

# Type LPX 85 °C Radial Snap-In Aluminum Electrolytic Capacitors

## High Voltage, High Value Radial Leded Snap-In



Type LPX radial leded snap-in aluminum electrolytic capacitors are a compact design for high density packaging and are ideal for high voltage, switch mode power supply input filtering applications.

### Highlights

- High voltage
- High Capacitance
- 85 °C
- Good for input filtering in consumer applications
- 22 to 35 mm diameter with 10 mm lead spacing

### Specifications



Complies with the EU Directive 2002/95/EC requirement restricting the use of Lead (Pb), Mercury (Hg), Cadmium (Cd), Hexavalent chromium (Cr(VI)), PolyBrominated Biphenyls (PBB) and PolyBrominated Diphenyl Ethers (PBDE).

**Capacitance Range:** 56 to 2,700 µF  
**Voltage Range:** 160 to 450 Vdc  
**Tolerance:** ±20%  
**Operating Temperature Range:** -40 °C to +85 °C  
**Dissipation Factor:**

| DF at 120 Hz, +25 °C |          |           |
|----------------------|----------|-----------|
| Vdc                  | 160 -250 | 400 - 450 |
| DF (%)               | 30       | 25        |

For values that are >1000 µF, the DF (%) increases 2% for every additional 1000 µF

### DC Leakage Test:

$$I = 3\sqrt{CV}$$

C = capacitance in µF  
 V = rated voltage  
 I = leakage current in µA

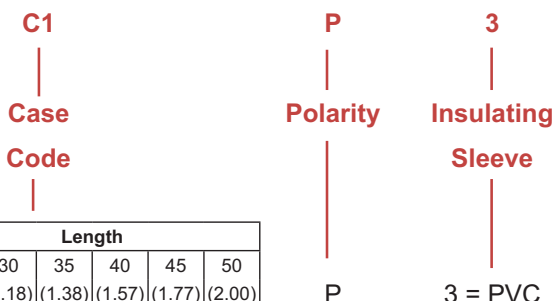
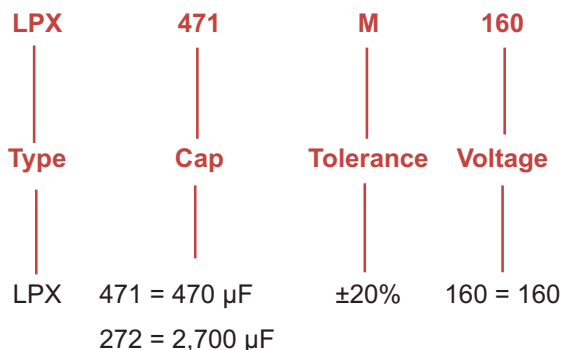
### Frequency Ripple Multipliers:

| Rated Vdc  | Ripple Multipliers |       |              |
|------------|--------------------|-------|--------------|
|            | 120 Hz             | 1 kHz | 10 to 50 kHz |
| 160 to 250 | 1.00               | 1.05  | 1.10         |
| 315 to 450 | 1.00               | 1.15  | 1.20         |

### Temperature Ripple Multipliers:

| Temperature | Ripple Multiplier |
|-------------|-------------------|
| +75 °C      | 1.60              |
| +65 °C      | 2.20              |
| +55 °C      | 2.60              |
| +55 °C      | 3.00              |

### Part Numbering System



| Diameter  | Length |        |        |        |        |        |
|-----------|--------|--------|--------|--------|--------|--------|
|           | 25     | 30     | 35     | 40     | 45     | 50     |
| mm        | 25     | 30     | 35     | 40     | 45     | 50     |
| (in.)     | (1.00) | (1.18) | (1.38) | (1.57) | (1.77) | (2.00) |
| 22 (.87)  | A1     | A3     | A5     | A7     | A4     | A9     |
| 25 (1.00) | C1     | C3     | C5     | C7     | C4     | C9     |
| 30 (1.18) | E1     | E3     | E5     | E7     | E4     | E9     |
| 35 (1.38) | H1     | H3     | H5     | H7     | H4     | H9     |

# Type LPX 85 °C Radial Snap-In Aluminum Electrolytic Capacitors

## Outline Drawing



## Ratings

| Cap<br>( $\mu$ F)             | Catalog<br>Part Number | Max ESR<br>@ 120 Hz<br>+25 °C<br>( $\Omega$ ) | Max Ripple<br>@ 120 Hz<br>+85 °C<br>(A) | Size<br>(Inches) |       | Size<br>(mm) |    |
|-------------------------------|------------------------|---|---|------------------|-------|--------------|----|
|                               |                        |   |   | D                | L     | D            | L  |
| <b>160 Vdc; 200 Vdc Surge</b> |                        |   |   |                  |       |              |    |
| 390                           | LPX391M160A1P3         | 0.51  | 1.3                                     | 0.866            | 0.984 | 22           | 25 |
| 470                           | LPX471M160C1P3         | 0.423   | 1.6                                     | 0.984            | 0.984 | 25           | 25 |
| 470                           | LPX471M160A3P3         | 0.423   | 1.6                                     | 0.866            | 1.181 | 22           | 30 |
| 560                           | LPX561M160C3P3         | 0.355   | 1.8                                     | 0.984            | 1.181 | 25           | 30 |
| 560                           | LPX561M160A5P3         | 0.355   | 1.8                                     | 0.866            | 1.378 | 22           | 35 |
| 680                           | LPX681M160E1P3         | 0.293   | 2.0                                     | 1.181            | 0.984 | 30           | 25 |
| 680                           | LPX681M160A7P3         | 0.293   | 2.1                                     | 0.866            | 1.575 | 22           | 40 |
| 680                           | LPX681M160C3P3         | 0.293   | 2.0                                     | 0.984            | 1.181 | 25           | 30 |
| 820                           | LPX821M160C5P3         | 0.243   | 2.0                                     | 0.984            | 1.378 | 25           | 35 |
| 820                           | LPX821M160E3P3         | 0.243   | 2.3                                     | 1.181            | 1.181 | 30           | 30 |
| 820                           | LPX821M160A4P3         | 0.243   | 2.4                                     | 0.866            | 1.772 | 22           | 45 |
| 1,000                         | LPX102M160C7P3         | 0.199   | 2.6                                     | 0.984            | 1.575 | 25           | 40 |
| 1,000                         | LPX102M160H1P3         | 0.199   | 2.3                                     | 1.378            | 0.984 | 35           | 25 |
| 1,000                         | LPX102M160E3P3         | 0.199   | 2.5                                     | 1.181            | 1.181 | 30           | 30 |
| 1,200                         | LPX122M160C4P3         | 0.166   | 3.0                                     | 0.984            | 1.772 | 25           | 45 |
| 1,200                         | LPX122M160H3P3         | 0.166   | 2.6                                     | 1.378            | 1.181 | 35           | 30 |
| 1,200                         | LPX122M160E5P3         | 0.166   | 2.9                                     | 1.181            | 1.378 | 30           | 35 |
| 1,500                         | LPX152M160H5P3         | 0.133   | 3.3                                     | 1.378            | 1.378 | 35           | 35 |
| 1,500                         | LPX152M160E7P3         | 0.133   | 3.3                                     | 1.181            | 1.575 | 30           | 40 |
| 1,800                         | LPX182M160E9P3         | 0.111   | 4.0                                     | 1.181            | 1.969 | 30           | 50 |
| 1,800                         | LPX182M160H7P3         | 0.111   | 3.7                                     | 1.378            | 1.575 | 35           | 40 |
| 2,200                         | LPX222M160H4P3         | 0.090   | 4.2                                     | 1.378            | 1.772 | 35           | 45 |
| 2,700                         | LPX272M160H9P3         | 0.074   | 4.6                                     | 1.378            | 1.969 | 35           | 50 |
| <b>200 Vdc; 250 Vdc Surge</b> |                        |   |   |                  |       |              |    |
| 270                           | LPX271M200A1P3         | 0.737   | 1.2                                     | 0.866            | 0.984 | 22           | 25 |
| 390                           | LPX391M200C1P3         | 0.510   | 1.6                                     | 0.984            | 0.984 | 25           | 25 |
| 390                           | LPX391M200A3P3         | 0.510   | 1.6                                     | 0.866            | 1.181 | 22           | 30 |
| 470                           | LPX471M200C3P3         | 0.423   | 1.8                                     | 0.984            | 1.181 | 25           | 30 |
| 470                           | LPX471M200A5P3         | 0.423   | 1.8                                     | 0.866            | 1.378 | 22           | 35 |
| 560                           | LPX561M200A7P3         | 0.355   | 2.1                                     | 0.866            | 1.575 | 22           | 40 |
| 560                           | LPX561M200C5P3         | 0.355   | 2.1                                     | 0.984            | 1.378 | 25           | 35 |
| 560                           | LPX561M200E1P3         | 0.355   | 1.9                                     | 1.181            | 0.984 | 30           | 25 |

| Cap<br>( $\mu$ F)             | Catalog<br>Part Number | Max ESR<br>@ 120 Hz<br>+25 °C<br>( $\Omega$ ) | Max Ripple<br>@ 120 Hz<br>+85 °C<br>(A) | Size<br>(Inches) |       | Size<br>(mm) |    |
|-------------------------------|------------------------|---|---|------------------|-------|--------------|----|
|                               |                        |   |   | D                | L     | D            | L  |
| <b>200 Vdc; 250 Vdc Surge</b> |                        |   |   |                  |       |              |    |
| 680                           | LPX681M200C7P3         | 0.293   | 2.5                                     | 0.984            | 1.575 | 25           | 40 |
| 680                           | LPX681M200A4P3         | 0.293   | 2.4                                     | 0.866            | 1.772 | 22           | 45 |
| 680                           | LPX681M200E3P3         | 0.293   | 2.3                                     | 1.181            | 1.181 | 30           | 30 |
| 820                           | LPX821M200E5P3         | 0.243   | 2.7                                     | 1.181            | 1.378 | 30           | 35 |
| 820                           | LPX821M200H3P3         | 0.243   | 2.7                                     | 1.378            | 1.181 | 35           | 30 |
| 820                           | LPX821M200C4P3         | 0.243   | 2.8                                     | 0.984            | 1.772 | 25           | 45 |
| 1,000                         | LPX102M200H3P3         | 0.199   | 2.7                                     | 1.378            | 1.181 | 35           | 30 |
| 1,000                         | LPX102M200E7P3         | 0.199   | 3.1                                     | 1.181            | 1.575 | 30           | 40 |
| 1,200                         | LPX122M200H5P3         | 0.166   | 3.1                                     | 1.378            | 1.378 | 35           | 35 |
| 1,200                         | LPX122M200E4P3         | 0.166   | 3.5                                     | 1.181            | 1.772 | 30           | 45 |
| 1,500                         | LPX152M200E9P3         | 0.133   | 4                                       | 1.181            | 1.969 | 30           | 50 |
| 1,500                         | LPX152M200H7P3         | 0.133   | 3.6                                     | 1.378            | 1.575 | 35           | 40 |
| 1,800                         | LPX182M200H4P3         | 0.111   | 4                                       | 1.378            | 1.772 | 35           | 45 |
| 2,200                         | LPX222M200H9P3         | 0.09  | 4.5                                     | 1.378            | 1.969 | 35           | 50 |
| <b>250 Vdc; 300 Vdc Surge</b> |                        |   |   |                  |       |              |    |
| 270                           | LPX271M250A3P3         | 0.737   | 1.4                                     | 0.866            | 1.181 | 22           | 30 |
| 270                           | LPX271M250C1P3         | 0.737   | 1.4                                     | 0.984            | 0.984 | 25           | 25 |
| 330                           | LPX331M250C3P3         | 0.603   | 1.7                                     | 0.984            | 1.181 | 25           | 30 |
| 330                           | LPX331M250A5P3         | 0.603   | 1.7                                     | 0.866            | 1.378 | 22           | 35 |
| 390                           | LPX391M250E1P3         | 0.51  | 1.8                                     | 1.181            | 0.984 | 30           | 25 |
| 390                           | LPX391M250A7P3         | 0.51  | 1.9                                     | 0.866            | 1.575 | 22           | 40 |
| 390                           | LPX391M250C3P3         | 0.51  | 1.8                                     | 0.984            | 1.181 | 25           | 30 |
| 470                           | LPX471M250A4P3         | 0.423   | 2.2                                     | 0.866            | 1.772 | 22           | 45 |
| 470                           | LPX471M250C5P3         | 0.423   | 2.1                                     | 0.984            | 1.378 | 25           | 35 |
| 470                           | LPX471M250E3P3         | 0.423   | 2.1                                     | 1.181            | 1.181 | 30           | 30 |
| 560                           | LPX561M250A9P3         | 0.355   | 2.5                                     | 0.866            | 1.969 | 22           | 50 |
| 560                           | LPX561M250H1P3         | 0.355   | 2.1                                     | 1.378            | 0.984 | 35           | 25 |
| 560                           | LPX561M250E3P3         | 0.355   | 2.2                                     | 1.181            | 1.181 | 30           | 30 |
| 560                           | LPX561M250C7P3         | 0.355   | 2.4                                     | 0.984            | 1.575 | 25           | 40 |
| 680                           | LPX681M250H3P3         | 0.293   | 2.5                                     | 1.378            | 1.181 | 35           | 30 |
| 680                           | LPX681M250C4P3         | 0.293   | 2.7                                     | 0.984            | 1.772 | 25           | 45 |
| 680                           | LPX681M250E5P3         | 0.293   | 2.6                                     | 1.181            | 1.378 | 30           | 35 |

# Type LPX 85 °C Radial Snap-In Aluminum Electrolytic Capacitors

| Cap<br>(µF)                   | Catalog<br>Part Number | Max ESR<br>@ 120 Hz<br>+25 °C<br>(Ω) | Max Ripple<br>@ 120 Hz<br>+85 °C<br>(A) | Size<br>(Inches)              |       | Size<br>(mm) |    |
|-------------------------------|------------------------|--------------------------------------|---|-------------------------------|-------|--------------|----|
|                               |                        |                                      |   | D                             | L     | D            | L  |
|                               |                        |                                      |   | <b>250 Vdc; 300 Vdc Surge</b> |       |              |    |
| 820                           | LPX821M250H5P3         | 0.243                                | 3.0                                     | 1.378                         | 1.378 | 35           | 35 |
| 820                           | LPX821M250E7P3         | 0.243                                | 3.0                                     | 1.181                         | 1.575 | 30           | 40 |
| 1,000                         | LPX102M250H7P3         | 0.199                                | 3.4                                     | 1.378                         | 1.575 | 35           | 40 |
| 1,000                         | LPX102M250E4P3         | 0.199                                | 3.4                                     | 1.181                         | 1.772 | 30           | 45 |
| 1,200                         | LPX122M250H4P3         | 0.166                                | 3.8                                     | 1.378                         | 1.772 | 35           | 45 |
| 1,500                         | LPX152M250H9P3         | 0.133                                | 4.2                                     | 1.378                         | 1.969 | 35           | 50 |
| <b>350 Vdc; 400 Vdc Surge</b> |                        |                                      |   |                               |       |              |    |
| 100                           | LPX101M350A1P3         | 1.989                                | 0.6                                     | 0.866                         | 0.984 | 22           | 25 |
| 120                           | LPX121M350C1P3         | 1.658                                | 0.7                                     | 0.984                         | 0.984 | 25           | 25 |
| 120                           | LPX121M350A3P3         | 1.658                                | 0.7                                     | 0.866                         | 1.181 | 22           | 30 |
| 150                           | LPX151M350C3P3         | 1.326                                | 0.8                                     | 0.984                         | 1.181 | 25           | 30 |
| 150                           | LPX151M350A5P3         | 1.326                                | 0.8                                     | 0.866                         | 1.378 | 22           | 35 |
| 180                           | LPX181M350A7P3         | 1.105                                | 0.9                                     | 0.866                         | 1.575 | 22           | 40 |
| 180                           | LPX181M350C3P3         | 1.105                                | 0.9                                     | 0.984                         | 1.181 | 25           | 30 |
| 180                           | LPX181M350E1P3         | 1.105                                | 1.0                                     | 1.181                         | 0.984 | 30           | 25 |
| 220                           | LPX221M350A4P3         | 0.904                                | 1.1                                     | 0.866                         | 1.772 | 22           | 45 |
| 220                           | LPX221M350E3P3         | 0.904                                | 1.1                                     | 1.181                         | 1.181 | 30           | 30 |
| 220                           | LPX221M350C5P3         | 0.904                                | 1.1                                     | 0.984                         | 1.378 | 25           | 35 |
| 270                           | LPX271M350E3P3         | 0.737                                | 1.2                                     | 1.181                         | 1.181 | 30           | 30 |
| 270                           | LPX271M350C7P3         | 0.737                                | 1.2                                     | 0.984                         | 1.575 | 25           | 40 |
| 270                           | LPX271M350A9P3         | 0.737                                | 1.3                                     | 0.866                         | 1.969 | 22           | 50 |
| 270                           | LPX271M350H1P3         | 0.737                                | 1.3                                     | 1.378                         | 0.984 | 35           | 25 |
| 330                           | LPX331M350C4P3         | 0.603                                | 1.4                                     | 0.984                         | 1.772 | 25           | 45 |
| 330                           | LPX331M350H3P3         | 0.603                                | 1.4                                     | 1.378                         | 1.181 | 35           | 30 |
| 330                           | LPX331M350E5P3         | 0.603                                | 1.4                                     | 1.181                         | 1.378 | 30           | 35 |
| 390                           | LPX391M350H3P3         | 0.51                                 | 1.6                                     | 1.378                         | 1.181 | 35           | 30 |
| 390                           | LPX391M350E7P3         | 0.51                                 | 1.8                                     | 1.181                         | 1.575 | 30           | 40 |
| 470                           | LPX471M350H5P3         | 0.423                                | 1.8                                     | 1.378                         | 1.378 | 35           | 35 |
| 470                           | LPX471M350E4P3         | 0.423                                | 1.9                                     | 1.181                         | 1.772 | 30           | 45 |
| 560                           | LPX561M350H7P3         | 0.355                                | 2.1                                     | 1.378                         | 1.575 | 35           | 40 |
| 680                           | LPX681M350H4P3         | 0.293                                | 2.4                                     | 1.378                         | 1.772 | 35           | 45 |
| <b>400 Vdc; 450 Vdc Surge</b> |                        |                                      |   |                               |       |              |    |
| 82                            | LPX820M400A1P3         | 2.426                                | 0.6                                     | 0.866                         | 0.984 | 22           | 25 |
| 100                           | LPX101M400A3P3         | 1.989                                | 0.7                                     | 0.866                         | 1.181 | 22           | 30 |
| 120                           | LPX121M400A3P3         | 1.658                                | 0.7                                     | 0.866                         | 1.181 | 22           | 30 |
| 120                           | LPX121M400C1P3         | 1.658                                | 0.7                                     | 0.984                         | 0.984 | 25           | 25 |
| 150                           | LPX151M400C3P3         | 1.326                                | 0.9                                     | 0.984                         | 1.181 | 25           | 30 |
| 180                           | LPX181M400A7P3         | 1.105                                | 1.0                                     | 0.866                         | 1.575 | 22           | 40 |

| Cap<br>(µF)                   | Catalog<br>Part Number | Max ESR<br>@ 120 Hz<br>+25 °C<br>(Ω) | Max Ripple<br>@ 120 Hz<br>+85 °C<br>(A) | Size<br>(Inches)              |       | Size<br>(mm) |    |
|-------------------------------|------------------------|--------------------------------------|---|-------------------------------|-------|--------------|----|
|                               |                        |                                      |   | D                             | L     | D            | L  |
|                               |                        |                                      |   | <b>400 Vdc; 450 Vdc Surge</b> |       |              |    |
| 180                           | LPX181M400C5P3         | 1.105                                | 1.0                                     | 0.984                         | 1.378 | 25           | 35 |
| 220                           | LPX221M400E3P3         | 0.904                                | 1.2                                     | 1.181                         | 1.181 | 30           | 30 |
| 220                           | LPX221M400H1P3         | 0.904                                | 1.2                                     | 1.378                         | 0.984 | 35           | 25 |
| 220                           | LPX221M400C7P3         | 0.904                                | 1.2                                     | 0.984                         | 1.575 | 25           | 40 |
| 270                           | LPX271M400C4P3         | 0.737                                | 1.4                                     | 0.984                         | 1.772 | 25           | 45 |
| 270                           | LPX271M400E5P3         | 0.737                                | 1.4                                     | 1.181                         | 1.378 | 30           | 35 |
| 270                           | LPX271M400H3P3         | 0.737                                | 1.4                                     | 1.378                         | 1.181 | 35           | 30 |
| 330                           | LPX331M400E7P3         | 0.603                                | 1.6                                     | 1.181                         | 1.575 | 30           | 40 |
| 330                           | LPX331M400H3P3         | 0.603                                | 1.5                                     | 1.378                         | 1.181 | 35           | 30 |
| 390                           | LPX391M400H5P3         | 0.510                                | 1.8                                     | 1.378                         | 1.378 | 35           | 35 |
| 390                           | LPX391M400E4P3         | 0.510                                | 1.8                                     | 1.181                         | 1.772 | 30           | 45 |
| 470                           | LPX471M400H7P3         | 0.423                                | 2.0                                     | 1.378                         | 1.575 | 35           | 40 |
| 470                           | LPX471M400E9P3         | 0.423                                | 2.0                                     | 1.181                         | 1.969 | 30           | 50 |
| 560                           | LPX561M400H4P3         | 0.355                                | 2.3                                     | 1.378                         | 1.772 | 35           | 45 |
| 680                           | LPX681M400H9P3         | 0.293                                | 2.6                                     | 1.378                         | 1.969 | 35           | 50 |
| <b>450 Vdc; 500 Vdc Surge</b> |                        |                                      |   |                               |       |              |    |
| 56                            | LPX560M450A1P3         | 3.553                                | 0.5                                     | 0.866                         | 0.984 | 22           | 25 |
| 68                            | LPX680M450A3P3         | 2.926                                | 0.6                                     | 0.866                         | 1.181 | 22           | 30 |
| 82                            | LPX820M450C1P3         | 2.426                                | 0.7                                     | 0.984                         | 0.984 | 25           | 25 |
| 82                            | LPX820M450A3P3         | 2.426                                | 0.7                                     | 0.866                         | 1.181 | 22           | 30 |
| 100                           | LPX101M450C3P3         | 1.989                                | 0.8                                     | 0.984                         | 1.181 | 25           | 30 |
| 100                           | LPX101M450A5P3         | 1.989                                | 0.8                                     | 0.866                         | 1.378 | 22           | 35 |
| 120                           | LPX121M450E1P3         | 1.658                                | 0.9                                     | 1.181                         | 0.984 | 30           | 25 |
| 120                           | LPX121M450C5P3         | 1.658                                | 1.0                                     | 0.984                         | 1.378 | 25           | 35 |
| 120                           | LPX121M450A7P3         | 1.658                                | 0.9                                     | 0.866                         | 1.575 | 22           | 40 |
| 150                           | LPX151M450A9P3         | 1.326                                | 1.1                                     | 0.866                         | 1.969 | 22           | 50 |
| 150                           | LPX151M450E3P3         | 1.326                                | 1.1                                     | 1.181                         | 1.181 | 30           | 30 |
| 150                           | LPX151M450C7P3         | 1.326                                | 1.1                                     | 0.984                         | 1.575 | 25           | 40 |
| 180                           | LPX181M450C4P3         | 1.105                                | 1.3                                     | 0.984                         | 1.772 | 25           | 45 |
| 180                           | LPX181M450H1P3         | 1.105                                | 1.2                                     | 1.378                         | 0.984 | 35           | 25 |
| 180                           | LPX181M450E7P3         | 1.105                                | 1.4                                     | 1.181                         | 1.575 | 30           | 40 |
| 220                           | LPX221M450H3P3         | 0.904                                | 1.5                                     | 1.378                         | 1.181 | 35           | 30 |
| 220                           | LPX221M450C9P3         | 0.904                                | 1.5                                     | 0.984                         | 1.969 | 25           | 50 |
| 220                           | LPX221M450E7P3         | 0.904                                | 1.6                                     | 1.181                         | 1.575 | 30           | 40 |
| 270                           | LPX271M450E4P3         | 0.737                                | 1.7                                     | 1.181                         | 1.772 | 30           | 45 |
| 270                           | LPX271M450H5P3         | 0.737                                | 1.7                                     | 1.378                         | 1.378 | 35           | 35 |
| 330                           | LPX331M450H7P3         | 0.603                                | 2.0                                     | 1.378                         | 1.575 | 35           | 40 |
| 330                           | LPX331M450E9P3         | 0.603                                | 2.0                                     | 1.181                         | 1.969 | 30           | 50 |
| 390                           | LPX391M450H4P3         | 0.510                                | 2.2                                     | 1.378                         | 1.772 | 35           | 45 |
| 470                           | LPX471M450H9P3         | 0.423                                | 2.5                                     | 1.378                         | 1.969 | 35           | 50 |

## Данный компонент на территории Российской Федерации

### Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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