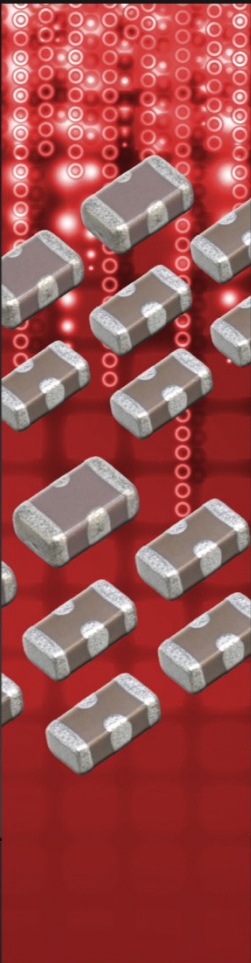




MULTILAYER CERAMIC CHIP CAPACITORS



CER Series Controlled ESR Capacitors

Type: CERB (C1608)
CERD (C2012)

Issue date: April 2011

**TDK MLCC
US Catalog**

Version B11

REMINDERS

Please read before using this product

SAFETY REMINDERS



REMINDERS

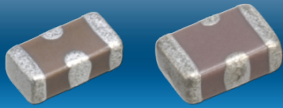
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CER Series

Controlled ESR Capacitors

Type: CERB (C1608), CERD (C2012)



Features



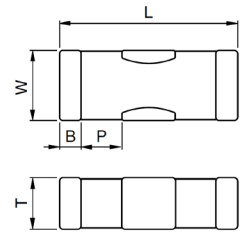
- This is a ceramic chip capacitor with the additional function of controlling (assures design of) the ESR (Equivalent Series Resistance) value as desired.
- This function enables control of voltage change, which can occur between the power source and the CPU, by controlling the impedance of capacitors located around the CPU.
- This enables a reduction in the number of parts used and contributes to cost savings, set downsizing, and upgrading quality.
- The replacement of existing products is easy because the mounting method is the same as products with two terminals.

Applications



- PC server
- Power decoupling and smoothing
- Voltage regulator
- Output filters
- Plane termination
- USB damping circuit
- Tantalum capacitor replacement

Shape & Dimensions



Dimensions in mm

Part Number Construction

CERD 2J X5R 0G 106 M T XXXX

Series Name

| Case Code | Length | Width |
|-----------|-------------|-------------|
| CERB | 1.60 ± 0.20 | 0.80 ± 0.10 |
| CERD | 2.00 ± 0.20 | 1.25 ± 0.20 |

ESR

| ESR Code | ESR Value |
|----------|-----------|
| 1C | 20mΩ |
| 1F | 35mΩ |
| 1J | 50mΩ |
| 2A | 100mΩ |
| 2C | 200mΩ |
| 2J | 500mΩ |
| 2M | 650mΩ |
| 3U | 1,200mΩ |

Temperature Characteristic

| Temperature Characteristics | Capacitance Change | Temperature Range |
|-----------------------------|--------------------|-------------------|
| X5R | ± 15% | -55 to +85°C |

Rated Voltage (DC)

| Voltage Code | Voltage (DC) |
|--------------|--------------|
| 0G | 4V |

Internal Codes

Packaging Style

| Packaging Code | Style |
|----------------|-------------|
| T | Tape & Reel |

Capacitance Tolerance

| Tolerance Code | Tolerance |
|----------------|-----------|
| M | ± 20% |

Nominal Capacitance (pF)

The capacitance is expressed in three digit codes and in units of pico Farads (pF). The first and second digits identify the first and second significant figures of the capacitance. The third digit identifies the multiplier. R designates a decimal point.

| Capacitance Code | Capacitance |
|------------------|-------------------|
| 0R5 | 0.5pF |
| 010 | 1pF |
| 102 | 1,000pF (1nF) |
| 105 | 1,000,000pF (1μF) |



Capacitance Range Table

CERB [EIA CC0603]

Class 2 (Temperature Stable)

Temperature Characteristics: X5R (-55 to +85°C, ±15%)

| TDK Part Number (Ordering Code) | ESR | Temperature Characteristics | Rated Voltage | Capacitance (pF) | Capacitance Tolerance | Thickness (mm) |
|---------------------------------|----------------|-----------------------------|---------------|------------------|-----------------------|----------------|
| CERB2CX5R0G105M | 200 mΩ ± 30% | X5R | 4V | 1,000,000 | ± 20% | 0.80 ± 0.10 |
| CERB2MX5R0G105M | 650 mΩ ± 30% | X5R | 4V | 1,000,000 | ± 20% | 0.80 ± 0.10 |
| CERB3UX5R0G105M | 1,200 mΩ ± 30% | X5R | 4V | 1,000,000 | ± 20% | 0.80 ± 0.10 |



Capacitance Range Table

CERD [EIA CC0805]

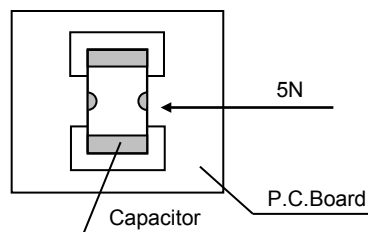
Class 2 (Temperature Stable)

Temperature Characteristics: X5R (-55 to +85°C, ±15%)

| TDK Part Number (Ordering Code) | ESR | Temperature Characteristics | Rated Voltage | Capacitance (pF) | Capacitance Tolerance | Thickness (mm) |
|---------------------------------|--------------|-----------------------------|---------------|------------------|-----------------------|----------------|
| CERD1CX5R0G106M | 20 mΩ ± 30% | X5R | 4V | 10,000,000 | ± 20% | 0.85 ± 0.15 |
| CERD1JX5R0G106M | 50 mΩ ± 30% | X5R | 4V | 10,000,000 | ± 20% | 0.85 ± 0.15 |
| CERD2AX5R0G106M | 100 mΩ ± 30% | X5R | 4V | 10,000,000 | ± 20% | 0.85 ± 0.15 |
| CERD2CX5R0G106M | 200 mΩ ± 30% | X5R | 4V | 10,000,000 | ± 20% | 0.85 ± 0.15 |
| CERD2JX5R0G106M | 500 mΩ ± 30% | X5R | 4V | 10,000,000 | ± 20% | 0.85 ± 0.15 |

CER Series – Controlled ESR Capacitors

| No. | Item | Performance | Test or Inspection Method |
|-----|---|--|---|
| 1 | External Appearance | No defects which may affect performance. | Inspect with magnifying glass (3×). |
| 2 | Insulation Resistance | 100MΩ•μF min. | Apply rated voltage for 60s. |
| 3 | ESR | Code | ESR |
| | | 1C | 20 mΩ |
| | | 1F | 35 mΩ |
| | | 1J | 50 mΩ |
| | | 2A | 100 mΩ |
| | | 2C | 200 mΩ |
| | | 2J | 500 mΩ |
| | | 2M | 650 mΩ |
| | | 3U | 1,200 mΩ |
| 4 | Voltage Proof | Withstand test voltage without insulation breakdown or other damage. | 2.5 x Rated Voltage (DC) shall be applied for 1 to 5s. Charge / discharge current shall not exceed 50mA. |
| 5 | Capacitance | Within the specified tolerance. | Measuring Frequency |
| | | | 1kHz±10% |
| | | | Measuring Voltage |
| | | | 1.0±0.2V _{rms} |
| 6 | Dissipation Factor | Temperature Characteristic | D.F. |
| | | X5R | 0.10 max. |
| 7 | Temperature Characteristics of Capacitance (Class 2) | Capacitance Change (%) | Capacitance shall be measured by the steps shown in the following table after thermal equilibrium is obtained for each step. ΔC be calculated ref. STEP3 reading |
| | | No Voltage Applied | |
| | | X5R: ± 15% | |
| | | | Step |
| | | | Temperature (°C) |
| | | | 1 |
| | | | 2 |
| | | | 3 |
| | | | 4 |
| | | | Reference temp. ± 2 |
| | | | Min. operating temp. ± 3 |
| | | | Reference temp. ± 2 |
| | | | Max. operating temp. ± 2 |
| | | | Measuring voltage: 0.1, 0.2, 0.5, 1.0Vrms. |
| 8 | Robustness of Terminations | No sign of termination coming off, breakage of ceramic, or other abnormal signs. | Reflow solder the capacitors on P.C. board (shown in Appendix 2) and apply a pushing force of 5N with 10±1s. |





General Specifications

CER Series – Controlled ESR Capacitors

| No. | Item | Performance | Test or Inspection Method | | | | | | | | | | |
|-------------|----------------------------------|---|--|-----------------------------------|--|-----------------------------------|---------|-----|--|--|--|-------------|---|
| 9 | Bending | No mechanical damage. | <p>Glue and wave solder the capacitor on P.C. board (shown in Appendix 1) and bend it for 1mm.</p> <p style="text-align: right;">Unit: mm</p> | | | | | | | | | | |
| 10 | Solderability | <p>New solder to cover over 75% of termination. 25% may have pin holes or rough spots but not concentrated in one spot. Ceramic surface of “A sections” shall not be exposed due to melting or shifting of termination material.</p> | <p>Completely soak both terminations in solder at $235 \pm 5^\circ\text{C}$ for $2 \pm 0.5\text{s}$.</p> <p>Solder : H63A (JIS Z 3282)</p> <p>Flux : Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.</p> | | | | | | | | | | |
| 11 | Resistance to solder heat | <p>External appearance: No cracks are allowed and terminations shall be covered at least 60% with new solder.</p> <table border="1"> <thead> <tr> <th rowspan="2">Capacitance</th> <th colspan="2">Characteristics</th> <th rowspan="2">Change from the value before test</th> </tr> <tr> <th>Class 2</th> <th>X5R</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td>$\pm 7.5\%$</td> </tr> </tbody> </table> <p>D.F. (Class 2): Meet the initial spec.</p> <p>Insulation Resistance: Meet the initial spec.</p> <p>Voltage proof: No insulation breakdown or other damage.</p> | Capacitance | Characteristics | | Change from the value before test | Class 2 | X5R | | | | $\pm 7.5\%$ | <p>Completely soak both terminations in solder at $260 \pm 5^\circ\text{C}$ for $5 \pm 1\text{s}$.</p> <p>Preheating condition Temp. : $150 \pm 10^\circ\text{C}$ Time : 1 ~ 2min.</p> <p>Flux: Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.</p> <p>Solder : H63A (JIS Z 3282)</p> <p>Leave the capacitor in ambient conditions for $48 \pm 4\text{h}$ before measurement.</p> |
| Capacitance | Characteristics | | | Change from the value before test | | | | | | | | | |
| | Class 2 | X5R | | | | | | | | | | | |
| | | | $\pm 7.5\%$ | | | | | | | | | | |
| 12 | Vibration | <p>External appearance: No mechanical damage.</p> <table border="1"> <thead> <tr> <th rowspan="2">Capacitance</th> <th colspan="2">Characteristics</th> <th rowspan="2">Change from the value before test</th> </tr> <tr> <th>Class 2</th> <th>X5R</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td>$\pm 7.5\%$</td> </tr> </tbody> </table> <p>D.F. (Class 2): Meet the initial spec.</p> | Capacitance | Characteristics | | Change from the value before test | Class 2 | X5R | | | | $\pm 7.5\%$ | <p>Solder the capacitors on P.C. board (shown in Appendix 2) before testing.</p> <p>Vibrate the capacitor with amplitude of 1.5mm P-P changing the frequencies from 10Hz to 55Hz and back to 10Hz in about 1min.</p> <p>Repeat this for 2h each in 3 perpendicular directions.</p> |
| Capacitance | Characteristics | | | Change from the value before test | | | | | | | | | |
| | Class 2 | X5R | | | | | | | | | | | |
| | | | $\pm 7.5\%$ | | | | | | | | | | |

CER Series – Controlled ESR Capacitors

| No. | Item | Performance | Test or Inspection Method | |
|-----------------------|---|--|--|-----|
| 13 | Temperature cycle | | Reflow solder the capacitors on a P.C. board (shown in Appendix 2) before testing. Expose the capacitor in the conditions in step 1 through step 4, and repeat 5 times consecutively. Leave the capacitor in ambient conditions for 48 ± 4 h before measurement. | |
| | External appearance | No mechanical damage. | | |
| | Capacitance | Characteristics | | |
| | | Change from the value before test | | |
| | | Class 2 | | X5R |
| | D.F. (Class 2) | Meet the initial spec. | | |
| Insulation Resistance | Meet the initial spec. | | | |
| Voltage Proof | No insulation breakdown or other damage. | | | |
| 14 | Moisture Resistance (Steady State) | | Reflow solder the capacitor on P.C. board (shown in Appendix 2) before testing. Leave at temperature $40 \pm 2^\circ\text{C}$, 90 to 95%RH for 500 +24,0h. Leave the capacitor in ambient condition for 48 ± 4 h before measurement. | |
| | External appearance | No mechanical damage. | | |
| | Capacitance | Characteristics | | |
| | | Change from the value before test | | |
| | | Class 2 | | X5R |
| | D.F. (Class 2) | 200% of initial spec. max. | | |
| Insulation Resistance | $10\text{M}\Omega \cdot \mu\text{F}$ min. | | | |
| 15 | Moisture Resistance | | Reflow solder the capacitors on P.C. board (shown in Appendix 2) before testing. Apply the rated voltage at temperature $40 \pm 2^\circ\text{C}$ and 90 to 95%RH for 500 +24,0h. Charge/discharge current shall not exceed 50mA. Leave the capacitor in ambient conditions for 48 ± 4 h before measurement. Voltage conditioning: Voltage treat the capacitors under testing temperature and voltage for 1 hour. Leave the capacitors in ambient condition for 48 ± 4 h before measurement. Use this measurement for initial value. | |
| | External appearance | No mechanical damage. | | |
| | Capacitance | Characteristics | | |
| | | Change from the value before test | | |
| | | Class 2 | | X5R |
| | D.F. (Class 2) | 200% of initial spec. max. | | |
| Insulation Resistance | $5\text{M}\Omega \cdot \mu\text{F}$ min. | | | |



CER Series – Controlled ESR Capacitors

| No. | Item | Performance | Test or Inspection Method | | | | | | | |
|-----------------------|---|--|---|-----------------------------------|--|-----------------------------------|---------|-----|------------|---|
| 16 | Life | | | | | | | | | |
| | External appearance | No mechanical damage. | Reflow solder the capacitors on P.C. board (shown in Appendix 2) before testing. Apply rated voltage at $85 \pm 2^\circ\text{C}$ for $1,000 \pm 48,0\text{h}$. | | | | | | | |
| | Capacitance | <table border="1"> <thead> <tr> <th colspan="2">Characteristics</th> <th>Change from the value before test</th> </tr> </thead> <tbody> <tr> <td>Class 2</td> <td>X5R</td> <td>$\pm 25\%$</td> </tr> </tbody> </table> | | Characteristics | | Change from the value before test | Class 2 | X5R | $\pm 25\%$ | Charge/discharge current shall not exceed 50mA. |
| | | Characteristics | | Change from the value before test | | | | | | |
| | Class 2 | X5R | $\pm 25\%$ | | | | | | | |
| D.F. (Class 2) | 200% of initial spec. max. | | Leave the capacitor in ambient conditions for $48 \pm 4\text{h}$ before measurement. Voltage conditioning: Voltage treat the capacitors under testing temperature and voltage for 1 hour. | | | | | | | |
| Insulation Resistance | $10\text{M}\Omega \cdot \mu\text{F}$ min. | | Leave the capacitors in ambient condition for $48 \pm 4\text{h}$ before measurement. Use this measurement for initial value. | | | | | | | |

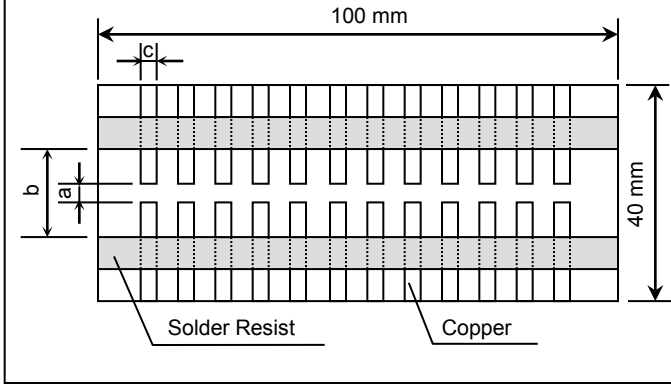
***As for the initial measurement of capacitors on number 7,11,12,13 and 14, leave capacitors at $150 - 10,0^\circ \text{C}$ for 1h and measure the value after leaving capacitors for $48 \pm 4\text{h}$ in ambient condition.**



CER Series – Controlled ESR Capacitors

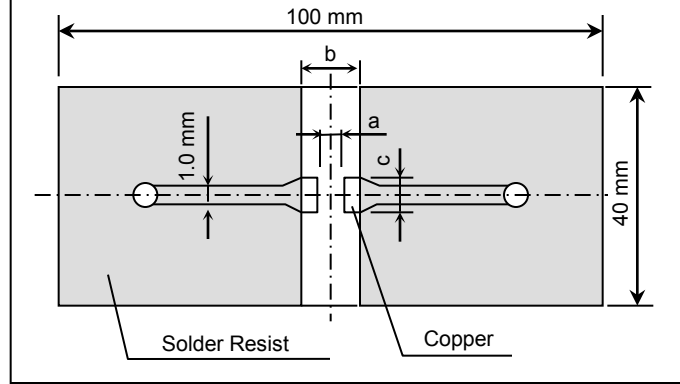
Appendix - 1

P.C. Board for reliability test



Appendix - 2

P.C. Board for bending test



Material : Glass Epoxy (As per JIS C6484 GE4)

P.C. Board thickness : Appendix-2a 0.8mm
 Appendix-1a, 1b, 2b 1.6mm

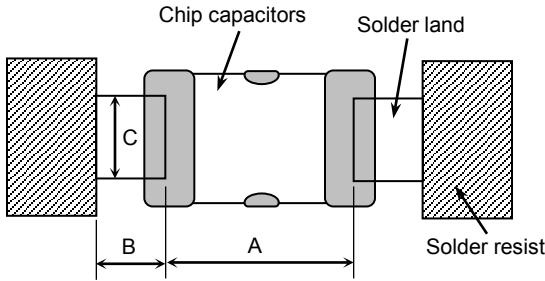
- Copper (thickness 0.035mm)
- Solder resist

| Case Code | | | Dimensions (mm) | | |
|-----------|-------|--------|-----------------|-----|------|
| Series | JIS | EIA | a | b | c |
| CERA | C1005 | CC0402 | 0.4 | 1.5 | 0.5 |
| CERB | C1608 | CC0603 | 1.0 | 3.0 | 1.2 |
| CERD | C2012 | CC0805 | 1.2 | 4.0 | 1.65 |
| CERF | C3216 | CC1206 | 2.2 | 5.0 | 2.9 |

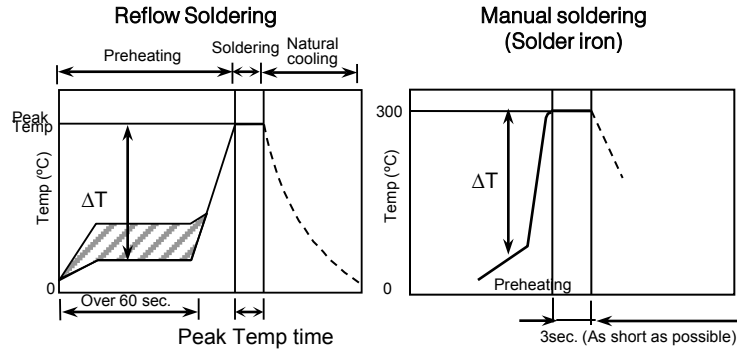
Soldering Information

CER Series – Controlled ESR Capacitors

Recommended Soldering Land Pattern



Recommended Soldering Profile

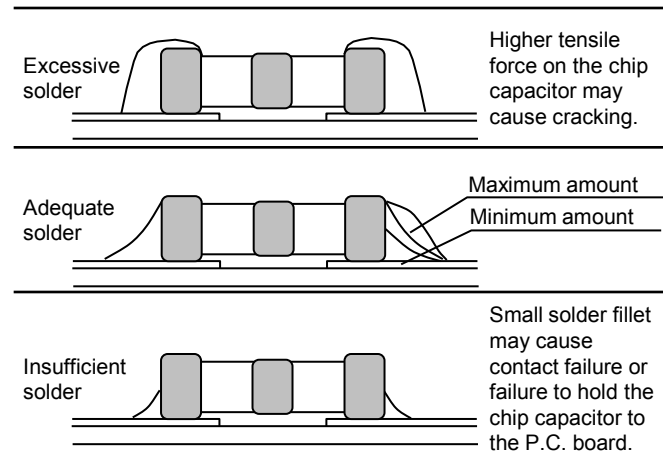


Reflow Soldering

Unit: mm

| Type | A | B | D | F |
|--------|-------------|-----------|-----------|-----------|
| Symbol | [CC0402] | [CC0603] | [CC0805] | [CC1206] |
| A | 0.3 - 0.5 | 0.6 - 0.8 | 0.9 - 1.2 | 2.0 - 2.4 |
| B | 0.35 - 0.45 | 0.6 - 0.8 | 0.7 - 0.9 | 1.0 - 1.2 |
| C | 0.4 - 0.6 | 0.6 - 0.8 | 0.9 - 1.2 | 1.1 - 1.6 |

Recommended Solder Amount



Recommended soldering duration

| Solder | Temp./Dura. | Reflow Soldering | |
|------------------|-------------|------------------|-----------------|
| | | Peak temp (°C) | Duration (sec.) |
| Sn-Pb Solder | | 230 max. | 20 max. |
| Lead-Free Solder | | 260 max. | 10 max. |

Recommended solder compositions

Sn-37Pb (Sn-Pb solder)

Sn-3.0Ag-0.5Cu (Lead Free Solder)

Preheating Condition

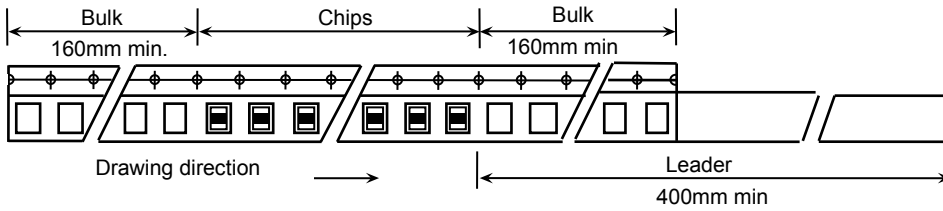
| Soldering | Temp. (°C) |
|------------------|---------------------|
| Reflow soldering | $\Delta T \leq 150$ |
| Manual soldering | $\Delta T \leq 150$ |



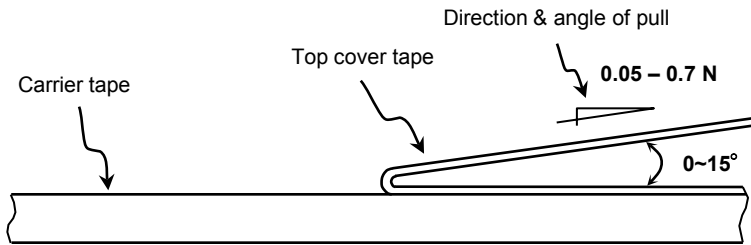
Packaging Information

CER Series – Controlled ESR Capacitors

Carrier Tape Configuration

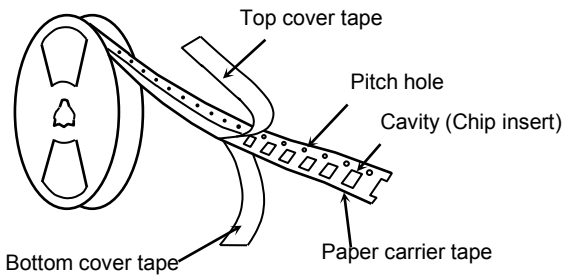


Peel Back Force (Top Tape)



- Carrier tape shall be flexible enough to be wound around a minimum radius of 30mm with components in tape.
- The missing of components shall be less than 0.1%
- Components shall not stick to the cover tape.
- The cover tape shall not protrude beyond the edges of the carrier tape not shall cover the sprocket holes.

Chip Quantity Per Reel and Structure of Reel



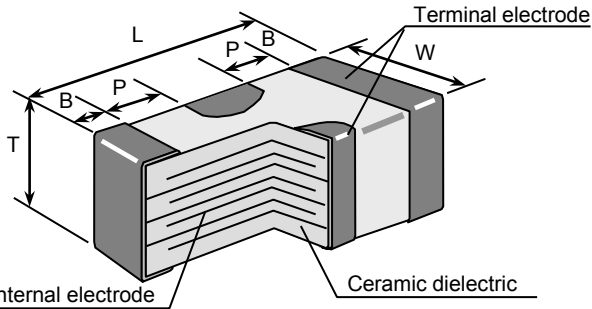
| Series | Case Code | | Chip Thickness | Taping Material | Chip quantity (pcs.) | |
|--------|-----------|--------|----------------|-----------------|----------------------|-------------------|
| | JIS | EIA | | | φ178mm (7") reel | φ330mm (13") reel |
| CERB | C1608 | CC0603 | 0.80 mm | Paper | 4,000 | 10,000 |
| CERD | C2012 | CC0805 | 085 mm | Paper | 4,000 | 10,000 |



Additional Information

CER Series – Controlled ESR Capacitors

• Shape & Dimensions



| Case Code | | | Dimensions (mm) | | | | |
|-----------|-------|--------|-----------------|------|------|------|------|
| Series | JIS | EIA | L | W | T | B | P |
| CERB | C1608 | CC0603 | 1.60 | 0.80 | 0.80 | 0.25 | 0.25 |
| CERD | C2012 | CC0805 | 2.00 | 1.25 | 0.85 | 0.30 | 0.25 |

• Environmental Information

TDK Corporation established internal product environmental assurance standards that include the six hazardous substances banned by the EU RoHS Directive¹ enforced on July 1, 2006 along with additional substances independently banned by TDK and has successfully completed making general purpose electronic components conform to the RoHS Directive².

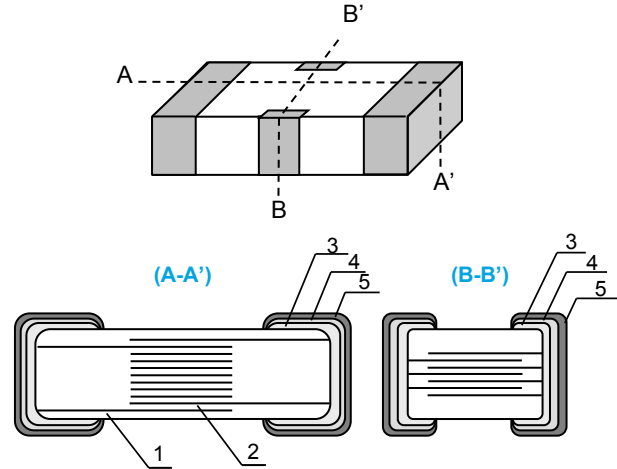
1. Abbreviation for Restriction on Hazardous Substances, which refers to the regulation EU Directive 2002/95/EC on hazardous substances by the European Union (EU) effective from July 1, 2006. The Directive bans the use of six specific hazardous substances in electric and electronic devices and products handled within the EU. The six substances are lead, mercury, cadmium, hexavalent chromium, PBB (polybrominated biphenyls), and PBDE (polybrominated diphenyl ethers).
2. This means that, in conformity with the EU Directive 2002/95/EC, lead, cadmium, mercury, hexavalent chromium, and specific bromine-based flame retardants, PBB and PBDE, have not been used, except for exempted applications.

For REACH (SVHC : 15 substances according to ECHA / October 2008) : All TDK MLCC do not contain these 15 substances.

For European Directive 2000/53/CE and 2005/673/CE : Cadmium, Hexavalent Chromium, Mercury, Lead are not contained in all TDK MLCC.

For European Directive 2003/11/CE : Pentabromodiphenyl-ether, Octabromodiphenyl-ether are not contained in all TDK MLCC.

• Inside Structure & Material System



| No. | NAME | MATERIAL | |
|-----|--------------------|--------------------|--------------------|
| | | Class 1 | Class 2 |
| (1) | Ceramic Dielectric | CaZrO ₃ | BaTiO ₃ |
| (2) | Internal Electrode | Nickel (Ni) | |
| (3) | Termination | Copper (Cu) | |
| (4) | | Nickel (Ni) | |
| (5) | | Tin (Sn) | |