# **COG 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	С	104	J	3	G	Α	С	TU
Ceramic	Case Size (L" x W")	Specification/ Series <sup>1</sup>	Capacitance Code (pF)	Capacitance Tolerance <sup>2</sup>	Rated Voltage (VDC)	Dielectric	Failure Rate/ Design	Termination Finish <sup>3</sup>	Packaging/ Grade (C-Spec)
	0201 0402 0603 0805 1206 1210 1808 1812 1825 2220 2225	C = Standard	Two significant digits and number of zeros. Use 9 for 1.0 - 9.9 pF Use 8 for 0.599 pF e.g., 2.2 pF = 229 e.g., 0.5 pF = 508	B = ±0.10 pF C = ±0.25 pF D = ±0.5 pF F = ±1% G = ±2% J = ±5% K = ±10% M = ±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"

<sup>&</sup>lt;sup>1</sup> Flexible termination option is available. Please see FT-CAP product bulletin C1062\_C0G\_FT-CAP\_SMD

<sup>&</sup>lt;sup>2</sup> Additional capacitance tolerance offerings may be available. Contact KEMET for details.

<sup>&</sup>lt;sup>3</sup> Additional termination finish options may be available. Contact KEMET for details.



## **Packaging C-Spec Ordering Options Table**

Packaging Type <sup>1</sup>	Packaging/Grade Ordering Code (C-Spec)
Bulk Bag/Unmarked	Not required (Blank)
7" Reel/Unmarked	TU
13" Reel/Unmarked	7411 (EIA 0603 and smaller case sizes) 7210 (EIA 0805 and larger case sizes)
7" Reel/Unmarked/2 mm pitch²	7081
13" Reel/Unmarked/2 mm pitch <sup>2</sup>	7082

<sup>&</sup>lt;sup>1</sup> Default packaging is "Bulk Bag". An ordering code C-Spec is not required for "Bulk Bag" packaging.

#### Benefits cont.

- 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**

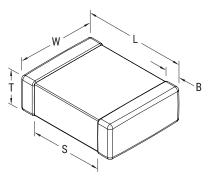
Lead (Pb)-free, RoHS, and REACH compliant without exemptions.

<sup>&</sup>lt;sup>1</sup> 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".

<sup>&</sup>lt;sup>2</sup> 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 (0.024) ±0.03 (0.001)	0.30 (0.012) ±0.03 (0.001)		0.15 (0.006) ±0.05 (0.002)	N/A	Solder Reflow
0402	1005	1.00 (0.040) ±0.05 (0.002)	0.50 (0.020) ±0.05 (0.002)		0.30 (0.012) ±0.10 (0.004)	0.30 (0.012)	Only
0603	1608	1.60 (0.063) ±0.15 (0.006)	0.80 (0.032) ±0.15 (0.006)		0.35 (0.014) ±0.15 (0.006)	0.70 (0.028)	
0805	2012	2.00 (0.079) ±0.20 (0.008)	1.25 (0.049) ±0.20 (0.008)		0.50 (0.02) ±0.25 (0.010)	0.75 (0.030)	Solder Wave or Solder Reflow
1206	3216	3.20 (0.126) ±0.20 (0.008)	1.60 (0.063) ±0.20 (0.008)		0.50 (0.02) ±0.25 (0.010)		
1210	3225	3.20 (0.126) ±0.20 (0.008)	2.50 (0.098) ±0.20 (0.008)	See Table 2 for Thickness	0.50 (0.02) ±0.25 (0.010)		
1808	4520	4.70 (0.185) ±0.50 (0.020)	2.00 (0.079) ±0.20 (0.008)		0.60 (0.024) ±0.35 (0.014)		
1812	4532	4.50 (0.177) ±0.30 (0.012)	3.20 (0.126) ±0.30 (0.012)		0.60 (0.024) ±0.35 (0.014)	N/A	Solder Reflow
1825	4564	4.50 (0.177) ±0.30 (0.012)	6.40 (0.252) ±0.40 (0.016)		0.60 (0.024) ±0.35 (0.014)		Only
2220	5650	5.70 (0.224) ±0.40 (0.016)	5.00 (0.197) ±0.40 (0.016)		0.60 (0.024) ±0.35 (0.014)		
2225	5664	5.60 (0.220) ±0.40 (0.016)	6.40 (0.248) ±0.40 (0.016)		0.60 (0.024) ±0.35 (0.014)		



#### **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%
<sup>1</sup> Dielectric Withstanding Voltage (DWV)	250% of rated voltage (5±1 seconds and charge/discharge not exceeding 50 mA)
<sup>2</sup> Dissipation Factor (DF) Maximum Limit at 25°C	0.1%
<sup>3</sup> Insulation Resistance (IR) Limit at 25°C	1,000 megohm microfarads or 100 GΩ (Rated voltage applied for 120±5 seconds at 25°C)

<sup>&</sup>lt;sup>1</sup>DWV is the voltage a capacitor can withstand (survive) for a short period of time. It exceeds the nominal and continuous working voltage of the capacitor.

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
COG	All	All	0.5	0.3% or ±0.25 pF	10% of Initial Limit

<sup>&</sup>lt;sup>2</sup> Capacitance and dissipation factor (DF) measured under the following conditions:

<sup>1</sup> MHz  $\pm$ 100 kHz and 1.0 Vrms  $\pm$ 0.2 V if capacitance  $\leq$  1,000 pF

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

<sup>&</sup>lt;sup>3</sup> To obtain IR limit, divide  $M\Omega$ - $\mu$ F value by the capacitance and compare to  $G\Omega$  limit. Select the lower of the two limits.



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

1.8 pF 2.0 pF 2.2 pF	189 209 229	B C D B C D		BB         BB         BB         BB           BB         BB         BB         BB           BB         BB         BB         BB	CF CF CF CF CF CF CF CF	DN DN DN DN DN DN	EB EB EB EB EB EB EB EB
2.4 pF 2.7 pF	249 279	B C D B C D		BB BB BB BB BB BB	CF C	DN DN DN DN DN DN DN DN DN	EB EB EB EB EB EB EB EB
3.0 pF 3.3 pF 3.6 pF	309 339 369	B C D B C D		BB   BB   BB   BB   BB   BB   BB   B	CF CF CF CF CF CF CF CF	DN D	EB E
3.9 pF 4.3 pF 4.7 pF	399 439 479	B C D B C D B C D		BB   BB   BB   BB   BB   BB   BB   B	CF CF CF CF CF CF	DN DN DN DN DN DN DN	EB E
5.1 pF 5.6 pF 6.2 pF	519 569 629	B C D B C D		BB         BB         BB         BB           BB         BB         BB         BB           BB         BB         BB         BB	CF CF CF CF CF CF CF CF	DN DN DN DN DN DN DN	EB E
6.8 pF 7.5 pF 8.2 pF	689 759 829	B C D B C D B C D		BB   BB   BB   BB   BB   BB   BB   B	CF C	DN DN DN DN DN DN DN DN DN	
9.1 pF 10 pF 11 pF	919 100 110	F G J K M	AB¹ AB¹ AB	BB BB BB BB	CF CF CF CF CF CF CF CF		EB EB EB EB EB EB EB EB
12 pF 13 pF 15 pF	120 130 150	F G J K M	AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup> AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup>	BB BB BB BB	CF CF CF CF CF CF CF CF	DN DN DN DN DN DN DN DN DN	EB E
16 pF 18 pF 20 pF 22 pF	160 180 200 220	F G J K M F G J K M	AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup> AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup>	BB BB BB BB BB	CF C	DN DN DN DN DN DN DN	EB EB EB EB EB EB EB EB
24 pF 27 pF 30 pF	240 270 300	F G J K M	AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup>	BB BB BB BB	CF CF CF CF CF CF CF CF	DN D	EB E
33 pF 36 pF 39 pF	330 360 390	F G J K M F G J K M	AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup>		CF CF CF CF CF CF CF CF	DN D	EB EB EB EB EB EB EB EB
43 pF 47 pF 51 pF	430 470 510	F G J K M	AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup>	BB	CF CF CF CF CF CF CF CF	DN D	EB EB EB EB EB EB EB EB
56 pF 62 pF 68 pF	560 620 680	F G J K M F G J K M	AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup>	2 BB	CF CF CF CF CF CF CF CF	DN D	EB EB EB EB EB EB EB EB
75 pF 82 pF 91 pF	750 820 910	F G J K M	AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup>	BB BB BB BB 2 BB BB BB BB BB BB BB BB	CF CF CF CF CF CF CF CF	DN D	EB EB EB EB EB EB EB EB
100 pF	101		AB <sup>2</sup> AB <sup>2</sup> AB <sup>3</sup>	<sup>2</sup> BB BB BB BB BB BB	B CF CF CF CF CF CF	DN DN DN DN DN DN DN	EB EB EB EB EB EB
		Rated Voltage (VDC)	5 5 5		10 16 25 25 50 100 200 250	10 25 25 50 100 200 250	10 25 50 100 200 250
Cap	Cap Code	Voltage Code	8 4 3		8 4 3 5 1 2 A	8 4 3 5 1 2 A	8 4 3 5 1 2 A
		Case Size/Series	C0201C	C0402C	C0603C	C0805C	C1206C

<sup>\*</sup>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

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

 $xx^2$  Available only in J, K, M tolerance.



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

	Con	Case Size/ Series	C0	20	1C			C0	40	2C					CO	60	3C					CO	80	5C					C1	120	6C		
Cap	Cap	Voltage Code	8	4	3	8	4	3	5	1	2	Α	8	4	3	5	1	2	A	8	4	3	5	1	2	Α	8	4	3	5	1	2	A
	Code	Rated Voltage (VDC)	2	16	25	10	16	25	20	100	200	250	1	9	25	20	100	200	250	2	16	25	20	100	200	250	2	92	25	20	100	200	250
		Capacitance Tolerance								•	.,	Pro	odu		vaila	abil	ity a	ınd	Chi	p Th	ickn S Din	ess	Coc	les	, , ,		_					.,,	
110 - 180 pF*	111 - 181*	F G J K M				ВВ	BB	ВВ	ВВ	BB	ВВ	_	CF	CF	CF		CF	_		_	DN				DN	DN	EB	EB	EB	EB	EB	EB	EB
200 – 270 pF*	201 – 271*	F G J K M				ВВ	ВВ	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF			CF		DN							EB	EB		EB	EB	EB
300 pF	301	F G J K M				ВВ	ВВ		ВВ	BB	BD	BD	CF	CF	CF		CF	1 -	1 -		DN								EB		EB	EB	EB
330 pF	331	F G J K M				ВВ		_	ВВ	BB	BD	BD		CF	CF		CF		_		DN				_	_		_	EB		EB		EB
360 pF	361	F G J K M				BB	BB	BB	BB	BB			CF	CF	CF	CF	1				DN	1	1	1		1			EB		EB	EB	EB
390 pF 430 pF	391 431	F G J K M F G J K M				BB BB		BB BB	BB BB	BB BB			CF CF	CF CF	CF CF	CF CF	1				DN DN	1	1	1		1			EB EB		EB EB		EB EB
470 pF	471	F G J K M				ВВ		ВВ	ВВ	ВВ			CF	CF	CF	CF		CF			DN	1	1	1		1			EB		EB		
510 pF	511	F G J K M				BB	BB	BB	BB	BB			CF	CF	CF	CF	CF	CF			DN	1	1	1	1	1			EB		EB	EB	EB
560 pF	561	F G J K M				BB	BB	BB	BB				CF	CF	CF	CF	-	_	_		DN	_	_	_	_	_			_	_	EB	_	
620 pF	621	F G J K M				ВВ	BB	BB	BB	BB			CF	CF	CF	CF		1 -	1 -		DN								EB		EB	EB	
680 pF	681	F G J K M				ВВ	ВВ	ВВ	ВВ	ВВ			CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	EB	B EB	EB	EB	EB	EB	EB
750 pF	751	F G J K M				ВВ	ВВ	ВВ	ВВ	ВВ			CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB
820 pF	821	F G J K M				ВВ		_		BB			CF	CF	CF	CF	-	-	_		DN					_			EB		EB		EB
910 pF	911	F G J K M				ВВ	ВВ			ВВ			CF	CF	CF	CF	CF				DN	1	1	1	1	1			EB		EB	EB	EB
1,000 pF	102	F G J K M				ВВ			BB	ВВ			CF	CF	CF	CF	CF	CF			DN								EB		EB		EB
1,100 pF	112	F G J K M				BB	BB		BB				CF	CF	CF	CF	CF				DN	1	1	1	1				EB		EB	EB	EB
1,200 pF 1,300 pF	122 132	F G J K M F G J K M				BB BB	BB BB	BB BB	BB BB				CF CF	CF CF	CF CF	CF CF	CF CF	1			DN DP	1	DP	1		1			EB EB		EB EC	EB EC	EB EC
1,500 pF	152	F G J K M				BB	BB	BB	BB				CF	CF	CF	CF	CF	-	_	DP	_	DP				DN			EB	_	ED	_	
1,600 pF	162	F G J K M				ВВ	BB	BB	טט				CF	CF	CF	CF	CF	1 -	1 -	DP			DP			DN			EB		ED	ED	ED
1,800 pF	182	F G J K M				ВВ	BB	ВВ					CF	CF	CF	CF		1 -	1 -	DP			DP			DN			EB		ED		
2,000 pF	202	F G J K M				ВВ	ВВ	ВВ					CF	CF	CF	CF	CF	СН	СН	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	ED	ED	ED
2,200 pF	222	F G J K M				ВВ	ВВ	ВВ					CF	CF	CF	CF	CF	СН	СН	I DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EE	EE	EE
2,400 pF	242	F G J K M											CF	CF	CF	CF	CF			DN		1	1	1		DN			EB		EC	EC	EC
2,700 pF	272	F G J K M											CF	CF	CF	CF	CF			DN		DN	1	1		DN			EB		EC		EC
3,000 pF	302	F G J K M											CF	CF	CF	CF	CF			DP		1	DP	1	1	DN			EC		EC		EB
3,300 pF	332 362	F G J K M											CF CF	CF CF	CF CF	CF CF	CF CF			DP DP		1	DP DP	1	DP DP	DN DP			EC EC		EE	EB EB	EB EB
3,600 pF 3,900 pF	392	F G J K M											CF	CF	CF	CF	_			DE	_	DE	_	_	_	DP			_	_	EF	_	EB
4,300 pF	432	F G J K M											CF	CF	CF	CF				DE									EC		EC	EB	EB
4,700 pF	472	F G J K M											CF	CF	CF	CF	CF			DE		DE							EC		EC		EB
5,100 pF	512	F G J K M											CF	CF	CF	CF				DE				DN					ED		ED	EB	EB
5,600 pF	562	F G J K M											CF	CF	CF	CF				DN	DN	DN	DN	DN	DP	DP	ED	ED	ED	ED	ED	EB	EB
6,200 pF	622	F G J K M											CF	CF	CF	CF				DN		1	1	1		DG			EB		EB	EB	EB
6,800 pF	682	F G J K M											CF	CF	CF	CF				DN		1	1	1		DG			EB		EB		
7,500 pF	752	F G J K M											CF	CF	CF					DN		1	1	1		DG			EB		EB	EB	EB
8,200 pF	822 912	F G J K M											CF CF	CF CF	CF CF					DN		1	DN DN	1	υG	DG	EC		EC EC		EB EB	EC EC	
9,100 pF 10,000 pF	103	F G J K M											CF	CF	-					DN	_	_	DN	_			ED		_	ED	_	_	EC
12,000 pF	123	F G J K M											CF	CF	CF						DN						EB		EB		EB		
15,000 pF	153	F G J K M												CF							DN						EB			EB			EF
18,000 pF	183	F G J K M																			DN	DN	DP				EB		EB			EH	
22,000 pF	223	F G J K M																		DP	DP	DP					EB		EB	EB	EC	EH	
27,000 pF	273	F G J K M																		DF							EB		EB		EE		
33,000 pF	333	F G J K M																			DG						EB			EB			
39,000 pF	393	F G J K M																			DG	1					EC			EE			
47,000 pF	473	F G J K M F G J K M																		ĮυG	DG	DG					EC ED		EC ED	EE EF	ĿΗ		
56,000 pF 68,000 pF	563 683	F G J K M																									EF			EH			
82,000 pF	823	F G J K M																										I EH					
0.10 μF	104	F G J K M																										I EH					
		Rated Voltage (VDC)	2	16	22	10	16	22	20	100	200	250	1	16	25	20	5	200	250	2	16	22	20	9	200	250	2	_	25	_	9	200	250
Сар	Cap Code	Voltage Code	8	4	3	8	4	3	5	1	2	Α	8	4	3	5	1	2	$\overline{}$	8	4	3	5	1	2		8	4	3	5	1	2	A
		Case Size/Series	C0	201	1C			CC	402	2C					C	060	3C					C	080	5C					C	120	6C		
			_	_	_	_		_		_		_		_	_	_	_		_	_						_	_		_	_		-	

<sup>\*</sup>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

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

 $xx^2$  Available only in J, K, M tolerance.



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

		С	as	e S		e/			C1	21	OC			(	C18	080	;	(	C18	120	;	C	:18	250		C	22	200	S	(	22	250	C
Сар	Cap	١,	Volta	ige	Coc	le	8	4	3	5	1	2	Α	5	1	2	Α	5	1	2	Α	5	1	2	Α	5	1	2	Α	5	1	2	Α
•	Code	Rate	ed Vo	olta	ae (	VDC)	2	16	25	20	100	200	250	20	100	200	250	20	100	200	250	20	100	200	250	20	100	200	250	20	100	200	250
		_	Capa Tol	acit	and	ce						. ~	_ ~		Prod	luct	Avai	ilabi	ity a	nd C	hip	Thic ess [	kne	ss C	odes			~				_ 7	2
1.0 - 9.1 pF*	109 - 919*	ВС	D				FB	FB	FB	FB	FB	FB	FB																				
10 - 91 pF*	100 - 910*			FG				FB	FB	FB	FB	FB	FB																				
100 - 300 pF*	101 - 301*			FG			FB	FB	FB	FB	FB	FB	FB	۱																			
330 - 430 pF* 470 - 910 pF*	331 - 431* 471 - 911*			F G		K M	FB FB	FB FB	FB	FB FB	FB FB	FB	FB	LF	LF	LF	LF	CB	CP	CD	CD												
1,000 pF	102			FG	_		FB	FB	FB FB	FB	FB	FB FB	FB FB	LF	LF LF	LF LF	LF LF	GB GB	GB GB	GB GB	GB GB												
1,100 pF	112		- 1	F		1 1	FB	FB	FB	FB	FB	FB	FB	LF	LF	LF	LF	GB	GB		GB												
1,200 pF	122			FG		1 1		FB	FB	FB	FB	FB	FB	LF	LF	LF	LF	GB	GB	GB	GB					l							
1,300 pF	132			FG				FB	FB	FB	FB	FC	FC	LF	LF	LF	LF	GB	GB	GB	GB	l				i				i			
1,500 pF	152			FG		1 1	FB	FB	FB	FB	FB	FE	FE	LF	LF	LF	LF	GB	GB	GB	GB	İ				İ				İ			
1,600 pF	162			FG	J	KM	FB	FB	FB	FB	FB	FE	FE	LF	LF	LF	LF	GB	GB	GB	GB												
1,800 pF	182			F	J		FB	FB	FB	FB	FB	FE	FE	LF	LF	LF	LF	GB	GB	GB	GB												
2,000 pF	202			FG				FB	FB	FB	FC	FE	FE	LF	LF	LF	LF	GB	GB	GB	GB												
2,200 pF	222			F				FB	FB	FB	FC	FG	FG	LF	LF	LF	LF	GB	GB	GB	GB												
2,400 pF	242			FG	_			FB	FB	FB	FC	FC	FC	LF	LF	LF	LF	0.0	0.0	0.0	0.0												
2,700 pF	272			F				FB	FB	FB	FC	FC	FC	LF	LF	LF	LF	GB	GB	GB	GB												
3,000 pF	302		- 1	F G		1 1		FB	FB	FB	FC FF	FF	FF	LF	LF LF			CD.	CD	CD	CD												
3,300 pF 3,600 pF	332 362			F G		1 1		FB FB	FB FB	FB FB	FF	FF FF	FF FF	LF LF	LF			GB	GB	GB	GB												
3,900 pF	392			F		1 1		FB	FB	FB	FF	FF	FF	LF	LF			GB	GB	GB	GB	НВ	HR	НВ	HR					l			
4,300 pF	432			FG	_		FB	FB	FB	FB	FF	FF	FF	LF	LF			0.5	OD	OD	OD	110	110	110	110								
4,700 pF	472			FG		KM	FF	FF	FF	FF	FG	FG	FG	LF	LF			GB	GB	GD	GD	НВ	НВ	НВ	НВ					KE	KE	KE	KE
5,100 pF	512			FG		KM	FB	FB	FB	FB	FG	FG	FG																	KE	KE	KE	KE
5,600 pF	562			FG	J	KM	FB	FB	FB	FB	FG	FG	FG					GB	GB	GH	GH	НВ	НВ	НВ	НВ					KE	KE	KE	KE
6,200 pF	622			FG	J	KM	FB	FB	FB	FB	FG	FB	FB																	KE	KE	KE	KE
6,800 pF	682			FG		KM	FB	FB	FB	FB	FG	FB	FB					GB	GB	GJ	GJ	НВ	НВ	НВ	НВ	JE	JE	JB		KE	KE	KE	KE
7,500 pF	752		- 1	FG		KM		FC	FC	FC	FC	FB	FB																	KE	KE	KE	KE
8,200 pF	822		- 1	FG				FC	FC	FC	FC	FB	FB					GB	GH	GB	GB	НВ	НВ	НВ	НВ	JE	JE	JB		KE	KE	KE	KE
9,100 pF	912			FG		1 1		FE	FE	FE	FE	FB	FB					٦	011	O.D.	0.0	I I I I	un				15	I.D.		KE	KE	KE	KE
10,000 pF	103			FG	_	KM	FF	FF	FF	FF FG	FF FB	FB	FB					GB	GH		GB	НВ	HB	HE	HE	JE	JE	JB		KE	KE	KE	KE
12,000 pF 15,000 pF	123 153	-		F G		K M	FG FG	FG FG	FG FG	FG	FB	FB FC	FB FC					GB GB	GG GB	GB GB	GB GB	HB HB	HB HB	пЕ	HE	JE JE	JE JE	JB JB		KE KE	KE		KE
18,000 pF	183			FG		KM	FB	FB	FB	FB	FB	FC	FC					GB	GB	GB	GB	НВ	HE			JE	JE	JB		KE	KE	KL	KL
22,000 pF	223			FG			FB	FB	FB	FB	FB	FF	FF					GB	GB	GB	GB	НВ	HE			JE	JB	JB		KE	KE		
27,000 pF	273			FG		KM	FB	FB	FB	FB	FB	FG	FG					GB	GB		GB	НВ	HG			JE	JB	JB		KE	KE		
33,000 pF	333			FG	_		FB	FB	FB	FB	FB	FH	FH					GB	_	GB	GB					JB	JB	JB		KE			
39,000 pF	393			FG	J	1 1	FB	FB	FB	FB	FE	FH	FH					GB		GB	GB					JB	JB	JB					
47,000 pF	473			FG		1 1		FB	FB	FB	FE	FJ	FJ					GB		GD	GD					JB	JB	JB					
56,000 pF	563			FG				FB	FB	FB	FF							GB	GB	1	GD					JB	JB	JB					
68,000 pF	683			F G	_	KM	FB	FB	FB	FC	FG							GB	GB	_	GK					JB	JB	JB					
82,000 pF	823			FG				FC	FC	FF	FH							GB		GM						JB	JB	JB					
0.10 µF	104			FG					FE	FG	FM							GB		GM	GM					JB	JB	JD					
0.12 μF 0.15 μF	124 154			FG		K M K M			FG FH	FH									GH GN							JB JB	JB JB	JD JG					
0.15 μF 0.18 μF	184			F	, ,	KM	FI		FJ	I IVI								GH	GIV							JB	JD						
0.16 μF 0.22 μF	224			F G	, J	KM	FK											GK								JB	JD						
0.22 μr 0.27 μF	274					KM		' '	"					l								l				JB	JF	"		l			
0.33 μF	334					KM								l				l				İ				JD	JG			İ			
0.39 μF	394			FG	J	K M	İ							l								l				JG				l			
0.47 µF	474	Щ		F G	i J	K M	<u> </u>											<u> </u>								JG							
	0	<u> </u>		_		VDC)	_	16	25	_	<del>-</del>	200		20		200	250	20	-		250	20	100	200		20	100			20	100	200	
Cap	Cap Code		Volta	_			8	4	3	5	1	2	A	5	1	2	A	5		2	A	5	1	2	A	5	1	2	A	5	1	2	
		Ca	se Size/Series			ries			C	1210	C				C18	08C			C18	12C			C18	25C			C22	20C			C22	25C	

<sup>\*</sup>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

Thickness	Case	Thickness ±	Paper 0	uantity <sup>1</sup>	Plastic (	Quantity				
Code	Size <sup>1</sup>	Range (mm)	7" Reel	13" Reel	7" Reel	13" Reel				
AB	0201	0.30±0.03	15,000	0	0	0				
BB	0402	0.50±0.05	10,000	50,000	0	0				
BD	0402	0.55±0.05	10,000	50,000	0	0				
CF	0603	0.80±0.07	4,000	15,000	0	0				
CH	0603	0.85±0.07	4,000	10,000	0	0				
DM	0805	0.70±0.20	4,000	15,000	0	0				
DN	0805	0.78±0.10	4,000	15,000	0	0				
DP	0805	0.90±0.10	4,000	15,000	0	0				
DE	0805	1.00±0.10	0	0	2,500	10,000				
DF	0805	1.10±0.10	0	0	2,500	10,000				
DG	0805	1.25±0.15	0	0	2,500	10,000				
EB	1206	0.78±0.10	0	0	4,000	10,000				
EC	1206	0.90±0.10	0	0	4,000	10,000				
ED	1206	1.00±0.10	0	0	2,500	10,000				
EE	1206	1.10±0.10	0	0	2,500	10,000				
EF	1206	1.20±0.15	0	0	2,500	10,000				
EH	1206	1.60±0.20	0	0	2,000	8,000				
FB	1210	0.78±0.10	0	0	4,000	10,000				
FC	1210	0.90±0.10	0	0	4,000	10,000				
FE FF	1210	1.00±0.10	0	0	2,500	10,000				
FG	1210 1210	1.10±0.10	0	0 0	2,500	10,000				
FH	1210	1.25±0.15 1.55±0.15	0 0	0	2,500 2,000	10,000 8,000				
FM	1210	1.70±0.15	0	0	2,000	8,000				
FJ	1210	1.85±0.20	0	0	2,000	8,000				
FK	1210	2.10±0.20	0	0	2,000	8,000				
NC	1706	1.00±0.15	ő	0	4,000	10,000				
LF	1808	1.00±0.15	ő	ő	2,500	10,000				
GB	1812	1.00±0.10	Ö	Ö	1,000	4,000				
GD	1812	1.25±0.15	Ö	Ö	1,000	4,000				
GH	1812	1.40±0.15	0	0	1,000	4,000				
GG	1812	1.55±0.10	0	0	1,000	4,000				
GK	1812	1.60±0.20	0	0	1,000	4,000				
GJ	1812	1.70±0.15	0	0	1,000	4,000				
GN	1812	1.70±0.20	0	0	1,000	4,000				
GM	1812	2.00±0.20	0	0	500	2,000				
НВ	1825	1.10±0.15	0	0	1,000	4,000				
HE	1825	1.40±0.15	0	0	1,000	4,000				
HG	1825	1.60±0.20	0	0	1,000	4,000				
JB	2220	1.00±0.15	0	0	1,000	4,000				
JD	2220	1.30±0.15	0	0	1,000	4,000				
JE	2220	1.40±0.15	0	0	1,000	4,000				
JF	2220	1.50±0.15	0	0	1,000	4,000				
JG	2220	1.70±0.15	0	0	1,000	4,000				
JL	2220	2.00±0.20	0	0	500	2,000				
KE	2225	1.40±0.15	0	0	1,000	4,000				
Thickness	Case	Thickness ±	7" Reel	13" Reel	7" Reel 13" Reel					
Code	Size <sup>1</sup>	Range (mm)	Paper Q	uantity <sup>1</sup>	Plastic Quantity					

Package quantity based on finished chip thickness specifications.

<sup>&</sup>lt;sup>1</sup> 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**

Dookse	ing Trees	Loose P	ackaging
Раска	jing Type	Bulk Bag	(default)
Packagi	ng C-Spec <sup>1</sup>	N	/A <sup>2</sup>
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	1	
1812	4532		
1825	4564		20,000
2220	5650		
2225	5664		

<sup>&</sup>lt;sup>1</sup> 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.

<sup>&</sup>lt;sup>2</sup> 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 our standard "Bulk Bag" packaging.



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

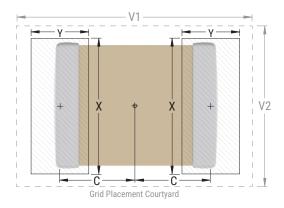
EIA Size Code	Metric Size Code	ı	Maxi	sity Lev mum (N otrusio	Most)	)		Media	sity Lev an (Nor rotrusio		)	ı		sity Lev mum (L rotrusio	.east)	)
Ooue	Oode	С	Y	X	V1	V2	С	Y	X	V1	V2	С	Υ	Х	<b>V</b> 1	V2
0201	0603	0.38	0.56	0.52	1.80	1.00	0.33	0.46	0.42	1.50	0.80	0.28	0.36	0.32	1.20	0.60
0402	1005	0.50	0.72	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
1210 <sup>1</sup>	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:**

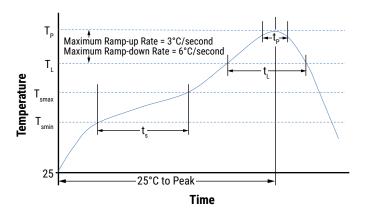
- Solder wave or solder reflow for EIA case sizes 0603, 0805 and 1206
- · All other EIA case sizes are limited to solder reflow only

#### **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	ion Finish
1 Tome I catale	SnPb	100% Matte Sn
Preheat/Soak		
Temperature Minimum (T <sub>Smin</sub> )	100°C	150°C
Temperature Maximum (T <sub>Smax</sub> )	150°C	200°C
Time ( $t_s$ ) from $T_{smin}$ to $T_{smax}$	60 - 120 seconds	60 - 120 seconds
Ramp-Up Rate (T <sub>L</sub> to T <sub>P</sub> )	3°C/second maximum	3°C/second maximum
Liquidous Temperature $(T_L)$	183°C	217°C
Time Above Liquidous (t <sub>L</sub> )	60 - 150 seconds	60 - 150 seconds
Peak Temperature (T <sub>P</sub> )	235°C	260°C
Time Within 5°C of Maximum Peak Temperature (t <sub>p</sub> )	20 seconds maximum	30 seconds maximum
Ramp-Down Rate $(T_P \text{ to } T_L)$	6°C/second maximum	6°C/second maximum
Time 25°C to Peak Temperature	6 minutes maximum	8 minutes maximum

Note 1: All temperatures refer to the center of the package, measured on the capacitor body surface that is facing up during assembly reflow.





### Table 4 - Performance & Reliability: Test Methods and Conditions

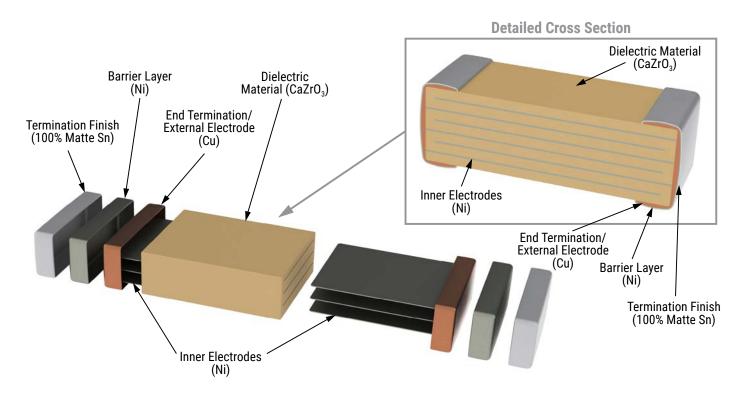
Stress	Reference	Test or Inspection Method	
Terminal Strength	JIS-C-6429	Appendix 1, Note: Force of 1.8 kg for 60 seconds.	
Board Flex	JIS-C-6429	Appendix 2, Note: Standard termination system – 2.0 mm (minimum) for all except 3 mm for COG. Flexible termination system – 3.0 mm (minimum).	
		Magnification 50 X. Conditions:	
Caldarability	J-STD-002	a) Method B, 4 hours at 155°C, dry heat at 235°C	
Solderability		b) Method B at 215°C category 3	
		c) Method D, category 3 at 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.	
	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 minutes, 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:

- · COG, 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.

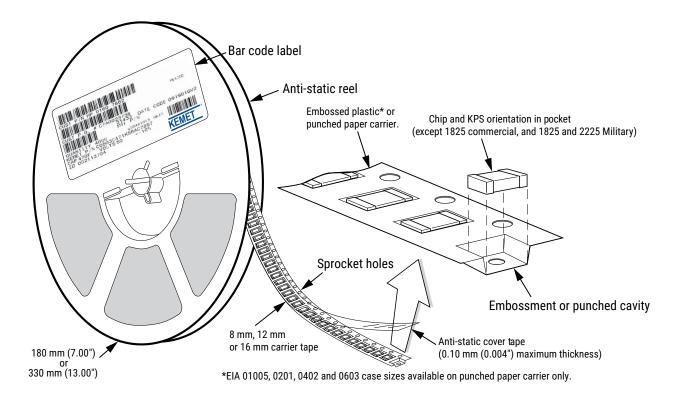


Table 5 - Carrier Tape Configuration, Embossed Plastic & Punched Paper (mm)

	Tape	Embosse	d Plastic	Punched Paper		
<b>EIA Case Size</b>	Size (W)*	7" Reel	13" Reel	7" Reel	13" Reel	
		Pitch (P₁)*		Pitch (P <sub>1</sub> )*		
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 and 2220	16	12	12			
Array 0612	8	4	4			

<sup>\*</sup>Refer to Figures 1 and 2 for W and  $P_1$  carrier tape reference locations.

#### **New 2 mm Pitch Reel Options\***

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

<sup>\* 2</sup> mm pitch reel only available for 0603 EIA case size. 2 mm pitch reel for 0805 EIA case size under development.

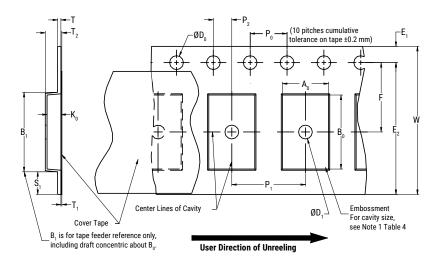
### Benefits of Changing from 4 mm to 2 mm Pitching Spacing

- 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.

<sup>\*</sup>Refer to Tables 6 and 7 for tolerance specifications.



# Figure 1 – Embossed (Plastic) Carrier Tape Dimensions



## **Table 6 – Embossed (Plastic) Carrier Tape Dimensions**

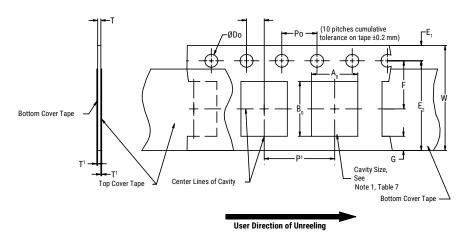
Metric will govern

	Constant Dimensions — Millimeters (Inches)								
Tape Size	D <sub>0</sub>	D <sub>1</sub> Minimum Note 1	E <sub>1</sub>	P <sub>0</sub>	P <sub>2</sub>	R Reference Note 2	S <sub>1</sub> Minimum Note 3	T Maximum	T <sub>1</sub> 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)	1.5	1.75 ±0.10 (0.069 ±0.004)	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		(0.059)				(1.181)			
	Variable Dimensions — Millimeters (Inches)								
Tape Size	Tape Size Pitch B <sub>1</sub> Maximum E <sub>2</sub> F P <sub>1</sub> T <sub>2</sub> W Maximum A <sub>0</sub> , B <sub>0</sub> & K <sub>0</sub>						& K <sub>0</sub>		
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) and 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 the embossment location and the hole location shall be applied independently of each other.
- 2. The tape with or without components shall pass around R without damage (see Figure 6.)
- 3. If  $S_1 < 1.0$  mm, there may not be enough area for a 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  $A_{n}$ ,  $B_{n}$  and  $K_{n}$  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 product,  $A_0$  and  $B_0$  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 <sub>0</sub>	E <sub>1</sub>	P <sub>0</sub>	P <sub>2</sub>	T <sub>1</sub> 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 <sub>1</sub>	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  $A_{n}$ ,  $B_{n}$  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.

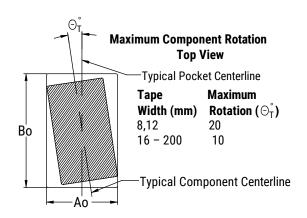
2. Cover Tape Peel Strength: The total peel strength of the cover tape from the carrier tape shall be:

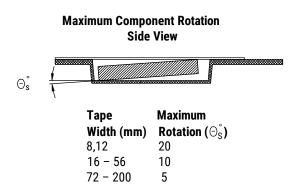
Tape Width	Peel Strength		
8 mm	0.1 to 1.0 newton (10 to 100 gf)		
12 and 16 mm	0.1 to 1.3 newton (10 to 130 gf)		

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.

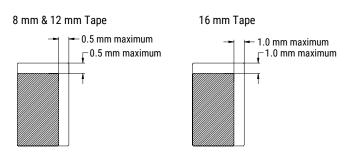
**3. Labeling:** Bar code labeling (standard or custom) shall be on the side of the reel opposite the sprocket holes. *Refer to EIA Standards 556 and 624*.

### Figure 3 - Maximum Component Rotation





# Figure 4 - Maximum Lateral Movement



# Figure 5 - Bending Radius

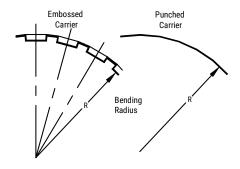
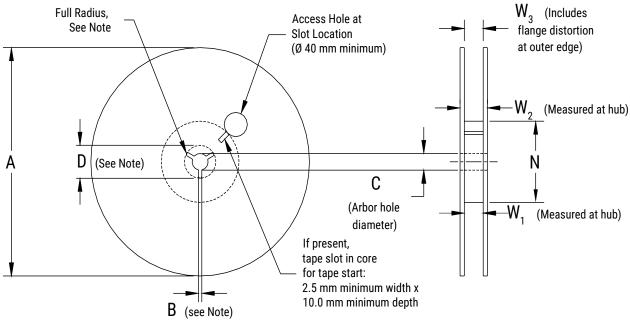




Figure 6 - Reel Dimensions



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

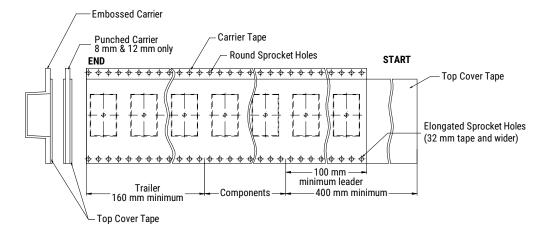
# **Table 8 - Reel Dimensions**

Metric will govern

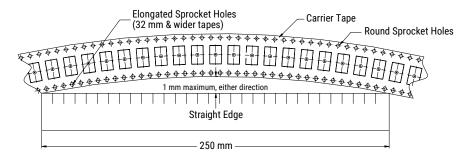
Constant Dimensions — Millimeters (Inches)								
Tape Size	A	B Minimum	С	D Minimum				
8 mm	178 ±0.20							
12 mm	(7.008 ±0.008) or	1.5 (0.059)	13.0 +0.5/-0.2 (0.521 +0.02/-0.008)	20.2 (0.795)				
16 mm	330 ±0.20 (13.000 ±0.008)	, ,	,	()				
	Variable Dimensions — Millimeters (Inches)							
Tape Size	N Minimum	W <sub>1</sub>	W <sub>2</sub> Maximum	W <sub>3</sub>				
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





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