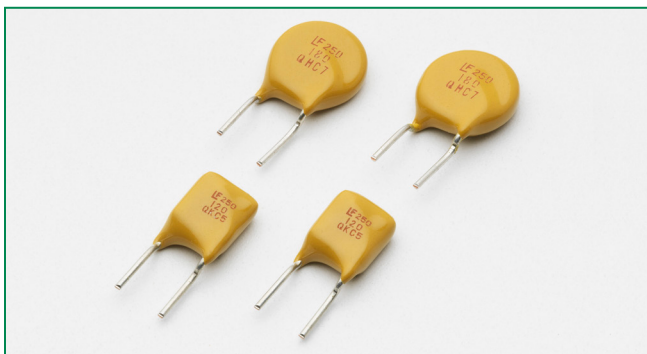


### 250R Series



#### Agency Approvals

| AGENCY                                                                            | AGENCY FILE NUMBER |
|-----------------------------------------------------------------------------------|--------------------|
|  | E183209            |
|  | R50120008          |

#### Description

The 250R Series is designed to protect against short duration high voltage fault currents (power cross or power induction surge) typically found in telecom applications (250Vrms). The series can be used to help telecom networking equipment meet the protection requirements specified in ITU K.20 and K.21.

#### Features

- 0.08 – 0.18 hold current range, 60VDC operating voltage
- 250VAC interrupt rating
- Fast time-to-trip
- Binned and sorted narrow resistance ranges available
- RoHS compliant, Lead-Free and Halogen-Free\*

#### Applications

- Customer Premises Equipment (CPE)
- Central Office (CO)/telecom centers
- LAN/WAN equipment
- Access equipment

#### Electrical Characteristics

| Part Number | $I_{hold}$<br>(A) | $I_{trip}$<br>(A) | $V_{max}$<br>$V_{int} / V_{op}$ | $I_{max}$<br>(A) | $P_d$<br>typ. (W) | Maximum Time To Trip |                | Resistance                |                           |                            | Agency Approvals                                                                      |                                                                                       |
|-------------|-------------------|-------------------|---------------------------------|------------------|-------------------|----------------------|----------------|---------------------------|---------------------------|----------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|             |                   |                   |                                 |                  |                   | Current<br>(A)       | Time<br>(Sec.) | $R_{min}$<br>( $\Omega$ ) | $R_{typ}$<br>( $\Omega$ ) | $R_{1max}$<br>( $\Omega$ ) |  |  |
| 250R080     | 0.08              | 0.16              | 250/60                          | 3                | 1                 | 0.35                 | 4.0            | 14                        | 22                        | 33                         | X                                                                                     | X                                                                                     |
| 250R080T    | 0.08              | 0.16              | 250/60                          | 3                | 1                 | 0.35                 | 4.0            | 15                        | 22                        | 33                         | X                                                                                     | X                                                                                     |
| 250R120     | 0.12              | 0.24              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 4                         | 8                         | 16                         | X                                                                                     | X                                                                                     |
| 250R120-RA  | 0.12              | 0.24              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 7                         | 9                         | 16                         | X                                                                                     | X                                                                                     |
| 250R120-RC  | 0.12              | 0.24              | 250/60                          | 3                | 1                 | 1                    | 3.0            | 5.4                       | 7.5                       | 14                         | X                                                                                     | X                                                                                     |
| 250R120-RF  | 0.12              | 0.24              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 6                         | 10.5                      | 16                         | X                                                                                     | X                                                                                     |
| 250R120-R1  | 0.12              | 0.24              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 6                         | 9                         | 16                         | X                                                                                     | X                                                                                     |
| 250R120-R2  | 0.12              | 0.24              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 8                         | 10.5                      | 16                         | X                                                                                     | X                                                                                     |
| 250R120-R3  | 0.12              | 0.24              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 8                         | 10                        | 16                         | X                                                                                     | X                                                                                     |
| 250R120T    | 0.12              | 0.24              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 7                         | 12                        | 16                         | X                                                                                     | X                                                                                     |
| 250R145     | 0.145             | 0.29              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 3                         | 6                         | 14                         | X                                                                                     | X                                                                                     |
| 250R145-RA  | 0.145             | 0.29              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 3                         | 5.5                       | 12                         | X                                                                                     | X                                                                                     |
| 250R145-RB  | 0.145             | 0.29              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 4.5                       | 6                         | 14                         | X                                                                                     | X                                                                                     |
| 250R145T    | 0.145             | 0.29              | 250/60                          | 3                | 1                 | 1                    | 2.5            | 5.4                       | 7.5                       | 14                         | X                                                                                     | X                                                                                     |
| 250R180     | 0.18              | 0.65              | 250/60                          | 10               | 1.8               | 1                    | 20             | 0.8                       | 2.2                       | 4                          | X                                                                                     | X                                                                                     |
| 250R180T    | 0.18              | 0.65              | 250/60                          | 10               | 1.8               | 1                    | 21             | 1.4                       | 3.9                       | 4.5                        | X                                                                                     | X                                                                                     |

Items with T at end of part number = pre-tripped device. See Part Ordering Number System section of this data sheet for additional information.

$I_{hold}$  = Hold current: maximum current device will pass without tripping in 20°C still air.

$I_{trip}$  = Trip current: minimum current at which the device will trip in 20°C still air.

$V_{int}$  = Maximum voltage the device can withstand without damage at rated current ( $I_{max}$ )

$V_{op}$  = The device regular operation voltage

$I_{max}$  = Maximum fault current device can withstand without damage at rated voltage ( $V_{max}$ )

$P_d$  = Power dissipated from device when in the tripped state at 20°C still air.

$R_{min}$  = Minimum resistance of device in initial (un-soldered) state.

$R_{typ}$  = Typical resistance of device in initial (un-soldered) state.

$R_{1max}$  = Maximum resistance of device at 20°C measured one hour after tripping.

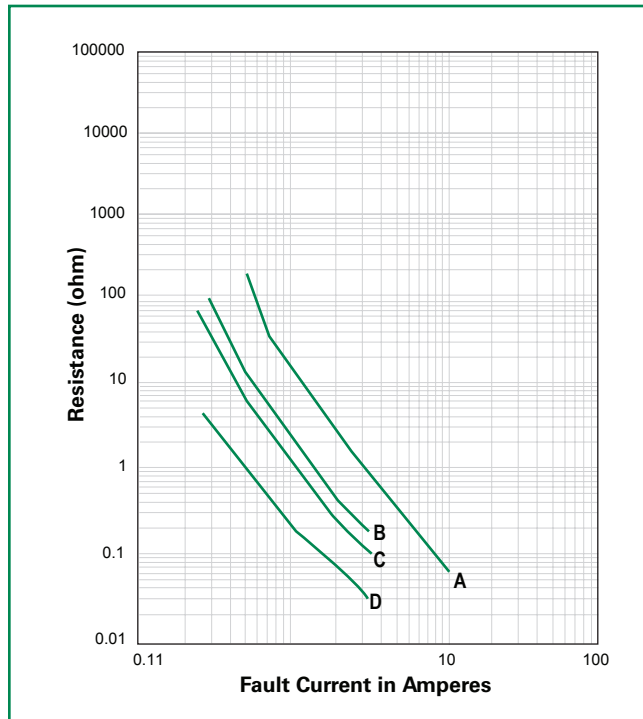
**Caution:** Operation beyond the specified rating may result in damage and possible arcing and flame.

\* Effective January 1, 2010, all 250R PTC products will be manufactured Halogen Free (HF). Existing Non-Halogen Free 250R PTC products may continue to be sold, until supplies are depleted.

### Temperature Derating

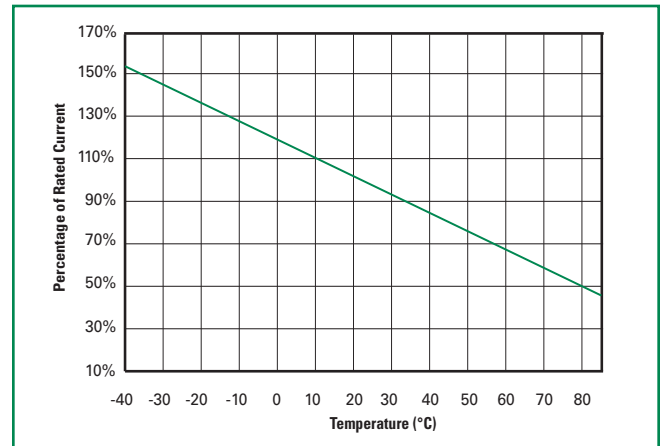
|             | Ambient Operation Temperature |       |      |       |      |      |      |      |       |
|-------------|-------------------------------|-------|------|-------|------|------|------|------|-------|
|             | -40°C                         | -20°C | 0°C  | 20°C  | 40°C | 50°C | 60°C | 70°C | 85°C  |
| Part Number | Hold Current (A)              |       |      |       |      |      |      |      |       |
| 250R080     | 0.12                          | 0.11  | 0.09 | 0.08  | 0.06 | 0.05 | 0.05 | 0.04 | 0.03  |
| 250R080T    | 0.12                          | 0.11  | 0.09 | 0.08  | 0.06 | 0.05 | 0.05 | 0.04 | 0.03  |
| 250R120     | 0.18                          | 0.16  | 0.14 | 0.12  | 0.10 | 0.09 | 0.08 | 0.06 | 0.05  |
| 250R120T    | 0.18                          | 0.16  | 0.14 | 0.12  | 0.10 | 0.09 | 0.08 | 0.06 | 0.05  |
| 250R145     | 0.26                          | 0.20  | 0.17 | 0.145 | 0.12 | 0.11 | 0.09 | 0.08 | 0.06  |
| 250R145T    | 0.26                          | 0.20  | 0.17 | 0.145 | 0.12 | 0.11 | 0.09 | 0.08 | 0.06  |
| 250R180     | 0.28                          | 0.23  | 0.21 | 0.18  | 0.16 | 0.13 | 0.10 | 0.11 | 0.083 |
| 250R180T    | 0.28                          | 0.23  | 0.21 | 0.18  | 0.16 | 0.13 | 0.10 | 0.11 | 0.083 |

### Average Time Current Curves



The average time current curves and Temperature Derating curve performance is affected by a number of variables, and these curves provided as guidance only. Customer must verify the performance in their application.

### Temperature Derating Curve



Note:  
Typical Temperature derating curve, refer to table for derating data

### Agency Specification Selection Guide For Telecom and Networking Applications

| Product | Lightning                                                                                                 | Power Cross                                                                                      |
|---------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 250R120 | ITU K.20/21/45 – 1.5kV 10/700µs                                                                           | ITU K.20/21/45 – 230Vac, 10Ω                                                                     |
| 250R145 | ITU K.20/21/45 – 4kV 10/700µs*                                                                            | ITU K.20/21/45 – 600Vac, 600Ω                                                                    |
| 250R180 | ITU K.20/21/45 – 1.5kV 10/700µs<br>ITU K.20/21/45 – 4kV 10/700µs*<br>Telcordia GR – 974 – 1.0kV 10/1000µs | ITU K.20/21/45 – 230Vac, 10Ω<br>ITU K.20/21/45 – 600Vac, 600Ω<br>Telcordia GR – 974- 283Vac, 10A |

\*Devices should be independently evaluated and tested for use in any specific application

### Protection Application Guide

| Region/Specification                           | Application                                                                                                                 | Device Selection                                                  |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| South America/Asia/Europe<br>ITU K.45          | *Access network equipment<br>Remote terminal<br>Repeaters<br>WAN equipment<br>Cross –connect                                | 250R180<br>250R180T<br>250R145<br>250R145T<br>250R120<br>250R120T |
| South America/Asia/Europe<br>ITU K.21          | Customer and IT equipment<br>Analog modems<br>ADSL, xDSL<br>Phone sets, PBX systems<br>Internet appliances<br>POS terminals | 250R180<br>250R180T<br>250R145<br>250R145T<br>250R120<br>250R120T |
| South America/Asia/Europe<br>ITU K.20          | Central Office<br>POTS/ISDN linecards<br>T1/E1/J1 linecards<br>ADSL/VDSL splitters<br>CSU/DSU                               | 250R180<br>250R180T<br>250R145<br>250R145T<br>250R120<br>250R120T |
| North America Telcordia<br>GR-974              | *Primary protection modules<br>MDF modules<br>Network interface                                                             | 250R180<br>250R180T<br>250R145<br>250R145T<br>250R120<br>250R120T |
| South America/Asia/Europe<br>ITU K.20          |                                                                                                                             |                                                                   |
| North America Telcordia<br>GR-1089             | *Intrabuilding communication systems<br>LAN, VOIP cards<br>Local loop handsets                                              | 250R180<br>250R180T<br>250R145<br>250R145T<br>250R120<br>250R120T |
| South America/Asia/Europe<br>ITU K.20 and K.21 |                                                                                                                             |                                                                   |
|                                                | LAN Intrabuilding power cross<br>Protection<br>LAN equipment, IP phone                                                      | 250R080                                                           |

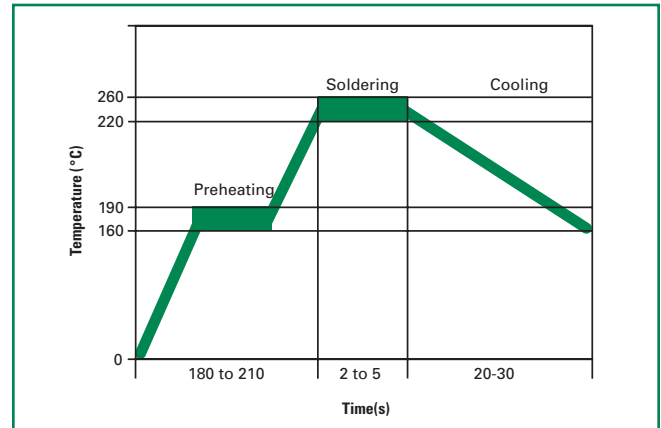
\*Resistance binned parts are recommended

### Soldering Parameters - Wave Soldering

|                          |                   |
|--------------------------|-------------------|
| Condition                | Wave Soldering    |
| Peak Temp/ Duration Time | 260°C ≤ 5 Sec     |
| ≥ 220°C                  | 2 Sec ~ 20 Sec    |
| Preheat 140°C ~ 180°C    | 180 Sec ~ 210 Sec |
| Storage Condition        | 0°C~35°C ≤ 70%RH  |

- Recommended soldering methods: heat element oven or N<sub>2</sub> environment for lead-free.
- Devices are designed to be wave soldered to the bottom side of the board.
- Devices can be cleaned using standard industry methods and solvents.
- This profile can be used for lead-free device

**Note:** If soldering temperatures exceed the recommended profile, devices may not meet the performance requirements.



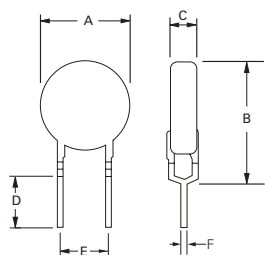
### Physical Specifications

|                           |                                                                  |
|---------------------------|------------------------------------------------------------------|
| Lead Material             | Tin-plated Copper                                                |
| Soldering Characteristics | Solderability per MIL-STD-202, Method 208                        |
| Insulating Material       | Cured, flame retardant epoxy polymer meets UL94V-0 requirements. |
| Device Labeling           | Marked with 'LF', voltage, current rating, and date code.        |

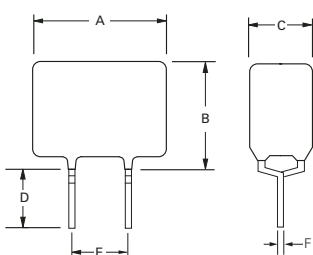
### Environmental Specifications

|                                                     |                                                     |
|-----------------------------------------------------|-----------------------------------------------------|
| Operating/Storage Temperature                       | -40°C to +85°C                                      |
| Maximum Device Surface Temperature in Tripped State | 125°C                                               |
| Passive Aging                                       | 65°C/85°C, 1000 hours                               |
| Humidity Aging                                      | +85°C, 85% R.H., 1000 hours                         |
| Thermal Shock                                       | MIL-STD-202, Method 107<br>+125°C to -55°C 10 times |
| Solvent Resistance                                  | MIL-STD-202, Method 215                             |
| Moisture Sensitivity Level                          | Level 1, J-STD-020                                  |

## Dimensions

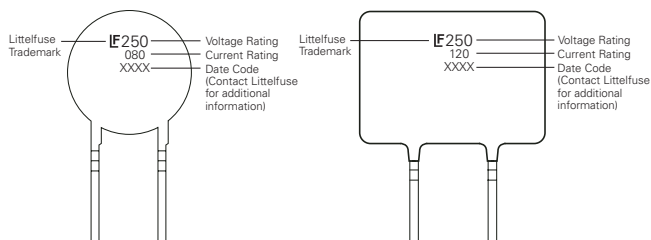


**Figure 1**



**Figure 2**

## Part Marking System

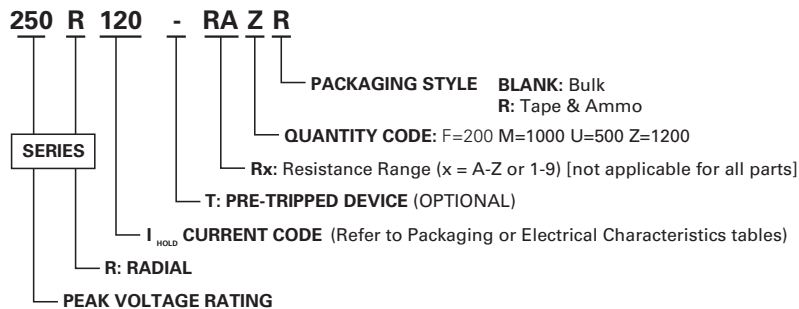


| Part Number | Figure | A      |      | B      |      | C      |      | D      |      | E      |      | Physical Characteristics |      |          |
|-------------|--------|--------|------|--------|------|--------|------|--------|------|--------|------|--------------------------|------|----------|
|             |        | Inches | mm   | Inches | mm   | Inches | mm   | Inches | mm   | Inches | mm   | Lead (dia)               |      | Material |
|             |        | Max.   | Max. | Max.   | Max. | Max.   | Max. | Min.   | Min. | Typ.   | Typ. | Inches                   | mm   |          |
| 250R080     | 1      | 0.23   | 5.8  | 0.39   | 9.9  | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R080T    | 1      | 0.23   | 5.8  | 0.39   | 9.9  | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R120     | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.15   | 3.8  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R120-RA  | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R120-RC  | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R120-RF  | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R120-R1  | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R120-R2  | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R120-R3  | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R120T    | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R145     | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R145-RA  | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R145-RB  | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R145T    | 2      | 0.26   | 6.5  | 0.43   | 11   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R180     | 1      | 0.37   | 9.5  | 0.47   | 12   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |
| 250R180T    | 1      | 0.37   | 9.5  | 0.47   | 12   | 0.18   | 4.6  | 0.19   | 4.7  | 0.20   | 5.1  | 0.026                    | 0.65 | Sn/Cu    |

## WARNING

- Users shall independently assess the suitability of these devices for each of their applications
- Operation of these devices beyond the stated maximum ratings could result in damage to the devices and lead to electrical arcing and/or fire
- These devices are intended to protect against the effects of temporary over-current or over-temperature conditions and are not intended to perform as protective devices where such conditions are expected to be repetitive or prolonged in duration
- Exposure to silicon-based oils, solvents, electrolytes, acids, and similar materials can adversely affect the performance of these PPTC devices
- These devices undergo thermal expansion under fault conditions, and thus shall be provided with adequate space and be protected against mechanical stresses
- Circuits with inductance may generate a voltage ( $L \, di/dt$ ) above the rated voltage of the PPTC device.

## Part Ordering Number System



## Packaging

| Part Number | Ordering Number | I <sub>hold</sub> (A) | I <sub>hold</sub> Code | Packaging Option | Quantity | Quantity & Packaging Codes |
|-------------|-----------------|-----------------------|------------------------|------------------|----------|----------------------------|
| 250R080     | 250R080U        | 0.080                 | 080                    | Bulk             | 500      | U                          |
|             | 250R080ZR       |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R080T    | 250R080TU       | 0.080                 | 080                    | Bulk             | 500      | U                          |
|             | 250R080TZR      |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R120     | 250R120U        | 0.120                 | 120                    | Bulk             | 500      | U                          |
|             | 250R120ZR       |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R120-RA  | 250R120-RAU     | 0.120                 | 120                    | Bulk             | 500      | U                          |
|             | 250R120-RAZR    |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R120-RC  | 250R120-RCU     | 0.120                 | 120                    | Bulk             | 500      | U                          |
|             | 250R120-RCZR    |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R120-RF  | 250R120-RFU     | 0.120                 | 120                    | Bulk             | 500      | U                          |
|             | 250R120-RFZR    |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R120-R1  | 250R120-R1U     | 0.120                 | 120                    | Bulk             | 500      | U                          |
|             | 250R120-R1ZR    |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R120-R2  | 250R120-R2U     | 0.120                 | 120                    | Bulk             | 500      | U                          |
|             | 250R120-R2ZR    |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R120-R3  | 250R120-R3U     | 0.120                 | 120                    | Bulk             | 500      | U                          |
|             | 250R120-R3ZR    |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R120T    | 250R120TU       | 0.120                 | 120                    | Bulk             | 500      | U                          |
|             | 250R120TZR      |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R145     | 250R145U        | 0.145                 | 145                    | Bulk             | 500      | U                          |
|             | 250R145ZR       |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R145-RA  | 250R145-RAU     | 0.145                 | 145                    | Bulk             | 500      | U                          |
|             | 250R145-RAZR    |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R145-RB  | 250R145-RBU     | 0.145                 | 145                    | Bulk             | 500      | U                          |
|             | 250R145-RBZR    |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R145T    | 250R145TU       | 0.145                 | 145                    | Bulk             | 500      | U                          |
|             | 250R145TZR      |                       |                        | Tape and Ammo    | 1200     | ZR                         |
| 250R180     | 250R180F        | 0.180                 | 180                    | Bulk             | 200      | F                          |
|             | 250R180MR       |                       |                        | Tape and Ammo    | 1000     | MR                         |
| 250R180T    | 250R180TF       | 0.180                 | 180                    | Bulk             | 200      | F                          |
|             | 250R180TMR      |                       |                        | Tape and Ammo    | 1000     | MR                         |

## Tape and Ammo Specifications

Devices taped using EIA468-B/IE286-2 standards. See table below and Figure 1 for details.

| Dimension                             | EIA Mark             | IEC Mark             | Dimensions      |              |
|---------------------------------------|----------------------|----------------------|-----------------|--------------|
|                                       |                      |                      | Dim. (mm)       | Tol. (mm)    |
| Carrier tape width                    | <b>W</b>             | <b>W</b>             | 18              | -0.5 / +1.0  |
| Hold down tape width                  | <b>W<sub>4</sub></b> | <b>W<sub>0</sub></b> | 11              | min.         |
| Top distance between tape edges       | <b>W<sub>6</sub></b> | <b>W<sub>2</sub></b> | 3               | max.         |
| Sprocket hole position                | <b>W<sub>5</sub></b> | <b>W<sub>1</sub></b> | 9               | -0.5 / +0.75 |
| Sprocket hole diameter*               | <b>D<sub>0</sub></b> | <b>D<sub>0</sub></b> | 4               | -0.32 / +0.2 |
| Abscissa to plane (straight lead)     | <b>H</b>             | <b>H</b>             | 18.5            | -/+ 3.0      |
| Abscissa to plane (kinked lead)       | <b>H<sub>0</sub></b> | <b>H<sub>0</sub></b> | 16              | -/+ 0.5      |
| Abscissa to top                       | <b>H<sub>1</sub></b> | <b>H<sub>1</sub></b> | 32.2            | max.         |
| Overall width without lead protrusion | <b>C<sub>1</sub></b> |                      | 42.5            | max.         |
| Overall width with lead protrusion    | <b>C<sub>2</sub></b> |                      | 43.2            | max.         |
| Lead protrusion                       | <b>L<sub>1</sub></b> | <b>L<sub>1</sub></b> | 1.0             | max.         |
| Protrusion of cut out                 | <b>L</b>             | <b>L</b>             | 11              | max.         |
| Protrusion beyond hold-down tape      | <b>I<sub>2</sub></b> | <b>I<sub>2</sub></b> | Not specified   |              |
| Sprocket hole pitch: 250R080-250R145  | <b>P<sub>0</sub></b> | <b>P<sub>0</sub></b> | 12.7            | -/+ 0.3      |
| Sprocket hole pitch: 250R180          | <b>P<sub>0</sub></b> | <b>P<sub>0</sub></b> | 25.4            | -/+ 0.5      |
| Pitch tolerance                       |                      |                      | 20 consecutive. | -/+ 1        |
| Device pitch: 250R080-250R145         |                      |                      | 12.7            |              |
| Device pitch: 250R180                 |                      |                      | 25.4            |              |
| Tape thickness                        | <b>t</b>             | <b>t</b>             | 0.9             | max.         |
| Tape thickness with splice            | <b>t<sub>1</sub></b> |                      | 2.0             | max.         |
| Splice sprocket hole alignment        |                      |                      | 0               | -/+ 0.3      |
| Body lateral deviation                | <b>Δh</b>            | <b>Δh</b>            | 0               | -/+ 1.0      |
| Body tape plane deviation             | <b>Δp</b>            | <b>Δp</b>            | 0               | -/+ 1.3      |
| Ordinate to adjacent component lead*  | <b>P<sub>1</sub></b> | <b>P<sub>1</sub></b> | 3.81            | -/+ 0.7      |
| Lead spacing                          | <b>F</b>             | <b>F</b>             | 5.1             | -/+ 0.7      |

\*Differs from EIA Specification

## Tape and Ammo Diagram

