STARPOWER

SEMICONDUCTOR **IGBT**

GD450HFA120C6S

1200V/450A 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 general inverter and UPS.

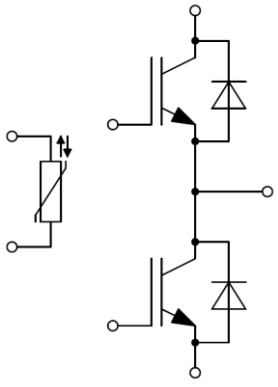
Features

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

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

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=90°C	450	A
I_{CRM}	Repetitive Peak Collector Current t_p=1ms	900	A

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	450	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	900	A

Module

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

Note: T_{vjop} > 150°C is allowed for operation at overload conditions.

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=450A,V_{GE}=15V, T_{vj}=25°C		1.50	1.95	V
		I_C=450A,V_{GE}=15V, T_{vj}=125°C		1.70		
		I_C=450A,V_{GE}=15V, T_{vj}=175°C		1.85		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=9.00mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.4	6.2	7.0	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_{vj}=25°C			50	uA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_{vj}=25°C			100	nA
R_{Gint}	Internal Gate Resistance			1.33		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		39.8		nF
C_{res}	Reverse Transfer Capacitance			0.36		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		2.88		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=450A, R_G=1.5Ω,L_S=30nH, V_{GE}=±15V,T_{vj}=25°C		542		ns
t_r	Rise Time			56		ns
$t_{d(off)}$	Turn-Off Delay Time			408		ns
t_f	Fall Time			146		ns
E_{on}	Turn-On Switching Loss			14.9		mJ
E_{off}	Turn-Off Switching Loss			42.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=450A, R_G=1.5Ω,L_S=30nH, V_{GE}=±15V,T_{vj}=125°C		551		ns
t_r	Rise Time			63		ns
$t_{d(off)}$	Turn-Off Delay Time			417		ns
t_f	Fall Time			240		ns
E_{on}	Turn-On Switching Loss			24.1		mJ
E_{off}	Turn-Off Switching Loss			54.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=450A, R_G=1.5Ω, L_S=30nH, V_{GE}=±15V,T_{vj}=175°C		554		ns
t_r	Rise Time			68		ns
$t_{d(off)}$	Turn-Off Delay Time			448		ns
t_f	Fall Time			301		ns
E_{on}	Turn-On Switching Loss			29.0		mJ
E_{off}	Turn-Off Switching Loss			60.0		mJ
I_{SC}	SC Data	t_P≤8μs,V_{GE}=15V, T_{vj}=150°C,V_{CC}=800V, V_{CEM}≤1200V		2150		A
		t_P≤6μs,V_{GE}=15V, T_{vj}=175°C,V_{CC}=800V, V_{CEM}≤1200V		1990		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=450A,V_{GE}=0V,T_{vj}=25°C		1.60	2.05	V
		I_F=450A,V_{GE}=0V,T_{vj}=125°C		1.65		
		I_F=450A,V_{GE}=0V,T_{vj}=175°C		1.65		
Q_r	Recovered Charge	V_{CC}=600V,I_F=450A, -di/dt=6491A/μs, L_S=30nH, V_{GE}=-15V,T_{vj}=25°C		20.8		μC
I_{RM}	Peak Reverse Recovery Current			273		A
E_{rec}	Reverse Recovery Energy			10.9		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=450A, -di/dt=5919A/μs, L_S=30nH, V_{GE}=-15V,T_{vj}=125°C		40		μC
I_{RM}	Peak Reverse Recovery Current			304		A
E_{rec}	Reverse Recovery Energy			18.7		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=450A, -di/dt=5688A/μs, L_S=30nH, V_{GE}=-15V,T_{vj}=175°C		49.0		μC
I_{RM}	Peak Reverse Recovery Current			313		A
E_{rec}	Reverse Recovery Energy			21.9		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		1.20		mΩ
R_{thJC}	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			0.080 0.128	K/W
R_{thCH}	Case-to-Heatsink (per IGBT) Case-to-Heatsink (per Diode)		0.025 0.027		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

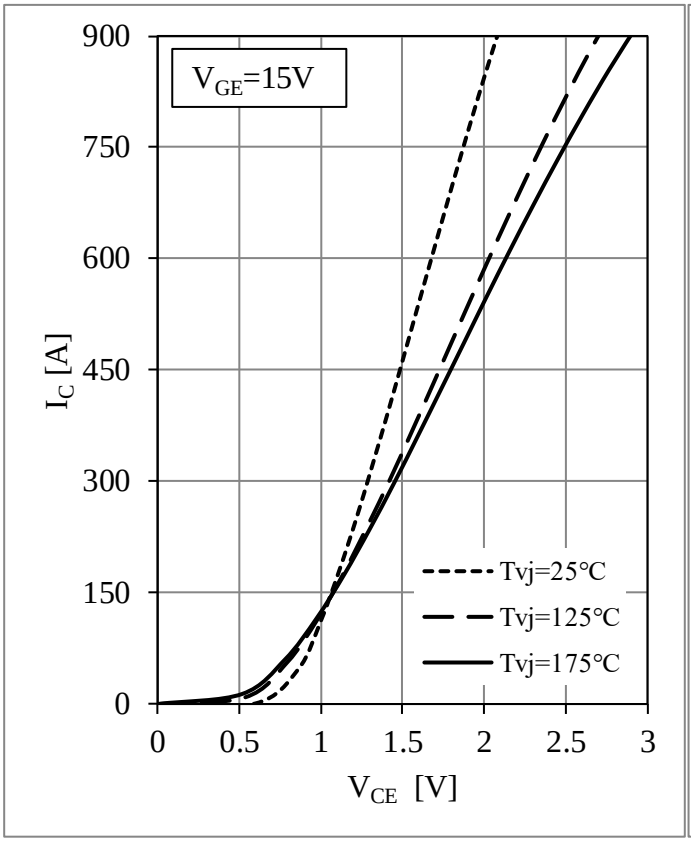


Fig 1. IGBT Output Characteristics

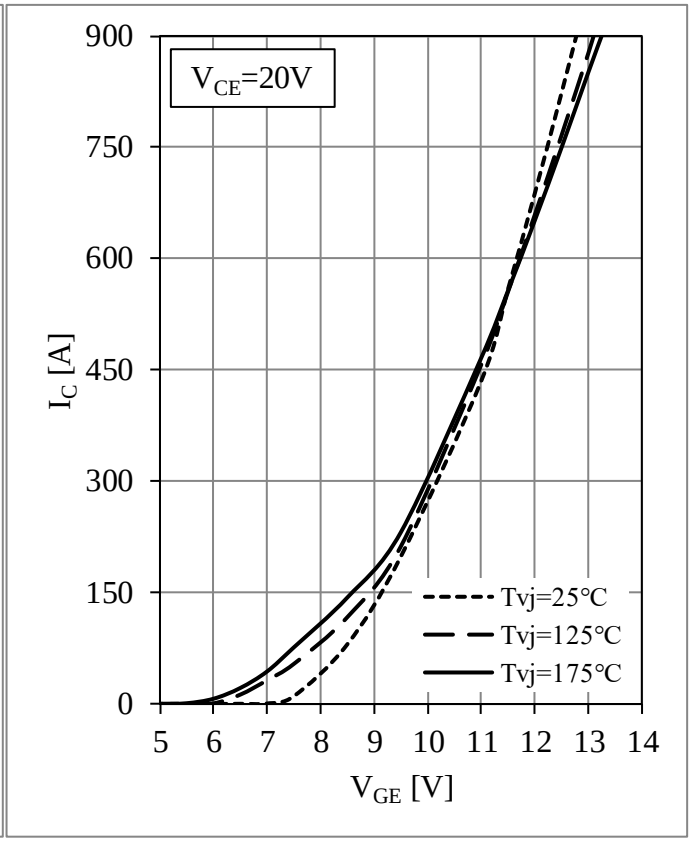


Fig 2. IGBT Transfer Characteristics

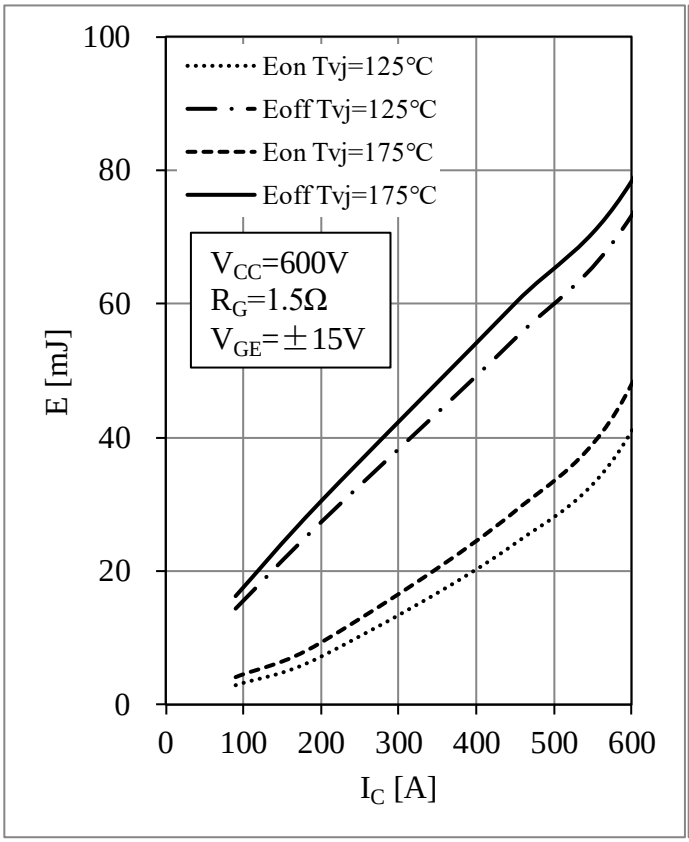


Fig 3. IGBT Switching Loss vs. I_C

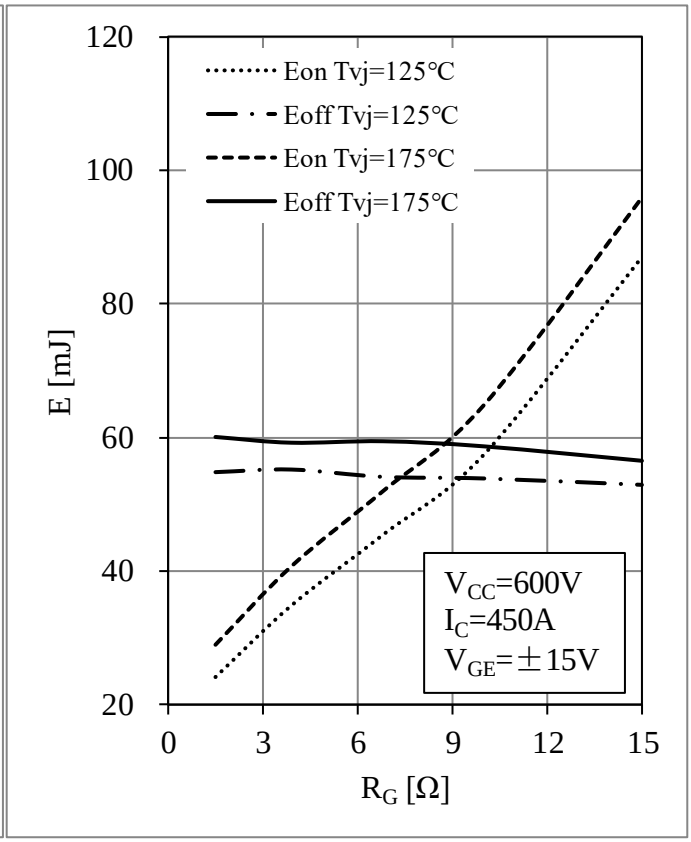


Fig 4. IGBT Switching Loss vs. R_G

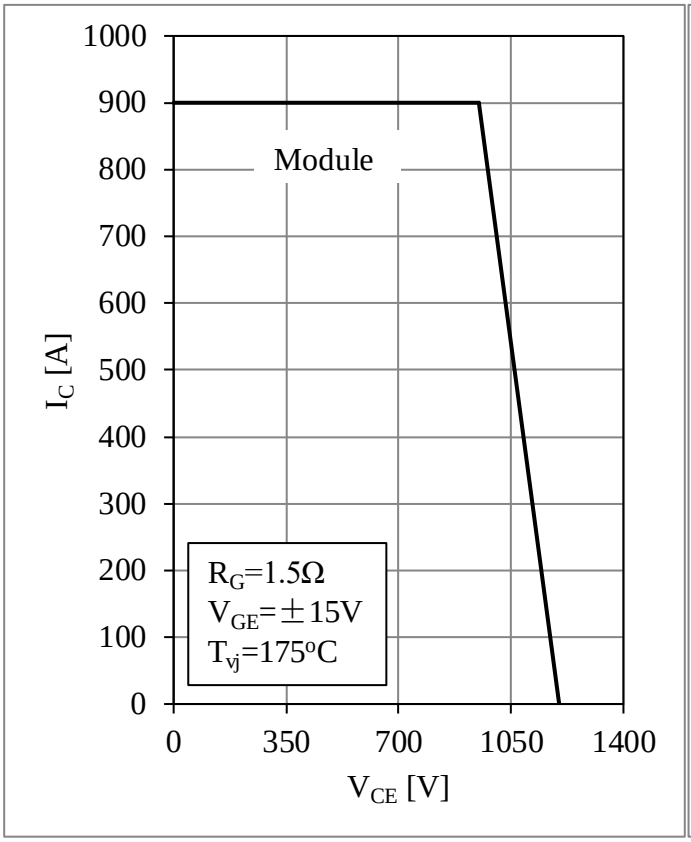


Fig 5. RBSOA

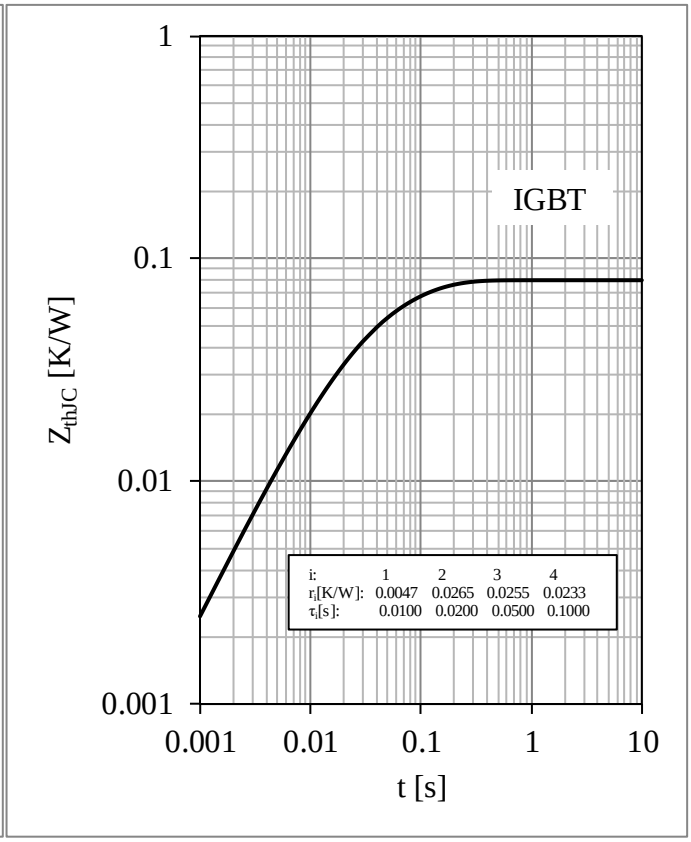


Fig 6. IGBT Transient Thermal Impedance

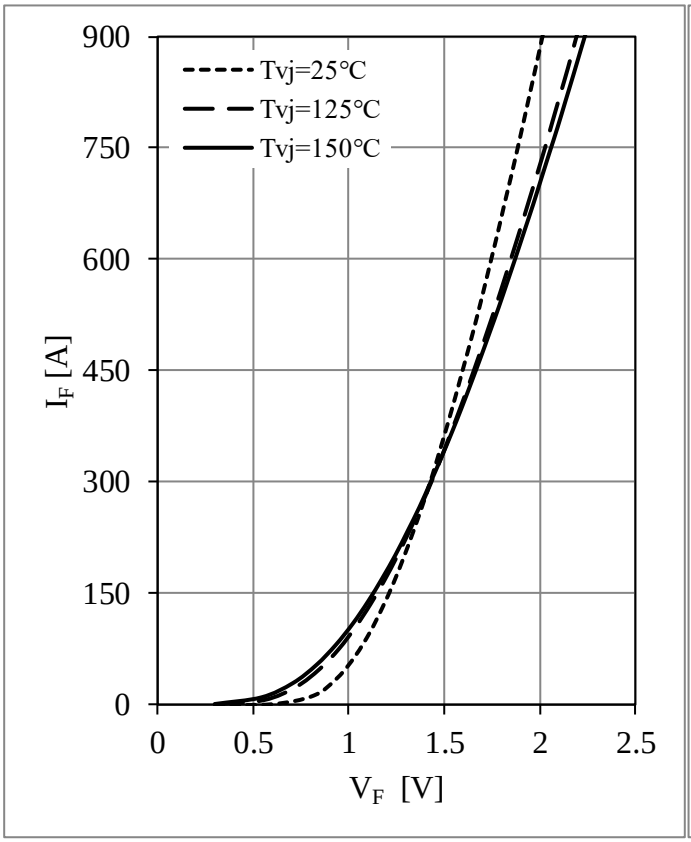


Fig 7. Diode Forward Characteristics

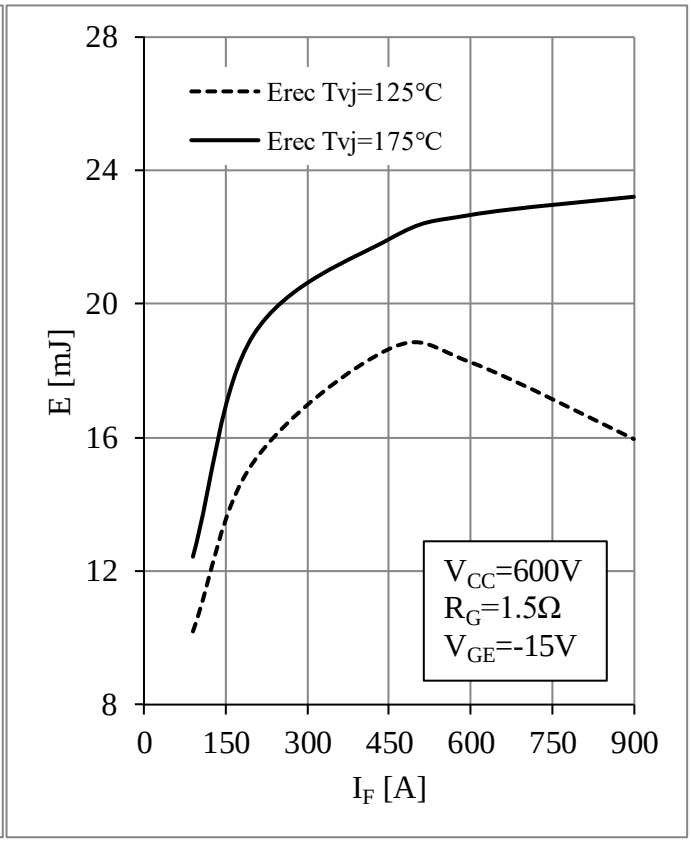


Fig 8. Diode Switching Loss vs. I_F

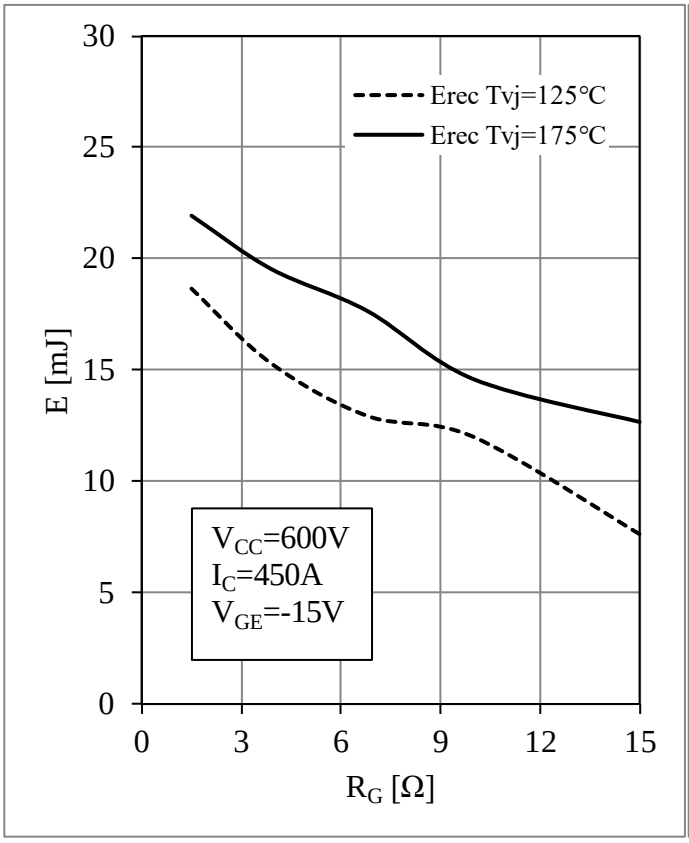


Fig 9. Diode Switching Loss vs. R_G

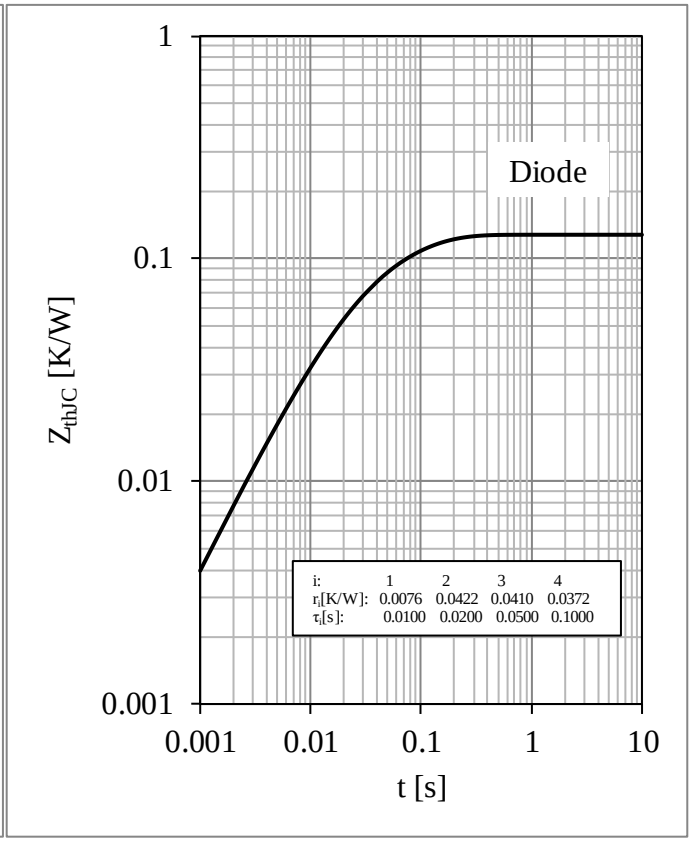


Fig 10. Diode Transient Thermal Impedance

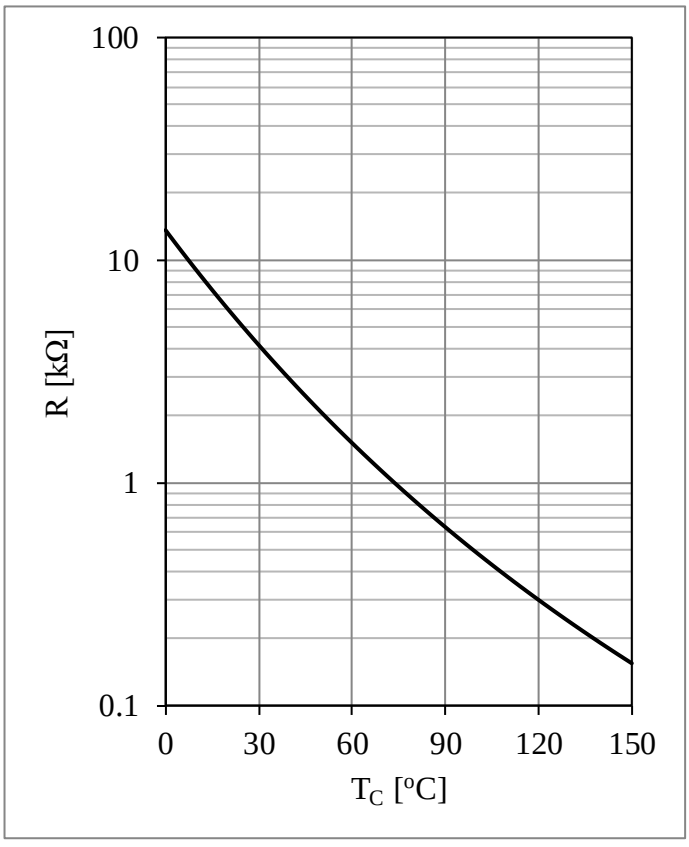
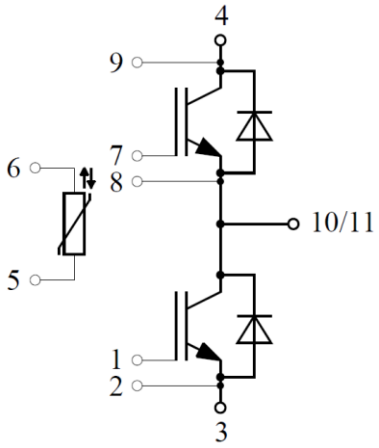


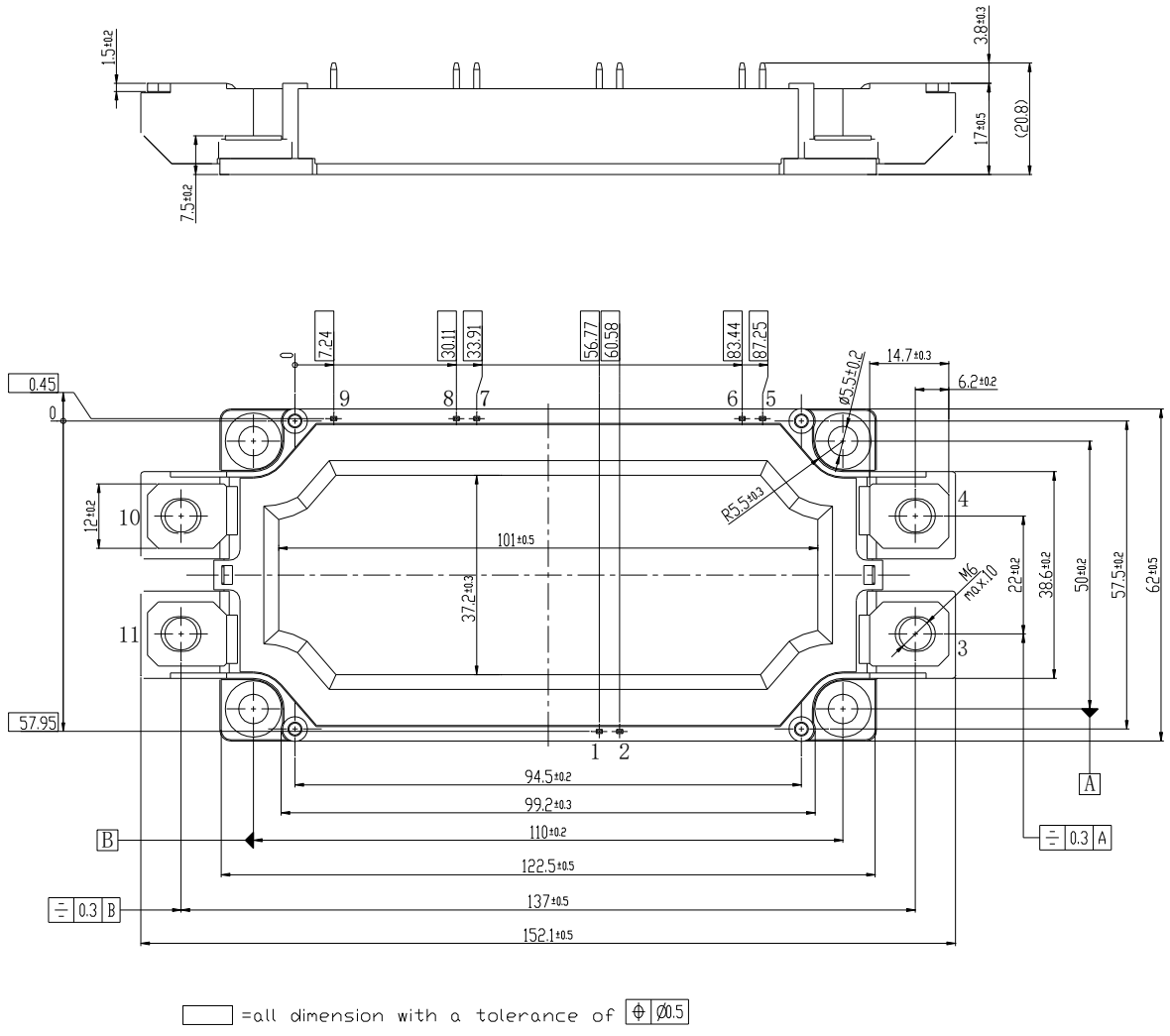
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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