

STARPOWER

SEMICONDUCTOR

IGBT

GD400CLX65C2S

650V/400A chopper 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 inductive heating.

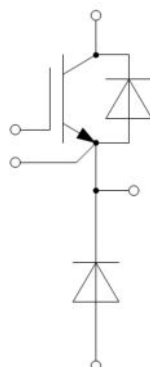
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 6 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 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	Values	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	485	A
	@ $T_C=60^{\circ}\text{C}$	400	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	800	A
P_D	Maximum Power Dissipation @ $T_{vj}=175^{\circ}\text{C}$	1190	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	650	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	Values	Unit
T_{vjmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{vjop}	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, $f=50\text{Hz}$, $t=1\text{min}$	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	$I_C=400\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.45	1.90	V
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.60		
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=6.40\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.1	5.8	6.5	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			1.0	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			1.0		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		46.4		nF
C_{res}	Reverse Transfer Capacitance			0.91		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		2.77		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=400\text{A}, R_G=1.8\Omega, L_S=43\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		243		ns
t_r	Rise Time			70		ns
$t_{d(off)}$	Turn-Off Delay Time			272		ns
t_f	Fall Time			65		ns
E_{on}	Turn-On Switching Loss			3.2		mJ
E_{off}	Turn-Off Switching Loss			8.3		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=400\text{A}, R_G=1.8\Omega, L_S=43\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^{\circ}\text{C}$		251		ns
t_r	Rise Time			76		ns
$t_{d(off)}$	Turn-Off Delay Time			292		ns
t_f	Fall Time			79		ns
E_{on}	Turn-On Switching Loss			5.7		mJ
E_{off}	Turn-Off Switching Loss			9.8		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=300\text{V}, I_C=400\text{A}, R_G=1.8\Omega, L_S=43\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^{\circ}\text{C}$		253		ns
t_r	Rise Time			77		ns
$t_{d(off)}$	Turn-Off Delay Time			294		ns
t_f	Fall Time			84		ns
E_{on}	Turn-On Switching Loss			6.3		mJ
E_{off}	Turn-Off Switching Loss			10.5		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=300\text{V}, V_{CEM} \leq 650\text{V}$		2000		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=400\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.55	2.00	V
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.50		
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		1.45		
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=400\text{A},$ $-di/dt=5335\text{A}/\mu\text{s}, V_{GE}=-15\text{V},$ $L_S=43\text{nH}, T_{vj}=25^{\circ}\text{C}$		11.9		μC
I_{RM}	Peak Reverse Recovery Current			191		A
E_{rec}	Reverse Recovery Energy			2.76		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=400\text{A},$ $-di/dt=4809\text{A}/\mu\text{s}, V_{GE}=-15\text{V},$ $L_S=43\text{nH}, T_{vj}=125^{\circ}\text{C}$		19.7		μC
I_{RM}	Peak Reverse Recovery Current			217		A
E_{rec}	Reverse Recovery Energy			4.35		mJ
Q_r	Recovered Charge	$V_R=300\text{V}, I_F=400\text{A},$ $-di/dt=4734\text{A}/\mu\text{s}, V_{GE}=-15\text{V},$ $L_S=43\text{nH}, T_{vj}=150^{\circ}\text{C}$		21.5		μC
I_{RM}	Peak Reverse Recovery Current			225		A
E_{rec}	Reverse Recovery Energy			4.70		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		0.35		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			0.126	K/W
	Junction-to-Case (per Diode)			0.204	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.022		K/W
	Case-to-Heatsink (per Diode)		0.036		
	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

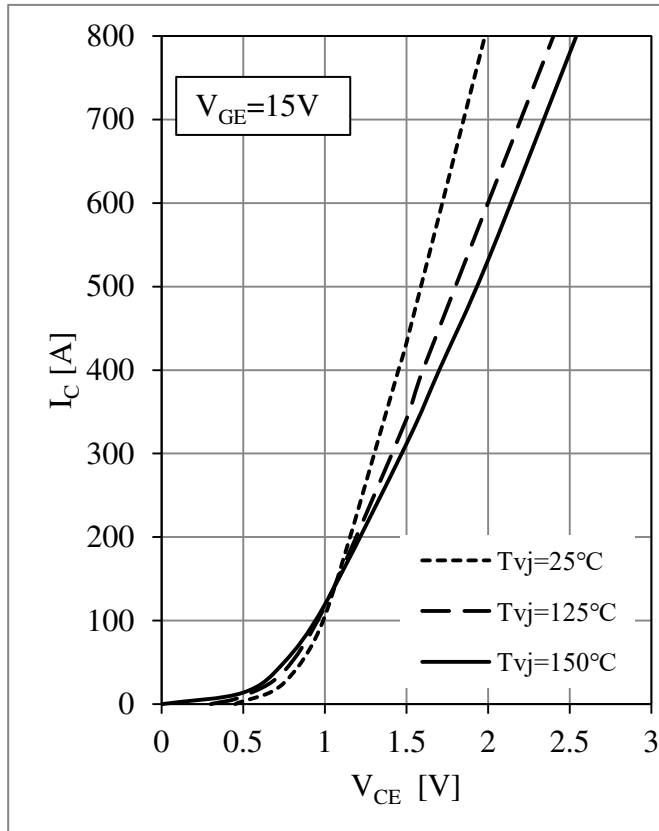


Fig 1. IGBT Output Characteristics

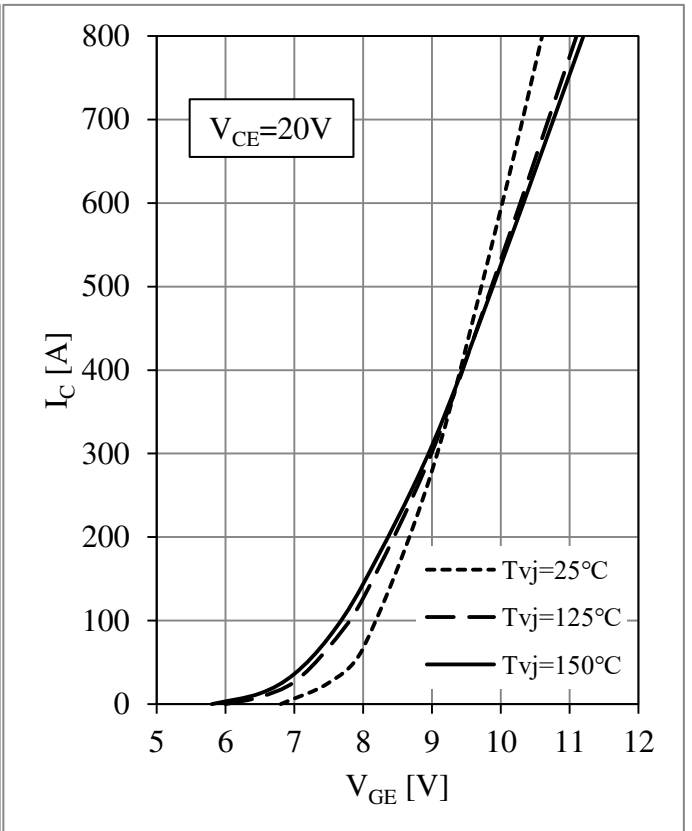
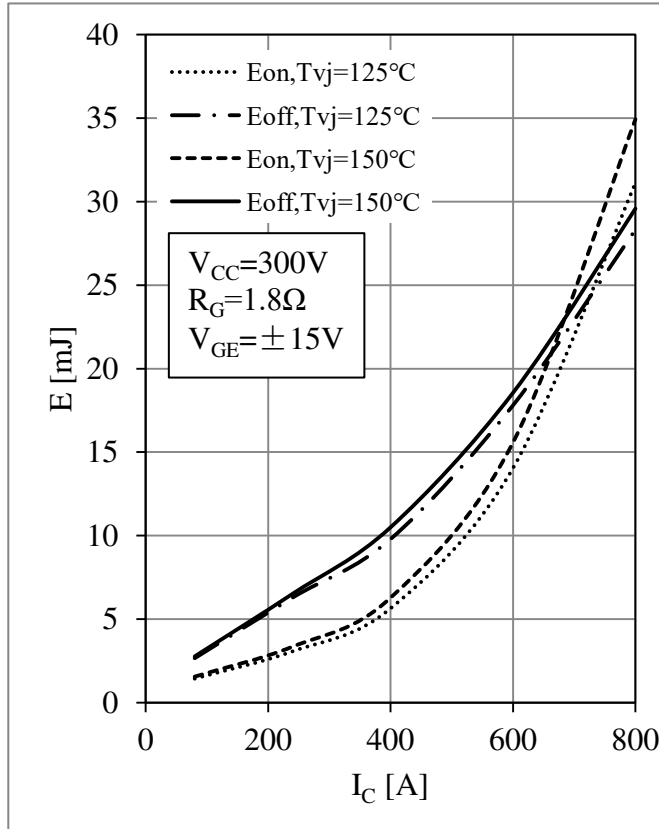
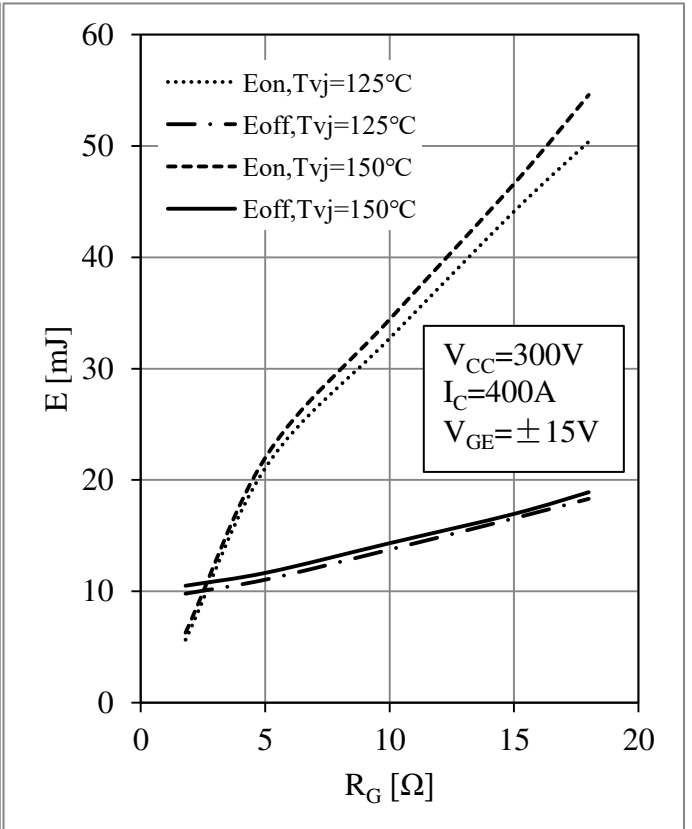


Fig 2. IGBT Transfer Characteristics

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

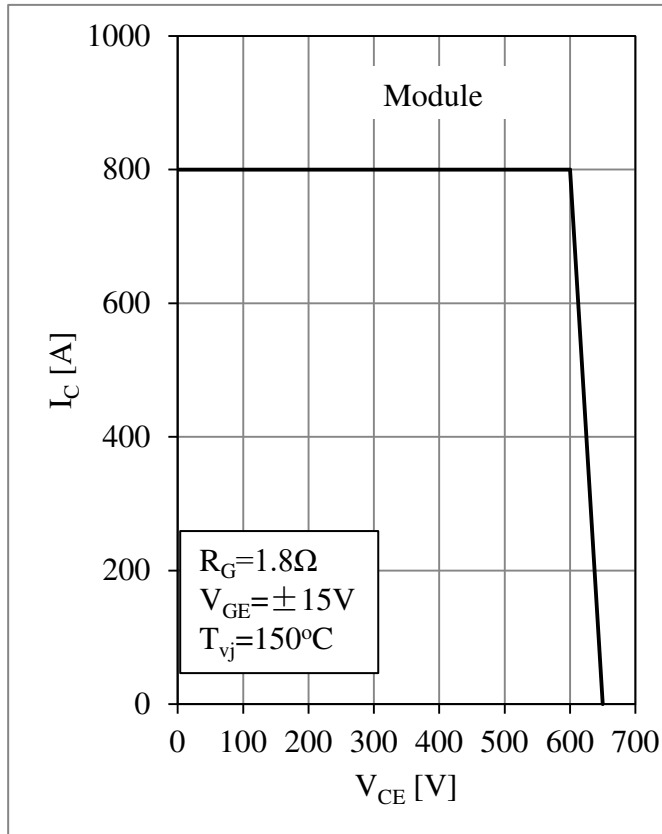


Fig 5. RBSOA

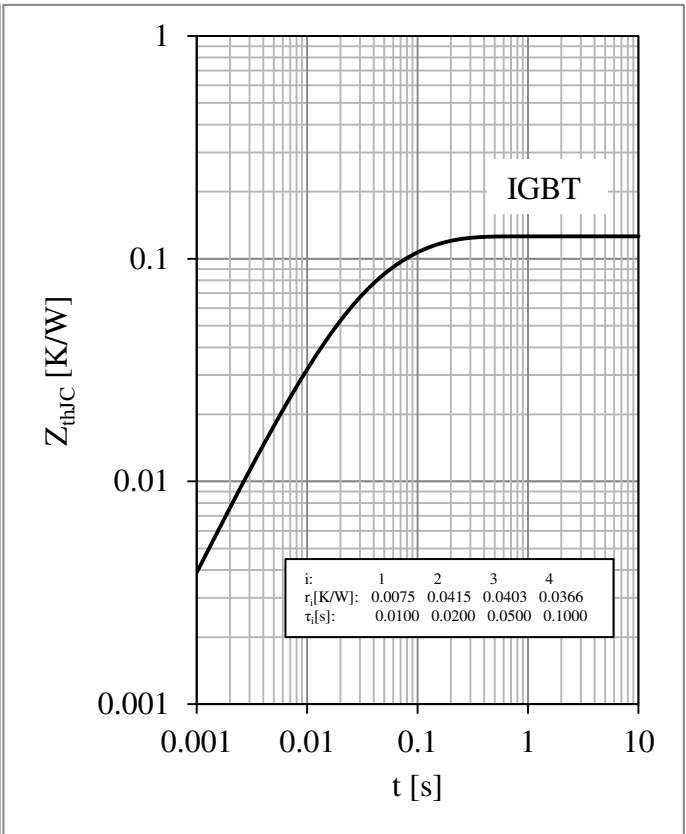


Fig 6. IGBT Transient Thermal Impedance

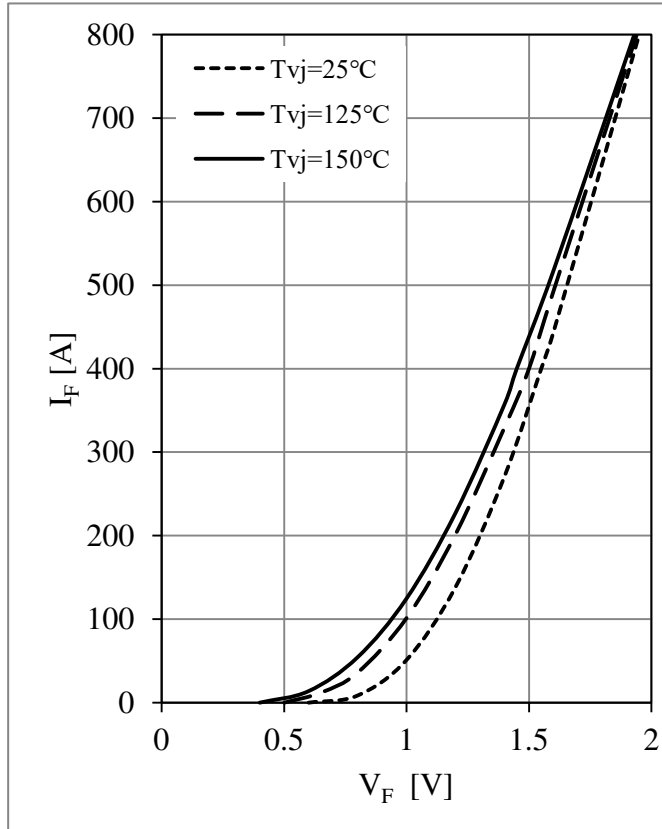
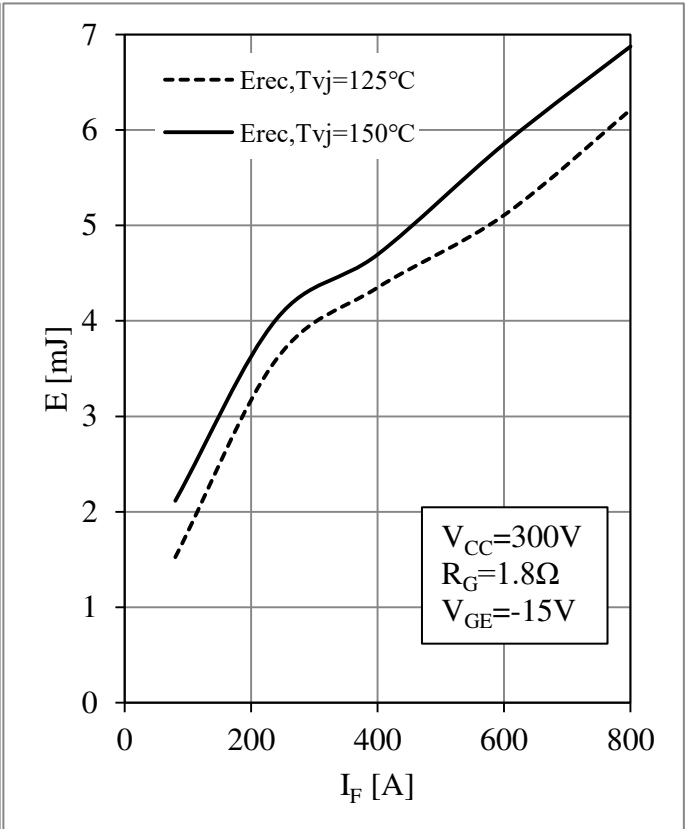


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

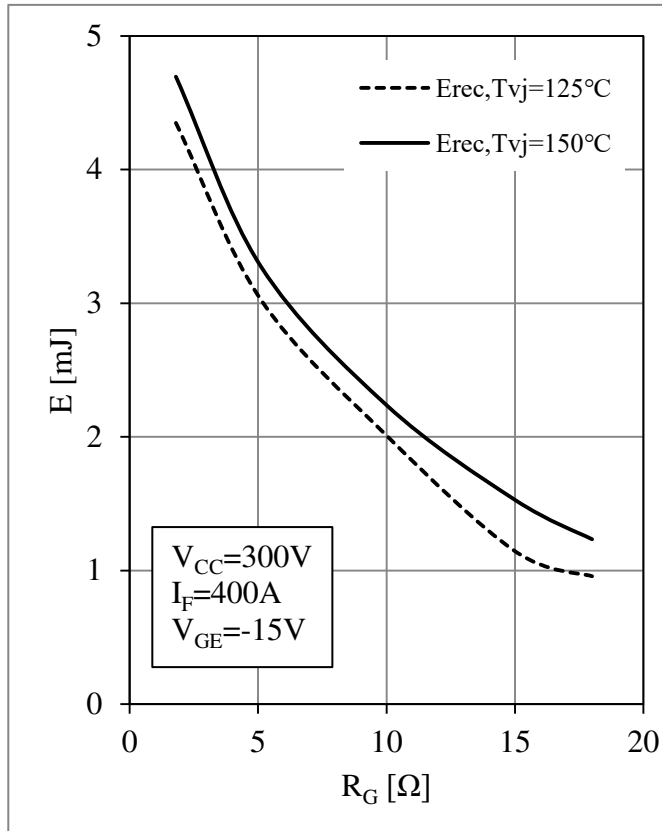
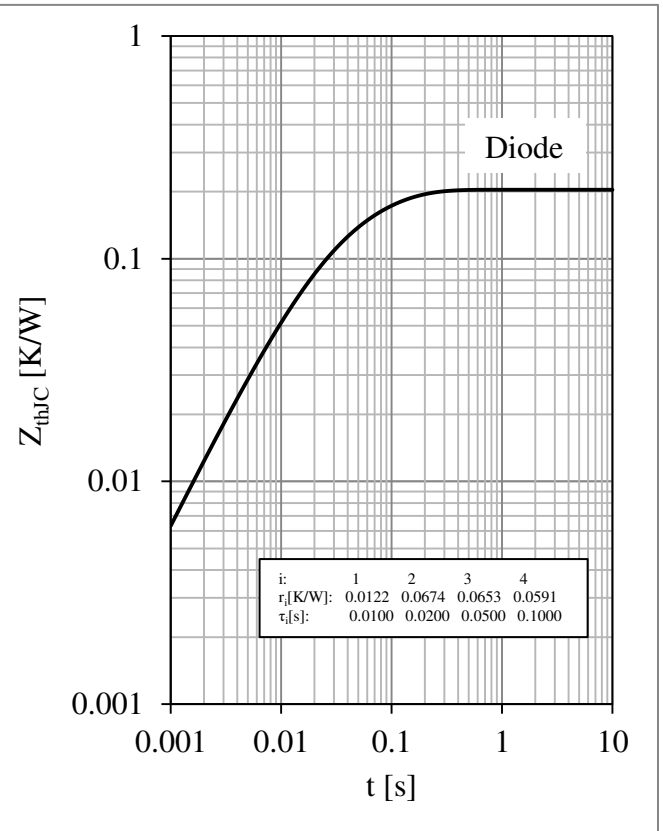
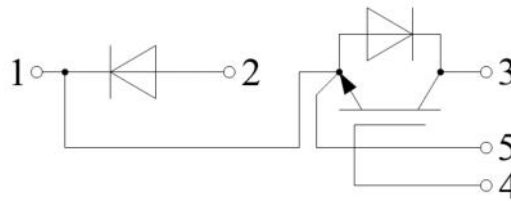
Fig 9. Diode Switching Loss vs. R_G 

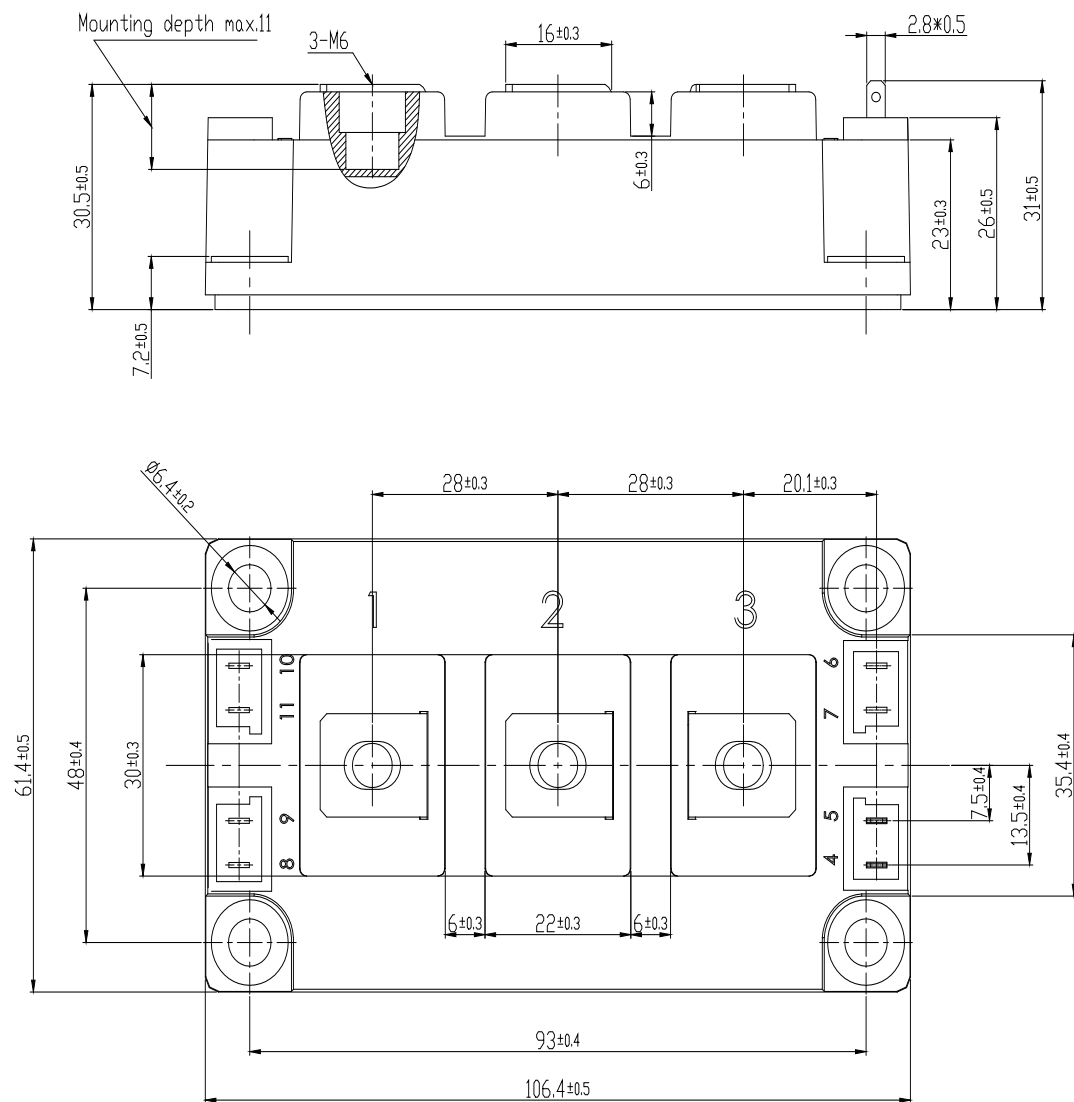
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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