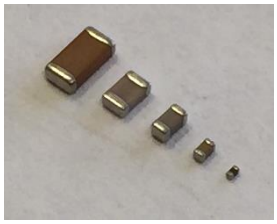
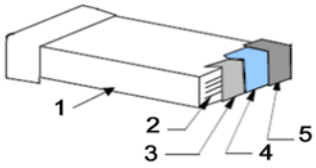
Features:

- -55°C to 125°C operating temperature range
- EIA sizes 0402, 0603, 0805, 1206, 1210 and 1812
- Capacitance offering from 0.1pF to 0.1uF
- RoHS compliant, REACH compliant, lead free and halogen free



Construction



1 - Ceramic layers (dielectric)

2 - Inner electrodes

3 - Base termination

4 - Nickel plating layer

5 - Tin plating layer

Electrical Specifications

Type/Code	Dielectric Code	Standard Tolerance		Capacitance Range	
		Code	Description	50V	100V
CML0402	C0G	C	± 0.25pF	0.1pF - 8.2pF	-
		J	± 5%	10pF - 1000pF	-
CML0603	C0G	C	± 0.25pF	0.5pF - 8.2pF	0.5pF - 8.2pF
		J	± 5%	10pF - 0.01uF	10pF - 0.01uF
CML0805	C0G	C	± 0.25pF	0.5pF - 8.2pF	0.5pF - 8.2pF
		J	± 5%	10pF - 0.022uF	10pF - 0.022uF
CML1206	C0G	C	± 0.25pF	1.2pF - 8.2pF	1.2pF - 8.2pF
		J	± 5%	10pF - 0.1uF	10pF - 0.022uF
CML1210	C0G	J	± 5%	10pF - 0.047uF	10pF - 0.047uF
CML1812	C0G	J	± 5%	10pF - 0.1uF	10pF - 0.1uF

How to Order

C	M	L	0	4	0	2	C	0	G	1	0	0	J	T	5	0	V

Product Series	
Code	Description
CML	Multilayer Ceramic

Size
Code
0402
0603
0805
1206
1210
1812

Dielectric
Code
C0G

Capacitance Range	
0.1pF to 0.10uF (E12)	
EIA Code	Capacitance
0R1	0.1pF
100	10pF
101	100pF
102	1000pF
103	0.01uF
104	0.1uF

Tolerance (*)	
Code	Description
C	± 0.25pF
G	± 2%
J	± 5%

(*) Other tolerances may be available. Contact Stackpole.

Packaging		
Code	Description	Size and Quantity
T	7" Paper Reel	Refer to Packaging Specifications
	7" Plastic Tape	

Max Working Voltage
50V
100V

Capacitance and Voltage Available

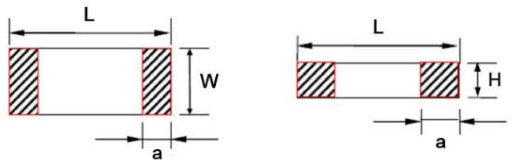
Dielectric		C0G										
EIA	Size	0402	0603		0805		1206		1210		1812	
Code	VDCW	50V	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V
0R1	0.1 pF											
0R2	0.2 pF											
0R3	0.3 pF											
0R4	0.4 pF											
0R5	0.5 pF											
0R6	0.6 pF											
0R7	0.7 pF											
0R8	0.8 pF											
0R9	0.9 pF											
1R0	1 pF											
1R2	1.2 pF											
1R5	1.5 pF											
1R8	1.8 pF											
2R0	2 pF											
2R2	2.2 pF											
2R7	2.7 pF											
3R0	3 pF											
3R3	3.3 pF											
3R9	3.9 pF											
4R7	4.7 pF											
5R0	5 pF											
5R6	5.6 pF											
6R8	6.8 pF											
8R2	8.2 pF											
100	10 pF											
120	12 pF											
150	15 pF											
180	18 pF											
220	22 pF											
270	27 pF											
330	33 pF											
390	39 pF											
470	47 pF											
560	56 pF											
680	68 pF											
820	82 pF											
101	100 pF											
121	120 pF											
151	150 pF											
181	180 pF											
221	220 pF											
271	270 pF											
331	330 pF											
391	390 pF											
471	470 pF											
561	560 pF											
681	680 pF											
821	820 pF											
102	1000 pF											
122	1200 pF											
152	1500 pF											
182	1800 pF											
222	2200 pF											
272	2700 pF											
332	3300 pF											
392	3900 pF											
472	4700 pF											
562	5600 pF											
682	6800 pF											
822	8200 pF											

Capacitance and Voltage Available (cont.)

Dielectric		C0G										
EIA	Size	0402	0603		0805		1206		1210		1812	
Code	VDCW	50V	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V
103	0.01 uF											
123	0.012 uF											
153	0.015 uF											
183	0.018 uF											
223	0.022 uF											
273	0.027 uF											
333	0.033 uF											
473	0.047 uF											
563	0.056 uF											
683	0.068 uF											
823	0.082 uF											
104	0.1 uF											

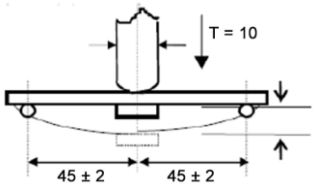
= Available

Mechanical Specifications and Packaging Specifications



Type/Code	Voltage	Capacitance Value	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML0402C0G	50V	0.1pF - 1000pF	0.039 ± 0.008 1.00 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.002 0.50 ± 0.05	0.010 ± 0.004 0.25 ± 0.10	inches mm	10000	-
CML0603C0G	50V and 100V	0.5pF - 0.01uF	0.063 ± 0.008 1.60 ± 0.20	0.031 ± 0.008 0.80 ± 0.20	0.031 ± 0.008 0.80 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm	4000	-
CML0805C0G	50V and 100V	0.5pF - 2200pF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.028 ± 0.008 0.70 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm	4000	-
		2700pF - 0.022uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.049 ± 0.006 1.25 ± 0.15	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	3000
CML1206C0G	50V and 100V	1.2pF - 6800pF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.035 ± 0.008 0.90 ± 0.20	0.024 ± 0.012 0.60 ± 0.30	inches mm	4000	-
		8200pF and 0.01uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.049 ± 0.004 1.25 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	3000
		0.012uF - 0.022uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
	50V	0.027uF - 0.1uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
CML1210C0G	50V and 100V	10pF - 0.01uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.037 ± 0.004 0.95 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		0.012uF and 0.015uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		0.018uF - 0.047uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.079 ± 0.008 2.00 ± 0.20	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
CML1812C0G	50V and 100V	10pF - 0.033uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		0.039uF - 0.1uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.016 3.20 ± 0.40	0.098 ± 0.012 2.50 ± 0.30	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	500

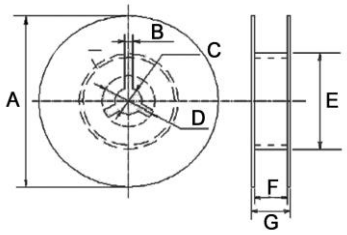
Environmental Characteristics

Test	Test Specification		Test Condition		
Capacitance	Should be within the specified tolerance.		C0G: (Class I) Cap ≤ 1000pF 1.0 ± 0.2 Vrms, 1 MHz ± 10% Cap > 1000pF 1.0 ± 0.2 Vrms, 1 KHz ± 10%		
Dissipation Factor (DF)	C0G (Class I)	DF	Capacitance	Measuring Frequency	Measuring Voltage
		≤ 0.56%	Cr < 5pF	1 MHZ ± 10%	1 ± 0.2 Vrms
		1.5 [(150 / Cr) + 7] x 10 - 4	5pF ≤ Cr < 50pF		
		≤ 0.15%	50pF ≤ Cr ≤ 1000pF		
		≤ 0.15%	> 1000pF	1 KHZ ± 10%	
Insulation Resistance	C0G (Class I)	C ≤ 10 nF, Ri ≥ 50000 MΩ C > 10 nF, RI*CR ≥ 500 S	Measuring Voltage: Rated Voltage (Max 500V) Duration: 60 ± 5 seconds Test Humidity: ≤ 75% Test Temperature: 25°C ± 5°C Test Current: ≤ 50 mA		
Dielectric Withstanding Voltage	No breakdown or damage.		Measuring voltage: Class I: 300% rated voltage Duration: 1 ~ 5 seconds Charge/Discharge Current: 50 mA max.		
Solderability	At least 95% of the terminal electrode is covered by new solder. Visual appearance: No visible damage.		Preheating Conditions: 80ºC to 120°C, 10 ~ 30 seconds Solder Temperature: 235ºC ± 5% (Sn/Pb: 63/37) Duration: 2 ± 0.5 seconds Solder Temperature: 245ºC ± 5°C (Lead-free) Duration: 2 ± 0.5 seconds		
Resistance to Soldering Heat	Item	C0G	Preheating Conditions: 100ºC to 200°C; 10 ± 2 minutes Solder Temperature: 265ºC ± 5°C Duration: 10 ± 1 seconds Clean the capacitor with solvent and examine it with a 10X (min.) microscope. Recovery Time: 24 ± 2 hours Recovery Condition: Room temperature.		
	Δ C/C	≤ ± 0.5% or ± 0.5pF whichever is larger			
	DF	Same to initial value			
	IR	Same to initial value			
	Appearance: No visible damage. At least 95% of the terminal electrode is covered by new solder.				
Resistance to Flexure of Substrate (Bending Strength)	Appearance: No visible damage. Δ C/C: ≤ ± 10%		Test Board: Al2O3 or PCB Warp: 1 mm Speed: 0.5 mm/second The measurement should be made with the board in the bending position.  Unit: mm		
Termination Adhesion	No visible damage		Applied Force: 5 N Duration: 10 ± 1 seconds		
Temperature Cycle	C0G: Δ C/C: ≤ ± 2.5% or ± 1pF, whichever is larger		Preheating Conditions: up-category Temperature: 1 hour Recovery Time: 24 ± 1 hours Initial Measurement Cycling times: 5 times, 1 cycle, 4 steps:		
			Step	Temp. (°C)	Time (min.)
			1	Low-category temp. C0G: -55ºC	30 ± 3
			2	Normal temp. (+20)	2 - 3
			3	Up-category temp. C0G: +125ºC	30 ± 3
			4	Normal temp. (+20ºC)	2 - 3
			Recovery time after test: 24 ± 2 hours		

Environmental Characteristics (cont.)

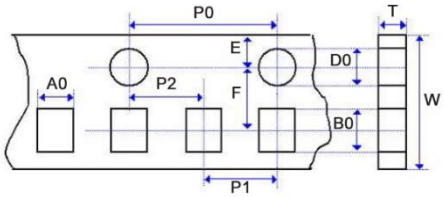
Test	Test Specification	Test Condition
Moisture Resistance	C0G: Δ C/C: ≤ ±5% or ± 1pF, whichever is larger DF: Not more than twice of initial value. IR: C0G: Ri ≥ 2500 M Ω or RI*CR ≥ 25 S whichever is smaller Appearance: No visible damage	Temperature: 40ºC ± 2°C Humidity: 90 ~ 95% R.H. Duration: 500 hours Recovery Conditions: Room temperature Recovery Time: 24 hours (Class I)
Life Test	C0G: Δ C/C: ≤ ± 3% or ± 1pF, whichever is larger DF: Not more than twice of initial value. IR: C0G: Ri ≥ 4000 M Ω or RI*CR ≥ 40 S whichever is smaller Appearance: No visible damage	Low-voltage (< 100V) Applied Voltage: 1.5 x rated voltage Duration: 1000 hours Temperature: 125°C (C0G) Charge/Discharge Current: 50 mA max. Recovery Conditions: Room temperature Recovery Time: 24 hours (Class I)
Middle and High Voltage Life Test	C0G: Δ C/C: ≤ ± 2% or ± 1pF, whichever is larger DF: Not more than twice of initial value. IR: C0G: Ri ≥ 4000 M Ω or Ri*CR ≥ 40 S whichever is smaller Appearance: No visible damage	Applied voltage: 100V ≤ rated voltage < 500V: 2 multiple 500V ≤ rated voltage ≤ 1000V: 1.5 multiple > 1000V rated voltage: 1.2 multiple Duration: 1000 hours Charge/Discharge Current: 50 mA max. Temperature: 125°C (C0G) Recovery Conditions: Room temperature Recovery Time: 24 hours (Class I)

Reel Specifications



Type/Code	A	B	C	D	E	F	G	Unit
CML_C0G (all sizes except 1812)	7.008 ± 0.079 178.00 ± 2.00	0.118 3.00	0.512 ± 0.020 13.00 ± 0.50	0.827 ± 0.031 21.00 ± 0.80	1.969 or more 50.00 or more	0.394 ± 0.059 10.00 ± 1.50	0.472 max 12.00 max	inches mm
CML_C0G (1812 size)	7.008 ± 0.079 178.00 ± 2.00	0.118 3.00	0.512 ± 0.020 13.00 ± 0.50	0.827 ± 0.031 21.00 ± 0.80	1.969 or more 50.00 or more	0.488 ± 0.079 12.40 ± 2.00	not defined	inches mm

Packaging Specifications – Paper Tape

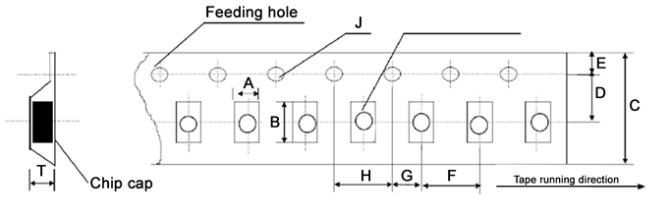


Type/Code	A_0	B_0	T	W	P_0	Unit
CML0402C0G	0.028 ± 0.008 0.70 ± 0.20	0.047 ± 0.008 1.20 ± 0.20	0.031 below 0.80 below	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0603C0G	0.043 ± 0.012 1.10 ± 0.30	0.071 ± 0.012 1.80 ± 0.30	0.047 max 1.20 max	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0805C0G	0.059 ± 0.008 1.50 ± 0.20	0.091 ± 0.008 2.30 ± 0.20	0.045 max 1.15 max	0.315 ± 0.006 8.00 ± 0.15	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML1206C0G	0.075 ± 0.020 1.90 ± 0.50	0.138 ± 0.020 3.50 ± 0.50	0.047 max 1.20 max	0.315 ± 0.008 8.00 ± 0.20	0.157 ± 0.004 4.00 ± 0.10	inches mm

Packaging Specifications – Paper Tape (cont.)

Type/Code	P_1	P_2	D_0	E	F	Unit
CML0402C0G	0.079 ± 0.002 2.00 ± 0.05	0.079 ± 0.002 2.00 ± 0.05	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches mm
CML0603C0G	0.157 ± 0.002 4.00 ± 0.05	0.079 ± 0.004 2.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches mm
CML0805C0G	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches mm
CML1206C0G	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm

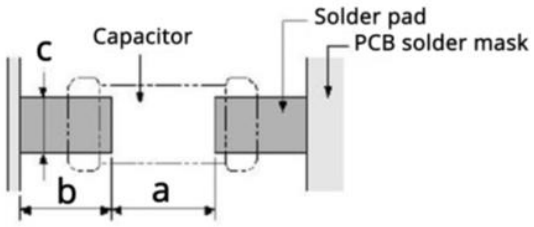
Packaging Specifications – Plastic Tape



Type/Code	A	B	C	D	E	Unit
CML0805C0G	0.061 ± 0.010 1.55 ± 0.25	0.094 ± 0.012 2.40 ± 0.30	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1206C0G (≤ 0.01uF)	0.077 ± 0.008 1.95 ± 0.20	0.142 ± 0.008 3.60 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1206C0G (≥ 0.012uF)	0.079 ± 0.012 2.00 ± 0.30	0.146 ± 0.012 3.70 ± 0.30	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1210C0G	0.106 ± 0.004 2.70 ± 0.10	0.135 ± 0.004 3.42 ± 0.10	0.315 ± 0.004 8.00 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1812C0G	0.144 ± 0.004 3.66 ± 0.10	0.195 ± 0.004 4.95 ± 0.10	0.472 ± 0.004 12.00 ± 0.10	0.217 ± 0.002 5.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
Type/Code	F	G	H	J	T	Unit
CML0805C0G	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.079 max 2.00 max	inches mm
CML1206C0G (≤ 0.01uF)	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.079 max 2.00 max	inches mm
CML1206C0G (≥ 0.012uF)	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.098 max 2.50 max	inches mm
CML1210C0G	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.126 max 3.20 max	inches mm
CML1812C0G	0.315 ± 0.004 8.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.157 max 4.00 max	inches mm

Recommended Solder Pad for Wave Soldering

Type	0603	0805	1206	1210	Unit
Length (L)	0.063 1.60	0.079 2.00	0.126 3.20	0.126 3.20	inches mm
Width (W)	0.031 0.80	0.049 1.25	0.063 1.60	0.098 2.50	inches mm
a	0.031 ~ 0.039 0.80 ~ 1.00	0.039 ~ 0.055 1.00 ~ 1.40	0.071 ~ 0.098 1.80 ~ 2.50	0.071 ~ 0.098 1.80 ~ 2.50	inches mm
b	0.020 ~ 0.031 0.50 ~ 0.80	0.031 ~ 0.059 0.80 ~ 1.50	0.031 ~ 0.067 0.80 ~ 1.70	0.031 ~ 0.067 0.80 ~ 1.70	inches mm
c	0.024 ~ 0.031 0.60 ~ 0.80	0.035 ~ 0.047 0.90 ~ 1.20	0.047 ~ 0.063 1.20 ~ 1.60	0.071 ~ 0.098 1.80 ~ 2.50	inches mm



NOTE: Solder pad information is for reference only.

Recommended Solder Pad for Reflow Soldering							
Type	0402	0603	0805	1206	1210	1812	Unit
Length (L)	0.043 1.10	0.063 1.60	0.079 2.00	0.126 3.20	0.126 3.20	0.177 4.50	inches mm
Width (W)	0.020 0.50	0.031 0.80	0.049 1.25	0.063 1.60	0.098 2.50	0.126 3.20	inches mm
a	0.018 ~ 0.022 0.45 ~ 0.55	0.024 ~ 0.031 0.60 ~ 0.80	0.031 ~ 0.047 0.80 ~ 1.20	0.071 ~ 0.098 1.80 ~ 2.50	0.071 ~ 0.098 1.80 ~ 2.50	0.098 ~ 0.138 2.50 ~ 3.50	inches mm
b	0.016 ~ 0.020 0.40 ~ 0.50	0.024 ~ 0.031 0.60 ~ 0.80	0.024 ~ 0.047 0.60 ~ 1.20	0.024 ~ 0.059 0.60 ~ 1.50	0.024 ~ 0.059 0.60 ~ 1.50	0.039 ~ 0.071 1.00 ~ 1.80	inches mm
c	0.018 ~ 0.022 0.45 ~ 0.55	0.024 ~ 0.031 0.60 ~ 0.80	0.035 ~ 0.063 0.90 ~ 1.60	0.047 ~ 0.079 1.20 ~ 2.00	0.071 ~ 0.126 1.80 ~ 3.20	0.091 ~ 0.138 2.30 ~ 3.50	inches mm

NOTE: Solder pad information is for reference only.

RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union's directive regarding "Restrictions on Hazardous Substances" (RoHS 3). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

RoHS Compliance Status						
Standard Product Series	Description	Package / Termination Type	Standard Series RoHS Compliant	Lead-Free Termination Composition	Lead-Free Mfg. Effective Date (Std Product Series)	Lead-Free Effective Date Code (YY/WW)
CML	Multilayer Ceramic Chip Capacitor	SMD	YES	100% Matte Sn over Ni	Always	Always

"Conflict Metals" Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the "conflict region" of the eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

Compliance to "REACH"

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, "The Registration, Evaluation, Authorization and Restriction of Chemicals", otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

Environmental Policy

It is the policy of Stackpole Electronics, Inc. to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.

CML_X5R Series

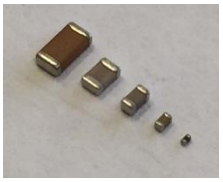
Multilayer Ceramic Chip Capacitor

Stackpole Electronics, Inc.

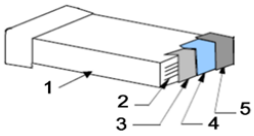
Resistive Product Solutions

Features:

- -55°C to 85°C operating temperature range
- EIA sizes 0402, 0603, 0805, 1206, 1210 and 1812
- Capacitance offering from 0.047 uF to 100 uF
- RoHS compliant, REACH compliant, lead free and halogen free



Construction



1 - Ceramic layers (dielectric)
2 - Inner electrodes
3 - Base termination
4 - Nickel plating layer
5 - Tin plating layer

Electrical Specifications

Type / Code	Dielectric	Standard Tolerance		Capacitance Range			
	Code	Code	Description	10V	16V	25V	50V
CML0402	X5R	K	± 10%	120 pF - 0.039 uF			
				0.047 uF - 0.1 uF			-
				0.12 uF - 0.47 uF		-	
CML0603	X5R	K	± 10%	0.47 uF - 1 uF			
				1.2 uF - 2.2 uF			-
CML0805	X5R	K	± 10%	150 pF - 0.39 uF			
				0.47 uF - 2.2 uF			-
CML1206	X5R	K	± 10%	150 pF - 4.7 uF			
				10 uF	-		
CML1210	X5R	K	± 10%	4.7 uF - 22 uF			-
				33 uF - 47 uF		-	
				68 uF - 100 uF	-		
CML1812	X5R	K	± 10%	-	4.7 uF - 6.8 uF		-
				10 uF			-
				15 uF - 22 uF		-	
				33 uF - 47 uF	-		

Note: J = ± 5% tolerance may be available

How to Order

C	M	L	0	4	0	2	X	5	R	1	0	4	K	T	5	0	V

Product Series	
Code	Description
CML	Multilayer Ceramic

Size
Code
0402
0603
0805
1206
1210
1812

Dielectric
Code
X5R

Capacitance Range	
0.1pF to 0.10uF (E12)	
EIA Code	Capacitance
473	0.047 uF
104	0.1 uF
105	1 uF
106	10 uF
107	100 uF

Tolerance (*)	
Code	Description
J	± 5%
K	± 10%

(*) Other tolerances may be available. Contact Stackpole.

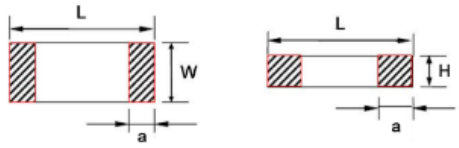
Packaging			
Code	Description	Size	Quantity
T	7" Paper Reel	Refer to Packaging Specifications	
	7" Plastic Tape		

Max Working Voltage
10V
16V
25V
50V

Capacitance and Voltage Available

Dielectric		X5R																				
EIA	Size	0402				0603				0805			1206				1210			1812		
Code	VDCW	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	10V	16V	25V	50V	10V	16V	25V	10V	16V	25V
473	0.047 uF				■																	
563	0.056 uF				■																	
683	0.068 uF				■																	
823	0.082 uF				■																	
104	0.1 uF	■	■	■	■																	
154	0.15 uF	■	■	■																		
224	0.22 uF	■	■	■																		
334	0.33 uF	■	■	■																		
474	0.47 uF	■	■	■		■	■	■	■													
684	0.68 uF	■	■	■		■	■	■	■													
105	1 uF	■	■	■		■	■	■	■	■	■	■										
155	1.5 uF	■	■	■		■	■	■		■	■	■										
225	2.2 uF	■	■	■		■	■	■		■	■	■	■	■	■	■						
335	3.3 uF	■				■	■	■		■	■	■	■	■	■	■						
475	4.7 uF	■				■	■	■		■	■	■	■	■	■	■	■	■	■		■	■
685	6.8 uF					■	■	■		■	■	■					■	■	■		■	■
106	10 uF					■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■
156	15 uF																■	■	■	■	■	
226	22 uF									■	■		■	■	■		■	■	■	■	■	
336	33 uF																■	■		■		
476	47 uF												■				■	■		■		
686	68 uF																■					
107	100 uF																■					

Mechanical Specifications and Packaging Specifications



Type / Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML0402X5R	10V - 50V	0.1 uF - 4.7 uF	0.039 ± 0.008 1.00 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.002 0.50 ± 0.05	0.010 ± 0.004 0.25 ± 0.10	inches mm	10000	-
CML0603X5R	10V - 50V	0.47 uF - 10 uF	0.063 ± 0.008 1.60 ± 0.20	0.031 ± 0.008 0.80 ± 0.20	0.031 ± 0.004 0.80 ± 0.10	0.012 ± 0.004 0.30 ± 0.10	inches mm	4000	-
CML0805X5R	10V - 16V	1 uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.039 ± 0.004 1.00 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	3000
		1.5 uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.047 ± 0.004 1.20 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	3000
		2.2 uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.031 ± 0.004 0.80 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	4000	-
		3.3 uF - 22 uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.047 ± 0.004 1.20 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	2000
	25V	1 uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.039 ± 0.004 1.00 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	3000
		1.5 uF - 2.2 uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.047 ± 0.004 1.20 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	3000
		3.3 uF - 10 uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.047 ± 0.004 1.20 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	2000

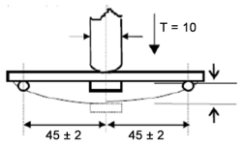
Mechanical Specifications and Packaging Specifications (cont.)

Type / Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML1206X5R	10V	2.2 uF - 3.3 uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.047 ± 0.004 1.20 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	3000
		4.7 uF - 22 uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
		47 uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.071 ± 0.004 1.80 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
	16V - 25V	2.2 uF - 3.3 uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.047 ± 0.004 1.20 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	3000
		4.7 uF - 22 uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
	50V	2.2 uF - 3.3 uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.047 ± 0.004 1.20 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	3000
		4.7 uF - 10 uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
CML1210X5R	10V	4.7 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.047 ± 0.004 1.20 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
		6.8 uF - 10 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.071 ± 0.004 1.80 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
		15 uF - 100 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.098 ± 0.010 2.50 ± 0.25	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	500
	16V	4.7 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.047 ± 0.004 1.20 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
		6.8 uF - 10 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.071 ± 0.004 1.80 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
		15 uF - 47 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.098 ± 0.010 2.50 ± 0.25	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	500
	25V	4.7 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.047 ± 0.004 1.20 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
		6.8 uF - 10 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.071 ± 0.004 1.80 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
		15 uF - 22 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.098 ± 0.010 2.50 ± 0.25	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	500
CML1812X5R	10V - 25V	4.7 uF - 47 uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.071 ± 0.004 1.80 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	1000

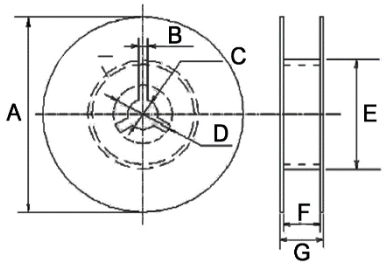
Environmental Characteristics

Test	Test Specification						Test Condition
Capacitance	Should be within the specified tolerance.						X5R: (Class II) Cap ≤ 10 uF 1.0 ± 0.2 Vrms, 1 KHz ± 10% Cap > 10 uF 0.5 ± 0.1 Vrms, 120 Hz ± 10%
Dissipation Factor (DF)	X5R (Class II)	X5R (≥ 0402)	≥ 50V	25V	16V	10V	Cap ≤ 10 uF 1.0 ± 0.2 Vrms, 1 KHz ± 10% Cap > 10 uF 0.5 ± 0.1 Vrms, 120 Hz ± 10%
			≤ 2.5%	≤ 3.5% (C < 0.47 uF) ≤ 10.0% (C ≥ 0.47 uF)		≤ 5% (C < 0.15 uF) ≤ 10.0% (C ≥ 0.15	
Insulation Resistance	X5R (Class II)	C ≤ 25 nF, Ri ≥ 10,000 MΩ C > 25 nF, RI*CR > 100 S					Measuring Voltage: Rated Voltage (Max 500V) Duration: 60 ± 5 seconds Test Humidity: ≤ 75% Test Temperature: 25°C ± 5°C Test Current: ≤ 50 mA
Dielectric Withstanding Voltage	No breakdown or damage.						Measuring voltage: Class II: 250% rated voltage Duration: 1 ~ 5 seconds Charge/Discharge Current: 50 mA max.

Environmental Characteristics (cont.)

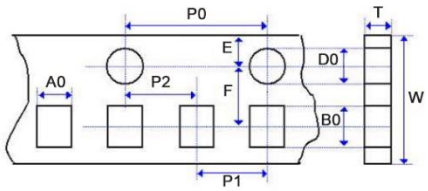
<table>
<tr><th>Test</th><th>Test Specification</th><th>Test Condition</th></tr>
<tr><td>Solderability</td><td>At least 95% of the terminal electrode is covered by new solder.
Visual appearance: No visible damage.</td><td>Preheating Conditions: 80ºC to 120°C, 10 ~ 30 seconds
Solder Temperature: 235ºC ± 5% (Sn/Pb: 63/37)
Duration: 2 ± 0.5 seconds
Solder Temperature: 245ºC ± 5°C (Lead-free)
Duration: 2 ± 0.5 seconds</td></tr>
<tr><td>Resistance to Soldering Heat</td><td><table><tr><th>Item</th><th>X5R</th></tr><tr><td>Δ C/C</td><td>-5 ~ + 10%</td></tr><tr><td>DF</td><td>Same to initial value</td></tr><tr><td>IR</td><td>Same to initial value</td></tr></table>Appearance: No visible damage. At least 95% of the terminal electrode is covered by new solder.</td><td>Preheating Conditions: 100ºC to 200°C; 10 ± 2 minutes
Solder Temperature: 265ºC ± 5 °C
Duration: 10 ± 1 seconds
Clean the capacitor with solvent and examine it with a 10X (min.) microscope.
Recovery Time: 24 ± 2 hours
Recovery Condition: Room temperature.</td></tr>
<tr><td>Resistance to Flexure of Substrate (Bending Strength)</td><td>Appearance: No visible damage. Δ C/C: ≤ ± 10%</td><td>Test Board: Al2O3 or PCB
Warp: 1 mm
Speed: 0.5 mm / second
The measurement should be made with the board in the bending position.
Unit: mm
  </td></tr>
<tr><td>Termination Adhesion</td><td>No visible damage</td><td>Applied Force: 5 N
Duration: 10 ± 1 seconds</td></tr>
<tr><td>Temperature Cycle</td><td>X5R: Δ C/C: ≤ ± 10%</td><td>Preheating Conditions: up-category temperature 1 hour
Recovery Time: 24 ± 1 hours
Initial Measurement
Cycling times: 5 times, 1 cycle, 4 steps:<table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Low-category temp.
X5R: -55ºC</td><td>30 ± 3</td></tr><tr><td>2</td><td>Normal temp. (+20ºC)</td><td>2 - 3</td></tr><tr><td>3</td><td>Up-category temp.
X5R: +85ºC</td><td>30 ± 3</td></tr><tr><td>4</td><td>Normal temp. (+20ºC)</td><td>2 - 3</td></tr></table>Recovery time after test: 24 ± 2 hours</td></tr>
<tr><td>Moisture Resistance</td><td>X5R: Δ C/C: ≤ ± 10%
DF: Not more than twice of initial value.
IR: X5R: Ri ≥ 1000 MΩ or RI*CR ≥ 25 S whichever is smaller
Appearance: No visible damage</td><td>Temperature: 40ºC ± 2°C
Humidity: 90 ~ 95% R.H.
Duration: 500 hours
Recovery Conditions: Room temperature
Recovery Time: 48 hours (Class II)</td></tr>
<tr><td>Life Test</td><td>X5R: Δ C/C: ≤ ± 20%
DF: Not more than twice of initial value.
IR: X5R: Ri ≥ 2000 MΩ or RI*CR ≥ 50 S whichever is smaller
Appearance: No visible damage</td><td>Low-voltage (< 100V)
Applied Voltage: 1.5 x rated voltage
Duration: 1000 hours
Temperature: 85°C (X5R)
Charge/Discharge Current: 50 mA max.
Recovery Conditions: Room temperature
Recovery Time: 48 hours (Class II)</td></tr>
</table>

Reel Specifications



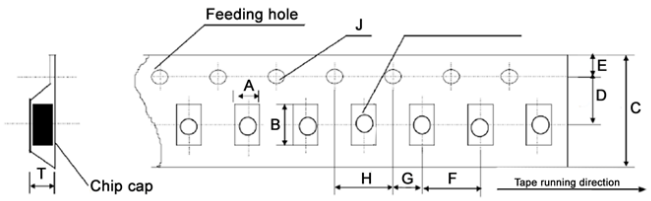
Type/Code	A	B	C	D	E	F	G	Unit
CML_X5R (all sizes)	7.008 ± 0.079 178.00 ± 2.00	0.118 3.00	0.512 ± 0.020 13.00 ± 0.50	0.827 ± 0.031 21.00 ± 0.80	1.969 or more 50.00 or more	0.394 ± 0.059 10.00 ± 1.50	0.472 max 12.00 max	inches mm

Paper Tape Specifications



Type/Code	A0	B0	T	W	P0	Unit
CML0402X5R	0.026 ± 0.004 0.65 ± 0.10	0.045 ± 0.004 1.15 ± 0.10	0.031 below 0.80 below	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0603X5R	0.043 ± 0.004 1.10 ± 0.10	0.075 ± 0.004 1.90 ± 0.10	0.043 max 1.10 max	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0805X5R	0.057 ± 0.006 1.45 ± 0.15	0.091 ± 0.006 2.30 ± 0.15	0.043 max 1.10 max	0.315 ± 0.006 8.00 ± 0.15	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML1206X5R	0.071 ± 0.008 1.80 ± 0.20	0.134 ± 0.008 3.40 ± 0.20	0.043 max 1.10 max	0.315 ± 0.008 8.00 ± 0.20	0.157 ± 0.004 4.00 ± 0.10	inches mm
Type/Code	P1	P2	D0	E	F	Unit
CML0402X5R	0.079 ± 0.002 2.00 ± 0.05	0.079 ± 0.002 2.00 ± 0.05	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches mm
CML0603X5R	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.002 4.00 ± 0.05	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches mm
CML0805X5R	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches mm
CML1206X5R	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm

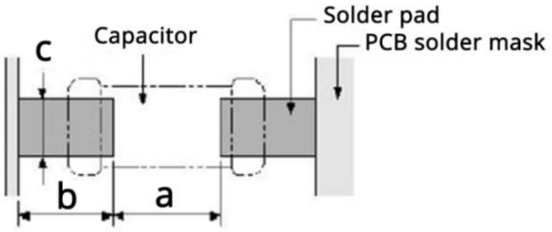
Plastic Tape Specifications



Type/Code	A	B	C	D	E	Unit
CML0805X5R	0.061 ± 0.008 1.55 ± 0.20	0.093 ± 0.008 2.35 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1206X5R	0.077 ± 0.008 1.95 ± 0.20	0.142 ± 0.008 3.60 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1210X5R	0.106 ± 0.004 2.70 ± 0.10	0.135 ± 0.004 3.42 ± 0.10	0.315 ± 0.004 8.00 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1812X5R	0.144 ± 0.004 3.66 ± 0.10	0.195 ± 0.004 4.95 ± 0.10	0.472 ± 0.004 12.00 ± 0.10	0.217 ± 0.002 5.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
Type/Code	F	G	H	J	T	Unit
CML0805X5R	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.059 max 1.50 max	inches mm
CML1206X5R	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.073 max 1.85 max	inches mm
CML1210X5R	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.126 max 3.20 max	inches mm
CML1812X5R	0.315 ± 0.004 8.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.157 max 4.00 max	inches mm

Recommended Solder Pad for Wave Soldering

Type	0603	0805	1206	1210	Unit
Length (L)	0.063 1.60	0.079 2.00	0.126 3.20	0.126 3.20	inches mm
Width (W)	0.031 0.80	0.049 1.25	0.063 1.60	0.098 2.50	inches mm
a	0.031 ~ 0.039 0.80 ~ 1.00	0.039 ~ 0.055 1.00 ~ 1.40	0.071 ~ 0.098 1.80 ~ 2.50	0.071 ~ 0.098 1.80 ~ 2.50	inches mm
b	0.020 ~ 0.031 0.50 ~ 0.80	0.031 ~ 0.059 0.80 ~ 1.50	0.031 ~ 0.067 0.80 ~ 1.70	0.031 ~ 0.067 0.80 ~ 1.70	inches mm
c	0.024 ~ 0.031 0.60 ~ 0.80	0.035 ~ 0.047 0.90 ~ 1.20	0.047 ~ 0.063 1.20 ~ 1.60	0.071 ~ 0.098 1.80 ~ 2.50	inches mm



NOTE: Solder pad information is for reference only.

Recommended Solder Pad for Reflow Soldering

Type	0402	0603	0805	1206	1210	1812	Unit
Length (L)	0.043 1.10	0.063 1.60	0.079 2.00	0.126 3.20	0.126 3.20	0.177 4.50	inches mm
Width (W)	0.020 0.50	0.031 0.80	0.049 1.25	0.063 1.60	0.098 2.50	0.126 3.20	inches mm
a	0.018 ~ 0.022 0.45 ~ 0.55	0.024 ~ 0.031 0.60 ~ 0.80	0.031 ~ 0.047 0.80 ~ 1.20	0.071 ~ 0.098 1.80 ~ 2.50	0.071 ~ 0.098 1.80 ~ 2.50	0.098 ~ 0.138 2.50 ~ 3.50	inches mm
b	0.016 ~ 0.020 0.40 ~ 0.50	0.024 ~ 0.031 0.60 ~ 0.80	0.024 ~ 0.047 0.60 ~ 1.20	0.024 ~ 0.059 0.60 ~ 1.50	0.024 ~ 0.059 0.60 ~ 1.50	0.039 ~ 0.071 1.00 ~ 1.80	inches mm
c	0.018 ~ 0.022 0.45 ~ 0.55	0.024 ~ 0.031 0.60 ~ 0.80	0.035 ~ 0.063 0.90 ~ 1.60	0.047 ~ 0.079 1.20 ~ 2.00	0.071 ~ 0.126 1.80 ~ 3.20	0.091 ~ 0.138 2.30 ~ 3.50	inches mm

NOTE: Solder pad information is for reference only.

RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union's directive regarding "Restrictions on Hazardous Substances" (RoHS 3). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

RoHS Compliance Status						
Standard Product Series	Description	Package / Termination Type	Standard Series RoHS Compliant	Lead-Free Termination Composition	Lead-Free Mfg. Effective Date (Std Product Series)	Lead-Free Effective Date Code (YY/WW)
CML	Multilayer Ceramic Chip Capacitor	SMD	YES	100% Matte Sn over Ni	Always	Always

"Conflict Metals" Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the "conflict region" of the eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

Compliance to "REACH"

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, "The Registration, Evaluation, Authorization and Restriction of Chemicals", otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

Environmental Policy

It is the policy of Stackpole Electronics, Inc. to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.

CML_X7R Series

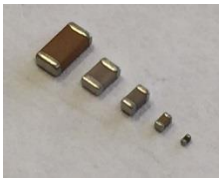
Multilayer Ceramic Chip Capacitor

Stackpole Electronics, Inc.

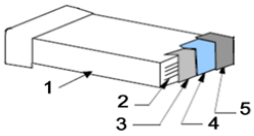
Resistive Product Solutions

Features:

- -55°C to 125°C operating temperature range
- EIA sizes 0402, 0603, 0805, 1206, 1210 and 1812
- Capacitance offering from 100 pF to 47uF
- RoHS compliant, REACH compliant, lead free and halogen free



Construction



1 - Ceramic layers (dielectric)
2 - Inner electrodes
3 - Base termination
4 - Nickel plating layer
5 - Tin plating layer

Electrical Specifications

Type/Code	Dielectric Code	Standard Tolerance		Capacitance Range				
		Code	Description	10V	16V	25V	50V	100V
CML0201	X7R	K	± 10%	1000pF - 0.022uF	100pF - 0.022uF	100pF - 0.01uF	100pF - 1000pF	-
CML0402	X7R	K	± 10%	100pF - 0.47uF	-			
				100pF - 0.22uF			-	
				100pF - 0.1uF				-
				100pF - 4700pF				
CML0603	X7R	K	± 10%	100pF - 2.2uF		-		
				100pF - 1.0uF				-
				100pF - 0.1uF				
CML0805	X7R	K	± 10%	100pF - 10uF		-		
				100pF - 4.7uF			-	
				100pF - 2.2uF				-
				100pF - 0.47uF				
CML1206	X7R	K	± 10%	150pF - 22uF		-		
				150pF - 10uF			-	
				150pF - 4.7uF				-
				150pF - 2.2uF				
CML1210	X7R	K	± 10%	1000pF - 47uF	-			
				1000pF - 22uF			-	
				1000pF - 10uF				-
				1000pF - 4.7uF				
CML1812	X7R	K	± 10%	1000pF - 1.0uF		1000pF - 10uF		1000pF - 2.2uF

Note: J = 5% tolerance may be available

How to Order

C	M	L	0	4	0	2	X	7	R	1	0	3	K	T	5	0	V

Product Series	
Code	Description
CML	Multilayer Ceramic

Size
Code
0201
0402
0603
0805
1206
1210
1812

Dielectric
Code
X7R

Capacitance Range	
0.1pF to 0.10uF (E12)	
EIA Code	Capacitance
101	100pF
102	1000pF
103	0.01uF
104	0.1uF
105	1uF
106	10uF

Tolerance (*)	
Code	Description
J	± 5%
K	± 10%

(*) Other tolerances may be available. Contact Stackpole.

Packaging			
Code	Description	Size	Quantity
T	7" Paper Reel	Refer to Packaging Specifications	
	7" Plastic Tape		

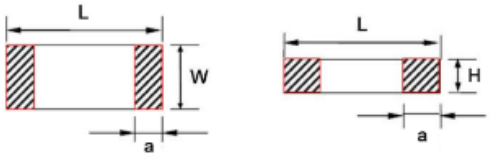
Max Working Voltage
10V
16V
25V
50V
100V

Capacitance and Voltage Available

Dielectric		X7R																													
EIA	Size	0201				0402					0603					0805					1206					1210					1812				
Code	VDCW	10V	16V	25V	50V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V
101	100 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■															
121	120 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■															
151	150 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
181	180 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
201	200 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
221	220 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
271	270 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
331	330 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
391	390 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
471	470 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
561	560 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
681	680 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
821	820 pF		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
102	1000 pF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
122	1200 pF	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
152	1500 pF	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
182	1800 pF	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
222	2200 pF	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
272	2700 pF	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
332	3300 pF	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
392	3900 pF	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
472	4700 pF	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
562	5600 pF	■	■	■		■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
682	6800 pF	■	■			■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
822	8200 pF	■	■			■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
103	0.01 uF	■	■	■		■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
123	0.012 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
153	0.015 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
183	0.018 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
223	0.022 uF	■	■			■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
273	0.027 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
333	0.033 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
393	0.039 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
473	0.047 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
563	0.056 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
683	0.068 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
823	0.082 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
104	0.1 uF					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
124	0.12 uF										■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
154	0.15 uF						■				■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
184	0.18 uF										■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
224	0.22 uF					■	■	■			■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
274	0.27 uF										■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
334	0.33 uF					■					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
394	0.39 uF										■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
474	0.47 uF					■					■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
564	0.56 uF										■	■				■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
684	0.68 uF										■	■				■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
824	0.82 uF										■	■				■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
105	1 uF										■	■	■	■		■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
155	1.5 uF															■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
225	2.2 uF										■	■				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
335	3.3 uf																				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
475	4.7 uF															■	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
685	6.8 uF																														■	■	■	■	■	■
106	10 uF															■	■	■			■	■	■			■	■	■	■					■	■	■	■
226	22 uF																				■	■				■	■	■								
476	47 uF																									■										

■ = Available

Mechanical Specifications and Packaging Specifications

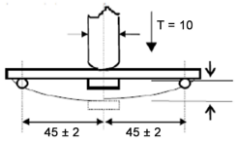


Type/Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML0201X7R	10V - 50V	100pF - 0.22uF	0.024 ± 0.001 0.60 ± 0.03	0.012 ± 0.001 0.30 ± 0.03	0.008 ± 0.001 0.20 ± 0.03	0.006 ± 0.002 0.15 ± 0.05	inches mm	15000	-
CML0402X7R	10V - 100V	100pF - 0.47uF	0.039 ± 0.008 1.00 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.010 ± 0.004 0.25 ± 0.10	inches mm	10000	-
CML0603X7R	10V - 100V	150pF - 2.2uF	0.063 ± 0.008 1.60 ± 0.20	0.031 ± 0.008 0.80 ± 0.20	0.031 ± 0.008 0.80 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm	4000	-
CML0805X7R	10V and 16V	100pF - 0.12uF	0.079 ± 0.006 2.00 ± 0.15	0.049 ± 0.004 1.25 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	4000	-
		0.15uF - 10uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	3000
	25V	100pF - 0.12uF	0.079 ± 0.006 2.00 ± 0.15	0.049 ± 0.004 1.25 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	4000	-
		0.15uF - 4.7uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	3000
	50V	100pF - 0.12uF	0.079 ± 0.006 2.00 ± 0.15	0.049 ± 0.004 1.25 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	4000	-
		0.15uF - 2.2uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	3000
	100V	100pF - 0.022uF	0.079 ± 0.006 2.00 ± 0.15	0.049 ± 0.004 1.25 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	inches mm	4000	-
		0.027uF - 0.47uF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm	-	3000
CML1206X7R	10V and 16V	150pF - 0.12uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.031 ± 0.004 0.80 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	4000	-
		0.15uF - 0.39uF	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.037 ± 0.004 0.95 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
		0.47uF - 2.2uF	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.045 ± 0.006 1.15 ± 0.15	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
		3.3uF - 22uF	0.130 ± 0.012 3.30 ± 0.30	0.067 ± 0.008 1.70 ± 0.20	0.067 ± 0.008 1.70 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
	25V	150pF - 0.12uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.031 ± 0.004 0.80 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	4000	-
		0.15uF - 0.39uF	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.037 ± 0.004 0.95 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
		0.47uF - 2.2uF	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.045 ± 0.006 1.15 ± 0.15	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
		3.3uF - 22uF	0.130 ± 0.012 3.30 ± 0.30	0.067 ± 0.008 1.70 ± 0.20	0.067 ± 0.008 1.70 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
	50V	150pF - 0.12uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.031 ± 0.004 0.80 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	4000	-
		0.15uF - 0.22uF	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.037 ± 0.004 0.95 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
		0.27uF - 0.33uF	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.049 ± 0.004 1.25 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
		0.39uF - 4.7uF	0.130 ± 0.012 3.30 ± 0.30	0.067 ± 0.008 1.70 ± 0.20	0.067 ± 0.008 1.70 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	2000
	100V	150pF - 0.068uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.031 ± 0.004 0.80 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	4000	-
		0.082uF and 0.12uF	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.049 ± 0.004 1.25 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
		0.1uF	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.037 ± 0.004 0.95 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	3000
		0.15uF - 3.3uF	0.130 ± 0.012 3.30 ± 0.30	0.067 ± 0.008 1.70 ± 0.20	0.067 ± 0.012 1.70 ± 0.30	0.024 ± 0.008 0.60 ± 0.20	inches mm	-	2000

Mechanical Specifications and Packaging Specifications (cont.)

Type/Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML1210X7R	10V	1000pF - 0.47uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.037 ± 0.004 0.95 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		0.56uF - 1.0uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		4.7uF and 10uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.079 ± 0.004 2.00 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		22uF and 47uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.098 ± 0.004 2.50 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
	16V and 25V	1000pF - 0.47uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.037 ± 0.004 0.95 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		0.56uF to 1.0uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		1.5uF to 3.3uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.071 ± 0.008 1.80 ± 0.20	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	2000
		4.7uF and 10uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.079 ± 0.004 2.00 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		22uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.098 ± 0.004 2.50 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
	50V	1000pF - 0.27uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.037 ± 0.004 0.95 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		0.33uF - 1.0uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		1.5uF - 10uF	0.126 ± 0.016 3.20 ± 0.40	0.098 ± 0.012 2.50 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
	100V	1000pF - 0.12uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.037 ± 0.004 0.95 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		0.15uF - 0.22uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	3000
		0.27uF and 0.33uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.008 2.50 ± 0.20	0.071 ± 0.008 1.80 ± 0.20	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	2000
		0.39uF - 0.56uF 1.5uF - 4.7uF	0.126 ± 0.016 3.20 ± 0.40	0.098 ± 0.012 2.50 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		0.68uF - 1.0uF	0.126 ± 0.016 3.20 ± 0.40	0.098 ± 0.012 2.50 ± 0.30	0.083 ± 0.012 2.10 ± 0.30	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
CML1812X7R	10V and 16V	1000pF to 1.0uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
	25V	1000pF to 1.5uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		2.2uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.008 1.60 ± 0.20	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		3.3uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.079 ± 0.008 2.00 ± 0.20	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		4.7uF - 10uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.016 3.20 ± 0.40	0.098 ± 0.008 2.50 ± 0.20	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	500
	50V	1000pF - 0.56uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		0.68uF - 1.5uF 3.3uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.079 ± 0.008 2.00 ± 0.20	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		2.2uF 4.7uF - 10uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	500
	100V	1000pF - 0.39uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.049 ± 0.004 1.25 ± 0.10	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		0.47uF - 1.5uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.079 ± 0.008 2.00 ± 0.20	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	1000
		2.2uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.016 3.20 ± 0.40	0.098 ± 0.012 2.50 ± 0.30	0.030 ± 0.010 0.75 ± 0.25	inches mm	-	500

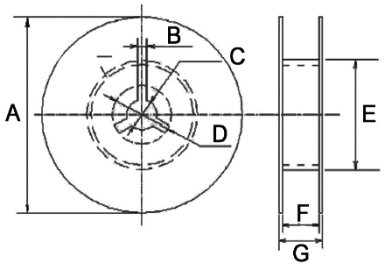
Environmental Characteristics

Test	Test Specification		Test Condition
Capacitance	Should be within the specified tolerance.		X7R: (Class II) Cap ≤ 10uF 1.0 ± 0.2 Vrms, 1 KHz ± 10% Cap > 10uF 0.5 ± 0.1 Vrms, 120 Hz ± 10%
Dissipation Factor (DF)	100V - 2.5%	(except for 0603 ≥ 0.068uF, 0805 ≥ 0.1uF, 1206 ≥ 0.47uF, 1210 ≥ 2.2uF, 1812 ≥ 4.7uF are all 10%)	Cap ≤ 10uF 1.0 ± 0.2 Vrms, 1 KHz ± 10% Cap > 10uF 0.5 ± 0.1 Vrms, 120 Hz ± 10%
	50V - 2.5%	(except for 0201, 0402 ≥ 0.012uF, 0603 ≥ 0.1uF, 0805 ≥ 0.18uF, 1206 ≥ 2.2uF, 1210 ≥ 10uF, 1812 ≥ 4.7uF are all 10%	
	25V - 3.5%	(except for 0201 ≥ 0.01uF, 0402 ≥ 0.056uF, 0603 ≥ 0.33uF, 0805 ≥ 1uF, 1206 ≥ 4.7uF, 1210 ≥ 22uF are all 10%	
	16V - 3.5%	(except for 0201 ≥ 0.01uF, 0402 ≥ 0.033uF, 0603 ≥ 0.15uF, 0805 ≥ 0.68uF, 1206 ≥ 2.2uF, 1210 ≥ 22uF are all 10%	
	10V - 5%	(except for 0201 ≥ 0.012uF, 0402 ≥ 0.15uF, 0603 ≥ 0.33uF, 0805 ≥ 2.2uF, 1206 ≥ 2.2uF, 1210 ≥ 22uF are all 10%, and 0201 ≥ 0.1uF, and 0402 ≥ 1uF are all 15%	
Insulation Resistance	X7R (Class II)	C ≤ 25nF, Ri ≥ 10000M Ω C > 25nF, RI*CR > 100S	Measuring Voltage: Rated Voltage (Max 500V) Duration: 60 ± 5 seconds Test Humidity: ≤ 75% Test Temperature: 25°C ± 5°C Test Current: ≤ 50 mA
Dielectric Withstanding Voltage	No breakdown or damage.		Measuring voltage: Class II: 250% rated voltage Duration: 1 ~ 5 seconds Charge/Discharge Current: 50 mA max.
Solderability	At least 95% of the terminal electrode is covered by new solder. Visual appearance: No visible damage.		Preheating Conditions: 80ºC to 120°C, 10 ~ 30 seconds Solder Temperature: 235ºC ± 5% (Sn/Pb: 63/37) Duration: 2 ± 0.5 seconds Solder Temperature: 245ºC ± 5°C (Lead-free) Duration: 2 ± 0.5 seconds
Resistance to Soldering Heat	Item	X7R	Preheating Conditions: 100ºC to 200°C; 10 ± 2 minutes Solder Temperature: 265ºC ± 5°C Duration: 10 ± 1 seconds Clean the capacitor with solvent and examine it with a 10X (min.) microscope. Recovery Time: 24 ± 2 hours Recovery Condition: Room temperature.
	Δ C/C	-5 ~ + 10%	
	DF	Same to initial value	
	IR	Same to initial value	
	Appearance: No visible damage. At least 95% of the terminal electrode is covered by new solder.		
Resistance to Flexure of Substrate (Bending Strength)	Appearance: No visible damage. Δ C/C: ≤ ± 10%		Test Board: Al2O3 or PCB Warp: 1 mm Speed: 0.5 mm / second The measurement should be made with the board in the bending position. Unit: mm 

Environmental Characteristics (cont.)

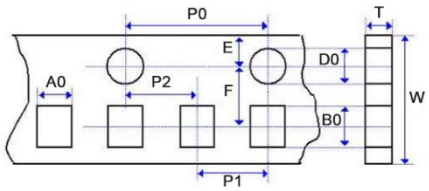
Test	Test Specification	Test Condition
Termination Adhesion	No visible damage	Applied Force: 5 N Duration: 10 ± 1 seconds
Temperature Cycle	X7R: Δ C/C: ≤ ± 10%	Preheating Conditions: up-category temperature 1 hour Recovery Time: 24 ± 1 hours Initial Measurement Cycling times: 5 times, 1 cycle, 4 steps: Step / Temp. (°C) / Time (min.) 1 / Low-category temp. X7R: -55ºC / 30 ± 3 2 / Normal temp. (+20ºC) / 2 - 3 3 / Up-category temp. X7R: +125ºC / 30 ± 3 4 / Normal temp. (+20ºC) / 2 - 3 Recovery time after test: 24 ± 2 hours
Moisture Resistance	X7R: Δ C/C: ≤ 12.5% DF: Not more than twice of initial value. IR: X7R: Ri ≥ 1000M Ω or RI*CR ≥ 25S whichever is smaller Appearance: No visible damage	Temperature: 40ºC ± 2°C Humidity: 90 ~ 95% R.H. Duration: 500 hours Recovery Conditions: Room temperature Recovery Time: 48 hours (Class II)
Life Test	X7R: Δ C/C: ≤ ± 25% DF: Not more than twice of initial value. IR: X7R: Ri ≥ 2000M Ω or RI*CR ≥ 50 S whichever is smaller Appearance: No visible damage	Low-voltage (< 100V) Applied Voltage: 1.5 x rated voltage Duration: 1000 hours Temperature: 125°C (X7R) Charge/Discharge Current: 50 mA max. Recovery Conditions: Room temperature Recovery Time: 48 hours (Class II)
Middle and High Voltage Life Test	X7R: Δ C/C: ≤ ± 20% DF: Not more than twice of initial value. IR: X7R Ri ≥ 2000M Ω or Ri*CR ≥ 50 S whichever is smaller Appearance: No visible damage	Applied voltage: 100V ≤ rated voltage < 500V: 2 multiple 500V ≤ rated voltage ≤ 1000V: 1.5 multiple > 1000V rated voltage: 1.2 multiple Duration: 1000 hours Charge/Discharge Current: 50 mA max. Temperature: 125°C (X7R) Recovery Conditions: Room temperature Recovery Time: 48 hours (Class II)

Reel Specifications



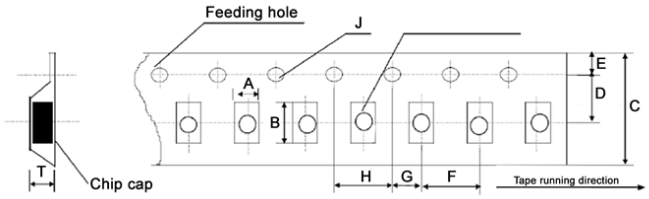
Type/Code	A	B	C	D	E	F	G	Unit
CML_X7R (all sizes)	7.008 ± 0.079 178.00 ± 2.00	0.118 3.00	0.512 ± 0.020 13.00 ± 0.50	0.827 ± 0.031 21.00 ± 0.80	1.969 or more 50.00 or more	0.394 ± 0.059 10.00 ± 1.50	0.472 max 12.00 max	inches mm

Packaging Specifications – Paper Tape



Type/Code	A0	B0	T	W	P0	Unit
CML0402X7R	0.026 ± 0.004 0.65 ± 0.10	0.045 ± 0.004 1.15 ± 0.10	0.031 below 0.80 below	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0603X7R	0.043 ± 0.004 1.10 ± 0.10	0.075 ± 0.004 1.90 ± 0.10	0.043 max 1.10 max	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0805X7R	0.057 ± 0.006 1.45 ± 0.15	0.091 ± 0.006 2.30 ± 0.15	0.043 max 1.10 max	0.315 ± 0.006 8.00 ± 0.15	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML1206X7R	0.071 ± 0.008 1.80 ± 0.20	0.134 ± 0.008 3.40 ± 0.20	0.043 max 1.10 max	0.315 ± 0.008 8.00 ± 0.20	0.157 ± 0.004 4.00 ± 0.10	inches mm
Type/Code	P1	P2	D0	E	F	Unit
CML0402X7R	0.079 ± 0.002 2.00 ± 0.05	0.079 ± 0.002 2.00 ± 0.05	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches mm
CML0603X7R	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.002 4.00 ± 0.05	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches mm
CML0805X7R	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.002 1.75 ± 0.05	0.138 ± 0.002 3.50 ± 0.05	inches mm
CML1206X7R	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm

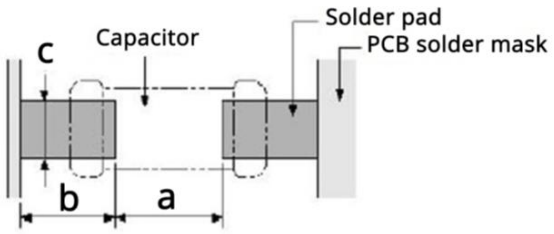
Packaging Specifications – Plastic Tape



Type/Code	A	B	C	D	E	Unit
CML0805X7R	0.061 ± 0.008 1.55 ± 0.20	0.093 ± 0.008 2.35 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1206X7R	0.077 ± 0.008 1.95 ± 0.20	0.142 ± 0.008 3.60 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1210X7R	0.106 ± 0.004 2.70 ± 0.10	0.135 ± 0.004 3.42 ± 0.10	0.315 ± 0.004 8.00 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1812X7R	0.144 ± 0.004 3.66 ± 0.10	0.195 ± 0.004 4.95 ± 0.10	0.472 ± 0.004 12.00 ± 0.10	0.217 ± 0.002 5.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
Type/Code	F	G	H	J	T	Unit
CML0805X7R	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.059 max 1.50 max	inches mm
CML1206X7R	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.073 max 1.85 max	inches mm
CML1210X7R	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.126 max 3.20 max	inches mm
CML1812X7R	0.315 ± 0.004 8.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	0.059-0/+0.004 1.5-0/+0.10	0.157 max 4.00 max	inches mm

Recommended Solder Pad for Wave Soldering

Type	0603	0805	1206	1210	Unit
Length (L)	0.063	0.079	0.126	0.126	inches
	1.60	2.00	3.20	3.20	mm
Width (W)	0.031	0.049	0.063	0.098	inches
	0.80	1.25	1.60	2.50	mm
a	0.031 ~ 0.039	0.039 ~ 0.055	0.071 ~ 0.098	0.071 ~ 0.098	inches
	0.80 ~ 1.00	1.00 ~ 1.40	1.80 ~ 2.50	1.80 ~ 2.50	mm
b	0.020 ~ 0.031	0.031 ~ 0.059	0.031 ~ 0.067	0.031 ~ 0.067	inches
	0.50 ~ 0.80	0.80 ~ 1.50	0.80 ~ 1.70	0.80 ~ 1.70	mm
c	0.024 ~ 0.031	0.035 ~ 0.047	0.047 ~ 0.063	0.071 ~ 0.098	inches
	0.60 ~ 0.80	0.90 ~ 1.20	1.20 ~ 1.60	1.80 ~ 2.50	mm



NOTE: Solder pad information is for reference only.

Recommended Solder Pad for Reflow Soldering

Type	0402	0603	0805	1206	1210	1812	Unit
Length (L)	0.043	0.063	0.079	0.126	0.126	0.177	inches
	1.10	1.60	2.00	3.20	3.20	4.50	mm
Width (W)	0.020	0.031	0.049	0.063	0.098	0.126	inches
	0.50	0.80	1.25	1.60	2.50	3.20	mm
a	0.018 ~ 0.022	0.024 ~ 0.031	0.031 ~ 0.047	0.071 ~ 0.098	0.071 ~ 0.098	0.098 ~ 0.138	inches
	0.45 ~ 0.55	0.60 ~ 0.80	0.80 ~ 1.20	1.80 ~ 2.50	1.80 ~ 2.50	2.50 ~ 3.50	mm
b	0.016 ~ 0.020	0.024 ~ 0.031	0.024 ~ 0.047	0.024 ~ 0.059	0.024 ~ 0.059	0.039 ~ 0.071	inches
	0.40 ~ 0.50	0.60 ~ 0.80	0.60 ~ 1.20	0.60 ~ 1.50	0.60 ~ 1.50	1.00 ~ 1.80	mm
c	0.018 ~ 0.022	0.024 ~ 0.031	0.035 ~ 0.063	0.047 ~ 0.079	0.071 ~ 0.126	0.091 ~ 0.138	inches
	0.45 ~ 0.55	0.60 ~ 0.80	0.90 ~ 1.60	1.20 ~ 2.00	1.80 ~ 3.20	2.30 ~ 3.50	mm

NOTE: Solder pad information is for reference only.

RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union's directive regarding "Restrictions on Hazardous Substances" (RoHS 3). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

RoHS Compliance Status						
Standard Product Series	Description	Package / Termination Type	Standard Series RoHS Compliant	Lead-Free Termination Composition	Lead-Free Mfg. Effective Date (Std Product Series)	Lead-Free Effective Date Code (YY/WW)
CML	Multilayer Ceramic Chip Capacitor	SMD	YES	100% Matte Sn over Ni	Always	Always

"Conflict Metals" Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the "conflict region" of the eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

Compliance to "REACH"

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, "The Registration, Evaluation, Authorization and Restriction of Chemicals", otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

Environmental Policy

It is the policy of Stackpole Electronics, Inc. to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.