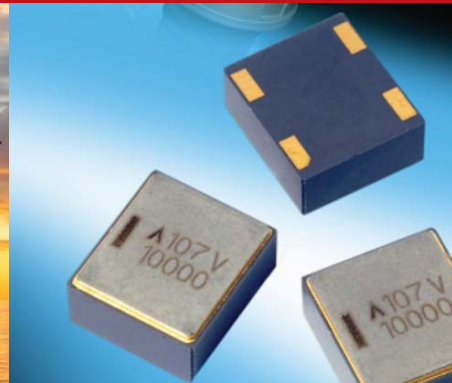




HIGH TEMPERATURE SOLUTIONS

Tantalum Capacitors | Ceramic Capacitors
Glass Capacitors | EMI Filters
Circuit Protection | NTC Thermistors



Version 15.1

www.avx.com



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INTRODUCTION

AVX is the world's leading manufacturer of passive electronic components. The demands for components used in extreme environmental conditions continue to grow considerably. The evolution of temperature critical applications are generating the need for components capable of enduring temperatures approaching or exceeding 250°C. AVX provides an array of components that fulfill these stringent requirements. Specific dielectric materials, construction methods and testing procedures are used to achieve exceptional high temperature performance. Advanced designs and testing capabilities at AVX provide the necessary tools to incorporate these components into high temperature applications such as down-hole oil exploration, aerospace and military equipment.



**For new designs
or applications
please contact AVX at:
high.temp@avx.com**



AVX
A KYOCERA GROUP COMPANY

TANTALUM CAPACITORS

THJ and THJ+ Series Capacitors

+175°C and +200°C

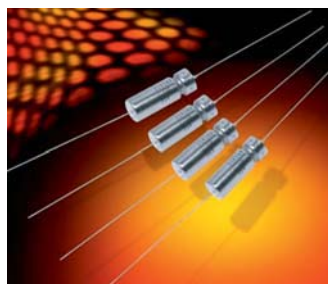


- 1st SMD +175°C tantalum capacitor on the market
- SMD = small size, fast pick & place ready
- Negative temperature operation (unlike wet electrolytics)
- 3x reflow +260°C and RoHS compliant
- Gold plated termination for hybrid assembly
- 200°C option available as THJ+ Series

Operating Temp	-55°C to +175°C (THJ) -55°C to +200°C (THJ+)
Case Size	1206 - 2917
Voltage	6.3V - 50V
Capacitance	0.1µF - 220µF

TWC-Y High Temperature Wet Tantalum Capacitors

+200°C



- Hermetically Sealed Axial Leaded Tantalum Case
- Standard Case Sizes: T1-T4 per M39006
- Surge Resistant
- Meets Shock & Vibration per MIL-STD-202, Method 213 & 204
- Capable of Continuous Operation at 200°C with 60% rated voltage for most values rated for 500 hours

Operating Temp	-55°C to +200°C
Case	Axial T1 - T4
Voltage	6V - 125V
Capacitance	22µF - 560µF

TWA-Y High Temperature Wet Tantalum Capacitors

+200°C



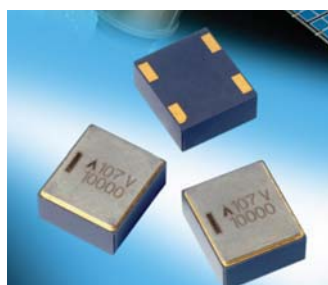
- Capable of withstanding life test up to 2000 hours at 200°C on selected values
- Hermetically sealed to withstand hard shock and vibration
- High capacitance cathode systems allows high level of CV in standard case sizes

Operating Temp	-55°C to +200°C
Case	Axial T1 - T4
Voltage	50V - 125V
Capacitance	22µF - 750µF

COMING SOON

THH Hermetic Series Capacitors

+230°C



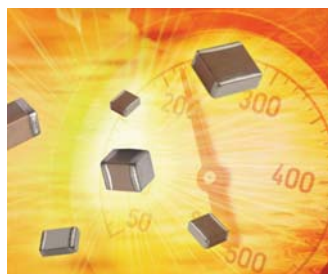
- World's first 230°C rated Tantalum capacitor
- Hermetically sealed SMD tantalum capacitors
- THH - Rated temperature up to 230°C
- Stability under humidity and ambient atmosphere
- Large case sizes including CTC-21D provide high capacitance values

Operating Temp	-55°C to +230°C
Case Size	9 (CTC-21D), I
Voltage	16V - 63V
Capacitance	3.3µF - 470µF

MLCC CERAMIC CAPACITORS

AT Series

200°C and 250°C

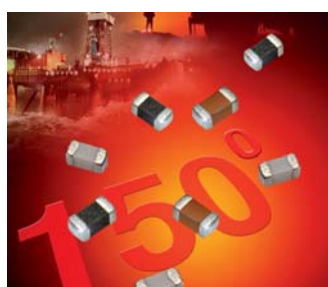


- High temperature C0G and VHT dielectrics
- Tested to MIL-STD-202
- Ideally suited for high temperature applications up to +250°C.
- Life tested to 1000hrs @ 200% rated voltage and +250°C.
- High current handling, volumetric efficiency, and insulation resistance.
- Very low ESR/ESL.
- Pd / Ag and 100% Tin Plated (RoHS Compliant) terminations available.

Operating Temp	-55°C to +250°C
Case Size	0805 - 2220
Voltage	16 - 50V
Capacitance	100pF - 1μF

X8R/X8L MLCC

+175°C and +200°C



- Designed for use in applications up to 150°C
- Excellent reliability compared to other capacitor technologies
- Low ESR / ESL compared to other technologies
- Tin solder finish
- FLEXITERM® available
- Epoxy termination for hybrid available
- Qualified to the highest automotive AEC-Q200 standards

Operating Temp	-55°C to +150°C
Case Size	0603 - 1206
Voltage	16 - 100V
Capacitance	330pF - 1μF

MLCC with FLEXITERM®

+150°C



- Flexible termination system able to withstand 5mm bend test guaranteed.
- Available with X8R dielectric for high temperature applications.
- Increased temperature cycling performance, 3000 cycles and beyond.
- Reduction in circuit board flex failures.
- Base metal electrode system.
- Automotive or commercial grade products available.

Operating Temp	-55°C to +150°C
Case Size	0603 - 1206
Voltage	25 - 50V
Capacitance	270pF - 0.47μF

MLCC with Tin/Lead Termination “B”

+150°C



- MLCC with Tin/Lead Terminations
- Available with NP0 (C0G) and X8R dielectrics for high temperature applications.

Operating Temp	-55°C to +150°C
Case Size	0402 - 2220
Voltage	16 - 500V
Capacitance	0.5pF - 0.47μF

Radial Leads/SkyCap® AR Series

+150°C



- Conformally Coated Radial Leaded MLCC
- Available with C0G (NP0), X7R and X8R Dielectric
- Rated to 3000, 2000, 1000, 200, 100, 50 Volts
- Epoxy case material
- 100% Tin leads
- Qualified to AEC-Q200, PPAP Available

Operating Temp	-55°C to +150°C
Lead Spacing	0.20 - 0.40 inches
Voltage	50 - 200V
Capacitance	1pF - 0.33μF

SWITCHED MODE POWER SUPPLY (SMPS)

SMX Style Stacked MLC Capacitors

+200°C



- Ideally suited for high temperature applications up to 200°C
- Very low ESR and ESL
- Excellent capacitance retention with frequency
- Excellent high frequency performance
- Low DC leakage current
- High current handling capabilities
- Custom configurations are available such as unique geometries, lead configurations, packaging, and stress relief mounting options.

Operating Temp	-55°C to +200°C
Case Size	SMX 1 - 6
Voltage	25 - 500V
Capacitance	0.0039 - 340µF

SXP Style SMPS MLC Capacitors

+200°C



- Low ESR, low ESL
- Low DC leakage
- Excellent high frequency performance
- Ideally suited for high temperature applications up to 200°C
- Excellent mechanical protection suitable for extreme harsh environment

Operating Temp	-55°C to +200°C
Case Size	SXP 1 - 4
Voltage	50 - 1000V
Capacitance	100pF - 10µF

GLASS DIELECTRIC

ET Series Glass Capacitors

+200°C



- Glass dielectric
- Working temperature range -75°C to 200°C
- Simple, rugged design and construction
- Available in both axial and radial leaded configurations
- Values from 0.5 pF to 2400 pF

Operating Temp	-75°C to +200°C
Case Size	ET06 - ET15
Voltage	50V
Capacitance	0.5pF - 2400pF

RF/MICROWAVE MLCCs

AQ Series

+175°C



- High current carrying capabilities
- High quality factors
- Very low ESR
- Very high series resonance
- Excellent stability under stresses of changing voltage

Operating Temp	-55°C to +175°C
Case Size	0605 - 1210
Voltage	50 - 500V
Capacitance	0.1pF - 5100pF

SQCB Series

+175°C



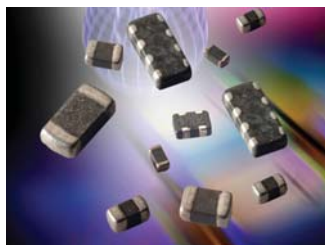
- Low ESR
- High Q
- High Self Resonance
- Capacitance Range 0.1 pF to 5100 pF
- 175°C Capability (+90 ± 30 PPM/°C Dielectric)

Operating Temp	-55°C to +175°C
Case Size	1210
Voltage	50 - 500V
Capacitance	0.1pF - 5100pF

CIRCUIT PROTECTION & SIGNAL INTEGRITY

High Temperature Automotive

+175°C



- Rated at 150°C
- ESD rating up to 25kV contact
- Low capacitance for capacitance sensitive applications - RF, antennas, data lines
- EMI/RFI attenuation in off state
- AEC Q200 qualified

Operating Temp	-55°C to +150°C
Case Size	0603 to 0612 4x array
Voltage	18V - 32V
Capacitance	10 - 22pF

Radial Leaded High Temperature Automotive

+175°C



- Rated at 150°C
- Epoxy encapsulated for harsh environment
- EMI/RFI attenuation in off state
- Excellent current and energy handling
- AEC Q200 qualified

Operating Temp	-55°C to +150°C
Size	VR15, VR20
Voltage	14V - 48V
Energy	0.1 - 2.0J
Peak Current	30 - 120A

NTC THERMISTORS

SMT NTC Thermistors

+150°C

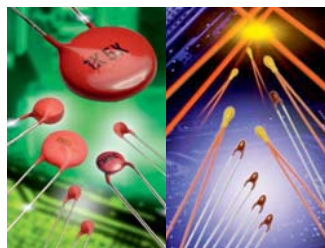


- Rated to 150°C
- Wide resistance range
- Fast thermal response
- Ni Barrier/100% Sn and PdPtAg termination options
- AEC Q200 qualified, custom hi-rel testing

Operating Temp	-55°C to +150°C
Case Size	0603 - 1206
Voltage	18Ω - 1MΩ
Capacitance	3250 - 4500K

Leaded and Leadless NTC Thermistors

+150°C



- Rated at 150°C
- Leaded disc or high accuracy bead NTC
- Various coating options and configurations
- Leadless options - metallized disc or high accuracy chip
- Fast response, excellent reliability
- AEC-Q200 qualified, custom hi-rel testing

Operating Temp	-55°C to +150°C
Disc Size	2.4mm - 9mm
Resistance	68Ω - 1MΩ
B value (25/85)	3250 - 4840K
Tolerance	From ±1%

ADVANCED TECHNOLOGY FILTERS

Hermetic High Temperature Solder-Ins

+200°C



- Fully Hermetic design
 - 400°C installation temperature
 - -55°C to +200°C operating temperature
 - Epoxy free construction
 - MIL-PRF-31033 Discoidal Capacitor
 - Custom designs available.
- Contact AVX at high.temp@avx.com

Operating Temp	-55°C to +200°C
Case Size	WQ/XQ/YQ/ZQ
Voltage	20 - 300V
Capacitance	10pF - 1.4mF

TANTALUM CAPACITORS

AVX is a worldwide leading supplier of tantalum capacitors. Tantalum capacitors provide high capacitance, high reliability, stable electrical performance under high temperature and no piezo noise effect.

Some of the innovative solutions include:

- **THJ Series**
High temperature tantalum chip capacitors rated up to 175°C. Capacitance ranges from 0.1 μ F to 220 μ F with voltage ratings up to 50V.
- **THJ Series with Extension to 200°C**
An extension of the THJ series, these SMD tantalum capacitors are rated up to 200°C with capacitance ranging from 10 μ F to 220 μ F.
- **TWC-Y Wet Tantalum**
The TWC-Y high temperature series represents a COTS-Plus version of conventional wet electrolytic tantalum capacitors that are designed for use at 200°C. The components listed are now capable of 500 hours of operation at extreme temperature with the applicable derated voltage.
- **TWA-Y Wet Tantalum**
Coming Soon
Wet electrolytic tantalum capacitors with a hermetic welded tantalum can and header assembly and 200°C operating temperature rating. Contact factory for customized options.
- **THH 230°C Hermetic Series**
High temperature SMD tantalum capacitors with ceramic hermetic seal. These components are rated for up to 230°C operating temperature up to 1000 hours at 50% rated voltage, and 200°C up to 10,000 hours at 50% rated voltage on selected codes.





FEATURES

- Improved reliability – 2x standard
- 175°C @ 0.5V_R continuous operation
- CV range: 0.10-220µF / 6.3-50V
- 5 case sizes available
- Low ESR options on approval
- High temperature automotive and industry applications

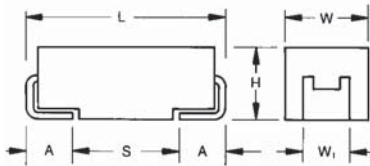


SnPb termination option is not RoHS compliant.

APPLICATIONS

- Automotive ECU and ABS control electronics
- Geothermal instrumentation

CHECK FOR UP-TO-DATE DATASHEET AT
<http://www.avx.com/docs/catalogs/thj.pdf>



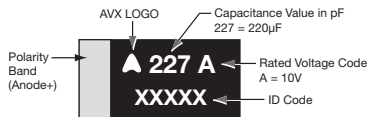
CASE DIMENSIONS: millimeters (inches)

Code	EIA Code	EIA Metric	L±0.20 (0.008)	W+0.20 (0.008) -0.10 (0.004)	H+0.20 (0.008) -0.10 (0.004)	W ₁ ±0.20 (0.008) -0.20 (0.008)	A+0.30 (0.012) -0.20 (0.008)	S Min.
A	1206	3216-18	3.20 (0.126)	1.60 (0.063)	1.60 (0.063)	1.20 (0.047)	0.80 (0.031)	1.10 (0.043)
B	1210	3528-21	3.50 (0.138)	2.80 (0.110)	1.90 (0.075)	2.20 (0.087)	0.80 (0.031)	1.40 (0.055)
C	2312	6032-28	6.00 (0.236)	3.20 (0.126)	2.60 (0.102)	2.20 (0.087)	1.30 (0.051)	2.90 (0.114)
D	2917	7343-31	7.30 (0.287)	4.30 (0.169)	2.90 (0.114)	2.40 (0.094)	1.30 (0.051)	4.40 (0.173)
E	2917	7343-43	7.30 (0.287)	4.30 (0.169)	4.10 (0.162)	2.40 (0.094)	1.30 (0.051)	4.40 (0.173)

W₁ dimension applies to the termination width for A dimensional area only.

MARKING

A, B, C, D, E CASE



HOW TO ORDER

THJ	B	105	*	035	R	JN	-
Type	Case Size See table above	Capacitance Code pF code: 1st two digits represent significant figures 3rd digit represents multiplier (number of zeros to follow)	Tolerance K=±10% M=±20%	Rated DC Voltage 006=6.3Vdc 010=10Vdc 016=16Vdc 020=20Vdc 025=25Vdc 035=35Vdc 050=50Vdc	Packaging R = Pure Tin 7" Reel S = Pure Tin 13" Reel A = Gold Plating 7" Reel B = Gold Plating 13" Reel H = Tin Lead 7" Reel (Contact Manufacturer) K = Tin Lead 13" Reel (Contact Manufacturer) H, K = Non RoHS	Standard Suffix OR 0100 Low ESR in mΩ	Additional characters may be added for special requirements V = Dry pack Option (selected codes only)

TECHNICAL SPECIFICATIONS

Technical Data:	All technical data relate to an ambient temperature of +25°C								
Capacitance Range:	0.10 µF to 220 µF								
Capacitance Tolerance:	±10%; ±20%								
Rated Voltage (V _R)	≤ +85°C:	6.3	10	16	20	25	35	50	
Category Voltage (V _C)	≤ +125°C:	4	7	10	13	17	23	33	
Category Voltage (V _C)	≤ +175°C:	3	5	8	10	12	17	25	
Surge Voltage (V _S)	≤ +85°C:	8	13	20	26	32	46	65	
Surge Voltage (V _S)	≤ +125°C:	5	8	13	16	20	28	40	
Surge Voltage (V _S)	≤ +175°C:	4	6	10	12	15	21	30	
Temperature Range:	-55°C to 175°C voltage derating.								
Reliability:	0.5% per 1000 hours at 85°C, V _R with 0.1Ω/V series impedance, 60% confidence level, 3.5 Fits at 40°C, 0.5V _R								
Termination Finish:	Sn Plating (standard), Gold Plating available on request								
	Meets requirements of AEC-Q200								

CAPACITANCE AND RATED VOLTAGE RANGE (LETTER DENOTES CASE SIZE)

Capacitance		Rated voltage (V_R) to 85°C (Voltage Code)						
μF	Code	6.3V (J)	10V (A)	16V (C)	20V (D)	25V (E)	35V (V)	50V (T)
0.10	104						A	
0.15	154						A	
0.22	224						A	
0.33	334						A	
0.47	474					A	B	
0.68	684					A	B	
1.0	105						A/B	
1.5	155				A		C	
2.2	225			A		B, B(1500)	C	
3.3	335		A	A	B		C	D
4.7	475	A	A	A/B			C	D
6.8	685	A	A	A/B		C	D	D
10	106	A	A/B	B		C	D	D/E
15	156	B	B	B	C		D	
22	226	B	B	C, C(500)		D	D, D(300)	
33	336	B	C	C	D		E	
47	476	C	C	C/D		D		
68	686	C	D	D				
100	107	D	D	E				
150	157	D						
220	227		E					

Available Ratings, (ESR ratings in mOhms in brackets)

Engineering samples - please contact manufacturer

*Codes under development - subject to change

Note: Voltage ratings are minimum values. AVX reserves the right to supply higher ratings in the same case size, to the same reliability standards.

RATINGS & PART NUMBER REFERENCE

AVX Part No.	Case Size	Capacitance (µF)	Rated Voltage (V)	Rated Temperature (°C)	Category Voltage (V)	Category Temperature (°C)	DCL (µA) Max.	DF % Max.	ESR Max. (Ω) @ 100kHz	MSL	100kHz RMS Current (mA)			
											25°C	85°C	125°C	175°C
6.3 Volt @ 85°C														
THJA475*006#JN	A	4.7	6.3	85	3	175	0.5	6	6	1	112	101	45	22
THJA685*006#JN	A	6.8	6.3	85	3	175	0.5	4.5	2.6	1	170	153	68	34
THJA106*006#JN	A	10	6.3	85	3	175	0.6	4.5	2.2	1	185	166	74	37
THJB156*006#JN	B	15	6.3	85	3	175	0.9	6	2.5	1	184	166	74	37
THJB226*006#JN	B	22	6.3	85	3	175	1.4	6	2.5	1	184	166	74	37
THJB336*006#JN	B	33	6.3	85	3	175	1.9	6	2.2	1	197	177	79	39
THJC476*006#JN	C	47	6.3	85	3	175	3.0	6	1.6	1	262	236	105	52
THJC686*006#JN	C	68	6.3	85	3	175	4.3	6	1.5	1	271	244	108	54
THJD107*006#JN	D	100	6.3	85	3	175	6	4.5	0.4	1	612	551	245	122
THJD157*006#JN	D	150	6.3	85	3	175	9.5	6	0.9	1	408	367	163	82
10 Volt @ 85°C														
THJA335*010#JN	A	3.3	10	85	5	175	0.5	6	5.5	1	117	105	47	23
THJA475*010#JN	A	4.7	10	85	5	175	0.5	4.5	2.9	1	161	145	64	32
THJA685*010#JN	A	6.8	10	85	5	175	0.7	4.5	2.6	1	170	153	68	34
THJA106*010#JN	A	10	10	85	5	175	1	6	2.7	1	167	150	67	33
THJB106*010#JN	B	10	10	85	5	175	1	4.5	1.8	1	217	196	87	43
THJB156*010#JN	B	15	10	85	5	175	1.5	4.5	1.5	1	238	214	95	48
THJB226*010#JN	B	22	10	85	5	175	2.2	6	2.4	1	188	169	75	38
THJC336*010#JN	C	33	10	85	5	175	3.3	6	1.6	1	262	236	105	52
THJC476*010#JN	C	47	10	85	5	175	4.7	4.5	0.5	1	469	422	188	94
THJD686*010#JN	D	68	10	85	5	175	6.8	4.5	0.4	1	612	551	245	122
THJD107*010#JN	D	100	10	85	5	175	10	6	0.9	1	408	367	163	82
THJE227*010#JN	E	220	10	85	5	175	22	10	0.5	1 ¹⁾	574	517	230	115
16 Volt @ 85°C														
THJA225*016#JN	A	2.2	16	85	8	175	0.5	6	6.5	1	107	97	43	21
THJA335*016#JN	A	3.3	16	85	8	175	0.5	6	5	1	122	110	49	24
THJA475*016#JN	A	4.7	16	85	8	175	0.8	4.5	2.9	1	161	145	64	32
THJB475*016#JN	B	4.7	16	85	8	175	0.8	6	3.5	1	156	140	62	31
THJA685*016#JN	A	6.8	16	85	8	175	1.1	6	3.5	1	146	132	59	29
THJB685*016#JN	B	6.8	16	85	8	175	1.1	6	2.5	1	184	166	74	37
THJB106*016#JN	B	10	16	85	8	175	1.6	6	2.8	1	174	157	70	35
THJB156*016#JN	B	15	16	85	8	175	2.4	6	2	1	206	186	82	41
THJC226*016#JN	C	22	16	85	8	175	3.5	6	1.6	1	262	236	105	52
THJC226*016#0500	C	22	16	85	8	175	3.5	4.5	0.5	1	469	422	188	94
THJC336*016#JN	C	33	16	85	8	175	5.3	6	1.5	1	271	244	108	54
THJC476*016#JN	C	47	16	85	8	175	7.5	6	0.9	1	371	334	148	74
THJD476*016#JN	D	47	16	85	8	175	7.5	6	0.9	1	408	367	163	82
THJD686*016#JN	D	68	16	85	8	175	10.9	4.5	0.9	1	408	367	163	82
THJE107*016#JN	E	100	16	85	8	175	16	8	0.4	1 ¹⁾	642	578	257	128
20 Volt @ 85°C														
THJA155*020#JN	A	1.5	20	85	10	175	0.5	6	6.5	1	107	97	43	21
THJB335*020#JN	B	3.3	20	85	10	175	0.7	6	3	1	168	151	67	34
THJC156*020#JN	C	15	20	85	10	175	3.0	6	1.7	1	254	229	102	51
THJD336*020#JN	D	33	20	85	10	175	6.6	6	0.9	1	408	367	163	82
25 Volt @ 85°C														
THJA474*025#JN	A	0.47	25	85	12	175	0.5	4	14	1	73	66	29	15
THJA684*025#JN	A	0.68	25	85	12	175	0.5	4	10	1	87	78	35	17
THJA105*025#JN	A	1.0	25	85	12	175	0.5	3	5.2	1	120	108	48	24
THJB225*025#JN	B	2.2	25	85	12	175	0.6	6	4.5	1	137	124	55	27
THJB225*025#1500	B	2.2	25	85	12	175	0.6	6	1.5	1	238	214	95	48
THJC685*025#JN	C	6.8	25	85	12	175	1.7	6	2	1	235	211	94	47
THJC106*025#JN	C	10	25	85	12	175	2.5	6	1.8	1	247	222	99	49
THJD226*025#JN	D	22	25	85	12	175	5.5	6	0.9	1	408	367	163	82
THJD336*025#JN	D	33	25	85	12	175	8.3	6	0.9	1	408	367	163	82
35 Volt @ 85°C														
THJA104*035#JN	A	0.1	35	85	17	175	0.5	4	24	1	56	50	22	11
THJA154*035#JN	A	0.15	35	85	17	175	0.5	4	21	1	60	54	24	12
THJA224*035#JN	A	0.22	35	85	17	175	0.5	4	18	1	65	58	26	13
THJA334*035#JN	A	0.33	35	85	17	175	0.5	4	15	1	71	64	28	14
THJB474*035#JN	B	0.47	35	85	17	175	0.5	4	10	1	92	83	37	18
THJB684*035#JN	B	0.68	35	85	17	175	0.5	4	8	1	103	93	41	21
THJA105*035#JN	A	1.0	35	85	17	175	0.5	4	7.5	1	100	90	40	20
THJB105*035#JN	B	1.0	35	85	17	175	0.5	4	6.5	1	114	103	46	23
THJC155*035#JN	C	1.5	35	85	17	175	0.5	6	4.5	1	156	141	63	31
THJC225*035#JN	C	2.2	35	85	17	175	0.8	6	3.5	1	177	160	71	35
THJC335*035#JN	C	3.3	35	85	17	175	1.2	6	2.5	1	210	189	84	42
THJC475*035#JN	C	4.7	35	85	17	175	1.6	6	2.2	1	224	201	89	45
THJD685*035#JN	D	6.8	35	85	17	175	2.4	6	1.3	1	340	306	136	68
THJD106*035#JN	D	10	35	85	17	175	3.5	6	1	1	387	349	155	77
THJD156*035#JN	D	15	35	85	17	175	5.3	6	0.9	1	408	367	163	82

RATINGS & PART NUMBER REFERENCE

AVX Part No.	Case Size	Capacitance (µF)	Rated Voltage (V)	Rated Temperature (°C)	Category Voltage (V)	Category Temperature (°C)	DCL (µA) Max.	DF % Max.	ESR Max. (Ω) @ 100kHz	MSL	100kHz RMS Current (mA)			
											25°C	85°C	125°C	175°C
THJD226*035#JN	D	22	35	85	17	175	7.7	6	0.6	1	500	450	200	100
THJD226*035#0300	D	22	35	85	17	175	7.7	6	0.3	1	707	636	283	141
THJE336*035#JN	E	33	35	85	17	175	11.6	6	0.5	1 ¹⁾	574	517	230	115
50 Volt @ 85°C														
THJD335*050#JN	D	3.3	50	85	25	175	1.7	6	1.1	1	369	332	148	74
THJD475*050#JN	D	4.7	50	85	25	175	2.4	6	0.9	1	463	417	185	93
THJD685*050#JN	D	6.8	50	85	25	175	3.4	6	0.7	1	408	367	163	82
THJD106*050#JN	D	10	50	85	25	175	5	6	0.7	1	463	417	185	93
THJE106*050#JN	E	10	50	85	25	175	5	6	0.7	1 ¹⁾	486	437	194	97

¹⁾ Dry pack option (see How to order) recommended for reduction of stress during soldering. Dry pack parts should be treated as MSL 3.

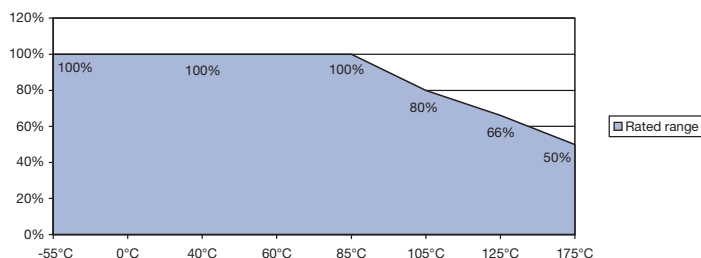
Moisture Sensitivity Level (MSL) is defined according to J-STD-020

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5V RMS with a maximum DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

The EIA & CECC standards for low ESR Solid Tantalum Capacitors allow an ESR movement to 1.25 times catalogue limit post mounting.

NOTE: AVX reserves the right to supply a higher voltage rating or tighter tolerance part in the same case size, to the same reliability standards.

THJ 175°C Voltage vs Temperature Rating



QUALIFICATION TABLE

TEST	THJ series (Temperature range -55°C to +175°C)									
	Condition			Characteristics						
Endurance	Determine after application of rated voltage for 2000 +48/-0 hours at 85±2°C and then leaving 1-2 hours at room temperature. Also determine of 175°C temperature, category voltage for 2000 +48/-0 hours and then leaving 1-2 hours at room temperature. Power supply impedance to be ≤0.1Ω/V.			Visual examination	no visible damage					
				DCL	1.25 x initial limit					
				ΔC/C	within ±10% of initial value					
				DF	initial limit					
				ESR	1.25 x initial limit					
Storage Life	175°C, 0V, 2000h			Visual examination	no visible damage					
				DCL	1.25 x initial limit					
				ΔC/C	within ±10% of initial value					
				DF	initial limit					
				ESR	1.25 x initial limit					
Biased Humidity	Determine after leaving for 1000 hours at 85±2°C, 85% relative humidity and rated voltage and then recovery 1-2 hours at room temperature.			Visual examination	no visible damage					
				DCL	2 x initial limit					
				ΔC/C	within ±10% of initial value					
				DF	1.2 x initial limit					
				ESR	1.25 x initial limit					
Temperature Stability	Step	Temperature(°C)	Duration(min)	+20°C	-55°C	+20°C	+125°C	+175°C	+20°C	
	1	+20±2	15	DCL	IL*	n/a	IL*	10 x IL*	12.5 x IL*	IL*
	2	-55+0/-3	15							
	3	+20±2	15	ΔC/C	n/a	+0/-10%	±5%	+10/-0%	+18/-0%	±5%
	4	+85+3/-0	15	DF	IL*	1.5 x IL*	IL*	1.5 x IL*	2 x IL*	IL*
	5	+175+3/-0	15	ESR	1.25 x IL*	2.5 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*
6	+20±2	15								
Surge Voltage	Test temperature: 175°C+3/0°C Test voltage: 1.3 x category voltage at 175°C Series protection resistance 1000±100Ω Discharge resistance: 1000Ω Number of cycles: 1000x Cycle duration: 6 min; 30 sec charge, 5 min 30 sec discharge			Visual examination	no visible damage					
				DCL	initial limit					
				ΔC/C	within ±5% of initial value					
				DF	initial limit					
				ESR	1.25 x initial limit					

*Initial Limit



FEATURES

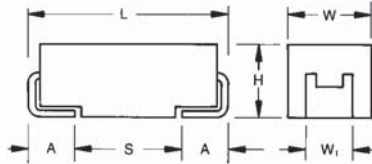
- SMD 200°C tantalum capacitor
- 200°C @ 0.33V_R 1000hrs continuous operation
- Leakage current after 200°C 1000hrs less than 1mA
- 3x reflow 260°C
- Gold plated termination for hybrid assembly
- Oil drilling, aerospace, automotive applications
- CV range: 10-220μF / 10-16V
- 2 case sizes available



APPLICATIONS

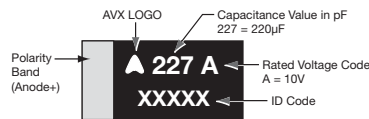
- Downhole drilling

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<http://www.avx.com/docs/catalogs/thj200c.pdf>



MARKING

B, E CASE



CASE DIMENSIONS: millimeters (inches)

Code	EIA Code	EIA Metric	L±0.20 (0.008)	W+0.20 (0.008) -0.10 (0.004)	H+0.20 (0.008) -0.10 (0.004)	W ₁ ±0.20 (0.008)	A+0.30 (0.012) -0.20 (0.008)	S Min.
B	1210	3528-21	3.50 (0.138)	2.80 (0.110)	1.90 (0.075)	2.20 (0.087)	0.80 (0.031)	1.40 (0.055)
E	2917	7343-43	7.30 (0.287)	4.30 (0.169)	4.10 (0.162)	2.40 (0.094)	1.30 (0.051)	4.40 (0.173)

W₁ dimension applies to the termination width for A dimensional area only.

HOW TO ORDER

THJ

Type

E

Case Size
See table above

107

Capacitance Code
pF code: 1st two digits represent significant figures
3rd digit represents multiplier (number of zeros to follow)

Tolerance
K=±10%
M=±20%

016

Rated DC Voltage
010=10Vdc
016=16Vdc

A

Packaging
A = Gold Plating 7" Reel
B = Gold Plating 13" Reel

JH

Standard Suffix

TECHNICAL SPECIFICATIONS

Technical Data:	All technical data relate to an ambient temperature of +25°C		
Capacitance Range:	10 μF to 220 μF		
Capacitance Tolerance:	±10%; ±20%		
Leakage Current DCL @ V _R 25°C	0.01CV		
Leakage Current DCL @ V _C 200°C, 1000 hrs	1mA		
Rated Voltage (V _R)	≤ +85°C:	10	16
Category Voltage (V _C)	≤ +200°C:	3.3	5.3
Surge Voltage (V _s)	≤ +85°C:	13	20
Surge Voltage (V _s)	≤ +200°C:	4.3	6.5
Temperature Range:	-55°C up 200°C with voltage derating		
Reliability:	0.5% per 1000 hours at 85°C, V _R with 0.1Ω/V series impedance, 1000 hrs at 200°C, 0.33V _R		
Termination Finished:	Gold Plating		
	Meets requirements of AEC-Q200		

CAPACITANCE AND RATED VOLTAGE RANGE (LETTER DENOTES CASE SIZE)

Capacitance		Rated voltage (V _R) to 85°C (Voltage Code)	
µF	Code	10V (A)	16V (C)
10	106		B
15	156		
22	226		
33	336		
47	476		
68	686		
100	107		E
150	157		
220	227	E	
330	337		
470	477		
680	687		

Available Ratings

Engineering samples - please contact manufacturer

*Codes under development – subject to change

Note: Voltage ratings are minimum values. AVX reserves the right to supply higher ratings in the same case size, to the same reliability standards

RATINGS & PART NUMBER REFERENCE

AVX Part No.	Case Size	Capacitance (µF)	Rated Voltage (V)	Rated Temperature (°C)	Category Voltage (V)	Category Temperature (°C)	DCL (µA) Max. @ V _R 25°C	DCL (mA) Max. @ V _c 200°C 1000 hrs	DF % Max.	ESR Max. (Ω) @ 100kHz	MSL	100kHz RMS Current (mA)			
												25°C	85°C	175°C	200°C
10 Volt @ 85°C															
THJE227*010#JH	E	220	10	85	3.3	200	22	1.0	10	0.25	1	812	731	162	81
16 Volt @ 85°C															
THJB106*016#JH	B	10	16	85	5.3	200	1.6	1.0	6	2.8	1	174	157	35	17
THJE107*016#JH	E	100	16	85	5.3	200	16	1.0	8	0.25	1	812	731	162	81

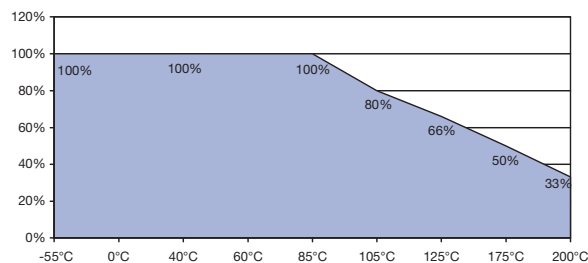
Moisture Sensitivity Level (MSL) is defined according to J-STD-020.

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5V RMS with a maximum DC bias of 2.2 volts.

DCL is measured at rated voltage after 5 minutes.

NOTE: AVX reserves the right to supply a higher voltage rating or tighter tolerance part in the same case size, to the same reliability standards.

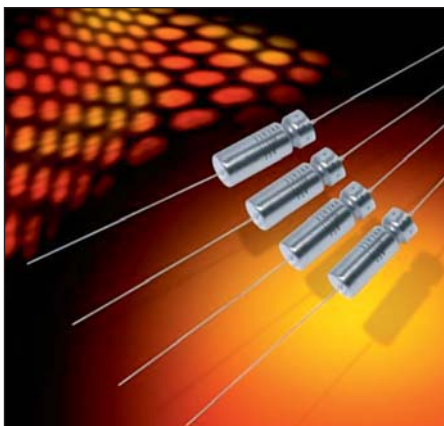
THJ 200°C Voltage vs Temperature Rating



QUALIFICATION TABLE

TEST	THJ 200°C series (Temperature range -55°C to +200°C)										
	Condition			Characteristics							
Endurance	Determine after application of rated voltage for 2000 +48/-0 hours at 85±2°C and then leaving 1-2 hours at room temperature. Also determine of 200°C temperature, category voltage for 2000 +48/-0 hours and then leaving 1-2 hours at room temperature. Power supply impedance to be ≤0.1Ω/V.			Visual examination	no visible damage						
				DCL	1.25 x initial limit						
				ΔC/C	within ±10% of initial value						
				DF	initial limit						
				ESR	1.25 x initial limit						
Storage Life	200°C, 0V, 2000h			Visual examination	no visible damage						
				DCL	1.25 x initial limit						
				ΔC/C	within ±10% of initial value						
				DF	initial limit						
				ESR	1.25 x initial limit						
Biased Humidity	Determine after leaving for 1000 hours at 85±2°C, 85% relative humidity and rated voltage and then recovery 1-2 hours at room temperature.			Visual examination	no visible damage						
				DCL	2 x initial limit						
				ΔC/C	within ±10% of initial value						
				DF	1.2 x initial limit						
				ESR	1.25 x initial limit						
Temperature Stability	Step	Temperature°C	Duration(min)		+20°C	-55°C	+20°C	+125°C	+200°C	+20°C	
	1	+20±2	15	DCL	IL*	n/a	IL*	10 x IL*	12.5 x IL*	IL*	
	2	-55+0/-3	15	ΔC/C	n/a	+0/-10%	±5%	+10/-0%	+18/-0%	±5%	
	3	+20±2	15	DF	IL*	1.5 x IL*	IL*	1.5 x IL*	2 x IL*	IL*	
	4	+85+3/-0	15	ESR	1.25 x IL*	2.5 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*	
	5	+200+3/-0	15								
	6	+20±2	15								
Surge Voltage	Test temperature: 200°C+3/0°C Test voltage: 1.3 x category voltage at 200°C Series protection resistance 1000±100Ω Discharge resistance: 1000Ω Number of cycles: 1000x Cycle duration: 6 min; 30 sec charge, 5 min 30 sec discharge			Visual examination	no visible damage						
				DCL	initial limit						
				ΔC/C	within ±5% of initial value						
				DF	initial limit						
				ESR	1.25 x initial limit						

*Initial Limit



The TWC-Y high temperature series represents a COTS-Plus version of conventional wet electrolytic tantalum capacitors that are designed for use at 200°C. The components listed are now capable of 500 hours of operation at extreme temperature with the applicable derated voltage.

This design includes a welded tantalum can and header assembly that provides a hermetic seal to withstand harsh environments.

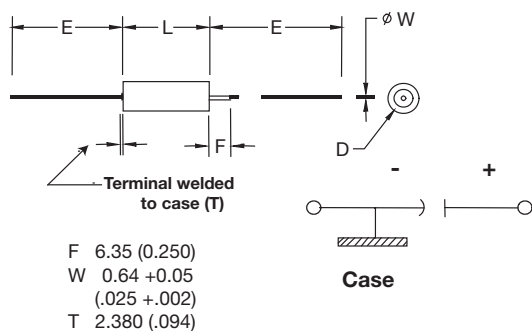
This is a new product line so please contact the factory for availability and additional details.

CHECK FOR UP-TO-DATE DATASHEET AT
<http://www.avx.com/docs/catalogs/twc200.pdf>

CASE DIMENSIONS: millimeters (inches)

Standard Case Size	AVX Case Size	L	D	D	E
		+0.79 (0.031)	Basic Case	Insulated Case	±6.35 (0.250)
		-0.41 (0.016)	±0.41 (0.016)	Max	
T1	A	11.51 (0.453)	4.78 (0.188)	5.56 (0.219)	38.10 (1.500)
T2	B	16.28 (0.641)	7.14 (0.281)	7.92 (0.312)	57.15 (2.250)
T3	D	19.46 (0.766)	9.52 (0.375)	10.31 (0.406)	57.15 (2.250)
T4	E	26.97 (1.062)	9.52 (0.375)	10.31 (0.406)	57.15 (2.250)

OUTLINE DIMENSIONS



200°C LIFE TEST:

These components are capable of 500 hours of operation at 200°C with the applicable 60% derated voltage. Following the life test components which are stabilized at 25°C ± 5°C shall exhibit:

Leakage less than 200% the original requirement or ± 10µA (whichever is greater)

ESR not greater than 200% the original requirement

Capacitance increase less than 10% or decrease less than 20% the initial measurement

HOW TO ORDER

AVX PART NUMBER:

TWC	B	476	*	050	□	C	Y	Z	00	00
Type	Case Size	Capacitance Code pF code: 1st two digits represent significant figures 3rd digit represents multiplier (number of zeros to follow)	Capacitance Tolerance M = ±20% K = ±10%	Voltage Code	Insulation Sleeve C = Without Sleeve S = With Sleeve	ESR C = Standard ESR	Qualification Y = High Temp.	Reliability Z = Non-ER	Termination Finish 00 = Sn/Pb 60/40 07 = 100% Tin	Custom Test Options 00 = Standard

For RoHS compliant products, please select correct termination style.

TECHNICAL SPECIFICATIONS

Technical Data: Unless otherwise specified, all technical data relate to an ambient temperature of +25°C

Capacitance Tolerance: ±10%; ±20%

Rated Voltage (V _R)	≤ 85°C	6	8	10	15	25	30	50	60	75	100	125
Category Voltage (V _C)	125°C	4	5	7	10	15	20	30	40	50	65	85
High Temp. Voltage (V_T)	200°C	3.6	4.8	6	9	12	18	30	36	45	60	75
Surge Voltage (V _S)	≤ 85°C	6.9	9.2	11.5	17.3	28.8	34.5	57.5	69	86.3	115	144

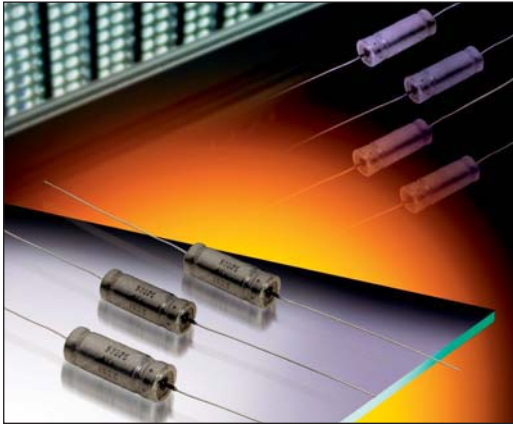
Temperature Range: -55°C to +200°C

STANDARD RATINGS & PART NUMBER REFERENCE

AVX Part Number	Cap (µF) +25°C at 120Hz	DC Rated Voltage (V) at +85°C	DC Leakage (µA)		DF (max)	ESR Max (Ohms) at 120Hz	Maximum Capacitance Change (%)			Case Size	
			+25°C	+85°C & +125°C			-55°C	+85°C	+125°C	Standard	AVX
6 VDC at 85°C 4 VDC at 125°C 3.6 VDC at 200°C											
TWCB147*006□CYZ0000	140	6	1	3	21	1.99	-40	14	16	T2	B
TWCD337*006□CYZ0000	330	6	2	7.9	36	1.45	-44	14	16	T3	D
TWCD567*006□CYZ0000	560	6	2	13	55	1.30	-64	17.5	20	T3	D
8 VDC at 85°C 5 VDC at 125°C 4.8 VDC at 200°C											
TWCB127*008□CYZ0000	120	8	1	2	20	2.21	-44	17.5	20	T2	B
TWCD297*008□CYZ0000	290	8	2	6	34	1.56	-64	17.5	20	T3	D
TWCD437*008□CYZ0000	430	8	2	14	46	1.42	-64	17.5	20	T3	D
10 VDC at 85°C 7 VDC at 125°C 6 VDC at 200°C											
TWCB107*010□CYZ0000	100	10	1	4	15	1.99	-36	14	16	T2	B
TWCD257*010□CYZ0000	250	10	2	10	30	1.59	-40	14	16	T3	D
TWCD397*010□CYZ0000	390	10	2	16	44	1.50	-64	17.5	20	T3	D
15 VDC at 85°C 10 VDC at 125°C 9 VDC at 200°C											
TWCB706*015□CYZ0000	70	15	1	4	13	2.46	-28	14	16	T2	B
TWCD177*015□CYZ0000	170	15	2	10	25	1.95	-32	14	16	T3	D
TWCD277*015□CYZ0000	270	15	2	16	32	1.57	-56	17.6	20	T3	D
25 VDC at 85°C 15 VDC at 125°C 15 VDC at 200°C											
TWCA686*025□CYZ0000	68	25	2	9	22	4.29	-50	12	15	T1	A
TWCB107*025□CYZ0000	100	25	1	10	15	1.99	-28	13	15	T2	B
TWCD127*025□CYZ0000	120	25	2	6	21	2.32	-32	13	15	T3	D
TWCD187*025□CYZ0000	180	25	2	18	26	1.92	-48	13	15	T3	D
TWCB277*025□CYZ0000	270	25	3	16	55	2.70	-62	13	16	T2	B
TWCD567*025□CYZ0000	560	25	7	28	76	1.80	-77	20	25	T3	D
30 VDC at 85°C 20 VDC at 125°C 18 VDC at 200°C											
TWCA566*030□CYZ0000	56	30	2	9	22	5.21	-48	12	15	T1	A
TWCB686*030□CYZ0000	68	30	1	8	13	2.54	-24	13	15	T2	B
TWCD107*030□CYZ0000	100	30	2	12	17	2.26	-28	10.5	12	T3	D
TWCD157*030□CYZ0000	150	30	2	18	23	2.03	-48	13	15	T3	D
TWCB227*030□CYZ0000	220	30	3	16	42	2.53	-60	13	16	T2	B
TWCE307*030□CYZ0000	300	30	8	32	31	1.37	-60	25	25	T4	E
TWCD397*030□CYZ0000	390	30	6	18	53	1.80	-65	18	25	T3	D
TWCD477*030□CYZ0000	470	30	8	32	64	1.81	-70	20	25	T3	D
TWCE567*030□CYZ0000	560	30	9	36	55	1.30	-65	25	30	T4	E
50 VDC at 85°C 30 VDC at 125°C 30 VDC at 200°C											
TWCA336*050□CYZ0000	33	50	2	9	12.3	4.95	-39	10	12	T1	A
TWCB476*050□CYZ0000	47	50	1	9	11	3.11	-28	13	15	T2	B
TWCD806*050□CYZ0000	60	50	2	12	12	2.65	-16	10.5	12	T3	D
TWCD826*050□CYZ0000	82	50	2	16	15	2.43	-32	13	15	T3	D
TWCB127*050□CYZ0000	120	50	4	24	22.5	2.49	-42	12	15	T2	B
TWCE167*050□CYZ0000	160	50	8	32	17	1.41	-50	25	25	T4	E
TWCD277*050□CYZ0000	270	50	8	32	37	1.82	-51	20	25	T3	D
TWCE337*050□CYZ0000	330	50	9	36	38	1.53	-46	25	30	T4	E
60V VDC at 85°C 40 VDC at 125°C 36 VDC at 200°C											
TWCA276*060□CYZ0000	27	60	3	12	10.2	5.01	-34	10	12	T1	A
TWCD506*060□CYZ0000	50	60	2	12	10	2.65	-16	10.5	12	T3	D
TWCD686*060□CYZ0000	68	60	2	16	13	2.54	-32	10.5	12	T3	D
TWCB107*060□CYZ0000	100	60	4	20	19	2.52	.36	12	15	T2	B
TWCE147*060□CYZ0000	140	60	8	32	16	1.52	-40	20	20	T4	E
TWCD227*060□CYZ0000	220	60	8	32	30	1.81	-45	16	20	T3	D
TWCE277*060□CYZ0000	270	60	9	36	27	1.33	-45	20	25	T4	E
75V VDC at 85°C 50 VDC at 125°C 45 VDC at 200°C											
TWCA226*075□CYZ0000	22	75	3	12	8.5	5.13	-29	10	12	T1	A
TWCD566*075□CYZ0000	56	75	2	17	11	2.61	-28	10.5	15	T3	D
TWCB826*075□CYZ0000	82	75	4	24	15.2	2.46	-30	12	15	T2	B
TWCE117*075□CYZ0000	110	75	9	36	12	1.45	-35	20	20	T4	E
TWCD187*075□CYZ0000	180	75	9	36	24.4	2.23	-40	16	20	T3	D
TWCE227*075□CYZ0000	220	75	10	40	37	1.80	-40	20	25	T4	E
100 VDC at 85°C 65 VDC at 125°C 60 VDC at 200°C											
TWCB226*100□CYZ0000	22	100	1	9	7.5	4.52	-16	8	8	T2	B
TWCE127*100□CYZ0000	120	100	12	48	25	2.76	-35	15	17	T4	E
125 VDC at 85°C 85 VDC at 125°C 75 VDC at 200°C											
TWCB276*125□CYZ0000	27	125	5	24	7.2	3.54	-18	12	15	T2	B
TWCE826*125□CYZ0000	82	125	12	48	17.4	2.82	-30	15	17	T4	E

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2V. DCL is measured at rated voltage after 5 minutes. Note: AVX reserves the right to supply higher voltage rating in the same case size to the same reliability standards.

**PRELIMINARY VERSION SUBJECT TO CHANGE
COMING SOON**



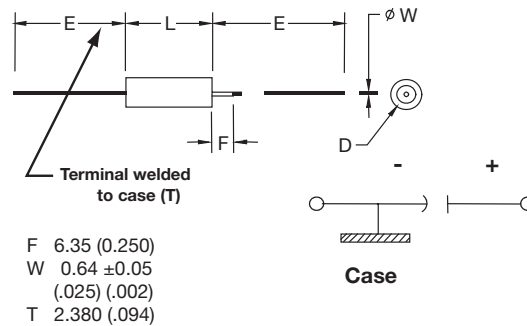
The TWA-Y series represents a high temperature version of conventional wet electrolytic Tantalum capacitors that are designed for use at 200°C. A high capacitance cathode system allows for high CV (capacitance/voltage) in standard case sizes.

Selected TWA-Y series values are capable of up to 2000 hours of operation at extreme temperatures with the applicable derated voltage.

This design includes a welded tantalum can and header assembly that provides a hermetic seal to withstand harsh shock and vibration requirements.

Contact the factory for additional options for customized component design.

OUTLINE DIMENSIONS



CASE DIMENSIONS: millimeters (inches)

DSCC Case Size	AVX Case Size	L	D		E
			Without Insulating Sleeve	With Insulating Sleeve Max	
		+0.79 (0.031) -0.41 (0.016)	±0.41 (0.016)		±6.35 (0.250)
T1	A	11.51 (0.453)	4.78 (0.188)	5.56 (0.219)	38.10 (1.500)
T2	B	16.28 (0.641)	7.14 (0.281)	7.92 (0.312)	57.15 (2.250)
T3	D	19.46 (0.766)	9.52 (0.375)	10.31 (0.406)	57.15 (2.250)
T4	E	26.97 (1.062)	9.52 (0.375)	10.31 (0.406)	57.15 (2.250)

VOLTAGE RATINGS (Operating Temperature -55°C to 200°C)

Voltage (DC)								
Rated Voltage: (V _R)	85°C	25	30	50	60	75	100	125
Derated Voltage: (V _C)	125°C	15	20	30	40	50	65	85
High Temperature Voltage: (V _T)	200°C	12	18	30	36	45	60	75

**PRELIMINARY VERSION SUBJECT TO CHANGE
COMING SOON**

HOW TO ORDER

AVX PART NUMBER:

TWA	E	757	*	075	□	B	Y	Z	0	^	00
Type	Case Size	Capacitance Code pF code: 1st two digits represent significant figures 3rd digit represents multiplier (number of zeros to follow)	Capacitance Tolerance K = ±10% M = ±20%	Voltage Code	Insulation Sleeve C = Without Sleeve S = With Sleeve	Packaging B = Tray Pack	Inspection Level Y = In accordance with CECC testing, designed for high temp	Reliability Z = Non-ER	Qualification Level 0 = N/A	Termination Finish 0 = Sn/Pb 60/40 7 = Matte tin	Custom Test Options 00 = Standard

LEAD-FREE
LEAD-FREE COMPATIBLE COMPONENT

RoHS COMPLIANT

For RoHS compliant products, please select correct termination style.

RIPPLE CURRENT MULTIPLIERS vs. Frequency, temperature and applied voltage^{1/2}

Frequency of Applied Ripple Current		120Hz				800Hz				1kHz			
		≤55	85	105	125	≤55	85	105	125	≤55	85	105	125
Ambient Still Air Temperature (°C)													
% of	100%	0.60	0.39	–	–	0.71	0.43	–	–	0.72	0.45	–	–
85°C	90%	0.60	0.46	–	–	0.71	0.55	–	–	0.72	0.55	–	–
Rated	80%	0.60	0.52	0.35	–	0.71	0.62	0.42	–	0.72	0.62	0.42	–
Peak	70%	0.60	0.58	0.44	–	0.71	0.69	0.52	–	0.72	0.70	0.52	–
Voltage	66-2/3%	0.60	0.60	0.46	0.27	0.71	0.71	0.55	0.32	0.72	0.72	0.55	0.32

Frequency of Applied Ripple Current		10kHz				40kHz				100kHz			
		≤55	85	105	125	≤55	85	105	125	≤55	85	105	125
Ambient Still Air Temperature (°C)													
% of	100%	0.88	0.55	–	–	1.00	0.63	–	–	1.10	0.69	–	–
85°C	90%	0.88	0.67	–	–	1.00	0.77	–	–	1.10	0.85	–	–
Rated	80%	0.88	0.76	0.52	–	1.00	0.87	0.59	–	1.10	0.96	0.65	–
Peak	70%	0.88	0.85	0.64	–	1.00	0.97	0.73	–	1.10	1.07	0.80	–
Voltage	66-2/3%	0.88	0.88	0.68	0.40	1.00	1.00	0.77	0.45	1.10	1.10	0.85	0.50

1/ At 125°C the rated voltage of the capacitors decreases to 66 2/3 of the 85°C rated voltage.

2/ The peak of the applied ac ripple voltage plus the applied dc voltage must not exceed the dc voltage rating of the capacitors.

**PRELIMINARY VERSION SUBJECT TO CHANGE
COMING SOON**

**CAPACITANCE AND RATED VOLTAGE, V_R (VOLTAGE CODE) RANGE
(LETTER DENOTES CASE SIZE)**

Capacitance		Rated Voltage DC (V_R) to 85°C				
μF	Code	50V	60V	75V	100V	125V
15	156					
22	226			A*		
33	336					
47	476					
68	686				B*	
100	107		B*			
120	127					
150	157				D	E
220	227					E
330	337	E*			E*	
400	407				E*	
470	477					
560	567					
680	687					
750	757			E		
1000	108					

Released codes

Engineering samples - please contact manufacturer

*Codes under development

**PRELIMINARY VERSION SUBJECT TO CHANGE
COMING SOON**

RATINGS & PART NUMBER REFERENCE

AVX Part Number	Cap (µF) 25°C at 120Hz	DC Rated Voltage (V) at 85°C	ESR Max (ohms) at 120Hz	DC Leakage max (µA)		TANG δ Max +25°C (%)	Impedance max (Ohms) -55°C at 120Hz	Maximum Capacitance Change (%)			AC Ripple (mA rms) 85°C at 40kHz	Case Size		Lifetime at 200°C (hrs.)
				+25°C	+85 & +125°C			-55°C	+85°C	+125°C		AVX	DSCC	
50 VDC at 85°C 30 VDC at 125°C 30 VDC at 200°C														
TWAE337*050□BYZ0^00	330	50	0.8	2.5	25	24	15	-50	8	15	1900	E	T4	1000
60 VDC at 85°C 40 VDC at 125°C 36 VDC at 200°C														
TWAB106*060□BYZ0^00	100	60	2.5	1.7	10	12	30	-40	8	15	1100	B	T2	1000
75 VDC at 85°C 50 VDC at 125°C 45 VDC at 200°C														
TWAA226*075□BYZ0^00	22	75	2.5	1.0	5	8	66	-25	5	9	1050	A	T1	1000
TWAE757*075□BYZ0^00	750	75	0.7	12.0	120	60	10	-40	20	30	3800	E	T4	500
100 VDC at 85°C 65 VDC at 125°C 60 VDC at 200°C														
TWAB686*100□BYZ0^00	68	100	2.5	2.0	10	13	37	-30	4	12	1650	B	T2	1000
TWAD157*100□BYZ0^00	150	100	1.6	3.0	25	22	22	-35	6	12	2100	D	T3	1000
TWAE337*100□BYZ0^00	330	100	0.8	6.0	60	30	10	-45	7	20	3600	E	T4	1000
TWAE407*100□BYZ0^00	400	100	0.8	10.0	100	30	10	-50	10	35	4100	E	T4	500
125 VDC at 85°C 85 VDC at 125°C 75 VDC at 200°C														
TWAE157*125□BYZ0^00	150	125	1.6	5.0	50	35	20	-35	6	16	2750	E	T4	1000
TWAE227*125□BYZ0^00	220	125	1.4	10.0	50	25	12	-40	8	15	3600	E	T4	1000

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2V. DCL is measured at rated voltage after 5 minutes.

NOTE: AVX reserves the rights to supply higher voltage rating in the same case size, to the same reliability standards.



FEATURES

- High temperature applications
- Operational temperature up to Ur to 230°C for 1000hrs service life *
- Ceramic case hermetic packaging
- Stability under humidity and ambient atmosphere exposure
- Large case sizes including CTC-21D provide high capacitance values
- Manufacturing and screening utilizing AVX patented Q-Process to effectively remove components that may experience excessive parametric shifts or instability in operation life



*Endurance qualification 200°C/0.5U_P/10,000hrs on selected codes

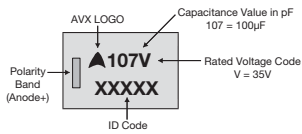
APPLICATIONS

- Oil drilling
- Extreme temperature applications

For additional information on Q-process please consult the AVX technical publication "Reaching the Highest Reliability for Tantalum Capacitors" (see the link: <http://www.avx.com/docs/techinfo/Qprocess.pdf>)

MARKING

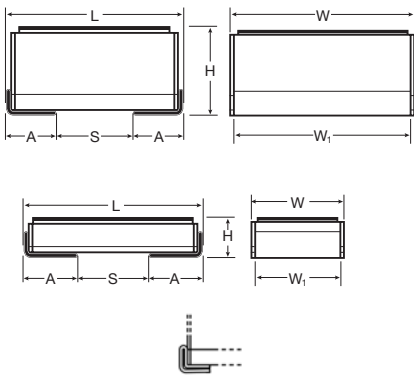
9, I CASE



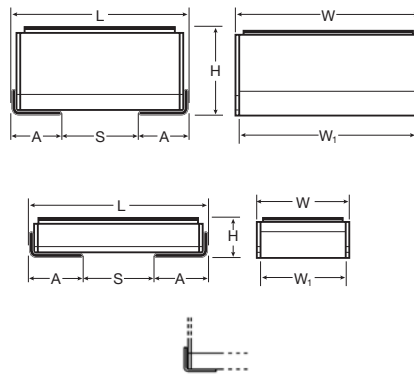
CASE DIMENSIONS: millimeters (inches)

Code	Type	L±0.20 (0.008)	W±0.20 (0.008)	H Max.	W ₁ ±0.20 (0.008)	A±0.20 (0.008)	S Min.
9 (CTC-21D)	J-lead (L shape)	11.50 ± 0.50 (0.453 ± 0.020)	12.50 ± 0.50 (0.492 ± 0.020)	6.15 (0.242)	12.50 ± 0.50 (0.492 ± 0.020)	1.90 ± 0.50 (0.075 ± 0.020)	7.00 (0.276)
9 (CTC-21D)	J-lead (flex)	12.10 ± 0.50 (0.476 ± 0.020)	12.50 ± 0.50 (0.492 ± 0.020)	6.50 (0.256)	12.00 ± 0.50 (0.472 ± 0.020)	2.00 ± 0.50 (0.079 ± 0.020)	7.20 (0.283)
9 (CTC-21D)	Undertab	11.00 (0.433)	12.50 (0.492)	5.95 (0.234)	10.50 (0.413)	1.50 (0.059)	7.80 (0.307)
I	J-lead (L shape)	11.50 ± 0.50 (0.453 ± 0.020)	6.00 ± 0.50 (0.236 ± 0.020)	2.70 (0.106)	6.00 ± 0.50 (0.236 ± 0.020)	3.50 ± 0.50 (0.138 ± 0.020)	4.00 (0.157)
I	J-lead (flex)	11.90 ± 0.50 (0.469 ± 0.020)	6.00 ± 0.50 (0.236 ± 0.020)	3.00 (0.118)	5.50 ± 0.50 (0.217 ± 0.020)	3.60 ± 0.50 (0.142 ± 0.020)	4.20 (0.165)
I	Undertab	11.00 (0.433)	6.00 (0.236)	2.50 (0.098)	4.00 (0.157)	3.20 (0.126)	4.40 (0.173)

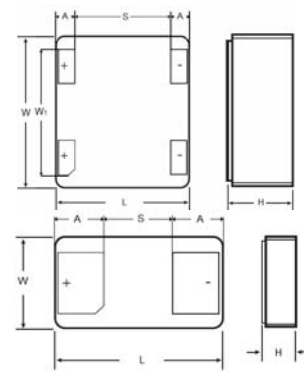
'J' Lead Termination (J-Flex)



'J' Lead Termination (L-Shape)



Undertab Termination



TECHNICAL SPECIFICATIONS

Technical Data:	All technical data relate to an ambient temperature of +25°C							
Capacitance Range:	3.3 μ F to 330 μ F							
Capacitance Tolerance:	\pm 20%							
Leakage Current DCL:	0.01CV							
Rated Voltage (V_R)	$\leq +175^\circ\text{C}$	16	20	25	35	50	63	
Category Voltage (V_C)	$\leq +200^\circ\text{C}$	13	16	20	28	40	50	
Category Voltage (V_C)	$\leq +215^\circ\text{C}$	10	13	16	23	33	41	
Category Voltage (V_C)	$\leq +230^\circ\text{C}$	8	10	12	17	25	31	
Temperature Range:	-55°C to +230°C for case size "9", -55°C to +215°C for case size "1"							
Reliability:	1% per 1000 hours at 85°C, V_r with 0.1 Ω /V series impedance, 60% confidence level							
Termination Finish:	Gold Plating (Undertab), Gold Plating (J-lead L shape), Nickel Plating (J-lead flex)							

HOW TO ORDER

AVX PART NUMBER

THH	9	107	M	035	W	0250	J
Type	Case Size See table above	Capacitance Code pF code: 1st two digits represent significant figures 3rd digit represents multiplier (number of zeros to follow)	Tolerance M = \pm 20%	Rated DC Voltage 016 = 16Vdc 020 = 20Vdc 025 = 25Vdc 035 = 35Vdc 050 = 50Vdc 063 = 63Vdc	Packaging W = Waffle B = Bulk	ESR in mΩ	Termination J = 'J' lead L shape U = Undertab W = 'J' lead flex



CAPACITANCE AND VOLTAGE RANGE (CODE DENOTES THE CASE SIZE)

Capacitance		Rated Voltage DC (V_R) at 85°C					
μ F	Code	16V (C)	20V (D)	25V (E)	35V (V)	50V (T)	63V (J)
3.3	335					I*	I*
4.7	475					I*	I*
6.8	685				I	I*	
10	106				I		
15	156		I*	I*	I*		
22	226	I	I*	I*	I*		
33	336	I*	I*	I*			9*
47	476	I	I*			9*	9
68	686					9*	
100	107			9*	9		
150	157		9*	9*	9*		
220	227	9*	9*				
330	337	9*					

Available ratings

Engineering samples - please contact manufacturer

*Codes under development – upon request, please contact manufacturer

RATINGS & PART NUMBER REFERENCE

AVX Part No.	Case Size	Capacitance (µF)	Rated Voltage (V)	Rated Temperature (°C)	Category Voltage (V)	Category Temperature (°C)	DCL (µA) Max.	DF % Max.	ESR Max. (mΩ) @ 100kHz	MSL	100kHz RMS Current (A)			Product Category
											25°C	85°C	230°C	
16 Volt @ 175°C														
THH1226M016W0500#	I	22	16	175	10	215	3.6	8	500	1	0.81	0.73	0.73	215
THH1336M016W0500#	I	33	16	175	10	215	5.3	8	500	1	0.81	0.73	0.73	215
THH1476M016W0500#	I	47	16	175	10	215	7.5	8	500	1	0.81	0.73	0.73	215
THH9227M016W0250#	9	220	16	175	8	230	35.2	8	250	1	1.26	1.13	1.13	230
THH9337M016W0250#	9	330	16	175	8	230	52.8	8	250	1	1.26	1.13	1.13	230
20 Volt @ 175°C														
THH1156M020W0500#	I	15	20	175	13	215	3	8	500	1	0.81	0.73	0.73	215
THH1226M020W0500#	I	22	20	175	13	215	4.4	8	500	1	0.81	0.73	0.73	215
THH1336M020W0500#	I	33	20	175	13	215	6.6	8	500	1	0.81	0.73	0.73	215
THH1476M020W0500#	I	47	20	175	13	215	9.4	8	500	1	0.81	0.73	0.73	215
THH9157M020W0250#	9	150	20	175	10	230	30	8	250	1	1.26	1.13	1.13	230
THH9227M020W0250#	9	220	20	175	10	230	44	8	250	1	1.26	1.13	1.13	230
25 Volt @ 175°C														
THH1156M025W0500#	I	15	25	175	16	215	3.8	8	500	1	0.81	0.73	0.73	215
THH1226M025W0500#	I	22	25	175	16	215	5.5	8	500	1	0.81	0.73	0.73	215
THH1336M025W0500#	I	33	25	175	16	215	8.3	8	500	1	0.81	0.73	0.73	215
THH9107M025W0250#	9	100	25	175	12	230	25	8	250	1	1.26	1.13	1.13	230
THH9157M025W0250#	9	150	25	175	12	230	37.5	8	250	1	1.26	1.13	1.13	230
35 Volt @ 175°C														
THH1685M035W0500#	I	6.8	35	175	23	215	2.4	8	500	1	0.81	0.73	0.73	215
THH1106M035W0500#	I	10	35	175	23	215	3.5	8	500	1	0.81	0.73	0.73	215
THH1156M035W0500#	I	15	35	175	23	215	5.3	8	500	1	0.81	0.73	0.73	215
THH1226M035W0500#	I	22	35	175	23	215	7.7	8	500	1	0.81	0.73	0.73	215
THH9107M035W0250#	9	100	35	175	17	230	35	8	250	1	1.26	1.13	1.13	230
THH9157M035W0250#	9	150	35	175	17	230	52.5	8	250	1	1.26	1.13	1.13	230
50 Volt @ 175°C														
THH1335M050W0500#	I	3.3	50	175	33	215	1.7	8	500	1	0.81	0.73	0.73	215
THH1475M050W0500#	I	4.7	50	175	33	215	2.4	8	500	1	0.81	0.73	0.73	215
THH1685M050W0500#	I	6.8	50	175	33	215	3.4	8	500	1	0.81	0.73	0.73	215
THH9476M050W0250#	9	47	50	175	25	230	23.5	8	250	1	1.26	1.13	1.13	230
THH9686M050W0250#	9	68	50	175	25	230	34	8	250	1	1.26	1.13	1.13	230
63 Volt @ 175°C														
THH1335M063W0500#	I	3.3	63	175	41	215	2.1	8	500	1	0.81	0.73	0.73	215
THH1475M063W0500#	I	4.7	63	175	41	215	3	8	500	1	0.81	0.73	0.73	215
THH9336M063W0250#	9	33	63	175	31	230	20.8	8	250	1	1.26	1.13	1.13	230
THH9476M063W0250#	9	47	63	175	31	230	29.6	8	250	1	1.26	1.13	1.13	230

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5V RMS with a maximum DC bias of 2.2 volts.

DCL is measured at rated voltage after 5 minutes.

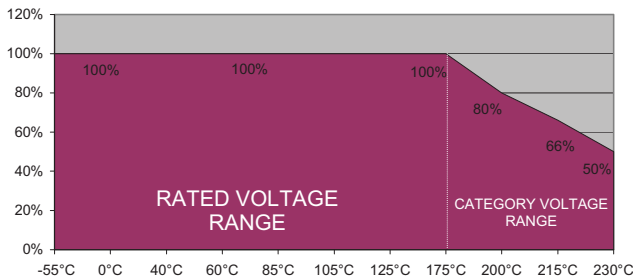
ESR change post 1000hrs allowed up to 3 times catalog limit.

Parts are aged at 230°C.

Moisture Sensitivity Level (MSL) is defined according to J-STD-020.

TEMPERATURE VOLTAGE DERATING

THH 230°C Voltage vs Temperature Rating for 1000 hrs service life



QUALIFICATION TABLE

TEST	THH 230°C hermetic series (Temperature range -55°C to +230°C)													
	Condition			Characteristics										
Endurance	Determine after application of rated voltage for 1000 +48/0 hours at 175±2°C and then leaving min. 2 hours at room temperature. Also determine of 200°C temperature, category voltage for 2000+48/-0 hours and then leaving min. 2 hours at room temperature. Also determine after application of 230°C temperature, category voltage for 1000+48/-0 hours and then leaving min. 2 hours at room temperature. Power supply impedance to be <3Ω.			Visual examination	no visible damage									
				DCL	1.25 x initial limit									
				ΔC/C	within ±20% of initial value									
				DF	1.5 x initial limit									
				ESR	3 x initial limit									
Endurance**	Determine after application of rated voltage for 200°C temperature, 0.5U _R for 10000+48/-0 hours and then leaving min. 2 hours at room temperature. Power supply impedance to be <3Ω.			Visual examination	no visible damage									
				DCL	1.25 x initial limit									
				ΔC/C	within ±20% of initial value									
				DF	1.5 x initial limit									
				ESR	3 x initial limit									
Storage Life	230°C, 0V, 1000h + 48/-0 hours			Visual examination	no visible damage									
				DCL	initial limit									
				ΔC/C	within ±5% of initial value									
				DF	initial limit									
				ESR	1.25 x initial limit									
Biased Humidity	Determine after leaving for 1000 hours at 85±2°C, 85% relative humidity and rated voltage and then recovery min. 2 hours at room temperature.			Visual examination	no visible damage									
				DCL	initial limit									
				ΔC/C	within ±10% of initial value									
				DF	initial limit									
				ESR	1.25 x initial limit									
Temperature Stability	Step	Temperature°C	Duration (min)		+20°C	-55°C	+22°C	+85°C	+125°C	+175°C	+200°C	+230°C	+22°C	
	1	+22	15											
	2	-55	15	DCL	IL*	n/a	IL*	10 x IL*	12.5 x IL*	n/a	n/a	n/a	IL*	
	3	+22	15											
	4	+85	15	ΔC/C	n/a	+0/-20%	±5%	+20/-0%	+30/-0%	+30/-0%	+30/-0%	+30/-0%	±5%	
	5	+125	15											
	6	+175	15	DF	IL*	1.5 x IL*	IL*	1.5 x IL*	2 x IL*	2 x IL*	2 x IL*	2 x IL*	IL*	
	7	+200	15											
	8	+230	15											
	9	+22	15	ESR	1.25 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*	1.25 x IL*
Surge Voltage	Test temperature: 85°C±3/0°C Surge voltage: 1.3 x rated voltage Series protection resistance: 33Ω Discharge resistance: 33Ω Number of cycles: 1000x Cycle duration: 5 min; 30 sec charge, 5 min 30 sec discharge			Visual examination	no visible damage									
				DCL	initial limit									
				ΔC/C	within ±20% of initial value									
				DF	initial limit									
				ESR	1.25 x initial limit									

*Initial Limit

**Endurance qualification 200°C / 0.5U_R / 10.000hrs on selected codes

CERAMIC CAPACITORS

Ceramic capacitors are the basic building block for every electronic design. AVX has a long history in manufacturing ceramic capacitors which enables us to offer a wide range of high temperature capacitors for down hole and mission critical applications.

- **AT Series**

Surface mount MLCCs with extended temperature range up to +200°C and +250°C, in C0G and VHT dielectrics.

- **X8R/X8L Dielectric**

MLCC performance elevated to accommodate high temperature applications up to +150°C.

- **FLEXITERM® and FLEXISAFE®**

Offer improved resistance against failures caused by board flexing and temperature shock.

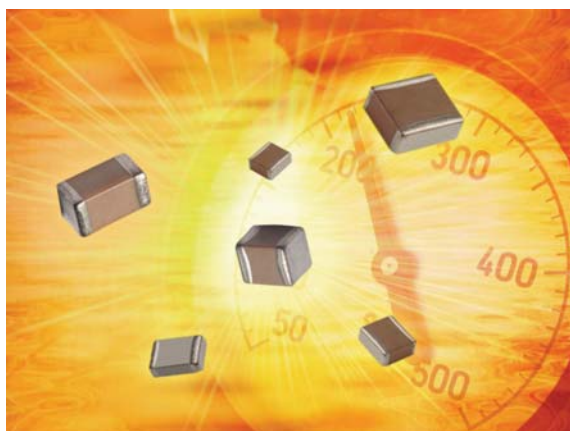
- **MLCC with Tin/Lead (Sn/Pb) Terminations**

Ceramic capacitors with Sn/Pb terminations and X8R dielectric for mission critical applications.

- **Radial Leaded SkyCap® AR Series**

Ceramic technology in leaded, epoxy encapsulated packaging for harsh environment applications.





Present military specifications, as well as a majority of commercial applications, require a maximum operating temperature of 125°C. However, the emerging market for high temperature electronics demands capacitors operating reliably at temperatures beyond 125°C. AVX's new high temperature chip capacitor product line, with verified capability of long-term operation up to 250°C is a response to both military and commercial business needs. The new capacitors demonstrate high current handling capabilities, high volumetric efficiency, high insulation resistance and low ESR/ESL. This product has been designed for the most demanding applications, such as "down-hole" oil exploration and aerospace programs.

HOW TO ORDER

AT10	3	T	104	K	A	T	2	A
AVX Style	Voltage Code	Temperature Coefficient	Capacitance Code (2 significant digits + no. of zeros)	Capacitance Tolerance	Test Level	Termination*	Packaging	Special Code
AT05 = 0805 AT06 = 1206 AT10 = 1210 AT12 = 1812 AT14 = 2225	16V = Y 25V = 3 50V = 5	COG 250°C = A COG 200°C = 2 VHT 250°C = T VHT 200°C = 4 (Class II)	101 = 100pF 102 = 1nF 103 = 10nF 104 = 100nF 105 = 1µF	J = ±5% K = ±10% M = ±20%	A = Standard	1 = Pd/Ag T = 100% Sn Plated (RoHS Compliant)	2 = 7" Reel 4 = 13" Reel 9 = Bulk	A = Standard
*Voltage rated at 200°C or 250°C								

ELECTRICAL SPECIFICATIONS

Temperature Coefficient

COG: A 0±30 ppm/°C, -55°C to +250°C

VHT: T ±15%, -55°C to +150°C

See TCC Plot for +250°C

Capacitance Test (MIL-STD-202, Method 305)

25°C, 1.0 ± 0.2 Vrms (open circuit voltage) @ 1kHz

Dissipation factor 25°C

COG: 0.15% Max at 1.0 ± 0.2 Vrms (open circuit voltage) @ 1kHz

VHT: 2.5% Max at 1.0 ± 0.2 Vrms (open circuit voltage) @ 1kHz

Insulation Resistance 25°C (MIL-STD-202, Method 302)

100GΩ or 1000MΩ.µF (whichever is less)

Insulation Resistance 125°C (MIL-STD-202, Method 302)

10GΩ or 100MΩ.µF (whichever is less)

Insulation Resistance 200°C (MIL-STD-202, Method 302)

1GΩ or 10MΩ.µF (whichever is less)

Insulation Resistance 250°C (MIL-STD-202, Method 302)

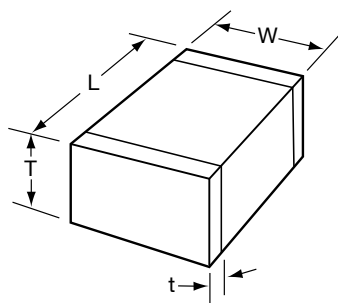
100MΩ or 1MΩ.µF (whichever is less)

Direct Withstanding Voltage 25°C (Flash Test)

250% rated voltage for 5 seconds with 50mA max charging current

(500 Volt units @ 750VDC)

DIMENSIONS

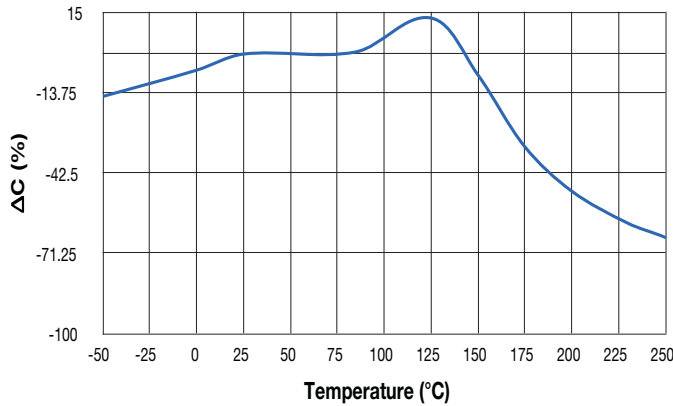


millimeters (inches)

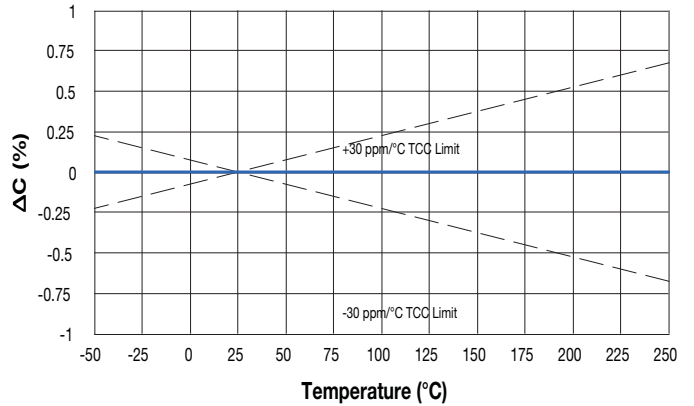
Size	AT05 = 0806	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225
(L) Length	2.01 ± 0.20 (0.079 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	4.50 ± 0.30 (0.177 ± 0.012)	5.72 ± 0.25 (0.225 ± 0.010)
(W) Width	1.25 ± 0.20 (0.049 ± 0.008)	1.60 ± 0.20 (0.063 ± 0.008)	2.50 ± 0.20 (0.098 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	6.35 ± 0.25 (0.250 ± 0.010)
(T) Thickness Max.	1.30 (0.051)	1.52 (0.060)	1.70 (0.067)	2.54 (0.100)	2.54 (0.100)
(t) terminal min. max.	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 1.02 (0.040)	0.25 (0.010) 1.02 (0.040)

PERFORMANCE CHARACTERISTICS

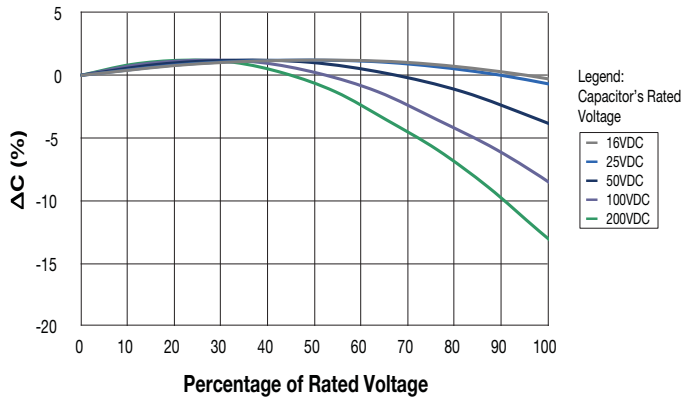
Typical Temperature Coefficient of Capacitance (VHT Dielectric)



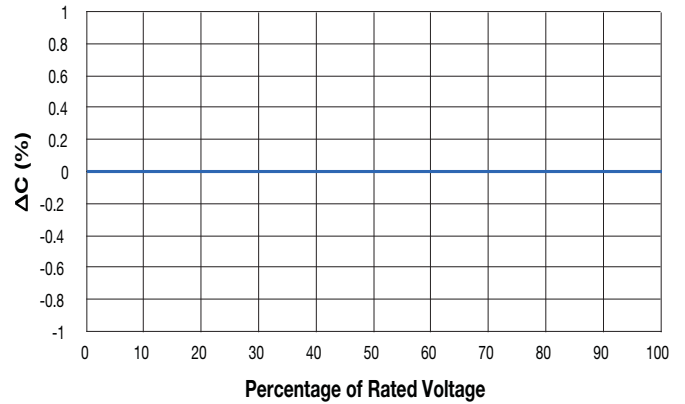
Typical Temperature Coefficient of Capacitance (C0G Dielectric)



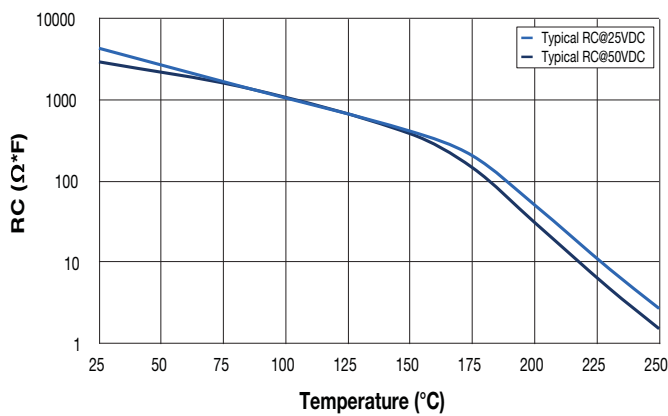
Typical Voltage Coefficient of Capacitance (VHT Dielectric)



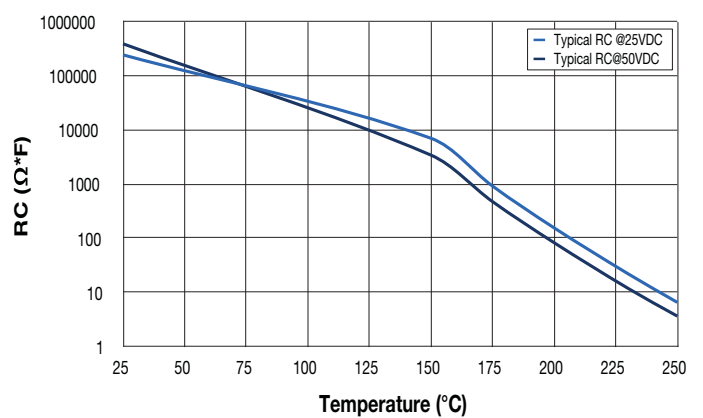
Typical Voltage Coefficient of Capacitance (C0G Dielectric)



RC vs Temperature (VHT Dielectric)

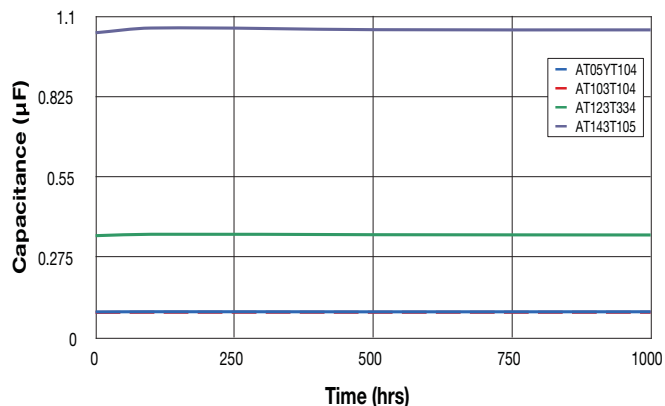


RC vs Temperature (C0G Dielectric)

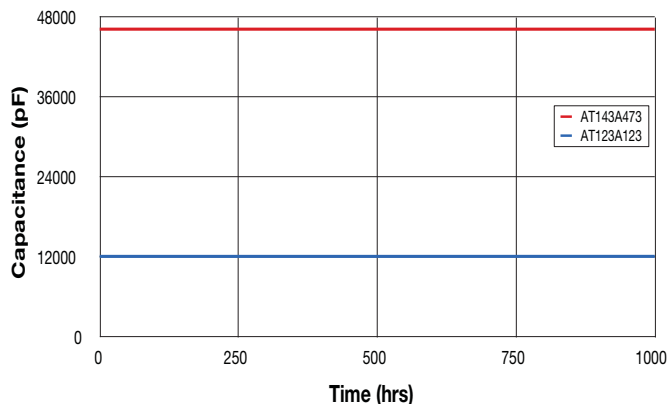


RELIABILITY

250°C Life Test @ 2x Rated Voltage (VHT Dielectric)



250°C Life Test @ 2x Rated Voltage (C0G Dielectric)



VAT - Failure Rate @ 90% Confidence Level (%/1000 hours)		
Temperature (°C)	50% Rated Voltage	100% Rated Voltage
200	0.002	0.017
250	0.026	0.210

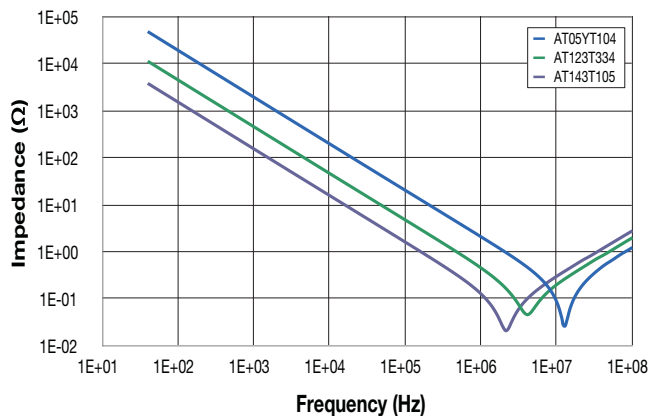
*Typical 1210, 1812, 2225 Failure Rate Analysis based on 250°C testing and voltage ratings specified on the following page.

C0G - Failure Rate @ 90% Confidence Level (%/1000 hours)		
Temperature (°C)	50% Rated Voltage	100% Rated Voltage
200	0.006	0.047
250	0.074	0.590

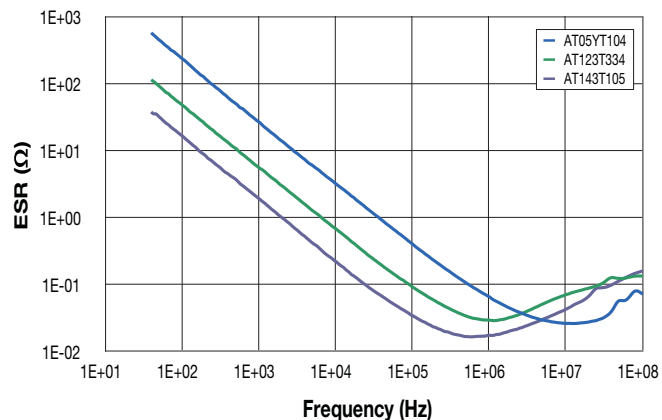
*Typical 1812 and 2225 Failure Rate Analysis based on 250°C testing and voltage ratings specified on the following page.

FREQUENCY RESPONSE

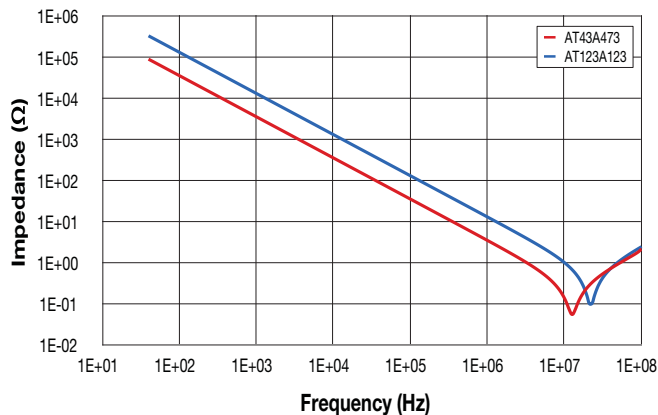
Impedance Frequency Response (VHT Dielectric)



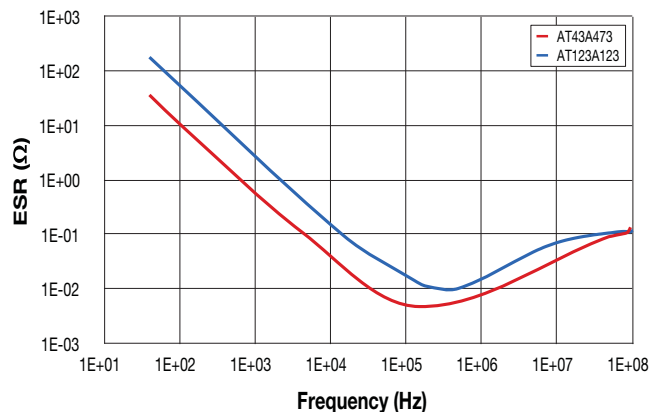
ESR Frequency Response (VHT Dielectric)



Impedance Frequency Response (C0G Dielectric)



ESR Frequency Response (C0G Dielectric)



CAPACITANCE RANGE

PREFERRED SIZES ARE SHADED

VHT Temp. Coefficient: 4 200°C Rated

Case Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225
Soldering	Reflow/Wave	Reflow/Wave	Reflow Only	Reflow Only	Reflow Only
(L) Length mm (in.)	2.01 ± 0.20 (0.079 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	4.60 ± 0.30 (0.177 ± 0.012)	2.75 ± 0.25 (0.225 ± 0.010)
(W) Width mm (in.)	1.25 ± 0.20 (0.049 ± 0.008)	1.60 ± 0.20 (0.063 ± 0.008)	2.50 ± 0.20 (0.098 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	6.35 ± 0.25 (0.250 ± 0.010)
(T) Thickness mm (in.)	1.30 (0.051)	1.52 (0.060)	1.70 (0.067)	2.54 (0.100)	2.54 (0.100)
(t) Terminal min max	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 1.02 (0.040)	0.25 (0.010) 1.02 (0.040)
Rated Temp. (°C)	200	200	200	200	200
Temp. Coefficient	4	4	4	4	4
Voltage (V)	50	50	50	50	50
Cap (pF)	1000 102				
	1200 122				
	1500 152				
	1800 182				
	2200 222				
	2700 272				
	3300 332				
	3900 392				
	4700 472				
	5600 562				
	6800 682				
	8200 822				
Cap (µF)	0.010 103				
	0.012 123				
	0.015 153				
	0.018 183				
	0.022 223				
	0.027 273				
	0.033 333				
	0.039 393				
	0.047 473				
	0.056 563				
	0.068 683				
	0.082 823				
	0.100 104				
	0.120 124				
	0.150 154				
	0.180 184				
	0.220 224				
	0.270 274				
	0.330 334				
	0.390 394				
	0.470 474				
	0.560 564				
	0.680 684				
	0.820 824				
	1.000 105				
Voltage (V)	50	50	50	50	50
Rated Temp. (°C)	200	200	200	200	200
Case Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225

VHT Temp. Coefficient: T 250°C Rated

Case Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225
Soldering	Reflow/Wave	Reflow/Wave	Reflow Only	Reflow Only	Reflow Only
(L) Length mm (in.)	2.01 ± 0.20 (0.079 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	4.60 ± 0.30 (0.177 ± 0.012)	2.75 ± 0.25 (0.225 ± 0.010)
(W) Width mm (in.)	1.25 ± 0.20 (0.049 ± 0.008)	1.60 ± 0.20 (0.063 ± 0.008)	2.50 ± 0.20 (0.098 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	6.35 ± 0.25 (0.250 ± 0.010)
(T) Thickness mm (in.)	1.30 (0.051)	1.52 (0.060)	1.70 (0.067)	2.54 (0.100)	2.54 (0.100)
(t) Terminal min max	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 1.02 (0.040)	0.25 (0.010) 1.02 (0.040)
Rated Temp. (°C)	250	250	250	250	250
Temp. Coefficient	T	T	T	T	T
Voltage (V)	25	25	25	25	25
Cap (pF)	1000 102				
	1200 122				
	1500 152				
	1800 182				
	2200 222				
	2700 272				
	3300 332				
	3900 392				
	4700 472				
	5600 562				
	6800 682				
	8200 822				
Cap (µF)	0.010 103				
	0.012 123				
	0.015 153				
	0.018 183				
	0.022 223				
	0.027 273				
	0.033 333				
	0.039 393				
	0.047 473				
	0.056 563				
	0.068 683				
	0.082 823				
	0.100 104				
	0.120 124				
	0.150 154				
	0.180 184				
	0.220 224				
	0.270 274				
	0.330 334				
	0.390 394				
	0.470 474				
	0.560 564				
	0.680 684				
	0.820 824				
	1.000 105				
Voltage (V)	25	25	25	25	25
Rated Temp. (°C)	250	250	250	250	250
Case Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225

Voltage rating per table. Capacitance values specified at 25°C, derate capacitance value based on TCC and VCC Plots on page 27.

NOTE: Contact factory for non-specified capacitance values.

CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

COG Temp. Coefficient: 2 200°C Rated

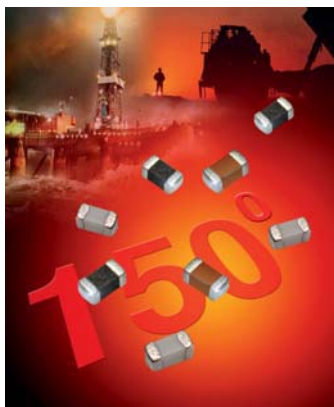
Case Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225
Soldering	Reflow/Wave	Reflow/Wave	Reflow Only	Reflow Only	Reflow Only
(L) Length mm (in.)	2.01 ± 0.20 (0.079 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	4.60 ± 0.30 (0.177 ± 0.012)	2.75 ± 0.25 (0.225 ± 0.010)
(W) Width mm (in.)	1.25 ± 0.20 (0.049 ± 0.008)	1.60 ± 0.20 (0.063 ± 0.008)	2.50 ± 0.20 (0.098 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	6.35 ± 0.25 (0.250 ± 0.010)
(T) Thickness mm (in.)	1.30 (0.051)	1.52 (0.060)	1.70 (0.067)	2.54 (0.100)	2.54 (0.100)
(t) Terminal min max	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 1.02 (0.040)	0.25 (0.010) 1.02 (0.040)
Rated Temp. (°C)	200	200	200	200	200
Temp. Coefficient	2	2	2	2	2
Voltage (V)	50	50	50	50	50
Cap (pF)	100 101				
	120 121				
	150 151				
	180 181				
	220 221				
	270 271				
	330 331				
	390 391				
	470 471				
	560 561				
	680 681				
	820 821				
	1000 102				
	1200 122				
	1500 152				
	1800 182				
	2200 222				
	2700 272				
	3300 332				
	3900 392				
	4700 472				
	5600 562				
	6800 682				
	8200 822				
Cap (µF)	0.010 103				
	0.012 123				
	0.015 153				
	0.018 183				
	0.022 223				
	0.027 273				
	0.033 333				
	0.039 393				
	0.047 473				
	0.056 563				
	0.068 683				
	0.082 823				
	0.100 104				
Voltage (V)	50	50	50	50	50
Rated Temp. (°C)	200	200	200	200	200
Case Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225

COG Temp. Coefficient: A 250°C Rated

Case Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225
Soldering	Reflow/Wave	Reflow/Wave	Reflow Only	Reflow Only	Reflow Only
(L) Length mm (in.)	2.01 ± 0.20 (0.079 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	4.60 ± 0.30 (0.177 ± 0.012)	2.75 ± 0.25 (0.225 ± 0.010)
(W) Width mm (in.)	1.25 ± 0.20 (0.049 ± 0.008)	1.60 ± 0.20 (0.063 ± 0.008)	2.50 ± 0.20 (0.098 ± 0.008)	3.20 ± 0.20 (0.126 ± 0.008)	6.35 ± 0.25 (0.250 ± 0.010)
(T) Thickness mm (in.)	1.30 (0.051)	1.52 (0.060)	1.70 (0.067)	2.54 (0.100)	2.54 (0.100)
(t) Terminal min max	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 0.75 (0.030)	0.25 (0.010) 1.02 (0.040)	0.25 (0.010) 1.02 (0.040)
Rated Temp. (°C)	250	250	250	250	250
Temp. Coefficient	A	A	A	A	A
Voltage (V)	25	25	25	25	25
Cap (pF)	100 101				
	120 121				
	150 151				
	180 181				
	220 221				
	270 271				
	330 331				
	390 391				
	470 471				
	560 561				
	680 681				
	820 821				
	1000 102				
	1200 122				
	1500 152				
	1800 182				
	2200 222				
	2700 272				
	3300 332				
	3900 392				
	4700 472				
	5600 562				
	6800 682				
	8200 822				
Cap (µF)	0.010 103				
	0.012 123				
	0.015 153				
	0.018 183				
	0.022 223				
	0.027 273				
	0.033 333				
	0.039 393				
	0.047 473				
	0.056 563				
	0.068 683				
	0.082 823				
	0.100 104				
Voltage (V)	25	25	25	25	25
Rated Temp. (°C)	250	250	250	250	250
Case Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225

Voltage rating per table. Capacitance values specified at 25°C, derate capacitance value based on TCC and VCC Plots on page 27.

NOTE: Contact factory for non-specified capacitance values.



AVX has developed a range of multilayer ceramic capacitors designed for use in applications up to 150°C. These capacitors are manufactured with an X8R and an X8L dielectric material. X8R material has capacitance variation of $\pm 15\%$ between -55°C and $+150^\circ\text{C}$. The X8L material has capacitance variation of $\pm 15\%$ between -55°C to 125°C and $+15\%$ to -40% from $+125^\circ\text{C}$ to $+150^\circ\text{C}$.

The need for X8R and X8L performance has been driven by customer requirements for parts that operate at elevated temperatures. They provide a highly reliable capacitor with low loss and stable capacitance over temperature.

They are ideal for automotive under the hood sensors, and various industrial applications. Typical industrial application would be drilling monitoring system. They can also be used as bulk capacitors for high temperature camera modules.

Both X8R and X8L dielectric capacitors are automotive AEC-Q200 qualified. Optional termination systems, tin, FLEXITERM® and conductive epoxy for hybrid applications are available. Providing this series with our FLEXITERM® termination system provides further advantage to customers by way of enhanced resistance to both, temperature cycling and mechanical damage.

CHECK FOR UP-TO-DATE DATASHEET AT
<http://www.avx.com/docs/catalogs/cauto.pdf>

HOW TO ORDER

0805

Size
0603
0805
1206

5

Voltage
16V = Y
25V = 3
50V = 5
100V = 1

F

Dielectric
X8R = F
X8L = L

104

Capacitance Code (In pF)
2 Sig. Digits + Number of Zeros
e.g. 10 μF = 106

K

Capacitance Tolerance
J = $\pm 5\%$
K = $\pm 10\%$
M = $\pm 20\%$

4

Failure Rate
4 = Automotive
A = Not Applicable

T

Terminations
T = Plated Ni and Sn
Z = FLEXITERM®
U = Conductive Epoxy for Hybrid apps

2

Packaging
2 = 7" Reel
4 = 13" Reel

A

Special Code
A = Std. Product

NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.



X8R

SIZE	WVDC	0603		0805		1206	
		25V	50V	25V	50V	25V	50V
331	Cap 330	G	G	J	J		
471	(pF) 470	G	G	J	J		
681	680	G	G	J	J		
102	1000	G	G	J	J	J	J
152	1500	G	G	J	J	J	J
222	2200	G	G	J	J	J	J
332	3300	G	G	J	J	J	J
472	4700	G	G	J	J	J	J
682	6800	G	G	J	J	J	J
103	Cap 0.01	G	G	J	J	J	J
153	(μF) 0.015	G	G	J	J	J	J
223	0.022	G	G	J	J	J	J
333	0.033	G	G	J	J	J	J
473	0.047	G	G	J	J	J	J
683	0.068	G		N	N	M	M
104	0.1			N	N	M	M
154	0.15			N	N	M	M
224	0.22			N		M	M
334	0.33					M	M
474	0.47					M	
684	0.68						
105	1						
SIZE	WVDC	25V	50V	25V	50V	25V	50V

X8L

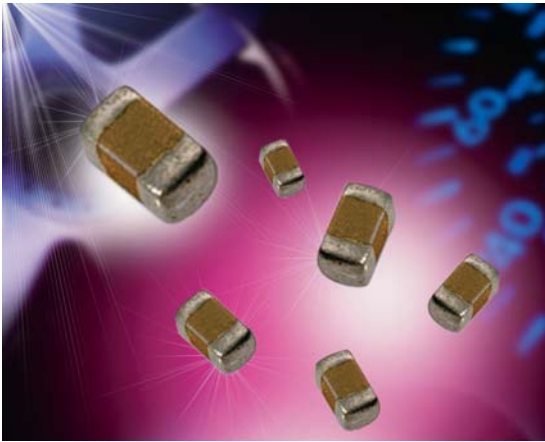
SIZE	WVDC	0603			0805			1206			
		25V	50V	100V	25V	50V	100V	16V	25V	50V	100V
331	Cap 330		G	G		J	J				
471	(pF) 470		G	G		J	J				
681	680		G	G		J	J				
102	1000		G	G		J	J				
152	1500		G	G		J	J			J	J
222	2200		G	G		J	J			J	J
332	3300		G	G		J	J			J	J
472	4700		G	G		J	J			J	J
682	6800		G	G		J	J			J	J
103	Cap 0.01		G	G		J	J			J	J
153	(μF) 0.015		G	G		J	J			J	J
223	0.022		G	G		J	J			J	J
333	0.033		G	G		J	J	N		J	J
473	0.047		G	G		J	J	N		J	J
683	0.068		G	G		J	J			J	J
104	0.1		G	G		J	J			J	M
154	0.15					J	N			J	J
224	0.22					N	N			J	J
334	0.33					N				J	M
474	0.47					N				M	M
684	0.68									M	P
105	1									M	P
SIZE	WVDC	25V	50V	100V	25V	50V	100V	16V	25V	50V	100V

Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.055)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
	PAPER					EMBOSSED							

 = AEC-Q200 Qualified

APPLICATIONS FOR X8R AND X8L CAPACITORS

- All market sectors with a 150°C requirement
- Automotive on engine applications
- Oil exploration applications
- Hybrid automotive applications
 - Battery control
 - Inverter / converter circuits
 - Motor control applications
 - Water pump
- Hybrid commercial applications
 - Emergency circuits
 - Sensors
 - Temperature regulation

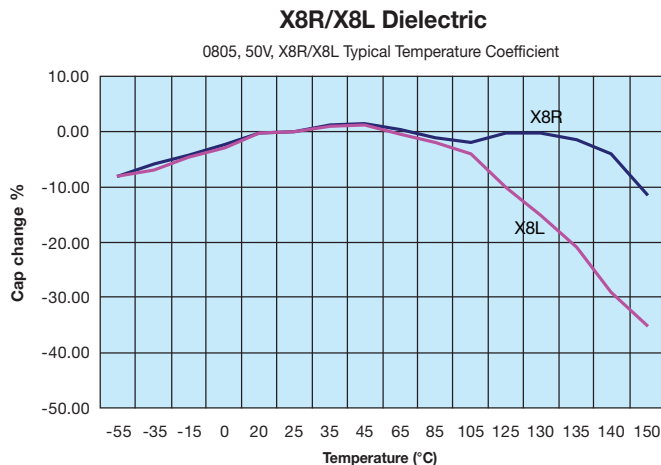


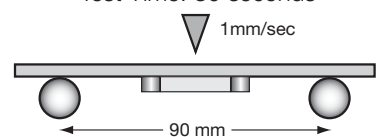
ADVANTAGES OF X8R AND X8L MLC CAPACITORS

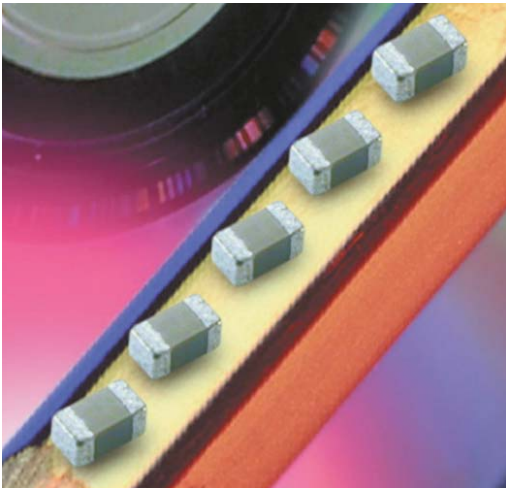
- Both ranges are qualified to the highest automotive AEC-Q200 standards
- Excellent reliability compared to other capacitor technologies
- RoHS compliant
- Low ESR / ESL compared to other technologies
- Tin solder finish
- FLEXITERM® available
- Epoxy termination for hybrid available
- 100V range available

ENGINEERING TOOLS FOR HIGH VOLTAGE MLC CAPACITORS

- Samples
- Technical Articles
- Application Engineering
- Application Support



Parameter/Test		X8R/X8L Specification Limits	Measuring Conditions	
Operating Temperature Range		-55°C to +150°C	Temperature Cycle Chamber	
Capacitance		Within specified tolerance	Freq.: 1.0 kHz ± 10%	
Dissipation Factor		≤ 2.5% for ≥ 50V DC rating ≤ 3.5% for 25V DC and 16V DC rating	Voltage: 1.0Vrms ± .2V	
Insulation Resistance		100,000MΩ or 1000MΩ - μF, whichever is less	Charge device with rated voltage for 120 ± 5 secs @ room temp/humidity	
Dielectric Strength		No breakdown or visual defects	Charge device with 300% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max) Note: Charge device with 150% of rated voltage for 500V devices.	
Resistance to Flexure Stresses	Appearance	No defects	Deflection: 2mm Test Time: 30 seconds 	
	Capacitance Variation	≤ ±12%		
	Dissipation Factor	Meets Initial Values (As Above)		
	Insulation Resistance	≥ Initial Value x 0.3		
Solderability		≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic solder at 230 ± 5°C for 5.0 ± 0.5 seconds	
Resistance to Solder Heat	Appearance	No defects, <25% leaching of either end terminal	Dip device in eutectic solder at 260°C for 60 seconds. Store at room temperature for 24 ± 2 hours before measuring electrical properties.	
	Capacitance Variation	≤ ±7.5%		
	Dissipation Factor	Meets Initial Values (As Above)		
	Insulation Resistance	Meets Initial Values (As Above)		
	Dielectric Strength	Meets Initial Values (As Above)		
Thermal Shock	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes
	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles and measure after 24 ± 2 hours at room temperature	
Load Life	Appearance	No visual defects	Charge device with 1.5 rated voltage (≤ 10V) in test chamber set at 150°C ± 2°C for 1000 hours (+48, -0) Remove from test chamber and stabilize at room temperature for 24 ± 2 hours before measuring.	
	Capacitance Variation	≤ ±12.5%		
	Dissipation Factor	≤ Initial Value x 2.0 (See Above)		
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)		
	Dielectric Strength	Meets Initial Values (As Above)		
Load Humidity	Appearance	No visual defects	Store in a test chamber set at 85°C ± 2°C/ 85% ± 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied. Remove from chamber and stabilize at room temperature and humidity for 24 ± 2 hours before measuring.	
	Capacitance Variation	≤ ±12.5%		
	Dissipation Factor	≤ Initial Value x 2.0 (See Above)		
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)		
	Dielectric Strength	Meets Initial Values (As Above)		



With increased requirements from the automotive industry for additional component robustness, AVX recognized the need to produce a MLCC with enhanced mechanical strength. It was noted that many components may be subject to severe flexing and vibration when used in various under the hood automotive and other harsh environment applications.

To satisfy the requirement for enhanced mechanical strength, AVX had to find a way of ensuring electrical integrity is maintained whilst external forces are being applied to the component. It was found that the structure of the termination needed to be flexible and after much research and development, AVX launched FLEXITERM®. FLEXITERM® is designed to enhance the mechanical flexure and temperature cycling performance of a standard ceramic capacitor with an X7R dielectric. **The industry standard for flexure is 2mm minimum. Using FLEXITERM®, AVX provides up to 5mm of flexure without internal cracks. Beyond 5mm, the capacitor will generally fail “open”.**

As well as for automotive applications FLEXITERM® will provide Design Engineers with a satisfactory solution when designing PCB's which may be subject to high levels of board flexure.

APPLICATIONS

High Flexure Stress Circuit Boards

- e.g. Depanelization: Components near edges of board.

Variable Temperature Applications

- Soft termination offers improved reliability performance in applications where there is temperature variation.
- e.g. All kind of engine sensors: Direct connection to battery rail.

Automotive Applications

- Improved reliability.
- Excellent mechanical performance and thermo mechanical performance.

PRODUCT ADVANTAGES

- High mechanical performance able to withstand, 5mm bend test guaranteed.
- Increased temperature cycling performance, 3000 cycles and beyond.
- Flexible termination system.
- Reduction in circuit board flex failures.
- Base metal electrode system.
- Automotive or commercial grade products available.

HOW TO ORDER

0805

Style
0603
0805
1206

5

Voltage
6 = 6.3V
Z = 10V
Y = 16V
3 = 25V
5 = 50V
1 = 100V
2 = 200V

F

Dielectric
F = X8R

104

Capacitance Code (In pF)
2 Sig Digits +
Number of Zeros
e.g., 104 = 100nF

K

Capacitance Tolerance
J = ±5%*
K = ±10%
M = ±20%

*≤1µF only

A

Failure Rate
A=Commercial
4 = Automotive

Z

Terminations
Z = FLEXITERM®
For FLEXITERM®
with Tin/Lead
termination see
AVX LD Series

2

Packaging
2 = 7" reel
4 = 13" reel

A

Special Code
A = Std. Product

NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers.



LEAD-FREE
LEAD-FREE COMPATIBLE
COMPONENT



RoHS
COMPLIANT

For RoHS compliant products,
please select correct termination style.

PERFORMANCE TESTING

AEC-Q200 Qualification:

- Created by the Automotive Electronics Council
- Specification defining stress test qualification for passive components

Testing:

Key tests used to compare soft termination to AEC-Q200 qualification:

- Bend Test
- Temperature Cycle Test

BOARD BEND TEST PROCEDURE

According to AEC-Q200

Test Procedure as per AEC-Q200:

Sample size: 20 components
Span: 90mm Minimum deflection spec: 2 mm

- Components soldered onto FR4 PCB (Figure 1)
- Board connected electrically to the test equipment (Figure 2)

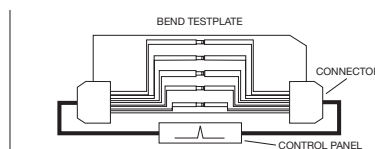


Fig 1 - PCB layout with electrical connections

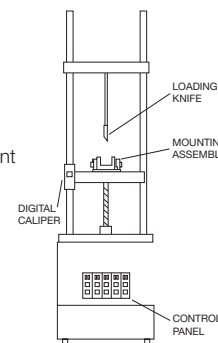


Fig 2 - Board Bend test equipment

BOARD BEND TEST RESULTS

AEC-Q200 Vrs AVX FLEXITERM[®] Bend Test

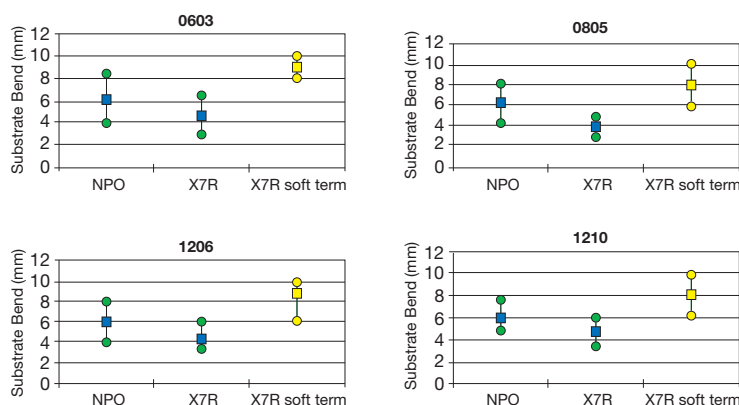


TABLE SUMMARY

Typical bend test results are shown below:

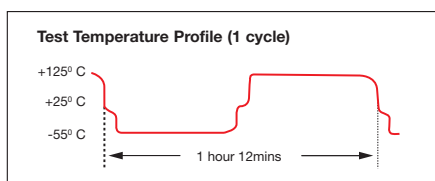
Style	Conventional Termination	FLEXITERM [®]
0603	>2mm	>5mm
0805	>2mm	>5mm
1206	>2mm	>5mm

TEMPERATURE CYCLE TEST PROCEDURE

Test Procedure as per AEC-Q200:

The test is conducted to determine the resistance of the component when it is exposed to extremes of alternating high and low temperatures.

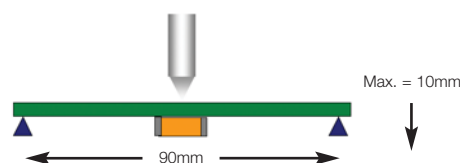
- Sample lot size quantity 77 pieces
- TC chamber cycle from -55°C to +125°C for 1000 cycles
- Interim electrical measurements at 250, 500, 1000 cycles
- Measure parameter capacitance dissipation factor, insulation resistance



AVX ENHANCED SOFT TERMINATION BEND TEST PROCEDURE

Bend Test

The capacitor is soldered to the printed circuit board as shown and is bent up to 10mm at 1mm per second:

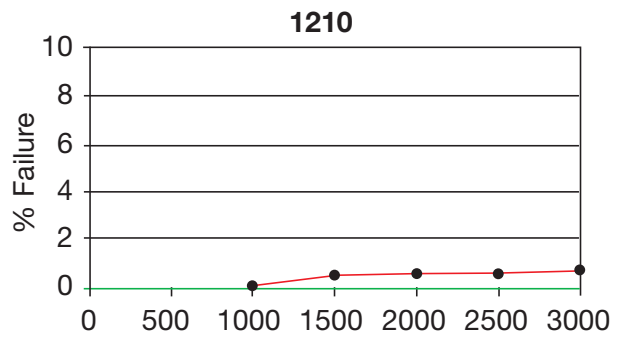
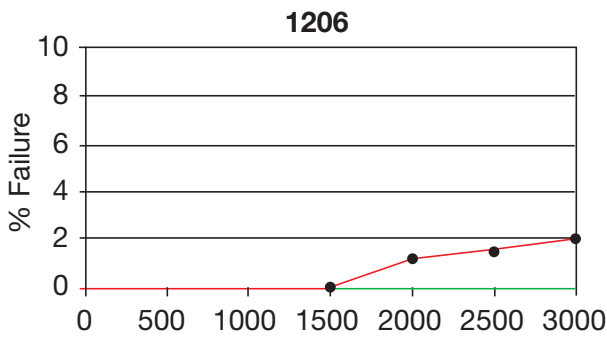
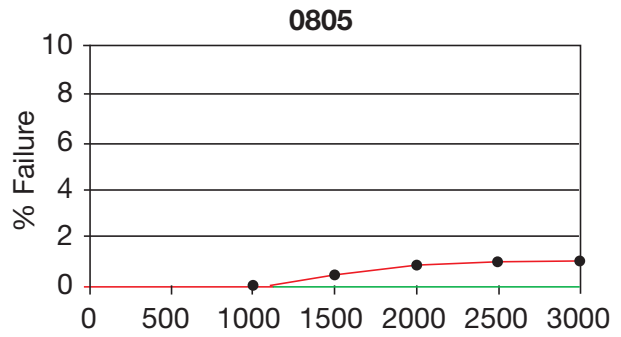
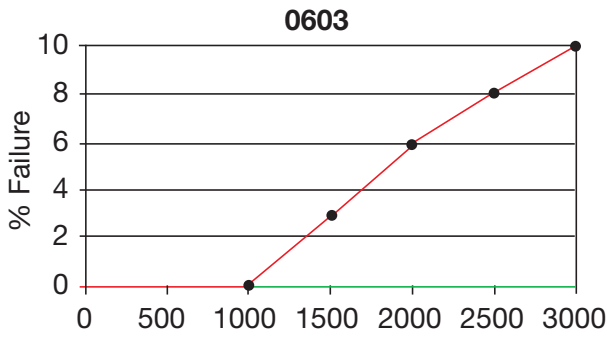


- The board is placed on 2 supports 90mm apart (capacitor side down)
- The row of capacitors is aligned with the load stressing knife



- The load is applied and the deflection where the part starts to crack is recorded (Note: Equipment detects the start of the crack using a highly sensitive current detection circuit)
- The maximum deflection capability is 10mm

BEYOND 1000 CYCLES: TEMPERATURE CYCLE TEST RESULTS



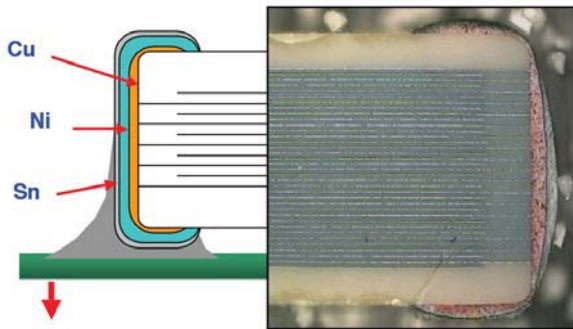
Soft Term - No Defects up to 3000 cycles

AEC-Q200 specification states 1000 cycles compared to AVX 3000 temperature cycles.

FLEXITERM® TEST SUMMARY

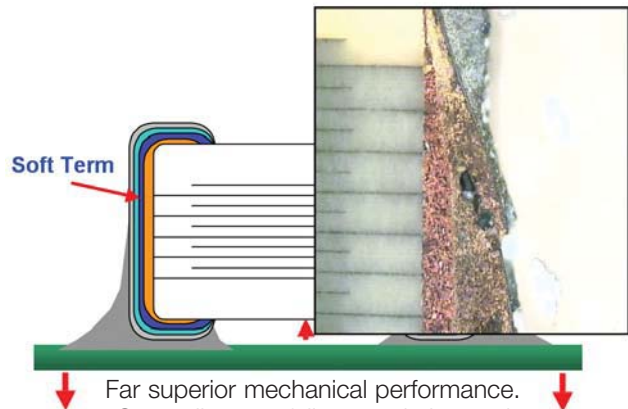
- Qualified to AEC-Q200 test/specification with the exception of using AVX 3000 temperature cycles (up to +150°C bend test guaranteed greater than 5mm).
- FLEXITERM® provides improved performance compared to standard termination systems.
- Board bend test improvement by a factor of 2 to 4 times.
- Temperature Cycling:
 - 0% Failure up to 3000 cycles
 - No ESR change up to 3000 cycles

WITHOUT SOFT TERMINATION



Major fear is of latent board flex failures.

WITH SOFT TERMINATION

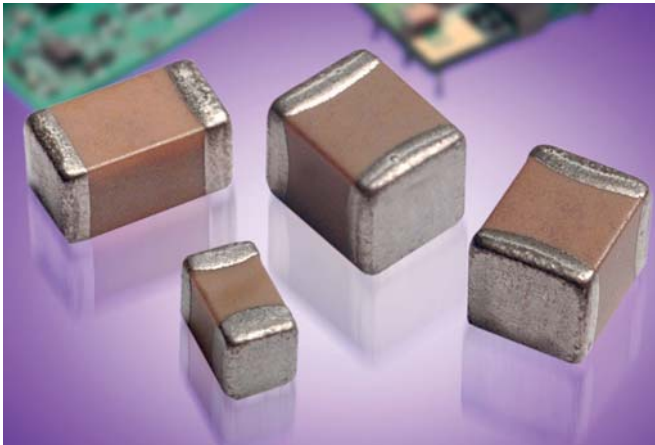


Far superior mechanical performance. Generally open failure mode beyond 5mm flexure.

SIZE		0603		0805		1206	
	WDC	25V	50V	25V	50V	25V	50V
271	Cap	270	G	G			
331	(pF)	330	G	G	J	J	
471		470	G	G	J	J	
681		680	G	G	J	J	
102		1000	G	G	J	J	J
152		1500	G	G	J	J	J
182		1800	G	G	J	J	J
222		2200	G	G	J	J	J
272		2700	G	G	J	J	J
332		3300	G	G	J	J	J
392		3900	G	G	J	J	J
472		4700	G	G	J	J	J
562		5600	G	G	J	J	J
682		6800	G	G	J	J	J
822		8200	G	G	J	J	J
103	Cap	0.01	G	G	J	J	J
123	(µF)	0.012	G	G	J	J	J
153		0.015	G	G	J	J	J
183		0.018	G	G	J	J	J
223		0.022	G	G	J	J	J
273		0.027	G	G	J	J	J
333		0.033	G	G	J	J	J
393		0.039	G	G	J	J	J
473		0.047	G	G	J	J	J
563		0.056	G		N	N	M
683		0.068	G		N	N	M
823		0.082			N	N	M
104		0.1			N	N	M
124		0.12			N	N	M
154		0.15			N	N	M
184		0.18			N		M
224		0.22			N		M
274		0.27					M
334		0.33					M
394		0.39					M
474		0.47					M
684		0.68					
824		0.82					
105		1					
	WDC	25V	50V	25V	50V	25V	50V
SIZE		0603		0805		1206	

Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.055)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
	PAPER					EMBOSSSED							

= AEC-Q200 Qualified



AVX Corporation will support those customers for commercial and military Multilayer Ceramic Capacitors with a termination consisting of 5% minimum lead. This termination is indicated by the use of a "B" in the 12th position of the AVX Catalog Part Number. This fulfills AVX's commitment to providing a full range of products to our customers. AVX has provided in the following pages a full range of values that we are currently offering in this special "B" termination. Please contact the factory if you require additional information on our MLCC Tin/Lead Termination "B" products.

Not RoHS Compliant

PART NUMBER

LD05	5	A	101	J	A	B	2	A
Size	Voltage	Dielectric	Capacitance Code (In pF)	Capacitance Tolerance	Failure Rate	Terminations	Packaging	Special Code
LD02 - 0402 LD03 - 0603 LD04 - 0504* LD05 - 0805 LD06 - 1206 LD10 - 1210 LD12 - 1812 LD13 - 1825 LD14 - 2225 LD20 - 2220	6.3V = 6 10V = Z 16V = Y 25V = 3 35V = D 50V = 5 100V = 1 200V = 2 500V = 7	C0G (NP0) = A X8R = F	2 Sig. Digits + Number of Zeros	B = ±.10 pF (<10pF) C = ±.25 pF (<10pF) D = ±.50 pF (<10pF) F = ±1% (≥ 10 pF) G = ±2% (≥ 10 pF) J = ±5% K = ±10% M = ±20%	A = Not Applicable	B = 5% min lead	2 = 7" Reel 4 = 13" Reel 7 = Bulk Cass. 9 = Bulk	A = Std. Product
							Contact Factory For Multiples	

*LD04 has the same CV ranges as LD03.

NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers.
Contact factory for non-specified capacitance values.

See FLEXITERM® section
for CV options

PREFERRED SIZES ARE SHADED

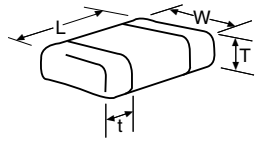
SIZE	LD02			LD03				LD05					LD06					
	Reflow/Wave			Reflow/Wave				Reflow/Wave					Reflow/Wave					
Soldering	All Paper			All Paper				Paper/Embossed					Paper/Embossed					
Packaging	All Paper			All Paper				Paper/Embossed					Paper/Embossed					
(L) Length	1.00 ± 0.10 (0.040 ± 0.004)			1.60 ± 0.15 (0.063 ± 0.006)				2.01 ± 0.20 (0.079 ± 0.008)					3.20 ± 0.20 (0.126 ± 0.008)					
(W) Width	0.50 ± 0.10 (0.020 ± 0.004)			0.81 ± 0.15 (0.032 ± 0.006)				1.25 ± 0.20 (0.049 ± 0.008)					1.60 ± 0.20 (0.063 ± 0.008)					
(t) Terminal	0.25 ± 0.15 (0.010 ± 0.006)			0.35 ± 0.15 (0.014 ± 0.006)				0.50 ± 0.25 (0.020 ± 0.010)					0.50 ± 0.25 (0.020 ± 0.010)					
WVDC	16	25	50	16	25	50	100	16	25	50	100	200	16	25	50	100	200	500
Cap (pF)	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
1.0	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
1.2	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
1.5	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
1.8	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
2.2	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
2.7	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
3.3	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
3.9	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
4.7	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
5.6	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
6.8	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
8.2	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
10	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
12	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
15	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
18	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
22	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
27	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
33	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
39	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
47	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
56	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
68	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
82	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
100	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
120	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
150	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
180	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
220	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	M
270	C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
330	C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
390	C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
470	C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
560				G	G	G		J	J	J	J	M	J	J	J	J	J	M
680				G	G	G		J	J	J	J		J	J	J	J	J	P
820				G	G	G		J	J	J	J		J	J	J	J	J	M
1000				G	G	G		J	J	J	J		J	J	J	J	J	Q
1200								J	J	J			J	J	J	J	J	Q
1500								J	J	J			J	J	J	J	J	Q
1800								J	J	J			J	J	M	M		
2200								J	J	N			J	J	M	P		
2700								J	J	N			J	J	M	P		
3300								J	J				J	J	M	P		
3900								J	J				J	J	M	P		
4700								J	J				J	J	M	P		
5600													J	J	M			
6800													M	M				
8200													M	M				
Cap (µF)													M	M				
0.010																		
0.012																		
0.015																		
0.018																		
0.022																		
0.027																		
0.033																		
0.039																		
0.047																		
0.068																		
0.082																		
0.1																		
WVDC	16	25	50	16	25	50	100	16	25	50	100	200	16	25	50	100	200	500
SIZE	LD02			LD03				LD05					LD06					

Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
	PAPER					EMBOSS							

PREFERRED SIZES ARE SHADED

SIZE		LD10					LD12					LD13			LD14		
Soldering		Reflow Only					Reflow Only					Reflow Only			Reflow Only		
Packaging		Paper/Embossed					All Embossed					All Embossed			All Embossed		
(L) Length	mm	3.20 ± 0.20					4.50 ± 0.30					4.50 ± 0.30			5.72 ± 0.25		
	(in.)	(0.126 ± 0.008)					(0.177 ± 0.012)					(0.177 ± 0.012)			(0.225 ± 0.010)		
(W) Width	mm	2.50 ± 0.20					3.20 ± 0.20					6.40 ± 0.40			6.35 ± 0.25		
	(in.)	(0.098 ± 0.008)					(0.126 ± 0.008)					(0.252 ± 0.016)			(0.250 ± 0.010)		
(t) Terminal	mm	0.50 ± 0.25					0.61 ± 0.36					0.61 ± 0.36			0.64 ± 0.39		
	(in.)	(0.020 ± 0.010)					(0.024 ± 0.014)					(0.024 ± 0.014)			(0.025 ± 0.015)		
Cap (pF)	WDC	25	50	100	200	500	25	50	100	200	500	50	100	200	50	100	200
0.5																	
1.0																	
1.2																	
1.5																	
1.8																	
2.2																	
2.7																	
3.3																	
3.9																	
4.7																	
5.6																	
6.8																	
8.2																	
10						J											
12						J											
15						J											
18						J											
22						J											
27						J											
33						J											
39						J											
47						J											
56						J											
68						J											
82						J											
100						J											
120						J											
150						J											
180						J											
220						J											
270						J											
330						J											
390						M											
470						M											
560	J	J	J	J	J	M											
680	J	J	J	J	J	M											
820	J	J	J	J	J	M											
1000	J	J	J	J	M	M	K	K	K	M	M	M	M	M	M	M	P
1200	J	J	J	M	M	M	K	K	K	M	M	M	M	M	M	M	P
1500	J	J	J	M	M	M	K	K	K	M	M	M	M	M	M	M	P
1800	J	J	J	M	M	M	K	K	K	M	M	M	M	M	M	M	P
2200	J	J	J	Q			K	K	K	P	M	M	M	M	M	M	P
2700	J	J	J	Q			K	K	K	P	M	M	M	M	M	M	P
3300	J	J	J				K	K	K	P	Q	M	M	M	M	M	P
3900	J	J	M				K	K	K	P	Q	M	M	M	M	M	P
4700	J	J	M				K	K	K	P	Q	M	M	M	M	M	P
5600	J	J					K	K	M	P	X	M	M	M	M	M	P
6800	J	J					K	K	M	X		M	M	M	M	M	P
8200	J	J					K	M	M			M	M	M	M	M	P
Cap (µF)	0.010	J	J				K	M	M			M	M		M	M	P
	0.012	J	J				K	M				M	M		M	M	P
	0.015						M	M				M	M		M	M	Y
	0.018						M	M				P	M		M	M	Y
	0.022						M	M				P			M	Y	Y
	0.027						M	M				P			P	Y	Y
	0.033						M	M				P			P		
	0.039						M	M				P			P		
	0.047						M	M				P			P		
	0.068						M	M							P		
	0.082						M	M							Q		
	0.1						M	M							Q		
Cap (µF)	WDC	25	50	100	200	500	25	50	100	200	500	50	100	200	50	100	200

Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
	PAPER					EMBOSSSED							



MLCC Tin/Lead Termination "B"

X8R Dielectric Capacitance Range



SIZE		LD03		LD05		LD06	
	WDC	25V	50V	25V	50V	25V	50V
271	Cap	270	G	G			
331	(pF)	330	G	G	J	J	
471		470	G	G	J	J	
681		680	G	G	J	J	
102		1000	G	G	J	J	J
152		1500	G	G	J	J	J
182		1800	G	G	J	J	J
222		2200	G	G	J	J	J
272		2700	G	G	J	J	J
332		3300	G	G	J	J	J
392		3900	G	G	J	J	J
472		4700	G	G	J	J	J
562		5600	G	G	J	J	J
682		6800	G	G	J	J	J
822		8200	G	G	J	J	J
103	Cap	0.01	G	G	J	J	J
123	(µF)	0.012	G	G	J	J	J
153		0.015	G	G	J	J	J
183		0.018	G	G	J	J	J
223		0.022	G	G	J	J	J
273		0.027	G	G	J	J	J
333		0.033	G	G	J	J	J
393		0.039	G	G	J	J	J
473		0.047	G	G	J	J	J
563		0.056	G		N	N	M
683		0.068	G		N	N	M
823		0.082			N	N	M
104		0.1			N	N	M
124		0.12			N	N	M
154		0.15			N	N	M
184		0.18			N		M
224		0.22			N		M
274		0.27					M
334		0.33					M
394		0.39					M
474		0.47					M
684		0.68					
824		0.82					
105		1					
	WDC	25V	50V	25V	50V	25V	50V
SIZE		LD03		LD05		LD06	

Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.055)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
	PAPER					EMBOSSSED							



AVX AR Series is a conformally coated radial leaded capacitor. We offer X8R dielectric, standard, with a 50V rating.

Conformally Coated Radial Leaded MLC

Temperature Coefficients: COG (NP0), X7R, X8R

3000, 2000, 1000, 200, 100, 50 Volts

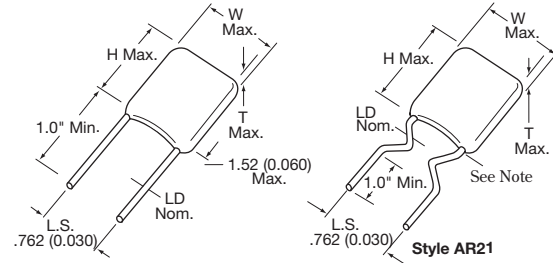
Case Material: Epoxy

Lead Material: RoHS Compliant, 100% Tin

Qualified: to AEC-Q200, PPAP Available

Temperature Range: up to 150°C

Dimensions: Millimeters (Inches)



Styles AR15, AR20, AR30, AR40

Note: Coating clean .784 (0.031) min. above seating plane

Drawings are for illustrative purposes only. Actual lead form shape could vary within stated tolerances based on body size.

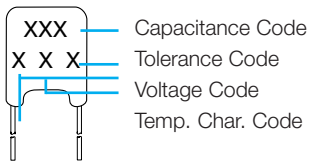
CHECK FOR UP-TO-DATE CATALOG AT
<http://www.avx.com/docs/catalogs/skycap.pdf>

HOW TO ORDER

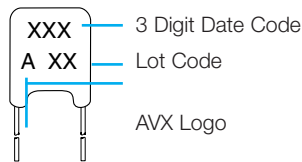
AR21	5	F	104	M	4	R	TR1
AVX Style	Voltage	Temperature Coefficient	Capacitance	Capacitance Tolerance	Failure Rate	Leads	Packaging
	5 = 50V 1 = 100V 2 = 200V A = 1000V G = 2000V H = 3000V	A = COG (NP0) C = X7R F = X8R	First two digits are the significant figures of capacitance. Third digit indicates the additional number of zeros. For example, order 100,000 pF as 104. (For values below 10pF use "R" in place of decimal point, e.g., 1R4 = 1.4pF.)	COG (NP0): C = ±.25pF D = ±.5pF F = ±1% (>50pF only) G = ±2% (>25pF only) J = ±5% K = ±10%	X7R: J = ±5% K = ±10% M = ±20% X8R: J = ±5% K = ±10% M = ±20%	4 = AEC-Q200	R = RoHS Long Lead 1.0" minimum
							Blank = Bulk Packaging T = Trimmed Leads .230"± .030" Bulk packaging TR1 = Tape and Reel Packaging AP1 = Ammopack Packaging
							See packaging specification page 46-47.

MARKING

FRONT



BACK



PACKAGING REQUIREMENTS

	Quantity per Bag
AR15, 20, 21, 30	1000 Pieces
AR40	500 Pieces

Note: AR15, AR20, AR21, AR30, and AR40 available on tape and reel per EIA specifications RS-468. See pages 42 and 43.

C0G (NP0) DIELECTRIC

EIA Characteristic

Dimensions: Millimeters (Inches)

AVX Style		AR15	AR20	AR21						
AVX "Insertable"		AR07	AR29	AR59						
Width (W)		3.81 (.150)	5.08 (.200)	5.08 (.200)						
Height (H)		3.81 (.150)	5.08 (.200)	5.08 (.200)						
Thickness (T)		2.54 (.100)	3.175 (.125)	3.175 (.125)						
Lead Spacing (L.S.)		2.54 (.100)	2.54 (.100)	5.08 (.200)						
Lead Diameter (L.D.)		.508 (.020)	.508 (.020)	.508 (.020)						
Cap in pF	Industry Preferred Values in Blue	WVDC			WVDC			WVDC		
		200	100	50	200	100	50	200	100	50
1	AR.....A1R0D4R									
10	AR.....A100K4R									
15	AR.....A150K4R									
22	AR.....A220K4R									
33	AR.....A330K4R									
39	AR.....A390K4R									
47	AR.....A470K4R									
68	AR.....A680K4R									
100	AR.....A101K4R									
150	AR.....A151K4R									
220	AR.....A221K4R									
330	AR.....A331K4R									
390	AR.....A391K4R									
470	AR.....A471K4R									
680	AR.....A681K4R									
1,000	AR.....A102K4R									
1,500	AR.....A152K4R									
2,200	AR.....A222K4R									
3,900	AR.....A392K4R									
4,700	AR.....A472K4R									
6800	AR.....A682K4R									
8200	AR.....A822K4R									

Notes:

"Insertable" make reference to alternative AVX style using the same range of capacitance available on the matrix.
 For others Styles, voltages, tolerance and lead lengths see Skycap catalog or contact factory.
 Others capacitance values available upon special request.
 Others styles available: AR12, AR14, AR62, AR89.

X8R DIELECTRIC

EIA Characteristic

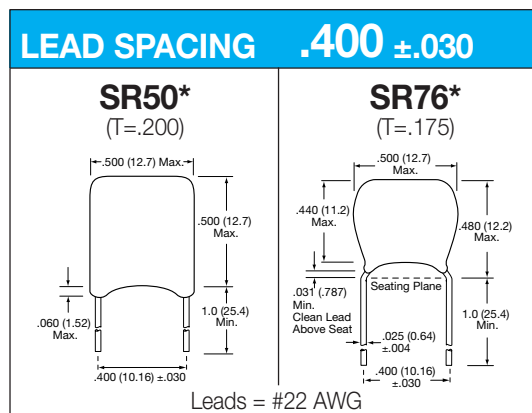
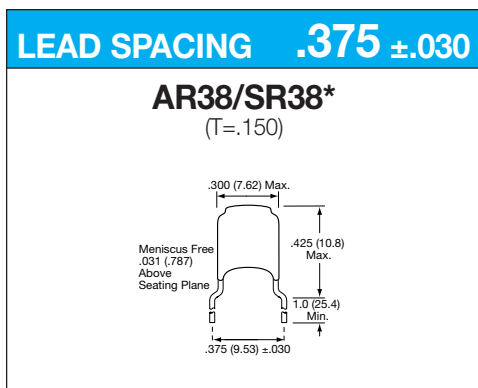
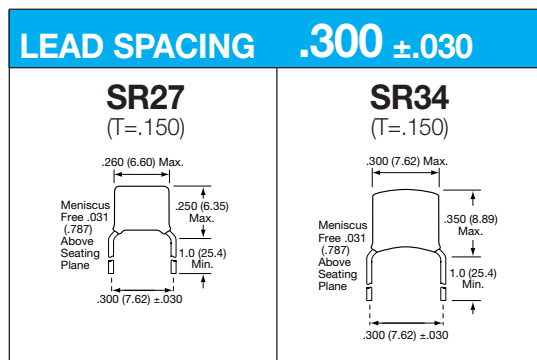
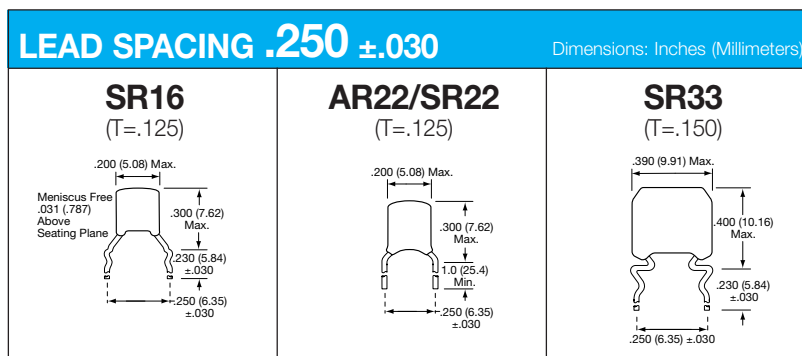
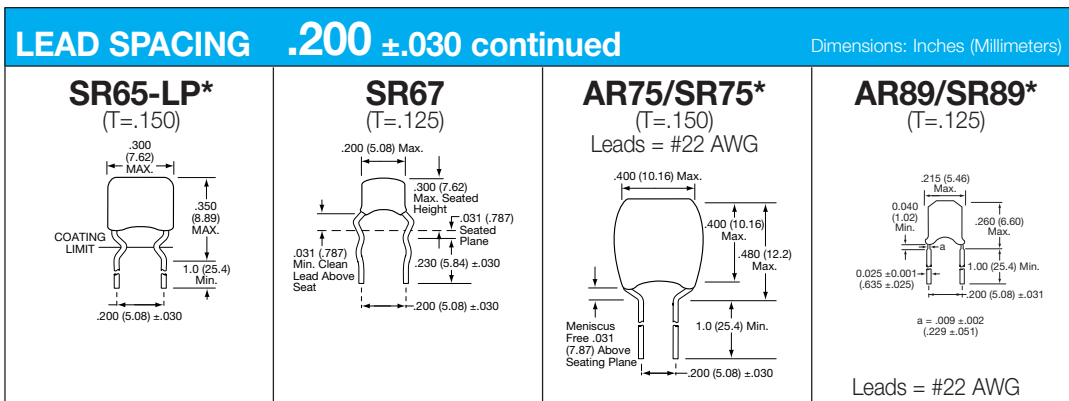
Dimensions: Millimeters (Inches)

AVX Style		AR20	AR21				
AVX "Insertable"		AR29	AR59				
Width (W)		5.08 (.200)	5.08 (.200)				
Height (H)		5.08 (.200)	5.08 (.200)				
Thickness (T)		3.175 (.125)	3.175 (.125)				
Lead Spacing (L.S.)		2.54 (.100)	5.08 (.200)				
Lead Diameter (L.D.)		.508 (.020)	.508 (.020)				
Cap in pF	Industry Preferred Values in Blue	WVDC			WVDC		
		200	100	50	200	100	50
1,000	AR.....F102K4R						
10,000	AR.....F103K4R						
100,000	AR.....F104K4R						
330,000	AR.....F334K4R						

LEAD SPACING .100 ±.030				Dimensions: Inches (Millimeters)
<p>AR07/SR07* (T=.100)</p>	<p>AR14/SR14 (T=.100)</p>	<p>AR15/SR15* (T=.100)</p>	<p>AR20/SR20* (T=.125)</p>	
<p>AR29/SR29* (T=.125)</p>	<p>AR62/SR62* (T=.125)</p> <p>Leads = #22 AWG</p>	<p>SR62-LP* (T=.100)</p> <p>Leads = #22 AWG</p>		

LEAD SPACING .200 ±.030					Dimensions: Inches (Millimeters)
<p>AR12/SR12* (T=.100)</p>	<p>SR13* (T=.125)</p>	<p>AR21/SR21* (T=.125)</p>	<p>SR21-85* (T=.125)</p>	<p>SR28* (T=.125)</p>	
<p>AR30/SR30* (T=.150)</p>	<p>SR30-LP* (T=.150)</p>	<p>AR32/SR32* (T=.150)</p>	<p>AR40/SR40* (T=.150)</p>	<p>AR59/SR59* (T=.125)</p>	
<p>SR61 (T=.150)</p>	<p>SR63* (T=.150)</p>	<p>SR64* (T=.150)</p> <p>Leads = #22 AWG</p>	<p>SR64-LP* (T=.150)</p> <p>Leads = #22 AWG</p>	<p>AR65/SR65* (T=.150)</p>	

*SL style available in all SR configurations.



- NOTES:**
1. All leads are #24 AWG unless otherwise noted.
 2. Available in tape and reel packaging(*).
 3. Other styles are also available, contact factory.
 4. (T = XXX) under type designation is maximum thickness in inches.

*SL style available in all SR configurations.

Drawings are for illustrative purposes only. Actual lead form shape could vary within stated tolerances based on body size.

GENERAL INFORMATION

1. Standard reel diameter is 355 millimeters (14 inches) maximum.
2. Reeling standard (#1 or #2) should be specified when ordering.

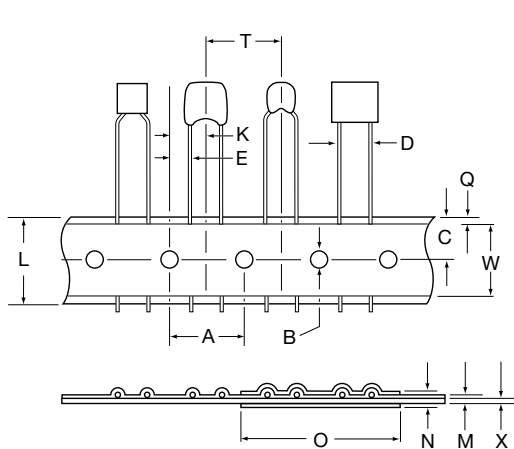
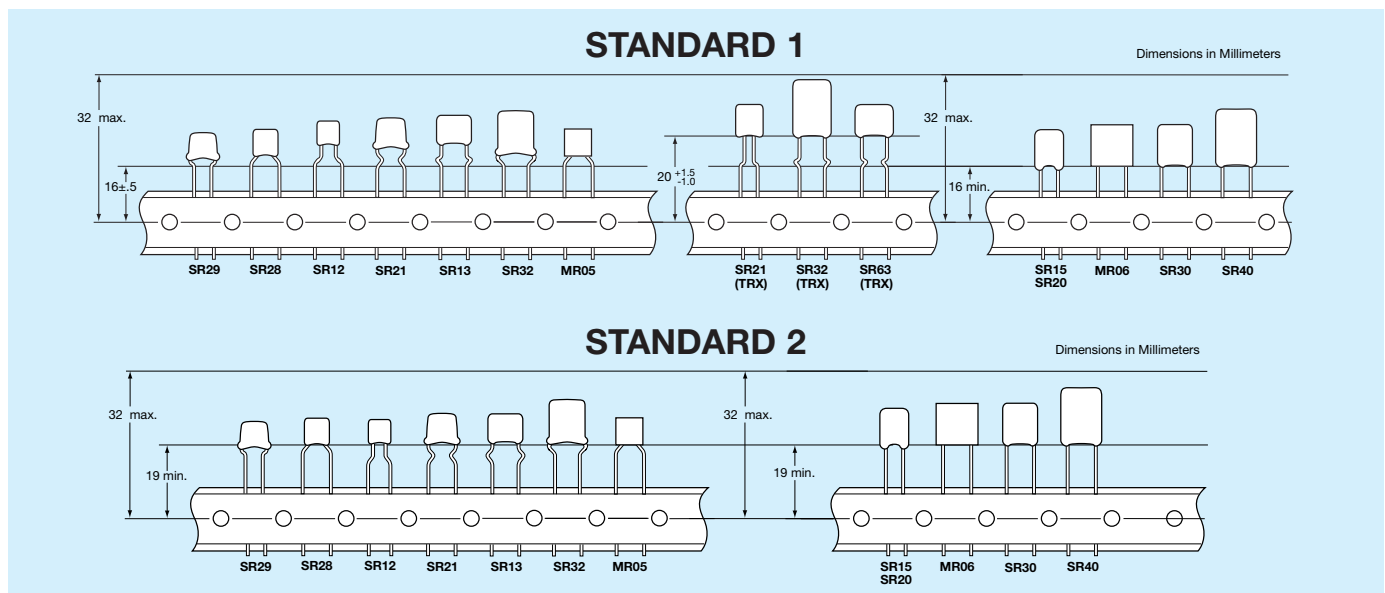
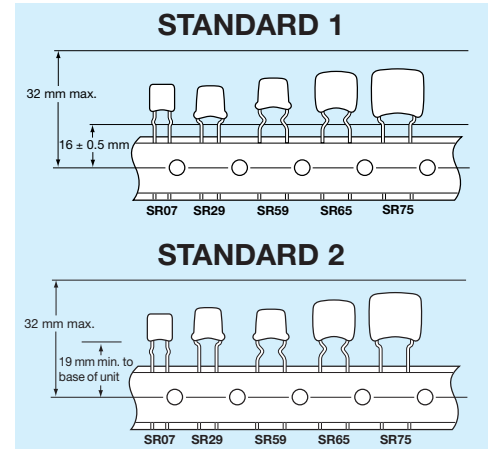
HOW TO ORDER

To specify tape and reel packaging, add TR1, TR2 or TRX to the end of the AVX 12 digit part number.

Examples:

SR215C104KARTR1
SR305E105MARTR2
SR215C103JARTRX

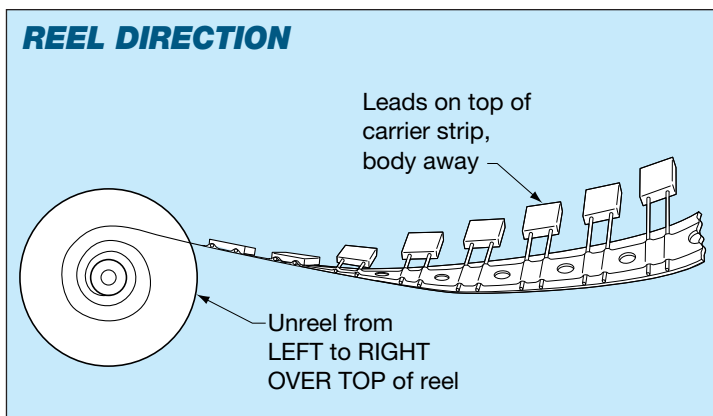
THE INSERTABLES



DESCRIPTION

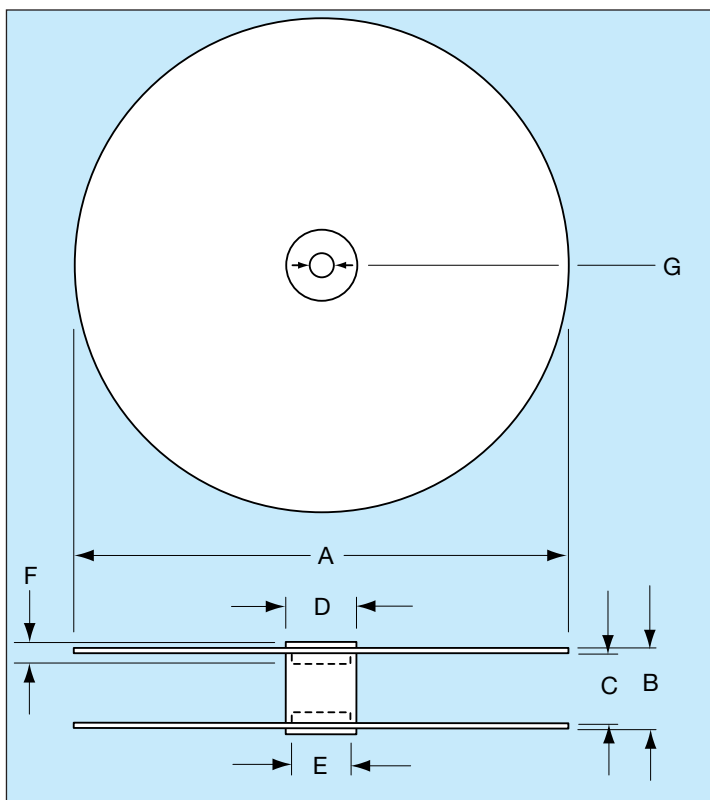
DIMENSIONS (MM)

A. Feed Hole Pitch	12.70 ± .20
B. Feed Hole Diameter	3.99 ± .20
C. Feed Hole Location	9.02 ± .51
D. Component Lead Spacing	5.00 ^{+ .79} _{-.20} or 2.54 ^{+ .79} _{-.20}
E. Component Lead Location	3.81 ± .51 or 5.00 ± .51 for 2.54 lead spacing 2.00 maximum
F. Component Lead Protrusion (edge of carrier to cut end of lead)	2.00 maximum
K. Component Body Location	6.35 ± .41
L. Carrier Tape Width	18.01 ^{+1.02} _{-.51}
M. Carrier Tape Assembly Thickness	.71 ± .20
N. Carrier Tape Spliced Thickness	1.42 maximum
O. Carrier Tape Spliced Length	50.80 - 88.90
Q. Adhesive Tape Border	3.00 maximum
R. Component Bent Leads (either direction)	.79 maximum
S. Component Misalignment	.99 maximum
T. Component Pitch	12.70 ± .99
W. Adhesive Tape Width	5.00 minimum
X. Carrier Tape Thickness	.51 ± .10
Y. Cumulative Pitch over 20 Pitches	254 ± 2.00



QUANTITY PER REEL SR/AR	
PART	PCS
SR15, 07, 12	3500
SR20, 21, 23, 28 13, 29, 59, 62, 89	3000
SR30, 32, 40, 63, 64 65, 75	2000
MR05, 06	2500

*SL style available in all SR configurations.



DESCRIPTION	DIMENSIONS (MM)
A – Reel Diameter	304.80 - 355
B – Reel Outside Width	50.80 maximum
C – Reel Inside Width	38.10 - 46.02
D – Core Diameter (O.D.)	102.01 maximum
E – Hub Recess Diameter	86.36 maximum
F – Hub Recess Depth	9.50 minimum
G – Arbor Hole Diameter	25.40 - 30.48

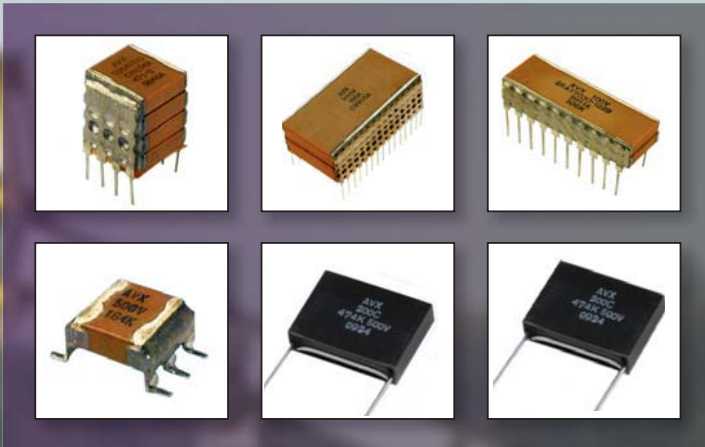
CONVERSION TABLE									
MM	IN	MM	IN	MM	IN	MM	IN	MM	IN
.10	.004	1.52	.060	5.00	.197	9.91	.390	32.00	1.260
.20	.007	2.00	.079	5.08	.200	10.03	.395	38.10	1.500
.38	.015	2.54	.100	6.22	.245	10.16	.400	46.02	1.812
.41	.016	3.00	.118	6.35	.250	11.68	.460	50.80	2.000
.51	.020	3.18	.125	6.60	.260	12.50	.492	86.36	3.400
.71	.028	3.48	.137	6.99	.275	12.70	.500	88.90	3.500
.79	.031	3.81	.150	7.62	.300	16.00	.630	102.01	4.016
.99	.039	3.99	.157	8.89	.350	18.01	.709	254.00	10.000
1.02	.040	4.45	.175	9.02	.355	25.40	1.000	304.80	12.000
1.42	.056	4.98	.196	9.50	.374	30.48	1.200	355.00	14.000

SWITCHED MODE POWER SUPPLY (SMPS) CAPACITORS

AVX SMPS capacitors utilize multilayer ceramic capacitor technology to achieve higher capacitance, voltage and high resistance to harsh high temperature environments.

Innovative solutions include:

- **SMX SMPS Stacked MLCCs**
AVX SMX capacitors are stacked SMPS capacitors ideally suited for high temperature applications up to +200°C. The wide product offering provides designers with solutions exhibiting high capacitance and high voltage ratings that are rated up to +200°C.
- **SXP SMPS Molded Radial MLCCs**
AVX encapsulated radial leaded MLCCs ideally suited for high temperature applications up to +200°C. This product offers mechanical protection to the ceramic element ensuring reliable operation in harsh environment applications.



SMPS Stacked MLC Capacitors

SMX Style for High Temperature Applications up to 200°C



SMX-style, stacked Switch Mode Power Supply Capacitors (SMPS) utilizing Multilayer Ceramic (MLCC) construction are ideally suited for high temperature applications up to 200°C. This product is intended for downhole oil exploration, including logging while drilling, geophysical probes, as well as space and aerospace electronics. The high temperature solder utilized in the construction of SMX-style parts assures reliable operation in harsh environments. The wide product offering provides designers a solution for high capacitance value and high voltage capacitors rated at 200°C. The SMX-style capacitors are ideally suited for applications as DC filters in high power, high frequency motor drives, high pulsed-current circuitry, as well as low power electronics.

SMX-style, SMPS capacitors are characterized with excellent performance in comparison to wet tantalum products. The main benefits of SMX-product over wet tantalum capacitors include:

- Much lower ESR and lower losses
- Excellent capacitance retention with frequency
- Excellent high frequency performance
- Low DC leakage current
- Much higher current handling capabilities

CHECK FOR UP-TO-DATE DATASHEET AT
<http://www.avx.com/docs/catalogs/smx.pdf>

ELECTRICAL SPECIFICATIONS

Temperature Coefficient

COG: A Temperature Coefficient 0 ±30 ppm/°C, -55° to +200°C
 X7R/X9U: C Temperature Coefficient ±15%, -55°C to +125°C
 +15% - 56%, -55°C to +200°C

Capacitance Test (MIL-STD-202 Method 305)
 25°C, 1.0±0.2 Vrms (open circuit voltage) at 1KHz

Dissipation Factor 25°C

COG: 0.15% Max @ 25°C, 1.0±0.2 Vrms (open circuit voltage) at 1KHz
 X7R/X9U: 2.5% Max @ 25°C, 1.0±0.2 Vrms (open circuit voltage) at 1KHz

Insulation Resistance 25°C (MIL-STD-202 Method 302)
 100K MΩ or 1000 MΩ-μF, whichever is less.

Insulation Resistance 125°C (MIL-STD-202 Method 302)
 10K MΩ or 100 MΩ-μF, whichever is less.

Insulation Resistance 200°C (MIL-STD-202 Method 302)
 100 MΩ or 1 MΩ -μF, whichever is less.

Dielectric Withstanding Voltage 25°C (Flash Test)
 250% rated voltage for 5 seconds with 50 mA max charging current. (500 Volt units @ 750 VDC)

Moisture Resistance (MIL-STD-202 Method 106)
 Ten cycles with no voltage applied.

Thermal Shock (MIL-STD-202 Method 107, Condition A)

Immersion Cycling (MIL-STD-202 Method 104, Condition B)

Resistance To Solder Heat (MIL-STD-202, Method 210, Condition B, for 20 seconds)

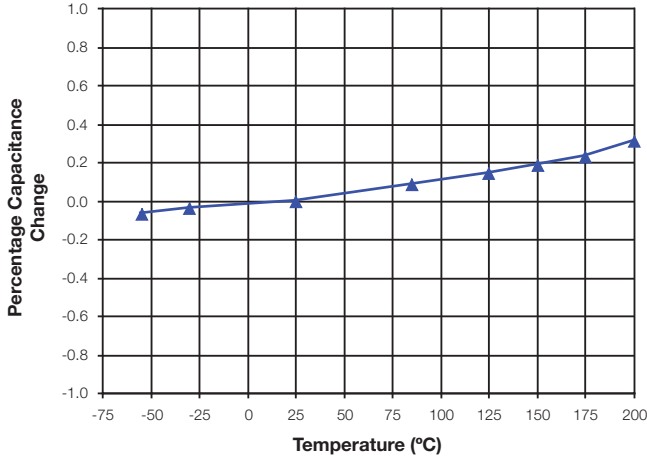
HOW TO ORDER AVX Styles: SMX1, SMX2, SMX3, SMX4, SMX5, SMX6

SMX	1	7	C	106	M	A	N	650
AVX Style SMX = Uncoated	Size	Voltage 3 = 25V 5 = 50V 1 = 100V 2 = 200V 7 = 500V	Temperature Coefficient COG = A X7R/X9U = C	Capacitance Code (2 significant digits + number of zeros) 10 pF = 100 100 pF = 101 1,000 pF = 102 22,000 pF = 223 220,000 pF = 224 1 μF = 105 10 μF = 106 100 μF = 107	Capacitance Tolerance COG: J = ±5% K = ±10% M = ±20% X7R: K = ±10% M = ±20% Z = +80%, -20%	Test Level A = Standard	Termination N = Straight Lead J = Leads formed in L = Leads formed out P = P Style Leads Z = Z Style Leads	Height Max Dimension "A" 120 = 0.120" 240 = 0.240" 360 = 0.360" 480 = 0.480" 650 = 0.650"

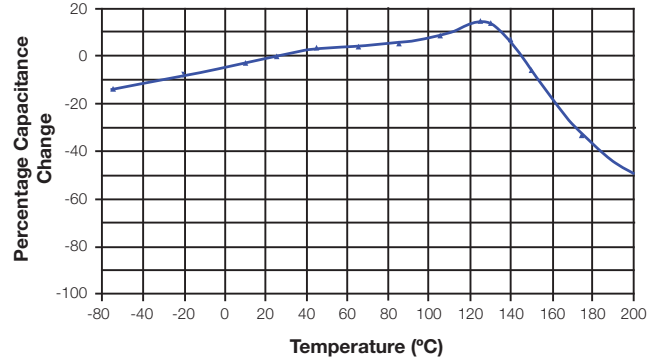
Note: Capacitors with X7R/X9U dielectric is not intended for applications across AC supply mains or AC line filtering with polarity reversal. Contact plant for recommendations.

Not RoHS Compliant

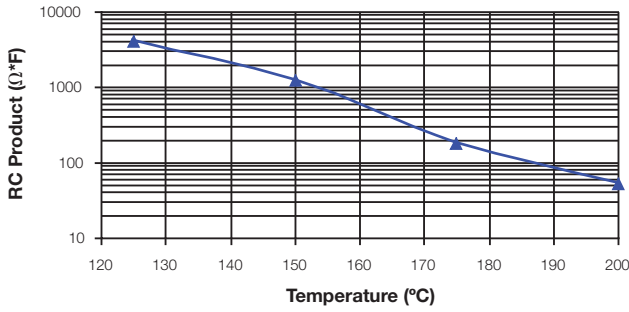
Typical Extended Temperature TCC
Characterization of C0G, SMPS Capacitors
 Test conditions: 1 Vrms, 1 kHz, 0 VDC bias



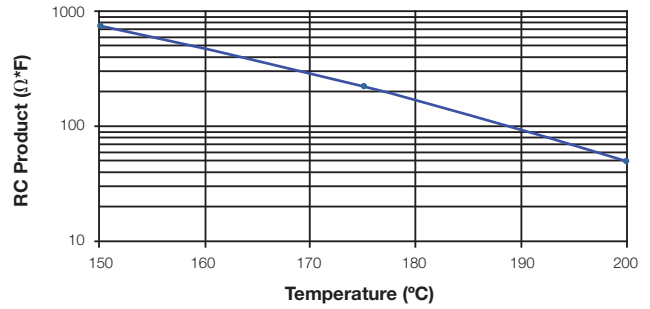
Typical Extended Temperature TCC
Characterization of VHT, SMPS Capacitors
 Test conditions: 1 Vrms, 1 kHz, 0 VDC bias



Typical Extended Temperature IR Characterization of
C0G, SMPS Capacitors

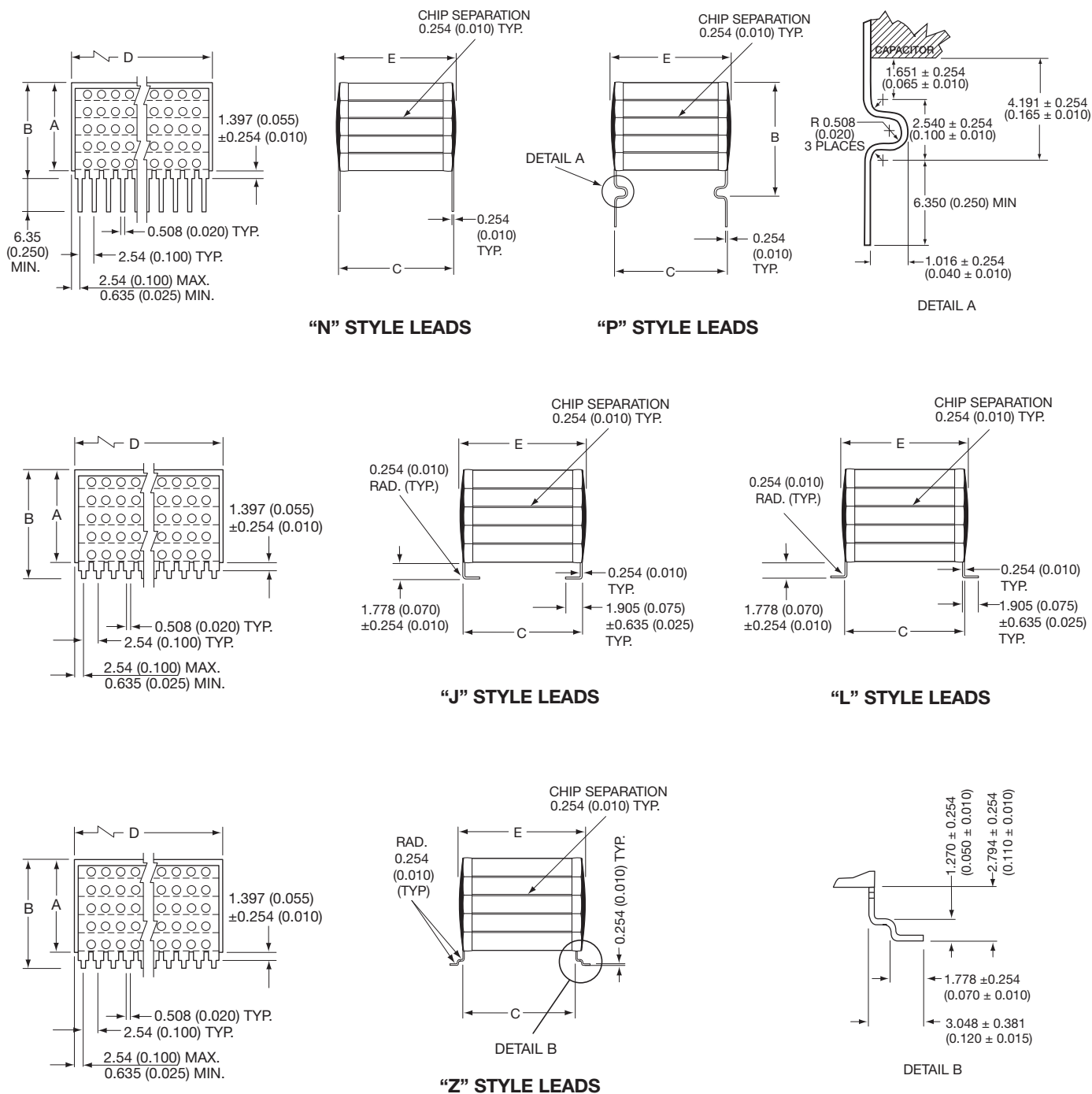


Typical Extended Temperature IR Characterization of
VHT, SMPS Capacitors



SMPS Stacked MLC Capacitors

SMX Style for High Temperature Applications up to 200°C



DIMENSIONS

millimeters (inches)

Style	A (max.)	B (max.)	C ±.635 (±0.025)	D ±.635 (±0.025)	E (max.)	No. of Leads per side
SMX1	See page 52 for maximum "A" Dimension	For "N" Style Leads: "A" Dimension Plus 1.651 (0.065) For "J" & "L" Style Leads: "A" Dimension Plus 2.032 (0.080) For "P" Style Leads: "A" Dimension Plus 4.445 (0.175) For "Z" Style Leads: "A" Dimension Plus 3.048 (0.120)	11.4 (0.450)	52.1 (2.050)	12.7 (0.500)	20
SMX2			20.3 (0.800)	38.4 (1.510)	22.1 (0.870)	15
SMX3			11.4 (0.450)	26.7 (1.050)	12.7 (0.500)	10
SMX4			10.2 (0.400)	10.2 (0.400)	11.2 (0.440)	4
SMX5			6.35 (0.250)	6.35 (0.250)	7.62 (0.300)	3
SMX6			31.8 (1.250)	52.1 (2.050)	34.3 (1.350)	20

Max Capacitance (µF) Available Versus Style with Height (A) of 0.120" - 3.05mm

AVX STYLE	SMX1			AN120		SMX2		AN120			SMX3		AN120			SMX4		AN120			SMX5		AN120			SMX6		AN120		
	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V
COG	1.0	.70	.40	.18	.068	1.2	1.0	.60	.26	.10	.50	.40	.20	.09	.033	.16	.13	.07	.02	.01	.05	.04	.02	.01	.0039	3.2	2.4	1.3	.50	.20
VHT	-	18	10	3.9	1.8	-	27	15	5.6	2.7	12	8.2	4.7	1.8	.82	3.9	2.7	1.5	.56	.27	1.5	1.0	.56	.22	.10	-	56	33	12	5.6

Max Capacitance (µF) Available Versus Style with Height (A) of 0.240" - 6.10mm

AVX STYLE	SMX1			AN240		SMX2		AN240			SMX3		AN240			SMX4		AN240			SMX5		AN240			SMX6		AN240		
	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V
COG	2.0	1.4	.80	.36	.13	2.4	2.0	1.2	.52	.20	1.0	.80	.40	.18	.068	.33	.26	.14	.05	.02	.10	.08	.05	.02	.0078	6.4	4.8	2.6	1.0	.40
VHT	-	33	18	6.8	3.3	-	47	27	10	4.7	22	15	8.2	3.3	1.5	6.8	4.7	2.7	1.0	.47	2.7	1.8	1.0	.39	.18	-	100	56	22	10

Max Capacitance (µF) Available Versus Style with Height (A) of 0.360" - 9.14mm

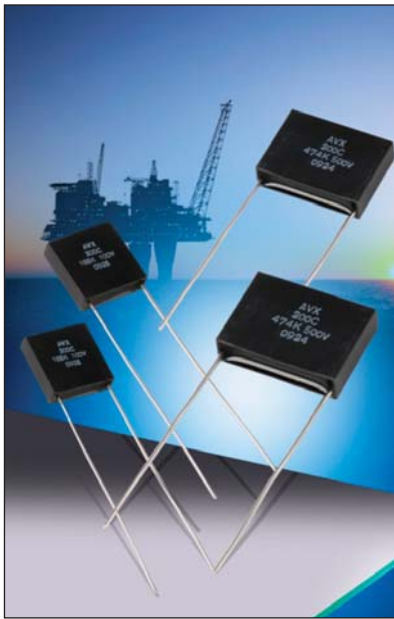
AVX STYLE	SMX1			AN360		SMX2		AN360			SMX3		AN360			SMX4		AN360			SMX5		AN360			SMX6		AN360		
	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V
COG	3.0	2.1	1.2	.54	.22	3.6	3.0	1.8	.78	.30	1.5	1.2	.60	.27	.10	.48	.39	.21	.07	.03	.15	.12	.07	.03	.011	10	7.2	3.9	1.5	.60
VHT	-	47	27	10	4.7	-	68	39	15	6.8	33	22	12	5.6	2.2	12	6.8	3.9	1.5	.68	3.9	2.7	1.5	.56	.27	-	150	82	33	15

Max Capacitance (µF) Available Versus Style with Height (A) of 0.480" - 12.2mm

AVX STYLE	SMX1			AN480		SMX2		AN480			SMX3		AN480			SMX4		AN480			SMX5		AN480			SMX6		AN480		
	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V
COG	4.0	2.8	1.6	.72	.27	4.8	4.0	2.2	1.0	.40	2.0	1.6	.80	.36	.130	.64	.52	.28	.10	.04	.20	.16	.10	.04	.015	13	9.6	5.2	2.0	.80
VHT	-	68	39	15	6.8	-	100	56	22	10	47	33	18	6.8	3.3	15	10	5.6	2.2	1.0	5.6	3.9	2.2	.82	.39	-	220	120	47	22

Max Capacitance (µF) Available Versus Style with Height (A) of 0.650" - 16.5mm

AVX STYLE	SMX1			AN650		SMX2		AN650			SMX3		AN650			SMX4		AN650			SMX5		AN650			SMX6		AN650		
	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V	25V	50V	100V	200V	500V
COG	5.0	3.5	2.0	.90	.34	6.0	5.0	3.0	1.3	.50	2.5	2.0	1.0	.45	.160	.82	.65	.35	.12	.05	.25	.20	.12	.05	.019	16	12	6.5	2.5	1.0
VHT	-	82	47	18	8.2	-	120	68	27	12	56	39	22	8.2	3.9	18	12	6.8	2.7	1.2	6.8	4.7	2.7	1.0	.47	-	270	150	56	27



SXP-style, encapsulated radial leaded MLC capacitors are ideally suited for high temperature applications up to 200°C. This product is intended for downhole oil exploration, including logging while drilling, geophysical probes, as well as space, aerospace and hybrid automotive applications. This product supplements the SMX family of capacitors and offers mechanical protection to the ceramic element in extreme harsh environment. The high temperature solder utilized in the construction of SXP-style parts assures reliable operation in high temperature and rugged environments. The SXP-style capacitors are ideally suited for applications as DC filters in high power, high frequency motor drives, high pulsed-current circuitry, as well as standard electronic equipment designed for high temperature applications.

SXP-style, switch mode power supply capacitors are characterized with excellent performance. The main benefits of SXP product include:

- Low ESR, low ESL
- Low DC leakage
- Excellent high frequency performance

CHECK FOR UP-TO-DATE DATASHEET AT
<http://www.avx.com/docs/Catalogs/SXP.pdf>

ELECTRICAL SPECIFICATIONS

Temperature Coefficient

COG:	A Temperature Coefficient	0 ±30 ppm/°C, -55° to +200°C
VHT:	C Temperature Coefficient	±15%, -55°C to +125°C +15% - 56%, -55°C to +200°C

Capacitance Test (MIL-STD-202 Method 305)
 25°C, 1.0±0.2 Vrms (open circuit voltage) at 1KHz

Dissipation Factor 25°C

COG:	0.15% Max @ 25°C, 1.0±0.2 Vrms (open circuit voltage) at 1KHz
X7R/X9U:	2.5% Max @ 25°C, 1.0±0.2 Vrms (open circuit voltage) at 1KHz

Insulation Resistance 25°C (MIL-STD-202 Method 302)
 100K MΩ or 1000 MΩ-μF, whichever is less.

Insulation Resistance 125°C (MIL-STD-202 Method 302)
 10K MΩ or 100 MΩ-μF, whichever is less.

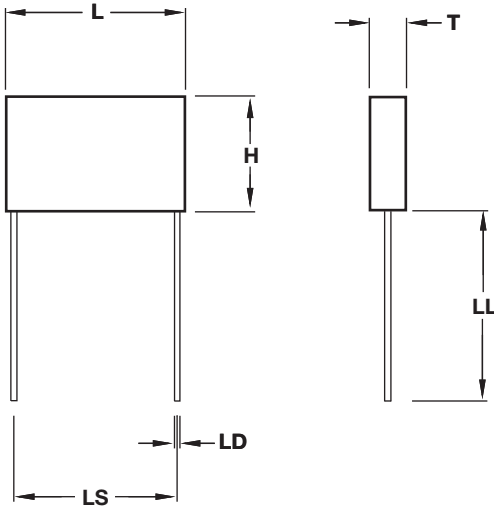
Insulation Resistance 200°C (MIL-STD-202 Method 302)
 1k MΩ or 10 MΩ -μF, whichever is less.

Dielectric Withstanding Voltage 25°C (Flash Test)
 250% rated voltage for 5 seconds with 50 mA max charging current. (150% for 500 VDC and 120% for 1000 VDC and higher voltage ratings)

HOW TO ORDER

SXP ┆	3 ┆	1 ┆	C ┆	104 ┆	M ┆	A ┆	A ┆
AVX Style	Size See Dimensions Chart	Voltage 5 = 50V 1 = 100V 2 = 200V 7 = 500V A = 1000V S = 1500V G = 2000V H = 3000V	Temperature Coefficient COG = A VHT = C	Capacitance Code (2 significant digits + number of zeros) 100 pF = 101 22,000 pF = 223 1μF = 105	Capacitance Tolerance COG: J = ±5% K = ±10% M = ±20% X7R: K = ±10% M = ±20% Z = +80%, -20%	Test Level A = Standard	Leads A = Standard Sn/Pb (min. 5% Pb)
						Not RoHS Compliant	
					Tighter tolerances available upon request		

STYLE



DIMENSIONS

millimeters (inches)

AVX Style	Length (L) ±0.25 (±0.010)	Height (H) ±0.25 (±0.010)	Thickness (T) ±0.25 (±0.010)	Lead Spacing ±0.76 (±0.030)	LD ±0.05 (±0.002)
SXP1	8.9 (0.350)	8.9 (0.350)	5.08 (0.200)	5.08 (0.200)	0.51 (0.020)
SXP2	11.4 (0.450)	11.4 (0.450)	5.08 (0.200)	5.08 (0.200)	0.51 (0.020)
SXP3	12.7 (0.500)	12.7 (0.500)	5.08 (0.200)	10.2 (0.400)	0.64 (0.025)
SXP4	22.4 (0.880)	16.3 (0.640)	5.84 (0.230)	19.8 (0.780)	0.81 (0.032)

CAPACITANCE RANGE

COG

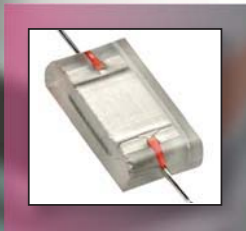
Style	50V	100V	200V	500V	1000V	1500V	2000V	3000V
SXP1 (MIN)	1000pF	1000pF	1000pF	100pF	100pF	100pF	100pF	100pF
(MAX)	.047μF	.027μF	8200pF	4700pF	2200pF	1000pF	560pF	270pF
SXP2 (MIN)	.01μF	1000pF	1000pF	100pF	100pF	100pF	100pF	100pF
(MAX)	.10μF	.056μF	.018μF	8200pF	4700pF	1800pF	1200pF	560pF
SXP3 (MIN)	.01μF	1000pF	1000pF	1000pF	1000pF	100pF	100pF	100pF
(MAX)	.15μF	.068μF	.022μF	.012μF	6800pF	2700pF	1500pF	1000pF
SXP4 (MIN)	.01μF	.01μF	1000pF	1000pF	1000pF	1000pF	100pF	100pF
(MAX)	.39μF	.22μF	.068μF	.033μF	.018μF	8200pF	4700pF	2700pF

VHT

Style	50V	100V	200V	500V	1000V	1500V	2000V	3000V
SXP1 (MIN)	.1μF	.01μF	.01μF	.01μF	.01μF	.01μF	1000pF	1000pF
(MAX)	1.5μF	1.0μF	.33μF	.12μF	.056μF	.022μF	.012μF	4700pF
SXP2 (MIN)	.1μF	.1μF	.01μF	.01μF	.01μF	.01μF	.01μF	1000pF
(MAX)	2.7μF	1.8μF	.68μF	.27μF	.10μF	.056μF	.022μF	8200pF
SXP3 (MIN)	.01μF	.1μF	.01μF	.01μF	.01μF	.01μF	.01μF	.01μF
(MAX)	3.9μF	2.7μF	1.0μF	.33μF	.15μF	.082μF	.033μF	.015μF
SXP4 (MIN)	1μF	.1μF	.1μF	.01μF	.01μF	.01μF	.01μF	.01μF
(MAX)	12μF	8.2μF	2.7μF	1.0μF	.47μF	.22μF	.10μF	.039μF

GLASS DIELECTRIC

AVX glass capacitors offer optimum, highly stable performance in harsh environments, capacitance retraceability, and a rugged, simple construction to eliminate mechanical problems.



HEAT

It's the enemy of reliable, long-term circuit performance. In many applications, very high temperatures are not a consideration in circuit design. But in a few specialized areas, elevated temperatures create very real design problems.

That's why AVX ET-Series capacitors keep working at temperatures where more ordinary capacitors usually fail...up to 200°C.

And, of course, AVX ET-Series capacitors provide all the high performance,

high reliability characteristics you've come to expect from all AVX glass capacitors...excellent stability, outstanding capacitance retraceability, rugged, simple construction to eliminate mechanical problems, and electrical performance specifications among the best available at any price.

So when the heat's on your next design and you can't alter the environment, choose AVX ET-Series glass capacitors. That'll be one less problem you'll have to solve.

FEATURES

- Available in both axial and radial leaded configurations
- Values from 0.5 pF to 2400 pF
- Working temperature range -75°C to 200°C
- "Burned In" versions available – 50 hours @ 1500 VDC, 25°C
- Simple, rugged design and construction
- Short lead times for most values

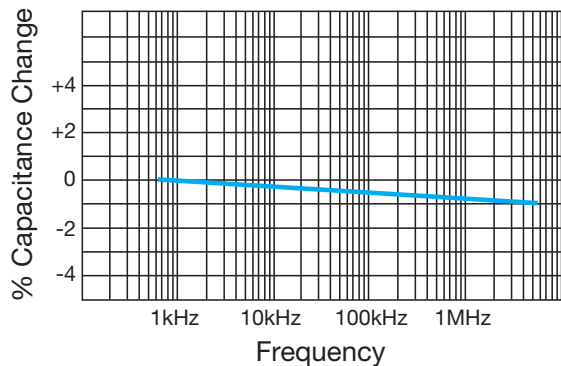
STANDARD OPERATING CHARACTERISTICS OF AVX ET-SERIES AXIAL AND RADIAL LEADED GLASS CAPACITORS

Working Temperature Range	-75°C to 200°C
Voltage Rating	50 VDC
Capacitance Range	0.5 pF to 2400 pF
Insulation Resistance	@ 25°C > 100,000 Megohms @ 200°C > 100 Megohms
Dissipation Factor	@ 25°C < .1% at 1kHz @ 200°C < 1% at 1kHz
Life	(1000 hours at rated voltage at 200°C) Post Test Delta C @ 25°C < 2% DF @ 25°C < 2.5% IR > 100 Megohms (axials) IR > 10 Megohms (radials)
Short Time (1 Hour) Exposure to Overtemperature (250°C)	No degradation
Voltage Coefficient	0

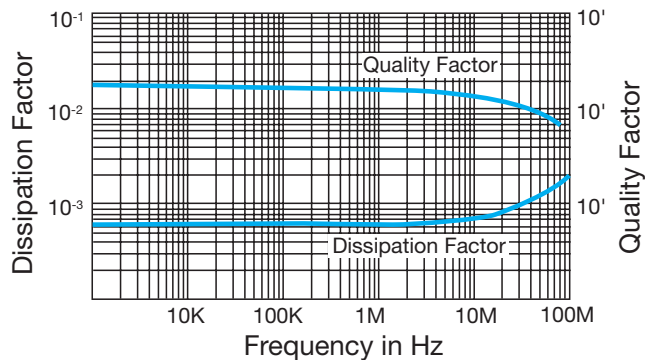
TYPICAL APPLICATIONS

In general, AVX ET-Series glass capacitors are ideally suited for any environment where high temperature could alter or destroy circuit performance. And since they are rated down to -75°C, ET-Series capacitors are also useful where cycling to colder temperatures may be a problem. Some applications where AVX ET-Series capacitors have already proven themselves include:

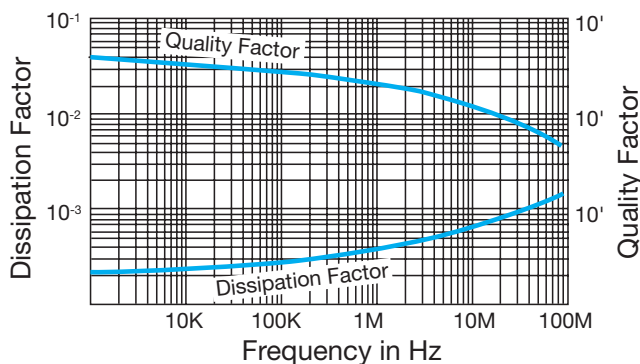
- Oil, well logging and downhole instrumentation, where frictional or geothermal heat is a problem.
- Geophysical pressure probes.
- Missile or aerospace applications where engine or environmental heat needs to be monitored or may cause circuit failure.
- Radar or other microwave applications.
- RF output circuitry where conduction or fan cooling cannot be entirely relied upon to remove all of the heat.
- Space and satellite applications where temperature changes are extreme and "zero failures" are a must.
- Industrial chemical process instrumentation where heat is a part of the process.
- Instrumentation for monitoring at-the-tool performance in metal cutting machinery.
- Fire-safe alarm or control circuitry.



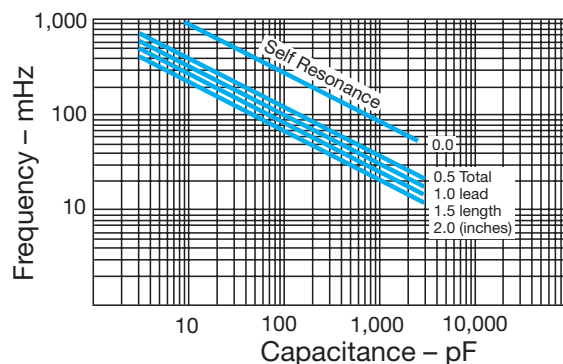
**% Capacitance Change vs. Frequency
Radial and Axial**



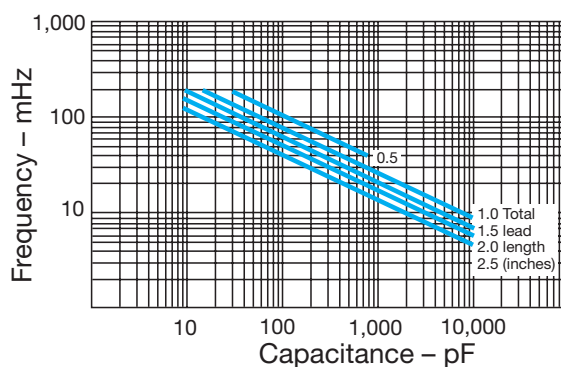
**Quality Factor and Dissipation Factor vs. Frequency
Radial**



**Quality Factor and Dissipation Factor vs. Frequency
Axial**



**Resonant Frequency vs. Capacitance
Radial**



**Resonant Frequency vs. Capacitance
Axial**

INTRODUCTION

AVX ET-Series axial leaded glass capacitors* are available in two standard case sizes and in a wide range of values and tolerances. All feature extremely stable glass dielectric, fused monolithic construction and true glass-to-metal hermetic seals at the leads for moisture resistance. All case sizes conform to industry dimensional standards.

PERFORMANCE CHARACTERISTICS

Tolerance: Available tolerances for each capacitance value are shown in the ordering information table on following page. Part marking codes are also provided.

Temperature Coefficient: Capacitance exhibits retraceability to within 10 ppm/°C over the temperature range -75°C to +200°C. See graph on following page.

Voltage Coefficient: Zero

Losses: Extremely low over the entire specified operating temperature range. Dissipation factor is 1% or less at 200°C at 1kHz.

Life: Delta C is less than 2% after 1000 hours at rated voltage, 200°C.

Insulation Resistance: Greater than 100,000 megohms at 25°C; greater than 100 megohms at 200°C. More than 100 megohms after life-testing.

Voltage/Temperature Rating: All ET-Series capacitors are rated at 50 VDC over their operating temperature range of -75°C to 200°C. No derating is required.

High Voltage Stabilization Screening: A special version of ET-Series axial leaded capacitors – designated ETR – is available. These capacitors have been “burned in” at room temperature for 50 hours at 1500 VDC.

Short Time Overtemperature Exposure: After exposure to 250°C for one hour, ET-Series capacitors have continued to perform to specification.

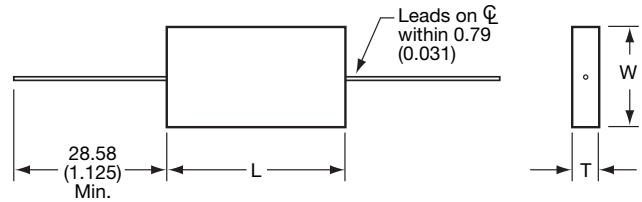
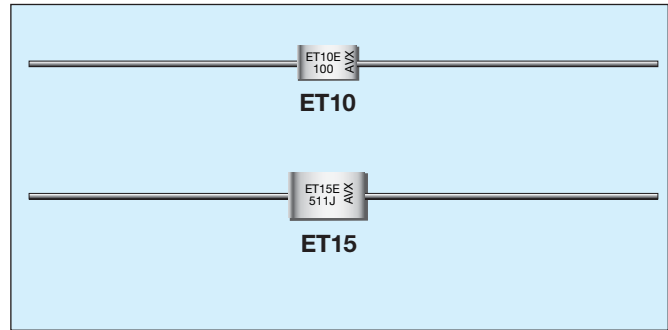
Moisture Resistance: Axial glass capacitors are hermetically sealed in glass, with a true metal-to-glass seal at the leads. This construction provides practical immunity to environmental effects such as shock, moisture, salt spray and solder heat.

Additional performance details are given in the AVX “Performance Characteristics of Multilayer Glass Dielectric Capacitors” technical paper.

*Radiation Resistance to the same level as the CY, CYR axial series.

HOW TO ORDER

ET Style Glass Capacitor	10 Case Size 10 15	E Operating Temperature Range -75°C to +200°C	101 Capacitance Code Capacitance Code is expressed in picofarads (pF). The first two digits represent significant figures and the third digit specifies the number of zeros to follow; i.e. 101 indicates 100 pF. For values below 10 pF, R = decimal point; i.e. 1R5 indicates 1.5 pF.	J Capacitance Tolerance C = ±.25 pF D = ±.50 pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%
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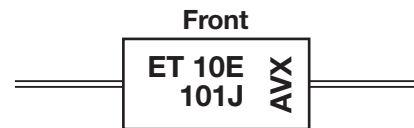
DIMENSIONS:

millimeters (inches)

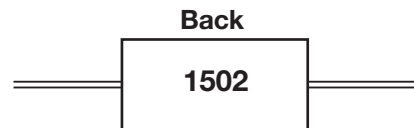
Case Size	L	W	T	Lead Dia. +0.1 (+0.004) -0.03 (-0.001)	Weight (grams)
ET10	8.74 ± 1.19 (0.344 ± 0.047)	4.37 ± 0.79 (0.172 ± 0.031)	1.98 ± 0.79 (0.078 ± 0.031)	5.08 (0.200)	.25 - .50
ET15	11.91 ± 1.19 (0.469 ± 0.047)	6.76 ± 0.79 (0.266 ± 0.031)	2.77 ± 1.19 (0.109 ± 0.047)	5.08 (0.200)	.75 - 1.25

Note: Standard leads are solder-coated Dumet.

MARKING



ET = Glass Capacitor
 ETR = Glass Capacitor with “burn in”
 10 = Case Size
 E = Operating Temperature Range



101 = Capacitance, Coded in pF
 J = Tolerance
 AVX = AVX Corporation
 0705 = Date Code

RATINGS & PART NUMBER REFERENCE (Standard Values)

ET Part No.	ETR Part No.	Cap (pF)	Tolerances Available Voltage	DC Working
ET10, ETR10				
ET10E0R5*	ETR10E0R5**	0.5	C	50
ET10E1R0	ETR10E1R0	1.0	C, D	50
ET10E1R5	ETR10E1R5	1.5	C, D	50
ET10E2R2	ETR10E2R2	2.2	C, D	50
ET10E2R7	ETR10E2R7	2.7	C, D	50
ET10E3R0	ETR10E3R0	3.0	C, D	50
ET10E3R3	ETR10E3R3	3.3	C, D	50
ET10E3R6	ETR10E3R6	3.6	C, D	50
ET10E3R9	ETR10E3R9	3.9	C, D	50
ET10E4R3	ETR10E4R3	4.3	C, D	50
ET10E4R7	ETR10E4R7	4.7	C, K	50
ET10E5R1	ETR10E5R1	5.1	C, J, K	50
ET10E5R6	ETR10E5R6	5.6	C, J, K	50
ET10E6R2	ETR10E6R2	6.2	C, J, K	50
ET10E6R8	ETR10E6R8	6.8	C, J, K	50
ET10E7R5	ETR10E7R5	7.5	C, J, K	50
ET10E8R2	ETR10E8R2	8.2	C, J, K	50
ET10E9R1	ETR10E9R1	9.1	C, J, K	50
ET10E100	ETR10E100	10	C, J, K, M	50
ET10E110	ETR10E110	11	C, J, K, M	50
ET10E120	ETR10E120	12	C, J, K, M	50
ET10E130	ETR10E130	13	C, G, J, K, M	50
ET10E150	ETR10E150	15	C, G, J, K, M	50
ET10E160	ETR10E160	16	C, G, J, K, M	50
ET10E180	ETR10E180	18	C, G, J, K, M	50
ET10E200	ETR10E200	20	C, G, J, K, M	50
ET10E220	ETR10E220	22	C, G, J, K, M	50
ET10E240	ETR10E240	24	C, G, J, K, M	50
ET10E270	ETR10E270	27	F, G, J, K, M	50
ET10E300	ETR10E300	30	F, G, J, K, M	50
ET10E330	ETR10E330	33	F, G, J, K, M	50
ET10E360	ETR10E360	36	F, G, J, K, M	50
ET10E390	ETR10E390	39	F, G, J, K, M	50
ET10E430	ETR10E430	43	F, G, J, K, M	50
ET10E470	ETR10E470	47	F, G, J, K, M	50
ET10E510	ETR10E510	51	F, G, J, K, M	50
ET10E560	ETR10E560	56	F, G, J, K, M	50
ET10E620	ETR10E620	62	F, G, J, K, M	50
ET10E680	ETR10E680	68	F, G, J, K, M	50
ET10E750	ETR10E750	75	F, G, J, K, M	50

Add letter for tolerance code above lines.

These capacitors include a "burn in", see page 58 High Voltage Stabilization Screening.

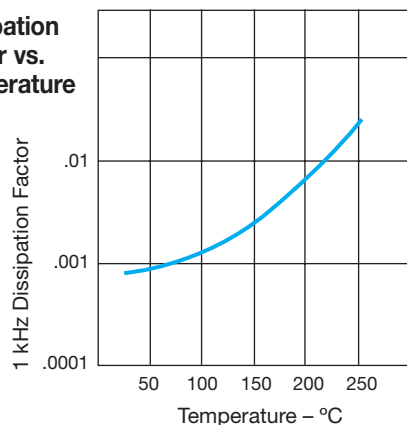
ET Part No.	ETR Part No.	Cap (pF)	Tolerances Available Voltage	DC Working
ET10, ETR10 (cont'd)				
ET10E820	ETR10E820	82	F, G, J, K, M	50
ET10E910	ETR10E910	91	F, G, J, K, M	50
ET10E101	ETR10E101	100	F, G, J, K, M	50
ET10E111	ETR10E111	110	F, G, J, K, M	50
ET10E121	ETR10E121	120	F, G, J, K, M	50
ET10E131	ETR10E131	130	F, G, J, K, M	50
ET10E151	ETR10E151	150	F, G, J, K, M	50
ET10E161	ETR10E161	160	F, G, J, K, M	50
ET10E181	ETR10E181	180	F, G, J, K, M	50
ET10E201	ETR10E201	200	F, G, J, K, M	50
ET10E221	ETR10E221	220	F, G, J, K, M	50
ET10E241	ETR10E241	240	F, G, J, K, M	50
ET10E271	ETR10E271	270	F, G, J, K, M	50
ET10E301	ETR10E301	300	F, G, J, K, M	50
ET15, ETR15				
ET15E221	ETR15E221	220	F, G, J, K, M	50
ET15E241	ETR15E241	240	F, G, J, K, M	50
ET15E271	ETR15E271	270	F, G, J, K, M	50
ET15E301	ETR15E301	300	F, G, J, K, M	50
ET15E331	ETR15E331	330	F, G, J, K, M	50
ET15E361	ETR15E361	360	F, G, J, K, M	50
ET15E391	ETR15E391	390	F, G, J, K, M	50
ET15E431	ETR15E431	430	F, G, J, K, M	50
ET15E471	ETR15E471	470	F, G, J, K, M	50
ET15E511	ETR15E511	510	F, G, J, K, M	50
ET15E561	ETR15E561	560	F, G, J, K, M	50
ET15E621	ETR15E621	620	F, G, J, K, M	50
ET15E681	ETR15E681	680	F, G, J, K, M	50
ET15E751	ETR15E751	750	F, G, J, K, M	50
ET15E821	ETR15E821	820	F, G, J, K, M	50
ET15E911	ETR15E911	910	F, G, J, K, M	50
ET15E102	ETR15E102	1000	F, G, J, K, M	50
ET15E112	ETR15E112	1100	F, G, J, K, M	50
ET15E122	ETR15E122	1200	F, G, J, K, M	50

Add letter for tolerance code above lines.

These capacitors include a "burn in", see page 58 High Voltage Stabilization Screening.

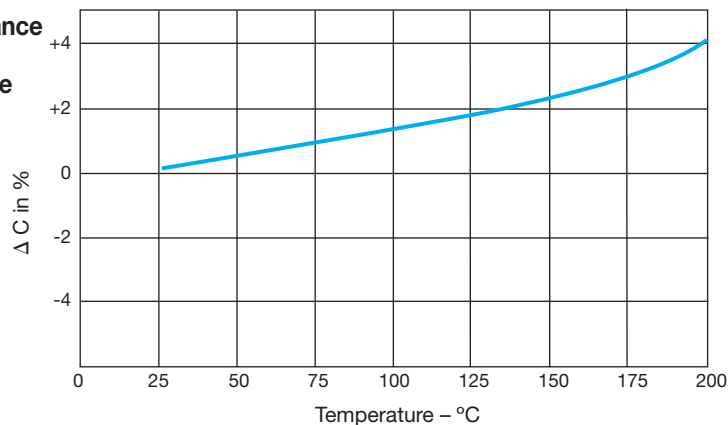
Dissipation Factor vs. Temperature

Axial



% Capacitance Change vs. Temperature

Axial



INTRODUCTION

AVX ET-Series radial leaded glass capacitors are available in a broad range of tolerances and values in three case sizes. The fused monolithic capacitive element is housed in a miniature rectangular molded case for high packaging efficiency in circuit board applications. The gold-plated Dumet leads can be soldered or welded.

PERFORMANCE CHARACTERISTICS

Tolerance: The ordering information table on the opposite page gives the available tolerances and values. An explanation of the part marking code is also provided.

Temperature Coefficient: Capacitance exhibits retraceability to within 10 ppm/°C over the temperature range -75°C to 200°C. See graph on following page.

Voltage Coefficient: Zero

Losses: Over the specified temperature range, losses are very low. At 200°C, 1kHz, the dissipation factor is 1% or less.

Life: Delta C is less than 2% after 1000 hours at rated voltage, 200°C.

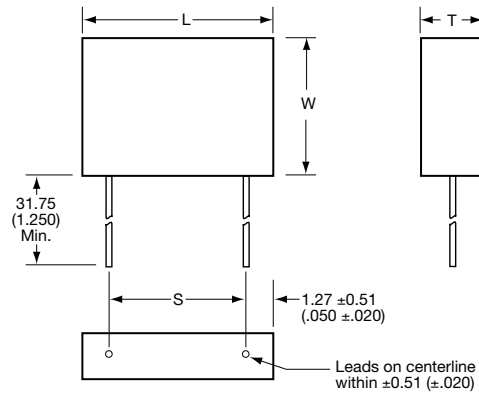
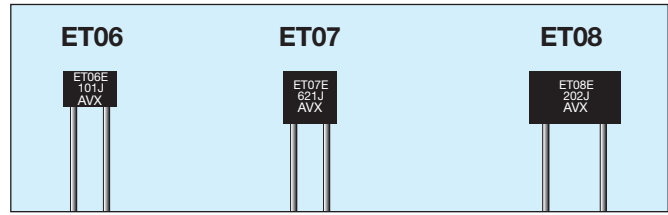
Insulation Resistance: 100,000 megohms or greater at 25°C; 100 megohms or greater at 200°C. More than 10 megohms after 1000 hour life-test.

Voltage/Temperature Rating: All ET-Series capacitors are rated at 50 VDC over the operating temperature range of -75°C to 200°C. Derating is not required.

High Voltage Stabilization Screening: A special version of ET-Series radial leaded capacitors – designated ETR – is available. These capacitors have been “burned in” at room temperature for 50 hours at 1500 VDC.

Short Time Overtemperature Exposure: After exposure to 250°C for one hour, ET-Series capacitors have continued to perform to specification.

Additional performance details are given in the AVX “Performance Characteristics of Multilayer Glass Dielectric Capacitors” technical paper.

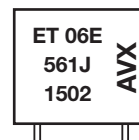


DIMENSIONS: millimeters (inches)

Case Size	L ±0.13 (±0.005)	W ±0.25 (±0.010)	T ±0.13 (±0.005)	S +0.51 (±0.020)	Weight (grams)
ET06	7.62 (0.300)	5.08 (0.200)	2.92 (0.115)	5.08 (0.200)	.3 - .4
ET07	7.62 (0.300)	7.62 (0.300)	2.92 (0.115)	5.08 (0.200)	.4 - .5
ET08	12.7 (0.500)	7.62 (0.300)	2.92 (0.115)	10.16 (0.400)	.7 - .8

Note: All leads are 24 AWG, 0.51 ± 0.05 (0.020 ± 0.002) diameter. Leads are solderable and welded gold-plated Dumet.

MARKING



AVX = AVX Corporation
 ET = Glass Capacitor
 ETR = Glass Capacitor with “burn in”
 06 = Case Size
 E = Operating Temperature Range
 561 = Capacitance, Coded in pF
 J = Tolerance
 1502 = Date Code

HOW TO ORDER

<p>ET</p> <p>↓</p> <p>Style</p> <p>Glass Capacitor</p>	<p>06</p> <p>↓</p> <p>Case Size</p> <p>06 07 08</p>	<p>E</p> <p>↓</p> <p>Operating Temperature Range</p> <p>-75°C to +200°C</p>	<p>561</p> <p>↓</p> <p>Capacitance Code</p> <p>Capacitance Code is expressed in picofarads (pF). The first two digits represent significant figures and the third digit specifies the number of zeros to follow; i.e. 561 indicates 560 pF. For values below 10 pF, R = decimal point; i.e. 1R5 indicates 1.5 pF.</p>	<p>J</p> <p>↓</p> <p>Capacitance Tolerance</p> <p>C = ±.25 pF D = ±.50 pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%</p>
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RATINGS & PART NUMBER REFERENCE (Standard Values*)

ET Part No.	ETR Part No.	Cap (pF)	Tolerances Available Voltage	DC Working
ET06, ETR06				
ET06E8R2	ETR06E8R2	8.2	C, J, K	50
ET06E9R1	ETR06E9R1	9.1	C, J, K	50
ET06E100	ETR06E100	10	C, J, K, M	50
ET06E110	ETR06E110	11	C, J, K, M	50
ET06E120	ETR06E120	12	C, J, K, M	50
ET06E130	ETR06E130	13	C, G, J, K, M	50
ET06E150	ETR06E150	15	C, G, J, K, M	50
ET06E160	ETR06E160	16	C, G, J, K, M	50
ET06E180	ETR06E180	18	C, G, J, K, M	50
ET06E200	ETR06E200	20	C, G, J, K, M	50
ET06E220	ETR06E220	22	C, G, J, K, M	50
ET06E240	ETR06E240	24	C, G, J, K, M	50
ET06E270	ETR06E270	27	F, G, J, K, M	50
ET06E300	ETR06E300	30	F, G, J, K, M	50
ET06E330	ETR06E330	33	F, G, J, K, M	50
ET06E360	ETR06E360	36	F, G, J, K, M	50
ET06E390	ETR06E390	39	F, G, J, K, M	50
ET06E430	ETR06E430	43	F, G, J, K, M	50
ET06E470	ETR06E470	47	F, G, J, K, M	50
ET06E510	ETR06E510	51	F, G, J, K, M	50
ET06E560	ETR06E560	56	F, G, J, K, M	50
ET06E620	ETR06E620	62	F, G, J, K, M	50
ET06E680	ETR06E680	68	F, G, J, K, M	50
ET06E750	ETR06E750	75	F, G, J, K, M	50
ET06E820	ETR06E820	82	F, G, J, K, M	50
ET06E910	ETR06E910	91	F, G, J, K, M	50

Add letter for tolerance code above lines.

These capacitors include a "burn in", see page 60 High Voltage Stabilization Screening.

ET Part No.	ETR Part No.	Cap (pF)	Tolerances Available Voltage	DC Working
ET08, ETR08				
ET08E112 *	ETR08E112 **	1100	F, G, J, K, M	50
ET08E122	ETR08E122	1200	F, G, J, K, M	50
ET08E132	ETR08E132	1300	F, G, J, K, M	50
ET08E152	ETR08E152	1500	F, G, J, K, M	50
ET08E162	ETR08E162	1600	F, G, J, K, M	50
ET08E182	ETR08E182	1800	F, G, J, K, M	50
ET08E202	ETR08E202	2000	F, G, J, K, M	50
ET08E222	ETR08E222	2200	F, G, J, K, M	50
ET08E242	ETR08E242	2400	F, G, J, K, M	50

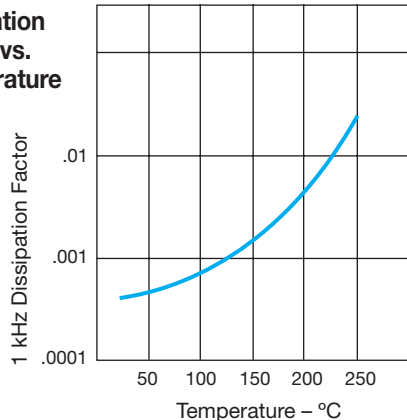
Add letter for tolerance code above lines.

These capacitors include a "burn in", see page 60 High Voltage Stabilization Screening.

*Other values may be available - contact AVX

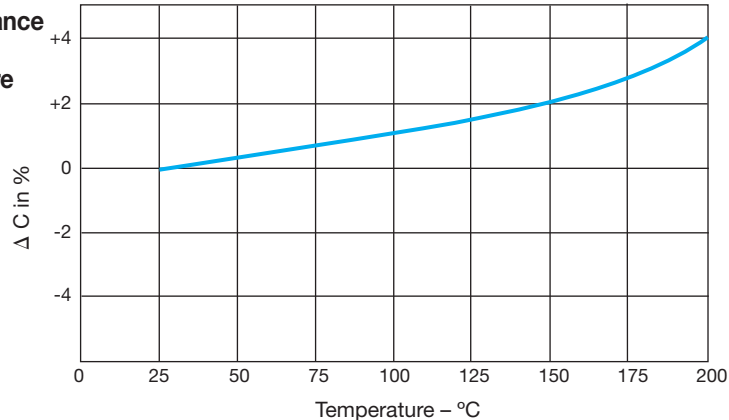
Dissipation Factor vs. Temperature

Radial



% Capacitance Change vs. Temperature

Radial



RF/MICROWAVE MLCCs

AVX offers RF/Microwave capacitors suitable for high temperature applications with operating frequency range well beyond 1GHz.

Solutions include:

- **AQ Series**

Porcelain and ceramic dielectric MLCCs best suited for applications from 10 MHz to 4.2GHz. Components are specified up to 175°C operating temperature.

- **SQ Series**

RF/microwave capacitors with ultra low ESR suitable for RF power amplifier applications. Components are specified up to 175°C operating temperature.





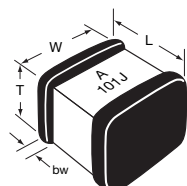
These porcelain and ceramic dielectric multilayer capacitor (MLC) chips are best suited for RF/ Microwave applications typically ranging from 10 MHz to 4.2 GHz. Characteristic is a fine grained, high density, high purity dielectric material impervious to moisture with heavy internal palladium electrodes.

These characteristics lend well to applications requiring:

- 1) high current carrying capabilities;
- 2) high quality factors;
- 3) very low equivalent series resistance;
- 4) very high series resonance;
- 5) excellent stability under stresses of changing voltage, frequency, time and temperature.

CHECK FOR UP-TO-DATE DATASHEET AT
<http://www.avx.com/docs/catalogs/aq.pdf>

MECHANICAL DIMENSIONS: inches (millimeters)



Case	Length (L)	Width (W)	Thickness (T)	Band Width (bw)
AQ11	.055±.015 (1.40±.381)	.055±.015 (1.40±.381)	.020/.057 (.508/1.45)	.010 + .010 -.005 (.254 +.254 -.127)
AQ12	.055 + .015 - .010 (1.40+ .381 - .254)	.055±.015 (1.40±.381)	.020/.057 (.508/1.45)	.010 + .010 -.005 (.254 +.254 -.127)
AQ13	.110±.020 (2.79±.508)	.110±.020 (2.79±.508)	.030/.102 (.762/2.59)	.015±.010 (.381±.254)
AQ14	.110 + .020 - .010 (2.79 +.889 -.254)	.110±.010 (2.79±.508)	.030/.102 (.762/2.59)	.015±.010 (.381±.254)

HOW TO ORDER

AQ T	11 T	E T	M T	100 T	J T	A T	T T	1A T
AVX Style AQ11 AQ12 AQ13 AQ14	Case Size (See chart)	Voltage Code 5 = 50V 1 = 100V E = 150V 2 = 200V 9 = 300V 7 = 500V	Temperature Coefficient Code M = +90±20ppm/°C (AQ11/12/13/14) A = 0±30ppm/°C (AQ11/12/13/14) C = 15% ("J" Termination only) (AQ12/14)	Capacitance EIA Capacitance Code in pF. First two digits = significant figures or "R" for decimal place. Third digit = number of zeros or after "R" significant figures.	Capacitance Tolerance Code B = ±.1 pF C = ±.25 pF D = ±.5 pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20% N = ±30%	Failure Rate Code A = Not Applicable	Termination Style Code 1 = Pd/Ag (AQ11/13 only) 7 = Ag/Ni/Au (AQ11/13 only) J = Nickel Barrier Sn/Pb (60/40) (AQ12/14 only) T = 100% Tin (AQ12/14 only)	Packaging Code 3A = 13" Reel ME = 7" Reel RE = 13" Reel WE = Waffle Pack

PACKAGING

Standard Packaging = Waffle Pack (maximum quantity is 80)

TAPE & REEL: All tape and reel specifications are in compliance with EIA RS481 (equivalent to IEC 286 part 3).

Sizes SQCA through SQCB, CDR11/12 through 13/14.

- 8mm carrier
- 7" reel: ≤0.040" thickness = 2000 pcs
 ≤0.075" thickness = 2000 pcs
- 13" reel: ≤0.075" thickness = 10,000 pcs

Not RoHS Compliant



For RoHS compliant products, please select correct termination style.

ELECTRICAL SPECIFICATIONS

AQ11, AQ12, AQ13, AQ14		
	M & A	C
Temperature Coefficient (TCC)	(M) $+90 \pm 20$ PPM/°C (-55°C to +125°C) (M) $+90 \pm 30$ PPM/°C (+125°C to +175°C) (A) 0 ± 30 PPM/°C	$\pm 15\%$ (-55°C to 125°C)
Capacitance Range	(M) 0.1 pF to 1000 pF (A) 0.1 pF to 5100 pF	0.001 μ F to 0.1 μ F
Operating Temperature	0.1 pF to 330 pF: from -55°C to +175°C 360 pF to 5100 pF: from -55°C to +125°C	-55°C to +125°C
Quality Factor (Q)	M Dielectric A & B Case	Greater than 10,000 at 1 MHz
	A Dielectric B Case	Greater than 10,000 at 1 MHz Greater than 2,000 at 1 MHz Greater than 2,000 at 1 KHz
	A Dielectric A Case	Greater than 10,000 at 1 MHz Greater than 2,000 at 1 MHz
Insulation Resistance (IR)	0.1 pF to 470 pF 10^6 Megohms min. @ 25°C at rated WVDC 10^5 Megohms min. @ 125°C at rated WVDC 510 pF to 5100 pF 10^5 Megohms min. @ 25°C at rated WVDC 10^4 Megohms min. @ 125°C at rated WVDC	10^4 Megohms min. @ 25°C at rated WVDC 10^3 Megohms min. @ 125°C at rated WVDC
Working Voltage (WVDC)	See Capacitance Values table	See Capacitance Values table
Dielectric Withstanding Voltage (DWV)	250% of rated WVDC for 5 secs (for 500V rated 150% of rated voltage)	250% of rated WVDC for 5 secs
Aging Effects	None	<3% per decade hour
Piezoelectric Effects	None	None
Capacitance Drift	\pm (0.02% or 0.02 pF), whichever is greater	Not Applicable

ENVIRONMENTAL CHARACTERISTICS

AVX SQLB will meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123

Thermal Shock	Mil-STD-202, Method 107, Condition A
Moisture Resistance	Mil-STD-202, Method 106
Low Voltage Humidity	Mil-STD-202, Method 103, condition A, with 1.5 VDC applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours
Life Test	Mil-STD-202, Method 108, for 2000 hours at 125°C
Shock	Mil-STD-202, Method 213, Condition J
Vibration	Mil-STD-202, Method 204, Condition B
Immersion	Mil-STD-202, Method 104, Condition B
Salt Spray	Mil-STD-202, Method 101, Condition B
Solderability	Mil-STD-202, Method 208
Terminal Strength	Mil-STD-202, Method 211
Temperature Cycling	Mil-STD-202, Method 102, Condition C
Barometric Pressure	Mil-STD-202, Method 105, Condition B
Resistance to Solder Heat	Mil-STD-202, Method 210, Condition C

TABLE I: TC: M (+90±20PPM/°C)
CASE SIZE 11, 12, 13 & 14

DIMENSIONS: inches (millimeters)

Case	Length	Width	Thickness	Band Width	Avail. Term.
11	.055±.015 (1.40±.381)	.055±.015 (1.40±.381)	.020/.057 (.508/1.45)	.010 +.010 -.005 (.254 +.254 -.127)	1 & 7
12	.055±.025 (1.40±.635)	.055±.015 (1.40±.381)	.020/.057 (.508/1.45)	.010 +.010 -.005 (.254 +.254 -.127)	J
13	.110±.020 (2.79±.508)	.110±.020 (2.79±.508)	.030/.102 (.762/2.59)	.015±.010 (.381±.254)	1 & 7
14	.110 +.035 -.020 (2.79 +.889 -.508)	.110±.020 (2.79±.508)	.030/.102 (.762/2.59)	.015±.010 (.381±.254)	J

Case: AQ11, AQ12		
Cap. pF	Cap. Tol.	WVDC
0.1	B	150
0.2	B	150
0.3	B,C	150
0.4	B,C	150
0.5	B, C, D	150
0.6	B, C, D	150
0.7	B, C, D	150
0.8	B, C, D	150
0.9	B, C, D	150
1.0	B, C, D	150
1.1	B, C, D	150
1.2	B, C, D	150
1.3	B, C, D	150
1.4	B, C, D	150
1.5	B, C, D	150
1.6	B, C, D	150
1.7	B, C, D	150
1.8	B, C, D	150
1.9	B, C, D	150
2.0	B, C, D	150
2.2	B, C, D	150
2.4	B, C, D	150
2.7	B, C, D	150
3.0	B, C, D	150
3.3	B, C, D	150
3.6	B, C, D	150
3.9	B, C, D	150
4.3	B, C, D	150
4.7	B, C, D	150
5.1	B, C, D	150
5.6	B, C, D	150
6.2	B, C, D	150
6.8	B, C, J, K, M	150
7.5	B, C, J, K, M	150
8.2	B, C, J, K, M	150
9.1	B, C, J, K, M	150
10	F, G, J, K, M	150
11	F, G, J, K, M	150
12	F, G, J, K, M	150
13	F, G, J, K, M	150
15	F, G, J, K, M	150
16	F, G, J, K, M	150
18	F, G, J, K, M	150
20	F, G, J, K, M	150
22	F, G, J, K, M	150
24	F, G, J, K, M	150
27	F, G, J, K, M	150
30	F, G, J, K, M	150
33	F, G, J, K, M	150
36	F, G, J, K, M	150
39	F, G, J, K, M	150
43	F, G, J, K, M	150
47	F, G, J, K, M	150
51	F, G, J, K, M	150
56	F, G, J, K, M	150
62	F, G, J, K, M	150
68	F, G, J, K, M	150
75	F, G, J, K, M	150
82	F, G, J, K, M	150
91	F, G, J, K, M	150
100	F, G, J, K, M	150

Case: AQ13, AQ14					
Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC
0.1	B	500	100	F, G, J, K, M	500
0.2	B	500	110	F, G, J, K, M	300
0.3	B,C	500	120	F, G, J, K, M	300
0.4	B,C	500	130	F, G, J, K, M	300
0.5	B, C, D	500	150	F, G, J, K, M	300
0.6	B, C, D	500	160	F, G, J, K, M	300
0.7	B, C, D	500	180	F, G, J, K, M	300
0.8	B, C, D	500	200	F, G, J, K, M	300
0.9	B, C, D	500	220	F, G, J, K, M	200
1.0	B, C, D	500	240	F, G, J, K, M	200
1.1	B, C, D	500	270	F, G, J, K, M	200
1.2	B, C, D	500	300	F, G, J, K, M	200
1.3	B, C, D	500	330	F, G, J, K, M	200
1.4	B, C, D	500	360	F, G, J, K, M	200
1.5	B, C, D	500	390	F, G, J, K, M	200
1.6	B, C, D	500	430	F, G, J, K, M	200
1.7	B, C, D	500	470	F, G, J, K, M	200
1.8	B, C, D	500	510	F, G, J, K, M	150
1.9	B, C, D	500	560	F, G, J, K, M	150
2.0	B, C, D	500	620	F, G, J, K, M	150
2.2	B, C, D	500	680	F, G, J, K, M	150
2.4	B, C, D	500	750	F, G, J, K, M	150
2.7	B, C, D	500	820	F, G, J, K, M	150
3.0	B, C, D	500	910	F, G, J, K, M	150
3.3	B, C, D	500	1000	F, G, J, K, M	150
3.6	B, C, D	500			
3.9	B, C, D	500			
4.3	B, C, D	500			
4.7	B, C, D	500			
5.1	B, C, D	500			
5.6	B, C, D	500			
6.2	B, C, D	500			
6.8	B, C, J, K, M	500			
7.5	B, C, J, K, M	500			
8.2	B, C, J, K, M	500			
9.1	B, C, J, K, M	500			
10	F, G, J, K, M	500			
11	F, G, J, K, M	500			
12	F, G, J, K, M	500			
13	F, G, J, K, M	500			
15	F, G, J, K, M	500			
16	F, G, J, K, M	500			
18	F, G, J, K, M	500			
20	F, G, J, K, M	500			
22	F, G, J, K, M	500			
24	F, G, J, K, M	500			
27	F, G, J, K, M	500			
30	F, G, J, K, M	500			
33	F, G, J, K, M	500			
36	F, G, J, K, M	500			
39	F, G, J, K, M	500			
43	F, G, J, K, M	500			
47	F, G, J, K, M	500			
51	F, G, J, K, M	500			
56	F, G, J, K, M	500			
62	F, G, J, K, M	500			
68	F, G, J, K, M	500			
75	F, G, J, K, M	500			
82	F, G, J, K, M	500			
91	F, G, J, K, M	500			

TABLE II: TC: A (0±30PPM/°C)
CASE SIZE 11, 12, 13 & 14

DIMENSIONS: inches (millimeters)

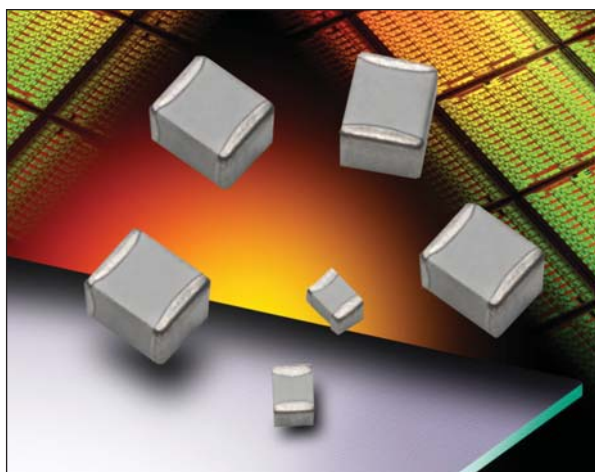
Case	Length	Width	Thickness	Band Width	Avail. Term.
11	.055±.015 (1.40±.381)	.055±.015 (1.40±.381)	.020/.057 (.508/1.45)	.010 +.010 -.005 (.254 +.254 -.127)	1 & 7
12	.055±.025 (1.40±.635)	.055±.015 (1.40±.381)	.020/.057 (.508/1.45)	.010 +.010 -.005 (.254 +.254 -.127)	J
13	.110±.020 (2.79±.508)	.110±.020 (2.79±.508)	.030/.102 (.762/2.59)	.015±.010 (.381±.254)	1 & 7
14	.110 +0.035 -0.020 (2.79 +.889 -.508)	.110±.020 (2.79±.508)	.030/.102 (.762/2.59)	.015±.010 (.381±.254)	J

Case: AQ11, AQ12					
Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC
0.1	B	150	24	F, G, J, K, M	150
0.2	B	150	27	F, G, J, K, M	150
0.3	B,C	150	30	F, G, J, K, M	150
0.4	B,C	150	33	F, G, J, K, M	150
0.5	B, C, D	150	36	F, G, J, K, M	150
0.6	B, C, D	150	39	F, G, J, K, M	150
0.7	B, C, D	150	43	F, G, J, K, M	150
0.8	B, C, D	150	47	F, G, J, K, M	150
0.9	B, C, D	150	51	F, G, J, K, M	150
1.0	B, C, D	150	56	F, G, J, K, M	150
1.1	B, C, D	150	62	F, G, J, K, M	150
1.2	B, C, D	150	68	F, G, J, K, M	150
1.3	B, C, D	150	75	F, G, J, K, M	150
1.4	B, C, D	150	82	F, G, J, K, M	150
1.5	B, C, D	150	91	F, G, J, K, M	150
1.6	B, C, D	150	100	F, G, J, K, M	150
1.7	B, C, D	150	110	F, G, J, K, M	50
1.8	B, C, D	150	120	F, G, J, K, M	50
1.9	B, C, D	150	130	F, G, J, K, M	50
2.0	B, C, D	150	150	F, G, J, K, M	50
2.2	B, C, D	150	160	F, G, J, K, M	50
2.4	B, C, D	150	180	F, G, J, K, M	50
2.7	B, C, D	150	200	F, G, J, K, M	50
3.0	B, C, D	150	220	F, G, J, K, M	50
3.3	B, C, D	150	240	F, G, J, K, M	50
3.6	B, C, D	150	270	F, G, J, K, M	50
3.9	B, C, D	150	300	F, G, J, K, M	50
4.3	B, C, D	150	330	F, G, J, K, M	50
4.7	B, C, D	150	360	F, G, J, K, M	50
5.1	B, C, D	150	390	F, G, J, K, M	50
5.6	B, C, D	150	430	F, G, J, K, M	50
6.2	B, C, D	150	470	F, G, J, K, M	50
6.8	B, C, J, K, M	150	510	F, G, J, K, M	50
7.5	B, C, J, K, M	150	560	F, G, J, K, M	50
8.2	B, C, J, K, M	150	620	F, G, J, K, M	50
9.1	B, C, J, K, M	150	680	F, G, J, K, M	50
10	F, G, J, K, M	150	750	F, G, J, K, M	50
11	F, G, J, K, M	150	820	F, G, J, K, M	50
12	F, G, J, K, M	150	910	F, G, J, K, M	50
13	F, G, J, K, M	150	1000	F, G, J, K, M	50
15	F, G, J, K, M	150			
16	F, G, J, K, M	150			
18	F, G, J, K, M	150			
20	F, G, J, K, M	150			
22	F, G, J, K, M	150			

Case: AQ13, AQ14					
Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC
0.1	B	500	51	F, G, J, K, M	500
0.2	B	500	56	F, G, J, K, M	500
0.3	B,C	500	62	F, G, J, K, M	500
0.4	B,C	500	68	F, G, J, K, M	500
0.5	B, C, D	500	75	F, G, J, K, M	500
0.6	B, C, D	500	82	F, G, J, K, M	500
0.7	B, C, D	500	91	F, G, J, K, M	500
0.8	B, C, D	500	100	F, G, J, K, M	500
0.9	B, C, D	500	110	F, G, J, K, M	300
1.0	B, C, D	500	120	F, G, J, K, M	300
1.1	B, C, D	500	130	F, G, J, K, M	300
1.2	B, C, D	500	150	F, G, J, K, M	300
1.3	B, C, D	500	160	F, G, J, K, M	300
1.4	B, C, D	500	180	F, G, J, K, M	300
1.5	B, C, D	500	200	F, G, J, K, M	300
1.6	B, C, D	500	220	F, G, J, K, M	200
1.7	B, C, D	500	240	F, G, J, K, M	200
1.8	B, C, D	500	270	F, G, J, K, M	200
1.9	B, C, D	500	300	F, G, J, K, M	200
2.0	B, C, D	500	330	F, G, J, K, M	200
2.2	B, C, D	500	360	F, G, J, K, M	200
2.4	B, C, D	500	390	F, G, J, K, M	200
2.7	B, C, D	500	430	F, G, J, K, M	200
3.0	B, C, D	500	470	F, G, J, K, M	200
3.3	B, C, D	500	510	F, G, J, K, M	150
3.6	B, C, D	500	560	F, G, J, K, M	150
3.9	B, C, D	500	620	F, G, J, K, M	150
4.3	B, C, D	500	680	F, G, J, K, M	150
4.7	B, C, D	500	750	F, G, J, K, M	150
5.1	B, C, D	500	820	F, G, J, K, M	150
5.6	B, C, D	500	910	F, G, J, K, M	150
6.2	B, C, D	500	1000	F, G, J, K, M	150
6.8	B, C, J, K, M	500	1100	F, G, J, K, M	50
7.5	B, C, J, K, M	500	1200	F, G, J, K, M	50
8.2	B, C, J, K, M	500	1300	F, G, J, K, M	50
9.1	B, C, J, K, M	500	1500	F, G, J, K, M	50
10	F, G, J, K, M	500	1600	F, G, J, K, M	50
11	F, G, J, K, M	500	1800	F, G, J, K, M	50
12	F, G, J, K, M	500	2000	F, G, J, K, M	50
13	F, G, J, K, M	500	2200	F, G, J, K, M	50
15	F, G, J, K, M	500	2400	F, G, J, K, M	50
16	F, G, J, K, M	500	2700	F, G, J, K, M	50
18	F, G, J, K, M	500	3000	F, G, J, K, M	50
20	F, G, J, K, M	500	3300	F, G, J, K, M	50
22	F, G, J, K, M	500	3600	F, G, J, K, M	50
24	F, G, J, K, M	500	3900	F, G, J, K, M	50
27	F, G, J, K, M	500	4300	F, G, J, K, M	50
30	F, G, J, K, M	500	4700	F, G, J, K, M	50
33	F, G, J, K, M	500	5000	F, G, J, K, M	50
36	F, G, J, K, M	500	5100	F, G, J, K, M	50
39	F, G, J, K, M	500			
43	F, G, J, K, M	500			
47	F, G, J, K, M	500			

TABLE III: TC: C (±15%) CASE SIZE 12 & 14

Case: AQ12									Case: AQ14								
Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC
1000	K, M, N	50	2200	K, M, N	50	5100	K, M, N	50	5000	K, M, N	50	15000	K, M, N	50	47000	K, M, N	50
1200	K, M, N	50	2700	K, M, N	50	5600	K, M, N	50	6800	K, M, N	50	18000	K, M, N	50	68000	K, M, N	50
1500	K, M, N	50	3300	K, M, N	50	6800	K, M, N	50	8200	K, M, N	50	27000	K, M, N	50	82000	K, M, N	50
1800	K, M, N	50	3900	K, M, N	50	8200	K, M, N	50	10000	K, M, N	50	33000	K, M, N	50	100000	K, M, N	50
2000	K, M, N	50	4700	K, M, N	50	10000	K, M, N	50	12000	K, M, N	50	39000	K, M, N	50			



SQCB (1111) are AVX's Ultra Low ESR microwave capacitors. Suitable for RF Power Amplifiers, they come in non-mag termination for MRI applications. They offer very High Q & resonant frequency and power handling capability.

FEATURES:

- Low ESR
- High Q
- High Self Resonance
- Capacitance Range
0.1 pF to 5100 pF
- 175°C Capability SQCB

APPLICATIONS:

- RF Power Amplifiers
- Low Noise Amplifiers
- Filter Networks
- MRI Systems

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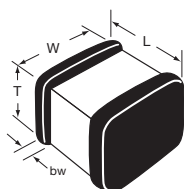
HOW TO ORDER

SQ	CB	7	M	100	J	A	T	1A
AVX Style SQ	Case Size CB = * *See Mechanical dimensions below	Voltage Code 5 = 50V E = 150V 2 = 200V V = 250V 9 = 300V 7 = 500V	Temperature Coefficient Code M = +90±20ppm/°C A = 0±30ppm/°C C = 15% (*J Termination only)	Capacitance EIA Capacitance Code in pF. First two digits = significant figures or "R" for decimal place. Third digit = number of zeros or after "R" significant figures.	Capacitance Tolerance Code B = ±.1 pF C = ±.25 pF D = ±.5 pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±20% N = ±30%	Failure Rate Code A = Not Applicable	Termination Style Code **1 = Pd/Ag **7 = Ag/Ni/Au J = Nickel Barrier Tin/Lead (60/40) **T = 100% Tin	Packaging Code 1A = 7" Reel Unmarked 6A = Waffle Pack Unmarked ME = 7" Reel Marked WE = Waffle Pack Unmarked *Vertical T&R available *500 piece reels available
							**RoHS compliant	

Not RoHS Compliant



For RoHS compliant products, please select correct termination style.



MECHANICAL DIMENSIONS: inches (millimeters)

Case	Length (L)	Width (W)	Thickness (T)	Band Width (bw)
SQCB*	.110 + .020 - .010 (2.79 +.508 -.254)	.110±.010 (2.79±.254)	.030/.102 (.762/2.59)	.015±.010 (.381±.254)

TAPE & REEL: All tape and reel specifications are in compliance with EIA RS481 (equivalent to IEC 286 part 3).

- 8mm carrier
- 7" reel: SQCB = 1000 pcs

WAFFLE PACK

SQCB 100 pcs

ELECTRICAL SPECIFICATIONS

		M & A	C
Temperature Coefficient (TCC)		(M) $+90 \pm 20$ PPM/°C (-55°C to +125°C) (M) $+90 \pm 30$ PPM/°C (+125°C to +175°C)* (A) 0 ± 30 PPM/°C	$\pm 15\%$ (-55°C to 125°C)
Capacitance Range		(M) 0.1 pF to 1000 pF (A) 0.1 pF to 5100 pF	0.001 μ F to 0.1 μ F
Operating Temperature		0.1 pF to 330 pF: from -55°C to +175°C* 360 pF to 5100 pF: from -55°C to +125°C	-55°C to +125°C
Quality Factor (Q)	M Dielectric B Case	Greater than 10,000 at 1 MHz	2.5% @ 1kHz
	A Dielectric B Case	Greater than 10,000 at 1 MHz Greater than 2,000 at 1 MHz Greater than 2,000 at 1 KHz	0.1 - 200 pF 220 - 1000 pF 1100 - 5100 pF
Insulation Resistance (IR)		0.2 pF to 470 pF 10^6 Megohms min. @ 25°C at rated WVDC 10^5 Megohms min. @ 125°C at rated WVDC 510 pF to 5100 pF 10^5 Megohms min. @ 25°C at rated WVDC 10^4 Megohms min. @ 125°C at rated WVDC	10^4 Megohms min. @ 25°C at rated WVDC 10^3 Megohms min. @ 125°C at rated WVDC
Working Voltage (WVDC)		See Capacitance Values table	See Capacitance Values table
Dielectric Withstanding Voltage (DWV)		250% of rated WVDC for 5 secs (for 500V rated 150% of rated voltage)	250% of rated WVDC for 5 secs
Aging Effects		None	<3% per decade hour
Piezoelectric Effects		None	None
Capacitance Drift		\pm (0.02% or 0.02 pF), whichever is greater	Not Applicable

* 175 SQCB & SOLB only

ENVIRONMENTAL CHARACTERISTICS

AVX SQ will meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123

Thermal Shock	Mil-STD-202, Method 107, Condition A
Moisture Resistance	Mil-STD-202, Method 106
Low Voltage Humidity	Mil-STD-202, Method 103, condition A, with 1.5 VDC applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours
Life Test	Mil-STD-202, Method 108, for 2000 hours at 125°C
Shock	Mil-STD-202, Method 213, Condition J
Vibration	Mil-STD-202, Method 204, Condition B
Immersion	Mil-STD-202, Method 104, Condition B
Salt Spray	Mil-STD-202, Method 101, Condition B
Solderability	Mil-STD-202, Method 208
Terminal Strength	Mil-STD-202, Method 211
Temperature Cycling	Mil-STD-202, Method 102, Condition C
Barometric Pressure	Mil-STD-202, Method 105, Condition B
Resistance to Solder Heat	Mil-STD-202, Method 210, Condition C

AVAILABLE CAPACITANCE/SIZE/WVDC/T.C.

Case Size B

TABLE IV: TC: M (+90±20PPM/°C)

Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC
0.1	B	500	2.7	B, C, D	500	20	F, G, J, K	500	150	F, G, J, K	300
0.2	B	500	3.0	B, C, D	500	22	F, G, J, K	500	160	F, G, J, K	300
0.3	B,C	500	3.3	B, C, D	500	24	F, G, J, K	500	180	F, G, J, K	300
0.4	B,C	500	3.6	B, C, D	500	27	F, G, J, K	500	200	F, G, J, K	300
0.5	B, C, D	500	3.9	B, C, D	500	30	F, G, J, K	500	220	F, G, J, K	200
0.6	B, C, D	500	4.3	B, C, D	500	33	F, G, J, K	500	240	F, G, J, K	200
0.7	B, C, D	500	4.7	B, C, D	500	36	F, G, J, K	500	270	F, G, J, K	200
0.8	B, C, D	500	5.1	B, C, D	500	39	F, G, J, K	500	300	F, G, J, K	200
0.9	B, C, D	500	5.6	B, C, D	500	43	F, G, J, K	500	330	F, G, J, K	200
1.0	B, C, D	500	6.2	B, C, D	500	47	F, G, J, K	500	360	F, G, J, K	200
1.1	B, C, D	500	6.8	B, C, J, K	500	51	F, G, J, K	500	390	F, G, J, K	200
1.2	B, C, D	500	7.5	B, C, J, K	500	56	F, G, J, K	500	430	F, G, J, K	200
1.3	B, C, D	500	8.2	B, C, J, K	500	62	F, G, J, K	500	470	F, G, J, K	200
1.4	B, C, D	500	9.1	B, C, J, K	500	68	F, G, J, K	500	510	F, G, J, K	150
1.5	B, C, D	500	10	F, G, J, K	500	75	F, G, J, K	500	560	F, G, J, K	150
1.6	B, C, D	500	11	F, G, J, K	500	82	F, G, J, K	500	620	F, G, J, K	150
1.7	B, C, D	500	12	F, G, J, K	500	91	F, G, J, K	500	680	F, G, J, K	150
1.8	B, C, D	500	13	F, G, J, K	500	100	F, G, J, K	500	750	F, G, J, K	150
1.9	B, C, D	500	15	F, G, J, K	500	110	F, G, J, K	300	820	F, G, J, K	150
2.0	B, C, D	500	16	F, G, J, K	500	120	F, G, J, K	300	910	F, G, J, K	150
2.2	B, C, D	500	18	F, G, J, K	500	130	F, G, J, K	300	1000	F, G, J, K	150
2.4	B, C, D	500									

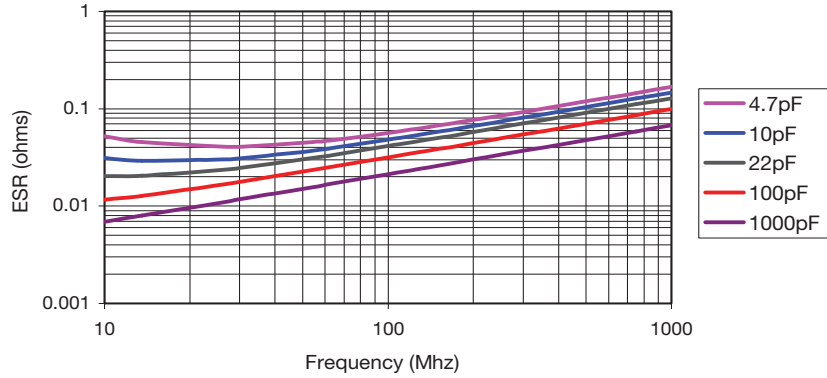
TABLE V: TC: A (0±30PPM/°C)

Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC
0.1	B	500	3.9	B, C, D	500	47	F, G, J, K	500	560	F, G, J, K	150
0.2	B	500	4.3	B, C, D	500	51	F, G, J, K	500	620	F, G, J, K	150
0.3	B,C	500	4.7	B, C, D	500	56	F, G, J, K	500	680	F, G, J, K	150
0.4	B,C	500	5.1	B, C, D	500	62	F, G, J, K	500	750	F, G, J, K	150
0.5	B, C, D	500	5.6	B, C, D	500	68	F, G, J, K	500	820	F, G, J, K	150
0.6	B, C, D	500	6.2	B, C, D	500	75	F, G, J, K	500	910	F, G, J, K	150
0.7	B, C, D	500	6.8	B, C, J, K	500	82	F, G, J, K	500	1000	F, G, J, K	150
0.8	B, C, D	500	7.5	B, C, J, K	500	91	F, G, J, K	500	1100	F, G, J, K	50
0.9	B, C, D	500	8.2	B, C, J, K	500	100	F, G, J, K	500	1200	F, G, J, K	50
1.0	B, C, D	500	9.1	B, C, J, K	500	110	F, G, J, K	300	1300	F, G, J, K	50
1.1	B, C, D	500	10	F, G, J, K	500	120	F, G, J, K	300	1500	F, G, J, K	50
1.2	B, C, D	500	11	F, G, J, K	500	130	F, G, J, K	300	1600	F, G, J, K	50
1.3	B, C, D	500	12	F, G, J, K	500	150	F, G, J, K	300	1800	F, G, J, K	50
1.4	B, C, D	500	13	F, G, J, K	500	160	F, G, J, K	300	2000	F, G, J, K	50
1.5	B, C, D	500	15	F, G, J, K	500	180	F, G, J, K	300	2200	F, G, J, K	50
1.6	B, C, D	500	16	F, G, J, K	500	200	F, G, J, K	300	2400	F, G, J, K	50
1.7	B, C, D	500	18	F, G, J, K	500	220	F, G, J, K	200	2700	F, G, J, K	50
1.8	B, C, D	500	20	F, G, J, K	500	240	F, G, J, K	200	3000	F, G, J, K	50
1.9	B, C, D	500	22	F, G, J, K	500	270	F, G, J, K	200	3300	F, G, J, K	50
2.0	B, C, D	500	24	F, G, J, K	500	300	F, G, J, K	200	3600	F, G, J, K	50
2.2	B, C, D	500	27	F, G, J, K	500	330	F, G, J, K	200	3900	F, G, J, K	50
2.4	B, C, D	500	30	F, G, J, K	500	360	F, G, J, K	200	4300	F, G, J, K	50
2.7	B, C, D	500	33	F, G, J, K	500	390	F, G, J, K	200	4700	F, G, J, K	50
3.0	B, C, D	500	36	F, G, J, K	500	430	F, G, J, K	200	5000	F, G, J, K	50
3.3	B, C, D	500	39	F, G, J, K	500	470	F, G, J, K	200	5100	F, G, J, K	50
3.6	B, C, D	500	43	F, G, J, K	500	510	F, G, J, K	150			

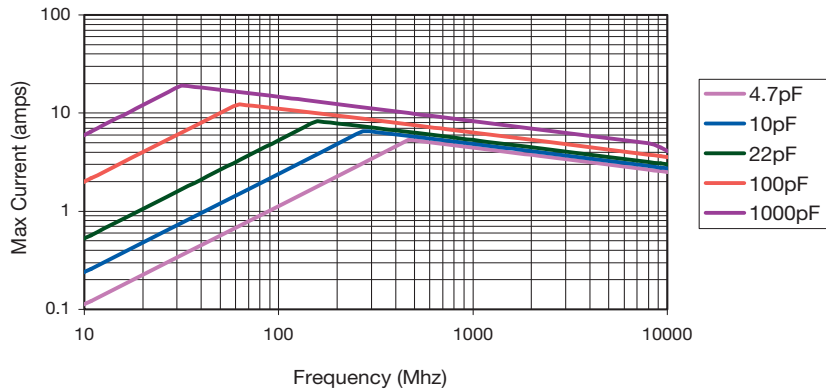
TABLE VI: TC: C (±15%)

Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC	Cap. pF	Cap. Tol.	WVDC
5000	K, M, N	50	15000	K, M, N	50	47000	K, M, N	50
6800	K, M, N	50	18000	K, M, N	50	68000	K, M, N	50
8200	K, M, N	50	27000	K, M, N	50	82000	K, M, N	50
10000	K, M, N	50	33000	K, M, N	50	100000	K, M, N	50
12000	K, M, N	50	39000	K, M, N	50			

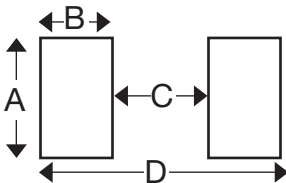
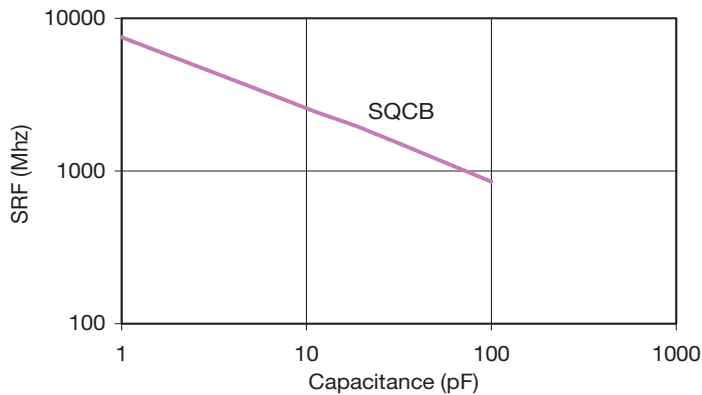
Typical ESR SQCB



SQCB Max Current



Series Resonant Frequency



MOUNTING PAD DIMENSIONS:

inches (millimeters)

A min	B min	C min	D min
0.131 (3.327)	0.051 (1.295)	0.074 (1.880)	0.177 (4.496)

DESIGN KITS

PN	Diel	Term	Range	Different Values	# per value
KITSQ800LF KITSQ1100LF	P90 C0G	100% Tin RoHS	1 to 10pF	16	15
KITSQ900LF KITSQ1200LF	P90 C0G	100% Tin RoHS	10 to 100pF	16	15
KITSQ1000LF KITSQ1300LF	P90 C0G	100% Tin RoHS	100 to 1000pF	16	15
KITSQ1400LF	C0G	100% Tin RoHS	1000 to 5100 pF	11	15

CIRCUIT PROTECTION & SIGNAL INTEGRITY

AVX multi-layer varistors (MLVs) help to protect sensitive electronic systems against electrostatic discharge (ESD) and other transients while reducing EMI/RFI.

High temperature circuit protection solutions include:

- **High Temperature CANBUS MLV**

Multi-Layer varistors designed and manufactured for protecting high frequency CANBUS communications lines in high temperature applications. Products have been tested, qualified, and specified to 150°C.

- **High Temperature Low Leakage MLV**

Multi-Layer varistors designed and manufactured for high temperature applications requiring low leakage circuit protection components. Products have been tested, qualified, and specified to 150°C.

- **Radial Leaded High Temperature MLV**

High Temperature Multi-Layer Varistors designed for protection and EMI/RFI filtering of sensitive circuits in high temperature applications. These varistors have been built for durability in harsh environments. Products have been tested, qualified, and specified to 150°C.





AVX High Temperature Multi-Layer Varistors are designed for underhood applications. Products have been tested, qualified, and specified to 150°C. The MLV advantage is EMI/RFI attenuation in the off state. This allows designers the ability to combine the circuit protection and EMI/RFI attenuation function into a single highly reliable device.

FEATURES

- Operating Temperature: -55°C to +150°C
- AEC Q200 qualified
- ESD rating to 25kV contact
- EMI/RFI attenuation in off state
- Excellent current and energy handling

APPLICATIONS

- Under hood
- Down Hole Drilling
- High temperature applications
- Communication Bus
- Sensors
- RF Circuits
- Capacitance sensitive applications and more

CAN SERIES

HOW TO ORDER

CAN	AT	01	R	P	
Type	Series	Case Size	Packaging	Termination	
Controlled Area Network Varistor	Automotive High Temperature	01 = 0603 02 = 0405 2-Element 04 = 0612 4-Element	D = 7" (1000 pcs) R = 7" (4,000 pcs) T = 13" (10,000pcs)	P = Ni Barrier/ 100% Sn (matte)	

AVX Part Number	V _W (DC)	V _W (AC)	V _B	I _L	E _T	I _P	Cap	Case Size	Elements
CANAT01--	≤ 18	≤ 14	120	10	0.015	4	22	0603	1
CANAT02--	≤ 18	≤ 14	70	10	0.015	4	22	0405	2
CANAT04--	≤ 18	≤ 14	100	10	0.015	4	22	0612	4

V _W (DC) DC Working Voltage [V]	I _L Maximum leakage current at the working voltage [μA]
V _W (AC) AC Working Voltage [V]	E _T Transient Energy Rating [J, 10x1000μS]
V _B Breakdown Voltage [V @ 1mA _{DC}]	I _P Peak Current Rating [A, 8x20μS]
V _C Clamping Voltage [V @ IVC]	Cap Capacitance [pF] @ 1KHz specified and 0.5VRMS

ANTENNAGUARD SERIES

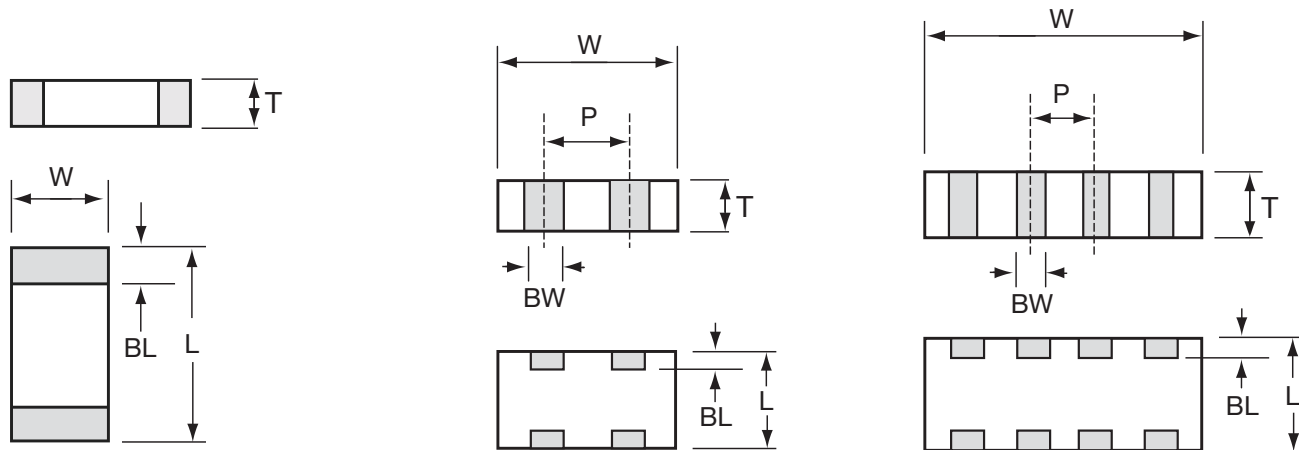
HOW TO ORDER

VCAT	06	AG	18	120	Y	A	T	1	A
Type	Case Size	Varistor Series	Working Voltage	Cap	Non-Std. Cap Tolerance	N/A	Termination Finish	Reel Size	Reel Quantity
High Temperature Varistor	04 = 0402 06 = 0603	AntennaGuard	18 = 18Vdc				P = Ni Barrier/ 100% Sn	1 = 7" 3 = 13"	A = 4000 or 10,000

AVX Part Number	V _W (DC)	V _W (AC)	I _L	Cap	Cap Tolerance	Case Size
VCAT06AG18120YAT--	≤ 18	≤ 14	10	12	+4, -2pF	0603

V _W (DC) DC Working Voltage [V]	I _L Maximum leakage current at the working voltage [μA]
V _W (AC) AC Working Voltage [V]	Cap Capacitance [pF] @ 1KHz specified and 0.5VRMS

PHYSICAL DIMENSIONS



0603 Discrete Dimensions

mm (inches)

L	W	T	BW	BL	P
1.60±0.15 (0.063±0.006)	0.80±0.15 (0.032±0.006)	0.90 MAX (0.035 MAX)	N/A	0.35±0.15 (0.014±0.006)	N/A

0405 2 Elements Array Dimensions

mm (inches)

L	W	T	BW	BL	P
1.00±0.15 (0.039±0.006)	1.37±0.15 (0.054±0.006)	0.66 MAX (0.026 MAX)	0.36±0.10 (0.014±0.004)	0.20±0.10 (0.008±0.004)	0.64 REF (0.025 REF)

0612 4 Elements Array Dimensions

mm (inches)

L	W	T	BW	BL	P
1.60±0.20 (0.063±0.008)	3.20±0.20 (0.126±0.008)	1.22 MAX (0.048 MAX)	0.41±0.10 (0.016±0.004)	0.18 ^{+0.25} _{-0.08} (0.008 ^{+0.010} _{-0.003})	0.76 REF (0.030 REF)



GENERAL DESCRIPTION

AVX High Temperature Low Leakage Multi-Layer Varistors are designed for under-hood and high temperature applications where low leakage component is required. Parts are tested, qualified and specified to 150°C.

The MLV advantage is EMI/RFI attenuation in the off state. This allows designers the ability to combine the circuit protection and EMI/RFI attenuation function into a single highly reliable device.

GENERAL CHARACTERISTICS

- Operating Temperature: -55°C to 150°C

FEATURES

- Rated at 150°C
- AEC Q200 qualified
- ESD rating to 25kV (HBM ESD Level 6)
- EMI/RFI attenuation in off state
- Very Low Leakage

APPLICATIONS

- Under hood
- High temperature applications
- Bus Interface Protection
- CAN Bus
- BCM, TCU
- Capacitance sensitive applications and more

COMMUNICATION BUS - HIGH TEMPERATURE LOW LEAKAGE VARISTOR

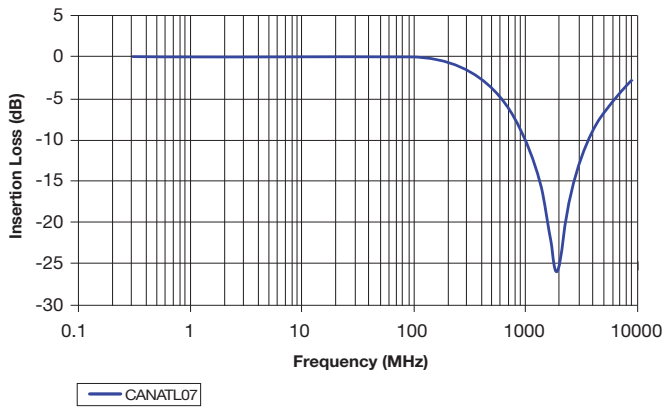
HOW TO ORDER

CAN	ATL	07	R	P	
Type	Series	Case Size	Packaging	Termination	
Controlled Area Network Varistor	Automotive High Temperature Low Leakage	07 = 0603	D = 7" (1000 pcs) R = 7" (4,000 pcs) T = 13" (10,000 pcs)	P = Ni Barrier/100% Sn	

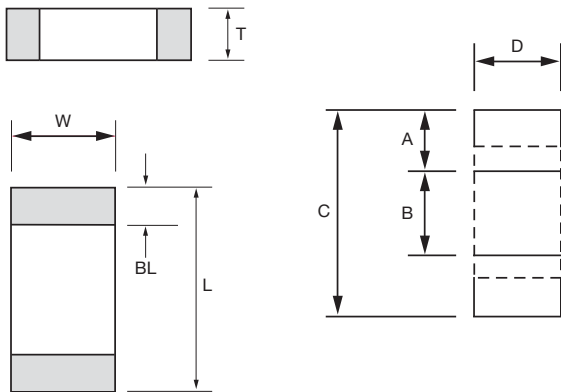
PN	V _w (DC)	V _w (AC)	V _B	V _C	I _{VC}	I _{L1}	I _{L2}	E _T	I _P	Typ Cap	Cap Tol	Freq	V _{Jump}	P _{Diss max}
CANATL07	32	25	61±15%	120	1	1	<1	0.05	5	10	±50%	M	27	0.003

V _w (DC)	DC Working Voltage [V]	I _{L2}	Typical leakage current at 28Vdc, 25°C [µA]
V _w (AC)	AC Working Voltage [V]	E _T	Transient Energy Rating [J, 10x1000µS]
V _B	Breakdown Voltage [V @ 1mA _{DC} , 25°C]	I _P	Peak Current Rating [A, 8x20µS]
V _C	Clamping Voltage [V @ I _{VC}]	Cap	Capacitance [pF] @ 1KHz specified and 0.5V _{RMS}
I _{VC}	Test Current for VC [A, 8x20µs]	V _{Jump}	Jump Start [V, 5 min]
I _{L1}	Maximum leakage current at the working voltage, 25°C [µA]	P _{DISS}	Max Power Dissipation [W]

S21 CHARACTERISTICS



PHYSICAL DIMENSIONS AND RECOMMENDED PAD LAYOUT



0603 Discrete Dimensions mm (inches)

L	W	T	BL
1.60±0.15 (0.063±0.006)	0.80±0.15 (0.032±0.006)	0.90 MAX (0.035 MAX)	0.35±0.15 (0.014±0.006)

0603 Soldering Pad mm (inches)

A	B	C	D
0.89 (0.035)	0.76 (0.030)	2.54 (0.100)	0.76 (0.030)



GENERAL DESCRIPTION

AVX High Temperature Multi-Layer Varistors are designed for underhood applications. Products have been tested, qualified, and specified to 150°C. The Radial Leaded TransGuard is built for durability in harsh environments. The MLV advantage is EMI/RFI attenuation in the off state. This allows designers to combine the circuit protection and EMI/RFI attenuation function into a single highly reliable device.

GENERAL CHARACTERISTICS

- Operating Temperatures:
-55°C to +150°C
- Working Voltage:
14-48Vdc

FEATURES

- Rated at 150°C
- AEC Q200 qualified
- ESD rated to 25kV (HBM ESD Level 6)
- EMI/RFI attenuation in off state
- Excellent current and energy handling

APPLICATIONS

- Under hood
- Down Hole Drilling
- DC Motors
- Relays
- Inductive Loads
- High Temperature/Harsh environment and more

HOW TO ORDER

VR15	AT	18	A	650	R	TR2
AVX Style VR15 VR20	Series AT = 150°C Automotive	Voltage 14 = 14V 18 = 18V 26 = 26V 48 = 48V	Energy A = 0.1J D = 0.4J S = 2.0J	Clamping Voltage 580 = 60V 650 = 67V 101 = 100V 151 = 150V	Leads R = RoHS Compliant	Packaging Blank = Bulk TR1 = T&R Standard 1 TR2 = T&R Standard 2

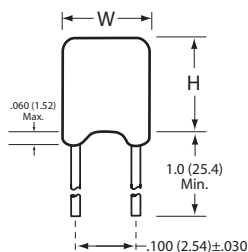


ELECTRICAL CHARACTERISTICS

AVX Part Number	V _{W DC}	V _{W AC}	V _B	V _C	I _{VC}	I _L	ET	ELD	IP	Cap	Freq	V _{JUMP}	P _{DISS}
VR15AT14A580	14.0	10.0	34.5±10%	60	1	10	0.1	0.15	30	120	K	27.5	0.002
VR15AT18A650	18.0	13.0	41.0±10%	67	1	10	0.1	0.15	30	90	M	29	0.002
VR20AT26D101	26.0	18.0	62.0±10%	100	1	10	0.4	1.5	100	225	K	48	0.008
VR20AT48S151	48.0	34.0	100.0±10%	150	1	10	2.0	3.5	250	275	K	48	0.040

V _{W(DC)}	DC Working Voltage [V]	E _t	Transient Energy Rating [J, 10x1000µS]
V _{W(AC)}	AC Working Voltage [V]	E _{LD}	Load Dump Energy (x10) [J]
V _B	Typical Breakdown Voltage [V @ 1mA _{DC}]	I _p	Peak Current Rating [A, 8x20µS]
V _C	Clamping Voltage [V @ I _{VC}]	Cap	Typical capacitance [pF] @ frequency specified and 0.5V _{RMS}
I _{VC}	Test Current for V _C	V _{JUMP}	Jump Start (V)
I _L	Maximum leakage current at the working voltage [µA]	P _{DISS}	Power Dissipation (W)

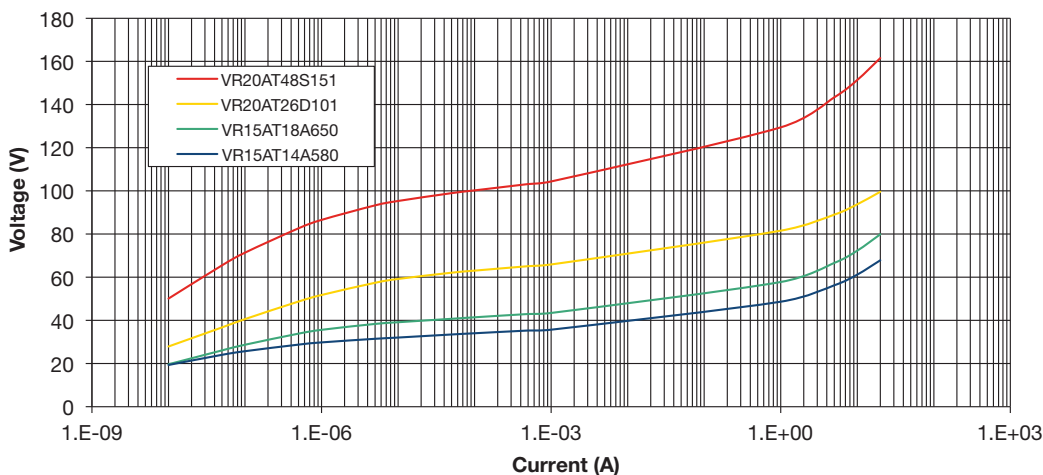
PHYSICAL DIMENSIONS



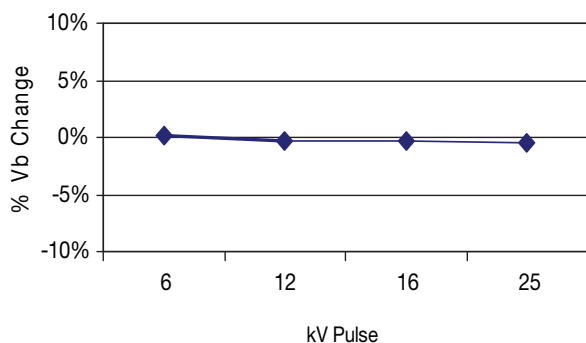
AVX Style	mm (inches)				
	Width (W)	Height (H)	Thickness (T)	Lead Spacing	Lead Diameter
VR15	4.32 Max. (0.170)	3.81 Max. (0.150)	2.54 Max. (0.100)	2.54 (0.100)	0.508 (0.020)
VR20	5.59 Max. (0.220)	5.08 Max. (0.200)	3.175 Max. (0.125)	2.54 (0.100)	0.508 (0.020)

TYPICAL PERFORMANCE CURVES

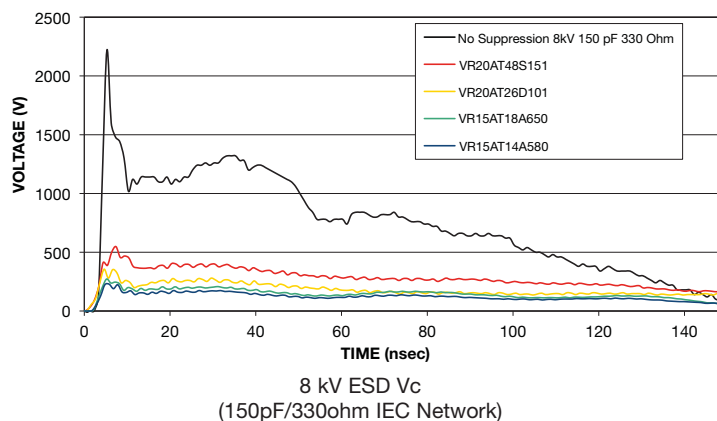
Typical Voltage Current Characteristics



AEC-Q200-002 ESD Characteristics



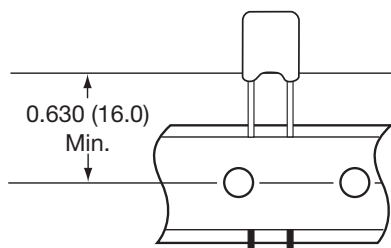
ESD Wave Absorption Characteristics



TAPE & REEL PACKAGING OPTIONS

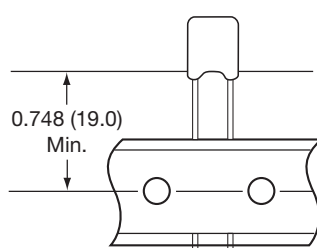
TR1

Tape & Reel Standard 1



TR2

Tape & Reel Standard 2



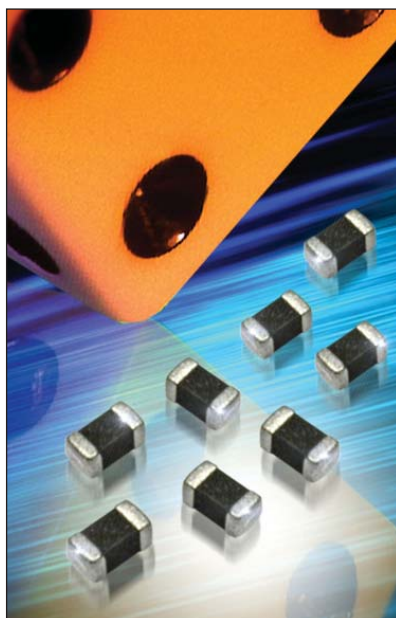
NTC THERMISTORS

AVX NTC thermistors are high quality devices that can be used for temperature compensation, temperature control and high in-rush current protection of sensitive circuitry.

NTC Thermistor Solutions Include:

- **NTC SMD Thermistors**
NTC thermistors especially developed for surface mounting applications, available in 0603, 0805 and 1206 case sizes. Products are specified to +150°C.
- **NTC Leaded Disc Thermistors**
Leaded thermistors designed and built for harsh environment applications. Products are specified to +150°C





Chip thermistors are a high quality and low cost device especially developed for surface mounting applications. They are widely used for temperature compensation but can also achieve temperature control of printed circuits.

A nickel barrier metallization provides outstanding qualities of solderability and enables this chip to meet the requirements of the most severe soldering processes.

APPLICATIONS

- LCD compensation
- CD players
- Heating systems
- Air-conditioning systems
- Compensation of pressure sensors
- Temperature control of Switch Mode Power Supplies
- Protection of power transistors in various electronic circuits

CHECK FOR UP-TO-DATE DATASHEET AT
<http://www.avx.com/docs/catalogs/nb12-20.pdf>

Types	NB 12 IEC SIZE : 0805	NB 20 IEC SIZE : 1206
DIMENSIONS: millimeters (inches)		
Terminations	Nickel Barrier	
Marking	On packaging only	
Climatic category	40/125/56	
Operating temperature	-55°C to +150°C	
Tolerance on R _n (25°C)	±5%, ±10%, ±20%	
Maximum dissipation at 25°C	0.12 W	0.24 W
Thermal dissipation factor	2 mW/°C	4 mW/°C
Thermal time constant	5 s	7s

HOW TO ORDER

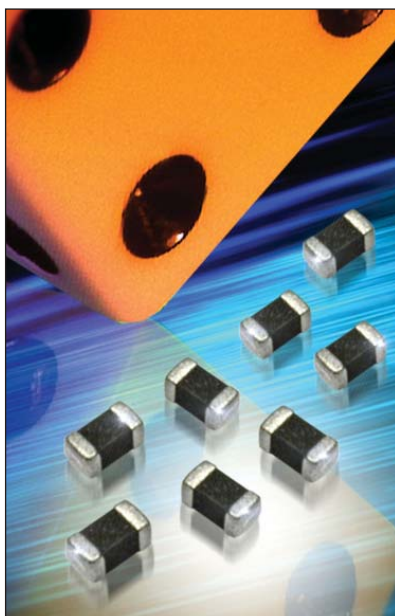
NB 12	K 0	0103	M	BA
Type	Material Code	Resistance	Tolerance	Suffix: Packaging
NB = Ni Barrier NB12 = 0805 NB20 = 1206 NB21 = 0603	K	10,000 Ω	M (±20%) J (±5%) K (±10%)	--: Bulk
			0603, 0805	1206
			BB: Cardboard tape (180mm diam. reel) BF: Cardboard tape (1/2 reel) BD: Cardboard tape (330mm diam. reel)	BA: Plastic tape (180mm diam. reel) BE: Plastic tape (1/2 reel) BC: Plastic tape (330mm diam. reel)



TABLE OF VALUES

NB 12 IEC SIZE : 0805				
Types	Rn at 25°C (Ω)	Material Code	B (K) ($\frac{\Delta B}{B}$ (1) ± 5% (2) ± 3%)	α at 25°C (%/°C)
NB 12 KC 0 180	18	KC	3470 ± 5%	- 3.9
NB 12 KC 0 220	22			
NB 12 KC 0 270	27			
NB 12 KC 0 330	33			
NB 12 KC 0 390	39			
NB 12 KC 0 470	47			
NB 12 KC 0 560	56			
NB 12 KC 0 680	68			
NB 12 KC 0 820	82			
NB 12 KC 0 101	100			
NB 12 MC 0 121	120	MC	3910 ± 3%	- 4.4
NB 12 MC 0 151	150			
NB 12 MC 0 181	180			
NB 12 MC 0 221	220			
NB 12 MC 0 271	270			
NB 12 MC 0 331	330			
NB 12 MC 0 391	390			
NB 12 MC 0 471	470			
NB 12 MC 0 561	560			
NB 12 MC 0 681	680			
NB 12 MC 0 821	820			
NB 12 MC 0 102	1,000			
NB 12 MC 0 122	1,200			
NB 12 MC 0 152	1,500			
NB 12 MC 0 182	1,800			
NB 12 MC 0 222	2,200			
NB 12 MC 0 272	2,700			
NB 12 MC 0 332	3,300			
NB 12 J 0 0332	3,300	J	3480 ± 3%	- 3.9
NB 12 J 0 0392	3,900			
NB 12 J 0 0472	4,700			
NB 12 J 0 0562	5,600			
NB 12 K 0 0682	6,800	K	3630 ± 3%	- 4.0
NB 12 K 0 0822	8,200			
NB 12 K 0 0103	10,000			
NB 12 L 0 0123	12,000	L	3790 ± 3%	- 4.2
NB 12 L 0 0153	15,000			
NB 12 M 0 0183	18,000	M	3950 ± 3%	- 4.4
NB 12 M 0 0223	22,000			
NB 12 M 0 0273	27,000			
NB 12 M 0 0333	33,000			
NB 12 N 0 0393	39,000	N	4080 ± 3%	- 4.6
NB 12 N 0 0473	47,000			
NB 12 N 0 0563	56,000			
NB 12 L 2 0683	68,000	L2	3805 ± 3%	- 4.1
NB 12 N 5 0683	68,000	N5	4160 ± 3%	- 4.7
NB 12 N 5 0823	82,000			
NB 12 P 0 0104	100,000	P	4220 ± 3%	- 4.7
NB 12 SC 0104	100,000	SC	4500 ± 3%	- 4.8
NB 12 P 0 0124	120,000	P	4220 ± 3%	- 4.7
NB 12 P 0 0154	150,000			
NB 12 P 0 0184	180,000			
NB 12 Q 0 0224	220,000	Q	4300 ± 3%	- 4.7
NB 12 Q 0 0274	270,000			
NB 12 R 0 0105	1,000,000	R	4400 ± 3%	- 4.8

NB 20 IEC SIZE : 1206				
Types	Rn at 25°C (Ω)	Material Code	B (K) ($\frac{\Delta B}{B}$ (1) ± 5% (2) ± 3%)	α at 25°C (%/°C)
NB 20 MC 0 221	220	MC	3910 ± 3%	- 4.4
NB 20 MC 0 102	1,000	MC	3910 ± 3%	- 4.4
NB 20 J 0 0472	4,700	J	3480 ± 3%	- 3.9
NB 20 J 0 0562	5,600			
NB 20 J 0 0682	6,800			
NB 20 J 5 0822	8,200	J5	3480 ± 3%	- 3.9
NB 20 K 0 0103	10,000	K	3630 ± 3%	- 4.0
NB 20 K 0 0123	12,000			
NB 20 L 0 0153	15,000	L	3790 ± 3%	- 4.2
NB 20 L 0 0183	18,000			
NB 20 L 0 0223	22,000			
NB 20 M 0 0273	27,000	M	3950 ± 3%	- 4.4
NB 20 M 0 0333	33,000			
NB 20 M 0 0393	39,000			
NB 20 M 0 0473	47,000			
NB 20 N 0 0563	56,000	N	4080 ± 3%	- 4.6
NB 20 N 0 0683	68,000			
NB 20 N 0 0823	82,000			
NB 20 N 5 0104	100,000	N5	4160 ± 3%	- 4.7
NB 20 P 0 0124	120,000	P	4220 ± 3%	- 4.7
NB 20 P 0 0154	150,000			
NB 20 P 0 0184	180,000			
NB 20 P 0 0224	220,000			
NB 20 Q 0 0274	270,000	Q	4300 ± 3%	- 4.7
NB 20 Q 0 0334	330,000			
NB 20 Q 0 0394	390,000			
NB 20 Q 0 0474	470,000			
NB 20 Q 0 0564	560,000	R	4400 ± 3%	- 4.8
NB 20 R 0 0684	680,000			
NB 20 R 0 0824	820,000			
NB 20 R 0 0105	1,000,000			



Chip thermistors are high quality and low cost devices especially developed for surface mounting applications. They are widely used for temperature compensation but can also achieve temperature control of printed circuits.

A nickel barrier metallization provides outstanding qualities of solderability and enables this chip to meet the requirements of the most severe soldering processes.

APPLICATIONS

- LCD compensation
- Battery packs
- Mobile phones
- CD players
- Heating systems
- Air-conditioning systems
- Temperature control of Switch Mode Power Supplies
- Compensation of pressure sensors
- Protection of power transistors in various electronic circuits

CHECK FOR UP-TO-DATE DATASHEET AT
<http://www.avx.com/docs/catalogs/nb21.pdf>

Types	NB 21 IEC SIZE : 0603
DIMENSIONS: millimeters (inches)	
Terminations	Nickel Barrier
Marking	On packaging only
Climatic category	40/125/56
Operating temperature	-55°C to +150°C
Tolerance on R _n (25°C)	±5%, ±10%, ±20%
Maximum dissipation at 25°C	0.07 W
Thermal dissipation factor	1 mW/°C
Thermal time constant	4 s

HOW TO ORDER

NB 21

Type

K 0

Material Code
K

0103

Resistance
10,000 Ω

M

Tolerance
M (±20%)
J (±5%)
K (±10%)

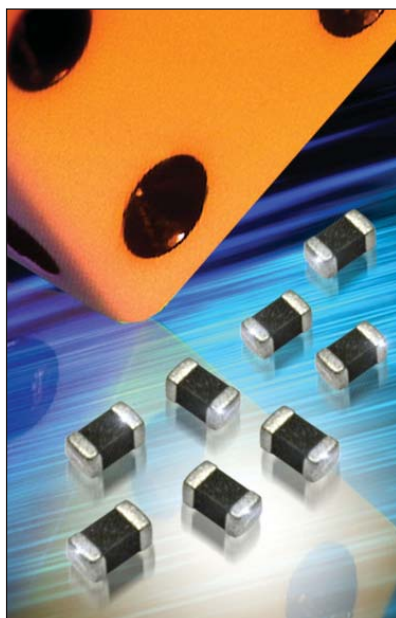
BA

Suffix: Packaging

- : Bulk
 BB: Cardboard tape (180mm diam. reel)
 BF: Cardboard tape (1/2 reel)
 BD: Cardboard tape (330mm diam. reel)

TABLE OF VALUES

NB 21 IEC SIZE : 0603				
Types	Rn at 25°C (Ω)	Material Code	B (K) $\left(\frac{\Delta B/B}{(1) \pm 5\%}\right)$ $\left(\frac{\Delta B/B}{(2) \pm 3\%}\right)$	α at 25°C (%/°C)
NB 21 KC 0 470	47	KC	3470 ± 5%	- 3.9
NB 21 KC 0 101	100			
NB 21 KC 0 471	470			
NB 21 MC 0 102	1,000	MC	3910 ± 3%	- 4.4
NB 21 J 0 0472	4,700	J	3480 ± 3%	- 3.9
NB 21 J 5 0682	6,800	J5	3480 ± 3%	- 3.9
NB 21 J 5 0103	10,000		3480 ± 3%	- 3.9
NB 21 K 0 0103	10,000	K	3630 ± 3%	- 4.0
NB 21 K 0 0153	15,000			
NB 21 L 0 0223	22,000	L	3790 ± 3%	- 4.2
NB 21 M 0 0333	33,000	M	3950 ± 3%	- 4.4
NB 21 M 0 0473	47,000			
NB 21 L 2 0683	68,000	L2	3805 ± 3%	- 4.1
NB 21 N 0 0683	68,000	N	4080 ± 3%	- 4.6
NB 21 N 5 0104	100,000	N5	4160 ± 3%	- 4.7
NB 21 P 0 0154	150,000	P	4220 ± 3%	- 4.7
NB 21 Q 0 0334	330,000	Q	4300 ± 3%	- 4.7
NB 21 Q 0 0474	470,000			



Chip thermistors are a high quality and low cost device especially developed for surface mounting applications. They are widely used for temperature compensation but can also achieve temperature control of printed circuits. Its silver - palladium - platinum metallization provides a high degree of resistance to dewetting of the terminations during soldering (typically 260°C / 30 s).

APPLICATIONS

- LCD compensation
- Battery packs
- Mobile phones
- CD players
- Heating systems
- Air-conditioning systems
- Temperature control of Switch Mode Power Supplies
- Compensation of pressure sensors
- Protection of power transistors in various electronic circuits

CHECK FOR UP-TO-DATE DATASHEET AT
<http://www.avx.com/docs/catalogs/nc12-20.pdf>

Types	NB 12 IEC SIZE : 0805	NB 20 IEC SIZE : 1206
DIMENSIONS: millimeters (inches)		
Terminations	Nickel Barrier	
Marking	On packaging only	
Climatic category	40/125/56	
Operating temperature	-55°C to +150°C	
Tolerance on R _n (25°C)	±5%, ±10%, ±20%	
Maximum dissipation at 25°C	0.12 W	0.24 W
Thermal dissipation factor	2 mW/°C	4 mW/°C
Thermal time constant	5 s	7s

HOW TO ORDER

NC 20

Type
 NC12 = 0805
 NC20 = 1206

K 0

Material Code
 K

0103

Resistance
 10,000 Ω

M

Tolerance
 M (±20%)
 J (±5%)
 K (±10%)

BA

Suffix: Packaging
 --: Bulk

0603, 0805
 BB: Cardboard tape (180mm diam. reel)
 BF: Cardboard tape (1/2 reel)
 BD: Cardboard tape (330mm diam. reel)

1206
 BA: Plastic tape (180mm diam. reel)
 BE: Plastic tape (1/2 reel)
 BC: Plastic tape (330mm diam. reel)

TABLE OF VALUES

NC 12 IEC SIZE : 0805				
Types	Rn at 25°C (Ω)	Material Code	B (K) ($\frac{1}{\Delta B/B} \pm 5\%$) ($\frac{2}{\Delta B/B} \pm 3\%$)	α at 25°C (%/°C)
NC 12 KC 0 180	18	KC	3470 ± 5%	- 3.9
NC 12 KC 0 220	22			
NC 12 KC 0 270	27			
NC 12 KC 0 330	33			
NC 12 KC 0 390	39			
NC 12 KC 0 470	47			
NC 12 KC 0 560	56			
NC 12 KC 0 680	68			
NC 12 KC 0 820	82			
NC 12 KC 0 101	100			
NC 12 MC 0 121	120	MC	3910 ± 3%	- 4.4
NC 12 MC 0 151	150			
NC 12 MC 0 181	180			
NC 12 MC 0 221	220			
NC 12 MC 0 271	270			
NC 12 MC 0 331	330			
NC 12 MC 0 391	390			
NC 12 MC 0 471	470			
NC 12 MC 0 561	560			
NC 12 MC 0 681	680			
NC 12 MC 0 821	820			
NC 12 MC 0 102	1,000			
NC 12 MC 0 122	1,200			
NC 12 MC 0 152	1,500			
NC 12 MC 0 182	1,800			
NC 12 MC 0 222	2,200			
NC 12 MC 0 272	2,700			
NC 12 MC 0 332	3,300			
NC 12 J 0 0332	3,300	J	3480 ± 3%	- 3.9
NC 12 J 0 0392	3,900			
NC 12 J 0 0472	4,700			
NC 12 J 0 0562	5,600			
NC 12 K 0 0682	6,800	K	3630 ± 3%	- 4.0
NC 12 K 0 0822	8,200			
NC 12 K 0 0103	10,000			
NC 12 K 0 0123	12,000			
NC 12 L 0 0153	15,000	L	3790 ± 3%	- 4.2
NC 12 L 0 0183	18,000			
NC 12 M 0 0223	22,000	M	3950 ± 3%	- 4.4
NC 12 M 0 0273	27,000			
NC 12 M 0 0333	33,000			
NC 12 M 0 0393	39,000			
NC 12 N 0 0473	47,000	N	4080 ± 3%	- 4.6
NC 12 N 0 0563	56,000			
NC 12 L 2 0683	68,000	L2	3805 ± 3%	- 4.1
NC 12 N 0 0823	82,000	N	4080 ± 3%	- 4.6
NC 12 P 0 0104	100,000	P	4220 ± 3%	- 4.7
NC 12 P 0 0124	120,000			
NC 12 P 0 0154	150,000			
NC 12 P 0 0184	180,000			
NC 12 Q 0 0224	220,000	Q	4300 ± 3%	-4.7

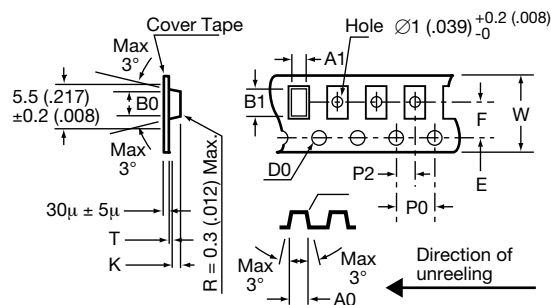
NC 20 IEC SIZE : 1206				
Types	Rn at 25°C (Ω)	Material Code	B (K) ($\frac{1}{\Delta B/B} \pm 5\%$) ($\frac{2}{\Delta B/B} \pm 3\%$)	α at 25°C (%/°C)
NC 20 KC 0 100	10	KC	3470 ± 5%	- 3.9
NC 20 KC 0 120	12			
NC 20 KC 0 150	15			
NC 20 KC 0 180	18			
NC 20 KC 0 220	22			
NC 20 KC 0 270	27			
NC 20 KC 0 330	33			
NC 20 KC 0 390	39			
NC 20 KC 0 470	47			
NC 20 KC 0 560	56			
NC 20 KC 0 680	68			
NC 20 KC 0 820	82			
NC 20 KC 0 101	100			
NC 20 MC 0 121	120	MC	3910 ± 3%	- 4.4
NC 20 MC 0 151	150			
NC 20 MC 0 181	180			
NC 20 MC 0 221	220			
NC 20 MC 0 271	270			
NC 20 MC 0 331	330			
NC 20 MC 0 391	390			
NC 20 MC 0 471	470			
NC 20 MC 0 561	560			
NC 20 MC 0 681	680			
NC 20 MC 0 821	820			
NC 20 MC 0 102	1,000			
NC 20 MC 0 122	1,200			
NC 20 MC 0 152	1,500			
NC 20 I 0 0182	1,800			
NC 20 I 0 0222	2,200			
NC 20 I 0 0272	2,700			
NC 20 I 0 0332	3,300			
NC 20 J 0 0392	3,900	J	3480 ± 3%	- 3.9
NC 20 J 0 0472	4,700			
NC 20 J 0 0562	5,600			
NC 20 J 0 0682	6,800			
NC 20 K 0 0822	8,200	K	3630 ± 3%	- 4.0
NC 20 K 0 0103	10,000			
NC 20 K 0 0123	12,000			
NC 20 K 0 0153	15,000			
NC 20 L 0 0183	18,000	L	3790 ± 3%	- 4.2
NC 20 L 0 0223	22,000			
NC 20 M 0 0273	27,000	M	3950 ± 3%	- 4.4
NC 20 M 0 0333	33,000			
NC 20 M 0 0393	39,000			
NC 20 M 0 0473	47,000			
NC 20 N 0 0563	56,000	N	4080 ± 3%	- 4.6
NC 20 N 0 0683	68,000			
NC 20 N 0 0823	82,000			
NC 20 N 0 0104	100,000			
NC 20 P 0 0124	120,000	P	4220 ± 3%	- 4.7
NC 20 P 0 0154	150,000			
NC 20 P 0 0184	180,000			
NC 20 P 0 0224	220,000			
NC 20 Q 0 0274	270,000	Q	4300 ± 3%	- 4.7
NC 20 Q 0 0334	330,000			
NC 20 Q 0 0394	390,000			
NC 20 Q 0 0474	470,000			
NC 20 R 0 0564	560,000	R	4400 ± 3%	- 4.8
NC 20 R 0 0684	680,000			
NC 20 R 0 0824	820,000			
NC 20 R 0 0105	1,000,000			

PACKAGING FOR AUTOMATIC INSERTION NTC CHIP THERMISTOR – NC/NB SERIES

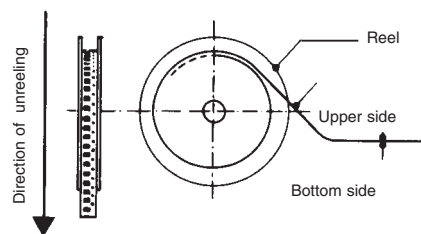
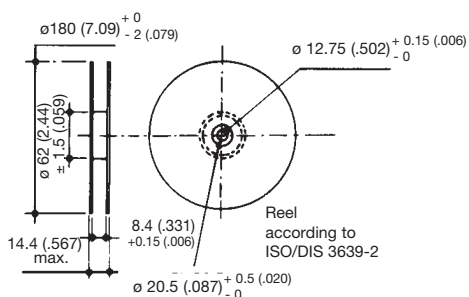
AUTOMATIC INSERTION

Super 8 Plastic Tape Packaging:

The mechanical and dimensional reel characteristics are in accordance with the IEC publication 286-3.



Designation	Symbol	Value	Tolerance
Tape width	W	8	±0.2
Tape thickness	T	0.4 max.	
Pitch of the sprocket holes	P0	4	±0.1
Diameter of the sprocket holes	D0	1.5 -0	±0.1
Distance	E	1.75	±0.1
Distance (center to center)	F	3.5	±0.05
Distance (center to center)	P2	2	±0.1
Sizes of the NC 12 (0805) cavities	A0	1.5	±0.1
	B0	2.4	±0.1
	K	1.4 max.	K ±0.1 (size is adjustable) (K = t1 +0.2)
NC 20 (1206)	A0	1.95	±0.1
	B0	3.55	±0.1
	K	1.5 max.	K ±0.1 (size is adjustable) (K = t1 +0.2)



QUANTITY PER REEL

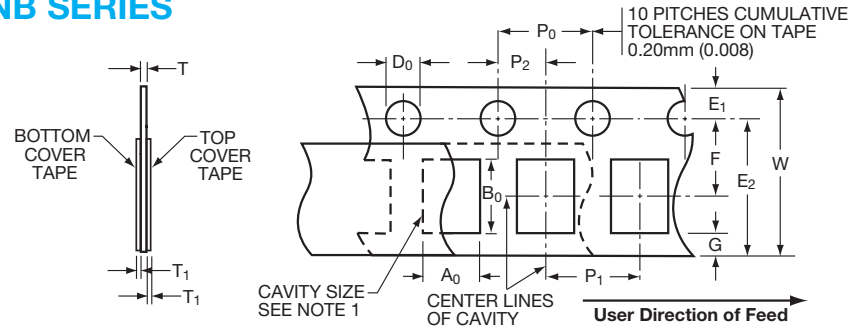
Type	Suffix	Qty Per Reel
NC - NB 12	BA	4000
	BE	2000
NC 20 - NB 20	BA	3000
	BE	1500

PACKAGING FOR AUTOMATIC INSERTION NTC CHIP THERMISTOR – NC/NB SERIES

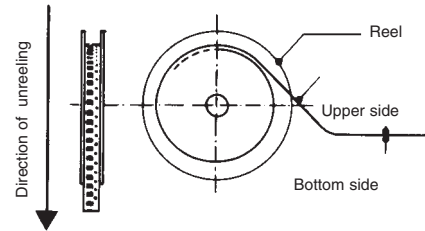
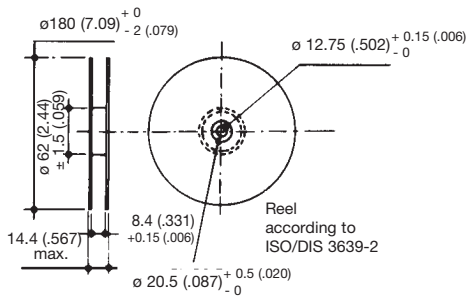
AUTOMATIC INSERTION

8mm Paper Tape Packaging:

The mechanical and dimensional reel characteristics are in accordance with the IEC publication 286-3.



Designation	Symbol	Value	Tolerance
Tape width	W	8	-.0.1/+0.3
Tape thickness	T	1.1 max.	
Pitch of the sprocket holes	P ₀	4	±0.1
Diameter of the sprocket holes	D ₀	1.5 -0/+0.1	±0.1
Distance	E ₁	1.75	±0.1
Distance (center to center)	F	3.5	±0.05
Distance (center to center)	P ₂	2	±0.05
Cover tape thickness	T ₁	0.10 max.	
Distance	E ₂	6.25 min.	
Distance	G	0.75 min.	
Component pitch	P ₁	0805/0603 0402	±0.1
			±0.1



QUANTITY PER REEL

Type	Suffix	Qty Per Reel
NB - NC 12	BB	4000
NB 21	BF	2000

SURFACE MOUNTING GUIDE CHIP THERMISTOR – APPLICATION NOTES

STORAGE

Good solderability is maintained for at least twelve months, provided the components are stored in their “as received” packaging at less than 40°C and 70% RH.

SOLDERABILITY / LEACHING

Terminations to be well soldered after immersion in a 60/40 tin/lead solder bath at $235 \pm 5^\circ\text{C}$ for 2 ± 1 seconds.

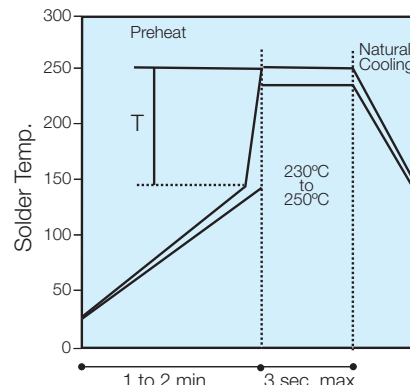
Terminations will resist leaching for at least the immersion times and conditions recommendations shown below.

P/N	Termination Type	Solder Tin/Lead	Solder Temp °C	Immersion Time Seconds
NC	AgPdPt	60/40	260 ± 5	15 max
NB	Nickel Barrier	60/40	260 ± 5	30 ± 1

NB products are compatible with a wide range of soldering conditions consistent with good manufacturing practice for surface mount components. This includes Pb free reflow processes with peak temperatures up to 270°C . Recommended profiles for reflow and wave soldering are shown below for reference.

NC products are recommended for lead soldering application or gluing techniques.

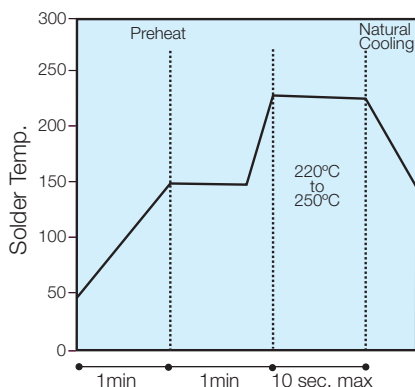
Wave



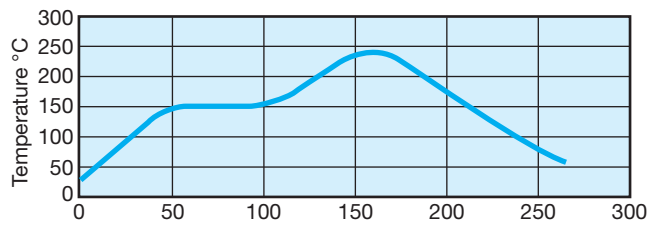
(Preheat chips before soldering)
T/maximum 150°C

- The visual standards used for evaluation of solder joints will need to be modified as lead free joints are not as bright as with tin-lead pastes and the fillet may not be as large.
- Resin color may darken slightly due to the increase in temperature required for the new pastes.
- Lead-free solder pastes do not allow the same self alignment as lead containing systems. Standard mounting pads are acceptable, but machine set up may need to be modified.

Reflow



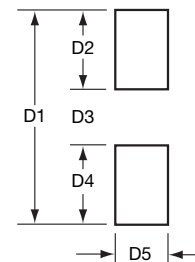
(Minimize soldering time)



- Pre-heating: $150^\circ\text{C} \pm 15^\circ\text{C}$ / 60-90s
- Max. Peak Gradient: 2.5°C/s
- Peak Temperature: $245^\circ\text{C} \pm 5^\circ\text{C}$
- Time at $>230^\circ\text{C}$: 40s Max.

RECOMMENDED SOLDERING PAD LAYOUT

Dimensions in mm (inches)



REFLOW SOLDERING

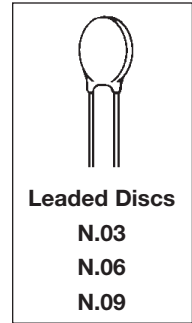
Case Size	P/N	D1	D2	D3	D4	D5
0402	NB23	1.70 (.067)	0.60 (.024)	0.50 (.020)	0.60 (.024)	0.50 (.020)
0603	NB21	2.30 (.091)	0.80 (.031)	0.70 (.028)	0.80 (.031)	0.75 (.030)
0805	NB12	3.00 (.118)	1.00 (.039)	1.00 (.039)	1.00 (.039)	1.25 (.049)
1206	NB20	4.00 (.157)	1.00 (.039)	2.00 (.079)	1.00 (.039)	2.50 (.098)

WAVE SOLDERING

Case Size	P/N	D1	D2	D3	D4	D5
0603	NB21	3.10 (.122)	1.20 (.047)	0.70 (.028)	1.20 (.047)	0.75 (.030)
0805	NB12	4.00 (.157)	1.50 (.059)	1.00 (.039)	1.50 (.059)	1.25 (.049)
1206	NB20	5.00 (.197)	1.50 (.059)	2.00 (.079)	1.50 (.059)	1.60 (.063)



- ND: epoxy-phenolic resin coating
 NE: epoxy resin coating (recommended for severe mounting conditions)
 NV: epoxy varnish coating
- Leads: Radial copper wire tinned
- Marking: on package only for ND03 & NE03
 ND/NE 06/09: Nominal resistance and tolerance for $\pm 5\%$, $\pm 10\%$
 NV06/09: Nominal resistance and tolerance
- Delivery Mode: Bulk, reeled or ammpacked



APPLICATIONS

- Commodity Product: 2 families
 ND or NE: general purpose
 NV: professional
- Alarm and temperature measurement application
- Temperature regulation application
- Level detection application
- Compensation application

CHECK FOR UP-TO-DATE DATASHEET AT
<http://avx.com/docs/Catalogs/nd-ne-nv.pdf>

HOW TO ORDER

NC06

Type

P0

Material Code
 P

0103

Resistance
 10K Ω

K

Tolerance
 K ($\pm 10\%$)

--

Packaging
 Bulk



LEAD-FREE
 LEAD-FREE COMPATIBLE
 COMPONENT



RoHS
 COMPLIANT

PERFORMANCE CHARACTERISTICS

Types	General purpose			Professional	
	ND03 or NE03	ND06 or NE06	ND09 or NE09	NV06	NV09
Climatic category				55/125/56-434	55/125/56-434
Operating Temperature	-55 to +150°C	-55 to +150°C	-55 to +150°C	-55 to +150°C	-55 to +150°C
Tolerance on R _n (25°C)	330 Ω to 1M Ω : $\pm 5, 10, 20\%$ 1500 Ω to 150 k Ω : $\pm 3\%$	$\pm 5\%, \pm 10\%, \pm 20\%$	$\pm 5\%, \pm 10\%, \pm 20\%$	$\pm 2\%, \pm 5\%, \pm 10\%$	$\pm 2\%, \pm 5\%, \pm 10\%$
Maximum dissipation at 25°C	0.25 W	0.71 W	0.9 W	0.69 W	0.85 W
Thermal dissipation factor	5 mW/°C	7.1 mW/°C	9 mW/°C	6.9 mW/°C	8.5 mW/°C
Thermal time constant	10 s	22 s	30 s	18 s	30 s
Response time	< 3s				

STANDARDIZATION

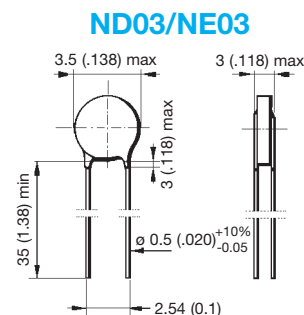
NV range : approved by NFC 93271
 Type: TN115 A for NV06
 TN116 for NV09
 List: GAM-T1
 List: LNZ

OPTIONS

Consult factory for availability of options:

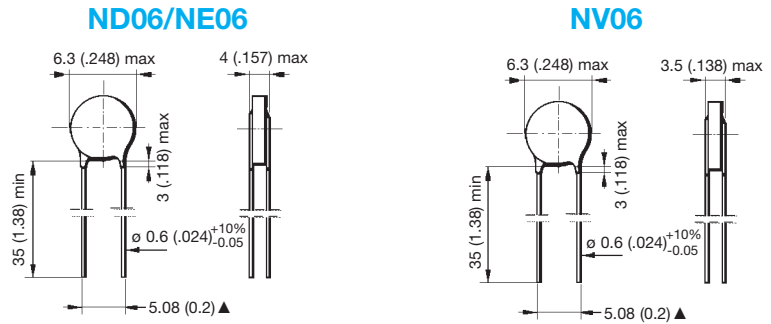
- other nominal resistance values
- other tolerances
- alternative lead materials or lengths
- controlled dimensions

TABLE OF VALUES
ND03/NE03 TYPE



Part Number	Rn at 25°C (Ω)	Material Code	B (K) ($\frac{\Delta B}{B}$ (1) ± 5% (2) ± 3%)	α at 25°C (%/°C)
N_03I00331 N_03I00471	330 470	I	3250 (1)	- 3.7
N_03J00681 N_03J00102	680 1,000	J	3480 (2)	- 3.9
N_03K00152 N_03K00222	1,500 2,200	K	3630 (2)	- 4.0
N_03L00272 N_03L00332	2,700 3,300	L	3790 (2)	- 4.2
N_03M00472 N_03M00682	4,700 6,800	M	3950 (2)	- 4.4
N_03N00103 N_03N00153	10,000 15,000	N	4080 (2)	- 4.6
N_03P00223 N_03P00333	22,000 33,000	P	4220 (2)	- 4.7
N_03Q00473 N_03Q00683	47,000 68,000	Q	4300 (2)	- 4.7
N_03R00104 N_03R00154	100,000 150,000	R	4400 (2)	- 4.8
N_03S00224	220,000	S	4520 (2)	- 5.0
N_03T00334 N_03T00474	330,000 470,000	T	4630 (2)	- 5.1
N_03U00105	1,000,000	U	4840 (2)	- 5.3

TABLE OF VALUES
ND06/NE06/NV06

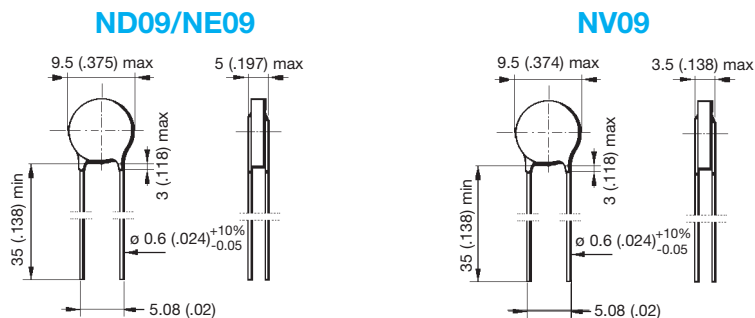


Part Number	Rn at 25°C (Ω)	Material Code	B (K) ($\frac{\Delta B}{B}$ (1) ± 5% (2) ± 3%)	α at 25°C (%/°C)
N_06J00151 N_06J00221	150 220	J	3480 (2)	- 3.9
N_06K00331 N_06K00471	330 470	K	3630 (2)	- 4.0
N_06L00681 N_06L00102	680 1,000	L	3790 (2)	- 4.2
N_06M00152	1,500	M	3950 (2)	- 4.4
N_06N00222 N_06N00332	2,200 3,300	N	4080 (2)	- 4.6
N_06P00472 N_06P00682 N_06P00103	4,700 6,800 10,000	P	4220 (2)	- 4.7
N_06Q00153 N_06Q00223	15,000 22,000	Q	4300 (2)	- 4.7
N_06R00333	33,000	R	4400 (2)	- 4.8
N_06S00473 N_06S00683	47,000 68,000	S	4520 (2)	- 5.0
N_06T00104	100,000	T	4630 (2)	- 5.1
N_06U00154 N_06U00224 N_06U00334	150,000 220,000 330,000	U	4840 (2)	- 5.3

For other resistance values, please consult us.

TABLE OF VALUES

ND09/NE09/NV09



Part Number	Rn at 25°C (Ω)	Material Code	B (K) ($\Delta B/B$ (1) ± 5% (2) ± 3%)	α at 25°C (%/°C)
N_09J00680 N_09J00101	68 100	J	3480 (2)	- 3.9
N_09K00151 N_09K00221	150 220	K	3630 (2)	- 4.0
N_09L00331	330	L	3790 (2)	- 4.2
N_09M00471 N_09M00681	470 680	M	3950 (2)	- 4.4
N_09N00102 N_09N00152	1,000 1,500	N	4080 (2)	- 4.6
N_09P00222 N_09P00332	2,200 3,300	P	4220 (2)	- 4.7
N_09Q00472 N_09Q00682	4,700 6,800	Q	4300 (2)	- 4.7
N_09R00103 N_09R00153	10,000 15,000	R	4400 (2)	- 4.8
N_09S00223	22,000	S	4520 (2)	- 5.0
N_09T00333 N_09T00473	33,000 47,000	T	4630 (2)	- 5.1
N_09U00683 N_09U00104 N_09U00154	68,000 100,000 150,000	U	4840 (2)	- 5.3

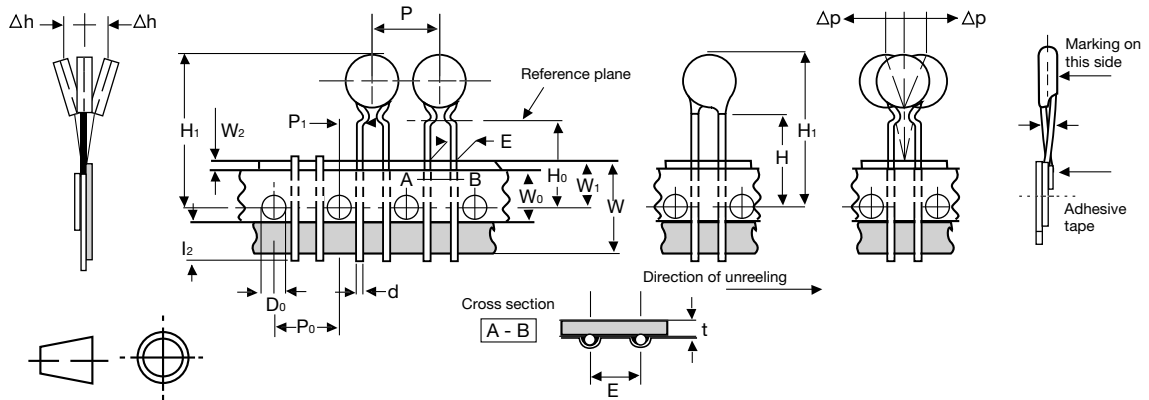
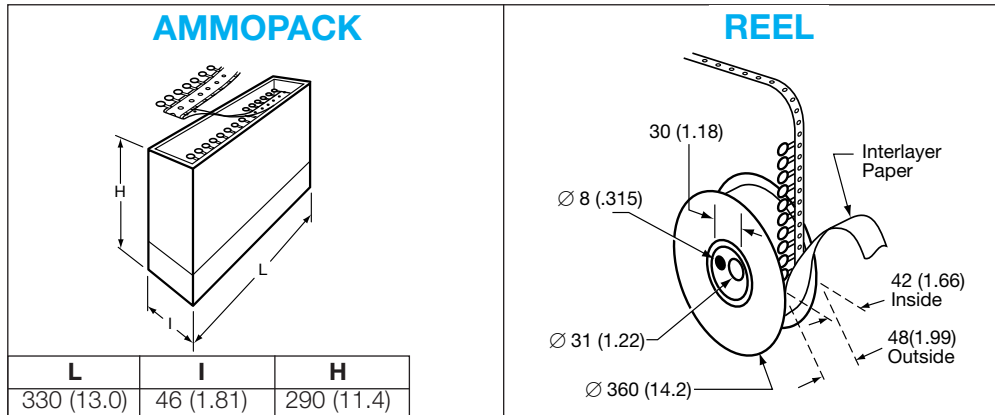
TAPING CHARACTERISTICS

Missing components

A maximum of 3 consecutive components may be missing from the bandolier, surrounded by at least 6 filled positions. The number of missing components may not exceed 0.5% of the total per packing module.

The beginning and the end of tape exhibit 8 or 9 blank positions.

DIMENSIONS: millimeters (inches)



Value	Tolerance	Dimensions Characteristics
18	+1 / -0.5	W Leading tape width
6	±0.3	W ₀ Adhesive tape width
9	+0.75 / -0.5	W ₁ Sprocket hole position
3 max.		W ₂ Distance between the top of the tape and the adhesive
4	±0.2	D ₀ Diameter of sprocket hole
16/19.5	±0.5	H ₀ Distance between the tape axis and the seating plane of the component
		H ₁ Distance between the tape axis and the top of component body

Value	Tolerance	Dimensions Characteristics	
12.7	±0.2	P ₀ Sprocket holes pitch	
254	±1	- Distance between 21 consecutive holes 20 pitches	
0.7	±0.2	t Total thickness of tape	
2.54	5.08	+0.6 -0.1	E Lead spacing
5.08	3.85	± 0.7	P ₁ Distance between the sprocket hole axis and the lead axis
12.7	±1.0	P Spacing of components	
0.5	0.6	±5%	d Lead diameter
0	±1.3	°P	Verticality of components
0	±2	°h	Alignment of components



High precision resistance and an outstanding ability to reproduce the sensibility index B, make these ranges of products the types of thermistors ideal for temperature measurement applications.

Leaded or unleaded, these small size and rapid response time thermistors are able to meet the most accurate requirements. Parts are complying to AEC-Q200 requirements.

FEATURES

- Small size
- Tight tolerance
- High precision

APPLICATIONS

- Engine Control Systems
- Airbag Sensor & Control Systems
- ABS/ESP Systems and more

CHECK FOR UP-TO-DATE CATALOG AT
<http://www.avx.com/docs/Catalogs/nj-ni-nk.pdf>

Types	NJ 28	NP 30	NI 24	NK 20
Finish	Coated chip with phenolic resin + varnish + tinned copper wires	Coated chip with epoxy	Coated chip with epoxy AWG30 insulated leads + Silver plated nickel wires	Chip
DIMENSIONS: millimeters (inches)				
Marking	On packaging only			
Operating temperature	-55°C to +150°C			
Tolerance on Rn (25°C)	±1%, ±2%, ±3%			
Maximum dissipation at 25°C	0.16 W			
Thermal dissipation factor*	3 mW/°C		3 mW/°C	2 mW/°C
Thermal time constant	8 s		8 s	6 s
Response time	< 2 s			

HOW TO ORDER

NJ28

Type

MA

Material Code
MA
(See table below)

0502

Resistance
5KΩ

F

Tolerance
F (±1%)

--

Packaging
Bulk



LEAD-FREE
LEAD-FREE COMPATIBLE
COMPONENT



RoHS
COMPLIANT

TABLE OF VALUES

NJ28 • NP30 • NI24 • NK200				
Types	Rn at 25°C (Ω)	Material Code	B (K) (ΔB/B (1) ± 5% (2) ± 3%)	α at 25°C (%/°C)
N__ KA 0202	2,000	KA	3625 ± 1%	- 4.1
N__ MA 0302	3,000	MA	3960 ± 0.5%	- 4.5
N__ MA 0502	5,000	MA	3960 ± 0.5%	- 4.5
N__ MA 0103	10,000	MA	3960 ± 0.5%	- 4.5
N__ NA 0103	10,000	NA	4100 ± 1%	- 4.6
N__ PA 0203	20,000	PA	4235 ± 1%	- 4.8
N__ QA 0503	50,000	QA	4250 ± 1%	- 4.8
N__ RA 0104	100,000	RA	4380 ± 1%	- 4.9

* -- = Add type as outlined above (Example NJ 2 8).

OPTIONS

Consult factory for availability of options:

- other nominal resistance values
- other tolerances
- alternative lead materials or lengths
- controlled dimensions

ADVANCED TECHNOLOGY FILTERS

AVX advanced technology filters are custom designed for a wide range of high temperature and mission critical applications.

Innovative solutions include:

- **Hermetic High Temperature Solder-Ins**

High frequency, high reliability filters designed for space savings in harsh environment applications. Components can withstand short high temperature excursions as high as 400°C and have an operating temperature range that goes up to 200°C.

Please email AVX at high.temp@avx.com for any inquiries.



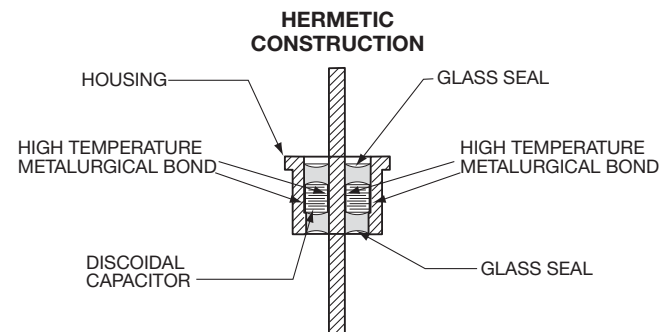
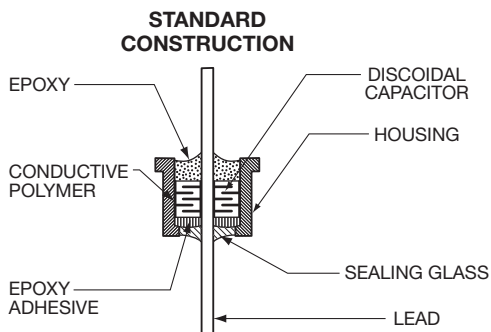


These are high frequency filters in space saving solder-in designs which will operate under harsh environments and meet the high reliability requirements of MIL-F-28861 without outgassing. AVX Filters Corporation has designed a filter which sets a new standard for the industry. These feed-thru filters are constructed with hi-rel semiconductor materials and rugged MLC discoidal capacitors. They are also manufactured at high temperatures (>500°C) without fluxes, epoxies or other polymers, thus eliminating failure mechanisms associated with conventional solder-ins. These solder-ins withstand short temperature excursions as high as 400°C, and can actually be operated at temperatures to 200°C. Available either as discrete packages in standard case sizes or as multiple filter brackets, all have hermetic glass-to-metal seals on both ends.

FEATURES

- Standard sizes
- Epoxy free construction
- Hermetic on both ends
- MIL-PRF-31033 Discoidal Capacitor
- 400°C installation

AVX FILTERS SOLDER-IN STYLE FILTER



STYLE

- Discrete, hermetically sealed solder-in filters
 - AVX Filters Series*
 - WQ: .400" Case Diameter
 - XQ: .250" Case Diameter
 - YQ: .165" Case Diameter
 - ZQ: .128" Case Diameter
- Custom design available
- Multiple filter arrays
 - Custom bracket housing employing discrete hermetic filters
 - Custom rugged bracket housings with inter-rated hermetic filtered feed-thrus

SPECIFICATIONS

- Operating temperature range: -55°C to 200°C
- 400°C rated installation temperature
- Voltage range: 50 to 300VDC
- Capacitance Range: 10 pF to 1.2 μF
- Hermeticity: 1×10^{-7} ATM cm³/sec minimum
- Rated current: up to 15 amps
- Circuits: C
- Designed to meet or exceed requirements of MIL-F-28861

CHARACTERISTICS

- Rugged monolithic ceramic capacitor construction
- Capacitor attached with solderless, fluxless, high temperature metallurgical bond
- Hermetic glass-to-metal seals on both ends
- No epoxies, resins or polymers to outgas or degrade in harsh environments



DOWN-HOLE APPLICATION NOTES

With extreme temperatures, high pressure, and high mechanical stress, down-hole applications present some of the toughest environments for passive components. AVX understands these challenges and is committed to meeting the demands of down-hole applications through innovative passive component solutions designed to maintain optimal performance in extreme conditions.

OVERVIEW

The global demand for oil and gas drives the development of increasingly sophisticated equipment utilized in down-hole oil exploration. Advanced down-hole electronics must provide optimal performance while subject to extreme environmental conditions below the earth's surface. Drilling depths of more than 7 miles result in internal module temperatures approaching or surpassing the 200°C mark and they continue to escalate.

In down-hole oil exploration, electronic sensors are utilized to relay information from the tool beneath the surface of the earth, to the drilling engineers on the oil rig. This information is collected by various sensors within the tool. Information logging consists of sending, receiving, recording and analyzing of essential data allowing engineers to make critical decisions on further drilling operations based on the characteristics of the material surrounding the well trajectory. In order to fulfill these demanding requirements, AVX provides a wide range of products that are capable of withstanding extreme temperatures. These components are implemented into logging modules such as sonic, gamma-ray, density, and resistivity logging tools.

BACKGROUND

AVX offers high temperature solutions through both ceramic and tantalum capacitors, each of which provides distinct highly reliable characteristics depending on what the application requires. AVX capacitors offer variety to meet today's size, voltage, temperature, and value constraints of many applications.

Ceramic Capacitors

AVX offers multilayer ceramic capacitors for high temperature applications. With manufacturing plants all over the world with state of the art equipment, AVX ceramic capacitors exhibit excellent reliability and performance. The construction of these capacitors is the key advantage of AVX ceramic products.

Multilayer ceramic capacitors are constructed with alternating layers of ceramic dielectric material, and layers of conductive electrode material. This is done by utilizing tape casting techniques or wet lay down techniques, depending on the type of capacitor, and then screen-printing the electrode material on top of the ceramic layer. As shown in Figure A, terminations are then added to the ends of the capacitor which connect the internal electrodes and allow for the capacitor to either be soldered to the board (SMD) or to the leads.

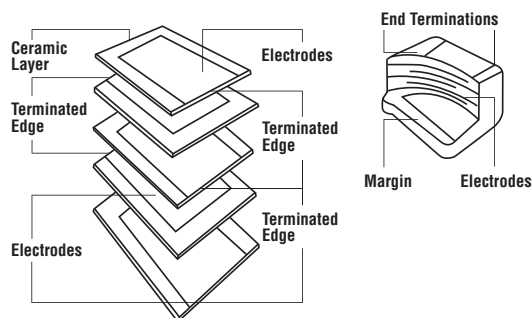


Figure A

Multilayer ceramic capacitors can be stacked to increase the electrical capabilities of the capacitor (capacitance and voltage). Since capacitance is additive when connected in parallel, the stacked construction can create high capacitance values while taking up the same footprint on the PCB.

AVX ceramic capacitors can also be encapsulated in a casing and fit with leads to further increase environmental durability. The encapsulated capacitors are then epoxy filled with a material that is CTE matched to the ceramic material.

Due to their construction and materials, there are certain requirements necessary to consider when using multilayer ceramic capacitors. While ceramic materials have exceptional compressive strength, they can be susceptible to fractures due to tensile stress. It is necessary to choose particular options provided by AVX products to address this issue. Custom leads are recommended for high vibration conditions as well as for temperatures that may exceed the recommended operating temperature. The custom leads and terminations absorb the tensile stress and prevent cracking in the ceramic capacitor. Thermal shock should also be considered to reduce the risk of differential expansion caused by the increased temperatures.

AVX provides highly reliable ceramic capacitors that take possible failure modes into consideration and provide a high quality product with exceptional performance while performing in harsh conditions.

Tantalum Capacitors

AVX manufactures both dry tantalum and wet tantalum capacitors for high temperature applications, each having its own unique manufacturing process.

As shown in Figure B, tantalum chip capacitors incorporate a porous tantalum metal pellet which forms the anode, while its oxide layer makes up the dielectric. AVX tantalum technology uses manganese dioxide as the counter electrode (cathode) with self-healing properties for long life. This construction allows for very high capacitance in a small package.

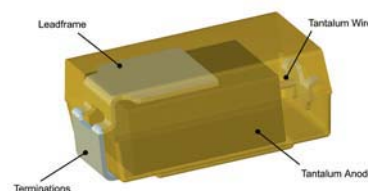


Figure B

Wet tantalum capacitors are constructed inside of a cylindrical tantalum can, containing the tantalum anode along with an electrolytic solution. A proprietary cathode is incorporated and allows for less wasted space which makes the wet tantalums an ideal candidate for high capacitance in a small size component.

The wet tantalums and tantalum chips are available with maximum operating temperatures from 175°C to 200°C. The leads on these products also absorb mechanical shock from vibration in down-hole applications.

For applications with temperatures above 200°C, AVX has developed a new construction technology (THH series) that uses a ceramic casing around the tantalum chip. THH series can operate at temperatures up to 230°C. These are hermetically sealed parts, capable of reliable operation in harsh environments.

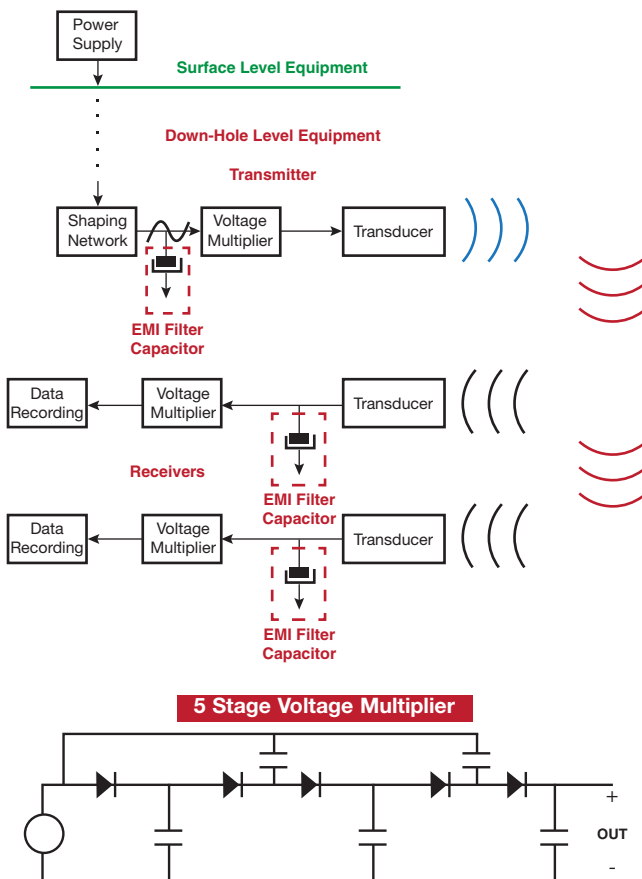
AVX provides products that exhibit optimal performance characteristics in down-hole environments. Whether ceramic or tantalum, AVX has a solution for the needs of the high temperature applications market.

SONIC LOGGING TOOL

Sonic logging is implemented in down-hole applications to determine the porosity of the materials surrounding the well hole. Facilitating sonic logging, the acoustic module consists of various piezoelectric sensors driven by voltage regulators, amplifiers, filters, and shaping networks that send and receive the acoustic signal the engineer uses to help determine the depth and direction of the down-hole tool. Due to the extreme conditions inside the well, the electronic module's components must be able to withstand vibrations and high temperatures during normal operating life conditions.

Sonic sensors used for porosity measurements in down-hole applications typically operate at lower frequencies in order to penetrate the dense surrounding materials. Tantalum capacitors perform exceptionally well at these low operating frequencies. AVX offers high temperature wet tantalum capacitors as well as high temperature tantalum chips. These tantalum products have operating temperatures up to 230°C with capacitance values ranging from 0.1µF-680µF and rated voltages from 3.6VDC-125VDC.

Sonic Tool Voltage Multiplier Diagram:



The sonic module consists of a transmitter and a receiver. The transmitter directs a low frequency acoustic signal around the borehole, part of which bounces back to the receiver. To filter the noise out of the signal, a high temperature tantalum capacitor is utilized, like AVX's THH. Ta capacitors exhibit high capacitance per volume due to the characteristics of the tantalum pentoxide dielectric layer. The dielectric layer is a thin film with a high dielectric constant and has a high surface area

due to the micro-porosity of the tantalum anode. Because capacitance is directly related to the dielectric constant and surface area, and inversely related to the thickness of the dielectric material, this technology provides very high volumetric efficiency.

The HV multiplier commonly utilizes SMT miniature HV MLCCs ranging in size from 0805 to 2225. AVX offers high voltage MLC chip and radial leaded options. C0G, N1500 and X7R dielectric materials are available in high voltage applications up to 5kV. Special design criteria in the HV radial series and AVX high voltage MLC chips allow for low leakage, capacitance values up to 15µF and tolerances as tight as 5%.

GAMMA-RAY LOGGING TOOL

The Gamma-Ray Log helps measure the amount of shale in a formation by measuring the naturally occurring radiation from various isotopes of the elements potassium, thorium, and uranium. Although the gamma-ray log cannot measure porosity like the sonic log, it is an excellent indicator of shale. Noting the differences in the Gamma-Ray Log and the porosity log (sonic log), engineers are able to estimate the volume of shale within a formation.

Gamma-Ray logs consist of gamma ray sensors that convert the detected radiation to a corresponding electrical signal. High voltage regulators, amplifiers, and decoupling ceramic capacitors used in and in-between stages, are used to transmit the signal from the gamma-ray sensor up to the surface for log evaluation. The low voltage signals are sometimes converted to higher voltages to improve signal to noise ratios of systems.

Gamma-Ray sensors are subject to extremely harsh conditions. Being implemented into the tool, these sensors operate deep below the surface where temperatures can exceed 200°C. Along with drastic temperature increases, the vibration in the tool is severe. It is necessary for the components in these sensors to have high temperature capabilities as well as optimum mechanical shock and vibration characteristics.

AVX offers high temperature ceramic capacitors designed specifically for these conditions. AVX high temperature ceramic stacked capacitors have exceptional 200°C performance with capacitance values up to 340µF. When using gamma radiation, the components must also be suitable at very high frequencies. Class I (C0G/NP0) ceramic capacitors are capable of withstanding the high frequency requirements in Gamma-Ray detection sensors as well as voltages up to 500V. Stacked ceramic capacitors are offered in various sizes, custom shapes, many lead styles including soft custom leads, and can even be encapsulated. These options allow the components to endure extreme mechanical shock and vibration conditions that Gamma-Ray sensors will encounter in the well.

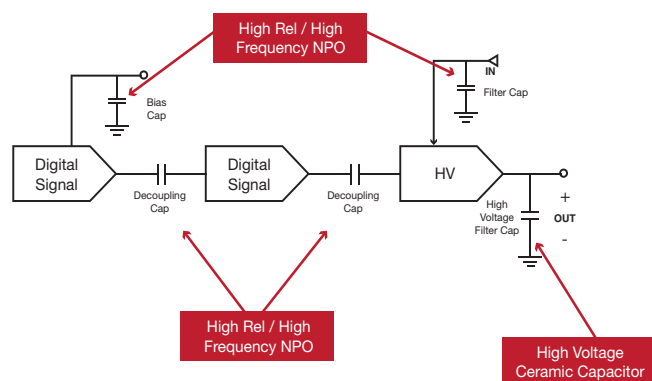
DENSITY LOGGING TOOL

The density tool is used to measure the bulk density, and ultimately porosity, of formations around well holes using gamma-rays. The density tool consists of a gamma-ray emitter (nuclear source), driven by a high voltage supply, and two or more gamma-ray detectors (receivers).

AVX ceramic capacitors are used in density sensor applications. As seen in the circuit, density sensors incorporate multiple filtering and decoupling capacitors. These capacitors need to be capable of high voltages and

high frequencies. Due to its excellent performance in harsh environments, high reliability NPO ceramic capacitors are chosen for these applications. As previously mentioned, AVX ceramic stacked capacitors have capacitance values up to 340 μ F and can withstand voltages up to 500V with no derating necessary. The effects of non-ideal parasitics in a capacitor become critical when using the capacitor for filtering to improve voltage quality with low ESR and low ESL being the most important factors. Superior ESR and ESL characteristics, along with advantageous volumetric capabilities, are the main qualities that make stacked MLCC capacitors ideal for these applications.

Radiation Tool High Voltage Supply Diagram:



RESISTIVITY LOGGING TOOL

Resistivity logs are used to indirectly measure the resistance of the various formations around a borehole.

The resistivity tool works by probing the various formations with magnetic fields that induce a current in the formation. Since current will flow through low resistance material, and fail to flow through high resistance material (like hydrocarbons), the resistivity tool helps to determine possible locations of oil deep inside the earth's crust.

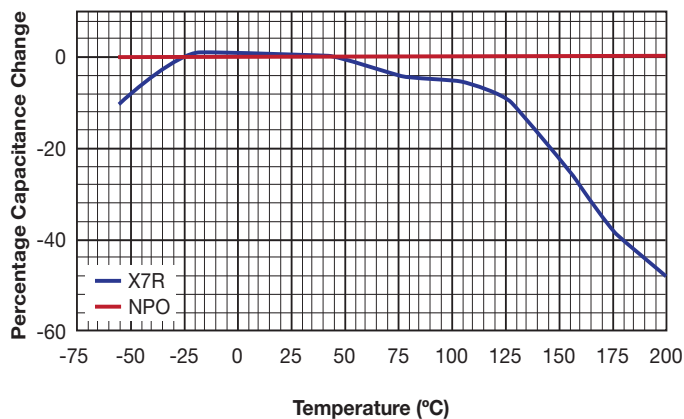
Several tools are used to measure resistivity including: the electric tool, induction tool, and focused electric tool. The three different tools conduct three different resistivity measurements on the formation surrounding the borehole:

As with all electronic devices, power must be supplied for the device to become operational. Because high temperatures can vary the output of the resistivity tool's power supply, and damage the resistivity tool's components, temperature compensation is used to control the output so that it does not become unstable. The temperature compensation network consists of a temperature-current transducer, like a thermistor, and a voltage to frequency converter used as feedback to control the output of the power supply.

The temperature compensation of network's voltage to frequency converter uses the thermistor's current to output a signal that can control the power supply's operation, while a timing capacitor is used to set the frequency of the VFC. For the voltage-to-frequency operation to be a success it is crucial that the RC network have the correct time constant, specified by the VFC device. Since the input to the capacitor can change polarity, and temperatures can vary greatly in

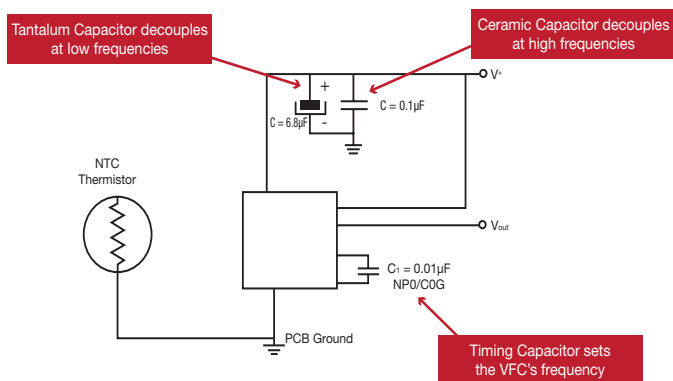
downhole environments, it is recommended that a high temperature capacitor with an NPO dielectric be implemented to reduce the effects of capacitance drift with temperature. The NPO dielectric material has the lowest capacitance change vs. temperature, making them an optimum candidate for filtering. See plot below.

Δ Capacitance vs. Temperature



To reduce noise at low frequencies, a large enough capacitor must be used with low leakage current, along with a bypass capacitor for higher frequencies connected from V+ to ground. Tantalum capacitors offer large capacitance values in a small package, performing well at low frequencies; while ceramic capacitors offer great decoupling capability at higher frequencies.

Temperature VFC Tool Diagram:



SUMMARY

Downhole oil exploration and other high temperature applications require that every component exposed to high temperature meet the high standards of that industry. AVX components provide solutions to a wide variety of these applications. High reliability and ideal performance under these harsh environmental conditions is the advantage AVX offers over competitive products. Many options and customizable designs are available for AVX components in order to suit the needs of all application requirements.

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