

STARPOWER

SEMICONDUCTOR™

IGBT

GD450HFL120C6S

Molding Type Module

1200V/450A 2 in one-package

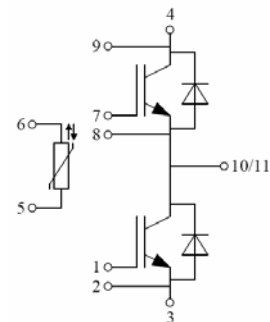
General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as general inverters and UPS.



Features

- High short circuit capability, self limiting to $6 \cdot I_C$
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Equivalent Circuit Schematic

Typical Applications

- AC inverter drives
- Switching mode power supplies
- Electronic welders at f_{sw} up to 20kHz

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

Symbol	Description	GD450HFL120C6S	Units
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	$\pm 20\text{V}$	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=80^{\circ}\text{C}$	600	A
		450	A
$I_{CM(1)}$	Pulsed Collector Current @ $T_C=80^{\circ}\text{C}$	900	A
I_F	Diode Continuous Forward Current	450	A
I_{FM}	Diode Maximum Forward Current	900	A
P_D	Maximum power Dissipation @ $T_J=150^{\circ}\text{C}$	2273	W
T_{SC}	Short Circuit Withstand Time @ $T_J=125^{\circ}\text{C}$	10	μs
T_J	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
I^2t -value, Diode	$V_R=0\text{V}$, $t=10\text{ms}$, $T_J=125^{\circ}\text{C}$	35000	A^2s
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500	V
Mounting Torque	Power Terminal Screw:M6	3.0 to 6.0	N.m
	Mounting Screw:M5	3.0 to 6.0	N.m

Notes:

(1) Repetitive rating: Pulse width limited by max. junction temperature

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{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	$I_C=6.0\text{mA}$, $V_{CE}=V_{GE}$, $T_J=25^{\circ}\text{C}$	5.0	6.2	7.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=450\text{A}$, $V_{GE}=15\text{V}$, $T_J=25^{\circ}\text{C}$		1.9		V
		$I_C=450\text{A}$, $V_{GE}=15\text{V}$, $T_J=125^{\circ}\text{C}$		2.1		

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=450A,$ $R_G=1.6\Omega, V_{GE} = \pm 15V,$ $T_j=25^\circ C$		190		ns
t_r	Rise Time			60		ns
$t_{d(off)}$	Turn-Off Delay Time			460		ns
t_f	Fall Time			55		ns
E_{on}	Turn-On Switching Loss			15.6		mJ
E_{off}	Turn-Off Switching Loss			33.2		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600V, I_C=450A,$ $R_G=1.6\Omega, V_{GE} = \pm 15V,$ $T_j=125^\circ C$		220		ns
t_r	Rise Time			60		ns
$t_{d(off)}$	Turn-Off Delay Time			530		ns
t_f	Fall Time			75		ns
E_{on}	Turn-On Switching Loss			25.0		mJ
E_{off}	Turn-Off Switching Loss			48.0		mJ
C_{ies}	Input Capacitance	$V_{CE} = 25V, f=1MHz,$ $V_{GE} = 0V$		31.5		nF
C_{oes}	Output Capacitance			2.25		nF
C_{res}	Reverse Transfer Capacitance			1.35		nF
I_{SC}	SC Data	$t_{SC} \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=900V,$ $V_{CEM} \leq 1200V$		1800		A
L_{CE}	Stray inductance			20		nH
$R_{CC'+EE'}$	Module lead resistance, terminal to chip	$T_C=25^\circ C$		1.10		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	Diode Reverse Recovery Charge	I _F =450A, V _R =600V, di/dt=-7800A/μs, V _{GE} =-15V	T _j =25℃		45.0		μC
			T _j =125℃		85.0		
I _{RM}	Diode Peak Reverse Recovery Current		T _j =25℃		315		A
			T _j =125℃		405		
E _{rec}	Reverse Recovery Energy		T _j =25℃		21.0		mJ
			T _j =125℃		39.0		

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		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$R_{100}=439\Omega$	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)		0.055	K/W
$R_{\theta JC}$	Junction-to-Case (per DIODE)		0.100	K/W
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)	0.009		K/W
Weight	Weight of Module	345		g

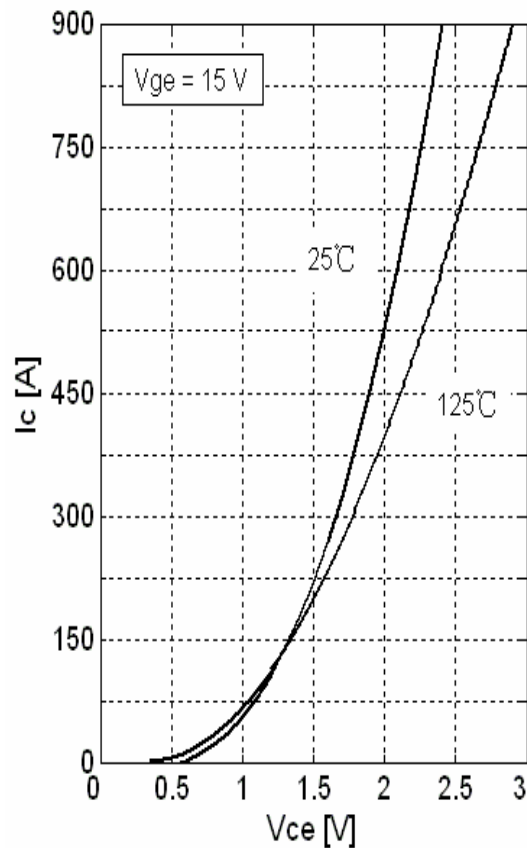


Fig 1. Typical IGBT Output Characteristics

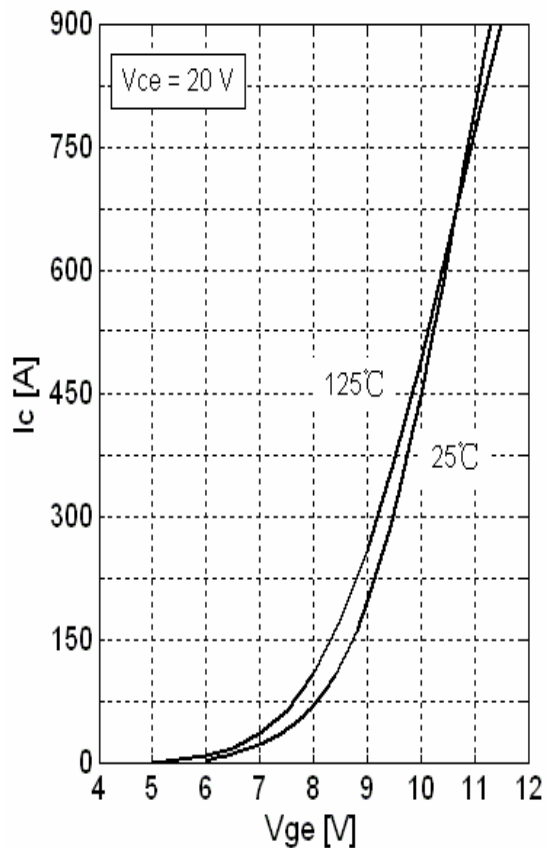


Fig 2. Typical IGBT Transfer Characteristics

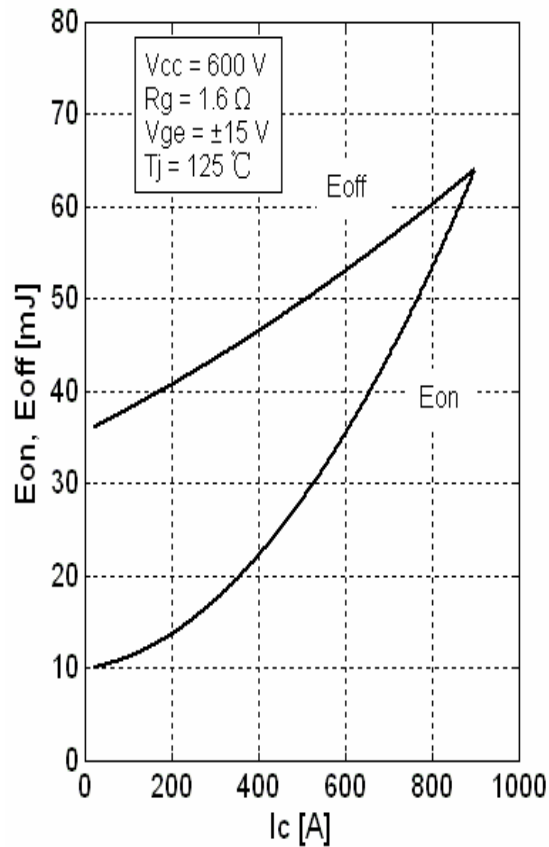


Fig 3. IGBT Switching Loss vs. Collector Current

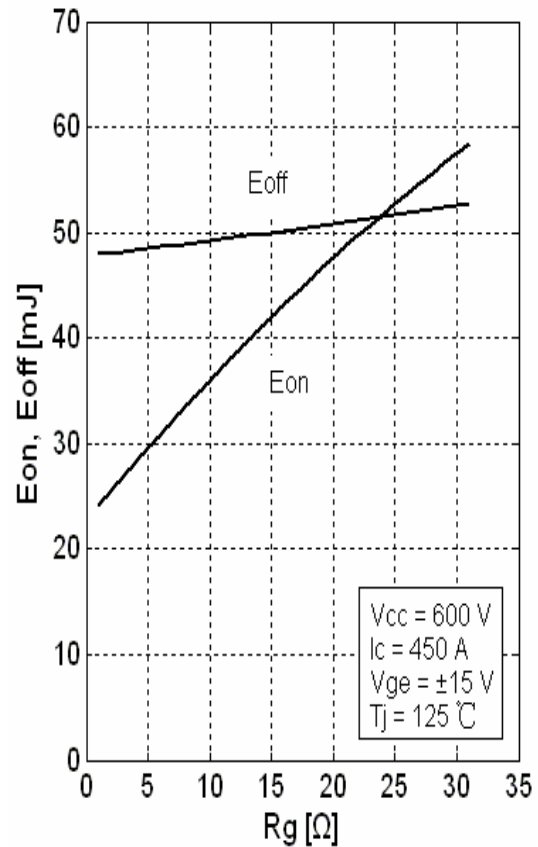


Fig 4. IGBT Switching Loss vs. Gate Resistor

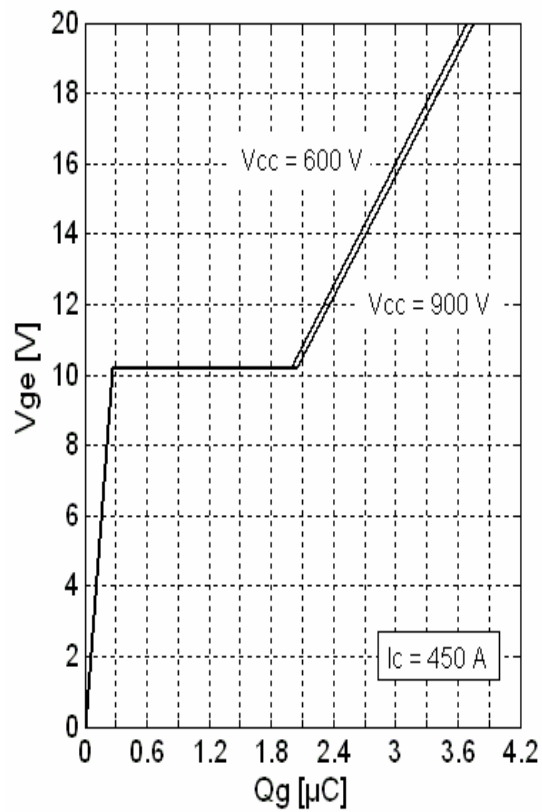


Fig 5. IGBT Gate Charge Characteristics

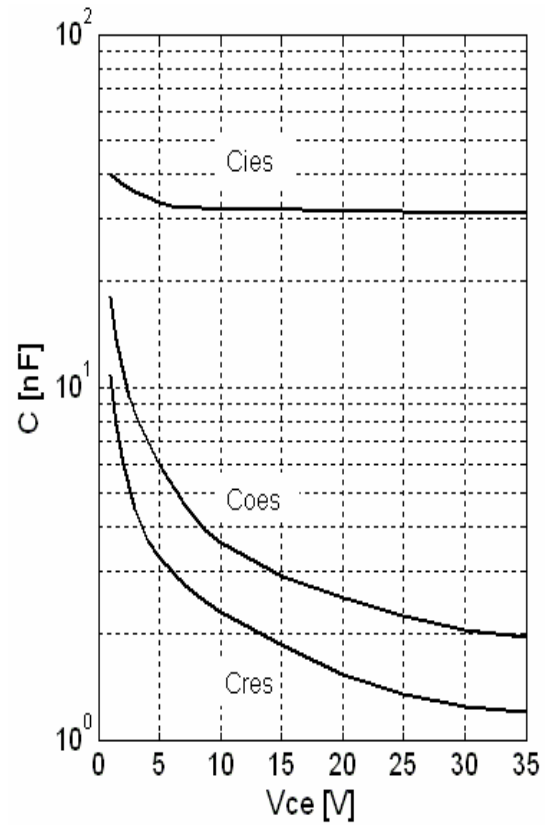
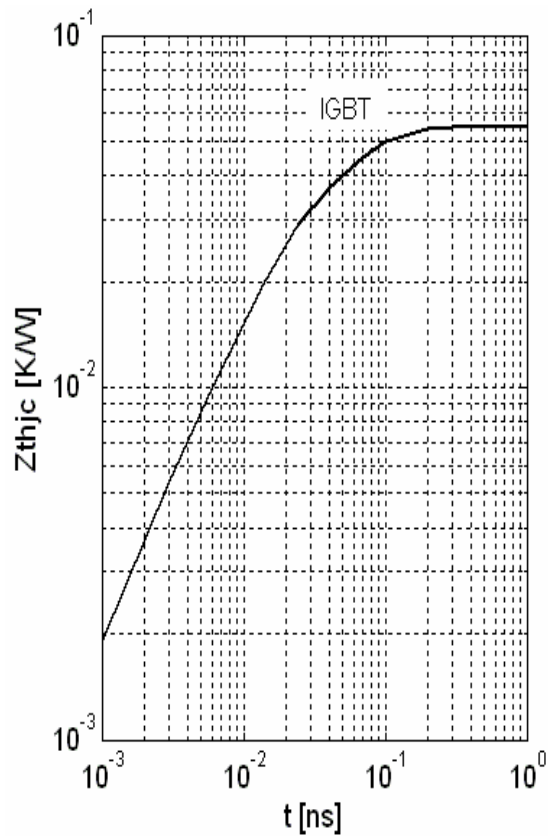
Fig 6. IGBT Typical Capacitance vs.
Collector-Emitter Voltage

Fig 7. IGBT transient thermal impedance

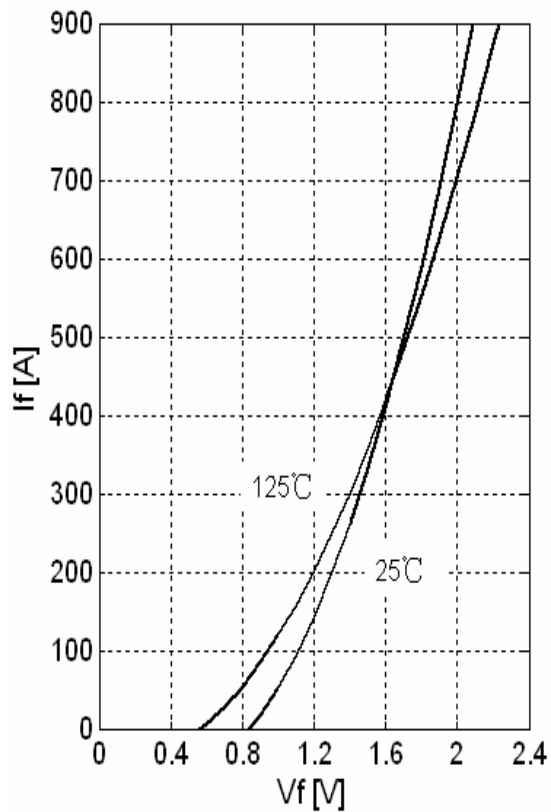


Fig 8. Typical Diode Forward Characteristics

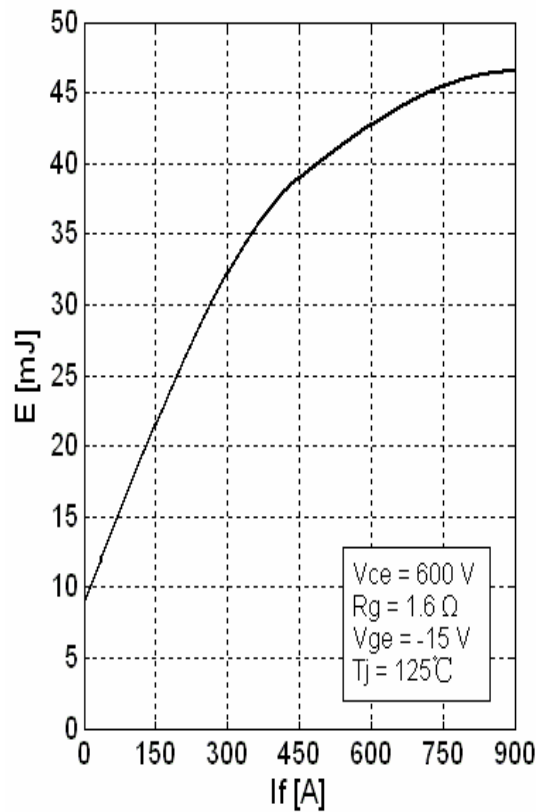


Fig 9. Diode Switching Loss vs. Collector Current

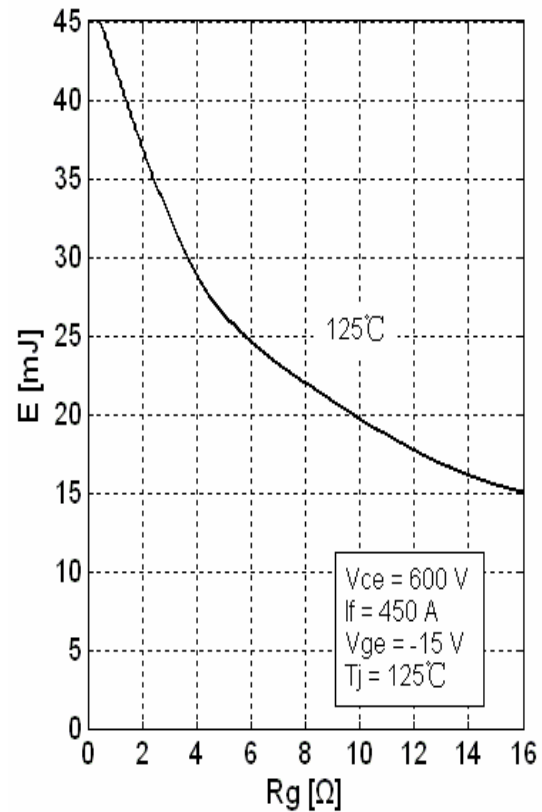


Fig 10. Diode Switching Loss vs. Gate Resistor

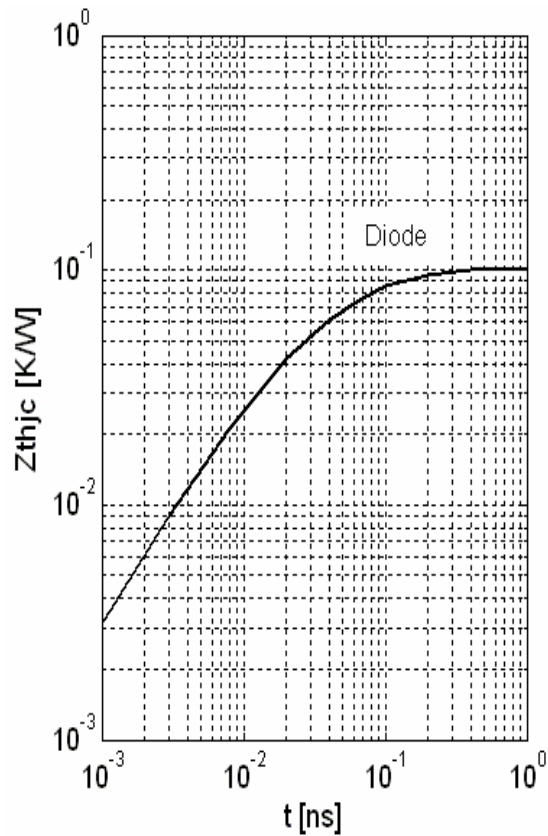


Fig 11. Diode transient thermal impedance

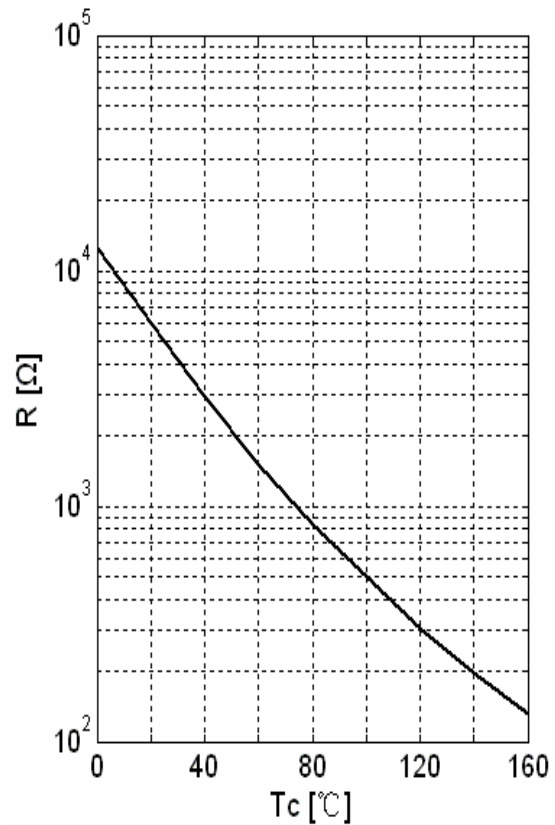
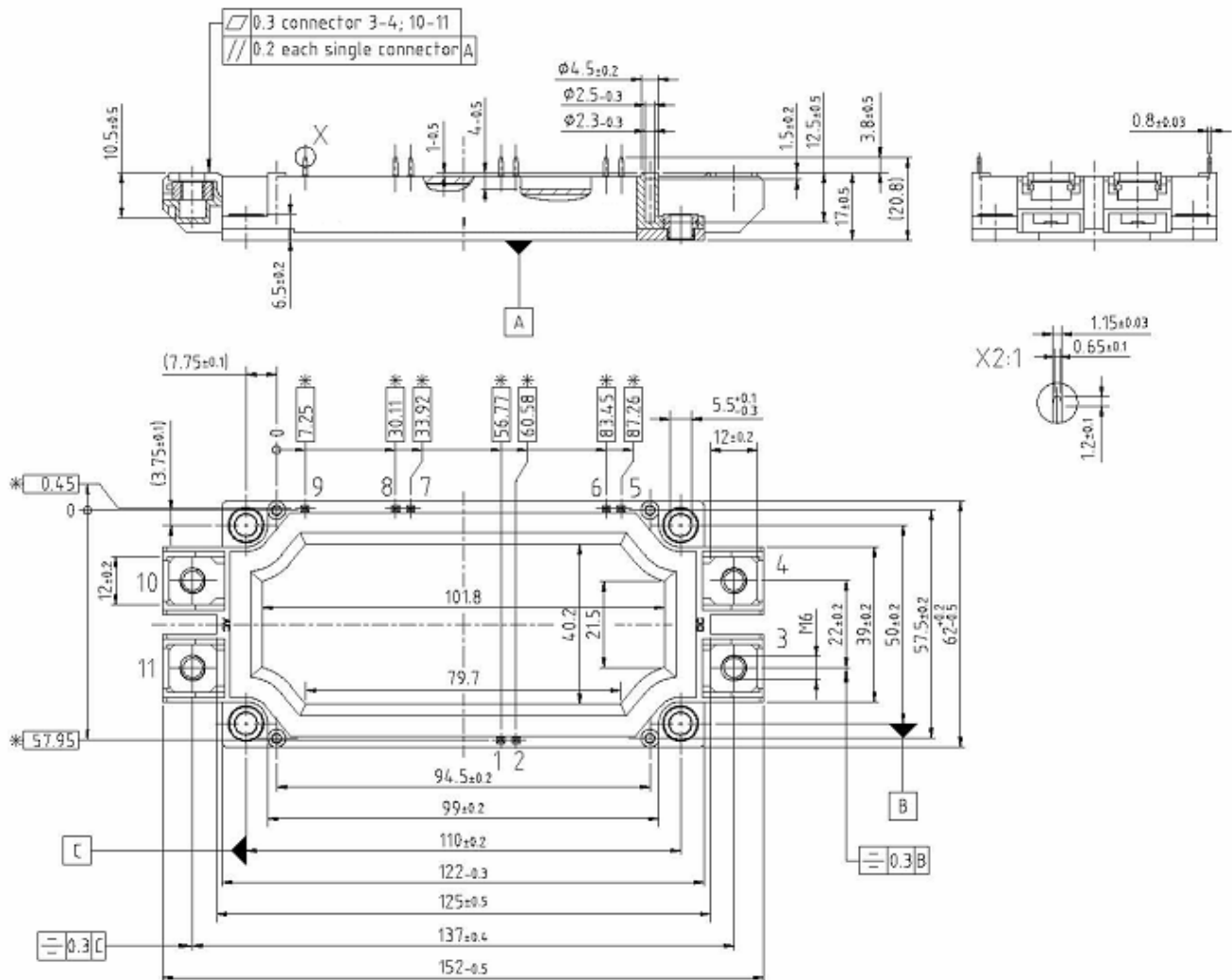


Fig 12. Typical NTC-temperature characteristic

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.com). 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 life 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.