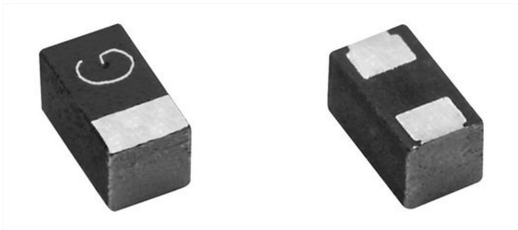
Solid Tantalum Chip Capacitors, MICROTAN®, High CV Leadframeless Molded



FEATURES

- Highest capacitance-voltage product in industry
- Mounting: Surface mount
- Small sizes include 0603 and 0402 footprint
- Lead (Pb)-free L-shaped face-down terminations
- 8 mm tape and reel packaging available per EIA-481 and reeling per IEC 60286-3 7" [178 mm] standard
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
GREEN (5-2008)

PERFORMANCE CHARACTERISTICS

Operating Temperature: - 55 °C to + 85 °C (to + 125 °C voltage derating)

Capacitance Range: 10 µF to 100 µF

Capacitance Tolerance: ± 20 % standard

Voltage Rating: 4 V_{DC} to 10 V_{DC}

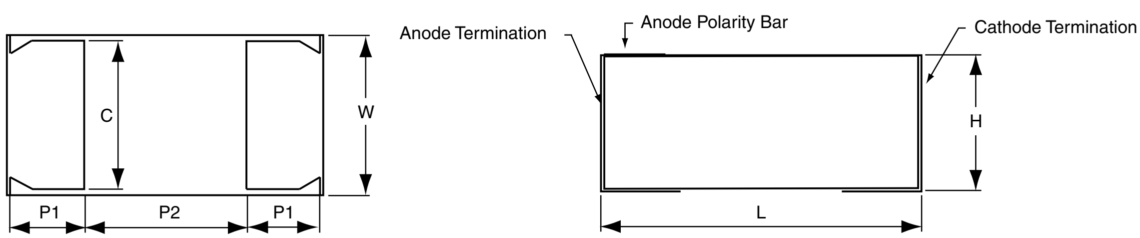
ORDERING INFORMATION

298W	107	X0	010	Q	2	T
TYPE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT + 85 °C	CASE CODE	TERMINATION	REEL SIZE AND PACKAGING
	This is expressed in pF. The first two digits are the significant figures. The third is the number of zeros to follow.	**X0 = ± 20 %** X9 = ± 10 %	This is expressed in V. To complete the three-digit block, zeros precede the voltage rating. A decimal point is indicated by an "R" (6R3 = 6.3 V).	See Ratings and Case Codes table	**2 = 100 % tin** 4 = Gold plated	T = Tape and reel **7" [178 mm] reel**

Note

- Preferred tolerances and reel sizes are in bold.
  We reserve the right to supply higher voltage ratings and tighter capacitance tolerance capacitors in the same case size. Voltage substitutions will be marked with the higher voltage rating.

DIMENSIONS in inches [millimeters]



CASE CODE	L	W	H (MAX.)	P1	P2 (REF.)	C
K	0.039 + 0.008 [1.0 + 0.2]	0.02 + 0.008 [0.5 + 0.2]	0.024 [0.6]	0.01 ± 0.004 [0.25 ± 0.1]	0.02 [0.5]	0.015 ± 0.004 [0.38 ± 0.1]
M	0.063 ± 0.008 [1.60 ± 0.2]	0.033 ± 0.008 [0.85 ± 0.2]	0.035 [0.9]	0.020 ± 0.004 [0.50 ± 0.1]	0.024 [0.60]	0.024 ± 0.004 [0.60 ± 0.1]
Q	0.126 ± 0.008 [3.2 ± 0.2]	0.063 ± 0.008 [1.6 ± 0.2]	0.039 [1.0]	0.031 ± 0.004 [0.80 ± 0.1]	0.063 [1.60]	0.047 ± 0.004 [1.20 ± 0.1]
G	0.063 ± 0.008 [1.60 ± 0.2]	0.033 ± 0.008 [0.85 ± 0.2]	0.047 [1.2]	0.020 ± 0.004 [0.50 ± 0.1]	0.024 [0.60]	0.024 ± 0.004 [0.60 ± 0.1]
L	0.079 ± 0.004 [2.0 ± 0.2]	0.050 ± 0.004 [1.25 ± 0.2]	0.039 [1.0]	0.020 ± 0.004 [0.50 ± 0.1]	0.04 [1.0]	0.035 ± 0.004 [0.90 ± 0.1]

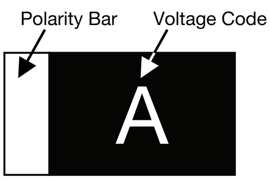
RATINGS AND CASE CODES

μF	4 V	6.3 V	10 V
10		K	
22	K [1]		M [1]
33			G [1]
47		G [1]/L [1]	
100	M [1]		Q
220	Q		

Note
[1] In development.

MARKING

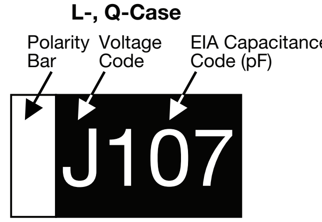
G-, M-Case



K-Case

VOLTAGE CODE		CAPACITANCE CODE	
V	**CODE**	**CAP. μF**	**CODE**
2.5	e	0.68	$\overline{w}$
4	G	1	A
6.3	J	2.2	J
10	A	3.3	N
16	C	4.7	S
20	D	6.8	W
25	E	10	α
35	V	15	e
50	T	22	j
		33	n
		47	s
		68	w
		100	$\overline{A}$
		150	$\overline{E}$
		220	$\overline{J}$

L-, Q-Case



STANDARD RATINGS

CAPACITANCE (μF)	CASE CODE	PART NUMBER	MAX. DCL AT + 25 °C (μA)	MAX. DF AT + 25 °C 120 Hz (%)	MAX. ESR AT + 25 °C 100 kHz (Ω)	MAX. RIPPLE 100 kHz I_{RMS} (A)	ΔC/C (%)
4 V_{DC} AT + 40 °C; 2.5 V_{DC} + 85 °C; 1.6 V_{DC} AT + 125 °C							
22	K [1]	298W226X0004K2T	25.0	40.0	20.0	TBD	± 30
100	M [1]	298W107X0004M2T	110.0	60.0	15.0	0.041	± 30
220	Q	298W227X0004Q2T	88.0	80.0	15.0	0.061	± 30
6.3 V_{DC} AT + 40 °C; 4.0 V_{DC} + 85 °C; 2.5 V_{DC} AT + 125 °C							
10	K	298W106X06R3K2T	10.0	30.0	15.0	0.032	± 30
47	L [1]	298W476X06R3L2T	3.0	25.0	2.0	TBD	± 30
47	G [1]	298W476X06R3G2T	30.0	50.0	15.0	TBD	± 30
10 V_{DC} AT + 40 °C; 6.3 V_{DC} + 85 °C; 4.0 V_{DC} AT + 125 °C							
22	M [1]	298W226X0010M2T	22.0	40.0	10.0	0.050	± 30
33	G [1]	298W336X0010G2T	33.0	45.0	15.0	TBD	± 30
100	Q	298W107X0010Q2T	100	75.0	15.0	0.060	± 35

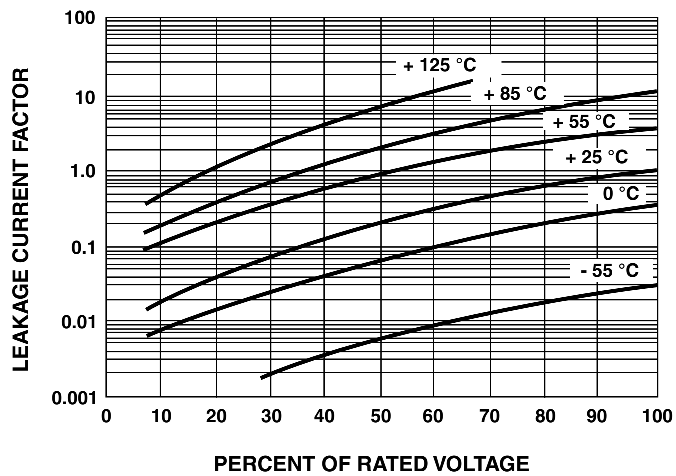
Note
[1] In development.

CAPACITORS PERFORMANCE CHARACTERISTICS

ELECTRICAL PERFORMANCE CHARACTERISTICS

ITEM	PERFORMANCE CHARACTERISTICS					
Category temperature range	- 55 °C to + 125 °C (with voltage derating)					
Capacitance tolerance	± 20 %, ± 10 % (at 120 Hz) 2 V_{RMS} at + 25 °C using a capacitance bridge					
Dissipation factor (at 120 Hz)	Limits per Standard Ratings table. Tested via bridge method, at 25 °C, 120 Hz					
ESR (100 kHz)	Limits per Standard Ratings table. Tested via bridge method, at 25 °C, 100 kHz					
Leakage current	After application of RV applied to capacitors for 5 min using a steady source of power with 1 kΩ resistor in series with the capacitor under test, leakage current at 25 °C is not more than described in.					
Operation temperatures	Rated voltage	- 55 °C/+ 40 °C	10 V	8.2 V	6.3 V	4.0 V
	Category voltage	+ 40 °C/+ 85 °C	6.3 V	5.2 V	4.0 V	2.5 V
	Category voltage	+ 85 °C/+ 125 °C	4 V	3.3 V	2.5 V	1.6 V

TYPICAL LEAKAGE CURRENT FACTOR RANGE

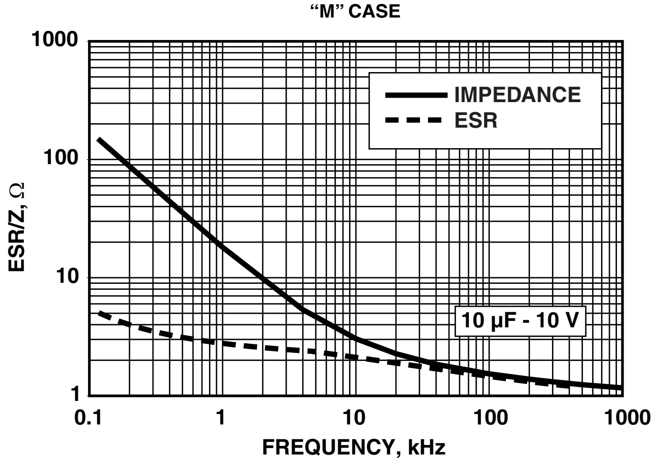


Notes

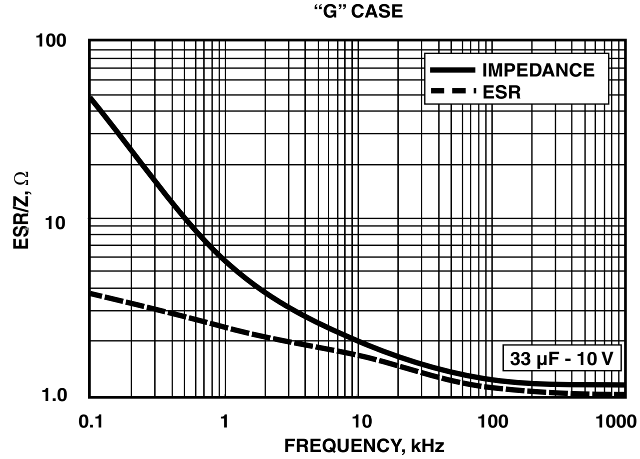
- At + 25 °C, the leakage current shall not exceed the value listed in the Standard Ratings Table
- At + 85 °C, the leakage current shall not exceed 10 times the value listed in the Standard Ratings Table
- At + 125 °C, the leakage current shall not exceed 12 times the value listed in the Standard Ratings Table

TYPICAL CURVES AT + 25 °C, IMPEDANCE AND ESR VS. FREQUENCY

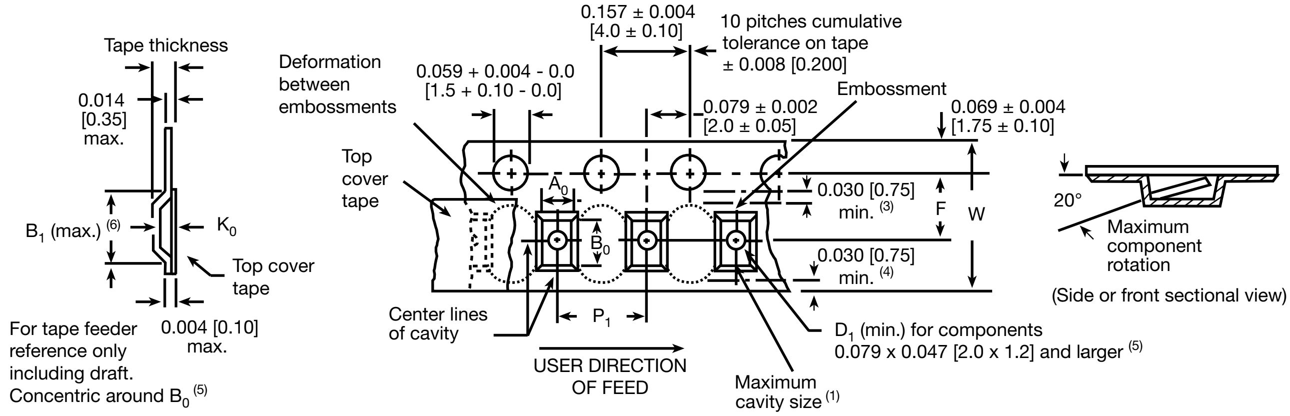
“M” CASE

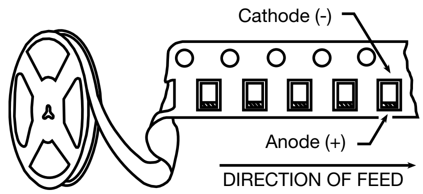


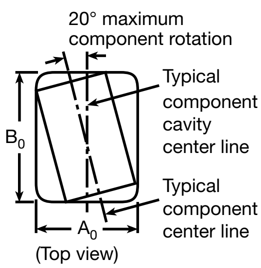
“G” CASE

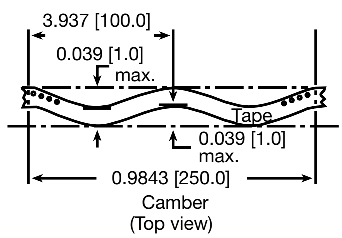


PLASTIC TAPE AND REEL PACKAGING in inches [millimeters]









Allowable camber to be 0.039/3.937 [1/100]
Non-cumulative over 9.843 [250.0]

Tape and Reel Specifications: All case sizes are available on plastic embossed tape per EIA-481. Tape reeling per IEC 60286-3 is also available. Standard reel diameter is 7" [178 mm], 13" [330 mm] reels are available and recommended as the most cost effective packaging method.

The most efficient packaging quantities are full reel increments on a given reel diameter. The quantities shown allow for the sealed empty pockets required to be in conformance with EIA-481. Reel size and packaging orientation must be specified in the Vishay Sprague part number.

Notes

- Metric dimensions will govern. Dimensions in inches are rounded and for reference only

(1) A_0, B_0, K_0, are determined by the maximum dimensions to the ends of the terminals extending from the component body and/or the body dimensions of the component. The clearance between the ends of the terminals or body of the component to the sides and depth of the cavity (A_0, B_0, K_0) must be within 0.002" (0.05 mm) minimum and 0.020" (0.50 mm) maximum. The clearance allowed must also prevent rotation of the component within the cavity of not more than 20°.

(2) Tape with components shall pass around radius “R” without damage. The minimum trailer length may require additional length to provide “R” minimum for 12 mm embossed tape for reels with hub diameters approaching N minimum.

(3) This dimension is the flat area from the edge of the sprocket hole to either outward deformation of the carrier tape between the embossed cavities or to the edge of the cavity whichever is less.

(4) This dimension is the flat area from the edge of the carrier tape opposite the sprocket holes to either the outward deformation of the carrier tape between the embossed cavity or to the edge of the cavity whichever is less.

(5) The embossed hole location shall be measured from the sprocket hole controlling the location of the embossement. Dimensions of embossement location shall be applied independent of each other.

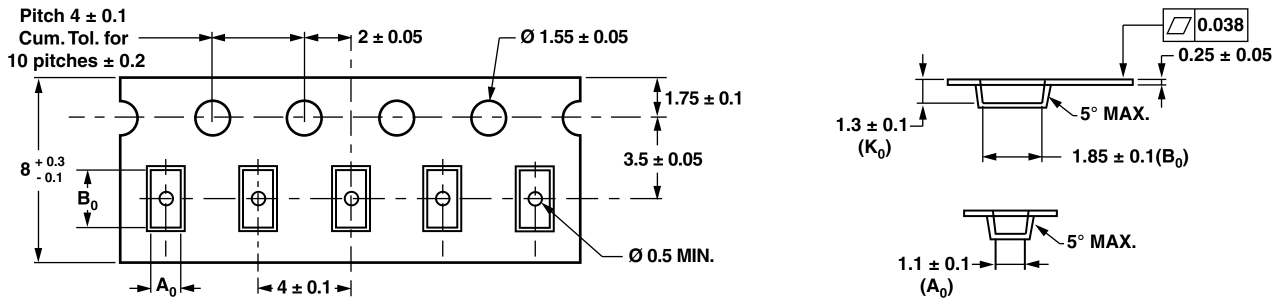
(6) B_1 dimension is a reference dimension tape feeder clearance only.

CASE CODE	TAPE SIZE	B_1 (MAX.)	D_1 (MIN.)	F	K_0 (MAX.)	P_1	W
298W							
Q	8 mm	0.165 [4.2]	0.039 [1.0]	0.138 ± 0.002 [3.5 ± 0.05]	0.094 [2.4]	0.157 ± 0.004 [4.0 ± 0.1]	0.315 ± 0.012 [8.0 ± 0.30]
G	8 mm	0.086 [2.19]	0.020 [0.5]	0.138 ± 0.002 [3.5 ± 0.05]	0.059 [1.5]	0.157 ± 0.004 [4.0 ± 0.1]	0.315 + 0.0118/- 0.0039 [8.0 + 0.30/- 0.10]

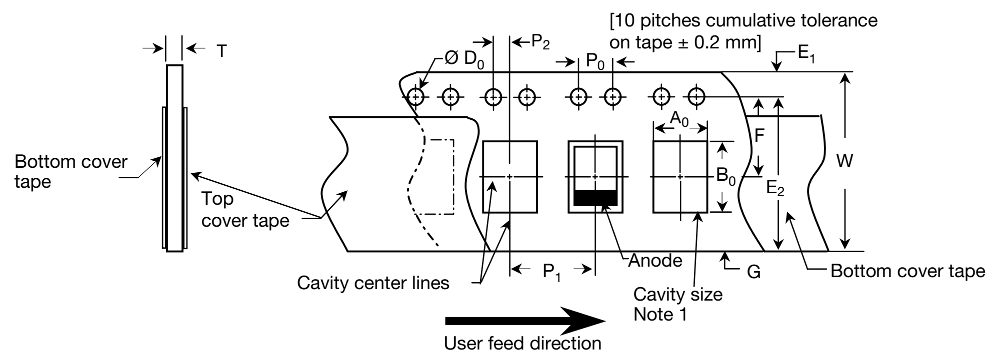
Note

- Metric dimensions will govern. Dimensions in inches are rounded and for reference only.

CARRIER TAPE DIMENSIONS G - CASE in millimeters



PAPER TAPE AND REEL PACKAGING in inches [millimeters]



CASE SIZE	TAPE SIZE	A_0	B_0	D_0	P_0	P_1	P_2	E	F	W	T
K	8 mm	0.033 ± 0.002 [0.85 ± 0.05]	0.053 ± 0.002 [1.35 ± 0.05]	0.06 ± 0.004 [1.5 ± 0.1]	0.157 ± 0.004 [4.0 ± 0.1]	0.078 ± 0.004 [2.0 ± 0.1]	0.079 ± 0.002 [2.0 ± 0.05]	0.069 ± 0.004 [1.75 ± 0.1]	0.0138 ± 0.002 [3.5 ± 0.05]	0.315 ± 0.008 [8.0 ± 0.2]	0.03 ± 0.002 [0.75 ± 0.05]
M	8 mm	0.041 ± 0.002 [1.05 ± 0.05]	0.071 ± 0.002 [1.8 ± 0.05]	0.06 ± 0.004 [1.5 ± 0.1]	0.157 ± 0.004 [4.0 ± 0.1]	0.157 ± 0.004 [4.0 ± 0.1]	0.079 ± 0.002 [2.0 ± 0.05]	0.069 ± 0.004 [1.75 ± 0.1]	0.0138 ± 0.002 [3.5 ± 0.05]	0.315 ± 0.008 [8.0 ± 0.2]	0.037 ± 0.002 [0.95 ± 0.05]

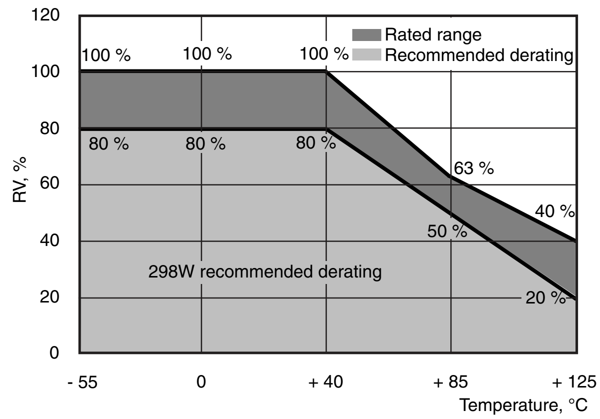
Note

(1) A_0, B_0 are determined by the maximum dimensions to the ends of the terminals extending from the component body and/or the body dimensions of the component. The clearance between the ends of the terminals or body of the component to the sides and depth of the cavity (A_0, B_0) must be within 0.002" (0.05 mm) minimum and 0.020" (0.50 mm) maximum. The clearance allowed must also prevent rotation of the component within the cavity of not more than 20°.

STANDARD PACKAGING QUANTITY

SERIES	CASE CODE	QUANTITY (PCS/REEL)
		7" REEL
298W	K	5000
	M	4000
	G	3000
	Q	2500
	A	2000

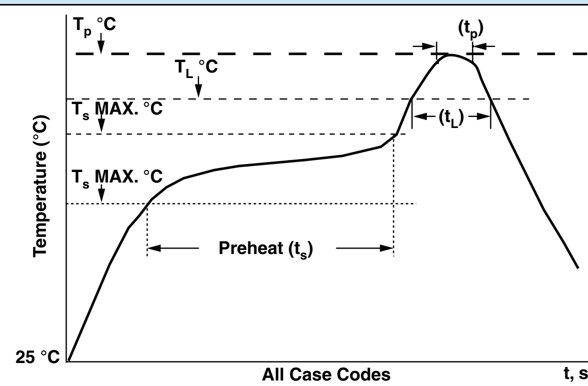
VOLTAGE VS. TEMPERATURE RATING



POWER DISSIPATION

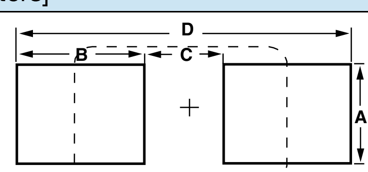
CASE CODE		MAXIMUM PERMISSIBLE POWER DISSIPATION AT + 25 °C (W) IN FREE AIR
298W	K	0.015
	M	0.025
	G	0.035

RECOMMENDED REFLOW PROFILES



TYPE	T_P Lead (Pb)-free	T_P Sn/Pb	t_P	T_L Lead (Pb)-free	T_L Sn/Pb	T_S MIN. Lead (Pb)-free	T_S MIN. Sn/Pb	T_S MAX. Lead (Pb)-free	T_S MAX. Sn/Pb	t_S Lead (Pb)-free	t_S Sn/Pb	t_L
298W	260 °C	225 °C	10	217 °C	183 °C	150 °C	100 °C	200 °C	150 °C	60 to 150	60 to 90	60 to 150

PAD DIMENSIONS in inches [millimeters]



CASE CODE	A (MIN.)	B (NOM.)	C (NOM.)	D(NOM.)
298W				
K	0.028 [0.70]	0.018 [0.45]	0.024 [0.60]	0.059 [1.50]
M, G	0.039 [1.00]	0.028 [0.70]	0.024 [0.60]	0.080 [2.00]
L	0.059 [1.50]	0.031 [0.80]	0.039 [1.0]	0.102 [2.60]
Q	0.071 [1.80]	0.067 [1.70]	0.053 [1.35]	0.187 [4.75]

GUIDE TO APPLICATION

1. **AC Ripple Current:** The maximum allowable ripple current shall be determined from the formula:

$$I_{RMS} = \sqrt{\frac{P}{R_{ESR}}}$$

where,

P = Power dissipation in Watts at + 25 °C as given in the table in paragraph number 5 (power dissipation).

R_{ESR} = The capacitor equivalent series resistance at the specified frequency.

2. **AC Ripple Voltage:** The maximum allowable ripple voltage shall be determined from the formula:

$$V_{RMS} = Z\sqrt{\frac{P}{R_{ESR}}}$$

or, from the formula:

$$V_{RMS} = I_{RMS} \times Z$$

where,

P = Power dissipation in Watts at + 25 °C as given in the table in paragraph number 5 (power dissipation).

R_{ESR} = The capacitor equivalent series resistance at the specified frequency.

Z = The capacitor impedance at the specified frequency.

2.1. The sum of the peak AC voltage plus the applied DC voltage shall not exceed the DC voltage rating of the capacitor.

2.2. The sum of the negative peak AC voltage plus the applied DC voltage shall not allow a voltage reversal exceeding 10 % of the DC working voltage at + 25 °C.

3. **Reverse Voltage:** These capacitors are capable of withstanding peak voltages in the reverse direction equal to 10 % of the DC rating at + 25 °C, 5 % of the DC rating at + 85 °C and 1 % of the DC rating at + 125 °C.

4. **Temperature Derating:** If these capacitors are to be operated at temperatures above + 25 °C, the permissible rms ripple current or voltage shall be calculated using the derating factors as shown:

TEMPERATURE	DERATING FACTOR
+ 25 °C	1.0
+ 85 °C	0.9
+ 125 °C	0.4

5. **Power Dissipation:** Power dissipation will be affected by the heat sinking capability of the mounting surface. Non-sinusoidal ripple current may produce heating effects which differ from those shown. It is important that the equivalent I_{RMS} value be established when calculating permissible operating levels. (Power Dissipation calculated using + 25 °C temperature rise.)

6. **Printed Circuit Board Materials:** Molded capacitors are compatible with commonly used printed circuit board materials (alumina substrates, FR4, FR5, G10, PTFE-fluorocarbon and porcelanized steel).

7. **Attachment:**

7.1. **Solder Paste:** The recommended thickness of the solder paste after application is 0.007" ± 0.001" [0.178 mm ± 0.025 mm]. Care should be exercised in selecting the solder paste. The metal purity should be as high as practical. The flux (in the paste) must be active enough to remove the oxides formed on the metallization prior to the exposure to soldering heat. In practice this can be aided by extending the solder preheat time at temperatures below the liquidous state of the solder.

7.2. **Soldering:** Capacitors can be attached by conventional soldering techniques; vapor phase, convection reflow, infrared reflow, wave soldering and hot plate methods. The Soldering Profile charts show recommended time/temperature conditions for soldering. Preheating is recommended. The recommended maximum ramp rate is 2 °C per second. Attachment with a soldering iron is not recommended due to the difficulty of controlling temperature and time at temperature. The soldering iron must never come in contact with the capacitor.

7.2.1 **Backward and Forward Compatibility:** Capacitors with SnPb or 100 % tin termination finishes can be soldered using SnPb or lead (Pb)-free soldering processes.

8. **Cleaning (Flux Removal) After Soldering:** Molded capacitors are compatible with all commonly used solvents such as TES, TMS, Prelete, Chlorethane, Terpene and aqueous cleaning media. However, CFC/ODS products are not used in the production of these devices and are not recommended. Solvents containing methylene chloride or other epoxy solvents should be avoided since these will attack the epoxy encapsulation material.

8.1. When using ultrasonic cleaning, the board may resonate if the output power is too high. This vibration can cause cracking or a decrease in the adherence of the termination. DO NOT EXCEED 9W/l at 40 kHz for 2 min.

9. **Recommended Mounting Pad Geometries:** Proper mounting pad geometries are essential for successful solder connections. These dimensions are highly process sensitive and should be designed to minimize component rework due to unacceptable solder joints. The dimensional configurations shown are the recommended pad geometries for both wave and reflow soldering techniques. These dimensions are intended to be a starting point for circuit board designers and may be fine tuned if necessary based upon the peculiarities of the soldering process and/or circuit board design.

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