# 1 to 3 Watt DO-41 Surmetic 30 Zener Voltage Regulator Diodes

## GENERAL DATA APPLICABLE TO ALL SERIES IN THIS GROUP

# 1 to 3 Watt Surmetic 30 Silicon Zener Diodes

**GENERAL DATA**

**1–3 WATT DO-41 SURMETIC 30**

**1 TO 3 WATT ZENER REGULATOR DIODES 3.3–400 VOLTS**

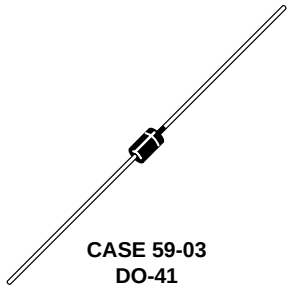
. . . a complete series of 1 to 3 Watt Zener Diodes with limits and operating characteristics that reflect the superior capabilities of silicon-oxide-passivated junctions. All this in an axial-lead, transfer-molded plastic package offering protection in all common environmental conditions.

**Specification Features:**

- Surge Rating of 98 Watts @ 1 ms
- Maximum Limits Guaranteed On Up To Six Electrical Parameters
- Package No Larger Than the Conventional 1 Watt Package

**Mechanical Characteristics:**

**CASE:** Void-free, transfer-molded, thermosetting plastic
**FINISH:** All external surfaces are corrosion resistant and leads are readily solderable
**POLARITY:** Cathode indicated by color band. When operated in zener mode, cathode will be positive with respect to anode
**MOUNTING POSITION:** Any
**WEIGHT:** 0.4 gram (approx)
**WAFER FAB LOCATION:** Phoenix, Arizona
**ASSEMBLY/TEST LOCATION:** Seoul, Korea



**CASE 59-03**
**DO-41**
**PLASTIC**

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Power Dissipation @ $T_L$ = 75°C<br>Lead Length = 3/8″<br>Derate above 75°C | $P_D$ | 3<br><br>24 | Watts<br><br>mW/°C |
| DC Power Dissipation @ $T_A$ = 50°C<br>Derate above 50°C | $P_D$ | 1<br>6.67 | Watt<br>mW/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | – 65 to +200 | °C |

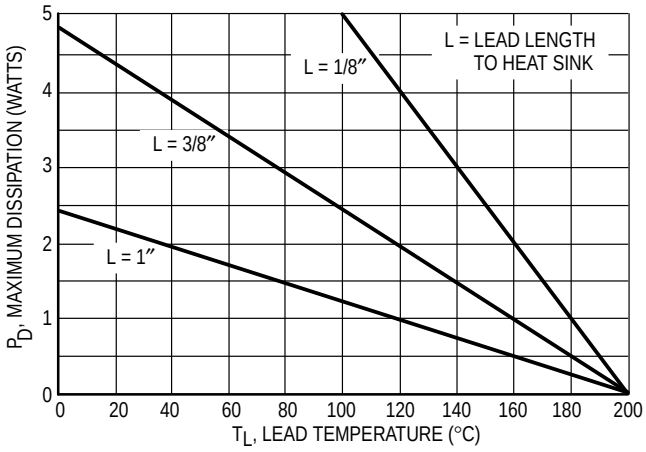



**Figure 1. Power Temperature Derating Curve**

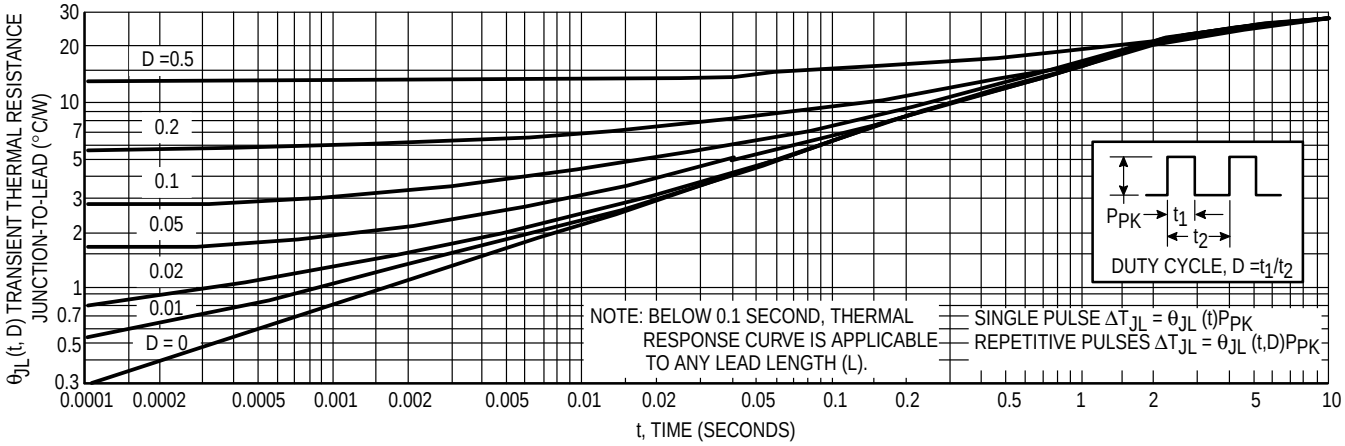



**Figure 2. Typical Thermal Response L, Lead Length = 3/8 Inch**

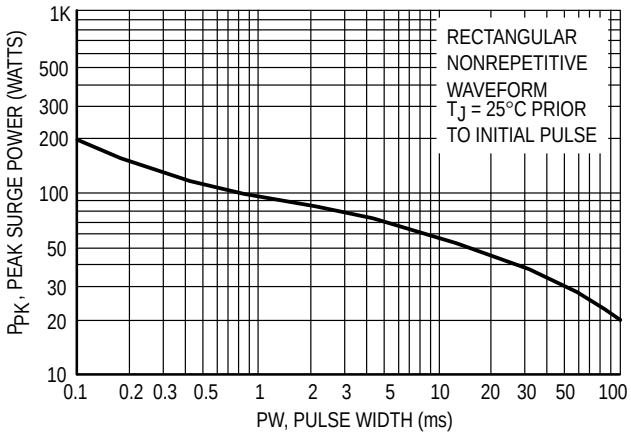



**Figure 3. Maximum Surge Power**

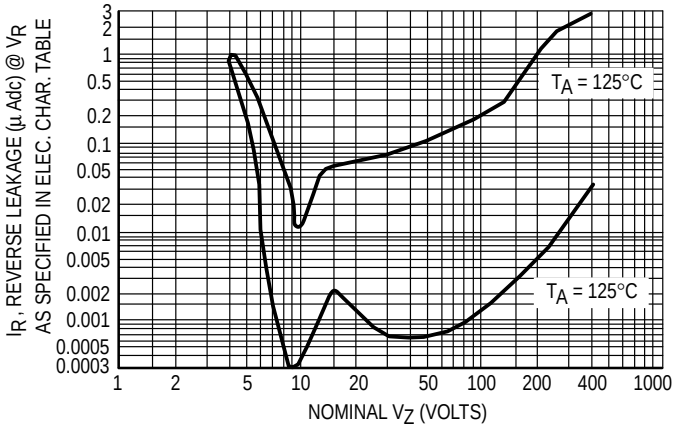



**Figure 4. Typical Reverse Leakage**

## APPLICATION NOTE

Since the actual voltage available from a given zener diode is temperature dependent, it is necessary to determine junction temperature under any set of operating conditions in order to calculate its value. The following procedure is recommended:

Lead Temperature, $T_L$, should be determined from:

$$T_L = \theta_{LA} P_D + T_A$$

$\theta_{LA}$ is the lead-to-ambient thermal resistance (°C/W) and $P_D$ is the power dissipation. The value for $\theta_{LA}$ will vary and depends on the device mounting method. $\theta_{LA}$ is generally 30–40°C/W for the various clips and tie points in common use and for printed circuit board wiring.

The temperature of the lead can also be measured using a thermocouple placed on the lead as close as possible to the tie point. The thermal mass connected to the tie point is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady-state conditions are achieved. Using the measured value of $T_L$, the junction temperature may be determined by:

$$T_J = T_L + \Delta T_{JL}$$

$\Delta T_{JL}$ is the increase in junction temperature above the lead temperature and may be found from Figure 2 for a train of power pulses (L = 3/8 inch) or from Figure 10 for dc power.

$$\Delta T_{JL} = \theta_{JL} P_D$$

For worst-case design, using expected limits of $I_Z$, limits of $P_D$ and the extremes of $T_J$ ($\Delta T_J$) may be estimated. Changes in voltage, $V_Z$, can then be found from:

$$\Delta V = \theta_{VZ} \Delta T_J$$

$\theta_{VZ}$, the zener voltage temperature coefficient, is found from Figures 5 and 6.

Under high power-pulse operation, the zener voltage will vary with time and may also be affected significantly by the zener resistance. For best regulation, keep current excursions as low as possible.

Data of Figure 2 should not be used to compute surge capability. Surge limitations are given in Figure 3. They are lower than would be expected by considering only junction temperature, as current crowding effects cause temperatures to be extremely high in small spots resulting in device degradation should the limits of Figure 3 be exceeded.

## TEMPERATURE COEFFICIENT RANGES

(90% of the Units are in the Ranges Indicated)

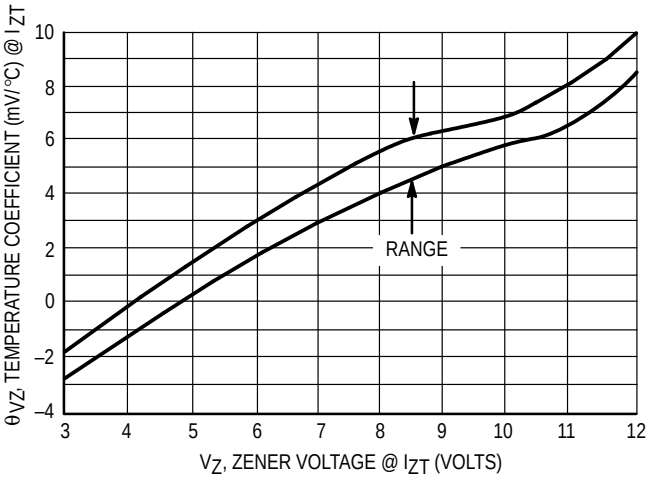



**Figure 5. Units To 12 Volts**

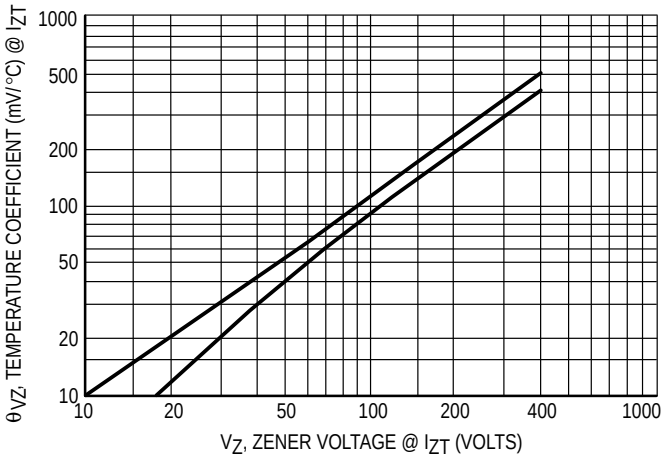



**Figure 6. Units 10 To 400 Volts**

## ZENER VOLTAGE versus ZENER CURRENT

(Figures 7, 8 and 9)

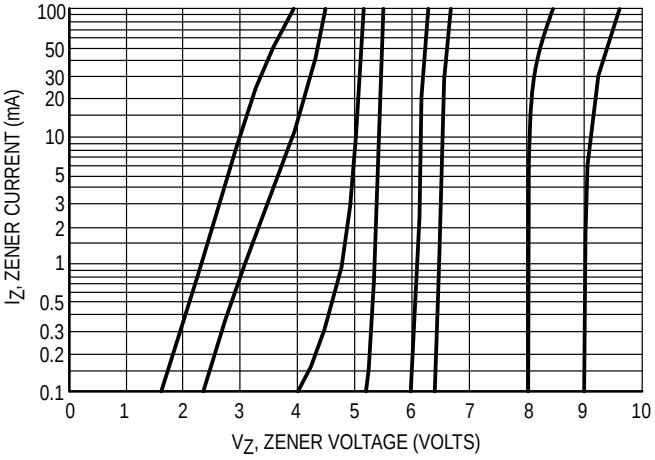



**Figure 7. $V_Z$ = 3.3 thru 10 Volts**

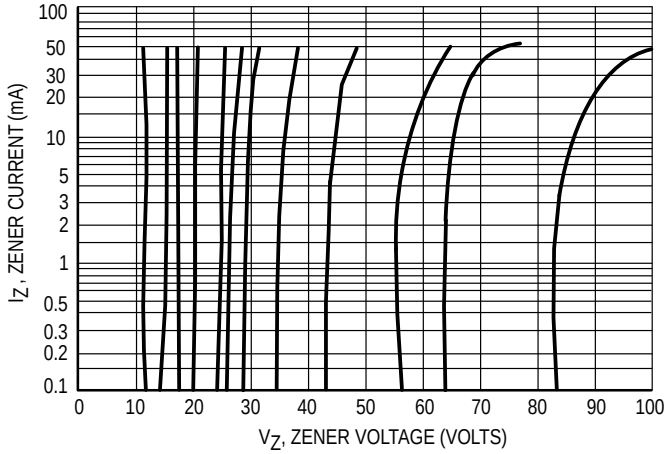



**Figure 8. $V_Z$ = 12 thru 82 Volts**

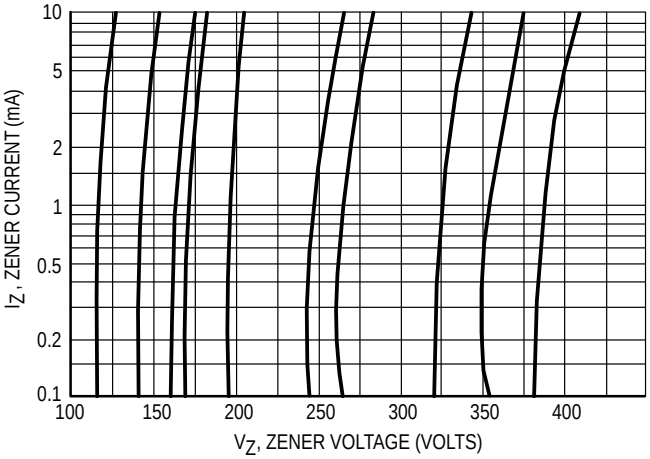



**Figure 9. $V_Z$ = 100 thru 400 Volts**

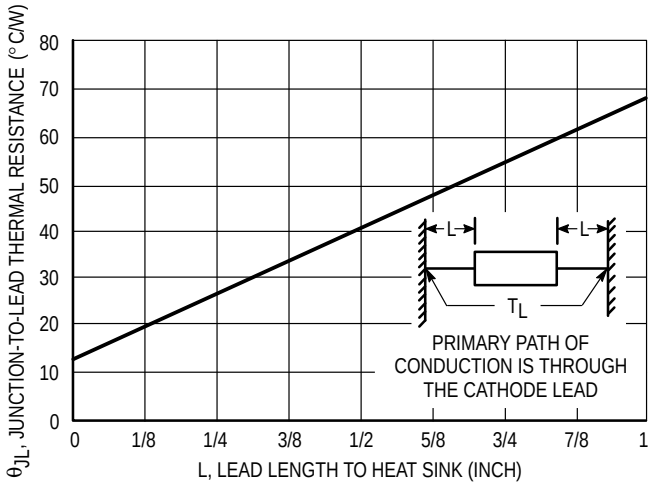



**Figure 10. Typical Thermal Resistance**

# GENERAL DATA — 1-3 WATT DO-41 SURMETIC 30

***MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Power Dissipation @ $T_L$ = 75°C, Lead Length = 3/8″<br>Derate above 75°C | $P_D$ | 1.5<br>12 | Watts<br>mW/°C |

***ELECTRICAL CHARACTERISTICS** ($T_L$ = 30°C unless otherwise noted. $V_F$ = 1.5 Volts Max @ $I_F$ = 200 mAdc for all types.)

| Motorola Type Number (Note 1) | Nominal Zener Voltage $V_Z$ @ $I_{ZT}$ Volts (Note 2 and 3) | Test Current $I_{ZT}$ mA | Max. Zener Impedance (Note 4) | | | Max. Reverse Leakage Current | | Maximum DC Zener Current $I_{ZM}$ mAdc |
|---|---|---|---|---|---|---|---|---|
| | | | $Z_{ZT}$ @ $I_{ZT}$ Ohms | $Z_{ZK}$ Ohms | @ $I_{ZK}$ mA | $I_R$ μA | @ $V_R$ Volts | |
| 1N5913B | 3.3 | 113.6 | 10 | 500 | 1 | 100 | 1 | 454 |
| 1N5914B | 3.6 | 104.2 | 9 | 500 | 1 | 75 | 1 | 416 |
| 1N5915B | 3.9 | 96.1 | 7.5 | 500 | 1 | 25 | 1 | 384 |
| 1N5916B | 4.3 | 87.2 | 6 | 500 | 1 | 5 | 1 | 348 |
| 1N5917B | 4.7 | 79.8 | 5 | 500 | 1 | 5 | 1.5 | 319 |
| ***1N5918B*** | ***5.1*** | ***73.5*** | ***4*** | ***350*** | ***1*** | ***5*** | ***2*** | ***294*** |
| 1N5919B | 5.6 | 66.9 | 2 | 250 | 1 | 5 | 3 | 267 |
| ***1N5920B*** | ***6.2*** | ***60.5*** | ***2*** | ***200*** | ***1*** | ***5*** | ***4*** | ***241*** |
| 1N5921B | 6.8 | 55.1 | 2.5 | 200 | 1 | 5 | 5.2 | 220 |
| 1N5922B | 7.5 | 50 | 3 | 400 | 0.5 | 5 | 6 | 200 |
| 1N5923B | 8.2 | 45.7 | 3.5 | 400 | 0.5 | 5 | 6.5 | 182 |
| 1N5924B | 9.1 | 41.2 | 4 | 500 | 0.5 | 5 | 7 | 164 |
| 1N5925B | 10 | 37.5 | 4.5 | 500 | 0.25 | 5 | 8 | 150 |
| 1N5926B | 11 | 34.1 | 5.5 | 550 | 0.25 | 1 | 8.4 | 136 |
| 1N5927B | 12 | 31.2 | 6.5 | 550 | 0.25 | 1 | 9.1 | 125 |
| 1N5928B | 13 | 28.8 | 7 | 550 | 0.25 | 1 | 9.9 | 115 |
| ***1N5929B*** | ***15*** | ***25*** | ***9*** | ***600*** | ***0.25*** | ***1*** | ***11.4*** | ***100*** |
| 1N5930B | 16 | 23.4 | 10 | 600 | 0.25 | 1 | 12.2 | 93 |
| 1N5931B | 18 | 20.8 | 12 | 650 | 0.25 | 1 | 13.7 | 83 |
| 1N5932B | 20 | 18.7 | 14 | 650 | 0.25 | 1 | 15.2 | 75 |
| 1N5933B | 22 | 17 | 17.5 | 650 | 0.25 | 1 | 16.7 | 68 |
| 1N5934B | 24 | 15.6 | 19 | 700 | 0.25 | 1 | 18.2 | 62 |
| 1N5935B | 27 | 13.9 | 23 | 700 | 0.25 | 1 | 20.6 | 55 |
| ***1N5936B*** | ***30*** | ***12.5*** | ***26*** | ***750*** | ***0.25*** | ***1*** | ***22.8*** | ***50*** |
| 1N5937B | 33 | 11.4 | 33 | 800 | 0.25 | 1 | 25.1 | 45 |
| 1N5938B | 36 | 10.4 | 38 | 850 | 0.25 | 1 | 27.4 | 41 |
| 1N5939B | 39 | 9.6 | 45 | 900 | 0.25 | 1 | 29.7 | 38 |
| 1N5940B | 43 | 8.7 | 53 | 950 | 0.25 | 1 | 32.7 | 34 |
| 1N5941B | 47 | 8 | 67 | 1000 | 0.25 | 1 | 35.8 | 31 |
| 1N5942B | 51 | 7.3 | 70 | 1100 | 0.25 | 1 | 38.8 | 29 |
| 1N5943B | 56 | 6.7 | 86 | 1300 | 0.25 | 1 | 42.6 | 26 |
| 1N5944B | 62 | 6 | 100 | 1500 | 0.25 | 1 | 47.1 | 24 |
| 1N5945B | 68 | 5.5 | 120 | 1700 | 0.25 | 1 | 51.7 | 22 |
| 1N5946B | 75 | 5 | 140 | 2000 | 0.25 | 1 | 56 | 20 |
| 1N5947B | 82 | 4.6 | 160 | 2500 | 0.25 | 1 | 62.2 | 18 |

(continued)

*Indicates JEDEC Registered Data.

***ELECTRICAL CHARACTERISTICS — continued** ($T_L$ = 30°C unless otherwise noted. $V_F$ = 1.5 Volts Max @ $I_F$ = 200 mAdc for all types.)

| Motorola Type Number (Note 1) | Nominal Zener Voltage $V_Z$ @ $I_{ZT}$ Volts (Note 2 and 3) | Test Current $I_{ZT}$ mA | Max. Zener Impedance (Note 4) | | | Max. Reverse Leakage Current | | Maximum DC Zener Current $I_{ZM}$ mAdc |
|---|---|---|---|---|---|---|---|---|
| | | | $Z_{ZT}$ @ $I_{ZT}$ Ohms | $Z_{ZK}$ Ohms | @ $I_{ZK}$ mA | $I_R$ µA | @ $V_R$ Volts | |
| 1N5948B | 91 | 4.1 | 200 | 3000 | 0.25 | 1 | 69.2 | 16 |
| 1N5949B | 100 | 3.7 | 250 | 3100 | 0.25 | 1 | 76 | 15 |
| 1N5950B | 110 | 3.4 | 300 | 4000 | 0.25 | 1 | 83.6 | 13 |
| 1N5951B | 120 | 3.1 | 380 | 4500 | 0.25 | 1 | 91.2 | 12 |
| 1N5952B | 130 | 2.9 | 450 | 5000 | 0.25 | 1 | 98.8 | 11 |
| 1N5953B | 150 | 2.5 | 600 | 6000 | 0.25 | 1 | 114 | 10 |
| 1N5954B | 160 | 2.3 | 700 | 6500 | 0.25 | 1 | 121.6 | 9 |
| ***1N5955B*** | ***180*** | ***2.1*** | ***900*** | ***7000*** | ***0.25*** | ***1*** | ***136.8*** | ***8*** |
| 1N5956B | 200 | 1.9 | 1200 | 8000 | 0.25 | 1 | 152 | 7 |

*Indicates JEDEC Registered Data.

**NOTE 1. TOLERANCE AND VOLTAGE DESIGNATION**
Tolerance designation — Device tolerances of ±5% are indicated by a “B” suffix.

Nominal zener voltages between those shown and ±1% and ±2% tight voltage tolerances. Consult factory.

**NOTE 2. SPECIAL SELECTIONS AVAILABLE INCLUDE:**

# GENERAL DATA — 1-3 WATT DO-41 SURMETIC 30

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted) $V_F$ = 1.5 V Max, $I_F$ = 200 mA for all types)

| Motorola Type No. (Note 1) | Nominal Zener Voltage $V_Z$ @ $I_{ZT}$ Volts (Note 2) | Test Current $I_{ZT}$ mA | Max Zener Impedance (Note 3) | | | Leakage Current | | Maximum Zener Current $I_{ZM}$ mA | Surge Current @ $T_A$ = 25°C $i_r$ – mA (Note 4) |
|---|---|---|---|---|---|---|---|---|---|
| | | | $Z_{ZT}$ @ $I_{ZT}$ Ohms | $Z_{ZK}$ @ $I_{ZK}$ Ohms | $I_{ZK}$ mA | $I_R$ @ μA Max | $V_R$ Volts | | |
| 3EZ3.9D5 | 3.9 | 192 | 4.5 | 400 | 1 | 80 | 1 | 630 | 4.4 |
| ***3EZ4.3D5*** | ***4.3*** | ***174*** | ***4.5*** | ***400*** | ***1*** | ***30*** | ***1*** | ***590*** | ***4.1*** |
| 3EZ4.7D5 | 4.7 | 160 | 4 | 500 | 1 | 20 | 1 | 550 | 3.8 |
| 3EZ5.1D5 | 5.1 | 147 | 3.5 | 550 | 1 | 5 | 1 | 520 | 3.5 |
| 3EZ5.6D5 | 5.6 | 134 | 2.5 | 600 | 1 | 5 | 2 | 480 | 3.3 |
| 3EZ6.2D5 | 6.2 | 121 | 1.5 | 700 | 1 | 5 | 3 | 435 | 3.1 |
| 3EZ6.8D5 | 6.8 | 110 | 2 | 700 | 1 | 5 | 4 | 393 | 2.9 |
| 3EZ7.5D5 | 7.5 | 100 | 2 | 700 | 0.5 | 5 | 5 | 360 | 2.66 |
| 3EZ8.2D5 | 8.2 | 91 | 2.3 | 700 | 0.5 | 5 | 6 | 330 | 2.44 |
| 3EZ9.1D5 | 9.1 | 82 | 2.5 | 700 | 0.5 | 3 | 7 | 297 | 2.2 |
| 3EZ10D5 | 10 | 75 | 3.5 | 700 | 0.25 | 3 | 7.6 | 270 | 2 |
| 3EZ11D5 | 11 | 68 | 4 | 700 | 0.25 | 1 | 8.4 | 245 | 1.82 |
| 3EZ12D5 | 12 | 63 | 4.5 | 700 | 0.25 | 1 | 9.1 | 225 | 1.66 |
| 3EZ13D5 | 13 | 58 | 4.5 | 700 | 0.25 | 0.5 | 9.9 | 208 | 1.54 |
| 3EZ14D5 | 14 | 53 | 5 | 700 | 0.25 | 0.5 | 10.6 | 193 | 1.43 |
| 3EZ15D5 | 15 | 50 | 5.5 | 700 | 0.25 | 0.5 | 11.4 | 180 | 1.33 |
| 3EZ16D5 | 16 | 47 | 5.5 | 700 | 0.25 | 0.5 | 12.2 | 169 | 1.25 |
| 3EZ17D5 | 17 | 44 | 6 | 750 | 0.25 | 0.5 | 13 | 159 | 1.18 |
| 3EZ18D5 | 18 | 42 | 6 | 750 | 0.25 | 0.5 | 13.7 | 150 | 1.11 |
| 3EZ19D5 | 19 | 40 | 7 | 750 | 0.25 | 0.5 | 14.4 | 142 | 1.05 |
| 3EZ20D5 | 20 | 37 | 7 | 750 | 0.25 | 0.5 | 15.2 | 135 | 1 |
| 3EZ22D5 | 22 | 34 | 8 | 750 | 0.25 | 0.5 | 16.7 | 123 | 0.91 |
| 3EZ24D5 | 24 | 31 | 9 | 750 | 0.25 | 0.5 | 18.2 | 112 | 0.83 |
| 3EZ27D5 | 27 | 28 | 10 | 750 | 0.25 | 0.5 | 20.6 | 100 | 0.74 |
| 3EZ28D5 | 28 | 27 | 12 | 750 | 0.25 | 0.5 | 21 | 96 | 0.71 |
| 3EZ30D5 | 30 | 25 | 16 | 1000 | 0.25 | 0.5 | 22.5 | 90 | 0.67 |
| 3EZ33D5 | 33 | 23 | 20 | 1000 | 0.25 | 0.5 | 25.1 | 82 | 0.61 |
| 3EZ36D5 | 36 | 21 | 22 | 1000 | 0.25 | 0.5 | 27.4 | 75 | 0.56 |
| 3EZ39D5 | 39 | 19 | 28 | 1000 | 0.25 | 0.5 | 29.7 | 69 | 0.51 |
| 3EZ43D5 | 43 | 17 | 33 | 1500 | 0.25 | 0.5 | 32.7 | 63 | 0.45 |
| 3EZ47D5 | 47 | 16 | 38 | 1500 | 0.25 | 0.5 | 35.6 | 57 | 0.42 |
| 3EZ51D5 | 51 | 15 | 45 | 1500 | 0.25 | 0.5 | 38.8 | 53 | 0.39 |
| 3EZ56D5 | 56 | 13 | 50 | 2000 | 0.25 | 0.5 | 42.6 | 48 | 0.36 |
| 3EZ62D5 | 62 | 12 | 55 | 2000 | 0.25 | 0.5 | 47.1 | 44 | 0.32 |
| 3EZ68D5 | 68 | 11 | 70 | 2000 | 0.25 | 0.5 | 51.7 | 40 | 0.29 |
| 3EZ75D5 | 75 | 10 | 85 | 2000 | 0.25 | 0.5 | 56 | 36 | 0.27 |
| 3EZ82D5 | 82 | 9.1 | 95 | 3000 | 0.25 | 0.5 | 62.2 | 33 | 0.24 |
| 3EZ91D5 | 91 | 8.2 | 115 | 3000 | 0.25 | 0.5 | 69.2 | 30 | 0.22 |
| 3EZ100D5 | 100 | 7.5 | 160 | 3000 | 0.25 | 0.5 | 76 | 27 | 0.2 |
| 3EZ110D5 | 110 | 6.8 | 225 | 4000 | 0.25 | 0.5 | 83.6 | 25 | 0.18 |
| 3EZ120D5 | 120 | 6.3 | 300 | 4500 | 0.25 | 0.5 | 91.2 | 22 | 0.16 |
| 3EZ130D5 | 130 | 5.8 | 375 | 5000 | 0.25 | 0.5 | 98.8 | 21 | 0.15 |
| 3EZ140D5 | 140 | 5.3 | 475 | 5000 | 0.25 | 0.5 | 106.4 | 19 | 0.14 |
| 3EZ150D5 | 150 | 5 | 550 | 6000 | 0.25 | 0.5 | 114 | 18 | 0.13 |
| 3EZ160D5 | 160 | 4.7 | 625 | 6500 | 0.25 | 0.5 | 121.6 | 17 | 0.12 |
| 3EZ170D5 | 170 | 4.4 | 650 | 7000 | 0.25 | 0.5 | 130.4 | 16 | 0.12 |
| 3EZ180D5 | 180 | 4.2 | 700 | 7000 | 0.25 | 0.5 | 136.8 | 15 | 0.11 |
| 3EZ190D5 | 190 | 4 | 800 | 8000 | 0.25 | 0.5 | 144.8 | 14 | 0.1 |

(continued)

**ELECTRICAL CHARACTERISTICS — continued** ($T_A$ = 25°C unless otherwise noted) $V_F$ = 1.5 V Max, $I_F$ = 200 mA for all types)

| Motorola Type No. (Note 1) | Nominal Zener Voltage $V_Z$ @ $I_{ZT}$ Volts (Note 2) | Test Current $I_{ZT}$ mA | Max Zener Impedance (Note 3) | | | Leakage Current | | Maximum Zener Current $I_{ZM}$ mA | Surge Current @ $T_A$ = 25°C $i_r$ – mA (Note 4) |
|---|---|---|---|---|---|---|---|---|---|
| | | | $Z_{ZT}$ @ $I_{ZT}$ Ohms | $Z_{ZK}$ @ $I_{ZK}$ Ohms | $I_{ZK}$ mA | $I_R$ @ μA Max | $V_R$ Volts | | |
| 3EZ200D5 | 200 | 3.7 | 875 | 8000 | 0.25 | 0.5 | 152 | 13 | 0.1 |
| 3EZ220D5 | 220 | 3.4 | 1600 | 9000 | 0.25 | 1 | 167 | 12 | 0.09 |
| 3EZ240D5 | 240 | 3.1 | 1700 | 9000 | 0.25 | 1 | 182 | 11 | 0.09 |
| 3EZ270D5 | 270 | 2.8 | 1800 | 9000 | 0.25 | 1 | 205 | 10 | 0.08 |
| 3EZ300D5 | 300 | 2.5 | 1900 | 9000 | 0.25 | 1 | 228 | 9 | 0.07 |
| 3EZ330D5 | 330 | 2.3 | 2200 | 9000 | 0.25 | 1 | 251 | 8 | 0.06 |
| 3EZ360D5 | 360 | 2.1 | 2700 | 9000 | 0.25 | 1 | 274 | 8 | 0.06 |
| 3EZ400D5 | 400 | 1.9 | 3500 | 9000 | 0.25 | 1 | 304 | 7 | 0.06 |

**NOTE 1. TOLERANCES**

Suffix 5 indicates 5% tolerance. Any other tolerance will be considered as a special device.

**NOTE 2. ZENER VOLTAGE ($V_Z$) MEASUREMENT**

Motorola guarantees the zener voltage when measured at 40 ms±10 ms 3/8″ from the diode body, and an ambient temperature of 25°C (+8°C, –2°C)

**NOTE 3. ZENER IMPEDANCE ($Z_Z$) DERIVATION**

The zener impedance is derived from the 60 cycle ac voltage, which results when an ac current having an rms value equal to 10% of the dc zener current ($I_{ZT}$ or $I_{ZK}$) is superimposed on $I_{ZT}$ or $I_{ZK}$.

**NOTE 4. SURGE CURRENT ($i_r$) NON-REPETITIVE**

The rating listed in the electrical characteristics table is maximum peak, non-repetitive, reverse surge current of 1/2 square wave or equivalent sine wave pulse of 1/120 second duration superimposed on the test current, $I_{ZT}$, per JEDEC standards, however, actual device capability is as described in Figure 3 of General Data sheet for Surmetic 30s.

**NOTE 5. SPECIAL SELECTIONS AVAILABLE INCLUDE:**

Nominal zener voltages between those shown. Tight voltage tolerances such as ±1% and ±2%. Consult factory.

**NOTE 3. ZENER VOLTAGE ($V_Z$) MEASUREMENT**

Motorola guarantees the zener voltage when meausred at 90 seconds while maintaining the lead temperature ($T_L$) at 30°C ±1°C, 3/8″ from the diode body.

**NOTE 4. ZENER IMPEDANCE ($Z_Z$) DERIVATION**

The zener impedance is derived from the 60 cycle ac voltage, which results when an ac current having an rms value equal to 10% of the dc zener current ($I_{ZT}$ or $I_{ZK}$) is superimposed on $I_{ZT}$ or $I_{ZK}$.

# GENERAL DATA — 1-3 WATT DO-41 SURMETIC 30

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted.) $V_F$ = 1.5 V Max, $I_F$ = 200 mA for all types.

| Type No. (Note 1) | Zener Voltage (Note 2) | | Test Current $I_{ZT}$ mA | Zener Impedance at $I_{ZT}$ f = 1000 Hz (Ohm) | | Blocking Voltage $I_R$ = 1 μA | Typical $T_C$ %/°C | Surge Current @ $T_L$ = 25°C $i_r$ – mA (Note 3) |
|---|---|---|---|---|---|---|---|---|
| | Min | Max | | Typ | Max | | | |
| MZD3.9 | 3.7 | 4.1 | 100 | 3.8 | 7 | — | –0.06 | 1380 |
| MZD4.3 | 4 | 4.6 | 100 | 3.8 | 7 | — | 0.055 | 1260 |
| MZD4.7 | 4.4 | 5 | 100 | 3.8 | 7 | — | 0.03 | 1190 |
| MZD5.1 | 4.8 | 5.4 | 100 | 2 | 5 | — | 0.03 | 1070 |
| MZD5.6 | 5.2 | 6 | 100 | 1 | 2 | 1.5 | +0.038 | 970 |
| MZD6.2 | 5.8 | 6.6 | 100 | 1 | 2 | 1.5 | +0.045 | 890 |
| MZD6.8 | 6.4 | 7.2 | 100 | 1 | 2 | 2 | +0.05 | 810 |
| MZD7.5 | 7 | 7.9 | 100 | 1 | 2 | 2 | +0.058 | 730 |
| MZD8.2 | 7.7 | 8.7 | 100 | 1 | 2 | 3.5 | +0.062 | 660 |
| MZD9.1 | 8.5 | 9.6 | 50 | 2 | 4 | 3.5 | +0.068 | 605 |
| MZD10 | 9.4 | 10.6 | 50 | 2 | 4 | 5 | +0.075 | 550 |
| MZD11 | 10.4 | 11.6 | 50 | 4 | 7 | 5 | +0.076 | 500 |
| MZD12 | 11.4 | 12.7 | 50 | 4 | 7 | 7 | +0.077 | 454 |
| MZD13 | 12.4 | 14.1 | 50 | 5 | 10 | 7 | +0.079 | 414 |
| MZD15 | 13.8 | 15.8 | 50 | 5 | 10 | 10 | +0.082 | 380 |
| MZD16 | 15.3 | 17.1 | 25 | 6 | 15 | 10 | +0.083 | 344 |
| ***MZD18*** | ***16.8*** | ***19.1*** | ***25*** | ***6*** | ***15*** | ***10*** | ***+0.085*** | ***304*** |
| MZD20 | 18.8 | 21.2 | 25 | 6 | 15 | 10 | +0.086 | 285 |
| MZD22 | 20.8 | 23.3 | 25 | 6 | 15 | 12 | +0.087 | 250 |
| MZD24 | 22.8 | 25.6 | 25 | 7 | 15 | 12 | +0.088 | 225 |
| MZD27 | 25.1 | 28.9 | 25 | 7 | 15 | 14 | +0.09 | 205 |
| MZD30 | 28 | 32 | 25 | 8 | 15 | 14 | +0.091 | 190 |
| MZD33 | 31 | 35 | 25 | 8 | 15 | 17 | +0.092 | 170 |
| MZD36 | 34 | 38 | 10 | 21 | 40 | 17 | +0.093 | 150 |
| MZD39 | 37 | 41 | 10 | 21 | 40 | 20 | +0.094 | 135 |
| MZD43 | 40 | 46 | 10 | 24 | 45 | 20 | +0.095 | 125 |
| MZD47 | 44 | 50 | 10 | 24 | 45 | 24 | +0.095 | 115 |
| MZD51 | 48 | 54 | 10 | 25 | 60 | 24 | +0.096 | 110 |
| MZD56 | 52 | 60 | 10 | 25 | 60 | 28 | +0.096 | 95 |
| MZD62 | 58 | 66 | 10 | 25 | 80 | 28 | +0.097 | 90 |
| MZD68 | 64 | 72 | 10 | 25 | 80 | 34 | +0.097 | 80 |
| MZD75 | 70 | 79 | 10 | 30 | 100 | 34 | +0.098 | 70 |
| MZD82 | 77 | 88 | 10 | 30 | 100 | 41 | +0.098 | 65 |
| MZD91 | 85 | 96 | 5 | 60 | 200 | 41 | +0.099 | 60 |
| MZD100 | 94 | 106 | 5 | 60 | 200 | 50 | +0.11 | 55 |
| MZD110 | 104 | 116 | 5 | 80 | 250 | 50 | +0.11 | 50 |
| MZD120 | 114 | 127 | 5 | 80 | 250 | 60 | +0.11 | 45 |
| MZD130 | 124 | 141 | 5 | 110 | 300 | 60 | +0.11 | — |
| MZD150 | 138 | 156 | 5 | 110 | 300 | 75 | +0.11 | — |
| MZD160 | 153 | 171 | 5 | 150 | 350 | 75 | +0.11 | — |
| MZD180 | 168 | 191 | 5 | 150 | 350 | 90 | +0.11 | — |
| MZD200 | 188 | 212 | 5 | 150 | 350 | 90 | +0.11 | — |

**NOTE 1. TOLERANCE AND TYPE NUMBER DESIGNATION**
The type numbers listed have zener voltage min/max limits as shown.

**NOTE 2. ZENER VOLTAGE ($V_Z$) MEASUREMENT**
The zener voltage is measured after the test current ($I_{ZT}$) has been applied for 40 ±10 milliseconds, while maintaining a lead temperautre ($T_L$) of 30°C at a point of 10 mm from the diode body.

**NOTE 3. ($i_r$) NON-REPETITIVE SURGE CURRENT**
Maximum peak, non-repetitive reverse surge current of half square wave or equivalent sine wave pulse of 50 ms duration, superimposed on the test current ($I_{ZT}$).

**NOTE 4. SPECIAL SELECTIONS AVAILABLE INCLUDE:**
Nominal zener voltages between those shown. Tight voltage tolerances such as ±1% and ±2%. Consult factory.

# GENERAL DATA — 1-3 WATT DO-41 SURMETIC 30

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted) $V_F$ = 1.5 V Max, $I_F$ = 200 mA for all types

| Motorola Type No. (Note 1) | Nominal Zener Voltage $V_Z$ @ $I_{ZT}$ Volts (Note 2) | Test Current $I_{ZT}$ mA | Max Zener Impedance (Note 3) | | | Leakage Current | | Surge Current @ $T_A$ = 25°C $i_r$ – mA (Note 4) |
|---|---|---|---|---|---|---|---|---|
| | | | $Z_{ZT}$ @ $I_{ZT}$ Ohms | $Z_{ZK}$ @ $I_{ZK}$ Ohms | $I_{ZK}$ mA | $I_R$ μA Max | @ $V_R$ Volts | |
| MZP4728A | 3.3 | 76 | 10 | 400 | 1 | 100 | 1 | 1380 |
| MZP4729A | 3.6 | 69 | 10 | 400 | 1 | 100 | 1 | 1260 |
| MZP4730A | 3.9 | 64 | 9 | 400 | 1 | 50 | 1 | 1190 |
| MZP4731A | 4.3 | 58 | 9 | 400 | 1 | 10 | 1 | 1070 |
| MZP4732A | 4.7 | 53 | 8 | 500 | 1 | 10 | 1 | 970 |
| MZP4733A | 5.1 | 49 | 7 | 550 | 1 | 10 | 1 | 890 |
| MZP4734A | 5.6 | 45 | 5 | 600 | 1 | 10 | 2 | 810 |
| MZP4735A | 6.2 | 41 | 2 | 700 | 1 | 10 | 3 | 730 |
| MZP4736A | 6.8 | 37 | 3.5 | 700 | 1 | 10 | 4 | 660 |
| MZP4737A | 7.5 | 34 | 4 | 700 | 0.5 | 10 | 5 | 605 |
| MZP4738A | 8.2 | 31 | 4.5 | 700 | 0.5 | 10 | 6 | 550 |
| MZP4739A | 9.1 | 28 | 5 | 700 | 0.5 | 10 | 7 | 500 |
| MZP4740A | 10 | 25 | 7 | 700 | 0.25 | 10 | 7.6 | 454 |
| MZP4741A | 11 | 23 | 8 | 700 | 0.25 | 5 | 8.4 | 414 |
| MZP4742A | 12 | 21 | 9 | 700 | 0.25 | 5 | 9.1 | 380 |
| MZP4743A | 13 | 19 | 10 | 700 | 0.25 | 5 | 9.9 | 344 |
| MZP4744A | 15 | 17 | 14 | 700 | 0.25 | 5 | 11.4 | 304 |
| MZP4745A | 16 | 15.5 | 16 | 700 | 0.25 | 5 | 12.2 | 285 |
| ***MZP4746A*** | ***18*** | ***14*** | ***20*** | ***750*** | ***0.25*** | ***5*** | ***13.7*** | ***250*** |
| MZP4747A | 20 | 12.5 | 22 | 750 | 0.25 | 5 | 15.2 | 225 |
| MZP4748A | 22 | 11.5 | 23 | 750 | 0.25 | 5 | 16.7 | 205 |
| ***MZP4749A*** | ***24*** | ***10.5*** | ***25*** | ***750*** | ***0.25*** | ***5*** | ***18.2*** | ***190*** |
| MZP4750A | 27 | 9.5 | 35 | 750 | 0.25 | 5 | 20.6 | 170 |
| ***MZP4751A*** | ***30*** | ***8.5*** | ***40*** | ***1000*** | ***0.25*** | ***5*** | ***22.8*** | ***150*** |
| MZP4752A | 33 | 7.5 | 45 | 1000 | 0.25 | 5 | 25.1 | 135 |
| MZP4753A | 36 | 7 | 50 | 1000 | 0.25 | 5 | 27.4 | 125 |
| MZP4754A | 39 | 6.5 | 60 | 1000 | 0.25 | 5 | 29.7 | 115 |
| MZP4755A | 43 | 6 | 70 | 1500 | 0.25 | 5 | 32.7 | 110 |
| MZP4756A | 47 | 5.5 | 80 | 1500 | 0.25 | 5 | 35.8 | 95 |
| MZP4757A | 51 | 5 | 95 | 1500 | 0.25 | 5 | 38.8 | 90 |
| MZP4758A | 56 | 4.5 | 110 | 2000 | 0.25 | 5 | 42.6 | 80 |
| MZP4759A | 62 | 4 | 125 | 2000 | 0.25 | 5 | 47.1 | 70 |
| MZP4760A | 68 | 3.7 | 150 | 2000 | 0.25 | 5 | 51.7 | 65 |
| MZP4761A | 75 | 3.3 | 175 | 2000 | 0.25 | 5 | 56 | 60 |
| MZP4762A | 82 | 3 | 200 | 3000 | 0.25 | 5 | 62.2 | 55 |
| MZP4763A | 91 | 2.8 | 250 | 3000 | 0.25 | 5 | 69.2 | 50 |
| MZP4764A | 100 | 2.5 | 350 | 3000 | 0.25 | 5 | 76 | 45 |
| 1M110ZS5 | 110 | 2.3 | 450 | 4000 | 0.25 | 5 | 83.6 | — |
| 1M120ZS5 | 120 | 2 | 550 | 4500 | 0.25 | 5 | 91.2 | — |
| 1M130ZS5 | 130 | 1.9 | 700 | 5000 | 0.25 | 5 | 98.8 | — |
| 1M150ZS5 | 150 | 1.7 | 1000 | 6000 | 0.25 | 5 | 114 | — |
| 1M160ZS5 | 160 | 1.6 | 1100 | 6500 | 0.25 | 5 | 121.6 | — |
| 1M180ZS5 | 180 | 1.4 | 1200 | 7000 | 0.25 | 5 | 136.8 | — |
| 1M200ZS5 | 200 | 1.2 | 1500 | 8000 | 0.25 | 5 | 152 | — |

**NOTE 1. TOLERANCE AND TYPE NUMBER DESIGNATION**
The type numbers listed have a standard tolerance on the nominal zener voltage of ±5%. The tolerance on the 1M type numbers is indicated by the digits following ZS in the part number. "5" indicates a ±5% $V_Z$ tolerance.

**NOTE 2. ZENER VOLTAGE ($V_Z$) MEASUREMENT**
Motorola guarantees the zener voltage when measured at 90 seconds while maintaining the lead temperature ($T_L$) at 30°C ±1°C, 3/8″ from the diode body.

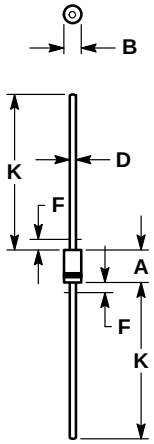
**NOTE 3. ZENER IMPEDANCE ($Z_Z$) DERIVATION**
The zener impedance is derived from the 60 cycle ac voltage, which results when an ac current having an rms value equal to 10% of the dc zener current ($I_{ZT}$ or $I_{ZK}$) is superimposed on $I_{ZT}$ or $I_{ZK}$.

**NOTE 4. SURGE CURRENT ($i_r$) NON-REPETITIVE**
The rating listed in the electrical characteristics table is maximum peak, non-repetitive, reverse surge current of 1/2 square wave or equivalent sine wave pulse of 1/120 second duration superimposed on the test current, $I_{ZT}$, however, actual device capability is as described in Figure 3 of General Data — Surmetic 30.

**NOTE 5. SPECIAL SELECTIONS AVAILABLE INCLUDE:**
Nominal zener voltages between those shown. Tight voltage tolerances such as ±1% and ±2%. Consult factory.

# Zener Voltage Regulator Diodes — Axial Leaded

## 1–3 Watt DO-41 Surmetic 30




NOTES:
1. ALL RULES AND NOTES ASSOCIATED WITH JEDEC DO-41 OUTLINE SHALL APPLY.
2. POLARITY DENOTED BY CATHODE BAND.
3. LEAD DIAMETER NOT CONTROLLED WITHIN F DIMENSION.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 4.07 | 5.20 | 0.160 | 0.205 |
| B | 2.04 | 2.71 | 0.080 | 0.107 |
| D | 0.71 | 0.86 | 0.028 | 0.034 |
| F | — | 1.27 | — | 0.050 |
| K | 27.94 | — | 1.100 | — |

**CASE 59-03**
**DO-41**
**PLASTIC**

(Refer to Section 10 for Surface Mount, Thermal Data and Footprint Information.)

**MULTIPLE PACKAGE QUANTITY (MPQ) REQUIREMENTS**

| Package Option | Type No. Suffix | MPQ (Units) |
|---|---|---|
| Tape and Reel | RL | 6K |
| Tape and Ammo | TA | 4K |

(Refer to Section 10 for more information on Packaging Specifications.)



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