

STARPOWER

SEMICONDUCTOR

IGBT

GD600HFX120C2SA_B20

1200V/600A 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 and UPS.

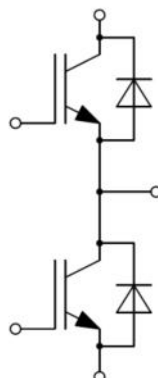
Features

- Low $V_{CE(sat)}$ Trench 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 HPS DBC technology

Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

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 Transient Gate-Emitter Voltage	± 20 ± 30	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	1096 600	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	1200	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	3947	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	600	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	1200	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	$I_C=600\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.70	2.15	V
		$I_C=600\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.05		
		$I_C=600\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.15		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=24.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.6	6.2	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	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^{\circ}\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			1.25		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		64.7		nF
C_{res}	Reverse Transfer Capacitance			1.88		nF
Q_G	Gate Charge	$V_{GE}=-15 \dots +15\text{V}$		5.38		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=600\text{A}, R_G=1.2\Omega, L_S=45\text{nH}, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		360		ns
t_r	Rise Time			100		ns
$t_{d(off)}$	Turn-Off Delay Time			487		ns
t_f	Fall Time			109		ns
E_{on}	Turn-On Switching Loss			72.4		mJ
E_{off}	Turn-Off Switching Loss			53.4		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=600\text{A}, R_G=1.2\Omega, L_S=45\text{nH}, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		380		ns
t_r	Rise Time			115		ns
$t_{d(off)}$	Turn-Off Delay Time			541		ns
t_f	Fall Time			189		ns
E_{on}	Turn-On Switching Loss			114		mJ
E_{off}	Turn-Off Switching Loss			69.1		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=600\text{A}, R_G=1.2\Omega, L_S=45\text{nH}, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		389		ns
t_r	Rise Time			120		ns
$t_{d(off)}$	Turn-Off Delay Time			561		ns
t_f	Fall Time			213		ns
E_{on}	Turn-On Switching Loss			128		mJ
E_{off}	Turn-Off Switching Loss			72.8		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$		2400		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	$I_F=600\text{A}, V_{GE}=0\text{V}, T_J=25^{\circ}\text{C}$		1.85	2.30	V
		$I_F=600\text{A}, V_{GE}=0\text{V}, T_J=125^{\circ}\text{C}$		1.90		
		$I_F=600\text{A}, V_{GE}=0\text{V}, T_J=150^{\circ}\text{C}$		1.95		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=600\text{A},$ $-di/dt=4820\text{A}/\mu\text{s}, V_{GE}=-15\text{V},$ $L_S=45\text{nH}, T_J=25^{\circ}\text{C}$		57.7		μC
I_{RM}	Peak Reverse Recovery Current			383		A
E_{rec}	Reverse Recovery Energy			27.5		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=600\text{A},$ $-di/dt=4090\text{A}/\mu\text{s}, V_{GE}=-15\text{V},$ $L_S=45\text{nH}, T_J=125^{\circ}\text{C}$		110		μC
I_{RM}	Peak Reverse Recovery Current			403		A
E_{rec}	Reverse Recovery Energy			45.0		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=600\text{A},$ $-di/dt=3860\text{A}/\mu\text{s}, V_{GE}=-15\text{V},$ $L_S=45\text{nH}, T_J=150^{\circ}\text{C}$		125		μC
I_{RM}	Peak Reverse Recovery Current			404		A
E_{rec}	Reverse Recovery Energy			50.7		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		0.42		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			0.038	K/W
	Junction-to-Case (per Diode)			0.070	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.031		K/W
	Case-to-Heatsink (per Diode)		0.057		
	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		320		g

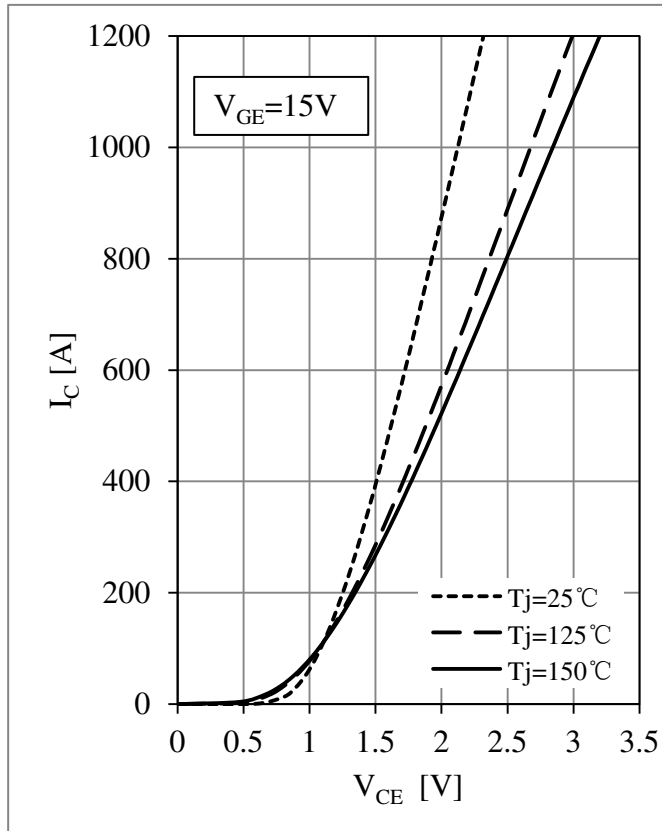


Fig 1. IGBT Output Characteristics

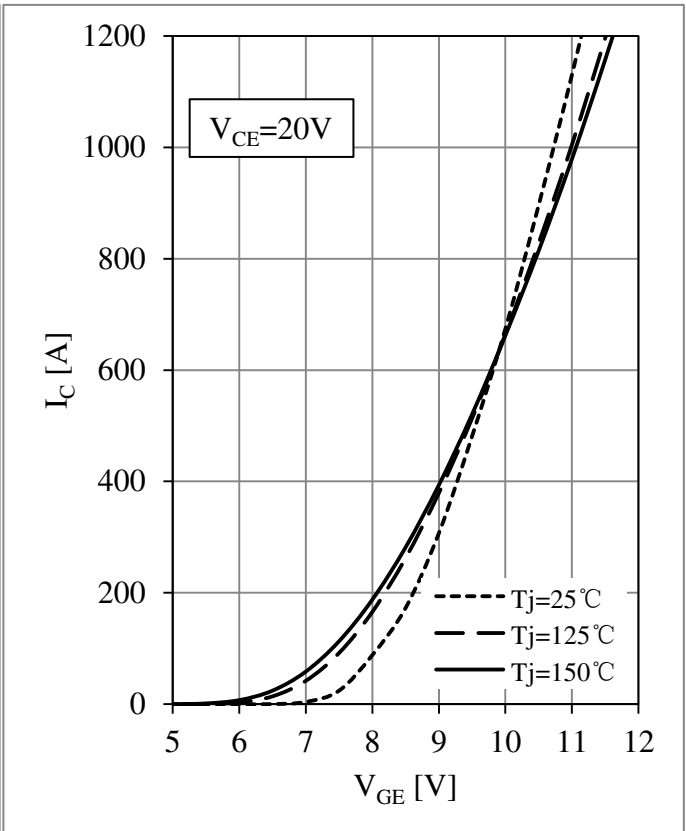
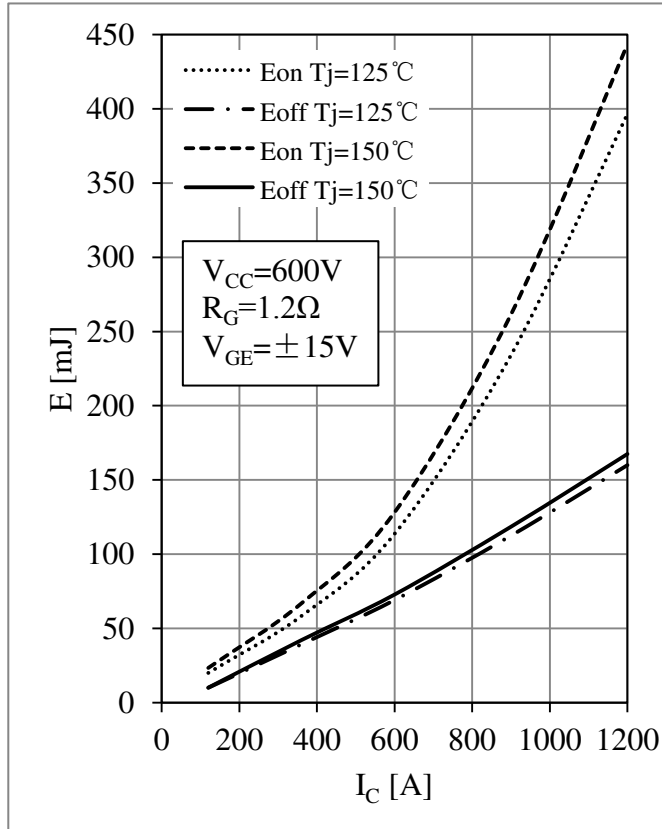
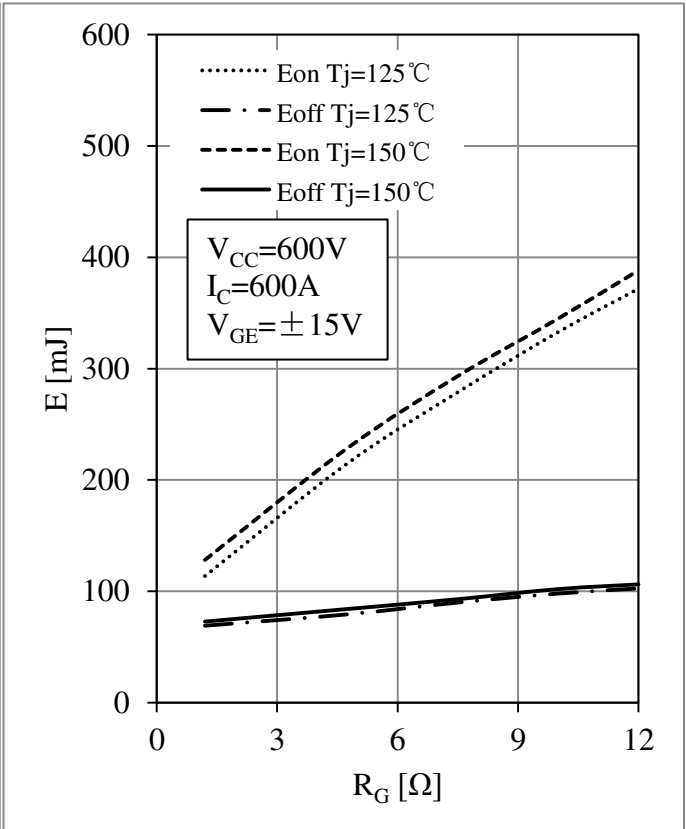


Fig 2. IGBT Transfer Characteristics

Fig 3. IGBT Switching Loss vs. I_C Fig 4. IGBT Switching Loss vs. R_G

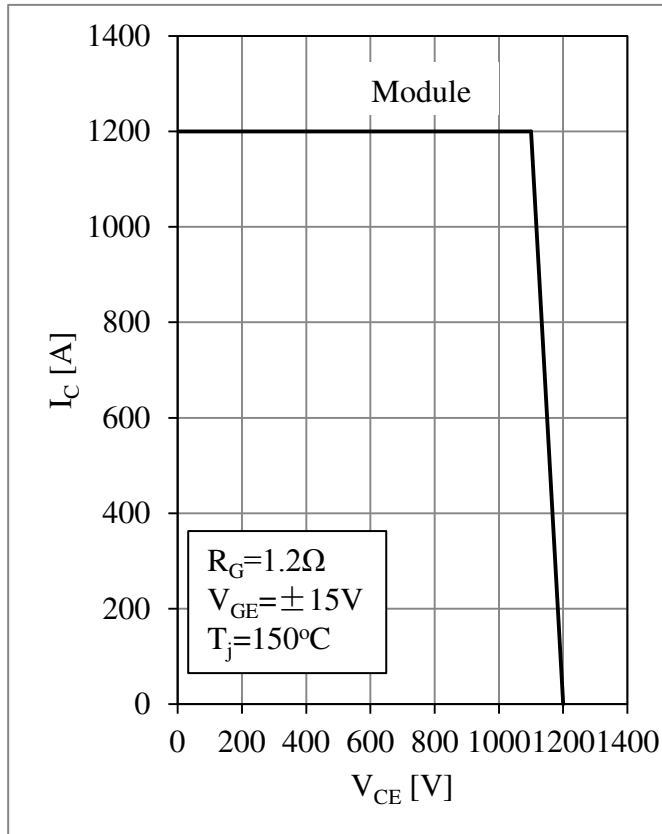


Fig 5. RBSOA

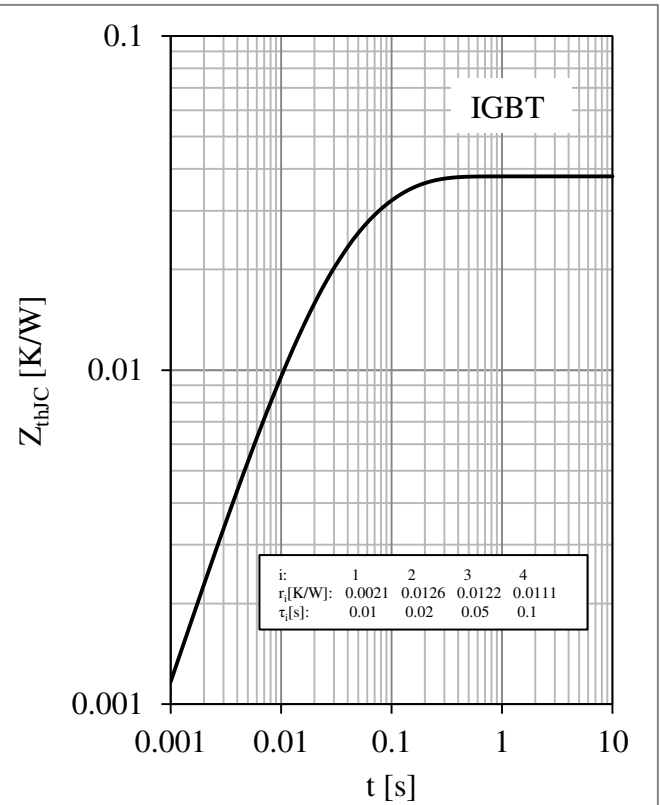


Fig 6. IGBT Transient Thermal Impedance

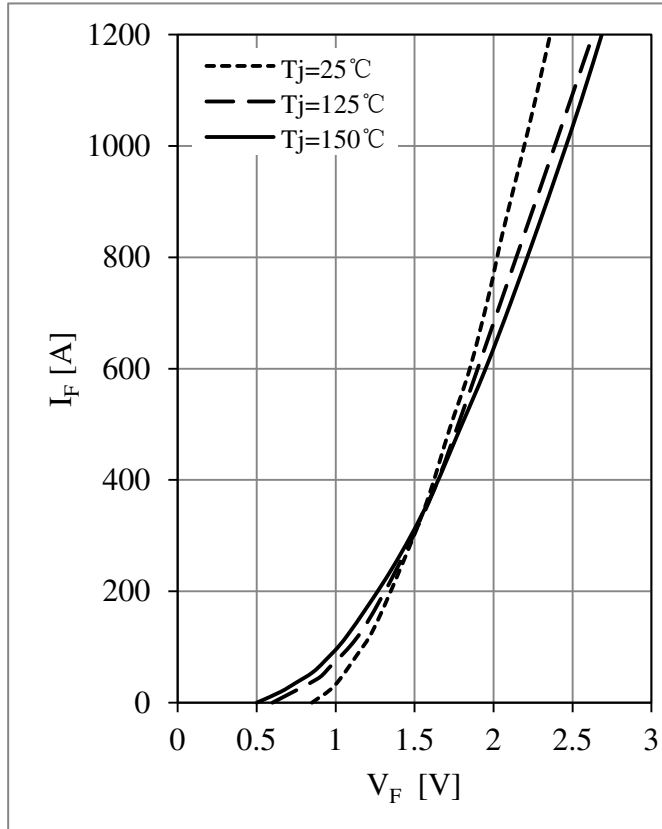
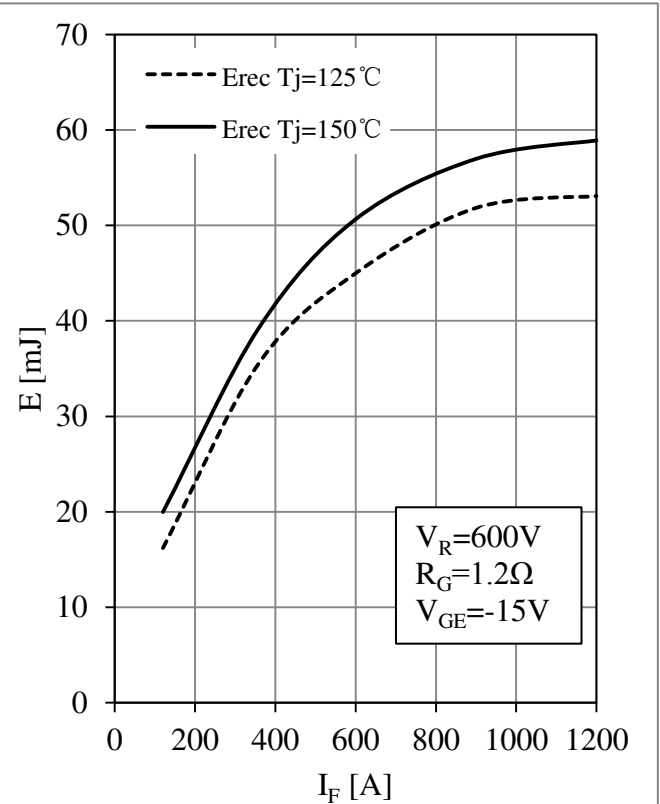


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

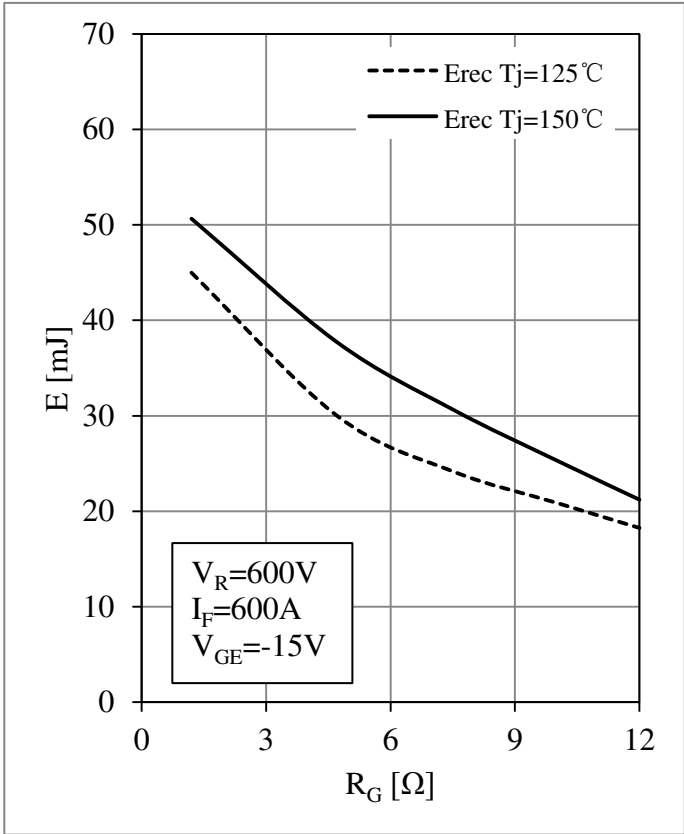


Fig 9. Diode Switching Loss vs. R_G

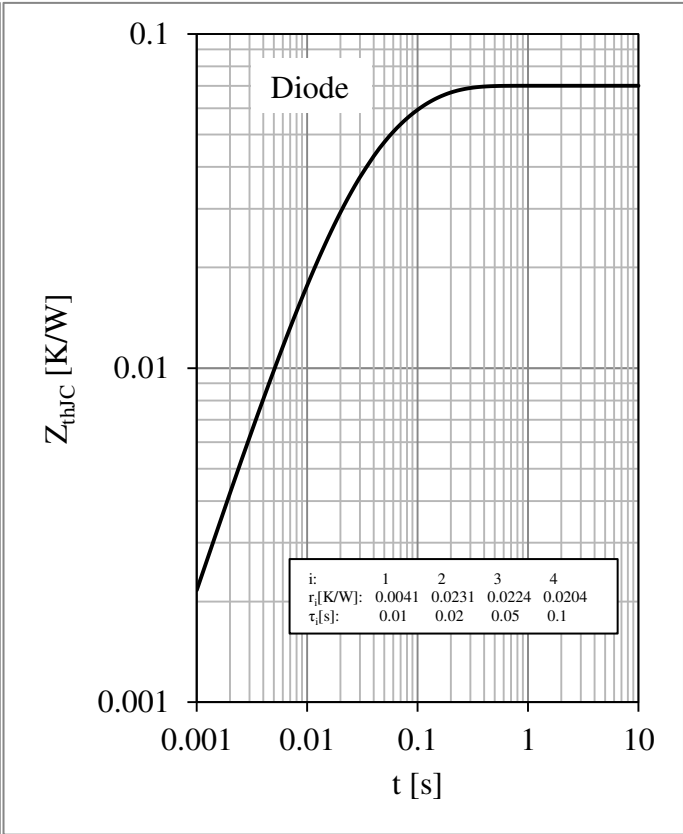
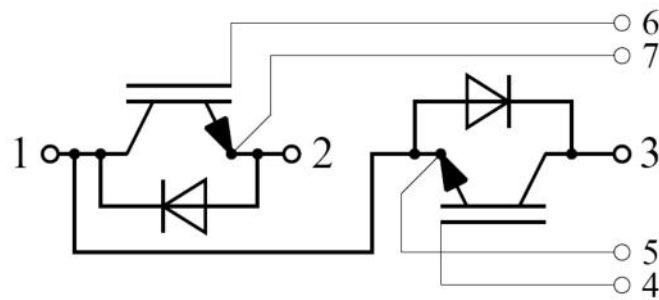


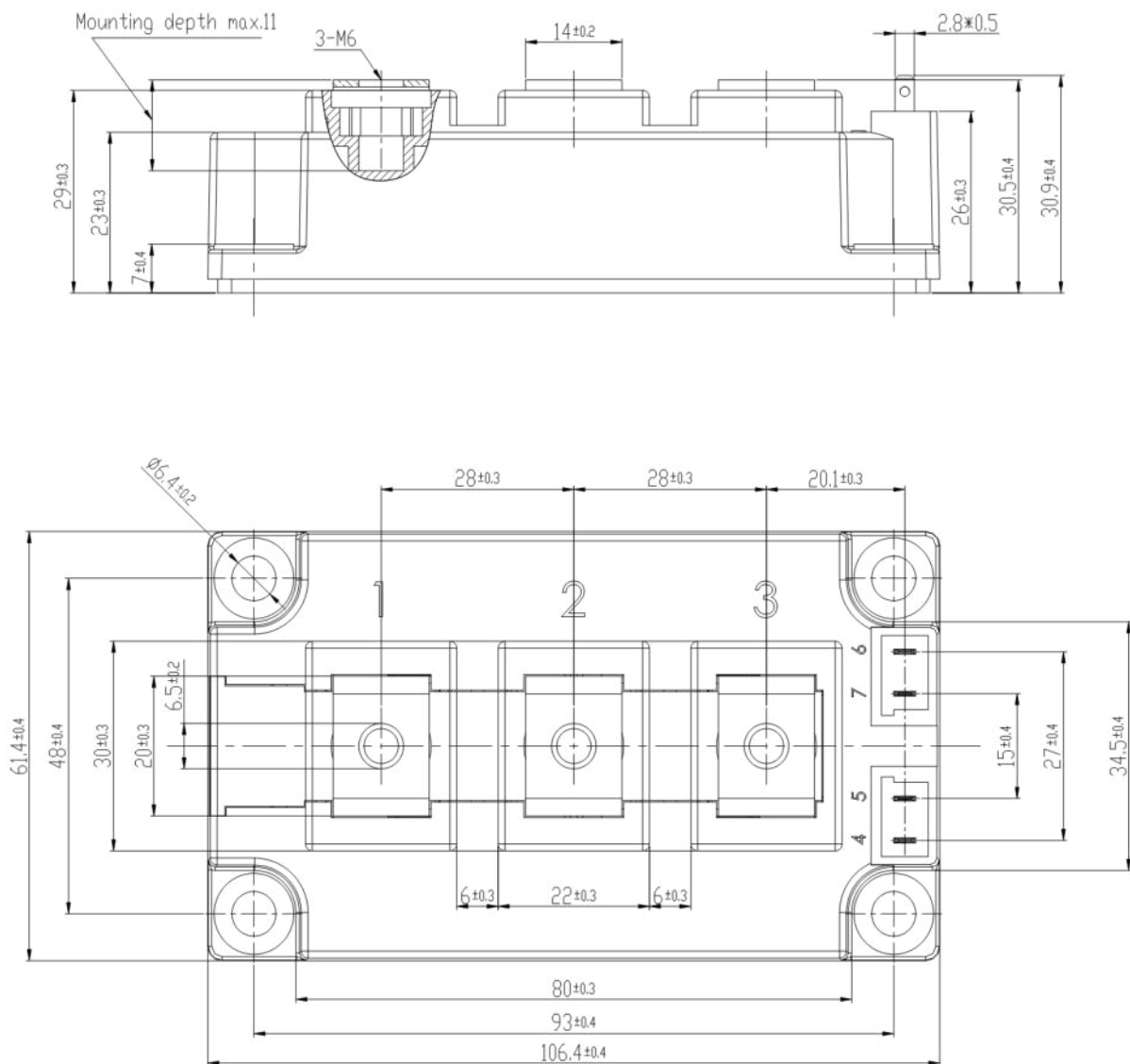
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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