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Revision of Mar. 2023

Surface Mount Multilayer Varistors

Product Identification:

MLV 0402 NA 006V 0020

(1) (2) (3) (4) (5)

(1) Series Code:
MLV – Surface Mount Multilayer Varistor
(2) Size Code:
Standard EIA Chip Size
(3) Application Code:
ES – Electrostatic Discharge Protection
NA – Normal Surge Protection
HA – High Surge Protection
(4) Max. Working Voltage:
012V – 12 V
(5) Surge Current for NA Series:
0020– 20A

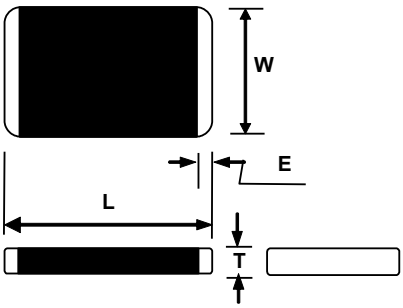
Operating Temperatures:

-55ºC to +85ºC for size 0603 or smaller

-55ºC to +125ºC for size 0805 or larger

Shape and Dimensions:

MLV Series



Size	L (mm)	W (mm)	T (mm)	E (mm)
0201	0.60 ± 0.03	0.30 ± 0.03	0.30 ± 0.03	0.30 ± 0.03
0402	1.00 ± 0.10	0.50 ± 0.10	0.50 ± 0.10	0.25 ± 0.10
0603	1.60 ± 0.15	0.80 ± 0.15	0.90 max.	0.30 ± 0.10
0805	2.00 ± 0.20	1.25 ± 0.15	1.00 max.	0.30 ± 0.10
1206	3.20 ± 0.20	1.60 ± 0.15	1.20 max.	0.50 ± 0.20
1210	3.20 ± 0.20	2.50 ± 0.20	1.50 max.	0.50 ± 0.20
1812	4.50 ± 0.20	3.20 ± 0.20	2.00 max.	0.60 ± 0.20
2220	5.70 ± 0.20	5.00 ± 0.20	3.00 max.	0.60 ± 0.20

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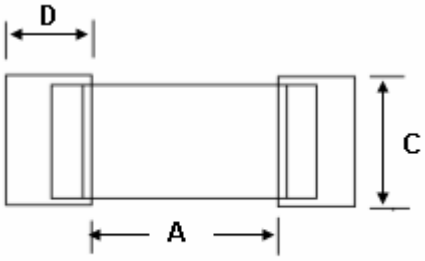
Terms and Definitions:

Term	Definition
Max. Working Voltage	Maximum steady-state DC operating voltage with typical leakage current less than 50 μA at 25°C
Varistor Voltage（BDV）	Breakdown DC voltage measured at current of 1 mA
Max. Clamping Voltage	Maximum peak voltage across the part, measured at a specified pulse current and wave-form
Surge Current	Maximum peak current with the specified 8/20 μs waveform without damage
Surge Shift △ V/V	The change of varistor voltage after applying the specified surge current
Energy Absorption	Maximum energy dissipated with a specified 10/1000 μs waveform without damage
Typical Capacitance	Capacitance measured with voltage bias less than 0.5 V_{RMS} at 1 KHz or 1 MHz
Nonlinear Exponentα	α=〔log（$V_{1mA}/V_{0.1mA}$）/ log（$I_{V1mA}/I_{V0.1mA}$）〕
Leakage Current	Typical leakage current at 25 °C〈 50 μA; Maximum leakage 200 μA.
Cut-off Frequency	The frequency of -3 dB insertion loss

Recommended Land Patterns:

MLV Series



Size	Solder pad layout		
	A (mm)	C (mm)	D (mm)
0201	0.25~0.35	0.20~0.30	0.25~0.35
0402	0.4~0.6	0.5~0.6	0.5~0.7
0603	0.9~1.2	0.6~1.0	0.8~1.2
0805	1.0~1.5	1.2~1.5	1.0~1.4
1206	1.8~2.5	1.2~1.8	1.0~1.4
1210	1.8~2.5	2.2~3.0	1.0~1.4
1812	2.5~3.3	2.8~3.6	1.2~1.8
2220	3.8~4.6	4.8~5.5	1.2~1.8

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Environmental Tests:

No.	Test	Requirement	Test condition	Test reference
1	Soldering heat resistance	BDV change ≤ ±10% No mechanical damage	One dip at 260°C for 5 sec.	MIL-STD-202 Method 210 IEC 60068-2-20
2	Solderability	New solder coverage ≥ 80%	One dip at 255°C for 5 sec. Non-active flux	MIL-STD-202 Method 208 IEC 60068-2-20
3	Maximum surge current	BDV change ≤ ±10% No mechanical damage	100 pulses of 8/20 μs with maximum surge current and 30 sec. interval at 25°C and 30 ~ 65% RH	CECC 42000 IEC 1051-1 Test 4.5
4	Maximum surge energy	BDV change ≤ ±10% No mechanical damage	100 pulses of 10/1000 μs with maximum surge current and 90 sec. interval at 25°C and 30 ~ 65% RH	CECC 42000
5	Thermal cycling	BDV change ≤ ±10% No mechanical damage Leakage current ≤ 200 μA	5 cycles between -40°C and 125ºC with 30 min. dwell time at the temperature extremes and 60 min. dwell time at 25°C	CECC 42000 IEC 60068-2-14
6	Low temperature resistance	BDV change ≤ ±10% No mechanical damage Leakage current ≤ 200 μA	1000 hr at -50°C	IEC 60068-2-1
7	Low temperature load resistance	BDV change ≤ ±10% No mechanical damage Leakage current ≤ 200 μA	1000 hr at -50°C with working voltage applied	IEC 60068-2-1
8	High temperature resistance	BDV change ≤ ±10% No mechanical damage Leakage current ≤ 200 μA	1000 hr at 150°C	MIL-STD-202 Method 108 CECC 42000
9	High temperature load resistance	BDV change ≤ ±10% No mechanical damage Leakage current ≤ 200 μA	1000 hr at 85°C with working voltage applied	CECC 42000
10	Humidity resistance	BDV change ≤ ±10% No mechanical damage Leakage current ≤ 200 μA	500 hr at 40°C and 90 ~ 95% RH	MIL-STD-202 Method 103 IEC 60068-2-3 CECC 42000;
11	Humidity load resistance	BDV change ≤ ±10% No mechanical damage Leakage current ≤ 200 μA	500 hr at 40°C and 90 ~ 95% RH with working voltage applied	MIL-STD-202 Method 103 IEC 60068-2-3 CECC 42000
12	ESD contact test*	Varistor voltage change > 115% working voltage	Contact electrostatic discharge 100 times with 1 second intervals at 8 KV (Level 4) and polarity: +,-	IEC 61000-4-2
13	ESD air test*	Varistor voltage change > 115% working voltage	Air contact electrostatic discharge 100 times with 1 second intervals at 15 KV (Level 4) and polarity:+,-	IEC 61000-4-2

* For ES series only.

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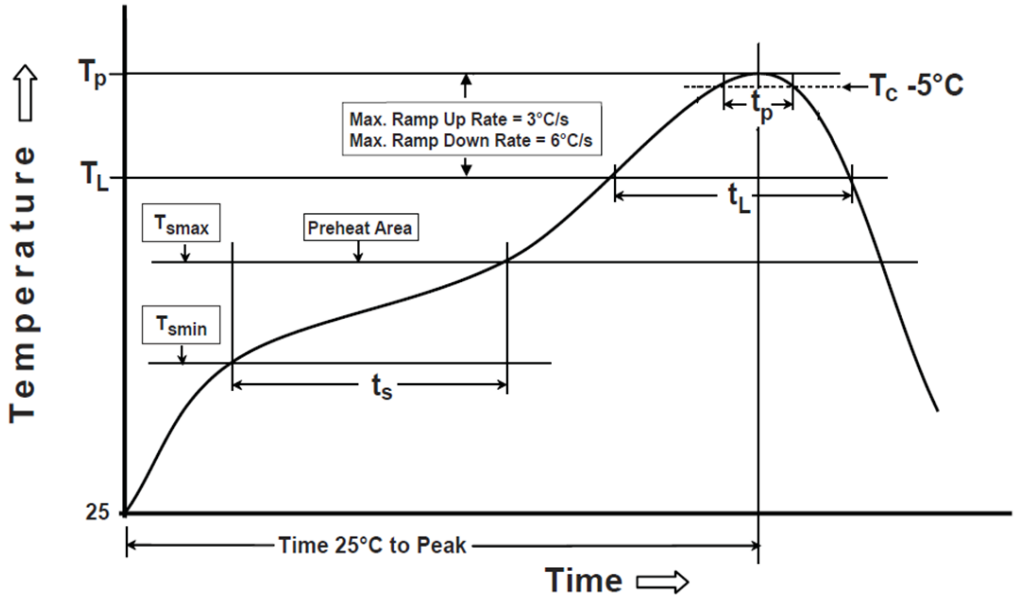
Soldering Temperature Profile:



Profile Feature	Pb-Free Assembly
Preheat/Soak Temperature Min (T_{smin}) Temperature Max (T_{smax}) Time (t_s) from (T_{smin} to T_{smax})	 150°C 200°C 60~120 seconds
Ramp-uprate (T_L to T_p)	3°C/second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L	217°C 60~150 seconds
Peak package body temperature (T_p)	260°C
Time (t_p)*within 5°C of the specified classification temperature (T_c)	30 seconds *
Ramp-down rate (T_p to T_L)	6°C/second max.
Time 25°C to peak temperature	8 minutes max.
* Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum	

Packaging:

Size	0402	0603	0805	1210	1812
Pcs	10000 （7 inch reel）	4000 （7 inch reel）	3000 （7 inch reel）	2000 （7 inch reel）	1000 （7 inch reel）

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Normal Surge Protection (NA) Series

Features:

- Fast Response < 0.5 ns
- Low Capacitance
- Low Clamping Voltage and High Energy Absorption

Application Fields:

- Telecommunications
- Automotive Systems
- Data Systems
- Power Supplies

Ordering Information:

Part Number	Working Voltage (max)		Breakdown Voltage	Clamping Voltage	Surge Current (max)	Typical Capacitance Ref.
	AC	DC	1 mA (V)	(V)	8/20 μs (A)	1 kHz (pF)
MLV0402NA006V0020	4	5.5	8 (7.5~10.5)	20	20	200
MLV0402NA009V0020	6	9	12 (10.2~13.8)	24	20	135
MLV0402NA011V0020	6	9	12 (10.2~13.8)	24	20	135
MLV0402NA014V0020	11	14	18 (15.3~20.7)	35	20	50
MLV0402NA018V0020	14	18	24 (21.6~26.4)	44	20	45
MLV0603NA006V0030	4	5.5	8 (7.5~10.5)	20	30	650
MLV0603NA009V0030	6	9	12 (10.2~13.8)	24	30	300
MLV0603NA014V0030	11	14	18 (15.3~20.7)	30	30	210
MLV0603NA018V0030	14	18	24 (21.6~26.4)	39	30	160
MLV0603NA022V0030	17	22	27 (24.3~29.7)	44	30	145
MLV0603NA030V0030	25	30	39 (35.1~42.9)	65	30	110
MLV0603NA038V0030	30	38	47(42.3~51.7)	77	30	90
MLV0805NA006V0080	4	5.5	8 (7.5~10.5)	20	80	1400
MLV0805NA009V0080	6	9	12 (10.2~13.8)	24	80	650
MLV0805NA011V0100	6	9	12 (10.2~13.8)	24	80	650
MLV0805NA014V0100	11	14	18 (15.3~20.7)	30	100	350
MLV0805NA018V0100	14	18	24 (21.6~26.4)	39	100	300
MLV0805NA022V0100	17	22	27 (24.3~29.7)	44	100	250
MLV0805NA026V0100	20	26	33 (29.7~36.3)	54	100	220
MLV0805NA030V0100	25	30	39 (35.1~42.9)	65	100	200
MLV0805NA038V0100	30	38	47 (42.3~51.7)	77	100	150
MLV0805NA045V0080	35	45	56 (50.4~61.6)	90	80	110
MLV1210NA018V0250	14	18	24 (21.6~26.4)	39	250	1150
MLV1812NA045V0500	35	45	56 (50.4~61.6)	90	500	1000

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