Surface Mount Multilayer Ceramic Chip Capacitors (SMD MLCCs)

Capacitor Array, X7R Dielectric, 10 – 200 VDC (Commercial & Automotive Grade)

Overview

KEMET's Ceramic Chip Capacitor Array in X7R dielectric is an advanced passive technology where multiple capacitor elements are integrated into one common monolithic structure. Array technology promotes reduced placement costs and increased throughput. This is achieved by alternatively placing one device rather than two or four discrete devices. Use of capacitor arrays also saves board space, which translates into increased board density and more functions per board. Arrays consume only a portion of the space required for standard chips resulting in savings in inventory and pick/place machine positions.

For added reliability, KEMET's Flexible Termination technology has been incorporated in order to provides superior flex performance. This technology was developed to address flex cracks, which are the primary failure mode of MLCCs and typically the result of excessive tensile and shear stresses produced during board flexure and thermal cycling. Flexible Termination technology inhibits the transfer of board stress to the rigid body of the MLCC, therefore mitigating flex cracks which can result in low IR or short circuit failures.

KEMET's X7R dielectric features a 125°C maximum operating temperature and is considered "temperature stable." The Electronics Industries Alliance (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.

KEMET automotive grade array capacitors meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

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Ordering Information

CA	06	4	X	104	K	4	R	A	C	TU
Ceramic Array	Case Size (L" x W")[1]	Number of Capacitors	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Dielectric	Failure Rate/ Design	Termination Finish[2]	Packaging/ Grade (C-Spec)
	06 = 0612	4 = 4	X = Flexible Termination	Two significant digits + number of zeros	J = ±5% K = ±10% M = ±20%	8 = 10 4 = 16 3 = 25 5 = 50 1 = 100 2 = 200	R = X7R	A = N/A	C = 100% Matte Sn L = SnPb (5% minimum Pb content)	See "Packaging C-Spec Ordering Options Table" below

[1] All previous reference to metric case dimension "1632" has been replaced with an inch standard reference of "0612". Please reference all new using the "0612" nomenclature. "CA064" replaces "C1632" in the ordering code.

[2] %HHMXMSREP XIVQMREXMSR ¼RMWL STXMSRW QE] FI EZEMPEFPI 'SRXEGX /)1)8 JSV

[2] 7R4F XIVQMREXMSR ¼RMWL STXMSR MW RSX EZEMPEFPI SR EYXSQSXMZI KVEHI TVS

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Packaging C-Spec Ordering Options Table

Packaging Type	Packaging/Grade Ordering Code (C-Spec)
Commercial Grade[1]	
Bulk Bag	Not Required (Blank)
7" Reel/Unmarked 13" Reel (Embossed Plastic Tape)/Unmarked	TU
13" Reel (Embossed Plastic Tape)/Unmarked	7210

Automotive C-Spec Information

KEMET Automotive Grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC–Q200, Stress Test Qualification for Passive Components. These products are supported by a Product Change Notification (PCN) and Production Part Approval Process warrant (PPAP).

Automotive products offered through our distribution channel have been assigned an inclusive ordering code C-Spec, "A This C-Spec was developed in order to better serve small and medium-sized companies that prefer an automotive grade component without the requirement to submit a customer Source Controlled Drawing (SCD) or specification for review by a KEMET engineering specialist. This C-Spec is therefore not intended for use by KEMET's OEM Automotive customers not granted the same "privileges" as other automotive C-Specs. Customer PCN approval and PPAP request levels are (see details below).

4VSHYGX 'LERKI 2SXM¼ GEXMSR 4'2

The KEMET Product Change Notification system is used to communicate primarily the following types of changes:

- Product/process changes that affect product form, fit, function, and/or reliability
- Changes in manufacturing site
- Product obsolescence

KEMET Automotive C-Spec	'YWXSQIV 2SXM¼ GEXMSR HYLXS		Days prior to implementation
	Process/Product change	Obsolescence*	
KEMET assigned[1]	Yes (with approval and sign off)	Yes	180 days minimum
AUTO	Yes (without approval)	Yes	90 days minimum

[1] /)1)8 EWWMKRIH ' 7TIGW VIUYMVI XLI WYFQMXXEP SJ E GYWXSQIV 7'(SV GYWXSQIV

Production Part Approval Process (PPAP)

The purpose of the Production Part Approval Process is:

- To ensure that supplier can meet the manufacturability and quality requirements for the purchased parts.
- To provide the evidence that all customer engineering design record and specification requirements are properly understood and fulfilled by the manufacturing organization.
- To demonstrate that the established manufacturing process has the potential to produce the part.

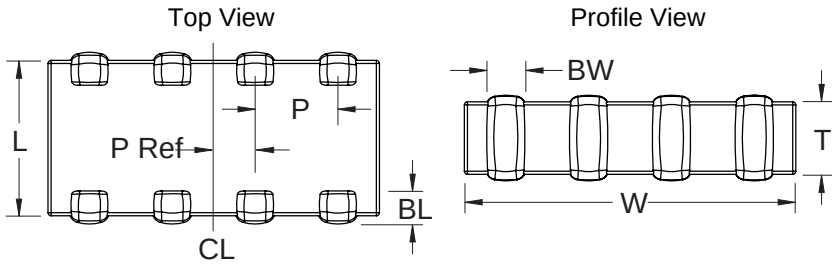
KEMET Automotive C-Spec	PPAP (Product Part Approval Process) Level				
	1	2	3	4	5
KEMET assigned[1]	O	O	O	O	O
AUTO	Š		Š		

[1] /)1)8 EWWMKRIH ' 7TIGW VIUYMVI XLI WYFQMXXEP SJ E GYWXSQIV 7'(SV GYWXSQIV

O Part number specific PPAP available
Š Product family PPAP only

Dimensions – Millimeters (Inches)

0612 (4-CAP)



EIA Size Code	Metric Size Code	L Length	W Width	BW Bandwidth	BL Bandlength	T Thickness	P Pitch	P Reference
0612	1632	1.60 (0.063) ±0.20 (0.008)	3.20 (0.126) ±0.20 (0.008)	0.40 (0.016) ±0.20 (0.008)	0.30 (0.012) ±0.20 (0.008)	See Table 2 for Thickness	0.80 (0.031) ±0.10 (0.004)	0.40 (0.016) ±0.05 (0.002)

5 Y E P M ¼ G E X M S R ' I V X M ¼ G E X M S R

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

Automotive Grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC–Q200, Stress Test Qualification for Passive

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	1,000 MΩ µF or 100GΩ (Rated voltage applied for 120 ±5 seconds at 25°C)

[1] 6IKEVHMRK %KMRK 6EXI 'ETEGMXERGI QIEWYVIQIRXW MRGPYHMRK XSPIVERGI EVI
[2] (;: MW XLI ZSPXEKI E GETEGMXSV GER [MXLWXERH WYVZMZI JSV E WLSVX TIVMSH capacitor.
[3] 'ETEGMXERGI ERH HMWWMTEXMSR JEGXSV (* QIEWYVIH YRHIV XLI JSPPS[MRK GSR
1 kHz ±50Hz and 1.0 ±0.2 VMJ GETEGMXERGI µ v*
120 Hz ±10Hz and 0.5 ±0.1 VMJ GETEGMXERGI " v*
[4] 8S SFXEMR -6 PMQMX HMZMHI 1º v* ZEPYI F] XLI GETEGMXERGI ERH GSQTEVI XS +º 2SXI ;LIR QIEWYVMRK GETEGMXERGI MX MW MQTSVXERX XS IRWYVI XLI WIX ZSPXEK EW %YXSQEXMG 0IZIP 'SRXVSP %0' 8LI %0' JIEXYVI WLSYPH FI W[MXGLIH XS 32

Post Environmental Limits

High Temperature Life, Biased Humidity, Moisture Resistance					
Dielectric	Rated DC Voltage	Capacitance Value	Dissipation Factor (Maximum %)	Capacitance Shift	Insulation Resistance
X7R	< 16	All	7.5	±20%	10% of Initial Limit
	16/25	All	5.0		
	50	≤ 0.02 µF	3.0		
		> 0.02 µF	5.0		
	> 50	All	3.0		

Dissipation Factor Limit Table

Rated DC Voltage	Capacitance	Dissipation Factor (Maximum %)
< 16	All	5.0
16/25	All	3.5
50	≤ 0.022 µF	2.5
	> 0.022 µF	3.5
> 50	All	2.5

Table 1 – Capacitance Range/Selection Waterfall (0612 Case Size)

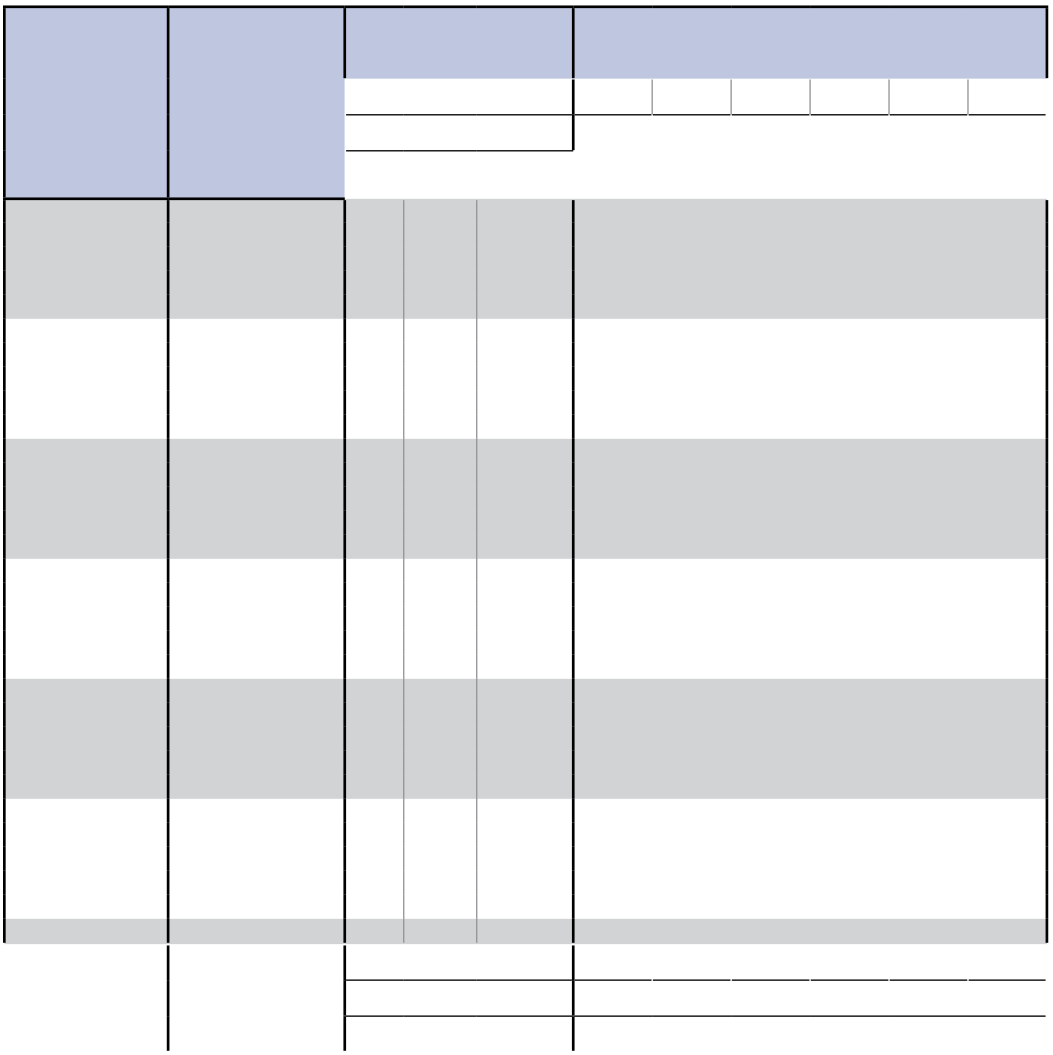


Table 2 – Chip Thickness/Tape & Reel Packaging Quantities

Thickness Code	Case Size	Thickness ± Range (mm)	Paper Quantity		Plastic Quantity	
			7" Reel	13" Reel	7" Reel	13" Reel
MA	0612	0.80 ±0.10	0	0	4,000	10,000

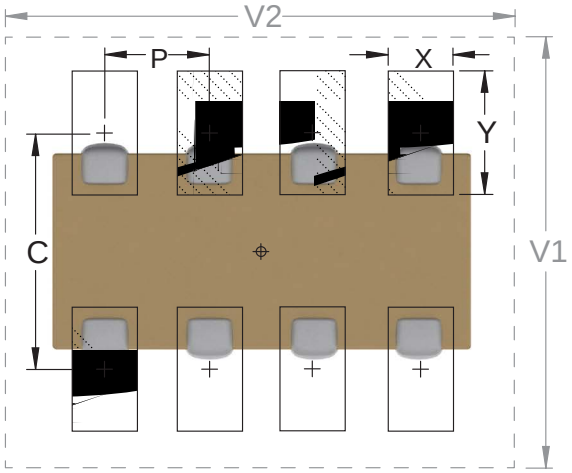
4EGOEKI UYERXMX] FEWIH SR ¼RMWLIH GLMT XLMGORIWW WTIGM¼GEXMSRW

Table 3 – Chip Capacitor Array Land Pattern Design Recommendations per IPC–7351

EIA SIZE CODE	METRIC SIZE CODE	(IRWMX] 0IZIP % Maximum (Most) Land Protrusion (mm)						(IRWMX] 0IZIP & Median (Nominal) Land Protrusion (mm)						(IRWMX] 0IZIP ' Minimum (Least) Land Protrusion (mm)					
		C	Y	X	P	V1	V2	C	Y	X	P	V1	V2	C	Y	X	P	V1	V2
0612/CA064	1632	1.80	1.10	0.50	0.80	3.90	4.40	1.80	0.95	0.50	0.80	3.30	3.90	1.70	0.85	0.40	0.80	2.80	3.60

Density Level A: *SV PS[HIRWMX] TVSHYGX ETTPMGEXMSRW 4VSZMHIW E [MHIV TVSGIWW [
Density Level B: *SV TVSHYGXW [MXL E QSHIVEXI PIZIP SJ GSQTSRIRX HIRWMX] 4VSZMHIW
Density Level C: *SV LMKL GSQTSRIRX HIRWMX] TVSHYGX ETTPMGEXMSRW &IJSVI EHETXMR
UYEPM¼GEXMSR XIWXMRK FEWIH SR XLI GSRHMXMSRW SYXPMRIH MR -4' 7XERHEVH

-QEKI FIPS[FEWIH SR (IRWMX] 0IZIP & JSV ER)-% GEWI WM^I



Grid Placement Courtyard

'ETEGMXSV 1EVOMRK 3TXMSREP

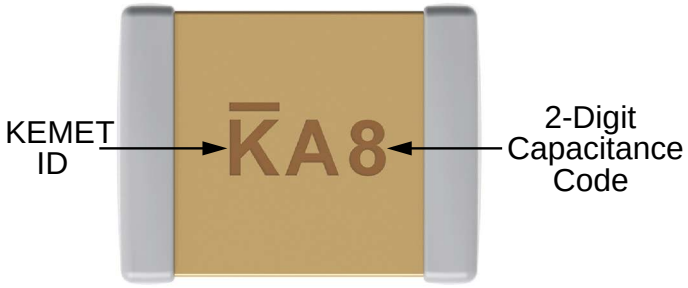
These surface mount multilayer ceramic capacitors are normally supplied unmarked. If required, they can be marked as an extra cost option. Marking is available on most KEMET devices but must be requested using the correct ordering code identifier(s). If this option is requested, two sides of the ceramic 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 not available on:

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

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.



Capacitor Marking (Optional) cont'd

'ETEGMXERGI T* *SV :EVMSYW %PTLE										
Alpha Character	Numeral									
	9	0	1	2	3	4	5	6	7	8
	Capacitance (pF)									
A	0.10	1.0	10	100	1,000	10,000	100,000	1,000,000	10,000,000	100,000,000
B	0.11	1.1	11	110	1,100	11,000	110,000	1,100,000	11,000,000	110,000,000
C	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
E	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
H	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
M	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
P	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
X	0.75	7.5	75	750	7,500	75,000	750,000	7,500,000	75,000,000	750,000,000
Y	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	0.40	4.0	40	400	4,000	40,000	400,000	4,000,000	40,000,000	400,000,000
e	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
y	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.

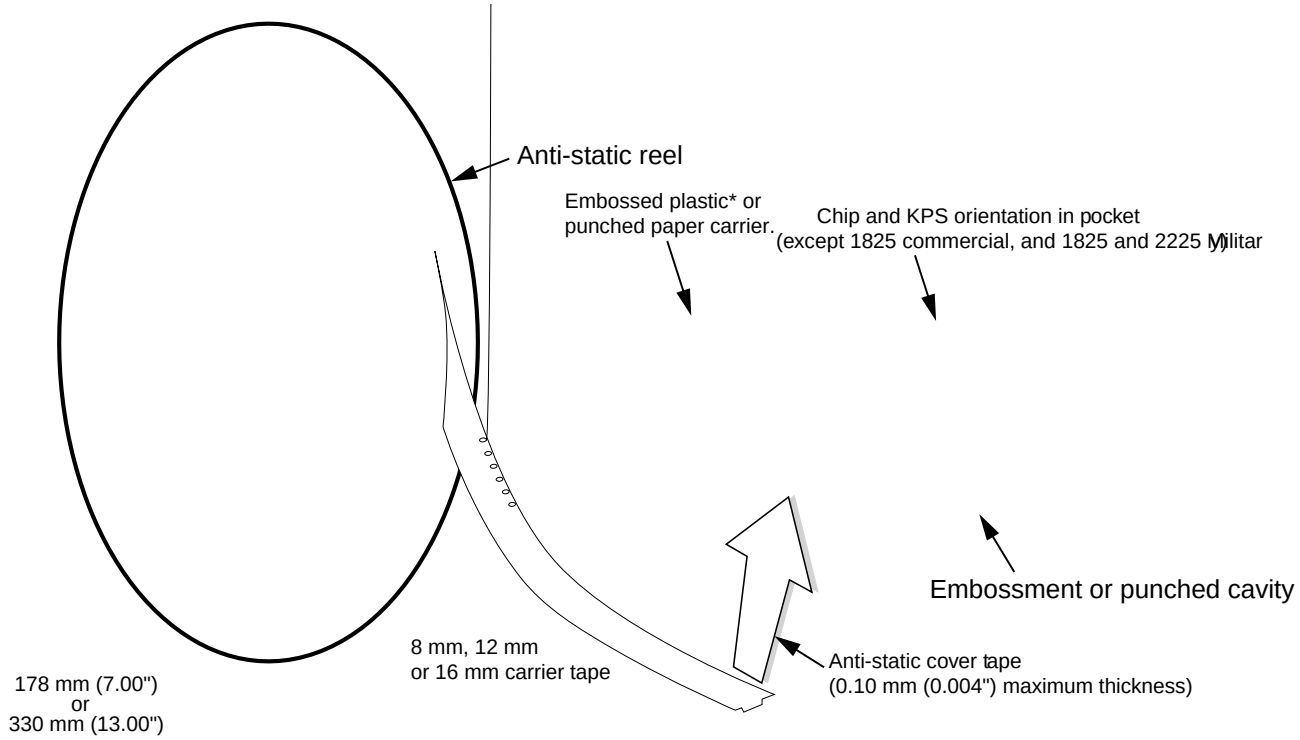


Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

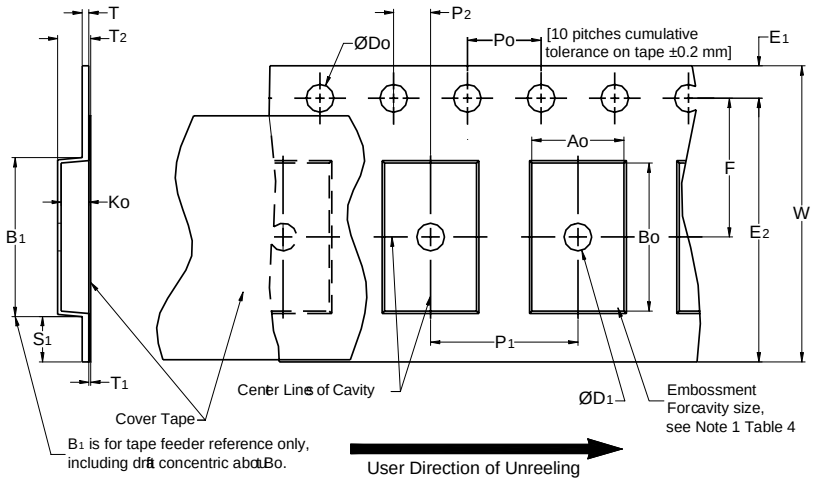


Table 6 – Embossed (Plastic) Carrier Tape Dimensions

Metric will govern2 -334.05 540.018..7461f5 4425 44265 449 l5 540re 36.2-334.4.2 69.018..7461 0 3 66.2-334.7e 3601

Figure 2 – Punched (Paper) Carrier Tape Dimensions

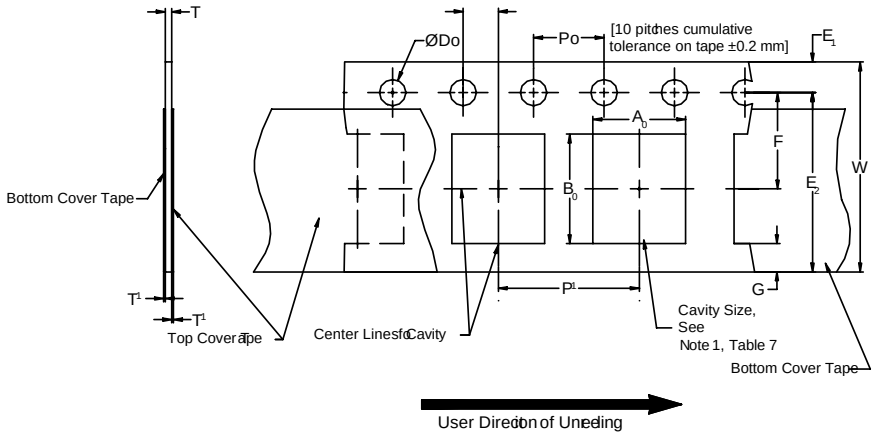


Table 7 – Punched (Paper) Carrier Tape Dimensions

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 ±0.006	7	*f*	

Packaging Information Performance Notes

'SZIV 8ETI &VIEO *SVGI 1.0 kg minimum.
'SZIV 8ETI 4IIP 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
165° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity
300 ±10 mm/minute.

0EFIPMRK Bar code labeling (standard or custom) shall be on the side of the reel opposite the sprocket holes. 6IJIV
Standards 556 and 624.

Figure 3 – Maximum Component Rotation

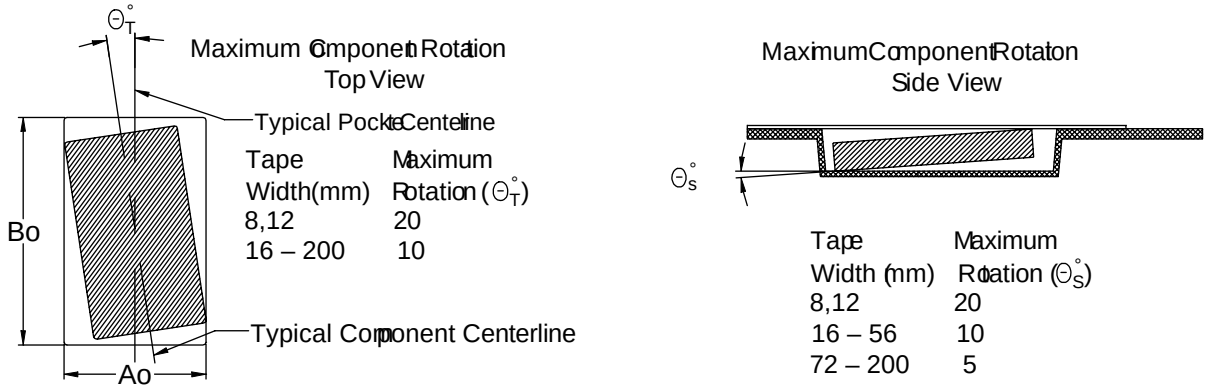


Figure 4 – Maximum Lateral Movement

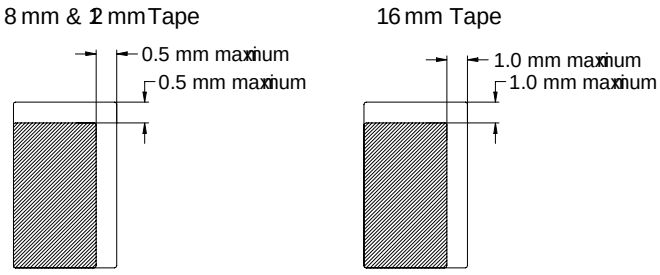


Figure 5 – Bending Radius

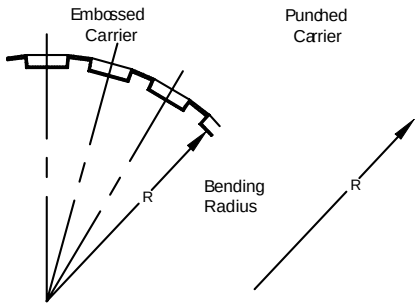


Figure 6 – Reel Dimensions

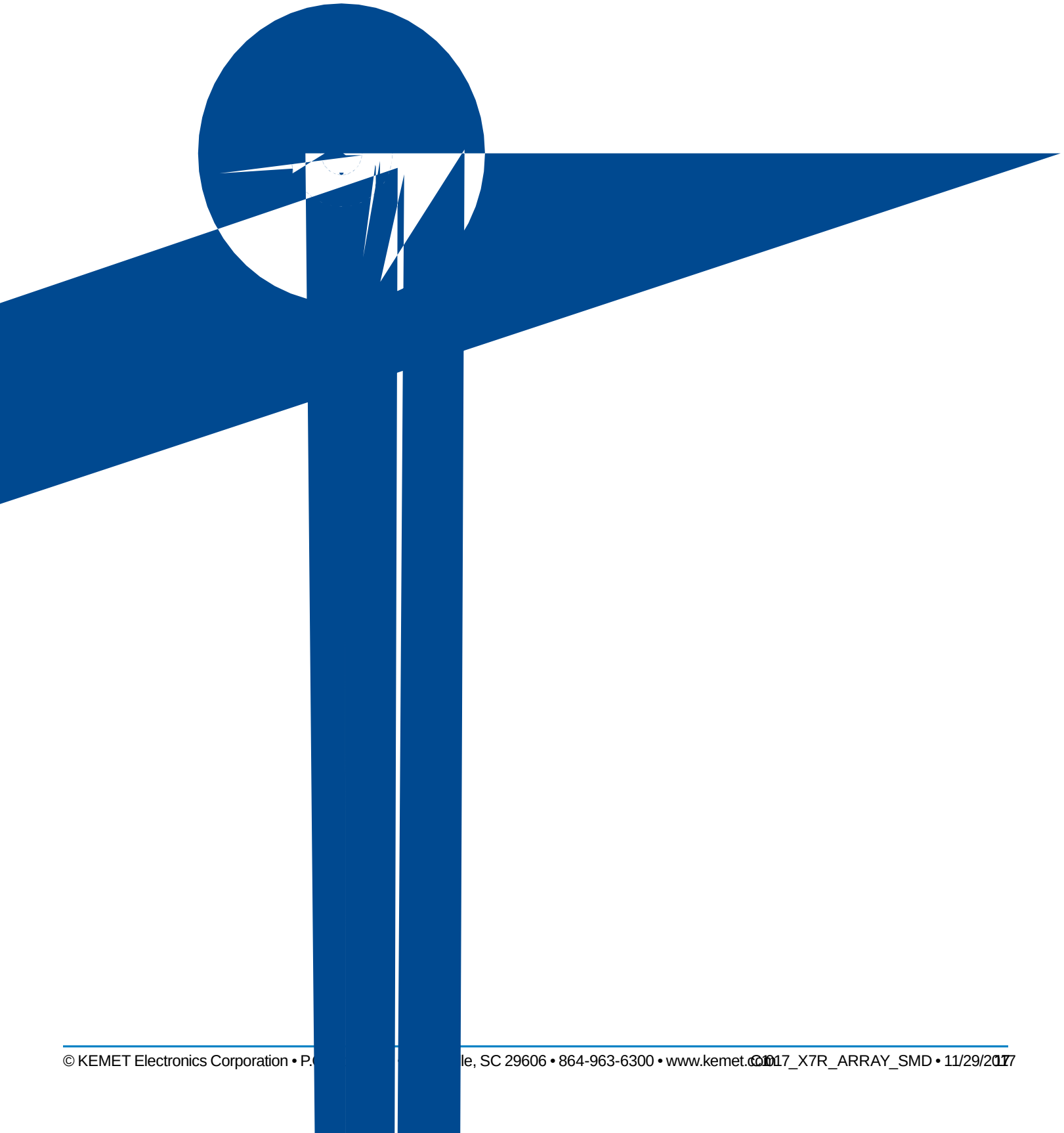
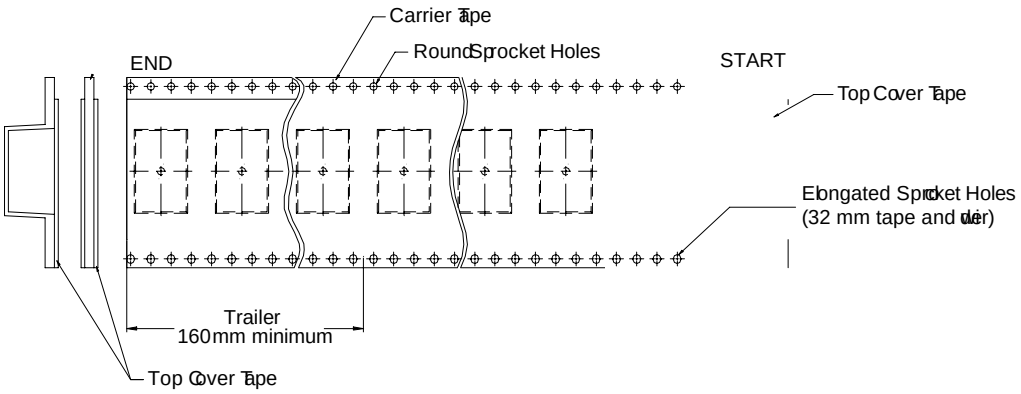


Figure 7 – Tape Leader & Trailer Dimensions



/)1)8)PIGXVSRMGW 'SVTSVEXMSR 7EPIW 3¾ GIW

For a complete list of our global sales o ces, please visit www.kemet.com/sales.

Disclaimer

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

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