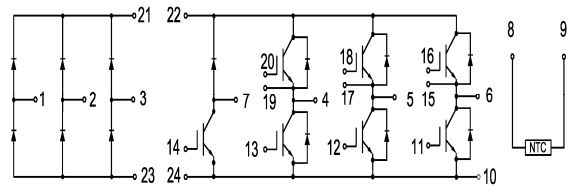


GTS40PI120T5H

IGBT Module

Features:

- Trench & Field Stop IGBT
- Short Circuit Rated >10 μ 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°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°C	40	A
		T _C = 25°C	75	A
I _{CM(1)}	Peak Collector Current Repetitive	T _J = 150°C	80	A
t _{SC}	Short Circuit Withstand Time		>10	μs
P _D	Maximum Power Dissipation per IGBT	T _C = 25°C T _{Jmax} = 150°C	280	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	$I_C = 4\text{mA}, V_{CE} = V_{GE}$	5.1	5.8	6.4	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 40\text{A}, V_{GE} = 15\text{V}$		1.90		V
		$T_J = 25^\circ\text{C}$				V
		$T_J = 125^\circ\text{C}$		2.30		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			6.1		nF
C_{oes}	Output Capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		0.58		nF
C_{res}	Reverse Transfer Capacitance			0.28		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 600\text{V}, I_C = 40\text{A}, R_{G(on)} = 4.7\Omega, V_{GE} = \pm 15\text{V},$ Inductive Load	$T_J = 25^\circ\text{C}$		130		ns
			$T_J = 125^\circ\text{C}$		132		
t_r	Rise Time	$V_{CC} = 600\text{V}, I_C = 40\text{A}, R_{G(off)} = 4.7\Omega, V_{GE} = \pm 15\text{V},$ Inductive Load	$T_J = 25^\circ\text{C}$		30		ns
			$T_J = 125^\circ\text{C}$		32		
$t_{d(off)}$	Turn-off Delay Time	$V_{CC} = 600\text{V}, I_C = 40\text{A}, R_{G(off)} = 4.7\Omega, V_{GE} = \pm 15\text{V},$ Inductive Load	$T_J = 25^\circ\text{C}$		210		ns
			$T_J = 125^\circ\text{C}$		220		
t_f	Fall Time	$V_{CC} = 600\text{V}, I_C = 40\text{A}, R_{G(off)} = 4.7\Omega, V_{GE} = \pm 15\text{V},$ Inductive Load	$T_J = 25^\circ\text{C}$		145		ns
			$T_J = 125^\circ\text{C}$		178		
E_{on}	Turn-on Switching Loss	$V_{CC} = 600\text{V}, I_C = 40\text{A}, R_{G(on)} = 4.7\Omega, V_{GE} = \pm 15\text{V},$ $di/dt = 1020\text{A}/\mu\text{s} (T_J = 125^\circ\text{C})$ Inductive Load	$T_J = 25^\circ\text{C}$		2.29		mJ
			$T_J = 125^\circ\text{C}$		2.85		
E_{off}	Turn-off Switching Loss	$V_{CC} = 600\text{V}, I_C = 40\text{A}, R_{G(off)} = 4.7\Omega, V_{GE} = \pm 15\text{V},$ $du/dt = 4180\text{V}/\mu\text{s} (T_J = 125^\circ\text{C})$ Inductive Load	$T_J = 25^\circ\text{C}$		0.61		mJ
			$T_J = 125^\circ\text{C}$		1.04		
Q_g	Total Gate Charge		$T_J = 25^\circ\text{C}$		662		nC
RBSOA	Reverse Bias Safe Operation Area	$I_C = 80\text{A}, V_{CC} = 1050\text{V}, V_p = 1200\text{V}, R_{G(off)} = 4.7\Omega, V_{GE} = +15\text{V to } 0\text{V}, T_J = 125^\circ\text{C}$	Trapezoid				
I_{SC}	SC data	$V_{CC} = 600\text{V}, V_{GE} = \pm 15\text{V}, tp = 10\mu\text{s}, R_{G(on)} = 15\Omega, R_{G(off)} = 15\Omega, T_J = 125^\circ\text{C}$		260			A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(per leg)			0.48			$^\circ\text{C}/\text{W}$

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	40	A
I_{FM}	Repetitive Peak Forward Current	80	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	$I_F = 40\text{A}$	$T_J = 25^{\circ}\text{C}$	1.80	2.10	V
			$T_J = 125^{\circ}\text{C}$	1.90		
I_{rr}	Peak Reverse Recovery Current	$I_F=40\text{A},$ $-diF /dt =1850\text{A}/\mu\text{s},$ $(T_J = 125^{\circ}\text{C})$ $V_{rr} = 600\text{V},$ $V_{GE} = -15\text{V}$	$T_J = 25^{\circ}\text{C}$	50		A
			$T_J = 125^{\circ}\text{C}$	60		
Q_{rr}	Reverse Recovery Charge	$I_F=40\text{A},$ $-diF /dt =1850\text{A}/\mu\text{s},$ $(T_J = 125^{\circ}\text{C})$ $V_{rr} = 600\text{V},$ $V_{GE} = -15\text{V}$	$T_J = 25^{\circ}\text{C}$	4.00		μC
E_{rec}	Reverse Recovery Energy		$T_J = 125^{\circ}\text{C}$	6.20		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case (per leg)		$T_J = 25^{\circ}\text{C}$	1.8		mJ
			$T_J = 125^{\circ}\text{C}$	3.5		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case (per leg)			0.68		$^{\circ}\text{C}/\text{W}$

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	$T_C = 100^{\circ}\text{C}$	15	A
		$T_C = 25^{\circ}\text{C}$	30	A
I_{CM}	Peak Collector Current Repetitive	$T_J = 175^{\circ}\text{C}$	30	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation (IGBT)	$T_C = 25^{\circ}\text{C}$ $T_{Jmax}=175^{\circ}\text{C}$	205	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	$I_C = 1 \text{ mA}, V_{CE} = V_{GE}$	4.5	5.5	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 15\text{A}, V_{GE} = 15\text{V}$	$T_J = 25^\circ\text{C}$	1.90	2.10	V
			$T_J = 125^\circ\text{C}$	2.20		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	$V_{GE} = \pm 20\text{V}, V_{CE} = 0\text{V}, T_J = 25^\circ\text{C}$			100	nA
C_{ies}	Input Capacitance	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		1.95		nF
C_{oes}	Output Capacitance			0.07		nF
C_{res}	Reverse Transfer Capacitance			0.04		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 600\text{V}, I_C = 15\text{A}, R_{Gon} = 15 \Omega, V_{GE} = \pm 15\text{V}, \text{Inductive Load}$	$T_J = 25^\circ\text{C}$		175		ns
			$T_J = 125^\circ\text{C}$		160		
t_r	Rise Time	$V_{CC} = 600\text{V}, I_C = 15\text{A}, R_{Gon} = 15 \Omega, V_{GE} = \pm 15\text{V}, \text{Inductive Load}$	$T_J = 25^\circ\text{C}$		50		ns
			$T_J = 125^\circ\text{C}$		55		
$t_{d(off)}$	Turn-off Delay Time	$V_{CC} = 600\text{V}, I_C = 15\text{A}, R_{Goff} = 15 \Omega, V_{GE} = \pm 15\text{V}, \text{Inductive Load}$	$T_J = 25^\circ\text{C}$		140		ns
			$T_J = 125^\circ\text{C}$		145		
t_f	Fall Time	$V_{CC} = 600\text{V}, I_C = 15\text{A}, R_{Goff} = 15 \Omega, V_{GE} = \pm 15\text{V}, \text{Inductive Load}$	$T_J = 25^\circ\text{C}$		245		ns
			$T_J = 125^\circ\text{C}$		380		
E_{on}	Turn-on Switching Loss	$V_{CC}=600\text{V}, I_C=15\text{A}, R_{Gon}=15 \Omega, V_{GE}=\pm 15\text{V}, di/dt=380\text{A}/\mu\text{s} (T_J=125^\circ\text{C}) \text{ Inductive Load}$	$T_J = 25^\circ\text{C}$		1.74		mJ
			$T_J = 125^\circ\text{C}$		2.08		
E_{off}	Turn-off Switching Loss	$V_{CC} = 600\text{V}, I_C = 15\text{A}, R_{Goff} = 15\Omega, V_{GE} = \pm 15\text{V}, du/dt=1360\text{V}/\mu\text{s} (T_J=125^\circ\text{C}) \text{ Inductive Load}$	$T_J = 25^\circ\text{C}$		0.63		mJ
			$T_J = 125^\circ\text{C}$		1.09		
Q_g	Total Gate Charge		$T_J = 25^\circ\text{C}$		140		nC
RBSOA	Reverse Bias Safe Operation Area	$I_C=30\text{A}, V_{CC}=1050\text{V}, V_p=1200\text{V}, R_{Goff} = 15\Omega, V_{GE}=+15\text{V to } 0\text{V}, T_J = 150^\circ\text{C}$	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)			0.73			$^\circ\text{C}/\text{W}$

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}	Repetitive Peak Forward Current	30	A

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

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_{FM}	Forward Voltage	$I_F=15\text{A}$	$T_J=25^\circ\text{C}$	1.60		V
			$T_J=125^\circ\text{C}$	1.70		
t_{rr}	Reverse Recovery Time		$T_J=25^\circ\text{C}$	241		ns
			$T_J=125^\circ\text{C}$	261		
I_{rr}	Peak Reverse Recovery Current	$I_F=15\text{A}$, $-di_F/dt=488\text{A}/\mu\text{s}$ ($T_J=125^\circ\text{C}$) $V_{rr} = 600\text{V}$, $V_{GE} = -15\text{V}$	$T_J=25^\circ\text{C}$	21.9		A
			$T_J=125^\circ\text{C}$	24.7		
Q_{rr}	Reverse Recovery Charge		$T_J=25^\circ\text{C}$	1.82		μC
			$T_J=125^\circ\text{C}$	2.37		
E_{rec}	Reverse Recovery Energy		$T_J=25^\circ\text{C}$	0.74		mJ
			$T_J=125^\circ\text{C}$	1.28		
$R_{\theta JC}$	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	$T_J = 25^\circ\text{C}$	1800	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	$T_J = 80^\circ\text{C}$	50	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	$T_J = 80^\circ\text{C}$	60	A
I_{FSM}	Surge Current @ $t_p=10$ ms	$T_J = 25^\circ\text{C}$	420	A
		$T_J = 150^\circ\text{C}$	350	
I^2t	I^2t - value	$T_J = 25^\circ\text{C}$	900	A^2s
		$T_J = 150^\circ\text{C}$	650	

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

V_F	Forward Voltage	$I_F=25\text{A}$	$T_J=25^\circ\text{C}$	1.10			V
			$T_J=150^\circ\text{C}$	1.05			
I_R	Reverse Current	$V_R=1600\text{V}$	$T_J=25^\circ\text{C}$			1	mA
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case				0.71		$^\circ\text{C}/\text{W}$

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)	$f=50\text{Hz}$, 1minute	2500		V
L_{sCE}	Stray Inductance Module			20	nH
T_J	Maximum Junction Temperature			175	$^\circ\text{C}$
T_{JOP}	Maximum Operating Junction Temperature Range		-40	+150	$^\circ\text{C}$
T_{stg}	Storage Temperature		-40	+125	$^\circ\text{C}$
CTI	Comparative Tracking Index		200		
$R_{\theta CS}$	Case-To-Sink Thermally (Conductive Grease Applied)			0.1	$^\circ\text{C}/\text{W}$
M	Mounting Screw:M5		3.0	5.0	N·m
G	Weight			200	g

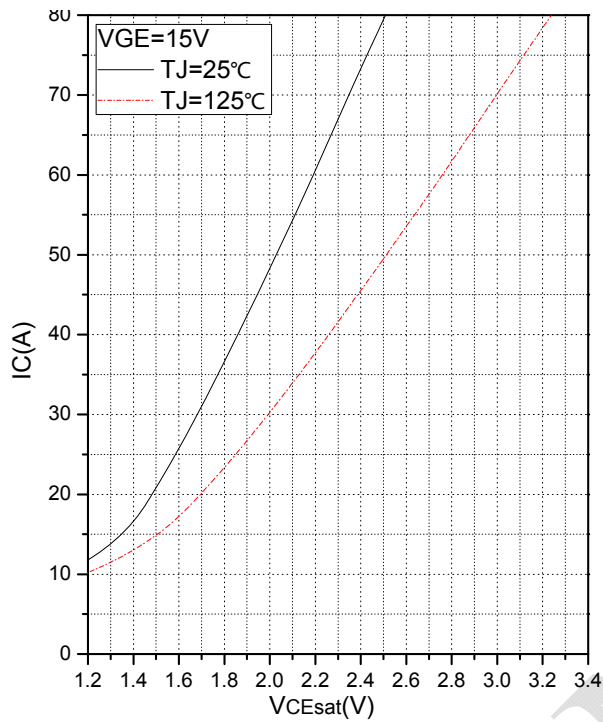


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

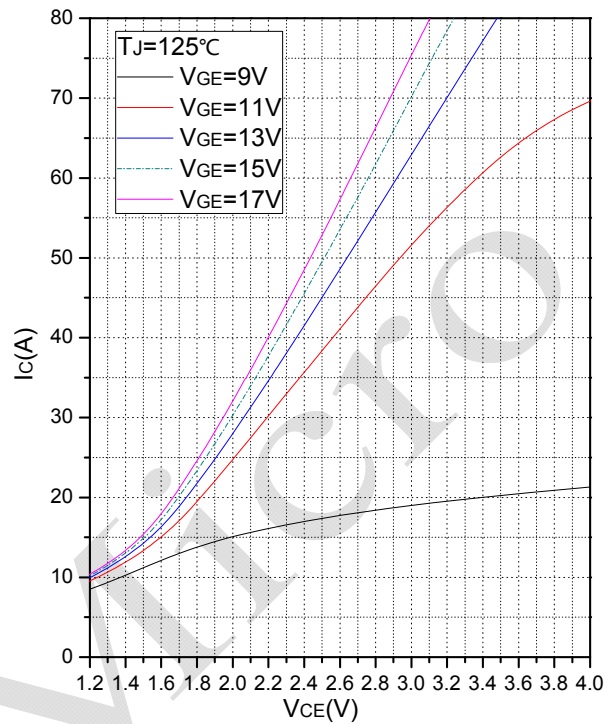


Fig.2 Typical Output Characteristics (Inverter)

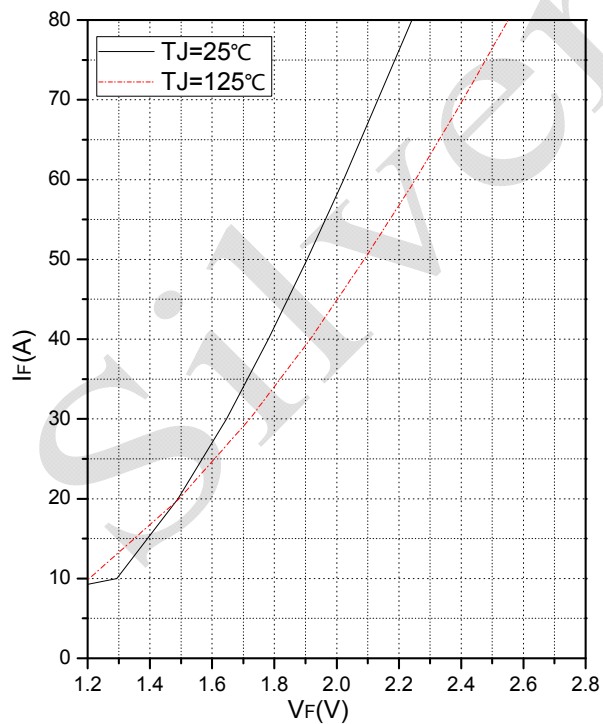


Fig.3 Forward Characteristics of FWD (Inverter)

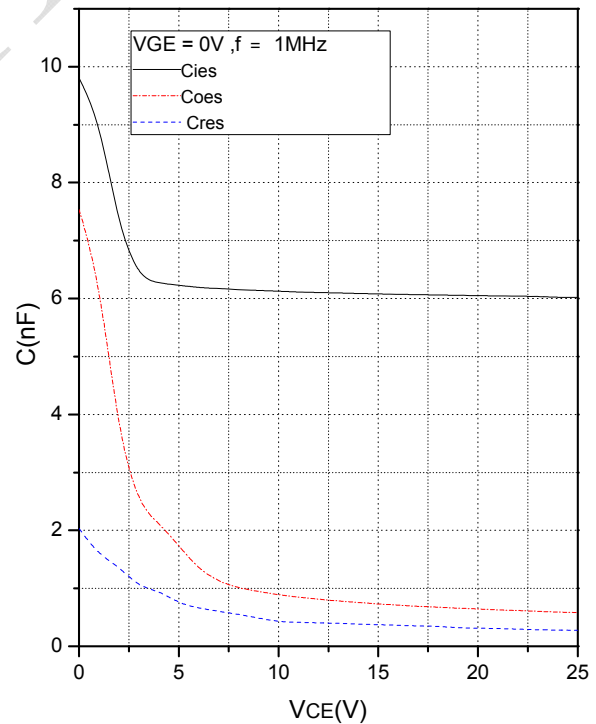


Fig.4 Capacitance Characteristics

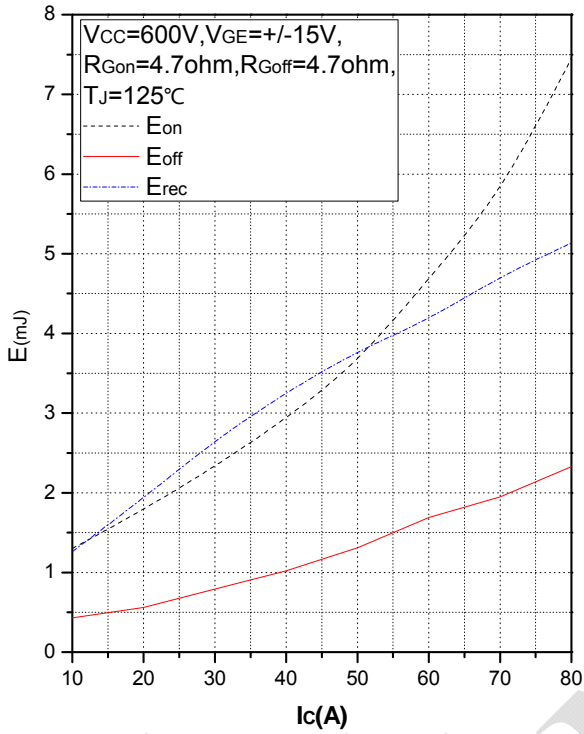


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

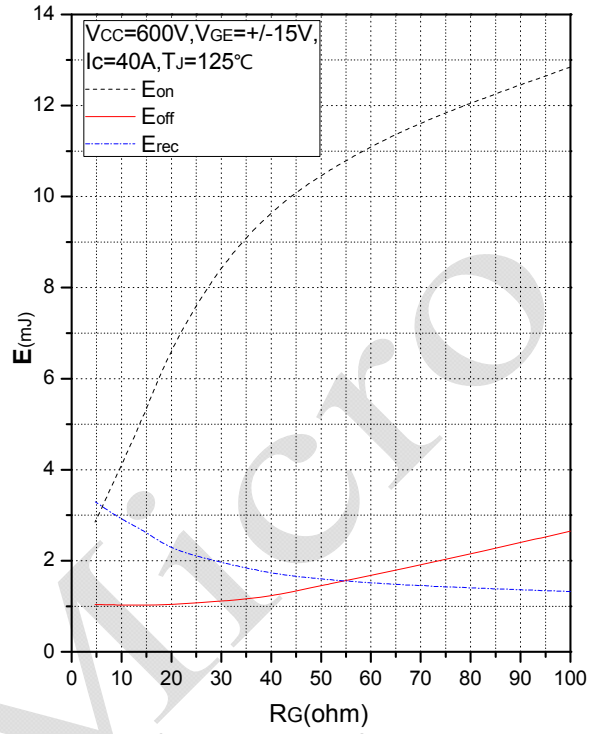


Fig.6 Typical Switching Loss vs. Gate Resistance (Inverter)

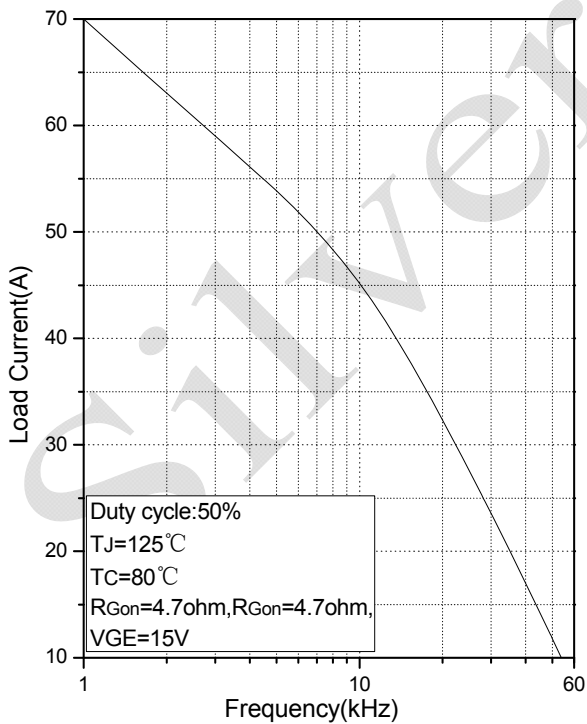


Fig.7 Typical Load Current vs. Frequency

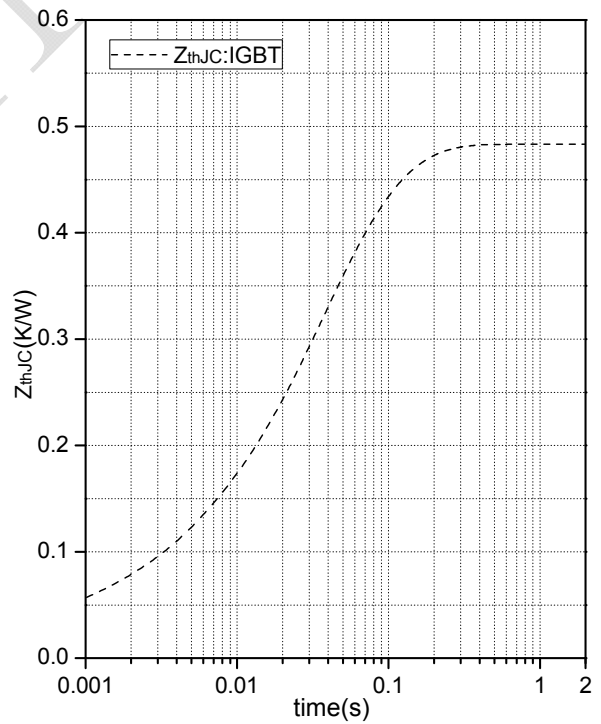


Fig.8 Transient Thermal Impedance (Inverter-IGBT)

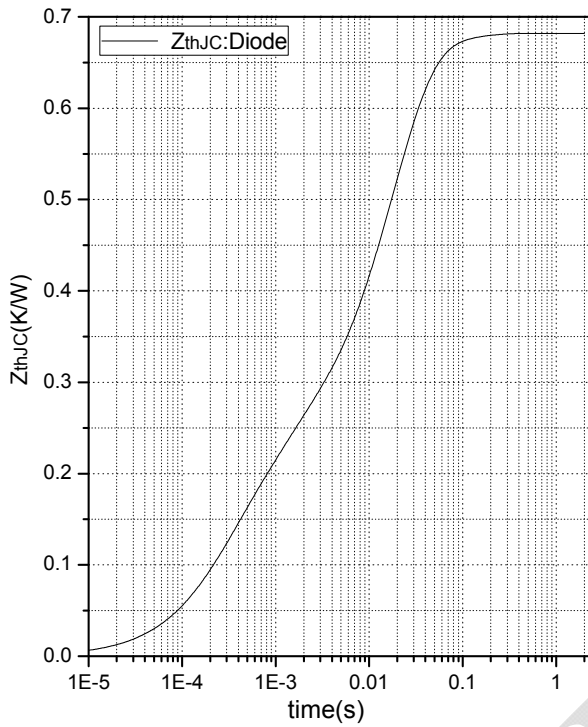


Fig.9 Transient Thermal Impedance (Inverter-Diode)

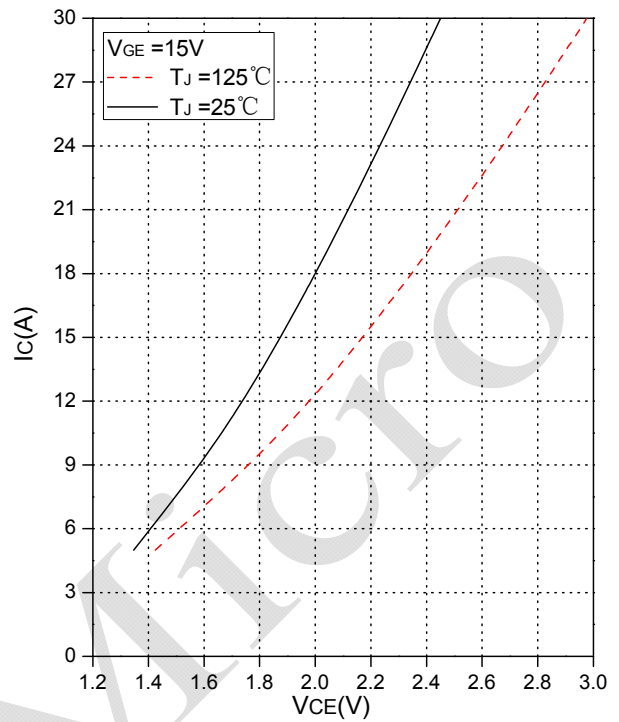


Fig.10 Typical Saturation Voltage Characteristics (Brake-Chopper)

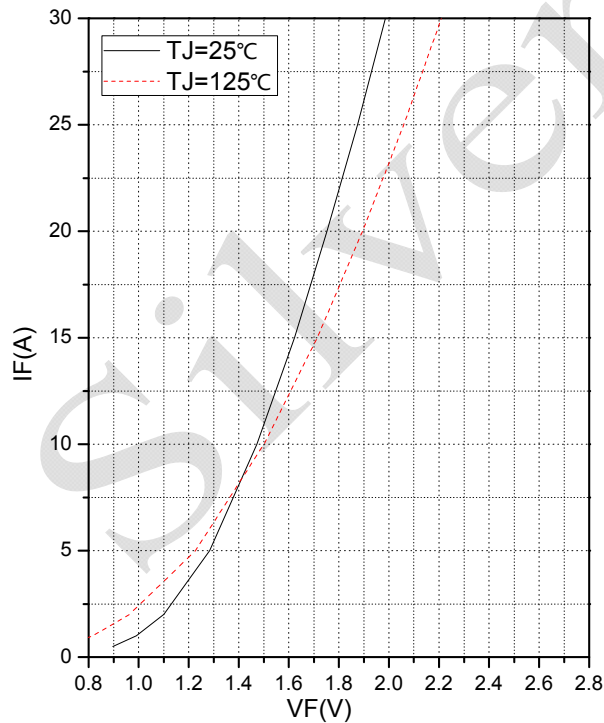


Fig.11 Forward Characteristics of Diode (Brake-Chopper)

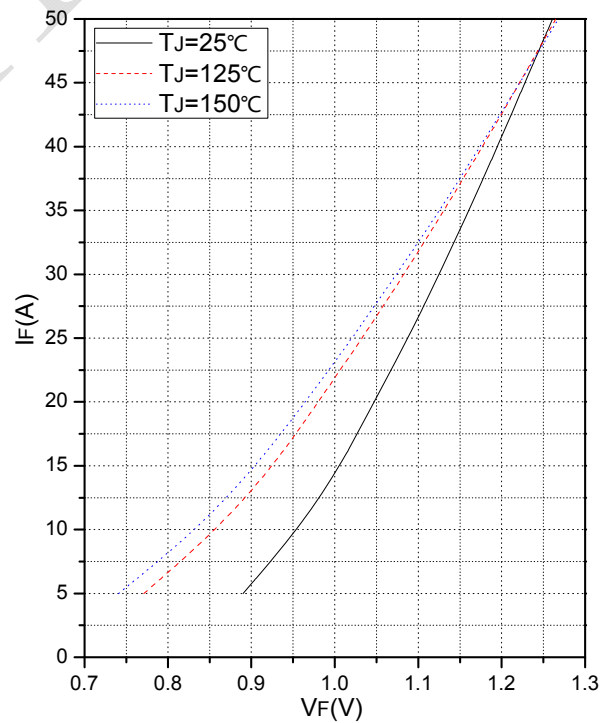


Fig.12 Forward Characteristics of Diode (Rectifier)

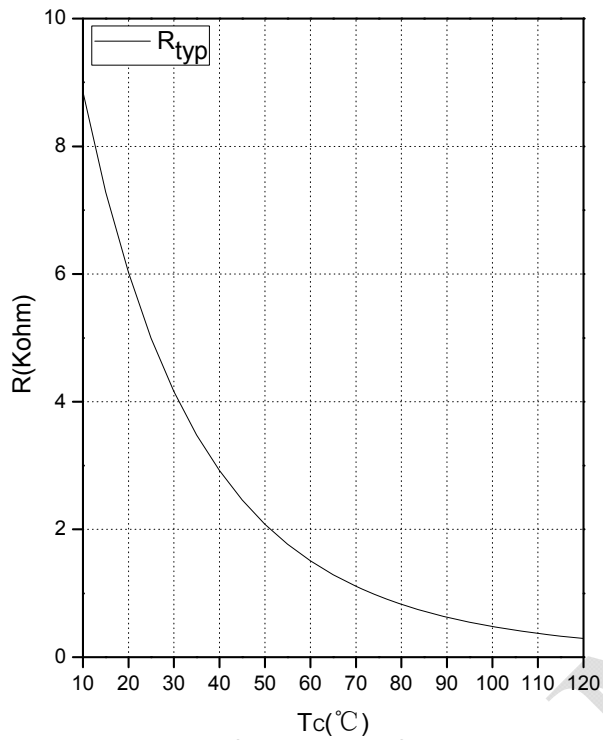


Fig.13 NTC Temperature Characteristics

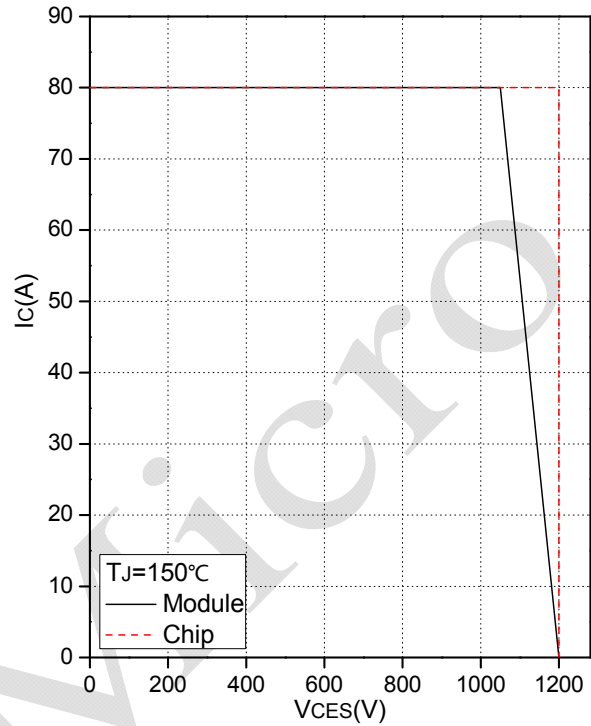
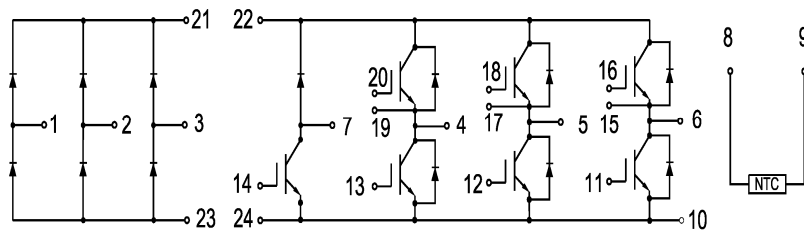
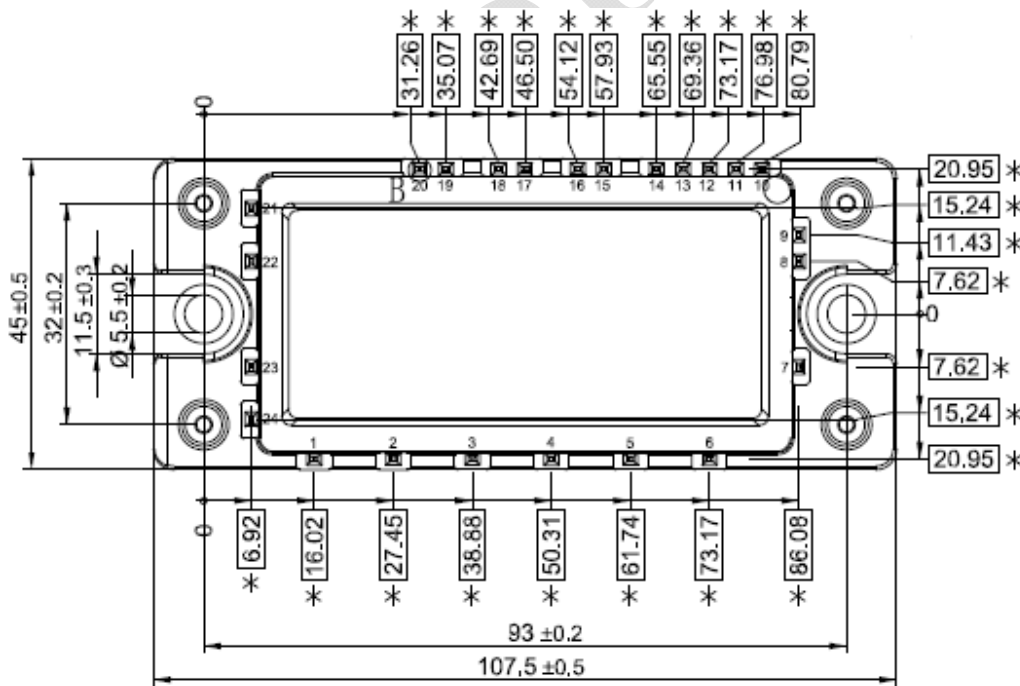
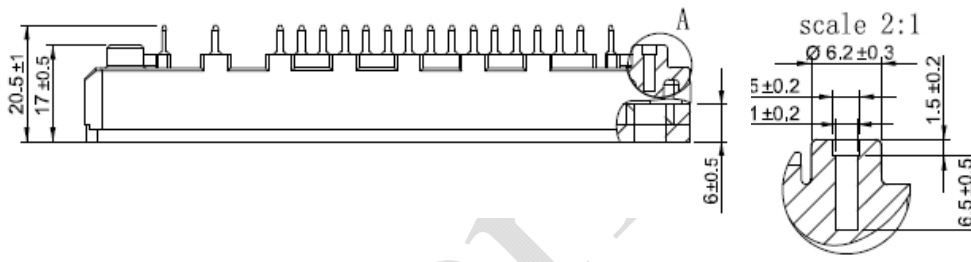
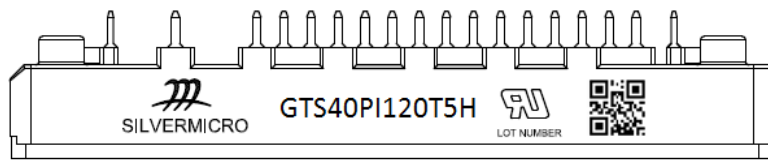


Fig.14 Reverse Bias Safe Operation Area (RBSOA)

Internal Circuit:



Package Outline (Unit: mm):



*=all dimensions with tolerance of ± 0.4



Date	Revision	Notes
05/24//2019	A	Final Version

Announcement

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