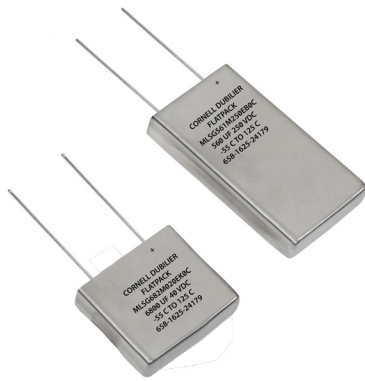


# Type MLSG – Flatpack™, 5000 hr@125 °C, Aluminum Electrolytic

Available with High Vibration and High Reliability Options



With over 5000 hrs of DC life at rated voltage, 125°C, type MLSG is our longest life steel-cased Flatpack™ capacitor. For systems requiring the highest life expectancy, type MLSG is the best choice. Enhance the reliability of your system even further by specifying type HRMLSG for a MIL-level burn-in. This series is also available in a high vibration package up to 50g's by specifying type HVMLSG.

## Highlights

- Longest Life
- Stainless-steel case
- 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 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	<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> <th>95 °C</th> <th>105 °C</th> <th>115 °C</th> <th>125 °C</th> </tr> </thead> <tbody> <tr> <td>1.41</td> <td>1.32</td> <td>1.22</td> <td>1.12</td> <td>1.00</td> <td>0.87</td> <td>0.71</td> <td>0.50</td> <td>0.00</td> </tr> </tbody> </table> <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> <th>95 °C</th> <th>105 °C</th> <th>115 °C</th> <th>125 °C</th> </tr> </thead> <tbody> <tr> <td>0.63</td> <td>0.58</td> <td>0.54</td> <td>0.49</td> <td>0.44</td> <td>0.38</td> <td>0.31</td> <td>0.22</td> <td>0.00</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 &amp; up</th> </tr> </thead> <tbody> <tr> <th>5 to 40 V</th> <td>0.95</td> <td>0.96</td> <td>1.00</td> <td>1.03</td> <td>1.04</td> <td>1.04</td> <td>1.04</td> </tr> <tr> <th>60 to 250 V</th> <td>0.80</td> <td>0.84</td> <td>1.00</td> <td>1.18</td> <td>1.25</td> <td>1.30</td> <td>1.30</td> </tr> </tbody> </table>	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	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		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
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Low Temperature Characteristics	<p>Impedance ratio: <math>Z_{-55 °C} / Z_{+25 °C}</math> @ 120 Hz</p> <p>≤ 10 (5 - 60 Vdc)</p> <p>≤ 2 (61 - 250 Vdc)</p>																																																												
DC Life Test	<p>5000 h at rated voltage @125 °C</p> <p>Δ Capacitance +/- 15% less than or equal to 60 Vdc</p> <p>Δ Capacitance +/- 10% greater than 60 Vdc</p> <p>ESR 200% of limit</p> <p>DCL 100% of limit</p>																																																												
Shelf Life Test	<p>500 h at 125 °C</p> <p>Δ Capacitance 100% of limit</p> <p>ESR 100% of limit</p> <p>DCL 100% of limit</p>																																																												
Endurance Life Test	<p>10,000 h at full load at 85 °C</p> <p>Δ Capacitance ±10%</p> <p>ESR 200% of limit</p> <p>DCL 100% of limit</p>																																																												
Vibration	<p>MIL-STD-202, Meth. 204, Sine Swept, IEC 60068-2-6</p> <p>Standard MLSG Flatpack™: 10g</p> <p>Type HVMLSG Flatpack™ 1.5" and 2.0" case length, 50g</p> <p>Type HVMLSG Flatpack™ 2.5" and 3.0" case length, 30g</p>																																																												
<p><b>Mounting:</b> Vibration capability is dependent upon mounting restraint. The optional welded mounting tabs, alone, are not capable of sustaining the high vibration levels.</p> <p>To achieve the high vibration levels as published on right, additional mounting restraint is required.</p>																																																													

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<b>Vibration Test</b>	<p><b>Level</b> 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><b>Amplitude</b> 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><b>Frequency Range</b> The vibration frequency shall be varied logarithmically between the approximate limits of 10 to 2,000 Hz.</p> <p><b>Sweep Time and Duration</b> 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>																											
<b>High Reliability Test/Burn-in</b>	<p>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.</p>																											
<b>Thermal Resistance</b>	<table border="1"> <thead> <tr> <th rowspan="2">Large Sides Heatsinked</th> <th>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>4.3</td> <td>3.1</td> <td>2.0</td> </tr> <tr> <td>Polyester</td> <td>4.7</td> <td>3.4</td> <td>2.2</td> </tr> <tr> <td rowspan="2">both</td> <td>None</td> <td>2.8</td> <td>2.0</td> <td>1.3</td> </tr> <tr> <td>Polyester</td> <td>3.0</td> <td>2.2</td> <td>1.4</td> </tr> </tbody> </table>	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
Large Sides Heatsinked	Case Length		1.5"	2.0"	3.0"																							
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<b>ESL</b>	<p>≤30 nH measured 1/4" from case at 1 MHz</p>																											
<b>Weight</b>	<p>Case EK 48g typical Case EA 63g typical Case EH 78g typical Case EB 93g typical</p>																											
<b>Terminals - lead free version available</b>	<p>18 AWG copper wire with 60/40 tin-lead electroplate, 20 amps max</p>																											
<b>Case Material</b>	<p>Stainless Steel</p>																											
<b>Ripple Current Capability</b>	<p>The ripple current capability is set by the maximum permissible internal core temperature, 125 °C.</p>																											
<b>Air Cooled</b>	<p>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.</p>																											
<b>Heatsink Cooled</b>	<p>Temperature rise from the internal hottest spot, the core, to ambient air is</p> $\Delta T = I^2(ESR)(\theta_{cc} + \theta_{ca}),$ <p>recommended max <math>\Delta T</math> of 30 °C where <math>\theta_{cc}</math> is the thermal resistance from core to case and <math>\theta_{ca}</math> 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 <math>\theta_{cc}</math>.</p>																											
<b>Example</b>	<p>As an illustration, suppose you operate an insulated MLSG332M060EB1C 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 + 2.2 or 4.9 °C/W. The power which would heat the core to 125 °C is (125 - 65)/4.9 or 12.24 W. For an ESR of 31 mΩ, 12.24 W equates to a ripple current of 19.87 A.</p>																											
<a href="#">Regulatory Information</a>																												

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## Part Numbering System

HV	HR	MLSG	821	M	200	EB	0	A
Optional High Vibration	Optional High Reliability	Type MLSG	Capacitance 821=820 μF 102 = 1000 μF	Tolerance M=±20%	Rated Voltage Vdc	Case Code EK, L=1.5 in. EA, L=2.0 in. EH, L=2.5 in. EB, L=3.0 in. * other sizes available	Insulation 0 = bare can 1 = polyester	Mounting Style A = mounting tabs C = two leads/no tabs D = hook leads/tabs * other mounting tab options available

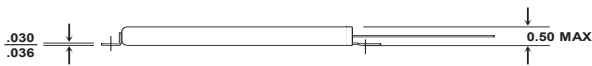
### Examples:

Standard MLSG: MLSG821M200EB0C  
 High Reliability: HRMLSG821M200EB0C  
 High Vibration: HVMLSG821M200EB0C  
 High Reliability, High Vibration: HVHRMLSG821M200EB0C

## Outline Drawings

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

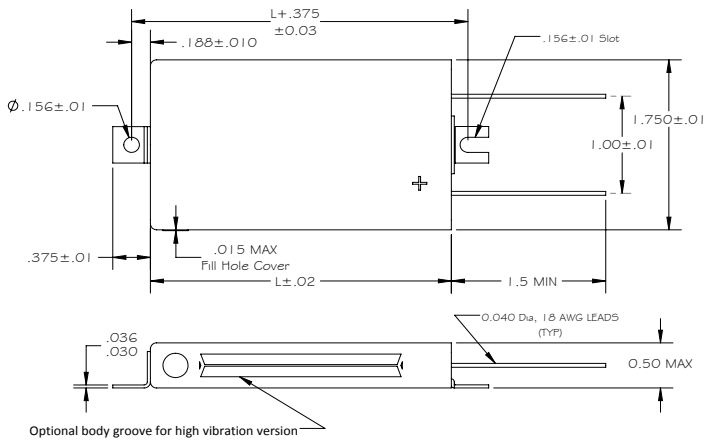
Standard Type MLSG



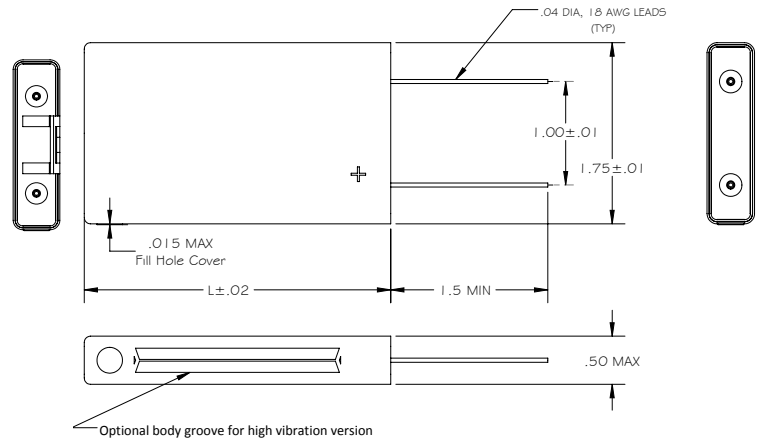
Type HV, Rilled Construction



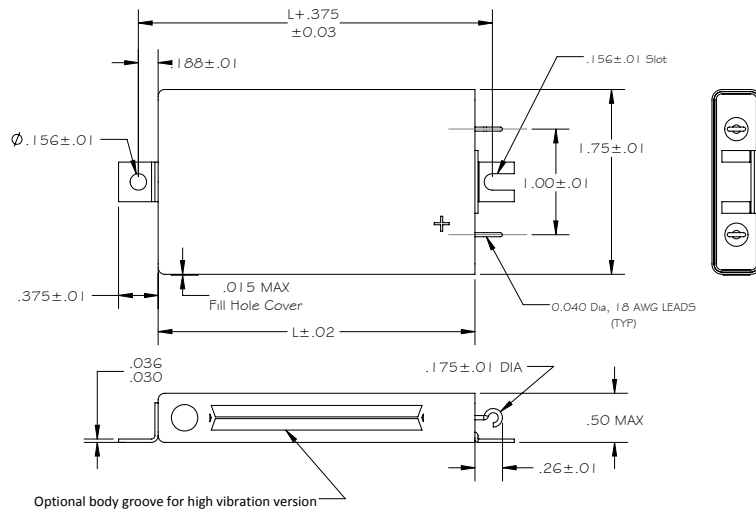
Style A: Mounting Tabs



Style C: No Tabs



Style D: Hook Leads



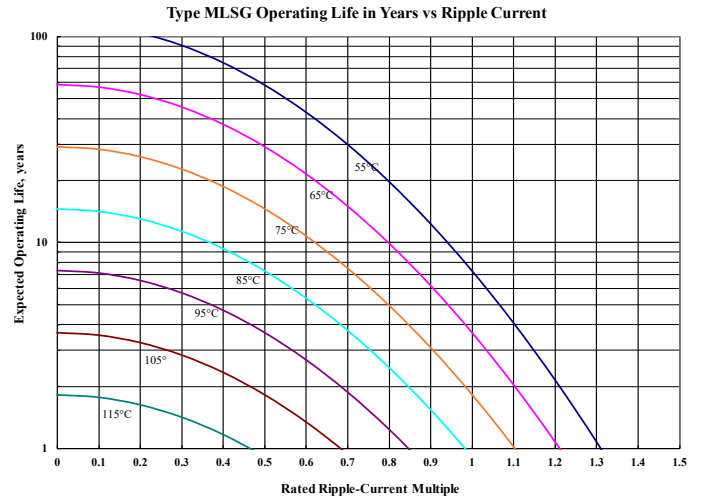
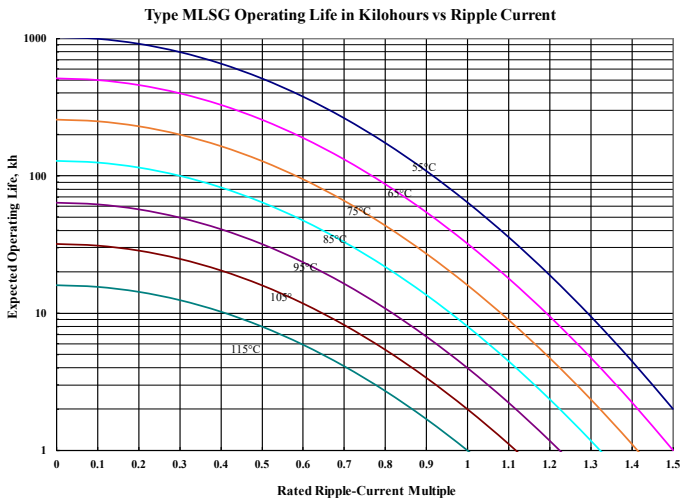
Mounting tabs are welded to the case.

# Type MLSG – Flatpack™, 5000 hr@125 °C, Aluminum Electrolytic

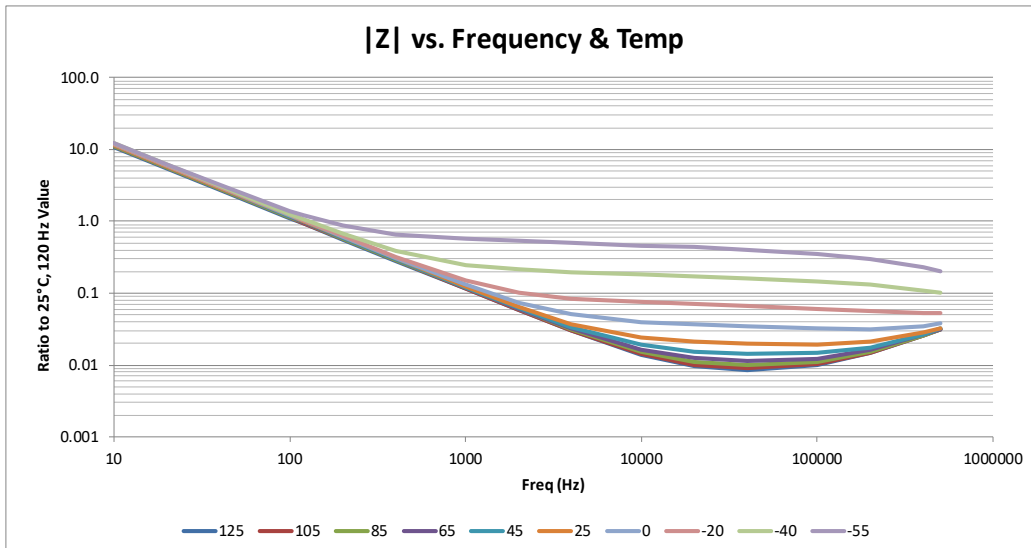
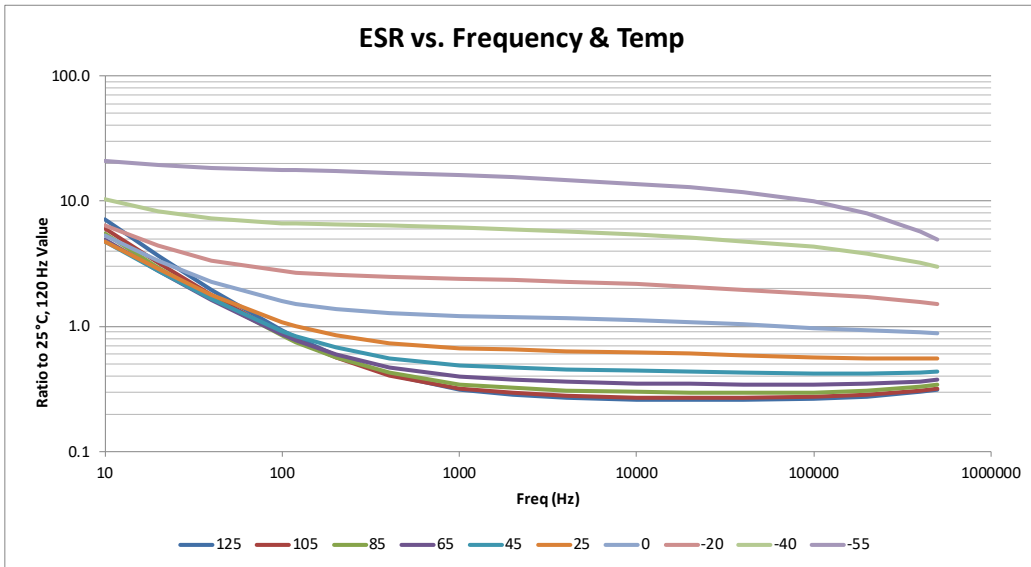
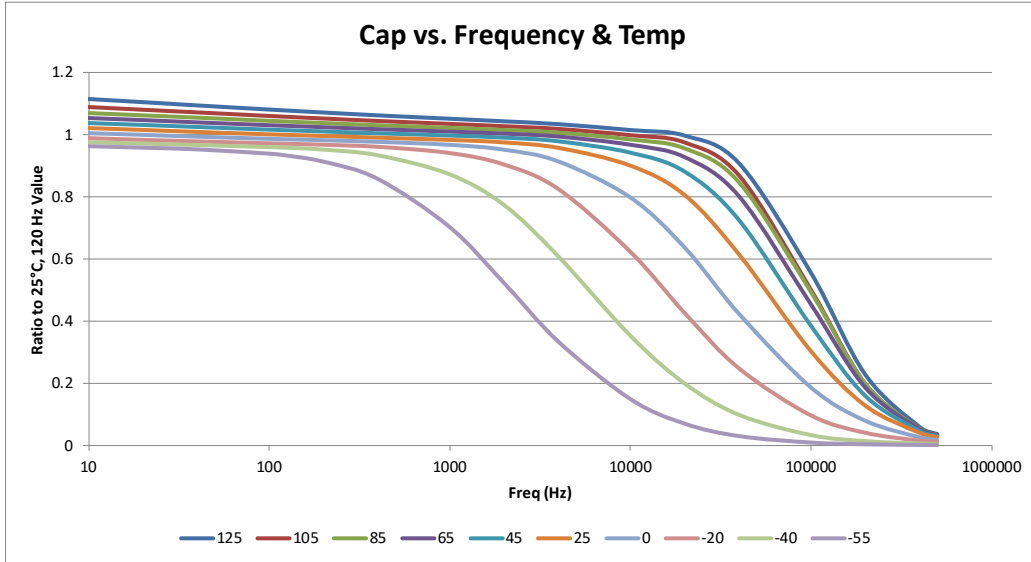
## Ratings

Voltage	Cap (μF)	Catalog Part Number	ESR max		Ripple (A)		Length (inches)
			25 °C (mΩ)	20 kHz	Case @ 85°C	20 kHz	
5 Vdc @ 125 °C 6 Vdc @ 105 °C 9 Vdc Surge @ 25 °C	19,000	MLSG193M005EK0C	76	66	11.6	12.5	1.5
	28,000	MLSG283M005EA0C	50	44	14.3	15.4	2
	47,000	MLSG473M005EB0C	30	26	18.5	19.9	3
20 Vdc @ 125 °C 24 Vdc @ 105 °C 30 Vdc Surge @ 25 °C	6,800	MLSG682M020EK0C	84	69	11	12.2	1.5
	17,000	MLSG173M020EB0A	33	27	17.6	19.5	3.0
40 Vdc @ 125 °C 48 Vdc @ 105 °C 60 Vdc Surge @ 25 °C	4,400	MLSG442M040EK0C	97	70	10.3	12.1	1.5
	6,300	MLSG632M040EA0A	62	46	12.9	15	2.0
	10,000	MLSG103M040EB0C	36	27	16.9	19.5	3.0
60 Vdc @ 125 °C 65 Vdc @ 105 °C 90 Vdc Surge @ 25 °C	1,500	MLSG152M060EK0A	106	77	9.8	11.5	1.5
	2,100	MLSG212M060EA0A	72	52	11.9	14.1	2.0
	3,300	MLSG332M060EB0C	44	31	15.3	18.2	3.0
100 Vdc @ 125 °C 120 Vdc @ 105 °C 150 Vdc Surge @ 25 °C	500	MLSG501M100EK0A	355	248	5.4	6.4	1.5
	770	MLSG771M100EA0C	238	166	6.6	7.8	2.0
	1,300	MLSG132M100EB0D	143	100	8.5	10.1	3.0
150 Vdc @ 125 °C 180 Vdc @ 105 °C 225 Vdc Surge @ 25 °C	360	MLSG361M150EK1A	388	253	5.1	6.4	1.5
	540	MLSG541M150EA1A	261	168	6.3	7.8	2.0
	900	MLSG901M150EB0C	158	100	8.1	10.1	3.0
200 Vdc @ 125 °C 250 Vdc @ 105 °C 300 Vdc Surge @ 25 °C	280	MLSG281M200EK1A	426	258	4.9	6.2	1.5
	400	MLSG401M200EA0A	285	172	6	7.7	2.0
	720	MLSG721M200EB0C	172	103	7.7	10	3.0
250 Vdc @ 125 °C 275 Vdc @ 105 °C 300 Vdc Surge @ 25 °C	220	MLSG221M250EK0C	597	393	4.1	5.1	1.5
	560	MLSG561M250EB0C	240	157	6.5	8.1	3.0

## Typical Performance Curves



Typical Performance Curves



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