Insulated Gate Bipolar Transistor (Ultrafast Speed IGBT), 100 A

SOT-227

FEATURES

- Ultrafast: Optimized for minimum saturation voltage and speed up to 40 kHz in hard switching, > 200 kHz in resonant mode
- Very low conduction and switching losses
- Fully isolate package (2500 $V_{AC/RMS}$)
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level

Pb-free
RoHS
COMPLIANT

PRODUCT SUMMARY

V_{CES}	600 V
$V_{CE(on)}$ (typical)	1.92 V
V_{GE}	15 V
I_C	100 A

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Lower overall losses available at frequencies = 20 kHz
- Easy to assemble and parallel
- Direct mounting to heatsink
- Lower EMI, requires less snubbing
- Plug-in compatible with other SOT-227 packages

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter breakdown voltage	V_{CES}		600	V
Continuous collector current	I_C	T_C = 25 °C	200	A
		T_C = 100 °C	100	
Pulsed collector current	I_{CM}		400	
Clamped inductive load current	I_{LM}	V_{CC} = 80 % (V_{CES}), V_{GE} = 20 V, L = 10 μH, R_G = 2.0 Ω, See fig. 13a	400	
Gate to emitter voltage	V_{GE}		± 20	V
Reverse voltage avalanche energy	E_{ARV}	Repetitive rating; pulse width limited by maximum junction temperature	160	mJ
RMS isolation voltage	V_{ISOL}	Any terminal to case, t = 1 minute	2500	V
Maximum power dissipation	P_D	T_C = 25 °C	500	W
		T_C = 100 °C	200	
Operating junction and storage temperature range	T_J, T_{Stg}		- 55 to + 150	°C
Mounting torque		6-32 or M3 screw	1.3 (12)	N · m (lbf · in)

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TYP.	MAX.	UNITS
Junction to case	R_{thJC}	-	0.25	°C/W
Case to sink, flat, greased surface	R_{thCS}	0.05	-	
Weight of module		30	-	g

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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
Emitter to collector breakdown voltage	$V_{(BR)ECS}$	V_{GE} = 0 V, I_C = 1.0 A Pulse width ≤ 80 μs; duty factor ≤ 0.1		18	-	-	
Temperature coeff. of breakdown	$\Delta V_{(BR)CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 10 mA		-	0.38	-	V/°C
Collector to emitter saturation voltage	$V_{CE(on)}$	I_C = 100 A	V_{GE} = 15 V See fig. 2, 5	-	1.60	1.9	V
		I_C = 200 A		-	1.92	-	
		I_C = 100 A, T_J = 150 °C		-	1.54	-	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 250 μA		3.0	-	6.0	
Temperature coeff. of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	V_{CE} = V_{GE}, I_C = 2.0 mA		-	- 11	-	mV/°C
Forward transconductance	g_{fe}	V_{CE} = 100 V, I_C = 100 A Pulse width 5.0 μs, single shot		79	-	-	S
Zero gate voltage collector current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V		-	-	1.0	mA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150 °C		-	-	10	
Gate to emitter leakage current	I_{GES}	V_{GE} = ± 20 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 = 100 A V_{CC} = 400 V V_{GE} = 15 V; See fig. 8	-	770	1200	nC
Gate-emitter charge (turn-on)	Q_{ge}		-	100	150	
Gate-collector charge (turn-on)	Q_{gc}		-	260	380	
Turn-on delay time	$t_{d(on)}$	T_J = 25 °C I_C = 100 A V_{CC} = 480 V V_{GE} = 15 V R_g = 2.0 Ω Energy losses include "tail" See fig. 9, 10, 14	-	54	-	ns
Rise time	t_r		-	79	-	
Turn-off delay time	$t_{d(off)}$		-	130	200	
Fall time	t_f		-	300	450	
Turn-on switching loss	E_{on}		-	0.98	-	mJ
Turn-off switching loss	E_{off}		-	3.48	-	
Total switching loss	E_{ts}		-	4.46	7.6	
Turn-on delay time	$t_{d(on)}$	T_J = 150 °C I_C = 100 A, V_{CC} = 480 V V_{GE} = 15 V, R_g = 2.0 Ω Energy losses include "tail" See fig. 10, 11, 14	-	56	-	ns
Rise time	t_r		-	75	-	
Turn-off delay time	$t_{d(off)}$		-	160	-	
Fall time	t_f		-	460	-	
Total switching loss	E_{ts}		-	7.24	-	mJ
Internal emitter inductance	L_E	Measured 5 mm from package	-	5.0	-	nH
Input capacitance	C_{ies}	V_{GE} = 0 V V_{CC} = 30 V f = 1.0 MHz; See fig. 7	-	16 500	-	pF
Output capacitance	C_{oes}		-	1000	-	
Reverse transfer capacitance	C_{res}		-	200	-	

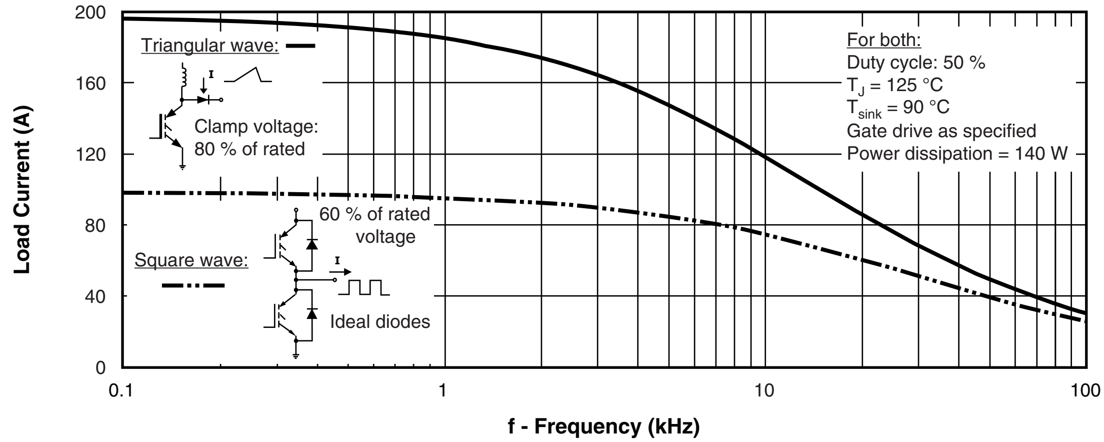


Fig. 1 - Typical Load Current vs. Frequency (Load Current = I_{RMS} of Fundamental)

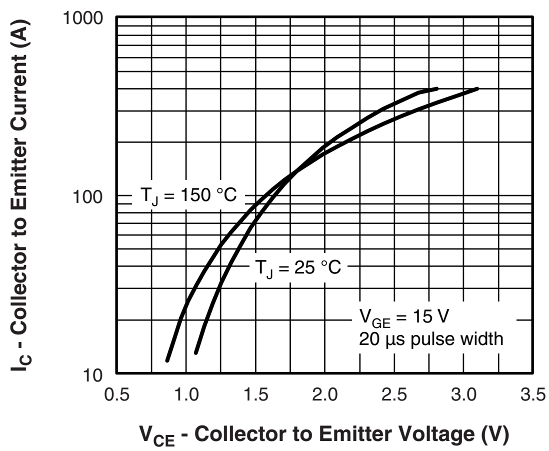


Fig. 2 - Typical Output Characteristics

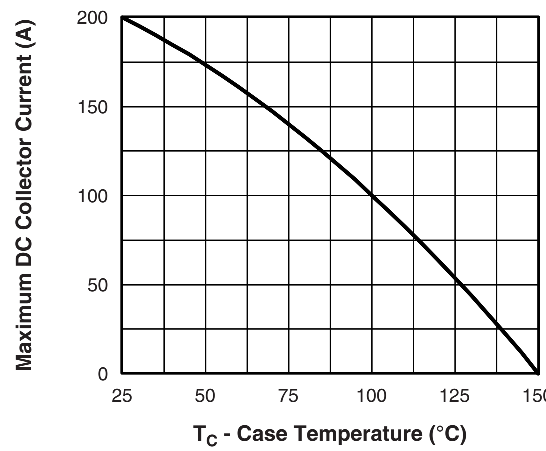


Fig. 4 - Maximum Collector Current vs. Case Temperature

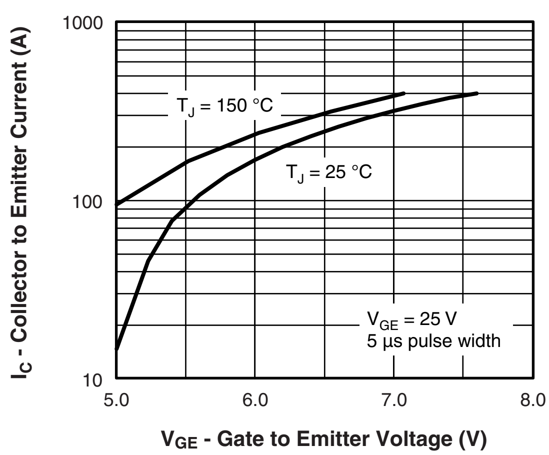


Fig. 3 - Typical Transfer Characteristics

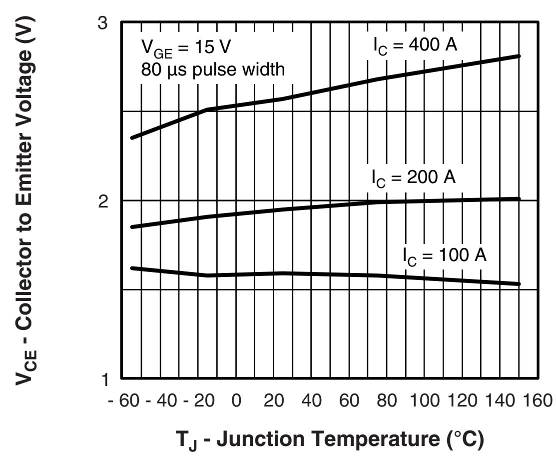


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

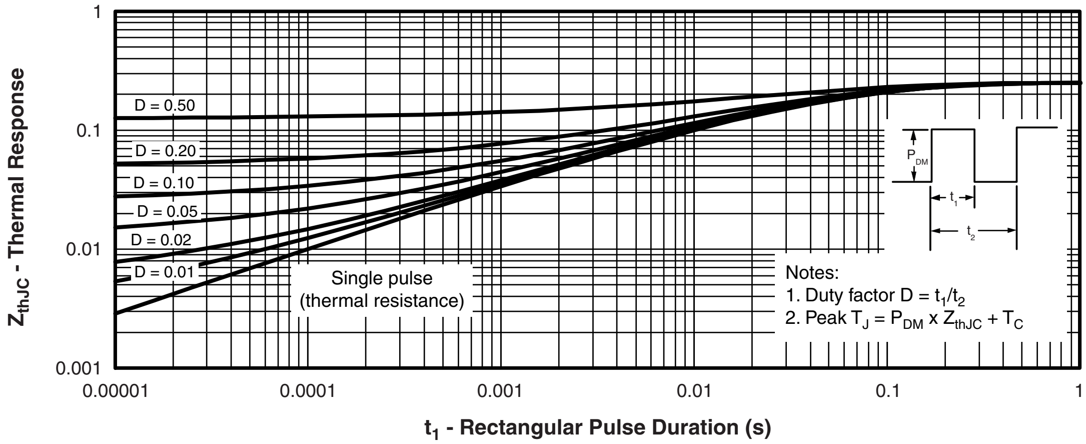


Fig. 6 - Maximum Effektive Transient Thermal Impedance, Junction to Case

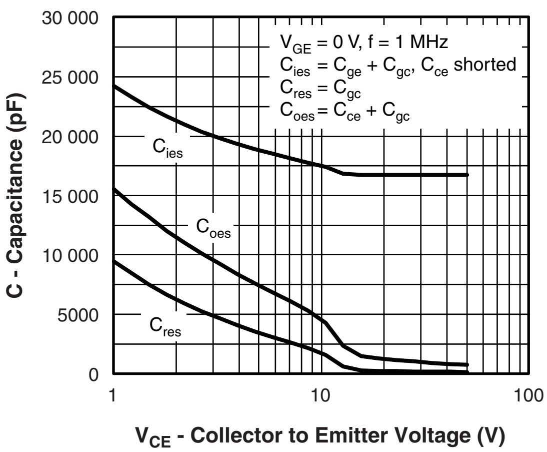


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

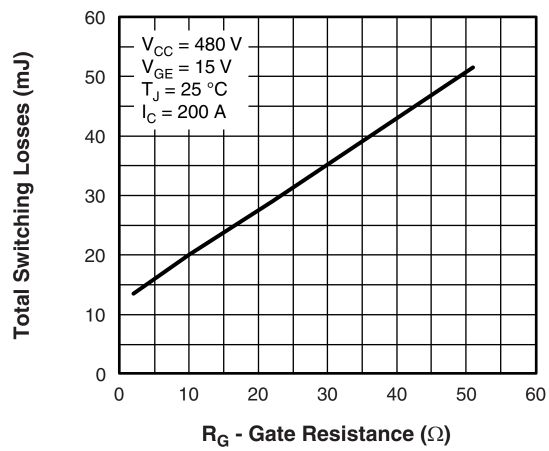


Fig. 9 - Typical Switching Losses vs. Gate Resistance

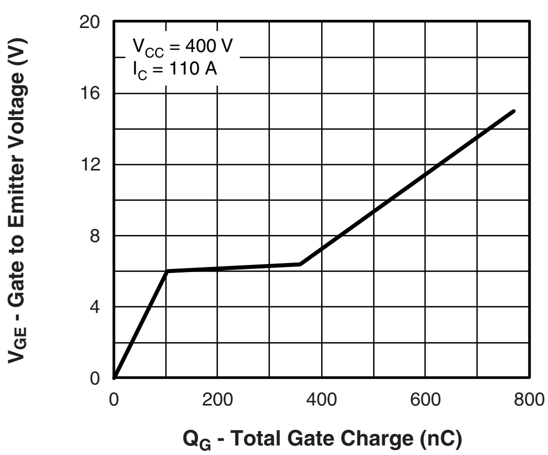


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

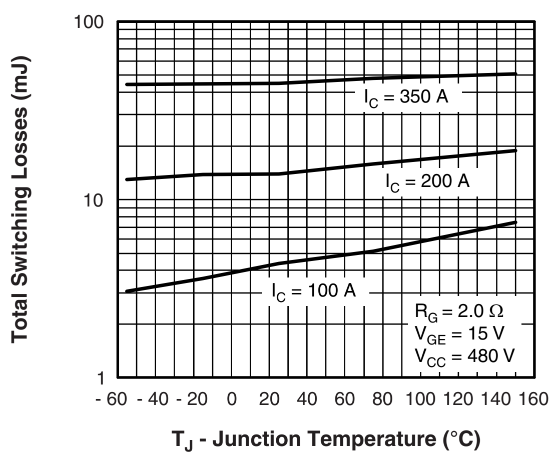


Fig. 10 - Typical Switching Losses vs. Junction Temperature

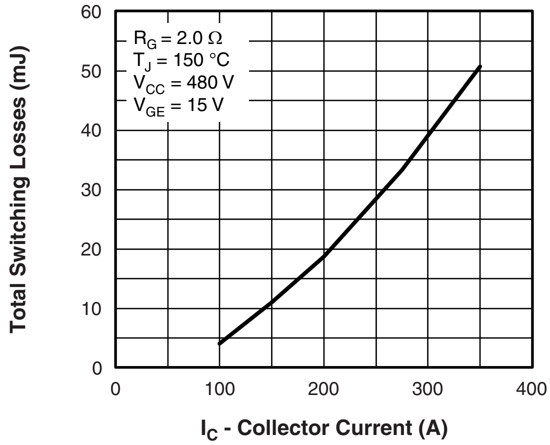


Fig. 11 - Typical Switching Losses vs. Collector Current

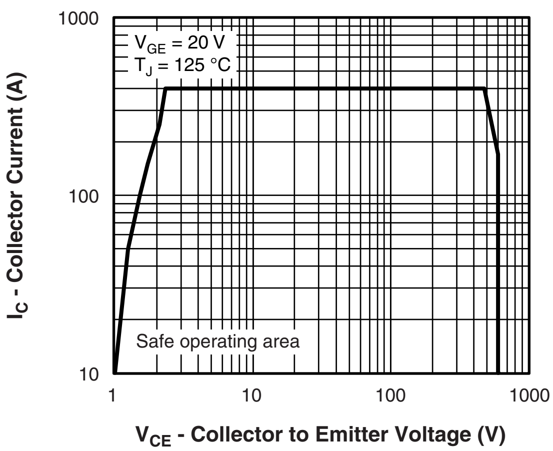
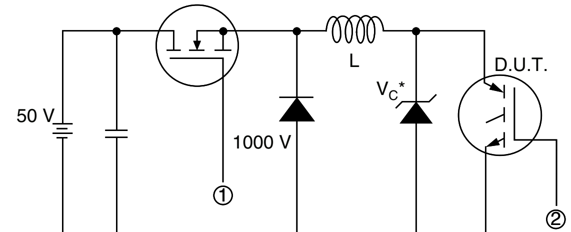


Fig. 12 - Turn-Off SOA



* 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 rated I_d

Fig. 13a - Clamped Inductive Load Test Circuit

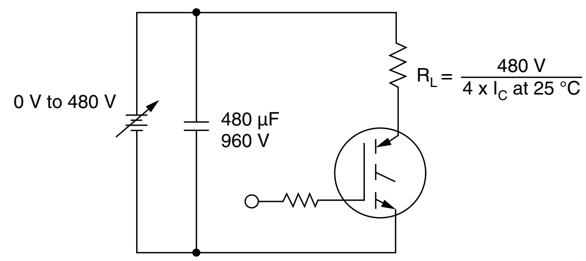
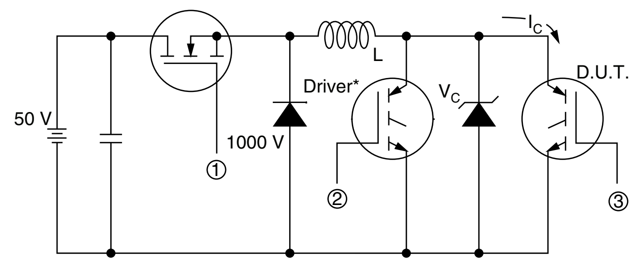
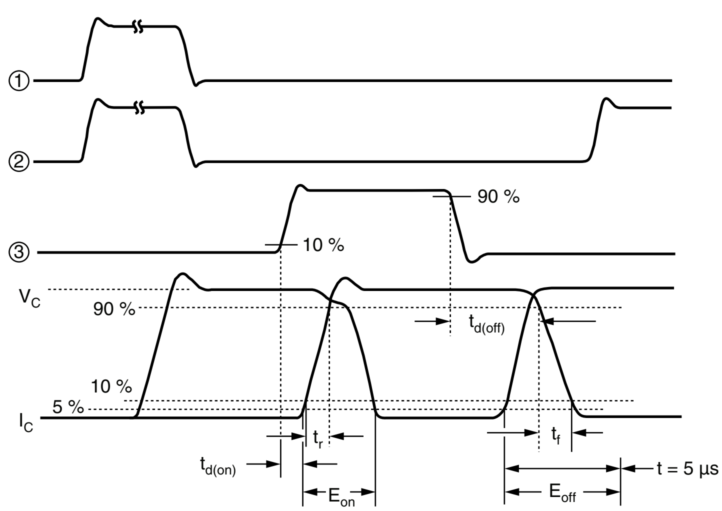


Fig. 13b - Pulsed Collector Current Test Circuit



* Driver same type as D.U.T., V_C = 480 V

Fig. 14a - Switching Loss Test Circuit



$E_{ts} = (E_{on} + E_{off})$

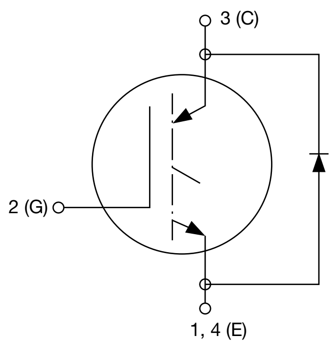
Fig. 14b - Switching Loss Waveforms

ORDERING INFORMATION TABLE

Device code	G	A	200	S	A	60	U	P
	1	2	3	4	5	6	7	8

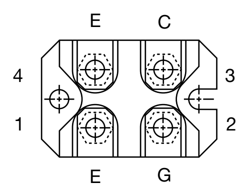
- **1** - Insulated Gate Bipolar Transistor (IGBT)
- **2** - Generation 4, IGBT silicon, DBC construction
- **3** - Current rating (200 = 200 A)
- **4** - Single switch, no diode
- **5** - SOT-227
- **6** - Voltage rating (60 = 600 V)
- **7** - Speed/type (U = Ultrafast)
- **8** - • None = Standard production
  • P = Lead (Pb)-free

CIRCUIT CONFIGURATION



n-channel

Lead assignment



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

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