

"High Side Chopper" IGBT SOT-227 (Trench IGBT), 100 A


SOT-227

FEATURES

- Trench IGBT technology
- Very low $V_{CE(on)}$
- Square RBSOA
- HEXFRED® clamping diode
- 10 μ s short circuit capability
- Fully isolated package
- Speed 4 kHz to 30 kHz
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- Compliant to RoHS directive 2002/95/EC


RoHS
COMPLIANT

PRODUCT SUMMARY

V_{CES}	1200 V
I_C DC	100 A at 71 °C
$V_{CE(on)}$ typical at 100 A, 25 °C	2.36 V

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	$T_C = 25\text{ °C}$	134	A
		$T_C = 80\text{ °C}$	92	
Pulsed collector current	I_{CM}		270	
Clamped inductive load current	I_{LM}		270	
Diode continuous forward current	I_F	$T_C = 25\text{ °C}$	87	
		$T_C = 80\text{ °C}$	59	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	$T_C = 25\text{ °C}$	463	W
		$T_C = 80\text{ °C}$	260	
Power dissipation, diode	P_D	$T_C = 25\text{ °C}$	338	
		$T_C = 80\text{ °C}$	190	
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1$ min	2500	V

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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	$V_{BR(CES)}$	$V_{GE} = 0\text{ V}$, $I_C = 1\text{ mA}$	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 50\text{ A}$	-	1.79	2.33	
		$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$	-	2.36	2.85	
		$V_{GE} = 15\text{ V}$, $I_C = 50\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.05	2.62	
		$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.8	3.42	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 500\text{ }\mu\text{A}$	5	5.8	7	
Temperature coefficient of threshold voltage	$V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$ ($25\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$)	-	- 15.6	-	mV/ $^{\circ}\text{C}$
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$	-	0.5	100	μA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	0.052	2	mA
Diode reverse breakdown voltage	V_{BR}	$I_R = 1\text{ mA}$	1200	-	-	V
Diode forward voltage drop	V_{FM}	$I_C = 50\text{ A}$, $V_{GE} = 0\text{ V}$	-	2.53	3.55	V
		$I_C = 100\text{ A}$, $V_{GE} = 0\text{ V}$	-	3.32	4.35	
		$I_C = 50\text{ A}$, $V_{GE} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	2.66	3.70	
		$I_C = 100\text{ A}$, $V_{GE} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	3.7	4.50	
Diode reverse leakage current	I_{RM}	$V_R = V_R$ rated	-	4	50	μA
		$T_J = 125\text{ }^{\circ}\text{C}$, $V_R = V_R$ rated	-	0.6	3	mA
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 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 = 100 A, V _{CC} = 600 V, V _{GE} = 15 V		-	400	-	nC	
Gate to emitter charge (turn-on)	Q _{ge}			-	120	-		
Gate to collector charge (turn-on)	Q _{gc}			-	170	-		
Turn-on switching loss	E _{on}	I _C = 100 A, V _{CC} = 600 V, V _{GE} = 15 V, R _g = 5 Ω, L = 500 μH	Energy losses include tail and diode recovery (see fig. 18)	-	21.9	-	mJ	
Turn-off switching loss	E _{off}			-	5.48	-		
Total switching loss	E _{tot}			-	27.38	-		
Turn-on switching loss	E _{on}	-		23.6	-			
Turn-off switching loss	E _{off}	-		7.65	-			
Total switching loss	E _{tot}	-		31.25	-			
Turn-on delay time	t _{d(on)}	I _C = 100 A, V _{CC} = 600 V, V _{GE} = 15 V, R _g = 5 Ω, L = 500 μH, T _J = 125 °C		-	195	-	ns	
Rise time	t _r			-	259	-		
Turn-off delay time	t _{d(off)}			-	188	-		
Fall time	t _f			-	212	-		
Reverse bias safe operating area	RBSOA	T _J = 150 °C, I _C = 270 A, R _g = 22 Ω, V _{GE} = 15 V to 0 V, V _{CC} = 900 V, V _P = 1200 V		Fullsquare				
Short circuit safe operating area	SCSOA	T _J = 150 °C, R _g = 22 Ω, V _{GE} = 15 V to 0 V, V _{CC} = 900 V, V _P = 1200 V		10			μs	
Diode reverse recovery time	t _{rr}	I _F = 50 A, dI _F /dt = 200 A/μs, V _R = 200 V		-	129	161	ns	
Diode peak reverse current	I _{rr}			-	11	14	A	
Diode recovery charge	Q _{rr}			-	700	1046	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		-	208	257	ns	
Diode peak reverse current	I _{rr}			-	17	21	A	
Diode recovery charge	Q _{rr}			-	1768	2698	nC	

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T_J, T_{Stg}	- 40	-	150	°C
Thermal resistance, junction to case — IGBT Diode	R_{thJC}	-	-	0.27	°C/W
		-	-	0.37	
Thermal resistance, case to sink per module	R_{thCS}	-	0.05	-	
Mounting torque, 6-32 or M3 screw		-	-	1.3	Nm
Weight		-	30	-	g

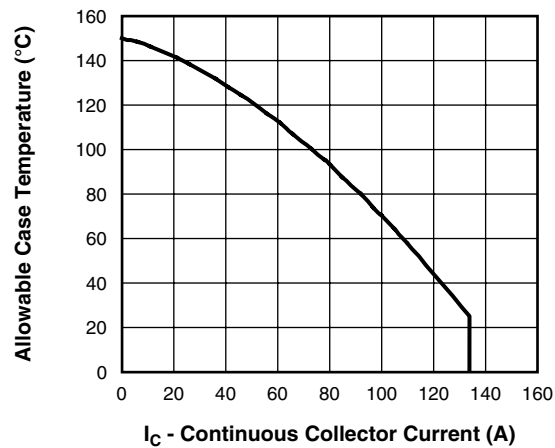


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

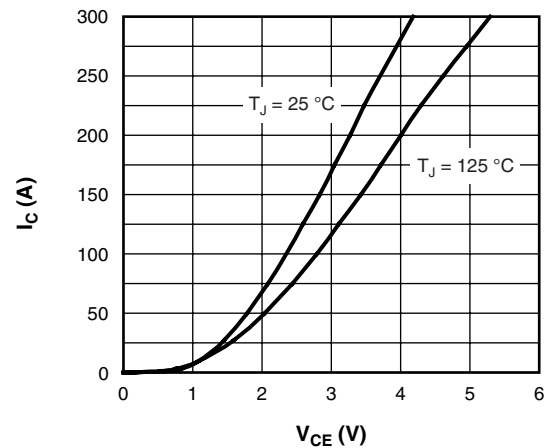


Fig. 3 - Typical IGBT Collector Current Characteristics

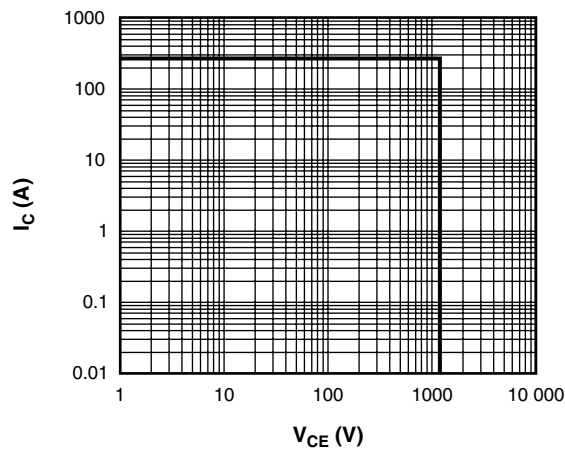


Fig. 2 - IGBT Reverse Bias SOA
 $T_J = 150\text{ °C}$, $V_{GE} = 15\text{ V}$

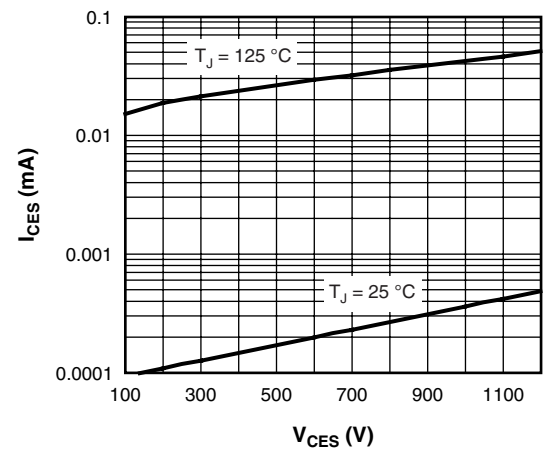


Fig. 4 - Typical IGBT Zero Gate Voltage Collector Current

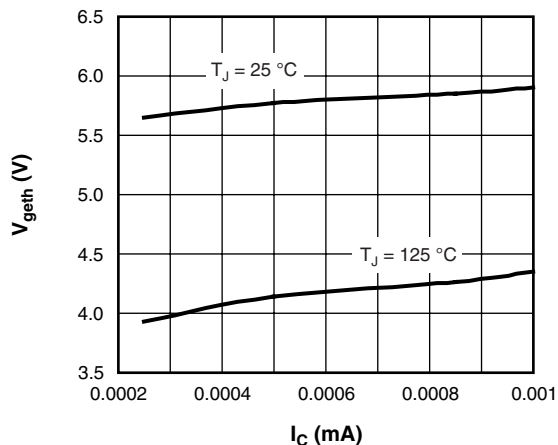


Fig. 5 - Typical IGBT Threshold Voltage

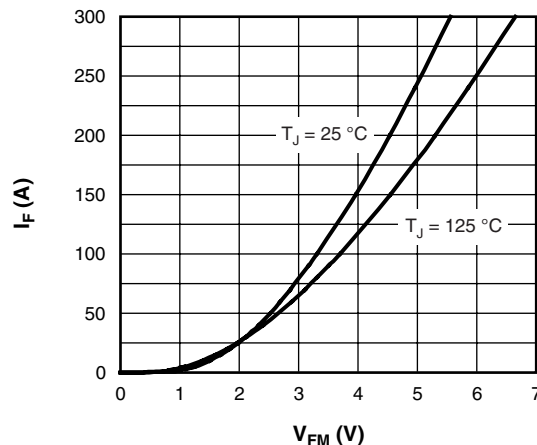


Fig. 8 - Typical Diode Forward Characteristics

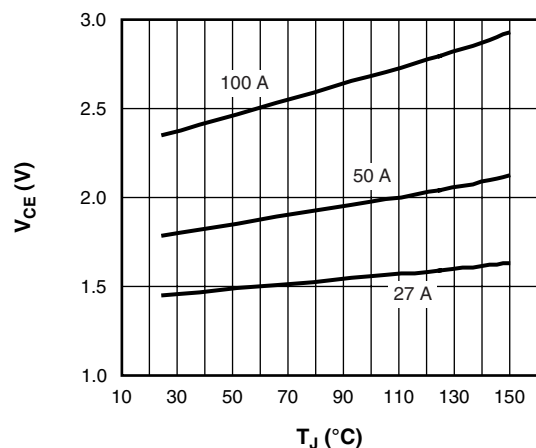


Fig. 6 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, $V_{GE} = 15$ V

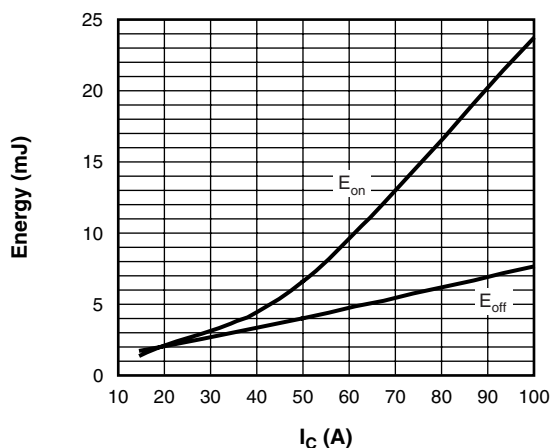


Fig. 9 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125$ °C, $L = 500$ μ H, $V_{CC} = 600$ V,
 $R_g = 5$ Ω , $V_{GE} = 15$ V

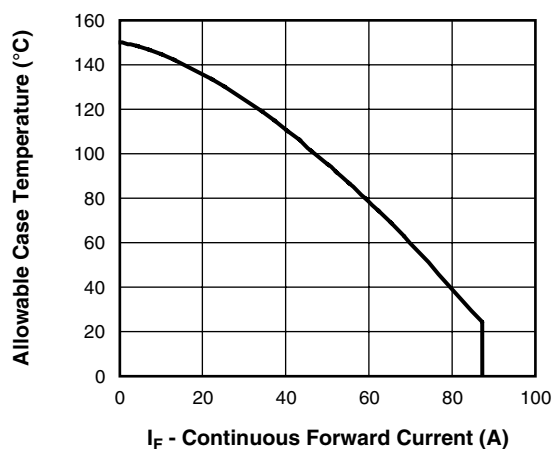


Fig. 7 - Maximum DC Forward Current vs. Case Temperature

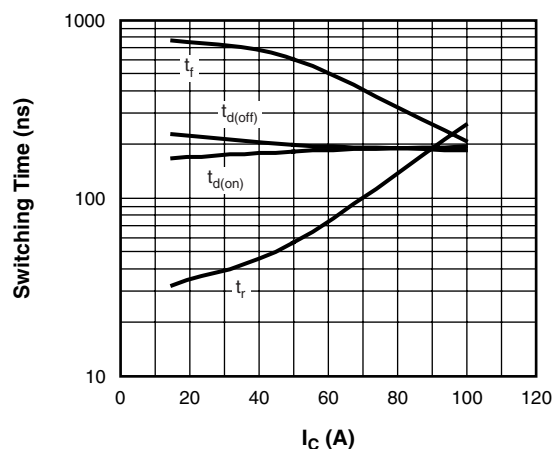


Fig. 10 - Typical IGBT Switching Time vs. I_C
 $T_J = 125$ °C, $L = 500$ μ H, $V_{CC} = 600$ V,
 $R_g = 5$ Ω , $V_{GE} = 15$ V

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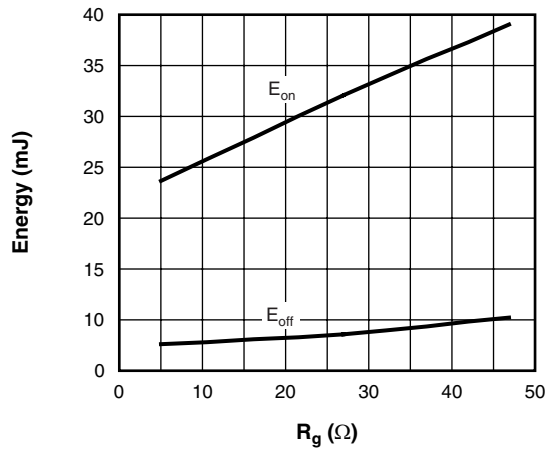


Fig. 11 - Typical IGBT Energy Loss vs. R_g
 $T_J = 125\text{ }^{\circ}\text{C}$, $I_C = 100\text{ A}$, $L = 500\text{ }\mu\text{H}$,
 $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$

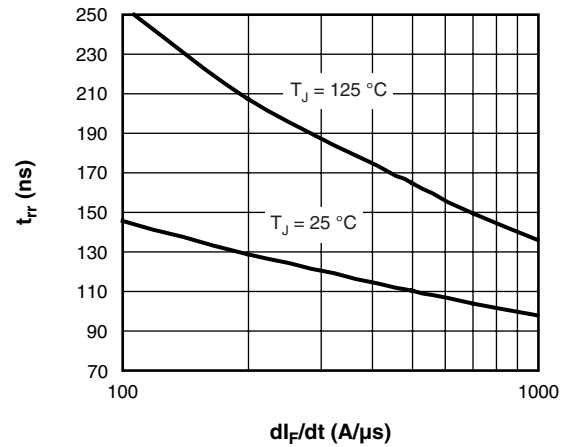


Fig. 13 - Typical t_{rr} Diode vs. dI_F/dt
 $V_R = 200\text{ V}$, $I_F = 50\text{ A}$

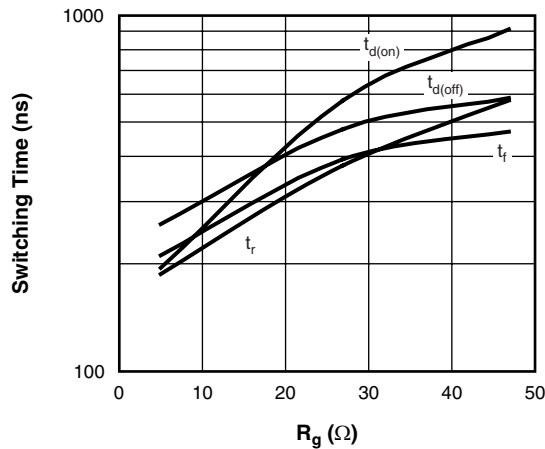


Fig. 12 - Typical IGBT Switching Time vs. R_g
 $T_J = 125\text{ }^{\circ}\text{C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 600\text{ V}$,
 $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$

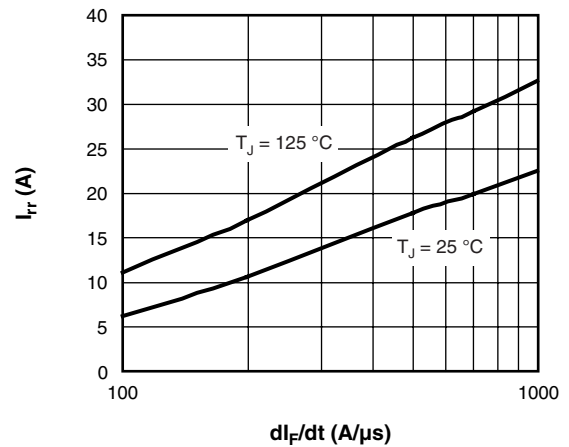


Fig. 14 - Typical I_{rr} Diode vs. dI_F/dt
 $V_R = 200\text{ V}$, $I_F = 50\text{ A}$

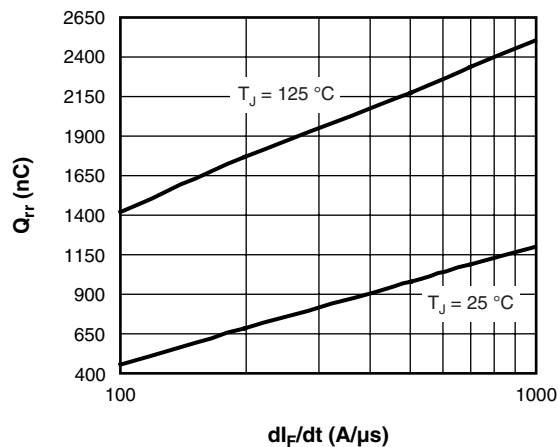


Fig. 15 - Typical Q_{rr} Diode vs. dI_F/dt
 $V_R = 200\text{ V}$, $I_F = 50\text{ A}$

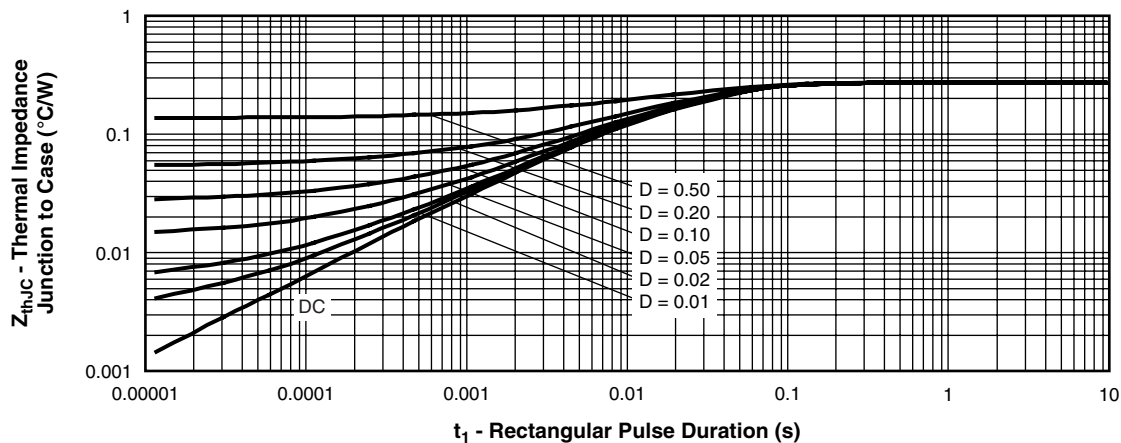


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

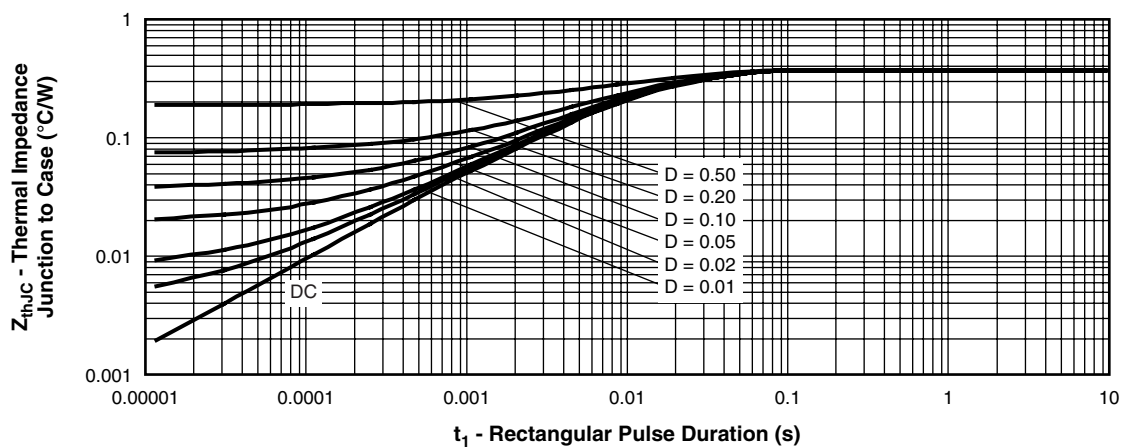
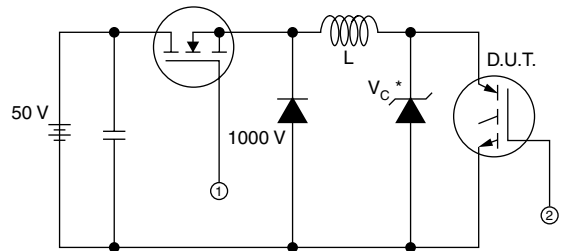


Fig. 17 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)

"High Side Chopper" IGBT SOT-227 Vishay High Power Products (Trench IGBT), 100 A



* 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. 18a - Clamped Inductive Load Test Circuit

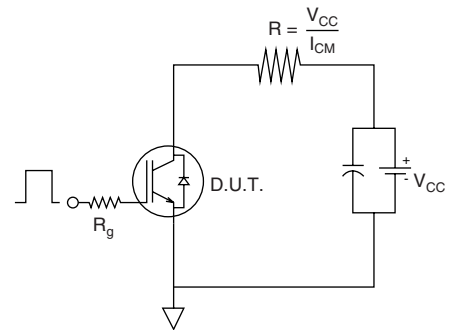


Fig. 18b - Pulsed Collector Current Test Circuit

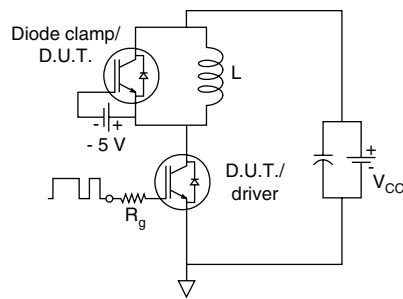


Fig. 19a - Switching Loss Test Circuit

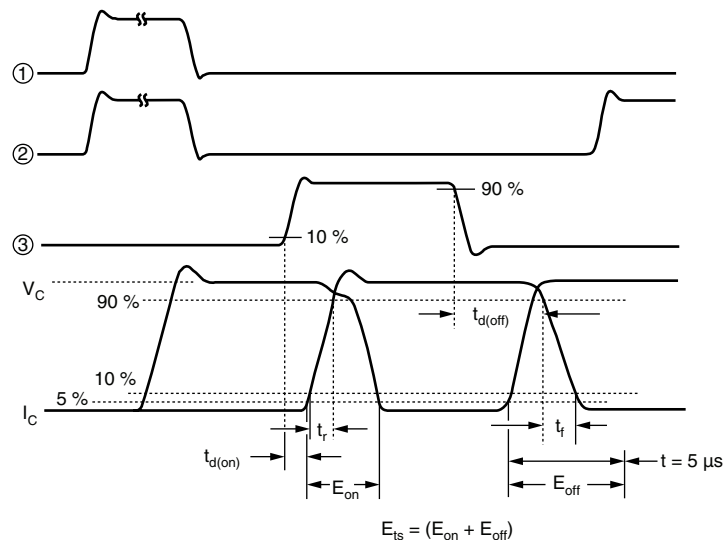


Fig. 19b - Switching Loss Waveforms Test Circuit

GT100NA120U

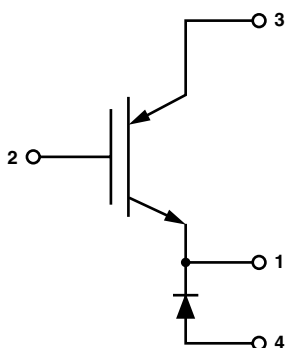
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ORDERING INFORMATION TABLE

Device code	G	T	100	N	A	120	U
	1	2	3	4	5	6	7
1	- Insulated Gate Bipolar Transistor (IGBT)						
2	- T = Trench IGBT						
3	- Current rating (100 = 100 A)						
4	- Circuit configuration (N = High side chopper)						
5	- Package indicator (A = SOT-227)						
6	- Voltage rating (120 = 1200 V)						
7	- Speed/type (U = Ultrafast IGBT)						

CIRCUIT CONFIGURATION



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



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