STARPOWER

SEMICONDUCTOR **IGBT**

GD450HNX120C6SMFA

1200V/450A 2 in one-package with Shunt

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.

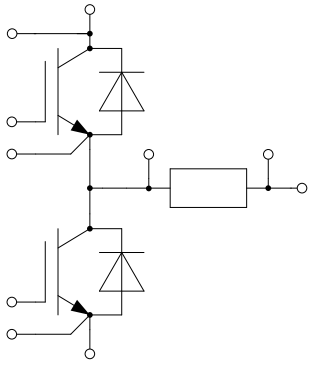
Features

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

Typical Applications

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

Equivalent Circuit Schematic



Absolute Maximum Ratings T_H=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_H=65°C	450	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	900	A
P_D	Maximum Power Dissipation @ T_{vj}=175°C	1562	W

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 tp limited by T_{vjop}	900	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	°C
T_{vjop}	Operating Junction Temperature(IGBT,Diode) Operating Junction Temperature(Shunt)	-40 to +150 -55 to +170	°C
T_{STG}	Storage Temperature Range	-40 to +125	°C
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V

IGBT Characteristics T_H=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		1.70	2.15	V
		I_C=450A,V_{GE}=15V, T_{vj}=125°C		1.95		
		I_C=450A,V_{GE}=15V, T_{vj}=150°C		2.00		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=18.0mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.6	6.2	6.8	V
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_{vj}=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_{vj}=25°C			400	nA
R_{Gint}	Internal Gate Resistance			0.7		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		46.6		nF
C_{res}	Reverse Transfer Capacitance			1.31		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		3.50		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		220		ns
t_r	Rise Time			79		ns
$t_{d(off)}$	Turn-Off Delay Time			272		ns
t_f	Fall Time			197		ns
E_{on}	Turn-On Switching Loss			34.6		mJ
E_{off}	Turn-Off Switching Loss			34.6		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		230		ns
t_r	Rise Time			82		ns
$t_{d(off)}$	Turn-Off Delay Time			366		ns
t_f	Fall Time			242		ns
E_{on}	Turn-On Switching Loss			51.2		mJ
E_{off}	Turn-Off Switching Loss			46.0		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}=150°C		235		ns
t_r	Rise Time			88		ns
$t_{d(off)}$	Turn-Off Delay Time			388		ns
t_f	Fall Time			253		ns
E_{on}	Turn-On Switching Loss			56.4		mJ
E_{off}	Turn-Off Switching Loss			46.5		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_{vj}=150°C,V_{CC}=800V, V_{CEM}≤1200V		1800		A

Diode Characteristics T_H=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		1.70		
		I_F=450A,V_{GE}=0V,T_{vj}=150°C		1.70		
Q_r	Recovered Charge	V_{CC}=600V,I_F=450A, -di/dt=7002A/μs,L_S=30nH, V_{GE}=-15V,T_{vj}=25°C		49.6		μC
I_{RM}	Peak Reverse Recovery Current			345		A
E_{rec}	Reverse Recovery Energy			16.8		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=450A, -di/dt=5424A/μs,L_S=30nH, V_{GE}=-15V,T_{vj}=125°C		86.8		μC
I_{RM}	Peak Reverse Recovery Current			376		A
E_{rec}	Reverse Recovery Energy			31.0		mJ
Q_r	Recovered Charge	V_{CC}=600V,I_F=450A, -di/dt=4024A/μs,L_S=30nH, V_{GE}=-15V,T_{vj}=150°C		109		μC
I_{RM}	Peak Reverse Recovery Current			403		A
E_{rec}	Reverse Recovery Energy			35.5		mJ

Shunt Characteristics T_H=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{20}	Rated resistance	T_H = 25 °C		0.33		mΩ
P	Load capacity per shunt resistor	T_H = 80°C,$T_{shunt,max}$=170°C			30	W

NTC Characteristics T_H=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_H=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_{thJH}	Junction-to-Heatsink (per IGBT) Junction-to-Heatsink (per Diode) Junction-to-Heatsink (per Shunt)			0.096 0.170 3.000	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

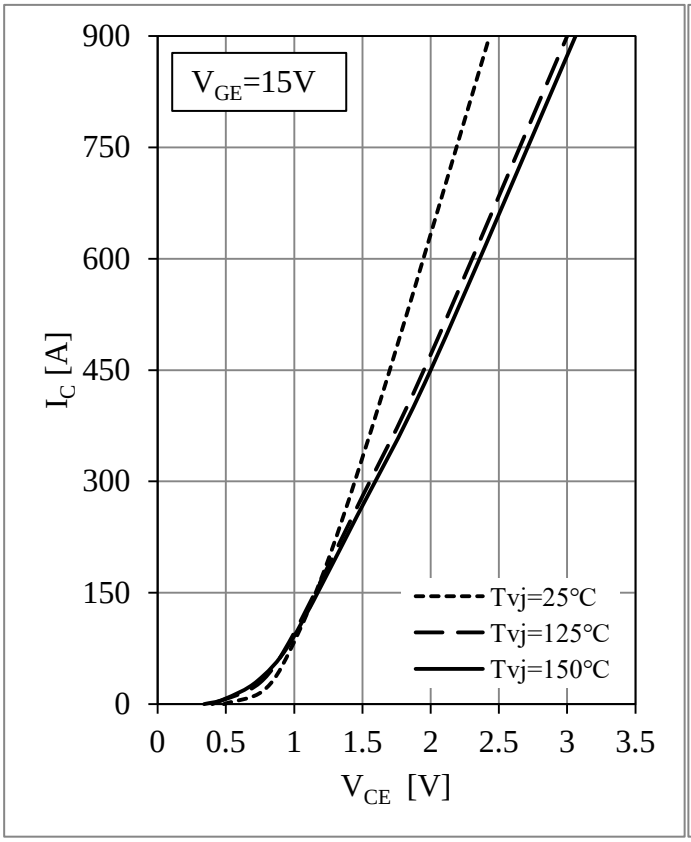


Fig 1. IGBT Output Characteristics

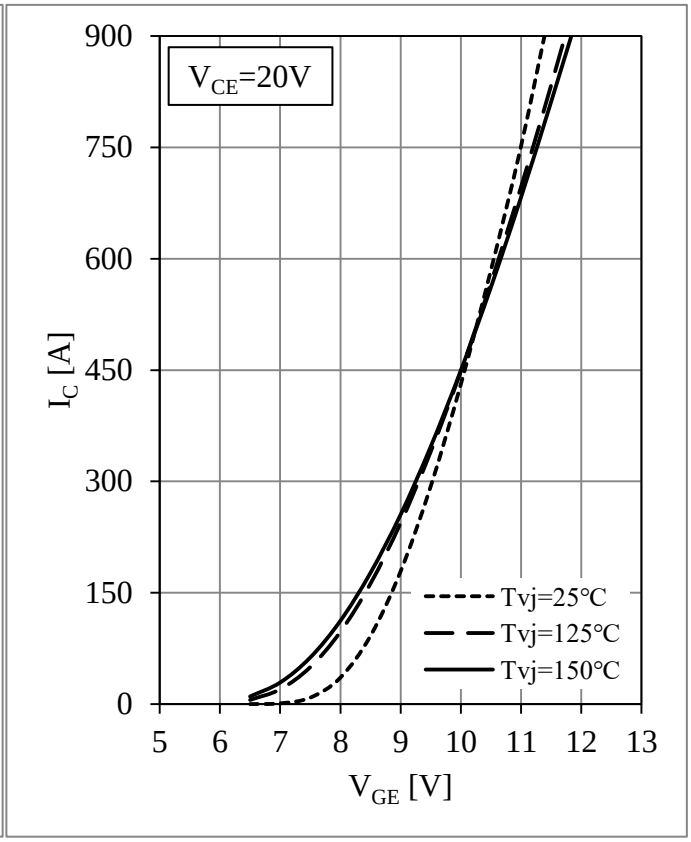


Fig 2. IGBT Transfer Characteristics

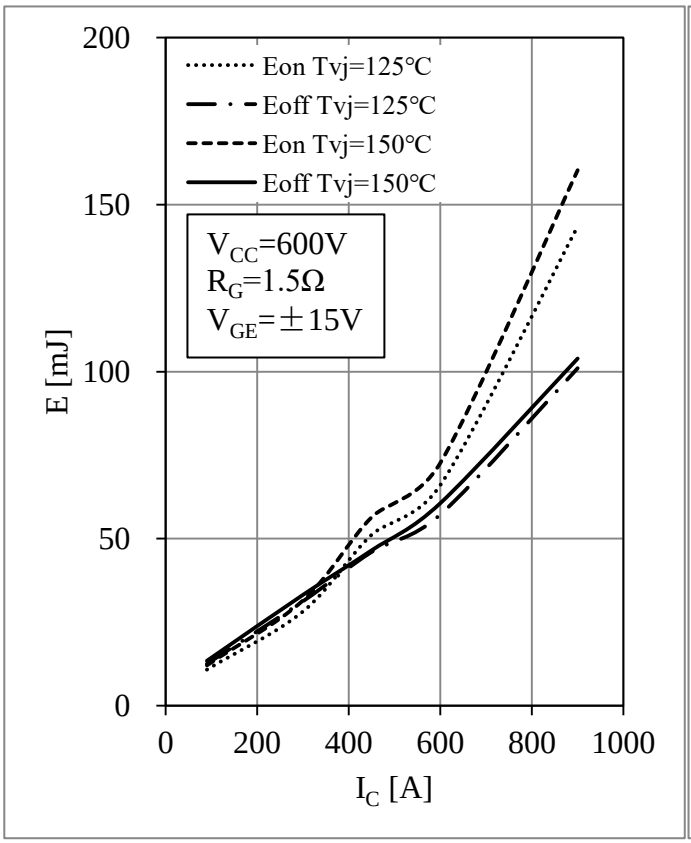


Fig 3. IGBT Switching Loss vs. I_C

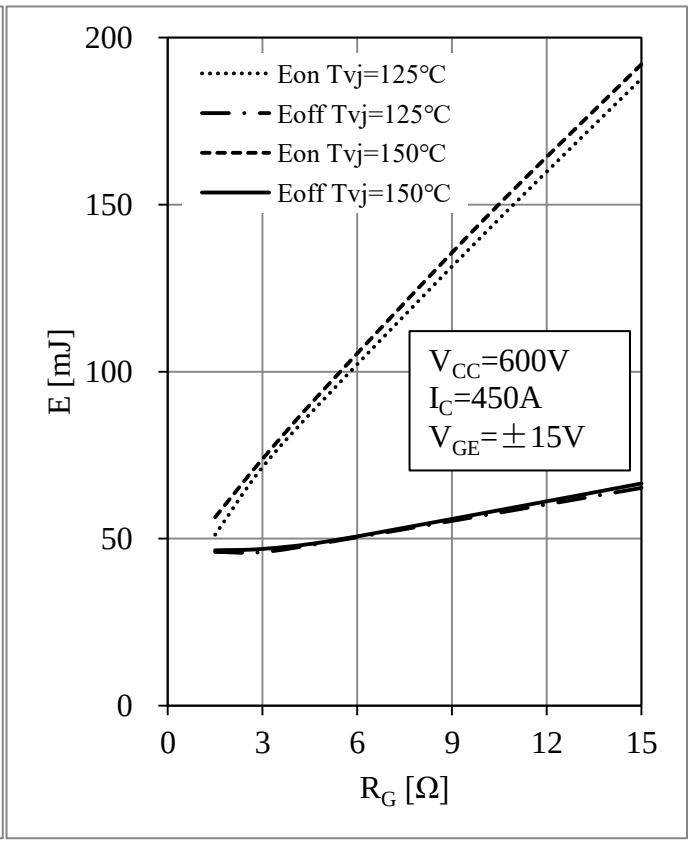


Fig 4. IGBT Switching Loss vs. R_G

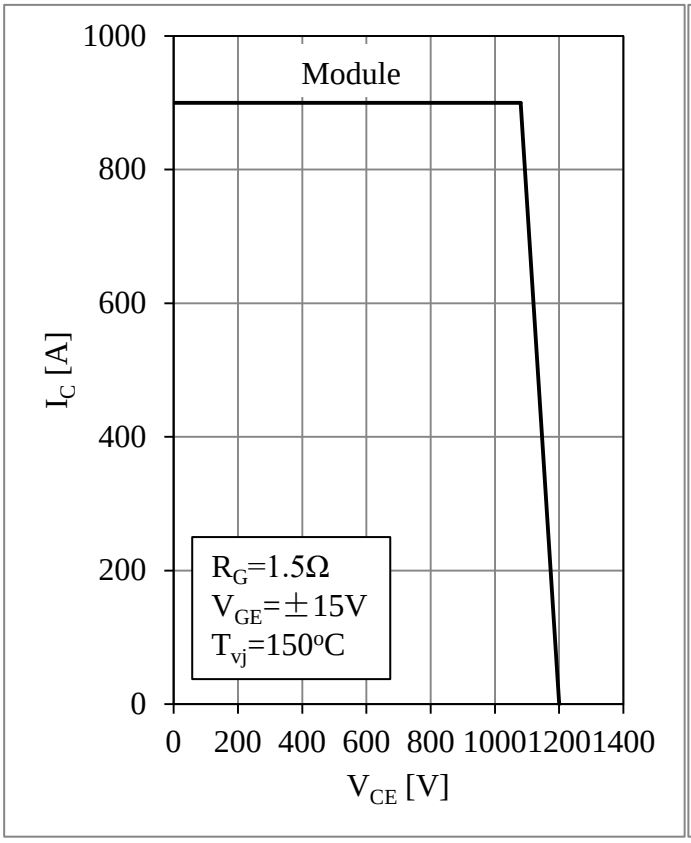


Fig 5. RBSOA

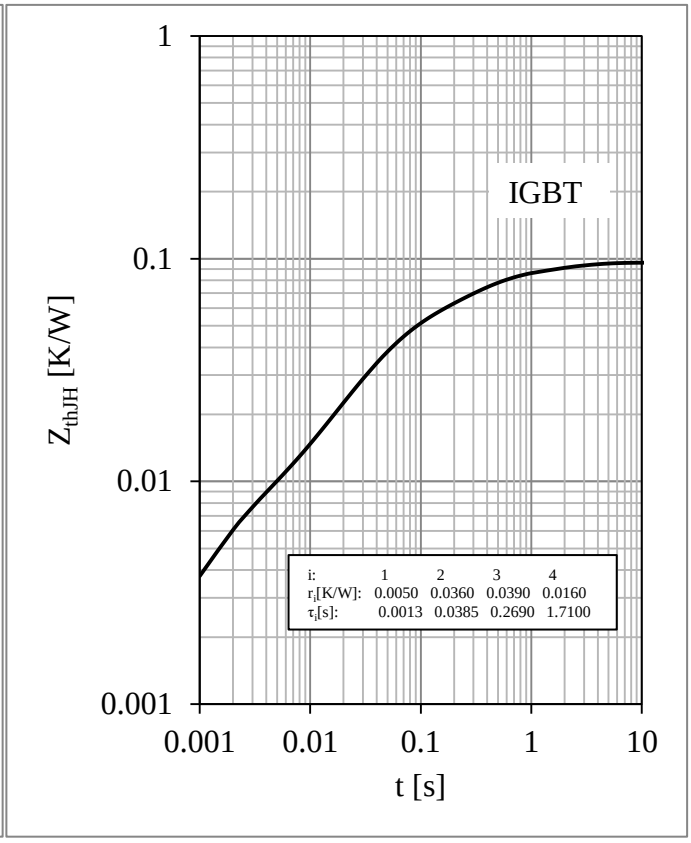


Fig 6. IGBT Transient Thermal Impedance

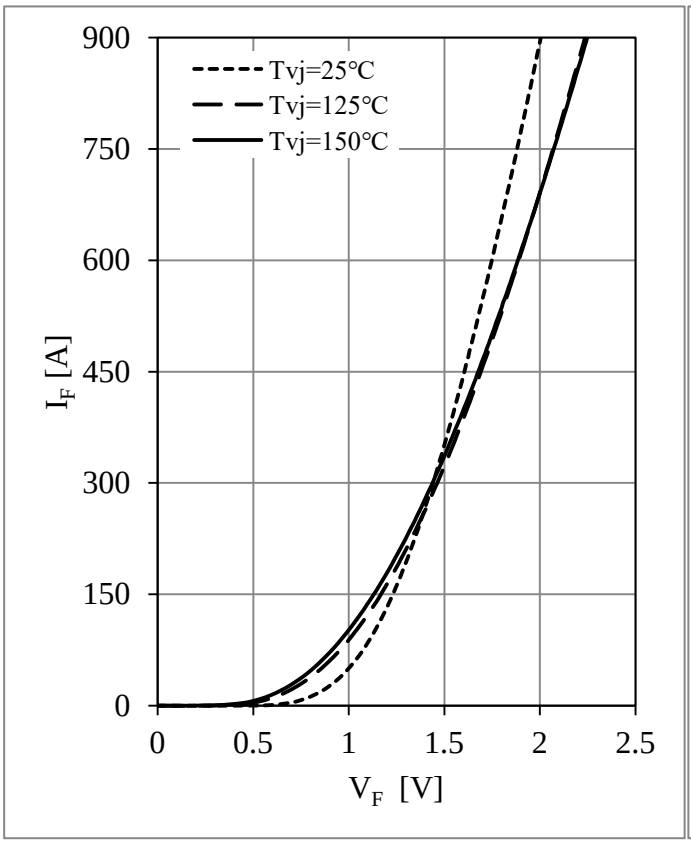


Fig 7. Diode Forward Characteristics

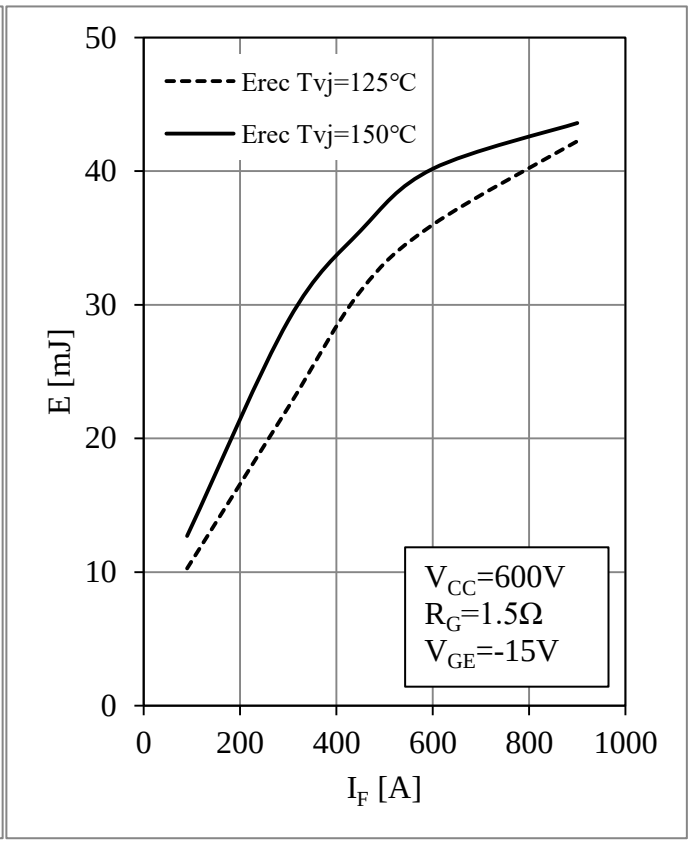


Fig 8. Diode Switching Loss vs. I_F

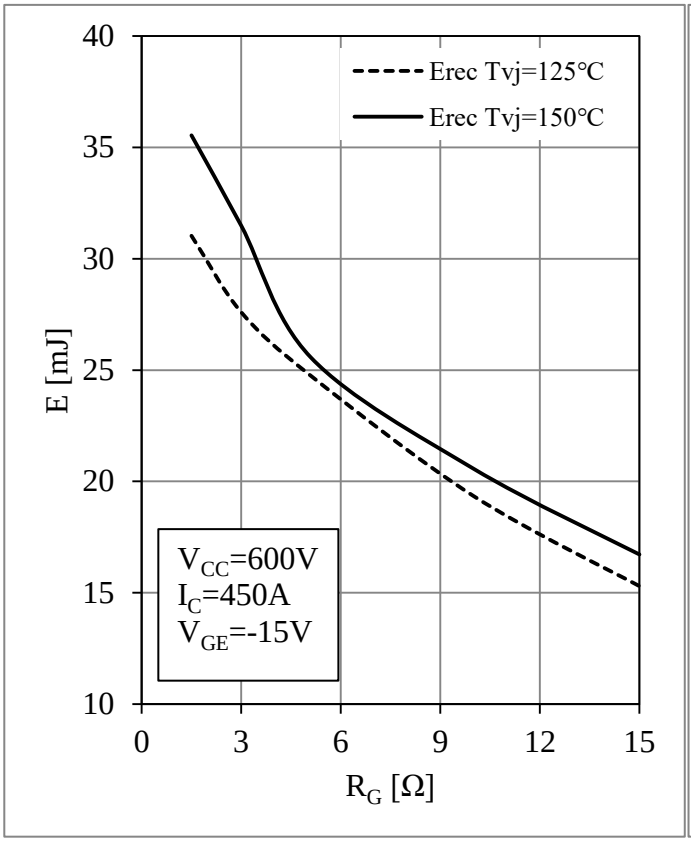


Fig 9. Diode Switching Loss vs. R_G

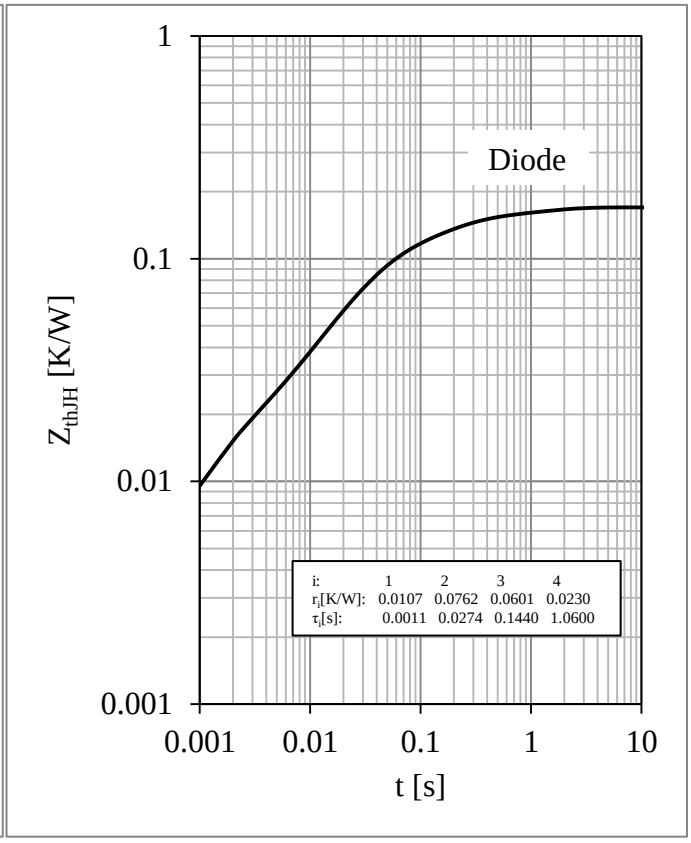


Fig 10. Diode Transient Thermal Impedance

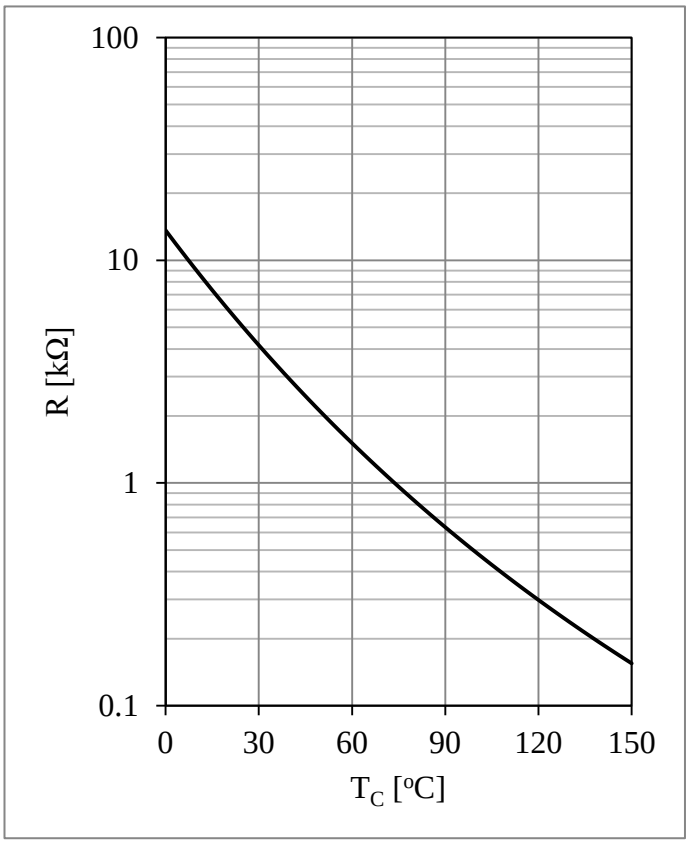
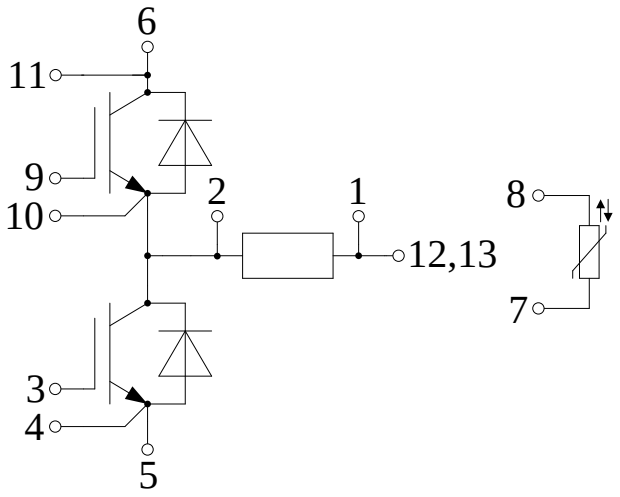


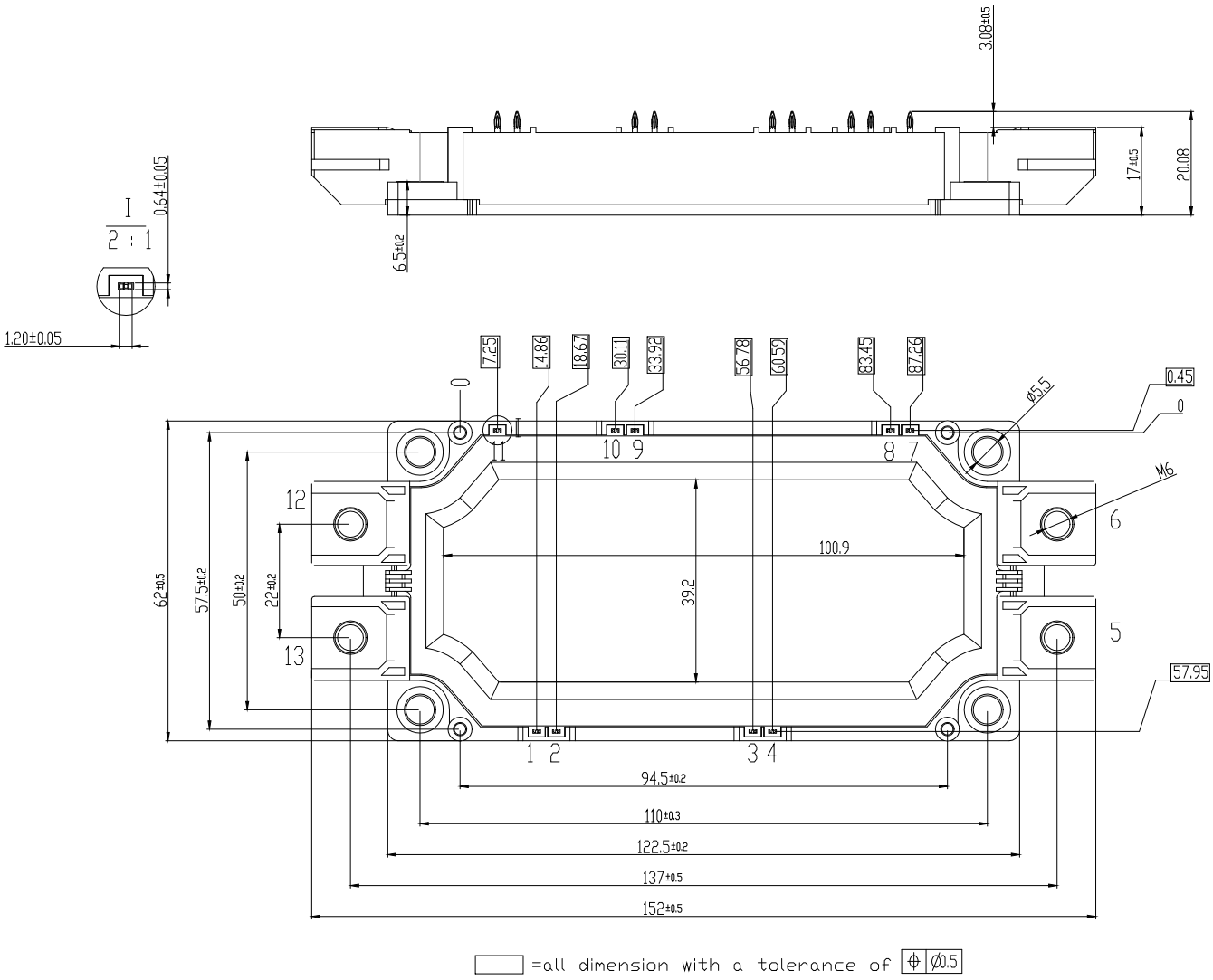
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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