

Insulated Gate Bipolar Transistor (Trench IGBT), 100 A


SOT-227

FEATURES

- Trench IGBT technology with positive temperature coefficient
- Square RBSOA
- 10 μ s 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

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

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	$I_C^{(1)}$	$T_C = 25\text{ °C}$	258	A
		$T_C = 80\text{ °C}$	174	
Pulsed collector current	I_{CM}		450	
Clamped inductive load current	I_{LM}		450	
Diode continuous forward current	I_F	$T_C = 25\text{ °C}$	50	
		$T_C = 80\text{ °C}$	34	
Peak diode forward current	I_{FSM}		180	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	$T_C = 25\text{ °C}$	893	W
		$T_C = 119\text{ °C}$	221	
Power dissipation, diode	P_D	$T_C = 25\text{ °C}$	176	
		$T_C = 119\text{ °C}$	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** ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

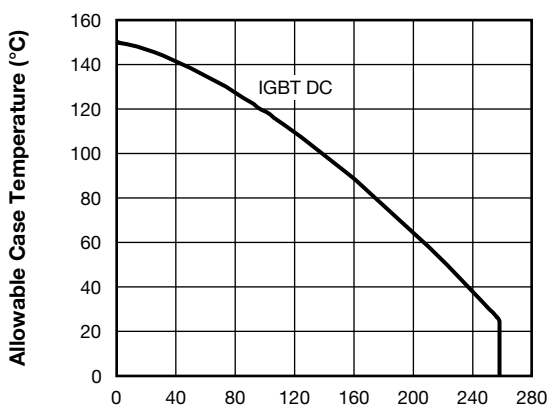
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{BR(CEs)}$	$V_{GE} = 0\text{ V}$, $I_C = 250\text{ }\mu\text{A}$	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$	-	1.73	2.1	
		$V_{GE} = 15\text{ V}$, $I_C = 100\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	1.98	2.2	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$, $I_C = 7.5\text{ mA}$	4.9	5.9	7.9	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$ ($25\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$)	-	-17.6	-	mV/ $^{\circ}\text{C}$
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$	-	0.6	100	μA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 1200\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	0.6	10	mA
Forward voltage drop	V_{FM}	$I_F = 40\text{ A}$, $V_{GE} = 0\text{ V}$	-	2.81	3.3	V
		$I_F = 40\text{ A}$, $V_{GE} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	3.07	3.4	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 200	nA

SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Turn-on switching loss	E_{on}	$I_C = 100\text{ A}$, $V_{CC} = 720\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 5\text{ }\Omega$, $L = 500\text{ }\mu\text{H}$, $T_J = 25\text{ }^{\circ}\text{C}$	-	5.2	-	mJ
Turn-off switching loss	E_{off}		-	7.1	-	
Total switching loss	E_{tot}		-	12.3	-	
Turn-on switching loss	E_{on}	$I_C = 100\text{ A}$, $V_{CC} = 720\text{ V}$, $V_{GE} = 15\text{ V}$, $R_g = 5\text{ }\Omega$, $L = 500\text{ }\mu\text{H}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	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	$T_J = 150\text{ }^{\circ}\text{C}$, $I_C = 450\text{ A}$, $R_g = 22\text{ }\Omega$, $V_{GE} = 15\text{ V}$ to 0 V , $V_{CC} = 900\text{ V}$, $V_P = 1200\text{ V}$, $L = 500\text{ }\mu\text{H}$	Fullsquare			
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}$, $dI_F/dt = 200\text{ A}/\mu\text{s}$, $V_{rr} = 400\text{ V}$	-	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}	$I_F = 50\text{ A}$, $dI_F/dt = 200\text{ A}/\mu\text{s}$, $V_{rr} = 400\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	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	$T_J = 150\text{ }^{\circ}\text{C}$, $R_g = 22\text{ }\Omega$, $V_{GE} = 15\text{ V}$ to 0 V , $V_{CC} = 900\text{ V}$, $V_P = 1200\text{ V}$	10			μs



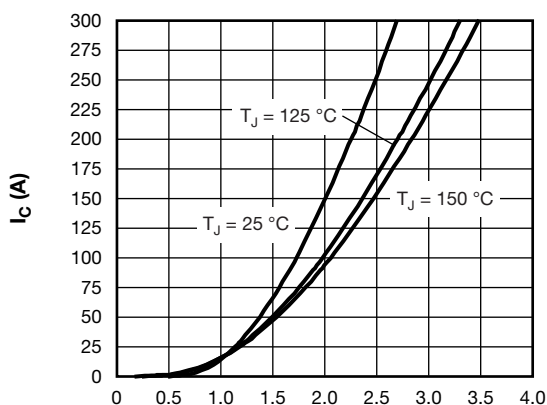
THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Junction and storage temperature range	T_J, T_{Stg}		-40	-	150	°C
Junction to case	R_{thJC}		-	-	0.14	°C/W
			-	-	0.71	
Case to heatsink	R_{thCS}	Flat, greased surface	-	0.1	-	
Weight			-	30	-	g
Mounting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



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I_C - Continuous Collector Current (A)

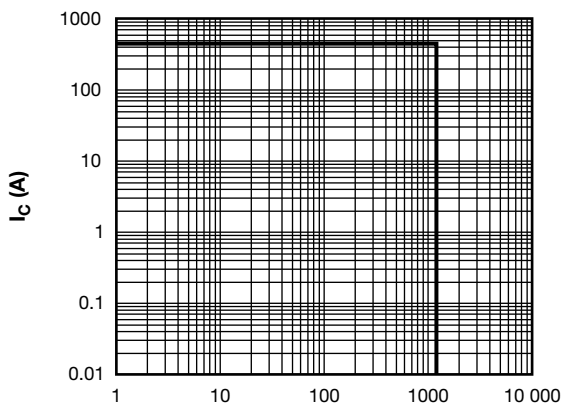
Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature



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V_{CE} (V)

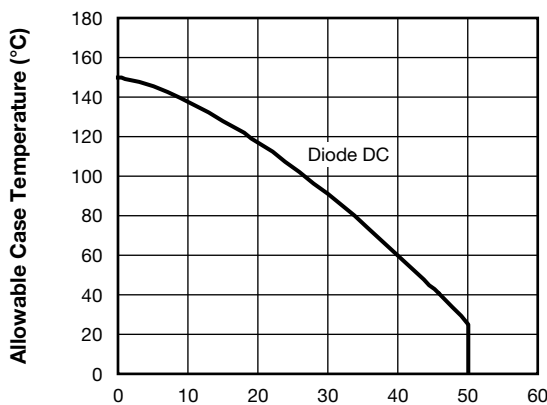
Fig. 3 - Typical IGBT Collector Current Characteristics
 $V_{GE} = 15$ V



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V_{CE} (V)

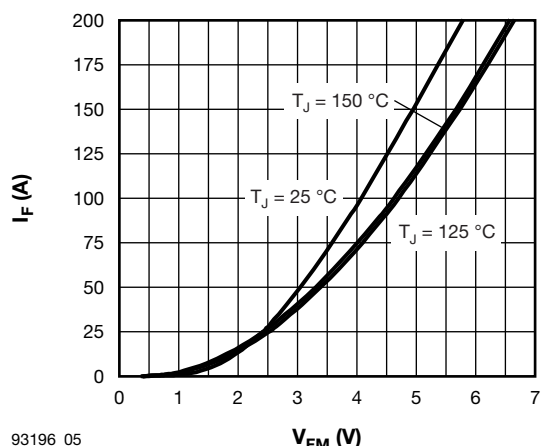
Fig. 2 - IGBT Reverse Bias SOA
 $T_J = 150$ °C, $V_{GE} = 15$ V



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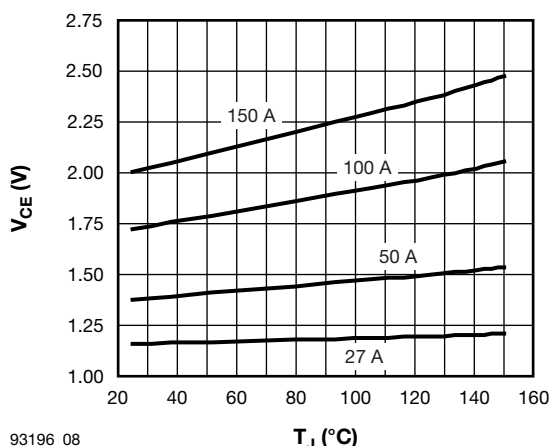
I_F - Continuous Forward Current (A)

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

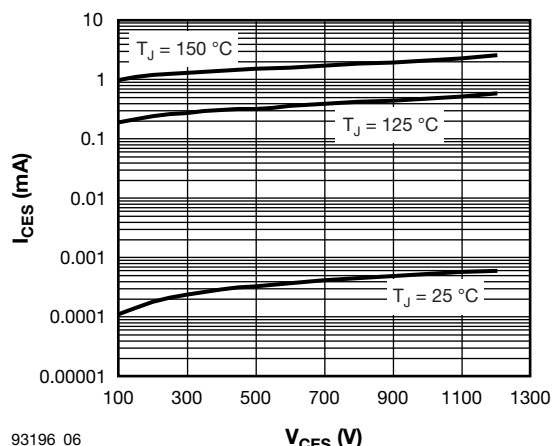


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Fig. 5 - Typical Diode Forward Characteristics

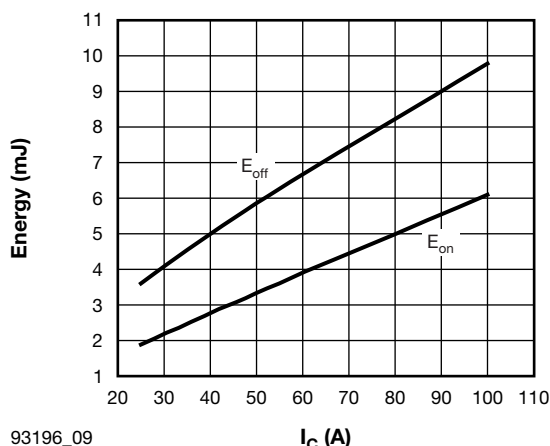


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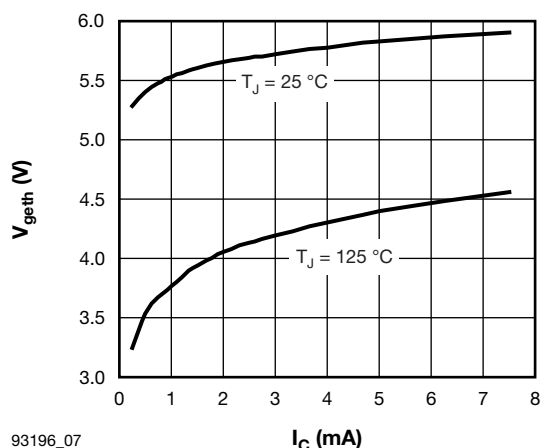
Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, $V_{GE} = 15\text{ V}$


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Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

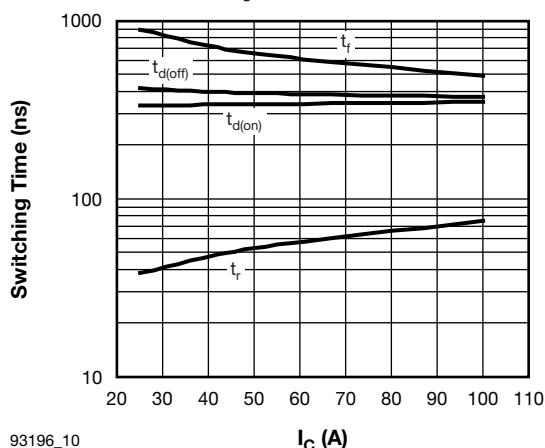


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Fig. 9 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125\text{ °C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 720\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$


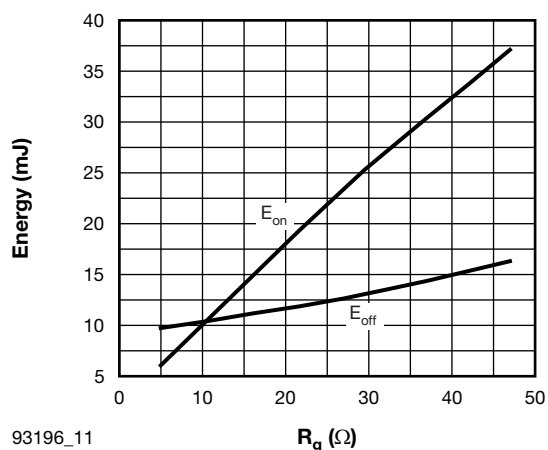
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Fig. 7 - Typical IGBT Threshold Voltage



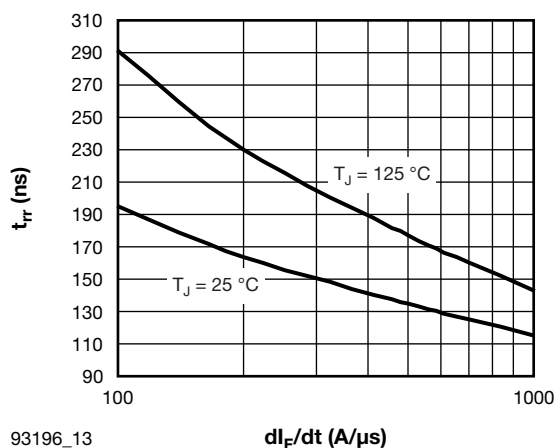
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Fig. 10 - Typical IGBT Switching Time vs. I_C
 $T_J = 125\text{ °C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 720\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$



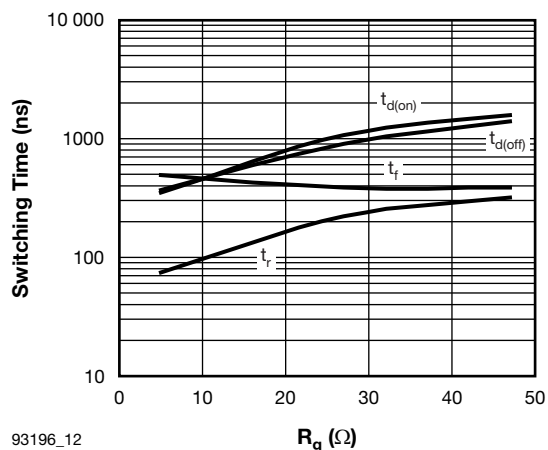
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Fig. 11 - Typical IGBT Energy Loss vs. R_g
 $T_J = 125^\circ\text{C}$, $I_C = 100\text{ A}$, $L = 500\text{ }\mu\text{H}$,
 $V_{CC} = 720\text{ V}$, $V_{GE} = 15\text{ V}$



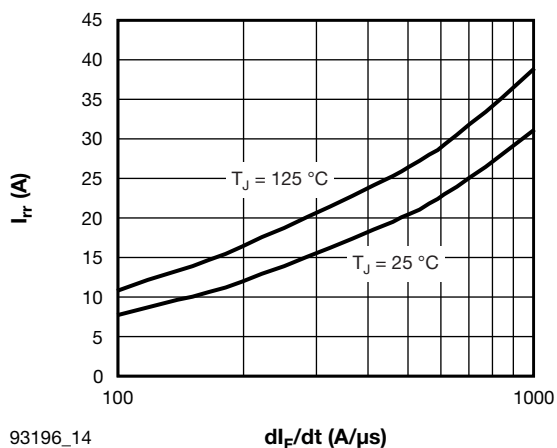
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Fig. 13 - Typical t_{rr} Diode vs. dI_F/dt
 $V_{rr} = 400\text{ V}$, $I_F = 50\text{ A}$



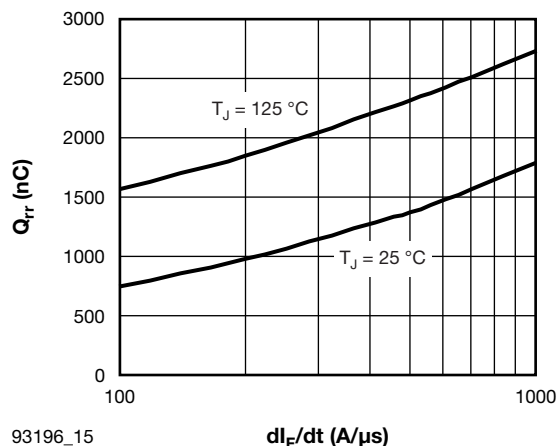
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Fig. 12 - Typical IGBT Switching Time vs. R_g
 $T_J = 125^\circ\text{C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 720\text{ V}$,
 $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$



93196_14

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



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

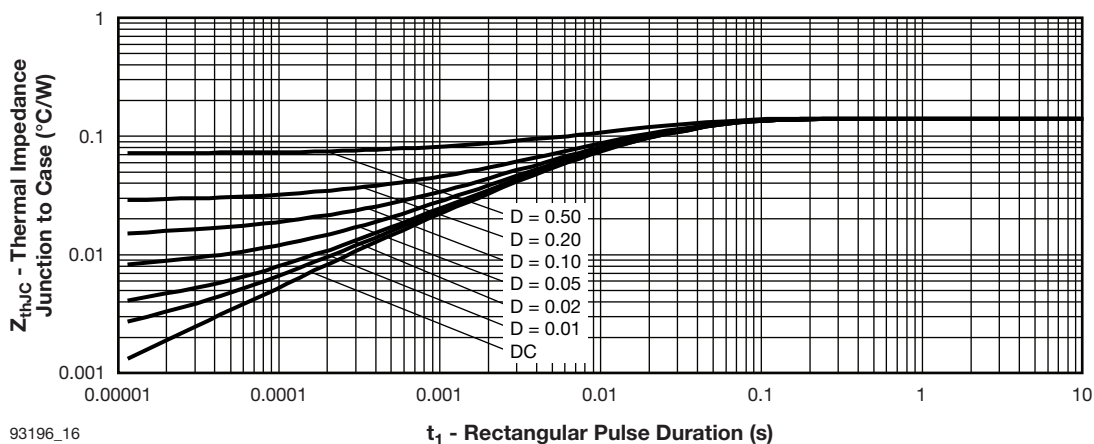


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

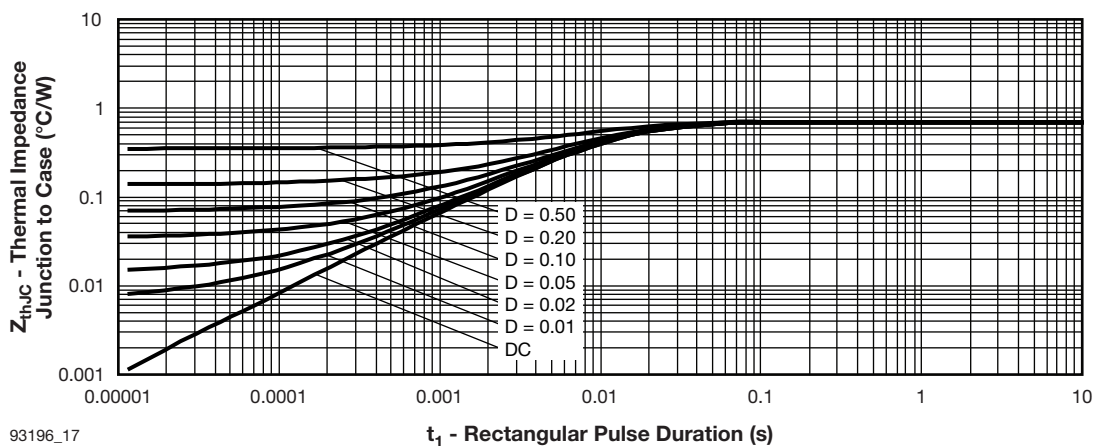


Fig. 17 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)

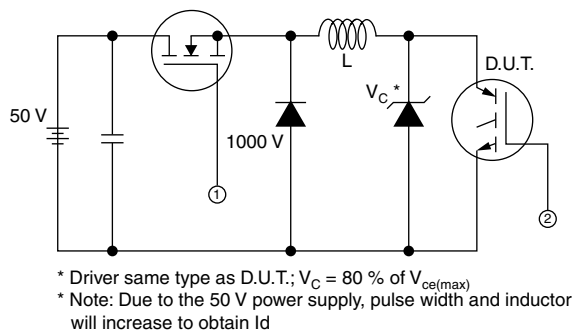


Fig. 18a - Clamped Inductive Load Test Circuit

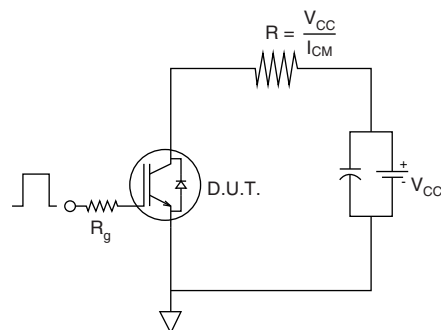


Fig. 18b - Pulsed Collector Current Test Circuit

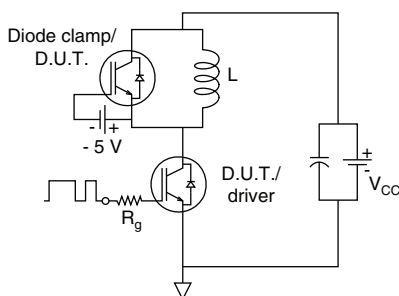


Fig. 19a - Switching Loss Test Circuit

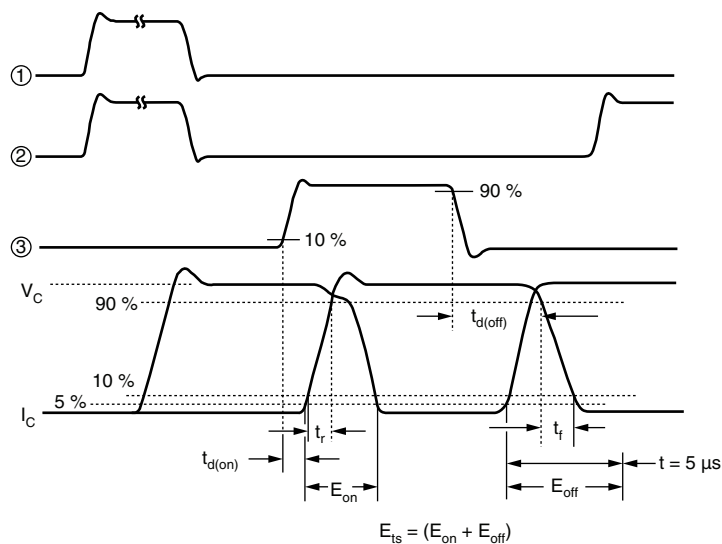
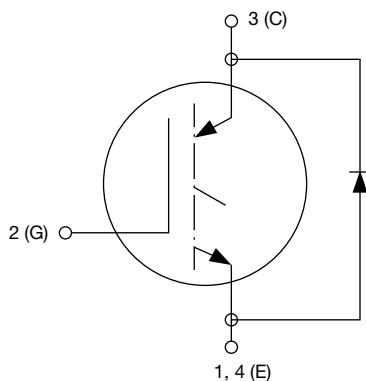


Fig. 19b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

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

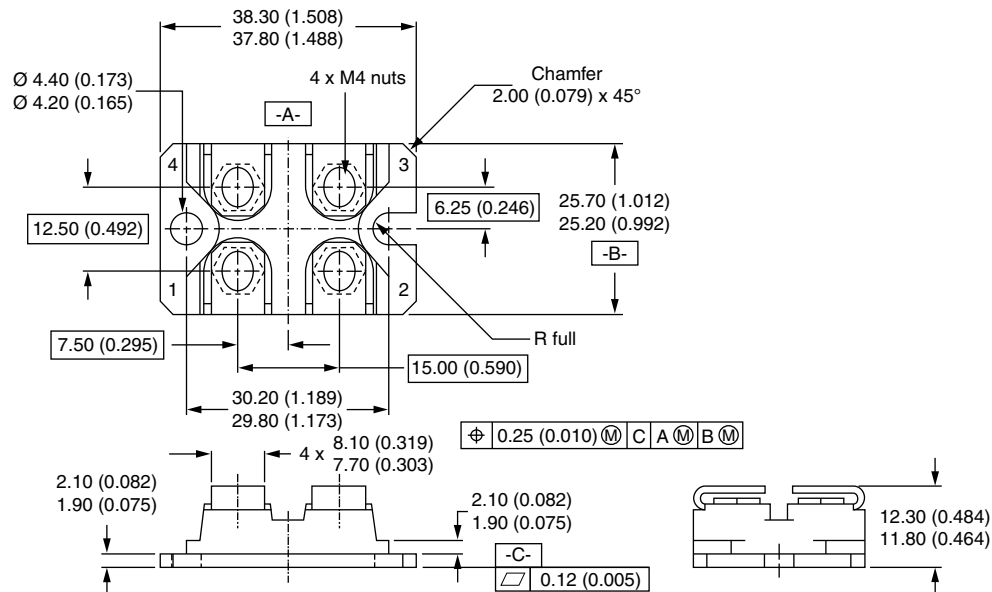
- 1** - Vishay Semiconductors product
- 2** - Insulated Gate Bipolar Transistor (IGBT)
- 3** - T = Trench IGBT technology
- 4** - Current rating (100 = 100 A)
- 5** - Circuit configuration (D = Single switch with antiparallel diode)
- 6** - Package indicator (A = SOT-227)
- 7** - Voltage rating (120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