

Features:

- Thin film technology for precision and stability
- Excellent power to size ratio
- Outstanding pulse handling
- Excellent overall stability
- Sn termination on Ni barrier layer
- Tight tolerance down to $\pm 0.1\%$
- Extremely low TCR down to $\pm 5 \text{ ppm}/^\circ\text{C}$
- High power rating up to 1W
- SMD enabled structure
- Part is inherently anti-sulfur
- AEC-Q200 compliant
- 100% RoHS compliant and lead free without exemption
- Halogen free
- REACH compliant



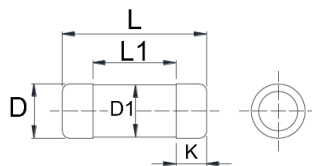
| Electrical Specifications | | | | | | | | | |
|---------------------------|--------------|------------------------------|--|---|--------------|-------------------------------|-----------|------------|----|
| Type/Code | Package Size | Power Rating (Watts) @ 70 °C | Maximum Working Voltage ⁽¹⁾ | Maximum Overload Voltage ⁽²⁾ | TCR (ppm/°C) | Ohmic Range (Ω) and Tolerance | | | |
| | | | | | | 0.1% | 0.5% | 1% | 5% |
| MLFA13 ⁽³⁾ | 0102 | 0.3 Jumper: 2 A | 200 | 400 | ± 50 | - | 1 - 1M | | |
| | | | | | ± 100 | - | 1 - 1M | | |
| | | | | | - | 0Ω (< 15mΩ) | | | |
| MLFA25 | 0204 | 0.4 Jumper: 3 A | 200 | 400 | ± 5 | 10 - 332K | - | | |
| | | | | | ± 15 | 10 - 300K | | | |
| | | | | | ± 25 | 10 - 1M | 10 - 3.4M | 1 - 3.4M | |
| | | | | | ± 50 | 10 - 1M | 1 - 3.4M | 0.2 - 3.4M | |
| | | | | | ± 100 | - | | 0.1 - 1M | |
| | | | | | - | 0Ω (< 15mΩ) | | | |
| MLFA1 | 0207 | 1 Jumper: 5 A | 350 | 700 | ± 5 | 10 - 332K | - | | |
| | | | | | ± 15 | 10 - 300K | | | |
| | | | | | ± 25 | 10 - 1M | 10 - 3.4M | 1 - 3.4M | |
| | | | | | ± 50 | 10 - 1M | 1 - 3.4M | 0.2 - 3.4M | |
| | | | | | ± 100 | - | | 0.1 - 1M | |
| | | | | | - | 0Ω (15mΩ) | | | |

⁽¹⁾ Working Voltage = $\sqrt{(P \cdot R)}$ or Max. Operating Voltage listed above, whichever is lower.

⁽²⁾ Overload Voltage = $2.5 \cdot \sqrt{(P \cdot R)}$ or Max. Overload Voltage listed above, whichever is lower.

⁽³⁾ Lower TCR with lower Power Ratings may be available - contact Stackpole
RCWV (Rated Continuous Working Voltage) = $\sqrt{(P \cdot R)}$ or Max Operating Voltage, whichever is lower.

Mechanical Specifications



| Type/Code | Weight (g) (1000 pc) | L Body Length | L1 (min.) Inner Body Length | D Body Diameter | D1 Middle Body Dia. | K Termination | Unit |
|-----------|----------------------|-------------------|--------------------------------|--------------------|------------------------|-------------------|--------|
| MLFA13 | 7.7 | 0.087 \pm 0.004 | 0.043 | 0.043 \pm 0.004 | 0.043 +0/-0.006 | 0.018 \pm 0.002 | inches |
| | | 2.20 \pm 0.10 | 1.10 | 1.10 \pm 0.10 | 1.10 +0/-0.15 | 0.45 \pm 0.05 | mm |
| MLFA25 | 18.7 | 0.138 \pm 0.008 | 0.067 | 0.055 \pm 0.006 | 0.055 +0/-0.008 | 0.031 \pm 0.004 | inches |
| | | 3.50 \pm 0.20 | 1.70 | 1.40 \pm 0.15 | 1.40 +0/-0.2 | 0.80 \pm 0.10 | mm |
| MLFA1 | 80.9 | 0.232 \pm 0.008 | 0.114 | 0.087 \pm 0.008 | 0.087 +0/-0.008 | 0.051 \pm 0.004 | inches |
| | | 5.90 \pm 0.20 | 2.90 | 2.20 \pm 0.20 | 2.20 +0/-0.2 | 1.30 \pm 0.10 | mm |

| Performance Characteristics | | | | |
|--|--|--|---|---------|
| Test | Test Method | Test Condition | Test Specification | |
| | | | 5% and below | Jumper |
| Temperature Coefficient of Resistance (T.C.R.) | JIS-C-5201-1 4.8 IEC-60115-1 4.8 | At 25°C / - 55°C and 25°C / + 125°C, 25°C is the reference temperature. 5ppm: At 25°C / -10°C and 25°C / +85°C, 25°C is the reference temperature | As specified | |
| Short Time Overload | JIS-C-5201-1 4.13 IEC-60115-1 4.13 | RCWV*2.5 or max. overload voltage whichever is lower for 5 seconds | 10 Ω - 270 KΩ: ± (0.1% + 0.01 Ω) < 10 Ω & > 270 KΩ: ± (0.15% + 0.01 Ω) MLFA13: ± (0.15% + 0.01 Ω) 5 ppm/°C: ± (0.05% + 0.01 Ω) | < 15 mΩ |
| Insulation Resistance | JIS-C-5201-1 4.6 IEC-60115-1 4.6 | Max. overload voltage for 1 minute | ≥10G | |
| Operational Life | MIL-STD-202 Method 108 | Condition D Steady State TA = 125°C at derated power. Measurement at 24 ± 4 hours after test conclusion. 5 ppm/°C: 70 ± 2°C, RCWV for 1000 hours with 1.5 hours "ON" and 0.5 hour "OFF" | 10 Ω - 270 KΩ: ± (0.25% + 0.01 Ω) <10 Ω & > 270 KΩ: ± (0.5% + 0.01 Ω) MLFA13: ± (0.5% + 0.01 Ω) | < 15 mΩ |
| Biased Humidity | MIL-STD-202 Method 103 | 1000 hours 85°C / 85% R.H. 10% of operating power | 10 Ω - 270 KΩ: ± (0.5% + 0.01 Ω) < 10 Ω & > 270 KΩ: ± (1% + 0.01 Ω) MLFA13: ± (2% + 0.01 Ω) | < 15 mΩ |
| High Temperature Exposure | MIL-STD-202 Method 108 | at +125°C / +155°C for 1000 hours | 10 Ω - 270 KΩ: ± (0.25% + 0.01 Ω) < 10 Ω & > 270 KΩ: ± (1% + 0.01 Ω) MLFA13: ± (1% + 0.01 Ω) | < 15 mΩ |
| Board Flex | AEC-Q200-005 | Bending once for 60 seconds with 2 mm | 10 Ω - 270 KΩ: ± (0.1% + 0.01 Ω) < 10 Ω & > 270 KΩ: ± (0.5% + 0.01 Ω) MLFA13: ± (0.5% + 0.01 Ω) | < 15 mΩ |
| Solderability | JIS-5201-1 4.17 IEC 60115-1 4.17 J-STD 002 | 245 ± 5°C for 3 seconds | 95% min. coverage | |
| Resistance to Soldering Heat | MIL-STD-202 Method 210 | 260 ± 5°C for 10 seconds | 10 Ω - 270 KΩ: ± (0.1% + 0.01 Ω) < 10 Ω & > 270 KΩ: ± 0.25% + 0.01 Ω) MLFA13: ± (0.25% + 0.01 Ω) 5 ppm/°C: ± (0.05% + 0.01 Ω) | < 15 mΩ |
| Voltage Proof | JIS-C-5201-1 4.7 IEC 60115-1 4.7 | 1.42 times max. operating voltage for 1 minute | No breakdown or flashover | |
| Leaching | JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1 | 260 ± 5°C for 30 seconds | Individual leaching area ≤ 5% Total leaching area ≤ 10% | |
| Temperature Cycling | JESD22 Method JA-104 | -55°C to + 125°C, 1000 cycles | 10 Ω - 270 KΩ: ± (0.25% + 0.01 Ω) < 10 Ω & > 270 KΩ: ± 0.5% + 0.01 Ω) MLFA13: ± (1% + 0.01 Ω) | < 15 mΩ |
| Mechanical Shock | MIL-STD-202 Method 213 | Wave Form: Tolerance for half sine shock pulse. Peak value is 100 g's. Normal duration (D) is 6. | ± (0.25% + 0.01 Ω) < 15 mΩ | |
| Vibration | MIL-STD-202 Method 204 | 5 g's for 20 minutes., 12 cycles each of 3 orientations 10-2000 Hz | ± (0.5% + 0.01 Ω) < 15 mΩ | |
| ESD | AEC-Q200-002 | Human body, 2 KV | ± (0.5% + 0.05 Ω) < 15 mΩ | |
| Resistance to Solvents | MIL-STD-202 Method 215 | Add aqueous wash chemical - OKEM clean or equivalent. Do not use banned solvents. | No visible damage on appearance and marking. | |
| Terminal Strength | AEC-Q200-006 | Force of 1.8 Kg for 60 seconds | No breakage | |
| Flammability | UL-94 | V - 0 or V - 1 are acceptable. Electrical test not required. | No ignition of the tissue paper or scorching of the pinewood board | |

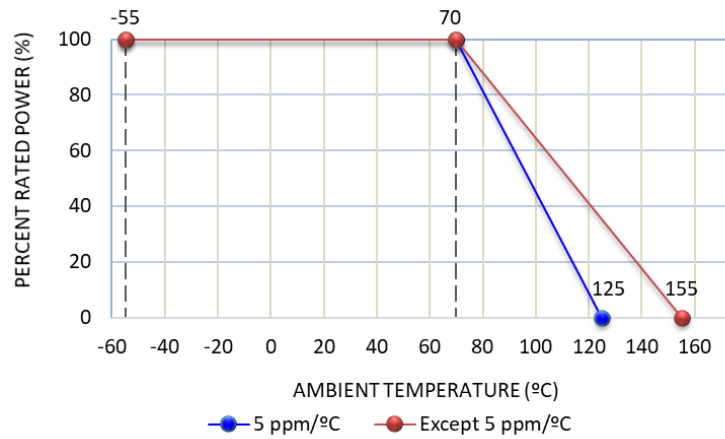
RCWV (rated continuous working voltage) = $\sqrt{P \cdot R}$ or max. operating voltage whichever is lower

Storage temperature: 15 ~ 28°C. Humidity < 80% R.H.

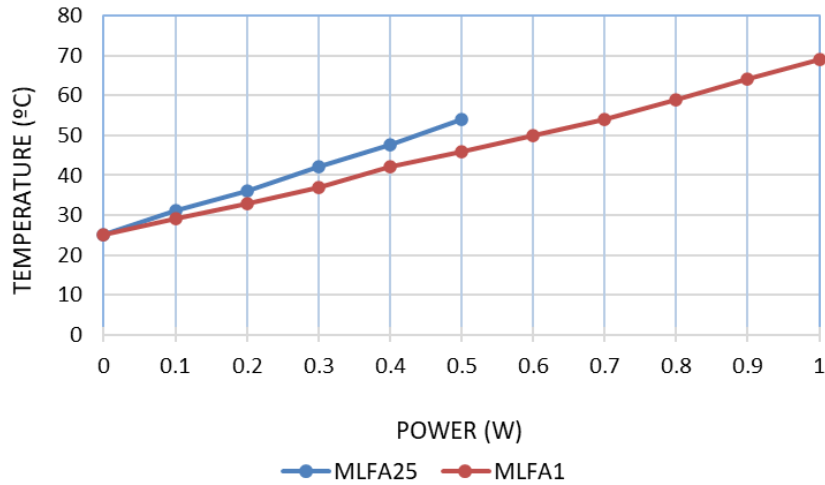
Operating temperature range is -55°C to +125°C for 5 ppm/°C

Operating temperature range is -55°C to +155°C for all others except 5 ppm/°C

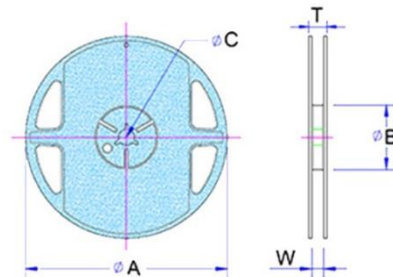
Power Derating Curve:



Hot Spot Temperature:

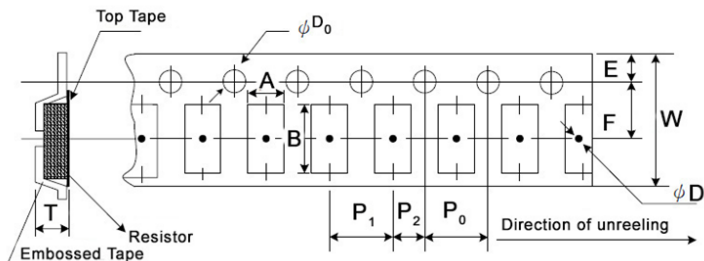


Reel Specifications



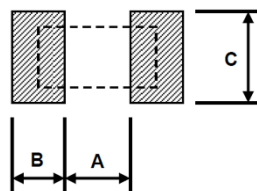
| Type/Code | Reel Diameter | øA | øB | øC | W | T | Unit |
|-----------|---------------|---------------|---------------|---------------|---------------|---------------|--------|
| MLFA13 | 0.276 | 7.028 ± 0.059 | 2.362 ± 0.039 | 0.512 ± 0.008 | 0.354 ± 0.020 | 0.492 ± 0.020 | inches |
| | 7.00 | 178.50 ± 1.50 | 60.00 ± 1.00 | 13.00 ± 0.20 | 9.00 ± 0.50 | 12.50 ± 0.50 | mm |
| MLFA25 | 0.276 | 7.028 ± 0.059 | 2.362 ± 0.039 | 0.512 ± 0.008 | 0.354 ± 0.020 | 0.492 ± 0.020 | inches |
| | 7.00 | 178.50 ± 1.50 | 60.00 ± 1.00 | 13.00 ± 0.20 | 9.00 ± 0.50 | 12.50 ± 0.50 | mm |
| MLFA1 | 0.276 | 7.028 ± 0.059 | 2.362 ± 0.039 | 0.512 ± 0.020 | 0.512 ± 0.020 | 0.610 ± 0.020 | inches |
| | 7.00 | 178.50 ± 1.50 | 60.00 ± 1.00 | 13.00 ± 0.50 | 13.00 ± 0.50 | 15.50 ± 0.50 | mm |

Packaging Specifications - Embossed Plastic Tape



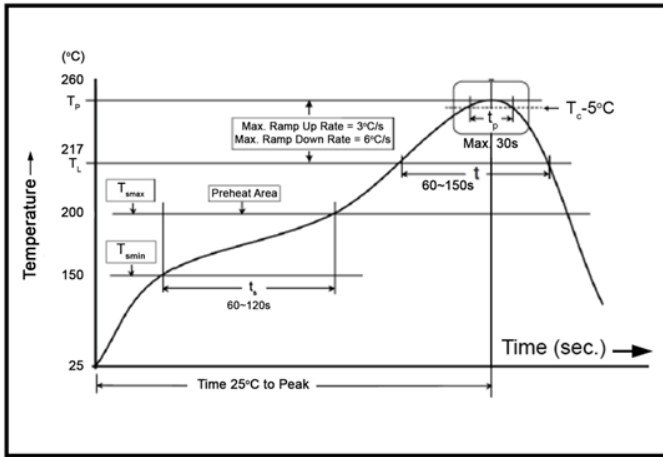
| Type/Code | A | B | W | E | F | P0 | Unit |
|-----------|---------------|---------------|---------------|---------------|---------------|---------------|--------|
| MLFA13 | 0.051 ± 0.004 | 0.094 ± 0.004 | 0.315 ± 0.004 | 0.069 ± 0.004 | 0.138 ± 0.002 | 0.157 ± 0.004 | inches |
| | 1.30 ± 0.10 | 2.40 ± 0.10 | 8.00 ± 0.10 | 1.75 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | mm |
| MLFA25 | 0.061 ± 0.004 | 0.144 ± 0.004 | 0.315 ± 0.004 | 0.069 ± 0.004 | 0.138 ± 0.002 | 0.157 ± 0.004 | inches |
| | 1.55 ± 0.10 | 3.65 ± 0.10 | 8.00 ± 0.10 | 1.75 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | mm |
| MLFA1 | 0.094 ± 0.004 | 0.242 ± 0.004 | 0.472 ± 0.004 | 0.069 ± 0.004 | 0.217 ± 0.002 | 0.157 ± 0.004 | inches |
| | 2.40 ± 0.10 | 6.15 ± 0.10 | 12.00 ± 0.10 | 1.75 ± 0.10 | 5.50 ± 0.05 | 4.00 ± 0.10 | mm |
| Type/Code | P1 | P2 | D0 | D1 | T | Unit | |
| MLFA13 | 0.157 ± 0.004 | 0.079 ± 0.002 | 0.059 ± 0.004 | 0.035 min. | 0.059 ± 0.004 | inches | |
| | 4.00 ± 0.10 | 2.00 ± 0.05 | 1.50 ± 0.10 | 0.90 min. | 1.50 ± 0.10 | mm | |
| MLFA25 | 0.157 ± 0.004 | 0.079 ± 0.002 | 0.059 ± 0.004 | 0.035 min. | 0.071 ± 0.004 | inches | |
| | 4.00 ± 0.10 | 2.00 ± 0.05 | 1.50 ± 0.10 | 0.90 min. | 1.80 ± 0.10 | mm | |
| MLFA1 | 0.157 ± 0.004 | 0.079 ± 0.002 | 0.059 ± 0.004 | 0.055 min. | 0.106 ± 0.004 | inches | |
| | 4.00 ± 0.10 | 2.00 ± 0.05 | 1.50 ± 0.10 | 1.40 min. | 2.70 ± 0.10 | mm | |

Recommended Pad Layout

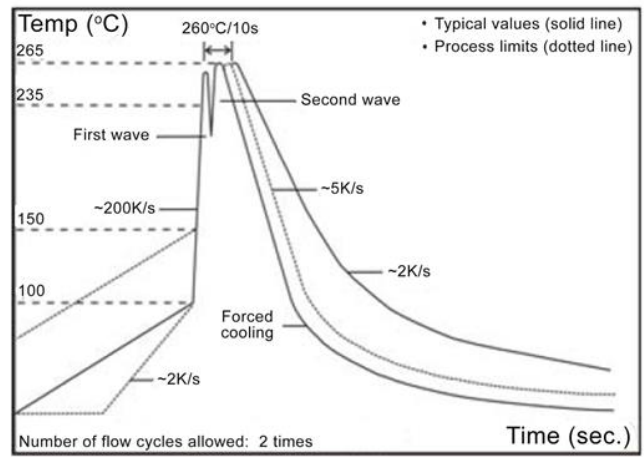


| Type/Code | A | B | C | Unit |
|-----------|-------|-------|-------|--------|
| MLFA13 | 0.039 | 0.031 | 0.059 | inches |
| | 1.00 | 0.80 | 1.50 | mm |
| MLFA25 | 0.063 | 0.047 | 0.063 | inches |
| | 1.60 | 1.20 | 1.60 | mm |
| MLFA1 | 0.118 | 0.067 | 0.094 | inches |
| | 3.00 | 1.70 | 2.40 | mm |

Soldering Condition:



IR Reflow Soldering



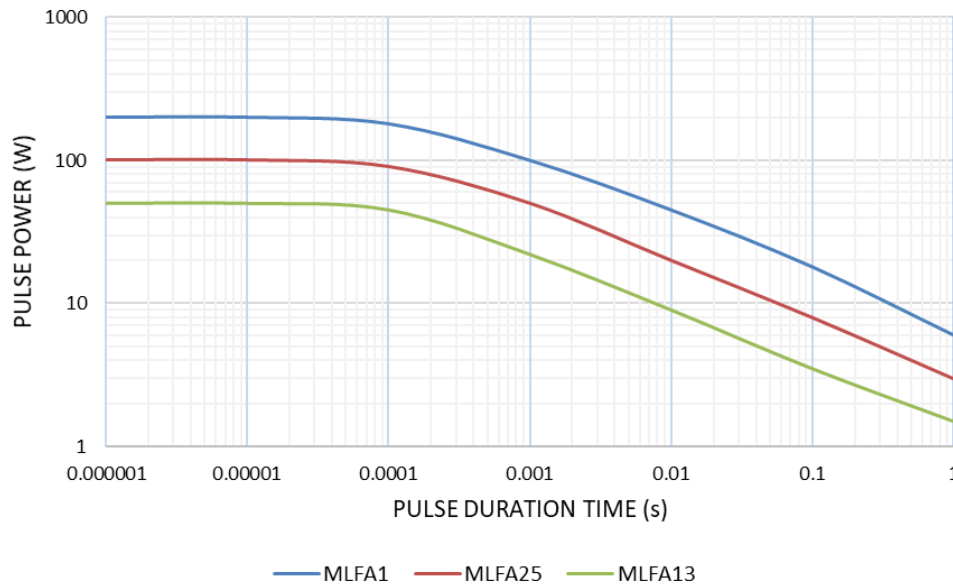
Wave Soldering (Flow Soldering)

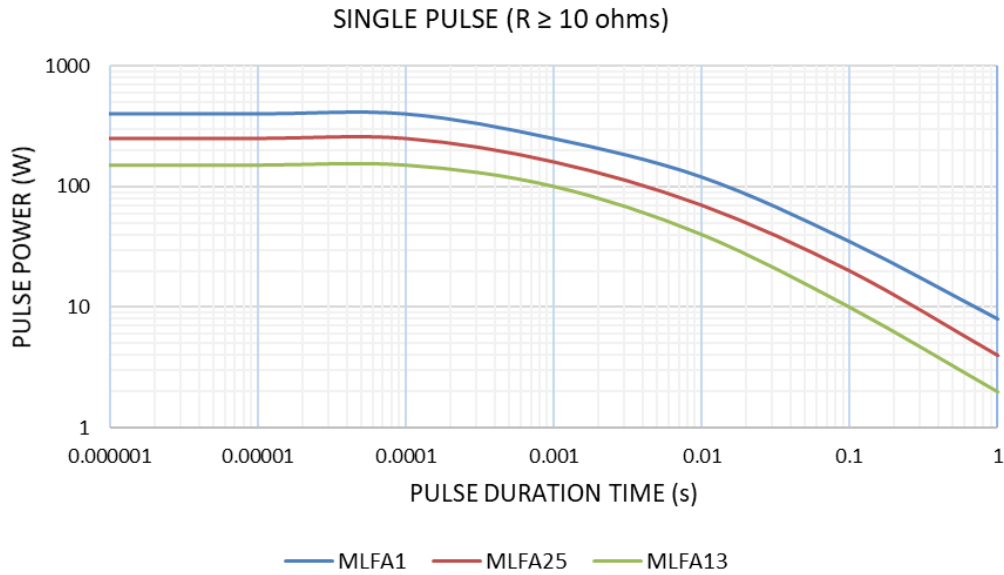
- (1) Time of IR reflow soldering at maximum temperature point 260°C: 10 seconds
- (2) Time of wave soldering at maximum temperature point 260°C: 10 seconds
- (3) Time of soldering iron at maximum temperature point 410°C: 5 seconds

Pulse Withstanding Capacity

The single impulse graph is the result of the impulse of rectangular shape applied. The limit of acceptance was a shift in resistance of less than 1% from the initial value. The power applied was subject to the restrictions of the maximum permissible impulse voltage graph shown.

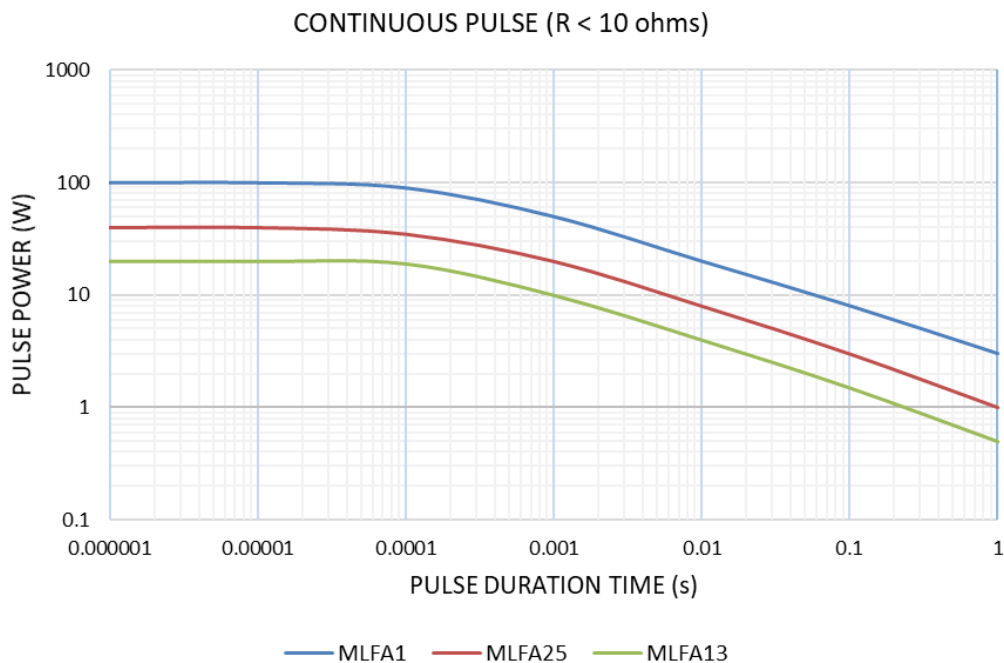
SINGLE PULSE (R < 10 ohms)

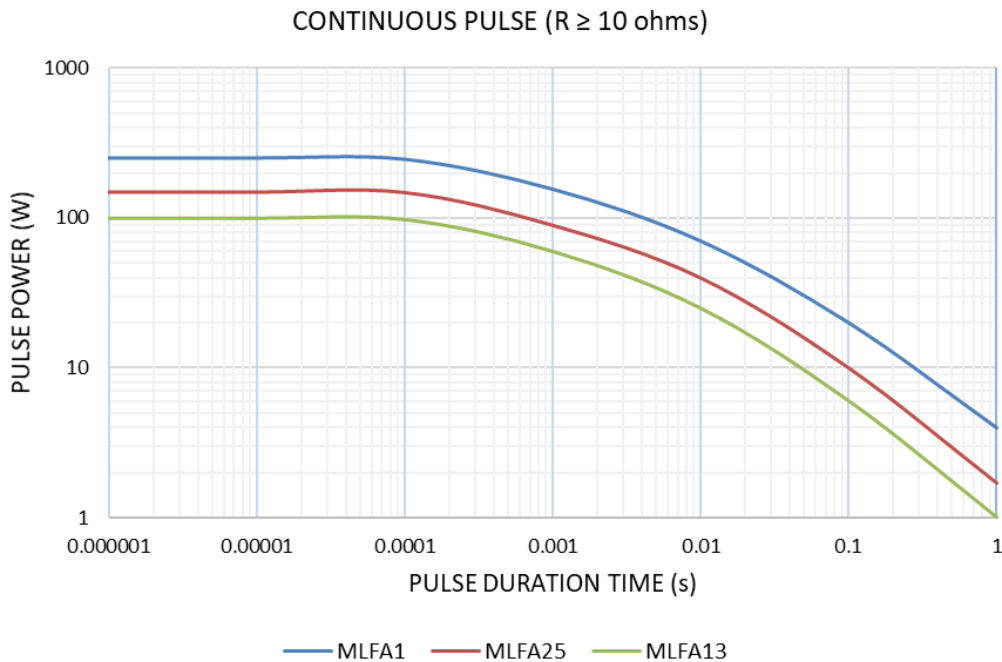




Continuous Pulse

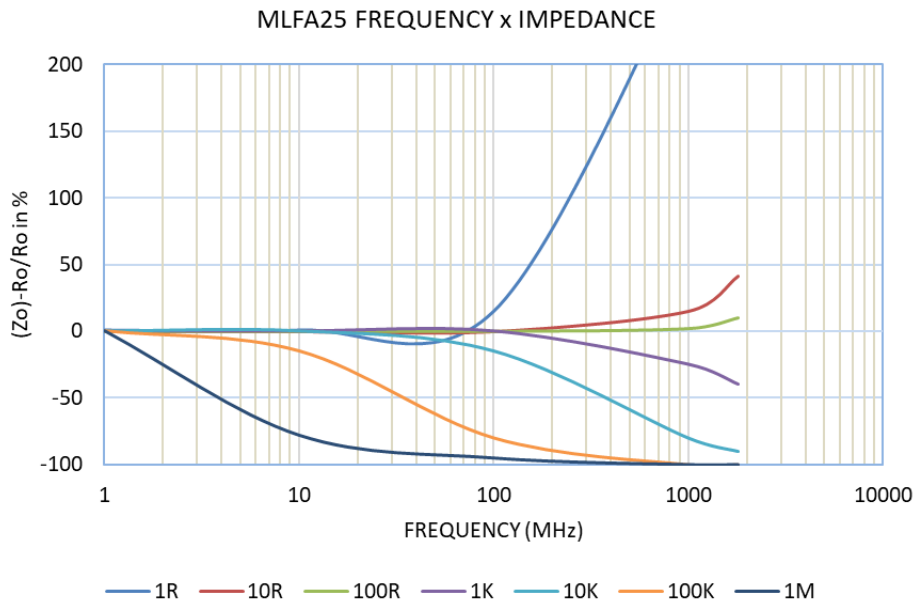
The continuous load graph was obtained by applying repetitive rectangular pulses where the pulse period was adjusted so that the average power dissipated in the resistor was equal to its rated power at 70°C. Again the limit of acceptance was a shift in resistance of less than 1% from the initial value.



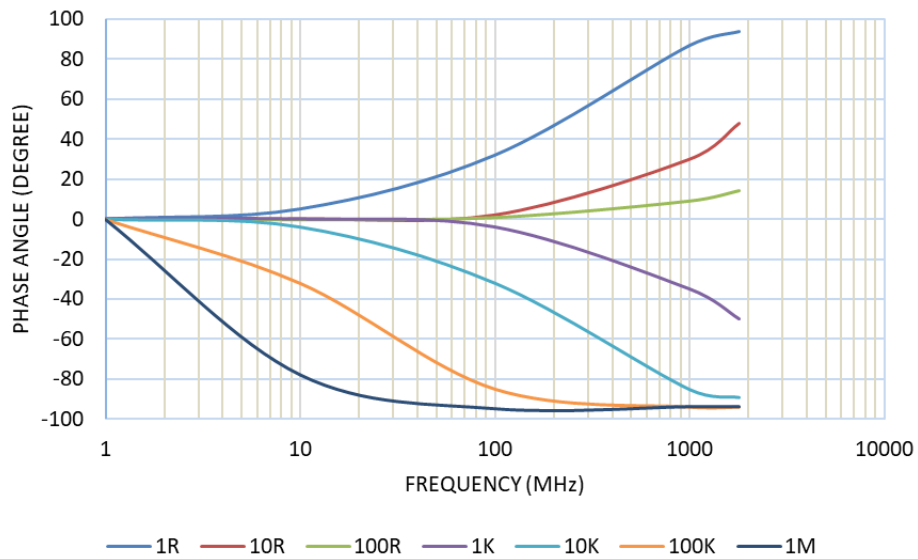


Frequency Behavior

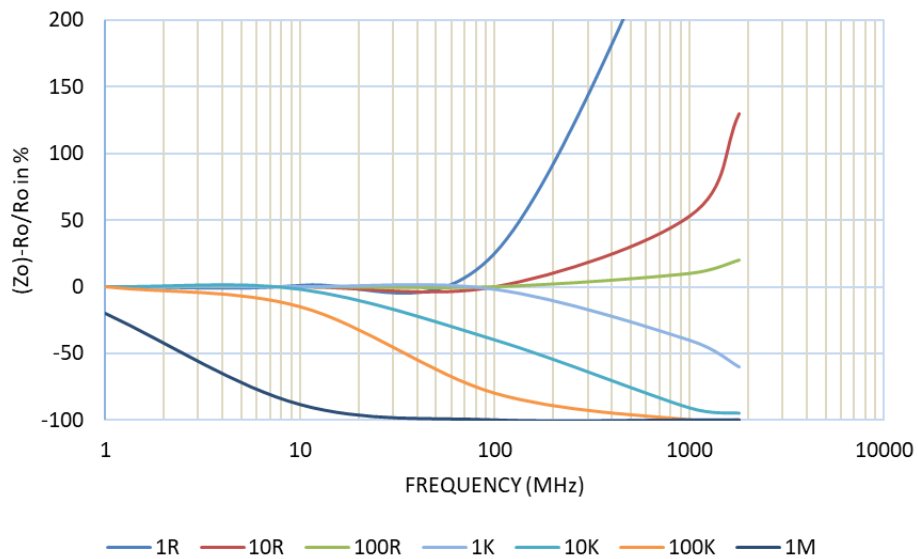
Resistors are designed to function according to Ohmic laws. This is basically true of resistors for frequencies up to 100 kHz. At higher frequencies, there is an additional contribution to the impedance by an ideal resistor switched in series with a coil and both switched parallel to a capacitor. The values of the capacitance and inductance are mainly determined by the dimensions of the terminations and the conductive path length. The environment surrounding components has a large influence on the behavior of the component on the printed-circuit board.

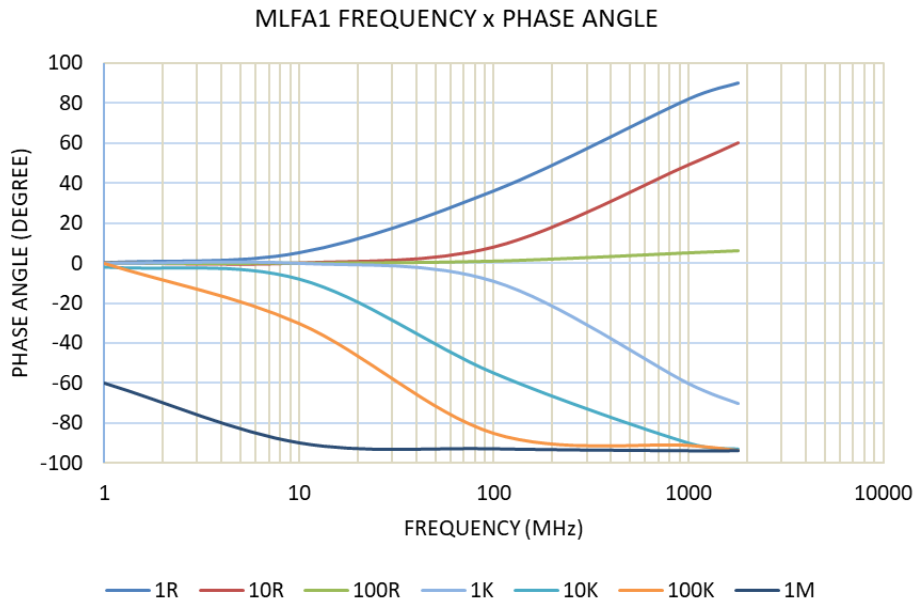


MLFA25 FREQUENCY x PHASE ANGLE



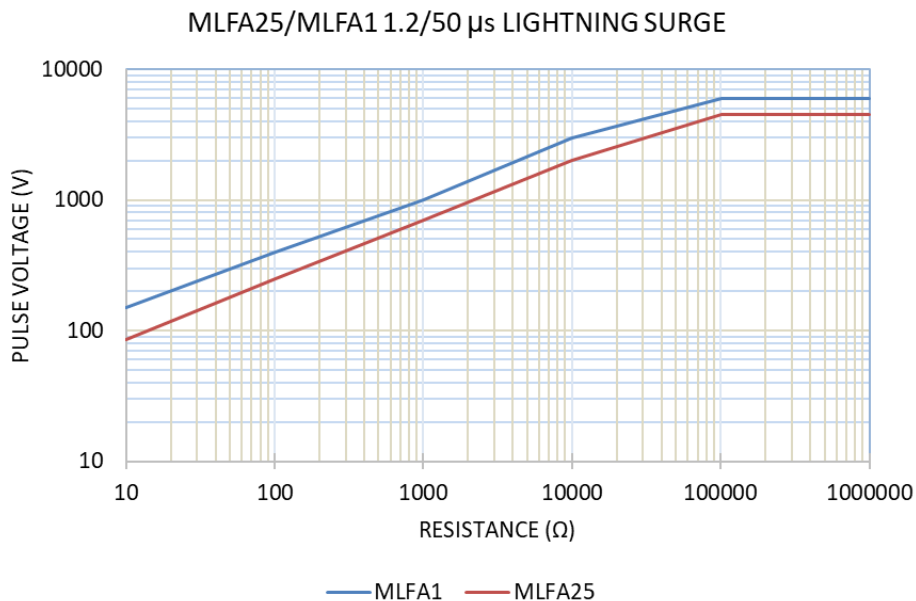
MLFA1 FREQUENCY x IMPEDANCE



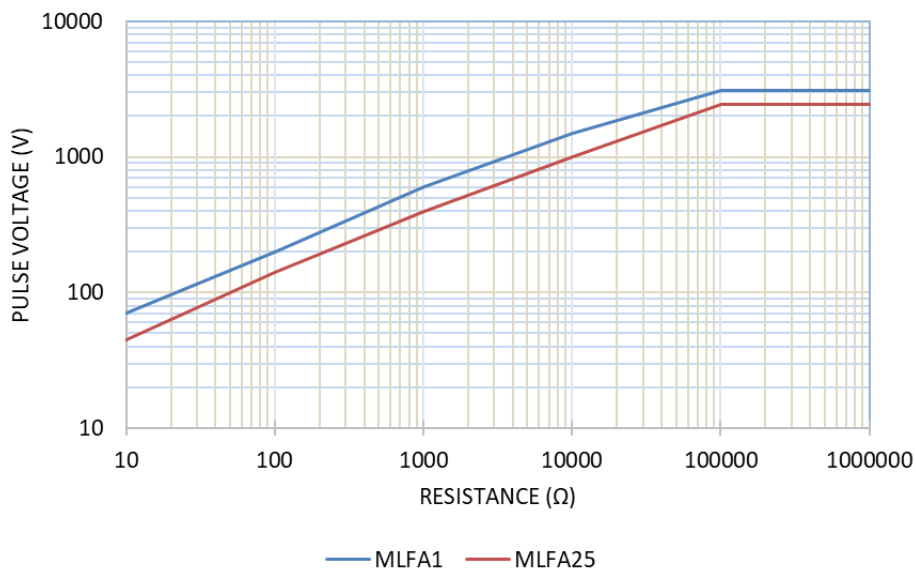


Lightning Surge

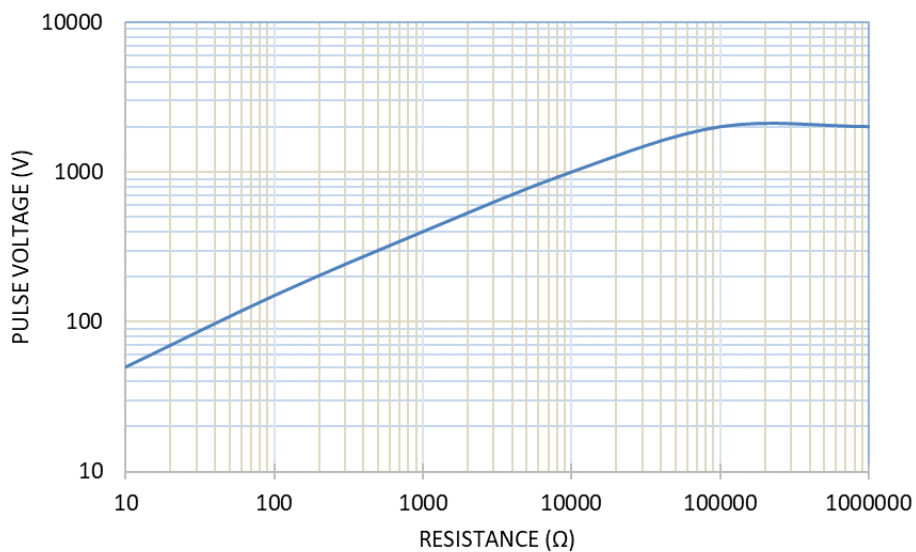
Resistors are tested in accordance with IEC 60 115-1 using both 1.2 / 50 μ s and 10 / 700 μ s pulse shapes. The limit of acceptance is a shift in resistance of less than 0.5% from the initial value.



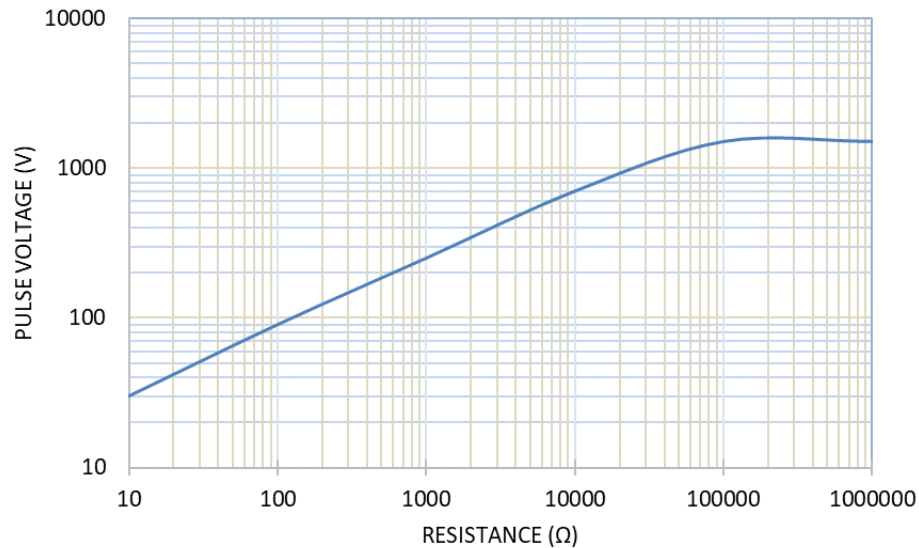
10/700 μ s LIGHTNING SURGE



MLFA13 1.2/50 μ s LIGHTNING SURGE



MLFA13 10/700 μs LIGHTNING SURGE



RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union’s directive regarding “Restrictions on Hazardous Substances” (RoHS 3). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

| RoHS Compliance Status | | | | | | |
|-------------------------|---|----------------------------|--------------------------------|-----------------------------------|--|---------------------------------------|
| Standard Product Series | Description | Package / Termination Type | Standard Series RoHS Compliant | Lead-Free Termination Composition | Lead-Free Mfg. Effective Date (Std Product Series) | Lead-Free Effective Date Code (YY/WW) |
| MLFA | Metal Film Melf Resistor (AEC-Q200 Qualified) | SMD | YES | 100% Matte Sn over Ni | Always | Always |

Conflict Metals” Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the “conflict region” of the eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

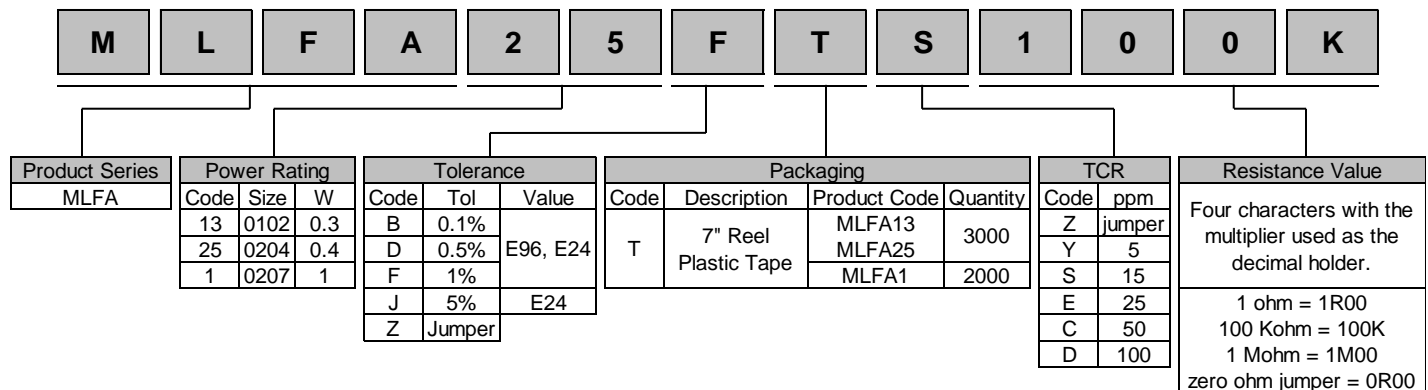
Compliance to “REACH”

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, “The Registration, Evaluation, Authorization and Restriction of Chemicals”, otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

Environmental Policy

It is the policy of Stackpole Electronics, Inc. (SEI) to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.

How to Order



Mouser Electronics

Authorized Distributor

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[MLFA1FTC4R30](#) [MLFA1FTC620R](#) [MLFA1FTC820K](#) [MLFA1JTD27K0](#) [MLFA1JTD330K](#) [MLFA1JTD3R60](#)
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[MLFA1FTC3R90](#) [MLFA1FTC910K](#) [MLFA1JTD130K](#) [MLFA1JTD18K0](#) [MLFA1JTD360R](#) [MLFA1JTD43R0](#)
[MLFA1JTD9R10](#) [MLFA25FTC1K00](#) [MLFA25FTC1R20](#) [MLFA25FTC20K0](#) [MLFA25FTC240R](#) [MLFA25FTC6K20](#)
[MLFA25FTC820R](#) [MLFA25FTC91K0](#) [MLFA25JTD2R20](#) [MLFA25JTD36R0](#) [MLFA25JTD560K](#) [MLFA25JTD910K](#)
[MLFA1FTC12K0](#) [MLFA1FTC2K40](#) [MLFA1FTC36K0](#) [MLFA1FTC43R0](#) [MLFA1FTC6R20](#) [MLFA1FTC9R10](#)
[MLFA1JTD150K](#) [MLFA1JTD20R0](#) [MLFA1JTD5R60](#) [MLFA25FTC10R0](#) [MLFA25FTC15K0](#) [MLFA25FTC220R](#)
[MLFA25FTC2R70](#) [MLFA25FTC47K0](#) [MLFA25FTC499K](#) [MLFA25FTC5K60](#) [MLFA25FTC5R60](#) [MLFA25FTC750R](#)
[MLFA25JTD3K30](#) [MLFA1FTC10K0](#) [MLFA1FTC240K](#) [MLFA1FTC240R](#) [MLFA1FTC300R](#) [MLFA1FTC3K90](#)
[MLFA1FTC4K30](#) [MLFA1FTC62R0](#) [MLFA1JTD110R](#) [MLFA1JTD16K0](#) [MLFA1JTD16R0](#) [MLFA1JTD1R60](#)
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[MLFA25FTC680K](#) [MLFA25JTD12R0](#) [MLFA25JTD33R0](#) [MLFA25JTD360K](#) [MLFA25JTD5K10](#) [MLFA25JTD6K80](#)
[MLFA25JTD6R20](#) [MLFA25JTD9K10](#) [MLFA1FTC100R](#) [MLFA1FTC15R0](#)