


"Low Side Chopper" IGBT SOT-227 (Warp 2 Speed IGBT), 70 A


SOT-227
FEATURES

- NPT warp 2 speed IGBT technology with positive temperature coefficient
- Square RBSOA
- Low $V_{CE(on)}$
- FRED Pt[®] hyperfast rectifier
- 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	70 A at 88 °C
$V_{CE(on)}$ typical at 70 A, 25 °C	2.4 V
I_F DC	70 A at 86 °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	$T_C = 25$ °C	111	A
		$T_C = 80$ °C	76	
Pulsed collector current	I_{CM}		120	
Clamped inductive load current	I_{LM}		120	
Diode continuous forward current	I_F	$T_C = 25$ °C	113	
		$T_C = 80$ °C	75	
Peak diode forward current	I_{FM}		200	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	$T_C = 25$ °C	447	W
		$T_C = 80$ °C	250	
Power dissipation, diode	P_D	$T_C = 25$ °C	236	
		$T_C = 80$ °C	132	
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ min	2500	V

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 = 1 mA	600	-	-	
Collector to emitter voltage	V _{CE(on)}	V _{GE} = 15 V, I _C = 35 A	-	1.69	1.88	V
		V _{GE} = 15 V, I _C = 70 A	-	2.23	2.44	
		V _{GE} = 15 V, I _C = 35 A, T _J = 125 °C	-	2.07	2.31	
		V _{GE} = 15 V, I _C = 70 A, T _J = 125 °C	-	2.89	3.21	
Gate threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 500 μA	3	3.9	5	
Temperature coefficient of threshold voltage	ΔV _{GE(th)} /ΔT _J	V _{CE} = V _{GE} , I _C = 1 mA (25 °C to 125 °C)	-	- 9	-	mV/°C
Collector to emitter leakage current	I _{CES}	V _{GE} = 0 V, V _{CE} = 600 V	-	1	100	μA
		V _{GE} = 0 V, V _{CE} = 600 V, T _J = 125 °C	-	0.07	2.0	mA
Diode reverse breakdown voltage	V _{BR}	I _R = 1 mA	600	-	-	V
Diode forward voltage drop	V _{FM}	I _C = 35 A, V _{GE} = 0 V	-	1.8	2.33	V
		I _C = 70 A, V _{GE} = 0 V	-	2.13	2.71	
		I _C = 35 A, V _{GE} = 0 V, T _J = 125 °C	-	1.35	1.81	
		I _C = 70 A, V _{GE} = 0 V, T _J = 125 °C	-	1.7	2.32	
Diode reverse leakage current	I _{RM}	V _R = V _R rated	-	0.1	50	μA
		T _J = 125 °C, V _R = V _R rated	-	0.01	3	mA
Gate to emitter leakage current	I _{GES}	V _{GE} = ± 20 V	-	-	± 200	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} = 400 V, V _{GE} = 15 V	-	320	-	nC	
Gate to emitter charge (turn-on)	Q _{ge}		-	42	-		
Gate to collector charge (turn-on)	Q _{gc}		-	110	-		
Turn-on switching loss	E _{on}	I _C = 70 A, V _{CC} = 360 V, V _{GE} = 15 V, R _g = 5 Ω, L = 500 μH, T _J = 25 °C	-	1.15	-	mJ	
Turn-off switching loss	E _{off}		-	1.16	-		
Total switching loss	E _{tot}		-	2.31	-		
Turn-on switching loss	E _{on}		Energy losses include tail and diode recovery (see fig. 18)	-	1.27		-
Turn-off switching loss	E _{off}			-	1.28		-
Total switching loss	E _{tot}			-	2.55		-
Turn-on delay time	t _{d(on)}		I _C = 70 A, V _{CC} = 360 V, V _{GE} = 15 V, R _g = 5 Ω, L = 500 μH, T _J = 125 °C	-	208	-	ns
Rise time	t _r			-	69	-	
Turn-off delay time	t _{d(off)}			-	208	-	
Fall time	t _f	-		100	-		
Reverse bias safe operating area	RBSOA	T _J = 150 °C, I _C = 120 A, R _g = 22 Ω, V _{GE} = 15 V to 0 V, V _{CC} = 400 V, V _P = 600 V	Fullsquare				
Diode reverse recovery time	t _{rr}	I _F = 50 A, di _F /dt = 200 A/μs, V _R = 200 V	-	59	93	ns	
Diode peak reverse current	I _{rr}		-	4	6	A	
Diode recovery charge	Q _{rr}		-	118	279	nC	
Diode reverse recovery time	t _{rr}	I _F = 50 A, di _F /dt = 200 A/μs, V _R = 200 V, T _J = 125 °C	-	130	159	ns	
Diode peak reverse current	I _{rr}		-	11	13	A	
Diode recovery charge	Q _{rr}		-	715	995	nC	



THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T_J, T_{Stg}	- 40	-	150	$^{\circ}C$
Thermal resistance, junction to case	IGBT	-	-	0.28	$^{\circ}C/W$
	Diode	-	-	0.53	
Thermal resistance, case to sink per module	R_{thCS}	-	0.05	-	
Mounting torque, 6-32 or M3 screw		-	-	1.3	Nm
Weight		-	30	-	g

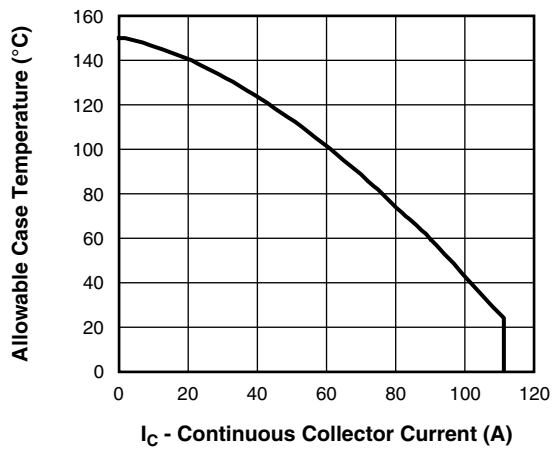


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

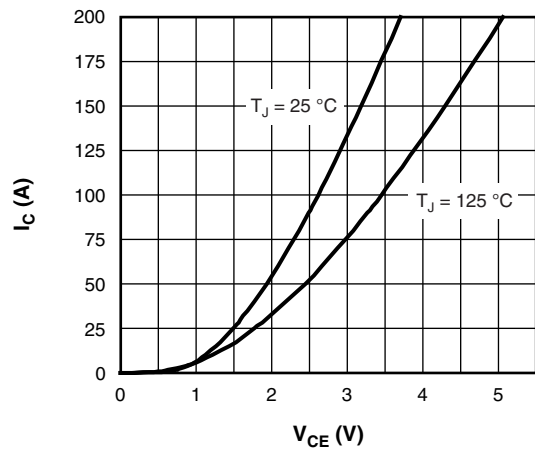


Fig. 3 - Typical IGBT Collector Current Characteristics

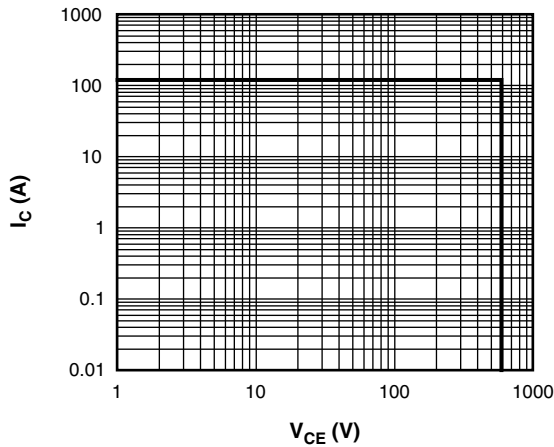


Fig. 2 - IGBT Reverse Bias SOA
 $T_J = 150^{\circ}C, V_{GE} = 15 V$

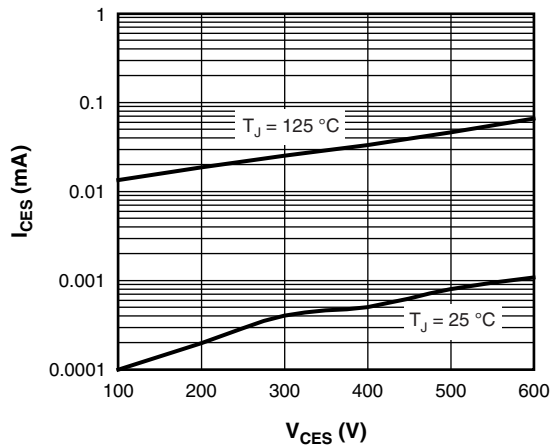


Fig. 4 - Typical IGBT Zero Gate Voltage Collector Current

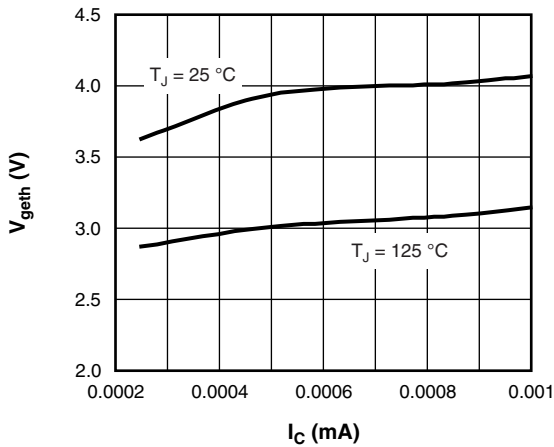


Fig. 5 - Typical IGBT Threshold Voltage

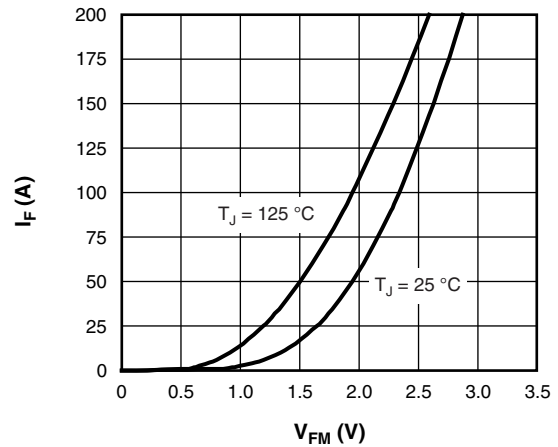


Fig. 8 - Typical Diode Forward Characteristics

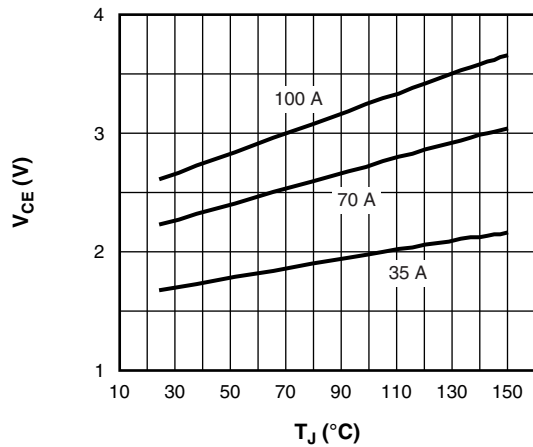


Fig. 6 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, $V_{GE} = 15\text{ V}$

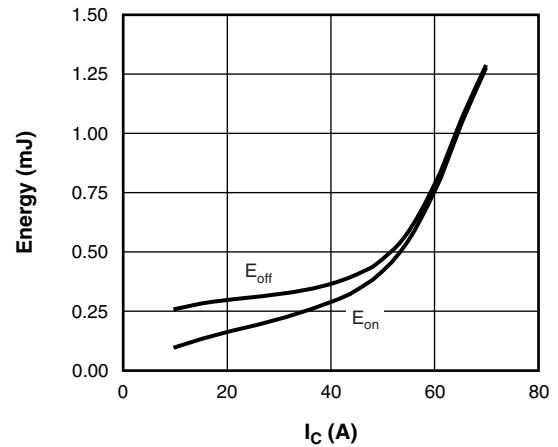


Fig. 9 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125\text{ °C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$

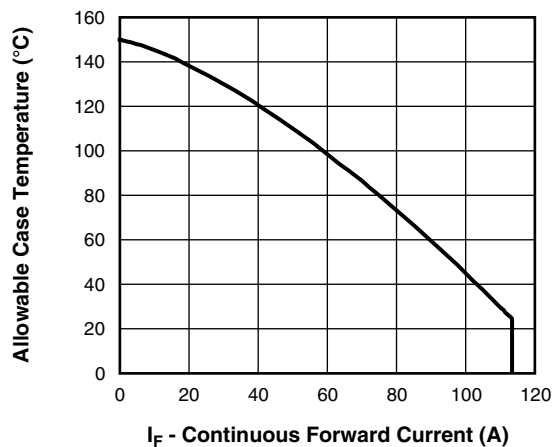


Fig. 7 - Maximum DC Forward Current vs. Case Temperature

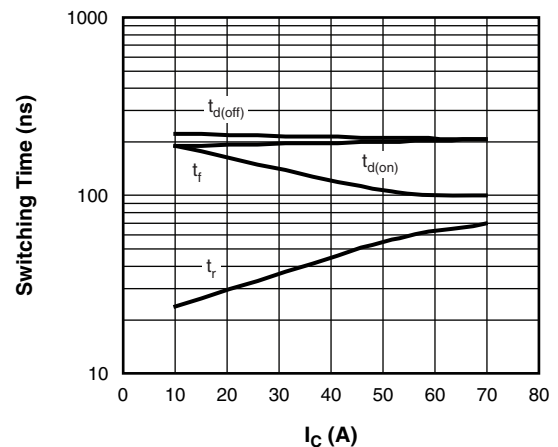
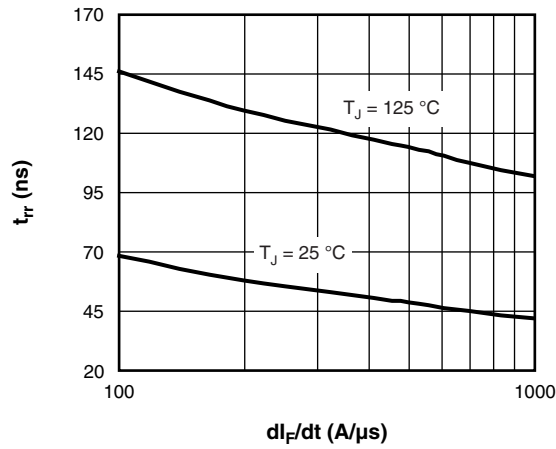
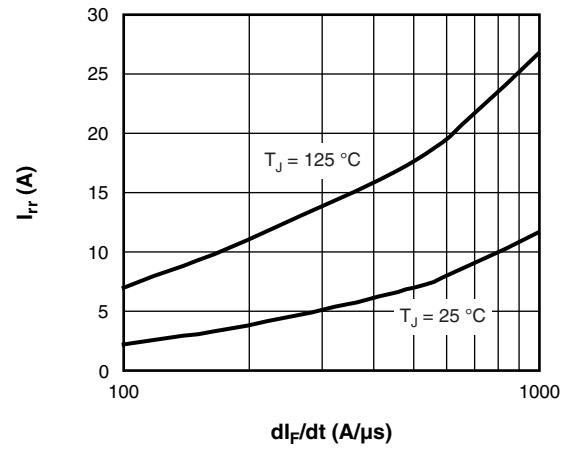
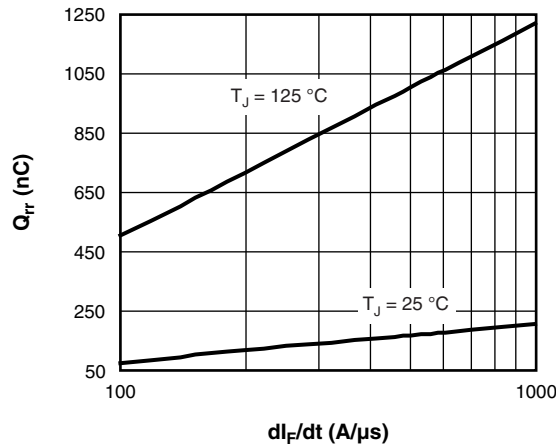
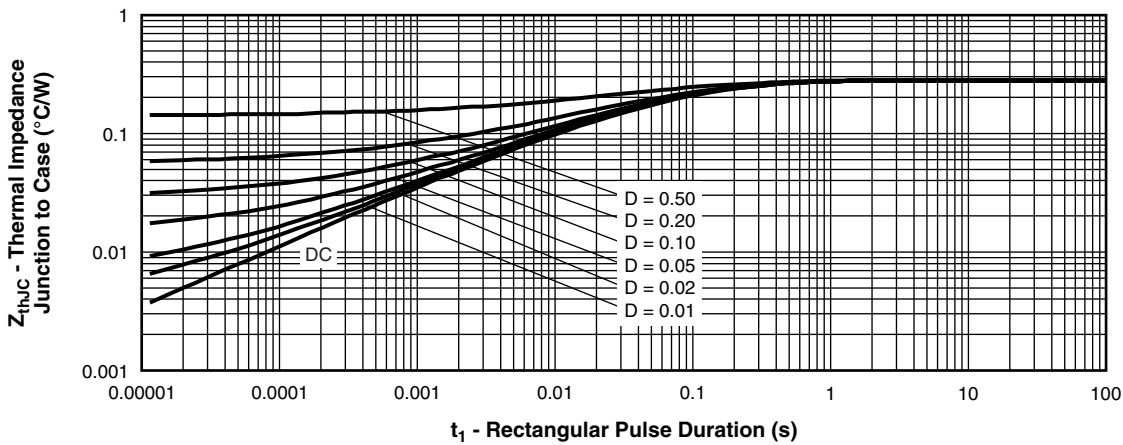


Fig. 10 - Typical IGBT Switching Time vs. I_C
 $T_J = 125\text{ °C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$


 Fig. 11 - Typical t_{rr} Diode vs. dl_F/dt
 $V_R = 200\text{ V}$, $I_F = 50\text{ A}$

 Fig. 12 - Typical I_{rr} Diode vs. dl_F/dt
 $V_{RR} = 200\text{ V}$, $I_F = 50\text{ A}$

 Fig. 13 - Typical Q_{rr} Diode vs. dl_F/dt
 $V_R = 200\text{ V}$, $I_F = 50\text{ A}$

 Fig. 14 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

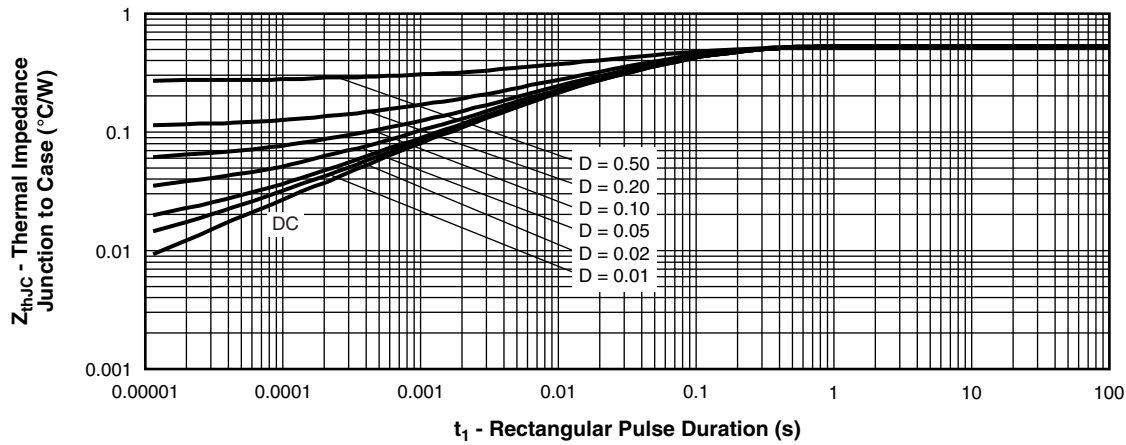


Fig. 15 - Maximum Thermal Impedance Z_{thJC} Characteristics (DIODE)

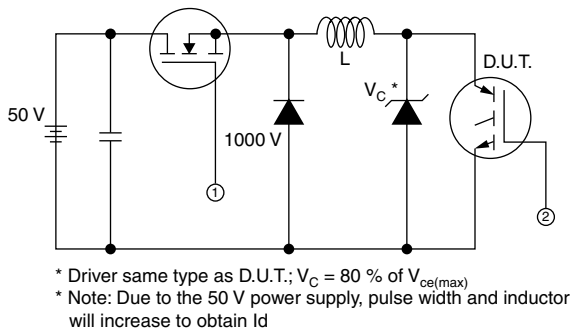


Fig. 16a - Clamped Inductive Load Test Circuit

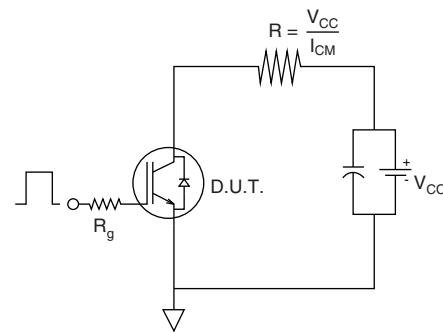


Fig. 16b - Pulsed Collector Current Test Circuit

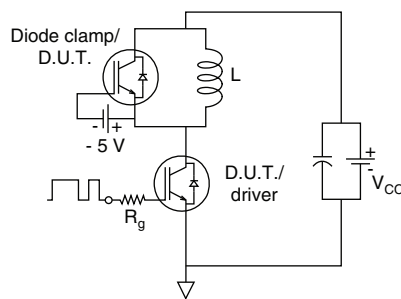


Fig. 17a - Switching Loss Test Circuit

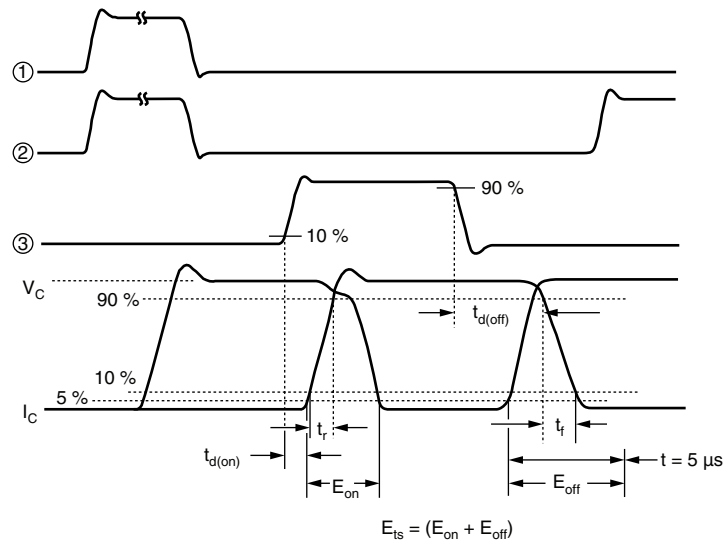


Fig. 17b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

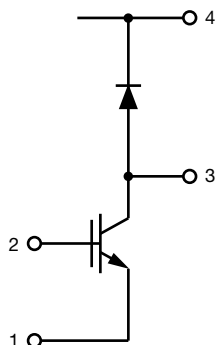
Device code	G	B	70	L	A	60	U	F	
	①	②	③	④	⑤	⑥	⑦	⑧	
	1	-	Insulated Gate Bipolar Transistor (IGBT)	2	-	B = IGBT Generation 5	3	-	Current rating (70 = 70 A)
	4	-	Circuit configuration (L = Low Side Chopper)	5	-	Package indicator (A = SOT-227)	6	-	Voltage rating (60 = 600 V)
	7	-	Speed/type (U = Ultrafast IGBT)	8	-	F = F/W FRED Pt [®] diode			

GB70LA60UF

Vishay Semiconductors "Low Side Chopper" IGBT SOT-227
(Warp 2 Speed IGBT), 70 A



CIRCUIT CONFIGURATION

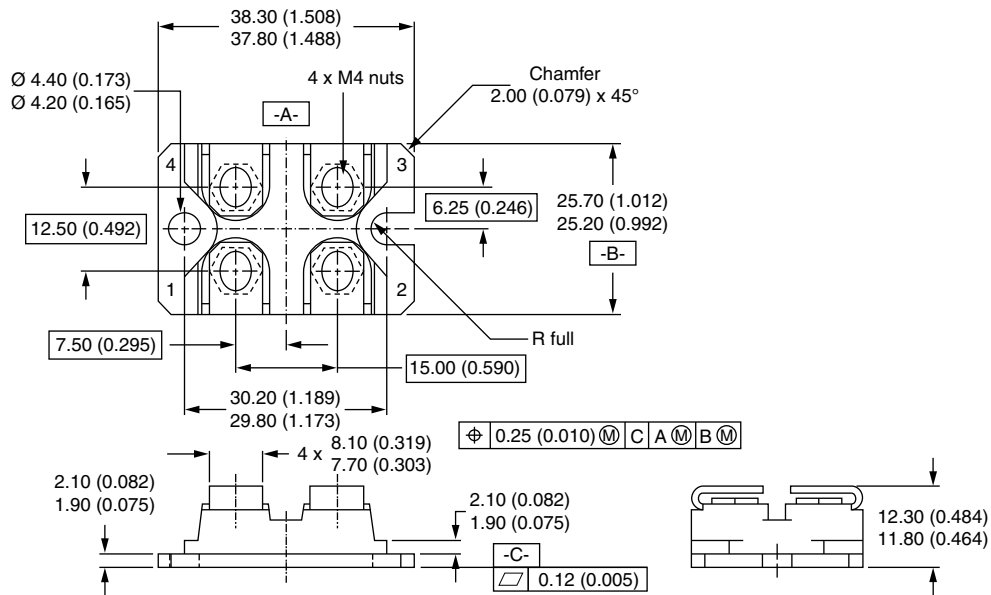


LINKS TO RELATED DOCUMENTS

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