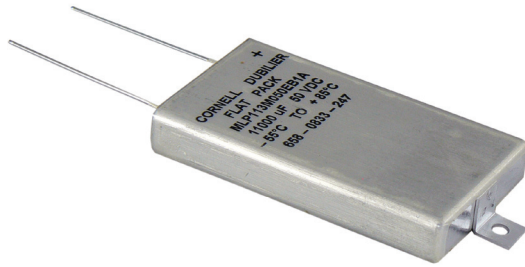


# Type MLP 85 °C Flatpack, Ultra Long Life, Aluminum Electrolytic

## 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<br>-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      | Ambient Temperature, No Heatsink                                                                                                                                                                          |       |       |        |        |       |       |             |
|                                 | 45 °C                                                                                                                                                                                                     | 55 °C | 65 °C | 75 °C  | 85 °C  |       |       |             |
|                                 | 1.00                                                                                                                                                                                                      | 0.90  | 0.75  | 0.56   | 0.27   |       |       |             |
|                                 | Case Temperature                                                                                                                                                                                          |       |       |        |        |       |       |             |
|                                 | 45 °C                                                                                                                                                                                                     | 55 °C | 65 °C | 75 °C  | 85 °C  |       |       |             |
|                                 | 3.79                                                                                                                                                                                                      | 3.32  | 2.77  | 2.08   | 1.00   |       |       |             |
|                                 | Frequency                                                                                                                                                                                                 |       |       |        |        |       |       |             |
|                                 |                                                                                                                                                                                                           | 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: $Z_{-55^{\circ}\text{C}}/Z_{+25^{\circ}\text{C}}$<br>≤ 10 (7.5 - 20 Vdc)<br>≤ 2 (25 – 250 Vdc)<br>Impedance ratio: $Z_{-20^{\circ}\text{C}}/Z_{+25^{\circ}\text{C}}$<br>≤ 4 (300–450Vdc) |       |       |        |        |       |       |             |
| Endurance Life Test             | 2000 h @ full load at +85 °C<br>Δ Capacitance ±10%<br>ESR 200% of limit<br>DCL 100% of limit                                                                                                              |       |       |        |        |       |       |             |
| Shelf Life Test                 | 500 h at 85 °C<br>Capacitance 100% of limit<br>ESR 100% of limit<br>DCL 100% of limit                                                                                                                     |       |       |        |        |       |       |             |
| Vibration                       | 10 Hz to 2 kHz, 0.06" pp max and 10g.<br>MIL-STD-202, Meth. 204                                                                                                                                           |       |       |        |        |       |       |             |

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|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                         |                    |             |             |             |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------|-------------|-------------|
| Thermal Resistance        | <b>Large Sides Heatsinked</b>                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Case Length</b> | <b>1.5"</b> | <b>2.0"</b> | <b>3.0"</b> |
|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Insulation</b>  | <b>°C/W</b> | <b>°C/W</b> | <b>°C/W</b> |
|                           | one                                                                                                                                                                                                                                                                                                                                                                                                                                     | None               | 3.0         | 1.8         | 1.2         |
|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                         | Polyester          | 4.3         | 2.6         | 1.7         |
|                           | both                                                                                                                                                                                                                                                                                                                                                                                                                                    | None               | 2.8         | 1.7         | 1.1         |
|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                         | Polyester          | 4.0         | 2.4         | 1.6         |
| ESL                       | <30 nH measured 1/4" from case at 1 MHz                                                                                                                                                                                                                                                                                                                                                                                                 |                    |             |             |             |
| Weight                    | Case EK 30 g typical<br>Case EA 42 g typical<br>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 $\theta_{cc}$ is the thermal resistance from core to case and $\theta_{ca}$ 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 $\theta_{cc}$ .                                                    |                    |             |             |             |
| 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 4.75 W. For an ESR of 31 mΩ, 4.7 W equates to a ripple current of 12.3 A. |                    |             |             |             |

## Part Numbering System

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

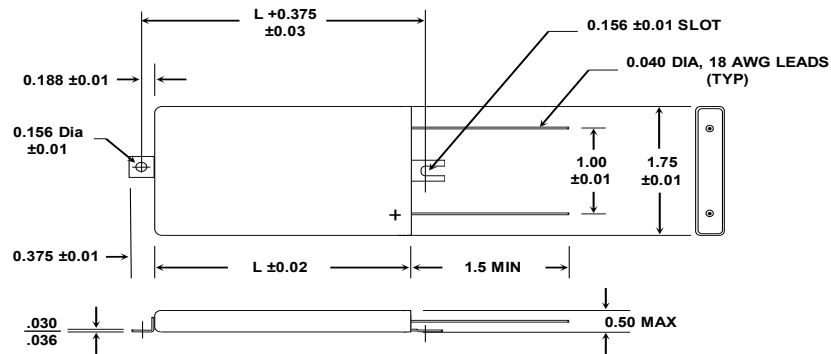
# Type MLP 85 °C Flatpack, Ultra Long Life, Aluminum Electrolytic

## Very Low Profile

## Outline Drawings

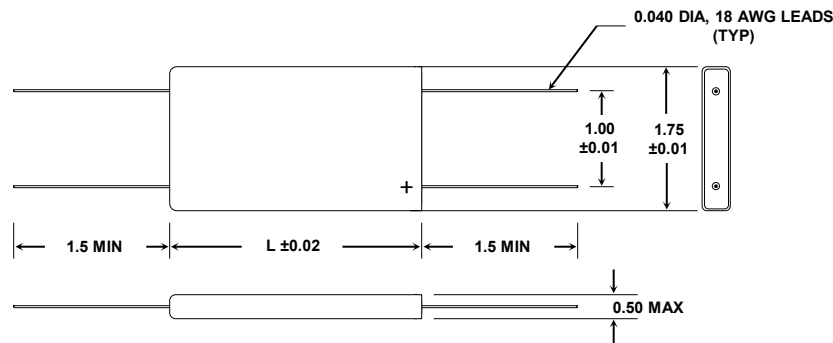
Style A: Mounting Tabs

Mounting tabs and negative lead are welded to the case.



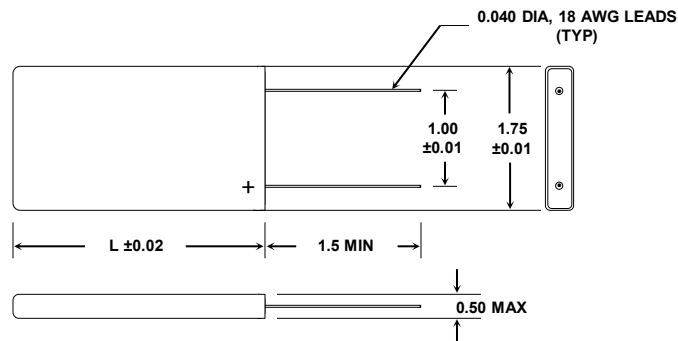
Style B: Four Leads

Three negative leads are welded to the case.



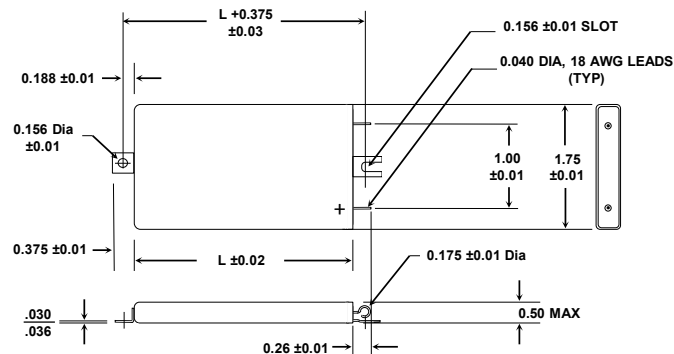
Style C: No Tabs

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

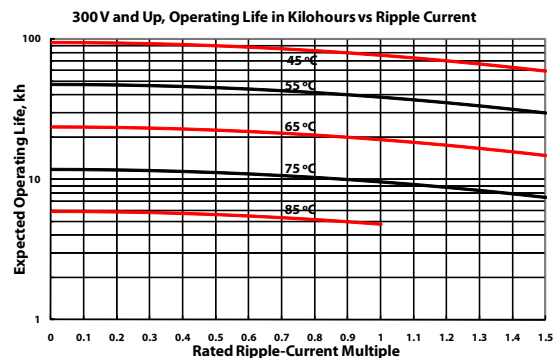
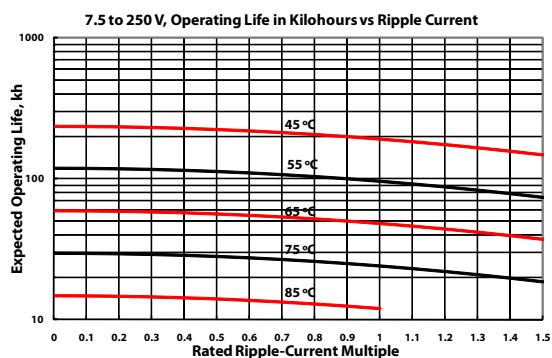
## Very Low Profile

## Ratings

| Cap.<br>(μF)           | Catalog<br>Part Number | ESR max<br>25 °C (mΩ) |        | Ripple (A)<br>Case @ 85 °C |        | Length<br>(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.<br>(μF)            | Catalog<br>Part Number | ESR max<br>25 °C (mΩ) |        | Ripple (A)<br>Case @ 85 °C |        | Length<br>(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                |

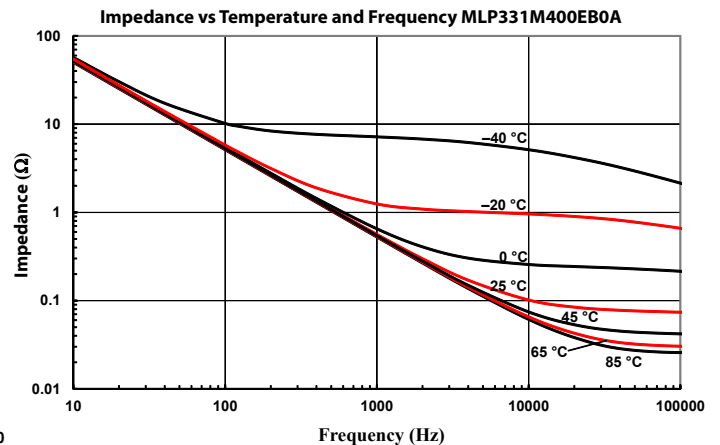
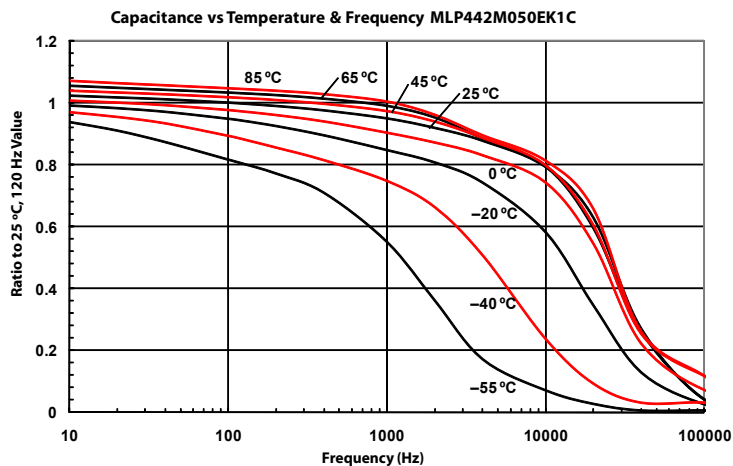
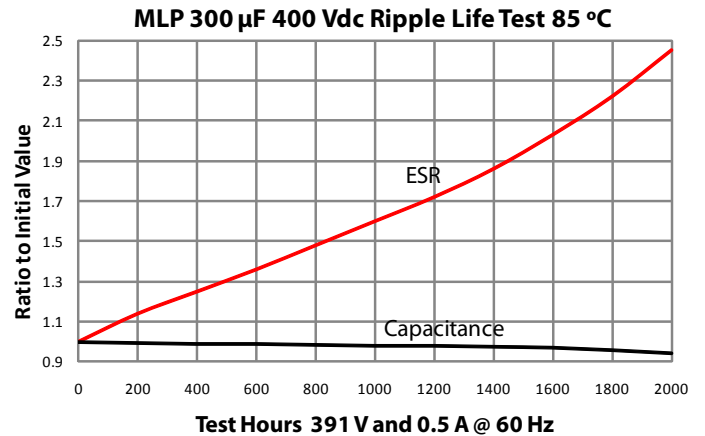
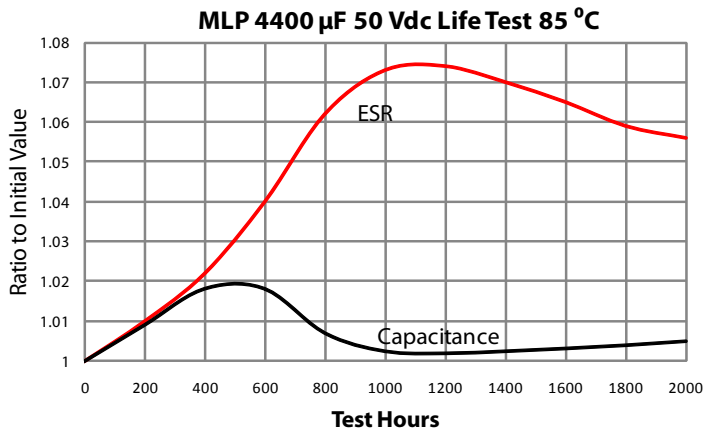
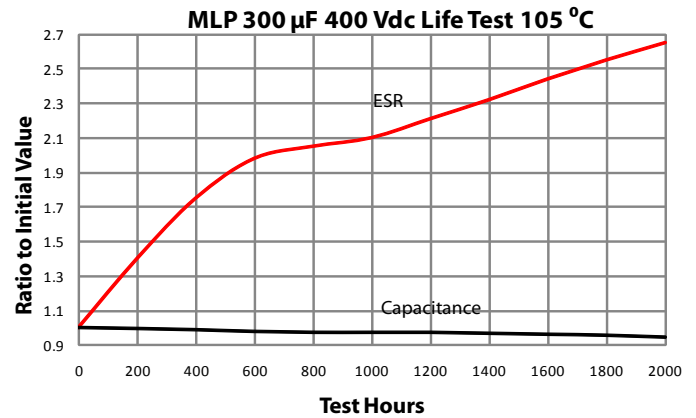
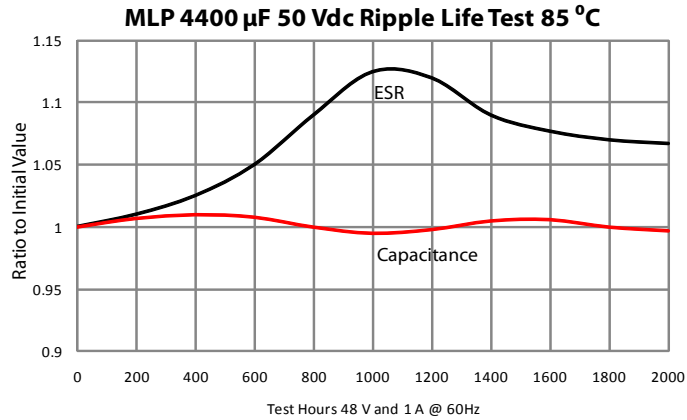
## Typical Performance Curves



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

## Very Low Profile

## Typical Performance Curves





**Стандарт  
Электрон  
Связь**

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