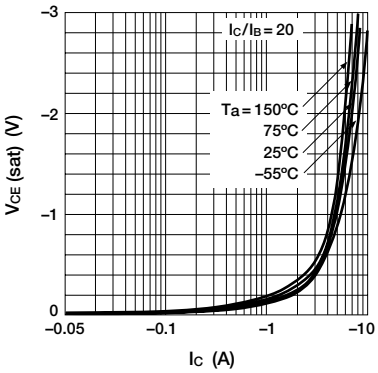
External Dimensions SMD-16A



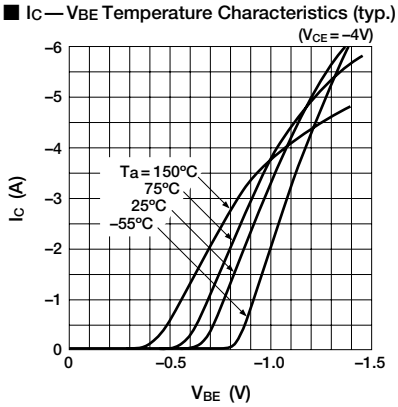
■ I_C — V_{CE} Characteristics



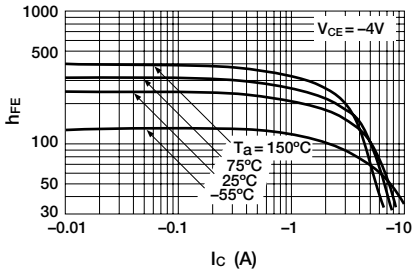
■ V_{CE} (sat) — I_C Temperature Characteristics (typ.)



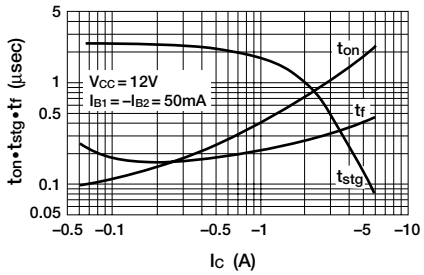
■ I_C — V_{BE} Temperature Characteristics (typ.)



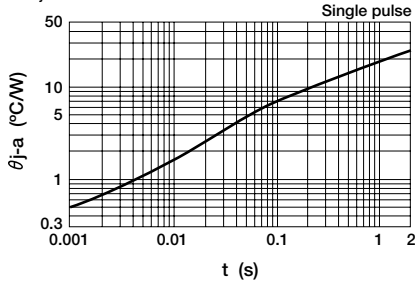
■ h_{FE} — I_C Temperature Characteristics



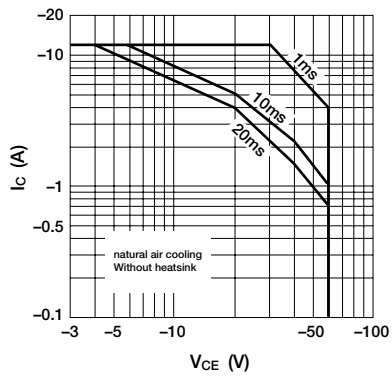
■ $t_{on} \cdot t_{stg} \cdot t_f$ — I_C Characteristics



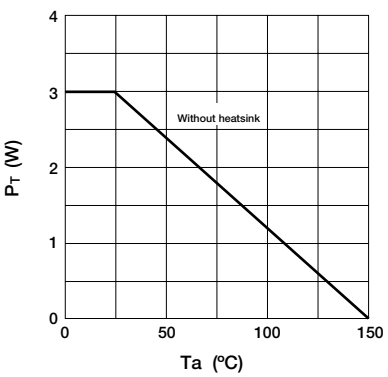
■ $\theta_{j\text{-}a}$ — t Characteristics



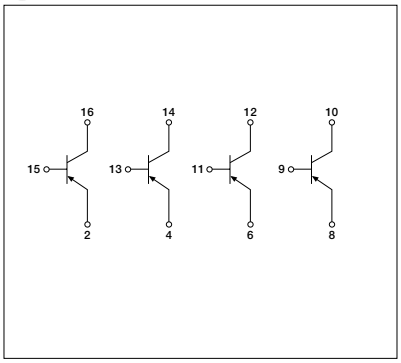
■ Safe Operating Area (single pulse)



■ P_T — Ta Derating



Equivalent Circuit Diagram



Surface-mount Power Transistor Array SDA04

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{CBO}	–60	V
V_{CEO}	–60	V
V_{EBO}	–6	V
I_C	–6 (pulse –12)	A
I_B	–1	A
P_T	2.5 (No Fin)	W
Tj	150	°C
Tstg	–55 to +150	°C

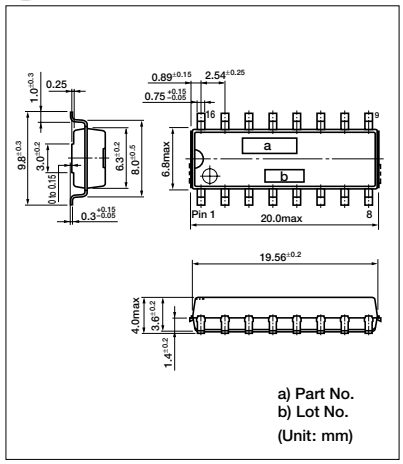
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	V_{CB} = –60V	–10max	μA
I_{EBO}	V_{EB} = –6V	–10max	μA
V_{CEO}	I_C = –25mA	–60min	V
h_{FE}	V_{CE} = –4V, I_C = –2A	100min	
V_{CE} (sat)	I_C = –2A, I_B = –0.1A	–0.4max	V

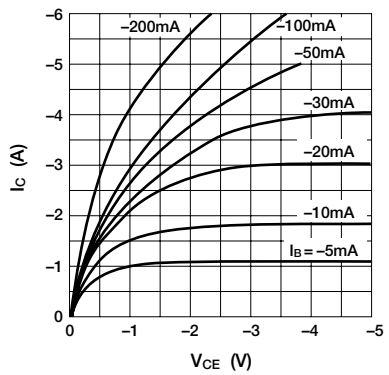
Typical Switching Characteristics

V_{CC} (V)	R_L (Ω)	I_C (A)	V_{BB1} (V)	V_{BB2} (V)	I_{B1} (mA)	I_{B2} (mA)	t_{on} (μs)	t_{stg} (μs)	t_f (μs)
–12	12	–1	–10	5	–50	50	0.4	1.75	0.22

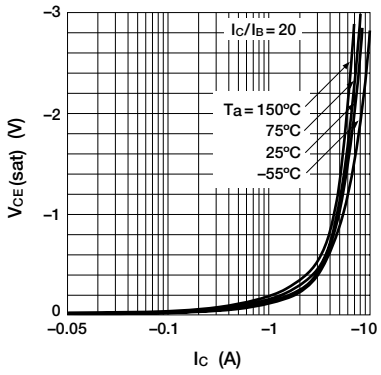
External Dimensions SMD-16A



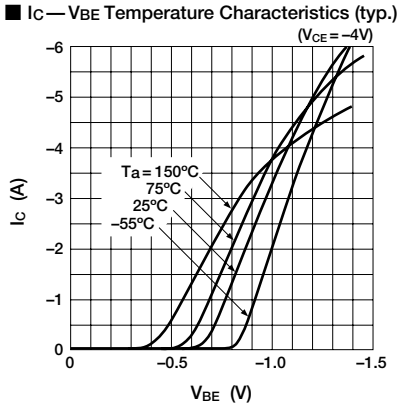
■ I_C — V_{CE} Characteristics



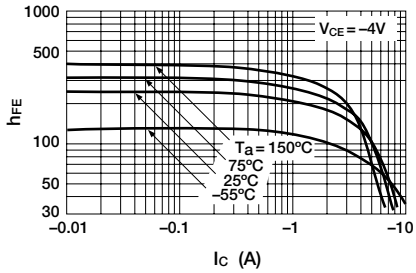
■ V_{CE} (sat) — I_C Temperature Characteristics (typ.)



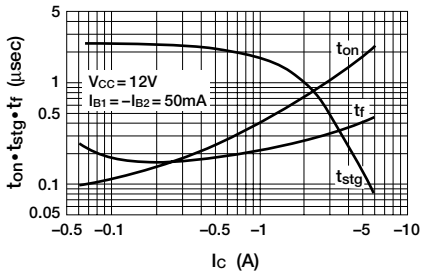
■ I_C — V_{BE} Temperature Characteristics (typ.)



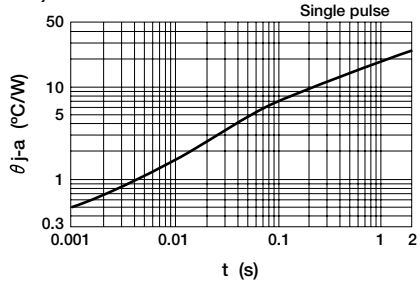
■ h_{FE} — I_C Temperature Characteristics



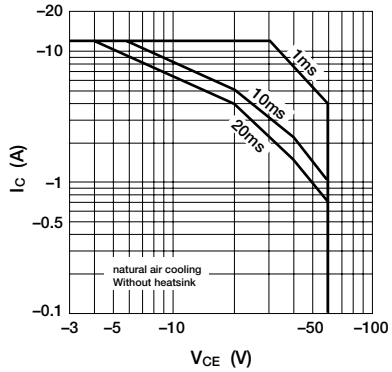
■ $t_{on} \cdot t_{stg} \cdot t_f$ — I_C Characteristics



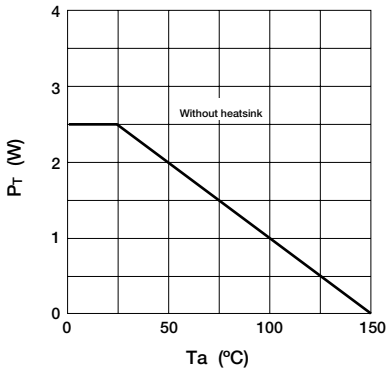
■ $\theta_{j\text{-}a}$ — t Characteristics



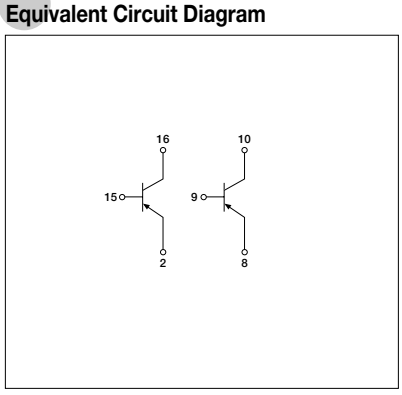
■ Safe Operating Area (single pulse)



■ P_T — Ta Derating



Equivalent Circuit Diagram



Surface-mount Power Transistor Array SDC09

Absolute Maximum Ratings (Ta=25ºC)

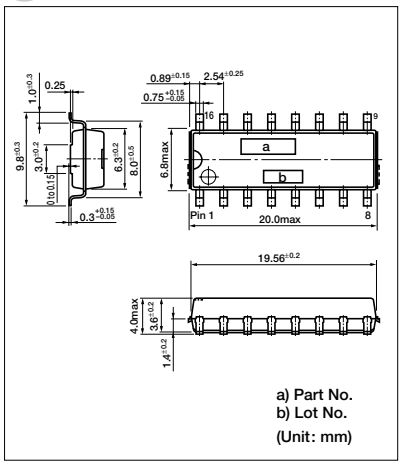
Symbol	Ratings	Unit
V_{CBO}	65±5	V
V_{CEO}	65±5	V
V_{EBO}	6	V
I_C	6 (pulse 10*)	A
I_B	1	A
P_T	2.8	W
Tj	150	ºC
Tstg	−55 to +150	ºC

* $P_W \leqq 100\mu s$, Duty ≦1%

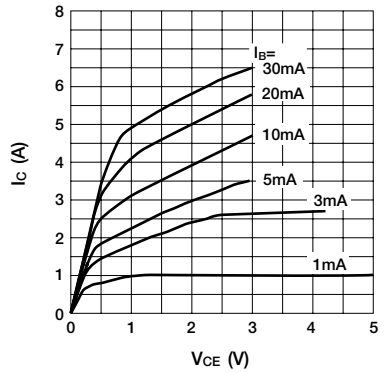
Electrical Characteristics (Ta=25ºC)

Symbol	Test Conditions	Ratings	Unit
I_{CBO}	$V_{CB}=60V$	10max	μA
I_{EBO}	$V_{EB}=6V$	10max	μA
V_{CEO}	$I_C=50mA$	60 to 70	V
h_{FE}	$V_{CE}=1V$, $I_C=1A$	400 to 1500	
V_{CE} (sat)	$I_C=1.5A$, $I_B=15mA$	0.15max	V
V_{FEC}	$I_{FEC}=6A$	1.5max	V
Es/b	L=10mH, single pulse	80min	mJ

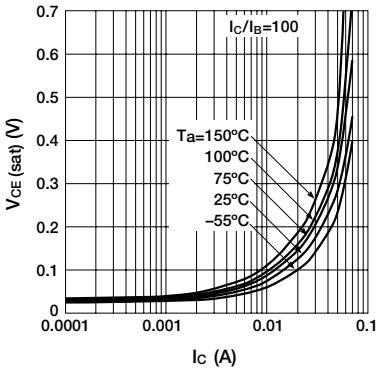
External Dimensions SMD-16A



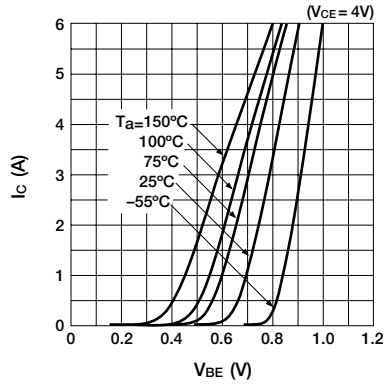
■ I_C — V_{CE} Characteristics



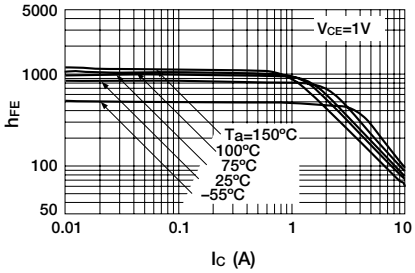
■ V_{CE} (sat) — I_C Temperature Characteristics (typ.)



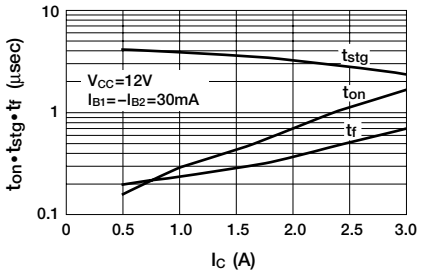
■ I_C — V_{BE} Temperature Characteristics (typ.)



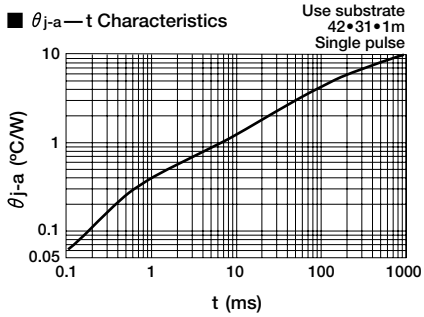
■ h_{FE} — I_C Temperature Characteristics



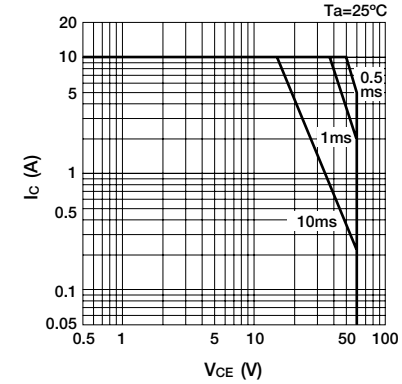
■ $t_{on} \cdot t_{stg} \cdot t_f$ — I_C Characteristics



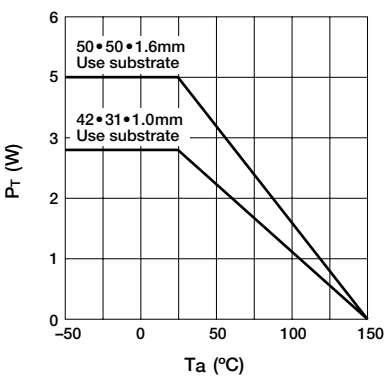
■ $\theta_{j\text{-}a}$ — t Characteristics



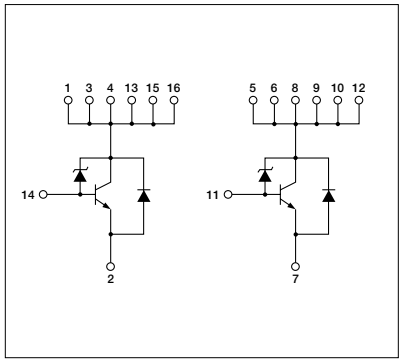
■ Safe Operating Area (single pulse)



■ P_T — Ta Derating



Equivalent Circuit Diagram



Surface-mount Power Transistor Array SPF0001

Absolute Maximum Ratings (Ta=25°C)

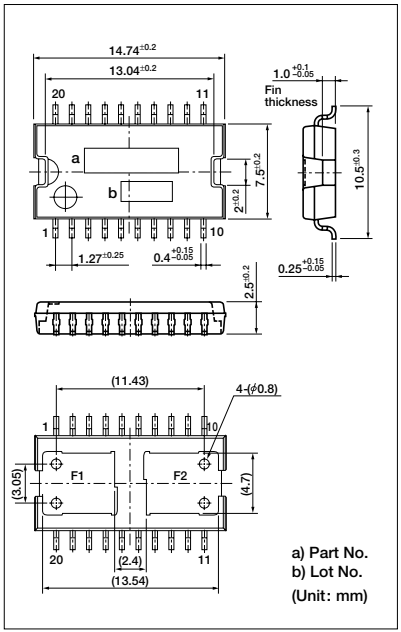
Symbol	Ratings	Unit
V_{CBO}	115±10	V
V_{CEO}	115±10	V
V_{EBO}	6	V
I_C	±6 (pulse ±10)	A
I_B	1	A
P_T *	2.5 (Ta=25°C)	W
Tj	150	°C
Tstg	−55 to +150	°C

* Use glass epoxy substrate (FR4) 70mm•100mm•1.6mm

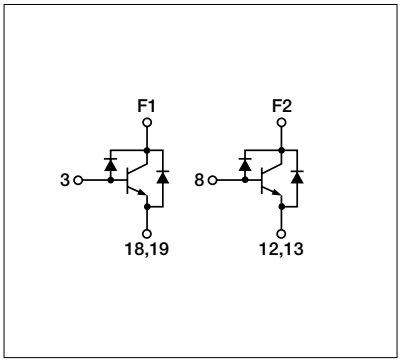
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings			Unit
		min	typ	max	
I_{CBO}	V_{CB}=105V			10	μA
I_{EBO}	V_{EB}=6V			10	μA
V_{CEO}	I_C=50mA	105	115	125	V
h_{FE}	V_{CE}=1V, I_C=1A	400	800	1500	
V_{CE} (sat)	I_C=1.2A, I_B=12mA		0.08	0.12	V
V_{FEC}	I_{FEC}=6A		1.25	1.5	V
Es/b	L=10mH	45			mJ

External Dimensions SMD-16A



Equivalent Circuit Diagram



MOS FET 2SK2701

Absolute Maximum Ratings (Ta=25°C)

Symbol	Ratings	Unit
V_{DSS}	450	V
V_{GSS}	±30	V
I_D	±7	A
$I_{D\ (pulse)}$*1	±28	A
P_T	35 (Tc=25°C)	W
E_{AS}*2	130	mJ
I_{AS}	7	A
Tch	150	°C
Tstg	−55 to +150	°C

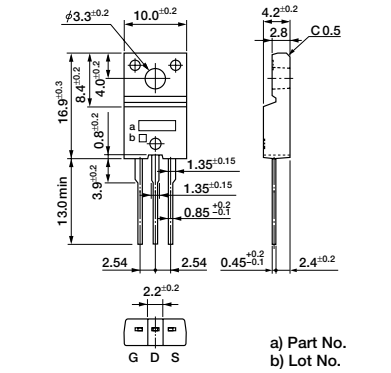
*1 $P_W \leqq 100\mu s$, duty ≦1%

*2 V_{DD} = 30V, L = 5mH, I_L = 7A, unclamped, $R_G = 50\Omega$

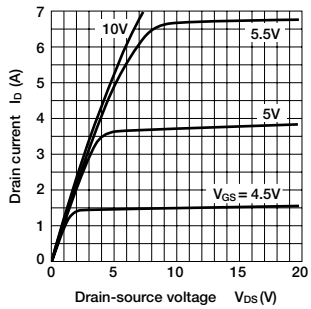
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings min	Ratings typ	Ratings max	Unit
$V_{(BR)\ DSS}$	I_D = 100μA, V_{GS} = 0V	450			V
I_{GSS}	V_{GS} = ±30V			±100	nA
I_{DSS}	V_{DS} = 450V, V_{GS} = 0V			100	μA
V_{TH}	V_{DS} = 10V, I_D = 1mA	2.0	3.0	4.0	V
$R_{e\ (yfs)}$	V_{DS} = 20V, I_D = 3.5A	3.5	5		S
$R_{DS\ (ON)}$	V_{DS} = 10V, I_D = 3.5A		0.84	1.10	Ω
Ciss	V_{DS} = 10V, f = 1.0MHz, V_{GS} = 0V		720		pF
Coss			150		pF
Crss			65		pF
$t_{d\ (on)}$	I_D = 3.5A, V_{DD} = 200V, R_L = 57Ω, V_{GS} = 10V		25		ns
t_r			40		ns
$t_{d\ (off)}$			70		ns
t_f			50		ns
V_{SD}	I_{SD} = 7A, V_{GS} = 0V		1.0	1.5	V

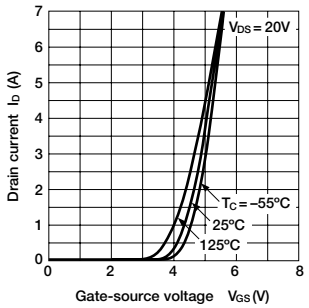
External Dimensions FM20 (full-mold)



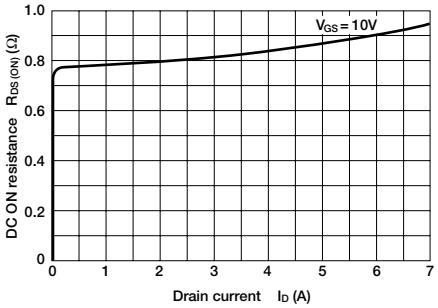
■ I_D — V_{DS} Characteristics



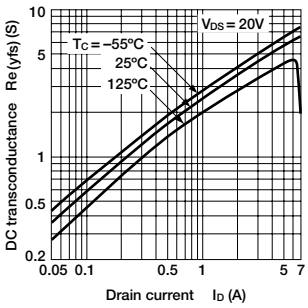
■ I_D — V_{GS} Characteristics



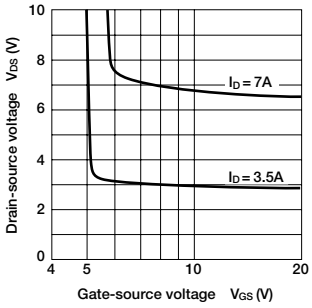
■ $R_{DS\ (ON)}$ — I_D Characteristics



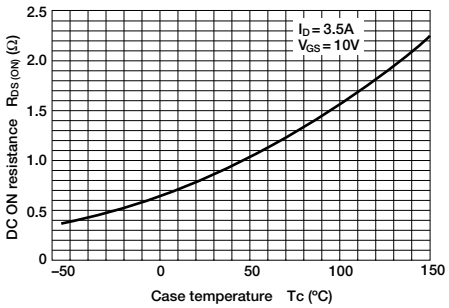
■ R_e (yfs) — I_D Characteristics



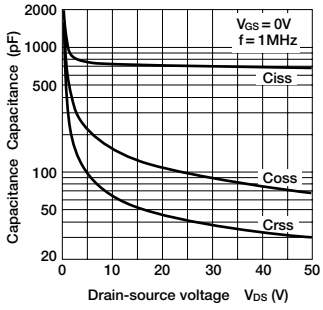
■ V_{DS} — V_{GS} Characteristics



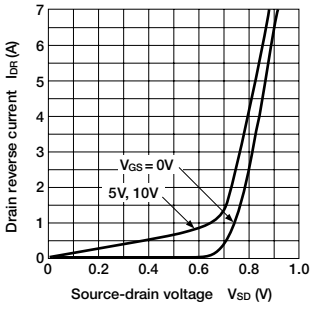
■ $R_{DS\ (ON)}$ — T_C Characteristics



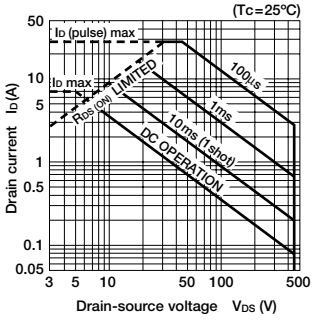
■ Capacitance — V_{DS} Characteristics



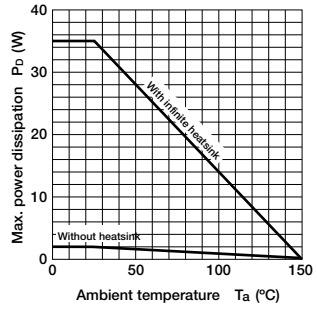
■ I_{DR} — V_{SD} Characteristics



■ Safe Operating Area (single pulse) (Tc=25°C)



■ P_D — T_a Derating



MOS FET FKV460 (under development)

Absolute Maximum Ratings (Ta=25°C)

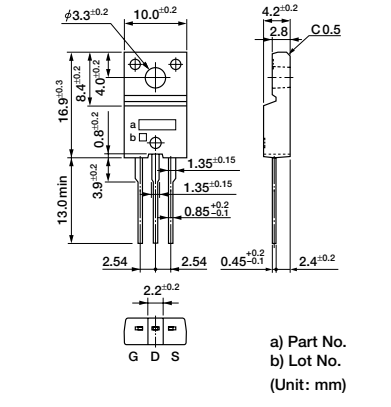
Symbol	Ratings	Unit
V_{DSS}	40	V
V_{GSS}	+20, –10	V
I_D	±60	A
$I_{D\ (pulse)}$*	±180	A
P_D	40 (Tc=25°C)	W
T_{ch}	150	°C
Tstg	–55 to +150	°C

* P_W ≦100μs, duty ≦1%

Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings			Unit
		min	typ	max	
$V_{(BR)\ DSS}$	I_D = 100μA, V_{GS} = 0V	40			V
I_{GSS}	V_{GS} = +20V			+10	μA
	V_{GS} = –10V			–5	
I_{DSS}	V_{DS} = 40V, V_{GS} = 0V			100	μA
V_{TH}	V_{DS} = 10V, I_D = 250μA	1.3		2.3	V
$Re_{(yfs)}$	V_{DS} = 10V, I_D = 25A	20			S
$R_{DS\ (ON)}$	V_{GS} = 10V, I_D = 25A		6	9	mΩ
Ciss	V_{DS} = 10V f = 1.0MHz V_{GS} = 0V		2000		pF
Coss			1200		pF
Crss			200		pF
$t_{d\ (on)}$	I_D = 25A V_{DD} ≒12V R_L = 0.48Ω V_{GS} = 10V		To be defined		ns
t_r					ns
$t_{d\ (off)}$					ns
t_f					ns
V_{SD}	I_{SD} = 50A, V_{GS} = 0V		1.0	1.5	V

External Dimensions TO220F (full-mold)



MOS FET FKV460S

Absolute Maximum Ratings (Ta=25°C)

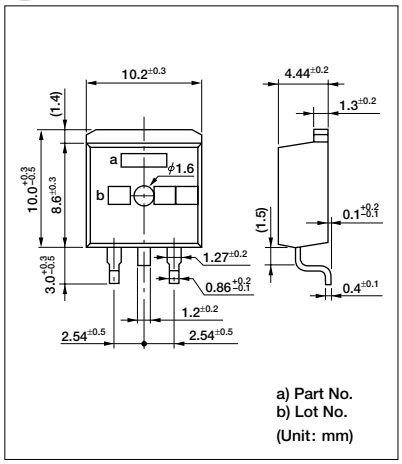
Symbol	Ratings	Unit
V_{DSS}	40	V
V_{GSS}	+20, –10	V
I_D	±60	A
$I_{D\ (pulse)}$*	±180	A
P_D	60 (Tc=25°C)	W
Tch	150	°C
Tstg	–55 to +150	°C

* $P_W \leqq 100\mu s$, duty ≦1%

Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings			Unit
		min	typ	max	
$V_{(BR)\ DSS}$	I_D=100μA, V_{GS}=0V	40			V
I_{GSS}	V_{GS}=+20V			+10	μA
	V_{GS}=–10V			–5	
I_{DSS}	V_{DS}=40V, V_{GS}=0V			100	μA
V_{TH}	V_{DS}=10V, I_D=250μA	1.3		2.3	V
$Re_{(yfs)}$	V_{DS}=10V, I_D=25A	20.0			S
$R_{DS\ (ON)}$	V_{GS}=10V, I_D=25A		7	9	mΩ
Ciss	V_{DS}=10V		2800		pF
Coss	f=1.0MHz		1400		pF
Crss	V_{GS}=0V		600		pF
$t_{d\ (on)}$	I_D=25A		20		ns
t_r	V_{DD}=12V		600		ns
$t_{d\ (off)}$	R_L=0.48Ω		250		ns
t_f	V_{GS}=10V		100		ns
V_{SD}	I_{SD}=50A, V_{GS}=0V		1.0	1.5	V

External Dimensions TO220S



a) Part No.
b) Lot No.
(Unit: mm)

MOS FET FKV560

Absolute Maximum Ratings (Ta=25ºC)

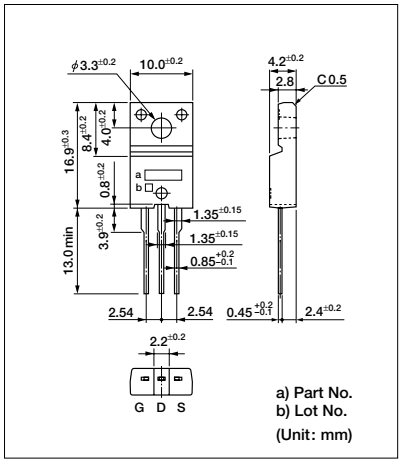
Symbol	Ratings	Unit
V_{DSS}	50	V
V_{GSS}	+20, –10	V
I_D	±60	A
$I_{D\ (pulse)}$*	±180	A
P_D	35 (Tc=25ºC)	W
Tch	150	ºC
Tstg	–55 to +150	ºC

* $P_W \leqq 100\mu s$, duty ≦1%

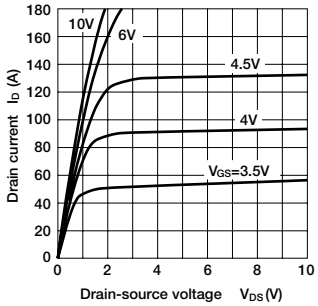
Electrical Characteristics (Ta=25ºC)

Symbol	Test Conditions	Ratings min	Ratings typ	Ratings max	Unit
$V_{(BR)\ DSS}$	I_D=100µA, V_{GS}=0V	50			V
I_{GSS}	V_{GS}=+20V			+10	µA
	V_{GS}=–10V			–5	
I_{DSS}	V_{DS}=50V, V_{GS}=0V			100	µA
V_{TH}	V_{DS}=10V, I_D=250µA	1.0		2.5	V
$Re_{(yfs)}$	V_{DS}=10V, I_D=25A	20			S
$R_{DS\ (ON)}$	V_{GS}=10V, I_D=25A		9	11	mΩ
Ciss	V_{DS}=10V		2700		pF
Coss	f=1.0MHz		1100		pF
Crss	V_{GS}=0V		500		pF
$t_{d\ (on)}$	I_D=25A		20		ns
t_r	V_{DD}≒12V		600		ns
$t_{d\ (off)}$	R_L=0.48Ω		300		ns
t_f	V_{GS}=10V		100		ns
V_{SD}	I_{SD}=50A, V_{GS}=0V		1.0	1.5	V
Di, t_{rr}	I_F=25A, di/dt=100A/µs		110		ns

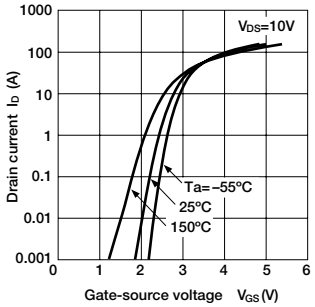
External Dimensions TO220F (full-mold)



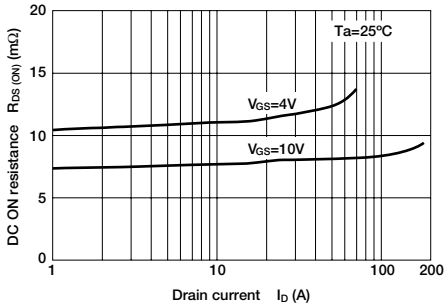
■ I_D — V_{DS} Characteristics



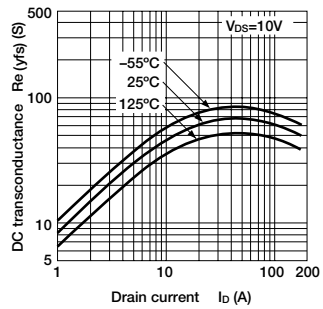
■ I_D — V_{GS} Characteristics



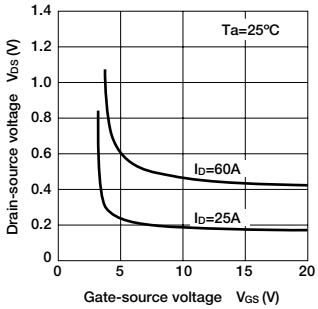
■ $R_{DS\ (ON)}$ — I_D Characteristics



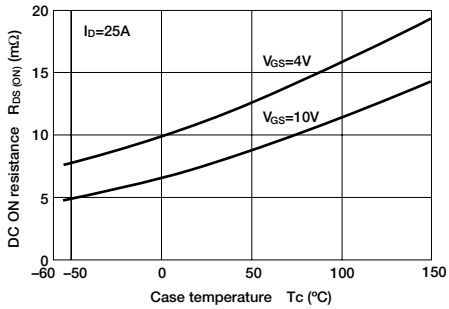
■ $Re_{(yfs)}$ — I_D Characteristics



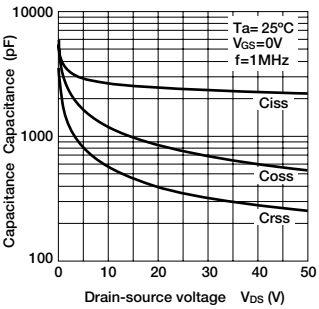
■ V_{DS} — V_{GS} Characteristics



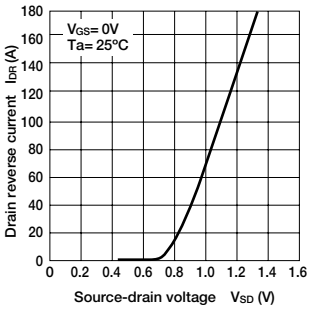
■ $R_{DS\ (ON)}$ — T_C Characteristics



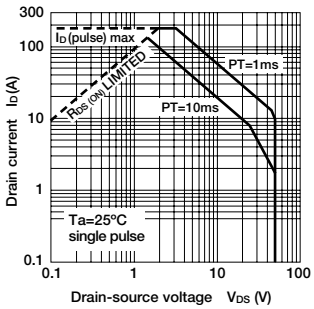
■ Capacitance — V_{DS} Characteristics



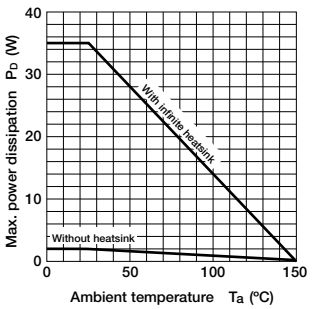
■ I_{DR} — V_{SD} Characteristics



■ Safe Operating Area



■ P_D — T_a Derating



MOS FET FKV560S

Absolute Maximum Ratings (Ta=25°C)

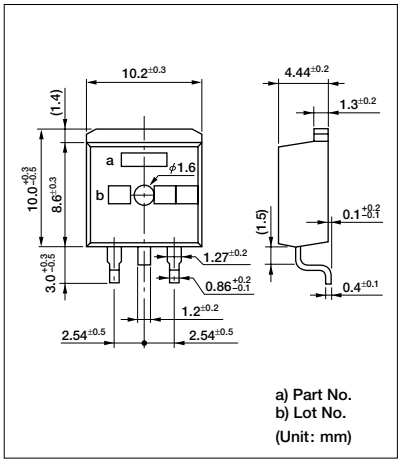
Symbol	Ratings	Unit
V_{DSS}	50	V
V_{GSS}	±20	V
I_D	±45	A
$I_{D\ (pulse)}$*	±135	A
P_D	60 (Tc=25°C)	W
Tch	150	°C
Tstg	−55 to +150	°C

* $P_W \leqq 100\mu s$, duty ≦1%

Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings			Unit
		min	typ	max	
$V_{(BR)\ DSS}$	I_D=100μA, V_{GS}=0V	50			V
I_{GSS}	V_{GS}=+20V			+10	μA
	V_{GS}=−20V			−5	
I_{DSS}	V_{DS}=50V, V_{GS}=0V			100	μA
V_{TH}	V_{DS}=10V, I_D=250μA	1.0		2.0	V
$Re_{(yfs)}$	V_{DS}=10V, I_D=25A	20.0			S
$R_{DS\ (ON)}$	V_{GS}=10V, I_D=25A		9	11	mΩ
Ciss	V_{DS}=10V		2000		pF
Coss	f=1.0MHz		1000		pF
Crss	V_{GS}=0V		150		pF
$t_{d\ (on)}$	I_D=25A		To be defined		ns
t_r	V_{DD}≒12V				ns
$t_{d\ (off)}$	R_L=0.48Ω				ns
t_f	V_{GS}=10V				ns
V_{SD}	I_{SD}=50A, V_{GS}=0V		1.0	1.5	V

External Dimensions TO220S



MOS FET FKV660 (under development)

Absolute Maximum Ratings (Ta=25°C)

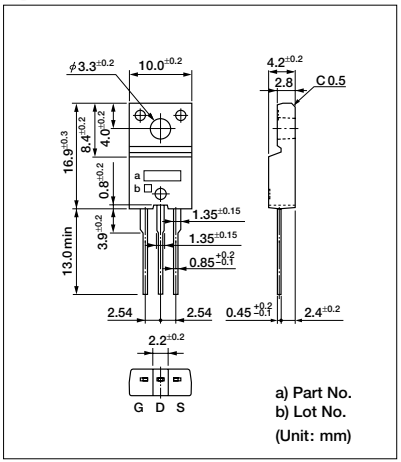
Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	±20	V
I_D	±50	A
$I_{D\ (pulse)}$*	±150	A
P_D	40 (Tc=25°C)	W
Tch	150	°C
Tstg	−55 to +150	°C

* $P_W \leqq 100\mu s$, duty ≦ 1%

Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings			Unit
		min	typ	max	
$V_{(BR)\ DSS}$	I_D = 100μA, V_{GS} = 0V	60			V
I_{GSS}	V_{GS} = +20V			+10	μA
	V_{GS} = −20V			−5	
I_{DSS}	V_{DS} = 60V, V_{GS} = 0V			100	μA
V_{TH}	V_{DS} = 10V, I_D = 250μA	1.0		2.0	V
$Re_{(yfs)}$	V_{DS} = 10V, I_D = 25A	20.0			S
$R_{DS\ (ON)}$	V_{GS} = 10V, I_D = 25A		11	14	mΩ
Ciss	V_{DS} = 10V, f = 1.0MHz, V_{GS} = 0V		2000		pF
Coss			900		pF
Crss			100		pF
$t_{d\ (on)}$	I_D = 25A, V_{DD} ≒ 12V, R_L = 0.48Ω, V_{GS} = 10V		To be defined		ns
t_r					ns
$t_{d\ (off)}$					ns
t_f					ns
V_{SD}	I_{SD} = 50A, V_{GS} = 0V		1.0	1.5	V

External Dimensions FM20 (full-mold)



MOS FET FKV660S

Absolute Maximum Ratings (Ta=25°C)

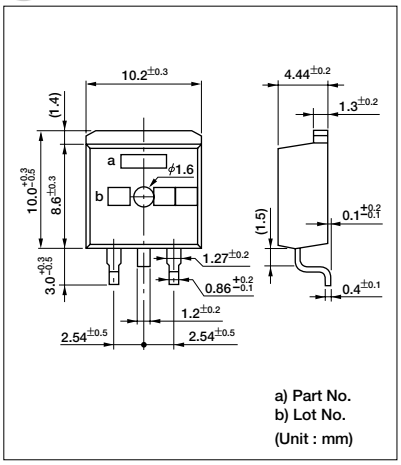
Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	+20, −10	V
I_D	±60	A
$I_{D(pulse)}$ ※	±180	A
P_D	60(Tc=25°C)	W
Tch	150	°C
Tstg	−40 to +150	°C

※P_W ≦100μs, duty≦1%

Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings			Unit
		min	typ	max	
$V_{(BR)DSS}$	I_D=100μA, V_{GS}=0V	60			V
I_{GSS}	V_{GS}=+20V			+10	μA
	V_{GS}=−10V			−5	
I_{DSS}	V_{DS}=60V, V_{GS}=0V			100	μA
V_{TH}	V_{DS}=10V, I_D=250μA	1.0		2.5	V
$Re_{(yfs)}$	V_{DS}=10V, I_D=25A	20			S
$R_{DS(ON)}$	V_{GS}=10V, I_D=25A		11	14	mΩ
Ciss	V_{DS}=10V		2500		pF
Coss	f=1.0MHz		900		pF
Crss	V_{GS}=0V		150		pF
$t_{d(on)}$	I_D=25A		50		ns
t_r	V_{DD}=12V		400		ns
$t_{d(off)}$	R_L=0.48Ω		400		ns
t_f	V_{GS}=10V		300		ns
V_{SD}	I_{SD}=50A, V_{GS}=0V		1.0	1.5	V

External Dimensions TO220S



a) Part No.
b) Lot No.
(Unit : mm)

MOS FET Array STA508A

Absolute Maximum Ratings (Ta=25°C)

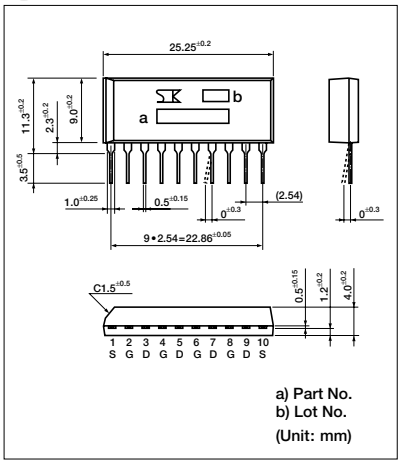
Symbol	Ratings	Unit
V_{DSS}	120	V
V_{GSS}	±20	V
I_D	±6	A
$I_{D\ (pulse)}$*1	±10	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	W
E_{AS} *2	80	mJ
Tch	150	°C
Tstg	−55 to +150	°C

*1 $P_W \leqq 100\mu s$, duty ≦ 1%
*2 $V_{DD}=12V$, L=10mH, unclamped, $R_G=50\Omega$

Electrical Characteristics (Ta=25°C)

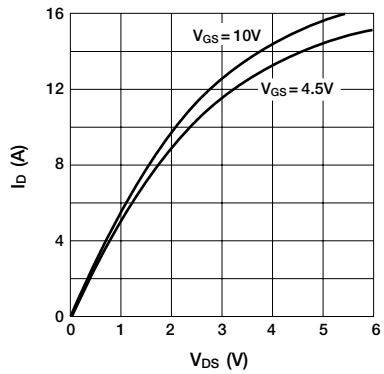
Symbol	Test Conditions	Ratings min	Ratings typ	Ratings max	Unit
$V_{(BR)\ DSS}$	$I_D=100\mu A$, $V_{GS}=0V$	120			V
I_{GSS}	$V_{GS}=\pm 20V$			±5	μA
I_{DSS}	$V_{DS}=120V$, $V_{GS}=0V$			100	μA
V_{TH}	$V_{DS}=10V$, $I_D=250\mu A$	1.0		2.0	V
$R_{e\ (yfs)}$	$V_{DS}=10V$, $I_D=4.0A$	5.0			S
$R_{DS\ (ON)}$	$V_{GS}=10V$, $I_D=4.0A$		0.15	0.2	Ω
	$V_{GS}=4V$, $I_D=4.0A$		0.2	0.25	Ω
Ciss	$V_{DS}=10V$		400		pF
Coss	f=1.0MHz		130		pF
Crss	$V_{GS}=0V$		30		pF
$t_{d\ (on)}$	$I_D=4A$		100		ns
t_r	$V_{DD} \fallingdotseq 12V$		300		ns
$t_{d\ (off)}$	$R_L=3\Omega$		250		ns
t_f	$V_{GS}=5V$		200		ns
V_{SD}	$R_G=50\Omega$		1.0	1.5	V
	$I_{SD}=6A$, $V_{GS}=0V$				

External Dimensions STA4 (LF412)

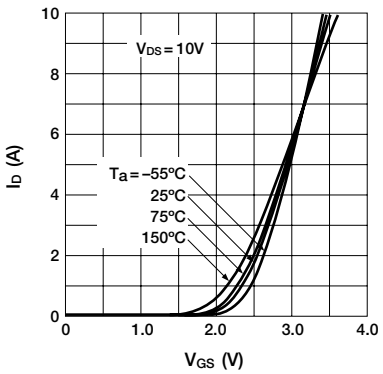


a) Part No.
b) Lot No.
(Unit: mm)

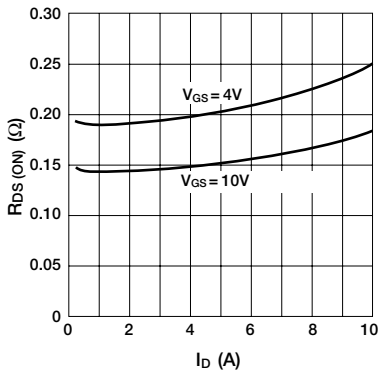
■ I_D — V_{DS} Characteristics



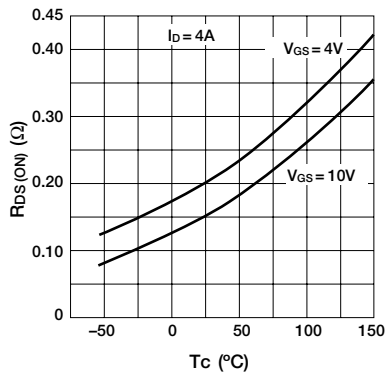
■ I_D — V_{GS} Characteristics



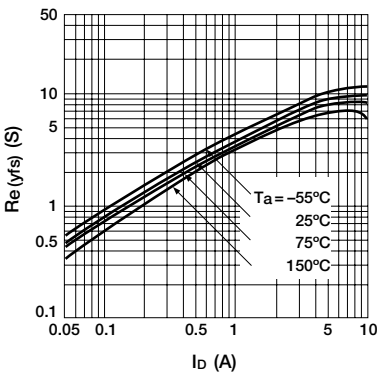
■ $R_{DS\ (ON)}$ — I_D Characteristics



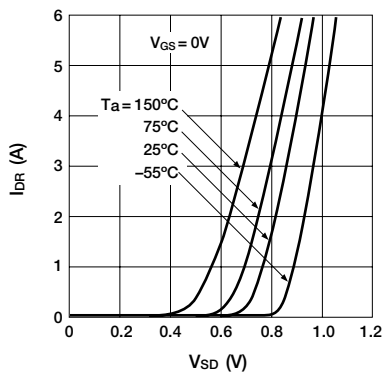
■ $R_{DS\ (ON)}$ — T_C Characteristics



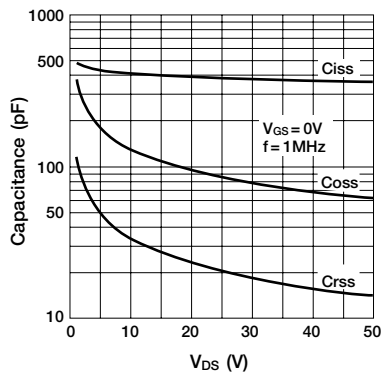
■ $R_{e\ (yfs)}$ — I_D Characteristics



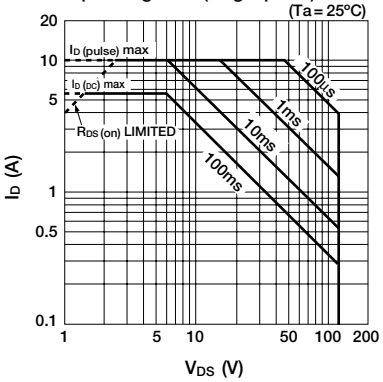
■ I_{DR} — V_{SD} Characteristics



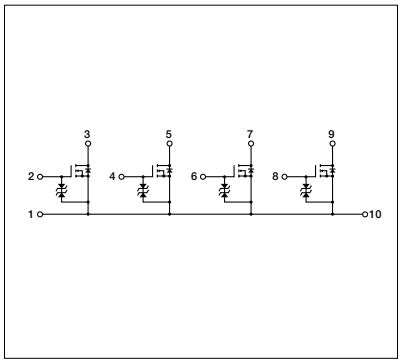
■ Capacitance — V_{DS} Characteristics



■ Safe Operating Area (single pulse) (Ta=25°C)



Equivalent Circuit Diagram



MOS FET Array STA509A

Absolute Maximum Ratings (Ta=25°C)

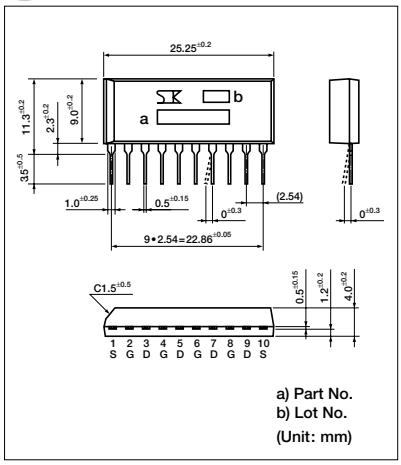
Symbol	Ratings	Unit
V_{DSS}	52±5	V
V_{GSS}	±20	V
I_D	±3	A
$I_{D\ (pulse)}$ *1	±6	A
P_T	4 (Ta=25°C)	W
	20 (Tc=25°C)	W
E_{AS} *2	40	mJ
T_{ch}	150	°C
Tstg	−55 to +150	°C

*1 $P_W \leqq 100\mu s$, duty ≦1%
*2 $V_{DD}=12V$, L=10mH, unclamped, $R_G=10\Omega$

Electrical Characteristics (Ta=25°C)

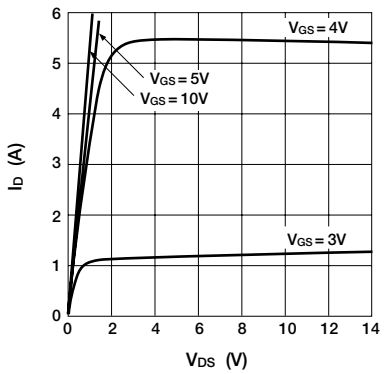
Symbol	Test Conditions	Ratings min	Ratings typ	Ratings max	Unit
$V_{(BR)\ DSS}$	$I_D=1mA$, $V_{GS}=0V$	47	52	57	V
I_{GSS}	$V_{GS}=\pm20V$			±1.0	μA
I_{DSS}	$V_{DS}=40V$, $V_{GS}=0V$			100	μA
V_{TH}	$V_{DS}=10V$, $I_D=250\mu A$	1.0		2.5	V
$R_{e\ (yfs)}$	$V_{DS}=10V$, $I_D=1.0A$	1.0			S
$R_{DS\ (ON)}$	$V_{GS}=10V$, $I_D=1.0A$		0.2	0.25	Ω
	$V_{GS}=4V$, $I_D=1.0A$		0.25	0.3	Ω
Ciss	$V_{DS}=10V$		200		pF
Coss	f=1.0MHz		120		pF
Crss	$V_{GS}=0V$		20		pF
$t_{d\ (on)}$	$I_D=1A$		2.0		μs
t_r	$V_{DD}\fallingdotseq12V$		7.4		μs
$t_{d\ (off)}$	$R_L=12\Omega$		3.3		μs
t_f	$V_{GS}=5V$		4.2		μs
V_{SD}	$R_{G1}=50\Omega$, $R_{G2}=10\Omega$		1.0	1.5	V
	$I_{SD}=6A$, $V_{GS}=0V$				

External Dimensions STA

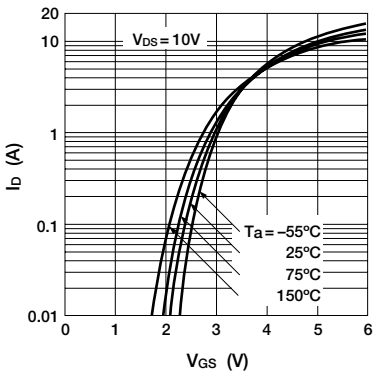


a) Part No.
b) Lot No.
(Unit: mm)

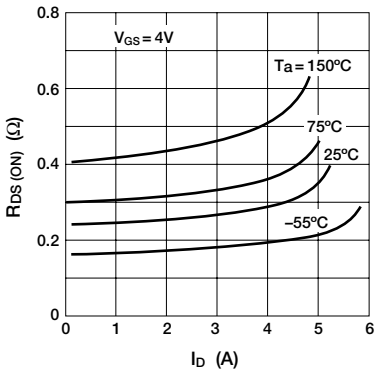
■ I_D — V_{DS} Characteristics



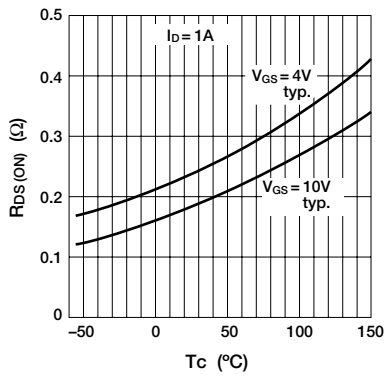
■ I_D — V_{GS} Characteristics



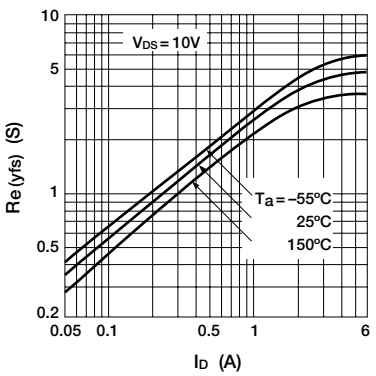
■ $R_{DS\ (ON)}$ — I_D Characteristics



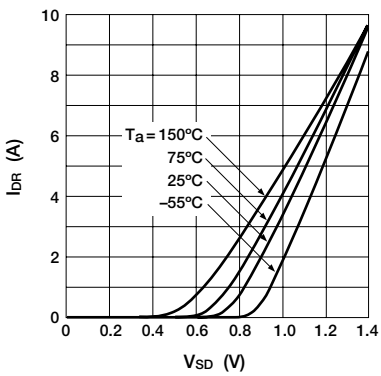
■ $R_{DS\ (ON)}$ — T_C Characteristics



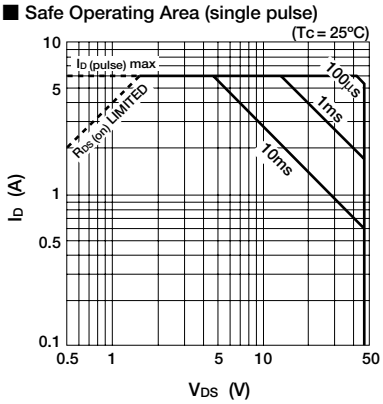
■ R_e (yfs) — I_D Characteristics



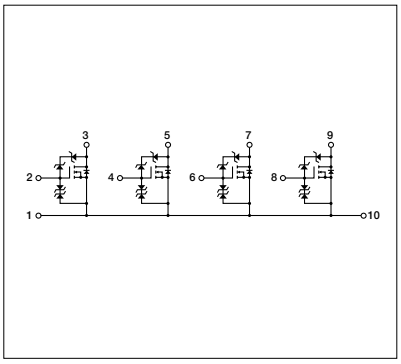
■ I_{DR} — V_{SD} Characteristics



■ Safe Operating Area (single pulse)



Equivalent Circuit Diagram



MOS FET Array SMA5113

Absolute Maximum Ratings (Ta=25°C)

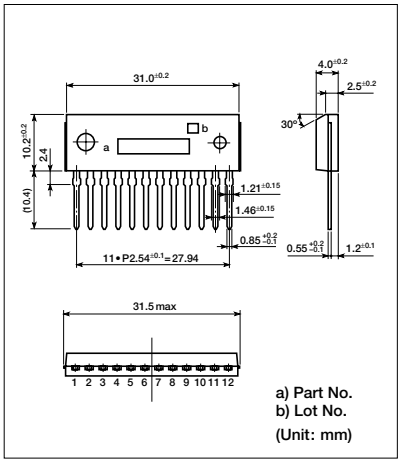
Symbol	Ratings	Unit
V_{DSS}	450	V
V_{GSS}	±30	V
I_D	±7	A
$I_{D\ (pulse)}$ *1	±28	A
P_T	4 (Ta=25°C, All circuits operate, No Fin)	W
	35 (Tc=25°C, All circuits operate, ∞ Fin)	W
E_{AS} *2	130	mJ
I_{AS}	7	A
θj-a	31.2 (Junction - Ambientare, Ta=25°C, All circuits operate)	°C/W
θj-c	3.57 (Junction - Case, Ta=25°C, All circuits operate)	°C/W
Tch	150	°C
Tstg	−55 to +150	°C

*1 $P_W \leqq 100\mu s$, duty ≦1%
*2 V_{DD}=30V, L=5mH, I_L=7A, unclamped, R_G=50Ω

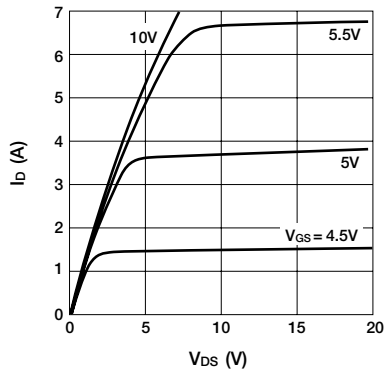
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings min	Ratings typ	Ratings max	Unit
$V_{(BR)\ DSS}$	I_D=100μA, V_{GS}=0V	450			V
I_{GSS}	V_{GS}=±30V			±100	nA
I_{DSS}	V_{DS}=450V, V_{GS}=0V			100	μA
V_{TH}	V_{DS}=10V, I_D=1mA	2.0		4.0	V
$R_{e\ (yfs)}$	V_{DS}=20V, I_D=3.5A	3.5	5.0		S
$R_{DS\ (ON)}$	V_{GS}=10V, I_D=3.5A		0.84	1.1	Ω
Ciss	V_{DS}=10V, f=1.0MHz, V_{GS}=0V		720		pF
Coss			150		pF
Crss			65		pF
$t_{d\ (on)}$	I_D=3.5A, V_{DD}≒200V, R_L=57Ω, V_{GS}=10V, R_G=50Ω		25		ns
t_r			40		ns
$t_{d\ (off)}$			70		ns
t_f			50		ns
V_{SD}	I_{SD}=7A, V_{GS}=0V		1.0	1.5	V

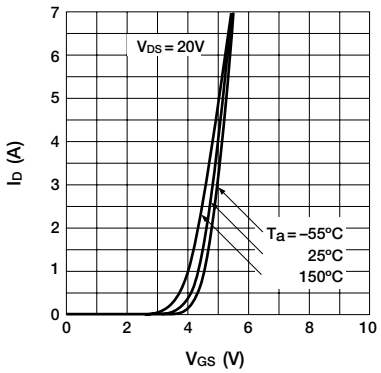
External Dimensions SMA (LF1000)



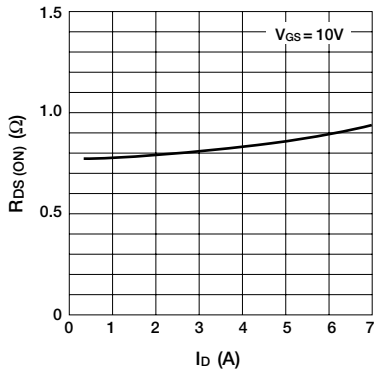
■ I_D — V_{DS} Characteristics



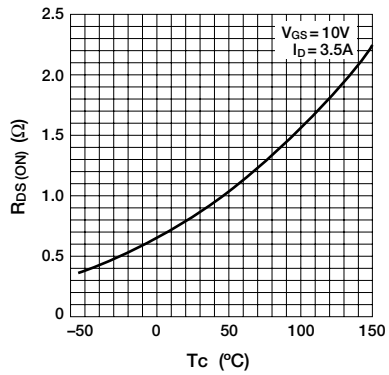
■ I_D — V_{GS} Characteristics



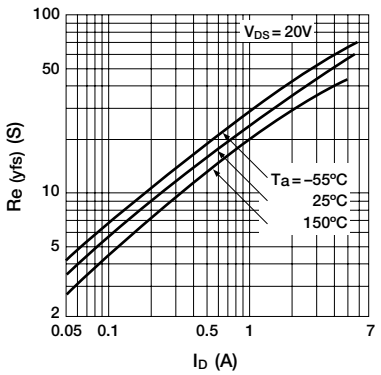
■ $R_{DS\ (ON)}$ — I_D Characteristics



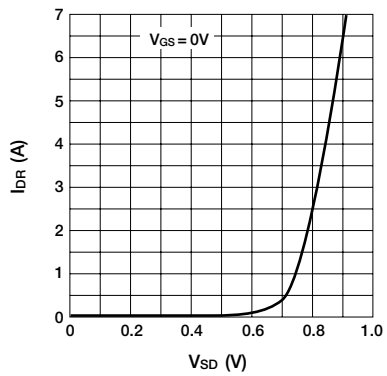
■ $R_{DS\ (ON)}$ — T_C Characteristics



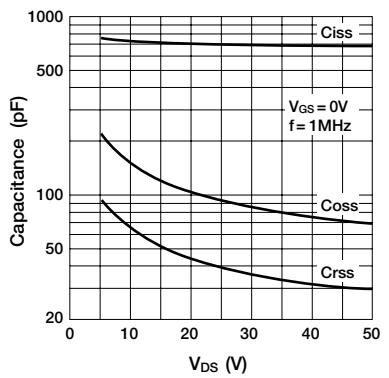
■ R_e (yfs) — I_D Characteristics



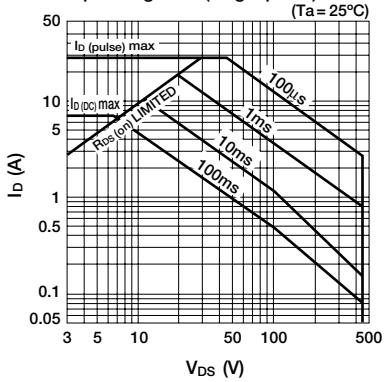
■ I_{DR} — V_{SD} Characteristics



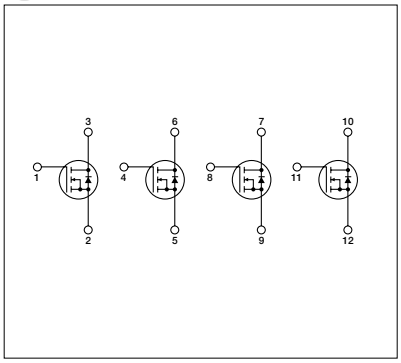
■ Capacitance — V_{DS} Characteristics



■ Safe Operating Area (single pulse) (Ta = 25°C)



Equivalent Circuit Diagram



MOS FET Array SLA5027

Absolute Maximum Ratings (Ta=25ºC)

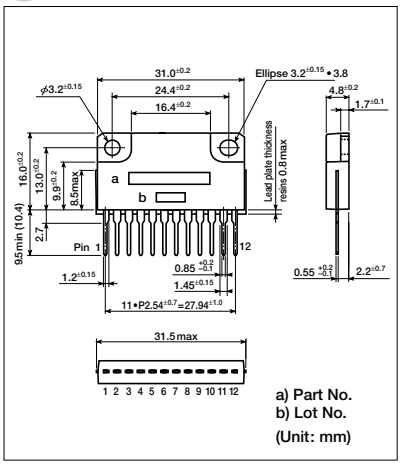
Symbol	Ratings	Unit
V_{DSS}	60	V
V_{GSS}	±20	V
I_D	±12	A
$I_{D\ (pulse)}$*1	±48	A
P_T	5 (Ta=25ºC, 4 circuits operate)	W
	60 (Tc=25ºC,4 circuits operate)	W
E_{AS}*2	250	mJ
$\theta j\text{-}c$	2.08	ºC/W
V_{ISO}	(Fin to lead terminal) AC1000	Vrms
Tch	150	ºC
Tstg	–55 to +150	ºC

*1 $P_W \leqq 250\mu s$, duty ≦1%
*2 V_{DD}=30V, L=10mH, unclamped, $R_G=50\Omega$

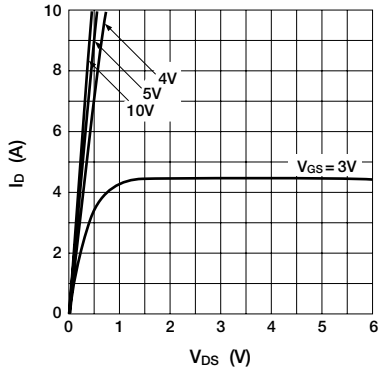
Electrical Characteristics (Ta=25ºC)

Symbol	Test Conditions	Ratings min	Ratings typ	Ratings max	Unit
$V_{(BR)\ DSS}$	I_D=100µA, V_{GS}=0V	60			V
I_{GSS}	V_{GS}=±20V			±100	µA
I_{DSS}	V_{DS}=60V, V_{GS}=0V			100	µA
V_{TH}	V_{DS}=10V, I_D=1mA	1.0	1.5	2.0	V
R_e (yfs)	V_{DS}=10V, I_D=8A	6.0	12.0		S
$R_{DS\ (ON)}$	V_{GS}=4V, I_D=8A		0.07	0.08	Ω
Ciss	V_{DS}=10V, f=1.0MHz, V_{GS}=0V		1100		pF
Coss			500		pF
Crss			170		pF
$t_{d\ (on)}$	I_D=8A, V_{DD}≒30V, R_L=3.75Ω, V_{GS}=5V, R_G=50Ω		50		ns
t_r			250		ns
$t_{d\ (off)}$			250		ns
t_f			180		ns
V_{SD}	I_{SD}=10A, V_{GS}=0V		1.0	1.5	V

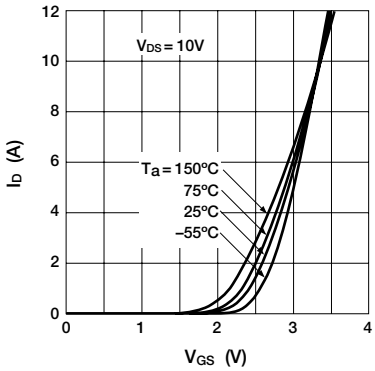
External Dimensions SLA (LF800)



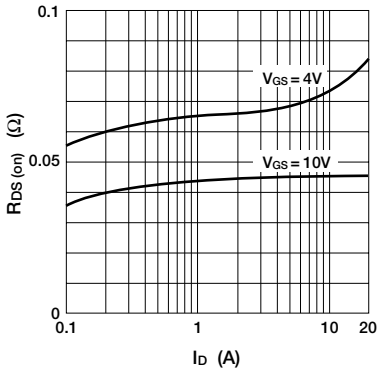
■ I_D — V_{DS} Characteristics



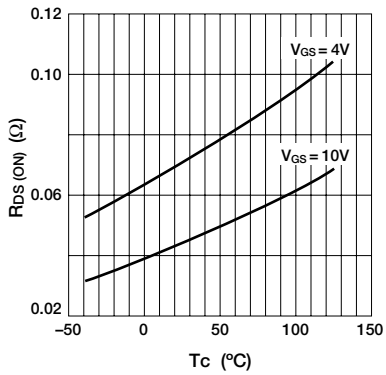
■ I_D — V_{GS} Characteristics



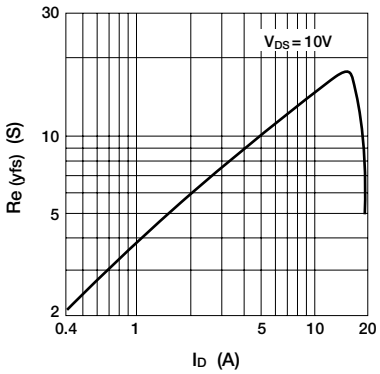
■ $R_{DS\ (ON)}$ — I_D Characteristics



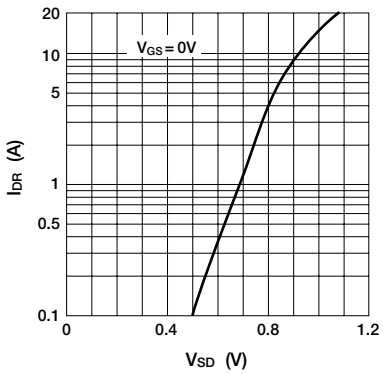
■ $R_{DS\ (ON)}$ — T_C Characteristics



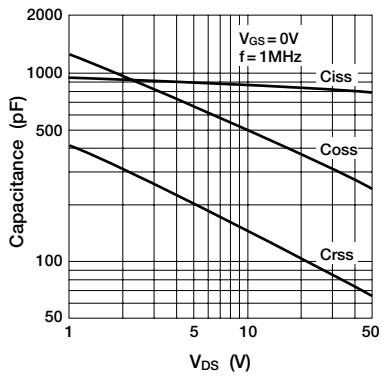
■ R_e (yfs) — I_D Characteristics



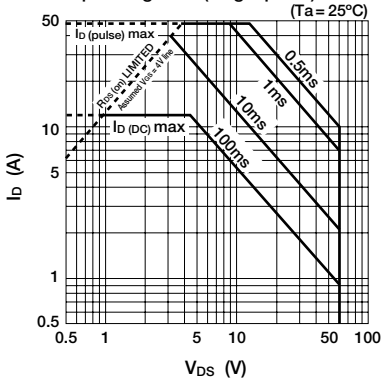
■ I_{DR} — V_{SD} Characteristics



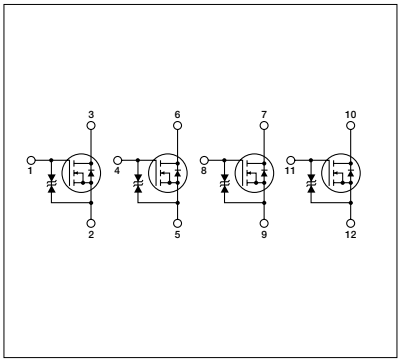
■ Capacitance — V_{DS} Characteristics



■ Safe Operating Area (single pulse) (Ta = 25ºC)



Equivalent Circuit Diagram



Surface-mount MOS FET Array SDK06

Absolute Maximum Ratings (Ta=25°C)

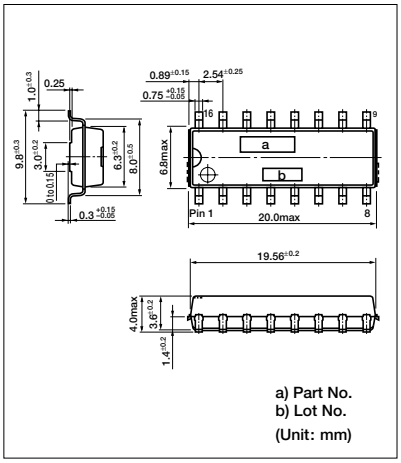
Symbol	Ratings	Unit
V_{DSS}	52±5	V
V_{GSS}	±20	V
I_D	±3	A
$I_{D\ (pulse)}$ *1	±6	A
P_T	3 (Tc=25°C, 4 circuits operate)	W
E_{AS} *2	40	mJ
Tch	150	°C
Tstg	−55 to +150	°C

*1 $P_W \leqq 100\mu s$, duty $\leqq 1\%$
*2 $V_{DD}=12V$, L=10mH, unclamped, $R_G=10\Omega$

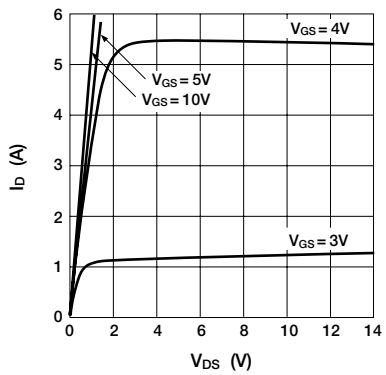
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings min	Ratings typ	Ratings max	Unit
$V_{(BR)\ DSS}$	I_D=1mA, V_{GS}=0V	47	52	57	V
I_{GSS}	$V_{GS}=\pm 20V$			±1.0	μA
I_{DSS}	V_{DS}=40V, V_{GS}=0V			100	μA
V_{TH}	V_{DS}=10V, I_D=250μA	1.0	1.8	2.5	V
$R_{e\ (yfs)}$	V_{DS}=10V, I_D=1.0A	1.0			S
$R_{DS\ (ON)}$	V_{GS}=10V, I_D=1.0A		0.2	0.25	Ω
	V_{GS}=4V, I_D=1.0A		0.25	0.3	Ω
Ciss	V_{DS}=10V		200		pF
Coss	f=1.0MHz		120		pF
Crss	V_{GS}=0V		20		pF
$t_{d\ (on)}$	I_D=1A		2.0		μs
t_r	$V_{DD} \fallingdotseq 12V$		7.4		μs
$t_{d\ (off)}$	$R_L=12\Omega$		3.3		μs
t_f	V_{GS}=5V		4.2		μs
V_{SD}	$R_{G1}=50\Omega$, $R_{G2}=10k\Omega$		1.0	1.5	V
	I_{SD}=1A, V_{GS}=0V				

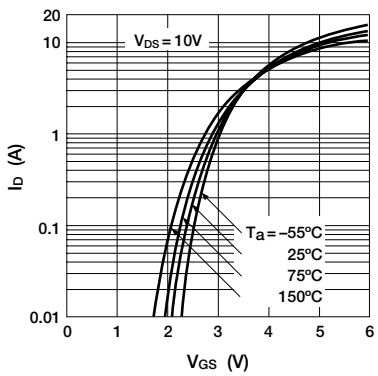
External Dimensions SMD-16A



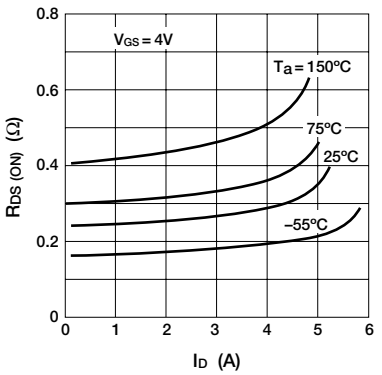
■ I_D — V_{DS} Characteristics



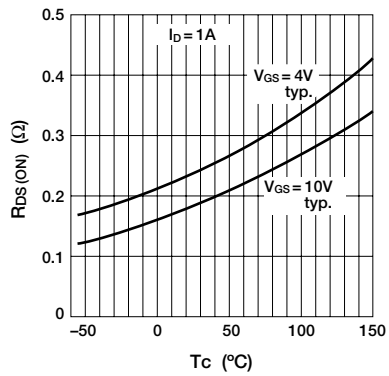
■ I_D — V_{GS} Characteristics



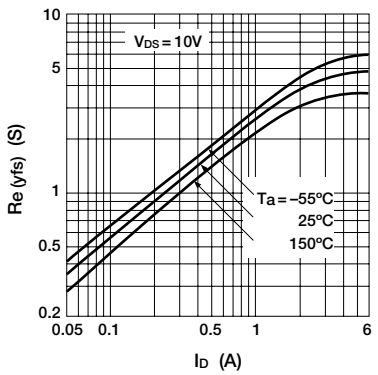
■ $R_{DS\ (ON)}$ — I_D Characteristics



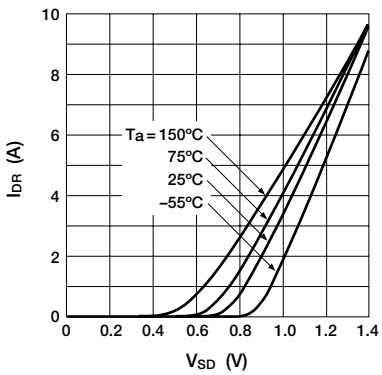
■ $R_{DS\ (ON)}$ — T_C Characteristics



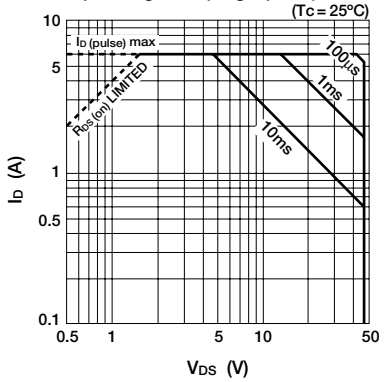
■ R_e (yfs) — I_D Characteristics



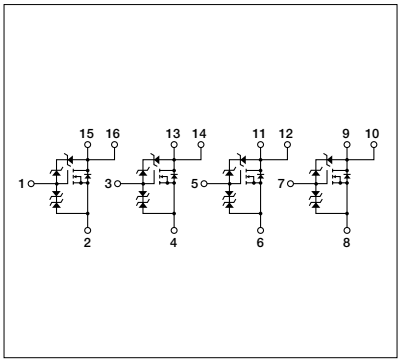
■ I_{DR} — V_{SD} Characteristics



■ Safe Operating Area (single pulse)



Equivalent Circuit Diagram



Surface-mount MOS FET Array SDK08

Absolute Maximum Ratings (Ta=25°C)

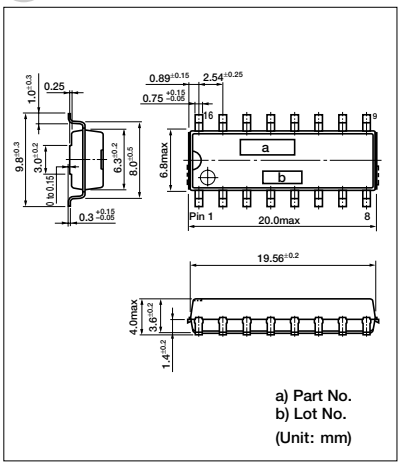
Symbol	Ratings	Unit
V_{DSS}	50	V
V_{GSS}	±20	V
I_D	±4.5	A
$I_{D\ (pulse)}$ *1	±9	A
P_T	4 (Tc=25°C, 4 circuits operate)	W
E_{AS} *2	80	mJ
Tch	150	°C
Tstg	−55 to +150	°C

*1 $P_W \leqq 100\mu s$, duty ≦1%
*2 V_{DD}=12V, L=10mH, unclamped, R_G=50Ω

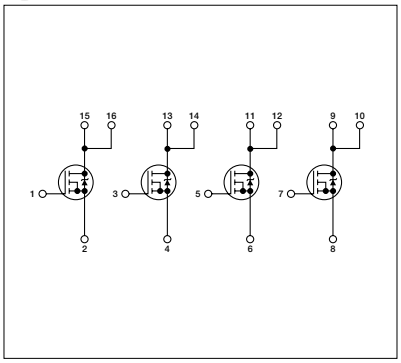
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings min	Ratings typ	Ratings max	Unit
$V_{(BR)\ DSS}$	I_D=100μA, V_{GS}=0V	50			V
I_{GSS}	V_{GS}=±20V			±100	nA
I_{DSS}	V_{DS}=50V, V_{GS}=0V			100	μA
V_{TH}	V_{DS}=10V, I_D=1mA	1.3	1.8	2.3	V
$R_{e\ (yfs)}$	V_{DS}=10V, I_D=4.0A	5.0	9.0	13.0	S
$R_{DS\ (ON)}$	V_{GS}=10V, I_D=4.0A		0.07	0.08	Ω
	V_{GS}=4V, I_D=4.0A		0.09	0.1	Ω
Ciss	V_{DS}=10V		700		pF
Coss	f=1.0MHz		300		pF
Crss	V_{GS}=0V		90		pF
$t_{d\ (on)}$	I_D=4A		50		ns
t_r	V_{DD}≒12V		80		ns
$t_{d\ (off)}$	R_L=3Ω		60		ns
t_f	V_{GS}=5V, R_G=50Ω		40		ns
V_{SD}	I_{SD}=6A, V_{GS}=0V		1.0	1.5	V

External Dimensions SMD-16A



Equivalent Circuit Diagram



Surface-mount MOS FET Array SDK09 (under development)

Absolute Maximum Ratings (Ta=25°C)

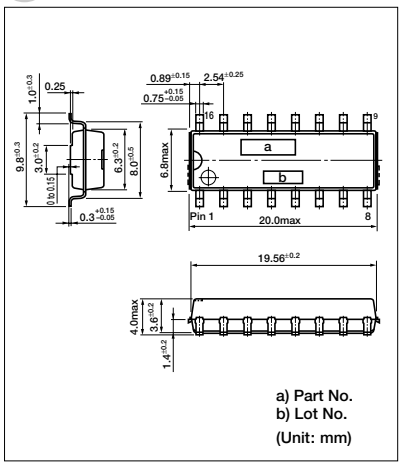
Symbol	Ratings	Unit
V_{DSS}	120	V
V_{GSS}	±20	V
I_D	±6	A
$I_{D\ (pulse)}$ *1	±10	A
P_T	3 (Tc=25°C, 4 circuits operate)	W
E_{AS} *2	80	mJ
Tch	150	°C
Tstg	−55 to +150	°C

*1 $P_W \leqq 100\mu s$, duty ≦1%
*2 V_{DD} = 12V, L = 10mH, unclamped, $R_G = 50\Omega$

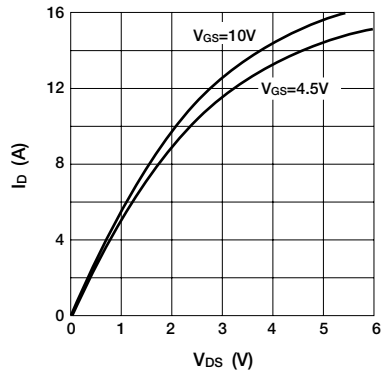
Electrical Characteristics (Ta=25°C)

Symbol	Test Conditions	Ratings min	Ratings typ	Ratings max	Unit
$V_{(BR)\ DSS}$	I_D=100μA, V_{GS}=0V	120			V
I_{GSS}	V_{GS}=±20V			±5	μA
I_{DSS}	V_{DS}=120V, V_{GS}=0V			100	μA
V_{TH}	V_{DS}=10V, I_D=250μA	1.0		2.0	V
Re (yfs)	V_{DS}=10V, I_D=4A	5.0			S
$R_{DS\ (ON)}$	V_{GS}=10V, I_D=4A		0.15	0.2	Ω
	V_{GS}=4V, I_D=4A		0.2	0.25	
Ciss	V_{DS}=10V, f=1.0MHz, V_{GS}=0V		400		pF
Coss			130		pF
Crss			30		pF
$t_{d\ (on)}$	I_D=4A, V_{DD}=12V, R_L=3Ω, V_{GS}=5V, R_G=50Ω		100		ns
t_r			300		ns
$t_{d\ (off)}$			250		ns
t_f			200		ns
V_{SD}	I_{SD}=6A, V_{GS}=0V		1.0	1.5	V

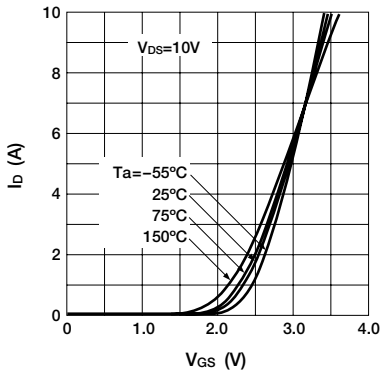
External Dimensions SMD-16A



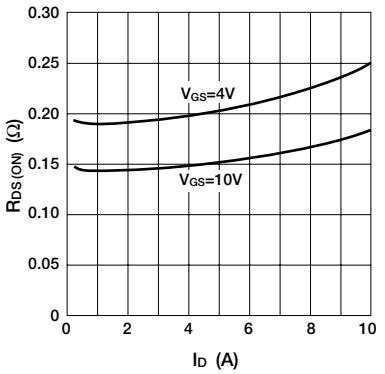
■ I_D — V_{DS} Characteristics



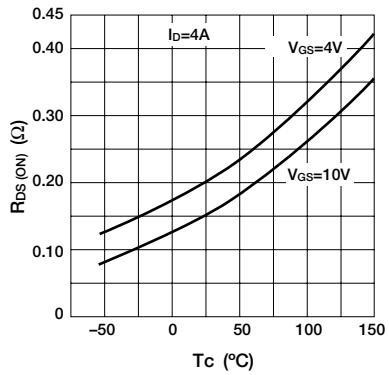
■ I_D — V_{GS} Characteristics



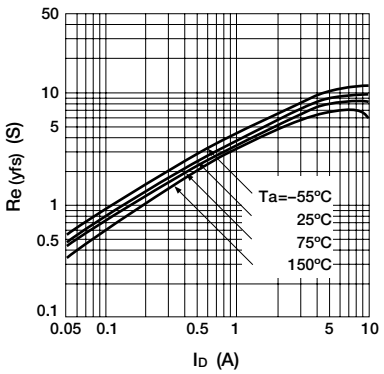
■ $R_{DS\ (ON)}$ — I_D Characteristics



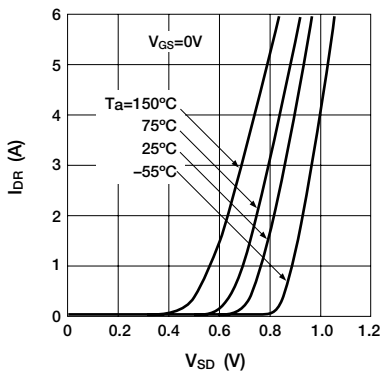
■ $R_{DS\ (ON)}$ — T_C Characteristics



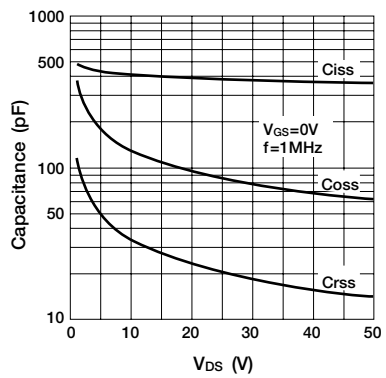
■ Re (yfs) — I_D Characteristics



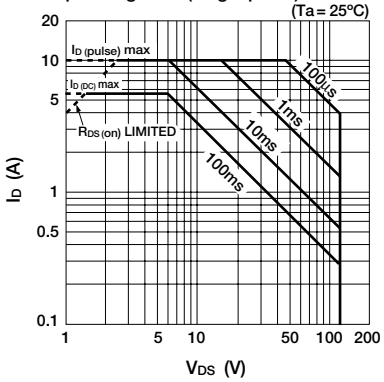
■ I_{DR} — V_{SD} Characteristics



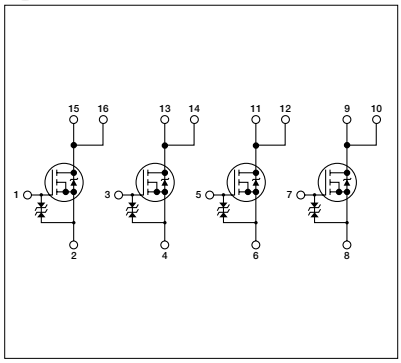
■ Capacitance — V_{DS} Characteristics



■ Safe Operating Area (single pulse)



Equivalent Circuit Diagram



Thyristor with built-in reverse diode for HID lamp ignition TFC561D

Features

- Repetitive peak off-state voltage: V_{DRM}=600V
- Repetitive peak surge on-state current: I_{TRM}=430A
- Critical rate-of-rise of on-state current: di/dt=1200A/μs
- Gate trigger current: I_{GT}=20mA max
- With built-in reverse diode

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Repetitive peak off-state voltage	V_{DRM}	600	V	Tj=–40 to +125°C, R_{GK}=1kΩ
Repetitive surge peak on-state current	I_{TRM}	430	A	V_D ≦430V, 100kcycle, * Wp=1.3μs, Ta=125°C
Critical rate-of-rise of on-state current	di/dt	1200	A/μs	*
Peak forward gate current	I_{FGM}	2.0	A	f ≧50Hz, duty ≦10%
Peak gate power loss	P_{GM}	5.0	W	f ≧50Hz, duty ≦10%
Average gate power loss	$P_{G\ (AV)}$	0.5	W	
Peak reverse gate voltage	V_{RGM}	5	V	f ≧50Hz
Diode repetitive peak surge forward current	I_{FRM}	240	A	V_D ≦430V, 100kcycle, * Wp=1.3μs, Ta=125°C
Junction temperature	Tj	–40 to +125	°C	
Storage temperature	Tstg	–40 to +125	°C	

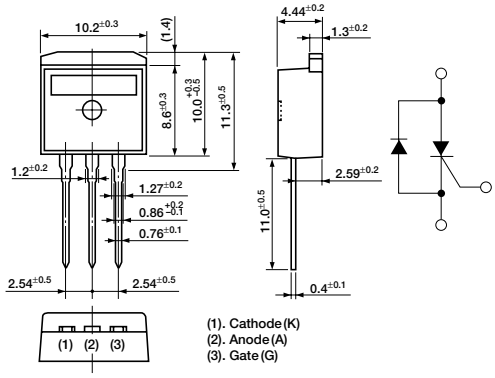
* The surge current for T=10ms /cycle shall be applied 50 cycles successively, and an interval time shall follow to cool down the junction temperature of the device to 125°C. This process shall be repeated up to 100K cycles.

Electrical Characteristics

(Tj=25°C)

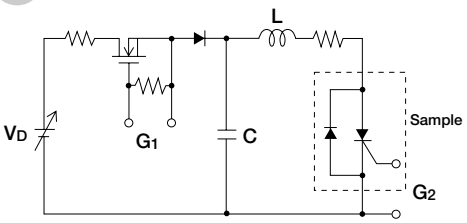
Parameter	Symbol	Ratings			Unit	Conditions
		min	typ	max		
On-state voltage	V_{TM}			1.4	V	I_T=10A
Gate trigger voltage	V_{GT}			1.5	V	V_D=6V, R_L=10Ω
Gate trigger current	I_{GT}			20	mA	V_D=6V, R_L=10Ω
Gate non-trigger voltage	V_{GD}	0.1			V	V_D=480V, Tj=125°C
Holding current	I_H	2	10.0		mA	R_{G-K}=1kΩ, Tj=25°C
Off-state current (1)	I_{DRM} (1)			100	μA	V_D=V_{DRM}, R_{G-K}=1kΩ, Tj=25°C
Off-state current (2)	I_{DRM} (2)			1	mA	V_D=V_{DRM}, R_{G-K}=1kΩ, Tj=125°C
Thermal resistance	Rth			4.0	°C/W	Junction to case
Diode forward voltage	V_F			1.4	V	I_F=10A

External Dimensions (unit: mm)

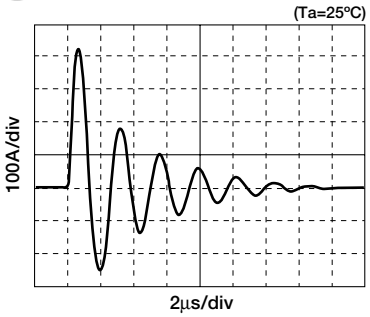


Weight: Approx. 1.5g

Measurement circuit



Current waveform (1cycle)



Part No.	Absolute maximum ratings				Electrical Characteristics					Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	T_{stg} (°C)	V_F (V) max	Condition I_F (A)	I_R (mA) max	V_Z (V)	Condition I_Z (mA)	
SG-9CNS	200	20	200	–40 to +150	1.10	20	0.25	—	—	1
SG-9CNR										
SG-9LCNS	200	20	300	–40 to +150	1.10	30	0.25	—	—	2
SG-9LCNR										
SG-9LLCNS	200	35	350	–40 to +150	1.10	35	0.25	—	—	2
SG-9LLCNR										

External Dimensions (unit: mm)

Fig. 1

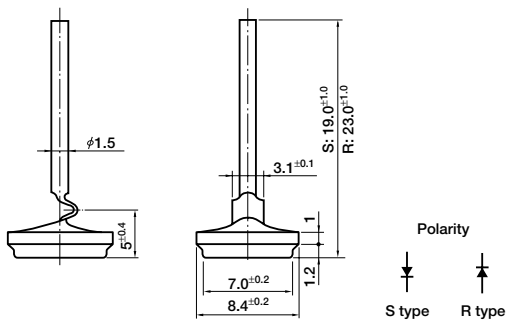
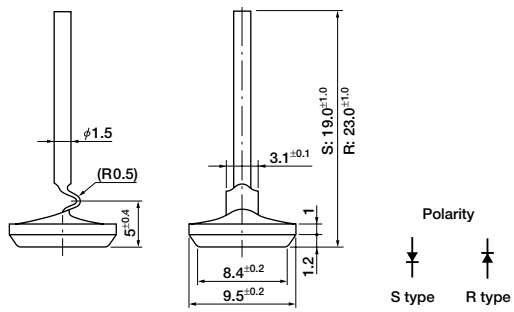


Fig. 2



High-voltage Diodes for Igniters

Part No.	Absolute Maximum Ratings						Electrical Characteristics (Ta=25°C)				Fig. No.
	V_{RM} (kV)	$I_{F(AV)}$ (mA) 50 Hz half-wave signal average	I_{RSM} (mA) Peak value of single shot triangular wave with 100μs half-power bandwidth	I_{RSM} (A) Peak value of 50 Hz half-wave signal	T_j (°C)	T_{stg} (°C)	V_F (V) max	Condition I_F (mA)	I_R (μA) $V_R=V_{RM}$ max	V_Z (kV) I_R=100μA	
SHV-05JS	2.5	30	30	3	−40 to +150		5	10	10	2.6 to 5.0	1
SHV-08J	4.0	30	30	3			8			4.5 to 8.0	2
SHV-30J	15.0	30	10	3			30			16.0 to 30.0	3

External Dimensions (unit: mm)

Fig. 1 (SHV-05JS)

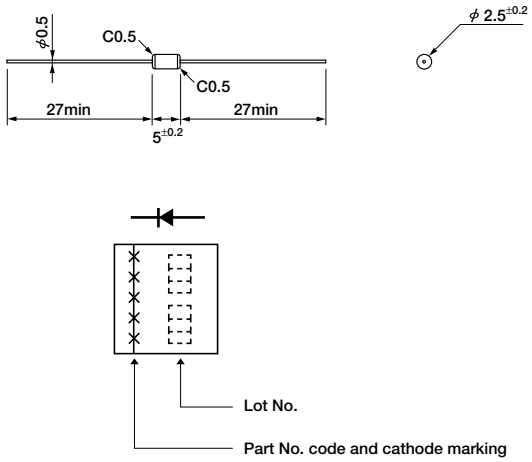


Fig. 2 (SHV-08J)

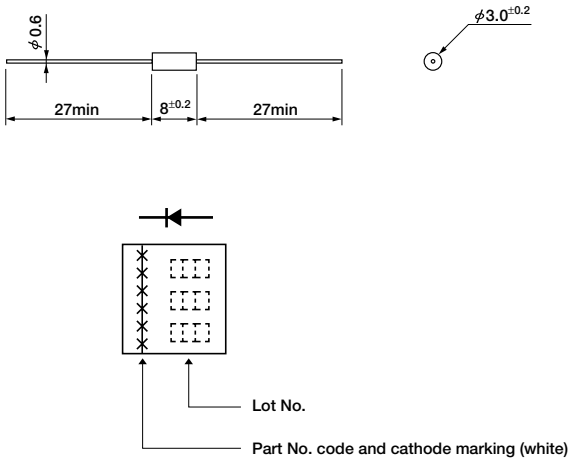
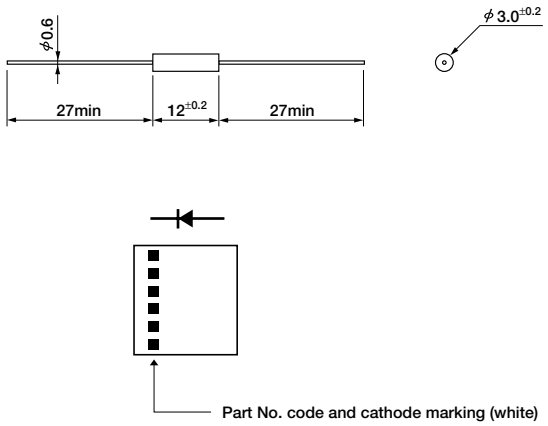


Fig. 3 (SHV-30J)



Power Zener Diode

(Ta=25°C)

Part No.	Absolute Maximum Ratings					Electrical Characteristics			External dimensions	Remarks
	P_R (W)	V_{DC} (V)	I_{ZSM} (A) 10ms rectangular wave single shot	Tj (°C)	Tstg (°C)	V_Z (V) 1mA instantaneous current	I_R (μA) max	$I_{R(H)}$ (mA) max		
SFPZ-68	50	20	2	−40 to +150		28±3.0	10	1.0	1	Surface-mount type
SPZ-G36	450	30	11			36±3.6	5	0.1	2	
PZ 628	1500	20	65			28±3.0	500	1.0	3	

External Dimensions (unit: mm)

Fig. 1

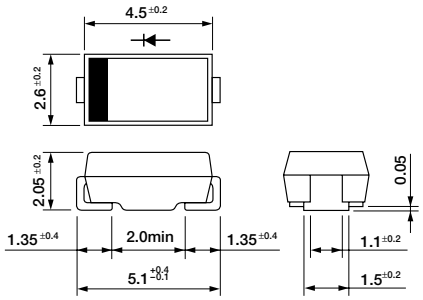


Fig. 2

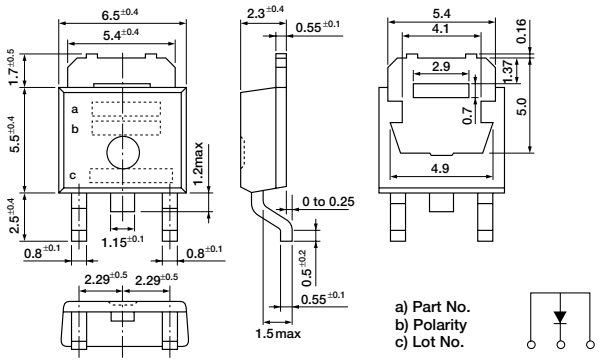
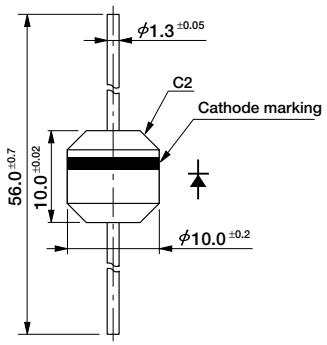


Fig. 3



Rectifier Diodes

■ Surface-mount Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics			Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	Condition I_F (A)	I_R (μA) max	
SFPM-52	200	0.9	30	–40 to +150		1.0	1.0	10	1
SFPM-62		1.0	45	–40 to +150		0.98	1.0	10	
SFPM-54	400	0.9	30	–40 to +150		1.0	1.0	10	1
SFPM-64		1.0	45	–40 to +150		0.98	1.0	10	

■ Axial Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics			Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	Condition I_F (A)	I_R (μA) max	
EM 1Y	100	1.0	45	–40 to +150		0.97	1.0	10	4
RM 4Y		3.0	200	–40 to +150		0.95	3.0	10	8
AM01Z	200	1.0	35	–40 to +150		0.98	1.0	10	2
EM01Z			45	–40 to +150		0.97	1.0	10	3
EM 1Z				–40 to +150		0.97	1.0	10	4
RM 1Z			50	–40 to +150		0.95	1.0	5	5
RO 2Z		1.2	80	–40 to +150		0.92	1.5	10	6
RM 2Z			100	–40 to +150		0.91	1.5	10	
RM 10Z		1.5	120	–40 to +150		0.91	1.5	10	5
RM 4Z		3.0	200	–40 to +150		0.95	3.0	10	8
AM01	400	1.0	35	–40 to +150		0.98	1.0	10	2
EM01			45	–40 to +150		0.97	1.0	10	3
EM 1				–40 to +150		0.97	1.0	10	4
RM 1			50	–40 to +150		0.95	1.0	5	5
EM 2		1.2	80	–40 to +150		0.92	1.2	10	4
RO 2				–40 to +150		0.92	1.5	10	6
RM 2			100	–40 to +150		0.91	1.5	10	
RM 10			150	–40 to +150		0.91	1.5	10	5
RM 3		2.5	150	–40 to +150		0.95	2.5	10	7
RM 4		3.0	200	–40 to +150		0.95	3.0	10	8
AM01A	600	1.0	35	–40 to +150		0.98	1.0	10	2
EM01A			45	–40 to +150		0.97	1.0	10	3
EM 1A				–40 to +150		0.97	1.0	10	4
RM 1A			50	–40 to +150		0.95	1.0	5	5
EM 2A		1.2	80	–40 to +150		0.92	1.2	10	4
RO 2A				–40 to +150		0.92	1.5	10	6
RM 11A			100	–40 to +150		0.92	1.5	10	5
RM 2A				–40 to +150		0.91	1.5	10	6
RM 10A			150	–40 to +150		0.91	1.5	10	5
RM 3A		2.5	150	–40 to +150		0.95	2.5	10	7
RM 4A		3.0	200	–40 to +150		0.95	3.0	10	8
RM 4AM		3.2	350	–40 to +150		0.92	3.5	10	
RM 1B	800	0.8	40	–40 to +150		1.2	1.0	5	5
EM 1B		1.0	35	–40 to +150		0.97	1.0	20	4
EM 2B		1.2	80	–40 to +150		0.92	1.2	10	
RO 2B				–40 to +150		0.92	1.5	10	6
RM 11B			100	–40 to +150		0.92	1.5	10	5
RM 2B				–40 to +150		0.91	1.5	10	6
RM 10B			150	–40 to +150		0.91	1.5	10	5
RM 3B		2.0	150	–40 to +150		0.95	2.5	10	7
RM 4B		3.0	150	–40 to +150		0.95	3.0	10	8

Part No.	Absolute Maximum Ratings					Electrical Characteristics			Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	Condition I_F (A)	I_R (μA) max	
RM 1C	1000	0.8	40	–40 to +150		1.2	1.0	5	5
EM 1C		1.0	35	–40 to +150		0.97	1.0	20	4
RO 2C		1.2	80	–40 to +150		0.92	1.5	10	6
RM 11C			100	–40 to +150		0.92	1.5	10	5
RM 2C				–40 to +150		0.91	1.5	10	6
RM 3C		2.0	150	–40 to +150		0.95	2.5	10	7
RM 4C		3.0	150	–40 to +150		0.95	3.0	10	8

■ Center-tap Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics			Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	Condition I_F (A)	I_R (μA) max	
FMM-31S,R	100	20	120	–40 to +150		1.10	10	10	10
FMM-22S,R	200	10	100	–40 to +150		1.10	5.0	10	9
FMM-32S,R		20	120	–40 to +150		1.10	10	10	10
FMM-24S,R	400	10	100	–40 to +150		1.10	5.0	10	9
FMM-34S,R		20	120	–40 to +150		1.10	10	10	10
FMM-26S,R	600	10	100	–40 to +150		1.10	5.0	10	9
FMM-36S,R		20	120	–40 to +150		1.10	10	10	10

Fast Recovery Rectifier Diodes

■ Axial Type

●trr1=I_F/I_{RP}=1:1, trr2=I_F/I_{RP}=1:2

Part No.	Absolute Maximum Ratings					Electrical Characteristics				Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (μA) max	trr1 (μs) max	trr2 (μs) max	
EU 2YX	100	1.2	25	–40 to +150		0.9	10	0.2	0.08	4
RU 2YX		1.5	30	–40 to +150		0.95	10	0.2	0.08	5
RU 3YX		2.0	50	–40 to +150		0.95	10	0.2	0.08	6
RU 4Y		3.5	70	–40 to +150		1.3	10	0.4	0.18	8
RU 30Y			80	–40 to +150		0.97	10	0.4	0.18	7
RU 4YX		4.0	70	–40 to +150		1.3	10	0.4	0.18	8
EU01Z	200	0.25	15	–40 to +150		2.5	10	0.4	0.18	3
EU 1Z				–40 to +150		2.5	10	0.4	0.18	4
AU01Z		0.5	15	–40 to +150		1.7	10	0.4	0.18	2
RF 1Z		0.6	15	–40 to +150		2.0	10	0.4	0.18	5
AS01Z			20	–40 to +150		1.5	10	1.5	0.6	2
EH 1Z			30	–40 to +150		1.35	10	4.0	1.3	4
RH 1Z			35	–40 to +150		1.3	5	4.0	1.3	5
ES01Z		0.7	30	–40 to +150		2.5	10	1.5	0.6	3
ES 1Z				–40 to +150		2.5	10	1.5	0.6	4
AU02Z		0.8	25	–40 to +150		1.3	10	0.4	0.18	2
EU02Z		1.0	15	–40 to +150		1.4	10	0.4	0.18	3
EU 2Z				–40 to +150		1.4	10	0.4	0.18	4
RU 2Z			20	–40 to +150		1.5	10	0.4	0.18	5
RU 4Z		3.5	70	–40 to +150		1.3	10	0.4	0.18	8
RU 30Z			80	–40 to +150		0.97	10	0.4	0.18	7
RU 1	400	0.25	15	–40 to +150		2.5	10	0.4	0.18	5
EU01				–40 to +150		2.5	10	0.4	0.18	3
EU 1				–40 to +150		2.5	10	0.4	0.18	4
AU01		0.5	15	–40 to +150		1.7	10	0.4	0.18	2
RF 1		0.6	15	–40 to +150		2.0	10	0.4	0.18	5
AS01			20	–40 to +150		1.5	10	1.5	0.6	2
EH 1			30	–40 to +150		1.35	10	4.0	1.3	4
RH 1			35	–40 to +150		1.3	5	4.0	1.3	5
ES01		0.7	30	–40 to +150		2.5	10	1.5	0.6	4
ES 1				–40 to +150		2.5	10	1.5	0.6	
AU02		0.8	25	–40 to +150		1.3	10	0.4	0.18	2
EU02		1.0	15	–40 to +150		1.4	10	0.4	0.18	3
EU 2			15	–40 to +150		1.4	10	0.4	0.18	4
RU 2M		1.1	20	–40 to +150		1.2	10	0.4	0.18	5
RU 3		1.5	20	–40 to +150		1.5	10	0.4	0.18	6
RU 3M			50	–40 to +150		1.1	10	0.4	0.18	
RU 30		2.0	200	–40 to +150		0.95	10	0.4	0.18	7
RU 4		3.0	50	–40 to +150		1.5	10	0.4	0.18	8
RU 31			150	–40 to +150		1.2	50	0.4	0.18	7
RU 4M		3.5	70	–40 to +150		1.3	10	0.4	0.18	8
RU 1A	600	0.25	15	–40 to +150		2.5	10	0.4	0.18	5
EU01A				–40 to +150		2.5	10	0.4	0.18	3
EU 1A				–40 to +150		2.5	10	0.4	0.18	4
RF 1A		0.6	15	–40 to +150		2.0	10	0.4	0.18	5
AS01A			20	–40 to +150		1.5	10	1.5	0.6	2
EH 1A			30	–40 to +150		1.35	10	4.0	1.3	4
RH 1A			35	–40 to +150		1.3	5	4.0	1.3	5
ES01A		0.7	30	–40 to +150		2.5	10	1.5	0.6	3
ES 1A				–40 to +150		2.5	10	1.5	0.6	4
RS 1A				–40 to +150		2.5	10	1.5	0.6	5

Part No.	Absolute Maximum Ratings					Electrical Characteristics				Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (μA) max	trr1 (μs) max	trr2 (μs) max	
EU02A	600	1.0	15	–40 to +150		1.4	10	0.4	0.18	3
EU 2A				–40 to +150		1.4	10	0.4	0.18	4
RU 2			20	–40 to +150		1.5	10	0.4	0.18	5
RU 2AM		1.1	20	–40 to +150		1.2	10	0.4	0.18	
RU 3A		1.5	20	–40 to +150		1.5	10	0.4	0.18	6
RU 20A			50	–40 to +150		1.1	10	0.4	0.18	5
RU 3AM				–40 to +150		1.1	10	0.4	0.18	6
RU 30A		2.0	200	–40 to +150		0.95	10	0.4	0.18	7
RU 4A		3.0	50	–40 to +150		1.5	10	0.4	0.18	8
RU 31A			150	–40 to +150		1.2	50	0.4	0.18	7
RU 4AM		3.5	70	–40 to +150		1.3	10	0.4	0.18	8
RU 1B	800	0.25	15	–40 to +150		2.5	10	0.4	0.18	5
RF 1B		0.6	15	–40 to +150		2.0	10	0.4	0.18	
RH 1B			35	–40 to +150		1.3	5	4.0	1.3	
RS 1B		0.7	30	–40 to +150		2.5	10	1.5	0.6	
RU 2B		1.0	20	–40 to +150		1.5	10	0.4	0.18	
RU 3B		1.1	20	–40 to +150		1.5	10	0.4	0.18	6
RU 4B		3.0	50	–40 to +150		1.6	10	0.4	0.18	8
RU 1C	1000	0.2	15	–40 to +150		3.0	10	0.4	0.18	5
RH 1C		0.6	35	–40 to +150		1.3	5	4.0	1.3	
RU 2C		0.8	20	–40 to +150		1.5	10	0.4	0.18	
RU 3C		1.5	20	–40 to +150		2.5	10	0.4	0.18	6
RU 4C		2.5	50	–40 to +150		1.6	50	0.4	0.18	8
ES01F	1500	0.5	20	–40 to +150		2.0	10	1.5	0.6	3
ES 1F				–40 to +150		2.0	10	1.5	0.6	4
RC 2	2000	0.2	20	–40 to +150		2.0	10	4.0	1.3	5

■ Frame 2-pin Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics				Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (μA) max	trr1 (μs) max	trr2 (μs) max	
FMU-G2YXS	100	10.0	100	–40 to +150		1.0	50	0.2	0.08	11

■ Center-tap Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics				Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (μA) max	trr1 (μs) max	trr2 (μs) max	
FMU-21S,R	100	10.0	40	–40 to +150		1.5	50	0.4	0.18	9
FMU-12S,R	200	5.0	30	–40 to +150		1.5	50	0.4	0.18	9
FMU-22S,R		10.0	40	–40 to +150		1.5	50	0.4	0.18	
FMU-32S,R		20.0	80	–40 to +150		1.5	50	0.4	0.18	10
FMU-14S,R	400	5.0	30	–40 to +150		1.5	50	0.4	0.18	9
FMU-24S,R		10.0	40	–40 to +150		1.5	50	0.4	0.18	
FMU-34S,R		20.0	80	–40 to +150		1.5	50	0.4	0.18	10

Ultra Fast Recovery Rectifier Diodes

■ Surface-mount Type

●trr1=I_F/I_{RP}=1:1, trr2=I_F/I_{RP}=1:2

Part No.	Absolute Maximum Ratings					Electrical Characteristics				Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (μA) max	trr1 (μs) max	trr2 (μs) max	
SFPL-52	200	0.9	25	–40 to +150		0.98	10	50	35	1
SFPL-62	200	1.0	25	–40 to +150		0.98	10	50	35	

■ Axial Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics				Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (μA) max	trr1 (ns) max	trr2 (ns) max	
AG01Y	70	1.0	25	–40 to +150		1.2	100	100	50	2
EG01Y			30	–40 to +150		1.2	100	100	50	3
EG 1Y		1.1	30	–40 to +150		1.2	100	100	50	4
RG 10Y		1.5	50	–40 to +150		1.1	500	100	50	5
RG 2Y				–40 to +150		1.1	500	100	50	6
RG 4Y		3.5	100	–40 to +150		1.3	1000	100	50	8
AG01Z	200	0.7	15	–40 to +150		1.8	100	100	50	2
EG01Z				–40 to +150		1.9	50	100	50	3
EG 1Z		0.8	15	–40 to +150		1.7	50	100	50	4
AL01Z		1.0	25	–40 to +150		0.98	100	50	35	2
EN 01Z			50	–40 to +150		0.92	10	100	50	3
RG 10Z		1.2	50	–40 to +150		1.5	500	100	50	5
RG 2Z				–40 to +150		1.5	500	100	50	6
EL 1Z		1.5	20	–40 to +150		0.98	100	100	50	4
EL02Z			25	–40 to +150		0.98	50	40	30	3
RN 1Z			60	–40 to +150		0.92	20	100	50	5
RL 10Z		2.0	30	–40 to +150		0.98	50	50	35	
RL 2Z				–40 to +150		0.98	100	50	35	6
RN 2Z			70	–40 to +150		0.92	50	100	50	
RN 3Z		3.0	80	–40 to +150		0.92	50	100	50	7
RG 4Z				–40 to +150		1.7	1000	100	50	8
RL 3Z		3.5	80	–40 to +150		0.95	50	50	35	7
RL 4Z				–40 to +150		0.95	150	50	35	8
RN 4Z			120	–40 to +150		0.92	50	100	50	
AG01	400	0.7	15	–40 to +150		1.8	100	100	50	2
EG01				–40 to +150		2.0	50	100	50	3
EG 1		0.8	15	–40 to +150		1.8	50	100	50	4
RG 10		1.2	50	–40 to +150		1.8	500	100	50	5
RG 2				–40 to +150		1.8	500	100	50	6
EL 1		1.5	20	–40 to +150		1.3	10	100	50	4
RL 2		2.0	40	–40 to +150		1.3	10	50	35	6
RG 4		3.0	80	–40 to +150		1.8	500	100	50	8
RL 3		3.5	80	–40 to +150		1.3	100	50	35	7
EG01A	600	0.5	10	–40 to +150		2.0	100	100	50	3
AG01A			15	–40 to +150		1.8	100	100	50	2
EG 1A		0.6	10	–40 to +150		2.0	100	100	50	4
RG 10A		1.0	50	–40 to +150		2.0	500	100	50	5
RG 2A				–40 to +150		2.0	500	100	50	6
RL 2A		1.2	30	–40 to +150		1.55	50	50	35	
RG 4A		2.0	50	–40 to +150		2.0	500	100	50	8
RL 3A			60	–40 to +150		1.7	50	50	35	7
RL 4A		3.0	80	–40 to +150		1.5	50	50	35	8
AP01C	1000	0.2	5	–40 to +150		4.0	100	200	80	2
EP01C				–40 to +150		4.0	5	200	80	3
RU 1P		0.4	10	–40 to +150		4.0	5	100	50	5
EG01C		0.5	10	–40 to +150		3.3	50	100	50	3
RG 1C		0.7	10	–40 to +150		3.3	20	100	50	5
RG 4C		2.0	60	–40 to +150		3.0	500	100	50	8
RP 1H	2000	0.1	5	–40 to +150		7.0	20	200	80	5

■ Frame 2-pin Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics				Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (μA) max	trr1 (ns) max	trr2 (ns) max	
FMP-G12S	200	5.0	65	–40 to +150		1.15	50	150	70	11
FML-G12S				–40 to +150		0.98	250	40	30	
FMN-G12S			100	–40 to +150		0.92	100	100	50	
FML-G22S		10.0	150	–40 to +150		0.98	500	40	30	
FML-G13S	300	5.0	70	–40 to +150		1.3	100	50	35	11
FMN-G14S	400	5.0	70	–40 to +150		1.0	50	100	50	11
FML-G14S				–40 to +150		1.3	100	50	35	
FMG-G26S	600	4.0	50	–40 to +150		2.5	500	100	50	11
FMN-G16S		5.0	50	–40 to +150		1.2	50	100	50	
FML-G16S				–40 to +150		1.5	100	50	35	
FMG-G36S		8.0	80	–40 to +150		2.5	500	100	50	12
FML-G26S		10.0	100	–40 to +150		1.7	100	65	40	11
FMD-G26S				–40 to +150		1.7	100	50	30	
FMG-G2CS	1000	4.0	30	–40 to +150		4.0	50	100	50	11
FMG-G3CS		5.0	60	–40 to +150		3.5	100	150	70	12

■ Center-tap Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics				Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (μA) max	trr1 (ns) max	trr2 (ns) max	
FMG-12S,R	200	5.0	35	–40 to +150		1.8	500	100	50	9
FML-12S				–40 to +150		0.98	150	40	30	
FMG-22S,R		10.0	65	–40 to +150		1.8	500	100	50	
FML-22S				–40 to +150		0.98	250	40	30	
FMG-32S,R		20.0	150	–40 to +150		1.8	1000	100	50	10
FML-32S				–40 to +150		0.98	600	40	30	
FMG-13S,R	300	5.0	35	–40 to +150		1.8	500	100	50	9
FML-13S			40	–40 to +150		1.3	50	50	35	
FMG-23S,R		10.0	65	–40 to +150		1.8	500	100	50	
FML-23S			70	–40 to +150		1.3	100	50	35	
FML-33S		20.0	100	–40 to +150		1.3	200	50	35	10
FMG-33S,R			150	–40 to +150		1.8	1000	100	50	
FMG-14S,R	400	5.0	35	–40 to +150		2.0	500	100	50	9
FML-14S			40	–40 to +150		1.3	50	50	35	
FMG-24S,R		8.0	65	–40 to +150		2.0	500	100	50	
FML-24S		10.0	70	–40 to +150		1.3	100	50	35	
FMG-34S,R		16.0	100	–40 to +150		2.0	1000	100	50	10
FML-34S		20.0	100	–40 to +150		1.3	200	50	35	
FMG-26S,R	600	6.0	50	–40 to +150		2.2	500	100	50	9
FMG-36S,R		15.0	80	–40 to +150		2.2	1000	100	50	10
FML-36S		20.0	100	–40 to +150		1.7	100	65	35	

■ Bridge Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics				Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (μA) max	trr1 (ns) max	trr2 (ns) max	
RBV-602L	200	6	100	–40 to +150		1	250	50	35	13

Schottky Barrier Diodes

■ Surface-mount Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics			Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (mA) max	H•I_R (mA) Ta=100°C max	
SFPJ-53	30	1.0	30	–40 to +150		0.45	1.0	10	1
SFPE-63		2.0	40	–40 to +150		0.55	0.2	20 (Tj=150°C)	
SFPJ-63				–40 to +150		0.45	2.0	20	
SFPJ-73		3.0	50	–40 to +150		0.45	3.0	30	
SPJ-63S		6.0	50	–40 to +150		0.45	3	30 (Tj=125°C)	14
SFPB-54	40	1.0	30	–40 to +150		0.55	1	50	1
SFPB-64		1.5	60	–40 to +150		0.55	5	50	
SFPE-64		2.0	40	–40 to +150		0.6	0.2	20 (Tj=150°C)	
SFPB-74			60	–40 to +150		0.5	5	50	
SPB-G34S		3.0	50	–40 to +150		0.55	3.5	50	14
SPB-G54S		5.0	60	–40 to +150		0.55	5	50	
SPB-64S		6.0	50	–40 to +150		0.55	3.5	50	
SFPB-56	60	0.7	10	–40 to +150		0.62	1	7.5	1
SFPB-66		2.0	25	–40 to +150		0.69	1	15	
SFPB-76			40	–40 to +150		0.62	2	20	
SPB-G56S		5.0	60	–40 to +150		0.7	3	50	14
SFPB-59	90	0.7	10	–40 to +150		0.81	1	5	1
SFPB-69		1.5	40	–40 to +150		0.81	2	10	

■ Axial Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics			Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (mA) max	H•I_R (mA) Ta=100°C max	
AK 03	30	1.0	25	–40 to +150		0.55	1	50 (Tj=100°C)	2
EK 03			40	–40 to +150		0.55	5	50	3
EK 13		1.5	40	–40 to +150		0.55	5	50	4
RK 13		1.7	60	–40 to +150		0.55	5	50	5
RK 33		2.5	50	–40 to +150		0.55	5	50	6
RJ 43		3.0	50	–40 to +150		0.45	3	30	8
RK 43			80	–40 to +150		0.55	5	50	
AK 04	40	1.0	25	–40 to +150		0.55	1	50 (Tj=100°C)	2
EK 04			40	–40 to +150		0.55	5	50	3
EK 14		1.5	40	–40 to +150		0.55	5	50	4
RK 14		1.7	60	–40 to +150		0.55	5	50	5
RK 34		2.5	50	–40 to +150		0.55	5	50	6
RK 44		3.0	80	–40 to +150		0.55	5	50	8
AK 06	60	0.7	10	–40 to +150		0.62	1	7.5	2
EK 06				–40 to +150		0.62	1	7.5	3
EK 16		1.5	25	–40 to +150		0.62	1	15	4
RK 16				–40 to +150		0.62	1	15	5
RK 36		2.0	40	–40 to +150		0.62	2	20	6
RK 46		3.5	70	–40 to +150		0.62	3	35	8
AK 09	90	0.7	10	–40 to +150		0.81	1	5	2
EK 09				–40 to +150		0.81	1	5	3
EK 19		1.5	40	–40 to +150		0.81	2	10	4
RK 19				–40 to +150		0.81	2	10	5
RK 39		2.0	50	–40 to +150		0.81	3	15	6
RK 49		3.5	60	–40 to +150		0.81	5	35	8

■ Frame 2-pin Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics			Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (mA) max	H•I_R (mA) Ta=100°C max	
FMB-G14	40	3.0	60	–40 to +150		0.55	5	100	11
FMB-G14L		5.0	60	–40 to +150		0.55	5	100	
FMB-G24H		10.0	150	–40 to +150		0.55	10	65	
FMB-G16L	60	6.0	50	–40 to +150		0.62	5	50	11
FMB-G19L	90	4.0	60	–40 to +150		0.81	5	35	11

■ Center-tap Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics			Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (mA) max	H•I_R (mA) Ta=100°C max	
FMB-24	40	4.0	50	–40 to +150		0.55	5	35	9
FMB-24M		6.0	60	–40 to +150		0.55	5	35	
FMB-24L		10	60	–40 to +150		0.55	5	35	
FME-24L			80	–40 to +150		0.6	0.5	30	
FMB-34S		12	75	–40 to +150		0.58	5	35	10
FMB-24H		15	100	–40 to +150		0.55	7.5	50	9
FME-24H				–40 to +150		0.6	0.75	50	
MPE-24H				–40 to +150		0.6	0.75	50 (Tj=150°C)	15
FMB-34			150	–40 to +150		0.55	10	65	10
FMB-34M		30	300	–40 to +150		0.55	20	100	
FMB-26	60	4.0	40	–40 to +150		0.62	1	20	9
FMB-26L		10	50	–40 to +150		0.62	2.5	50	
FMB-36		15	100	–40 to +150		0.62	5	75	10
FMB-36M		30	150	–40 to +150		0.62	10	150	
FMB-29	90	4.0	50	–40 to +150		0.81	3	15	9
FMB-29L		8.0	60	–40 to +150		0.81	5	35	
FMB-39		15	60	–40 to +150		0.81	10	50	10
FMB-39M		20	150	–40 to +150		0.81	15	60	

■ Bridge Type

Part No.	Absolute Maximum Ratings					Electrical Characteristics			Fig. No.
	V_{RM} (V)	$I_{F(AV)}$ (A)	I_{FSM} (A)	Tj (°C)	Tstg (°C)	V_F (V) max	I_R (mA) max	H•I_R (mA) Ta=100°C max	
RBV-406B	60	4.0	40	–40 to +150		0.62	2	20	13

General-purpose Diodes - External Dimensions

(Unit: mm)

Fig. 1

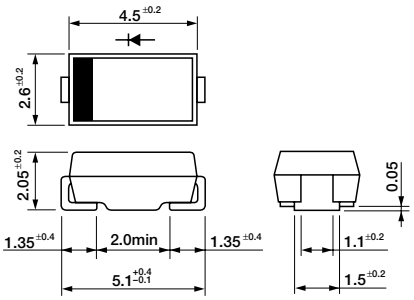


Fig. 2

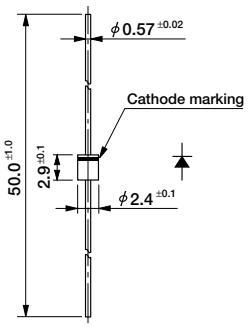


Fig. 3

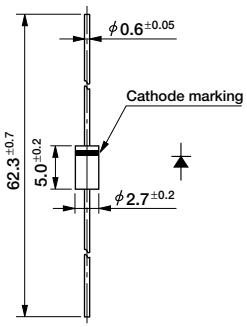


Fig. 4

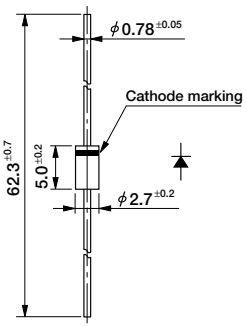


Fig. 5

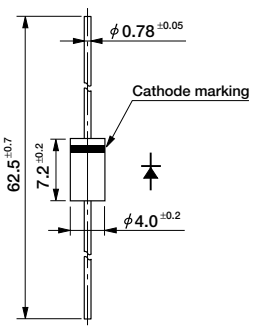


Fig. 6

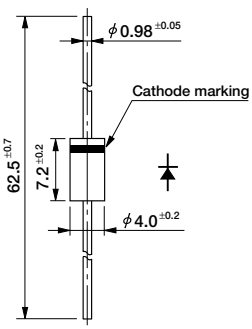


Fig. 7

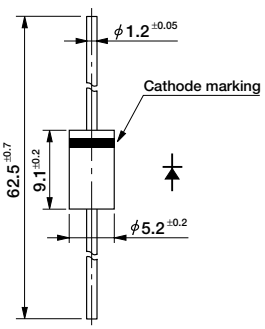


Fig. 8

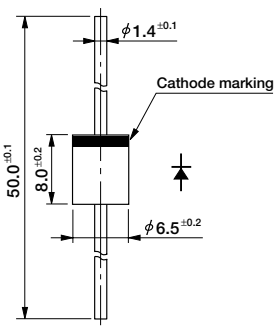


Fig. 9

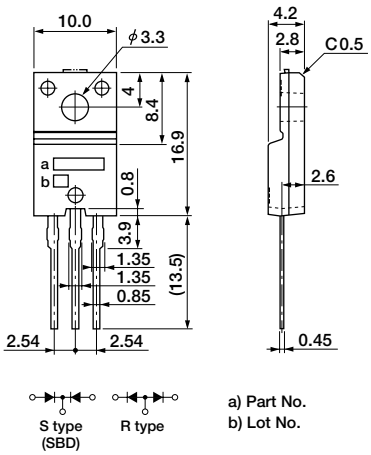
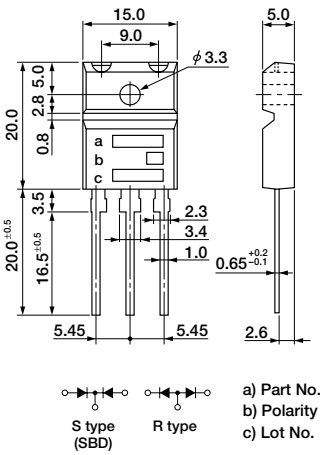


Fig. 10



(Unit: mm)

Fig. 11 Full-mold

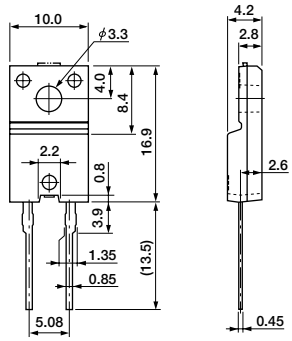
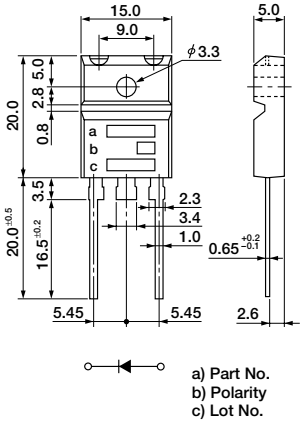
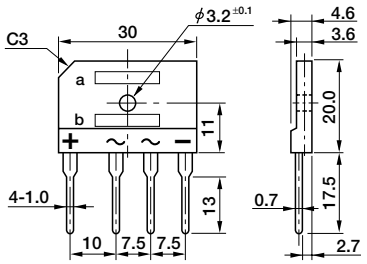


Fig. 12 Full-mold



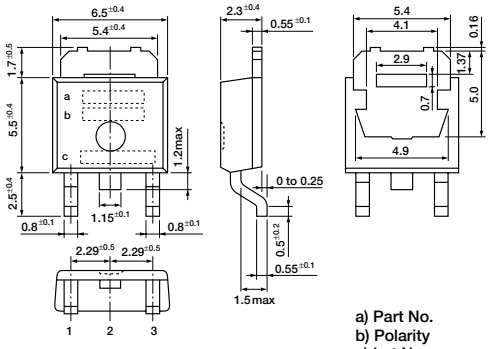
a) Part No.
b) Polarity
c) Lot No.

Fig. 13



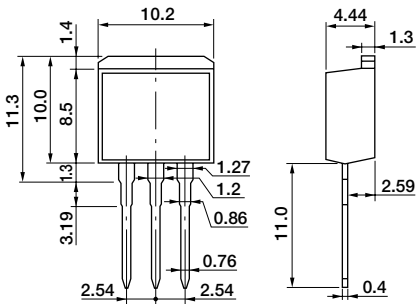
a) Part No.
b) Lot No.

Fig. 14



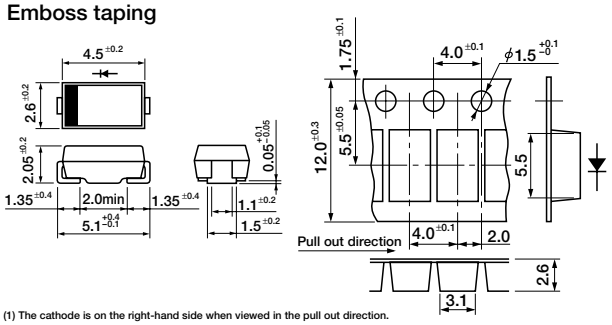
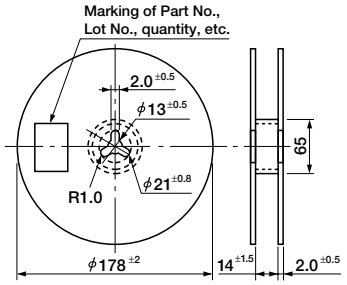
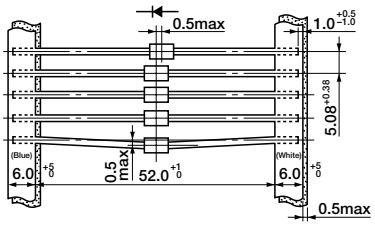
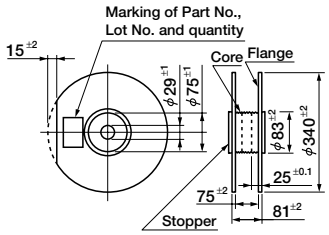
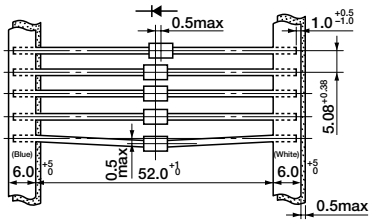
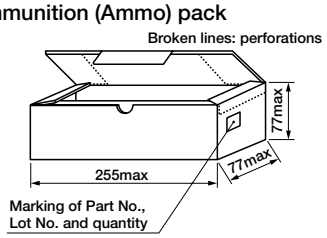
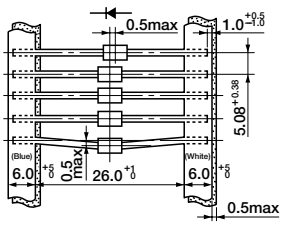
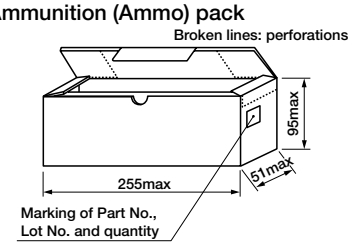
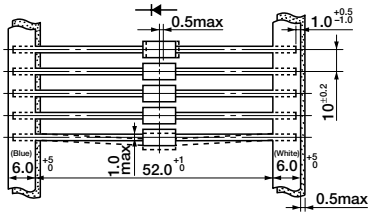
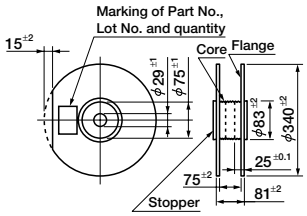
a) Part No.
b) Polarity
c) Lot No.

Fig. 15

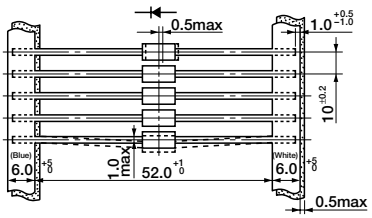
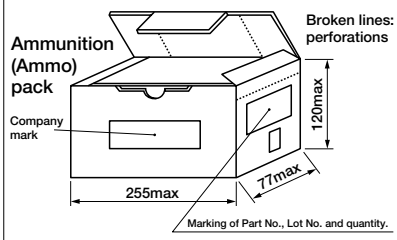
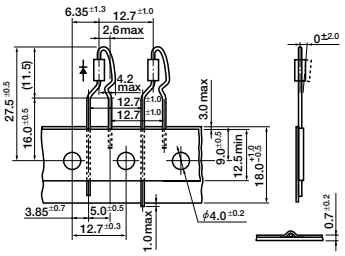
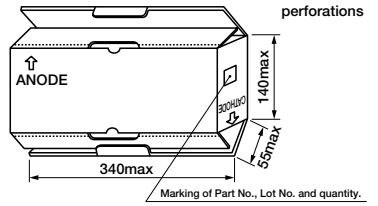
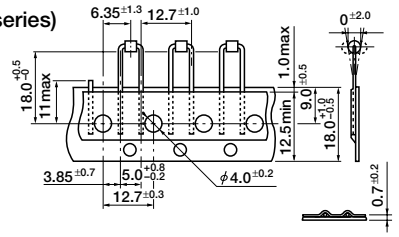
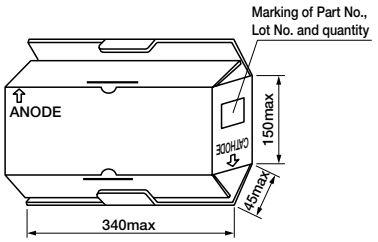
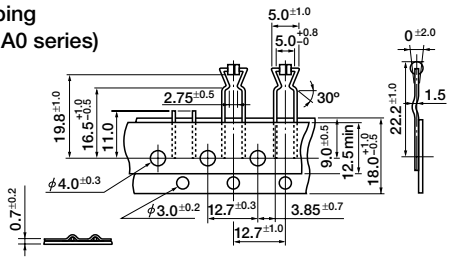


General-purpose Diodes - Taping Specifications

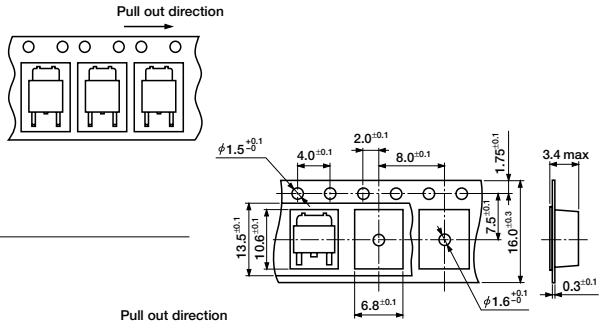
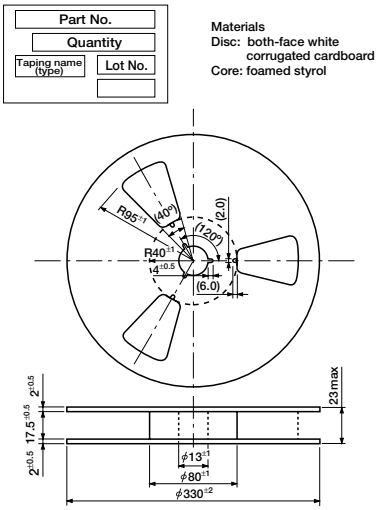
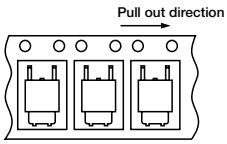
Taping Specifications

Taping Name	Taping Dimensions (mm)	Packaging Dimensions (mm) and Markings	Packaging Quantity
V A suffix "V" is added to Part No. for tape packaging.	Emboss taping  (1) The cathode is on the right-hand side when viewed in the pull out direction. (2) The electrode side of the product is on the bottom when casing. (3) A leader tape of 150 to 200 mm in length is provided. (4) The leading and trailing edge of the leader tape are provided with a pitch of at least 10 mm. (5) Reversed polarity taping available on request (specify taping name "VL").	Reel 	1,800 pcs. per reel
V A suffix "V" is added to Part No. for tape packaging.	Axial taping 	Reel 	5,000 pcs. per reel (2.7ϕ body 2.4ϕ body) 3,000 pcs. (4ϕ body)
V1 A suffix "V1" is added to Part No. for tape packaging.	Axial taping 	Ammunition (Ammo) pack 	2,000 pcs. per box (2.7ϕ body) 3000 pcs. (2.4ϕ body) 1000 pcs. (4ϕ body)
V0 A suffix "V0" is added to Part No. for tape packaging.	Axial taping 	Ammunition (Ammo) pack 	2,000 pcs. per box (2.7ϕ body) 3000 pcs. (2.4ϕ body)
V3 A suffix "V3" is added to Part No. for tape packaging.	Axial taping 	Reel 	1,500 pcs. per reel (5.2ϕ body)

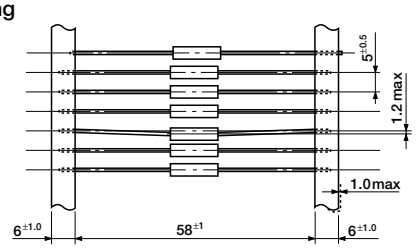
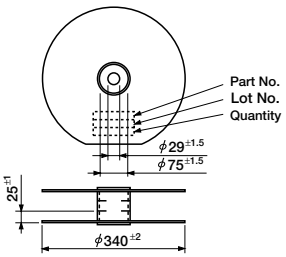
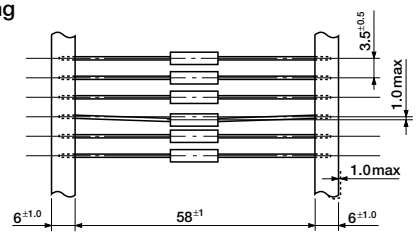
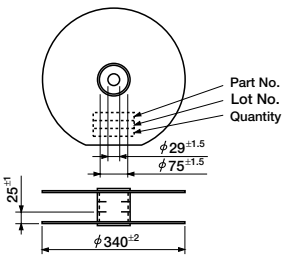
Taping Specifications

Taping Name	Taping Dimensions (mm)	Packaging Dimensions (mm) and Markings	Packaging Quantity
V4 A suffix "V4" is added to Part No. for tape packaging.	Axial taping 		1,000 pcs. per box (5.2φ body)
W A suffix "W" is added to Part No. for tape packaging.	Radial taping 	Ammunition (Ammo) pack 	4,000 pcs. per box (2.7φ body 0.6φ leads only)
WS A suffix "WS" is added to Part No. for tape packaging.	Radial taping (applies to A0 series) 	Ammunition (Ammo) pack 	2,500 pcs. per box (2.4φ body)
WK A suffix "WK" is added to Part No. for tape packaging.	Radial taping (applies to A0 series) 		

Power Surface-mount - Taping Specifications

Taping Name	Taping Dimensions (mm)	Packaging Dimensions (mm) and Markings	Packaging Quantity
VL A suffix "VL" is added to Part No. for tape packaging.			3,000 pcs. per reel
VR A suffix "VR" is added to Part No. for tape packaging.			3,000 pcs. per reel

High-voltage Diodes - Taping Specifications

Taping Name	Taping Dimensions (mm)	Packaging Dimensions (mm) and Markings	Packaging Quantity
V1 A suffix "V1" is added to Part No. for tape packaging.	Axial taping 		5,000 pcs. per reel
VD A suffix "VD" is added to Part No. for tape packaging.	Axial taping 		8,000 pcs. per reel

Uni-Color LED Lamp

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Unit	Ratings						Ratings
		GaP	GaAsP	GaAℓAs	AℓGaInP	InGaN	GaN	
I_F	mA	30						
ΔI_F	mA/°C	−0.45						Above 25°C
I_{FP}	mA	100					70	f=1kHz, tw=100μs
V_R	V	3		4	5			
Top	°C	−30 to +85			−25 to +85			
Tstg	°C	−30 to +100						

Outline	Emitting color	Part No.	Lens color	Electro-optical characteristics (Ta=25°C) V_F (V) typ	V_F (V) max	I_V (mcd) typ	I_V Condition I_F (mA)	λp (nm) typ	Chip material	Contact mount	Fig. No.
5φ Round	Deep red	SEL1110R	Diffused red	2.0	2.5	2.8	5	700	GaP	×	1
		SEL1110W	Diffused white			2.8				×	
		SEL1110S	Tinted red			4.5				×	
	High-intensity red	SEL1610W	Diffused white	1.75	2.2	1000	20	660	GaAℓAs	×	
		SEL1610C	Clear			1200				×	
	Red	SEL1210R	Diffused red	1.9	2.5	26	20	630	GaAsP	×	
		SEL1210S	Tinted red			75				×	
	Amber	SEL1810D	Diffused orange	1.9	2.5	18	10	610	GaAsP	×	
		SEL1810A	Tinted orange			37				×	
	Orange	SEL1910D	Diffused orange	1.9	2.5	14	10	587	GaAsP	×	
		SEL1910A	Tinted orange			25				×	
	Yellow	SEL1710Y	Diffused yellow	2.0	2.5	22	10	570	GaP	×	
		SEL1710K	Tinted yellow			65				×	
	Green	SEL1410G	Diffused green	2.0	2.5	32	20	560	GaP	×	
		SEL1410E	Tinted green			84				×	
	Pure green	SEL1510C	Clear	2.0	2.5	50	20	555	GaP	×	
	Red	SEL1210RM	Diffused red	1.9	2.5	36	20	630	GaAsP	×	2
		SEL1210SM	Tinted red			75				×	
	Amber	SEL1810DM	Diffused orange	1.9	2.5	18	10	610	GaAsP	×	
		SEL1810AM	Tinted orange			37				×	
	Orange	SEL1910DM	Diffused orange	1.9	2.5	19	10	587	GaAsP	×	
		SEL1910AM	Tinted orange			34				×	
	Yellow	SEL1710KM	Tinted yellow	2.0	2.5	65	10	570	GaP	×	
	Green	SEL1410GM	Diffused green	2.0	2.5	30	20	560	GaP	×	
		SEL1410EM	Tinted green			84				×	
	Pure green	SEL1510CM	Clear	2.0	2.5	50	20	555	GaP	×	
	Ultra high-intensity red	SELU1210CXM	Clear	2.0	2.5	280	20	635	AℓGaInP	×	3
	Ultra high-intensity amber	SELU1810CXM	Clear	2.0	2.5	570	20	615	AℓGaInP	×	
	Ultra high-intensity pure green	SELU1D10CXM	Clear	3.3	4.0	2000	20	525	InGaN	×	
	Ultra high-intensity blue	SELU1E10CXM	Clear	3.3	4.0	600	20	470	InGaN	×	

Outline	Emitting color	Part No.	Lens color	Electro-optical characteristics (Ta=25°C) V_F (V) typ	V_F (V) max	I_V (mcd) typ	I_V Condition I_F (mA)	λp (nm) typ	Chip material	Contact mount	Fig. No.
5φ Round	Ultra high-intensity red	SELU1250CM	Clear	2.0	2.5	900	20	635	AℓGaInP	○	4
	Red	SEL1250SM	Tinted red	1.9	2.5	75	20	630	GaAsP	○	
		SEL1250RM	Diffused red			48				○	
	Amber	SEL1850AM	Tinted orange	1.9	2.5	90	20	610	GaAsP	○	
		SEL1850DM	Diffused orange			60				○	
	Orange	SEL1950KM	Tinted orange	1.9	2.5	96	20	587	GaAsP	○	
	Green	SEL1450EKM	Tinted green	2.0	2.5	190	20	560	GaP	○	
		SEL1450GM-YG	Diffused green			120				○	
	Pure green	SEL1550CM	Clear	2.0	2.5	72	20	555	GaP	○	
	Ultra high-intensity pure green	SELU1D50CM	Clear	3.3	4.0	6000	20	525	InGaN	×	
	Ultra high-intensity blue	SELU1E50CM	Clear	3.3	4.0	1850	20	470	InGaN	×	
	High-intensity red	SEL1615C	Clear	1.75	2.2	700	20	660	GaAℓAs	×	5
5φ Cylindrical	Deep red	SEL1111R	Diffused red	2.0	2.5	1.4	10	700	GaP	×	6
	Red	SEL1211R	Diffused red	1.9	2.5	12	20	630	GaAsP	×	
	Amber	SEL1811D	Diffused orange	1.9	2.5	8.0	10	610	GaAsP	×	
	Orange	SEL1911D	Diffused orange	1.9	2.5	8.0	10	587	GaAsP	×	
	Yellow	SEL1711Y	Diffused yellow	2.0	2.5	13	10	570	GaP	×	
	Green	SEL1411G	Diffused green	2.0	2.5	30	20	560	GaP	×	
4.6X5.6φ Egg-shaped	Ultra high-intensity red	SELU1253CMKT	Clear	2.0	2.5	200	20	635	AℓGaInP	×	7
	Ultra high-intensity amber	SELU1853CMKT	Clear	2.0	2.5	450	20	615	AℓGaInP	×	
	Green	SEL1453CEMKT	Tinted green	2.0	2.5	140	20	560	GaP	×	
4φ Round	Deep red	SEL4110S	Tinted red	2.0	2.5	2.4	5	700	GaP	×	8
		SEL4110R	Diffused red			1.7				×	
	Red	SEL4210S	Tinted red	1.9	2.5	30	20	630	GaAsP	×	
		SEL4210R	Diffused red			17				×	
	Amber	SEL4810A	Tinted orange	1.9	2.5	20	10	610	GaAsP	×	
		SEL4810D	Diffused orange			15				×	
	Orange	SEL4910A	Tinted orange	1.9	2.5	26	10	587	GaAsP	×	
		SEL4910D	Diffused orange			16				×	
	Yellow	SEL4710K	Tinted yellow	2.0	2.5	36	10	570	GaP	×	
		SEL4710Y	Diffused yellow			14				×	
	Green	SEL4410E	Tinted green	2.0	2.5	87	20	560	GaP	×	
		SEL4410G	Diffused green			34				×	
	Pure green	SEL4510C	Clear	2.0	2.5	45	20	555	GaP	×	
	Deep red	SEL4114S	Tinted red	2.0	2.5	3.8	10	700	GaP	○	9
		SEL4114R	Diffused red			2.8				○	
	Red	SEL4214S	Tinted red	1.9	2.5	40	20	630	GaAsP	○	
		SEL4214R	Diffused red			24				○	
	Amber	SEL4814A	Tinted orange	1.9	2.5	20	10	610	GaAsP	○	
		SEL4814D	Diffused orange			15				○	
	Orange	SEL4914A	Tinted orange	1.9	2.5	26	10	587	GaAsP	○	
		SEL4914D	Diffused orange			11				○	
	Yellow	SEL4714K	Tinted yellow	2.0	2.5	38	10	570	GaP	○	
		SEL4714Y	Diffused yellow			27				○	
	Green	SEL4414E	Tinted green	2.0	2.5	69	20	560	GaP	○	
		SEL4414G	Diffused green			48				○	
	Pure green	SEL4514C	Clear	2.0	2.5	26	20	555	GaP	○	

Uni-Color LED Lamp

Outline	Emitting color	Part No.	Lens color	Electro-optical characteristics (Ta=25°C) VF (V) typ	VF (V) max	Iv (mcd) typ	Iv Condition IF (mA)	λp (nm) typ	Chip material	Contact mount	Fig. No.
3φ Round	Deep red	SEL6110S	Tinted red	2.0	2.5	3.9	10	700	GaP	○	10
		SEL6110R	Diffused red			2.6				○	
	Red	SEL6210S	Tinted red	1.9	2.5	41	20	630	GaAsP	○	
		SEL6210R	Diffused red			18				○	
	Amber	SEL6810A	Tinted orange	1.9	2.5	22	10	610	GaAsP	○	
		SEL6810D	Diffused orange			9.6				○	
	Orange	SEL6910A	Tinted orange	1.9	2.5	22	10	587	GaAsP	○	
		SEL6910D	Diffused orange			11				○	
	Yellow	SEL6710K	Tinted yellow	2.0	2.5	37	10	570	GaP	○	
		SEL6710Y	Diffused yellow			11				○	
	Green	SEL6410E	Tinted green	2.0	2.5	90	20	560	GaP	○	
		SEL6410G	Diffused green			30				○	
	Pure green	SEL6510C	Clear	2.0	2.5	42	20	555	GaP	○	
		SEL6510G	Diffused green			9.6				○	
	Red	SEL6214S	Tinted red	1.9	2.5	18	20	630	GaAsP	○	11
	Amber	SEL6814A	Tinted orange	1.9	2.5	9.0	10	610	GaAsP	○	
	Ultra-high-intensiti light amber	SELS6B14C	Clear	2.0	2.5	120	20	600	AℓGaInP	○	
	Orange	SEL6914A	Tinted orange	1.9	2.5	8.0	10	587	GaAsP	○	
		SEL6914W	Diffused white			5.0				○	
	Yellow	SEL6714K	Tinted yellow	2.0	2.5	66	20	570	GaP	○	
		SEL6714W	Diffused white			30				○	
	Green	SEL6414E	Tinted green	2.0	2.5	42	20	560	GaP	○	
	Deep green	SEL6414E-TG	Tinted green			18		558		○	
	Pure green	SEL6514C	Clear	2.0	2.5	12	20	555	GaP	○	
	Red	SEL6215S	Tinted red	1.9	2.5	45	20	630	GaAsP	○	12
	Orange	SEL6915A	Tinted orange	1.9	2.5	60	20	587	GaAsP	○	
	Yellow	SEL6715C	Clear	2.0	2.5	90	20	570	GaP	○	
	Green	SEL6415E	Tinted green	2.0	2.5	81	20	560	GaP	○	
	Pure green	SEL6515C	Clear	2.0	2.5	44	20	555	GaP	○	
	Deep red	SEL2110S	Tinted red	2.0	2.5	4	10	700	GaP	×	13
		SEL2110R	Diffused red			1.8				×	
		SEL2110W	Diffused white			1.8				×	
	High-intensity red	SEL2610C	Clear	1.75	2.2	350	20	660	GaAℓAs	×	
	Red	SEL2210S	Tinted red	1.9	2.5	40	20	630	GaAsP	×	
		SEL2210R	Diffused red			15				×	
		SEL2210W	Diffused white			15				×	
	Amber	SEL2810A	Tinted orange	1.9	2.5	22	10	610	GaAsP	×	
		SEL2810D	Diffused orange			9.0				×	
	Orange	SEL2910A	Tinted orange	1.9	2.5	16	10	587	GaAsP	×	
		SEL2910D	Diffused orange			8.0				×	
	Ultra high-intensity yellow	SELU2710C	Clear	2.0	2.5	270	20	572	AℓGaInP	×	
	Yellow	SEL2710K	Tinted yellow	2.0	2.5	40	10	570	GaP	×	
		SEL2710Y	Diffused yellow			14				×	
	Green	SEL2410E	Tinted green	2.0	2.5	77	20	560	GaP	×	
		SEL2410G	Diffused green			20				×	

Outline	Emitting color	Part No.	Lens color	Electro-optical characteristics (Ta=25°C) VF (V) typ	VF (V) max	Iv (mcd) typ	Iv Condition IF (mA)	λp (nm) typ	Chip material	Contact mount	Fig. No.
3φ Round	Pure green	SEL2510C	Clear	2.0	2.5	43	20	555	GaP	×	
		SEL2510G	Diffused green			8.2				×	
	Ultra high-intensity pure green	SELU2D10C	Clear	3.3	4.0	1200	20	525	InGaN	×	13
	Ultra high-intensity blue	SELU2E10C	Clear	3.3	4.0	400	20	470	InGaN	×	
	Blue	SEL2E10C	Clear	3.8	4.8	60	20	430	GaN	×	
	Red	SEL2215S	Tinted red	1.9	2.5	45	20	630	GaAsP	×	
		SEL2215R	Diffused red			38				×	
	Amber	SEL2815A	Tinted orange	1.9	2.5	80	10	610	GaAsP	×	
		SEL2815D	Diffused orange			60				×	
	Orange	SEL2915A	Tinted orange	1.9	2.5	81	10	587	GaAsP	×	
		SEL2915D	Diffused orange			53				×	14
	Yellow	SEL2715K	Tinted yellow	2.0	2.5	130	10	570	GaP	×	
		SEL2715Y	Diffused yellow			110				×	
	Green	SEL2415E	Tinted green	2.0	2.5	110	20	560	GaP	×	
		SEL2415G	Diffused green			72				×	
	Pure green	SEL2515C	Clear	2.0	2.5	52	20	555	GaP	×	
3φ Cylindrical	Deep red	SEL2111R	Diffused red	2.0	2.5	0.7	10	700	GaP	×	
	Orange	SEL2911D	Diffused orange	1.9	2.5	3.3	10	587	GaAsP	×	15
	Green	SEL2411G	Diffused green	2.0	2.5	18	20	560	GaP	×	
2φ Round	Deep red	SEL4117R	Diffused red	2.0	2.5	1.1	10	700	GaP	×	
	Amber	SEL4817D	Diffused orange	1.9	2.5	7.5	10	610	GaAsP	×	
	Orange	SEL4917D	Diffused orange	1.9	2.5	7.5	10	587	GaAsP	×	16
	Yellow	SEL4717Y	Diffused yellow	2.0	2.5	14	20	570	GaP	×	
	Green	SEL4417G	Diffused green	2.0	2.5	16	20	560	GaP	×	
Inverted-cone typ for surface illumination	Red	SEL1213C	Tinted red	1.9	2.5	7.0	20	630	GaAsP	×	
	Amber	SEL1813A	Tinted orange	1.9	2.5	8.0	20	610	GaAsP	×	
	Orange	SEL1913K	Tinted light orange	1.9	2.5	8.0	20	587	GaAsP	×	17
	Yellow	SEL1713K	Tinted yellow	2.0	2.5	15	20	570	GaP	×	
	Green	SEL1413E	Tinted green	2.0	2.5	12	20	560	GaP	×	
	Pure green	SEL1513E	Tinted light green	2.0	2.5	5.0	20	555	GaP	×	
	Green	SEL6413E	Tinted green	2.0	2.5	14	20	560	GaP	○	18
	Pure green	SEL6513C	Clear	2.0	2.5	5.0	20	555	GaP	○	
	High-intensity red	SEL2613CS-S	Tinted light red	1.7	2.5	80	20	660	GaAℓAs	×	
	Red	SEL2213C	Clear	1.9	2.5	7.0	20	630	GaAsP	×	
	Amber	SEL2813A	Tinted orange	1.9	2.5	8.0	20	610	GaAsP	×	
	Orange	SEL2913K	Tinted light orange	1.9	2.5	8.0	20	587	GaAsP	×	
	Yellow	SEL2713K	Tinted yellow	2.0	2.5	17	20	570	GaP	×	19
	Green	SEL2413E	Tinted green	2.0	2.5	14	20	560	GaP	×	
		SEL2413G	Diffused green			12				×	
	Pure green	SEL2513E	Tinted green	2.0	2.5	5.0	20	555	GaP	×	
3X5 Rectangular	Deep red	SEL1121R	Diffused red	2.0	2.5	0.9	10	700	GaP	×	
	Amber	SEL1821D	Diffused orange	1.9	2.5	3.0	10	610	GaAsP	×	
	Orange	SEL1921D	Diffused orange	1.9	2.5	3.8	10	587	GaAsP	×	20
	Yellow	SEL1721Y	Diffused yellow	2.0	2.5	7.0	10	570	GaP	×	
	Green	SEL1421G	Diffused green	2.0	2.5	12	20	560	GaP	×	

Uni-Color LED Lamp

Outline	Emitting color	Part No.	Lens color	Electro-optical characteristics (Ta=25ºC) VF (V) typ	VF (V) max	IV (mcd) typ	IV Condition IF (mA)	λp (nm) typ	Chip material	Contact mount	Fig. No.
2.5X5 Rectangular	Red	SEL1222R	Diffused red	1.9	2.5	9.0	20	630	GaAsP	×	21
	Amber	SEL1822D	Diffused orange	1.9	2.5	4.8	10	610	GaAsP	×	
	Orange	SEL1922D	Diffused orange	1.9	2.5	4.5	10	587	GaAsP	×	
	Yellow	SEL1722Y	Diffused yellow	2.0	2.5	7.8	10	570	GaP	×	
		SEL1722K	Tinted yellow			12				×	
	Green	SEL1422G	Diffused green	2.0	2.5	7.2	20	560	GaP	×	
2X5 Rectangular	Deep red	SEL1120R	Diffused red	2.0	2.5	0.9	10	700	GaP	×	22
	Red	SEL1220R	Diffused red	1.9	2.5	4.8	20	630	GaAsP	×	
	Amber	SEL1820D	Diffused orange	1.9	2.5	3.0	10	610	GaAsP	×	
	Orange	SEL1920D	Diffused orange	1.9	2.5	3.8	10	587	GaAsP	×	
	Yellow	SEL1720Y	Diffused yellow	2.0	2.5	7.0	10	570	GaP	×	
	Green	SEL1420G	Diffused green	2.0	2.5	11	20	560	GaP	×	
1X5 Rectangular	Deep red	SEL1124R	Diffused red	2.0	2.5	0.5	10	700	GaP	×	23
	Amber	SEL1824D	Diffused orange	1.9	2.5	4.0	10	610	GaAsP	×	
	Orange	SEL1924D	Diffused orange	1.9	2.5	3.0	10	587	GaAsP	×	
	Yellow	SEL1724Y	Diffused yellow	2.0	2.5	6.0	10	570	GaP	×	
	Green	SEL1424G	Diffused green	2.0	2.5	15	20	560	GaP	×	
2X4 Rectangular	Red	SEL4225C	Clear	1.9	2.5	12	20	630	GaAsP	×	24
		SEL4225R	Diffused red			5.4				×	
	Amber	SEL4825A	Tinted orange	1.9	2.5	5.4	10	610	GaAsP	×	
		SEL4825D	Diffused orange			4.0				×	
	Orange	SEL4925A	Tinted orange	1.9	2.5	4.5	10	587	GaAsP	×	
		SEL4925D	Diffused orange			4.0				×	
	Yellow	SEL4725K	Tinted yellow	2.0	2.5	13	10	570	GaP	×	
		SEL4725Y	Diffused yellow			5.0				×	
	Green	SEL4425E	Tinted green	2.0	2.5	20	20	560	GaP	×	
		SEL4425G	Diffused green			10				×	
	Pure green	SEL4525C	Clear	2.0	2.5	6.6	20	555	GaP	×	
	Red	SEL4226C	Clear	1.9	2.5	12	20	630	GaAsP	○	25
		SEL4226R	Diffused red			10				○	
	Amber	SEL4826A	Tinted orange	1.9	2.5	5.4	10	610	GaAsP	○	
		SEL4826D	Diffused orange			4.5				○	
	Orange	SEL4926A	Tinted orange	1.9	2.5	6.0	10	587	GaAsP	○	
		SEL4926D	Diffused orange			4.5				○	
	Yellow	SEL4726K	Tinted yellow	2.0	2.5	14	10	570	GaP	○	
		SEL4726Y	Diffused yellow			8.6				○	
	Green	SEL4426E	Tinted green	2.0	2.5	20	20	560	GaP	○	
		SEL4426G	Diffused green			14				○	
4φ Bow-shaped	Red	SEL4227C	Clear	1.9	2.5	15	20	630	GaAsP	×	26
	Green	SEL4427EP	Tinted green	2.0	2.5	19	20	560	GaP	×	
	Red	SEL6227S	Tinted red	1.9	2.5	14	20	630	GaAsP	○	27
	Orange	SEL6927A	Tinted orange	1.9	2.5	10	10	587	GaAsP	○	
	Green	SEL6427EP	Tinted green	2.0	2.5	26	20	560	GaP	○	

Outline	Emitting color	Part No.	Lens color	Electro-optical characteristics (Ta=25ºC) VF (V) typ	VF (V) max	IV (mcd) typ	IV Condition IF (mA)	λp (nm) typ	Chip material	Contact mount	Fig. No.
3.1φ Bow-shaped	High-intensity red	SEL4628C-S	Clear	1.7	2.2	200	20	660	GaAℓAs	×	28
	Red	SEL4228C	Clear	1.9	2.5	27	20	630	GaAsP	×	
	Amber	SEL4828A	Tinted orange	1.9	2.5	14	10	610	GaAsP	×	
	Orange	SEL4928A	Tinted orange	1.9	2.5	14	10	587	GaAsP	×	
	Yellow	SEL4728K	Tinted yellow	2.0	2.5	30	10	570	GaP	×	
	Green	SEL4428E	Tinted green	2.0	2.5	63	20	560	GaP	×	
	Deep green	SEL4428B-TG	Tinted dark blue	2.0	2.5	18	20	558	GaP	×	
	Pure green	SEL4528C	Clear	2.0	2.5	30	20	555	GaP	×	
	Red	SEL4229R	Diffused red	1.9	2.5	21	20	630	GaAsP	○	29
	Amber	SEL4829A	Tinted orange	1.9	2.5	18	10	610	GaAsP	○	
	Orange	SEL4929A	Tinted orange	1.9	2.5	18	10	587	GaAsP	○	
	Yellow	SEL4729KH	Tinted yellow	2.0	2.5	60	10	570	GaP	○	
	Green	SEL4429E	Tinted green	2.0	2.5	60	20	560	GaP	○	
5mm Pitch lead rectangular	High-intensity red	SEL5620C	Clear	1.7	2.2	100	20	660	GaAℓAs	○	30
	Red	SEL5220S	Tinted red	1.9	2.5	20	20	630	GaAsP	○	
	Amber	SEL5820A	Tinted orange	1.9	2.5	12	20	610	GaAsP	○	
	Orange	SEL5920A	Tinted orange	1.9	2.5	12	20	587	GaAsP	○	
	Green	SEL5420E	Tinted green	2.0	2.5	20	20	560	GaP	○	
	Pure green	SEL5520C	Clear	2.0	2.5	6.0	20	555	GaP	○	
	Ultra high-intensity blue	SELU5E20C	Clear	3.3	4.0	60	10	470	InGaN	○	
5mm Pitch lead 3φ lens-type	Red	SEL5221S	Tinted red	1.9	2.5	35	20	630	GaAsP	○	31
	Amber	SEL5821A	Tinted orange	1.9	2.5	60	20	610	GaAsP	○	
	Orange	SEL5921A	Tinted orange	1.9	2.5	60	20	587	GaAsP	○	
	Yellow	SEL5721C	Clear	2.0	2.5	90	20	570	GaP	○	
	Green	SEL5421E	Tinted green	2.0	2.5	95	20	560	GaP	○	
	Pure green	SEL5521C	Clear	2.0	2.5	35	20	555	GaP	○	
5mm Pitch lead bow-shaped	Ultra high-intensity red	SELS5223C	Clear	2.0	2.5	100	20	635	AℓGaInP	○	32
	Red	SEL5223S	Tinted red	1.9	2.5	25	20	630	GaAsP	○	
	Ultra high-intensity amber	SELS5823C	Clear	2.0	2.5	130	20	615	AℓGaInP	○	
		SELU5823C	Clear			185				○	
	Amber	SEL5823A	Tinted orange	1.9	2.5	35	20	610	GaAsP	○	
	Ultra-high-intensiti light amber	SELS5B23C	Clear	2.0	2.5	135	20	600	AℓGaInP	○	
	Ultra high-intensity orange	SELS5923C	Clear	2.0	2.5	145	20	590	AℓGaInP	○	
	Orange	SEL5923A	Tinted orange	1.9	2.5	35	20	587	GaAsP	○	
	Ultra high-intensity yellow	SELU5723C	Clear	2.0	2.5	155	20	572	AℓGaInP	○	
	Yellow	SEL5723C	Clear	2.0	2.5	60	20	570	GaP	○	
	Green	SEL5423E	Tinted green	2.0	2.5	40	20	560	GaP	○	
	Pure green	SEL5523C	Clear	2.0	2.5	13	20	555	GaP	○	
	Ultra high-intensity blue	SELU5E23C	Clear	3.6	4.0	110	10	470	InGaN	○	
	Blue	SEL5E23C	Clear	4.0	4.8	20	20	430	GaN	○	
5mm Pitch lead egg-shaped	Red	SEL5255S	Tinted red	1.9	2.5	35	20	630	GaAsP	○	33
	Orange	SEL5955A	Tinted orange	1.9	2.5	25	20	587	GaAsP	○	
	Yellow	SEL5755C	Clear	2.0	2.5	140	20	570	GaP	○	

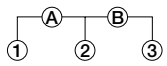
Bi-Color LED Lamp

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Unit	Ratings	Conditions
I_F	mA	30	
ΔI_F	mA/°C	–0.45	Above 25°C
I_{FP}	mA	100	f=1kHz, tw=100μs
V_R	V	4	
Top	°C	–30 to +85	
Tstg	°C	–30 to +100	

■ Internal wiring diagram



Outline	Part No.	Emitting color	Lens color	Electro-optical characteristics (Ta=25°C) V_F (V) typ	V_F (V) max	Iv (mcd) typ	Iv Condition I_F (mA)	λp (nm) typ	Common	Contact mount	Fig. No.
5φ Round	SML11516C	A Deep red	Clear	2.0	2.5	15	20	700	Cathode	×	34
		B Pure green		2.0	2.5	50	20	555			
	SML1216C	A Red	Clear	1.9	2.5	65	20	630	Cathode	×	
		B Green		2.0	2.5	90	20	560			
	SML1216W	A Red	Diffused white	1.9	2.5	60	20	630	Cathode	×	
		B Green		2.0	2.5	60	20	560			
	SML1516W	A Deep red	Diffused white	2.0	2.5	6.0	20	700	Cathode	×	
		B Pure green		2.0	2.5	20	20	555			
	SML16716CN	A High-intensity red	Clear	1.7	2.2	100	20	660	Anode	×	
		B Yellow		2.4	3.0	140	20	570			
	SML16716WN	A High-intensity red	Diffused white	1.7	2.2	50	20	660	Anode	×	
		B Yellow		2.4	3.0	70	20	570			
	SML1816W	A Amber	Diffused white	1.9	2.5	50	20	610	Cathode	×	
		B Green		2.0	2.5	60	20	560			
	SML19416W	A Orange	Diffused white	1.9	2.5	45	20	587	Cathode	×	
		B Green		2.0	2.5	60	20	560			
	SML12451W	A Red	Diffused white	1.9	2.5	40	20	630	Cathode	×	35
		B Green		2.0	2.5	60	20	560			
	SML16751WN	A High-intensity red	Diffused white	1.7	2.2	50	20	660	Anode	×	
		B Yellow		2.4	3.0	60	20	570			
2.5X5 Rectangular	SML12460C	A Red	Clear	1.9	2.5	10	20	630	Cathode	×	36
		B Green		2.0	2.5	25	20	560			
	SML16760CN	A High-intensity red	Clear	1.7	2.2	30	20	660	Anode	×	
		B Yellow		2.4	3.0	40	20	570			
	SML19460C	A Orange	Clear	1.9	2.5	15	20	587	Cathode	×	
		B Green		2.0	2.5	25	20	560			
3.3X6 Rectangular	SML72420C	A Red	Clear	1.9	2.5	15	20	630	Cathode	○	37
		B Green		2.0	2.5	20	20	560			
	SML78420C	A Amber	Clear	1.9	2.5	10	20	610	Cathode	○	
		B Green		2.0	2.5	20	20	560			
	SML79420C	A Orange	Clear	1.9	2.5	10	20	587	Cathode	○	
		B Green		2.0	2.5	20	20	560			

Outline	Part No.	Emitting color	Lens color	Electro-optical characteristics (Ta=25°C) V_F (V) typ	V_F (V) max	Iv (mcd) typ	Iv Condition I_F (mA)	λp (nm) typ	Common	Contact mount	Fig. No.
3.3X6 Bow-shaped	SML72423C	A Red	Clear	1.9	2.5	25	20	630	Cathode	○	38
		B Green		2.0	2.5	35	20	560			
	SML72923C	A Red	Clear	1.9	2.5	25	20	630	Cathode	○	
		B Orange		1.9	2.5	25	20	587			
	SML78423C	A Amber	Clear	1.9	2.5	25	20	610	Cathode	○	
		B Green		2.0	2.5	35	20	560			
	SML79423C	A Orange	Clear	1.9	2.5	25	20	587	Cathode	○	
		B Green		2.0	2.5	35	20	560			
	SMLS79723C	A Ultra high-intensity orange	Clear	2.0	2.5	150	20	590	Cathode	○	
		B Yellow		2.0	2.5	40	20	570			
Egg-shaped	SML72755C	A Red	Clear	1.9	2.5	45	20	630	Cathode	○	39
		B Yellow		2.0	2.5	75	20	570			
	SML79255C	A Orange	Clear	1.9	2.5	40	20	587	Cathode	○	
		B Red		2.0	2.5	45	20	630			
	SML79455C	A Orange	Clear	1.9	2.5	45	20	587	Cathode	○	
		B Green		2.0	2.5	75	20	560			
	SML76755WN	A High-intensity red	Diffused white	1.7	2.2	50	20	660	Anode	○	
		B Yellow		2.4	3.0	50	20	570			
	SMLU72755C	A Ultra high-intensity red	Clear	2.0	2.5	160	20	635	Cathode	○	
		B Ultra high-intensity yellow		2.0	2.5	170	20	572			
	SMLU78755C	A Ultra high-intensity amber	Clear	2.0	2.5	280	20	615	Cathode	○	
		B Ultra high-intensity yellow		2.0	2.5	170	20	572			

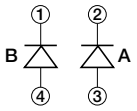
Surface Mount LED

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Unit	Ratings						Conditions
		GaP	GaAsP	GaAℓAs	AℓGaInP	InGaN	GaN	
I_F	mA	30						
ΔI_F	mA/°C	–0.45						Above 25°C
I_{FP}	mA	70						f=1kHz, tw=100μs
V_R	V	4				5		
Top	°C	–30 to +85				–25 to +85		
Tstg	°C	–30 to +100						

■ Internal wiring diagram



■ Uni-Color

Outline	Emitting color	Part No.	Lens color	Electro-optical characteristics (Ta=25°C)						Fig. No.
				V_F (V)		I_V (mcd)	Condition I_F (mA)	λp (nm)	Chip material	
				typ	max	typ		typ		
Flat lens type	Deep red	SEC1101C	Clear	2.0	2.5	1.5	20	700	GaP	40
	High-intensity red	SEC1601C	Clear	1.7	2.2	100	20	660	GaAℓAs	
	Red	SEC1201C	Clear	1.9	2.5	10	20	630	GaAsP	
	Amber	SEC1801C	Clear	1.9	2.5	16	20	610	GaAsP	
	Orange	SEC1901C	Clear	1.9	2.5	13	20	587	GaAsP	
	Yellow	SEC1701C-YG	Clear	2.0	2.5	25	20	570	GaP	
	Green	SEC1401C	Clear	2.0	2.5	22	20	560	GaP	
	Deep reen	SEC1401E-TG	Tinted green	2.0	2.5	11	20	558	GaP	
	Pure green	SEC1501C	Clear	2.0	2.5	8.0	20	555	GaP	
	Ultra high-intensity pure green	SECU1D01C	Clear	3.3	4.0	150	20	525	InGaN	
	Ultra high-intensity blue	SECU1E01C	Clear	3.3	4.0	50	20	470	InGaN	
	Blue	SEC1E01C	Clear	3.9	4.8	6.0	20	430	GaN	
Inner lens type	High-intensity red	SEC1603C	Clear	1.7	2.2	150	20	660	GaAℓAs	41
	Ultra high-intensity red	SECS1203C	Clear	1.9	2.5	100	20	635	AℓGaInP	
	Red	SEC1203C	Clear	1.9	2.5	15	20	630	GaAsP	
	Ultra high-intensity amber	SELS1803C	Clear	1.9	2.5	10	3	615	AℓGaInP	
	Amber	SEC1803C	Clear	1.9	2.5	20	20	610	GaAsP	
	Ultra high-intensity orange	SELS1903C	Clear	1.9	2.5	10	3	590	AℓGaInP	
	Orange	SEC1903C	Clear	1.9	2.5	15	20	587	GaAsP	
	Yellow	SEC1703C	Clear	2.0	2.5	35	20	570	GaP	
	Green	SEC1403C	Clear	2.0	2.5	33	20	560	GaP	
	Deep green	SEC1403E-TG	Clear	2.0	2.5	15	20	558	GaP	
	Pure green	SEC1503C	Clear	2.0	2.5	10	20	555	GaP	

■ Bi-Color

Outline	Part No.	Emitting color	Lens color	Electro-optical characteristics (Ta=25°C)					Fig. No.
				V_F (V)		I_V (mcd)	Condition I_F (mA)	λp (nm)	
				typ	max	typ		typ	
Flat lens type	SEC2422C	A Red	Clear	1.9	2.5	10	20	630	42
		B Green		2.0	2.5	20	20	560	
	SEC2442C	A Green	Clear	2.0	2.5	20	20	560	
		B Green		2.0	2.5	20	20	560	
	SEC2462C	A High-intensity red	Clear	1.7	2.2	20	20	660	
		B Green		2.0	2.5	20	20	560	
	SEC2492C	A Orange	Clear	1.9	2.5	10	20	587	
		B Green		2.0	2.5	20	20	560	
	SEC2552C	A Pure green	Clear	2.0	2.5	5.0	20	555	
		B Pure green		2.0	2.5	5.0	20	555	
	SEC2592C	A Orange	Clear	1.9	2.5	10	20	587	
		B Pure green		2.0	2.5	5.0	20	555	
	SEC2762C-YG	A High-intensity red	Clear	1.7	2.2	20	20	660	
		B Yellow		2.0	2.5	20	20	570	
Inner lens type	SEC2484C	A Amber	Clear	1.9	2.5	20	20	610	43
		B Green		2.0	2.5	30	20	560	
	SEC2554C	A Pure green	Clear	2.0	2.5	10	20	555	
		B Pure green		2.0	2.5	10	20	555	
	SEC2494C	A Orange	Clear	1.9	2.5	20	20	587	
		B Green		2.0	2.5	30	20	560	
	SEC2764C	A High-intensity red	Clear	1.7	2.2	50	20	660	
		B Yellow		2.0	2.5	50	20	570	
	SEC2774C	A Yellow	Clear	2.0	2.5	50	20	570	
		B Yellow		2.0	2.5	50	20	570	

Infrared LED

Absolute Maximum Ratings

(Ta=25°C)

Parameter	Unit	Ratings	Ratings
I_F	mA	150	
ΔI_F	mA/°C	−1.33	Above 25°C
I_{FP}	mA	1000	f=1kHz, tw=10μs
V_R	V	5	
Top	°C	−30 to +85	
Tstg	°C	−30 to +100	

Outline	Part No.	Lens color	Electro-optical characteristics (Ta=25°C)						Contact mount	Fig. No.
			V_F (V)		Ie (mW/sr)	Condition	λp (nm)	Chip material		
			typ	max	typ		typ			
5φ Round	SID1010CM	Clear	1.3	1.5	130	(Constant voltage) V_{CC}=3V, R=2.2Ω	940	GaAs	×	44
	SID1K10CM	Clear	1.3	1.5	200		940	GaAs	×	
	SID1010CXM	Clear	1.3	1.5	60		940	GaAs	×	
	SID1K10CXM	Clear	1.3	1.5	110		940	GaAs	×	
	SID1050CM	Clear	1.3	1.5	250		940	GaAs	○	45
	SID303C	Clear	1.3	1.5	80		940	GaAs	×	46
	SID313BP	Transparent light purpl	1.3	1.5	130		940	GaAs	×	
	SID1003BQ	Transparent light navy blue	1.3	1.5	180		940	GaAs	×	
	SID307BR	Transparent dark navy blue	1.3	1.5	200		940	GaAs	×	
	SID1G307C	Clear	1.5	1.8	50	I_F=50mA	850	GaAs	×	
3φ Round	SID2010C	Clear	1.3	1.5	7.0		940	GaAs	×	47
	SID2K10C	Clear	1.3	1.5	14		940	GaAs	×	

General-purpose LEDs - External Dimensions

(Unit: mm)

Fig. 1

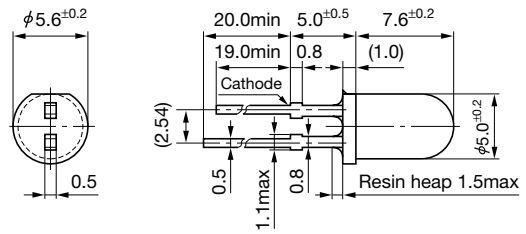


Fig. 2

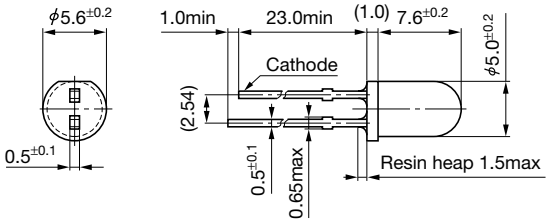


Fig. 3

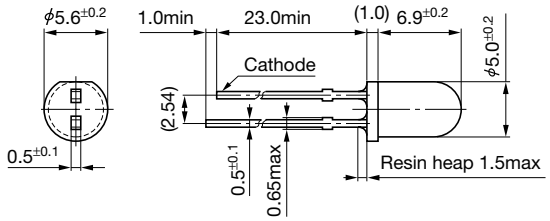


Fig. 4

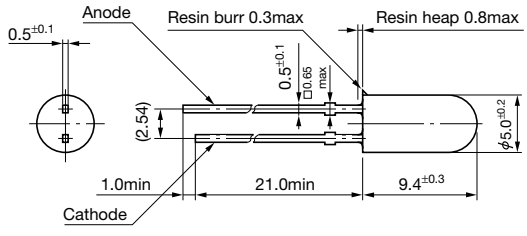


Fig. 5

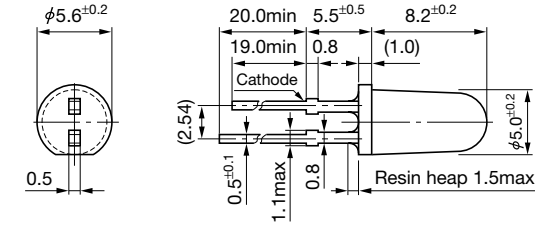


Fig. 6

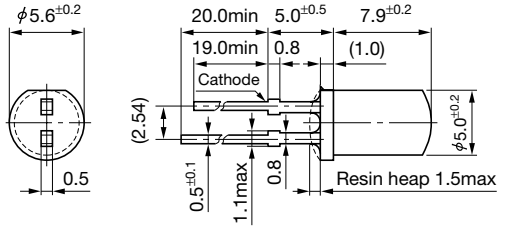


Fig. 7

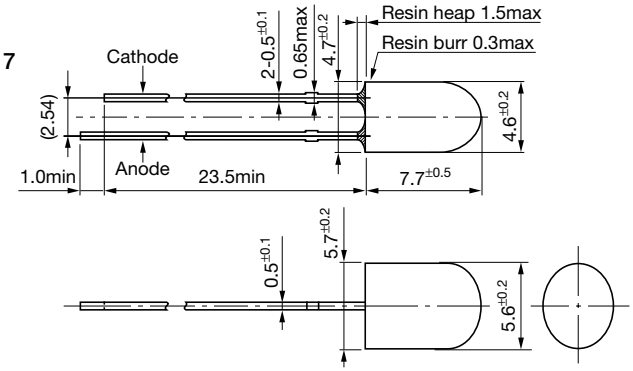


Fig. 8

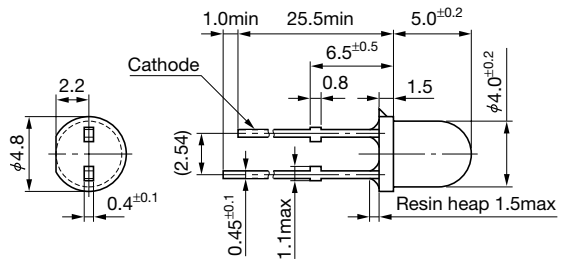


Fig. 9

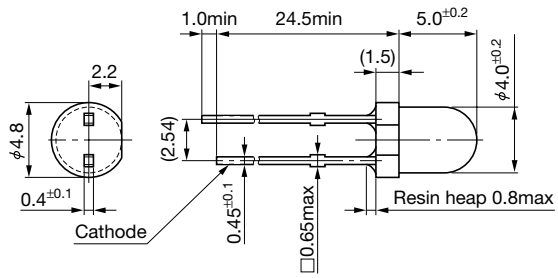
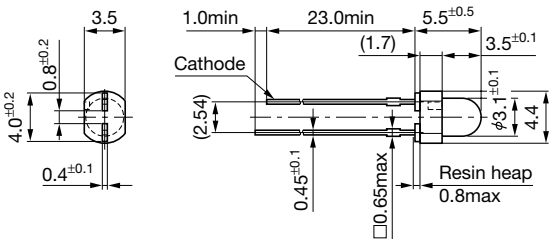


Fig. 10



(Unit: mm)

Fig. 11

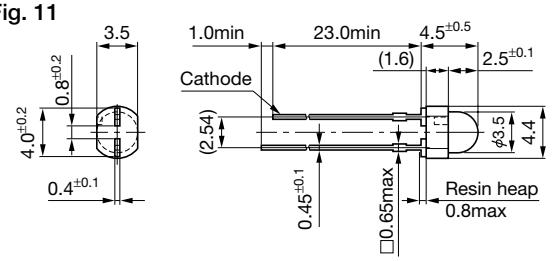


Fig. 12

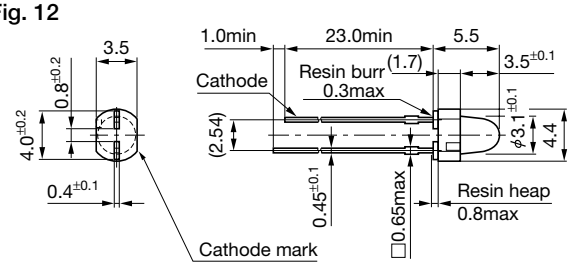


Fig. 13

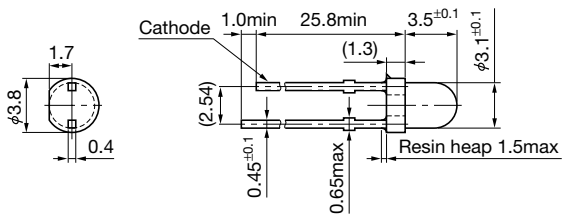


Fig. 14

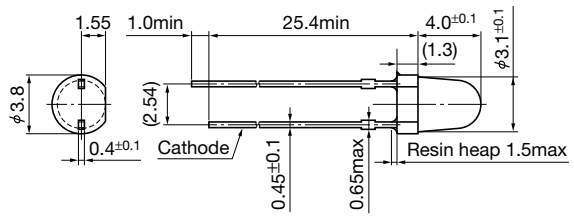


Fig. 15

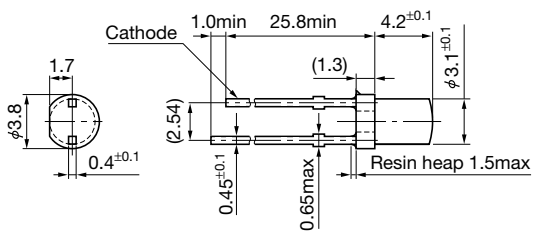


Fig. 16

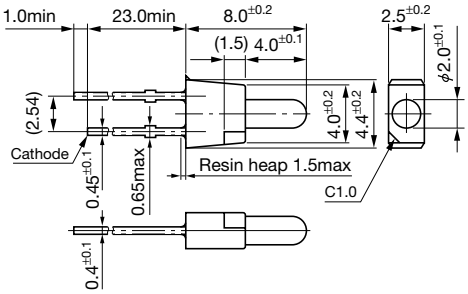


Fig. 17

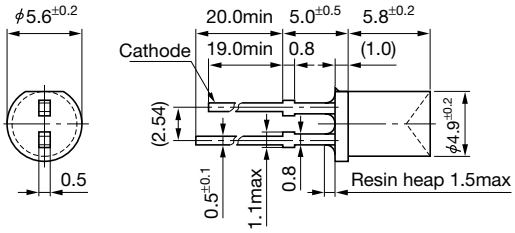


Fig. 18

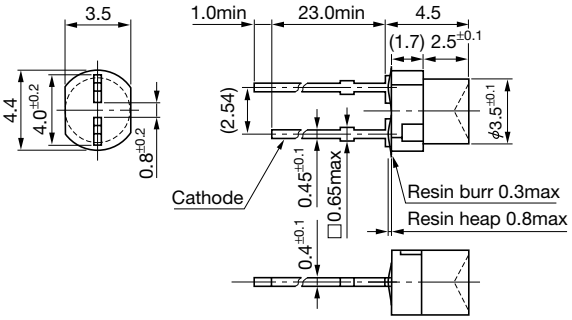


Fig. 19

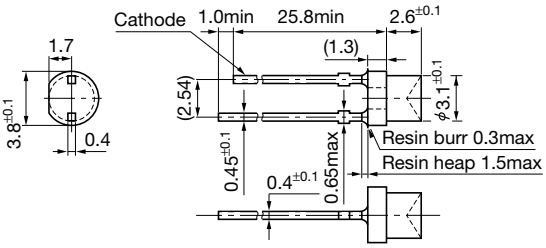
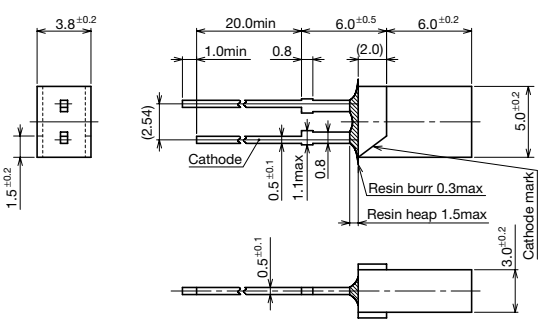


Fig. 20



(Unit: mm)

Fig. 21

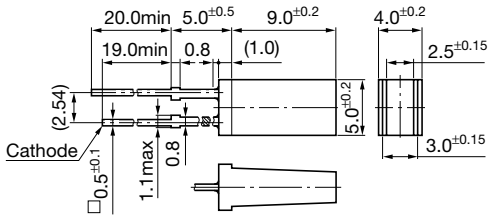


Fig. 22

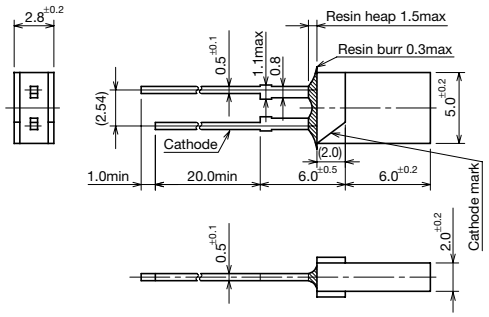


Fig. 23

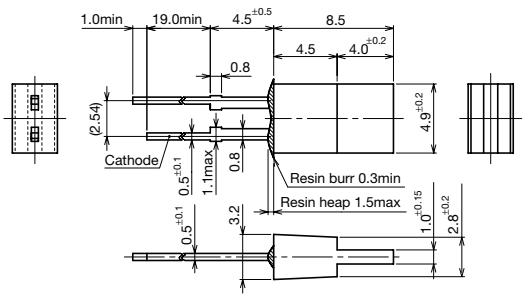


Fig. 24

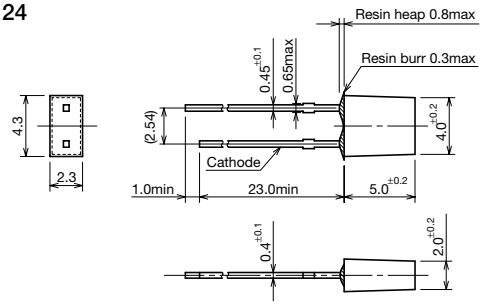


Fig. 25

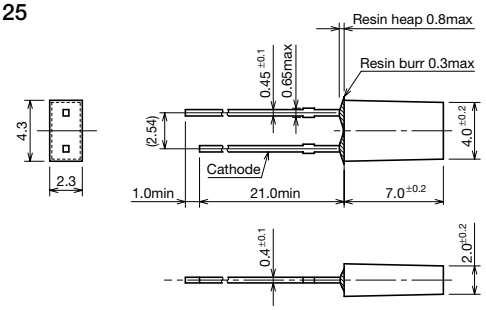


Fig. 26

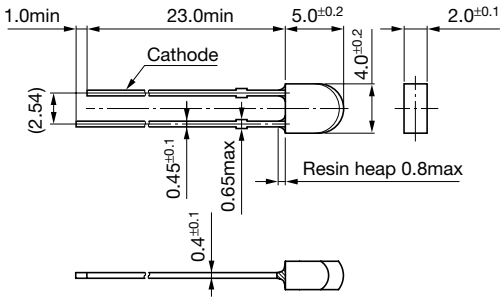


Fig. 27

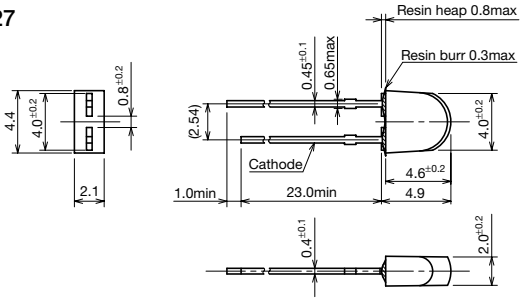


Fig. 28

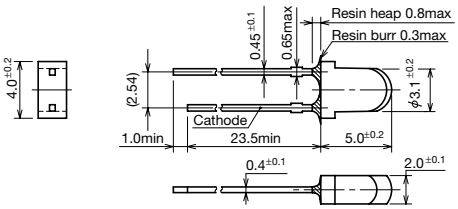
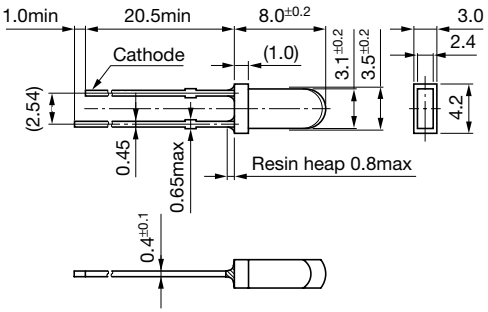


Fig. 29



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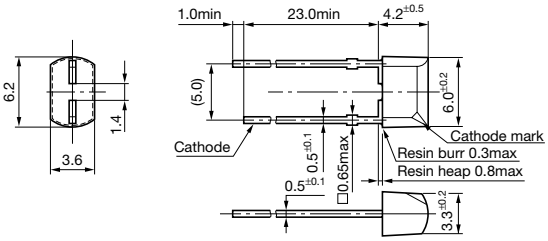


(Unit: mm)

Fig. 31

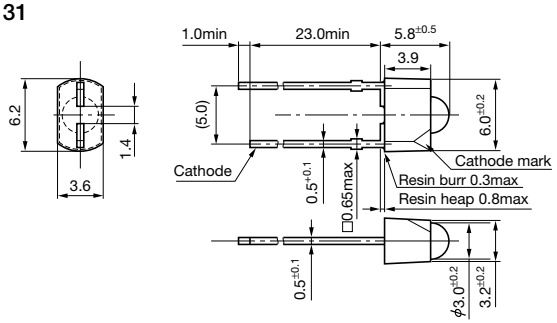


Fig. 32

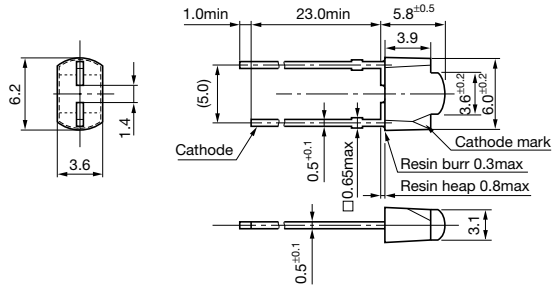
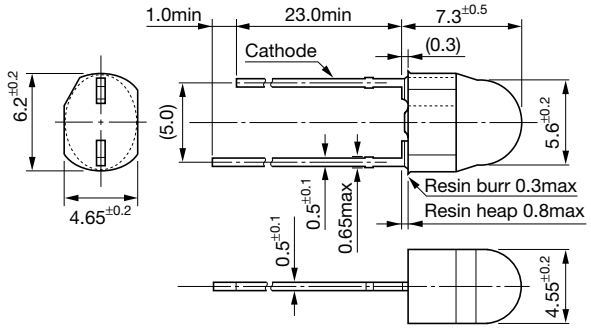


Fig. 33



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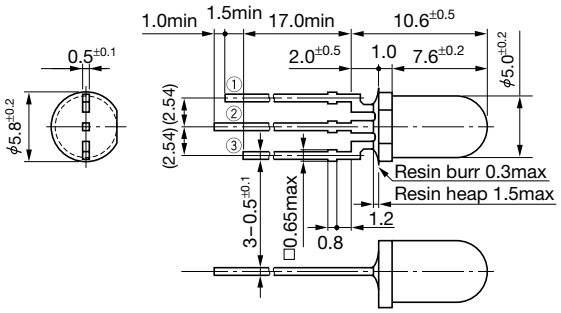
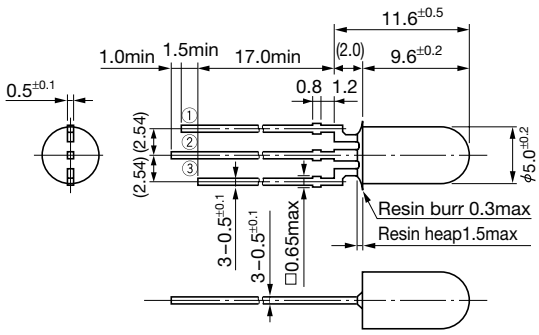


Fig. 35



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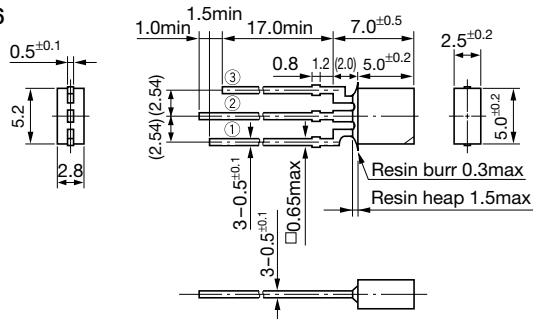

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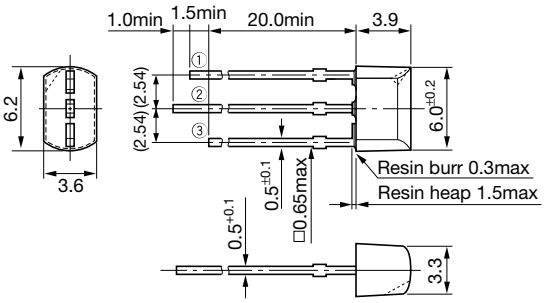

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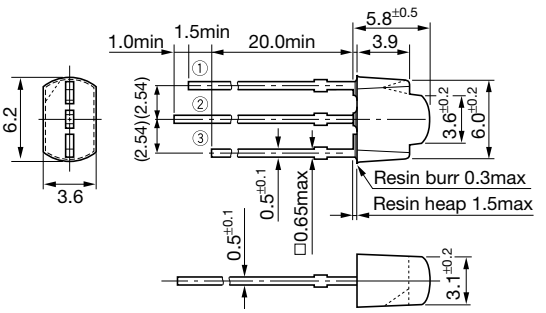

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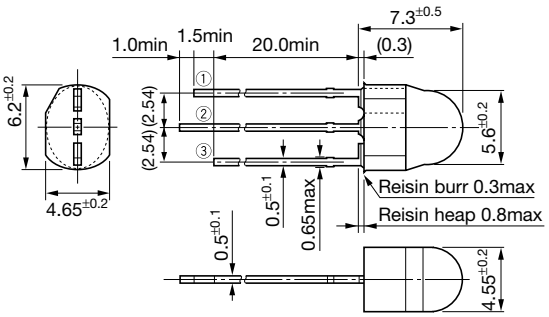

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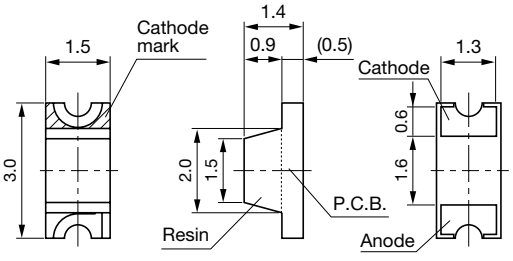
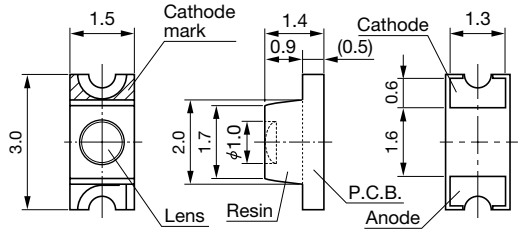


(Unit: mm)

Fig. 41



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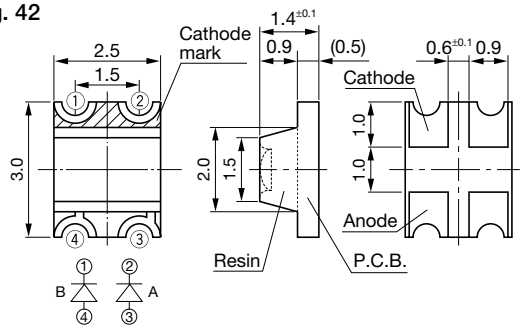

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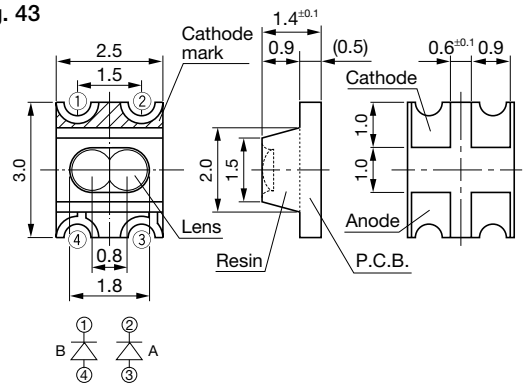

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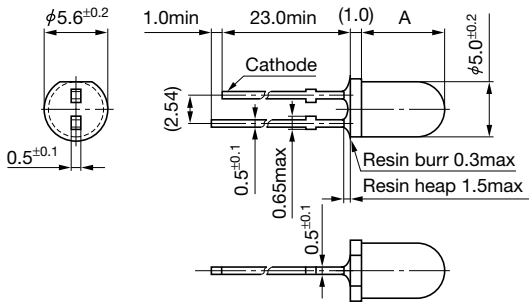


Dimension A (mm)	
SID303C	$3.0^{\pm0.5}$
SID313BP SID1003BQ	$3.6^{\pm0.5}$
SID307BR SID1G307C	$4.2^{\pm0.5}$

Fig. 45

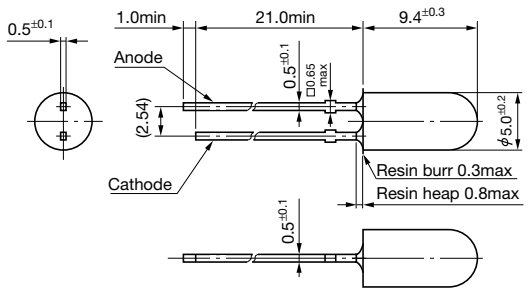


Fig. 46

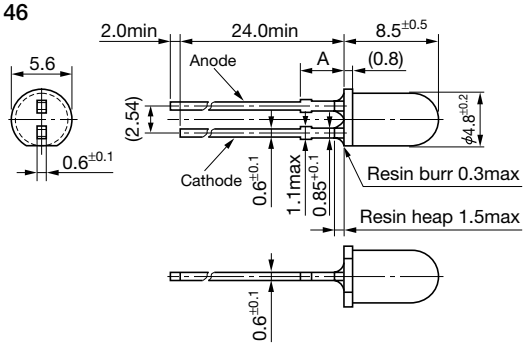
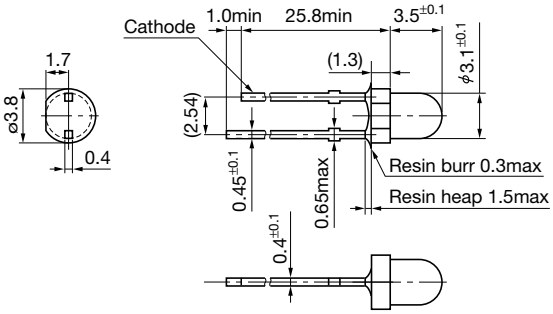


Fig. 47



Index by Part No.

Index by Part No.

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