

Multilayer ceramic capacitors are available in a variety of physical sizes and configurations, including leaded devices and surface mounted chips. Leaded styles include molded and conformally coated parts with axial and radial leads. However, the basic capacitor element is similar for all styles. It is called a chip and consists of formulated dielectric materials which have been cast into thin layers, interspersed with metal electrodes alternately exposed on opposite

edges of the laminated structure. The entire structure is fired at high temperature to produce a monolithic block which provides high capacitance values in a small physical volume. After firing, conductive terminations are applied to opposite ends of the chip to make contact with the exposed electrodes. Termination materials and methods vary depending on the intended use.

### TEMPERATURE CHARACTERISTICS

Ceramic dielectric materials can be formulated with a wide range of characteristics. The EIA standard for ceramic dielectric capacitors (RS-198) divides ceramic dielectrics into the following classes:

**Class I:** Temperature compensating capacitors, suitable for resonant circuit application or other applications where high Q and stability of capacitance characteristics are required. Class I capacitors have predictable temperature coefficients and are not affected by voltage, frequency or time. They are made from materials which are not ferro-electric, yielding superior stability but low volumetric efficiency. Class I capacitors are the most stable type available, but have the lowest volumetric efficiency.

**Class II:** Stable capacitors, suitable for bypass or coupling applications or frequency discriminating circuits where Q and stability of capacitance characteristics are not of a major importance. Class II capacitors have temperature characteristics of  $\pm 15\%$  or less. They are made from materials which are ferro-electric, yielding higher volumetric efficiency but less stability. Class II capacitors are affected by temperature, voltage, frequency and time.

**Class III:** General purpose capacitors, suitable for by-pass coupling or other applications in which dielectric losses, high insulation resistance and stability of capacitance characteristics are of little or no importance. Class III capacitors are similar to Class II capacitors except for temperature characteristics, which are greater than  $\pm 15\%$ . Class III capacitors have the highest volumetric efficiency and poorest stability of any type.

KEMET leaded ceramic capacitors are offered in the three most popular temperature characteristics:

**C0G:** Class I, with a temperature coefficient of  $0 \pm 30$  ppm per degree C over an operating temperature range of  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$  (Also known as "NP0").

**X7R:** Class II, with a maximum capacitance change of  $\pm 15\%$  over an operating temperature range of  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$ .

**Z5U:** Class III, with a maximum capacitance change of  $+22\% - 56\%$  over an operating temperature range of  $+10^\circ\text{C}$  to  $+85^\circ\text{C}$ .

Specified electrical limits for these three temperature characteristics are shown in Table 1.

### SPECIFIED ELECTRICAL LIMITS

PARAMETER	TEMPERATURE CHARACTERISTICS		
	C0G	X7R	Z5U
Dissipation Factor: Measured at following conditions: C0G — 1 kHz and 1 vrms if capacitance > 1000 pF 1 MHz and 1 vrms if capacitance $\leq$ 1000 pF X7R — 1 kHz and 1 vrms* Z5U — 1 kHz and 0.5 vrms	0.15%	2.5%	4.0%
Dielectric Strength: 2.5 times rated DC voltage.	Pass Subsequent IR Test		
Insulation Resistance (IR): At rated DC voltage, whichever of the two is smaller	1,000 M $\Omega$ - $\mu$ F or 100 G $\Omega$	1,000 M $\Omega$ - $\mu$ F or 100 G $\Omega$	1,000 M $\Omega$ - $\mu$ F or 10 G $\Omega$
Temperature Characteristics: Range, $^\circ\text{C}$ Capacitance Change without DC voltage	-55 to 125 $0 \pm 30$ ppm/ $^\circ\text{C}$	-55 to 125 $\pm 15\%$	+10 to 85 $+22\%, -56\%$

\* 1 MHz and 1 vrms if capacitance  $\leq$  100 pF on military product.

Table 1

## GENERAL

### Working Voltage:

C0G – 50, 100 & 200 Volts  
X7R – 50, 100 & 200 Volts

### Temperature Characteristics:

C0G – 0 ±30 PPM/°C from -55°C to +125°C  
X7R – ±15% from -55°C to +125°C

### Capacitance Tolerance:

C0G – ±0.5 pF, ±1%, ±2%, ±5%, ±10%, ±20%  
(±0.5 pF is tightest available tolerance)  
X7R – ±10%, ±20%, -0 +100%, -20% +80%

### Construction:

Monolithic block of ceramic dielectric with interdigitated internal electrodes, encapsulated in a molded case, and having axial or radial leads. Meets flame test requirements of UL Standard 94V-0.

### Terminal Strength:

EIA-RS-198D Method 303 Condition A (2.2 kg)

## ELECTRICAL

### Capacitance:

Within specified tolerance when measured with 1 volt rms at 1 kHz (1000 pF or less at 1 MHz for C0G).

### Dissipation Factor:

25°C at 1 kHz (1000 pF or less at 1 MHz for C0G).  
C0G – .15% maximum  
X7R – 2.5% maximum

### Insulation Resistance:

After 2 minutes electrification at 25°C and rated voltage  
C0G – 100K megohms or 1000 megohm - μF, whichever is less.  
X7R – 100K megohms or 1000 megohm - μF, whichever is less.

### Dielectric Withstanding Voltage:

250% of rated voltage for 5 seconds with current limited to 50 mA at 25°C.

### Life Test:

2000 hours at 200% of rated voltage at 125°C. Post-Test limits at 25°C are:

#### Capacitance Change:

C0G – less than 3% or 0.25 pF, whichever is higher  
X7R – ±20% of initial value

#### Dissipation Factor:

C0G – .25% maximum  
X7R – 3.0% maximum

### Insulation Resistance:

C0G – 10K megohms or 100 megohm - μF, whichever is less  
X7R – 10K megohms or 100 megohm - μF, whichever is less

### Dielectric Withstanding Voltage:

250% of rated voltage for 5 seconds with current limited to 50 mA.

## ENVIRONMENTAL

### Moisture Resistance:

MIL-STD-202, Method 106, or EIA-RS-198D, Method 204, Condition A, except 20 cycles.

### Insulation Resistance:

C0G – 10K megohms or 100 megohm - μF, whichever is less  
X7R – 10K megohms or 100 megohm - μF, whichever is less

### Dielectric Withstanding Voltage:

250% of rated voltage for 5 seconds with current limited to 50 mA.

### Immersion Cycling:

MIL-STD-202, Method 104, Condition B. Post-Test limits at 25°C are:

### Insulation Resistance:

C0G – 10K megohms or 100 megohm - μF, whichever is less  
X7R – 10K megohms or 100 megohm - μF, whichever is less

### Solderability:

MIL-STD-202, Method 208, Sn62 solder, 245°C for 5 ±1/2 seconds.

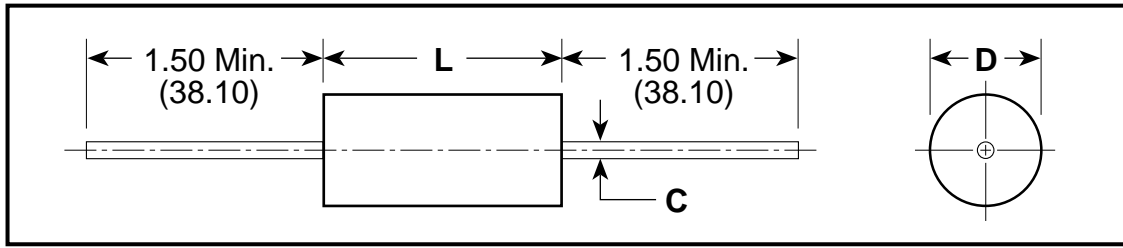
### Resistance to Soldering Heat:

MIL-STD-202, Method 210, Condition B (260°C, 10 secs).  
Depth of immersion — to a minimum of .050" from the capacitor body.

### Lead Material:

Axial: Solder-coated copper clad steel  
Radial: Solder-coated copper

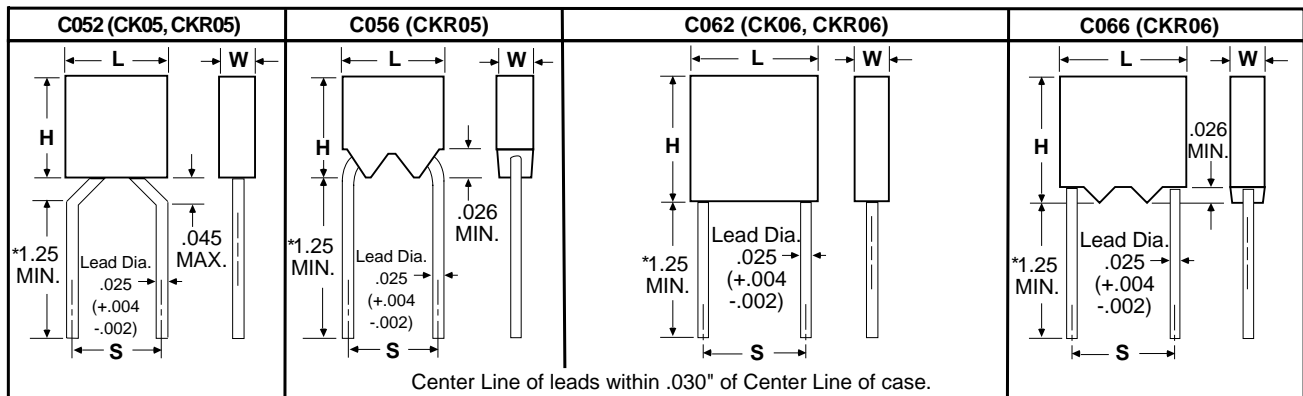
**CAPACITOR OUTLINE DRAWINGS (AXIAL LEADS)**



**DIMENSIONS — INCHES & (MILLIMETERS)**

CASE SIZE	MILITARY EQUIVALENT STYLES	L	D	C
C114	CK12, CKR11	.160 ± .010 (4.06 ± .25)	.090 ± .010 (2.29 ± .25)	.020, +.000, -.003 (.51, +.00, -.08)
C124	CK13, CKR12	.250 ± .010 (6.35 ± .25)	.090 ± .010 (2.29 ± .25)	.020, +.000, -.003 (.51, +.00, -.08)
C192	CK14, CKR14	.390 ± .010 (9.91 ± .25)	.140 ± .010 (3.56 ± .25)	.025, +.002, -.002 (.64, +.05, -.05)
C202	CK15, CKR15	.500 ± .020 (12.70 ± .51)	.250 ± .015 (6.35 ± .38)	.025, +.002, -.002 (.64, +.05, -.05)
C222	CK16, CKR16	.690 ± .030 (17.53 ± .76)	.350 ± .020 (8.89 ± .51)	.025, +.002, -.002 (.64, +.05, -.05)

**CAPACITOR OUTLINE DRAWINGS (RADIAL LEADS)**

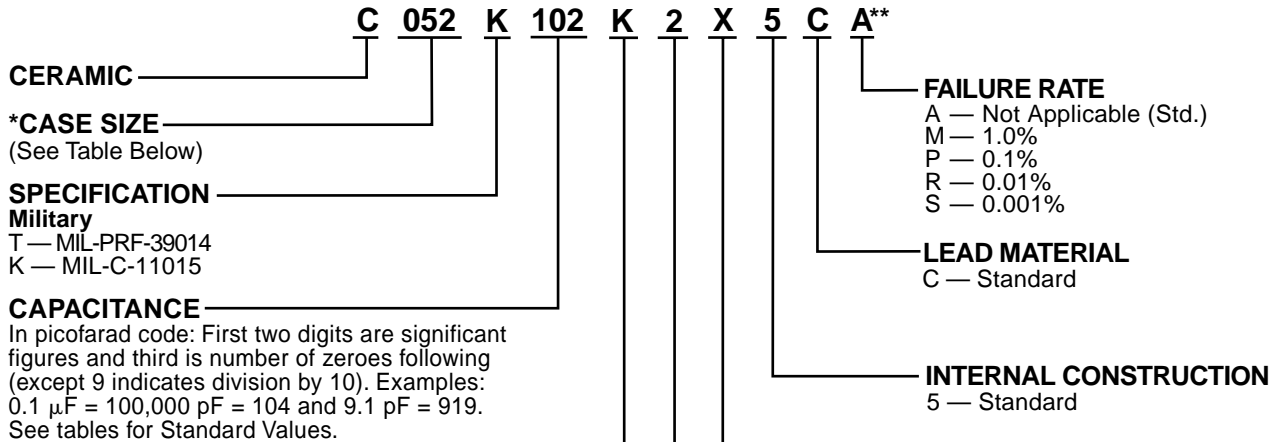


\* Leads are .625 minimum when tape and reel packaged.

**DIMENSIONS — INCHES & (MILLIMETERS)**

CASE SIZE	MILITARY EQUIVALENT STYLES	H HEIGHT	L LENGTH	W WIDTH	S LEAD SPACING
C052/ C056	CK05, CKR05	.190 ± .010 (4.83 ± .25)	.190 ± .010 (4.83 ± .25)	.090 ± .010 (2.29 ± .25)	.200 ± .015 (5.08 ± .38)
C062/ C066	CK06, CKR06	.290 ± .010 (7.37 ± .25)	.290 ± .010 (7.37 ± .25)	.090 ± .010 (2.29 ± .25)	.200 ± .015 (5.08 ± .38)

**ORDERING INFORMATION**



TEMPERATURE CHARACTERISTIC					
KEMET Designator	Military Equivalent	EIA Equivalent	Capacitance Change With Temp.		
			Temp. Range, °C	Measured Without DC Bias Voltage	Measured With Bias (Rated Voltage)
X (Stable)	BX	X7R	-55 to +125	$\pm$ 15%	+15% -25%
R (Stable)	BR	X7R	-55 to +125	$\pm$ 15%	+15% -40%

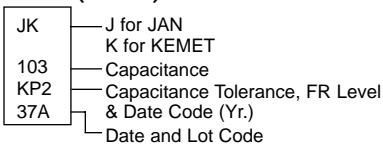
*CASE SIZES	
RADIAL	AXIAL
C052	C114
C056	C124
C062	C192
C066	C202
	C222

**\*\*Part Number Example: C052K102K2X5CA (14 digits – no spaces)**

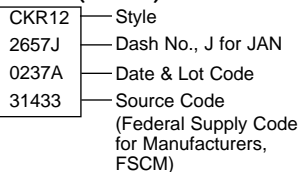
**MARKING INFORMATION**

**C114T (CKR11) THROUGH C222T (CKR16) PER MIL-PRF-39014**

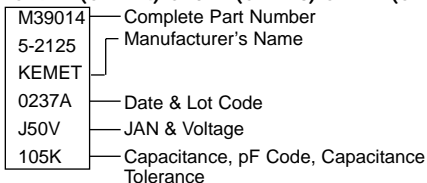
**C114T (CKR11)**



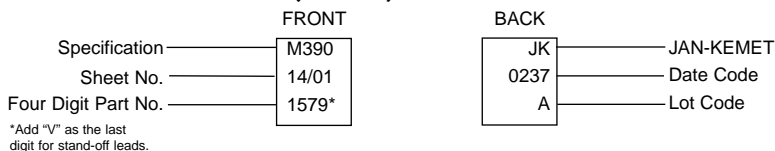
**C124T (CKR12)**



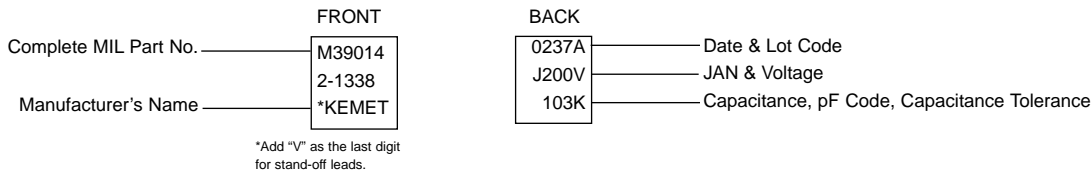
**C192T (CKR14) C202T (CKR15) C222T (CKR16)**



**C052/56T (CKR05) PER MIL-PRF-39014/01**

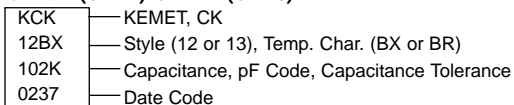


**C062/66T (CKR06) PER MIL-PRF-39014/02**

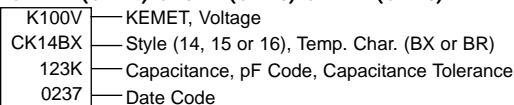


**C114K (CK12) THROUGH C222K (CK16) PER MIL-C-11015**

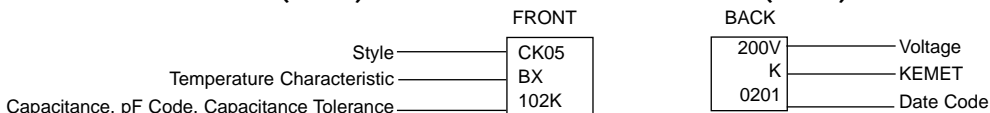
**C114K (CK12) C124K (CK13)**



**C192K (CK14) C202K (CK15) C222K (CK16)**



**C052K (CK05) PER MIL-C-11015/18 & C062K (CK06) PER MIL-C-11015/19**



MIL-C-11015  
MIL-PRF-39014



# CERAMIC MOLDED/AXIAL — MIL-C-11015 & MIL-PRF-39014

## STABLE TEMPERATURE CHARACTERISTICS—BX & BR (EIA-X7R)

### RATINGS & PART NUMBER REFERENCE

CAP. pF	TOL. %	KEMET PART NUMBER	MIL-C-11015/20	MIL-PRF-39014/05	MIL-PRF-39014/05 For Failure Rate Levels (2)			
					M	P	R	S
<b>100 VOLT — C114 SIZE (MILITARY—CK12 or CKR11)</b>								
10	10	C114(1)100K1X5C(2)	CK12BX100K	CKR11BX100K(2)	2601	2801	2001	2201
10	20	C114(1)100M1X5C(2)	CK12BX100M	CKR11BX100M(2)	2602	2802	2002	2202
12	10	C114(1)120K1X5C(2)	CK12BX120K	CKR11BX120K(2)	2603	2803	2003	2203
15	10	C114(1)150K1X5C(2)	CK12BX150K	CKR11BX150K(2)	2604	2804	2004	2204
15	20	C114(1)150M1X5C(2)	CK12BX150M	CKR11BX150M(2)	2605	2805	2005	2205
18	10	C114(1)180K1X5C(2)	CK12BX180K	CKR11BX180K(2)	2606	2806	2006	2206
22	10	C114(1)220K1X5C(2)	CK12BX220K	CKR11BX220K(2)	2607	2807	2007	2207
22	20	C114(1)220M1X5C(2)	CK12BX220M	CKR11BX220M(2)	2608	2808	2008	2208
27	10	C114(1)270K1X5C(2)	CK12BX270K	CKR11BX270K(2)	2609	2809	2009	2209
33	10	C114(1)330K1X5C(2)	CK12BX330K	CKR11BX330K(2)	2610	2810	2010	2210
33	20	C114(1)330M1X5C(2)	CK12BX330M	CKR11BX330M(2)	2611	2811	2011	2211
39	10	C114(1)390K1X5C(2)	CK12BX390K	CKR11BX390K(2)	2612	2812	2012	2212
47	10	C114(1)470K1X5C(2)	CK12BX470K	CKR11BX470K(2)	2613	2813	2013	2213
47	20	C114(1)470M1X5C(2)	CK12BX470M	CKR11BX470M(2)	2614	2814	2014	2214
56	10	C114(1)560K1X5C(2)	CK12BX560K	CKR11BX560K(2)	2615	2815	2015	2215
68	10	C114(1)680K1X5C(2)	CK12BX680K	CKR11BX680K(2)	2616	2816	2016	2216
68	20	C114(1)680M1X5C(2)	CK12BX680M	CKR11BX680M(2)	2617	2817	2017	2217
82	10	C114(1)820K1X5C(2)	CK12BX820K	CKR11BX820K(2)	2618	2818	2018	2218
100	10	C114(1)101K1X5C(2)	CK12BX101K	CKR11BX101K(2)	2619	2819	2019	2219
100	20	C114(1)101M1X5C(2)	CK12BX101M	CKR11BX101M(2)	2620	2820	2020	2220
120	10	C114(1)121K1X5C(2)	CK12BX121K	CKR11BX121K(2)	2621	2821	2021	2221
150	10	C114(1)151K1X5C(2)	CK12BX151K	CKR11BX151K(2)	2622	2822	2022	2222
150	20	C114(1)151M1X5C(2)	CK12BX151M	CKR11BX151M(2)	2623	2823	2023	2223
180	10	C114(1)181K1X5C(2)	CK12BX181K	CKR11BX181K(2)	2624	2824	2024	2224
220	10	C114(1)221K1X5C(2)	CK12BX221K	CKR11BX221K(2)	2625	2825	2025	2225
220	20	C114(1)221M1X5C(2)	CK12BX221M	CKR11BX221M(2)	2626	2826	2026	2226
270	10	C114(1)271K1X5C(2)	CK12BX271K	CKR11BX271K(2)	2627	2827	2027	2227
330	10	C114(1)331K1X5C(2)	CK12BX331K	CKR11BX331K(2)	2628	2828	2028	2228
330	20	C114(1)331M1X5C(2)	CK12BX331M	CKR11BX331M(2)	2629	2829	2029	2229
390	10	C114(1)391K1X5C(2)	CK12BX391K	CKR11BX391K(2)	2630	2830	2030	2230
470	10	C114(1)471K1X5C(2)	CK12BX471K	CKR11BX471K(2)	2631	2831	2031	2231
470	20	C114(1)471M1X5C(2)	CK12BX471M	CKR11BX471M(2)	2632	2832	2032	2232
560	10	C114(1)561K1X5C(2)	CK12BX561K	CKR11BX561K(2)	2633	2833	2033	2233
680	10	C114(1)681K1X5C(2)	CK12BX681K	CKR11BX681K(2)	2634	2834	2034	2234
680	20	C114(1)681M1X5C(2)	CK12BX681M	CKR11BX681M(2)	2635	2835	2035	2235
820	10	C114(1)821K1X5C(2)	CK12BX821K	CKR11BX821K(2)	2636	2836	2036	2236
1,000	10	C114(1)102K1X5C(2)	CK12BX102K	CKR11BX102K(2)	2637	2837	2037	2237
1,000	20	C114(1)102M1X5C(2)	CK12BX102M	CKR11BX102M(2)	2638	2838	2038	2238
1,200	10	C114(1)122K1X5C(2)	CK12BX122K	CKR11BX122K(2)	2639	2839	2039	2239
1,500	10	C114(1)152K1X5C(2)	CK12BX152K	CKR11BX152K(2)	2640	2840	2040	2240
1,500	20	C114(1)152M1X5C(2)	CK12BX152M	CKR11BX152M(2)	2641	2841	2041	2241
1,800	10	C114(1)182K1X5C(2)	CK12BX182K	CKR11BX182K(2)	2642	2842	2042	2242
2,200	10	C114(1)222K1X5C(2)	CK12BX222K	CKR11BX222K(2)	2643	2843	2043	2243
2,200	20	C114(1)222M1X5C(2)	CK12BX222M	CKR11BX222M(2)	2644	2844	2044	2244
2,700	10	C114(1)272K1X5C(2)	CK12BX272K	CKR11BX272K(2)	2645	2845	2045	2245
3,300	10	C114(1)332K1X5C(2)	CK12BX332K	CKR11BX332K(2)	2646	2846	2046	2246
3,300	20	C114(1)332M1X5C(2)	CK12BX332M	CKR11BX332M(2)	2647	2847	2047	2247
3,900	10	C114(1)392K1X5C(2)	CK12BX392K	CKR11BX392K(2)	2648	2848	2048	2248
4,700	10	C114(1)472K1X5C(2)	CK12BX472K	CKR11BX472K(2)	2649	2849	2049	2249
4,700	20	C114(1)472M1X5C(2)	CK12BX472M	CKR11BX472M(2)	2650	2850	2050	2250
<b>50 VOLT — C114 SIZE (MILITARY—CK12 or CKR11)</b>								
5,600	10	C114(1)562K5X5C(2)	CK12BX562K	CKR11BX562K(2)	2651	2851	2051	2251
6,800	10	C114(1)682K5X5C(2)	CK12BX682K	CKR11BX682K(2)	2652	2852	2052	2252
6,800	20	C114(1)682M5X5C(2)	CK12BX682M	CKR11BX682M(2)	2653	2853	2053	2253
8,200	10	C114(1)822K5X5C(2)	CK12BX822K	CKR11BX822K(2)	2654	2854	2054	2254
10,000	10	C114(1)103K5X5C(2)	CK12BX103K	CKR11BX103K(2)	2655	2855	2055	2255
10,000	20	C114(1)103M5X5C(2)	CK12BX103M	CKR11BX103M(2)	2656	2856	2056	2256
<b>100 VOLT — C124 SIZE (MILITARY—CK13 or CKR12)</b>								
5,600	10	C124(1)562K1X5C(2)	CK13BX562K	CKR12BX562K(2)	2657	2857	2057	2257
6,800	10	C124(1)682K1X5C(2)	CK13BX682K	CKR12BX682K(2)	2658	2858	2058	2258
6,800	20	C124(1)682M1X5C(2)	CK13BX682M	CKR12BX682M(2)	2659	2859	2059	2259
8,200	10	C124(1)822K1X5C(2)	CK13BX822K	CKR12BX822K(2)	2660	2860	2060	2260
10,000	10	C124(1)103K1X5C(2)	CK13BX103K	CKR12BX103K(2)	2661	2861	2061	2261
10,000	20	C124(1)103M1X5C(2)	CK13BX103M	CKR12BX103M(2)	2662	2862	2062	2262
<b>50 VOLT — C124 SIZE (MILITARY—CK13 or CKR12)</b>								
12,000	10	C124(1)123K5X5C(2)	CK13BX123K	CKR12BX123K(2)	2663	2863	2063	2263
15,000	10	C124(1)153K5X5C(2)	CK13BX153K	CKR12BX153K(2)	2664	2864	2064	2264
15,000	20	C124(1)153M5X5C(2)	CK13BX153M	CKR12BX153M(2)	2665	2865	2065	2265
18,000	10	C124(1)183K5X5C(2)	CK13BX183K	CKR12BX183K(2)	2666	2866	2066	2266
22,000	10	C124(1)223K5X5C(2)	CK13BX223K	CKR12BX223K(2)	2667	2867	2067	2267
22,000	20	C124(1)223M5X5C(2)	CK13BX223M	CKR12BX223M(2)	2668	2868	2068	2268
27,000	10	C124K273K5R5CA	CK13BR273K					
33,000	10	C124K333K5R5CA	CK13BR333K					
33,000	20	C124K333M5R5CA	CK13BR333M					
39,000	10	C124K393K5R5CA	CK13BR393K					
47,000	10	C124K473K5R5CA	CK13BR473K					
47,000	20	C124K473M5R5CA	CK13BR473M					

(1) Insert proper letter for specification: K — MIL-C-11015; T — MIL-PRF-39014 (2) Failure Rate Designator: A — Not applicable (MIL-C-11015); M — 1%/1000 Hours, P — .1%/1000 Hours, R — .01%/1000 Hours, S — .001%/1000 Hours (MIL-PRF-39014)

**RATINGS & PART NUMBER REFERENCE**

CAP. pF	TOL. %	KEMET PART NUMBER	MIL-C-11015/20	MIL-PRF-39014/05	MIL-PRF-39014/05 For Failure Rate Levels (2)			
					M	P	R	S
<b>50 VOLT — C124 SIZE (MILITARY—CK13 or CKR12) (Cont'd)</b>								
27,000	10	C124T273K5X5C(2)		CKR12BX273K(2)	2669	2869	2069	2269
33,000	10	C124T333K5X5C(2)		CKR12BX333K(2)	2670	2870	2070	2270
33,000	20	C124T333M5X5C(2)		CKR12BX333M(2)	2671	2871	2071	2271
39,000	10	C124T393K5X5C(2)		CKR12BX393K(2)	2672	2872	2072	2272
47,000	10	C124T473K5X5C(2)		CKR12BX473K(2)	2673	2873	2073	2273
47,000	20	C124T473M5X5C(2)		CKR12BX473M(2)	2674	2874	2074	2274
<b>100 VOLT — C192 SIZE (MILITARY—CK14 or CKR14)</b>								
12,000	10	C192(1)123K1X5C(2)	CK14BX123K	CKR14BX123K(2)	2675	2875	2075	2275
15,000	10	C192(1)153K1X5C(2)	CK14BX153K	CKR14BX153K(2)	2676	2876	2076	2276
15,000	20	C192(1)153M1X5C(2)	CK14BX153M	CKR14BX153M(2)	2677	2877	2077	2277
18,000	10	C192(1)183K1X5C(2)	CK14BX183K	CKR14BX183K(2)	2678	2878	2078	2278
22,000	10	C192(1)223K1X5C(2)	CK14BX223K	CKR14BX223K(2)	2679	2879	2079	2279
22,000	20	C192(1)223M1X5C(2)	CK14BX223M	CKR14BX223M(2)	2680	2880	2080	2280
27,000	10	C192(1)273K1X5C(2)	CK14BX273K	CKR14BX273K(2)	2681	2881	2081	2281
33,000	10	C192(1)333K1X5C(2)	CK14BX333K	CKR14BX333K(2)	2682	2882	2082	2282
33,000	20	C192(1)333M1X5C(2)	CK14BX333M	CKR14BX333M(2)	2683	2883	2083	2283
39,000	10	C192(1)393K1X5C(2)	CK14BX393K	CKR14BX393K(2)	2684	2884	2084	2284
47,000	10	C192(1)473K1X5C(2)	CK14BX473K	CKR14BX473K(2)	2685	2885	2085	2285
47,000	20	C192(1)473M1X5C(2)	CK14BX473M	CKR14BX473M(2)	2686	2886	2086	2286
56,000	10	C192(1)563K1R5C(2)	CK14BR563K	CKR14BR563K(2)	2693	2893	2093	2293
68,000	10	C192(1)683K1R5C(2)	CK14BR683K	CKR14BR683K(2)	2694	2894	2094	2294
68,000	20	C192(1)683M1R5C(2)	CK14BR683M	CKR14BR683M(2)	2695	2895	2095	2295
82,000	10	C192(1)823K1R5C(2)	CK14BR823K	CKR14BR823K(2)	2696	2896	2096	2296
100,000	10	C192(1)104K1R5C(2)	CK14BR104K	CKR14BR104K(2)	2697	2897	2097	2297
100,000	20	C192(1)104M1R5C(2)	CK14BR104M	CKR14BR104M(2)	2698	2898	2098	2298
<b>50 VOLT — C192 SIZE (MILITARY—CK14 or CKR14)</b>								
56,000	10	C192T563K5X5C(2)		CKR14BX563K(2)	2687	2887	2087	2287
68,000	10	C192T683K5X5C(2)		CKR14BX683K(2)	2688	2888	2088	2288
68,000	20	C192T683M5X5C(2)		CKR14BX683M(2)	2689	2889	2089	2289
82,000	10	C192T823K5X5C(2)		CKR14BX823K(2)	2690	2890	2090	2290
100,000	10	C192T104K5X5C(2)		CKR14BX104K(2)	2691	2891	2091	2291
100,000	20	C192T104M5X5C(2)		CKR14BX104M(2)	2692	2892	2092	2292
120,000	10	C192(1)124K5R5C(2)	CK14BR124K	CKR14BR124K(2)	2699	2899	2099	2299
150,000	10	C192(1)154K5R5C(2)	CK14BR154K	CKR14BR154K(2)	2700	2900	2100	2300
150,000	20	C192(1)154M5R5C(2)	CK14BR154M	CKR14BR154M(2)	2701	2901	2101	2301
180,000	10	C192(1)184K5R5C(2)	CK14BR184K	CKR14BR184K(2)	2702	2902	2102	2302
220,000	10	C192(1)224K5R5C(2)	CK14BR224K	CKR14BR224K(2)	2703	2903	2103	2303
220,000	20	C192(1)224M5R5C(2)	CK14BR224M	CKR14BR224M(2)	2704	2904	2104	2304
270,000	10	C192(1)274K5R5C(2)	CK14BR274K	CKR14BR274K(2)	2705	2905	2105	2305
<b>100 VOLT — C202 SIZE (MILITARY—CK15 or CKR15)</b>								
56,000	10	C202T563K1X5C(2)		CKR15BX563K(2)	2706	2906	2106	2306
68,000	10	C202T683K1X5C(2)		CKR15BX683K(2)	2707	2907	2107	2307
68,000	20	C202T683M1X5C(2)		CKR15BX683M(2)	2708	2908	2108	2308
82,000	10	C202T823K1X5C(2)		CKR15BX823K(2)	2709	2909	2109	2309
100,000	10	C202(1)104K1X5C(2)	CK15BX104K	CKR15BX104K(2)	2710	2910	2110	2310
100,000	20	C202(1)104M1X5C(2)	CK15BX104M	CKR15BX104M(2)	2711	2911	2111	2311
120,000	10	C202(1)124K1R5C(2)	CK15BR124K	CKR15BR124K(2)	2712	2912	2112	2312
150,000	10	C202(1)154K1R5C(2)	CK15BR154K	CKR15BR154K(2)	2713	2913	2113	2313
150,000	20	C202(1)154M1R5C(2)	CK15BR154M	CKR15BR154M(2)	2714	2914	2114	2314
180,000	10	C202(1)184K1R5C(2)	CK15BR184K	CKR15BR184K(2)	2715	2915	2115	2315
220,000	10	C202(1)224K1R5C(2)	CK15BR224K	CKR15BR224K(2)	2716	2916	2116	2316
220,000	20	C202(1)224M1R5C(2)	CK15BR224M	CKR15BR224M(2)	2717	2917	2117	2317
270,000	10	C202(1)274K1R5C(2)	CK15BR274K	CKR15BR274K(2)	2718	2918	2118	2318
330,000	10	C202(1)334K1R5C(2)	CK15BR334K	CKR15BR334K(2)	2719	2919	2119	2319
330,000	20	C202(1)334M1R5C(2)	CK15BR334M	CKR15BR334M(2)	2720	2920	2120	2320
<b>50 VOLT — C202 SIZE (MILITARY—CK15 or CKR15)</b>								
470,000	10	C202(1)474K5R5C(2)	CK15BR474K	CKR15BR474K(2)	2721	2921	2121	2321
470,000	20	C202(1)474M5R5C(2)	CK15BR474M	CKR15BR474M(2)	2722	2922	2122	2322
680,000	10	C202T684K5R5C(2)		CKR15BR684K(2)	2723	2923	2123	2323
680,000	20	C202T684M5R5C(2)		CKR15BR684M(2)	2724	2924	2124	2324
1,000,000	10	C202(1)105K5R5C(2)	CK15BR105K	CKR15BR105K(2)	2725	2925	2125	2325
1,000,000	20	C202(1)105M5R5C(2)	CK15BR105M	CKR15BR105M(2)	2726	2926	2126	2326
<b>100 VOLT — C222 SIZE (MILITARY—CK16 or CKR16)</b>								
470,000	10	C222(1)474K1R5C(2)	CK16BR474K	CKR16BR474K(2)	2727	2927	2127	2327
470,000	20	C222(1)474M1R5C(2)	CK16BR474M	CKR16BR474M(2)	2728	2928	2128	2328
680,000	10	C222T684K1R5C(2)		CKR16BR684K(2)	2729	2929	2129	2329
680,000	20	C222T684M1R5C(2)		CKR16BR684M(2)	2730	2930	2130	2330
1,000,000	10	C222(1)105K1R5C(2)	CK16BR105K	CKR16BR105K(2)	2731	2931	2131	2331
1,000,000	20	C222(1)105M1R5C(2)	CK16BR105M	CKR16BR105M(2)	2732	2932	2132	2332
<b>50 VOLT — C222 SIZE (MILITARY—CK16 or CKR16)</b>								
2,200,000	10	C222(1)225K5R5C(2)	CK16BR225K	CKR16BR225K(2)	2733	2933	2133	2333
2,200,000	20	C222(1)225M5R5C(2)	CK16BR225M	CKR16BR225M(2)	2734	2934	2134	2334
3,300,000	10	C222(1)335K5R5C(2)	CK16BR335M	CKR16BR335K(2)	2735	2935	2135	2335
3,300,000	20	C222(1)335M5R5C(2)	CK16BR335M	CKR16BR335M(2)	2736	2936	2136	2336

MIL-C-11015  
MIL-PRF-39014

(1) Insert proper letter for specification: K — MIL-C-11015; T — MIL-PRF-39014 (2) Failure Rate Designator: A — Not applicable (MIL-C-11015); M — 1%/1000 Hours, P — .1%/1000 Hours, R — .01%/1000 Hours, S — .001%/1000 Hours (MIL-PRF-39014)



**RATINGS & PART NUMBER REFERENCE**

CAP. pF	TOL. %	KEMET PART NUMBER	MIL-C-11015/19	MIL-PRF-39014/02	MIL-PRF-39014/02 For Failure Rate Levels (2)			
					M	P	R	S
<b>200 VOLT — C062/C066 SIZE (MILITARY—CK06 or CKR06)</b>								
1,200	10	C06(4)1122K2X5C(2)	CK06BX122K	CKR06BX122K(2)(3)	1201(3)	1241(3)	1281(3)	1321(3)
1,500	10	C06(4)1152K2X5C(2)	CK06BX152K	CKR06BX152K(2)(3)	1202(3)	1242(3)	1282(3)	1322(3)
1,500	20	C06(4)1152M2X5C(2)	CK06BX152M	CKR06BX152M(2)(3)	1203(3)	1243(3)	1283(3)	1323(3)
1,800	10	C06(4)1182K2X5C(2)	CK06BX182K	CKR06BX182K(2)(3)	1204(3)	1244(3)	1284(3)	1324(3)
2,200	10	C06(4)1222K2X5C(2)	CK06BX222K	CKR06BX222K(2)(3)	1206(3)	1246(3)	1286(3)	1326(3)
2,200	20	C06(4)1222M2X5C(2)	CK06BX222M	CKR06BX222M(2)(3)	1207(3)	1247(3)	1287(3)	1327(3)
2,700	10	C06(4)1272K2X5C(2)	CK06BX272K	CKR06BX272K(2)(3)	1208(3)	1248(3)	1288(3)	1328(3)
3,300	10	C06(4)1332K2X5C(2)	CK06BX332K	CKR06BX332K(2)(3)	1209(3)	1249(3)	1289(3)	1329(3)
3,300	20	C06(4)1332M2X5C(2)	CK06BX332M	CKR06BX332M(2)(3)	1210(3)	1250(3)	1290(3)	1330(3)
3,900	10	C06(4)1392K2X5C(2)	CK06BX392K	CKR06BX392K(2)(3)	1211(3)	1251(3)	1291(3)	1331(3)
4,700	10	C06(4)1472K2X5C(2)	CK06BX472K	CKR06BX472K(2)(3)	1212(3)	1252(3)	1292(3)	1332(3)
4,700	20	C06(4)1472M2X5C(2)	CK06BX472M	CKR06BX472M(2)(3)	1213(3)	1253(3)	1293(3)	1333(3)
5,600	10	C06(4)1562K2X5C(2)	CK06BX562K	CKR06BX562K(2)(3)	1214(3)	1254(3)	1294(3)	1334(3)
6,800	10	C06(4)1682K2X5C(2)	CK06BX682K	CKR06BX682K(2)(3)	1215(3)	1255(3)	1295(3)	1335(3)
6,800	20	C06(4)1682M2X5C(2)	CK06BX682M	CKR06BX682M(2)(3)	1216(3)	1256(3)	1296(3)	1336(3)
8,200	10	C06(4)1822K2X5C(2)	CK06BX822K	CKR06BX822K(2)(3)	1217(3)	1257(3)	1297(3)	1337(3)
10,000	10	C06(4)1103K2X5C(2)	CK06BX103K	CKR06BX103K(2)(3)	1218(3)	1258(3)	1298(3)	1338(3)
10,000	20	C06(4)1103M2X5C(2)	CK06BX103M	CKR06BX103M(2)(3)	1219(3)	1259(3)	1299(3)	1339(3)
<b>100 VOLT — C062/C066 SIZE (MILITARY—CK06 or CKR06)</b>								
12,000	10	C06(4)1123K1X5C(2)	CK06BX123K	CKR06BX123K(2)(3)	1231(3)	1271(3)	1311(3)	1351(3)
15,000	10	C06(4)1153K1X5C(2)	CK06BX153K	CKR06BX153K(2)(3)	1220(3)	1260(3)	1300(3)	1340(3)
15,000	20	C062K153M1X5CA	CK06BX153M					
18,000	10	C06(4)1183K1X5C(2)	CK06BX183K	CKR06BX183K(2)(3)	1221(3)	1261(3)	1301(3)	1341(3)
22,000	10	C06(4)1223K1X5C(2)	CK06BX223K	CKR06BX223K(2)(3)	1222(3)	1262(3)	1302(3)	1342(3)
22,000	20	C062K223M1X5CA	CK06BX223M					
27,000	10	C06(4)1273K1X5C(2)	CK06BX273K	CKR06BX273K(2)(3)	1232(3)	1272(3)	1312(3)	1352(3)
33,000	10	C06(4)1333K1X5C(2)	CK06BX333K	CKR06BX333K(2)(3)	1223(3)	1263(3)	1303(3)	1343(3)
33,000	20	C062K333M1X5CA	CK06BX333M					
39,000	10	C06(4)1393K1X5C(2)	CK06BX393K	CKR06BX393K(2)(3)	1224(3)	1264(3)	1304(3)	1344(3)
47,000	10	C06(4)1473K1X5C(2)	CK06BX473K	CKR06BX473K(2)(3)	1225(3)	1265(3)	1305(3)	1345(3)
47,000	20	C062K473M1X5CA	CK06BX473M					
56,000	10	C06(4)1563K1X5C(2)	CK06BX563K	CKR06BX563K(2)(3)	1226(3)	1266(3)	1306(3)	1346(3)
68,000	10	C06(4)1683K1X5C(2)	CK06BX683K	CKR06BX683K(2)(3)	1227(3)	1267(3)	1307(3)	1347(3)
68,000	20	C062K683M1X5CA	CK06BX683M					
82,000	10	C06(4)1823K1X5C(2)	CK06BX823K	CKR06BX823K(2)(3)	1229(3)	1269(3)	1309(3)	1349(3)
100,000	10	C06(4)1104K1X5C(2)	CK06BX104K	CKR06BX104K(2)(3)	1230(3)	1270(3)	1310(3)	1350(3)
100,000	20	C062K104M1X5CA	CK06BX104M					
<b>50 VOLT — C062/C066 SIZE (MILITARY—CK06 or CKR06)</b>								
120,000	10	C06(4)1124K5X5C(2)	CK06BX124K	CKR06BX124K(2)(3)	1233(3)	1273(3)	1313(3)	1353(3)
150,000	10	C06(4)1154K5X5C(2)	CK06BX154K	CKR06BX154K(2)(3)	1234(3)	1274(3)	1314(3)	1354(3)
150,000	20	C062K154M5X5CA	CK06BX154M					
180,000	10	C06(4)1184K5X5C(2)	CK06BX184K	CKR06BX184K(2)(3)	1235(3)	1275(3)	1315(3)	1355(3)
220,000	10	C06(4)1224K5X5C(2)	CK06BX224K	CKR06BX224K(2)(3)	1236(3)	1276(3)	1316(3)	1356(3)
220,000	20	C062K224M5X5CA	CK06BX224M					
270,000	10	C06(4)1274K5X5C(2)	CK06BX274K	CKR06BX274K(2)(3)	1237(3)	1277(3)	1317(3)	1357(3)
330,000	10	C06(4)1334K5X5C(2)	CK06BX334K	CKR06BX334K(2)(3)	1238(3)	1278(3)	1318(3)	1358(3)
330,000	20	C062K334M5X5CA	CK06BX334M					
390,000	10	C06(4)1394K5X5C(2)	CK06BX394K	CKR06BX394K(2)(3)	1239(3)	1279(3)	1319(3)	1359(3)
470,000	10	C06(4)1474K5X5C(2)	CK06BX474K	CKR06BX474K(2)(3)	1240(3)	1280(3)	1320(3)	1360(3)
470,000	20	C062K474M5X5CA	CK06BX474M					
560,000	10	C06(4)1564K5X5C(2)	CK06BX564K	CKR06BX564K(2)(3)	1404(3)	1408(3)	1412(3)	1416(3)
680,000	10	C06(4)1684K5X5C(2)	CK06BX684K	CKR06BX684K(2)(3)	1405(3)	1409(3)	1413(3)	1417(3)
680,000	20	C062K684M5X5CA	CK06BX684M					
820,000	10	C06(4)1824K5X5C(2)	CK06BX824K	CKR06BX824K(2)(3)	1406(3)	1410(3)	1414(3)	1418(3)
1,000,000	10	C06(4)1105K5X5C(2)	CK06BX105K	CKR06BX105K(2)(3)	1407(3)	1411(3)	1415(3)	1419(3)
1,000,000	20	C062K105M5X5CA	CK06BX105M					

MIL-C-11015  
MIL-PRF-39014

(1) Insert proper letter for specification: K — MIL-C-11015; T — MIL-PRF-39014.  
 (2) Failure Rate Designator: A — Not applicable (MIL-C-11015); M — 1%/1000 Hours, P — .1%/1000 Hours, R — .01%/1000 Hours, S — .001%/1000 Hours (MIL-PRF-39014)  
 (3) Add "V" for stand-off design (C066). Leave blank for the flat bottom design (C062).  
 (4) Insert "2" for standard design (Style C062). Insert "6" for stand-off design (Style C066). Note: Stand-offs are available only with the CKR, not the CK.



**Ceramic Axial**  
Lead Tape and Reel Packaging

KEMET offers standard reeling of Molded and Conformally Coated Axial Leaded Ceramic Capacitors for automatic insertion or lead forming machines per EIA specification RS-296. KEMET'S internal specification four-digit suffix, 7200, is placed at the end of the part number to designate tape and reel packaging, ie: C410C104Z5U5CA7200.

Paper (50 lb.) test minimum is inserted between the layers of capacitors wound on reels for component pitch  $\leq 0.400"$ . Capacitor lead length may extend only a maximum of  $.0625"$  (1.59mm) beyond the tapes' edges. Capacitors are centered in a row between the two tapes and will deviate only  $\pm 0.031$  (0.79mm) from the row center. A minimum of  $36"$  (91.5 cm) leader tape is provided at each end of the reel capacitors. Universal splicing clips are used to connect the tape. Standard reel quantities are shown on page 34.

Figure 1

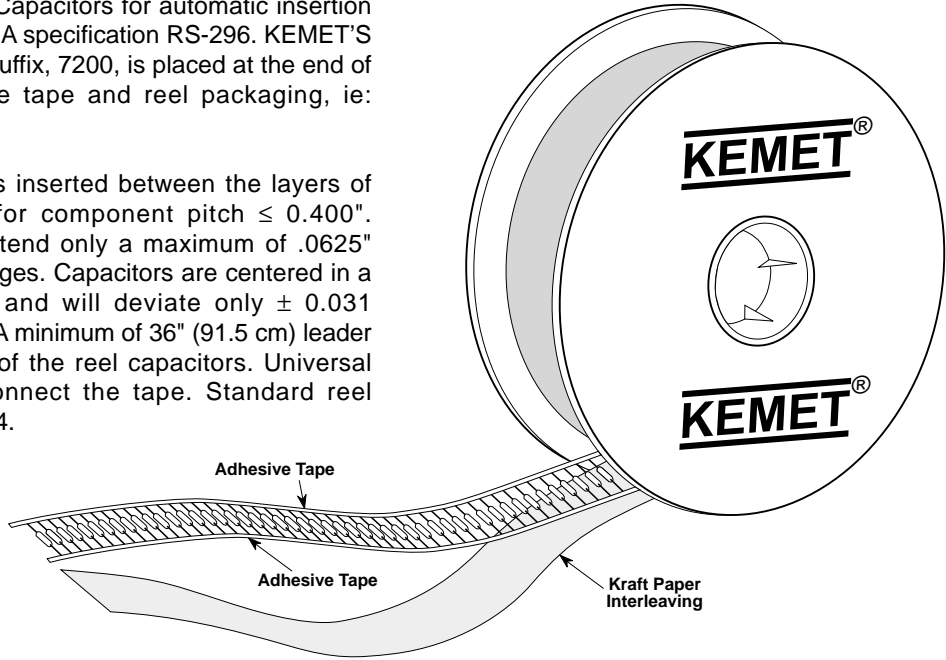


Figure 2

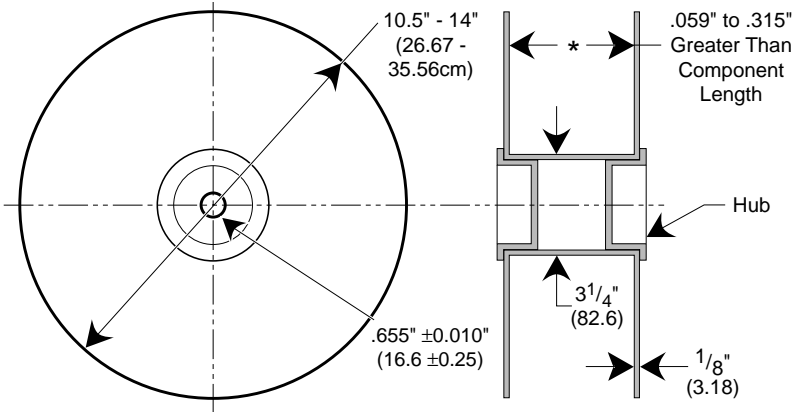


Figure 3

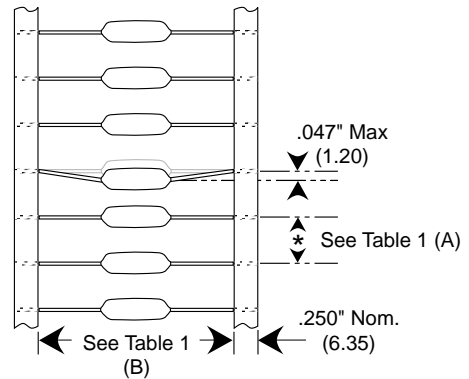


Table 1 **Dimensions in Inches & (Millimeters)**

Component Body Diameter	Component Pitch "A"	Inside Tape Spacing "B" $\pm 1.5\text{mm}$ (0.059")	
	0.020" or ( $\pm 0.5\text{mm}$ )	I	III*
0" (0mm) to 0.197" (5mm) 0.197" (5.01mm) to 0.394" (10mm)	0.197" or (5mm) 0.394" or (10mm)	2.062" (52.4mm)	2.874" (73mm)

\* Not Available for Conformally Coated Parts.

## Ceramic Radial Lead Tape and Reel Packaging

KEMET offers standard reeling of Molded and Conformally Coated Radial Leaded Ceramic Capacitors for automatic insertion per EIA specification RS-468. Parts are taped to a tagboard carrier strip, and wound on a reel as shown in Figure 1. Kraft paper interleaving is inserted between the layers of capacitors on the reel. Ammopack is also available, with the same lead tape configuration and package quantities.

Figure 1

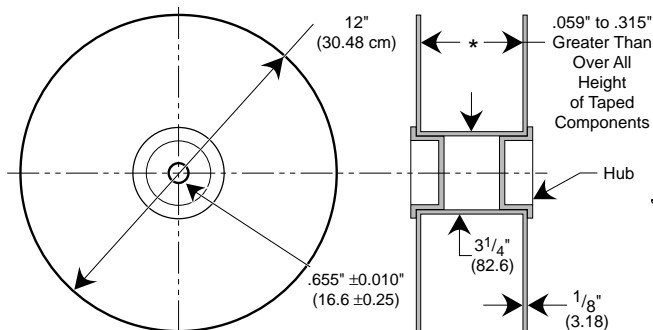
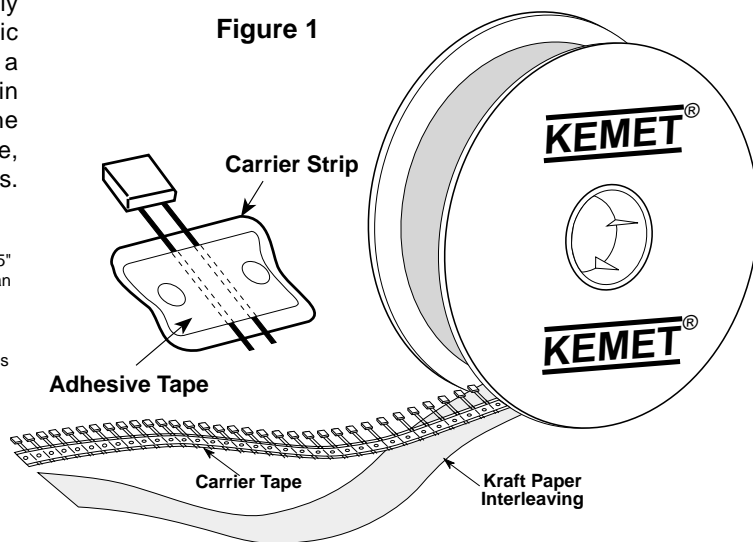


Figure 3: Standard Reel

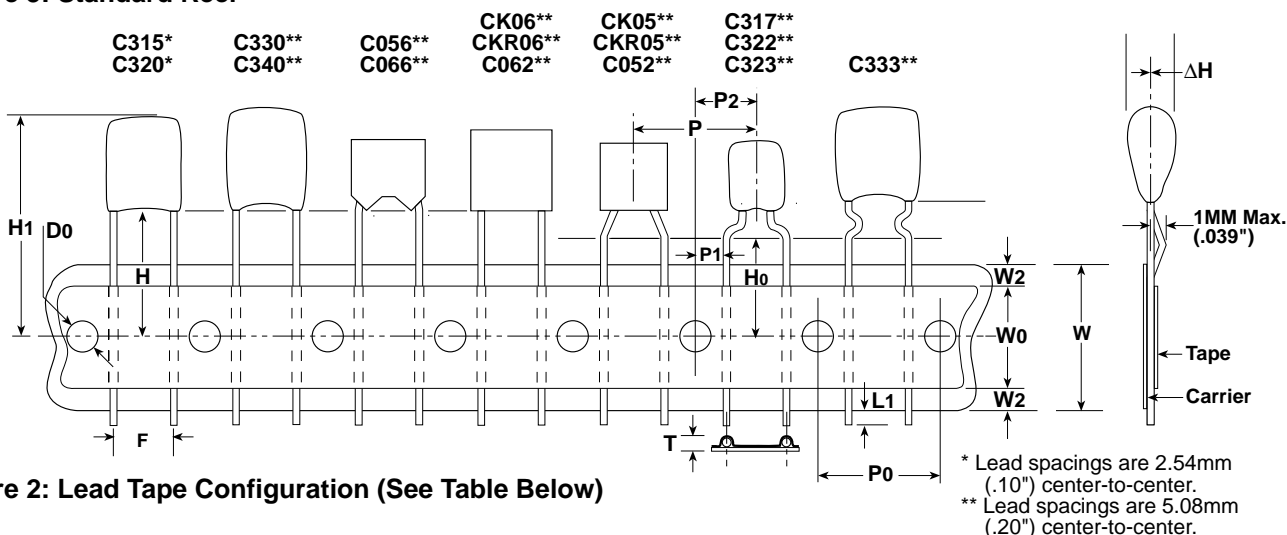


Figure 2: Lead Tape Configuration (See Table Below)

### Ceramic Radial Tape and Reel Dimensions in Millimeters & (Inches)

Dimension	Symbol	Nominal mm (inch)		Tolerance mm (inch)	Dimension	Symbol	Nominal mm (inch)		Tolerance mm (inch)	
Sprocket Hole Diameter	Do	4.0 (.157)		± 0.2 (.008)	Height to Seating Plane (formed leads) (2)	Ho	C7301 16.0 (.630)	C7303 18.0 (.709)	C7301 ±0.5 (.020)	C7303 Minimum
Sprocket Hole Pitch	P0	12.7 (.500)		± 0.3 (.012)	Component Alignment	Δh	4.0 (.157)		±0.2 (.008)	
Component Pitch	P	12.7 (.500)		± 0.3 (.012)	Lead Protrusion	L1	1.0 (.039)		Maximum	
Lead Spacing (1)	F	5.08 (.20)	2.54 (.10)	+0.6 -0.2 (+.024 -.008)	Composite Tape Thickness	t	0.7 (.051)		±0.2 (.008)	
Sprocket Hole Center to Lead Center (1)	P1	3.81 (.150)	5.08 (.200)	± 0.7 (.028)	Overall Tape and Lead Thickness	T	1.5 (.059)		Maximum	
Sprocket Hole Center to Component Center	P2	6.35 (.250)		± 1.3 (.051)	Carrier Tape Width	W	18.0 (.709)		+1.0 - 0.5 (+.039 -.020)	
Height to Seating Plane (straight leads) (2)	H	C7301 16.0 (.630)	C7303 18.0 (.709)	C7301 ±0.5 (.020)	Hold-Down Tape Width	W0	5.0 (.197)		Minimum	
Component Height Above Tape Center	H1	32.2 (1.27)		Maximum	Hold-Down Tape Location	W2	3.0 (.118)		Maximum	

(1) Measured at the egress from the carrier tape, on the component side.  
 (2) Determined by a 4 digit suffix placed at the end of the part number, as follows:  
 7301 = Recommended for parts with formed leads. Example: C322C104K5R5CA7301  
 7303 = Recommended for parts with straight leads. Example: C320C104K5R5CA7303

<b>CERAMIC PACKAGING</b>					
<b>KEMET Number</b>	<b>Military Style</b>	<b>Military Specification</b>	<b>Standard (1) Bulk Quantity</b>	<b>Standard Reel Quantity</b>	<b>Reel Size</b>
C114C-K-G	CK12, CC75	MIL-C-11015/	200/Box	5000	12"
C124C-K-G	CK13, CC76	MIL-PRF-20	200/Box	5000	12"
C192C-K-G	CK14, CC77		100/Box	3000	12"
C202C-K	CK15		25/Box	500	12"
C222C-K	CK16		10/Tray	300	12"
C052C-K-G	CK05, CC05		100/Bag	2000	12"
C062C-K-G	CK06, CC06		100/Bag	1500	12"
C114G	CCR75	MIL-PRF-20	200/Box	5000	12"
C124G	CCR76		200/Box	5000	12"
C192G	CCR77		100/Box	3000	12"
C202G	CC78-CCR78		25/Box	500	12"
C222G	CC79-CCR79		10/Tray	300	12"
C052/56G	CCR05		100/Bag	1700	12"
C062/66G	CCR06		100/Bag	1500	12"
C512G	CC07-CCR07		Footnote (2)	N/A	N/A
C522G	CC08-CCR08		Footnote (2)	N/A	N/A
C114T	CKR11	MIL-PRF-39014	200/Box	5000	12"
C124T	CKR12		200/Box	5000	12"
C192T	CKR14		100/Box	3000	12"
C202T	CKR15		25/Box	500	12"
C222T	CKR16		10/Tray	300	12"
C052/56T	CKR05		100/Bag	1700	12"
C062/66T	CKR06		100/Bag	1500	12"
C31X			500/Bag	2500	12"
C32X			500/Bag	2500	12"
C33X			250/Bag	1500	12"
C340			100/Bag	1000	12"
C350			50/Bag	N/A	N/A
C410			300/Box	5000	12"
C412			200/Box	5000	12"
C420			300/Box	5000	12"
C430			200/Box	2500	12"
C440			200/Box	2500	12"
C512	N/A	N/A	Footnote (2)	N/A	N/A
C522	N/A	N/A	Footnote (2)	N/A	N/A

NOTE: (1) Standard packaging refers to number of pieces per bag, box, tray or vial.

(2) Quantity varies. For further details, please consult the factory.