

Insulated Gate Bipolar Transistor (Ultrafast IGBT), 90 A


SOT-227

FEATURES

- NPT Generation V IGBT technology
- Square RBSOA
- Positive $V_{CE(on)}$ temperature coefficient
- Fully isolated package
- Speed 8 kHz to 60 kHz
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996 
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

PRODUCT SUMMARY

V_{CES}	1200 V
$V_{CE(on)}$ typical at 75 A, 25 °C	3.3 V
I_C DC	90 A at 90 °C
Speed	8 kHz to 30 kHz
Package	SOT-227
Circuit	Single Switch no diode

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Easy to assemble and parallel
- Direct mounting on heatsink
- Plug-in compatible with other SOT-227 packages
- Low EMI, requires less snubbing

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		1200	V
Continuous collector current	$I_C^{(1)}$	$T_C = 25\text{ °C}$	149	A
		$T_C = 90\text{ °C}$	90	
Pulsed collector current	I_{CM}		200	
Clamped inductive load current	I_{LM}		200	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	$T_C = 25\text{ °C}$	862	W
		$T_C = 90\text{ °C}$	414	
Isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ min	2500	V

Note

(1) Maximum collector current admitted is 100 A, to do exceed the maximum temperature of terminals

ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ °C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{BR(CES)}$	$V_{GE} = 0\text{ V}$, $I_C = 250\text{ }\mu\text{A}$	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 75\text{ A}$	-	3.3	3.8	
		$V_{GE} = 15\text{ V}$, $I_C = 75\text{ A}$, $T_J = 125\text{ °C}$	-	3.6	3.9	
		$V_{GE} = 15\text{ V}$, $I_C = 75\text{ A}$, $T_J = 150\text{ °C}$	-	3.7	-	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	4	5	6	
		$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$, $T_J = 125\text{ °C}$	-	3.2	-	
Temperature coefficient of threshold voltage	$V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$ (25 °C to 125 °C)	-	-12	-	mV/°C
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$	-	7	250	μA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$, $T_J = 125\text{ °C}$	-	1.4	10	mA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$, $T_J = 150\text{ °C}$	-	6.5	20	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 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 = 50 A, V _{CC} = 600 V, V _{GE} = 15 V		-	690	-	nC
Gate to emitter charge (turn-on)	Q _{ge}			-	65	-	
Gate to collector charge (turn-on)	Q _{gc}			-	250	-	
Turn-on switching loss	E _{on}	I _C = 75 A, V _{CC} = 600 V, V _{GE} = 15 V, R _g = 5 Ω, L = 500 μH, T _J = 25 °C	Energy losses include tail and diode recovery Diode used HFA16PB120	-	1.2	-	mJ
Turn-off switching loss	E _{off}			-	2.1	-	
Total switching loss	E _{tot}			-	3.3	-	
Turn-on delay time	t _{d(on)}			-	250	-	ns
Rise time	t _r			-	38	-	
Turn-off delay time	t _{d(off)}			-	280	-	
Fall time	t _f			-	90	-	
Turn-on switching loss	E _{on}	I _C = 75 A, V _{CC} = 600 V, V _{GE} = 15 V, R _g = 5 Ω, L = 500 μH, T _J = 125 °C		-	1.7	-	mJ
Turn-off switching loss	E _{off}			-	4.08	-	
Total switching loss	E _{tot}			-	5.78	-	
Turn-on delay time	t _{d(on)}			-	245	-	ns
Rise time	t _r			-	48	-	
Turn-off delay time	t _{d(off)}			-	280	-	
Fall time	t _f			-	140	-	
Reverse bias safe operating area	RBSOA	T _J = 150 °C, I _C = 200 A, R _g = 22 Ω, V _{GE} = 15 V to 0 V, V _{CC} = 900 V, V _P = 1200 V, L = 500 μH		Fullsquare			

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL		MIN.	TYP.	MAX.	UNITS
Junction and storage temperature range	T_J , T_{Stg}		-40	-	150	$^{\circ}\text{C}$
Thermal resistance junction to case	R_{thJC}		-	-	0.145	$^{\circ}\text{C/W}$
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	-	-	1.3 (11.5)	Nm (lbf.in)
Case style		SOT-227				

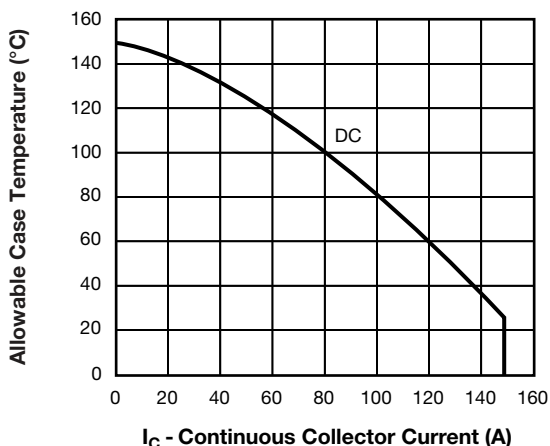


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

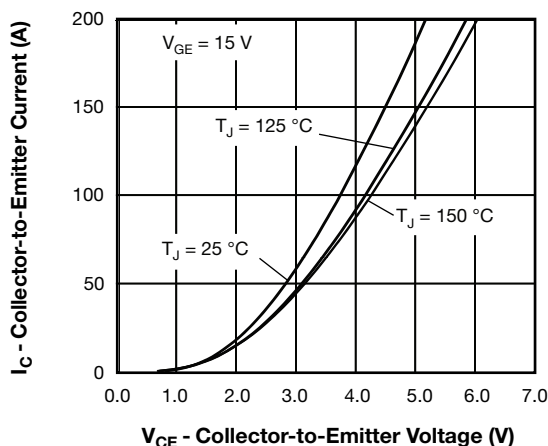


Fig. 2 - Typical Collector to Emitter Current Output Characteristics of IGBT

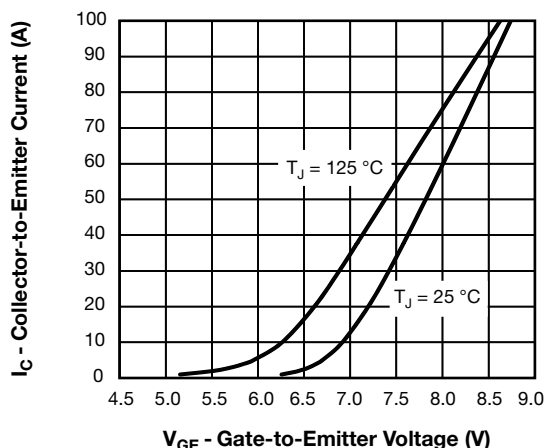


Fig. 3 - Typical IGBT Transfer Characteristics

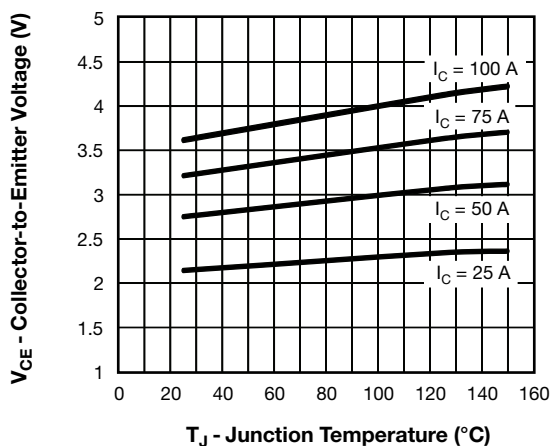
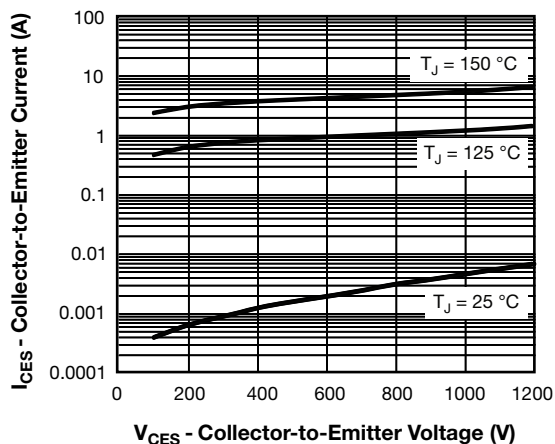

Fig. 6 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, $V_{GE} = 15\text{ V}$


Fig. 4 - Typical IGBT Zero Gate Voltage Collector Current

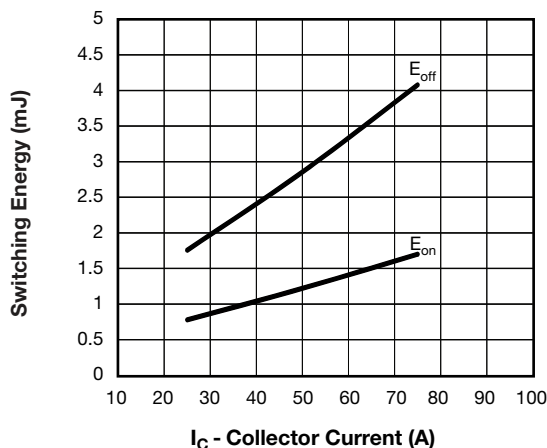
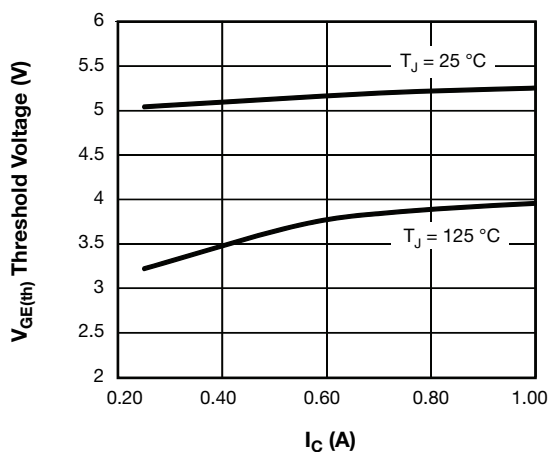
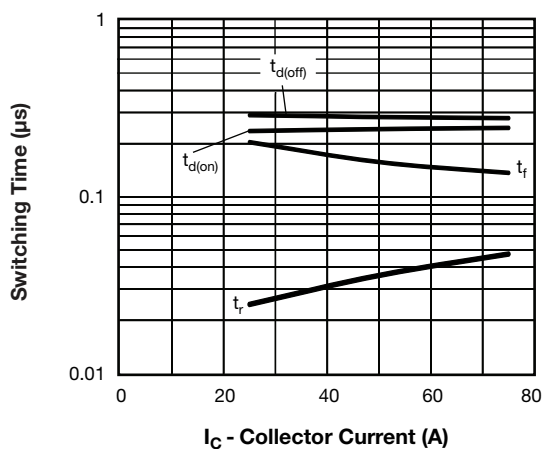

Fig. 7 - Typical IGBT Energy Losses vs. I_C
 $T_J = 125\text{ °C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 600\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$, Diode used HFA16PB120


Fig. 5 - Typical IGBT Threshold Voltage


Fig. 8 - Typical IGBT Switching Time vs. I_C
 $T_J = 125\text{ °C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 600\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$, Diode used HFA16PB120

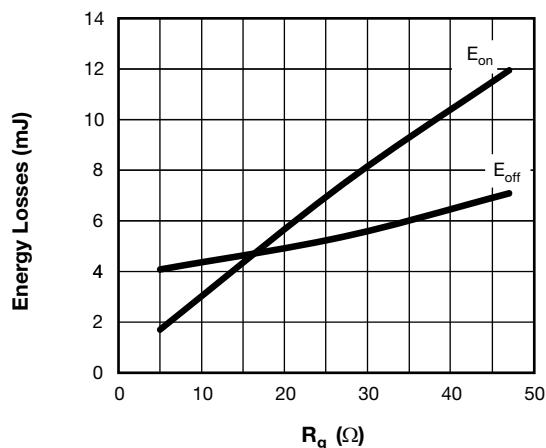


Fig. 9 - Typical IGBT Energy Loss vs. R_g ,
 $T_J = 125^\circ\text{C}$, $I_C = 75\text{ A}$, $L = 500\text{ }\mu\text{H}$,
 $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, Diode used HFA16PB120

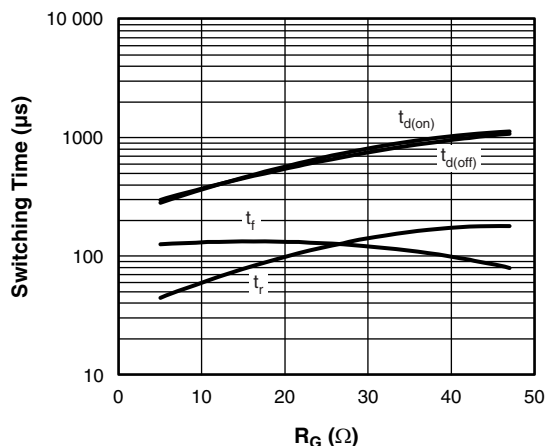


Fig. 10 - Typical IGBT Switching Time vs. R_g ,
 $T_J = 125^\circ\text{C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 600\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$

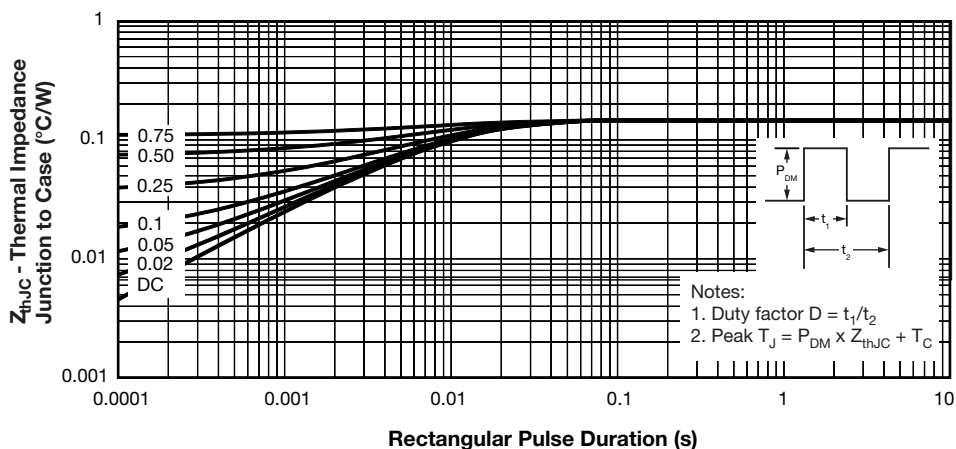


Fig. 11 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

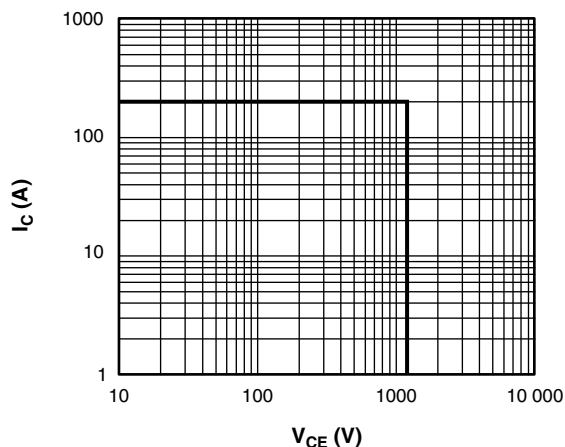


Fig. 12 - IGBT Reverse Bias SOA, $T_J = 150^\circ\text{C}$, $V_{GE} = 15\text{ V}$

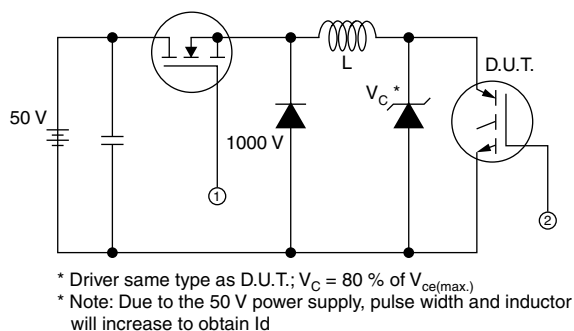


Fig. 13a - Clamped Inductive Load Test Circuit

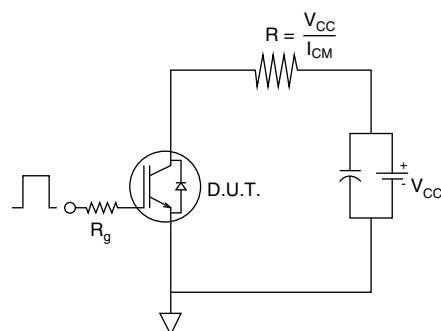


Fig. 13b - Pulsed Collector Current Test Circuit

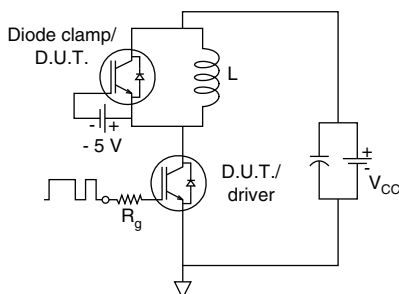


Fig. 14a - Switching Loss Test Circuit

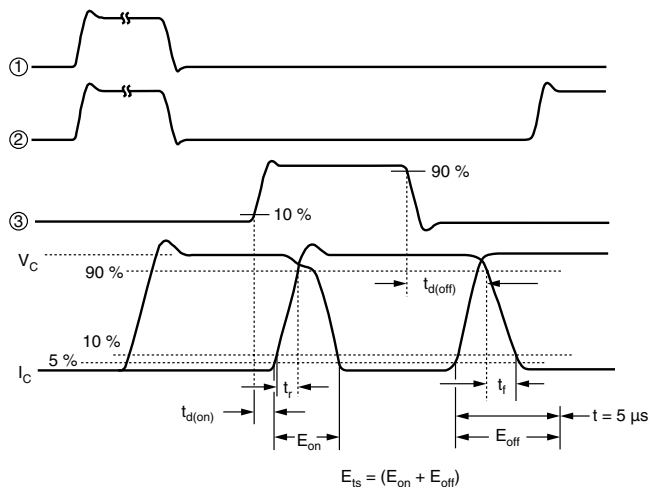
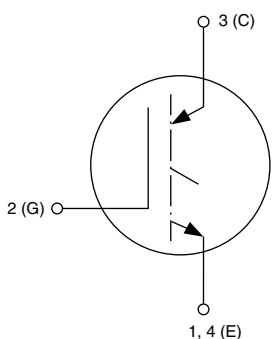
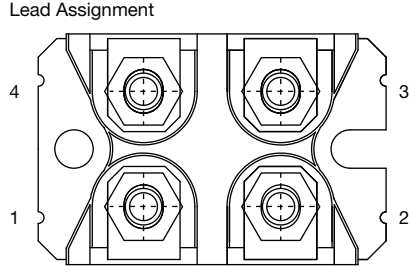


Fig. 14b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

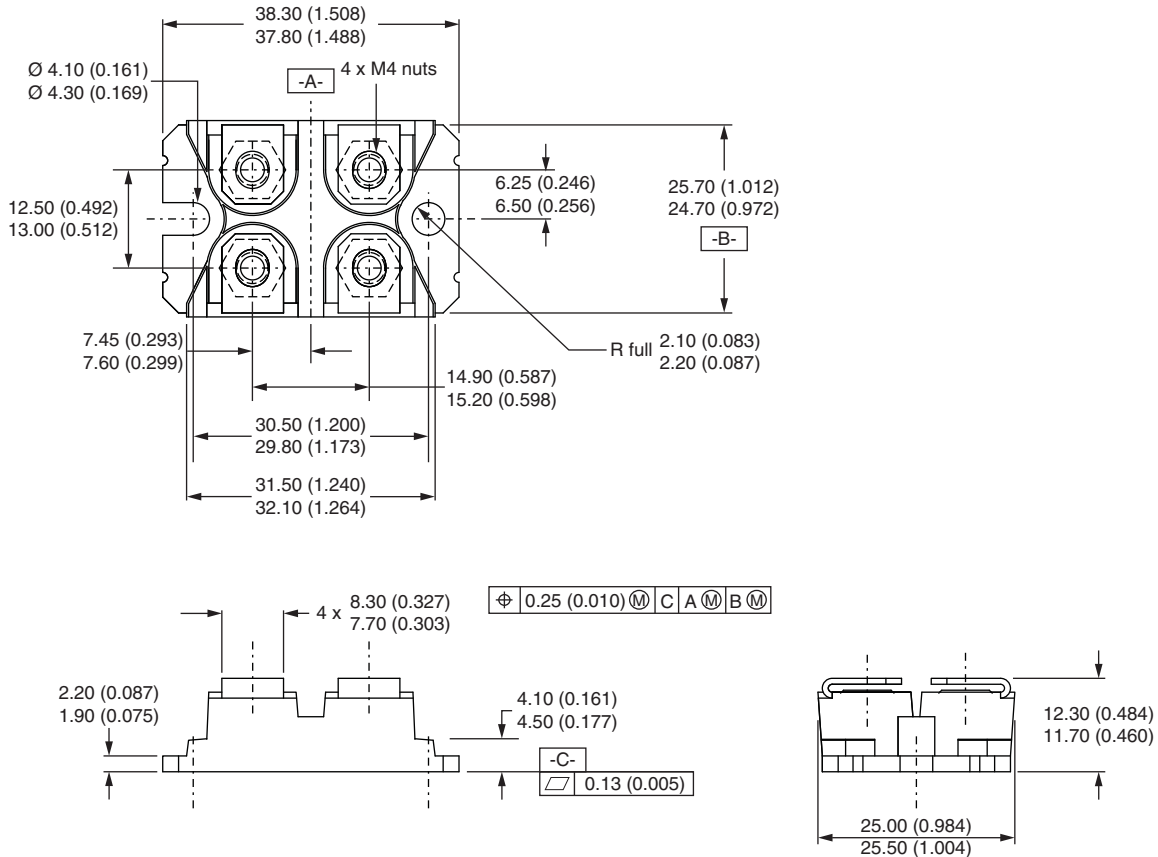
Device code	VS-	G	B	90	S	A	120	U
	1	2	3	4	5	6	7	8
1	- Vishay Semiconductors product							
2	- Insulated Gate Bipolar Transistor (IGBT)							
3	- B = IGBT Generation 5							
4	- Current rating (90 = 90 A)							
5	- Circuit configuration (S = Single switch without antiparallel diode)							
6	- Package indicator (A = SOT-227)							
7	- Voltage rating (120 = 1200 V)							
8	- Speed/type (U = Ultrafast IGBT)							

CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Single switch, no antiparallel diode	S	 

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

SOT-227 Generation II

DIMENSIONS in millimeters (inches)



Note

- Controlling dimension: millimeter



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