





## Features

- Surface mount packaging for automated assembly
- Small footprint size (1210) and low profile for space-constrained mobile applications
- Ultra-low resistance
- RoHS compliant\* and halogen free\*\*
- Agency recognition:  

## Applications

- Thermal protection for Li-ion and polymer battery packs
- Game consoles
- PC motherboards
- USB port protection - USB 2.0, 3.0 & OTG
- Mobile phones
- Digital cameras

## MF-USML Series - Low Ohmic PTC Resettable Fuses

### Electrical Characteristics

Model	V max. Volts	I max. Amps	I <sub>hold</sub>	I <sub>trip</sub>	Resistance		Max. Time To Trip		Tripped Power Dissipation
			Amperes at 23 °C		Ohms at 23 °C		Amperes at 23 °C	Seconds at 23 °C	Watts at 23 °C
			Hold	Trip	R <sub>Min.</sub>	R <sub>1Max.</sub>			Typ.
MF-USML175	6	50	1.75	3.50	0.0060	0.0400	8.00	2.50	0.8
MF-USML190	6	50	1.90	4.90	0.0060	0.0300	9.50	3.00	0.8
MF-USML200	6	50	2.00	4.00	0.0050	0.0300	8.00	3.00	0.8
MF-USML230	6	50	2.30	4.60	0.0045	0.0240	8.00	3.50	0.8
MF-USML250	6	50	2.50	5.00	0.0045	0.0220	8.00	3.50	0.8
MF-USML270	6	50	2.70	5.40	0.0040	0.0200	8.00	4.00	0.8
MF-USML300	6	50	3.00	6.00	0.0040	0.0180	8.00	4.00	0.8
MF-USML350	6	50	3.50	7.00	0.0030	0.0180	17.50	2.00	0.8
MF-USML380	6	50	3.80	8.00	0.0020	0.0160	19.00	2.00	0.8
MF-USML400	6	50	4.00	8.00	0.0015	0.0155	20.00	2.00	0.8
MF-USML450	6	50	4.50	9.00	0.0010	0.0150	22.50	2.00	0.8
MF-USML500	6	50	5.00	10.00	0.0010	0.0145	25.00	2.00	0.8
MF-USML600	6	50	6.00	12.00	0.0010	0.0140	30.00	2.00	0.8
MF-USML650	6	50	6.50	13.00	0.0010	0.0140	32.50	2.00	0.8
MF-USML700	6	50	7.00	14.00	0.0010	0.0135	35.00	2.00	0.8

### Environmental Characteristics

Operating Temperature.....	-40 °C to +85 °C
Storage Condition	
Before Opening .....	+40 °C max. / 70 % RH max.
After Opening.....	+40 °C max. / 10 % RH max.
Floor Condition After Opening .....	Consumption within 4 weeks at floor condition +30 °C max. / 60 % RH max.
Passive Aging .....	+85 °C, 1000 hours..... ±10 % typical resistance change
Humidity Aging.....	+85 °C, 85 % R.H. 100 hours ..... ±15 % typical resistance change
Thermal Shock .....	+85 °C to -40 °C, 20 times..... ±30 % typical resistance change
Solvent Resistance.....	MIL-STD-202, Method 215 ..... No change
Vibration .....	MIL-STD-883C, Method 2007.1..... No change
	Condition A
Moisture Sensitivity Level (MSL) .....	<a href="#">See Note</a>
ESD Classification - HBM.....	Class 6

### Test Procedures And Requirements

Test	Test Conditions	Accept/Reject Criteria
Visual/Mech.....	Verify dimensions and materials.....	Per MF physical description
Resistance.....	In still air @ 23 °C.....	R <sub>min</sub> ≤ R ≤ R <sub>1max</sub>
Time to Trip.....	At specified current, V <sub>max</sub> , 23 °C.....	T ≤ max. time to trip (seconds)
Hold Current.....	30 min. at I <sub>hold</sub> .....	No trip
Trip Cycle Life.....	V <sub>max</sub> , I <sub>max</sub> , 100 cycles.....	No arcing or burning
Trip Endurance.....	V <sub>max</sub> , 48 hours.....	No arcing or burning
Solderability.....	245 °C ± 5 °C, 5 seconds.....	95 % min. coverage
UL File Number .....	E174545	
TÜV Certificate Number .....	<a href="#">R 50302873</a>	



**WARNING Cancer and Reproductive Harm**  
[www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)

\* RoHS Directive 2002/95/EC Jan. 27, 2003 including annex and RoHS Recast 2011/65/EU June 8, 2011.

\*\*Bourns considers a product to be "halogen free" if (a) the Bromine (Br) content is 900 ppm or less; (b) the Chlorine (Cl) content is 900 ppm or less; and (c) the total Bromine (Br) and Chlorine (Cl) content is 1500 ppm or less.

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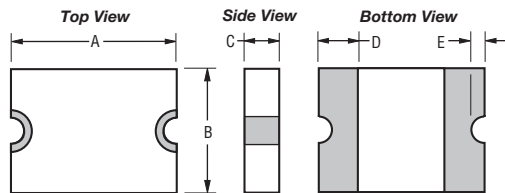
# MF-USML Series - Low Ohmic PTC Resettable Fuses

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## Product Dimensions

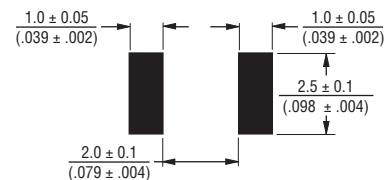
Model	A		B		C		D	E	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Min.	Max.
MF-USML175	3.00 (0.118)	3.43 (0.135)	2.35 (0.093)	2.80 (0.110)	0.30 (0.012)	0.60 (0.024)	0.25 (0.010)	0.05 (0.002)	0.45 (0.018)
MF-USML190									
MF-USML200									
MF-USML230									
MF-USML250									
MF-USML270									
MF-USML300									
MF-USML350	3.00 (0.118)	3.43 (0.135)	2.35 (0.093)	2.80 (0.110)	0.60 (0.024)	1.20 (0.047)	0.25 (0.010)	0.05 (0.002)	0.45 (0.018)
MF-USML380									
MF-USML400									
MF-USML450									
MF-USML500									
MF-USML600									
MF-USML650									
MF-USML700									

DIMENSIONS:  $\frac{\text{MM}}{(\text{INCHES})}$



Terminal material:  
ENIG-plated terminals

### Recommended Pad Layout



## Packaging Specifications

MF-USML175~MF-USML400 = 5000 pcs. per reel  
MF-USML450~MF-USML700 = 3500 pcs. per reel

## Thermal Derating Table - $I_{hold}$ (Amps)

Model	Ambient Operating Temperature								
	-40 °C	-20 °C	0 °C	23 °C	40 °C	50 °C	60 °C	70 °C	85 °C
MF-USML175	2.57	2.33	2.07	1.75	1.49	1.34	1.24	1.00	0.88
MF-USML190	2.80	2.55	2.25	1.90	1.60	1.46	1.35	1.09	0.95
MF-USML200	2.94	2.65	2.35	2.00	1.70	1.53	1.42	1.14	1.00
MF-USML230	3.40	3.17	2.74	2.30	1.94	1.72	1.60	1.30	1.15
MF-USML250	3.70	3.35	2.95	2.50	2.10	1.90	1.75	1.40	1.25
MF-USML270	3.98	3.60	3.18	2.70	2.28	2.03	1.90	1.52	1.35
MF-USML300	4.41	3.99	3.54	3.00	2.55	2.30	2.13	1.71	1.50
MF-USML350	5.10	4.65	4.13	3.50	2.98	2.65	2.50	2.00	1.75
MF-USML380	5.59	5.05	4.48	3.80	3.23	2.95	2.70	2.17	1.90
MF-USML400	5.80	5.25	4.70	4.00	3.40	3.10	2.80	2.28	2.00
MF-USML450	6.30	5.65	4.95	4.50	3.83	3.40	2.95	2.50	2.05
MF-USML500	7.00	6.25	5.50	5.00	4.25	3.75	3.25	2.75	2.25
MF-USML600	8.40	7.50	6.60	6.00	5.10	4.50	3.90	3.30	2.65
MF-USML650	9.10	8.15	7.15	6.50	5.50	4.90	4.25	3.60	2.85
MF-USML700	9.80	8.75	7.70	7.00	5.95	5.25	4.55	3.85	3.05

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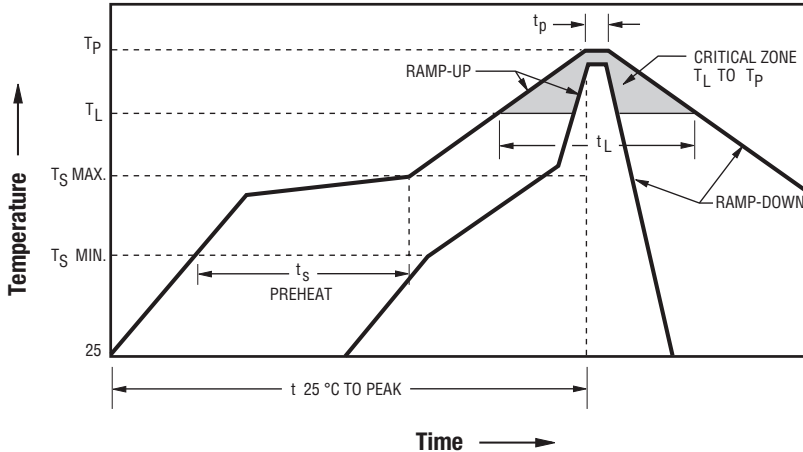
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# MF-USML Series - Low Ohmic PTC Resettable Fuses

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## Solder Reflow Recommendations



### Notes:

- MF-USML models cannot be wave soldered or hand soldered. Please contact Bourns for soldering recommendations.
- All temperatures refer to topside of the package, measured on the package body surface.
- If reflow temperatures exceed the recommended profile, devices may not meet the published specifications.
- Compatible with Pb and Pb-free solder reflow profiles.
- Excess solder may cause a short circuit, especially during hand soldering. Please refer to the Multifuse® Polymer PTC Soldering Recommendation guidelines.

Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate ( $T_{smax}$ to $T_p$ )	3 °C / second max.
PREHEAT: Temperature Min. ( $T_{smin}$ ) Temperature Max. ( $T_{smax}$ ) Time ( $T_{smin}$ to $T_{smax}$ ) (ts)	150 °C 200 °C 60~180 seconds
TIME MAINTAINED ABOVE: Temperature ( $T_L$ ) Time ( $t_L$ )	217 °C 60~150 seconds
Peak Temperature ( $T_p$ )	260 °C
Time within 5 °C of Actual Peak Temperature ( $t_p$ )	20~40 seconds
Ramp-Down Rate	6 °C / second max.
Time 25 °C to Peak Temperature	8 minutes max.

### How to Order

**MF - USML 175 - 2**

Multifuse® Product Designator  
Series  
USML = 1210 Low-Ohmic Surface Mount Component  
Hold Current, Ihold  
175 - 700 (1.75 - 7.00 Amps)  
Packaging  
Packaged per EIA 481  
-2 = Tape and Reel

### Typical Part Marking

Represents total content. Layout may vary.

PART IDENTIFICATION:  
MF-USML175 = U17  
MF-USML190 = U19  
MF-USML200 = U20  
MF-USML230 = U23  
MF-USML250 = U25  
MF-USML270 = U27  
MF-USML300 = U30  
MF-USML350 = U35  
MF-USML380 = U38  
MF-USML400 = U40  
MF-USML450 = U45  
MF-USML500 = U50  
MF-USML600 = U60  
MF-USML650 = U65  
MF-USML700 = U70

MANUFACTURING DATE CODE IS LOCATED ON PACKING LABEL.

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### Asia-Pacific:

Tel: +886-2 2562-4117  
Email: asiacus@bourns.com

### Europe:

Tel: +36 88 885 877  
Email: eurocus@bourns.com

### The Americas:

Tel: +1-951 781-5500  
Email: americus@bourns.com  
[www.bourns.com](http://www.bourns.com)

MF-USML SERIES, REV. I, 02/19

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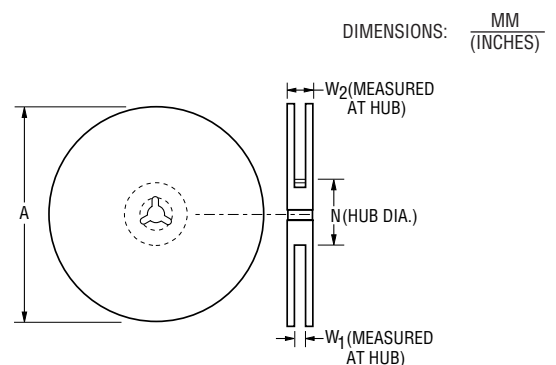
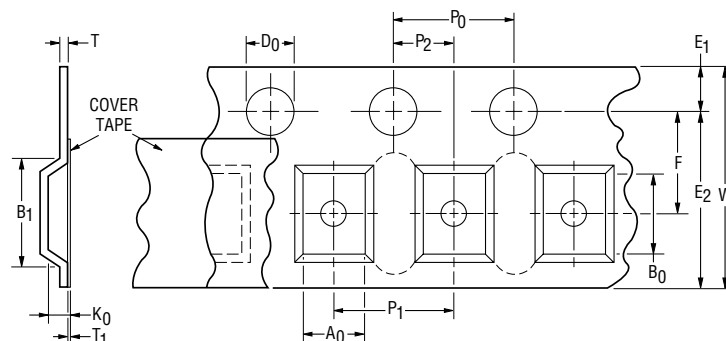
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# MF-USML Series - Low Ohmic PTC Resettable Fuses

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Tape Dimensions	MF-USML Series per EIA 481
W	$12.0 \pm 0.3$ (0.472 $\pm$ 0.012)
P <sub>0</sub>	$4.0 \pm 0.1$ (0.157 $\pm$ 0.004)
P <sub>1</sub>	$4.0 \pm 0.1$ (0.157 $\pm$ 0.004)
P <sub>2</sub>	$2.0 \pm 0.05$ (0.079 $\pm$ 0.002)
A <sub>0</sub>	$2.9 \pm 0.10$ (0.114 $\pm$ 0.004)
B <sub>0</sub>	$3.50 \pm 0.10$ (0.138 $\pm$ 0.004)
B <sub>1</sub> max.	$4.5$ (0.177)
D <sub>0</sub>	$1.5 + 0.1/-0.0$ (0.059 + 0.004/-0)
F	$5.5 \pm 0.05$ (0.216 + 0.002)
E <sub>1</sub>	$1.75 \pm 0.10$ (0.069 $\pm$ 0.004)
E <sub>2</sub> typ.	$10.25$ (0.404)
T max.	$0.6$ (0.024)
T <sub>1</sub> max.	$0.1$ (0.004)
K <sub>0</sub> (MF-USML175~MF-USML400)	$0.65 \pm 0.10$ (0.026 $\pm$ 0.004)
K <sub>0</sub> (MF-USML450~MF-USML700)	$1.10 \pm 0.10$ (0.043 $\pm$ 0.004)
Leader min.	$390$ (15.35)
Trailer min.	$160$ (6.30)
<b>Reel Dimensions</b>	
A max.	$185$ (7.283)
N min.	$50$ (1.97)
W <sub>1</sub>	$12.4 + 1/-0$ (0.488 + 0.039/-0)
W <sub>2</sub> max.	$15.4$ (0.606)



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**Application Notice**

- Users are responsible for independent and adequate evaluation of Bourns® Multifuse® Polymer PTC devices in the user's application, including the PPTC device characteristics stated in the applicable data sheet.
- Polymer PTC devices must not be allowed to operate beyond their stated maximum ratings. Operation in excess of such maximum ratings could result in damage to the PTC device and possibly lead to electrical arcing and/or fire. Circuits with inductance may generate a voltage above the rated voltage of the polymer PTC device and should be thoroughly evaluated within the user's application during the PTC selection and qualification process.
- Polymer PTC devices are intended to protect against adverse effects of temporary overcurrent or overtemperature conditions up to rated limits and are not intended to serve as protective devices where overcurrent or overvoltage conditions are expected to be repetitive or prolonged.
- In normal operation, polymer PTC devices experience thermal expansion under fault conditions. Thus, a polymer PTC device must be protected against mechanical stress, and must be given adequate clearance within the user's application to accommodate such thermal expansion. Rigid potting materials or fixed housings or coverings that do not provide adequate clearance should be thoroughly examined and tested by the user, as they may result in the malfunction of polymer PTC devices if the thermal expansion is inhibited.
- Exposure to lubricants, silicon-based oils, solvents, gels, electrolytes, acids, and other related or similar materials may adversely affect the performance of polymer PTC devices.
- Aggressive solvents may adversely affect the performance of polymer PTC devices. Conformal coating, encapsulating, potting, molding, and sealing materials may contain aggressive solvents including but not limited to xylene and toluene, which are known to cause adverse effects on the performance of polymer PTCs. Such aggressive solvents must be thoroughly cured or baked to ensure their complete removal from polymer PTCs to minimize the possible adverse effect on the device.
- Recommended storage conditions should be followed at all times. Such conditions can be found on the applicable data sheet and on the Multifuse® Polymer PTC Moisture/Reflow Sensitivity Classification (MSL) note:  
[https://www.bourns.com/docs/RoHS-MSL/msl\\_mf.pdf](https://www.bourns.com/docs/RoHS-MSL/msl_mf.pdf)

MFAN 12/18

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Bourns® products are not recommended, authorized or intended for use in nuclear, lifesaving, life-critical or life-sustaining applications, nor in any other applications where failure or malfunction may result in personal injury, death, or severe property or environmental damage. Unless expressly and specifically approved in writing by two authorized Bourns representatives on a case-by-case basis, use of any Bourns® products in such unauthorized applications might not be safe and thus is at the user's sole risk. Life-critical applications include devices identified by the U.S. Food and Drug Administration as Class III devices and generally equivalent classifications outside of the United States.

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