

## General Specifications

### GENERAL DESCRIPTION

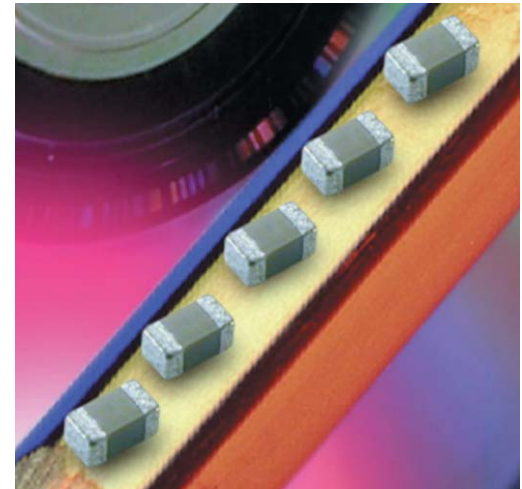
With increased requirements from the automotive industry for additional component robustness, AVX recognized the need to produce a MLCC with enhanced mechanical strength. It was noted that many components may be subject to severe flexing and vibration when used in various under the hood automotive and other harsh environment applications.

To satisfy the requirement for enhanced mechanical strength, AVX had to find a way of ensuring electrical integrity is maintained whilst external forces are being applied to the component. It was found that the structure of the termination needed to be flexible and after much research and development, AVX launched FLEXITERM®. FLEXITERM® is designed to enhance the mechanical flexure and temperature cycling performance of a standard ceramic capacitor with an X7R dielectric. **The industry standard for flexure is 2mm minimum. Using FLEXITERM®, AVX provides up to 5mm of flexure without internal cracks. Beyond 5mm, the capacitor will generally fail “open”.**

As well as for automotive applications FLEXITERM® will provide Design Engineers with a satisfactory solution when designing PCB's which may be subject to high levels of board flexure.

### PRODUCT ADVANTAGES

- High mechanical performance able to withstand, 5mm bend test guaranteed.
- Increased temperature cycling performance, 3000 cycles and beyond.
- Flexible termination system.
- Reduction in circuit board flex failures.
- Base metal electrode system.
- Automotive or commercial grade products available.



### APPLICATIONS

#### High Flexure Stress Circuit Boards

- e.g. Depanelization: Components near edges of board.

#### Variable Temperature Applications

- Soft termination offers improved reliability performance in applications where there is temperature variation.
- e.g. All kind of engine sensors: Direct connection to battery rail.

#### Automotive Applications

- Improved reliability.
- Excellent mechanical performance and thermo mechanical performance.

### HOW TO ORDER

#### 0805

**Style**  
0603  
0805  
1206  
1210  
1812  
2220

#### 5

**Voltage**  
6 = 6.3V  
Z = 10V  
Y = 16V  
3 = 25V  
5 = 50V  
1 = 100V  
2 = 200V

#### C

**Dielectric**  
C = X7R  
F = X8R

#### 104

**Capacitance Code (In pF)**  
2 Sig Digits +  
Number of Zeros  
e.g., 104 = 100nF

#### K

**Capacitance Tolerance**  
J = ±5%\*  
K = ±10%  
M = ±20%  
  
\*≤1µF only

#### A

**Failure Rate**  
A=Commercial  
4 = Automotive

#### Z

**Terminations**  
Z = FLEXITERM®  
For FLEXITERM®  
with Tin/Lead  
termination see  
AVX LD Series

#### 2

**Packaging**  
2 = 7" reel  
4 = 13" reel

#### A

**Special Code**  
A = Std. Product

NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers.



## Specifications and Test Methods

### PERFORMANCE TESTING

#### AEC-Q200 Qualification:

- Created by the Automotive Electronics Council
- Specification defining stress test qualification for passive components



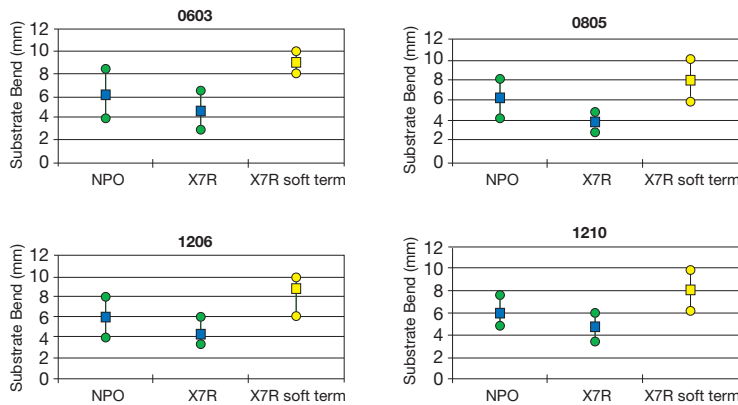
#### Testing:

Key tests used to compare soft termination to AEC-Q200 qualification:

- Bend Test
- Temperature Cycle Test

### BOARD BEND TEST RESULTS

AEC-Q200 Vrs AVX FLEXITERM® Bend Test



### TABLE SUMMARY

Typical bend test results are shown below:

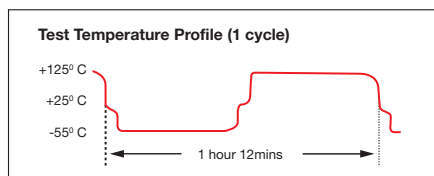
| Style | Conventional Termination | FLEXITERM® |
|-------|--------------------------|------------|
| 0603  | >2mm                     | >5mm       |
| 0805  | >2mm                     | >5mm       |
| 1206  | >2mm                     | >5mm       |

### TEMPERATURE CYCLE TEST PROCEDURE

#### Test Procedure as per AEC-Q200:

The test is conducted to determine the resistance of the component when it is exposed to extremes of alternating high and low temperatures.

- Sample lot size quantity 77 pieces
- TC chamber cycle from -55°C to +125°C for 1000 cycles
- Interim electrical measurements at 250, 500, 1000 cycles
- Measure parameter capacitance dissipation factor, insulation resistance



### BOARD BEND TEST PROCEDURE

According to AEC-Q200

Test Procedure as per AEC-Q200:

Sample size: 20 components  
Span: 90mm Minimum deflection spec: 2 mm

- Components soldered onto FR4 PCB (Figure 1)
- Board connected electrically to the test equipment (Figure 2)

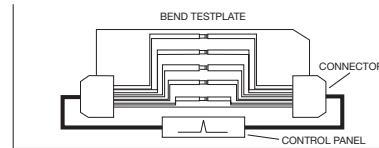


Fig 1 - PCB layout with electrical connections

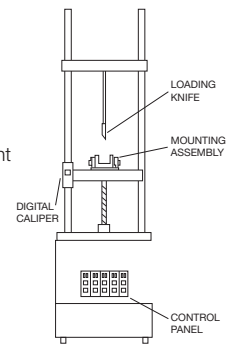
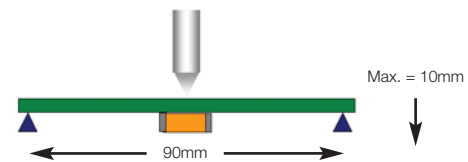


Fig 2 - Board Bend test equipment

### AVX ENHANCED SOFT TERMINATION BEND TEST PROCEDURE

#### Bend Test

The capacitor is soldered to the printed circuit board as shown and is bent up to 10mm at 1 mm per second:

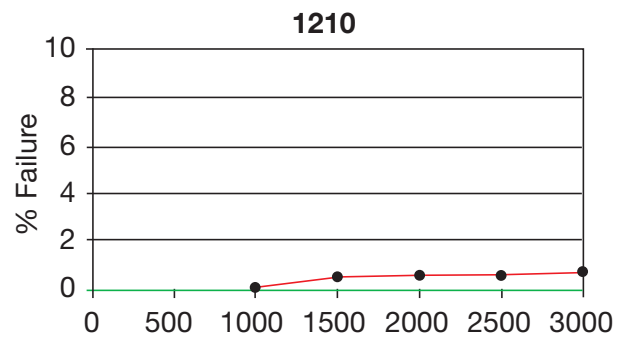
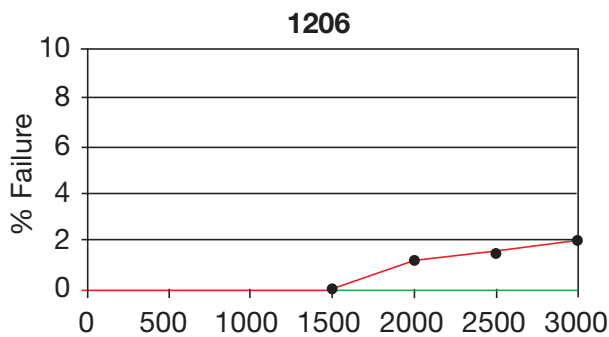
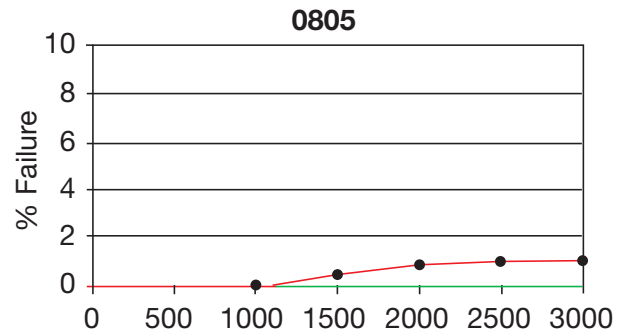
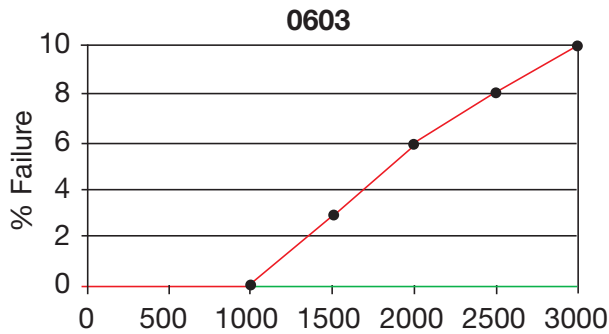


- The board is placed on 2 supports 90mm apart (capacitor side down)
- The row of capacitors is aligned with the load stressing knife



- The load is applied and the deflection where the part starts to crack is recorded (Note: Equipment detects the start of the crack using a highly sensitive current detection circuit)
- The maximum deflection capability is 10mm

### BEYOND 1000 CYCLES: TEMPERATURE CYCLE TEST RESULTS



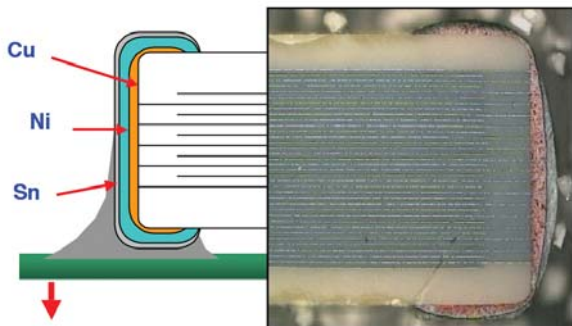
**Soft Term - No Defects up to 3000 cycles**

**AEC-Q200 specification states 1000 cycles compared to AVX 3000 temperature cycles.**

### FLEXITERM® TEST SUMMARY

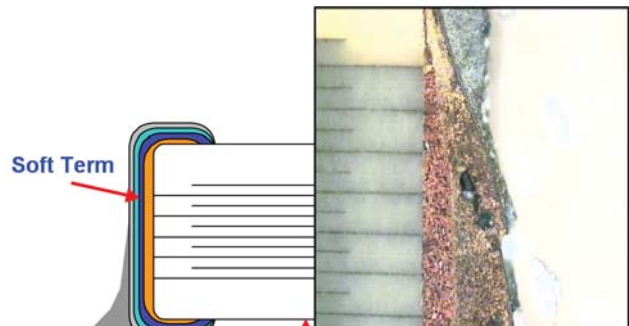
- Qualified to AEC-Q200 test/specification with the exception of using AVX 3000 temperature cycles (up to +150°C bend test guaranteed greater than 5mm).
- FLEXITERM® provides improved performance compared to standard termination systems.
- Board bend test improvement by a factor of 2 to 4 times.
- Temperature Cycling:
  - 0% Failure up to 3000 cycles
  - No ESR change up to 3000 cycles

#### WITHOUT SOFT TERMINATION



Major fear is of latent board flex failures.

#### WITH SOFT TERMINATION



Far superior mechanical performance. Generally open failure mode beyond 5mm flexure.

# MLCC with FLEXITERM<sup>®</sup>



## X8R Dielectric Capacitance Range

| SIZE |       | 0603 |     | 0805 |     | 1206 |     |
|------|-------|------|-----|------|-----|------|-----|
|      | WVDC  | 25V  | 50V | 25V  | 50V | 25V  | 50V |
| 271  | Cap   | G    | G   |      |     |      |     |
| 331  | (pF)  | G    | G   | J    | J   |      |     |
| 471  | 470   | G    | G   | J    | J   |      |     |
| 681  | 680   | G    | G   | J    | J   |      |     |
| 102  | 1000  | G    | G   | J    | J   | J    | J   |
| 152  | 1500  | G    | G   | J    | J   | J    | J   |
| 182  | 1800  | G    | G   | J    | J   | J    | J   |
| 222  | 2200  | G    | G   | J    | J   | J    | J   |
| 272  | 2700  | G    | G   | J    | J   | J    | J   |
| 332  | 3300  | G    | G   | J    | J   | J    | J   |
| 392  | 3900  | G    | G   | J    | J   | J    | J   |
| 472  | 4700  | G    | G   | J    | J   | J    | J   |
| 562  | 5600  | G    | G   | J    | J   | J    | J   |
| 682  | 6800  | G    | G   | J    | J   | J    | J   |
| 822  | 8200  | G    | G   | J    | J   | J    | J   |
| 103  | Cap   | G    | G   | J    | J   | J    | J   |
| 123  | (µF)  | G    | G   | J    | J   | J    | J   |
| 153  | 0.015 | G    | G   | J    | J   | J    | J   |
| 183  | 0.018 | G    | G   | J    | J   | J    | J   |
| 223  | 0.022 | G    | G   | J    | J   | J    | J   |
| 273  | 0.027 | G    | G   | J    | J   | J    | J   |
| 333  | 0.033 | G    | G   | J    | J   | J    | J   |
| 393  | 0.039 | G    | G   | J    | J   | J    | J   |
| 473  | 0.047 | G    | G   | J    | J   | J    | J   |
| 563  | 0.056 | G    |     | N    | N   | M    | M   |
| 683  | 0.068 | G    |     | N    | N   | M    | M   |
| 823  | 0.082 |      |     | N    | N   | M    | M   |
| 104  | 0.1   |      |     | N    | N   | M    | M   |
| 124  | 0.12  |      |     | N    | N   | M    | M   |
| 154  | 0.15  |      |     | N    | N   | M    | M   |
| 184  | 0.18  |      |     | N    |     | M    | M   |
| 224  | 0.22  |      |     | N    |     | M    | M   |
| 274  | 0.27  |      |     |      |     | M    | M   |
| 334  | 0.33  |      |     |      |     | M    | M   |
| 394  | 0.39  |      |     |      |     | M    |     |
| 474  | 0.47  |      |     |      |     | M    |     |
| 684  | 0.68  |      |     |      |     |      |     |
| 824  | 0.82  |      |     |      |     |      |     |
| 105  | 1     |      |     |      |     |      |     |
| SIZE | WVDC  | 25V  | 50V | 25V  | 50V | 25V  | 50V |

| Letter         | A               | C               | E               | G               | J               | K               | M               | N               | P               | Q               | X               | Y               | Z               |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Max. Thickness | 0.33<br>(0.013) | 0.56<br>(0.022) | 0.71<br>(0.028) | 0.90<br>(0.035) | 0.94<br>(0.037) | 1.02<br>(0.040) | 1.27<br>(0.050) | 1.40<br>(0.055) | 1.52<br>(0.060) | 1.78<br>(0.070) | 2.29<br>(0.090) | 2.54<br>(0.100) | 2.79<br>(0.110) |
|                | PAPER           |                 |                 |                 |                 | EMBOSSED        |                 |                 |                 |                 |                 |                 |                 |

= AEC-Q200 Qualified

## X7R Dielectric Capacitance Range

|                | 0603            |                 |                 |                 |                 | 0805            |                 |                 |                 |                 | 1206            |                 |                 |     |      | 1210 |     |     |     | 1812 |     |     |     | 2220 |     |     |      |  |  |
|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----|------|------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|------|--|--|
|                | 16V             | 25V             | 50V             | 100V            | 200V            | 10V             | 16V             | 25V             | 50V             | 100V            | 200V            | 16V             | 25V             | 50V | 100V | 200V | 16V | 25V | 50V | 100V | 16V | 25V | 50V | 100V | 25V | 50V | 100V |  |  |
| 101            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 121            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 151            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 181            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 221            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 271            | J               | J               | J               | J               | J               | J               |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 331            | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 391            | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 471            | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 561            | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 681            | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 821            | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 102            | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 122            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 152            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 182            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 222            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 272            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 332            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 392            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 472            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 562            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 682            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 822            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 103            | J               | J               | J               | J               |                 | J               | J               | J               | J               | J               | J               | J               | J               | J   | J    |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 123            | J               | J               | J               |                 |                 | J               | J               | J               | J               | M               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 153            | J               | J               | J               |                 |                 | J               | J               | J               | J               | M               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 183            | J               | J               | J               |                 |                 | J               | J               | J               | J               | M               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 223            | J               | J               | J               |                 |                 | J               | J               | J               | J               | M               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 273            | J               | J               | J               |                 |                 | J               | J               | J               | J               | M               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 333            | J               | J               | J               |                 |                 | J               | J               | J               | J               | M               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 393            | J               | J               | J               |                 |                 | J               | J               | J               | J               | M               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 473            | J               | J               | J               |                 |                 | J               | J               | J               | J               | M               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 563            | J               | J               | J               |                 |                 | J               | J               | J               | J               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 683            | J               | J               | J               |                 |                 | J               | J               | J               | J               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 823            | J               | J               | J               |                 |                 | J               | J               | J               | J               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 104            | J               | J               | J               |                 |                 | J               | J               | J               | J               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 124            |                 |                 |                 |                 |                 | J               | J               | J               | N               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 154            |                 |                 |                 |                 |                 | M               | M               | N               | N               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 184            |                 |                 |                 |                 |                 | M               | M               | N               | N               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 224            |                 |                 |                 |                 |                 | M               | M               | N               | N               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 274            |                 |                 |                 |                 |                 | N               | N               | N               | N               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 334            |                 |                 |                 |                 |                 | N               | N               | N               | N               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 394            |                 |                 |                 |                 |                 | N               | N               | N               | N               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 474            |                 |                 |                 |                 |                 | N               | N               | N               | N               | N               |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 564            |                 |                 |                 |                 |                 | N               | N               | N               |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 684            |                 |                 |                 |                 |                 | N               | N               | N               |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 824            |                 |                 |                 |                 |                 | N               | N               | N               |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 105            |                 |                 |                 |                 |                 | N               | N               | N               |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 155            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 185            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 225            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 335            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 475            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 106            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| 226            |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
|                | 16V             | 25V             | 50V             | 100V            | 200V            | 10V             | 16V             | 25V             | 50V             | 100V            | 200V            | 16V             | 25V             | 50V | 100V | 200V | 16V | 25V | 50V | 100V | 16V | 25V | 50V | 100V | 25V | 50V | 100V |  |  |
|                | 0603            |                 |                 |                 |                 | 0805            |                 |                 |                 |                 | 1206            |                 |                 |     |      | 1210 |     |     |     | 1812 |     |     |     | 2220 |     |     |      |  |  |
| Letter         | A               | C               | E               | G               | J               | K               | M               | N               | P               | Q               | X               | Y               | Z               |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
| Max. Thickness | 0.33<br>(0.013) | 0.56<br>(0.022) | 0.71<br>(0.028) | 0.90<br>(0.035) | 0.94<br>(0.037) | 1.02<br>(0.040) | 1.27<br>(0.050) | 1.40<br>(0.055) | 1.52<br>(0.060) | 1.78<br>(0.070) | 2.29<br>(0.090) | 2.54<br>(0.100) | 2.79<br>(0.110) |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |
|                | PAPER           |                 |                 |                 |                 | EMBOSSSED       |                 |                 |                 |                 |                 |                 |                 |     |      |      |     |     |     |      |     |     |     |      |     |     |      |  |  |

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- 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.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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