



信昌電子陶瓷股份有限公司
Prosperity Dielectrics Co., Ltd.

No.220-1, Sec. 2, Nanshan Rd., Lujhu, Taoyuan 33860, Taiwan, R.O.C.
Tel. : 886-3-3224471 Fax : 886-3-3212216

Messrs. : 一般共用

Date : _____

APPROVAL SHEET

Product Name : Safety Certified Multilayer Ceramic Chip Capacitors

Part No. : FK / FH Series

Description : X1/Y2 & X2 Class, Size 1808~2220, C0G/X7R, 250VAC & UL E231248 Certified, Size 1206, X7R, 2.5KVDC

| PREPARED BY | APPROVED BY |
|-------------|-------------|
| | |

信昌電子陶瓷股份有限公司

PROSPERITY DIELECTRICS CO., LTD.

桃園縣蘆竹鄉南山路二段 220-1 號 <http://www.pdc.com.tw>

Tel: 03-322-4471 ext: Fax: 03-322-5231 / 03-321-2215

Contact: _____ Mobile: _____





信昌電子陶瓷股份有限公司
Prosperity Dielectrics Co., Ltd.

No.220-1, Sec. 2, Nanshan Rd., Lujhu, Taoyuan 33860, Taiwan, R.O.C.
 Tel. : 886-3-3224471 Fax : 886-3-3212216

SPECIFICATION

FOR

Product Name : Safety Certified Multilayer Ceramic Chip Capacitors

Part No. : FK / FH Series

Description : X1/Y2 & X2 Class, Size 1808~2220, C0G/X7R, 250VAC & UL E231248 Certified, Size 1206, X7R, 2.5KVDC

| | |
|------------------|--------------------------|
| SPEC. No. | : <u>FKFH-000-001-03</u> |
| DATE | : |

| DRAWN BY | CHECEKED BY | APPROVED BY |
|-------------------|-------------------|------------------|
| Yvens Chou | Yvens Chou | Ryan Chen |



1. INTRODUCTION

PROSPERITY's SAFETY CERTIFIED CAPACITORS are designed for surge or lightning immunity in modem facsimile and other equipments. The capacitors of series FK are class X1/Y2 compliant respectively.

The green type capacitors in FK series are manufactured by using environmentally friendly materials without lead or cadmium.

The terminations are composed of plated nickel and pure tin to feature the superior leaching resistance during soldering.

2. FEATURES

- High reliability and stability.
- Small size and high capacitance.
- RoHS compliant.
- Safety standard approval by :
EN 60384-14 : 2013
IEC 60384-14 : 2013
UL 60384-14 (Ed 2.0)
UL 62368-1 (2nd Edition)
- Certificate number :
R 50041666 & R 50359148 by TUV.
E346791 (FOWX2/8) by UL, E231248 by UL.
- HALOGEN compliant.



3. APPLICATIONS

- Modem.
- Facsimile.
- Telephone.
- Other electronic equipment for lightning or surge protection and isolation.

4. HOW TO ORDER

| <u>FK</u> | <u>08</u> | <u>N</u> | <u>100</u> | <u>J</u> | <u>502</u> | <u>E</u> | <u>F</u> | <u>G</u> |
|------------|-----------|------------|-------------|-----------|---------------|-----------|-----------|--------------|
| PDC Family | Size | Dielectric | Capacitance | Tolerance | Rated Voltage | Packaging | Thickness | Control Code |
| Table1 | Table2 | Table3 | Table4 | Table5 | Table6 | Table7 | Table8 | Table9 |

※ Reference document with No.11 reference table detail.

5. EXTERNAL DIMENSIONS

| Size Inch (mm) | L (mm) | W (mm) | Code / T (mm) | M _B (mm) | |
|----------------|---------------|-----------|-----------------------------|---------------------|--|
| 1206(3216) | 3.30±0.30 | 1.60±0.20 | See No.11 Reference Table 8 | 0.50±0.25 | |
| 1808(4520) | 4.50+0.5/-0.3 | 2.00±0.25 | | 0.75±0.35 | |
| 1812(4532) | 4.50+0.5/-0.3 | 3.20±0.40 | | 0.75±0.35 | |
| 2211(5728) | 5.70±0.40 | 2.80±0.30 | | 0.85±0.35 | |
| 2220(5750) | 5.70±0.40 | 5.00±0.40 | | 0.85±0.35 | |

Fig. 5.1 The outline of MLCC

6. GENERAL ELECTRICAL DATA

| Dielectric | C0G | | X7R | | | | | | | |
|------------------------------------|--|--|---|-----------------|-------------|-------------------------|-------------|---|--|--|
| Size | 1808, 1812, 2211 | | 1808, 1812, 2211, 2220 | 1206 | | | | | | |
| Rated voltage | 250VAC | | | 2.5KVDC | | | | | | |
| Capacitance range | X1/Y2 Class (Impulse 6KV) : 4pF ~ 100pF X1/Y2 Class (Impulse 5KV) : 3pF ~ 720pF X2 Class : 3pF ~ 1000pF | | X1/Y2 Class : 100pF ~ 4700pF X2 Class : 150pF ~ 22000pF | 100pF ~ 1000pF | | | | | | |
| Capacitance tolerance | <table border="1"> <thead> <tr> <th>Cap. Rang</th> <th>Tolerance Spec.</th> </tr> </thead> <tbody> <tr> <td>Cap.<10pF</td> <td>D (±0.5pF)</td> </tr> <tr> <td>10pF≤Cap.</td> <td>F (±1%), G (±2%), J (±5%), K (±10%), M (±20%)</td> </tr> </tbody> </table> | | Cap. Rang | Tolerance Spec. | Cap.<10pF | D (±0.5pF) | 10pF≤Cap. | F (±1%), G (±2%), J (±5%), K (±10%), M (±20%) | J (±5%) K (±10%) M (±20%) | |
| Cap. Rang | Tolerance Spec. | | | | | | | | | |
| Cap.<10pF | D (±0.5pF) | | | | | | | | | |
| 10pF≤Cap. | F (±1%), G (±2%), J (±5%), K (±10%), M (±20%) | | | | | | | | | |
| Tan δ | <table border="1"> <thead> <tr> <th>Cap. Rang</th> <th>Q Spec.</th> </tr> </thead> <tbody> <tr> <td>Cap.<30pF</td> <td>Q≥400+20C</td> </tr> <tr> <td>Cap.≥30pF</td> <td>Q≥1000</td> </tr> </tbody> </table> | | Cap. Rang | Q Spec. | Cap.<30pF | Q≥400+20C | Cap.≥30pF | Q≥1000 | ≤2.5% | |
| Cap. Rang | Q Spec. | | | | | | | | | |
| Cap.<30pF | Q≥400+20C | | | | | | | | | |
| Cap.≥30pF | Q≥1000 | | | | | | | | | |
| Capacitance & Tan δ Test condition | Measured at the condition of 30~70% related humidity | | | | | | | | | |
| | for 25°C at ambient temperature | | Preconditioning for Class II MLCC : Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Cap. Rang</th> <th>Test Condition</th> </tr> </thead> <tbody> <tr> <td>Cap.≤1000pF</td> <td>1.0±0.2Vrms, 1.0MHz±10%</td> </tr> <tr> <td>Cap.>1000pF</td> <td>1.0±0.2Vrms, 1.0KHz±10%</td> </tr> </tbody> </table> | | Cap. Rang | Test Condition | Cap.≤1000pF | 1.0±0.2Vrms, 1.0MHz±10% | Cap.>1000pF | 1.0±0.2Vrms, 1.0KHz±10% | 1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature | |
| Cap. Rang | Test Condition | | | | | | | | | |
| Cap.≤1000pF | 1.0±0.2Vrms, 1.0MHz±10% | | | | | | | | | |
| Cap.>1000pF | 1.0±0.2Vrms, 1.0KHz±10% | | | | | | | | | |
| Insulation resistance | ≥100GΩ or RxC≥1000Ω-F, whichever is smaller | | ≥10GΩ or RxC≥500Ω-F, whichever is smaller | | | | | | | |
| Operating temperature | -55°C to +125°C | | | | | | | | | |
| Temperature coefficient | ±30ppm /°C | | ±15% | | | | | | | |
| Termination | Cu or Ag/Ni/Sn (lead-free termination) | | | | | | | | | |

7. CAPACITANCE RANGE

| Class | | X1/Y2 (FK series) | | | | | | | | X2 (FH series) | | | | | |
|---------------|----------|----------------------------|------|------|------|------|------|------|------|----------------|------|------|------|------|---------|
| Rated voltage | | 250Vac | | | | | | | | | | | | | 2.5KVdc |
| Certificated | | TUV IEC60384-14 / UL 60384 | | | | | | | | | | | | | |
| Dielectric | | C0G | | | | X7R | | | | C0G | | X7R | | | X7R |
| Cap.(pF) | EIA Size | 1808 | 1812 | 2211 | 2211 | 1808 | 1812 | 2211 | 2220 | 1808 | 1812 | 1808 | 1812 | 2220 | 1206 |
| | Impulse | 5KV | | | 6KV | 5KV | | | | 2.5KV | | | | | --- |
| 3.0 | 3R0 | D | | | | | | | | D | | | | | |
| 3.3 | 3R3 | D | | | | | | | | D | | | | | |
| 4.0 | 4R0 | D | | F | F | | | | | D | | | | | |
| 4.7 | 4R7 | D | | F | F | | | | | D | | | | | |
| 5.0 | 5R0 | D | | F | F | | | | | D | | | | | |
| 5.6 | 5R6 | D | | F | F | | | | | D | | | | | |
| 6.8 | 6R8 | D | | F | F | | | | | D | | | | | |
| 8.2 | 8R2 | D | | F | F | | | | | D | | | | | |
| 9.0 | 9R0 | D | | F | F | | | | | D | | | | | |
| 10 | 100 | D | C | F | F | | | | | D | C | | | | |
| 12 | 120 | D | C | F | F | | | | | D | C | | | | |
| 15 | 150 | D | C | F | F | | | | | D | C | | | | |
| 18 | 180 | D | C | F | F | | | | | D | C | | | | |
| 22 | 220 | D | C | F | F | | | | | D | C | | | | |
| 27 | 270 | D | C | F | F | | | | | D | C | | | | |
| 33 | 330 | D | C | F | F | | | | | D | C | | | | |
| 39 | 390 | E | C | F | F | | | | | E | C | | | | |
| 47 | 470 | E | C | F | F | | | | | E | C | | | | |
| 56 | 560 | E | C | F | F | | | | | E | C | | | | |
| 68 | 680 | E | C | F | G | | | | | E | C | | | | |
| 82 | 820 | E | C | F | G | | | | | E | C | | | | |
| 100 | 101 | F | C | F | H | E | | | | F | C | | | | C |
| 120 | 121 | F | C | G | | E | | | | F | C | | | | C |
| 130 | 131 | F | C | G | | E | | E | | F | C | | | | C |
| 150 | 151 | F | C | G | | E | E | E | | F | C | E | | | C |
| 160 | 161 | F | C | G | | E | E | E | F | F | C | E | | | C |
| 180 | 181 | F | C | G | | E | E | E | F | F | C | E | | | C |
| 220 | 221 | F | F | G | | E | E | E | F | F | C | E | | | C |
| 270 | 271 | F | F | G | | F | E | E | F | F | C | E | E | | C |
| 300 | 301 | | F | G | | F | E | E | F | F | C | E | E | | C |
| 330 | 331 | | F | G | | F | E | E | F | F | C | E | E | | C |
| 390 | 391 | | F | G | | F | E | E | F | F | C | E | E | | C |
| 470 | 471 | | F | G | | F | E | F | F | F | C | E | E | | C |
| 560 | 561 | | | G | | F | E | F | F | F | C | E | E | | C |
| 680 | 681 | | | G | | F | F | F | F | F | F | E | E | | C |
| 720 | 721 | | | G | | F | F | F | F | F | F | E | E | | C |
| 820 | 821 | | | | | F | F | F | F | F | F | E | E | | C |
| 1000 | 102 | | | | | F | G | G | F | F | F | F | E | | C |
| 1200 | 122 | | | | | | | G | G | | | F | E | | |
| 1500 | 152 | | | | | | | G | G | | | F | F | | |
| 1800 | 182 | | | | | | | G | G | | | F | F | | |
| 2200 | 222 | | | | | | | G | G | | | F | G | | |
| 2700 | 272 | | | | | | | | G | | | | G | | |
| 3300 | 332 | | | | | | | | G | | | | G | | |
| 3900 | 392 | | | | | | | | G | | | | G | | |
| 4700 | 472 | | | | | | | | G | | | | G | | |
| 5600 | 562 | | | | | | | | | | | | G | | |
| 6800 | 682 | | | | | | | | | | | | | | |
| 8200 | 822 | | | | | | | | | | | | | | |
| 10000 | 103 | | | | | | | | | | | | | G | |
| 12000 | 123 | | | | | | | | | | | | | G | |
| 15000 | 153 | | | | | | | | | | | | | G | |
| 18000 | 183 | | | | | | | | | | | | | G | |
| 22000 | 223 | | | | | | | | | | | | | H | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Standard Methods | Test Condition | Requirements | | | | | | | | | | | | | | |
|----------------|---|--|---|--|-----------------|----------------|-------------------|---------------|-------------------|---|--|---|----------------|--------------|---------------|---|----------------|---|
| 1. | Visual examination and Dimensions | IEC 60384-1 4.1 | --- | * No remarkable defect. * Dimensions to confirm to individual specification sheet. | | | | | | | | | | | | | | |
| 2. | Capacitance | IEC 60384-1 4.2.2 | * Class I : (C0G) Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%. * Class II : (X7R) 1.0±0.2Vrms, 1KHz±10%. | * Capacitance is within specified tolerance. * C _R means rated capacitance for conform to the E6 series of preferred values given in IEC 60063. | | | | | | | | | | | | | | |
| 3. | Q/D.F. (Dissipation Factor) | IEC 60384-1 4.2.3 | | <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Q/D.F.</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Class I (C0G)</td> <td>Q≥1000</td> <td>Cap.≥30pF</td> </tr> <tr> <td>Q≥400+20C</td> <td>Cap.<30pF</td> </tr> <tr> <td>Class II (X7R)</td> <td>D.F.≤2.5%</td> <td></td> </tr> </tbody> </table> | Dielectric | Q/D.F. | Remark | Class I (C0G) | Q≥1000 | Cap.≥30pF | Q≥400+20C | Cap.<30pF | Class II (X7R) | D.F.≤2.5% | | | | |
| Dielectric | Q/D.F. | Remark | | | | | | | | | | | | | | | | |
| Class I (C0G) | Q≥1000 | Cap.≥30pF | | | | | | | | | | | | | | | | |
| | Q≥400+20C | Cap.<30pF | | | | | | | | | | | | | | | | |
| Class II (X7R) | D.F.≤2.5% | | | | | | | | | | | | | | | | | |
| 4. | Temperature Coefficient | IEC 60384-21/22 4.6 | * With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp.</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> </tbody> </table> | T.C. | Operating Temp. | C0G | -55~125°C at 25°C | X7R | -55~125°C at 25°C | <table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>±15%</td> </tr> </tbody> </table> | T.C. | Capacitance Change | C0G | ±30ppm/°C | X7R | ±15% | | |
| T.C. | Operating Temp. | | | | | | | | | | | | | | | | | |
| C0G | -55~125°C at 25°C | | | | | | | | | | | | | | | | | |
| X7R | -55~125°C at 25°C | | | | | | | | | | | | | | | | | |
| T.C. | Capacitance Change | | | | | | | | | | | | | | | | | |
| C0G | ±30ppm/°C | | | | | | | | | | | | | | | | | |
| X7R | ±15% | | | | | | | | | | | | | | | | | |
| 5. | Voltage proof (Dielectric Strength) | IEC 60384-14 4.2.1 | * To apply voltage : X Capacitor : 1075Vdc (4.3U _R). Y Capacitor : 1500Vac. * Duration : 60 sec. * The charge current shall not exceed 0.05A. * The voltage shall be raised from the near zero to the test voltage a rate not exceeding 150V(r.m.s.)/sec. * For FH06X series : 2.5KVdc. | * No evidence of damage or flash over during test. | | | | | | | | | | | | | | |
| 6. | Insulation Resistance | IEC 60384-21/22 4.5.3 | <table border="1"> <thead> <tr> <th>Rated Vol.(V)</th> <th>Apply Voltage</th> <th>Charge Current</th> <th>Charge Time</th> </tr> </thead> <tbody> <tr> <td>>500</td> <td>500Vdc</td> <td>≤50mA</td> <td>60 sec.</td> </tr> </tbody> </table> | Rated Vol.(V) | Apply Voltage | Charge Current | Charge Time | >500 | 500Vdc | ≤50mA | 60 sec. | <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Requirements</th> </tr> </thead> <tbody> <tr> <td>Class I (C0G)</td> <td>≥100GΩ or RxC≥1000Ω-F, whichever is smaller</td> </tr> <tr> <td>Class II (X7R)</td> <td>≥10GΩ or RxC≥500Ω-F, whichever is smaller</td> </tr> </tbody> </table> | Dielectric | Requirements | Class I (C0G) | ≥100GΩ or RxC≥1000Ω-F, whichever is smaller | Class II (X7R) | ≥10GΩ or RxC≥500Ω-F, whichever is smaller |
| Rated Vol.(V) | Apply Voltage | Charge Current | Charge Time | | | | | | | | | | | | | | | |
| >500 | 500Vdc | ≤50mA | 60 sec. | | | | | | | | | | | | | | | |
| Dielectric | Requirements | | | | | | | | | | | | | | | | | |
| Class I (C0G) | ≥100GΩ or RxC≥1000Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | |
| Class II (X7R) | ≥10GΩ or RxC≥500Ω-F, whichever is smaller | | | | | | | | | | | | | | | | | |
| 7. | Solderability | IEC 60384-21/22 4.10 | * Solder temperature : 235±5°C (1210). * Solder temperature : 245±5°C (1808~2225). * Dipping time : 2±0.5 sec. | * 75% min. coverage of all metalized area. | | | | | | | | | | | | | | |
| 8. | Resistance to Soldering Heat | IEC 60384-14 4.4 IEC 60384-21/22 4.9 | * Solder temperature : 260±5°C. * Dipping time : 10±1 sec. * Preheating : 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Measurement to be made after keeping at room temperature for 24±2 hrs (Class I). | <table border="1"> <thead> <tr> <th>Dielectric</th> <th>I.R.</th> <th>Cap. Change</th> <th>Q/D.F.</th> </tr> </thead> <tbody> <tr> <td>Class I (C0G)</td> <td>≥1GΩ</td> <td>Within ±2.5% or ±0.25pF, whichever is larger</td> <td rowspan="2">≤100% of initial requirement</td> </tr> <tr> <td>Class II (X7R)</td> <td>≥1GΩ</td> <td>Within ±7.5%</td> </tr> </tbody> </table> | Dielectric | I.R. | Cap. Change | Q/D.F. | Class I (C0G) | ≥1GΩ | Within ±2.5% or ±0.25pF, whichever is larger | ≤100% of initial requirement | Class II (X7R) | ≥1GΩ | Within ±7.5% | | | |
| Dielectric | I.R. | Cap. Change | Q/D.F. | | | | | | | | | | | | | | | |
| Class I (C0G) | ≥1GΩ | Within ±2.5% or ±0.25pF, whichever is larger | ≤100% of initial requirement | | | | | | | | | | | | | | | |
| Class II (X7R) | ≥1GΩ | Within ±7.5% | | | | | | | | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Standard Methods | Test Condition | Requirements | | | | | | | | | | | | | | | |
|----------------|--|---|---|--|------------|-------------|-------------|----------------------------|---------------|--|---|--|----------------|----------------------------|---|---|------------|-----|--|
| 9. | Temperature Cycle | IEC 60384-21/22 4.11 | * Conduct the five cycles according to the temperatures and time. | <table border="1"> <thead> <tr> <th>Dielectric</th> <th>I.R.</th> <th>Cap. Change</th> <th>Q/D.F.</th> </tr> </thead> <tbody> <tr> <td>Class I (C0G)</td> <td rowspan="2">To meet initial requirement</td> <td>Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is larger</td> <td>$\leq 1.0(Q) \times$ initial requirement</td> </tr> <tr> <td>Class II (X7R)</td> <td>Within $\pm 7.5\%$</td> <td>$\leq 1.5(D.F.) \times$ initial requirement</td> </tr> </tbody> </table> | Dielectric | I.R. | Cap. Change | Q/D.F. | Class I (C0G) | To meet initial requirement | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is larger | $\leq 1.0(Q) \times$ initial requirement | Class II (X7R) | Within $\pm 7.5\%$ | $\leq 1.5(D.F.) \times$ initial requirement | | | | |
| | | | Dielectric | | I.R. | Cap. Change | Q/D.F. | | | | | | | | | | | | |
| Class I (C0G) | To meet initial requirement | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is larger | $\leq 1.0(Q) \times$ initial requirement | | | | | | | | | | | | | | | | |
| Class II (X7R) | | Within $\pm 7.5\%$ | $\leq 1.5(D.F.) \times$ initial requirement | | | | | | | | | | | | | | | | |
| | | | <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(°C)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30\pm3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30\pm3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> | Step | Temp.(°C) | Time(min.) | 1 | Min. operating temp. +0/-3 | 30 \pm 3 | 2 | Room temp. | 2~3 | 3 | Max. operating temp. +3/-0 | 30 \pm 3 | 4 | Room temp. | 2~3 | |
| Step | Temp.(°C) | Time(min.) | | | | | | | | | | | | | | | | | |
| 1 | Min. operating temp. +0/-3 | 30 \pm 3 | | | | | | | | | | | | | | | | | |
| 2 | Room temp. | 2~3 | | | | | | | | | | | | | | | | | |
| 3 | Max. operating temp. +3/-0 | 30 \pm 3 | | | | | | | | | | | | | | | | | |
| 4 | Room temp. | 2~3 | | | | | | | | | | | | | | | | | |
| | | | * Measurement to be made after keeping at room temperature for 24c hrs (Class I) | | | | | | | | | | | | | | | | |
| 10. | Humidity (Damp Heat) Steady State | IEC 60384-14 4.12 | * Test temp. : 40 \pm 2°C. | <table border="1"> <thead> <tr> <th>Dielectric</th> <th>I.R.</th> <th>Cap. Change</th> <th>Q/D.F.</th> </tr> </thead> <tbody> <tr> <td>Class I (C0G)</td> <td>$\geq 1\text{G}\Omega$ or $R_x C \geq 25 \Omega\text{-F}$, whichever is smaller</td> <td>Within $\pm 3.0\%$ or $\pm 2\text{pF}$, whichever is larger</td> <td>$\leq 0.25\%$</td> </tr> <tr> <td>Class II (X7R)</td> <td>whichever is smaller</td> <td>Within $\pm 15\%$</td> <td>$\leq 2.0(D.F.) \times$ initial requirement</td> </tr> </tbody> </table> | Dielectric | I.R. | Cap. Change | Q/D.F. | Class I (C0G) | $\geq 1\text{G}\Omega$ or $R_x C \geq 25 \Omega\text{-F}$, whichever is smaller | Within $\pm 3.0\%$ or $\pm 2\text{pF}$, whichever is larger | $\leq 0.25\%$ | Class II (X7R) | whichever is smaller | Within $\pm 15\%$ | $\leq 2.0(D.F.) \times$ initial requirement | | | |
| | | | Dielectric | | I.R. | Cap. Change | Q/D.F. | | | | | | | | | | | | |
| Class I (C0G) | $\geq 1\text{G}\Omega$ or $R_x C \geq 25 \Omega\text{-F}$, whichever is smaller | Within $\pm 3.0\%$ or $\pm 2\text{pF}$, whichever is larger | $\leq 0.25\%$ | | | | | | | | | | | | | | | | |
| Class II (X7R) | whichever is smaller | Within $\pm 15\%$ | $\leq 2.0(D.F.) \times$ initial requirement | | | | | | | | | | | | | | | | |
| | | | * Humidity : 90~95% RH. * Test time : 500 +24/-0hrs. * Applied voltage : 250Vac. * Measurement to be made after keeping at room temp. for 24 \pm 2 hrs (Class I) and 48 \pm 4 hrs (Class II). | * No remarkable damage. | | | | | | | | | | | | | | | |
| 11. | Passive Flammability | IEC 60384-14 4.17 IEC 60384-1 4.38 | * Volume sample : 21.56 mm ³ . * Flame exposure time : 5 sec. Max. * Category of flammability : C. | * Capacitor didn't burn at all. (FH06X series not include) | | | | | | | | | | | | | | | |
| 12. | Active Flammability | IEC 60384-14 4.17 IEC 60384-1 4.38 | * The capacitors applied UR (250Vac). Then each sample shall be subjected to 20 discharges from a tank capacitor, charge to a voltage that, when discharged, places Ui 2500V for X2, Ui 5000V for X1Y2 across the capacitor under test. The interval between successive discharges shall be 5 sec. | * The cheese cloth shall not burn with a flame. (FH06X series not include) | | | | | | | | | | | | | | | |
| 13. | High Temperature Load (Endurance) | IEC 60384-14 4.14 | * Impulse Voltage : Each individual capacitor shall be subjected to a Vp = 5.0KV (X1Y2 Class Impulse 5KV) & Vp = 6.0KV (X1Y2 Class Impulse 6KV) impulse for three times before applied to endurance test. | * Appearance : No mechanical damage. * Cap. change : C0G within $\pm 5\%$ or $\pm 0.5\text{pF}$, whichever is larger. X7R within $\pm 20\%$. * D.F. value : C0G $\leq 0.25\%$. X7R $\leq 5.0\%$. * I.R. $\geq 1\text{G}\Omega$. * Dielectric strength satisfies the specified initial value. | | | | | | | | | | | | | | | |
| | | | * Test temp. : 125 \pm 3°C. * Test time : 1000 +48/-0 hrs. * Applied voltage : X capacitor : 1.25UR (312.5Vac). Y capacitor : 1.70UR (425Vac). Once every hour the voltage shall be increased to 1000Vrms for 0.1 sec. * Measurement to be made after keeping at room temp. for 24 \pm 2 hrs (Class I) and 48 \pm 4 hrs (Class II). | | | | | | | | | | | | | | | | |
| | | | For FH06X series : * Test temp. : 125 \pm 3°C. * To apply voltage : 2.5KVdc. * Test time : 1000 +24/-0 hrs. * Measurement to be made after keeping at room temp. for 48 \pm 4 hrs. | | | | | | | | | | | | | | | | |

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item | Standard Methods | Test Condition | Requirements | | | | | | |
|----------------|---|--|---|---|------------|-------------|---------------|---|----------------|---------------|
| 14. | Resistance to Flexure of Substrate | IEC 60384-21/22 4.8 | <p>* Capacitors mounted on a substrate. The board shall be bent 1mm with a rate of 1mm/sec.</p> | <p>* No remarkable damage.</p> <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>Class I (COG)</td> <td>Within ±3.0% or ±2pF, whichever is larger</td> </tr> <tr> <td>Class II (X7R)</td> <td>Within ±12.5%</td> </tr> </tbody> </table> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</p> | Dielectric | Cap. Change | Class I (COG) | Within ±3.0% or ±2pF, whichever is larger | Class II (X7R) | Within ±12.5% |
| Dielectric | Cap. Change | | | | | | | | | |
| Class I (COG) | Within ±3.0% or ±2pF, whichever is larger | | | | | | | | | |
| Class II (X7R) | Within ±12.5% | | | | | | | | | |
| 15. | Adhesive Strength of Termination | IEC 60384-21/22 4.15 IEC 60384-1 4.13 | <p>* Capacitors mounted on a substrate. A force of 10N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10±1 sec.</p> | <p>* No remarkable damage or removal of the terminations.</p> | | | | | | |
| 16. | Vibration | IEC 60384-1 4.17 | <p>* Reflow solder the capacitors on P. C. Board before test.</p> <p>* Vibration frequency : 10~55 Hz/min.</p> <p>* Total amplitude : 1.5mm.</p> <p>* Repeat the conditions for 2 hours each in 3 perpendicular directions.</p> | <p>* No remarkable damage.</p> <p>* Cap. change and Q/D.F. : To meet initial spec.</p> | | | | | | |
| 17. | Impulse Voltage | IEC 60384-14 4.13 | <p>* X1 : 4.0KV, X2 : 2.5KV.</p> <p>* Y2 : 5.0KV.</p> <p>* Number of impulse : 24 max.</p> | <p>* There shall be no permanent breakdown or flashover.</p> <p>(FH06X series not include)</p> | | | | | | |

9. PACKAGE DIMENSION AND QUANTITY

| Size | Thickness (mm) | Plastic tape | |
|------------|----------------|--------------|----------|
| | | 7" reel | 13" reel |
| 1206(3216) | 1.25±0.10 | 3k | 10k |
| 1808(4520) | 1.25±0.10 | 2k | 10k |
| | 1.60±0.20 | 2k | 8k |
| 1812(4532) | 2.00±0.20 | 1k | 6k |
| | 1.25±0.10 | 1k | - |
| | 1.60±0.20 | 1k | - |
| | 2.00±0.20 | 1k | - |
| 2211(5728) | 2.50±0.30 | 0.5k | 3k |
| | 1.60±0.20 | 1k | - |
| | 2.00±0.20 | 1k | - |
| | 2.50±0.30 | 0.5k | - |
| 2220(5750) | 2.80±0.30 | 0.5k | - |
| | 2.00±0.20 | 1k | - |
| | 2.50±0.30 | 0.5k | 2k |

| REEL DIMENSIONS | |
|-----------------|------------------------------|
| Size | 1206, 1808, 1812, 2211, 2220 |
| Reel size | 7" |
| C | 13.0 +0.5/-0.2 |
| W ₁ | 12.4 +2.0/-0 |
| A | 178.0±0.1 |
| N | 80.0±1.0 |

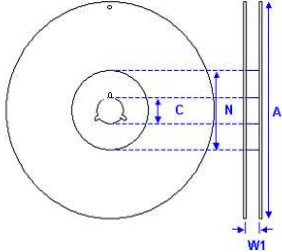
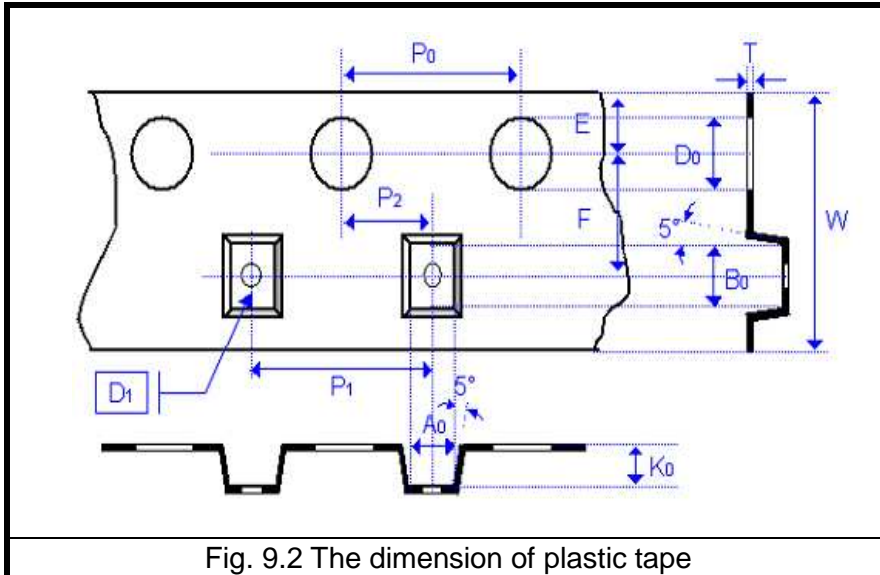


Fig. 9.1 The dimension of plastic tape

9.1. EMBOSSED TAPE DIMENSIONS



| Size | 1206 | 1808 | | 1812 | | 2211 | | 2220 | | | |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Chip Thickness | 1.25±0.10 | 1.25±0.10 | 1.40±0.15 | 2.00±0.20 | 1.25±0.10 | 1.60±0.20 | 2.00±0.20 | 2.50±0.30 | 2.80±0.30 | 2.00±0.20 | 2.50±0.30 |
| A ₀ | <2.00 | <2.50 | <2.50 | <2.50 | <3.90 | <3.90 | <3.30 | <3.30 | <3.30 | <5.80 | <5.80 |
| B ₀ | <3.60 | <5.30 | <5.30 | <5.30 | <5.30 | <5.30 | <6.50 | <6.50 | <6.50 | <6.50 | <6.50 |
| T | 0.23±0.05 | 0.25±0.05 | 0.25±0.05 | 0.25±0.05 | 0.25±0.05 | 0.25±0.05 | 0.30±0.10 | 0.30±0.10 | 0.30±0.10 | 0.30±0.10 | 0.30±0.10 |
| K ₀ | <2.50 | <2.50 | <2.50 | <2.50 | <2.50 | <3.00 | <2.50 | <3.10 | <3.10 | <2.50 | <3.10 |
| W | 8.00±0.10 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 | 12.0±0.20 |
| P ₀ | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 |
| 10xP ₀ | 40.00±0.20 | 40.0±0.20 | 40.0±0.20 | 40.0±0.20 | 40.00±0.20 | 40.00±0.20 | 40.0±0.20 | 40.0±0.20 | 40.0±0.20 | 40.00±0.20 | 40.00±0.20 |
| P ₁ | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 4.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 | 8.00±0.10 |
| P ₂ | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 | 2.00±0.05 |
| D ₀ | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 | 1.50±0.10/-0 |
| D ₁ | 1.00±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 | 1.50±0.10 |
| E | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 | 1.75±0.10 |
| F | 3.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 | 5.50±0.05 |
| Unit : | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm |

Prosperity Dielectrics Co., Ltd.

No.220-1, Sec. 2, Nanshan Rd., Lujhu, Taoyuan 33860, Taiwan, R.O.C.

<http://www.pdc.com.tw>

SPEC. No. : FKFH-000-001-03



10. APPLICATION NOTES

STORAGE

To prevent the damage of solderability of terminations, the following storage conditions are recommended :

Indoors under 5 ~ 40°C and 20% ~ 70% RH.

No harmful gases containing sulfuric acid, ammonia, hydrogen sulfide or chlorine.

Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance. The product is recommended to be used within 12 months after shipment and checked the solderability before use.

HANDLING

Chip capacitors are dense, hard, brittle, and abrasive materials. They are liable to suffer mechanical damage, in the form of cracks or chips. Chip Capacitors should be handled with care to avoid contamination or damage. To use vacuum or plastic tweezers to pick up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

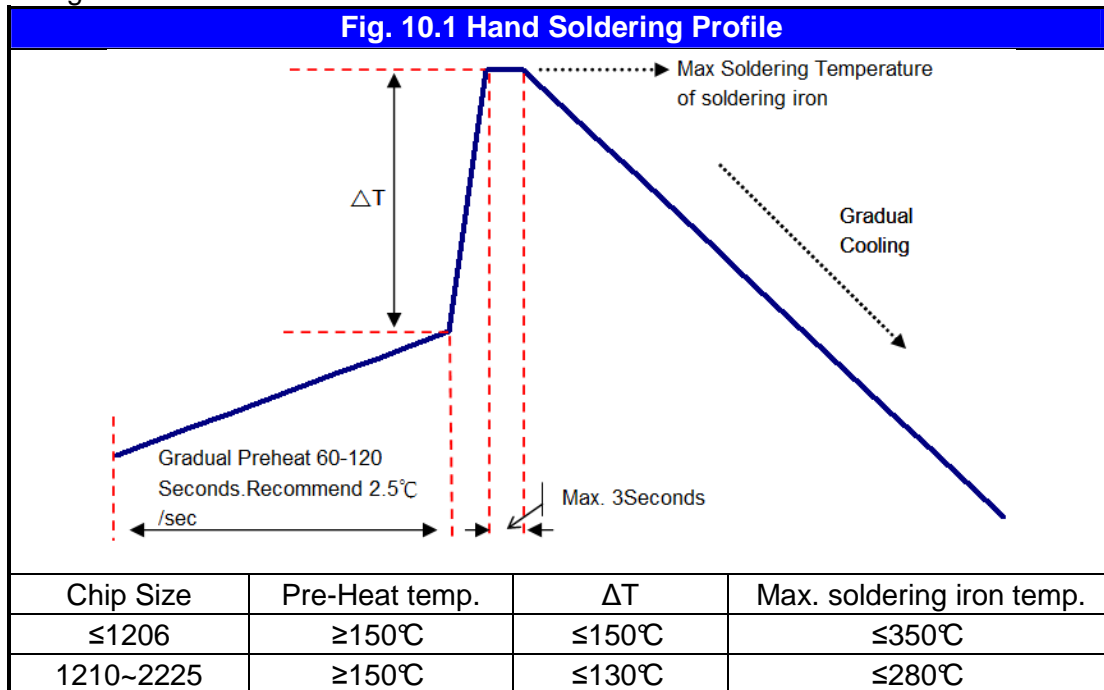
PREHEAT

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

SOLDERING

Use mildly activated rosin RA and RMA fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

a.) Hand soldering :



* Soldering iron tip diameter ≤ 1.0 mm and wattage max. 20W.

* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.

* The required amount of solder shall be melted on the soldering tip.

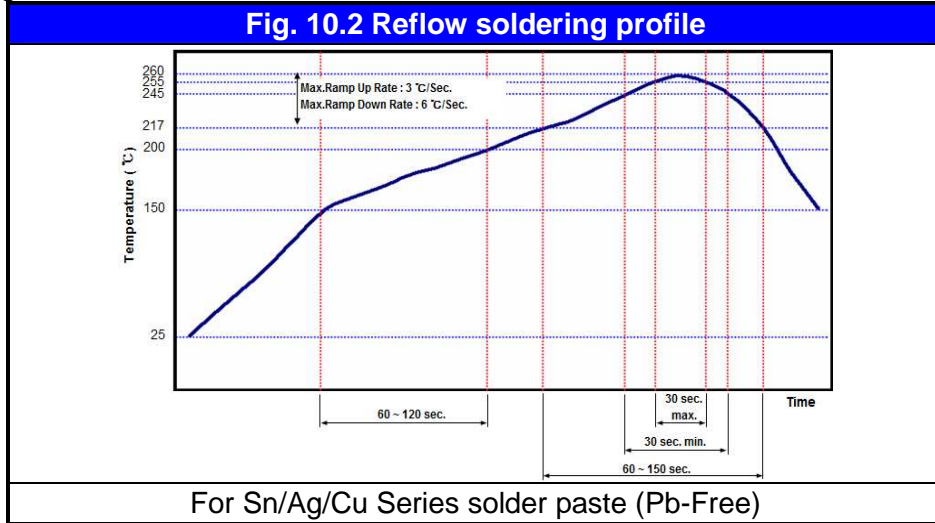
* The tip of iron should not contact the ceramic body directly.

* The Capacitors shall be cooled gradually at room temperature after soldering.

* Forced air cooling is not allowed.

10. APPLICATION NOTES

b.) Reflow soldering :



Soldering conditions :

Class I :

| Size Inch (mm) | Temper. Cher. | Capacitance | Condition | |
|----------------|---------------|-------------|-----------|--------|
| | | | Wave | Reflow |
| ≤0402(1005) | Class I - C0G | All | X | O |
| 0603(1608) | Class I - C0G | All | O | O |
| 0805(2012) | Class I - C0G | All | O | O |
| 1206(3216) | Class I - C0G | All | O | O |
| ≥1210(3225) | Class I - C0G | All | X | O |

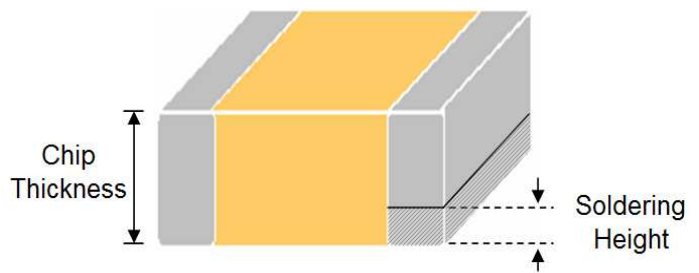
Class II :

| Size Inch (mm) | Temper. Cher. | Capacitance | Condition | |
|----------------|----------------|-------------|-----------|--------|
| | | | Wave | Reflow |
| ≤0402(1005) | Class II - X7R | All | X | O |
| 0603 (1608) | Class II - X7R | Cap. <2.2μF | O | O |
| | | Cap. ≥2.2μF | X | O |
| 0805 (2012) | Class II - X7R | Cap. <4.7μF | O | O |
| | | Cap. ≥4.7μF | X | O |
| 1206 (3216) | Class II - X7R | Cap. <4.7μF | O | O |
| | | Cap. ≥4.7μF | X | O |
| ≥1210 (3225) | Class II - X7R | All | X | O |

10. APPLICATION NOTES

Soldering height :

The solder climbing minimum height is suggesting to 25% of chip thickness or 500um whichever is less.
(Reference from IPC-610E)



COOLING

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint.

CLEANING

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

11. REFERENCE TABLE

| Table 1 PDC Family | |
|--------------------|-----------------------|
| Code | Description |
| FK | Safety X1 & Y2 series |
| FH | Safety X2 series |

| Table 6 Rated Voltage | | | | | |
|-----------------------|-------------|--------------------|-------------|------|-------------|
| Code | Description | Code | Description | Code | Description |
| 252 (FH06X) | 2.5KV | 302 (FH series) | 2.5KV | 502 | 5KV |
| | | | | 602 | 6KV |

| Table 2 Size | | | | | |
|--------------|-------------|------|-------------|------|-------------|
| Code | Description | Code | Description | Code | Description |
| 06 | 1206 (3216) | 12 | 1812 (4532) | 20 | 2220 (5750) |
| 08 | 1808 (4520) | 21 | 2211 (5728) | | |

| Table 7 Packaging Type | | | |
|------------------------|----------------------------------|------|-------------------------------|
| Code | Description | Code | Description |
| B | Bulk | T | Tray package |
| E | Tape and 7" Reel, Embossed Tape | P | Tape and 7" Reel, Paper Tape |
| K | Tape and 10" Reel, Embossed Tape | D | Tape and 10" Reel, Paper Tape |
| L | Tape and 13" Reel, Embossed Tape | G | Tape and 13" Reel, Paper Tape |

| Table 3 Dielectric Material Characteristics | | | |
|---|-------------|------|-------------|
| Code | Description | Code | Description |
| N | C0G | X | X7R |

| Table 4 Capacitance Rule Code | | | |
|-------------------------------|----------------------------------|------|------------------------------------|
| Code | Description | Code | Description |
| R47 | 0.47pF | 102 | $102=10 \times 10^2=1000\text{pF}$ |
| OR5 | 0.5pF | 104 | $104=10 \times 10^4=100\text{nF}$ |
| 100 | $100=10 \times 10^0=10\text{pF}$ | 106 | $106=10 \times 10^6=10\mu\text{F}$ |

| Table 8 Thickness Description | | | | | |
|-------------------------------|--------------|------|--------------|------|--------------|
| Code | Description | Code | Description | Code | Description |
| C | 1.25±0.10 mm | E | 1.60±0.20 mm | G | 2.50±0.30 mm |
| D | 1.40±0.15 mm | F | 2.00±0.20 mm | H | 2.80±0.30 mm |

| Table 5 Tolerance | | | | | |
|-------------------|-------------|------|-------------|------|-------------|
| Code | Description | Code | Description | Code | Description |
| B | ±0.10 pF | F | ±1 % | K | ±10 % |
| C | ±0.25 pF | G | ±2 % | M | ±20 % |
| D | ±0.50 pF | J | ±5 % | | |

| Table 9 Special Control Code | |
|------------------------------|----------------|
| Code | Description |
| G | RoHS Compliant |