

STARPOWER

SEMICONDUCTOR

IGBT

GD400CUT120C2S_G8

1200V/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

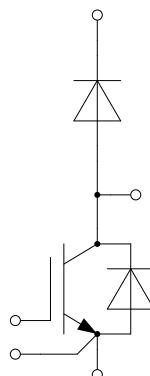
- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



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	1200	V
V_{GES}	Gate-Emitter Voltage	± 30	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	630	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 @ $T_j=175^{\circ}\text{C}$	2083	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	$I_C=400\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.70	2.15	V
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.95		
		$I_C=400\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=16.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.0	5.7	6.5	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			0.5		Ω
C_{ies}	Input Capacitance	$V_{CE}=30\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		39.6		nF
C_{res}	Reverse Transfer Capacitance				1.20	
Q_G	Gate Charge	$V_{GE}=15\text{V}$		2.40		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}, R_G=2.0\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		408		ns
t_r	Rise Time			119		ns
$t_{d(off)}$	Turn-Off Delay Time			573		ns
t_f	Fall Time			135		ns
E_{on}	Turn-On Switching Loss			10.5		mJ
E_{off}	Turn-Off Switching Loss			36.2		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}, R_G=2.0\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		409		ns
t_r	Rise Time			120		ns
$t_{d(off)}$	Turn-Off Delay Time			632		ns
t_f	Fall Time			188		ns
E_{on}	Turn-On Switching Loss			13.2		mJ
E_{off}	Turn-Off Switching Loss			53.6		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=400\text{A}, R_G=2.0\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$		410		ns
t_r	Rise Time			123		ns
$t_{d(off)}$	Turn-Off Delay Time			638		ns
t_f	Fall Time			198		ns
E_{on}	Turn-On Switching Loss			14.4		mJ
E_{off}	Turn-Off Switching Loss			56.1		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		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
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=125^{\circ}\text{C}$		1.85		
		$I_F=400\text{A}, V_{GE}=0\text{V}, T_j=150^{\circ}\text{C}$		1.85		
Q_r	Recovered Charge			40.5		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=400\text{A},$ $-di/dt=3350\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^{\circ}\text{C}$		259		A
E_{rec}	Reverse Recovery Energy			19.7		mJ
Q_r	Recovered Charge			67.9		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=400\text{A},$ $-di/dt=3350\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^{\circ}\text{C}$		323		A
E_{rec}	Reverse Recovery Energy			32.6		mJ
Q_r	Recovered Charge			77.7		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=400\text{A},$ $-di/dt=3350\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^{\circ}\text{C}$		342		A
E_{rec}	Reverse Recovery Energy			38.3		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
$R_{\theta JC}$	Junction-to-Case (per IGBT)			0.072	K/W
	Junction-to-Case (per Diode)			0.095	
$R_{\theta CS}$	Case-to-Sink (per IGBT)		0.088		K/W
	Case-to-Sink (per Diode)		0.116		
$R_{\theta CS}$	Case-to-Sink		0.035		K/W
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

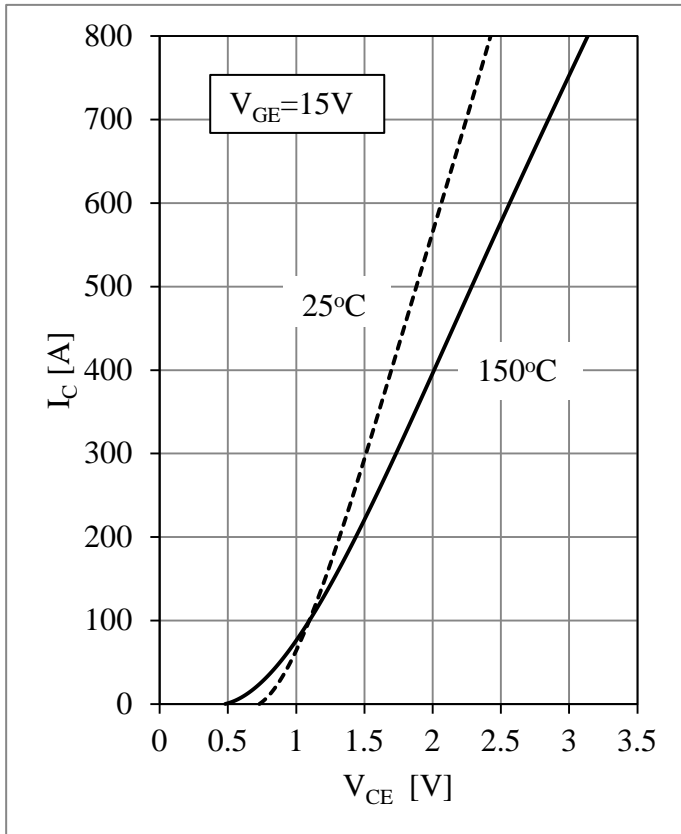


Fig 1. IGBT Output Characteristics

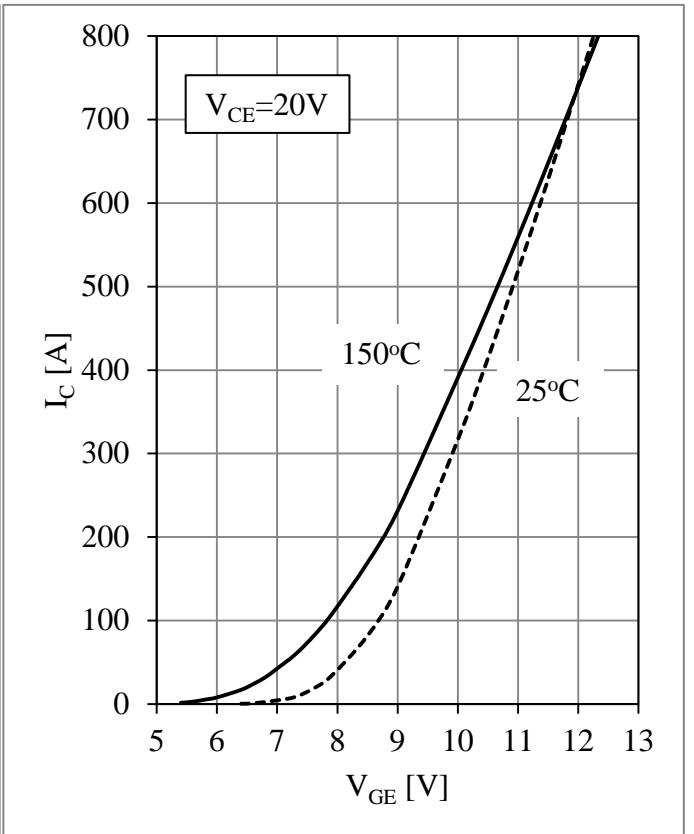


Fig 2. IGBT Transfer Characteristics

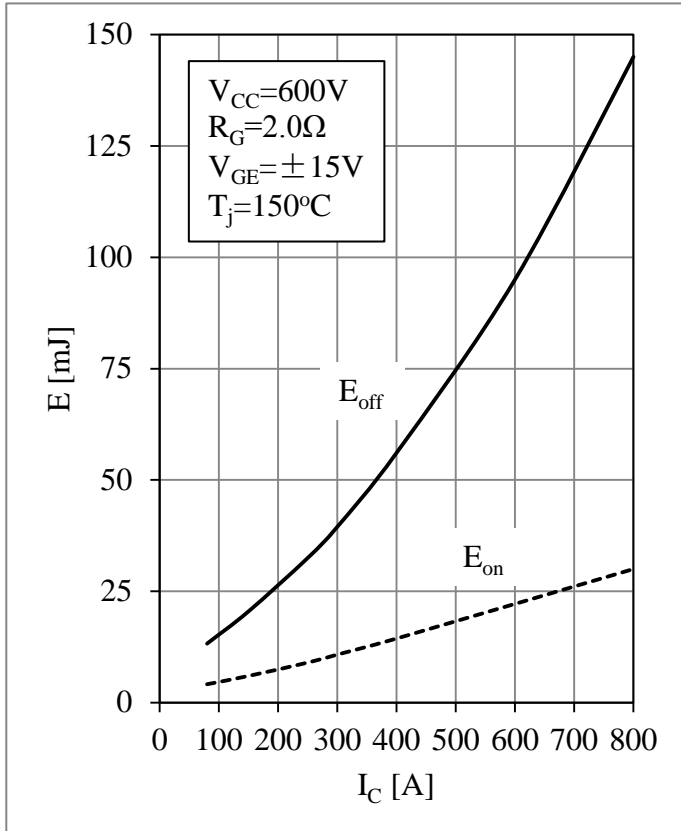


Fig 3. IGBT Switching Loss vs. I_c

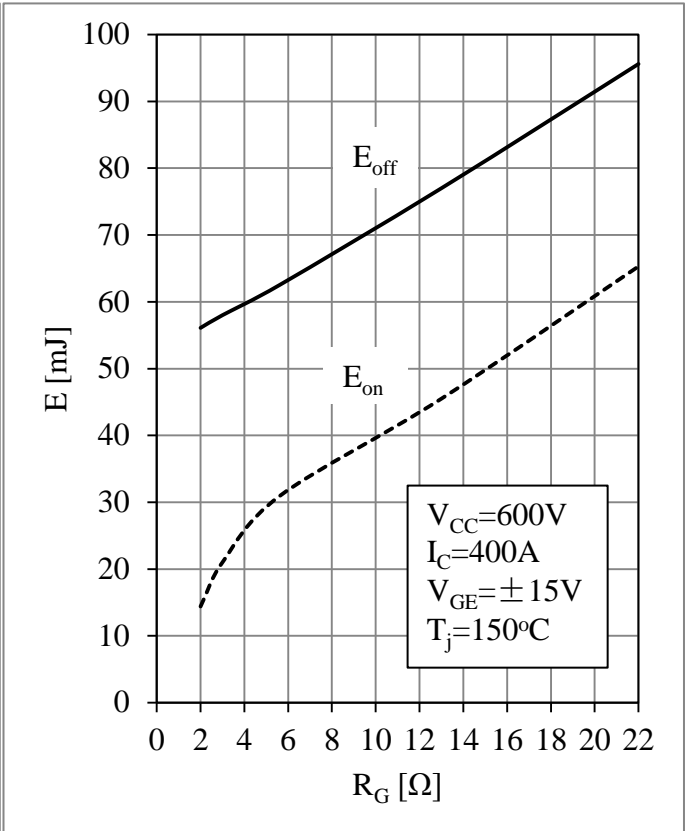


Fig 4. IGBT Switching Loss vs. R_g

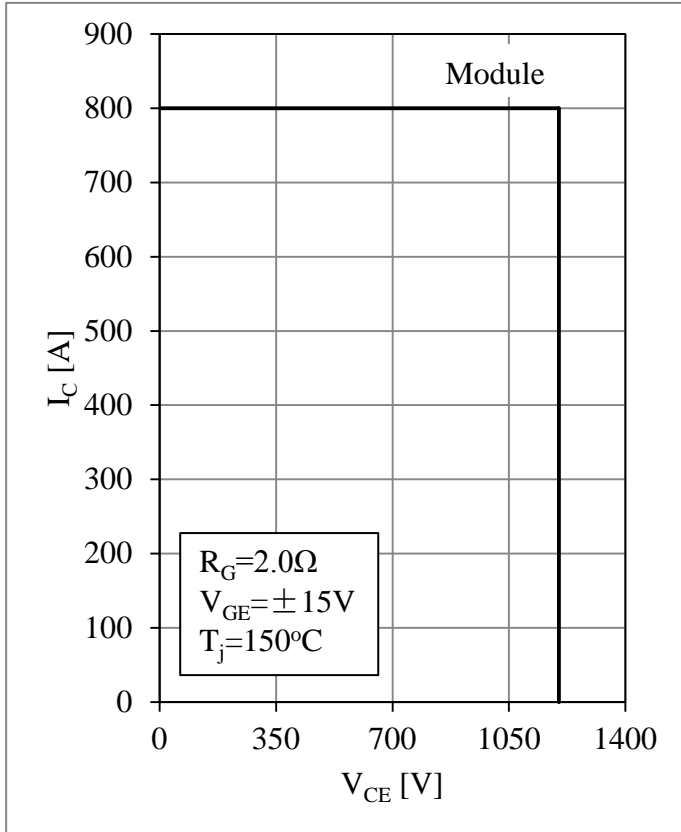


Fig 5. RBSOA

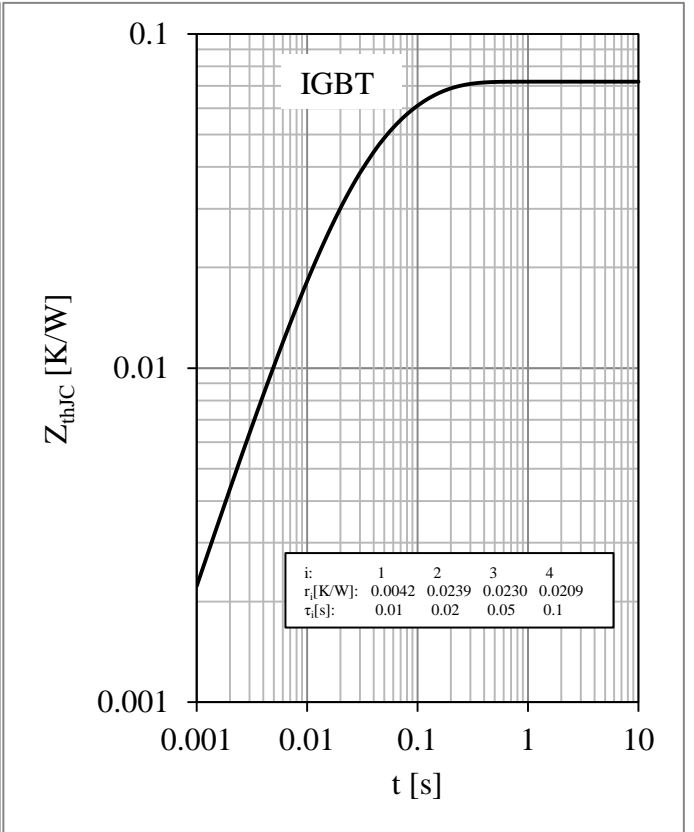


Fig 6. IGBT Transient Thermal Impedance

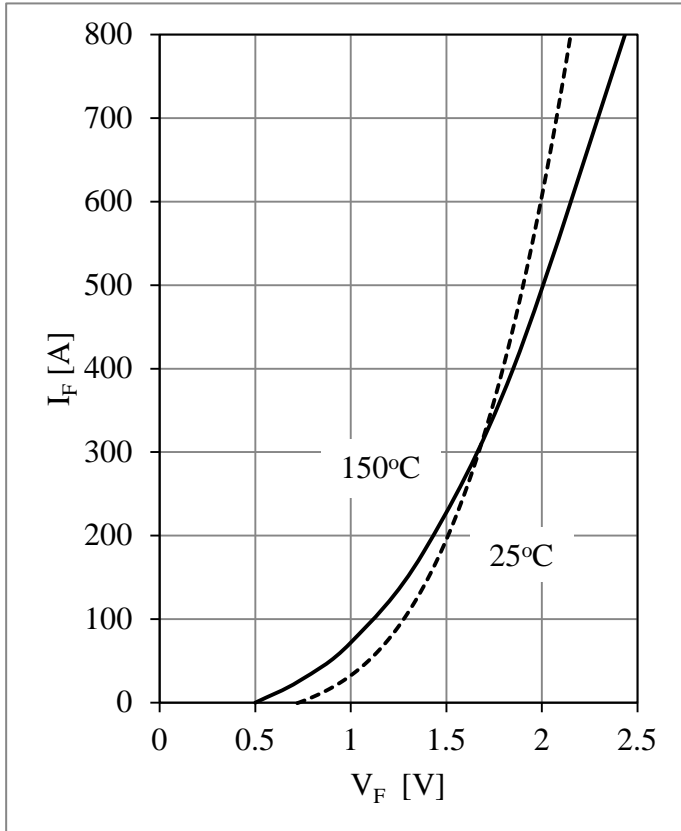


Fig 7. Diode Forward Characteristics

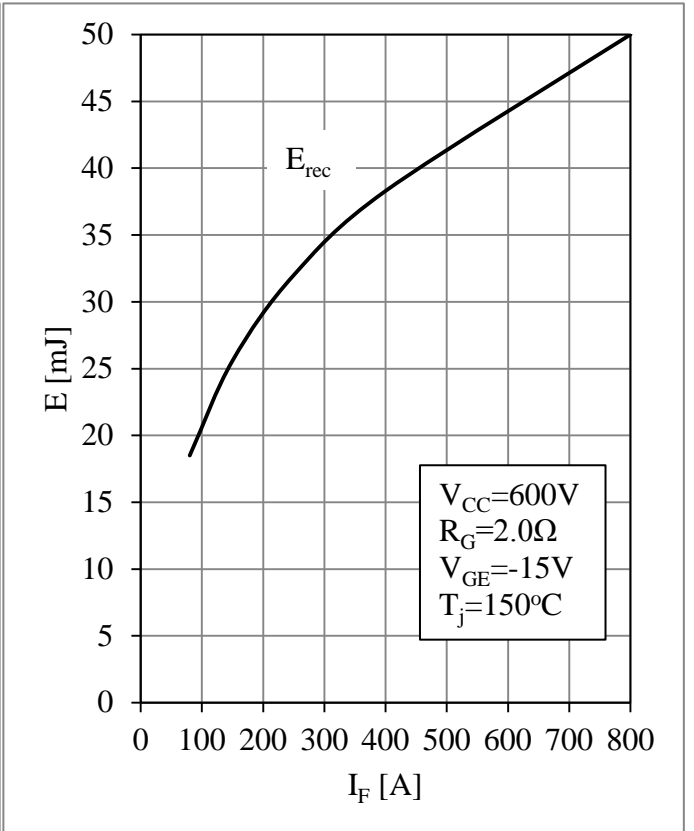


Fig 8. Diode Switching Loss vs. I_F

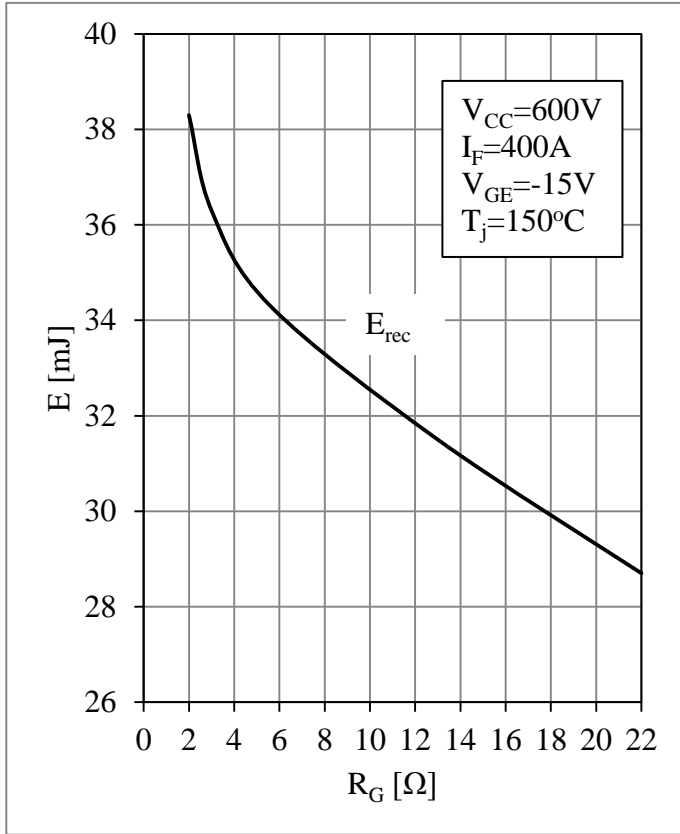


Fig 9. Diode Switching Loss vs. R_G

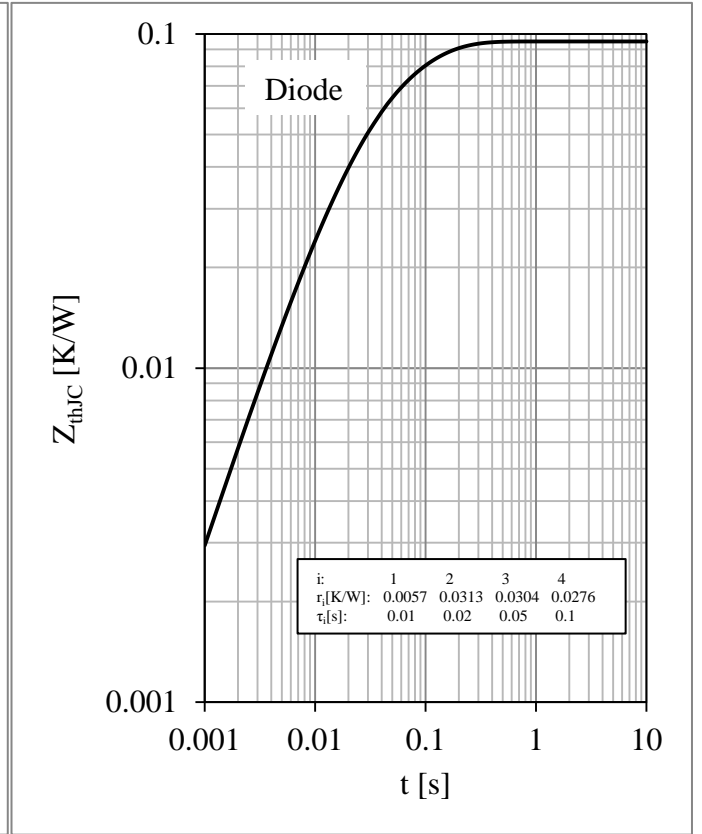
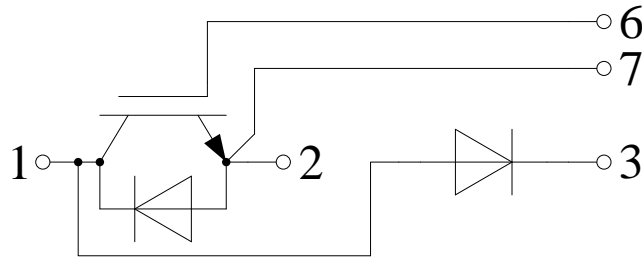


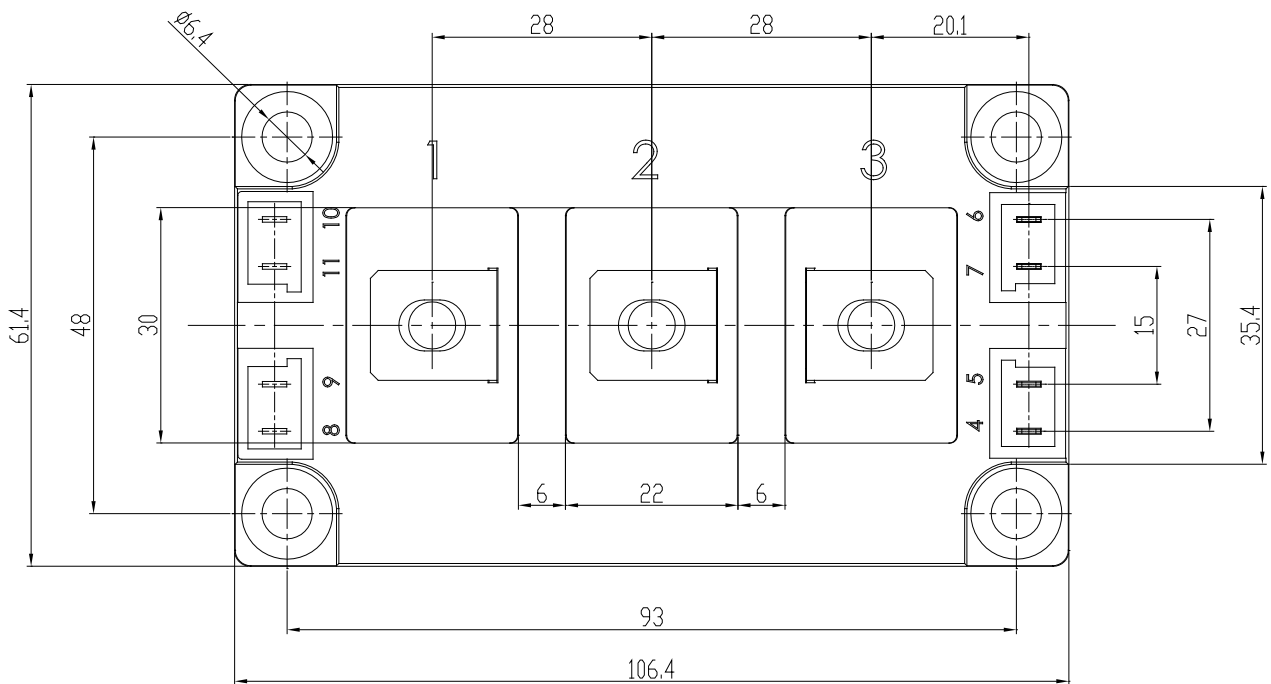
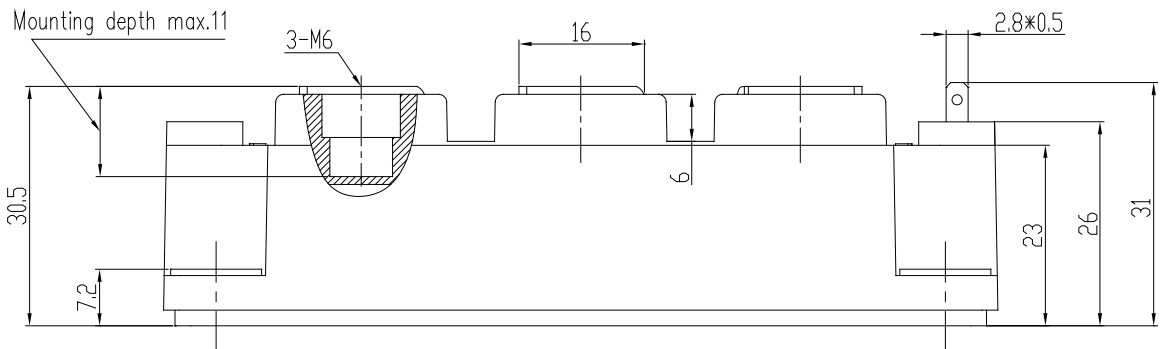
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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