

# Solid Tantalum Surface Mount Chip Capacitors TANTAMOUNT<sup>®</sup>, Molded Case, for Medical Instruments



## PERFORMANCE / ELECTRICAL CHARACTERISTICS

[www.vishay.com/doc?40209](http://www.vishay.com/doc?40209)

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

**Capacitance Range:** 1 μF to 220 μF

**Capacitance Tolerance:** ± 10 %, ± 20 % standard

**Voltage Rating:** 4 V<sub>DC</sub> to 20 V<sub>DC</sub>

## FEATURES

- **For non-life support medical applications**
- High reliability
- Weibull grading options
- DC leakage at 0.005 CV
- 100 % surge current tested (B, C, D, E cases)
- Terminations: 100 % matte tin and tin / lead
- Standard EIA 535BAAC case sizes (A through E)
- Manufacturing location is certified to medical standard ISO 13485
- Compliant terminations
- Dry pack as per IPC / JEDEC<sup>®</sup> J-STD-033 standard
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS\***  
Available

**HALOGEN  
FREE  
GREEN  
(5-2008)**  
Available

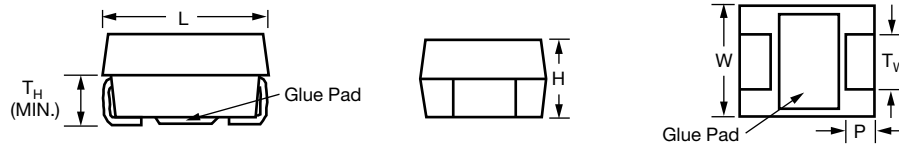
## Note

\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details.

ORDERING INFORMATION							
TM3	C	226	K	6R3	C	B	A
TYPE	CASE CODE	CAPACITANCE	CAPACITANCE TOLERANCE	DC VOLTAGE RATING AT +85 °C	TERMINATION AND PACKAGING	RELIABILITY LEVEL	SURGE CURRENT
	See Ratings and Case Codes table.	This is expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros to follow.	K = ± 10 % M = ± 20 %	This is expressed in volts. To complete the three-digit block, zeros precede the voltage rating. A decimal point is indicated by an "R" (6R3 = 6.3 V).	C: matte tin, 7" (178 mm) reel H: matte tin, 7" (178 mm) ½ reel E: tin / lead, 7" (178 mm) reel L: tin / lead, 7" (178 mm) ½ reel V: matte tin, 7" (178 mm) reel, dry pack T: tin / lead, 7" (178 mm) reel, dry pack	B = 0.1 % Weibull FRL S = hi-rel std. (40 h burn-in) Z = non-established reliability	A = 10 cycles at +25 °C, 1.1 RV Z = no surge (for A case only)

## Note

- Dry pack as specified in J-STD-033 for MSL3. Applicable for D and E cases only.

**DIMENSIONS** in inches (millimeters)


CASE CODE	EIA SIZE	L	W	H	P	T <sub>w</sub>	T <sub>H</sub> (MIN.)
A	3216-18	0.126 ± 0.008 [3.2 ± 0.20]	0.063 ± 0.008 [1.6 ± 0.20]	0.063 ± 0.008 [1.6 ± 0.20]	0.031 ± 0.012 [0.80 ± 0.30]	0.047 ± 0.004 [1.2 ± 0.10]	0.028 [0.70]
B	3528-21	0.138 ± 0.008 [3.5 ± 0.20]	0.110 ± 0.008 [2.8 ± 0.20]	0.075 ± 0.008 [1.9 ± 0.20]	0.031 ± 0.012 [0.80 ± 0.30]	0.087 ± 0.004 [2.2 ± 0.10]	0.028 [0.70]
C	6032-28	0.236 ± 0.012 [6.0 ± 0.30]	0.126 ± 0.012 [3.2 ± 0.30]	0.098 ± 0.012 [2.5 ± 0.30]	0.051 ± 0.012 [1.3 ± 0.30]	0.087 ± 0.004 [2.2 ± 0.10]	0.039 [1.0]
D	7343-31	0.287 ± 0.012 [7.3 ± 0.30]	0.169 ± 0.012 [4.3 ± 0.30]	0.110 ± 0.012 [2.8 ± 0.30]	0.051 ± 0.012 [1.3 ± 0.30]	0.094 ± 0.004 [2.4 ± 0.10]	0.039 [1.0]
E	7343-43	0.287 ± 0.012 [7.3 ± 0.30]	0.169 ± 0.012 [4.3 ± 0.30]	0.157 ± 0.012 [4.0 ± 0.30]	0.051 ± 0.012 [1.3 ± 0.30]	0.094 ± 0.004 [2.4 ± 0.10]	0.039 [1.0]

**Note**

- Glue pad (non-conductive, part of molded case) is dedicated for glue attachment (as user option).

**RATINGS AND CASE CODES**

μF	4 V	6.3 V	10 V	16 V	20 V
1.0				A	
1.5			A	A	
2.2		A	A	A/B	B
3.3		A	A	A/B	B
4.7			A/B	A/B	C
6.8		B	B	B	B/C
10		A/B	A/B	B/C	C
15			B/C	B/C	
22		A/B/C	B/C	B/C/D	C/D
33		B	B/C/D	D	D
47		B/C/D	C/D	C/D	E
68	B	D	D	D	
100	D	D	D	D/E	
150	D	D			
220	D/E	D/E	E		

**MARKING**

<p>Indicates TM3 Series</p> <p>Capacitance Code, pF</p> <p>J 225M</p> <p>Polarity Band (+)</p> <p>Voltage Code</p> <p><b>A Case</b></p>	"A" CASE VOLTAGE CODE		<p>Indicates TM3 Series</p> <p>Capacitance μF</p> <p>Voltage</p> <p>22 M10</p> <p>Polarity Band (+)</p> <p>Date Code</p> <p>Vishay Sprague Logo</p> <p><b>B, C, D, E Cases</b></p>
	VOLTS	CODE	
4.0	G		
6.3	J		
10	A		
16	C		
20	D		
25	E		
35	V		
50	T		

**Marking**

Capacitor marking includes an anode (+) polarity band, capacitance in microfarads and the voltage rating. "A" case capacitors use a letter code for the voltage and EIA capacitance code.

The Vishay Sprague® trademark is included if space permits. Capacitors rated at 6.3 V are marked 6 V.

A manufacturing date code is marked on all capacitors.

Call the factory for further explanation.



STANDARD RATINGS						
CAPACITANCE ( $\mu$ F)	CASE CODE	PART NUMBER	MAX. DCL AT +25 °C ( $\mu$ A)	MAX. DF AT +25 °C 120 Hz (%)	MAX. ESR AT +25 °C 100 kHz ( $\Omega$ )	MAX. RIPPLE 100 kHz $I_{RMS}$ (A)
<b>4 V<sub>DC</sub> AT +85 °C; 2.7 V<sub>DC</sub> AT +125 °C</b>						
68	B	TM3B686(1)004(2)(3)A	1.36	6	1.90	0.21
100	D	TM3D107(1)004(4)(3)A	2.00	6	0.70	0.46
150	D	TM3D157(1)004(4)(3)A	3.00	8	0.60	0.50
220	D	TM3D227(1)004(4)(3)A	4.40	8	0.60	0.50
220	E	TM3E227(1)004(4)(3)A	4.40	8	0.50	0.57
<b>6.3 V<sub>DC</sub> AT +85 °C; 4 V<sub>DC</sub> AT +125 °C</b>						
2.2	A	TM3A225(1)6R3(2)(3)Z	0.25	6	7.60	0.10
3.3	A	TM3A335(1)6R3(2)(3)Z	0.25	6	6.30	0.11
6.8	B	TM3B685(1)6R3(2)(3)A	0.25	6	3.40	0.16
10	A	TM3A106(1)6R3(2)(3)Z	0.32	6	3.40	0.15
10	B	TM3B106(1)6R3(2)(3)A	0.30	6	2.90	0.17
22	A	TM3A226(1)6R3(2)(3)Z	0.66	6	2.90	0.16
22	B	TM3B226(1)6R3(2)(3)A	0.69	6	2.00	0.21
22	C	TM3C226(1)6R3(2)(3)A	0.66	6	1.80	0.25
33	B	TM3B336(1)6R3(2)(3)A	0.99	6	1.90	0.21
47	B	TM3B476(1)6R3(2)(3)A	1.41	6	1.90	0.21
47	C	TM3C476(1)6R3(2)(3)A	1.41	6	1.40	0.28
47	D	TM3D476(1)6R3(4)(3)A	1.41	6	0.80	0.43
68	D	TM3D686(1)6R3(4)(3)A	2.04	6	0.70	0.46
100	D	TM3D107(1)6R3(4)(3)A	3.00	6	0.14	1.04
150	D	TM3D157(1)6R3(4)(3)A	4.50	8	0.60	0.50
220	D	TM3D227(1)6R3(4)(3)A	6.60	8	0.60	0.50
220	E	TM3E227(1)6R3(4)(3)A	6.60	8	0.50	0.57
<b>10 V<sub>DC</sub> AT +85 °C; 7 V<sub>DC</sub> AT +125 °C</b>						
1.5	A	TM3A155(1)010(2)(3)Z	0.25	6	8.00	0.10
2.2	A	TM3A225(1)010(2)(3)Z	0.25	6	6.30	0.11
3.3	A	TM3A335(1)010(2)(3)Z	0.25	6	5.50	0.12
4.7	A	TM3A475(1)010(2)(3)Z	0.25	6	5.00	0.12
4.7	B	TM3B475(1)010(2)(3)A	0.25	6	3.40	0.16
6.8	B	TM3B685(1)010(2)(3)A	0.34	6	2.90	0.17
10	A	TM3A106(1)010(2)(3)Z	0.50	6	3.40	0.15
10	B	TM3B106(1)010(2)(3)A	0.50	6	2.50	0.18
15	B	TM3B156(1)010(2)(3)A	0.75	6	2.00	0.21
15	C	TM3C156(1)010(2)(3)A	0.75	6	1.80	0.25
22	B	TM3B226(1)010(2)(3)A	1.10	6	1.90	0.21
22	C	TM3C226(1)010(2)(3)A	1.10	6	0.35	0.56
33	B	TM3B336(1)010(2)(3)A	1.65	6	1.90	0.21
33	C	TM3C336(1)010(2)(3)A	1.65	6	1.40	0.28
33	D	TM3D336(1)010(4)(3)A	1.65	6	0.80	0.43
47	C	TM3C476(1)010(2)(3)A	2.35	6	1.10	0.32
47	D	TM3D476(1)010(4)(3)A	2.35	6	0.70	0.46
68	D	TM3D686(1)010(4)(3)A	3.40	6	0.70	0.46
100	D	TM3D107(1)010(4)(3)A	5.00	6	0.60	0.50
220	E	TM3E227(1)010(4)(3)A	11.00	8	0.50	0.57

**Note**

- Part number definitions:
  - Capacitance tolerance: K, M
  - Termination and packaging: C, E, H, L
  - Reliability level: B, S, Z
  - Termination and packaging: C, E, H, L, V, T



STANDARD RATINGS						
CAPACITANCE ( $\mu$ F)	CASE CODE	PART NUMBER	MAX. DCL AT +25 °C ( $\mu$ A)	MAX. DF AT +25 °C 120 Hz (%)	MAX. ESR AT +25 °C 100 kHz ( $\Omega$ )	MAX. RIPPLE 100 kHz $I_{RMS}$ (A)
<b>16 V<sub>DC</sub> AT +85 °C; 10 V<sub>DC</sub> AT +125 °C</b>						
1.0	A	TM3A105(1)016(2)(3)Z	0.25	4	9.30	0.09
1.5	A	TM3A155(1)016(2)(3)Z	0.25	6	6.70	0.11
2.2	A	TM3A225(1)016(2)(3)Z	0.25	6	4.00	11.00
2.2	B	TM3B225(1)016(2)(3)A	0.25	6	4.60	0.14
3.3	A	TM3A335(1)016(2)(3)Z	0.26	6	3.50	0.15
3.3	B	TM3B335(1)016(2)(3)A	0.26	6	3.50	0.16
4.7	A	TM3A475(1)016(2)(3)Z	0.38	6	5.00	0.12
4.7	B	TM3B475(1)016(2)(3)A	0.38	6	2.90	0.17
6.8	B	TM3B685(1)016(2)(3)A	0.54	6	2.50	0.18
10	B	TM3B106(1)016(2)(3)A	0.80	6	2.00	0.21
10	C	TM3C106(1)016(2)(3)A	0.80	6	1.80	0.25
15	B	TM3B156(1)016(2)(3)A	1.20	6	2.00	0.21
15	C	TM3C156(1)016(2)(3)A	1.20	6	0.40	0.52
22	B	TM3B226(1)016(2)(3)A	1.76	6	1.90	0.21
22	C	TM3C226(1)016(2)(3)A	1.76	6	1.40	0.28
22	D	TM3D226(1)016(4)(3)A	1.76	6	0.80	0.43
33	D	TM3D336(1)016(4)(3)A	2.64	6	0.70	0.46
47	C	TM3C476(1)016(2)(3)A	3.76	6	1.00	0.33
47	D	TM3D476(1)016(4)(3)A	3.76	6	0.70	0.46
68	D	TM3D686(1)016(4)(3)A	5.44	6	0.60	0.50
100	D	TM3D107(1)016(4)(3)A	8.00	8	0.60	0.50
100	E	TM3E107(1)016(4)(3)A	8.00	8	0.60	0.52
<b>20 V<sub>DC</sub> AT +85 °C; 13 V<sub>DC</sub> AT +125 °C</b>						
2.2	B	TM3B225(1)020(2)(3)A	0.25	6	3.50	0.16
3.3	B	TM3B335(1)020(2)(3)A	0.33	6	3.00	0.17
4.7	C	TM3C475(1)020(2)(3)A	0.47	6	2.30	0.22
6.8	B	TM3B685(1)020(2)(3)A	0.68	6	2.50	0.18
6.8	C	TM3C685(1)020(2)(3)A	0.68	6	1.90	0.24
10	C	TM3C106(1)020(2)(3)A	1.00	6	1.70	0.25
22	C	TM3C226(1)020(2)(3)A	2.20	6	1.10	0.32
22	D	TM3D226(1)020(4)(3)A	2.20	6	0.70	0.46
33	D	TM3D336(1)020(4)(3)A	3.30	6	0.70	0.46
47	E	TM3E476(1)020(4)(3)A	4.70	6	0.60	0.52

**Note**

- Part number definitions:
  - Capacitance tolerance: K, M
  - Termination and packaging: C, E, H, L
  - Reliability level: B, S, Z
  - Termination and packaging: C, E, H, L, V, T



<b>RECOMMENDED VOLTAGE DERATING GUIDELINES</b> (for temperatures below +85 °C)	
<b>STANDARD CONDITIONS. FOR EXAMPLE: OUTPUT FILTERS</b>	
Capacitor Voltage Rating	Operating Voltage
4.0	2.5
6.3	3.3
10	5.0
16	8.0
20	10
<b>SEVERE CONDITIONS. FOR EXAMPLE: INPUT FILTERS</b>	
Capacitor Voltage Rating	Operating Voltage
4.0	2.5
6.3	3.6
10	6.0
16	10
20	12

<b>POWER DISSIPATION</b>	
CASE CODE	MAXIMUM PERMISSIBLE POWER DISSIPATION AT +25 °C (W) IN FREE AIR
A	0.075
B	0.085
C	0.110
D	0.150
E	0.165

<b>STANDARD PACKAGING QUANTITY</b>		
CASE CODE	UNITS PER REEL	
	7" FULL REEL	7" HALF REEL
A	2000	1000
B	2000	1000
C	500	250
D	500	250
E	400	200

<b>PRODUCT INFORMATION</b>	
Guide for Molded Tantalum Capacitors	<a href="http://www.vishay.com/doc?40074">www.vishay.com/doc?40074</a>
Pad Dimensions	
Packaging Dimensions	
Moisture Sensitivity	<a href="http://www.vishay.com/doc?40135">www.vishay.com/doc?40135</a>
<b>SELECTOR GUIDES</b>	
Solid Tantalum Selector Guide	<a href="http://www.vishay.com/doc?49053">www.vishay.com/doc?49053</a>
Solid Tantalum Chip Capacitors	<a href="http://www.vishay.com/doc?40091">www.vishay.com/doc?40091</a>
<b>FAQ</b>	
Frequently Asked Questions	<a href="http://www.vishay.com/doc?40110">www.vishay.com/doc?40110</a>

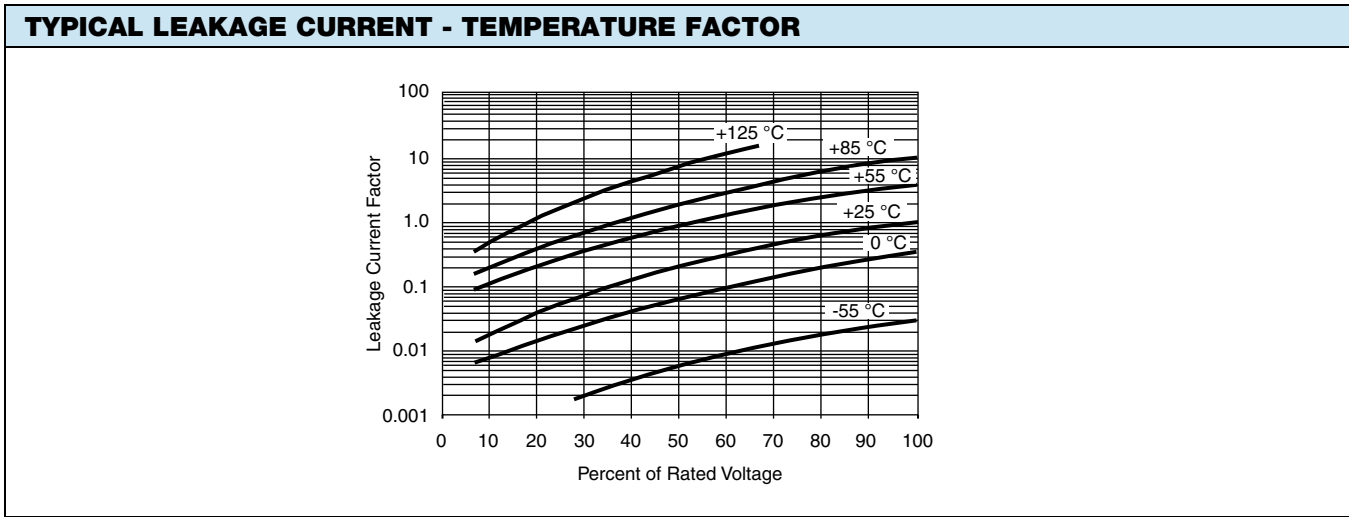


## COTS Tantalum Capacitors

ELECTRICAL PERFORMANCE CHARACTERISTICS				
ITEM	PERFORMANCE CHARACTERISTICS			
Category temperature range	-55 °C to +85 °C (to +125 °C with voltage derating)			
Capacitance tolerance	± 20 %, ± 10 %, tested via bridge method, at 25 °C, 120 Hz			
Dissipation factor	Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 120 Hz			
ESR	Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 100 kHz			
Leakage current	After application of rated voltage 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 0.01 CV or 0.5 μA, whichever is greater. <i>Note that the leakage current varies with temperature and applied voltage. See graph below for the appropriate adjustment factor.</i>			
Capacitance change by temperature	+15 % max. (at +125 °C) +10 % max. (at +85 °C) -10 % max. (at -55 °C)			
Reverse voltage	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 1 % of the DC rating at +125 °C Vishay does not recommend intentional or repetitive application of reverse voltage.			
Ripple current	For maximum ripple current values (at 25 °C) refer to relevant datasheet. If capacitors are to be used at temperatures above +25 °C, the permissible RMS ripple current (or voltage) shall be calculated using the derating factors: 1.0 at +25 °C 0.9 at +85 °C 0.4 at +125 °C			
Maximum operating and surge voltages vs. temperature	<b>+85 °C</b>		<b>+125 °C</b>	
	<b>RATED VOLTAGE (V)</b>	<b>SURGE VOLTAGE (V)</b>	<b>CATEGORY VOLTAGE (V)</b>	<b>SURGE VOLTAGE (V)</b>
	4.0	5.2	2.7	3.4
	6.3	8.0	4.0	5.0
	10	13	7.0	8.0
	16	20	10	12
	20	26	13	16
	25	32	17	20
	35	46	23	28
	40	52	26	31
	50	65	33	40
	50 <sup>(1)</sup>	60	33	40
	63	75	42	50
75	75	50	50	

### Notes

- All information presented in this document reflects typical performance characteristics
- <sup>(1)</sup> Capacitance value 15 μF and higher



**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.

ENVIRONMENTAL PERFORMANCE CHARACTERISTICS			
ITEM	CONDITION	POST TEST PERFORMANCE	
Surge voltage	MIL-PRF-55365 1000 successive test cycles at 85 °C of surge voltage (as specified in the table above), in series with a 33 Ω resistor at the rate of 30 s ON, 30 s OFF	Capacitance change Dissipation factor Leakage current	Within ± 10 % of initial value Initial specified limit Initial specified limit
Life test at +85 °C	MIL-STD-202, method 108 1000 h application of rated voltage at 85 °C	Capacitance change Dissipation factor Leakage current	Within ± 10 % of initial value Initial specified limit Shall not exceed 125 % of initial limit
Life test at +125 °C	MIL-STD-202, method 108 1000 h application 2/3 of rated voltage at 125 °C	Capacitance change Dissipation factor Leakage current	Within ± 10 % of initial value Initial specified limit Shall not exceed 125 % of initial limit
Moisture resistance	MIL-STD-202, method 106 at rated voltage, 20 cycles	Capacitance change Dissipation factor Leakage current	Within ± 15 % of initial value Shall not exceed 150 % of initial limit Shall not exceed 200 % of initial limit
Stability at low and high temperatures	MIL-PRF-55365	Delta cap limit at -55 °C, 85 °C is ± 10 % of initial value Delta cap limit at 125 °C is ± 15 % of initial value Delta cap at step 3 and final step 25 °C is ± 10 % DCL at 85 °C: 10 x initial specified value DCL at 125 °C: 12 x initial specified value DCL at 25 °C: initial specified value at RV	
Thermal shock	MIL-STD-202, method 107 At -55 °C / +125 °C, for 5 cycles, 30 min at each temperature	Capacitance change Dissipation factor Leakage current	Within ± 10 % of initial value Initial specified limit Initial specified limit



MECHANICAL PERFORMANCE CHARACTERISTICS		
ITEM	CONDITION	POST TEST PERFORMANCE
Terminal strength / Shear force test	Apply a pressure load of 5 N for 10 s ± 1 s horizontally to the center of capacitor side body	Capacitance change    Within ± 10 % of initial value Dissipation factor    Initial specified limit Leakage current        Initial specified limit  There shall be no mechanical or visual damage to capacitors post-conditioning.
Vibration	MIL-STD-202, method 204, condition D, 10 Hz to 2000 Hz, 20 g peak, 8 h, at rated voltage	Electrical measurements are not applicable, since the same parts are used for shock (specified pulse) test.  There shall be no mechanical or visual damage to capacitors post-conditioning.
Shock (specified pulse)	MIL-STD-202, method 213, condition I, 100 g peak	Capacitance change    Within ± 10 % of initial value Dissipation factor    Initial specified limit Leakage current        Initial specified limit  There shall be no mechanical or visual damage to capacitors post-conditioning.
Resistance to soldering heat	MIL-STD-202, method 210, condition J (leadbearing capacitors) and K (lead (Pb)-free capacitors), one heat cycle	Capacitance change    Within ± 10 % of initial value Dissipation factor    Initial specified limit Leakage current        Initial specified limit
Solderability	MIL-STD-202, method 208, ANSI/J-STD-002, test B (leadbearing) and B1 (lead (Pb)-free). Preconditioning per category C (category E - optional). Does not apply to gold terminations. Lead (Pb)-free and leadbearing capacitors are backward and forward compatible	Solder coating of all capacitors shall meet specified requirements.  There shall be no mechanical or visual damage to capacitors post-conditioning.
Resistance to solvents	MIL-STD-202, method 215	There shall be no mechanical or visual damage to capacitors post-conditioning. Body marking shall remain legible.
Flammability	Encapsulation materials meet UL 94 V-0 with an oxygen index of 32 %	





## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

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## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**