

# STARPOWER

SEMICONDUCTOR

IGBT

## GD300HFF120C2S

1200V/300A 2 in one-package

### General Description

STARPOWER IGBT Power Module provides ultra switching speed as well as short circuit ruggedness. They are designed for the applications such as electronic welder and inductive heating.

### Features

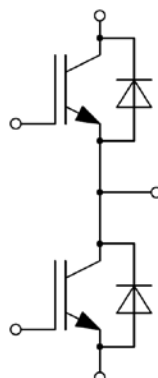
- Low  $V_{CE(sat)}$  Trench IGBT technology
- $V_{CE(sat)}$  with positive temperature coefficient
- Low switching losses
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



### Typical Applications

- Switching mode power supply
- Inductive heating
- Electronic welder

### 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	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^{\circ}\text{C}$	444	A
	@ $T_C=85^{\circ}\text{C}$	300	
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	600	A
$P_D$	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	1595	W

**Diode**

Symbol	Description	Value	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_F$	Diode Continuous Forward Current	300	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	600	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	$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.90	2.35	V
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.40		
		$I_C=300\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.55		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=7.5\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.2	6.0	6.8	V
$I_{CES}$	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			1.0	mA
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			100	nA
$R_{Gint}$	Internal Gate Resistance			2.5		$\Omega$
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		31.1		nF
$C_{res}$	Reverse Transfer Capacitance			0.87		nF
$Q_G$	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		2.33		$\mu\text{C}$
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=300\text{A}, R_G=0.5\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		374		ns
$t_r$	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			326		ns
$t_f$	Fall Time			204		ns
$E_{on}$	Turn-On Switching Loss			20.7		mJ
$E_{off}$	Turn-Off Switching Loss			10.4		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=300\text{A}, R_G=0.5\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		419		ns
$t_r$	Rise Time			63		ns
$t_{d(off)}$	Turn-Off Delay Time			383		ns
$t_f$	Fall Time			218		ns
$E_{on}$	Turn-On Switching Loss			31.2		mJ
$E_{off}$	Turn-Off Switching Loss			17.8		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=300\text{A}, R_G=0.5\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$		419		ns
$t_r$	Rise Time			65		ns
$t_{d(off)}$	Turn-Off Delay Time			388		ns
$t_f$	Fall Time			222		ns
$E_{on}$	Turn-On Switching Loss			34.4		mJ
$E_{off}$	Turn-Off Switching Loss			17.9		mJ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage	$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.90	2.35	V
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.90		
		$I_F=300\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.90		
$Q_r$	Recovered Charge			15.3		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=300\text{A},$ $-di/dt=4800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		135		A
$E_{rec}$	Reverse Recovery Energy			5.1		mJ
$Q_r$	Recovered Charge			39.3		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=300\text{A},$ $-di/dt=4800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		198		A
$E_{rec}$	Reverse Recovery Energy			14.6		mJ
$Q_r$	Recovered Charge			45.6		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=300\text{A},$ $-di/dt=4800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		213		A
$E_{rec}$	Reverse Recovery Energy			17.0		mJ

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
$L_{CE}$	Stray Inductance		15		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.25		m $\Omega$
$R_{thJC}$	Junction-to-Case (per IGBT)			0.094	K/W
	Junction-to-Case (per Diode)			0.105	
$R_{thCH}$	Case-to-Heatsink (per IGBT)		0.038		K/W
	Case-to-Heatsink (per Diode)		0.042		
	Case-to-Heatsink (per Module)		0.010		
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

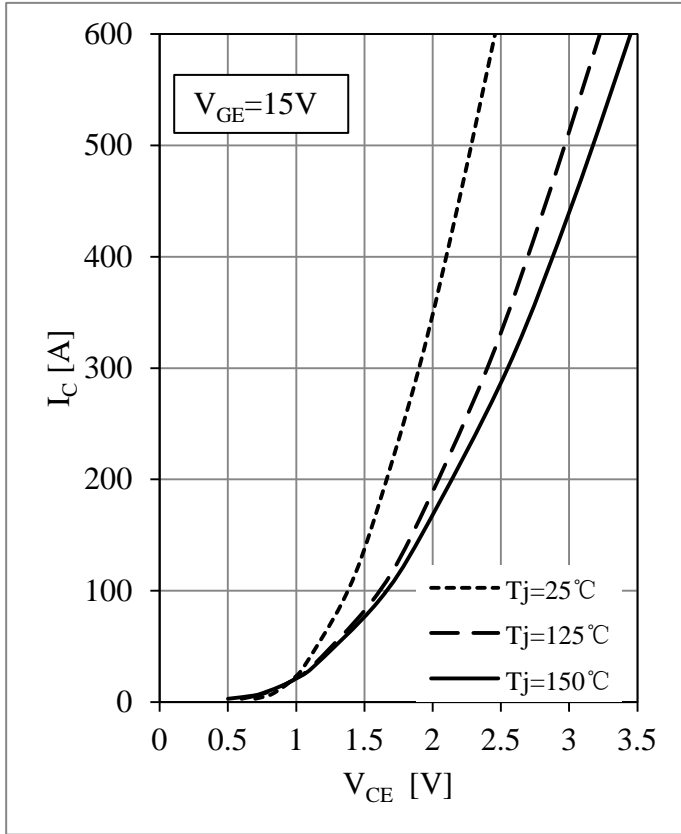


Fig 1. IGBT Output Characteristics

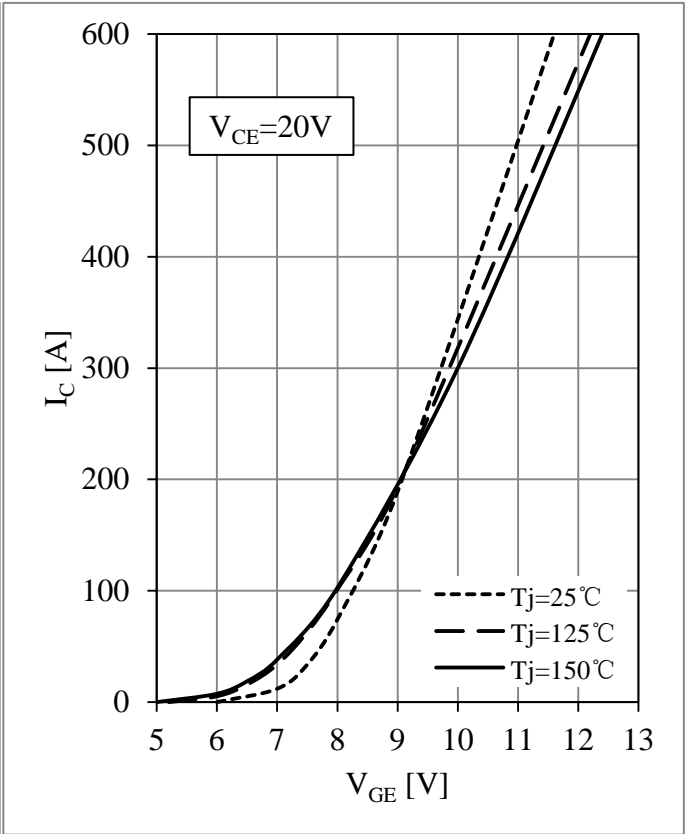


Fig 2. IGBT Transfer Characteristics

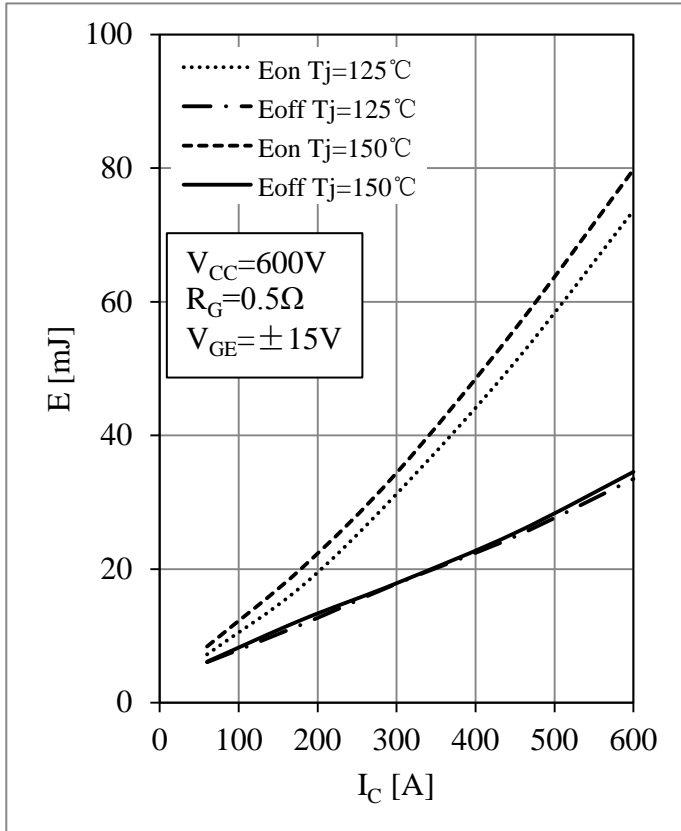


Fig 3. IGBT Switching Loss vs.  $I_C$

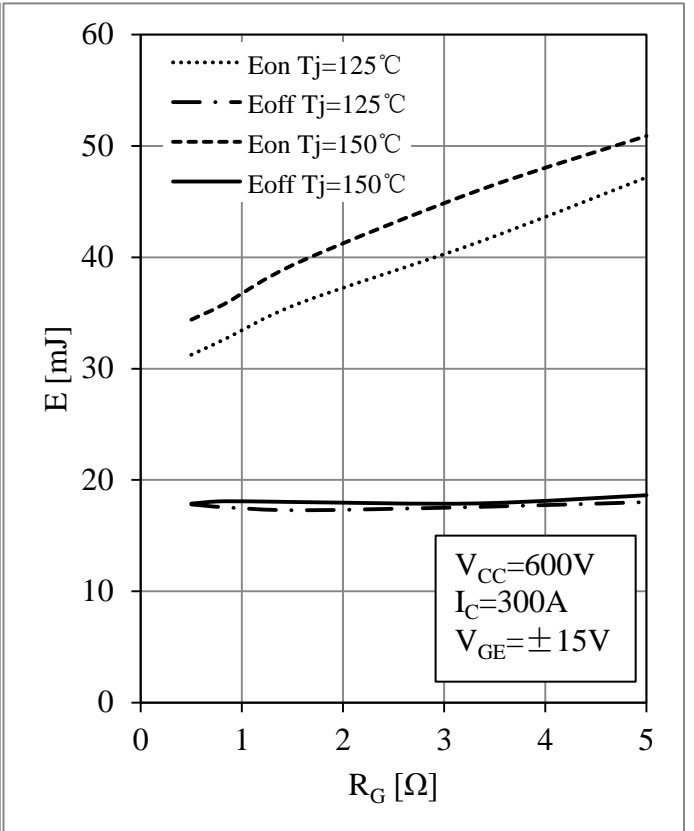


Fig 4. IGBT Switching Loss vs.  $R_G$

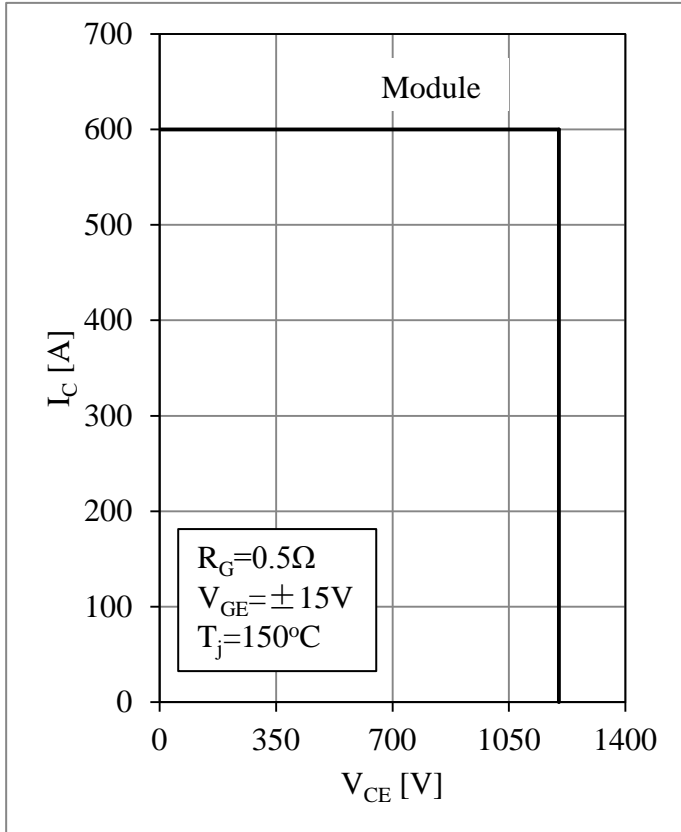


Fig 5. RBSOA

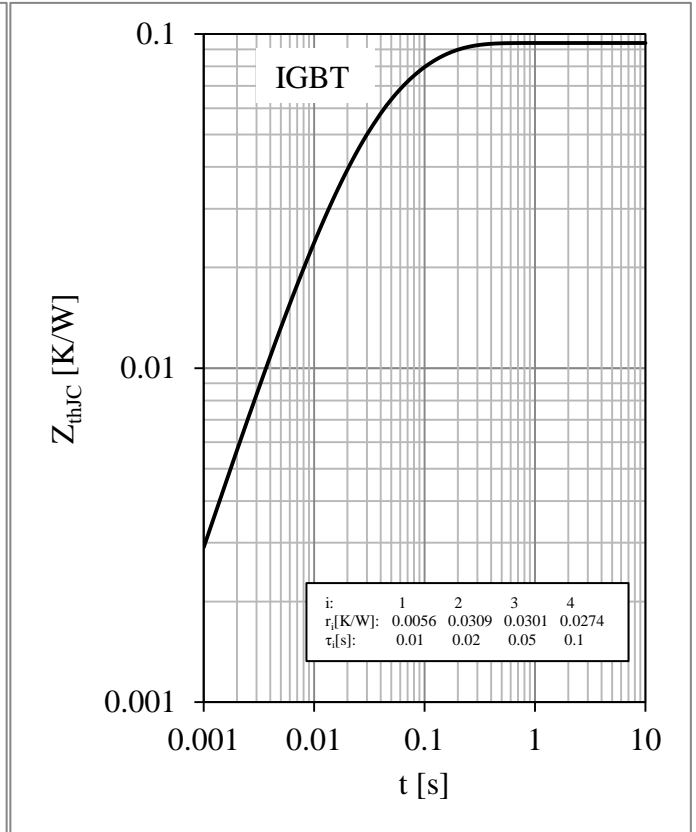


Fig 6. IGBT Transient Thermal Impedance

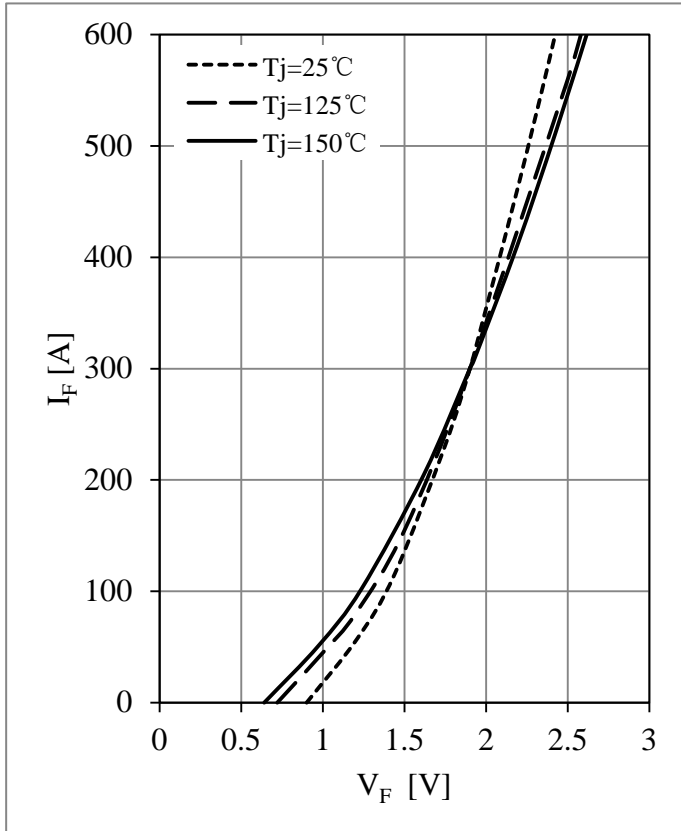


Fig 7. Diode Forward Characteristics

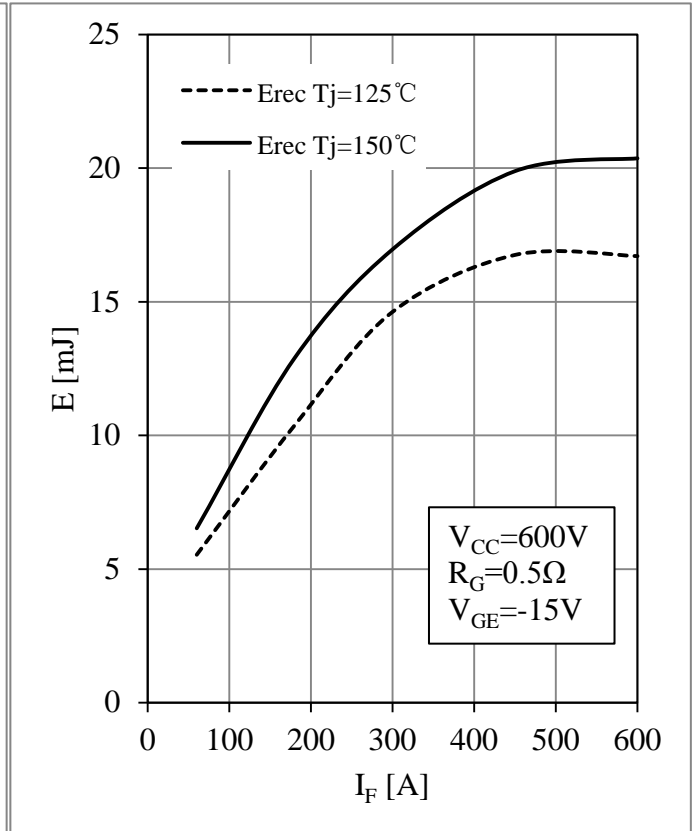


Fig 8. Diode Switching Loss vs.  $I_F$

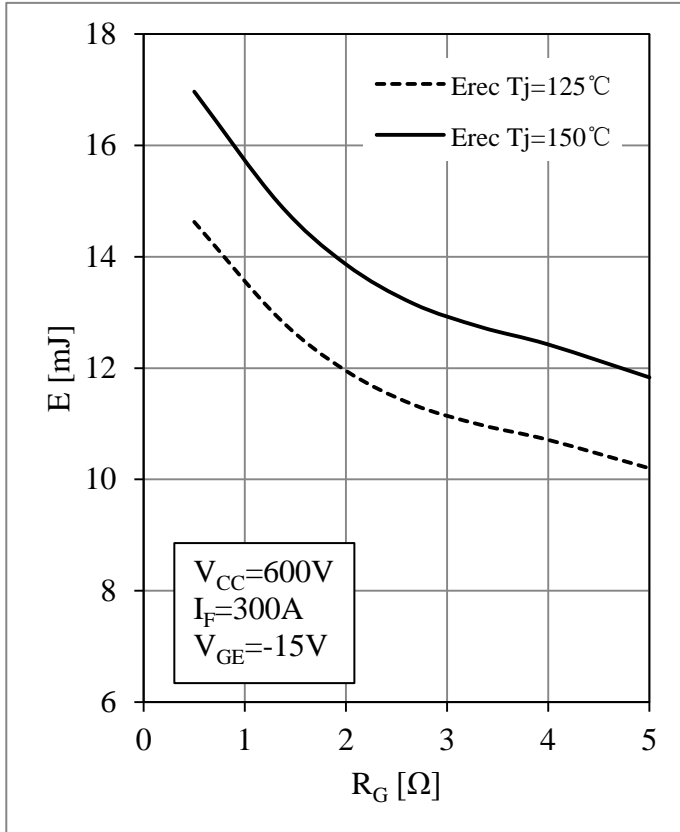


Fig 9. Diode Switching Loss vs.  $R_G$

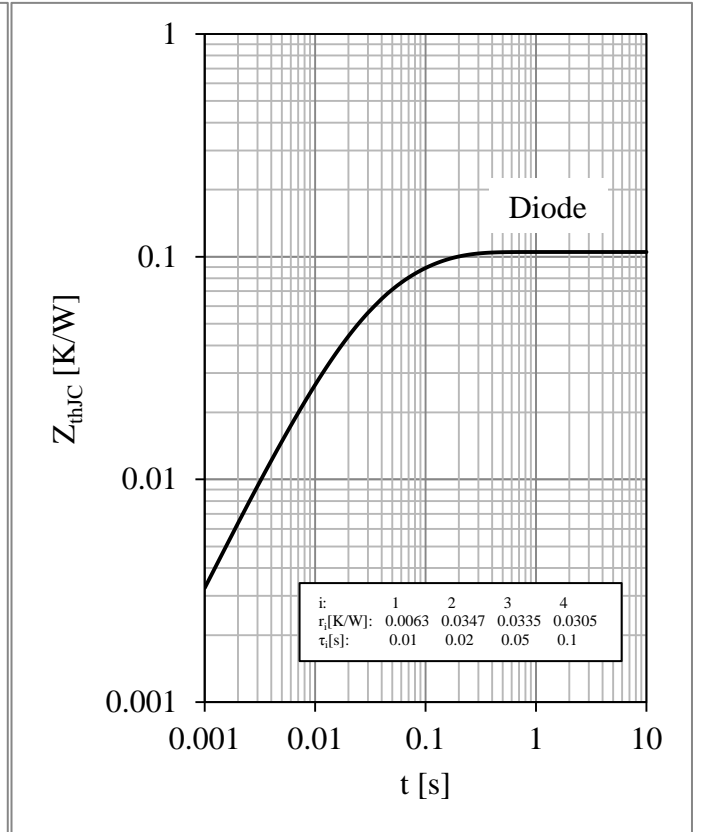


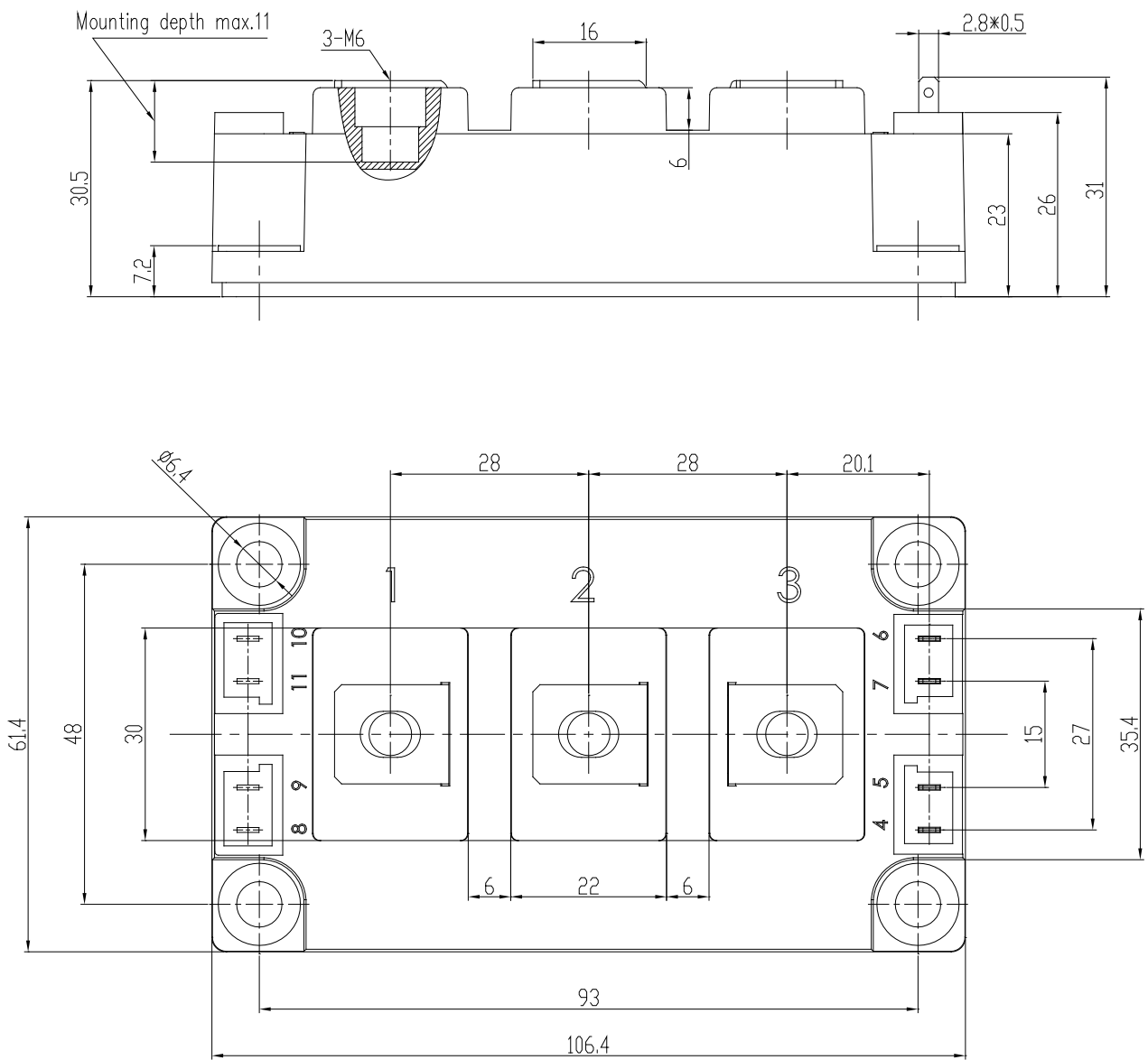
Fig 10. Diode Transient Thermal Impedance

**Circuit Schematic**



**Package Dimensions**

Dimensions in Millimeters





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