

ELITAVIA





THINKING
Your Best Choice

ESD PROTECTOR
LCP SERIE
TVMG SERIE

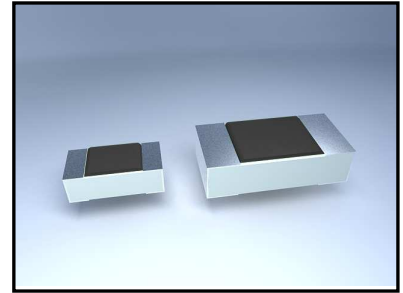
ESD Protector : LCP Series

Ultra-Low Capacitance ESD Suppressor for High-Speed Application



■ Features

1. RoHS compliant and lead-free
2. EIA size 0402, 0603
3. Ultra-low capacitance ($<0.2\text{pF}$) and low leakage current ($<0.05\mu\text{A}$)
4. Fast response time ($<1\text{ns}$)
5. Bi-directional device
6. Rate for ESD protection and pass IEC 61000-4-2 level 4 test



■ Recommended Applications

1. High-Speed Data Lines (HDMI, Serial ATA, USB, IEEE1394)
2. Antenna Circuit (Cellular phone, GPS...)
3. Digital Cameras
4. Set-Top Boxes
5. Printer Ports

■ Part Number Code

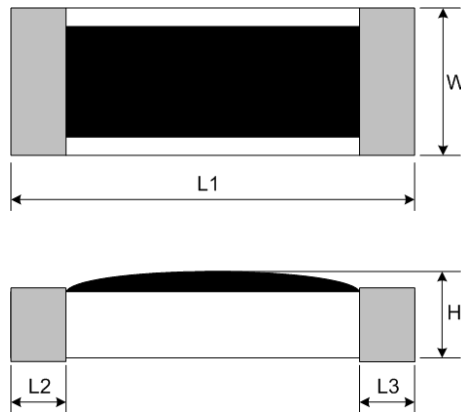
L	C	P	0	G	0	5	0	M	0	R	2	R					
1	2	3	4	5	6	7	8	9	10	11	12	13					
Product Type			Size		Max. Operating Voltage (V _{DC})			Max. Capacitance			Packaging						
LCP	THINKING Low Capacitance ESD Suppressor LCP Type		0	0402	050		5V	M0R2	0.2pF (@1MHZ, 1Vrms)		R	Reel					
			1	0603	120		12V										
				Series Code													
				G		G Series											

ESD Protector : LCP Series

Ultra-Low Capacitance ESD Suppressor for High-Speed Application



■ Structures and Dimensions



(Unit: mm)

Part No.	Size (EIA)	L1	W	H	L2 and L3
LCP0G	0402	1.00 ± 0.15	0.50 ± 0.10	0.35 ± 0.10	0.20 ± 0.10
LCP1G	0603	1.60 ± 0.15	0.80 ± 0.15	0.50 ± 0.15	0.35 ± 0.15

■ Electrical Characteristics

Part No.	Size	Max. Operating Voltage	Typical Trigger Voltage	Max. Capacitance @1MHZ, 1Vrms	Clamping Voltage @8KV, 30ns (*1)		Max. Leakage Current @V _{DC}	Min. ESD Pulse Withstand	Insulation Resistance	Operating Temperature Range
		V _{DC} (V)	V _T (V)	C (pF)	V _c (V)		I _L (μA)	Times	R(MΩ)	(°C)
					Typical	Max.				
LCP0G050M0R2R	0402	5	300	0.2	30	100	0.05	1000	>100	-40 ~ +85
LCP1G050M0R2R	0603									
LCP0G120M0R2	0402	12	360							
LCP1G120M0R2	0603									

Note *1: The clamping voltage follows IEC 61000-4-2, level 4 8 kV contact discharge and shall be measured at 30 ns after initiation of pulse.

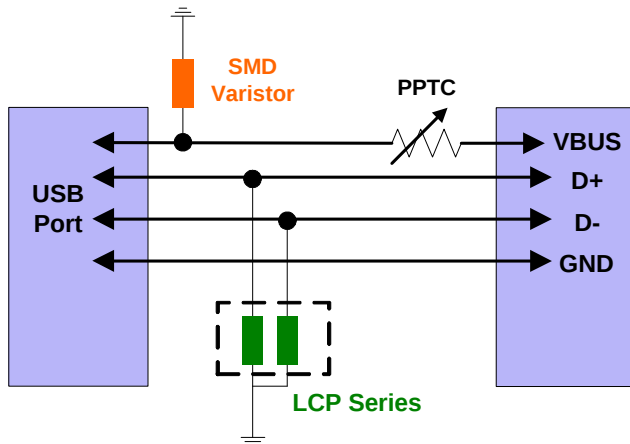
ESD Protector : LCP Series

Ultra-Low Capacitance ESD Suppressor for High-Speed Application

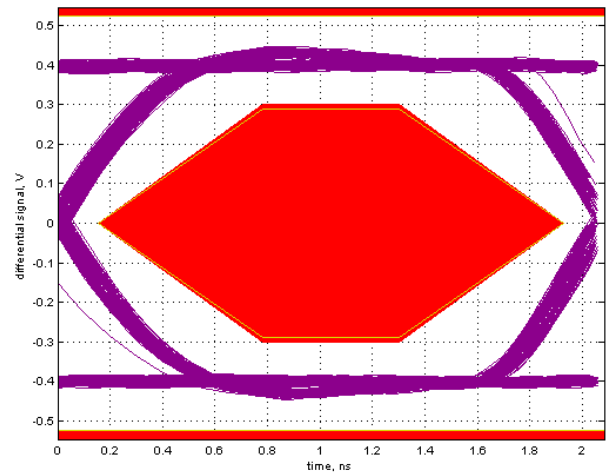


■ Typical Application Circuit

USB 2.0 Protection

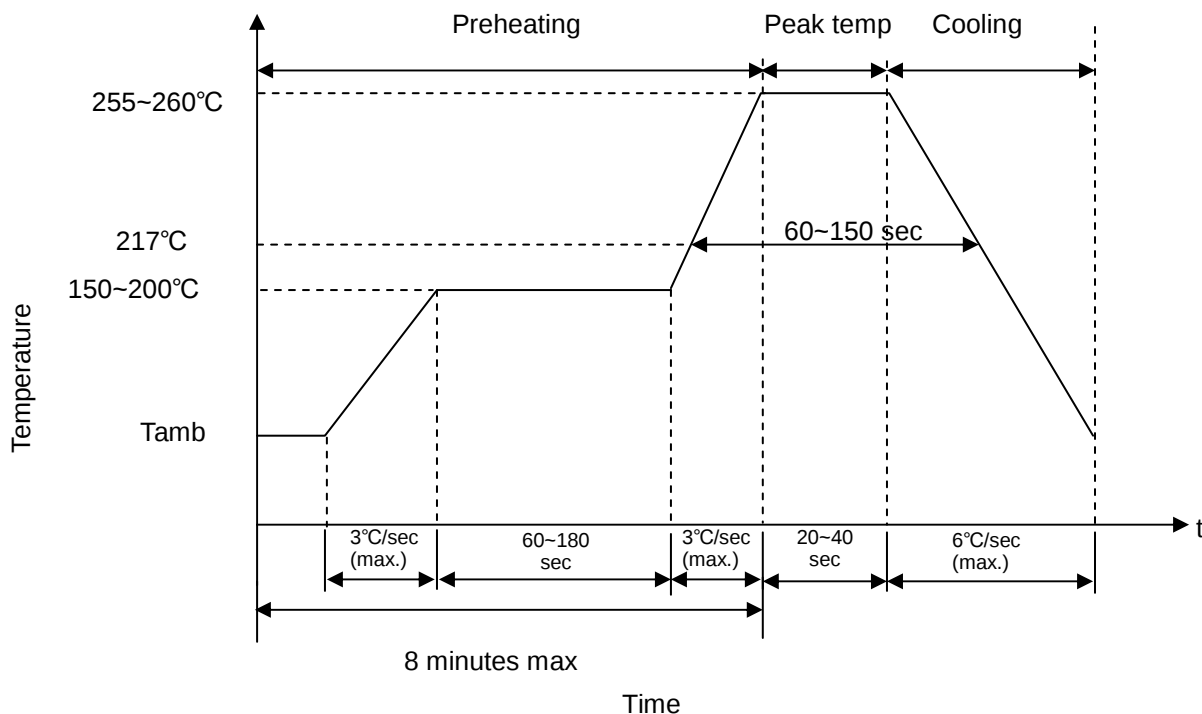


■ Eye Diagram



■ Soldering Recommendation

● IR-Reflow Soldering Profile



ESD Protector : LCP Series

Ultra-Low Capacitance ESD Suppressor for High-Speed Application

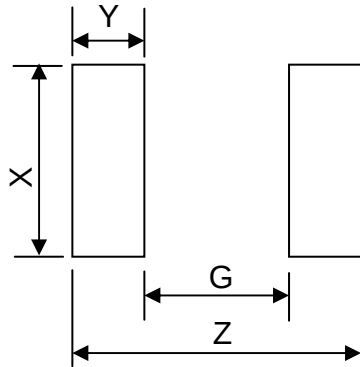


■ Recommended Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	360°C (max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	Φ3mm (max.)

Caution: Please do not directly touch the component surface with soldering iron to avoid its damage.

■ Recommended Soldering Pad Dimensions

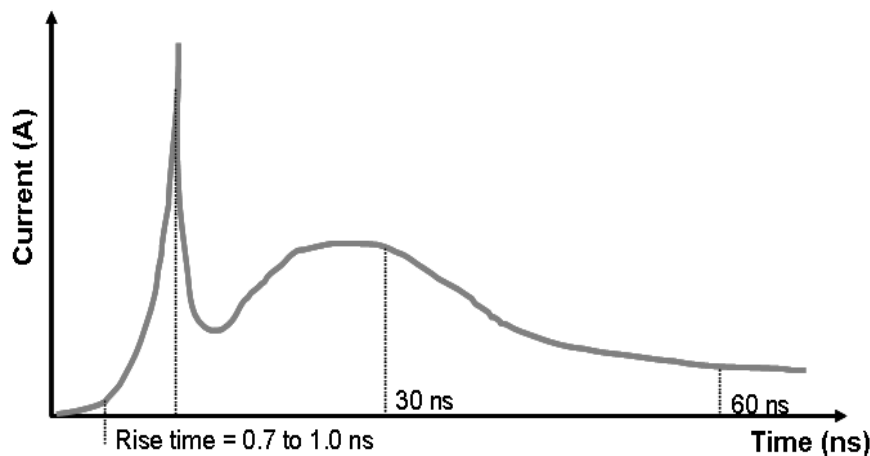


Size (EIA)	Z (mm)	G (mm)	X (mm)	Y (mm)
0402	1.7	0.5	0.6	0.6
0603	3.0	1.0	1.0	1.0

■ Electrostatic Discharge-ESD Reliability

Severity Level	Discharge Voltage	Initial Current	30 ns Current	60 ns Current
1	2 kV	7.5 A	4A	2A
2	4 kV	15.0 A	8A	4A
3	6 kV	22.5 A	12A	6A
4	8 kV	30.0 A	16A	8A

* Follow IEC61000-4-2



ESD Protector : LCP Series

Ultra-Low Capacitance ESD Suppressor for High-Speed Application



■ Reliability

Item	Standard	Test conditions / Methods	Specifications		
Resistance to Soldering Heat	IEC 60068-2-58	260 ± 5 °C, 10 ± 1 sec	I _L ≤ 10μA No visible damage		
High Temperature Load	IEC 61051-1	85 ± 2 °C, 1000 ± 24 hrs at V _{DC}	I _L ≤ 10μA No visible damage		
Damp Heat Load, Steady State	IEC 61051-1	40±2°C, 90-95%RH, 1000±24hrs, at V _{DC}	I _L ≤ 10μA No visible damage		
Rapid Change of Temperature	IEC 61051-1	The conditions shown below shall be repeated 5 cycles		I _L ≤ 10μA No visible damage	
		Step	Temperature (°C)		Period (minutes)
		1	-40±5		30±3
		2	Room temperature		5±3
		3	85±5		30±3
		4	Room temperature		5±3

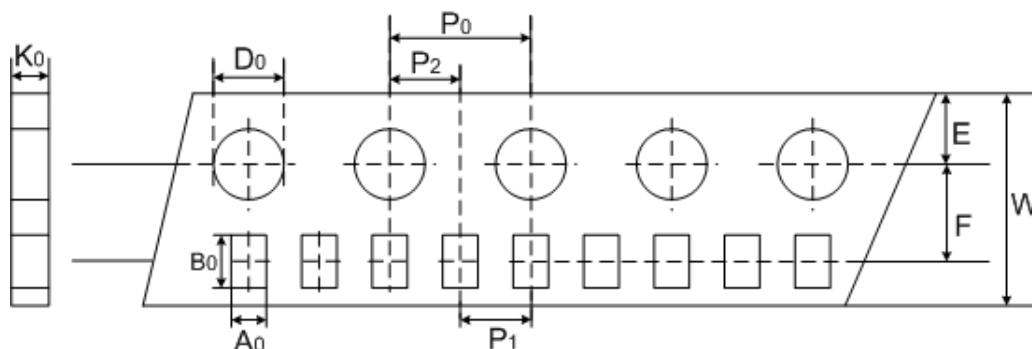
ESD Protector : LCP Series

Ultra-Low Capacitance ESD Suppressor for High-Speed Application

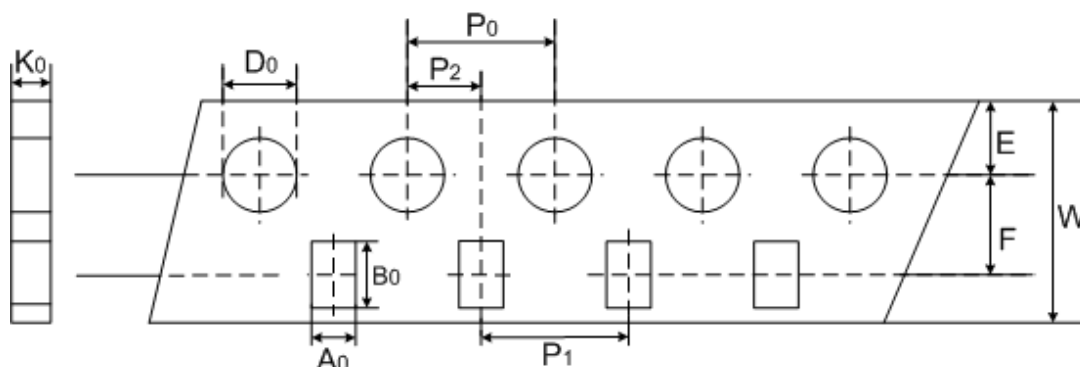


■ Packaging

● Taping Specification



Index Type	A_0	B_0	W	E	F	P_1	P_2	P_0	D_0	K_0
0402	± 0.05	± 0.12	± 0.2	± 0.1	± 0.05	± 0.1	± 0.05	± 0.1	± 0.1	± 0.1



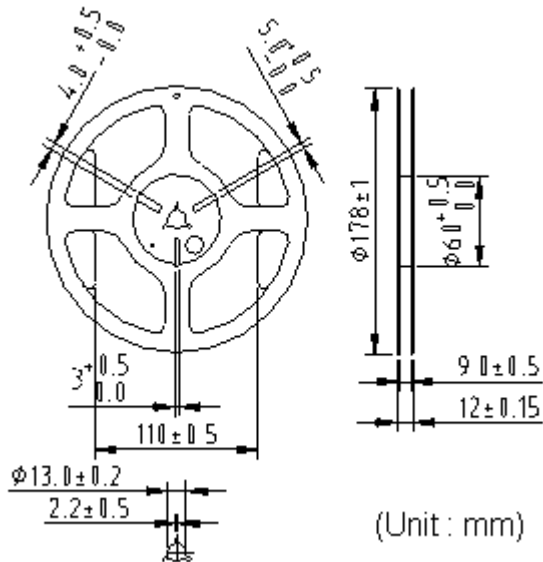
Index Type	A_0	B_0	W	E	F	P_1	P_2	P_0	D_0	K_0
0603	± 0.2	± 0.2	± 0.2	± 0.1	± 0.05	± 0.1	± 0.05	± 0.1	± 0.1	± 0.1

ESD Protector : LCP Series

Ultra-Low Capacitance ESD Suppressor for High-Speed Application



■ Quantity



● Reel Packing

Type	Quantity (pcs/reel)
0402	10,000
0603	4,000

■ Warehouse Storage Conditions of Products

● Storage Conditions :

1. Storage Temperature : -10°C~+40°C
2. Relative Humidity : ≤75%RH
3. Keep away from corrosive atmosphere and sunlight.

● Period of Storage: 1 year.

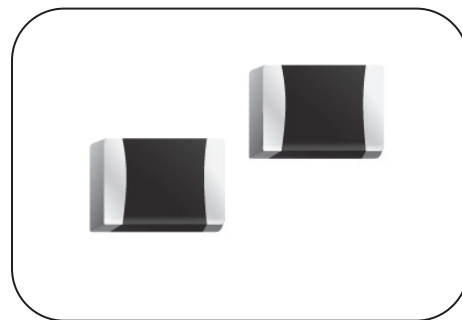
Metal Oxide Varistor : TVM-G Series



SMD Type for ESD Suppressor

■ Feature

1. RoHS & Halogen Free (HF) compliant
2. Low clamping voltage
3. EIA size: 0201, 0402, 0603, 0805
4. Operating voltage: 5.5Vdc ~ 30Vdc
5. Bidirectional and symmetrical V/I characteristics
6. Multilayer ceramic construction technology
7. Rate for IEC61000-4-2 ESD level 4 test
8. Variable capacitance
9. Operating temperature range: -40°C ~ +85°C
Storage temperature range: -40°C ~ +125°C



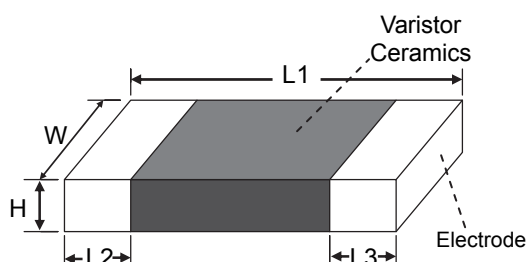
■ Recommended Applications

1. Cellular phones
2. I/O port for mother board
3. LCD module
4. Data line (e.g. USB)
5. PDA
6. Bluetooth headset

■ Part Number Code

T	V	M	0	G	5	R	5	M	4	1	1	R													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16										
Product Type		Series		Max. Continuous Voltage(V _{DC})		Typical Capacitance		Packaging		Optional Suffix															
TVM	THINKING SMD Varistor TVM Series	G	G Series	5R5	5.5V	K500	50x10 ⁰ pF=50pF (@1KHz)	R	Reel	RoHS & HF Compliant															
				090	9x10 ⁰ =9V	M411	41x10 ¹ pF=410pF (@1MHz)	B	Bulk																
		Size(EIA)																							
		A	0201																						
		0	0402																						
		1	0603																						
		2	0805																						

■ Structure and Dimensions



(Unit: mm)

Series	Size (EIA)	L1	W	Hmax.	L2 and L3
TVMA	0201	0.60±0.05	0.30±0.05	0.35	0.15±0.05
TVM0	0402	1.00±0.15	0.50±0.10	0.60	0.20±0.10
TVM1	0603	1.60±0.15	0.80±0.15	0.95	0.35±0.15
TVM2	0805	2.00±0.20	1.25±0.20	1.00	0.40±0.20

Metal Oxide Varistor : TVM-G Series

SMD Type for ESD Suppressor



Electrical Characteristics

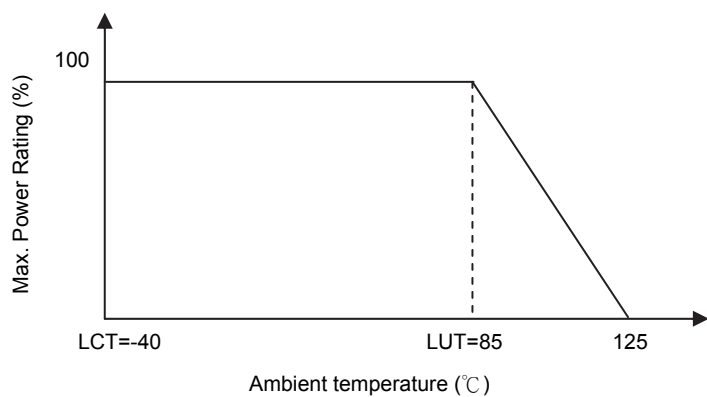
Part No.	EIA Size	Max. Continuous Voltage	Varistor Voltage (@ 1mA DC)	Max. Clamping Voltage (8/20μs)		Max. Surge Current (8/20μs)	Max. Energy (10/1000μs)	Typical Capacitance @1MHz
		V _{DC}	V _{1mA}	V _p	I _p	I _{max}	W _{max}	C _p
		(V)	(V)	(V)	(A)	(A)	(J)	(pF)
TVMAG5R5M330R	0201	5.5	12.7~17.3	40	1	1	0.01	33
TVMAG5R5M470R	0201	5.5	12.7~17.3	36	1	1	0.01	47
TVM0G5R5M100R	0402	5.5	8.8~13.2	35	1	1	0.01	10
TVM0G5R5M220R	0402	5.5	8.8~13.2	33	1	1	0.01	22
TVM0G5R5M330R	0402	5.5	8.8~13.2	31	1	4	0.02	33
TVM0G5R5M400R	0402	5.5	8.8~13.2	30	1	4	0.02	40
TVM0G5R5M900R	0402	5.5	8.8~13.2	30	1	10	0.05	90
TVM0G5R5M261R	0402	5.5	8.8~13.2	25	1	20	0.05	260
TVM0G5R5M411R	0402	5.5	8.8~13.2	25	1	20	0.05	410
TVM1G5R5M100R	0603	5.5	8.8~13.2	35	1	1	0.01	10
TVM1G5R5M220R	0603	5.5	8.8~13.2	34	1	2	0.02	22
TVM1G5R5M761R	0603	5.5	8.0~12.0	25	1	30	0.1	760
TVM2G5R5M991R	0805	5.5	8.0~12.0	25	1	40	0.1	990
TVM0G090M220R	0402	9	11~16	38	1	2	0.02	22
TVM0G090M400R	0402	9	11~16	35	1	4	0.02	40
TVM0G090M141R	0402	9	11~16	30	1	20	0.05	140
TVM0G090M201R	0402	9	11~16	30	1	20	0.05	200
TVM1G090M220R	0603	9	11~16	40	1	2	0.02	22
TVM2G090M521R	0805	9	11~16	29	1	40	0.1	520
TVM0G140M400R	0402	14	15.9~21.5	42	1	4	0.02	40
TVM0G140M900R	0402	14	15.9~21.5	38	1	20	0.05	90
TVM0G140M151R	0402	14	15.9~21.5	38	1	20	0.05	150
TVM1G140M181R	0603	14	15.9~21.5	37	1	30	0.1	180
TVM2G140M321R	0805	14	15.9~20.3	34	1	40	0.1	320
TVM2G140M561R	0805	14	15.9~20.3	32	1	120	0.3	560
TVMAG180M030R	0201	18	46~75	135	1	1	0.01	3
TVM0G180M030R	0402	18	46~75	135	1	1	0.01	3
TVM0G180M120R	0402	18	22~28	55	1	2	0.03	12
TVM0G180M300R	0402	18	22~28	52	1	4	0.05	30
TVM0G180M500R	0402	18	22~28	50	1	20	0.05	50
TVM1G180M030R	0603	18	46~75	135	1	1	0.01	3
TVM1G180M120R	0603	18	22~28	55	1	2	0.03	12
TVM1G180M121R	0603	18	22~28	50	1	30	0.1	120
TVM2G180M291R	0805	18	22~28	44	1	40	0.1	290
TVM2G180M521R	0805	18	22~28	44	1	120	0.3	520
TVM1G260M111R	0603	26	31~38	60	1	30	0.1	110
TVM2G260M141R	0805	26	29.5~38.5	60	1	40	0.1	140
TVM2G260M221R	0805	26	29.5~38.5	60	1	100	0.3	220
TVM1G300M900R	0603	30	37~46	74	1	30	0.1	90
TVM2G300M900R	0805	30	37~46	72	1	30	0.1	90

Metal Oxide Varistor : TVM-G Series

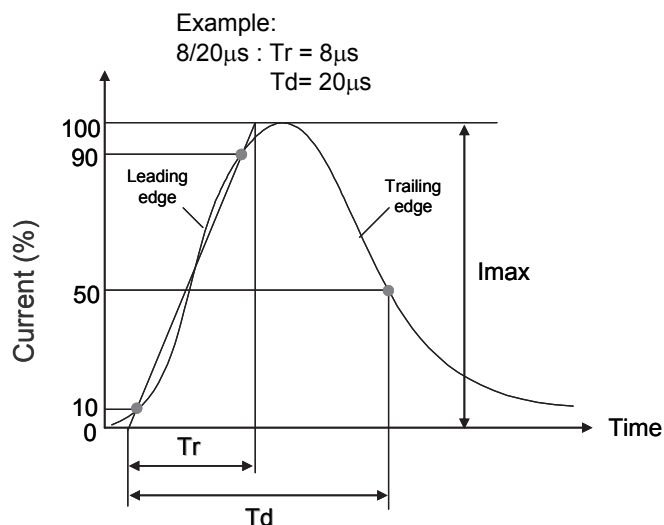


SMD Type for ESD Suppressor

■ Power Derating Curve

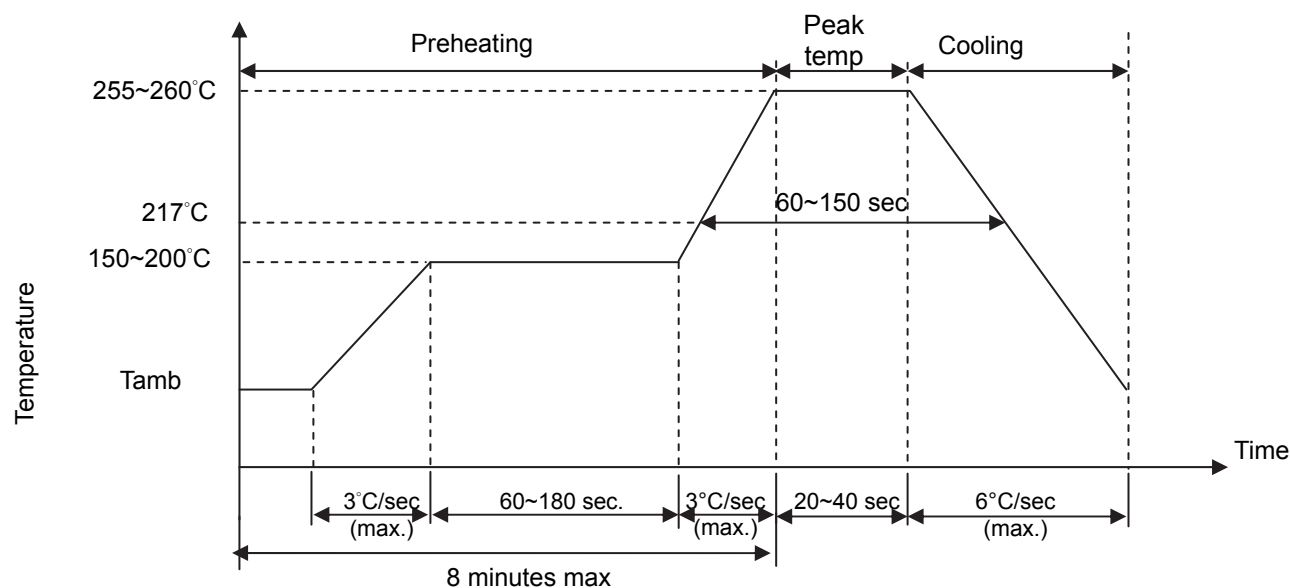


■ Surge Current Standard Waveform



■ Soldering Recommendation

● IR-reflow Soldering Profile



Metal Oxide Varistor : TVM-G Series

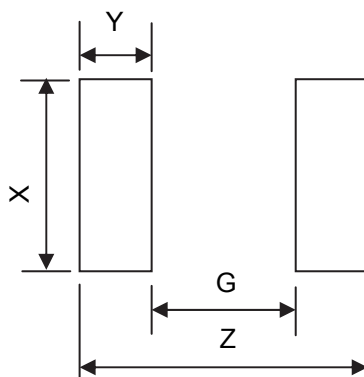
SMD Type for ESD Suppressor



● Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	360°C (max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	Φ3 mm (max.)
Caution: Please do not touch the component surface with soldering iron directly to avoid its damage.	

■ Recommended Soldering Pad Dimensions



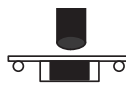
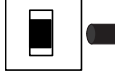
Size	Z (mm)	G (mm)	X (mm)	Y (mm)
0201	0.8	0.3	0.3	0.25
0402	1.7	0.5	0.6	0.6
0603	3.0	1.0	1.0	1.0
0805	3.4	1.0	1.4	1.2

Metal Oxide Varistor : TVM-G Series

SMD Type for ESD Suppressor



■ Reliability

Item	Standard	Test conditions / Methods	Specifications															
Bending Strength	IEC 60068-2-21	Warp: 2mm ; Speed<0.5mm/sec Duration: 10 sec on PCB 	$ \Delta V_{1mA}/V_{1mA} \leq 5\%$ No visible damage															
Adhesion	Specification standard	Speed < 0.5mm/sec on PCB 	$W \geq 0.5Kgf$ the terminal electrode shall be break off not the chip element															
Damp Heat Load, Steady State	IEC 60068-2-78	40±2℃ 90~95% RH 500±24hrs at V _{dc}	$ \Delta V_{1mA}/V_{1mA} \leq 10\%$ No visible damage															
High Temp. Storage	IEC 61051-1	125±5 °C x 1000±24 hrs	$ \Delta V_{1mA}/V_{1mA} \leq 5\%$ No visible damage															
Rapid Change of Temperature	IEC 61051-1	The conditions shown below shall be repeated 5 cycles on PCB <table border="1"><thead><tr><th>Step</th><th>Temperature (℃)</th><th>Period (minutes)</th></tr></thead><tbody><tr><td>1</td><td>-40±3</td><td>30±3</td></tr><tr><td>2</td><td>Room temperature</td><td>5±3</td></tr><tr><td>3</td><td>125±2</td><td>30±3</td></tr><tr><td>4</td><td>Room temperature</td><td>5±3</td></tr></tbody></table>	Step	Temperature (℃)	Period (minutes)	1	-40±3	30±3	2	Room temperature	5±3	3	125±2	30±3	4	Room temperature	5±3	$ \Delta V_{1mA}/V_{1mA} \leq 5\%$ No visible damage
Step	Temperature (℃)	Period (minutes)																
1	-40±3	30±3																
2	Room temperature	5±3																
3	125±2	30±3																
4	Room temperature	5±3																
High Temp. Load	IEC 61051-1	85±2 °C 1000±24 hrs at V _{DC}	$ \Delta V_{1mA}/V_{1mA} \leq 5\%$ No visible damage															
Low Temp. Load	Specification standard	-40±5 °C 1000±24 hrs at V _{DC}	$ \Delta V_{1mA}/V_{1mA} \leq 5\%$ No visible damage															
Max. Energy	Specification standard	10/1000µs Waveform, Wmax, 1 surge current	$ \Delta V_{1mA}/V_{1mA} \leq 10\%$ No visible damage															
Vibration	IEC 61051-1	Frequency range: 10~55Hz Amplitude: 0.75mm or 98m/s ² Direction: 3 mutually perpendicular directions, 2 hrs each	$ \Delta V_{1mA}/V_{1mA} \leq 5\%$ No visible damage															
Varistor Voltage Temp. Coefficient	Specification standard	Measure V _{1mA} at -40℃, 25℃, 125℃	$ T_c \leq 0.05\%/^{\circ}C$															
Climatic Sequence	IEC 61051-1	a. 125℃ x 16 hrs b. 1st cycle: 55℃ 93%RH x 24 hrs c. -40℃ x 2 hrs d. 5 cycles: 55℃ 93%RH x 24 hrs/cycle	$ \Delta V_{1mA}/V_{1mA} \leq 5\%$ No visible damage															
Solderability	IEC 60068-2-58	245 ± 5 °C, 3 ± 0.3 sec	At least 95% of terminal electrode is covered by new solder															
Resistance to Soldering Heat	IEC 60068-2-58	260±5℃, 10±1 sec	$ \Delta V_{1mA}/V_{1mA} \leq 5\%$ No visible damage															
Electrostatic Discharge (ESD)	IEC 61000-4-2	Contact discharge test voltage: 8KV Polarity: Positive/Negative Number of test pulse: 10/10 times Discharge network: 150pF, 330Ω Operating temperature: 15~35℃ Operating humidity: 25~75 RH	1. CP≤2pF $ \Delta V_{1mA}/V_{1mA} \leq 30\%$ 2. CP>2pF $ \Delta V_{1mA}/V_{1mA} \leq 10\%$ No visible damage															

Metal Oxide Varistor : TVM-G Series

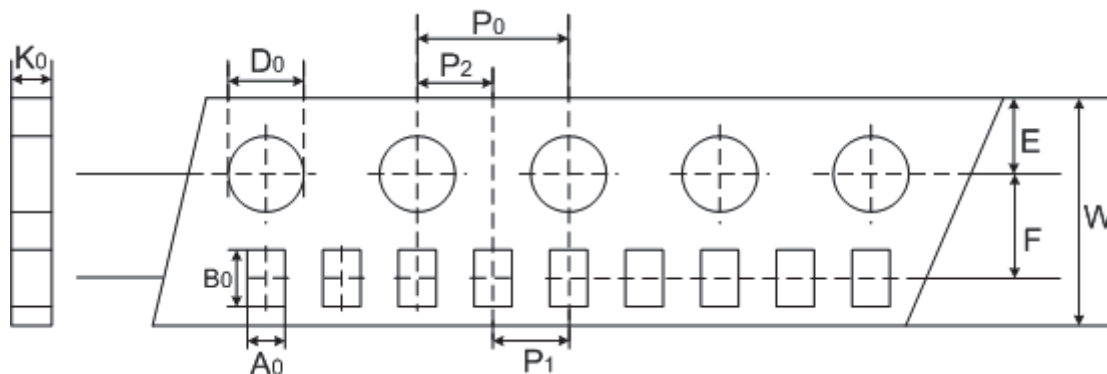


SMD Type for ESD Suppressor

■ Packaging

● Taping Specification

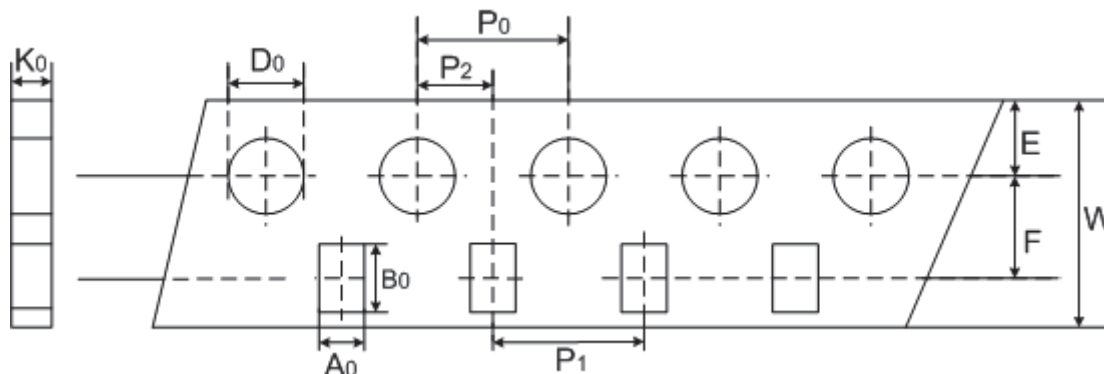
For 0201 & 0402 Series



(Unit: mm)

Index Size	A_0 ± 0.05	B_0 ± 0.12	W ± 0.2	E ± 0.1	F ± 0.05	P_1 ± 0.1	P_2 ± 0.05	P_0 ± 0.1	D_0 ± 0.1	K_0 ± 0.1
0201	0.38	0.68	8	1.75	3.5	2	2	4	1.55	0.38
0402	0.62	1.12	8	1.75	3.5	2	2	4	1.55	0.60

For 0603 & 0805 Series



(Unit: mm)

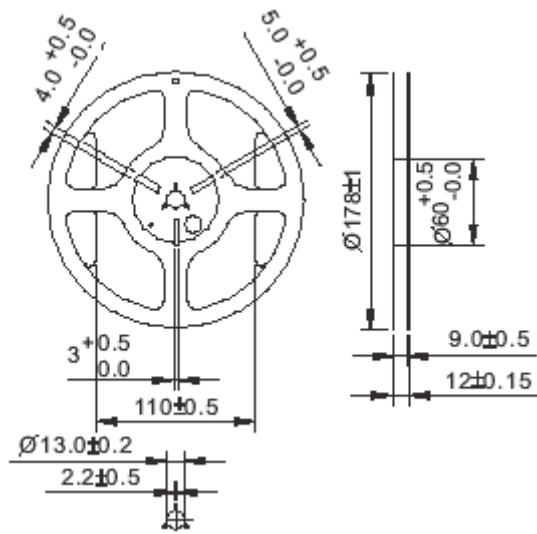
Index Size	A_0 ± 0.2	B_0 ± 0.2	W ± 0.2	E ± 0.1	F ± 0.05	P_1 ± 0.1	P_2 ± 0.05	P_0 ± 0.1	D_0 ± 0.1	K_0 ± 0.1
0603	1.1	1.9	8	1.75	3.5	4	2	4	1.55	0.95
0805	1.5	2.3	8	1.75	3.5	4	2	4	1.55	1.0

Metal Oxide Varistor : TVM-G Series

SMD Type for ESD Suppressor



- Quantity



(Unit: mm)

Size	Quantity (pcs/reel)
0201	15,000
0402	10,000
0603	4,000
0805	3,500

■ Warehouse Storage Conditions of Products

- Storage Conditions:
 1. Storage Temperature: $-10^{\circ}\text{C} \sim +40^{\circ}\text{C}$
 2. Relative Humidity: $\leq 75\% \text{RH}$
 3. Keep away from corrosive atmosphere and sunlight.
- Period of Storage: 1 year