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 & 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 and boasts 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

C	1206	C	106	M	4	R	A	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 + 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" below

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

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

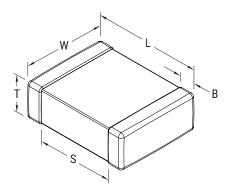


Packaging C-Spec Ordering Options Table

Packaging Type ¹	Packaging/Grade Ordering Code (C-Spec)
Bulk Bag/Unmarked	Not required (Blank)
7" Reel/Unmarked	TU
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 and smaller case sizes) 7215 (EIA 0805 and larger case sizes)
7" Reel/Unmarked/2mm pitch ²	7081
13" Reel/Unmarked/2mm pitch ²	7082

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

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)		Golder Reliow
1210 ¹	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.

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".



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
⁴Insulation 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 \pm 50 Hz and 1.0 \pm 0.2 Vrms if capacitance \leq 10 μ F

120 Hz \pm 10 Hz and 0.5 \pm 0.1 Vrms if capacitance > 10 μ F

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 (X7R Dielectric)

EIA Case Size		

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.



Post Environmental Limits

	High Tempe	erature Life, E	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		
	0603	> 25		3.0		
		< 16	≥ 1.0 µF	20.0		
		16/25	≥ 1.0 μF	20.0		
		< 16	< 2.2 μF	7.5		
		16/25	\ 2.2 μΓ	5.0		
	0805	> 25	< 1.0 μF	3.0		
	0803	< 16	≥ 2.2 µF			
		16/25	2 2.2 μr	20.0		
X7R		> 25	≥ 1.0 µF		± 20%	10% of Initial
A/R		< 16		7.5	1 20%	Limit
		16/25	< 10 µF	5.0		
	1206	> 25		3.0		
	1200	35/50	≥ 2.2 µF			
		< 16	≥ 10 µF	20.0		
		16/25	2 10 με			
		< 16		7.5		
		16/25	< 22 µF	5.0		
	1210	> 25		3.0		
		< 16	> 22 uE	20.0		
		16/25	≥ 22 µF	20.0		
		< 16		7.5		
	1808-2225	16/25	All	5.0		
		> 25		3.5		



Dissipation Factor (DF) Limit Table

$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	EIA Case Size	Rated DC Voltage	Capacitance	Dissipation Factor (Maximum %)
		< 16	AII	5.0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		16	All	3.5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0402	25	< 0.1 µF	3.5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		25	≥ 0.1 µF	10.0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		> 25	All	2.5
		< 16		5.0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		16/25	< 1.0 µF	3.5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0603	> 25		2.5
$0805 = \begin{array}{c ccccccccccccccccccccccccccccccccccc$			≥ 1.0 µF	10.0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				5.0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			< 2.2 µF	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			< 1.0 μF	2.5
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0805	< 16	-	
$1206 \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		16/25	≥ 2.2 µF	10.0
$1206 \begin{tabular}{c ccccccccccccccccccccccccccccccccccc$		> 25	≥ 1.0 µF	
1206 35/50 ≥ 2.2 μF 10.0 < 16 ≥ 10 μF 10.0 < 16 ≤ 22 μF 3.5 1210 ≥ 25 ≤ 22 μF 3.5 < 16 ≤ 25 ≤ 2.5 < 16 ≤ 22 μF 10.0 1808-2225 16/25 All 3.5 35/50 ≤ 22 μF 10.0 1808-2225 16/25 All 3.5 35/50 ≤ 20/50 1808-2225 16/25 All 3.5 2.5 3.5 10.0 3.5 10.0		< 16		5.0
1206 35/50 ≥ 2.2 μF 10.0 <16 16/25 ≥ 10 μF 10.0 5.0 16/25 <22 μF 3.5 2.5 <16 16/25 ≥ 22 μF 10.0 1808-2225 16/25 All 35/50 ≥ 10 μF 10.0 5.0 5.0 3.5 2.5 4.16 5.0 5.0 4.16 3.5 5.0 4.16 5.0 3.5		16/25	< 10 µF	3.5
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1006	> 25		2.5
16/25 ≥ 10 μF 10.0 16/25 < 16 16/25 < 22 μF 3.5 < 2.5 < 16 16/25 ≥ 22 μF 10.0 10.0 1808-2225 All 3.5 2.5 5.0 3.5 3.5 2.5 All 3.5 3.5 3.5 3.5 3.5 3.5 All 3.5 3.5	1200	35/50	≥ 2.2 µF	10.0
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		< 16	> 10 mE	10.0
16/25		16/25	2 10 µr	10.0
1210		< 16		5.0
< 16 $16/25 $ $ ≥ 22 μF $ $ 10.0 $ $ ≤ 16 $ $ ≤ 16 $ $ ≤ 16/25 $ $ ≤ 16/25 $ $ ≤ 16/25 $ $ ≤ 16/25 $ $ ≤ 16/25 $ $ ≤ 16/25 $ $ ≤ 10.0$		16/25	< 22 μF	3.5
16/25 ≥ 22 μF 10.0 < 16 5.0 1808-2225 16/25 All 3.5	1210	> 25		2.5
< 16			≥ 22 µF	10.0
1808-2225 16/25 All 3.5				5.0
	1808-2225		ΔΙΙ	
> 25	1000 2223		ΔII	



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

			e Si erie			CO)40	2C				CO	60	3C						C	080	5C							C1	20	6C			
Сар	Cap	Volt	age C	ode	9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	6	5	1	2	A	9	8	4	3	6	5	1	2	Α
	Code		d Volt (VDC)		6.3	10	9	25	20	6.3	9	16	25	20	100	200	6.3	10	16	25	35	20	100	200	250	6.3	10	16	25	35	20	100	200	250
		_	Tolera						Prod	uct /	Avai	labil	ity a	nd C	hip	Thic	kne	ess C	ode	s - S	See 1	Γable	2 fc	or Cl	hip T	hick	nes	s Di	men	sion	S			
10-20 pF*	100-200*	J	K	М	ВВ	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN		EB	EB	EB	EB	EB	EB	EB	EB	
22 pF	220	J	K	М	ВВ	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DM				DM	DM	DN	DN		EB	EB	EB	EB	EB	EB	EB	EB	
24-91pF	240-910*	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN		DN	DN		DN	DN	DN		EB	EB	EB	EB	EB	EB	EB	EB	
100-150 pF**	101-151**	J	K	M	BB	BB	BB BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN		DN	DN	DN	DNI	EB EB	EB	EB	EB	EB	EB	EB	EB EB	
180-820 pF** 1000pF	181-821** 102	J	K K	M	BB BB	BB BB	BB	BB BB	BB BB	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 EB	EB EB	EB EB	EB EB	EB EB	EB EB	EB	EB
1200 pF	122	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
1500 pF	152	Ĵ	K	М	ВВ	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
1800 pF	182	J	K	М	ВВ	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
2200 pF	222	J	K	М	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
2700 pF	272	J	K	М	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
3300 pF	332	J	K	М	ВВ	ВВ	ВВ	ВВ	ВВ	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
3900 pF	392	J	K	М	ВВ	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN		DN	DN		DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
4700 pF	472	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN		DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
5600 pF	562	J	K	М	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN		DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
6800 pF	682	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF	CF	DN	DN	DN	DN		DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
8200 pF	822	J	K K	M	BB	BB BB	BB BB	BB	BB	CF	CF	CF	CF CF	CF	CF	CF CF	DN	DN	DN	DN		DN	DN	DN	DN	EB EB	EB	EB	EB EB	EB	EB	EB EB	EB	EB EB
10000 pF 12000 pF	103 123	J	K	M	BB BB	BB	BB	BB BB	BB BB	CF CF	CF CF	CF CF	CF	CF CF	CF CF	UF	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	DN DN	EB	EB EB	EB EB	EB	EB EB	EB EB	EB	EB EB	EB
15000 pF	153	J	K	M	ВВ	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF		DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
18000 pF	183	J	K	M	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF		DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
22000 pF	223	J	K	М	BB	BB	BB	BB	BB	CF	CF	CF	CF	CF	CF		DN	DN	DN	DN	DN	DN	DN	DN	DN	EB	EB	EB	EB	EB	EB	EB	EB	EB
27000 pF	273	Ĵ	K	М	ВВ	BB	BB	BB		CF	CF	CF	CF	CF	CF		DN	DN	DN	DN	DN	DN	DP	DE		EB	EB	EB	EB	EB	EB	EB	EB	EB
33000 pF	333	Ĵ	K	М	ВВ	BB	BB	BB		CF	CF	CF	CF	CF	CF		DN		DN	DN		DN	DP	DE		EB	EB	EB	EB	EB	EB	EB	EB	EB
39000 pF	393	J	K	М	ВВ	ВВ	ВВ	ВВ		CF	CF	CF	CF	CF	CF		DN	DN	DN	DN	DN	DN	DP	DE		EB	EB	EB	EB	EB	EB	EC	EB	EB
47000 pF	473	J	K	М	ВВ	BB	ВВ	BB		CF	CF	CF	CF	CJ	CF		DO	DO	DO	DO	DO	DO	DE	DG		EB	EB	EB	EB	EB	EB	EC	ED	ED
56000 pF	563	J	K	М	ВВ	BB	ВВ			CF	CF	CF	CF	CF			DP	DP	DP	DP	DP	DP	DE	DG		EB	EB	EB	EB	EB	EB	EB	ED	ED
68000 pF	683	J	K	M	ВВ	BB	ВВ			CF	CF	CF	CF	CF			DP	DP	DP	DP	DP	DP	DE			EB	EB	EB	EB	EB	EB	EB	ED	ED
82000 pF	823	J	K	М	ВВ	BB	BB			CF	CF	CF	CF	CF			DP	DP	DP	DP	DP	DP	DE			EB	EB	EB	EB	EB	EB	EB	ED	ED
0.1 μF	104	J	K	М	ВВ	BB	BB	BB1		CF	CF	CF	CF	CF			DN	DN	DN	DN	_	DN	DE			EB	EB	EB	EB	EB	EB	EB	EM	EM
0.12 μF	124	J	K	М						CF	CF	CF	CF	CF			DN	DN	DN	DN	DP	DP	DG			EC	EC	EC	EC	EC	EC	EC	EG	
0.15 μF	154	J	K	M						CF	CF	CF	CF	CF			DN	DN	DN	DN	DP	DP	DG			EC	EC	EC	EC	EC	EC	EC	EG	
0.18 µF	184	J	K	M						CF	CF	CF	CF				DN	DN	DN	DN	DG	DG	DG			EC	EC	EC	EC	EC	EC	EC		
0.22 μF	224 274	J	K K	M						CF CF	CF	CF	CF				DN	DN	DN DP	DN DP	DG	DG	DG			EC	EC	EC	EC	EC	EC	EC EM		
0.27 μF 0.33 μF	334	J	K	M						CF	CF CF	CF CF					DP DG	DP DG	DG	DG	DP DP	DP DP				EB EB	EB EB	EB EB	EB EB	EC EC	EC EC	EG		
0.33 μF 0.39 μF	394	J	K	M	1					CF	CF	CF					DG	DG	DG	DG	DE	DE				EB	EB	EB	EB	EC	EC	EG		
0.39 μF	474	J	K	M						CF	CF	CF	CG ¹				DG	DG	DG	DG	DE	DE				EC	EC	EC	EC	EC	EC	EG		
0.47 μF	564	Ĵ	K	М	l					<u> </u>	"	"					DP	DP	DP	DG	DH	DH				ED	ED	ED	ED	EC	EC	EM		
0.68 µF	684	Ĵ	K	M	l					İ							DP	DP	DP	DG						EE	EE	EE	EE	ED	ED	EM		
0.82 µF	824	J	K	М													DP	_	DP	DG						EF	EF	EF	EF	ED	ED	EH		
1 μF	105	J	K	М						CG1	CG ¹	CG1	CD1				DP	DP	DP	DG	DG ¹	DG ¹				EP	EP	EP	EP	ED	ED	EH		
1.2 μF	125	J	K	М														DE								ED		ED						
1.5 µF	155	J	K	М														DG								ED	ED		EG					
1.8 µF	185	J	K	М														DG								ED		ED						
2.2 μF	225	J	K	M						CG1	CG1						DG	DG	DG	DG1						EH		EH1		EH	EH			
2.7 μF	275	Rate	K ed Volt	M tage	6.3	10	16	25	20	6.3	2	16	25	•	2	2	6.3	2	16	25	35	20	100	200	15	EN EN	EN EN	6 EN	25 H	35	20	100	200	<u>.</u>
0	Cap		(VDC)		-	-		-					_	50 ر	100	200	⊢	+	-	-	-		_	_	250	┢	_	_			-			250
Cap	Code		age C se Siz		9	8	0404	3	5	9	8	4	3	5	1	2	9	8	4	3	6	5	1	2	Α	9	8	4	3	6	5	1	2	Α
			Series	<u>s</u>			0402					Ü	0603	—							080	J.							<u> </u>	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)

KEMET reserves the right to substitute product with an improved temperature characteristic, tighter capacitance tolerance and/or higher voltage capability within the same form factor (configuration and dimensions).

^{**}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, M tolerance.

 xx^2 Available only in M tolerance.



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

			se S erie	ize/ es		CO	40:	2C				CO	60	3C						C	080	5C							C1	120	6C			
Cap	Cap	Volt	tage (Code	9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	6	5	1	2	Α	9	8	4	3	6	5	1	2	Α
Сир	Code		ed Vol		6.3	1	16	25	50	6.3	1	16	25	20	100	200	6.3	1	16	25	35	20	100	200	250	6.3	1	16	25	35	20	100	200	250
		Сар	Toler	ance				F	Prod	uct /	Avai	labil	ity a	nd C	hip	Thic	kne	ss C	ode	s – S	See T	Table	e 2 f	or Cl	hip 1	hick	nes	s Di	men	sion	s			
3.3 µF	335	J	K	М																						ED	ED	ED	EH					
3.9 µF	395	J	K	М													l									EF	EF	EF	EH					
4.7 μF	475	J	K	M													DG1	DG1	DG1							EH1	EH1	EH1	EH1	EH1	EH1			
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													DG1	DG ¹								EH	EH	EH	EH1					
22 μF	226	J	K	М																						EH1	EH1							
			ed Vol (VDC		6.3	10	16	25	50	6.3	10	16	25	20	100	200	6.3	10	16	25	35	20	100	200	250	6.3	10	16	25	35	20	100	200	250
Сар	Cap Code	Volt	tage (Code	9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	6	5	1	2	A	9	8	4	3	6	5	1	2	A
	Juc	ze/ s		C	0402	2C				C	0603	3C						С	080	5C							С	120	6C					

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

	Con		se Si Serie				C	C12	100	;			C1	80	8C		C1	181:	2C		(C18	250	C		C2	222	0C		(22	250	С
Cap	Cap	Vol	tage C	ode	9	8	4	3	5	1	2	A	5	1	2	3	5	1	2	A	5	1	2	Α	3	5	1	2	Α	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
		Сар	Tolera	ance				Pr	odu	t Av	aila	bilit	y an	d Ch	ip T	hickı	ness	Coc	les -	- Se	e Tal	ole 2	for	Chip	Thi	ckne	ess [Dime	nsio	ns			
10 - 91 pF*	100 - 910*	J	K	М	FB	FB	FB	FB	FB	FB	FB																						
11 pF	110	J	K	M	FB	FB	FB	FB	FB	FB	FB																			l			
12 pF	120	J	K	M	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	M	FB	FB	FB	FB	FB	FB	FB																						
16 pF	160	J	K	M	FB	FB	FB	FB	FB	FB	FB																						
18 pF	180	J	K	M	FB	FB	FB	FB	FB	FB	FB																						
20 pF	200	J	K	M	FB	FB	FB	FB	FB	FB	FB																			l			
22 pF	220	J	K	M	FB	FB	FB	FB	FB	FB	FB																			l			
24 pF	240	J	K	М	FB	FB	FB	FB	FB	FB	FB																			l			
27 pF	270	J	K	М	FB	FB	FB	FB	FB	FB	FB																			İ			
30 pF	300	J	K	М	FB	FB	FB	FB	FB	FB	FB										l									İ			
33 pF	330	J	K	М	FB	FB	FB	FB	FB	FB	FB										l									İ			
36 pF	360	J	K	М	FB	FB	FB	FB	FB	FB	FB										l				l					İ			
39 pF	390	J	K	М	FB	FB	FB	FB	FB	FB	FB		İ			l					İ				İ					İ			
43 pF	430	J	K	М	FB	FB	FB	FB	FB	FB	FB																						
47 pF	470	J	K	М	FB	FB	FB	FB	FB	FB	FB										l									İ			
51 pF	510	J	K	М	FB	FB	FB	FB	FB	FB	FB										l									İ			
56 pF	560	J	K	М	FB	FB	FB	FB	FB	FB	FB										l									İ			
		Rat	ed Volt (VDC)		6.3	2	16	25	20	100	200	250	20	100	200	25	20	92	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	A	5	1	2	A	3	5	1	2	Α	5	1	2	A
	Joue		Case Size/ Series					C12	10C				С	1808	3C		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)

KEMET reserves the right to substitute product with an improved temperature characteristic, tighter capacitance tolerance and/or higher voltage capability within the same form factor (configuration and dimensions).

^{**}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, M tolerance.

xx² Available only in M tolerance.



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

KEMET reserves the right to substitute product with an improved temperature characteristic, tighter capacitance tolerance and/or higher voltage capability within the same form factor (configuration and dimensions).

 xx^1 Available only in K, M tolerance.

 xx^2 Available only in M tolerance.

^{*}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)



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

	000		se Si Serie				(212	100	;			C1	808	BC		C1	812	2C		(C18	250)		C2	22	0C		(22	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		ed Vol (VDC)		6.3	10	16	25	20	100	200	250	20	100	200	25	20	100	200	250	20	100	200	250	22	20	100	200	250	20	100	200	250
		Cap	Tolera	ance										d Ch	ip T	nickı						_			Thi		_	_			_	_	
0.12 μF 0.15 μF	124 154	J J	K	M M	FB FC	FB FC	FB FC		FB FC			FH FM				GB GB		GB GB			НВ		HB HB		JC	JC JC	JC	JC	JC JC		KC KC		KC KC
0.13 μF	184	J	K	M	FC		FC	FC		FD		FK				GB		GB					НВ		JC	JC	JC	JC	JC		KC		KC
0.22 μF	224	J	K	М	FC		FC	FC		FD	FK	FK				GB	GB	GB		GG			НВ		JC	JC	JC			KC	KC		KC
0.27 μF 0.33 μF	274 334	J	K	M M	FC FD		FC FD	FC FD	FC FD	FD FD						GB GB	GB GB	GG GG		GG		HB	HB HB	HB	JC	JC JC	JC	JC	JC	KB KB	KC KC		KC KC
0.39 μF	394	J	K	М	FD	FD	FD	FD	FD	FD						GB	GB	GG	GG	GG	НВ	НВ	HD	HD	JC	JC	JC	JC	JC	KB	KC	KC	KC
0.47 μF 0.56 μF	474 564	J	K	M M	FD FD	FD FD	FD FD	FD FD	FD FD	FD FF						GB GC	GB	GG GG	GJ	GJ		HB HD		HD HD	JC JC	JC	JC	JC JD	JC JD	KB KB	KC KC	KD KD	KD KD
0.56 μF 0.68 μF	684	J	K	M	FD		FD			FG						GC	GC	66			пв	חח	пи	пи	JU	JU	JU	JU	JU	ND	N.C	Kυ	עט
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^{*}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)

KEMET reserves the right to substitute product with an improved temperature characteristic, tighter capacitance tolerance and/or higher voltage capability within the same form factor (configuration and dimensions).

^{**}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, M tolerance.

xx² Available only in M tolerance.



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

BB	Table 2A	<u> </u>	······································	pe a nee.	- uokuginig	quantities	
BB	Thickness	Case	Thickness ±	Paper Q	uantity ¹	Plastic (Quantity
CF 0603 0.80±0.07* 4,000 15,000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Code	Size ¹	Range (mm)	7" Reel	13" Reel	7" Reel	13" Reel
CG 0603 0.80±0.10* 4,000 15,000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						0	0
CD 0603 0.80±0.15 4,000 10,000 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
CJ 0603 0.80±0.15* 4.000 15,000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							-
DM 0805 0.70±0.20* 4.000 15,000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
DN DN DN DN DN DN DN DN							
DO							
DP 0805					15,000		
DE 0805 1.00±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 4,000 10,000 4,000 10,000 EC 1206 0.90±0.10 0 0 4,000 10,000 ED 1206 1.00±0.10 0 0 4,000 10,000 EE 1206 1.00±0.10 0 0 0 2,500 10,000 EE 1206 1.00±0.10 0 0 0 2,500 10,000 EE 1206 1.20±0.15 0 0 0 2,500 10,000 EF 1206 1.20±0.20 0 0 0 2,500 10,000 EF 1206 1.20±0.20 0 0 0 2,500 10,000 EM 1206 1.20±0.15 0 0 0 2,500 10,000 EF 1206 1.20±0.20 0 0 0 2,500 10,000 EF 1206 1.60±0.20 0 0 0 2,500 10,000 EH 1206 1.60±0.20 0 0 0 2,000 8,000 FB 1210 0.78±0.10 0 0 0 4,000 10,000 FC 1210 0.90±0.10 0 0 4,000 10,000 FF 1210 1.00±0.10 0 0 0 4,000 10,000 FF 1210 1.00±0.10 0 0 0 2,500 10,000 FF 1210 1.00±0.10 0 0 0 2,500 10,000 FF 1210 1.00±0.10 0 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 0 2,500 10,000 FF 1210 1.00±0.10 0 0 0 4,000 10,000 FF 1210 1.55±0.15 0 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 0 2,000 8,000 FF 1210 1.00±0.15 0 0 0 2,000 8,000 FF 1210 1.00±0.15 0 0 0 2,000 8,000 FF 1210 1.00±0.15 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
DG							
DH							
EB							
EC 1206 0.99±0.10 0 0 4,000 10,000 ED 1206 1.00±0.10 0 0 4,000 10,000 ED 1206 1.00±0.10 0 0 0 2,500 10,000 EE 1206 1.20±0.15 0 0 2,500 10,000 EF 1206 1.20±0.15 0 0 2,500 10,000 EM 1206 1.20±0.15 0 0 2,500 10,000 EM 1206 1.20±0.15 0 0 2,500 10,000 EM 1206 1.20±0.15 0 0 2,500 10,000 EM 1206 1.25±0.15 0 0 2,500 10,000 EM 1206 1.60±0.15 0 0 2,000 8,000 EM 1206 1.60±0.15 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 FF 1210 0.95±0.10 0 0 4,000 10,000 FF 1210 0.95±0.10 0 0 4,000 10,000 FF 1210 0.95±0.10 0 0 0 4,000 10,000 FF 1210 1.00±0.10 0 0 2,500 10,000 FF 1210 1.00±0.10 0 0 2,500 10,000 FF 1210 1.25±0.15 0 0 2,500 10,000 FF 1210 1.25±0.15 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 2,000 8,000 FM 1210 1.55±0.15 0 0 2,000 8,000 FM 1210 1.55±0.15 0 0 2,000 8,000 FM 1210 1.55±0.15 0 0 2,000 8,000 FM 1210 1.55±0.15 0 0 2,000 8,000 FM 1210 1.55±0.15 0 0 2,000 8,000 FM 1210 1.55±0.15 0 0 2,000 8,000 FM 1210 1.50±0.20 0 0 2,000 8,000 FM 1210 1.50±0.20 0 0 2,000 8,000 FM 1210 1.50±0.20 0 0 2,000 8,000 FM 1210 1.50±0.20 0 0 2,000 8,000 FM 1210 1.50±0.20 0 0 2,000 8,000 FM 1210 1.50±0.20 0 0 2,000 8,000 FM 1210 1.50±0.15 0 0 2,500 10,000 FM 1210 1.50±0.15 0 0 2,500 10,000 FM 1210 1.50±0.15 0 0 2,500 10,000 FM 1210 1.50±0.15 0 0 2,500 10,000 FM 1210 1.50±0.15 0 0 0 2,500 10,000 FM 1210 1.50±0.15 0 0 0 2,500 10,000 FM 1210 1.50±0.15 0 0 0 2,500 10,000 FM 1210 1.50±0.15 0 0 0 0 0 0 0 0 0 0 0,000 FM 1210 1.50±0.15 0 0 0 0 0 0 0 0,000 0 0 0 0,000 FM 1210 1.50±0.15 0 0 0 0 0 0 0 0 0,000 FM 1210 1.50±0.15 0 0 0 0 0 0 0 0,000 0 0 0 0,000 0 0 0							
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 EM 120±0.15 0 0 0 2,500 10,000 EM 1206 1.25±0.15 0 0 0 2,500 10,000 EM 1206 1.60±0.15 0 0 0 2,500 10,000 EM 1206 1.60±0.15 0 0 0 2,000 8,000 FB 1210 0.78±0.10 0 0 0 4,000 10,000 FC 1210 0.90±0.10 0 0 4,000 10,000 FC 1210 0.90±0.10 0 0 4,000 10,000 FF 1210 0.95±0.10 0 0 0 2,500 10,000 FF 1210 0.95±0.10 0 0 0 2,500 10,000 FF 1210 1.00±0.10 0 0 2,500 10,000 FF 1210 1.00±0.10 0 0 2,500 10,000 FF 1210 1.00±0.15 0 0 2,500 10,000 FF 1210 1.00±0.15 0 0 2,500 10,000 FF 1210 1.00±0.15 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 2,000 8,000 FM 1210 1.55±0.15 0 0 2,000 8,000 FM 1210 1.85±0.20 0 0 2,000 8,000 FM 1210 1.90±0.20 0 0 2,000 8,000 FM 1210 1.90±0.20 0 0 2,000 8,000 FM 1210 1.90±0.20 0 0 2,000 8,000 FS 1210 1.90±0.20 0 0 2,000 8,000 FS 1210 2.50±0.30 0 0 1,000 4,000 FS 1210 2.50±0.30 0 0 1,000 4,000 FS 1210 2.50±0.30 0 0 1,000 4,000 FS 1210 2.50±0.30 0 0 1,000 4,000 EF 1210 1.00±0.15 0 0 2,500 10,000 FS 1210 2.50±0.30 0 0 1,000 4,000 HC 1706 1.00±0.15 0 0 4,000 10,000 LD 1808 0.90±0.10 0 0 2,500 10,000 GB 1812 1.00±0.15 0 0 0 1,000 4,000 GG 1812 1.00±0.15 0 0 1,000 4,000 GG 1812 1.55±0.15 0 0 0 1,000 4,000 GG 1812 1.50±0.20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	EC	1206	0.90±0.10				10,000
EE 1206 1.10±0.15 0 0 2,500 10,000 EF 1206 1.20±0.15 0 0 0 2,500 10,000 EM 1206 1.20±0.15 0 0 0 2,500 10,000 EM 1206 1.25±0.15 0 0 0 2,500 10,000 EM 1206 1.25±0.15 0 0 0 2,500 10,000 EM 1206 1.60±0.20 0 0 0 2,000 8,000 EH 1206 1.60±0.20 0 0 0 2,000 8,000 EH 1206 0.78±0.10 0 0 0 4,000 10,000 FB 1210 0.78±0.10 0 0 0 4,000 10,000 FC 1210 0.95±0.10 0 0 0 4,000 10,000 FD 1210 0.95±0.10 0 0 0 4,000 10,000 FF 1210 1.10±0.10 0 0 0 2,500 10,000 FF 1210 1.10±0.10 0 0 0 2,500 10,000 FF 1210 1.25±0.15 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 2,000 8,000 FH 1210 1.55±0.15 0 0 2,000 8,000 FH 1210 1.55±0.15 0 0 2,000 8,000 FJ 1210 1.85±0.20 0 0 2,000 8,000 FJ 1210 1.90±0.20 0 0 2,000 8,000 FK 1210 1.90±0.20 0 0 2,000 8,000 FK 1210 1.90±0.20 0 0 0 2,000 8,000 FK 1210 1.90±0.20 0 0 0 2,000 8,000 FK 1210 2.50±0.30 0 0 0,000 FS 1210 2.50±0.30 0 0 0 2,000 8,000 FS 1210 2.50±0.30 0 0 0 2,000 8,000 FS 1210 2.50±0.30 0 0 0 2,000 8,000 FS 1210 2.50±0.30 0 0 0 2,000 8,000 FS 1210 2.50±0.30 0 0 0 2,000 8,000 FS 1210 2.50±0.30 0 0 0 2,000 8,000 FS 1210 2.50±0.30 0 0 0 2,000 8,000 FS 1210 2.50±0.30 0 0 0 2,000 8,000 FS 1210 2.50±0.30 0 0 0 1,000 4,000 FS 1210 2.50±0.15 0 0 0 2,5500 10,000 FS 1210 2.50±0.30 0 0 0 1,000 4,000 FS 1210 2.50±0.15 0 0 0 2,5500 10,000 FS 1210 2.50±0.15 0 0 0 0 0 2,5500 10,000 FS 1210 2.50±0.15 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	EN		0.95±0.10	0	0		10,000
EF 1206 1.20±0.15 0 0 2,500 10,000 EP 1206 1.20±0.20 0 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 EG 1206 1.60±0.20 0 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 FF 1210 0.90±0.10 0 0 4,000 10,000 FF 1210 1.00±0.10 0 0 2,500 10,000 FF 1210 1.00±0.10 0 0 2,500 10,000 FF 1210 1.00±0.10 0 0 2,500 10,000 FF 1210 1.25±0.15 0 0 2,500 10,000 FF 1210 1.55±0.15 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 2,000 8,000 FF 1210 1.55±0.15 0 0 2,000 8,000 FF 1210 1.55±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 2.50±0.30 0 0 1,000 4,000 10,000 FF 1210 1.90±0.20 0 0 2,000 8,000 FF 1210 1.90±0.20 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 10,000 FF 1210 1.90±0.20 0 0 0 2,500 10,000 10,							10,000
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GO 1812 2.50±0.20 0 0 500 2,000 HB 1825 1.10±0.15 0 0 1,000 4,000 Thickness ± Code Thickness ± Sizel 7" Reel 13" Reel 7" Reel 13" Reel							
HB 1825 1.10±0.15 0 0 1,000 4,000 Thickness ± Case Size! Thickness ± Pange (mm) 7" Reel 13" Reel 7" Reel 13" Reel							
Thickness Case Thickness ± 7" Reel 13" Reel 7" Reel 13" Reel							
Code Size ¹ Range (mm) Paper Quantity1 Plastic Quantity	Thickness	Case	Thickness ±	7" Reel	13" Reel		13" Reel
11. 4				Paper Q	uantity1	Plastic (Quantity

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
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	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 Typo	Loose Packaging				
Packayi	ng Type	Bulk Bag	(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

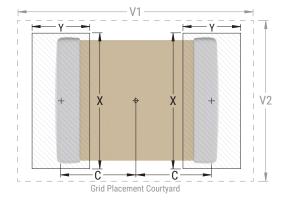
EIA Size Code	Metric Size Code	ı	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)			Density Level C: Minimum (Least) Land Protrusion (mm)					
		С	Y	X	V 1	V2	С	Y	X	V1	V2	С	Y	X	V1	V2
0402	1005	0.50	0.72	0.72	2.20	1.20	0.45	0.62	0.62	1.90	1.00	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.

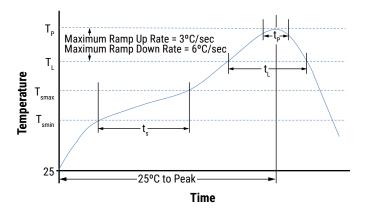


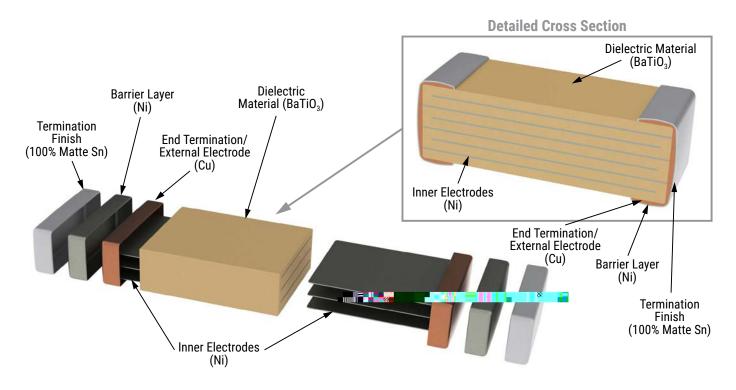


Table 4 - Performance & Reliability: Test Methods and Conditions

Reference		Test or Inspection Me	ethod				
JIS-C-6429	Appendix 1, Note: Force of 1.8 kg for 60 seconds.						
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	is:					
L 0TD 000	a) Method B, 4 hours at	155°C, dry heat at 235°C					
J-21D-002	b) Method B at 215°C ca	ntegory 3					
	c) Method D, category 3	at 260°C					
JESD22 Method JA-104	1,000 Cycles (-55°C to +125°C	C). Measurement at 24 hou	rs +/- 4 hours after tes	t conclusion.			
MIL-STD-202 Method 103	Measurement at 24 hours +/- Low Volt Humidity: 1,000 hou	4 hours after test conclus rs 85°C/85% RH and 1.5 V.	ion. Add 100 K ohm resisto				
MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a a	nd 7b not required.					
MIL-STD-202 Method 107	-55°C/+125°C. Note: Number seconds.	of cycles required – 300. I		- 20			
	1,000 hours at 125°C with 2 X	rated voltage applied excl	uding the following:				
MIL-STD-202 Method	Case Size	Capacit	C	p t			
108 /EIA-198							
	JIS-C-6429 JIS-C-6429 J-STD-002 JESD22 Method JA-104 MIL-STD-202 Method 103 MIL-STD-202 Method 107 MIL-STD-202 Method 107	JIS-C-6429 Appendix 1, Note: Force of 1.8 Appendix 2, Note: Standard to COG. Flexible termination sys Magnification 50 X. Condition a) Method B, 4 hours at b) Method B at 215°C cac c) Method D, category 3 JESD22 Method JA-104 MIL-STD-202 Method 103 MIL-STD-202 Method 106 MIL-STD-202 Method 107 MIL-STD-202 Method 107 MIL-STD-202 Method 107 MIL-STD-202 Method 107 MIL-STD-202 Method 107 MIL-STD-202 Method 107 MIL-STD-202 Method 107 MIL-STD-202 Method 108 Case Size	Appendix 1, Note: Force of 1.8 kg for 60 seconds. Appendix 2, Note: Standard termination system – 2.0 mm (COG. Flexible termination system – 3.0 mm (minimum). Magnification 50 X. Conditions: a) Method B, 4 hours at 155°C, dry heat at 235°C b) Method B at 215°C category 3 c) Method D, category 3 at 260°C JESD22 Method JA–104 I,000 Cycles (-55°C to +125°C). Measurement at 24 hour Measurement at 24 hours +/- 4 hours after test conclus Low Volt Humidity: 1,000 hours 85°C/85% RH and rated volt Measurement at 24 hours +/- 4 hours after test conclus to 24 hours/cycle. Steps 7a and 7b not required. Measurement at 24 hours +/- 4 hours after test conclus to 24 hours/cycle. Steps 7a and 7b not required. Measurement at 24 hours +/- 4 hours after test conclus to 24 hours +/- 4 hours after test conclus to 25°C/+125°C. Note: Number of cycles required – 300. I seconds. Dwell time – 15 minutes. Air – Air. 1,000 hours at 125°C with 2 X rated voltage applied excl	Appendix 1, Note: Force of 1.8 kg for 60 seconds. Appendix 2, Note: Standard termination system – 2.0 mm (minimum) for all exc COG. Flexible termination system – 3.0 mm (minimum). Magnification 50 X. Conditions: a) Method B, 4 hours at 155°C, dry heat at 235°C b) Method B at 215°C category 3 c) Method D, category 3 at 260°C JESD22 Method JA–104 1,000 Cycles (-55°C to +125°C). Measurement at 24 hours +/- 4 hours after test 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 resisto Measurement at 24 hours +/- 4 hours after test conclusion. MIL–STD–202 Method 106 MIL–STD–202 Method 107 MIL–STD–202 Method 107 MIL–STD–202 Method 107 MIL–STD–202 Method 107 MIL–STD–202 Method 107 MIL–STD–202 Method 107 MIL–STD–202 Method 107 Case Size Capacit C			



Construction (Typical)





Capacitor Marking (Optional):

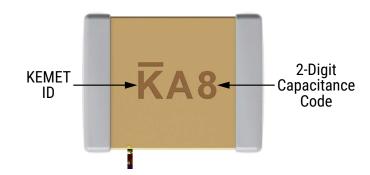
These surface mount multilayer ceramic capacitors are normally supplied unmarked. If required, they can be marked as an extra cost option. Marking is available on most KEMET devices but must be requested using the correct ordering code identifier(s). If this option is requested, two sides of the ceramic 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.

•	X/R dielectric products in capacitance values outline	!C
	below	

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 µF. Orientation of marking is vendor optional.



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



Capacitor Marking (Optional) cont'd

	Capacitance (pF) For Various Alpha/Numeral Identifiers									
Alpho		Numeral								
Alpha Character	9	0	1	2	3	4	5	6	7	8
Cildiacter					Capa	citance	e (pF)			
Α	0.1	10	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	12	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	18	18	180	1,800	18,000	180,000	1,800,000	18,000,000	180,000,000
Н	0.2	2 0	20	200	2,000	20,000	200,000	2,000,000	20,000,000	200,000,000
J	0.22	22	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	0.3	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
T	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
a	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	0.4	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	0.5	5 0	50	500	5,000	50,000	500,000	5,000,000	50,000,000	500,000,000
m	0.6	6 0	60	600	6,000	60,000	600,000	6,000,000	60,000,000	600,000,000
n	0.7	7 0	70	700	7,000	70,000	700,000	7,000,000	70,000,000	700,000,000
t	0.8	8 0	80	800	8,000	80,000	800,000	8,000,000	80,000,000	800,000,000
у	0.9	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.

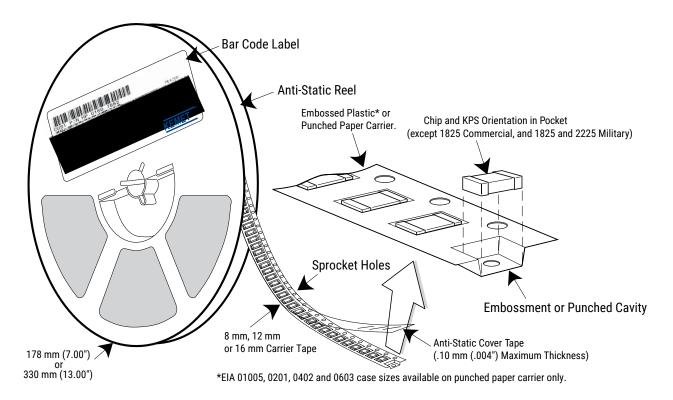


Table 5 - Carrier Tape Configuration, Embossed Plastic & Punched Paper (mm)

	Tape	Tape Embossed Plastic			d 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 & 2220	16	12	12		
Array 0508 & 0612	8	4	4		

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

New 2 mm Pitch Reel Options*

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

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

Benefits of Changing from 4 mm to 2 mm Pitching Spacing

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

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



Figure 1 – Embossed (Plastic) Carrier Tape Dimensions



Figure 2 - Punched (Paper) Carrier Tape Dimensions

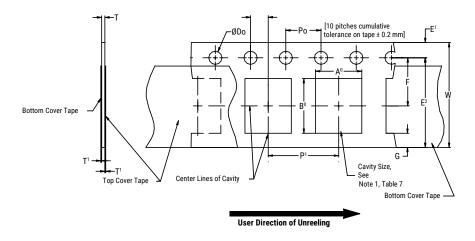


Table 7 - Punched (Paper) Carrier Tape Dimensions

Metric will govern

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

- 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

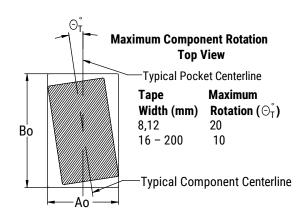
- 1. Cover Tape Break Force: 1.0 Kg minimum.
- 2. Cover Tape Peel Strength: The total peel strength of the cover tape from the carrier tape shall be:

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



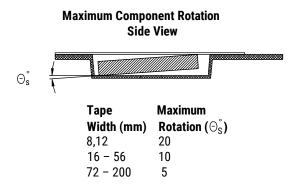


Figure 4 - Maximum Lateral Movement

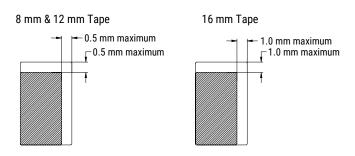


Figure 5 - Bending Radius

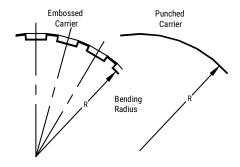




Figure 6 – Reel Dimensions



Figure 7 - Tape Leader & Trailer Dimensions

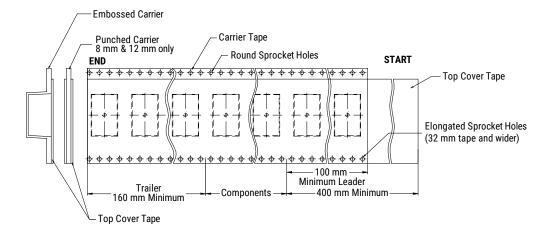
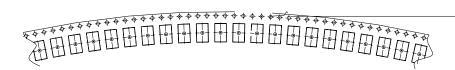


Figure 8 - Maximum Camber





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