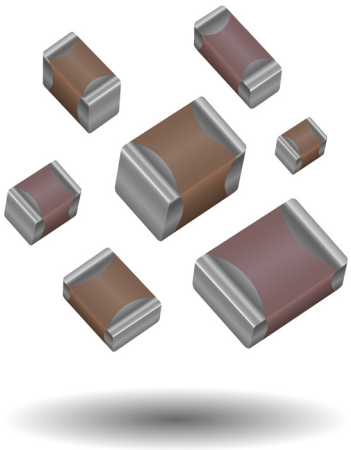
# MLCC Medical Applications – MM Series

## General Specifications



The AVX MM series is a multi-layer ceramic capacitor designed for use in medical applications other than implantable/life support. These components have the design & change control expected for medical devices and also offer enhanced LAT including reliability testing and 100% inspection.

## APPLICATIONS

### Implantable, Non-Life Supporting Medical Devices

- e.g. implanted temporary cardiac monitor, insulin pumps

### External, Life Supporting Medical Devices

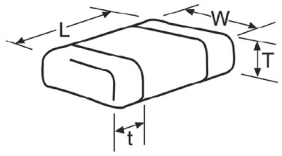
- e.g. heart pump external controller

### External Devices

- e.g. patient monitoring, diagnostic equipment

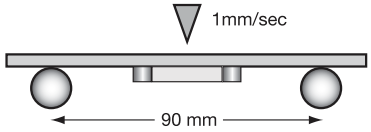
## HOW TO ORDER

| MM02 | Z | A | 100 | J | G | T | 3 | A |
|---|---|---|---|---|---|---|---|---|
| **Size**<br>MM02 = 0402<br>MM03 = 0603<br>MM05 = 0805<br>MM06 = 1206<br>MM10 = 1210<br>MM08 = 1808<br>MM12 = 1812<br>MM20 = 2220 | **Rated Voltage**<br>Z = 10V<br>Y = 16V<br>3 = 25V<br>5 = 50V<br>1 = 100V<br>2 = 200V<br>V = 250V<br>7 = 500V | **Dielectric Code**<br>A = NP0 (C0G)<br>C = X7R | **Capacitance Code (In pF)**<br>(2 significant digits + number of zeros)<br>**for values <10pF:** letter R denotes decimal point.<br>Example:<br>68pF = 680<br>8.2pF = 8R2 | **Capacitance Tolerance**<br>B = ±0.1pF<br>C = ±0.25pF<br>D = ±0.5pF<br>F = ±1% (≥10pF)<br>G = ±2% (≥10pF)<br>J = ±5%<br>K = ±10%<br>M = ±20% | **Failure Rate**<br>C = Standard Range<br>Contact AVX for others | **Termination Finish**<br>T = Plated Ni & Sn (NP0 only)<br>Z = Flexiterm (X7R only) | **Packaging**<br>2 = 7" Reel<br>4 = 13" Reel | **Special Code**<br>A = Standard<br>Contact AVX for others |



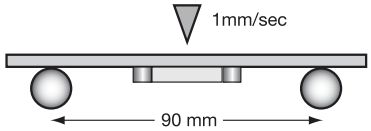

## COMMERCIAL VS MM SERIES PROCESS COMPARISON

| | Commercial | MM Series |
|---|---|---|
| **Administrative** | Standard part numbers; no restriction on who purchases these parts | Specific series part number, used to control supply of product |
| **Design** | Minimum ceramic thickness of 0.020" on all X7R product | Minimum ceramic thickness of 0.029" (0.74mm) |
| **Dicing** | Side & end margins = 0.003" min | Side & end margins = 0.004" min<br>Cover layers = 0.003" min |
| **Lot Qualification Destructive Physical Analysis (DPA)** | As per EIA RS469 | Increased sample plan – stricter criteria |
| **Visual/Cosmetic Quality** | Standard process and inspection | 100% inspection |
| **Application Robustness** | Standard sampling for accelerated wave solder on X7R dielectrics | Increased sampling for accelerated wave solder on X7R and NP0 followed by lot by lot reliability testing |
| **Design/Change Control** | Required to inform customer of changes in:<br>• form<br>• fit<br>• function | AVX will qualify and notify customers before making any change to the following materials or processes:<br>• Dielectric formulation, type, or supplier<br>• Metal formulation, type, or supplier<br>• Termination material formulation, type, or supplier<br>• Manufacturing equipment type<br>• Quality testing regime including sample size and accept/ reject criteria |

| Parameter/Test | | NP0 Specification Limits | Measuring Conditions | |
|---|---|---|---|---|
| **Operating Temperature Range** | | -55ºC to +125ºC | Temperature Cycle Chamber | |
| **Capacitance** | | Within specified tolerance | Freq.: 1.0 MHz ± 10% for cap ≤ 1000 pF<br>1.0 kHz ± 10% for cap > 1000 pF<br>Voltage: 1.0Vrms ± .2V | |
| **Q** | | <30 pF: Q≥ 400+20 x Cap Value<br>≥30 pF: Q≥ 1000 | | |
| **Insulation Resistance** | | 100,000MΩ or 1000MΩ - µF, whichever is less | Charge device with rated voltage for 60 ± 5 secs @ room temp/humidity | |
| **Dielectric Strength** | | No breakdown or visual defects | Charge device with 300% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max)<br>Note: Charge device with 150% of rated voltage for 500V devices. | |
| **Resistance to Flexure Stresses** | Appearance | No defects | Deflection: 2mm<br>Test Time: 30 seconds<br>  | |
| | Capacitance Variation | ±5% or ±.5 pF, whichever is greater | | |
| | Q | Meets Initial Values (As Above) | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 | | |
| **Solderability** | | ≥ 95% of each terminal should be covered with fresh solder | Dip device in eutectic solder at 230 ± 5ºC for 5.0 ± 0.5 seconds | |
| **Resistance to Solder Heat** | Appearance | No defects, <25% leaching of either end terminal | Dip device in eutectic solder at 260ºC for 60 seconds. Store at room temperature for 24 ± 2 hours before measuring electrical properties. | |
| | Capacitance Variation | ≤ ±2.5% or ±.25 pF, whichever is greater | | |
| | Q | Meets Initial Values (As Above) | | |
| | Insulation Resistance | Meets Initial Values (As Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |
| **Thermal Shock** | Appearance | No visual defects | Step 1: -55ºC ± 2º | 30 ± 3 minutes |
| | Capacitance Variation | ≤ ±2.5% or ±.25 pF, whichever is greater | Step 2: Room Temp | ≤ 3 minutes |
| | Q | Meets Initial Values (As Above) | Step 3: +125ºC ± 2º | 30 ± 3 minutes |
| | Insulation Resistance | Meets Initial Values (As Above) | Step 4: Room Temp | ≤ 3 minutes |
| | Dielectric Strength | Meets Initial Values (As Above) | Repeat for 5 cycles and measure after 24 hours at room temperature | |
| **Load Life** | Appearance | No visual defects | Charge device with twice rated voltage in test chamber set at 125ºC ± 2ºC for 1000 hours (+48, -0).<br><br>Remove from test chamber and stabilize at room temperature for 24 hours before measuring. | |
| | Capacitance Variation | ≤ ±3.0% or ± .3 pF, whichever is greater | | |
| | Q | ≥ 30 pF: Q≥ 350<br>≥10 pF, <30 pF: Q≥ 275 +5C/2<br><10 pF: Q≥ 200 +10C | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 (See Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |
| **Load Humidity** | Appearance | No visual defects | Store in a test chamber set at 85ºC ± 2ºC/ 85% ± 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied.<br><br>Remove from chamber and stabilize at room temperature for 24 ± 2 hours before measuring. | |
| | Capacitance Variation | ≤ ±5.0% or ± .5 pF, whichever is greater | | |
| | Q | ≥ 30 pF: Q≥ 350<br>≥10 pF, <30 pF: Q≥ 275 +5C/2<br><10 pF: Q≥ 200 +10C | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 (See Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |

### PREFERRED SIZES ARE SHADED

| SIZE | | 0603 | | | | 0805 | | | | | 1206 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WVDC | 16 | 25 | 50 | 100 | 16 | 25 | 50 | 100 | 16 | 25 | 50 | 100 |
| Cap (pF) | 0.5 0R5 | | | | | | | | | | | | |
| | 1.0 1R0 | | | | | | | | | | | | |
| | 1.2 1R2 | | | | | | | | | | | | |
| | 1.5 1R5 | | | | | | | | | | | | |
| | 1.8 1R8 | | | | | | | | | | | | |
| | 2.2 2R2 | | | | | | | | | | | | |
| | 2.7 2R7 | | | | | | | | | | | | |
| | 3.3 3R3 | | | | | | | | | | | | |
| | 3.9 3R9 | | | | | | | | | | | | |
| | 4.7 4R7 | | | | | | | | | | | | |
| | 5.6 5R6 | | | | | | | | | | | | |
| | 6.8 6R8 | | | | | | | | | | | | |
| | 8.2 8R2 | | | | | | | | | | | | |
| | 10 100 | | | | | | | | | | | | |
| | 12 120 | | | | | | | | | | | | |
| | 15 150 | | | | | | | | | | | | |
| | 18 180 | | | | | | | | | | | | |
| | 22 220 | | | | | | | | | | | | |
| | 27 270 | | | | | | | | | | | | |
| | 33 330 | | | | | | | | | | | | |
| | 39 390 | | | | | | | | | | | | |
| | 47 470 | | | | | | | | | | | | |
| | 56 560 | | | | | | | | | | | | |
| | 68 680 | | | | | | | | | | | | |
| | 82 820 | | | | | | | | | | | | |
| | 100 101 | | | | | | | | | | | | |
| | 120 121 | | | | | | | | | | | | |
| | 150 151 | | | | | | | | | | | | |
| | 180 181 | | | | | | | | | | | | |
| | 220 221 | | | | | | | | | | | | |
| | 270 271 | | | | | | | | | | | | |
| | 330 331 | | | | | | | | | | | | |
| | 390 391 | | | | | | | | | | | | |
| | 470 471 | | | | | | | | | | | | |
| | 560 561 | | | | | | | | | | | | |
| | 680 681 | | | | | | | | | | | | |
| | 820 821 | | | | | | | | | | | | |
| | 1000 102 | | | | | | | | | | | | |
| | 1200 122 | | | | | | | | | | | | |
| | 1500 152 | | | | | | | | | | | | |
| WVDC | | 16 | 25 | 50 | 100 | 16 | 25 | 50 | 100 | 16 | 25 | 50 | 100 |
| SIZE | | 0603 | | | | 0805 | | | | | 1206 | | |

| Parameter/Test | | X7R Specification Limits | Measuring Conditions | |
|---|---|---|---|---|
| **Operating Temperature Range** | | -55ºC to +125ºC | Temperature Cycle Chamber | |
| **Capacitance** | | Within specified tolerance | Freq.: 1.0 kHz ± 10%<br>Voltage: 1.0Vrms ± .2V | |
| **Q** | | ≤ 10% for ≥ 50V DC rating<br>≤ 12.5% for 25V DC rating<br>≤ 12.5% for 25V and 16V DC rating<br>≤ 12.5% for ≤ 10V DC rating | | |
| **Insulation Resistance** | | 100,000MΩ or 1000MΩ - µF, whichever is less | Charge device with rated voltage for 120 ± 5 secs @ room temp/humidity | |
| **Dielectric Strength** | | No breakdown or visual defects | Charge device with 300% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max)<br>Note: Charge device with 150% of rated voltage for 500V devices. | |
| **Resistance to Flexure Stresses** | Appearance | No defects | Deflection: 2mm<br>Test Time: 30 seconds<br>  | |
| | Capacitance Variation | ≤ ±12% | | |
| | Dissipation Factor | Meets Initial Values (As Above) | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 | | |
| **Solderability** | | ≥ 95% of each terminal should be covered with fresh solder | Dip device in eutectic solder at 230 ± 5ºC for 5.0 ± 0.5 seconds | |
| **Resistance to Solder Heat** | Appearance | No defects, <25% leaching of either end terminal | Dip device in eutectic solder at 260ºC for 60 seconds. Store at room temperature for 24 ± 2 hours before measuring electrical properties. | |
| | Capacitance Variation | ≤ ±7.5% | | |
| | Dissipation Factor | Meets Initial Values (As Above) | | |
| | Insulation Resistance | Meets Initial Values (As Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |
| **Thermal Shock** | Appearance | No visual defects | Step 1: -55ºC ± 2º | 30 ± 3 minutes |
| | Capacitance Variation | ≤ ±7.5% | Step 2: Room Temp | ≤ 3 minutes |
| | Dissipation Factor | Meets Initial Values (As Above) | Step 3: +125ºC ± 2º | 30 ± 3 minutes |
| | Insulation Resistance | Meets Initial Values (As Above) | Step 4: Room Temp | ≤ 3 minutes |
| | Dielectric Strength | Meets Initial Values (As Above) | Repeat for 5 cycles and measure after 24 ± 2 hours at room temperature | |
| **Load Life** | Appearance | No visual defects | Charge device with 1.5 rated voltage (≤ 10V) in test chamber set at 125ºC ± 2ºC for 1000 hours (+48, -0)<br><br>Remove from test chamber and stabilize at room temperature for 24 ± 2 hours before measuring. | |
| | Capacitance Variation | ≤ ±12.5% | | |
| | Dissipation Factor | ≤ Initial Value x 2.0 (See Above) | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 (See Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |
| **Load Humidity** | Appearance | No visual defects | Store in a test chamber set at 85ºC ± 2ºC/ 85% ± 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied.<br><br>Remove from chamber and stabilize at room temperature and humidity for 24 ± 2 hours before measuring. | |
| | Capacitance Variation | ≤ ±12.5% | | |
| | Dissipation Factor | ≤ Initial Value x 2.0 (See Above) | | |
| | Insulation Resistance | ≥ Initial Value x 0.3 (See Above) | | |
| | Dielectric Strength | Meets Initial Values (As Above) | | |

# MM Series – MLCC for Medical Applications

## X7R Capacitance Range

### PREFERRED SIZES ARE SHADED

| SIZE | | | 0402 | | | 0603 | | | | | | 0805 | | | | | | | 1206 | | | | | | | | 1210 | | | | | | | | 1808 | | | 1812 | | | | 2220 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | WVDC | 16 | 25 | 50 | 10 | 16 | 25 | 50 | 100 | 200 | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 50 | 100 | 200 | 50 | 100 | 200 | 250 | 25 | 50 | 100 |
| Cap | 220 | 221 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (pF) | 270 | 271 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 330 | 331 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 390 | 391 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 470 | 471 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 560 | 561 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 680 | 681 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 820 | 821 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1000 | 102 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1200 | 122 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1500 | 152 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1800 | 182 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2200 | 222 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2700 | 272 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 3300 | 332 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 3900 | 392 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4700 | 472 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5600 | 562 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 6800 | 682 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 8200 | 822 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| cap | 0.010 | 103 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| uF | 0.012 | 123 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.015 | 153 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.018 | 183 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.022 | 223 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.027 | 273 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.033 | 333 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.039 | 393 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.047 | 473 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.056 | 563 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.068 | 683 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.082 | 823 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.10 | 104 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.12 | 124 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.15 | 154 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.22 | 224 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.33 | 334 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.47 | 474 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.56 | 564 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.68 | 684 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.82 | 824 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1.0 | 105 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1.2 | 125 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1.5 | 155 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | WVDC | | 16 | 25 | 50 | 10 | 16 | 25 | 50 | 100 | 200 | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 10 | 16 | 25 | 50 | 100 | 200 | 250 | 500 | 50 | 100 | 200 | 50 | 100 | 200 | 250 | 25 | 50 | 100 |
| SIZE | | | 0402 | | | 0603 | | | | | | 0805 | | | | | | | 1206 | | | | | | | | 1210 | | | | | | | | 1808 | | | 1812 | | | | 2220 | | |

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

AVX:

MM031A220JCT2A MM031A330JCT2A MM051A471JCT2A MM055A681JCT2A MM061A101JCT2A MM061A471JCT2A MM031C103KCZ2A MM035C104KCZ2A MM035C223KCZ2A MM051C103KCZ2A MM062C102KCZ2A MM102C104KCZ2A