

# STARPOWER

SEMICONDUCTOR™

# IGBT

## GD400SGT120C2S

Molding Type Module

1200V/400A 1 in one-package

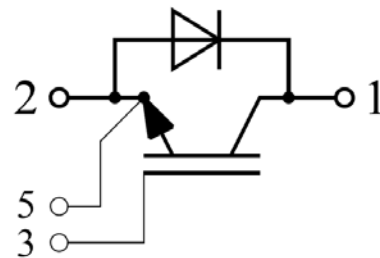
### General Description

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



### Features

- Low  $V_{CE(sat)}$  trench IGBT technology
- Low switching loss
- 10 $\mu$ s short circuit capability
- Low inductance case
- $V_{CE(sat)}$  with positive temperature coefficient
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Equivalent Circuit Schematic

### Typical Applications

- AC inverter drives
- Switching mode power supplies
- UPS

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

Symbol	Description	GD400SGT120C2S	Units
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^\circ\text{C}$	680	A
	@ $T_C=80^\circ\text{C}$	400	
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	800	A
$I_F$	Diode Continuous Forward Current @ $T_C=80^\circ\text{C}$	400	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	800	A
$P_D$	Maximum Power Dissipation @ $T_j=175^\circ\text{C}$	2419	W
$T_{jmax}$	Maximum Junction Temperature	175	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-40 to +125	$^\circ\text{C}$
$V_{ISO}$	Isolation Voltage RMS, $f=50\text{Hz}$ , $t=1\text{min}$	2500	V
Mounting Torque	Power Terminal Screw:M4	1.1 to 2.0	N.m
	Power Terminal Screw:M6	2.5 to 5.0	
	Mounting Screw:M6	3.0 to 5.0	N.m

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^\circ\text{C}$	1200			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

**On Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=16.0\text{mA}$ , $V_{CE}=V_{GE}$ , $T_j=25^\circ\text{C}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=400\text{A}$ , $V_{GE}=15\text{V}$ , $T_j=25^\circ\text{C}$		1.70	2.05	V
		$I_C=400\text{A}$ , $V_{GE}=15\text{V}$ , $T_j=125^\circ\text{C}$		2.00		

**Switching Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=400A,$ $R_G=1.8\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		251		ns
$t_r$	Rise Time			89		ns
$t_{d(off)}$	Turn-Off Delay Time			555		ns
$t_f$	Fall Time			128		ns
$E_{on}$	Turn-On Switching Loss			23.0		mJ
$E_{off}$	Turn-Off Switching Loss			39.5		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=400A,$ $R_G=1.8\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		302		ns
$t_r$	Rise Time			101		ns
$t_{d(off)}$	Turn-Off Delay Time			650		ns
$t_f$	Fall Time			179		ns
$E_{on}$	Turn-On Switching Loss			33.1		mJ
$E_{off}$	Turn-Off Switching Loss			58.9		mJ
$C_{ies}$	Input Capacitance	$V_{CE}=25V, f=1MHz,$ $V_{GE}=0V$		28.8		nF
$C_{oes}$	Output Capacitance			1.51		nF
$C_{res}$	Reverse Transfer Capacitance			1.31		nF
$I_{SC}$	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		1600		A
$R_{Gint}$	Internal Gate Resistance			1.9		$\Omega$
$L_{CE}$	Stray Inductance				20	nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal To Chip			0.18		m $\Omega$

**Electrical Characteristics of DIODE**  $T_C=25^\circ C$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_F$	Diode Forward Voltage	$I_F=400A$	$T_j=25^\circ C$	1.65	2.10	V
			$T_j=125^\circ C$	1.65		
$Q_r$	Recovered Charge	$I_F=400A,$	$T_j=25^\circ C$	39.8		$\mu C$
			$T_j=125^\circ C$	75.1		
$I_{RM}$	Peak Reverse Recovery Current	$V_R=600V,$ $R_G=1.8\Omega,$	$T_j=25^\circ C$	275		A
			$T_j=125^\circ C$	362		
$E_{rec}$	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$	18.0		mJ
			$T_j=125^\circ C$	34.1		

**Thermal Characteristics**

<b>Symbol</b>	<b>Parameter</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
$R_{\theta JC}$	Junction-to-Case (per IGBT)		0.067	K/W
$R_{\theta JC}$	Junction-to-Case (per DIODE)		0.124	K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)	0.035		K/W
Weight	Weight of Module	300		g

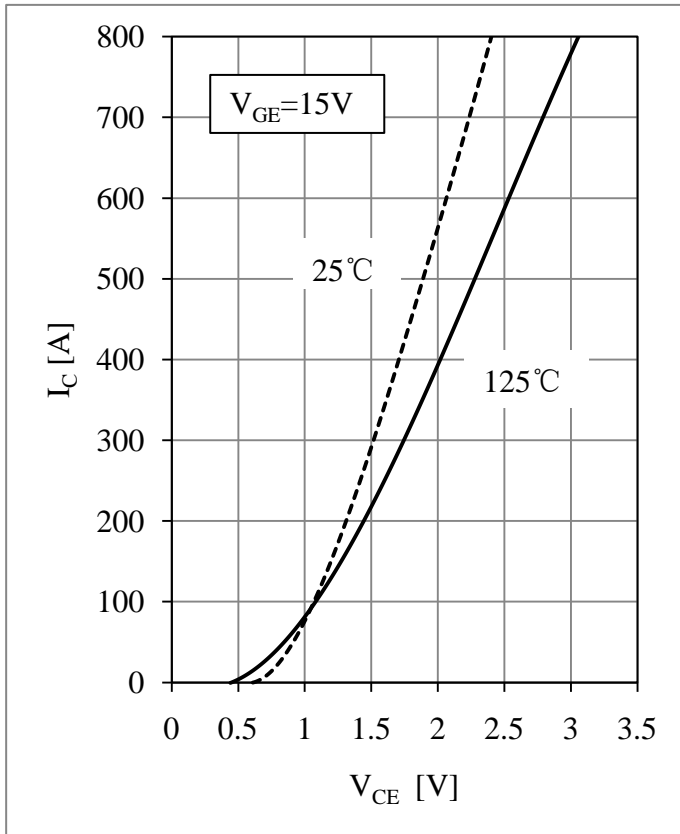


Fig 1. IGBT Output Characteristic

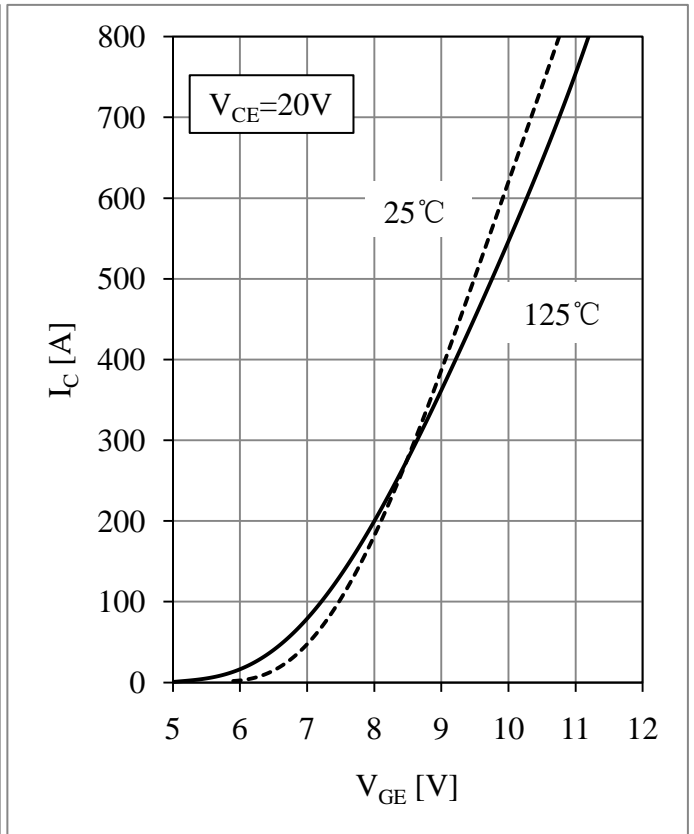


Fig 2. IGBT Transfer Characteristic

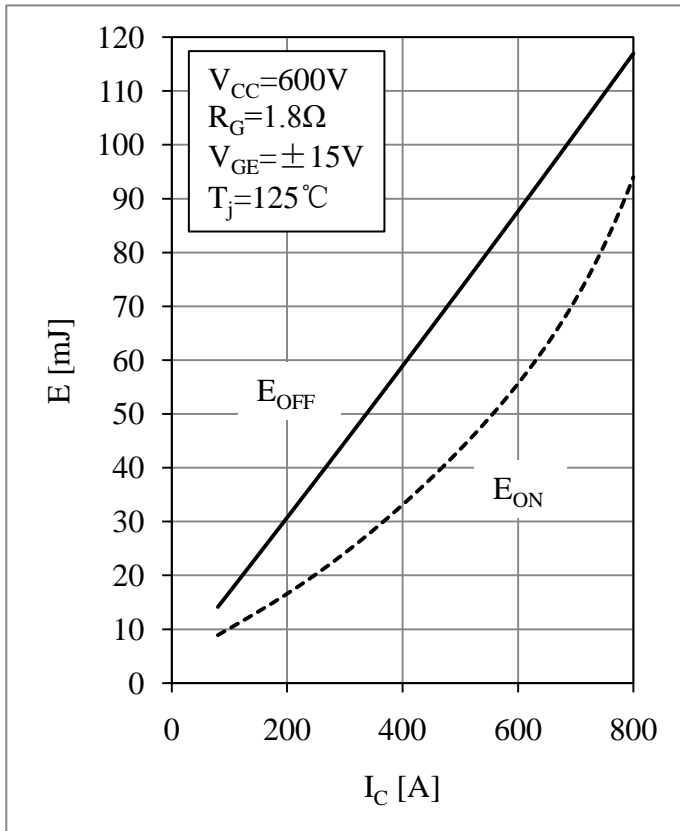


Fig 3. IGBT Switching Loss vs.  $I_C$

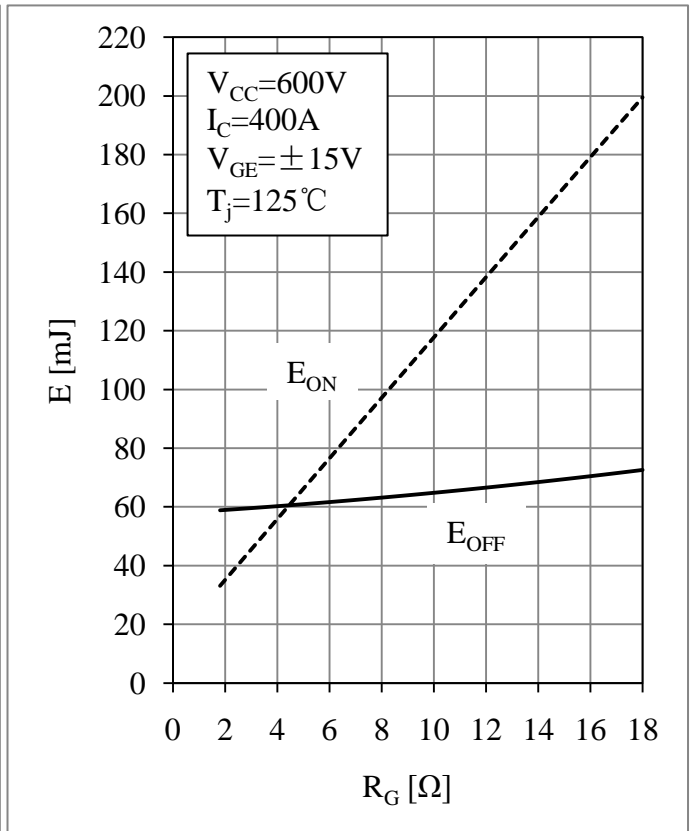


Fig 4. IGBT Switching Loss vs.  $R_G$

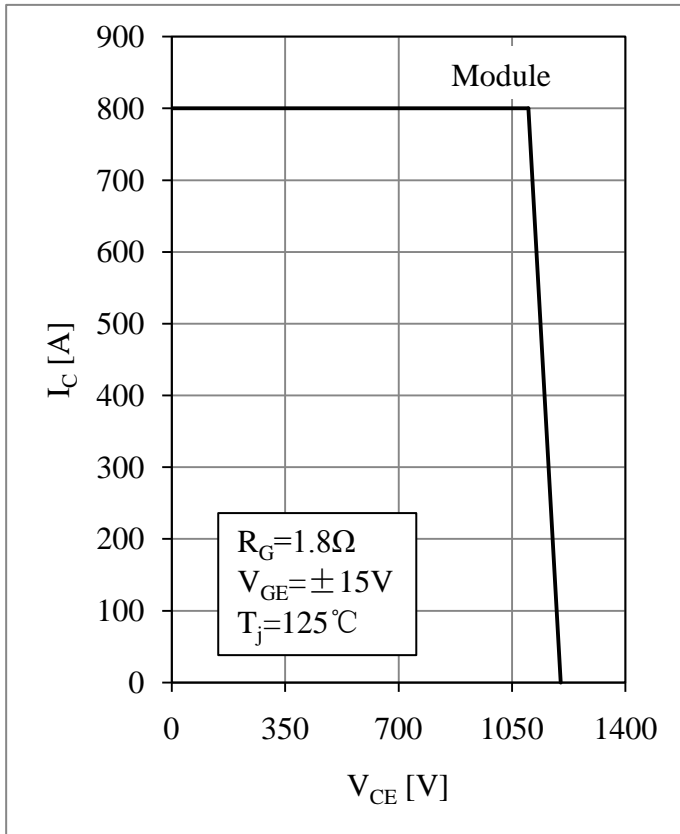


Fig 5. RBSOA

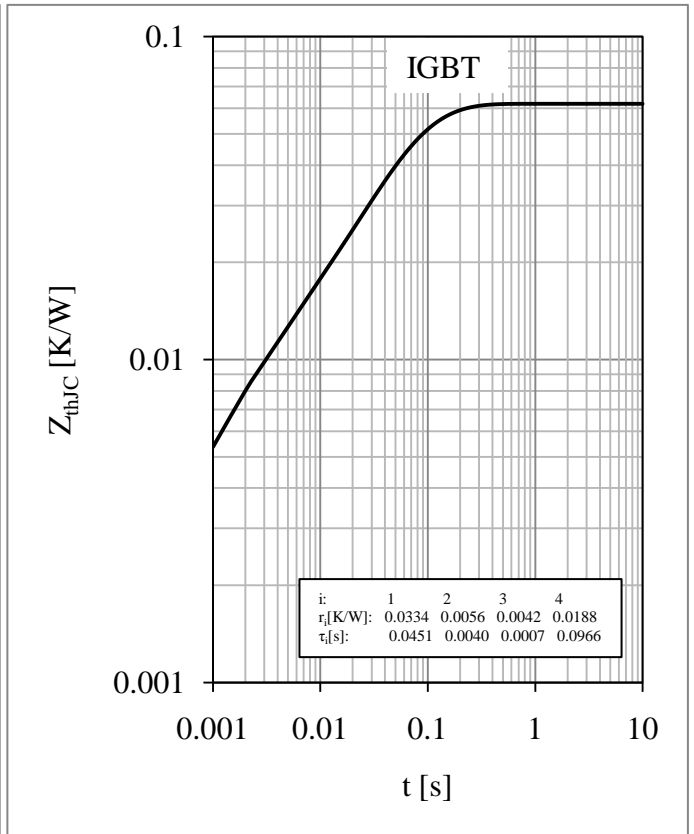


Fig 6. IGBT Transient Thermal Impedance

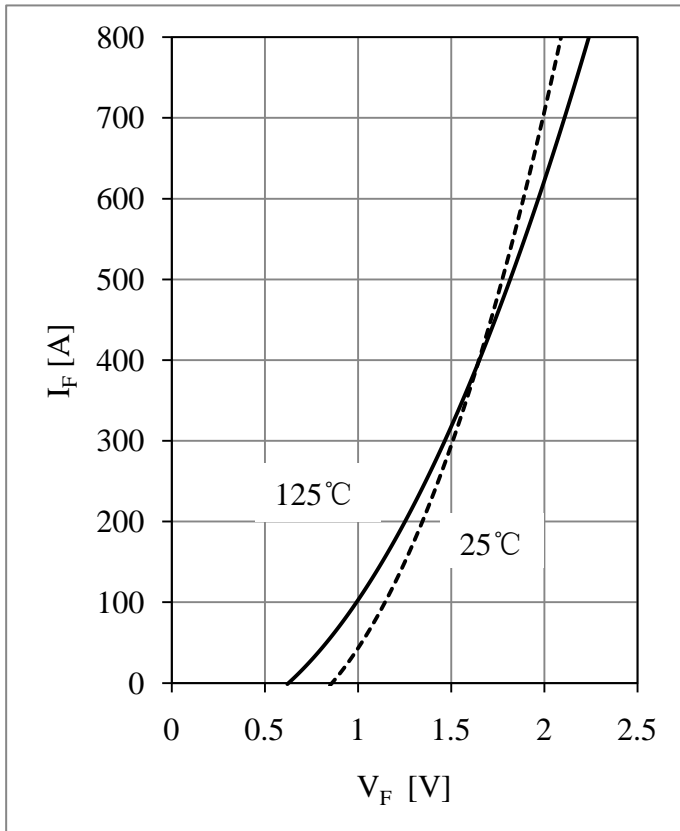


Fig 7. Diode Forward Characteristic

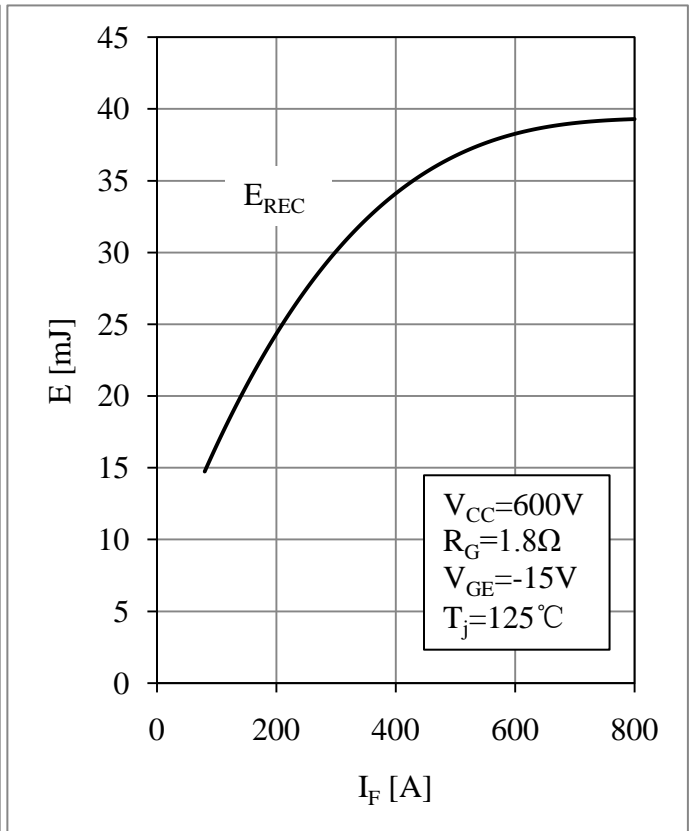


Fig 8. Diode Switching Loss vs.  $I_F$

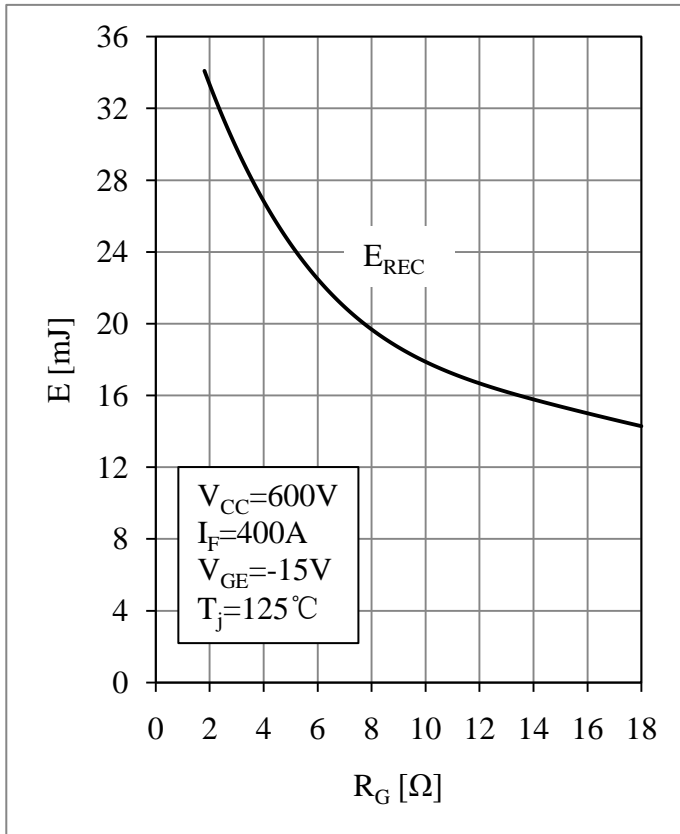


Fig 9. Diode Switching Loss vs.  $R_G$

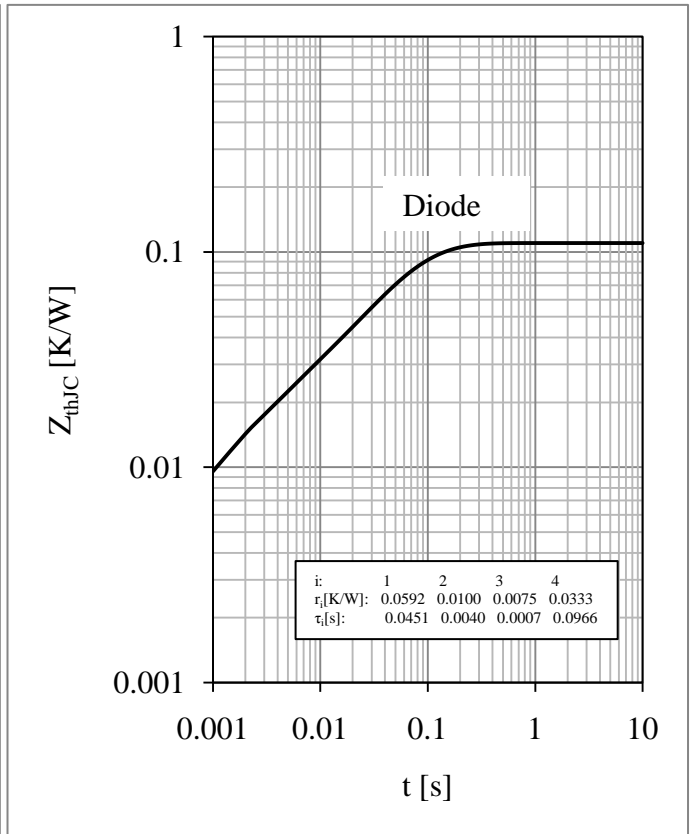
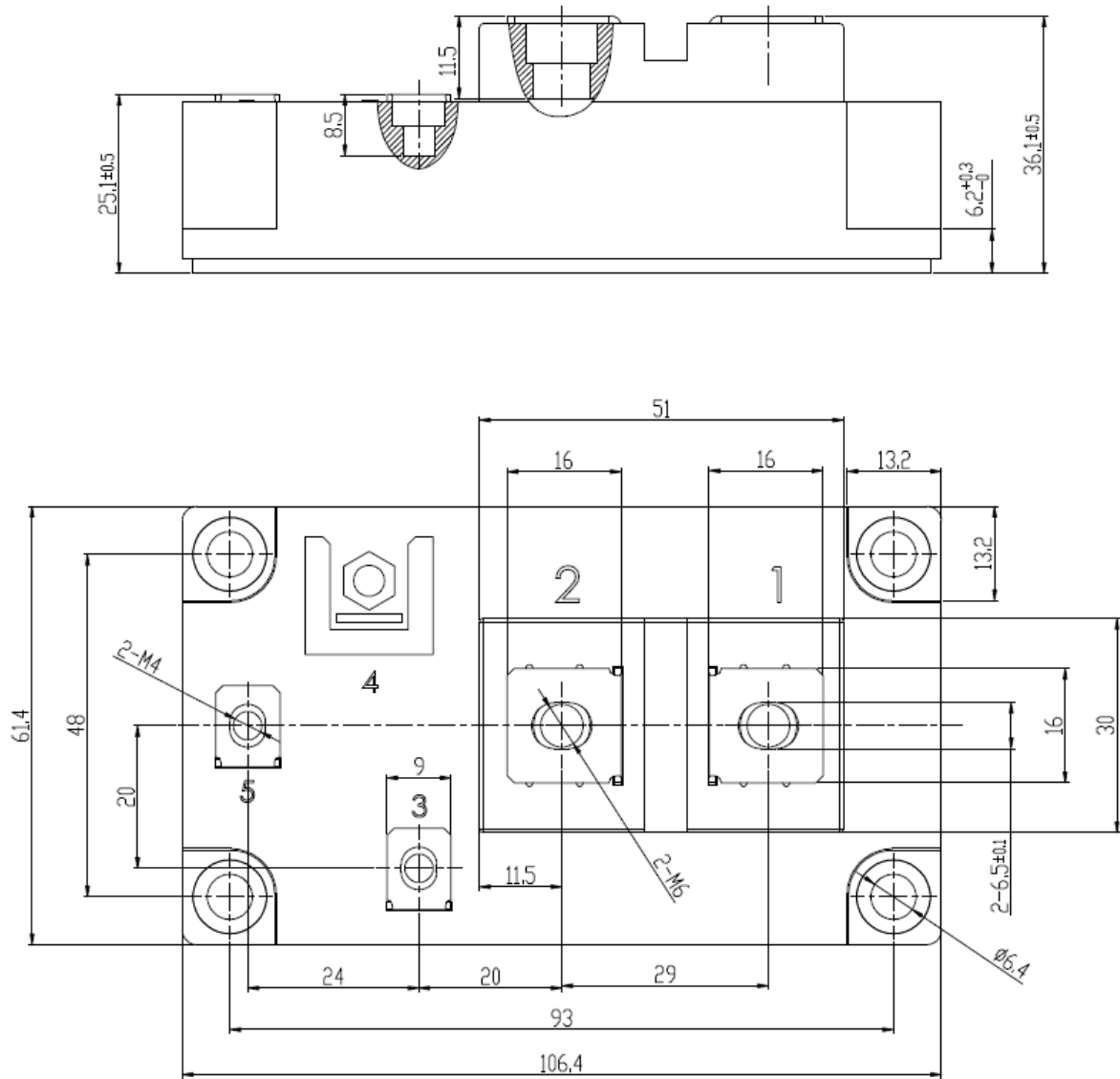


Fig 10. Diode Transient Thermal Impedance

**Package Dimensions**

Dimensions in Millimeters





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