

Features

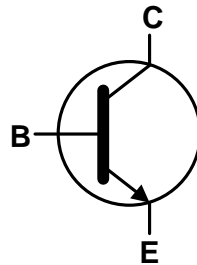
- Avalanche Transistor
- 50A Peak Avalanche Current (Pulse width = 20ns)
- $BV_{CES} > 150V$
- $BV_{CEO} > 50V$
- Specifically designed for Avalanche mode operation
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

Description

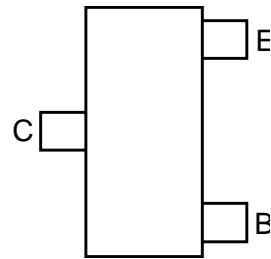
The FMMT413 is an NPN silicon planar bipolar transistor designed for operating in avalanche mode. Tight process control and low inductance packaging combine to produce high current pulses with fast edges.



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 [Ⓔ]
- Weight: 0.008 grams (Approximate)

Applications

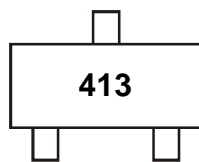
- Laser Diode Drivers for Ranging and Measurement (LIDAR)
- Radar Systems
- Fast Edge Switch Generator
- High Speed Pulse Generators

Ordering Information (Note 4)

Product	Compliance	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
FMMT413TD	AEC-Q101	413	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



413 = Product Type Marking Code

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

Characteristic	Symbol	Value	Unit
Collector-Base Voltage	V _{CBO}	150	V
Collector-Emitter Voltage	V _{CES}	150	V
Collector-Emitter Voltage	V _{CEO}	50	V
Emitter-Base Voltage	V _{EBO}	6	V
Continuous Collector Current	I _C	100	mA
Peak Collector Current (Pulse Width = 20ns)	I _{CM}	50	A

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

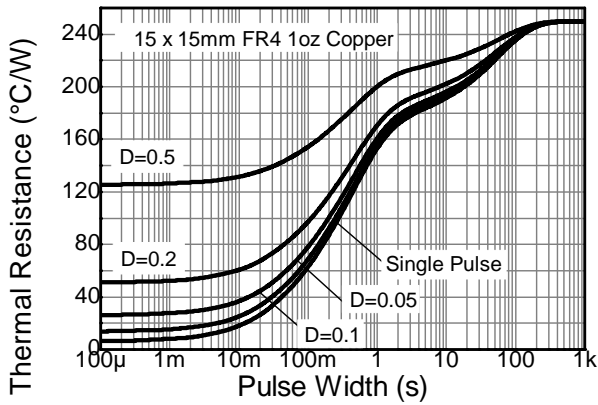
Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P _D	500	mW
Thermal Resistance, Junction to Ambient (Note 5)	R _{θJA}	250	°C/W
Thermal Resistance, Junction to Lead (Note 6)	R _{θJL}	197	°C/W
Operating and Storage Temperature Range	T _J , T _{STG}	-55 to +150	°C

ESD Ratings (Note 7)

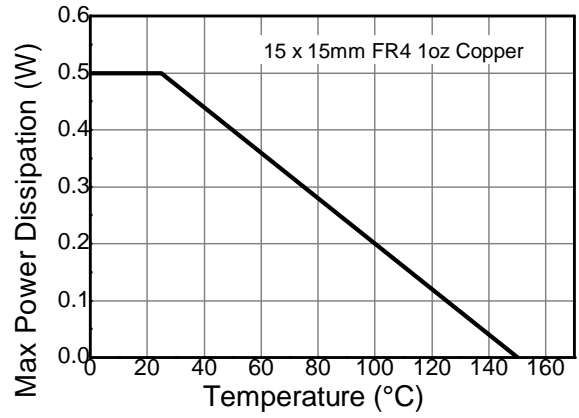
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	400	V	C

- 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.

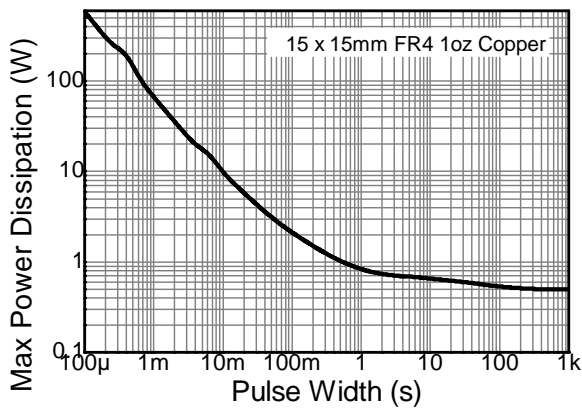
Thermal Characteristics and Derating Information



Transient Thermal Impedance



Derating Curve



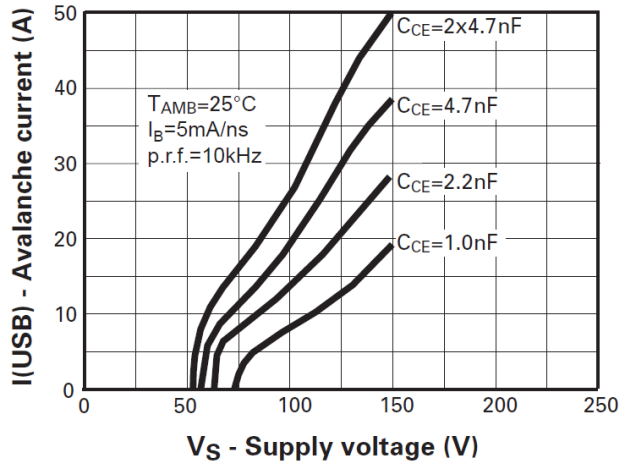
Pulse Power Dissipation

Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Base Breakdown Voltage	BV_{CBO}	150	—	—	V	$I_C = 100\mu\text{A}$
Collector-Emitter Breakdown Voltage	BV_{CES}	150	—	—	V	$I_C = 100\mu\text{A}$
Collector-Emitter Breakdown Voltage (Note 8)	BV_{CEO}	50	—	—	V	$I_C = 10\text{mA}$
Emitter-Base Breakdown Voltage	BV_{EBO}	6	—	—	V	$I_E = 100\mu\text{A}$
Collector-Base Cutoff Current	I_{CBO}	—	—	100	nA	$V_{CB} = 120\text{V}$
Emitter-Base Cutoff Current	I_{EBO}	—	—	100	nA	$V_{EB} = 4\text{V}$
Static Forward Current Transfer Ratio (Note 8)	h_{FE}	50	—	—	—	$I_C = 10\text{mA}$, $V_{CE} = 10\text{V}$
Collector-Emitter Saturation Voltage (Note 8)	$V_{CE(sat)}$	—	—	150	mV	$I_C = 10\text{mA}$, $I_B = 1\text{mA}$
Base-Emitter Saturation Voltage (Note 8)	$V_{BE(sat)}$	—	—	800	mV	$I_C = 10\text{mA}$, $I_B = 1\text{mA}$
Pulsed Current in Second Breakdown (Note 9)	I_{USB}	—	22 30	—	A A	$V_C = 110\text{V}$, $C_{CE} = 4.7\text{nF}$ $V_C = 130\text{V}$, $C_{CE} = 4.7\text{nF}$
Collector-Emitter Inductance	L_{ce}	—	2.5	—	nH	Standard SOT23 leads
Output Capacitance	C_{obo}	—	2	—	pF	$V_{CB} = 10\text{V}$, $I_E = 0$ $f = 1\text{MHz}$
Transition Frequency	f_T	—	150	—	MHz	$V_{CE} = 5\text{V}$, $I_C = 10\text{mA}$, $f = 20\text{MHz}$

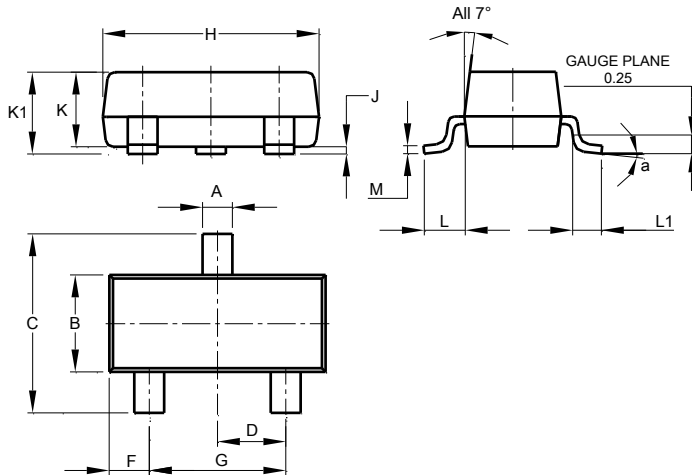
Notes: 8. Measured under pulsed conditions. Pulse width $\leq 300\mu\text{s}$. Duty cycle $\leq 2\%$.
9. Measured with a circuit possessing an approximate loop inductance of 12nH.

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



Package Outline Dimensions

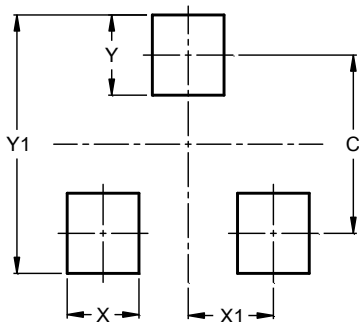
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



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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