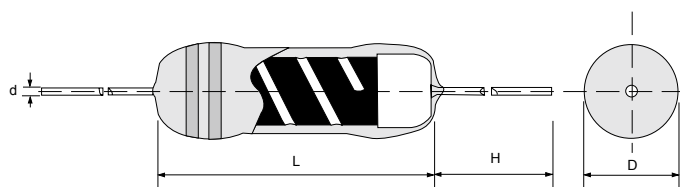


MSD MINIATURE SIZE Pulse Safety Resistor

Quality • Reliability
Cost-Down via Technology

MSD



Specifications Per

- IEC 60115-4
- MIL-11804

Features

- Special composite film on high grade ceramic substrate
- Flameproof coating meets UL 94 V-0 and overload test UL 1412
- Excellent anti-surge capability
- Absorbs pulse from city power line, direct crossing or inductive coupling
- Protects electric equipment or parts from accidental shock
- Low-cost alternative to wire-wound resistors
- Products meet RoHS requirements and do not contain substances of very high concern identified by European Chemicals Agency

DIMENSIONS

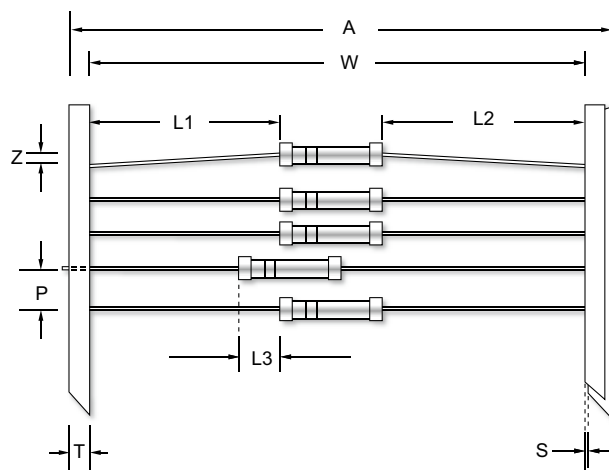
Type	Body Length (L, mm)	Body Diameter (D, mm)	Lead Wire Length (H, mm)	Lead Wire Diameter (d, mm)	Net Weight Per 1000 Pcs
MSD51	6.50 ± 0.5	2.6 ± 0.2	28 ± 3.0	0.6 ± 0.03	300 Grams
MSD101	8.80 ± 1.0	3.2 ± 0.3	28 ± 3.0	0.6 ± 0.03	340 Grams
MSD201	11.0 ± 1.0	4.0 ± 0.5	28 ± 3.0	0.7 ± 0.03	500 Grams
MSD301	13.5 ± 1.0	5.0 ± 0.5	30 ± 3.0	0.8 ± 0.03	1050 Grams
MSD401	15.5 ± 1.0	5.5 ± 0.5	30 ± 3.0	0.8 ± 0.03	1200 Grams
MSD501	19.0 ± 1.0	6.0 ± 0.5	30 ± 3.0	0.8 ± 0.03	1620 Grams
MSD601	19.0 ± 1.0	8.0 ± 0.5	30 ± 3.0	0.8 ± 0.03	3100 Grams

GENERAL SPECIFICATIONS

Type	Power Rating (at 70°C)	Maximum Working Voltage	Maximum Overload Voltage	Minimum Resistance	Maximum Resistance	Resistance Tolerance	Available Resistance Values
MSD51	1/2W	350V	600V	0.1Ω	120KΩ	±0.1~5%	E-24/E-96
MSD101	1W	350V	600V	0.1Ω	120KΩ	±0.1~5%	E-24/E-96
MSD201	2W	350V	600V	0.1Ω	120KΩ	±0.1~5%	E-24/E-96
MSD301	3W	350V	700V	0.1Ω	150KΩ	±0.1~5%	E-24/E-96
MSD401	4W	350V	700V	0.1Ω	150KΩ	±0.1~5%	E-24/E-96
MSD501	5W	450V	800V	0.1Ω	180KΩ	±0.1~5%	E-24/E-96
MSD601	6W	500V	800V	0.1Ω	200KΩ	±0.1~5%	E-24/E-96

Special sizes, values, and specifications not listed available on special order.

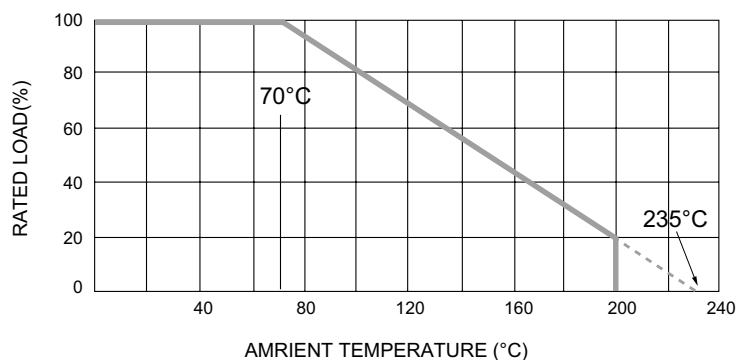
TAPING SPECIFICATIONS



Unit (mm)

Type	A (Max.)	L1-L2 (Max.)	L3 (Max.)	P ±0.5	S (Max.)	T ±0.5	W ±1.5	Z (Max.)
MSD51	65	±1.0	0.5	5.0	0.8	6.0	52.5	1.2
MSD101	65	±1.0	0.5	5.0	0.8	6.0	52.5	1.2
MSD201	76	±1.5	1.0	10.0	0.8	6.0	63.5	1.2
MSD301	76	±1.5	1.0	10.0	0.8	6.0	63.5	1.2
MSD401	76	±1.5	1.0	10.0	0.8	6.0	63.5	1.2
MSD501	76	±1.5	1.0	10.0	0.8	6.0	63.5	1.2
MSD601	76	±1.5	1.0	10.0	0.8	6.0	63.5	1.2

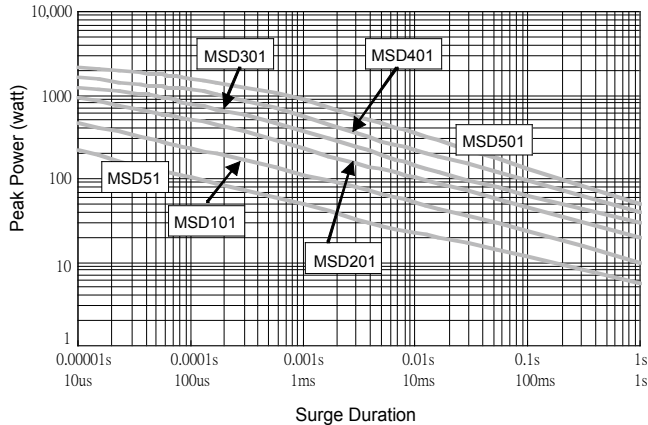
POWER DERATING CURVE



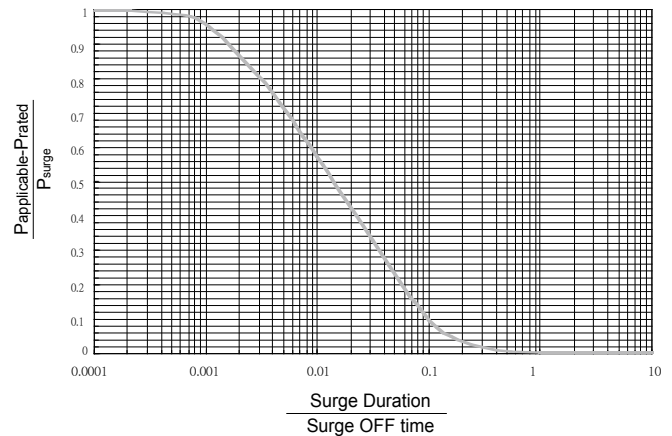
MSD MINIATURE SIZE Pulse Safety Resistor

Quality • Reliability
Cost-Down via Technology

■ SINGLE SURGE PERFORMANCE



■ SURGE POWER DERATING CURVE



Notes:

1. Above graph is accurate for NON REPETITIVE applications operating in an ambient temperature of 70°C or less. For temperatures above 70°C, the graph power must be derated further by 0.62% per °C until 200°C.
2. For applicable surge power in continuous-surge applications please see SURGE POWER DERATING CURVE.

■ TECHNICAL SPECIFICATIONS

Characteristics	Limits	
Dielectric Withstanding Voltage, VAC or DC	1/2W	350
	1W to 2W	600
	3W to 6W	1000
Temperature Coefficient, PPM / °C*	±20~±300 (Typically ±300)	
Operating Temperature Range, °C	-55~+200	
Insulation Resistance, MΩ	10 ⁴	

* Not applicable to all resistance values. Please check with us regarding the PPM of specific resistance value(s).

■ SURGE PERFORMANCE SPECIFICATIONS

Characteristics		Limits
Max. Surge Voltage	MSD51	3000V DC
	MSD101	4000V DC
	MSD201	5000V DC
	MSD301	5500V DC
	MSD401	6000V DC
	MSD501	6500V DC
	MSD601	7000V DC
Surge Voltage = $\sqrt{(1000 \times P \times R)}$ DC P is power rating, R is resistance value, surge voltage is not more than 2 times of max. surge voltage. Surge spec = 1.2/50μs Period = 1 sec Number of surges = 50		±5%

MSD MINIATURE SIZE Pulse Safety Resistor

Quality • Reliability
Cost-Down via Technology

■ PART NUMBER

Example: MSD301J10K0TKZTB500

MSD301	J	10K0	TKZ	TB500
Type	Tolerance*	Resistance	TCR	Packaging
	B (0.1%) D (0.5%) F (1%) J (5%)	10KΩ 4-character code containing - 3 significant digits 1 letter multiplier MULTIPLIER R = 1 K = 10 ³ M = 10 ⁶ G = 10 ⁹	3-character code TKZ = Default Product Temperature Coefficient. Information of typical product temperature coefficient can be found in the Technical Summary section of the datasheet.**	5-character code TB = Tape Box (pieces per box) <u>MSD51/MSD101</u> 2K0 = 2,000 <u>MSD201</u> 1K0 = 1,000 <u>MSD301/401/501</u> 500 = 500 <u>MSD601</u> 400 = 400

* Listed values may not be applicable to all product types or to all resistance values. Please check with us before placing order.

** For the availabilities of non-default temperature coefficient, please check with us. Reference for TCR letter codes can be found in section (4) of Part Number Construction in the Appendices.

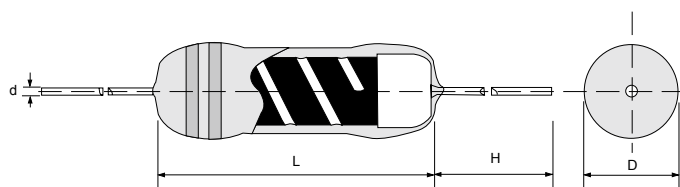
■ PERFORMANCE SPECIFICATIONS

Characteristics	Test Conditions	Limits
Short Time Over Load	IEC 60115-1 4.13 5 seconds 2.5x rated voltage (not over max. overload voltage)	±1%
Load Life In Humidity	IEC 60115-1 4.24 56 days rated load at (40±2)°C and (93±3)% relative humidity	±5%
Load Life 1,000 hours	IEC 60115-1 4.25.1 Rated load with 1.5 hours ON, 0.5 hours OFF, at (70±2)°C	±5%
Resistance To Soldering Heat	IEC 60115-1 4.18.2 Leads immersed till 3mm from the body in (260±5)°C solder for 10±1 seconds	±1%
Solderability	IEC 60115-1 4.17.2 Solder area covered after (235±3)°C/(2±0.2) seconds with flux applied	90% Min.
Vibration	IEC 60115-1 4.22 Six hours in each parallel and axial direction with a simple harmonic motion having an amplitude of 1.52mm and 10 to 2,000 Hz.	±1%
Thermal Endurance	IEC 60115-1 4.25.3 1000 hours at 200°C without load	±1%
Thermal Shock	IEC 60115-1 4.19 -55°C 30minutes, +155°C 30minutes, 5 cycles	±1%

MSD Pulse Safety Resistor

Quality • Reliability
Cost-Down via Technology

MSD



Specifications Per

- IEC 60115-4
- MIL-11804

Features

- Special composite film on high grade ceramic substrate
- Flameproof coating meets UL 94 V-0 and overload test UL 1412
- Excellent anti-surge capability
- Absorbs pulse from city power line, direct crossing or inductive coupling
- Protects electric equipment or parts from accidental shock
- Low-cost alternative to wire-wound resistors
- Products meet RoHS requirements and do not contain substances of very high concern identified by European Chemicals Agency

DIMENSIONS

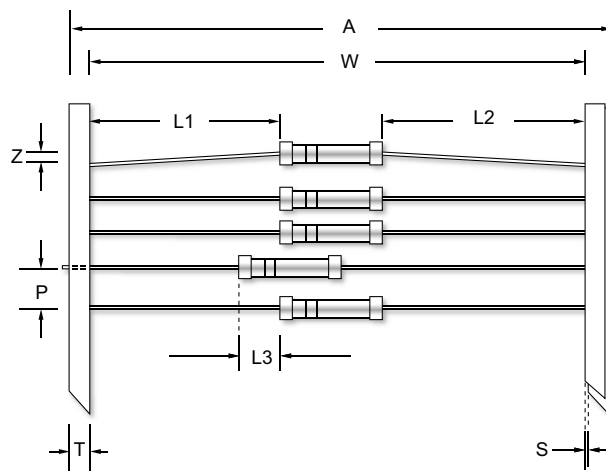
Type	Body Length (L, mm)	Body Diameter (D, mm)	Lead Wire Length (H, mm)	Lead Wire Diameter (d, mm)	Net Weight Per 1000 Pcs
MSD25	6.50 ± 1.0	2.6 ± 0.2	26 ± 3.0	0.6 ± 0.03	300 Grams
MSD50	8.80 ± 1.0	3.2 ± 0.3	28 ± 3.0	0.6 ± 0.03	340 Grams
MSD100	11.0 ± 1.0	4.0 ± 0.5	28 ± 3.0	0.7 ± 0.03	500 Grams
MSD200	13.5 ± 1.0	5.0 ± 0.5	30 ± 3.0	0.8 ± 0.03	1050 Grams
MSD300	15.5 ± 1.0	5.5 ± 0.5	30 ± 3.0	0.8 ± 0.03	1200 Grams
MSD400	19.0 ± 1.0	6.0 ± 0.5	30 ± 3.0	0.8 ± 0.03	1600 Grams
MSD500	19.0 ± 1.0	8.0 ± 0.5	30 ± 3.0	0.8 ± 0.03	3100 Grams
MSD600	24.0 ± 1.0	8.0 ± 0.5	30 ± 3.0	0.8 ± 0.03	3700 Grams

GENERAL SPECIFICATIONS

Type	Power Rating (at 70°C)	Maximum Working Voltage	Maximum Overload Voltage	Minimum Resistance	Maximum Resistance	Resistance Tolerance	Available Resistance Values
MSD25	1/4W	250V	500V	0.1Ω	1MΩ	±5%	E-24
MSD50	1/2W	350V	500V	0.1Ω	120KΩ	±0.1~5%	E-24/E-96
MSD100	1W	350V	600V	0.1Ω	120KΩ	±0.1~5%	E-24/E-96
MSD200	2W	350V	600V	0.1Ω	150KΩ	±0.1~5%	E-24/E-96
MSD300	3W	350V	700V	0.1Ω	150KΩ	±0.1~5%	E-24/E-96
MSD400	4W	450V	700V	0.1Ω	180KΩ	±0.1~5%	E-24/E-96
MSD500	5W	500V	800V	0.1Ω	200KΩ	±0.1~5%	E-24/E-96
MSD600	6W	500V	1000V	0.1Ω	220KΩ	±0.1~5%	E-24/E-96

Special sizes, values, and specifications not listed available on special order.

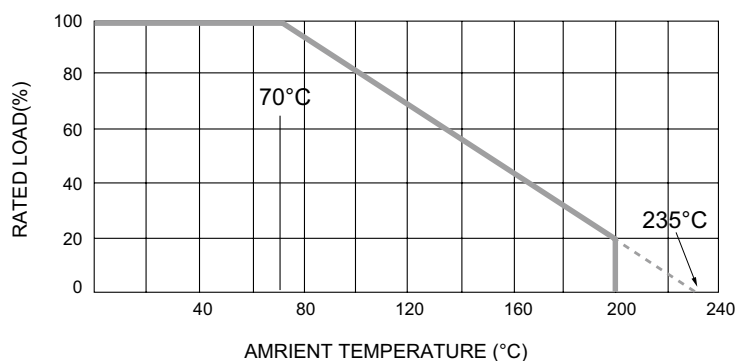
TAPING SPECIFICATIONS



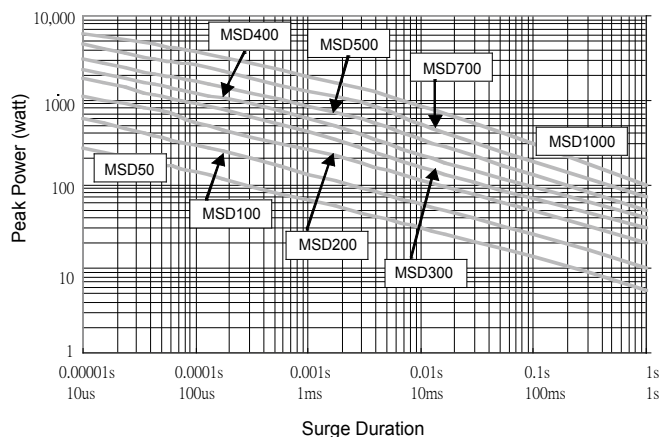
Unit (mm)

Type	A (Max.)	L1-L2 (Max.)	L3 (Max.)	P ±0.5	S (Max.)	T ±0.5	W ±1.5	Z (Max.)
MSD25	65	±1.0	0.5	5.0	0.8	6.0	52.5	1.2
MSD50	65	±1.0	0.5	5.0	0.8	6.0	52.5	1.2
MSD100	65	±1.0	0.5	5.0	0.8	6.0	52.5	1.2
MSD200	76	±1.5	1.0	10.0	0.8	6.0	63.5	1.2
MSD300	76	±1.5	1.0	10.0	0.8	6.0	63.5	1.2
MSD400	76	±1.5	1.0	10.0	0.8	6.0	63.5	1.2
MSD500	76	±1.5	1.0	10.0	0.8	6.0	63.5	1.2
MSD600	97	±1.5	1.0	10.0	0.8	6.0	83.0	1.2

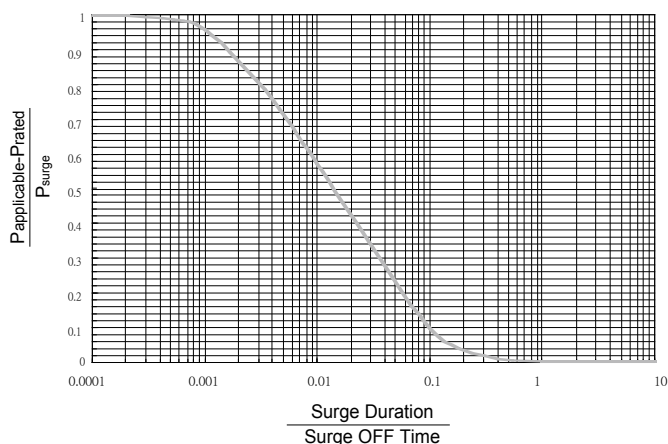
POWER DERATING CURVE



■ SINGLE SURGE PERFORMANCE



■ SURGE POWER DERATING CURVE



Notes:

1. Above graph is accurate for NON REPETITIVE applications operating in an ambient temperature of 70°C or less. For temperatures above 70°C, the graph power must be derated further by 0.62% per °C until 200°C.
2. For applicable surge power in continuous-surge applications please see SURGE POWER DERATING CURVE.

■ TECHNICAL SPECIFICATIONS

Characteristics	Limits	
Dielectric Withstanding Voltage, VAC or DC	1/4W	250
	1/2W	350
	1W to 2W	600
	3W to 6W	1000
Temperature Coefficient, PPM / °C*	±20~±300 (Typically ±300)	
Operating Temperature Range, °C	-55~+200	
Insulation Resistance, MΩ	10 ⁴	

* Not applicable to all resistance values. Please check with us regarding the PPM of specific resistance value(s).

■ SURGE PERFORMANCE SPECIFICATIONS

Characteristics		Limits
Max. Surge Voltage	MSD50	4000V DC
	MSD100	5000V DC
	MSD200	6000V DC
	MSD300	7000V DC
	MSD400	7500V DC
	MSD500	8000V DC
	MSD600	9000V DC
	MSD1000	10000V DC
Surge Voltage = $\sqrt{(1200 \times P \times R)}$ DC P is power rating, R is resistance value, surge voltage is not more than 2 times of max. surge voltage. Surge spec = 1.2/50μs Period = 1 sec Number of surges = 50		±5%

MSD

Pulse Safety Resistor

Quality • Reliability
Cost-Down via Technology

■ PART NUMBER

Example: MSD200J10K0TKZTB500

MSD200	J	10K0	TKZ	TB500
Type	Tolerance*	Resistance	TCR	Packaging
	B (0.1%) D (0.5%) F (1%) J (5%)	10KΩ 4-character code containing - 3 significant digits 1 letter multiplier <u>MULTIPLIER</u> R = 1 K = 10 ³ M = 10 ⁶ G = 10 ⁹	3-character code TKZ = Default Product Temperature Coefficient. Information of typical product temperature coefficient can be found in the Technical Summary section of the datasheet.**	5-character code TB = Tape Box (pieces per box) <u>MSD25/MSD50</u> 2K0 = 2,000 <u>MSD100</u> 1K0 = 1,000 <u>MSD200/300/400</u> 500 = 500 <u>MSD500</u> 400 = 400 <u>MSD600</u> 250 = 250

* Listed values may not be applicable to all product types or to all resistance values. Please check with us before placing order.

** For the availabilities of non-default temperature coefficient, please check with us. Reference for TCR letter codes can be found in section (4) of Part Number Construction in the Appendices.

■ PERFORMANCE SPECIFICATIONS

Characteristics	Test Conditions		Limits
Short Time Over Load	IEC 60115-1 4.13 5 seconds 2.5x rated voltage (not over max. overload voltage)		±1%
Load Life In Humidity	IEC 60115-1 4.24 56 days rated load at (40±2)°C and (93±3)% relative humidity		±5%
Load Life 1,000 hours	IEC 60115-1 4.25.1 Rated load with 1.5 hours ON, 0.5 hours OFF, at (70±2)°C		±5%
Resistance To Soldering Heat	IEC 60115-1 4.18.2 Leads immersed till 3mm from the body in (260±5)°C solder for 10±1 seconds		±1%
Solderability	IEC 60115-1 4.17.2 Solder area covered after (235±3)°C/(2±0.2) seconds with flux applied		90% Min.
Vibration	IEC 60115-1 4.22 Six hours in each parallel and axial direction with a simple harmonic motion having an amplitude of 1.52mm and 10 to 2,000 Hz.		±1%
Thermal Endurance	IEC 60115-1 4.25.3 1000 hours at 200°C without load		±1%
Thermal Shock	IEC 60115-1 4.19 -55°C 30minutes, +155°C 30minutes, 5 cycles	1/4W 1/2~6W	±2% ±3%