Features

- Formerly a KEKOVARICON product
- One standard model size available - 6 x 9 mm
- Operating voltage range (V_{dc}): 3 to 125 V (up to 170 V upon request)
- Operating voltage range (V_{rms}): 2 to 95 V (up to 130 V upon request)
- Capacitance range: 10 nF to 1 µF (lower values available upon request)
- X7R capacitor temperature characteristics
- Available in tape and reel packaging for automatic pick-and-place
- AEC-Q200 Grade 1 upon request
- RoHS compliant*

MV Series – Low Voltage Dual Function Varicons

General Information

The MV series is series of dual function protective devices that help protect against voltage surges in a low voltage region against high frequency noise. This component typically replaces two components – a low voltage varistor and a capacitor.

MV series varicons incorporate a varistor function in the DC voltage range from 3 to 125 V (up to 170 V upon request) and function as high frequency bypass capacitors operating in the capacitance range from 10 nF to 1 µF. Lower capacitance values are also available. They are intended for protection of all sensitive electronic devices experiencing both voltage transients and high frequency noise produced by electromechanical devices, such as buzzers, relays, etc.

MV series varicons are square shaped components with in-line leads requiring very little mounting space - at least 30 % less than the two components they typically replace.

Absolute Maximum Ratings

Parameter	Value	Units
Continuous: Steady State Applied Voltage DC Voltage Range (V_{dc}) AC Voltage Range (V_{rms})	 3 to 170 2 to 130**	 V V
Transient: Non-Repetitive Surge Current, 8/20 µs Waveform (I_{max}) Non-Repetitive Surge Energy, 10/1000 µs Waveform (W_{max})	 150 0.1 to 2.5	 A J
Capacitance Range	10 to 1000	nF
Capacitor Temperature Characteristics	X7R	
Operating Ambient Temperature	-40 to +125	°C
Storage Temperature Range	-40 to +150	°C
Threshold Voltage Temperature Coefficient	< +0.05	%/°C
Insulation Resistance	> 1	GΩ
Isolation Voltage Capability	> 1.25	kV
Response Time	< 25	ns
Climatic Category	40 / 125 / 56	

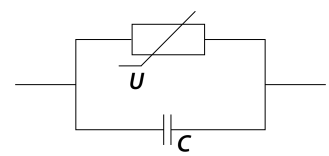
** Varistors with rated voltages of 2 to 8 V_{rms} are non-standard and available only upon request.

Additional Information

Click these links for more information:

PRODUCT SELECTOR | TECHNICAL LIBRARY | INVENTORY | SAMPLES | CONTACT

Dual Function Component Symbol



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WARNING Cancer and Reproductive Harm
www.P65Warnings.ca.gov

*RoHS Directive 2015/863, Mar 31, 2015 and Annex.
Specifications are subject to change without notice.
Users should verify actual device performance in their specific applications.
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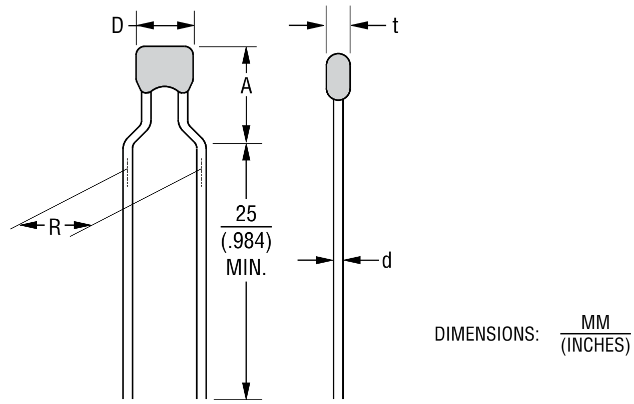
Device Ratings

Model	V_{rms}	V_{dc}	V_n @ 1 mA	V_c @ 1 A	W_{max} 10/1000 µs	P max.	I_{max} 8/20 µs	C Typ. @ 1 kHz
	V	V	V	V	J	W	A	nF
MV 11 K 103 MX	11	14	18	35	0.8	0.01	150	10
MV 11 K 104 MX	11	14	18	35	0.8	0.01	150	100
MV 11 K 105 MX	11	14	18	35	0.8	0.01	150	1000
MV 14 K 103 MX	14	18	22	38	0.9	0.01	150	10
MV 14 K 104 MX	14	18	22	38	0.9	0.01	150	100
MV 14 K 105 MX	14	18	22	38	0.9	0.01	150	1000
MV 17 K 103 MX	17	22	27	49	1.1	0.01	150	10
MV 17 K 104 MX	17	22	27	49	1.1	0.01	150	100
MV 17 K 105 MX	17	22	27	49	1.1	0.01	150	1000
MV 20 K 103 MX	20	26	33	54	1.3	0.01	150	10
MV 20 K 104 MX	20	26	33	54	1.3	0.01	150	100
MV 20 K 105 MX	20	26	33	54	1.3	0.01	150	1000
MV 25 K 103 MX	25	31	39	65	1.7	0.01	150	10
MV 25 K 104 MX	25	31	39	65	1.7	0.01	150	100
MV 25 K 105 MX	25	31	39	65	1.7	0.01	150	1000
MV 30 K 103 MX	30	38	47	77	2.0	0.01	150	10
MV 30 K 104 MX	30	38	47	77	2.0	0.01	150	100
MV 30 K 105 MX	30	38	47	77	2.0	0.01	150	1000
MV 35 K 103 MX	35	45	56	90	2.2	0.01	150	10
MV 35 K 104 MX	35	45	56	90	2.2	0.01	150	100
MV 35 K 105 MX	35	45	56	90	2.2	0.01	150	1000
MV 40 K 103 MX	40	56	68	110	2.3	0.01	150	10
MV 40 K 104 MX	40	56	68	110	2.3	0.01	150	100
MV 40 K 105 MX	40	56	68	110	2.3	0.01	150	1000
MV 50 K 103 MX	50	65	82	135	2.3	0.01	150	10
MV 50 K 104 MX	50	65	82	135	2.3	0.01	150	100
MV 50 K 105 MX	50	65	82	135	2.3	0.01	150	1000
MV 60 K 103 MX	60	85	100	165	2.3	0.01	150	10
MV 60 K 104 MX	60	85	100	165	2.3	0.01	150	100
MV 60 K 105 MX	60	85	100	165	2.3	0.01	150	1000
MV 95 K 103 MX	95	125	150	250	2.5	0.01	150	10
MV 95 K 104 MX	95	125	150	250	2.5	0.01	150	100
MV 95 K 105 MX	95	125	150	250	2.5	0.01	150	1000

"X" indicates X7R temperature characteristics; other capacitance values and voltages are available upon request.

Product Dimensions



D max.	A max.	R	d	t max.
6.0 (.236)	9.0 (.354)	5.0 (.197)	0.6 (.024)	5.5 (.217)

How to Order

MV20K103MXRL1yy

- Series Designator
  - MV Series
- Max. Continuous Working Voltage (V_{rms})
- V_n Tolerance
  - K = ± 10 %
- Capacitance Code
  - 103 = 10 nF
  - 104 = 100 nF
  - 105 = 1000 nF
- Capacitance Tolerance
  - K = ± 10 %
  - L = ± 15 %
  - M = ± 20 %
- Dielectric Type
  - X = X7R
- Packaging
  - B = Bulk
  - R = Reel
  - A = Ammo Pack (Available upon Request)
- Lead Style
  - 1 = Crimped
- Special Parameters

Instructions for Creating Orderable Part Number:

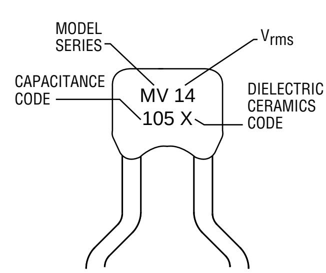
1) Start with base part number in characteristics table (example: MV20K103MX).

2) Add Packaging: R (example part number becomes MV20K103MXR).

3) Add Lead Style: L1 (example part number becomes MV20K103MXRL1)

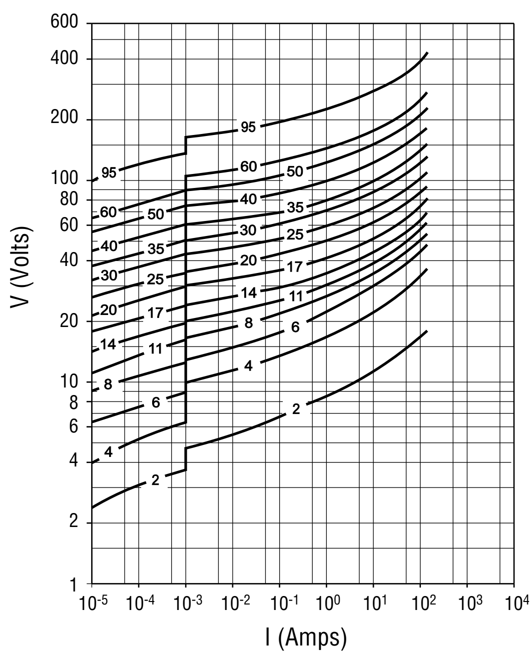
4) Part number can have no spaces or lower case letters.

Typical Part Marking



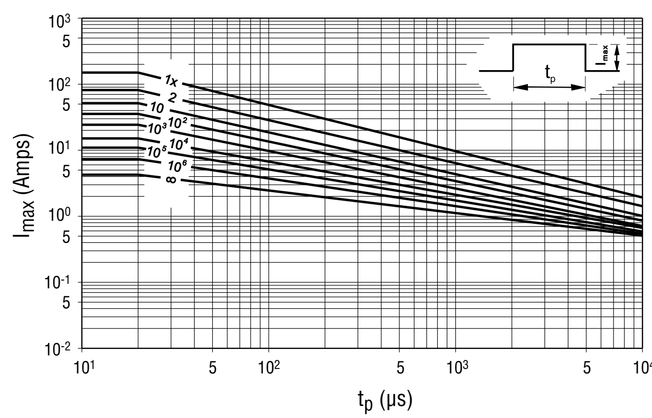
Protection Level

(MV11 ~ MV95 K)



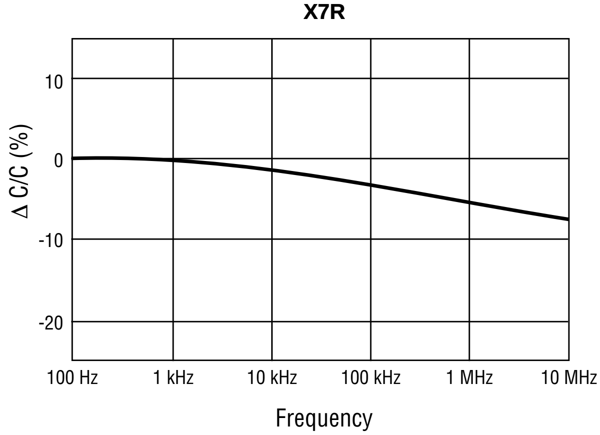
Pulse Rating Curves

(MV11 ~ MV95 K)



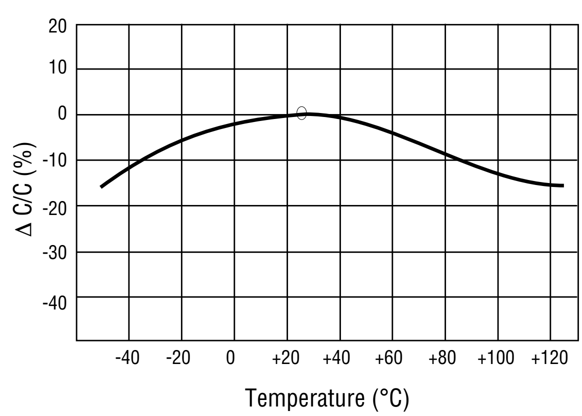
Capacitance - Frequency Characteristics

X7R



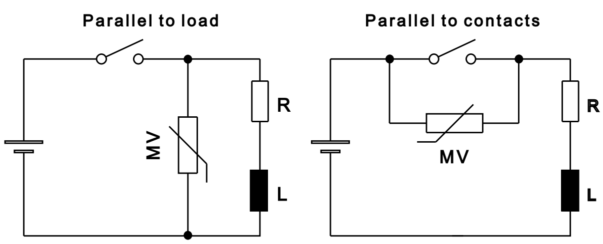
Capacitance - Temperature Characteristics

X7R

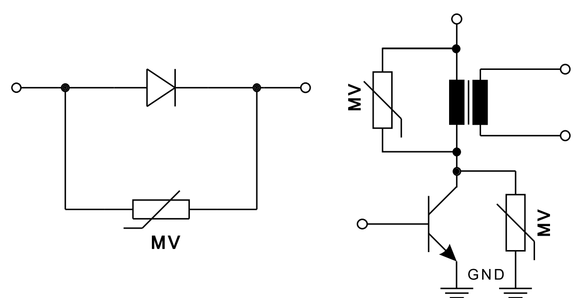


Application Circuits

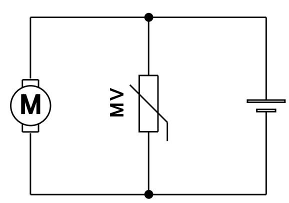
(a) Elimination of sparks from relay circuits (no delay in operating time)



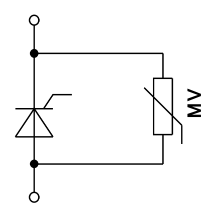
(b) Elimination of noise from micro motors



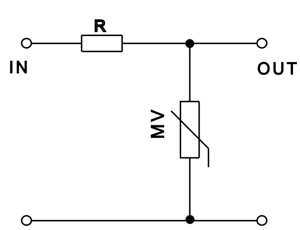
(c) Stabilization of voltages and absorption of line surges



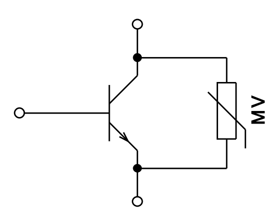
(d) Absorption of piezoelectric alarm shock noise



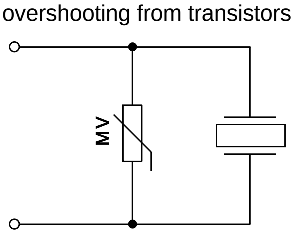
(e) Protection of semi-conductive components including transistors and diodes



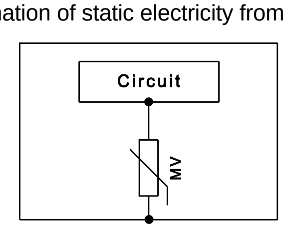
(f) Improved thyristor configuration - better elimination of vibration than conventional circuits



(g) Elimination of overshooting from transistors



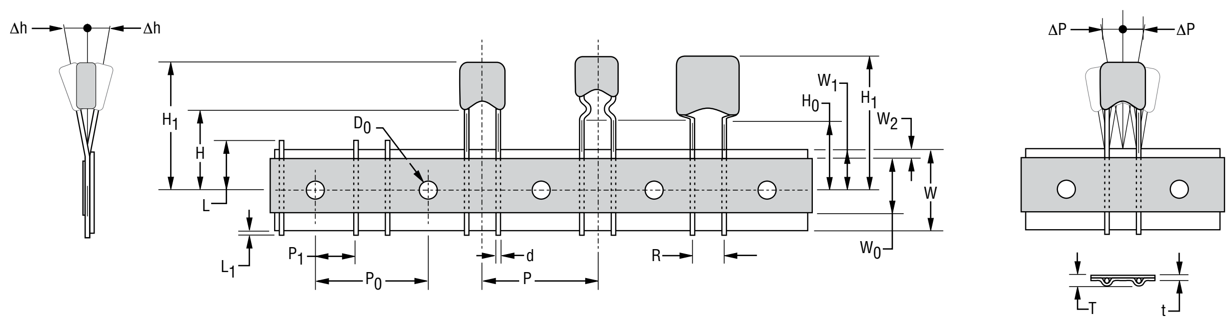
(h) Elimination of static electricity from circuits



Packaging Specifications

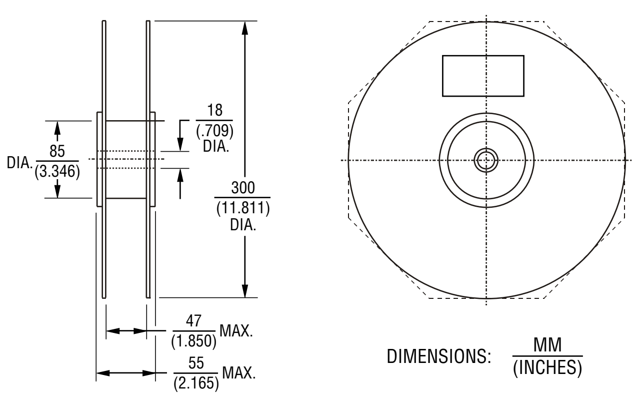
Tape

Conforms to IES Publication 286-2 Ed. 3: 2008-03

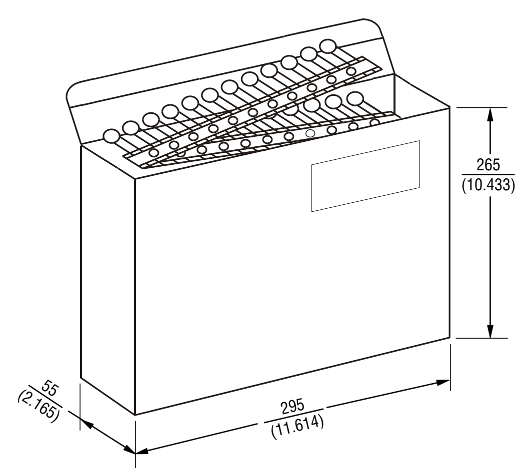


Dimensions on Next Page

Reel



Ammo Pack (Available upon Special Request)



Packaging Specifications - Tape (Continued)

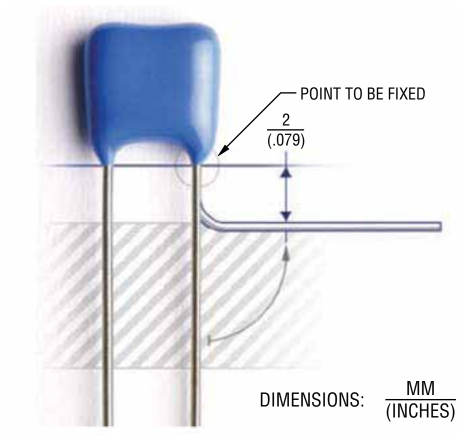
Symbol	Parameter	Dimension
W	Carrier tape width	18 +1.0/-0.5 (.709 +.039/-.020)
W_0	Hold down tape width	5 (.197) MIN.
W_1	Sprocket hole position	9 +0.75/-0.5 (.354 +.030/-.020)
W_2	Distance between the upper edges of the carrier tape and hold down tape	3 (.118) MAX.
T	Total tape thickness	1.5 (.059) MAX.
t	Tape thickness	0.9 (.035) MAX.
P	Pitch of component	12.7 ± 1.0 (.500 ± .039)
P_0	Feed hole pitch	12.7 ± 0.3 (.500 ± .012)
P_1	Feed hole center to pitch	3.85 ± 0.7 (.152 ± .028)
R	Lead spacing	5 +0.5/-0.2 (.197 +.020/-.008)
ΔP	Component alignment	±1.3 (±.051) MAX.
Δh	Component alignment	±2 (±.079) MAX.
d	Wire diameter	0.6 (.024) MAX.
D_0	Feed hold diameter	4 ± 0.2 (.157 ± .008)
H	Height from tape center to component base	18 +2.0/-0.0 (.709 +.079/-.000)
H_0	Seating plane height	16 ± 0.5 (.630 ± .020)
H_1	Component height	32.2 (1.268) MAX.
L	Protrusion - cut out	11 (.433) MAX.
L_1	Protrusion - cut off	0.5 (.020) MAX.

DIMENSIONS: MM (INCHES)

Packaging Quantities

Bulk	1500
Reel	1500

Assembly Recommendations for Through-Hole Components



Very often before soldering through-hole components, their leads get bent. It is important not to damage the components during lead bending. Damage most commonly incurred during bending is cracks in epoxy parts, which can lead to increased humidity sensitivity of a component and, consequentially, a shorter lifetime.

In order to avoid epoxy damage, it is necessary to:
- fix the most sensitive point (epoxy parts) of a component body
- bend the wire at least 2 mm below the end of epoxy parts

Other potential damage to a component which can lead to component failure or a shorter lifetime is thermal shock during manual soldering with a soldering iron. This can occur when a soldering iron is placed too close to one point of the component body and it happens most often when the solder joint is too close to the varistor body.

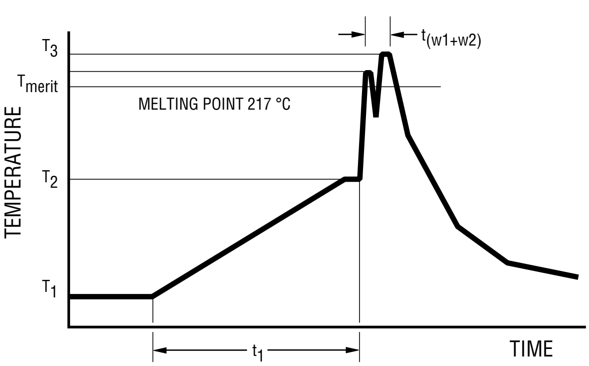
Resistance to Soldering Heat

In the case of automatic wave soldering, it is important to provide sufficient resistance to soldering heat. In order to prevent any potential problems, internal standards were introduced for testing the resistance to soldering heat of through-hole components: 300 °C, 10 seconds.

Pb-free Wave Soldering Profile Recommendations

Recommended soldering profiles for all above components are in accordance with JEDEC standard curves (J-STD-020D) and are, therefore, compatible with the Pb-free process.

Lead-free Wave Soldering Profile - Pb-free wave profile requirements for soldering heat resistance of components



Parameter	Symbol	Specification
Preheating temperature gradient		4 °C/sec. max.
Preheating time	t_1	2 to 5 min.
Min. preheating temperature	T_1	130 °C
Max. preheating temperature	T_2	180 °C
Melting temperature/point	T_{meltv}	217 °C
Time in wave soldering phase (w_1+w_2)	t_{w1+w2}	10 sec.
Max. wave temperature (w_1+w_2)	T_S	265 °C +0/-5 °C
Cooling temperature gradient		6° C/sec. max.
Temperature jump from T_2 to T_3 (w_1)	$T_{3(w1)}$ - T_2	120 °C max
Time from 25 °C to T_3 (wave temperature)		8 min. max.

Reliability Testing Procedures

Varistor test procedures comply with CECC 42200, IEC 1051-1/2 (and AEC-Q200, if applicable). Test results are available upon customer request. Special tests can be performed upon customer request.

Reliability Parameter	Test	Tested According to	Condition to be Satisfied after Testing
AC/DC Bias Reliability	AC/DC Life Test	CECC 42200, Test 4.20 or IEC 1051-1, Test 4.20, AEC-Q200 Test 8 - 1000 h at UCT	$\vert\delta V_n$ (1 mA)$\vert < 10$ %
Pulse Current Capability	I_{max} 8/20 μs	CECC 42200, Test C 2.1 or IEC 1051-1, Test 4.5	$\vert\delta V_n$ (1 mA)$\vert < 10$ % no visible damage
Pulse Energy Capability	W_{max} 10/1000 μs	CECC 42200, Test C 2.1 or IEC 1051-1, Test 4.5	$\vert\delta V_n$ (1 mA)$\vert < 10$ % no visible damage
WLD Capability	WLD x 10	ISO 7637, Test pulse 5, 10 pulses at rate of 1 per minute	$\vert\delta V_n$ (1 mA)$\vert < 15$ % no visible damage
V_{jump} Capability	V_{jump} 5 min.	Increase of supply voltage to $V \geq V_{jump}$ for 1 minute	$\vert\delta V_n$ (1 mA)$\vert < 15$ % no visible damage
Environmental and Storage Reliability	Climatic Sequence	CECC 42200, Test 4.16 or IEC 1051-1, Test 4.17 a) Dry heat, 16h, UCT, Test Ba, IEC 68-2-2 b) Damp heat, cyclic, the first cycle: 55 °C, 93 % RH, 24 h, Test Db 68-2-4 c) Cold, LCT, 2 h, Test Aa, IEC 68-2-1 d) Damp heat cyclic, remaining 5 cycles: 55 °C, 93 % RH, 24 h/cycle, Test Bd, IEC 68-2-30	$\vert\delta V_n$ (1 mA)$\vert < 10$ %
	Thermal Shock	CECC 42200, Test 4.12, Test Na, IEC 68-2-14, AEC-Q200 Test 16, 5	$\vert\delta V_n$ (1 mA)$\vert < 10$ % no visible damage
	Steady State Damp Heat	CECC 42200, Test 4.17, Test Ca, IEC 68-2-3, AEC-Q200 Test 6, 56 days, 40 °C, 93 % RH, AEC-Q200 Test 7: Bias, Rh, T all at 85.	$\vert\delta V_n$ (1 mA)$\vert < 10$ %
	Storage Test	IEC 68-2-2, Test Ba, AEC-Q200 Test 3, 1000 h at maximum storage temperature	$\vert\delta V_n$ (1 mA)$\vert < 5$ %

Continued on Next Page

Reliability Testing Procedures (Continued)

Reliability Parameter	Test	Tested According to	Condition to be Satisfied after Testing
Mechanical Reliability	Solderability	CECC 42200, Test 4.10.1, Test Ta, IEC 68-2-20 solder bath and reflow method	Solderable at shipment and after 2 years of storage, criteria: >95% must be covered by solder for reflow meniscus
	Resistance to Soldering Heat	CECC 42200, Test 4.10.2, Test Tb, IEC 68-2-20 solder bath nad reflow method	$\lvert \delta V_n$ (1 mA)$\rvert < 5$ %
	Terminal Strength	JIS-C-6429, App. 1, 18N for 60 sec. - same for AEC-Q200 Test 22	No visual damage
	Board Flex	JIS-C-6429, App. 2, 2 mm min. AEC-Q200 test 21 - Board flex: 2 mm flex min.	$\lvert \delta V_n$ (1 mA)$\rvert < 2$ % No visible damage
	Vibration	CECC 42200, Test 4.15, Test Fc, IEC 68-2-6, AEC-Q200 Test 14 Frequency range 10 to 55 Hz (AEC: 10-2000 Hz) Amplitude 0.75 m/s^2 or 98 m/s^2 (AEC: 5 g for 20 minutes) Total duration 6 h (3x2 h) (AEC: 12 cycles each of 3 directions) Waveshape - half sine	$\lvert \delta V_n$ (1 mA)$\rvert < 2$ % No visible damage
	Mechanical Shock	CECC 42200, Test 4.14, Test Ea, IEC 68-2-27, AEC-Q200 Test 13. Acceleration = 490 m/s^2 (AEC: MIL-STD-202-Method 213), Pulse duration = 11 ms, Waveshape - half sine; Number of shocks = 3x6	$\lvert \delta V_n$ (1 mA)$\rvert < 10$ % No visible damage
Electrical Transient Conduction	ISO-7637-1 Pulses	AEC-Q200 Test 30: Test pulses 1 to 3. Also other pulses - freestyle.	$\lvert \delta V_n$ (1 mA)$\rvert < 10$ % No visible damage

Terminology

Term	Symbol	Definition
Rated AC Voltage	V_{rms}	Maximum continuous sinusoidal AC voltage (<5 % total harmonic distortion) which may be applied to the component under continuous operation conditions at +25 °C
Rated DC Voltage	V_{dc}	Maximum continuous DC voltage (<5 % ripple) which may be applied to the component under continuous operating conditions at +25 °C
Supply Voltage	V	The voltage by which the system is designated and to which certain operating characteristics of the system are referred; V_{rms} = 1.1 x V
Leakage Current	I_{dc}	The current passing through the varistor at V_{dc} and at +25 ° or at any other specified temperature
Varistor Voltage	V_n	Voltage across the varistor measured at a given reference current (I_n)
Reference Current	I_n	Reference current = 1 mA DC
Clamping Voltage Protection Level	V_c	The peak voltage developed across the varistor under standard atmospheric conditions, when passing an 8/20 μs class current pulse
Class Current	I_c	A peak value of current which is 1/10 of the maximum peak current for 100 pulses at two per minute for the 8/20 μs pulse
Voltage Clamping Ratio	V_c/V_{app}	A figure of merit measure of the varistor clamping effectiveness as defined by the symbols V_c/V_{app}, where (V_{app} = V_{rms} or V_{dc})
Jump Start Transient	V_{jump}	The jump start transient results from the temporary application of an overvoltage in excess of the rated battery voltage. The circuit power supply may be subjected to a temporary overvoltage condition due to the voltage regulation failing or it may be deliberately generated when it becomes necessary to boost start the car.
Rated Single Pulse Transient Energy	W_{max}	Energy which may be dissipated for a single 10/1000 μs pulse of a maximum rated current, with rated AC voltage or rated DC voltage also applied, without causing device failure
Load Dump Transient	WLD	Load Dump is a transient which occurs in automotive environments. It is an exponentially decaying positive voltage which occurs in the event of a battery disconnect while the alternator is still generating charging current with other loads remaining on the alternator circuit at the time of battery disconnect.
Rated Peak Single Pulse Transient Current	I_{max}	Maximum peak current which may be applied for a single 8/20 μs pulse, with rated line voltage also applied, without causing device failure
Rated Transient Average Power Dissipation	P	Maximum average power which may be dissipated due to a group of pulses occurring within a specified isolated time period, without causing device failure at 25 °C
Capacitance	C	Capacitance between two terminals of the varistor measured @ 1 kHz
Non-linearity Exponent	α	A measure of varistor nonlinearity between two given operating currents, I_n and I_1 as described by I = k V exp(a), where: - k is a device constant, - $I_1 < I < I_n$ and - a log (I_1/I_n)/log(V_1/V_n) = 1/log (V_1/V_n), where: - I_r is reference current (1 mA) and V_n is varistor voltage - I_1 = 10 I_n, V_1 is the voltage measured at I_1
Response Time	tr	The time lag between application of a surge and varistor's "turn-on" conduction action
Varistor Voltage Temperature Coefficient	TC	(V_n @ 85 °C - V_n @ 25 °C) / (V_n @ 25 °C) x 60 °C) x 100
Insulation Resistance	IR	Minimum resistance between shorted terminals and varistor surface
Isolation Voltage		The maximum peak voltage which may be applied under continuous operating conditions between the varistor terminations and any conducting mounting surface
Operating Temperature		The range of ambient temperature for which the varistor is designed to operate continuously as defined by the temperature limits of its climatic category
Climatic Category	LCT/UCT/DHD	LCT & UCT = Lower and Upper Category Temperature - the minimum and maximum ambient temperatures for which a varistor has been designed to operate continuously. DHD = Dump Heat Test Duration
Storage Temperature		Storage temperature range without voltage applied
Current/Energy Derating		Derating of maximum values when operated above UCT

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