C0G Dielectric, 10 – 250 VDC (Commercial Grade)



Overview

KEMET's COG dielectric features a 125°C maximum operating temperature and is considered "stable." The Electronics Components, Assemblies & Materials Association (EIA) characterizes COG dielectric as a Class I material. Components of this classification are temperature compensating and are suited for resonant circuit applications or those where Q

and stability of capacitance characteristics are required. COG exhibits no change in capacitance with respect to time and voltage and boasts a negligible change in capacitance with reference to ambient temperature. Capacitance change is limited to ±30 ppm/°C from -55°C to +125°C.

Benefits

- -55°C to +125°C operating temperature range
- · Lead (Pb)-Free, RoHS, and REACH compliant
- EIA 0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, and 2225 case sizes
- DC voltage ratings of 10 V, 16 V, 25 V, 50 V, 100 V, 200 V and 250 V
- Capacitance offerings ranging from 0.5 pF up to 0.47 μF
- Available capacitance tolerances of ±0.10 pF, ±0.25 pF, ±0.5 pF, ±1%, ±2%, ±5%, ±10%, and ±20%
- No piezoelectric noise
- Extremely low ESR and ESL
- High thermal stability
- · High ripple current capability



Ordering Information

C	1206	C	104	J	3	G	Α	С	TU
Ceramic	Case Size (L" x W")	Specification/ Series ¹	Capacitance Code (pF)	Capacitance Tolerance ²	Rated Voltage (VDC)	Dielectric	Failure Rate/ Design	Termination Finish ³	Packaging/Grade (C-Spec)
	0201 0402 0603 0805 1206 1210 1808 1812 1825 2220 2225	C = Standard	2 significant digits + number of zeros. Use 9 for 1.0 – 9.9 pF Use 8 for 0.5 – .99 pF e.g., 2.2 pF = 229 e.g., 0.5 pF = 508	$B = \pm 0.10 \text{ pF}$ $C = \pm 0.25 \text{ pF}$ $D = \pm 0.5 \text{ pF}$ $F = \pm 1\%$ $G = \pm 2\%$ $J = \pm 5\%$ $K = \pm 10\%$ $M = \pm 20\%$	8 = 10 4 = 16 3 = 25 5 = 50 1 = 100 2 = 200 A = 250	G = COG	A = N/A	C = 100% Matte Sn	See "Packaging C-Spec Ordering Options Table" below

¹ Flexible termination option is available. Please see FT-CAP product bulletin C1062_C0G_FT-CAP_SMD

² Additional capacitance tolerance offerings may be available. Contact KEMET for details.

³ Additional termination finish options may be available. Contact KEMET for details.



Packaging C-Spec Ordering Options Table

Packaging Type ¹	Packaging/Grade Ordering Code (C-Spec)
Bulk Bag / Unmarked	Not required (Blank)
7" Reel / Unmarked	TU
7" Reel / Unmarked / 2 mm pitch ²	7081
13" Reel / Unmarked / 2 mm pitch ²	7082

¹ Default packaging is "Bulk Bag". An ordering code C-Spec is not required for "Bulk Bag" packaging.

Benefits cont'd

- · Preferred capacitance solution at line frequencies and into the MHz range
- · No capacitance change with respect to applied rated DC voltage
- Negligible capacitance change with respect to temperature from -55°C to +125°C
- · No capacitance decay with time
- · Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb plated termination finish option available upon request (5% Pb minimum)

Applications

Typical applications include critical timing, tuning, circuits requiring low loss, circuits with pulse, high current, decoupling, bypass, filtering, transient voltage suppression, blocking and energy storage.

Qualification/Certification

Commercial Grade products are subject to internal qualification. Details regarding test methods and conditions are referenced in Table 4, Performance and Reliability.

Environmental Compliance

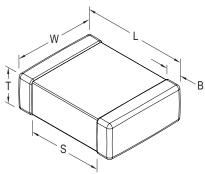
Lead (Pb)-Free, RoHS, and REACH compliant without exemptions.

¹ The terms "Marked" and "Unmarked" pertain to laser marking option of capacitors. All packaging options labeled as "Unmarked" will contain capacitors that have not been laser marked. The option to laser mark is not available on these devices. For more information see "Capacitor Marking".

² The 2 mm pitch option allows for double the packaging quantity of capacitors on a given reel size. This option is limited to EIA 0603 (1608 metric) case size devices. For more information regarding 2 mm pitch option see "Tape & Reel Packaging Information".



Dimensions – Millimeters (Inches)



EIA Size Code	Metric Size Code	L Length	W Width	T Thickness	B Bandwidth	S Separation Minimum	Mounting Technique
0201	0603	0.60 (.024) ± 0.03 (.001)	0.30 (.012) ± 0.03 (.001)		0.15 (.006) ± 0.05 (.002)	N/A	Colder Defloy Only
0402	1005	1.00 (.040) ± 0.05 (.002)	0.50 (.020) ± 0.05 (.002)		0.30 (.012) ± 0.10 (.004)	0.30 (.012)	Solder Reflow Only
0603	1608	1.60 (.063) ± 0.15 (.006)	0.80 (.032) ± 0.15 (.006)		0.35 (.014) ± 0.15 (.006)	0.70 (.028)	
0805	2012	2.00 (.079) ± 0.20 (.008)	1.25 (.049) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	0.75 (.030)	Solder Wave or Solder Reflow
1206	3216	3.20 (.126) ± 0.20 (.008)	1.60 (.063) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)		Coldol Rollow
1210	3225	3.20 (.126) ± 0.20 (.008)	2.50 (.098) ± 0.20 (.008)	See Table 2 for Thickness	0.50 (0.02) ± 0.25 (.010)		
1808	4520	4.70 (.185) ± 0.50 (.020)	2.00 (.079) ± 0.20 (.008)	11110111000	0.60 (.024) ± 0.35 (.014)		
1812	4532	4.50 (.177) ± 0.30 (.012)	3.20 (.126) ± 0.30 (.012)		0.60 (.024) ± 0.35 (.014)	N/A	Caldan Dafface Only
1825	4564	4.50 (.177) ± 0.30 (.012)	6.40 (.252) ± 0.40 (.016)		0.60 (.024) ± 0.35 (.014)		Solder Reflow Only
2220	5650	5.70 (.224) ± 0.40 (.016)	5.00 (.197) ± 0.40 (.016)		0.60 (.024) ± 0.35 (.014)		
2225	5664	5.60 (.220) ± 0.40 (.016)	6.40 (.248) ± 0.40 (.016)		0.60 (.024) ± 0.35 (.014)		



Electrical Parameters/Characteristics

Item	Parameters/Characteristics
Operating Temperature Range	-55°C to +125°C
Capacitance Change with Reference to +25°C and 0 VDC Applied (TCC)	±30 ppm/°C
Aging Rate (Maximum % Capacitance Loss/Decade Hour)	0%
Dielectric Withstanding Voltage (DWV)	250% of rated voltage (5 ±1 seconds and charge/discharge not exceeding 50 mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	0.1%
Insulation Resistance (IR) Limit @ 25°C	1,000 megohm microfarads or 100 G Ω (Rated voltage applied for 120 ±5 seconds @ 25°C)

To obtain IR limit, divide $M\Omega$ - μ F value by the capacitance and compare to $G\Omega$ limit. Select the lower of the two limits.

Capacitance and Dissipation Factor (DF) measured under the following conditions:

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 and Agilent E4980 have a feature known as Automatic Level Control (ALC). The ALC feature should be switched to "ON."

Post Environmental Limits

	High Temperatu	ıre Life, Biased	Humidity, Mois	ture Resistance	
Dielectric	Rated DC Voltage	Capacitance Value	Dissipation Factor (Maximum %)	Capacitance Shift	Insulation Resistance
C0G	All	All	0.5	0.3% or ±0.25 pF	10% of Initial Limit

¹ MHz ±100 kHz and 1.0 Vrms ±0.2 V if capacitance ≤ 1,000 pF

¹ kHz ±50 Hz and 1.0 Vrms ±0.2 V if capacitance > 1,000 pF



Table 1A – Capacitance Range/Selection Waterfall (0201 – 1206 Case Sizes)

		Case Size/ Series	C0201C		C0402C	C0603C	C0805C	C1206C
Сар	Cap	Voltage Code	8 4 3	8 4	3 5 1 2 A	A 8 4 3 5 1 2 A	8 4 3 5 1 2 A	8 4 3 5 1 2 A
	Code	Rated Voltage (VDC)	16 10	5 5	25 50 100 250	250 250 250 250	10 16 50 50 200 250	10 16 25 50 100 200 250
		Capacitance Tolerance		1	Produ	luct Availability and Chip e Table 2 for Chip Thickno	Thickness Codes	
0.50 & 0.75 pF	508 & 758	B C D		BB BB			ON DN DN DN DN DN	
0.75 pF	758 109 – 919*	B C D		BB BB	B BB BB B BB BB		DN DN DN DN DN DN DN DN DN DN DN DN DN	EB EB EB EB EB EB
1.0 – 9.1 pF* 1.1 pF	119	B C D			B BB BB		DN DN DN DN DN DN DN	
1.2 pF	129	B C D		BB BB			DN DN DN DN DN DN DN	
1.3 pF	139	BCD		BB BB	B BB BB	CF CF CF CF CF CF CF	DN DN DN DN DN DN	
1.5 pF	159	BCD		BB BB			DN DN DN DN DN DN DN	
1.6 pF	169	B C D		BB BB			DN DN DN DN DN DN DN	
1.8 pF	189	BCD		BB BB				EB EB EB EB EB EB
2.0 pF	209	BCD		BB BB			DN DN DN DN DN DN DN	
2.2 pF 2.4 pF	229 249	B C D B C D		BB BB			DN DN DN DN DN DN DN DN DN DN DN DN DN DN	
2.4 pF 2.7 pF	279	B C D		BB BE			DN DN DN DN DN DN DN	
3.0 pF	309	B C D		BB BE			DN DN DN DN DN DN DN	
3.3 pF	339	B C D		BB BB			ON DN DN DN DN DN	
3.6 pF	369	BCD		BB BB			DN DN DN DN DN DN DN	
3.9 pF	399	B C D		BB BB			DN DN DN DN DN DN DN	
4.3 pF	439	BCD		BB BB			DN DN DN DN DN DN DN	
4.7 pF	479	BCD		BB BB				EB EB EB EB EB EB
5.1 pF	519	B C D		BB BB			DN DN DN DN DN DN DN	
5.6 pF 6.2 pF	569 629	B C D B C D		BB BB			DN DN DN DN DN DN DN DN DN DN DN DN DN	
6.8 pF	689	B C D		BB BB			DN DN DN DN DN DN DN	
7.5 pF	759	B C D		BB BE			DN DN DN DN DN DN DN	
8.2 pF	829	BCD		BB BE			DN DN DN DN DN DN	
9.1 pF	919	BCD		BB BE			DN DN DN DN DN DN DN	
10 pF	100		I AB1 AB1 AB				DN DN DN DN DN DN DN	
11 pF	110	F G J K M		BB BB			DN DN DN DN DN DN DN	
12 pF	120		AB ² AB ² AB				DN DN DN DN DN DN DN	
13 pF 15 pF	130 150	F G J K M	AB ² AB ² AB	BB BB			DN DN DN DN DN DN DN DN DN DN DN DN DN	
16 pF	160	F G J K M		BB BB			DN DN DN DN DN DN DN	
18 pF	180		AB ² AB ² AB				DN DN DN DN DN DN DN	
20 pF	200	FGJKM		BB BB			DN DN DN DN DN DN	
22 pF	220	F G J K M	AB ² AB ² AB	BB BB	B BB BB	CF CF CF CF CF CF CF	OM DM DM DM DN DN	EB EB EB EB EB EB
24 pF	240	F G J K N		BB BB			DN DN DN DN DN DN DN	
27 pF	270		AB ² AB ² AB				DN DN DN DN DN DN DN	
30 pF	300	F G J K N		BB BE			DN DN DN DN DN DN DN	
33 pF	330 360		AB ² AB ² AB		B BB BB BB		DN DN DN DN DN DN DN	
36 pF 39 pF	390		AB ² AB ² AB				ON DN DN DN DN DN DN ON DN DN DN DN DN	
43 pF	430	F G J K N			B BB BB	CF CF CF CF CF CF CF		
47 pF	470	F G J K M				CF CF CF CF CF CF CF		
51 pF	510	F G J K M			B BB BB	CF CF CF CF CF CF CF		
56 pF	560	F G J K M					DN DN DN DN DN DN	
62 pF	620	F G J K M		BB BE		CF CF CF CF CF CF CF		
68 pF	680		AB ² AB ² AB				DN DN DN DN DN DN DN	
75 pF	750	F G J K N		BB BB		CF CF CF CF CF CF CF CF		
82 pF 91 pF	820 910				B BB BB	CF CF CF CF CF CF CF CF	DN DN DN DN DN DN DN	
100 pF	101			2 BB RF	B BB BB BR BB BR	B CF CF CF CF CF CF CF CF	DN DN DN DN DN DN DN	EB EB EB ER FR FR
		Rated Voltage (VDC)						
Сар	Cap Code	Voltage Code	8 4 3	8 4			8 4 3 5 1 2 A	
		Case Size/Series			C0402C	C0603C	C0805C	C1206C

^{*}Capacitance range Includes E24 decade values only. (i.e., 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82 and 91).

These products are protected under US Patents 7,172,985 & 7,670,981, other patents pending, and any foreign counterparts.

xx1 Available only in D, J, K,M tolerance

xx² Available only in J, K, M tolerance.



Table 1A - Capacitance Range/Selection Waterfall (0201 - 1206 Case Sizes) cont'd

		Case Size/ Series	CO)20 ⁻	1C			C0	402	2C					C)60	3C					CO	80	5C					C 1	120	6C		
Сар	Cap	Voltage Code	8	4	3	8	4	3	5	1	2	Α	8	4	3	5	1	2	Α	8	4	3	5	1	2	Α	8	4	3	5	1	2	Α
	Code	Rated Voltage (VDC)	10	16	25	10	9	25	20	100	200	250	10	9	52	20	9	200	250	9	16	25	20	9		_	9	9	25	20	100	200	250
		Capacitance		_															_												_	~	
		Tolerance								_	s	ee	Tak	ole :	2 fc	r C	hip	Th	ick	nes	s D	ime	ens	ion	ıs								
110 – 180 pF*	111 – 181*	F G J K M				BB				BB		BB	CF			CF										N DN		EB					
200 – 270 pF* 300 pF	201 – 271* 301	F G J K M F G J K M				BB BB	BB BB			BB BB		BB BD	CF CF	CF CF	CF CF	CF CF	CF CF	CF CF								N DN		EB EB			EB EB	EB EB	
330 pF	331	F G J K M				BB	BB				BD			CF			CF	CF								N DN							EB
360 pF	361	FGJKM				ВВ	ВВ		BB				CF	CF	CF	CF	CF	CF							_	N DN		EB		_	EB	EB	
390 pF	391	F G J K M				ВВ	ВВ	- 1	ВВ				CF	CF	CF	CF	CF	CF						1		ND N			1		EB		
430 pF	431	F G J K M				BB				BB			CF	CF	CF	CF	CF	CF						1		N DN			1		EB	EB	
470 pF	471 511	F G J K M				BB BB	BB BB			BB			CF CF	CF CF	CF CF	CF CF	CF CF	CF CF								P DP		EB	1	1	EB EB	EB EB	
510 pF 560 pF	561	F G J K M				BB	_	_	ВВ				CF	CF	CF	CF	CF	CF	_							N DN		_	_	_	_	EB	_
620 pF	621	F G J K M				BB	BB			BB			CF	CF	CF	CF	CF	CF	1 -							N DN						EB	
680 pF	681	F G J K M				ВВ	ВВ			ВВ			CF	CF	CF	CF	CF	CF		DN	DN	DN	DN	DN	ID1	ND N	EB	EB	EB	EB	EB	EB	EB
750 pF	751	F G J K M				ВВ	ВВ			BB			CF	CF	CF	CF	CF	CF								N DN					EB	EB	
820 pF	821	F G J K M F G J K M				BB BB	BB BB		_	BB BB			CF CF	CF CF	CF CF	CF CF	CF CF	CF CF		DN						N DN		EB EB			EB	EB	EB EB
910 pF 1,000 pF	911 102					BB	BB	- 1	- 1				CF	CF	CF	CF	CF	CF		DN						P DP		EB			EB EB		EB
1,100 pF	112	F G J K M				BB		BB		ы			CF	CF	CF	CF	CF	CH		DN			1			N DN			1		EB		
1,200 pF	122	F G J K M				ВВ	BB						CF	CF	CF	CF	CF	СН		DN			1			N DN			1		EB		EB
1,300 pF	132	F G J K M				ВВ	_	_	ВВ				CF	CF	CF	CF	CF	СН	-	DP	DP	DP	DP	_	_	N DN		_	_	EB	EC	EC	EC
1,500 pF	152	F G J K M				ВВ	ВВ		BB				CF	CF	CF	CF	CF	CH	1 -	DP						N DN							EC
1,600 pF	162	F G J K M				BB	BB						CF	CF	CF	CF	CF	CH		DP	DP	DP DP	DP			ND N						ED	
1,800 pF 2,000 pF	182 202	F G J K M F G J K M				BB BB	BB BB						CF CF	CF CF	CF CF	CF CF	CF CF		CH							N DN			EB			ED	ED ED
2,200 pF	222	F G J K M					BB						CF	CF			CF									N DN							EE
2,400 pF	242	FGJKM											CF	CF	CF	CF	CF			DN						N DN		EB					
2,700 pF	272	F G J K M											CF	CF	CF	CF	CF			DN						N DN					EC		EC
3,000 pF	302	F G J K M											CF	CF	CF	CF	CF			DP		DP	1			N DN		EC	1				EB
3,300 pF 3,600 pF	332 362	F G J K M F G J K M											CF CF	CF CF	CF CF	CF CF	CF CF			DP DP	DP DP	DP DP	DP DP			N DN		EC EC	1		EE	EB	EB EB
3,900 pF	392	F G J K M											CF	CF	CF	CF	CF			DE		DE		_				_		_		EB	_
4,300 pF	432	F G J K M											CF	CF	CF	CF	CF			DE		DE		DN	DF	DP		EC			EC		
4,700 pF	472	F G J K M											CF	CF	CF	CF	CF			DE		DE				DP		EC					
5,100 pF	512	F G J K M											CF	CF	CF	CF				DE		DE				DP		ED				EB	
5,600 pF 6,200 pF	562 622	F G J K M F G J K M											CF CF	CF CF	CF	CF CF				DN						P DP G DG						EB	EB EB
6,800 pF	682	F G J K M											CF	CF	CF	CF				DN						3 DG					EB	EB	1
7,500 pF	752	F G J K M											CF	CF	CF	0.				DN			1	1		3 DG		EB	1	1	EB	EB	
8,200 pF	822	F G J K M											CF	CF	CF					DN	DN	DN	DN	DN	DO	G DG			EC	1	EB		EC
9,100 pF	912	F G J K M											CF	CF	CF					DN			_	DN	_		EC		EC		_		EC
10,000 pF	103	F G J K M											CF	CF	CF									DP				ED					EC
12,000 pF 15,000 pF	123 153	F G J K M F G J K M											CF CF	CF CF							DN			DE			EB			EB FB	EB EB		ED FF
18,000 pF	183	F G J K M																			DN			50							EB		
22,000 pF	223	F G J K M																		DP	DP	DP					EB	EB	EB	EB	EC	EH	EH
27,000 pF	273	F G J K M																			DF						EB	EB	EB	EB	EE		
33,000 pF	333	F G J K M																			DG						EB	EB	EB	EB	EE		
39,000 pF 47,000 pF	393 473	F G J K M F G J K M																			DG DG							EC EC					
56,000 pF	563	F G J K M																		100	DG	טט						ED					
68,000 pF	683	F G J K M																										EF					
82,000 pF	823	F G J K M																									EH	EH	EH	EH			
0.10 μF	104	F G J K M										Į												_				EH				_	
	Сар	Rated Voltage (VDC)		16	25	10	9	52	20	Š	200	250	10	16	52		ş			9	16	25	_	9		250	9	_	22		100	700	250
Сар	Code	Voltage Code	8		3	8	4	3	5	1	2	Α	8	4	3	5	1	2	Α	8	4	3	_	1	2	Α	8	4			1	2	Α
		Case Size/Series	C)20°	1C			C0	402	<u></u>	10				C	060	3C					C	080	5C					C′	120	6C		

^{*}Capacitance range Includes E24 decade values only. (i.e., 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82 and 91). xx¹ Available only in D, J, K,M tolerance

xx² Available only in J, K, M tolerance.

These products are protected under US Patents 7,172,985 & 7,670,981, other patents pending, and any foreign counterparts.



Table 1B – Capacitance Range/Selection Waterfall (1210 – 2225 Case Sizes)

			e Size/ eries			C1	210	C			(C18 (080		(C18	120		(C18	 250	<u>, </u>	(222	200	;	(222	250	,
0	Cap					_	-	4	_		_	4	_		-	4	_		-	4	_		_	4	_		_	4	_	
Сар	Code		ge Code	8	4	3	5	1	2	Α 0	5	100	2	A 0	5	1	2	A 0	5	1	2	A 0	5	1	2	Α 0	5 (1	2	Α 0
			oltage (VDC) citance	9	16	25	20	100	200	250	20	$\overline{}$	8 8	520	S Pili	₽ 2	2 2	250	S Th	e e e	8 2 3	250	្រ des	\$	200	250	20	9	200	250
			rance																ess					•						
1.0 – 9.1 pF*	109 – 919*	BCD		FB																										
10 – 91 pF* 100 – 300 pF*	100 – 910* 101 – 301*		F G J K M F G J K M	FB FB																										
330 – 430 pF*	331 – 431*		FGJKM	FB	LF	LF	LF	LF																						
470 – 910 pF*	471 – 911*		F G J K M	FB	LF	LF	LF	LF	GB	GB	GB	GB																		
1,000 pF	102		F G J K M	FB	LF	LF	LF	LF	GB	GB	GB	GB																		
1,100 pF	112		F G J K M	FB	LF	LF	LF	LF	GB			GB																		
1,200 pF	122		F G J K M F G J K M		FB FB	FB	FB FB	FB	FB	FB FC	LF LF	LF LF	LF LF	LF	GB		GB	GB												
1,300 pF 1,500 pF	132 152		F G J K M F G J K M		FB	FB FB	FB	FB FB	FC FE	FE	LF	LF	LF	LF LF	GB GB		GB GB	GB GB												
1,600 pF	162		F G J K M		FB	FB	FB	FB	FE	FE	LF	LF	LF	LF	GB			GB												
1,800 pF	182		F G J K M		FB	FB	FB	FB	FE	FE	LF	LF	LF	LF	GB	GB	GB	GB												
2,000 pF	202		F G J K M		FB	FB	FB	FC	FE	FE	LF	LF	LF	LF	GB	GB	GB	GB												
2,200 pF	222		F G J K M	FB	FB	FB	FB	FC	FG	FG	LF	LF	LF	LF	GB	GB	GB	GB												
2,400 pF 2,700 pF	242 272		FGJKM FGJKM	FB FB	FB FB	FB FB	FB FB	FC FC	FC FC	FC FC	LF LF	LF LF	LF LF	LF LF	GB	GB	GB	CP												
3,000 pF	302		F G J K M		FB	FB	FB	FC	FF	FF	LF	LF	LI	LI	GB	GB	GB	GB												
3,300 pF	332		FGJKM		FB	FB	FB	FF	FF	FF	LF	LF			GB	GB	GB	GB												
3,600 pF	362		F G J K M		FB	FB	FB	FF	FF	FF	LF	LF																		
3,900 pF	392		F G J K M		FB	FB	FB	FF	FF	FF	LF	LF			GB	GB	GB	GB	НВ	НВ	НВ	НВ								
4,300 pF	432		F G J K M		FB	FB	FB	FF	FF	FF	LF	LF			0.0	0.0	0.0	0.0	- 15										1/ E	V-
4,700 pF 5,100 pF	472 512		F G J K M F G J K M		FF FB	FF FB	FF FB	FG FG	FG FG	FG FG	LF	LF			GB	GB	GD	GD	HB	НВ	НВ	HB					KE	KE KE	KE KE	KE KE
5,600 pF	562		F G J K M		FB	FB	FB	FG	FG	FG					GB	GB	GH	GH	HR	НВ	НВ	НВ					KE	KE	KE	KE
6,200 pF	622		FGJKM	FB	FB	FB	FB	FG	FB	FB					OD	OD	011	011	110	טוו	טוו	טוו					KE	KE		KE
6,800 pF	682	i i	F G J K M	FB	FB	FB	FB	FG	FB	FB					GB	GB	GJ	GJ	НВ	НВ	НВ	ΗВ	JE	JE	JB		KE	KE	KE	KE
7,500 pF	752		F G J K M	FC	FC	FC	FC	FC	FB	FB																	KE	KE	KE	KE
8,200 pF	822		F G J K M		FC	FC	FC	FC	FB	FB					GB	GH	GB	GB	НВ	НВ	HB	НВ	JE	JE	JB		KE	KE	KE	KE
9,100 pF	912		F G J K M F G J K M		FE FF	FE FF	FE FF	FE FF	FB FB	FB FB					CD	CII	CD	CD	LID	LID				-	ID		KE KE	KE	KE KE	KE
10,000 pF 12,000 pF	103 123		F G J K M		FG	FG	FG	FB	FB	FB					GB GB		GB GB	GB GB	HB HB	HB HB	HE	HE	JE JE	JE JE	JB JB		KE	KE	KE	KE KE
15,000 pF	153		FGJKM		FG	FG	FG	FB	FC	FC					GB		GB	GB	НВ	НВ			JE	JE	JB		KE	KE	KE	
18,000 pF	183		F G J K M		FB	FB	FB	FB	FC	FC					GB	GB	GB	GB	НВ	HE			JE	JE	JB		KE	KE		
22,000 pF	223		F G J K M	FB	FB	FB	FB	FB	FF	FF					GB		GB	GB	НВ	HE			JE	JB	JB		KE	KE		
27,000 pF	273		F G J K M	FB	FB	FB	FB	FB	FG	FG					GB		GB	GB	HB	HG			JE	JB	JB		KE	KE		
33,000 pF 39,000 pF	333 393		F G J K M F G J K M		FB FB	FB FB	FB FB	FB FE	FH FH	FH FH					GB GB		GB GB	GB GB					JB JB	JB JB	JB JB		KE			
47,000 pF	473		F G J K M	FB	FB	FB	FB	FE	FJ	FJ					GB		GD	GD					JB	JB	JB					
56,000 pF	563		GJKM		FB	FB	FB	FF							GB		GD	GD					JB	JB	JB					
68,000 pF	683		G J K M		FB	FB	FC	FG							GB	1	GK	GK					JB	JB	JB					
82,000 pF	823		G J K M		FC	FC	FF	FH							GB		GM						JB	JB	JB					
0.10 µF	104		F G J K M				FG	FM							GB		GM	GM					JB	JB	JD					
0.12 μF 0.15 μF	124 154		F G J K M F G J K M			FG FH										GH GN							JB JB	JB JB	JD JG					
0.15 µF 0.18 µF	184		G J K M	F.I	FJ		1 IVI								GH	GIV							JB	JD						
0.22 µF	224		= G J K M	FK	FK	FK									GK								JB	JD						
0.27 µF	274	F	F G J K M	l																			JB	JF						
0.33 µF	334		G J K M																				JD	JG						
0.39 µF	394 474		GJKM																				JG							
0.47 μF	474		F G J K M		(0	10	_	9	9	0	-	9	9		-	0	9	0		9	9		JG 0	9	9	٥	0	9	9	
	Сар		oltage (VDC)	9	_	52	20	_	200		20		200	250	20	<u> </u>		250	20	100	200		20	5	700		20	r.	200	250
Сар	Code		ge Code	8	4	3	5	1	2	Α	5	1	2	Α	5	1	2	Α	5	1	2		5	1	2	Α	5	1	2	Α
			e Size/ eries			C1	210	C			(C18	08C			C18	12C		(C18:	25C		_	C22	20C	;	•	C22	25C	

^{*}Capacitance range Includes E24 decade values only. (i.e., 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82 and 91). These products are protected under US Patents 7,172,985 & 7,670,981, other patents pending, and any foreign counterparts.



Table 2A – Chip Thickness/Tape & Reel Packaging Quantities

0201 0402 0402 0603 0603 0805 0805 0805 0805 1206 1206 1206 1206 1210 1210 1210 1210 1210 1210	Range (mm) 0.30 ± 0.03 0.50 ± 0.05 0.55 ± 0.05 0.80 ± 0.07 0.85 ± 0.07 0.70 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.50 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10	7" Reel 15,000 10,000 10,000 4,000 4,000 4,000 4,000 0 0 0 4,000 0 0 0	13" Reel 0 50,000 50,000 15,000 10,000 15,000 15,000 0 0 0 10,000 0 0 0 0 0 0 0 0 0 0 0	7" Reel 0 0 0 0 0 0 0 0 0 2,500 2,500 2,500 4,000 4,000 2,500	13" Reel 0 0 0 0 0 0 0 0 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000
0402 0402 0603 0603 0805 0805 0805 0805 0805 1206 1206 1206 1206 1210 1210 1210 1210	0.50 ± 0.05 0.55 ± 0.05 0.80 ± 0.07 0.85 ± 0.07 0.70 ± 0.20 0.70 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.10 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10	10,000 10,000 4,000 4,000 4,000 4,000 4,000 0 0 0	50,000 50,000 15,000 10,000 15,000 15,000 0 0 0 10,000 0 0 0 0 0 0 0	0 0 0 0 0 0 0 2,500 2,500 2,500 4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	0 0 0 0 0 0 0 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000
0402 0603 0603 0805 0805 0805 0805 0805 1206 1206 1206 1206 1210 1210 1210 1210	0.55 ± 0.05 0.80 ± 0.07 0.85 ± 0.07 0.70 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.10 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.10 ± 0.10	10,000 4,000 4,000 4,000 4,000 0 0 0 0 4,000 0 0 0	50,000 15,000 10,000 15,000 15,000 0 0 0 10,000 0 0 0 0 0	0 0 0 0 0 2,500 2,500 2,500 4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	0 0 0 0 0 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000
0603 0603 0805 0805 0805 0805 0805 1206 1206 1206 1206 1210 1210 1210 1210	0.80 ± 0.07 0.85 ± 0.07 0.70 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.10 ± 0.10 1.20 ± 0.10	4,000 4,000 4,000 4,000 0 0 0 4,000 0 0 0	15,000 10,000 15,000 15,000 0 0 0 10,000 0 0 0 0 0 0	0 0 0 0 2,500 2,500 4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	0 0 0 0 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000
0603 0805 0805 0805 0805 0805 0805 1206 1206 1206 1206 1210 1210 1210 1210 1210	0.85 ± 0.07 0.70 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.10 ± 0.10	4,000 4,000 4,000 4,000 0 0 0 4,000 0 0 0	10,000 15,000 15,000 0 0 0 10,000 0 0 0 0 0 0	0 0 0 2,500 2,500 2,500 4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	0 0 0 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000 10,000
0805 0805 0805 0805 0805 0805 1206 1206 1206 1206 1210 1210 1210 1210	0.70 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10	4,000 4,000 4,000 0 0 0 4,000 0 0 0 0 0	15,000 15,000 0 0 0 10,000 0 0 0 0 0 0 0	0 0 0 2,500 2,500 4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	0 0 0 10,000 10,000 10,000 10,000 10,000 10,000 8,000 10,000 10,000 10,000
0805 0805 0805 0805 1206 1206 1206 1206 1206 1210 1210 1210	0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10	4,000 4,000 0 0 0 4,000 0 0 0 0 0 0	15,000 15,000 0 0 0 10,000 0 0 0 0 0 0	0 0 2,500 2,500 4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	0 0 10,000 10,000 10,000 10,000 10,000 10,000 10,000 8,000 10,000 10,000 10,000
0805 0805 0805 1206 1206 1206 1206 1206 1210 1210 1210	0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.10 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.01 ± 0.10 1.02 ± 0.10 1.02 ± 0.10 1.03 ± 0.10 1.04 ± 0.10 1.05 ± 0.10 1.05 ± 0.10	4,000 0 0 0 4,000 0 0 0 0 0 0	15,000 0 0 0 10,000 0 0 0 0 0 0	0 2,500 2,500 4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	0 10,000 10,000 10,000 10,000 10,000 10,000 10,000 8,000 10,000 10,000 10,000
0805 0805 1206 1206 1206 1206 1206 1206 1210 1210	1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 0 4,000 0 0 0 0 0 0 0	0 0 10,000 0 0 0 0 0 0 0	2,500 2,500 2,500 4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	10,000 10,000 10,000 10,000 10,000 10,000 10,000 8,000 10,000 10,000 10,000
0805 0805 1206 1206 1206 1206 1206 1210 1210 1210	1.10 ± 0.10 1.25 ± 0.15 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 4,000 0 0 0 0 0 0 0 0	0 0 10,000 0 0 0 0 0 0 0	2,500 2,500 4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	10,000 10,000 10,000 10,000 10,000 10,000 10,000 8,000 10,000 10,000 10,000
1206 1206 1206 1206 1206 1206 1210 1210	0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	4,000 0 0 0 0 0 0 0 0 0	10,000 0 0 0 0 0 0 0 0 0	4,000 4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	10,000 10,000 10,000 10,000 10,000 8,000 10,000 10,000 10,000
1206 1206 1206 1206 1206 1210 1210 1210	0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	4,000 2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	10,000 10,000 10,000 10,000 8,000 10,000 10,000 10,000
1206 1206 1206 1206 1210 1210 1210 1210	1.00 ± 0.10 1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 0 0 0 0 0 0	0 0 0 0 0 0 0	2,500 2,500 2,500 2,000 4,000 4,000 2,500 2,500	10,000 10,000 10,000 8,000 10,000 10,000 10,000
1206 1206 1206 1210 1210 1210 1210 1210	1.10 ± 0.10 1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 0 0 0 0 0 0	0 0 0 0 0 0	2,500 2,500 2,000 4,000 4,000 2,500 2,500	10,000 10,000 8,000 10,000 10,000 10,000
1206 1206 1210 1210 1210 1210 1210	1.20 ± 0.15 1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 0 0 0 0	0 0 0 0 0	2,500 2,000 4,000 4,000 2,500 2,500	10,000 8,000 10,000 10,000 10,000
1206 1210 1210 1210 1210 1210	1.60 ± 0.20 0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 0 0 0 0	0 0 0 0	2,000 4,000 4,000 2,500 2,500	8,000 10,000 10,000 10,000 10,000
1210 1210 1210 1210 1210	0.78 ± 0.10 0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 0 0 0	0 0 0 0	4,000 4,000 2,500 2,500	10,000 10,000 10,000 10,000
1210 1210 1210 1210	0.90 ± 0.10 1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 0 0 0	0 0 0	4,000 2,500 2,500	10,000 10,000 10,000
1210 1210 1210	1.00 ± 0.10 1.10 ± 0.10 1.25 ± 0.15	0 0 0	0 0	2,500 2,500	10,000 10,000
1210 1210	1.10 ± 0.10 1.25 ± 0.15	0 0	0	2,500	10,000
1210	1.25 ± 0.15	0			
17 10	LOG CULIC	0	Ö	2,000	8,000
1210	1.70 ± 0.20	0	0	2,000	8,000
1210	1.85 ± 0.20	0	0	2,000	8,000
1210	2.10 ± 0.20	0	0	2,000	8,000
1706	1.00 ± 0.15	0	0	4,000	10,000
1808	1.00 ± 0.15	0	0	2,500	10,000
1812	1.00 ± 0.10	0	0	1,000	4,000
1812	1.25 ± 0.15	0	0	1,000	4,000
1812 1812	1.40 ± 0.15	0	0	1,000 1,000	4,000
	1.55 ± 0.10	0	0		4,000 4,000
					4,000
					4,000
1812					2,000
1825	1.10 ± 0.15	ő	Ö		4,000
1825	1.40 ± 0.15	0	0	1,000	4,000
1825	1.60 ± 0.20	0	0	1,000	4,000
2220	1.00 ± 0.15	0	0	1,000	4,000
2220	1.30 ± 0.15	0	0	1,000	4,000
		0	0		4,000
		-			4,000
			-		4,000 2,000
					4,000
444 0		·			13" Reel
	Thickness ±				
	1825 1825 1825 2220	1812 1.70 ± 0.15 1812 1.70 ± 0.20 1812 2.00 ± 0.20 1825 1.10 ± 0.15 1825 1.40 ± 0.15 1825 1.60 ± 0.20 2220 1.00 ± 0.15 2220 1.30 ± 0.15 2220 1.40 ± 0.15 2220 1.50 ± 0.15 2220 1.70 ± 0.15 2220 1.70 ± 0.15 2220 1.40 ± 0.15 2220 1.40 ± 0.15 2225 1.40 ± 0.15	1812 1.70 ± 0.15 0 1812 1.70 ± 0.20 0 1812 2.00 ± 0.20 0 1825 1.10 ± 0.15 0 1825 1.40 ± 0.15 0 1825 1.60 ± 0.20 0 2220 1.00 ± 0.15 0 2220 1.30 ± 0.15 0 2220 1.40 ± 0.15 0 2220 1.50 ± 0.15 0 2220 1.70 ± 0.15 0 2220 2.00 ± 0.20 0 2225 1.40 ± 0.15 0 Thickness \pm Size1 Response (mm)	1812 1.70 ± 0.15 0 0 1812 1.70 ± 0.20 0 0 1812 2.00 ± 0.20 0 0 1825 1.10 ± 0.15 0 0 1825 1.60 ± 0.20 0 0 2220 1.00 ± 0.15 0 0 2220 1.30 ± 0.15 0 0 2220 1.40 ± 0.15 0 0 2220 1.50 ± 0.15 0 0 2220 1.70 ± 0.15 0 0 2220 1.70 ± 0.15 0 0 2220 2.00 ± 0.20 0 0 2225 1.40 ± 0.15 0 0 Case Thickness \pm 7" Reel 13" Reel	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

Package quantity based on finished chip thickness specifications.

¹ If ordering using the 2 mm Tape and Reel pitch option, the packaging quantity outlined in the table above will be doubled. This option is limited to EIA 0603 (1608 metric) case size devices. For more information regarding 2 mm pitch option see "Tape & Reel Packaging Information".



Table 2B - Bulk Packaging Quantities

Dooloo	ulu u Tuu o	Loose Pa	ackaging
Раска	ging Type	Bulk Bag	(default)
Packagi	ng C-Spec ¹	N/	/A ²
Cas	e Size	Packaging Quantities ((pieces/unit packaging)
EIA (in)	Metric (mm)	Minimum	Maximum
0402	1005		
0603	1608		
0805	2012		50,000
1206	3216		
1210	3225	1	
1808	4520		
1812	4532		
1825	4564		20,000
2220	5650		
2225	5664		

¹ The "Packaging C-Spec" is a 4 to 8 digit code which identifies the packaging type and/or product grade. When ordering, the proper code must be included in the 15th through 22nd character positions of the ordering code. See "Ordering Information" section of this document for further details. Commercial Grade product ordered without a packaging C-Spec will default to our standard "Bulk Bag" packaging. Contact KEMET if you require a bulk bag packaging option for Automotive Grade products.

² A packaging C-Spec (see note 1 above) is not required for "Bulk Bag" packaging (excluding Anti-Static Bulk Bag and Automotive Grade products). The 15th through 22nd character positions of the ordering code should be left blank. All product ordered without a packaging C-Spec will default to out standard "Bulk Bag" packaging.



Table 3 - Chip Capacitor Land Pattern Design Recommendations per IPC-7351

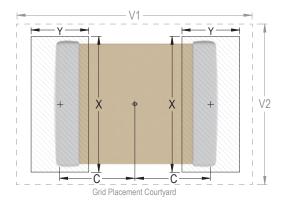
EIA Size Code	Metric Size Code		Maxi	sity Lev mum (M rotrusio	lost))		Media	sity Lev an (Nor rotrusio)	Density Level C: Minimum (Least) Land Protrusion (mm)							
Oouc	Oouc	С	Y	Х	V1	V2	С	Y	X	V1	V2	С	Υ	Х	V1	V2			
0201	0603	0.38	0.56	0.52	1.80	1.00	0.33	0.46	0.42	1.50	0.80	0.28	0.36	0.32	1.20	0.60			
0402	1005	0.50	0.72	0.72	2.20	1.20	0.45	0.62	0.62	1.90	1.00	0.40	0.52	0.52	1.60	0.80			
0603	1608	0.90	1.15	1.10	4.00	2.10	0.80	0.95	1.00	3.10	1.50	0.60	0.75	0.90	2.40	1.20			
0805	2012	1.00	1.35	1.55	4.40	2.60	0.90	1.15	1.45	3.50	2.00	0.75	0.95	1.35	2.80	1.70			
1206	3216	1.60	1.35	1.90	5.60	2.90	1.50	1.15	1.80	4.70	2.30	1.40	0.95	1.70	4.00	2.00			
1210	3225	1.60	1.35	2.80	5.65	3.80	1.50	1.15	2.70	4.70	3.20	1.40	0.95	2.60	4.00	2.90			
1210¹	3225	1.50	1.60	2.90	5.60	3.90	1.40	1.40	2.80	4.70	3.30	1.30	1.20	2.70	4.00	3.00			
1808	4520	2.30	1.75	2.30	7.40	3.30	2.20	1.55	2.20	6.50	2.70	2.10	1.35	2.10	5.80	2.40			
1812	4532	2.15	1.60	3.60	6.90	4.60	2.05	1.40	3.50	6.00	4.00	1.95	1.20	3.40	5.30	3.70			
1825	4564	2.15	1.60	6.90	6.90	7.90	2.05	1.40	6.80	6.00	7.30	1.95	1.20	6.70	5.30	7.00			
2220	5650	2.75	1.70	5.50	8.20	6.50	2.65	1.50	5.40	7.30	5.90	2.55	1.30	5.30	6.60	5.60			
2225	5664	2.70	1.70	6.90	8.10	7.90	2.60	1.50	6.80	7.20	7.30	2.50	1.30	6.70	6.50	7.00			

¹ Only for capacitance values ≥ 22 μF

Density Level A: For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes. KEMET only recommends wave soldering of EIA 0603, 0805 and 1206 case sizes.

Density Level B: For products with a moderate level of component density. Provides a robust solder attachment condition for reflow solder processes. **Density Level C:** For high component density product applications. Before adapting the minimum land pattern variations the user should perform qualification testing based on the conditions outlined in IPC Standard 7351 (IPC–7351).

Image below based on Density Level B for an EIA 1210 case size.





Soldering Process

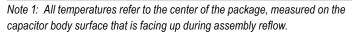
Recommended Soldering Technique:

- Solder wave or solder reflow for EIA case sizes 0603, 0805 and 1206
- · All other EIA case sizes are limited to solder reflow only

Recommended Reflow Soldering Profile:

KEMET's families of surface mount multilayer ceramic capacitors (SMD MLCCs) are compatible with wave (single or dual), convection, IR or vapor phase reflow techniques. Preheating of these components is recommended to avoid extreme thermal stress. KEMET's recommended profile conditions for convection and IR reflow reflect the profile conditions of the IPC/J-STD-020 standard for moisture sensitivity testing. These devices can safely withstand a maximum of three reflow passes at these conditions.

Profile Feature	Terminati	on Finish
Frome reature	SnPb	100% Matte Sn
Preheat/Soak		
Temperature Minimum (T _{Smin})	100°C	150°C
Temperature Maximum (T _{Smax})	150°C	200°C
Time (t_s) from T_{smin} to T_{smax}	60 – 120 seconds	60 – 120 seconds
Ramp-Up Rate (T _L to T _P)	3°C/second maximum	3°C/second maximum
Liquidous Temperature (T _L)	183°C	217°C
Time Above Liquidous (t _L)	60 – 150 seconds	60 – 150 seconds
Peak Temperature (T _P)	235°C	260°C
Time Within 5°C of Maximum Peak Temperature (t _P)	20 seconds maximum	30 seconds maximum
Ramp-Down Rate (T _P to T _L)	6°C/second maximum	6°C/second maximum
Time 25°C to Peak Temperature	6 minutes maximum	8 minutes maximum



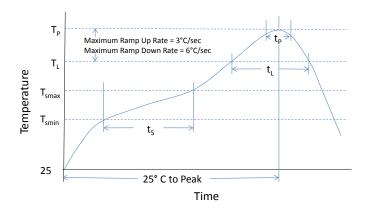




Table 4 – Performance & Reliability: Test Methods and Conditions

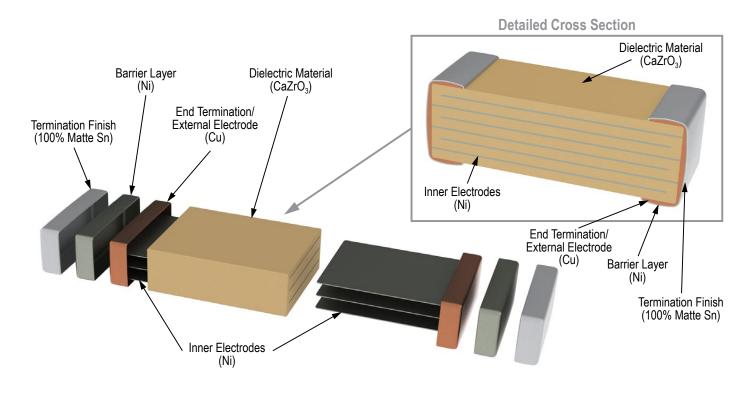
Stress	Reference	Test or Inspection Method
Terminal Strength	JIS-C-6429	Appendix 1, Note: Force of 1.8 kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note: Standard termination system – 2.0 mm (minimum) for all except 3 mm for C0G. Flexible termination system – 3.0 mm (minimum).
		Magnification 50 X. Conditions:
Solderability	J-STD-002	a) Method B, 4 hours @ 155°C, dry heat @ 235°C
Solderability	J-51D-002	b) Method B @ 215°C category 3
		c) Method D, category 3 @ 260°C
Temperature Cycling	JESD22 Method JA-104	1,000 Cycles (-55°C to +125°C). Measurement at 24 hours +/- 4 hours after test conclusion.
Digged Humidity	MIL-STD-202 Method 103	Load Humidity: 1,000 hours 85°C/85% RH and rated voltage. Add 100 K ohm resistor. Measurement at 24 hours +/- 4 hours after test conclusion.
Biased Humidity		Low Volt Humidity: 1,000 hours 85°C/85% RH and 1.5 V. Add 100 K ohm resistor. Measurement at 24 hours +/- 4 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a and 7b not required. Measurement at 24 hours +/- 4 hours after test conclusion.
Thermal Shock	MIL-STD-202 Method 107	-55°C/+125°C. Note: Number of cycles required – 300, maximum transfer time – 20 seconds, dwell time – 15 minutes. Air – Air.
High Temperature Life	MIL-STD-202 Method 108 /EIA-198	1,000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2 X rated voltage applied.
Storage Life	MIL-STD-202 Method 108	150°C, 0 VDC for 1,000 hours.
Vibration	MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations. Note: Use 8" X 5" PCB 0.031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10 – 2,000 Hz
Mechanical Shock	MIL-STD-202 Method 213	Figure 1 of Method 213, Condition F.
Resistance to Solvents	MIL-STD-202 Method 215	Add aqueous wash chemical, OKEM Clean or equivalent.

Storage and Handling

Ceramic chip capacitors should be stored in normal working environments. While the chips themselves are quite robust in other environments, solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. In addition, packaging materials will be degraded by high temperature- reels may soften or warp and tape peel force may increase. KEMET recommends that maximum storage temperature not exceed 40°C and maximum storage humidity not exceed 70% relative humidity. Temperature fluctuations should be minimized to avoid condensation on the parts and atmospheres should be free of chlorine and sulfur bearing compounds. For optimized solderability chip stock should be used promptly, preferably within 1.5 years of receipt.



Construction



Capacitor Marking (Optional):

Laser marking option is not available on:

- C0G, Ultra Stable X8R and Y5V dielectric devices
- EIA 0402 case size devices
- EIA 0603 case size devices with Flexible Termination option.
- · KPS Commercial and Automotive grade stacked devices.

These capacitors are supplied unmarked only.



Tape & Reel Packaging Information

KEMET offers multilayer ceramic chip capacitors packaged in 8, 12 and 16 mm tape on 7" and 13" reels in accordance with EIA Standard 481. This packaging system is compatible with all tape-fed automatic pick and place systems. See Table 2 for details on reeling quantities for commercial chips.

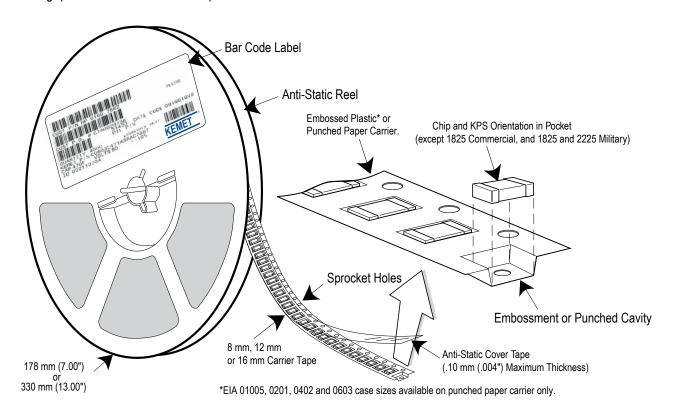


Table 5 – Carrier Tape Configuration, Embossed Plastic & Punched Paper (mm)

	Tape	Embosse	ed Plastic	Punched Paper		
EIA Case Size	Size (W)*	7" Reel	13" Reel	7" Reel	13" Reel	
		Pitch (P ₁)*		Pitch (P ₁)*		
01005 – 0402	8			2	2	
0603	8			2/4	2/4	
0805	8	4	4	4	4	
1206 – 1210	8	4	4	4	4	
1805 – 1808	12	4	4			
≥ 1812	12	8	8			
KPS 1210	12	8	8			
KPS 1812 & 2220	16	12	12			
Array 0508 & 0612	8	4	4			

^{*}Refer to Figures 1 & 2 for W and P_1 carrier tape reference locations.

New 2 mm Pitch Reel Options*

Packaging Ordering Code (C-Spec)	Packaging Type/Options
C-3190	Automotive grade 7" reel unmarked
C-3191	Automotive grade 13" reel unmarked
C-7081	Commercial grade 7" reel unmarked
C-7082	Commercial grade 13" reel unmarked

^{* 2} mm pitch reel only available for 0603 EIA case size. 2 mm pitch reel for 0805 EIA case size under development.

Benefits of Changing from 4 mm to 2 mm Pitching Spacing

- · Lower placement costs
- Double the parts on each reel results in fewer reel changes and increased efficiency
- Fewer reels result in lower packaging, shipping and storage costs, reducing waste

^{*}Refer to Tables 6 & 7 for tolerance specifications.



Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

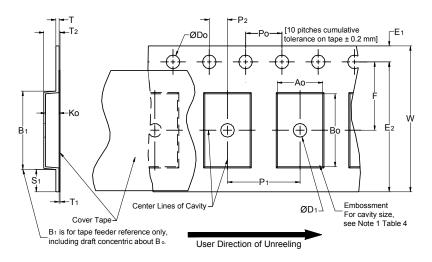


Table 6 – Embossed (Plastic) Carrier Tape Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)									
Tape Size	D ₀	D ₁ Minimum Note 1	E ₁	P ₀	P ₂	R Reference Note 2	S ₁ Minimum Note 3	T Maximum	T ₁ Maximum
8 mm		1.0 (0.039)				25.0 (0.984)			
12 mm	1.5 +0.10/-0.0 (0.059 +0.004/-0.0)		4.0 ±0.10 (0.157 ±0.004)	2.0 ±0.05 (0.079 ±0.002)	30	0.600 (0.024)	0.600 (0.024)	0.100 (0.004)	
16 mm						(1.181)			
	Variable Dimensions — Millimeters (Inches)								
Tape Size	Tape Size Pitch B ₁ Maximum E ₂ F P ₁ T ₂ W Maximum A ₀ ,B ₀ & K ₀								& K ₀
8 mm	Single (4 mm)	4.35 (0.171)	6.25 (0.246)	3.5 ±0.05 (0.138 ±0.002)	4.0 ±0.10 (0.157 ±0.004)	2.5 (0.098)	8.3 (0.327)		
12 mm	Single (4 mm) & Double (8 mm)	8.2 (0.323)	10.25 (0.404)	5.5 ±0.05 (0.217 ±0.002)	8.0 ±0.10 (0.315 ±0.004)	4.6 (0.181)	12.3 (0.484)	Not	te 5
16 mm	Triple (12 mm)	12.1 (0.476)	14.25 (0.561)	7.5 ±0.05 (0.138 ±0.002)	12.0 ±0.10 (0.157 ±0.004)	4.6 (0.181)	16.3 (0.642)		

- 1. 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.
- 2. The tape with or without components shall pass around R without damage (see Figure 6).
- 3. If S₄ < 1.0 mm, there may not be enough area for cover tape to be properly applied (see EIA Standard 481 paragraph 4.3 section b).
- 4. B, dimension is a reference dimension for tape feeder clearance only.
- 5. The cavity defined by A_o, B_o and K_o shall surround the component with sufficient clearance that:
 - (a) the component does not protrude above the top surface of the carrier tape.
 - (b) the component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.
 - (c) rotation of the component is limited to 20° maximum for 8 and 12 mm tapes and 10° maximum for 16 mm tapes (see Figure 3).
 - (d) lateral movement of the component is restricted to 0.5 mm maximum for 8 and 12 mm wide tape and to 1.0 mm maximum for 16 mm tape (see Figure 4).
 - (e) for KPS Series product, A₀ and B₀ are measured on a plane 0.3 mm above the bottom of the pocket.
 - (f) see Addendum in EIA Standard 481 for standards relating to more precise taping requirements.



Figure 2 – Punched (Paper) Carrier Tape Dimensions

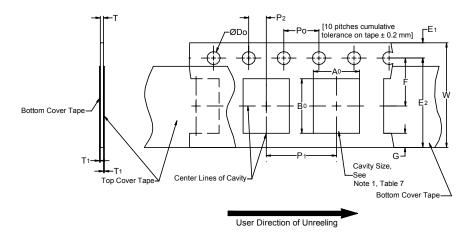


Table 7 – Punched (Paper) Carrier Tape Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)								
Tape Size	D ₀	E ₁	P ₀	P ₂	T ₁ Maximum	G Minimum	R Reference Note 2	
8 mm	1.5 +0.10 -0.0 (0.059 +0.004 -0.0)	1.75 ±0.10 (0.069 ±0.004)	4.0 ±0.10 (0.157 ±0.004)	2.0 ±0.05 (0.079 ±0.002)	0.10 (0.004) Maximum	0.75 (0.030)	25 (0.984)	
Variable Dimensions — Millimeters (Inches)								
Tape Size	Pitch	E2 Minimum	F	P ₁	T Maximum	W Maximum	A_0B_0	
8 mm	Half (2 mm)	6.25	3.5 ±0.05	2.0 ±0.05 (0.079 ±0.002)	1.1	8.3 (0.327)	Note 1	
8 mm	Single (4 mm)	(0.246)	(0.138 ±0.002)	4.0 ±0.10 (0.157 ±0.004)	(0.098)	8.3 (0.327)	Note 1	

- 1. The cavity defined by A_{α} , B_{α} and T shall surround the component with sufficient clearance that:
 - a) the component does not protrude beyond either surface of the carrier tape.
 - b) the component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.
 - c) rotation of the component is limited to 20° maximum (see Figure 3).
 - d) lateral movement of the component is restricted to 0.5 mm maximum (see Figure 4).
 - e) see Addendum in EIA Standard 481 for standards relating to more precise taping requirements.
- 2. The tape with or without components shall pass around R without damage (see Figure 6).



Packaging Information Performance Notes

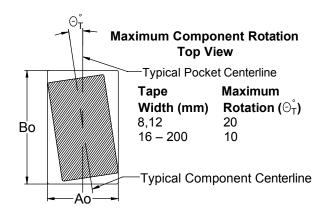
- 1. Cover Tape Break Force: 1.0 Kg minimum.
- 2. Cover Tape Peel Strength: The total peel strength of the cover tape from the carrier tape shall be:

Tape Width	Peel Strength
8 mm	0.1 to 1.0 Newton (10 to 100 gf)
12 and 16 mm	0.1 to 1.3 Newton (10 to 130 gf)

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° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of 300 ± 10 mm/minute.

3. Labeling: Bar code labeling (standard or custom) shall be on the side of the reel opposite the sprocket holes. *Refer to EIA Standards 556 and 624.*

Figure 3 – Maximum Component Rotation



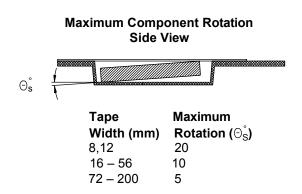


Figure 4 – Maximum Lateral Movement

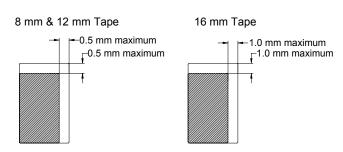


Figure 5 - Bending Radius

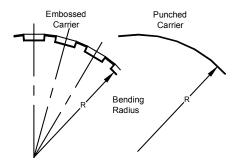
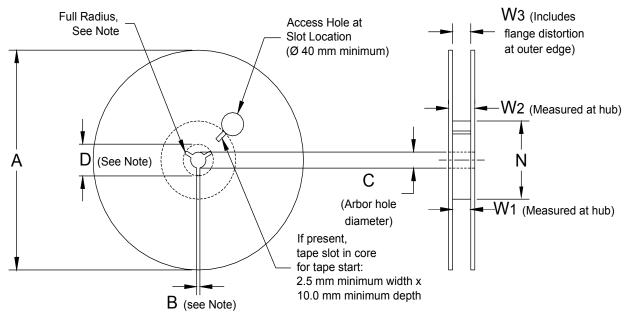




Figure 6 – Reel Dimensions



Note: Drive spokes optional; if used, dimensions B and D shall apply.

Table 8 - Reel Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)								
Tape Size	A	B Minimum	С	D Minimum				
8 mm	178 ±0.20	1.5 (0.059)	13.0 +0.5/-0.2 (0.521 +0.02/-0.008)	20.2 (0.795)				
12 mm	(7.008 ±0.008) or							
16 mm	330 ±0.20 (13.000 ±0.008)			()				
	Variable Dimensions — Millimeters (Inches)							
Tape Size	N Minimum	W ₁	W ₂ Maximum	W_3				
8 mm		8.4 +1.5/-0.0 (0.331 +0.059/-0.0)	14.4 (0.567)					
12 mm	50 (1.969)	12.4 +2.0/-0.0 (0.488 +0.078/-0.0)	18.4 (0.724)	Shall accommodate tape width without interference				
16 mm		16.4 +2.0/-0.0 (0.646 +0.078/-0.0)	22.4 (0.882)					



Figure 7 – Tape Leader & Trailer Dimensions

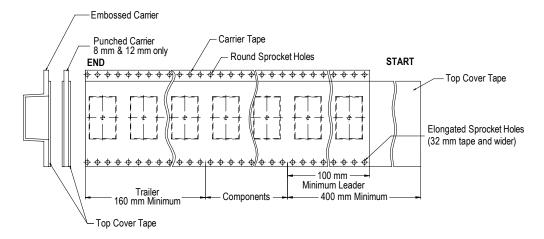
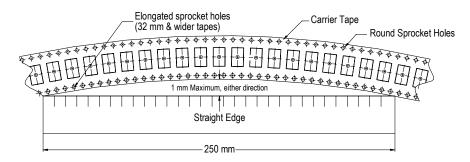


Figure 8 – Maximum Camber





KEMET Corporation World Headquarters

2835 KEMET Way Simpsonville, SC 29681

Mailing Address: P.O. Box 5928 Greenville, SC 29606

www.kemet.com Tel: 864-963-6300 Fax: 864-963-6521

Corporate Offices Fort Lauderdale, FL Tel: 954-766-2800

North America

Northeast

Wilmington, MA Tel: 978-658-1663

Southeast

Lake Mary, FL Tel: 407-855-8886

Central

Novi, MI

Tel: 248-994-1030

Irving, TX

Tel: 972-915-6041

West

Milpitas, CA Tel: 408-433-9950

Mexico

Guadalajara, Jalisco Tel: 52-33-3123-2141

Europe

Southern Europe Sasso Marconi, Italy Tel: 39-051-939111

Skopje, Macedonia Tel: 389-2-55-14-623

Central Europe

Landsberg, Germany Tel: 49-8191-3350800

Kamen, Germany Tel: 49-2307-438110

Northern Europe

Wyboston, United Kingdom Tel: 44-1480-273082

Espoo, Finland Tel: 358-9-5406-5000

Asia

Northeast Asia

Hong Kong Tel: 852-2305-1168

Shenzhen, China Tel: 86-755-2518-1306

Beijing, China

Tel: 86-10-5877-1075

Shanghai, China Tel: 86-21-6447-0707

Seoul, South Korea Tel: 82-2-6294-0550

Taipei, Taiwan

Tel: 886-2-27528585

Southeast Asia

Singapore

Tel: 65-6701-8033

Penang, Malaysia Tel: 60-4-6430200

Bangalore, India Tel: 91-806-53-76817

Note: KEMET reserves the right to modify minor details of internal and external construction at any time in the interest of product improvement. KEMET does not assume any responsibility for infringement that might result from the use of KEMET Capacitors in potential circuit designs. KEMET is a registered trademark of KEMET Electronics Corporation.



Disclaimer

All product specifications, statements, information and data (collectively, the "Information") in this datasheet are subject to change. The customer is responsible for checking and verifying the extent to which the Information contained in this publication is applicable to an order at the time the order is placed.

All Information given herein is believed to be accurate and reliable, but it is presented without guarantee, warranty, or responsibility of any kind, expressed or implied.

Statements of suitability for certain applications are based on KEMET Electronics Corporation's ("KEMET") knowledge of typical operating conditions for such applications, but are not intended to constitute – and KEMET specifically disclaims – any warranty concerning suitability for a specific customer application or use. The Information is intended for use only by customers who have the requisite experience and capability to determine the correct products for their application. Any technical advice inferred from this Information or otherwise provided by KEMET with reference to the use of KEMET's products is given gratis, and KEMET assumes no obligation or liability for the advice given or results obtained.

Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

Although all product—related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicted or that other measures may not be required.