Insulated Gate Bipolar Transistor (Ultrafast Speed IGBT), 100 A

SOT-227

PRIMARY CHARACTERISTICS	
V_{CES}	600 V
$V_{CE(on)}$ (typical)	1.92 V
V_{GE}	15 V
I_C	100 A
Speed	8 kHz to 30 kHz
Package	SOT-227
Circuit configuration	Single switch no diode

FEATURES

- Ultrafast: optimized for minimum saturation voltage and speed up to 30 kHz in hard switching, > 200 kHz in resonant mode
- Very low conduction and switching losses
- Fully isolate package (2500 $V_{AC/RMS}$)
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS
COMPLIANT

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Lower overall losses available at frequencies = 20 kHz
- Easy to assemble and parallel
- Direct mounting to heatsink
- Lower EMI, requires less snubbing
- Plug-in compatible with other SOT-227 packages

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter breakdown voltage	V_{CES}		600	V
Continuous collector current	I_C	T_C = 25 °C	200	
		T_C = 100 °C	100	
Pulsed collector current	I_{CM}		400	A
Clamped inductive load current	I_{LM}	V_{CC} = 80 % (V_{CES}), V_{GE} = 20 V, L = 10 μH, R_g = 2.0 Ω, see fig. 13a	400	
Gate to emitter voltage	V_{GE}		± 20	V
Reverse voltage avalanche energy	E_{ARV}	Repetitive rating; pulse width limited by maximum junction temperature	160	mJ
RMS isolation voltage	V_{ISOL}	Any terminal to case, t = 1 min	2500	V
Maximum power dissipation	P_D	T_C = 25 °C	500	W
		T_C = 100 °C	200	
Operating junction and storage temperature range	T_J, T_{Stg}		-55 to +150	°C
Mounting torque		6-32 or M3 screw	1.3 (12)	Nm (lbf.in)

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Junction and storage temperature range	T_J, T_{Stg}		-55	-	150	
Thermal resistance, junction to case	R_{thJC}		-	-	0.25	°C/W
Thermal resistance case to heatsink	R_{thCS}	Flat, greased, surface	-	0.05	-	
Weight			-	30	-	g
Mounting torque		Torque to terminal	-	-	1.1 (9.7)	Nm (lbf.in)
		Torque to heatsink	-	-	1.8 (15.9)	Nm (lbf.in)
Case style			SOT-227			

ELECTRICAL SPECIFICATIONS (T_J = 25 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Collector to emitter breakdown voltage	$V_{(BR)CES}$	V_{GE} = 0 V, I_C = 250 μA	600	-	-	V
Emitter to collector breakdown voltage	$V_{(BR)ECS}$	V_{GE} = 0 V, I_C = 1.0 A Pulse width ≤ 80 μs; duty factor ≤ 0.1 %	18	-	-	
Temperature coefficient of breakdown voltage	$\Delta V_{(BR)CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 10 mA	-	0.38	-	V/°C
Collector to emitter saturation voltage	$V_{CE(on)}$	I_C = 100 A; V_{GE} = 15 V, See fig. 2, 5	-	1.60	1.9	V
		I_C = 200 A	-	1.92	-	
		I_C = 100 A, T_J = 150 °C	-	1.54	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, I_C = 250 μA	3.0	-	6.0	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, I_C = 2.0 mA	-	-11	-	mV/°C
Forward transconductance	g_{fe}	V_{CE} = 100 V, I_C = 100 A Pulse width 5.0 μs, single shot	79	-	-	S
Zero gate voltage collector current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V	-	-	1.0	mA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150 °C	-	-	10	
Gate to emitter leakage current	I_{GES}	V_{GE} = ± 20 V	-	-	± 250	nA

SWITCHING CHARACTERISTICS (T_J = 25 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Total gate charge (turn-on)	Q_g	I_C = 100 A V_{CC} = 400 V V_{GE} = 15 V; See fig. 8	-	770	1200	nC
Gate-emitter charge (turn-on)	Q_{ge}		-	100	150	
Gate-collector charge (turn-on)	Q_{gc}		-	260	380	
Turn-on delay time	$t_{d(on)}$	T_J = 25 °C I_C = 100 A V_{CC} = 480 V V_{GE} = 15 V R_g = 2.0 Ω Energy losses include "tail" See fig. 9, 10, 14	-	54	-	ns
Rise time	t_r		-	79	-	
Turn-off delay time	$t_{d(off)}$		-	130	200	
Fall time	t_f		-	300	450	
Turn-on switching loss	E_{on}		-	0.98	-	mJ
Turn-off switching loss	E_{off}		-	3.48	-	
Total switching loss	E_{ts}		-	4.46	7.6	
Turn-on delay time	$t_{d(on)}$	T_J = 150 °C I_C = 100 A, V_{CC} = 480 V V_{GE} = 15 V, R_g = 2.0 Ω Energy losses include "tail" See fig. 10, 11, 14	-	56	-	ns
Rise time	t_r		-	75	-	
Turn-off delay time	$t_{d(off)}$		-	160	-	
Fall time	t_f		-	460	-	
Total switching loss	E_{ts}		-	7.24	-	mJ
Internal emitter inductance	L_E	Measured 5 mm from package	-	5.0	-	nH
Input capacitance	C_{ies}	V_{GE} = 0 V V_{CC} = 30 V f = 1.0 MHz; See fig. 7	-	16 500	-	pF
Output capacitance	C_{oes}		-	1000	-	
Reverse transfer capacitance	C_{res}		-	200	-	

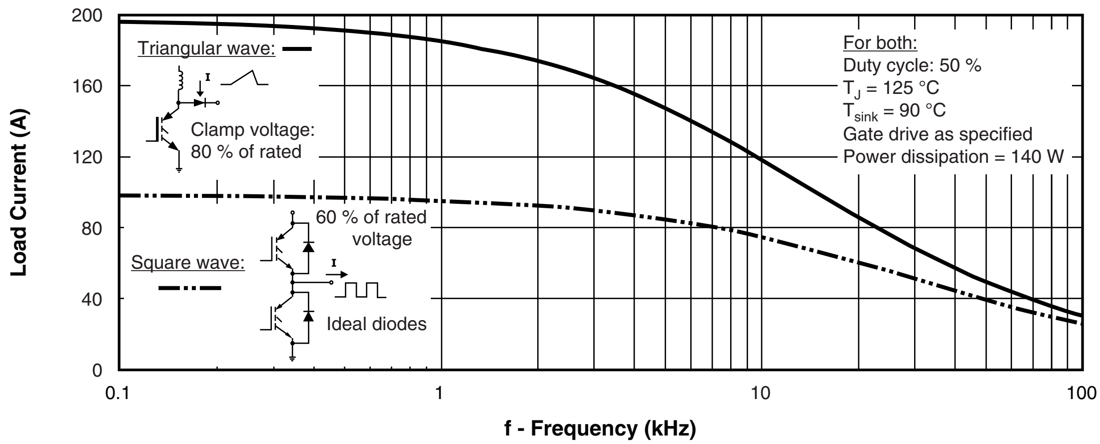


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of Fundamental)

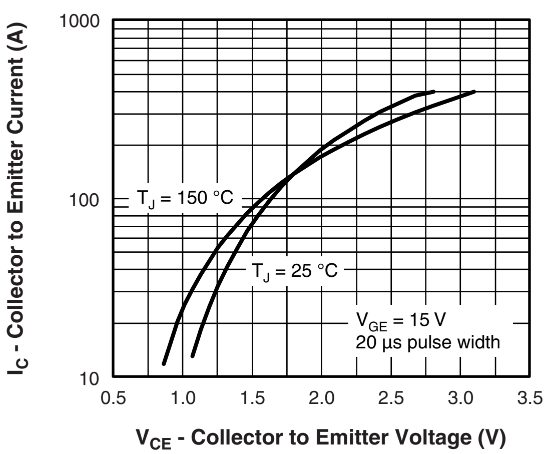


Fig. 2 - Typical Output Characteristics

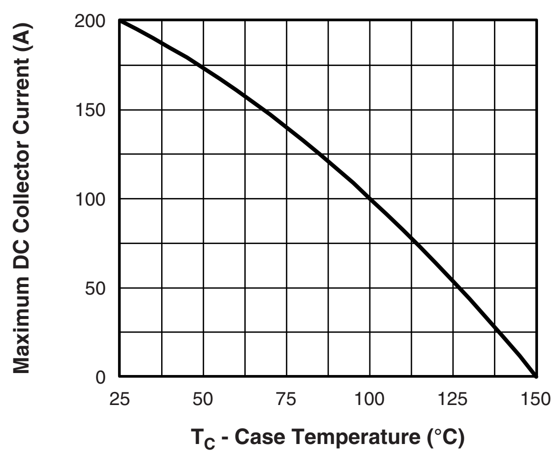


Fig. 4 - Maximum Collector Current vs. Case Temperature

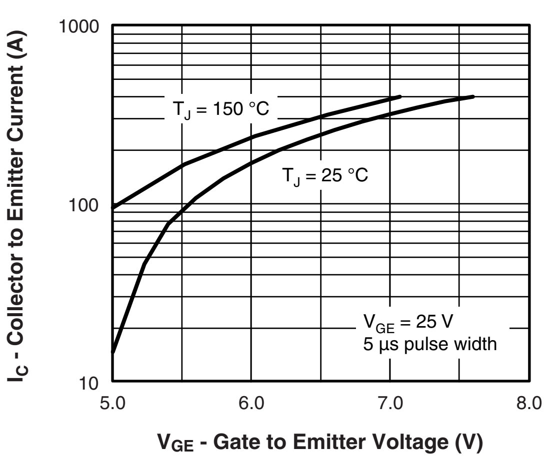


Fig. 3 - Typical Transfer Characteristics

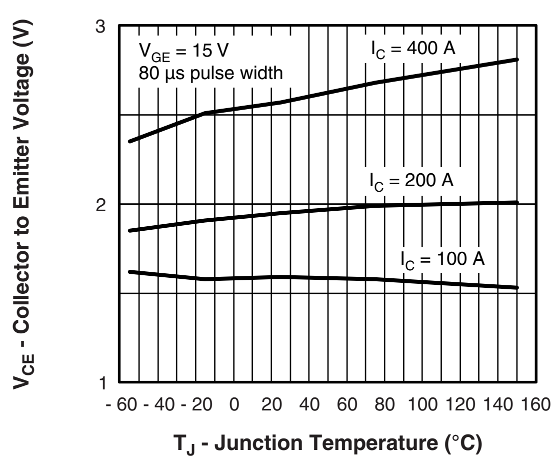


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

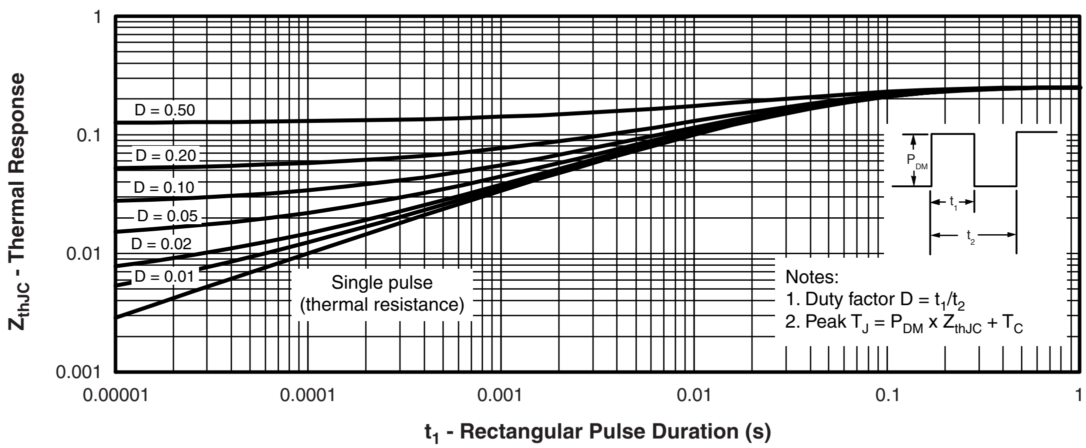


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

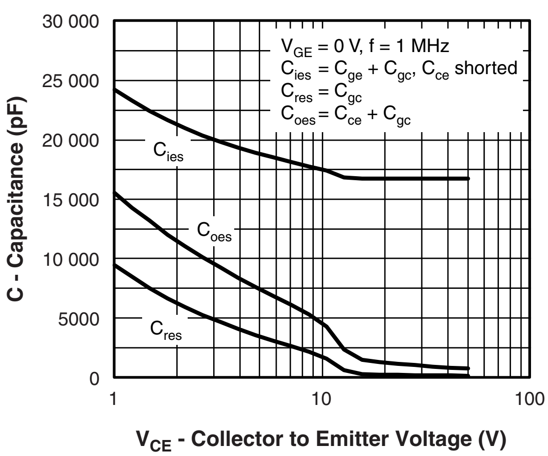


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

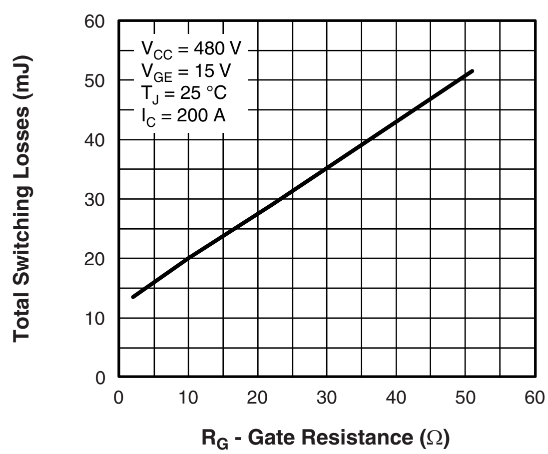


Fig. 9 - Typical Switching Losses vs. Gate Resistance

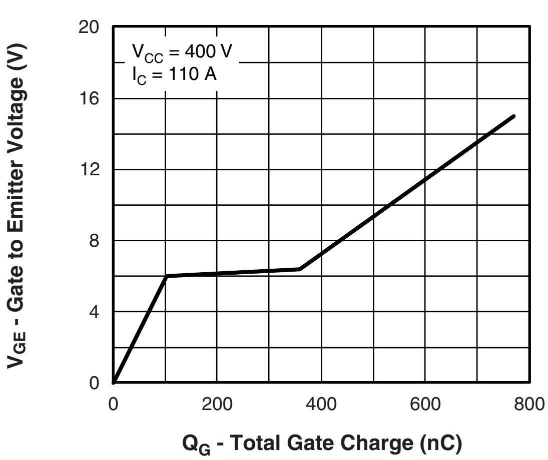


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

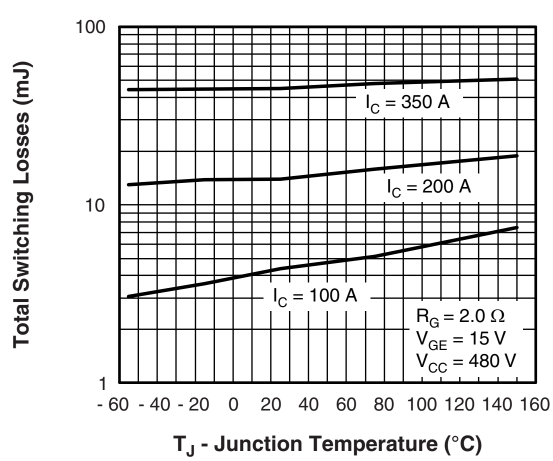


Fig. 10 - Typical Switching Losses vs. Junction Temperature

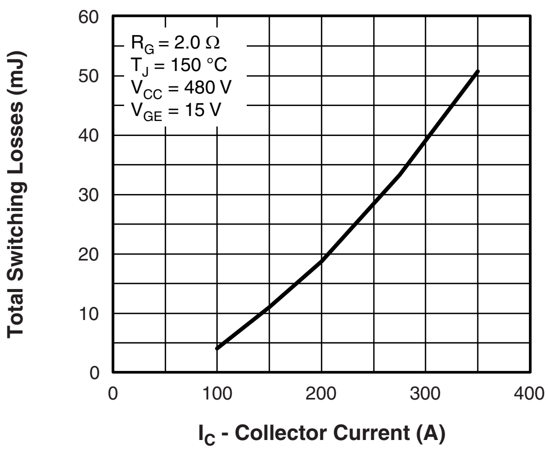


Fig. 11 - Typical Switching Losses vs. Collector Current

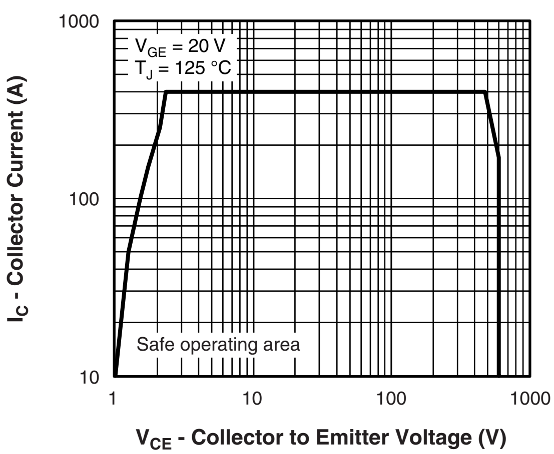
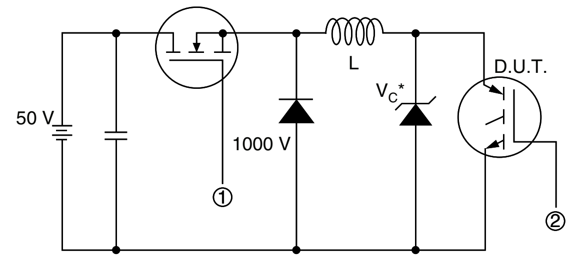


Fig. 12 - Turn-Off SOA



* Driver same type as D.U.T.; V_C = 80 % of V_{CE} (max)

Note: Due to the 50 V power supply, pulse width and inductor will increase to obtain rated I_d

Fig. 13a - Clamped Inductive Load Test Circuit

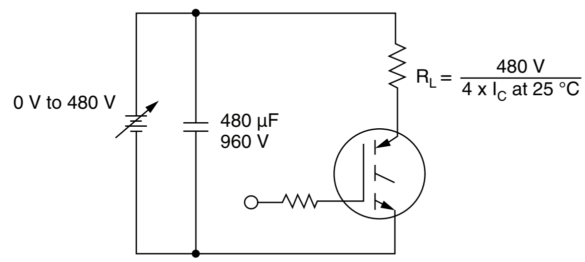
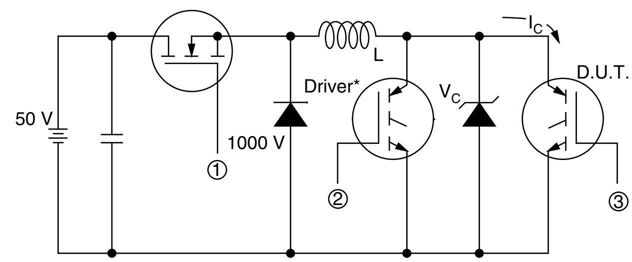
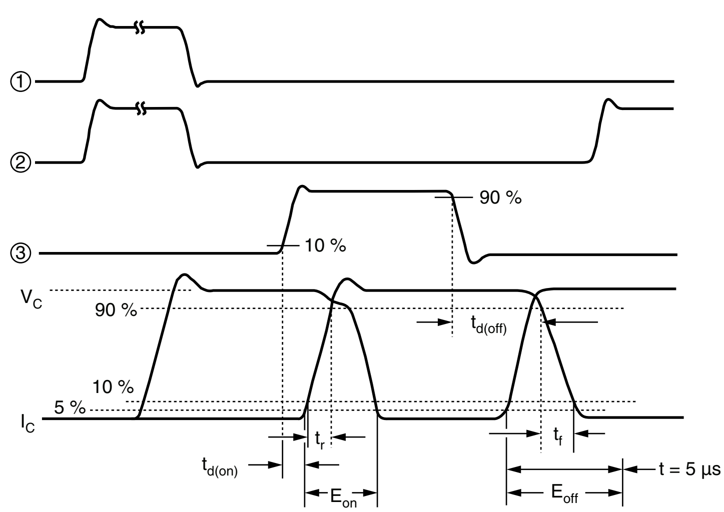


Fig. 13b - Pulsed Collector Current Test Circuit



* Driver same type as D.U.T., V_C = 480 V

Fig. 14a - Switching Loss Test Circuit



$E_{ts} = (E_{on} + E_{off})$

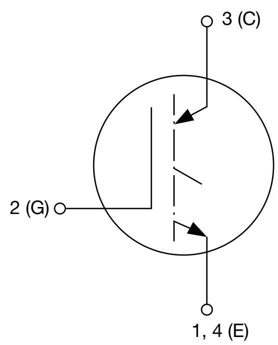
Fig. 14b - Switching Loss Waveforms

ORDERING INFORMATION TABLE

Device code	VS-	G	A	200	S	A	60	U	P
	1	2	3	4	5	6	7	8	9

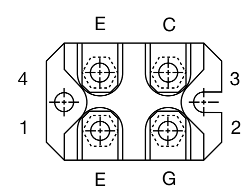
1 - Vishay Semiconductors product
2 - Insulated gate bipolar transistor (IGBT)
3 - Generation 4, IGBT silicon, DBC construction
4 - Current rating (200 = 200 A)
5 - Single switch no diode
6 - SOT-227
7 - Voltage rating (60 = 600 V)
8 - Speed/type (U = ultrafast)
9 - • None = standard production
• P = lead (Pb)-free

CIRCUIT CONFIGURATION



n-channel

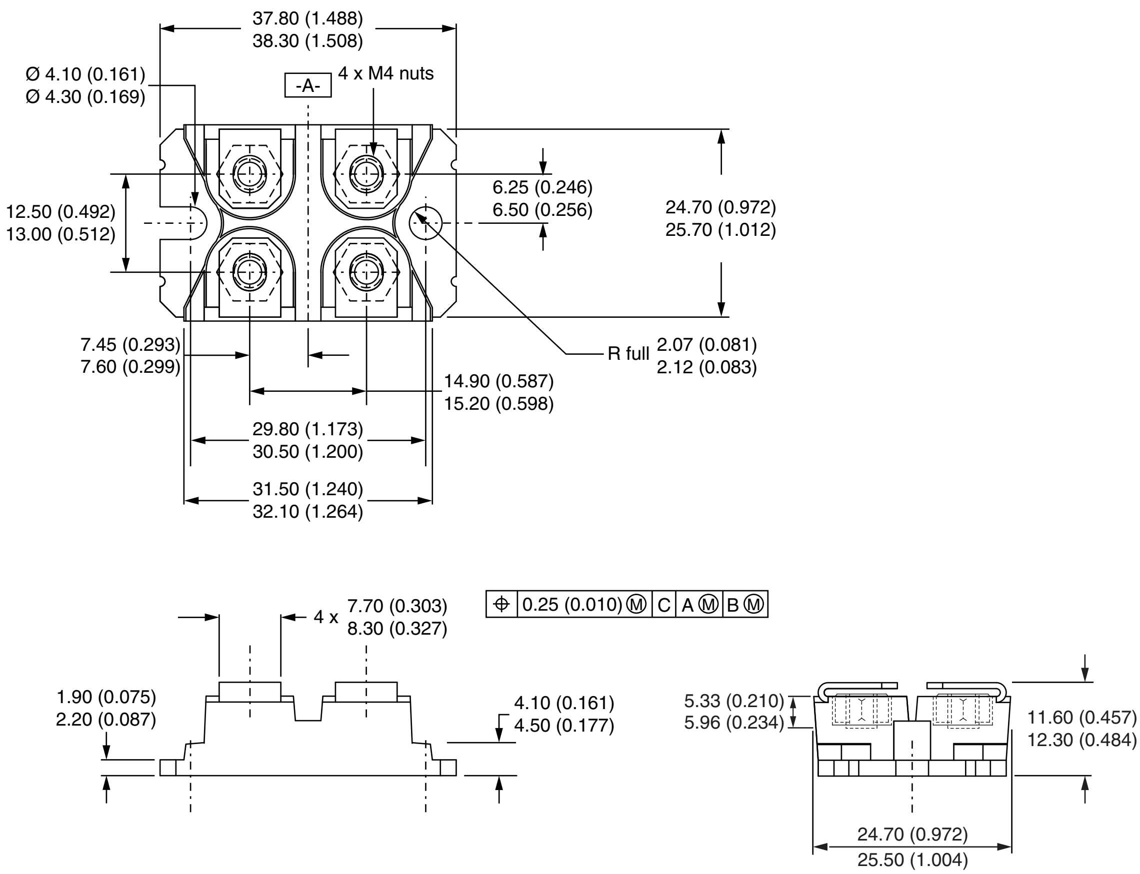
Lead assignment



LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95425
Packaging information	www.vishay.com/doc?95423

SOT-227 Generation 2

DIMENSIONS in millimeters (inches)



Note

- Controlling dimension: millimeter

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