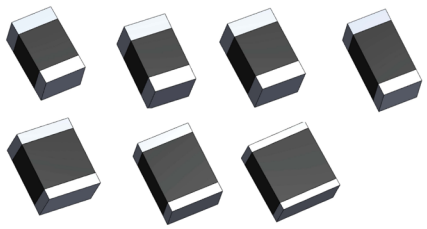
AMLV

Automotive grade multilayer varistor



Product features

- Automotive grade varistor
- Seven compact footprint options:
  0402 (1005 metric) , 0603 (1608 metric), 0805 (2012 metric), 1206 (3216 metric), 1210 (3225 metric), 1812 (4532 metric), 2220 (5750 metric)
- Working voltage: 5.5 Vdc to 56 Vdc
  4.0 Vac to 40 Vac
- Bi-directional
- Peak current (8/20 µs) up to 1200 A
- Multilayer construction suited for high reliability automotive applications
- V-jump and load-dump protection
- Meets moisture sensitivity level (MSL): 1

Applications

- Various automotive electrical control unit (ECU) applications
- Automotive bus systems
  (LIN, CAN, CAN-FD, FlexRay)
- Advanced driver assistance system (ADAS)
- In vehicle infotainment system (IVI)
- Seat motor circuit
- LED driver/ LED lamp
- Keyless entry
- Bluetooth
- Wiper motor
- Door control module

Environmental compliance

Pb HALOGEN HF FREE RoHS

Ordering part number

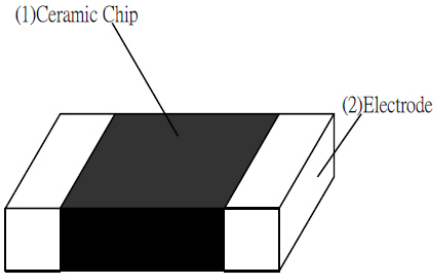
AMLV 04 V05 C033

- Family name
- Package size
- Working voltage (Vdc)
- Capacitance code (pf)

Product specifications

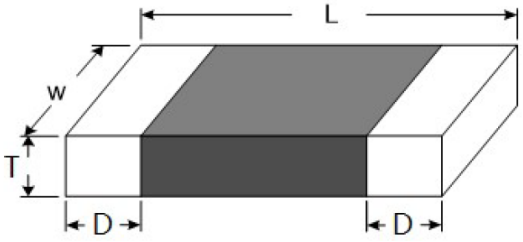
Part number	Working voltage (Vdc)	Working voltage (Vac)	Varistor voltage @ 1 mAdc (V min)	Varistor voltage @ 1 mAdc (V max)	Maximum clamping voltage 8/20 µs (V)	Energy absorption 10/1000 µs (J)	Peak current 8/20 µs (A)	Typical capacitance @ 1 MHz (pF)	V_{jump} (5 min) (V)	W_{LD} (10x) (J)	Leakage current @ Vdc (µA)
AMLV04V05C033	5.5	4	8.8	13.2	31 @ 1 A	0.02	4	33 @ 1 MHz	-	-	≤20
AMLV04V05C090	5.5	4	8.8	13.2	30 @ 1 A	0.05	10	90 @ 1 MHz	-	-	≤20
AMLV04V18C012	18	14	22	28	55 @ 1 A	0.03	2	12 @ 1 MHz	-	-	≤20
AMLV04V18C040	18	14	22	28	50 @ 1 A	0.05	20	40 @ 1 MHz	-	-	≤20
AMLV06V09C490	9	7	11	16	29 @ 1 A	0.1	30	490 @ 1 MHz	-	-	≤20
AMLV06V18C012	18	14	23	30	55 @ 1 A	0.03	2	12 @ 1 MHz	-	-	≤20
AMLV06V26C110	26	20	31	38	60 @ 1 A	0.1	30	110 @ 1 MHz	-	-	≤20
AMLV06V32C010	32	25	51.9	70.1	120 @ 1 A	0.05	5	10 @ 1 MHz	-	-	≤20
AMLV08V16C650	16	12	21.6	26.4	40 @ 1 A	0.3	120	650 @ 1 kHz	24.5	1	≤20
AMLV08V18C650	18	14	23	28	44 @ 1 A	0.3	120	650 @ 1 kHz	24.5	1	≤20
AMLV08V26C500	26	20	29.7	36.3	56 @ 1 A	0.3	80	500 @ 1 kHz	27	1	≤20
AMLV08V31C250	31	25	35.1	42.9	67 @ 1 A	0.3	80	250 @ 1 kHz	29	0.5	≤20
AMLV12V18C1000	18	14	22.95	28.05	42 @ 1 A	0.6	150	1000 @ 1 kHz	24.5	1.5	≤20
AMLV12V26C800	26	20	29.7	36.3	54 @ 1 A	0.7	200	800 @ 1 kHz	27.5	1.2	≤20
AMLV12V34C550	34	26	42.3	51.7	77 @ 1 A	0.4	200	550 @ 1 kHz	50	1.5	≤20
AMLV12V48C270	48	37	55.8	68.2	100 @ 1 A	0.4	100	270 @ 1 kHz	59	1.2	≤20
AMLV12V56C250	56	40	61.2	74.8	110 @ 1 A	0.5	100	250 @ 1 kHz	65	1.5	≤20
AMLV13V18C3100	18	14	22.95	28.05	42 @ 2.5 A	1.6	500	3100 @ 1 kHz	27.5	3	≤20
AMLV13V26C1500	26	20	29.7	36.3	54 @ 2.5 A	1.9	400	1500 @ 1 kHz	27	3	≤20
AMLV13V31C1200	31	25	35.1	42.9	65 @ 2.5 A	1.7	300	1200 @ 1 kHz	29	3	≤20
AMLV13V34C1100	34	26	42.3	51.7	75 @ 2.5 A	2.3	300	1100 @ 1 kHz	50	3	≤20
AMLV13V45C600	45	35	50.4	61.6	90 @ 2.5 A	2.0	250	600 @ 1 kHz	60	1.5	≤20
AMLV18V16C4500	16	12	21.6	26.4	40 @ 5 A	2.4	800	4500 @ 1 kHz	24.5	6	≤20
AMLV18V26C3200	26	20	29.7	36.3	54 @ 5 A	3.0	800	3200 @ 1 kHz	30	6	≤20
AMLV18V30C1700	30	23	35	43.0	77 @ 5 A	3.8	600	1700 @ 1 kHz	45	6	≤20
AMLV22V16C20000	16	12	21.6	26.4	42 @ 10 A	10	1200	20000 @ 1 kHz	24.5	25	≤20
AMLV22V34C6500	34	26	42.3	51.7	77 @ 10 A	12	1200	6500 @ 1 kHz	50	12	≤20
AMLV22V38C3000	38	30	42.3	51.7	77 @ 10 A	12	1000	3000 @ 1 kHz	50	12	≤20

Construction

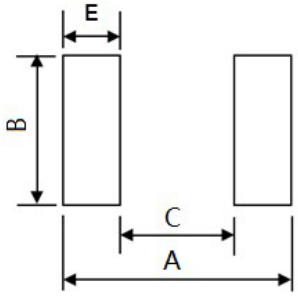


Component	Material
1. Ceramic chip	Metal oxides
2. Electrode	Ag-Ni-Sn

Dimensions—mm



Pad layout



Part size	L	W	T (maximum)	D	A	B	C	E
AMLV04	1.00±0.15	0.50±0.10	0.6	0.20±0.10	1.7	0.6	0.5	0.6
AMLV06	1.60±0.15	0.80±0.15	0.95	0.35±0.15	2.8	1	0.8	1
AMLV08	2.00±0.20	1.25±0.20	1	0.40±0.20	3.4	1.4	1	1.2
AMLV12	3.20±0.30	1.60±0.20	1.5	0.50±0.20	4.5	1.8	2.1	1.2
AMLV13	3.20±0.30	2.50±0.25	1.5	0.50±0.20	4.5	2.8	2.1	1.2
AMLV18	4.50±0.40	3.20±0.30	2	0.60±0.30	6	3.6	3	1.5
AMLV22	5.70±0.40	5.00±0.30	2.5	0.60±0.30	7.2	5.5	4.2	1.5

General specifications

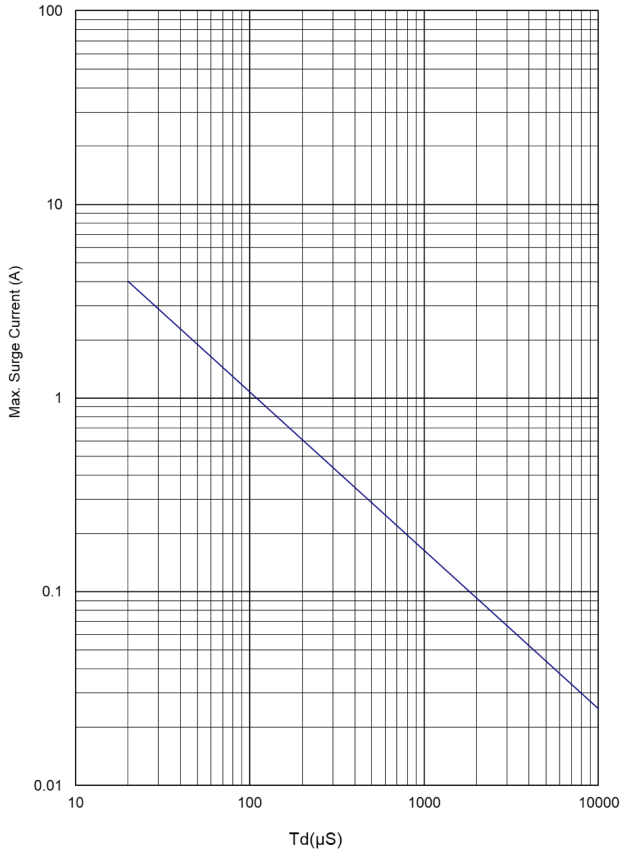
Operating temperature	- 55 °C to +125 °C (without derating)
Storage temperature (component)	- 55 °C to +150 °C
High temperature exposure	MIL-STD-202 Method 108, Temperature: +150 °C +3/-0 °C, Duration 1000 hours unpowered
Temperature cycling	JESD22 Method JA-104, Temperature: -40 °C + 0/-3 °C to +125 °C +3/-0 °C. Cycle time: 2 cycles/hour, Number of cycles: 1000 cycles
Moisture resistance	MIL-STD-202 Method 106, Duration of 1 cycle 24 hours, Number of cycles: 10 unpowered

Step	Temp./ °C		Humidity	Period
	Start	Finish	%	hr
1	25	65	90~100	2.5
2	65	65	90~100	3.0
3	65	25	80~100	2.5
4	25	65	90~100	2.5
5	65	65	90~100	3.0
6	65	25	80~100	2.5
7	25	25	80~100	8.0

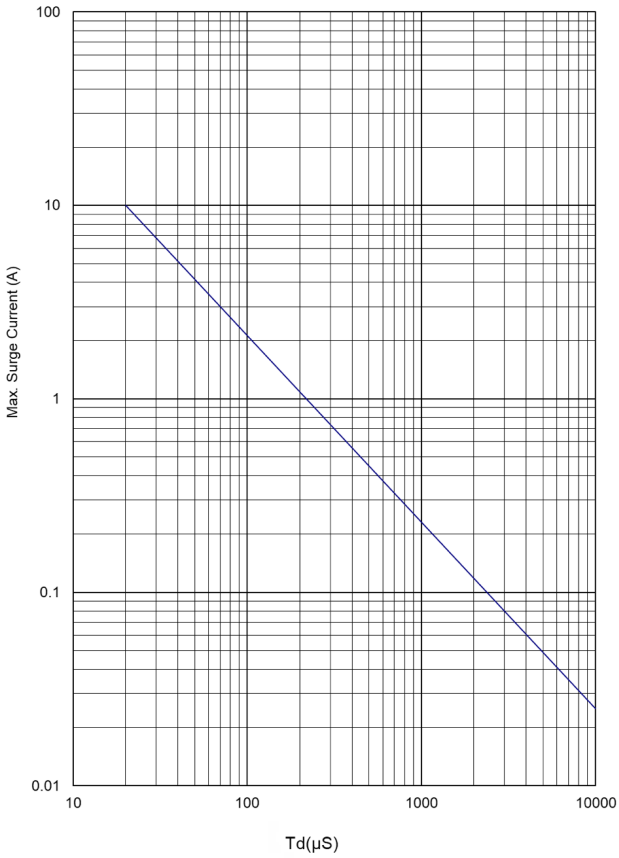
Biased humidity	MIL-STD-202 Method 103, Temperature: +85 °C, Humidity: 85%, Duration: 1000 hours, Bias at working voltage Vdc
Operational life	MIL-STD-202 Method 108, Temperature: +125 °C, Duration: 1000 hours, Bias at working voltage Vdc
Resistance to solvent	MIL-STD-202 Method 215, Solvent 1: 1 part (by volume) of isopropyl alcohol, 3 parts (by volume) of mineral spirits
Mechanical shock	MIL-STD-202 Method 213, Test condition F Peak value: 1500 g's, Half sin waveform, normal duration 0.5 ms, In 3 directions perpendicularly intersecting each other (total 18 times)
Vibration	MIL-STD-202 Method 204, Acceleration: 5 g's Sweep time: 20 minutes, Frequency range: 10 to 2000 Hz, 3 x 12 cycles
Resistance to soldering heat	MIL-STD-202 Method 210, Condition B, no pre-heat of samples. Temperature: +260 ± 5 °C, time: 10 ± 1 s. Immersion and emersion rate: 25 mm/s ± 6 mm/s, 1 cycle
Thermal shock	MIL-STD-202 Method 107, Temperature: -55 °C + 0/-3 °C to +125 °C + 3/-0 °C max., transfer time: 20 s, Dwell time: 15 minutes, air to air Number of cycles: 300 cycles
ESD	AEC-Q200-002, Discharge capacitance: 150 pF Charging voltage: 6 kV Contact discharge, 1 pulse each polarity
Solderability	IEC60068-2-58, J-STD-002, a) 4 hours @ +155 °C dry heat, dip @ +245 ± 5 °C, 3 ± 0.3 s b) Steam aging 8 hours ± 15 minutes @ +93 ± 3 °C, dip @ +260 ± 5 °C, 7 ± 0.5 s, 95% of termination wetted
Board flex	AEC-Q200-005, Bend the board: 2 mm (min.), Duration of the applied forces: 60 + 5/-0 S No visible damage
Electrical transient conduction	ISO7637-2, Test pulses 5a Numbers of pulses: 10, Test energy: W_{LD} (Load dump)

Maximum surge current derating curves

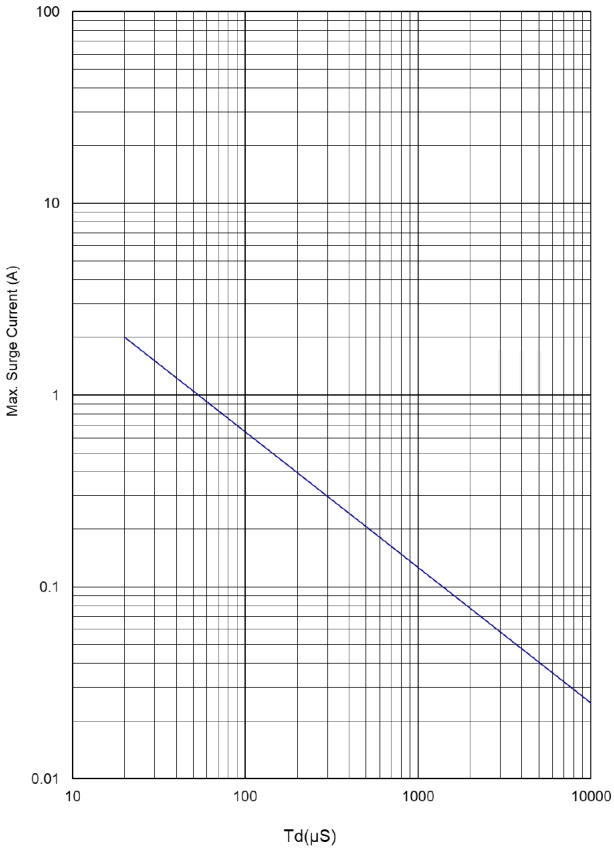
AMLV04V05C033



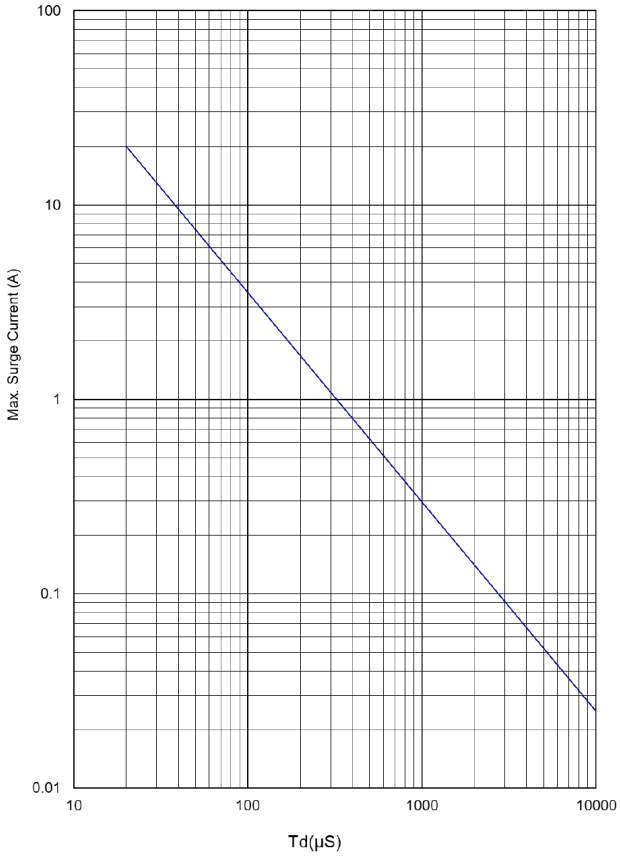
AMLV04V05C090



AMLV04V18C012

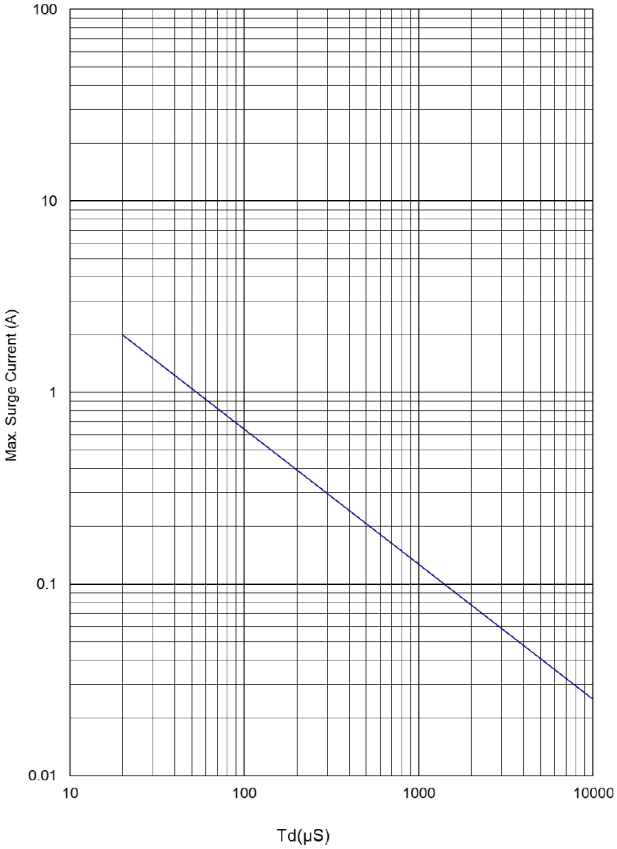


AMLV04V18C040

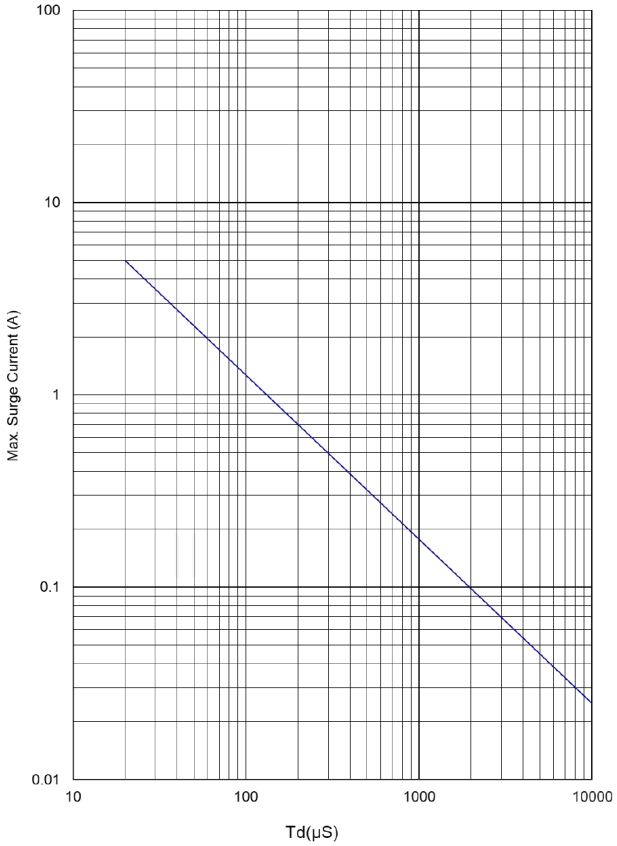


Maximum surge current derating curves

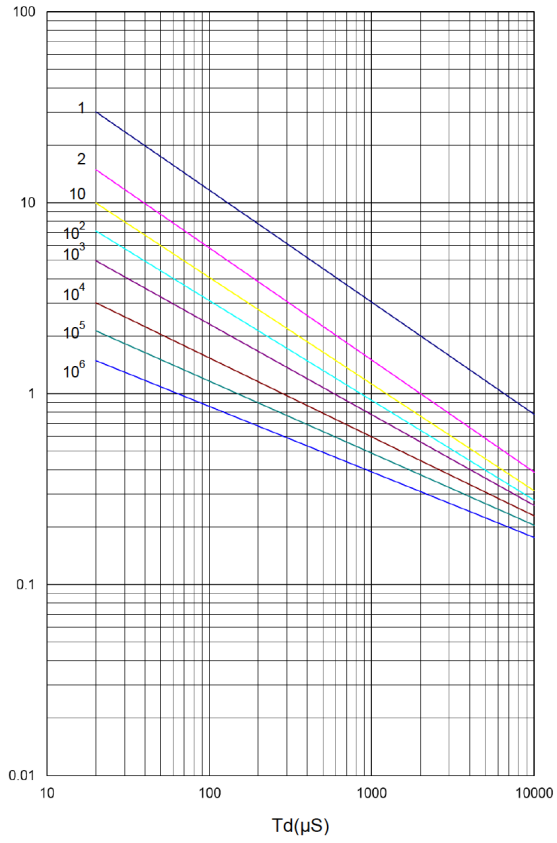
AMLV06V18C012



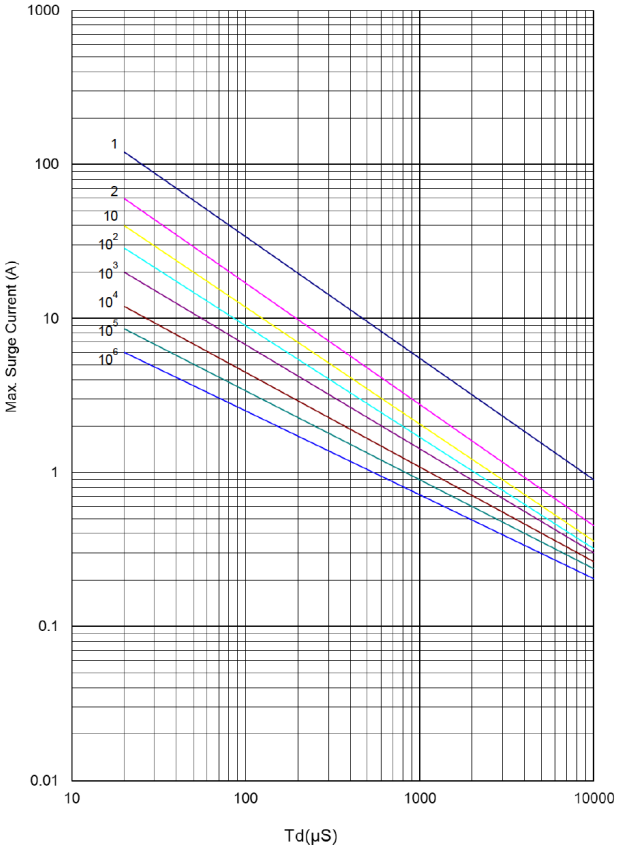
AMLV06V32C010



AMLV06V09C490, AMLV06V26C110

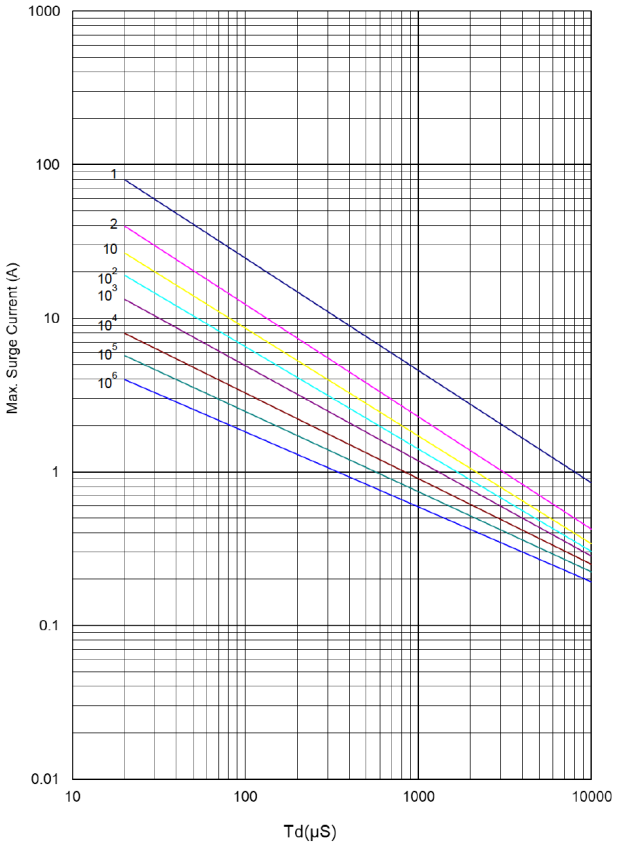


AMLV08V16C650, AMLV08V18C650

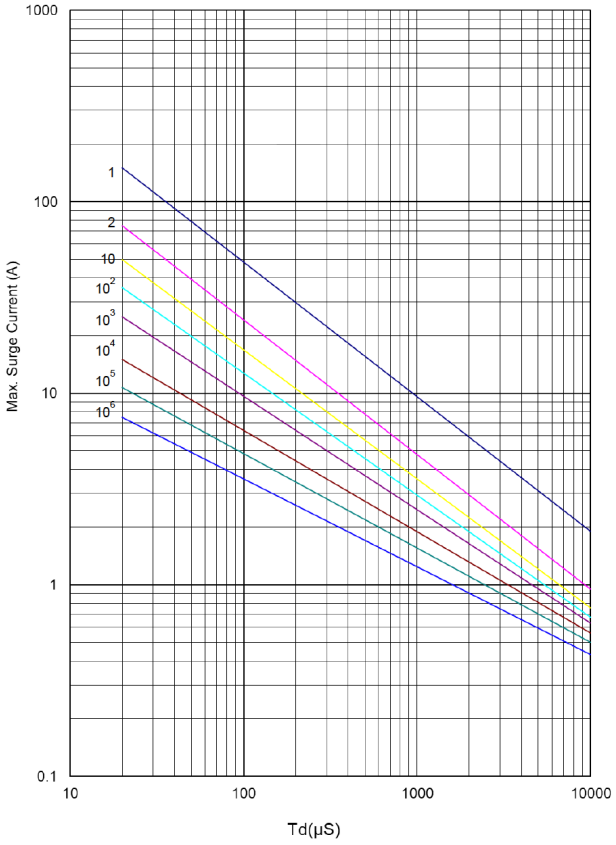


Maximum surge current derating curves

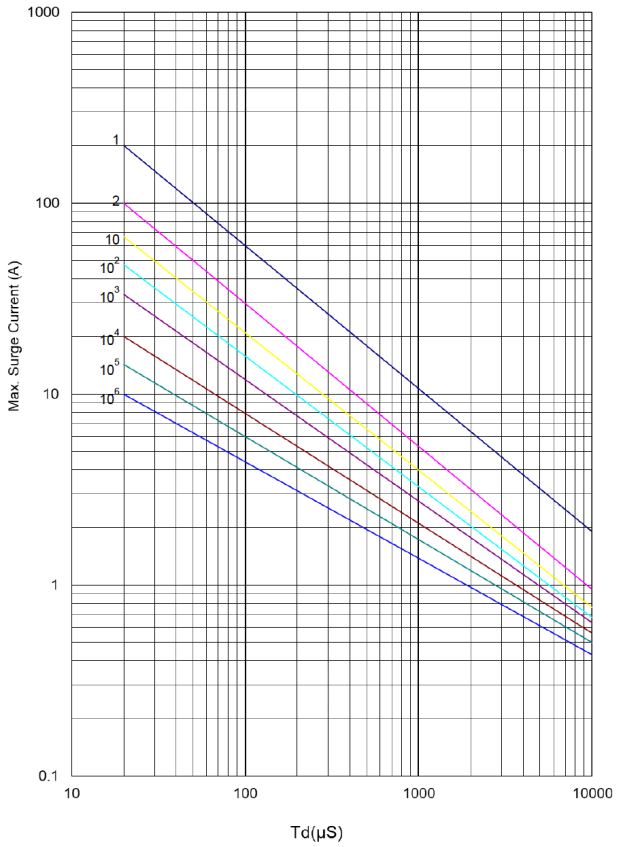
AMLV08V26C500, AMLV08V31C250



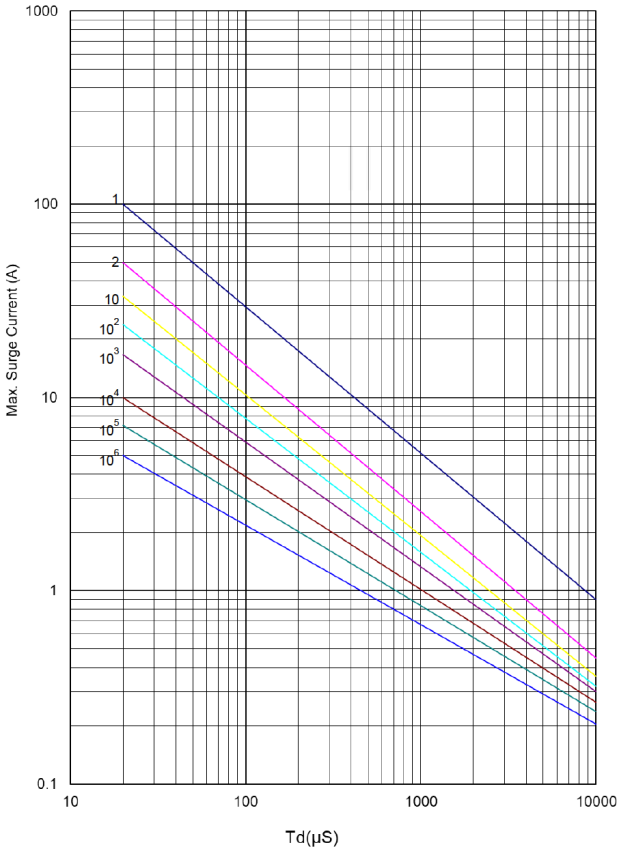
AMLV12V18C1000



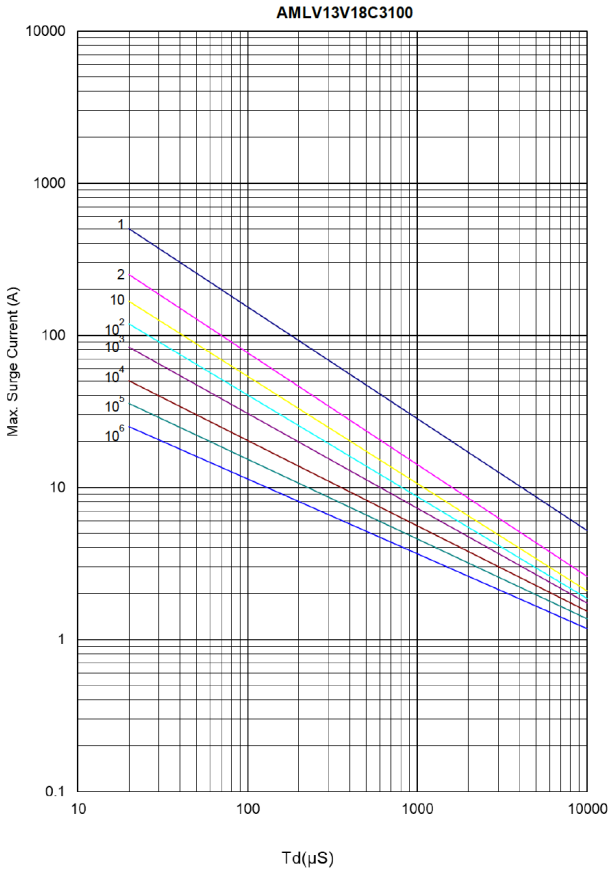
AMLV12V26C800, AMLV12V34C550

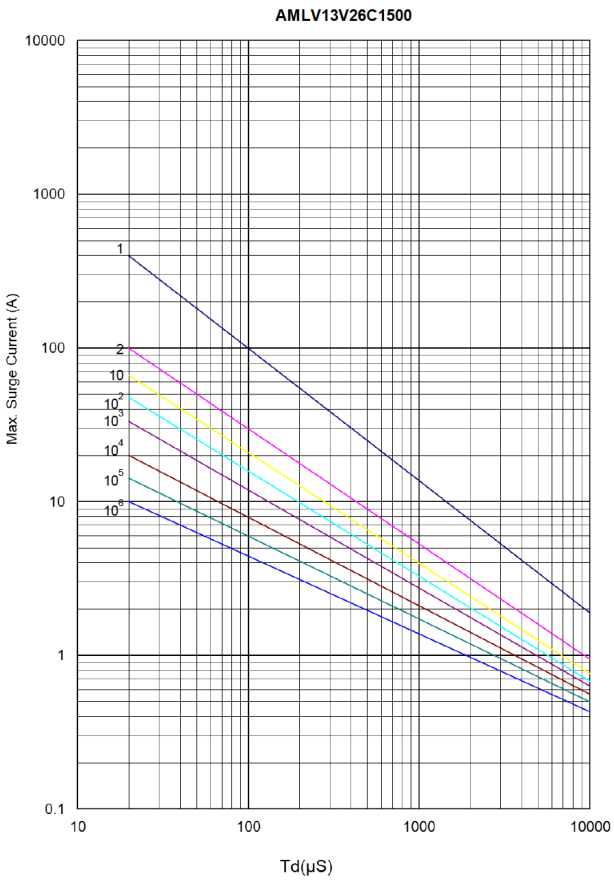


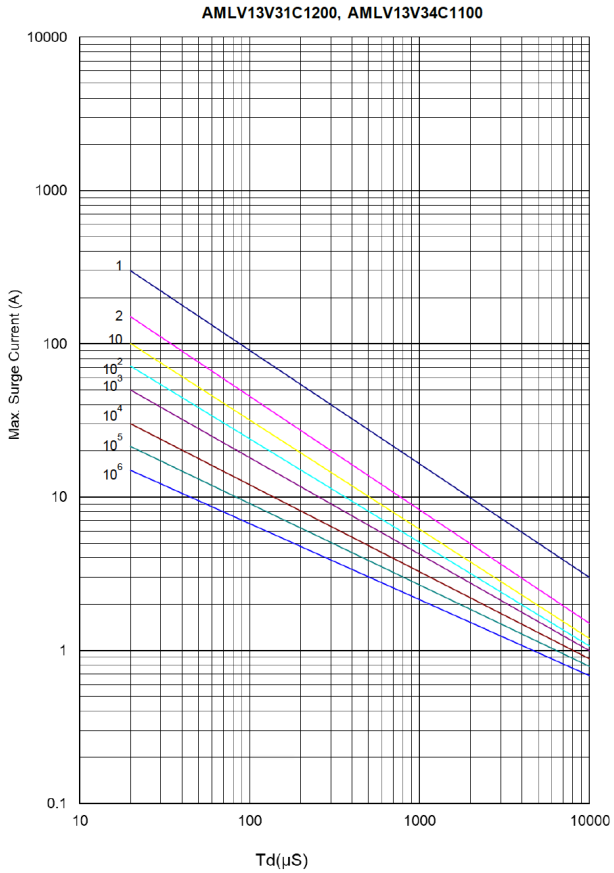
AMLV12V48C270, AMLV12V56C250

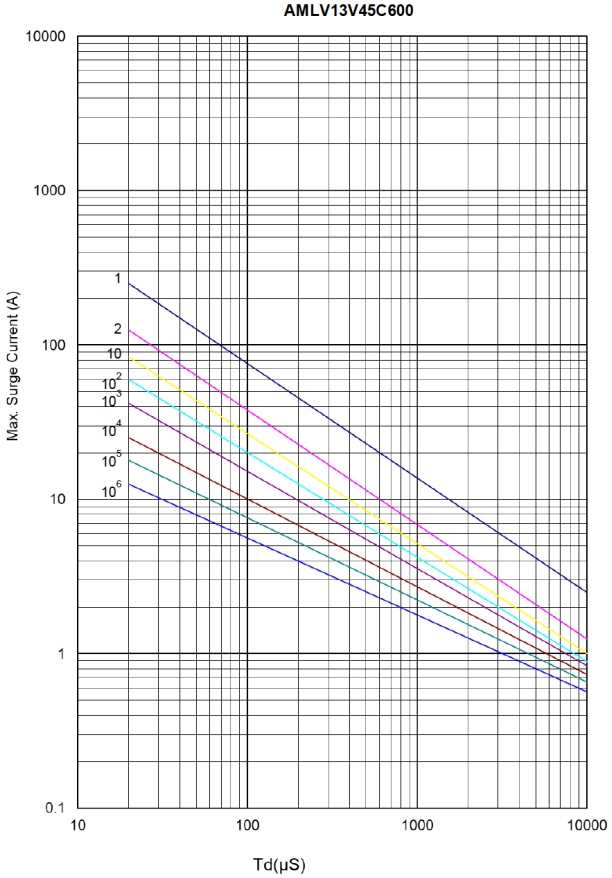


Maximum surge current derating curves



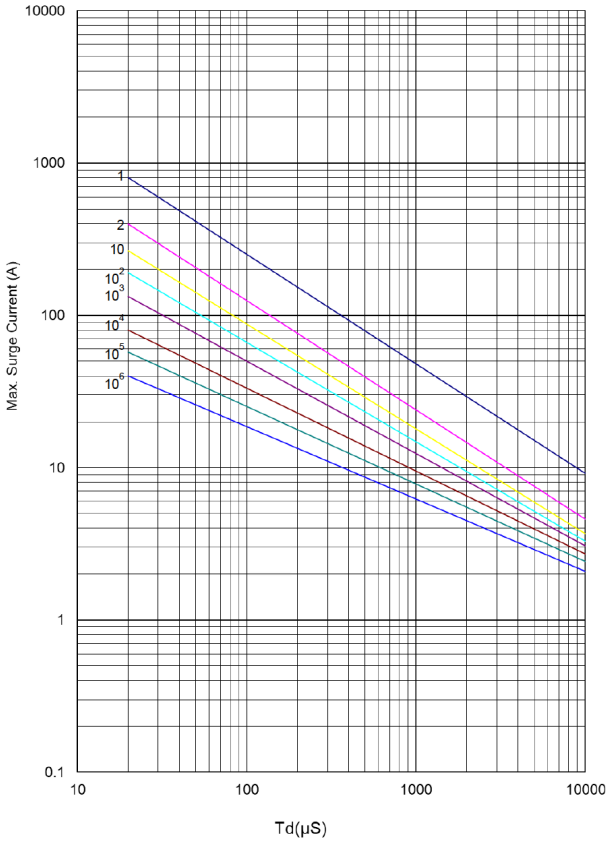




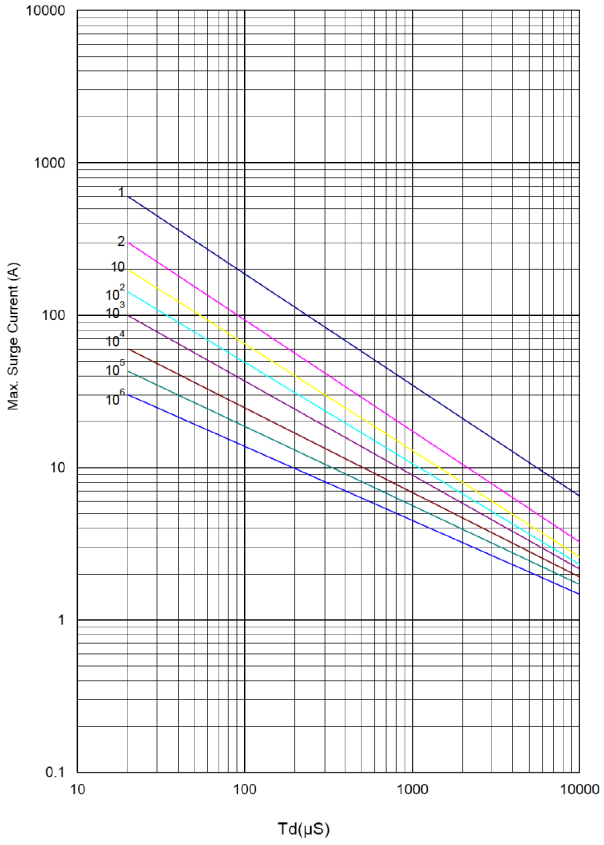


Maximum surge current derating curves

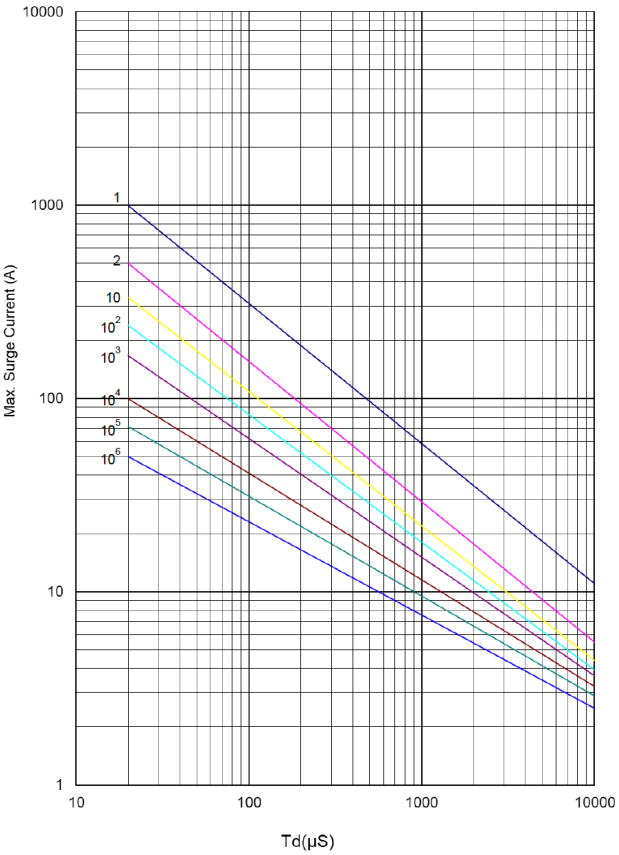
AMLV18V16C4500, AMLV18V26C3200



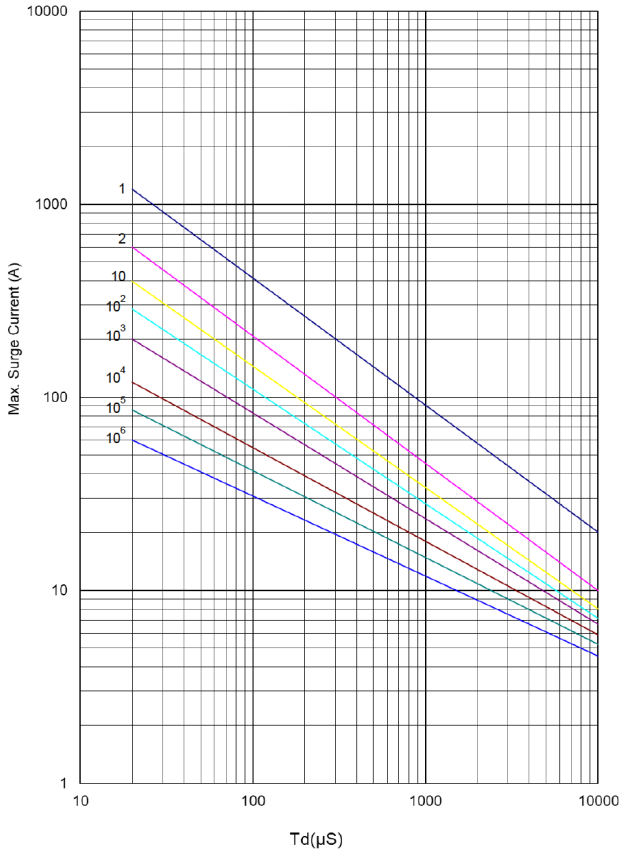
AMLV18V30C1700



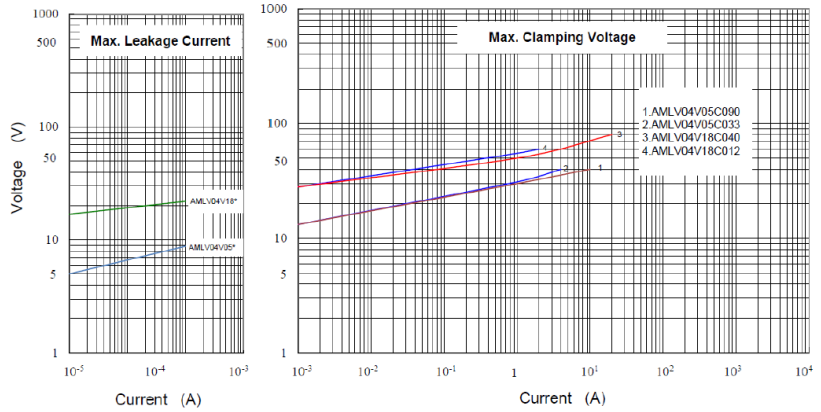
AMLV22V38C3000

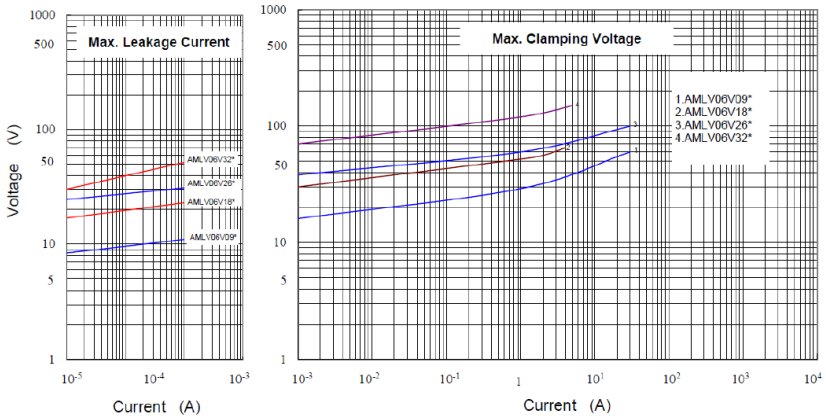


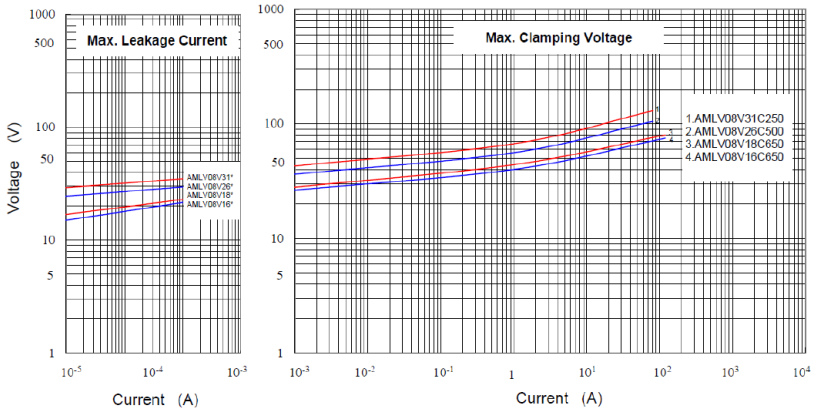
AMLV22V16C20000, AMLV22V34C6500

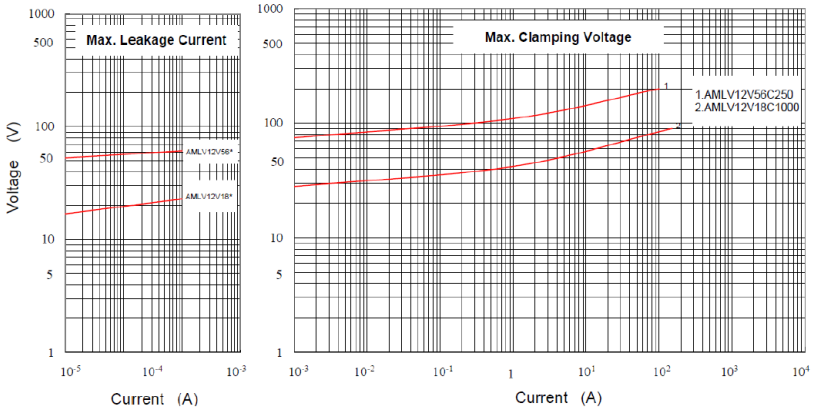


Maximum leakage current and maximum clamping voltage curves

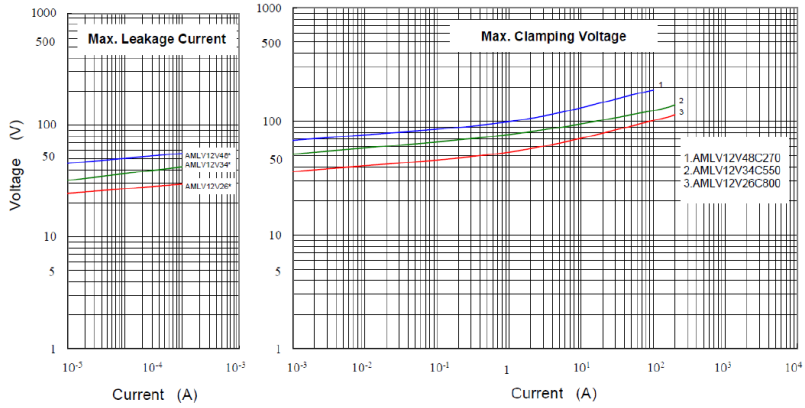


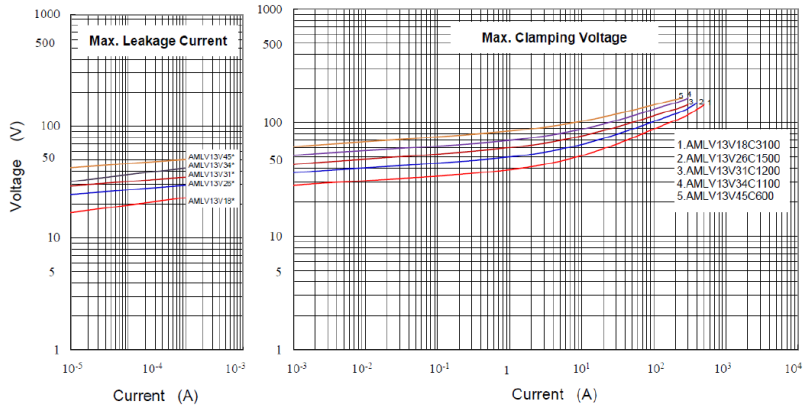


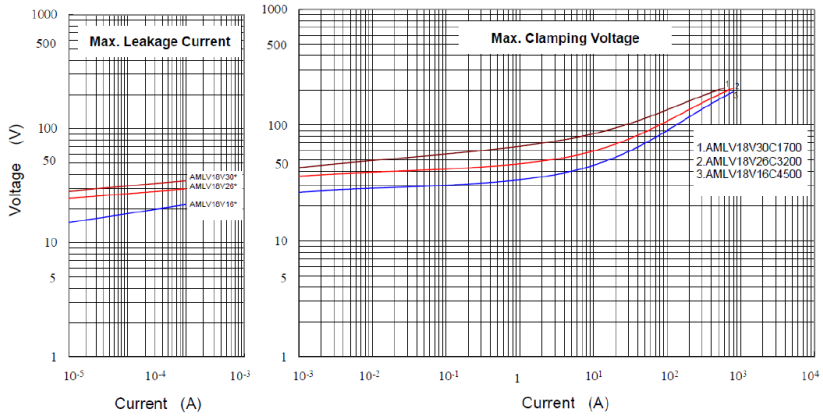


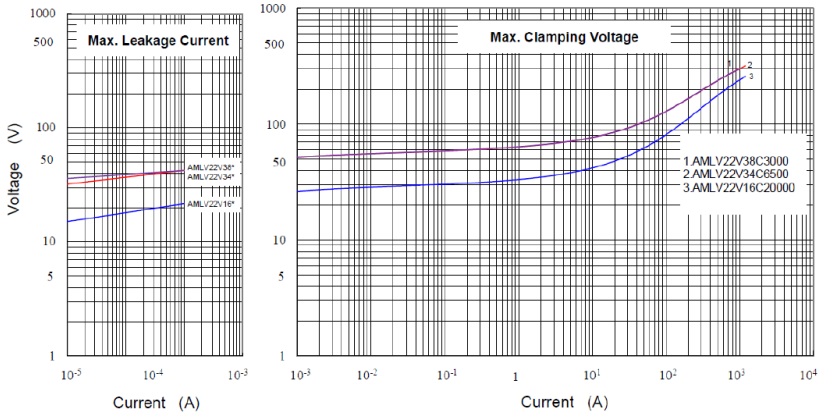


Maximum leakage current and maximum clamping voltage curves

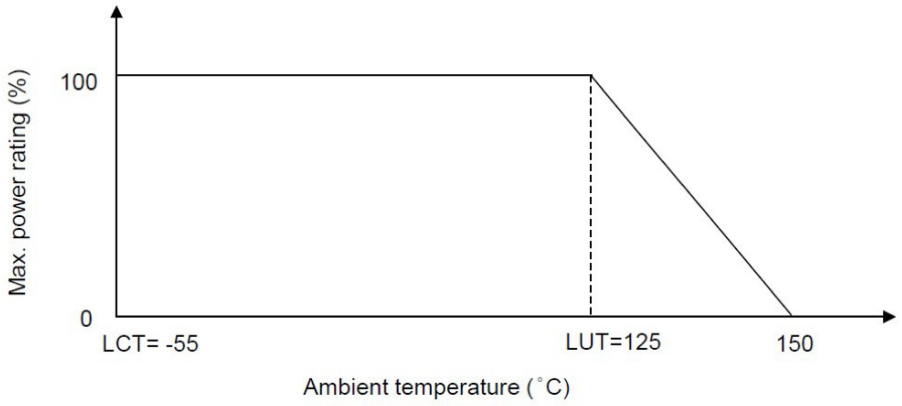






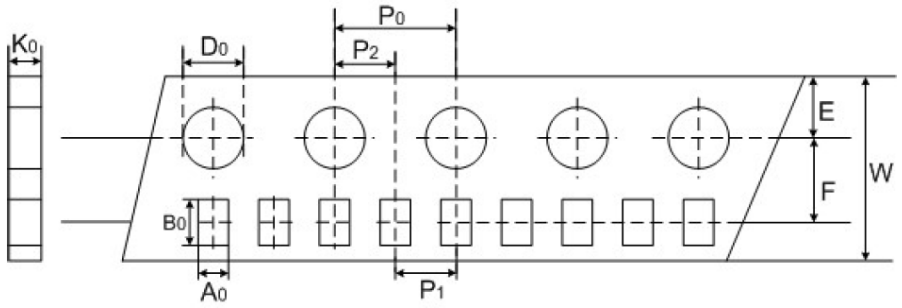


Power derating curve



Packaging information - mm

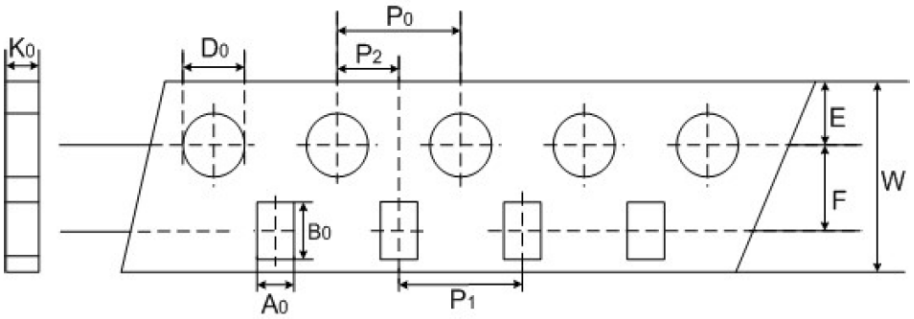
AMLV04: 10,000 parts on a 7" diameter tape and reel (EIA-481 compliant)



Dimension	AMLV04
A0	0.62 ± 0.05
B0	1.12 ± 0.12
W	8 ± 0.2
E	1.75 ± 0.1
F	3.5 ± 0.05
P0	4 ± 0.1
P1	2 ± 0.1
P2	2 ± 0.05
D0	1.55 ± 0.1
K0	0.60 ± 0.1

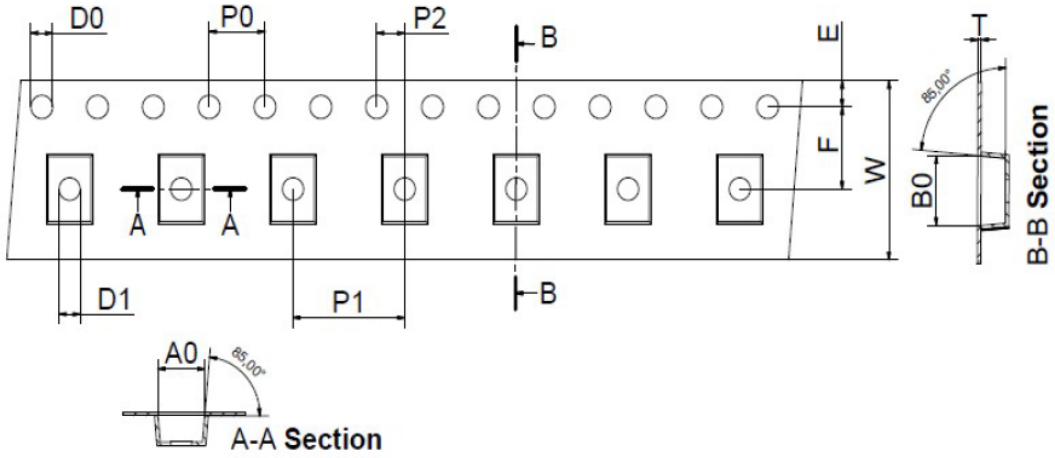
Packaging information - mm

AMLV06: 4,000 parts on a 7" diameter tape and reel (EIA-481 compliant)
AMLV08: 3,500 parts on a 7" diameter tape and reel (EIA-481 compliant)



Dimension	AMLV06	AMLV08
A0	1.1 ± 0.2	1.5 ± 0.2
B0	1.9 ± 0.2	2.3 ± 0.2
W	8 ± 0.2	8 ± 0.2
E	1.75 ± 0.1	1.75 ± 0.1
F	3.5 ± 0.05	3.5 ± 0.05
P0	4 ± 0.1	4 ± 0.1
P1	4 ± 0.1	4 ± 0.1
P2	2 ± 0.05	2 ± 0.05
D0	1.55 ± 0.1	1.55 ± 0.1
K0	0.95 ± 0.1	1.00 ± 0.1

AMLV12 and AMLV13: 2500 parts on a 7" diameter tape and reel (EIA-481 compliant)
AMLV18: 1000 part on a 7" diameter tape and reel (EIA-481 compliant)
AMLV22: 800 part on a 7" diameter tape and reel (EIA-481 compliant)



Dimension	AMLV12	AMLV13	AMLV18	AMLV22
A0	1.85 ± 0.2	2.75 ± 0.2	3.65 ± 0.2	5.50 ± 0.2
B0	3.45 ± 0.2	3.55 ± 0.2	4.96 ± 0.2	6.25 ± 0.2
W	8 ± 0.2	8 ± 0.2	12 ± 0.3	12 ± 0.3
E	1.75 ± 0.1	1.75 ± 0.1	1.75 ± 0.1	1.75 ± 0.1
F	3.5 ± 0.05	3.5 ± 0.05	5.5 ± 0.05	5.5 ± 0.05
P0	4 ± 0.1	4 ± 0.1	4 ± 0.1	4 ± 0.1
P1	4 ± 0.1	4 ± 0.1	8 ± 0.1	8 ± 0.1
P2	2 ± 0.05	2 ± 0.05	2 ± 0.05	2 ± 0.05
D0	1.55 ± 0.1	1.55 ± 0.1	1.55 ± 0.1	1.55 ± 0.1
D1	1.00 ± 0.1	1.00 ± 0.1	1.50 ± 0.1	1.50 ± 0.1
T	0.25 ± 0.1	0.25 ± 0.1	0.25 ± 0.1	0.25 ± 0.1

Solder reflow profile

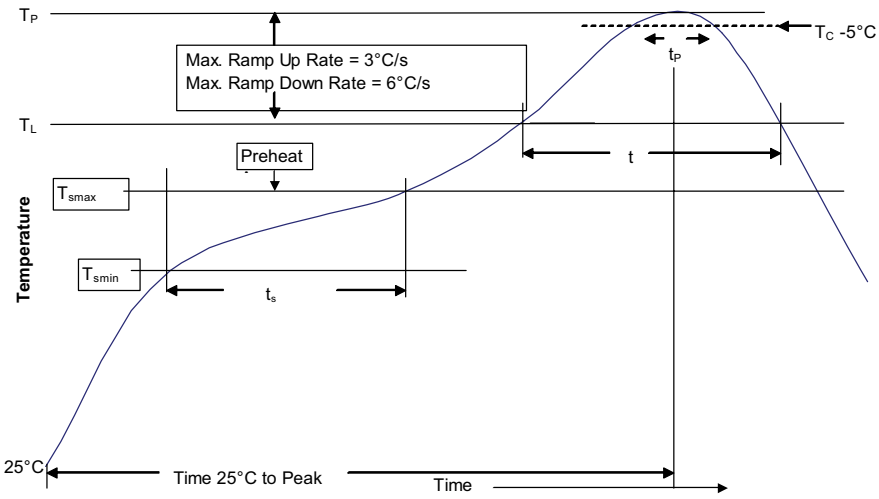


Table 1 - Standard SnPb solder (T_C)

Package thickness	Volume mm3 <350	Volume mm3 ≥350
<2.5 mm)	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2 - Lead (Pb) Free Solder (T_C)

Package thickness	Volume mm³ <350	Volume mm³ 350 - 2000	Volume mm³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 – 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

Reference JDEC J-STD-020

Profile feature		Standard SnPb solder	Lead (Pb) free solder
Preheat and soak	• Temperature min. (T_{smin})	100 °C	150 °C
	• Temperature max. (T_{smax})	150 °C	200 °C
	• Time (T_{smin} to T_{smax}) (t_s)	60-120 seconds	60-120 seconds
Average ramp up rate T_{smax} to T_p		3 °C/ second max.	3 °C/ second max.
Liquidous temperature (T_L) Time at liquidous (t_L)		183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body temperature (T_P)*		Table 1	Table 2
Time (t_p)** within 5 °C of the specified classification temperature (T_C)		20 seconds**	30 seconds**
Average ramp-down rate (T_p to T_{smax})		6 °C/ second max.	6 °C/ second max.
Time 25 °C to peak temperature		6 minutes max.	8 minutes max.

* Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.
** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.

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