

STARPOWER

SEMICONDUCTOR

IGBT

GD1200HFX170V6S

1700V/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 Motor drives and High-power converters.

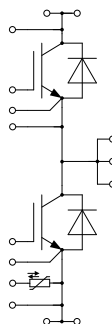
Features

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

Typical Applications

- High-power converters
- Motor drives
- Traction drives

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 @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	1936 1200	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	2400	A
P_D	Maximum Power Dissipation @ $T_{vj}=175^{\circ}\text{C}$	7281	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1700	V
I_F	Diode Continuous Forward Current	1200	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	2400	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{vjop}	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	$I_C=1200\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.85	2.20	V
		$I_C=1200\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		2.25		
		$I_C=1200\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		2.35		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=48.0\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.6	6.2	6.8	V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			400	nA
R_{Gint}	Internal Gate Resistance			0.53		Ω
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		145		nF
C_{res}	Reverse Transfer Capacitance			3.48		nF
Q_G	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		11.3		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=1200\text{A}, R_{Gon}=1.0\Omega, R_{Goff}=0.5\Omega, L_S=60\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		484		ns
t_r	Rise Time			163		ns
$t_{d(off)}$	Turn-Off Delay Time			496		ns
t_f	Fall Time			293		ns
E_{on}	Turn-On Switching Loss			263		mJ
E_{off}	Turn-Off Switching Loss			248		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=1200\text{A}, R_{Gon}=1.0\Omega, R_{Goff}=0.5\Omega, L_S=60\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^{\circ}\text{C}$		510		ns
t_r	Rise Time			176		ns
$t_{d(off)}$	Turn-Off Delay Time			584		ns
t_f	Fall Time			511		ns
E_{on}	Turn-On Switching Loss			410		mJ
E_{off}	Turn-Off Switching Loss			344		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=1200\text{A}, R_{Gon}=1.0\Omega, R_{Goff}=0.5\Omega, L_S=60\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^{\circ}\text{C}$		517		ns
t_r	Rise Time			180		ns
$t_{d(off)}$	Turn-Off Delay Time			590		ns
t_f	Fall Time			540		ns
E_{on}	Turn-On Switching Loss			469		mJ
E_{off}	Turn-Off Switching Loss			363		mJ
I_{SC}	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		6800		A
		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$		4750		

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=1200\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.80	2.25	V
		$I_F=1200\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.90		
		$I_F=1200\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		1.95		
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=1200\text{A},$ $-di/dt=7226\text{A}/\mu\text{s}, L_s=60\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=25^{\circ}\text{C}$		160		μC
I_{RM}	Peak Reverse Recovery Current			928		A
E_{rec}	Reverse Recovery Energy			80.9		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=1200\text{A},$ $-di/dt=6334\text{A}/\mu\text{s}, L_s=60\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=125^{\circ}\text{C}$		307		μC
I_{RM}	Peak Reverse Recovery Current			1124		A
E_{rec}	Reverse Recovery Energy			152		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_F=1200\text{A},$ $-di/dt=6139\text{A}/\mu\text{s}, L_s=60\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=150^{\circ}\text{C}$		351		μC
I_{RM}	Peak Reverse Recovery Current			1159		A
E_{rec}	Reverse Recovery Energy			171		mJ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	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 $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		10		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.35		mΩ
R_{thJC}	Junction-to-Case (per IGBT)			20.6	K/kW
	Junction-to-Case (per Diode)			37.2	
R_{thCH}	Case-to-Heatsink (per IGBT)		15.1		K/kW
	Case-to-Heatsink (per Diode)		18.2		
M	Terminal Connection Torque, Screw M3	0.9		1.1	N.m
	Terminal Connection Torque, Screw M8	8.0		10.0	
	Mounting Torque, Screw M6	3.0		6.0	
G	Weight of Module		1030		g

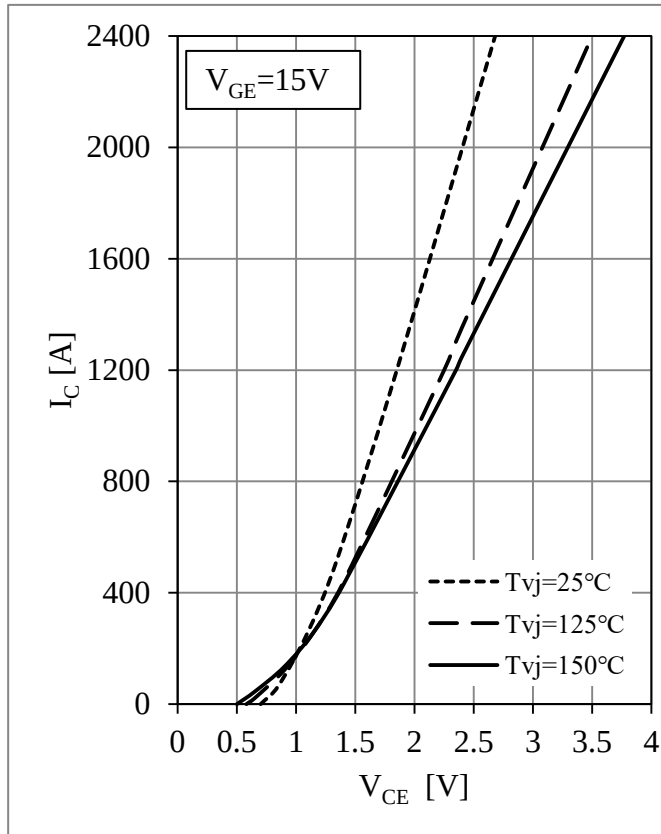


Fig 1. IGBT Output Characteristics

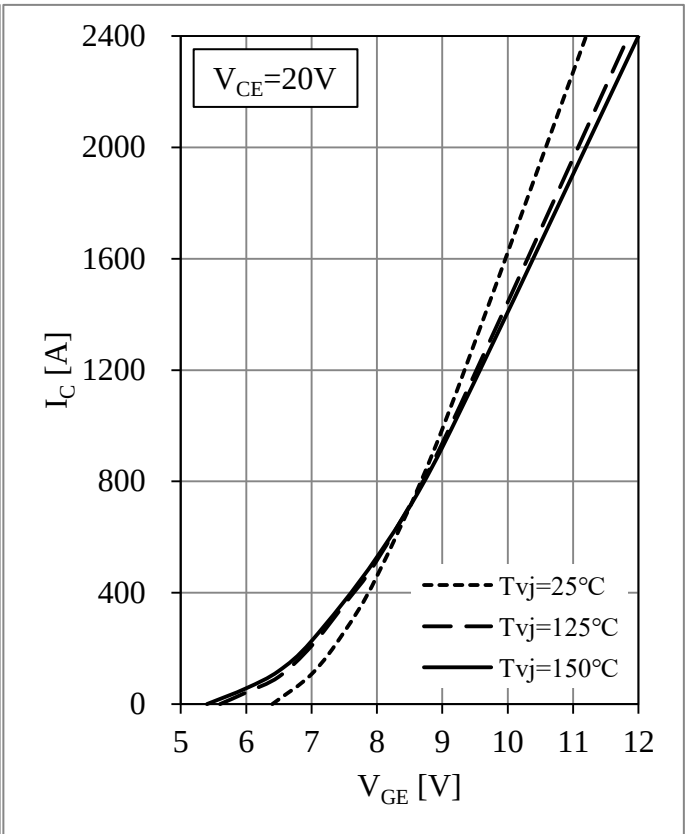
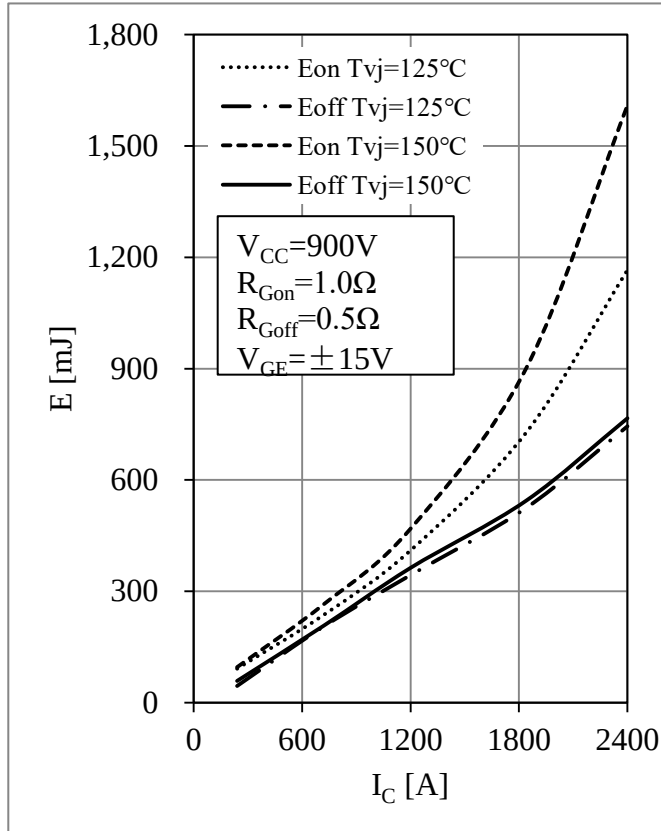
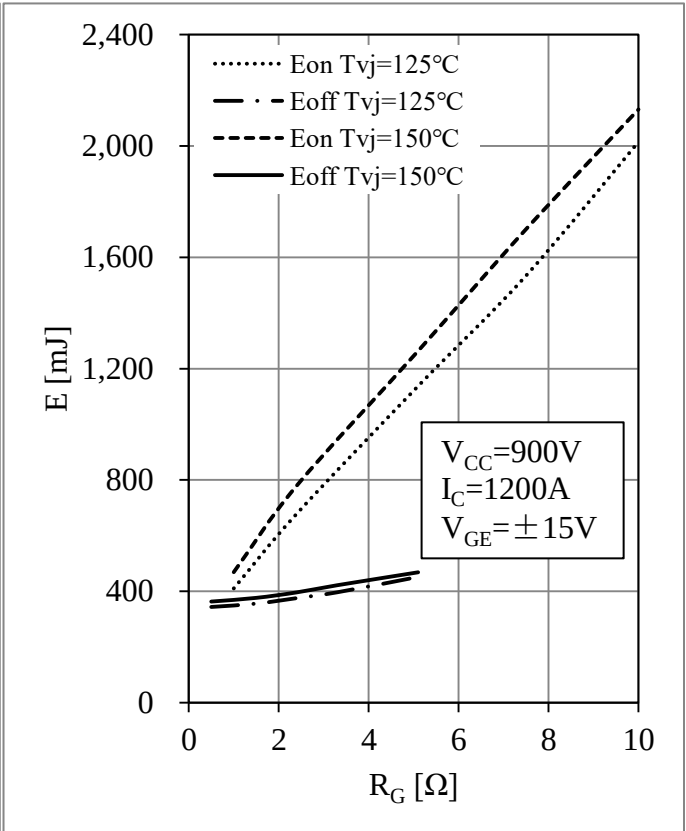


Fig 2. IGBT Transfer Characteristics

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

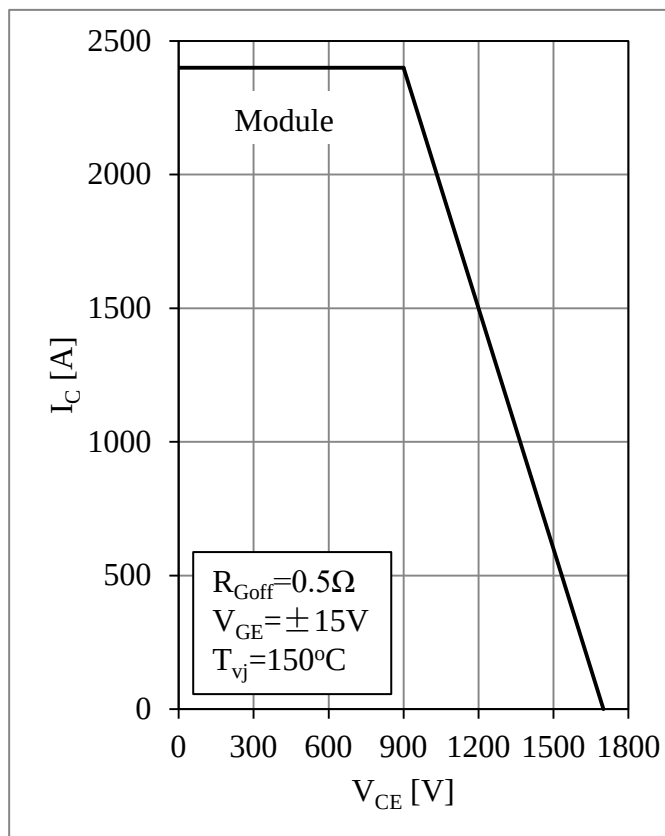


Fig 5. RBSOA

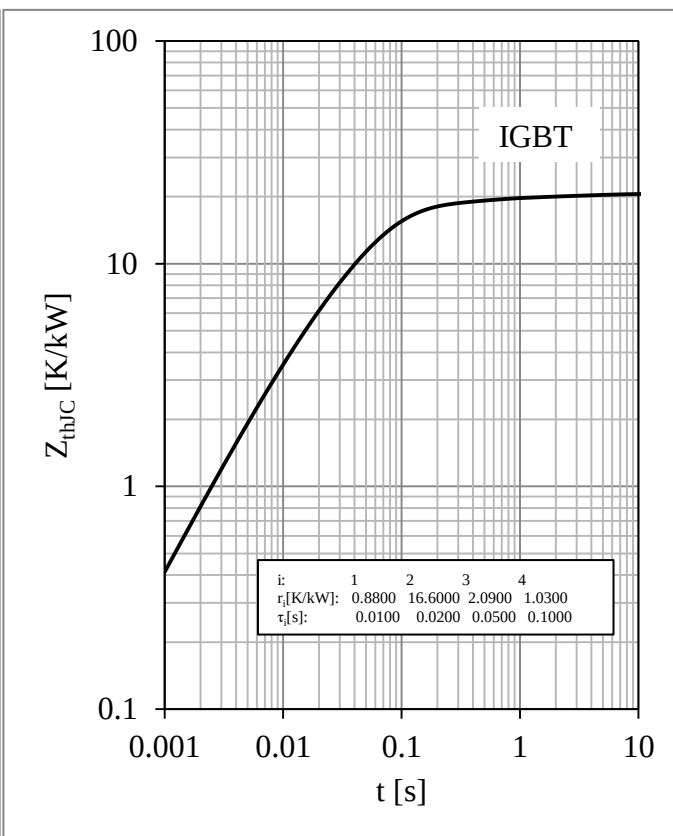


Fig 6. IGBT Transient Thermal Impedance

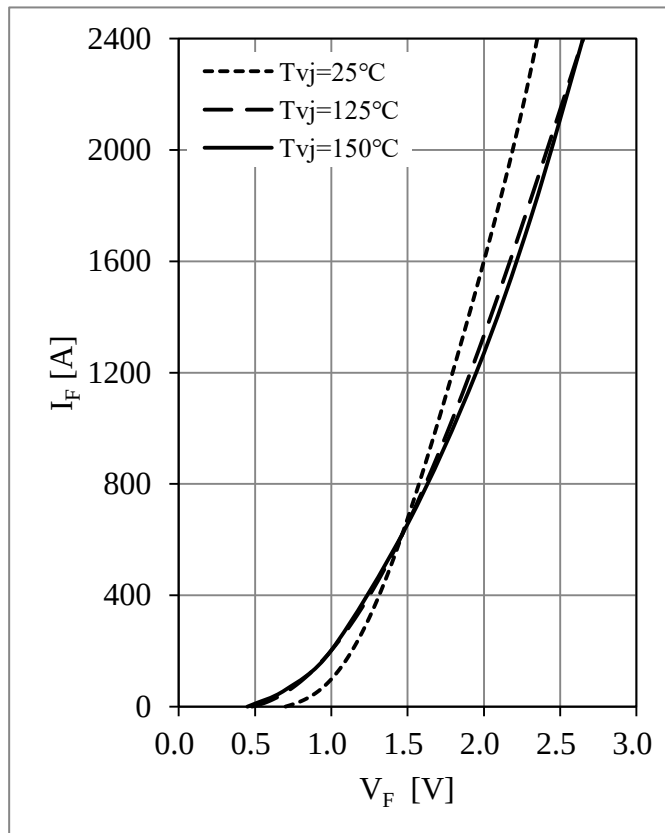
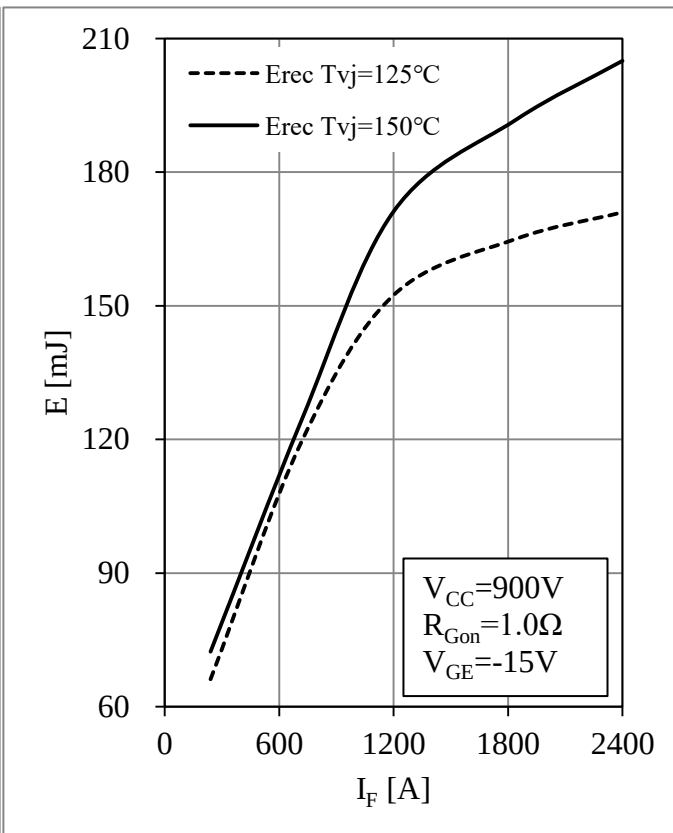


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs. I_F

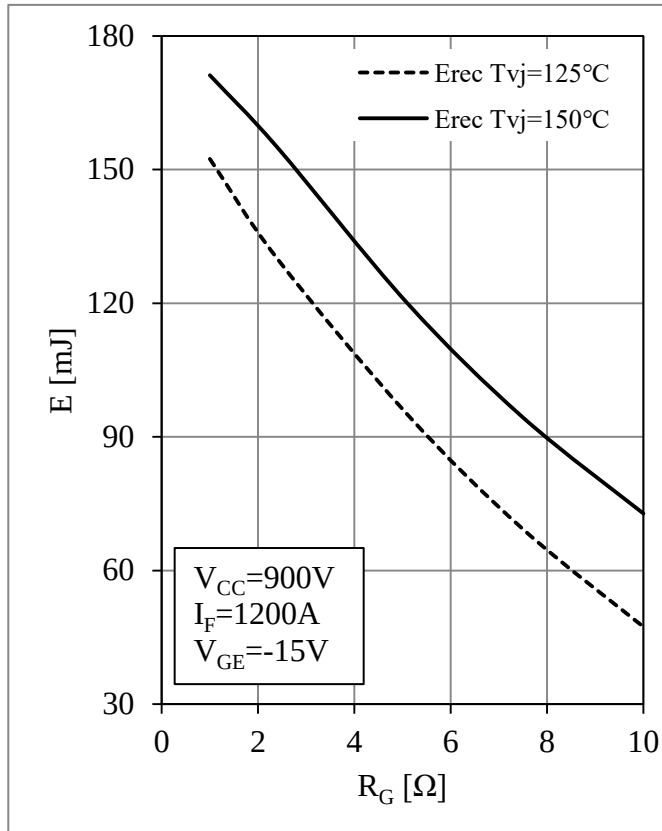
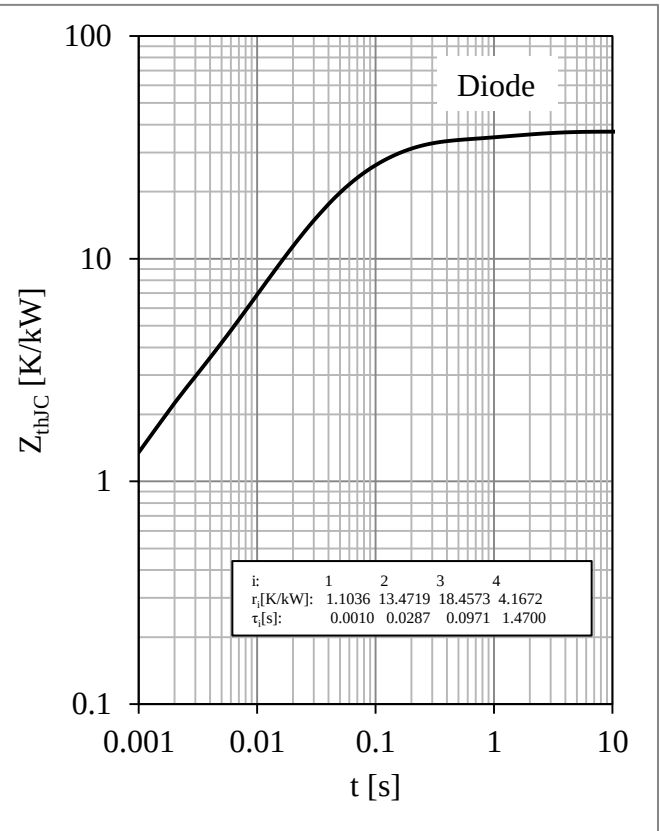
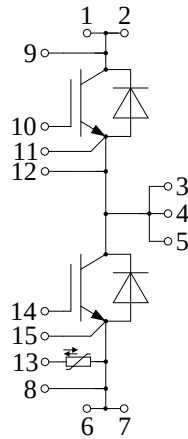
Fig 9. Diode Switching Loss vs. R_G 

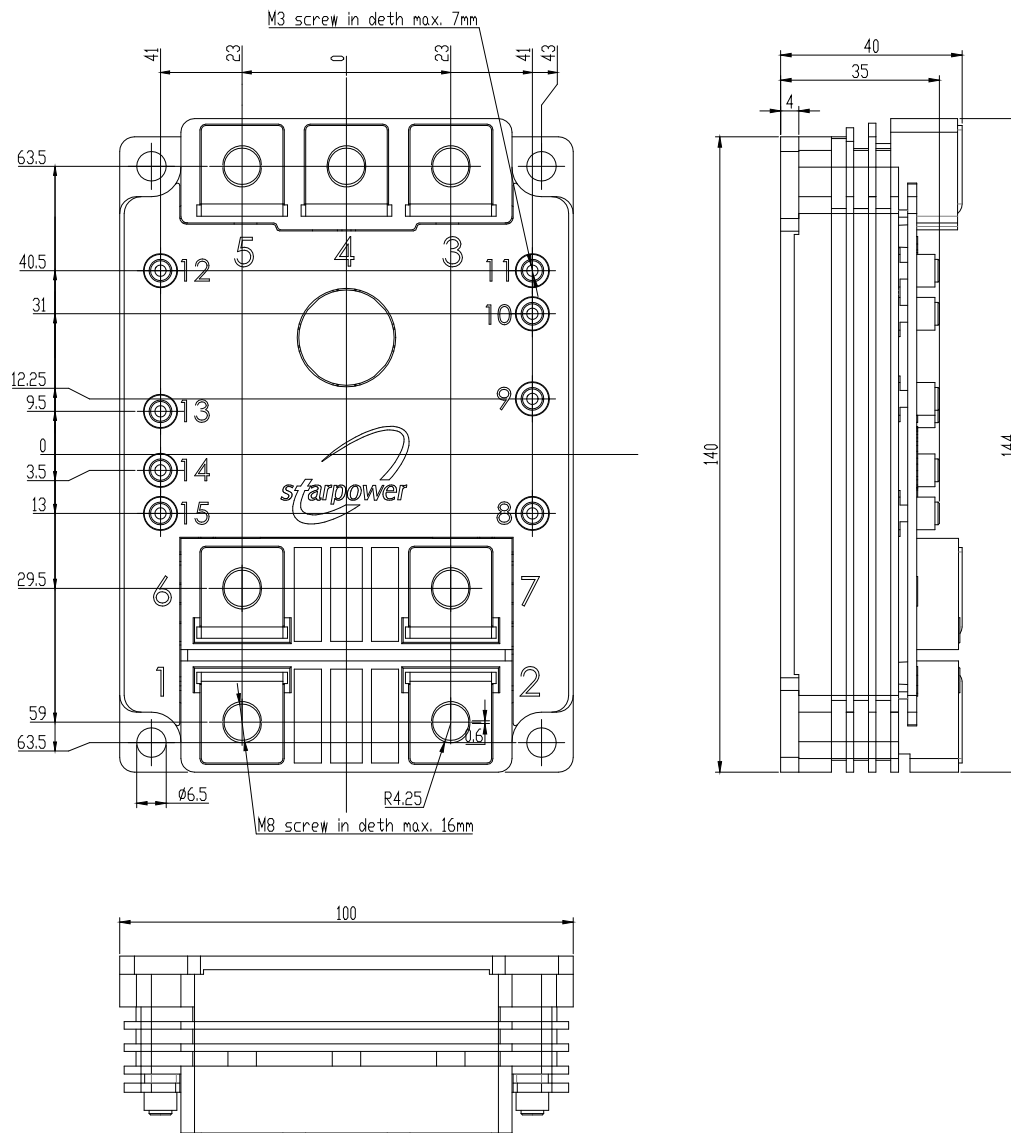
Fig 10. Diode Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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