

STARPOWER

SEMICONDUCTOR

IGBT

GD150CUL170C2S

1700V/150A 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

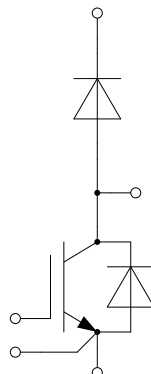
- Low $V_{CE(sat)}$ SPT+ IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Typical Applications

- Inverter for motor drive
- Wind turbine
- High power converter

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 @ $T_C=25^{\circ}\text{C}$	240	A
	@ $T_C=100^{\circ}\text{C}$	150	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	300	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	1127	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	300	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	$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.40	2.85	V	
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		2.80			
		$I_C=150\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.90			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=6.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.4	6.2	7.4	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	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			400	nA	
R_{Gint}	Internal Gate Resistance			3.9		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		10.2		nF	
C_{res}	Reverse Transfer Capacitance			0.36		nF	
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		1.22		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=150\text{A}, R_G=9.1\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		373		ns	
t_r	Rise Time			123		ns	
$t_{d(off)}$	Turn-Off Delay Time			336		ns	
t_f	Fall Time			339		ns	
E_{on}	Turn-On Switching Loss			56.4		mJ	
E_{off}	Turn-Off Switching Loss			25.4		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=900\text{V}, I_C=150\text{A}, R_G=9.1\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		382		ns
t_r	Rise Time				123		ns
$t_{d(off)}$	Turn-Off Delay Time			371		ns	
t_f	Fall Time			726		ns	
E_{on}	Turn-On Switching Loss			61.0		mJ	
E_{off}	Turn-Off Switching Loss			40.0		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=150\text{A}, R_G=9.1\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			391		ns
t_r	Rise Time				123		ns
$t_{d(off)}$	Turn-Off Delay Time			384		ns	
t_f	Fall Time			813		ns	
E_{on}	Turn-On Switching Loss			67.1		mJ	
E_{off}	Turn-Off Switching Loss			44.0		mJ	
I_{SC}	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		500		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	$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.80	2.25	V
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.95		
		$I_F=150\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.90		
Q_r	Recovered Charge			33.4		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}, I_F=150\text{A},$ $-di/dt=1150\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		98		A
E_{rec}	Reverse Recovery Energy			19.9		mJ
Q_r	Recovered Charge			53.0		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}, I_F=150\text{A},$ $-di/dt=1150\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		119		A
E_{rec}	Reverse Recovery Energy			31.1		mJ
Q_r	Recovered Charge			65.3		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=900\text{V}, I_F=150\text{A},$ $-di/dt=1150\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		132		A
E_{rec}	Reverse Recovery Energy			34.2		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)			0.133	K/W
	Junction-to-Case (per Diode)			0.213	
R_{thCH}	Case-to-Heatsink (per IGBT)		0.079		K/W
	Case-to-Heatsink (per Diode)		0.126		
	Case-to-Heatsink (per Module)		0.035		
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

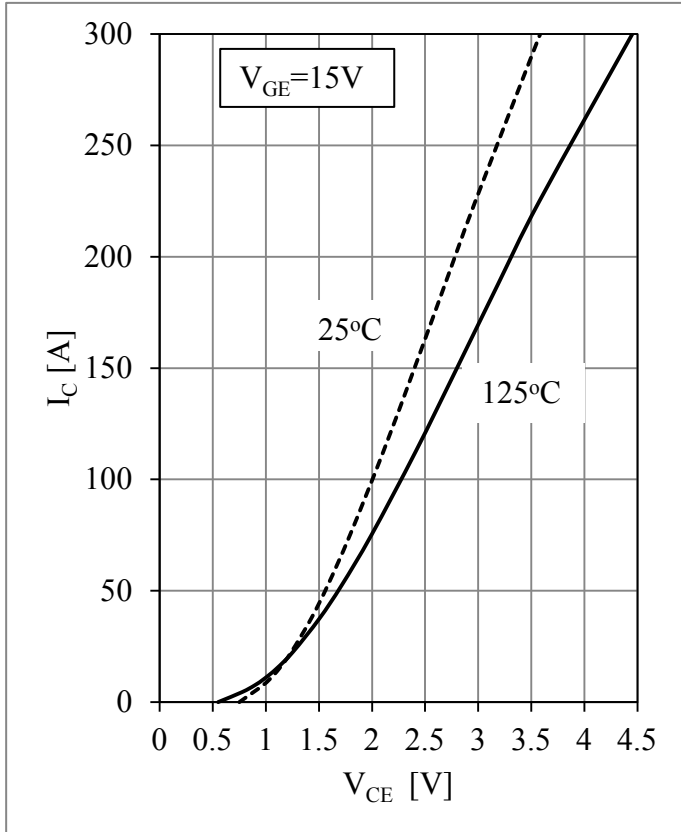


Fig 1. IGBT Output Characteristics

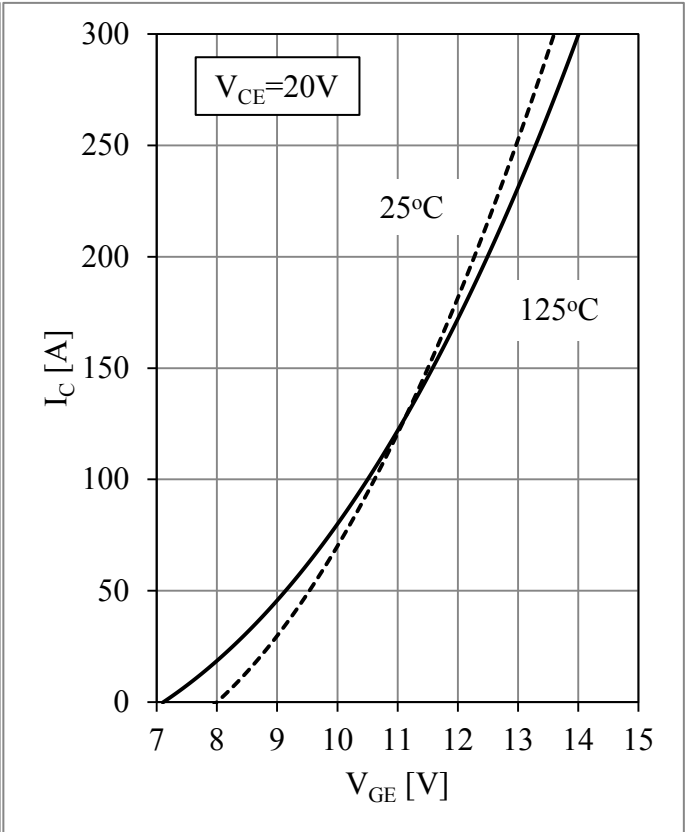


Fig 2. IGBT Transfer Characteristics

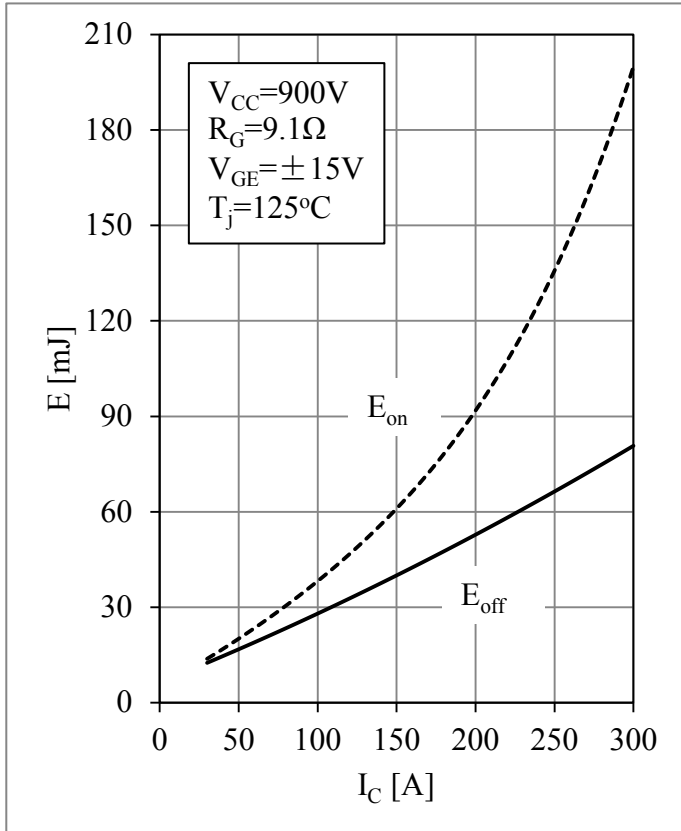


Fig 3. IGBT Switching Loss vs. I_C

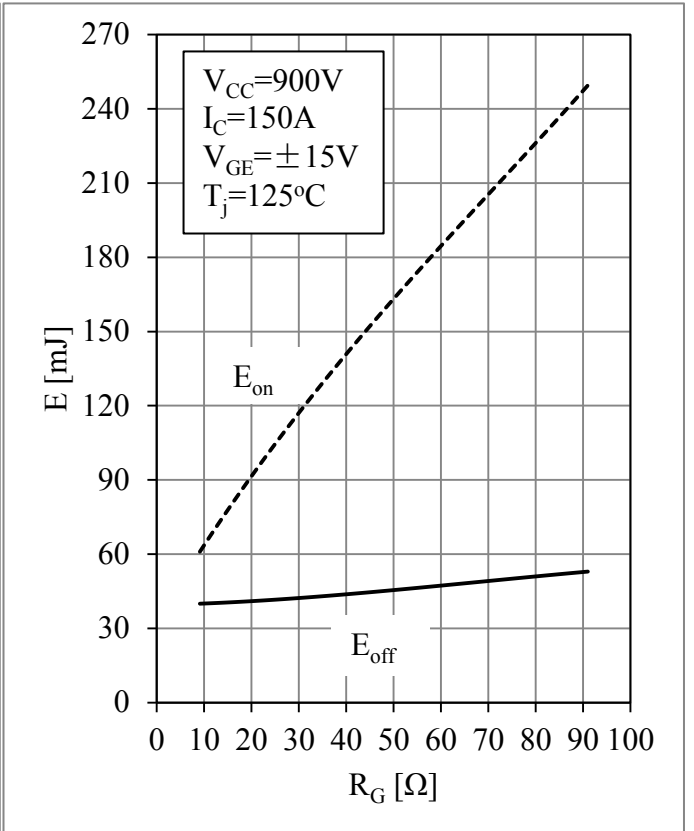


Fig 4. IGBT Switching Loss vs. R_G

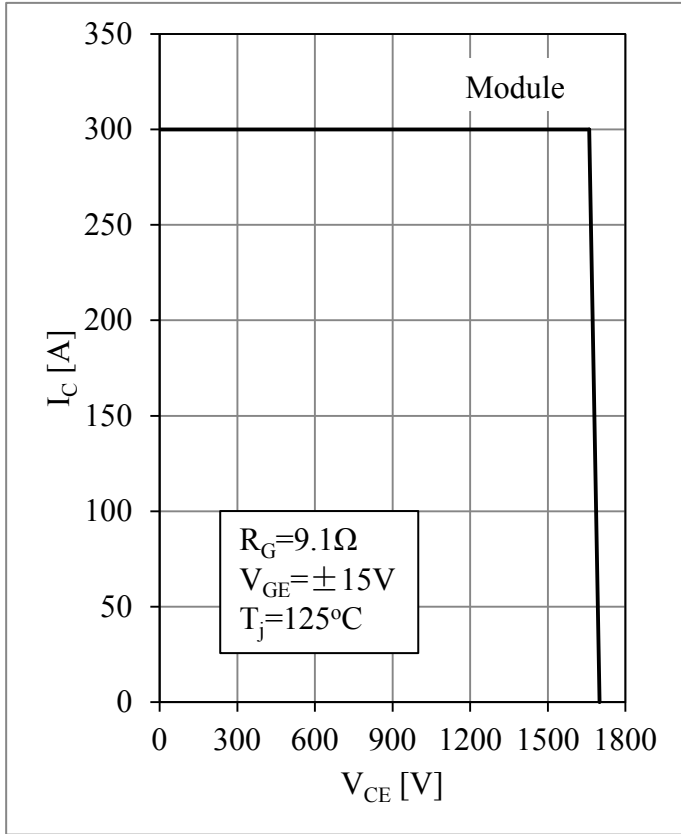


Fig 5. RBSOA

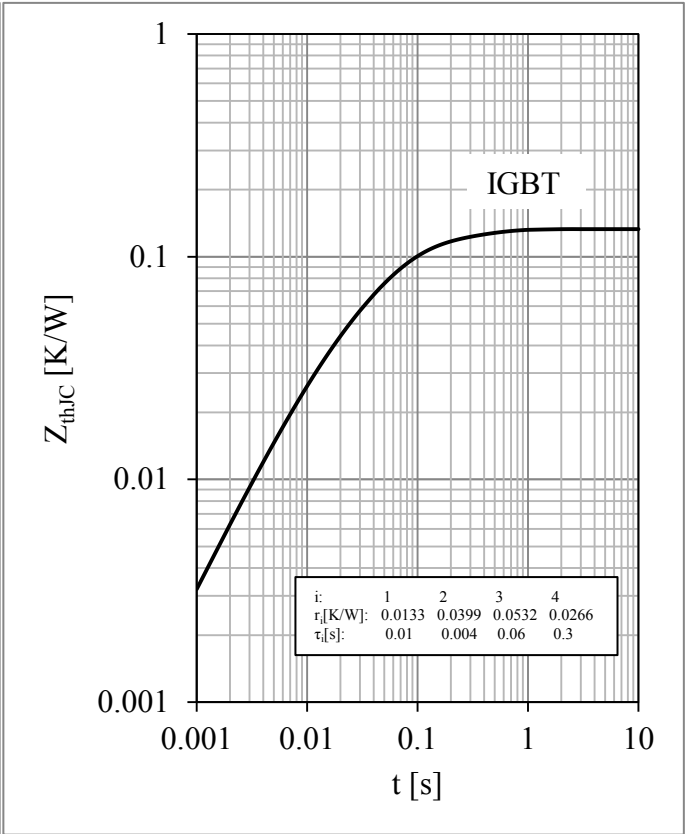


Fig 6. IGBT Transient Thermal Impedance

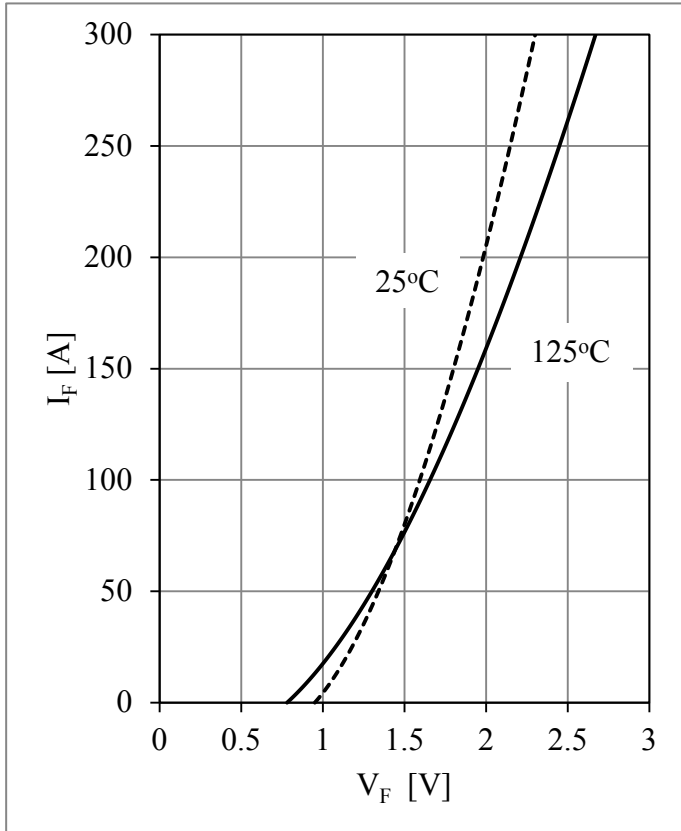


Fig 7. Diode Forward Characteristics

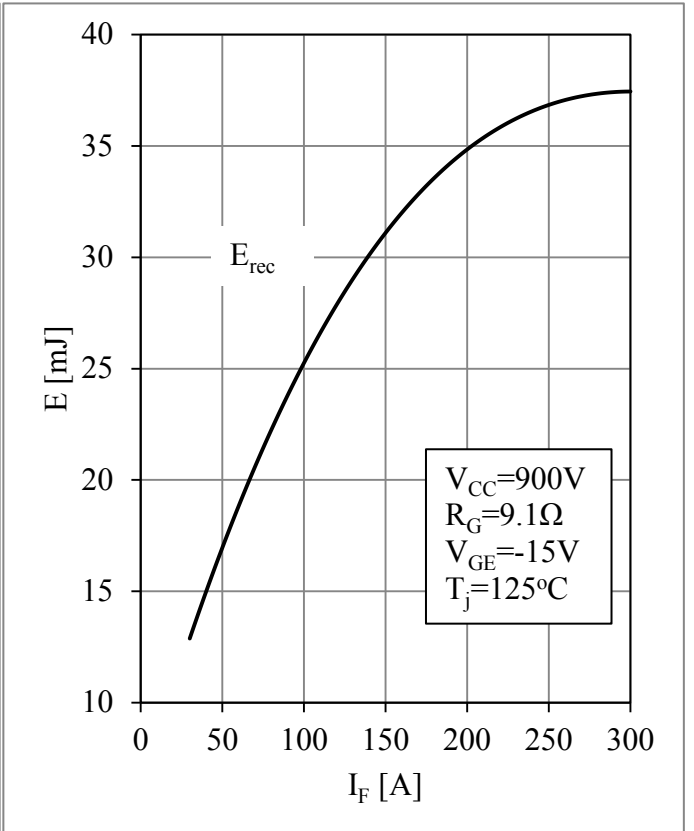


Fig 8. Diode Switching Loss vs. I_F

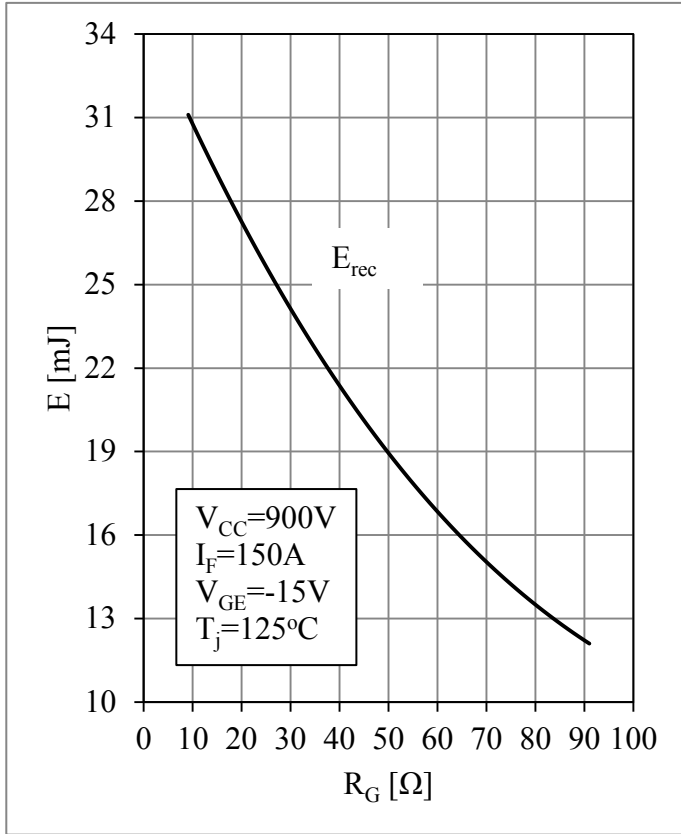


Fig 9. Diode Switching Loss vs. R_G

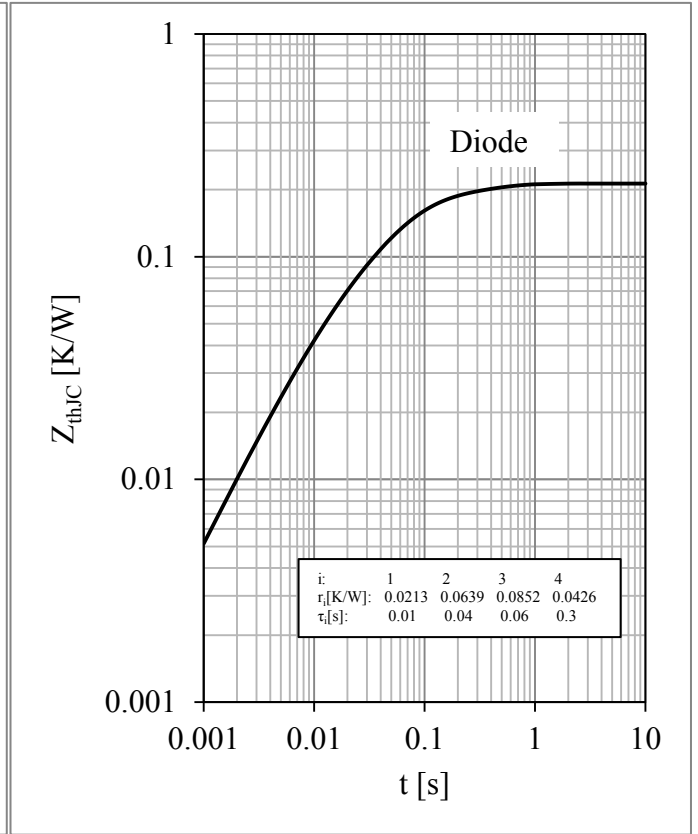
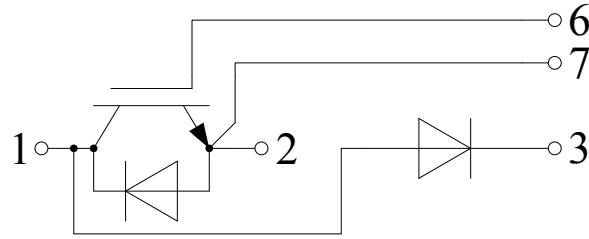


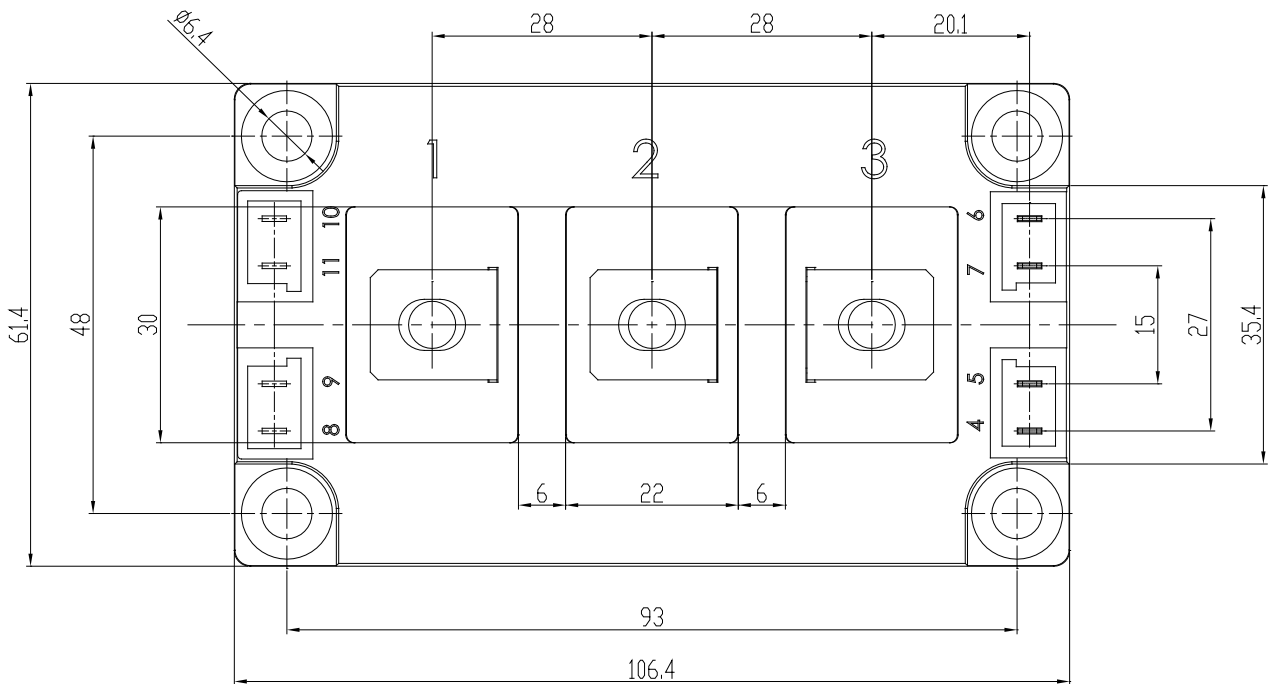
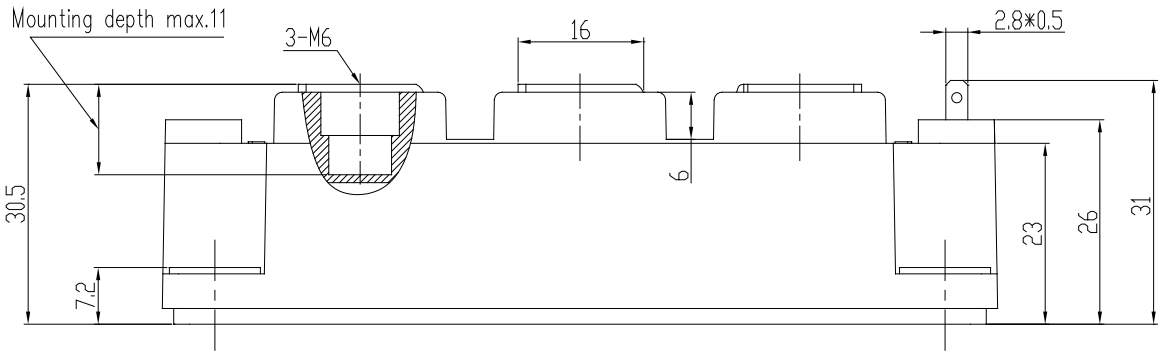
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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