

DATA SHEET

SURFACE MOUNT MULTILAYER
CERAMIC CAPACITORS

Automotive grade

NP0/X7R

6.3 V TO 630 V

0.47 pF to 2.2 μ F

RoHS compliant & Halogen Free



| Automotive grade | NP0/X7R | **6.3 V to 630 V**

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 3 Sizes from 0402 to 0805

| CAP. | 0402 | | 0603 | | 0805 | | |
|---------|----------|---------|---------|---------|---------|---------|---------|
| | 50 V | 50 V | 100 V | 250 V | 50 V | 100 V | 250 V |
| 0.47 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 0.56 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 0.68 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 0.82 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 1.0 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 1.2 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 1.5 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 1.8 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 2.2 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 2.7 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 3.3 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 3.9 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 4.7 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 5.6 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 6.8 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 8.2 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 10 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 12 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 15 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 18 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 22 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 27 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 33 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 39 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 47 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 56 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 68 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 82 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 100 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |

NOTE

1. Values in shaded cells indicate thickness class in mm

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 4 Sizes from 0402 to 0805 (continued)

| CAP. | 0402 | | 0603 | | 0805 | | |
|--------|----------|---------|---------|---------|---------|----------|----------|
| | 50 V | 50 V | 100 V | 250 V | 50 V | 100 V | 250 V |
| 120 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 150 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 180 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 |
| 220 pF | 0.5±0.05 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 |
| 270 pF | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 |
| 330 pF | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 |
| 390 pF | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 |
| 470 pF | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 |
| 560 pF | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.85±0.1 | 0.85±0.1 |
| 680 pF | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.6±0.1 | 0.85±0.1 | 0.85±0.1 |
| 820 pF | | | | | 0.6±0.1 | 0.85±0.1 | 0.85±0.1 |
| 1.0 nF | | 0.8±0.1 | | | 0.6±0.1 | 0.85±0.1 | 0.85±0.1 |

NOTE

Values in shaded cells indicate thickness class in mm

CAPACITANCE RANGE & THICKNESS FOR NP0

Table 5 Sizes from 1206 to 1210

| CAP. | 1206 | | | | | 1210 | | | |
|--------|---------|---------|----------|----------|----------|----------|----------|----------|----------|
| | 50 V | 100 V | 250 V | 500 V | 630 V | 50 V | 100 V | 250 V | 500 V |
| 10 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 12 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 15 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 18 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 22 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 27 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 33 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 39 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 47 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 56 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 68 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 82 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 100 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 120 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 150 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 180 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 220 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 270 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 330 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 390 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 470 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 560 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 680 pF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 1.25±0.2 | | | | |
| 820 pF | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 | | | | |
| 1.0 nF | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 1.2 nF | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 1.5 nF | 0.6±0.1 | 0.6±0.1 | 0.85±0.1 | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 1.8 nF | 0.6±0.1 | 0.6±0.1 | | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 |
| 2.2 nF | 0.6±0.1 | 0.6±0.1 | | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | |
| 2.7 nF | 0.6±0.1 | 0.6±0.1 | | | | 1.25 | | | |

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 6 Sizes from 0201 to 0603

| CAP. | 0201 | 0402 | | 0603 | | | | | | |
|--------|----------|----------|----------|----------|----------|-----|------|------|------|-------|
| | 25V | 10V | 16 V | 25 V | 50 V | 10V | 16 V | 25 V | 50 V | 100 V |
| 100 pF | 0.3±0.03 | | | | | | | | | |
| 150 pF | 0.3±0.03 | | | | | | | | | |
| 220 pF | 0.3±0.03 | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 | | | | | |
| 330 pF | 0.3±0.03 | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 | | | | | |
| 470 pF | 0.3±0.03 | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 | | | | | |

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 8 Size 0805

| CAP. | 0805 | 10 V | 16 V | 25 V | 50 V | 100 V | 250 V | 500 V |
|------|------|------|------|------|------|-------|-------|-------|
|------|------|------|------|------|------|-------|-------|-------|

CAPACITANCE RANGE & THICKNESS FOR X7R

Table 9 Size 1206

| CAP. | 1206 6.3 V | 10V | 16V | 25V | 50 V | 100 V | 250 V |
|--------|---------------|----------|----------|----------|----------|----------|----------|
| 22 nF | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 |
| 33 nF | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | |
| 47 nF | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | |
| 68 nF | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 | |
| 100 nF | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 | |
| 150 nF | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | |
| 220 nF | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 1.25±0.2 | 1.25±0.2 | |
| 330 nF | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 0.85±0.1 | 1.60±0.2 | | |
| 470 nF | 1.00±0.1 | 1.00±0.1 | 1.00±0.1 | 1.00±0.1 | 1.60±0.2 | | |
| 680 nF | 1.15±0.1 | 1.15±0.1 | 1.15±0.1 | 1.60±0.2 | 1.60±0.2 | | |
| 1 µF | 1.15±0.1 | 1.15±0.1 | 1.15±0.1 | 1.60±0.2 | 1.60±0.2 | | |
| 2.2 µF | 1.60±0.2 | 1.60±0.2 | 1.60±0.2 | 1.60±0.2 | 1.60±0.2 | | |

NOTE

Values in shaded cells indicate thickness class in mm

| Automotive grade | NP0/X7R | **6.3 V to 630 V**

CAPACITANCE RANGE & THICKNESS FOR 4C-ARRAY

Table 12 Temperature characteristic material from X7R

| CAPACITANCE | 0508 (4 x 0402) | | | 0612 (4 x 0603) | | |
|-------------|-----------------|---------|---------|-----------------|---------|---------|
| | 16 V | 25 V | 50 V | 16 V | 25 V | 50 V |
| 220 pF | | | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 330 pF | | | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 470 pF | | | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 680 pF | | | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 1.0 nF | 0.6±0.1 | 0.6±0.1 | 0.6±0.1 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 1.5 nF | 0.6±0.1 | 0.6±0.1 | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 2.2 nF | 0.6±0.1 | 0.6±0.1 | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 3.3 nF | 0.6±0.1 | 0.6±0.1 | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 4.7 nF | 0.6±0.1 | 0.6±0.1 | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 6.8 nF | 0.6±0.1 | 0.6±0.1 | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 10 nF | 0.6±0.1 | 0.6±0.1 | | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 |
| 15 nF | 0.6±0.1 | | | 0.8±0.1 | 0.8±0.1 | |
| 22 nF | 0.6±0.1 | | | 0.8±0.1 | 0.8±0.1 | |
| 33 nF | 0.6±0.1 | | | 0.8±0.1 | 0.8±0.1 | |
| 47 nF | 0.6±0.1 | | | 0.8±0.1 | 0.8±0.1 | |
| 68 nF | 0.6±0.1 | | | | | |
| 100 nF | 0.6±0.1 | | | | | |

NOTE

Values in shaded cells indicate thickness class in mm

THICKNESS CLASSES AND PACKING QUANTITY

Table 13

| SIZE CODE | THICKNESS CLASSIFICATION | TAPE WIDTH QUANTITY PER REEL | Ø 180 MM / 7 INCH | | Ø 330 MM / 13 INCH | |
|-----------|--------------------------|---------------------------------|-------------------|---------|--------------------|---------|
| | | | Paper | Blister | Paper | Blister |
| 0201 | 0.3 ±0.03 mm | 8 mm | 15,000 | --- | 50,000 | --- |
| 0402 | 0.5 ±0.05 mm | 8 mm | 10,000 | --- | 50,000 | --- |
| 0603 | 0.8 ±0.1 mm | 8 mm | 4,000 | --- | 15,000 | --- |
| 0805/0508 | 0.6 ±0.1 mm | 8 mm | 4,000 | --- | 20,000 | --- |
| | 0.85 ±0.1 mm | 8 mm | 4,000 | --- | 15,000 | --- |
| 1206/0612 | 1.25 ±0.2 mm | 8 mm | --- | 3,000 | --- | 10,000 |
| | 0.6 ±0.1 mm | 8 mm | 4,000 | --- | 20,000 | --- |
| | 0.85 ±0.1 mm | 8 mm | 4,000 | --- | 15,000 | --- |
| | 1.0/1.15 ±0.1 mm | 8 mm | --- | 3,000 | --- | 10,000 |
| | 1.25 ±0.2 mm | 8 mm | --- | 3,000 | --- | 10,000 |
| 1210 | 1.6 ±0.2 mm | 8 mm | --- | 2,000 | --- | 10,000 |
| | 0.85 ±0.1 mm | 8 mm | ---mm | | | |

ELECTRICAL CHARACTERISTICS

NP0/X7R DIELECTRIC CAPACITORS; NI/SIN TERMINATIONS

Unless otherwise specified, all test and measurements shall be made under standard atmospheric conditions for testing as given in 5.3 of IEC 60068-1:

- Temperature: 15 °C to 35 °C
- Relative humidity: 25% to 75%
- Air pressure: 86 kPa to 106 kPa

Before the measurements are made, the capacitor shall be stored at the measuring temperature for a time sufficient to allow the entire capacitor to reach this temperature.

The period as prescribed for recovery at the end of a test is normally sufficient for this purpose.

Table 14

| DESCRIPTION | | VALUE |
|---------------------------|-----------|---------------------------------|
| Capacitance range | | 0.47 pF to 1 μF |
| Capacitance tolerance | | |
| NP0 | C < 10 pF | ±0.25 pF, ±0.5 pF |
| | C ≥ 10 pF | ±2%, ±5% |
| X7R | | ±5% ⁽¹⁾ , ±10%, ±20% |
| Dissipation factor (D.F.) | | |
| NP0 | C < 30 pF | 1 / (400 + >>> BD |

SOLDERING CONDITIONS

The lead free MLCCs are able to stand the reflow soldering conditions as below:

- Temperature: above 220 °C
- Endurance: 95 to 120 seconds
- Cycles: 3 times

The test of "soldering heat resistance" is carried out in accordance with the schedule of "MIL-STD-202F-method 210F", "The robust construction of chip capacitors allows them to be completely immersed in a solder bath of 270 °C for 10 seconds". Therefore, it is possible to mount MLCCs on one side of a PCB and other discrete components on the reverse (mixed PCBs). Surface Mount Capacitors are tested for solderability at 245 °C during 2 seconds. The test condition for no leaching is 260°C for 30 seconds.

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---------------------------|-----------------------|---|----------------------------|
| Mounting | IEC 60384-21/22 4.3 | The capacitors may be mounted on printed-circuit boards or ceramic substrates | No visible damage |
| Capacitance | IEC 60384-21/22 4.5.1 | Class 1: At 20 °C, 24 hours after annealing f = 1 MHz for C ≤ 1nF, measuring at voltage V _{rms} at 20 °C f = 1 KHz for C > 1nF, measuring at voltage V _{rms} at 20 °C Class 2: At 20 °C, 24 hours after annealing f = 1 KHz, measuring at voltage V _{rms} at 20 °C | Within specified tolerance |
| Dissipation Factor (D.F.) | IEC 60384-21/22 4.5.2 | Class 1: At 20 °C, 24 hours after annealing f = 1 MHz for C ≤ 1nF, measuring at voltage V _{rms} at 20 °C f = 1 KHz for C > 1nF, measuring at voltage V _{rms} at 20 °C Class 2: At 20 °C, 24 hours after annealing f = 1 KHz, measuring at voltage V | |

| TEST | TEST METHOD | | PROCEDURE | REQUIREMENTS |
|-------------------------------|-------------|---|---|--|
| Temperature Cycling | AEC-Q200 | 4 | Preconditioning: 150 +0/- 10 °C for 1 hour, then keep for 24 ± 1 hours at room temperature 1000 cycles with following detail: 30 minutes at lower category temperature 30 minutes at upper category temperature Recovery time 24 ± 2 hours | No visual damage <hr/> C/C Class1: NP0: Within ±1% or 0.5pF, whichever is greater. Class2: X7R: ±10% <hr/> D.F. meet initial specified value IR meet initial specified value |
| Destructive Physical Analysis | AEC-Q200 | 5 | 10ea X 3 lots. Note: Only applies to SMD ceramics. Electrical test not required. | |
| Moisture Resistance | AEC-Q200 | 6 | T=24 hrs/per cycle; 10 continuous cycles unpowered. Measurement at 24 ± 2 hours after test condition. | No visual damage <hr/> C/C NP0: Within ±3% or 3 pF, whichever is greater X7R: ±15% <hr/> D.F. Within initial specified value IR NP0: 10,000 MΩ X7R: Meet initial specified value |

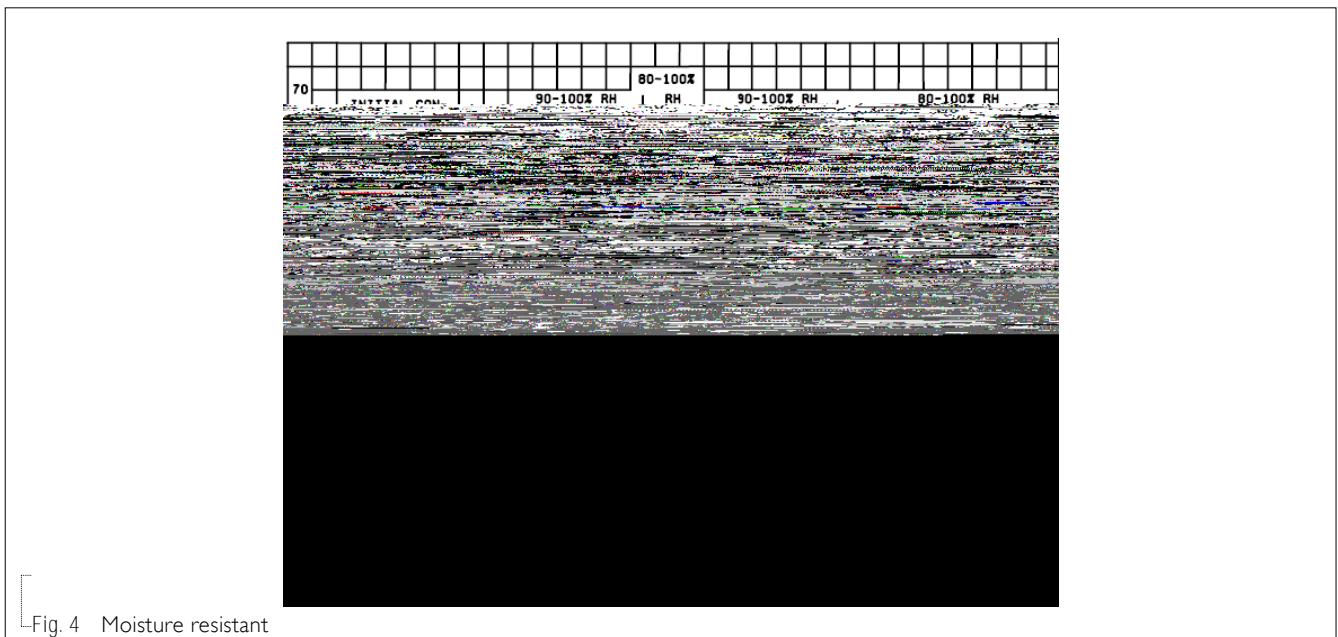


Fig. 4 Moisture resistant

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|-----------------|-------------|--|--------------|
| Biased Humidity | AEC-Q200 7 | I. Preconditioning, class 2 only: 150 +/-10 °C /1 hour, then keep for | |

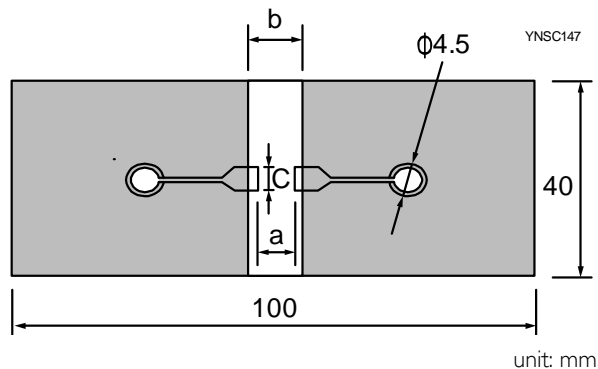
| TEST | TEST METHOD | | PROCEDURE | REQUIREMENTS |
|--------------------|-------------|----|--|---|
| Operational Life | AEC-Q200 | 8 | <ol style="list-style-type: none"> Preconditioning, class 2 only: 150 +0/-10 °C /1 hour, then keep for 24 ±1 hour at room temp Initial measure: Spec: refer to initial spec C, D, IR Endurance test: Temperature: X7R: 125 °C Specified stress voltage applied for 1,000 hours: Applied 2.0 × U_r for general products Applied 1.5 × U_r for high cap. Products High voltage series follows with below stress condition: Applied 1.5 × U_r for 200V, 250V series Applied 1.3 × U_r for 500V, 630V series Applied 1.2 × U_r for 1KV, 2KV, 3KV series Recovery time: 24 ±2 hours Final measure: C, D, IR <p>Note: If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be preconditioned according to "IEC 60384 4.1" and then the requirement shall be met.</p> | <p>No visual damage</p> <hr/> <p>C/C NP0: Within ±2% or 1 pF, whichever is greater X7R: ±15%</p> <hr/> <p>D.F. NP0: 2 × specified value. X7R: 16V: 7% or specified value whichever is greater 25V: 5% or specified value whichever is greater</p> <p>IR NP0: 4,000 MΩ or IR × C_r 40s whichever is less X7R: 1,000 MΩ or IR × C_r 50s whichever is less</p> |
| External Visual | AEC-Q200 | 9 | Any applicable method using × 10 magnification | In accordance with specification |
| Physical Dimension | AEC-Q200 | 10 | Verify physical dimensions to the applicable device specification. | In accordance with specification |
| Mechanical Shock | AEC-Q200 | 13 | <p>Three shocks in each direction shall be applied along the three mutually perpendicular axes of the test specimen (18 shocks)</p> <p>Peak value: 1,500 g's</p> <p>Duration: 0.5 ms</p> <p>Velocity change: 15.4 ft/s</p> <p>Waveform: Half-sin</p> | <p>C/C NP0: Within ±0.5% or 0.5 pF, whichever is greater X7R: ±10%</p> <hr/> <p>D.F. Within initial specified value</p> <p>IR Within initial specified value</p> |
| Vibration | AEC-Q200 | 14 | <p>5 g's for 20 minutes, 12 cycles each of 3 orientations.</p> <p>Note: Use 8" × 5" PCB, 0.31" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10-2000 Hz.</p> | <p>C/C NP0: Within ±0.5% or 0.5 pF, whichever is greater X7R: ±10%</p> <hr/> <p>D.F: meet initial specified value IR meet initial specified value</p> |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|------------------------------|-------------|--|--|
| Resistance to Soldering Heat | AEC-Q200 15 | Precondition: 150 +0/- 10 °C for 1 hour, then keep for 24 ± 1 hours at room temperature Preheating: for size 1206: 120 °C to 150 °C for 1 minute Preheating: for size >1206: 100 °C to 120 °C for 1 minute and 170 °C to 200 °C for 1 minute Solder bath temperature: 260 ± 5 °C Dipping time: 10 ± 0.5 seconds Recovery time: 24 ± 2 hours | Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned <hr/> C/C Class1: NP0: Within ± 1% or 0.5 pF, whichever is greater. Class2: X7R: ± 10% D.F. within initial specified value IR within initial specified value |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|-----------------------------|-------------|---|--|
| Electrical Characterization | AEC-Q200 19 | <p>Parametrically test per lot and sample size requirements, summary to show Min, Max, Mean and Standard deviation at room as well as Min and Max operating temperatures.</p> <p>Class 1: NP0: -55 °C to +125 °C Normal temperature: 20 °C</p> <p>Class 2: X7R: -55 °C to +125 °C Normal temperature: 20 °C</p> | <p>C/C</p> <p>Class 1: NP0: ±30 ppm/°C</p> <p>Class 2: X7R: ±15%</p> |

| | | | |
|------------|-------------|---|---|
| Board Flex | AEC-Q200 21 | <p>Part mounted on a 100 mm X 40 mm FR4 PCB board, which is 1.6 ±0.2 mm thick and has a layer-thickness 35 µm ± 10 µm.</p> <p>Part should be mounted using the following soldering reflow profile.</p> <p>Conditions:</p> <p>Class 1: Bending 3 mm at a rate of 1 mm/s, radius jig 340 mm</p> <p>Class 2: Bending 2 mm at a rate of 1 mm/s, radius jig 340 mm</p> | <p>No visible damage</p> <p>C/C</p> <p>Class 1: NP0: Within ±1% or 0.5 pF, whichever is greater</p> <p>Class 2: X7R: ±10%</p> |
|------------|-------------|---|---|

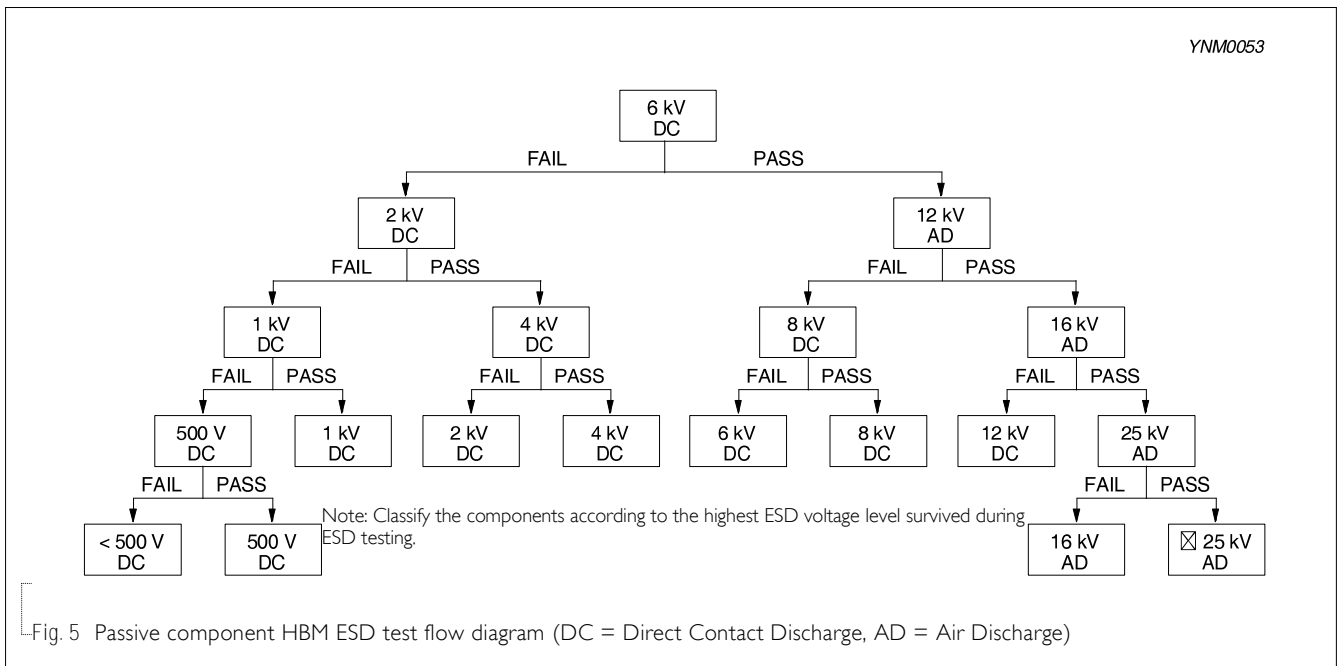
Test Substrate:



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| Terminal Strength | AEC-Q200 22 | <p>With the component mounted on a PCB obtained with the device to be tested, apply a 17.7N (1.8Kg) force to the side of a device being tested.</p> <p>This force shall be applied for 60+1 seconds.</p> <p>Also the force shall be applied gradually as not to apply a shock to the component being tested.</p> <p>* Apply 2N force for 0402 size.</p> | <p>Magnification of 20X or greater may be employed for inspection of the mechanical integrity of the device body, terminals and body/terminal junction.</p> <p>Before, during and after the test, the device shall comply with all electrical requirements stated in this specification.</p> |
|-------------------|-------------|---|--|

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|----------------|-------------|---|---|
| Beam Load Test | AEC-Q200 23 | Place the part in the beam load fixture. Apply a force until the part breaks or the minimum acceptable force level required in the user specification(s) is attained. | 0805 Thickness > 0.5mm: 20N Thickness 0.5mm: 8N 1206 Thickness 1.25 mm: 54N Thickness < 1.25 mm: 15N |
| Voltage Proof | | <ol style="list-style-type: none"> Specified stress voltage applied for 1~5 seconds Ur = 100 V: series applied 2.5 Ur 100 V < Ur = 200 V series applied (1.5 Ur + 100) 200 V < Ur = 500 V series applied (1.3 Ur + 100) Ur > 500 V: 1.3 Ur Ur = 1000 V: 1.2 Ur Charge/Discharge current is less than 50 mA | No breakdown or flashover |



REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|-----------|---------------|---------------------|--|
| Version 9 | Mar. 22, 2018 | - | - Add 0402 X7R 100nF 25~50V |
| Version 8 | Nov. 22, 2017 | - | - Add X7R/0201/25V/100pF~10nF |
| Version 7 | Jul. 7, 2017 | - | - Add X7R/0805/330nF to 470nF/50V, X7R/1206/10uF/6.3V |
| Version 6 | Mar. 31, 2017 | - | - Add NPO/0603/1nF/50V, X7R/0603/1uF/10V, X7R/0603/470nF/16V, X7R/0603/220nF/25V |
| Version 5 | Nov. 15, 2016 | - | - Add Soldering Condition |
| Version 4 | Jun. 14, 2016 | - | - Add X7R/0805/2.2uF/10V and NPO/1206/1.2nF to 1.5nF/250V |
| Version 3 | Jul. 21, 2015 | - | - Tests and Requirements update |
| Version 2 | Jul. 17, 2014 | - | - Tests and Requirements update |
| Version 1 | Apr. 19, 2013 | - | - Capacitance range update |
| Version 0 | Dec. 25, 2012 | - | - New |

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