

STARPOWER

SEMICONDUCTOR™

IGBT

GD450HTT170C7S

Molding Type Module

1700V/450A 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 general inverters and UPS.



Features

- Low $V_{CE(sat)}$ trench IGBT technology
- Low switching losses
- 10 μ s short circuit capability
- Square RBSOA
- $V_{CE(sat)}$ with positive temperature coefficient
- 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

IGBT-inverter $T_C=25^{\circ}\text{C}$ unless otherwise noted**Maximum Rated Values**

Symbol	Description	GD450HTT170C7S	Units
V_{CES}	Collector-Emitter Voltage @ $T_j=25^{\circ}\text{C}$	1700	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	650	A
	@ $T_C=80^{\circ}\text{C}$	450	
I_{CM}	Pulsed Collector Current $t_p=1\text{ms}$	900	A
P_{tot}	Total Power Dissipation @ $T_j=175^{\circ}\text{C}$	2604	W

Off Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^{\circ}\text{C}$	1700			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	$I_C=18.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		2.00	2.45	V
		$I_C=450\text{A}, V_{GE}=15\text{V}, T_j=125^{\circ}\text{C}$		2.40		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900\text{V}, I_C=450\text{A}, R_G=3.3\Omega, V_{GE}=\pm 15\text{V}, T_j=25^{\circ}\text{C}$		282		ns	
t_r	Rise Time			80		ns	
$t_{d(off)}$	Turn-Off Delay Time				805		ns
t_f	Fall Time				178		ns
E_{on}	Turn-On Switching Loss				96		mJ
E_{off}	Turn-Off Switching Loss				96		mJ

$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=450A,$ $R_G=3.3\Omega, V_{GE}=\pm 15V,$ $T_j=125^\circ C$	298		ns
t_r	Rise Time		102		ns
$t_{d(off)}$	Turn-Off Delay Time		990		ns
t_f	Fall Time		303		ns
E_{on}	Turn-On Switching Loss		140		mJ
E_{off}	Turn-Off Switching Loss		140		mJ
C_{ies}	Input Capacitance	$V_{CE}=25V, f=1Mhz,$ $V_{GE}=0V$	39.6		nF
C_{oes}	Output Capacitance		1.65		nF
C_{res}	Reverse Transfer Capacitance		1.31		nF
I_{SC}	SC Data	$t_{sc} \leq 10\mu s, V_{GE} \leq 15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1700V$	1800		A
R_{Gint}	Internal Gate Resistance		1.7		Ω
Q_G	Gate charge	$V_{GE}=-15\dots+15V$	5.1		μC

DIODE-inverter $T_C=25^\circ C$ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD450HTT170C7S	Units
V_{RRM}	Collector-Emitter Voltage @ $T_j=25^\circ C$	1700	V
I_F	DC Forward Current @ $T_C=80^\circ C$	450	A
I_{FRM}	Repetitive Peak Forward Current $t_p=1ms$	900	A

Characteristics Values

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	$I_F=450A, V_{GE}=0V$	$T_j=25^\circ C$	1.80	2.20	V
			$T_j=125^\circ C$		1.90	
Q_r	Recovered Charge	$I_F=450A,$	$T_j=25^\circ C$	116		μC
			$T_j=125^\circ C$	190		
I_{RM}	Peak Reverse Recovery Current	$V_R=900V,$ $di/dt=-4450A/\mu s,$	$T_j=25^\circ C$	520		A
			$T_j=125^\circ C$	568		
E_{rec}	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$	60		mJ
			$T_j=125^\circ C$	110		

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}	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-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

IGBT Module

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$		3400		V
L_{CE}	Stray Inductance		20		nH
$R_{\text{CC}'+\text{EE}'}$	Module Lead Resistance, Terminal to Chip @ $T_C=25^{\circ}\text{C}$		1.1		m Ω
$R_{\theta\text{JC}}$	Junction-to-Case (per IGBT)			0.048	K/W
	Junction-to-Case (per DIODE)			0.104	
$R_{\theta\text{CS}}$	Case-to-Sink (Conductive grease applied)		0.005		K/W
T_j	Maximum Junction Temperature			175	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40		125	$^{\circ}\text{C}$
Mounting	Power Terminal Screw:M5	3.0		6.0	N.m
Torque	Mounting Screw:M6	3.0		6.0	N.m
Weight	Weight of Module		910		g

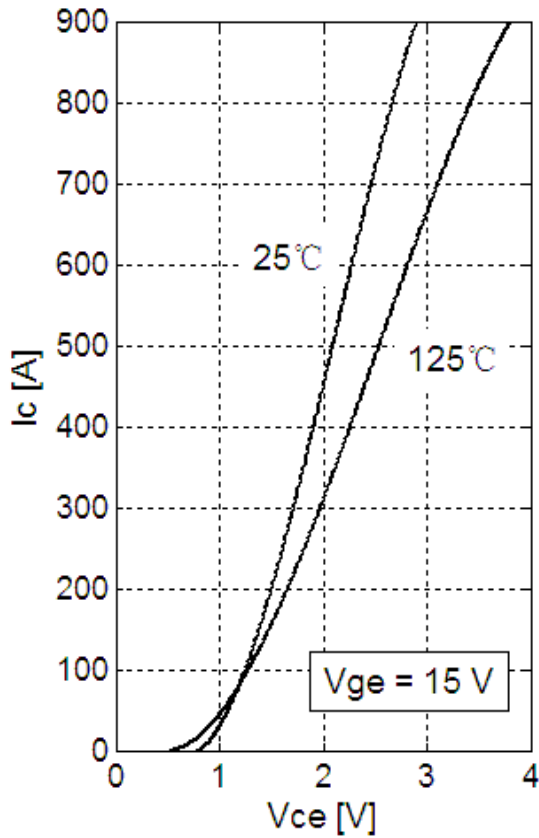


Fig 1. IGBT Output Characteristics

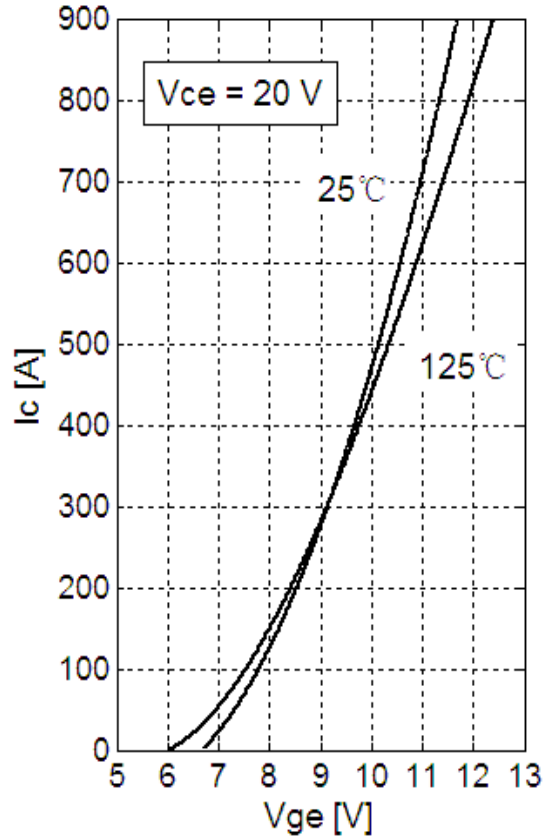


Fig 2. IGBT Transfer Characteristics

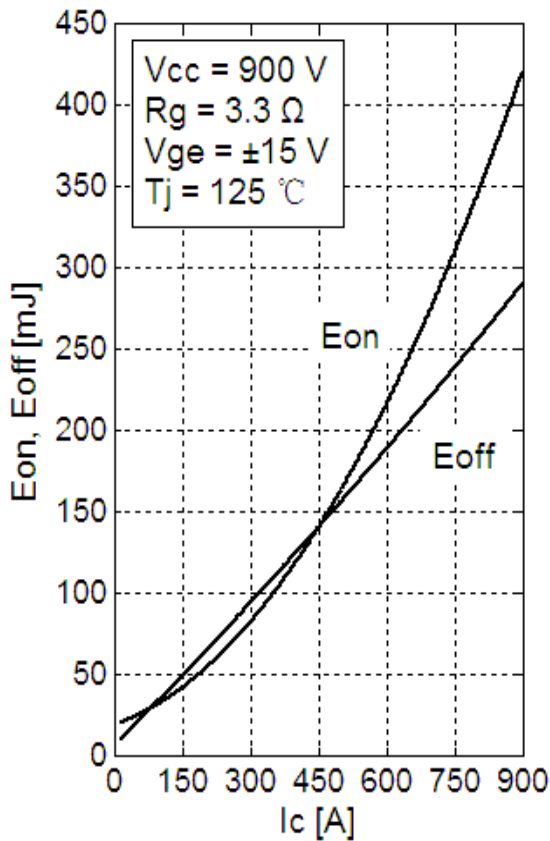


Fig 3. IGBT Switching Loss vs. I_c

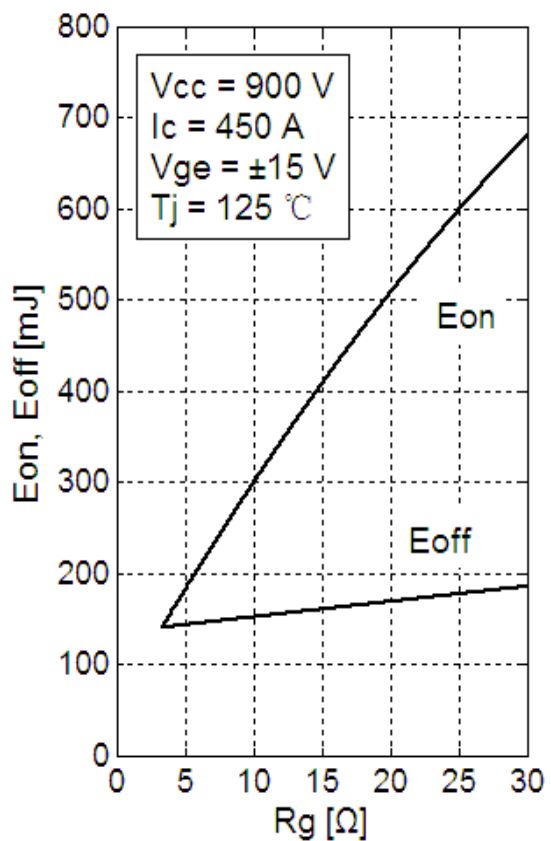


Fig 4. IGBT Switching Loss vs. R_g

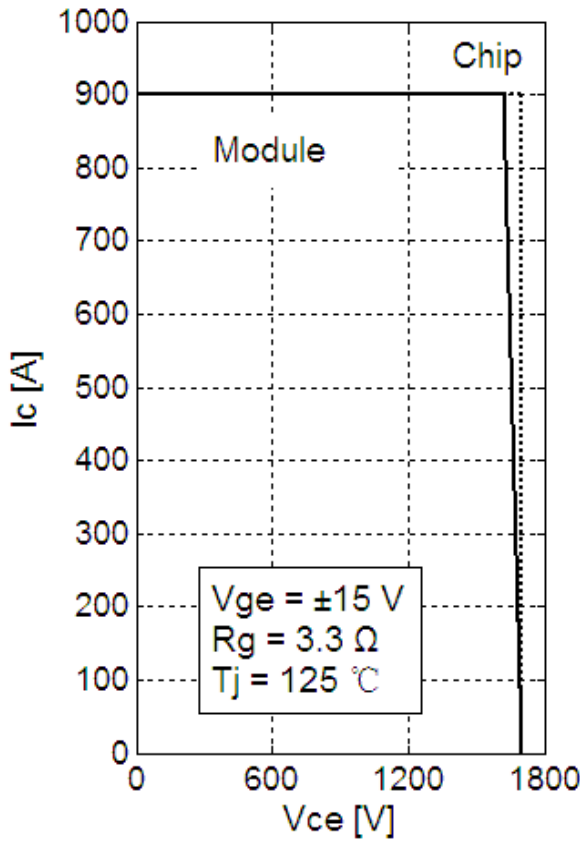


Fig 5. RBSOA

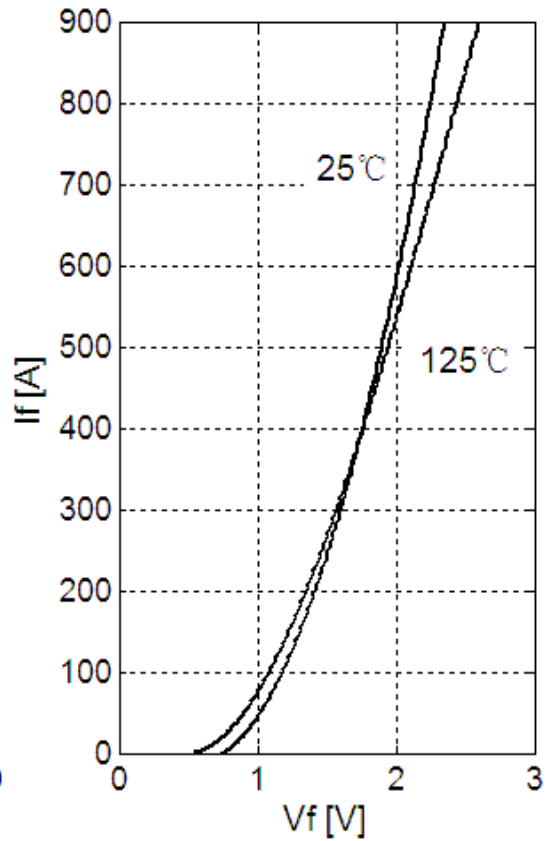


Fig 6. Diode Forward Characteristics

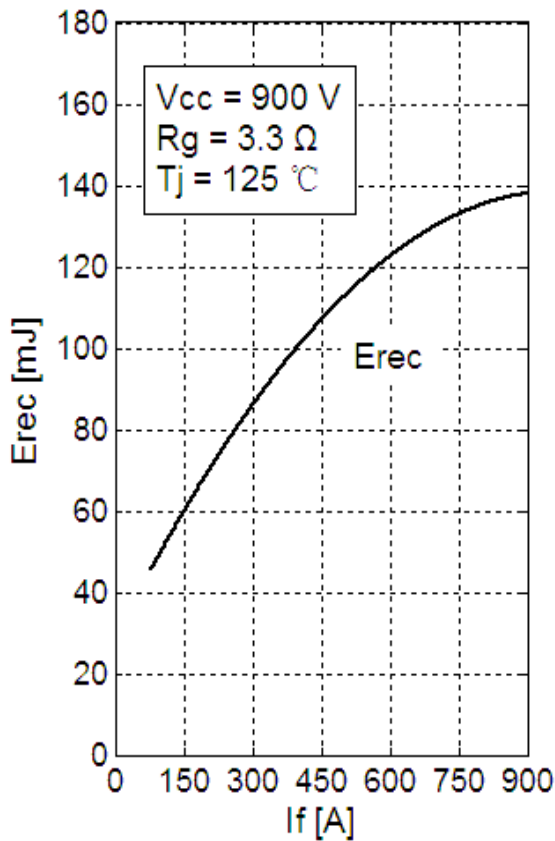


Fig 7. Diode Switching Loss vs. I_f

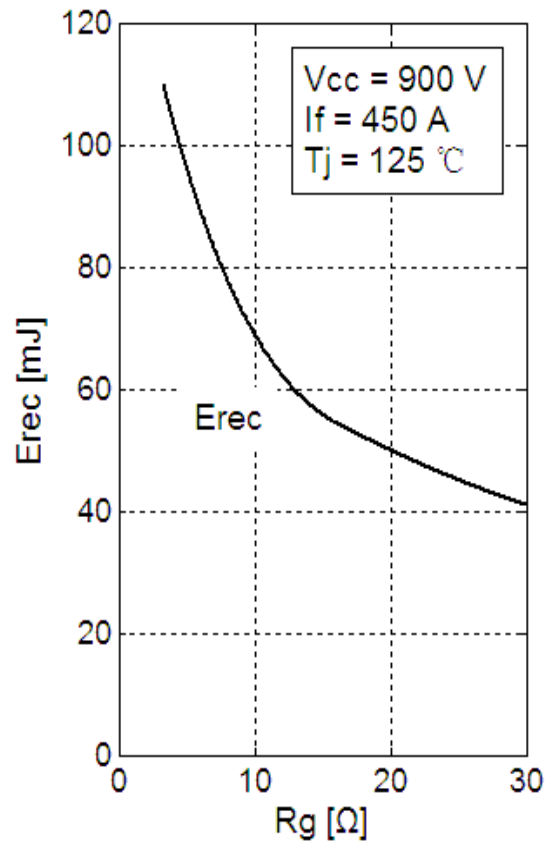


Fig 8. Diode Switching Loss vs. R_g

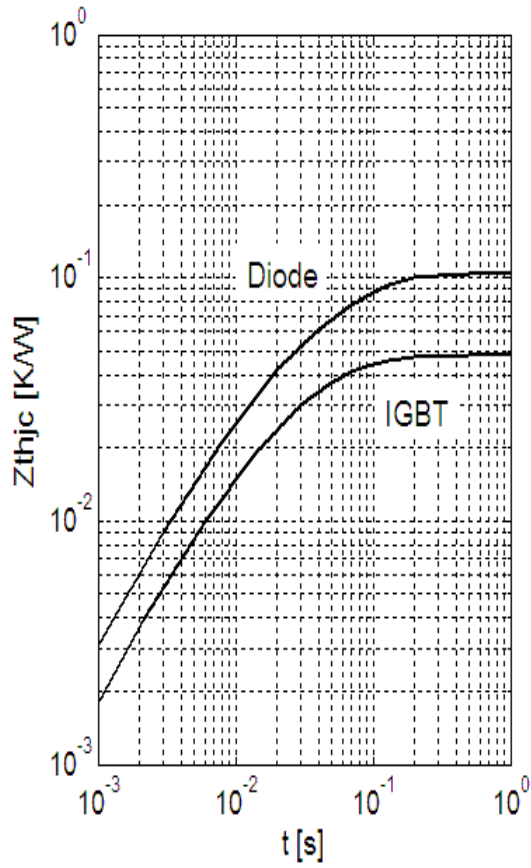


Fig 9. Transient Thermal Impedance

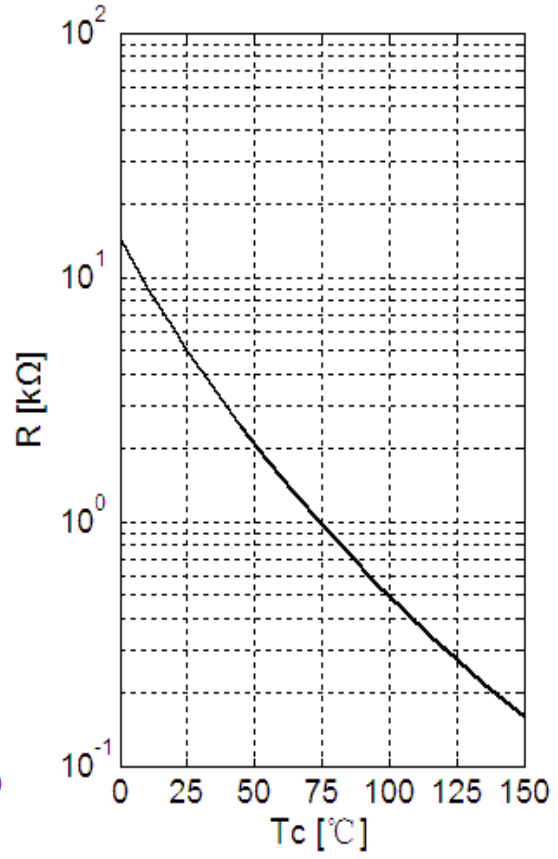
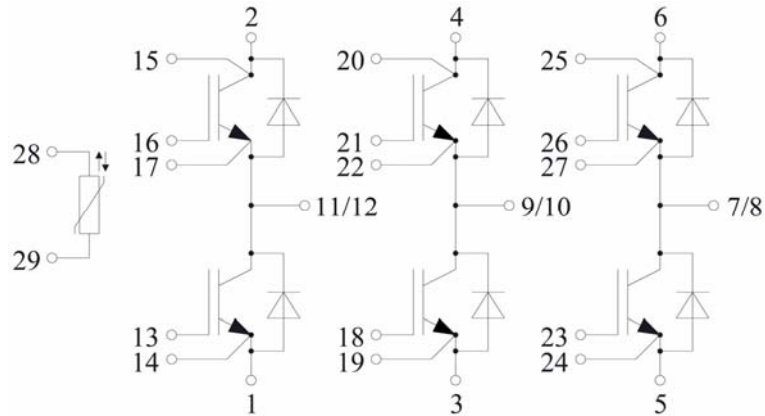


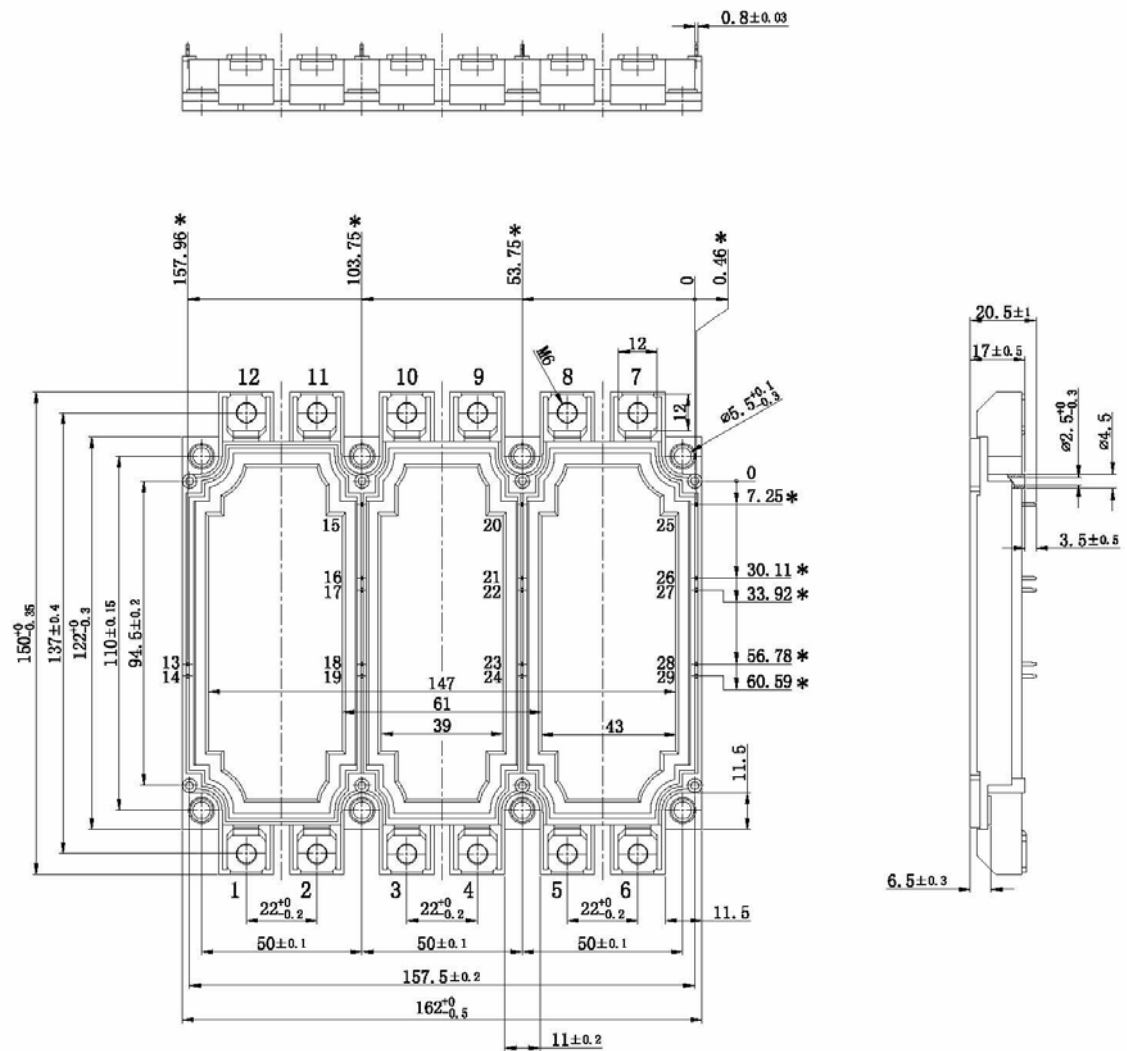
Fig 10. NTC-Temperature Characteristic

Equivalent Circuit Schematic



Package Dimension

Dimensions in Millimeters



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