

# Type 381LR 105 °C Highest Ripple, Snap-In Aluminum

## Ultra-High Ripple Capabilities



Compared to standard 105 °C snap-ins like the Type 381L/LX Type 381LR can handle an extra 25% ripple current or more. This remarkable capability stems from advances in electrolyte that give extremely low ESR values. In high ripple current applications like motor drives you can save by using fewer capacitors.

### Highlights

- The right choice for motor drive bus capacitors
- The right choice for UPS bus capacitors
- Compare to Type 381L
- Up to 2 times the ripple current

### Specifications

|                                 |                                                                                               |       |        |         |        |             |
|---------------------------------|-----------------------------------------------------------------------------------------------|-------|--------|---------|--------|-------------|
| Temperature Range               | -40 °C to + 105 °C ≤ 315 Vdc<br>-25 °C to + 105 °C ≥ 350 Vdc                                  |       |        |         |        |             |
| Rated Voltage Range             | 200 Vdc to 450 Vdc                                                                            |       |        |         |        |             |
| Capacitance Range               | 56 μF to 2,200 μF                                                                             |       |        |         |        |             |
| Capacitance Tolerance           | ± 20%                                                                                         |       |        |         |        |             |
| Leakage Current                 | ≤3 √CV μA, 4 mA max, 5 minutes                                                                |       |        |         |        |             |
| Ripple Current Multipliers      | Ambient Temperature                                                                           |       |        |         |        |             |
|                                 | 45 °C                                                                                         | 60 °C | 70 °C  | 85 °C   | 105 °C |             |
|                                 | 2.35                                                                                          | 2.20  | 2.00   | 1.70    | 1.00   |             |
| Ripple Current Multipliers      | Frequency                                                                                     |       |        |         |        |             |
|                                 | 50 Hz                                                                                         | 60 Hz | 120 Hz | 500 kHz | 1 kHz  | 10 kHz & Up |
|                                 | 0.75                                                                                          | 0.80  | 1.00   | 1.20    | 1.25   | 1.40        |
| Low Temperature Characteristics | Impedance ratio: Z <sub>-20°C</sub> /Z <sub>+25°C</sub><br>≤ 3 (200–450Vdc)                   |       |        |         |        |             |
| Endurance Life Test             | 3000 h at full load at 105 °C<br>Δ Capacitance ±20%<br>ESR 200% of limit<br>DCL 100% of limit |       |        |         |        |             |
| Shelf Life Test                 | 1000 h at 105 °C<br>Δ Capacitance ±20%<br>ESR 200% of limit<br>DCL 100% of limit              |       |        |         |        |             |
| Vibration                       | 10 to 55 Hz, 0.06" and 10 g max, 2 h each plane                                               |       |        |         |        |             |
| RoHS Compliant                  |                                                                                               |       |        |         |        |             |

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## Ultra-High Ripple Capabilities

### Part Numbering System

381LR

Type

381LR

271

Cap

271 = 270  $\mu$ F  
222 = 2200  $\mu$ F

M

Tolerance

M =  $\pm 20\%$

200

Voltage

160 = 160 Vdc  
450 = 450 Vdc

H01

Case  
Code

2

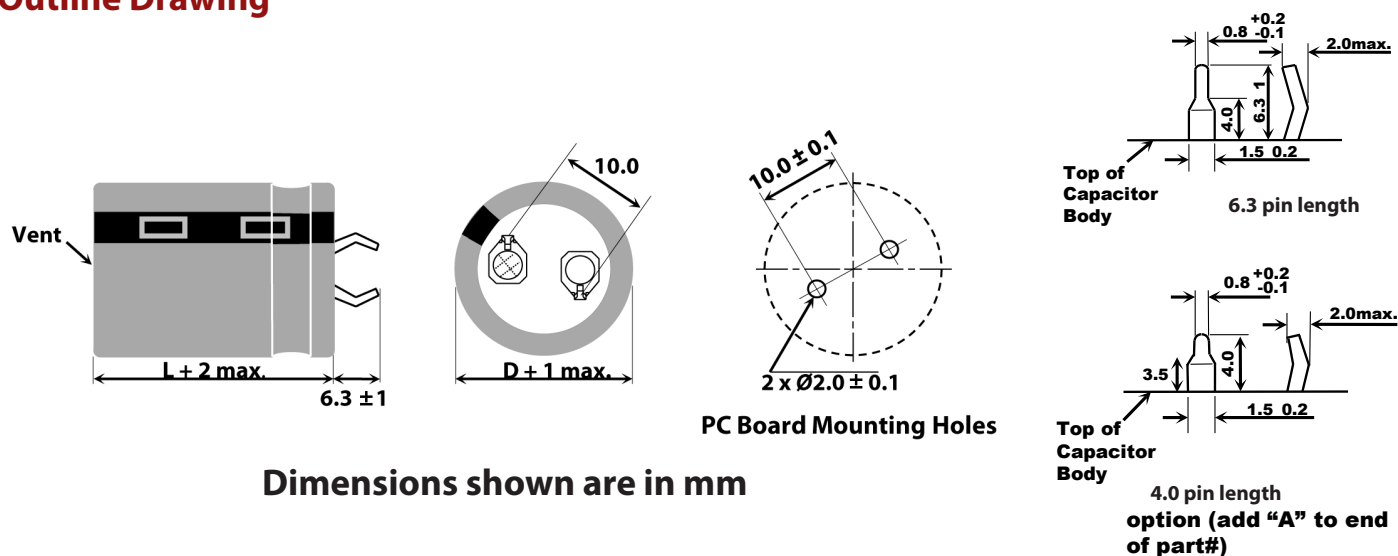
Insulating  
Sleeve

2 = PVC

+D

Blank = no end disk if <250 V  
D = end disk, any voltage

## Outline Drawing



Note that for 200 volts and under the insulating end disc is optional - If one is needed add a (+D) to the end of the part numbering system.

## Insulated Case Dimensions

| Case Code | DIAMETER D |        | LENGTH L |        | Typical Weight (grams) | Case Code | DIAMETER D |        | LENGTH L |        | Typical Weight (grams) |
|-----------|------------|--------|----------|--------|------------------------|-----------|------------|--------|----------|--------|------------------------|
|           | mm         | inches | mm       | inches |                        |           | mm         | inches | mm       | inches |                        |
| H01       | 22         | 0.87   | 25       | 0.98   | 16                     | K01       | 30         | 1.18   | 25       | 0.98   | 30                     |
| H02       | 22         | 0.87   | 30       | 1.18   | 19                     | K02       | 30         | 1.18   | 30       | 1.18   | 35                     |
| H03       | 22         | 0.87   | 35       | 1.38   | 22                     | K03       | 30         | 1.18   | 35       | 1.38   | 40                     |
| H04       | 22         | 0.87   | 40       | 1.57   | 24                     | K04       | 30         | 1.18   | 40       | 1.57   | 44                     |
| H45       | 22         | 0.87   | 45       | 1.77   | 28                     | K45       | 30         | 1.18   | 45       | 1.77   | 49                     |
| H05       | 22         | 0.87   | 50       | 1.97   | 31                     | K05       | 30         | 1.18   | 50       | 1.97   | 53                     |
| J01       | 25         | 0.98   | 25       | 0.98   | 20                     | A01       | 35         | 1.38   | 25       | 0.98   | 42                     |
| J02       | 25         | 0.98   | 30       | 1.18   | 24                     | A02       | 35         | 1.38   | 30       | 1.18   | 48                     |
| J03       | 25         | 0.98   | 35       | 1.38   | 27                     | A03       | 35         | 1.38   | 35       | 1.38   | 54                     |
| J04       | 25         | 0.98   | 40       | 1.57   | 31                     | A04       | 35         | 1.38   | 40       | 1.57   | 60                     |
| J45       | 25         | 0.98   | 45       | 1.77   | 35                     | A45       | 35         | 1.38   | 45       | 1.77   | 67                     |
| J05       | 25         | 0.98   | 50       | 1.97   | 38                     | A05       | 35         | 1.38   | 50       | 1.97   | 74                     |
|           |            |        |          |        |                        | A55       | 35         | 1.38   | 55       | 2.17   | 80                     |

# Type 381LR 105 °C Highest Ripple, Snap-In Aluminum

## Ultra-High Ripple Capabilities

### Ratings

|                         |                  | ESR Max |        | Ripple Amps |        | Nominal |
|-------------------------|------------------|---------|--------|-------------|--------|---------|
|                         |                  | @ 25° C |        | @ 105 °C    |        | Size    |
| Cap.                    | Catalog          | 120 Hz  | 20 kHz | 120 Hz      | 20 kHz | D x L   |
| (µF)                    | Part Number      | (Ω)     | (Ω)    | (A)         | (A)    | (mm)    |
| 200 Vdc (250 Vdc Surge) |                  |         |        |             |        |         |
| 270                     | 381LR271M200H012 | 0.553   | 0.249  | 1.42        | 2.03   | 22 X 25 |
| 330                     | 381LR331M200H022 | 0.452   | 0.203  | 1.56        | 2.23   | 22 X 30 |
| 390                     | 381LR391M200H022 | 0.383   | 0.172  | 1.71        | 2.44   | 22 X 30 |
| 390                     | 381LR391M200J012 | 0.383   | 0.172  | 1.71        | 2.44   | 25 X 25 |
| 470                     | 381LR471M200H032 | 0.317   | 0.143  | 1.85        | 2.64   | 22 X 35 |
| 470                     | 381LR471M200J022 | 0.317   | 0.143  | 1.85        | 2.64   | 25 X 30 |
| 560                     | 381LR561M200H042 | 0.266   | 0.120  | 2.14        | 3.05   | 22 X 40 |
| 560                     | 381LR561M200J022 | 0.266   | 0.120  | 2.14        | 3.05   | 25 X 30 |
| 560                     | 381LR561M200K012 | 0.266   | 0.120  | 2.14        | 3.05   | 30 X 25 |
| 680                     | 381LR681M200H452 | 0.219   | 0.099  | 2.42        | 3.45   | 22 X 45 |
| 680                     | 381LR681M200J032 | 0.219   | 0.099  | 2.42        | 3.45   | 25 X 35 |
| 680                     | 381LR681M200K022 | 0.219   | 0.099  | 2.42        | 3.45   | 30 X 30 |
| 820                     | 381LR821M200H052 | 0.182   | 0.082  | 2.63        | 3.76   | 22 X 50 |
| 820                     | 381LR821M200J042 | 0.182   | 0.082  | 2.63        | 3.76   | 25 X 40 |
| 820                     | 381LR821M200K022 | 0.182   | 0.082  | 2.63        | 3.76   | 30 X 30 |
| 820                     | 381LR821M200A012 | 0.182   | 0.082  | 2.63        | 3.76   | 35 X 25 |
| 1000                    | 381LR102M200J452 | 0.149   | 0.067  | 2.84        | 4.06   | 25 X 45 |
| 1000                    | 381LR102M200K032 | 0.149   | 0.067  | 2.84        | 4.06   | 30 X 35 |
| 1000                    | 381LR102M200A022 | 0.149   | 0.067  | 2.84        | 4.06   | 35 X 30 |
| 1200                    | 381LR122M200K042 | 0.124   | 0.062  | 3.13        | 4.47   | 30 X 40 |
| 1200                    | 381LR122M200A032 | 0.124   | 0.062  | 3.13        | 4.47   | 35 X 35 |
| 1500                    | 381LR152M200K052 | 0.099   | 0.050  | 3.56        | 5.06   | 30 X 50 |
| 1500                    | 381LR152M200A042 | 0.099   | 0.050  | 3.56        | 5.06   | 35 X 40 |
| 1800                    | 381LR182M200A452 | 0.083   | 0.041  | 3.84        | 5.48   | 35 X 45 |
| 2200                    | 381LR222M200A052 | 0.066   | 0.040  | 4.12        | 5.89   | 35 X 50 |
| 250 Vdc (300 Vdc Surge) |                  |         |        |             |        |         |
| 220                     | 381LR221M250H022 | 0.678   | 0.305  | 1.28        | 1.83   | 22 X 30 |
| 270                     | 381LR271M250H022 | 0.553   | 0.249  | 1.42        | 2.03   | 22 X 30 |
| 270                     | 381LR271M250J012 | 0.553   | 0.249  | 1.42        | 2.03   | 25 X 25 |
| 330                     | 381LR331M250H032 | 0.452   | 0.203  | 1.64        | 2.34   | 22 X 35 |
| 330                     | 381LR331M250J022 | 0.452   | 0.203  | 1.64        | 2.34   | 25 X 30 |
| 390                     | 381LR391M250H042 | 0.383   | 0.172  | 1.72        | 2.45   | 22 X 40 |
| 390                     | 381LR391M250J022 | 0.383   | 0.172  | 1.72        | 2.45   | 25 X 30 |
| 390                     | 381LR391M250K012 | 0.383   | 0.172  | 1.72        | 2.45   | 30 X 25 |
| 470                     | 381LR471M250H452 | 0.317   | 0.143  | 1.85        | 2.64   | 22 X 45 |
| 470                     | 381LR471M250J032 | 0.317   | 0.143  | 1.85        | 2.64   | 25 X 35 |
| 470                     | 381LR471M250K022 | 0.317   | 0.143  | 1.85        | 2.64   | 30 X 30 |
| 560                     | 381LR561M250J042 | 0.266   | 0.120  | 2.14        | 3.05   | 25 X 40 |
| 560                     | 381LR561M250K022 | 0.266   | 0.120  | 2.14        | 3.05   | 30 X 30 |
| 560                     | 381LR561M250A012 | 0.266   | 0.120  | 2.14        | 3.05   | 35 X 25 |
| 680                     | 381LR681M250J452 | 0.219   | 0.099  | 2.42        | 3.45   | 25 X 45 |

|                         |                  | ESR Max |        | Ripple Amps |        | Nominal |
|-------------------------|------------------|---------|--------|-------------|--------|---------|
|                         |                  | @ 25° C |        | @ 105 °C    |        | Size    |
| Cap.                    | Catalog          | 120 Hz  | 20 kHz | 120 Hz      | 20 kHz | D x L   |
| (µF)                    | Part Number      | (Ω)     | (Ω)    | (A)         | (A)    | (mm)    |
| 250 Vdc (300 Vdc Surge) |                  |         |        |             |        |         |
| 680                     | 381LR681M250K032 | 0.219   | 0.099  | 2.42        | 3.45   | 30 X 35 |
| 680                     | 381LR681M250A022 | 0.219   | 0.099  | 2.42        | 3.45   | 35 X 30 |
| 820                     | 381LR821M250K042 | 0.182   | 0.082  | 2.63        | 3.76   | 30 X 40 |
| 820                     | 381LR821M250A032 | 0.182   | 0.082  | 2.63        | 3.76   | 35 X 35 |
| 1000                    | 381LR102M250K052 | 0.149   | 0.067  | 2.84        | 4.06   | 30 X 50 |
| 1000                    | 381LR102M250A042 | 0.149   | 0.067  | 2.84        | 4.06   | 35 X 40 |
| 1200                    | 381LR122M250A452 | 0.124   | 0.062  | 3.13        | 4.47   | 35 X 45 |
| 1500                    | 381LR152M250A052 | 0.099   | 0.050  | 3.56        | 5.06   | 35 X 50 |
| 400 Vdc (450 Vdc Surge) |                  |         |        |             |        |         |
| 82                      | 381LR820M400H012 | 1.617   | 0.728  | 0.8         | 1.14   | 22 X 25 |
| 100                     | 381LR101M400H022 | 1.326   | 0.597  | 0.91        | 1.3    | 22 X 30 |
| 100                     | 381LR101M400J012 | 1.960   | 0.960  | 0.91        | 1.3    | 25 X 25 |
| 120                     | 381LR121M400H032 | 1.105   | 0.497  | 1.02        | 1.46   | 22 X 35 |
| 120                     | 381LR121M400J022 | 1.105   | 0.497  | 1.02        | 1.46   | 25 X 30 |
| 150                     | 381LR151M400H042 | 1.105   | 0.387  | 1.07        | 1.53   | 22 X 40 |
| 150                     | 381LR151M400J022 | 1.105   | 0.387  | 1.07        | 1.53   | 25 X 30 |
| 150                     | 381LR151M400K012 | 1.105   | 0.387  | 1.07        | 1.53   | 30 X 25 |
| 180                     | 381LR181M400H452 | 0.737   | 0.322  | 1.12        | 1.6    | 22 X 45 |
| 180                     | 381LR181M400J032 | 0.737   | 0.322  | 1.12        | 1.6    | 25 X 35 |
| 180                     | 381LR181M400K022 | 0.737   | 0.322  | 1.12        | 1.6    | 30 X 30 |
| 220                     | 381LR221M400H052 | 0.603   | 0.271  | 1.42        | 2.03   | 22 X 50 |
| 220                     | 381LR221M400J042 | 0.603   | 0.271  | 1.42        | 2.03   | 25 X 40 |
| 220                     | 381LR221M400K022 | 0.603   | 0.271  | 1.42        | 2.03   | 30 X 30 |
| 220                     | 381LR221M400A012 | 0.603   | 0.271  | 1.42        | 2.03   | 35 X 25 |
| 270                     | 381LR271M400J452 | 0.491   | 0.221  | 1.56        | 2.23   | 25 X 45 |
| 270                     | 381LR271M400K032 | 0.491   | 0.221  | 1.56        | 2.23   | 30 X 35 |
| 270                     | 381LR271M400A022 | 0.491   | 0.221  | 1.56        | 2.23   | 35 X 30 |
| 330                     | 381LR331M400K042 | 0.402   | 0.181  | 1.71        | 2.44   | 30 X 40 |
| 330                     | 381LR331M400A022 | 0.402   | 0.181  | 1.71        | 2.44   | 35 X 30 |
| 390                     | 381LR391M400K452 | 0.34    | 0.153  | 1.85        | 2.64   | 30 X 45 |
| 390                     | 381LR391M400A032 | 0.34    | 0.153  | 1.85        | 2.64   | 35 X 35 |
| 470                     | 381LR471M400A042 | 0.282   | 0.127  | 2.01        | 2.87   | 35 X 40 |
| 560                     | 381LR561M400A452 | 0.237   | 0.107  | 2.35        | 3.36   | 35 X 45 |
| 420 Vdc (470 Vdc Surge) |                  |         |        |             |        |         |
| 68                      | 381LR680M420H012 | 1.95    | 0.878  | 0.76        | 1.08   | 22 X 25 |
| 82                      | 381LR820M420H022 | 1.617   | 0.728  | 0.8         | 1.14   | 22 X 30 |
| 82                      | 381LR820M420J012 | 1.617   | 0.728  | 0.8         | 1.14   | 25 X 25 |
| 100                     | 381LR101M420H022 | 1.326   | 0.597  | 0.91        | 1.3    | 22 X 30 |
| 100                     | 381LR101M420J012 | 1.326   | 0.597  | 0.91        | 1.3    | 25 X 25 |
| 120                     | 381LR121M420H032 | 1.105   | 0.497  | 1.02        | 1.46   | 22 X 35 |
| 120                     | 381LR121M420J022 | 1.105   | 0.497  | 1.02        | 1.46   | 25 X 30 |

# Type 381LR 105 °C Highest Ripple, Snap-In Aluminum

## Ultra-High Ripple Capabilities

| Cap.                    | Catalog          | ESR Max |        | Ripple Amps |        | Nominal |
|-------------------------|------------------|---------|--------|-------------|--------|---------|
|                         |                  | @ 25° C |        | @ 105 °C    |        | Size    |
|                         |                  | 120 Hz  | 20 kHz | 120 Hz      | 20 kHz | D x L   |
| (μF)                    | Part Number      | (Ω)     | (Ω)    | (A)         | (A)    | (mm)    |
| 420 Vdc (470 Vdc Surge) |                  |         |        |             |        |         |
| 150                     | 381LR151M420K012 | 0.884   | 0.398  | 1.07        | 1.53   | 30 X 25 |
| 180                     | 381LR181M420H452 | 0.737   | 0.332  | 1.12        | 1.6    | 22 X 45 |
| 180                     | 381LR181M420J042 | 0.737   | 0.332  | 1.12        | 1.6    | 25 X 40 |
| 180                     | 381LR181M420K022 | 0.737   | 0.332  | 1.12        | 1.6    | 30 X 30 |
| 180                     | 381LR181M420A012 | 0.737   | 0.332  | 1.12        | 1.6    | 35 X 25 |
| 220                     | 381LR221M420J452 | 0.603   | 0.271  | 1.42        | 2.03   | 25 X 45 |
| 220                     | 381LR221M420K032 | 0.603   | 0.271  | 1.42        | 2.03   | 30 X 35 |
| 220                     | 381LR221M420A022 | 0.603   | 0.271  | 1.42        | 2.03   | 35 X 30 |
| 270                     | 381LR271M420J052 | 0.491   | 0.221  | 1.68        | 2.4    | 25 X 50 |
| 270                     | 381LR271M420K042 | 0.491   | 0.221  | 1.68        | 2.4    | 30 X 40 |
| 270                     | 381LR271M420A022 | 0.491   | 0.221  | 1.68        | 2.4    | 35 X 30 |
| 330                     | 381LR331M420K452 | 0.402   | 0.181  | 1.78        | 2.54   | 30 X 45 |
| 330                     | 381LR331M420A032 | 0.402   | 0.181  | 1.78        | 2.54   | 35 X 35 |
| 390                     | 381LR391M420K052 | 0.34    | 0.153  | 1.91        | 2.73   | 30 X 50 |
| 390                     | 381LR391M420A042 | 0.34    | 0.153  | 1.91        | 2.73   | 35 X 40 |
| 470                     | 381LR471M420A452 | 0.282   | 0.127  | 2.23        | 3.18   | 35 X 45 |
| 450 Vdc (500 Vdc Surge) |                  |         |        |             |        |         |
| 56                      | 381LR560M450H012 | 2.368   | 1.066  | 0.67        | 0.95   | 22 X 25 |
| 68                      | 381LR680M450H022 | 1.95    | 0.878  | 0.76        | 1.08   | 22 X 30 |
| 68                      | 381LR680M450J012 | 1.95    | 0.878  | 0.76        | 1.08   | 25 X 25 |
| 82                      | 381LR820M450H022 | 1.617   | 0.728  | 0.8         | 1.14   | 22 X 30 |
| 82                      | 381LR820M450J012 | 1.617   | 0.728  | 0.8         | 1.14   | 25 X 25 |

| Cap.                    | Catalog          | ESR Max |        | Ripple Amps |        | Nominal |
|-------------------------|------------------|---------|--------|-------------|--------|---------|
|                         |                  | @ 25° C |        | @ 105 °C    |        | Size    |
|                         |                  | 120 Hz  | 20 kHz | 120 Hz      | 20 kHz | D x L   |
| (μF)                    | Part Number      | (Ω)     | (Ω)    | (A)         | (A)    | (mm)    |
| 450 Vdc (500 Vdc Surge) |                  |         |        |             |        |         |
| 100                     | 381LR101M450H032 | 1.326   | 0.597  | 0.91        | 1.3    | 22 X 35 |
| 100                     | 381LR101M450J022 | 1.326   | 0.597  | 0.91        | 1.3    | 25 X 30 |
| 120                     | 381LR121M450H042 | 1.105   | 0.497  | 1.02        | 1.46   | 22 X 40 |
| 120                     | 381LR121M450J032 | 1.105   | 0.497  | 1.02        | 1.46   | 25 X 35 |
| 120                     | 381LR121M450K012 | 1.105   | 0.497  | 1.02        | 1.46   | 30 X 25 |
| 150                     | 381LR151M450H452 | 0.884   | 0.396  | 1.07        | 1.53   | 22 X 45 |
| 150                     | 381LR151M450J042 | 0.884   | 0.396  | 1.07        | 1.53   | 25 X 40 |
| 150                     | 381LR151M450K022 | 0.884   | 0.396  | 1.07        | 1.53   | 30 X 30 |
| 150                     | 381LR151M450A012 | 0.884   | 0.396  | 1.07        | 1.53   | 35 X 25 |
| 180                     | 381LR181M450H052 | 0.737   | 0.332  | 1.12        | 1.6    | 22 X 50 |
| 180                     | 381LR181M450J042 | 0.737   | 0.332  | 1.12        | 1.6    | 25 X 40 |
| 180                     | 381LR181M450K022 | 0.737   | 0.332  | 1.12        | 1.6    | 30 X 30 |
| 180                     | 381LR181M450A012 | 0.737   | 0.332  | 1.12        | 1.6    | 35 X 25 |
| 220                     | 381LR221M450J452 | 0.603   | 0.271  | 1.42        | 2.03   | 25 X 45 |
| 220                     | 381LR221M450K032 | 0.603   | 0.271  | 1.42        | 2.03   | 30 X 35 |
| 220                     | 381LR221M450A022 | 0.603   | 0.271  | 1.42        | 2.03   | 35 X 30 |
| 270                     | 381LR271M450K042 | 0.491   | 0.221  | 1.72        | 2.45   | 30 X 40 |
| 270                     | 381LR271M450A032 | 0.491   | 0.221  | 1.72        | 2.45   | 35 X 35 |
| 330                     | 381LR331M450K052 | 0.402   | 0.181  | 1.85        | 2.64   | 30 X 50 |
| 330                     | 381LR331M450A042 | 0.402   | 0.181  | 1.85        | 2.64   | 35 X 40 |
| 390                     | 381LR391M450A042 | 0.34    | 0.153  | 1.97        | 2.82   | 35 X 40 |
| 470                     | 381LR471M450A052 | 0.282   | 0.127  | 2.47        | 3.53   | 35 X 50 |

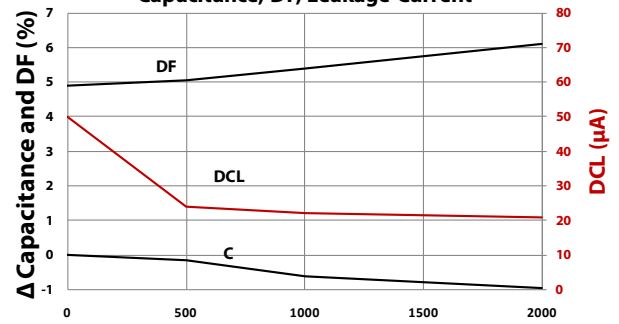
## Typical Performance Curves

Life Test 105 °C, Full Load, 220 μF, 400 Vdc  
Capacitance, DF, Leakage Current

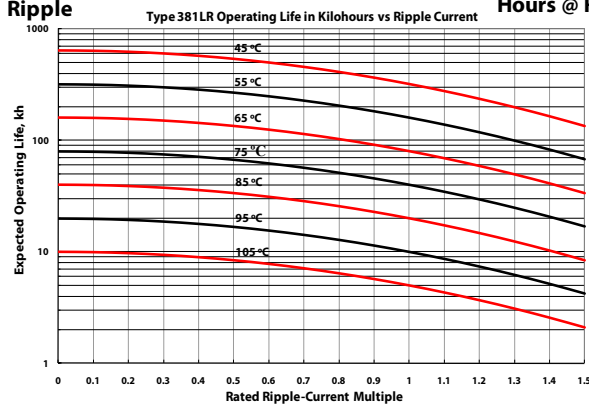


Hours @ Rated Max Temp, Voltage, Ripple

Life Test 105 °C, Full Load, 330 μF, 400 Vdc  
Capacitance, DF, Leakage Current



Hours @ Rated Max Temp, Voltage, Ripple



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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