

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

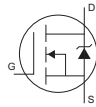
THERMAL - MECHANICAL SPECIFICATIONS

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 °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		-	-	476	A
Pulsed source current (body diode)	I_{SM}	MOSFET symbol showing the integral reverse p-n junction diode 	-	-	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

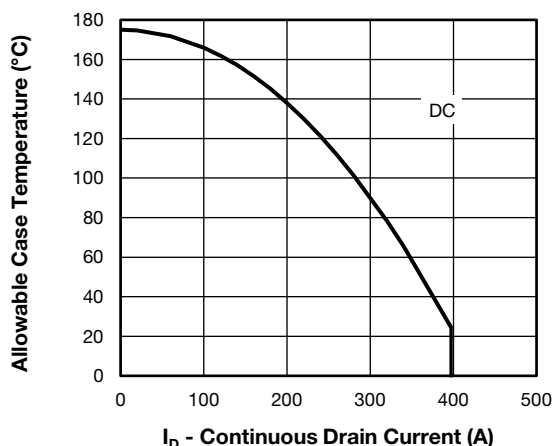


Fig. 1 - Maximum Continuous Drain Current vs. Case Temperature

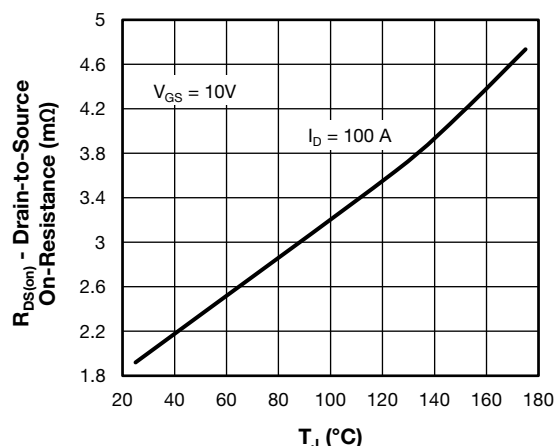


Fig. 4 - Typical Drain-to-Source On-Resistance vs. Temperature

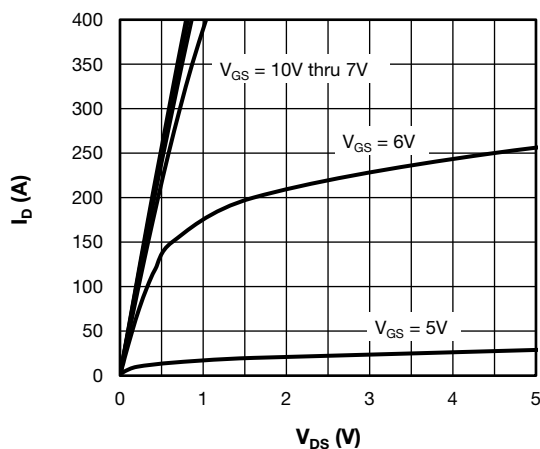
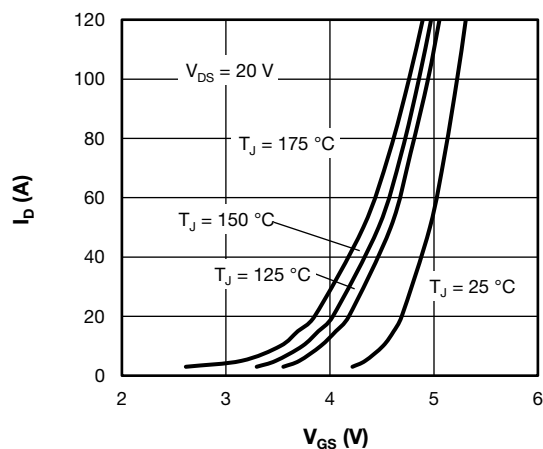

Fig. 2 - Typical Drain to Source Current Output Characteristics at $T_J = 25^\circ C$


Fig. 5 - Typical Transfer Characteristics

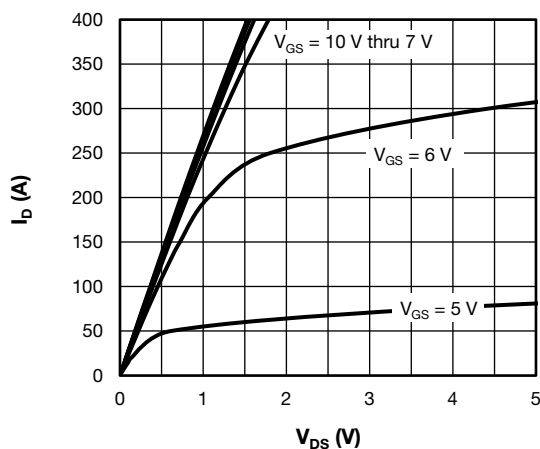
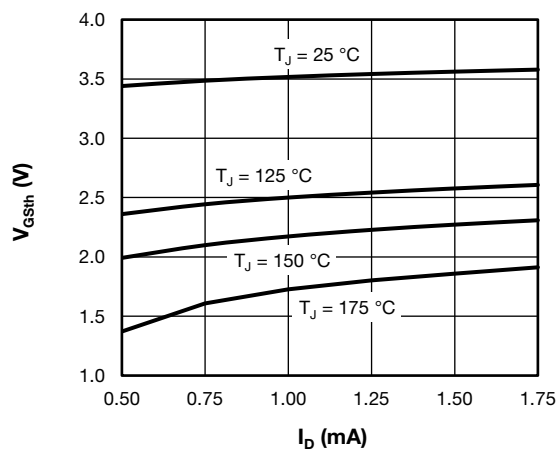

Fig. 3 - Typical Drain to Source Current Output Characteristics at $T_J = 125^\circ C$


Fig. 6 - Typical Gate Threshold Voltage Characteristics

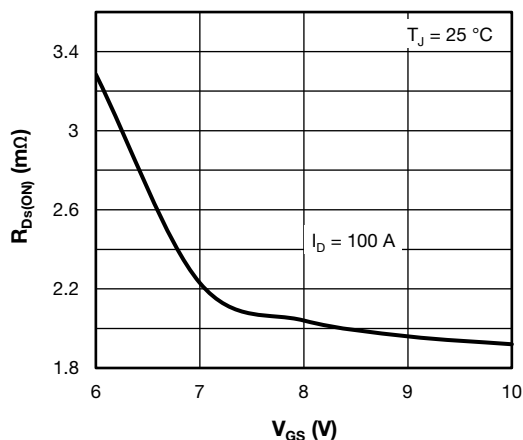


Fig. 7 - Typical Drain - State Resistance vs. Gate to Source Voltage

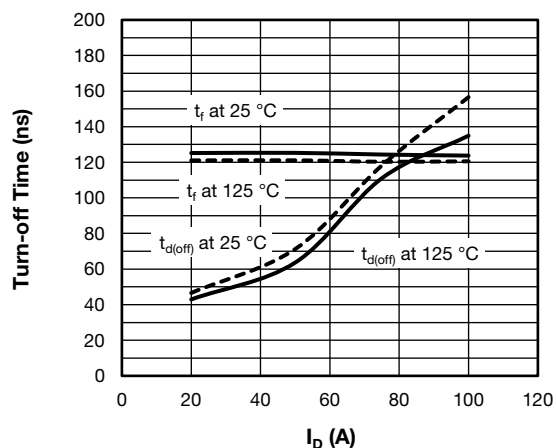
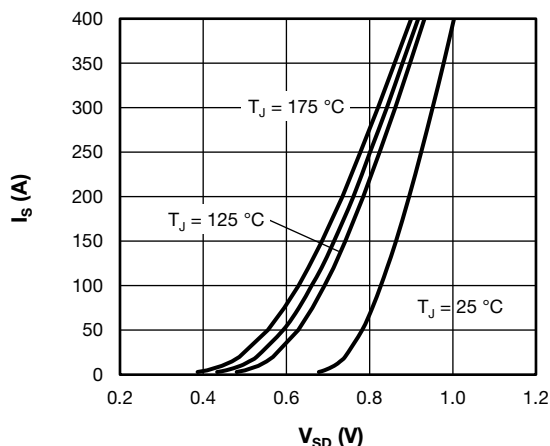

Fig. 10 - Typical Turn-off Switching Time vs. I_D


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

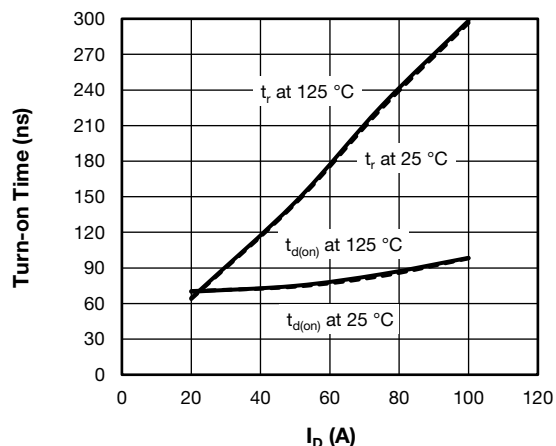
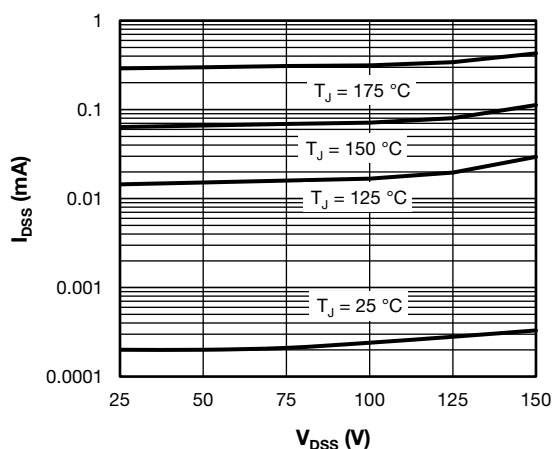

Fig. 11 - Typical Turn-on Switching Time vs. I_D


Fig. 9 - Typical Zero Gate Voltage Drain Current

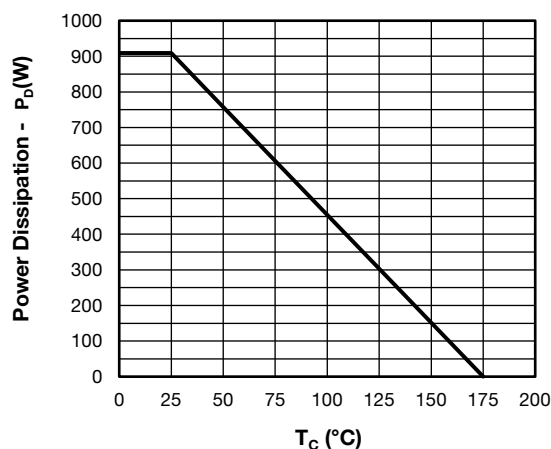


Fig. 12 - Power Dissipation Curve

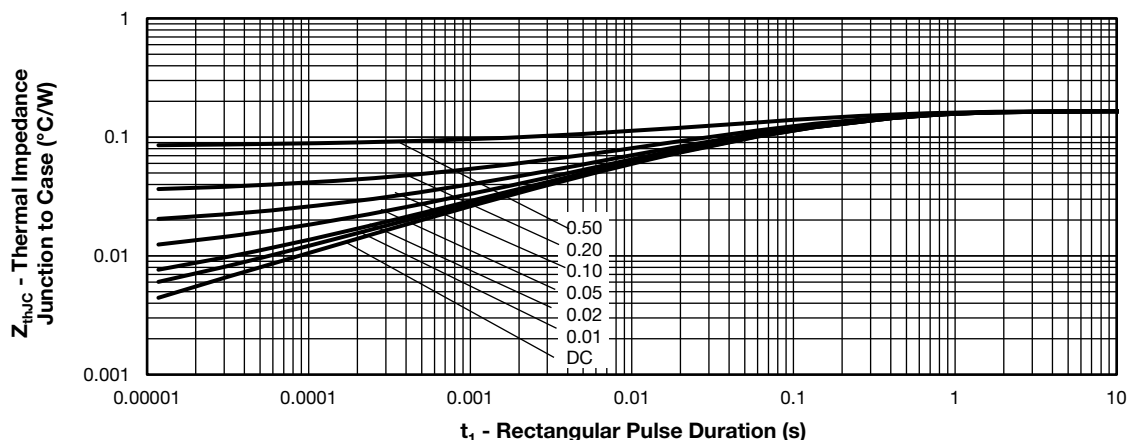


Fig. 13 - Maximum Thermal Impedance Junction-to-Case Characteristics

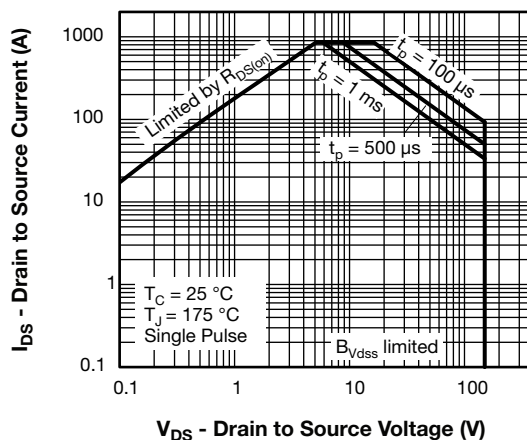
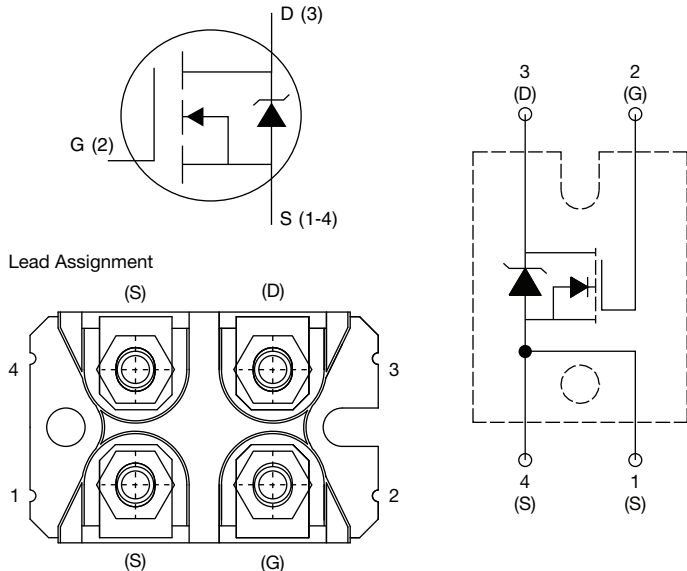


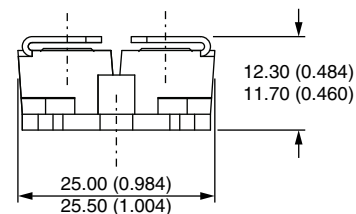
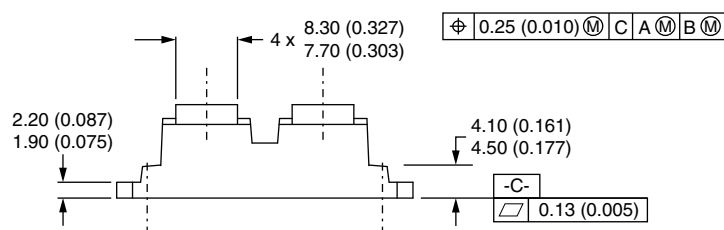
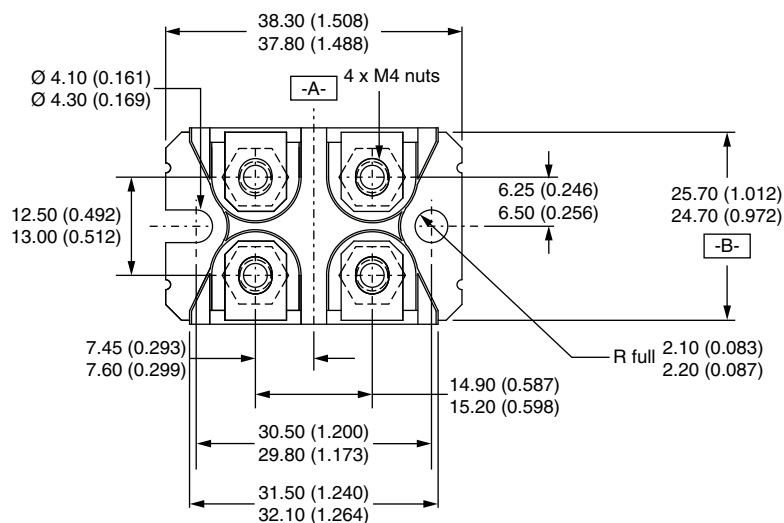
Fig. 14 - Safe Operating Area

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)						

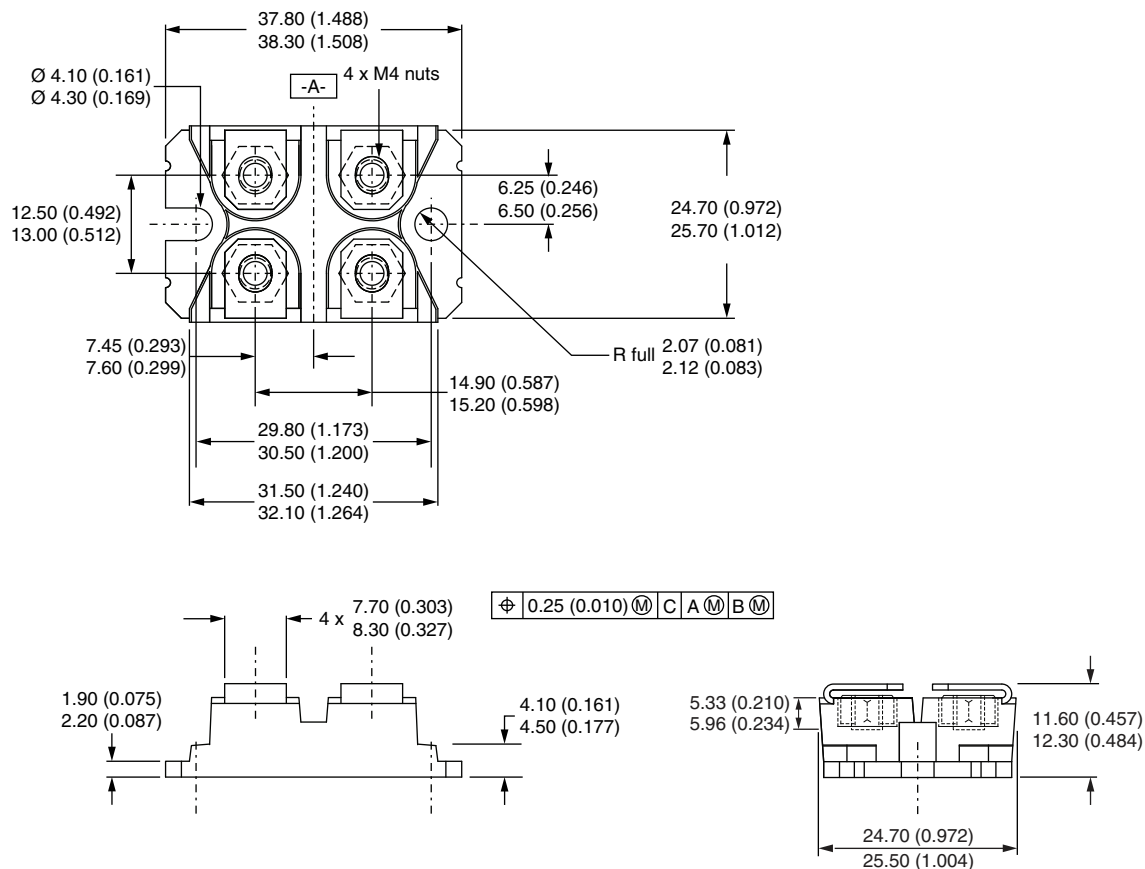
CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Single switch	S	

DIMENSIONS in millimeters



SOT-227 Generation 2

DIMENSIONS in millimeters (inches)



Note

- Controlling dimension: millimeter



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