

Description

The ZMR250Q/ZMR330Q/ZMR500Q of three terminal fixed positive voltage regulators feature internal current limit and will shut down under thermal overload conditions making the devices difficult to destroy.

The circuit design offers an exceptionally low quiescent current, only 30µA for the 2.5V device, ideal for low power applications. The initial devices in the series regulate to 2.5V or 5V with a drive capability up to 50mA.

All three devices are designed with space saving in mind and are available in the small outline SOT23 (Type DN) package. All three have an input voltage range of at least 20V plus the output voltage.

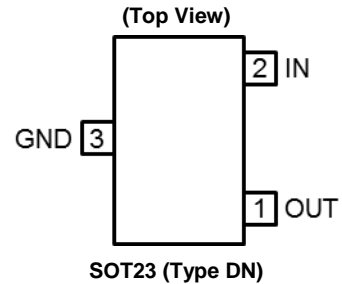
The ZMR250Q, ZMR330Q and ZMR500Q have been qualified to AEC-Q100 Grade 1 and are Automotive Compliant supporting PPAPs.

Features

- 2.5V, 3.3V and 5V Output
- Output Current up to 50mA
- Very Low Quiescent Current (30µA)
- Unconditionally Stable
- Internal Short Circuit Current Limit
- Green Molding in SOT23 (Type DN)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- Automotive Compliant
- **Qualified to AEC-Q100 Standards for High Reliability**
- **PPAP Capable (Note 4)**

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
 4. Automotive products are AEC-Q100 qualified and are PPAP capable. http://www.diodes.com/product_compliance_definitions.html.

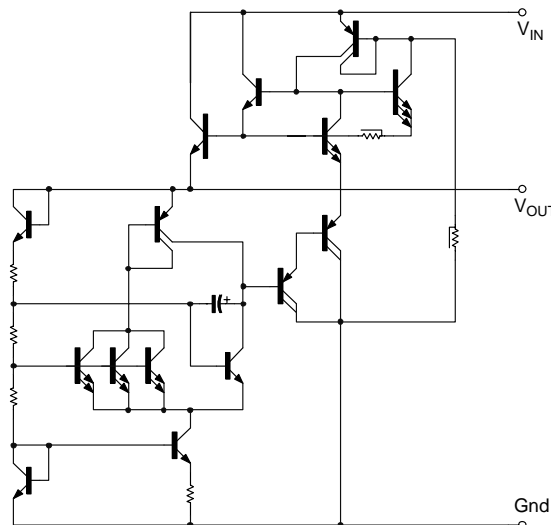
Pin Assignments



Applications

- Automotive Point of Load Regulation

Equivalent Circuit



Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---|----------------------|------------------|
| Input Voltage (Note 5) ZMR250Q ZMR330Q ZMR500Q | 22.5 24 25 | V |
| Power Dissipation ($T_A = +25^\circ\text{C}$) (Note 6) SOT23 (Type DN) | 500 | mW |
| Output Current (I_O) | 100 | mA |
| Ambient Temperature | -55 to +125 | $^\circ\text{C}$ |
| Maximum Junction Temperature | +125 | $^\circ\text{C}$ |
| Storage Temperature | -65 to +150 | $^\circ\text{C}$ |
| ESD Rating | | |
| HBM | Human Body Model | 1.5 |
| MM | Machine Model | 350 |
| CDM | Charged Device Model | 1 |

Caution: Stresses greater than the 'Absolute Maximum Ratings' specified above, may cause permanent damage to the device. These are stress ratings only; functional operation of the device at conditions between maximum recommended operating conditions and absolute maximum ratings is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.

(Semiconductor devices are ESD sensitive and may be damaged by exposure to ESD events. Suitable ESD precautions should be taken when handling and transporting these devices.)

- Notes:**
- The maximum operating input voltage and output current of the device will be governed by the maximum power dissipation of the selected package. Maximum package power dissipation is specified at $+25^\circ\text{C}$ and must be linearly derated to zero at $T_A = T_J = +125^\circ\text{C}$.
 - Maximum power dissipation for the SOT23 (Type DN) package is calculated assuming that the device is mounted on a ceramic substrate measuring 15mm x 15mm x 0.6mm.

Recommended Operating Conditions

| Input Voltage Range | Min | Max | Unit |
|----------------------------|-----|------|------------------|
| ZMR250Q | 4.2 | 22.5 | V |
| ZMR330Q | 4.8 | 24 | V |
| ZMR500Q | 7.0 | 25 | V |
| Junction Temperature Range | -40 | +125 | $^\circ\text{C}$ |
| Ambient Temperature Range | -40 | +125 | $^\circ\text{C}$ |

Electrical Characteristics (@T_A = +25°C, I_O = 10mA, V_{IN} = 6.5V, unless otherwise specified.)

ZMR250Q

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|-----------------------------------|--|---|-------|-------|-------|-------|
| V _O | Output Voltage | — | 2.438 | 2.5 | 2.563 | V |
| | | — | 2.360 | — | 2.640 | V |
| | | V _{IN} = 4.5V to 22.5V I _O = 0 to 50mA T _J = -40°C to +125°C | 2.360 | — | 2.640 | V |
| ΔV _O | Line Regulation | V _{IN} = 4.5V to 22.5V | — | 5 | 15 | mV |
| ΔV _O | Load Regulation | I _O = 0 to 50mA | — | 20 | 30 | mV |
| | | I _O = 0 to 10mA | — | 12 | — | |
| I _S | Supply Current | T _J = -40°C to +125°C | — | 30 | 40 | μA |
| ΔI _S | Supply Current Change | I _O = 0 to 50mA | — | 1 | ±10 | μA |
| | | V _{IN} = 4.5V to 22.5V | — | 2 | ±10 | |
| V _N | Output Noise Voltage | f = 10Hz to 10kHz | — | 65 | — | μVrms |
| ΔV _{IN} /ΔV _O | Ripple Rejection | V _{IN} = 6.3V to 18V, f = 120Hz | 55 | 75 | — | dB |
| V _{IN} | Input Voltage Required to Maintain Regulation | — | — | 3.9 | — | V |
| ΔV _O /ΔT | Average Temperature Coefficient V _O | I _O = 5.0mA T _J = -40°C to +125°C | — | 0.275 | 0.700 | mV/°C |

Electrical Characteristics (@T_A = +25°C, I_O = 10mA, V_{IN} = 7V, unless otherwise specified.)

ZMR330Q

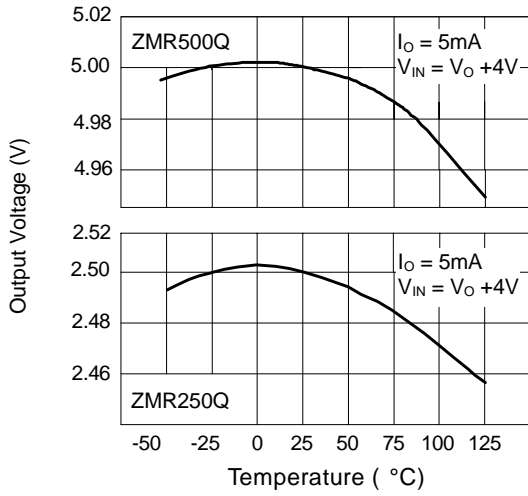
| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|-----------------------------------|---|---|-------|------|-------|-------|
| V _O | Output Voltage | — | 3.217 | 3.3 | 3.383 | V |
| | | — | 3.148 | — | 3.393 | V |
| | | V _{IN} = 5V to 24V I _O = 0 to 50mA T _J = -40°C to +125°C | 3.148 | — | 3.408 | V |
| ΔV _O | Line Regulation | V _{IN} = 5V to 24V | — | 5 | 15 | mV |
| ΔV _O | Load Regulation | I _O = 0 to 50mA | — | 20 | 50 | mV |
| | | I _O = 0 to 10mA | — | 13 | — | |
| I _S | Supply Current | T _J = -40°C to +125°C | — | 120 | 170 | μA |
| ΔI _S | Supply Current Change | I _O = 0 to 50mA | — | 5 | ±10 | μA |
| | | V _{IN} = 5V to 20V | — | 2 | ±10 | |
| V _N | Output Noise Voltage | f = 10Hz to 10kHz | — | 80 | — | μVrms |
| ΔV _{IN} /ΔV _O | Ripple Rejection | V _{IN} = 6V to 20V, f = 120Hz | 55 | — | — | dB |
| V _{IN} | Input Voltage Required to Maintain Regulation | — | — | 4.74 | — | V |

Electrical Characteristics (@T_A = +25°C, I_O = 10mA, V_{IN} = 10V, unless otherwise specified.)

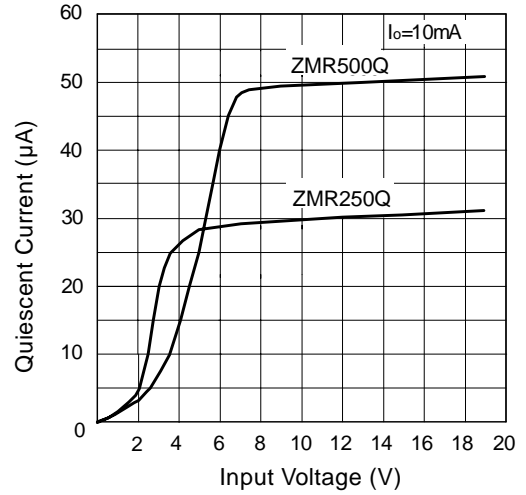
ZMR500Q

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|-----------------------------------|--|---|-------|-------|-------|-------|
| V _O | Output Voltage | — | 4.875 | 5 | 5.125 | V |
| | | — | 4.780 | — | 5.160 | V |
| | | V _{IN} = 7V to 25V I _O = 0 to 50mA T _J = -40°C to +125°C | 4.780 | — | 5.175 | V |
| ΔV _O | Line Regulation | V _{IN} = 7V to 25V | — | 5 | 15 | mV |
| ΔV _O | Load Regulation | I _O = 0 to 50mA | — | 25 | 40 | mV |
| | | I _O = 0 to 10mA | — | 15 | — | |
| I _S | Supply Current | T _J = -40°C to +125°C | — | 50 | 70 | μA |
| ΔI _S | Supply Current Change | I _O = 0 to 50mA | — | 1 | ±10 | μA |
| | | V _{IN} = 7V to 25V | — | 2 | ±10 | |
| V _N | Output Noise Voltage | f = 10Hz to 10kHz | — | 90 | — | μVrms |
| ΔV _{IN} /ΔV _O | Ripple Rejection | V _{IN} = 8V to 18V, f = 120Hz | 55 | 72 | — | dB |
| V _{IN} | Input Voltage Required to Maintain Regulation | — | — | 6.7 | — | V |
| ΔV _O /ΔT | Average Temperature Coefficient V _O | I _O = 5.0mA, T _J = -40°C to +125°C | — | 0.275 | 0.700 | mV/°C |

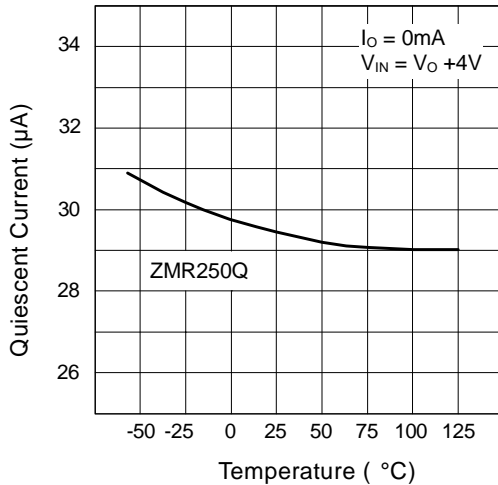
Typical Characteristics



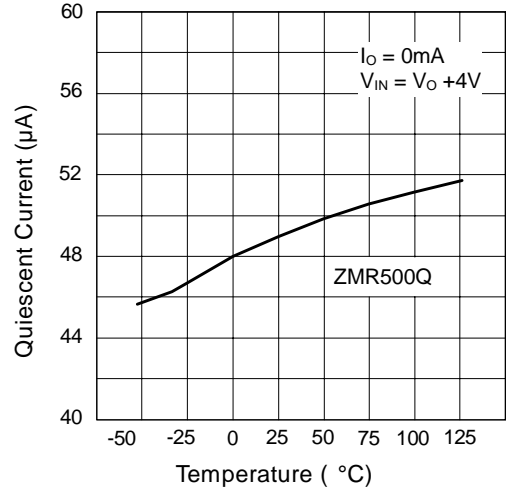
Output Voltage vs. Temperature



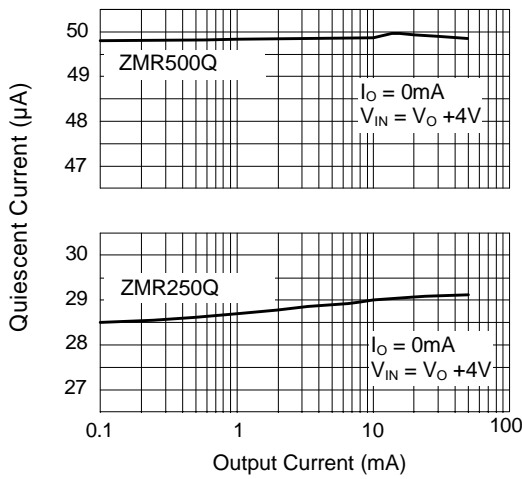
Quiescent Current vs. Input Voltage



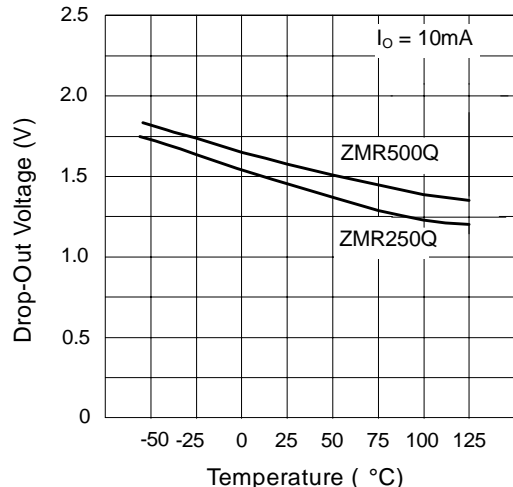
Quiescent Current vs. Temperature



Quiescent Current vs. Temperature

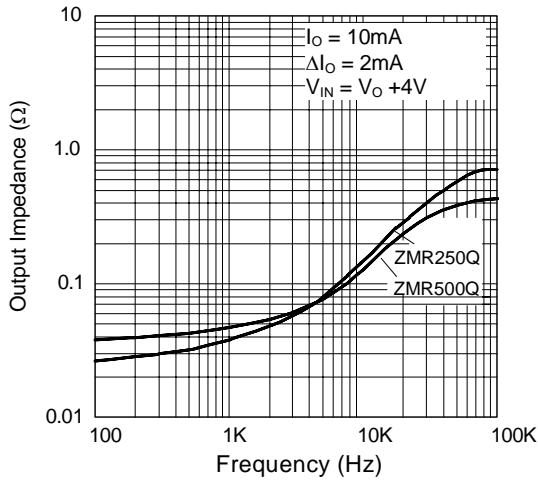


Quiescent Current vs. Output Current

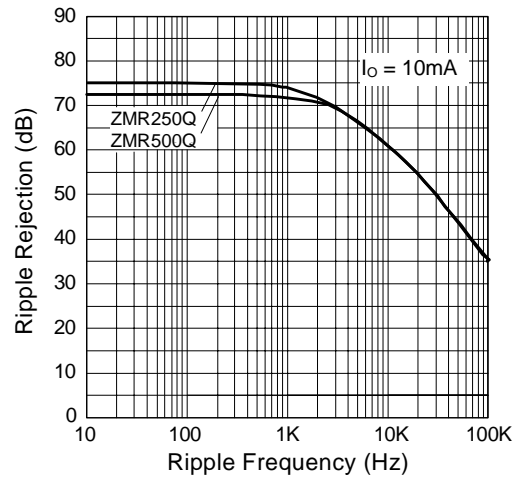


Drop-out Voltage vs. Temperature

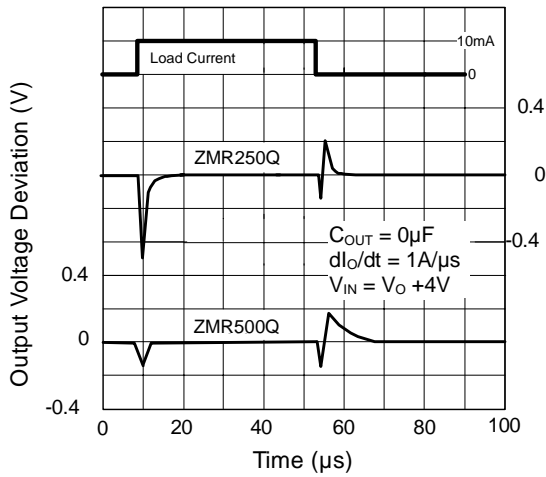
Typical Characteristics (Cont.)



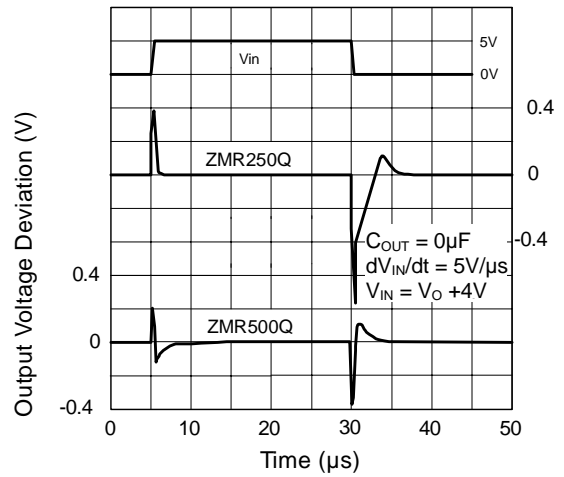
Output Impedance v Frequency



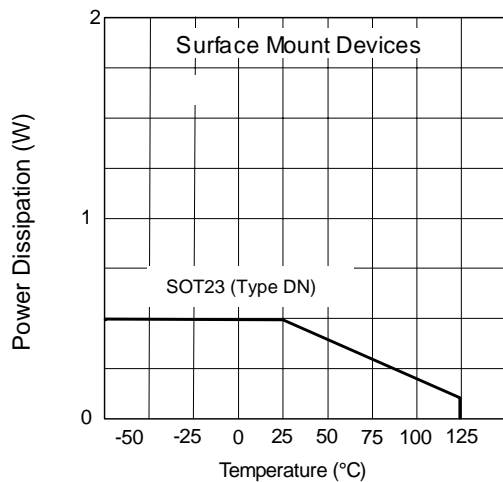
Ripple Rejection v Ripple Frequency



Load Transient Response

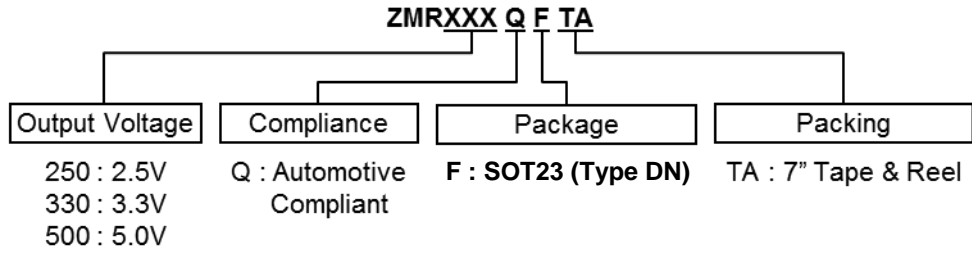


Line Transient Response



Power Derating

Ordering Information

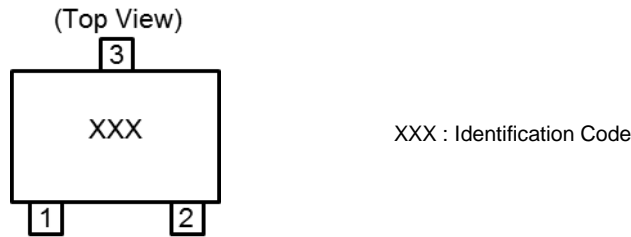


| Part Number | Package | Package Code | Identification Code | Packing: 7" Tape and Reel | | | Qualification Grade (Note 7) |
|-------------|-----------------|--------------|---------------------|---------------------------|------------|--------------------|------------------------------|
| | | | | Quantity | Tape Width | Part Number Suffix | |
| ZMR250QFTA | SOT23 (Type DN) | F | 25K | 3000 | 8mm | TA | Automotive Compliant |
| ZMR330QFTA | SOT23 (Type DN) | F | 330 | 3000 | 8mm | TA | Automotive Compliant |
| ZMR500QFTA | SOT23 (Type DN) | F | 50K | 3000 | 8mm | TA | Automotive Compliant |

Note: 7. ZMR250Q, ZMR330Q and ZMR500Q have been qualified to AEC-Q100 grade 1 and are classified as "Automotive Compliant" which supports PPAP documentation. See ZMR250/330/500 datasheet for commercial qualified versions.

Marking Information

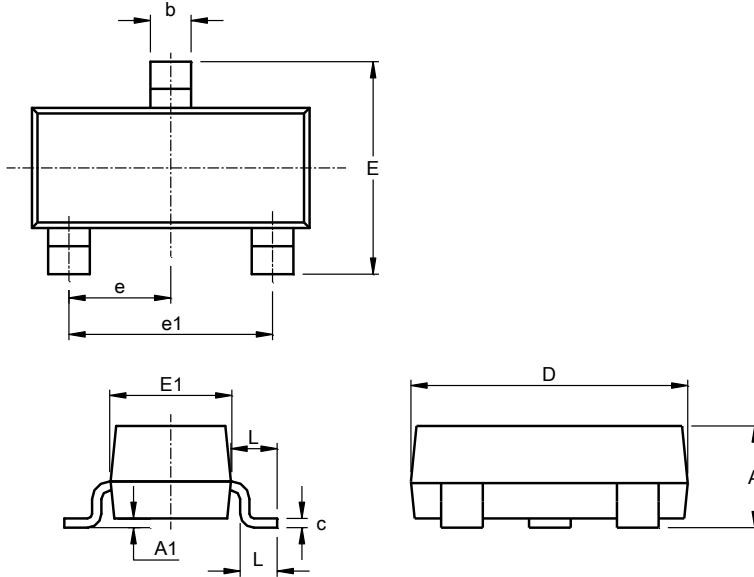
SOT23 (Type DN)



Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

SOT23 (Type DN)

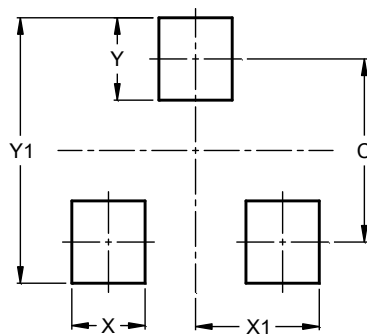


| SOT23 (Type DN) | | | |
|----------------------|----------|------|------|
| Dim | Min | Max | Typ |
| A | 0.89 | 1.12 | 1.00 |
| A1 | 0.01 | 0.10 | 0.05 |
| b | 0.30 | 0.51 | 0.45 |
| c | 0.08 | 0.20 | 0.10 |
| D | 2.80 | 3.04 | 3.00 |
| E | 2.10 | 2.64 | 2.42 |
| E1 | 1.20 | 1.40 | 1.37 |
| e | 0.95 REF | | |
| e1 | 1.90 REF | | |
| L | 0.25 | 0.60 | 0.30 |
| L1 | 0.45 | 0.62 | 0.54 |
| All Dimensions in mm | | | |

Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

SOT23 (Type DN)



| Dimensions | Value (in mm) |
|------------|---------------|
| C | 2.0 |
| X | 0.8 |
| X1 | 1.35 |
| Y | 0.9 |
| Y1 | 2.9 |

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