STARPOWER

SEMICONDUCTOR **IGBT**

GD200FFX120P3SA

1200V/200A 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.

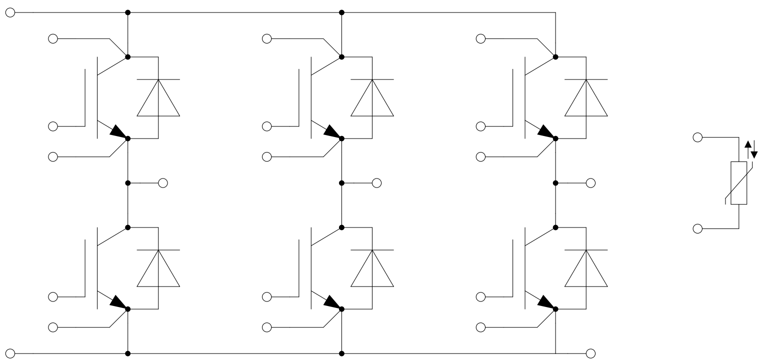
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10μs 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

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

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°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°C @ T_C=100°C	351 200	A
I_{CM}	Pulsed Collector Current t_p=1ms	400	A
P_D	Maximum Power Dissipation @ T_j=175°C	1239	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	200	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	400	A

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=200A,V_{GE}=15V, T_j=25°C		1.70	2.15	V
		I_C=200A,V_{GE}=15V, T_j=125°C		1.95		
		I_C=200A,V_{GE}=15V, T_j=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=5.0mA,V_{CE}=V_{GE}, T_j=25°C	5.2	6.0	6.8	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			2.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		20.7		nF
C_{res}	Reverse Transfer Capacitance			0.58		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		1.55		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=200A, R_G=2.2Ω,V_{GE}=±15V, L_S=40nH,T_j=25°C		70		ns
t_r	Rise Time			30		ns
$t_{d(off)}$	Turn-Off Delay Time			276		ns
t_f	Fall Time			226		ns
E_{on}	Turn-On Switching Loss			7.59		mJ
E_{off}	Turn-Off Switching Loss			14.3		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=200A, R_G=2.2Ω,V_{GE}=±15V, L_S=40nH,T_j=125°C		85		ns
t_r	Rise Time			33		ns
$t_{d(off)}$	Turn-Off Delay Time			322		ns
t_f	Fall Time			308		ns
E_{on}	Turn-On Switching Loss			12.0		mJ
E_{off}	Turn-Off Switching Loss			20.1		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=200A, R_G=2.2Ω,V_{GE}=±15V, L_S=40nH,T_j=150°C		88		ns
t_r	Rise Time			34		ns
$t_{d(off)}$	Turn-Off Delay Time			329		ns
t_f	Fall Time			327		ns
E_{on}	Turn-On Switching Loss			13.1		mJ
E_{off}	Turn-Off Switching Loss			20.9		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=800V, V_{CEM}≤1200V		800		A

Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=200A,V_{GE}=0V,T_j=25°C		1.85	2.30	V
		I_F=200A,V_{GE}=0V,T_j=125°C		1.90		
		I_F=200A,V_{GE}=0V,T_j=150°C		1.95		
Q_r	Recovered Charge	V_R=600V,I_F=200A, -di/dt=7530A/μs,V_{GE}=-15V L_S=40nH,T_j=25°C		14.4		μC
I_{RM}	Peak Reverse Recovery Current			272		A
E_{rec}	Reverse Recovery Energy			7.47		mJ
Q_r	Recovered Charge	V_R=600V,I_F=200A, -di/dt=5770A/μs,V_{GE}=-15V L_S=40nH,T_j=125°C		18.9		μC
I_{RM}	Peak Reverse Recovery Current			284		A
E_{rec}	Reverse Recovery Energy			13.5		mJ
Q_r	Recovered Charge	V_R=600V,I_F=200A, -di/dt=5740A/μs,V_{GE}=-15V L_S=40nH,T_j=150°C		21.1		μC
I_{RM}	Peak Reverse Recovery Current			296		A
E_{rec}	Reverse Recovery Energy			14.3		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		30		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		1.00		mΩ
R_{thJC}	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			0.121 0.175	K/W
R_{thCH}	Case-to-Heatsink (per IGBT) Case-to-Heatsink (per Diode)		0.081 0.075		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		485		g

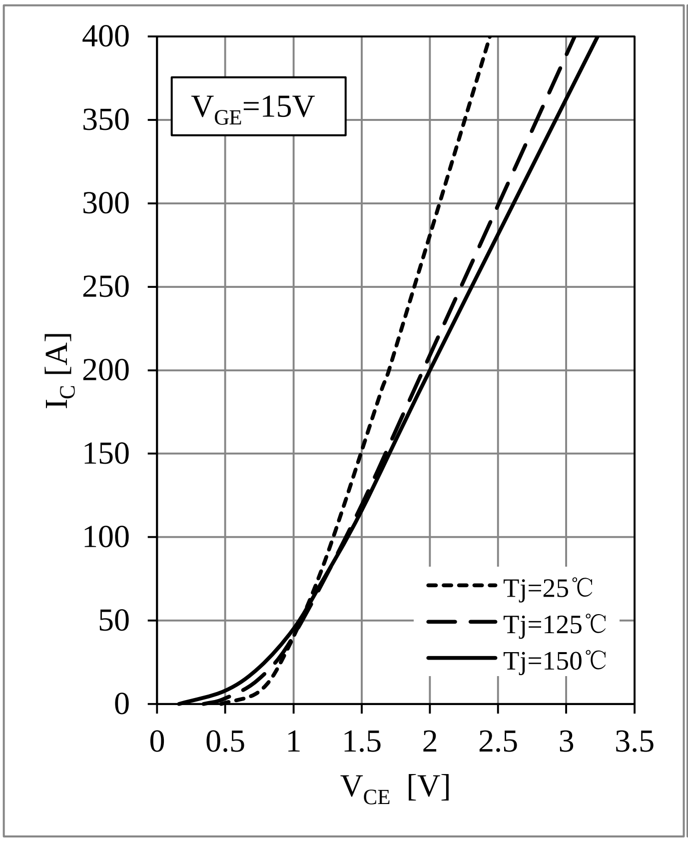


Fig 1. IGBT Output Characteristics

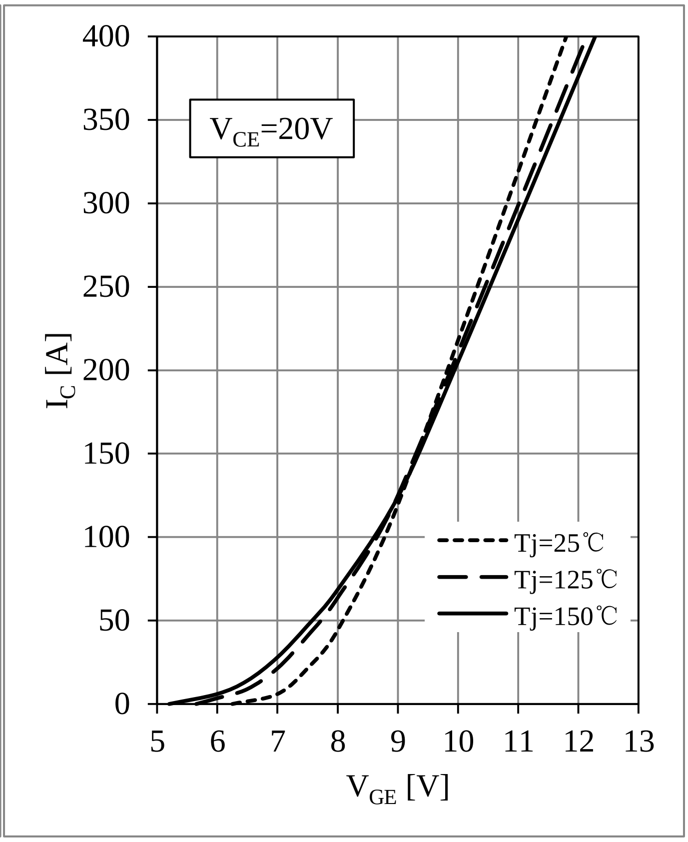


Fig 2. IGBT Transfer Characteristics

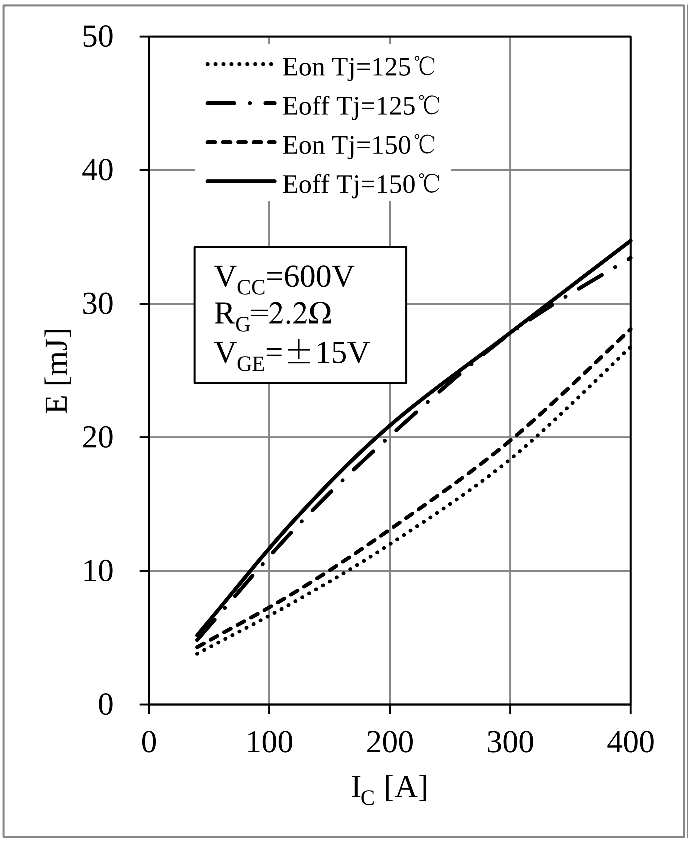


Fig 3. IGBT Switching Loss vs. I_C

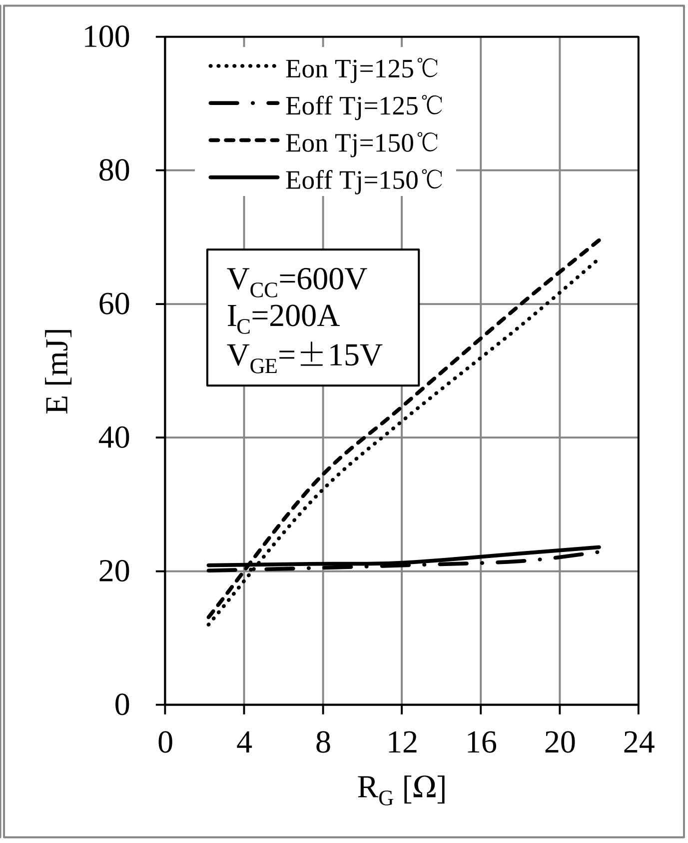


Fig 4. IGBT Switching Loss vs. R_G

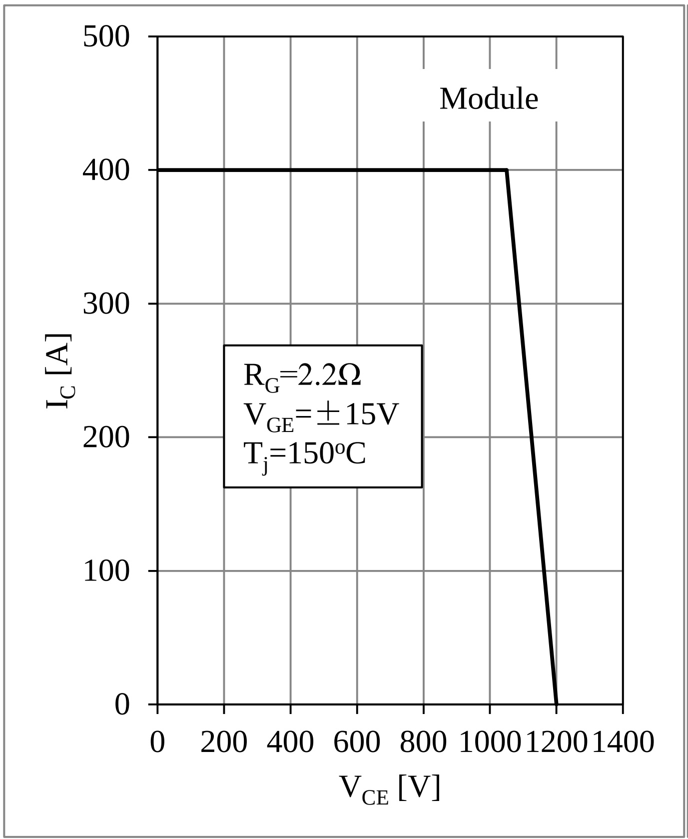


Fig 5. RBSOA

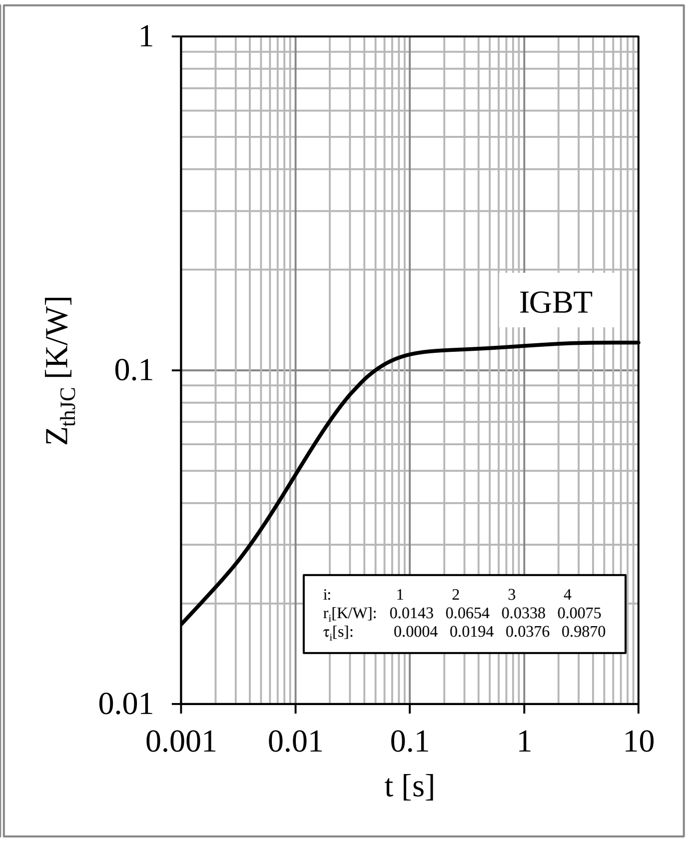


Fig 6. IGBT Transient Thermal Impedance

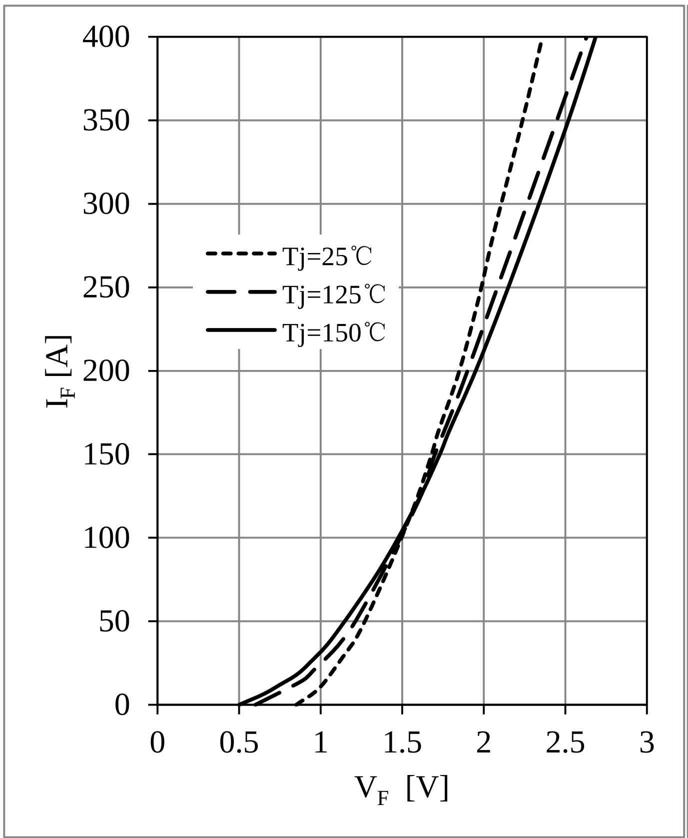


Fig 7. Diode Forward Characteristics

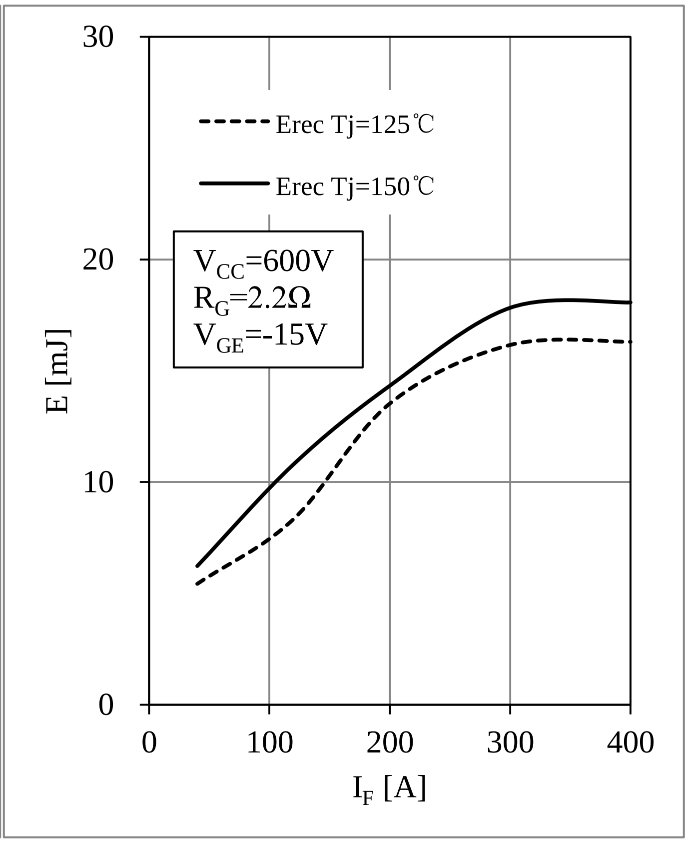


Fig 8. Diode Switching Loss vs. I_F

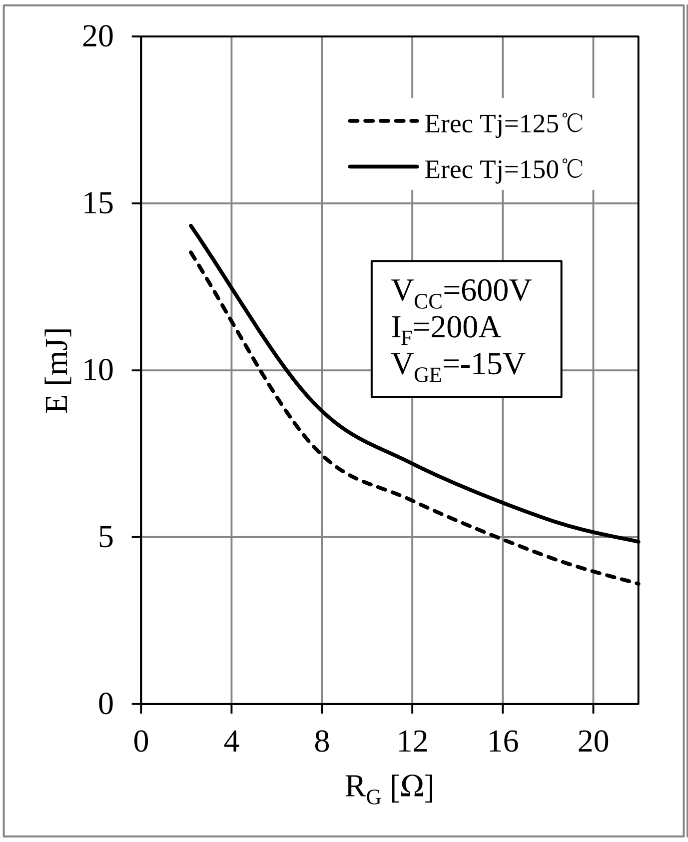


Fig 9. Diode Switching Loss vs. R_G

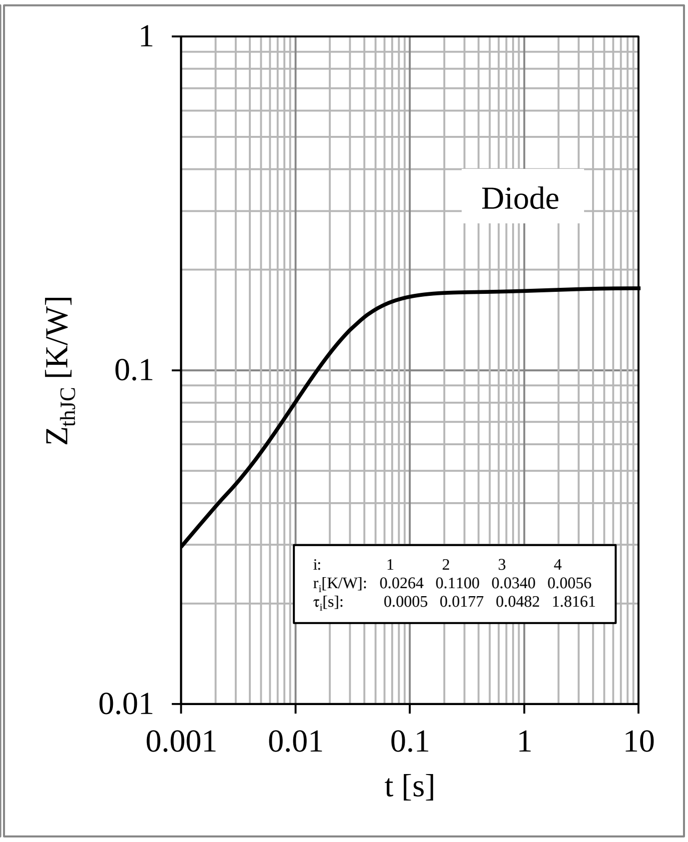


Fig 10. Diode Transient Thermal Impedance

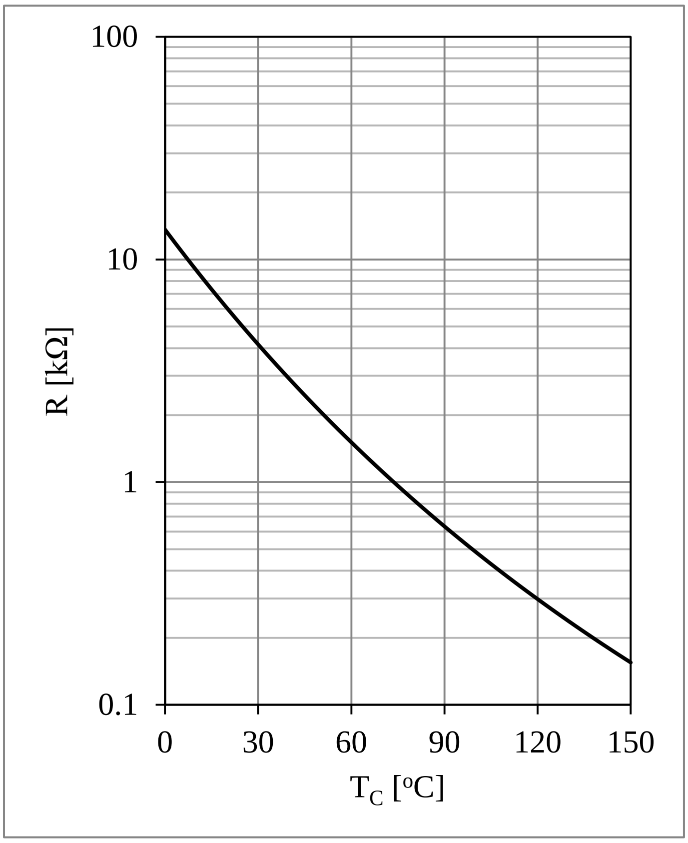
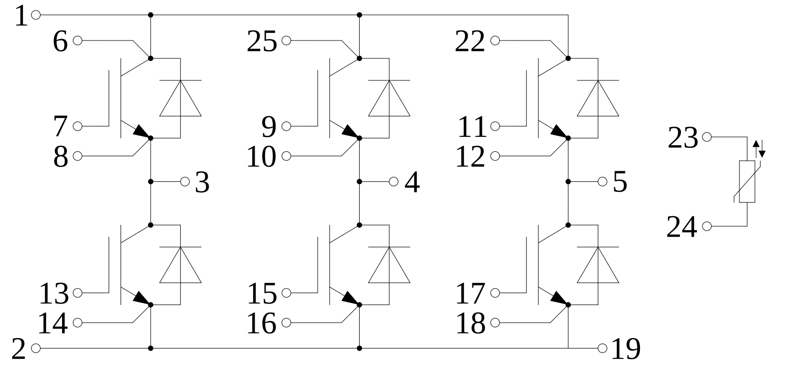


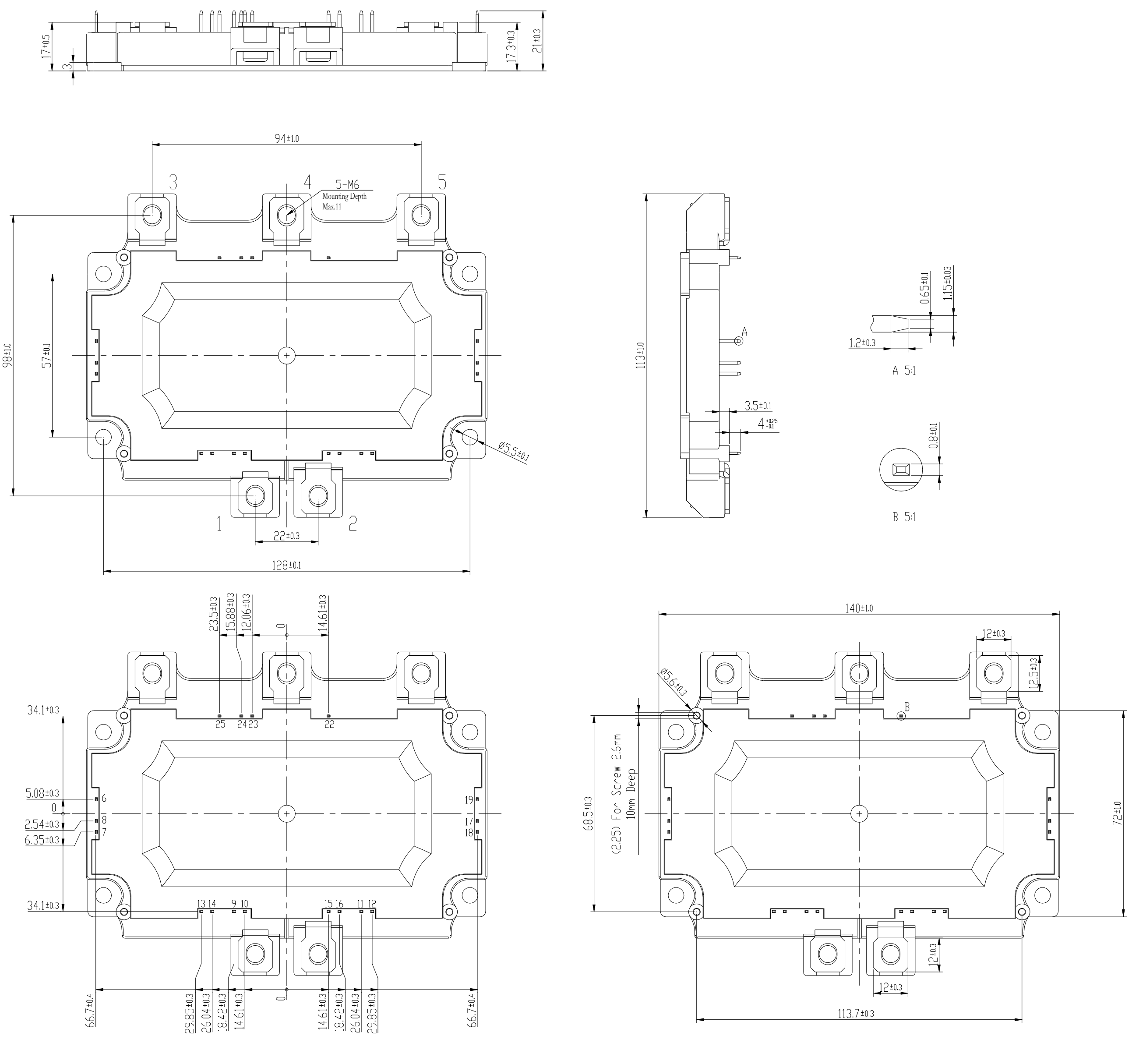
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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