



**THE DATASHEET OF  
C323C103KCR5TA**



# High Voltage Goldmax, 300 Series, Conformally Coated, X7R Dielectric, 500 – 3,000 VDC (Commercial Grade)

## Overview

KEMET's 300 Series High Voltage Goldmax conformally coated radial leaded ceramic capacitors in X7R dielectric feature a 125°C maximum operating temperature. The Electronics Industries Alliance (EIA) characterizes X7R dielectric as a Class II "temperature stable" 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  $\pm 15\%$  from  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

These devices offer low leakage current, exhibit low ESR at high frequencies and find conventional use as snubbers

or filters in applications such as switching power supplies and in lighting ballasts. Their exceptional performance at high frequencies has made them a preferred choice of design engineers worldwide. In addition to their use in power supplies, these capacitors are widely used in industries related to telecommunications, medical, military, aerospace, semiconductor and test/diagnostic equipment



## Ordering Information

| C       | 320        |     |     | C                        | 473  | K   | C   | R          | 5                 | T   | A               | 7301  |
|---------|------------|-----|-----|--------------------------|--|---|---|------------|-------------------|---|-----------------|---|
| Ceramic | Style/Size |     |     | Specification/<br>Series | Capacitance<br>Code (pF)   | Capacitance<br>Tolerance <sup>1</sup>             | Rated Voltage<br>(VDC)  | Dielectric | Design            | Lead<br>Finish <sup>2</sup>                 | Failure<br>Rate | Packaging<br>(C-Spec)                                     |
|         | 315        | 324 | 335 | C =<br>Standard          | First two digits<br>represent<br>significant<br>figures. Third<br>digit specifies<br>number of<br>zeros. | J = $\pm 5\%$<br>K = $\pm 10\%$<br>M = $\pm 20\%$ | C = 500<br>B = 630<br>D = 1,000<br>F = 1,500<br>G = 2,000<br>Z = 2,500<br>H = 3,000 | R =<br>X7R | 5 =<br>Multilayer | T = 100%<br>Matte Sn<br>H = SnPb<br>(60/40) | A =<br>N/A      | See<br>"Packaging<br>C-Spec<br>Ordering<br>Options Table" |
|         | 316        | 325 | 336 |                          |  |   |   |            |                   |   |                 |   |
|         | 317        | 326 | 340 |                          |  |   |   |            |                   |   |                 |   |
|         | 318        | 327 | 346 |                          |  |   |   |            |                   |   |                 |   |
|         | 320        | 328 | 350 |                          |  |   |   |            |                   |   |                 |   |
|         | 321        | 330 | 356 |                          |  |   |   |            |                   |   |                 |   |
|         | 322        | 331 |     |                          |  |   |   |            |                   |   |                 |   |
|         | 323        | 333 |     |                          |  |   |   |            |                   |   |                 |   |

<sup>1</sup> Additional capacitance tolerance offerings may be available. Contact KEMET for details.

<sup>2</sup> Lead materials:

Standard: 100% matte tin (Sn) with nickel (Ni) underplate and steel core ("T" designation).

Alternative 1: 60% tin (Sn)/40% lead (Pb) finish with copper-clad steel core ("H" designation).

Alternative 2: 60% tin (Sn)/40% lead (Pb) finish with 100% copper core (available with "H" designation code with C-Spec). Contact KEMET for C-Spec details.

## Benefits

- Radial leaded form factor
- Conformally coated
- 0.100", 0.200", 0.250" and 0.400" lead spacing
- Operating temperature range of -55°C to +125°C
- Lead (Pb)-free, RoHS and REACH compliant
- X7R temperature stable dielectric
- DC voltage ratings of 500 V, 630 V, 1 KV, 1.5 KV, 2 KV, 2.5 KV, and 3 KV
- Capacitance offerings ranging from 10 pF to 0.56  $\mu$ F
- Available capacitance tolerances of  $\pm 5\%$ ,  $\pm 10\%$  and  $\pm 20\%$
- High temperature solder lead attach
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated lead finish allowing for excellent solderability
- SnPb-plated lead finish option available upon request (Sn60/Pb40)
- Encapsulation meets flammability standard UL 94V-0

## Applications

Typical applications include switch mode power supplies (input filters, resonators, tank circuits, snubber circuits, output filters), high voltage coupling and DC blocking, lighting ballasts, voltage multiplier circuits, DC/DC converters and coupling capacitors in  $\dot{C}$ uk converters. Markets include power supply, LCD fluorescent backlight ballasts, HID lighting, telecom equipment, industrial and medical equipment/control, LAN/WAN interface, analog and digital modems, and automotive. X7R dielectrics are not designed for AC line filtering applications.

## Application Notes

X7R dielectric is not recommended for AC line filtering or pulse applications.

## Packaging C-Spec Ordering Options Table

| Packaging Type <sup>1</sup>                     | Packaging/Grade Ordering Code (C-Spec) |
|---|--|
| Bulk Bag  | Not required (Blank)                   |
| 12" Tape & Reel (16.0 $\pm$ 0.5 mm lead length) | 7301                                   |
| 12" Tape & Reel (18.0 mm minimum lead length)   | 7303 and TR                            |
| Ammo Pack (16.0 $\pm$ 0.5 mm lead length)       | 7305                                   |
| Ammo Pack (18.0 mm minimum lead length)         | 7317                                   |

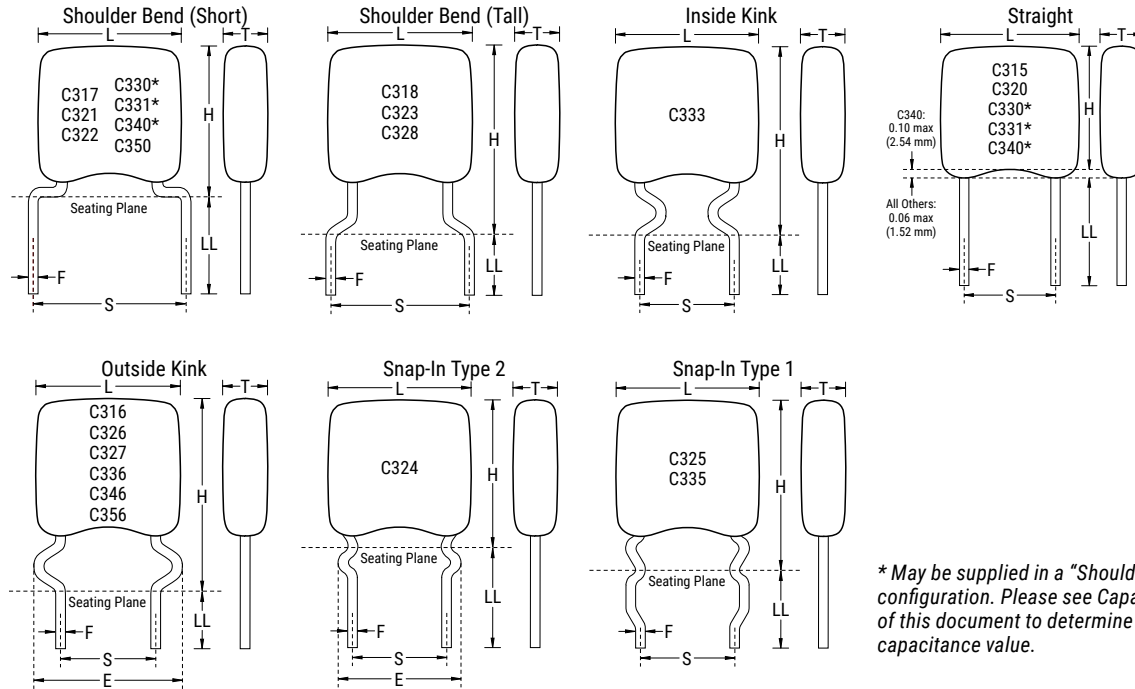
<sup>1</sup> Default packaging is "Bulk Bag". An ordering code C-Spec is not required for "Bulk Bag" packaging. Bulk bag option is required for Size/Style C321 and C331.

<sup>1</sup> "Tape and Reel" packaging option is not available for Size/Style C321 and C331. For more information see "Packaging Quantities".

<sup>1</sup> "Ammo Pack" packaging option is not available for Size/Style C321, C331, C350 and C356. For more information see "Packaging Quantities".

<sup>1</sup> "Ammo Pack" and "Tape and Reel" packaging options have the same lead tape configuration. For more information see "Tape & Reel Packaging Information".

## Dimensions – Inches (Millimeters)



\* May be supplied in a "Shoulder Bend" or "Straight" Lead configuration. Please see Capacitance Range Waterfall section of this document to determine lead configuration availability by capacitance value.

| Series | Style/Size   | S Lead Spacing<br>±0.030 (0.78) | L Length<br>Maximum | H Height<br>Maximum | T Thickness<br>Maximum | F Lead Diameter<br>+0.004 (0.10),<br>-0.001 (0.025) | LL Lead Length<br>Minimum |
|--------|--------------|---------------------------------|---------------------|---------------------|------------------------|---|---------------------------|
| C31X   | 315          | 0.100 (2.54)                    | 0.150 (3.81)        | 0.130 (3.30)        | 0.120 (3.14)           | 0.020 (0.51)  | 0.276 (7.00)              |
|        | 316          |                                 | 0.150 (3.81)        | 0.230 (5.84)        | 0.150 (3.81)           |   | 0.200 (5.08)              |
| C32X   | 324          |                                 | 0.200 (5.08)        | 0.260 (6.60)        | 0.200 (5.08)           |   | 0.276 (7.00)              |
|        | 320          | 0.200 (5.08)                    | 0.230 (5.84)        | 0.150 (3.81)        | 0.276 (7.00)           |   |                           |
| C31X   | 326          | 0.200 (5.08)                    | 0.350 (8.89)        | 0.200 (5.08)        | 0.200 (5.08)           |   |                           |
|        | 317          | 0.200 (5.08)                    | 0.150 (3.81)        | 0.200 (5.08)        | 0.120 (3.14)           |   | 0.276 (7.00)              |
| C32X   | 318          | 0.250 (6.35)                    | 0.150 (3.81)        | 0.235 (5.97)        | 0.150 (3.81)           |   | 0.276 (7.00)              |
|        | 321          | 0.200 (5.08)                    | 0.200 (5.08)        | 0.260 (6.60)        | 0.200 (5.08)           |   | 0.276 (7.00)              |
|        | 322          |                                 | 0.200 (5.08)        | 0.260 (6.60)        | 0.150 (3.81)           |   | 0.276 (7.00)              |
|        | 323          |                                 | 0.200 (5.08)        | 0.300 (7.62)        | 0.150 (3.81)           |   | 0.276 (7.00)              |
|        | 325          |                                 | 0.200 (5.08)        | 0.320 (8.13)        | 0.200 (5.08)           | 0.276 (7.00)  |                           |
|        | 328          |                                 | 0.200 (5.08)        | 0.325 (8.26)        | 0.200 (5.08)           | 0.276 (7.00)  |                           |
|        | 327          |                                 | 0.200 (5.08)        | 0.350 (8.89)        | 0.200 (5.08)           | 0.200 (5.08)  |                           |
| 330    | 0.300 (7.62) |                                 | 0.360 (9.14)        | 0.200 (5.08)        | 0.276 (7.00)           |   |                           |
| C33X   | 331          | 0.250 (6.35)                    | 0.300 (7.62)        | 0.360 (9.14)        | 0.250 (6.35)           | 0.276 (7.00)  |                           |
|        | 333          | 0.200 (5.08)                    | 0.300 (7.62)        | 0.420 (10.67)       | 0.200 (5.08)           | 0.276 (7.00)  |                           |
|        | 335          |                                 | 0.300 (7.62)        | 0.420 (10.67)       | 0.250 (6.35)           | 0.276 (7.00)  |                           |
|        | 336          |                                 | 0.300 (7.62)        | 0.450 (11.43)       | 0.250 (6.35)           | 0.200 (5.08)  |                           |
| C34X   | 340          |                                 | 0.400 (10.16)       | 0.460 (11.68)       | 0.270 (6.85)           | 0.276 (7.00)  |                           |
|        | 346          | 0.400 (10.16)                   | 0.590 (14.97)       | 0.270 (6.85)        | 0.200 (5.08)           |   |                           |
| C35X   | 350          | 0.400 (10.16)                   | 0.500 (12.70)       | 0.560 (14.22)       | 0.270 (6.85)           | 0.276 (7.00)  |                           |
|        | 356          |                                 | 0.500 (12.70)       | 0.670 (17.02)       | 0.270 (6.85)           | 0.200 (5.08)  |                           |

## Qualification/Certification

Commercial Grade products are subject to internal qualification. Details regarding test methods and conditions are referenced in Table 2, Performance & Reliability.

## Environmental Compliance

Lead (Pb)-free, REACH and RoHS compliant without exemptions when ordered with a 100% tin (Sn) wire lead finish. Product ordered with tin/ lead (Sn60/Pb40) wire lead finish do not meet RoHS criteria.

| Series     | Termination Finish (Wire Lead) | RoHS Compliant | RoHS Exemption Code | REACH Compliant <sup>1</sup> | Halogen Free |
|------------|--------------------------------|----------------|---------------------|------------------------------|--------------|
| 300 (C3XX) | 100% Matte Sn                  | Yes            | n/a                 | Yes                          | Yes          |
|            | Sn60/Pb40                      | No             | n/a                 | Yes                          | Yes          |

<sup>1</sup> REACH compliance indicates product does not contain Substance/s of Very High Concern (SVHC)

## 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%   |
| Aging Rate (Maximum % Cap Loss/Decade Hour)                        | 3.0%   |
| Dielectric Withstanding Voltage                                    | 150% of rated voltage for voltage rating of < 1,000 V<br>120% of rated voltage for voltage rating of ≥ 1,000 V<br>(5±1 seconds and charge/discharge not exceeding 50 mA at 25°C) |
| Dissipation Factor (DF) Maximum Limit at 25°C                      | 2.5%   |
| Insulation Resistance (IR) Limit at 25°C                           | See Insulation Resistance Limit Table<br>(500 VDC applied for 120±5 seconds at 25°C)   |

Regarding aging rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1,000 hours.

To obtain IR limit, divide  $M\Omega\text{-}\mu\text{F}$  value by the capacitance and compare to  $G\Omega$  limit. Select the lower of the two limits.

Capacitance and dissipation factor (DF) measured under the following conditions:

$$1 \text{ kHz } \pm 50 \text{ Hz and } 1.0 \pm 0.2 V_{\text{rms}}$$

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 and Agilent E4980 have a feature known as Automatic Level Control (ALC). The ALC feature should be switched to "ON."

## Insulation Resistance Limit Table

| Style/Size                   | Rated Voltage (VDC) | 1,000 Megohm Microfarads or 100 GΩ | 100 Megohm Microfarads or 10 GΩ |
|------------------------------|---------------------|------------------------------------|---------------------------------|
| C31X                         | ≤ 1000              | ≤ 1.8 nF                           | ≥ 2.2 nF                        |
| C320, C322, C323, C326, C328 |                     | ≤ 1.8 nF                           | ≥ 2.2 nF                        |
| C321, C324, C325, C327       |                     | ≤ 10 nF                            | ≥ 12 nF                         |
| C33X                         |                     | ≤ 10 nF                            | ≥ 12 nF                         |
| C34X                         |                     | ≤ 10 nF                            | ≥ 12 nF                         |
| C35X                         |                     | ≤ 120 nF                           | ≥ 150 nF                        |
| C31X                         | > 1000              | All                                | N/A                             |
| C32X                         |                     |                                    |                                 |
| C33X                         |                     |                                    |                                 |
| C34X                         |                     |                                    |                                 |
| C35X                         |                     |                                    |                                 |

## Post Environmental Limits

| High Temperature Life, Biased Humidity and Storage Life |                  |                   |                                |                   |                       |
|---|------------------|-------------------|--------------------------------|-------------------|-----------------------|
| Style/Size  | Rated DC Voltage | Capacitance Value | Dissipation Factor (Maximum %) | Capacitance Shift | Insulation Resistance |
| All   | All              | All               | 3.0                            | ± 20%             | 10% of Initial Limit  |

**Table 1A – C31X Style/Size, Capacitance Range Waterfall**

| <b>C315, C316, C317, C318 Style/Size (0.100" &amp; 0.200" Lead Spacing)</b> |                                 |   |            |             |
|---|---------------------------------|---|------------|-------------|
| <b>Rated Voltage (VDC)</b>  |                                 | <b>500</b>                                      | <b>630</b> | <b>1000</b> |
| <b>Voltage Code</b>   |                                 | <b>C</b>  | <b>B</b>   | <b>D</b>    |
| <b>Capacitance</b>  | <b>Capacitance Tolerance</b>    | <b>Capacitance Code (Available Capacitance)</b> |            |             |
| 10pF  | J = ±5%<br>K = ±10%<br>M = ±20% | 100   | 100        | 100         |
| 12pF  |                                 | 120   | 120        | 120         |
| 15pF  |                                 | 150   | 150        | 150         |
| 18pF  |                                 | 180   | 180        | 180         |
| 22pF  |                                 | 220   | 220        | 220         |
| 27pF  |                                 | 270   | 270        | 270         |
| 33pF  |                                 | 330   | 330        | 330         |
| 39pF  |                                 | 390   | 390        | 390         |
| 47pF  |                                 | 470   | 470        | 470         |
| 56pF  |                                 | 560   | 560        | 560         |
| 68pF  |                                 | 680   | 680        | 680         |
| 82pF  |                                 | 820   | 820        | 820         |
| 100pF   |                                 | 101   | 101        | 101         |
| 120pF   |                                 | 121   | 121        | 121         |
| 150pF   |                                 | 151   | 151        | 151         |
| 180pF   |                                 | 181   | 181        | 181         |
| 220pF   |                                 | 221   | 221        | 221         |
| 270pF   |                                 | 271   | 271        | 271         |
| 330pF   |                                 | 331   | 331        | 331         |
| 390pF   |                                 | 391   | 391        | 391         |
| 470pF   |                                 | 471   | 471        | 471         |
| 560pF   |                                 | 561   | 561        | 561         |
| 680pF   |                                 | 681   | 681        | 681         |
| 820pF   |                                 | 821   | 821        | 821         |
| 1000pF  |                                 | 102   | 102        | 102         |
| 1200pF  |                                 | 122   | 122        | 122         |
| 1500pF  |                                 | 152   | 152        | 152         |
| 1800pF  |                                 | 182   | 182        | 182         |
| 2200pF  |                                 | 222   | 222        | 222         |
| 2700pF  |                                 | 272   | 272        | 272         |
| 3300pF  |                                 | 332   | 332        | 332         |
| 3900pF  |                                 | 392   | 392        | 392         |
| 4700pF  |                                 | 472   | 472        | 472         |
| 5600pF  |                                 | 562   | 562        |             |
| 6800pF  |                                 | 682   | 682        |             |
| 8200pF  | 822                             | 822   |            |             |
| 0.01μF  | 103                             |   |            |             |
| 0.012μF   | 123                             |   |            |             |
| <b>Rated Voltage (VDC)</b>  |                                 | <b>500</b>                                      | <b>630</b> | <b>1000</b> |
| <b>Voltage Code</b>   |                                 | <b>C</b>  | <b>B</b>   | <b>D</b>    |

**Table 1B – C32X Style/Size, Capacitance Range Waterfall**

| <b>C320, C322, C323, C326, C328 Style/Size (0.100" &amp; 0.200" Lead Spacing)</b> |                                 |   |             |             |             |             |
|---|---------------------------------|---|-------------|-------------|-------------|-------------|
| <b>Rated Voltage (VDC)</b>  |                                 | <b>500</b>                                      | <b>630</b>  | <b>1000</b> | <b>1500</b> | <b>2000</b> |
| <b>Voltage Code</b>   |                                 | <b>C</b>  | <b>B</b>    | <b>D</b>    | <b>F</b>    | <b>G</b>    |
| <b>Capacitance</b>  | <b>Capacitance Tolerance</b>    | <b>Capacitance Code (Available Capacitance)</b> |             |             |             |             |
| 10pF  | J = ±5%<br>K = ±10%<br>M = ±20% | 100   | 100         | 100         | 100         | 100         |
| 12pF  |                                 | 120   | 120         | 120         | 120         | 120         |
| 15pF  |                                 | 150   | 150         | 150         | 150         | 150         |
| 18pF  |                                 | 180   | 180         | 180         | 180         | 180         |
| 22pF  |                                 | 220   | 220         | 220         | 220         | 220         |
| 27pF  |                                 | 270   | 270         | 270         | 270         | 270         |
| 33pF  |                                 | 330   | 330         | 330         | 330         | 330         |
| 39pF  |                                 | 390   | 390         | 390         | 390         | 390         |
| 47pF  |                                 | 470   | 470         | 470         | 470         | 470         |
| 56pF  |                                 | 560   | 560         | 560         | 560         | 560         |
| 68pF  |                                 | 680   | 680         | 680         | 680         | 680         |
| 82pF  |                                 | 820   | 820         | 820         | 820         | 820         |
| 100pF   |                                 | 101   | 101         | 101         | 101         | 101         |
| 120pF   |                                 | 121   | 121         | 121         | 121         | 121         |
| 150pF   |                                 | 151   | 151         | 151         | 151         | 151         |
| 180pF   |                                 | 181   | 181         | 181         | 181         | 181         |
| 220pF   |                                 | 221   | 221         | 221         | 221         | 221         |
| 270pF   |                                 | 271   | 271         | 271         | 271         | 271         |
| 330pF   |                                 | 331   | 331         | 331         | 331         | 331         |
| 390pF   |                                 | 391   | 391         | 391         | 391         | 391         |
| 470pF   |                                 | 471   | 471         | 471         | 471         | 471         |
| 560pF   |                                 | 561   | 561         | 561         | 561         | 561         |
| 680pF   |                                 | 681   | 681         | 681         | 681         | 681         |
| 820pF   |                                 | 821   | 821         | 821         | 821         | 821         |
| 1000pF  |                                 | 102   | 102         | 102         | 102         | 102         |
| 1200pF  |                                 | 122   | 122         | 122         | 122         | 122         |
| 1500pF  |                                 | 152   | 152         | 152         | 152         | 152         |
| 1800pF  |                                 | 182   | 182         | 182         | 182         | 182         |
| 2200pF  |                                 | 222   | 222         | 222         | 222         | 222         |
| 2700pF  |                                 | 272   | 272         | 272         | 272         | 272         |
| 3300pF  |                                 | 332   | 332         | 332         | 332         | 332         |
| 3900pF  |                                 | 392   | 392         | 392         | 392         | 392         |
| 4700pF  |                                 | 472   | 472         | 472         | 472         | 472         |
| 5600pF  |                                 | 562   | 562         | 562         | 562         | 562         |
| 6800pF  |                                 | 682   | 682         | 682         | 682         | 682         |
| 8200pF  |                                 | 822   | 822         | 822         | 822         |             |
| 0.01µF  |                                 | 103   | 103         | 103         | 103         |             |
| 0.012µF   |                                 | 123   | 123         | 123         | 123         |             |
| 0.015µF   |                                 | 153   | 153         | 153         | 153         |             |
| 0.018µF   |                                 | 183   | 183         | 183         | 183         |             |
| 0.022µF   |                                 | 223   | 223         | 223         | 223         |             |
| 0.027µF   |                                 | 273   | 273         | 273         | 273         |             |
| 0.033µF   |                                 | 333   | 333         | 333         | 333         |             |
| 0.039µF   |                                 | 393   | 393         | 393         | 393         |             |
| 0.047µF   |                                 | 473   | 473         | 473         |             |             |
| 0.056µF   | 563                             | 563   | 563         |             |             |             |
| 0.068µF   | 683                             | 683   | 683         |             |             |             |
| 0.082µF   | 823                             | 823   |             |             |             |             |
| 0.1µF   | 104                             | 104   |             |             |             |             |
| 0.12µF  | 124                             |   |             |             |             |             |
| 0.15µF  | 154                             |   |             |             |             |             |
| <b>Rated Voltage (VDC)</b>  | <b>500</b>                      | <b>630</b>                                      | <b>1000</b> | <b>1500</b> | <b>2000</b> |             |
| <b>Voltage Code</b>   | <b>C</b>                        | <b>B</b>  | <b>D</b>    | <b>F</b>    | <b>G</b>    |             |

**Table 1C – C32X Style/Size, Capacitance Range Waterfall**

| C321, C324, C325, C327 Style/Size (0.100" & 0.200" Lead Spacing) |                                 |  |     |      |      |      |
|--|---------------------------------|--|-----|------|------|------|
| Rated Voltage (VDC)  |                                 | 500                                      | 630 | 1000 | 1500 | 2000 |
| Voltage Code   |                                 | C  | B   | D    | F    | G    |
| Capacitance  | Capacitance Tolerance           | Capacitance Code (Available Capacitance) |     |      |      |      |
| 10pF   | J = ±5%<br>K = ±10%<br>M = ±20% | 100                                      | 100 | 100  | 100  | 100  |
| 12pF   |                                 | 120                                      | 120 | 120  | 120  | 120  |
| 15pF   |                                 | 150                                      | 150 | 150  | 150  | 150  |
| 18pF   |                                 | 180                                      | 180 | 180  | 180  | 180  |
| 22pF   |                                 | 220                                      | 220 | 220  | 220  | 220  |
| 27pF   |                                 | 270                                      | 270 | 270  | 270  | 270  |
| 33pF   |                                 | 330                                      | 330 | 330  | 330  | 330  |
| 39pF   |                                 | 390                                      | 390 | 390  | 390  | 390  |
| 47pF   |                                 | 470                                      | 470 | 470  | 470  | 470  |
| 56pF   |                                 | 560                                      | 560 | 560  | 560  | 560  |
| 68pF   |                                 | 680                                      | 680 | 680  | 680  | 680  |
| 82pF   |                                 | 820                                      | 820 | 820  | 820  | 820  |
| 100pF  |                                 | 101                                      | 101 | 101  | 101  | 101  |
| 120pF  |                                 | 121                                      | 121 | 121  | 121  | 121  |
| 150pF  |                                 | 151                                      | 151 | 151  | 151  | 151  |
| 180pF  |                                 | 181                                      | 181 | 181  | 181  | 181  |
| 220pF  |                                 | 221                                      | 221 | 221  | 221  | 221  |
| 270pF  |                                 | 271                                      | 271 | 271  | 271  | 271  |
| 330pF  |                                 | 331                                      | 331 | 331  | 331  | 331  |
| 390pF  |                                 | 391                                      | 391 | 391  | 391  | 391  |
| 470pF  |                                 | 471                                      | 471 | 471  | 471  | 471  |
| 560pF  |                                 | 561                                      | 561 | 561  | 561  | 561  |
| 680pF  |                                 | 681                                      | 681 | 681  | 681  | 681  |
| 820pF  |                                 | 821                                      | 821 | 821  | 821  | 821  |
| 1000pF   |                                 | 102                                      | 102 | 102  | 102  | 102  |
| 1200pF   |                                 | 122                                      | 122 | 122  | 122  | 122  |
| 1500pF   |                                 | 152                                      | 152 | 152  | 152  | 152  |
| 1800pF   |                                 | 182                                      | 182 | 182  | 182  | 182  |
| 2200pF   |                                 | 222                                      | 222 | 222  | 222  | 222  |
| 2700pF   |                                 | 272                                      | 272 | 272  | 272  | 272  |
| 3300pF   |                                 | 332                                      | 332 | 332  | 332  | 332  |
| 3900pF   |                                 | 392                                      | 392 | 392  | 392  | 392  |
| 4700pF   |                                 | 472                                      | 472 | 472  | 472  | 472  |
| 5600pF   |                                 | 562                                      | 562 | 562  | 562  | 562  |
| 6800pF   |                                 | 682                                      | 682 | 682  | 682  | 682  |
| 8200pF   |                                 | 822                                      | 822 | 822  | 822  |      |
| 0.01μF   |                                 | 103                                      | 103 | 103  | 103  |      |
| 0.012μF  |                                 | 123                                      | 123 | 123  | 123  |      |
| 0.015μF  |                                 | 153                                      | 153 | 153  | 153  |      |
| 0.018μF  |                                 | 183                                      | 183 | 183  | 183  |      |
| 0.022μF  |                                 | 223                                      | 223 | 223  | 223  |      |
| 0.027μF  |                                 | 273                                      | 273 | 273  | 273  |      |
| 0.033μF  |                                 | 333                                      | 333 | 333  | 333  |      |
| 0.039μF  |                                 | 393                                      | 393 | 393  | 393  |      |
| 0.047μF  |                                 | 473                                      | 473 | 473  |      |      |
| 0.056μF  | 563                             | 563                                      | 563 |      |      |      |
| 0.068μF  | 683                             | 683                                      | 683 |      |      |      |
| 0.082μF  | 823                             | 823                                      |     |      |      |      |
| 0.1μF  | 104                             | 104                                      |     |      |      |      |
| 0.12μF   | 124                             |  |     |      |      |      |
| 0.15μF   | 154                             |  |     |      |      |      |
| Rated Voltage (VDC)  |                                 | 500                                      | 630 | 1000 | 1500 | 2000 |
| Voltage Code   |                                 | C  | B   | D    | F    | G    |

**Table 1D – C33X Style/Size, Capacitance Range Waterfall**

| C330, C331, C333, C335, C336, Style/Size (0.200" and 0.250" Lead Spacing) |                                 |  |      |      |      |      |      |      |
|---|---------------------------------|--|------|------|------|------|------|------|
| Rated Voltage (VDC)   |                                 | 500                                      | 630  | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code  |                                 | C  | B    | D    | F    | G    | Z    | H    |
| Capacitance   | Capacitance Tolerance           | Capacitance Code (Available Capacitance) |      |      |      |      |      |      |
| 10pF  | J = ±5%<br>K = ±10%<br>M = ±20% | 100*                                     | 100* | 100* | 100* | 100* | 100  | 100  |
| 12pF  |                                 | 120*                                     | 120* | 120* | 120* | 120* | 120  | 120  |
| 15pF  |                                 | 150*                                     | 150* | 150* | 150* | 150* | 150  | 150  |
| 18pF  |                                 | 180*                                     | 180* | 180* | 180* | 180* | 180  | 180  |
| 22pF  |                                 | 220*                                     | 220* | 220* | 220* | 220* | 220  | 220  |
| 27pF  |                                 | 270*                                     | 270* | 270* | 270* | 270* | 270  | 270  |
| 33pF  |                                 | 330*                                     | 330* | 330* | 330* | 330* | 330  | 330  |
| 39pF  |                                 | 390*                                     | 390* | 390* | 390* | 390* | 390  | 390  |
| 47pF  |                                 | 470*                                     | 470* | 470* | 470* | 470* | 470  | 470  |
| 56pF  |                                 | 560*                                     | 560* | 560* | 560* | 560* | 560  | 560  |
| 68pF  |                                 | 680*                                     | 680* | 680* | 680* | 680* | 680  | 680  |
| 82pF  |                                 | 820*                                     | 820* | 820* | 820* | 820* | 820  | 820  |
| 100pF   |                                 | 101*                                     | 101* | 101* | 101* | 101* | 101  | 101  |
| 120pF   |                                 | 121*                                     | 121* | 121* | 121* | 121* | 121  | 121  |
| 150pF   |                                 | 151*                                     | 151* | 151* | 151* | 151* | 151  | 151  |
| 180pF   |                                 | 181*                                     | 181* | 181* | 181* | 181* | 181  | 181  |
| 220pF   |                                 | 221*                                     | 221* | 221* | 221* | 221* | 221  | 221  |
| 270pF   |                                 | 271*                                     | 271* | 271* | 271* | 271* | 271  | 271  |
| 330pF   |                                 | 331*                                     | 331* | 331* | 331* | 331* | 331  | 331  |
| 390pF   |                                 | 391*                                     | 391* | 391* | 391* | 391* | 391  | 391  |
| 470pF   |                                 | 471*                                     | 471* | 471* | 471* | 471* | 471  | 471  |
| 560pF   |                                 | 561*                                     | 561* | 561* | 561* | 561* | 561  | 561  |
| 680pF   |                                 | 681*                                     | 681* | 681* | 681* | 681* | 681  | 681  |
| 820pF   |                                 | 821*                                     | 821* | 821* | 821* | 821* | 821  | 821  |
| 1000pF  |                                 | 102*                                     | 102* | 102* | 102* | 102* | 102  | 102  |
| 1200pF  |                                 | 122*                                     | 122* | 122* | 122* | 122* | 122  | 122  |
| 1500pF  |                                 | 152*                                     | 152* | 152* | 152* | 152* | 152  | 152  |
| 1800pF  |                                 | 182*                                     | 182* | 182* | 182* | 182* | 182  | 182  |
| 2200pF  |                                 | 222*                                     | 222* | 222* | 222* | 222* | 222  | 222  |
| 2700pF  |                                 | 272*                                     | 272* | 272* | 272* | 272* | 272  | 272  |
| 3300pF  |                                 | 332*                                     | 332* | 332* | 332* | 332* | 332  | 332  |
| 3900pF  |                                 | 392*                                     | 392* | 392* | 392* | 392* | 392  | 392  |
| 4700pF  |                                 | 472*                                     | 472* | 472* | 472* | 472* | 472  | 472  |
| 5600pF  |                                 | 562*                                     | 562* | 562* | 562* | 562* | 562  | 562  |
| 6800pF  |                                 | 682*                                     | 682* | 682* | 682* | 682* | 682  | 682  |
| 8200pF  |                                 | 822*                                     | 822* | 822* | 822* | 822  | 822  | 822  |
| 0.01µF  |                                 | 103*                                     | 103* | 103* | 103* | 103  | 103  | 103  |
| 0.012µF   |                                 | 123*                                     | 123* | 123* | 123* | 123  | 123  | 123  |
| 0.015µF   |                                 | 153*                                     | 153* | 153* | 153* | 153  |      |      |
| 0.018µF   |                                 | 183*                                     | 183* | 183* | 183* | 183  |      |      |
| 0.022µF   |                                 | 223*                                     | 223* | 223* | 223* |      |      |      |
| 0.027µF   |                                 | 273*                                     | 273* | 273* | 273* |      |      |      |
| 0.033µF   |                                 | 333*                                     | 333* | 333* | 333* |      |      |      |
| 0.039µF   |                                 | 393*                                     | 393* | 393* | 393* |      |      |      |
| 0.047µF   |                                 | 473*                                     | 473* | 473* | 473  |      |      |      |
| 0.056µF   | 563*                            | 563*                                     | 563* | 563  |      |      |      |      |
| 0.068µF   | 683*                            | 683*                                     | 683* | 683  |      |      |      |      |
| 0.082µF   | 823*                            | 823*                                     | 823  |      |      |      |      |      |
| 0.1µF   | 104*                            | 104*                                     | 104  |      |      |      |      |      |
| 0.12µF  | 124*                            | 124                                      | 124  |      |      |      |      |      |
| 0.15µF  | 154*                            | 154                                      | 154  |      |      |      |      |      |
| 0.18µF  | 184                             | 184                                      |      |      |      |      |      |      |
| 0.22µF  | 224                             | 224                                      |      |      |      |      |      |      |
| 0.27µF  | 274                             | 274                                      |      |      |      |      |      |      |
| 0.33µF  | 334                             | 334                                      |      |      |      |      |      |      |
| 0.39µF  | 394                             |  |      |      |      |      |      |      |
| Rated Voltage (VDC)   |                                 | 500                                      | 630  | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code  |                                 | C  | B    | D    | F    | G    | Z    | H    |

\* Capacitor is supplied with a "Shoulder-Bend" lead configuration in Style/Size C330 and C331.

Table 1D – C33X Style/Size, Capacitance Range Waterfall cont.

| C330, C331, C333, C335, C336, Style/Size (0.200" and 0.250" Lead Spacing) |                       |  |     |      |      |      |      |      |
|---|-----------------------|--|-----|------|------|------|------|------|
| Rated Voltage (VDC)   |                       | 500                                      | 630 | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code  |                       | C  | B   | D    | F    | G    | Z    | H    |
| Capacitance   | Capacitance Tolerance | Capacitance Code (Available Capacitance) |     |      |      |      |      |      |
|   |                       | 0.47µF                                   | 474 |      |      |      |      |      |
| 0.50µF  |                       | 504                                      |     |      |      |      |      |      |
| Rated Voltage (VDC)   |                       | 500                                      | 630 | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code  |                       | C  | B   | D    | F    | G    | Z    | H    |

\* Capacitor is supplied with a "Shoulder-Bend" lead configuration in Style/Size C330 and C331.

Table 1E – C34X Style/Size, Capacitance Range Waterfall

| C340, C346 Style/Size (0.200" Lead Spacing) |                       |  |                                 |      |      |      |      |      |
|---|-----------------------|--|---------------------------------|------|------|------|------|------|
| Rated Voltage (VDC)                         |                       | 500                                      | 630                             | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code                                |                       | C  | B                               | D    | F    | G    | Z    | H    |
| Capacitance                                 | Capacitance Tolerance | Capacitance Code (Available Capacitance) |                                 |      |      |      |      |      |
|   |                       | 10pF                                     | J = ±5%<br>K = ±10%<br>M = ±20% | 100* | 100* | 100* | 100* | 100* |
| 12pF  | 120*                  | 120*                                     |                                 | 120* | 120* | 120* | 120  | 120  |
| 15pF  | 150*                  | 150*                                     |                                 | 150* | 150* | 150* | 150  | 150  |
| 18pF  | 180*                  | 180*                                     |                                 | 180* | 180* | 180* | 180  | 180  |
| 22pF  | 220*                  | 220*                                     |                                 | 220* | 220* | 220* | 220  | 220  |
| 27pF  | 270*                  | 270*                                     |                                 | 270* | 270* | 270* | 270  | 270  |
| 33pF  | 330*                  | 330*                                     |                                 | 330* | 330* | 330* | 330  | 330  |
| 39pF  | 390*                  | 390*                                     |                                 | 390* | 390* | 390* | 390  | 390  |
| 47pF  | 470*                  | 470*                                     |                                 | 470* | 470* | 470* | 470  | 470  |
| 56pF  | 560*                  | 560*                                     |                                 | 560* | 560* | 560* | 560  | 560  |
| 68pF  | 680*                  | 680*                                     |                                 | 680* | 680* | 680* | 680  | 680  |
| 82pF  | 820*                  | 820*                                     |                                 | 820* | 820* | 820* | 820  | 820  |
| 100pF                                       | 101*                  | 101*                                     |                                 | 101* | 101* | 101* | 101  | 101  |
| 120pF                                       | 121*                  | 121*                                     |                                 | 121* | 121* | 121* | 121  | 121  |
| 150pF                                       | 151*                  | 151*                                     |                                 | 151* | 151* | 151* | 151  | 151  |
| 180pF                                       | 181*                  | 181*                                     |                                 | 181* | 181* | 181* | 181  | 181  |
| 220pF                                       | 221*                  | 221*                                     |                                 | 221* | 221* | 221* | 221  | 221  |
| 270pF                                       | 271*                  | 271*                                     |                                 | 271* | 271* | 271* | 271  | 271  |
| 330pF                                       | 331*                  | 331*                                     |                                 | 331* | 331* | 331* | 331  | 331  |
| 390pF                                       | 391*                  | 391*                                     |                                 | 391* | 391* | 391* | 391  | 391  |
| 470pF                                       | 471*                  | 471*                                     |                                 | 471* | 471* | 471* | 471  | 471  |
| 560pF                                       | 561*                  | 561*                                     |                                 | 561* | 561* | 561* | 561  | 561  |
| 680pF                                       | 681*                  | 681*                                     |                                 | 681* | 681* | 681* | 681  | 681  |
| 820pF                                       | 821*                  | 821*                                     |                                 | 821* | 821* | 821* | 821  | 821  |
| 1000pF                                      | 102*                  | 102*                                     |                                 | 102* | 102* | 102* | 102  | 102  |
| 1200pF                                      | 122*                  | 122*                                     |                                 | 122* | 122* | 122* | 122  | 122  |
| 1500pF                                      | 152*                  | 152*                                     |                                 | 152* | 152* | 152* | 152  | 152  |
| 1800pF                                      | 182*                  | 182*                                     |                                 | 182* | 182* | 182* | 182  | 182  |
| 2200pF                                      | 222*                  | 222*                                     |                                 | 222* | 222* | 222* | 222  | 222  |
| 2700pF                                      | 272*                  | 272*                                     |                                 | 272* | 272* | 272* | 272  | 272  |
| 3300pF                                      | 332*                  | 332*                                     | 332*                            | 332* | 332* | 332  | 332  |      |
| 3900pF                                      | 392*                  | 392*                                     | 392*                            | 392* | 392* | 392  | 392  |      |
| 4700pF                                      | 472*                  | 472*                                     | 472*                            | 472* | 472* | 472  | 472  |      |
| 5600pF                                      | 562*                  | 562*                                     | 562*                            | 562* | 562* | 562  | 562  |      |
| 6800pF                                      | 682*                  | 682*                                     | 682*                            | 682* | 682* | 682  | 682  |      |
| 8200pF                                      | 822*                  | 822*                                     | 822*                            | 822* | 822* | 822  | 822  |      |
| Rated Voltage (VDC)                         |                       | 500                                      | 630                             | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code                                |                       | C  | B                               | D    | F    | G    | Z    | H    |

\* Capacitor is supplied with a "Shoulder-Bend" lead configuration in Style/Size C340.

**Table 1E – C34X Style/Size, Capacitance Range Waterfall cont.**

| C340, C346 Style/Size (0.200" Lead Spacing) |                                 |  |      |      |      |      |      |      |
|---|---------------------------------|--|------|------|------|------|------|------|
| Rated Voltage (VDC)                         |                                 | 500                                      | 630  | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code                                |                                 | C  | B    | D    | F    | G    | Z    | H    |
| Capacitance                                 | Capacitance Tolerance           | Capacitance Code (Available Capacitance) |      |      |      |      |      |      |
| 0.01µF                                      | J = ±5%<br>K = ±10%<br>M = ±20% | 103*                                     | 103* | 103* | 103* | 103  | 103  | 103  |
| 0.012µF                                     |                                 | 123*                                     | 123* | 123* | 123* | 123  | 123  | 123  |
| 0.015µF                                     |                                 | 153*                                     | 153* | 153* | 153* | 153  |      |      |
| 0.018µF                                     |                                 | 183*                                     | 183* | 183* | 183* | 183  |      |      |
| 0.022µF                                     |                                 | 223*                                     | 223* | 223* | 223* |      |      |      |
| 0.027µF                                     |                                 | 273*                                     | 273* | 273* | 273* |      |      |      |
| 0.033µF                                     |                                 | 333*                                     | 333* | 333* | 333* |      |      |      |
| 0.039µF                                     |                                 | 393*                                     | 393* | 393* | 393* |      |      |      |
| 0.047µF                                     |                                 | 473*                                     | 473* | 473* | 473  |      |      |      |
| 0.056µF                                     |                                 | 563*                                     | 563* | 563* | 563  |      |      |      |
| 0.068µF                                     |                                 | 683*                                     | 683* | 683* | 683  |      |      |      |
| 0.082µF                                     |                                 | 823*                                     | 823* | 823  |      |      |      |      |
| 0.1µF                                       |                                 | 104*                                     | 104* | 104  |      |      |      |      |
| 0.12µF                                      |                                 | 124*                                     | 124  | 124  |      |      |      |      |
| 0.15µF                                      |                                 | 154*                                     | 154  | 154  |      |      |      |      |
| 0.18µF                                      |                                 | 184                                      | 184  |      |      |      |      |      |
| 0.22µF                                      |                                 | 224                                      | 224  |      |      |      |      |      |
| 0.27µF                                      |                                 | 274                                      | 274  |      |      |      |      |      |
| 0.33µF                                      |                                 | 334                                      | 334  |      |      |      |      |      |
| 0.39µF                                      |                                 | 394                                      |      |      |      |      |      |      |
| 0.47µF                                      | 474                             |  |      |      |      |      |      |      |
| 0.50µF                                      | 504                             |  |      |      |      |      |      |      |
| Rated Voltage (VDC)                         |                                 | 500                                      | 630  | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code                                |                                 | C  | B    | D    | F    | G    | Z    | H    |

\* Capacitor is supplied with a "Shoulder-Bend" lead configuration in Style/Size C340.

**Table 1F – C35X Style/Size, Capacitance Range Waterfall**

| C350, C356 Style/Size (0.400" Lead Spacing) |                                 |  |     |      |      |      |      |      |
|---|---------------------------------|--|-----|------|------|------|------|------|
| Rated Voltage (VDC)                         |                                 | 500                                      | 630 | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code                                |                                 | C  | B   | D    | F    | G    | Z    | H    |
| Capacitance                                 | Capacitance Tolerance           | Capacitance Code (Available Capacitance) |     |      |      |      |      |      |
| 100pF                                       | J = ±5%<br>K = ±10%<br>M = ±20% | 101                                      | 101 | 101  | 101  | 101  | 101  | 101  |
| 120pF                                       |                                 | 121                                      | 121 | 121  | 121  | 121  | 121  | 121  |
| 150pF                                       |                                 | 151                                      | 151 | 151  | 151  | 151  | 151  | 151  |
| 180pF                                       |                                 | 181                                      | 181 | 181  | 181  | 181  | 181  | 181  |
| 220pF                                       |                                 | 221                                      | 221 | 221  | 221  | 221  | 221  | 221  |
| 270pF                                       |                                 | 271                                      | 271 | 271  | 271  | 271  | 271  | 271  |
| 330pF                                       |                                 | 331                                      | 331 | 331  | 331  | 331  | 331  | 331  |
| 390pF                                       |                                 | 391                                      | 391 | 391  | 391  | 391  | 391  | 391  |
| 470pF                                       |                                 | 471                                      | 471 | 471  | 471  | 471  | 471  | 471  |
| 560pF                                       |                                 | 561                                      | 561 | 561  | 561  | 561  | 561  | 561  |
| 680pF                                       |                                 | 681                                      | 681 | 681  | 681  | 681  | 681  | 681  |
| 820pF                                       |                                 | 821                                      | 821 | 821  | 821  | 821  | 821  | 821  |
| 1000pF                                      |                                 | 102                                      | 102 | 102  | 102  | 102  | 102  | 102  |
| 1200pF                                      |                                 | 122                                      | 122 | 122  | 122  | 122  | 122  | 122  |
| 1500pF                                      |                                 | 152                                      | 152 | 152  | 152  | 152  | 152  | 152  |
| 1800pF                                      |                                 | 182                                      | 182 | 182  | 182  | 182  | 182  | 182  |
| 2200pF                                      |                                 | 222                                      | 222 | 222  | 222  | 222  | 222  | 222  |
| 2700pF                                      |                                 | 272                                      | 272 | 272  | 272  | 272  | 272  | 272  |
| 3300pF                                      |                                 | 332                                      | 332 | 332  | 332  | 332  | 332  | 332  |
| 3900pF                                      |                                 | 392                                      | 392 | 392  | 392  | 392  | 392  | 392  |
| 4700pF                                      |                                 | 472                                      | 472 | 472  | 472  | 472  | 472  | 472  |
| 5600pF                                      |                                 | 562                                      | 562 | 562  | 562  | 562  | 562  | 562  |
| 6800pF                                      |                                 | 682                                      | 682 | 682  | 682  | 682  | 682  | 682  |
| 8200pF                                      |                                 | 822                                      | 822 | 822  | 822  | 822  | 822  | 822  |
| 0.01µF                                      |                                 | 103                                      | 103 | 103  | 103  | 103  | 103  | 103  |
| 0.012µF                                     |                                 | 123                                      | 123 | 123  | 123  | 123  | 123  | 123  |
| 0.015µF                                     |                                 | 153                                      | 153 | 153  | 153  | 153  | 153  | 153  |
| 0.018µF                                     |                                 | 183                                      | 183 | 183  | 183  | 183  | 183  | 183  |
| 0.022µF                                     |                                 | 223                                      | 223 | 223  | 223  | 223  | 223  | 223  |
| 0.027µF                                     |                                 | 273                                      | 273 | 273  | 273  | 273  | 273  | 273  |
| 0.033µF                                     |                                 | 333                                      | 333 | 333  | 333  | 333  |      |      |
| 0.039µF                                     |                                 | 393                                      | 393 | 393  | 393  | 393  |      |      |
| 0.047µF                                     |                                 | 473                                      | 473 | 473  | 473  | 473  |      |      |
| 0.056µF                                     |                                 | 563                                      | 563 | 563  | 563  | 563  |      |      |
| 0.068µF                                     |                                 | 683                                      | 683 | 683  | 683  | 683  |      |      |
| 0.082µF                                     |                                 | 823                                      | 823 | 823  | 823  | 823  |      |      |
| 0.1µF                                       |                                 | 104                                      | 104 | 104  | 104  | 104  |      |      |
| 0.12µF                                      |                                 | 124                                      | 124 | 124  | 124  |      |      |      |
| 0.15µF                                      |                                 | 154                                      | 154 | 154  | 154  |      |      |      |
| 0.18µF                                      |                                 | 184                                      | 184 |      |      |      |      |      |
| 0.22µF                                      |                                 | 224                                      | 224 |      |      |      |      |      |
| 0.27µF                                      |                                 | 274                                      | 274 |      |      |      |      |      |
| 0.33µF                                      |                                 | 334                                      | 334 |      |      |      |      |      |
| 0.39µF                                      |                                 | 394                                      | 394 |      |      |      |      |      |
| 0.47µF                                      |                                 | 474                                      | 474 |      |      |      |      |      |
| 0.56µF                                      | 564                             |  |     |      |      |      |      |      |
| Rated Voltage (VDC)                         |                                 | 500                                      | 630 | 1000 | 1500 | 2000 | 2500 | 3000 |
| Voltage Code                                |                                 | C  | B   | D    | F    | G    | Z    | H    |

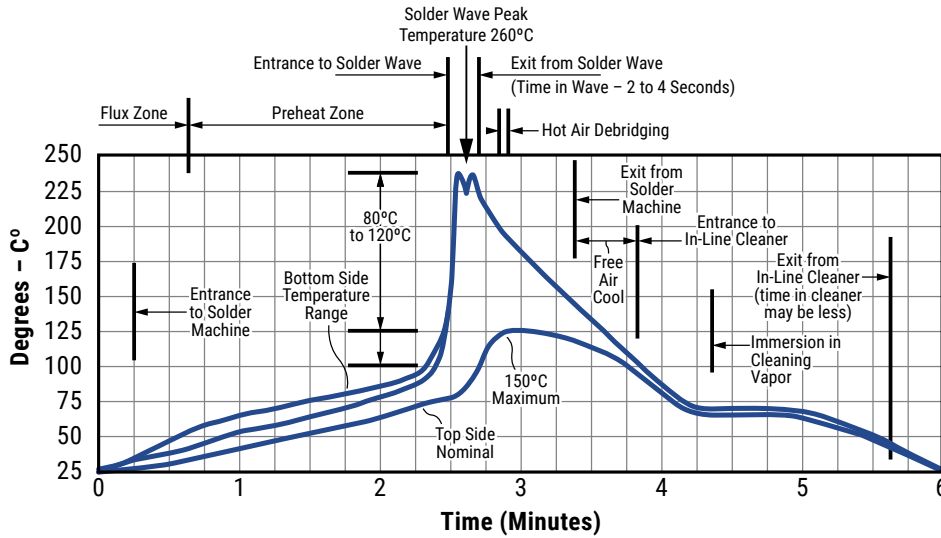
## Soldering Process

### Recommended Soldering Methods:

- Solder Wave
- Hand Soldering (Manual)

### Recommended Soldering Profile:

- Optimum Wave Solder Profile



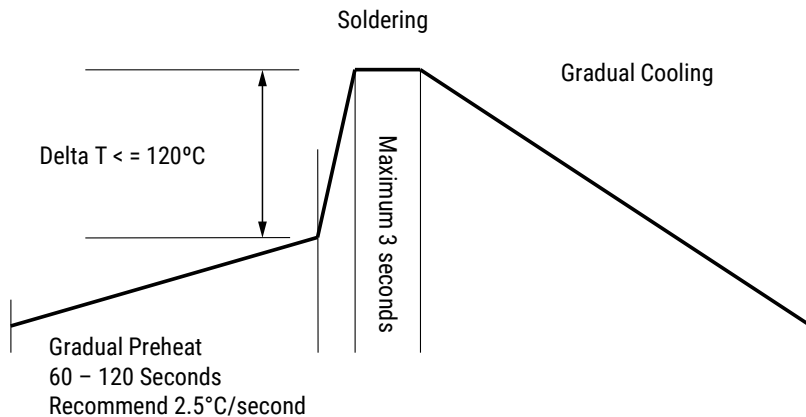
## Mounting

All encased capacitors will pass the Resistance to Soldering Heat of MIL-STD-202, Method 210, Condition C. This test simulates wave solder 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 ceramic capacitors.

- Hand Soldering (Manual)

### Manual Solder Profile with Pre-heating



**Table 2 – Performance & Reliability: Test Methods and Conditions**

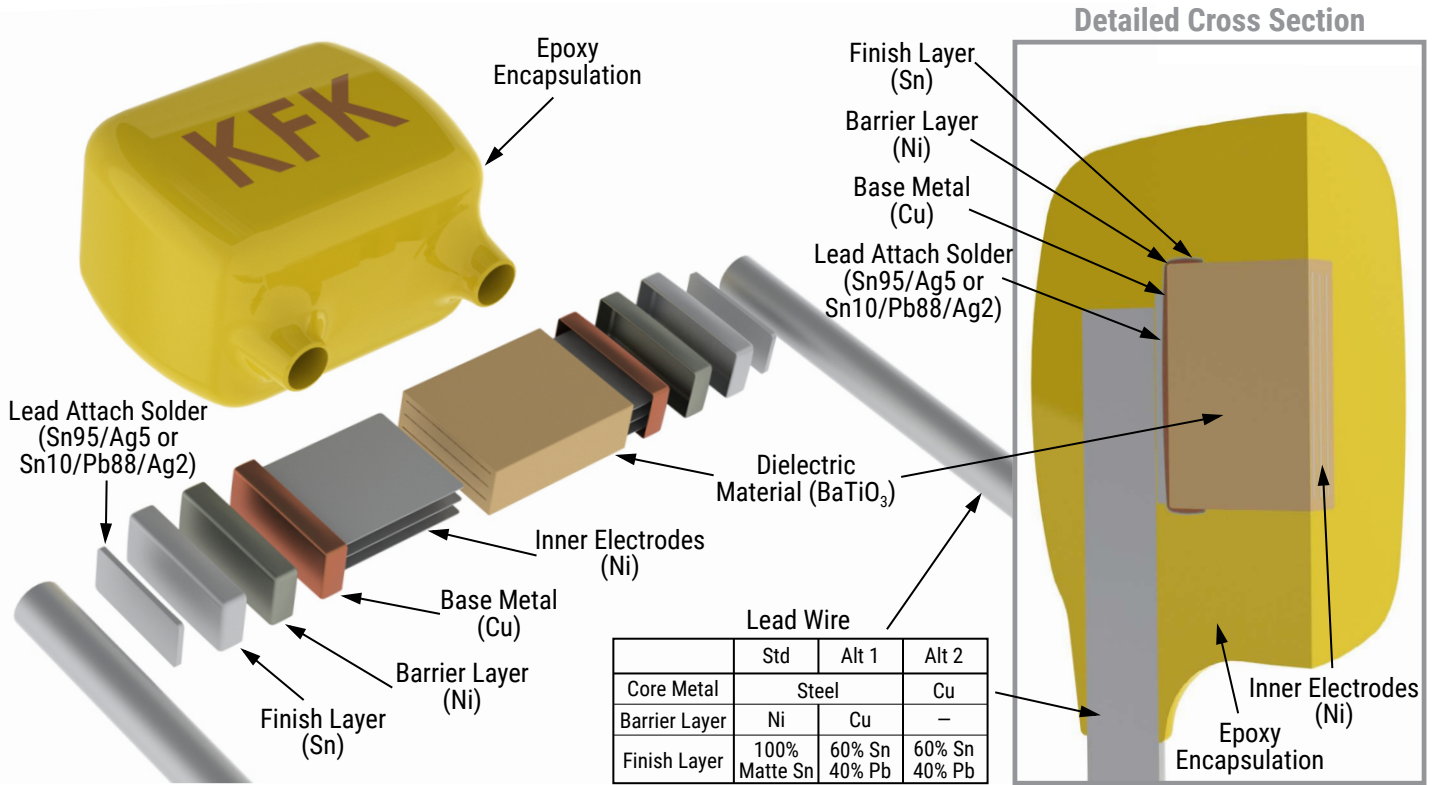
| Stress                       | Reference                      | Test or Inspection Method   |
|------------------------------|--------------------------------|---|
| Solderability                | J-STD-002                      | Magnification 50X. Conditions:<br>a) Method A, at 235°C, Category 3   |
| Temperature Cycling          | JESD22 Method JA-104           | 1,000 cycles (-55°C to +125°C), measurement at 24 hours +/-4 hours after test conclusion.   |
| Biased Humidity              | MIL-STD-202 Method 103         | Load humidity, 1,000 hours 85°C/85%RH and 200Vdc maximum. Add 100 K ohm resistor. Measurement at 24 hours +/-4 hours after test conclusion.   |
|                              |                                | Low volt humidity, 1,000 hours 85°C/85%RH and 1.5 V. Add 100 K ohm resistor. Measurement at 24 hours +/-4 hours after test conclusion.  |
| Moisture Resistance          | MIL-STD-202 Method 106         | t = 24 hours/cycle. Steps 7a and 7b not required. Unpowered. Measurement at 24 hours +/-4 hours after test conclusion.  |
| Thermal Shock                | MIL-STD-202 Method 107         | -55°C to +125°C. Note: Number of cycles required – 300. Maximum transfer time – 20 seconds. Dwell time – 15 minutes. Air – Air.   |
| High Temperature Life        | MIL-STD-202 Method 108/EIA-198 | 1,000 hours at 125°C with 1.2 X rated voltage applied.  |
| Storage Life                 | MIL-STD-202 Method 108         | 125°C, 0 VDC for 1,000 hours.   |
| Vibration                    | MIL-STD-202 Method 204         | 5 g for 20 minutes, 12 cycles each of 3 orientations. Note: Use 8"X5" PCB .031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10 – 2000 Hz. |
| Resistance to Soldering Heat | MIL-STD-202 Method 210         | Condition B. No preheat of samples. Note: single wave solder – procedure 2.   |
| Terminal Strength            | MIL-STD-202 Method 211         | Conditions A (454g), Condition C (227g)   |
| Mechanical Shock             | MIL-STD-202 Method 213         | Figure 1 of Method 213, Condition C.  |
| Resistance to Solvents       | MIL-STD-202 Method 215         | Add aqueous wash chemical – OKEM Clean or equivalent.   |

## Storage & Handling

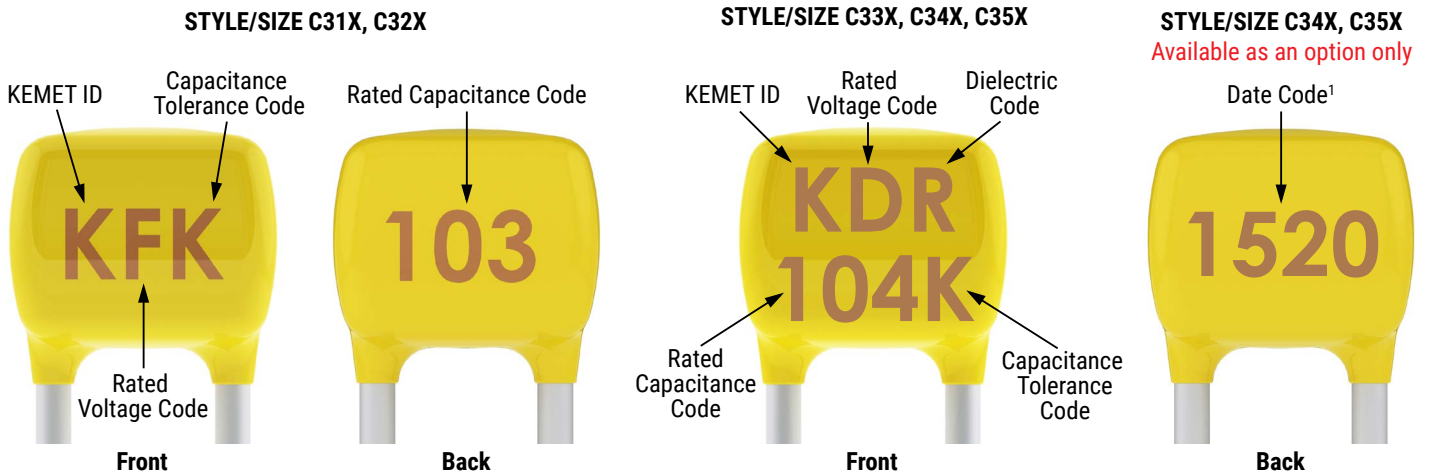
The un-mounted storage life of a leaded ceramic capacitor is dependent upon storage and atmospheric conditions as well as packaging materials. While the ceramic chips enveloped under the epoxy coating themselves are quite robust in most environments, solderability of the wire lead on the final epoxy-coated product 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 and exposure to direct sunlight – reels may soften or warp, and tape peel force may increase.

KEMET recommends storing the un-mounted capacitors in their original packaging, in a location away from direct sunlight, and where the temperature and relative humidity do not exceed 40 degrees centigrade and 70% respectively. For optimum solderability, capacitor stock should be used promptly, preferably within 18 months of receipt. For applications requiring pre-tinning of components, storage life may be extended if solderability is verified. Before cleaning, bonding or molding these devices, it is important to verify that your process does not affect product quality and performance. KEMET recommends testing and evaluating the performance of a cleaned, bonded or molded product prior to implementing and/or qualifying any of these processes.

## Construction



## Marking



<sup>1</sup> To properly request the inclusion of the date code in the marking information provided on the component, ordering code C-SPEC 9207 must be added to the end of the ordering code.

| Date Code                        |  |
|----------------------------------|--|
| 15                               | 20   |
| Manufacturing Year:<br>15 = 2015 | Manufacturing Week:<br>20 = Week 20<br>(of mfg. calendar year) |

## Packaging Quantities

| Style/<br>Size | Standard Bulk<br>Quantity | Ammo Pack<br>Quantity<br>Maximum | Reel Quantity<br>Maximum<br>(12" Reel) |
|----------------|---------------------------|----------------------------------|--|
| 315            | 500/Bag                   | 2500                             | 2500                                   |
| 316            |                           |                                  |  |
| 317            |                           |                                  |  |
| 318            |                           |                                  |  |
| 320            |                           |                                  |  |
| 321            |                           | N/A                              | N/A                                    |
| 322            |                           | 2500                             | 2500                                   |
| 323            |                           |                                  |  |
| 324            |                           |                                  |  |
| 325            |                           |                                  |  |
| 326            |                           |                                  |  |
| 327            |                           |                                  |  |
| 328            | 250/Bag                   | 1500                             | 1500                                   |
| 330            |                           | N/A                              | N/A                                    |
| 331            |                           | 1500                             |  |
| 333            |                           | 1500                             |  |
| 335            |                           | 1500                             |  |
| 336            | 100/Bag                   | 1000                             | 1000                                   |
| 340            |                           |                                  |  |
| 346            | 50/Bag                    | N/A                              | 500                                    |
| 350            |                           |                                  |  |
| 356            |                           |                                  |  |

## Tape & Reel Packaging Information

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

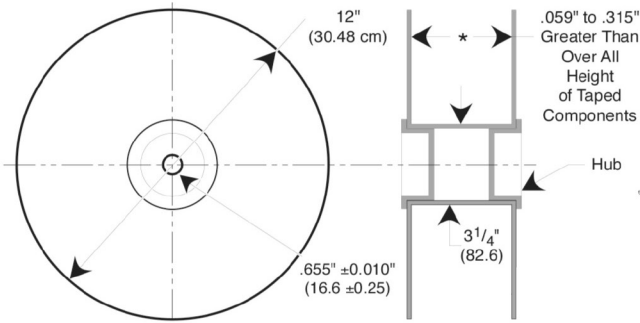


Figure 3: Standard Reel

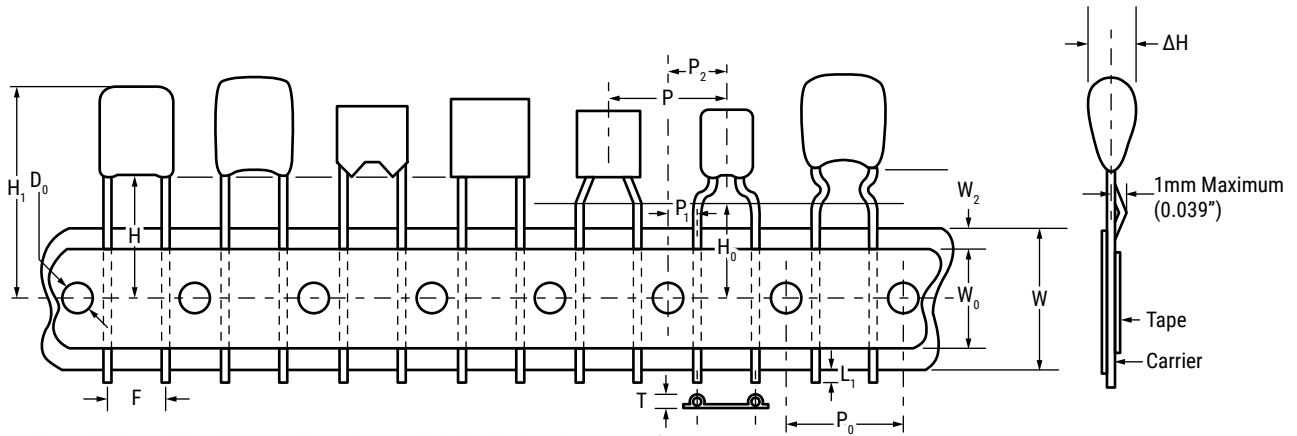
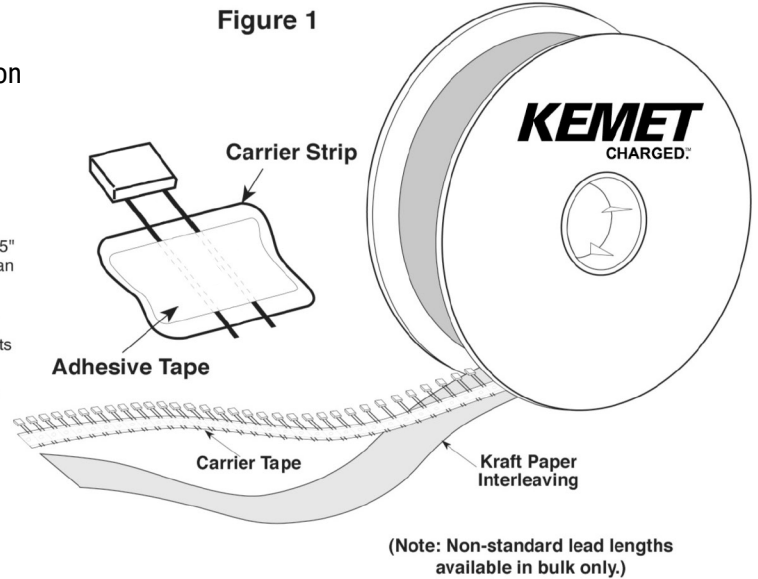


Figure 2: Lead Tape Configuration (See Table Below)

## Ceramic Radial Tape and Reel Dimensions

Metric will govern

| Constant Dimensions – Millimeters (Inches) |                       |                            |                  |                     |                |                                     |                  |                  |
|--|-----------------------|----------------------------|------------------|---------------------|----------------|-------------------------------------|------------------|------------------|
| $D_0$<br>±0.2 (0.008)                      | $P_0$<br>±0.3 (0.012) | $\Delta H$<br>±0.2 (0.008) | $L_1$<br>Maximum | $t$<br>±0.2 (0.008) | $T$<br>Maximum | $W$<br>+1.0/-0.5<br>(+0.039/-0.020) | $W_0$<br>Minimum | $W_2$<br>Maximum |
| 4.00 (0.157)                               | 12.7 (0.500)          | 4.0 (0.157)                | 1.0 (0.039)      | 0.7 (0.051)         | 1.5 (0.059)    | 18.0 (0.709)                        | 5.0 (0.197)      | 3.0 (0.118)      |

## Ceramic Radial Tape and Reel Dimensions cont.

Metric will govern

| Variable Dimensions – Millimeters (Inches) |  |                   |                               |                               |                         |  |                         |           |           |           |           |
|--|--|-------------------|-------------------------------|-------------------------------|-------------------------|--|-------------------------|-----------|-----------|-----------|-----------|
| F<br>±0.78 (0.030) <sup>1</sup>            | P <sub>1</sub><br>±0.30 (0.012) <sup>1</sup> | P<br>±0.3 (0.012) | P <sub>2</sub><br>±1.3 (0.51) | H                             |                         | H <sub>0</sub>                         |                         |           |           |           |           |
|  |  |                   |                               | Straight Lead Configuration   |                         | Formed Lead Configuration <sup>2</sup> |                         |           |           |           |           |
|  |  |                   |                               | Packaging C-Spec <sup>3</sup> |                         |  |                         | 7301/7305 | 7303/7317 | 7301/7305 | 7303/7317 |
|  |  |                   |                               | 7301/7305                     |                         | 7303/7317                              |                         |           |           |           |           |
| 2.54 (0.100)                               | 5.08 (0.200)                                 | 12.7 (0.500)      | 6.35 (0.250)                  | 16.0±0.5<br>(0.630±0.020)     | 18.0 (0.709)<br>Minimum | 16.0±0.5<br>(0.630±0.020)              | 18.0 (0.709)<br>Minimum |           |           |           |           |
| 4.32 (0.170)                               | 3.89 (0.153)                                 | 12.7 (0.500)      | 6.35 (0.250)                  |                               |                         |  |                         |           |           |           |           |
| 5.08 (0.200)                               | 3.81 (0.150)                                 | 12.7 (0.500)      | 6.35 (0.250)                  |                               |                         |  |                         |           |           |           |           |
| 5.59 (0.220)                               | 3.25 (0.128)                                 | 12.7 (0.500)      | 6.35 (0.250)                  |                               |                         |  |                         |           |           |           |           |
| 6.98 (0.275)                               | 2.54 (0.100)                                 | 12.7 (0.500)      | 6.35 (0.250)                  |                               |                         |  |                         |           |           |           |           |
| 7.62 (0.300)                               | 2.24 (0.088)                                 | 12.7 (0.500)      | 6.35 (0.250)                  |                               |                         |  |                         |           |           |           |           |
| 9.52 (0.375)                               | 7.62 (0.300)                                 | 12.7 (0.500)      | 6.35 (0.250)                  |                               |                         |  |                         |           |           |           |           |
| 10.16 (0.400)                              | 7.34 (0.290)                                 | 25.4 (1.000)      | N/A                           |                               |                         |  |                         |           |           |           |           |
| 12.06 (0.475)                              | 6.35 (0.250)                                 | 25.4 (1.000)      | N/A                           |                               |                         |  |                         |           |           |           |           |
| 14.60 (0.575)                              | 5.08 (0.200)                                 | 25.4 (1.000)      | N/A                           |                               |                         |  |                         |           |           |           |           |
| 17.14 (0.675)                              | 3.81 (0.15)                                  | 25.4 (1.000)      | N/A                           |                               |                         |  |                         |           |           |           |           |

<sup>1</sup> Measured at the egress from the carrier tape, on the component side.

<sup>2</sup> Formed lead configuration includes: "shoulder bend", "inside kink", "outside kink", and "snap-in". For more information regarding available lead configurations see "Dimensions" section of this document.

<sup>3</sup> The "Packaging C-Spec" is a 4 digit code which identifies the packaging type, lead length and/or lead material. When ordering, the proper code must be included in the 15th through 18th character positions of the ordering code. See "Ordering Information" section of this document for further details.

| Symbol Reference Table |   |
|------------------------|---|
| D <sub>0</sub>         | Sprocket Hole Diameter                        |
| P <sub>0</sub>         | Sprocket Hole Pitch                           |
| P                      | Component Pitch                               |
| F                      | Lead Spacing                                  |
| P <sub>1</sub>         | Sprocket Hole Center to Lead Center           |
| P <sub>2</sub>         | Sprocket Hole Center To Component Center      |
| H                      | Height to Seating Plane (Straight Leads Only) |
| H <sub>0</sub>         | Height to Seating Plane (Formed Leads Only)   |
| H <sub>1</sub>         | Component Height Above Tape Center            |
| ΔH                     | Component Alignment                           |
| L <sub>1</sub>         | Lead Protrusion                               |
| t                      | Composite Tape Thickness                      |
| W                      | Carrier Tape Width                            |
| W <sub>0</sub>         | Hold-Down Tape Width                          |
| W <sub>2</sub>         | Hold-Down Tape Location                       |

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