

STARPOWER

SEMICONDUCTOR

IGBT

GD1600SGL170C3SN

1700V/1600A 1 in one-package

General Description

STARPOWER IGBT Power Module provides ultrafast switching speed as well as short circuit ruggedness. It's designed for the applications such as high power converters.

Features

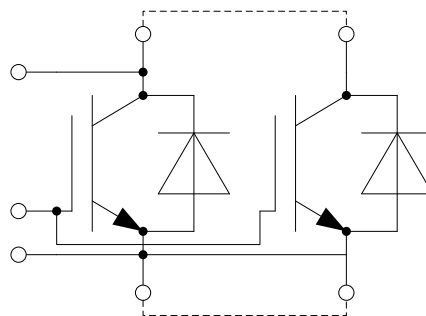
- Low $V_{CE(sat)}$ SPT+ IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Typical Applications

- High Power Converters
- Motor Drives
- AC Inverter Drives

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_C=25^{\circ}\text{C}$ unless otherwise noted**IGBT**

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1700	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	3079	A
	@ $T_C=100^{\circ}\text{C}$	1600	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	3200	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	14.15	kW

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	V
I_F	Diode Continuous Forward Current	1600	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	3200	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	4000	V

IGBT Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=1600\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.00	2.45	V	
		$I_C=1600\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.40			
		$I_C=1600\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.50			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=64.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.4	6.2	7.4	V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			5.0	mA	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			400	nA	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		108		nF	
C_{res}	Reverse Transfer Capacitance				3.68		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		17.0		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=1600\text{A}, R_{Gon}=0.8\Omega, R_{Goff}=0.6\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		490		ns	
t_r	Rise Time			160		ns	
$t_{d(off)}$	Turn-Off Delay Time			1050		ns	
t_f	Fall Time			300		ns	
E_{on}	Turn-On Switching Loss				345		mJ
E_{off}	Turn-Off Switching Loss				420		mJ
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=900\text{V}, I_C=1600\text{A}, R_{Gon}=0.8\Omega, R_{Goff}=0.6\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		570		ns
t_r	Rise Time				170		ns
$t_{d(off)}$	Turn-Off Delay Time				1200		ns
t_f	Fall Time				460		ns
E_{on}	Turn-On Switching Loss				500		mJ
E_{off}	Turn-Off Switching Loss				570		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=1600\text{A}, R_{Gon}=0.8\Omega, R_{Goff}=0.6\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			580		ns
t_r	Rise Time				170		ns
$t_{d(off)}$	Turn-Off Delay Time				1200		ns
t_f	Fall Time				510		ns
E_{on}	Turn-On Switching Loss				540		mJ
E_{off}	Turn-Off Switching Loss				600		mJ
I_{SC}	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		7500		A

Diode Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=1600\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.80	2.25	V
		$I_F=1600\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.90		
		$I_F=1600\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.95		
Q_r	Recovered Charge	$V_{CC}=900\text{V}, I_F=1600\text{A},$ $-di/dt=9300\text{A}/\mu\text{s}, V_{GE}=\pm 15\text{V},$ $T_j=25^{\circ}\text{C}$		390		μC
I_{RM}	Peak Reverse Recovery Current			1650		A
E_{rec}	Reverse Recovery Energy			235		mJ
Q_r	Recovered Charge	$V_{CC}=900\text{V}, I_F=1600\text{A},$ $-di/dt=9300\text{A}/\mu\text{s}, V_{GE}=\pm 15\text{V},$ $T_j=125^{\circ}\text{C}$		680		μC
I_{RM}	Peak Reverse Recovery Current			1900		A
E_{rec}	Reverse Recovery Energy			440		mJ
Q_r	Recovered Charge	$V_{CC}=900\text{V}, I_F=1600\text{A},$ $-di/dt=9300\text{A}/\mu\text{s}, V_{GE}=\pm 15\text{V},$ $T_j=150^{\circ}\text{C}$		765		μC
I_{RM}	Peak Reverse Recovery Current			1950		A
E_{rec}	Reverse Recovery Energy			500		mJ

Module Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		12		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.19		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			10.6	K/kW
	Junction-to-Case (per Diode)			18.2	
R_{thCH}	Case-to-Heatsink (per IGBT)		9.5		K/kW
	Case-to-Heatsink (per Diode)		16.3		
	Case-to-Heatsink (per Module)		6.0		
M	Terminal Connection Torque, Screw M4	1.8		2.1	N.m
	Terminal Connection Torque, Screw M8	8.0		10	
	Mounting Torque, Screw M6	4.25		5.75	
G	Weight of Module		1500		g

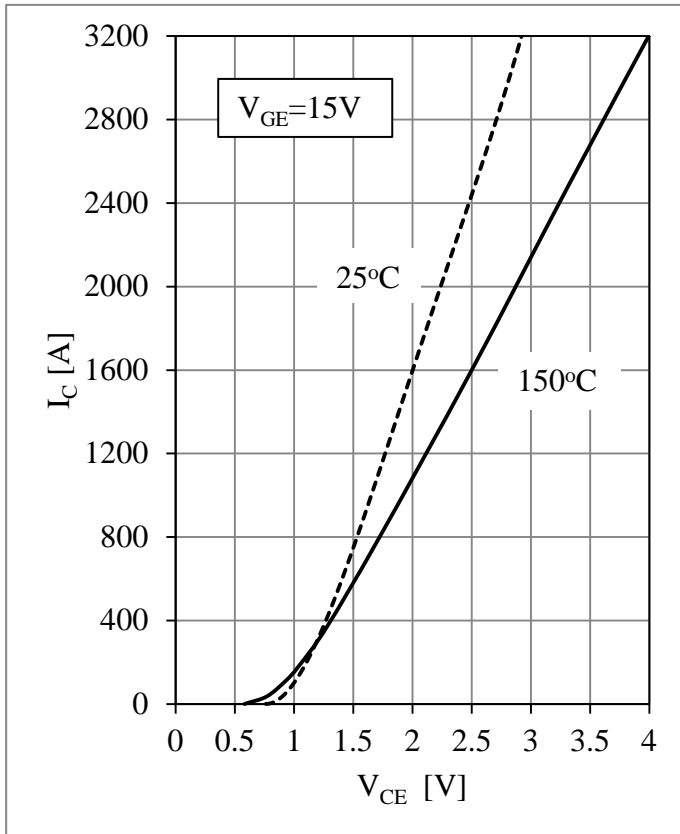


Fig 1. IGBT Output Characteristics

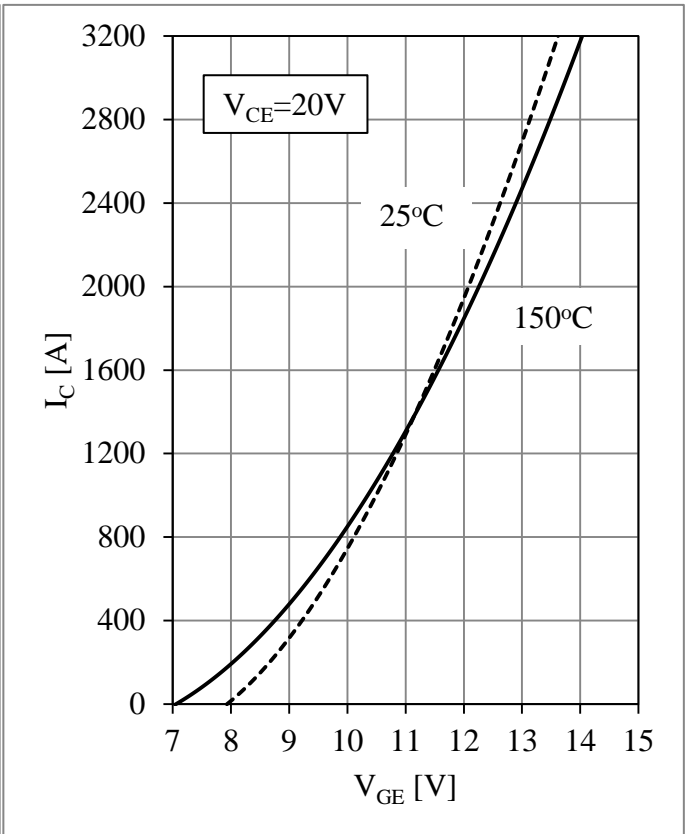


Fig 2. IGBT Transfer Characteristics

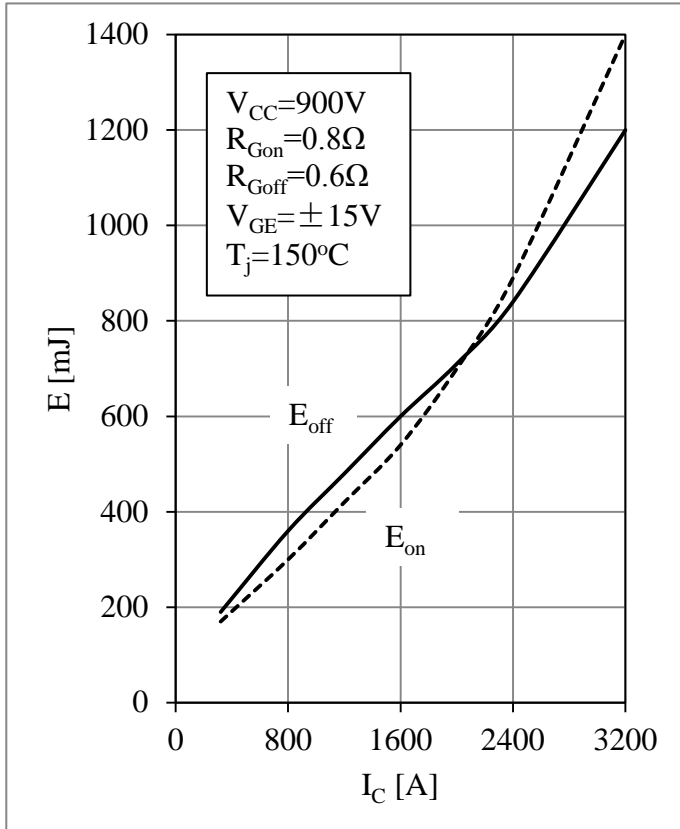


Fig 3. IGBT Switching Loss vs. I_C

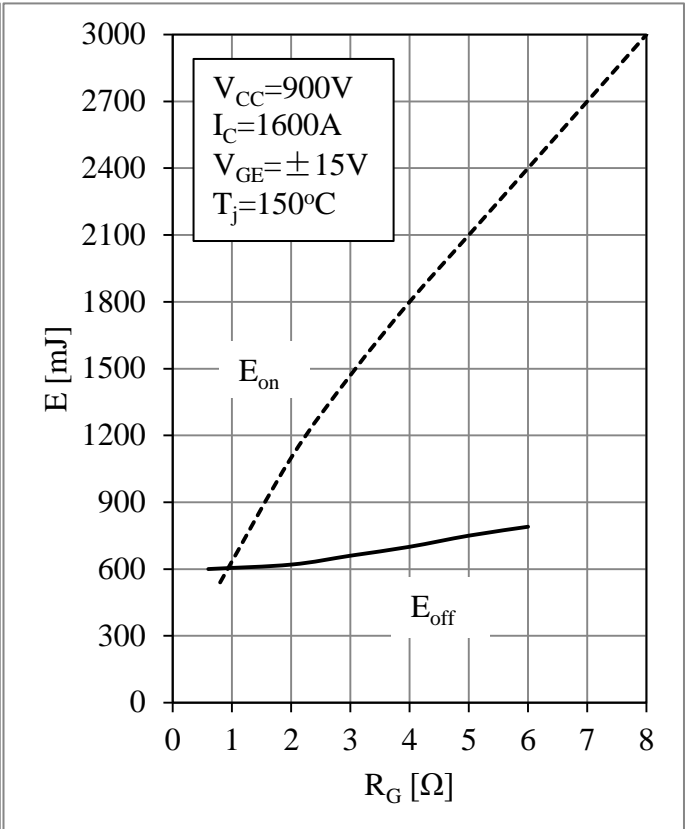


Fig 4. IGBT Switching Loss vs. R_G

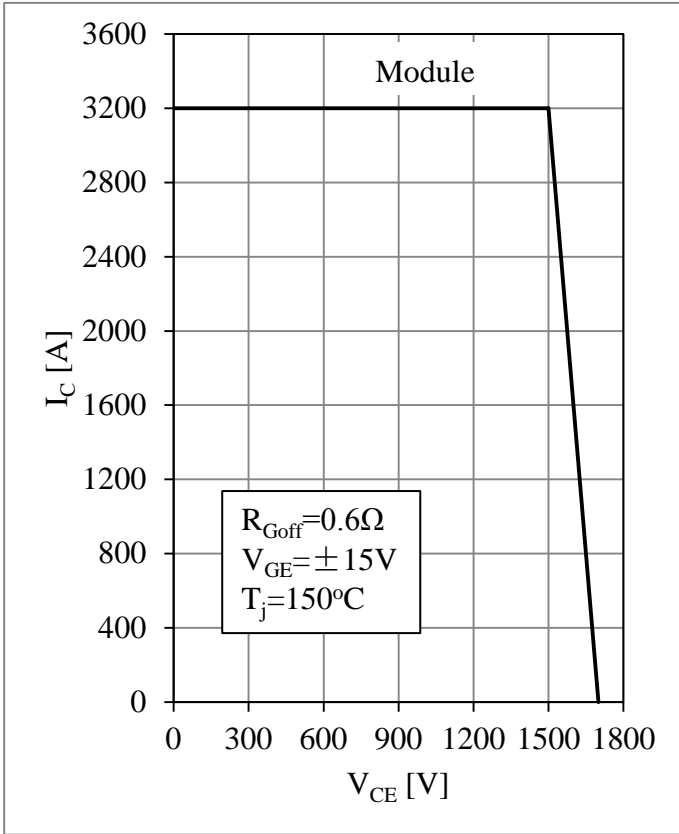


Fig 5. RBSOA

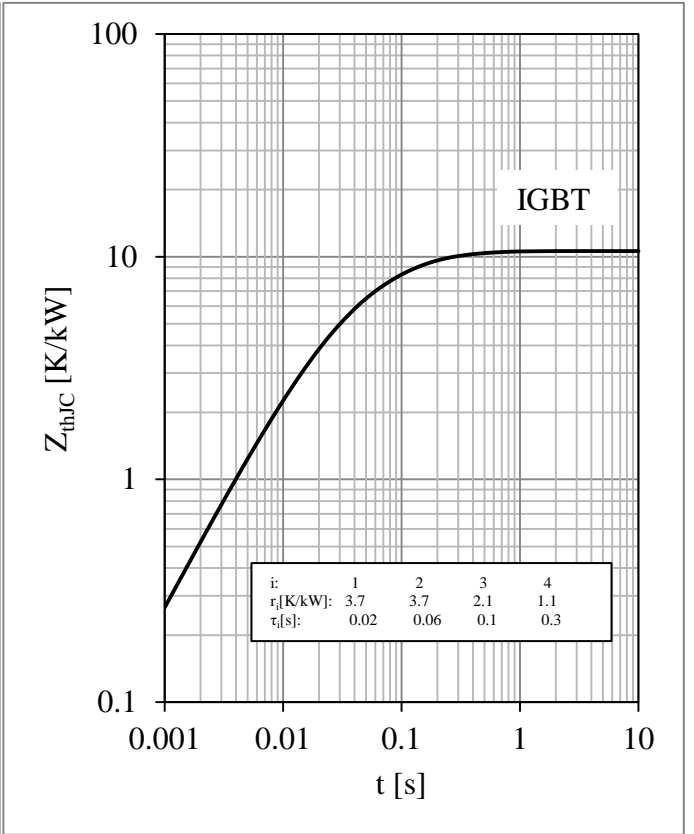


Fig 6. IGBT Transient Thermal Impedance

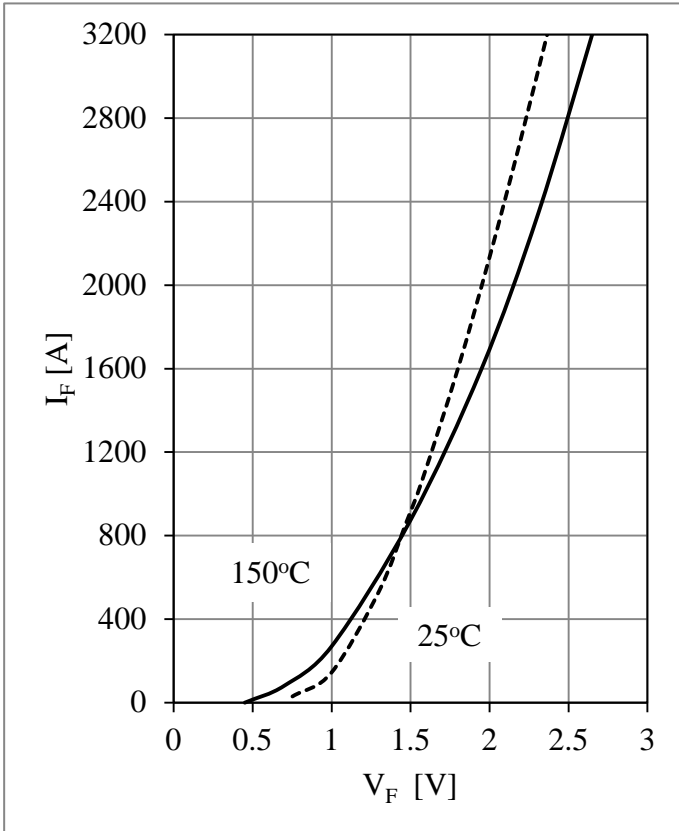


Fig 7. Diode Forward Characteristics

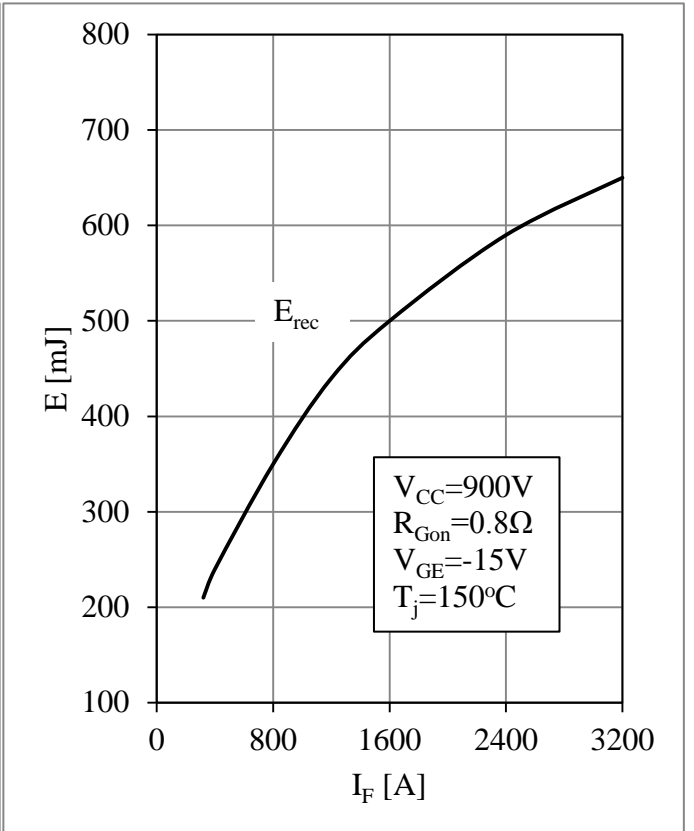


Fig 8. Diode Switching Loss vs. I_F

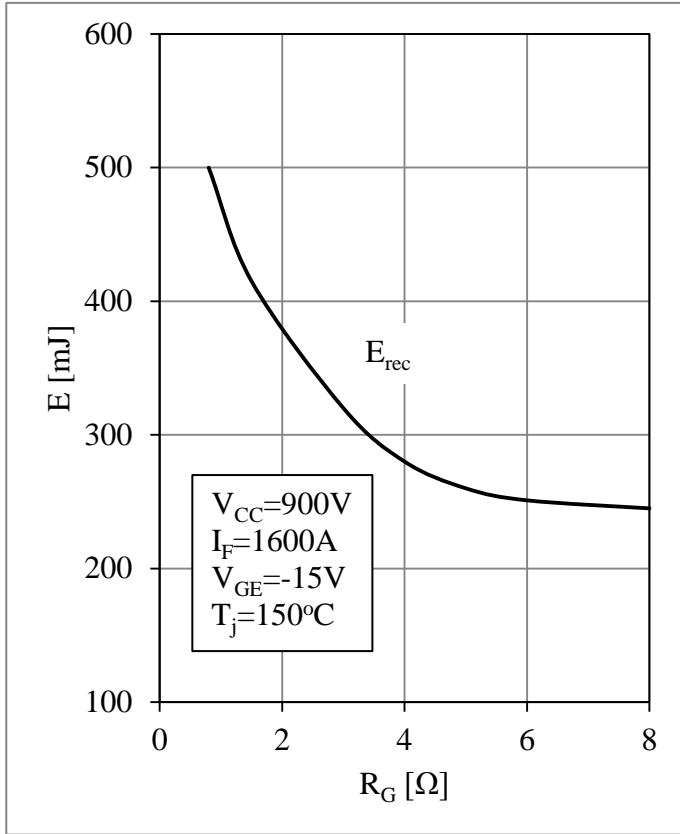


Fig 9. Diode Switching Loss vs. R_G

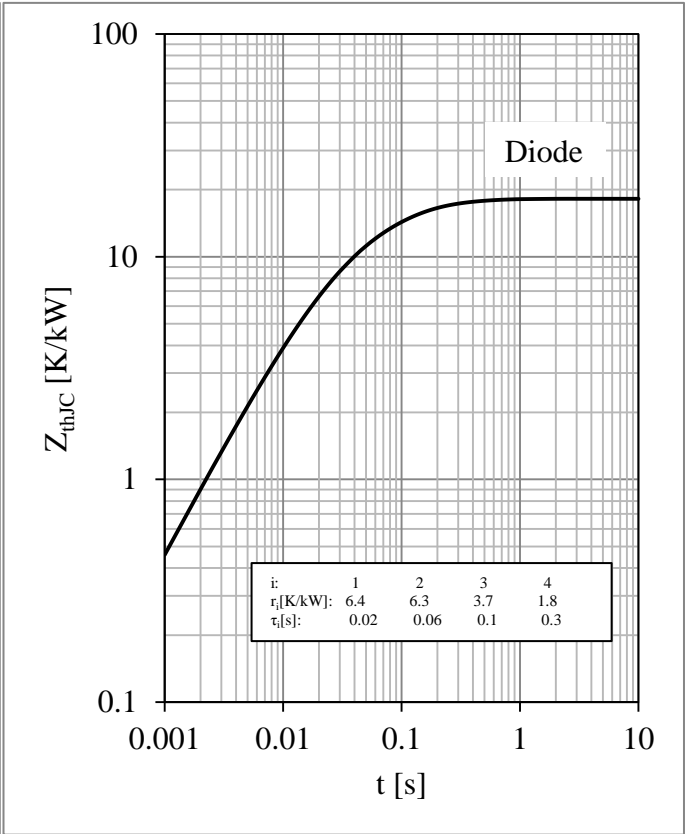
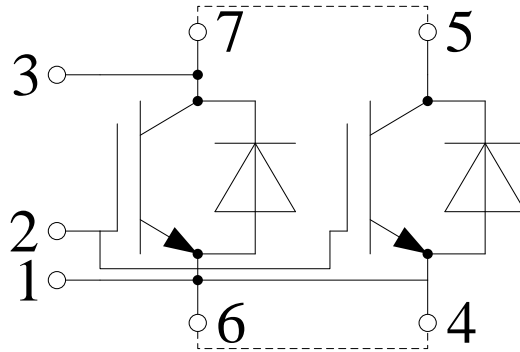


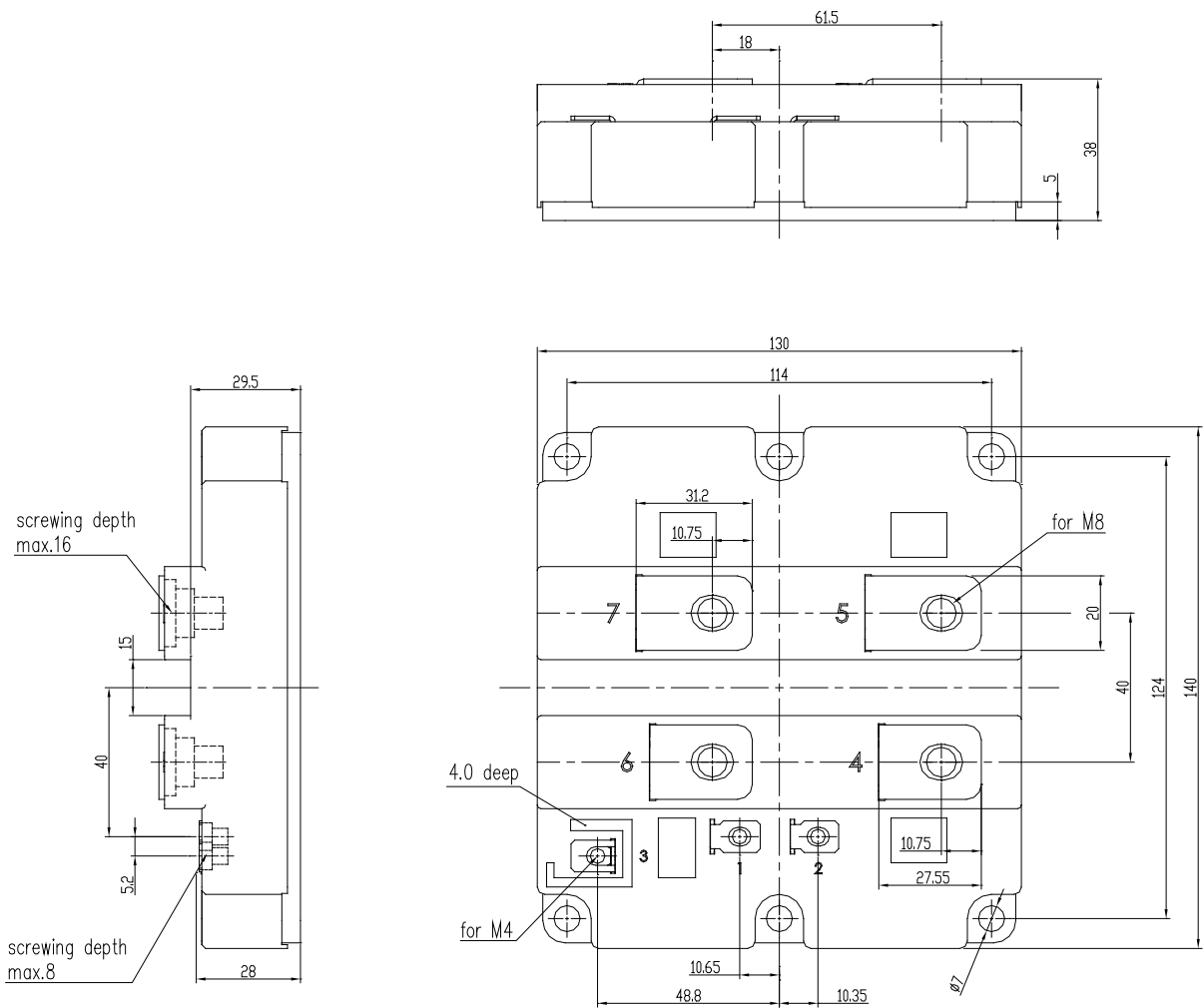
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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