



**THE DATASHEET OF
T498X476K035ZTE500**



Overview

The KEMET T498 Series is a high temperature product that offers optimum performance characteristics in applications with operating temperatures up to 150°C. Advanced materials and testing allow this series to perform with a reliability level of 0.5%/1,000 hours at rated voltage and temperature. The T498 Series is available in five standard EIA case sizes with RoHS compliant terminations as standard.

Benefits

- Meets or exceeds EIA Standard 535BAAC
- Taped and reeled per EIA 481-1
- Symmetrical, compliant terminations
- Optional gold-plated terminations
- Laser-marked case
- 100% surge current testing
- Complies with AEC-Q200
- Capacitance values of 0.47 µF to 220 µF
- Tolerances of ±10% and ±20%
- Voltage rating of 6 – 50 VDC
- 100% steady-state accelerated aging
- Temperature/voltage derating is 2/3 at 150°C
- RoHS Compliant and lead-free terminations standard
- Operating temperature range of -55°C to +150°C

Applications

Typical applications include decoupling and filtering in industrial and automotive end applications such as DC/DC converters, portable electronics, telecommunications, and control units operating at temperatures up to 150°C.



Environmental Compliance

RoHS Compliant (6/6) according to Directive 2002/95/EC when ordered with 100% Sn solder.



RoHS Compliant

SPICE

For a detailed analysis of specific part numbers, please visit www.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 | 498 | X | 227 | M | 010 | A | T | E800 | |
|-----------------|------------------------|---------------|--|-----------------------|---|---------------------|---|--|------------------------------------|
| Capacitor Class | Series | Case Size | Capacitance Code (pF) | Capacitance Tolerance | Voltage | Failure Rate/Design | Lead Material | ESR | Packaging (C-Spec) |
| T = Tantalum | High Temperature 150°C | A, B, C, D, X | First two digits represent significant figures. Third digit specifies number of zeros. | K = ±10% M = ±20% | 006 = 6.3 V 010 = 10 V 016 = 16 V 020 = 20 V 025 = 25 V 035 = 35 V 050 = 50 V | A = N/A Z = N/A | T = 100% Matte Tin (Sn) Plated G = Gold Plated | Last three digits specify ESR in mΩ. (800 = 800 mΩ) | Blank = 7" Reel 7280 = 13" Reel |

Performance Characteristics

| Item | Performance Characteristics |
|-------------------------|---|
| Operating Temperature | -55°C to 150°C |
| Rated Capacitance Range | 0.33 – 220 µF @ 120 Hz/25°C |
| Capacitance Tolerance | K Tolerance (10%), M Tolerance (20%) |
| Rated Voltage Range | 6 – 50 V |
| DF (120 Hz) | Refer to Part Number Electrical Specification Table |
| ESR (100 kHz) | Refer to Part Number Electrical Specification Table |
| Leakage Current | ≤ 0.01 CV (µA) at rated voltage after 5 minutes |

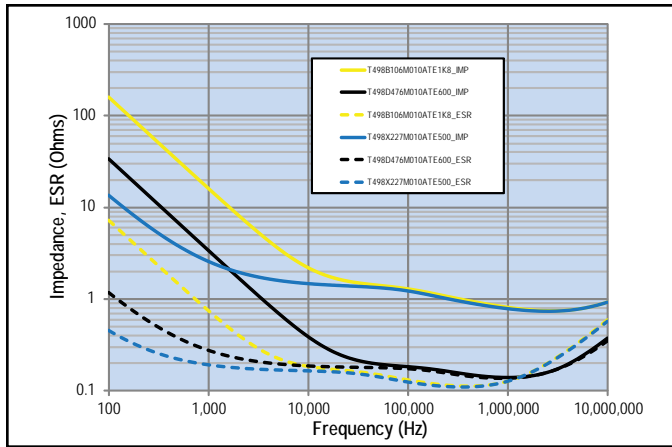
Qualification

| Test | Condition | Characteristics | | | | | |
|----------------------------|---|-----------------|--|-------|-----------------------------|----------|--|
| Endurance | 150°C @ 2/3 rated voltage, 2,000 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 | 150°C @ 0 volts, 2,000 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, -55°C to 150°C, 1,000 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, +150°C, +25°C | +25°C | -55°C | +85°C | +150°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 1,000 cycles (150°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, Method 213, Condition I, 100 G peak MIL–STD–202, Method 204, Condition D, 10 Hz to 2,000 Hz, 20 G peak | ΔC/C | Within ±10% of initial value | | | | |
| | | DF | Within initial limits | | | | |
| | | DCL | Within initial limits | | | | |

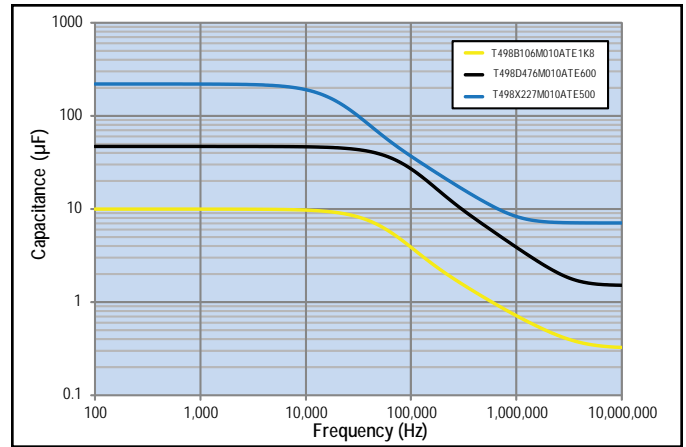
*IL = Initial Limit

Electrical Characteristics

ESR vs. Frequency

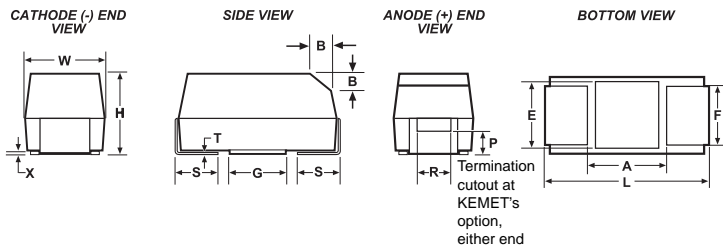


Capacitance vs. Frequency



Dimensions – Millimeters (Inches)

Metric will govern



| Case Size | | Component | | | | | | | | | | | | |
|-----------|---------|----------------------------|----------------------------|----------------------------|--------------------|--------------------|-------------------------|------------------------------|------------|------------|-------------|-------------|------------|------------|
| KEMET | EIA | L* | W* | H* | F* ±0.1 ±(.004) | S* ±0.3 ±(.012) | B* ±0.15 (Ref) ±.006 | X (Ref) | P (Ref) | R (Ref) | T (Ref) | A (Min) | G (Ref) | E (Ref) |
| A | 3216-18 | 3.2 ±0.2 (0.126 ±0.008) | 1.6 ±0.2 (0.063 ±0.008) | 1.6 ±0.2 (0.063 ±0.008) | 1.2 (.047) | 0.8 (.031) | 0.4 (.016) | 0.10 ± 0.10 (.004 ± .004) | 0.4 (.016) | 0.4 (.016) | 0.13 (.005) | 0.8 (.31) | 1.1 (.043) | 1.3 (.051) |
| B | 3528-21 | 3.5 ±0.2 (0.138 ±0.008) | 2.8 ±0.2 (0.110 ±0.008) | 1.9 ±0.2 (0.075 ±0.008) | 2.2 (.087) | 0.8 (.031) | 0.4 (.016) | 0.10 ± 0.10 (.004 ± .004) | 0.5 (.020) | 1.0 (.039) | 0.13 (.005) | 1.1 (0.043) | 1.8 (.071) | 2.2 (.087) |
| C | 6032-28 | 6.0 ±0.3 (0.236 ±0.03) | 3.2 ±0.3 (0.126 ±0.012) | 2.5 ±0.3 (0.098 ±0.012) | 2.2 (.087) | 1.3 (.051) | 0.5 (.020) | 0.10 ± 0.10 (.004 ± .004) | 0.9 (.035) | 1.0 (.039) | 0.13 (.005) | 2.5(.098) | 2.8 (.110) | 2.4 (.094) |
| D | 7343-31 | 7.3 ±0.3 (0.287 ±0.012) | 4.3 ±0.3 (0.169 ±0.012) | 2.8 ±0.3 (0.110 ±0.012) | 2.4 (.094) | 1.3 (.051) | 0.5 (.020) | 0.10 ± 0.10 (.004 ± .004) | 0.9 (.035) | 1.0 (.039) | 0.13 (.005) | 3.8 (.150) | 3.5 (.138) | 3.5 (.138) |
| X | 7343-43 | 7.3 ±0.3 (0.287 ±0.012) | 4.3 ±0.3 (0.169 ±0.012) | 4.0 ±0.3 (0.157 ±0.012) | 2.4 (.094) | 1.3 (.051) | 0.5 (.020) | 0.10 ± 0.10 (.004 ± .004) | 1.7 (.067) | 1.0 (.039) | 0.13 (.005) | 3.8 (.150) | 3.5 (.138) | 3.5 (.138) |

Notes: (Ref) – Dimensions provided for reference only. No dimensions provided for B, P or R because low profile cases do not have a bevel or a notch.

* MIL-PRF-55365/8 specified dimensions

Table 1 – Ratings & Part Number Reference

| Rated Voltage | Rated Cap | Case Code/ Case Size | KEMET Part Number | DC Leakage | DF | ESR | Maximum Allowable Ripple Current | | | Moisture Sensitivity |
|---------------|-----------|-------------------------|------------------------------|-----------------------|-------------------------|--------------------------|----------------------------------|----------------------|-----------------------|------------------------|
| VDC | μF | KEMET/EIA | (See below for part options) | μA +20°C Max/5 Min | % @ +20°C 120 Hz Max | mΩ @ 20°C 100 kHz Max | (mA) 100 kHz 25°C | (mA) 100 kHz 85°C | (mA) 100 kHz 125°C | Reflow Temp ≤ 260°C |
| 6.3 | 10 | B/3528-21 | T498B106(1)006A(2)E2K1 | 0.6 | 6.0 | 2100 | 201 | 181 | 80 | 1 |
| 6.3 | 15 | B/3528-21 | T498B156(1)006A(2)E1K8 | 0.9 | 6.0 | 1800 | 217 | 195 | 87 | 1 |
| 6.3 | 22 | C/6032-28 | T498C226(1)006A(2)E1K3 | 1.4 | 6.0 | 1300 | 291 | 262 | 116 | 1 |
| 6.3 | 33 | B/3528-21 | T498B336(1)006A(2)E1K7 | 2.1 | 6.0 | 1700 | 224 | 202 | 90 | 1 |
| 6.3 | 47 | C/6032-28 | T498C476(1)006A(2)E800 | 3.0 | 6.0 | 800 | 371 | 334 | 148 | 1 |
| 6.3 | 100 | D/7343-31 | T498D107(1)006A(2)E600 | 6.3 | 8.0 | 600 | 500 | 450 | 200 | 1 |
| 10 | 2.2 | A/3216-18 | T498A225(1)010A(2)E4K6 | 0.5 | 6.0 | 4600 | 128 | 115 | 51 | 1 |
| 10 | 3.3 | A/3216-18 | T498A335(1)010A(2)E3K6 | 0.5 | 6.0 | 3600 | 144 | 130 | 58 | 1 |
| 10 | 4.7 | A/3216-18 | T498A475(1)010A(2)E2K9 | 0.5 | 6.0 | 2900 | 161 | 145 | 64 | 1 |
| 10 | 4.7 | B/3528-21 | T498B475(1)010A(2)E2K7 | 0.5 | 6.0 | 2700 | 177 | 159 | 71 | 1 |
| 10 | 10 | B/3528-21 | T498B106(1)010A(2)E1K8 | 1.0 | 6.0 | 1800 | 217 | 195 | 87 | 1 |
| 10 | 15 | B/3528-21 | T498B156(1)010A(2)E1K5 | 1.5 | 6.0 | 1500 | 238 | 214 | 95 | 1 |
| 10 | 15 | C/6032-28 | T498C156(1)010A(2)E1K8 | 1.5 | 6.0 | 1800 | 247 | 222 | 99 | 1 |
| 10 | 22 | B/3528-21 | T498B226(1)010A(2)E1K5 | 2.2 | 6.0 | 1500 | 238 | 214 | 95 | 1 |
| 10 | 22 | C/6032-28 | T498C226(1)010A(2)E1K1 | 2.2 | 6.0 | 1100 | 316 | 284 | 126 | 1 |
| 10 | 47 | D/7343-31 | T498D476(1)010A(2)E600 | 4.7 | 6.0 | 600 | 500 | 450 | 200 | 1 |
| 10 | 100 | D/7343-31 | T498D107(1)010A(2)E600 | 10.0 | 8.0 | 600 | 500 | 450 | 200 | 1 |
| 10 | 220 | X/7343-43 | T498X227(1)010A(2)E500 | 22.0 | 8.0 | 500 | 574 | 517 | 230 | 1 |
| 16 | 1 | A/3216-18 | T498A105(1)016A(2)E6K5 | 0.5 | 4.0 | 6500 | 107 | 96 | 43 | 1 |
| 16 | 3.3 | A/3216-18 | T498A335(1)016A(2)E3K4 | 0.5 | 6.0 | 3400 | 149 | 134 | 60 | 1 |
| 16 | 4.7 | B/3528-21 | T498B475(1)016A(2)E2K1 | 0.8 | 6.0 | 2100 | 201 | 181 | 80 | 1 |
| 16 | 6.8 | A/3216-18 | T498A685(1)016A(2)E2K6 | 1.1 | 6.0 | 2600 | 170 | 153 | 68 | 1 |
| 16 | 6.8 | B/3528-21 | T498B685(1)016A(2)E1K8 | 1.1 | 6.0 | 1800 | 217 | 195 | 87 | 1 |
| 16 | 10 | B/3528-21 | T498B106(1)016A(2)E2K8 | 1.6 | 6.0 | 2800 | 174 | 157 | 70 | 1 |
| 16 | 10 | C/6032-28 | T498C106(1)016A(2)E1K4 | 1.6 | 6.0 | 1400 | 280 | 252 | 112 | 1 |
| 16 | 15 | C/6032-28 | T498C156(1)016A(2)E1K1 | 2.4 | 6.0 | 1100 | 316 | 284 | 126 | 1 |
| 16 | 22 | C/6032-28 | T498C226(1)016A(2)E1K0 | 3.5 | 6.0 | 1000 | 332 | 299 | 133 | 1 |
| 16 | 33 | D/7343-31 | T498D336(1)016A(2)E600 | 5.3 | 6.0 | 600 | 500 | 450 | 200 | 1 |
| 16 | 47 | D/7343-31 | T498D476(1)016A(2)E600 | 7.5 | 6.0 | 600 | 500 | 450 | 200 | 1 |
| 16 | 68 | D/7343-31 | T498D686(1)016A(2)E600 | 10.9 | 6.0 | 600 | 500 | 450 | 200 | 1 |
| 16 | 100 | X/7343-43 | T498X107(1)016A(2)E100 | 16.0 | 8.0 | 100 | 1285 | 1157 | 514 | 1 |
| 20 | 1 | A/3216-18 | T498A105(1)020A(2)E5K9 | 0.5 | 0.5 | 5900 | 113 | 102 | 45 | 1 |
| 20 | 10 | C/6032-28 | T498C106(1)020A(2)E1K1 | 2.0 | 2.0 | 1100 | 316 | 284 | 126 | 1 |
| 25 | 0.47 | A/3216-18 | T498A474(1)025A(2)E8K5 | 0.5 | 4.0 | 8500 | 94 | 85 | 38 | 1 |
| 25 | 2.2 | B/3528-21 | T498B225(1)025A(2)E3K0 | 0.6 | 6.0 | 3000 | 168 | 151 | 67 | 1 |
| 25 | 10 | C/6032-28 | T498C106(1)025A(2)E1K1 | 2.5 | 6.0 | 1100 | 316 | 284 | 126 | 1 |
| 25 | 10 | D/7343-31 | T498D106(1)025A(2)E1K0 | 2.5 | 6.0 | 1000 | 387 | 348 | 155 | 1 |
| 25 | 15 | D/7343-31 | T498D156(1)025A(2)E700 | 3.8 | 6.0 | 700 | 463 | 417 | 185 | 1 |
| 25 | 22 | D/7343-31 | T498D226(1)025A(2)E600 | 5.5 | 6.0 | 600 | 500 | 450 | 200 | 1 |
| 25 | 33 | D/7343-31 | T498D336(1)025A(2)E600 | 8.3 | 6.0 | 600 | 500 | 450 | 200 | 1 |
| 35 | 0.33 | A/3216-18 | T498A334(1)035A(2)E11K | 0.5 | 4.0 | 11000 | 83 | 75 | 33 | 1 |
| 35 | 1 | A/3216-18 | T498A105(1)035A(2)E10K | 0.5 | 4.0 | 10000 | 87 | 78 | 35 | 1 |
| 35 | 1.5 | C/6032-28 | T498C155(1)035A(2)E3K3 | 0.5 | 6.0 | 3300 | 183 | 165 | 73 | 1 |
| 35 | 3.3 | C/6032-28 | T498C335(1)035A(2)E1K7 | 1.2 | 6.0 | 1700 | 254 | 229 | 102 | 1 |
| 35 | 6.8 | D/7343-31 | T498D685(1)035A(2)E900 | 2.4 | 6.0 | 900 | 408 | 367 | 163 | 1 |
| VDC | μF | KEMET/EIA | (See below for part options) | μA +20°C Max/5 Min | % @ +20°C 120 Hz Max | mΩ @ 20°C 100 kHz Max | (mA) 100 kHz 25°C | (mA) 100 kHz 85°C | (mA) 100 kHz 125°C | Reflow Temp ≤ 260°C |
| Rated Voltage | Rated Cap | Case Code/ Case Size | KEMET Part Number | DC Leakage | DF | ESR | Maximum Allowable Ripple Current | | | Moisture Sensitivity |

(1) To complete KEMET part number, insert M for ±20% or K for ±10%. Designates capacitance tolerance.

(2) To complete KEMET part number, insert T = 100% Matte Tin (Sn) Plated, G = Gold Plated. Designates termination finish.

Refer to Ordering Information for additional detail.

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at KEMET's option. Voltage substitution will be marked with the higher voltage rating. Substitutions can include better than series.

Table 1 – Ratings & Part Number Reference cont'd

| Rated Voltage | Rated Cap | Case Code/ Case Size | KEMET Part Number | DC Leakage | DF | ESR | Maximum Allowable Ripple Current | | | Moisture Sensitivity |
|---------------|-----------|-------------------------|------------------------------|-----------------------|-------------------------|--------------------------|----------------------------------|----------------------|-----------------------|------------------------|
| | | | | | | | (mA) 100 kHz 25°C | (mA) 100 kHz 85°C | (mA) 100 kHz 125°C | |
| VDC | μF | KEMET/EIA | (See below for part options) | μA +20°C Max/5 Min | % @ +20°C 120 Hz Max | mΩ @ 20°C 100 kHz Max | (mA) 100 kHz 25°C | (mA) 100 kHz 85°C | (mA) 100 kHz 125°C | Reflow Temp ≤ 260°C |
| 35 | 10 | D/7343-31 | T498D106(1)035A(20)E700 | 3.5 | 6.0 | 700 | 463 | 417 | 185 | 1 |
| 35 | 22 | X/7343-43 | T498X226(1)035A(2)E500 | 7.7 | 6.0 | 500 | 574 | 517 | 230 | 1 |
| 35 | 33 | X/7343-43 | T498X336(1)035A(2)E500 | 11.6 | 6.0 | 500 | 574 | 517 | 230 | 1 |
| 50 | 3.3 | D/7343-31 | T498D335(1)050A(2)E1K1 | 1.7 | 6.0 | 1100 | 369 | 332 | 148 | 1 |
| 50 | 10 | D/7343-31 | T498D106(1)050A(2)E1K0 | 5.0 | 6.0 | 1000 | 387 | 348 | 155 | 1 |
| VDC | μF | KEMET/EIA | (See below for part options) | μA +20°C Max/5 Min | % @ +20°C 120 Hz Max | mΩ @ 20°C 100 kHz Max | (mA) 100 kHz 25°C | (mA) 100 kHz 85°C | (mA) 100 kHz 125°C | Reflow Temp ≤ 260°C |
| Rated Voltage | Rated Cap | Case Code/ Case Size | KEMET Part Number | DC Leakage | DF | ESR | Maximum Allowable Ripple Current | | | Moisture Sensitivity |

(1) To complete KEMET part number, insert M for ±20% or K for ±10%. Designates capacitance tolerance.

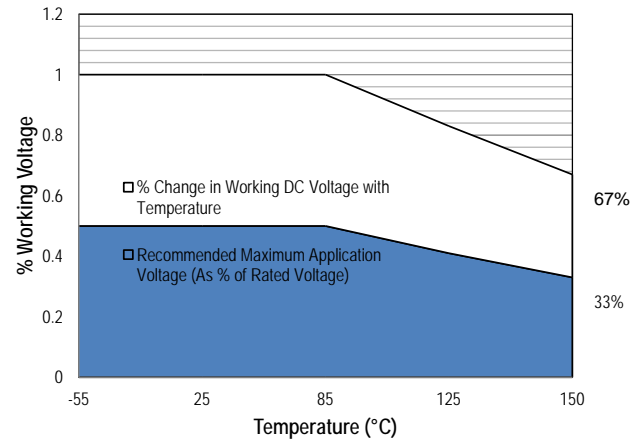
(2) To complete KEMET part number, insert T = 100% Matte Tin (Sn) Plated, G = Gold Plated. Designates termination finish.

Refer to Ordering Information for additional detail.

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at KEMET's option. Voltage substitution will be marked with the higher voltage rating. Substitutions can include better than series.

Recommended Voltage Derating Guidelines

| Rated Voltage | Working Voltage | | Recommended Application Voltage (for maximum reliability) | |
|---------------|-----------------|-------|---|-------|
| | 85°C | 150°C | 85°C | 150°C |
| 6.3 | 6.3 | 4.22 | 3.15 | 2.08 |
| 10 | 10 | 6.70 | 5 | 3.30 |
| 16 | 16 | 10.72 | 8 | 5.28 |
| 20 | 20 | 13.40 | 10 | 6.60 |
| 25 | 25 | 16.75 | 12.5 | 8.25 |
| 35 | 35 | 23.45 | 17.5 | 11.55 |
| 50 | 50 | 33.50 | 25 | 16.50 |



Ripple Current/Ripple Voltage

| KEMET Series and Case Code | EIA Case Code | Maximum Power Dissipation (P max) mWatts @ 25°C w/+20°C Rise |
|----------------------------|---------------|--|
| A | 3216-18 | 75 |
| B | 3528-21 | 85 |
| C | 6032-28 | 110 |
| D | 7343-31 | 150 |
| X | 7343-43 | 165 |
| E | 7360-38 | 200 |
| T428P | 7360-38 | 325 |
| S | 3216-12 | 60 |
| T | 3528-12 | 70 |
| U | 6032-15 | 90 |
| V | 7343-20 | 125 |
| T510X | 7343-43 | 270 |
| T510E | 7360-38 | 285 |

| Temperature Compensation Multipliers for Maximum Power Dissipation | | | | |
|--|------|-------|--------|---------|
| ≤ 25°C | 85°C | 125°C | 150°C* | 175°C** |
| 1.00 | 0.90 | 0.40 | 0.30 | 0.20 |

T = Environmental Temperature

*T498 Only

**T499 Only

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

$$I(max) = \sqrt{P_{max}/R}$$

$$E(max) = \sqrt{P_{max} \cdot R}$$

I = rms ripple current (amperes)

E = rms ripple voltage (volts)

P max = 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

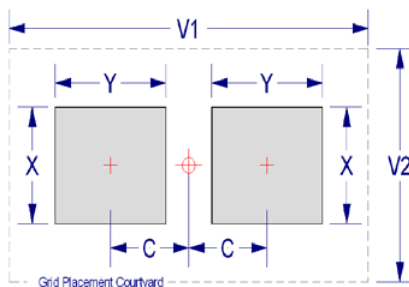
| KEMET Case | Metric Size Code EIA | Density Level A: Maximum (Most) Land Protrusion (mm) | | | | | Density Level B: Median (Nominal) Land Protrusion (mm) | | | | | Density Level C: Minimum (Least) Land Protrusion (mm) | | | | |
|----------------|-------------------------------|--|------|------|-------|------|--|------|------|------|------|---|------|------|------|------|
| | | X | Y | C | V1 | V2 | X | Y | C | V1 | V2 | X | Y | C | V1 | V2 |
| A | 3216-18 | 1.35 | 2.15 | 1.45 | 6.10 | 2.80 | 1.25 | 1.75 | 1.35 | 5.00 | 2.30 | 1.15 | 1.35 | 1.25 | 4.10 | 2.00 |
| B | 3528-21 | 2.35 | 2.15 | 1.45 | 6.10 | 4.00 | 2.25 | 1.75 | 1.35 | 5.00 | 3.50 | 2.15 | 1.35 | 1.25 | 4.10 | 3.20 |
| C | 6032-28 | 2.35 | 2.65 | 2.60 | 8.90 | 4.40 | 2.25 | 2.25 | 2.50 | 7.80 | 3.90 | 2.15 | 1.85 | 2.40 | 6.90 | 3.60 |
| D | 7343-31 | 2.55 | 3.75 | 2.70 | 10.20 | 5.50 | 2.45 | 3.35 | 2.60 | 9.10 | 5.00 | 2.35 | 2.95 | 2.50 | 8.20 | 4.70 |
| X ¹ | 7343-43 | 2.55 | 3.75 | 2.70 | 10.20 | 5.50 | 2.45 | 3.35 | 2.60 | 9.10 | 5.00 | 2.35 | 2.95 | 2.50 | 8.20 | 4.70 |

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 Height of these chips may create problems in wave soldering.



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.

Please 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 occurs, the iron should be removed immediately. "Wiping" the edges of a chip and heating the top surface is not recommended.

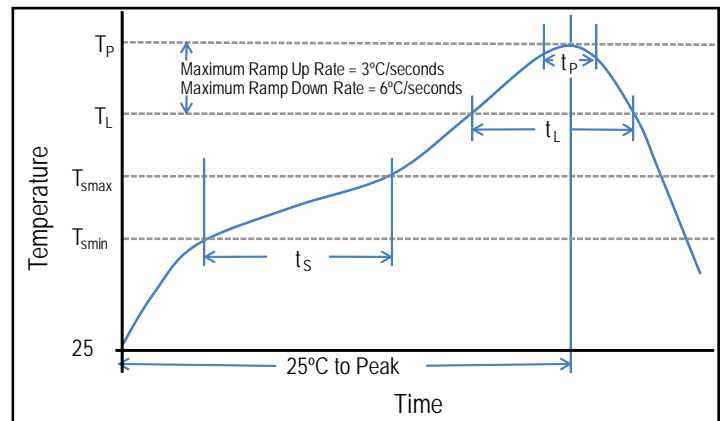
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

| Profile Feature | SnPb Assembly | Pb-Free Assembly |
|---|---------------------|---------------------|
| 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 to T_P) | 3°C/seconds maximum | 3°C/seconds maximum |
| Liquidous Temperature (T_L) | 183°C | 217°C |
| Time Above Liquidous (t_L) | 60 – 150 seconds | 60 – 150 seconds |
| Peak Temperature (T_P) | 220°C* 235°C** | 250°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/seconds maximum | 6°C/seconds maximum |
| Time 25°C to Peak Temperature | 6 minutes maximum | 8 minutes maximum |

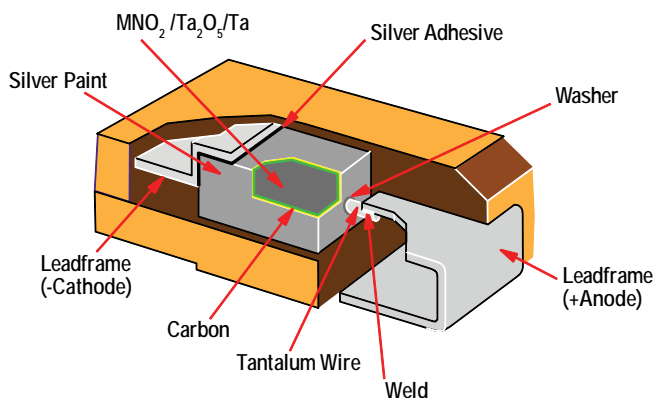
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.

*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

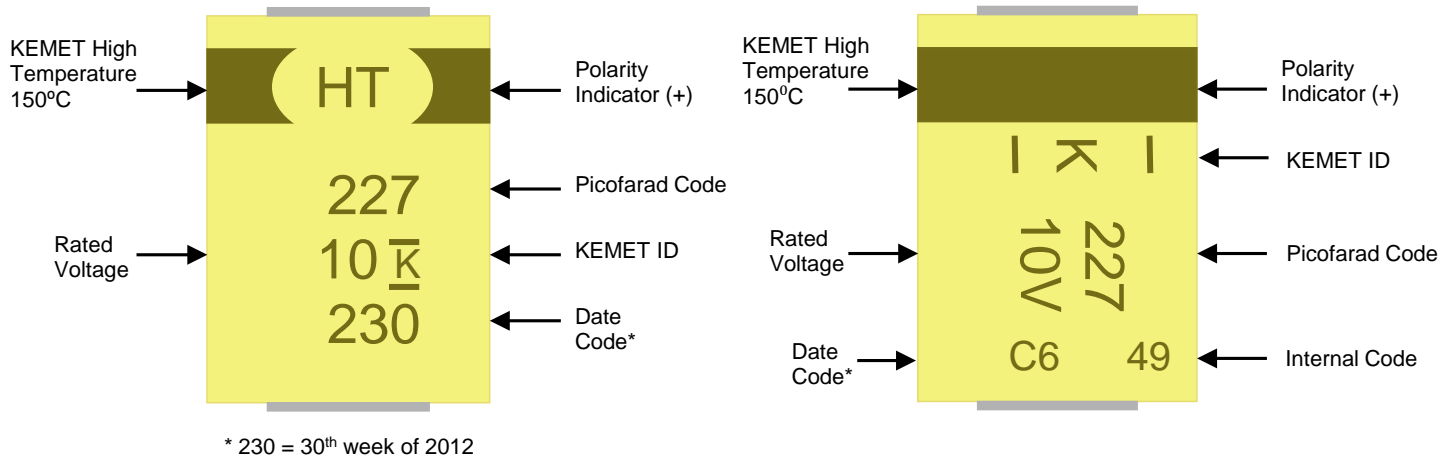


Construction



Capacitor Marking

C, D, X Case Sizes



| Date Code * | |
|--|--|
| 1 st digit = Last number of Year | 9 = 2009 0 = 2010 1 = 2011 2 = 2012 3 = 2013 4 = 2014 |
| 2 nd and 3 rd digit = Week of the Year | 01 = 1 st week of the Year to 52 = 52 nd week of the Year |

| Date Code* | | |
|------------|---------|---------|
| Year | Month | |
| X = 2009 | 1 = Jan | 7 = Jul |
| A = 2010 | 2 = Feb | 8 = Aug |
| B = 2011 | 3 = Mar | 9 = Spt |
| C = 2012 | 4 = Apr | O = Oct |
| D = 2013 | 5 = May | N = Nov |
| E = 2014 | 6 = Jun | D = Dec |

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 40°C and maximum storage humidity not exceed 60% relative humidity. 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 and 12 mm plastic tape on 7" and 13" reels in accordance with *EIA Standard 481-1: Embossed Carrier Taping of Surface Mount Components for Automatic Handling*. This packaging system is compatible with all tape-fed automatic pick-and-place systems.

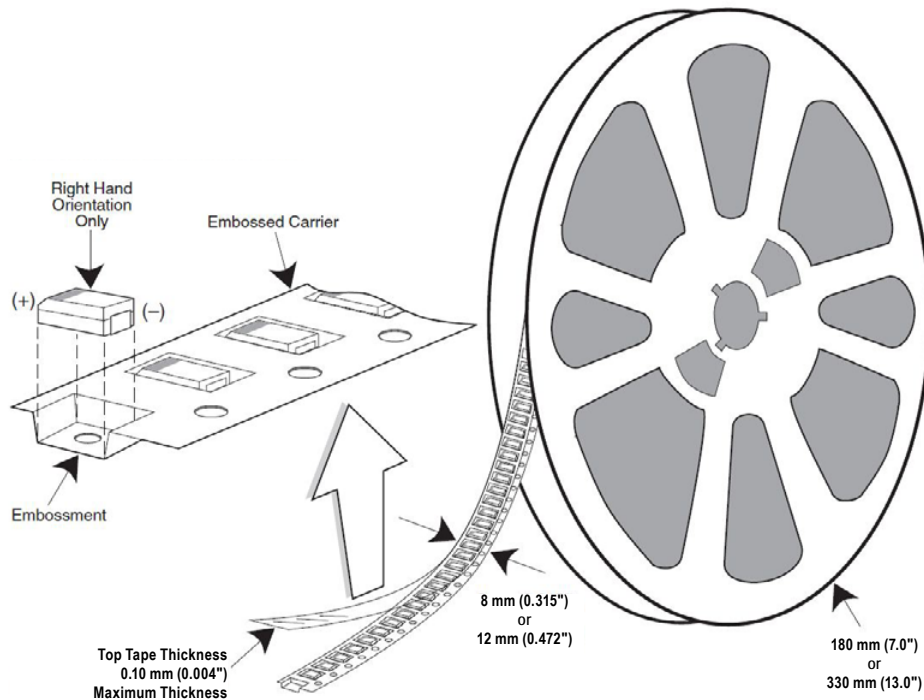


Table 3 – Packaging Quantity

| Case Code | | Tape Width (mm) | 7" Reel* | 13" Reel* |
|-----------|---------|-----------------|----------|-----------|
| KEMET | EIA | | | |
| 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/T428P | 7360-38 | 12 | 500 | 2,000 |
| H | 7360-20 | 12 | 1,000 | 2,500 |

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

Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

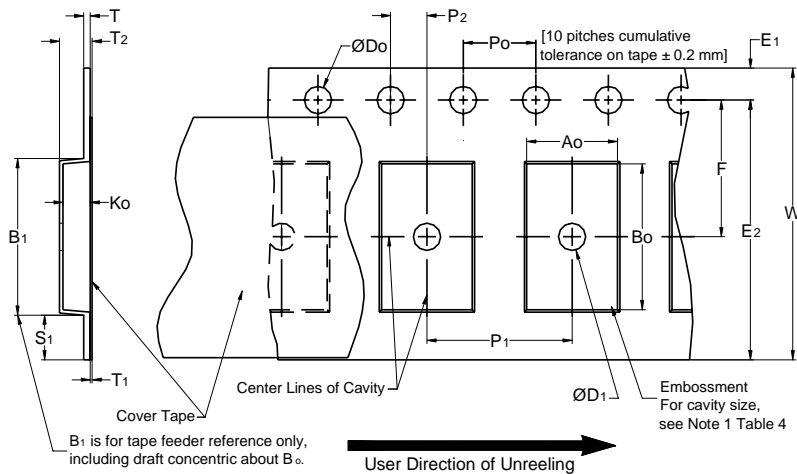


Table 4 – Embossed (Plastic) Carrier Tape Dimensions

Metric will govern

| Constant Dimensions — Millimeters (Inches) | | | | | | | | | |
|--|---------------------------------------|----------------------------------|------------------------------|-----------------------------|-----------------------------|------------------------|----------------------------------|--|------------------------|
| Tape Size | D ₀ | D ₁ Minimum Note 1 | E ₁ | P ₀ | P ₂ | R Reference Note 2 | S ₁ Minimum Note 3 | T Maximum | T ₁ Maximum |
| 8 mm | 1.5 +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) |
| 12 mm | | 1.5 (0.059) | | | | 30 (1.181) | | | |
| 16 mm | | | | | | | | | |
| Variable Dimensions — Millimeters (Inches) | | | | | | | | | |
| Tape Size | Pitch | B ₁ Maximum Note 4 | E ₂ Minimum | F | P ₁ | T ₂ Maximum | W Maximum | A ₀ , B ₀ & K ₀ | |
| 8 mm | Single (4 mm) | 4.35 (0.171) | 6.25 (0.246) | 3.5 ±0.05 (0.138 ±0.002) | 4.0 ±0.10 (0.157 ±0.004) | 2.5 (0.098) | 8.3 (0.327) | Note 5 | |
| 12 mm | Single (4 mm) & Double (8 mm) | 8.2 (0.323) | 10.25 (0.404) | 5.5 ±0.05 (0.217 ±0.002) | 8.0 ±0.10 (0.315 ±0.004) | 4.6 (0.181) | 12.3 (0.484) | | |
| 16 mm | Triple (12 mm) | 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) | | |

- 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.
- The tape, with or without components, shall pass around R without damage (see Figure 5).
- If S₁ < 1.0 mm, there may not be enough area for cover tape to be properly applied (see EIA Standard 481–D, paragraph 4.3, section b).
- B₁ dimension is a reference dimension for tape feeder clearance only.
- The cavity defined by A₀, B₀ and K₀ shall surround the component with sufficient clearance that:
 - the component does not protrude above the top surface of the carrier tape.
 - the component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.
 - rotation of the component is limited to 20° maximum for 8 and 12 mm tapes and 10° maximum for 16 mm tapes (see Figure 2).
 - lateral movement of the component is restricted to 0.5 mm maximum for 8 mm and 12 mm wide tape and to 1.0 mm maximum for 16 mm tape (see Figure 3).
 - see Addendum in EIA Standard 481–D 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 |
|--------------|----------------------------------|
| 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 2 – Maximum Component Rotation

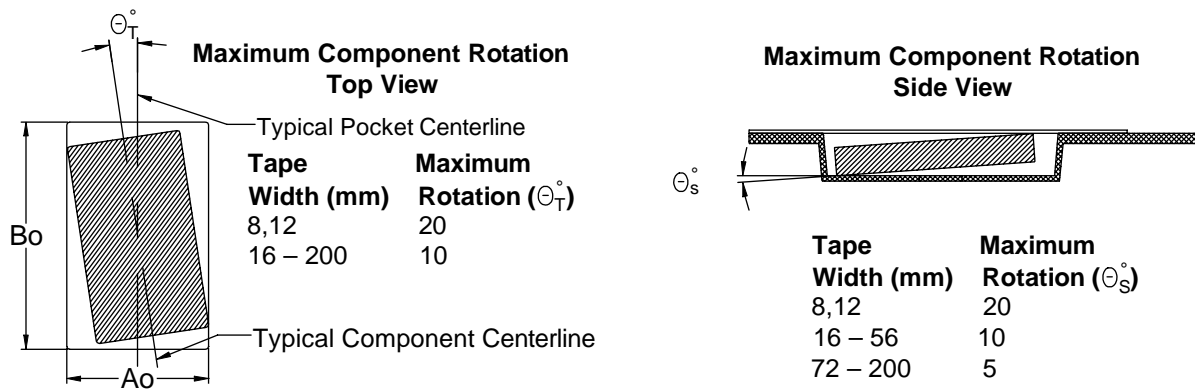


Figure 3 – Maximum Lateral Movement

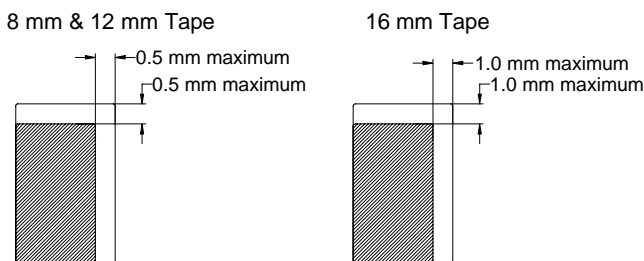


Figure 4 – Bending Radius

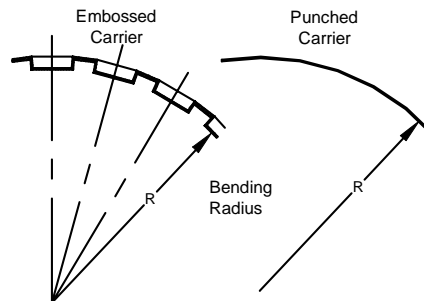
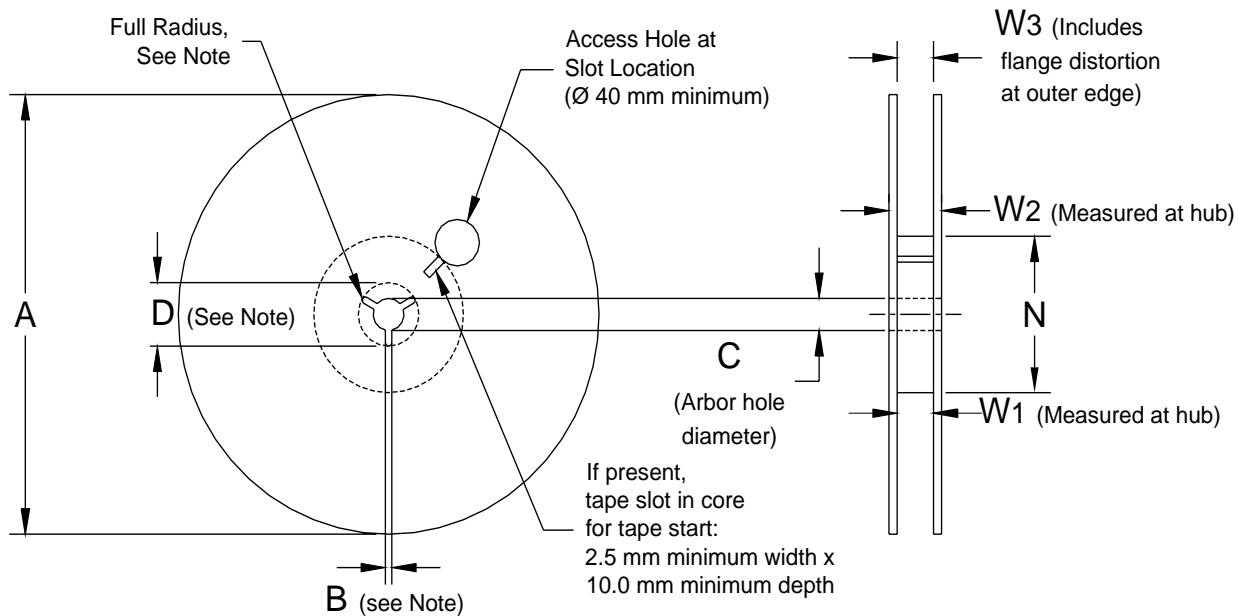


Figure 5 – Reel Dimensions



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 Minimum | C | D Minimum |
| 8 mm | 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) |
| 12 mm | | | | |
| 16 mm | | | | |
| Variable Dimensions — Millimeters (Inches) | | | | |
| Tape Size | N Minimum | W ₁ | W ₂ Maximum | W ₃ |
| 8 mm | 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 |
| 12 mm | | 12.4 +2.0/-0.0 (0.488 +0.078/-0.0) | 18.4 (0.724) | |
| 16 mm | | 16.4 +2.0/-0.0 (0.646 +0.078/-0.0) | 22.4 (0.882) | |

Figure 6 – Tape Leader & Trailer Dimensions

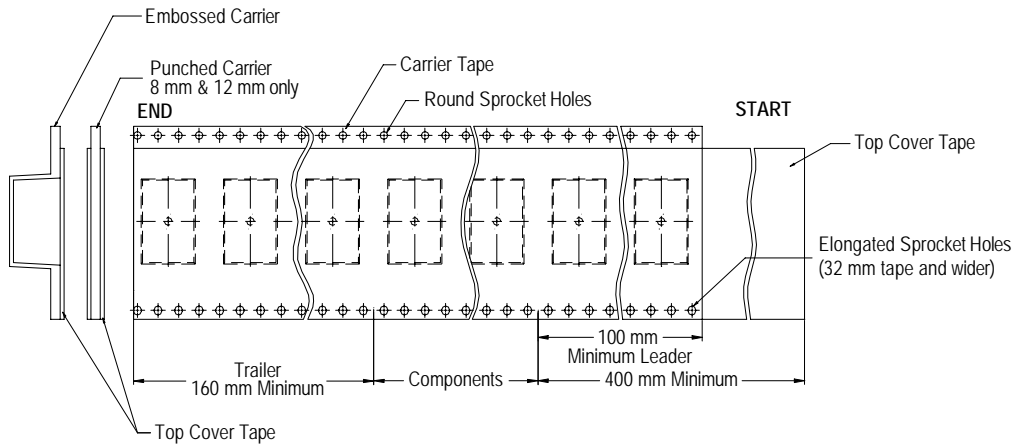
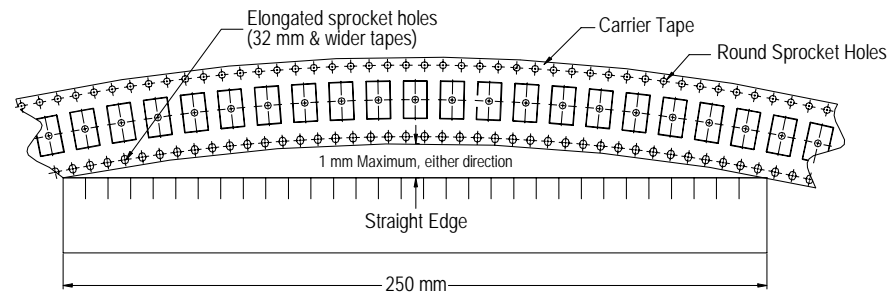


Figure 7 – Maximum Camber



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| Tools | |
|--------------------------------|---|
| Resource | Location |
| Configure A Part: CapEdge | http://capacitoredge.kemet.com |
| SPICE & FIT Software | http://www.kemet.com/spice |
| Search Our FAQs: KnowledgeEdge | http://www.kemet.com/keask |
| Electrolytic LifeCalculator | http://www.kemet.com:8080/elc |

| Product Information | |
|--|---|
| Resource | Location |
| Products | http://www.kemet.com/products |
| Technical Resources (Including Soldering Techniques) | http://www.kemet.com/technicalpapers |
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| Sample Request | http://www.kemet.com/sample |
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