

NPN AVALANCHE TRANSISTOR IN SOT23

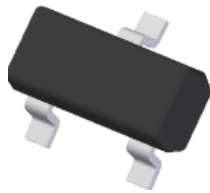
Features

- Avalanche Transistor
- 60A Peak Avalanche Current (Pulse width = 20ns)
- $BV_{CES} > 260V$ (415) & $320V$ (417)
- $BV_{CEO} > 100V$
- Specifically designed for Avalanche mode operation
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

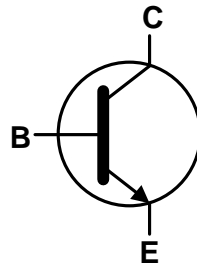
Description

The FMMT415/417 are NPN silicon planar bipolar transistors designed for operating in avalanche mode. Tight process control and low inductance packaging combine to produce high-current pulses with fast edges.

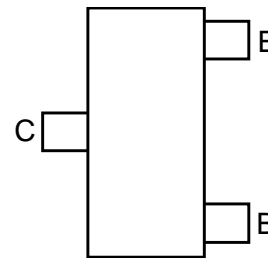
SOT23



Top View



Device Symbol



Top View
Pin-Out

Mechanical Data

- Case: SOT23
- Case Material: Molded Plastic. "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 ^(e3)
- Weight: 0.008 grams (Approximate)

Applications

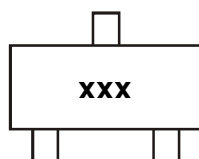
- Laser Diode Drivers for Ranging and Measurement (LIDAR)
- Radar Systems
- Fast Edge Switch Generator
- High Speed Pulse Generators

Ordering Information (Note 4)

| Product | Compliance | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|-----------|------------|---------|--------------------|-----------------|-------------------|
| FMMT415TD | AEC-Q101 | 415 | 7 | 8 | 500 |
| FMMT417TD | AEC-Q101 | 417 | 7 | 8 | 500 |

- 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. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

Marking Information



xxx = Product Type Marking Code
(See Ordering Information)

Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

| Characteristic | Symbol | FMMT415 | FMMT417 | Unit |
|---|------------------|---------|---------|------|
| Collector-Base Voltage | V _{CBO} | 260 | 320 | V |
| Collector-Emitter Voltage | V _{CES} | 260 | 320 | V |
| Collector-Emitter Voltage | V _{CEO} | 100 | 100 | V |
| Emitter-Base Voltage | V _{EBO} | 6 | | V |
| Continuous Collector Current | I _C | 500 | | mA |
| Peak Collector Current (Pulse Width = 20ns) | I _{CM} | 60 | | A |

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

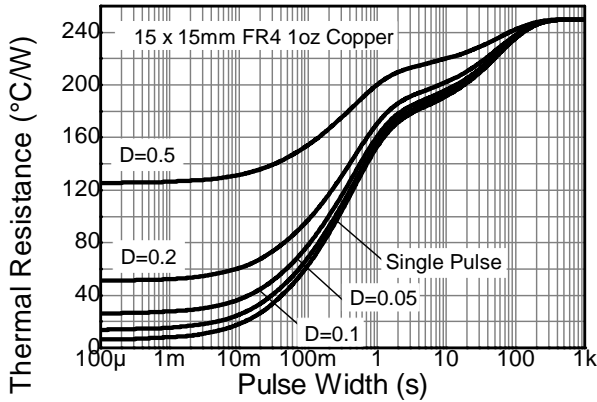
| Characteristic | Symbol | Value | Unit |
|--|-----------------------------------|-------------|------|
| Power Dissipation (Note 5) | P _D | 500 | mW |
| Thermal Resistance, Junction to Ambient (Note 5) | R _{θJA} | 250 | °C/W |
| Thermal Resistance, Junction to Lead (Note 6) | R _{θJL} | 197 | °C/W |
| Operating and Storage Temperature Range | T _J , T _{STG} | -55 to +150 | °C |

ESD Ratings (Note 7)

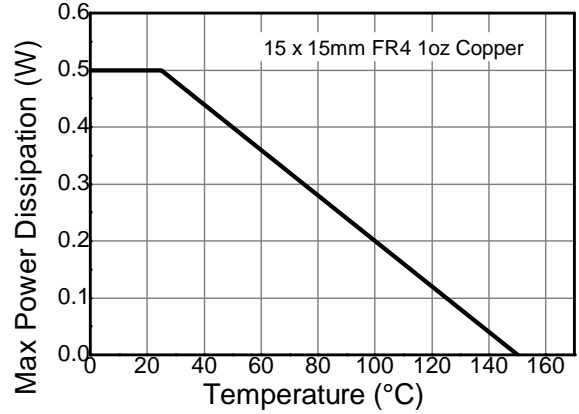
| Characteristic | Symbol | Value | Unit | JEDEC Class |
|--|---------|-------|------|-------------|
| Electrostatic Discharge - Human Body Model | ESD HBM | 4,000 | V | 3A |
| Electrostatic Discharge - Machine Model | ESD MM | 400 | V | C |

- Notes:
5. For a device mounted with the collector lead on 15mm x 15mm 1oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
 6. Thermal resistance from junction to solder-point (at the end of the collector lead).
 7. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

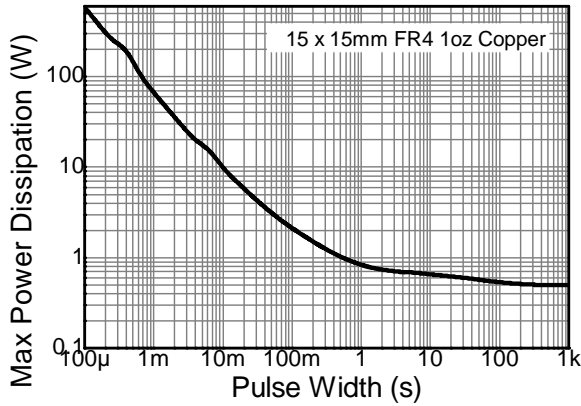
Thermal Characteristics and Derating Information



Transient Thermal Impedance



Derating Curve



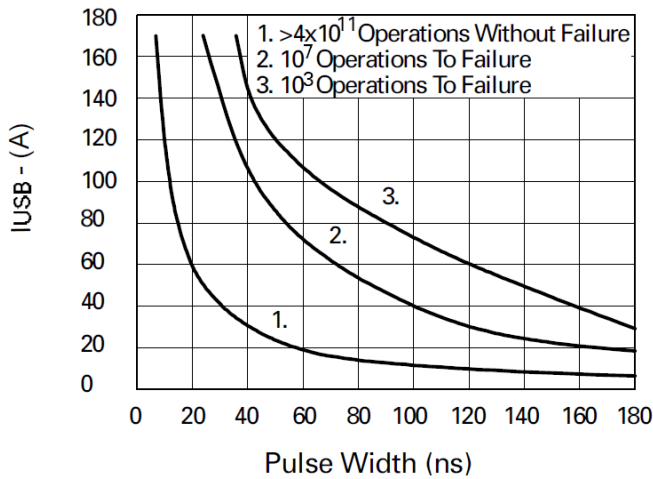
Pulse Power Dissipation

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

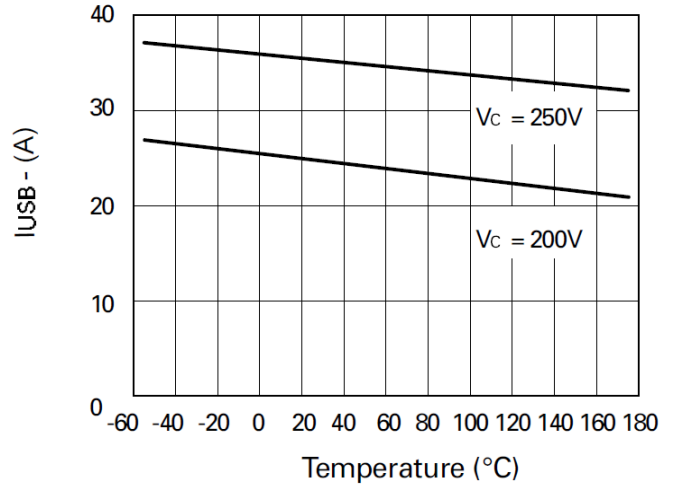
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|--|----------------------|-----|-----|-----------|----------|---|
| Collector-Emitter Breakdown Voltage | FMMT415 | 260 | — | — | V | I _C = 1mA T _J = -55 to +150°C |
| | FMMT417 | 320 | — | — | | I _C = 1mA |
| Collector-Emitter Breakdown Voltage (Note 8) | BV _{CEO} | 100 | — | — | V | I _C = 100μA |
| Emitter-Base Breakdown Voltage | BV _{EBO} | 6 | — | — | V | I _E = 100μA |
| Collector Cutoff Current | I _{CB0} | — | — | 100 10 | nA μA | V _{CB} = 180V V _{CB} = 180V, T _J = +100°C |
| Emitter Cutoff Current | I _{EBO} | — | — | 100 | nA | V _{EB} = 4V |
| Static Forward Current Transfer Ratio (Note 8) | h _{FE} | 25 | — | — | — | I _C = 10mA, V _{CE} = 10V |
| Collector-Emitter Saturation Voltage (Note 8) | V _{CE(sat)} | — | — | 500 | mV | I _C = 10mA, I _B = 1mA |
| Base-Emitter Saturation Voltage (Note 8) | V _{BE(sat)} | — | — | 900 | mV | I _C = 10mA, I _B = 1mA |
| Pulsed Current in Second Breakdown | I _{USB} | — | 25 | — | A | V _C = 200V, C _{CE} = 620pF |
| | | | 35 | — | A | V _C = 250V, C _{CE} = 620pF |
| Collector-Emitter Inductance | L _{ce} | — | 2.5 | — | nH | Standard SOT23 leads |
| Output Capacitance | C _{obo} | — | — | 8 | pF | V _{CB} = 20V, I _E = 0 f = 100MHz |
| Transition Frequency | f _T | 40 | — | — | MHz | V _{CE} = 20V, I _C = 10mA, f = 20MHz |

Note: 8. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

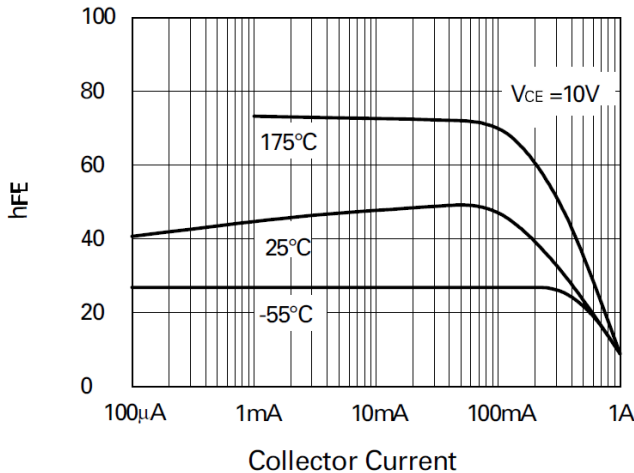
Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)



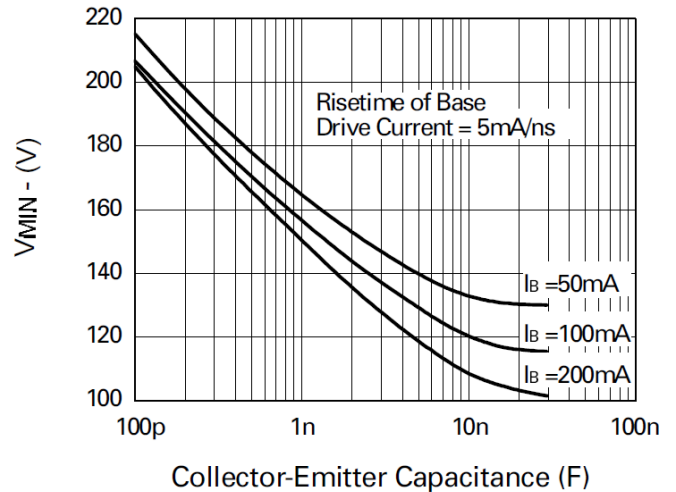
Maximum Avalanche Current v Pulse Width



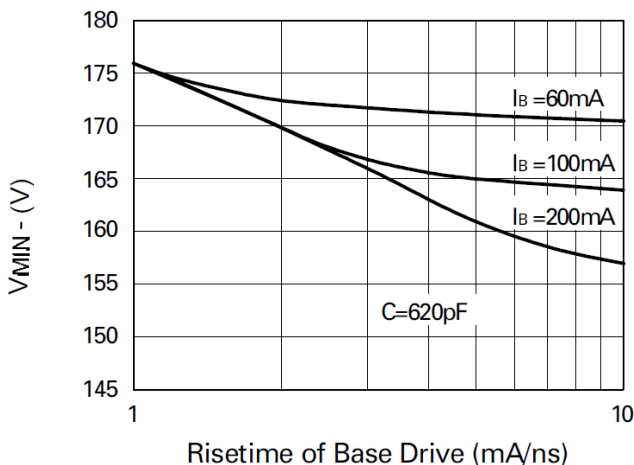
IUSB v Temperature for the specified conditions



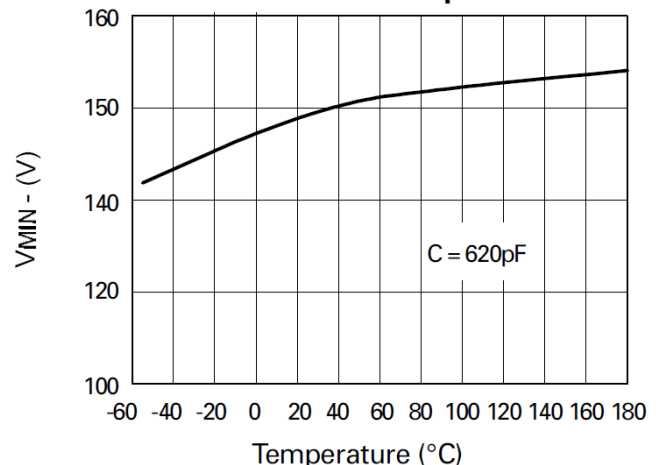
hFE v I_C



Minimum starting voltage as a function of capacitance



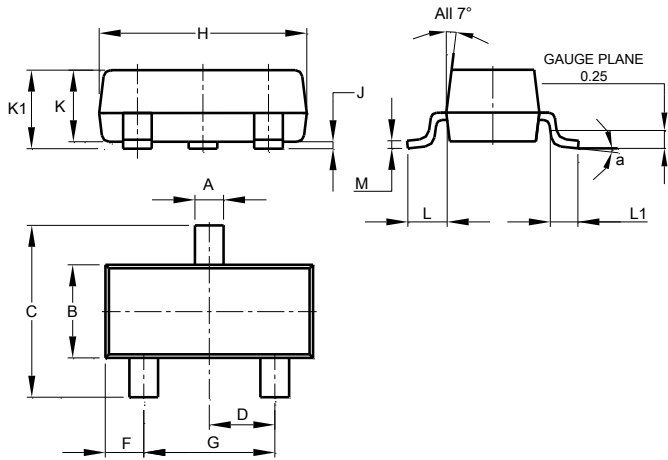
Minimum starting voltage as a function of drive current



Minimum starting voltage as a function of temperature

Package Outline Dimensions

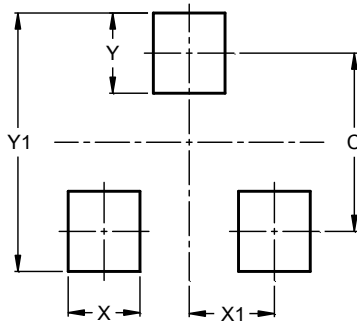
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



| SOT23 | | | |
|----------------------|-------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.37 | 0.51 | 0.40 |
| B | 1.20 | 1.40 | 1.30 |
| C | 2.30 | 2.50 | 2.40 |
| D | 0.89 | 1.03 | 0.915 |
| F | 0.45 | 0.60 | 0.535 |
| G | 1.78 | 2.05 | 1.83 |
| H | 2.80 | 3.00 | 2.90 |
| J | 0.013 | 0.10 | 0.05 |
| K | 0.890 | 1.00 | 0.975 |
| K1 | 0.903 | 1.10 | 1.025 |
| L | 0.45 | 0.61 | 0.55 |
| L1 | 0.25 | 0.55 | 0.40 |
| M | 0.085 | 0.150 | 0.110 |
| a | 0° | 8° | -- |
| All Dimensions in mm | | | |

Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



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

Note: For high voltage applications, the appropriate industry sector guidelines should be considered with regards to creepage and clearance distances between device terminals and PCB tracking.

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