

# Tantalum Through-Hole Capacitors – Radial Dipped

## T363 & T369 MIL-PRF-49137/2

### (CX02 & CX12 Style)

## Overview

KEMET's T363 and T369 series of radial dipped capacitors are manufactured to fulfill the requirements of MIL-PRF-49137 style CX02 and CX12, while maintaining all performance characteristics of the UltraDip II capacitors. In addition to the standard UltraDip II process testing, all products supplied to MIL-PRF-49137 are sampled on a lot-by-lot basis for Group A and Group B inspection to

ensure compliance and also receives an additional post-process burn-in for at least two hours under accelerated voltage stress in excess of 125% of DC rated voltage. This post-process burn-in is equivalent to 200 hours under rated conditions.

## Benefits

- Tape & Reel packaging per EIA Specification RS-468
- Laser-marked case
- Qualified to MIL-PRF-49137
- Capacitance values of 0.1 – 330  $\mu$ F
- Tolerances of  $\pm 10\%$  and  $\pm 20\%$
- Voltage rating of 6 – 50 VDC
- T363 case sizes: A, B, C, D
- T369 case sizes: A, B

## Applications

Typical applications include filtering, bypassing, coupling, blocking, and RC timing circuits, or other applications that can benefit from compactness.

T363



T369



## Ordering Information

| T               | 36X        | A                   | 105  | M                                | 035   | A              | S                  |  |
|-----------------|------------|---------------------|--|----------------------------------|---|----------------|--------------------|--|
| Capacitor Class | Series     | Case Size           | Capacitance Code (pF)  | Capacitance Tolerance            | Rated Voltage (VDC)   | Failure Rate   | Termination Finish | Packaging  |
| T = Tantalum    | 363<br>369 | A,<br>B,<br>C,<br>D | First two digits represent significant figures. Third digit specifies number of zeros to follow. | M = $\pm 20\%$<br>K = $\pm 10\%$ | 006 = 6<br>010 = 10<br>015 = 15<br>020 = 20<br>025 = 25<br>035 = 35<br>050 = 50 | Not Applicable | S = Standard       | Blank = Bulk<br>7301 = Tape & Reel<br>7303 = Tape & Reel<br>7305 = Ammo<br>7317 = Ammo |

## Ordering Information – Defense MIL-PRF-49137/2 (CX02 and CX12 Style)

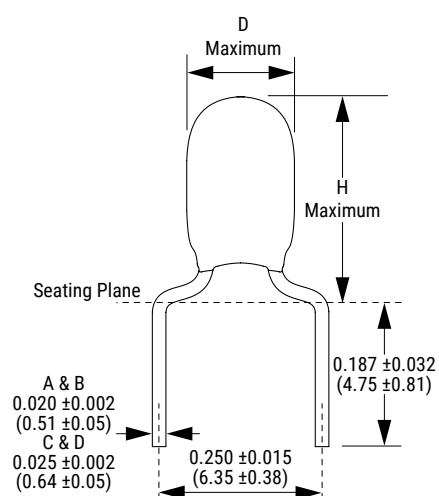
| CX   | J   | 225  | K                                |
|--|---|--|----------------------------------|
| Style  | Voltage   | Capacitance Code (pF)  | Capacitance Tolerance            |
| CX = Capacitors, Fixed, Solid Electrolyte, Tantalum, Polar, Conformal Coated, Nonhermetically Sealed.<br><br>02 / 12 = Style | D = 6 V<br>F = 10 V<br>H = 15 V<br>J = 20 V<br>K = 25 V<br>M = 35 V<br>N = 50 V | First two digits represent significant figures. Third digit specifies number of zeros to follow. | M = $\pm 20\%$<br>K = $\pm 10\%$ |

## Performance Characteristics

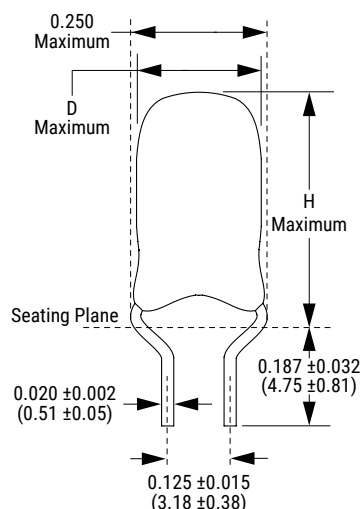
| Item                    | Performance Characteristics  |
|-------------------------|--|
| Operating Temperature   | -55°C to 125°C   |
| Rated Capacitance Range | 0.1 – 330 µF at 120 Hz/25°C  |
| Capacitance Tolerance   | M tolerance ±20%, K tolerance ±10%   |
| Rated Voltage Range     | 6 – 50 V   |
| DF (120 Hz at 25°C)     | Refer to Part Number Electrical Specification Table                            |
| Leakage Current         | Refer to Part Number Electrical Specification Table (rated voltage up to 85°C) |

## Dimensions – Inches (Millimeters)

**T363 (CX02)**



**T369 (CX12)**



| KEMET Case Size | Style | MIL Case Size | D Maximum Diameter | H Maximum Height | Lead Size Diameter |
|-----------------|-------|---------------|--------------------|------------------|--------------------|
| A               | CX02  | A             | 0.175 (4.45)       | 0.425 (10.80)    | 0.020              |
| B               |       | B             | 0.250 (6.35)       | 0.500 (12.70)    | 0.020              |
| C               |       | C             | 0.350 (8.89)       | 0.650 (16.51)    | 0.025              |
| D               |       | D             | 0.400 (10.16)      | 0.750 (19.05)    | 0.025              |
| A               | CX12  | E             | 0.175 (4.45)       | 0.350 (8.89)     | 0.020              |
| B               |       | F             | 0.250 (6.35)       | 0.500 (12.70)    | 0.020              |

**Table 1 - Ratings and Part Number Reference**

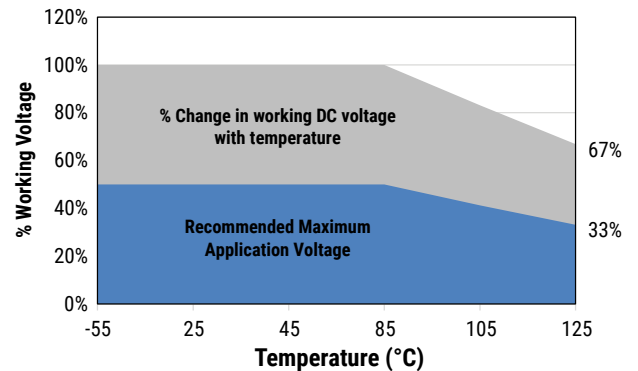
| Rated Voltage | Rated Capacitance | Case Code<br>Case Size | KEMET Part Number               | DC Leakage                      | DF % at 25°C             | Military Part Number<br>Per MIL-PRF-49137/2 |                |
|---------------|-------------------|------------------------|---------------------------------|---------------------------------|--------------------------|---|----------------|
|               |                   |                        |                                 |                                 |                          | CX02 (T363)                                 | CX12 (T369)    |
| (V) 85°C      | µF                |                        |                                 | µA at 25°C<br>Maximum/5 Minutes | 120 Hz<br>Maximum        |   |                |
| 6             | 6.8               | A                      | T36(1)A685(2)006AS              | 0.5                             | 6.0                      | CX02D685(2)                                 | CX12D685(2)    |
| 6             | 47.0              | B                      | T36(1)B476(2)006AS              | 2.3                             | 6.0                      | CX02D476(2)                                 | CX12D476(2)    |
| 6             | 68.0              | B                      | T36(1)B686(2)006AS              | 3.3                             | 6.0                      | CX02D686(2)                                 | CX12D686(2)    |
| 6             | 150.0             | C                      | T363C157(2)006AS                | 7.2                             | 8.0                      | CX02D157(2)                                 |                |
| 6             | 330.0             | D                      | T363D337(2)006AS                | 10.0                            | 8.0                      | CX02D337(2)                                 |                |
| 10            | 4.7               | A                      | T36(1)A475(2)010AS              | 0.5                             | 5.0                      | CX02F475(2)                                 | CX12F475(2)    |
| 10            | 33.0              | B                      | T36(1)B336(2)010AS              | 2.6                             | 6.0                      | CX02F336(2)                                 | CX12F336(2)    |
| 10            | 100.0             | C                      | T363C107(2)010AS                | 8.0                             | 8.0                      | CX02F107(2)                                 |                |
| 10            | 220.0             | D                      | T363D227(2)010AS                | 10.0                            | 8.0                      | CX02F227(2)                                 |                |
| 15            | 3.3               | A                      | T36(1)A335(2)015AS              | 0.5                             | 5.0                      | CX02H335(2)                                 | CX12H335(2)    |
| 15            | 22.0              | B                      | T36(1)B226(2)015AS              | 2.6                             | 6.0                      | CX02H226(2)                                 | CX12H226(2)    |
| 15            | 68.0              | C                      | T363C686(2)015AS                | 8.2                             | 6.0                      | CX02H686(2)                                 |                |
| 15            | 150.0             | D                      | T363D157(2)015AS                | 10.0                            | 8.0                      | CX02H157(2)                                 |                |
| 20            | 2.2               | A                      | T36(1)A225(2)020AS              | 0.5                             | 5.0                      | CX02J225(2)                                 | CX12J225(2)    |
| 20            | 15.0              | B                      | T36(1)B156(2)020AS              | 2.4                             | 6.0                      | CX02J156(2)                                 | CX12J156(2)    |
| 20            | 47.0              | C                      | T363C476(2)020AS                | 7.5                             | 6.0                      | CX02J476(2)                                 |                |
| 20            | 100.0             | D                      | T363D107(2)020AS                | 10.0                            | 8.0                      | CX02J107(2)                                 |                |
| 25            | 1.5               | A                      | T36(1)A155(2)025AS              | 0.5                             | 5.0                      | CX02K155(2)                                 | CX12K155(2)    |
| 25            | 10.0              | B                      | T36(1)B106(2)025AS              | 2.0                             | 6.0                      | CX02K106(2)                                 | CX12K106(2)    |
| 25            | 33.0              | C                      | T363C336(2)025AS                | 6.6                             | 6.0                      | CX02K336(2)                                 |                |
| 25            | 68.0              | D                      | T363D686(2)025AS                | 10.0                            | 6.0                      | CX02K686(2)                                 |                |
| 35            | 6.8               | B                      | T36(1)B685(2)035AS              | 1.9                             | 5.0                      | CX02M685(2)                                 | CX12M685(2)    |
| 35            | 22.0              | C                      | T363C226(2)035AS                | 6.2                             | 6.0                      | CX02M226(2)                                 |                |
| 35            | 33.0              | D                      | T363D336(2)035AS                | 9.2                             | 6.0                      | CX02M336(2)                                 |                |
| 35            | 47.0              | D                      | T363D476(2)035AS                | 10.0                            | 6.0                      | CX02M476(2)                                 |                |
| 50            | 0.1               | A                      | T36(1)A104(2)050AS              | 0.5                             | 3.0                      | CX02N104(2)                                 | CX12N104(2)    |
| 50            | 0.15              | A                      | T36(1)A154(2)050AS              | 0.5                             | 3.0                      | CX02N154(2)                                 | CX12N154(2)    |
| 50            | 0.22              | A                      | T36(1)A224(2)050AS              | 0.5                             | 3.0                      | CX02N224(2)                                 | CX12N224(2)    |
| 50            | 0.33              | A                      | T36(1)A334(2)050AS              | 0.5                             | 3.0                      | CX02N334(2)                                 | CX12N334(2)    |
| 50            | 0.47              | A                      | T36(1)A474(2)050AS              | 0.5                             | 3.0                      | CX02N474(2)                                 | CX12N474(2)    |
| 50            | 0.68              | A                      | T36(1)A684(2)050AS              | 0.5                             | 3.0                      | CX02N684(2)                                 | CX12N684(2)    |
| 50            | 1.0               | A                      | T36(1)A105(2)050AS              | 0.5                             | 3.0                      | CX02N105(2)                                 | CX12N105(2)    |
| 50            | 1.5               | B                      | T36(1)B155(2)050AS              | 0.6                             | 5.0                      | CX02N155(2)                                 | CX12N155(2)    |
| 50            | 2.2               | B                      | T36(1)B225(2)050AS              | 0.9                             | 5.0                      | CX02N225(2)                                 | CX12N225(2)    |
| 50            | 3.3               | B                      | T36(1)B335(2)050AS              | 1.3                             | 5.0                      | CX02N335(2)                                 | CX12N335(2)    |
| 50            | 4.7               | B                      | T36(1)B475(2)050AS              | 1.9                             | 5.0                      | CX02N475(2)                                 | CX12N475(2)    |
| 50            | 6.8               | C                      | T363B685(2)050AS                | 2.7                             | 5.0                      | CX02N685(2)                                 |                |
| 50            | 10.0              | C                      | T363C106(2)050AS                | 4.0                             | 6.0                      | CX02N106(2)                                 |                |
| 50            | 15.0              | C                      | T363C156(2)050AS                | 6.0                             | 6.0                      | CX02N156(2)                                 |                |
| 50            | 22.0              | D                      | T363D226(2)050AS                | 8.8                             | 6.0                      | CX02N226(2)                                 |                |
| (V) 85°C      | µF                | Case Size Code         | µA at 25°C<br>Maximum/5 Minutes | 120 Hz Maximum                  | Ω at 25°C<br>100 kHz Max | CX02<br>(T363)                              | CX12<br>(T369) |
| Rated Voltage | Rated Capacitance |                        | DC Leakage                      | DF % at 25°C                    | ESR                      | Military Part Number<br>Per MIL-PRF-49137/2 |                |

(1) To complete KEMET Part Number, insert Series Designation as follows: "3" - T363 (CX02); "9" - T369 (CX12)

(2) To complete KEMET or military part number, insert M - 20%, K - ±10%. Designates Capacitance tolerance.

## Recommended Voltage Derating Guidelines

|   | -55°C to 85°C | 85°C to 125°C |
|---|---------------|---------------|
| % Change in working DC voltage with temperature | $V_R$         | 66% of $V_R$  |
| Recommended Maximum Application Voltage         | 50% of $V_R$  | 33% of $V_R$  |



## Ripple Current/Ripple Voltage

Permissible AC ripple voltage and current are related to equivalent series resistance (ESR) and the power dissipation capabilities of the device. Permissible AC ripple voltage that may be applied is limited by following criteria:

1. Dissipated power must not exceed the limits specified for the Series.
2. The positive peak AC voltage plus the DC bias voltage, if any, must not exceed the DC voltage rating of the capacitor.
3. The negative peak AC voltage in combination with bias voltage, if any, must not exceed the allowable limits specified for reverse voltage.

Thermal capacities for the various case sizes have been determined empirically and are listed below. The “ripple voltage” permissible may be calculated from the impedance and ESR data shown in the respective product section.

| Temperature Compensation Multipliers<br>for Maximum Power Dissipation |                           |                            |
|---|---------------------------|----------------------------|
| $T \leq 25^\circ\text{C}$   | $T \leq 85^\circ\text{C}$ | $T \leq 125^\circ\text{C}$ |
| 1.00  | 0.90                      | 0.40                       |

$T$  = Environmental Temperature

The maximum power dissipation rating must be reduced with increasing environmental operating temperatures. Refer to the Temperature Compensation Multiplier table for details.

| Case Size | Maximum Power Dissipation<br>(Pmax) Watts at 25°C |
|-----------|---|
| A         | 0.050   |
| B         | 0.075   |
| C         | 0.090   |
| D         | 0.135   |

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

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

$$E(\text{max}) = Z \sqrt{P_{\text{max}}/R}$$

$I$  = rms ripple current (amperes)

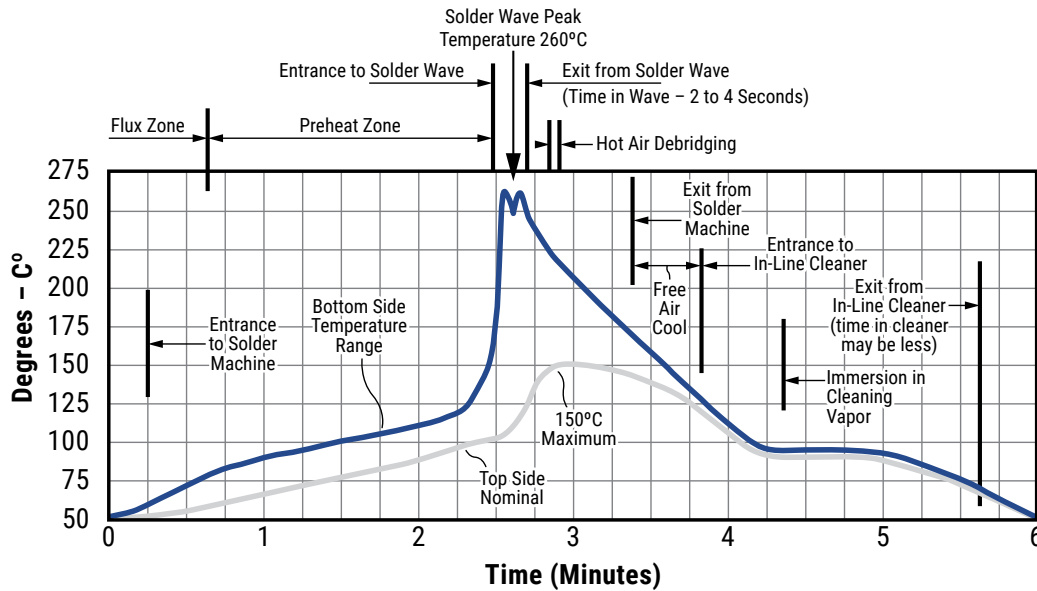
$E$  = rms ripple voltage (volts)

$P_{\text{max}}$  = maximum power dissipation (watts)

$R$  = ESR at specified frequency (ohms)

$Z$  = Impedance at specified frequency (ohms) Soldering Process

## Optimum Solder Wave Profile



## Reverse Voltage

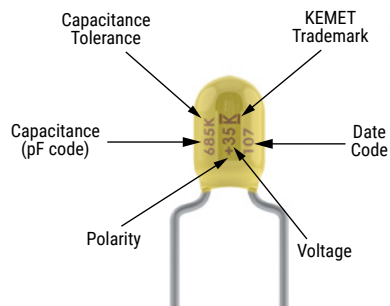
Although these are polar capacitors, some degree of transient voltage reversal is permissible, as seen below. The capacitors should not be operated continuously in reverse mode, even within these limits.

| Temperature | Percentage of Rated Voltage |
|-------------|-----------------------------|
| +25°C       | 15                          |
| +85°C       | 5                           |
| +125°C      | 1                           |

## Mounting

All encased capacitors will pass the Resistance to Soldering Heat Test of MIL-STD-202, Method 210, Condition C. This test simulates wave solder of topside board mount product. This demonstration of resistance to solder heat is in accordance with what is believed to be the industry standard. More severe treatment must be considered reflective of an improper soldering process. The above figure is a recommended solder wave profile for both axial and radial leaded solid tantalum capacitors. Table 2 – Performance & Reliability: Test Methods and Conditions

## Capacitor Marking



## Storage

Tantalum molded radial/axial capacitors should be stored in normal working environments. KEMET recommends that maximum storage temperature not exceed 40°C and maximum storage humidity not exceed 60% RH. Storage at high temperature may cause a small, temporary increase in leakage current (measured under standard conditions), but the original value is usually restored within a few minutes after application of rated voltage. Storage at high humidity may increase capacitance and dissipation factor. Solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. For optimized solderability capacitors stock should be used promptly, preferably within three years of receipt.

## Tape & Reel Packaging Information

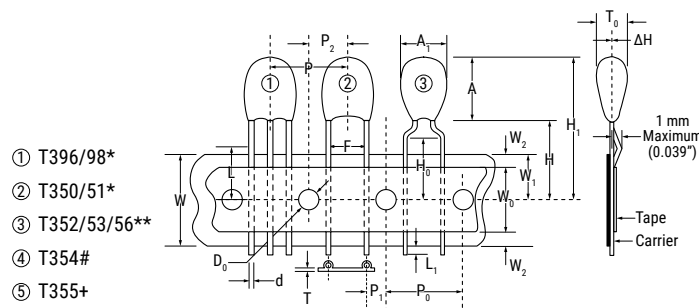
**Table 2 – Packaging Quantity**

| Case Size | Standard Bulk Quantity | Standard Reel Quantity | Reel C-Spec | Ammo Pack Quantity |
|-----------|------------------------|------------------------|-------------|--------------------|
| A         | 1,000                  | 1,500                  | C-7301/7303 | 2,500              |
| B         | 1,000                  | 1,500                  |             | 2,000              |
| C         | 500                    | 500                    |             | 800                |
| D         | 500                    | 500                    | Pending     | 800                |

T363 A - D cases.

T369 A and B cases only.

**Figure 1**



| Dimension                                    | Symbol         | Nominal<br>mm (inch)   |                        | Tolerance<br>mm (inch)      |                   |
|--|----------------|------------------------|------------------------|-----------------------------|-------------------|
| Body Height (1)                              | A              | 17.0 (0.67)            |                        | Maximum                     |                   |
| Body Width (1)                               | A <sub>1</sub> | 15.24 (0.600)          |                        | Maximum                     |                   |
| Sprocket Hole Diameter                       | D <sub>0</sub> | 4.0 (0.157)            |                        | ±0.3 (±0.012)               |                   |
| Lead Diameter                                | d              | 0.51 (0.020)           | 0.64 (0.025)           | ±0.05 (±0.002)              |                   |
| Lead Center (4)                              | F              | See Note Below         |                        |                             |                   |
| Component Base to Tape Center (4)            | H              | C-7301<br>16.0 (0.630) | C-7303<br>18.0 (0.709) | C-7301<br>±0.5 (±0.02)      | C-7303<br>Minimum |
| Lead Standoff Height                         | H <sub>0</sub> | C-7301<br>16.0 (0.630) | C-7303<br>18.0 (0.709) | C-7301<br>±0.5 (±0.02)      | C-7303<br>Minimum |
| Component Height Above Tape Center           | H <sub>1</sub> | 32.25 (1.270)          |                        | Maximum                     |                   |
| Component Alignment Front to Rear            | ΔH             | 0                      |                        | 1.0 (0.039)                 |                   |
| Cut Out Length                               | L              | 11.0 (0.433)           |                        | Maximum                     |                   |
| Lead Protrusion                              | L <sub>1</sub> | 1.0 (0.039)            |                        | Maximum                     |                   |
| Component Pitch (5)                          | P              | 12.7 (0.500)           |                        | ±1.0 (±0.039)               |                   |
| Sprocket Hole Pitch (2)                      | P <sub>0</sub> | 12.7 (0.500)           |                        | ±0.03 (±0.012)              |                   |
| Sprocket Hole Center to Lead Center (3) (4)  | P <sub>1</sub> | See Note Below         |                        | ±0.7 (±0.028)               |                   |
| Sprocket Hole Center to Component Center (5) | P <sub>2</sub> | See Note Below         |                        |                             |                   |
| Body Thickness                               | T <sub>0</sub> | 10.2 (0.400)           |                        | Maximum                     |                   |
| Total Tape Thickness                         | T              | 0.7 (0.28)             |                        | ±0.02 (±0.008)              |                   |
| Carrier Tape Width                           | W              | 18.0 (0.709)           |                        | +1.0/-0.5 (+0.039/-0.020)   |                   |
| Hold-Down Tape Width                         | W <sub>0</sub> | 15 mm (0.561)          | 6 mm (0.236)           | +1.0/-0.8 (+0.039/-0.031)   |                   |
| Sprocket Hole Location                       | W <sub>1</sub> | 9.0 (0.354)            |                        | +0.075/-0.5 (+0.030/-0.020) |                   |
| Hold-Down Tape Location                      | W <sub>2</sub> | 12.0 (0.472)           |                        | Maximum                     |                   |

**Notes:**

- (1) See Dimensions table for specific values per case size.
- (2) Cumulative pitch error ±1.0 mm (0.039) maximum in 20 consecutive sprocket hole locations.
- (3) Measured at bottom of standoff.
- (4) P<sub>1</sub> and F measured at egress from carrier tape.
- (5) P and P<sub>2</sub> measured at egress from carrier tape.

\* Lead spacings are 2.5 mm (0.098") center to center (T350 A-H)

\*\* Lead spacings are 5.0 mm (0.197") center to center

# Lead spacings are 6.35 mm (0.25") center to center

+ Lead spacings are 3.18 mm (0.125") center to center

| F Dimensions:            | P <sub>1</sub> Dimensions:         |
|--------------------------|------------------------------------|
| 0.100" ±0.015            | Lead Spacing                       |
| 0.125" ±0.015            | 0.100" - 0.200 ±0.028"             |
| 0.200" ±0.015            | 0.125" - 0.187 ±0.028"             |
| 0.250" ±0.015"           | 0.200" - 0.150 ±0.028"             |
| 0.100" ±0.015 (3 leaded) | 0.250" - 0.125 ±0.028"             |
|                          | 0.100" - 0.100 ±0.028" ( 3 leaded) |



## KEMET Electronics Corporation Sales Offices

For a complete list of our global sales offices, please visit [www.kemet.com/sales](http://www.kemet.com/sales).

---

## Disclaimer

YAGEO Corporation and its affiliates do not recommend the use of commercial or automotive grade products for high reliability applications or manned space flight.

All product specifications, statements, information and data (collectively, the "Information") in this datasheet are subject to change. The customer is responsible for checking and verifying the extent to which the Information contained in this publication is applicable to an order at the time the order is placed. All Information given herein is believed to be accurate and reliable, but it is presented without guarantee, warranty, or responsibility of any kind, expressed or implied.

Statements of suitability for certain applications are based on KEMET Electronics Corporation's ("KEMET") knowledge of typical operating conditions for such applications, but are not intended to constitute – and KEMET specifically disclaims – any warranty concerning suitability for a specific customer application or use. The Information is intended for use only by customers who have the requisite experience and capability to determine the correct products for their application. Any technical advice inferred from this Information or otherwise provided by KEMET with reference to the use of KEMET's products is given gratis, and KEMET assumes no obligation or liability for the advice given or results obtained.

Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (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 indicated or that other measures may not be required.