Surface Mount Multilayer Ceramic Capacitors (SMD MLCCs) for High Power Applications

# HiQ CBR Series, C0G Dielectric, Low ESR 6.3 – 500 VDC, 1 MHz – 50 GHz (RF & Microwave)

## Overview

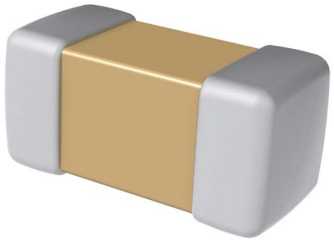
KEMET's HiQ CBR RF Capacitor Series features a copper electrode BME (Base Metal Electrode) system that offers ultra-low ESR and High Q in the VHF, UHF, and microwave frequency bands. Low ESR allows for higher RF currents which are ideal for applications such as cellular base stations and telecommunication networks.

CBR Series capacitors exhibit no change in capacitance with respect to time and voltage, and boast a negligible change in capacitance with reference to ambient temperature.

HiQ-CBR RF & MICROWAVE

KEMET's HiQ CBR RF capacitors are characterized using ModelithicsTM substrate scalable models and is available in most EDA software. Contact KEMET Sales for details on accessing models.





## Benefits

- Ultra-low ESR and High Q
- High SRF
- High thermal stability
- 1 MHz to 50 GHz frequency range
- Operating temperature range of −55°C to +125°C
- Base metal electrode (BME) dielectric system
- Pb-free and RoHS compliant
- 0201, 0402, 0603 and 0805 case sizes (inches)
- DC voltage ratings from 6.3 – 500 V
- Capacitance offerings ranging from 0.1 pF up to 100 pF
- Available capacitance tolerances of ±0.05 pF, ±0.1 pF, ±0.25 pF, ±0.5 pF, ±1%, ±2%, and ±5%
- Negligible capacitance change with respect to temperature
- 100% pure matte tin-plated termination finish allowing for excellent solderability

## Applications

- RF power amplifiers (PA)
- Cellular base stations (4G, 5G)
- Wireless LAN
- Telecommunication Networks
- GPS
- Bluetooth
- Bypass, coupling, filtering, impedance matching, DC blocking



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## Ordering Information

| CBR | 02 | C | 330 | F | 9 | G | A | C | |
|---|---|---|---|---|---|---|---|---|---|
| Series | Case Size (L"x W") | Specification/ Series | Capacitance Code (pF) | Capacitance Tolerance | Rated Voltage (VDC) | Dielectric | Termination Style | Termination Finish | Packaging/ Grade (C-Spec) |
| CBR | 02 = 0201<br>04 = 0402<br>06 = 0603<br>08 = 0805 | C = Standard | Two significant digits and number of zeros<br>Use 9 for 1.0 – 9.9 pF<br>Use 8 for 0.1 – 0.99 pF<br>e.g., 2.2 pF = 229<br>e.g., 0.5 pF = 508 | A = ±0.05 pF<br>B = ±0.1 pF<br>C = ±0.25 pF<br>D = ±0.5 pF<br>F = ±1%<br>G = ±2%<br>J = ±5% | 9 = 6.3 V<br>8 = 10 V<br>3 = 25 V<br>5 = 50 V<br>1 = 100 V<br>2 = 200 V<br>A = 250 V<br>C = 500 V | G = C0G | A = N/A | C = 100% Matte Sn | See "Packaging C-Spec Ordering Options Table" |

## Tape & Reel Packaging Information

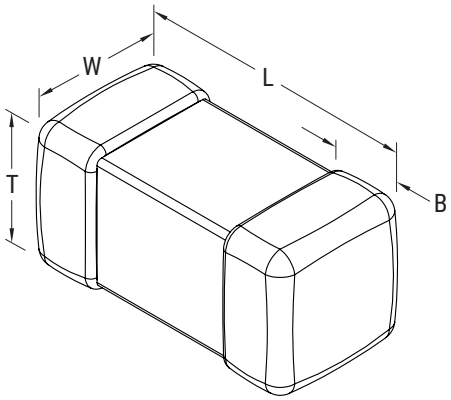
| Packaging Type | Packaging Ordering Code (C-SPEC) |
|---|---|
| 7" Reel | Blank |
| 13" Reel | 7411 (EIA 0603 and smaller case sizes)<br>7210 (EIA 0805 case size) |

## Environmental Compliance

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



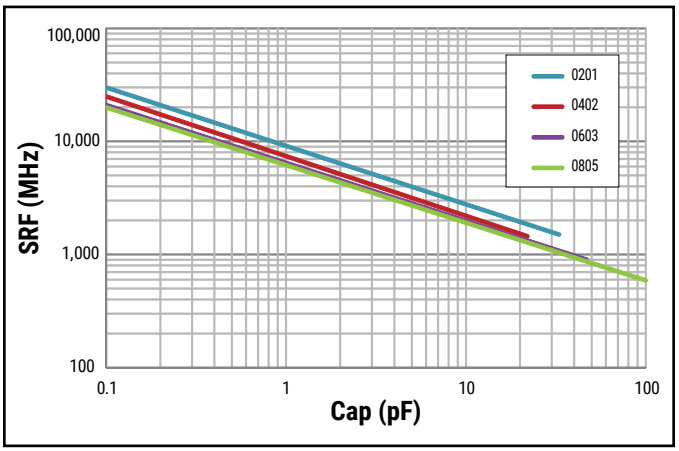
## Dimensions – Millimeters (Inches)




| Case Size (in.) | Case Size (mm) | L Length | W Width | T Thickness | B Bandwidth | Mounting Technique |
|---|---|---|---|---|---|---|
| 0201 | 0603 | 0.60±0.03 (0.024±0.001) | 0.30±0.03 (0.012±0.001) | 0.30±0.03 (0.012±0.001) | 0.15±0.05 (0.006±0.002) | Solder Reflow Only |
| 0402 | 1005 | 1.00±0.05 (0.040±0.002) | 0.50±0.05 (0.020±0.002) | 0.50±0.05 (0.020±0.002) | 0.25+0.05/−0.10 (0.010+0.002/−0.004) | |
| 0603 | 1608 | 1.60±0.10 (0.063±0.004) | 0.80±0.10 (0.031±0.004) | 0.80 ± 0.10 (0.031 ± 0.004) | 0.40 ± 0.20 (0.016 ± 0.008) | Solder Wave or Solder Reflow |
| 0805 | 2012 | 2.00±0.20 (0.079±0.008) | 1.25±0.20 (0.049±0.008) | 0.85 ± 0.10 (0.031 ± 0.004) | 0.50 ± 0.25 (0.020 ± 0.010) | |

## Electrical Characteristics

SRF (MHz) vs. Cap (pF)



# Table 1 – CBR Series, Capacitance Range Waterfall

| Case Size – Inches (mm) | | 0201 (0603) | | | | | 0402 (1005) | | | | | 0603 (1608) | | | 0805 (2012) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated Voltage (VDC) | | 6.3 | 10 | 25 | 50 | 100 | 25 | 50 | 100 | 200 | 250 | 50 | 100 | 250 | 50 | 100 | 250 | 500 |
| Voltage Code | | 9 | 8 | 3 | 5 | 1 | 3 | 5 | 1 | 2 | A | 5 | 1 | A | 5 | 1 | A | C |
| Capacitance | Capacitance Tolerance | Capacitance Code (Available Capacitance) | | | | | | | | | | | | | | | | |
| 0.1 pF | | 108* | 108* | 108* | 108* | 108* | 108* | 108* | 108* | 108* | 108* | | | | | | | |
| 0.2 pF | A = ±0.05 pF | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 |
| 0.3 pF | B = ±0.1 pF | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 | 308 |
| 0.4 pF | | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 | 408 |
| 0.5 pF | | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 |
| 0.6 pF | | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 | 608 |
| 0.7 pF | | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 | 708 |
| 0.8 pF | | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 | 808 |
| 0.9 pF | | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 | 908 |
| 1.0 pF | | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 | 109 |
| 1.1 pF | | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 119 |
| 1.2 pF | | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 | 129 |
| 1.3 pF | | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 | 139 |
| 1.4 pF | | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 | 149 |
| 1.5 pF | | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 | 159 |
| 1.6 pF | | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 |
| 1.7 pF | | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 |
| 1.8 pF | | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 | 189 |
| 1.9 pF | | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 |
| 2.0 pF | | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 | 209 |
| 2.1 pF | | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 | 219 |
| 2.2 pF | | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 | 229 |
| 2.3 pF | | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 239 |
| 2.4 pF | | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 | 249 |
| 2.5 pF | | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 |
| 2.6 pF | | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 | 269 |
| 2.7 pF | A = ±0.05 pF | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 | 279 |
| 2.8 pF | B = ±0.1 pF | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 |
| 2.9 pF | C = ±0.25 pF | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 | 299 |
| 3.0 pF | | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 | 309 |
| 3.1 pF | | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 |
| 3.2 pF | | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 |
| 3.3 pF | | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 |
| 3.4 pF | | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 | 349 |
| 3.5 pF | | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 | 359 |
| 3.6 pF | | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 | 369 |
| 3.7 pF | | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 | 379 |
| 3.8 pF | | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 | 389 |
| 3.9 pF | | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 |
| 4.0 pF | | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 | 409 |
| 4.1 pF | | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 | 419 |
| 4.2 pF | | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 |
| 4.3 pF | | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 |
| 4.4 pF | | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 |
| 4.5 pF | | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 |
| 4.6 pF | | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 | 469 |
| 4.7 pF | | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 | 479 |
| 4.8 pF | | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 | 489 |
| 4.9 pF | | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 | 499 |
| 5.0 pF | | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 | 509 |
| Rated Voltage (VDC) | | 6.3 | 10 | 25 | 50 | 100 | 25 | 50 | 100 | 200 | 250 | 50 | 100 | 250 | 50 | 100 | 250 | 500 |
| Voltage Code | | 9 | 8 | 3 | 5 | 1 | 3 | 5 | 1 | 2 | A | 5 | 1 | A | 5 | 1 | A | C |

** Available only in "B" ( ±0.1pF) capacitance tolerance.*

## Table 1 – CBR Series, Capacitance Range Waterfall cont.

| Case Size – Inches (mm) | | 0201 (0603) | | | | | 0402 (1005) | | | | | 0603 (1608) | | | 0805 (2012) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated Voltage (VDC) | | 6.3 | 10 | 25 | 50 | 100 | 25 | 50 | 100 | 200 | 250 | 50 | 100 | 250 | 50 | 100 | 250 | 500 |
| Voltage Code | | 9 | 8 | 3 | 5 | 1 | 3 | 5 | 1 | 2 | A | 5 | 1 | A | 5 | 1 | A | C |
| Capacitance | Capacitance Tolerance | Capacitance Code (Available Capacitance) | | | | | | | | | | | | | | | | |
| 5.1 pF | | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 | 519 |
| 5.2 pF | | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 | 529 |
| 5.3 pF | | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 | 539 |
| 5.4 pF | | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 | 549 |
| 5.5 pF | | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 | 559 |
| 5.6 pF | | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 | 569 |
| 5.7 pF | | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 | 579 |
| 5.8 pF | | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 | 589 |
| 5.9 pF | | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 | 599 |
| 6.0 pF | | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 | 609 |
| 6.1 pF | | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 | 619 |
| 6.2 pF | | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 | 629 |
| 6.3 pF | | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 | 639 |
| 6.4 pF | | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 | 649 |
| 6.5 pF | | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 | 659 |
| 6.6 pF | | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 | 669 |
| 6.7 pF | | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 | 679 |
| 6.8 pF | | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 | 689 |
| 6.9 pF | | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 | 699 |
| 7.0 pF | | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 | 709 |
| 7.1 pF | | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 | 719 |
| 7.2 pF | | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 | 729 |
| 7.3 pF | | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 | 739 |
| 7.4 pF | B = ±0.1 pF | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 | 749 |
| 7.5 pF | C = ±0.25 pF | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 | 759 |
| 7.6 pF | D = ±0.5 pF | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 | 769 |
| 7.7 pF | | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 | 779 |
| 7.8 pF | | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 | 789 |
| 7.9 pF | | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 | 799 |
| 8.0 pF | | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 | 809 |
| 8.1 pF | | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 | 819 |
| 8.2 pF | | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 | 829 |
| 8.3 pF | | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 | 839 |
| 8.4 pF | | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 | 849 |
| 8.5 pF | | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 | 859 |
| 8.6 pF | | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 | 869 |
| 8.7 pF | | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 | 879 |
| 8.8 pF | | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 | 889 |
| 8.9 pF | | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 | 899 |
| 9.0 pF | | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 | 909 |
| 9.1 pF | | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 | 919 |
| 9.2 pF | | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 | 929 |
| 9.3 pF | | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 | 939 |
| 9.4 pF | | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 | 949 |
| 9.5 pF | | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 | 959 |
| 9.6 pF | | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 | 969 |
| 9.7 pF | | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 | 979 |
| 9.8 pF | | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 | 989 |
| 9.9 pF | | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 | 999 |
| Rated Voltage (VDC) | | 6.3 | 10 | 25 | 50 | 100 | 25 | 50 | 100 | 200 | 250 | 50 | 100 | 250 | 50 | 100 | 250 | 500 |
| Voltage Code | | 9 | 8 | 3 | 5 | 1 | 3 | 5 | 1 | 2 | A | 5 | 1 | A | 5 | 1 | A | C |

## Table 1 – CBR Series, Capacitance Range Waterfall cont.

| Case Size – Inches (mm) | | 0201 (0603) | | | | | 0402 (1005) | | | | | 0603 (1608) | | | 0805 (2012) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated Voltage (VDC) | | 6.3 | 10 | 25 | 50 | 100 | 25 | 50 | 100 | 200 | 250 | 50 | 100 | 250 | 50 | 100 | 250 | 500 |
| Voltage Code | | 9 | 8 | 3 | 5 | 1 | 3 | 5 | 1 | 2 | A | 5 | 1 | A | 5 | 1 | A | C |
| Capacitance | Capacitance Tolerance | Capacitance Code (Available Capacitance) | | | | | | | | | | | | | | | | |
| 10 pF | F = ±1%<br>G = ±2%<br>J = ±5% | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 11 pF | | 110 | 110 | 110 | 110 | | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| 12 pF | | 120 | 120 | 120 | 120 | | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 | 120 |
| 13 pF | | 130 | 130 | 130 | 130 | | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 |
| 15 pF | | 150 | 150 | 150 | 150 | | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| 16 pF | | 160 | 160 | 160 | 160 | | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 |
| 18 pF | | 180 | 180 | 180 | 180 | | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 | 180 |
| 20 pF | | 200 | 200 | 200 | 200 | | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| 22 pF | | 220 | 220 | 220 | 220 | | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 |
| 24 pF | | 240 | 240 | 240 | 240 | | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| 27 pF | | 270 | 270 | 270 | 270 | | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 |
| 30 pF | | 300 | 300 | 300 | 300 | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| 33 pF | | 330 | 330 | 330 | 330 | | 330 | 330 | 330 | 330 | 330 | 330 | 330 | 330 | 330 | 330 | 330 | 330 |
| 36 pF | | 360 | 360 | 360 | 360 | | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| 39 pF | | 390 | 390 | 390 | 390 | | 390 | 390 | 390 | 390 | 390 | 390 | 390 | 390 | 390 | 390 | 390 | 390 |
| 43 pF | | | | | | | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 | 430 |
| 47 pF | | | | | | | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 |
| 51 pF | | | | | | | 510 | 510 | 510 | 510 | 510 | 510 | 510 | 510 | 510 | 510 | 510 | 510 |
| 56 pF | | | | | | | 560 | 560 | 560 | 560 | 560 | 560 | 560 | 560 | 560 | 560 | 560 | 560 |
| 62 pF | | | | | | | 620 | 620 | 620 | 620 | 620 | 620 | 620 | 620 | 620 | 620 | 620 | 620 |
| 68 pF | | | | | | | 680 | 680 | 680 | 680 | 680 | 680 | 680 | 680 | 680 | 680 | 680 | 680 |
| 75 pF | | | | | | | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | |
| 82 pF | | | | | | | 820 | 820 | 820 | 820 | 820 | 820 | 820 | 820 | 820 | 820 | 820 | |
| 91 pF | | | | | | | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 910 | |
| 100 pF | | | | | | | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | |
| Rated Voltage (VDC) | | 6.3 | 10 | 25 | 50 | 100 | 25 | 50 | 100 | 200 | 250 | 50 | 100 | 250 | 50 | 100 | 250 | 500 |
| Voltage Code | | 9 | 8 | 3 | 5 | 1 | 3 | 5 | 1 | 2 | A | 5 | 1 | A | 5 | 1 | A | C |

## Table 2 – Chip Thickness/Reeling Quantities

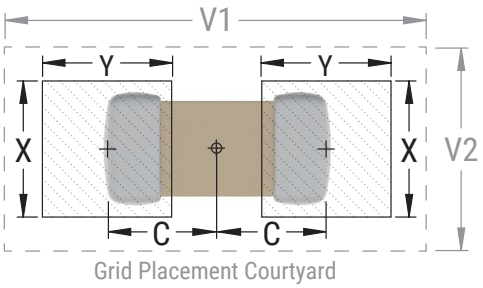
| Chip Size Inches (mm) | Chip Thickness (mm) | Reel Quantity | |
|---|---|---|---|
| | | 7" Paper | 13" Paper |
| 0201 (0603) | 0.30 ±0.03 | 15,000 | 50,000 |
| 0402 (1005) | 0.50 ±0.05 | 10,000 | 50,000 |
| 0603 (1608) | 0.80 ±0.10 | 4,000 | 15,000 |
| 0805 (2012) | 0.85 ±0.10 | 4,000 | 15,000 |

## Table 3 – Chip Capacitor Land Pattern Design Recommendations per IPC–7351 (mm)

| Case Size (Inches) | Case Size (mm) | Density Level A: Maximum (Most) Land Protrusion | | | | | Density Level B: Median (Nominal) Land Protrusion | | | | | Density Level C: Minimum (Least) Land Protrusion | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C | Y | X | V1 | V2 | C | Y | X | V1 | V2 | C | Y | X | V1 | V2 |
| 0201 | 0603 | 0.38 | 0.56 | 0.52 | 1.80 | 1.00 | 0.33 | 0.46 | 0.42 | 1.50 | 0.80 | 0.28 | 0.36 | 0.32 | 1.20 | 0.60 |
| 0402 | 1005 | 0.50 | 0.72 | 0.72 | 2.20 | 1.20 | 0.45 | 0.62 | 0.62 | 1.90 | 1.00 | 0.40 | 0.52 | 0.52 | 1.60 | 0.80 |
| 0603 | 1608 | 0.90 | 1.15 | 1.10 | 4.00 | 2.10 | 0.80 | 0.95 | 1.00 | 3.10 | 1.50 | 0.60 | 0.75 | 0.90 | 2.40 | 1.20 |
| 0805 | 2012 | 1.00 | 1.35 | 1.55 | 4.40 | 2.60 | 0.90 | 1.15 | 1.45 | 3.50 | 2.00 | 0.75 | 0.95 | 1.35 | 2.80 | 1.70 |

***Density Level A:*** *For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes. KEMET only recommends wave soldering of 0603(1608) and 0805 (2012) case sizes.*
***Density Level B:*** *For products with a moderate level of component density. Provides a robust solder attachment condition for reflow solder processes.*
***Density Level C:*** *For high component density product applications. Before adapting the minimum land pattern variations the user should perform qualification testing based on the conditions outlined in IPC Standard 7351 (IPC–7351).*

*Image below based on Density Level B for an EIA 1608 case size.*



## Soldering Process

**Recommended Soldering Technique:**

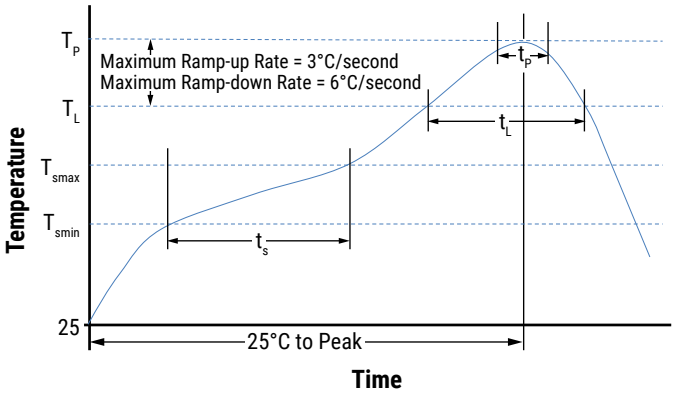
- Solder wave or solder reflow for EIA case sizes 0603, 0805, and 1206
- All other EIA case sizes are limited to solder reflow only

**Recommended Reflow Soldering Profile:**

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

| Profile Feature | Termination Finish |
|---|---|
| | SnPb |
| **Preheat/Soak** | |
| Temperature Minimum ($T_{Smin}$) | 100°C |
| Temperature Maximum ($T_{Smax}$) | 150°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 ($T_L$) | 183°C |
| Time Above Liquidous ($t_L$) | 60 – 150 seconds |
| Peak Temperature ($T_P$) | 235°C |
| Time Within 5°C of Maximum Peak Temperature ($t_P$) | 20 seconds maximum |
| Ramp-Down Rate ($T_P$ to $T_L$) | 6°C/second maximum |
| Time 25°C to Peak Temperature | 6 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.*



## Table 4 – Performance & Reliability: Test Methods & Conditions

<table>
<tr><th>Test</th><th>Test Condition</th><th>Limits</th></tr>
<tr><td>Capacitance (Cap)</td><td>1 MHz ±100 kHz and 1.0 ±0.2 $V_{RMS}$</td><td>Within Tolerance</td></tr>
<tr><td>Quality Factor (Q)</td><td>1 MHz ±100 kHz and 1.0 ±0.2 $V_{RMS}$</td><td>≥ 1,000 for capacitance values ≥ 30 pF<br>≥ 400 + 20C for capacitance values < 30 pF<br>(C = Capacitance in pF)</td></tr>
<tr><td>Insulation Resistance</td><td>Apply rated voltage for 120 seconds at 25°C</td><td>10 GΩ minimum</td></tr>
<tr><td>Temperature Coefficient of Capacitance (TCC)</td><td>1 MHz ±100 kHz and 1.0 ±0.2 $V_{RMS}$</td><td>0 ± 30 PPM/°C<br>(0 ± 60PPM/°C for 0201 case size product ≥ 22 pF)</td></tr>
<tr><td>Dielectric Withstanding Voltage (DWV)</td><td><table><tr><th>Voltage</th><th>DWV Voltage</th></tr><tr><td><100 V</td><td>250%</td></tr><tr><td>200 V</td><td>200%</td></tr><tr><td>250 V</td><td>200%</td></tr><tr><td>500 V</td><td>150%</td></tr></table>(5 ±1 seconds and charge/discharge not exceeding 50 mA)</td><td>Cap: Initial Limit<br>DF: Initial Limit<br>IR: Initial Limit<br><br>Withstand test voltage without insulation breakdown or damage</td></tr>
<tr><td>Aging Rate</td><td>Capacitance measurements are indexed to a referee time of 1,000 hours.</td><td>0%</td></tr>
<tr><td>Terminal Strength</td><td><table><tr><th>Case Size</th><th>Force</th></tr><tr><td>0201</td><td>2N</td></tr><tr><td>0402</td><td>5N</td></tr><tr><td>0603</td><td>5N</td></tr><tr><td>0805</td><td>10N</td></tr></table>Terminal strength test per specific case size,<br>Time: 10±1 seconds</td><td>No evidence of mechanical damage</td></tr>
<tr><td>Solderability</td><td>Solder Temperature: 245 ±5°C<br>Dipping Time: 3 ±0.5 seconds</td><td>95% minimum coverage of termination finish.</td></tr>
<tr><td>Board Flex</td><td>Capacitor is mounted to a substrate which is flexed by means of ram at a rate of 1 mm per second until the deflection becomes 1 mm. (Deflection is maintained for 5 ±1 second)<br>Store at room temperature for 24 ±2 hours before measuring electrical properties.</td><td>No visible damage.<br>Capacitance change: within ±5.0% or ±0.5 pF, whichever is larger.<br>(Capacitance change is monitored during flexure.)</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>Solder Temperature: 260 ±5°C<br>Dipping Time: 10 ±1 second<br>Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.<br>Store at room temperature for 24 ±2 hours before measuring electrical properties.</td><td>No visible damage.<br>Capacitance change: within ±2.5% or ±0.25 pF, whichever is larger.<br>Q/DF, IR and dielectric strength: To meet initial requirements.<br>25% maximum leaching on each edge.</td></tr>
</table>

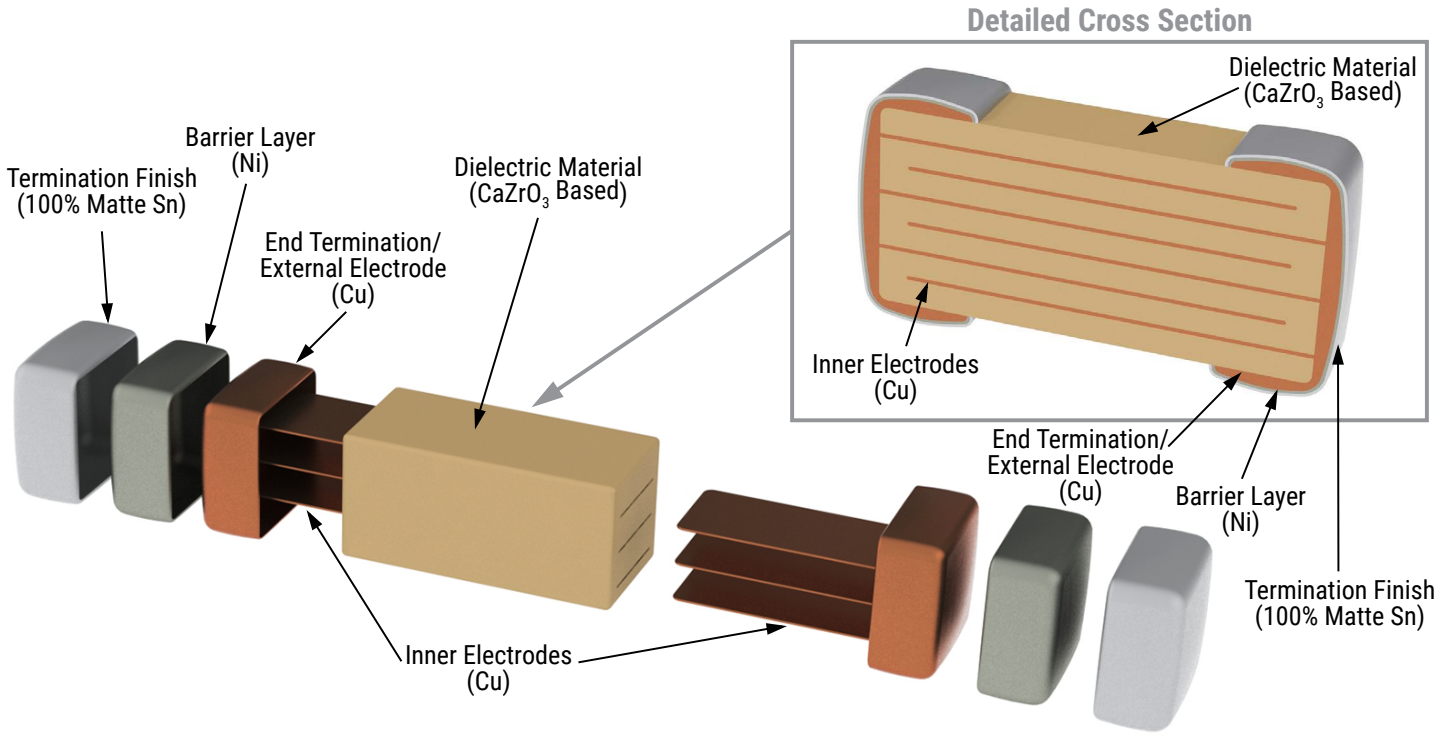
## Table 4 – Performance & Reliability: Test Methods & Conditions cont.

<table>
<tr><th>Test</th><th>Test Condition</th><th>Limits</th></tr>
<tr><td>Temperature Cycling</td><td>5 cycles of steps 1 - 4:
<table>
<tr><th>Step</th><th>Temperature (°C)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Minimum operating temperature +0/−3</td><td>30 ±3</td></tr>
<tr><td>2</td><td>Room temperature</td><td>2 ~ 3</td></tr>
<tr><td>3</td><td>Maximum operating temperature +3/−0</td><td>30 ±3</td></tr>
<tr><td>4</td><td>Room temperature (25°C)</td><td>2 ~ 3</td></tr>
</table>
Store at room temperature for 24 ±2 hours before measuring electrical properties.</td><td>No visible damage.<br>Capacitance change: within ±2.5% or ±0.25 pF, whichever is larger.<br>Q/DF, IR and dielectric strength: To meet initial requirements.</td></tr>
<tr><td>Humidity (Damp Heat) Load</td><td>Test temperature: 40 ±2°C<br>Humidity: 90 ~ 95% RH<br>Test Time: 500 +24/−0 hours<br>Applied Voltage: Rated voltage<br>Store at room temperature for 24 ±2 hours before measuring electrical properties.</td><td>No visible damage.<br>Capacitance change: within ±7.5% or ±0.75 pF, whichever is larger.<br>Q value: Capacitance ≥ 30 pF, Q ≥ 200,<br>Capacitance < 30 pF, Q ≥ 100+10/3°C<br>IR: ≥ 500 MΩ</td></tr>
<tr><td>High Temperature Life</td><td>Test temperature: 125 ±3°C<br>Applied Voltage:<br>200% of rated voltage (6.3 VDC – 100 VDC)<br>150% of rated voltage (200 VDC and 500 VDC)<br>Test Time: 1,000 +24/−0 hours<br>Store at room temperature for 24 ±2 hours before measuring electrical properties.</td><td>No visible damage.<br>Capacitance change: within ±3.0% or ±0.3 pF, whichever is larger.<br>Q/DF value: Capacitance ≥ 30 pF, Q ≥350,<br>10 pF ≤ Capacitance < 30 pF, Q ≥ 275 +5°C<br>Capacitance <10 pF, Q ≥ 200 +10°C<br>IR: ≥1 GΩ</td></tr>
<tr><td>ESR</td><td>The ESR should be measured at room temperature and tested at frequency 1 ±0.1 GHz.</td><td>
<table>
<tr><th>0201 Case Size</th><th>0402 Case Size</th></tr>
<tr><td>0.1 pF ≤ Capacitance ≤ 1 pF: < 350 mΩ/pF</td><td>0.1 pF ≤ Capacitance ≤ 1 pF: < 350 mΩ/pF</td></tr>
<tr><td>1.0 pF < Capacitance ≤ 5.0 pF: < 300 mΩ</td><td>1.0 pF < Capacitance ≤ 5.0 pF: < 300 mΩ</td></tr>
<tr><td>5.0 pF < Capacitance ≤ 22.0 pF: < 250 mΩ</td><td>5.0 pF < Capacitance ≤ 100 pF: < 250 mΩ</td></tr>
<tr><th>0603 Case Size</th><th>0805 Case Size</th></tr>
<tr><td>0.3 pF ≤ Capacitance ≤ 1 pF: < 1,500 mΩ</td><td>0.3 pF ≤ Capacitance ≤ 1 pF: < 1,500 mΩ</td></tr>
<tr><td>1 pF < Capacitance ≤ 10 pF: < 250 mΩ</td><td>1 pF < Capacitance ≤ 10 pF: < 250 mΩ</td></tr>
<tr><td>10 pF < Capacitance ≤ 100 pF: < 200 mΩ</td><td>Capacitance > 10 pF: < 200 mΩ</td></tr>
</table>
</td></tr>
<tr><td></td><td>The ESR should be measured at room temperature and tested at frequency 500 ±50 MHz.</td><td>0201 case size, 22 pF ≤ Cap ≤ 33 pF: < 300 mΩ</td></tr>
</table>

## Storage and 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. 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 of receipt.

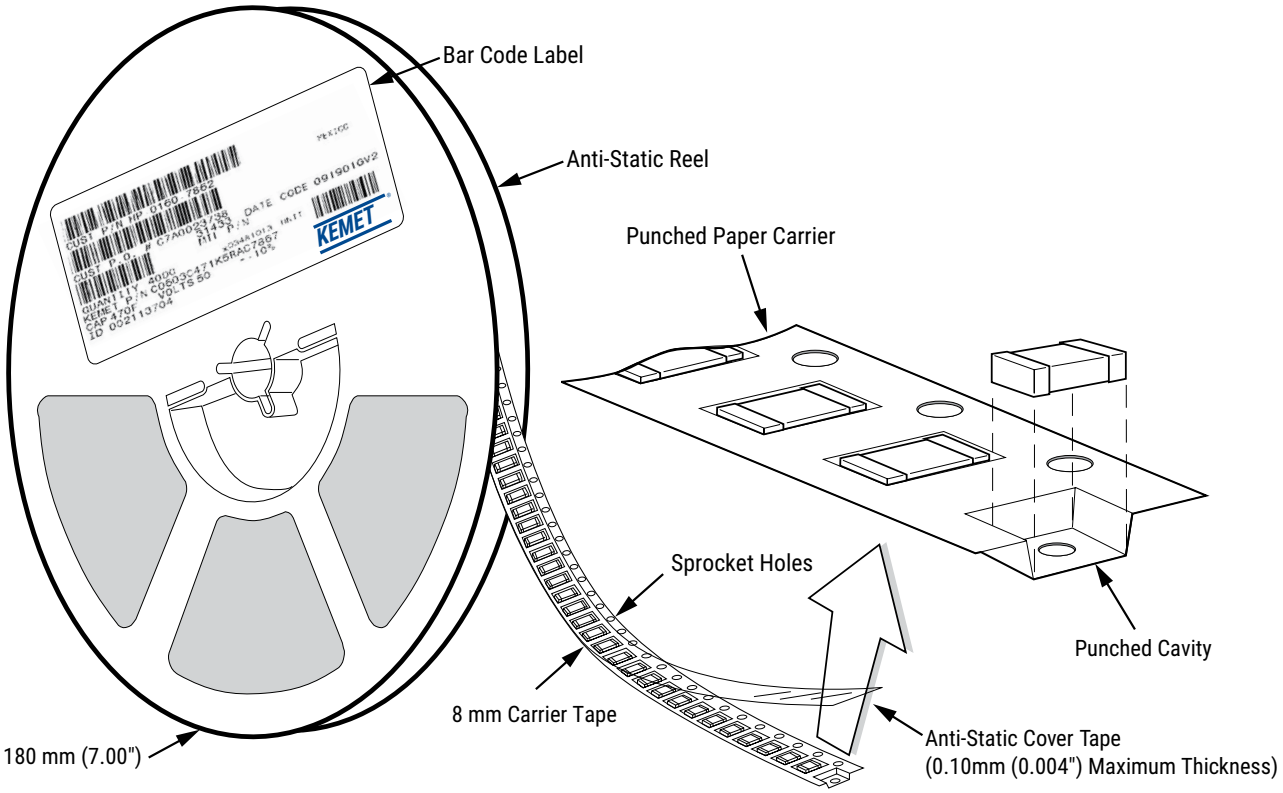
## Construction



## Tape & Reel Packaging Information

KEMET offers RF and Microwave Multilayer Ceramic Chip Capacitors packaged in 8 mm tape on 7" reels in accordance with EIA Standard 481. This packaging system is compatible with all tape-fed automatic pick and place systems.

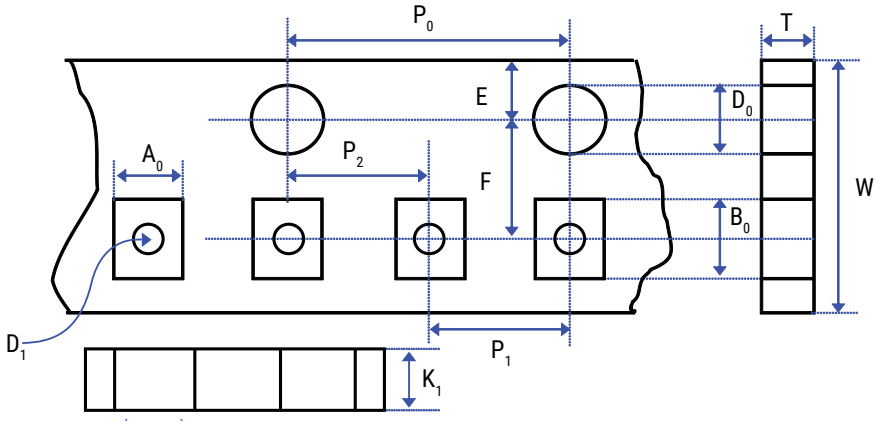
## Table 5 – Carrier Tape Configuration (mm)




| EIA Case Size | Tape Size (W)* | Lead Space ($P_1$)* |
|---|---|---|
| 0201 – 0402 | 8 | 2 |
| 0603 – 1210 | 8 | 4 |

**Refer to Figure 1 for W and $P_1$ carrier tape reference locations.*
**Refer to Table 6 for tolerance specifications.*

## Figure 1 – Punched (Paper) Carrier Tape Dimensions




## Table 6 – Punched (Paper) Carrier Tape Dimensions

Metric will govern

| Constant Dimensions — Millimeters (Inches) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Tape Size | $D_0$ | $E_1$ | $P_0$ | $P_2$ | R Reference Note 2 | $K_0$ | | |
| 8 mm | 1.55+0.05 (0.061+0.002) | 1.55±0.05 (0.061±0.002) | 4.0±0.10 (0.157±0.004) | 2.0±0.05 (0.079±0.002) | 25.0 (0.984) | - | | |
| **Variable Dimensions — Millimeters (Inches)** | | | | | | | | |
| Tape Size | Pitch | $A_0$ | $B_0$ | F | $P_1$ | T | W | $D_1$ |
| 8 mm | Half (2 mm) | 0.37±0.03 (0.015±0.001) | 0.67±0.03 (0.03±0.001) | 3.5±0.05 (0.138±0.002) | 2.0±0.05 (0.079±0.002) | 0.42±0.03 (0.017±0.001) | 8.0±0.10 (0.315±0.004) | - |
| | | 0.62±0.05 (0.025±0.002) | 1.12±0.05 (0.04±0.002) | | | 0.60±0.05 (0.024±0.002) | | |
| 8 mm | Single (4 mm) | 1.00±0.10 (0.040±0.004) | 1.80±0.10 (0.07±0.004) | | 4.0±0.10 (0.157±0.004) | 0.95±0.05 (0.037±0.002) | | |
| | | 1.50±0.10 (0.06±0.004) | 2.30±0.10 (0.09±0.004) | | | 0.95±0.05 (0.037±0.002) | | |

*2. The tape with or without components shall pass around R without damage (see Figure 3).*

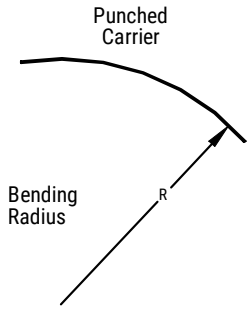
## Packaging Information Performance Notes

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

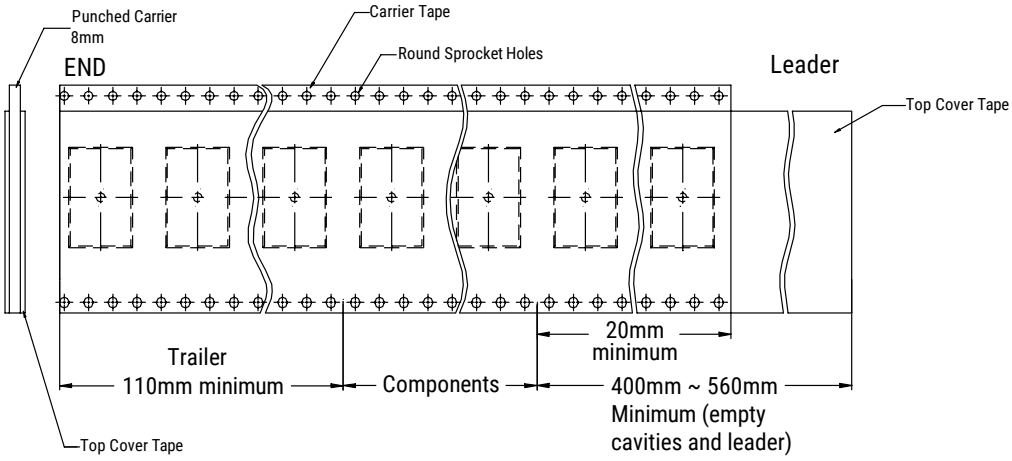
| Tape Width | Peel Strength |
|---|---|
| 8 mm | 0.1 to 1.0 newton (10 to 100 gf) |
| 12 and 16 mm | 0.1 to 1.3 newton (10 to 130 gf) |

The direction of the pull shall be opposite the direction of the carrier tape travel. The pull angle of the carrier tape shall be 165° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of 300 ±10 mm/minute.
**3. Labeling:** Bar code labeling (standard or custom) shall be on the side of the reel opposite the sprocket holes. *Refer to EIA Standards 556 and 624*.

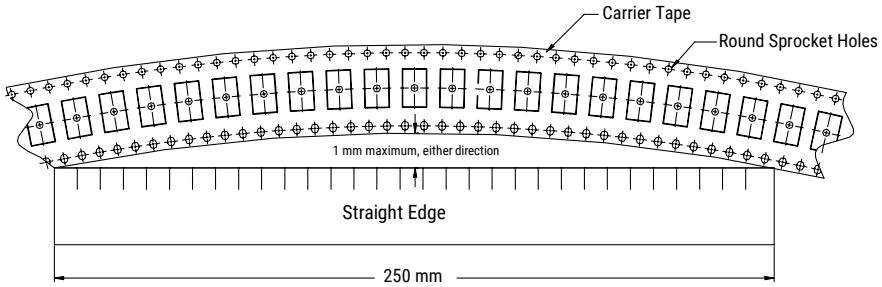
## Figure 2 – Bending Radius



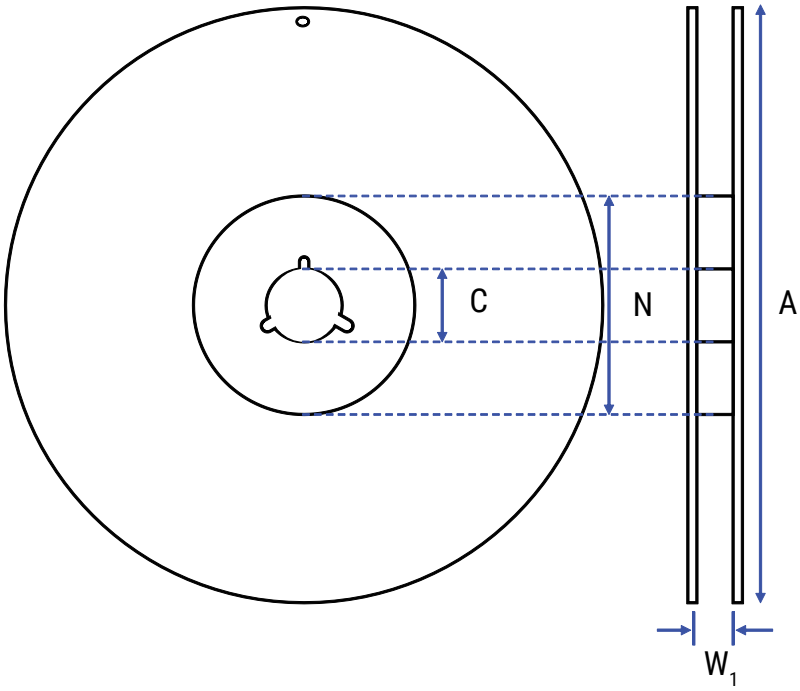

## Figure 3 – Tape Leader & Trailer Dimensions



## Figure 4 – Maximum Camber




## Figure 5 – Reel Dimensions




## Table 7 – Reel Dimensions

Metric will govern

| Constant Dimensions — Millimeters (Inches) | | | |
|---|---|---|---|
| Tape Size | Reel Size | A | C |
| 8 mm | 7 | 178±0.10 (7.008±0.004) | 13.0±0.20 (0.512±0.008) |
| **Variable Dimensions — Millimeters (Inches)** | | | |
| Tape Size | N Minimum See Note 2, Table 6 | $W_1$ | |
| 8 mm | 60±0.10 (2.4±0.04) | 8.4+1.5/−0.0 (0.331+0.059/−0.0) | |

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