

# **FEATURES**

- C0G (NP0), X7R, X5R, Z5U and Y5V Dielectrics
- 10, 16, 25, 50, 100 and 200 Volts
- Standard End Metalization: Tin-plate over nickel barrier
- Available Capacitance Tolerances: ±0.10 pF; ±0.25 pF; ±0.5 pF; ±1%; ±2%; ±5%; ±10%; ±20%; and +80%-20%
- Tape and reel packaging per EIA481-1. (See page 92 for specific tape and reel information.) Bulk Cassette packaging (0402, 0603, 0805 only) per IEC60286-6 and EIAJ 7201.
- RoHS Compliant

# **CAPACITOR OUTLINE DRAWINGS**



# DIMENSIONS—MILLIMETERS AND (INCHES)

EIA SIZE CODE	METRIC SIZE CODE	L - LENGTH	W - WIDTH	T THICKNESS	B - BANDWIDTH	S SEPARATION minimum	MOUNTING TECHNIQUE
0201*	0603	0.6 (.024) ± .03 (.001)	0.3 ± (.012) ± .03 (.001)		0.15 (.006) ± .05 (.002)	N/A	Solder Reflow
0402*	1005	1.0 (.04) ± .05 (.002)	0.5 (.02) ± .05 (.002)		0.20 (.008)40 (.016)	0.3 (.012)	Solder Reliow
0603	1608	1.6 (.063) ± .15 (.006)	0.8 (.032) ± .15 (.006)		0.35 (.014) ± .15 (.006)	0.7 (.028)	
0805*	2012	2.0 (.079) ± .20 (.008)	1.25 (.049) ± .20 (.008)		0.50 (.02) ± .25 (.010)	0.75 (.030)	Solder Wave + or
1206*	3216	3.2 (.126) ± .20 (.008)	1.6 (.063) ± .20 (.008)	See page 78	0.50 (.02) ± .25 (.010)	N/A	Solder Reflow
1210*	3225	3.2 (.126) ± .20 (.008)	2.5 (.098) ± .20 (.008)	for thickness	0.50 (.02) ± .25 (.010)	N/A	
1808	4520	4.5 (.177) ± .30 (.012)	2.0 (.079) ± .20 (.008)	dimensions.	0.60 (.024) ± .35 (.014)	N/A	
1812	4532	4.5 (.177) ± .30 (.012)	3.2 (.126) ± .30 (.012)		0.60 (.024) ± .35 (.014)	N/A	
1825*	4564	4.5 (.177) ± .30 (.012)	6.4 (.252) ± .40 (.016)		0.60 (.024) ± .35 (.014)	N/A	Solder Reflow
2220	5650	5.6 (.220) ± .40 (.016)	5.0 (.197) ± .40 (.016)		0.60 (.024) ± .35 (.014)	N/A	1
2225	5664	5.6 (.220) ± .40 (.016)	6.3 (.248) ± .40 (.016)		0.60 (.024) ± .35 (.014)	N/A	

\* Note: Indicates EIA Preferred Case Sizes (Tightened tolerances apply for 0402, 0603, and 0805 packaged in bulk bassette, see page 96.) + For extended value 1210 case size - solder reflow only.

CAPACITOR ORDERING <u>C</u> 0805 <u>C</u> 103 <u>K</u>	G INFORMATION(Standard Chips - For Military see page 87)5RA5RC*
CERAMIC	C-Standard (Tin-plated nickel barrier)
CAPACITANCE CODE Expressed in Picofarads (pF)	A- Not Applicable
First two digits represent significant figures. Third digit specifies number of zeros. (Use 9 for 1.0 through 9.9pF. Use 8 for 0.5 through 0.99pF) (Example: 2.2pF = 229 or 0.50 pF = 508) <b>CAPACITANCE TOLERANCE</b> $B - \pm 0.10pF$ J $- \pm 5\%$ $C - \pm 0.25pF$ K $- \pm 10\%$ $D - \pm 0.5pF$ M $- \pm 20\%$	TEMPERATURE CHARACTERISTIC           Designated by Capacitance           Change Over Temperature Range           G - C0G (NP0) (±30 PPM/°C)           R - X7R (±15%) (-55°C + 125°C)           P- X5R (±15%) (-55°C + 85°C)           U - Z5U (+22%, -56%) (+10°C + 85°C)           V - Y5V (+22%, -82%) (-30°C + 85°C)           VOLTAGE
$F - \pm 1\%$ $P - (GMV) - special order only$ $G - \pm 2\%$ $Z - +80\%$ , -20%	1 - 100V 3 - 25V 2 - 200V 4 - 16V 5 - 50V 8 - 10V
* Part Number Example: C0805C10	

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# CERAMIC CHIP/STANDARD

	<b>A 1</b>		C0204+					AN		nAI			201	, 040	JZ, 1	000			, 12	00			~	1206*		
Cap pF	Cap Code	Cap Tolerance	25V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	200V	10V	16V	25V	805* 50V	100V	200V	10V	16V	25V	1206* 50V	100V	200V
Cap pF           0.050           0.750           0.751           1.0           1.13           1.5           1.6           1.8           2.0           2.24           2.7           3.0           3.3           3.6           3.9           4.3           4.7           5.6           8.2           9.1           10.0           11.0           12.0           13.0           15.0           14.0           22.0           24.0           27.0           33.0           36.0           37.0           38.0           39.0           43.0           47.0           51.0           550.0           82.0           91.0           100.0           120.0           220.0           240.0           220.0           220.0           220.0           220.0           220.0	Cap Code 508 758 758 758 758 758 758 758 758 758 75	C,D C,D C,D C,D C,D C,D C,D C,D C,D C,D	C0201*           25V           AA^           AA-           AA-		1	C0402	*				CO	603*		-			CO	805*	-							
330.0 360.0 390.0 430.0 510.0 560.0 560.0 620.0 680.0 910.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 1200.0 2200.0 2200.0 2400.0 3000.0 3000.0 3000.0 3000.0 3000.0 3000.0 5100.0 5600.0 9100.0 15.000.0 5500.0 910.0 15.000.0 5500.0 910.0 10.000.0 5500.0 910.0 10.000.0 5500.0 910.0 10.000.0 5500.0 910.0 10.000.0 5500.0 910.0 500.0 910.0 10.000.0 5500.0 910.0 10.000.0 5500.0 910.0 10.000.0 5500.0 910.0 10.000.0 5500.0 910.0 10.000.0 5500.0 910.0 10.000.0 5500.0 910.0 10.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 910.000.0 900.000.0 900.000.0 900.000.000.	391 431 471 511 511 621 621 621 621 621 751 102 112 2132 2132 2122 2132 2222 222 222 2	F,G,JK,M F,G,JK,MF,G,JK,M F,G,JK,M F,G,JK,MF,G,JK,M F,G,JK,MF,G,JK,M F,G,JK,MF,G		88 88 88 88 88 88 88 88 88 88 88 88 88				88 88 88 88 88 88 88 88 88 88 88 88 88	සි ස		888888888888888888888888888888888888888	සි ස	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		DC DC DC DC DC DC DC DC DC DC DC DC DC D	B C C C C C C C C C C C C C C C C C C C	22232222222222222222222222222222222222	22222222222222222222222222222222222222	8 H 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2							BB BB BB CCCCED BB BB CCC BD BD EB CCC

#### COG CAPACITANCE RANGE - 0201, 0402, 0603, 0805, 1206

\* Indicates EIA preferred chip sizes.

NOTE: For non-standard capacitance values or voltages, contact your local KEMET sales representative. 50 Volt Ceramic Chips can be used in 63 volt applications.

Improved product with higher ratings and tighter capacitance tolerance product may be substituted within the same size (length, width, and thickness) at KEMET's option. Reels with such substitutions will be marked with the improved KEMET part numbers.

• Greater or equal to J (5%) tolerance available. • J Tolerance Only; ^ = D Tolerance Only ~ = J,K,M Tolerance Only

### See page 78 for Thickness Code Reference Chart.

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**Ceramic Surface Mount** 



# **CERAMIC CHIP/STANDARD**

#### COG CAPACITANCE RANGE - 1210, 1812, 1825, 2220, 2225

Cap	Cap	Cap			C1	210*				C1812	•		C1825	j*		C222	0		C222	i
pF	Code	Tolerance	10V	16V	25V	50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V	50V	100V	200V
0.5-2.4	508-249	D	FB	FB	FB	FB	FB	FB												
2.7-9.1	279-919	D K,M	FB	FB	FB	FB	FB	FB												
10.0-13.0	100-130	D J,K,M	FB	FB	FB	FB	FB	FB												
15.0-24.0	150-240	D G,J,K,M	FB	FB	FB	FB	FB	FB												
27.0-51.0	270-510	D,F,G,J,K,M	FB	FB	FB	FB	FB	FB												
56.0-82.0	560-820	F,G,J,K,M	FB	FB	FB	FB	FB	FB												
91.0-360.0	910-361	F,G,J,K,M	FB	FB	FB	FB	FB	FB												
390.0	391	F.G.J.K.M	FB	FB	FB	FB	FB	FB												
430.0 470.0	431 471	F,G,J,K,M F.G.J.K.M	FB FB	FB FB	FB FB	FB FB	FB FB	FB FB	GB	GB	GB									
510.0	511	F.G.J.K.M	FB	FB	FB	FB	FB	FB	GB	GB	GB	_						_		
560.0	561	F,G,J,K,M	FB	FB	FB	FB	FB	FB	GB	GB	GB									
620.0	621	F.G.J.K.M	FB	FB	FB	FB	FB	FB												
680.0	681	F.G.J.K.M	FB	FB	FB	FB	FB	FB	GB	GB	GB									
750.0	751	F,G,J,K,M	FB	FB	FB	FB	FB	FB			-									
820.0	821	F.G.J.K.M	FB	FB	FB	FB	FB	FB	GB	GB	GB									
910.0	911	F,G,J,K,M	FB	FB	FB	FB	FB	FB												
1,000.0	102	F,G,J,K,M	FB	FB	FB	FB	FB	FB	GB	GB	GB									
1,100.0	112 122	F,G,J,K,M	FB FB	FB FB	FB FB	FB FB	FB FB	FB FB	GB	GB	GB									
1,200.0	122	F,G,J,K,M F.G.J.K.M	FB	FB	FB	FB	FB	FC	GB	GB	GB									
1,500.0	152	F,G,J,K,M	FB	FB	FB	FB	FB	FE	GB	GB	GB									
1,600.0	162	F.G.J.K.M	FB	FB	FB	FB	FB	FE	55	00	00									
1.800.0	182	F.G.J.K.M	FB	FB	FB	FB	FB	FE	GB	GB	GB									
2,000.0	202	F,G,J,K,M	FB	FB	FB	FB	FC	FE												
2,200.0	222	F,G,J,K,M	FB	FB	FB	FB	FC	FG	GB	GB	GB									
2,400.0	242	F,G,J,K,M	FB	FB	FB	FB	FC	FC												
2,700.0	272	F,G,J,K,M	FB	FB	FB	FB	FC	FC	GB	GB	GB									
3,000.0	302	F,G,J,K,M	FB	FB	FB	FB	FC	FF			~~									
3,300.0	332 362	F,G,J,K,M F.G.J.K.M	FB	FB	FB	FB	FF	FF	GB	GB	GB	_				_		_		
3,600.0 3,900.0	362	F,G,J,K,M F,G,J,K,M	FB	FB	FB	FB	FF	FF	GB	GB	GB	нв	нв	нв						
4.300.0	432	F.G.J.K.M	FB	FB	FB	FB	FF	FF	GD	GB	GB	пь	пь	пь						
4,700.0	472	F.G.J.K.M	FF	FF	FF	FF	FG	FG	GB	GB	GD	HB	HB	HB				кв	КВ	КВ
5,100.0	512	F.G.J.K.M	FB	FB	FB	FB	FG	FG												
5,600.0	562	F,G,J,K,M	FB	FB	FB	FB	FG	FG	GB	GB	GH	HB	HB	HB				KB	KB	KB
6,200.0	622	F,G,J,K,M	FB	FB	FB	FB	FG													
6,800.0	682	F,G,J,K,M	FB	FB	FB	FB	FG		GB	GB	GJ	HB	HB	HB	JB	JB		KB	KB	KB
7,500.0	752	F,G,J,K,M	FC	FC	FC	FC	FC													
8,200.0	822	F.G.J.K.M	FC	FC	FC	FC	FC		GB	GH		HB	HB	HB	JB	JB		KB	KB	KB
9,100.0 10.000.0	912 103	F.G.J.K.M F.G.J.K.M	FE	FE	FE	FE	FE FF		GB	GH		нв	нв	HE	JB	JB		кв	кв	кв
12.000.0	123	F,G,J,K,M	FG	FG	FG	FG	FB		GB	GG		HB	HB	HE	JB	JB		KB	KB	KB
15.000.0	153	F,G,J,K,M	FG	FG	FG	FG	FB		GB	GB		HB	HB		JB	JB		KB	KB	KE
18,000.0	183	F,G,J,K,M	FB	FB	FB	FB	FB		GB	GB		HB	HE		JB	JB		KB	KB	
22,000.0	223	F,G,J,K,M	FB	FB	FB	FB	FB		GB	GB		HB	HE		JB	JB		KB	KB	
27,000.0	273	F,G,J,K,M	FB	FB	FB	FB	FB		GB	GB		HB	HF		JB	JB		KB	KE	
33,000.0	333	F,G,J,K,M	FB	FB	FB	FB	FB		GB	GB					JB	JB		KB		
47,000.0	473	F.G.J.K.M	FB	FB	FB	FB	FE		GB	GB					JB	JB				
56,000.0 68.000.0	563 683	F,G,J,K,M F.G.J.K.M	FB	FB	FB	FB	FF		GB	GB					JB JB	JB JB				
82.000.0	823	F,G,J,K,M F,G,J,K,M	FC	FC	FC	FF	FH		GB	GB					JB	JB				
100.000.0	104	F.G.J.K.M	FE	FE	FE	FG	FM+		GB	GD					JB	JB				
120.000.0	124	F.G.J.K.M	FG	FG	FG	FH			GB	GH					JB	JB				
150,000.0	154	F,G,J,K,M	FH	FH	FH	FM+			GD	GN					JB	JB				
220,000.0	224		FK+	FK+	FK+				GK						JB	JD				
270,000.0	274	F.G.J.K.M													JB	JF				
330,000.0	334	F.G.J.K.M													JD	JH				
470,000.0	474	F,G,J,K,M													JG					
560,000.0	564	F,G,J,K,M																		

#### X7R CAPACITANCE RANGE - 0402, 0603, 0805, 1206

Сар	Cap	Cap Tol			C0402						C0603							C0805							C1206			
pF	Code		6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	100V	200V	6.3V	10V	16V	25V	50V	100V	200V	6.3V	10V	16V	25V	50V	100V	200V
150 180	151 181	J, K, M J, K, M	BB BB	BB BB	BB BB	BB BB	BB BB	СВ	DC																			
220	221	J, K, M	BB	BB	BB	BB	BB	CB	DC																			
270 330	271 331	J, K, M J, K, M	BB BB	BB BB	BB BB	BB BB	BB BB	CB CB	DC DC																			
390	391	J, K, M	BB	BB	BB	BB	BB	CB	DC																			
470	471	J, K, M	BB	BB	BB	BB	BB	CB	DC																			
560 680	561 681	J, K, M J, K, M	BB BB	BB BB	BB BB	BB BB	BB BB	CB CB	DC DC																			
820	821	J, K, M	BB	BB	BB	BB	BB	CB	DC	DC	DC	DC	DC	DC	DČ													
1,000 1,200	102 122	J, K, M J, K, M	BB BB	BB BB	BB BB	BB BB	BB BB	CB CB	DC DC	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB												
1,500	152	J, K, M	BB	BB	BB	BB	BB	CB	DC	EB	EB	EB	EB	EB	EB	EB												
1,800 2,200	182 222	J, K, M J, K, M	BB BB	BB BB	BB BB	BB BB	BB BB	CB CB	DC DC	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB												
2,700	272	J, K, M J, K, M	BB	BB	BB	BB	BB	CB	DC	EB	EB	EB	EB	EB	EB	EB												
3,300	332	J, K, M	BB BB	BB	BB	BB	BB	CB	DC	EB	EB	EB	EB	EB	EB	EB												
3,900 4,700	392 472	J, K, M J, K, M	BB	BB BB	BB BB	BB BB	BB BB	CB CB	DC DC	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB												
5,600	562	J, K, M	BB	BB	BB	BB	BB	CB	DC	EB	EB	EB	EB	EB	EB	EB												
6,800 8,200	682 822	J, K, M J, K, M	BB BB	BB BB	BB BB	BB BB	BB BB	CB CB	DC DC	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB												
10,000	103	J, K, M	BB	BB	BB	BB	BB	CB	DC	EB	EB	EB	EB	EB	EB	EB												
12,000 15,000	123 153	J, K, M J, K, M	BB BB	BB BB	BB BB	BB BB	BB BB	CB CB	CB CB	CB CB	CB CB	CB CB	CB CB		DC DC	DC DC	DC DC	DC DC	DC DC	DC DD	DC DC	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB
18,000	183	J, K, M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DD	DC	EB	EB	EB	EB	EB	EB	EB
22,000		J, K, M	BB BB	BB	BB BB	BB	BB	CB	CB	CB	CB	CB	CB CB		DC	DC	DC	DC DC	DC	DD DD	DC	EB	EB	EB	EB	EB	EB	EB
27,000 33,000	273 333	J, K, M J, K, M	BB	BB BB	BB	BB BB		CB CB	CB CB	CB CB	CB CB	CB CB	СВ		DC DC	DC DC	DC DC	DC	DC DC	DD	DE DE	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB
39,000	393	J, K, M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DD	DE	EB	EB	EB	EB	EB	EC	EB
47,000 56,000	473 563	J, K, M J, K, M	BB BB	BB BB	BB BB	BB		CB CB	CB CB	CB CB	CB CB	CB CB	СВ		DC DD	DC DD	DC DD	DC DD	DC DD	DE DE	DG DG	EB EB	EB EB	EB EB	EB EB	EB EB	EC EB	ED ED
68,000	683	J, K, M	BB	BB	BB			CB	CB	CB	CB	CB			DD	DD	DD	DD	DD	DE		EB	EB	EB	EB	EB	EB	ED
82,000 100,000	823 104	J, K, M J, K, M	BB BB	BB BB	BB BB			CB CB	CB CB	CB CB	CB CB	CB CB			DD DD	DD DD	DD DD	DD DD	DD DD	DE DE		EB EB	EB EB	EB EB	EB EB	EB EB	EB EB	ED EM
120,000	124	J, K, M	00	00	00			CB	CB	CB	CD	CB			DC	DC	DC	DC	DD	DG		EC	EC	EC	EC	EC	EC	EM
150,000 180,000	154	J, K, M J, K, M						CB CB	CB CB	CB CB		CD			DC DC	DC DC	DC DC	DC DC	DD DD			EC EC	EC EC	EC EC	EC EC	EC EC	EC EC	EG
220,000	184 224	J, K, M J, K, M						CB	CB	CB	CD				DC	DC	DC	DC	DD	DG		EC	EC	EC	EC	EC	EC	
270,000	274	J, K, M						CB	CB	CB					DD	DD DD	DD	DD DD	00			EB	EB	EB	EB	EC	EM	
330,000 390,000	334 394	J, K, M J, K, M						CB CB	CB CB	CB CB					DD DG	DD DG	DD DG	DD DG	DD DE			EB EB	EB EB	EB EB	EB EB	EC EC	EG EG	
470,000	474	J, K, M						CB	CB	ĊВ					DD	DD	DD	DD	DE			EC	EC	EC	EC	EC	EG	
560,000 680,000	564 684	J, K, M J, K, M													DD DD	DD DD	DD DD	DG DG	DH DH			ED EE	ED EE	ED EE	ED EE	EC ED		
820,000	824	J, K, M													DD	DD	DD	DG				EF	EF	EF	EF	ED		
1,000,000 1,200,000	105 125	J, K, M J, K, M						CC*	CC*	CC*					DD DE	DD DE	DD DE	DG				EF ED	EF ED	EF ED	EG EG	ED EH		
1,500,000	155	J, K, M													DG	DG	DG					EF	EF	EF	EG	EH		
1,800,000 2,200,000	185 225	J, K, M J, K, M													DG	DG DG	DG DG					EF ED	EF	EF ED	EF	EH		
2,200,000	225	J, K, M J, K, M													DG	DG	DG					EN	EN	EN	27	EH		
3,300,000	335	J, K, M																				ED	ED	ED	EH			
3,900,000 4,700,000	395 475	J, K, M J, K, M																				EF EF+	EF EF+	EF EF+	EH+			
5,600,000	565	J, K, M																				EH+	EH+	EH+				
6,800,000 8,200,000	685 825	J, K, M J, K, M																				EH+ EH+	EH+ EH+	EH+ EH+				
10,000,000		J, K, M																				EH+	EH+	EH+				

\* Capacitance K or M. ontact KEMET Sales Rep for J tolerance availability. +\_ Reflow Only. NOTE: For non-standard capacitance values or voltages, contact your local KEMET sales representative.

Improved product with higher ratings and tighter capacitance tolerance product may be substituted within the same size (length, width, and thickness) at KEMET's option. Reels with such substitutions will be marked with the improved KEMET part numbers.

#### See page 78 for Thickness Code Reference Chart.

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Thickness Code	Chip Size	Chip Thickness Range (mm)	Qty per Reel 7" Plastic	Qty per Reel 13" Plastic	Qty per Reel 7" Paper	Qty per Reel 13" Paper	Qty per Bull Cassette
AA	0201	$0.30 \pm 0.03$	N/A	N/A	15,000	N/A	N/A
BB	0402	$0.50 \pm 0.05$	N/A	N/A	10,000	50,000	50,000
CB	0603	$0.80 \pm 0.07$	N/A	N/A	4,000	10,000	15,000
CC	0603	0.80 ± 0.10	N/A	N/A	4,000	10,000	N/A
CD DB	0603	$0.80 \pm 0.15$	N/A N/A	N/A	4,000 4,000	10,000	N/A
DD	0805 0805	$0.60 \pm 0.10$ $0.78 \pm 0.10$	N/A N/A	N/A N/A	4,000	10,000 10,000	10,000 N/A
DD	0805	$0.78 \pm 0.10$ $0.90 \pm 0.10$	N/A	N/A	4,000	10,000	N/A
DE	0805	$1.00 \pm 0.10$	2,500	10,000	N/A	N/A	N/A
DF	0805	1.10 ± 0.10	2,500	10,000	N/A	N/A	N/A
DG	0805	1.25 ± 0.15	2,500	10,000	N/A	N/A	N/A
DH	0805	1.25 ± 0.20	2,500	10,000	N/A	N/A	N/A
DJ	0805	1.25 ± 0.20	3,000	N/A	N/A	N/A	N/A
DK	0805	$1.25 \pm 0.15$	3,000	N/A	N/A	N/A	N/A
DL	0805	$0.95 \pm 0.10$	4,000	10,000	N/A	N/A	N/A
EB EC	1206	$0.78 \pm 0.10$	4,000	10,000	4,000	10,000 N/A	N/A
ED	1206 1206	$0.90 \pm 0.10$ 1.00 ± 0.10	4,000 2,500	10,000 10,000	N/A N/A	N/A N/A	N/A N/A
EE	1206	$1.00 \pm 0.10$ $1.10 \pm 0.10$	2,500	10,000	N/A N/A	N/A	N/A
EF	1206	1.20 ± 0.15	2,500	10,000	N/A	N/A	N/A
EG	1200	$1.20 \pm 0.15$ 1.60 ± 0.15	2,000	8,000	N/A	N/A	N/A
EH	1206	1.60 ± 0.20	2,000	8,000	N/A	N/A	N/A
EJ	1206	$1.70 \pm 0.20$	2,000	8,000	N/A	N/A	N/A
EK	1206	0.80 ± 0.10	2,000	8,000	N/A	N/A	N/A
EL	1206	1.15 ± 0.15	2,000	8,000	N/A	N/A	N/A
EM	1206	$1.25 \pm 0.15$	2,500	10,000	N/A	N/A	N/A
EN	1206	$0.95 \pm 0.10$	4,000	10,000	N/A	N/A	N/A
FB	1210	$0.78 \pm 0.10$	4,000	<u>10,000</u> 10.000	N/A	N/A	N/A
FC FD	<u>1210</u> 1210	$0.90 \pm 0.10$ $0.95 \pm 0.10$	4,000 4,000	10,000	N/A N/A	N/A N/A	N/A N/A
FE	1210	$1.00 \pm 0.10$	2,500	10,000	N/A N/A	N/A	N/A
FF	1210	1.10 ± 0.10	2,500	10,000	N/A	N/A	N/A
FG	1210	1.25 ± 0.15	2,500	10,000	N/A	N/A	N/A
FH	1210	1.55 ± 0.15	2,000	8,000	N/A	N/A	N/A
FJ	1210	1.85 ± 0.20	2,000	8,000	N/A	N/A	N/A
FK	1210	2.10 ± 0.20	2,000	8,000	N/A	N/A	N/A
FL	1210	1.40 ± 0.15	2,000	8,000	N/A	N/A	N/A
FM	1210	1.70 ± 0.20	2,000	8,000	N/A	N/A	N/A
FN	1210	1.85 ± 0.20	2,000	8,000	N/A	N/A	N/A
FO FP	<u>1210</u> 1210	$1.50 \pm 0.20$	2,000 2,000	8,000 8,000	N/A N/A	N/A N/A	N/A N/A
FQ	1210	$1.60 \pm 0.20$ 2.50 ± 0.22	1,500	N/A	N/A N/A	N/A	N/A
FR	1210	2.25 ± 0.20	2,000	8,000	N/A	N/A	N/A
FS	1210	$2.50 \pm 0.20$	1,000	4,000	N/A	N/A	N/A
FT	1210	1.90 ± 0.20	1,500	4,000	N/A	N/A	N/A
LD	1808	0.90 ± 0.10	4,000	10,000	N/A	N/A	N/A
GB	1812	$1.00 \pm 0.10$	1,000	4,000	N/A	N/A	N/A
GC	1812	$1.10 \pm 0.10$	1,000	4,000	N/A	N/A	N/A
GD	1812	$1.25 \pm 0.15$	1,000	4,000	N/A	N/A	N/A
GE GF	<u>1812</u> 1812	$1.30 \pm 0.10$ 1.50 ± 0.10	1,000 1,000	4,000	N/A N/A	N/A N/A	N/A N/A
GG	1812	$1.50 \pm 0.10$ $1.55 \pm 0.10$	1,000	4,000	N/A N/A	N/A N/A	N/A N/A
GH	1812	$1.40 \pm 0.15$	1,000	4,000	N/A	N/A N/A	N/A N/A
GJ	1812	1.70 ± 0.15	1,000	4,000	N/A	N/A	N/A
GK	1812	$1.60 \pm 0.20$	1,000	4,000	N/A	N/A	N/A
GL	1812	1.90 ± 0.20	1,000	4,000	N/A	N/A	N/A
GM	1812	$2.00 \pm 0.20$	1,000	4,000	N/A	N/A	N/A
GN	1812	1.70 ± 0.20	1,000	4,000	N/A	N/A	N/A
GO	1812	$2.50 \pm 0.20$	500	N/A	N/A	N/A	N/A
HB HC	1825	$1.10 \pm 0.15$	1,000 1,000	4,000	N/A N/A	N/A N/A	N/A N/A
HD	1825 1825	1.15 ± 0.15 1.30 ± 0.15	1,000	4,000	N/A N/A	N/A N/A	N/A N/A
HE	1825	$1.40 \pm 0.15$	1,000	4,000	N/A	N/A N/A	N/A
HF	1825	1.50 ± 0.15	1,000	4,000	N/A	N/A	N/A
JB	2220	1.00 ± 0.15	1,000	4,000	N/A	N/A	N/A
JC	2220	$1.10 \pm 0.15$	1,000	4,000	N/A	N/A	N/A
JD	2220	1.30 ± 0.15	1,000	4,000	N/A	N/A	N/A
JE	2220	1.40 ± 0.15	1,000	4,000	N/A	N/A	N/A
JF	2220	$1.50 \pm 0.15$	1,000	4,000	N/A	N/A	N/A
JG	2220	$1.70 \pm 0.15$	1,000	4,000	N/A	N/A	N/A
JH	2220	$1.80 \pm 0.15$	1,000	4,000	N/A	N/A	N/A
JO KB	2220 2225	$2.40 \pm 0.15$ 1.00 ± 0.15	500	2,000	N/A N/A	N/A N/A	N/A N/A
KB	2225	$1.00 \pm 0.15$ $1.10 \pm 0.15$	<u>1,000</u> 1,000	4,000 4,000	N/A N/A	N/A N/A	<u>N/A</u>
KD	2225	$1.10 \pm 0.15$ $1.30 \pm 0.15$	1,000	4,000	N/A N/A	N/A N/A	N/A
KE	2225	$1.40 \pm 0.15$	1,000	4,000	N/A	N/A	N/A

#### Thickness Code Reference Chart Packaging Quantity Based on Finished Chip Thickness Specifications

This chart refers to ceramic chip thickness codes on pages 73 – 76.

Note: TU suffix represents tape and reel packaging of unmarked components.

Note: TM suffix represents tape and reel packaging of marked components.

Cases sizes  $\leq$ 1210 are 8mm tape with 4mm pitch and Case Sizes >1210 are 12mm tape and 8mm pitch.



**Packaging Information** 

# Tape & Reel Packaging

**KEMET** offers Multilayer Ceramic Chip Capacitors packaged in 8mm and 12mm plastic tape on 7" and 13" reels in accordance with EIA standard 481-1: Taping of surface mount components for automatic handling. This packaging system is compatible with all tape fed automatic pick and place systems. See page 78 for details on reeling quantities for commercial chips and page 87 for MIL-PRF-55681 chips.



Case Sizes  $\leq$  1210 are 8 mm tape with 4 mm pitch. Case Sizes >1210 are 12 mm tape with 8 mm pitch.

Note: TU suffix represents tape and reel packaging of unmarked components. TM suffix represents tape and reel packaging of marked components.

#### **Reflow Solder** Wave Solder Grid Placement Х Y(ref) Smin Dimension Ζ G Х Y(ref) C(ref) Ζ G Courtyard 0.74 0402 2.14 0.28 0.93 1.21 Not Recomm hah 2.78 3.30 0603 1.73 0.68 1.08 1.05 3.18 0.68 0.80 1.25 1.93 1.50 С 3.70 2.20 0805 0.70 1.60 1.30 2.00 0.70 1.10 1206 4.50 1.50 2.00 1.50 3.00 4.90 1.50 1.40 1.70 3.20 2.90 3.20 1210 4.50 1.50 1.50 3.00 4.90 1.50 2.00 1.70 3.70 1812 5.90 2.30 1.80 4.10 1825 5.90 2.30 6.90 1.80 4.10 Not Recommended 2220 7.00 3.30 5.50 1.85 5.15 2225 7.00 3.30 6.80 1.85 5.15 Calculation Formula G Z = Lmin + 2Jt + Tt

SURFACE MOUNT LAND DIMENSIONS - CERAMIC CHIP CAPACITORS - MM

7

X = Wmin + 2Js + Ts

Tt, Th, Ts = Combined tolerances

Х



# TANTALUM, CERAMIC AND ALUMINUM CHIP CAPACITORS

**Packaging Information** 

# **Performance Notes**

**Peel Strength** 

1. Cover Tape Break Force: 1.0 Kg Minimum.

2. Cover Tape Peel Strength: The total peel strength of the cover tape from the carrier tape shall be:

Tape Width	
8 mm	0.1 Newto
12 mm	0.1 Newto

0.1 Newton to 1.0 Newton (10g to 100g) 0.1 Newton to 1.3 Newton (10g to 130g)

The direction of the pull shall be opposite the direction of the carrier tape travel. The pull angle of the carrier tape shall be  $165^{\circ}$  to  $180^{\circ}$  from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of  $300 \pm 10$  mm/minute.

- **3. Reel Sizes:** Molded tantalum capacitors are available on either 180 mm (7") reels (standard) or 330 mm (13") reels (with C-7280). Note that 13" reels are preferred.
- **4. Labeling:** Bar code labeling (standard or custom) shall be on the side of the reel opposite the sprocket holes. Refer to EIA-556.

## Embossed Carrier Tape Configuration: Figure 1



## Table 1 — EMBOSSED TAPE DIMENSIONS (Metric will govern)

		С	onstant	Dimensions —	- Millimeters (li	nches)			
Tape Size	D <sub>0</sub>		E	P₀	P <sub>2</sub>	T Max	T₁ Max		
8 mm and	1.5 +0.10 -0	-	±0.10	4.0 ±0.10	2.0 ±0.05	0.600	0.100		
12 mm	(0.059 +0.004, -0		±0.004)	(0.157 ±0.004)	(0.079 ±0.002)	(0.024)	(0.004)		
		V	/ariable	Dimensions —	Millimeters (Ir	iches)		ł	
Tape Size	Pitch	B₁ Max.	D₁ Min.	F	P <sub>1</sub>	R Min.	T <sub>2</sub> Max	W	A <sub>0</sub> B <sub>0</sub> K <sub>0</sub>
		Note 1	Note 2			Note 3			Note 4
8 mm	Single (4 mm)	4.4	1.0	3.5 ±0.05	4.0 ±0.10	25.0	2.5	8.0 ±0.30	
		(0.173)	(0.039)	(0.138 ±0.002)	(0.157 ±0.004)	(0.984)	(0.098)	(.315 ±0.012)	
12 mm	Double (8 mm)	8.2 (0.323)	1.5 (0.059)	5.5 ±0.05 (0.217 ±0.002)	8.0 ±0.10 (0.315 ±0.004)	30.0 (1.181)	4.6 (0.181)	12.0 ±0.30 (0.472 ±0.012)	
	I I			1	1	1	1		1

## NOTES

1. B1 dimension is a reference dimension for tape feeder clearance only.

- 2. The embossment hole location shall be measured from the sprocket hole controlling the location of the embossment. Dimensions of embossment location and hole location shall be applied independent of each other.
- 3. Tape with components shall pass around radius "R" without damage (see sketch A). The minimum trailer length (Fig. 2) may require additional length to provide R min. for 12 mm embossed tape for reels with hub diameters approaching N min. (Table 2)
- 4. The cavity defined by A<sub>0</sub>, B<sub>0</sub>, and K<sub>0</sub> shall be configured to surround the part with sufficient clearance such that the chip does not protrude beyond the sealing plane of the cover tape, the chip can be removed from the cavity in a vertical direction without mechanical restriction, rotation of the chip is limited to 20 degrees maximum in all 3 planes, and lateral movement of the chip is restricted to 0.5 mm maximum in the pocket (not applicable to vertical clearance.)

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# TANTALUM, CERAMIC AND ALUMINUM CHIP CAPACITORS



**Packaging Information** 

## **Embossed Carrier Tape Configuration (cont.)**



Table 2 – REEL DIMENSIONS (Metric will govern)

Tape Size	A Max	B* Min	С	D* Min	N Min	<b>W</b> <sub>1</sub>	W <sub>2</sub> Max	W <sub>3</sub>
8 mm	330.0 (12.992)	1.5 (0.059)	13.0 ± 0.20 (0.512 ± 0.008)	20.2 (0.795)	50.0 (1.969) See Note 3	8.4 +1.5, -0.0 (0.331 +0.059, -0.0)	14.4 (0.567)	7.9 Min (0.311) 10.9 Max (0.429)
12 mm	330.0 (12.992)	1.5 (0.059)	13.0 ± 0.20 (0.512 ± 0.008)	20.2 (0.795)	Table 1	12.4 +2.0, -0.0 (0.488 +0.078, -0.0)	18.4 (0.724)	11.9 Min (0.469) 15.4 Max (0.606)

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**Packaging Information** 

## Punched Carrier (Paper Tape) Configuration (Ceramic Chips Only):



Table 1: 8 & 12mm Punched Tape (Metric Dimensions Will Govern)

**Constant Dimensions - Millimeters (Inches)** 

Tape Size	D <sub>0</sub>	E	P <sub>0</sub>	P <sub>2</sub>	T <sub>1</sub>	G <sub>1</sub>	G <sub>2</sub>	R Min.
8mm and 12mm	1.5 +0.10, -0.0 (.059 +0.004, -0.0)		$4.0 \pm 0.10$ (.157 $\pm 0.004$ )	$2.0 \pm 0.05$ (.079 $\pm$ 0.002)	(.004)	0.75 (.030) Min.		25 (.984) See Note 2 Table 1

## Table 1: 8 & 12mm Punched Tape (Metric Dimensions Will Govern)

Variable Dimensions - Millimeters (Inches)

Tape Size	P <sub>1</sub>	F	W	A <sub>0</sub> B <sub>0</sub>	Т
8mm 1/2 Pitch	$\begin{array}{c} 2.0 \pm 0.10 \\ (.079 \pm .004) \\ \text{See Require-} \\ \text{ments} \\ \text{Section 3.3 (d)} \end{array}$	3.5 ± 0.05 (.138 ± .002)	$8.0 \pm 0.3$ (.315 $\pm 0.012$ )	See Note 1 Table 1	1.1mm (.043) Max. for Paper Base Tape and 1.6mm (.063) Max. for Non-
8mm	$\begin{array}{c} 4.0 \pm 0.10 \\ (0.157 \pm .004) \end{array}$				Paper Base Compositions.
12mm	4.0 ± 0.10 (0.157 ± .004)	$5.5\pm0.05$	$12.0\pm0.3$		See Note 3.
12mm Double Pitch	$\begin{array}{c} 8.0 \pm 0.10 \\ (0.315 \pm .004) \end{array}$	(.217 ± .002)	(.472 ± .012)		

#### Note:

1.  $A_0$ ,  $B_0$  and T determined by the maximum dimensions to the ends of the terminals extending from the body and/or the body dimensions of the component. The clearance between the ends of the terminals or body of the component to the sides and depth of the cavity ( $A_0$ ,  $B_0$  and T) must be within 0.05mm (.002) minimum and 0.50mm (.020) maximum. The clearance allowed must also prevent rotation of the component within the cavity of not more than 20 degrees (see sketches A and B).

2. Tape with components shall pass around radius "R" without damage.

3. KEMET nominal thicknesses are: 0402 = 0.6mm and all others 0.95mm minimum.



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Packaging Information

### Bulk Cassette Packaging (Ceramic Chips only) (Meets Dimensional Requirements IEC-286-6 and EIAJ 7201)



# Table 2 – Capacitance Values Available In Bulk Cassette Packaging

				5	5
	Case Size	Dielectric	Voltage	Min. Cap Value	Max. Cap Value
	0402	All	All	All	All
	0603	All	All	All	All
	0805	C0G	200 100 50	109 109 109	181 331 102
		X7R	200 100 50 25 16	221 221 221 221 221 221	392 103 273 104 104
*		Y5V	25 16	104 104	224 224

## Table 1 – Capacitor Dimensions for Bulk Cassette Packaging – Millimeters

5.0

Metric Size Code	EIA Size Code	Length L	Width W	Thickness T	Bandwidth B	Minimum Separation S	Number of Pcs/Cassette
1005 1608 2012	0402 0603 0805	$1.6 \pm 0.07$	$\begin{array}{c} 0.5 \pm 0.05 \\ 0.8 \pm 0.07 \\ 1.25 \pm 0.10 \end{array}$	$\begin{array}{c} 0.5 \pm .05 \\ 0.8 \pm .07 \\ 0.6 \pm .10 \end{array}$	0.2 to 0.4 0.2 to 0.5 0.5 to 0.75	0.3 0.7 0.75	50,000 15,000 10,000

Terminations: KEMET nickel barrier layer with a tin overplate.

#### CAPACITOR MARKING TABLE (Marking Optional - Not Available for 0402 Size or Y5V Dielectric)

Numeral	ral Capacitance (pF) For Various Numeral Identifiers								
Alpha Character	9	0	1	2	3	4	5	6	7
A	0.10	1.0	10	100	1000	10,000	100,000	1,000,000	10,000,000
В	0.11	1.1	11	110	1100	11,000	110,000	1,100,000	11,000,000
С	0.12	1.2	12	120	1200	12,000	120,000	1,200,000	12,000,000
D	0.13	1.3	13	130	1300	13,000	130,000	1,300,000	13,000,000
E	0.15	1.5	15	150	1500	15,000	150,000	1,500,000	15,000,000
F	0.16	1.6	16	160	1600	16,000	160,000	1,600,000	16,000,000
G	0.18	1.8	18	180	1800	18,000	180,000	1,800,000	18,000,000
н	0.20	2.0	20	200	2000	20,000	200,000	2,000,000	20,000,000
J	0.22	2.2	22	220	2200	22,000	220,000	2,200,000	22,000,000
К	0.24	2.4	24	240	2400	24,000	240,000	2,400,000	24,000,000
L	0.27	2.7	27	270	2700	27,000	270,000	2,700,000	27,000,000
M	0.30	3.0	30	300	3000	30,000	300,000	3,000,000	30,000,000
N	0.33	3.3	33	330	3300	33,000	330,000	3,300,000	33,000,000
Р	0.36	3.6	36	360	3600	36,000	360,000	3,600,000	36,000,000
Q	0.39	3.9	39	390	3900	39,000	390,000	3,900,000	39,000,000
R	0.43	4.3	43	430	4300	43,000	430,000	4,300,000	43,000,000
S	0.47	4.7	47	470	4700	47,000	470,000	4,700,000	47,000,000
Т	0.51	5.1	51	510	5100	51,000	510,000	5,100,000	51,000,000
U	0.56	5.6	56	560	5600	56,000	560,000	5,600,000	56,000,000
V	0.62	6.2	62	620	6200	62,000	620,000	6,200,000	62,000,000
W	0.68	6.8	68	680	6800	68,000	680,000	6,800,000	68,000,000
X	0.75	7.5	75	750	7500	75,000	750,000	7,500,000	75,000,000
Y	0.82	8.2	82	820	8200	82,000	820,000	8,200,000	82,000,000
Z	0.91	9.1	91	910	9100	91,000	910,000	9,100,000	91,000,000
а	0.25	2.5	25	250	2500	25,000	250,000	2,500,000	25,000,000
b	0.35	3.5	35	350	3500	35,000	350,000	3,500,000	35,000,000
d	0.40	4.0	40	400	4000	40,000	400,000	4,000,000	40,000,000
е	0.45	4.5	45	450	4500	45,000	450,000	4,500,000	45,000,000
f	0.50	5.0	50	500	5000	50,000	500,000	5,000,000	50,000,000
m	0.60	6.0	60	600	6000	60,000	600,000	6,000,000	60,000,000
n	0.70	7.0	70	700	7000	70,000	700,000	7,000,000	70,000,000
t	0.80	8.0	80	800	8000	80,000	800,000	8,000,000	80,000,000
у	0.90	9.0	90	900	9000	90,000	900,000	9,000,000	90,000,000

Laser marking is available as an extra-cost option for most KEMET ceramic chips. Such marking is two sided, and includes a  $\overline{K}$  to identify KEMET, followed by two characters (per EIA-198 - see table below) to identify the capacitance value. Note that marking is not available for size 0402 nor for any Y5V chip. In addition, the 0603 marking option is limited to the  $\overline{K}$  only.

