

## Automotive Conductive Polymer Chip Capacitors



### FEATURES

- Conductive polymer electrode
- Benign failure mode under recommended use conditions
- Robust design for automotive applications
- Meets requirements of AEC-Q200
- Humidity 85°C/85%RH, Vr, (up to 500 or 1000 hours see reference table)
- Basic reliability 1%/1000hrs@85°C Vr with 60% confidence level
- -55 to +125°C operation temperature
- Full voltage range: 4-35V
- DCL 0.1 CV
- 3x reflow 260°C compatible



### APPLICATIONS

- Automotive, DC/DC converters, Telecommunications, Industrial
- Reference AVX polymer guide for more information.

### MARKING

#### B, D, Y CASE



AVX's qualification of TCQ capacitors meets requirements of AEC-Q200. TCQ series is manufactured in an ISO TS 16949 certified facility.

### 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 <sub>1</sub> ±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)
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)
Y	2917	7343-20	7.30 (0.287)	4.30 (0.169)	2.00 (0.079) max	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

**TCQ**

Type

**B**

Case Size  
See table above

**476**

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

**M**

Tolerance  
M = ±20%

**006**

Rated DC Voltage  
004 = 4Vdc  
006 = 6.3Vdc  
010 = 10Vdc  
016 = 16Vdc  
020 = 20Vdc  
025 = 25Vdc  
035 = 35Vdc

**#**

Packaging  
R = Pure Tin 7" Reel  
S = Pure Tin 13" Reel

**0070**

ESR in mΩ

### TECHNICAL SPECIFICATIONS

Technical Data:	All technical data relate to an ambient temperature of +25°C
Capacitance Range:	4.7 µF to 220 µF
Capacitance Tolerance:	±20%
Leakage Current DCL:	0.1CV
Temperature Range:	-55°C to +125°C
Reliability:	1% per 1000 hours at 85°C, V <sub>R</sub> with 0.1Ω/V series impedance 60% confidence level Meets requirements of AEC-Q200 (for humidity 85°C/85%RH, V <sub>R</sub> details see reference table)

NOTE: Conductive Polymer Capacitors are designed to operate within the limits of the environmental conditions specified for each series. If operated continuously at their maximum temperature and / or humidity limit, or beyond these limits, capacitors may exhibit a parametric shift in capacitance and increases in ESR. These changes may occur earlier if the specified environmental conditions are exceeded. Similarly, their normal operational time period will be significantly extended if their general duty cycle includes operation below maximum temperature within humidity controlled environments. Careful attention should be paid to maximum temperature with associated high humidity environments as well as voltage derating, ripple current and current surges. Please reference the AVX Conductive Polymer Capacitor Guidelines for more information or contact factory for application assistance.

## Automotive Conductive Polymer Chip Capacitors

### CAPACITANCE AND RATED VOLTAGE RANGE (LETTER DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V <sub>R</sub> ) @ 105°C						
µF	Code	4V (G)	6.3V (J)	10V (A)	16V (C)	20V (D)	25V (E)	35V (V)
3.3	335							
4.7	475							B(200)*
6.8	685						B(200)*	
10	106					B(200)*		D(70)
15	156						D(70)	
22	226		B(70)	B(70)*		D(70)		
33	336		B(70)	B(70)*	D(70)			
47	476		B(70)	B(70)*	D(70)			
68	686			D(25,40)				
100	107			D(25,40)				
150	157		D(25,40)					
220	227	D(25), Y(25)						

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)	Maximum Operating Temp. (°C)	DCL Max (µA)	DF Max (%)	ESR Max @ 100kHz (mΩ)	MSL	100kHz RMS Current (mA)				Humidity 85°C/85%RH, Vr (hrs)
									45°C	85°C	105°C	125°C	
<b>4 Volt</b>													
TCQD227M004#0025	D	220	4	125	88	6	25	3	3000	2100	1350	750	1000
TCQY227M004#0025	Y	220	4	125	88	6	25	3	2720	1904	1224	680	500
<b>6.3 Volt</b>													
TCQB226M006#0070	B	22	6.3	125	13.2	6	70	3	1336	935	601	334	500
TCQB336M006#0070	B	33	6.3	125	19.8	6	70	3	1336	935	601	334	500
TCQB476M006#0070	B	47	6.3	125	28.2	6	70	3	1336	935	601	334	500
TCQD157M006#0025	D	150	6.3	125	90	6	25	3	3000	2100	1350	750	1000
TCQD157M006#0040	D	150	6.3	125	90	6	40	3	2372	1660	1067	593	1000
<b>10 Volt</b>													
TCQD686M010#0025	D	68	10	125	68	6	25	3	3000	2100	1350	750	1000
TCQD686M010#0040	D	68	10	125	68	6	40	3	2372	1660	1067	593	1000
TCQD107M010#0025	D	100	10	125	100	6	25	3	3000	2100	1350	750	1000
TCQD107M010#0040	D	100	10	125	100	6	40	3	2372	1660	1067	593	1000
<b>16 Volt</b>													
TCQD336M016#0070	D	33	16	125	52.8	6	70	3	1793	1255	807	448	1000
TCQD476M016#0070	D	47	16	125	75.2	6	70	3	1793	1255	807	448	1000
<b>20 Volt</b>													
TCQD226M020#0070	D	22	20	125	44	6	70	3	1793	1255	807	448	1000
<b>25 Volt</b>													
TCQD156M025#0070	D	15	25	125	37.5	6	70	3	1793	1255	807	448	1000
<b>35 Volt</b>													
TCQD106M035#0070	D	10	35	125	35	6	70	3	1793	1255	807	448	1000

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, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

ESR allowed to move up to 1.25 times catalog limit post mounting.

For typical weight and composition see page 223.

**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.**

### RECOMMENDED DERATING FACTOR

Voltage and temperature derating as percentage of  $V_r$ .

Rated voltage	Operating Temperature		
	$\leq 85^\circ\text{C}$	$105^\circ\text{C}$	$125^\circ\text{C}$
$\leq 10\text{V}$	90%	90%	60%
$\geq 16\text{V}$	80%	80%	54%



### QUALIFICATION TABLE

TEST	TCQ series (Temperature range $-55^\circ\text{C}$ to $125^\circ\text{C}$ )										
	Condition			Characteristics							
<b>Endurance</b>	Determine after application of $125^\circ\text{C}$ temperature, 2/3 rated voltage for 1000 +48/-0 hours and then leaving 1-2 hours at room temperature. Power supply impedance to be $\leq 0.1\Omega/V$ .			Visual examination	no visible damage						
				DCL	2 x initial limit						
				$\Delta C/C$	within +10/-20% of initial value						
				DF	2 x initial limit						
				ESR	2 x initial limit						
<b>Storage Life</b>	$125^\circ\text{C}$ , 0V, 1000h			Visual examination	no visible damage						
				DCL	2x initial limit						
				$\Delta C/C$	within +10/-20% of initial value						
				DF	2 x initial limit						
				ESR	2 x initial limit						
<b>Biased Humidity</b>	Determine after leaving for 1000 (500) hours at $85\pm 2^\circ\text{C}$ , 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						
				$\Delta C/C$	within +35/-5% of initial value						
				DF	1.5 x initial limit						
				ESR	2 x initial limit						
<b>Temperature Stability</b>	Step	Temperature $^\circ\text{C}$	Duration(min)		+20 $^\circ\text{C}$	-55 $^\circ\text{C}$	+20 $^\circ\text{C}$	+85 $^\circ\text{C}$	+125 $^\circ\text{C}$	+20 $^\circ\text{C}$	
	1	+20 $\pm$ 2	15	DCL	IL*	n/a	IL*	10 x IL*	12.5 x IL*	IL*	
	2	-55+0/-3	15								
	3	+20 $\pm$ 2	15	$\Delta C/C$	n/a	$\pm 20\%$	$\pm 5\%$	$\pm 20\%$	$\pm 30\%$	$\pm 5\%$	
	4	+85+3/-0	15	DF	IL*	IL*	IL*	1.2 x IL*	1.5 x IL*	IL*	
	5	+125+3/-0	15								
6	+20 $\pm$ 2	15									
<b>Surge Voltage</b>	Test temperature: $125^\circ\text{C} +3/0^\circ\text{C}$ Surge voltage: 1.3x 2/3x rated voltage at $125^\circ\text{C}$ Charge/Discharge resistance: $1000\pm 100\Omega$ Number of cycles: 1000x Cycle duration: 6 min; 30 sec charge, 5 min 30 sec discharge			Visual examination	no visible damage						
				DCL	initial limit						
				$\Delta C/C$	within +10/-20% of initial value for $V_r \leq 10\text{V}$ within +20/-30% of initial value for $V_r \geq 16\text{V}$						
				DF	initial limit for $V_r \leq 10\text{V}$ 1.25x initial limit for $V_r \geq 16\text{V}$						
				ESR	1.25 x initial limit						

\*Initial Limit

For use outside of recommended conditions and special request, please contact manufacturer.

Initial measurement max. 1hr after the removal from dry pack or after pretreatment at  $85^\circ\text{C}$  for 24 hours.

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