

VEJ Series

Features

- 4 ϕ ~ 18 ϕ , 105°C, 2,000 hours assured
- Designed for surface mounting on high density PC board
- RoHS Compliance



Marking color: Black

Specifications

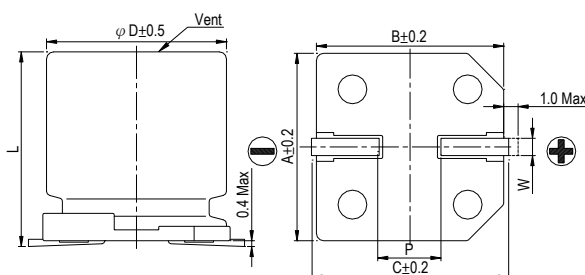
| Items | Performance | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|----------------|-----------------|------------|--------------------|---|-----------------|---|-----------------|------------------------|------------------|-----------------|---|---|-----------------|----------|------------------------|------|------|------|------|------|---|---|------------------|------|-----------|----------------------|------|------|------|------|------|------|------|---|---|--------------|-----------------|----|---|---|---|---|---|---|---|---|-----------|----------------------|----|---|---|---|---|---|---|---|----|
| Category Temperature Range | 6.3 ~ 100V | 160 ~ 400V | 450V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | -55°C ~ +105°C | -40°C ~ +105°C | -25°C ~ +105°C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Capacitance Tolerance | ±20% (at 120Hz, 20°C) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Leakage Current (at 20°C) | <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>6.3 ~ 100V</th> <th>160 ~ 450V</th> </tr> </thead> <tbody> <tr> <td>Time</td> <td colspan="2">after 2 minutes</td> </tr> <tr> <td>Case size</td> <td>4 ~ 10 ϕ</td> <td>12.5 ~ 18 ϕ</td> </tr> <tr> <td>Leakage Current</td> <td>I = 0.01CV or 3μA, whichever is greater</td> <td>I = 0.03CV or 4μA, whichever is greater</td> </tr> </tbody> </table> <p>Where, C = rated capacitance in μF V = rated DC working voltage in V</p> | | | Rated voltage | 6.3 ~ 100V | 160 ~ 450V | Time | after 2 minutes | | Case size | 4 ~ 10 ϕ | 12.5 ~ 18 ϕ | Leakage Current | I = 0.01CV or 3 μ A, whichever is greater | I = 0.03CV or 4 μ A, whichever is greater | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated voltage | 6.3 ~ 100V | 160 ~ 450V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Time | after 2 minutes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Case size | 4 ~ 10 ϕ | 12.5 ~ 18 ϕ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Leakage Current | I = 0.01CV or 3 μ A, whichever is greater | I = 0.03CV or 4 μ A, whichever is greater | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tan δ (at 120Hz, 20°C) | <table border="1"> <thead> <tr> <th>Rated Voltage</th> <th>6.3</th> <th>10</th> <th>16</th> <th>25</th> <th>35</th> <th>50</th> <th>63</th> <th>100</th> <th>160 ~ 250</th> <th>400 ~ 450</th> </tr> </thead> <tbody> <tr> <td>4 ~ 10 ϕ</td> <td>0.45</td> <td>0.35</td> <td>0.28</td> <td>0.18</td> <td>0.16</td> <td>0.14</td> <td>0.12</td> <td>0.12</td> <td>-</td> <td>-</td> </tr> <tr> <td>12.5 ~ 18 ϕ</td> <td>0.40</td> <td>0.38</td> <td>0.34</td> <td>0.26</td> <td>0.22</td> <td>0.18</td> <td>0.14</td> <td>0.10</td> <td>0.20</td> <td>0.25</td> </tr> </tbody> </table> <p>When the capacitance exceeds 1,000μF, 0.02 shall be added every 1,000μF increase.</p> | | | Rated Voltage | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 | 160 ~ 250 | 400 ~ 450 | 4 ~ 10 ϕ | 0.45 | 0.35 | 0.28 | 0.18 | 0.16 | 0.14 | 0.12 | 0.12 | - | - | 12.5 ~ 18 ϕ | 0.40 | 0.38 | 0.34 | 0.26 | 0.22 | 0.18 | 0.14 | 0.10 | 0.20 | 0.25 | | | | | | | | | | | | | | | | | | | | | | | | |
| Rated Voltage | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 | 160 ~ 250 | 400 ~ 450 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 ~ 10 ϕ | 0.45 | 0.35 | 0.28 | 0.18 | 0.16 | 0.14 | 0.12 | 0.12 | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12.5 ~ 18 ϕ | 0.40 | 0.38 | 0.34 | 0.26 | 0.22 | 0.18 | 0.14 | 0.10 | 0.20 | 0.25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Low Temperature Characteristics (at 120Hz) | <p>Impedance ratio shall not exceed the values given in the table below.</p> <table border="1"> <thead> <tr> <th colspan="2">Rated Voltage</th> <th>6.3</th> <th>10</th> <th>16</th> <th>25</th> <th>35</th> <th>50</th> <th>63</th> <th>100</th> <th>160 ~ 250</th> <th>400 ~ 450</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Impedance Ratio</td> <td>Z(-25°C)</td> <td>ϕ D < 12.5</td> <td>4</td> <td>4</td> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>3</td> <td>-</td> </tr> <tr> <td>/Z(+20°C)</td> <td>ϕ D \geq 12.5</td> <td>5</td> <td>4</td> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>3</td> <td>6</td> </tr> <tr> <td>Z(-55/-40°C)</td> <td>ϕ D < 12.5</td> <td>12</td> <td>8</td> <td>6</td> <td>4</td> <td>3</td> <td>3</td> <td>3</td> <td>4</td> <td>-</td> </tr> <tr> <td>/Z(+20°C)</td> <td>ϕ D \geq 12.5</td> <td>10</td> <td>8</td> <td>6</td> <td>4</td> <td>3</td> <td>3</td> <td>3</td> <td>3</td> <td>10</td> </tr> </tbody> </table> | | | Rated Voltage | | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 | 160 ~ 250 | 400 ~ 450 | Impedance Ratio | Z(-25°C) | ϕ D < 12.5 | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | - | /Z(+20°C) | ϕ D \geq 12.5 | 5 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | 6 | Z(-55/-40°C) | ϕ D < 12.5 | 12 | 8 | 6 | 4 | 3 | 3 | 3 | 4 | - | /Z(+20°C) | ϕ D \geq 12.5 | 10 | 8 | 6 | 4 | 3 | 3 | 3 | 3 | 10 |
| Rated Voltage | | 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 | 160 ~ 250 | 400 ~ 450 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Impedance Ratio | Z(-25°C) | ϕ D < 12.5 | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | /Z(+20°C) | ϕ D \geq 12.5 | 5 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Z(-55/-40°C) | ϕ D < 12.5 | 12 | 8 | 6 | 4 | 3 | 3 | 3 | 4 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | /Z(+20°C) | ϕ D \geq 12.5 | 10 | 8 | 6 | 4 | 3 | 3 | 3 | 3 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Endurance | <table border="1"> <thead> <tr> <th>Test Time</th> <th>2,000 Hrs</th> </tr> </thead> <tbody> <tr> <td>Capacitance Change</td> <td>Within ±25% of initial value for ϕ D \leq 6.3mm; Within ±20% of initial value for ϕ D \geq 8mm</td> </tr> <tr> <td>Tanδ</td> <td>Less than 300% of specified value for ϕ D \leq 6.3mm; Less than 200% of specified value for ϕ D \geq 8mm</td> </tr> <tr> <td>Leakage Current</td> <td>Within specified value</td> </tr> </tbody> </table> <p>* The above Specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage applied for 2,000 hours at 105°C.</p> | | | Test Time | 2,000 Hrs | Capacitance Change | Within ±25% of initial value for ϕ D \leq 6.3mm; Within ±20% of initial value for ϕ D \geq 8mm | Tan δ | Less than 300% of specified value for ϕ D \leq 6.3mm; Less than 200% of specified value for ϕ D \geq 8mm | Leakage Current | Within specified value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test Time | 2,000 Hrs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Tan δ | Less than 300% of specified value for ϕ D \leq 6.3mm; Less than 200% of specified value for ϕ D \geq 8mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Leakage Current | Within specified value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shelf Life Test | <p>Test time: 1,000 hours; other items are the same as those for the Endurance. The rated voltage shall be applied to the capacitors before the measurements for 160 ~ 450V (Refer to JIS C 5101-4 4.1).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ripple Current & Frequency Multipliers | <table border="1"> <thead> <tr> <th rowspan="2">Cap. (μF)</th> <th colspan="4">Freq. (Hz)</th> </tr> <tr> <th>50</th> <th>120</th> <th>1k</th> <th>10k up</th> </tr> </thead> <tbody> <tr> <td>Under 1,000</td> <td>0.80</td> <td>1.00</td> <td>1.25</td> <td>1.40</td> </tr> <tr> <td>1,000 < C \leq 8,200</td> <td>0.85</td> <td>1.00</td> <td>1.15</td> <td>1.25</td> </tr> </tbody> </table> | | | Cap. (μ F) | Freq. (Hz) | | | | 50 | 120 | 1k | 10k up | Under 1,000 | 0.80 | 1.00 | 1.25 | 1.40 | 1,000 < C \leq 8,200 | 0.85 | 1.00 | 1.15 | 1.25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap. (μ F) | Freq. (Hz) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 50 | 120 | 1k | 10k up | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Under 1,000 | 0.80 | 1.00 | 1.25 | 1.40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1,000 < C \leq 8,200 | 0.85 | 1.00 | 1.15 | 1.25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Diagram of Dimensions

Fig. 1



Fig. 2



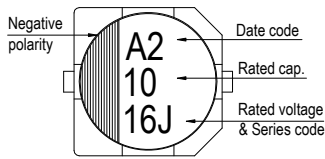
Lead Spacing and Diameter

Unit: mm

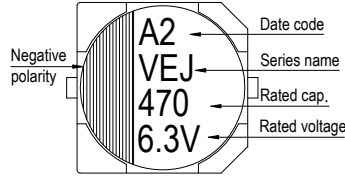
| ϕ D | L | A | B | C | W | P \pm 0.2 | Fig. No. |
|----------|----------------|------|------|------|-----------|-------------|----------|
| 4 | 5.7 \pm 0.3 | 4.3 | 4.3 | 5.1 | 0.5 ~ 0.8 | 1.0 | 1 |
| 5 | 5.7 \pm 0.3 | 5.3 | 5.3 | 5.9 | 0.5 ~ 0.8 | 1.5 | 1 |
| 6.3 | 5.7 \pm 0.3 | 6.6 | 6.6 | 7.2 | 0.5 ~ 0.8 | 2.0 | 1 |
| 6.3 | 7.7 \pm 0.3 | 6.6 | 6.6 | 7.2 | 0.5 ~ 0.8 | 2.0 | 1 |
| 8 | 6.5 \pm 0.3 | 8.4 | 8.4 | 9.0 | 0.5 ~ 0.8 | 2.3 | 1 |
| 8 | 10 \pm 0.5 | 8.4 | 8.4 | 9.0 | 0.7 ~ 1.1 | 3.1 | 1 |
| 10 | 7.7 \pm 0.3 | 10.4 | 10.4 | 11.0 | 0.7 ~ 1.3 | 4.7 | 1 |
| 10 | 10 \pm 0.5 | 10.4 | 10.4 | 11.0 | 0.7 ~ 1.3 | 4.7 | 1 |
| 12.5 | 13.5 \pm 0.5 | 13.0 | 13.0 | 13.7 | 1.1 ~ 1.4 | 4.4 | 2 |
| 12.5 | 16 \pm 0.5 | 13.0 | 13.0 | 13.7 | 1.1 ~ 1.4 | 4.4 | 2 |
| 16 | 16.5 \pm 0.5 | 17.0 | 17.0 | 18.0 | 1.1 ~ 1.4 | 6.4 | 2 |
| 16 | 21.5 \pm 0.5 | 17.0 | 17.0 | 18.0 | 1.1 ~ 1.4 | 6.4 | 2 |
| 18 | 16.5 \pm 0.5 | 19.0 | 19.0 | 20.0 | 1.1 ~ 1.4 | 6.4 | 2 |
| 18 | 21.5 \pm 0.5 | 19.0 | 19.0 | 20.0 | 1.1 ~ 1.4 | 6.4 | 2 |

Marking

$\phi D \leq 6.3 \text{ mm}$



$\phi D = 8 \sim 10 \text{ mm}$



$\phi D \geq 12.5 \text{ mm}$



Dimension & Permissible Ripple Current

Dimension: $\phi D \times L$ (mm)

Ripple Current: mA/rms at 120 Hz, 105°C

| V. DC μF | Contents | 6.3V (0J) | | 10V (1A) | | 16V (1C) | | 25V (1E) | | 35V (1V) | | 50V (1H) | | 63V (1J) | | 100V (2A) | |
|------------------------|----------|--------------------|----------------|--------------------|----------------|--------------------|----------------|--------------------|----------------|-------------------|----------|-------------------|----------|-------------------|----------|--------------------|------------|
| | | $\phi D \times L$ | mA | $\phi D \times L$ | mA | $\phi D \times L$ | mA | $\phi D \times L$ | mA | $\phi D \times L$ | mA | $\phi D \times L$ | mA | $\phi D \times L$ | mA | $\phi D \times L$ | mA |
| 1 | 010 | | | | | | | | | | | 4×5.7 | 8 | 4×5.7 | 8 | | |
| 2.2 | 2R2 | | | | | | | | | | | 4×5.7 | 12 | 4×5.7 | 12 | | |
| 3.3 | 3R3 | | | | | | | | | | | 4×5.7 | 14 | 5×5.7 | 17 | | |
| 4.7 | 4R7 | | | | | | | 4×5.7 | 17 | 4×5.7 | 17 | 5×5.7 | 20 | 6.3×5.7 | 22 | | |
| 10 | 100 | | | | | 4×5.7 | 20 | 4×5.7 | 20 | 5×5.7 | 27 | 6.3×5.7 | 32 | 6.3×5.7 8×6.5 | 32 51 | | |
| 22 | 220 | 4×5.7 | 22 | 4×5.7 | 22 | 5×5.7 | 30 | 5×5.7 | 30 | 6.3×5.7 | 44 | 6.3×5.7 8×6.5 | 38 67 | 6.3×7.7 | 58 | 8×10 | 100 |
| 33 | 330 | 5×5.7 | 34 | 5×5.7 | 34 | 5×5.7 | 34 | 6.3×5.7 | 46 | 6.3×5.7 8×6.5 | 46 76 | 6.3×7.7 | 65 | 8×10 | 140 | 10×10 | 150 |
| 47 | 470 | 5×5.7 | 38 | 5×5.7 | 38 | 6.3×5.7 | 48 | 6.3×5.7 8×6.5 | 48 79 | 6.3×7.7 | 80 | 6.3×7.7 | 70 | 8×10 | 170 | 12.5×13.5 | 250 |
| 100 | 101 | 6.3×5.7 | 69 | 6.3×5.7 8×6.5 | 69 90 | 6.3×5.7 | 69 | 6.3×7.7 | 100 | 8×10 | 240 | 8×10 | 210 | 10×10 | 310 | 12.5×13.5 | 380 |
| 220 | 221 | 6.3×7.7 8×6.5 | 120 120 | 6.3×7.7 | 120 | 6.3×7.7 | 120 | 8×10 10×7.7 | 270 270 | 8×10 | 270 | 10×10 | 330 | 12.5×13.5 | 470 | 16×16.5 | 450 |
| 330 | 331 | 8×10 | 290 | 8×10 | 290 | 8×10 10×7.7 | 290 290 | 8×10 | 290 | 10×10 | 370 | 12.5×13.5 | 490 | 16×16.5 | 650 | 18×16.5 16×21.5 | 590 750 |
| 470 | 471 | 8×10 | 320 | 8×10 10×7.7 | 320 320 | 10×10 | 380 | 10×10 | 380 | 12.5×13.5 | 520 | 12.5×16 | 550 | 16×16.5 | 700 | 18×21.5 | 980 |
| 1,000 | 102 | 10×10 | 410 | 10×10 | 410 | 12.5×13.5 | 550 | 12.5×16 | 550 | 16×16.5 | 800 | 18×16.5 | 990 | | | | |
| 2,200 | 222 | 12.5×13.5 | 680 | 12.5×13.5 | 680 | 16×16.5 | 900 | 16×16.5 | 900 | 18×16.5 | 1,050 | | | | | | |
| 3,300 | 332 | 12.5×16 | 850 | 16×16.5 | 950 | 16×16.5 | 950 | 18×16.5 16×21.5 | 1,150 1,200 | | | | | | | | |
| 4,700 | 472 | 16×16.5 | 1,000 | 16×16.5 | 1,000 | 18×16.5 16×21.5 | 1,225 1,275 | 18×21.5 | 1,300 | | | | | | | | |
| 6,800 | 682 | 18×16.5 16×21.5 | 1,290 1,350 | 18×16.5 16×21.5 | 1,290 1,350 | | | | | | | | | | | | |
| 8,200 | 822 | 18×21.5 | 1,450 | 18×21.5 | 1,450 | | | | | | | | | | | | |

| V. DC μF | Contents | 160V (2C) | | 200V (2D) | | 250V (2E) | | 400V (2G) | | 450V (2W) | |
|------------------------|----------|-------------------|-----|-------------------|-----|-------------------|-----|-------------------|-----|-------------------|-----|
| | | $\phi D \times L$ | mA | $\phi D \times L$ | mA | $\phi D \times L$ | mA | $\phi D \times L$ | mA | $\phi D \times L$ | mA |
| 4.7 | 4R7 | | | | | 12.5×13.5 | 65 | 12.5×13.5 | 45 | 12.5×13.5 | 45 |
| 10 | 100 | | | 12.5×13.5 | 80 | 12.5×13.5 | 70 | 12.5×13.5 | 50 | 12.5×16 | 75 |
| 22 | 220 | | | 12.5×16 | 110 | 12.5×13.5 | 105 | 16×16.5 | 85 | 16×16.5 | 85 |
| 33 | 330 | 12.5×13.5 | 95 | 12.5×16 | 120 | 16×16.5 | 180 | 18×16.5 | 100 | 18×16.5 | 100 |
| 47 | 470 | 16×16.5 | 240 | 16×16.5 | 220 | 16×16.5 | 220 | 18×21.5 | 130 | | |
| 100 | 101 | 16×16.5 | 250 | 18×16.5 | 280 | 18×16.5 | 260 | | | | |

Part Numbering System

VEJ series 470 μF $\pm 20\%$ 6.3V Carrier Tape 8 $\phi \times 10L$ Pb-free and PET coating case

VEJ **471** **M** **OJ** **TR** - **0810**

Series name Capacitance Capacitance Tolerance Rated Voltage Package Type Terminal Type Case size Lead Wire and Coating Type

Note: For more details, please refer to "Part Numbering System (SMD Type)" on page 12.

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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