



DATA SHEET

MLCC Chip Capacitor Size 0603

Serie: I11004

| | | |
|--------------|------------|------------------------------------|
| Mat. Code | X7R | Material: X7R= X7R Material |
| Voltage Code | 101 | Voltage: 101= 100Volt |
| Range Code | 472 | Range: 472= 4700pf |

**MLCC Chip Capacitor Size
0603**

Serie No.: **I11004**

Customer:

| | | | | | | | | | |
|-------|--------|------|--------|--------|--------|-----------|-----------|------|------------|
| DRW: | Jason | CHKD | Wilson | MATL: | Wilson | TOLERANCE | Mason | DATE | 14.10.2010 |
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Structure of Chip Capacitor



| No | Name |
|----|---------------------|
| 1 | Ceramic dielectric |
| 2 | Inner Electrode |
| 3 | Substrate Electrode |
| 4 | Nickel Layer |
| 5 | Tin Layer |

Nominal Capacitance Unit (pf)

| Ordering Code | Actual Value |
|---------------|--------------|
| 0P5 | 0,5pf |
| 1R0 | 1,0pf |
| 102 | 1000pf |
| 224 | 220000pf |

Note: The first two digits are significant; third digit denotes number of zeros after range; P= decimal point

Capacitance Tolerance

| Ord. Code | B | C | D | F | G | J | K | M | S | Z |
|-----------|-------|--------|-------|------|------|------|-----|-----|----------------|----------------|
| Tolerance | 0,1pf | 0,25pf | 0,5pf | 1,0% | 2,0% | 5,0% | 10% | 20% | +.50% /-20% | +.80% /-20% |

Note: These capacitance tolerance B,C,D are just applicable th capacitance that eqals to or less.

Dielectric Style

| Dielectric Code | CG | HG | LG | PH | RH | SH | TH | UJ | SL | X | B | E | F |
|-----------------|------------|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| Dielectric | COG NPO | HG | LG | PH | RH | SH | TH | UJ | SL | X5R | X7R | Z5U | Y5V |

| | | | | | | | | | |
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Drawing



Dimensions (mm)

| Chip-Size Code | L | W | T | WB |
|----------------|------|------|------|------|
| 0603 | 1,60 | 0,80 | 0,80 | 0,30 |

Note: We can design according to customer special requirements

Rated Voltage (V)

| Code | Actual Value |
|------|--------------|
| 6V3 | 6,3 |
| 500 | 50 |
| 201 | 200 |
| 102 | 1000 |

Note: The first two digits are significant; third digit denotes number of zeros after range; P= decimal point

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Terminal Material Styles

| Ordering Code | Termination Material |
|---------------|---------------------------------|
| S | (Silver Solderable Termination) |
| C | (Copper Solderable Termination) |
| N | (Nickel Barrier Termination) |

Application

Hi-Q COG capacitance are ideally suited for RF and Microwave application requiring high Q, low ESR, and high resonant frequency

Temperature Coefficient / Characteristics

| Dielectric | Temperature Coefficient | Temperature Point |
|------------|-------------------------|---------------------------------|
| COG/NPO | . 0 +/- 30 ppm/°C | +.20°C > -55°C > +20°C > +125°C |
| HG | -.33 +/-30 ppm/°C | +.20°C > -55°C > +20°C > +85°C |
| LG | -.75 +/-30 ppm/°C | +.20°C > -55°C > +20°C > +85°C |
| CH | 0 +/-60 ppm/°C | +.20°C > -55°C > +20°C > +85°C |
| PH | -.150 +/-60 ppm/°C | +.20°C > -55°C > +20°C > +85°C |
| RH | -.220 +/-60 ppm/°C | +.20°C > -55°C > +20°C > +85°C |
| SH | -.330 +/-60 ppm/°C | +.20°C > -55°C > +20°C > +85°C |
| TH | -.470 +/-60 ppm/°C | +.20°C > -55°C > +20°C > +85°C |
| UJ | -.750 +/-120 ppm/°C | +.20°C > -55°C > +20°C > +85°C |
| SL | -.1000 +140 ppm/°C | +.20°C > -55°C > +20°C > +85°C |
| X7R | . +/-15% | +.20°C > -55°C > +20°C > +125°C |
| X5R | . +/-15% | +.20°C > -55°C > +20°C > +85°C |
| Z5U | -.56% ~ +22% | +.20°C > -55°C > +20°C > +85°C |
| Y5V | -.80% ~ +30% | +.20°C > -55°C > +20°C > +85°C |

Note: Nominal Temperature coefficient and allowed tolerance of class 1 are decided by the changing of the capacitance between 20°C and 85°C

Note for CQ

The following Q value is just confirmed by general customer. If there is a higher requirement for Q value requirements, we can design and produce according to the special requirements.

For the customer whose requirements for frequency is between 1MHz and 2,4GHz or higher frequency, we can design it according to their requirements. The frequency of CQ is a little bit higher than that of CF. Please choose them according to your requirements.

| Capacitance (pf) | Q value at 300MHz | | Capacitance (pf) | Q value at 300MHz | | Capacitance (pf) | Q value at 300MHz | |
|------------------|-------------------|------|------------------|-------------------|------|------------------|-------------------|------|
| | O805 | O603 | | O805 | O603 | | O805 | O603 |
| 4,7 | 1000 | 800 | 11 | 450 | 360 | 24 | 200 | 160 |
| 5,2 | 900 | 720 | 12 | 400 | 320 | 27 | 175 | 140 |
| 5,6 | 850 | 680 | 13 | 375 | 300 | 30 | 150 | 120 |
| 6,2 | 800 | 640 | 14 | 350 | 280 | 33 | 140 | 112 |
| 6,8 | 700 | 560 | 15 | 325 | 260 | 36 | 130 | 104 |
| 7,5 | 650 | 20 | 16 | 300 | 240 | 39 | 120 | 96 |
| 8,2 | 575 | 460 | 18 | 250 | 200 | 43 | 110 | 88 |
| 9,1 | 525 | 420 | 20 | 225 | 180 | 47 | 100 | 80 |
| 10 | 500 | 400 | 22 | 215 | 172 | | | |

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Note for CF

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For the customer whose requirements for frequency is between 1MHz and 2,4GHz or higher frequency, we can design it according to their requirements. The frequency of CQ is a little bit higher than that of CF. Please choose them according to your requirements.

| Capacitance (pf) | Q value at 300MHz | | Capacitance (pf) | Q value at 300MHz | | Capacitance (pf) | Q value at 300MHz | |
|------------------|-------------------|------|------------------|-------------------|------|------------------|-------------------|------|
| | O805 | O603 | | O805 | O603 | | O805 | O603 |
| 4,7 | 400 | 320 | 20 | 90 | 72 | 91 | 24 | 20 |
| 5,2 | 36 | 288 | 22 | 86 | 69 | 100 | 22 | 18 |
| 5,6 | 340 | 272 | 24 | 80 | 64 | 110 | 20 | 16 |
| 6,2 | 320 | 256 | 27 | 70 | 56 | 120 | 28 | 15 |
| 6,8 | 280 | 224 | 30 | 60 | 48 | 130 | 16 | 13 |
| 7,5 | 260 | 208 | 33 | 56 | 45 | | | |
| 8,2 | 230 | 184 | 36 | 52 | 42 | | | |
| 9,1 | 210 | 168 | 39 | 48 | 39 | | | |
| 10 | 200 | 160 | 43 | 44 | 36 | | | |
| 11 | 180 | 144 | 47 | 40 | 32 | | | |
| 12 | 160 | 128 | 51 | 36 | 29 | | | |
| 13 | 150 | 120 | 56 | 34 | 28 | | | |
| 14 | 140 | 112 | 62 | 32 | 26 | | | |
| 15 | 130 | 104 | 68 | 30 | 24 | | | |
| 16 | 120 | 96 | 75 | 28 | 23 | | | |
| 18 | 100 | 80 | 82 | 26 | 20 | | | |

High Voltage MLCC

Middle & High Voltage MLCC is a kind of special design MLCC that bases on the technology of general MLCC. This kind of MLCC has stable high voltage reliability and suitable to SMT. Middle & High Voltage MLCC is widely applicable for many direct high voltage circuits in which it can improve the performance of the circuit.

Application

Analog & Digital modems
 LAN & WAN Interface
 Lighting Ballast Circuits
 Voltage Multipliers
 DC-DC-Converter
 Back-Lighting Inverters

Measurement Method for High Voltage MLCC

| Rated Voltage Range | Measuring Method |
|---------------------|----------------------------------------------------------------------------|
| 500V ≤ Vr ≤ 1000V | Force 150% Rated Voltage for 5seconds. Max. current should not exceed 50mA |
| 1000V ≤ Vr ≤ 2000V | Force 120% Rated Voltage for 5seconds. Max. current should not exceed 50mA |
| 2000V ≤ Vr ≤ 5000V | Force 120% Rated Voltage for 5seconds. Max. current should not exceed 10mA |

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Reliability Test

| Item | Technical specification | | | | Test Methods and Remarks | | | |
|--------------------------------|------------------------------|------------------------------------------|--------|------------------------------|----------------------------|-------------|------------------------------|--|
| Capacitance | Class I | Should be within the specified tolerance | | Capacitance | Measuring Frequency | | Measuring Voltage | |
| | | | | ≤1000pf | 1MHz +/- 10% | | 1,0 Tol. 0,2Vrms | |
| | | | | ≥1000pf | 1KHz +/- 10% | | | |
| DF, tan Dissipation Favctor | Class II | Should be within the specified tolerance | | C≤10μF | Test Frequency 1KHZ +/-10% | | | |
| | | | | Test Voltage 1,0 +/- 0,2Vrms | | | | |
| | | | | X7R, Y5V | | | | |
| | | | | C>10μF | Test Frequency 1KHZ +/-10% | | | |
| | | | | Test Voltage 1,0 +/- 0,2Vrms | | | | |
| | | | | Z5U | | | | |
| | Test Frequency 1KHZ +/-10% | | | | | | | |
| | Test Voltage 1,0 +/- 0,2Vrms | | | | | | | |
| | Class I | DF≤ 0,15% | | Capacitance | Measuring Frequency | | Measuring Voltage | |
| | | | | ≤1000pf | 1MHz +/- 10% | | 1,0 Tol. 0,2Vrms | |
| ≥1000pf | | | | 1KHz +/- 10% | | | | |
| Class II | X7R | >50V | 25V | 16V | 10V | 6,3V | C= 10μF | |
| | | ≤ 2,5% | ≤ 3,5% | ≤ 3,5% | ≤ 5% | ≤ 5% | Test Frequency 1KHZ +/-10% | |
| | | | | | | ≤ 10% | Test Voltage 1,0 +/- 0,2Vrms | |
| | | | | | | (C≥ 3,3μF) | | |

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Reliability Test

| | | | | | | | | | |
|---------------------------------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------------------------------------------------|--|-------------------------|
| DF, tan Dissipation Factor | Class II | Y5V / Z5U | ≥25V | 16V | 10V | 6,3V | C= 10μF X7R; Y5V | | |
| | | | ≤ 7,0% | ≤12,5% | ≤12,5% | ≤12,5% | Test Frequency 120Hz +/-20Hz | | |
| | | | (C < 1,0μF) | | | | Test Voltage 0,5 +/- 0,1Vrms | | |
| | | | ≤ 9,0% | | | | Test Frequency 0,1KHz | | |
| (C ≥ 1,0μF) | Test Voltage 0,5 +/- 0,05Vrms | | | | | | | | |
| (IR) Insulation Resistance | Class I | C ≤ 10nf, Ri ≥ 50000MΩ C > 10nf, Ri ≥ 500S | | | | | Measuring Voltage: Rated Voltage Duration: 60Sec. +/- 5s | | |
| | | | | | | | | | Class II |
| | Y5V / Z5U | C ≤ 25nf, Ri ≥ 4000MΩ C > 25nf, Ri ≥ 100S | | | | | | | |
| | | Item | | | | | | | Technical Specification |
| (DWV) Dielectric Withstanding Voltage | No Breakdown or damage | | | | Measuring Voltage: Class I: 300% Rated Voltage Class II: 250% Rated Voltage Duration : 5 +/-1sec Charge / Discharge Current : 50mA max. This method excludes high voltage MLCC | | | | |
| Solderability | At least 95% of the terminal electrode is covered by new solder. Visual Appearance: No visible damage: | | | | Solder Temperature: 235°C +/- 5°C Duration : 2 +/-0,5sec | | | | |

| | |
|---------------------------------|---------------|
| MLCC Chip Capacitor Size | |
| 0603 | |
| Part No.: | I11004 |
| Customer: | |

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|-------|--------|------|--------|--------|--------|-----------|-----------|-----------|------------|
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Reliability Test

| | | | | | | |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------|-------------|--------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resistance to Soldering Heat | Item | NPO to SL | X7R | Y5V | Z5U | Preheating conditions: 100 to 200°C +/- 10°C 2mon. Solder Temperature: 265°C +/- 5°C Duration 5sec. +/- 1sec. Clean the capacitor with solvent and examine it with a 10x(min) microscope. Recovery time : 24hrs +/-2hrs Recovery conditions: Room temperature |
| | C/C | ≤ 0,5% | . -5 ~ +10% | . -10 ~ +20% | | |
| | DF | Same to initial Value | | | | |
| | IR | Same to initial Value | | | | |
| | Apperance: No visible damage. At least 95% of the terminal electrode is covered by new solder. | | | | | |
| Resistance to Flexure of Substrate (Bending Strength) | Apperance: No visible damage. | | | | | <p>Test Board: Al2O3 or PCB Wrap: 1mm Speed 0,5mm/sec. Unit: mm The measurement should be mader with the board in bending position.</p> |
| | C/C | ≤ +/- 10% | | | | |

MLCC Chip Capacitor Size 0603

Part No.: **I11004**

| | | | | | | | | | |
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Reliability Test

| Item | Technical specification | | Test Methods and Remarks | | |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------|
| Termination Adhesion | No visible damage | | Applied Force: 5N Duration: 10sec +/- 1sec | | |
| Temperature Cycle | Class I : $\leq \pm 1\%$ or 1pf whichever is larger. Class II: B: $\leq \pm 10\%$ E,F: $\leq \pm 20\%$ | | Preheating conditions: up-category temperature 1hrs Recovery time: 24hrs +/-1hrs Initial Measurement Cycling Tiems 5times, 1cycle, 4steps | | |
| | | | Step | Temperature (°C) | Time (min) |
| | | | 1 | Low-category temp. (NPO / X7R / Y5V / Z5U) | 30 |
| | | | 2 | Normal Temp. (+20) | 2~3 |
| | | | 3 | Up-category temp. (NPO / X7R / Y5V / Z5U) | 30 |
| 4 | Normal Temp. (+20) | 2~3 | | | |
| Moisture Resistance | C/C | Class I $\leq \pm 2\%$ or 1pf whichever is larger | Temperature: 40°C +/-2°C Humidity: 90~95% RH Voltage: Rated Voltage Duration: 500hrs Charge/Discharge Current: 50mA max. Recovery Time; 24hrs (Class I) or 48hrs (Class II) | | |
| | | Class II B: $\leq \pm 10\%$ Class II E,F: $\leq \pm 30\%$ | | | |
| | DF | Not more than twice of initial value | | | |
| | IR | Class I: $R_i \geq 2500M\Omega$ $R_i/C_r \geq 25sec$ whichever is smaller | | | |
| | | Class II: $R_i \geq 1000M\Omega$ $R_i/C_r \geq 25sec$ whichever is smaller | | | |
| Visual Apperance: No visible damage | | Recovery time after test 24hrs +/- 2hrs | | | |

Note: Pretreatment (only for class 2 capacitor)

Pretradtment (only for class 2 capacitor) is a method to treat the capacitor before measurement. First place the capacitor in the up-category temperasture or other specified higher temperature environment for 1 hour. Then recovery the capacitor at standard pressure conditions for 24hours +/-1hrs..

**MLCC Chip Capacitor Size
0603**

Part No.: **I11004**

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Package Conditions



Dimension of paper taping for size 0603, 0805, 1206



Dimension of paper taping for size 0402



| Paper Size Size Code | A | B | C | D | E | F | G | H | J | T |
|-------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 0603 | 1,10 ±0,20 | 1,90 ±0,20 | 8,00 ±0,20 | 3,50 ±0,05 | 1,75 ±0,10 | 4,00 ±0,10 | 2,00 ±0,10 | 4,00 ±0,10 | 1,50 ±0,10 | 1,10 below |
| 0805 | 1,45 ±0,20 | 2,30 ±0,20 | 8,00 ±0,20 | 3,50 ±0,05 | 1,75 ±0,10 | 4,00 ±0,10 | 2,00 ±0,10 | 4,00 ±0,10 | 1,50 ±0,10 | 1,10 below |
| 1206 | 1,80 ±0,20 | 3,40 ±0,20 | 8,00 ±0,20 | 3,50 ±0,05 | 1,75 ±0,10 | 4,00 ±0,10 | 2,00 ±0,10 | 4,00 ±0,10 | 1,50 ±0,10 | 1,10 below |

| Code | W1 | L1 | D | C | B | P1 | P2 | P0 | d | t |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0402 | 0,65 | 1,15 | 8,0 | 3,5 | 1,75 | 2 | 2 | 4 | 1,5 | 0,8 |
| | ±0,20 | ±0,20 | ±0,20 | ±0,05 | ±0,10 | ±0,05 | ±0,05 | ±0,05 | ±0,10 | below |

MLCC Chip Capacitor Size 0603

Part No.: **I11004**

| | | | | | | | | | |
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Package Conditions

Dimension of paper taping for size 0805 ~ 1812



| Paper Size Size Code | A | B | C | D | E | F | G | H | J | T |
|----------------------|---------------|---------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 0805 | 1,55 ±0,20 | 2,35 ±0,20 | 8,00 ±0,20 | 3,50 ±0,05 | 1,75 ±0,10 | 4,00 ±0,10 | 2,00 ±0,10 | 4,00 ±0,10 | 1,50 ±0,10 | 1,50 below |
| 1206 | 1,95 ±0,20 | 3,60 ±0,20 | 8,00 ±0,20 | 3,50 ±0,05 | 1,75 ±0,10 | 4,00 ±0,10 | 2,00 ±0,10 | 4,00 ±0,10 | 1,50 ±0,10 | 1,50 below |
| 1210 | 2,70 ±0,10 | 3,42 ±0,10 | 8,00 ±0,10 | 3,50 ±0,05 | 1,75 ±0,10 | 4,00 ±0,10 | 2,00 ±0,10 | 4,00 ±0,10 | 1,55 ±0,10 | 1,55 ±0,10 |
| 1808 | 2,20 ±0,10 | 4,95 ±0,10 | 12,00 ±0,10 | 5,50 ±0,05 | 1,75 ±0,10 | 4,00 ±0,10 | 2,00 ±0,10 | 4,00 ±0,10 | 1,50 ±0,10 | 1,80 ±0,10 |
| 1812 | 3,66 ±0,10 | 4,95 ±0,10 | 12,00 ±0,10 | 5,50 ±0,05 | 1,75 ±0,10 | 8,00 ±0,10 | 2,00 ±0,10 | 4,00 ±0,10 | 1,55 ±0,10 | 1,85 ±0,10 |



MLCC Chip Capacitor Size 0603

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Package Conditions



Dimension of Reel (mm)

| | A | B | C | D | E | F | G |
|----------|---------------|-----|--------------|--------------|----------------|--------------|------------|
| 7' Reel | Ø178 ± 2,0 | 3,0 | Ø13 ± 0,5 | Ø21 ± 0,8 | Ø50 or more | Ø10 ± 1,5 | 12 max. |
| 13' Reel | Ø330± 2,0 | 3,0 | Ø13 ± 0,5 | Ø21 ± 0,8 | Ø50 or more | Ø10 ± 1,5 | 12 max. |

Taping Specification

Paper Taping



Embossed Taping



Standard: 0,1N < peeling strength < 0,7N

No paper dirty remains on the scotch when peeling, and sticks to top an bottem tape

**MLCC Chip Capacitor Size
0603**

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Packing Quantity

| Size | Packing Style Quantity | | | |
|------|------------------------|-------|-------|-------|
| | PT | ET | BC | BP |
| 0402 | 10000 | ----- | 20000 | 5000 |
| 0603 | 5000 | ----- | 15000 | 5000 |
| 0805 | 5000 | 2500 | 10000 | 5000 |
| 1206 | 5000 | 2500 | 5000 | 5000 |
| 1210 | ----- | 2000 | ----- | 2000 |
| 1808 | ----- | 2000 | ----- | 2000 |
| 1812 | ----- | 2000 | ----- | 2000 |
| 2225 | ----- | ----- | ----- | 500 |
| 3035 | ----- | ----- | ----- | ----- |

Note: We can choose packing style and quantity can be according to the customer requirement

Soldering Informations

Storage Methods

The guaranteed period for solderability is 6 month (Under deliver package conditions).

Storage conditions:

Temperature: 5~40°C

Relative Humidity: 20~70%

Precautions for use

The Multilayer Ceramic Capacitor (MLCC) may fail in a short circuit modern in an open circuit mode when subjected to severe conditions of electrical and / or mechanical stress beyond the specified rating and specified conditions in the specification, which will result in burn out, flaming or glowing in the worst case.

Following precautions for safety and Application Notes shall be taken in your major consideration. If you have a question about the precautions für handling, please consult our engineering department of our factory.

Manual Soldering

Manual Soldering can pose a great risk of ceramic thermal cracks in capacitors. The hot soldering iron tip comes into direct contact with the end terminations, and operator careless may cause the tip of the soldering iron to come into direct contact with the ceramic body of the capacitor. Therefore the soldering iron must be handled carefully, and pay much attention to the selection of the soldering iron tip and temperature contact of the tip.

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Soldering Profile Curve

Classification Reflow Profile (JEDEC J-STD-020C)



Too much solder
Cracks tend occur due to large stress



Not enough solder
Weak holding force may cause bad connection between the capacitor and PCB



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Ordering Information

| Serie | Range | Material | Voltage | Capacitance Tolerance | Termination Material | No Function | No Function | ROHS | Packing | |
|-------|-------|----------|---------|-----------------------|----------------------|-------------|-------------|------|---------|--|
|-------|-------|----------|---------|-----------------------|----------------------|-------------|-------------|------|---------|--|

| | | | | | | | | | | |
|---------------|------------|------------|------------|----------|----------|----------|----------|----------|-----------|--|
| I11004 | 472 | X7R | 101 | K | S | N | N | R | TR | |
|---------------|------------|------------|------------|----------|----------|----------|----------|----------|-----------|--|

| | | | | | | | | | | |
|-------------------------------|-------------|-------------------|--------------|-------------|-----------------------|----------------|----------------|---------------------|-----------------|---------------|
| MLCC Chip Capacitor Size 0603 | 472= 4700pf | X7R= X7R Material | 101= 100Volt | K= Tol. 10% | S= Silver Termination | N= No Function | N= No Function | R= Rohs Conform | TR= Tape / Reel | |
| | | | | | C= Copper Termination | | | N= NON Rohs Conform | | BU= Bulk Ware |
| | | | | | N= Nickel Termination | | | | | |

MLCC Chip Capacitor Size 0603

Part No.: **I11004**

| | | | | | | | | | |
|-------|--------|------|--------|--------|--------|-----------|-----------|------|------------|
| DRW: | Jason | CHKD | Wilson | MATL: | Wilson | TOLERANCE | Mason | DATE | 14.10.2010 |
| APPD: | Schumi | | | FINISH | Jamy | | Sheet No. | | 14 from 14 |

Customer: