

STARPOWER

SEMICONDUCTOR

IGBT

GD1100HFA120C6SF

1200V/1100A 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 hybrid and electric vehicle.

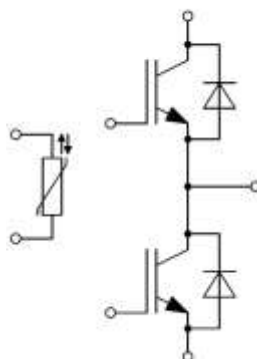
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 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 Si_3N_4 AMB technology
- PressFIT contact technology

Typical Applications

- Hybrid and electric vehicle
- Inverter for motor drive
- Uninterruptible power supply

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_F=25^{\circ}\text{C}$ unless otherwise noted**IGBT**

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage Transient Gate-Emitter Voltage	± 20 ± 30	V
I_{CN}	Implemented Collector Current	1100	A
I_C	Collector Current @ $T_F=75^{\circ}\text{C}$	750	A
I_{CRM}	Repetitive Peak Collector Current $t_p=1\text{ms}$	2200	A
P_D	Maximum Power Dissipation @ $T_F=75^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	1428	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_{FN}	Implemented Collector Current	1100	A
I_F	Diode Continuous Forward Current @ $T_F=75^{\circ}\text{C}$	610	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1\text{ms}$	2200	A
I_{FSM}	Surge Forward Current $t_p=10\text{ms}$ @ $T_{vj}=125^{\circ}\text{C}$ @ $T_{vj}=175^{\circ}\text{C}$	2392 2448	A
I^2t	I^2t -value, $t_p=10\text{ms}$ @ $T_{vj}=125^{\circ}\text{C}$ @ $T_{vj}=175^{\circ}\text{C}$	28608 29964	A^2s

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{vjop}	Operating Junction Temperature	-40 to +175	$^{\circ}\text{C}$
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 $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=900\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.30	1.75	V
		$I_C=900\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.45		
		$I_C=900\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.45		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=30.0\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.2	6.0	6.8	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			50	μA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			100	nA
R_{Gint}	Internal Gate Resistance			0.67		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		92.1		nF
C_{res}	Reverse Transfer Capacitance			0.47		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		6.79		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=900\text{A}, R_G=0.5\Omega, L_S=35\text{nH}, V_{GE}=-8/+15\text{V}, T_{vj}=25^{\circ}\text{C}$		180		ns
t_r	Rise Time			85		ns
$t_{d(off)}$	Turn-Off Delay Time			482		ns
t_f	Fall Time			142		ns
E_{on}	Turn-On Switching Loss			52.6		mJ
E_{off}	Turn-Off Switching Loss			94.0		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=900\text{A}, R_G=0.5\Omega, L_S=35\text{nH}, V_{GE}=-8/+15\text{V}, T_{vj}=125^{\circ}\text{C}$		182		ns
t_r	Rise Time			94		ns
$t_{d(off)}$	Turn-Off Delay Time			555		ns
t_f	Fall Time			217		ns
E_{on}	Turn-On Switching Loss			85.1		mJ
E_{off}	Turn-Off Switching Loss			118		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=900\text{A}, R_G=0.5\Omega, L_S=35\text{nH}, V_{GE}=-8/+15\text{V}, T_{vj}=175^{\circ}\text{C}$		183		ns
t_r	Rise Time			98		ns
$t_{d(off)}$	Turn-Off Delay Time			599		ns
t_f	Fall Time			263		ns
E_{on}	Turn-On Switching Loss			102		mJ
E_{off}	Turn-Off Switching Loss			125		mJ
I_{SC}	SC Data	$t_p \leq 6\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=175^{\circ}\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$		3200		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=900\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.60	2.00	V
		$I_F=900\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.60		
		$I_F=900\text{A}, V_{GE}=0\text{V}, T_{vj}=175^{\circ}\text{C}$		1.50		
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=900\text{A},$ $-di/dt=7697\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-8\text{V}, T_{vj}=25^{\circ}\text{C}$		73.6		μC
I_{RM}	Peak Reverse Recovery Current			563		A
E_{rec}	Reverse Recovery Energy			23.6		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=900\text{A},$ $-di/dt=7697\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-8\text{V}, T_{vj}=125^{\circ}\text{C}$		118		μC
I_{RM}	Peak Reverse Recovery Current			583		A
E_{rec}	Reverse Recovery Energy			36.6		mJ
Q_r	Recovered Charge	$V_R=600\text{V}, I_F=900\text{A},$ $-di/dt=7697\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-8\text{V}, T_{vj}=175^{\circ}\text{C}$		147		μC
I_{RM}	Peak Reverse Recovery Current			602		A
E_{rec}	Reverse Recovery Energy			45.3		mJ

NTC Characteristics $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		k Ω
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		3433		K

Module Characteristics $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		20		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.80		m Ω
R_{thJF}	Junction-to-Cooling Fluid (per IGBT)			0.070	K/W
	Junction-to-Cooling Fluid (per Diode)			0.094	
	$\Delta V/\Delta t=10.0\text{dm}^3/\text{min}, T_F=75^{\circ}\text{C}$				
M	Terminal Connection Torque, Screw M6	3.0		6.0	N.m
	Mounting Torque, Screw M5	3.0		6.0	
G	Weight of Module		400		g

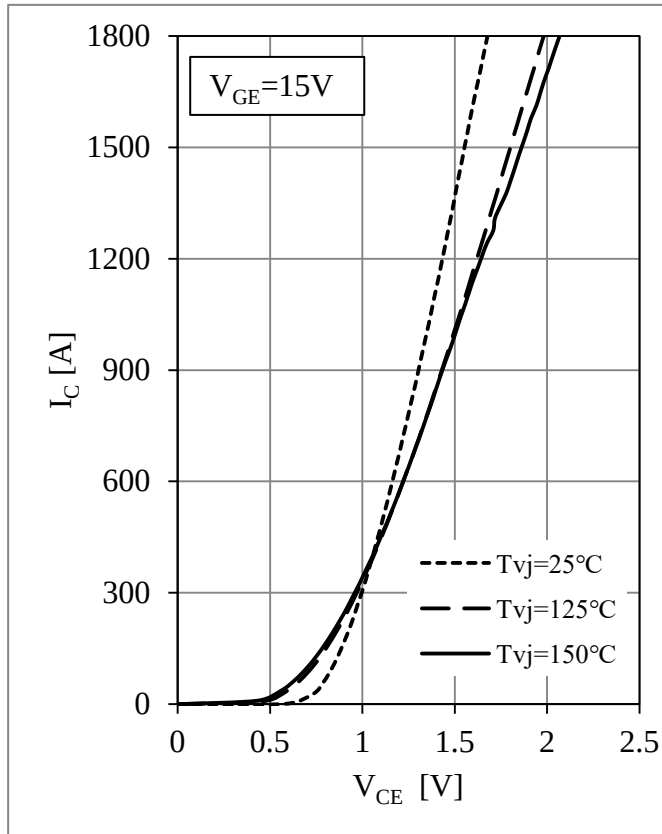


Fig 1. IGBT Output Characteristics

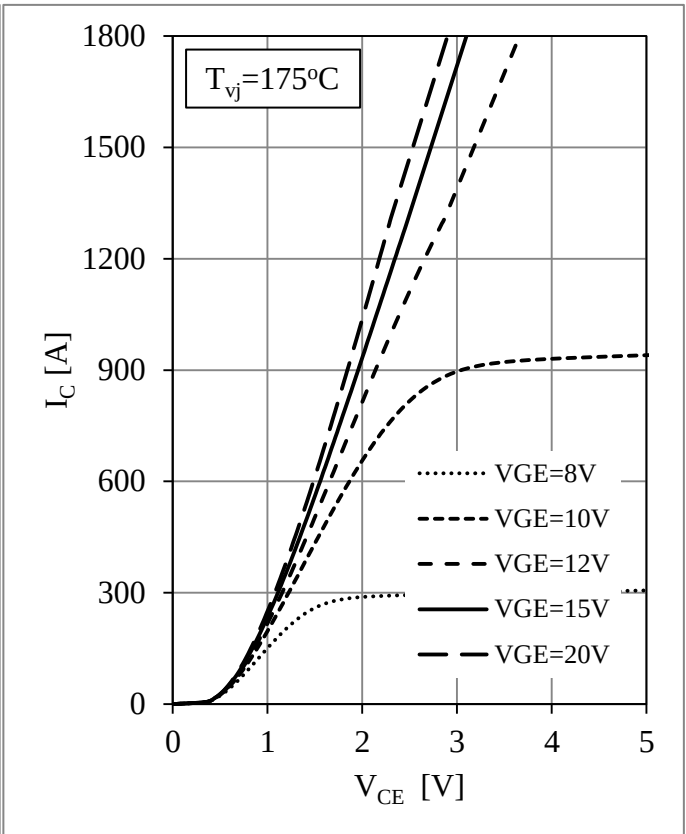


Fig 2. IGBT Transfer Characteristics

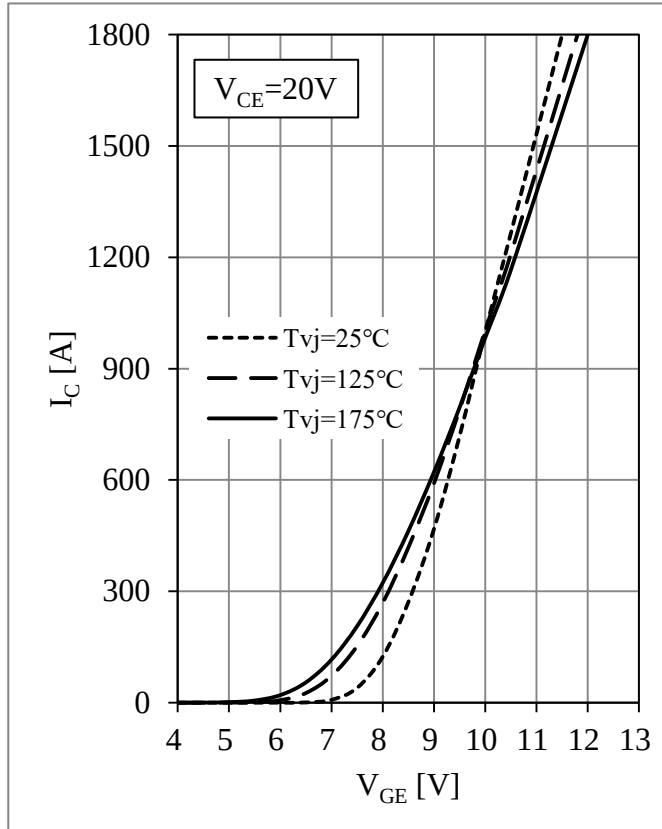
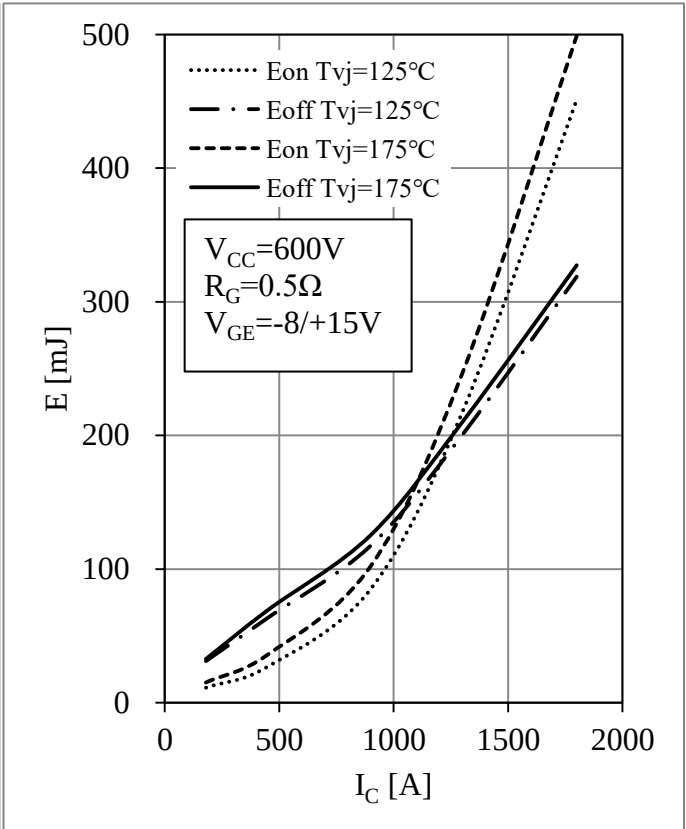


Fig 3. IGBT Transfer Characteristics

Fig 4. IGBT Switching Loss vs. I_C

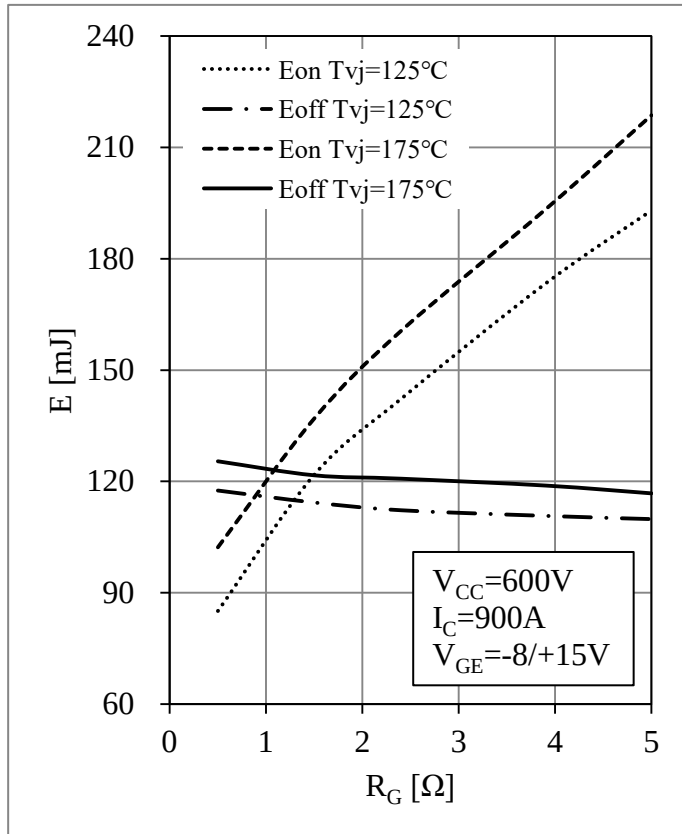
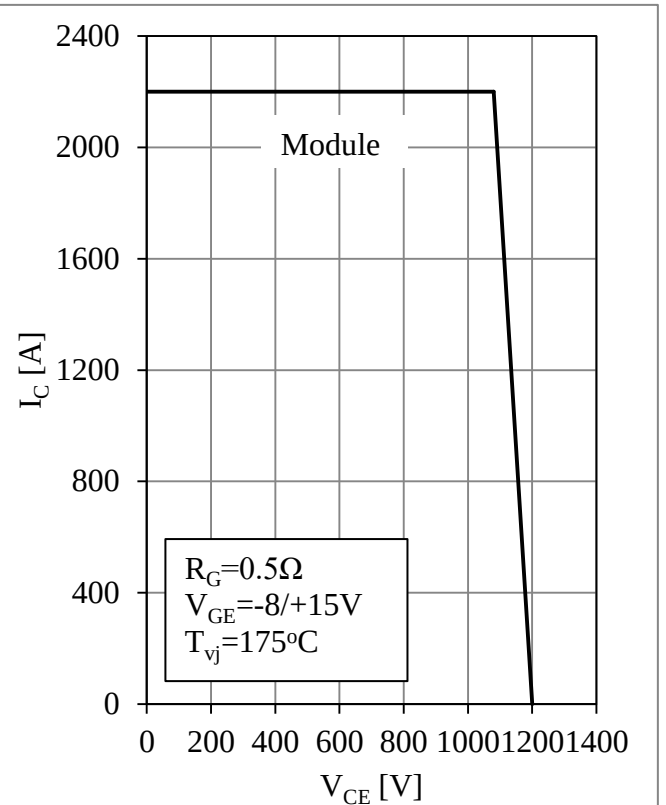
Fig 5. IGBT Switching Loss vs. R_G 

Fig 6. RBSOA

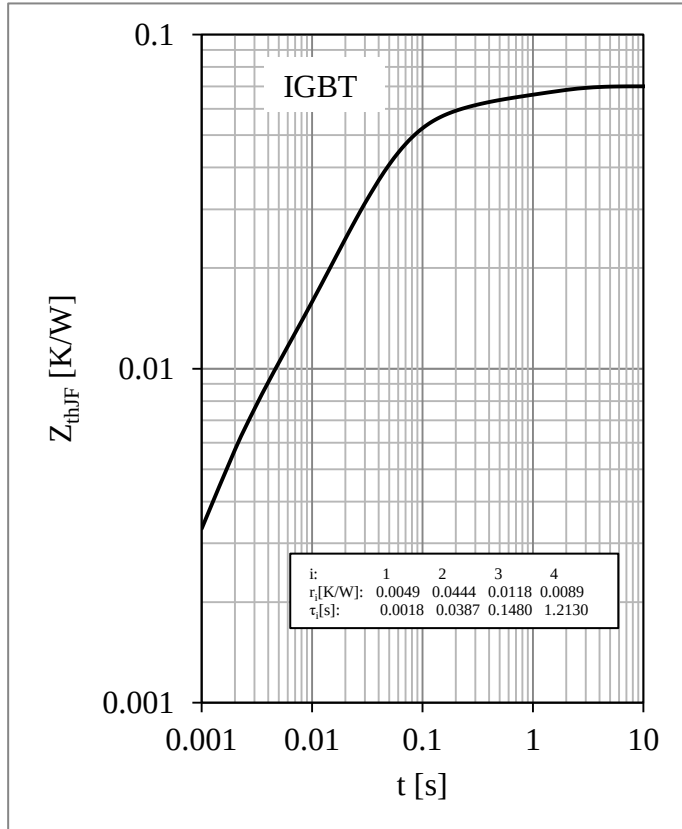


Fig 7. IGBT Transient Thermal Impedance

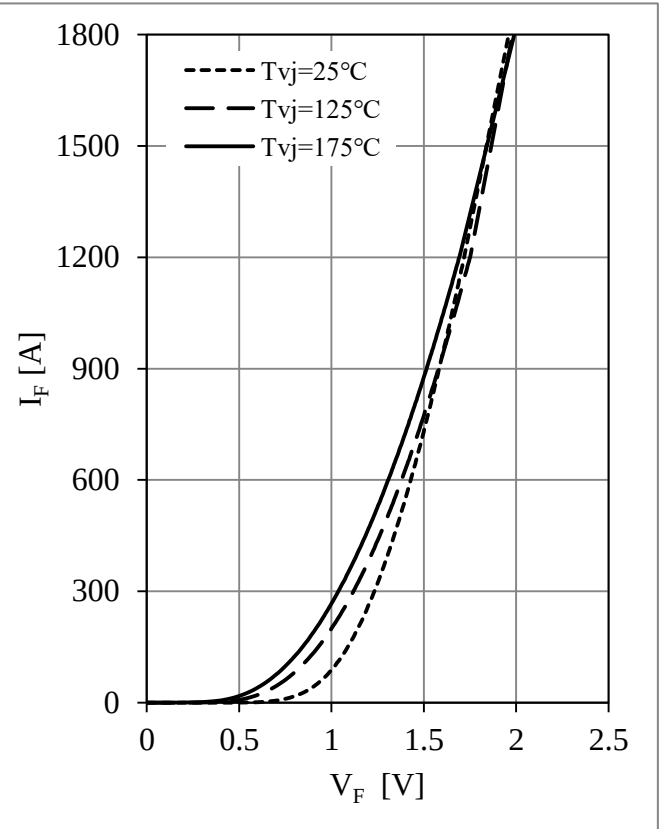


Fig 8. Diode Forward Characteristics

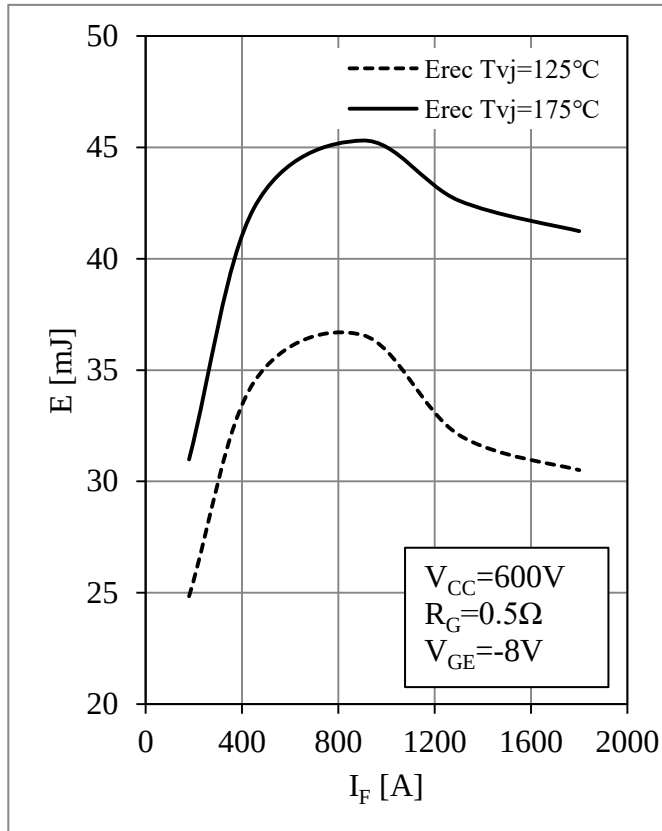
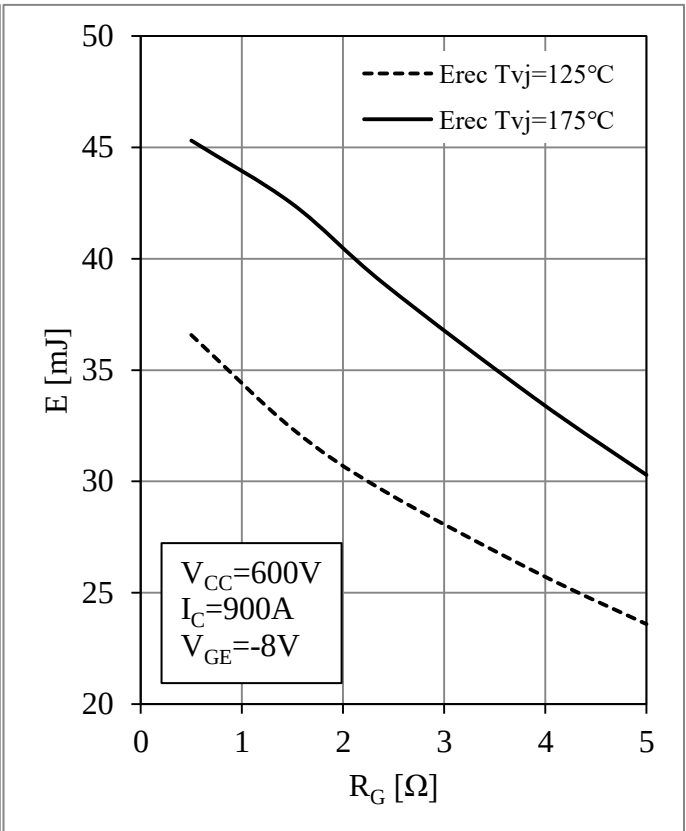
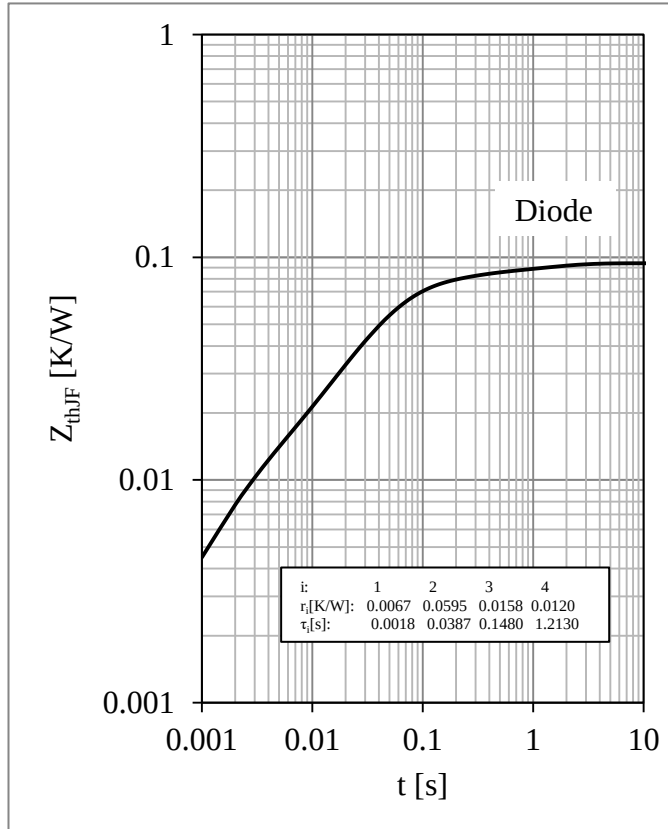
Fig 9. Diode Switching Loss vs. I_F Fig 10. Diode Switching Loss vs. R_G 

Fig 11. Diode Transient Thermal Impedance

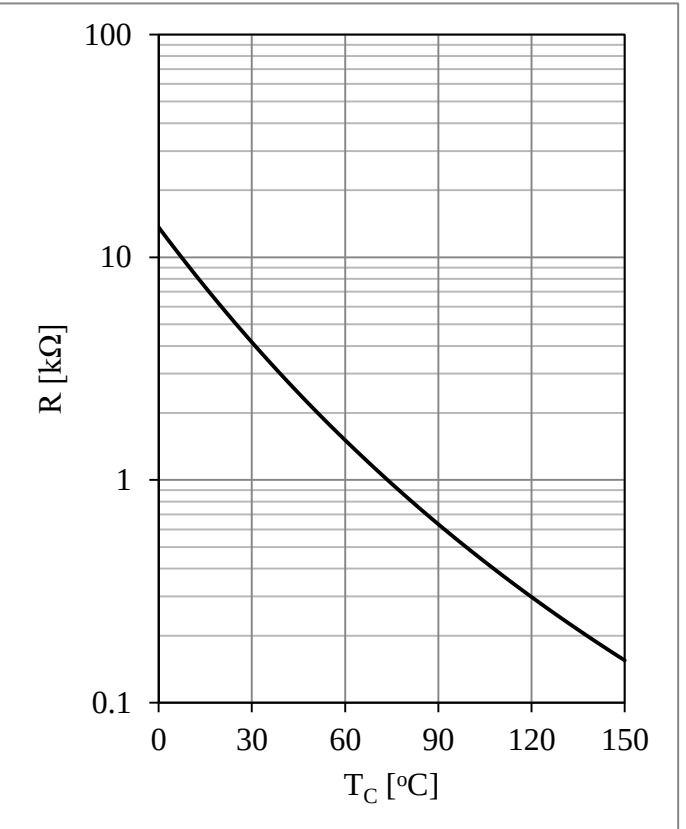
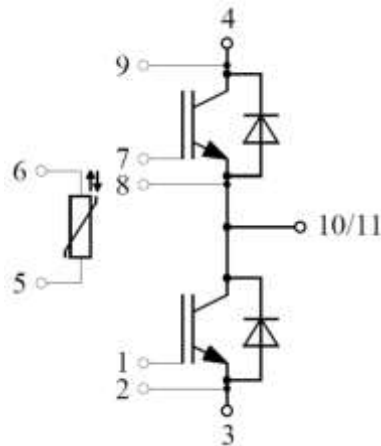


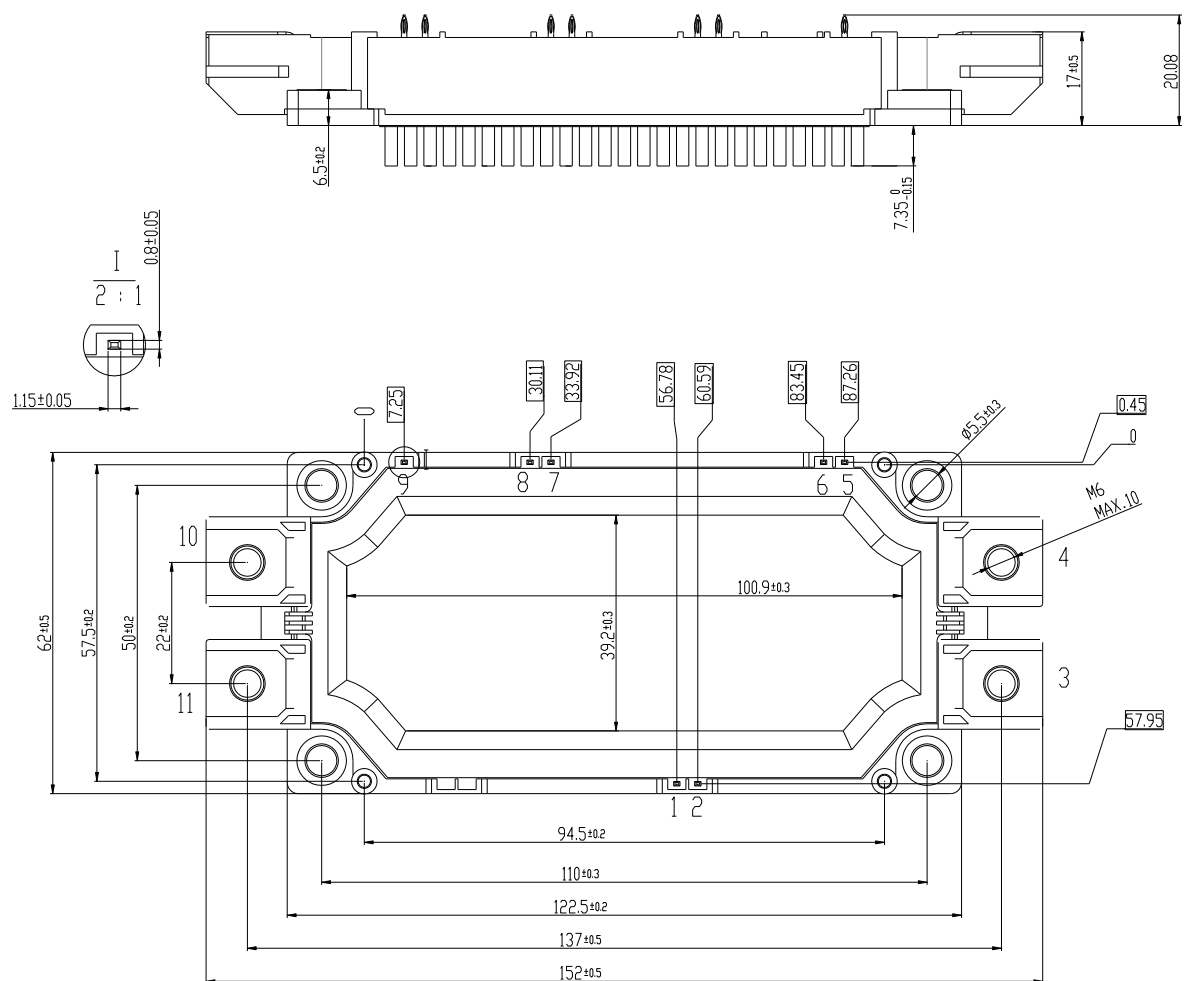
Fig 12. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



 =all dimension with a tolerance of ± 0.5

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