

# Type CMR , High-Reliability, Mica Capacitors

## High-Reliability Dipped Capacitors/MIL-PRF-39001

Type CMR meets requirement of MIL-PRF-39001, Type CMR high-reliability dipped silvered mica capacitors are ideal for high-grade ground, airborne, and spaceborne devices, such as computers, jetcraft, and missiles.



## Specifications

- Voltage Range:** 50 Vdc to 500 Vdc
- Capacitance Range:** 1 pF to 91,000 pF
- Capacitance Tolerance:**  $\pm\frac{1}{2}$  pF (D),  $\pm 1\%$  (F),  $\pm 2\%$  (G),  $\pm 5\%$  (J)
- Temperature Range:**  $-55\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$  (O),  $-55\text{ }^{\circ}\text{C}$  to  $150\text{ }^{\circ}\text{C}$  (P)  
P temperature range available only for CMR04, CMR05, CMR06, CMR07, CMR08
- Reliability:** Meets Requirements of MIL-PRF-39001  
Established reliability to .01%/1,000 hours failure rate

## Ratings and Dimensions

| Cap (pF)      | Catalog Part Number | L in (mm)  | H in (mm)  | T in (mm)  | S in (mm)  | d in (mm) |
|---------------|---------------------|------------|------------|------------|------------|-----------|
| <b>50 Vdc</b> |                     |            |            |            |            |           |
| 22            | CMR03E220DOYR       | .270 (6.9) | .190 (4.8) | .110 (2.8) | .120 (3.0) | .016 (.4) |
| 24            | CMR03E240DOYR       | .270 (6.9) | .190 (4.8) | .110 (2.8) | .120 (3.0) | .016 (.4) |
| 27            | CMR03E270JOYR       | .270 (6.9) | .190 (4.8) | .110 (2.8) | .120 (3.0) | .016 (.4) |
| 30            | CMR03E300JOYR       | .270 (6.9) | .190 (4.8) | .110 (2.8) | .120 (3.0) | .016 (.4) |
| 33            | CMR03E330JOYR       | .270 (6.9) | .190 (4.8) | .110 (2.8) | .120 (3.0) | .016 (.4) |
| 36            | CMR03E360JOYR       | .270 (6.9) | .190 (4.8) | .110 (2.8) | .120 (3.0) | .016 (.4) |
| 39            | CMR03E390JOYR       | .270 (6.9) | .190 (4.8) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 43            | CMR03E430JOYR       | .270 (6.9) | .190 (4.8) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 47            | CMR03E470JOYR       | .270 (6.9) | .190 (4.8) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 51            | CMR03E510JOYR       | .270 (6.9) | .190 (4.8) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 56            | CMR03E560JOYR       | .270 (6.9) | .200 (5.1) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 62            | CMR03E620JOYR       | .270 (6.9) | .200 (5.1) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 68            | CMR03E680JOYR       | .270 (6.9) | .200 (5.1) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 75            | CMR03E750JOYR       | .270 (6.9) | .200 (5.1) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 82            | CMR03E820JOYR       | .270 (6.9) | .200 (5.1) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 91            | CMR03F910JOYR       | .270 (6.9) | .200 (5.1) | .130 (3.3) | .120 (3.0) | .016 (.4) |
| 100           | CMR03F101JOYR       | .270 (6.9) | .200 (5.1) | .130 (3.3) | .120 (3.0) | .016 (.4) |
| 110           | CMR03F111JOYR       | .270 (6.9) | .200 (5.1) | .130 (3.3) | .120 (3.0) | .016 (.4) |
| 120           | CMR03F121JOYR       | .270 (6.9) | .200 (5.1) | .130 (3.3) | .120 (3.0) | .016 (.4) |
| 130           | CMR03F131JOYR       | .270 (6.9) | .210 (5.3) | .130 (3.3) | .120 (3.0) | .016 (.4) |

| Cap (pF)       | Catalog Part Number | L in (mm)  | H in (mm)  | T in (mm)  | S in (mm)  | d in (mm) |
|----------------|---------------------|------------|------------|------------|------------|-----------|
| 150            | CMR03F151JOYR       | .270 (6.9) | .210 (5.3) | .140 (3.6) | .120 (3.0) | .016 (.4) |
| 160            | CMR03F161JOYR       | .270 (6.9) | .210 (5.3) | .140 (3.6) | .120 (3.0) | .016 (.4) |
| 180            | CMR03F181JOYR       | .270 (6.9) | .210 (5.3) | .140 (3.6) | .120 (3.0) | .016 (.4) |
| 200            | CMR03F201JOYR       | .270 (6.9) | .220 (5.6) | .150 (3.8) | .120 (3.0) | .016 (.4) |
| 220            | CMR03F221JOYR       | .270 (6.9) | .220 (5.6) | .150 (3.8) | .120 (3.0) | .016 (.4) |
| 240            | CMR03F241JOYR       | .270 (6.9) | .220 (5.6) | .160 (4.1) | .120 (3.0) | .016 (.4) |
| 270            | CMR03F271JOYR       | .270 (6.9) | .230 (5.8) | .160 (4.1) | .120 (3.0) | .016 (.4) |
| 300            | CMR03F301JOYR       | .270 (6.9) | .230 (5.8) | .170 (4.3) | .120 (3.0) | .016 (.4) |
| 330            | CMR03F331JOYR       | .270 (6.9) | .240 (6.1) | .180 (4.6) | .120 (3.0) | .016 (.4) |
| 360            | CMR03F361JOYR       | .270 (6.9) | .240 (6.1) | .180 (4.6) | .120 (3.0) | .016 (.4) |
| 390            | CMR03F391JOYR       | .270 (6.9) | .250 (6.4) | .190 (4.8) | .120 (3.0) | .016 (.4) |
| 400            | CMR03F401JOYR       | .270 (6.9) | .250 (6.4) | .190 (4.8) | .120 (3.0) | .016 (.4) |
| <b>100 Vdc</b> |                     |            |            |            |            |           |
| 15             | CMR03C150DOAR       | .270 (6.9) | .190 (4.8) | .110 (2.8) | .120 (3.0) | .016 (.4) |
| 18             | CMR03C180DOAR       | .270 (6.9) | .190 (4.8) | .110 (2.8) | .120 (3.0) | .016 (.4) |
| 20             | CMR03E200DOAR       | .270 (6.9) | .190 (4.8) | .110 (2.8) | .120 (3.0) | .016 (.4) |
| 22             | CMR03E220DOAR       | .270 (6.9) | .190 (4.8) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 24             | CMR03E240DOAR       | .270 (6.9) | .190 (4.8) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 27             | CMR03E270JOAR       | .270 (6.9) | .190 (4.8) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 30             | CMR03E300JOAR       | .270 (6.9) | .200 (5.1) | .120 (3.0) | .120 (3.0) | .016 (.4) |
| 33             | CMR03E330JOAR       | .270 (6.9) | .200 (5.1) | .120 (3.0) | .120 (3.0) | .016 (.4) |

# Type CMR , High-Reliability, Mica Capacitors

| Cap (pF)       | Catalog Part Number | L in (mm)   | H in (mm)   | T in (mm)   | S in (mm)   | d in (mm)   |
|----------------|---------------------|-------------|-------------|-------------|-------------|-------------|
| 36             | CMR03E360JOAR       | .270 (6.9)  | .200 (5.1)  | .120 (3.0)  | .120 (3.0)  | .016 (.4)   |
| 39             | CMR03E390JOAR       | .270 (6.9)  | .200 (5.1)  | .120 (3.0)  | .120 (3.0)  | .016 (.4)   |
| 43             | CMR03E430JOAR       | .270 (6.9)  | .200 (5.1)  | .120 (3.0)  | .120 (3.0)  | .016 (.4)   |
| 47             | CMR03E470JOAR       | .270 (6.9)  | .200 (5.1)  | .130 (3.3)  | .120 (3.0)  | .016 (.4)   |
| 51             | CMR03E510JOAR       | .270 (6.9)  | .200 (5.1)  | .130 (3.3)  | .120 (3.0)  | .016 (.4)   |
| 56             | CMR03E560JOAR       | .270 (6.9)  | .200 (5.1)  | .130 (3.3)  | .120 (3.0)  | .016 (.4)   |
| 62             | CMR03E620JOAR       | .270 (6.9)  | .210 (5.3)  | .130 (3.3)  | .120 (3.0)  | .016 (.4)   |
| 68             | CMR03E680JOAR       | .270 (6.9)  | .210 (5.3)  | .140 (3.6)  | .120 (3.0)  | .016 (.4)   |
| 75             | CMR03E750JOAR       | .270 (6.9)  | .210 (5.3)  | .140 (3.6)  | .120 (3.0)  | .016 (.4)   |
| 82             | CMR03E820JOAR       | .270 (6.9)  | .210 (5.3)  | .140 (3.6)  | .120 (3.0)  | .016 (.4)   |
| 91             | CMR03F910JOAR       | .270 (6.9)  | .210 (5.3)  | .140 (3.6)  | .120 (3.0)  | .016 (.4)   |
| 100            | CMR03F101JOAR       | .270 (6.9)  | .220 (5.6)  | .150 (3.8)  | .120 (3.0)  | .016 (.4)   |
| 110            | CMR03F111JOAR       | .270 (6.9)  | .220 (5.6)  | .150 (3.8)  | .120 (3.0)  | .016 (.4)   |
| 120            | CMR03F121JOAR       | .270 (6.9)  | .220 (5.6)  | .160 (4.1)  | .120 (3.0)  | .016 (.4)   |
| 130            | CMR03F131JOAR       | .270 (6.9)  | .230 (5.8)  | .160 (4.1)  | .120 (3.0)  | .016 (.4)   |
| 150            | CMR03F151JOAR       | .270 (6.9)  | .230 (5.8)  | .170 (4.3)  | .120 (3.0)  | .016 (.4)   |
| 160            | CMR03F161JOAR       | .270 (6.9)  | .240 (6.1)  | .170 (4.3)  | .120 (3.0)  | .016 (.4)   |
| 170            | CMR03F171JOAR       | .270 (6.9)  | .240 (6.1)  | .180 (4.6)  | .120 (3.0)  | .016 (.4)   |
| 180            | CMR03F181JOAR       | .270 (6.9)  | .240 (6.1)  | .180 (4.6)  | .120 (3.0)  | .016 (.4)   |
| 200            | CMR03F201JOAR       | .270 (6.9)  | .250 (6.4)  | .190 (4.8)  | .120 (3.0)  | .016 (.4)   |
| 330            | CMR04F331JOAR       | .390 (9.9)  | .380 (9.7)  | .220 (5.6)  | .150 (3.8)  | .016 (.4)   |
| 360            | CMR04F361JOAR       | .390 (9.9)  | .380 (9.7)  | .220 (5.6)  | .150 (3.8)  | .016 (.4)   |
| 390            | CMR04F391JOAR       | .390 (9.9)  | .380 (9.7)  | .220 (5.6)  | .150 (3.8)  | .016 (.4)   |
| 75000          | CMR08F753JOAR       | 1.47 (37.3) | .910 (23.1) | .440 (11.2) | 1.05 (26.7) | .040 (1.02) |
| 82000          | CMR08F823JOAR       | 1.48 (37.6) | .920 (23.3) | .460 (11.7) | 1.05 (26.7) | .040 (1.02) |
| 91000          | CMR08F913JOAR       | 1.50 (38.1) | .940 (23.9) | .500 (12.7) | 1.05 (26.7) | .040 (1.02) |
| <b>300 Vdc</b> |                     |             |             |             |             |             |
| 1              | CMR03C1R0DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 1.5            | CMR03C1R5DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 2              | CMR03C2R0DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 2.5            | CMR03C2R5DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 3              | CMR03C3R0DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 3.5            | CMR03C3R5DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 4              | CMR03C4R0DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 4.5            | CMR03C4R5DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 5              | CMR03C5R0DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 6              | CMR03C6R0DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 7              | CMR03C7R0DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 8              | CMR03C8R0DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 9              | CMR03C9R0DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 10             | CMR03C100DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 11             | CMR03C110DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 12             | CMR03C120DOCR       | .270 (6.9)  | .190 (4.8)  | .110 (2.8)  | .120 (3.0)  | .016 (.4)   |
| 15             | CMR03C150DOCR       | .270 (6.9)  | .190 (4.8)  | .120 (3.0)  | .120 (3.0)  | .016 (.4)   |
| 18             | CMR03C180DOCR       | .270 (6.9)  | .200 (5.1)  | .120 (3.0)  | .120 (3.0)  | .016 (.4)   |
| 20             | CMR03E200DOCR       | .270 (6.9)  | .200 (5.1)  | .120 (3.0)  | .120 (3.0)  | .016 (.4)   |
| 22             | CMR03E220DOCR       | .270 (6.9)  | .200 (5.1)  | .120 (3.0)  | .120 (3.0)  | .016 (.4)   |
| 24             | CMR03E240DOCR       | .270 (6.9)  | .200 (5.1)  | .120 (3.0)  | .120 (3.0)  | .016 (.4)   |
| 27             | CMR03E270JOCR       | .270 (6.9)  | .200 (5.1)  | .130 (3.3)  | .120 (3.0)  | .016 (.4)   |
| 30             | CMR03E300JOCR       | .270 (6.9)  | .200 (5.1)  | .130 (3.3)  | .120 (3.0)  | .016 (.4)   |
| 33             | CMR03E330JOCR       | .270 (6.9)  | .200 (5.1)  | .130 (3.3)  | .120 (3.0)  | .016 (.4)   |
| 36             | CMR03E360JOCR       | .270 (6.9)  | .210 (5.3)  | .130 (3.3)  | .120 (3.0)  | .016 (.4)   |
| 39             | CMR03E390JOCR       | .270 (6.9)  | .210 (5.3)  | .130 (3.3)  | .120 (3.0)  | .016 (.4)   |
| 43             | CMR03E430JOCR       | .270 (6.9)  | .210 (5.3)  | .140 (3.6)  | .120 (3.0)  | .016 (.4)   |
| 47             | CMR03E470JOCR       | .270 (6.9)  | .210 (5.3)  | .140 (3.6)  | .120 (3.0)  | .016 (.4)   |
| 51             | CMR03E510JOCR       | .270 (6.9)  | .210 (5.3)  | .140 (3.6)  | .120 (3.0)  | .016 (.4)   |
| 56             | CMR03E560JOCR       | .270 (6.9)  | .220 (5.6)  | .150 (3.8)  | .120 (3.0)  | .016 (.4)   |

| Cap (pF)       | Catalog Part Number | L in (mm)   | H in (mm)   | T in (mm)   | S in (mm)   | d in (mm)   |
|----------------|---------------------|-------------|-------------|-------------|-------------|-------------|
| 62             | CMR03E620JOCR       | .270 (6.9)  | .220 (5.6)  | .150 (3.8)  | .120 (3.0)  | .016 (.4)   |
| 68             | CMR03E680JOCR       | .270 (6.9)  | .220 (5.6)  | .150 (3.8)  | .120 (3.0)  | .016 (.4)   |
| 75             | CMR03E750JOCR       | .270 (6.9)  | .230 (5.8)  | .160 (4.1)  | .120 (3.0)  | .016 (.4)   |
| 82             | CMR03E820JOCR       | .270 (6.9)  | .230 (5.8)  | .160 (4.1)  | .120 (3.0)  | .016 (.4)   |
| 91             | CMR03F910JOCR       | .270 (6.9)  | .230 (5.8)  | .170 (4.3)  | .120 (3.0)  | .016 (.4)   |
| 100            | CMR03F101JOCR       | .270 (6.9)  | .240 (6.1)  | .180 (4.6)  | .120 (3.0)  | .016 (.4)   |
| 110            | CMR03F111JOCR       | .270 (6.9)  | .240 (6.1)  | .180 (4.6)  | .120 (3.0)  | .016 (.4)   |
| 120            | CMR03F121JOCR       | .270 (6.9)  | .250 (6.4)  | .190 (4.8)  | .120 (3.0)  | .016 (.4)   |
| 270            | CMR04F271JOCR       | .390 (9.9)  | .380 (9.7)  | .220 (5.6)  | .150 (3.8)  | .016 (.4)   |
| 300            | CMR04F301JOCR       | .390 (9.9)  | .380 (9.7)  | .220 (5.6)  | .150 (3.8)  | .016 (.4)   |
| 56000          | CMR08F563JOCR       | 1.46 (37.1) | .910 (23.1) | .420 (10.7) | 1.05 (26.7) | .040 (1.02) |
| 62000          | CMR08F623JOCR       | 1.47 (37.3) | .920 (23.3) | .450 (11.4) | 1.05 (26.7) | .040 (1.02) |
| 68000          | CMR08F683JOCR       | 1.48 (37.6) | .920 (23.3) | .470 (11.9) | 1.05 (26.7) | .040 (1.02) |
| <b>500 Vdc</b> |                     |             |             |             |             |             |
| 1              | CMR04C1R0DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 1              | CMR05C1R0DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 1.5            | CMR04C1R5DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 1.5            | CMR05C1R5DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 2              | CMR04C2R0DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 2              | CMR05C2R0DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 2.5            | CMR04C2R5DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 2.5            | CMR05C2R5DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 3              | CMR04C3R0DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 3              | CMR05C3R0DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 3.5            | CMR04C3R5DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 3.5            | CMR05C3R5DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 4              | CMR04C4R0DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 4              | CMR05C4R0DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 4.5            | CMR04C4R5DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 4.5            | CMR05C4R5DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 5              | CMR04C5R0DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 5              | CMR05C5R0DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 6              | CMR04C6R0DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 6              | CMR05C6R0DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 7              | CMR04C7R0DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 7              | CMR05C7R0DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 8              | CMR04C8R0DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 8              | CMR05C8R0DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 9              | CMR04C9R0DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 9              | CMR05C9R0DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 10             | CMR04C100DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 10             | CMR05C100DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 11             | CMR04C110DODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 11             | CMR05C110DODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 12             | CMR04C120JODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 12             | CMR05C120JODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 15             | CMR04C150JODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 15             | CMR05C150JODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 18             | CMR04C180JODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 18             | CMR05C180JODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 20             | CMR04E200JODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 20             | CMR05E200JODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 22             | CMR04E220JODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 22             | CMR05E220JODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 24             | CMR04E240JODR       | .360 (9.1)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |
| 24             | CMR05E240JODR       | .450 (11.4) | .360 (9.1)  | .170 (4.3)  | .225 (5.7)  | .025 (.6)   |
| 27             | CMR04E270JODR       | .370 (9.4)  | .330 (8.4)  | .190 (4.8)  | .150 (3.8)  | .016 (.4)   |

# Type CMR , High-Reliability, Mica Capacitors

| Cap (pF) | Catalog Part Number | L in (mm)   | H in (mm)  | T in (mm)  | S in (mm)  | d in (mm) | Cap (pF) | Catalog Part Number | L in (mm)   | H in (mm)   | T in (mm)   | S in (mm)   | d in (mm)   |
|----------|---------------------|-------------|------------|------------|------------|-----------|----------|---------------------|-------------|-------------|-------------|-------------|-------------|
| 27       | CMR05E270JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 360      | CMR05F361JODR       | .470 (11.9) | .400 (10.2) | .220 (5.6)  | .225 (5.7)  | .025 (.6)   |
| 30       | CMR04E300JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 390      | CMR05F391JODR       | .470 (11.9) | .400 (10.2) | .220 (5.6)  | .225 (5.7)  | .025 (.6)   |
| 30       | CMR05E300JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 430      | CMR06F431JODR       | .640 (16.3) | .510 (13.0) | .200 (5.1)  | .350 (8.9)  | .032 (.8)   |
| 33       | CMR04E330JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 470      | CMR06F471JODR       | .640 (16.3) | .510 (13.0) | .200 (5.1)  | .350 (8.9)  | .032 (.8)   |
| 33       | CMR05E330JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 510      | CMR06F511JODR       | .650 (16.5) | .510 (13.0) | .200 (5.1)  | .350 (8.9)  | .032 (.8)   |
| 36       | CMR04E360JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 560      | CMR06F561JODR       | .650 (16.5) | .510 (13.0) | .200 (5.1)  | .350 (8.9)  | .032 (.8)   |
| 36       | CMR05E360JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 620      | CMR06F621JODR       | .650 (16.5) | .510 (13.0) | .200 (5.1)  | .350 (8.9)  | .032 (.8)   |
| 39       | CMR04E390JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 680      | CMR06F681JODR       | .650 (16.5) | .510 (13.0) | .210 (5.3)  | .350 (8.9)  | .032 (.8)   |
| 39       | CMR05E390JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 750      | CMR06F751JODR       | .650 (16.5) | .510 (13.0) | .210 (5.3)  | .350 (8.9)  | .032 (.8)   |
| 43       | CMR04E430JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 820      | CMR06F821JODR       | .650 (16.5) | .510 (13.0) | .210 (5.3)  | .350 (8.9)  | .032 (.8)   |
| 43       | CMR05E430JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 1000     | CMR06F102JODR       | .650 (16.5) | .520 (13.2) | .220 (5.6)  | .350 (8.9)  | .032 (.8)   |
| 47       | CMR04E470JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 1100     | CMR06F112JODR       | .650 (16.5) | .520 (13.2) | .220 (5.6)  | .350 (8.9)  | .032 (.8)   |
| 47       | CMR05E470JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 1200     | CMR06F122JODR       | .660 (16.8) | .520 (13.2) | .220 (5.6)  | .350 (8.9)  | .032 (.8)   |
| 51       | CMR04E510JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 1300     | CMR06F132JODR       | .660 (16.8) | .520 (13.2) | .220 (5.6)  | .350 (8.9)  | .032 (.8)   |
| 51       | CMR05E510JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 1500     | CMR06F152JODR       | .660 (16.8) | .520 (13.2) | .230 (5.8)  | .350 (8.9)  | .032 (.8)   |
| 56       | CMR04E560JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 1600     | CMR06F162JODR       | .660 (16.8) | .530 (13.5) | .230 (5.8)  | .350 (8.9)  | .032 (.8)   |
| 56       | CMR05E560JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 1800     | CMR06F182JODR       | .670 (17.0) | .530 (13.5) | .240 (6.1)  | .350 (8.9)  | .032 (.8)   |
| 62       | CMR04E620JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 2000     | CMR06F202JODR       | .670 (17.0) | .530 (13.5) | .240 (6.1)  | .350 (8.9)  | .032 (.8)   |
| 62       | CMR05E620JODR       | .450 (11.4) | .360 (9.1) | .170 (4.3) | .225 (5.7) | .025 (.6) | 2200     | CMR06F222JODR       | .670 (17.0) | .530 (13.5) | .250 (6.4)  | .350 (8.9)  | .032 (.8)   |
| 68       | CMR04E680JODR       | .370 (9.4)  | .340 (8.6) | .190 (4.8) | .150 (3.8) | .016 (.4) | 2400     | CMR06F242JODR       | .670 (17.0) | .540 (13.7) | .260 (6.6)  | .350 (8.9)  | .032 (.8)   |
| 68       | CMR05E680JODR       | .450 (11.4) | .360 (9.1) | .180 (4.6) | .225 (5.7) | .025 (.6) | 2700     | CMR06F272JODR       | .680 (17.3) | .540 (13.7) | .270 (6.9)  | .350 (8.9)  | .032 (.8)   |
| 75       | CMR04E750JODR       | .370 (9.4)  | .340 (8.6) | .200 (5.1) | .150 (3.8) | .016 (.4) | 3000     | CMR06F302JODR       | .680 (17.3) | .550 (14.0) | .280 (7.1)  | .350 (8.9)  | .032 (.8)   |
| 75       | CMR05E750JODR       | .450 (11.4) | .360 (9.1) | .180 (4.6) | .225 (5.7) | .025 (.6) | 3300     | CMR06F332JODR       | .680 (17.3) | .550 (14.0) | .290 (7.4)  | .350 (8.9)  | .032 (.8)   |
| 82       | CMR04E820JODR       | .370 (9.4)  | .350 (8.9) | .200 (5.1) | .150 (3.8) | .016 (.4) | 3600     | CMR06F362JODR       | .680 (17.3) | .560 (14.2) | .300 (7.6)  | .350 (8.9)  | .032 (.8)   |
| 82       | CMR05E820JODR       | .450 (11.4) | .360 (9.1) | .180 (4.6) | .225 (5.7) | .025 (.6) | 3900     | CMR06F392JODR       | .690 (17.5) | .560 (14.2) | .310 (7.9)  | .350 (8.9)  | .032 (.8)   |
| 91       | CMR04F910JODR       | .370 (9.4)  | .350 (8.9) | .200 (5.1) | .150 (3.8) | .016 (.4) | 4300     | CMR06F432JODR       | .690 (17.5) | .570 (14.5) | .330 (8.4)  | .350 (8.9)  | .032 (.8)   |
| 91       | CMR05F910JODR       | .460 (11.7) | .360 (9.1) | .180 (4.6) | .225 (5.7) | .025 (.6) | 4700     | CMR06F472JODR       | .700 (17.8) | .580 (14.7) | .350 (8.9)  | .350 (8.9)  | .032 (.8)   |
| 100      | CMR04F101JODR       | .370 (9.4)  | .350 (8.9) | .200 (5.1) | .150 (3.8) | .016 (.4) | 5100     | CMR07F512JODR       | .780 (19.8) | .860 (21.8) | .280 (7.1)  | .425 (10.8) | .040 (1.0)  |
| 100      | CMR05F101JODR       | .460 (11.7) | .360 (9.1) | .180 (4.6) | .225 (5.7) | .025 (.6) | 5600     | CMR07F562JODR       | .780 (19.8) | .870 (22.1) | .290 (7.4)  | .425 (10.8) | .040 (1.0)  |
| 110      | CMR04F111JODR       | .380 (9.7)  | .350 (8.9) | .200 (5.1) | .150 (3.8) | .016 (.4) | 6200     | CMR07F622JODR       | .780 (19.8) | .870 (22.1) | .290 (7.4)  | .425 (10.8) | .040 (1.0)  |
| 110      | CMR05F111JODR       | .460 (11.7) | .370 (9.4) | .180 (4.6) | .225 (5.7) | .025 (.6) | 6800     | CMR07F682JODR       | .780 (19.8) | .870 (22.1) | .300 (7.6)  | .425 (10.8) | .040 (1.0)  |
| 120      | CMR04F121JODR       | .380 (9.7)  | .350 (8.9) | .200 (5.1) | .150 (3.8) | .016 (.4) | 7500     | CMR07F752JODR       | .790 (20.1) | .880 (22.4) | .310 (7.9)  | .425 (10.8) | .040 (1.0)  |
| 120      | CMR05F121JODR       | .460 (11.7) | .370 (9.4) | .180 (4.6) | .225 (5.7) | .025 (.6) | 8200     | CMR07F822JODR       | .790 (20.1) | .880 (22.4) | .320 (8.1)  | .425 (10.8) | .040 (1.0)  |
| 130      | CMR04F131JODR       | .380 (9.7)  | .360 (9.1) | .200 (5.1) | .150 (3.8) | .016 (.4) | 9100     | CMR07F912JODR       | .790 (20.1) | .880 (22.4) | .330 (8.4)  | .425 (10.8) | .040 (1.0)  |
| 130      | CMR05F131JODR       | .460 (11.7) | .370 (9.4) | .180 (4.6) | .225 (5.7) | .025 (.6) | 10000    | CMR07F103JODR       | .800 (20.3) | .890 (22.6) | .340 (8.6)  | .425 (10.8) | .040 (1.0)  |
| 150      | CMR04F151JODR       | .380 (9.7)  | .360 (9.1) | .210 (5.3) | .150 (3.8) | .016 (.4) | 11000    | CMR07F113JODR       | .800 (20.3) | .890 (22.6) | .350 (8.9)  | .425 (10.8) | .040 (1.0)  |
| 150      | CMR05F151JODR       | .460 (11.7) | .370 (9.4) | .190 (4.8) | .225 (5.7) | .025 (.6) | 12000    | CMR07F123JODR       | .800 (20.3) | .890 (22.6) | .360 (9.1)  | .425 (10.8) | .040 (1.0)  |
| 160      | CMR04F161JODR       | .380 (9.7)  | .360 (9.1) | .210 (5.3) | .150 (3.8) | .016 (.4) | 13000    | CMR07F133JODR       | .810 (20.6) | .890 (22.6) | .370 (9.4)  | .425 (10.8) | .040 (1.0)  |
| 160      | CMR05F161JODR       | .460 (11.7) | .370 (9.4) | .190 (4.8) | .225 (5.7) | .025 (.6) | 15000    | CMR07F153JODR       | .810 (20.6) | .900 (22.9) | .390 (9.9)  | .425 (10.8) | .040 (1.0)  |
| 180      | CMR04F181JODR       | .380 (9.7)  | .370 (9.4) | .210 (5.3) | .150 (3.8) | .016 (.4) | 16000    | CMR07F163JODR       | .820 (20.8) | .900 (22.9) | .410 (10.4) | .425 (10.8) | .040 (1.0)  |
| 180      | CMR05F181JODR       | .460 (11.7) | .370 (9.4) | .190 (4.8) | .225 (5.7) | .025 (.6) | 18000    | CMR07F183JODR       | .820 (20.8) | .910 (23.1) | .430 (10.9) | .425 (10.8) | .040 (1.0)  |
| 200      | CMR04F201JODR       | .390 (9.9)  | .380 (9.7) | .220 (5.6) | .150 (3.8) | .016 (.4) | 22000    | CMR08F223JODR       | 1.42 (36.1) | .880 (22.4) | .310 (7.9)  | 1.05 (26.7) | .040 (1.02) |
| 200      | CMR05F201JODR       | .460 (11.7) | .380 (9.7) | .190 (4.8) | .225 (5.7) | .025 (.6) | 24000    | CMR08F243JODR       | 1.43 (36.3) | .880 (22.4) | .320 (8.1)  | 1.05 (26.7) | .040 (1.02) |
| 220      | CMR04F221JODR       | .390 (9.9)  | .380 (9.7) | .220 (5.6) | .150 (3.8) | .016 (.4) | 27000    | CMR08F273JODR       | 1.43 (36.3) | .880 (22.4) | .330 (8.4)  | 1.05 (26.7) | .040 (1.02) |
| 220      | CMR05F221JODR       | .460 (11.7) | .380 (9.7) | .200 (5.1) | .225 (5.7) | .025 (.6) | 30000    | CMR08F303JODR       | 1.44 (36.6) | .890 (22.6) | .350 (8.9)  | 1.05 (26.7) | .040 (1.02) |
| 240      | CMR04F241JODR       | .390 (9.9)  | .380 (9.7) | .220 (5.6) | .150 (3.8) | .016 (.4) | 33000    | CMR08F333JODR       | 1.44 (36.6) | .890 (22.6) | .360 (9.1)  | 1.05 (26.7) | .040 (1.02) |
| 240      | CMR05F241JODR       | .460 (11.7) | .380 (9.7) | .200 (5.1) | .225 (5.7) | .025 (.6) | 36000    | CMR08F363JODR       | 1.45 (36.8) | .900 (22.9) | .380 (9.7)  | 1.05 (26.7) | .040 (1.02) |
| 270      | CMR05F271JODR       | .470 (11.9) | .390 (9.9) | .210 (5.3) | .225 (5.7) | .025 (.6) | 39000    | CMR08F393JODR       | 1.45 (36.8) | .900 (22.9) | .400 (10.2) | 1.05 (26.7) | .040 (1.02) |
| 300      | CMR05F301JODR       | .470 (11.9) | .390 (9.9) | .210 (5.3) | .225 (5.7) | .025 (.6) | 43000    | CMR08F433JODR       | 1.46 (37.1) | .910 (23.1) | .420 (10.7) | 1.05 (26.7) | .040 (1.02) |
| 330      | CMR05F331JODR       | .470 (11.9) | .390 (9.9) | .210 (5.3) | .225 (5.7) | .025 (.6) | 47000    | CMR08F473JODR       | 1.47 (37.3) | .910 (23.1) | .450 (11.4) | 1.05 (26.7) | .040 (1.02) |
|          |                     |             |            |            |            |           | 51000    | CMR08F513JODR       | 1.48 (37.6) | .920 (23.3) | .470 (11.9) | 1.05 (26.7) | .040 (1.02) |

# Type CMR , High-Reliability, Mica Capacitors

## Specifications

**Capacitance** is within tolerance when measured at these frequencies:  
 1 - 1000 pF @ 1 MHz  
 > 1000 pF @ 1 Khz

**Dissipation Factor** limits are below. Measure dissipation factor at 1 MHz when the capacitance is 1 pF to 1000 pF, and at 1 kHz when the capacitance is greater than 1000 pF. Dissipation factor is equal to  $DF = 2\pi fRC$ , where  $f$  is the test frequency,  $R$  is the equivalent series resistance, and  $C$  is the capacitance. For other capacitance values, see Figure 1.

| Capacitance  | Dissipation Factor   |
|--------------|----------------------|
| 100-1000 pF  | 0.00075 max at 1 MHz |
| 1100-3300 pF | 0.0014 max at 1 kHz  |
| 3600-9100 pF | 0.0013 max at 1 kHz  |
| 10,000 pF    | 0.0012 max at 1 kHz  |

**Quality Factor (Q)** is the reciprocal of dissipation factor.

**Insulation Resistance** for capacitance up to 10,000 pF is greater than 100 G. at 25 °C, greater than 10 G. at 125 °C, and greater than 5 G. at 150 °C. For other capacitance values and temperatures, see Figure 2.

**Withstanding Voltage** is two times the rated voltage, and can be applied up to 5 seconds without damage.

**Temperature Coefficient and Capacitance Drift** measure the capacitors'

capacitance at 25 °C, -55 °C, 25 °C, 125 °C (or 150 °C) and at 25 °C after stabilizing at each temperature. The capacitance will meet the limits of the Characteristic table shown in Ordering Information.

**Failure Rate:** Type CMR capacitors have specified failure rate levels ranging from 0.01% to 1.0% per 1000 hours. The failure rate level is established at 90% confidence level and is referred to operational life at full rated voltage at maximum rated temperature.

**High Voltage Stabilization:** We subject capacitors with Failure Levels M, P, and R to a burn-in at twice rated voltage, at rated temperature, for a minimum of 48 hours. Capacitors that show damage, arcing, breakdown, or low IR are removed. We reject the lot if more than 8% of the capacitors fail.

**Solderability:** After an 8-hour steam aging, coat leads with a rosin flux (R) and immerse in molten 245 °C  $\pm$  5 °C 60/40 tin/lead solder. Solder coverage will be no less than 95% when examined at 10X magnification.

**Life Test:** Subject the capacitors to maximum operating temperature (+125 °C or +150 °C) with 1.5 times rated voltage applied for 10,000 hours. Take readings and make visual observations every 2000 hours.

There will be no visual damage and the capacitors will meet the after-test limits on the following page.

**Resistance to Solvents:** Subject the capacitors to three cycles of 3 minute immersion in solvent, 10 strokes with bristle brush and, where applicable, ½ minute in vapor, per MIL-STD-202, Method 215. Repeat the three cycles for three solvent mixtures: Isopropyl alcohol mixture (Solvent 1), azeotrope mixture (Solvent 3), and water/propylene-glycol mixture (Solvent 4). The marking will not rub off or smear and there will be no visible damage to the capacitor body. Refer to MIL-STD-202 for details.

**Resistance to Soldering Heat:** Capacitors will meet the requirements of MIL-STD-202, Method 210 Test Condition G. Immerse capacitor leads to within .250 inches (6.4 mm) of the body in molten tin/lead solder (260 °C  $\pm$  5 °C) for 10  $\pm$  2 seconds. Allow to cool. Capacitors will meet the after-test limits on the following page.

**Marking** of capacitors conforms to method I of MIL-STD-1285, and includes the type designation, "JAN," brand, trademark, source code, date code, rated voltage, capacitance, capacitance tolerance, and the highest rated temperature. Small capacitors are marked with the letter "J".

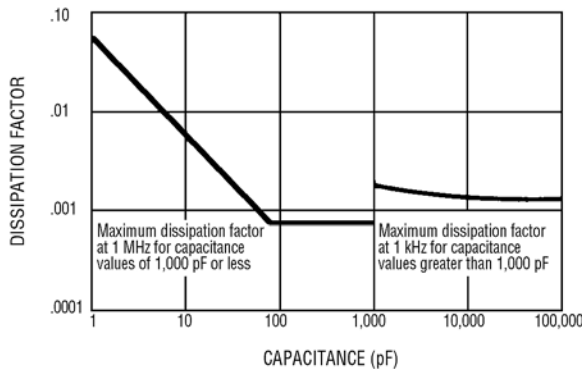


Figure 1. DF vs. Capacitance

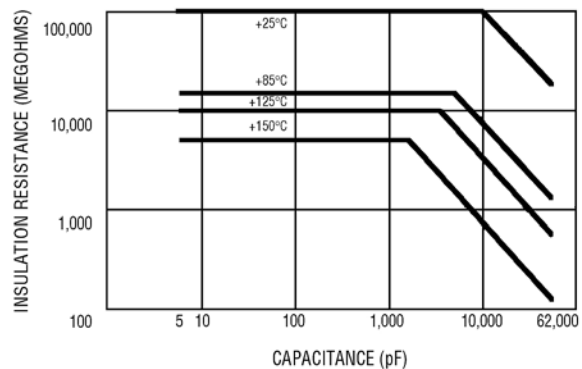


Figure 2. IR vs. Capacitance

# Type CMR , High-Reliability, Mica Capacitors

**Moisture Resistance:** Capacitors will meet the requirements of MIL-STD-202, Method 106F as outlined here and diagrammed on the right. Apply 100 V or the rated voltage (whichever is less) to half of the capacitors. Don't apply voltage to the other half. Refer to MIL-STD-202 for details.

1. Dry capacitors for 24 hours in a  $50 \pm 2$  °C oven and then allow to stabilize at room temperature.
2. Subject the capacitors to 20 24-hour continuous cycles with relative humidity and temperature as shown.
3. 4 to 24 hours after completion of the last cycle the capacitors will show no visual damage and will meet the after-test limits below.



## After-Test Limits

| Test                | Withstand Voltage | Insulation Resistance | Capacitance Change (whichever is greater) | DF      | Q      |
|---------------------|-------------------|-----------------------|---|---------|--------|
| Moisture Resistance | IL                | 30 GΩ                 | NV±1% or ±1 pF                            | 150% IL | 2/3xIL |
| Life Test           | IL                | IL                    | NV±1% or ±1 pF                            | 150% IL | 2/3xIL |
| Solder Heat         | IL                | IL                    | IV±5% or ±5pF                             | IL      | IL     |

IL=Initial Limit NV=Nominal Value IV=Initial Value

## Ordering Information

Order by complete part number, as below.  
For other options, write your requirements on your quote request.

## Part Numbering System

|                       |          |                                       |                                  |  |   |  |
|-----------------------|----------|---------------------------------------|----------------------------------|--|---|--|
| <b>CMR05</b>          | <b>C</b> | <b>100</b>                            | <b>J</b>                         | <b>P</b>   | <b>D</b>  | <b>R</b>                                 |
| <b>CDE Type</b>       |          | <b>Capacitance</b>                    | <b>Capacitance Tolerance</b>     | <b>Temperature Range</b>                                       | <b>Voltage</b>  | <b>Failure Rate</b>                      |
| 122 = 1200pF          |          | 1R0 = 1.0pF<br>361 = 360pF<br>F = ±1% | D = ±.5 pf<br>G = ±2%<br>J = ±5% | O = -55 °C to +125 °C<br>P = -55 °C to +150 °C*<br>C = 300 Vdc | Y = 50 Vdc<br>A = 100 Vdc<br>P = .1%/1000 hrs.<br>D = 500 Vdc | M = 1.0%/1000 hrs.<br>R = .01%/1000 hrs. |
| <b>Characteristic</b> |          |                                       |                                  |  |   |  |

|          | Temp. Coeff. ppm/°C | Capacitance Drift | Standard Cap. Range |
|----------|---------------------|-------------------|---------------------|
| <b>C</b> | -200 to +200        | ±(0.5% +0.1pF)    | 1 – 18 pF           |
| <b>E</b> | -20 to +100         | ±(0.1% +0.1pF)    | 20 – 82 pF          |
| <b>F</b> | -200 to + 70        | ±(0.05% +0.1pF)   | 91 pF and up        |

\*P temperature range available for CMR04, CMR05, CMR06, CMR07, CMR08

## Type CMR , High-Reliability, Mica Capacitors

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- Оперативные сроки поставки под заказ (от 5 рабочих дней);
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- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
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- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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