STARPOWER

SEMICONDUCTOR **IGBT**

GD900HFA120C6S

1200V/900A 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.

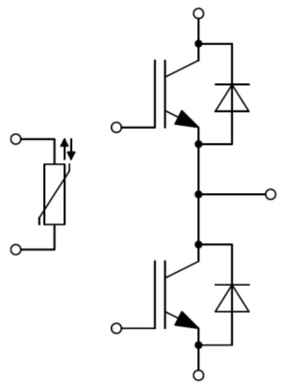
Features

- 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 DBC technology

Typical Applications

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

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

IGBT

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=90°C	900	A
I_{CM}	Pulsed Collector Current t_p=1ms	1800	A
P_D	Maximum Power Dissipation @ T_j=175°C	3409	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	900	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1800	A
I_{FSM}	Surge Forward Current t_p=10ms @ T_j=25°C @ T_j=150°C	4100 3000	A
I^2t	I^2t-value,t_p=10ms @ T_j=25°C @ T_j=150°C	84000 45000	A^2s

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	°C
T_{jop}	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature Range	-40 to +125	°C
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V

IGBT Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=900A,V_{GE}=15V, T_j=25°C		1.40	1.85	V
		I_C=900A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=900A,V_{GE}=15V, T_j=175°C		1.65		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=24.0mA,V_{CE}=V_{GE}, T_j=25°C	5.5	6.3	7.0	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			0.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		51.5		nF
C_{res}	Reverse Transfer Capacitance			0.36		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		13.6		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=900A, R_G=0.51Ω, L_S=40nH, V_{GE}=-8V/+15V, T_j=25°C		330		ns
t_r	Rise Time			140		ns
$t_{d(off)}$	Turn-Off Delay Time			842		ns
t_f	Fall Time			84		ns
E_{on}	Turn-On Switching Loss			144		mJ
E_{off}	Turn-Off Switching Loss			87.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=900A, R_G=0.51Ω, L_S=40nH, V_{GE}=-8V/+15V, T_j=125°C		373		ns
t_r	Rise Time			155		ns
$t_{d(off)}$	Turn-Off Delay Time			915		ns
t_f	Fall Time			135		ns
E_{on}	Turn-On Switching Loss			186		mJ
E_{off}	Turn-Off Switching Loss			104		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=900A, R_G=0.51Ω, L_S=40nH, V_{GE}=-8V/+15V, T_j=175°C		390		ns
t_r	Rise Time			172		ns
$t_{d(off)}$	Turn-Off Delay Time			950		ns
t_f	Fall Time			162		ns
E_{on}	Turn-On Switching Loss			209		mJ
E_{off}	Turn-Off Switching Loss			114		mJ
I_{SC}	SC Data	t_P≤8μs,V_{GE}=15V, T_j=150°C,V_{CC}=800V, V_{CEM}≤1200V		3200		A
		t_P≤6μs,V_{GE}=15V, T_j=175°C,V_{CC}=800V, V_{CEM}≤1200V		3000		A

Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=900A,V_{GE}=0V,T_j=25°C		1.55	2.00	V
		I_F=900A,V_{GE}=0V,T_j=125°C		1.65		
		I_F=900A,V_{GE}=0V,T_j=175°C		1.55		
Q_r	Recovered Charge	V_R=600V,I_F=900A, -di/dt=4930A/μs,V_{GE}=-8V, L_S=40nH,T_j=25°C		91.0		μC
I_{RM}	Peak Reverse Recovery Current			441		A
E_{rec}	Reverse Recovery Energy			26.3		mJ
Q_r	Recovered Charge	V_R=600V,I_F=900A, -di/dt=4440A/μs,V_{GE}=-8V, L_S=40nH,T_j=125°C		141		μC
I_{RM}	Peak Reverse Recovery Current			493		A
E_{rec}	Reverse Recovery Energy			42.5		mJ
Q_r	Recovered Charge	V_R=600V,I_F=900A, -di/dt=4160A/μs,V_{GE}=-8V, L_S=40nH,T_j=175°C		174		μC
I_{RM}	Peak Reverse Recovery Current			536		A
E_{rec}	Reverse Recovery Energy			52.4		mJ

NTC Characteristics T_C=25°C unless otherwise noted

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

Module Characteristics T_C=25°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		mΩ
R_{thJC}	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			0.044 0.076	K/W
R_{thCH}	Case-to-Heatsink (per IGBT) Case-to-Heatsink (per Diode) Case-to-Heatsink (per Module)		0.028 0.049 0.009		K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M5	3.0 3.0		6.0 6.0	N.m
G	Weight of Module		350		g

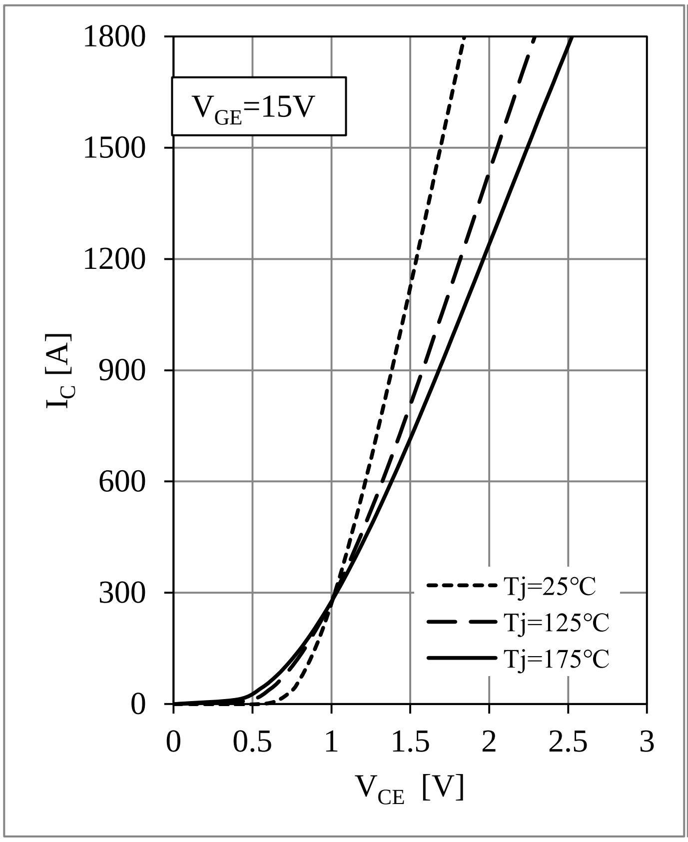


Fig 1. IGBT Output Characteristics

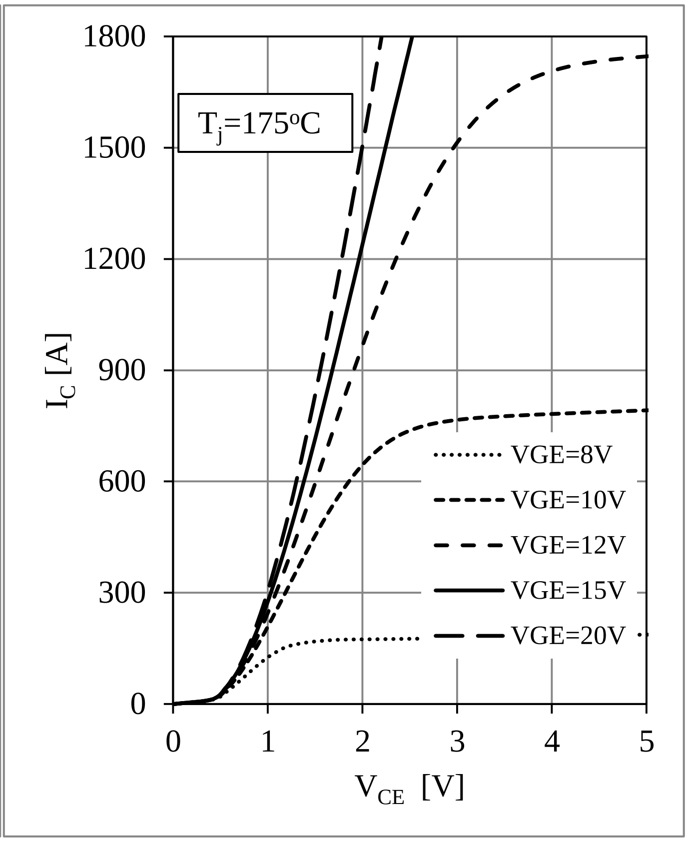


Fig 2. IGBT Transfer Characteristics

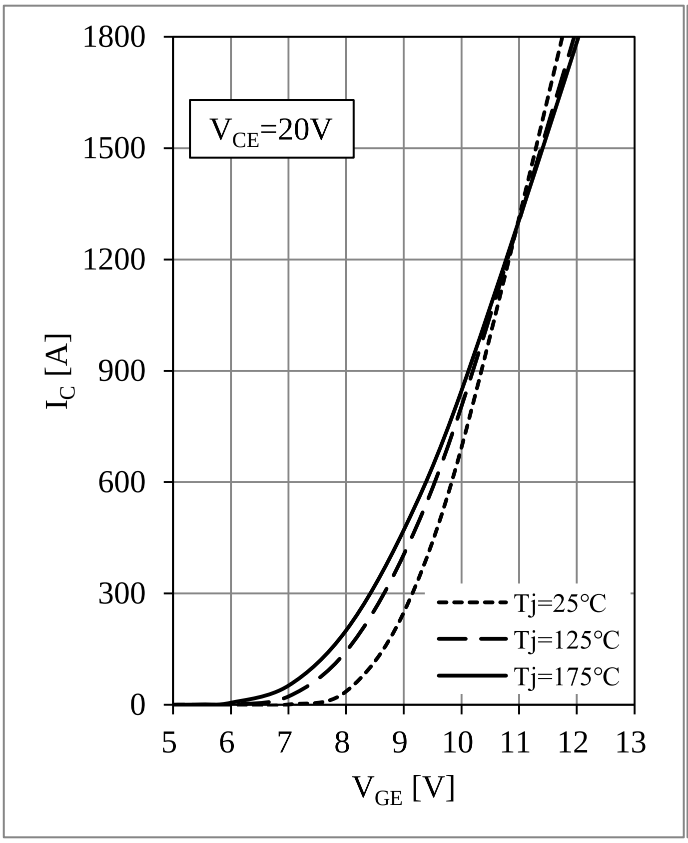


Fig 3. IGBT Transfer Characteristics

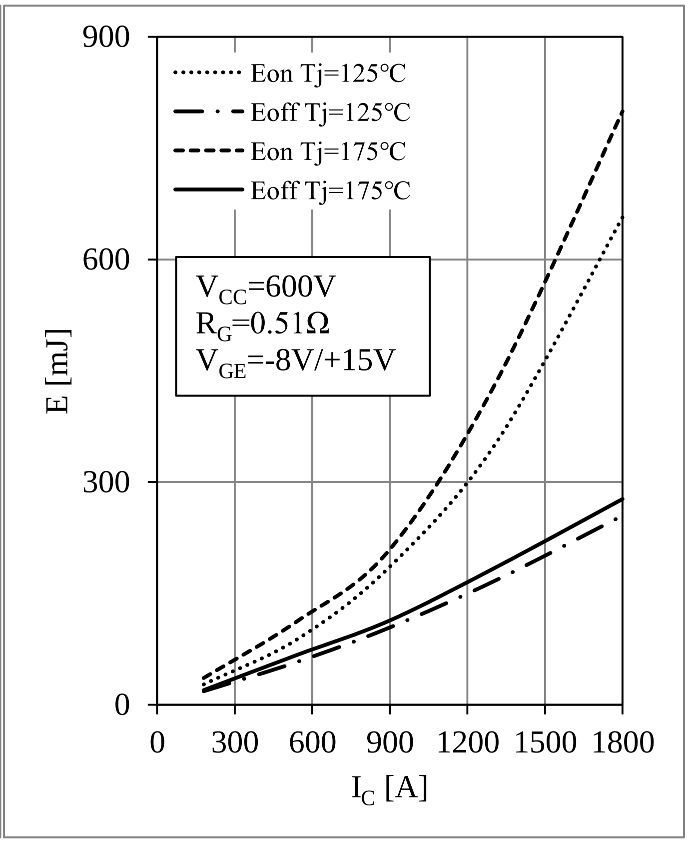
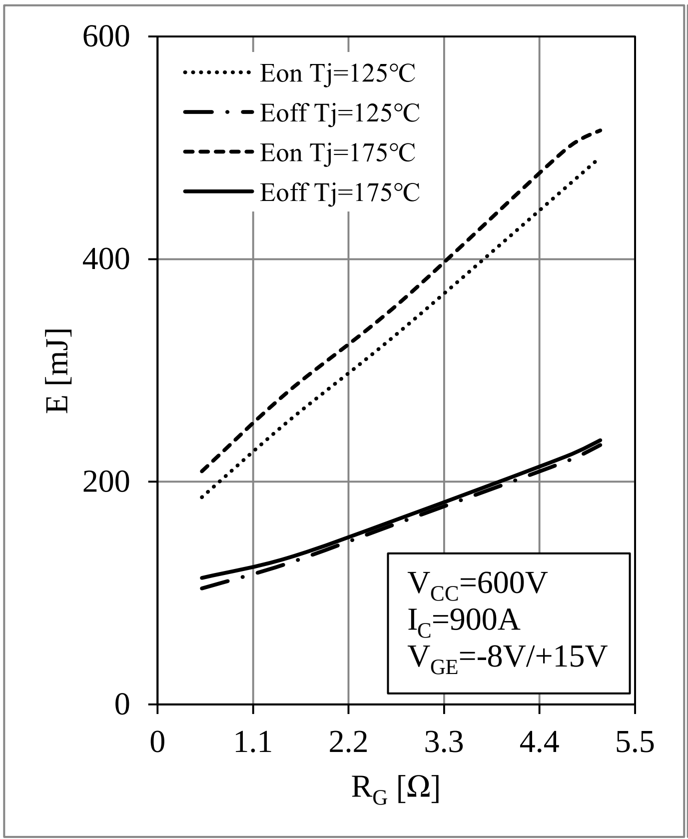


Fig 4. IGBT Switching Loss vs. I_C



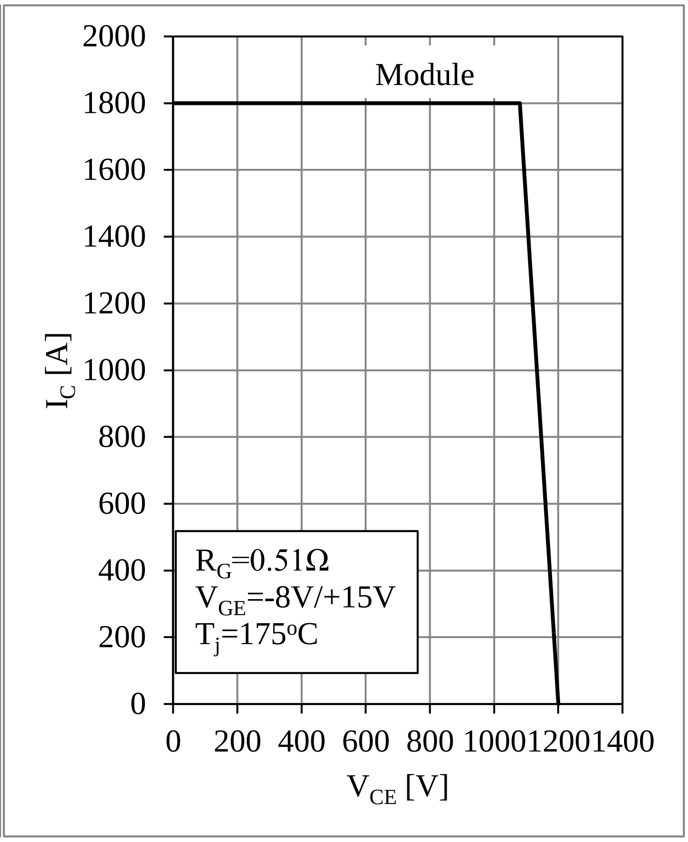
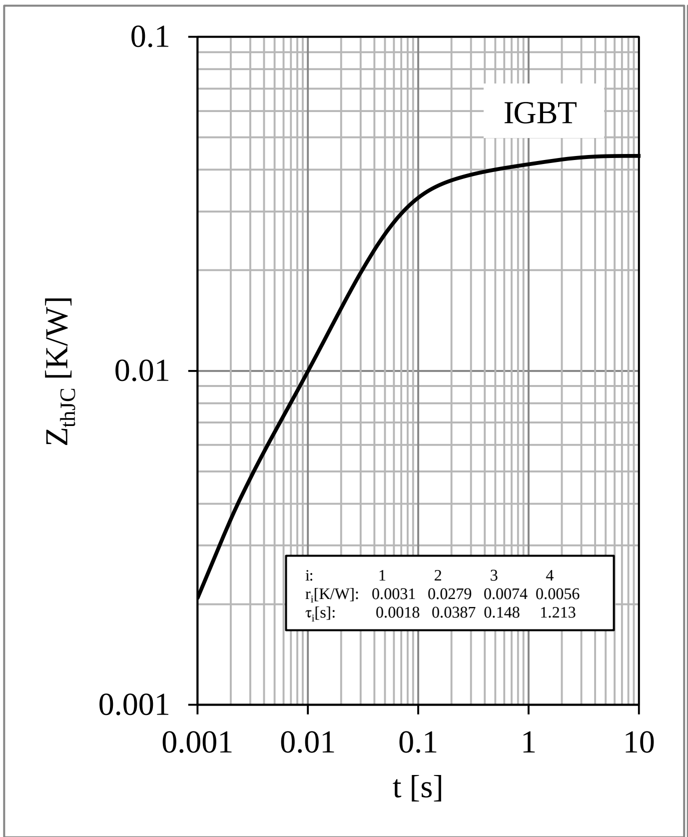


Fig 5. IGBT Switching Loss vs. R_G

Fig 6. RBSOA



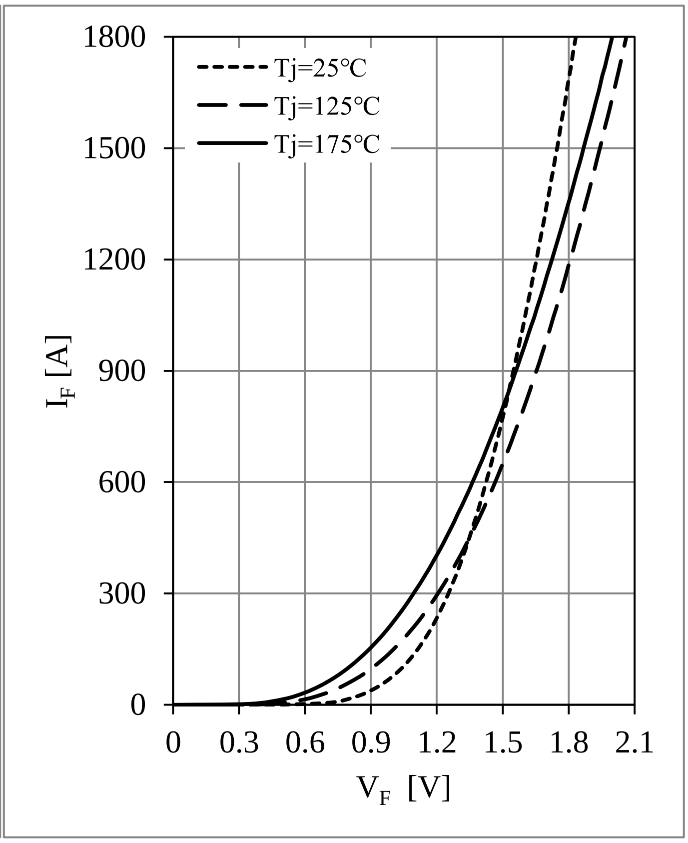


Fig 7. IGBT Transient Thermal Impedance

Fig 8. Diode Forward Characteristics

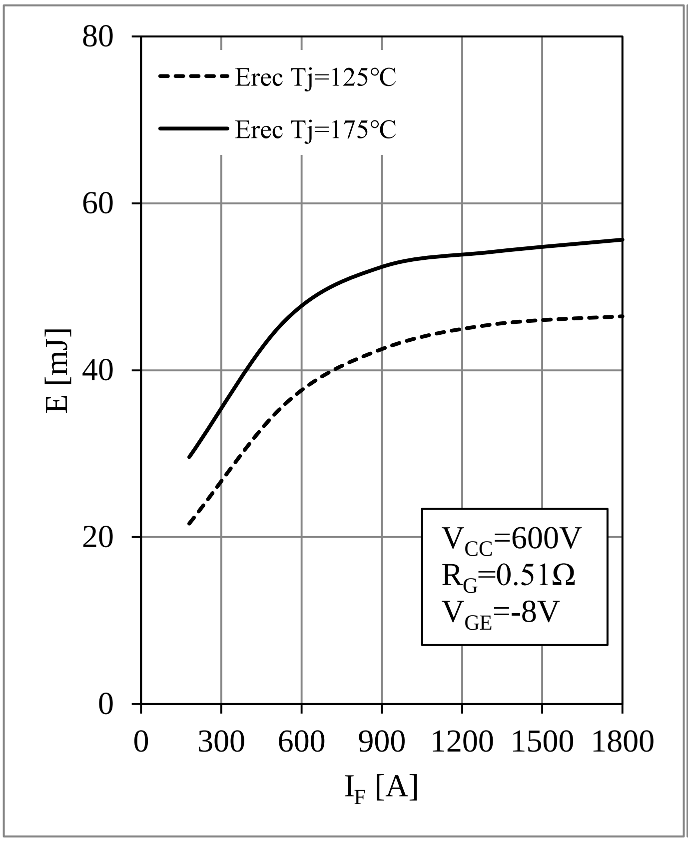


Fig 9. Diode Switching Loss vs. I_F

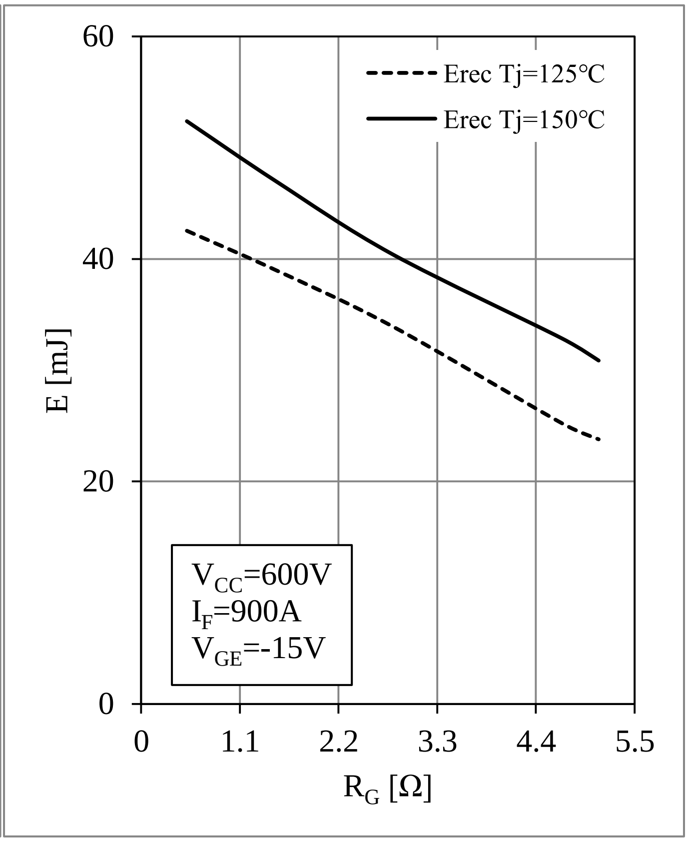
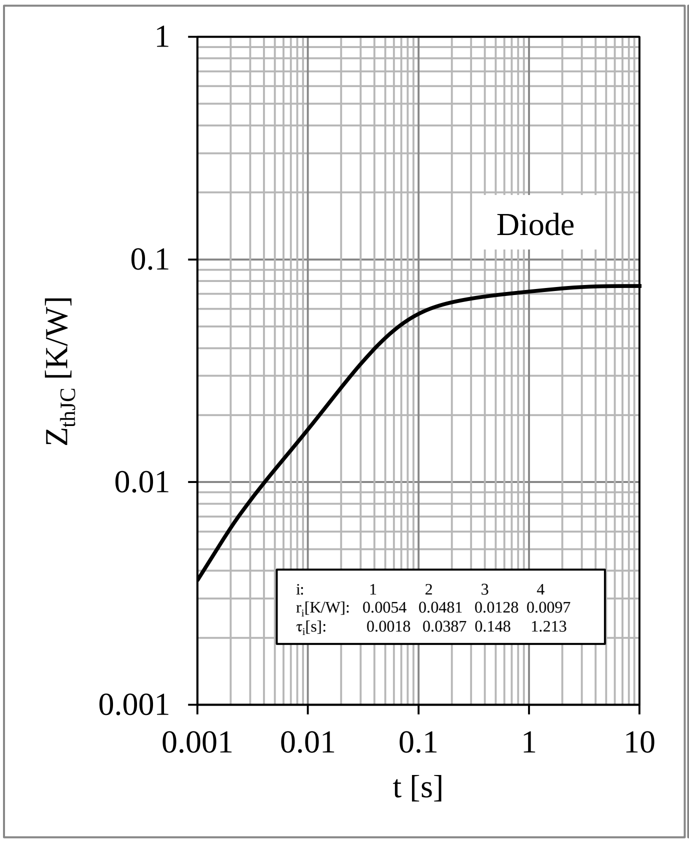


Fig 10. Diode Switching Loss vs. R_G



i:	1	2	3	4
r_i[K/W]:	0.0054	0.0481	0.0128	0.0097
τ_i[s]:	0.0018	0.0387	0.148	1.213

Fig 11. Diode Transient Thermal Impedance

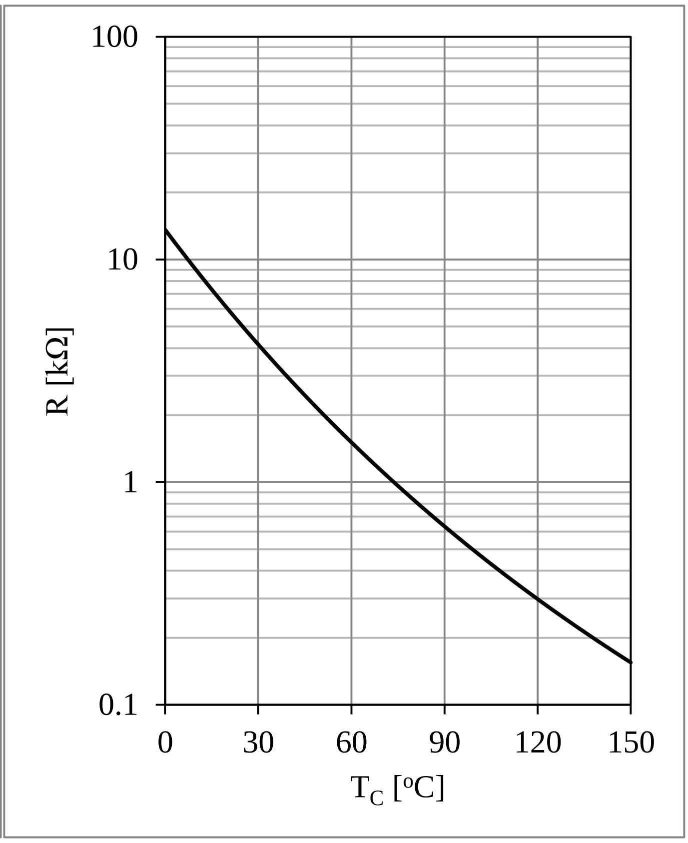
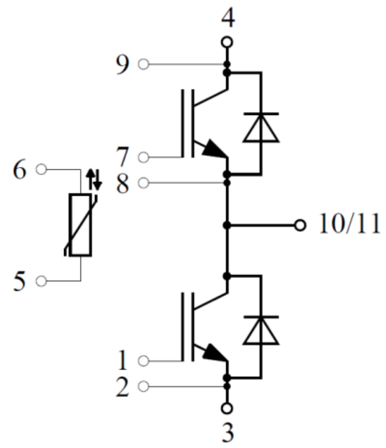


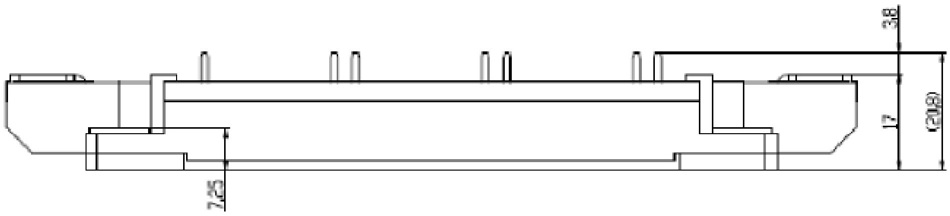
Fig12. NTC Temperature Characteristic

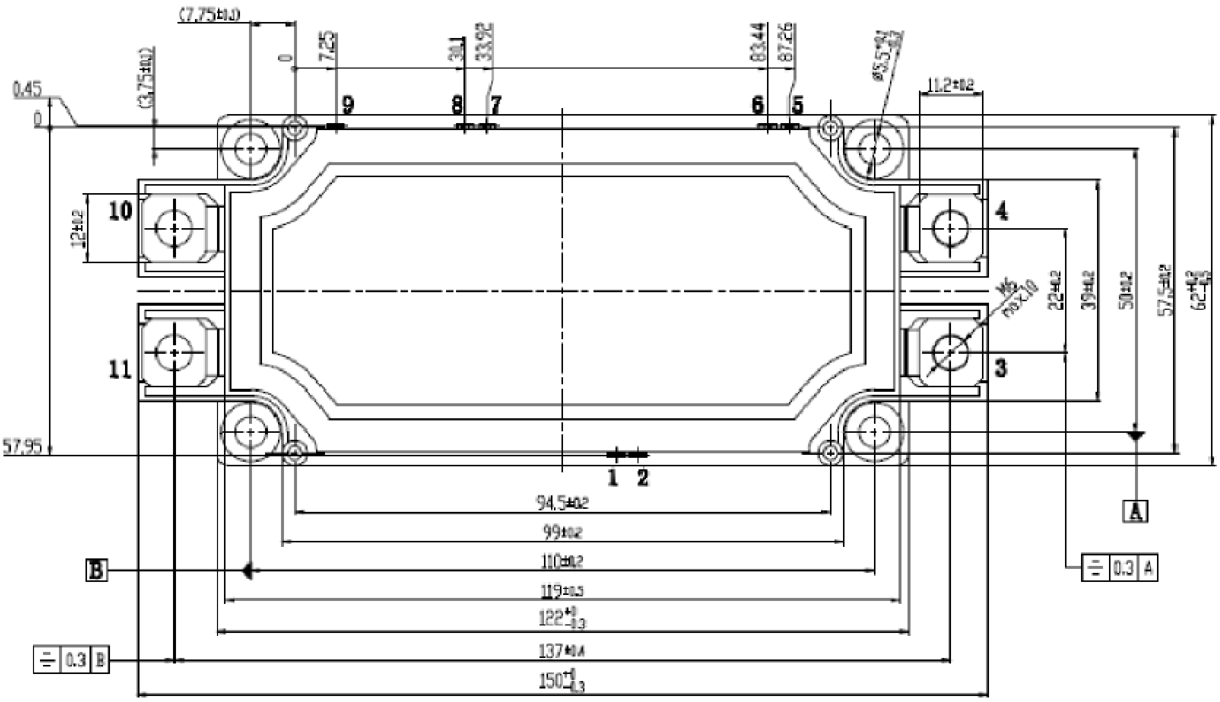
Circuit Schematic



Package Dimensions

Dimensions in Millimeters





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