

STARPOWER

SEMICONDUCTOR

IGBT

GD400HFU120C2SD

1200V/400A 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.

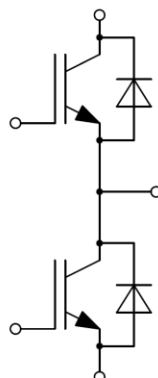
Features

- NPT IGBT technology
- 10 μ s short circuit capability
- Low switching losses
- $V_{CE(sat)}$ with positive temperature coefficient
- 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	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	519	A
	@ $T_C=65^{\circ}\text{C}$	400	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	800	A
P_D	Maximum Power Dissipation @ $T_{vj}=150^{\circ}\text{C}$	2450	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	400	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	800	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	150	$^{\circ}\text{C}$
T_{vjop}	Operating Junction Temperature	-40 to +125	$^{\circ}\text{C}$
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

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	$I_C=400\text{A}, V_{GE}=15\text{V}, T_{vj}=25^\circ\text{C}$		2.90	3.35	V	
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_{vj}=125^\circ\text{C}$		3.60			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=16.0\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^\circ\text{C}$	4.5	5.5	6.5	V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$			5.0	mA	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^\circ\text{C}$			400	nA	
R_{Gint}	Internal Gate Resistance			0.6		Ω	
C_{ies}	Input Capacitance			26.0		nF	
C_{res}	Reverse Transfer Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		1.70		nF	
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		4.2		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}, R_G=2.2\Omega, V_{GE}=\pm 15\text{V}, T_{vj}=25^\circ\text{C}$		76		ns	
t_r	Rise Time			57		ns	
$t_{d(off)}$	Turn-Off Delay Time			529		ns	
t_f	Fall Time			73		ns	
E_{on}	Turn-On Switching Loss			5.90		mJ	
E_{off}	Turn-Off Switching Loss			23.2		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=600\text{V}, I_C=400\text{A}, R_G=2.2\Omega, V_{GE}=\pm 15\text{V}, T_{vj}=125^\circ\text{C}$		81		ns
t_r	Rise Time				62		ns
$t_{d(off)}$	Turn-Off Delay Time			567		ns	
t_f	Fall Time			81		ns	
E_{on}	Turn-On Switching Loss			10.1		mJ	
E_{off}	Turn-Off Switching Loss			31.7		mJ	
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=125^\circ\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$			2800		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	$I_F=400\text{A}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$		1.85	2.30	V
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_{vj}=125^\circ\text{C}$		1.90		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=400\text{A},$ $-di/dt=5100\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_{vj}=25^\circ\text{C}$		52.7		μC
I_{RM}	Peak Reverse Recovery Current			322		A
E_{rec}	Reverse Recovery Energy			33.9		mJ
Q_r	Recovered Charge			61.4		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=400\text{A},$ $-di/dt=5500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_{vj}=125^\circ\text{C}$		349		A
E_{rec}	Reverse Recovery Energy			35.7		mJ

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance			30	nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.35		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			0.051	K/W
	Junction-to-Case (per Diode)			0.115	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.029		K/W
	Case-to-Heatsink (per Diode)		0.065		
	Case-to-Heatsink (per Module)		0.010		
M	Terminal Connection Torque, Screw M5	2.5		5.0	N.m
	Mounting Torque, Screw M6	3.0		5.0	
G	Weight of Module		300		g

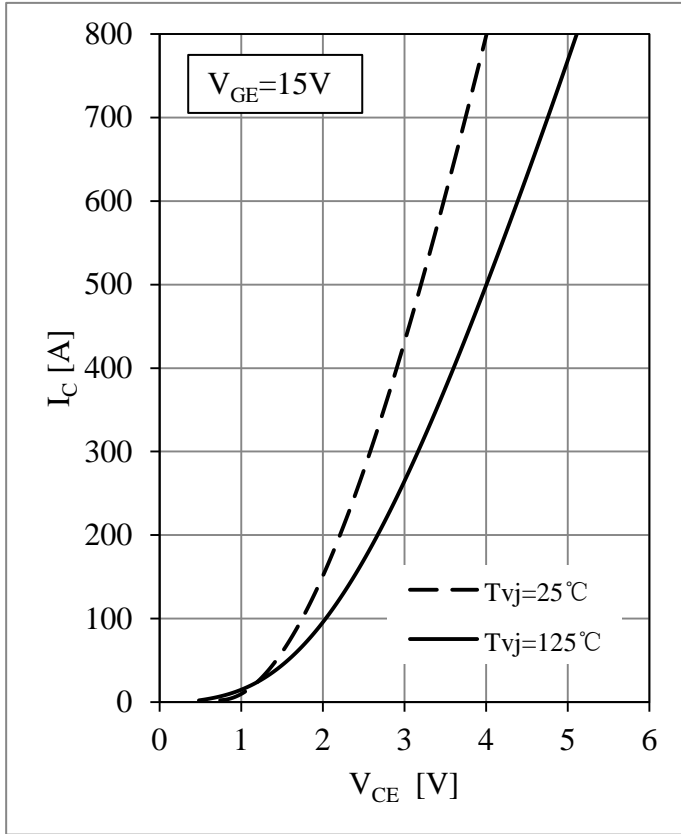


Fig 1. IGBT Output Characteristics

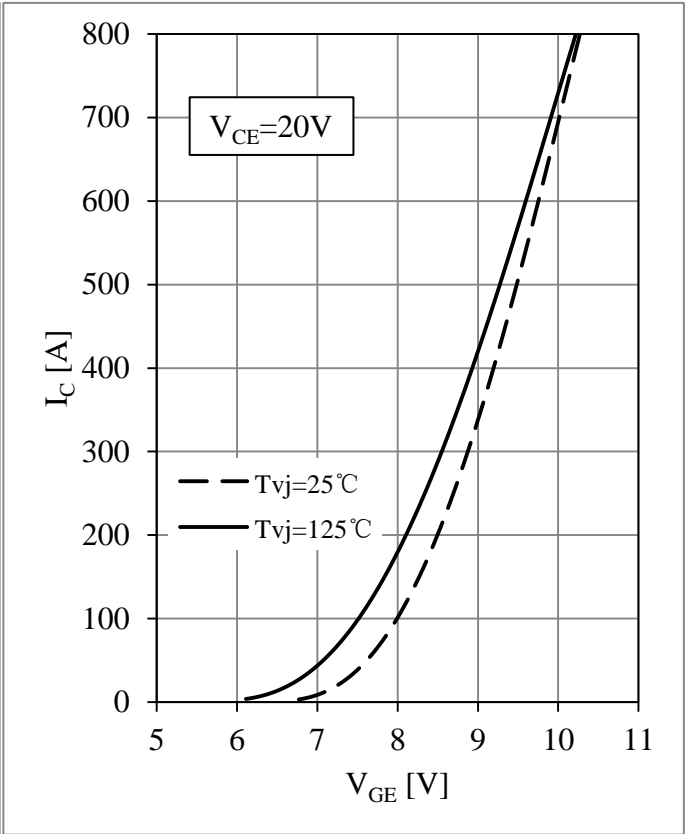


Fig 2. IGBT Transfer Characteristics

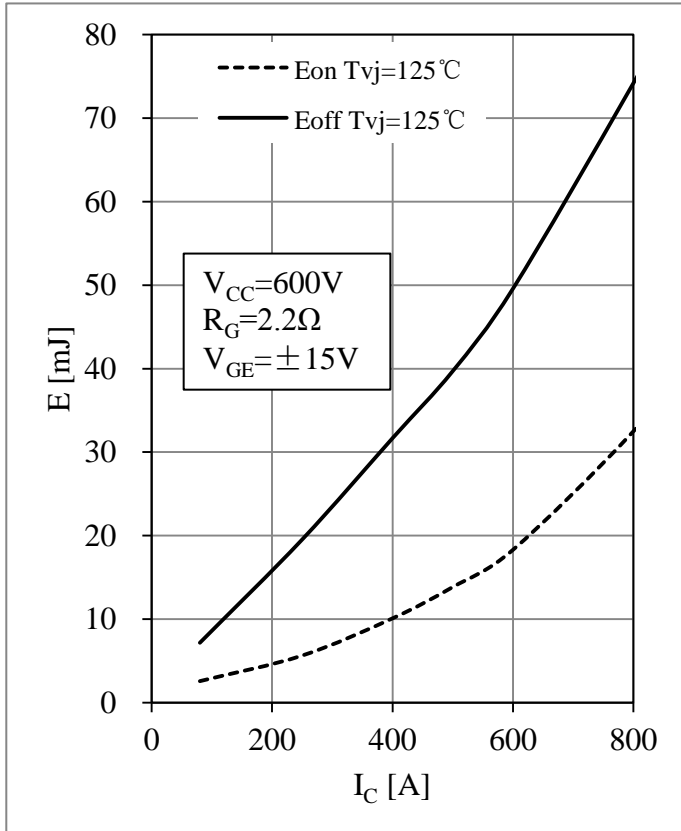


Fig 3. IGBT Switching Loss vs. I_c

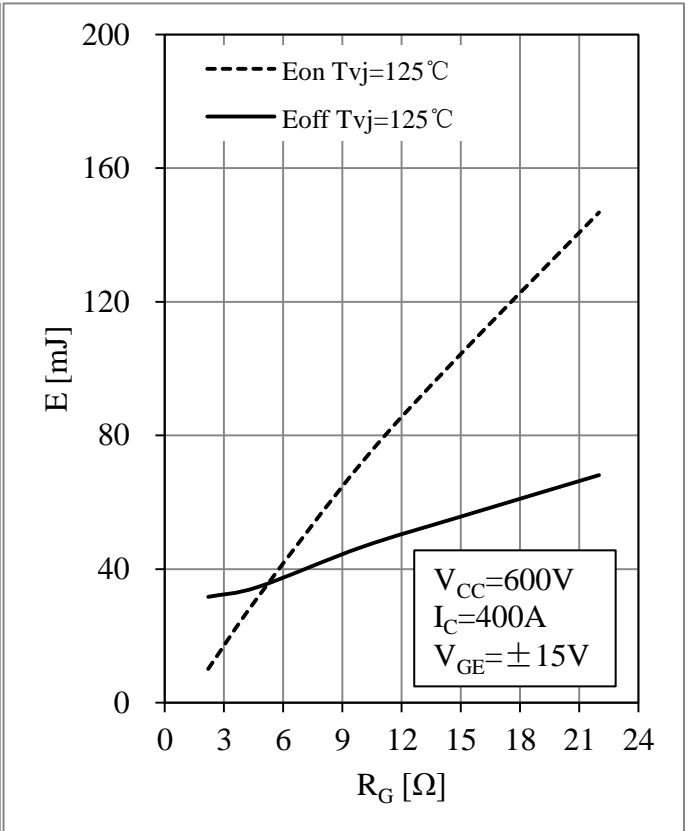


Fig 4. IGBT Switching Loss vs. R_g

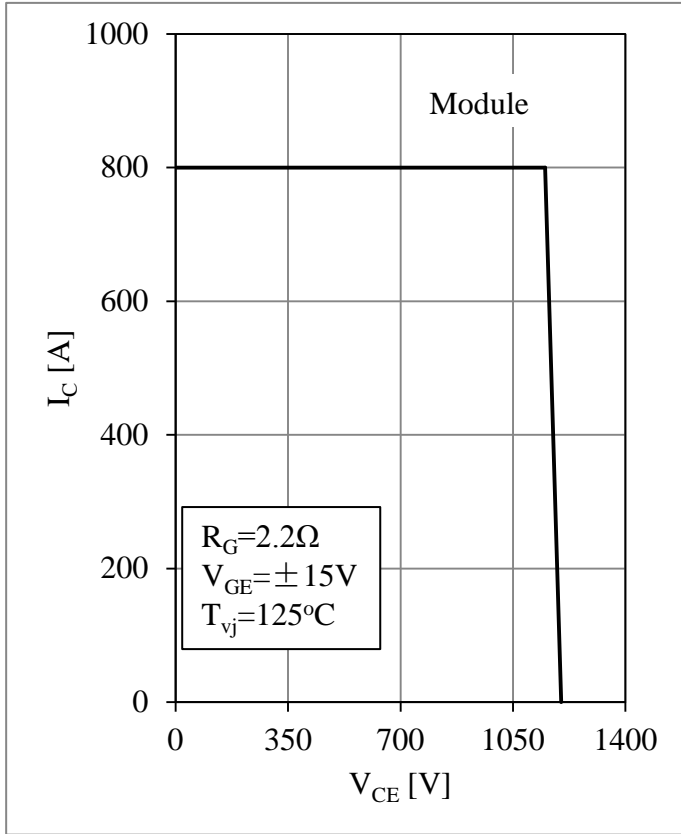


Fig 5. RBSOA

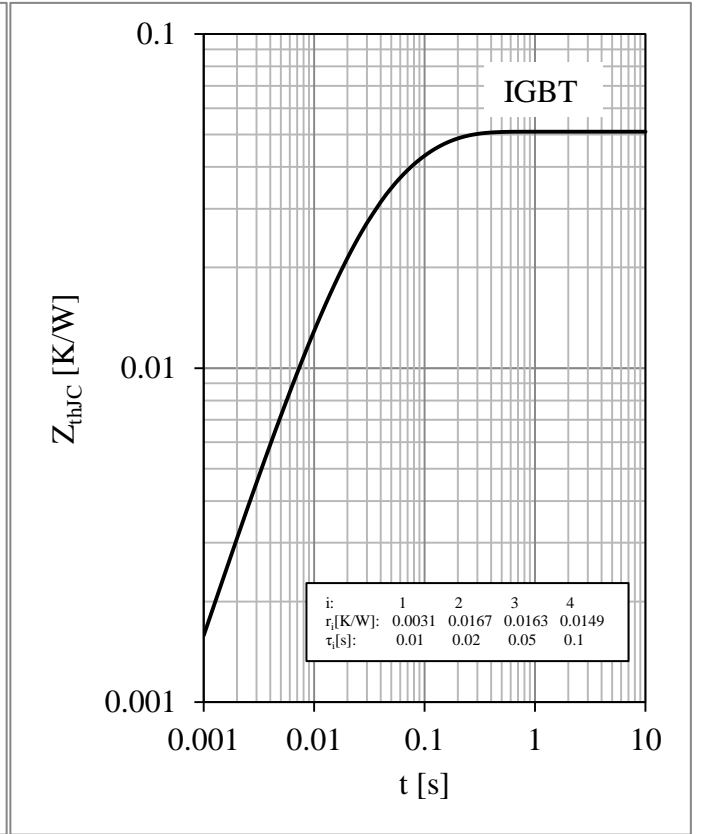


Fig 6. IGBT Transient Thermal Impedance

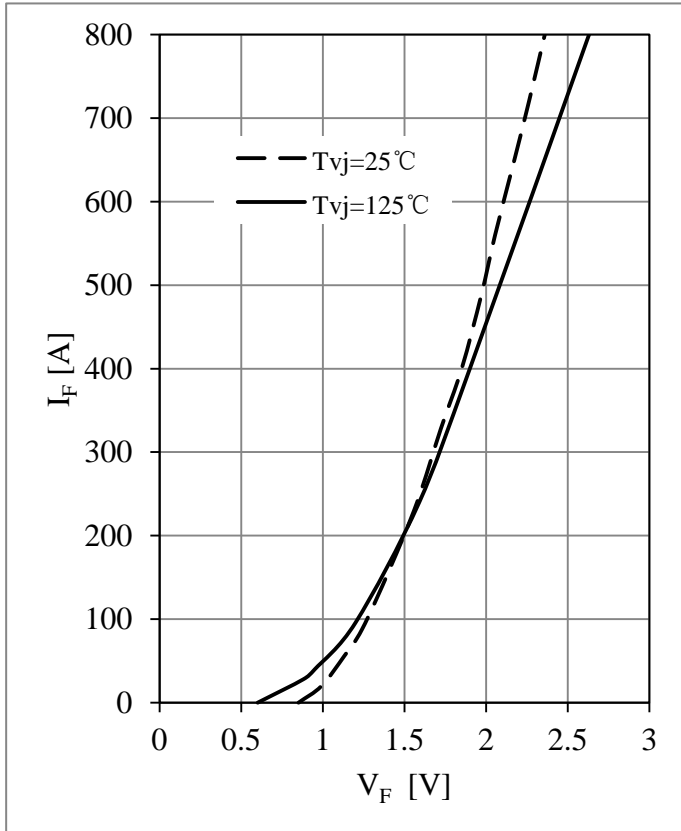


Fig 7. Diode Forward Characteristics

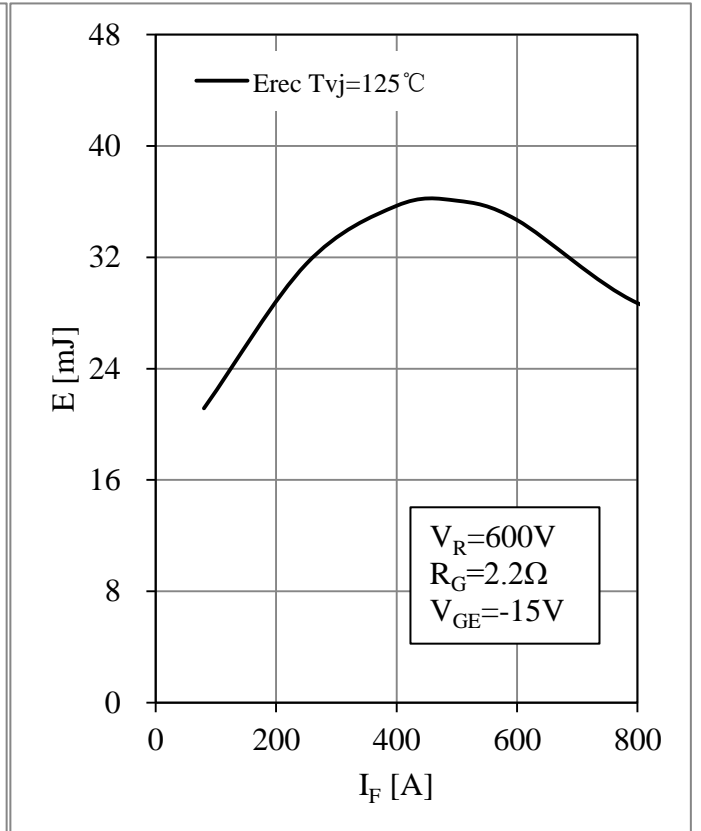


Fig 8. Diode Switching Loss vs. I_F

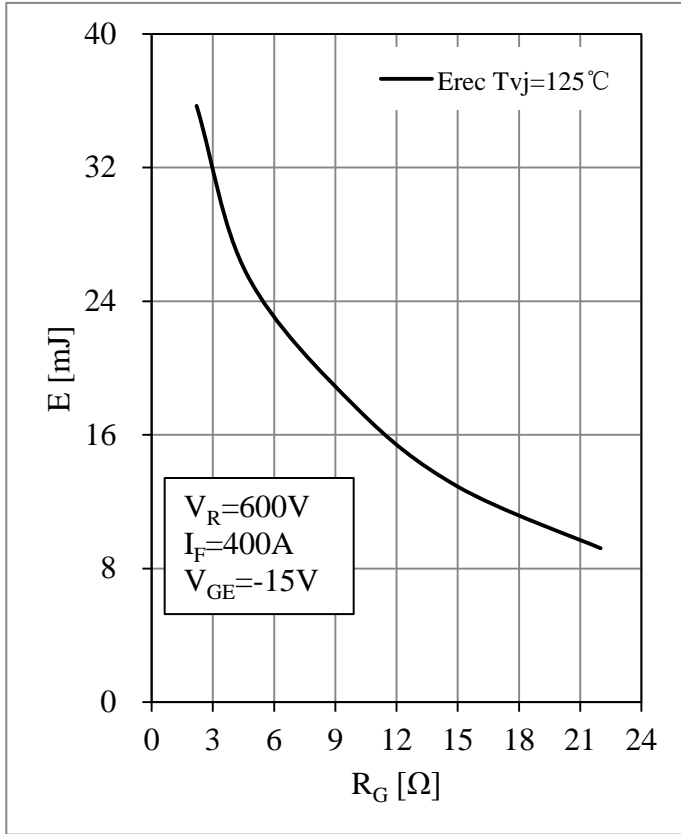


Fig 9. Diode Switching Loss vs. R_G

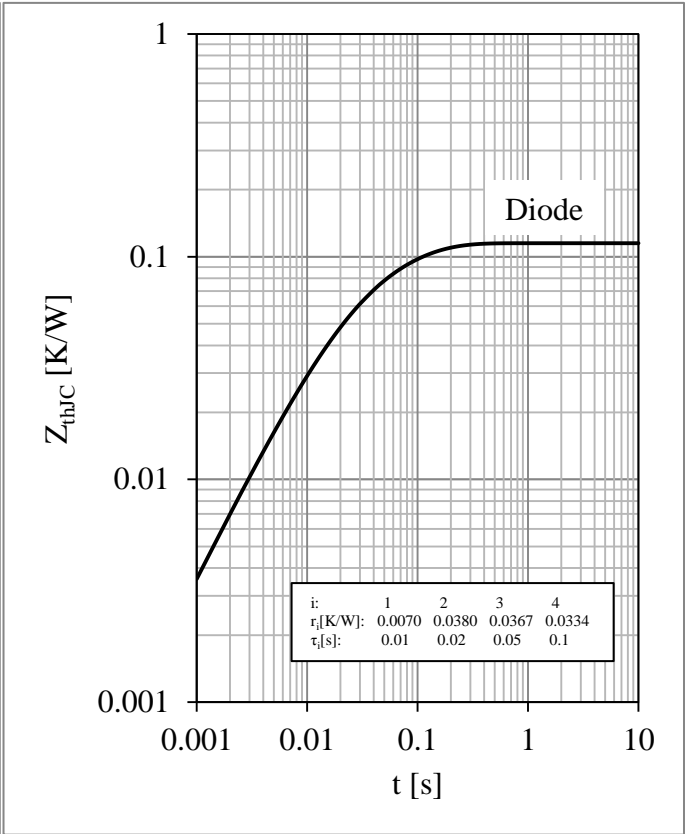
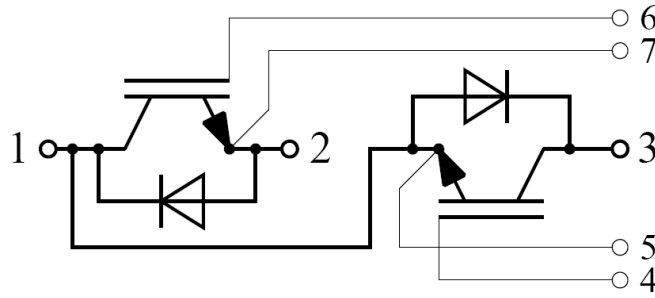


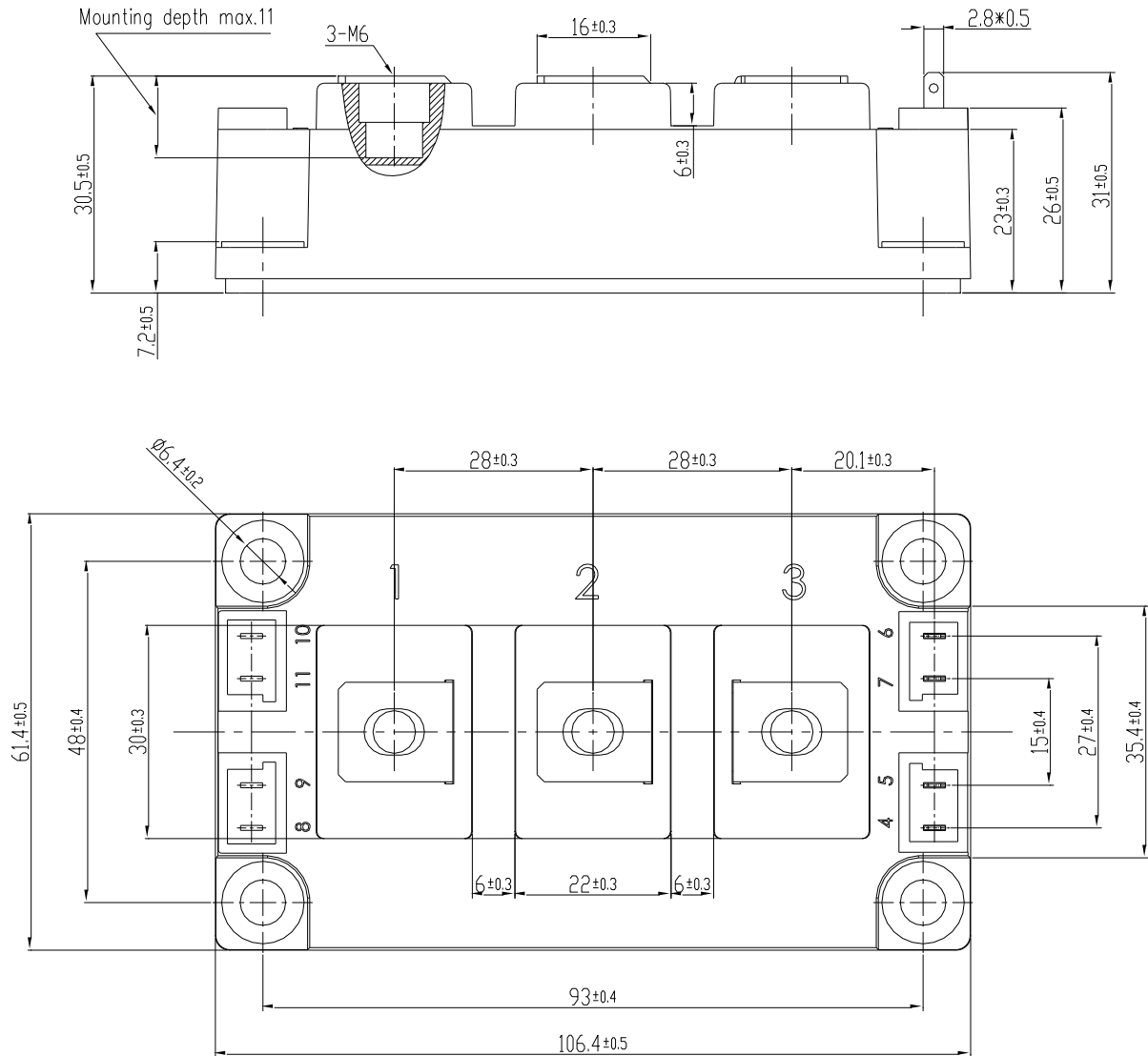
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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