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

Pb-free

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 °C	125	A
		T_C = 80 °C	85	
Pulsed collector current	I_{CM}		300	
Clamped inductive load current	I_{LM}		300	
Diode continuous forward current	I_F	T_C = 25 °C	160	
		T_C = 80 °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 °C	447	W
		T_C = 80 °C	250	
Power dissipation, diode	P_D	T_C = 25 °C	313	
		T_C = 80 °C	175	
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 = 250 µA	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 100 A	-	2.4	2.8	
		V_{GE} = 15 V, I_C = 100 A, T_J = 125 °C	-	3	3.4	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 250 µA	3	3.9	5	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	V_{CE} = V_{GE}, I_C = 1 mA (25 °C to 125 °C)	-	- 10	-	mV/°C
Collector to emitter leakage current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V	-	7	100	µA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150 °C	-	4	10	mA
Forward voltage drop	V_{FM}	I_C = 100 A, V_{GE} = 0 V	-	1.6	2.1	V
		I_C = 100 A, V_{GE} = 0 V, T_J = 125 °C	-	1.7	2	
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 = 100 A, V_{CC} = 480 V, V_{GE} = 15 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 A, V_{CC} = 360 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 µH, T_J = 25 °C	Energy losses include tail and diode recovery (see fig. 18)	-	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 A, V_{CC} = 360 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 µH, T_J = 125 °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 °C, I_C = 300 A, R_g = 22 Ω, V_{GE} = 15 V to 0 V, V_{CC} = 400 V, V_P = 600 V, L = 500 µH		Fullsquare			
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/µs, V_R = 200 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 A, dI_F/dt = 200 A/µs, V_R = 200 V, T_J = 125 °C		-	144	185	ns
Diode peak reverse current	I_{rr}			-	16	19	A
Diode recovery charge	Q_{rr}			-	1136	1758	nC

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER		**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Maximum junction and storage temperature range		T_J, T_{Stg}	- 40	-	150	°C
Junction to case	IGBT	R_{thJC}	-	-	0.28	°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

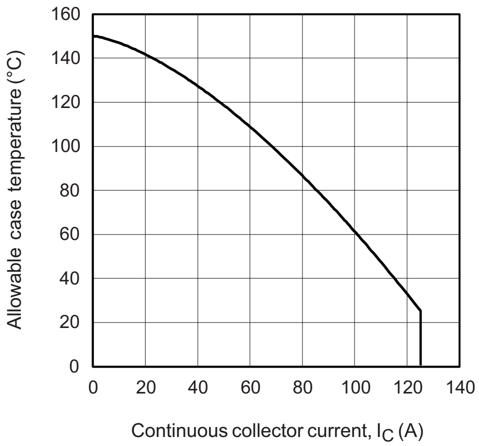


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

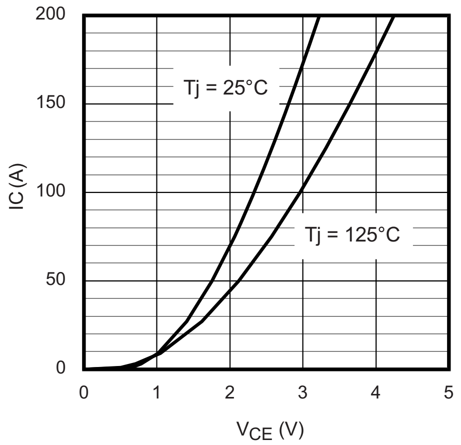


Fig. 3 - Typical IGBT Collector Current Characteristics

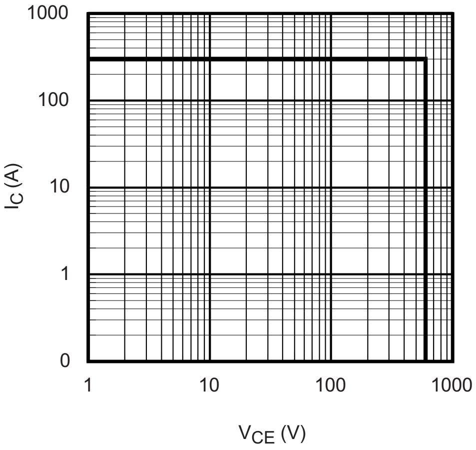


Fig. 2 - IGBT Reverse Bias SOA
T_J = 150 °C, V_{GE} = 15 V

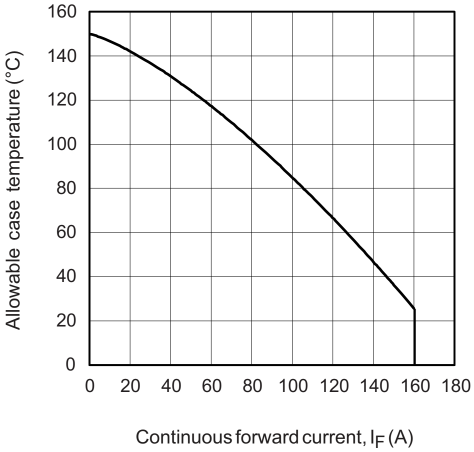


Fig. 4 - Maximum DC Forward Current vs. Case Temperature

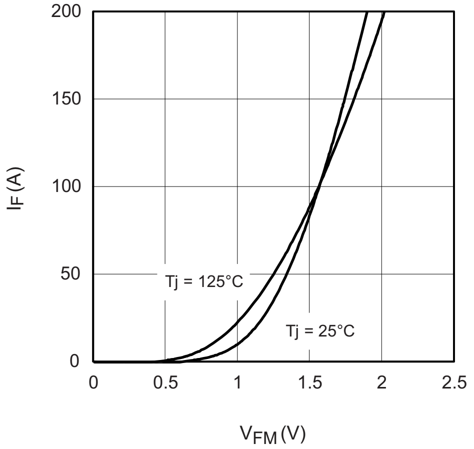


Fig. 5 - Typical Diode Forward Characteristics

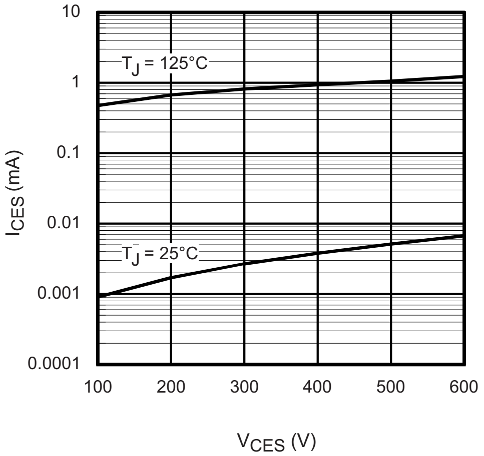


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

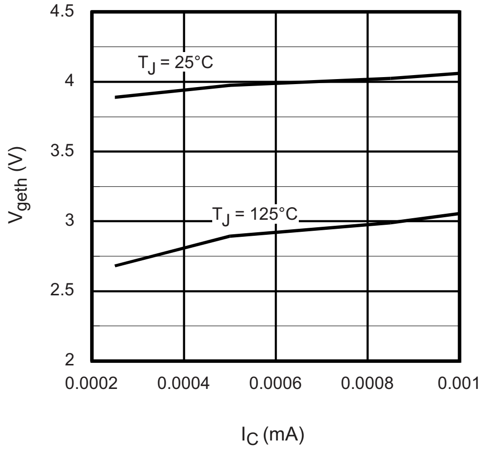


Fig. 7 - Typical IGBT Threshold Voltage

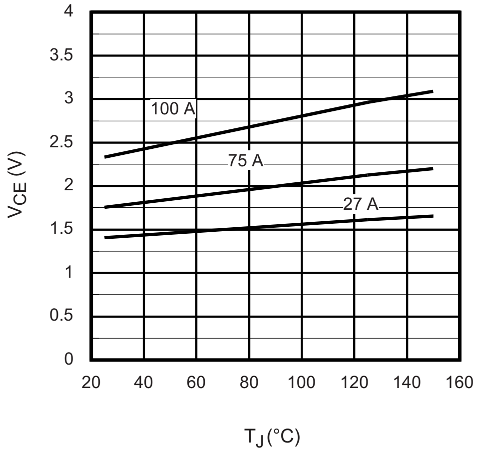


Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

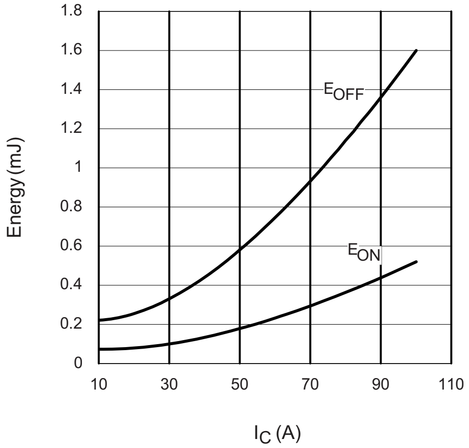


Fig. 9 - Typical IGBT Energy Loss vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 360 V,
R_g = 5 Ω, V_{GE} = 15 V

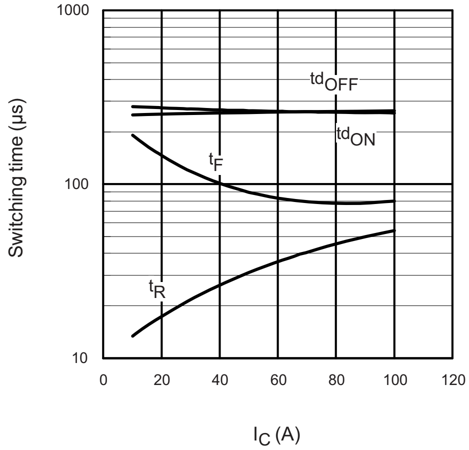


Fig. 10 - Typical IGBT Switching Time vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 360 V,
R_g = 5 Ω, V_{GE} = 15 V

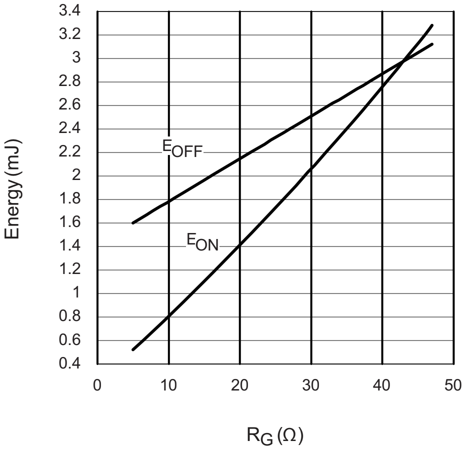


Fig. 11 - Typical IGBT Energy Loss vs. R_g
T_J = 125 °C, I_C = 100 A, L = 500 µH,
V_{CC} = 360 V, V_{GE} = 15 V

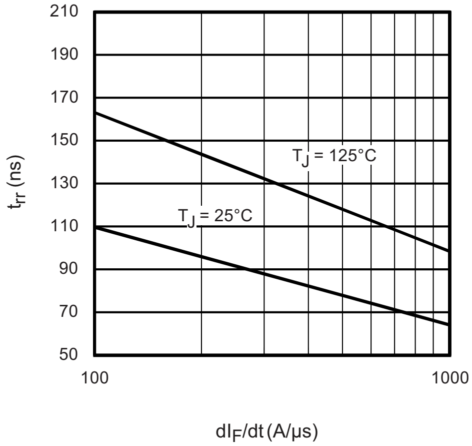


Fig. 13 - Typical t_{rr} diode vs. dI_F/dt
V_{RR} = 200 V, I_F = 50 A

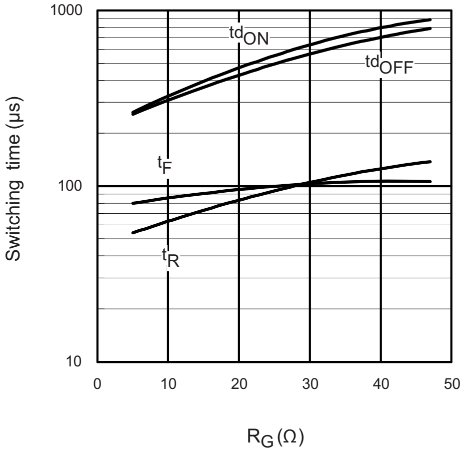


Fig. 12 - Typical IGBT Switching Time vs. R_g
T_J = 125 °C, L = 500 µH, V_{CC} = 360 V,
I_C = 100 A, V_{GE} = 15 V

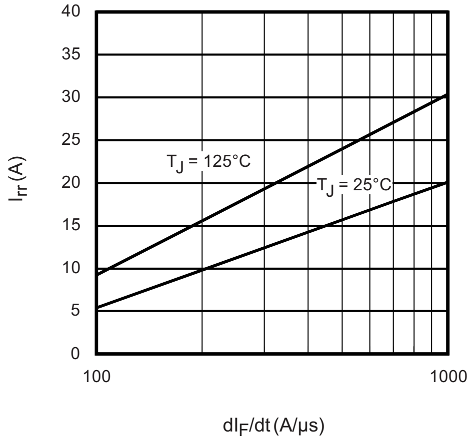


Fig. 14 - Typical I_{rr} diode vs. dI_F/dt
V_{RR} = 200 V, I_F = 50 A

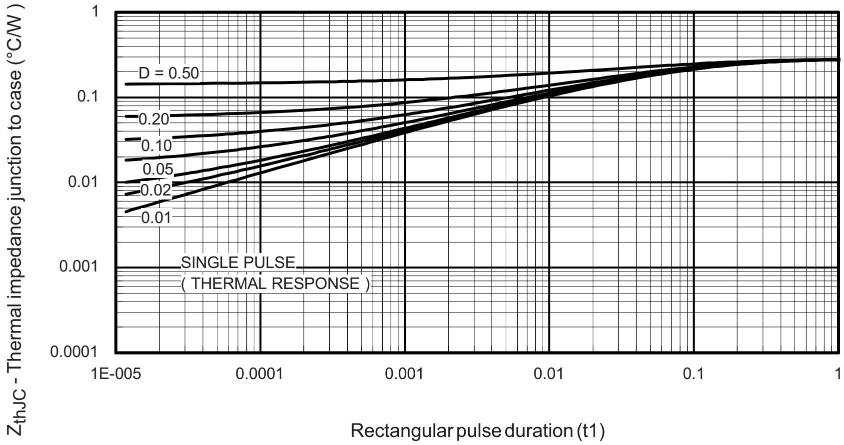


Fig. 15 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

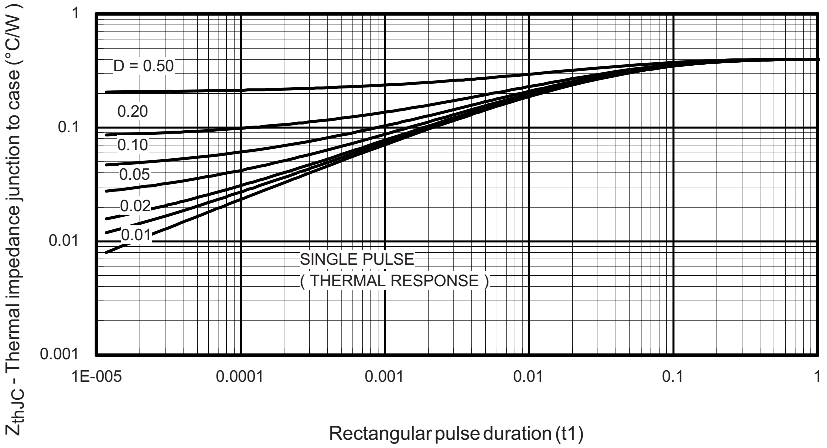
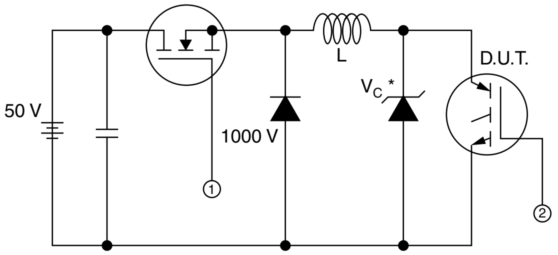


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (diode)



* 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 Id

Fig. 17a - Clamped Inductive Load Test Circuit

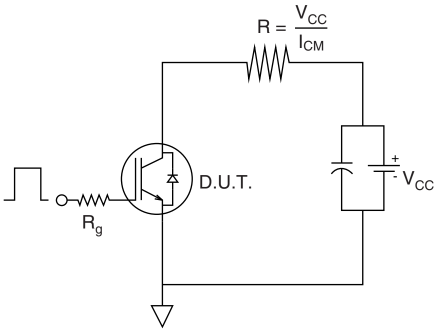


Fig. 17b - Pulsed Collector Current Test Circuit

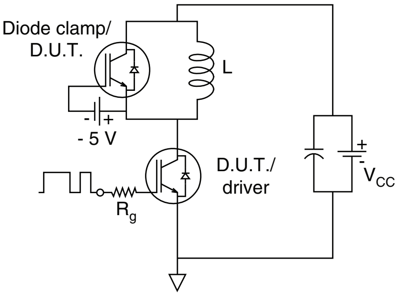


Fig. 18a - Switching Loss Test Circuit

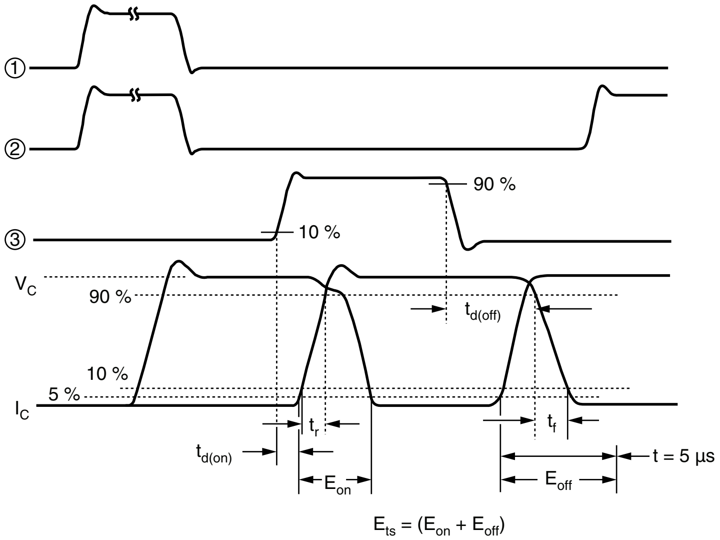


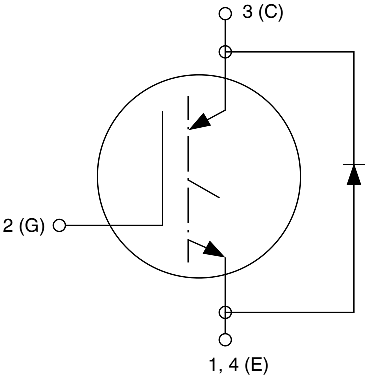
Fig. 18b - Switching Loss Waveforms Test Circuit

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

CIRCUIT CONFIGURATION



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

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