

STARPOWER

SEMICONDUCTOR

IGBT

GD400CUX170C2S

1700V/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 general inverters and UPS.

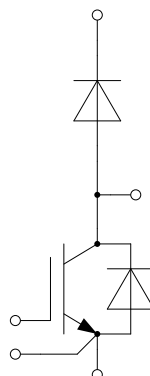
Features

- 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 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	1700	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	648	A
	@ $T_C=100^{\circ}\text{C}$	400	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	800	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	2380	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	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	$I_C=400\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.85	2.20	V
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.25		
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}$		2.35		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=16.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.6	6.2	6.8	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$			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
R_{Gint}	Internal Gate Resistance			1.88		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		48.2		nF
C_{res}	Reverse Transfer Capacitance			1.17		nF
Q_G	Gate Charge	$V_{GE}=-15\text{V}\dots+15\text{V}$		3.77		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=400\text{A}, R_G=0.82\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		204		ns
t_r	Rise Time			38		ns
$t_{d(off)}$	Turn-Off Delay Time			425		ns
t_f	Fall Time			113		ns
E_{on}	Turn-On Switching Loss			97.9		mJ
E_{off}	Turn-Off Switching Loss			84.0		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=400\text{A}, R_G=0.82\Omega, V_{GE}=\pm 15\text{V}, T_j=125^{\circ}\text{C}$		208		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			528		ns
t_f	Fall Time			184		ns
E_{on}	Turn-On Switching Loss			141		mJ
E_{off}	Turn-Off Switching Loss			132		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=400\text{A}, R_G=0.82\Omega, V_{GE}=\pm 15\text{V}, T_j=150^{\circ}\text{C}$		216		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			544		ns
t_f	Fall Time			204		ns
E_{on}	Turn-On Switching Loss			161		mJ
E_{off}	Turn-Off Switching Loss			137		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^{\circ}\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		1600		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	$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$		1.80	2.25	V
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.90		
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.95		
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=400\text{A},$ $-di/dt=8800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		116		μC
I_{RM}	Peak Reverse Recovery Current			666		A
E_{rec}	Reverse Recovery Energy			63.8		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=400\text{A},$ $-di/dt=8800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		187		μC
I_{RM}	Peak Reverse Recovery Current			662		A
E_{rec}	Reverse Recovery Energy			114		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=400\text{A},$ $-di/dt=8800\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		209		μC
I_{RM}	Peak Reverse Recovery Current			640		A
E_{rec}	Reverse Recovery Energy			132		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)			0.063	K/W
	Junction-to-Case (per Diode)			0.105	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.022		K/W
	Case-to-Heatsink (per Diode)		0.037		
	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

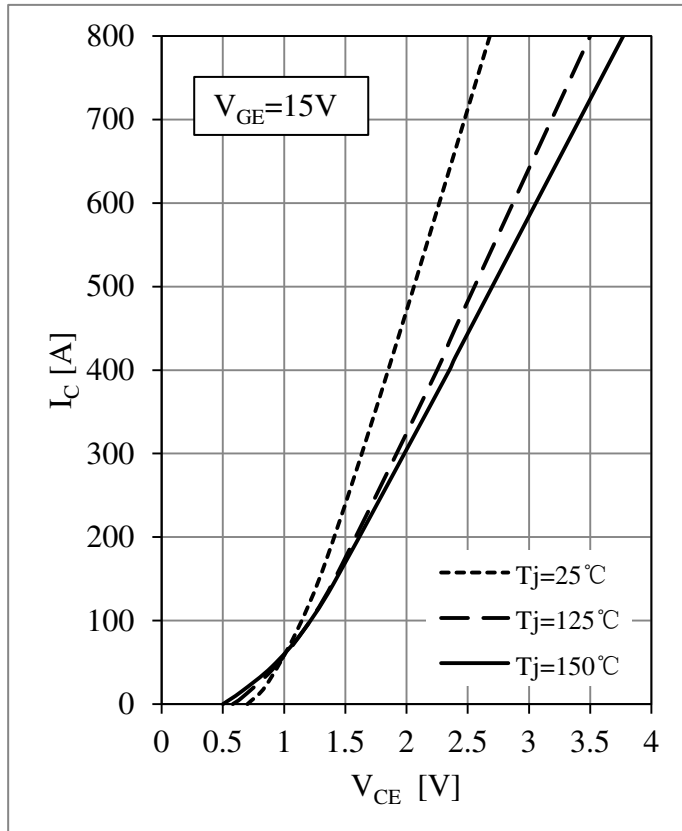


Fig 1. IGBT Output Characteristics

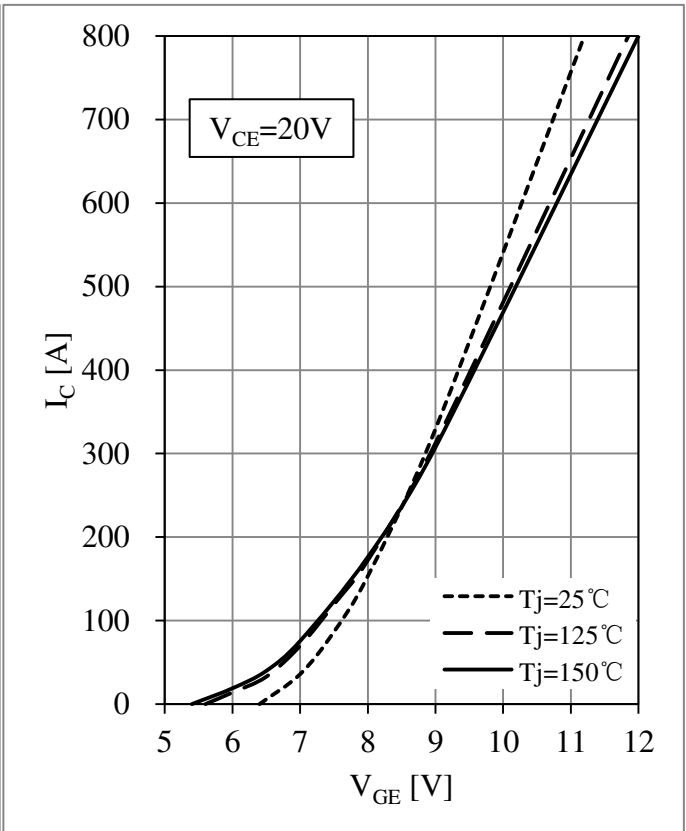
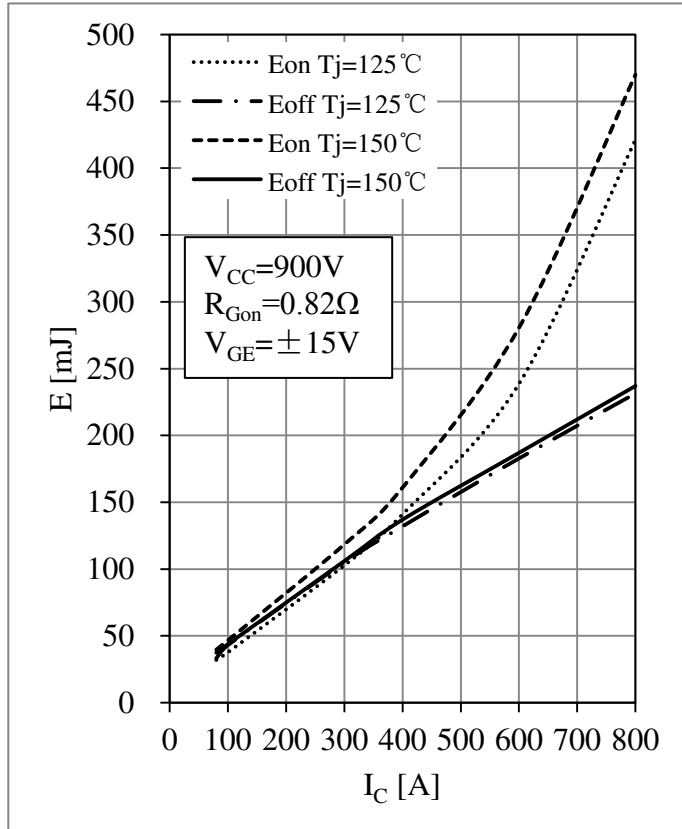
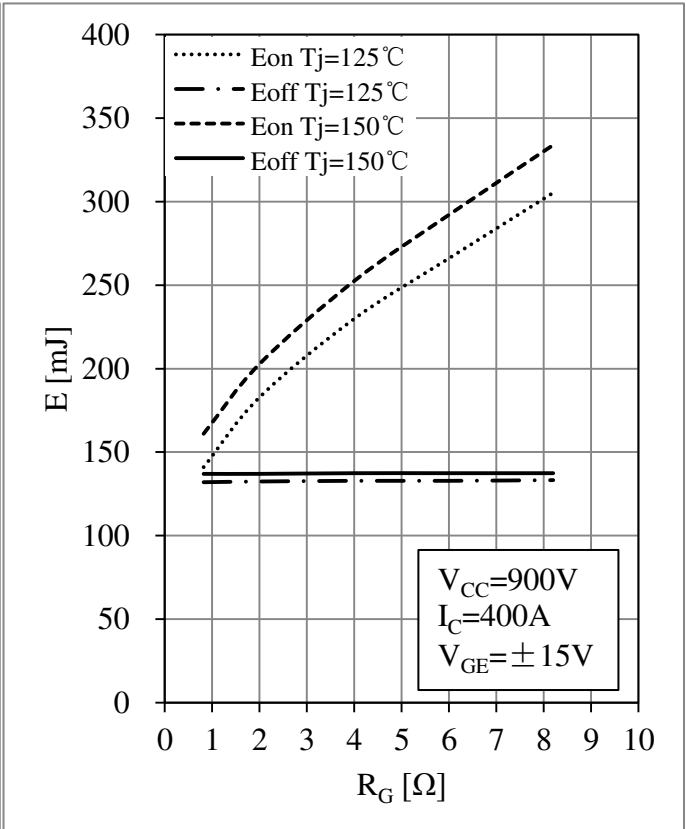


Fig 2. IGBT Transfer Characteristics

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

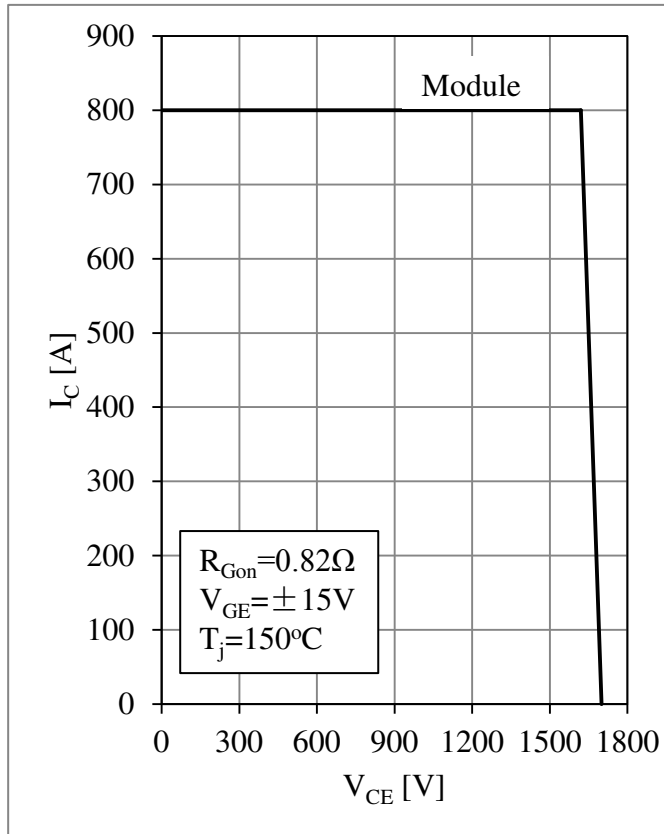


Fig 5. RBSOA

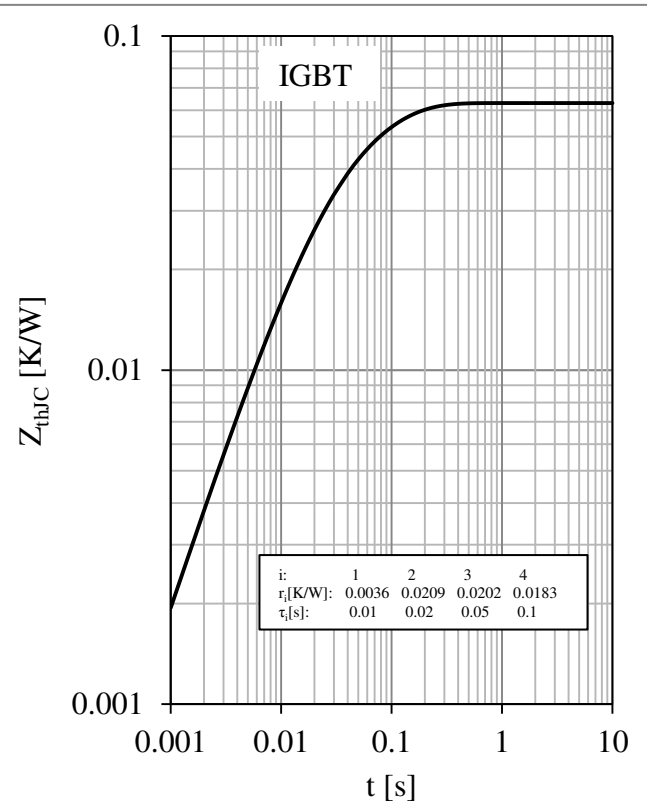


Fig 6. IGBT Transient Thermal Impedance

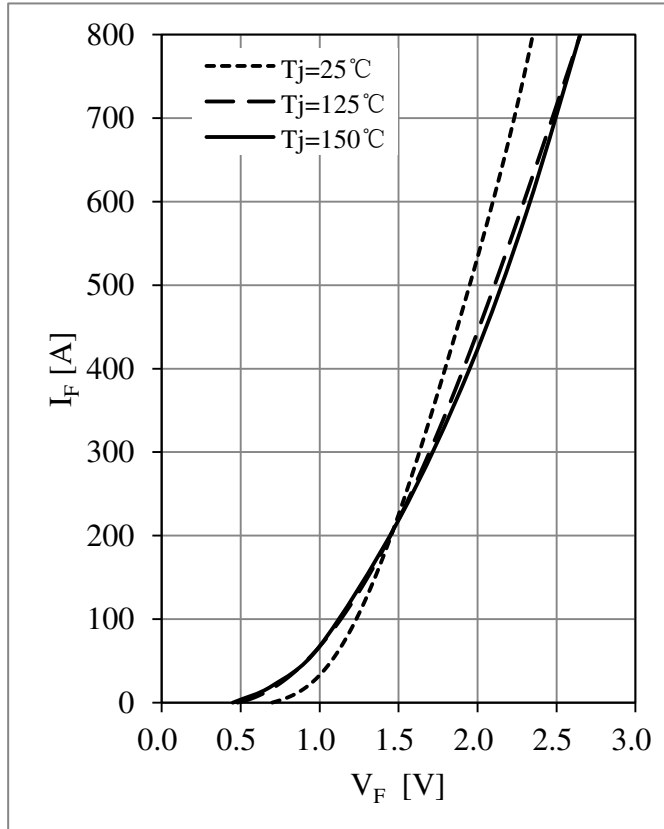
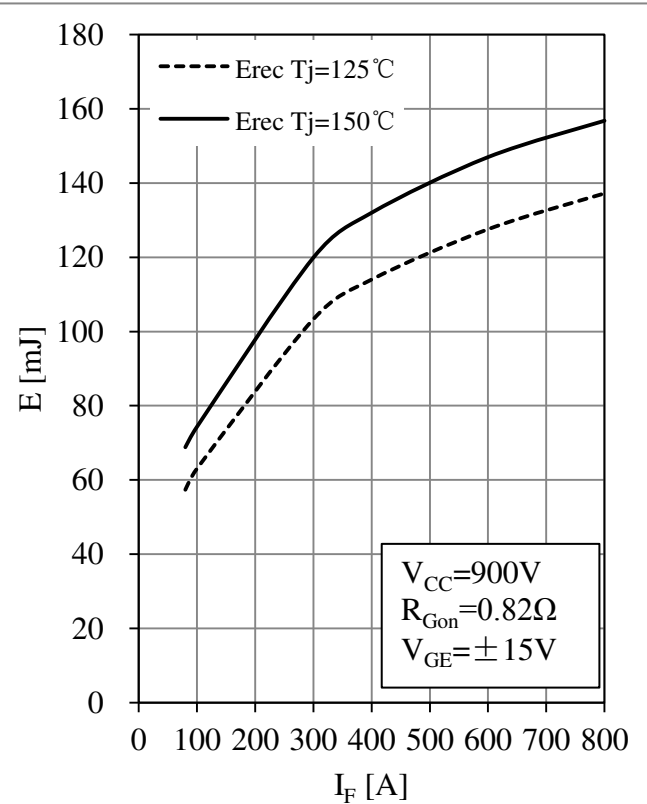


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

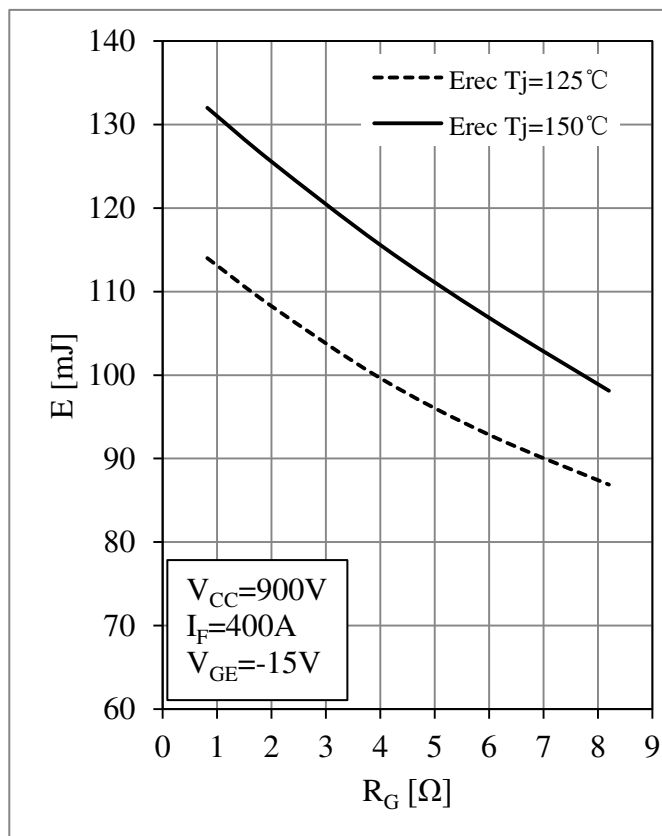
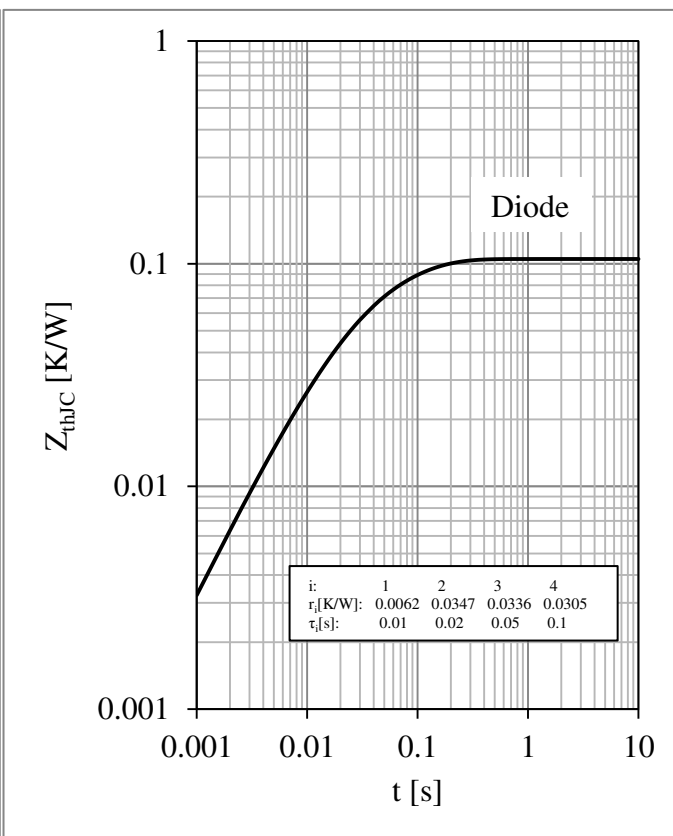
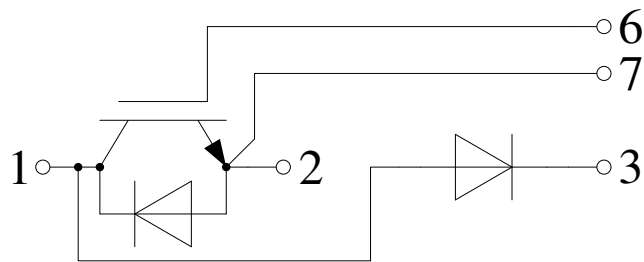
Fig 9. Diode Switching Loss vs. R_G 

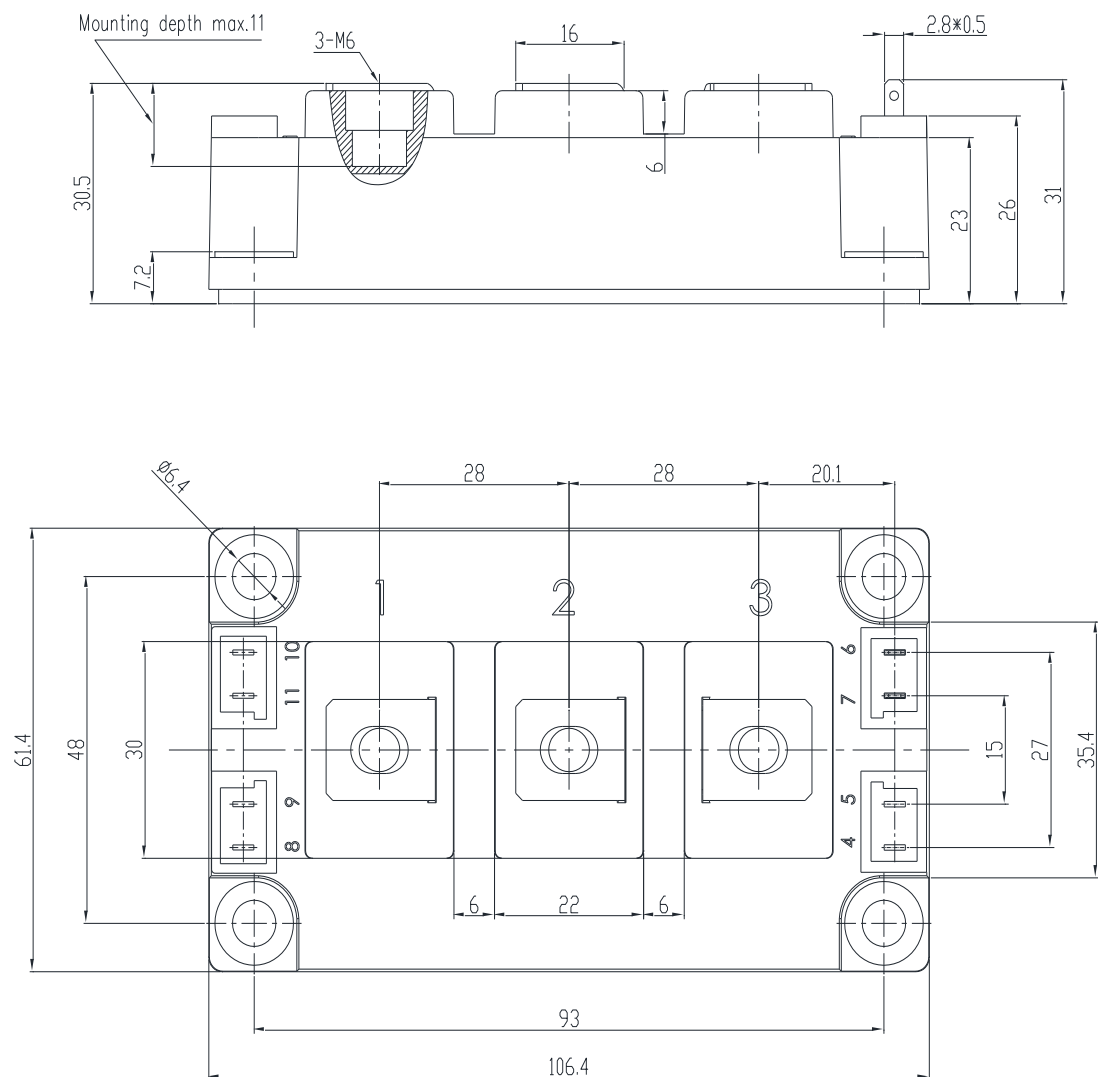
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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