

GTS15PI120B2H

IGBT Module

Preliminary Data

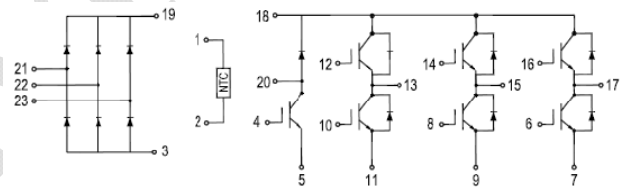
Features:

- Short Circuit Rated >10 μ s
- Low Saturation Voltage: $V_{CE(sat)} = 2.15V @ I_C = 15A, T_C = 25^\circ C$
- Low Switching Loss
- 100% RBSOA Tested ($2 \times I_C$)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement



Applications:

- Industrial Inverters
- Servo Applications



IGBT, Inverter

Maximum Rated Values ($T_C = 25^\circ C$ unless otherwise specified)

V_{CES}	Collector-Emitter Blocking Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C = 80^\circ C,$	15	A
		$T_C = 25^\circ C$	30	A
I_{CM}	Repetitive Peak Collector Current	$T_J = 150^\circ C$	30	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	$T_C = 25^\circ C$ $T_{Jmax} = 150^\circ C$	170	W

Electrical Characteristics of IGBT ($T_C=25^\circ\text{C}$ unless otherwise specified)

Static characteristics

Symbol	Description	Conditions	Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C = 1\text{mA}, V_{CE} = V_{GE}$	5.2	5.9	6.7	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 15\text{A}, V_{GE} = 15\text{V}$	$T_J = 25^\circ\text{C}$	2.15	2.50	V
			$T_J = 125^\circ\text{C}$	2.40		V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE} = 0\text{V}, V_{CE} = V_{CES}, T_J = 25^\circ\text{C}$			1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}, T_J = 25^\circ\text{C}$			200	nA
C_{ies}	Input Capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		1.12		nF
C_{oes}	Output Capacitance			0.09		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 600\text{V}, I_C = 15\text{A}, R_g = 20\Omega, V_{GE} = \pm 15\text{V},$ Inductive Load	$T_J = 25^\circ\text{C}$	78.7		ns
			$T_J = 125^\circ\text{C}$	53.4		
t_r	Rise Time		$T_J = 25^\circ\text{C}$	34.7		ns
			$T_J = 125^\circ\text{C}$	35.6		
$t_{d(off)}$	Turn-off Delay Time		$T_J = 25^\circ\text{C}$	146.4		ns
			$T_J = 125^\circ\text{C}$	154.7		
t_f	Fall Time		$T_J = 25^\circ\text{C}$	280		ns
			$T_J = 125^\circ\text{C}$	383		
E_{on}	Turn-on Switching Loss		$T_J = 25^\circ\text{C}$	1.4		mJ
			$T_J = 125^\circ\text{C}$	1.59		
E_{off}	Turn-off Switching Loss	$T_J = 25^\circ\text{C}$	0.41		mJ	
		$T_J = 125^\circ\text{C}$	0.76			
Q_g	Total Gate Charge	$T_J = 25^\circ\text{C}$	399		nC	
RBSOA	Reverse Bias Safe Operation Area	$I_C=30\text{A}, V_{CC}=1050\text{V}, V_p=1200\text{V}, R_g = 20\Omega, V_{GE}=\pm 15\text{V to } 0\text{V}, T_J = 150^\circ\text{C}$	Trapezoid			
SCSOA	Short Circuit Safe Operation Area	$V_{CC} = 600\text{V}, V_{GE} = 15\text{V}, T_J = 150^\circ\text{C}$	10			μs
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(Per leg)			0.77		$^\circ\text{C/W}$

Diode, Inverter
Maximum Rated Values ($T_C=25^\circ\text{C}$ unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	15	A
I_{FM}	Diode Maximum Forward Current	30	A

Electrical Characteristics of Diode ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_{FM}	Forward Voltage	$I_F = 15\text{A}$	$T_J = 25^\circ\text{C}$	2.00		V
			$T_J = 125^\circ\text{C}$	2.20		
I_{rr}	Peak Reverse Recovery Current		$T_J = 25^\circ\text{C}$	12		A
			$T_J = 125^\circ\text{C}$	15		
Q_{rr}	Reverse Recovery Charge	$I_F = 15\text{A}$, $di/dt = 370\text{A}/\mu\text{s}$, $V_{rr} = 600\text{V}$, $V_{GE} = -15\text{V}$	$T_J = 25^\circ\text{C}$	0.94		μC
			$T_J = 125^\circ\text{C}$	1.64		
E_{rec}	Reverse Recovery Energy		$T_J = 25^\circ\text{C}$	0.37		mJ
			$T_J = 125^\circ\text{C}$	0.75		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case (Per leg)			1.28		$^\circ\text{C}/\text{W}$

IGBT, Brake-Chopper
Maximum Rated Values ($T_C=25^\circ\text{C}$ unless otherwise specified)

V_{CES}	Collector-Emitter Blocking Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C = 80^\circ\text{C}$,	15	A
		$T_C = 25^\circ\text{C}$	30	A
I_{CM}	Repetitive Peak Collector Current	$T_J = 150^\circ\text{C}$	30	A
t_{sc}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	$T_C = 25^\circ\text{C}$ $T_{Jmax} = 150^\circ\text{C}$	170	W

Electrical Characteristics of IGBT ($T_C=25^\circ\text{C}$ unless otherwise specified)

Static characteristics

Symbol	Description	Conditions	Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C = 1\text{mA}, V_{CE} = V_{GE}$	5.2	5.9	6.7	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 15\text{A}, V_{GE} = 15\text{V}$	$T_J = 25^\circ\text{C}$	2.15	2.50	V
			$T_J = 125^\circ\text{C}$	2.40		V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE} = 0\text{V}, V_{CE} = V_{CES}, T_J = 25^\circ\text{C}$			1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}, T_J = 25^\circ\text{C}$			200	nA
C_{ies}	Input Capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		1.12		nF
C_{oes}	Output Capacitance			0.09		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 600\text{V}, I_C = 15\text{A}, R_G = 20\Omega, V_{GE} = \pm 15\text{V},$ Inductive Load	$T_J = 25^\circ\text{C}$	78.7		ns
			$T_J = 125^\circ\text{C}$	53.4		
t_r	Rise Time		$T_J = 25^\circ\text{C}$	34.7		ns
			$T_J = 125^\circ\text{C}$	35.6		
$t_{d(off)}$	Turn-off Delay Time		$T_J = 25^\circ\text{C}$	146.4		ns
			$T_J = 125^\circ\text{C}$	154.7		
t_f	Fall Time		$T_J = 25^\circ\text{C}$	280		ns
			$T_J = 125^\circ\text{C}$	383		
E_{on}	Turn-on Switching Loss		$T_J = 25^\circ\text{C}$	1.4		mJ
			$T_J = 125^\circ\text{C}$	1.59		
E_{off}	Turn-off Switching Loss	$T_J = 25^\circ\text{C}$	0.41		mJ	
		$T_J = 125^\circ\text{C}$	0.76			
Q_g	Total Gate Charge	$T_J = 25^\circ\text{C}$	399		nC	
RBSOA	Reverse Bias Safe Operation Area	$I_C=30\text{A}, V_{CC}=1050\text{V}, V_p=1200\text{V}, R_g = 20\Omega, V_{GE}=\pm 15\text{V to } 0\text{V}, T_J = 150^\circ\text{C}$	Trapezoid			
SCSOA	Short Circuit Safe Operation Area	$V_{CC} = 600\text{V}, V_{GE} = 15\text{V}, T_J = 150^\circ\text{C}$	10			μs
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(Per leg)			0.77		$^\circ\text{C/W}$

Diode, Brake-Chopper Maximum Rated Values ($T_C=25^\circ\text{C}$ unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	15	A
I_{FM}	Diode Maximum Forward Current	30	A

Electrical Characteristics of FWD ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_{FM}	Forward Voltage	$I_F = 15\text{A}$	$T_J = 25^\circ\text{C}$	2.00		V
			$T_J = 125^\circ\text{C}$	2.20		
I_{rr}	Peak Reverse Recovery Current	$I_F = 15\text{A}$, $di/dt = 370\text{A}/\mu\text{s}$, $V_{rr} = 600\text{V}$, $V_{GE} = -15\text{V}$	$T_J = 25^\circ\text{C}$	12		A
			$T_J = 125^\circ\text{C}$	15		
Q_{rr}	Reverse Recovery Charge		$T_J = 25^\circ\text{C}$	0.94		μC
			$T_J = 125^\circ\text{C}$	1.64		
E_{rec}	Reverse Recovery Energy		$T_J = 25^\circ\text{C}$	0.37		mJ
			$T_J = 125^\circ\text{C}$	0.75		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case (Per leg)			1.28		$^\circ\text{C}/\text{W}$

Diode, Rectifier Maximum Rated Values ($T_C=25^\circ\text{C}$ unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	$T_J = 25^\circ\text{C}$	1600	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	$T_J = 80^\circ\text{C}$	20	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	$T_J = 80^\circ\text{C}$	30	A
I_{FSM}	Surge Current @ $t_p=10$ ms	$T_J = 25^\circ\text{C}$	300	A
		$T_J = 150^\circ\text{C}$	250	
I^2t	I^2t - value	$T_J = 25^\circ\text{C}$	450	A^2s
		$T_J = 150^\circ\text{C}$	300	

Electrical Characteristics of Diode ($T_C=25^\circ\text{C}$ unless otherwise specified)

V_F	Forward Voltage	$I_F = 15 \text{ A}$	$T_J = 25^\circ\text{C}$	1.05			V
			$T_J = 150^\circ\text{C}$	1.00			
I_R	Reverse Current	$V_R=1200\text{V}$	$T_J = 25^\circ\text{C}$			1	mA
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case				1.04		$^\circ\text{C}/\text{W}$

Internal NTC-Thermistor Characteristics

R_{25}	$T_C = 25^\circ\text{C}$	22.7		k Ω
$\Delta R/R$	$T_C = 100^\circ\text{C}$, $R_{100} = 481\Omega$		± 3	%
P_{25}	$T_C = 25^\circ\text{C}$	200		mW
$B_{25/50}$	$R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$	3950		K
$B_{25/80}$	$R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$	4000		K

Module

Symbol	Description	Min	Typ	Max	Unit
V_{iso}	Isolation Voltage (All Terminals Shorted)	$f = 50\text{Hz}$, 1minute	2500		V
T_J	Maximum Junction Temperature			150	$^\circ\text{C}$
T_{JOP}	Maximum Operating Junction Temperature Range	-40		+150	$^\circ\text{C}$
T_{stg}	Storage Temperature	-40		+125	$^\circ\text{C}$
$R_{\theta CS}$	Case-To-Sink Thermally (Conductive Grease Applied)		0.05		$^\circ\text{C}/\text{W}$
T	Power Terminals Screw:M4	1.0		1.5	N·m
G	Weight		24		g

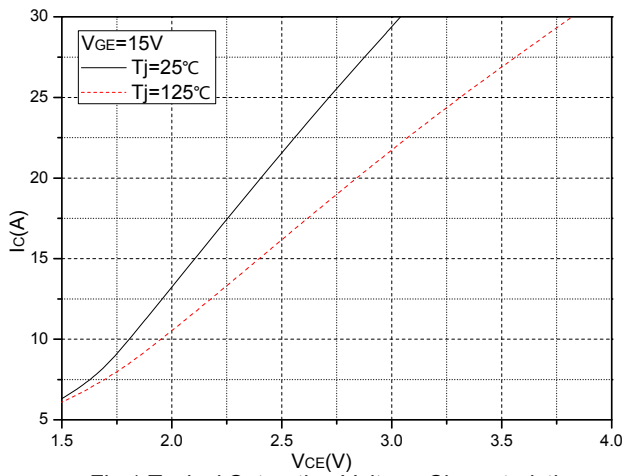


Fig.1 Typical Saturation Voltage Characteristics

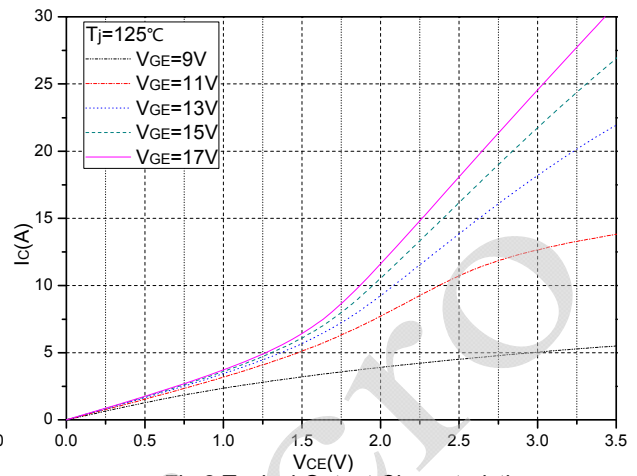


Fig.2 Typical Output Characteristics

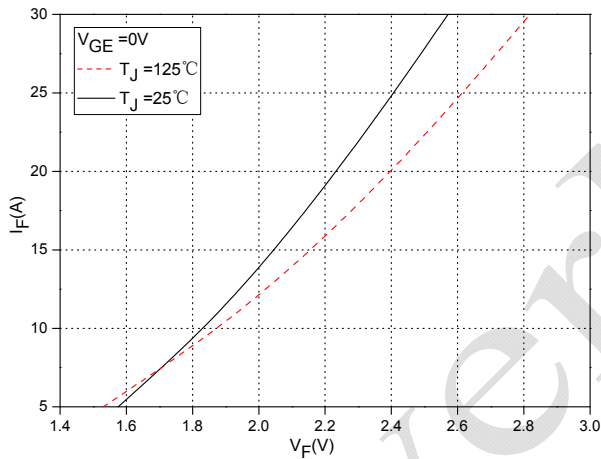


Fig.3 Forward Characteristics of Diode

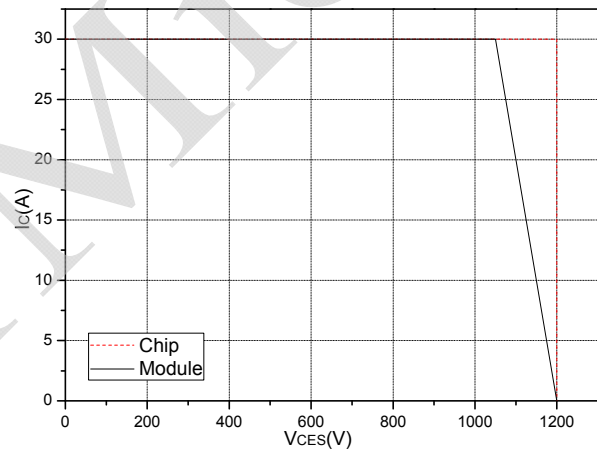


Fig.4 Reverse Bias Safe Operation Area (RBSOA)

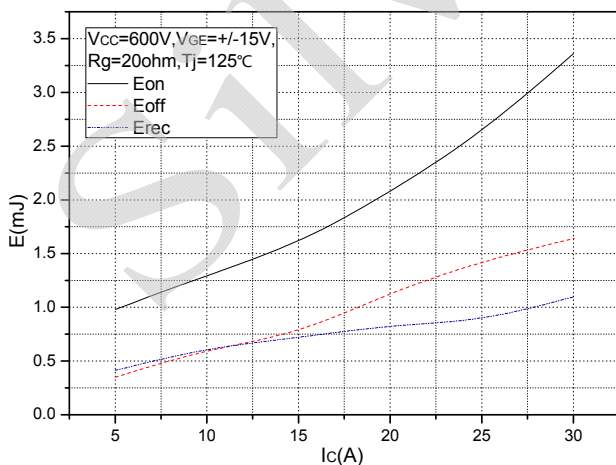


Fig.5 Typical Switching Loss vs. Collector Current

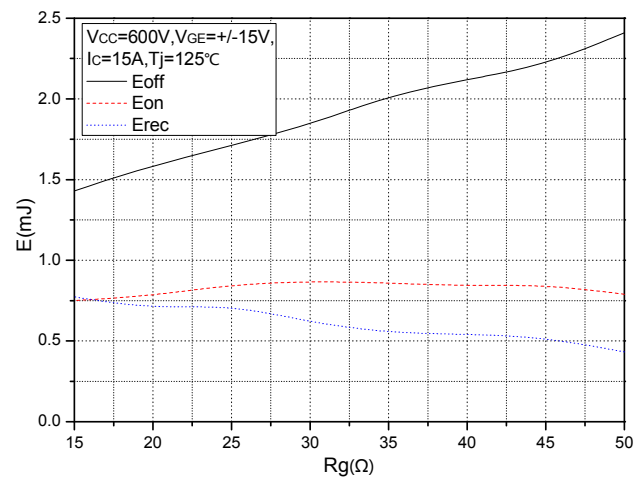


Fig.6 Typical Switching Loss vs. Gate Resistance

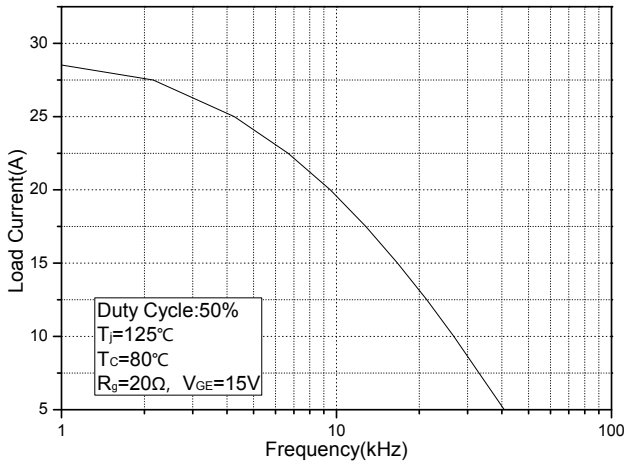


Fig.7 Typical Load Current vs. Frequency

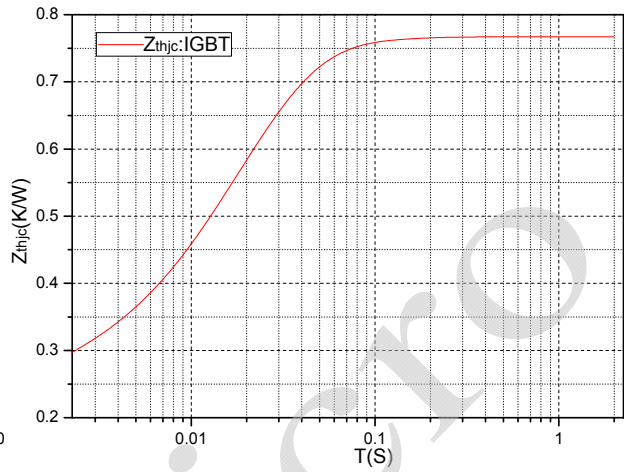


Fig.8 Transient Thermal Impedance (Inverter-IGBT)

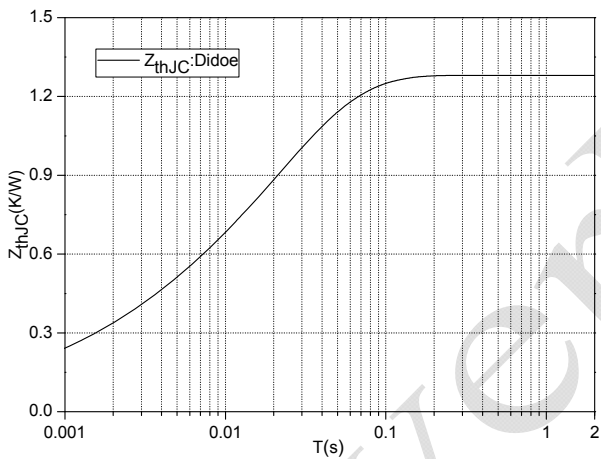


Fig.9 Transient Thermal Impedance (Inverter-Diode)

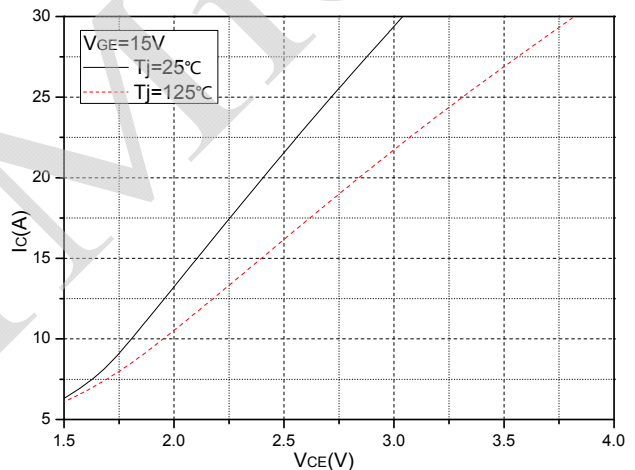


Fig.10 Typical Saturation Voltage Characteristics (Brake-Chopper)

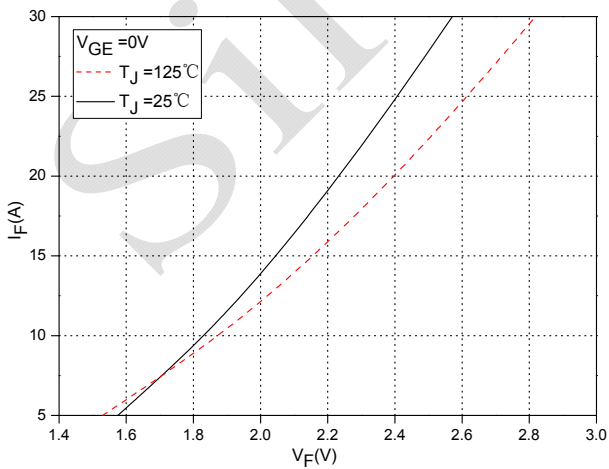


Fig.11 Forward Characteristics of FWD (Brake-Chopper)

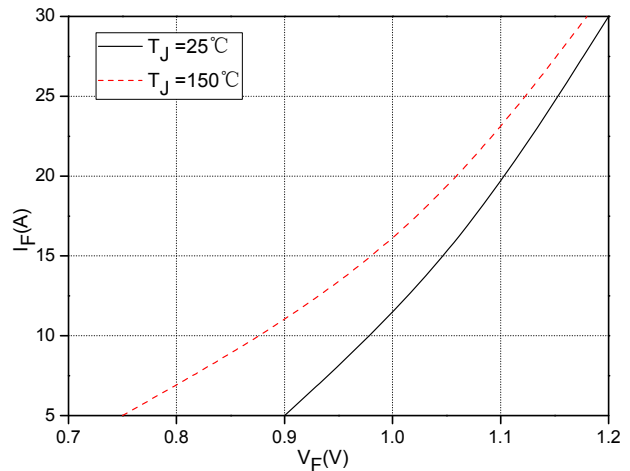


Fig.12 Forward Characteristics of Diode (Rectifier)

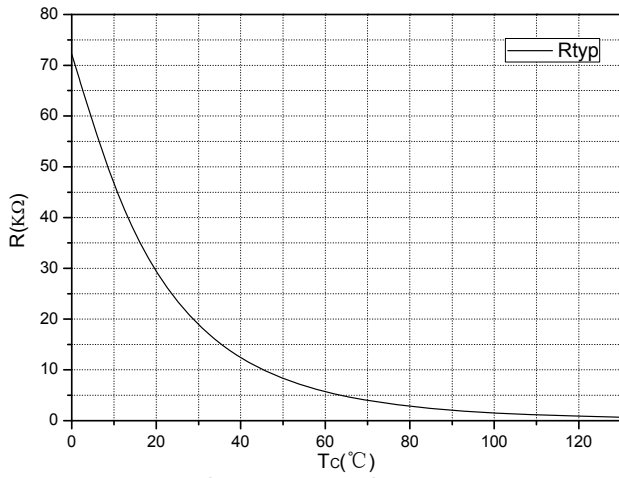
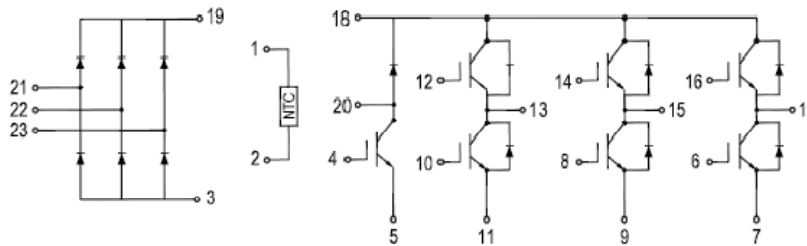


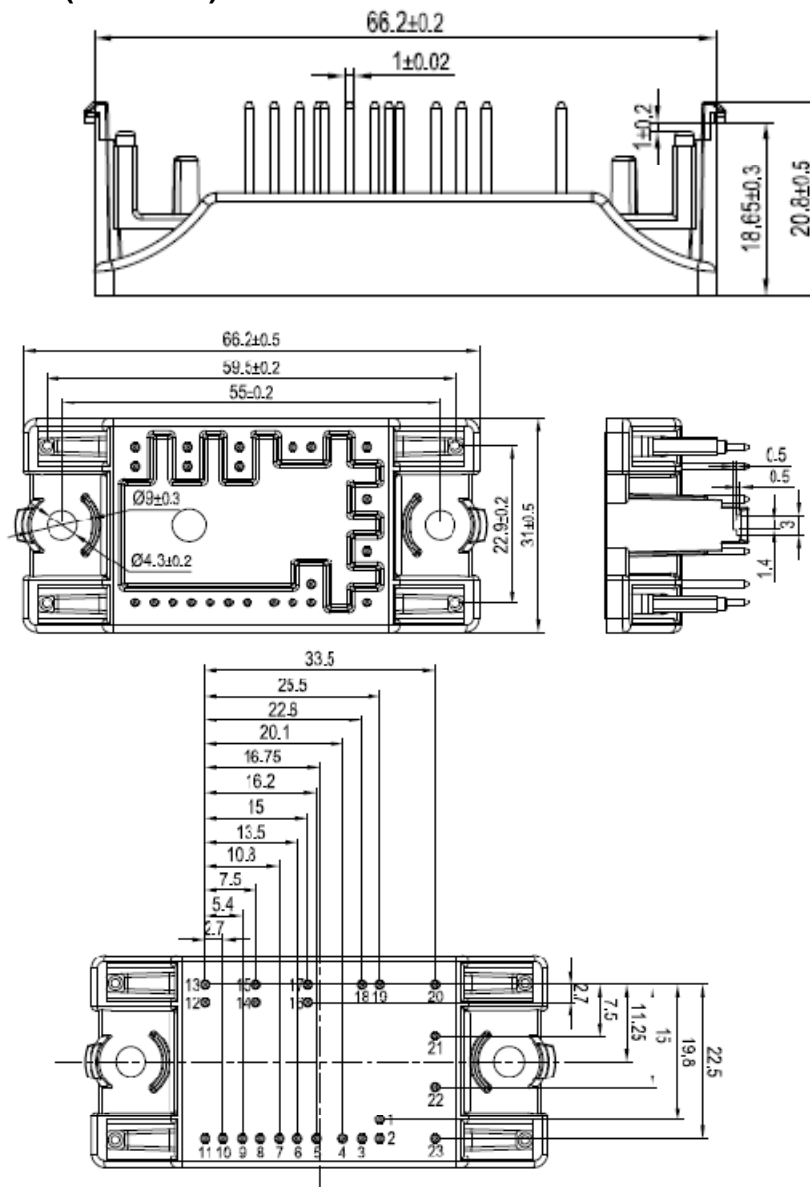
Fig.13 NTC Temperature Characteristics

SilverMicro

Internal Circuit



Package Outline (Unit: mm):





Announcement

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