

# COG with KONNEKT™ Technology, 50 – 3,000 VDC (Commercial & Automotive Grade)



## Overview

KEMET's COG with KONNEKT™ technology surface mount capacitors are designed for high-efficiency and high-density power applications. KONNEKT high density packaging technology uses an innovative Transient Liquid Phase Sintering (TLPS) material to create a surface mount multi-chip solution for high density packaging. By utilizing KEMET's robust and proprietary COG base metal electrode (BME) dielectric system, these capacitors are well suited for power converters, inverters, snubbers, and resonators where high efficiency is a primary concern.

With an operating temperature range up to 125°C, these capacitors can be mounted close to fast switching semiconductors in high power density applications, which require minimal cooling. COG with KONNEKT technology also exhibits high mechanical robustness compared to other dielectric technologies, allowing the capacitor to be mounted without the use of metal frames.

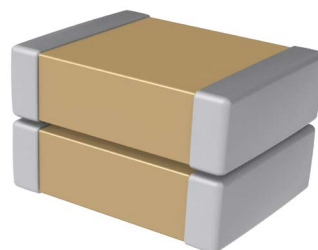
COG with KONNEKT series compliments the KC-LINK with KONNEKT series by offering a wider voltage range and operating temperature range up to 125°C

## Benefits

- Extremely high-power density and ripple current capability
- Extremely low equivalent series resistance (ESR)
- Extremely low equivalent series inductance (ESL)
- Capacitance offerings ranging from 0.78 nF – 940 nF
- DC voltage ratings from 50 – 3,000 V
- EIA sizes 1812 and 2220
- Operating temperature range of -55°C to +125°C
- No capacitance shift with voltage
- No piezoelectric noise
- High thermal stability
- Surface mountable using standard MLCC reflow profiles

## Applications

- Wide bandgap (WBG), silicon carbide (SiC) and gallium nitride (GaN) systems
- Data centers
- EV/HEV (drive systems, charging)
- LLC resonant converters
- Switched tank converters
- Wireless charging systems
- Photovoltaic systems
- Power converters
- Inverters
- DC link
- Snubber


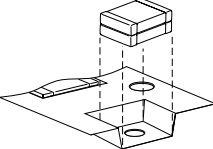

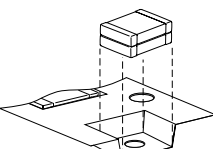


## Ordering Information

| C       | 1812               | C                     | 943                                  | K                     | C  | G          | L                    | C                  | XXXX  |
|---------|--------------------|-----------------------|--------------------------------------|-----------------------|--|------------|----------------------|--------------------|---|
| Ceramic | Case Size (L"x W") | Specification/ Series | Capacitance Code (pF)                | Capacitance Tolerance | Rated Voltage (V)  | Dielectric | Subclass Designation | Termination Finish | Orientation and Packaging (Suffix/C-Spec)                     |
| C       | 1812<br>2220       | C = Standard          | Two single digits + number of zeros. | K = ±10%              | 5 = 50 V<br>1 = 100 V<br>2 = 200 V<br>A = 250 V<br>C = 500 V<br>B = 630 V<br>D = 1,000 V<br>F = 1,500 V<br>G = 2,000 V<br>Z = 2,500 V<br>H = 3,000 V | G = COG    | L = KONNEKT          | C = 100% matte Sn  | See "Packaging and Orientation C-Spec Ordering Options Table" |

Additional termination finish options may be available. Contact KEMET for details.

## Orientation and Packaging (Suffix/C-Spec) Options Table

| Mounting Orientation <sup>1</sup>   | Tape and Reel Illustration  | Packaging Type    | Packaging/Grade Ordering Code (C-Spec) |
|---|---|-------------------|--|
| <b>Commercial Grade</b>   |   |                   |  |
| Standard<br> |  | 7" Reel/Unmarked  | TU                                     |
|   |   | 13" Reel/Unmarked | 7210                                   |
| <b>Automotive Grade</b>   |   |                   |  |
| Standard<br> |  | 7" Reel/Unmarked  | AUTO                                   |
|   |   | 13" Reel/Unmarked | AUTO7210                               |

<sup>1</sup> Orientation refers to the positioning of the KONNEKT capacitors in the Tape and Reel pockets. This allows pick and place machines to place capacitors on the PCB in the correct orientation.

## Automotive C-Spec Information

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

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

### Product Change Notification (PCN)

The KEMET product change notification system is used to communicate primarily the following types of changes:

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

| KEMET Automotive C-Spec     | Customer Notification Due To:    |               | Days Prior To Implementation |
|-----------------------------|----------------------------------|---------------|------------------------------|
|                             | Process/Product change           | Obsolescence* |                              |
| KEMET assigned <sup>1</sup> | Yes (with approval and sign off) | Yes           | 180 days minimum             |
| AUTO                        | Yes (without approval)           | Yes           | 90 days minimum              |

<sup>1</sup> KEMET assigned C-Specs require the submittal of a customer SCD or customer specification for review. For additional information contact KEMET.

### Production Part Approval Process (PPAP)

The purpose of the Production Part Approval Process is:

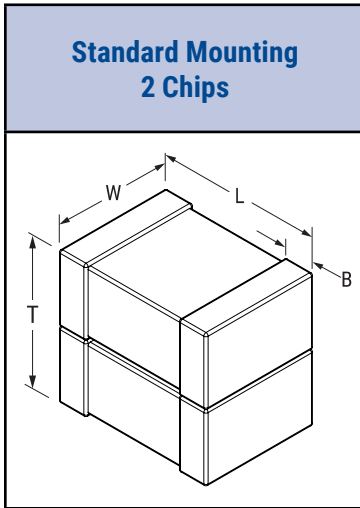
- To ensure that supplier can meet the manufacturability and quality requirements for the purchased parts.
- To provide the evidence that all customer engineering design records and specification requirements are properly understood and fulfilled by the manufacturing organization.
- To demonstrate that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

| KEMET Automotive C-Spec     | PPAP (Product Part Approval Process) Level |   |   |   |   |
|-----------------------------|--|---|---|---|---|
|                             | 1  | 2 | 3 | 4 | 5 |
| KEMET assigned <sup>1</sup> | ●  | ● | ● | ● | ● |
| AUTO                        |  |   | ○ |   |   |

<sup>1</sup> KEMET assigned C-Specs require the submittal of a customer SCD or customer specification for review. For additional information contact KEMET.

- Part number specific PPAP available
- Product family PPAP only

## Dimensions – Millimeters (Inches)



| EIA SIZE CODE | METRIC SIZE CODE | Number of Chips | Mounting | L LENGTH                      | W WIDTH                       | T THICKNESS                       | B BANDWIDTH                   | Mounting Technique | Typical Average Piece Weight (g) |
|---------------|------------------|-----------------|----------|-------------------------------|-------------------------------|-----------------------------------|-------------------------------|--------------------|----------------------------------|
| 1812          | 4532             | 2               | Standard | 4.50 (0.177)<br>±0.30 (0.012) | 3.20 (0.126)<br>±0.30 (0.012) | See Table 1A and 1B for Thickness | 0.60 (0.024)<br>±0.35 (0.014) | Solder Reflow Only | See Table 1A and 1B for Weights  |
| 2220          | 5750             | 2               | Standard | 5.70 (0.224)<br>±0.40 (0.016) | 5.00 (0.197)<br>±0.40 (0.016) |                                   |                               |                    |                                  |

**Table 1A - 1812 Product Ordering Codes, Ratings, and Package Quantities**

| KEMET Part Number <sup>1</sup> | Capacitance | Cap Code | Voltage | Number of Chips | Thickness mm (inch)         | Typical Average Piece Weight (g) | Tape & Reel Quantity |                 |
|--------------------------------|-------------|----------|---------|-----------------|-----------------------------|----------------------------------|----------------------|-----------------|
|                                |             |          |         |                 |                             |                                  | 7" Tape & Reel       | 13" Tape & Reel |
| C1812(a)444(b)5GLC(c)          | 440 nF      | 444      | 50 V    | 2               | 3.3 (0.130)<br>±0.4 (0.016) | 0.19                             | 500                  | 2,000           |
| C1812(a)304(b)1GLC(c)          | 300 nF      | 304      | 100 V   |                 | 3.5 (0.138)<br>±0.4 (0.016) | 0.19                             | 500                  | 2,000           |
| C1812(a)204(b)2GLC(c)          | 200 nF      | 204      | 200 V   |                 | 4.1 (0.161)<br>±0.4 (0.016) | 0.24                             | 275                  | 1,050           |
| C1812(a)204(b)AGLC(c)          | 200 nF      | 204      | 250 V   |                 | 4.1 (0.161)<br>±0.4 (0.016) | 0.24                             | 275                  | 1,050           |
| C1812(a)943(b)CGLC(c)          | 94 nF       | 943      | 500 V   |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.30                             | 200                  | 850             |
| C1812(a)943(b)BGLC(c)          | 94 nF       | 943      | 630 V   |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.30                             | 200                  | 850             |
| C1812(a)303(b)DGLC(c)          | 30 nF       | 303      | 1,000 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.30                             | 200                  | 850             |
| C1812(a)542(b)FGLC(c)          | 5.4 nF      | 542      | 1,500 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.30                             | 200                  | 850             |
| C1812(a)302(b)GGLC(c)          | 3 nF        | 302      | 2,000 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.30                             | 200                  | 850             |
| C1812(a)142(b)ZGLC(c)          | 1.4 nF      | 142      | 2,500 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.30                             | 200                  | 850             |
| C1812(a)781(b)HGLC(c)          | 0.78 nF     | 781      | 3,000 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.30                             | 200                  | 850             |

<sup>1</sup> Complete part number requires additional characters in the numbered positions provided in order to indicate capacitance tolerance and grade.

For each numbered position, available options are as follows:

- (a) End Termination "C".
- (b) Capacitance tolerance character "K".
- (c) C-Spec for Product Grade, Reeling and Mounting Orientation.

**Table 1B - 2220 Product Ordering Codes, Ratings, and Package Quantities**

| KEMET Part Number <sup>1</sup> | Capacitance | Cap Code | Voltage | Number of Chips | Thickness mm (inch)         | Typical Average Piece Weight (g) | Tape & Reel Quantity |                 |
|--------------------------------|-------------|----------|---------|-----------------|-----------------------------|----------------------------------|----------------------|-----------------|
|                                |             |          |         |                 |                             |                                  | 7" Tape & Reel       | 13" Tape & Reel |
| C2220(a)944(b)5GLC(c)          | 940 nF      | 944      | 50 V    | 2               | 3.5 (0.138)<br>±0.4 (0.016) | 0.45                             | 475                  | 1825            |
| C2220(a)664(b)1GLC(c)          | 660 nF      | 664      | 100 V   |                 | 3.5 (0.138)<br>±0.4 (0.016) | 0.45                             | 475                  | 1825            |
| C2220(a)444(b)2GLC(c)          | 440 nF      | 444      | 200 V   |                 | 4.1 (0.161)<br>±0.4 (0.016) | 0.45                             | 225                  | 950             |
| C2220(a)204(b)CGLC(c)          | 200 nF      | 204      | 500 V   |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.65                             | 300                  | 1,250           |
| C2220(a)204(b)BGLC(c)          | 200 nF      | 204      | 630 V   |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.65                             | 300                  | 1,250           |
| C2220(a)663(b)DGLC(c)          | 66 nF       | 663      | 1,000 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.65                             | 300                  | 1,250           |
| C2220(a)143(b)FGLC(c)          | 14 nF       | 143      | 1,500 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.65                             | 300                  | 1,250           |
| C2220(a)782(b)GGLC(c)          | 7.8 nF      | 782      | 2,000 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.65                             | 300                  | 1,250           |
| C2220(a)362(b>ZGLC(c)          | 3.6 nF      | 362      | 2,500 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.65                             | 300                  | 1,250           |
| C2220(a)202(b)HGLC(c)          | 2 nF        | 202      | 3,000 V |                 | 5.1 (0.200)<br>±0.4 (0.016) | 0.65                             | 300                  | 1,250           |

<sup>1</sup> Complete part number requires additional characters in the numbered positions provided in order to indicate capacitance tolerance and grade.

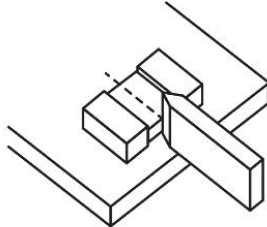
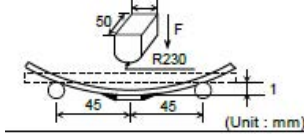
For each numbered position, available options are as follows:

- (a) End Termination "C".
- (b) Capacitance tolerance character "K".
- (c) C-Spec for Product Grade, Reeling and Mounting Orientation.

**Table 2 - Performance and Reliability: Test Methods and Conditions (Commercial Only)**

| Test  | Reference                        | Test Condition  | Limits  |                          |       |       |     |       |     |                                  |              |        |  |
|---|----------------------------------|---|---|--------------------------|-------|-------|-----|-------|-----|----------------------------------|--------------|--------|--|
| Visual and Mechanical                               | KEMET Internal                   | No defects that may affect performance (10X)  | Dimensions according KEMET Spec Sheet   |                          |       |       |     |       |     |                                  |              |        |  |
| Capacitance (Cap)                                   | KEMET Internal                   | 1 kHz $\pm$ 50 Hz and 1.0 $\pm$ 0.2 V <sub>rms</sub> of capacitance<br>Capacitance measurements (including tolerance) are indexed to a referee time of 1,000 hours  | Within Tolerance  |                          |       |       |     |       |     |                                  |              |        |  |
| Dissipation Factor (DF)                             | KEMET Internal                   | 1 kHz $\pm$ 50 Hz and 1.0 $\pm$ 0.2 V <sub>rms</sub>  | Dissipation factor (DF) maximum limit at 25°C = 0.1%  |                          |       |       |     |       |     |                                  |              |        |  |
| Insulation Resistance (IR)                          | KEMET Internal                   | For < 500 VDC:<br>Rated voltage applied for 120 $\pm$ 5 seconds at 25°C<br><br>For $\geq$ 500 VDC:<br>500 V applied for 120 $\pm$ 5 seconds at 25°C   | Within Specification<br><br>To obtain IR limit, divide M $\Omega$ - $\mu$ F value by the capacitance and compare to G $\Omega$ limit. Select the lower of the two limits.<br><br>1,000 M $\Omega$ - $\mu$ F or 100 G $\Omega$ |                          |       |       |     |       |     |                                  |              |        |  |
| Temperature Coefficient of Capacitance (TCC)        | KEMET Internal                   | Frequency: 1 kHz $\pm$ 50 Hz<br>Capacitance change with reference to +25°C and 0 VDC applied<br><br>* See part number specification sheet for voltage<br><br><table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>+25°C</td> </tr> <tr> <td>2</td> <td>-55°C</td> </tr> <tr> <td>3</td> <td>+25°C<br/>(Reference Temperature)</td> </tr> <tr> <td>4</td> <td>+125°C</td> </tr> </tbody> </table> | Step  | Temperature (°C)         | 1     | +25°C | 2   | -55°C | 3   | +25°C<br>(Reference Temperature) | 4            | +125°C | $\pm$ 30 PPM/°C  |
| Step  | Temperature (°C)                 |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| 1   | +25°C                            |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| 2   | -55°C                            |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| 3   | +25°C<br>(Reference Temperature) |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| 4   | +125°C                           |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| Dielectric Withstanding Voltage (DWV)               | KEMET Internal                   | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Rated DC Voltage</th> <th>DWV Voltage (% of Rated)</th> </tr> </thead> <tbody> <tr> <td>&lt; 500</td> <td>250%</td> </tr> <tr> <td>500</td> <td>150%</td> </tr> <tr> <td>630</td> <td>130%</td> </tr> <tr> <td><math>\geq</math> 1,000</td> <td>120%</td> </tr> </tbody> </table><br>(5 $\pm$ 1 seconds and charge/discharge not exceeding 50 mA)  | Rated DC Voltage  | DWV Voltage (% of Rated) | < 500 | 250%  | 500 | 150%  | 630 | 130%                             | $\geq$ 1,000 | 120%   | Cap: Initial Limit<br>DF: Initial Limit<br>IR: Initial Limit<br><br>Withstand test voltage without insulation breakdown or damage. |
| Rated DC Voltage                                    | DWV Voltage (% of Rated)         |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| < 500   | 250%                             |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| 500   | 150%                             |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| 630   | 130%                             |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| $\geq$ 1,000  | 120%                             |   |   |                          |       |       |     |       |     |                                  |              |        |  |
| Aging Rate (Maximum % Capacitance Loss/Decade Hour) | KEMET Internal                   | Maximum % capacitance loss/decade hour  | 0% Loss/Decade Hour   |                          |       |       |     |       |     |                                  |              |        |  |

**Table 2 - Performance and Reliability: Test Methods and Conditions (Commercial Only) cont.**

| Test                | Reference              | Test Condition  | Limits   |       |      |     |      |                                  |
|---------------------|------------------------|---|--|-------|------|-----|------|----------------------------------|
| Terminal Strength   | KEMET Internal         | Shear stress test per specific case size, Time: 60±1 seconds<br><br><table border="1" style="display: inline-table; margin-right: 20px;"> <thead> <tr> <th>Case Size</th> <th>Force</th> </tr> </thead> <tbody> <tr> <td>1812</td> <td rowspan="2">18N</td> </tr> <tr> <td>2220</td> </tr> </tbody> </table>  | Case Size  | Force | 1812 | 18N | 2220 | No evidence of mechanical damage |
| Case Size           | Force                  |   |  |       |      |     |      |                                  |
| 1812                | 18N                    |   |  |       |      |     |      |                                  |
| 2220                |                        |   |  |       |      |     |      |                                  |
| Board Flex          | AEC-Q200-005           | Standard Termination System 3.0 mm<br>Test time: 60± 5 seconds<br>Ramp time: 1 mm/second<br><br>  | No evidence of mechanical damage   |       |      |     |      |                                  |
| Solderability       | J-STD-002              | Magnification 10X. Conditions:<br>Category 2 (Dry Bake 155°C/4 hours ±15 minutes)<br>a) Method B, 245°C, SnPb<br>b) Method B1 at 245°C, Pb-Free<br>c) Method D, at 260°C, SnPb or Pb-Free   | Visual Inspection.<br>95% coverage on termination.<br>No leaching  |       |      |     |      |                                  |
| Temperature Cycling | JESD22 Method JA-104   | 1,000 cycles (-55°C to +125°C)<br>2 – 3 cycles per hour<br>Soak Time 1 or 5 minutes   | Measurement at 24 hours ±4 hours after test conclusion.<br>Cap: Initial Limit<br>DF: Initial Limit<br>IR: Initial Limit  |       |      |     |      |                                  |
| Biased Humidity     | MIL-STD-202 Method 103 | Load Humidity:<br>1,000 hours 85°C/85% RH and 200 VDC. Add 100 KΩ resistor.<br><br>Low Volt Humidity:<br>1,000 hours 85°C/85% RH and 1.5 V. Add 100 KΩ resistor.  | Measurement at 24 hours ±4 hours after test conclusion.<br>Within Post Environmental Limits<br>Cap: ±0.3% or ±0.25 pF shift<br>IR: 10% of Initial Limit<br>DF Limits Maximum: 0.5% |       |      |     |      |                                  |
| Moisture Resistance | MIL-STD-202 Method 106 | Number of cycles required 10, 24 hours per cycle.<br>Steps 7a and 7b not required.  | Measurement at 24 hours ±4 hours after test conclusion.<br>Within Post Environmental Limits<br>Cap: ±0.3% or ±0.25 pF shift<br>IR: 10% of Initial Limit<br>DF Limits Maximum: 0.5% |       |      |     |      |                                  |



**Table 2 - Performance and Reliability: Test Methods and Conditions (Commercial Only) cont.**

| Test                   | Reference              | Test Condition  | Limits   |
|------------------------|------------------------|---|--|
| Thermal Shock          | MIL-STD-202 Method 107 | Number of cycles required 5, (-55°C to 125°C)<br>Dwell time 15 minutes.   | Cap: Initial Limit<br>DF: Initial Limit<br>IR: Initial Limit   |
| High Temperature Life  | MIL-STD-202 Method 108 | 1,000 hours at 125°C with 1.0 X rated voltage applied   | Measurement at 24 hours ±4 hours after test conclusion.<br>Within Post Environmental Limits<br>Cap: ±0.3% or ±0.25 pF shift<br>IR: 10% of Initial Limit<br>DF Limits Maximum: 0.5% |
| Storage Life           |                        | 1,000 hours at 125°C, Unpowered   |  |
| Vibration              | MIL-STD-202 Method 204 | 5 g's for 20 minutes, 12 cycles each of 3 orientations.<br>Test from 10 – 2,000 Hz                                      | Cap: Initial Limit<br>DF: Initial Limit<br>IR: Initial Limit   |
| Mechanical Shock       | MIL-STD-202 Method 213 | 1,500 g's 0.5 ms Half-sine,<br>Velocity Change 15.4 feet/second<br>(Condition F)  | Cap: Initial Limit<br>DF: Initial Limit<br>IR: Initial Limit   |
| Resistance to Solvents | MIL-STD-202 Method 215 | Add Aqueous wash chemical OKEMCLEAN<br>(A 6% concentrated Oakite cleaner) or equivalent.<br>Do not use banned solvents. | Visual Inspection 10X<br>Readable marking,<br>no decoloration or stains.<br>No physical damage.  |

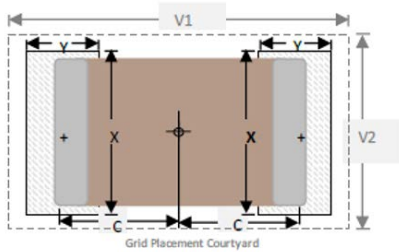
**Environmental Compliance**



Lead (Pb)-free, RoHS, and REACH compliant without exemptions.

**Table 3 – KONNEKT Land Pattern Design Recommendations per IPC-7351 (mm)**

| Chip Number | Mounting | EIA SIZE CODE | METRIC SIZE CODE | Median (Nominal) Land Protrusion |      |      |      |      |
|-------------|----------|---------------|------------------|----------------------------------|------|------|------|------|
|             |          |               |                  | C                                | Y    | X    | V1   | V2   |
| 2           | Standard | 1812          | 4532             | 2.05                             | 1.40 | 3.50 | 6.00 | 4.00 |
| 2           | Standard | 2220          | 5750             | 2.65                             | 1.50 | 5.40 | 7.30 | 5.90 |



## Storage & Handling

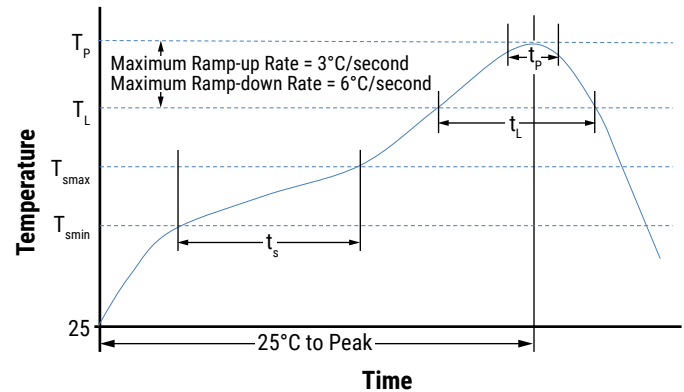
Ceramic chip capacitors should be stored in normal working environments. While the chips themselves are quite robust in other environments, solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. In addition, packaging materials will be degraded by high temperature – reels may soften or warp and tape peel force may increase. KEMET recommends that maximum storage temperature not exceed 40°C and maximum storage humidity not exceed 70% relative humidity. In addition, temperature fluctuations should be minimized to avoid condensation on the parts and atmospheres should be free of chlorine and sulfur bearing compounds. For optimized solderability chip stock should be used promptly, preferably within 1.5 years upon receipt.

## Soldering Process

### Recommended Reflow Soldering Profile

KEMET's KONNEKT family of high density surface mount multilayer ceramic capacitors (SMD MLCCs) are compatible with convection and IR reflow techniques. Preheating of these components is recommended to avoid extreme thermal stress. KEMET's recommended profile conditions for convection and IR reflow reflect the profile conditions of the IPC/J-STD-020 standard for moisture sensitivity testing. These devices can safely withstand a maximum of three reflow passes at these conditions.

| Profile Feature                                       | Termination Finish |
|---|--------------------|
|   | 100% matte Sn      |
| <b>Preheat/Soak</b>                                   |                    |
| Temperature Minimum ( $T_{Smin}$ )                    | 150°C              |
| Temperature Maximum ( $T_{Smax}$ )                    | 200°C              |
| Time ( $t_s$ ) from $T_{Smin}$ to $T_{Smax}$          | 60 – 120 seconds   |
| Ramp-Up Rate ( $T_L$ to $T_p$ )                       | 3°C/second maximum |
| Liquidous Temperature ( $T_L$ )                       | 217°C              |
| Time Above Liquidous ( $t_L$ )                        | 60 – 150 seconds   |
| Peak Temperature ( $T_p$ )                            | 260°C              |
| Time Within 5°C of Maximum Peak Temperature ( $t_p$ ) | 30 seconds maximum |
| Ramp-Down Rate ( $T_p$ to $T_L$ )                     | 6°C/second maximum |
| Time 25°C to Peak Temperature                         | 8 minutes maximum  |



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

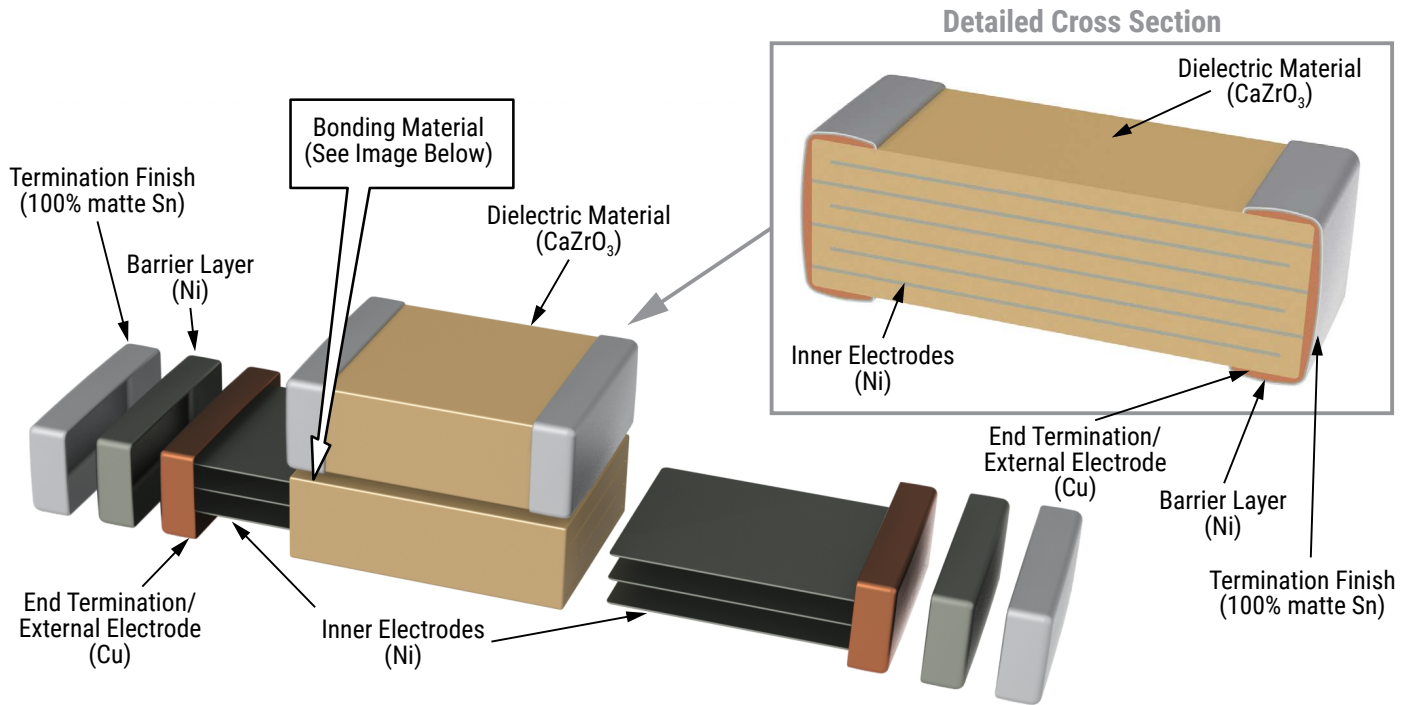
### Hand Soldering and Removal of KONNEKT Capacitors

The preferred method of attachment for KEMET's KONNEKT Capacitors is IR or convection reflow where temperature, time and air flow are well controlled.

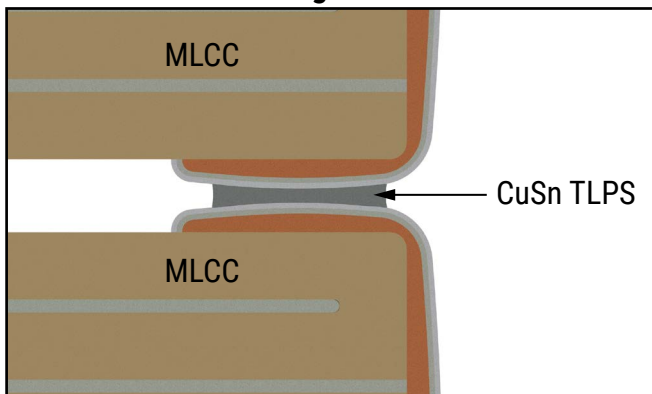
However, it is understood that the manual attachment of KONNEKT capacitors is necessary for prototype and lab testing. In these instances, care must be taken not to introduce excessive temperature gradients in the KONNEKT part type that may lead to cracking in the ceramic or separation of the TLPS material.

Please see [KEMET's KONNEKT Soldering Guidelines here](#).

## Construction – Standard Termination

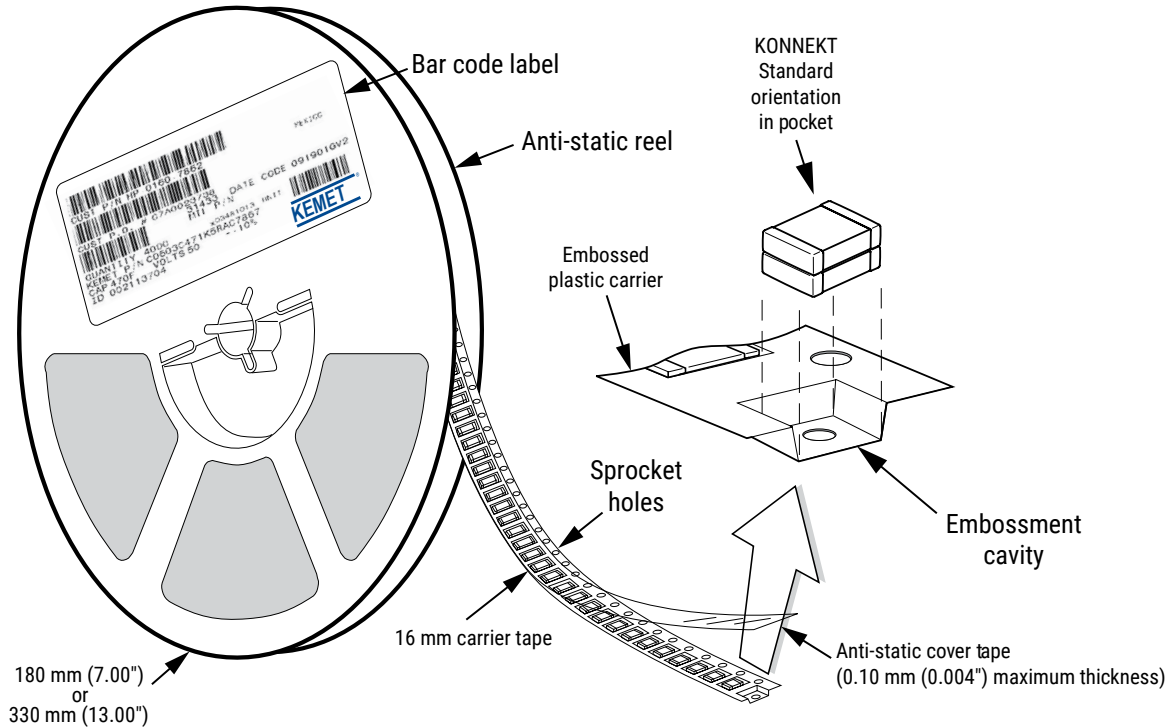


### Bonding Material



## Tape & Reel Packaging Information

KEMET offers X7R with KONNEKT technology capacitors packaged in 16 mm tape on 7" and 13" reels in accordance with EIA Standard 481. This packaging system is compatible with all tape-fed automatic pick and place systems.

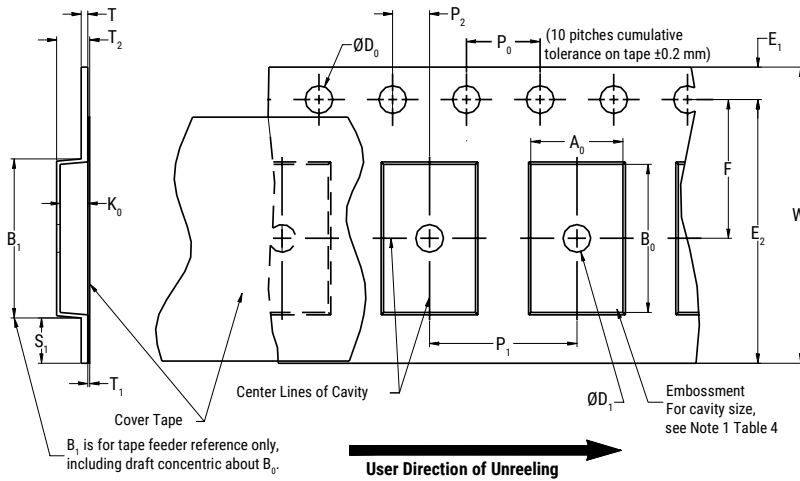


**Table 4 – Carrier Tape Configuration, Embossed Plastic (mm)**

| EIA Case Size | Number of Chips | Chip Thickness                 | Tape Size (W) <sup>1</sup> | Embossed Plastic                     |          |
|---------------|-----------------|--------------------------------|----------------------------|--------------------------------------|----------|
|               |                 |                                |                            | 7" Reel                              | 13" Reel |
|               |                 |                                |                            | Pitch (P <sub>1</sub> ) <sup>2</sup> |          |
| KONNEKT 1812  | 2               | ≤ 3.5 mm                       | 16                         | 8                                    | 8        |
|               |                 | > 3.5 mm                       |                            | 12                                   | 12       |
| KONNEKT 2220  | 2               | ≤ 3.5 mm<br>>5.0 mm & ≤ 5.3 mm | 16                         | 8                                    | 8        |
|               |                 | > 3.5 mm ≤ 5.0                 |                            | 12                                   | 12       |

1. Refer to Figures 1 and 2 for W and P<sub>1</sub> carrier tape reference locations.  
 2. Refer to Tables 4 and 5 for tolerance specifications.

**Figure 1 – Embossed (Plastic) Carrier Tape Dimensions**



**Table 5 – Embossed (Plastic) Carrier Tape Dimensions**

Metric will govern

| Constant Dimensions – Millimeters (Inches) |                                       |                                  |                            |                           |                           |                       |                                  |                  |                           |
|--|---------------------------------------|----------------------------------|----------------------------|---------------------------|---------------------------|-----------------------|----------------------------------|------------------|---------------------------|
| Tape Size                                  | D <sub>0</sub>                        | D <sub>1</sub> Minimum<br>Note 1 | E <sub>1</sub>             | P <sub>0</sub>            | P <sub>2</sub>            | R Reference<br>Note 2 | S <sub>1</sub> Minimum<br>Note 3 | T<br>Maximum     | T <sub>1</sub><br>Maximum |
| 16 mm                                      | 1.5 +0.10/-0.0<br>(0.059 +0.004/-0.0) | 1.5<br>(0.059)                   | 1.75±0.10<br>(0.069±0.004) | 4.0±0.10<br>(0.157±0.004) | 2.0±0.05<br>(0.079±0.002) | 30<br>(1.181)         | 0.600<br>(0.024)                 | 0.600<br>(0.024) | 0.100<br>(0.004)          |

| Variable Dimensions – Millimeters (Inches) |                 |           |               |                                  |                           |                           |                            |                           |                 |  |
|--|-----------------|-----------|---------------|----------------------------------|---------------------------|---------------------------|----------------------------|---------------------------|-----------------|--|
| Case Size                                  | Number of Chips | Tape Size | Pitch         | B <sub>1</sub> Maximum<br>Note 4 | E <sub>2</sub><br>Minimum | F                         | P <sub>1</sub>             | T <sub>2</sub><br>Maximum | W<br>Maximum    | A <sub>0</sub> , B <sub>0</sub> & K <sub>0</sub> |
| 1812                                       | 2               | 16 mm     | Triple (12mm) | 7.9<br>(0.311)                   | 14.25<br>(0.561)          | 7.5±0.05<br>(0.138±0.002) | 12.0±0.10<br>(0.472±0.004) | 6.5<br>(0.256)            | 16.3<br>(0.642) | Note 5   |
|  |                 |           | Double (8mm)  | 7.5<br>(0.295)                   |                           |                           | 8.0±0.10<br>(0.315±0.004)  |                           |                 |  |
| 2220                                       | 2               | 16 mm     | Triple (12mm) | 8.5<br>(0.335)                   | 14.25<br>(0.561)          | 7.5±0.05<br>(0.138±0.002) | 12.0±0.10<br>(0.472±0.004) | 6.5<br>(0.256)            | 16.3<br>(0.642) | Note 5   |
|  |                 |           | Double (8mm)  | 9.2<br>(0.363)                   |                           |                           | 8.0±0.10<br>(0.315±0.004)  |                           |                 |  |

1. The embossment hole location shall be measured from the sprocket hole controlling the location of the embossment. Dimensions of embossment location and hole location shall be applied independent of each other.
2. The tape with or without components shall pass around R without damage (see Figure 6).
3. If  $S_1 < 1.0$  mm, there may not be enough area for cover tape to be properly applied. See EIA Document 481, Paragraph 4.3 (b).
4. B<sub>1</sub> dimension is a reference dimension for tape feeder clearance only.
5. The cavity defined by A<sub>0</sub>, B<sub>0</sub> and K<sub>0</sub> shall surround the component with sufficient clearance that:
  - (a) the component does not protrude above the top surface of the carrier tape.
  - (b) the component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.
  - (c) rotation of the component is limited to 20° maximum for 8 and 12 mm tapes and 10° maximum for 16 mm tapes (see Figure 3).
  - (d) lateral movement of the component is restricted to 0.5 mm maximum for 8 mm and 12 mm wide tape and to 1.0 mm maximum for 16 mm tape (see Figure 4).
  - (e) For KPS product, A<sub>0</sub> and B<sub>0</sub> are measured on a plane 0.3 mm above the bottom of the pocket.
  - (f) see Addendum in EIA Document 481 for standards relating to more precise taping requirements.

## Packaging Information Performance Notes

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

| Tape Width | Peel Strength                    |
|------------|----------------------------------|
| 16 mm      | 0.1 to 1.3 newton (10 to 130 gf) |

## Table 6 – Reel Dimensions

Metric will govern

| Constant Dimensions – Millimeters (Inches) |   |                                       |  |   |
|--|---|---------------------------------------|--|---|
| Tape Size                                  | A   | B Minimum                             | C                                      | D Minimum   |
| 16 mm                                      | 178±0.20<br>(7.008±0.008)<br>or<br>330±0.20<br>(13.000±0.008) | 1.5<br>(0.059)                        | 13.0 +0.5/-0.2<br>(0.521 +0.02/-0.008) | 20.2<br>(0.795)                                   |
| Variable Dimensions – Millimeters (Inches) |   |                                       |  |   |
| Tape Size                                  | N Minimum<br>See Note 2, Tables 2-3                           | W <sub>1</sub>                        | W <sub>2</sub> Maximum                 | W <sub>3</sub>                                    |
| 16 mm                                      | 50<br>(1.969)   | 16.4 +2.0/-0.0<br>(0.646 +0.078/-0.0) | 22.4<br>(0.882)                        | Shall accommodate tape width without interference |

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