Insulated Gate Bipolar Transistor (Trench IGBT), 100 A

SOT-227

PRODUCT SUMMARY	
V_{CES}	1200 V
I_C DC	100 A at 119 °C
$V_{CE(on)}$ typical at 100 A, 25 °C	1.73 V
Package	SOT-227
Circuit	Single Switch Diode

FEATURES

- Trench IGBT technology with positive temperature coefficient
- Square RBSOA
- 10 µs short circuit capability
- HEXFRED® antiparallel diodes with ultrasoft reverse recovery
- T_J maximum = 150 °C
- Fully isolated package
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

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
- Speed 4 kHz to 30 kHz
- Very low $V_{CE(on)}$
- 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 (1)	T_C = 25 °C	258	A
		T_C = 80 °C	174	
Pulsed collector current	I_{CM}		450	
Clamped inductive load current	I_{LM}		450	
Diode continuous forward current	I_F	T_C = 25 °C	50	
		T_C = 80 °C	34	
Peak diode forward current	I_{FSM}		180	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	T_C = 25 °C	893	W
		T_C = 119 °C	221	
Power dissipation, diode	P_D	T_C = 25 °C	176	
		T_C = 119 °C	44	
Isolation voltage	V_{ISOL}	Any terminal to case, t = 1 min	2500	V

Note

(1) Maximum continuous collector current must be limited to 100 A to do not exceed the maximum temperature of terminals

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	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 100 A	-	1.73	2.1	
		V_{GE} = 15 V, I_C = 100 A, T_J = 125 °C	-	1.98	2.2	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 7.5 mA	4.9	5.9	7.9	
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)	-	-17.6	-	mV/°C
Collector to emitter leakage current	I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V	-	0.6	100	μA
		V_{GE} = 0 V, V_{CE} = 1200 V, T_J = 125 °C	-	0.6	10	mA
Forward voltage drop	V_{FM}	I_F = 40 A, V_{GE} = 0 V	-	2.81	3.3	V
		I_F = 40 A, V_{GE} = 0 V, T_J = 125 °C	-	3.07	3.4	
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**
Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 720 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. 20)	-	5.2	-	mJ
Turn-off switching loss	E_{off}			-	7.1	-	
Total switching loss	E_{tot}			-	12.3	-	
Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 720 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 μH, T_J = 125 °C		-	6.1	-	
Turn-off switching loss	E_{off}			-	9.8	-	
Total switching loss	E_{tot}			-	15.9	-	
Turn-on delay time	$t_{d(on)}$			-	350	-	ns
Rise time	t_r			-	75	-	
Turn-off delay time	$t_{d(off)}$			-	374	-	
Fall time	t_f			-	493	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 450 A, R_g = 22 Ω, V_{GE} = 15 V to 0 V, V_{CC} = 900 V, V_P = 1200 V, L = 500 μH		Fullsquare			
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/μs, V_{rr} = 400 V		-	164	194	ns
Diode peak reverse current	I_{rr}			-	12	15	A
Diode recovery charge	Q_{rr}			-	994	1455	nC
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/μs, V_{rr} = 400 V, T_J = 125 °C		-	230	273	ns
Diode peak reverse current	I_{rr}			-	16.5	20	A
Diode recovery charge	Q_{rr}			-	1864	2730	nC
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

THERMAL AND MECHANICAL SPECIFICATIONS							
PARAMETER		SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Junction and storage temperature range		T_J, T_{Stg}		-40	-	150	°C
Junction to case	IGBT	R_{thJC}		-	-	0.14	°C/W
	Diode			-	-	0.71	
Case to heatsink		R_{thCS}	Flat, greased surface	-	0.1	-	
Weight				-	30	-	g
Mounting torque				-	-	1.3	Nm
Case style		SOT-227					

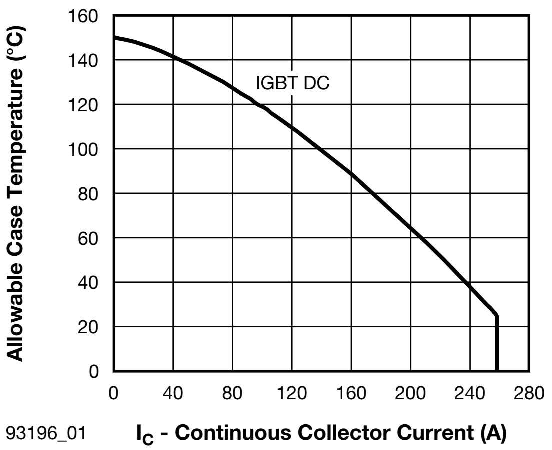


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

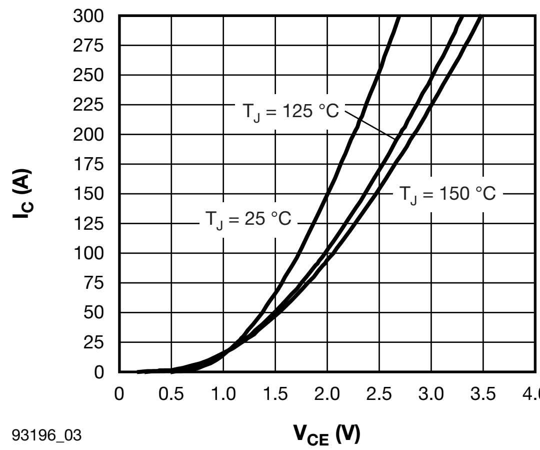


Fig. 3 - Typical IGBT Collector Current Characteristics V_{GE} = 15 V

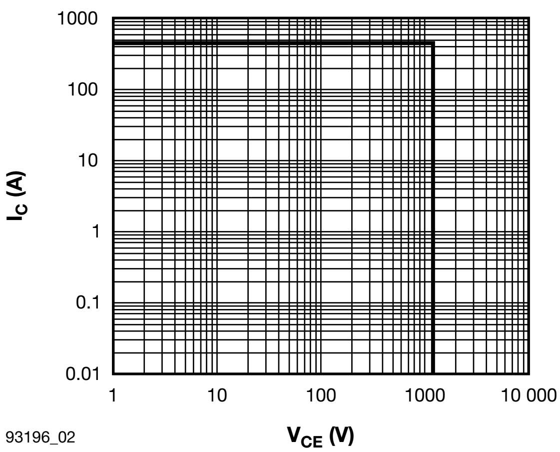


Fig. 2 - IGBT Reverse Bias SOA T_J = 150 °C, V_{GE} = 15 V

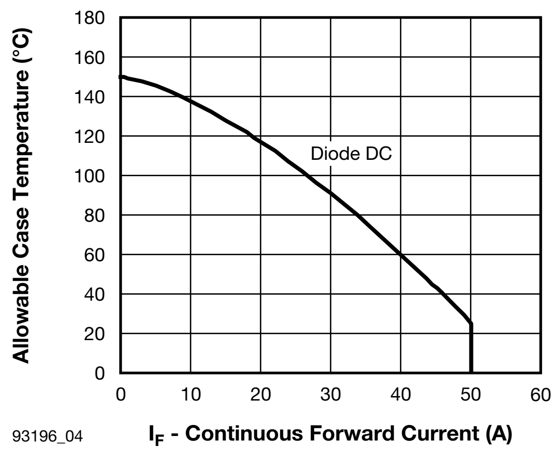


Fig. 4 - Maximum DC Forward Current vs. Case Temperature

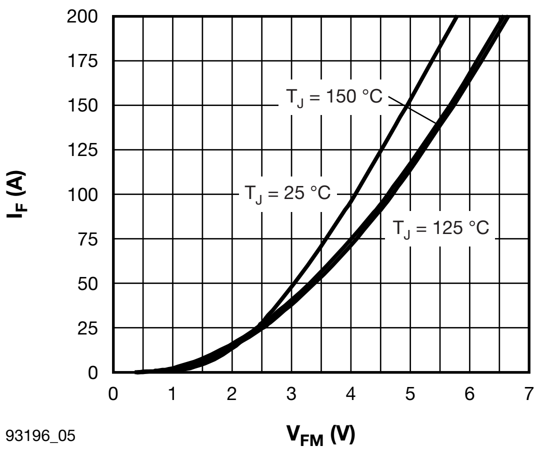


Fig. 5 - Typical Diode Forward Characteristics

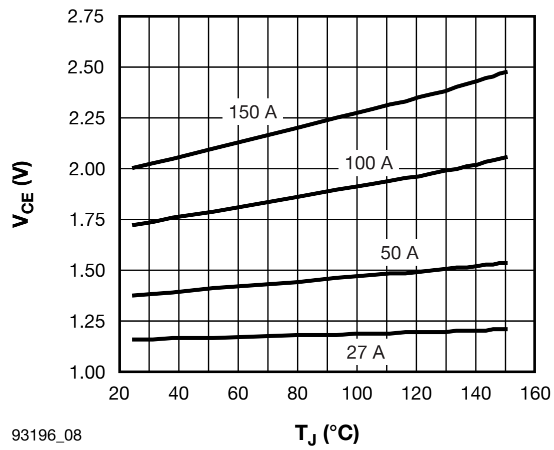


Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

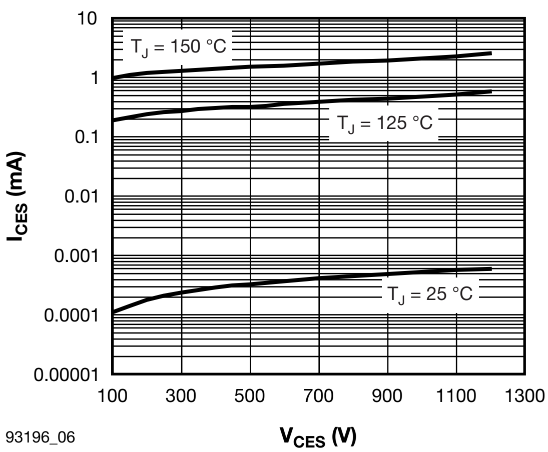


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

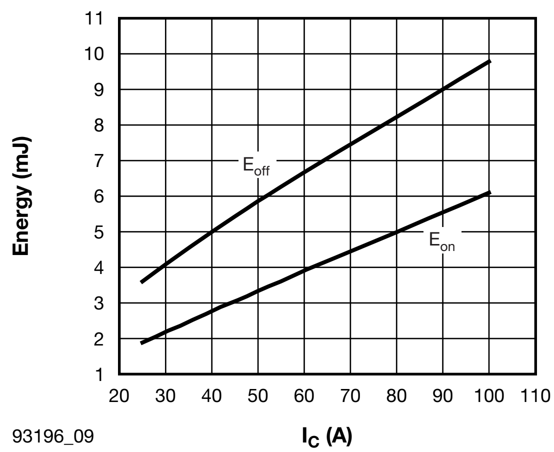


Fig. 9 - Typical IGBT Energy Loss vs. I_C
T_J = 125 °C, L = 500 μH, V_{CC} = 720 V,
R_g = 5 Ω, V_{GE} = 15 V

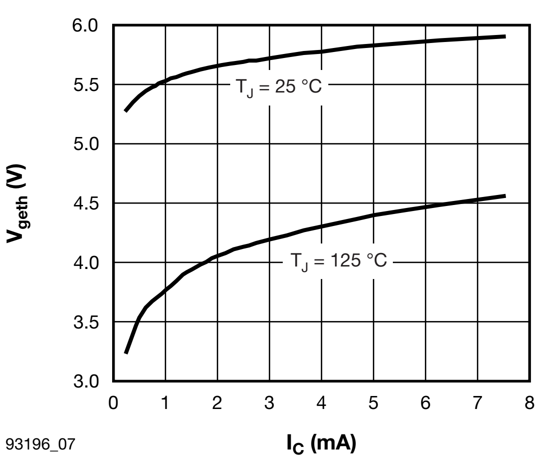


Fig. 7 - Typical IGBT Threshold Voltage

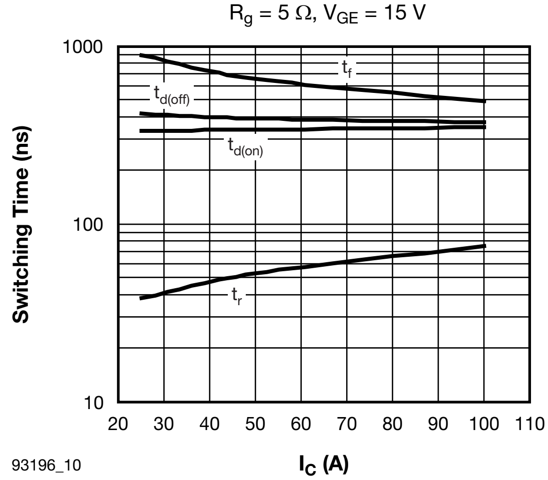


Fig. 10 - Typical IGBT Switching Time vs. I_C
T_J = 125 °C, L = 500 μH, V_{CC} = 720 V,
R_g = 5 Ω, V_{GE} = 15 V

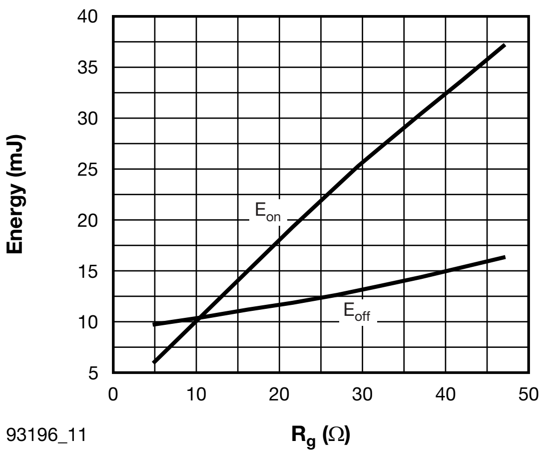


Fig. 11 - Typical IGBT Energy Loss vs. R_g
T_J = 125 °C, I_C = 100 A, L = 500 µH,
V_{CC} = 720 V, V_{GE} = 15 V

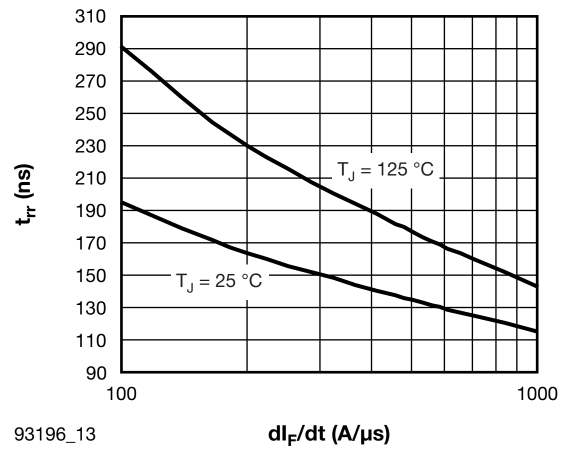


Fig. 13 - Typical t_{rr} Diode vs. dI_F/dt
V_{rr} = 400 V, I_F = 50 A

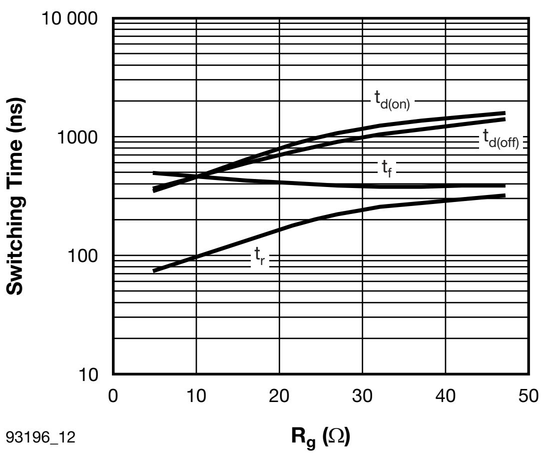


Fig. 12 - Typical IGBT Switching Time vs. R_g
T_J = 125 °C, L = 500 µH, V_{CC} = 720 V,
I_C = 100 A, V_{GE} = 15 V

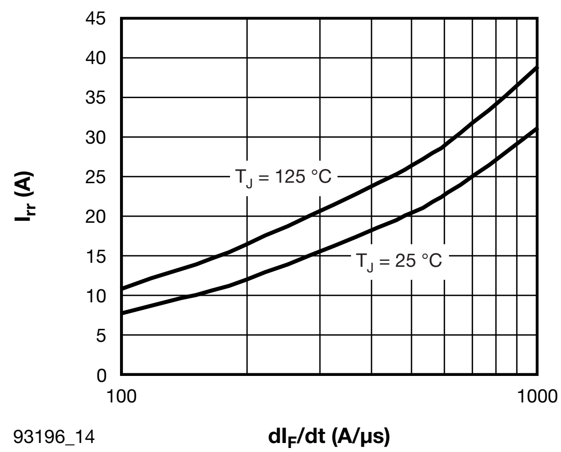


Fig. 14 - Typical I_{rr} Diode vs. dI_F/dt
V_{rr} = 400 V, I_F = 50 A

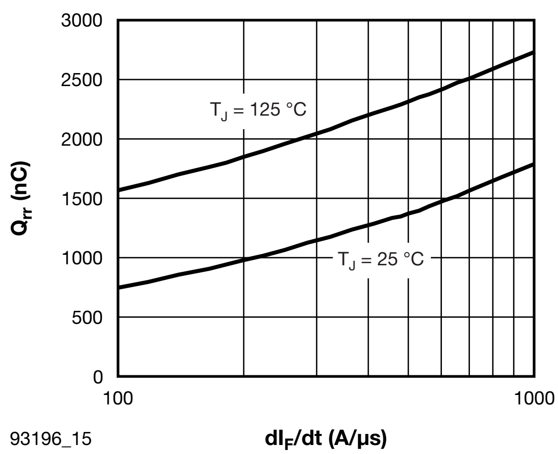


Fig. 15 - Typical Q_{rr} Diode vs. dI_F/dt
V_{rr} = 400 V, I_F = 50 A

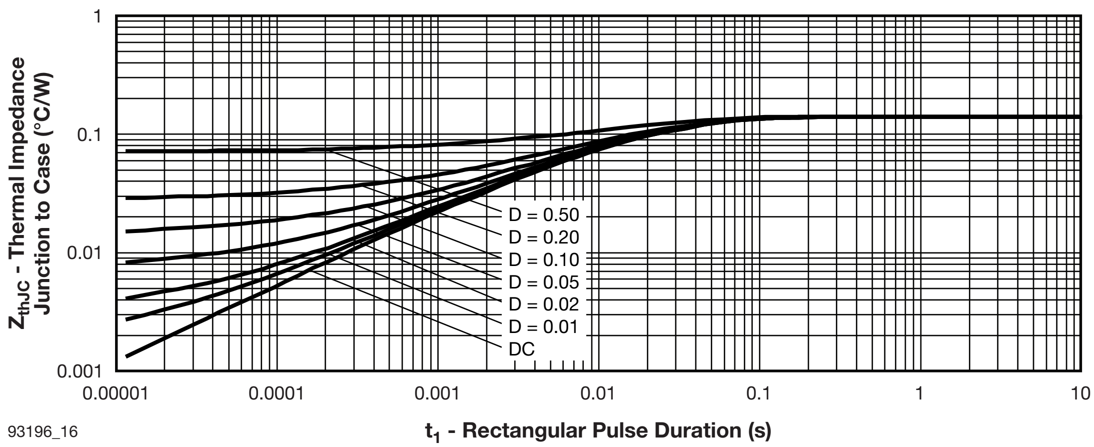


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

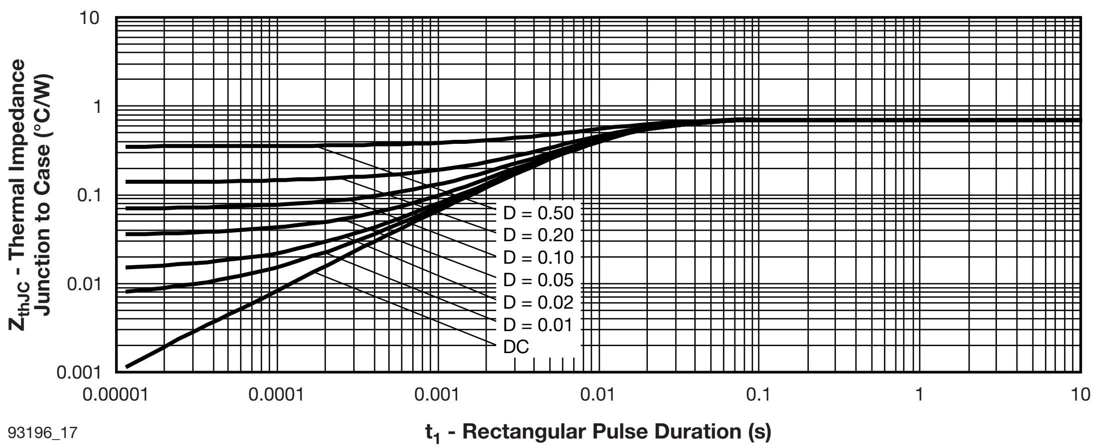
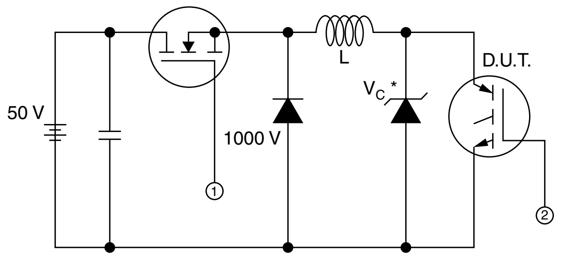


Fig. 17 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)



* 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. 18a - Clamped Inductive Load Test Circuit

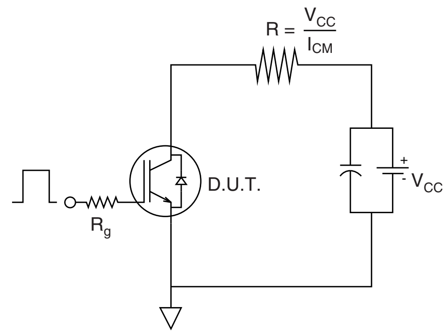


Fig. 18b - Pulsed Collector Current Test Circuit

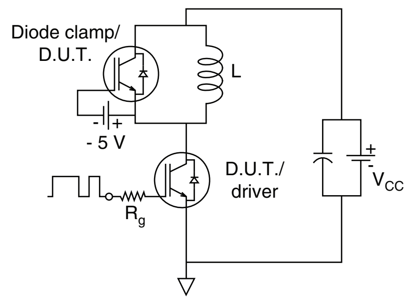
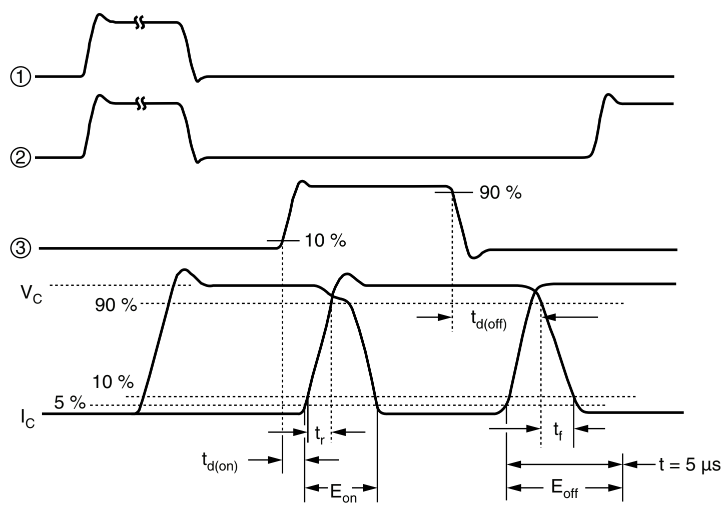


Fig. 19a - Switching Loss Test Circuit



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

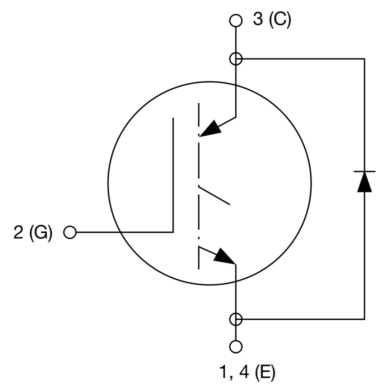
Fig. 19b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

Device code	VS-	G	T	100	D	A	120	U
	1	2	3	4	5	6	7	8

1 - Vishay Semiconductors product
2 - Insulated Gate Bipolar Transistor (IGBT)
3 - T = Trench IGBT technology
4 - Current rating (100 = 100 A)
5 - Circuit configuration (D = Single switch with antiparallel diode)
6 - Package indicator (A = SOT-227)
7 - Voltage rating (120 = 1200 V)
8 - Speed/type (U = Ultrafast)

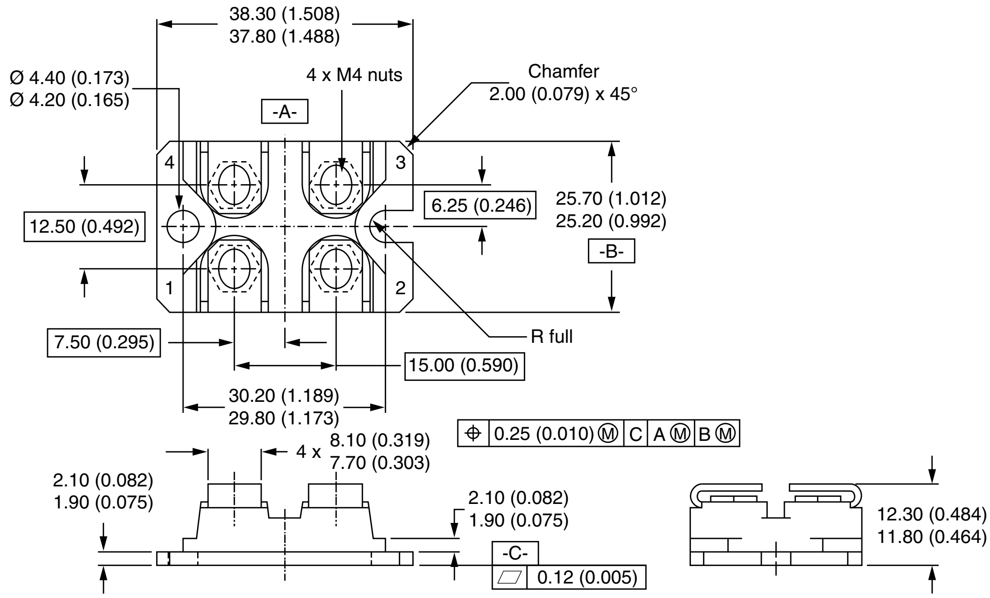
CIRCUIT CONFIGURATION



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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