Table 1: Bill of Materials

**Schematic:** noise_r1.sch Tue Aug 22 20:23:04 2006
**BOM:** noise_r1.bom Wed Aug 23 20:06:46 2006

| Qty | Reference | Value | Footprint | Mfg PN | Notes |
|---|---|---|---|---|---|
| 1 | C1 | 1uF | 1206 | TDK C3216X7R1H105K | |
| 1 | C2 | 0.01uF | 0805 | Kemet C0805C103K5RACTU | |
| 1 | C3 | 3300pF | 0603 | BC VJ0603Y332KXACW1BC | |
| 2 | C4, C5 | 0.1uF | 0805 | Kemet C0805C104K5RACTU | |
| 1 | J1 | | CON_HDR.. | Mill-Max 800-10-005-20-001 | |
| 1 | Q1 | | SOT23.. | On-Semiconductor BC817-40LT1 | |
| 1 | R1 | 100K | 0805 | Yageo 9C08052A1003FKHFT | |
| 2 | R3, R4 | 4.7M | 0805 | Yageo RC0805FR-074M7L | |
| 1 | R5 | 1K | 0805 | Yageo RC0805FR-071KL | |
| 1 | R6 | 3.3K | 0805 | Rohm MCR10EZHF3301 | |
| 1 | U1 | | SOIC.. | On-Semiconductor MC33078D | |

Table 2: Component List

**Schematic:** noise_r1.sch Tue Aug 22 20:23:04 2006
**BOM:** noise_r1.bom Wed Aug 23 20:06:46 2006

| Reference | Value | Footprint | Mfg PN | Notes |
|---|---|---|---|---|
| C1 | 1uF | 1206 | TDK C3216X7R1H105K | |
| C2 | 0.01uF | 0805 | Kemet C0805C103K5RACTU | |
| C3 | 3300pF | 0603 | BC VJ0603Y332KXACW1BC | |
| C4 | 0.1uF | 0805 | Kemet C0805C104K5RACTU | |
| C5 | 0.1uF | 0805 | Kemet C0805C104K5RACTU | |
| J1 | | CON_HDR.. | Mill-Max 800-10-005-20-001 | |
| Q1 | | SOT23.. | On-Semiconductor BC817-40LT1 | |
| R1 | 100K | 0805 | Yageo 9C08052A1003FKHFT | |
| R3 | 4.7M | 0805 | Yageo RC0805FR-074M7L | |
| R4 | 4.7M | 0805 | Yageo RC0805FR-074M7L | |
| R5 | 1K | 0805 | Yageo RC0805FR-071KL | |
| R6 | 3.3K | 0805 | Rohm MCR10EZHF3301 | |
| U1 | | SOIC.. | On-Semiconductor MC33078D | |

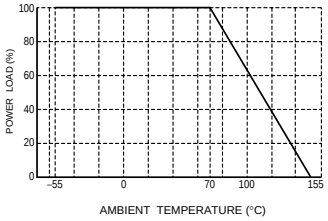
# Thick film rectangular

## **MCR10** (2012 size : 1 / 8W)

**●Features**

1) Power rating of 1 / 8W
2) Highly reliable chip resistor
   Ruthenium oxide dielectric offers superior resistance to the elements.
3) Electrodes not corroded by soldering
   Thick film makes the electrodes very strong.
4) Leading the world in development and mass production.
   Since start of production in 1982 (first in the wold), this component has established a solid reputation as a general–purpose chip resistor.
5) ROHM resistors have approved ISO–9001 certification.
   Design and specifications are subject to change without notice. Carefully check the specification sheet before using or ordering it.

**●Ratings**

| Item | Conditions | Specifications |
|---|---|---|
| Rated power | Power must be derated according to the power derating curve in Figure 1 when ambient temperature exceeds 70°C.<br>  <br><br>Fig.1 | 0.125W (1 / 8W)<br>at 70°C |
| Rated voltage | The voltage rating is calculated by the following equation.<br>If the value obtained exceeds the limiting element voltage, the voltage rating is equal to the maximum operating voltage.<br>$E=\sqrt{P\times R}$<br>E: Rated voltage (V)<br>P: Rated power (W)<br>R: Nominal resistance (Ω) | Limiting element voltage 150V |
| Nominal resistance | See Table 1. | |
| Operating temperature | | –55°C to + 155°C |

# Class 2 X7R 10/16/25/50/100 V

Vishay BCcomponents

## Surface Mount Multilayer Chip Capacitors

### FEATURES

- Stable class 2 dielectric
- Four standard sizes
- High capacitance per unit volume
- Supplied in tape on reel
- For high frequency applications
- Ni-barrier with 100 % tin terminations.

### APPLICATIONS

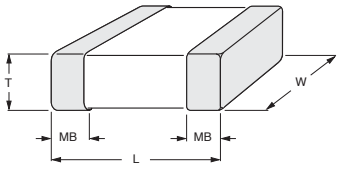
- Consumer electronics
- Telecommunications
- Data processing

### GENERAL SPECIFICATIONS

**NOTE:** Electrical characteristics values - temperature at 20 ± 1 °C, pressure at 86 to 106 Kpa and humidity at 63 to 67 % unless otherwise stated
**Rated Voltage $U_R$ (DC):** 10 V; 16 V; 25 V; 50 V; 100 V
**Capacitance Range:** 100 pF to 1.0 µF
**Tolerance on Capacitance:**
After 1000 hours; ± 5; ± 10, ± 20

**Tan δ:**
50 V ≤ 2.5 %
25 V and 16 V ≤ 3.5 %
10 V ≤ 5 %
**Temperature Coefficient:** ± 15 %
**Insulation Resistance after 120 seconds at $U_R$ (DC):**
$R_{ins}$10 GΩ minimum or 500ΩF minimum, whichever is less
**Climatic Category (IEC 68):** 55/125/56

**DIMENSIONS** in inches [millimeters]




| SIZE CODE | L | W | T MAX. | MB |
|---|---|---|---|---|
| 0402 | 0.040 ± 0.002 [1.0 ± 0.05] | 0.020 ± 0.002 [0.5 ± 0.05] | 0.022 [0.55] | 0.010 + 0.002/- 0.004 [0.25 +0.05/– 0.1] |
| 0603 | 0.063 ± 0.004 [1.6 ± 0.10] | 0.030 ± 0.004 [0.8 ± 0.07] | 0.035 [0.87] | 0.015 ± 0.006 [0.40 ± 0.15] |
| 0805 | 0.080 ± 0.006 [2.0 ± 0.15] | 0.050 ± 0.006 [1.25 ± 0.15] | 0.053 [1.35] | 0.020 ± 0.008 [0.50 ± 0.20] |
| 1206 | 0.125 ± 0.006 [3.2 ± 0.15] | 0.063 ± 0.006 [1.6 ± 0.15] | 0.069 [1.80] | 0.025 ± 0.008 [0.60 ± 0.20] |

### ORDERING INFORMATION

| VJ0402 | Y | 101 | J | X | Q | C | W1BC |
|---|---|---|---|---|---|---|---|
| SIZE CODE | DIELECTRIC | CAPACITANCE | TOLERANCE | TERMINATION | VOLTAGE | PACKAGING | TECHNOLOGY |
| 0402<br>0603<br>0805<br>1206 | Y = X7R | two significant digits followed by the number of zeros:<br>101 = 100<br>102 = 1000<br>152 = 1500<br>103 = 10000 | J = ± 5 %<br>K = ± 10 %<br>M = ± 20 % | X = Ni Barrier | Q = 10 V<br>J = 16 V<br>X = 25 V<br>A = 50 V<br>B = 100 V | C = 7 inch reel/paper<br>P = 13 inch reel/paper<br>T = 7 inch reel/blister<br>R = 13 inch reel/blister | |

U1

# MC33078, MC33079

# Low Noise Dual/Quad Operational Amplifiers

The MC33078/9 series is a family of high quality monolithic amplifiers employing Bipolar technology with innovative high performance concepts for quality audio and data signal processing applications. This family incorporates the use of high frequency PNP input transistors to produce amplifiers exhibiting low input voltage noise with high gain bandwidth product and slew rate. The all NPN output stage exhibits no deadband crossover distortion, large output voltage swing, excellent phase and gain margins, low open loop high frequency output impedance and symmetrical source and sink AC frequency performance.

The MC33078/9 family offers both dual and quad amplifier versions and is available in the plastic DIP and SOIC packages (P and D suffixes).

### Features

- Dual Supply Operation: ±5.0 V to ±18 V
- Low Voltage Noise: 4.5 nV/$\sqrt{Hz}$
- Low Input Offset Voltage: 0.15 mV
- Low T.C. of Input Offset Voltage: 2.0 μV/°C
- Low Total Harmonic Distortion: 0.002%
- High Gain Bandwidth Product: 16 MHz
- High Slew Rate: 7.0 V/μs
- High Open Loop AC Gain: 800 @ 20 kHz
- Excellent Frequency Stability
- Large Output Voltage Swing: +14.1 V/ −14.6 V
- ESD Diodes Provided on the Inputs
- Pb−Free Packages are Available

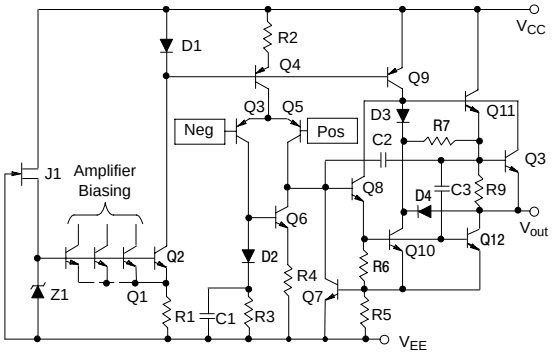


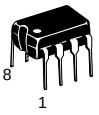

**Figure 1. Representative Schematic Diagram**
(Each Amplifier)

**ON Semiconductor®**

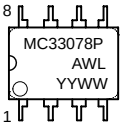
**http://onsemi.com**

**MARKING DIAGRAMS**

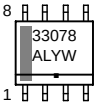
**DUAL**



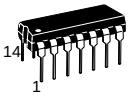
**PDIP−8**
**P SUFFIX**
**CASE 626**



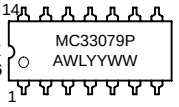

**SOIC−8**
**D SUFFIX**
**CASE 751**



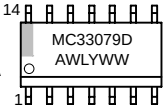

**QUAD**



**PDIP−14**
**P SUFFIX**
**CASE 646**




**SOIC−14**
**D SUFFIX**
**CASE 751A**




A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
▪ = Pb−Free Package

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

Q1

# BC817-16LT1, BC817-25LT1, BC817-40LT1

## General Purpose Transistors

### NPN Silicon

**Features**

- Pb−Free Packages are Available

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector − Emitter Voltage | $V_{CEO}$ | 45 | V |
| Collector − Base Voltage | $V_{CBO}$ | 50 | V |
| Emitter − Base Voltage | $V_{EBO}$ | 5.0 | V |
| Collector Current − Continuous | $I_C$ | 500 | mAdc |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation FR−5 Board, (Note 1) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 225<br>1.8 | mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 556 | °C/W |
| Total Device Dissipation Alumina Substrate, (Note 2) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 300<br>2.4 | mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 417 | °C/W |
| Junction and Storage Temperature | $T_J$, $T_{stg}$ | −55 to +150 | °C |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. FR−5 = 1.0 x 0.75 x 0.062 in.
2. Alumina = 0.4 x 0.3 x 0.024 in 99.5% alumina.

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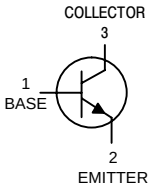
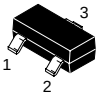
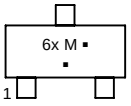
**http://onsemi.com**




**SOT−23**
**CASE 318**
**STYLE 6**

**MARKING DIAGRAM**




6x = Device Code
x = A, B, or C
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or overbar may vary depending upon manufacturing location.

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

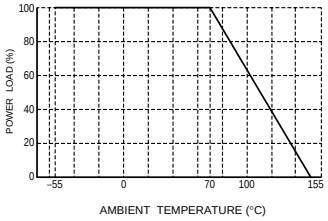
# Thick film rectangular

## **MCR10** (2012 size : 1 / 8W)

**●Features**

1) Power rating of 1 / 8W
2) Highly reliable chip resistor
   Ruthenium oxide dielectric offers superior resistance to the elements.
3) Electrodes not corroded by soldering
   Thick film makes the electrodes very strong.
4) Leading the world in development and mass production.
   Since start of production in 1982 (first in the wold), this component has established a solid reputation as a general–purpose chip resistor.
5) ROHM resistors have approved ISO–9001 certification.
   Design and specifications are subject to change without notice. Carefully check the specification sheet before using or ordering it.

**●Ratings**

| Item | Conditions | Specifications |
|---|---|---|
| Rated power | Power must be derated according to the power derating curve in Figure 1 when ambient temperature exceeds 70°C.<br>  <br><br>Fig.1 | 0.125W (1 / 8W)<br>at 70°C |
| Rated voltage | The voltage rating is calculated by the following equation.<br>If the value obtained exceeds the limiting element voltage, the voltage rating is equal to the maximum operating voltage.<br>$E=\sqrt{P\times R}$<br>E: Rated voltage (V)<br>P: Rated power (W)<br>R: Nominal resistance (Ω) | Limiting element voltage: 150V |
| Nominal resistance | See Table 1. | |
| Operating temperature | | –55°C to + 155°C |

MILL-MAX®

**INTERCONNECTS**
**.030" dia. Pins, Straight and Right Angle**
**Single Row**

**Series 800, 801**

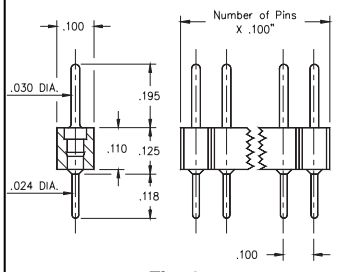



**Fig. 1**

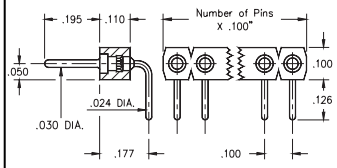



**Fig. 2**

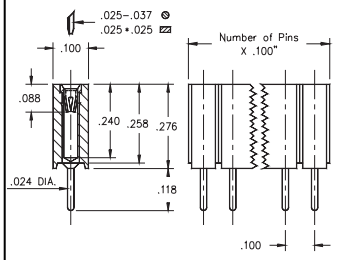



**Fig. 3**

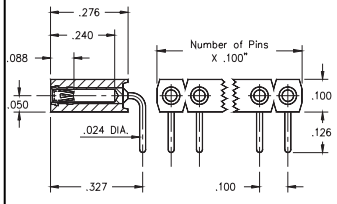
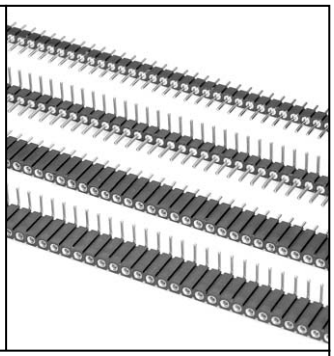



**Fig. 4**

- Receptacles accept .030" diameter and .025" square pins such as Series 890 and 892 pin headers.
- Pin interconnects available with straight (MM# 7007) or right angle (MM# 5005) solder tails. (See page 173 for details)
- Sockets are available with straight (MM# 1304) or right angle (MM# 1305) solder tails. (See pages 146 & 147 for details)



## Ordering Information

**Fig. 1** — **Series 800...10-001 Straight Pin Header**

800-XX-0_ _-10-001

**Specify # of pins** → 01-64

**Fig. 2** — **Series 800...20-001 Right Angle Pin Header**

800-XX-0 _ _-20-001

**Specify # of pins** → 01-64

***XX= Plating Code See Below***

| SPECIFY PLATING CODE XX= | 10 | 90 | | |
|---|---|---|---|---|
| Pin Plating | 10µ" Au | 200µ" Sn/Pb | | |

**Fig. 3** — **Series 801...10-001 Straight Socket**

801-XX-0_ _-10-001

**Specify # of pins** → 01-50

**Fig. 4** — **Series 801...20-001 Right Angle Socket**

801-XX-0 _ _-20-001

**Specify # of pins** → 01-50

***XX= Plating Code See Below***

| SPECIFY PLATING CODE XX= | | | 93 | 99 |
|---|---|---|---|---|
| Sleeve (Pin) | | | 200µ" Sn/Pb | 200µ"Sn/Pb |
| Contact (Clip) | | | 30µ" Au | 200µ"Sn/Pb |

TDK

# General Multilayer Ceramic Chip Capacitors
# C Series

## FEATURES

- High capacitance has been achieved through precision technologies that enable the use of multiple thinner ceramic dielectric layers.
- A monolithic structure ensures superior mechanical strength and reliability.
- High-accuracy automatic mounting is facilitated through the maintenance of very precise dimensional tolerances.
- Composed of only ceramics and metals, these capacitors provide extremely dependable performance, exhibiting virtually no degradation even when subjected to temperature extremes.
- Low stray capacitance ensures high conformity with nominal values, thereby simplifying the circuit design process.
- Low residual inductance assures superior frequency characteristics.
- Because electrostatic capacity has been obtained up to the electrolytic capacitor range, these capacitors offer long service life and are optimally suited for power supply designs that require high levels of reliability.
- Owing to their low ESR and excellent frequency characteristics, these products are optimally suited for high frequency and high-density type power supplies.

## PRODUCT IDENTIFICATION

| C | 0603 | CH | 1H | 100 | D | □ |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |

(1) Series name

(2) Dimensions L×W

| | |
|---|---|
| 0603 | 0.6×0.3mm |
| 1005 | 1.0×0.5mm |
| 1608 | 1.6×0.8mm |
| 2012 | 2.0×1.25mm |
| 3216 | 3.2×1.6mm |
| 3225 | 3.2×2.5mm |
| 4532 | 4.5×3.2mm |
| 5750 | 5.7×5.0mm |

(3) Capacitance temperature characteristics

Class 1 (Temperature compensation)

| Temperature characteristics | Capacitance change | Temperature range |
|---|---|---|
| CH | 0±60ppm/°C | –25 to +85°C |
| C0G | 0±30ppm/°C | –55 to +125°C |
| SL | +350 to –1000ppm/°C | +20 to +85°C |

Class 2

| Temperature characteristics | Capacitance change | Temperature range |
|---|---|---|
| B(JB*) | ±10% | –25 to +85°C |
| F(JF*) | +30, –80% | –25 to +85°C |
| X7R | ±15% | –55 to +125°C |
| X5R | ±15% | –55 to +85°C |
| Y5V | +22, –82% | –30 to +85°C |

*JB(JIS: BJ), JF(JIS: FJ)

(4) Rated voltage Edc

| | |
|---|---|
| 0J | 6.3V |
| 1A | 10V |
| 1C | 16V |
| 1E | 25V |
| 1H | 50V |

(5) Nominal capacitance

The capacitance is expressed in three digit codes and in units of pico farads (pF).

The first and second digits identify the first and second significant figures of the capacitance.

The third digit identifies the multiplier.

R designates a decimal point.

| | |
|---|---|
| 010 | 1pF |
| 100 | 10pF |
| 102 | 1,000pF |
| 0R5 | 0.5pF |

(6) Capacitance tolerance

| Symbol | Tolerance | Applicable capacitance range |
|---|---|---|
| C | ±0.25pF | 10pF or less |
| D | ±0.5pF | |
| J | ±5% | Over 10pF |
| K | ±10% | |
| M | ±20% | |
| Z | +80, –20% | |

(7) Packaging style

| | |
|---|---|
| T | Taping (reel) |
| B | Bulk |

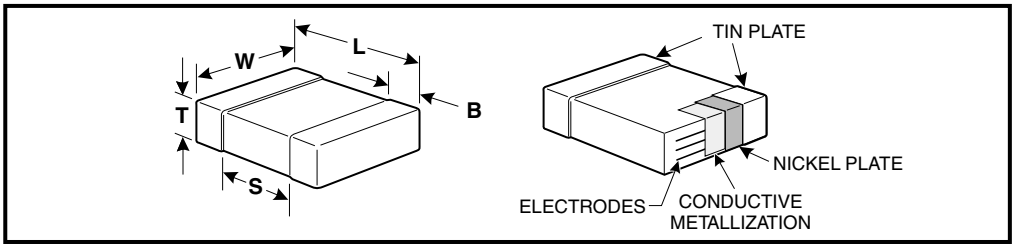
# CERAMIC CHIP CAPACITORS

KEMET

## FEATURES

- C0G (NP0), X7R, X5R, Z5U and Y5V Dielectrics
- 10, 16, 25, 50, 100 and 200 Volts
- Standard End Metalization: Tin-plate over nickel barrier
- Available Capacitance Tolerances: ±0.10 pF; ±0.25 pF; ±0.5 pF; ±1%; ±2%; ±5%; ±10%; ±20%; and +80%-20%
- Tape and reel packaging per EIA481-1. (See page 92 for specific tape and reel information.) Bulk Cassette packaging (0402, 0603, 0805 only) per IEC60286-6 and EIAJ 7201.
- RoHS Compliant

## CAPACITOR OUTLINE DRAWINGS




## DIMENSIONS—MILLIMETERS AND (INCHES)

| EIA SIZE CODE | METRIC SIZE CODE (Ref only) | L # LENGTH | W # WIDTH | | B BANDWIDTH | S MIN. SEPARATION | MOUNTING TECHNIQUE |
|---|---|---|---|---|---|---|---|
| 0402* | 1005 | 1.0 (.04) ± .05(.002) | 0.5 (.02) ± .05 (.002) | | 0.20 (0.008)-0.40 (0.016) | 0.3 (.012) | Solder Reflow |
| 0603* | 1608 | 1.6 (.063) ± 0.15 (.006) | 0.8 (.032) ± 0.15 (.006) | | 0.35 (.014) ±0.15 (.006) | 0.7 (.028) | |
| 0805* | 2012 | 2.0 (.079) ± 0.2 (.008) | 1.25 (.049) ± 0.2 (.008) | | 0.5 (.02) ±.25 (.010) | 0.75 (.030) | Solder Wave † or Solder Reflow |
| 1206* | 3216 | 3.2 (.126) ± 0.2 (.008) | 1.6 (.063) ± 0.2 (.008) | | 0.5 (.02) ±.25 (.010) | N/A | |
| 1210* | 3225 | 3.2 (.126) ± 0.2 (.008) | 2.5 (.098) ± 0.2 (.008) | | 0.5 (.02) ±.25 (.010) | N/A | |
| 1812 | 4532 | 4.5 (.177) ± 0.3 (.012) | 3.2 (.126) ± 0.3 (.012) | | 0.6 (.024) ±.35 (.014) | N/A | |
| 1825* | 4564 | 4.5 (.177) ± 0.3 (.012) | 6.4 (.252) ± 0.4 (.016) | | 0.6 (.024) ±.35 (.014) | N/A | Solder Reflow |
| 2220 | 5650 | 5.6 (.220) ± 0.4 (.016) | 5.0 (.197) ± 0.4 (.016) | | 0.6 (.024) ±.35 (.014) | N/A | |
| 2225 | 5664 | 5.6 (.220) ± 0.4 (.016) | 6.3 (.248) ± 0.4 (.016) | | 0.6 (.024) ±.35 (.014) | N/A | |

See page 77 for thickness dimensions.

* Note: Indicates EIA Preferred Case Sizes (Tightened tolerances apply for 0402, 0603, and 0805 packaged in bulk cassette, see page 96.)
† For extended value 1210 case size – solder reflow only.

## CAPACITOR ORDERING INFORMATION (Standard Chips - For Military see page 90)

C 0805 C 103 K 5 R A C*

**CERAMIC**

**SIZE CODE**

**SPECIFICATION**
C - Standard

**CAPACITANCE CODE**
Expressed in Picofarads (pF)
First two digits represent significant figures.
Third digit specifies number of zeros. (Use 9 for 1.0 through 9.9pF. Use 8 for 0.5 through 0.99pF)
(Example: 2.2pF = 229 or 0.50 pF = 508)

**CAPACITANCE TOLERANCE**

| | |
|---|---|
| B – ±0.10pF | J – ±5% |
| C – ±0.25pF | K – ±10% |
| D – ±0.5pF | M – ±20% |
| F – ±1% | P – (GMV) – special order only |
| G – ±2% | Z – +80%, -20% |

**VOLTAGE**

| | |
|---|---|
| 1 - 100V | 3 - 25V |
| 2 - 200V | 4 - 16V |
| 5 - 50V | 8 - 10V |
| | 9 - 6.3V |

**TEMPERATURE CHARACTERISTIC**
Designated by Capacitance Change Over Temperature Range
G – C0G (NP0) (±30 PPM/°C)
R – X7R (±15%) (-55°C + 125°C)
P– X5R (±15%) (-55°C + 85°C)
U – Z5U (+22%, -56%) (+10°C + 85°C)
V – Y5V (+22%, -82%) (-30°C + 85°C)

**FAILURE RATE LEVEL**
A- Not Applicable

**END METALLIZATION**
C-Standard (Tin-plated nickel barrier)

*** Part Number Example: C0805C103K5RAC (14 digits - no spaces)**