

Insulated Gate Bipolar Transistor (Warp 2 Speed IGBT), 100 A


SOT-227

FEATURES

- NPT warp 2 speed IGBT technology with positive temperature coefficient
- Square RBSOA
- HEXFRED® antiparallel diodes with ultrasoft reverse recovery
- Fully isolated package
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC


RoHS
COMPLIANT

PRODUCT SUMMARY

V_{CES}	600 V
I_C DC	100 A at 61 °C
$V_{CE(on)}$ typical at 100 A, 25 °C	2.4 V
I_F DC	100 A at 85 °C

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Easy to assemble and parallel
- Direct mounting to heatsink
- Plug-in compatible with other SOT-227 packages
- Higher switching frequency up to 150 kHz
- Lower conduction losses and switching losses
- Low EMI, requires less snubbing

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C	$T_C = 25\text{ °C}$	125	A
		$T_C = 80\text{ °C}$	85	
Pulsed collector current	I_{CM}		300	
Clamped inductive load current	I_{LM}		300	
Diode continuous forward current	I_F	$T_C = 25\text{ °C}$	160	
		$T_C = 80\text{ °C}$	105	
Peak diode forward current	I_{FM}		200	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	$T_C = 25\text{ °C}$	447	W
		$T_C = 80\text{ °C}$	250	
Power dissipation, diode	P_D	$T_C = 25\text{ °C}$	313	
		$T_C = 80\text{ °C}$	175	
Isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ min	2500	V

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{BR(CES)}$	$V_{GE} = 0\text{ V}$, $I_C = 250\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$	-	2.4	2.8	
		$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	3	3.4	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	3	3.9	5	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$ ($25\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$)	-	- 10	-	mV/ $^{\circ}\text{C}$
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$	-	7	100	μA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	4	10	mA
Forward voltage drop	V_{FM}	$I_C = 100\text{ A}$, $V_{GE} = 0\text{ V}$	-	1.6	2.1	V
		$I_C = 100\text{ A}$, $V_{GE} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.7	2	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 200	nA

SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	Q_g	$I_C = 100\text{ A}$, $V_{CC} = 480\text{ V}$, $V_{GE} = 15\text{ V}$	-	460	690	nC
Gate to emitter charge (turn-on)	Q_{ge}		-	160	250	
Gate to collector charge (turn-on)	Q_{gc}		-	70	130	
Turn-on switching loss	E_{on}	$I_C = 100\text{ A}$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 5\text{ }\Omega$, $L = 500\text{ }\mu\text{H}$, $T_J = 25\text{ }^{\circ}\text{C}$	-	0.36	-	mJ
Turn-off switching loss	E_{off}		-	1.42	-	
Total switching loss	E_{tot}		-	1.78	-	
Turn-on switching loss	E_{on}	$I_C = 100\text{ A}$, $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 5\text{ }\Omega$, $L = 500\text{ }\mu\text{H}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	0.52	-	
Turn-off switching loss	E_{off}		-	1.6	-	
Total switching loss	E_{tot}		-	2.12	-	
Turn-on delay time	$t_{d(on)}$		-	264	-	ns
Rise time	t_r		-	54	-	
Turn-off delay time	$t_{d(off)}$		-	257	-	
Fall time	t_f		-	80	-	
Reverse bias safe operating area	RBSOA	$T_J = 150\text{ }^{\circ}\text{C}$, $I_C = 300\text{ A}$, $R_g = 22\text{ }\Omega$, $V_{GE} = 15\text{ V}$ to 0 V , $V_{CC} = 400\text{ V}$, $V_P = 600\text{ V}$, $L = 500\text{ }\mu\text{H}$	Fullsquare			
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}$, $di_F/dt = 200\text{ A}/\mu\text{s}$, $V_R = 200\text{ V}$	-	95	120	ns
Diode peak reverse current	I_{rr}		-	10	13	A
Diode recovery charge	Q_{rr}		-	480	780	nC
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}$, $di_F/dt = 200\text{ A}/\mu\text{s}$, $V_R = 200\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	144	185	ns
Diode peak reverse current	I_{rr}		-	16	19	A
Diode recovery charge	Q_{rr}		-	1136	1758	nC



Insulated Gate Bipolar Transistor (Warp 2 Speed IGBT), 100 A

GB100DA60UP

Vishay Semiconductors

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T_J, T_{Stg}	- 40	-	150	$^{\circ}\text{C}$
Junction to case	IGBT	-	-	0.28	$^{\circ}\text{C/W}$
	Diode	-	-	0.4	
Case to sink per module	R_{thCS}	-	0.05	-	
Mounting torque, 6-32 or M3 screw		-	-	1.3	Nm
Weight		-	30	-	g

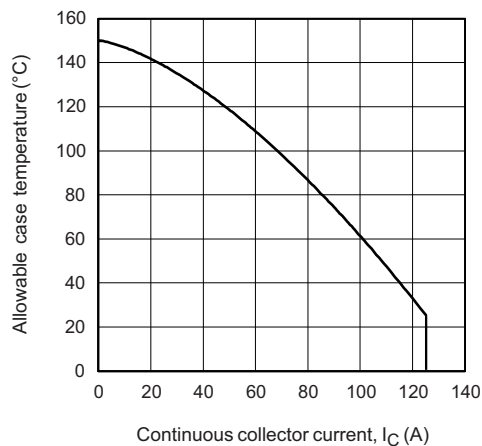


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

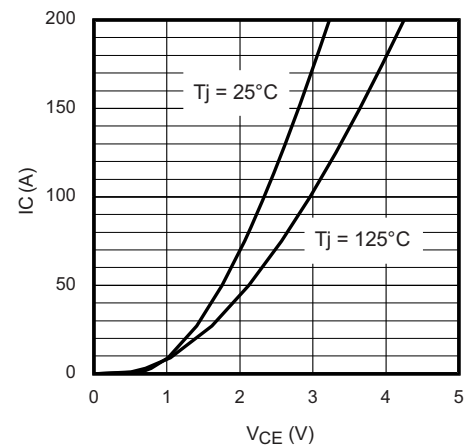


Fig. 3 - Typical IGBT Collector Current Characteristics

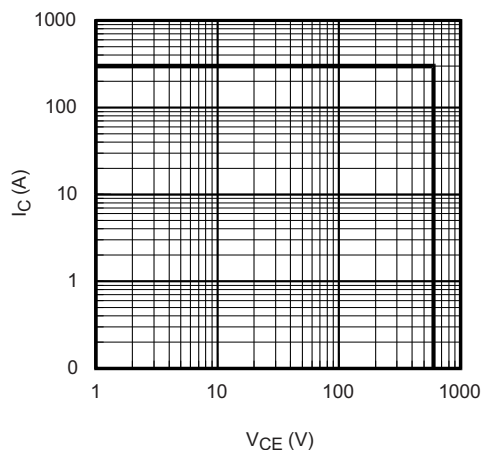


Fig. 2 - IGBT Reverse Bias SOA
 $T_J = 150^{\circ}\text{C}$, $V_{GE} = 15\text{ V}$

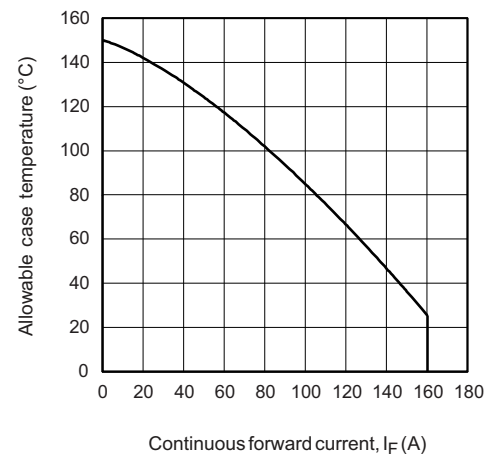


Fig. 4 - Maximum DC Forward Current vs. Case Temperature

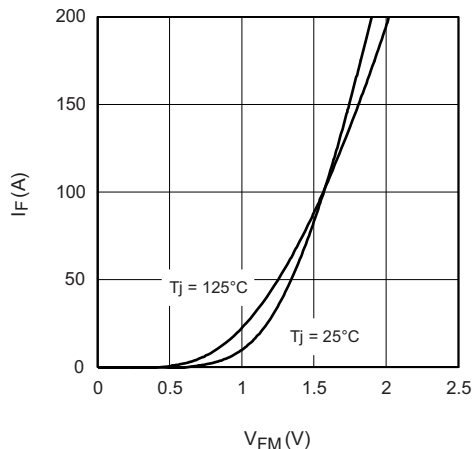


Fig. 5 - Typical Diode Forward Characteristics

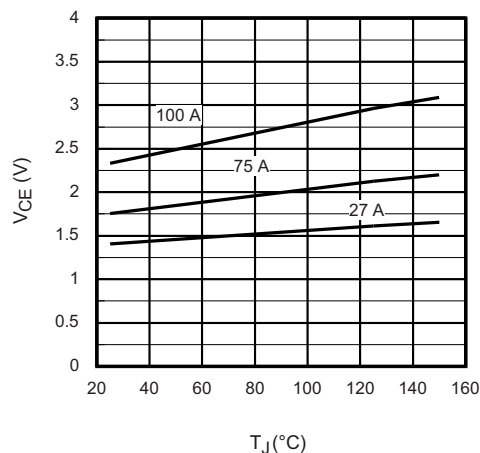


Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, $V_{GE} = 15$ V

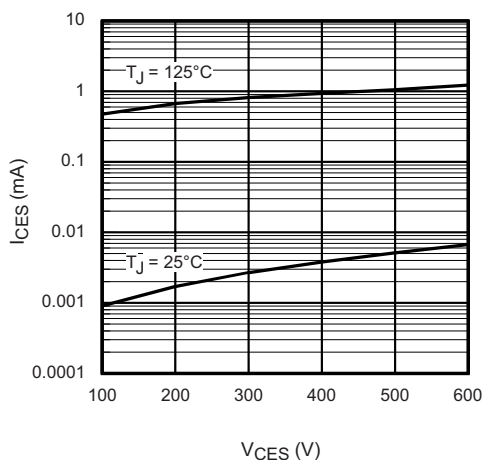


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

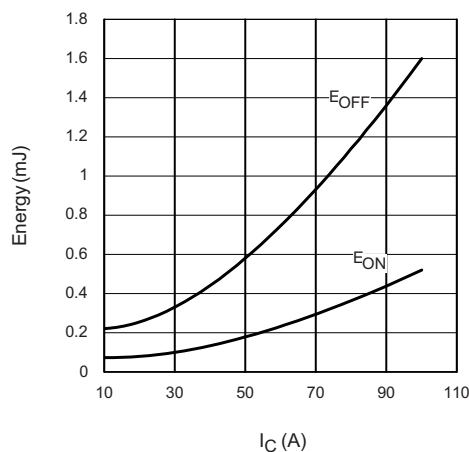


Fig. 9 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125^\circ\text{C}$, $L = 500\ \mu\text{H}$, $V_{CC} = 360$ V,
 $R_g = 5\ \Omega$, $V_{GE} = 15$ V

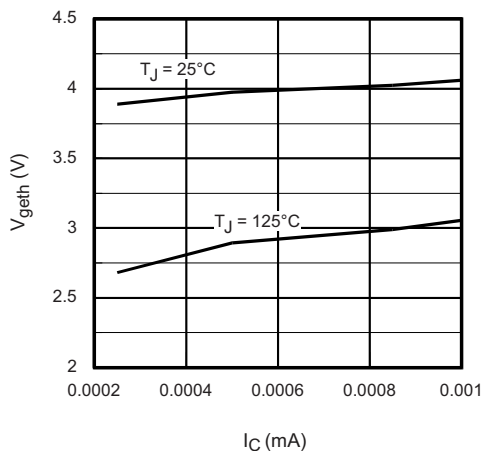


Fig. 7 - Typical IGBT Threshold Voltage

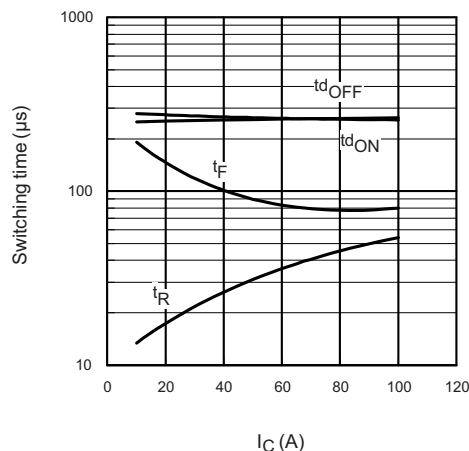


Fig. 10 - Typical IGBT Switching Time vs. I_C
 $T_J = 125^\circ\text{C}$, $L = 500\ \mu\text{H}$, $V_{CC} = 360$ V,
 $R_g = 5\ \Omega$, $V_{GE} = 15$ V

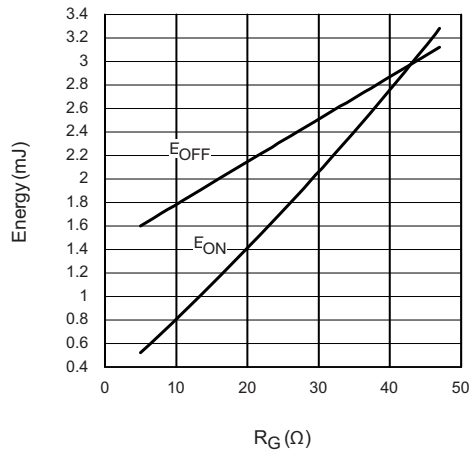


Fig. 11 - Typical IGBT Energy Loss vs. R_g
 $T_J = 125^\circ\text{C}$, $I_C = 100\text{ A}$, $L = 500\text{ }\mu\text{H}$,
 $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$

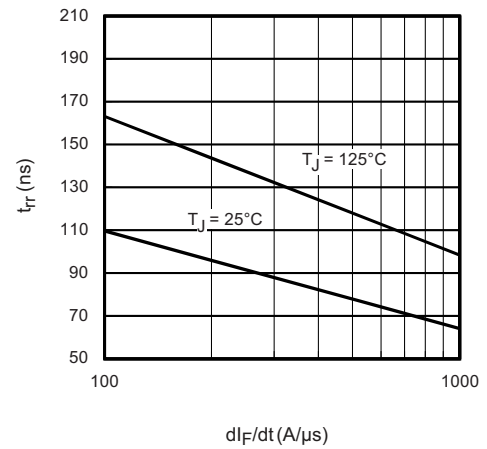


Fig. 13 - Typical t_{rr} diode vs. dI/dt
 $V_{RR} = 200\text{ V}$, $I_F = 50\text{ A}$

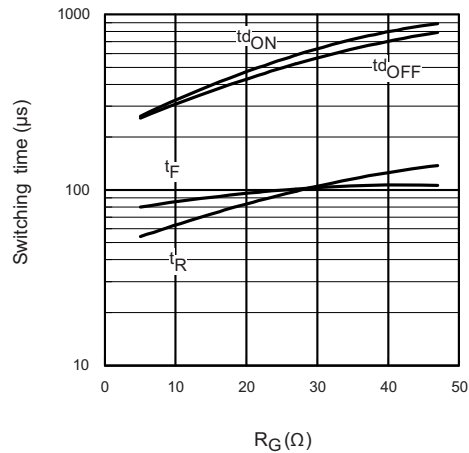


Fig. 12 - Typical IGBT Switching Time vs. R_g
 $T_J = 125^\circ\text{C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$,
 $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$

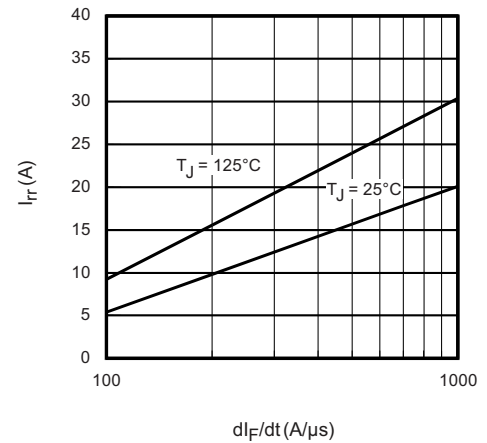


Fig. 14 - Typical I_{rr} diode vs. dI/dt
 $V_{RR} = 200\text{ V}$, $I_F = 50\text{ A}$

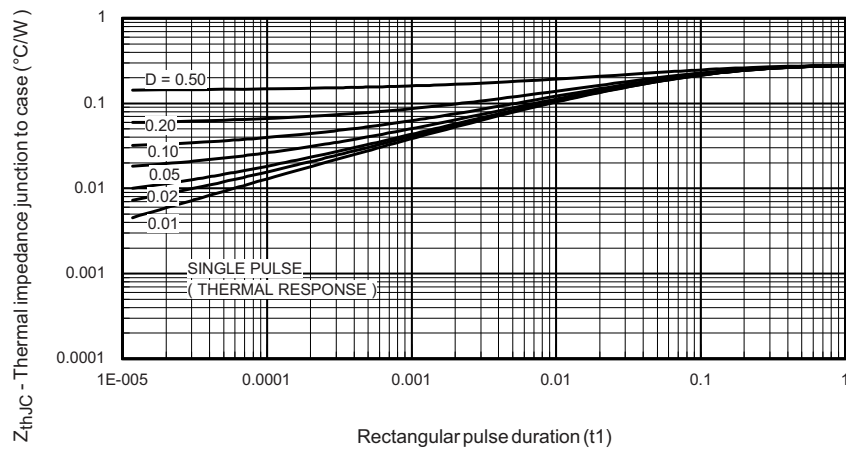


Fig. 15 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

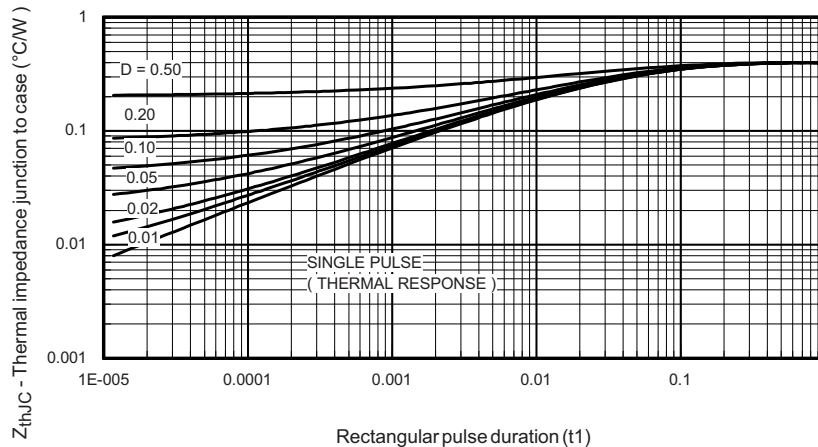
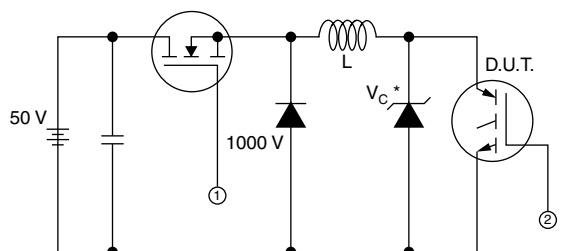


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (diode)



* 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 I_d

Fig. 17a - Clamped Inductive Load Test Circuit

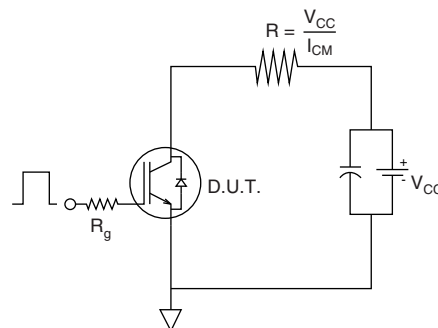


Fig. 17b - Pulsed Collector Current Test Circuit

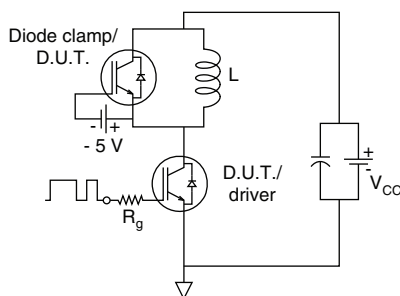


Fig. 18a - Switching Loss Test Circuit

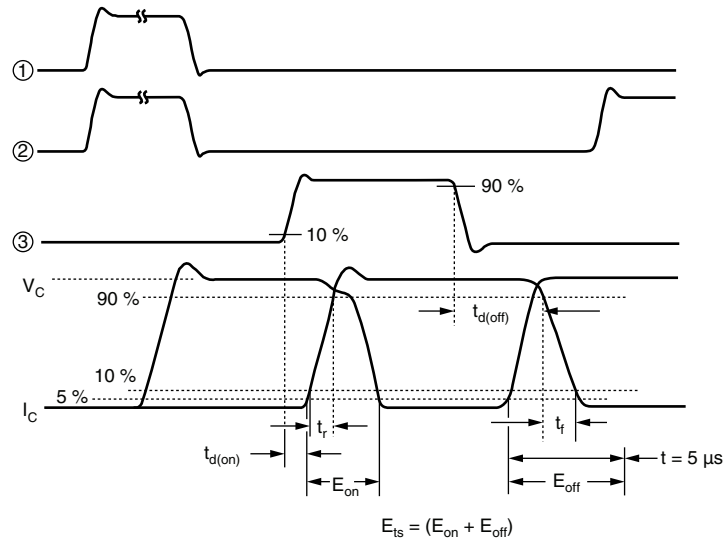


Fig. 18b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

Device code	G	B	100	D	A	60	U	P
	①	②	③	④	⑤	⑥	⑦	⑧
1	- Insulated Gate Bipolar Transistor (IGBT)							
2	- B = IGBT Generation 5							
3	- Current rating (100 = 100 A)							
4	- Circuit configuration (D = Single switch with antiparallel diode)							
5	- Package indicator (A = SOT-227)							
6	- Voltage rating (60 = 600 V)							
7	- Speed/type (U = Ultrafast IGBT)							
8	- Totally lead (Pb)-free							

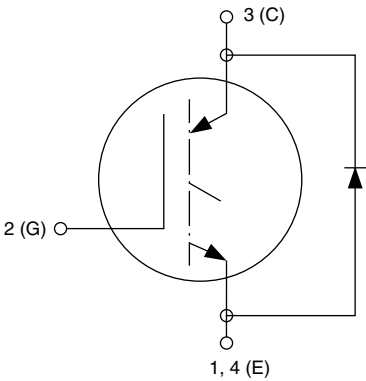
GB100DA60UP

Vishay Semiconductors

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(Warp 2 Speed IGBT), 100 A



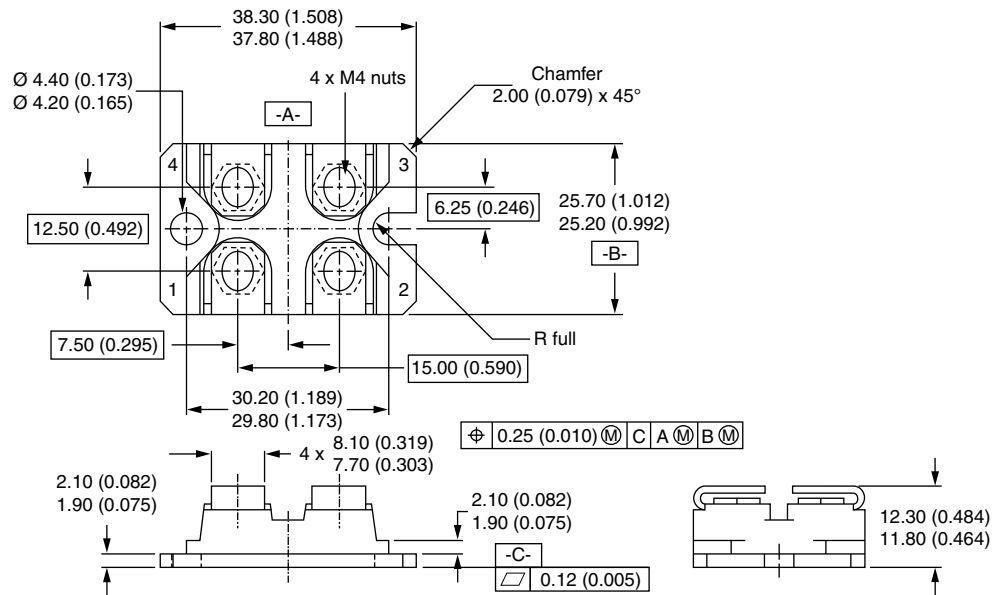
CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95036
Packaging information	www.vishay.com/doc?95037

SOT-227

DIMENSIONS in millimeters (inches)



Notes

- Dimensioning and tolerancing per ANSI Y14.5M-1982
- Controlling dimension: millimeter



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