MIL-PRF (CWR Style) Established Reliability

T409 Series CWR09 Style MIL-PRF-55365/4

Overview

The KEMET T409 series is approved to MIL-PRF-55365/4 (CWR09), with Weibull failure rates of B level (0.1% failures per 1000 hours), C level (0.01% failures per 1000 hours), or D level (0.001% failures per 1000 hours). This CWR09 product is a precision-molded device, with compliant terminations and indelible laser marking. Tape and reeling per EIA 481-D is standard.

Benefits

- Established reliability options
- Taped and reeled per EIA 481-D
- Symmetrical, compliant terminations
- Laser-marked case
- 100% surge current test available on all case sizes
- Qualified to MIL-PRF-55365/4, Style CWR09
- Termination options B, C, H, K
- Weibull failure options B, C, and D
- Voltage rating of 4-50 VDC
- Operating temperature range of -55˚C to +125˚C

Applications

Typical applications include decoupling and filtering in Military and aerospace applications requiring CWR09 devices.

Environmental Compliance

RoHS Compliant (6/6)* according to Directive 2002/95/EC

**When ordered with 100% Sn Solder*

SPICE

For a detailed analysis of specific part numbers, please visit kemet.com for a free download of KEMET's SPICE software. The KEMET SPICE program is freeware intended to aid design engineers in analyzing the performance of these capacitors over frequency, temperature, ripple, and DC bias conditions.

Ordering Information

T	409	G	225	K	004	A	H	4252
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/ Design	Lead Material	Surge
T = Tantalum	CWR 09 Established Reliability	A = 1005 B = 1505 C = 2005 D = 1510 E = 2010 F = 2214 G = 2711 H = 2915	First two digits represent significant figures. Third digit specifies number of zeros.	J = ±5% K = ±10% M = ±20%	004 = 4V 006 = 6.3V 010 = 10V 015 = 15V 020 = 20V 025 = 25V 035 = 35V 050 = 50V	A = N/A B = 0.1%/1000 hrs C = .01%/1000 hrs D=.001%/1000 hrs	C = Hot Solder Dipped H = Standard Solder Coated (SnPb 5% Pb minimum) B = Gold Plated K = Solder Fused	4250= 25ºC after Weibull 4251 = -55ºC and 85ºC after Weibull 4252 = -55ºC and 85ºC before Weibull

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 125°C
Rated Capacitance Range	0.1µF - 100µF @ 120 Hz/25°C
Capacitance Tolerance	J Tolerance (5%), K Tolerance (10%), M Tolerance (20%)
Rated Voltage Range	4V - 50V
DF(120Hz)	Refer to Part Number Electrical Specification Table
ESR (100kHz)	Refer to Part Number Electrical Specification Table
Leakage Current	≤ 0.01CV (µA) at Rated Voltage after 5 minutes

Qualification

Test	Condition		Characteristics			
Endurance	85°C @ Rated Voltage, 2000 Hours. 125°C @ 2/3 Rated Voltage, 2000 Hours.		ΔC/C	Within ± 10% of initial value		
			DF	Within initial limits		
			DCL	Within 1.25 x initial limit		
			ESR	Within initial limits		
Storage Life	125°C @ 0 Volts, 2000 Hours.		ΔC/C	Within ± 10% of initial value		
			DF	Within initial limits		
			DCL	Within 1.25 x initial limit		
			ESR	Within initial limits		
Thermal Shock	MIL-Std-202, Method 107, Condition B, mounted, -55C° to 125°C, 1000 cycles.		ΔC/C	Within ± 5% of initial value		
			DF	Within initial limits		
			DCL	Within 1.25 x initial limit		
			ESR	Within initial limits		
Temperature Stability	Extreme temperature exposure at a succession of continuous steps at +25°C, -55°C, +25°C, +85°C, +125°C, +25°C.		+25°C	-55°C	+85°C	+125°C
		ΔC/C	IL*	±10%	±10%	±20%
		DF	IL	IL	1.5 x IL	1.5 x IL
		DCL	IL	n/a	10 x IL	12 x IL
Surge Voltage	25°C and 85° C, 1.32 x Rated Voltage 1000 cycles (125°C, 1.2 x Rated Voltage).		ΔC/C	Within ± 5% of initial value		
			DF	Within initial limits		
			DCL	Within initial limits		
			ESR	Within initial limits		
Mechanical Shock/Vibration	MIL-Std-202, Meth. 213, Cond. I, 100G Peak. MIL-Std-202, Meth. 204, Cond. D, 10Hz to 2000Hz, 20G Peak.		ΔC/C	Within ±10% of initial value		
			DF	Within initial limits		
			DCL	Within initial limits		

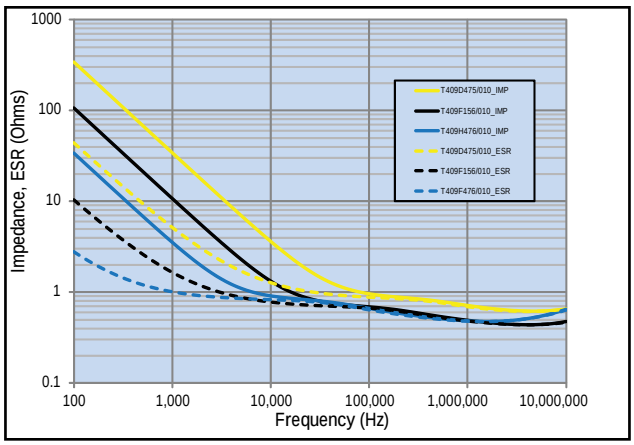
**IL = Initial Limit*

Certification

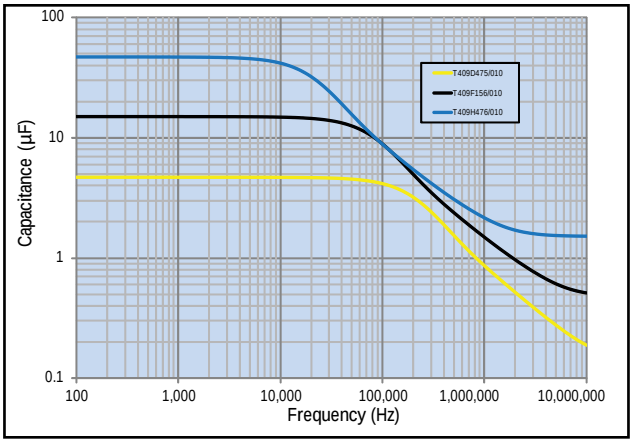
MIL-PRF-55365/4

Electrical Characteristics

ESR vs. Frequency

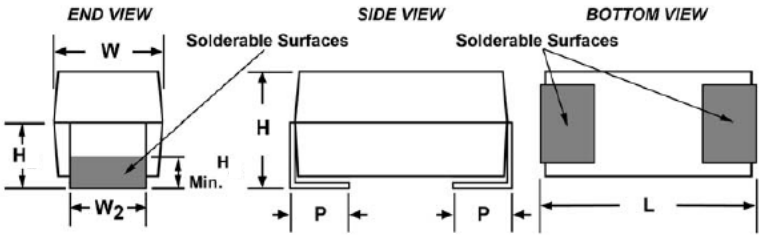


Capacitance vs. Frequency



Dimensions – Millimeters (Inches)

Metric will govern



Case Size		Component			
KEMET	L* +/- 0.38 (.015)	W* +/- 0.38 (.015)	H* +/- 0.38 (.015)	P +.025(.010), -0.13(.005)	W_2
A	2.54 (.100)	1.27 (.050)	1.27 (.050)	0.76 (.030)	1.27 +/- 0.13 (.050 +/- .005)
B	3.81 (.150)	1.27 (.050)	1.27 (.050)	0.76 (.030)	1.27 +/- 0.13 (.050 +/- .005)
C	5.08 (.200)	1.27 (.050)	1.27 (.050)	0.76 (.030)	1.27 +/- 0.13 (.050 +/- .005)
D	3.81 (.150)	2.54 (.100)	1.27 (.050)	0.76 (.030)	2.41 +.13, -.25 (.095 +.005, -.010)
E	5.08 (.200)	2.54 (.100)	1.27 (.050)	0.76 (.030)	2.41 +.13, -.25 (.095 +.005, -.010)
F	5.59 (.220)	3.43 (.135)	1.78 (.070)	0.76 (.030)	3.30 +/- 0.13 (.130 +/- .005)
G	6.73 (.265)	2.79 (.110)	2.79 (.110)	1.27 (.050)	2.67 +/- 0.13 (.105 +/- .005)
H	7.24 (.285)	3.81 (.150)	2.79 (.110)	1.27 (.050)	3.68 +.013, -0.51 (.145 + .005, - .020)

Table 1 – Ratings & Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL-C-55365/4F Part Number	DC Leakage	DF	ESR	Moisture Sensitivity
85°C	120Hz	KEMET/EIA	(See below for part options)	(See below for part options)	µAmps +20°C	+20°C 120Hz	+20°C 100kHz	Temp≤260°C
VDC	µF				max/5min	% Max	Ohms	J-STD-020D
4	2.2	A/1005	T409A225(1)004(2)(3)(4)	CWR09C(3)225(1)(2)(5)	0.1	6.0	8.0	1.0
4	4.7	B/1505	T409B475(1)004(2)(3)(4)	CWR09C(3)475(1)(2)(5)	0.2	6.0	8.0	1.0
4	6.8	C/2005	T409C685(1)004(2)(3)(4)	CWR09C(3)685(1)(2)(5)	0.3	6.0	5.5	1.0
4	10	D/1510	T409D106(1)004(2)(3)(4)	CWR09C(3)106(1)(2)(5)	0.4	8.0	4.0	1.0
4	15	E/2010	T409E156(1)004(2)(3)(4)	CWR09C(3)156(1)(2)(5)	0.6	8.0	3.5	1.0
4	33	F/2214	T409F336(1)004(2)(3)(4)	CWR09C(3)336(1)(2)(5)	1.3	8.0	2.2	1.0
4	68	G/2711	T409G686(1)004(2)(3)(4)	CWR09C(3)686(1)(2)(5)	2.7	10.0	1.1	1.0
4	100	H/2915	T409H107(1)004(2)(3)(4)	CWR09C(3)107(1)(2)(5)	4.0	10.0	0.9	1.0
6.3	1.5	A/1005	T409A155(1)006(2)(3)(4)	CWR09D(3)155(1)(2)(5)	0.1	6.0	8.0	1.0
6.3	3.3	B/1505	T409B335(1)006(2)(3)(4)	CWR09D(3)335(1)(2)(5)	0.2	6.0	8.0	1.0
6.3	4.7	C/2005	T409C475(1)006(2)(3)(4)	CWR09D(3)475(1)(2)(5)	0.3	6.0	5.5	1.0
6.3	6.8	D/1510	T409D685(1)006(2)(3)(4)	CWR09D(3)685(1)(2)(5)	0.4	6.0	4.5	1.0
6.3	10	E/2010	T409E106(1)006(2)(3)(4)	CWR09D(3)106(1)(2)(5)	0.6	8.0	3.5	1.0
6.3	22	F/2214	T409F226(1)006(2)(3)(4)	CWR09D(3)226(1)(2)(5)	1.4	8.0	2.2	1.0
6.3	47	G/2711	T409G476(1)006(2)(3)(4)	CWR09D(3)476(1)(2)(5)	3.0	10.0	1.1	1.0
6.3	68	H/2915	T409H686(1)006(2)(3)(4)	CWR09D(3)686(1)(2)(5)	4.3	10.0	0.9	1.0
10	1	A/1005	T409A105(1)010(2)(3)(4)	CWR09F(3)105(1)(2)(5)	0.1	6.0	10.0	1.0
10	2.2	B/1505	T409B225(1)010(2)(3)(4)	CWR09F(3)225(1)(2)(5)	0.2	6.0	8.0	1.0
10	3.3	C/2005	T409C335(1)010(2)(3)(4)	CWR09F(3)335(1)(2)(5)	0.3	6.0	5.5	1.0
10	4.7	D/1510	T409D475(1)010(2)(3)(4)	CWR09F(3)475(1)(2)(5)	0.5	6.0	4.5	1.0
10	6.8	E/2010	T409E685(1)010(2)(3)(4)	CWR09F(3)685(1)(2)(5)	0.7	6.0	3.5	1.0
10	15	F/2214	T409F156(1)010(2)(3)(4)	CWR09F(3)156(1)(2)(5)	1.5	8.0	2.5	1.0
10	33	G/2711	T409G336(1)010(2)(3)(4)	CWR09F(3)336(1)(2)(5)	3.3	10.0	1.1	1.0
10	47	H/2915	T409H476(1)010(2)(3)(4)	CWR09F(3)476(1)(2)(5)	4.7	10.0	0.9	1.0
15	0.68	A/1005	T409A684(1)015(2)(3)(4)	CWR09H(3)684(1)(2)(5)	0.1	6.0	12.0	1.0
15	1.5	B/1505	T409B155(1)015(2)(3)(4)	CWR09H(3)155(1)(2)(5)	0.2	6.0	8.0	1.0
15	2.2	C/2005	T409C225(1)015(2)(3)(4)	CWR09H(3)225(1)(2)(5)	0.3	6.0	5.5	1.0
15	3.3	D/1510	T409D335(1)015(2)(3)(4)	CWR09H(3)335(1)(2)(5)	0.5	6.0	5.0	1.0
15	4.7	E/2010	T409E475(1)015(2)(3)(4)	CWR09H(3)475(1)(2)(5)	0.7	6.0	4.0	1.0
15	10	F/2214	T409F106(1)015(2)(3)(4)	CWR09H(3)106(1)(2)(5)	1.5	6.0	2.5	1.0
15	22	G/2711	T409G226(1)015(2)(3)(4)	CWR09H(3)226(1)(2)(5)	3.3	6.0	1.1	1.0
15	33	H/2915	T409H336(1)015(2)(3)(4)	CWR09H(3)336(1)(2)(5)	5.0	8.0	0.9	1.0
20	0.47	A/1005	T409A474(1)020(2)(3)(4)	CWR09J(3)474(1)(2)(5)	0.1	8.0	14.0	1.0
20	0.68	B/1505	T409B684(1)020(2)(3)(4)	CWR09J(3)684(1)(2)(5)	0.1	6.0	10.0	1.0
20	1	B/1505	T409B105(1)020(2)(3)(4)	CWR09J(3)105(1)(2)(5)	0.2	6.0	12.0	1.0
20	1.5	C/2005	T409C155(1)020(2)(3)(4)	CWR09J(3)155(1)(2)(5)	0.3	6.0	6.0	1.0
20	2.2	D/1510	T409D225(1)020(2)(3)(4)	CWR09J(3)225(1)(2)(5)	0.4	6.0	5.0	1.0
20	3.3	E/2010	T409E335(1)020(2)(3)(4)	CWR09J(3)335(1)(2)(5)	0.7	6.0	4.0	1.0
20	6.8	F/2214	T409F685(1)020(2)(3)(4)	CWR09J(3)685(1)(2)(5)	1.4	6.0	2.4	1.0
20	15	G/2711	T409G156(1)020(2)(3)(4)	CWR09J(3)156(1)(2)(5)	3.0	6.0	1.1	1.0
20	22	H/2915	T409H226(1)020(2)(3)(4)	CWR09J(3)226(1)(2)(5)	4.4	6.0	0.9	1.0
25	0.33	A/1005	T409A334(1)025(2)(3)(4)	CWR09K(3)334(1)(2)(5)	0.1	6.0	15.0	1.0
25	0.68	B/1505	T409B684(1)025(2)(3)(4)	CWR09K(3)684(1)(2)(5)	0.2	6.0	7.5	1.0
25	1	C/2005	T409C105(1)025(2)(3)(4)	CWR09K(3)105(1)(2)(5)	0.3	6.0	6.5	1.0
VDC	µF	KEMET/EIA	(see below for part options)	(See below for part options)	max/5min	% Max	Ohms	J-STD-020D
85°C	120Hz				µAmps +20°C	+20°C 120Hz	+20°C 100kHz	Temp≤260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL-C-55365/4F Part Number	DC Leakage	DF	ESR	Moisture Sensitivity

(1) To complete KEMET/CWR part number, insert M for ± 20%, K for ± 10%, or J for ± 5%. Designates Capacitance tolerance.

(2) To complete KEMET/CWR part number, insert B (0.1%/1000Hrs), C (0.01%/1000Hrs), D (0.001%/1000Hrs) or A = N/A. Designates Reliability Level.

(3) To complete KEMET/CWR part number, insert B = Gold Plated, C = Hot solder dipped, H = Solder plated or K = Solder Fused. Designates Termination Finish.

(4) To complete KEMET part number, insert 4250 = +25°C after Weibull, 4251 = -55°C +85°C after Weibull, or 4252 = -55°C +85°C before Weibull. Designates Surge current option.

(5) To complete CWR part number, insert A = +25°C after Weibull, B = -55°C +85°C after Weibull, or C = -55°C +85°C before Weibull. Designates Surge current option.

Refer to Ordering Information for additional detail.

Roll Over for Order Info.

Table 1 – Ratings & Part Number Reference con't

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL-C-55365/4F Part Number	DC Leakage	DF	ESR	Moisture Sensitivity
85°C	120Hz	KEMET/EIA	(See below for part options)	(See below for part options)	µAmps +20°C	+20°C 120Hz	+20°C 100kHz	Temp≤260°C
VDC	µF				max/5min	% Max	Ohms	J-STD-020D
25	1.5	D/1510	T409D155(1)025(2)(3)(4)	CWR09K(3)155(1)(2)(5)	0.4	6.0	6.5	1.0
25	2.2	E/2010	T409E225(1)025(2)(3)(4)	CWR09K(3)225(1)(2)(5)	0.6	6.0	3.5	1.0
25	4.7	F/2214	T409F475(1)025(2)(3)(4)	CWR09K(3)475(1)(2)(5)	1.2	6.0	2.5	1.0
25	6.8	G/2711	T409G685(1)025(2)(3)(4)	CWR09K(3)685(1)(2)(5)	1.7	6.0	1.2	1.0
25	10	G/2711	T409G106(1)025(2)(3)(4)	CWR09K(3)106(1)(2)(5)	2.5	6.0	1.4	1.0
25	15	H/2915	T409H156(1)025(2)(3)(4)	CWR09K(3)156(1)(2)(5)	3.8	6.0	1.0	1.0
35	0.22	A/1005	T409A224(1)035(2)(3)(4)	CWR09M(3)224(1)(2)(5)	0.1	6.0	18.0	1.0
35	0.47	B/1505	T409B474(1)035(2)(3)(4)	CWR09M(3)474(1)(2)(5)	0.2	6.0	10.0	1.0
35	0.68	C/2005	T409C684(1)035(2)(3)(4)	CWR09M(3)684(1)(2)(5)	0.2	6.0	8.0	1.0
35	1	D/1510	T409D105(1)035(2)(3)(4)	CWR09M(3)105(1)(2)(5)	0.4	6.0	6.5	1.0
35	1.5	E/2010	T409E155(1)035(2)(3)(4)	CWR09M(3)155(1)(2)(5)	0.5	6.0	4.5	1.0
35	3.3	F/2214	T409F335(1)035(2)(3)(4)	CWR09M(3)335(1)(2)(5)	1.2	6.0	2.5	1.0
35	4.7	G/2711	T409G475(1)035(2)(3)(4)	CWR09M(3)475(1)(2)(5)	1.6	6.0	1.5	1.0
35	6.8	H/2915	T409H685(1)035(2)(3)(4)	CWR09M(3)685(1)(2)(5)	2.4	6.0	1.3	1.0
50	0.1	A/1005	T409A104(1)050(2)(3)(4)	CWR09N(3)104(1)(2)(5)	0.1	6.0	22.0	1.0
50	0.15	A/1005	T409A154(1)050(2)(3)(4)	CWR09N(3)154(1)(2)(5)	0.1	6.0	17.0	1.0
50	0.22	B/1505	T409B224(1)050(2)(3)(4)	CWR09N(3)224(1)(2)(5)	0.1	6.0	14.0	1.0
50	0.33	B/1505	T409B334(1)050(2)(3)(4)	CWR09N(3)334(1)(2)(5)	0.2	6.0	12.0	1.0
50	0.47	C/2005	T409C474(1)050(2)(3)(4)	CWR09N(3)474(1)(2)(5)	0.2	6.0	8.0	1.0
50	0.68	D/1510	T409D684(1)050(2)(3)(4)	CWR09N(3)684(1)(2)(5)	0.3	6.0	7.0	1.0
50	1	E/2010	T409E105(1)050(2)(3)(4)	CWR09N(3)105(1)(2)(5)	0.5	6.0	6.0	1.0
50	1.5	F/2214	T409F155(1)050(2)(3)(4)	CWR09N(3)155(1)(2)(5)	0.8	6.0	4.0	1.0
50	2.2	F/2214	T409F225(1)050(2)(3)(4)	CWR09N(3)225(1)(2)(5)	1.1	6.0	2.5	1.0
50	3.3	G/2711	T409G335(1)050(2)(3)(4)	CWR09N(3)335(1)(2)(5)	1.7	6.0	2.0	1.0
50	4.7	H/2915	T409H475(1)050(2)(3)(4)	CWR09N(3)475(1)(2)(5)	2.4	6.0	1.5	1.0
VDC	µF	KEMET/EIA	(see below for part options)	(See below for part options)	max/5min	% Max	Ohms	J-STD-020D
85°C	120Hz				µAmps +20°C	+20°C 120Hz	+20°C 100kHz	Temp≤260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	MIL-C-55365/4F Part Number	DC Leakage	DF	ESR	Moisture Sensitivity

(1) To complete KEMET/CWR part number, insert M for ± 20%, K for ± 10%, or J for ± 5%. Designates Capacitance tolerance.

(2) To complete KEMET/CWR part number, insert B (0.1%/1000Hrs), C (0.01%/1000Hrs), D (0.001%/1000Hrs) or A = N/A. Designates Reliability Level.

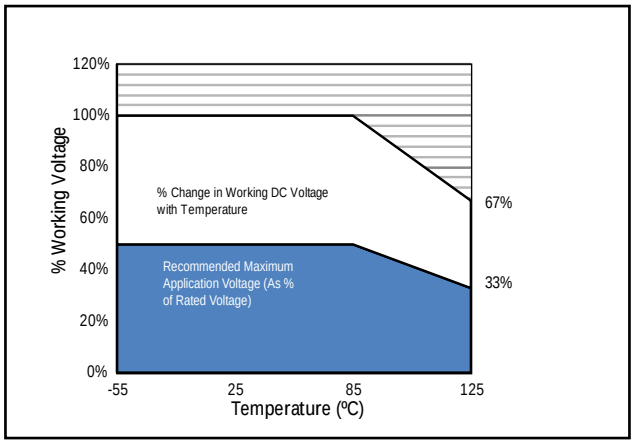
(3) To complete KEMET/CWR part number, insert B = Gold Plated, C = Hot solder dipped, H = Solder plated or K = Solder Fused. Designates Termination Finish.

(4) To complete KEMET part number, insert 4250 = +25°C after Weibull, 4251 = -55°C +85°C after Weibull, or 4252 = -55°C +85°C before Weibull. Designates Surge current option.

(5) To complete CWR part number, insert A = +25°C after Weibull, B = -55°C +85°C after Weibull, or C = -55°C +85°C before Weibull. Designates Surge current option.

Refer to Ordering Information for additional detail.

Recommended Voltage Derating Guidelines



Ripple Current/Ripple Voltage

Case Code		Maximum Power Dissipation (Pmax) mWatts @ 25°C w/+20°C Rise
KEMET	EIA	
A	1005	50
B	1505	70
C	2005	75
D	1510	80
E	2010	90
F	2214	100
G	2711	125
H	2915	150

Temperature Compensation Multipliers for Maximum Power Dissipation		
≤25°C	85°C	125°C
1.00	0.90	0.40

T= Environmental Temperature

Using the P max of the device, the maximum allowable rms ripple current or voltage may be determined.

$I(max) = \sqrt{P\ max/R}$
$E(max) = \sqrt{P\ max * R}$

I = rms ripple current (amperes)
E = rms ripple voltage (volts)
Pmax = maximum power dissipation(watts)
R = ESR at specified frequency (ohms)

Reverse Voltage

Solid tantalum capacitors are polar devices and may be permanently damaged or destroyed if connected with the wrong polarity. The positive terminal is identified on the capacitor body by a stripe plus in some cases a beveled edge. A small degree of transient reverse voltage is permissible for short periods per the table. The capacitors should not be operated continuously in reverse mode, even within these limits.

Temperature	Permissible Transient Reverse Voltage
25°C	15% of Rated Voltage
85°C	5% of Rated Voltage
125°C	1% of Rated Voltage

Table 2 – Land Dimensions/Courtyard

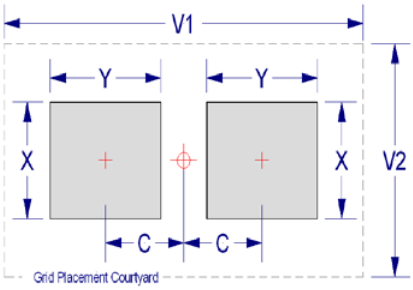
KEMET	Metric Size Code	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
Case	**EIA**	X	Y	**C**	V1	V2	X	Y	**C**	V1	V2	X	Y	**C**	V1	V2
A[1]	1005	1.45	2.15	1.20	5.60	2.70	1.35	1.85	1.05	4.50	2.20	1.25	1.55	0.90	3.60	1.90
B	1505	1.45	2.30	1.75	6.80	2.70	1.35	1.90	1.65	5.70	2.20	1.25	1.55	1.55	4.90	1.92
C	2005	1.45	2.30	2.40	8.10	2.70	1.35	1.90	2.30	7.00	2.20	1.25	1.55	2.15	6.10	1.90
D	1510	2.60	2.30	1.75	6.80	4.00	2.45	1.90	1.65	5.70	3.50	2.35	1.55	1.55	4.90	3.20
E	2010	2.60	2.30	2.40	8.10	4.00	2.45	1.90	2.30	7.00	3.50	2.35	1.55	2.15	6.10	3.20
F	2214	3.50	2.30	2.65	8.60	4.90	3.35	1.90	2.55	7.50	4.40	3.25	1.55	2.45	6.70	4.10
G	2711	2.85	2.80	2.95	9.70	4.20	2.75	2.40	2.85	8.60	3.70	2.65	2.05	2.75	7.80	3.40
H	2915	3.85	2.80	3.20	10.20	5.20	3.75	2.40	3.10	9.10	4.70	3.65	2.05	3.00	8.30	4.40

Density Level A: For low-density Product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.

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).

[1] Land pattern geometry is too small for silkscreen outline.



Soldering Process

KEMET's families of surface mount capacitors 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-020D standard for moisture sensitivity testing. The devices can safely withstand a maximum of three reflow passes at these conditions.

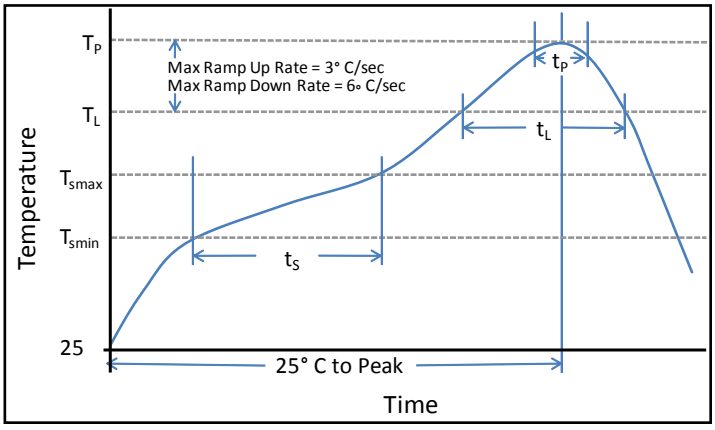
Note that although the X/7343-43 case size can withstand wave soldering, the tall profile (4.3 mm maximum) dictates care in wave process development.

Hand soldering should be performed with care due to the difficulty in process control. If performed, care should be taken to avoid contact of the soldering iron to the molded case. The iron should be used to heat the solder pad, applying solder between the pad and the termination, until reflow occurs. Once reflow occurred, the iron should be removed immediately. "Wiping" the edges of a chip and heating the top surface is not recommended.

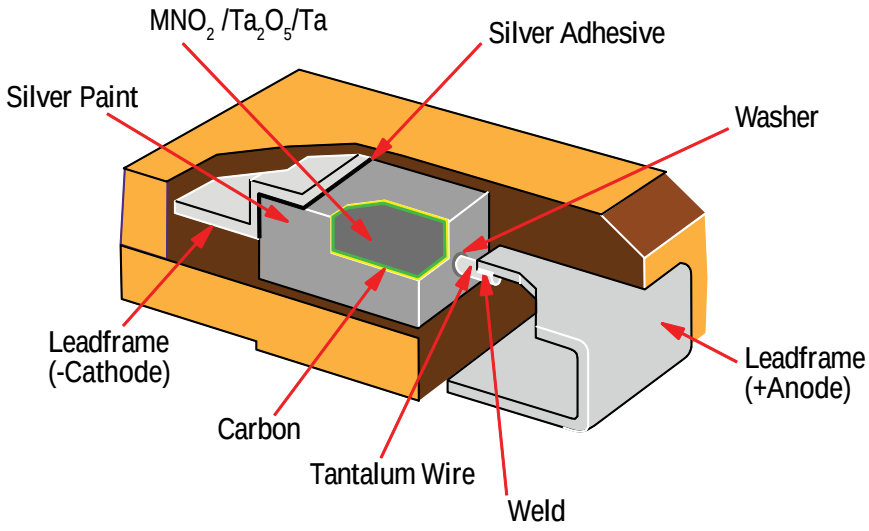
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and is not harmful to the product. Marking permanency is not affected by this change.

Profile Feature	SnPb Assembly	Pb-Free Assembly
Preheat/Soak		
Temperature Min (T_{Smin})	100°C	150°C
Temperature Max (T_{Smax})	150°C	200°C
Time (t_s) from T_{smin} to T_{smax})	60–120 sec	60–120 sec
Ramp-up Rate (T_L to T_P)	3°C/sec max	3°C/sec max
Liquidous Temperature (T_L)	183°C	217°C
Time Above Liquidous (t_L)	60–150 sec	60–150 sec
Peak Temperature (T_P)	220°C* 235°C**	250°C* 260°C**
Time within 5°C of Max Peak Temperature (t_P)	20 sec max	30 sec max
Ramp-down Rate (T_P to T_L)	6°C/sec max	6°C/sec max
Time 25°C to Peak Temperature	6 minutes max	8 minutes max

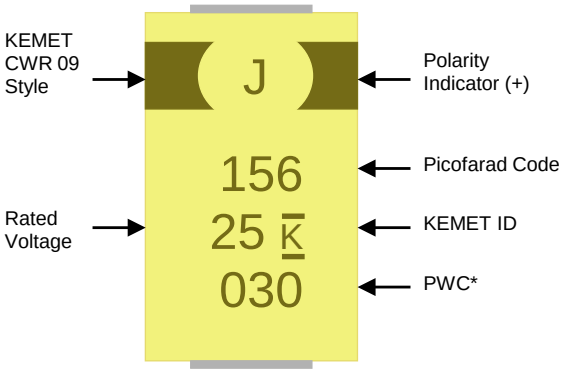
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.
**Case Size D, E, P, Y and X*
***Case Size A, B, C, H, I, K, M, R, S, T, U, V, W and Z*



Construction



Capacitor Marking



* 030 = 30th week of 2010

Storage

Tantalum chip capacitors should be stored in normal working environments. While the chips themselves are quite robust in other environments, solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. In addition, packaging materials will be degraded by high temperature - reels may soften or warp, and tape peel force may increase. KEMET recommends that maximum storage temperature not exceed 40ºC, and maximum storage humidity not exceed 60% relative humidity. In addition, temperature fluctuations should be minimized to avoid condensation on the parts, and atmospheres should be free of chlorine and sulphur bearing compounds. For optimized solderability, chip stock should be used promptly, preferably within three years of receipt.

Tape & Reel Packaging Information

KEMET's Molded Tantalum and Aluminum Chip Capacitor families are packaged in 8 mm and 12 mm plastic tape on 7" and 13" reels, in accordance with EIA Standard 481-D: Taping of Surface Mount Components for Automatic Handling. This packaging system is compatible with all tape fed automatic pick and place systems.

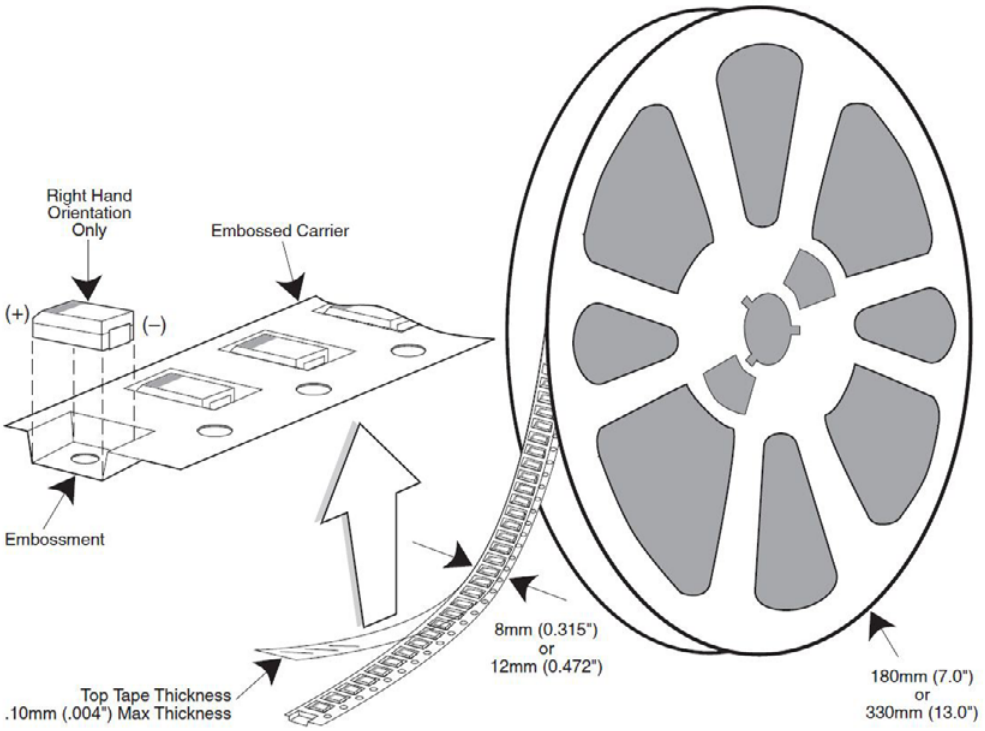


Table 3 – Packaging Quantity

Case Code		Tape Width-mm	7" Reel*	13" Reel*
KEMET	EIA			
R	2012-12	8	2,500	10,000
I	3216-10	8	3,000	12,000
S	3216-12	8	2,500	10,000
T	3528-12	8	2,500	10,000
M	3528-15	8	2,000	8,000
U	6032-15	12	1,000	5,000
L	6032-19	12	1,000	5,000
W	7343-15	12	1,000	3,000
Z	7343-17	12	1,000	3,000
V	7343-20	12	1,000	3,000
A	3216-18	8	2,000	9,000
B	3528-21	8	2,000	8,000
C	6032-28	12	500	3,000
D	7343-31	12	500	2,500
Y	7343-40	12	500	2,000
X	7343-43	12	500	2,000
E	7260-38	12	500	2,000

** No c-spec required for 7" reel packaging. C-7280 required for 13" reel packaging.*

Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

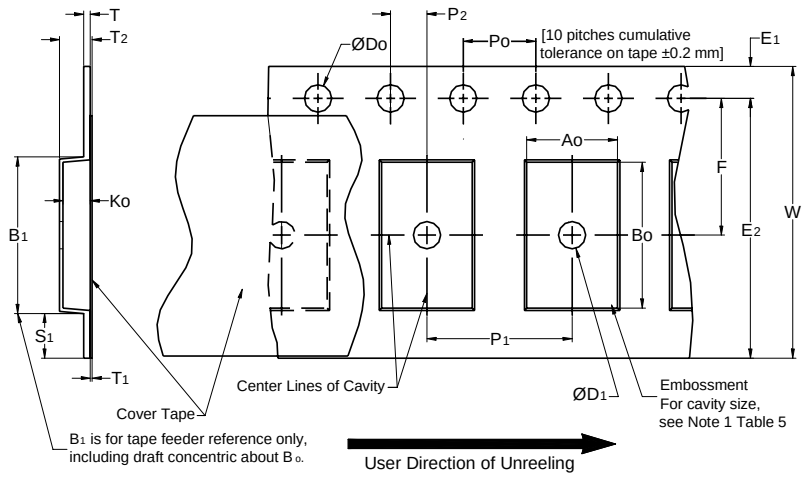


Table 4 – Embossed (Plastic) Carrier Tape Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)									
Tape Size	D_0	D_1 Min. Note 1	E_1	P_0	P_2	R Ref. Note 2	S_1 Min. Note 3	T Max.	T_1 Max.
8mm	1.5 +0.10/-0.0 (0.059 +0.004/-0.0)	1.0 (0.039)	1.75 ± 0.10 (0.069 ± 0.004)	4.0 ± 0.10 (0.157 ± 0.004)	2.0 ± 0.05 (0.079 ± 0.002)	25.0 (0.984)	0.600 (0.024)	0.600 (0.024)	0.100 (0.004)
12mm		1.5 (0.059)				30 (1.181)			
16mm									

Variable Dimensions — Millimeters (Inches)								
Tape Size	Pitch	B_1 Max. Note 4	E_2 Min.	F	P_1	T_2 Max	W Max	A_0,B_0 & K_0
8mm	Single (4mm)	4.35 (0.171)	6.25 (0.246)	3.5 ± 0.05 (0.138 ± 0.002)	4.0 ± 0.10 (0.157 ± 0.004)	2.5 (0.098)	8.3 (0.327)	Note 5
12mm	Single (4mm) & Double (8mm)	8.2 (0.323)	10.25 (0.404)	5.5 ± 0.05 (0.217 ± 0.002)	8.0 ± 0.10 (0.315 ± 0.004)	4.6 (0.181)	12.3 (0.484)	
16mm	Triple (12mm)	12.1 (0.476)	14.25 (0.561)	5.5 ± 0.05 (0.217 ± 0.002)	8.0 ± 0.10 (0.315 ± 0.004)	4.6 (0.181)	16.3 (0.642)	

1. The embossment hole location shall be measured from the sprocket hole controlling the location of the embossment. Dimensions of embossment location and hole location shall be applied independent of each other.

2. The tape with or without components shall pass around R without damage (see Figure 5).

3. If S_1<1.0 mm, there may not be enough area for cover tape to be properly applied (see EIA Document 481 paragraph 4.3 (b)).

4. B_1 dimension is a reference dimension for tape feeder clearance only.

5. The cavity defined by A_0, B_0 and K_0 shall surround the component with sufficient clearance that:

(a) the component does not protrude above the top surface of the carrier tape.

(b) the component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.

(c) rotation of the component is limited to 20° maximum for 8 and 12mm tapes and 10° maximum for 16mm tapes (see Figure 3).

(d) lateral movement of the component is restricted to 0.5 mm maximum for 8mm and 12mm wide tape and to 1.0mm maximum for 16mm tape (see Figure 4).

(e) see Addendum in EIA Document 481 for standards relating to more precise taping requirements.

Packaging Information Performance Notes

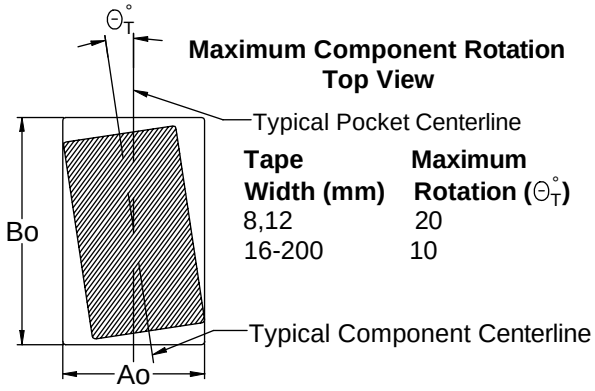
1. **Cover Tape Break Force:** *1.0 Kg minimum.*
2. **Cover Tape Peel Strength:** *The total peel strength of the cover tape from the carrier tape shall be:*

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

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-556 and EIA-624.*

Figure 2 – Maximum Component Rotation



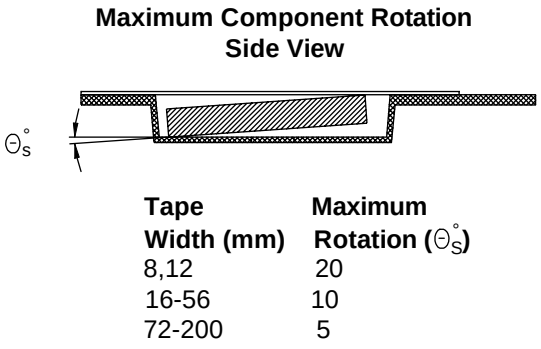


Figure 3 – Maximum Lateral Movement

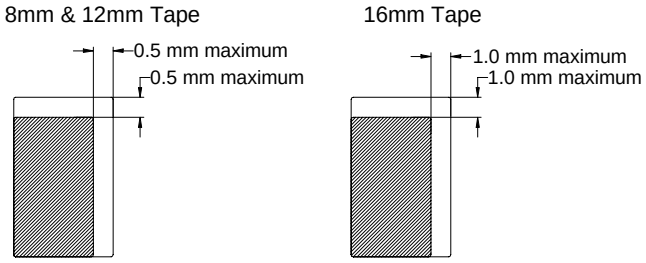


Figure 4 – Bending Radius

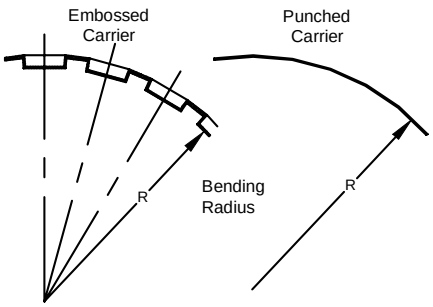
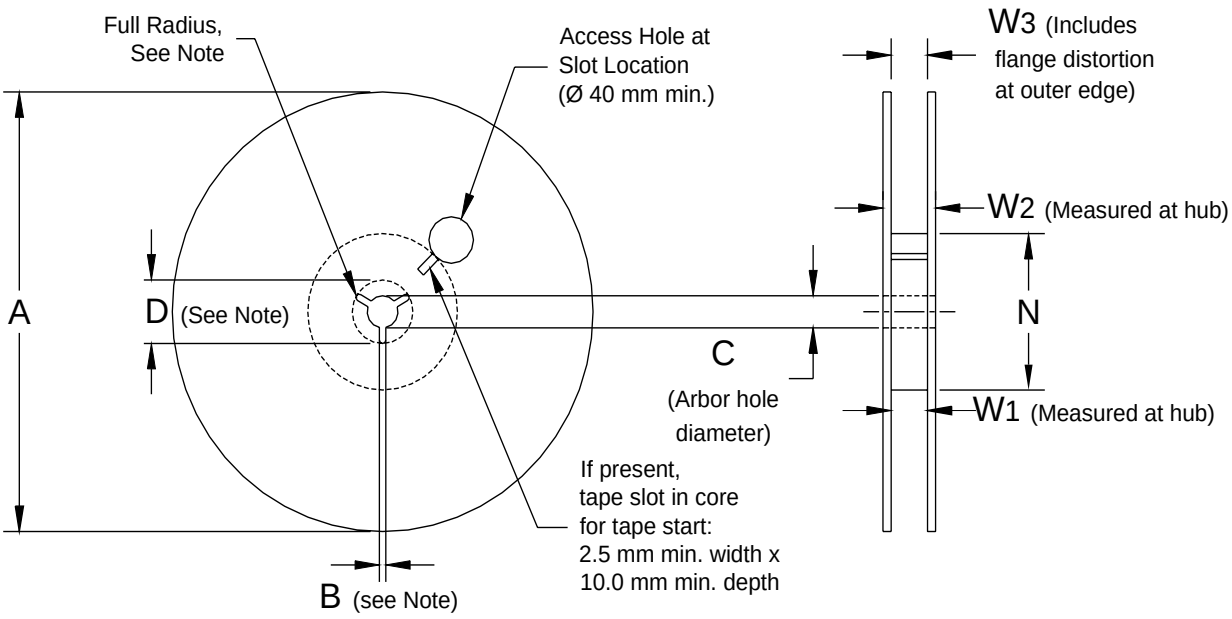


Figure 5 – Reel Dimensions



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

Table 5 – Reel Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)				
Tape Size	A	B Min	C	D Min
8mm	178 ± 0.20 (7.008 ± 0.008) or 330 ± 0.20 (13.000 ± 0.008)	1.5 (0.059)	13.0 +0.5/-0.2 (0.521 +0.02/-0.008)	20.2 (0.795)
12mm				
16mm				

Variable Dimensions — Millimeters (Inches)				
Tape Size	N Min	W_1	W_2 Max	W_3
8mm	50 (1.969)	8.4 +1.5/-0.0 (0.331 +0.059/-0.0)	14.4 (0.567)	Shall accommodate tape width without interference
12mm		12.4 +2.0/-0.0 (0.488 +0.078/-0.0)	18.4 (0.724)	
16mm		16.4 +2.0/-0.0 (0.646 +0.078/-0.0)	22.4 (0.882)	

Figure 6 – Tape Leader & Trailer Dimensions

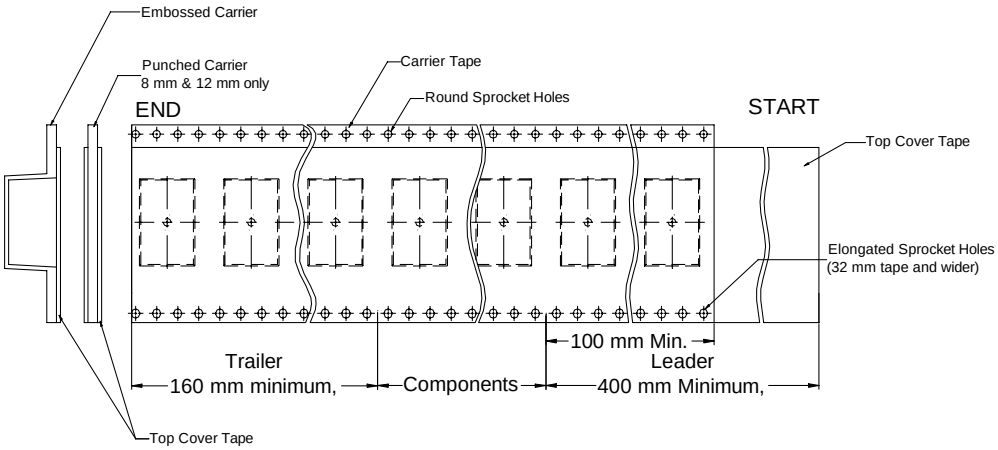
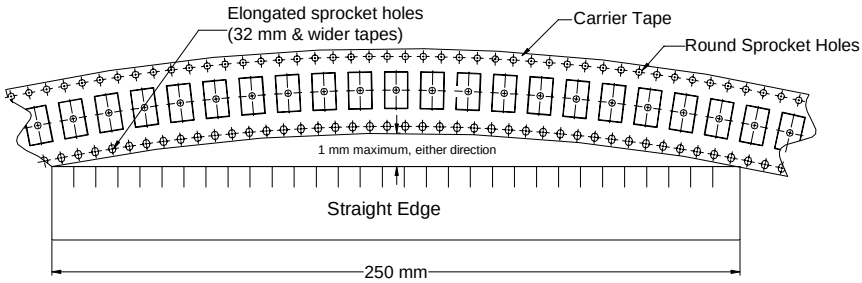


Figure 7 – Maximum Camber



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Resource	Location
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SPICE & FIT Software	http://www.kemet.com/spice
Search Our FAQs: KnowledgeEdge	http://www.kemet.com/keask

Product Information	
Resource	Location
Products	http://www.kemet.com/products
Technical Resources (Including Soldering Techniques)	http://www.kemet.com/technicalpapers
RoHS Statement	http://www.kemet.com/rohs
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