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

SOT-227

FEATURES

- Ultrafast: Optimized for minimum saturation voltage and speed 0 to 40 kHz in hard switching, > 200 kHz in resonant mode
- Very low conduction and switching losses
- Fully isolated 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 market

Pb-free
RoHS COMPLIANT

BENEFITS

- Designed for increased operating efficiency in power conversion: PFC, 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

PRODUCT SUMMARY	
V_{CES}	600 V
I_C DC	100 A
$V_{CE(on)}$ at 100 A, 25 °C	1.8 V

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	100	A
		T_C = 100 °C	50	
Pulsed collector current	I_{CM}		200	
Clamped inductive load current	I_{LM}	Repetitive rating: V_{GE} = 20 V; pulse width limited by maximum junction temperature (fig. 20)	200	
Gate to emitter voltage	V_{GE}		± 20	V
RMS isolation voltage	V_{ISOL}	Any terminal to case, t = 1 minute	2500	
Maximum power dissipation	P_D	T_C = 25 °C	250	W
		T_C = 100 °C	100	
Operating junction and storage temperature range	T_J, T_{Stg}		- 55 to + 150	°C
Mounting torque		6 to 32 or M3 screw	12 (1.3)	lbf · in (N · m)

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TYP.	MAX.	UNITS
Junction to case, IGBT	R_{thJC}	-	0.50	°C/W
Thermal resistance, junction to case, diode	R_{thJC}	-	1.0	
Case to sink, flat, greased surface	R_{thCS}	0.05	-	
Weight of module		30	-	g

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
Temperature coeffecient of breakdown voltage	$\Delta V_{(BR)CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 1.0 mA		-	0.36	-	V/°C
Collector to emitter saturation voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 50 A	See fig. 1, 4	-	1.49	2.1	V
		V_{GE} = 15 V, I_C = 100 A		-	1.80	-	
		V_{GE} = 15 V, I_C = 50 A, T_J = 150 °C		-	1.47	-	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 250 µA		3.0	-	6.0	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	V_{CE} = V_{GE}, I_C = 250 µA		-	- 7.6	-	mV/°C
Forward transconductance	g_{fe}	V_{CE} = 100 V, I_C = 50 A		34	52	-	S
Zero gate voltage collector current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V		-	-	250	µA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150 °C		-	-	1.3	mA
Diode forward voltage drop	V_{FM}	I_C = 50 A	See fig. 12	-	1.3	1.6	V
		I_C = 50 A, T_J = 150 °C		-	1.16	1.3	
Gate to emitter leakage current	I_{GES}	V_{GE} = ± 20 V		-	-	± 100	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		See fig. 7	-	430	640	nC
Gate emitter charge (turn-on)	Q_{ge}				-	48	72	
Gate collector charge (turn-on)	Q_{gc}				-	130	190	
Turn-on delay time	$t_{d(on)}$	T_J = 25 °C I_C = 60 A, V_{CC} = 480 V V_{GE} = 15 V, R_g = 5.0 Ω energy losses include “tail” and diode reverse recovery			-	57	-	ns
Rise time	t_r				-	80	-	
Turn-off delay time	$t_{d(off)}$				-	240	-	
Fall time	t_f				-	120	-	
Turn-on switching loss	E_{on}				-	0.41	-	mJ
Turn-off switching loss	E_{off}				-	2.51	-	
Total switching loss	E_{ts}				-	2.92	4.4	
Turn-on delay time	$t_{d(on)}$	T_J = 150 °C I_C = 60 A, V_{CC} = 480 V V_{GE} = 15 V, R_g = 5.0 Ω energy losses include “tail” and diode reverse recovery			-	57	-	ns
Rise time	t_r				-	80	-	
Turn-off delay time	$t_{d(off)}$				-	380	-	
Fall time	t_f				-	170	-	
Total switching loss	E_{ts}				-	4.78	-	mJ
Internal emitter inductance	L_E				-	2.0	-	nH
Input capacitance	C_{ies}	V_{GE} = 0 V V_{CC} = 30 V f = 1.0 MHz		See fig. 6	-	7400	-	pF
Output capacitance	C_{oes}				-	730	-	
Reverse transfer capacitance	C_{res}				-	90	-	
Diode reverse recovery time	t_{rr}	T_J = 25 °C	See fig. 13	I_F = 50 A V_R = 200 V dI/dt = 200 A/µs	-	90	140	ns
		T_J = 125 °C			-	120	180	
Diode peak reverse recovery current	I_{rr}	T_J = 25 °C	See fig. 14		-	7.3	11	A
		T_J = 125 °C			-	11	16	
Diode reverse recovery charge	Q_{rr}	T_J = 25 °C	See fig. 15		-	360	550	nC
		T_J = 125 °C			-	780	1200	
Diode peak rate of fall recovery during t_b	$dI_{(rec)M}/dt$	T_J = 25 °C	See fig. 16		-	370	-	A/µs
		T_J = 125 °C			-	220	-	

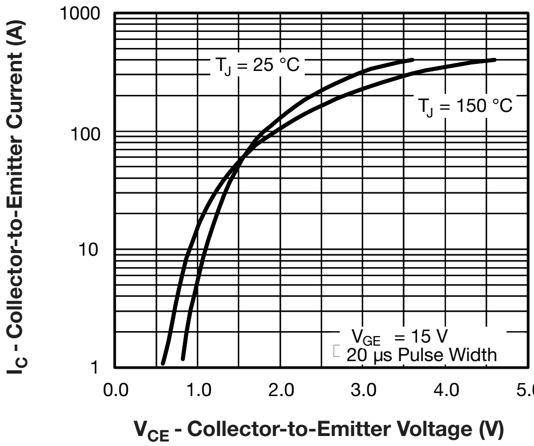


Fig. 1 - Typical Output Characteristics

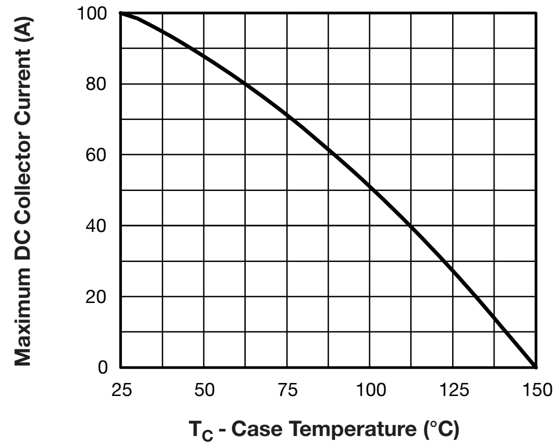


Fig. 3 - Maximum Collector Current vs. Case Temperature

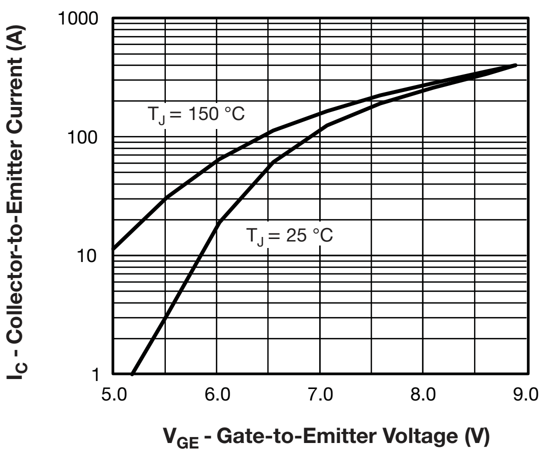


Fig. 2 - Typical Transfer Characteristics

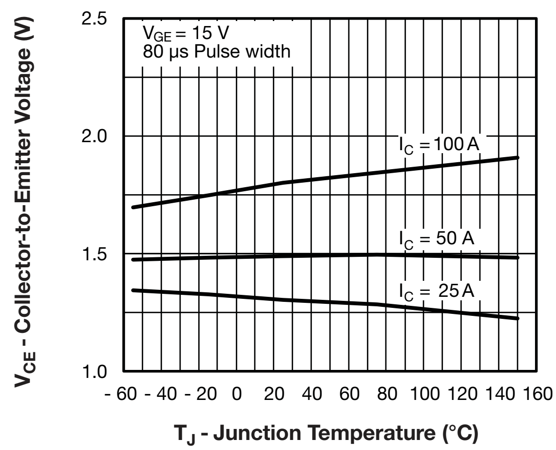


Fig. 4 - Typical Collector to Emitter Voltage vs. Junction Temperature

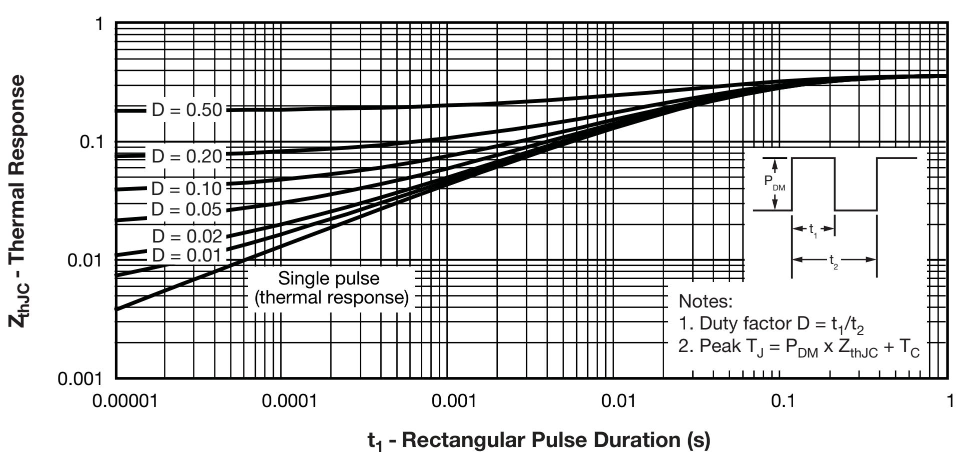


Fig. 5 - Maximum Effective Transient Thermal Impedance, Junction to Case

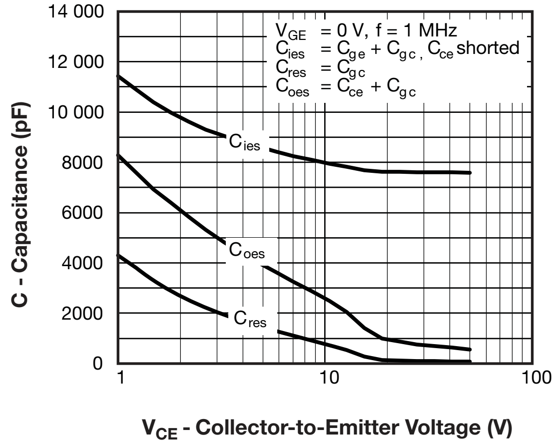


Fig. 6 - Typical Capacitance vs. Collector to Emitter Voltage

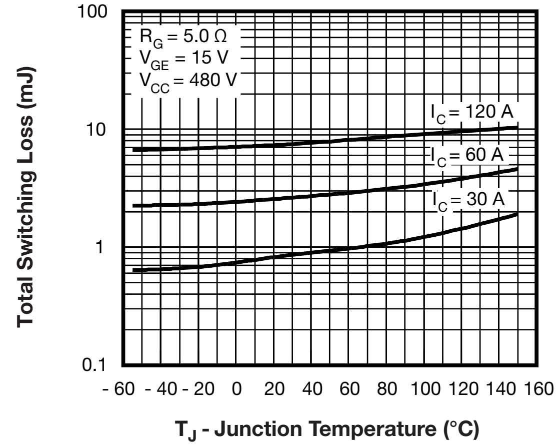


Fig. 9 - Typical Switching Losses vs. Junction Temperature

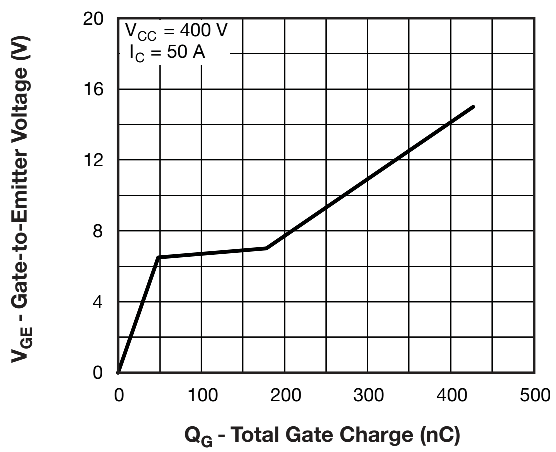


Fig. 7 - Typical Gate Charge vs. Gate to Emitter Voltage

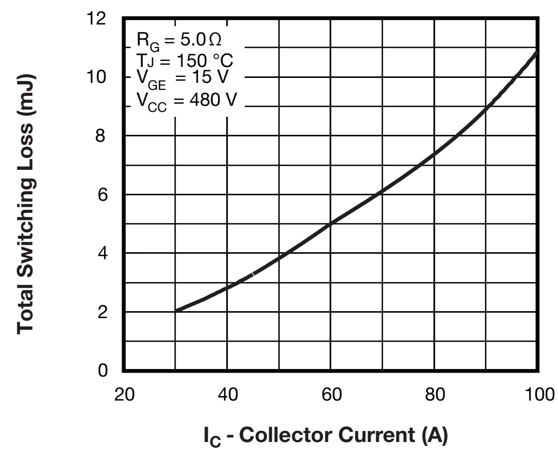


Fig. 10 - Typical Switching Losses vs. Collector to Emitter Current

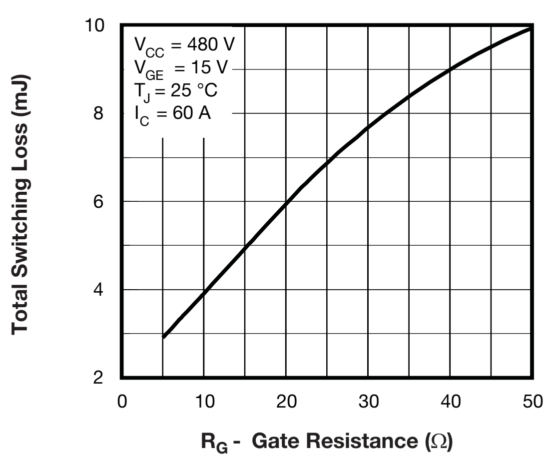


Fig. 8 - Typical Switching Losses vs. Gate Resistance

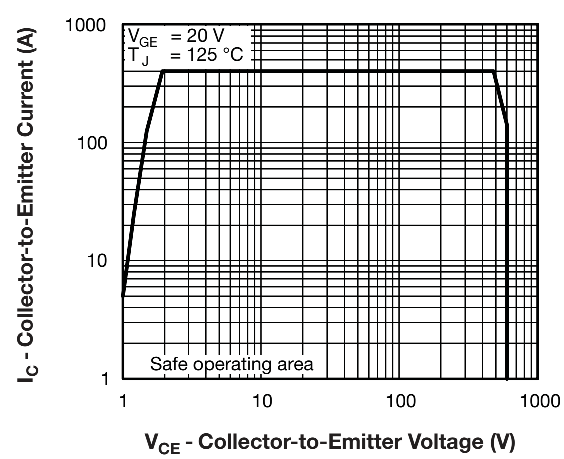


Fig. 11 - Turn-Off SOA

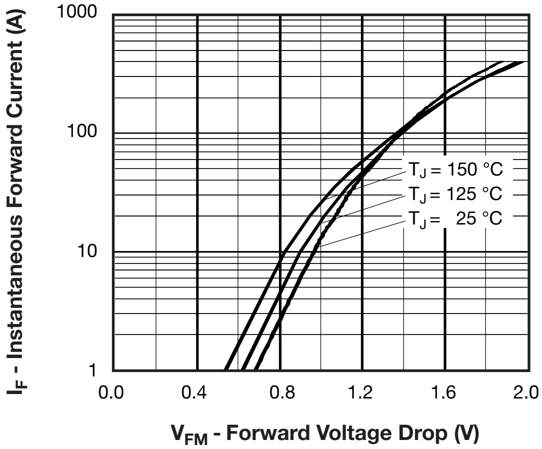


Fig. 12 - Typical Forward Voltage Drop vs. Instantaneous Forward Current

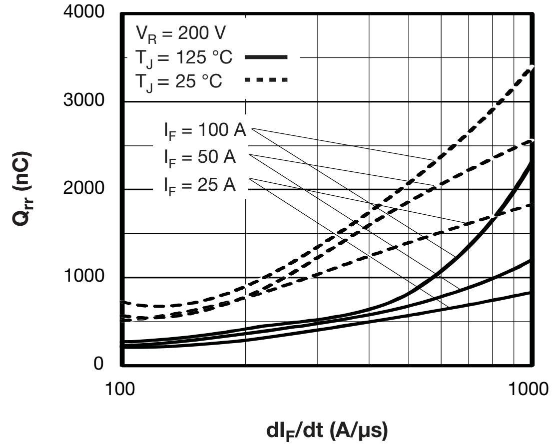


Fig. 15 - Typical Stored Charge vs. dI_F/dt

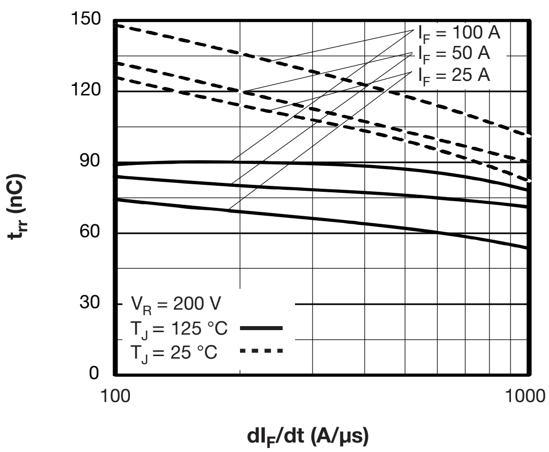


Fig. 13 - Typical Reverse Recovery vs. dI_F/dt

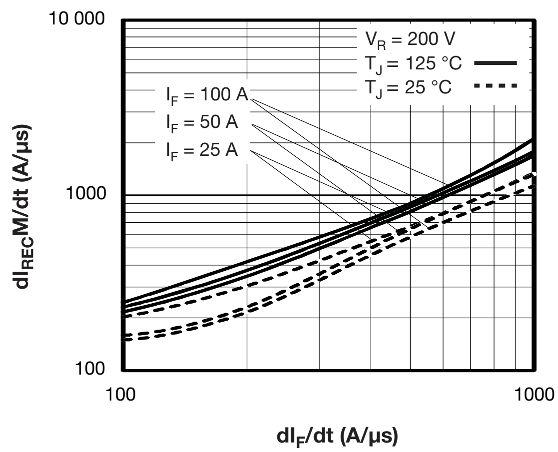


Fig. 16 - Typical $dI_{(rec)M}/dt$ vs. dI_F/dt

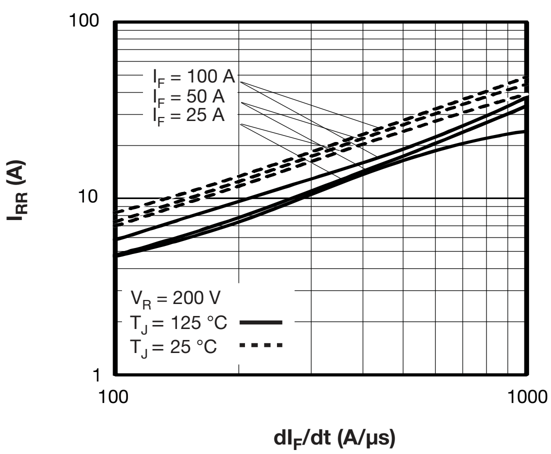


Fig. 14 - Typical Recovery Current vs. dI_F/dt

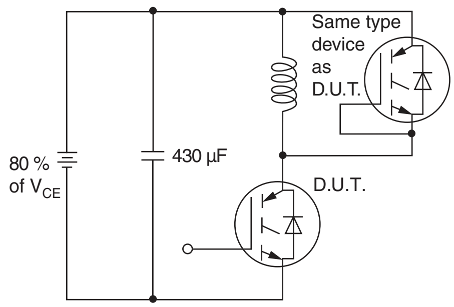


Fig. 17a - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

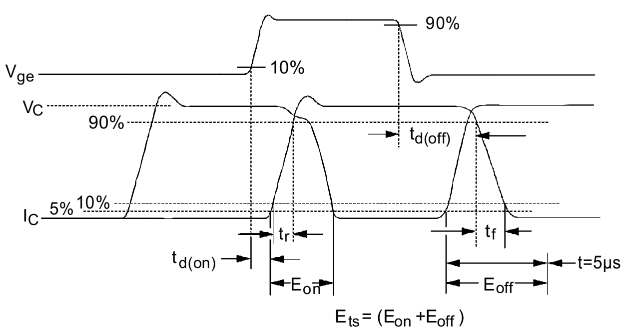


Fig. 17b - Test Waveforms for Circuit of Fig. 17a, Defining E_{off}, $t_{d(off)}$, t_f

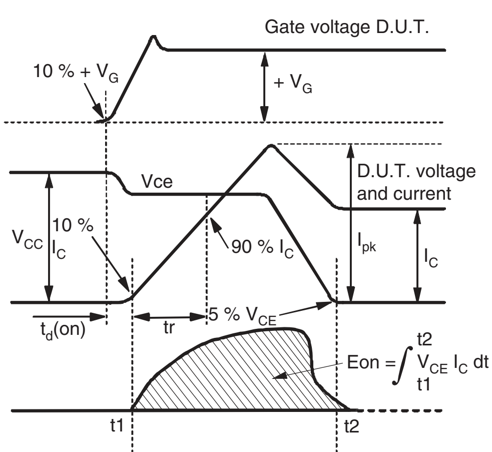


Fig. 17c - Test Waveforms for Circuit of Fig. 17a, Defining E_{on}, $t_{d(on)}$, t_r

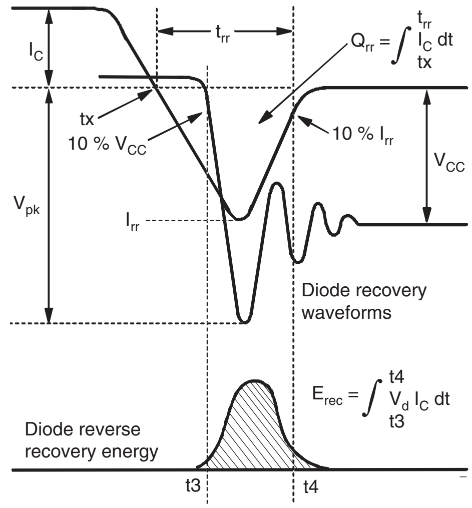


Fig. 1 - Test Waveforms for Circuit of Fig. 17a, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

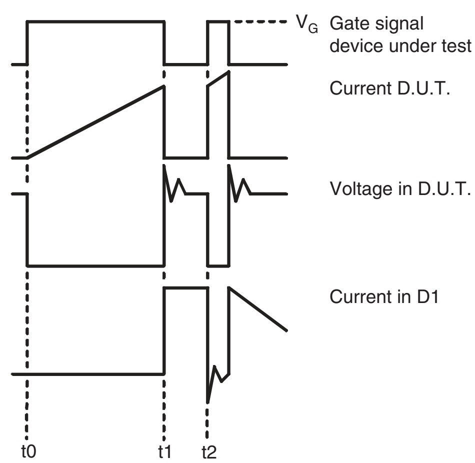


Fig. 17e - Macro Waveforms for Figure 17a's Test Circuit

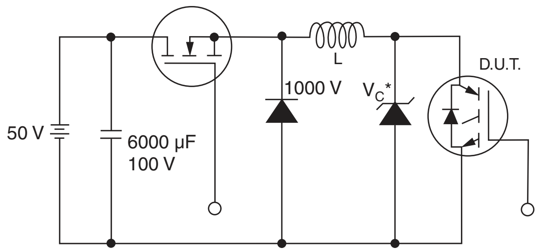


Fig. 18a - Clamped Inductive Load Test Circuit

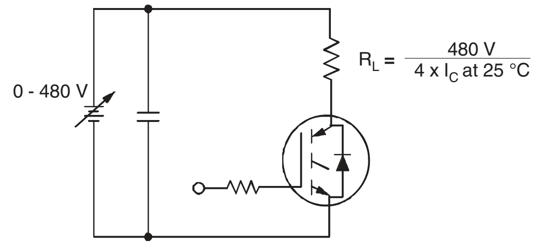


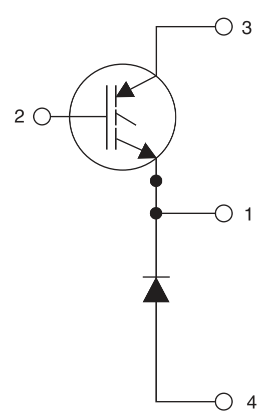
Fig. 18b - Pulsed Collector Current Test Circuit

ORDERING INFORMATION TABLE

Device code	VS-	G	A	100	N	A	60	U	P
	1	2	3	4	5	6	7	8	9

1	-	Vishay Semiconductors product
2	-	Device: G = IGBT
3	-	Silicon technology: A = Generation 4 IGBT, Generation 2 HEXFRED®
4	-	Current rating (100 = 100 A)
5	-	N = High side chopper
6	-	SOT-227
7	-	Voltage rating (60 = 600 V)
8	-	U = Ultrafast with matching diode
9	-	• None = Standard production • P = Lead (Pb)-free

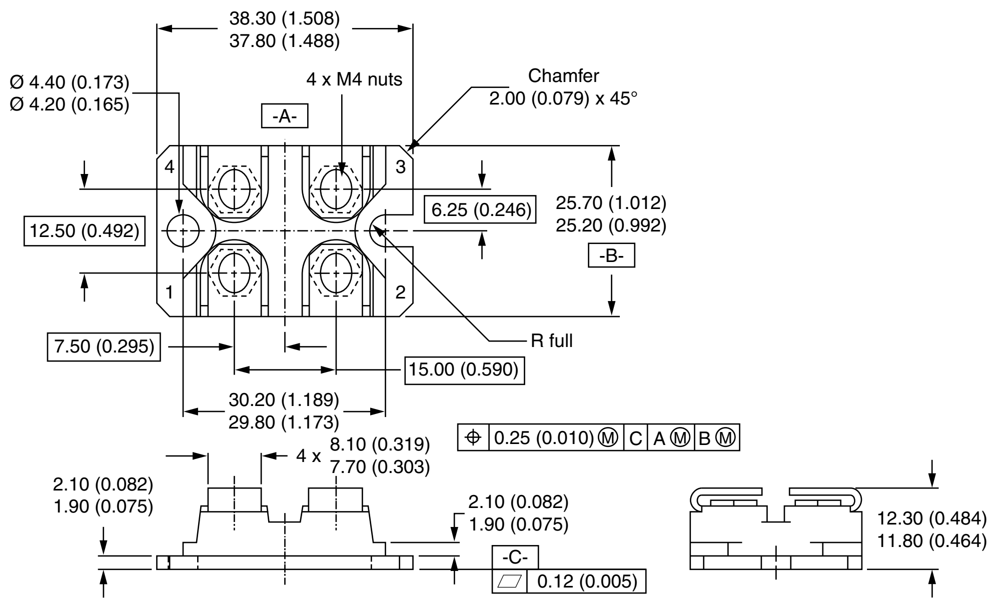
CIRCUIT CONFIGURATION



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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