X7R Dielectric, 6.3 – 250 VDC (Commercial Grade)



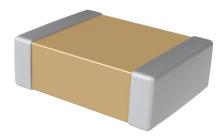
Overview

KEMET's X7R dielectric features a 125°C maximum operating temperature and is considered temperature stable. The Electronics Components, Assemblies and Materials Association (EIA) characterizes X7R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating

circuits where Q and stability of capacitance characteristics are not critical. X7R exhibits a predictable change in capacitance with respect to time and voltage, boasting a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to ±15% from -55°C to +125°C.

Benefits

- -55°C to +125°C operating temperature range
- · Lead (Pb)-free, RoHS, and REACH Compliant
- · Temperature stable dielectric
- EIA 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, and 2225 case sizes
- DC voltage ratings of 6.3 V, 10 V, 16 V, 25 V, 35 V, 50 V, 100 V, 200 V, and 250 V
- Capacitance offerings ranging from 10 pF to 47 μF
- Available capacitance tolerances of ±5%, ±10%, and ±20%
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb termination finish option available upon request (5% Pb minimum)



Applications

Typical applications include decoupling, bypass, filtering and transient voltage suppression.



Ordering Information

С	1206	С	106	M	4	R	Α	С	TU
Ceramic	Case Size (L" x W")	Specification/ Series ¹	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Dielectric	Failure Rate/ Design	Termination Finish ²	Packaging/ Grade (C-Spec)
	0402 0603 0805 1206 1210 1808 1812 1825 2220 2225	C = Standard	Two significant digits and number of zeros.	J = ±5% K = ±10% M = ±20%	9 = 6.3 8 = 10 4 = 16 3 = 25 6 = 35 5 = 50 1 = 100 2 = 200 A = 250	R = X7R	A = N/A	C = 100% Matte Sn	See "Packaging C-Spec Ordering Options Table"

¹ Flexible termination option is available. Please see FT-CAP product bulletin C1013_X7R_FT-CAP_SMD.

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
13" Reel/Unmarked	7411 (EIA 0603 and smaller case sizes) 7210 (EIA 0805 and larger case sizes)
7" Reel/Marked	TM
13" Reel/Marked	7040 (EIA 0603) 7215 (EIA 0805 and larger case sizes)
7" Reel/Unmarked/2 mm pitch²	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.

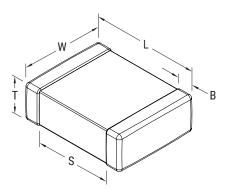
² Additional termination finish options may be available. Contact KEMET for details.

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. Please contact KEMET if you require a laser marked option. 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
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)	Solder reflow 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)		
1210¹	3225	3.20 (0.126) ±0.20 (0.008)	2.50 (0.098) ±0.20 (0.008)	See Table 2	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)	for Thickness	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)		

 $^{^{1}}$ For capacitance values ≥ 4.7 μF add 0.02 (0.001) to the width tolerance dimension and 0.10 (0.004) to the length tolerance dimension.

Qualification/Certification

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

Environmental Compliance

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



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)	±15%
¹ Aging Rate (Maximum % Capacitance Loss/Decade Hour)	3.0%
² Dielectric Withstanding Voltage (DWV)	250% of rated voltage (5 ±1 seconds and charge/discharge not exceeding 50mA)
³ Dissipation Factor (DF) Maximum Limit at 25°C	See Dissipation Factor Limit Table
⁴ Insulation Resistance (IR) Minimum Limit at 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ±5 seconds at 25°C)

¹Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 48 or 1,000 hours. Please refer to a part number specific datasheet for referee time details.

1 kHz ±50 Hz and 1.0 ±0.2 V_{rms} if capacitance \leq 10 μF

120 Hz ±10 Hz and 0.5 ±0.1 V_{rm} s if capacitance > 10 μF

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."

Insulation Resistance Limit Table

EIA Case Size	Rated DC Voltage	1,000 megohm microfarads or 100 GΩ	500 megohm microfarads or 10 GΩ	100 megohm microfarads or 10 GΩ
0402	ALL	< 0.012 µF	≥ 0.012 µF	N/A
0603	≤ 200 V	< 0.047 µF	≥ 0.047 µf < 0.47 µf	≥ 0.47 µf
0003	250 V	N/A	N/A	ALL
0805	≤ 200 V	< 0.15 µF	≥ 0.15 µF < 2.2 µf	≥ 2.2 µf
0805	250 V	< .027 μF	N/A	≥ .027 µF
1206	≤ 200 V	< 0.47 µF	≥ 0.47 µF < 2.2 µf	≥ 2.2 µf
1200	250 V	< 0.12 µF	N/A	≥ 0.12 µF
1010	≤ 200 V	< 0.39 µF	≥ 0.39 µF < 10 µf	≥ 10 µf
1210	250 V	< 0.27 μF	N/A	≥ 0.27 µF
1808	ALL	ALL	N/A	N/A
1812	ALL	< 2.2 μF	≥ 2.2 µF	N/A
1825	ALL	ALL	N/A	N/A
2220	ALL	< 10 µF	≥ 10 µF	N/A
2225	ALL	ALL	N/A	N/A

²DWV 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.

³ Capacitance and dissipation factor (DF) measured under the following conditions:

⁴To 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.



Dissipation Factor (DF) Limit Table

EIA Case Size	Rated DC Voltage	Capacitance	Dissipation Factor (Maximum %)
	< 16	All	5.0
	16	All	3.5
0402	25	< 0.1 µF	3.5
	25	≥ 0.1 µF	10.0
	> 25	All	2.5
	< 16		5.0
	16/25	< 1.0 μF	3.5
0603¹	> 25		2.5
	< 16	≥ 1.0 µF	10.0
	16/25	2 1.0 με	10.0
	< 16	< 2.2 μF	5.0
	16/25	< 2.2 με	3.5
0805	> 25	< 1.0 µF	2.5
0803	< 16	≥ 2.2 µF	
	16/25	2 2.2 μr	10.0
	> 25	≥ 1.0 µF	
	< 16	< 10 μF	5.0
	16/25	\ 10 μF	3.5
1206²	> 25	All	2.5
	< 16	≥ 10 µF	10.0
	16/25	- 10 μ1	
	< 16		5.0
	16/25	< 22 µF	3.5
1210³	> 25		2.5
	< 16	≥ 22 µF	10.0
	16/25	- 22 Hi	
	< 16		5.0
1808-2225	16/25	All	3.5
	> 25		2.5

¹ For Capacitance values 0.22uF (16 and 25 Volts) DF is 5%.

 $^{^{2}}$ For Capacitance value 2.2uF (25 Volts) and ≥ 2.2 μF (35 and 50 Volts) DF is 10%.

³ For Capacitance value 10uF (25 Volts) DF is 10%.



Post Environmental Limits

	High Tempe	erature Life, I	Biased Humid	lity, Moisture	Resistance	
Dielectric	Case Size	Rated DC Voltage	Capacitance Value	Dissipation Factor (Maximum %)	Capacitance Shift	Insulation Resistance
		< 16		7.5		
	0402	16/25	All	5.0		
		> 25		3.0		
		< 16		7.5		
		16/25	< 1.0 μF	5.0		
	0603¹	> 25		3.0		
		< 16	. 105	20.0		
		16/25	≥ 1.0 µF	20.0		
		< 16	. 2 25	7.5		
		16/25	< 2.2 μF	5.0		
	0005	> 25	< 1.0 µF	3.0		
	0805	< 16	. 2 25			
		16/25	≥ 2.2 µF	20.0		
X7R		> 25	≥ 1.0 µF		± 20%	10% of Initial limit
		< 16	. 105	7.5		""""
		16/25	< 10 μF	5.0		
	1206²	> 25	All	3.0		
		< 16	. 10	20.0		
		16/25	≥ 10 µF	20.0		
		< 16		7.5		
		16/25	< 22 μF	5.0		
	1210³	> 25		3.0		
		< 16	. 225	20.0		
		16/25	≥ 22 µF	20.0		
		< 16		7.5		
	1808-2225	16/25	All	5.0		
		> 25		3.5		

¹ For Capacitance values 0.22 uF (16 and 25 Volts) DF is 7.5%.

 $^{^2}$ For Capacitance value 2.2 uF (25 Volts) and ≥ 2.2 μF (35 and 50 Volts) DF is 20%.

³ For Capacitance value 10 uF (25 Volts) DF is 20%.



Table 1A - Capacitance Range/Selection Waterfall (0402 - 1206 Case Sizes)

			se Si Serie			CO	40	2C				C	06	03	C						CO	80	5C							C1	20	6C			
Cap	Cap	Vol	tage C	ode	9	8	4	3	5	9	8	4	3	5	1	2	A	9	8	4	3	6	5	1	2	A	9	8	4	3	6	5	1	2	Α
	Code	Rate	ed Vol (VDC)		6.3	2	16	25	20	6.3	2	9	25	20	100	200	250	6.3	10	16	25	32	20	100	200	250	6.3	5	16	25	35	20	100	200	250
		Сар	Toler						Pro	duct	Ava	ilab	ility	and	Chi	p Th	ickn	ess	Cod	es -	- Se	e Tal	ole 2	for	Chi	p Th	ickr	iess	Dim	ens	ions				
10 - 20 pF*	100 - 200*	J	K	М	ВВ	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF						DN		DN			EB								
22 pF 24 - 91pF	220 240 - 910*	J	K	M	BB BB	BB BB	BB BB	BB BB	BB BB	CF CF	CF CF	CF CF	CF CF	CF CF	CF CF	CF CF		DM DN	DM DN		DN	DM DN	DM DN	DN DN	DN DN		EB EB								
100 - 150 pF**	101 - 151**	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF		DN	DN		DN	DN	DN	DN	DN		EB								
180 - 820 pF**	181 - 821**	J	K	М	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF	CF	CF	CF		DN	DN	DN	DN	DN	DN	DN		DN		EB							
1000pF	102	J	K	М	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN		DN	EB								
1200 pF	122	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN		DN	EB								
1500 pF	152 182	J	K	M	BB BB	BB BB	BB BB	BB BB	BB BB	CF CF	CF CF	CF CF	CF CF	CF CF	CF CF	CF CF	CF CF	DN DN	DN	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	EB EB								
1800 pF 2200 pF	222	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	CF	DN	DN DN	DN	DN		DN	DN		DN	EB								
2700 pF	272	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN	_	EB							
3300 pF	332	J	K	М	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	ЕВ	EB	ЕВ
3900 pF	392	J	K	М	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN		EB							
4700 pF	472	J	K	М	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF	CF	CF	CF	CF	DN	DN		DN	DN	DN	DN	DN	DN	EB								
5600 pF	562	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN		EB							
6800 pF 8200 pF	682 822	J	K	M	BB BB	BB BB	BB BB	BB BB	BB BB	CF CF	CF CF	CF CF	CF CF	CF CF	CF CF	CF CF	CF CF	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	EB EB								
10000 pF	103	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN	EB								
12000 pF	123	Ĵ	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	0.	٥.	DN	DN	DN	DN	DN	DN	DN		DN		EB							
15000 pF	153	J	K	М	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF	CF	CF			DN	DN	DN	DN	DN	DN	DN	DN	DN	EB								
18000 pF	183	J	K	М	ВВ	BB	BB	ВВ	BB	CF	CF	CF	CF	CF	CF			DN	DN	DN	DN	DN	DN	DN	DN	DN		EB							
22000 pF	223	J	K	М	ВВ	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF			DN	DN	DN			DN	DN	DN	DN	EB								
27000 pF	273	J	K	M	BB	BB	BB	BB		CF	CF	CF	CF	CF	CF			DN	DN	DN	DN	DN	DN	DP	DE	DG		EB							
33000 pF 39000 pF	333 393	J	K	M M	BB BB	BB BB	BB BB	BB BB		CF CF	CF CF	CF CF	CF CF	CF CF	CF CF			DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	DP DP	DE DE	DG DG	EB EB	EB EB	EB EB	EB EB	EB EB	EB EB	EB EC	EB EB	EB EB
47000 pF	473	J	K	M	BB	BB	BB	BB		CF	CF	CF	CF	CJ	CF			DN	DN	DN	DN	DN	DN	DE	DG	DG	EB	EB	EB	EB	EB	EB	EC	ED	ED
56000 pF	563	J	K	M	BB	BB	BB	00		CF	CF	CF	CF	CF	01			DP	DP	DP	DP	DP	DP	DE	DG	DG	EB	ED	ED						
68000 pF	683	J	K	М	ВВ	ВВ	ВВ			CF	CF	CF	CF	CF				DP	DP	DP	DP	DP	DP	DE	DG	DG	ЕВ	EB	EB	EB	EB	EB	EB	ED	ED
82000 pF	823	J	K	М	ВВ	ВВ	ВВ			CF	CF	CF	CF	CF				DP	DP	DP	DP	DP	DP	DE			EB	ED	ED						
0.1 μF	104	J	K	М	ВВ	BB	BB	BB1		CJ	CJ	CJ	CJ	CJ				DN	DN	DN	DN	DN	DN	DE			EB	EM	EM						
0.12 µF	124	J	K	M						CF	CF	CF	CF	CF				DN	DN	DN	DN	DP	DP	DG			EC	EG	EM						
0.15 µF	154 184	J	K	M M						CF CF	CF CF	CF CF	CF CF	CF				DN DN	DN DN	DN DN	DN DN	DP DG	DP DG	DG DG			EC EC	EG EM	EG EM						
0.18 μF 0.22 μF	224	J	K	M						CF	CF	CF	CF					DN	DN	DN	DN	DG	DG	DG			EC	EG	EG						
0.22 μr 0.27 μF	274	J	K	M						CF	CF	CF	01					DP	DP	DP	DP	DP	DP	00			EB	EB	EB	EB	EC	EC	EM		
0.33 μF	334	J	K	М	П					CF	CF	CF						DG	DG	DG	DG	DP	DP				EB	EB	EB	EB	EC	EC	EG		
0.39 µF	394	J	K	М	İ					CF	CF	CF						DG	DG	DG	DG	DE	DE				EB	EB	EB	EB	EC	EC	EG		I
0.47 μF	474	J	K	М						CF	CF	CF	CG1					DG	DG	DG	DG	DE	DE				EC	EC	EC	EC	EC	EC	EG		
0.56 μF	564	J	K	M														DP	DP	DP	DG		DH				ED	ED	ED	ED	EC	EC	EM		
0.68 µF	684 824	J	K	M														DP DP	DP DP	DP DP	DG DG	DH	υН				EF	EE EF	EE EF	EE EF	ED	ED ED	EM EH		
0.82 μF 1 μF	105	J J	K	M						CG1	CG1	CG ¹	CD1									DG ¹	DG1				EP	EP	EP	EP	ED	ED			
1.2 μF	125	J	K	M							00	00	OD						DE		20	50	50				ED	ED			EH		LII		
1.5 µF	155	J	K	M															DG								ED	ED			EH				
1.8 μF	185	J	K	М														DG	DG	DG							ED	ED	ED	EF	EH	EH			
2.2 µF	225	J	K	М						CG1	CG1							DG	DG	DG	DG ¹						EH		EH1		EH	EH			
2.7 µF	275	J	K	M																							EN		EN						
3.3 μF 3.9 μF	335 395	J	K	M M						1																	ED EF	ED EF							
3.9 μF 4.7 μF	475	J J	K	M														DG	DG	DG	DG								EH		EH1	EH1			
μι	.,, <u>,</u>	Rated Voltage ್ಲ				2	91	25	20	6.3	2	91	25	20	100	200	250	6.3	10	16	52	35	20	100	200	250	6.3	2	9	25	32	22	100	200	250
Con	Сар		(VDC)		9	8	4	3	5	9	8	4	3	5	1	2	A 2	9	8	4	3	რ 6	5	1	2	A A	9	8	4	3	6	5	1	2	75 A
Cap	Code	Case Size/ C0402C					ļ ,	٥						Α		0	4				1		A	ļ <u>"</u>		4				'		_			
		Series C0402C									C06	UJU							U	0805									1206	,c					

^{*}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).

^{**}Capacitance range Includes E12 decade values only. (i.e., 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, and 82).

xx¹ Available only in K and M tolerance.



Table 1A - Capacitance Range/Selection Waterfall (0402 - 1206 Case Sizes) cont'd

		Case Size/ Series		CO	40	2C				C	06	03	С						CO	80	5C							C1	20	6C			
Сар	Сар	Voltage Code	9	8	4	3	5	9	8	4	3	5	1	2	Α	9	8	4	3	6	5	1	2	A	9	8	4	3	6	5	1	2	Α
	Code	Rated Voltage (VDC)	6.3	10	16	25	20	6.3	10	16	25	20	100	200	250	6.3	10	16	25	32	20	100	200	250	6.3	10	16	25	32	20	100	200	250
		Cap Tolerance					Pro	duct	Ava	ilab	ility	and	Chi	p Th	ickr	ess	Cod	les -	- Se	e Ta	ble 2	2 for	Chi	p Th	iicki	iess	Dim	iens	ions	;			
5.6 μF	565	J K M																							EH	EH	EH						
6.8 µF	685	J K M																							EH	EH	EH						
8.2 μF	825	J K M																							EH	EH	EH						
10 μF	106	J K M														DH	DH								EH	EH	EH	EH					
22 µF	226	J K M																							EH1	EH1							
		Rated Voltage (VDC)	6.3	10	16	25	20	6.3	10	16	25	20	100	200	250	6.3	1	16	25	35	50	100	200	250	6.3	10	16	25	35	50	100	200	250
Cap	Cap Code	Voltage Code	9	8	4	3	5	9	8	4	3	5	1	2	A	9	8	4	3	6	5	1	2	A	9	8	4	3	6	5	1	2	Α
	Code 📖	Case Size/ Series		C)402	2C					C06	030	;		•				C	080	5C							C	1206	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).

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

	Cap		se Si Serie				(C12	100	;			C1	808	8C		C1	81	2C		(C18	250	2		C2	22	0C		(222	250)
Cap		Vol	tage C	ode	9	8	4	3	5	1	2	A	5	1	2	3	5	1	2	A	5	1	2	A	3	5	1	2	A	5	1	2	A
	Code	Rat	ed Volt (VDC)		6.3	10	16	25	20	100	200	250	20	100	200	25	20	100	200	250	20	100	200	250	25	20	100	200	250	50	100	200	250
		Cap	Tolera	nce								bilit	y an	d Ch	ip T	hick	ness	Coc	les -	- Se	e Tal	ole 2	for	Chip	Thi	ckne	ess I	Dime	nsio	ns			
10 - 91 pF*	100 - 910*	J	K	М	FB	FB	FB	FB	FB	FB	FB																						
11 pF	110	J	K	М	FB	FB	FB	FB	FB	FB	FB																			l			
12 pF	120	J	K	М	FB	FB	FB	FB	FB	FB	FB																			l			
13 pF	130	J	K	M	FB	FB	FB	FB	FB	FB	FB																			l			
15 pF	150	J	K	М	FB	FB	FB	FB	FB	FB	FB																						
16 pF	160	J	K	M	FB	FB	FB	FB	FB	FB	FB																			1			
18 pF	180	J	K	M	FB	FB	FB	FB	FB	FB	FB																			1			
20 pF	200	J	K	M	FB	FB	FB	FB	FB	FB	FB																			1			
22 pF	220	J	K	M	FB	FB	FB	FB	FB	FB	FB																			1			
24 pF	240	J	K	M	FB	FB	FB	FB	FB	FB	FB																						
27 pF	270	J	K	M	FB	FB	FB	FB	FB	FB	FB																						
30 pF	300	J	K	M	FB	FB	FB	FB	FB	FB	FB					1														l			
33 pF	330	J	K	M	FB	FB	FB	FB	FB	FB	FB					1														l			
36 pF	360	J	K	M	FB	FB	FB	FB	FB	FB	FB																						
39 pF	390	J	K	M	FB	FB	FB	FB	FB	FB	FB																						
43 pF	430	J	K	M	FB	FB	FB	FB	FB	FB	FB																			1			
47 pF	470	J	K	M	FB	FB	FB	FB	FB	FB	FB																			1			
51 pF	510	J	K	М	FB	FB	FB	FB	FB	FB	FB		l			1					l				l					l			
56 pF	560	J	K	M	FB	FB	FB	FB	FB	FB	FB										l												
62 pF	620	J	K	М	FB	FB	FB	FB	FB	FB	FB																						
68 pF	680	J	K	M	FB FB	FB	FB	FB	FB	FB	FB																						
75 pF	750	J	K M			FB	FB	FB	FB	FB	FB																						
	0	Rat	ed Volt (VDC)		6.3	5	91	22	20	100	200	250	20	100	200	25	20	100	200	250	20	100	200	250	22	20	90	200	250	20	100	200	250
Cap	Cap Code	Vol	oltage Code			8	4	3	5	1	2	A	5	1	2	3	5	1	2	A	5	1	2	A	3	5	1	2	A	5	1	2	A
			se Siz Series					C12	10C				C	1808	3C		С	1812	2C			C18	25C			C	2220	С			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).

^{**}Capacitance range Includes E12 decade values only. (i.e., 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, and 82).

xx¹ Available only in K and M tolerance.

^{**}Capacitance range Includes E12 decade values only. (i.e., 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, and 82).

 xx^1 Available only in K and M tolerance.



Table 1B - Capacitance Range/Selection Waterfall (1210 - 2225 Case Sizes) cont'd

			se Si Serie	-			(C12	100				C1	808	8C		C1	81:	2C		(C18	250	C		C2	222	0C		(C22	250	;
Cap	Cap Code	Vol	tage C	ode	9	8	4	3	5	1	2	A	5	1	2	3	5	1	2	A	5	1	2	A	3	5	1	2	A	5	1	2	Α
	Code	Rate	ed Volt (VDC)	•	6.3	10	16	25	20	100	200	250	20	100	200	22	20	100	200	250	20	100	200	250	25	20	100	200	250	50	100	200	250
		Cap	Tolera	ance				Pr	oduc	ct Av	aila	bilit	y an	d Ch	ip Tl	nickı	ness	Coc	les -	- Se	e Tal	ole 2	for	Chip	Thi	ckne	ess [Dime	nsio	ns			
82 pF 91 pF	820 910	J	K K	M M	FB FB																												
100 - 270 pF**	101 - 271**	J	K	M	FB										ł									l									
110 pF	111	Ĵ	K	M	FB																												
120 pF	121	J	K	М	FB																			İ									
130 pF	131	J	K	M	FB																												
150 pF	151	J	K	M	FB																												
180 pF	181	J	K	M	FB																												
220 pF	221	J	K	M	FB																												
270 pF	271 331	J	K	M	FB FB	FB FB	FB FB	FB FB	FB FB	FB FB	FB FB		LF	LF	LF																		
330 pF 390 pF	391	J	K	M	FB		LF	LF	LF																								
470 - 1,200 pF**	471 - 122**	J	K	M	FB		LF	LF	LF	GB	GB	GB	GB																				
560 pF	561	Ĵ	K	M	FB		LF	LF	LF	GB	GB	GB	GB																				
680 pF	681	J	K	М	FB		LF	LF	LF	GB	GB	GB	GB						İ					İ									
820 pF	821	J	K	М	FB		LF	LF	LF	GB	GB	GB	GB																				
1,000 pF	102	J	K	М	FB		LF	LF	LF	GB	GB	GB	GB																				
1,200 pF	122	J	K	М	FB		LF	LF	LF	GB	GB	GB	GB																				
1,500 pF	152	J	K	M	FB	FB	FB	FB	FB	FB	FE		LF	LF	LF	GB	GB	GB	GB														
1,800 pF	182	J	K	M	FB FB	FB FB	FB FB	FB FB	FB	FB FB	FE FB	гр	LF LF	LF LF	LF	GB	GB GB	GB GB	GB GB														
2,200 pF 2,700 pF	222 272	J	K	M	FB	FB	FB	FB	FB FB	FB	FB	FB FB	LF	LF	LF LF	GB GB	GB	GB	GB														
3,300 pF	332	J	K	M	FB	LF	LF	LF	GB	GB	GB	GB											l										
3,900 pF	392	Ĵ	K	M	FB	LF	LF		GB	GB	GB	GB		НВ	НВ	НВ																	
4,700 pF	472	Ĵ	K	M	FB	LD	LD	LD	GB	GB	GB	GD		НВ	НВ	НВ							KE	KE	KE								
5,600 pF	562	J	K	М	FB	LD	LD	LD	GB	GB	GB	GH		НВ	НВ	НВ							KE	KE	KE								
6,800 pF	682	J	K	М	FB	LD	LD	LD	GB	GB	GB	GB	GB	НВ	НВ	НВ		JE	JE	JE			KE	KE	KE								
8,200 pF	822	J	K	М	FB	LD	LD	LD	GB	GB	GB	GB	GB	НВ	НВ	НВ		JE	JE	JE			KE	KE	KE								
10,000 pF	103	J	K	M	FB	LD	LD	LD	GB	GB	GB	GB	GB		НВ	HE		JE	JE	JE			KE	KE	KE								
12,000 pF	123	J	K	M	FB	LD	LD	LD	GB	GB	GB	GB	GB	НВ	НВ	HE		JE	JE	JE			KE	KE	KE								
15,000 pF	153	J	K	M	FB	FB	FB	FB	FB	FB FB	FB FB	FB	LD	LD	LD LD	GB	GB	GB	GB		НВ	HB			JE	JE	JE			KE	KE	KE	
18,000 pF 22,000 pF	183 223	J	K	M	FB FB	FB FB	FB FB	FB FB	FB FB	FB	FB	FB FB	LD LD	LD LD	LD	GB GB	GB GB	GB GB	GB GB	GB	HB HB	HE HB	НВ	НВ	JE JE	JE JE	JE JE			KE	KE KE		
27,000 pF 27,000 pF	273	J	K	M	FB	LD	LD		GB	GB	GB	GB		НВ	НВ	НВ	НВ	JE	JE	JE			KE	KE									
33,000 pF	333	Ĵ	K	M	FB	LD	LD		GB	GB	GB	GB		НВ	НВ	НВ	НВ	JB	JB	JB			KE	IXE									
39,000 pF	393	Ĵ	K	M	FB	LD	LD		GB	GB	GB	GB		НВ	НВ	НВ	НВ	JB	JB	JB			``-										
47,000 pF	473	J	K	М	FB	FB	FB	FB	FB	FB	FC	FC	LD	LD		GB	GB	GB	GB		НВ	НВ	НВ	НВ	JB	JB	JB						
56,000 pF	563	J	K	М	FB	FB	FB	FB	FB	FB	FC	FC	LD	LD		GB	GB	GB	GB	GB	НВ	НВ	НВ	НВ	JB	JB	JB						
68,000 pF	683	J	K	М	FB	FB	FB	FB	FB	FB	FC	FC	LD			GB	GB	GB	GB	-	НВ	НВ	НВ	НВ	JB	JB	JB						
82,000 pF	823	J	K	M	FB	FB	FB	FB	FB	FC	FF	FF	LD			GB	GB		GB		НВ	НВ	НВ	НВ	JC	JC	JC	JC	JC	,,a	W2	1/2	1/0
0.10 µF	104	J	K	M	FB	FB	FB	FB	FB	FD	FG		LD			GB	GB		GB	GB	НВ	НВ	НВ	НВ	JC	JC	JC	JC	JC	KC	KC		KC
0.12 μF 0.15 μF	124 154	J	K	M	FB FC	FB FC	FB FC	FB FC	FB FC	FD FD	FH	FH FM				GB GB	GB GB	GB GB	GB GE		HB	HB HB	HB HB	HB HB	JC	JC JC	JC JC	JC	JC	KC KC	KC KC	KC KC	KC KC
0.15 μF 0.18 μF	184	J	K	M	FC	FC	FC	FC	FC	FD	FK					GB	GB	GB	GG	GG			НВ	НВ	JC	JC	JC	JC	JC	KC	KC	KC	KC
0.16 μF 0.22 μF	224	Ĵ	K	M	FC	FC	FC	FC	FC	FD	FK					GB	GB			GG			НВ	НВ	JC	JC	JC	JC	JC	KC	KC	KC	KC
0.27 μF	274	Ĵ	K	M	FC	FC	FC	FC	FC	FD	FP	FP	İ			GB	GB	GG	GG	GG		НВ	НВ	НВ	JC	JC	JC	JC	JC	КВ	KC	KC	KC
0.33 μF	334	Ĵ	K	М	FD	FD	FD	FD	FD	FD	i .	FM	l			GB	GB	GG		GG			НВ	НВ	JC	JC	JC	JC	JC	КВ	KC	KC	KC
0.39 µF	394	J	K	М	FD	FD	FD	FD	FD	FD	FK					GB	GB	GG	GG	GG	НВ	НВ	HD	HD	JC	JC	JC	JC	JC	КВ	KC	KC	KC
0.47 μF	474	J	K	М	FD	FD	FD	FD	FD	FD	FS	FS				GB	GB	GG	GJ	GJ	НВ	НВ	HD	HD	JC	JC	JC	JC	JC	KB	KC	KD	KD
		Rate	Rated Voltage (VDC)			10	16	25	20	100	200	250	20	100	200	25	20	100	200	250	20	100	200	250	25	20	100	200	250	20	100	200	250
Cap	Cap Code	Vol	Voltage Code		9	8	4	3	5	1	2	A	5	1	2	3	5	1	2	A	5	1	2	A	3	5	1	2	A	5	1	2	A
			se Siz Series					C12	10C				С	1808	3C		С	1812	2C			C18	25C			C	2220	С			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).

^{**}Capacitance range Includes E12 decade values only. (i.e., 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, and 82).

 xx^1 Available only in K and M tolerance.



Table 1B - Capacitance Range/Selection Waterfall (1210 - 2225 Case Sizes) cont'd

	Con		se Si Serie				(C12	100	C			C1	80	8C		C1	181:	2C		(C18	250	0		C2	222	0C		(22	250	,
Cap	Cap	Vol	tage C	ode	9	8	4	3	5	1	2	Α	5	1	2	3	5	1	2	A	5	1	2	Α	3	5	1	2	A	5	1	2	Α
	Code		ed Volt (VDC)		6.3	10	16	25	20	100	200	250	20	100	200	25	20	100	200	250	20	100	200	250	25	20	100	200	250	20	100	200	250
		Cap	Tolera	ance				Pr	odu	ct Av	aila	bilit	y an	d Ch	ip T	hickı	ness	Coc	les ·	- Se	e Tal	ole 2	for	Chip	Thi	ckne	ess I	Dime	nsic	ons			
0.56 μF	564	J	K	М	FD	FD	FD	FD	FD	FF						GC	GC	GG			НВ	HD	HD	HD		JC	JC	JD	JD	KB	KC	KD	KD
0.68 μF	684	J	K	M	FD	FD	FD	FD	FD	FG						GC					НВ	HD			JC	JC	JD	JD	JD	KB	KC	KD	KD
0.82 μF	824	J	K	M	FF	FF	FF	FF	FF	FL						GE	GE				НВ	HF	HF	HF	JC	JC	JF	JF	JF	KB	KC	KE	KE
1.0 μF	105	J	K	M	FH	FH	FH	FH		FM						GE	GE				НВ	HF	HF	HF	JC	JC	JF	JF	JF	KB	KD	KE	KE
1.2 μF	125	J	K	M	FH	FH	FH	FH	FG	FH						GB	GB	1 -			НВ				JC	JC				KB	KE	KE	KE
1.5 µF	155	J	K	M	FH	FH	FH	FH	FG	FM						GC	GC				нс				JC	JC				KC			
1.8 µF	185	J	K	M	FH	FH	FH	1	FG	FJ						GE	GE	1 -			HD				JD	JD				KD			
2.2 µF	225	J	K	M	FJ	FJ	FJ	FJ	FG	FT1						G0	G0				HF				JF	JF				KD			
2.7 µF	275	J	K	M	FE	FE	FE	FG	FH							GJ	GJ	GJ															
3.3 µF	335	J	K	M	FF	FF	FF	FM								GL	GL	GL															
3.9 µF	395	J	K	M	FG	FG	FG	FG	FK							GK	GK																
4.7 μF	475	J	K	M	FC	FC	FC	FG	FS							GK	GK								JF	JF							
5.6 μF	565	J	K	M	FF	FF	FF	FH																									
6.8 µF	685	J	K	M	FG	FG		FM																									
8.2 μF	825	J	K	M	FH	FH	FH	FK																									
10 μF	106	J	K	M	FT1	FT1	FT1	FS ¹	FS ¹							GK									JF	JO				l			
12 μF	126	J	K	M																										l			
15 μF	156	J	K	М	FM	FM							l			l					l				JO	JO				l			
18 μF	186	J	K	М																													
22 µF	226	J	K	М	FS	FS	FS ¹	FS ¹																	JO								
47 μF	476	J	K	М	FS ¹	FS ¹																											
					6.3	10	16	25	20	100	200	250	20	100	200	25	20	100	200	250	20	100	200	250	25	20	100	200	250	20	100	200	250
Cap	Cap Code	Vol	tage C	ode	9	8	4	3	5	1	2	Α	5	1	2	3	5	1	2	Α	5	1	2	Α	3	5	1	2	Α	5	1	2	Α
	Coue		se Siz Series					C12	10C				С	1808	BC .		С	1812	2C			C18	25C			C	2220	C			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).

^{**}Capacitance range Includes E12 decade values only. (i.e., 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, and 82).

 xx^1 Available only in K and M tolerance.



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

Table 2A	<u> </u>	······································	po a mooi			
Thickness	Case	Thickness ±	Paper Q	uantity ¹	Plastic (Quantity
Code	Size ¹	Range (mm)	7" Reel	13" Reel	7" Reel	13" Reel
BB	0402	0.50 ± 0.05	10,000	50,000	0	0
CF	0603	0.80 ± 0.07*	4,000	15,000	0	0
CG	0603	0.80 ± 0.10*	4,000	15,000	0	0
CD CJ	0603 0603	0.80 ± 0.15 0.80 ± 0.15*	4,000 4,000	10,000 15,000	0 0	0 0
DM	0805	0.70 ± 0.20*	4,000	15,000	0	0
DN	0805	0.78 ± 0.10*	4,000	15,000	Ö	Ö
DO	0805	0.80 ± 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
DG	0805	1.25 ± 0.15	0	0	2,500	10,000
DH	0805	1.25 ± 0.20	0	0	2,500	10,000
EB EC	1206 1206	0.78 ± 0.10 0.90 ± 0.10	4,000 0	10,000	4,000 4,000	10,000 10,000
EN	1206	0.90 ± 0.10 0.95 ± 0.10	0	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
EP	1206	1.20 ± 0.20	0	0	2,500	10,000
EM	1206	1.25 ± 0.15	0	0	2,500	10,000
EG	1206	1.60 ± 0.15	0	0	2,000	8,000
EH FB	1206	1.60 ± 0.20	0	0	2,000	8,000
FC	1210 1210	0.78 ± 0.10 0.90 ± 0.10	0 0	0 0	4,000 4,000	10,000 10,000
FD	1210	0.95 ± 0.10	0	0	4,000	10,000
FE	1210	1.00 ± 0.10	0	0	2,500	10,000
FF	1210	1.10 ± 0.10	0	0	2,500	10,000
FG	1210	1.25 ± 0.15	0	0	2,500	10,000
FL	1210	1.40 ± 0.15	0	0	2,000	8,000
FH	1210	1.55 ± 0.15	0	0	2,000	8,000
FP FM	1210 1210	1.60 ± 0.20 1.70 ± 0.20	0 0	0 0	2,000 2,000	8,000 8,000
FJ	1210	1.85 ± 0.20	0	0	2,000	8,000
FT	1210	1.90 ± 0.20	0	0	2,000	8,000
FK	1210	2.10 ± 0.20	0	0	2,000	8,000
FS	1210	2.50 ± 0.30	0	0	1,000	4,000
NA	1706	0.90 ± 0.10	0	0	4,000	10,000
NC	1706	1.00 ± 0.15	0	0	4,000	10,000
LD LF	1808 1808	0.90 ± 0.10 1.00 ± 0.15	0 0	0 0	2,500 2,500	10,000 10,000
GB	1812	1.00 ± 0.15 1.00 ± 0.10	0	0	1,000	4,000
GC	1812	1.10 ± 0.10	0	0	1,000	4,000
GD	1812	1.25 ± 0.15	Ö	Ő	1,000	4,000
GE	1812	1.30 ± 0.10	0	0	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 GJ	1812 1812	1.60 ± 0.20	0 0	0 0	1,000	4,000
GL GL	1812	1.70 ± 0.15 1.90 ± 0.20	0	0	1,000 500	4,000 2,000
GO GO	1812	2.50 ± 0.20	0	0	500	2,000
Thickness	Case	Thickness ±	7" Reel	13" Reel	7" Reel	13" Reel
Code	Size ¹	Range (mm)	Paper Q	uantity1	Plastic (Quantity

 $\label{prop:package} \textit{Package quantity based on finished chip thickness specifications}.$

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 2A - Chip Thickness/Tape & Reel Packaging Quantities cont'd

Thickness	Case	Thickness ±	Paper Q	uantity ¹	Plastic Quantity		
Code	Size ¹	Range (mm)	7" Reel	13" Reel	7" Reel	13" Reel	
НВ	1825	1.10 ± 0.15	0	0	1,000	4,000	
HC	1825	1.15 ± 0.15	0	0	1,000	4,000	
HD	1825	1.30 ± 0.15	0	0	1,000	4,000	
HE	1825	1.40 ± 0.15	0	0	1,000	4,000	
HF	1825	1.50 ± 0.15	0	0	1,000	4,000	
JB	2220	1.00 ± 0.15	0	0	1,000	4,000	
JC	2220	1.10 ± 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	
J0	2220	2.40 ± 0.15	0	0	500	2,000	
KB	2225	1.00 ± 0.15	0	0	1,000	4,000	
KC	2225	1.10 ± 0.15	0	0	1,000	4,000	
KD	2225	1.30 ± 0.15	0	0	1,000	4,000	
KE	2225	1.40 ± 0.15	0	0	1,000	4,000	
Thickness	Case	e Thickness ±	7" Reel	13" Reel	7" Reel	13" Reel	
Code	Size ¹	Range (mm)	Paper Q	uantity1	Plastic (Quantity	

Package quantity based on finished chip thickness specifications.

Table 2B - Bulk Packaging Quantities

Dookogi	ng Type	Loose P	Loose Packaging				
Packayi	ng Type	Bulk Bag	g (default)				
Packagin	g C-Spec¹	N,	/A²				
Case	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.

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."

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 our standard "Bulk Bag" packaging.



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

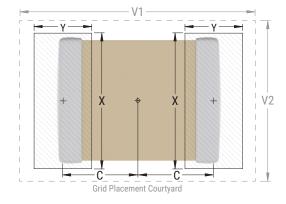
EIA Size Code	Metric Size Code	Density Level A: Maximum (Most) Land Protrusion (mm)					ı	Density Level B: Median (Nominal) Land Protrusion (mm)			Density Level C: Minimum (Least) Land Protrusion (mm)					
		С	Y	X	V1	V2	С	Y	X	V1	V2	С	Y	X	V1	V2
0402	1005	0.50	0.72	0.72	2.20	1.20	0.45	0.62	0.62	1.90	1.00	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	ion Finish		
rionie i catale	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 $(T_L \text{ to } T_p)$	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		

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

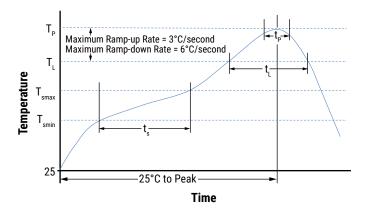




Table 4 - Performance & Reliability: Test Methods and Conditions

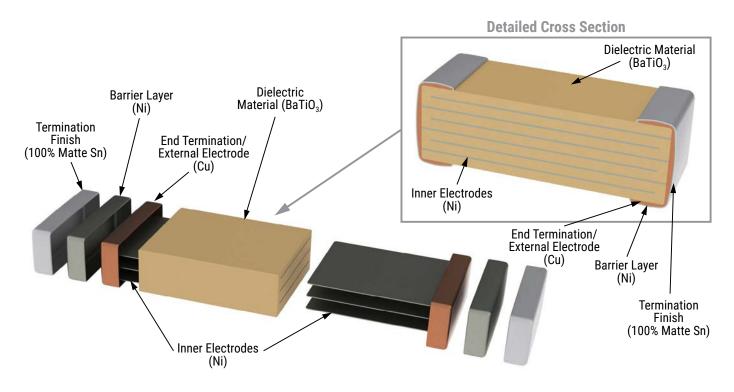
Stress	Reference		Test or Inspection Mo	ethod						
Terminal Strength	JIS-C-6429	Appendix 1, Note: Force of 1.8 kg for 60 seconds.								
Board Flex	JIS-C-6429	Appendix 2, Note: Standard termination system – 2.0 mm (minimum) for all except 3 mm for COG. Flexible termination system – 3.0 mm (minimum).								
		Magnification 50 X. Condition	ns:							
0-141:1:4	1 CTD 002	a) Method B, 4 hours a	t 155°C, dry heat at 235°C							
Solderability	J-STD-002	b) Method B, category	3 at 215°C							
		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 hou	ırs ±4 hours after test conclusion.						
Biased 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. 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 Measurement at 24 hours ±4	and 7b not required. hours after test conclusior	1.						
Thermal Shock	MIL-STD-202 Method 107	-55°C/+125°C. Note: Number seconds. Dwell time - 15 mi		Maximum transfer time – 20						
		1,000 hours at 125°C with 2 X rated voltage applied excluding the following:								
_	MIL-STD-202	Case Size	Capacitance	Applied Voltage						
High Temperature Life	Method 108/EIA-198	0603 & 0805	≥ 1.0 µF	1.5 X						
		1206 & 1210	≥ 10 µF	1.5 A						
Storage Life	MIL-STD-202 Method 108	150°C, 0 VDC for 1,000 hours	S.							
Vibration	MIL-STD-202 Method 204		side and 2 secure points at	ote: Use 8" X 5" PCB 0.031" thick corners of opposite sides. Parts - 2,000 Hz						
Mechanical Shock	MIL-STD-202 Method 213	Figure 1 of Method 213, Con	dition F.							
Resistance to Solvents	MIL-STD-202 Method 215	Add aqueous wash chemica	, OKEM Clean or equivalent	•						

Storage & 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 (Typical)





Capacitor Marking (Optional):

These surface mount multilayer ceramic capacitors are normally supplied unmarked. If required, they can be marked as an extra cost option. Marking is available on most KEMET devices, but must be requested using the correct ordering code identifier(s). If this option is requested, two sides of the ceramic body will be laser marked with a "K" to identify KEMET, followed by two characters (per EIA–198 - see table below) to identify the capacitance value. EIA 0603 case size devices are limited to the "K" character only.

Laser marking option is <u>not</u> 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
- X7R dielectric products in capacitance values outlined below.

EIA Case Size	Metric Size Code	Capacitance
0603	1608	≤ 170 pF
0805	2012	≤ 150 pF
1206	3216	≤ 910 pF
1210	3225	≤ 2,000 pF
1808	4520	≤ 3,900 pF
1812	4532	≤ 6,700 pF
1825	4564	≤ 0.018 µF
2220	5650	≤ 0.027 µF
2225	5664	≤ 0.033 µF

Marking appears in legible contrast. Illustrated below is an example of an MLCC with laser marking of "KA8", which designates a KEMET device with rated capacitance of 100 μ F. Orientation of marking is vendor optional.





Capacitor Marking (Optional) cont'd

	Capacitance (pF) For Various Alpha/Numeral Identifiers											
Alpho						Numera	ıl					
Alpha Character	9	0	1	2	3	4	5	6	7	8		
Cilaracter	Capacitance (pF)											
Α	0.10	1.0	10	100	1,000	10,000	100,000	1,000,000	10,000,000	100,000,000		
В	0.11	1.1	11	110	1,100	11,000	110,000	1,100,000	11,000,000	110,000,000		
С	0.12	1.2	12	120	1,200	12,000	120,000	1,200,000	12,000,000	120,000,000		
D	0.13	1.3	13	130	1,300	13,000	130,000	1,300,000	13,000,000	130,000,000		
Е	0.15	1.5	15	150	1,500	15,000	150,000	1,500,000	15,000,000	150,000,000		
F	0.16	1.6	16	160	1,600	16,000	160,000	1,600,000	16,000,000	160,000,000		
G	0.18	1.8	18	180	1,800	18,000	180,000	1,800,000	18,000,000	180,000,000		
Н	0.20	2.0	20	200	2,000	20,000	200,000	2,000,000	20,000,000	200,000,000		
J	0.22	2.2	22	220	2,200	22,000	220,000	2,200,000	22,000,000	220,000,000		
K	0.24	2.4	24	240	2,400	24,000	240,000	2,400,000	24,000,000	240,000,000		
L	0.27	2.7	27	270	2,700	27,000	270,000	2,700,000	27,000,000	270,000,000		
М	0.30	3.0	30	300	3,000	30,000	300,000	3,000,000	30,000,000	300,000,000		
N	0.33	3.3	33	330	3,300	33,000	330,000	3,300,000	33,000,000	330,000,000		
Р	0.36	3.6	36	360	3,600	36,000	360,000	3,600,000	36,000,000	360,000,000		
Q	0.39	3.9	39	390	3,900	39,000	390,000	3,900,000	39,000,000	390,000,000		
R	0.43	4.3	43	430	4,300	43,000	430,000	4,300,000	43,000,000	430,000,000		
S	0.47	4.7	47	470	4,700	47,000	470,000	4,700,000	47,000,000	470,000,000		
Т	0.51	5.1	51	510	5,100	51,000	510,000	5,100,000	51,000,000	510,000,000		
U	0.56	5.6	56	560	5,600	56,000	560,000	5,600,000	56,000,000	560,000,000		
V	0.62	6.2	62	620	6,200	62,000	620,000	6,200,000	62,000,000	620,000,000		
W	0.68	6.8	68	680	6,800	68,000	680,000	6,800,000	68,000,000	680,000,000		
Χ	0.75	7.5	75	750	7,500	75,000	750,000	7,500,000	75,000,000	750,000,000		
Υ	0.82	8.2	82	820	8,200	82,000	820,000	8,200,000	82,000,000	820,000,000		
Z	0.91	9.1	91	910	9,100	91,000	910,000	9,100,000	91,000,000	910,000,000		
а	0.25	2.5	25	250	2,500	25,000	250,000	2,500,000	25,000,000	250,000,000		
b	0.35	3.5	35	350	3,500	35,000	350,000	3,500,000	35,000,000	350,000,000		
d	0.40	4.0	40	400	4,000	40,000	400,000	4,000,000	40,000,000	400,000,000		
е	0.45	4.5	45	450	4,500	45,000	450,000	4,500,000	45,000,000	450,000,000		
f	0.50	5.0	50	500	5,000	50,000	500,000	5,000,000	50,000,000	500,000,000		
m	0.60	6.0	60	600	6,000	60,000	600,000	6,000,000	60,000,000	600,000,000		
n	0.70	7.0	70	700	7,000	70,000	700,000	7,000,000	70,000,000	700,000,000		
t	0.80	8.0	80	800	8,000	80,000	800,000	8,000,000	80,000,000	800,000,000		
у	0.90	9.0	90	900	9,000	90,000	900,000	9,000,000	90,000,000	900,000,000		



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.

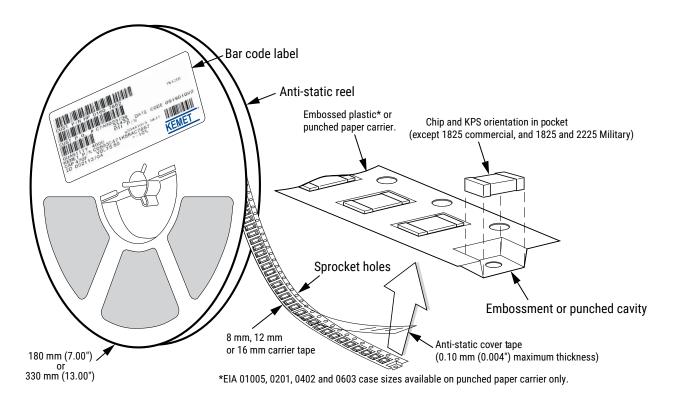


Table 5 - Carrier Tape Configuration, Embossed Plastic & Punched Paper (mm)

	Tape	Embosse	ed Plastic	Punched Paper		
EIA Case Size	Size	7" Reel	13" Reel	7" Reel	13" Reel	
	(W)*	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 and 2220	16	12	12			
Array 0612	8	4	4			

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

New 2 mm	Pitch Ro	eel Options*
----------	----------	--------------

	Packaging Ordering Code (C-Spec)	Packaging Type/Options
1	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 and 7 for tolerance specifications.



Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

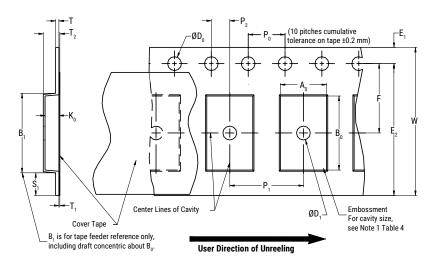


Table 6 – Embossed (Plastic) Carrier Tape Dimensions

Metric will govern

	Constant Dimensions — Millimeters (Inches)										
Tape Size	D 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)	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)		0.600 (0.024)	0.600 (0.024)	0.100 (0.004)		
16 mm		(0.059)									
		1	Variable Dime	ensions — Mill	imeters (Inch	nes)					
Tape Size	Pitch	B ₁ Maximum Note 4	${\sf E_2^{}}$ Minimum	F	P ₁	T ₂ Maximum	W Maximum	A ₀ ,B 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) 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)	Note 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_{α} , B_{α} and K_{α} 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

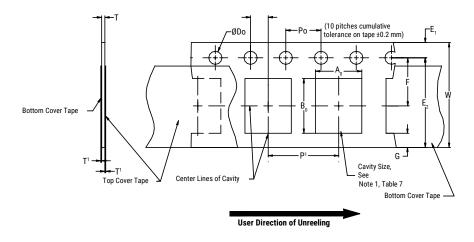


Table 7 - Punched (Paper) Carrier Tape Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)									
Tape Size	D 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	$A_0 B_0$		
8 mm	Half (2 mm)	6.25 (0.246)	3.5 ±0.05 (0.138 ±0.002)	2.0 ±0.05 (0.079 ±0.002)	1.1 (0.098)	8.3 (0.327)	Note 1		
8 mm	Single (4 mm)			4.0 ±0.10 (0.157 ±0.004)		8.3 (0.327)			

- 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

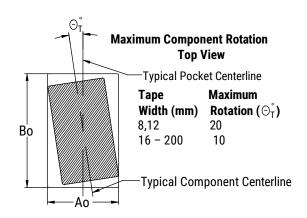
- 1. Cover Tape Break Force: 1.0 kg minimum.
- 2. Cover Tape Peel Strength: The total peel strength of the cover tape from the carrier tape shall be:

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



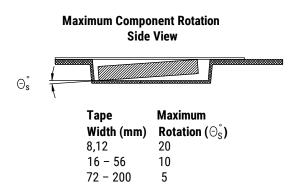


Figure 4 - Maximum Lateral Movement

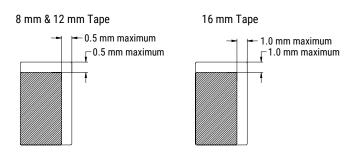


Figure 5 - Bending Radius

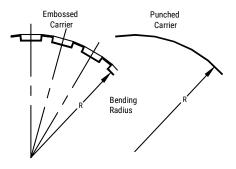
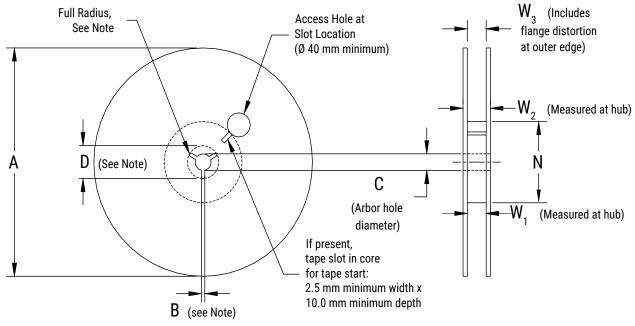




Figure 6 - Reel Dimensions



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		13.0 +0.5/-0.2 (0.521 +0.02/-0.008)	20.2 (0.795)				
12 mm	(7.008 ±0.008) or	1.5 (0.059)						
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

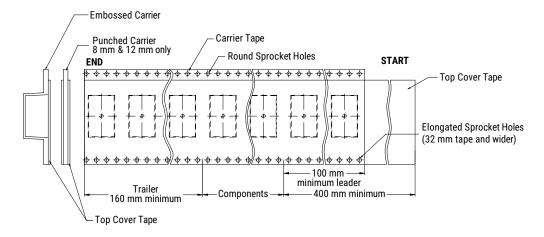


Figure 8 - Maximum Camber





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