THE FMMT413 IS NOT RECOMMENDED FOR NEW DESIGNS.
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Lead-free Green

FMMT413

NPN AVALANCHE TRANSISTOR IN SOT23

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.

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)**
- **For automotive applications requiring specific change control (i.e.: parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please refer to the related automotive grade (Q-suffix) part. A listing can be found at https://www.diodes.com/products/automotive/automotive-products/.**
- **This part is qualified to JEDEC standards (as references in AEC-Q) for High Reliability. https://www.diodes.com/quality/product-definitions/**

Mechanical Data

- Package: SOT23
- Package 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)

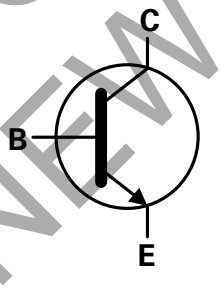
Applications

- Laser diode drivers for ranging and measurement (LIDAR)
- Radar systems
- Fast edge switch generators
- High-speed pulse generators

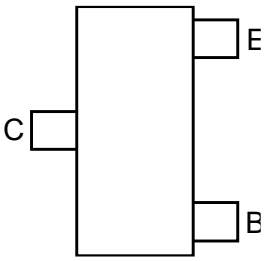
SOT23



Top View



Device Symbol



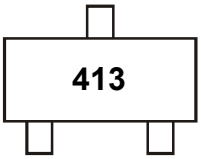
Top View
Pin-Out

Ordering Information (Note 4)

Orderable Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
FMMT413TD	SOT23	413	7	8	500	Reel

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ 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 https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information



413 = Product Type Marking Code

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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)	$R_{\theta JA}$	250	°C/W
Thermal Resistance, Junction to Lead	(Note 6)	$R_{\theta JL}$	197	°C/W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

ESD Ratings (Note 7)

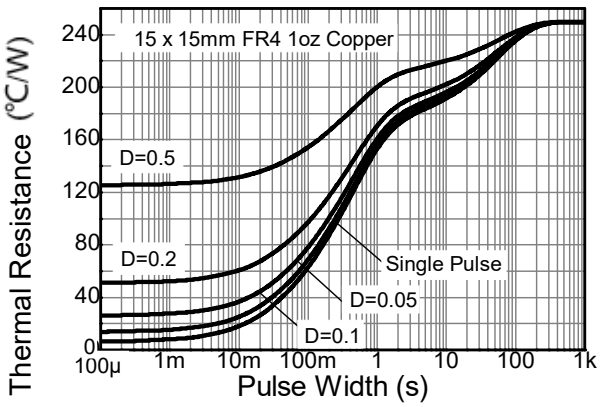
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge - Machine Model	ESD MM	400	V	C

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 specifications JESD22-A114 and JESD22-A115.

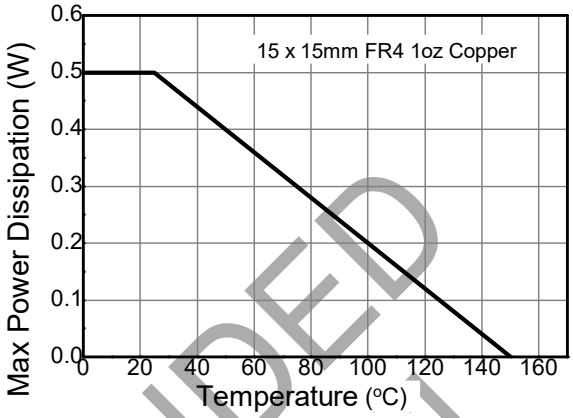
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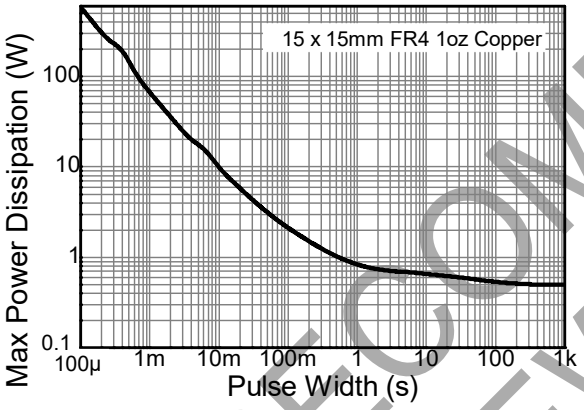
Thermal Characteristics and Derating Information



Transient Thermal Impedance



Derating Curve



Pulse Power Dissipation

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

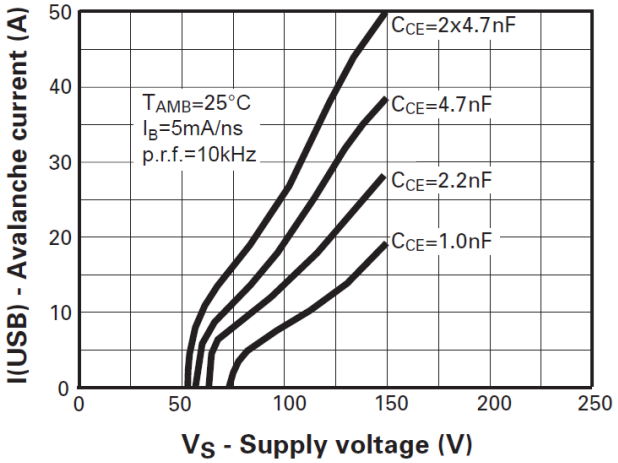
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Collector-Base Breakdown Voltage	BV_{CBO}	150	—	—	V	I_C = 100µA
Collector-Emitter Breakdown Voltage	BV_{CES}	150	—	—	V	I_C = 100µA
Collector-Emitter Breakdown Voltage (Note 8)	BV_{CEO}	50	—	—	V	I_C = 10mA
Emitter-Base Breakdown Voltage	BV_{EBO}	6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

Notes: 8. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.
9. Measured with a circuit possessing an approximate loop inductance of 12nH.

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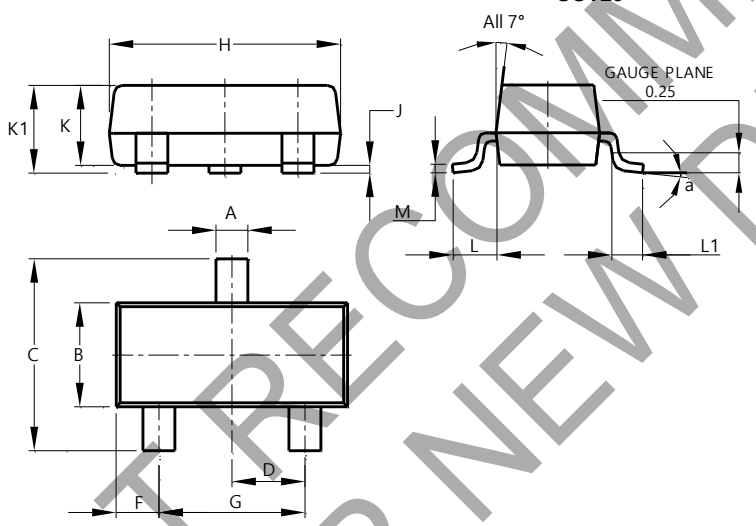
Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)



Package Outline Dimensions

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

SOT23

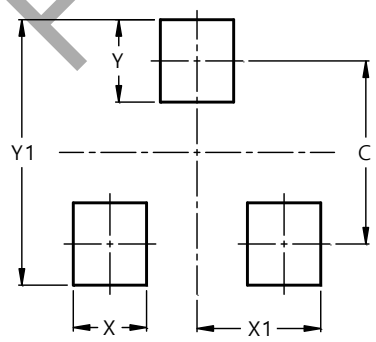


SOT23			
Dim	**Min**	**Max**	**Typ**
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

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

SOT23



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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