Type MLS 125 °C Flatpack, Ultra Long Life, Aluminum Electrolytic

Now Available with High Vibration and High Reliability Options

Encased in rugged stainless steel, the MLS is perfect for high reliability military systems and applications operating above 85 °C. For our highest performing 125 °C Flatpacks, choose type HVMLS available in a special stainless steel case for high vibration applications up to 50g. Specify type HRMLS for high reliability Flatpacks which are subjected to MIL level burn-in processes to ensure established reliability.

Highlights

- Near-hermetic welded seal
- Stainless-steel case
- 100 years expected operating life
- Withstands more than 80,000 feet altitude
- Type HV up to 50g
- Type HR, High Reliability

Specifications

Temperature Range	–55 °C to +125 °C
Rated Voltage Range	5.0 Vdc to 250 Vdc
Capacitance Range	220 µF to 47,000 µF
Capacitance Tolerance	±20%
Leakage Current	≤ 0.002 CV µA, @ 25 °C and 5 mins.
Ripple Current Multipliers	Case Temperature 45 °C: 1.41 · 55 °C: 1.32 · 65 °C: 1.22 · 75 °C: 1.12 · 85 °C: 1.00 · 95 °C: 0.87 · 105 °C: 0.71 · 115 °C: 0.50 · 125 °C: 0.00 Ambient Temperature, No Heatsink 45 °C: 0.63 · 55 °C: 0.58 · 65 °C: 0.54 · 75 °C: 0.49 · 85 °C: 0.44 · 95 °C: 0.38 · 105 °C: 0.31 · 115 °C: 0.22 · 125 °C: 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

Low Temperature Characteristics	Impedance ratio: $Z_{-55\,°C}/Z_{+25\,°C}$ ≤ 10 (5 - 20 Vdc) ≤ 2 (25 - 250 Vdc)
Endurance Life Test	10,000 h @ full load at 85 °C Δ Capacitance ±10% ESR 200% of limit DCL 100% of limit
DC Life Test	2000 h at rated voltage &125 °C Δ Capacitance ±10% ESR 200% of limit DCL 100% of limit
Shelf Life Test	500 h at 125 °C Capacitance 100% of limit ESR 100% of limit DCL 100% of limit
Vibration *Mounting: Vibration capability is dependent upon mounting restraint. The optional welded mounting tabs, alone, are not capable of sustaining the high vibration levels.* *To achieve the high vibration levels as published on right, additional mounting restraint is required.*	Standard MLS Flatpack: 10g 10 Hz to 2 kHz Sine Swept, 0.06" pp max and 10g. Type HVMLS Flatpack 1.5" and 2.0" case length, 50g Type HVMLS Flatpack 2.5" and 3.0" case length, 30g MIL-STD-202, Meth. 204, Sine Swept, IEC 60068-2-6

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Vibration Test

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.

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.

Frequency Range
The vibration frequency shall be varied logarithmically between the approximate limits of 10 to 2,000 Hz.

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.

High Reliability Test/Burn-in

Established Reliability capacitors shall be subjected to a minimum of 100 percent of the dc rated voltage at 85 °C for 48 hours minimum but not to exceed 96 hours. During this test, capacitors shall be adequately protected against temporary voltage surges of 10 percent or more of the test voltage. After burn-in, the capacitors shall be returned to room ambient conditions and the dc leakage, capacitance, and ESR shall be measured with respect to specified limits.

Thermal Resistance

Large Sides Heatsinked	Case Length	1.5"	2.0"	3.0"
	Insulation	°C/W	°C/W	°C/W
one	None	4.3	3.1	2.0
	Polyester	4.7	3.4	2.2
both	None	2.8	2.0	1.3
	Polyester	3.0	2.2	1.4

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, 20 amps max

Case Material

Stainless Steel

Ripple Current Capability

The 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 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 θcc is the thermal resistance from core to case and θca from case to ambient. To calculate maximum ripple capability with the MLS attached to a heatsink use the maximum core temperature and the values for θcc.

Example

As an illustration, suppose you operate an insulated 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 20.7 A, however, the wire leads are rated for only 20 A.

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Part Numbering System

HV	HR	MLS	821	M	200	EB	0	A
Optional	**Optional**	**Type**	**Capacitance**	**Tolerance**	**Rated Voltage**	**Case Code**	**Insulation**	**Mounting Style**
High Vibration	**High Reliability**	**MLS**	**821**=820 µF **102** = 1000 µF	**M=**±20%	Vdc	**EK,** L=1.5 in. **EA**, L=2.0 in **EB**, L=3.0 in. * other sizes available	**0** = bare can **1** = polyester	**A =** mounting tabs **C** = two leads/no tabs **D** = hook leads/tabs * other mounting tab options available

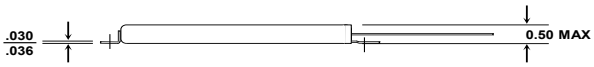
Examples:

Standard MLS: MLS821M200EB0C
High Reliability: HRMLS821M200EB0C
High Vibration: HVMLS821M200EB0C
High Reliability, High Vibration: HVHRMLS821M200EB0C

Outline Drawings

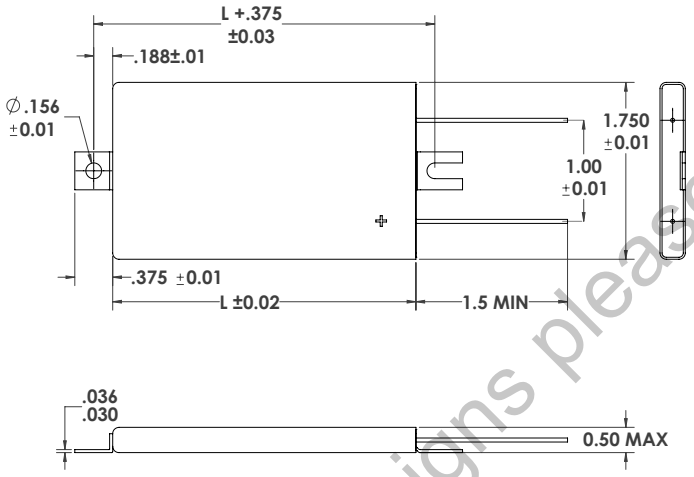
Note: The polyester tape wrap may add up to 0.020 inches to the thickness and width of the capacitor.

Standard Type MLS

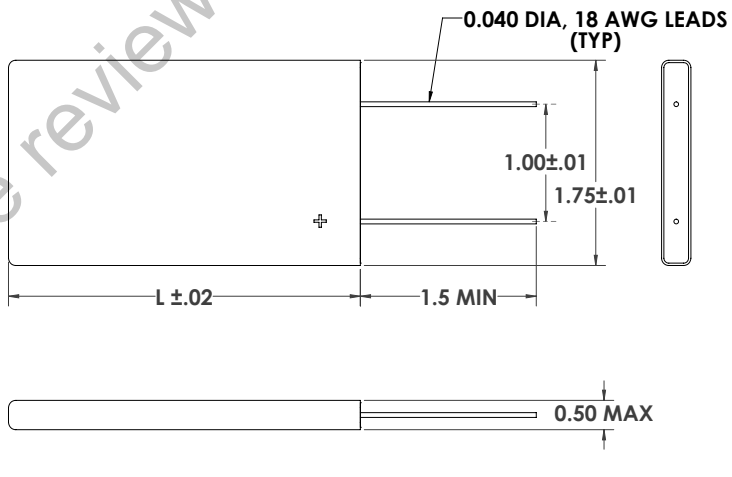


Type HV, Rilled Construction

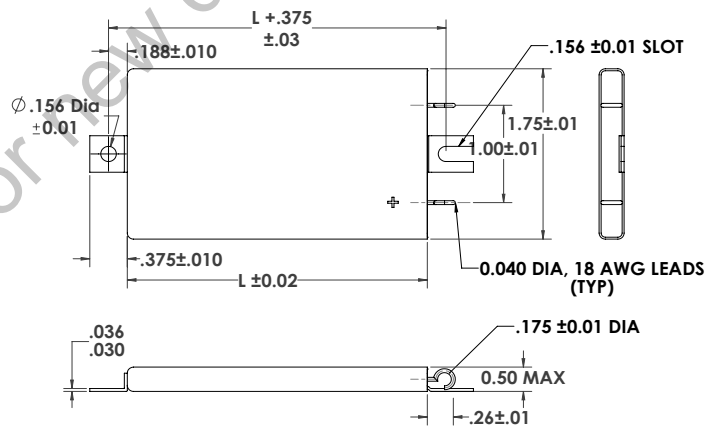
Style A: Mounting Tabs



Style C: No Tabs



Style D: Hook Leads



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

Mounting tabs are welded to the case.

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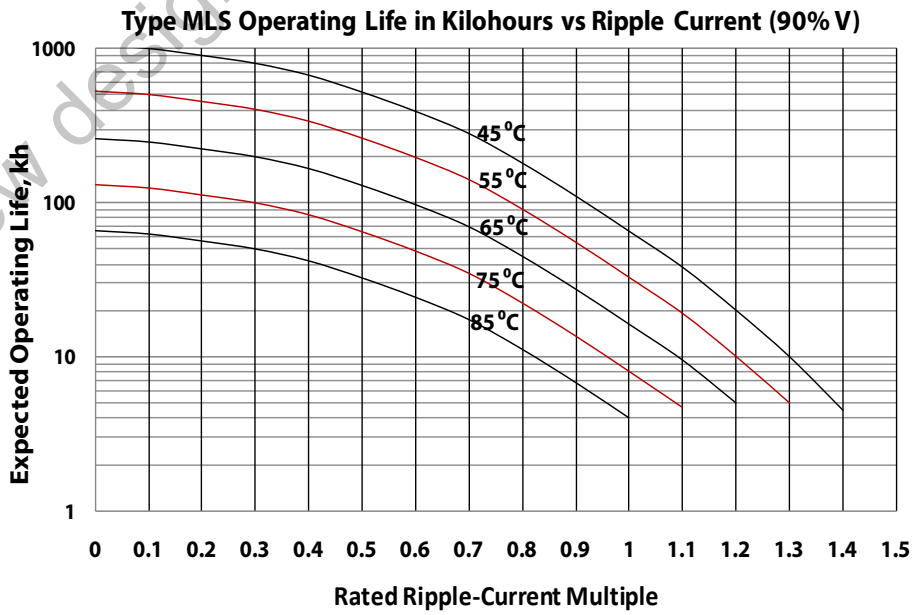
Ratings

Cap (µF)	Catalog Part Number	ESR max 25 °C (mΩ) 120 Hz	ESR max 25 °C (mΩ) 20 kHz	Ripple (A) Case @ 85°C 120 Hz	Ripple (A) Case @ 85°C 20 kHz	Length (inches)
	125 °C: 5 Vdc, 105 °C: 7.5 Vdc, 25 °C Surge: 10 Vdc					
19,000	MLS193M5R0EK0C	76	66	11.6	12.5	1.5
28,000	MLS283M5R0EA0c	50	44	14.3	15.4	2.0
47,000	MLS473M5R0EB0C	30	26	18.5	19.9	3.0
	125 °C: 7.5 Vdc, 105 °C: 10 V, 25 °C Surge: 13 Vdc					
17,000	MLS173M7R5EK0C	77	67	11.5	12.4	1.5
26,000	MLS263M7R5EA0c	51	45	14.1	15.1	2.0
43,000	MLS433M7R5EB0C	31	27	18.2	19.5	3.0
	125 °C: 10 Vdc, 105 °C: 16 V, 25 °C Surge: 20 Vdc					
13,000	MLS133M010EK0C	81	69	11.3	12.2	1.5
23,000	MLS233M010EA0C	51	45	14.0	15.0	2.0
38,000	MLS383M010EB0C	31	27	18.2	19.5	3.0
	125 °C: 20 Vdc, 105 °C: 30 V, 25 °C Surge: 40 Vdc]					
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
	125 °C: 40 Vdc, 105 °C: 50 V, 25 °C Surge: 63 Vdc					
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
	125 °C: 60 Vdc, 105 °C: 80 V, 25 °C Surge: 100 Vdc					
1,500	MLS152M060EK0C	106	77	9.8	11.5	1.5
2,100	MLS212M060EA0C	72	52	11.9	14.1	2.0
3,300	MLS332M060EB0C	44	31	15.3	18.2	3.0
	125 °C: 75 Vdc, 105 °C: 100 V, 25 °C Surge: 125 Vdc					
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
	125 °C: 100 Vdc, 105 °C: 150 V, 25 °C Surge: 180 Vdc					
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
	125 °C: 150 Vdc, 105 °C: 200 V, 25 °C Surge: 250 Vdc					
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
	125 °C: 200 Vdc, 105 °C: 250 Vdc, 25 °C Surge: 300 Vdc					
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
	125 °C: 250 Vdc, 105 °C: 250 Vdc, 25 °C Surge: 300 Vdc					
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

Typical Performance Curves



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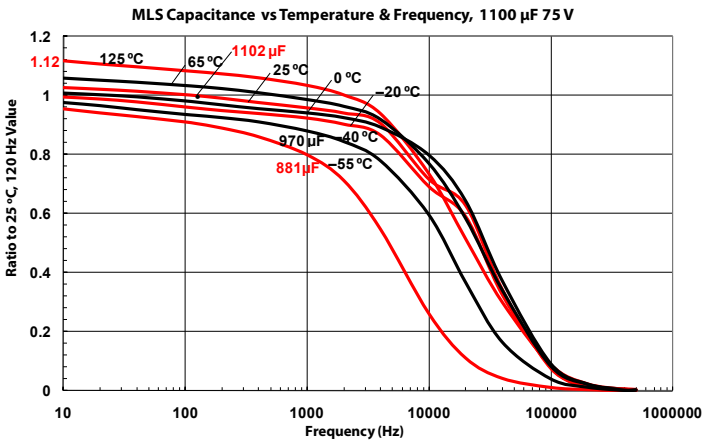

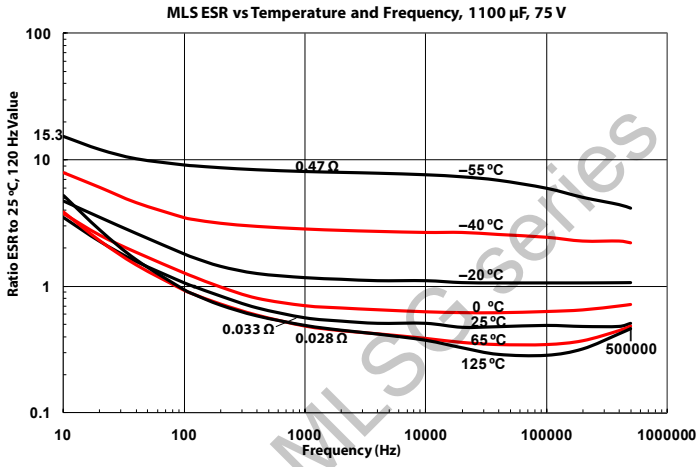

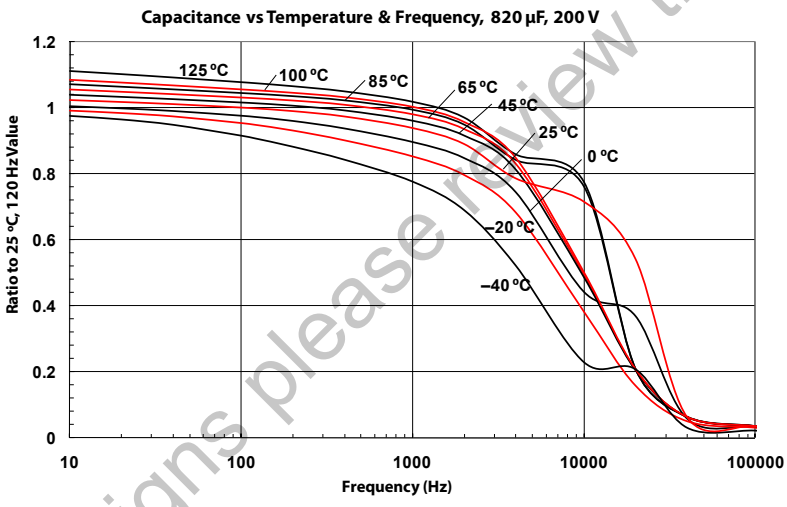

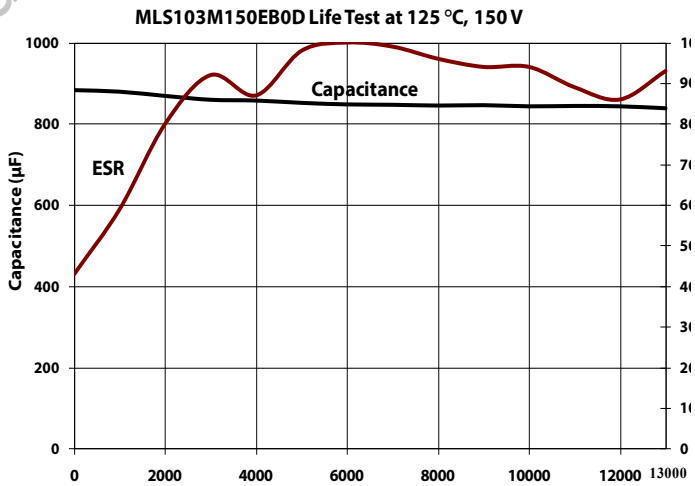

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