

SOT-227 Power Module Single Switch - Power MOSFET, 400 A



SOT-227

FEATURES

- $I_D = 400\text{ A}$, $T_C = 25\text{ °C}$
- ThunderFET Power MOSFET
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Maximum 175 °C junction temperature
- UL approved file E78996 
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**
PRIMARY CHARACTERISTICS

V_{DSS}	150 V
$R_{DS(on)}$ at 200 A	1.93 mΩ
I_D	300 A at 90 °C
Type	Modules - MOSFET
Package	SOT-227

APPLICATIONS

- DC/DC conversions
- Motor drives
- DC/AC inverter
- Power supplies
- Uninterruptible power supplies
- AC/DC switch-mode power supplies

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
MOSFET				
Drain to source voltage	V_{DSS}		150	V
Continuous drain current, V_{GS} at 10 V	I_D	$T_C = 25\text{ °C}$	400	A
		$T_C = 90\text{ °C}$	300	
Pulsed drain current	$I_{DM}^{(1)}$		860	
Power dissipation	P_D	$T_C = 25\text{ °C}$	909	W
Gate to source voltage	V_{GS}		± 20	V
Single pulse avalanche current	E_{AS}		720	J
Avalanche current	I_{AS}	$T_C = 25\text{ °C}$, $L = 10\text{ mH}$, $V_{GS} = 10\text{ V}$	120	A
MODULE				
Operating junction temperature range	T_J		-55 to +175	°C
Operating storage temperature range	T_{Stg}		-40 to +150	
Insulation voltage (RMS)	V_{ISOL}	any terminal to case, $t = 1\text{ min}$	2500	V

Note

(1) Limited at max. junction temperature

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T_J		-55	-	175	°C
Operating storage temperature range	T_{Stg}		-40	-	150	
Junction to case	MOSFET	R_{thJC}	-	-	0.165	°C/W
Case to heatsink	Module	R_{thCS}	Flat, greased surface	0.1	-	
Weight			-	30	-	g
Mounting torque		Torque to terminal	-	-	1.1 (9.7)	Nm (lbf. in)
		Torque to heatsink	-	-	1.3 (11.5)	Nm (lbf. in)
Case style			SOT-227			

ELECTRICAL CHARACTERISTICS ($T_J = 25\text{ °C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Drain to source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 500\text{ }\mu\text{A}$	150	-	-	V
Breakdown voltage temperature coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	Reference to $25\text{ °C}, I_D = 1.0\text{ mA}$	-	9.0	-	mV/°C
Static drain to source on-resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 200\text{ A}$	-	1.93	2.75	mΩ
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 1.0\text{ mA}$	1.80	3.46	5.4	V
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{DS} = V_{GS}, I_D = 1.0\text{ mA}$ (25 °C to 125 °C)	-	9.6	-	mV/°C
Forward transconductance	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 100\text{ A}, V_{GS} = 10\text{ V}$	-	200	-	S
Drain to source leakage current	I_{DSS}	$V_{DS} = 150\text{ V}, V_{GS} = 0\text{ V}$	-	0.5	10.0	μA
		$V_{DS} = 150\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ °C}$	-	19	-	
Gate to source leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$	-	-	± 200	nA
Total gate charge	Q_g	$I_D = 250\text{ A}$ $V_{DS} = 75\text{ V}$ $V_{GS} = 10\text{ V}$	-	250	-	nC
Gate to source charge	Q_{gs}		-	79	-	
Gate to drain ("Miller") charge	Q_{gd}		-	82	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 75\text{ V}$ $I_D = 100\text{ A}$ $R_g = 1\text{ }\Omega$ $V_{GS} = 10\text{ V}$	-	139	-	ns
Rise time	t_r		-	285	-	
Turn-off delay time	$t_{d(off)}$		-	120	-	
Fall time	t_f		-	142	-	
Input capacitance	C_{iss}	$V_{GS} = 0\text{ V}$ $V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$	-	13.7	-	nF
Output capacitance	C_{oss}		-	2.2	-	
Reverse transfer capacitance	C_{rss}		-	0.104	-	

SOURCE-DRAIN RATINGS AND CHARACTERISTICS ($T_J = 25\text{ °C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Continuous source current (body diode)	I_S	MOSFET symbol showing the integral reverse p-n junction diode 	-	-	476	A
Pulsed source current (body diode)	I_{SM}		-	-	850	
Diode forward voltage	V_{SD}	$I_S = 250\text{ A}, V_{GS} = 0\text{ V}$	-	0.95	-	V
Reverse recovery time	t_{rr}	$T_J = 25\text{ °C}, I_F = I_S = 50\text{ A},$ $dI/dt = 100\text{ A}/\mu\text{s}, V_R = 50\text{ V}$	-	171	-	ns
Reverse recovery charge	Q_{rr}		-	1032	-	nC
Reverse recovery current	I_{RM}		-	12	-	A

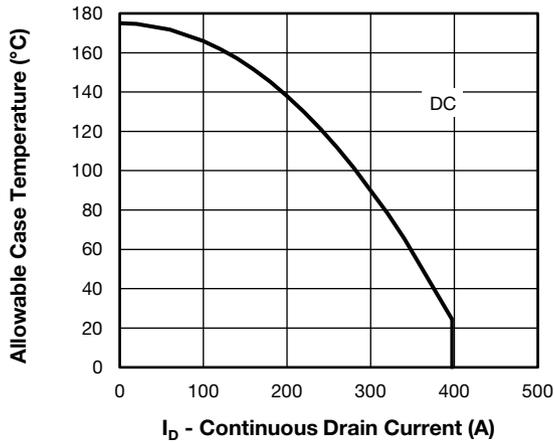


Fig. 1 - Maximum Continuous Drain Current vs. Case Temperature

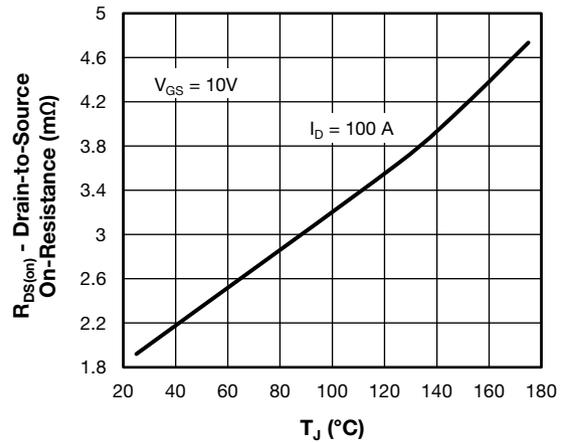


Fig. 4 - Typical Drain-to-Source On-Resistance vs. Temperature

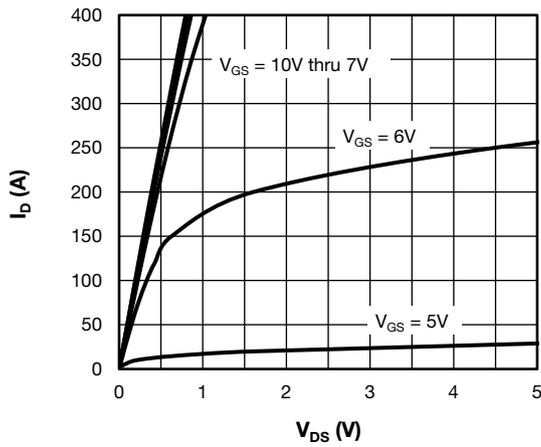


Fig. 2 - Typical Drain to Source Current Output Characteristics at $T_J = 25\text{ }^\circ\text{C}$

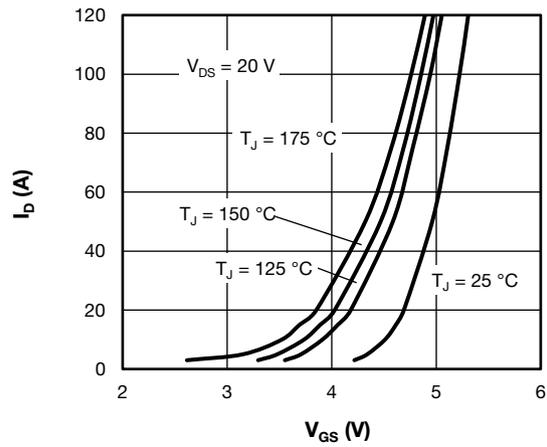


Fig. 5 - Typical Transfer Characteristics

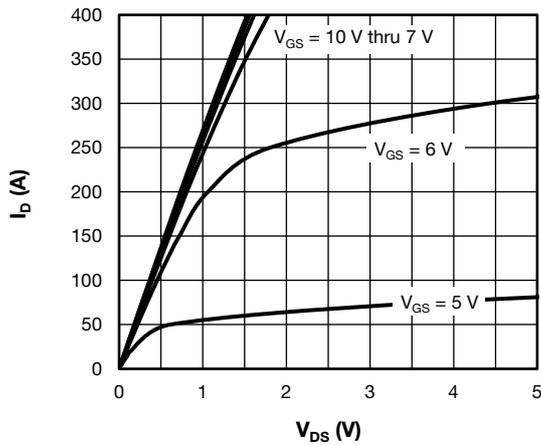


Fig. 3 - Typical Drain to Source Current Output Characteristics at $T_J = 125\text{ }^\circ\text{C}$

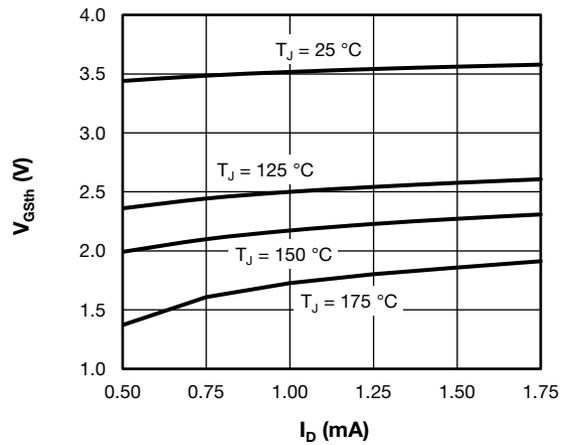


Fig. 6 - Typical Gate Threshold Voltage Characteristics

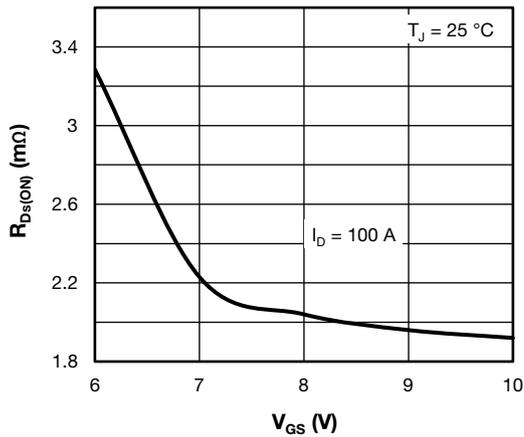


Fig. 7 - Typical Drain - State Resistance vs. Gate to Source Voltage

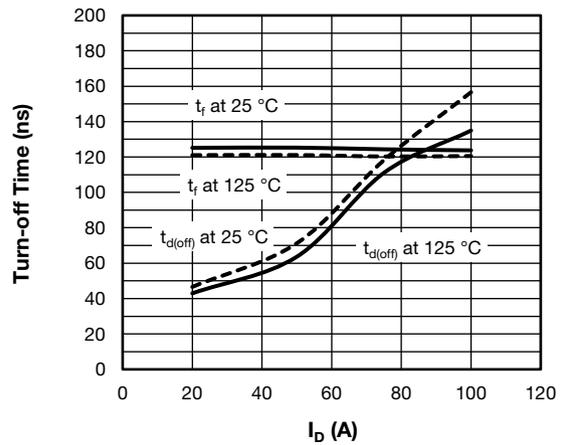


Fig. 10 - Typical Turn-off Switching Time vs. I_D

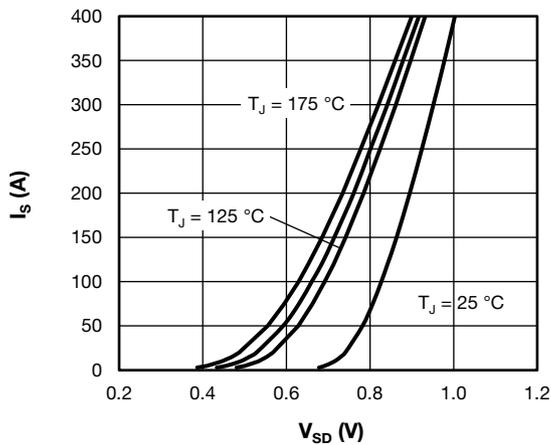


Fig. 8 - Typical Body Diode Source-to-Drain Current Characteristics

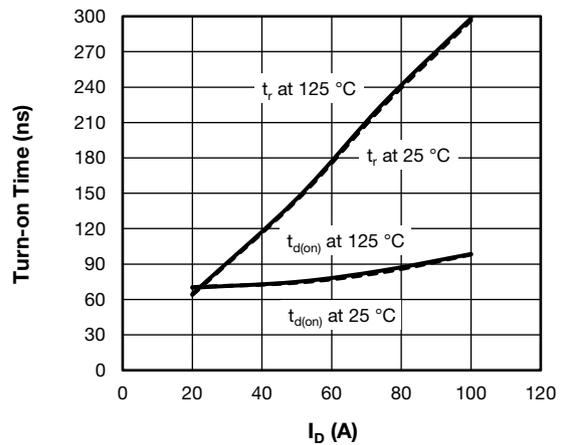


Fig. 11 - Typical Turn-on Switching Time vs. I_D

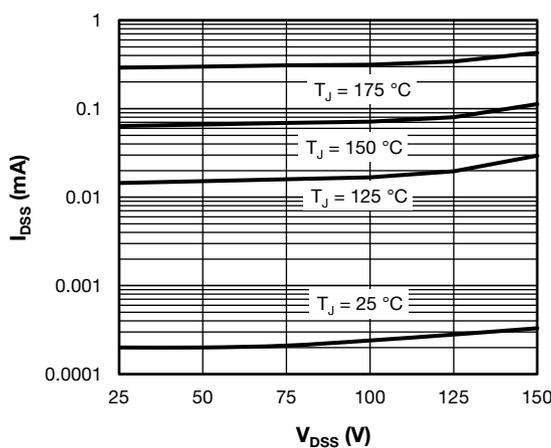


Fig. 9 - Typical Zero Gate Voltage Drain Current

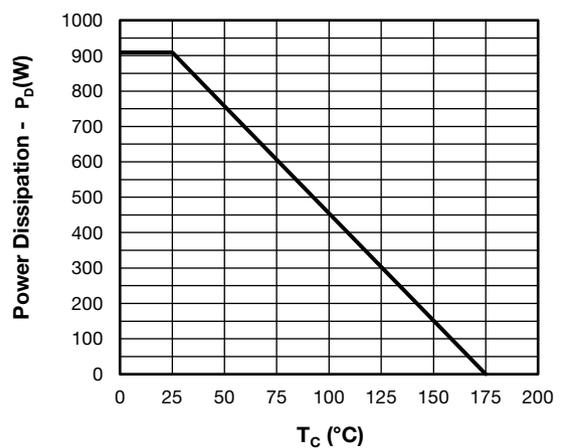


Fig. 12 - Power Dissipation Curve

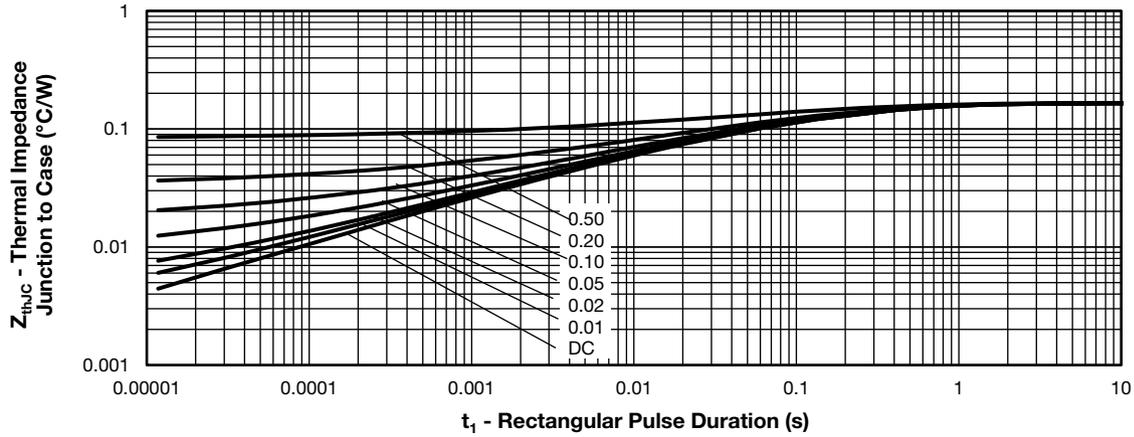


Fig. 13 - Maximum Thermal Impedance Junction-to-Case Characteristics

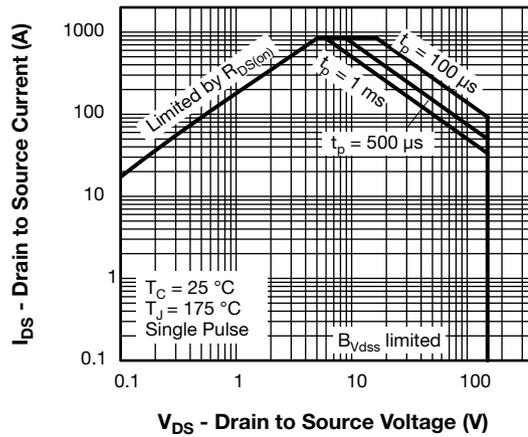


Fig. 14 - Safe Operating Area

ORDERING INFORMATION TABLE

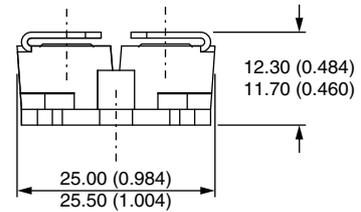
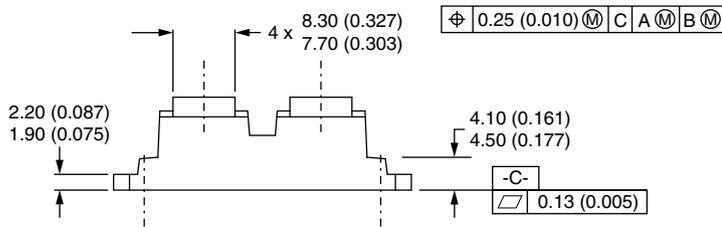
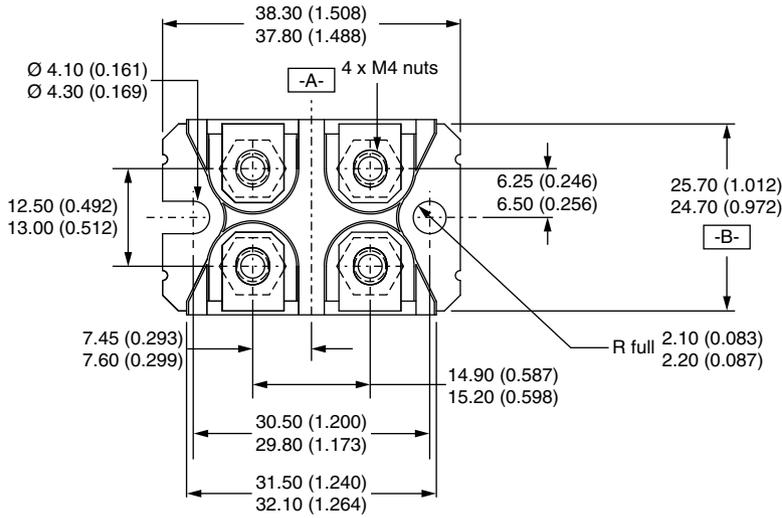
Device code	VS-	F	C	420	S	A	15
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

- 1** - Vishay Semiconductors product
- 2** - MOSFET module
- 3** - MOSFET die generation
- 4** - Current rating (420 = 420 A)
- 5** - Circuit configuration (S = single switch)
- 6** - Package indicator (SOT-227)
- 7** - Voltage rating (15 = 150 V)

CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Single switch	S	<p>The circuit drawing for the 'Single switch' configuration (code S) consists of three parts:</p> <ul style="list-style-type: none"> Schematic: A diode and a transistor are shown. The diode's cathode is connected to the transistor's base. The diode's anode is connected to the transistor's emitter. The transistor's collector is connected to the diode's cathode. The diode is labeled D (3), the transistor's gate is G (2), and the transistor's source is S (1-4). Lead Assignment: A diagram of the component's package showing four leads. Lead 1 is labeled (S), lead 2 is (G), lead 3 is (D), and lead 4 is (S). Wiring Diagram: A detailed circuit diagram showing the connection of the four leads. Lead 3 (D) is connected to the diode's anode. Lead 2 (G) is connected to the transistor's base. Lead 4 (S) is connected to the transistor's emitter. Lead 1 (S) is connected to the diode's cathode.



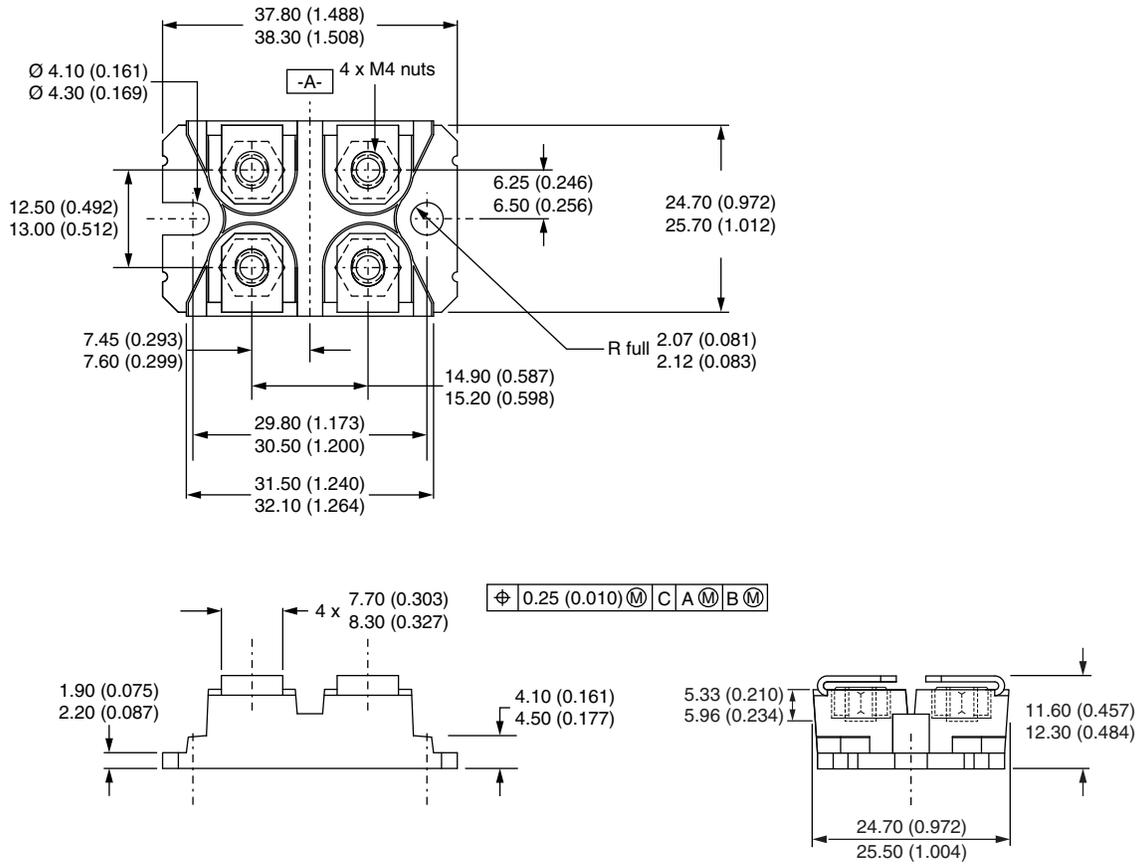
DIMENSIONS in millimeters





SOT-227 Generation 2

DIMENSIONS in millimeters (inches)



Note

- Controlling dimension: millimeter



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