Reliable ESD protection of single lines

Description

Due to the ongoing miniaturization, today's electronic devices are more and more sensitive to electrostatic discharges (ESD). Therefore reliable protection components become absolutely necessary to safeguard your valuable electronics against the impact of ESD.

Multilayer Varistors are ceramic semiconductors optimized specifically for high performance in ESD applications. They have a non-linear voltage/current characteristic for effectively suppressing extremely fast voltage transients and offer superior parametric stability over the complete operating range of –40 °C to +85 °C.

Multilayer Varistors are bi-directional devices. A single Multilayer Varistor connected from signal/data line to ground routes both positive and negative ESD transitions safely to the ground plane. This technique eliminates the need to route ESD charge into the power plane, possibly damaging nearby integrated circuits.

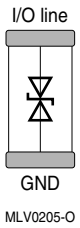
Features

- Bidirectional ESD protection to IEC 61000-4-2 (level 4)
- Suitable for uni and bidirectional lines
- Bidirectional ESD protection in a two-pin line
- Routes all ESD events, both positive and negative, safely to ground
- Suitable for DC working voltages up to 16 V
- Very low capacitance down to 0.6 pF
- No derating of maximum ratings up to 85 °C
- Extremely fast response time < 0.5 ns
- Nickel barrier terminations suitable for lead-free soldering
- RoHS-compatible

Applications

- Mobile communication
- Portable handheld products (e.g. PDA)
- Peripherals (e.g. printers, memory cards, etc.)
- EDP products (e.g. desktop and notebook computers)
- Interfaces (e.g. audio and video, USB, IEEE 1394, Ethernet, DVI)
- Consumer products (Flat TVs, set-top boxes, MP3 players, digital cameras, etc.)
- Liquid crystal displays (LCD) / monitors

Pin configuration



Due to the symmetrical configuration no marking information is needed. I/O and GND can be interchanged.

Maximum ratings (T_A = 85 °C)

Rating	Symbol	Value	Unit
Maximum DC working voltage	V_{DC}	CT0402M4G: 5.5 CT0402S11AG: 14 CT0402L14G: 16 CT0402S14AHSG: 16 CT0402S17AG: 19 CT0402V150RFG: 16 CT0402V275RFG: 16 CT0402S5ARFG: 5.6	V
Air discharge ESD capability (to IEC 61000-4-2 method)	V_{ESD}	15	kV
Contact discharge ESD capability (to IEC 61000-4-2 method)	V_{ESD}	8	kV
Operating temperature (without derating)	T_{op}	–40 to +85	°C
Storage temperature	T_{stg}	–40 to +125	°C

Characteristics (T_A = 25 °C)

B72590T0040M060: CT0402M4G

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	I_{BR} = 1 mA	8	-	12	V
Leakage current	I_{leak}	V_{leak} = 3 V	-	0.01	0.5	µA
Clamping voltage	V_{clamp}	I_{PP} = 1 A, 8/20 µs	-	19	24	V
Capacitance	C	V = 1 V, f = 1 MHz	-	200	-	pF

B72590T0110S160: CT0402S11AG

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	I_{BR} = 1 mA	16.5	-	20.3	V
Leakage current	I_{leak}	V_{leak} = 3 V	-	0.01	0.5	µA
Clamping voltage	V_{clamp}	I_{PP} = 1 A, 8/20 µs	-	-	35	V
Capacitance	C	V = 1 V, f = 1 MHz	-	120	-	pF

B72590T0140L060: CT0402L14G

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	I_{BR} = 1 mA	20	23.5	27	V
Leakage current	I_{leak}	V_{leak} = 3 V	-	0.01	0.5	µA
Clamping voltage	V_{clamp}	I_{PP} = 1 A, 8/20 µs	-	-	46	V
Capacitance	C	V = 1 V, f = 1 MHz	-	47	-	pF

B72590T8140S160: CT0402S14AHSG

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	I_{BR} = 1 mA	23	28	33	V
Leakage current	I_{leak}	V_{leak} = 3 V	-	0.01	0.5	µA
Clamping voltage	V_{clamp}	I_{PP} = 1 A, 8/20 µs	-	-	66	V
Capacitance	C	V = 1 V, f = 1 MHz	-	10	15	pF

B72590T0170S160: CT0402S17AG

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	I_{BR} = 1 mA	25	-	40	V
Leakage current	I_{leak}	V_{leak} = 3 V	-	0.01	0.5	µA
Clamping voltage	V_{clamp}	I_{PP} = 1 A, 8/20 µs	-	59	-	V
Capacitance	C	V = 1 V, f = 1 MHz	-	33	-	pF

B72590T7151V060: CT0402V150RFG

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	I_{BR} = 1 mA	-	150	200	V
Leakage current	I_{leak}	V_{leak} = 3 V	-	0.001	0.1	µA
Clamping voltage	V_{clamp}	I_{PP} = 1 A, 8/20 µs	-	-	290	V
Capacitance	C	V = 1 V, f = 1 MHz	-	2	3	pF

B72590T7271V060: CT0402V275RFG

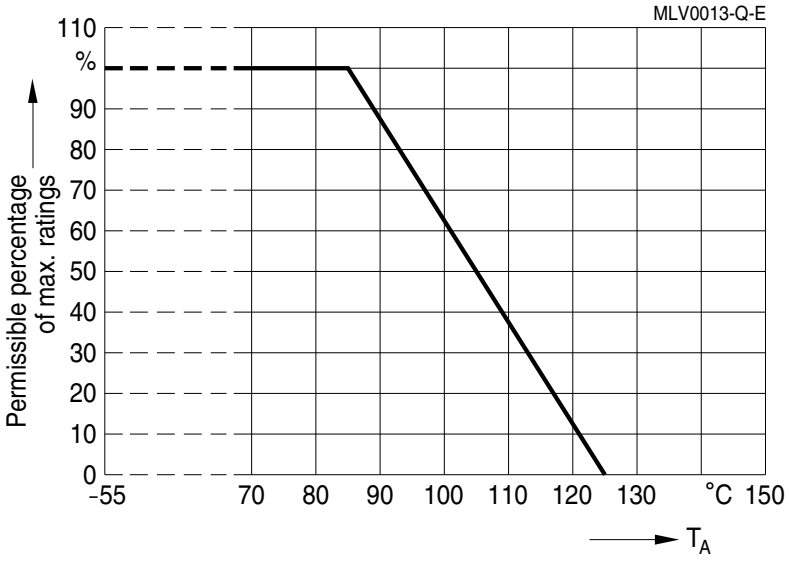
Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	I_{BR} = 1 mA	-	275	350	V
Leakage current	I_{leak}	V_{leak} = 3 V	-	0.001	0.1	µA
Capacitance	C	V = 1 V, f = 1 MHz	-	1.5	2	pF

B72590T7050S160: CT0402S5ARFG

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Breakdown voltage	V_{BR}	I_{BR} = 1 mA	150	210	-	V
Leakage current	I_{leak}	V_{leak} = 3 V	-	0.001	0.1	µA
Capacitance	C	V = 1 V, f = 1 MHz	-	0.6	1	pF

Note: Any operating voltage lower than V_{leak} results in lower leakage current.

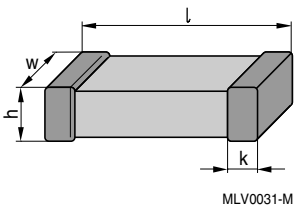
Typical characteristics



Dimensional drawing

Dimensions in mm for case size 0402

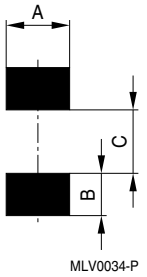
Symbol	Min.	Max.
l	0.85	1.15
w	0.4	0.6
h	0.4	0.6
k	0.1	0.3



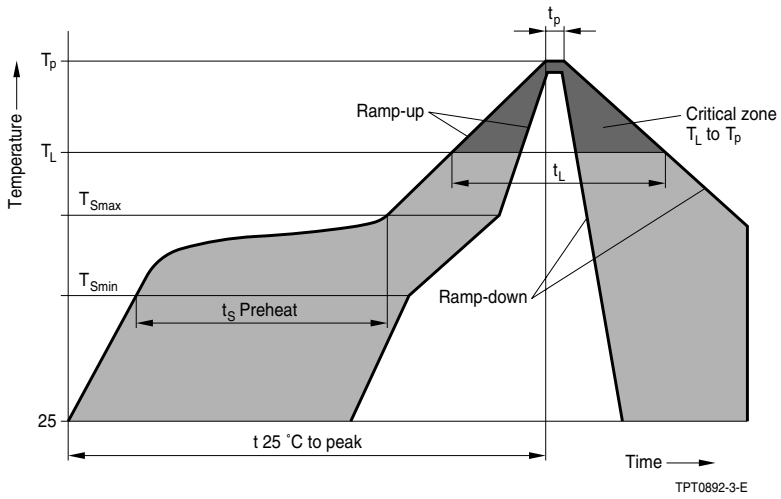
Recommended solder pad

Dimensions in mm for case size 0402

Symbol	
A	0.6
B	0.6
C	0.5



Recommended infrared reflow soldering temperature profile



Profile feature	Sn-Pb eutectic assembly	Pb-free assembly
Average ramp-up rate (T_{Smax} to T_p)	3 °C/ s max.	3 °C/ s max.
Preheat		
- Temperature min (T_{Smin})	100 °C	150 °C
- Temperature max (T_{Smax})	150 °C	200 °C
- Time (t_{Smin} to t_{Smax})	60 … 120 s	60 … 180 s
Time maintained above		
- Temperature min (T_L)	183 °C	217 °C
- Time (t_L)	60 … 150 s	60 … 150 s
Peak classification temperature (T_p)	220 °C … 240 °C	240 °C … 260 °C
Time within 5 °C of actual peak temperature (t_p)	10 … 30 s	20 … 40 s
Ramp-down rate	6 °C/ s max.	6 °C/ s max.
Time 25 °C to peak temperature	6 min max.	8 min max.

Note: All temperatures refer to topside of the package, measured on the package body surface.

Soldering guidelines

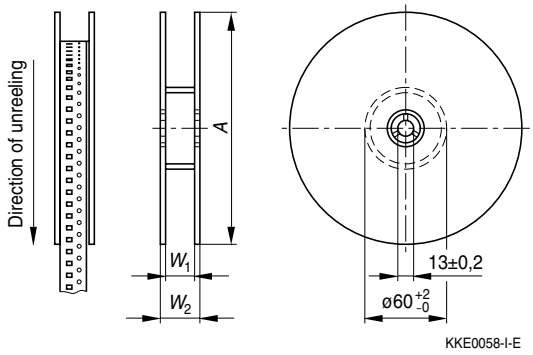
The usage of mild, non-activated fluxes for soldering is recommended, as well as proper cleaning of the PCB.
The components are suitable for reflow soldering to JEDEC J-STD-020C.

Storage conditions

As far as possible, the components shall be employed within 12 months. They should be left in their original packing to avoid soldering problems due to oxidized contacts.
Storage temperature: –25 °C up to 45 °C
Relative humidity: < 75 % annual average, < 95 % on max. 30 days in a year.

Reel dimensions in mm

Definition	Symbol	Dim.	Tolerance
Reel diameter	A	180	+0/ –3
Reel width (inside)	W_1	8.4	+1.5/ –0
Reel width (outside)	W_2	14.4	max.



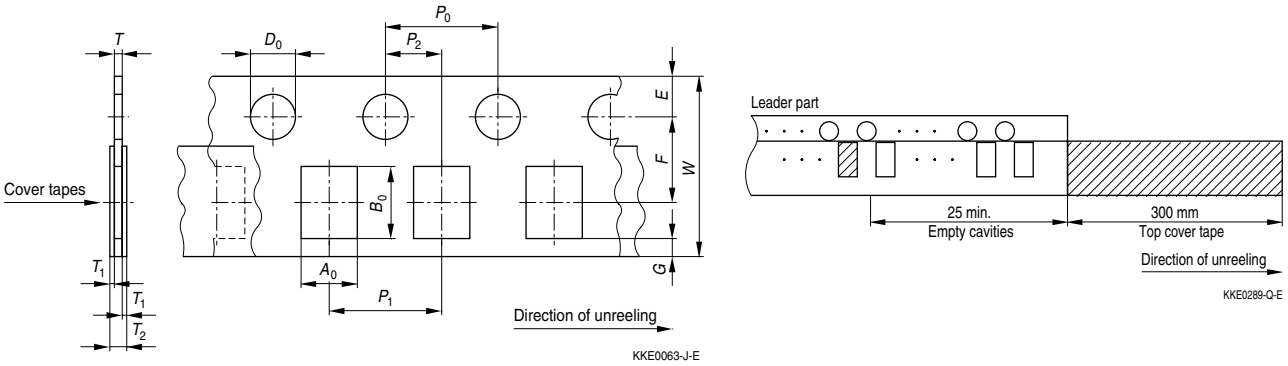
Package: 8-mm tape
Reel material: Plastic

Selection guide

Type	Ordering code	Case size	Pcs. per reel	Reel size
CT0402M4G	B72590T0040M060	0402	10000	180 mm
CT0402S11AG	B72590T0110S160	0402	10000	180 mm
CT0402L14G	B72590T0140L060	0402	10000	180 mm
CT0402S14AHSG	B72590T8140S160	0402	10000	180 mm
CT0402S17AG	B72590T0170S160	0402	10000	180 mm
CT0402V150RFG	B72590T7151V060	0402	10000	180 mm
CT0402V275RFG	B72590T7271V060	0402	10000	180 mm
CT0402S5ARFG	B72590T7050S160	0402	10000	180 mm

Taping to IEC 60286-3

Tape material: Cardboard



Dimensions and tolerances in mm for case size 0402:

Definition	Symbol	Dim.	Tolerance
Compartment width	A_0	0.6	± 0.2
Compartment length	B_0	1.15	± 0.2
Sprocket hole diameter	D_0	1.5	+0.1/ –0
Sprocket hole pitch	P_0	4.0	± 0.1 1)
Distance centre hole to centre compartment	P_2	2.0	± 0.05
Pitch of the component compartments	P_1	2.0	± 0.1
Tape width	W	8.0	± 0.3
Distance edge to centre of hole	E	1.75	± 0.1
Distance centre hole to centre compartment	F	3.5	± 0.05
Distance compartment to edge	G	0.75	min.
Thickness tape	T	0.6	max.
Overall thickness	T_2	0.7	max.

1) ≤ ± 0.2 mm over any 10 pitches

Note

Multilayer Varistors are not suitable for switching applications or for voltage stabilization, where static power dissipation is required.

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The following applies to all products named in this publication:

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