

STARPOWER

SEMICONDUCTOR

IGBT

GD1200HFY120C3S

1200V/1200A 2 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 high power converters.

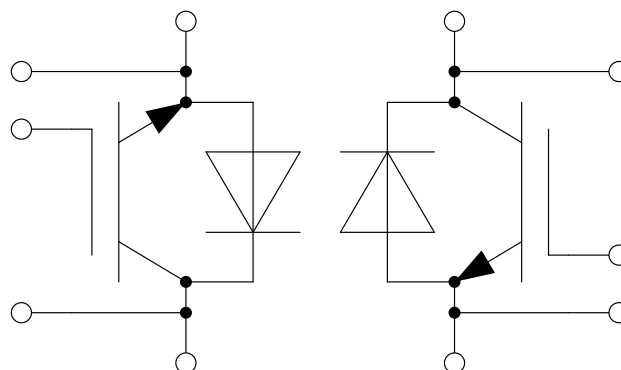
Features

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

Typical Applications

- High Power Converters
- Motor Drives
- Wind Turbines

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 @ $T_C=25^{\circ}\text{C}$	1772	A
	@ $T_C=90^{\circ}\text{C}$	1200	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	2400	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	5.56	kW

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	1200	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	2400	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, $f=50\text{Hz}, t=1\text{min}$	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	$I_C=1200\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.70	2.15	V	
		$I_C=1200\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.95			
		$I_C=1200\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.00			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=48.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.6	6.2	6.8	V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			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			1.0		Ω	
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		124		nF	
C_{res}	Reverse Transfer Capacitance			3.48		nF	
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		9.32		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=1200\text{A}, R_G=3\Omega, V_{GE}=-9/+15\text{V}, L_S=65\text{nH}, T_j=25^\circ\text{C}$		647		ns	
t_r	Rise Time			343		ns	
$t_{d(off)}$	Turn-Off Delay Time			1707		ns	
t_f	Fall Time			208		ns	
E_{on}	Turn-On Switching Loss			196		mJ	
E_{off}	Turn-Off Switching Loss			293		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=600\text{V}, I_C=1200\text{A}, R_G=3\Omega, V_{GE}=-9/+15\text{V}, L_S=65\text{nH}, T_j=125^\circ\text{C}$		1028		ns
t_r	Rise Time				402		ns
$t_{d(off)}$	Turn-Off Delay Time				2211		ns
t_f	Fall Time				239		ns
E_{on}	Turn-On Switching Loss			314		mJ	
E_{off}	Turn-Off Switching Loss			344		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=1200\text{A}, R_G=3\Omega, V_{GE}=-9/+15\text{V}, L_S=65\text{nH}, T_j=150^\circ\text{C}$			1095		ns
t_r	Rise Time				416		ns
$t_{d(off)}$	Turn-Off Delay Time			2339		ns	
t_f	Fall Time			244		ns	
E_{on}	Turn-On Switching Loss			363		mJ	
E_{off}	Turn-Off Switching Loss			364		mJ	
I_{SC}	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=600\text{V}, V_{CEM} \leq 1200\text{V}$		4800		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	$I_F=1200\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.85	2.30	V
		$I_F=1200\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		1.90		
		$I_F=1200\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.95		
Q_r	Recovered Charge			70.1		μC
I_{RM}	Peak Reverse Recovery Current	$V_{CC}=600\text{V}, I_F=1200\text{A},$ $-di/dt=3200\text{A}/\mu\text{s}, V_{GE}=-9\text{V},$ $L_S=65\text{nH}, T_j=25^\circ\text{C}$		406		A
E_{rec}	Reverse Recovery Energy			27.8		mJ
Q_r	Recovered Charge			120		μC
I_{RM}	Peak Reverse Recovery Current	$V_{CC}=600\text{V}, I_F=1200\text{A},$ $-di/dt=2750\text{A}/\mu\text{s}, V_{GE}=-9\text{V},$ $L_S=65\text{nH}, T_j=125^\circ\text{C}$		461		A
E_{rec}	Reverse Recovery Energy			47.2		mJ
Q_r	Recovered Charge			146		μC
I_{RM}	Peak Reverse Recovery Current	$V_{CC}=600\text{V}, I_F=1200\text{A},$ $-di/dt=2600\text{A}/\mu\text{s}, V_{GE}=-9\text{V},$ $L_S=65\text{nH}, T_j=150^\circ\text{C}$		486		A
E_{rec}	Reverse Recovery Energy			56.9		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		0.37		m Ω
R_{thJC}	Junction-to-Case (per IGBT)			27.0	K/kW
	Junction-to-Case (per Diode)			45.8	
R_{thCH}	Case-to-Heatsink (per IGBT)		19.1		K/kW
	Case-to-Heatsink (per Diode)		32.4		
	Case-to-Heatsink (per Module)		6.0		
M	Terminal Connection Torque, Screw M4	1.8		2.1	N.m
	Terminal Connection Torque, Screw M8	8.0		10	
	Mounting Torque, Screw M6	4.25		5.75	
G	Weight of Module		1500		g

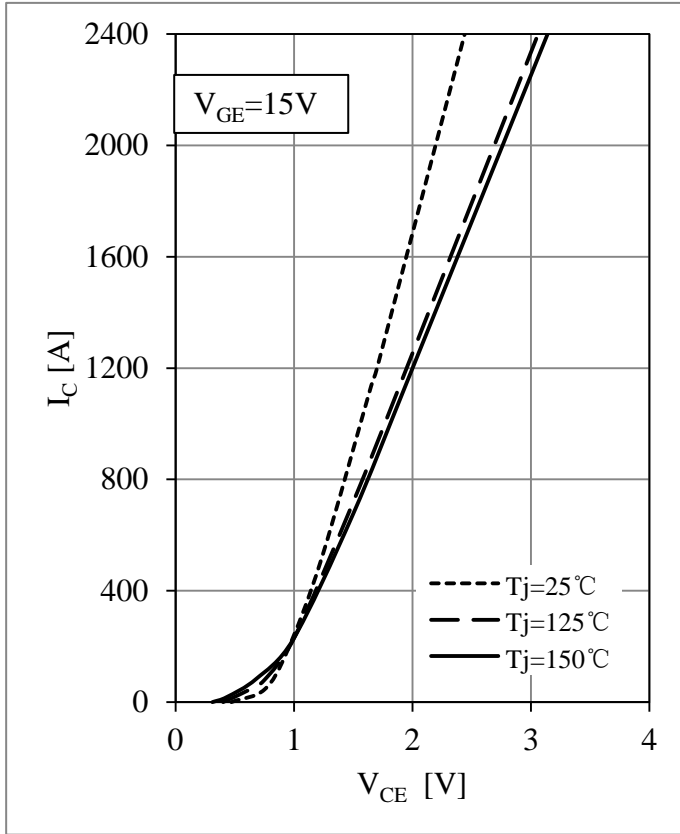


Fig 1. IGBT Output Characteristics

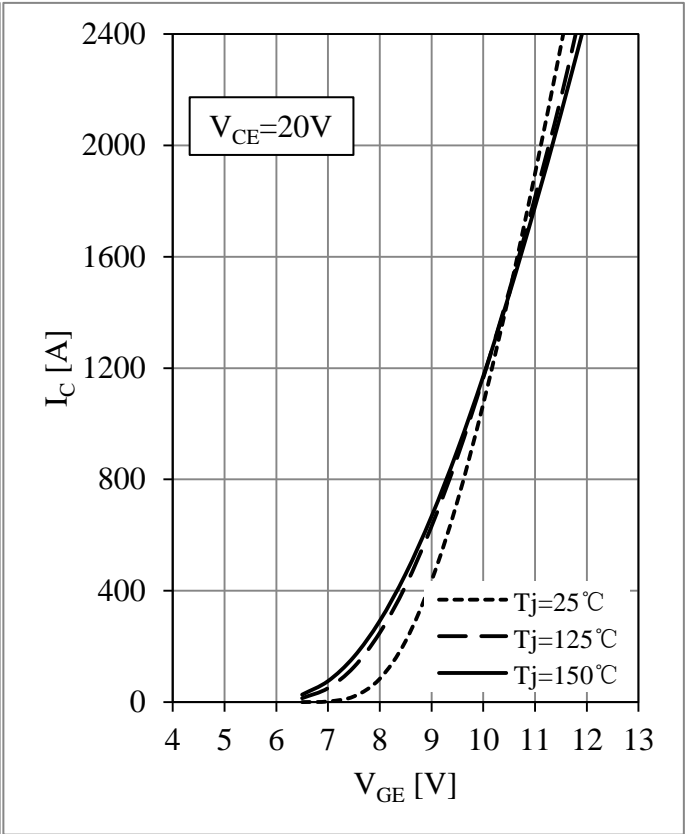


Fig 2. IGBT Transfer Characteristics

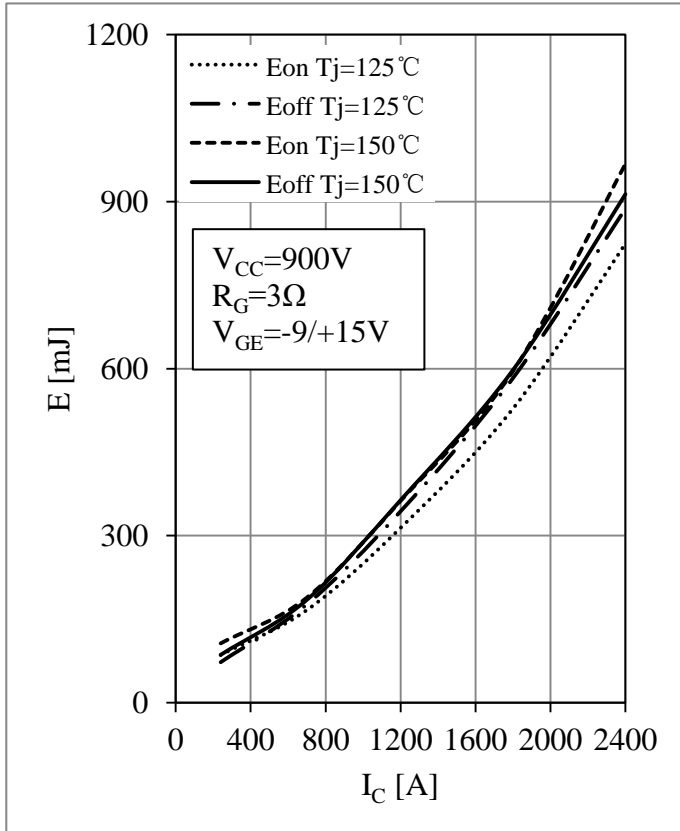


Fig 3. IGBT Switching Loss vs. I_C

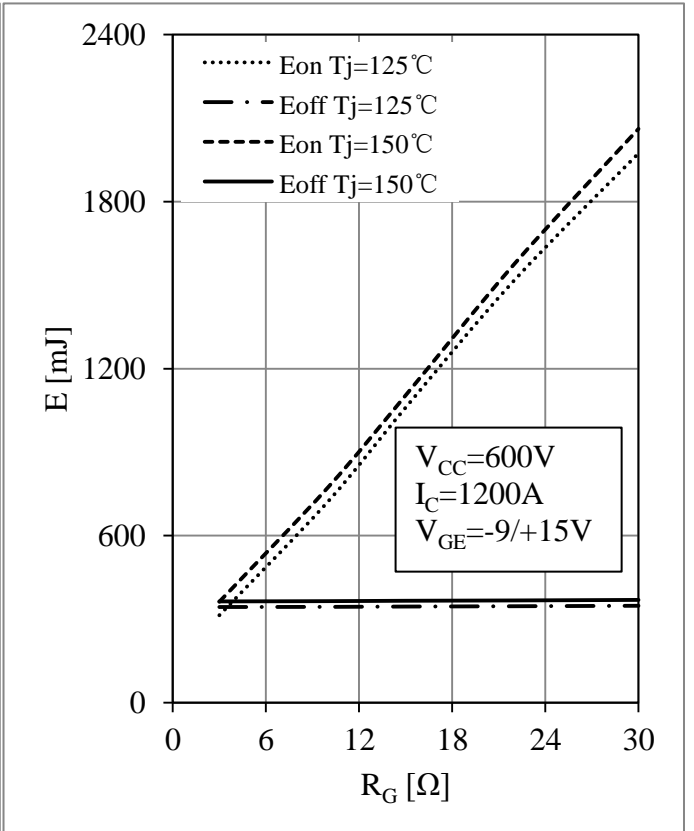


Fig 4. IGBT Switching Loss vs. R_G

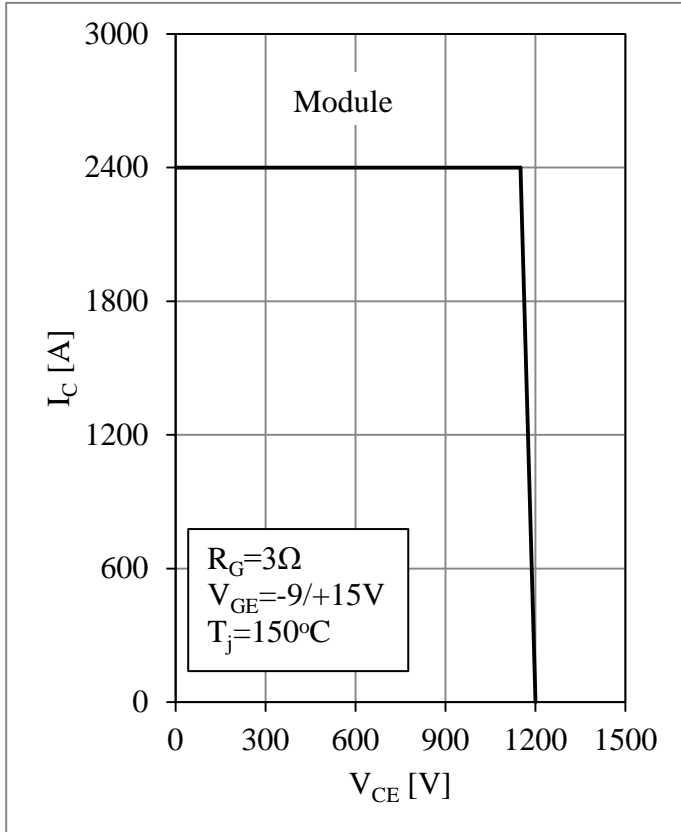


Fig 5. RBSOA

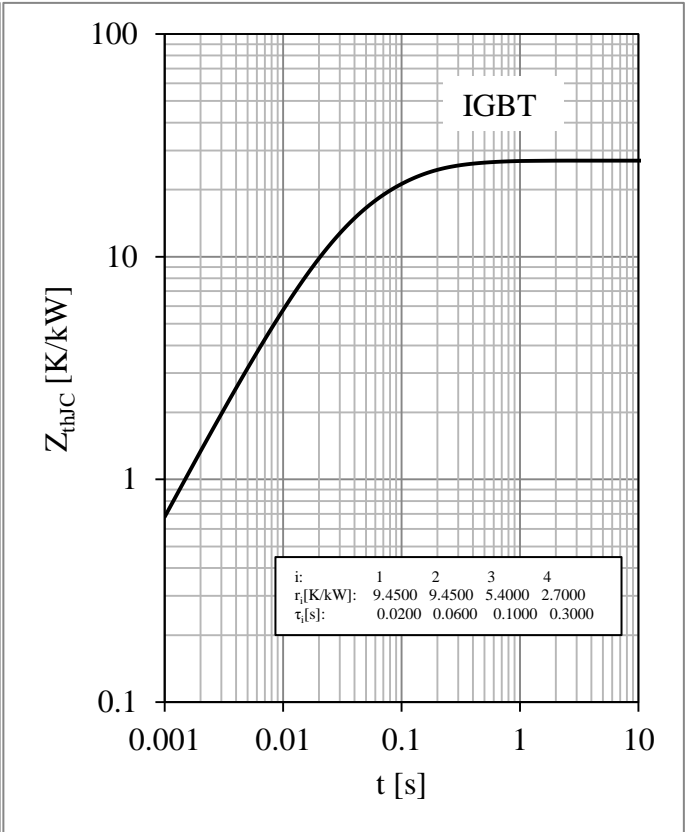


Fig 6. IGBT Transient Thermal Impedance

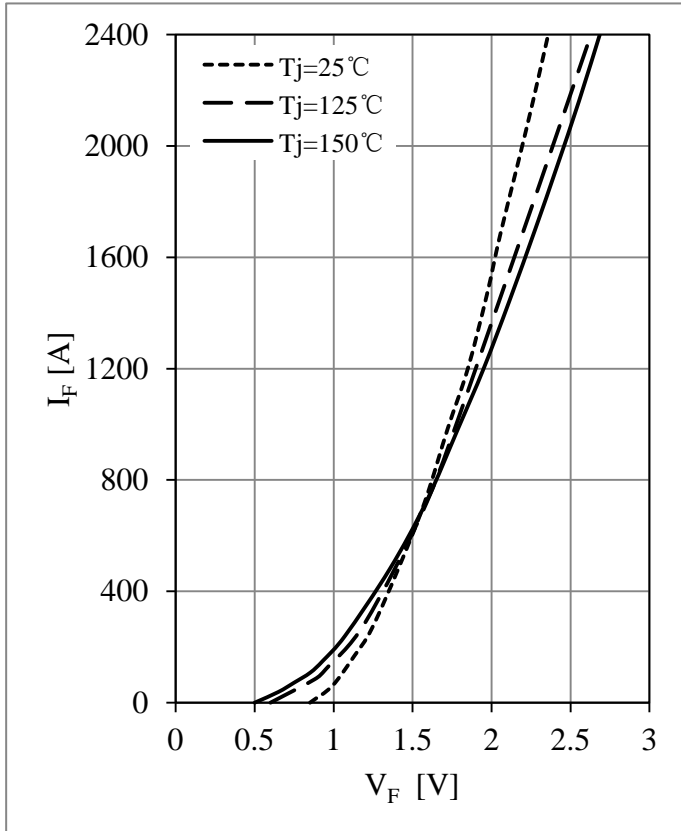


Fig 7. Diode Forward Characteristics

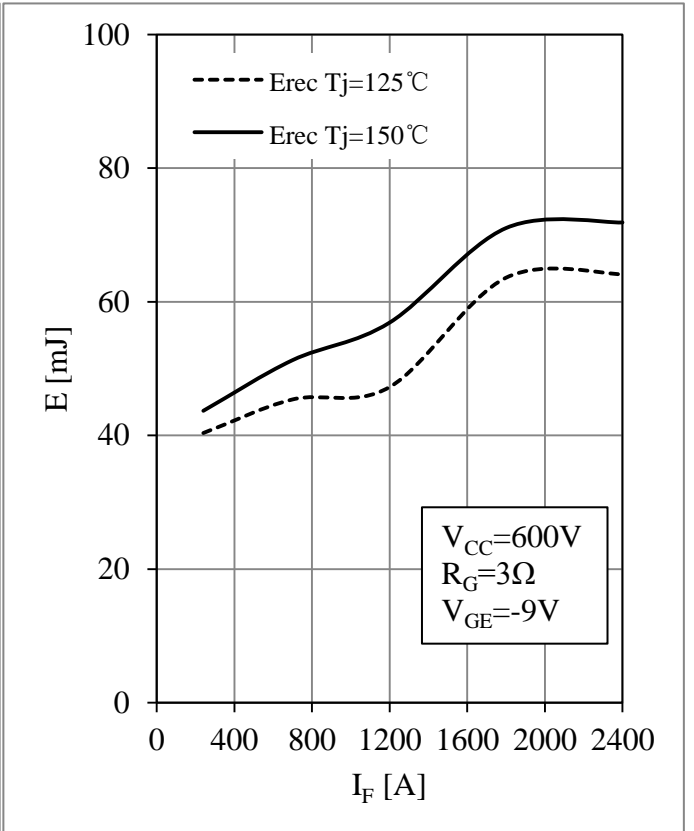


Fig 8. Diode Switching Loss vs. I_F

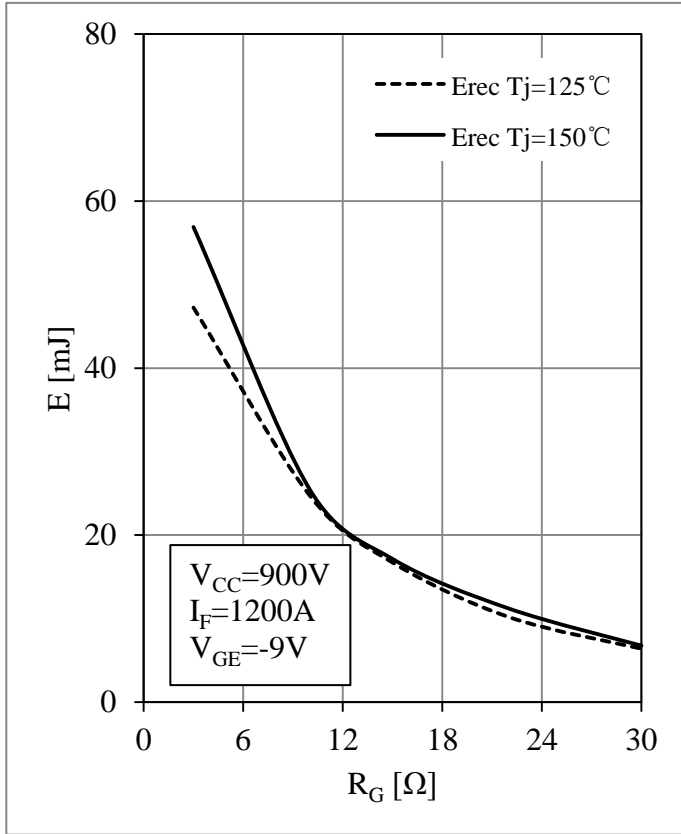


Fig 9. Diode Switching Loss vs. R_G

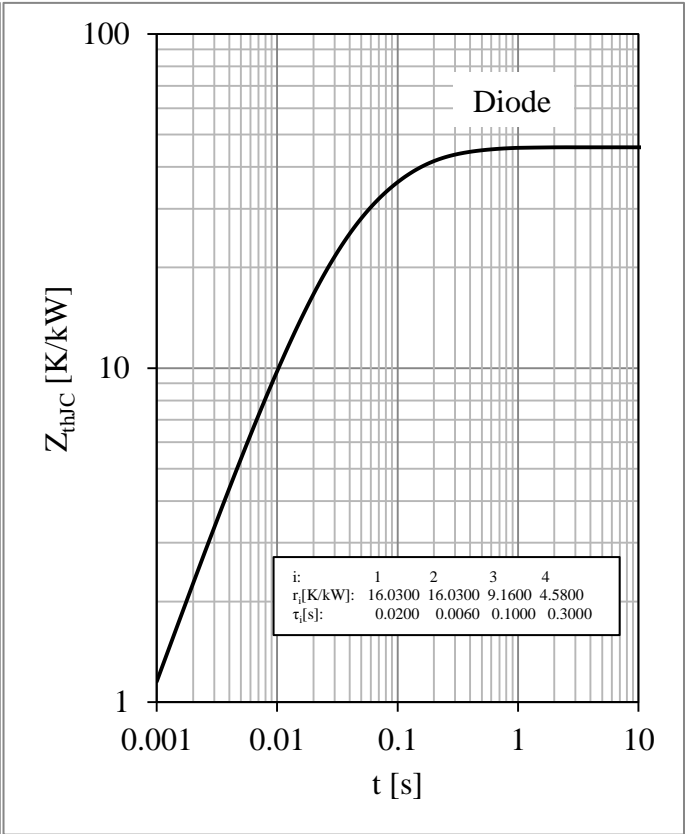
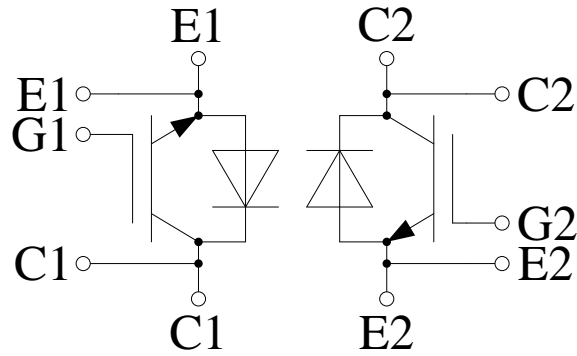


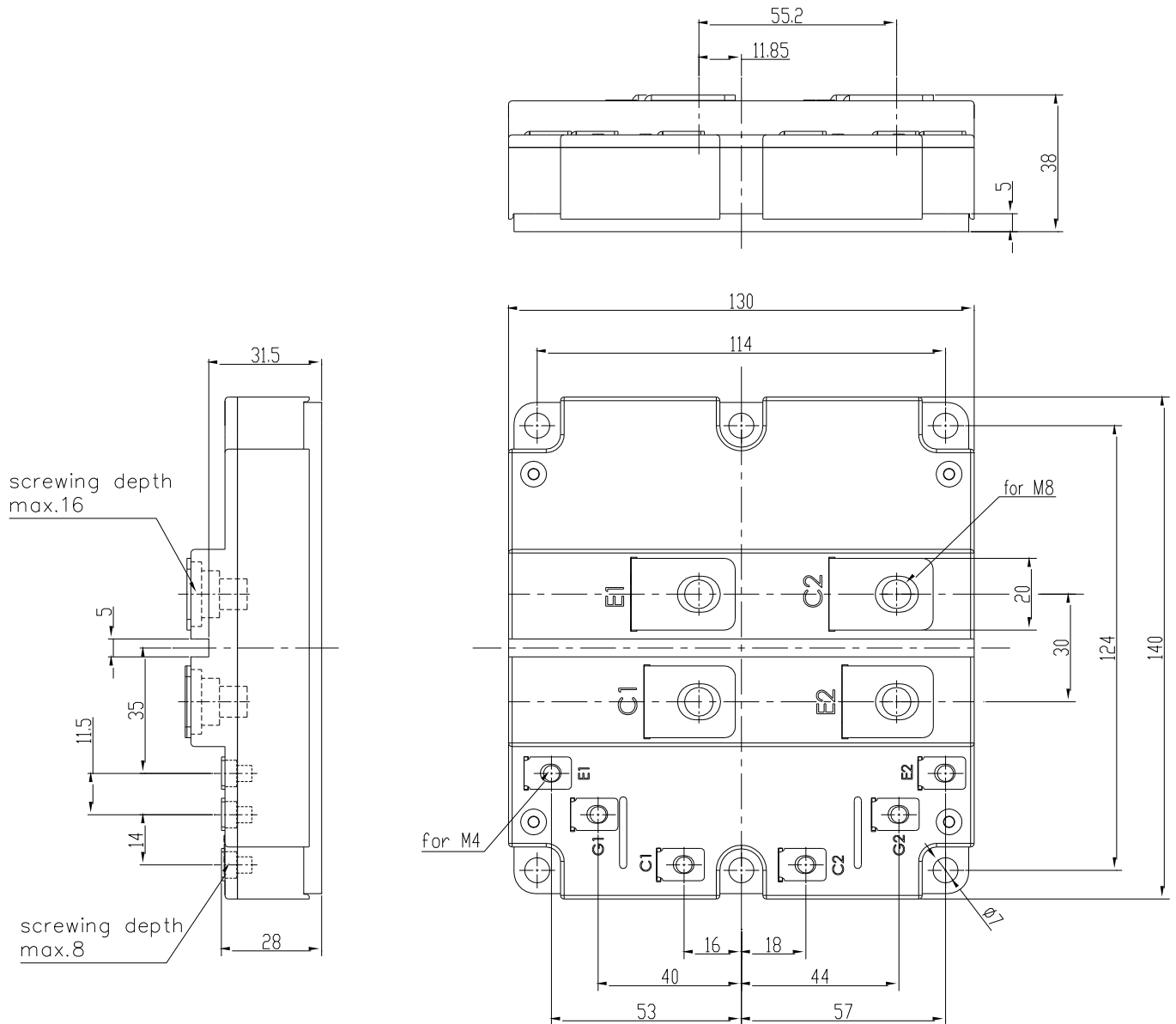
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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