

Insulated Gate Bipolar Transistor (Trench IGBT), 100 A


SOT-227

PRODUCT SUMMARY	
V_{CES}	600 V
I_C DC	100 A at 117 °C
$V_{CE(on)}$ typical at 100 A, 25 °C	1.72 V
I_F DC	100 A at 25 °C
Package	SOT-227

FEATURES

- Trench IGBT technology with positive temperature coefficient
- Square RBSOA
- 3 μ s short circuit capability
- FRED Pt[®] antiparallel diodes with ultrasoft reverse recovery
- T_J maximum = 175 °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
- Lower conduction losses and switching losses
- Low EMI, requires less snubbing

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C ⁽¹⁾	$T_C = 25$ °C	184	A
		$T_C = 80$ °C	137	
Pulsed collector current	I_{CM}		350	
Clamped inductive load current	I_{LM}		350	
Diode continuous forward current	I_F	$T_C = 25$ °C	100	
		$T_C = 80$ °C	71	
Peak diode forward current	I_{FSM}		200	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	$T_C = 25$ °C	577	W
		$T_C = 117$ °C	223	
Power dissipation, diode	P_D	$T_C = 25$ °C	205	
		$T_C = 117$ °C	79	
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	$V_{BR(CES)}$	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	$V_{GE} = 15\text{ V}, I_C = 100\text{ A}$	-	1.72	2.0	
		$V_{GE} = 15\text{ V}, I_C = 100\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	2.0	2.2	
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	3.5	4.6	6.5	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$ (25 °C to 125 °C)	-	- 16.8	-	mV/°C
Collector to emitter leakage current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	-	0.6	100	μA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	0.15	3	mA
Forward voltage drop	V_{FM}	$I_F = 40\text{ A}, V_{GE} = 0\text{ V}$	-	1.78	2.21	V
		$I_F = 40\text{ A}, V_{GE} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	1.39	1.74	
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}	$I_C = 100\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 5\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 25\text{ }^\circ\text{C}$	-	0.35	-	mJ
Turn-off switching loss	E_{off}		-	2.08	-	
Total switching loss	E_{tot}		-	2.43	-	
Turn-on switching loss	E_{on}	$I_C = 100\text{ A}, V_{CC} = 360\text{ V}, V_{GE} = 15\text{ V}, R_g = 5\text{ }\Omega, L = 500\text{ }\mu\text{H}, T_J = 125\text{ }^\circ\text{C}$	-	0.41	-	ns
Turn-off switching loss	E_{off}		-	2.83	-	
Total switching loss	E_{tot}		-	3.24	-	
Turn-on delay time	$t_{d(on)}$		-	162	-	
Rise time	t_r		-	55	-	
Turn-off delay time	$t_{d(off)}$		-	150	-	
Fall time	t_f	-	129	-		
Reverse bias safe operating area	RBSOA	$T_J = 175\text{ }^\circ\text{C}, I_C = 350\text{ A}, R_g = 22\text{ }\Omega, V_{GE} = 15\text{ V to } 0\text{ V}, V_{CC} = 400\text{ V}, V_p = 600\text{ V}, L = 500\text{ }\mu\text{H}$	Fullsquare			
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 200\text{ V}$	-	61	85	ns
Diode peak reverse current	I_{rr}		-	4	7	A
Diode recovery charge	Q_{rr}		-	120	297	nC
Diode reverse recovery time	t_{rr}	$I_F = 50\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 200\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	133	154	ns
Diode peak reverse current	I_{rr}		-	12	15	A
Diode recovery charge	Q_{rr}		-	750	1150	nC
Short circuit safe operating area	SCSOA	$T_J = 175\text{ }^\circ\text{C}, R_g = 22\text{ }\Omega, V_{GE} = 15\text{ V to } 0\text{ V}, V_{CC} = 400\text{ V}, V_p = 600\text{ V}$	3			μs

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T_J, T_{Stg}	- 40	-	175	°C
Junction to case	IGBT	-	-	0.26	°C/W
	Diode	-	-	0.73	
Case to sink per module	R_{thCS}	-	0.05	-	
Mounting torque, 6-32 or M3 screw		-	-	1.3	Nm
Weight		-	30	-	g

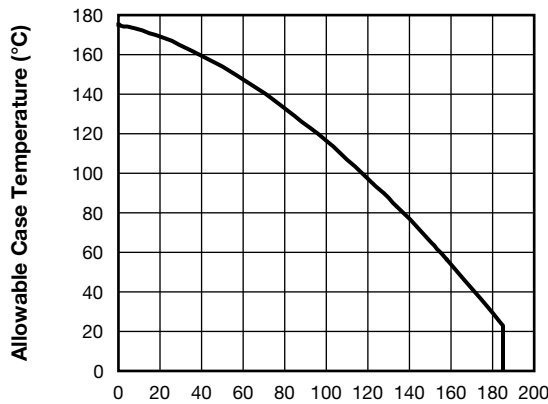
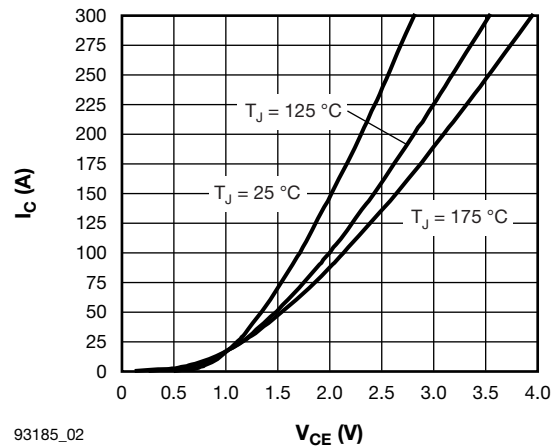
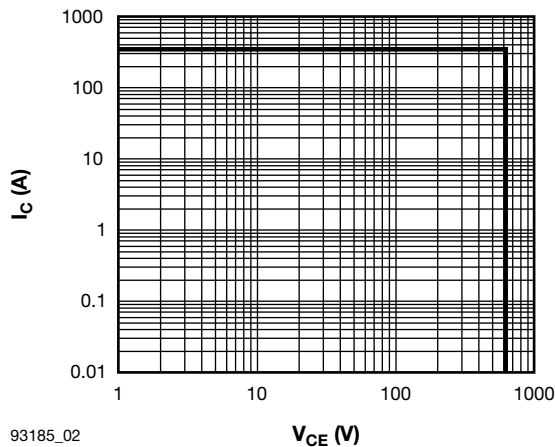

 93185_01 **I_C - Continuous Collector Current (A)**

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



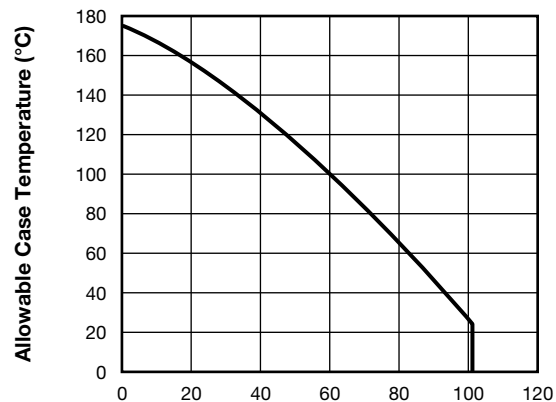
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 V_{CE} (V)

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


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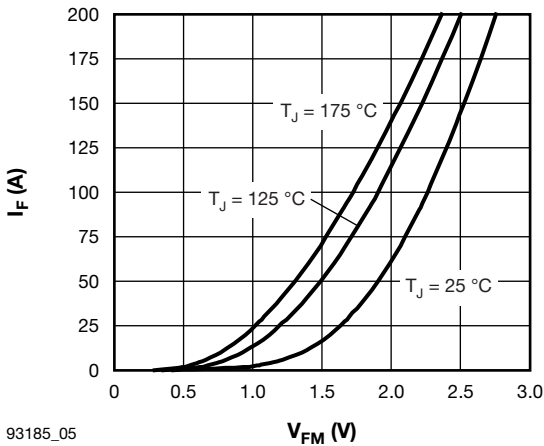
 V_{CE} (V)

 Fig. 2 - IGBT Reverse Bias SOA
 $T_J = 175$ °C, $V_{GE} = 15$ V


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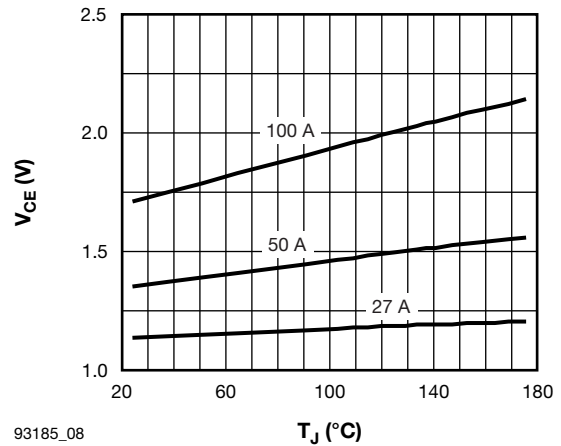
 I_F - Continuous Forward Current (A)

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



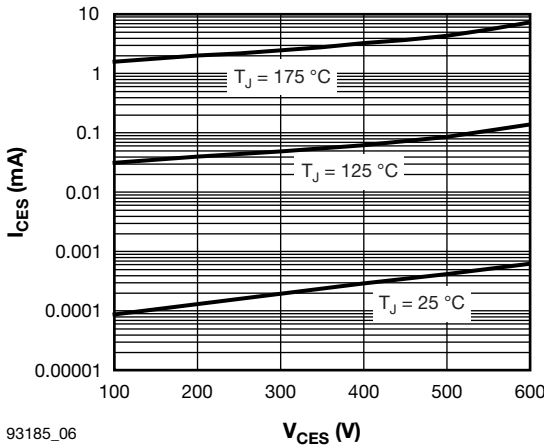
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Fig. 5 - Typical Diode Forward Characteristics



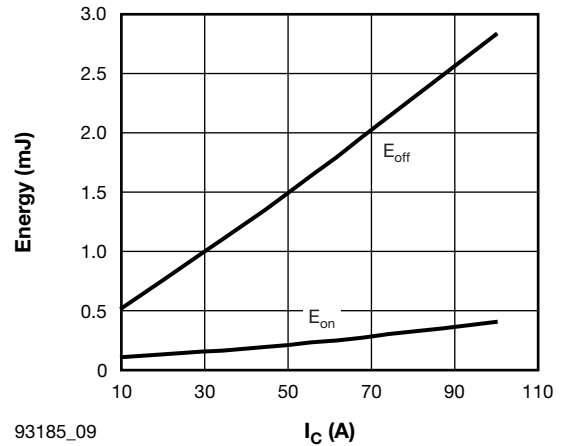
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Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, $V_{GE} = 15\text{ V}$



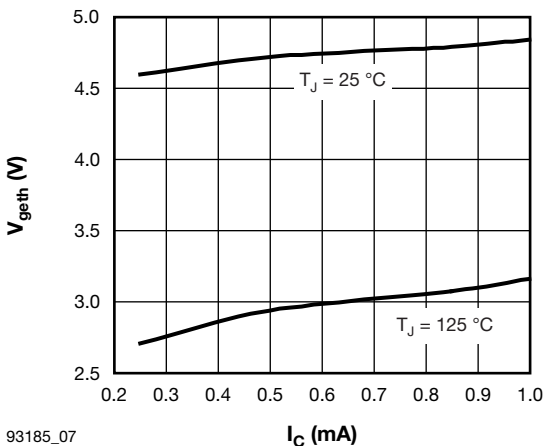
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Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current



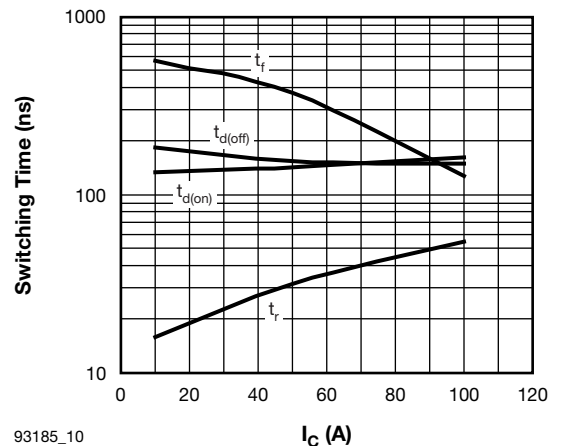
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Fig. 9 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125\text{ °C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$



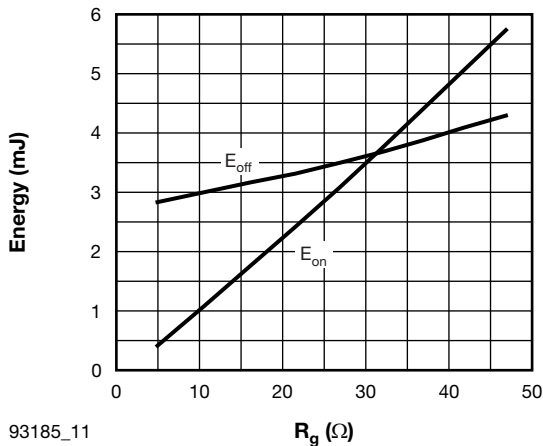
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Fig. 7 - Typical IGBT Threshold Voltage



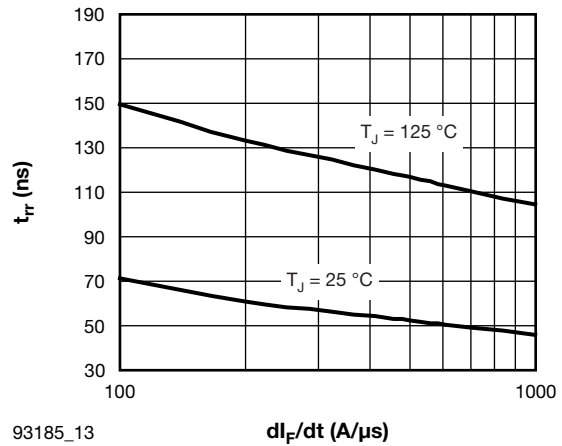
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Fig. 10 - Typical IGBT Switching Time vs. I_C
 $T_J = 125\text{ °C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$



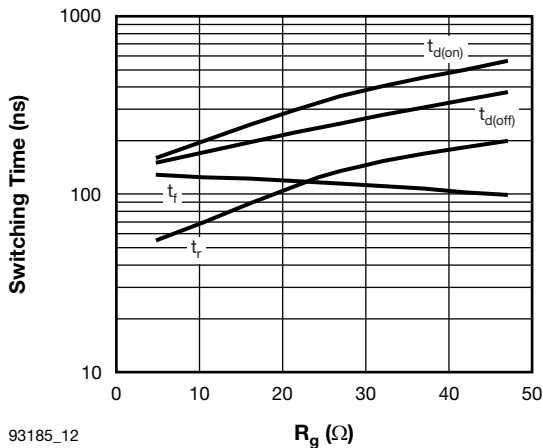
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Fig. 11 - Typical IGBT Energy Loss vs. R_g
 $T_J = 125\text{ }^\circ\text{C}$, $I_C = 100\text{ A}$, $L = 500\text{ }\mu\text{H}$,
 $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$



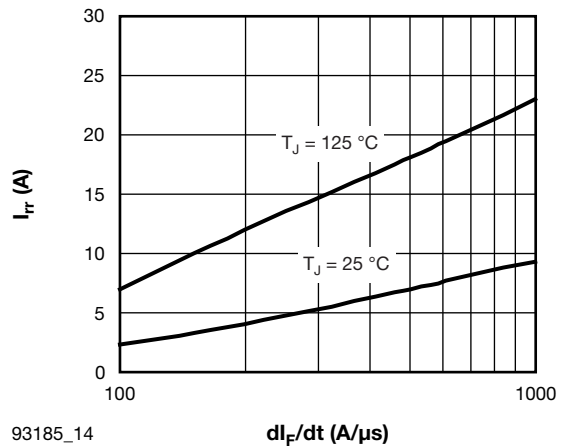
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Fig. 13 - Typical t_{rr} Diode vs. dI_F/dt
 $V_{rr} = 200\text{ V}$, $I_F = 50\text{ A}$



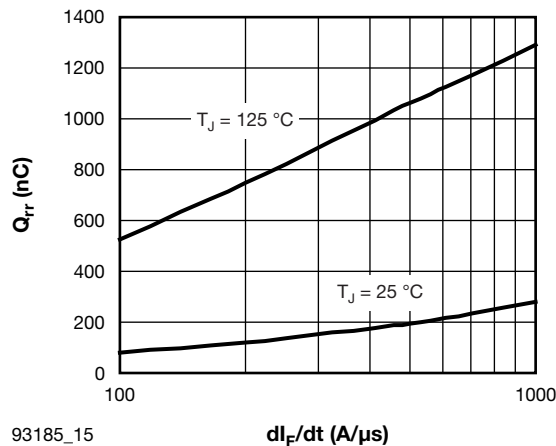
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Fig. 12 - Typical IGBT Switching Time vs. R_g
 $T_J = 125\text{ }^\circ\text{C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$,
 $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$



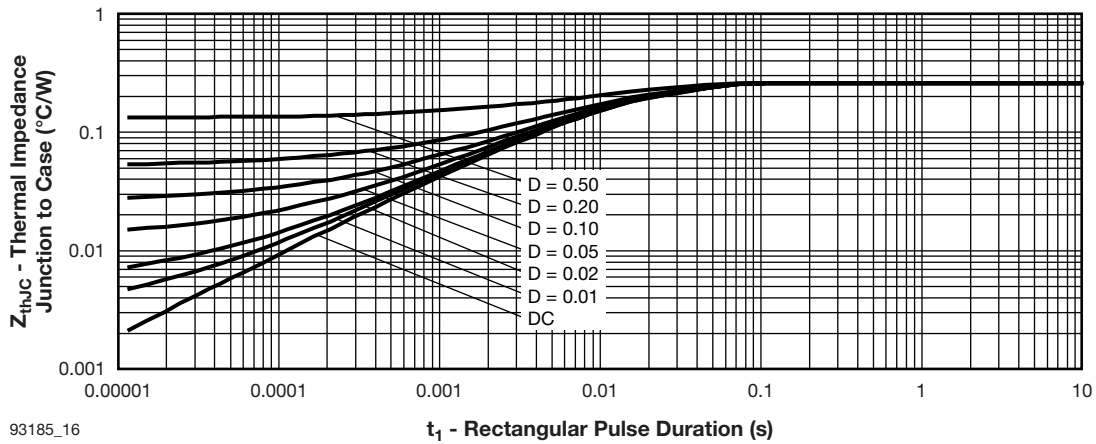
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Fig. 14 - Typical I_{rr} Diode vs. dI_F/dt
 $V_{rr} = 200\text{ V}$, $I_F = 50\text{ A}$



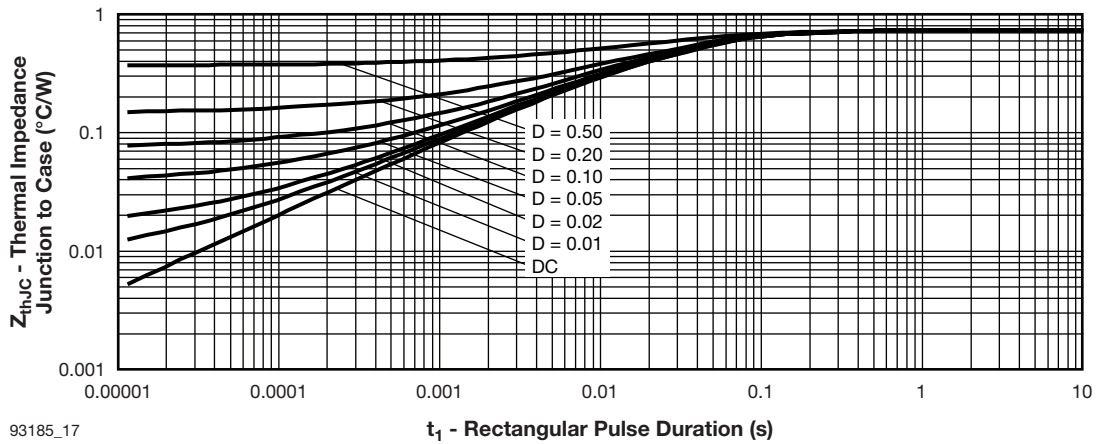
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Fig. 15 - Typical Q_{rr} Diode vs. dI_F/dt
 $V_{rr} = 200\text{ V}$, $I_F = 50\text{ A}$



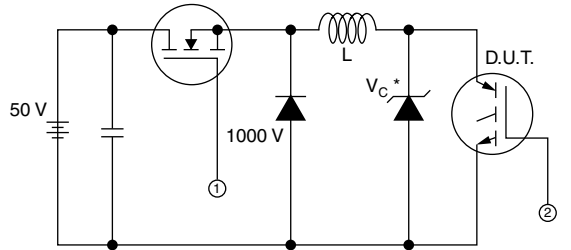
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Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)



93185_17

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 I_d

Fig. 18a - Clamped Inductive Load Test Circuit

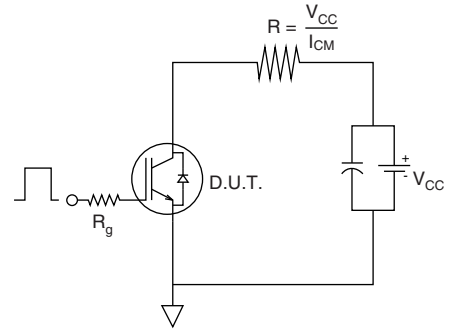


Fig. 18b - Pulsed Collector Current Test Circuit

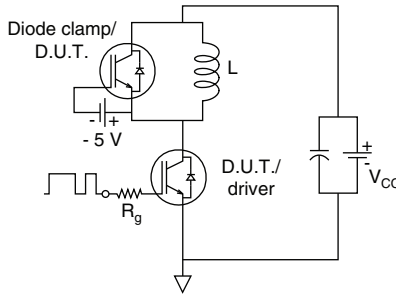


Fig. 19a - Switching Loss Test Circuit

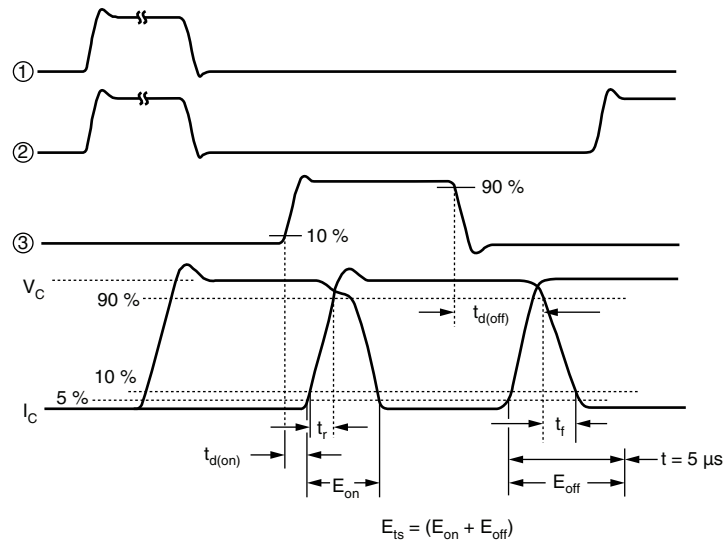
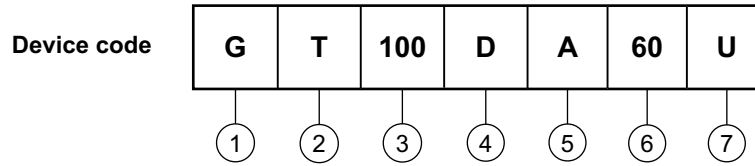
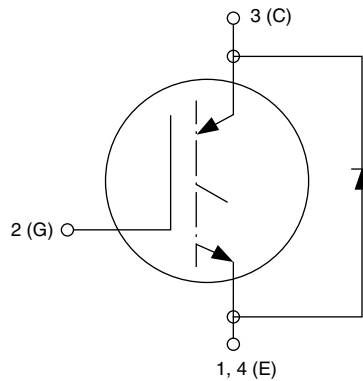


Fig. 19b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE


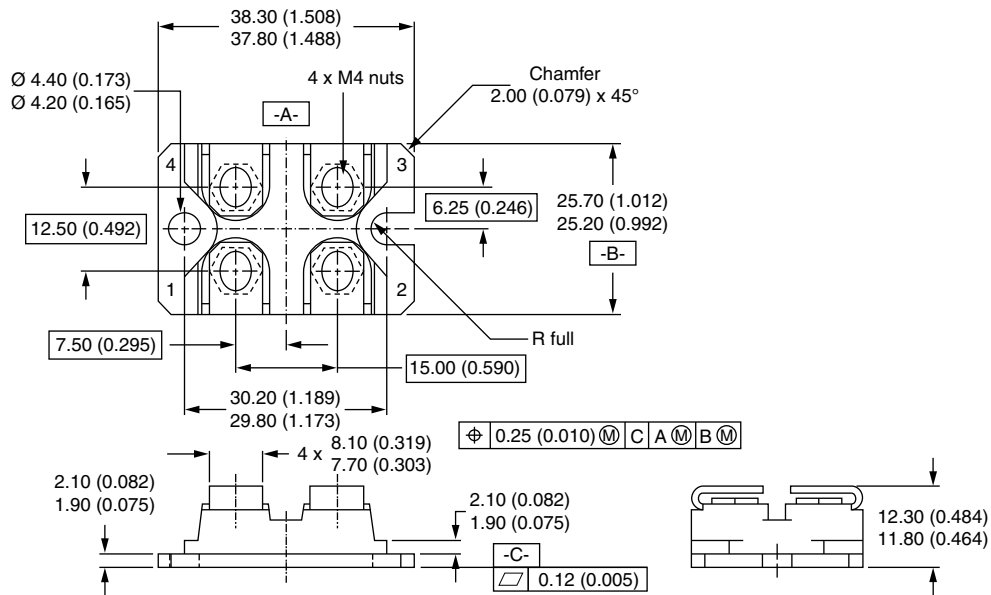
- 1** - Insulated Gate Bipolar Transistor (IGBT)
- 2** - T = Trench IGBT technology
- 3** - Current rating (100 = 100 A)
- 4** - Circuit configuration (D = Single switch with antiparallel diode)
- 5** - Package indicator (A = SOT-227)
- 6** - Voltage rating (60 = 600 V)
- 7** - Speed/type (U = Ultrafast)

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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