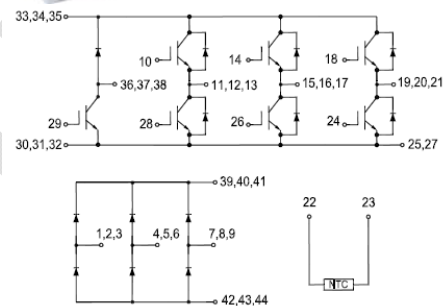


GT150PI120T6H-T4M

IGBT Module

Features:

- Field Stop Trench Gate IGBT
- Short Circuit Rated $>10\mu\text{s}$
- Low Saturation Voltage
- 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 ($T_C=25^\circ\text{C}$ unless otherwise specified)

V_{CES}	Collector-Emitter Blocking Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C=100^\circ\text{C}$	150	A
		$T_C=25^\circ\text{C}$	300	A
I_{CM}	Peak Collector Current Repetitive	$T_J=175^\circ\text{C}$	300	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	$T_C=25^\circ\text{C}$ $T_{Jmax}=175^\circ\text{C}$	1085	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	$I_C=4\text{mA}$, $V_{CE}=V_{GE}$	5.0	5.9	6.6	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=150\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^{\circ}\text{C}$	1.70	2.00	V
			$T_J=125^{\circ}\text{C}$	1.90		V
			$T_J=150^{\circ}\text{C}$	2.00		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	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_J=25^{\circ}\text{C}$			400	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		10.13		nF
C_{oes}	Out Capacitance			1.01		nF
C_{res}	Reverse Transfer Capacitance			0.77		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V, I_C=150A,$ $R_{Gon}=4.7\Omega, V_{GE}= \pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		258		ns	
			$T_J=125^{\circ}C$		258			
			$T_J=150^{\circ}C$		260			
t_r	Rise Time		$T_J=25^{\circ}C$		85		ns	
			$T_J=125^{\circ}C$		89			
			$T_J=150^{\circ}C$		89			
$t_{d(off)}$	Turn-off Delay Time		$V_{CC}=600V, I_C=150A,$ $R_{Goff}=4.7\Omega, V_{GE}= \pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		265		ns
				$T_J=125^{\circ}C$		277		
				$T_J=150^{\circ}C$		284		
t_f	Fall Time	$T_J=25^{\circ}C$			205		ns	
		$T_J=125^{\circ}C$			376			
		$T_J=150^{\circ}C$			428			
E_{on}	Turn-on Switching Loss	$V_{CC}=600V, I_C=150A,$ $R_{Gon}=4.7\Omega, V_{GE}= \pm 15V,$ $di/dt=1550A/\mu s$ ($T_J=150^{\circ}C$) Inductive Load		$T_J=25^{\circ}C$		12.5		mJ
				$T_J=125^{\circ}C$		15.7		
				$T_J=150^{\circ}C$		17.5		

E_{off}	Turn-off Switching Loss	$V_{CC}=600V, I_C=150A,$ $R_{Goff}=4.7\Omega, V_{GE}=\pm 15V,$ $du/dt=4106V/\mu s$ ($T_J=150^\circ C$) Inductive Load	$T_J=25^\circ C$		10.3		mJ
			$T_J=125^\circ C$		15.8		
			$T_J=150^\circ C$		17.4		
Q_g	Total Gate Charge	$V_{GE}=+15V \dots -15V$	$T_J = 25^\circ C$		0.71		μC
$R_{g internal}$	Internal Gate Resistance		$T_J=25^\circ C$		5		Ω
RBSOA	$I_C=300A, V_{CC}=1050V, V_p=1200V, R_{Goff}=4.7\Omega, V_{GE}=+15V$ to $0V, T_J=150^\circ C$			Trapezoid			
SC Data	$V_{CC}=600V, R_{Gon}=4.7 \Omega, R_{Goff}=4.7 \Omega, t_p=10\mu s, V_{GE}=+/-15V, T_J=125^\circ C$				680		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case (per leg)				0.138		$^\circ C/W$

Diode, Inverter

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

V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	150	A
I_{FM}	Repetitive Peak Forward Current	300	A

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

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_{FM}	Forward Voltage	$I_F=150A$	$T_J=25^\circ C$	1.50		V
			$T_J=125^\circ C$	1.50		
			$T_J=150^\circ C$	1.50		
t_{rr}	Reverse Recovery Time	$I_F=150A,$ $-diF/dt=1670A/\mu s(T_J=150^\circ C),$ $V_R=600V,$ $V_{GE}=-15V$	$T_J=25^\circ C$	371		ns
			$T_J=125^\circ C$	562		
			$T_J=150^\circ C$	625		
I_{rr}	Peak Reverse Recovery Current	$I_F=150A,$ $-diF/dt=1670A/\mu s(T_J=150^\circ C),$ $V_R=600V,$ $V_{GE}=-15V$	$T_J=25^\circ C$	127		A
			$T_J=125^\circ C$	142		
			$T_J=150^\circ C$	145		

Q _{rr}	Reverse Recovery Charge	I _F =150A, -diF/dt=1670A/μs(T _J =150℃), V _R =600V, V _{GE} =-15V	T _J =25℃		22.6		μC
			T _J =125℃		34.6		
			T _J =150℃		39.4		
E _{rec}	Reverse Recovery Energy		T _J =25℃		9.7		mJ
			T _J =125℃		15.2		
			T _J =150℃		17.6		
R _{θJC}	Diode Thermal Resistance: Junction-To-Case (per leg)				0.213		℃/W

IGBT, Brake-Chopper

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	$T_C=100^\circ C$	100	A
		$T_C=25^\circ C$	200	A
I_{CM}	Peak Collector Current Repetitive	$T_J=175^\circ C$	200	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation (IGBT)	$T_C=25^\circ C$ $T_{Jmax}=175^\circ C$	714	W

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

Static Characteristics

Symbol	Description	Conditions		Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1\text{ mA}$, $V_{CE}=V_{GE}$		5.0	5.5	6.6	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=100A$, $V_{GE}=15V$	$T_J=25^\circ C$		1.70	2.00	V
			$T_J=125^\circ C$		1.90		V
			$T_J=150^\circ C$		1.90		V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0V$, $V_{CE}=V_{CES}$, $T_J=25^\circ C$				1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=\pm 20V$, $V_{CE}=0V$, $T_J=25^\circ C$				200	nA

C_{ies}	Input Capacitance	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		8.03		nF
C_{oes}	Output Capacitance			1.22		nF
C_{res}	Reverse Transfer Capacitance			0.59		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V, I_C=100A, R_{Gon}=1\Omega, V_{GE}=\pm 15V, \text{Inductive Load}$	$T_J=25^\circ C$		228		ns
			$T_J=125^\circ C$		250		
			$T_J=150^\circ C$		254		
t_r	Rise Time	$V_{CC}=600V, I_C=100A, R_{Gon}=1\Omega, V_{GE}=\pm 15V, \text{Inductive Load}$	$T_J=25^\circ C$		63		ns
			$T_J=125^\circ C$		67		
			$T_J=150^\circ C$		69		
$t_{d(off)}$	Turn-off Delay Time	$V_{CC}=600V, I_C=100A, R_{Goff}=1\Omega, V_{GE}=\pm 15V, \text{Inductive Load}$	$T_J=25^\circ C$		269		ns
			$T_J=125^\circ C$		279		
			$T_J=150^\circ C$		284		
t_f	Fall Time	$V_{CC}=600V, I_C=100A, R_{Goff}=1\Omega, V_{GE}=\pm 15V, \text{Inductive Load}$	$T_J=25^\circ C$		184		ns
			$T_J=125^\circ C$		291		
			$T_J=150^\circ C$		317		
E_{on}	Turn-on Switching Loss	$V_{CC}=600V, I_C=100A, R_{Gon}=1\Omega, V_{GE}=\pm 15V, di/dt=1387A/\mu s(T_J=150^\circ C), \text{Inductive Load}$	$T_J=25^\circ C$		3.1		mJ
			$T_J=125^\circ C$		4.3		
			$T_J=150^\circ C$		4.8		
E_{off}	Turn-off Switching Loss	$V_{CC}=600V, I_C=100A, R_{Goff}=1\Omega, V_{GE}=\pm 15V, du/dt=4448V/\mu s(T_J=150^\circ C), \text{Inductive Load}$	$T_J=25^\circ C$		5.28		mJ
			$T_J=125^\circ C$		8.33		
			$T_J=150^\circ C$		9.30		
Q_g	Total Gate Charge	$V_{GE}=+15V \dots -15V$	$T_J=25^\circ C$		745		nC
$R_{g \text{ internal}}$	Internal Gate Resistance		$T_J=25^\circ C$		7.5		Ω
RBSOA	$I_C=200A, V_{CC}=1050V, V_p=1200V, R_{Goff}=1\Omega, V_{GE}=+15V \text{ to } 0V, T_J=150^\circ C$			Trapezoid			
SC data	$V_{CC}=600V, t_p=10\mu s, V_{GE}=\pm 15V, R_{Gon}=1\Omega, R_{Goff}=1\Omega, T_J=25^\circ C$				575		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case (per leg)				0.21		$^\circ C/W$

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	50	A
I_{FM}	Repetitive Peak Forward Current	100	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 =50 A	T _J =25℃		1.50		V
			T _J =125℃		1.60		
			T _J =150℃		1.60		
t _{rr}	Reverse Recovery Time	I _F =50A, -diF/dt =1197A/μs(T _J =150℃), V _R =600V, V _{GE} =-15V	T _J =25℃		318		ns
			T _J =125℃		539		
			T _J =150℃		554		
I _{rr}	Peak Reverse Recovery Current		T _J =25℃		57		A
			T _J =125℃		60		
			T _J =150℃		65		
Q _{rr}	Reverse Recovery Charge		T _J =25℃		7.95		μC
			T _J =125℃		12.78		
			T _J =150℃		14.17		
E _{rec}	Reverse Recovery Energy		T _J =25℃		3.15		mJ
			T _J =125℃		5.21		
			T _J =150℃		6.05		
R _{θJC}	Diode Thermal Resistance: Junction-To-Case (per leg)				0.51		℃/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	$T_J=80^{\circ}\text{C}$	150	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	$T_J=80^{\circ}\text{C}$	200	A
I_{FSM}	Surge Current @ $t_p=10$ ms	$T_J=25^{\circ}\text{C}$	1320	A
		$T_J=150^{\circ}\text{C}$	1200	
I^2t	I^2t - value	$T_J=25^{\circ}\text{C}$	8712	A^2s
		$T_J=150^{\circ}\text{C}$	7200	

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

V _F	Forward Voltage	I _F =150 A	T _J =25℃	1.10			V
			T _J =150℃	1.00			
I _R	Reverse Current	V _R =1600V	T _J =25℃			1	mA
R _{θJC}	Diode Thermal Resistance: Junction-To-Case （per leg）				0.22		℃/W

Internal NTC-Thermistor Characteristics

R_{25}	$T_C=25^{\circ}\text{C}$	5		k Ω
$\Delta R/R$	$T_C=100^{\circ}\text{C}$, $R_{100}=481\Omega$		± 5	%
P_{25}	$T_C=25^{\circ}\text{C}$	50		mW
$B_{25/50}$	$R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$	3380		K
$B_{25/80}$	$R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$	3440		K

Module

Symbol	Description		Min	Typ	Max	Unit
V _{iso}	Isolation Voltage (All Terminals Shorted)	f = 50Hz, 1minute	2500			V
T _J	Maximum Junction Temperature				175	°C
T _{JOP}	Maximum Operating Junction Temperature Range		-40		+150	°C
T _{stg}	Storage Temperature		-40		+125	°C
CTI	Comparative Tracking Index		200			V
R _{θCS}	Case-To-Sink Thermally (Conductive Grease Applied)			0.02		°C/W
M	Mounting Screw:M5		4.0		6.0	N·m
G	Weight			300		g

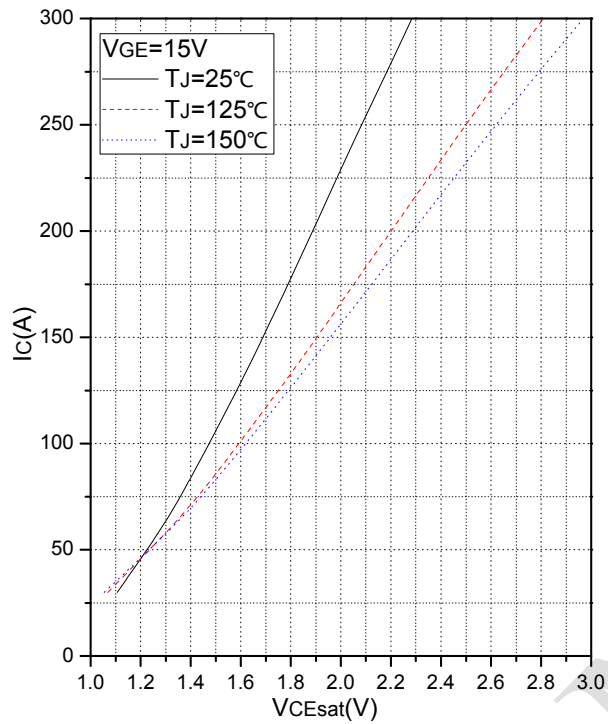


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

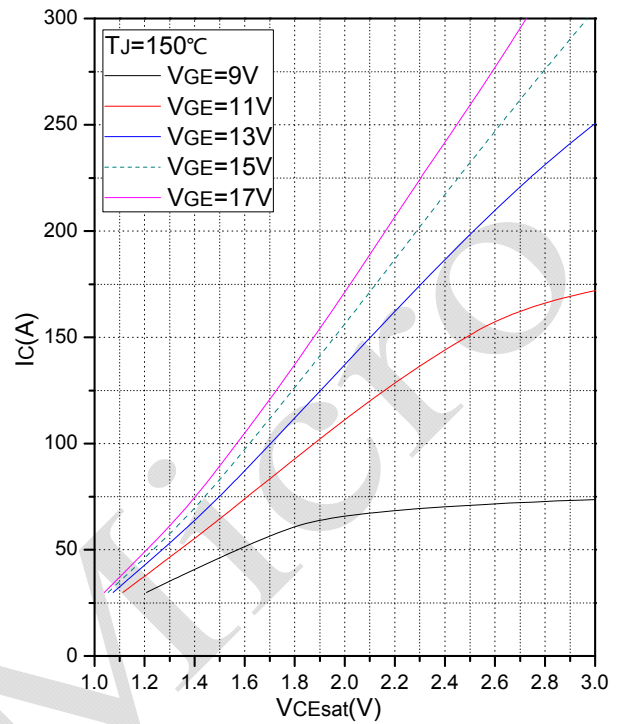


Fig.2 Typical Output Characteristics (Inverter)

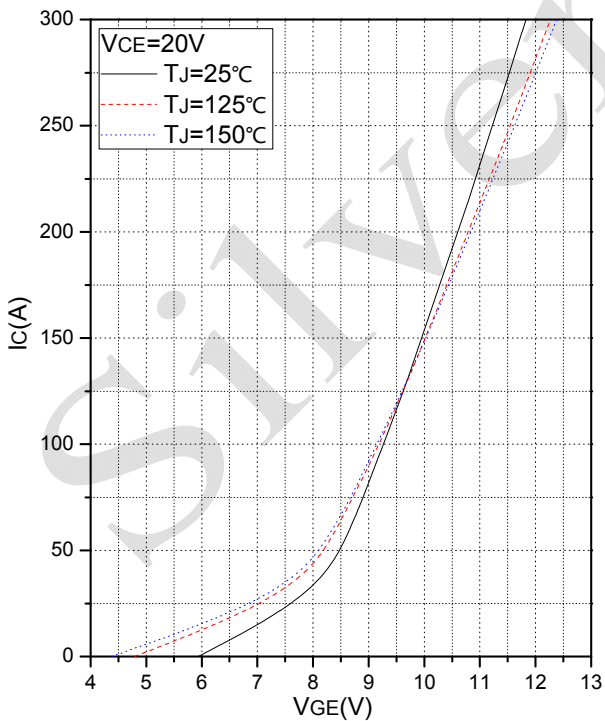


Fig.3 Transfer Characteristic (Inverter)

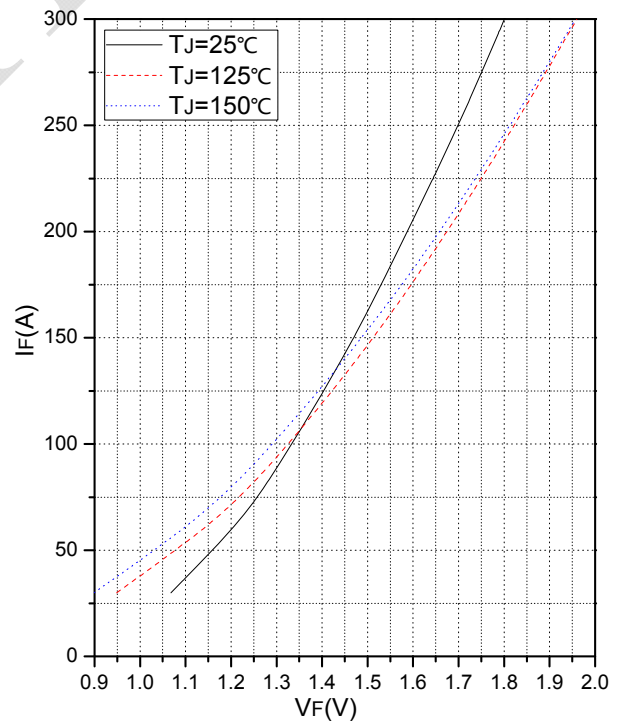


Fig.4 Forward Characteristics of Diode (Inverter)

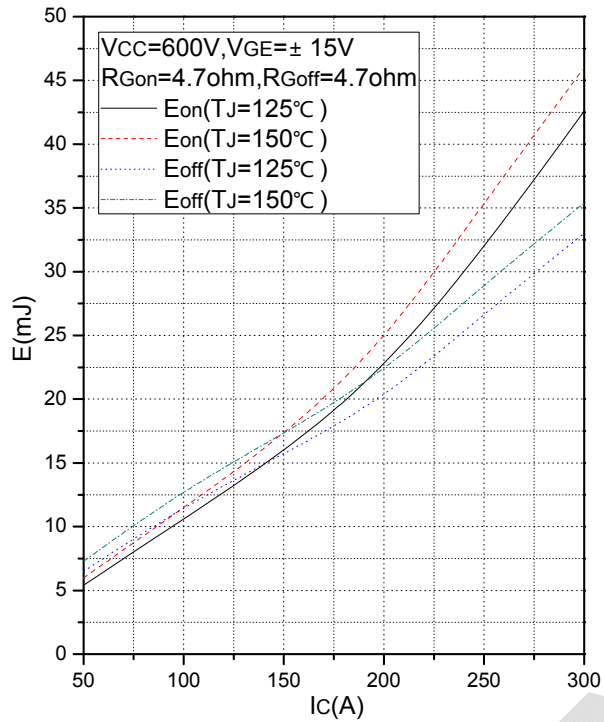


Fig.5 Typical Switching Loss vs. Collector Current

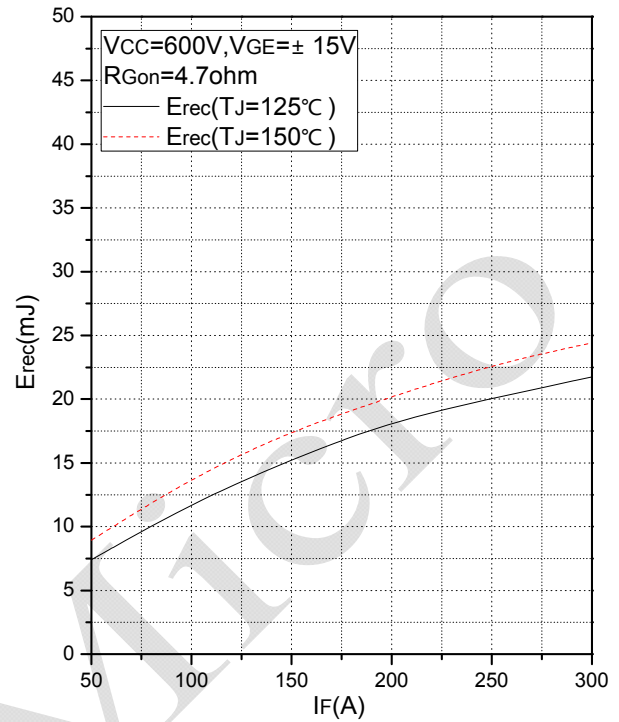


Fig.6 Typical Switching Loss vs. Forward Current

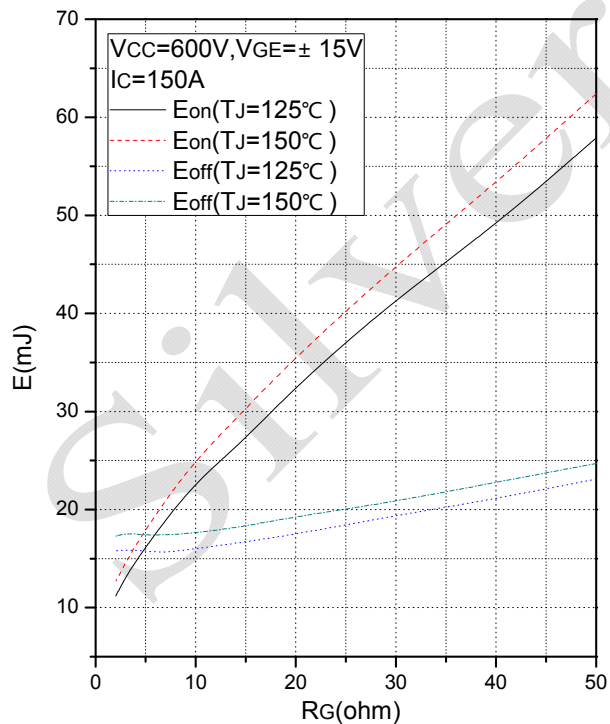


Fig.7 Typical Switching Loss vs. Gate Resistance

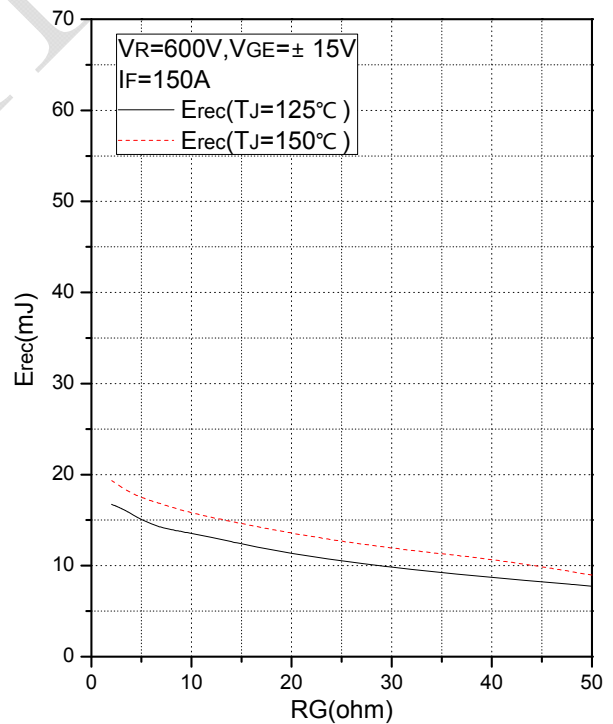


Fig.8 Typical Switching Loss vs. Gate Resistance

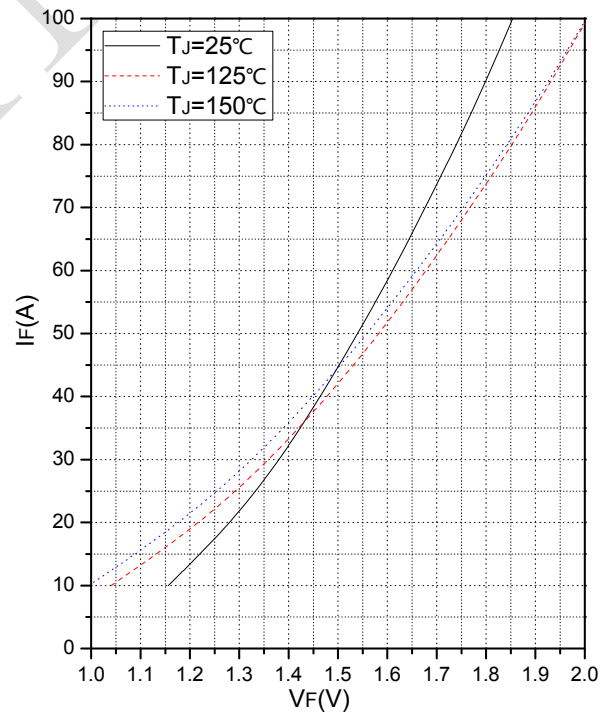
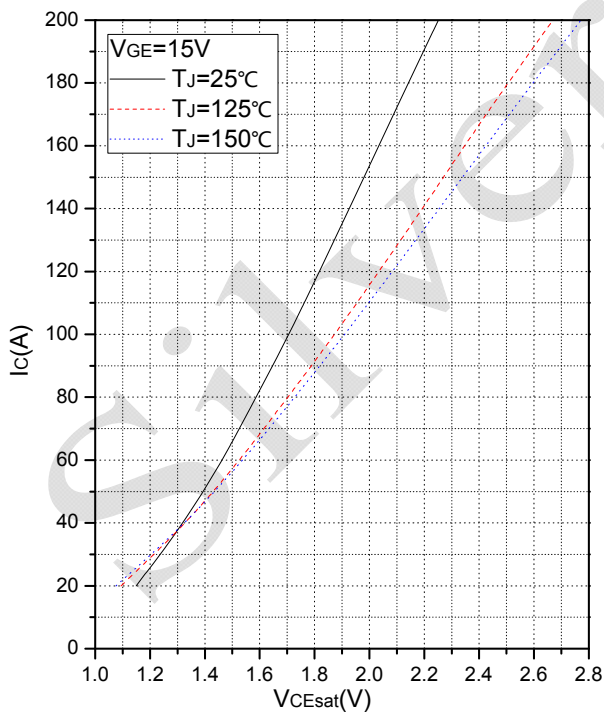
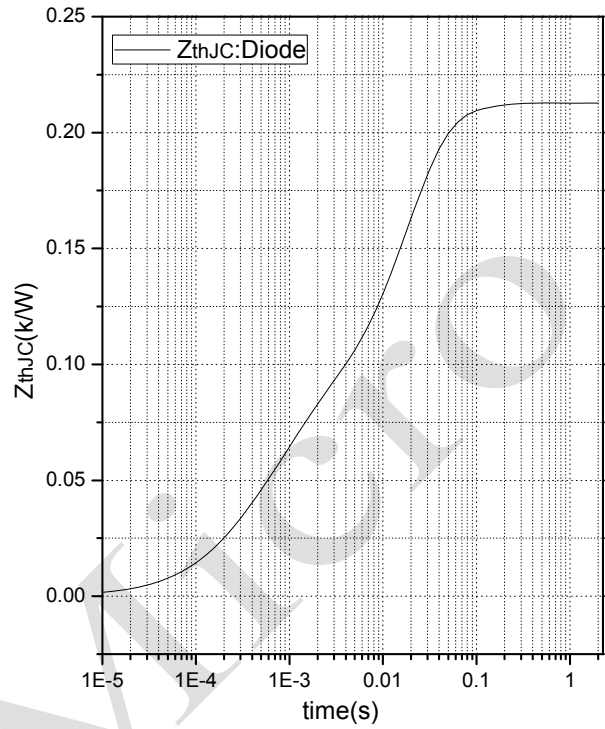
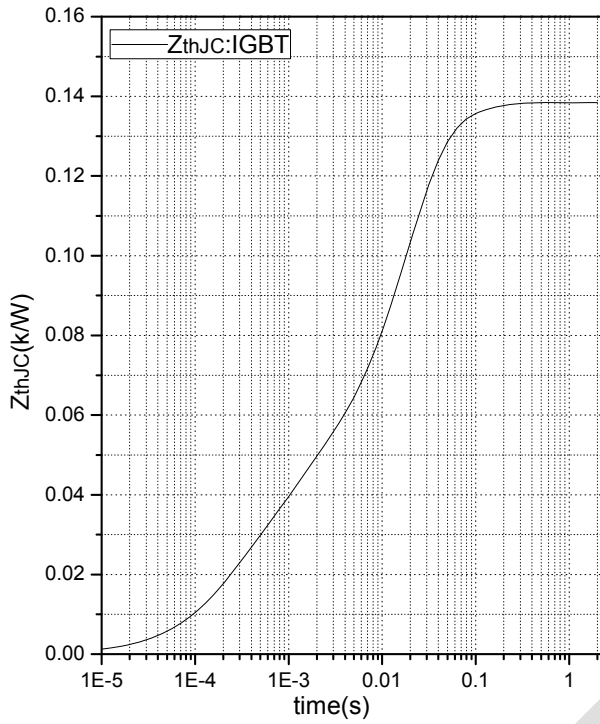


Fig.11 Typical Saturation Voltage Characteristics (Brake-Chopper) Fig.12 Forward Characteristics of Diode (Brake-Chopper)

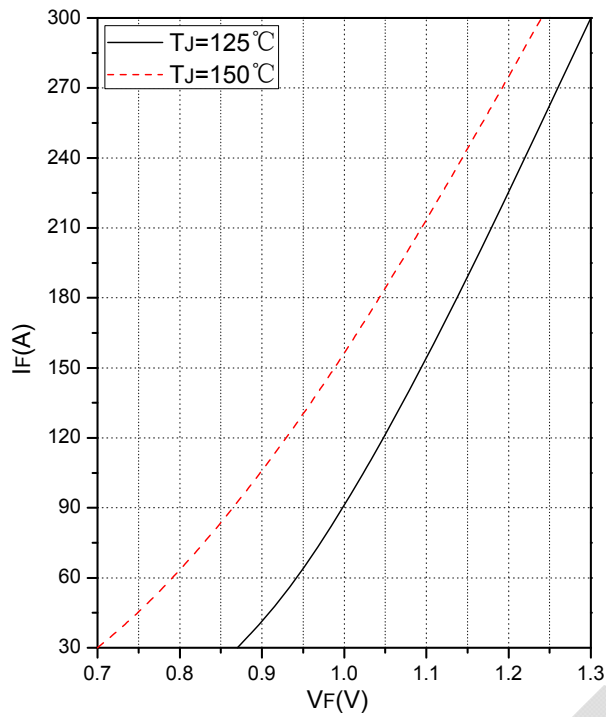


Fig.13 Forward Characteristics of Diode (Rectifier)

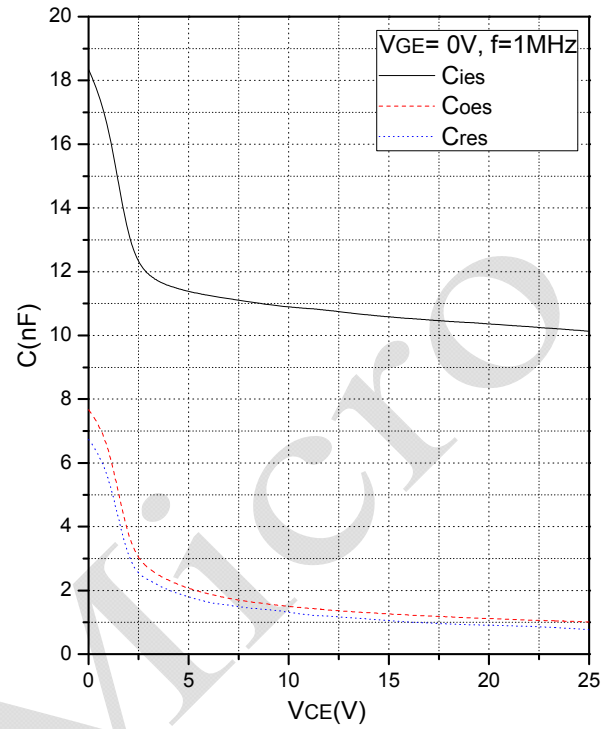


Fig.14 Reverse Bias Safe Operation Area (RBSOA)

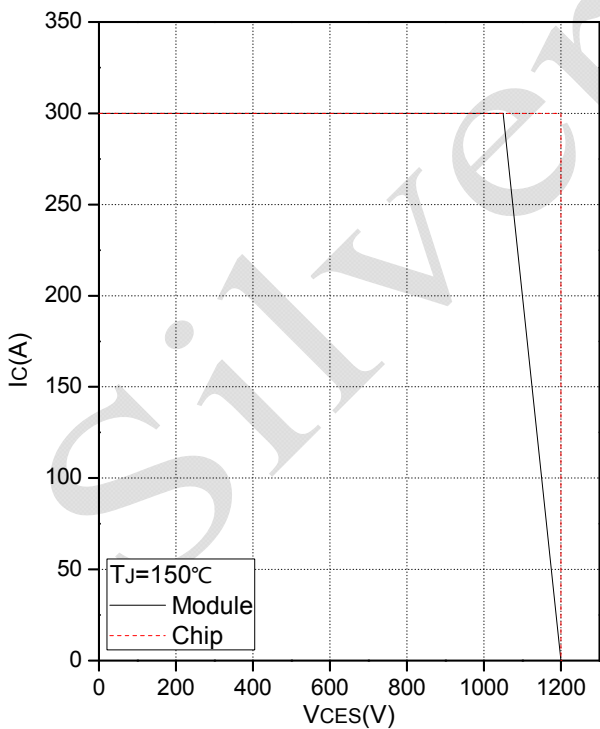


Fig.15 Reverse Bias Safe Operation Area (RBSOA)

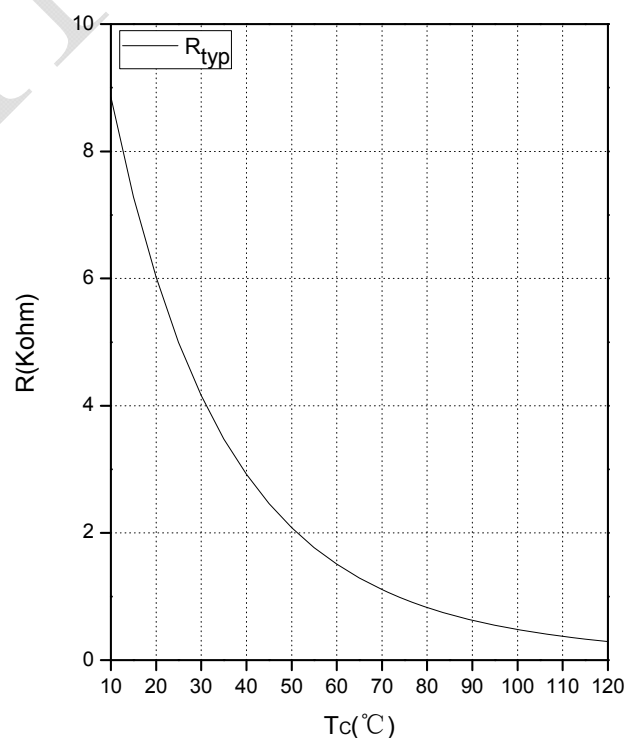
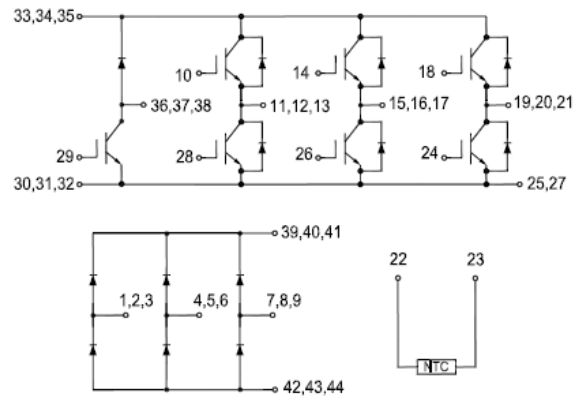
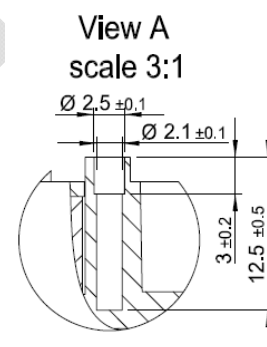
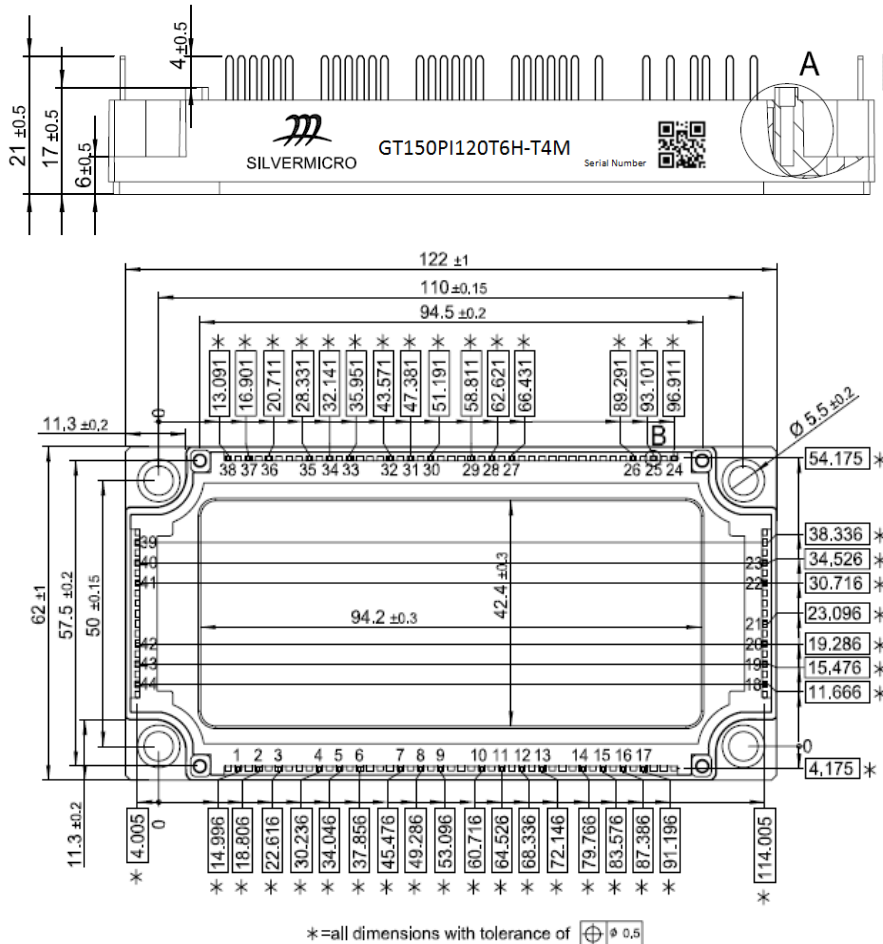


Fig.16 NTC Temperature Characteristics

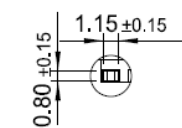
Internal Circuit:



Package Outline (Unit: mm):



View A
scale 3:1



View B
scale 3:1

Date	Revision	Notes
01/17/2019	01	Initial Release.
09/11/2019	A	Final Version.

Announcement

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