

# ALUMINUM ELECTROLYTIC CAPACITORS

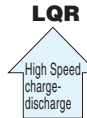
# LNx

Screw Terminal Type, 85°C  
High ripple longer life.



High Ripple Current Long Life

- Suited for use in industrial power supplies for inverter circuitry, etc.
- High ripple current, extra-high voltage application.
- High reliability, long life for 20,000 hours application of rated ripple current at +85°C.
- Extended range up to  $\phi 100 \times 250L$  size.
- Flame retardant electroly to type available.
- Compliant to the RoHS directive (2011/65/EU, (EU)2015/863).



**LNx** ← Long life **LNy**

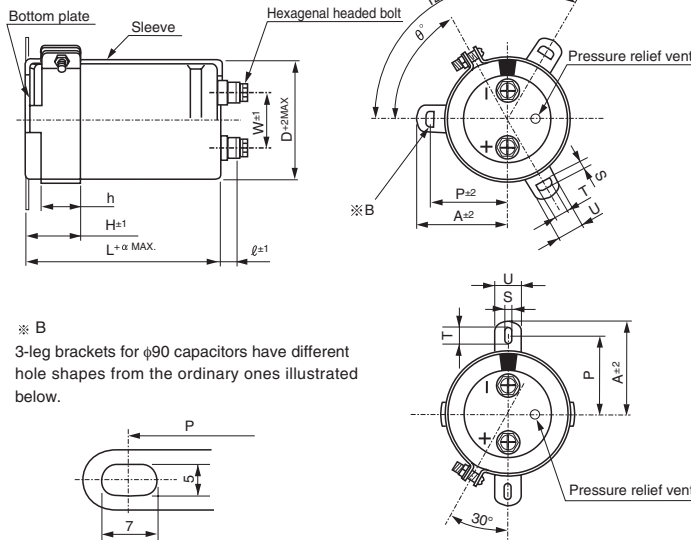


## Specifications

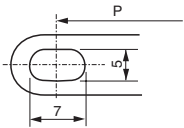
| Item                                  | Performance Characteristics   |
|---------------------------------------|---|
| Category Temperature Range            | - 25 to +85°C   |
| Rated Voltage Range                   | 350 to 630V   |
| Rated Capacitance Range               | 1000 to 27000 $\mu$ F   |
| Capacitance Tolerance                 | $\pm 20\%$ at 120Hz, 20°C   |
| Leakage Current                       | After 5 minutes' application of rated voltage, leakage current is not more than $3\sqrt{CV}$ ( $\mu$ A) or 5 mA, whichever is smaller (at 20°C).<br>[C: Rated Capacitance( $\mu$ F), V: Voltage (V)]  |
| Tangent of loss angle (tan $\delta$ ) | See refer to next page (Measurement frequency : 120Hz at 20°C)  |
| Stability at Low Temperature          | Rated voltage (V) 350 to 630<br>Impedance ratio ZT/Z20(MAX.) Z - 25°C / Z +20°C<br>8  |
|                                       | Measurement frequency : 120Hz   |
| Endurance                             | The specifications listed at right shall be met when the capacitors are restored to 20°C after the standard ripple current is applied for 20000 hours at 85°C, the peak voltage shall not exceed the rated voltage. (2000 hours at 85°C for the parts rated at 630V, 5000 hours at 85°C for the parts rated at 500V and 550V) |
|                                       | The specifications listed at right shall be met when the capacitors are restored to 20°C after D.C. bias plus rated ripple current is applied for 5000 hours at 85°C, the peak voltage shall not exceed the rated voltage.  |
|                                       | Capacitance change Within $\pm 20\%$ of the initial capacitance value   |
|                                       | tan $\delta$ 300% or less than the initial specified value  |
| Shelf Life                            | Leakage current Less than or equal to the initial specified value   |
|                                       | After storing the capacitors under no load at 85°C for 1000 hours and then performing voltage treatment based on JIS C 5101-4 clause 4.1 at 20°C, they shall meet the specified values for the endurance characteristics listed above.  |
| Marking                               | Printed with white color letter on black sleeve.  |

## Drawing

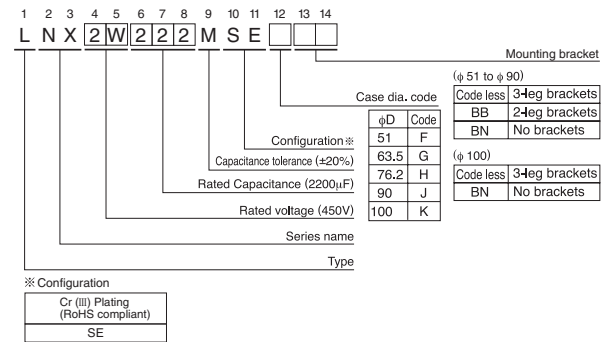
### Method mount metal bracket



※ B  
3-leg brackets for  $\phi 90$  capacitors have different hole shapes from the ordinary ones illustrated below.



### Type numbering system (Example : 450V 2200 $\mu$ F)



Please refer to page 348 for schematic of dimensions.  
※ Please contact to us if PVCless products are required.

### Dimension of terminal pitch (W) and length ( $\ell$ ) and Nominal dia. of bolt (mm)

| $\phi D$ | W    | $\ell$ | $\alpha$ | Nominal dia. of bolt |
|----------|------|--------|----------|----------------------|
| 51       | 22.0 | 6      | 3        | M5                   |
| 63.5     | 28.6 | 6      | 3        | M5                   |
| 76.2     | 31.8 | 6      | 3        | M5                   |
| 90       | 31.8 | 6      | 3        | M5                   |
| 100      | 41.5 | 10     | 4        | M8                   |

### Dimensions of mounting bracket (mm)

| Symbol         | Leg shape $\phi D$ | 3-Leg |      |      |      | 2-Leg |      |      |      |     |
|----------------|--------------------|-------|------|------|------|-------|------|------|------|-----|
|                |                    | 51    | 63.5 | 76.2 | 90   | 100   | 51   | 63.5 | 76.2 | 90  |
| P              |                    | 32.5  | 38.1 | 44.5 | 50.8 | 56.3  | 33.2 | 40.5 | 46.5 | 53  |
| A              |                    | 38.5  | 43   | 49.2 | 58.5 | 62    | 40   | 46.5 | 53   | 59  |
| T              |                    | 7.5   | 8.0  | 7.0  | 8.0  | 8.0   | 6.0  | 7.0  | 6.0  | 6.0 |
| S              |                    | 5.0   | 5.0  | 5.0  | 5.0  | 5.0   | 4.5  | 4.5  | 4.5  | 4.5 |
| U              |                    | 12    | 14   | 14   | 18   | 16    | 14   | 14   | 14   | 14  |
| $\theta^\circ$ |                    | 60    | 60   | 60   | 60   | 60    | 30   | 30   | 30   | 30  |
| H              |                    | 20    | 25   | 30   | 35   | 36    | 25   | 35   | 35   | 35  |
| h              |                    | 15    | 20   | 24   | 25   | 30    | 15   | 20   | 20   | 20  |

● Dimension table in next page.



■ Dimensions

| 350V (2V) |                 |                                      |                                   |       |                      |              |
|-----------|-----------------|--------------------------------------|-----------------------------------|-------|----------------------|--------------|
| Cap. (μF) | Size φD × L(mm) | Standard ripple (Arms) <sup>*1</sup> | Rated ripple (Arms) <sup>*2</sup> | tan δ | Leakage Current (mA) | Code         |
| 1000      | 51 × 60         | 3.5                                  | 4.6                               | 0.2   | 1.77                 | LNX2V102MSEF |
| 1200      | 51 × 70         | 4.2                                  | 5.3                               | 0.2   | 1.94                 | LNX2V122MSEF |
| 1500      | 51 × 80         | 4.9                                  | 6.3                               | 0.2   | 2.17                 | LNX2V152MSEF |
| 1800      | 51 × 90         | 5.6                                  | 7.3                               | 0.2   | 2.38                 | LNX2V182MSEF |
| 2200      | 51 × 110        | 6.7                                  | 8.8                               | 0.2   | 2.63                 | LNX2V222MSEF |
| 2700      | 51 × 130        | 8.0                                  | 10.3                              | 0.2   | 2.91                 | LNX2V272MSEF |
|           | 63.5 × 90       | 7.7                                  | 9.9                               | 0.2   | 2.91                 | LNX2V272MSEG |
| 3300      | 51 × 150        | 9.2                                  | 12.1                              | 0.2   | 3.22                 | LNX2V332MSEF |
|           | 63.5 × 100      | 9.0                                  | 11.8                              | 0.2   | 3.22                 | LNX2V332MSEG |
| 3900      | 63.5 × 110      | 10.4                                 | 12.5                              | 0.2   | 3.50                 | LNX2V392MSEG |
|           | 76.2 × 90       | 10.3                                 | 12.2                              | 0.2   | 3.50                 | LNX2V392MSEH |
| 4700      | 63.5 × 130      | 12.0                                 | 14.8                              | 0.2   | 3.84                 | LNX2V472MSEG |
|           | 76.2 × 100      | 11.9                                 | 14.0                              | 0.2   | 3.84                 | LNX2V472MSEH |
| 5600      | 63.5 × 150      | 14.0                                 | 17.0                              | 0.2   | 4.20                 | LNX2V562MSEG |
|           | 76.2 × 110      | 13.5                                 | 16.4                              | 0.2   | 4.20                 | LNX2V562MSEH |
| 6800      | 63.5 × 170      | 16.3                                 | 19.6                              | 0.2   | 4.62                 | LNX2V682MSEG |
|           | 76.2 × 130      | 16.0                                 | 19.1                              | 0.2   | 4.62                 | LNX2V682MSEH |
| 8200      | 76.2 × 150      | 18.7                                 | 22.0                              | 0.2   | 5.00                 | LNX2V822MSEH |
|           | 90 × 130        | 18.2                                 | 21.4                              | 0.2   | 5.00                 | LNX2V822MSEJ |
| 10000     | 76.2 × 170      | 21.8                                 | 25.5                              | 0.2   | 5.00                 | LNX2V103MSEH |
|           | 90 × 150        | 21.3                                 | 25.3                              | 0.2   | 5.00                 | LNX2V103MSEJ |
| 12000     | 76.2 × 190      | 25.1                                 | 29.1                              | 0.2   | 5.00                 | LNX2V123MSEH |
|           | 90 × 150        | 24.8                                 | 28.8                              | 0.2   | 5.00                 | LNX2V123MSEJ |
| 15000     | 90 × 190        | 29.0                                 | 36.0                              | 0.2   | 5.00                 | LNX2V153MSEJ |
| 18000     | 90 × 220        | 32.4                                 | 39.7                              | 0.2   | 5.00                 | LNX2V183MSEJ |
| 22000     | 100 × 220       | 38.0                                 | 43.2                              | 0.2   | 5.00                 | LNX2V223MSEK |
| 27000     | 100 × 250       | 42.0                                 | 47.0                              | 0.2   | 5.00                 | LNX2V273MSEK |

| 400V (2G) |                 |                                      |                                   |       |                      |              |
|-----------|-----------------|--------------------------------------|-----------------------------------|-------|----------------------|--------------|
| Cap. (μF) | Size φD × L(mm) | Standard ripple (Arms) <sup>*1</sup> | Rated ripple (Arms) <sup>*2</sup> | tan δ | Leakage Current (mA) | Code         |
| 1000      | 51 × 70         | 3.8                                  | 5.0                               | 0.2   | 1.89                 | LNX2G102MSEF |
| 1200      | 51 × 80         | 4.5                                  | 5.8                               | 0.2   | 2.07                 | LNX2G122MSEF |
| 1500      | 51 × 100        | 5.3                                  | 6.8                               | 0.2   | 2.32                 | LNX2G152MSEF |
| 1800      | 51 × 110        | 6.0                                  | 8.2                               | 0.2   | 2.54                 | LNX2G182MSEF |
| 2200      | 51 × 130        | 7.0                                  | 9.3                               | 0.2   | 2.81                 | LNX2G222MSEF |
|           | 63.5 × 90       | 6.8                                  | 8.9                               | 0.2   | 2.81                 | LNX2G222MSEG |
| 2700      | 63.5 × 110      | 8.2                                  | 10.8                              | 0.2   | 3.11                 | LNX2G272MSEG |
|           | 76.2 × 90       | 8.1                                  | 10.6                              | 0.2   | 3.11                 | LNX2G272MSEH |
| 3300      | 63.5 × 130      | 9.6                                  | 12.9                              | 0.2   | 3.44                 | LNX2G332MSEG |
|           | 76.2 × 100      | 9.3                                  | 12.4                              | 0.2   | 3.44                 | LNX2G332MSEH |
| 3900      | 63.5 × 150      | 11.0                                 | 14.4                              | 0.2   | 3.74                 | LNX2G392MSEG |
|           | 76.2 × 100      | 10.5                                 | 13.9                              | 0.2   | 3.74                 | LNX2G392MSEH |
| 4700      | 63.5 × 170      | 12.6                                 | 16.6                              | 0.2   | 4.11                 | LNX2G472MSEG |
|           | 76.2 × 130      | 12.3                                 | 16.0                              | 0.2   | 4.11                 | LNX2G472MSEH |
| 5600      | 63.5 × 190      | 14.7                                 | 18.8                              | 0.2   | 4.49                 | LNX2G562MSEG |
|           | 76.2 × 150      | 14.3                                 | 18.3                              | 0.2   | 4.49                 | LNX2G562MSEH |
| 6800      | 76.2 × 170      | 16.7                                 | 21.2                              | 0.2   | 4.94                 | LNX2G682MSEH |
|           | 90 × 130        | 16.3                                 | 20.7                              | 0.2   | 4.94                 | LNX2G682MSEJ |
| 8200      | 76.2 × 190      | 19.3                                 | 24.1                              | 0.2   | 5.00                 | LNX2G822MSEH |
|           | 90 × 150        | 19.0                                 | 23.7                              | 0.2   | 5.00                 | LNX2G822MSEJ |
| 10000     | 76.2 × 220      | 22.7                                 | 28.3                              | 0.2   | 5.00                 | LNX2G103MSEH |
|           | 90 × 170        | 22.2                                 | 28.0                              | 0.2   | 5.00                 | LNX2G103MSEJ |
| 12000     | 90 × 190        | 25.5                                 | 31.9                              | 0.2   | 5.00                 | LNX2G123MSEJ |
| 15000     | 100 × 190       | 29.6                                 | 37.0                              | 0.2   | 5.00                 | LNX2G153MSEK |
| 18000     | 100 × 220       | 33.0                                 | 40.5                              | 0.2   | 5.00                 | LNX2G183MSEK |
| 22000     | 100 × 250       | 41.4                                 | 44.7                              | 0.2   | 5.00                 | LNX2G223MSEK |

| 450V (2W) |                 |                                      |                                   |       |                      |              |
|-----------|-----------------|--------------------------------------|-----------------------------------|-------|----------------------|--------------|
| Cap. (μF) | Size φD × L(mm) | Standard ripple (Arms) <sup>*1</sup> | Rated ripple (Arms) <sup>*2</sup> | tan δ | Leakage Current (mA) | Code         |
| 1000      | 51 × 80         | 4.0                                  | 5.2                               | 0.2   | 2.01                 | LNX2W102MSEF |
| 1200      | 51 × 100        | 4.7                                  | 6.3                               | 0.2   | 2.20                 | LNX2W122MSEF |
| 1500      | 51 × 110        | 5.4                                  | 7.3                               | 0.2   | 2.46                 | LNX2W152MSEF |
| 1800      | 51 × 130        | 6.4                                  | 8.7                               | 0.2   | 2.70                 | LNX2W182MSEF |
|           | 63.5 × 90       | 6.1                                  | 7.6                               | 0.2   | 2.70                 | LNX2W182MSEG |
| 2200      | 63.5 × 110      | 7.2                                  | 9.6                               | 0.2   | 2.98                 | LNX2W222MSEG |
|           | 76.2 × 90       | 7.1                                  | 9.4                               | 0.2   | 2.98                 | LNX2W222MSEH |
| 2700      | 63.5 × 130      | 8.6                                  | 11.3                              | 0.2   | 3.30                 | LNX2W272MSEG |
|           | 76.2 × 100      | 8.3                                  | 11.0                              | 0.2   | 3.30                 | LNX2W272MSEH |
| 3300      | 63.5 × 150      | 10.0                                 | 13.3                              | 0.2   | 3.65                 | LNX2W332MSEG |
|           | 76.2 × 110      | 9.7                                  | 12.9                              | 0.2   | 3.65                 | LNX2W332MSEH |
| 3900      | 63.5 × 170      | 11.4                                 | 15.1                              | 0.2   | 3.97                 | LNX2W392MSEG |
|           | 76.2 × 130      | 11.2                                 | 14.6                              | 0.2   | 3.97                 | LNX2W392MSEH |
| 4700      | 63.5 × 190      | 13.0                                 | 17.3                              | 0.2   | 4.36                 | LNX2W472MSEG |
|           | 76.2 × 150      | 12.9                                 | 16.9                              | 0.2   | 4.36                 | LNX2W472MSEH |
| 5600      | 76.2 × 170      | 15.4                                 | 19.4                              | 0.2   | 4.76                 | LNX2W562MSEH |
|           | 90 × 150        | 15.3                                 | 19.1                              | 0.2   | 4.76                 | LNX2W562MSEJ |
| 6800      | 76.2 × 190      | 17.3                                 | 22.0                              | 0.2   | 5.00                 | LNX2W682MSEH |
|           | 90 × 150        | 17.1                                 | 21.6                              | 0.2   | 5.00                 | LNX2W682MSEJ |
| 8200      | 76.2 × 220      | 20.3                                 | 25.7                              | 0.2   | 5.00                 | LNX2W822MSEH |
|           | 90 × 170        | 19.8                                 | 25.4                              | 0.2   | 5.00                 | LNX2W822MSEJ |
| 10000     | 90 × 190        | 23.0                                 | 29.6                              | 0.2   | 5.00                 | LNX2W103MSEJ |
| 12000     | 90 × 220        | 26.9                                 | 33.5                              | 0.2   | 5.00                 | LNX2W123MSEJ |
| 15000     | 100 × 220       | 31.1                                 | 38.0                              | 0.2   | 5.00                 | LNX2W153MSEK |
| 18000     | 100 × 250       | 37.0                                 | 41.3                              | 0.2   | 5.00                 | LNX2W183MSEK |

| 500V (2H) |                 |                                      |                                   |       |                      |              |
|-----------|-----------------|--------------------------------------|-----------------------------------|-------|----------------------|--------------|
| Cap. (μF) | Size φD × L(mm) | Standard ripple (Arms) <sup>*1</sup> | Rated ripple (Arms) <sup>*2</sup> | tan δ | Leakage Current (mA) | Code         |
| 1000      | 51 × 110        | 4.2                                  | —                                 | 0.2   | 2.12                 | LNX2H102MSEF |
| 1200      | 63.5 × 90       | 4.8                                  | —                                 | 0.2   | 2.32                 | LNX2H122MSEG |
| 1500      | 63.5 × 90       | 5.5                                  | —                                 | 0.2   | 2.59                 | LNX2H152MSEG |
| 1800      | 63.5 × 110      | 6.5                                  | —                                 | 0.2   | 2.84                 | LNX2H182MSEG |
| 2200      | 63.5 × 130      | 7.7                                  | —                                 | 0.2   | 3.14                 | LNX2H222MSEG |
| 2700      | 76.2 × 110      | 8.8                                  | —                                 | 0.2   | 3.48                 | LNX2H272MSEH |
| 3300      | 76.2 × 130      | 10.4                                 | —                                 | 0.2   | 3.85                 | LNX2H332MSEH |
| 3900      | 76.2 × 150      | 12.1                                 | —                                 | 0.2   | 4.18                 | LNX2H392MSEH |
| 4700      | 90 × 130        | 13.7                                 | —                                 | 0.2   | 4.59                 | LNX2H472MSEJ |
| 5600      | 90 × 150        | 15.9                                 | —                                 | 0.2   | 5.00                 | LNX2H562MSEJ |
| 6800      | 90 × 170        | 18.5                                 | —                                 | 0.2   | 5.00                 | LNX2H682MSEJ |
| 8200      | 90 × 190        | 21.4                                 | —                                 | 0.2   | 5.00                 | LNX2H822MSEJ |
| 10000     | 100 × 190       | 23.8                                 | —                                 | 0.2   | 5.00                 | LNX2H103MSEK |
| 12000     | 100 × 220       | 27.8                                 | —                                 | 0.2   | 5.00                 | LNX2H123MSEK |

Ripple current (Arms) at 85°C 120Hz

## LNx

### ■ Dimensions

| 550V (2L) |                 |                                      |                                   |       |                      |              |
|-----------|-----------------|--------------------------------------|-----------------------------------|-------|----------------------|--------------|
| Cap. (μF) | Size φD × L(mm) | Standard ripple (Arms) <sup>*1</sup> | Rated ripple (Arms) <sup>*2</sup> | tan δ | Leakage Current (mA) | Code         |
| 1000      | 51 × 130        | 4.3                                  | —                                 | 0.2   | 2.22                 | LNx2L102MSEF |
| 1200      | 63.5 × 110      | 5.0                                  | —                                 | 0.2   | 2.43                 | LNx2L122MSEG |
| 1500      | 63.5 × 130      | 6.0                                  | —                                 | 0.2   | 2.72                 | LNx2L152MSEG |
| 1800      | 76.2 × 110      | 6.7                                  | —                                 | 0.2   | 2.98                 | LNx2L182MSEH |
| 2200      | 76.2 × 130      | 8.0                                  | —                                 | 0.2   | 3.30                 | LNx2L222MSEH |
| 2700      | 76.2 × 150      | 9.4                                  | —                                 | 0.2   | 3.65                 | LNx2L272MSEH |
| 3300      | 76.2 × 170      | 11.0                                 | —                                 | 0.2   | 4.04                 | LNx2L332MSEH |
| 3900      | 90 × 150        | 12.5                                 | —                                 | 0.2   | 4.39                 | LNx2L392MSEJ |
| 4700      | 90 × 170        | 14.5                                 | —                                 | 0.2   | 4.82                 | LNx2L472MSEJ |
| 5600      | 90 × 190        | 16.6                                 | —                                 | 0.2   | 5.00                 | LNx2L562MSEJ |
| 6800      | 90 × 220        | 19.5                                 | —                                 | 0.2   | 5.00                 | LNx2L682MSEJ |
| 8200      | 100 × 220       | 21.6                                 | —                                 | 0.2   | 5.00                 | LNx2L822MSEK |
| 10000     | 100 × 250       | 25.2                                 | —                                 | 0.2   | 5.00                 | LNx2L103MSEK |

| 630V(2J)  |                 |                                      |                                   |       |                      |              |
|-----------|-----------------|--------------------------------------|-----------------------------------|-------|----------------------|--------------|
| Cap. (μF) | Size φD × L(mm) | Standard ripple (Arms) <sup>*1</sup> | Rated ripple (Arms) <sup>*2</sup> | tan δ | Leakage Current (mA) | Code         |
| 1000      | 63.5 × 130      | 5.9                                  | —                                 | 0.3   | 2.38                 | LNx2J102MSEG |
| 1200      | 76.2 × 110      | 6.7                                  | —                                 | 0.3   | 2.60                 | LNx2J122MSEH |
| 1500      | 76.2 × 130      | 8.1                                  | —                                 | 0.3   | 2.91                 | LNx2J152MSEH |
| 1800      | 76.2 × 150      | 9.6                                  | —                                 | 0.3   | 3.19                 | LNx2J182MSEH |
| 2200      | 90 × 130        | 10.7                                 | —                                 | 0.3   | 3.53                 | LNx2J222MSEJ |
| 2700      | 90 × 150        | 12.6                                 | —                                 | 0.3   | 3.91                 | LNx2J272MSEJ |
| 3300      | 90 × 170        | 14.7                                 | —                                 | 0.3   | 4.32                 | LNx2J332MSEJ |
| 3900      | 90 × 190        | 17.3                                 | —                                 | 0.3   | 4.70                 | LNx2J392MSEJ |
| 4700      | 100 × 220       | 21.4                                 | —                                 | 0.3   | 5.00                 | LNx2J472MSEK |
| 5600      | 100 × 250       | 24.7                                 | —                                 | 0.3   | 5.00                 | LNx2J562MSEK |

Ripple current (Arms) at 85°C 120Hz

### ● Frequency coefficient of rated ripple current

| Frequency (Hz) | 50   | 60   | 120  | 360  | 1k   | 10k or more |
|----------------|------|------|------|------|------|-------------|
| Coefficient    | 0.80 | 0.82 | 1.00 | 1.20 | 1.35 | 1.40        |

- (※ 1) • Standard ripple current:  
Ripple current value allowable for the life time of 20,000 hours at 85°C.  
(5,000 hours at 85°C for the voltage rating of 500V and 550V. 2,000 hours at 85°C for the voltage rating of 630V)
- (※ 2) • Maximum rated ripple current:  
Ripple current value allowable for the life time of 5,000 hours at 85°C.

- 3-leg bracket is furnished as standard.  
In case no-bracket or 2-leg bracket required, please put BN or BB at the end of type number.

Ex. 3-leg bracket LNx2G472MSEH  
2-leg bracket LNx2G472MSEHBB  
No bracket LNx2G472MSEHBN

- Flame-retardant type electrolyte is also available.  
Please contact to Nichicon representative for the rated ripple current value.

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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