# Notice for TAIYO YUDEN Products

[ For High Quality and/or Reliability Equipment
(Automotive Electronic Equipment / Industrial Equipment) ]

Please read this notice before using the TAIYO YUDEN products.

## ⚠ REMINDERS

- Product information in this catalog is as of October 2018. All of the contents specified herein are subject to change without notice due to technical improvements, etc. Therefore, please check for the latest information carefully before practical application or use of our products.

  Please note that TAIYO YUDEN shall not be in any way responsible for any damages and defects in products or equipment incorporating our products, which are caused under the conditions other than those specified in this catalog or individual product specification sheets.

- Please contact TAIYO YUDEN for further details of product specifications as the individual product specification sheets are available.

- Please conduct validation and verification of our products in actual condition of mounting and operating environment before using our products.

- The products listed in this catalog are intended for use in general electronic equipment (e.g., AV equipment, OA equipment, home electric appliances, office equipment, information and communication equipment), medical equipment classified as Class I or II by IMDRF, industrial equipment, and automotive interior applications, etc. Please be sure to contact TAIYO YUDEN for further information before using the products for any equipment which may directly cause loss of human life or bodily injury (e.g., transportation equipment including, without limitation, automotive powertrain control system, train control system, and ship control system, traffic signal equipment, medical equipment classified as Class III by IMDRF).

  Please do not incorporate our products into any equipment requiring high levels of safety and/or reliability (e.g., aerospace equipment, aviation equipment*, medical equipment classified as Class IV by IMDRF, nuclear control equipment, undersea equipment, military equipment).

  *Note: There is a possibility that our products can be used only for aviation equipment that does not directly affect the safe operation of aircraft (e.g., in-flight entertainment, cabin light, electric seat, cooking equipment) if such use meets requirements specified separately by TAIYO YUDEN. Please be sure to contact TAIYO YUDEN for further information before using our products for such aviation equipment.

  When our products are used even for high safety and/or reliability-required devices or circuits of general electronic equipment, it is strongly recommended to perform a thorough safety evaluation prior to use of our products and to install a protection circuit as necessary.

  Please note that unless you obtain prior written consent of TAIYO YUDEN, TAIYO YUDEN shall not be in any way responsible for any damages incurred by you or third parties arising from use of the products listed in this catalog for any equipment requiring inquiry to TAIYO YUDEN or prohibited for use by TAIYO YUDEN as described above.

- Information contained in this catalog is intended to convey examples of typical performances and/or applications of our products and is not intended to make any warranty with respect to the intellectual property rights or any other related rights of TAIYO YUDEN or any third parties nor grant any license under such rights.

- Please note that the scope of warranty for our products is limited to the delivered our products themselves and TAIYO YUDEN shall not be in any way responsible for any damages resulting from a fault or defect in our products. Notwithstanding the foregoing, if there is a written agreement (e.g., supply and purchase agreement, quality assurance agreement) signed by TAIYO YUDEN and your company, TAIYO YUDEN will warrant our products in accordance with such agreement.

- The contents of this catalog are applicable to our products which are purchased from our sales offices or authorized distributors (hereinafter "TAIYO YUDEN's official sales channel"). Please note that the contents of this catalog are not applicable to our products purchased from any seller other than TAIYO YUDEN's official sales channel.

- Caution for Export
  Some of our products listed in this catalog may require specific procedures for export according to "U.S. Export Administration Regulations", "Foreign Exchange and Foreign Trade Control Law" of Japan, and other applicable regulations. Should you have any questions on this matter, please contact our sales staff.

# Automotive Application Guide

We classify automotive electronic equipment into the following four application categories and set usable application categories for each of our products. When using our products for automotive electronic equipment, please be sure to check such application categories and use our products accordingly. Should you have any questions on this matter, please contact us.

| Category | Automotive Electronic Equipment (Typical Example) |
|---|---|
| POWERTRAIN | • Engine ECU (Electronically Controlled Fuel Injector)<br>• Cruise Control Unit<br>• 4WS (4 Wheel Steering)<br>• Automatic Transmission<br>• Power Steering<br>• HEV/PHV/EV Core Control (Battery, Inverter, DC-DC)<br>• Automotive Locator (Car location information providing device), etc. |
| SAFETY | • ABS (Anti-Lock Brake System)<br>• ESC (Electronic Stability Control)<br>• Airbag<br>• ADAS (Equipment that directly controls running, turning and stopping), etc. |
| BODY & CHASSIS | • Wiper<br>• Automatic Door<br>• Power Window<br>• Keyless Entry System<br>• Electric Door Mirror<br>• Interior Lighting<br>• LED Headlight<br>• TPMS (Tire Pressure Monitoring System)<br>• Anti-Theft Device (Immobilizer), etc. |
| INFOTAINMENT | • Car Infotainment System<br>• ITS/Telematics System<br>• Instrument Cluster<br>• ADAS (Sensor, Equipment that is not interlocked with safety equipment or powertrain), etc. |



▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our product specification sheets. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our website (http://www.ty-top.com/) .

# MULTILAYER CERAMIC CAPACITORS

REFLOW
AEC- Q200



■PART NUMBER

| J | M | K | 3 1 6 | △ | B J | 1 0 6 | M | L | H | T | △ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ | ⑩ | ⑪ | ⑫ |

△=Blank space

①Rated voltage

| Code | Rated voltage[VDC] |
|---|---|
| A | 4 |
| J | 6.3 |
| L | 10 |
| E | 16 |
| T | 25 |
| G | 35 |
| U | 50 |
| H | 100 |
| Q | 250 |
| S | 630 |

②Series name

| Code | Series name |
|---|---|
| M | Multilayer ceramic capacitor |
| V | Multilayer ceramic capacitor for high frequency |
| W | LW reverse type multilayer capacitor |

③End termination

| Code | End termination |
|---|---|
| K | Plated |
| J | Soft Termination |
| S | Cu Internal Electrodes (For High Frequency) |
| F | High Reliability Application |

④Dimension(L×W)

| Type | Dimensions (L×W)[mm] | EIA(inch) |
|---|---|---|
| 063 | 0.6 × 0.3 | 0201 |
| 105 | 1.0 × 0.5 | 0402 |
| | 0.52× 1.0 ※ | 0204 |
| 107 | 1.6 × 0.8 | 0603 |
| | 0.8 × 1.6 ※ | 0306 |
| 212 | 2.0 × 1.25 | 0805 |
| | 1.25× 2.0 ※ | 0508 |
| 316 | 3.2 × 1.6 | 1206 |
| 325 | 3.2 × 2.5 | 1210 |
| 432 | 4.5 × 3.2 | 1812 |

Note : ※LW reverse type(□WK) only

⑤Dimension tolerance

| Code | Type | L[mm] | W[mm] | T[mm] |
|---|---|---|---|---|
| △ | ALL | Standard | Standard | Standard |
| A | 063 | 0.6±0.05 | 0.3±0.05 | 0.3±0.05 |
| | 105 | 1.0±0.10 | 0.5±0.10 | 0.5±0.10 |
| | 107 | 1.6+0.15/−0.05 | 0.8+0.15/−0.05 | 0.8+0.15/−0.05 |
| | 212 | 2.0+0.15/−0.05 | 1.25+0.15/−0.05 | 0.85±0.10 |
| | | | | 1.25+0.15/−0.05 |
| | 316 | 3.2±0.20 | 1.6±0.20 | 1.6±0.20 |
| | 325 | 3.2±0.30 | 2.5±0.30 | 2.5±0.30 |
| B | 105 | 1.0+0.15/−0.05 | 0.5+0.15/−0.05 | 0.5+0.15/−0.05 |
| | 107 | 1.6+0.20/−0 | 0.8+0.20/−0 | 0.8+0.20/−0 |
| | 212 | 2.0+0.20/−0 | 1.25+0.20/−0 | 0.85±0.10 |
| | | | | 1.25+0.20/−0 |
| | 316 | 3.2±0.30 | 1.6±0.30 | 1.6±0.30 |
| C | 105 | 1.0+0.20/−0 | 0.5+0.20/−0 | 0.5+0.20/−0 |
| | 107 | 1.6+0.25/−0 | 0.8+0.25/−0 | 0.8+0.25/−0 |
| | 212 | 2.0+0.25/−0 | 1.25+0.25/−0 | 1.25+0.25/−0 |
| K | 212 | 2.0±0.15 | 1.25±0.15 | 0.85±0.15 |
| | 316 | 3.2±0.20 | 1.6±0.20 | 1.15±0.20 |
| | | | | 1.6±0.20 |
| | 325 | 3.2±0.50 | 2.5±0.30 | 2.5±0.30 |

Note: cf. STANDARD EXTERNAL DIMENSIONS △= Blank space

⑥Temperature characteristics code

■High dielectric type

| Code | Applicable standard | | Temperature range[℃] | Ref. Temp.[℃] | Capacitance change | Capacitance tolerance | Tolerance code |
|---|---|---|---|---|---|---|---|
| BJ | EIA | X5R | −55～+ 85 | 25 | ±15% | ±10% | K |
| | | | | | | ±20% | M |
| C6 | EIA | X6S | −55～+105 | 25 | ±22% | ±10% | K |
| | | | | | | ±20% | M |
| B7 | EIA | X7R | −55～+125 | 25 | ±15% | ±10% | K |
| | | | | | | ±20% | M |
| C7 | EIA | X7S | −55～+125 | 25 | ±22% | ±10% | K |
| | | | | | | ±20% | M |
| D7 | EIA | X7T | −55～+125 | 25 | +22%/−33% | ±10% | K |
| | | | | | | ±20% | M |

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■Temperature compensating type

| Code | Applicable standard | | Temperature range[℃] | Ref. Temp.[℃] | Capacitance change | Capacitance tolerance | Tolerance code |
|---|---|---|---|---|---|---|---|
| CG | JIS | CG | −55～＋125 | 20 | 0±30ppm/℃ | ±0.1pF | B |
| | | | | | | ±0.25pF | C |
| | | | | | | ±0.5pF | D |
| | EIA | C0G | | 25 | | ±1pF | F |
| | | | | | | ±2% | G |
| | | | | | | ±5% | J |

⑦Nominal capacitance

| Code (example) | Nominal capacitance |
|---|---|
| 0R5 | 0.5pF |
| 010 | 1pF |
| 100 | 10pF |
| 101 | 100pF |
| 102 | 1,000pF |
| 103 | 0.01μF |
| 104 | 0.1μF |
| 105 | 1.0μF |
| 106 | 10μF |
| 107 | 100μF |

Note : R=Decimal point

⑧Capacitance tolerance

| Code | Capacitance tolerance |
|---|---|
| A | ±0.05pF |
| B | ±0.1pF |
| C | ±0.25pF |
| D | ±0.5pF |
| G | ±2% |
| J | ±5% |
| K | ±10% |
| M | ±20% |

⑨Thickness

| Code | Thickness[mm] |
|---|---|
| P | 0.3 |
| T | |
| V | 0.5 |
| C | 0.7(107type or more) |
| A | 0.8 |
| D | 0.85(212type or more) |
| F | 1.15 |
| G | 1.25 |
| L | 1.6 |
| N | 1.9 |
| M | 2.5 |

⑩Special code

| Code | Special code |
|---|---|
| H | MLCC for Industrial and Automotive |

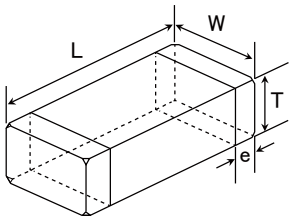
⑪Packaging

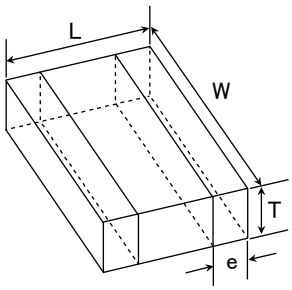
| Code | Packaging |
|---|---|
| F | φ178mm Taping (2mm pitch) |
| R | φ178mm Embossed Taping (4mm pitch) |
| T | φ178mm Taping (4mm pitch) |
| P | φ178mm Taping (4mm pitch, 1000 pcs/reel)<br>325 type(Thickness code M) |

⑫Internal code

| Code | Internal code |
|---|---|
| △ | Standard |

■STANDARD EXTERNAL DIMENSIONS




※ LW reverse type

| Type( EIA ) | Dimension [mm] (inch) | | | | |
|---|---|---|---|---|---|
| | L | W | T | *1 | e |
| □MK063(0201) | 0.6±0.03 (0.024±0.001) | 0.3±0.03 (0.012±0.001) | 0.3±0.03 (0.012±0.001) | T | 0.15±0.05 (0.006±0.002) |
| □MK105(0402) □MF105(0402) | 1.0±0.05 (0.039±0.002) | 0.5±0.05 (0.020±0.002) | 0.5±0.05 (0.020±0.002) | V | 0.25±0.10 (0.010±0.004) |
| □WK105(0204)※ | 0.52±0.05 (0.020±0.002) | 1.0±0.05 (0.039±0.002) | 0.3±0.05 (0.012±0.002) | P | 0.18±0.08 (0.007±0.003) |
| □MK107(0603) □MF107(0603) | 1.6±0.10 (0.063±0.004) | 0.8±0.10 (0.031±0.004) | 0.8±0.10 (0.031±0.004) | A | 0.35±0.25 (0.014±0.010) |
| □MJ107(0603) | 1.6±0.10 (0.063±0.004) | 0.8±0.10 (0.031±0.004) | 0.8±0.10 (0.031±0.004) | A | 0.35+0.3/−0.25 (0.014+0.012/−0.010) |
| □VS107(0603) | 1.6±0.10 (0.063±0.004) | 0.8±0.10 (0.031±0.004) | 0.7±0.10 (0.028±0.004) | C | 0.35±0.25 (0.014±0.010) |
| □WK107(0306)※ | 0.8±0.10 (0.031±0.004) | 1.6±0.10 (0.063±0.004) | 0.5±0.05 (0.020±0.002) | V | 0.25±0.15 (0.010±0.006) |
| □MK212(0805) □MF212(0805) | 2.0±0.10 (0.079±0.004) | 1.25±0.10 (0.049±0.004) | 0.85±0.10 (0.033±0.004) | D | 0.5±0.25 (0.020±0.010) |
| | | | 1.25±0.10 (0.049±0.004) | G | |
| □MJ212(0805) | 2.0±0.10 (0.079±0.004) | 1.25±0.10 (0.049±0.004) | 0.85±0.10 (0.033±0.004) | D | 0.5+0.35/−0.25 (0.020+0.014/−0.010) |
| | | | 1.25±0.10 (0.049±0.004) | G | |
| □VS212(0805) | 2.0±0.10 (0.079±0.004) | 1.25±0.10 (0.049±0.004) | 0.85±0.10 (0.033±0.004) | D | 0.5±0.25 (0.020±0.010) |
| □WK212(0508)※ | 1.25±0.15 (0.049±0.006) | 2.0±0.15 (0.079±0.006) | 0.85±0.10 (0.033±0.004) | D | 0.3±0.2 (0.012±0.008) |
| □MK316(1206) □MF316(1206) | 3.2±0.15 (0.126±0.006) | 1.6±0.15 (0.063±0.006) | 1.15±0.10 (0.045±0.004) | F | 0.5+0.35/−0.25 (0.020+0.014/−0.010) |
| | | | 1.6±0.20 (0.063±0.008) | L | |
| □MJ316(1206) | 3.2±0.15 (0.126±0.006) | 1.6±0.15 (0.063±0.006) | 1.15±0.10 (0.045±0.004) | F | 0.6+0.4/−0.3 (0.024+0.016/−0.012) |
| | | | 1.6±0.20 (0.063±0.008) | L | |
| □MK325(1210) □MF325(1210) | 3.2±0.30 (0.126±0.012) | 2.5±0.20 (0.098±0.008) | 1.15±0.10 (0.045±0.004) | F | 0.6±0.3 (0.024±0.012) |
| | | | 1.9±0.20 (0.075±0.008) | N | |
| | | | 2.5±0.20 (0.098±0.008) | M | |
| □MJ325(1210) | 3.2±0.30 (0.126±0.012) | 2.5±0.20 (0.098±0.008) | 1.9±0.20 (0.075±0.008) | N | 0.6+0.4/−0.3 (0.024+0.016/−0.012) |
| | | | 2.5±0.20 (0.098±0.008) | M | |
| □MK432(1812) | 4.5±0.40 (0.177±0.016) | 3.2±0.30 (0.126±0.012) | 2.5±0.20 (0.098±0.008) | M | 0.9±0.6 (0.035±0.024) |

Note : ※. LW reverse type, *1.Thickness code

■STANDARD QUANTITY

| Type | EIA (inch) | Dimension | | Standard quantity [pcs] | |
|---|---|---|---|---|---|
| | | [mm] | Code | Paper tape | Embossed tape |
| 063 | 0201 | 0.3 | T | 15000 | — |
| 105 | 0402 | 0.5 | V | 10000 | — |
| | 0204 ※ | 0.30 | P | | |
| 107 | 0603 | 0.7 | C | 4000 | — |
| | | 0.8 | A | | |
| | | 0.8 | A | 3000 (Soft Termination) | — |
| | | 0.8 | A | — | 3000 (Soft Termination) |
| | 0306 ※ | 0.50 | V | — | 4000 |
| 212 | 0805 | 0.85 | D | 4000 | — |
| | | 1.25 | G | — | 3000 |
| | | 1.25 | G | — | 2000 (Soft Termination) |
| | 0508 ※ | 0.85 | D | 4000 | — |
| 316 | 1206 | 1.15 | F | — | 3000 |
| | | 1.6 | L | — | 2000 |
| 325 | 1210 | 1.15 | F | — | 2000 |
| | | 1.9 | N | | |
| | | 2.5 | M | — | 500 (T), 1000 (P) |
| 432 | 1812 | 2.5 | M | — | 500 |

Note : ※.LW Reverse type (□WK)

■PART NUMBER

- All the Multilayer Ceramic Capacitors of the catalog lineup are RoHS compliant.
- Capacitance tolerance code is applied to □ of part number.
- All the Multilayer Ceramic Capacitors in the catalog lineup are applicable for reflow-soldering.

Note)
- The exchange of individual specifications is necessary depending on the application and circuit condition. Please contact Taiyo Yuden sales channels.
- *1: Automotive (AEC-Q200 Qualified) products for POWERTRAIN, and SAFETY. Please check "Automotive Application Guide" for further details before using the products.
  < AEC-Q200 : AEC-Q200 qualified>
  All the Multilayer Ceramic Capacitors of *1 marks are tested based on the test conditions and methods defined in AEC-Q200 family item.
  125℃ products: AEC-Q200 Grade1 (we conduct the evaluation at the test condition of Grade1.)
  Please consult with TAIYO YUDEN's official sales channel for the details of the product specification and AEC-Q200 test results, etc., and please review and approve TAIYO YUDEN's product specification before ordering.
- *3: For standard case size, please kindly refer to ④Dimension, ⑤Dimension tolerance, ⑨Thickness and STANDARD EXTERNAL DIMENSIONS.



## High Reliability Application Multilayer Ceramic Capacitors

### ●105TYPE (Demension:1.0×0.5mm JIS:1005 EIA:0402)

【Temperature Characteristic B7 : X7R(−55～+125℃)】 0.5mm thickness(V)

| Part number 1 | Part number 2 | Rated voltage [V] | Temperature characteristics | | Capacitance [F] | Capacitance tolerance [%] | tan δ [%] | HTLT Rated voltage x % | Thickness*3 [mm] | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| UMF105 B7102□VHF | | 50 | | X7R | 1000 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| UMF105 B7222□VHF | | | | X7R | 2200 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| UMF105 B7472□VHF | | | | X7R | 4700 p | ±10, ±20 | 2.5 | 150 | 0.5±0.05 | *1 |
| UMF105 B7103□VHF | | | | X7R | 0.01 μ | ±10, ±20 | 3.5 | 200 | 0.5±0.05 | *1 |
| TMF105 B7102□VHF | | 25 | | X7R | 1000 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| TMF105 B7222□VHF | | | | X7R | 2200 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| TMF105 B7472□VHF | | | | X7R | 4700 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| TMF105 B7103□VHF | | | | X7R | 0.01 μ | ±10, ±20 | 3.5 | 200 | 0.5±0.05 | *1 |
| TMF105 B7223□VHF | | | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 150 | 0.5±0.05 | *1 |
| TMF105 B7473□VHF | | | | X7R | 0.047 μ | ±10, ±20 | 3.5 | 150 | 0.5±0.05 | *1 |
| EMF105 B7102□VHF | | 16 | | X7R | 1000 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| EMF105 B7222□VHF | | | | X7R | 2200 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| EMF105 B7472□VHF | | | | X7R | 4700 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| EMF105 B7103□VHF | | | | X7R | 0.01 μ | ±10, ±20 | 3.5 | 200 | 0.5±0.05 | *1 |
| EMF105 B7223□VHF | | | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 200 | 0.5±0.05 | *1 |
| EMF105 B7473□VHF | | | | X7R | 0.047 μ | ±10, ±20 | 3.5 | 200 | 0.5±0.05 | *1 |
| EMF105 B7104□VHF | | | | X7R | 0.1 μ | ±10, ±20 | 5 | 150 | 0.5±0.05 | *1 |
| LMF105 B7102□VHF | | 10 | | X7R | 1000 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| LMF105 B7222□VHF | | | | X7R | 2200 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| LMF105 B7472□VHF | | | | X7R | 4700 p | ±10, ±20 | 2.5 | 200 | 0.5±0.05 | *1 |
| LMF105 B7103□VHF | | | | X7R | 0.01 μ | ±10, ±20 | 3.5 | 200 | 0.5±0.05 | *1 |
| LMF105 B7223□VHF | | | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 200 | 0.5±0.05 | *1 |
| LMF105 B7473□VHF | | | | X7R | 0.047 μ | ±10, ±20 | 3.5 | 200 | 0.5±0.05 | *1 |
| LMF105 B7104□VHF | | | | X7R | 0.1 μ | ±10, ±20 | 5 | 200 | 0.5±0.05 | *1 |

### ●107TYPE (Dimension:1.6×0.8mm JIS:1608 EIA:0603)

【Temperature Characteristic B7 : X7R(−55～+125℃)】 0.8mm thickness(A)

| Part number 1 | Part number 2 | Rated voltage [V] | Temperature characteristics | | Capacitance [F] | Capacitance tolerance [%] | tan δ [%] | HTLT Rated voltage x % | Thickness*3 [mm] | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| UMF107 B7223□AHT | | 50 | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 200 | 0.8±0.10 | *1 |
| UMF107 B7104□AHT | | | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 0.8±0.10 | *1 |
| TMF107 B7223□AHT | | 25 | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 200 | 0.8±0.10 | *1 |
| TMF107 B7104□AHT | | | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 0.8±0.10 | *1 |
| EMF107 B7223□AHT | | 16 | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 200 | 0.8±0.10 | *1 |
| EMF107 B7104□AHT | | | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 0.8±0.10 | *1 |
| EMF107 B7105□AHT | | | | X7R | 1 μ | ±10, ±20 | 10 | 150 | 0.8±0.10 | *1 |
| LMF107 B7223□AHT | | 10 | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 200 | 0.8±0.10 | *1 |
| LMF107 B7104□AHT | | | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 0.8±0.10 | *1 |
| LMF107 B7105□AHT | | | | X7R | 1 μ | ±10, ±20 | 10 | 150 | 0.8±0.10 | *1 |

■PART NUMBER

●212TYPE (Dimension:2.0×1.25mm JIS:2012 EIA:0805)

【Temperature Characteristic B7 : X7R(−55～+125℃)】 1.25mm thickness(G)

| Part number 1 | Part number 2 | Rated voltage [V] | Temperature characteristics | | Capacitance [F] | Capacitance tolerance [%] | tan δ [%] | HTLT Rated voltage x % | Thickness*3 [mm] | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| HMF212 B7103□GHT | | 100 | | X7R | 0.01 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| HMF212 B7223□GHT | | | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| UMF212 B7103□GHT | | 50 | | X7R | 0.01 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| UMF212 B7223□GHT | | | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| UMF212 B7473□GHT | | | | X7R | 0.047 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| UMF212 B7104□GHT | | | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| UMF212 B7224□GHT | | | | X7R | 0.22 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| UMF212 B7105□GHT | | | | X7R | 1 μ | ±10, ±20 | 10 | 150 | 1.25±0.10 | *1 |
| TMF212 B7103□GHT | | 25 | | X7R | 0.01 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| TMF212 B7223□GHT | | | | X7R | 0.022 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| TMF212 B7473□GHT | | | | X7R | 0.047 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| TMF212 B7104□GHT | | | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| TMF212 B7224□GHT | | | | X7R | 0.22 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| TMF212 B7105□GHT | | | | X7R | 1 μ | ±10, ±20 | 10 | 200 | 1.25±0.10 | *1 |
| EMF212 B7473□GHT | | 16 | | X7R | 0.047 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| EMF212 B7104□GHT | | | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| EMF212 B7224□GHT | | | | X7R | 0.22 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| EMF212 B7105□GHT | | | | X7R | 1 μ | ±10, ±20 | 10 | 200 | 1.25±0.10 | *1 |
| EMF212AB7475□GHT | | | | X7R | 4.7 μ | ±10, ±20 | 10 | 150 | 1.25+0.15/−0.05 | *1 |
| LMF212 B7473□GHT | | 10 | | X7R | 0.047 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| LMF212 B7104□GHT | | | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| LMF212 B7224□GHT | | | | X7R | 0.22 μ | ±10, ±20 | 3.5 | 200 | 1.25±0.10 | *1 |
| LMF212 B7105□GHT | | | | X7R | 1 μ | ±10, ±20 | 10 | 200 | 1.25±0.10 | *1 |
| LMF212 B7475□GHT | | | | X7R | 4.7 μ | ±10, ±20 | 10 | 150 | 1.25±0.10 | *1 |

●316TYPE (Dimension:3.2×1.6mm JIS:3216 EIA:1206)

【Temperature Characteristic B7 : X7R(−55～+125℃)】 1.15mm thickness(F)

| Part number 1 | Part number 2 | Rated voltage [V] | Temperature characteristics | | Capacitance [F] | Capacitance tolerance [%] | tan δ [%] | HTLT Rated voltage x % | Thickness*3 [mm] | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| HMF316 B7102□FHT | | 100 | | X7R | 1000 p | ±10, ±20 | 2.5 | 200 | 1.15±0.10 | *1 |
| HMF316 B7222□FHT | | | | X7R | 2200 p | ±10, ±20 | 2.5 | 200 | 1.15±0.10 | *1 |
| HMF316 B7472□FHT | | | | X7R | 4700 p | ±10, ±20 | 2.5 | 200 | 1.15±0.10 | *1 |
| HMF316 B7103□FHT | | | | X7R | 0.01 μ | ±10, ±20 | 2.5 | 200 | 1.15±0.10 | *1 |
| UMF316 B7102□FHT | | 50 | | X7R | 1000 p | ±10, ±20 | 2.5 | 200 | 1.15±0.10 | *1 |
| UMF316 B7222□FHT | | | | X7R | 2200 p | ±10, ±20 | 2.5 | 200 | 1.15±0.10 | *1 |
| UMF316 B7472□FHT | | | | X7R | 4700 p | ±10, ±20 | 2.5 | 200 | 1.15±0.10 | *1 |
| UMF316 B7103□FHT | | | | X7R | 0.01 μ | ±10, ±20 | 2.5 | 200 | 1.15±0.10 | *1 |

【Temperature Characteristic B7 : X7R(−55～+125℃)】 1.6mm thickness(L)

| Part number 1 | Part number 2 | Rated voltage [V] | Temperature characteristics | | Capacitance [F] | Capacitance tolerance [%] | tan δ [%] | HTLT Rated voltage x % | Thickness*3 [mm] | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| HMF316 B7104□LHT | | 100 | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 1.6±0.20 | *1 |
| UMF316 B7104□LHT | | 50 | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 1.6±0.20 | *1 |
| UMF316 B7105□LHT | | | | X7R | 1 μ | ±10, ±20 | 3.5 | 150 | 1.6±0.20 | *1 |
| TMF316 B7104□LHT | | 25 | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 1.6±0.20 | *1 |
| TMF316AB7475□LHT | | | | X7R | 4.7 μ | ±10, ±20 | 10 | 150 | 1.6±0.20 | *1 |
| EMF316AB7106□LHT | | 16 | | X7R | 10 μ | ±10, ±20 | 10 | 150 | 1.6±0.20 | *1 |
| JMF316AB7106□LHT | | 6.3 | | X7R | 10 μ | ±10, ±20 | 10 | 200 | 1.6±0.20 | *1 |

●325TYPE (Dimension:3.2×2.5mm JIS:3225 EIA:1210)

【Temperature Characteristic B7 : X7R(−55～+125℃)】 2.5mm thickness(M)

| Part number 1 | Part number 2 | Rated voltage [V] | Temperature characteristics | | Capacitance [F] | Capacitance tolerance [%] | tan δ [%] | HTLT Rated voltage x % | Thickness*3 [mm] | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| HMF325 B7225□MHP | | 100 | | X7R | 2.2 μ | ±10, ±20 | 3.5 | 150 | 2.5±0.20 | *1 |
| UMF325 B7225□MHP | | 50 | | X7R | 2.2 μ | ±10, ±20 | 3.5 | 200 | 2.5±0.20 | *1 |
| UMF325 B7475□MHP | | | | X7R | 4.7 μ | ±10, ±20 | 5 | 150 | 2.5±0.20 | *1 |
| TMF325 B7225□MHP | | 25 | | X7R | 2.2 μ | ±10, ±20 | 3.5 | 200 | 2.5±0.20 | *1 |
| TMF325 B7475□MHP | | | | X7R | 4.7 μ | ±10, ±20 | 5 | 200 | 2.5±0.20 | *1 |
| EMF325 B7225□MHP | | 16 | | X7R | 2.2 μ | ±10, ±20 | 3.5 | 200 | 2.5±0.20 | *1 |
| EMF325 B7475□MHP | | | | X7R | 4.7 μ | ±10, ±20 | 5 | 200 | 2.5±0.20 | *1 |
| LMF325 B7225□MHP | | 10 | | X7R | 2.2 μ | ±10, ±20 | 3.5 | 200 | 2.5±0.20 | *1 |
| LMF325 B7475□MHP | | | | X7R | 4.7 μ | ±10, ±20 | 5 | 200 | 2.5±0.20 | *1 |



▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our product specification sheets. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our website (http://www.ty-top.com/) .

■PART NUMBER

【Temperature Characteristic B7 : X7R(−55～+125℃)】 1.9mm thickness(N)

| Part number 1 | Part number 2 | Rated voltage [V] | Temperature characteristics | | Capacitance [F] | Capacitance tolerance [%] | tan δ [%] | HTLT Rated voltage x % | Thickness*3 [mm] | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| HMF325 B7223□NHT | | 100 | | X7R | 0.022 μ | ±10, ±20 | 2.5 | 200 | 1.9±0.20 | *1 |
| HMF325 B7473□NHT | | | | X7R | 0.047 μ | ±10, ±20 | 2.5 | 200 | 1.9±0.20 | *1 |
| UMF325 B7223□NHT | | 50 | | X7R | 0.022 μ | ±10, ±20 | 2.5 | 200 | 1.9±0.20 | *1 |
| UMF325 B7473□NHT | | | | X7R | 0.047 μ | ±10, ±20 | 2.5 | 200 | 1.9±0.20 | *1 |
| UMF325 B7104□NHT | | | | X7R | 0.1 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| UMF325 B7224□NHT | | | | X7R | 0.22 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| UMF325 B7474□NHT | | | | X7R | 0.47 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| UMF325 B7105□NHT | | | | X7R | 1 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| TMF325 B7224□NHT | | 25 | | X7R | 0.22 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| TMF325 B7474□NHT | | | | X7R | 0.47 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| TMF325 B7105□NHT | | | | X7R | 1 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| EMF325 B7224□NHT | | 16 | | X7R | 0.22 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| EMF325 B7474□NHT | | | | X7R | 0.47 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| EMF325 B7105□NHT | | | | X7R | 1 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| LMF325 B7224□NHT | | 10 | | X7R | 0.22 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| LMF325 B7474□NHT | | | | X7R | 0.47 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |
| LMF325 B7105□NHT | | | | X7R | 1 μ | ±10, ±20 | 3.5 | 200 | 1.9±0.20 | *1 |



▶ This catalog contains the typical specification only due to the limitation of space. When you consider the purchase of our products, please check our product specification sheets. For details of each product (characteristics graph, reliability information, precautions for use, and so on), see our website (http://www.ty-top.com/) .

## ■PACKAGING

### ①Minimum Quantity

●Taped package

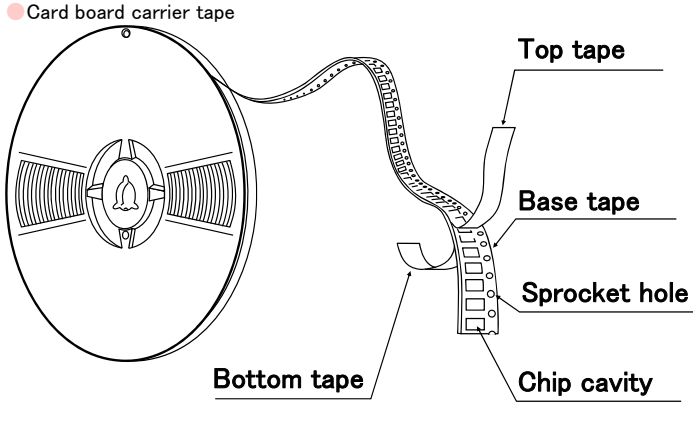
| Type(EIA) | Thickness | | Standard quantity [pcs] | |
|---|---|---|---|---|
| | mm | code | Paper tape | Embossed tape |
| □MK021(008004) | 0.125 | K | — | 50000 |
| □VS021(008004) | | | | |
| □MK042(01005) | 0.2 | C, D | — | 40000 |
| □VS042(01005) | 0.2 | C | | |
| □MK063(0201) | 0.3 | P,T | 15000 | — |
| □WK105(0204) ※ | 0.3 | P | 10000 | — |
| □MK105(0402)<br>□MF105(0402) | 0.13 | H | — | 20000 |
| | 0.18 | E | — | 15000 |
| | 0.2 | C | 20000 | — |
| | 0.3 | P | 15000 | — |
| | 0.5 | V | 10000 | — |
| □VK105(0402) | 0.5 | W | 10000 | — |
| □MK107(0603) | 0.45 | K | 4000 | — |
| □WK107(0306) ※ | 0.5 | V | — | 4000 |
| □MF107(0603) | 0.8 | A | 4000 | — |
| □VS107(0603) | 0.7 | C | 4000 | — |
| □MJ107(0603) | 0.8 | A | 3000 | 3000 |
| □MK212(0805)<br>□WK212(0508) ※<br>□MF212(0805) | 0.45 | K | 4000 | — |
| | 0.85 | D | | |
| | 1.25 | G | — | 3000 |
| □VS212(0805) | 0.85 | D | 4000 | — |
| □MJ212(0805) | 0.85 | D | 4000 | — |
| | 1.25 | G | — | 2000 |
| □MK316(1206)<br>□MF316(1206) | 0.85 | D | 4000 | — |
| | 1.15 | F | — | 3000 |
| | 1.6 | L | — | 2000 |
| □MJ316(1206) | 1.15 | F | — | 3000 |
| | 1.6 | L | — | 2000 |
| □MK325(1210)<br>□MF325(1210) | 0.85 | D | — | 2000 |
| | 1.15 | F | | |
| | 1.9 | N | | |
| | 2.0max. | Y | | |
| | 2.5 | M | — | 1000 |
| □MJ325(1210) | 1.9 | N | — | 2000 |
| | 2.5 | M | — | 500(T), 1000(P) |
| □MK432(1812) | 2.5 | M | — | 500 |

Note : ※ LW Reverse type.

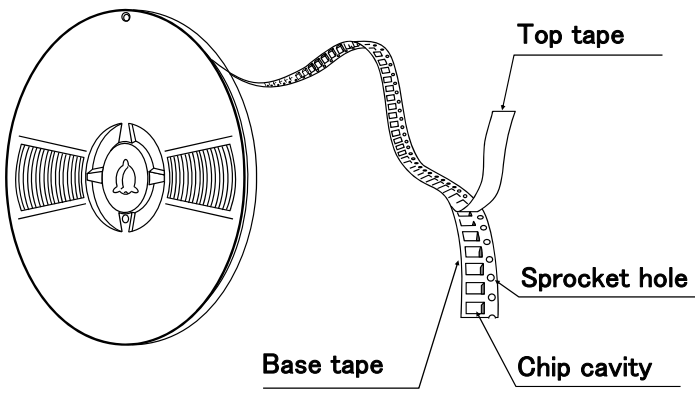
### ②Taping material

※No bottom tape for pressed carrier tape

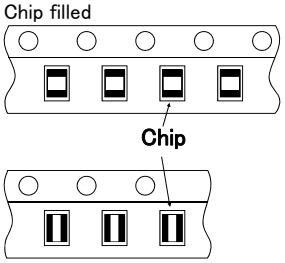
●Card board carrier tape




●Embossed tape



Chip filled



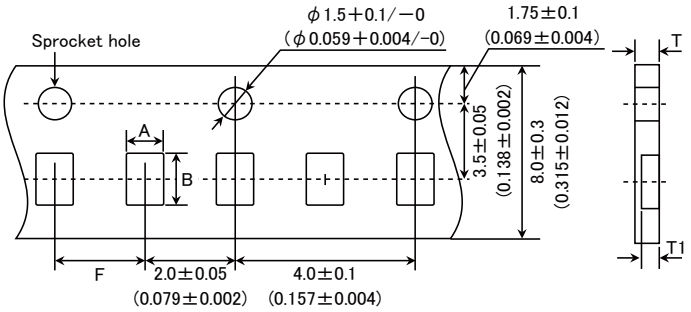

※ LW Reverse type.

## ③Representative taping dimensions

●Paper Tape(8mm wide)

●Pressed carrier tape( 2mm pitch)

Unit:mm(inch)



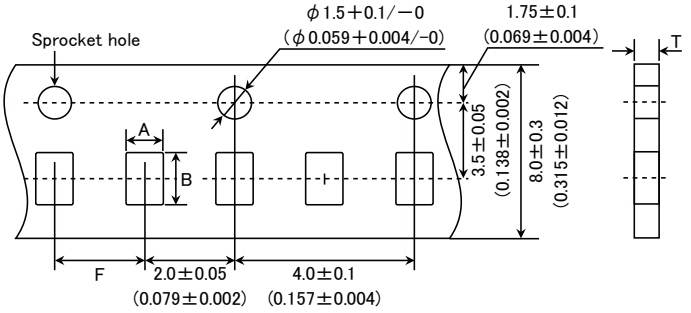

| Type(EIA) | Chip Cavity | | Insertion Pitch | Tape Thickness | |
|---|---|---|---|---|---|
| | A | B | F | T | T1 |
| □MK063(0201) | 0.37 | 0.67 | 2.0±0.05 | 0.45max. | 0.42max. |
| □WK105(0204) ※ | 0.65 | 1.15 | | | |
| □MK105(0402) (*1 C) | | | | 0.4max. | 0.3max. |
| □MK105(0402) (*1 P) | | | | 0.45max. | 0.42max. |

Note *1 Thickness, C:0.2mm ,P:0.3mm. ※ LW Reverse type.

Unit:mm

●Punched carrier tape (2mm pitch)

Unit:mm(inch)

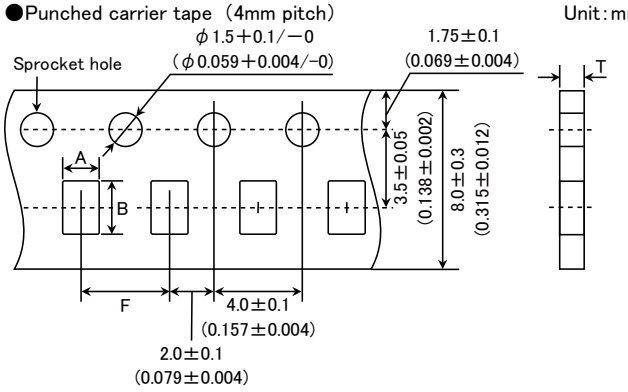



| Type(EIA) | Chip Cavity | | Insertion Pitch | Tape Thickness |
|---|---|---|---|---|
| | A | B | F | T |
| □MK105 (0402)<br>□MF105 (0402)<br>□VK105 (0402) | 0.65 | 1.15 | 2.0±0.05 | 0.8max. |

Unit:mm

●Punched carrier tape (4mm pitch)

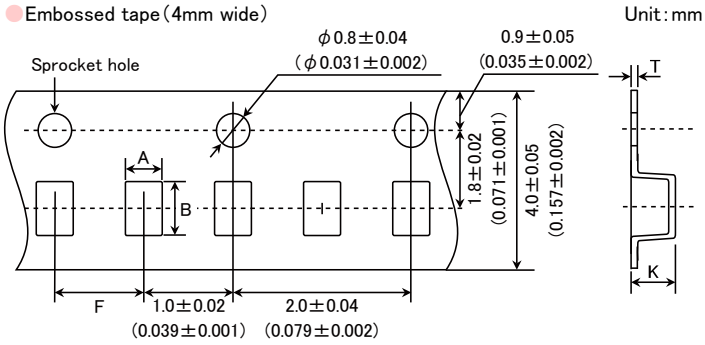
Unit:mm(inch)



| Type(EIA) | Chip Cavity | | Insertion Pitch | Tape Thickness |
|---|---|---|---|---|
| | A | B | F | T |
| □MK107(0603)<br>□WK107(0306) ※<br>□MF107(0603) | 1.0 | 1.8 | 4.0±0.1 | 1.1max. |
| □MK212(0805)<br>□WK212(0508) ※ | 1.65 | 2.4 | | 1.1max. |
| □MK316(1206) | 2.0 | 3.6 | | |

Note : Taping size might be different depending on the size of the product. ※ LW Reverse type. Unit : mm

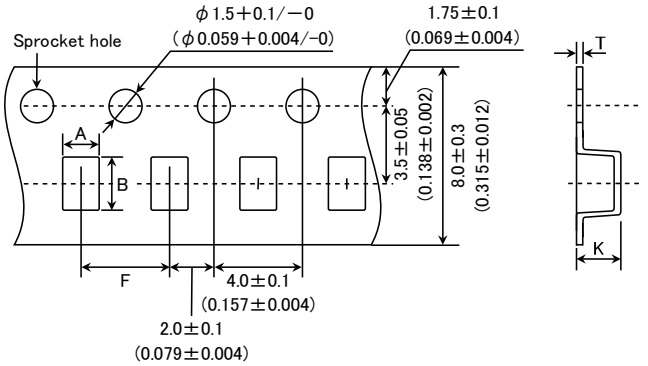
● Embossed tape (4mm wide) Unit : mm (inch)




| Type(EIA) | Chip Cavity | | Insertion Pitch | Tape Thickness | |
|---|---|---|---|---|---|
| | A | B | F | K | T |
| □MK021(008004) | 0.135 | 0.27 | 1.0±0.02 | 0.5max. | 0.25max. |
| □VS021(008004) | | | | | |
| □MK042(01005) | 0.23 | 0.43 | | | |
| □VS042(01005) | | | | | |

Unit : mm

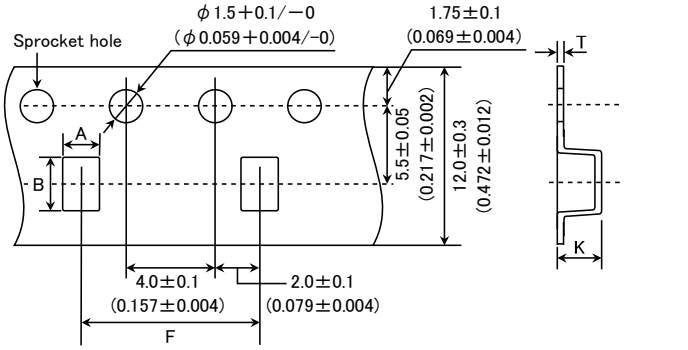
● Embossed tape (8mm wide) Unit : mm (inch)




| Type(EIA) | Chip Cavity | | Insertion Pitch | Tape Thickness | |
|---|---|---|---|---|---|
| | A | B | F | K | T |
| □MK105(0402) | 0.6 | 1.1 | 2.0±0.1 | 0.6max | 0.2±0.1 |
| □WK107(0306) ※ | 1.0 | 1.8 | 4.0±0.1 | 1.3max. | 0.25±0.1 |
| □MK212(0805)<br>□MF212(0805) | 1.65 | 2.4 | | 3.4max. | 0.6max. |
| □MK316(1206)<br>□MF316(1206) | 2.0 | 3.6 | | | |
| □MK325(1210)<br>□MF325(1210) | 2.8 | 3.6 | | | |

Note : ※ LW Reverse type. Unit : mm

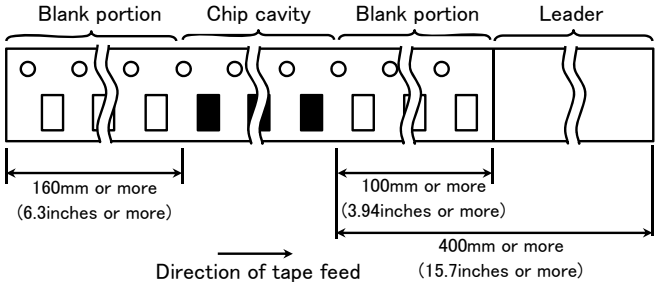
● Embossed tape (12mm wide)　　Unit : mm (inch)



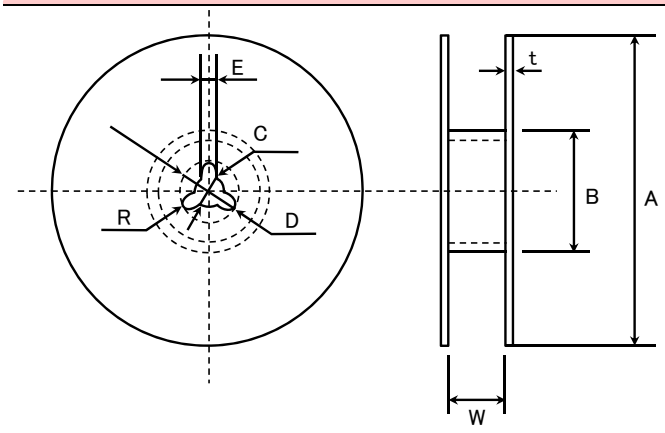

| Type(EIA) | Chip Cavity | | Insertion Pitch | Tape Thickness | |
|---|---|---|---|---|---|
| | A | B | F | K | T |
| □MK325(1210) | 3.1 | 4.0 | 8.0±0.1 | 4.0max. | 0.6max. |
| □MK432(1812) | 3.7 | 4.9 | 8.0±0.1 | 4.0max. | 0.6max. |

Unit : mm

## ④Trailer and Leader




## ⑤Reel size



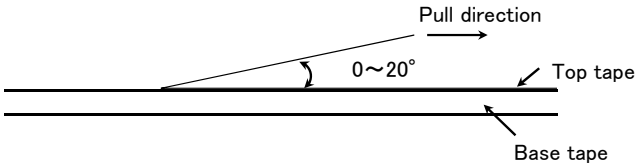

| A | B | C | D | E | R |
|---|---|---|---|---|---|
| φ178±2.0 | φ50min. | φ13.0±0.2 | φ21.0±0.8 | 2.0±0.5 | 1.0 |

| | T | W |
|---|---|---|
| 4mm wide tape | 1.5max. | 5±1.0 |
| 8mm wide tape | 2.5max. | 10±1.5 |
| 12mm wide tape | 2.5max. | 14±1.5 |

Unit : mm

## ⑥Top Tape Strength

The top tape requires a peel-off force of 0.1 to 0.7N in the direction of the arrow as illustrated below.



# High Reliability Application Multilayer Ceramic Capacitors

■RELIABILITY DATA

| 1. Operating Temperature Range | |
|---|---|
| Specified Value | X7R(−55℃ to +125℃) |
| Test Methods and Remarks | Continuous use is available in this range. (reference temperature : 25℃) |

| 2.Highest Operating temperature Range | |
|---|---|
| Specified Value | X7R(−55℃ to +125℃) |
| Test Methods and Remarks | Maximum ambient temperature at which capacitors can be continuously used with rated voltage applied. |

| 3. Rated Voltage | |
|---|---|
| Specified Value | Please refer to the page of the "PART NUMBERS". |
| Test Methods and Remarks | Continuous maximum applied voltage. If an AC voltage is loaded on a DC voltage, the sum of the two peak voltages should be lower than the rated voltage of the capacitor. |

| 4. Shape and Dimensions | |
|---|---|
| Specified Value | Please refer to the page of the "EXTERNAL DIMENSIONS". |

| 5. Heat Treatment (Class Ⅱ) | |
|---|---|
| Test Methods and Remarks | Initial value shall be measured after test sample is heat−treated at 150+0/−10℃ for an hour and kept at room temperature for 24 ± 2 hours. |

| 6. Voltage Treatment (Class Ⅱ) | |
|---|---|
| Test Methods and Remarks | Initial value shall be measured after test sample is voltage−treated for an hour at temperature and voltage which are specified as test conditions, and kept at room temperature for 24 ±2 hours. |

| 7. Dielectric Withstanding Voltage (between terminals) | |
|---|---|
| Specified Value | No abnormality. |
| Test Methods and Remarks | Applied voltage : Rated voltage × 2.5<br>Duration : 1 to 5 seconds.<br>Charging and discharging current shall be 50mA max. |

| 8. Insulation Resistance | |
|---|---|
| Specified Value | Larger than whichever smaller of 500 MΩ・μF or $10^4$ MΩ |
| Test Methods and Remarks | Applied voltage : Rated voltage<br>Duration : 60±5 seconds.<br>Charging and discharging current shall be 50mA max. |

| 9. Capacitance and Tolerance | |
|---|---|
| Specified Value | Please refer to the page of the "PART NUMBERS". |
| Test Methods and Remarks | Measurement frequency : 1kHz±10%(C≦10μF)<br>Measurement voltage : 1±0.2Vrms(C≦10μF)<br>0.5±0.1V(6.3V rated voltage)<br>Heat treatment specified in No.5 of the specification shall be conducted prior to measurement. |
| 10. Q or Dissipation factor (tan δ) | |
| Specified Value | Please refer to the page of the "PART NUMBERS". |
| Test Methods and Remarks | Measurement frequency : 1kHz±10%(C≦10μF)<br>Measurement voltage : 1±0.2Vrms(C≦10μF)<br>0.5±0.1V(6.3V rated voltage)<br>Heat treatment specified in No.5 of the specification shall be conducted prior to measurement. NO DC bias is applied. |

## 11. Temperature Characteristic (without DC bias)

**Specified Value**

X7R(−55℃ to +125℃):±15%

**Test Methods and Remarks**

Confirming to EIA RS−198−D (1991)
Heat treatment specified in No.5 of the specification shall be conducted prior to measurement.
Change of the maximum capacitance deviation in step 1 to 5.

| step | Temperature(℃) |
|---|---|
| 1 | +25 |
| 2 | Minimum operating temperature |
| 3 | +25 |
| 4 | Maximum operating temperature |
| 5 | +25 |

## 12. Adhesive Force of Terminal Electrodes

**Specified Value**

Appearance: Terminal electrodes shall be no exfoliation or a sign of exfoliation.

**Test Methods and Remarks**

Solder lands refer to fig.1.

| | 1608 size | larger than 2012 size |
|---|---|---|
| Applying force | 5N | 10N |
| Duration | 30±5 seconds. | |
| Board | Glass epoxy-resin substrate | |
| Thickness | 1.6mm | |

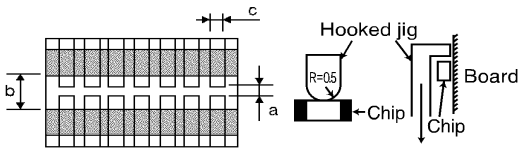


Fig.1

| | Case size | | | |
|---|---|---|---|---|
| Dimension | 1608 | 2012 | 3216 | 3225 |
| a | 1.0 | 1.2 | 2.2 | 2.2 |
| b | 3.0 | 4.0 | 5.0 | 5.0 |
| c | 1.2 | 1.65 | 2.0 | 2.9 |

## 13. Vibration

**Specified Value**

Appearance : No abnormality
Capacitance change : Initial value shall be satisfied.
Dissipation factor : Initial value shall be satisfied.
Insulation resistance : Initial value shall be satisfied.

**Test Methods and Remarks**

Heat treatment specified in No.5 of the specification shall be conducted prior to test. Measurement shall be conducted after test sample is heat treated as specified in No.5.
Solder lands refer to figure 1.
Direction of the vibration test : X, Y, Z each of 3 orientations for 2 hours respectively (total 6 hours)
Vibrationfrequency : 10 to 55 to 10Hz (1 minutes each)
Total amplitude : 1.5 mm
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

## 14. Resistance to Soldering Heat

**Specified Value**

Appearance : No abnormality
Capacitance change : ≦±7.5%
Dissipation factor : Initial value shall be satisfied.
Insulation resistance : Initial value shall be satisfied.
Dielectric withstanding voltage (between terminals) : No abnormality

**Test Methods and Remarks**

Heat treatment specified in No.5 of the specification shall be conducted prior to test.
Immerse test sample in an solder solution (Sn-3Ag-0.5Cu).
Soldering temperature : 270℃±5℃
Duration : 3±0.5 seconds
Soaking position : Test sample is soaked until the termnal electrode is covered in solder solution.
Preheating condition : 3216 size or smaller size: 120 to 150℃ for 1 minute,
3225 size: 100 to 120℃ for 1 minute, 170 to 200℃ for 1 minute.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

## 15. Solderability

**Specified Value**

More than 95% of terminal electrode shall be covered with fresh solder.

**Test Methods and Remarks**

Heat treatment specified in No.5 of the specification shall be conducted prior to test.
Immerse test sample in an solder solution(Sn-3Ag-0.5Cu).
Soldering temperature : 245℃±5℃
Duration : 4±1 seconds
Dipping position : Test sample is immersed until the terminal electrode is covered in solder solution.

## 16. Thermal shock

**Specified Value**

| | |
|---|---|
| Appearance | : No abnormality |
| Capacitance change | : ≦±7.5% |
| Dissipation factor | : Initial value shall be satisfied. |
| Insulation resistance | : Initial value shall be satisfied. |
| Dielectric withstanding voltage | (between terminals) : No abnormality |

**Test Methods and Remarks**

Heat treatment specified in No.5 of the specification shall be conducted prior to test.
Measurement shall be conducted after test sample is heat treated as specified in No.5.
condition of the one cycle (Air−Air)

| Step | Temperature(℃) | Time(min.) | Transfer time |
|---|---|---|---|
| 1 | Minimum usage temperature | 15 | within 20 seconds |
| 2 | Maximum usage temperature | 15 | within 20 seconds |

Test cycles:100 times.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

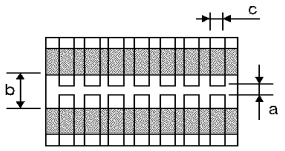


Fig.2

| | Case size | | | |
|---|---|---|---|---|
| Dimension | 1608 | 2012 | 3216 | 3225 |
| a | 0.6 | 0.8 | 2.0 | 2.0 |
| b | 2.2 | 3.0 | 4.4 | 4.4 |
| c | 0.9 | 1.3 | 1.7 | 2.6 |

## 17. Humidity Loading

**Specified Value Note1**

| | |
|---|---|
| Appearance | : No abnormality |
| Capacitance change | : ±12.5% |
| Dissipation factor | : 5.0%max. |
| Insulation resistance | : Larger than whichever smaller of 25MΩ･μF or 500MΩ |

**Test Methods and Remarks**

| | |
|---|---|
| Test condition | : 85℃/85%RH. |
| Duration | : 1000 +48/−0 hours. |
| DC bias | : Applied rated voltage. |

Voltage treatment specified in No.6 of the specification shall be conducted prior to test.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

## 18. High Temperature Loading

**Specified Value Note1**

| | |
|---|---|
| Appearance | : No abnormality |
| Capacitance change | : ≦±12.5% |
| Dissipation factor | : 5.0%max. |
| Insulation resistance | : Larger than whichever smaller of 25MΩ･μF or 500MΩ |

**Test Methods and Remarks**

Voltage treatment specified in No.6 of the specification shall be conducted prior to test.
Test sample shall be put in thermostatic oven with maximum temperature.

| | |
|---|---|
| Applied voltage | : Rated voltage x 2 |
| Duration | : 1000 +48/−0 hours. |

Charging and discharging current shall be 50mA or less.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

## 19. Resistance to Flexure of substrate

**Specified Value**

| | |
|---|---|
| Appearance | : No abnormality |
| Capacitance change | : ≦±12.5% |
| Dissipation factor | : 5.0%max. |
| Insulation resistance | : Initial value shall be satisfied. |

**Test Methods and Remarks**

| | |
|---|---|
| Warp | : 1mm |
| Testing board | : Grass epoxy − resin substrate |
| Thickness | : 1.6mm |
| Test board and solder lands | : Refer to fig. 3. |

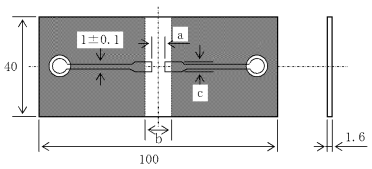


Fig.3

| | Case size | | | |
|---|---|---|---|---|
| Dimension | 1608 | 2012 | 3216 | 3225 |
| a | 0.6 | 0.8 | 2.0 | 2.0 |
| b | 2.2 | 3.0 | 4.4 | 4.4 |
| c | 0.9 | 1.3 | 1.7 | 2.6 |

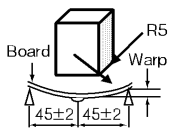


Fig.4

Measurement shall be made with board in the bent position.(fig.4)

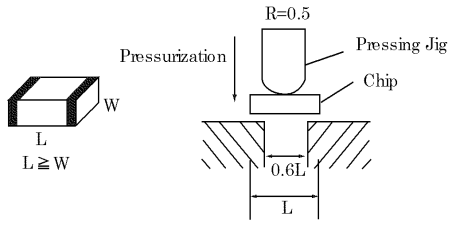
| 20. High Temperature Exposure | |
|---|---|
| Specified Value<br>Note1 | Appearance : No abnormality<br>Capacitance change : ≦±12.5%<br>Dissipation factor : 5.0%max.<br>Insulation resistance : Larger than whichever smaller of 500MΩ･μF or 10000MΩ |
| Test Methods and Remarks | Heat treatment specified in No.5 of the specification shall be conducted prior to test.<br>Test sample shall be put in thermostatic oven with maximum temperature.<br>Duration : 1000 +48/−0 hours.<br>Initial value shall be measured after test sample is heat−treated specified No.5.<br>Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours. |

| 21. Temperature Cycling | |
|---|---|
| Specified Value<br>Note1 | Appearance : No abnormality<br>Capacitance change : ≦±7.5%<br>Dissipation factor : Initial value shall be satisfied<br>Insulation resistance : Initial value shall be satisfied |
| Test Methods and Remarks | Heat treatment specified in No.5 of the specification shall be conducted prior to test.<br>Measurement shall be conducted after test sample is heat treated as specified in No.5.<br>condition of the one cycle |

| Step | Temperature(℃) | Time(min.) |
|---|---|---|
| 1 | Minimum usage temperature | 30±3 |
| 2 | +25 | 2 to 3 |
| 3 | Maximum usage temperature | 30±3 |
| 4 | +25 | 2 to 3 |

Test cycles:200 times
Solder lands refer to fig. 2.
Measurement after the test shall be made after test sample is kept at room temperature for 24 ±2 hours.

| 22. Body strength | |
|---|---|
| Specified Value | No mechanical damage |
| Test Methods and Remarks | Applying force : 10N<br>Applying time : 10 seconds |




Note 1 The figures indicate typical specifications. Please refer to individual specifications in detail.

# Precautions on the use of High Reliability Application Multilayer Ceramic Capacitors

■PRECAUTIONS

## 1.Circuit Design

**Precautions**

◆Verification of operating environment, electrical rating and performance

1. A malfunction in medical equipment, spacecraft, nuclear reactors, etc. may cause serious harm to human life or have severe social ramifications.
   As such, any capacitors to be used in such equipment may require higher safety and/or reliability considerations and should be clearly differentiated from components used in general purpose applications.

◆Operating Voltage (Verification of Rated voltage)

1. The operating voltage for capacitors must always be lower than their rated values.
   If an AC voltage is loaded on a DC voltage, the sum of the two peak voltages should be lower than the rated value of the capacitor chosen. For a circuit where both an AC and a pulse voltage may be present, the sum of their peak voltages should also be lower than the capacitor's rated voltage.
2. Even if the applied voltage is lower than the rated value, the reliability of capacitors might be reduced if either a high frequency AC voltage or a pulse voltage having rapid rise time is present in the circuit.

## 2. PCB Design

**Precautions**

◆Pattern configurations (Design of Land-patterns)

1. When capacitors are mounted on a PCB, the amount of solder used (size of fillet) can directly affect capacitor performance. Therefore, the following items must be carefully considered in the design of solder land patterns:
   (1) The amount of solder applied can affect the ability of chips to withstand mechanical stresses which may lead to breaking or cracking. Therefore, when designing land-patterns it is necessary to consider the appropriate size and configuration of the solder pads which in turn determines the amount of solder necessary to form the fillets.
   (2) When more than one part is jointly soldered onto the same land or pad, the pad must be designed so that each component's soldering point is separated by solder-resist.

◆Pattern configurations (Capacitor layout on panelized [breakaway] PC boards)

1. After capacitors have been mounted on the boards, chips can be subjected to mechanical stresses in subsequent manufacturing processes (PCB cutting, board inspection, mounting of additional parts, assembly into the chassis, wave soldering the reflow soldered boards etc.) For this reason, planning pattern configurations and the position of SMD capacitors should be carefully performed to minimize stress.

**Technical considerations**

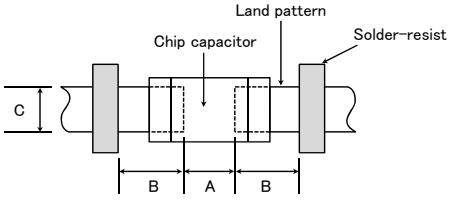
◆Pattern configurations (Design of Land-patterns)

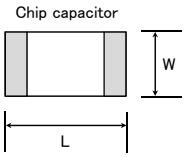
1. The following diagrams and tables show some examples of recommended patterns to prevent excessive solder amounts. (larger fillets which extend above the component end terminations) Examples of improper pattern designs are also shown.
   (1) Recommended land dimensions for a typical chip capacitor land patterns for PCBs

Recommended land dimensions for reflow-soldering (unit: mm)

| Type | | 107 | 212 | 316 | 325 |
|---|---|---|---|---|---|
| Size | L | 1.6 | 2.0 | 3.2 | 3.2 |
| | W | 0.8 | 1.25 | 1.6 | 2.5 |
| A | | 0.8～1.0 | 0.8～1.2 | 1.8～2.5 | 1.8～2.5 |
| B | | 0.6～0.8 | 0.8～1.2 | 1.0～1.5 | 1.0～1.5 |
| C | | 0.6～0.8 | 0.9～1.6 | 1.2～2.0 | 1.8～3.2 |

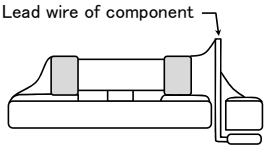
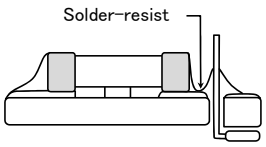
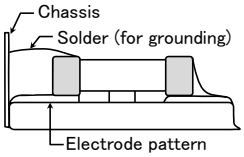
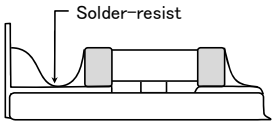
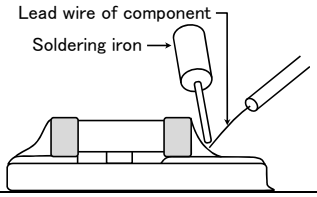
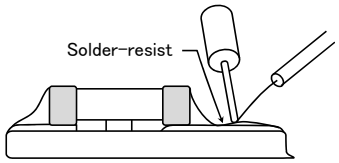
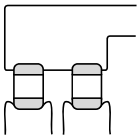
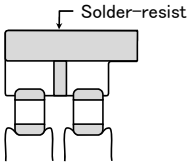
Land patterns for PCBs



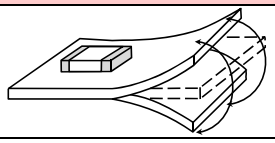
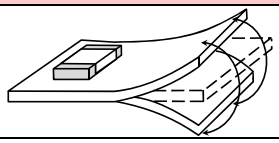

Excess solder can affect the ability of chips to withstand mechanical stresses. Therefore, please take proper precautions when designing land-patterns.

(2) Examples of good and bad solder application

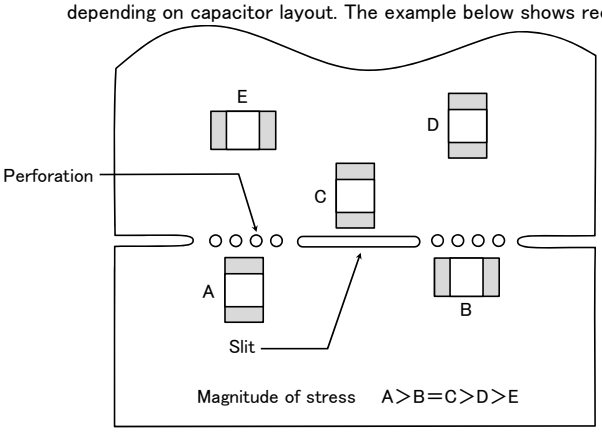
| Items | Not recommended | Recommended |
|---|---|---|
| Mixed mounting of SMD and leaded components |  |  |
| Component placement close to the chassis |  |  |
| Hand-soldering of leaded components near mounted components |  |  |
| Horizontal component placement |  |  |

◆Pattern configurations (Capacitor layout on panelized [breakaway] PC boards)

1-1. The following is examples of good and bad capacitor layout; SMD capacitors should be located to minimize any possible mechanical stresses from board warp or deflection.

| Items | Not recommended | Recommended |
|---|---|---|
| Deflection of board |  |  Place the product at a right angle to the direction of the anticipated mechanical stress. |

1-2. To layout the capacitors for the breakaway PC board, it should be noted that the amount of mechanical stresses given will vary depending on capacitor layout. The example below shows recommendations for better design.




1-3. When breaking PC boards along their perforations, the amount of mechanical stress on the capacitors can vary according to the method used. The following methods are listed in order from least stressful to most stressful: push-back, slit, V-grooving, and perforation. Thus, any ideal SMD capacitor layout must also consider the PCB splitting procedure.

## 3.Soldering

### Precautions

◆Selection of Flux

1. Since flux may have a significant effect on the performance of capacitors, it is necessary to verify the following conditions prior to use;
   (1) Flux used should be with less than or equal to 0.1 wt% (equivalent to chlorine) of halogenated content. Flux having strong acidity content should not be applied.
   (2) When soldering capacitors on the board, the amount of flux applied should be controlled at the optimum level.
   (3) When using water-soluble flux, special care should be taken to properly clean the boards.

◆Soldering

1. Temperature, time, amount of solder, etc. are specified in accordance with the following recommended conditions.
   Sn-Zn solder paste can affect MLCC reliability performance.
   Please contact us prior to usage.

### Technical considerations

◆Selection of Flux

1-1. When too much halogenated substance (Chlorine, etc.) content is used to activate the flux, or highly acidic flux is used, an excessive amount of residue after soldering may lead to corrosion of the terminal electrodes or degradation of insulation resistance on the surface of the capacitors.

1-2. Flux is used to increase solderability in flow soldering, but if too much is applied, a large amount of flux gas may be emitted and may detrimentally affect solderability. To minimize the amount of flux applied, it is recommended to use a flux-bubbling system.

1-3. Since the residue of water-soluble flux is easily dissolved by water content in the air, the residue on the surface of capacitors in high humidity conditions may cause a degradation of insulation resistance and therefore affect the reliability of the components. The cleaning methods and the capability of the machines used should also be considered carefully when selecting water-soluble flux.

◆Soldering

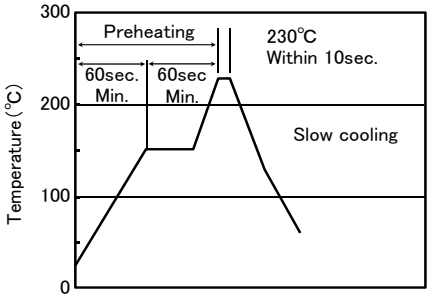
1-1. Preheating when soldering

Heating: Ceramic chip components should be preheated to within 100 to 130℃ of the soldering.
Cooling: The temperature difference between the components and cleaning process should not be greater than 100℃.
Ceramic chip capacitors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling. Therefore, the soldering process must be conducted with great care so as to prevent malfunction of the components due to excessive thermal shock.

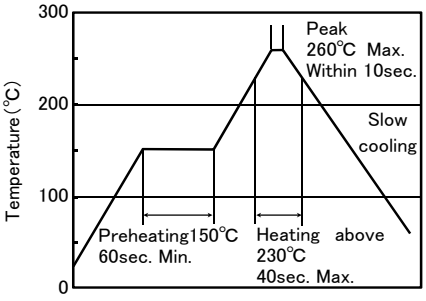
【Recommended conditions for soldering】

[Reflow soldering]

Temperature profile




【Recommended conditions for Pd Free soldering】

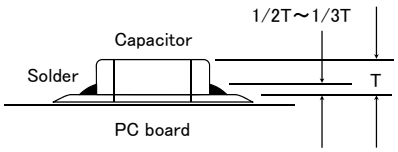



※Ceramic chip components should be preheated to within 100 to 130℃ of the soldering.

※Assured to be reflow soldering for 2 times.

Caution

①The ideal condition is to have solder mass (fillet) controlled to 1/2 to 1/3 of the thickness of the capacitor, as shown below:




②Because excessive dwell times can detrimentally affect solderability, soldering duration should be kept as close to recommended times as possible.