STARPOWER

SEMICONDUCTOR **IGBT**

GD600HTA120P6H

1200V/600A 6 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.

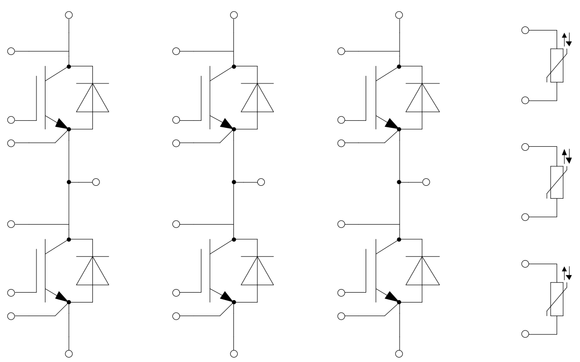
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching losses
- 6μs 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 pinfin baseplate using Si_3N_4AMB technology

Typical Applications

- Automotive application
- Hybrid and electric vehicle
- Inverter for motor drive

Equivalent Circuit Schematic



Absolute Maximum Ratings T_F=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_{CN}	Implemented Collector Current	600	A
I_C	Collector Current @ T_F=85°C	450	A
I_{CM}	Pulsed Collector Current t_p=1ms	1200	A
P_D	Maximum Power Dissipation @ T_F=75°C T_j=175°C	970	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_{FN}	Implemented Collector Current	600	A
I_F	Diode Continuous Forward Current	450	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1200	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	°C
T_{jop}	Operating Junction Temperature continuous For 10s within a period of 30s,occurrence maximum 3000 times over lifetime	-40 to +150 +150 to +175	°C
T_{STG}	Storage Temperature Range	-40 to +125	°C
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V
d_{Creep}	Terminal to Heatsink Terminal to Terminal	9.0 9.0	mm
d_{Clear}	Terminal to Heatsink Terminal to Terminal	4.5 4.5	mm

IGBT Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=450A,V_{GE}=15V, T_j=25°C		1.40		V
		I_C=450A,V_{GE}=15V, T_j=150°C		1.65		
		I_C=450A,V_{GE}=15V, T_j=175°C		1.70		
		I_C=600A,V_{GE}=15V, T_j=25°C		1.60		
		I_C=600A,V_{GE}=15V, T_j=150°C		1.90		
		I_C=600A,V_{GE}=15V, T_j=175°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=15.6mA,V_{CE}=V_{GE}, T_j=25°C		6.4		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			1.67		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		81.2		nF
C_{oes}	Output Capacitance			1.56		nF
C_{res}	Reverse Transfer Capacitance			0.53		nF
Q_G	Gate Charge	V_{CE} =600V,I_C =600A, V_{GE}=-8…+15V		5.34		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=600A, R_{Gon}=1.0Ω,R_{Goff}=2.2Ω, L_S=22nH, V_{GE}=-8V/+15V, T_j=25°C		290		ns
t_r	Rise Time			81		ns
$t_{d(off)}$	Turn-Off Delay Time			895		ns
t_f	Fall Time			87		ns
E_{on}	Turn-On Switching Loss			53.5		mJ
E_{off}	Turn-Off Switching Loss			47.5		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=600A, R_{Gon}=1.0Ω,R_{Goff}=2.2Ω, L_S=22nH, V_{GE}=-8V/+15V, T_j=150°C		322		ns
t_r	Rise Time			103		ns
$t_{d(off)}$	Turn-Off Delay Time			1017		ns
t_f	Fall Time			171		ns
E_{on}	Turn-On Switching Loss			84.2		mJ
E_{off}	Turn-Off Switching Loss			63.7		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=600A, R_{Gon}=1.0Ω,R_{Goff}=2.2Ω, L_S=22nH, V_{GE}=-8V/+15V, T_j=175°C		334		ns
t_r	Rise Time			104		ns
$t_{d(off)}$	Turn-Off Delay Time			1048		ns
t_f	Fall Time			187		ns
E_{on}	Turn-On Switching Loss			89.8		mJ
E_{off}	Turn-Off Switching Loss			65.4		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V,		2000		A

		T_j=175°C,V_{CC}=800V, V_{CEM}≤1200V				

Diode Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=450A,V_{GE}=0V,T_j=25°C		1.80		V
		I_F=450A,V_{GE}=0V,T_j=150°C		1.75		
		I_F=450A,V_{GE}=0V,T_j=175°C		1.70		
		I_F=600A,V_{GE}=0V,T_j=25°C		1.95		
		I_F=600A,V_{GE}=0V,T_j=150°C		1.95		
		I_F=600A,V_{GE}=0V,T_j=175°C		1.90		
Q_r	Recovered Charge	V_R=600V,I_F=600A, -di/dt=7040A/μs,V_{GE}=-8V L_S=22nH,T_j=25°C		22.5		μC
I_{RM}	Peak Reverse Recovery Current			304		A
E_{rec}	Reverse Recovery Energy			10.8		mJ
Q_r	Recovered Charge	V_R=600V,I_F=600A, -di/dt=5790A/μs,V_{GE}=-8V L_S=22nH,T_j=150°C		46.6		μC
I_{RM}	Peak Reverse Recovery Current			336		A
E_{rec}	Reverse Recovery Energy			18.2		mJ
Q_r	Recovered Charge	V_R=600V,I_F=600A, -di/dt=5520A/μs,V_{GE}=-8V L_S=22nH,T_j=175°C		49.8		μC
I_{RM}	Peak Reverse Recovery Current			346		A
E_{rec}	Reverse Recovery Energy			19.8		mJ

NTC Characteristics T_F=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_F=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		8		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.75		mΩ
△p	△V/△t=10.0dm³/min,T_F=75°C		64		mbar
p	Maximum Pressure In Cooling Circuit			2.5	bar
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode) △V/△t=10.0dm³/min,T_F=75°C		0.090 0.126	0.103 0.145	K/W
M	Terminal Connection Torque, Screw M5 Mounting Torque, Screw M4	3.6 1.8		4.4 2.2	N.m
G	Weight of Module		750		g

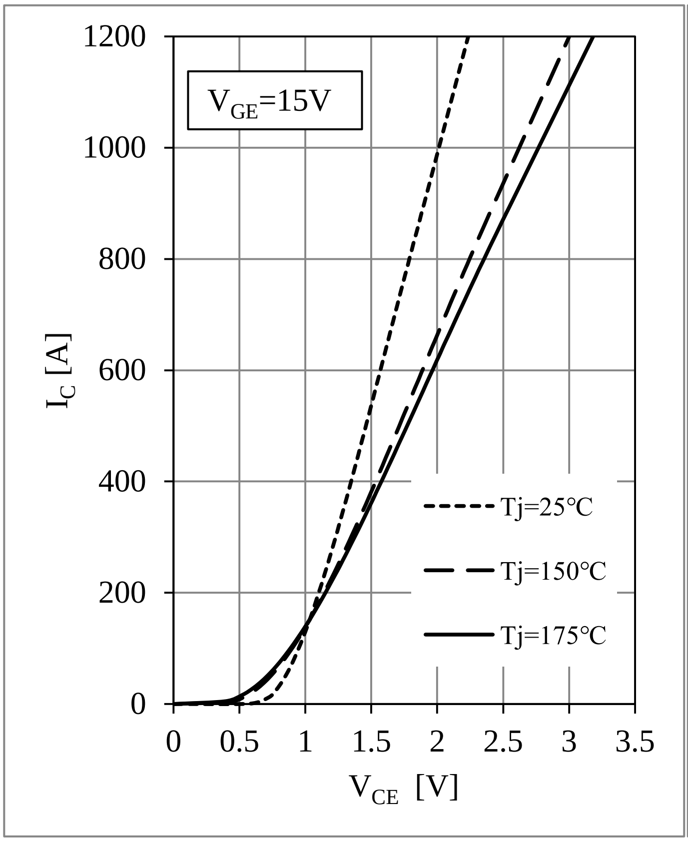


Fig 1. IGBT Output Characteristics

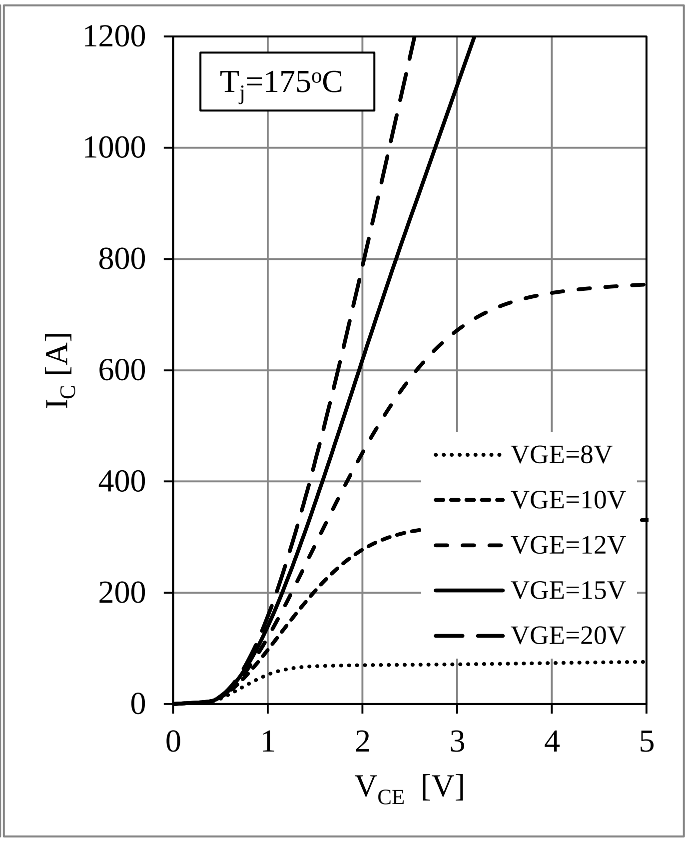


Fig 2. IGBT Output Characteristics

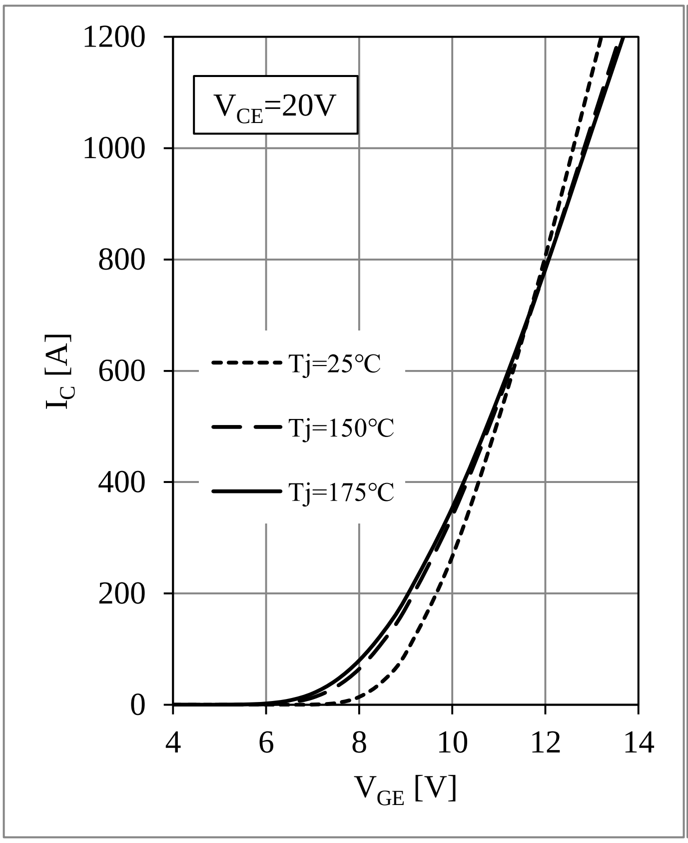


Fig 3. IGBT Transfer Characteristics

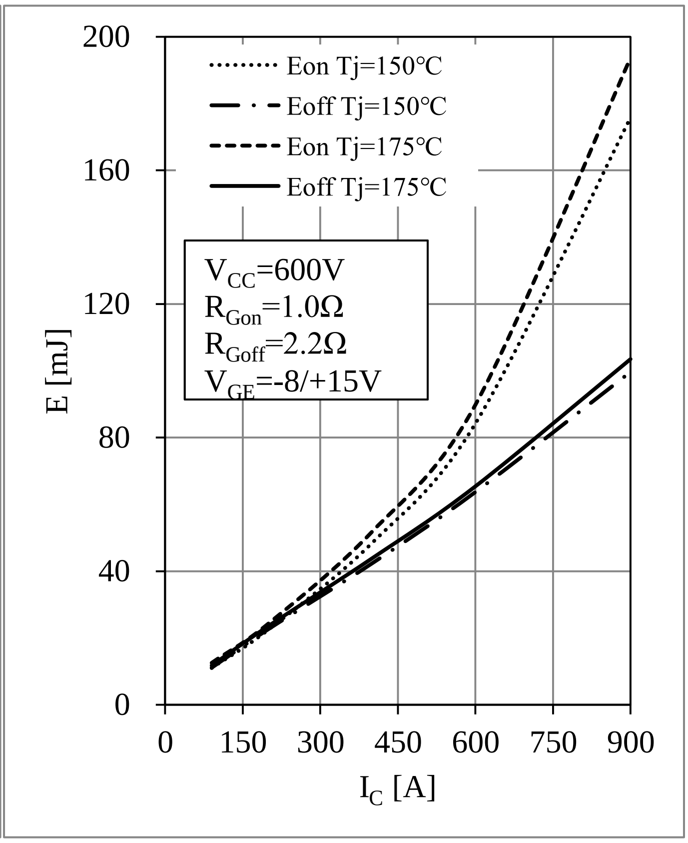


Fig 4. IGBT Switching Loss vs. I_C

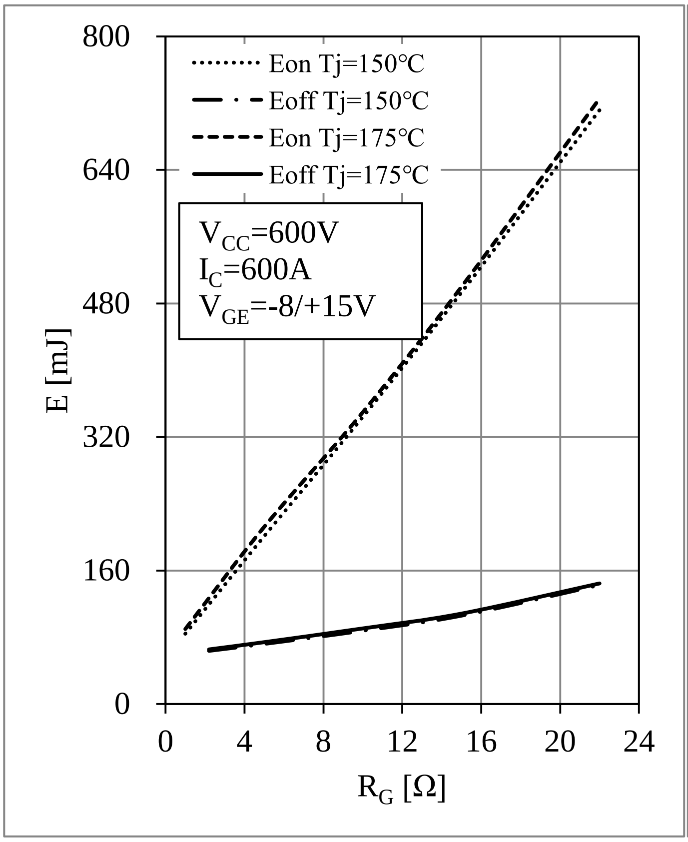


Fig 5. IGBT Switching Loss vs. R_G

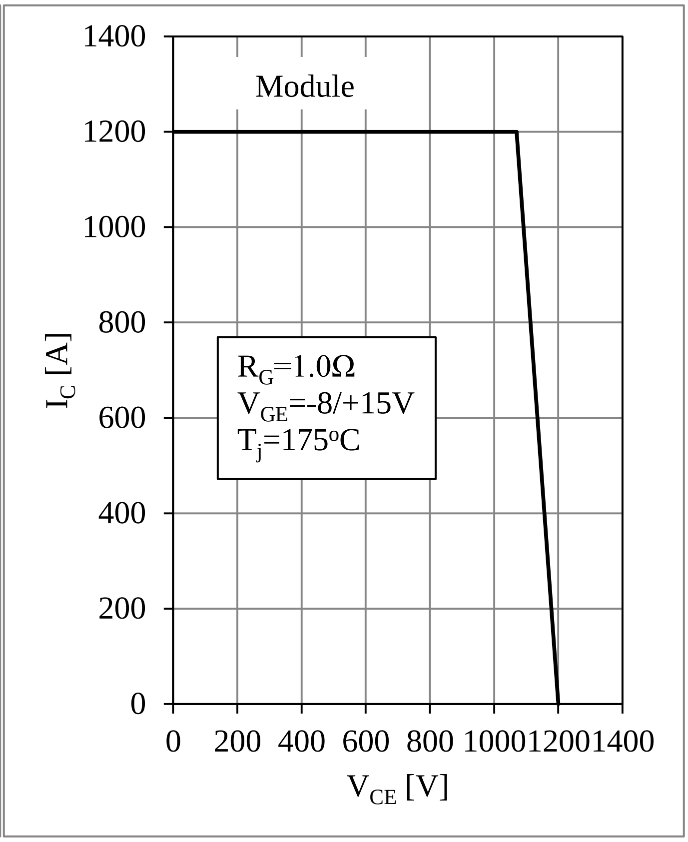


Fig 6. RBSOA

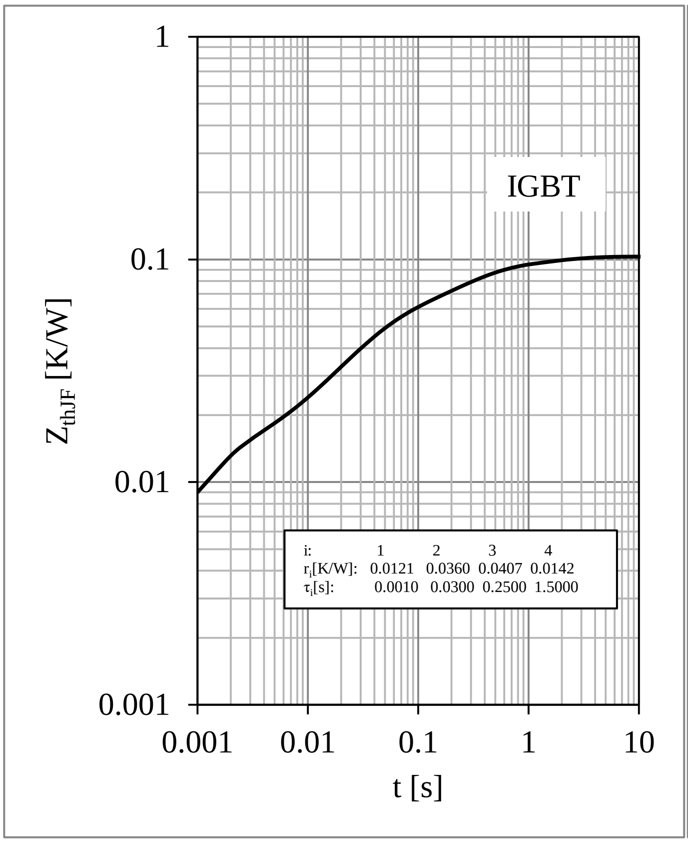


Fig 7. IGBT Transient Thermal Impedance

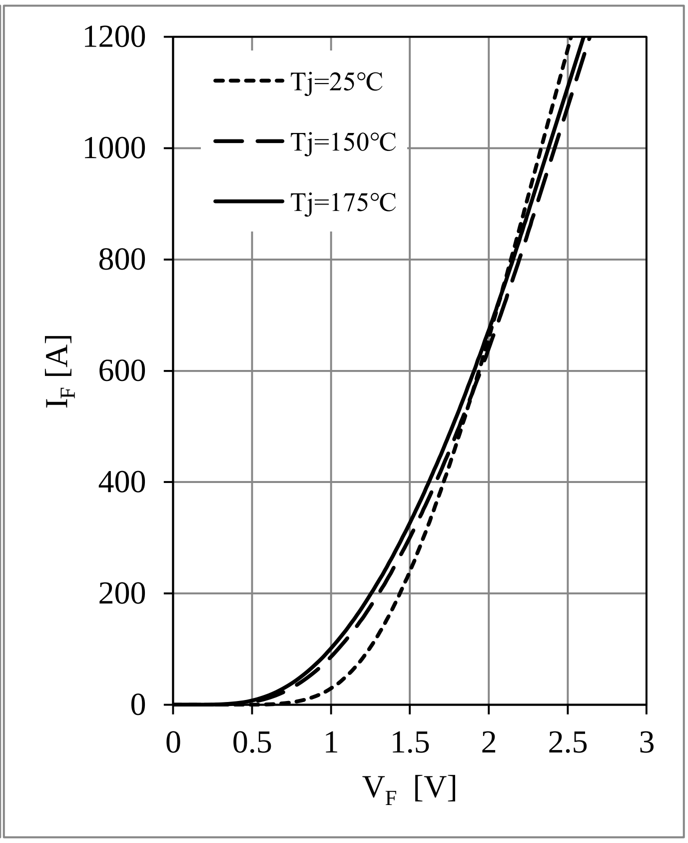


Fig 8. Diode Forward Characteristics

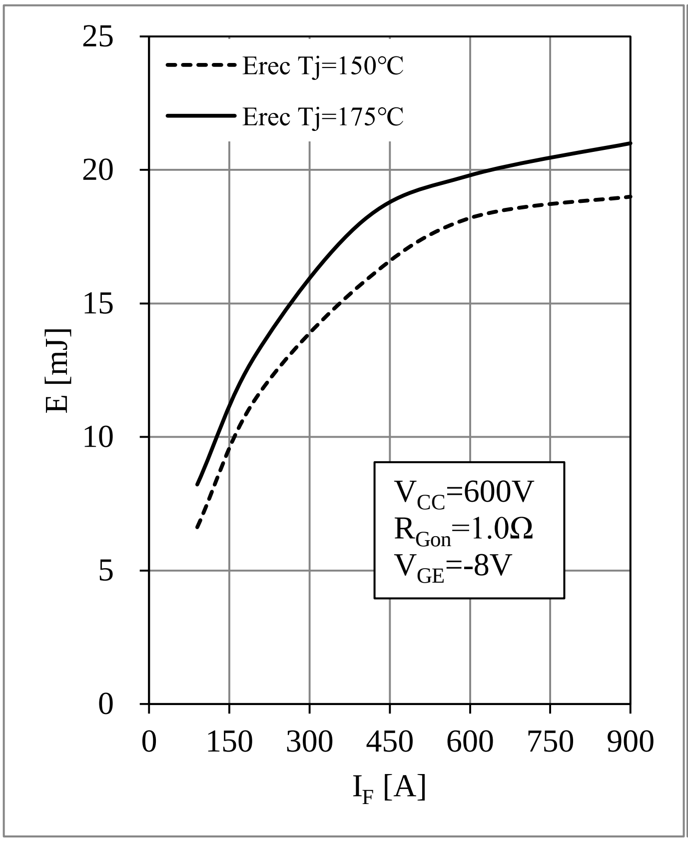


Fig 9. Diode Switching Loss vs. I_F

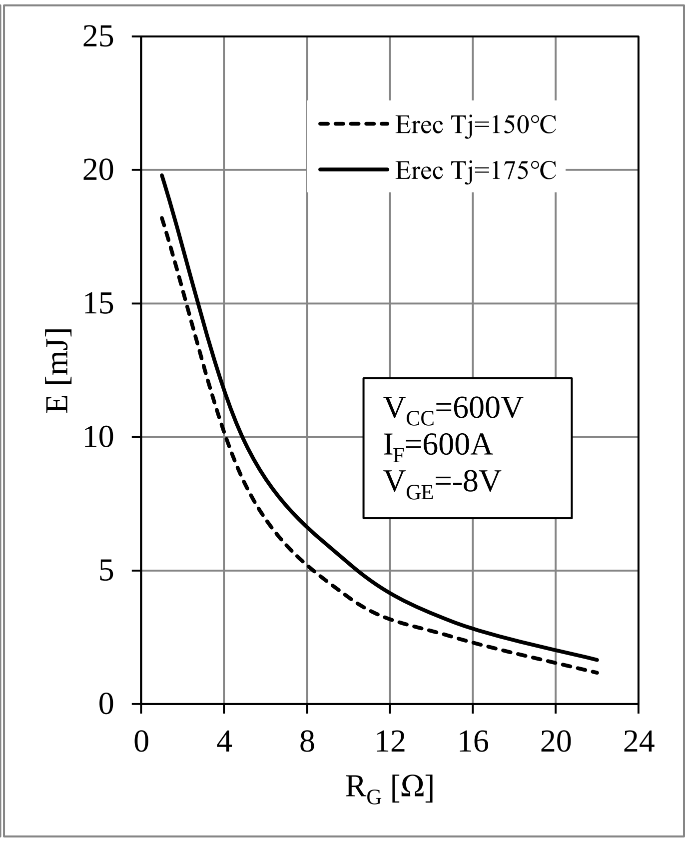


Fig 10. Diode Switching Loss vs. R_G

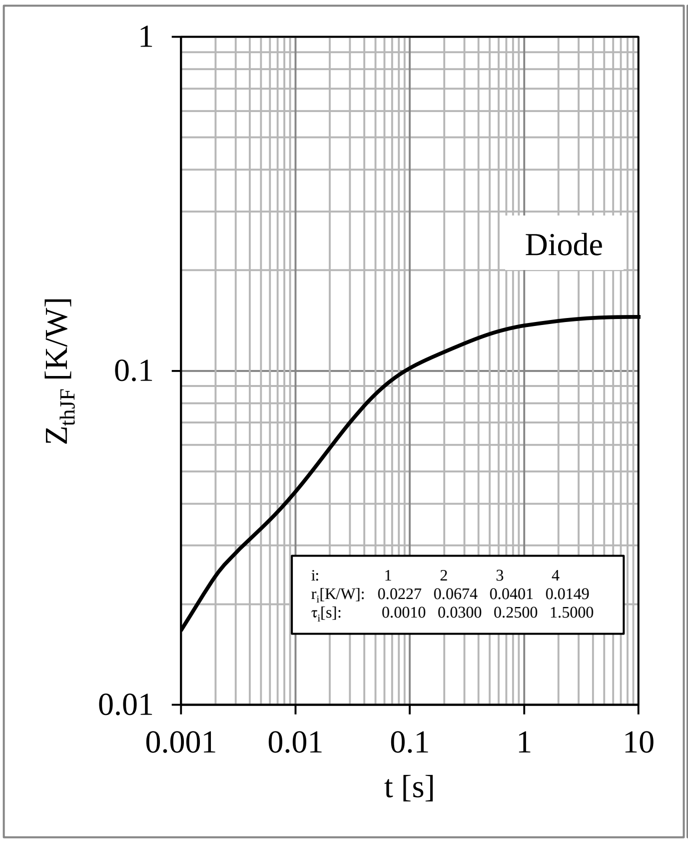


Fig 11. Diode Transient Thermal Impedance

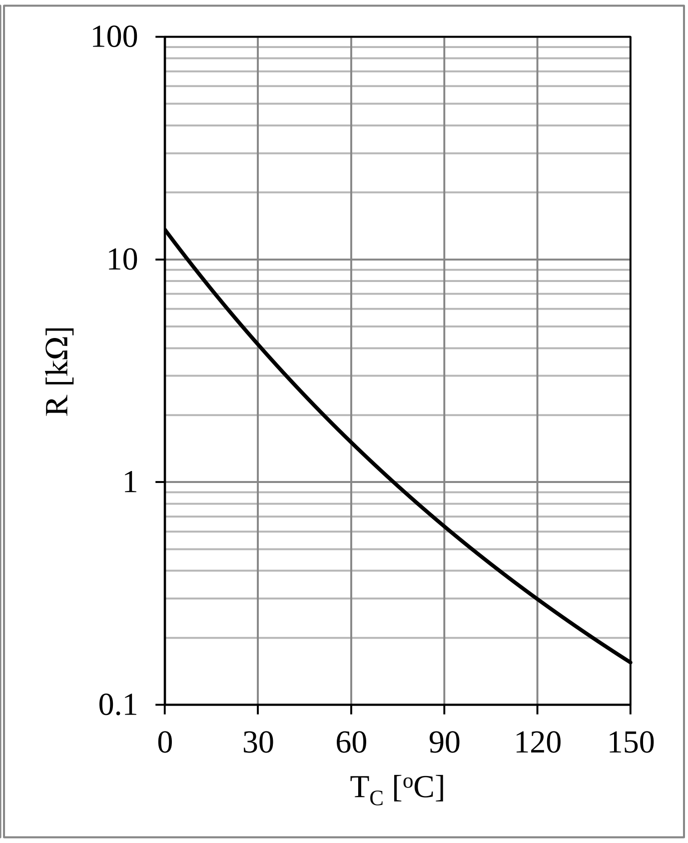


Fig 12. NTC Temperature Characteristic

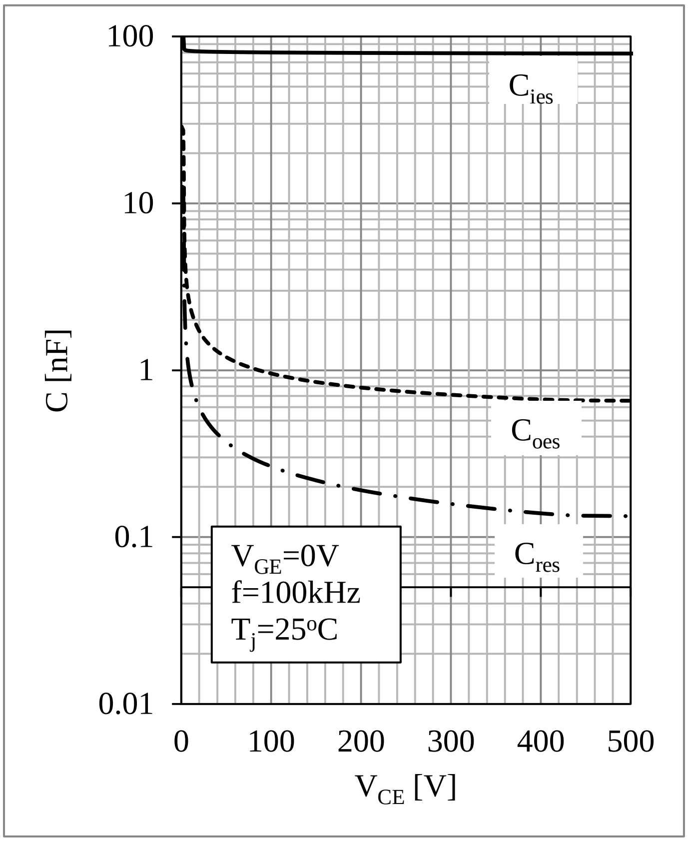
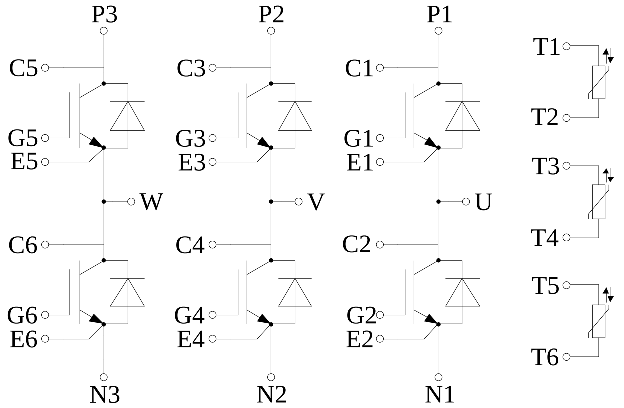


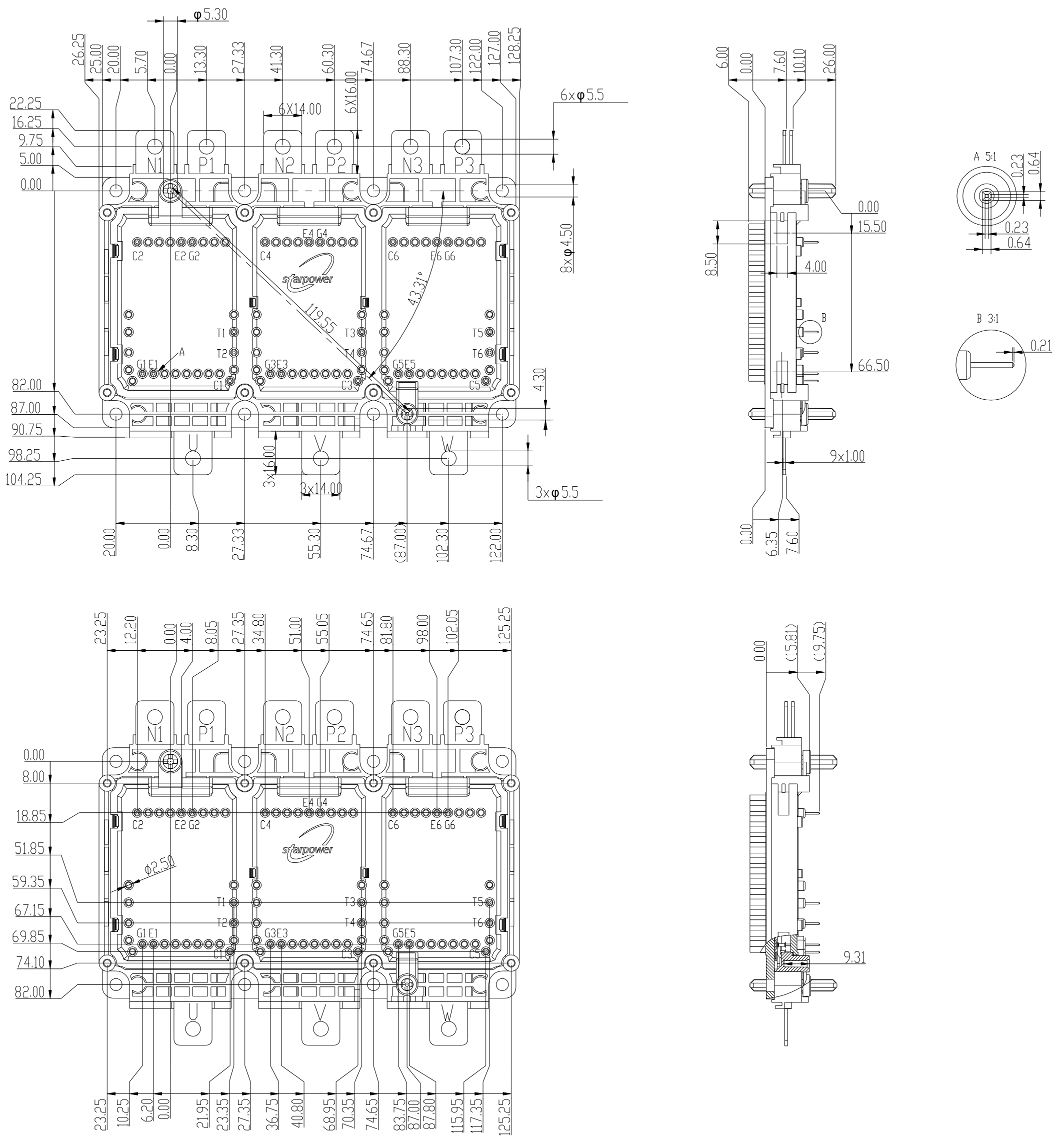
Fig 13. IGBT Capacity Charcteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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