

STARPOWER

SEMICONDUCTOR

IGBT

GD450HFT120P1S

Molding Type Module**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 wind and solar power.



Features

- Low $V_{CE(sat)}$ trench IGBT technology
- 10 μ s 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
- High power and thermal cycling capability

Typical Applications

- Auxiliary Inverters
- High Power Converters
- UPS
- Wind and Solar Power
- Traction Drives

Absolute Maximum Ratings $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Description	GD450HFT120P1S	Units
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	710 450	A
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	900	A
I_F	Diode Continuous Forward Current	450	A
I_{FM}	Diode Maximum Forward Current $t_p=1\text{ms}$	900	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	2.37	kW
T_{jmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	4000	V
Mounting Torque	Power Terminal Screw:M4	1.8 to 2.1	N.m
	Power Terminal Screw:M8	8.0 to 10	N.m
	Mounting Screw:M5	3.0 to 6.0	N.m
Weight	Weight of Module	825	g

Electrical Characteristics of IGBT $T_C=25^{\circ}\text{C}$ unless otherwise noted**Off Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^{\circ}\text{C}$	1200			V
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}$, $V_{GE}=0\text{V}$, $T_j=25^{\circ}\text{C}$			5.0	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}$, $V_{CE}=0\text{V}$, $T_j=25^{\circ}\text{C}$			400	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=18.0\text{mA}$, $V_{CE}=V_{GE}$, $T_j=25^{\circ}\text{C}$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=450\text{A}$, $V_{GE}=15\text{V}$, $T_j=25^{\circ}\text{C}$		1.70	2.15	V
		$I_C=450\text{A}$, $V_{GE}=15\text{V}$, $T_j=125^{\circ}\text{C}$		2.00		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=450A,$ $R_G=1.6\Omega, V_{GE}=\pm 15V,$ $T_j=25^\circ C$		251		ns
t_r	Rise Time			89		ns
$t_{d(off)}$	Turn-Off Delay Time			545		ns
t_f	Fall Time			135		ns
E_{on}	Turn-On Switching Loss			21.9		mJ
E_{off}	Turn-Off Switching Loss			43.2		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=450A,$ $R_G=1.6\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$		299		ns
t_r	Rise Time			101		ns
$t_{d(off)}$	Turn-Off Delay Time			655		ns
t_f	Fall Time			158		ns
E_{on}	Turn-On Switching Loss			33.1		mJ
E_{off}	Turn-Off Switching Loss			64.9		mJ
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1MHz,$ $V_{GE}=0V$		32.3		nF
C_{oes}	Output Capacitance			1.69		nF
C_{res}	Reverse Transfer Capacitance			1.46		nF
I_{SC}	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		1800		A
R_{Gint}	Internal Gate Resistance			2.5		Ω
Q_G	Gate Charge	$V_{CC}=600V, I_C=450A,$ $V_{GE}=-15 \sim +15V$		4.3		μC
L_{CE}	Stray Inductance			18		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal To Chip			0.30		m Ω

Electrical Characteristics of Diode $T_C=25^\circ C$ unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _F	Diode Forward Voltage	I _F =450A	T _j =25℃		1.65	2.15	V
			T _j =125℃		1.65		
Q _r	Recovered Charge	I _F =450A, V _R =600V, R _G =1.6Ω, V _{GE} =-15V	T _j =25℃		46		μC
			T _j =125℃		86		
I _{RM}	Peak Reverse Recovery Current		T _j =25℃		313		A
			T _j =125℃		406		
E _{rec}	Reverse Recovery Energy		T _j =25℃		21.2		mJ
			T _j =125℃		38.9		

Electrical Characteristics of NTC $T_C=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			5.0		k Ω
$\Delta R/R$	Deviation of R_{100}	$T_C=100^{\circ}\text{C}, R_{100}=493\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case (per IGBT)		63.2	K/kW
$R_{\theta JC}$	Junction-to-Case (per Diode)		109.6	K/kW
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)	4.5		K/kW
Weight	Weight of Module	825		g

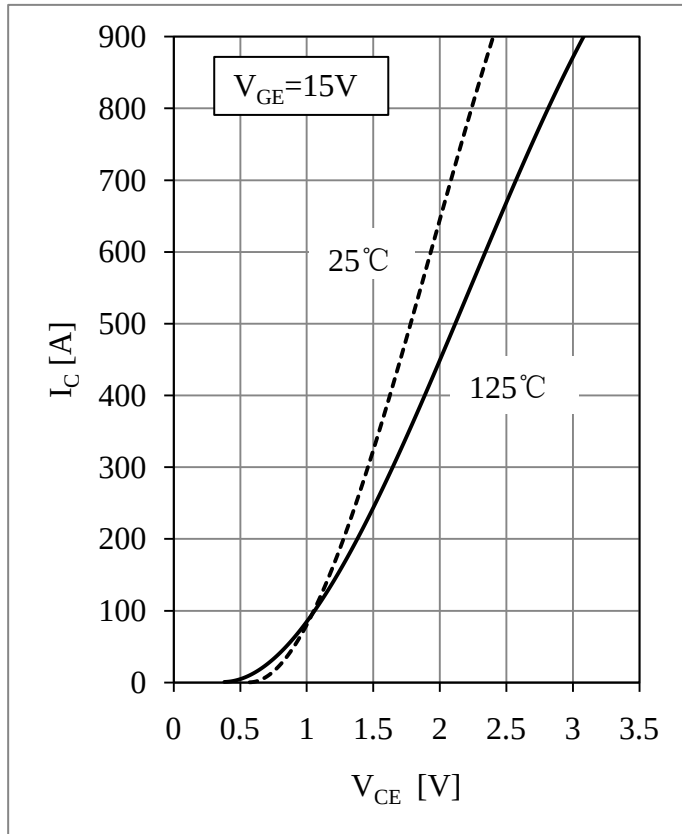


Fig 1. IGBT Output Characteristic

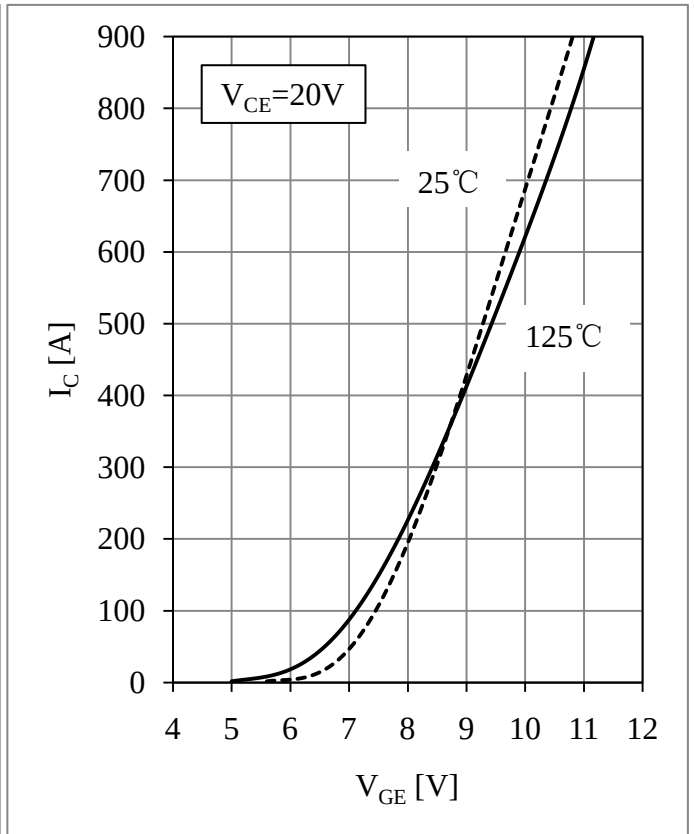
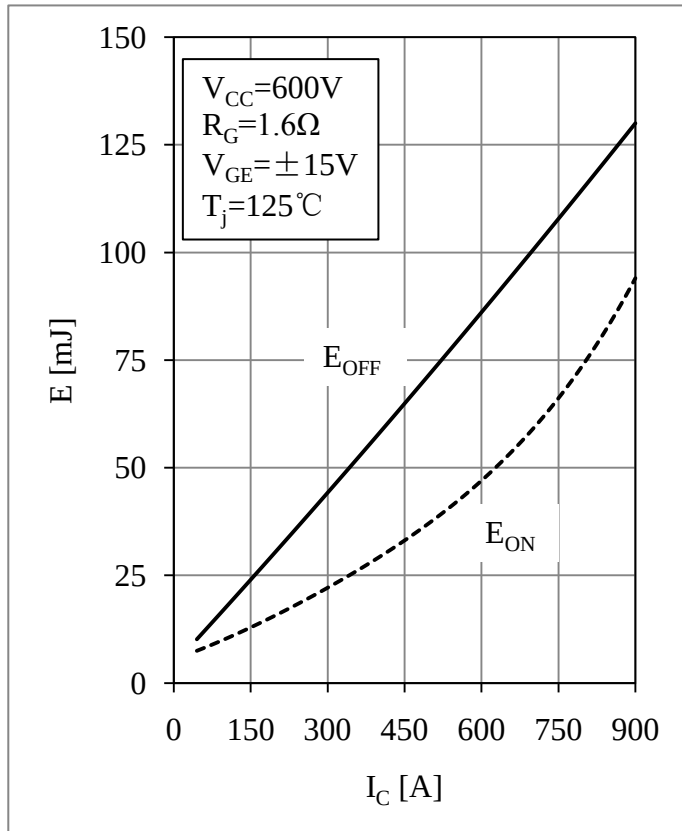
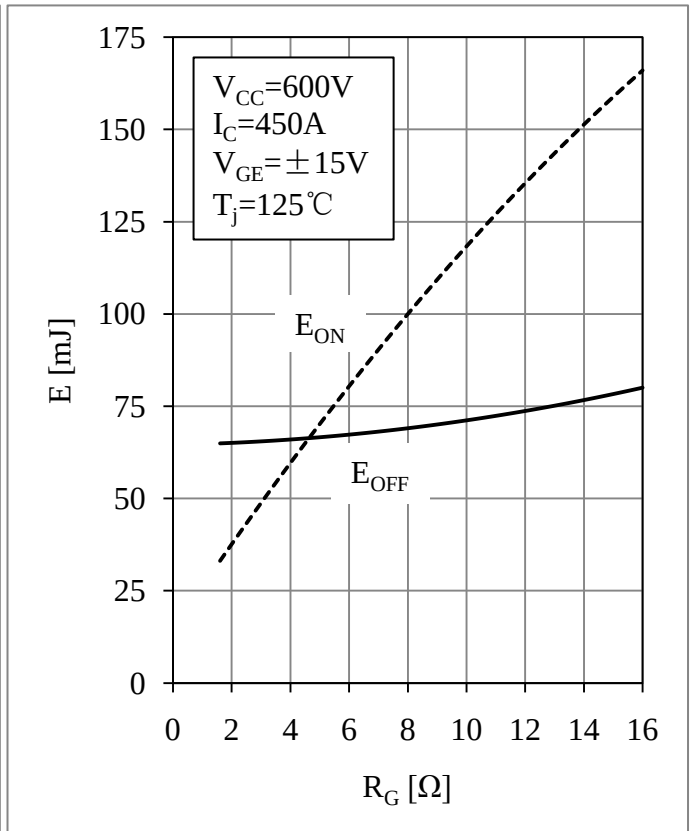


Fig 2. IGBT Transfer Characteristic

Fig 3. IGBT Switching Loss vs. I_C Fig 4. IGBT Switching Loss vs. R_G

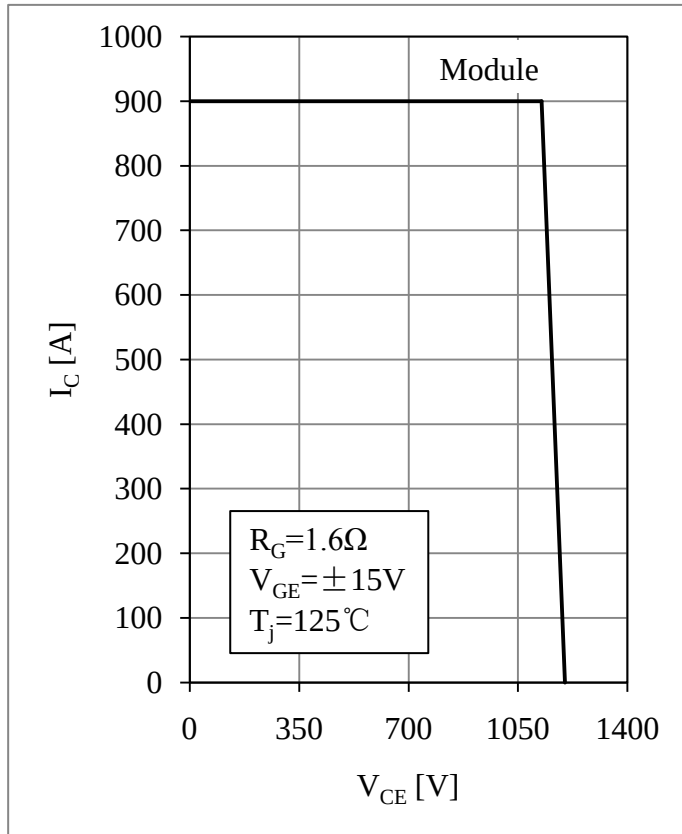


Fig 5. RBSOA

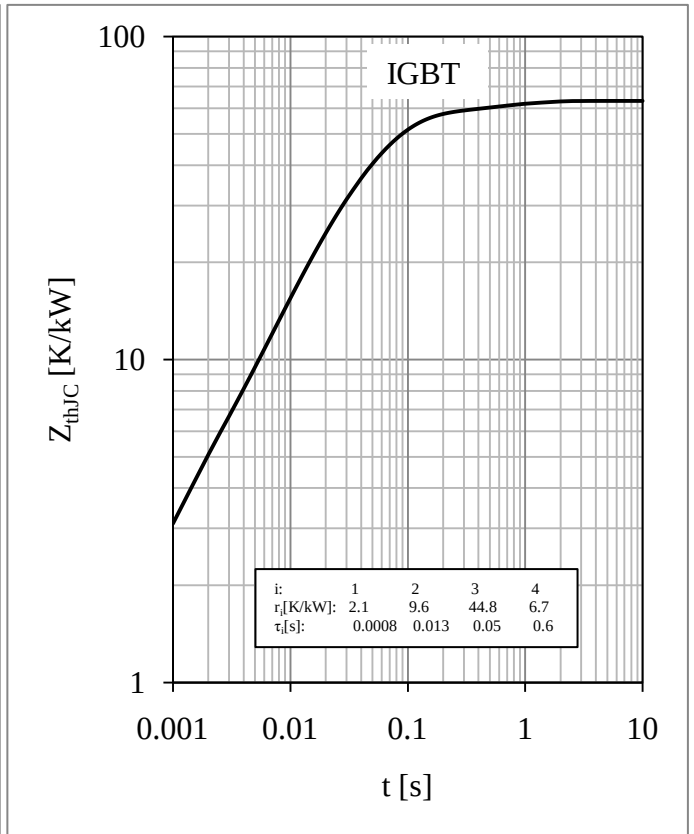


Fig 6. IGBT Transient Thermal Impedance

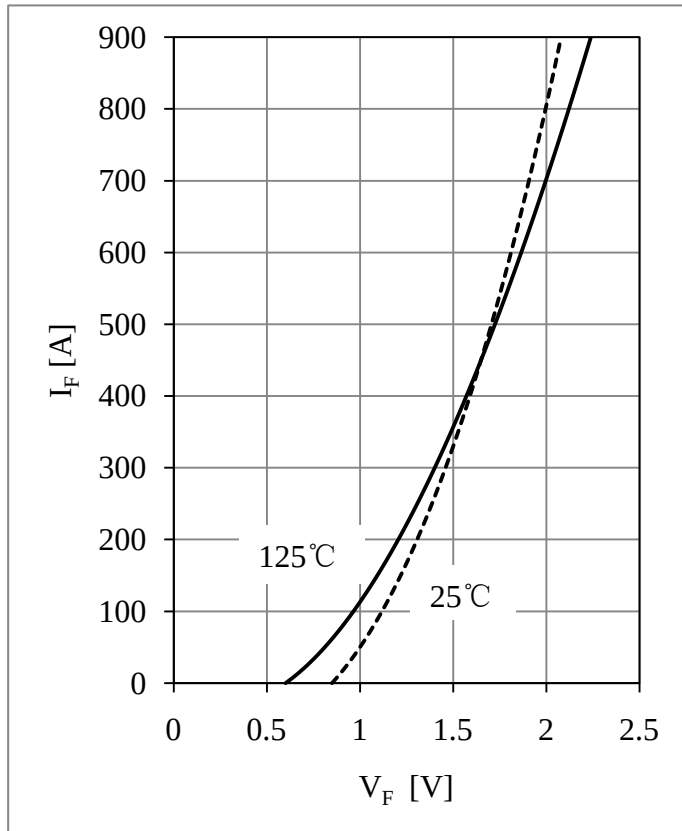
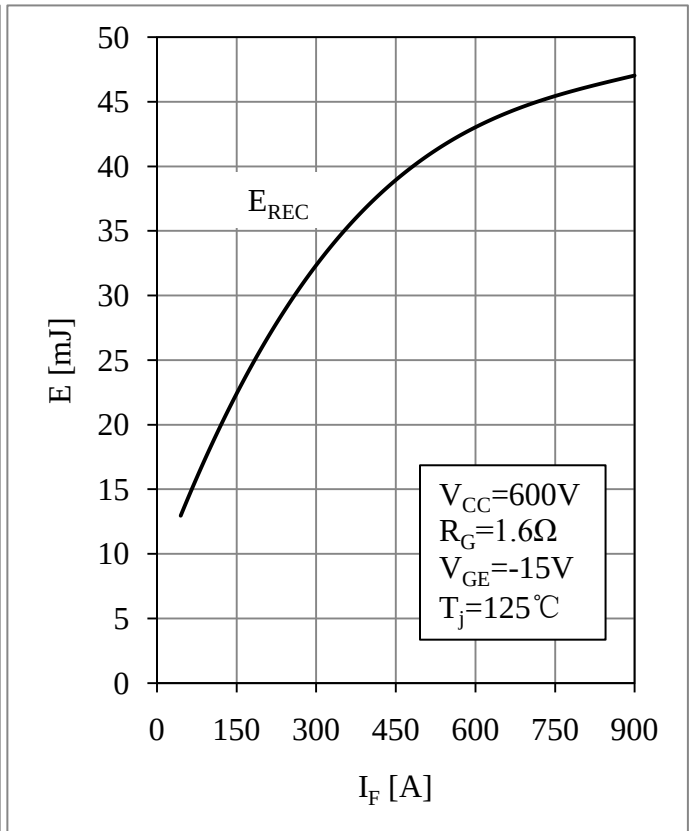


Fig 7. Diode Forward Characteristic

Fig 8. Diode Switching Loss vs. I_F

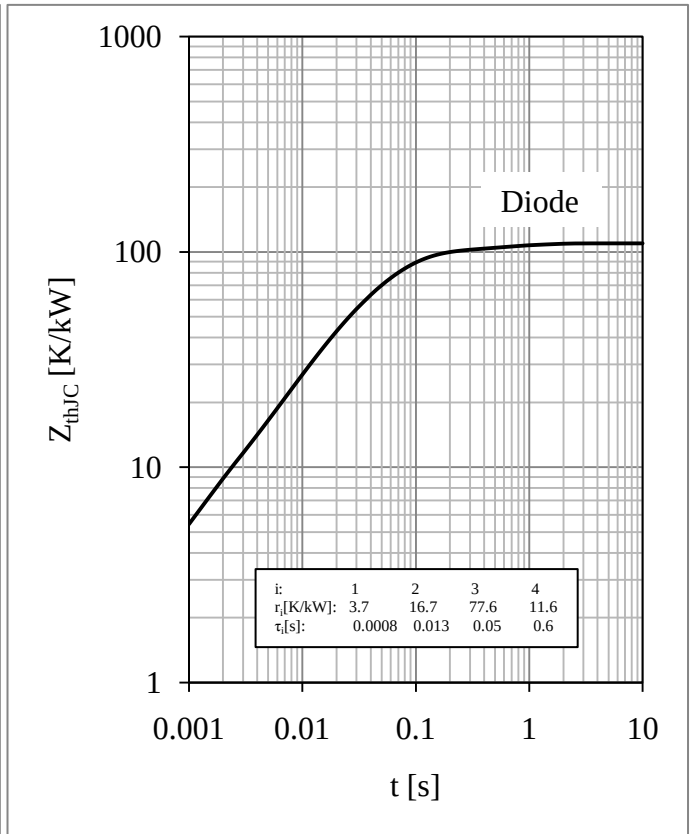
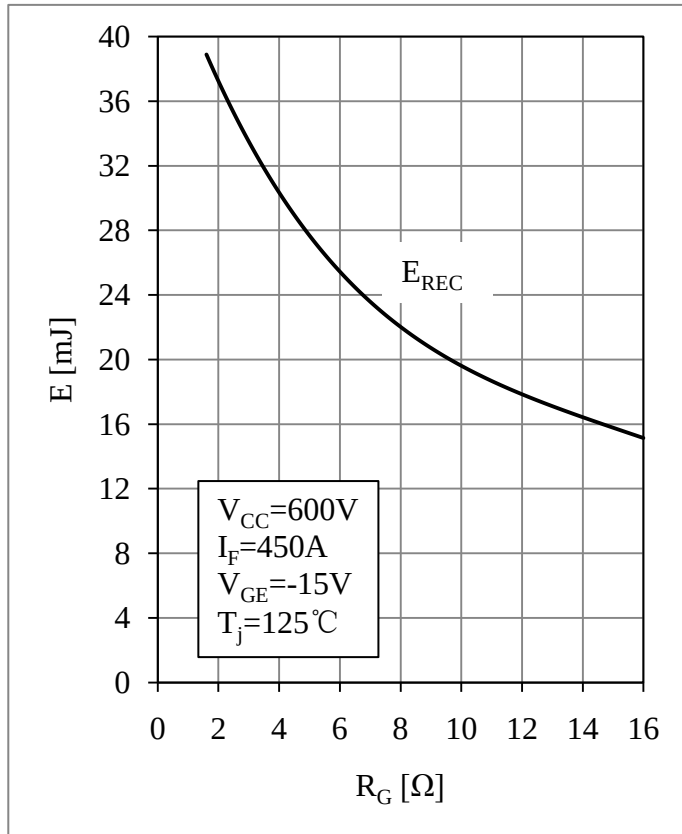
Fig 9. Diode Switching Loss vs. R_G

Fig 10. Diode Transient Thermal Impedance

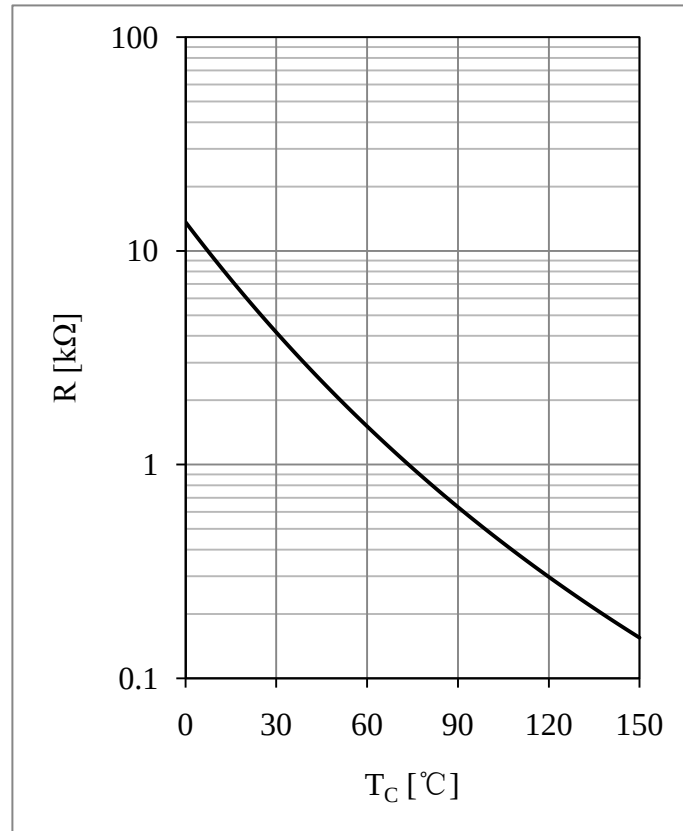
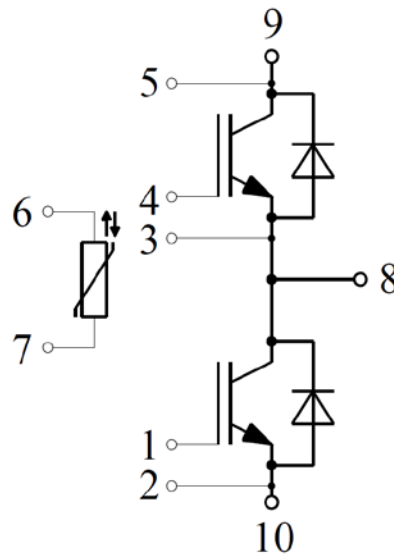


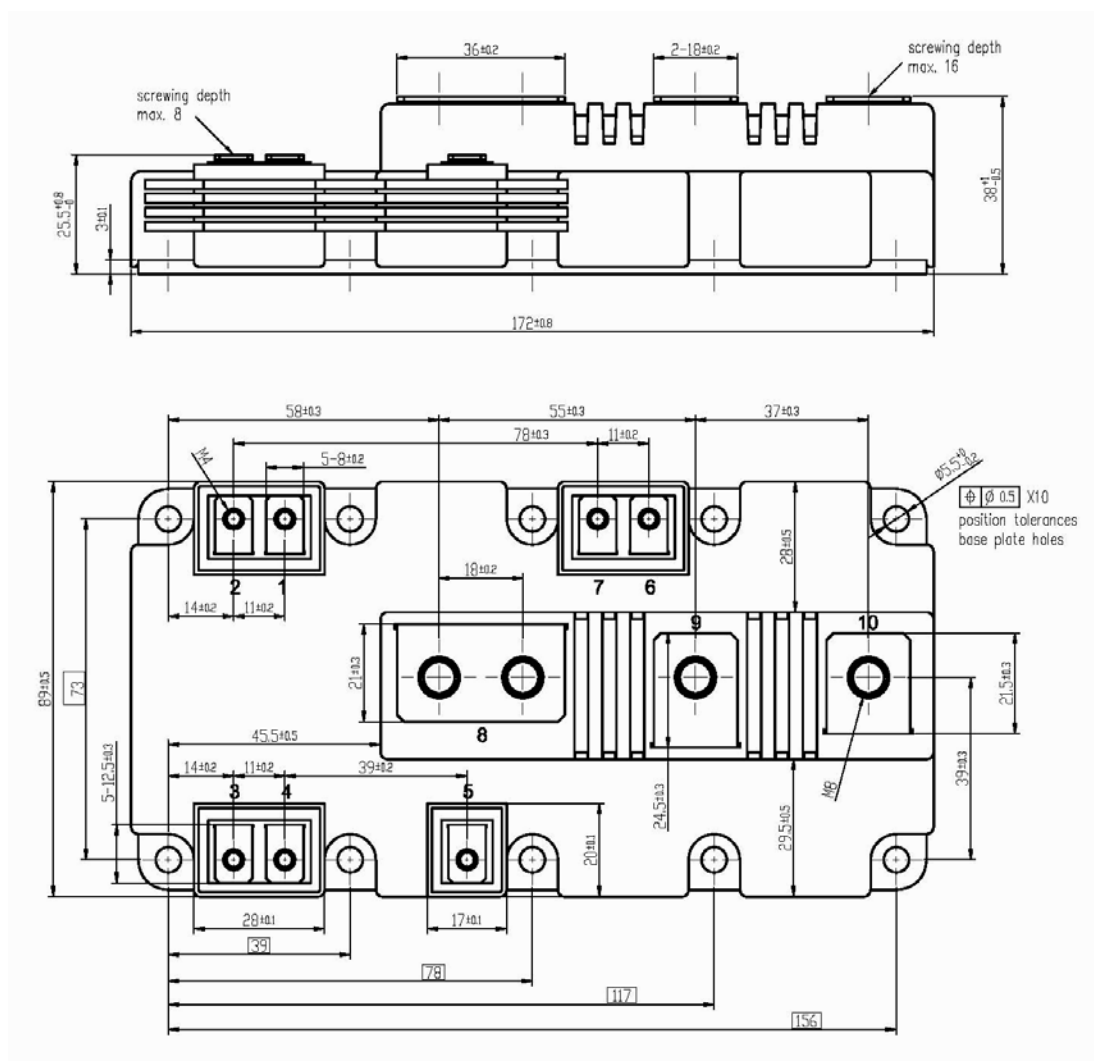
Fig 14. NTC Temperature Characteristic

Equivalent Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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