STARPOWER

SEMICONDUCTOR™

IGBT

GD450HTT120C7S Preliminary

Molding Type Module

1200V/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
- 10μs 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℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD450HTT120C7S	Units
V_{CES}	Collector-Emitter Voltage @ T_j=25℃	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25℃ @ T_C=80℃	650 450	A
I_{CM}	Pulsed Collector Current t_p=1ms	900	A
P_{tot}	Total Power Dissipation @ T_j=175℃	2155	W
T_{SC}	Short Circuit Withstand Time @ T_j=150℃	10	μs

Off Characteristics

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

On Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=18.0mA,V_{CE}=V_{GE}, T_j=25℃	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=450A,V_{GE}=15V, T_j=25℃		1.70	2.15	V
		I_C=450A,V_{GE}=15V, T_j=125℃		1.90		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
E_{on}	Turn-On Switching Loss	V_{CC}=600V,I_C=450A, R_G=1.6Ω,V_{GE}=±15V, T_j=25℃		23.0		mJ
E_{off}	Turn-Off Switching Loss			31.0		mJ
E_{tot}	Total Switching Loss			54.0		mJ
E_{on}	Turn-On Switching Loss	V_{CC}=600V,I_C=450A, R_G=1.6Ω,V_{GE}=±15V, T_j=125℃		36.0		mJ
E_{off}	Turn-Off Switching Loss			48.0		mJ
E_{tot}	Total Switching Loss			84.0		mJ

$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=450A, R_G=1.6Ω,V_{GE}=±15V, T_j=25℃		160		ns
t_r	Rise Time			90		ns
$t_{d(off)}$	Turn-Off Delay Time			500		ns
t_f	Fall Time			130		ns
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=450A, R_G=1.6Ω,V_{GE}=±15V, T_j=125℃		170		ns
t_r	Rise Time			100		ns
$t_{d(off)}$	Turn-Off Delay Time			570		ns
t_f	Fall Time			160		ns
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_{SC}≤10μs,V_{GE}≤15V, T_j=125℃,V_{CC}=900V, V_{CEM}≤1200V		1800		A
R_{Gint}	Internal Gate Resistance			1.7		Ω
Q_G	Gate charge	V_{GE}=-15…+15V		4.3		μC

DIODE-inverter T_C=25℃ unless otherwise noted

Maximum Rated Values

Symbol	Description	GD450HTT120C7S	Units
V_{RRM}	Collector-Emitter Voltage @ T_j=25℃	1200	V
I_F	DC Forward Current @ T_C=80℃	450	A
I_{FRM}	Repetitive Peak Forward Current t_p=1ms	900	A
I^2t	I^2t-value,V_R=0V, t_p=10ms, T_j=125℃	35000	A^2s

Characteristics Values

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=450A,V_{GE}=0V	T_j=25℃		1.65	2.15	V
			T_j=125℃		1.65		
Q_r	Recovered Charge	I_F=450A, V_R=600V, di/dt=-5200A/μs, V_{GE}=-15V	T_j=25℃		45.1		ns
			T_j=125℃		84.6		
I_{RM}	Peak Reverse Recovery Current		T_j=25℃		316		A
			T_j=125℃		404		
E_{rec}	Reverse Recovery Energy		T_j=25℃		21.1		mJ
			T_j=125℃		38.9		

Electrical Characteristics of NTC T_C=25℃ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
R_{25}	Rated Resistance			5.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100℃,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

IGBT Module

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min		2500		V
L_{CE}	Stray Inductance		20		nH
$R_{CC'+EE'}$	Module Lead Resistance,Terminal to Chip @ T_C=25℃		1.1		mΩ
$R_{\theta JC}$	Junction-to-Case (per IGBT) Junction-to-Case (per DIODE)			0.058 0.102	K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)		0.005		K/W
T_j	Maximum Junction Temperature			150	℃
T_{STG}	Storage Temperature Range	-40		125	℃
Mounting Torque	Power Terminal Screw:M5	3.0		6.0	N.m
	Mounting Screw:M6	3.0		6.0	N.m
Weight	Weight of Module		910		g

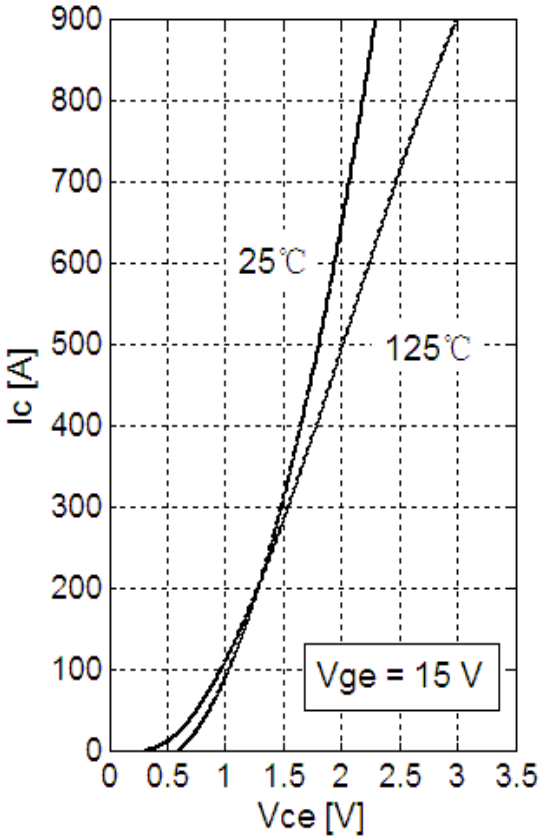


Fig 1. IGBT Output Characteristics

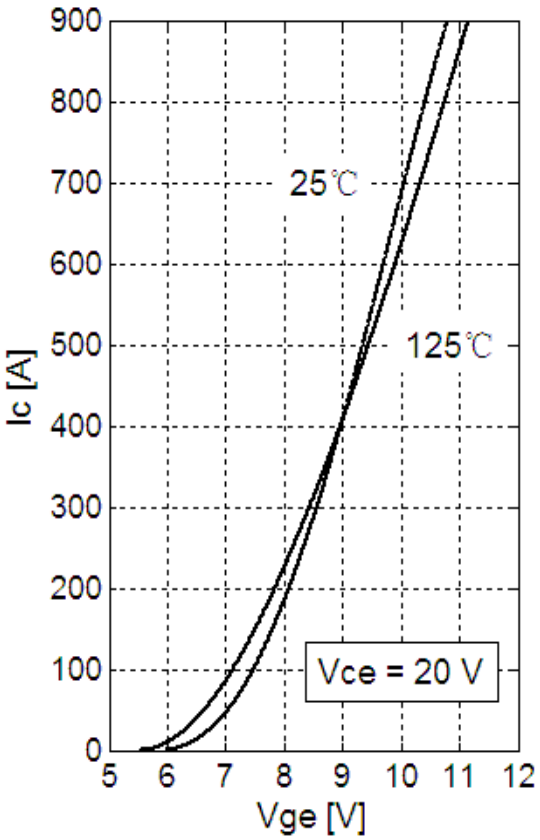


Fig 2. IGBT Transfer Characteristics

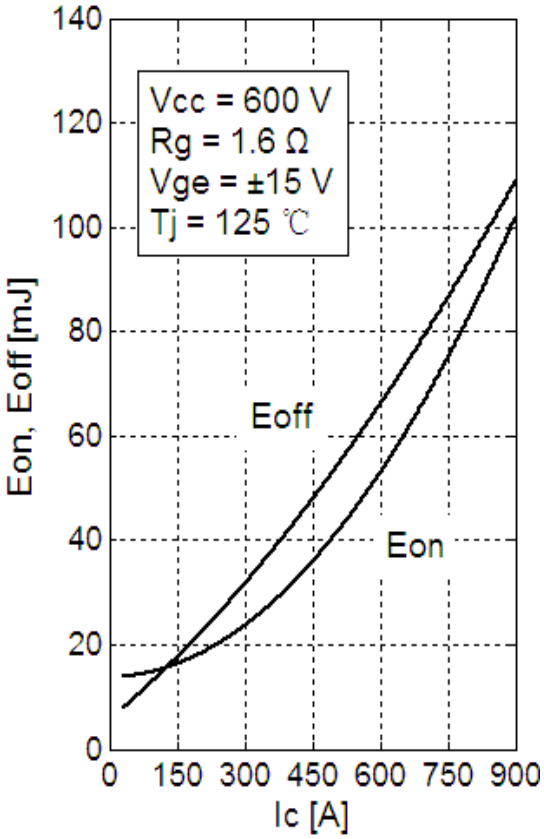


Fig 3. IGBT Switching Loss vs. I_C

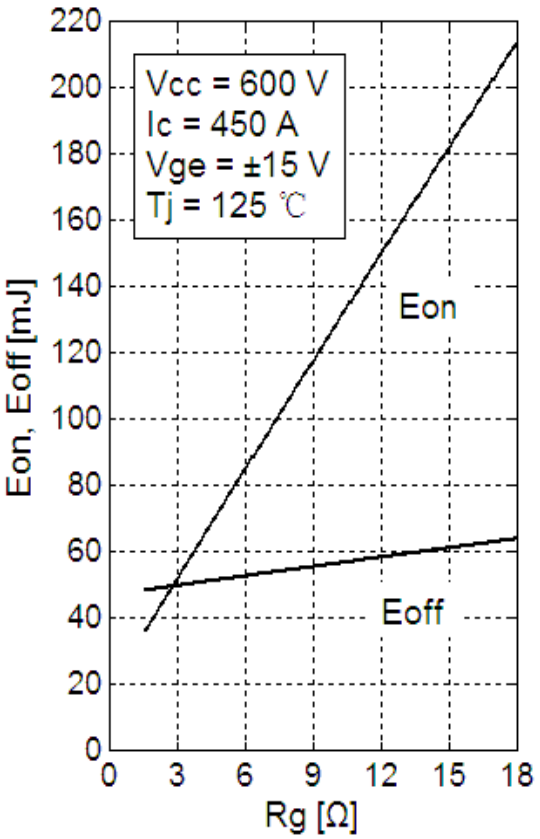


Fig 4. IGBT Switching Loss vs. R_G

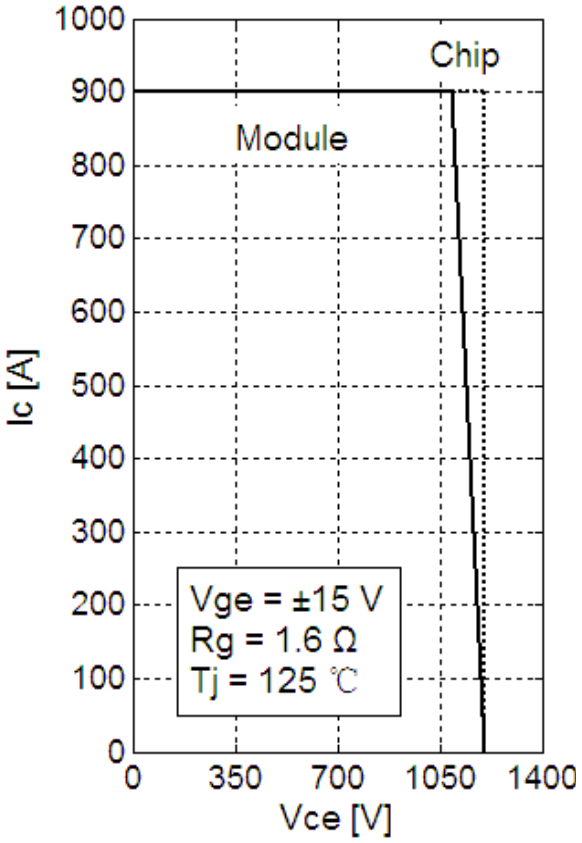


Fig 5. RBSOA

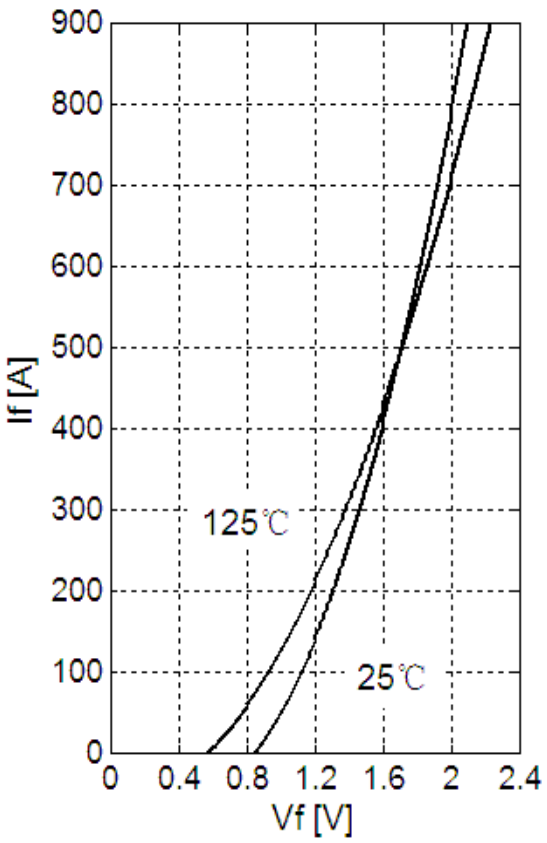


Fig 6. Diode Forward Characteristics

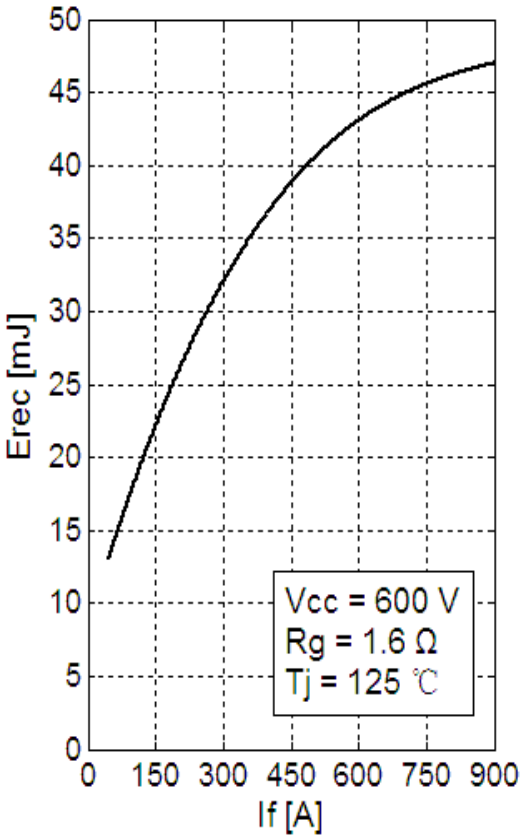


Fig 7. Diode Switching Loss vs. I_F

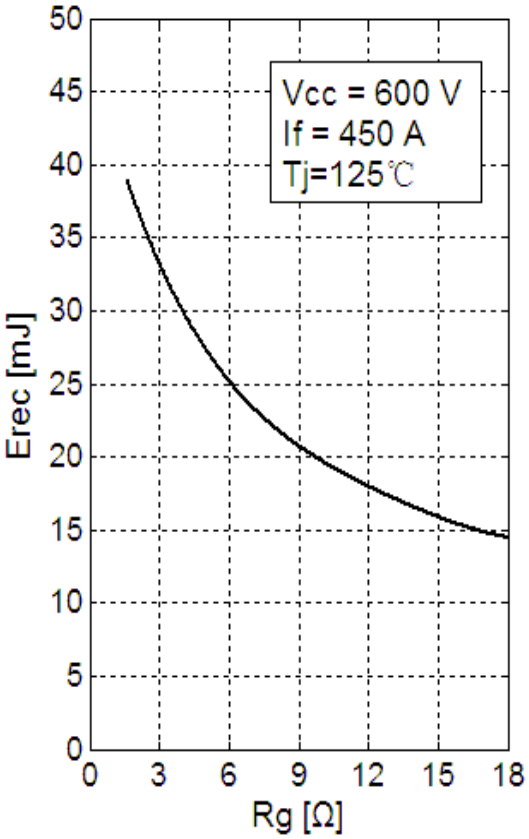


Fig 8. Diode Switching Loss vs. R_G

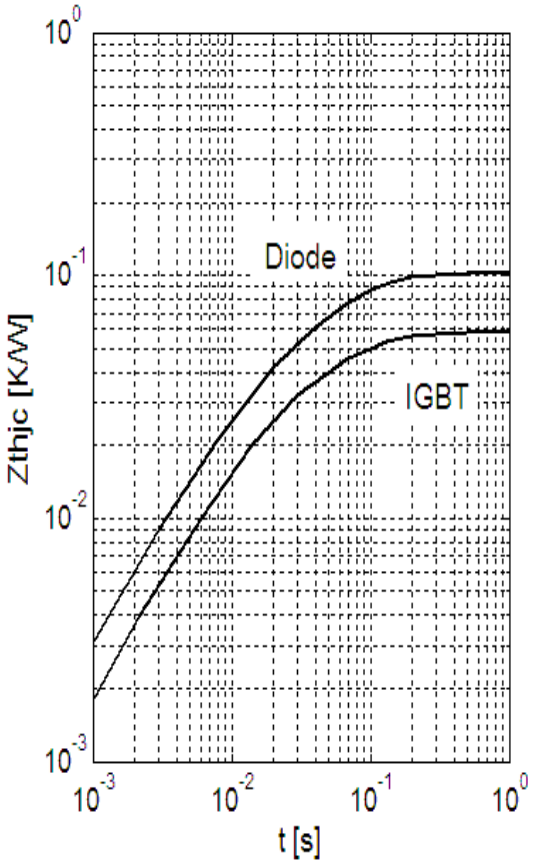


Fig 9. Transient Thermal Impedance

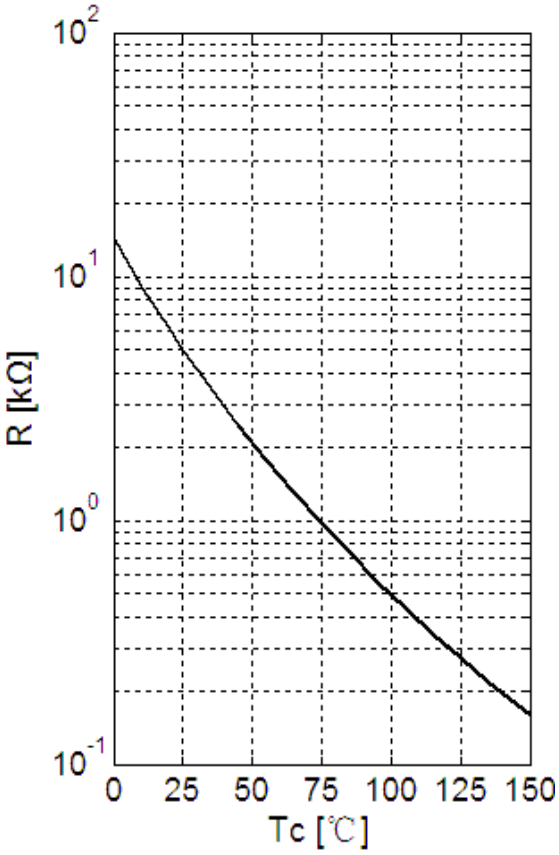
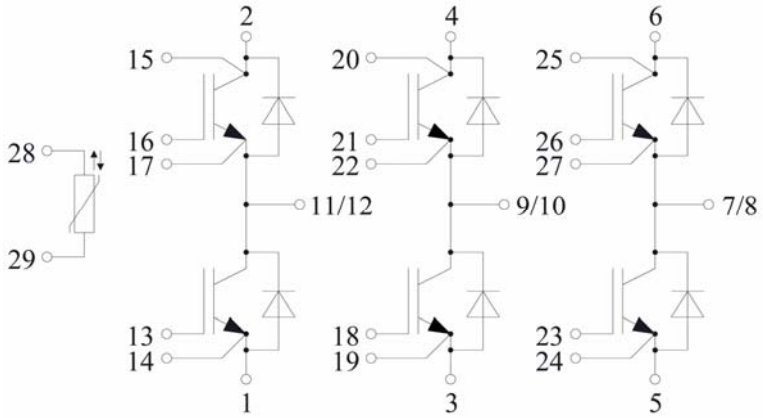


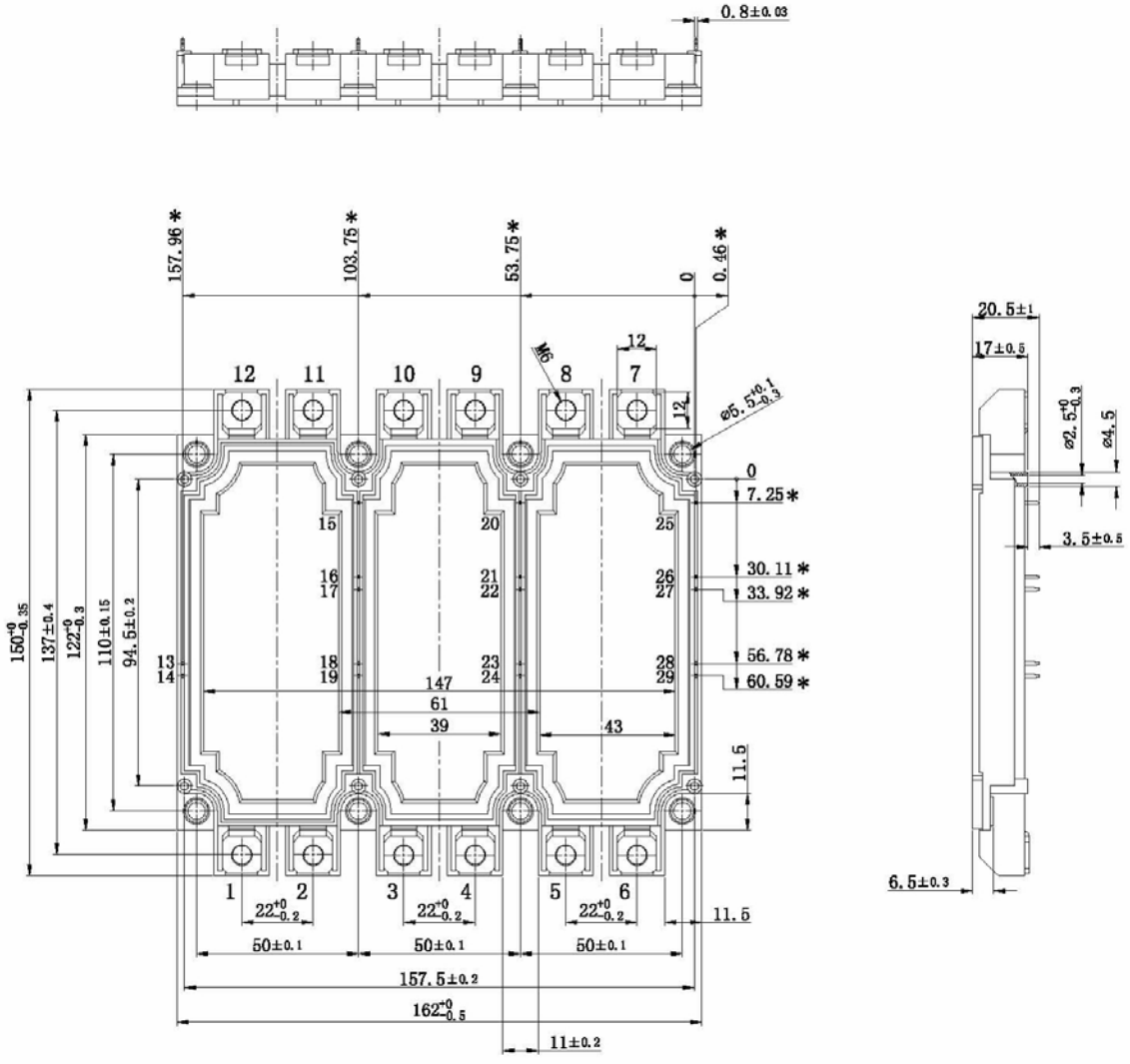
Fig 10. NTC-Temperature Characteristic

Equivalent Circuit Schematic



Package Dimension

Dimensions in Millimeters



Terms and Conditions of Usage

The data contained in this product datasheet is exclusively intended for technically trained staff. you and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application.

This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.

Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see www.powersemi.cc), For those that are specifically interested we may provide application notes.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify.

If and to the extent necessary, please forward equivalent notices to your customers.
Changes of this product data sheet are reserved.