

STARPOWER

SEMICONDUCTOR

IGBT

GD400HFF120C2S

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

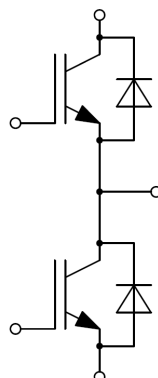
- Low $V_{CE(sat)}$ Trench IGBT technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low switching losses
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



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	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	620	A
	@ $T_C=90^{\circ}\text{C}$	400	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	800	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	2272	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_{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	$I_C=400\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.90	2.35	V
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.40		
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.55		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=10.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	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			1.9		Ω
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}, R_G=0.38\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		1496		ns
t_r	Rise Time			200		ns
$t_{d(off)}$	Turn-Off Delay Time			1304		ns
t_f	Fall Time			816		ns
E_{on}	Turn-On Switching Loss			27.6		mJ
E_{off}	Turn-Off Switching Loss			20.8		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}, R_G=0.38\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		1676		ns
t_r	Rise Time			252		ns
$t_{d(off)}$	Turn-Off Delay Time			1532		ns
t_f	Fall Time			872		ns
E_{on}	Turn-On Switching Loss			41.6		mJ
E_{off}	Turn-Off Switching Loss			23.6		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}, R_G=0.38\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$		1676		ns
t_r	Rise Time			260		ns
$t_{d(off)}$	Turn-Off Delay Time			1552		ns
t_f	Fall Time			888		ns
E_{on}	Turn-On Switching Loss			46.0		mJ
E_{off}	Turn-Off Switching Loss			24.0		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	$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.90	2.35	V
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.90		
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.90		
Q_r	Recovered Charge			20.4		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=400\text{A},$ $-di/dt=6400\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		180		A
E_{rec}	Reverse Recovery Energy			6.8		mJ
Q_r	Recovered Charge			52.4		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=400\text{A},$ $-di/dt=6400\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		264		A
E_{rec}	Reverse Recovery Energy			19.5		mJ
Q_r	Recovered Charge			60.8		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=400\text{A},$ $-di/dt=6400\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		284		A
E_{rec}	Reverse Recovery Energy			22.6		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 Ω
R_{thJC}	Junction-to-Case (per IGBT)			0.066	K/W
	Junction-to-Case (per Diode)			0.093	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.034		K/W
	Case-to-Heatsink (per Diode)		0.048		
	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

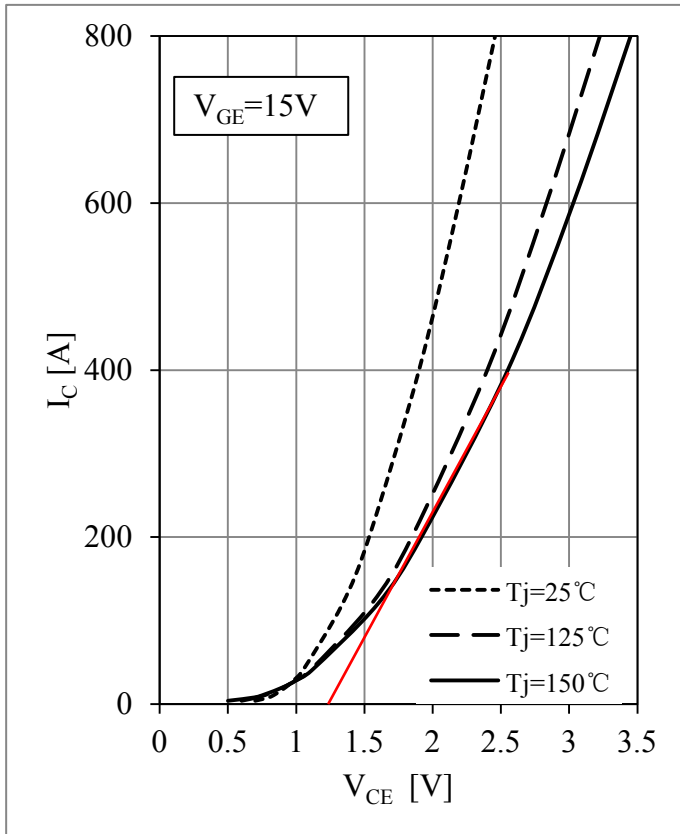


Fig 1. IGBT Output Characteristics

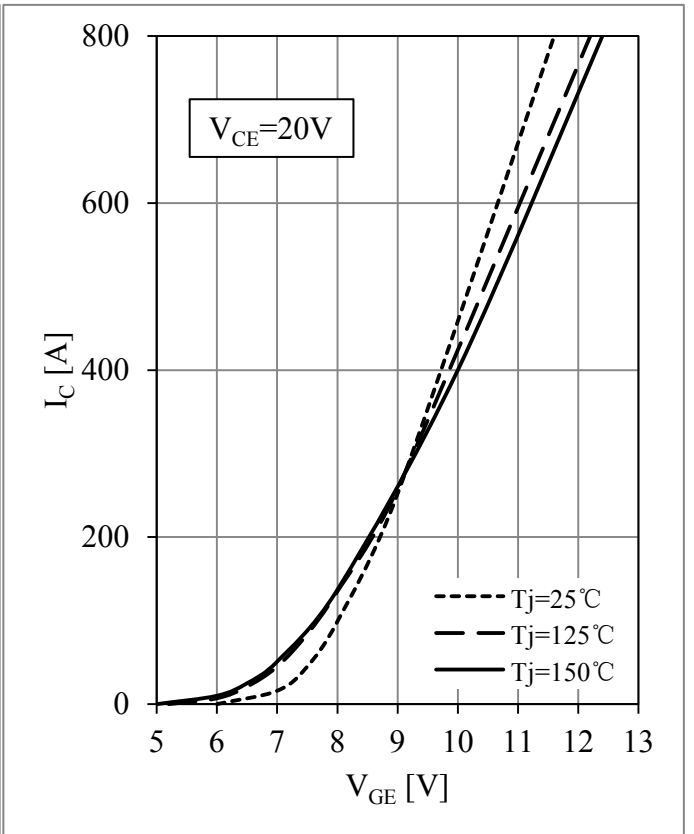


Fig 2. IGBT Transfer Characteristics

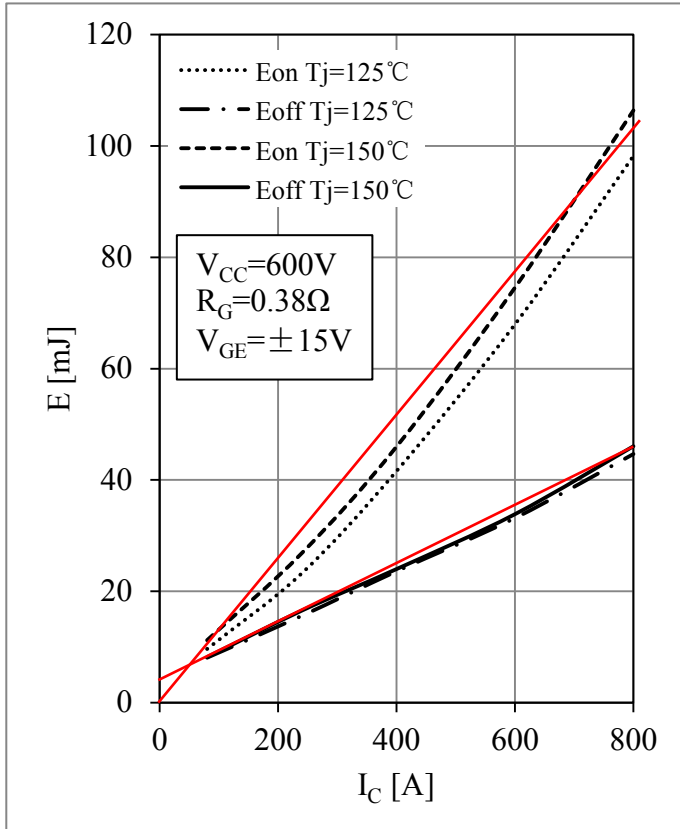


Fig 3. IGBT Switching Loss vs. I_C

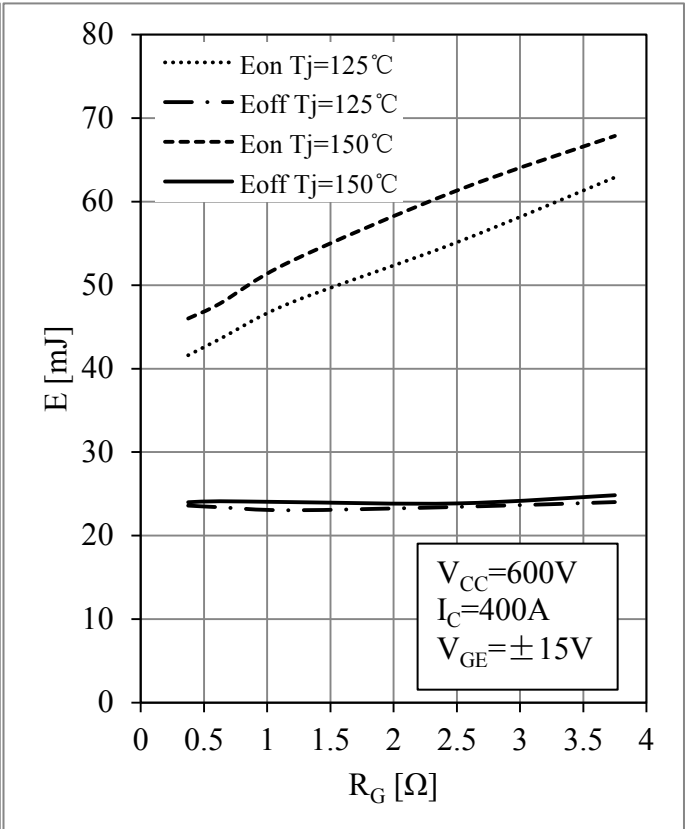


Fig 4. IGBT Switching Loss vs. R_G

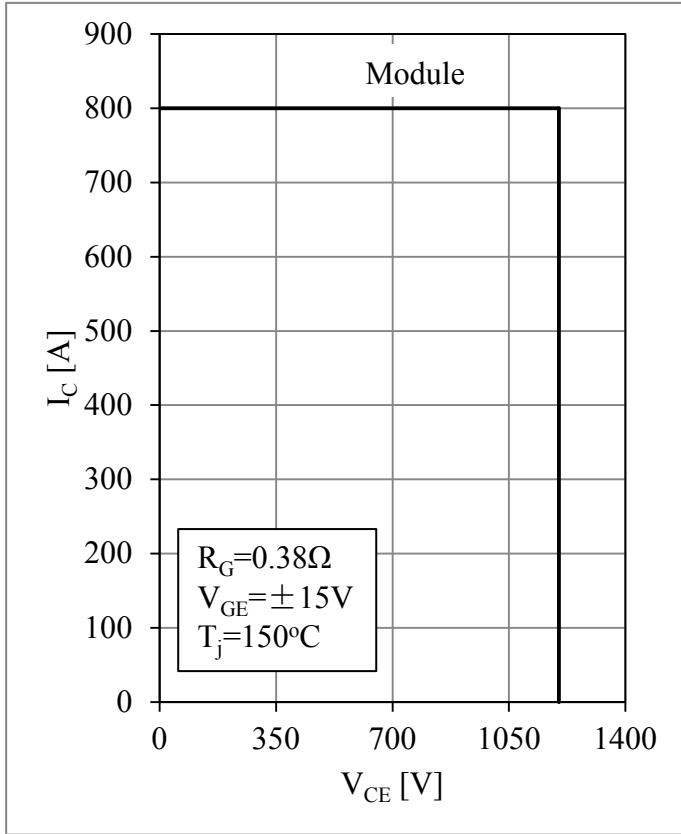


Fig 5. RBSOA

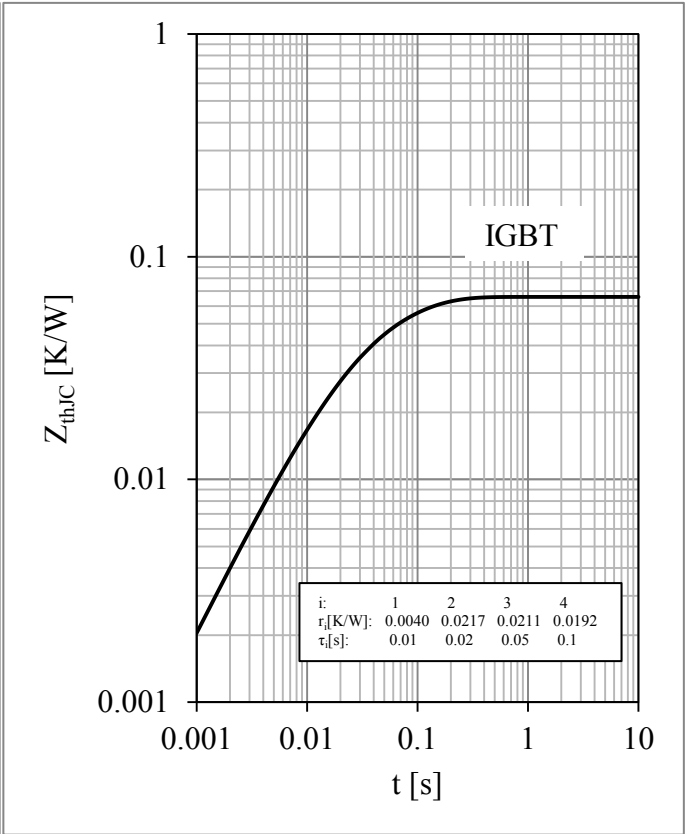


Fig 6. IGBT Transient Thermal Impedance

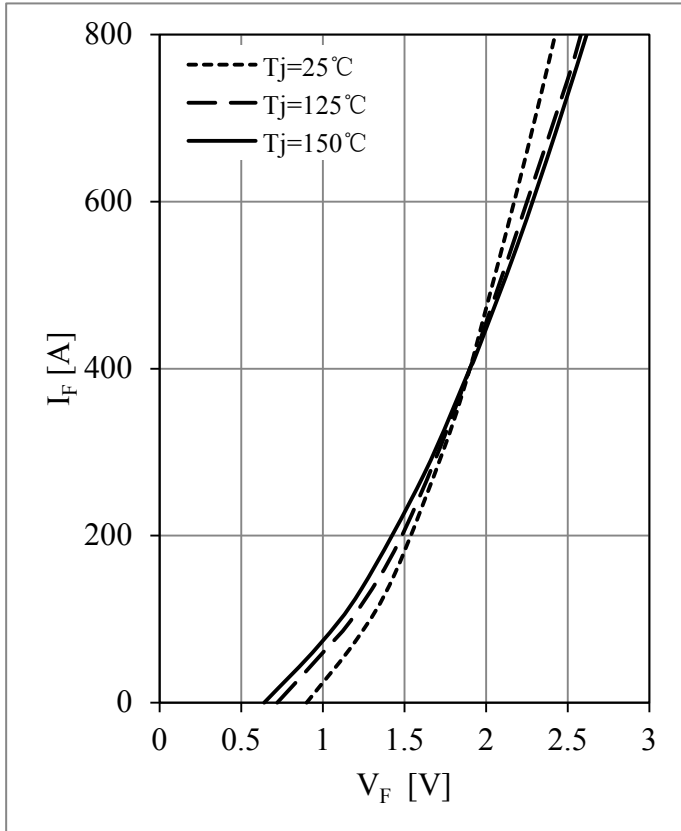


Fig 7. Diode Forward Characteristics

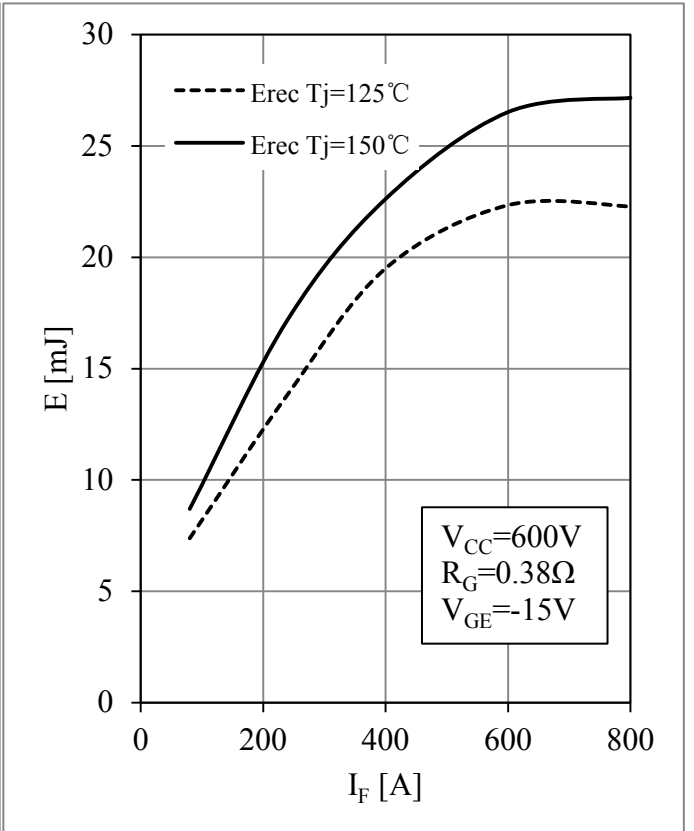


Fig 8. Diode Switching Loss vs. I_F

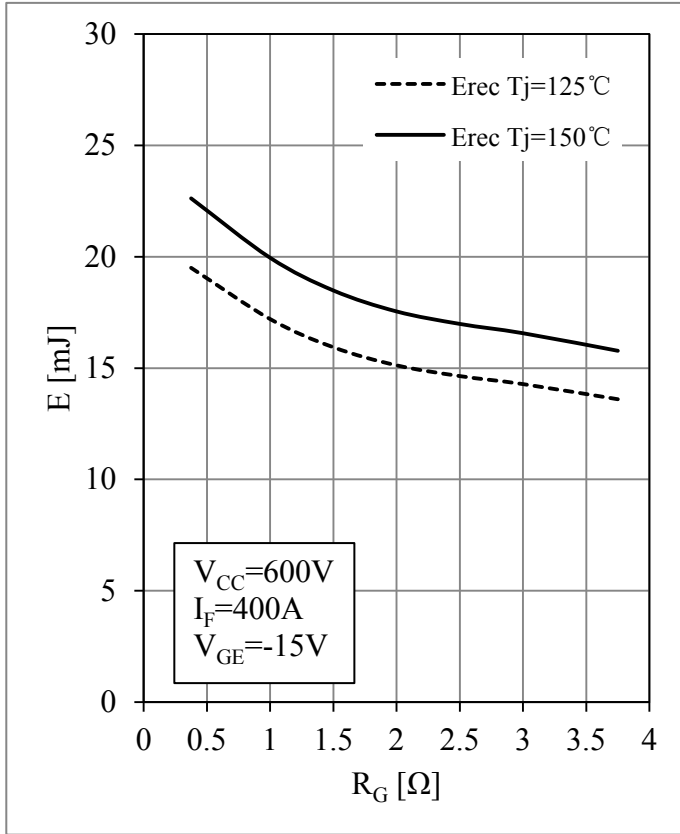


Fig 9. Diode Switching Loss vs. R_G

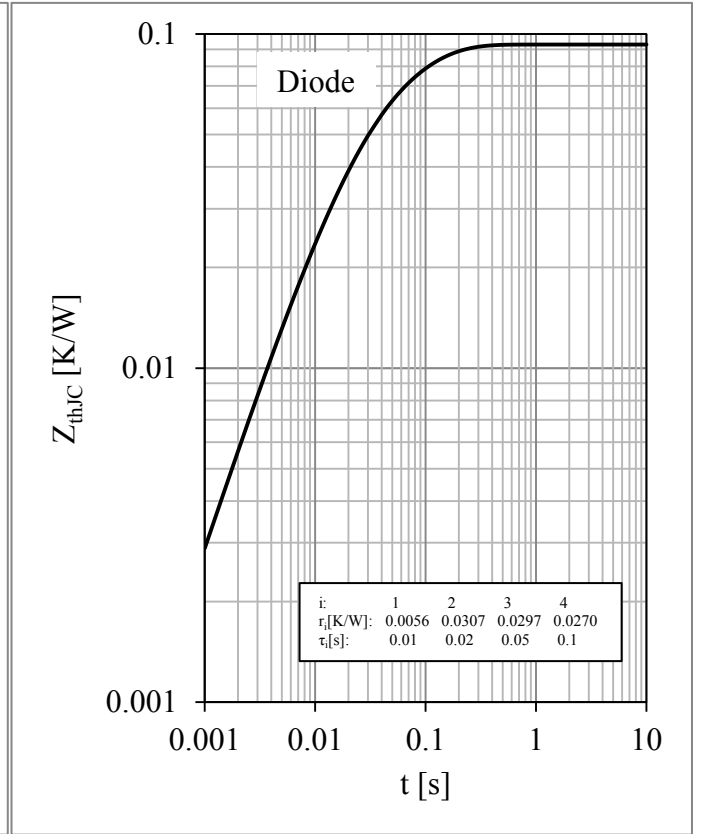
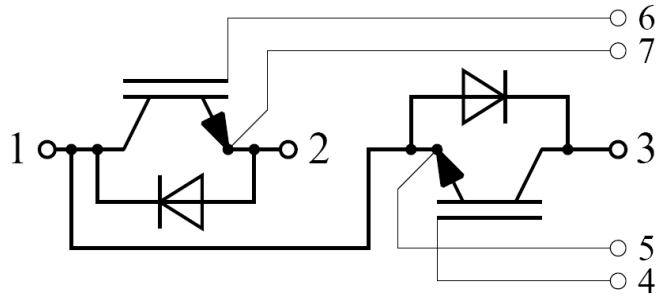


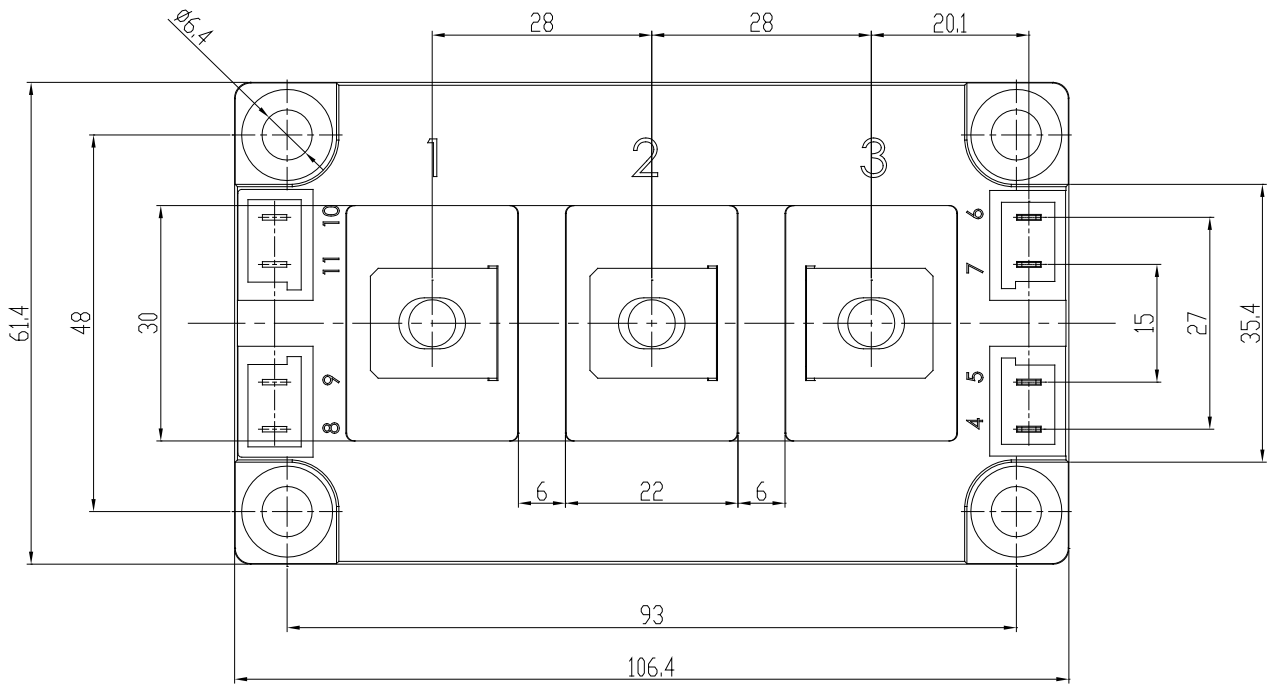
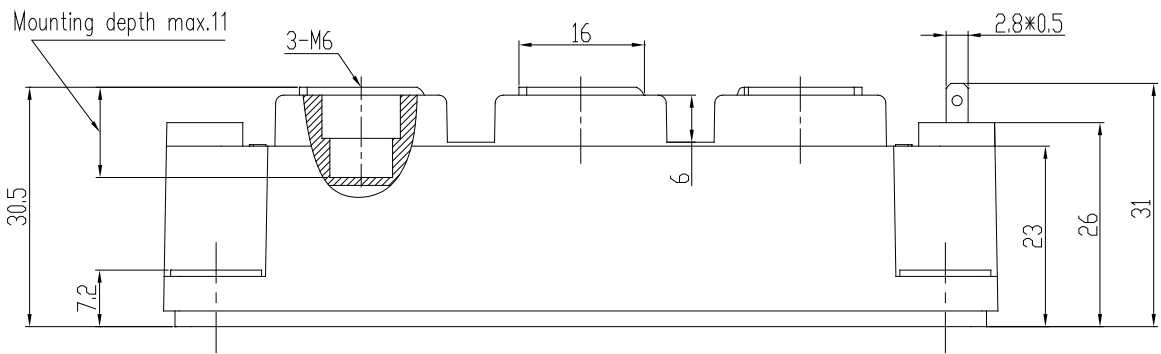
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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