Agilent Technologies

Advanced Design System 2002

Vendor Component Libraries
muRata Manufacturing
Measurement-Based SMT Library

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Contents

Chapter 1: muRata Manufacturing Measurement-Based SMT Library

The muRata Manufacturing Measurement-Based SMT Library contains the following types of nonlinear models:

- “muRata Manufacturing Measurement-Based SMT Capacitors” on page 2-1
- “muRata Manufacturing Measurement-Based SMT Inductors” on page 3-1

The muRata Manufacturing Measurement-Based SMT Library consists of discrete-value linear models representing 211 surface mount capacitors and 114 surface mount inductors. The models were extracted from data provided by muRata.

Note The library itself is a binary file named *mbMrtLibrary.library* which can be found in *$HPEESOF_DIR/ComponentLibs/models*.

Schematic Design

This section describes the schematic design of the muRata manufacturing measurement-based library components and specifies the simulation models that are incorporated in the design.

Figure 1-1 shows an example of how a measurement-based muRata library SMT capacitor component appears when placed into the Schematic design window. The annotation consists of the component name, the default component ID prefix (in this case, C), and the component parameter, PART_NUM.

Figure 1-1. muRata Manufacturing Measurement-Based SMT Capacitor Component Example

Each library component represents a series of discrete parts with a common case style. The PART_NUM parameter is used to identify a specific discrete part in the selected component. In the Component Parameter dialog box, the Parameter Entry Mode option button for the PART_NUM parameter contains discrete part attributable to the selected component. This option button also includes options for the Discrete Value Optimization and assignment to a specified Variable.

Important In the Variable Part Index assignment, you assign the index number (not the nominal value) to the PART_NUM parameter.

For example, Table 1-1 lists the Parameter Entry Mode options (representing 37 parts ranging from 0.5pF-100pF) for the mb_mrt_GRH_708_19950721 component PART_NUM parameter.

Table 1-1. Discrete Value Optimization Variables

Parameter Entry Mode	Nominal Value	Parameter Entry Mode	Nominal Value
Discrete optimize	(does not apply)	Variable Part Index	(does not apply)
GRH708CK0R5C200	0.5	GRH708CH200J200	20
GRH708CKR75C200	0.75	GRH708CH220J200	22
GRH708CK010C200	1.0	GRH708CH240J200	24
GRH708CK1R5C200	1.5	GRH708CH270J200	27
GRH708CK020C200	2.0	GRH708CH300J200	30
GRH708CJ030C200	3.0	GRH708CH330J200	33
GRH708CH040C200	4.0	GRH708CH360J200	36
GRH708CH050C200	5.0	GRH708CH390J100	39
GRH708CH060C200	6.0	GRH708CH430J100	43
GRH708CH070C200	7.0	GRH708CH470J100	47
GRH708CH080C200	8.0	GRH708CH510J100	51
GRH708CH090C200	9.0	GRH708CH560J100	56
GRH708CH100D200	10	GRH708CH620J100	62
GRH708CH110J200	11	GRH708CH680J100	68
GRH708CH120J200	12	GRH708CH750J50	75
GRH708CH130J200	13	GRH708CH820J50	82

Table 1-1. Discrete Value Optimization Variables (continued)

Parameter Entry Mode	Nominal Value	Parameter Entry Mode	Nominal Value
GRH708CH150J200	15	GRH708CH910J50	91
GRH708CH160J200	16	GRH708CH101J50	100
GRH708CH180J200	18		

The *label* field appearing at the top of the Component Parameter dialog box contains the selected component label.

The measurement-based muRata library component represents an equivalent circuit model embedded within the netlist of the schematic design. Several physical models, described in detail in the following subsections, have been implemented in this library for different series.

Unlike the passive SMT component libraries, the measurement-based libraries do not allow the option of choosing different footprint dimensions, since the measurements are board-dependent.

Statistical Yield Analysis is not available through this library.

For discussions on specific models, refer to:

- “muRata Manufacturing Measurement-Based GRH Capacitors” on page 2-2
- “muRata Manufacturing Measurement-Based GRM Capacitors” on page 2-5

Chapter 2: muRata Manufacturing Measurement-Based SMT Capacitors

The muRata Manufacturing Measurement-Based SMT Capacitor Library groups available for selection from the Schematic and Layout windows are:

For a discussion on the schematic design of the muRata manufacturing measurement-based library components, refer to "Schematic Design" on page 1-1.

muRata Manufacturing Measurement-Based GRH Capacitors

Model

Figure 2-1 shows the equivalent circuit model schematic design of the muRata Manufacturing Measurement-based GRH series SMT capacitors that is based on device measurements and modeling performed by muRata.

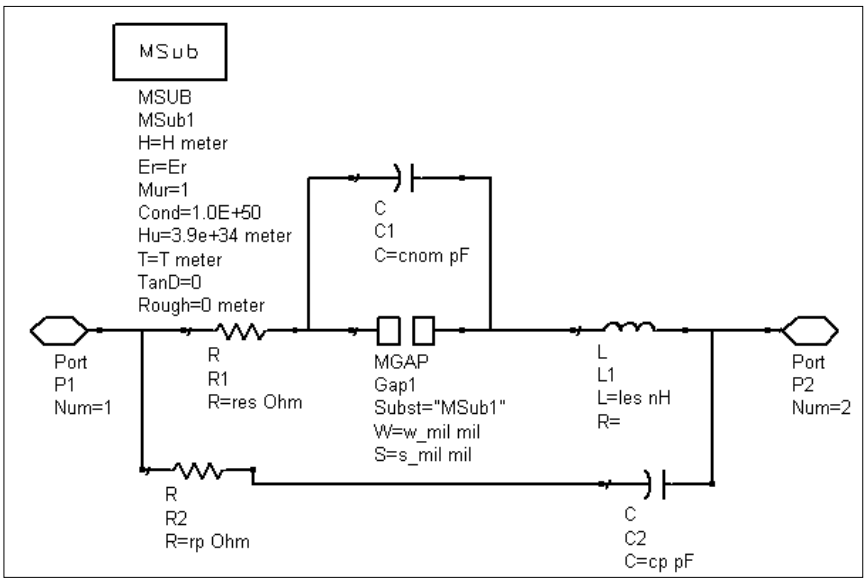

Figure 2-1. muRata Manufacturing Measurement-Based GRH Capacitors Equivalent Circuit Model Schematic Design

The model used for the muRata Manufacturing Measurement-based GRH Series SMT capacitors has been supplied by muRata. This data is based on the capacitors being mounted on a FR4 substrate material. The substrate parameters are constant for all the discrete parts in this component. The FR4 Substrate Parameters are:

Substrate Thickness = 60 mils

Relative Dielectric Constant = 4.43

Relative permiability = 1

Conductor conductivity = 1.0E+306

Cover height = 1.0E+308 meter

Metal thickness = 0 meter

Dielectric Loss Tangent = 0

Conductor Surface roughness = 0 meter

Width of the conductor = 50 mils

Length of the gap = 30 mils

The values of the equivalent circuit components for the GRH model are extracted from *$HPEESOF_DIR/ComponentLibs/models/mbMrt.library*. This model is verified up to 6 GHz.

The equivalent circuit component values are described below:

Cnom: Nominal capacitance, in pF

Rp: Insulation resistance, in Ohm

Cp: Parallel capacitance causing parallel resonance, in pF

Res: Series resistance, in Ohm

Les: Series inductance causing series resonance, in nH

W: Width of the conductor, in mils

S: Length of the gap, in mils

Data

The muRata Manufacturing Measurement-based GRH series SMT capacitors are based on highly accurate models verified up to the first two self-resonant frequencies for each device. Applications of the GRH708 series include cellular phones, GPS and RF LAN.

The muRata Manufacturing Measurement-based GRH series SMT capacitors includes 1 component representing a single case style. The naming convention for this component is *mb_mrt_GRH_<case style>_<extraction date>*.

where:

Thermal coefficient = C0G (0 ±30 ppm/°C thermal coefficient over the temperature range of –55 to 125°C)

Case dimensions (length × width) = (708) 0.080 inches × 0.050 inches

The schematic design model for the muRata Manufacturing Measurement-based GRH series SMT capacitors is given by the muRata Manufacturing Measurement-based GRH capacitor model.

Table 2-1. muRata Measurement-Based GRH Series SMT Capacitors

Component Name	Description
mb_mrt_GRH_708_19950721	muRata Manufacturing GRH Series, 708 Case, 37 Parts: 0.5pF-100pF

muRata Manufacturing Measurement-Based GRM Capacitors

Model

Figure 2-2 shows the equivalent circuit model schematic design of the muRata Manufacturing Measurement-based GRM series SMT capacitors that is based on device measurements and modeling performed by muRata.

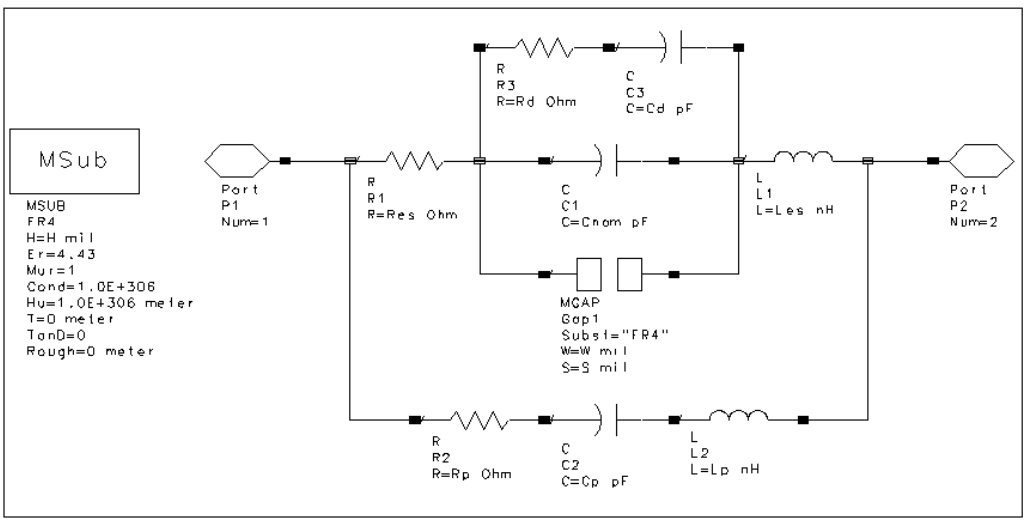

Figure 2-2. muRata Manufacturing Measurement-Based GRM Capacitors Equivalent Circuit Model Schematic Design

The model used for the muRata Manufacturing Measurement-based GRM series SMT capacitors has been supplied muRata. This data is based on the capacitors being mounted on a FR4 substrate material. The substrate parameters are constant for all the discrete parts in this component. The FR4 Substrate Parameters are:

Substrate Thickness (for case sizes 36 and 39) = 30 mils

Substrate Thickness (for case size 40) = 60 mils

Relative Dielectric Constant = 4.43

Relative permiability = 1

Conductor conductivity = 1.0E+306

Cover height = 1.0E+308 meter

Metal thickness = 0 meter

Dielectric Loss Tangent = 0

Conductor Surface roughness = 0 meter

Width of the conductor (for case sizes 36 and 39) = 34.5 mils

Width of the conductor (for case size 40) = 50 mils

Length of the gap (for case sizes 36 and 39) = 19.5 mils

Length of the gap (for case size 40) = 30 mils

The values of the equivalent circuit components for the GRH model are extracted from *$HPEESOF_DIR/ComponentLibs/models/mbMrt.library*. This model is verified up to 6 GHz.

The equivalent circuit component values are described below:

Cnom: Nominal capacitance, in pF

Rp: Insulation resistance, in Ohm

Cp: Parallel capacitance causing parallel resonance, in pF

Lp: Parallel inductance causing parallel resonance, in nH

Res: Series resistance, in Ohm

Les: Series inductance causing series resonance, in nH

Rd: Second-order parallel resistance, in Ohm

Cp: Second-order parallel capacitance providing higher-order resonance, in pF

W: Width of the conductor, in mil

S: Length of the gap, in mil

Data

The muRata Manufacturing Measurement-Based GRM Series SMT capacitors are based on highly accurate models verified up to the first two self resonant frequencies

for each device. The muRata Manufacturing Measurement-based GRM series SMT capacitors are used in pagers, cellular radio, and base stations.

The muRata Manufacturing Measurement-Based GRM Series SMT capacitors include 3 components, representing 3 case styles. The naming convention for these components is *mb_mrt_GRM_<case style>_<extraction date>*.

where:

case style = 36, 39 or 40

case dimensions (length × width) are:

36: 0.040 inches × 0.020 inches

39: 0.060 inches × 0.030 inches

40: 0.080 inches × 0.050 inches

The schematic design model for the muRata Manufacturing Measurement-based GRM series SMT capacitors is given by the muRata Manufacturing Measurement-based GRM capacitor model.

Table 2-2. muRata Measurement-Based GRM Series SMT Capacitors

Component Name	Description
mb_mrt_GRM_36_19950721	muRata Manufacturing GRM Series, 36 Case, 58 Parts: 0.5pF-10nF
mb_mrt_GRM_39_19950721	muRata Manufacturing GRM Series, 39 Case, 58 Parts: 0.5pF-10nF
mb_mrt_GRM_40_19950721	muRata Manufacturing GRM Series, 40 Case, 58 Parts: 0.5pF-10nF

Chapter 3: muRata Manufacturing Measurement-Based SMT Inductors

For a discussion on the schematic design of the muRata manufacturing measurement-based library components, refer to "Schematic Design" on page 1-1.

muRata Manufacturing Measurement-Based LQG, LQP and LQN Series Inductors Model

The model design and measurement and model data for these inductors has been derived by muRata. LQG and LQN series have a unique equivalent circuit model for each case size and the LQP series has the same equivalent circuit model for both case sizes.

LQG Series muRata Manufacturing Measurement-Based Inductors

Schematic Design and Model

For a discussion on the schematic design of the muRata manufacturing measurement-based library components, refer to "Schematic Design" on page 1-1.

For a discussion on the LQG Series model, refer to "muRata Manufacturing Measurement-Based LQG, LQP and LQN Series Inductors Model" on page 3-2.

Data

The muRata Manufacturing Measurement-Based LQG Series SMT inductors are based on highly accurate models verified within the frequency range specified in Table 3-1 for each device for the case style 11A. The frequency range for all the values of the case style 21N is 1.0MHz to 1.0GHz. The muRata Manufacturing Measurement-based LQG series SMT inductors are used in pagers, cellular radio, and wireless communication equipment.

Table 3-1. Frequency Range for Each Discrete Component of muRata Manufacturing Measurement-Based LQG Series 11A Case Style

Part Number	Minimum Frequency	Maximum Frequency	Part Number	Minimum Frequency	Maximum Frequency
LQG11A1N2S00	10 MHz	6.0 GHz	LQG11A10NJ00	10 MHz	4.5 GHz
LQG11A1N5S00	10 MHz	6.0 GHz	LQG11A12NJ00	10 MHz	4.1 GHz
LQG11A1N8S00	10 MHz	6.0 GHz	LQG11A15NJ00	10MHz	3.7 GHz
LQG11A2N2S00	10 MHz	6.0 GHz	LQG11A18NJ00	10 MHz	3.4 GHz
LQG11A2N7S00	10 MHz	6.0 GHz	LQG11A22NJ00	10 MHz	3.1 GHz
LQG11A3N3S00	10 MHz	6.0 GHz	LQG11A27NJ00	10 MHz	2.7 GHz
LQG11A3N9S00	10 MHz	6.0 GHz	LQG11A33NJ00	10 MHz	2.4 GHz
LQG11A4N7S00	10 MHz	6.0 GHz	LQG11A39NJ00	10 MHz	2.3 GHz
LQG11A5N6S00	10 MHz	6.0 GHz	LQG11A47NJ00	10 MHz	2.2 GHz
LQG11A6N8J00	10 MHz	6.0 GHz	LQG11A56NJ00	10 MHz	2.1 GHz
LQG11A8N2J00	10 MHz	5.5 GHz	LQG11A68NJ00	10 MHz	1.7 GHz

The muRata Manufacturing Measurement-Based LQG Series SMT inductors include 2 components, representing 2 case styles. The naming convention for these components is *mb_mrt_LQG_<case style>_<extraction date>*.

where:

case style = 11A or 21N

case dimensions (length × width) are:

11A: 0.063 inches × 0.031 inches

21N: 0.070 inches × 0.049 inches

The equivalent circuit model for the muRata Manufacturing Measurement-based LQG series SMT inductors are given by the muRata Manufacturing Measurement-based LQG11A and LQG21N inductor models.

Table 3-2. muRata Manufacturing Measurement-Based LQG Series SMT Inductors

Component Name	Description
mb_mrt_LQG_11A_19970328	muRata Manufacturing GRH Series, 708 Case, 37 Parts: 0.5pF-100pF
mb_mrt_LQG_21N_19970429	muRata Manufacturing GRM Series, 36 Case, 58 Parts: 0.5pF-10nF

LQN Series muRata Manufacturing Measurement-Based Inductors

Schematic Design and Model

For a discussion on the schematic design of the muRata manufacturing measurement-based library components, refer to "Schematic Design" on page 1-1.

For a discussion on the LQG Series model, refer to "muRata Manufacturing Measurement-Based LQG, LQP and LQN Series Inductors Model" on page 3-2.

Data

The muRata Manufacturing Measurement-Based LQN Series SMT inductors are based on highly accurate models verified within the frequency range specified in Table 3-4 and Table 3-4 for each Discrete Component Value. The muRata Manufacturing Measurement-based LQN series 1H case style SMT inductors are used in mobile communication equipment, FM radio tuners, TV tuners and VIF circuits whereas the high Q value at high frequencies and high self-resonant

frequencies make the 21A case style SMT inductors suitable for use in high frequency circuits of communications equipment.

Table 3-3. Frequency Range for Each Discrete Component of muRata Manufacturing Measurement-Based LQN Series 1H Case Style

Part Number	Minimum Frequency	Maximum Frequency	Part Number	Minimum Frequency	Maximum Frequency
LQN1H54NK04	1.0 MHz	1.8 GHz	LQN1HR39K04	1.0 MHz	1.0 GHz
LQN1H95NK04	1.0 MHz	1.5 GHz	LQN1HR50K04	1.0 MHz	1.0 GHz
LQN1HR14K04	1.0 MHz	1.2 GHz	LQN1HR61K04	1.0 MHz	1.0 GHz
LQN1HR21K04	1.0 MHz	1.0 GHz	LQN1HR75K04	1.0 MHz	1.0 GHz
LQN1HR29K04	1.0 MHz	1.0 GHz	LQN1HR88K04	1.0 MHz	1.0 GHz

Table 3-4. Frequency Range for Each Discrete Component of muRata Manufacturing Measurement-Based LQN Series 21A Case Style

Part Number	Minimum Frequency	Maximum Frequency	Part Number	Minimum Frequency	Maximum Frequency
LQN21A3N3D04	10 MHz	6.0 GHz	LQN21A39NJ04	10 MHz	2.4 GHz
LQN21A6N8D04	10 MHz	6.0 GHz	LQN21A47NJ04	10 MHz	2.2 GHz
LQN21A8N2D04	10 MHz	5.3 GHz	LQN21A56NJ04	10 MHz	2.0 GHz
LQN21A10NJ04	10 MHz	4.2GHz	LQN21A68NJ04	10 MHz	1.7 GHz
LQN21A12NJ04	10 MHz	3.8 GHz	LQN21A82NJ04	10 MHz	1.6 GHz
LQN21A15NJ04	10 MHz	3.5 GHz	LQN21AR10J04	10 MHz	1.5 GHz
LQN21A18NJ04	10 MHz	3.3 GHz	LQN21AR12J04	10 MHz	1.5 GHz
LQN21A22NJ04	10 MHz	3.0 GHz	LQN21AR15J04	10 MHz	1.5 GHz
LQN21A27NJ04	10 MHz	2.9 GHz	LQN21AR18J04	10 MHz	1.3 GHz
LQN21A33NJ04	10 MHz	2.4 GHz	LQN21AR22J04	10 MHz	1.2 GHz

The muRata Manufacturing Measurement-Based LQN Series SMT inductors include 2 components, representing 2 case styles. The naming convention for these components is *mb_mrt_LQN_<case style>_<extraction date>*.

where:

case style = 1H or 21A

case dimensions (length × width) are:

1H: 0.126 inches × 0.063 inches

21A: 0.079 inches × 0.059 inches

The equivalent circuit model for the muRata Manufacturing Measurement-based LQN series SMT inductors are given by the muRata Manufacturing Measurement-based LQN1H and LQN21A inductor models.

Table 3-5. muRata Manufacturing Measurement-Based LQN Series SMT Inductors

Component Name	Description
mb_mrt_LQN_1H_19970429	muRata Manufacturing GRM Series, 39 Case, 58 Parts: 0.5pF-10nF
mb_mrt_LQN_21A_19970328	muRata Manufacturing GRM Series, 40 Case, 58 Parts: 0.5pF-10nF

LQP Series muRata Manufacturing Measurement-Based Inductors

Schematic Design and Model

For a discussion on the schematic design of the muRata manufacturing measurement-based library components, refer to "Schematic Design" on page 1-1.

For a discussion on the LQG Series model, refer to "muRata Manufacturing Measurement-Based LQG, LQP and LQN Series Inductors Model" on page 3-2.

Data

The muRata Manufacturing Measurement-Based LQP Series SMT inductors are based on highly accurate models verified within the frequency range specified in Tables 3-6 and Table 3-7 for each Discrete Component Value. The muRata Manufacturing Measurement-based LQP series SMT inductors are used in pagers, cellular radio, and wireless communication equipment.

Table 3-6. Frequency Range for Each Discrete Component of muRata Manufacturing Measurement-Based LQP Series 11A Case Style

Part Number	Minimum Frequency	Maximum Frequency	Part Number	Minimum Frequency	Maximum Frequency
LQP11A1N3C00	10 MHz	6.0 GHz	LQP11A6N8C00	10 MHz	5.5 GHz
LQP11A1N5C00	10 MHz	6.0 GHz	LQP11A8N2C00	10 MHz	5.0 GHz
LQP11A1N8C00	10 MHz	6.0 GHz	LQP11A10NG00	10 MHz	4.6 GHz
LQP11A2N2C00	10 MHz	6.0 GHz	LQP11A12NG00	10 MHz	4.0 GHz
LQP11A2N7C00	10 MHz	6.0 GHz	LQP11A15NG00	10 MHz	3.6 GHz
LQP11A3N3C00	10 MHz	6.0 GHz	LQP11A18NG00	10 MHz	3.3 GHz
LQP11A3N9C00	10 MHz	6.0 GHz	LQP11A22NG00	10 MHz	3.0 GHz
LQP11A4N7C00	10 MHz	6.0 GHz	LQP11A27NG00	10 MHz	2.8 GHz
LQP11A5N6C00	10 MHz	6.0 GHz	LQP11A33NG00	10 MHz	2.5 GHz

Table 3-7. Frequency Range for Each Discrete Component of muRata Manufacturing Measurement-Based LQP Series 21A Case Style

Part Number	Minimum Frequency	Maximum Frequency	Part Number	Minimum Frequency	Maximum Frequency
LQP21A1N5C14	10 MHz	6.0 GHz	LQP21A15NG14	10 MHz	3.1 GHz
LQP21A1N8C14	10 MHz	6.0 GHz	LQP21A18NG14	10 MHz	2.8 GHz
LQP21A2N2C14	10 MHz	6.0 GHz	LQP21A22NG14	10 MHz	2.5 GHz
LQP21A2N7C14	10 MHz	6.0 GHz	LQP21A27NG14	10 MHz	2.3 GHz
LQP21A3N3C14	10 MHz	6.0 GHz	LQP21A33NG14	10 MHz	2.1 GHz
LQP21A3N9C14	10 MHz	6.0 GHz	LQP21A39NG14	10 MHz	1.9 GHz
LQP21A4N7C14	10 MHz	6.0 GHz	LQP21A47NG14	10 MHz	1.8 GHz
LQP21A5N6C14	10 MHz	6.0 GHz	LQP21A56NG14	10 MHz	1.8 GHz
LQP21A6N8C14	10 MHz	5.2 GHz	LQP21A68NG14	10 MHz	1.6 GHz
LQP21A8N2C14	10 MHz	4.5 GHz	LQP21A82NG14	10 MHz	1.6GHz
LQP21A10NG14	10 MHz	3.9 GHz	LQP21AR10G14	10 MHz	1.5 GHz
LQP21A12NG14	10 MHz	3.5 GHz			

The muRata Manufacturing Measurement-Based LQP Series SMT inductors include 2 components, representing 2 case styles. The naming convention for these components is *mb_mrt_LQP_<case style>_<extraction date>*.

where:

case style = 11A or 21A

case dimensions (length × width) are:

11A: 0.063 inches × 0.031 inches

21A: 0.079 inches × 0.049 inches

The equivalent circuit model for the muRata Manufacturing Measurement-based LQP series SMT inductors is given by the muRata Manufacturing Measurement-based LQP inductor model.

Table 3-8. muRata Manufacturing Measurement-Based LQP Series SMT Inductors

Component Name	Description
mb_mrt_LQP_11A_19970328	muRata Manufacturing LQG Series, 11A Case, 22 Parts: 1.2nH-68nH
mb_mrt_LQP_21A_19970328	muRata Manufacturing LQG Series, 21N Case, 21 Parts: 100nH-4.7uH

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