

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


**RoHS
COMPLIANT**
PRODUCT SUMMARY

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

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

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter breakdown voltage	V_{CES}		600	V
Continuous collector current	I_C	$T_C = 25\text{ °C}$	100	A
		$T_C = 100\text{ °C}$	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	$T_C = 25\text{ °C}$	250	W
		$T_C = 100\text{ °C}$	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 coefficient of breakdown voltage	ΔV _{(BR)CES} /ΔT _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	-	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	ΔV _{GE(th)} /ΔT _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	-	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	-	430	640	nC	
Gate emitter charge (turn-on)	Q _{ge}	V _{CC} = 400 V	-	48	72		
Gate collector charge (turn-on)	Q _{gc}	V _{GE} = 15 V	-	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}	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	-	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	-	7400	-	pF	
Output capacitance	C _{oes}	V _{CC} = 30 V	-	730	-		
Reverse transfer capacitance	C _{res}	f = 1.0 MHz	-	90	-		
Diode reverse recovery time	t _{rr}	T _J = 25 °C	See fig. 13	-	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	dl _(rec) M/dt	T _J = 25 °C	See fig. 16	-	370	-	A/μs
		T _J = 125 °C		-	220	-	

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

Vishay Semiconductors

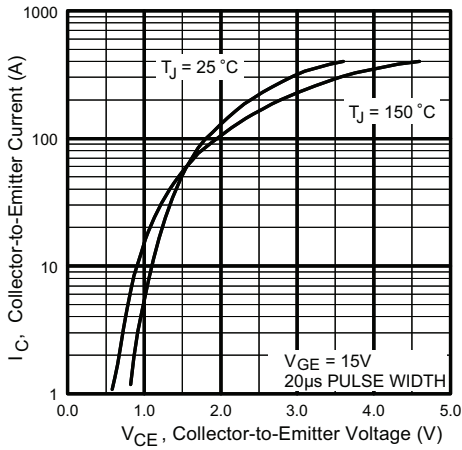


Fig. 1 - Typical Output Characteristics

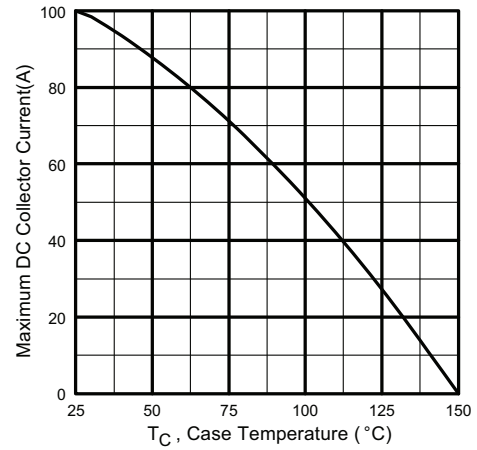


Fig. 3 - Maximum Collector Current vs. Case Temperature

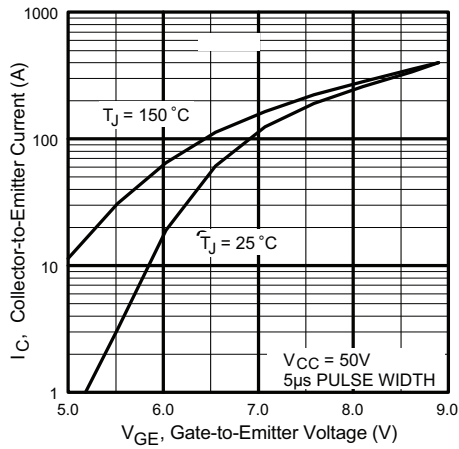


Fig. 2 - Typical Transfer Characteristics

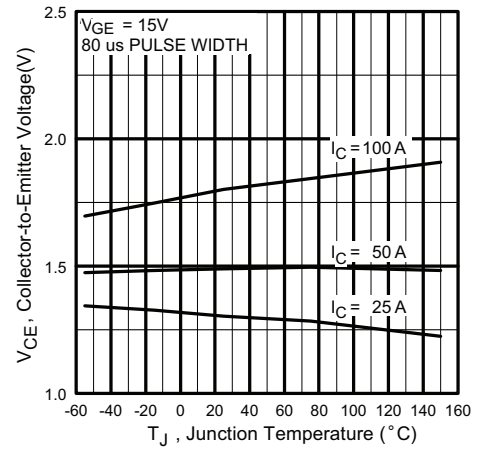


Fig. 4 - Typical Collector to Emitter Voltage vs. Junction Temperature

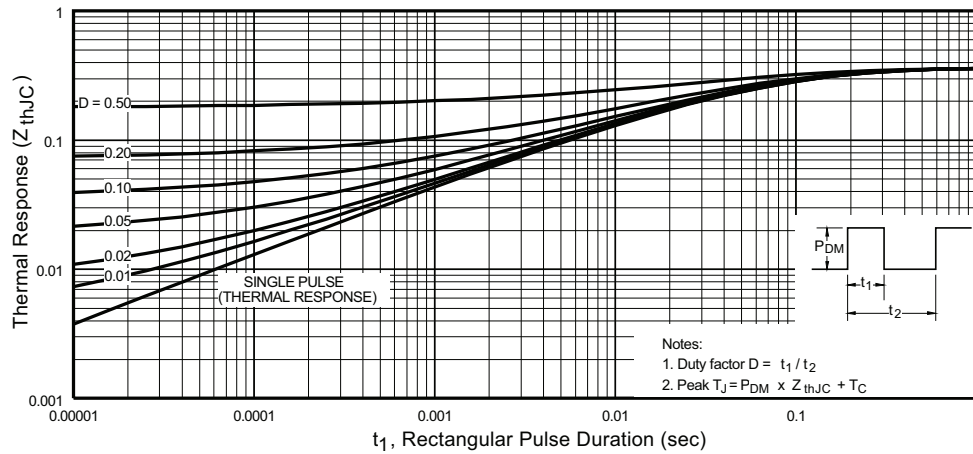


Fig. 5 - Maximum Effective Transient Thermal Impedance, Junction to Case

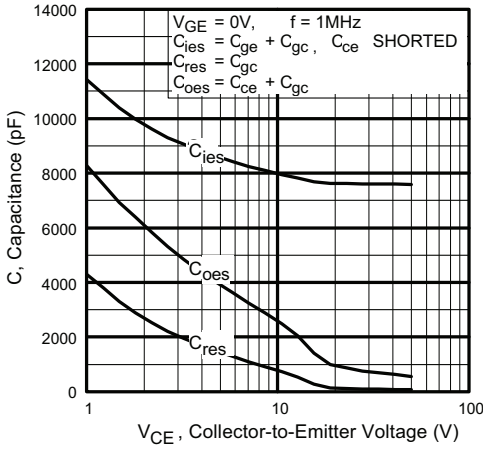


Fig. 6 - Typical Capacitance vs. Collector to Emitter Voltage

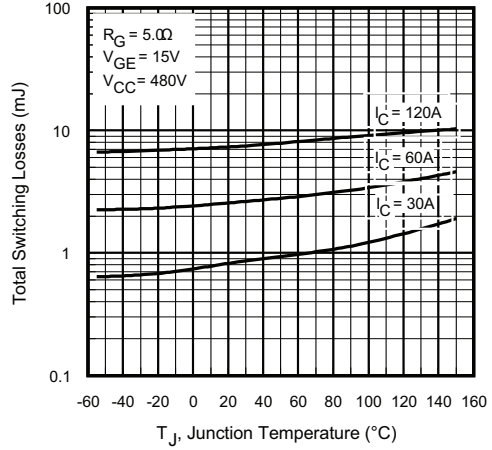


Fig. 9 - Typical Switching Losses vs. Junction Temperature

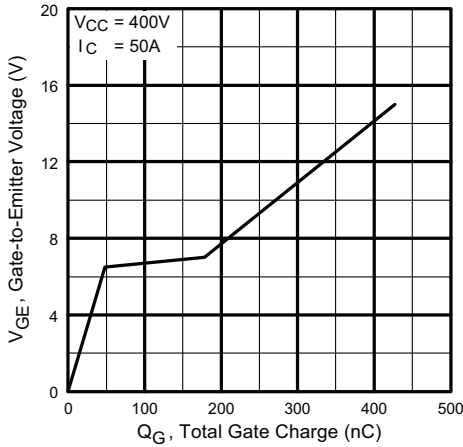


Fig. 7 - Typical Gate Charge vs. Gate to Emitter Voltage

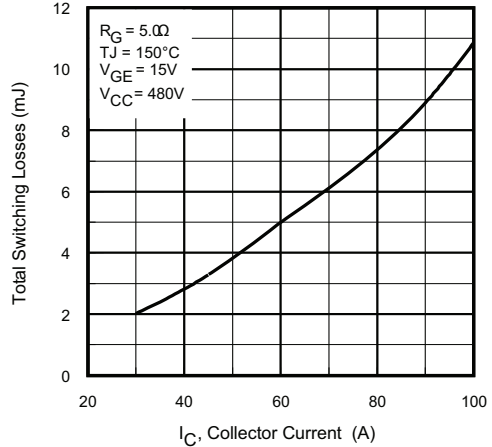


Fig. 10 - Typical Switching Losses vs. Collector to Emitter Current

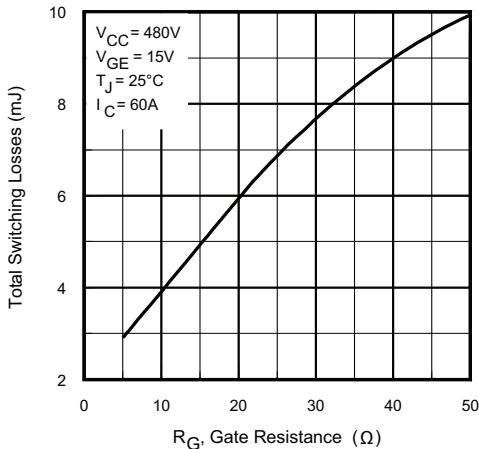


Fig. 8 - Typical Switching Losses vs. Gate Resistance

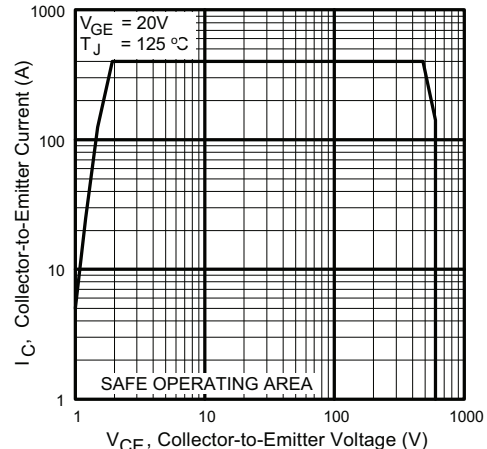


Fig. 11 - Turn-Off SOA

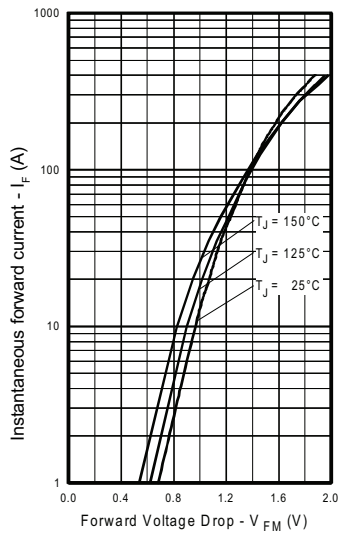


Fig. 12 - Typical Forward Voltage Drop vs. Instantaneous Forward Current

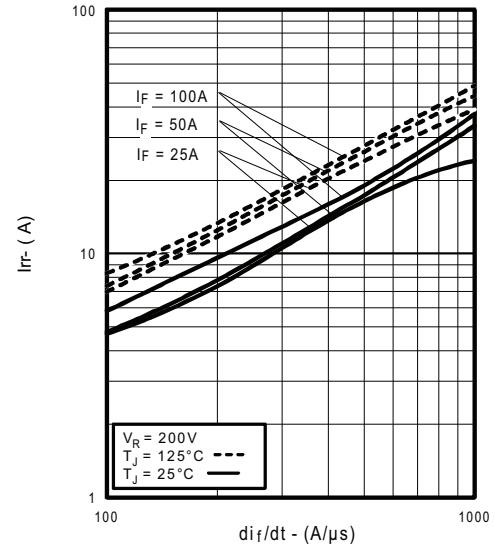


Fig. 14 - Typical Recovery Current vs. di_f/dt

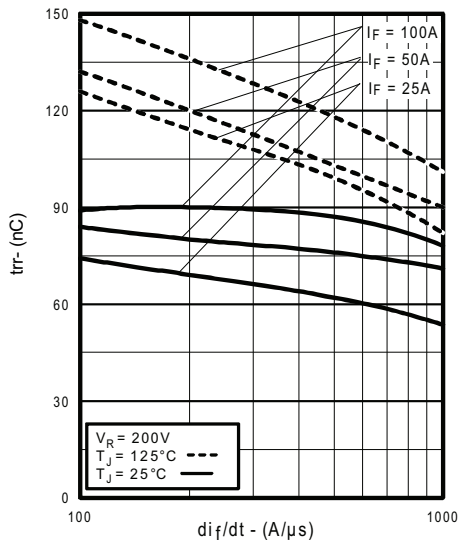


Fig. 13 - Typical Reverse Recovery vs. di_f/dt

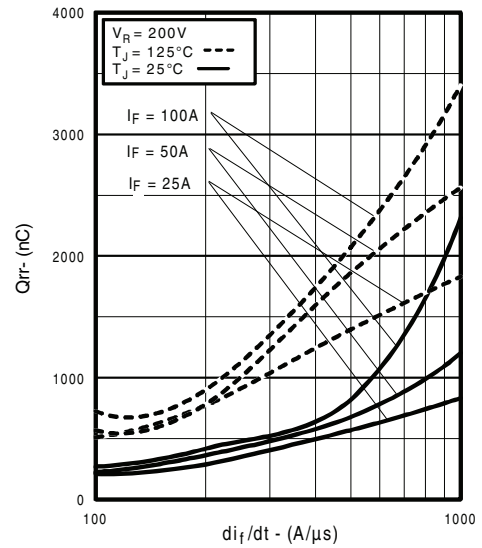


Fig. 15 - Typical Stored Charge vs. di_f/dt

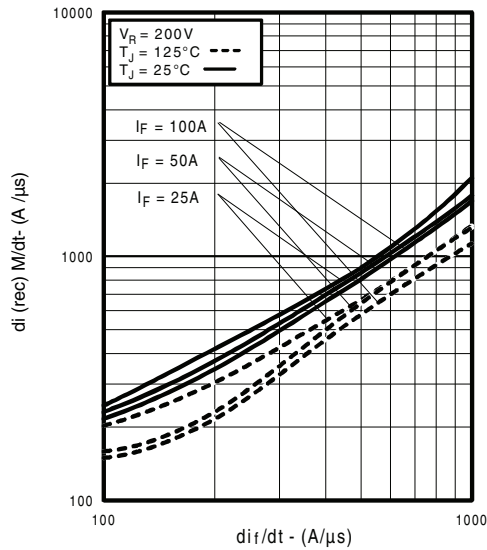


Fig. 16 - Typical $dI_{(rec)M}/dt$ vs. dI_F/dt

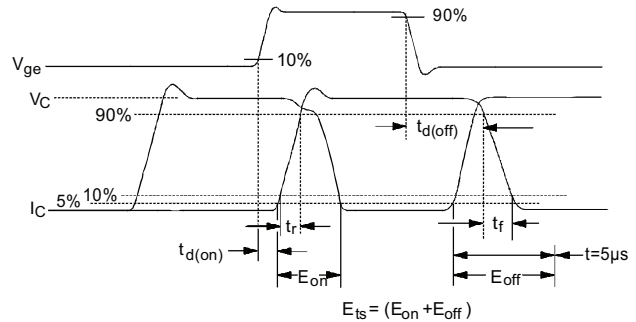


Fig. 17b - Test Waveforms for Circuit of Fig. 17a, Defining E_{off} , $t_{d(off)}$, t_f

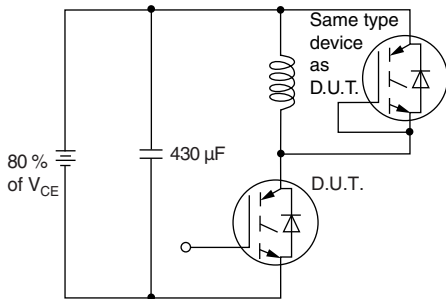


Fig. 17a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

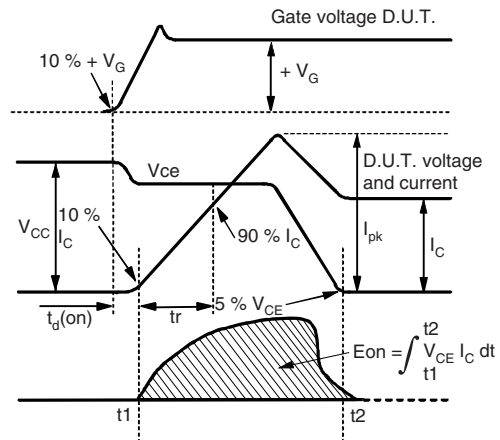


Fig. 17c - Test Waveforms for Circuit of Fig. 17a, Defining E_{on} , $t_{d(on)}$, t_r

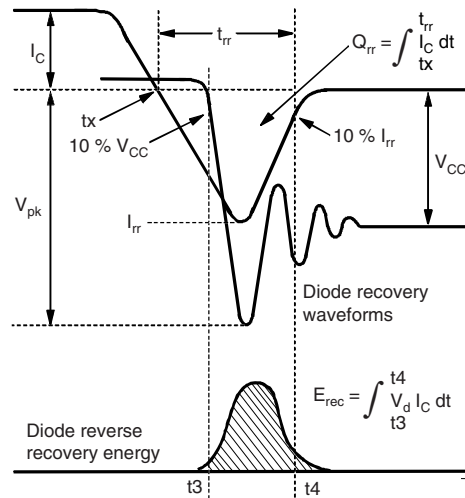
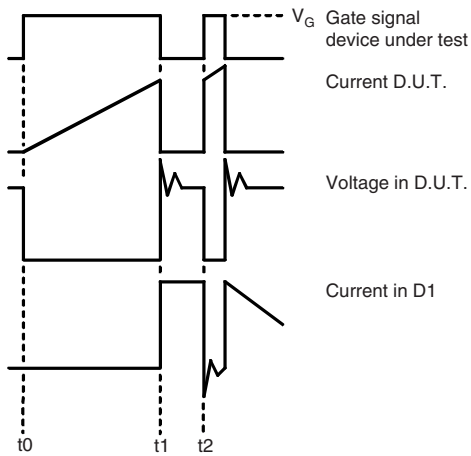

 Fig. 17d - Test Waveforms for Circuit of Fig. 17a,
 Defining E_{rec} , t_{tr} , Q_{rr} , I_{rr}


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

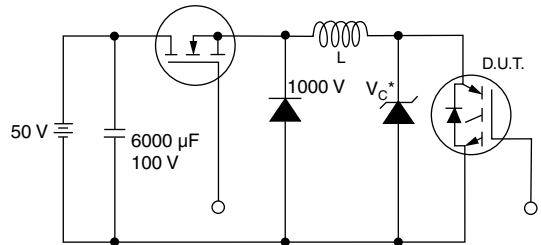


Fig. 18a - Clamped Inductive Load Test Circuit

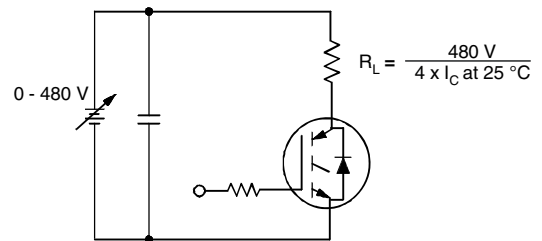


Fig. 18b - Pulsed Collector Current Test Circuit

GA100NA60UP

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(Warp 2 Speed IGBT), 100 A

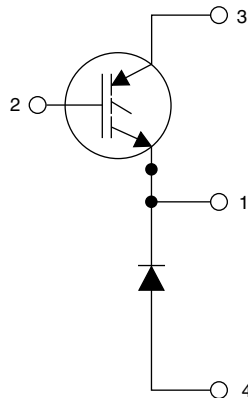


ORDERING INFORMATION TABLE

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

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

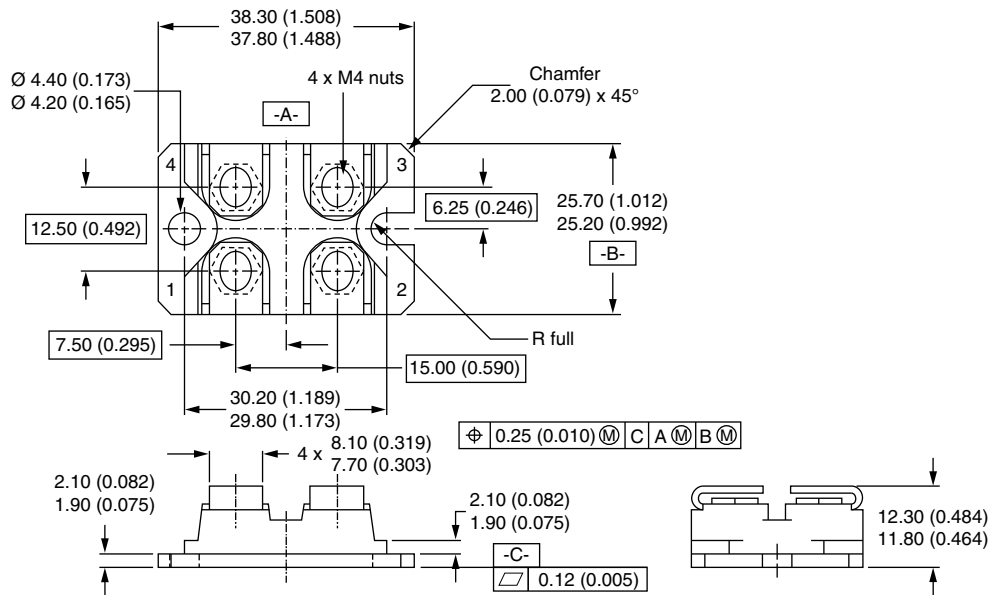
CIRCUIT CONFIGURATION



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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