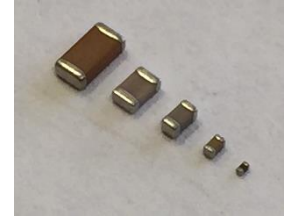
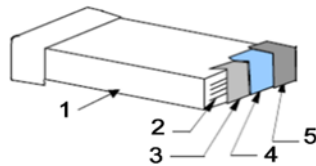


Features:

- 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	0.1pF to 0.10uF (E12)		Code	Description	Code	Description	Size and Quantity							
CML	Multilayer Ceramic	0402 0603 0805 1206 1210 1812	C0G	EIA Code	Capacitance	B	± 0.1 pF	T	7" Paper Reel 7" Plastic Tape	Refer to Packaging Specifications	50V 100V						
				0R1	0.1 pF	C	± 0.25 pF										
				100	10 pF	G	± 2%										
				101	100 pF	J	± 5%										
				102	1000 pF												
				103	0.01 uF												
				104	0.1 uF												

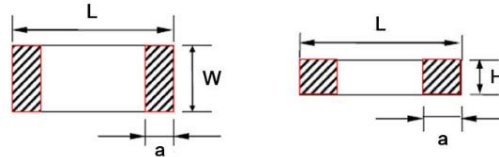
(*) Other tolerances may be available. Contact Stackpole.

Capacitance and Voltage Available

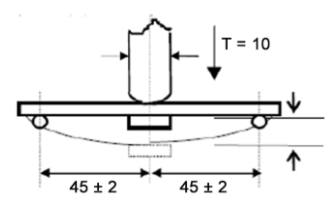
Dielectric		C0G												
EIA Code	Size	0402		0603		0805		1206		1210		1812		
	VDCW	50V	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V
0R1	0.1 pF													
0R2	0.2 pF													
0R3	0.3 pF													
0R4	0.4 pF													
0R5	0.5 pF													
0R6	0.6 pF													
0R7	0.7 pF													
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	50V	100V	50V	50V	100V	50V	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

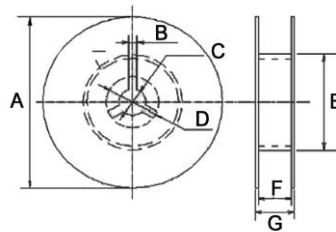


Type / Code	Voltage	Capacitance Value	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML0402C0G	50 V	0.1 pF - 1000 pF	0.039 ± 0.008 1.00 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.002 0.50 ± 0.05	0.010 ± 0.004 0.25 ± 0.10	inches mm	10000	-
CML0603C0G	50 V - 100 V	0.1 pF - 6800 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] x 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					

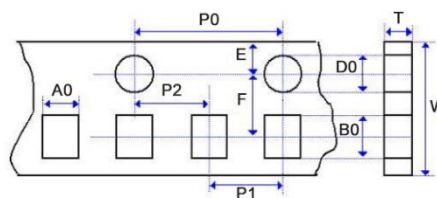
Environmental Characteristics (cont.)		
Test	Test Specification	Test Condition
Moisture Resistance	C0G: $\Delta C/C: \leq \pm 2\%$ or ± 1 pF, whichever is larger DF: Not more than twice of initial value. IR: C0G: $R_i \geq 2500$ M Ω or $R_i \cdot CR \geq 25$ S whichever is smaller Appearance: No visible 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

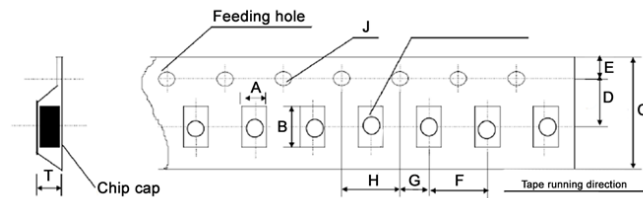


Type / Code	A ₀	B ₀	T	W	P ₀	Unit
CML0402C0G	0.026 \pm 0.004 0.65 \pm 0.10	0.045 \pm 0.004 1.15 \pm 0.10	0.031 below 0.80 below	0.315 \pm 0.004 8.00 \pm 0.10	0.157 \pm 0.004 4.00 \pm 0.10	inches mm
CML0603C0G	0.043 \pm 0.004 1.10 \pm 0.10	0.075 \pm 0.004 1.90 \pm 0.10	0.043 max 1.10 max	0.315 \pm 0.004 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

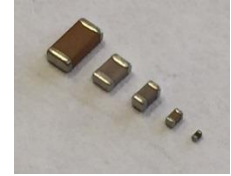
Plastic Tape Specifications



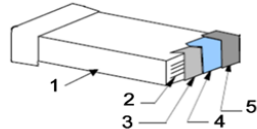
Type / Code	A	B	C	D	E	Unit
CML0805C0G	0.061 ± 0.008 1.55 ± 0.20	0.093 ± 0.008 2.35 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1206C0G	0.077 ± 0.008 1.95 ± 0.20	0.142 ± 0.008 3.60 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ±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

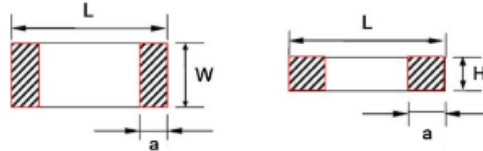
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
C	M	L	0	4	0	2	X	7	R	1	0	3	K	T	5	0	V

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			16 V
		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 Stackpole.

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																												
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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



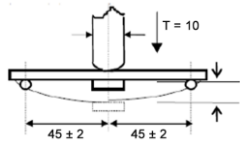
Type / Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML0402X7R	10 V - 50 V	100 pF - 0.47 uF	0.039 ± 0.008 1.00 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.002 0.50 ± 0.05	0.010 ± 0.004 0.25 ± 0.10	inches mm	10000	-
CML0603X7R	10 V - 100 V	150 pF - 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		

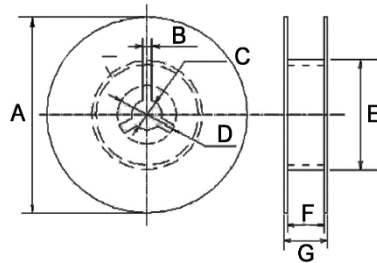
Mechanical Specifications and Packaging Specifications (cont.)

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									

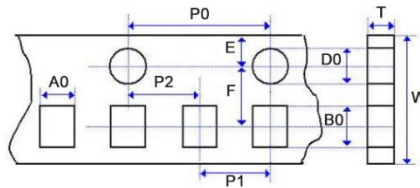
Environmental Characteristics (cont.)		
Test	Test Specification	Test Condition
Moisture Resistance	X7R: $\Delta C/C: \leq \pm 10\%$ DF: Not more than twice of initial value. IR: X7R: $R_i \geq 1000M \Omega$ or $R_i \cdot CR \geq 25S$ whichever is smaller Appearance: No visible damage	Temperature: $40 \pm 2^\circ C$ 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 \pm 1.50	0.472 max 12.00 max	inches mm

Paper Tape Specifications

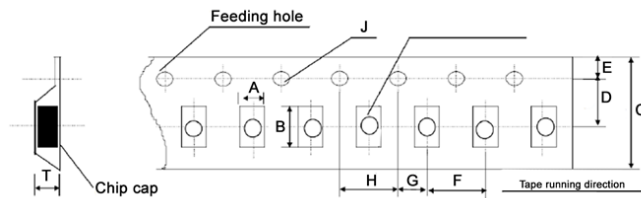


Type / Code	A0	B0	T	W	P0	Unit
CML0402X7R	0.026 ± 0.004 0.65 ± 0.10	0.045 ± 0.004 1.15 ± 0.10	0.031 below 0.80 below	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0603X7R	0.043 ± 0.004 1.10 ± 0.10	0.075 ± 0.004 1.90 ± 0.10	0.043 max 1.10 max	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00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

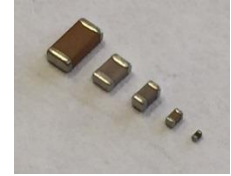
Plastic Tape Specifications



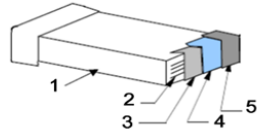
Type / Code	A	B	C	D	E	Unit
CML0805X7R	0.061 ± 0.008 1.55 ± 0.20	0.093 ± 0.008 2.35 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ± 0.004 1.75 ± 0.10	inches mm
CML1206X7R	0.077 ± 0.008 1.95 ± 0.20	0.142 ± 0.008 3.60 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.069 ±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

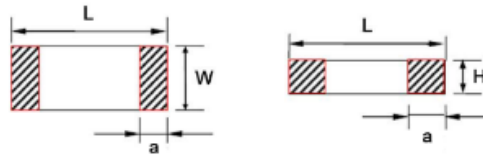
How to Order

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												

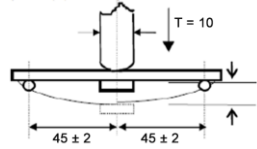
(*) Other tolerances may be available. Contact Stackpole.

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

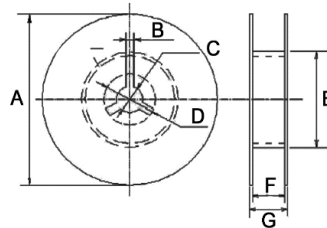


Type / Code	Voltage	Capacitance Range	L	W	H	a	Unit	Packaging (7" Reel) Qty.	
								Paper Tape	Plastic Tape
CML0402Y5V	10 V - 50 V	1000 pF - 1 uF	0.039 ± 0.008 1.00 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.002 0.50 ± 0.05	0.010 ± 0.004 0.25 ± 0.10	inches mm	10000	-
CML0603Y5V	10 V - 100 V	1000 pF - 10 uF	0.063 ± 0.008 1.60 ± 0.20	0.031 ± 0.008 0.80 ± 0.20	0.031 ± 0.004 0.80 ± 0.09	0.012 ± 0.004 0.30 ± 0.10	inches mm	4000	-
CML0805Y5V	10 V	1000 pF - 0.22 uF	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	-
		0.33 uF - 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	-	3000
	16 V	1000 pF - 0.22 uF	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	-
		0.33 uF - 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	-	3000
	25 V	1000 pF - 0.22 uF	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	-
		0.33 uF - 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	-	3000
	50 V	1000 pF - 0.22 uF	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	-
		0.33 uF - 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	-
	100 V	0.01 uF - 0.1 uF	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	-
CML1206Y5V	10 V - 16 V	1000 pF - 10 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	-
		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
	25 V	1000 pF - 10 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	-
	50 V - 100 V	1000 pF - 4.7 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	-
CML1210Y5V	100 V	0.015 uF - 1 uF	0.126 ± 0.012 3.20 ± 0.30	0.098 ± 0.012 2.50 ± 0.30	0.039 ± 0.004 1.00 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	inches mm	-	2000
CML1812Y5V	100 V	0.15 uF - 2.2 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

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						

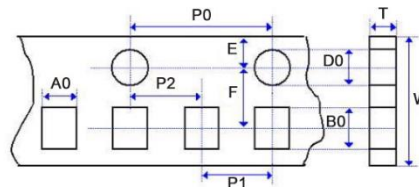
Environmental Characteristics (cont.)		
Test	Test Specification	Test Condition
Moisture Resistance	Y5V: $\Delta C/C: \leq \pm 30\%$ DF: Not more than twice of initial value. IR: Y5V: $R_i \geq 1000 M \Omega$ or $R_i \cdot CR \geq 25 S$ whichever is smaller Appearance: No visible damage	Temperature: $40 \pm 2^\circ C$ 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

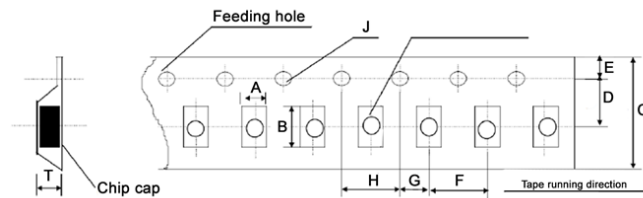


Type / Code	A0	B0	T	W	P0	Unit
CML0402Y5V	0.026 ± 0.004 0.65 ± 0.10	0.045 ± 0.004 1.15 ± 0.10	0.031 below 0.80 below	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
CML0603Y5V	0.043 ± 0.004 1.10 ± 0.10	0.075 ± 0.004 1.90 ± 0.10	0.043 max 1.10 max	0.315 ± 0.004 8.00 ± 0.10	0.157 ± 0.004 4.00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