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

FEATURES

- Ultra-low profile: 0.8 mm to 1.0 mm in a variety of case sizes
- Highest capacitance-voltage product in industry
- Lead (Pb)-free L-shaped terminations for superior board mounting
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

PERFORMANCE CHARACTERISTICS

Operating Temperature: - 55 °C to + 125 °C (above 85 °C, voltage derating is required)

Capacitance Tolerance: ± 10 % ± 20 %

Voltage Range: 4 V_{DC} to 35 V_{DC}

Capacitance Range: 3.3 µF to 220 µF

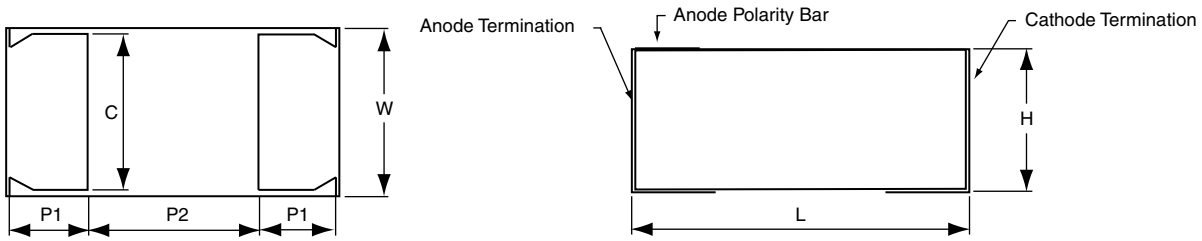
ORDERING INFORMATION

TL8	A0	227	M	004	C
TYPE	CASE CODE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT + 85 °C	TERMINATION/ PACKAGING
	See Ratings and Case Codes table.	This is expressed in pF. The first two digits are the significant figures. The third is the number of zeros to follow.	**M = ± 20 %** K = ± 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).	**C = 100 % tin 7" (178 mm) reel**

Note

- Preferred tolerance 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	H (MAX.)	L	W	P1	P2 (REF.)	C
W0	0.039 [1.0]	0.079 ± 0.008 [2.00 ± 0.20]	0.050 ± 0.008 [1.25 ± 0.20]	0.020 ± 0.004 [0.50 ± 0.10]	0.040 [1.00]	0.035 ± 0.004 [0.90 ± 0.10]
W9	0.035 [0.9]					
A0	0.039 [1.0]	0.126 ± 0.008 [3.20 ± 0.20]	0.063 ± 0.008 [1.60 ± 0.20]	0.031 ± 0.004 [0.80 ± 0.10]	0.063 [1.60]	0.047 ± 0.004 [1.20 ± 0.10]
B0	0.039 [1.0]	0.138 ± 0.008 [3.50 ± 0.20]	0.110 ± 0.008 [2.80 ± 0.20]	0.031 ± 0.004 [0.80 ± 0.20]	0.078 [1.95]	0.095 ± 0.004 [2.40 ± 0.10]

RATINGS AND CASE CODES

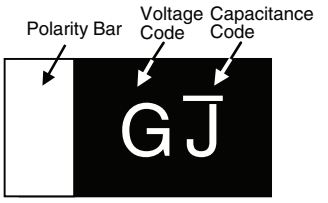
µF	4 V	6.3 V	10 V	16 V	20 V	25 V	35 V
1.5							
2.2							
3.3							A0 (1)
4.7						W0 (1)	
6.8							
10				W0 (1)	A0 (1)		
15							
22			W9				
33			W0 (1)		B0		
47		W0 (1)	W9 (1)/A0 (1)				
68							
100		A0	A0/B0 (1)				
150							
220	A0						
330							
470							

Note

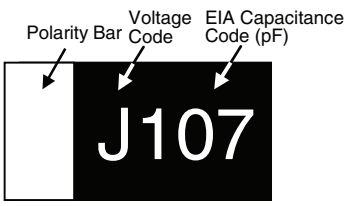
(1) In development.

MARKING

Wx-cases

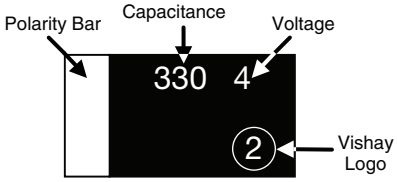


Ax-cases



VOLTAGE CODE		CAPACITANCE CODE	
V	CODE	CAP, µF	CODE
2.5	e	0.68	w̄
4.0	G	1.0	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	Ā
		150	Ē
		220	J̄

Bx-cases



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)
4 V_{DC} AT + 40 °C; 2.5 V_{DC} + 85 °C; 1.6 V_{DC} AT + 125 °C						
220	A0	TL8A0227M004C	88	80	7.0	0.089
6.3 V_{DC} AT + 40 °C; 4.0 V_{DC} + 85 °C; 2.5 V_{DC} AT + 125 °C						
47	W0 (1)	TL8W0476M6R3C	3.0	25	3.0	0.108
100	A0	TL8A0107M6R3C	6.3	30	1.1	0.220
10 V_{DC} AT + 40 °C; 6.3 V_{DC} + 85 °C; 4.0 V_{DC} AT + 125 °C						
22	W9	TL8W9226M010C	22	40	10.0	0.084
33	W0 (1)	TL8W0336M010C	3.3	30	6.0	0.076
47	W9 (1)	TL8W9476M010C	9.4	35	5.0	0.084
47	A0 (1)	TL8A0476M010C	15	30	5.0	0.105
100	A0	TL8A0107M010C	100	50	7.0	0.089
100	B0 (1)	TL8B0107M010C	10	18	TBD	TBD
16 V_{DC} AT + 40 °C; 10 V_{DC} + 85 °C; 6.3 V_{DC} AT + 125 °C						
10	W0 (1)	TL8W0106M016C	1.6	18	4.0	TBD
20 V_{DC} AT + 40 °C; 13 V_{DC} + 85 °C; 8 V_{DC} AT + 125 °C						
10	A0 (1)	TL8A0106M020C	4.0	15	5.0	0.105
33	B0	TL8B0336M020C	33	15	5.0	0.118
25 V_{DC} AT + 40 °C; 17 V_{DC} + 85 °C; 10 V_{DC} AT + 125 °C						
4.7	W0 (1)	TL8W0475M025C	TBD	TBD	TBD	TBD
35 V_{DC} AT + 40 °C; 23 V_{DC} + 85 °C; 14 V_{DC} AT + 125 °C						
3.3	A0 (1)	TL8A0335(1)035C	1.2	10	10.0	0.074

Notes

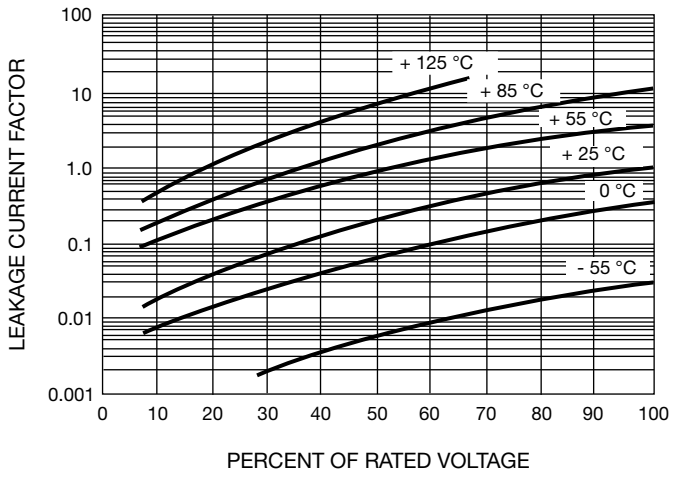
- Part number definition:
  (1) Capacitance tolerance: K = 10 %, M = 20 %

(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	4 V	6.3 V	10 V	16 V	20 V	25 V	35 V
	Category voltage	+ 40 °C/+ 85 °C	2.5 V	4.0 V	6.3 V	10 V	13 V	17 V	23 V
	Category voltage	+ 85 °C/+ 125 °C	1.6 V	2.5 V	4 V	6.3 V	8.0 V	10 V	14 V

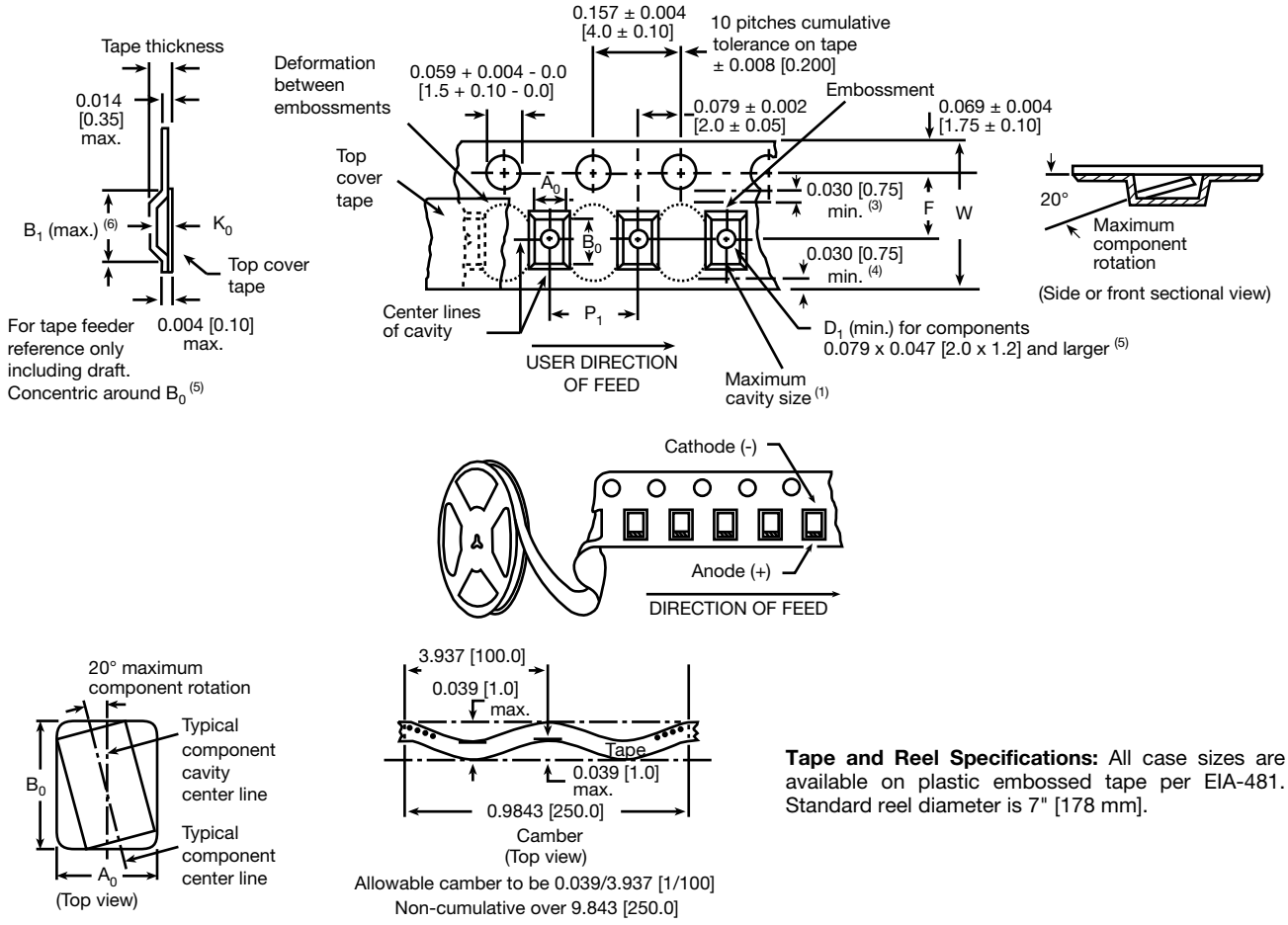
TYPICAL LEAKAGE CURRENT FACTOR RANGE



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

PLASTIC TAPE AND REEL PACKAGING in inches [millimeters]



Tape and Reel Specifications: All case sizes are available on plastic embossed tape per EIA-481. Standard reel diameter is 7" [178 mm].

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.

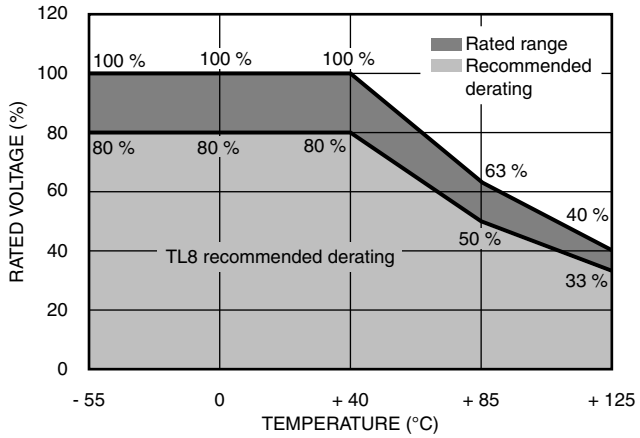
CARRIER TAPE DIMENSIONS in inches [millimeters]

CASE CODE	TAPE SIZE	B_1 (MAX.)	D_1 (MIN.)	F	K_0 (MAX.)	P_1	W
A0	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 ± 0.3]
W0	8 mm	0.094 [2.4]	0.029 [0.75]	0.138 ± 0.002 [3.5 ± 0.05]	0.045 [1.15]	0.157 ± 0.004 [4.0 ± 0.1]	0.315 ± 0.012 [8.0 ± 0.3]
W9	8 mm	0.126 [3.2]	0.029 [0.75]	0.138 ± 0.002 [3.5 ± 0.05]	0.045 [1.15]	0.157 ± 0.004 [4.0 ± 0.1]	0.315 ± 0.012 [8.0 ± 0.3]
B0	12 mm	0.181 [4.61]	0.059 [1.5]	0.217 ± 0.002 [5.5 ± 0.05]	0.049 [1.25]	0.157 ± 0.004 [4.0 ± 0.1]	0.472 ± 0.012 [12 ± 0.3]

STANDARD PACKAGING QUANTITY

CASE CODE	QUANTITY (pcs/reel)
	7" REEL
A0	2500
W0, W9	3000
B0	3000

VOLTAGE VS. TEMPERATURE RATING

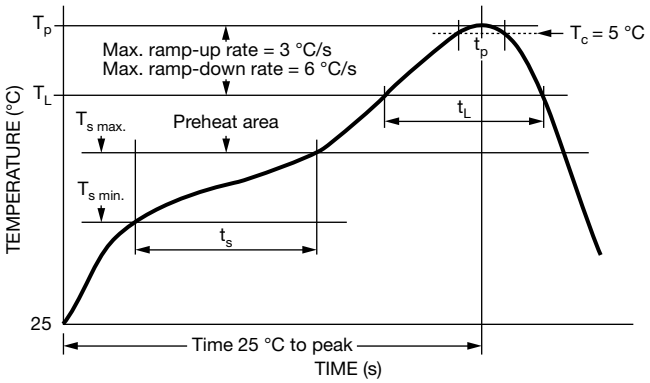


POWER DISSIPATION

CASE CODE	MAXIMUM PERMISSIBLE POWER DISSIPATION AT + 25 °C (W) IN FREE AIR
A0	0.055
W0, W9	0.035
B0	0.070

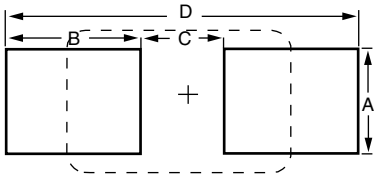
RECOMMENDED REFLOW PROFILES

Capacitors should withstand Reflow profile as per J-STD-020 standard



PROFILE FEATURE	LEAD (Pb)-FREE ASSEMBLY
Preheat/soak	
Temperature min. ($T_{s\ min.}$)	150 °C
Temperature max. ($T_{s\ max.}$)	200 °C
Time (t_s) from ($T_{s\ min.}$ to $T_{s\ max.}$)	60 s to 120 s
Ramp-up	
Ramp-up rate (T_L to T_p)	3 °C/s max.
Liquidous temperature (T_L)	217 °C
Time (t_L) maintained above T_L	60 s to 150 s
Peak package body temperature (T_p) max.	260 °C
Time (t_p) within 5 °C of the peak max. temperature	30 s
Ramp-down	
Ramp-down rate (T_p to T_L)	6 °C/s max.
Time from 25 °C to peak temperature	8 min max.

PAD DIMENSIONS in inches [millimeters]



CASE CODE	A (MIN.)	B (NOM.)	C (NOM.)	D(NOM.)
Wx-cases	0.059 [1.50]	0.031 [0.80]	0.039 [1.00]	0.102 [2.60]
Ax-cases	0.071 [1.80]	0.067 [1.70]	0.053 [1.35]	0.187 [4.75]
Bx-cases	0.118 [3.00]	0.071 [1.80]	0.065 [1.65]	0.207 [5.25]

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 W at + 25 °C as given in the tables in the product datasheets (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:

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

or, from the formula:

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

where,

P = Power dissipation in W at + 25 °C as given in the tables in the product datasheets (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 s. 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.

PRODUCT INFORMATION	
Micro Guide	www.vishay.com/doc?40115
Moisture Sensitivity	www.vishay.com/doc?40135
SELECTOR GUIDES	
Solid Tantalum Selector Guide	www.vishay.com/doc?49053
Solid Tantalum Chip Capacitors	www.vishay.com/doc?40091
FAQ	
Frequently Asked Questions	www.vishay.com/doc?40110

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