

# Type MLS 125 °C Stainless Flatpack, Ultra-Long Life, Aluminum

## Type MLS 125 °C



The Type MLS extends the super performance of the MLP from a maximum operating temperature of 85 °C to 125 °C. While the MLP is inherently capable of operation at 125 °C, its flat aluminum case can't withstand the higher temperature without inflating from internal pressure. The MLS incorporates a rugged, stainless steel case which assures flatness to beyond 125 °C. The MLS is perfect for hi-rel military systems and applications operating above 85 °C.

### Highlights

- Near-hermetic welded seal
- Stainless-steel case
- 100 years expected operating life
- New 2 inch case size

### Specifications

**Operating Temperature:**

-55 °C to +125 °C

**Rated Voltage:**

5.0 to 250 Vdc

**Capacitance:**

220 to 47,000 µF ±20%

**Load Life:**

2,000 h @ +125 °C

**Leakage Current:**

0.002 CV µA @ 25 °C and 5 min

**Cold Impedance:**

-55 °C multiple of 25 °C Z is ≤ 10 for up to 20 V, 2 for 25 V to 250 V

**Ripple Current Multipliers:**

**Case Temperature**

| 45 °C | 55 °C | 65 °C | 75 °C | 85 °C | 95 °C | 105 °C | 115 °C | 125 °C |
|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| 1.41  | 1.32  | 1.22  | 1.12  | 1.00  | 0.87  | 0.71   | 0.50   | 0.00   |

**Ambient Temperature, No Heatsink**

| 45 °C | 55 °C | 65 °C | 75 °C | 85 °C | 95 °C | 105 °C | 115 °C | 125 °C |
|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| 0.63  | 0.58  | 0.54  | 0.49  | 0.44  | 0.38  | 0.31   | 0.22   | 0.00   |

**Frequency**

|             | 50 Hz | 60 Hz | 120 Hz | 360 Hz | 1 kHz | 5 kHz | 10 kHz & up |
|-------------|-------|-------|--------|--------|-------|-------|-------------|
| 5 to 40 V   | 0.95  | 0.96  | 1.00   | 1.03   | 1.04  | 1.04  | 1.04        |
| 60 to 250 V | 0.80  | 0.84  | 1.00   | 1.18   | 1.25  | 1.30  | 1.30        |

**EIA Ripple Life:**

10,000 h full load at 85 C per EIA IS-749

Δ capacitance ±10%

ESR 200% of limit

DCL 100% of limit

**Shelf Life:**  
**Thermal Resistance:**

500 h at 125 °C, capacitance, ESR & DCL, initial requirements

| Large Sides Heatsinked | Case Length | 1.5" | 2.0" | 3.0" |
|------------------------|-------------|------|------|------|
|                        | Insulation  | °C/W | °C/W | °C/W |
| one                    | None        | 3.3  | 2.6  | 1.3  |
|                        | Polyester   | 4.5  | 3.6  | 1.8  |
| both                   | None        | 2.8  | 2.2  | 1.1  |
|                        | Polyester   | 4    | 3.2  | 1.6  |

**Vibration:**

10 Hz to 2 kHz 0.06" pp max and 10 g, MIL-STD-202, Meth. 204

**ESL:**

< 30 nH measured 1/4" from case at 1 MHz

**Weight:**

Case EK 43 g typical

Case EA 76 g typical

Case EB 92 g typical

**Terminals:**

18 AWG copper wire with 60/40 tin-lead electroplate



#### RoHS-5 Compliant

Has more than 1000 ppm lead in some homogenous material but otherwise complies with the EU Directive 2002/95/EC requirement restricting the use of Lead (Pb), Mercury (Hg), Cadmium (Cd), Hexavalent chromium (Cr(VI)), PolyBrominated Biphenyls (PBB) and PolyBrominated Diphenyl Ethers (PBDE).

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## Specifications

**Ripple Current Capability** is set by the maximum permissible internal core temperature, 125 °C.

**Air Cooled.** The ripple currents in the ratings tables are for 85 °C case temperatures. For air temperatures without a heatsink use the Ambient Temperature, No Heatsink multipliers.

**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  $\Theta_{cc}$ .

As an illustration, suppose you operate an MLS332M060EB1C 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 MLS and the heatsink, and the total thermal resistance is 2.7 + 1.8 or 4.5 °C/W. The power which would heat the core to 125 °C is (125-65)/4.5 or 13.3 W. For an ESR of 31 mΩ, 13.3 W equates to a ripple current of 20.7A, however, the wire leads are rated for only 20 A.

## Outline Drawings

Style A: Mounting Tabs



| Case Code | Length L (in) | Weight (g) |
|-----------|---------------|------------|
| EK        | 1.5           | 43         |
| EA        | 2.0           | 76         |
| EB        | 3.0           | 92         |

Style C: Two Leads, No Tabs



Style D: Hook Leads



Note: The mounting tabs are at case potential and the negative lead connects to the case through the electrolyte.

## Part Numbering System

|            |                             |           |               |   |                               |   |
|------------|-----------------------------|-----------|---------------|---|-------------------------------|---|
| <b>MLS</b> | <b>821</b>                  | <b>M</b>  | <b>200</b>    | <b>EB</b>                                       | <b>0</b>                      | <b>A</b>  |
| Type       | Capacitance                 | Tolerance | Rated Voltage | Case Code                                       | Insulation                    | Mounting Style  |
| MLS        | 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>C = two leads/no tabs<br>D = hook leads/tabs |

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## MLS102M150EB0D Life Test at 125 °C, 150 V



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## Typical Performance Curves



### Ratings

| Cap<br>( $\mu$ F)   | Catalog Part Number | ESR max<br>25 °C (m $\Omega$ ) |        | Ripple (A)<br>Case @ 85°C |        | Length<br>(inches) |
|---|---------------------|--------------------------------|--------|---------------------------|--------|--------------------|
|   |                     | 120 Hz                         | 20 kHz | 120 Hz                    | 20 kHz |                    |
| <b>5 Vdc (7.5 Vdc Surge) [105 °C: 7.5 Vdc (10 Vdc Surge)]</b> |                     |                                |        |                           |        |                    |
| 19,000  | MLS193M5R0EK0C      | 76                             | 66     | 12.6                      | 13.6   | 1.5                |
| 28,000  | MLS283M5R0EA0C      | 50                             | 44     | 19.9                      | 21.4   | 2.0                |
| 47,000  | MLS473M5R0EB0C      | 30                             | 26     | 32.0                      | 34.4   | 3.0                |
| <b>7.5 Vdc (10 Vdc Surge) [105 °C: 10 Vdc (13 Vdc Surge)]</b> |                     |                                |        |                           |        |                    |
| 17,000  | MLS173M7R5EK0C      | 77                             | 67     | 12.5                      | 13.5   | 1.5                |
| 26,000  | MLS263M7R5EA0C      | 51                             | 45     | 19.8                      | 21.1   | 2.0                |
| 43,000  | MLS433M7R5EB0C      | 31                             | 27     | 31.5                      | 33.8   | 3.0                |
| <b>10 Vdc (15 Vdc Surge) [105 °C: 16 Vdc (20 Vdc Surge)]</b>  |                     |                                |        |                           |        |                    |
| 13,000  | MLS133M010EK0C      | 81                             | 69     | 12.2                      | 13.3   | 1.5                |
| 23,000  | MLS233M010EA0C      | 51                             | 45     | 19.8                      | 21.1   | 2.0                |
| 38,000  | MLS383M010EB0C      | 31                             | 27     | 31.5                      | 33.8   | 3.0                |
| <b>20 Vdc (30 Vdc Surge) [105 °C: 30 Vdc (40 Vdc Surge)]</b>  |                     |                                |        |                           |        |                    |
| 6,800   | MLS682M020EK0C      | 84                             | 69     | 11.0                      | 12.2   | 1.5                |
| 10,000  | MLS103M020EA0C      | 56                             | 46     | 13.6                      | 15.0   | 2.0                |
| 17,000  | MLS173M020EB0C      | 33                             | 27     | 17.6                      | 19.5   | 3.0                |
| <b>40 Vdc (50 Vdc Surge) [105 °C: 50 Vdc (63 Vdc Surge)]</b>  |                     |                                |        |                           |        |                    |
| 4,400   | MLS442M040EK0C      | 97                             | 70     | 10.3                      | 12.1   | 1.5                |
| 6,600   | MLS662M040EA0C      | 62                             | 46     | 12.9                      | 15.0   | 2.0                |
| 11,000  | MLS113M040EB0C      | 36                             | 27     | 16.9                      | 19.5   | 3.0                |
| <b>60 Vdc (75 Vdc Surge) [105 °C: 80 Vdc (100 Vdc Surge)]</b> |                     |                                |        |                           |        |                    |
| 1,500   | MLS152M060EK0C      | 106                            | 77     | 9.8                       | 11.5   | 1.5                |

| Cap<br>( $\mu$ F)  | Catalog Part Number | ESR max<br>25 °C (m $\Omega$ ) |        | Ripple (A)<br>Case @ 85°C |        | Length<br>(inches) |
|--|---------------------|--------------------------------|--------|---------------------------|--------|--------------------|
|  |                     | 120 Hz                         | 20 kHz | 120 Hz                    | 20 kHz |                    |
| 2,100  | MLS212M060EA0C      | 72                             | 52     | 11.9                      | 14.1   | 2.0                |
| 3,300  | MLS332M060EB0C      | 44                             | 31     | 15.3                      | 18.2   | 3.0                |
| <b>75 Vdc (100 Vdc Surge) [105 °C: 100 Vdc (125 Vdc Surge)]</b>  |                     |                                |        |                           |        |                    |
| 1,100  | MLS112M075EK0C      | 112                            | 78     | 9.6                       | 11.5   | 1.5                |
| 1,600  | MLS162M075EA0C      | 76                             | 54     | 11.6                      | 13.8   | 2.0                |
| 2,700  | MLS272M075EB0C      | 46                             | 33     | 14.9                      | 17.6   | 3.0                |
| <b>100 Vdc (125 Vdc Surge) [105 °C: 150 Vdc (180 Vdc Surge)]</b> |                     |                                |        |                           |        |                    |
| 500  | MLS501M100EK0C      | 355                            | 248    | 5.4                       | 6.4    | 1.5                |
| 770  | MLS771M100EA0C      | 238                            | 166    | 6.6                       | 7.8    | 2.0                |
| 1,300  | MLS132M100EB0C      | 143                            | 100    | 8.5                       | 10.1   | 3.0                |
| <b>150 Vdc (175 Vdc Surge) [105 °C: 200 Vdc (250 Vdc Surge)]</b> |                     |                                |        |                           |        |                    |
| 400  | MLS401M150EK0C      | 388                            | 253    | 5.1                       | 6.4    | 1.5                |
| 600  | MLS601M150EA0C      | 261                            | 168    | 6.3                       | 7.8    | 2.0                |
| 1,000  | MLS102M150EB0C      | 158                            | 100    | 8.1                       | 10.1   | 3.0                |
| <b>200 Vdc (225 Vdc Surge) [105 °C: 250 Vdc (300 Vdc Surge)]</b> |                     |                                |        |                           |        |                    |
| 330  | MLS331M200EK0C      | 426                            | 258    | 4.9                       | 6.2    | 1.5                |
| 490  | MLS491M200EA0C      | 285                            | 172    | 6.0                       | 7.7    | 2.0                |
| 820  | MLS821M200EB0C      | 172                            | 103    | 7.7                       | 10.0   | 3.0                |
| <b>250 Vdc (275 Vdc Surge) [105 °C: 250 Vdc (300 Vdc Surge)]</b> |                     |                                |        |                           |        |                    |
| 220  | MLS221M250EK0C      | 597                            | 393    | 4.1                       | 5.1    | 1.5                |
| 330  | MLS331M250EA0C      | 399                            | 262    | 5.0                       | 6.3    | 2.0                |
| 560  | MLS561M250EB0C      | 240                            | 157    | 6.5                       | 8.1    | 3.0                |



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