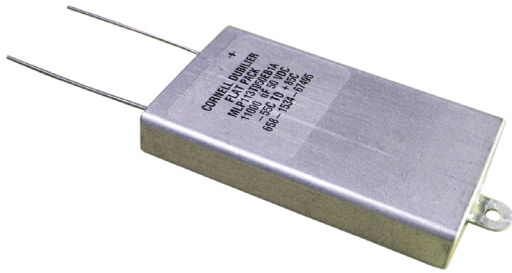


Type MLP 85 °C Flatpack, Ultra Long Life, Aluminum Electrolytic

Very Low Profile



The MLP's high-energy storage and box-shape make it perfect for voltage holdup or filtering in military SEM-E modules, telecom circuit packs and computer cards. The MLP delivers up to 20 joules of energy storage in a 1/2" height with 50 year's life at +45 °C. You can readily heatsink it to double the ripple-current capability. The MLP is the square-peg component that fits the square-holes in electronic assemblies.

Highlights

- Low-profile replacement for snap-ins
- Double the ripple capability with a heatsink
- Nearly hermetic welded seal assures 50-year life
- Withstands more than 80,000 feet altitude

Specifications

| Temperature Range | -55°C to +85°C ≤250 Vdc -40°C to +85°C ≥300 Vdc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|--|-------|--------|--------|-------|-------|-------------|------|------|------|------|-------|-------|-------|-------|-------|------|------|------|------|------|--|-------|-------|--------|--------|-------|-------|-------------|-------------|------|------|------|------|------|------|------|-------------|------|------|------|------|------|------|------|
| Rated Voltage Range | 7.5 Vdc to 450 Vdc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Capacitance Range | 110 µF to 47,000 µF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Capacitance Tolerance | ±20% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Leakage Current | ≤ 0.002 CV µA, @ 25 °C and 5 min. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ripple Current Multipliers | <p>Ambient Temperature, No Heatsink</p> <table border="1"> <thead> <tr> <th>45 °C</th> <th>55 °C</th> <th>65 °C</th> <th>75 °C</th> <th>85 °C</th> </tr> </thead> <tbody> <tr> <td>1.00</td> <td>0.90</td> <td>0.75</td> <td>0.56</td> <td>0.27</td> </tr> </tbody> </table> <p>Case Temperature</p> <table border="1"> <thead> <tr> <th>45 °C</th> <th>55 °C</th> <th>65 °C</th> <th>75 °C</th> <th>85 °C</th> </tr> </thead> <tbody> <tr> <td>3.79</td> <td>3.32</td> <td>2.77</td> <td>2.08</td> <td>1.00</td> </tr> </tbody> </table> <p>Frequency</p> <table border="1"> <thead> <tr> <th></th> <th>50 Hz</th> <th>60 Hz</th> <th>120 Hz</th> <th>360 Hz</th> <th>1 kHz</th> <th>5 kHz</th> <th>10 kHz & up</th> </tr> </thead> <tbody> <tr> <th>7.5 to 63 V</th> <td>0.94</td> <td>0.95</td> <td>1.00</td> <td>1.04</td> <td>1.05</td> <td>1.06</td> <td>1.06</td> </tr> <tr> <th>80 to 450 V</th> <td>0.80</td> <td>0.85</td> <td>1.00</td> <td>1.17</td> <td>1.24</td> <td>1.28</td> <td>1.29</td> </tr> </tbody> </table> | 45 °C | 55 °C | 65 °C | 75 °C | 85 °C | 1.00 | 0.90 | 0.75 | 0.56 | 0.27 | 45 °C | 55 °C | 65 °C | 75 °C | 85 °C | 3.79 | 3.32 | 2.77 | 2.08 | 1.00 | | 50 Hz | 60 Hz | 120 Hz | 360 Hz | 1 kHz | 5 kHz | 10 kHz & up | 7.5 to 63 V | 0.94 | 0.95 | 1.00 | 1.04 | 1.05 | 1.06 | 1.06 | 80 to 450 V | 0.80 | 0.85 | 1.00 | 1.17 | 1.24 | 1.28 | 1.29 |
| 45 °C | 55 °C | 65 °C | 75 °C | 85 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.00 | 0.90 | 0.75 | 0.56 | 0.27 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 45 °C | 55 °C | 65 °C | 75 °C | 85 °C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.79 | 3.32 | 2.77 | 2.08 | 1.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 50 Hz | 60 Hz | 120 Hz | 360 Hz | 1 kHz | 5 kHz | 10 kHz & up | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7.5 to 63 V | 0.94 | 0.95 | 1.00 | 1.04 | 1.05 | 1.06 | 1.06 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 80 to 450 V | 0.80 | 0.85 | 1.00 | 1.17 | 1.24 | 1.28 | 1.29 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Low Temperature Characteristics | Impedance ratio: $Z_{-55°C} / Z_{+25°C}$ ≤ 10 (7.5 - 20 Vdc) ≤ 2 (25 - 250 Vdc) Impedance ratio: $Z_{-20°C} / Z_{+25°C}$ ≤ 4 (300-450Vdc) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Endurance Life Test | 2000 h @ full load at +85 °C Δ Capacitance ±10% ESR 200% of limit DCL 100% of limit | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shelf Life Test | 500 h at 85 °C Capacitance 100% of limit ESR 100% of limit DCL 100% of limit | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vibration | All case sizes: 10g. MIL-STD-202, Meth. 204, Sine Swept, EIEC 60068-2-6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Type MLP 85 °C Flatpack, Ultra Long Life, Aluminum Electrolytic

Very Low Profile

| Vibration Test | <p>Level The specimens, while deenergized or operating under the load conditions specified, shall be subjected to the vibration amplitude, frequency range, and duration specified for each case size.</p> <p>Amplitude The specimens shall be subjected to a simple harmonic motion having an amplitude of either 0.06-inch double amplitude (maximum total excursion) or peak level specified above (XXg peak), whichever is less. The tolerance on vibration amplitude shall be ±10 percent.</p> <p>Frequency Range The vibration frequency shall be varied logarithmically between the approximate limits of 10 to 2,000 Hz.</p> <p>Sweep Time and Duration The entire frequency range of 10 to 2,000 Hz and return to 10 Hz shall be traversed in 20 minutes. This cycle shall be performed 12 times in each of three mutually perpendicular directions (total of 36 times), so that the motion shall be applied for a total period of approximately 12 hours. Interruptions are permitted provided the requirements for rate of change and test duration are met.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------|---|------------------------|-------------|------|------|------|------------|------|------|------|-----|------|-----|-----|-----|-----------|-----|-----|-----|------|------|-----|-----|-----|-----------|-----|-----|-----|
| Thermal Resistance | <table border="1" data-bbox="769 728 1516 976"> <thead> <tr> <th rowspan="2">Large Sides Heatsinked</th> <th rowspan="2">Case Length</th> <th>1.5"</th> <th>2.0"</th> <th>3.0"</th> </tr> <tr> <th>Insulation</th> <th>°C/W</th> <th>°C/W</th> <th>°C/W</th> </tr> </thead> <tbody> <tr> <td rowspan="2">one</td> <td>None</td> <td>2.9</td> <td>2.1</td> <td>1.4</td> </tr> <tr> <td>Polyester</td> <td>3.3</td> <td>2.4</td> <td>1.6</td> </tr> <tr> <td rowspan="2">both</td> <td>None</td> <td>2.7</td> <td>1.9</td> <td>1.2</td> </tr> <tr> <td>Polyester</td> <td>2.9</td> <td>2.1</td> <td>1.3</td> </tr> </tbody> </table> | Large Sides Heatsinked | Case Length | 1.5" | 2.0" | 3.0" | Insulation | °C/W | °C/W | °C/W | one | None | 2.9 | 2.1 | 1.4 | Polyester | 3.3 | 2.4 | 1.6 | both | None | 2.7 | 1.9 | 1.2 | Polyester | 2.9 | 2.1 | 1.3 |
| Large Sides Heatsinked | Case Length | | | 1.5" | 2.0" | 3.0" | | | | | | | | | | | | | | | | | | | | | | |
| | | Insulation | °C/W | °C/W | °C/W | | | | | | | | | | | | | | | | | | | | | | | |
| one | None | 2.9 | 2.1 | 1.4 | | | | | | | | | | | | | | | | | | | | | | | | |
| | Polyester | 3.3 | 2.4 | 1.6 | | | | | | | | | | | | | | | | | | | | | | | | |
| both | None | 2.7 | 1.9 | 1.2 | | | | | | | | | | | | | | | | | | | | | | | | |
| | Polyester | 2.9 | 2.1 | 1.3 | | | | | | | | | | | | | | | | | | | | | | | | |
| ESL | <30 nH measured 1/4" from case at 1 MHz | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Weight | Case EK 30 g typical Case EA 42 g typical Case EB 66 g typical | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Terminals | 18 AWG copper wire with 60/40 tin-lead electroplate, 20 amps max | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Double the Ripple Current | Attach the MLP to an external heatsink and you can easily double the ripple current capability and assure long life through cooler operation. The broad, flat top and bottom on the MLP are ideal for cooling the capacitor and removing the heat caused by ripple current. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ripple Current Capability | The ripple current capability is set by the maximum permissible internal core temperature, 88 °C. This assures that the case does not inflate beyond 0.5 inch height. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Air Cooled | The ripple currents in the ratings tables are for 85 °C case temperatures. For air temperatures without a heatsink use the multipliers Ambient Temperature, No Heatsink. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Heatsink Cooled | Temperature rise from the internal hottest spot, the core, to ambient air is $\Delta T = I^2(ESR)(\theta_{cc} + \theta_{ca})$ where θ_{cc} is the thermal resistance from core to case and θ_{ca} from case to ambient. To calculate maximum ripple capability with the MLP attached to a heatsink use the maximum core temperature and the values for θ_{cc} . | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Example | As an illustration, suppose you operate an insulated MLP332M080EB1C in 65 °C air and attach it to a commercial heatsink with a free-air thermal resistance of 2.7 °C/W. Use a good thermal grease between the MLP and the heatsink, and the total thermal resistance is 2.7 + 1.7 or 4.4 °C/W. The power which would heat the core to 88 °C is (88-65)/4.4 or 5.2 W. For an ESR of 31 mΩ, 5.2 W equates to a ripple current of 13 A. | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Type MLP 85 °C Flatpack, Ultra Long Life, Aluminum Electrolytic

Very Low Profile

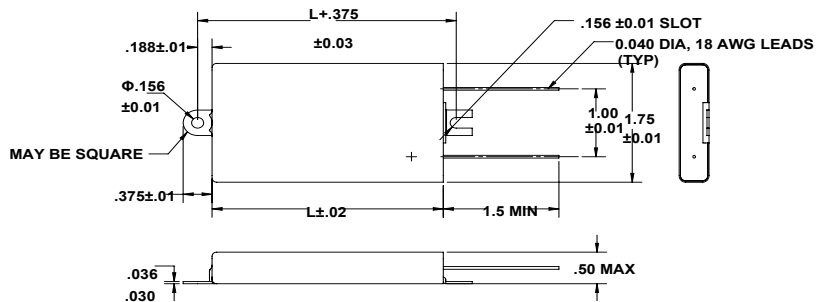
Part Numbering System

| | | | | | | |
|-------------------------|--|-------------------------------------|----------------------------------|---|---|---|
| MLP Type MLP | 102 Capacitance 821=820 μ F 102 = 1000 μ F | M Tolerance M= \pm 20% | 200 Rated Voltage Vdc | EB Case Code EK, L=1.5 in. EA, L=2.0 in. EB, L=3.0 in. | 0 Insulation 0 = bare can 1 = polyester | A Mounting Style A = mounting tabs B = four leads C = two leads/no tabs D = hook leads/tabs E = hook leads/no tabs |
|-------------------------|--|-------------------------------------|----------------------------------|---|---|---|

Outline Drawings

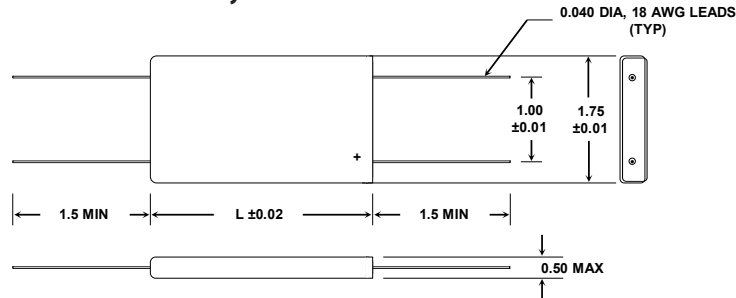
Note: The polyester tape wrap may add up to 0.020 inches to the thickness and width of the capacitor.

Style A: Mounting Tabs



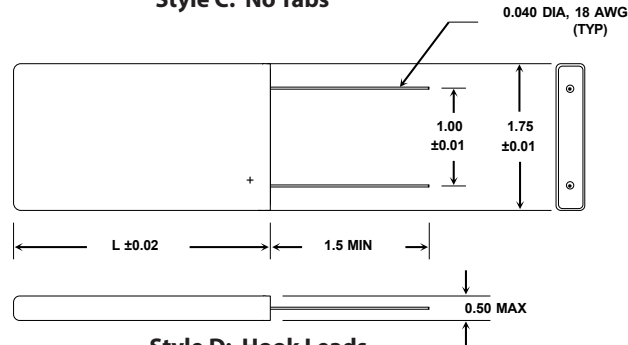
Mounting tabs and negative lead are welded to the case.

Style B: Four Leads



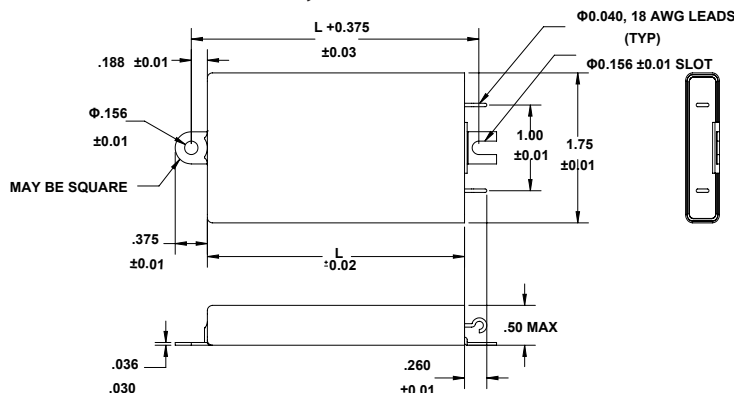
Three negative leads are welded to the case.

Style C: No Tabs



The negative lead is welded to the case.

Style D: Hook Leads



Mounting tabs and negative lead are welded to the case.

| Case Code | Length L (in) | Weight (g) |
|-----------|---------------|------------|
| EK | 1.5 | 30 |
| EA | 2.0 | 42 |
| EB | 3.0 | 66 |

Type MLP 85 °C Flatpack, Ultra Long Life, Aluminum Electrolytic

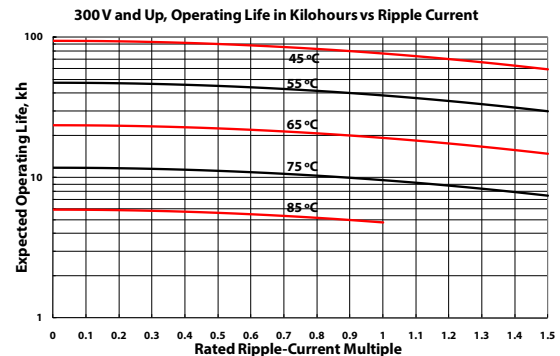
Very Low Profile

Ratings

| Cap. (µF) | Catalog Part Number | ESR max 25 °C (mΩ) | | Ripple (A) Case @ 85 °C | | Length (Inches) |
|-------------------------------|---------------------|--------------------|--------|-------------------------|--------|-----------------|
| | | 120 Hz | 20 kHz | 120 Hz | 20 kHz | |
| 7.5 Vdc (10 Vdc Surge) | | | | | | |
| 19,000 | MLP193M7R5EK0A | 76 | 66 | 4.2 | 4.5 | 1.5 |
| 28,000 | MLP283M7R5EA0A | 50 | 44 | 5.8 | 6.2 | 2.0 |
| 47,000 | MLP473M7R5EB0A | 30 | 26 | 9.1 | 9.8 | 3.0 |
| 10 Vdc (13 Vdc Surge) | | | | | | |
| 17000 | MLP173M010EK0A | 77 | 67 | 4.2 | 4.5 | 1.5 |
| 26000 | MLP263M010EA0A | 51 | 45 | 5.8 | 6.1 | 2.0 |
| 43000 | MLP433M010EB0A | 30 | 27 | 9.0 | 9.6 | 3.0 |
| 16 Vdc (20 Vdc Surge) | | | | | | |
| 13000 | MLP133M016EK0A | 81 | 69 | 4.1 | 4.4 | 1.5 |
| 21000 | MLP213M016EA0A | 53 | 46 | 5.7 | 6.1 | 2.0 |
| 38000 | MLP383M016EB0A | 31 | 27 | 9.0 | 9.6 | 3.0 |
| 20 Vdc (25 Vdc Surge) | | | | | | |
| 9600 | MLP962M020EK0A | 84 | 69 | 4.0 | 4.4 | 1.5 |
| 14000 | MLP143M020EA0A | 56 | 46 | 5.5 | 6.1 | 2.0 |
| 24000 | MLP243M020EB0A | 33 | 27 | 8.7 | 9.6 | 3.0 |
| 25 Vdc (30 Vdc Surge) | | | | | | |
| 8000 | MLP802M025EK0A | 87 | 69 | 3.9 | 4.4 | 1.5 |
| 12000 | MLP123M025EA0A | 57 | 46 | 5.5 | 6.1 | 2.0 |
| 20000 | MLP203M025EB0A | 34 | 27 | 8.6 | 9.6 | 3.0 |
| 35 Vdc (50 Vdc Surge) | | | | | | |
| 5600 | MLP562M035EK0A | 90 | 70 | 3.4 | 4.4 | 1.5 |
| 8400 | MLP842M035EA0A | 59 | 46 | 5.4 | 6.1 | 2.0 |
| 14000 | MLP143M035EB0A | 35 | 27 | 8.4 | 9.6 | 3.0 |
| 50 Vdc (63 Vdc Surge) | | | | | | |
| 4400 | MLP442M050EK0A | 97 | 70 | 3.7 | 4.4 | 1.5 |
| 6600 | MLP662M050EA0A | 62 | 46 | 5.2 | 6.1 | 2.0 |
| 11000 | MLP113M050EB0A | 36 | 27 | 8.3 | 9.6 | 3.0 |
| 63 Vdc (75 Vdc Surge) | | | | | | |
| 2200 | MLP222M063EK0A | 101 | 76 | 3.7 | 4.2 | 1.5 |
| 3300 | MLP332M063EA0A | 64 | 50 | 5.2 | 5.8 | 2.0 |
| 5600 | MLP562M063EB0A | 36 | 29 | 8.3 | 9.3 | 3.0 |
| 80 Vdc (100 Vdc Surge) | | | | | | |
| 1500 | MLP152M080EK0A | 106 | 77 | 3.6 | 4.2 | 1.5 |
| 2100 | MLP212M080EA0A | 72 | 52 | 4.9 | 5.7 | 2.0 |
| 3300 | MLP332M080EB0A | 44 | 31 | 7.5 | 9.0 | 3.0 |

| Cap. (µF) | Catalog Part Number | ESR max 25 °C (mΩ) | | Ripple (A) Case @ 85 °C | | Length (Inches) |
|--------------------------------|---------------------|--------------------|--------|-------------------------|--------|-----------------|
| | | 120 Hz | 20 kHz | 120 Hz | 20 kHz | |
| 100 Vdc (125 Vdc Surge) | | | | | | |
| 1100 | MLP112M100EK0A | 112 | 78 | 3.5 | 4.2 | 1.5 |
| 1600 | MLP162M100EA0A | 76 | 54 | 4.7 | 5.6 | 2.0 |
| 2700 | MLP272M100EB0A | 46 | 33 | 7.4 | 8.7 | 3.0 |
| 150 Vdc (180 Vdc Surge) | | | | | | |
| 500 | MLP501M150EK0A | 355 | 248 | 1.9 | 2.3 | 1.5 |
| 770 | MLP771M150EA0A | 238 | 166 | 2.7 | 3.2 | 2.0 |
| 1300 | MLP132M150EB0A | 143 | 100 | 4.2 | 5.0 | 3.0 |
| 200 Vdc (250 Vdc Surge) | | | | | | |
| 400 | MLP401M200EK0A | 388 | 253 | 1.9 | 2.3 | 1.5 |
| 600 | MLP601M200EA0A | 261 | 168 | 2.6 | 3.2 | 2.0 |
| 1000 | MLP102M200EB0A | 158 | 100 | 3.8 | 5.0 | 3.0 |
| 250 Vdc (300 Vdc Surge) | | | | | | |
| 330 | MLP331M250EK0A | 426 | 258 | 1.8 | 2.3 | 1.5 |
| 490 | MLP491M250EA0A | 285 | 172 | 2.4 | 3.1 | 2.0 |
| 820 | MLP821M250EB0A | 172 | 103 | 3.8 | 4.9 | 3.0 |
| 300 Vdc (350 Vdc Surge) | | | | | | |
| 220 | MLP221M300EK0A | 597 | 393 | 1.5 | 1.9 | 1.5 |
| 330 | MLP331M300EA0A | 399 | 262 | 2.1 | 2.5 | 2.0 |
| 560 | MLP561M300EB0A | 240 | 157 | 3.2 | 4.0 | 3.0 |
| 350 Vdc (400 Vdc Surge) | | | | | | |
| 150 | MLP151M350EK0A | 1000 | 734 | 1.2 | 1.4 | 1.5 |
| 220 | MLP221M350EA0A | 683 | 503 | 1.6 | 1.8 | 2.0 |
| 370 | MLP371M350EB0A | 420 | 310 | 2.3 | 2.8 | 3.0 |
| 400 Vdc (450 Vdc Surge) | | | | | | |
| 130 | MLP131M400EK0A | 1320 | 970 | 1.0 | 1.2 | 1.5 |
| 200 | MLP201M400EA0A | 882 | 648 | 1.4 | 1.6 | 2.0 |
| 330 | MLP331M400EB0A | 530 | 390 | 2.1 | 2.5 | 3.0 |
| 420 Vdc (475 Vdc Surge) | | | | | | |
| 130 | MLP131M420EK0A | 1320 | 970 | 1.0 | 1.2 | 1.5 |
| 200 | MLP201M420EA0A | 882 | 648 | 1.4 | 1.6 | 2.0 |
| 330 | MLP331M420EB0A | 530 | 390 | 2.1 | 2.5 | 3.0 |
| 450 Vdc (500 Vdc Surge) | | | | | | |
| 110 | MLP111M450EK0A | 1456 | 1190 | 0.96 | 1.1 | 1.5 |
| 170 | MLP171M450EA0A | 973 | 797 | 1.3 | 1.5 | 2.0 |
| 280 | MLP281M450EB0A | 585 | 480 | 2.0 | 2.3 | 3.0 |

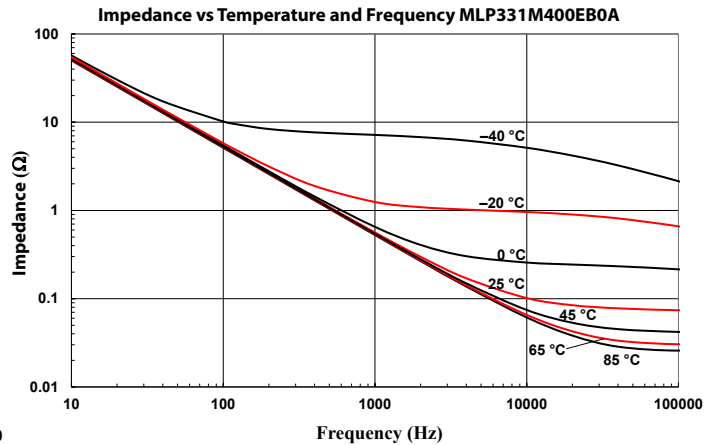
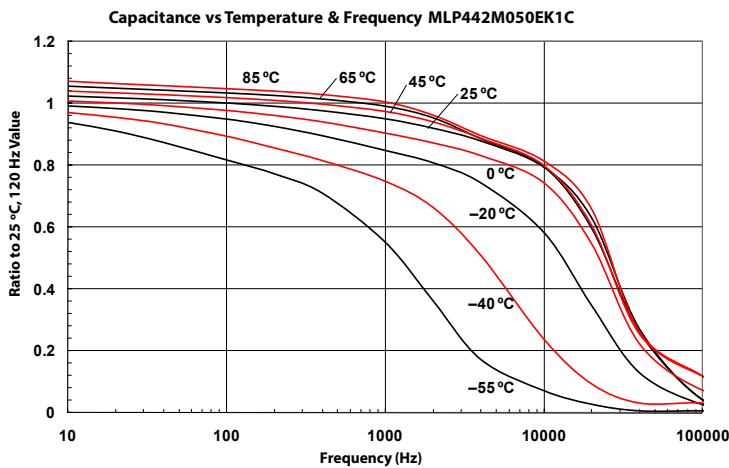
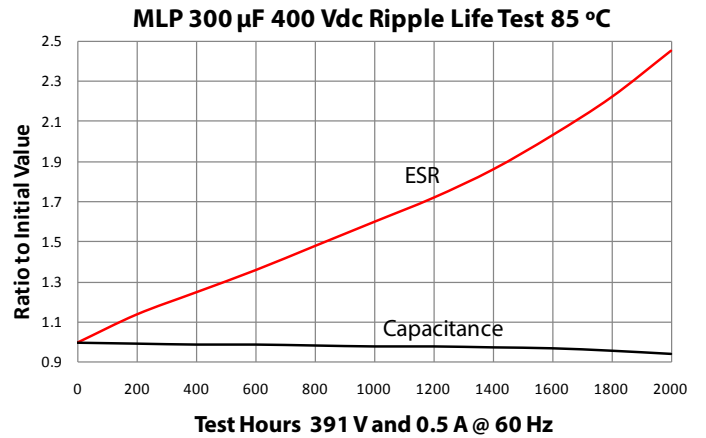
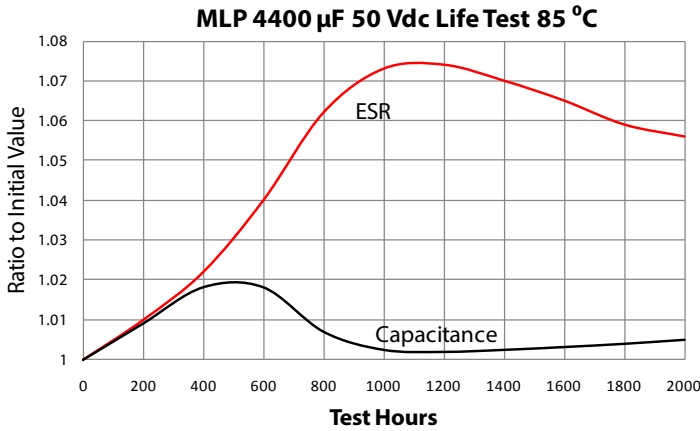
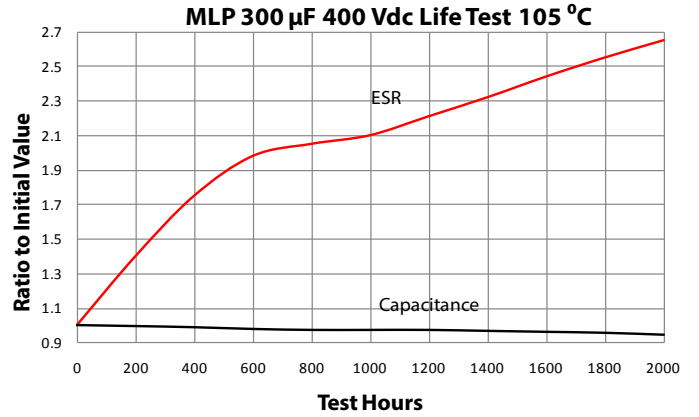
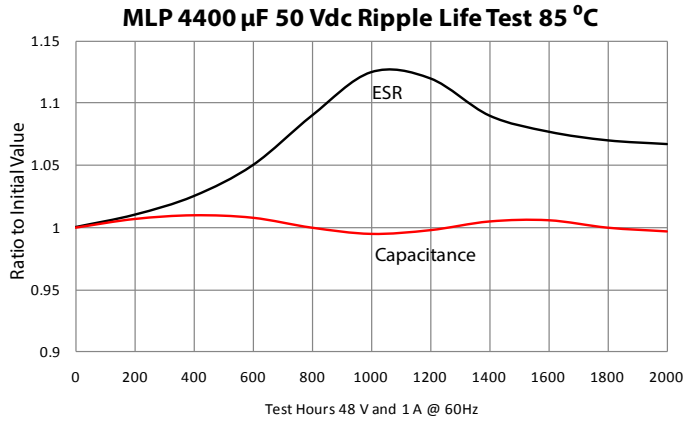
Typical Performance Curves



Type MLP 85 °C Flatpack, Ultra Long Life, Aluminum Electrolytic

Very Low Profile

Typical Performance Curves



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