

STARPOWER

SEMICONDUCTOR

IGBT

GD450HFL170C2S

1700V/450A 2 in one-package

General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as general inverters.

Features

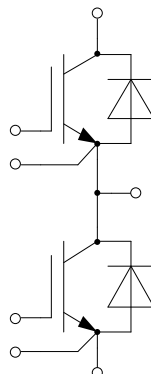
- Low $V_{CE(sat)}$ SPT+ IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Typical Applications

- Inverter for motor drive
- Wind turbine
- High power converter

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 @ $T_C=25^{\circ}\text{C}$	683	A
	@ $T_C=95^{\circ}\text{C}$	450	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	900	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	2678	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	V
I_F	Diode Continuous Forward Current	450	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	900	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	$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.00	2.45	V	
		$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.40			
		$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.50			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=18.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.4	6.1	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	
R_{Gint}	Internal Gate Resistance			0.3		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		30.0		nF	
C_{res}	Reverse Transfer Capacitance			1.08		nF	
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		2.70		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=450\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		504		ns	
t_r	Rise Time			183		ns	
$t_{d(off)}$	Turn-Off Delay Time			616		ns	
t_f	Fall Time			188		ns	
E_{on}	Turn-On Switching Loss			126		mJ	
E_{off}	Turn-Off Switching Loss			89		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=900\text{V}, I_C=450\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		506		ns
t_r	Rise Time				194		ns
$t_{d(off)}$	Turn-Off Delay Time			704		ns	
t_f	Fall Time			352		ns	
E_{on}	Turn-On Switching Loss			162		mJ	
E_{off}	Turn-Off Switching Loss			124		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=450\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			510		ns
t_r	Rise Time				198		ns
$t_{d(off)}$	Turn-Off Delay Time			727		ns	
t_f	Fall Time			429		ns	
E_{on}	Turn-On Switching Loss			174		mJ	
E_{off}	Turn-Off Switching Loss			132		mJ	
I_{SC}	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		1440		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	$I_F=450\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.87	2.32	V
		$I_F=450\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		2.00		
		$I_F=450\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		2.05		
Q_r	Recovered Charge			107		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}, I_F=450\text{A},$ $-di/dt=3000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		519		A
E_{rec}	Reverse Recovery Energy			75		mJ
Q_r	Recovered Charge			159		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}, I_F=450\text{A},$ $-di/dt=3000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		597		A
E_{rec}	Reverse Recovery Energy			113		mJ
Q_r	Recovered Charge			170		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}, I_F=450\text{A},$ $-di/dt=3000\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		611		A
E_{rec}	Reverse Recovery Energy			119		mJ

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance			20	nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.35		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			0.056	K/W
	Junction-to-Case (per Diode)			0.112	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.105		K/W
	Case-to-Heatsink (per Diode)		0.210		
	Case-to-Heatsink (per Module)		0.035		
M	Terminal Connection Torque, Screw M6	2.5		5.0	N.m
	Mounting Torque, Screw M6	3.0		5.0	
G	Weight of Module		300		g

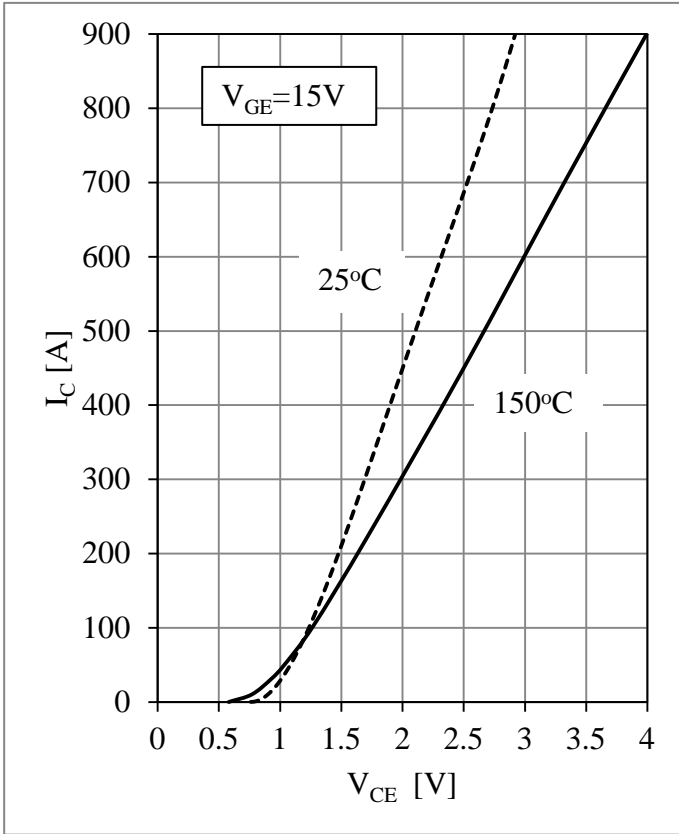


Fig 1. IGBT Output Characteristics

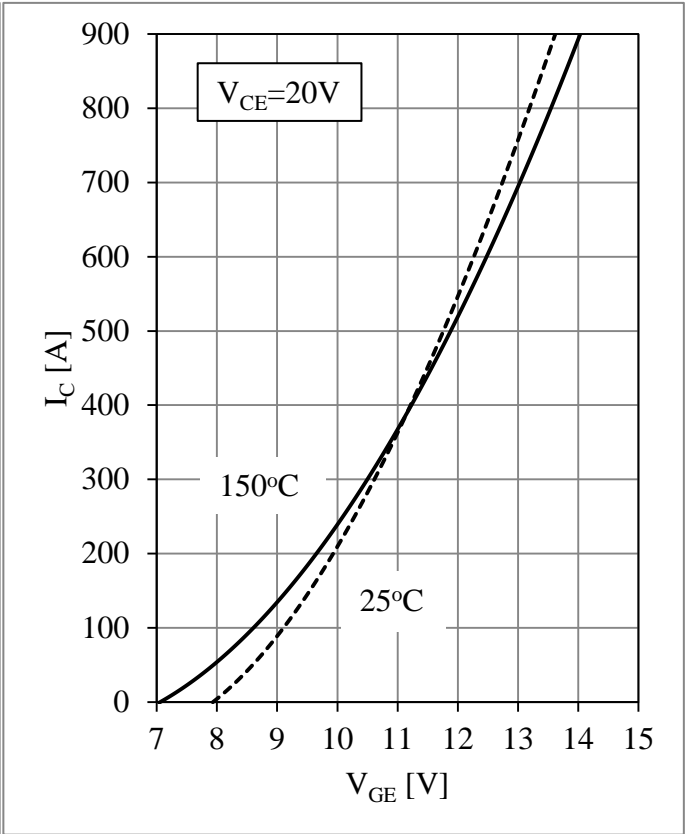


Fig 2. IGBT Transfer Characteristics

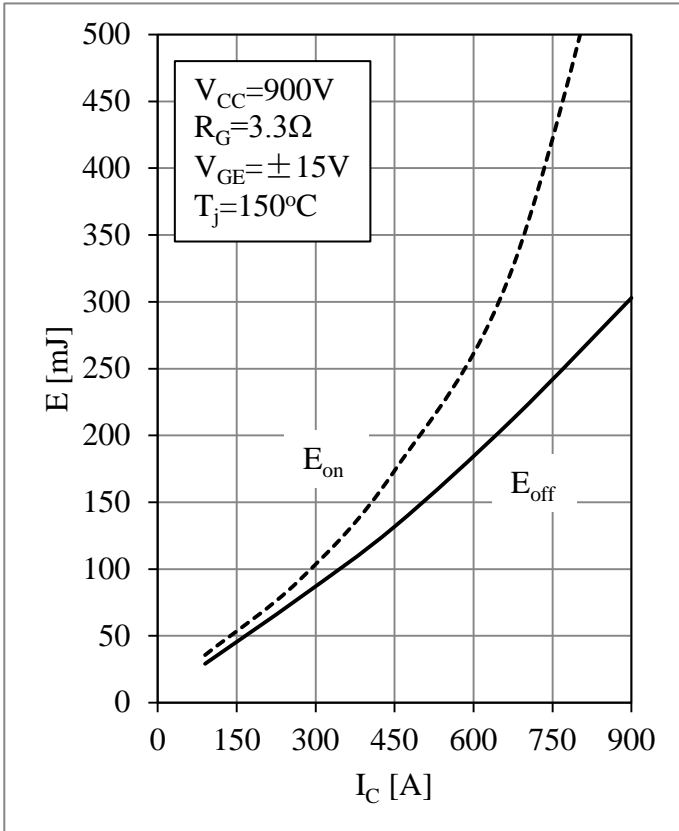


Fig 3. IGBT Switching Loss vs. I_C

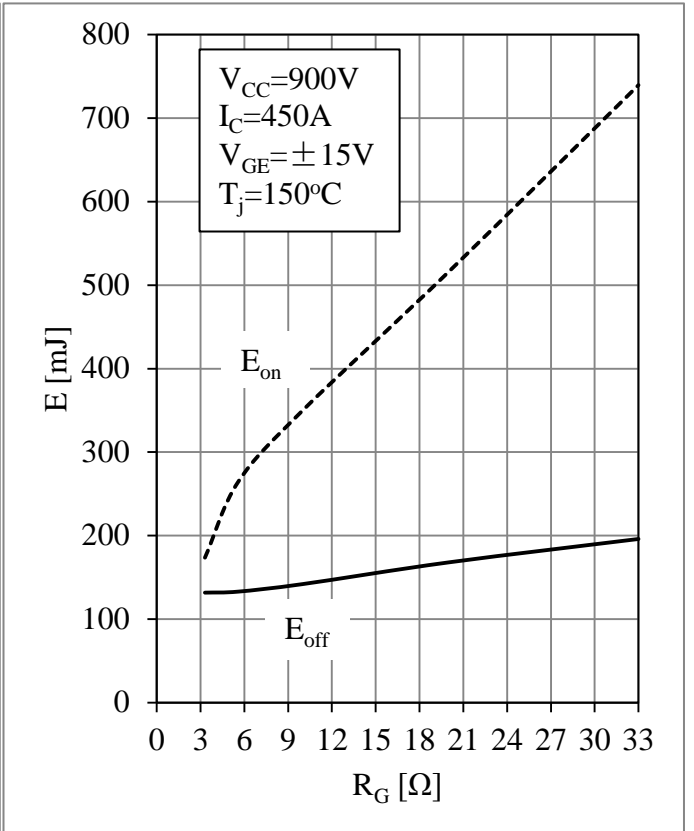


Fig 4. IGBT Switching Loss vs. R_G

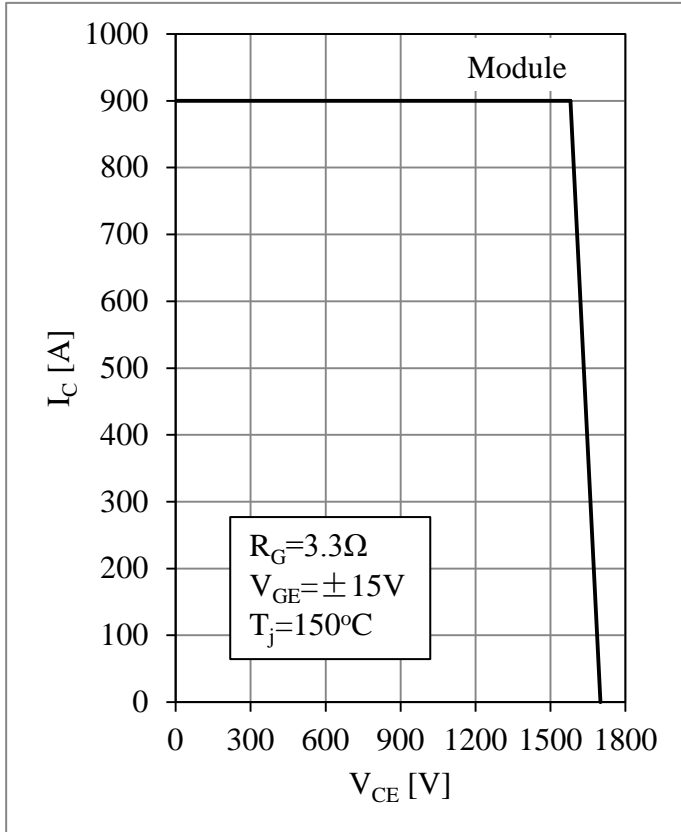


Fig 5. RBSOA

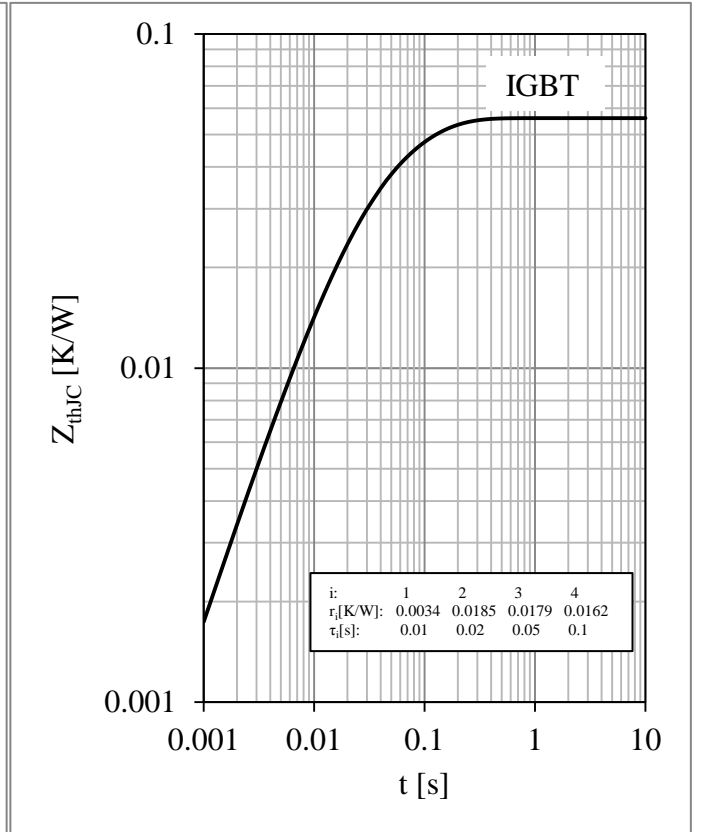


Fig 6. IGBT Transient Thermal Impedance

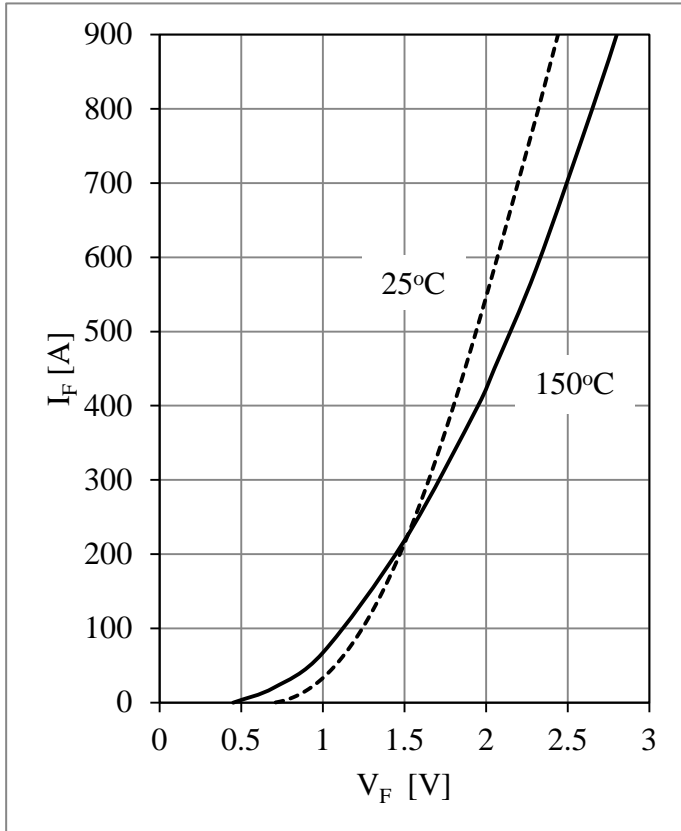


Fig 7. Diode Forward Characteristics

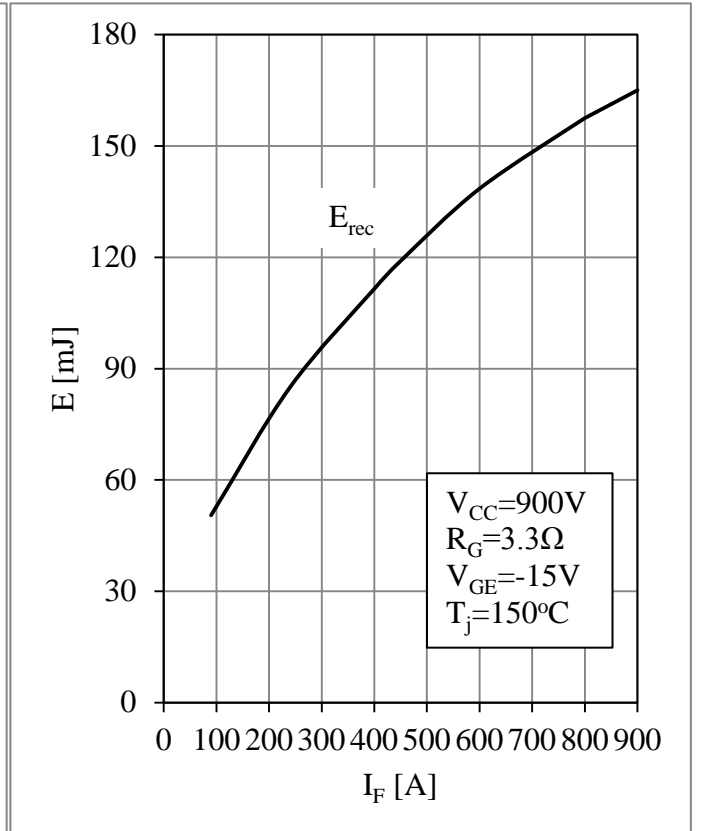


Fig 8. Diode Switching Loss vs. I_F

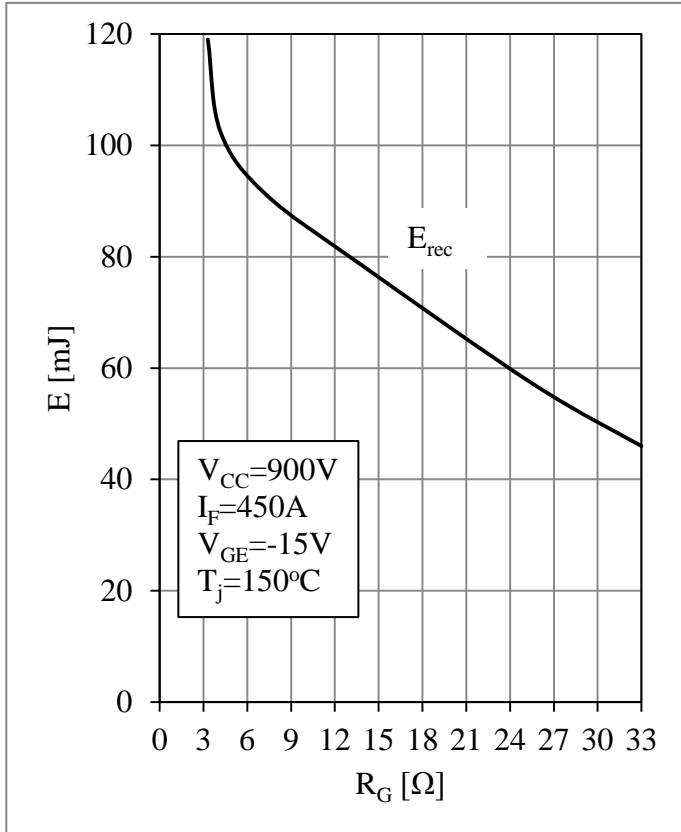


Fig 9. Diode Switching Loss vs. R_G

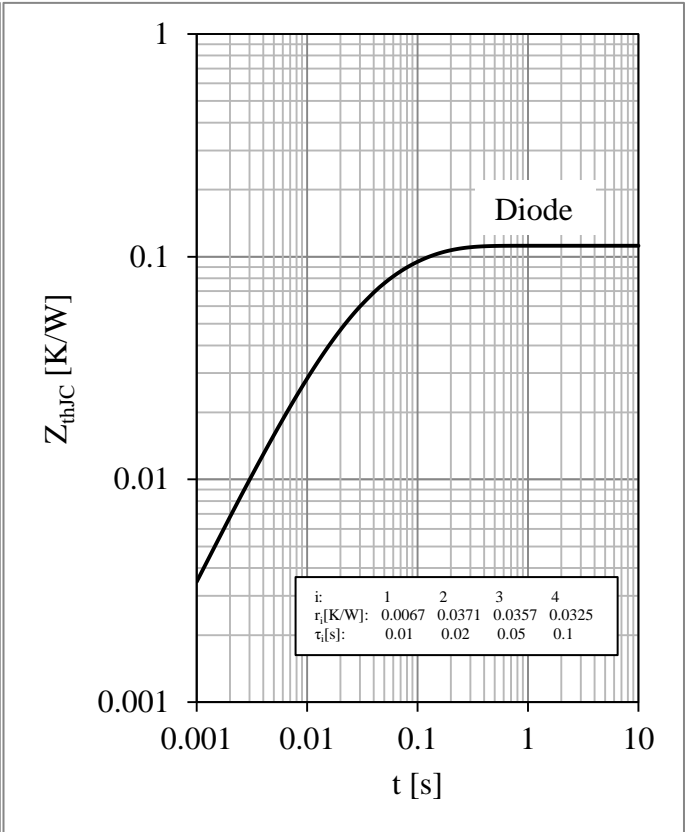
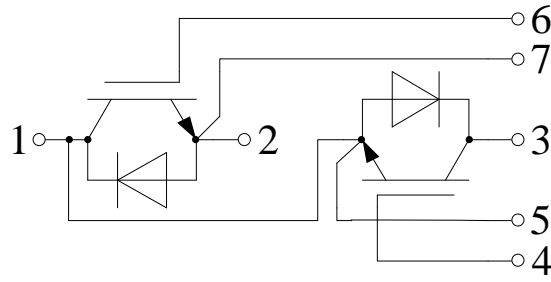


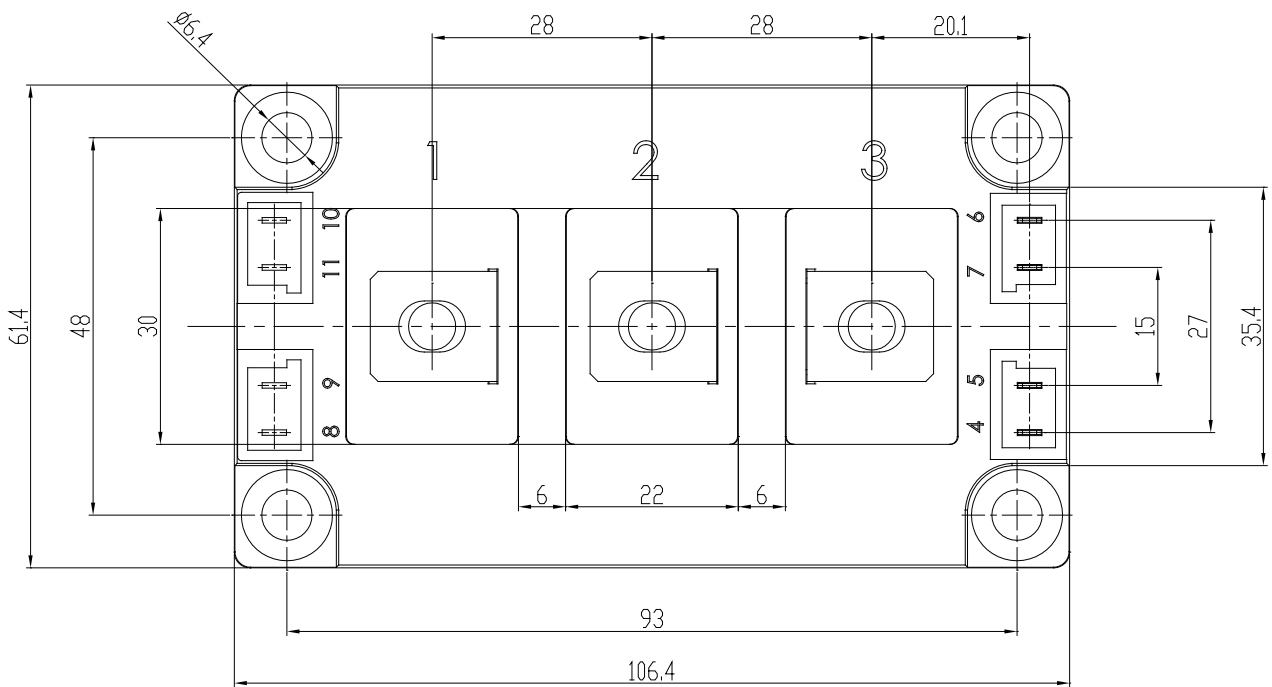
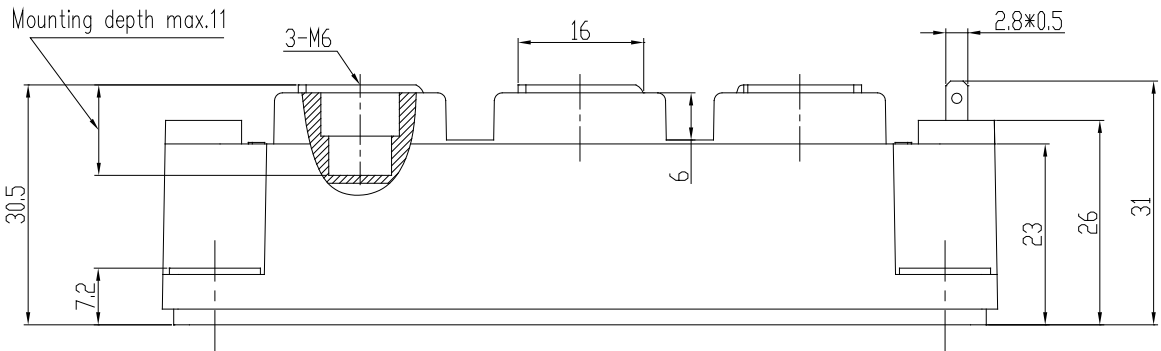
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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