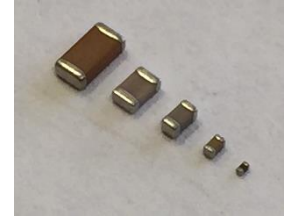
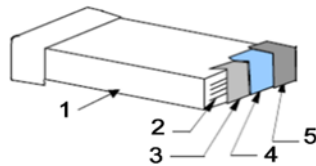


Features:

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



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	50 V	100 V
CML0402	C0G	C	± 0.25 pF	0.1 pF - 8.2 pF	-
		J	± 5%	10 pF - 1000 pF	-
CML0603	C0G	C	± 0.25 pF	0.1 pF - 6.8 pF	0.5 pF - 8.2 pF
		J	± 5%	10 pF - 6800 pF	10 pF - 1000 pF
CML0805	C0G	C	± 0.25 pF	0.3 pF - 6.8 pF	0.5 pF - 8.2 pF
		J	± 5%	10 pF - 0.022 uF	10 pF - 3300 pF
CML1206	C0G	C	± 0.25 pF	0.3 pF - 8.2 pF	0.5 pF - 8.2 pF
		J	± 5%	10 pF - 3300 pF 3900 pF - 4700 pF	10 pF - 3300 pF -
CML1210	C0G	C	± 0.25 pF	-	1 pF - 8.2 pF
		J	± 5%	10 pF - 0.1 uF	10 pF - 6800 pF
CML1812	C0G	C	± 0.25 pF	-	3 pF - 8.2 pF
		J	± 5%	10 pF - 0.1 uF	10 pF - 0.01 uF

Note: Capacitance values < 10pF: B = ± 0.1 pF may be available
Capacitance values ≥ 10pF: G = ± 2% may be available

How to Order

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
C	M	L	0	4	0	2	C	0	G	1	0	0	J	T	5	0	V

Product Series		Size	Dielectric	Capacitance Range		Tolerance (*)		Packaging			Max Working Voltage
Code	Description	Code	Code	EIA Code	Capacitance	Code	Description	Code	Description	Size and Quantity	
CML	Multilayer Ceramic	0402	C0G	0R1	0.1 pF	B	± 0.1 pF	T	7" Paper Reel	Refer to Packaging Specifications	50 V
		0603			10 pF	C	± 0.25 pF				
		0805			100 pF	G	± 2%				
		1206			100 pF	J	± 5%				
		1210			1000 pF						
		1812			0.01 uF						
				104	0.1 uF						100 V

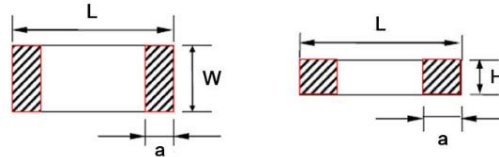
(*) Other tolerances may be available. Contact factory.

Capacitance and Voltage Available

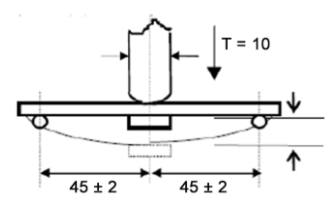
Dielectric		C0G													
EIA Code	Size VDCW	0402			0603			0805		1206		1210		1812	
		50V	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V	
0R1	0.1 pF														
0R2	0.2 pF														
0R3	0.3 pF														
0R4	0.4 pF														
0R5	0.5 pF														
0R6	0.6 pF														
0R7	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														
751	750 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														

Capacitance and Voltage Available (cont.)															
Dielectric		C0G													
EIA Code	Size	0402			0603			0805		1206		1210		1812	
	VDCW	50V	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V	
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														

Mechanical Specifications and Packaging Specifications

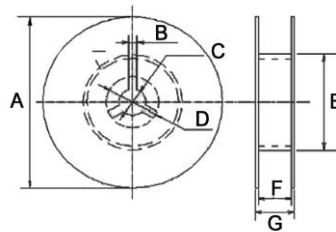


Type / Code	Voltage	Capacitance Value	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML0402C0G	50 V	0.1 pF - 1000 pF	0.039 ± 0.008 1.00 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.002 0.50 ± 0.05	0.010 ± 0.004 0.25 ± 0.10	inches mm	10000	-
CML0603C0G	50 V - 100 V	0.1 pF - 6800 pF	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	-
CML0805C0G	50 V	0.3 pF - 1500 pF 4700 pF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.028 ± 0.002 0.70 ± 0.05	0.020 ± 0.008 0.50 ± 0.20	inches mm	4000	-
		1800 pF - 3900 pF 5600 pF - 8200 pF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.031 ± 0.004 0.80 ± 0.09	0.020 ± 0.008 0.50 ± 0.20	inches mm	4000	-
		0.01 uF - 0.022 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
		0.5 pF - 3300 pF	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	-
CML1206C0G	50 V	0.3 pF - 8200 pF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.028 ± 0.002 0.70 ± 0.05	0.024 ± 0.012 0.60 ± 0.30	inches mm	4000	-
		0.01 uF - 0.1 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
	100 V	0.5 pF - 3300 pF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.031 ± 0.004 0.80 ± 0.09	0.024 ± 0.012 0.60 ± 0.30	inches mm	4000	-
CML1210C0G	50 V	10 pF - 0.1 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	-	3000
	100 V	1 pF - 6800 pF	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
CML1812C0G	50 V	10 pF - 0.1 uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.047 ± 0.004 1.20 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	1000
	100 V	3 pF - 0.01 uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.047 ± 0.004 1.20 ± 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.		C0G: (Class I) Cap ≤ 1000 pF 1.0 ± 0.2 Vrms, 1 MHz ± 10% Cap > 1000 pF 1.0 ± 0.2 Vrms, 1 KHz ± 10%		
Dissipation Factor (DF)	C0G (Class I)	DF	Capacitance		
		≤ 0.56%	Cr < 5 pF		
		$1.5 [(150 / Cr) + 7] \times 10^{-4}$	5 pF ≤ Cr < 50 pF		
		≤ 0.15%	50 pF ≤ Cr ≤ 1000 pF		
		≤ 0.15%	> 1000 pF		
Insulation Resistance	C0G (Class I)	C ≤ 10 nF, Ri ≥ 50000 M Ω 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: ≤ 50mA		
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: 80 to 120 °C, 10 ~ 30 seconds		
			Solder Temperature: 235 ± 5% (Sn/Pb: 63/37) Duration: 2 ± 0.5 seconds		
			Solder Temperature: 245 ± 5 °C (Lead-free) Duration: 2 ± 0.5 seconds		
Resistance to Soldering Heat	Item	C0G	Preheating Conditions: 100 to 200 °C; 10 ± 2 minutes Solder Temperature: 265 ± 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 ± 0.5 pF 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: ≤ ± 1% or ± 1 pF, 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: -55	30 ± 3
			2	Normal temp. (+20)	2 - 3
3	Up-category temp. C0G: +125	30 ± 3			
4	Normal temp. (+20)	2 - 3			
			Recovery time after test: 24 ± 2 hours		

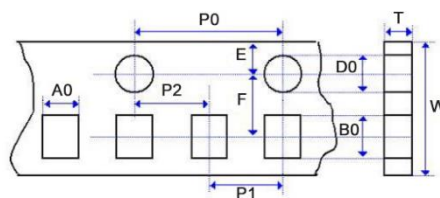
Environmental Characteristics (cont.)		
Test	Test Specification	Test Condition
Moisture Resistance	C0G: $\Delta C/C: \leq \pm 2\%$ or ± 1 pF, whichever is larger DF: Not more than twice of initial value. IR: C0G: $R_i \geq 2500$ M Ω or $R_i \cdot CR \geq 25$ S whichever is smaller Appearance: No visible damage	Temperature: 40 ± 2 °C Humidity: 90 ~ 95% R.H. Duration: 500 hours Recovery Conditions: Room temperature Recovery Time: 24 hours (Class I)
Life Test	C0G: $\Delta C/C: \leq \pm 2\%$ or ± 1 pF, whichever is larger DF: Not more than twice of initial value. IR: C0G: $R_i \geq 4000$ M Ω or $R_i \cdot CR \geq 40$ S whichever is smaller Appearance: No visible damage	Low-voltage (< 100 V) 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: $\Delta C/C: \leq \pm 2\%$ or ± 1 pF, whichever is larger DF: Not more than twice of initial value. IR: C0G: $R_i \geq 4000$ M Ω or $R_i \cdot CR \geq 40$ S whichever is smaller Appearance: No visible damage	Applied voltage: 100 V \leq rated voltage < 500 V: 2 multiple 500 V \leq rated voltage \leq 1000 V: 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)	7.008 \pm 0.079 178.00 \pm 2.00	0.118 3.00	0.512 \pm 0.020 13.00 \pm 0.50	0.827 \pm 0.031 21.00 \pm 0.80	1.969 or more 50.00 or more	0.394 \pm 0.059 10.00 \pm 1.50	0.472 max 12.00 max	inches mm

Paper Tape Specifications

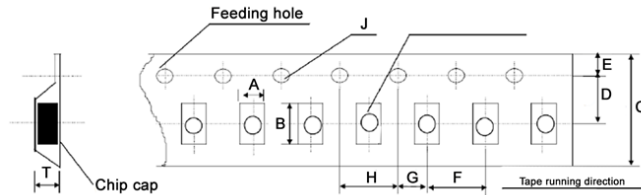


Type / Code	A ₀	B ₀	T	W	P ₀	Unit
CML0402C0G	0.026 \pm 0.004 0.65 \pm 0.10	0.045 \pm 0.004 1.15 \pm 0.10	0.031 below 0.80 below	0.315 \pm 0.004 8.00 \pm 0.10	0.157 \pm 0.004 4.00 \pm 0.10	inches mm
CML0603C0G	0.043 \pm 0.004 1.10 \pm 0.10	0.075 \pm 0.004 1.90 \pm 0.10	0.043 max 1.10 max	0.315 \pm 0.004 8.00 \pm 0.10	0.157 \pm 0.004 4.00 \pm 0.10	inches mm
CML0805C0G	0.057 \pm 0.006 1.45 \pm 0.15	0.091 \pm 0.006 2.30 \pm 0.15	0.043 max 1.10 max	0.315 \pm 0.006 8.00 \pm 0.15	0.157 \pm 0.004 4.00 \pm 0.10	inches mm
CML1206C0G	0.071 \pm 0.008 1.80 \pm 0.20	0.134 \pm 0.008 3.40 \pm 0.20	0.043 max 1.10 max	0.315 \pm 0.008 8.00 \pm 0.20	0.157 \pm 0.004 4.00 \pm 0.10	inches mm

Paper Tape Specifications (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	0.079 ± 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
CML0805C0G	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
CML1206C0G	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

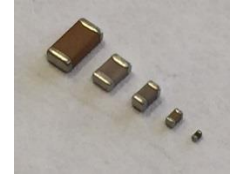
Plastic Tape Specifications



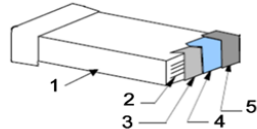
Type / Code	A	B	C	D	E	Unit
CML0805C0G	0.061 ± 0.008 1.55 ± 0.20	0.093 ± 0.008 2.35 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1206C0G	0.077 ± 0.008 1.95 ± 0.20	0.142 ± 0.008 3.60 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
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	0.059 max 1.50 max	inches mm
CML1206C0G	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
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

Features:

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



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	10 V	16 V	25 V	50 V	100 V
CML0402	X7R	K	± 10%	120 pF - 0.039 uF			-	
				0.012 uF - 0.1 uF			-	
CML0603	X7R	K	± 10%	150 pF - 0.1 uF			-	
				0.012 uF - 0.18 uF			-	
				0.12 uF - 0.33 uF			-	
CML0805	X7R	K	± 10%	0.12 uF - 2.2 uF			-	
				150 pF - 0.1 uF			-	
				0.12 uF - 0.39 uF			-	
CML1206	X7R	K	± 10%	0.12 uF - 2.2 uF			-	
				150 pF - 1 uF			-	
CML1210	X7R	K	± 10%	2.2 uF - 4.7 uF			-	
				-			150 pF - 2.2 uF	
				220 pF - 10 uF			-	
CML1812	X7R	K	± 10%	47 uF			-	
				-			270 pF - 1 uF	
				-			470 pF - 4.7 uF	
				6.8 uF			-	

Note: J = 5% tolerance may be available

How to Order

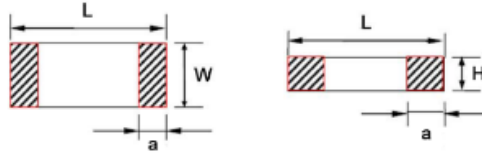
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
C	M	L	0	4	0	2	X	7	R	1	0	3	K	T	5	0	V

Product Series		Size	Dielectric	Capacitance Range		Tolerance (*)		Packaging			Max Working Voltage
Code	Description	Code	Code	0.1pF to 0.10uF (E12)	EIA Code	Capacitance	Code	Description	Code	Description	Quantity
CML	Multilayer Ceramic	0402	X7R	101	100 pF	J	± 5%	T	7" Paper Reel	Refer to Packaging Specifications	10 V
		0603		102	1000 pF	K	± 10%				7" Plastic Tape
		0805		103	0.01 uF			25 V			
		1206		104	0.1 uF			50 V			
		1210		105	1 uF			100 V			
		1812		106	10 uF						

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

Dielectric		X7R																											
EIA Code	Size	0402				0603				0805				1206				1210				1812							
	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	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																												
751	750 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																												
125	1.2 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																												

Mechanical Specifications and Packaging Specifications



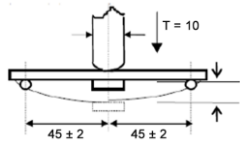
Type / Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML0402X7R	10 V - 50 V	100 pF - 0.47 uF	0.039 ± 0.008 1.00 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.002 0.50 ± 0.05	0.010 ± 0.004 0.25 ± 0.10	inches mm	10000	-
CML0603X7R	10 V - 100 V	150 pF - 2.2 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	-
CML0805X7R	10 V	150 pF - 0.33 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	-
		0.47 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	-
		0.56 uF - 0.68 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
		0.82 uF - 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 - 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	
	16 V	150 pF - 0.33 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	-
		0.47 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	-
		0.56 uF - 0.68 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
		0.82 uF - 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 - 4.7 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	
	25 V	150 pF - 0.33 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	-
		0.47 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	-
		0.56 uF - 0.68 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
		0.82 uF - 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	-	2000	
3.3 uF - 4.7 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		
CML0805X7R	50 V	150 pF - 0.33 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	-		
		0.47 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	-		
		0.56 uF - 0.68 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		
		0.82 uF - 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		
	100 V	100 pF	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.028 ± 0.020 0.70 ± 0.50	0.020 ± 0.008 0.50 ± 0.20	inches mm	4000	-		
		150 pF - 0.047 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	-		
		0.056 uF - 0.1 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		
CML1206X7R	10 V	200 pF - 0.33 uF	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	-		
		0.47 uF - 0.68 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		
		0.82 uF - 1.5 uF	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	-		
		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		
	16 V - 25 V	200 pF - 0.33 uF	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	-		
		0.47 uF - 0.68 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		
		0.82 uF - 1.5 uF	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	-		
		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		
	50 V	200 pF - 0.33 uF	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	-		
		0.47 uF - 0.68 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		
		0.82 uF - 1.5 uF	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	-		
		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	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		
	100 V	150 pF - 0.056 uF	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	-		
		0.068 uF - 0.33 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		
		0.47 uF - 1 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		

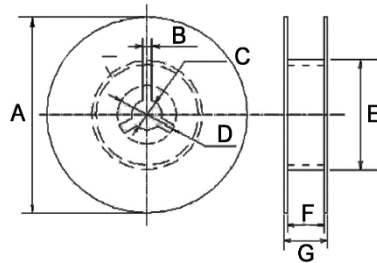
Mechanical Specifications and Packaging Specifications (cont.)

Type / Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.		
								Paper Tape	Plastic Tape	
CML1210X7R	10 V	220 pF - 0.47 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	
		0.68 uF - 1 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000	
		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	
		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	
		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	
	16 V - 25 V	220 pF - 0.47 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	
		0.68 uF - 1 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000	
		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	
		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	
		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	
	50 V	220 pF - 0.47 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	
		0.68 uF - 1 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000	
		4.7 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	
		10 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	
	100 V	150 pF - 0.22 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.055 ± 0.004 1.40 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000	
		0.33 uF - 2.2 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000	
	CML1812X7R	16 V - 25 V	470 pF - 1 uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	1000
			1.5 uF - 6.8 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
		50 V	470 pF - 1 uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	1000
			1.5 uF - 4.7 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
100 V		270 pF - 0.56 uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.004 1.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	1000	
		0.68 uF - 1 uF	0.177 ± 0.016 4.50 ± 0.40	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.009 1.60 ± 0.24	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.					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)	X7R (Class II)	X7R (≥ 0402)	≥ 50V	25V	16V	10V				
			≤ 2.5%	≤ 3.5% (C < 0.47uF) ≤ 10.0% (C ≥ 0.47uF)	≤ 5% (C < 0.15uF) ≤ 10.0% (C ≥ 0.15 uF)					
Insulation Resistance	X7R (Class II)	C ≤ 25nF, Ri ≥ 10000M Ω C > 25nF, Ri*CR > 100S				Measuring Voltage: Rated Voltage (Max 500 V) 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: 80 to 120 °C, 10 ~ 30 seconds				
						Solder Temperature: 235 ± 5% (Sn/Pb: 63/37) Duration: 2 ± 0.5 seconds				
						Solder Temperature: 245 ± 5 °C (Lead-free) Duration: 2 ± 0.5 seconds				
Resistance to Soldering Heat	Item	X7R				Preheating Conditions: 100 to 200 °C; 10 ± 2 minutes Solder Temperature: 265 ± 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								
Resistance to Flexure of Substrate (Bending Strength)	Appearance: No visible damage. Δ C/C: ≤ ± 10%					Test Board: Al2O3 or PCB Warp: 1 mm Speed: 0.5mm / 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	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: -55	30 ± 3		
						2	Normal temp. (+20)	2 - 3		
3	Up-category temp. X7R: +125	30 ± 3								
4	Normal temp. (+20)	2 - 3								
Recovery time after test: 24 ± 2 hours										

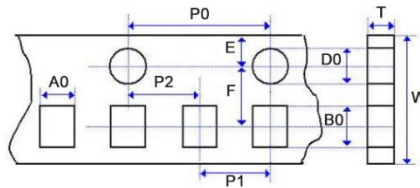
Environmental Characteristics (cont.)		
Test	Test Specification	Test Condition
Moisture Resistance	X7R: $\Delta C/C: \leq \pm 10\%$ DF: Not more than twice of initial value. IR: X7R: $R_i \geq 1000M \Omega$ or $R_i \cdot CR \geq 25S$ whichever is smaller Appearance: No visible damage	Temperature: $40 \pm 2^\circ C$ Humidity: 90 ~ 95% R.H. Duration: 500 hours Recovery Conditions: Room temperature Recovery Time: 48 hours (Class II)
Life Test	X7R: $\Delta C/C: \leq \pm 20\%$ DF: Not more than twice of initial value. IR: X7R: $R_i \geq 2000M \Omega$ or $R_i \cdot CR \geq 50 S$ whichever is smaller Appearance: No visible damage	Low-voltage (< 100 V) Applied Voltage: 1.5 x rated voltage Duration: 1000 hours Temperature: $125^\circ C$ (X7R) Charge/Discharge Current: 50 mA max. Recovery Conditions: Room temperature Recovery Time: 48 hours (Class II)
Middle and High Voltage Life Test	X7R: $\Delta C/C: \leq \pm 20\%$ DF: Not more than twice of initial value. IR: X7R: $R_i \geq 2000M \Omega$ or $R_i \cdot CR \geq 50 S$ whichever is smaller Appearance: No visible damage	Applied voltage: $100 V \leq \text{rated voltage} < 500 V$: 2 multiple $500V \leq \text{rated voltage} \leq 1000 V$: 1.5 multiple > 1000 V rated voltage: 1.2 multiple Duration: 1000 hours Charge/Discharge Current: 50 mA max. Temperature: $125^\circ C$ (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

Paper Tape Specifications

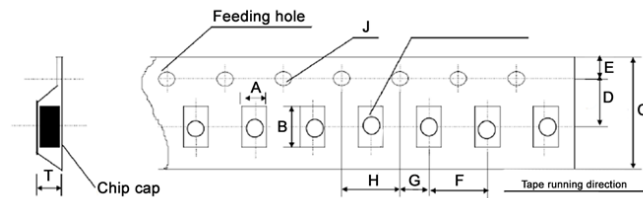


Type / Code	A0	B0	T	W	P0	Unit
CML0402X7R	0.026 ± 0.004 0.65 ± 0.10	0.045 ± 0.004 1.15 ± 0.10	0.031 below 0.80 below	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0603X7R	0.043 ± 0.004 1.10 ± 0.10	0.075 ± 0.004 1.90 ± 0.10	0.043 max 1.10 max	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 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

Paper Tape Specifications (cont.)

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

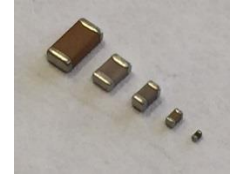
Plastic Tape Specifications



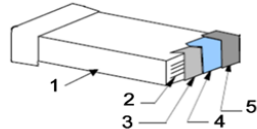
Type / Code	A	B	C	D	E	Unit
CML0805X7R	0.061 ± 0.008 1.55 ± 0.20	0.093 ± 0.008 2.35 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1206X7R	0.077 ± 0.008 1.95 ± 0.20	0.142 ± 0.008 3.60 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 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

Features:

- Lead free, halogen free, RoHS and REACH compliant
- -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



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	10 V	16 V	25 V	50 V
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

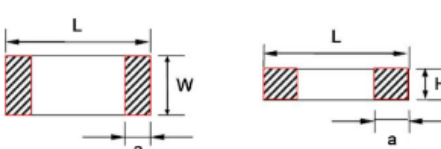
How to Order

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
C	M	L	0	4	0	2	X	5	R	1	0	4	K	T	5	0	V

Product Series		Size	Dielectric	Capacitance Range		Tolerance (*)		Packaging			Max Working Voltage
Code	Description	Code	Code	0.1pF to 0.10uF (E12)	EIA Code	Capacitance	Code	Description	Code	Description	Quantity
CML	Multilayer Ceramic	0402	X5R	473	0.047 uF		J	± 5%	T	7" Paper Reel	Refer to Packaging Specifications
		0603		104	0.1 uF		K	± 10%		7" Plastic Tape	
		0805		105	1 uF						
		1206		106	10 uF						
		1210		107	100 uF						
		1812									

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

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																						

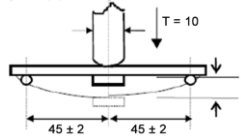
Mechanical Specifications and Packaging Specifications										
										
Type / Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.		
								Paper Tape	Plastic Tape	
CML0402X5R	10 V - 50 V	0.1 uF - 4.7 uF	0.039 ± 0.008 1.00 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.002 0.50 ± 0.05	0.010 ± 0.004 0.25 ± 0.10	inches mm	10000	-	
CML0603X5R	10 V - 50 V	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	10 V - 16 V	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	-	
	25 V	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	
		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.)

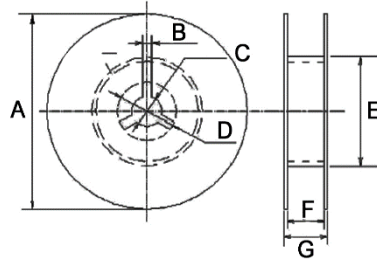
Type / Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML1206X5R	10 V	2.2 uF - 3.3 uF	0.126 ± 0.012 3.20 ± 0.30	0.063 ± 0.012 1.60 ± 0.30	0.047 ± 0.004 1.20 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	3000
		4.7 uF - 22 uF	0.126 ± 0.012 3.20 ± 0.30	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
	16 V - 25 V	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
	50 V	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	10 V	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
	16 V	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
	25 V	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	10 V - 25 V	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	
			≤ 2.5%	≤ 3.5% (C < 0.47 uF) ≤ 10.0% (C ≥ 0.47 uF)	≤ 5% (C < 0.15 uF) ≤ 10.0% (C ≥ 0.15 uF)		
Insulation Resistance	X5R (Class II)	C ≤ 25 nF, Ri ≥ 10,000 M Ω C > 25 nF, Ri*CR > 100 S				Measuring Voltage: Rated Voltage (Max 500 V) 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.		

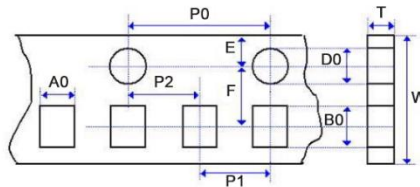
Environmental Characteristics (cont.)																	
Test	Test Specification	Test Condition															
Solderability	At least 95% of the terminal electrode is covered by new solder. Visual appearance: No visible damage.	Preheating Conditions: 80 to 120 °C, 10 ~ 30 seconds															
		Solder Temperature: 235 ± 5% (Sn/Pb: 63/37) Duration: 2 ± 0.5 seconds															
		Solder Temperature: 245 ± 5 °C (Lead-free) Duration: 2 ± 0.5 seconds															
Resistance to Soldering Heat	Item	X5R															
	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															
																	
Termination Adhesion	No visible damage	Applied Force: 5 N Duration: 10 ± 1 seconds															
Temperature Cycle	X5R: 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:															
		<table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Low-category temp. X5R: -55</td> <td>30 ± 3</td> </tr> <tr> <td>2</td> <td>Normal temp. (+20)</td> <td>2 - 3</td> </tr> <tr> <td>3</td> <td>Up-category temp. X5R: +85</td> <td>30 ± 3</td> </tr> <tr> <td>4</td> <td>Normal temp. (+20)</td> <td>2 - 3</td> </tr> </tbody> </table>	Step	Temp. (°C)	Time (min.)	1	Low-category temp. X5R: -55	30 ± 3	2	Normal temp. (+20)	2 - 3	3	Up-category temp. X5R: +85	30 ± 3	4	Normal temp. (+20)	2 - 3
		Step	Temp. (°C)	Time (min.)													
		1	Low-category temp. X5R: -55	30 ± 3													
2	Normal temp. (+20)	2 - 3															
3	Up-category temp. X5R: +85	30 ± 3															
4	Normal temp. (+20)	2 - 3															
Recovery time after test: 24 ± 2 hours																	
Moisture Resistance	X5R: Δ C/C: ≤ ± 10% DF: Not more than twice of initial value. IR: X5R: Ri ≥ 1000 M Ω or RI*CR ≥ 25 S whichever is smaller Appearance: No visible damage	Temperature: 40 ± 2 °C Humidity: 90 ~ 95% R.H. Duration: 500 hours Recovery Conditions: Room temperature Recovery Time: 48 hours (Class II)															
Life Test	X5R: Δ C/C: ≤ ± 20% DF: Not more than twice of initial value. IR: X5R: Ri ≥ 2000 M Ω or RI*CR ≥ 50 S whichever is smaller Appearance: No visible damage	Low-voltage (< 100 V) 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)															

Reel Specifications



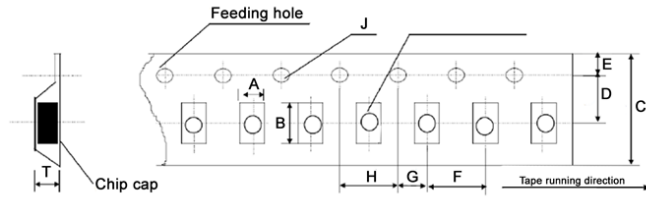
Type / Code	A	B	C	D	E	F	G	Unit
CML_X5R (all sizes)	7.008 ± 0.079 178.00 ± 2.00	0.118 3.00	0.512 ± 0.020 13.00 ± 0.50	0.827 ± 0.031 21.00 ± 0.80	1.969 or more 50.00 or more	0.394 ± 0.059 10.00 ± 1.50	0.472 max 12.00 max	inches mm

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

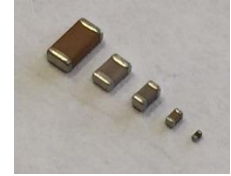
Plastic Tape Specifications



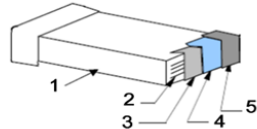
Type / Code	A	B	C	D	E	Unit
CML0805X5R	0.061 ± 0.008	0.093 ± 0.008	0.315 ± 0.008	0.138 ± 0.002	0.069 ± 0.004	inches
	1.55 ± 0.20	2.35 ± 0.20	8.00 ± 0.20	3.50 ± 0.05	1.75 ± 0.10	mm
CML1206X5R	0.077 ± 0.008	0.142 ± 0.008	0.315 ± 0.008	0.138 ± 0.002	0.069 ± 0.004	inches
	1.95 ± 0.20	3.60 ± 0.20	8.00 ± 0.20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

Features:

- Lead free, Halogen free, RoHS and REACH compliant
- -30 °C to 85 °C operating temperature range
- EIA sizes 0402, 0603, 0805, 1206, 1210 and 1812
- Capacitance offering from 1000 pF to 22 uF



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	10 V	16 V	25 V	50 V	100 V	
CML0402	Y5V	Z	+80% / -20%	1000 pF - 0.1 uF					-
				0.12 uF - 0.18 uF					-
				0.12 uF - 0.47 uF					-
				0.12 uF - 1 uF					-
CML0603	Y5V	Z	+80% / -20%	10000 pF - 0.1 uF					-
				10000 pF - 0.82 uF					-
				0.18 uF - 2.2 uF					-
CML0805	Y5V	Z	+80% / -20%	0.012 uF - 0.1 uF					-
				1 uF - 4.7 uF					-
CML1206	Y5V	Z	+80% / -20%	10000 pF - 1 uF					-
				2.2 uF - 4.7 uF					-
				10 uF					-
CML1210	Y5V	Z	+80% / -20%						0.015 uF - 1 uF
CML1812	Y5V	Z	+80% / -20%						0.15 uF - 2.2 uF

Note: M = ±20% tolerance may be available

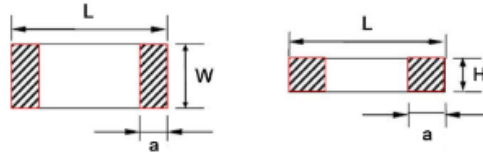
How to Order

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
C	M	L	0	4	0	2	Y	5	V	1	0	3	Z	T	5	0	V
Product Series		Size	Dielectric	Capacitance Range		Tolerance (*)		Packaging				Max Working Voltage					
Code	Description	Code	Code	0.1pF to 0.10uF (E6)		Code	Description	Code	Description	Size	Quantity						
CML	Multilayer Ceramic	0402 0603 0805 1206 1210 1812	Y5V	EIA Code	Capacitance	M	± 20%	T	7" Paper Reel 7" Plastic Tape	Refer to Packaging Specifications		10 V 16 V 25 V 50 V 100 V					
				102	1000 pF	Z	+80%/-20%										
				103	0.01 uF												
				104	0.1 uF												
				105	1 uF												
				106	10 uF												

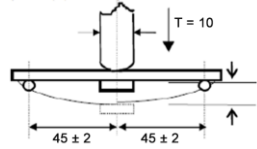
(*) Other tolerances may be available. Contact factory.

Dielectric		Y5V																						
EIA	Size	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		
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																							
224	0.22 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																							
125	1.2 uF																							
135	1.3 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																							

Mechanical Specifications and Packaging Specifications

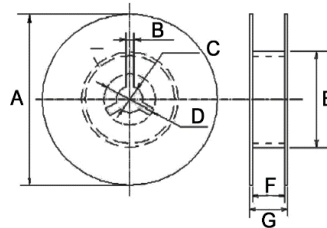


Type / Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML0402Y5V	10 V - 50 V	1000 pF - 1 uF	0.039 ± 0.008	0.020 ± 0.008	0.020 ± 0.002	0.010 ± 0.004	inches	10000	-
			1.00 ± 0.20	0.50 ± 0.20	0.50 ± 0.05	0.25 ± 0.10	mm		
CML0603Y5V	10 V - 100 V	1000 pF - 10 uF	0.063 ± 0.008	0.031 ± 0.008	0.031 ± 0.004	0.012 ± 0.004	inches	4000	-
			1.60 ± 0.20	0.80 ± 0.20	0.80 ± 0.09	0.30 ± 0.10	mm		
CML0805Y5V	10 V	1000 pF - 0.22 uF	0.079 ± 0.008	0.049 ± 0.008	0.028 ± 0.020	0.020 ± 0.008	inches	4000	-
		0.33 uF - 2.2 uF	0.079 ± 0.008	0.049 ± 0.008	0.031 ± 0.004	0.020 ± 0.008	inches		
		3.3 uF - 22 uF	0.079 ± 0.008	0.049 ± 0.008	0.047 ± 0.004	0.020 ± 0.008	inches		
	16 V	1000 pF - 0.22 uF	0.079 ± 0.008	0.049 ± 0.008	0.028 ± 0.002	0.020 ± 0.008	inches	4000	-
		0.33 uF - 2.2 uF	0.079 ± 0.008	0.049 ± 0.008	0.031 ± 0.004	0.020 ± 0.008	inches		
		3.3 uF - 10 uF	0.079 ± 0.008	0.049 ± 0.008	0.047 ± 0.004	0.020 ± 0.008	inches		
	25 V	1000 pF - 0.22 uF	0.079 ± 0.008	0.049 ± 0.008	0.028 ± 0.002	0.020 ± 0.008	inches	4000	-
		0.33 uF - 2.2 uF	0.079 ± 0.008	0.049 ± 0.008	0.031 ± 0.004	0.020 ± 0.008	inches		
		3.3 uF - 4.7 uF	0.079 ± 0.008	0.049 ± 0.008	0.047 ± 0.004	0.020 ± 0.008	inches		
	50 V	1000 pF - 0.22 uF	0.079 ± 0.008	0.049 ± 0.008	0.028 ± 0.002	0.020 ± 0.008	inches	4000	-
		0.33 uF - 2.2 uF	0.079 ± 0.008	0.049 ± 0.008	0.031 ± 0.004	0.020 ± 0.008	inches		
	100 V	0.01 uF - 0.1 uF	0.079 ± 0.008	0.049 ± 0.008	0.028 ± 0.002	0.020 ± 0.008	inches	4000	-
			2.00 ± 0.20	1.25 ± 0.20	0.70 ± 0.05	0.50 ± 0.20	mm		
CML1206Y5V	10 V - 16 V	1000 pF - 10 uF	0.126 ± 0.012	0.063 ± 0.012	0.031 ± 0.004	0.024 ± 0.012	inches	4000	-
		22 uF	0.126 ± 0.012	0.063 ± 0.012	0.063 ± 0.004	0.024 ± 0.012	inches		
	25 V	1000 pF - 10 uF	0.126 ± 0.012	0.063 ± 0.012	0.031 ± 0.004	0.024 ± 0.012	inches	4000	-
				3.20 ± 0.30	1.60 ± 0.30	0.80 ± 0.10	0.60 ± 0.30		
	50 V - 100 V	1000 pF - 4.7 uF	0.126 ± 0.012	0.063 ± 0.012	0.031 ± 0.004	0.024 ± 0.012	inches	4000	-
				3.20 ± 0.30	1.60 ± 0.30	0.80 ± 0.10	0.60 ± 0.30		
CML1210Y5V	100 V	0.015 uF - 1 uF	0.126 ± 0.012	0.098 ± 0.012	0.039 ± 0.004	0.024 ± 0.012	inches	-	2000
CML1812Y5V	100 V	0.15 uF - 2.2 uF	0.177 ± 0.016	0.126 ± 0.012	0.063 ± 0.004	0.024 ± 0.012	inches	-	1000
			4.50 ± 0.40	3.20 ± 0.30	1.60 ± 0.10	0.60 ± 0.30	mm		

Environmental Characteristics						
Test	Test Specification			Test Condition		
Capacitance	Should be within the specified tolerance.			Y5V: (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)	Y5V (Class II)	≥ 25V	16V	10V	Cap ≤ 10uF 1.0 ± 0.2 Vrms, 1 KHz ± 10% Cap > 10uF 0.5 ± 0.1 Vrms, 120 Hz ± 10%	
		≤ 7% (C < 1uF) ≤ 9% (C ≥ 1uF)	≤ 15%	≤ 15%		
Insulation Resistance	Y5V (Class II)	C ≤ 25 nF, Ri ≥ 4,000 M Ω 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.		
Solderability	At least 95% of the terminal electrode is covered by new solder. Visual appearance: No visible damage.			Preheating Conditions: 80 to 120 °C, 10 ~ 30 seconds		
				Solder Temperature: 235 ± 5% (Sn/Pb: 63/37) Duration: 2 ± 0.5 seconds		
				Solder Temperature: 245 ± 5 °C (Lead-free) Duration: 2 ± 0.5 seconds		
Resistance to Soldering Heat	Item	Y5V		Preheating Conditions: 100 to 200 °C; 10 ± 2 minutes Solder Temperature: 265 ± 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	-10 ~ +20%				
	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: 1mm 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	Y5V: Δ C/C: ≤ ± 20%			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. Y5V: -25	30 ± 3
				2	Normal temp. (+20)	2 - 3
				3	Up-category temp. Y5V: +85	30 ± 3
				4	Normal temp. (+20)	2 - 3
Recovery time after test: 24 ± 2 hours						

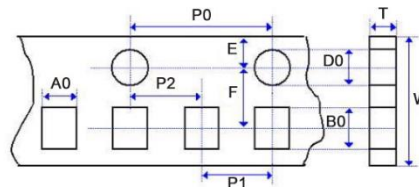
Environmental Characteristics (cont.)		
Test	Test Specification	Test Condition
Moisture Resistance	Y5V: $\Delta C/C: \leq \pm 30\%$ DF: Not more than twice of initial value. IR: Y5V: $R_i \geq 1000 M \Omega$ or $R_i \cdot CR \geq 25 S$ whichever is smaller Appearance: No visible damage	Temperature: $40 \pm 2^\circ C$ Humidity: 90 ~ 95% R.H. Duration: 500 hours Recovery Conditions: Room temperature Recovery Time: 48 hours (Class II)
Life Test	Y5V: $\Delta C/C: \leq \pm 30\%$ DF: Not more than twice of initial value. IR: Y5V: $R_i \geq 2000 M \Omega$ or $R_i \cdot CR \geq 50 S$ whichever is smaller Appearance: No visible damage	Low-voltage (<100V) Applied Voltage: 1.5 x rated voltage Duration: 1000 hours Temperature: $85^\circ C$ (Y5V) Charge/Discharge Current: 50mA max. Recovery Conditions: Room temperature Recovery Time: 48 hours (Class II)
Middle and High Voltage Life Test	Y5V: $\Delta C/C: \leq \pm 30\%$ DF: Not more than twice of initial value. IR: Y5V $R_i \geq 2000M \Omega$ or $R_i \cdot CR \geq 50 S$ whichever is smaller Appearance: No visible damage	Applied voltage: $100 V \leq \text{rated voltage} < 500 V$: 2 multiple $500V \leq \text{rated voltage} \leq 1000 V$: 1.5 multiple > 1000V rated voltage: 1.2 multiple Duration: 1000 hours Charge/Discharge Current: 50 mA max. Temperature: $85^\circ C$ (Y5V) Recovery Conditions: Room temperature Recovery Time: 48 hours (Class II)

Reel Specifications



Type / Code	A	B	C	D	E	F	G	Unit
CML_Y5V (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 \pm 1.50	0.472 max 12.00 max	inches mm

Paper Tape Specifications

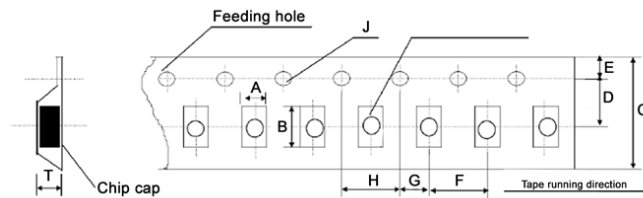


Type / Code	A0	B0	T	W	P0	Unit
CML0402Y5V	0.026 ± 0.004 0.65 ± 0.10	0.045 ± 0.004 1.15 ± 0.10	0.031 below 0.80 below	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0603Y5V	0.043 ± 0.004 1.10 ± 0.10	0.075 ± 0.004 1.90 ± 0.10	0.043 max 1.10 max	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0805Y5V	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
CML1206Y5V	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

Paper Tape Specifications (cont.)

Type / Code	P1	P2	D0	E	F	Unit
CML0402Y5V	0.079 ± 0.002	0.079 ± 0.002	0.059-0/+0.004	0.069 ± 0.002	0.138 ± 0.002	inches
	2.00 ± 0.05	2.00 ± 0.05	1.5-0/+0.10	1.75 ± 0.05	3.50 ± 0.05	mm
CML0603Y5V	0.079 ± 0.004	0.157 ± 0.002	0.059-0/+0.004	0.069 ± 0.002	0.138 ± 0.002	inches
	2.00 ± 0.10	4.00 ± 0.05	1.5-0/+0.10	1.75 ± 0.05	3.50 ± 0.05	mm
CML0805Y5V	0.079 ± 0.004	0.157 ± 0.004	0.059-0/+0.004	0.069 ± 0.002	0.138 ± 0.002	inches
	2.00 ± 0.10	4.00 ± 0.10	1.5-0/+0.10	1.75 ± 0.05	3.50 ± 0.05	mm
CML1206Y5V	0.079 ± 0.004	0.157 ± 0.004	0.059-0/+0.004	0.069 ± 0.004	0.138 ± 0.002	inches
	2.00 ± 0.10	4.00 ± 0.10	1.5-0/+0.10	1.75 ± 0.10	3.50 ± 0.05	mm

Plastic Tape Specifications



Type / Code	A	B	C	D	E	Unit
CML0805Y5V	0.061 ± 0.008	0.093 ± 0.008	0.315 ± 0.008	0.138 ± 0.002	0.069 ± 0.004	inches
	1.55 ± 0.20	2.35 ± 0.20	8.00 ± 0.20	3.50 ± 0.05	1.75 ± 0.10	mm
CML1206Y5V	0.077 ± 0.008	0.142 ± 0.008	0.315 ± 0.008	0.138 ± 0.002	0.069 ± 0.004	inches
	1.95 ± 0.20	3.60 ± 0.20	8.00 ± 0.20	3.50 ± 0.05	1.75 ± 0.10	mm
CML1210Y5V	0.106 ± 0.004	0.135 ± 0.004	0.315 ± 0.004	0.138 ± 0.002	0.069 ± 0.004	inches
	2.70 ± 0.10	3.42 ± 0.10	8.00 ± 0.10	3.50 ± 0.05	1.75 ± 0.10	mm
CML1812Y5V	0.144 ± 0.004	0.195 ± 0.004	0.472 ± 0.004	0.217 ± 0.002	0.069 ± 0.004	inches
	3.66 ± 0.10	4.95 ± 0.10	12.00 ± 0.10	5.50 ± 0.05	1.75 ± 0.10	mm
Type / Code	F	G	H	J	T	Unit
CML0805Y5V	0.157 ± 0.004	0.079 ± 0.004	0.157 ± 0.004	0.059-0/+0.004	0.059 max	inches
	4.00 ± 0.10	2.00 ± 0.10	4.00 ± 0.10	1.5-0/+0.10	1.50 max	mm
CML1206Y5V	0.157 ± 0.004	0.079 ± 0.004	0.157 ± 0.004	0.059-0/+0.004	0.073 max	inches
	4.00 ± 0.10	2.00 ± 0.10	4.00 ± 0.10	1.5-0/+0.10	1.85 max	mm
CML1210Y5V	0.157 ± 0.004	0.079 ± 0.002	0.157 ± 0.004	0.059-0/+0.004	0.126 max	inches
	4.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	1.5-0/+0.10	3.20 max	mm
CML1812Y5V	0.315 ± 0.004	0.079 ± 0.002	0.157 ± 0.004	0.059-0/+0.004	0.157 max	inches
	8.00 ± 0.10	2.00 ± 0.05	4.00 ± 0.10	1.5-0/+0.10	4.00 max	mm