

## 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**

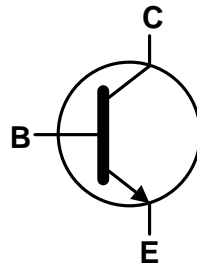
### Description

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.

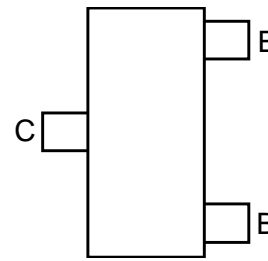
SOT23



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 <sup>(e3)</sup>
- Weight: 0.008 grams (Approximate)

### Applications

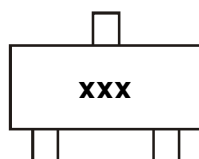
- Laser Diode Drivers for Ranging and Measurement (LIDAR)
- Radar Systems
- Fast Edge Switch Generator
- High Speed Pulse Generators

### 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](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<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	FMMT415	FMMT417	Unit
Collector-Base Voltage	V <sub>CBO</sub>	260	320	V
Collector-Emitter Voltage	V <sub>CES</sub>	260	320	V
Collector-Emitter Voltage	V <sub>CEO</sub>	100	100	V
Emitter-Base Voltage	V <sub>EBO</sub>	6		V
Continuous Collector Current	I <sub>C</sub>	500		mA
Peak Collector Current (Pulse Width = 20ns)	I <sub>CM</sub>	60		A

### Thermal Characteristics (@T<sub>A</sub> = +25°C, unless otherwise specified.)

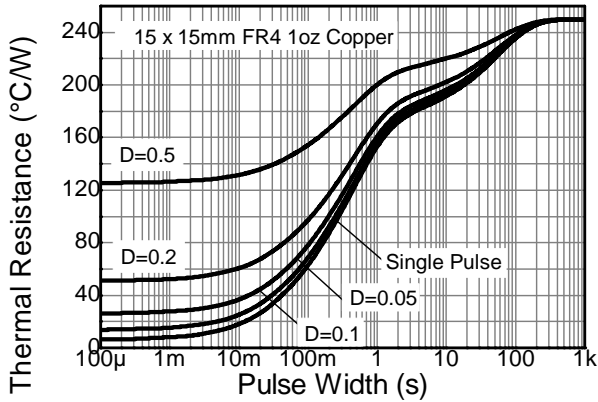
Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P <sub>D</sub>	500	mW
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	250	°C/W
Thermal Resistance, Junction to Lead (Note 6)	R <sub>θJL</sub>	197	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

### ESD Ratings (Note 7)

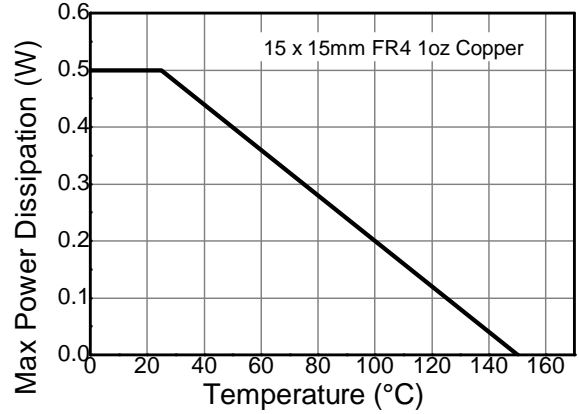
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	400	V	C

- 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.

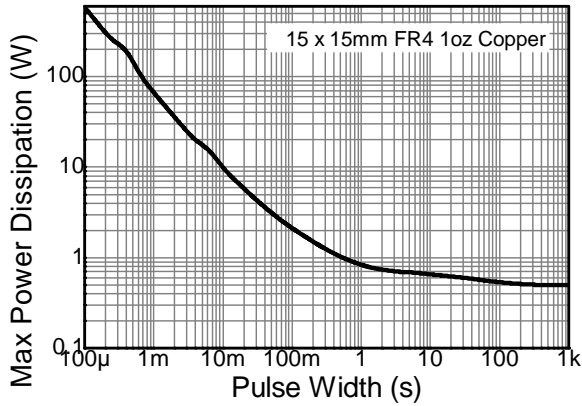
**Thermal Characteristics and Derating Information**



**Transient Thermal Impedance**



**Derating Curve**



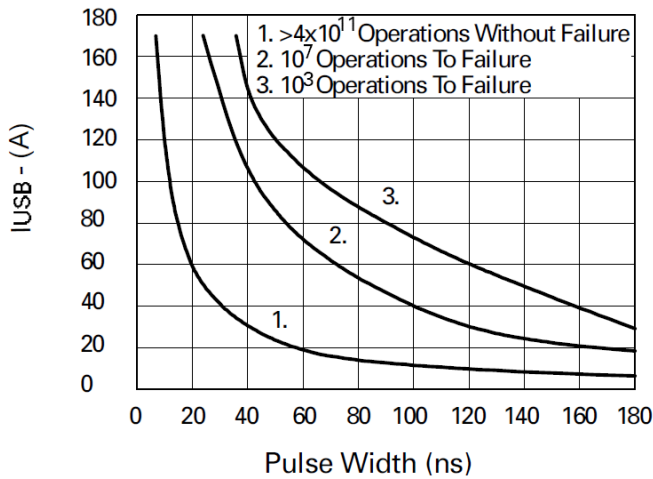
**Pulse Power Dissipation**

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

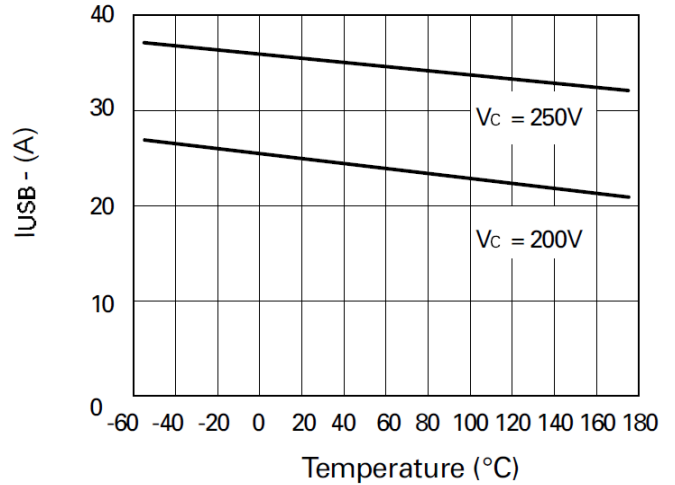
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Emitter Breakdown Voltage	FMMT415	260	—	—	V	I <sub>C</sub> = 1mA T <sub>J</sub> = -55 to +150°C
	FMMT417	320	—	—		I <sub>C</sub> = 1mA
Collector-Emitter Breakdown Voltage (Note 8)	BV <sub>CEO</sub>	100	—	—	V	I <sub>C</sub> = 100μA
Emitter-Base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

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

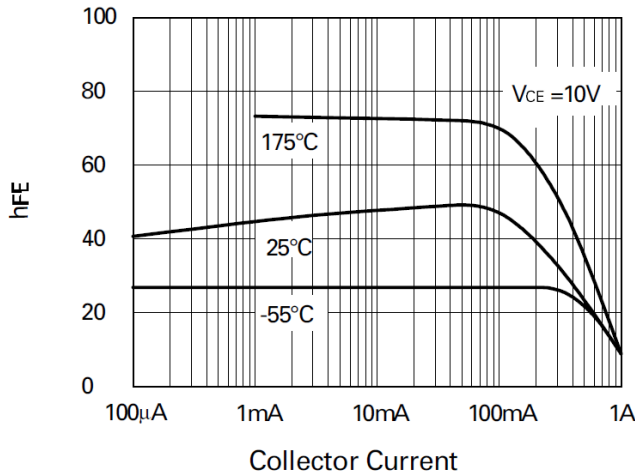
**Typical Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)



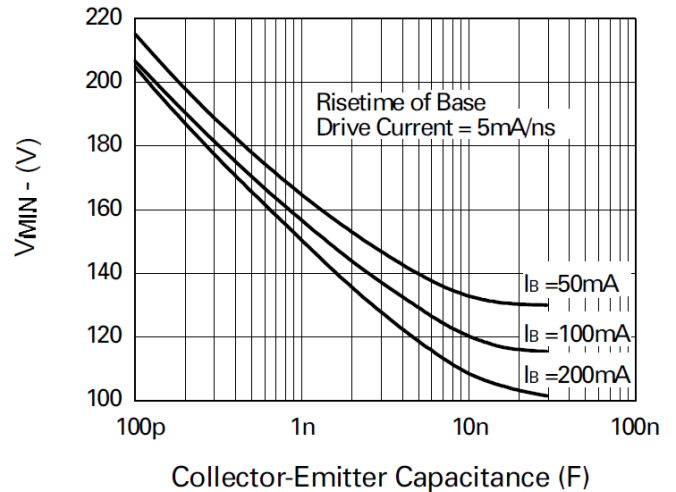
**Maximum Avalanche Current v Pulse Width**



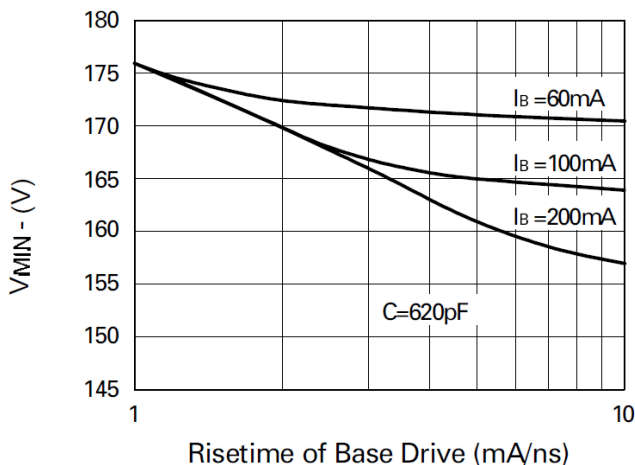
**IUSB v Temperature for the specified conditions**



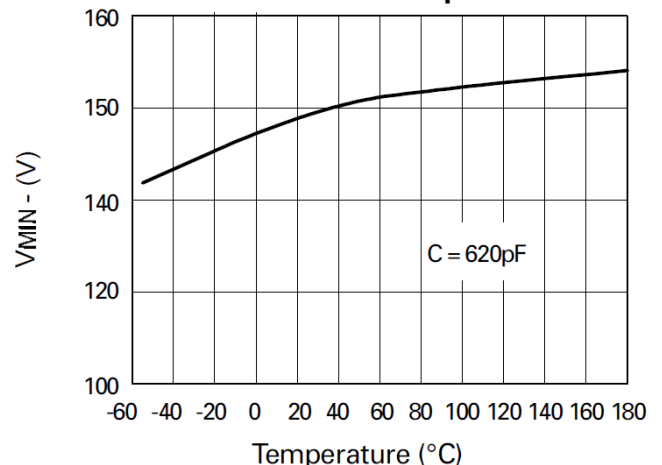
**hFE v I<sub>C</sub>**



**Minimum starting voltage as a function of capacitance**



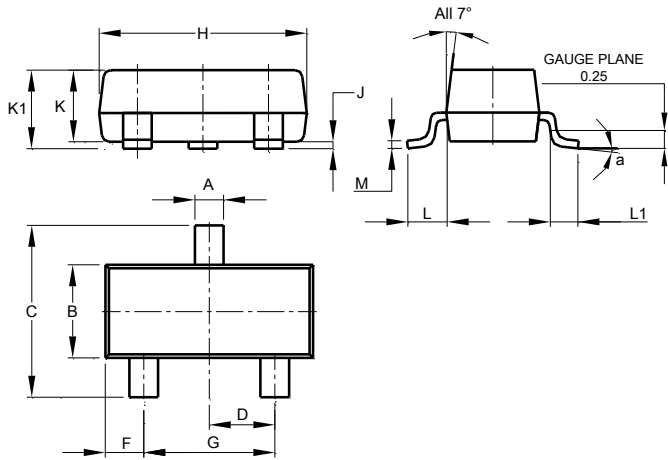
**Minimum starting voltage as a function of drive current**



**Minimum starting voltage as a function of temperature**

## Package Outline Dimensions

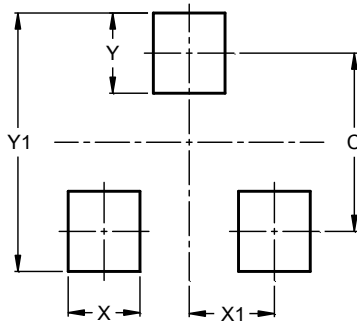
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



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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