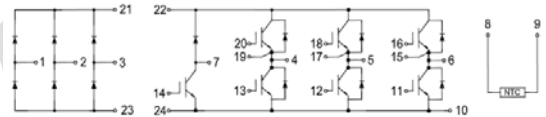
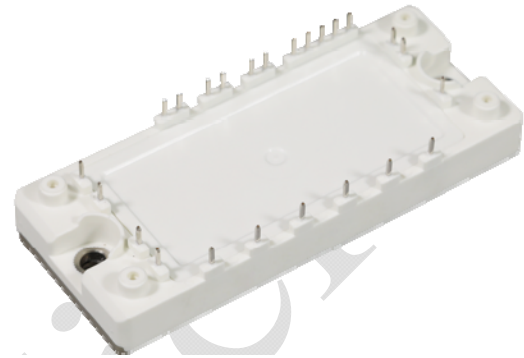


GT40PI120T5H

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

V _{CES}	Collector-Emitter Blocking Voltage	T _J =25°C	1200	V
V _{GES}	Gate-Emitter Voltage		±20	V
I _C	Continuous Collector Current	T _C = 100°C	40	A
		T _C = 25°C	80	A
I _{CM}	Peak Collector Current Repetitive	t _p =1ms	80	A
t _{SC}	Short Circuit Withstand Time		>10	μs
P _D	Maximum Power Dissipation per IGBT	T _C = 25°C T _{Jmax} =175°C	319	W

Electrical Characteristics of IGBT

Static Characteristics

Symbol	Description	Conditions	Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1mA, V_{CE}=V_{GE}, T_J=25^{\circ}C$	5.0	5.8	6.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=40A, V_{GE}=15V$	$T_J=25^{\circ}C$	2.05		V
			$T_J=125^{\circ}C$	2.45		V
			$T_J=150^{\circ}C$	2.55		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	$V_{CE}=25V, V_{GE}=0V, f=100kHz, T_J=25^{\circ}C$		2.83		nF
C_{oes}	Output Capacitance			0.22		nF
C_{res}	Reverse Transfer Capacitance			0.08		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 600V, I_C = 40A,$ $R_{G\ on} = 30\Omega, V_{GE} = \pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		104		ns
			$T_J=125^{\circ}C$		102		
			$T_J=150^{\circ}C$		110		
t_r	Rise Time		$T_J=25^{\circ}C$		76		ns
			$T_J=125^{\circ}C$		77		
			$T_J=150^{\circ}C$		90		
$t_{d(off)}$	Turn-off Delay Time		$T_J=25^{\circ}C$		219		ns
			$T_J=125^{\circ}C$		226		
			$T_J=150^{\circ}C$		243		
t_f	Fall Time	$T_J=25^{\circ}C$		251		ns	
		$T_J=125^{\circ}C$		398			
		$T_J=150^{\circ}C$		428			
E_{on}	Turn-on Switching Loss	$V_{CC}=600V, I_C=40A,$ $R_{G\ on}=30\Omega, V_{GE}= \pm 15V,$ $di/dt=354A/\mu s$ ($T_J=150^{\circ}C$) Inductive Load	$T_J=25^{\circ}C$		4.93		mJ
		$T_J=125^{\circ}C$		5.80			
		$T_J=150^{\circ}C$		6.60			

E _{off}	Turn-off Switching Loss	V _{CC} = 600V, I _C = 40A, R _{Goff} = 30Ω, V _{GE} = ±15V, du/dt=3140V/μs (T _J =150°C) Inductive Load	T _J =25°C		2.35		mJ
			T _J =125°C		3.17		
			T _J =150°C		3.43		
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25°C		494		nC
RBSOA	I _C =80A, V _{CC} =1050V, V _p =1200V, R _G =30 Ω, V _{GE} =+15V to 0V, T _J =125°C			Trapezoid			
I _{SC}	V _{CC} =600V, V _{GE} =15V, T _J =150°C			10			μs
R _{θJC}	IGBT Thermal Resistance: Junction-To-Case(per leg)				0.47		°C/W

Diode, Inverter Maximum Rated Values

V _{RRM}	Repetitive Peak Reverse Voltage	T _J =25°C	1200	V
I _F	Diode Continuous Forward Current		40	A
I _{FM}	Repetitive Peak Forward Current	tp=1ms	80	A

Electrical Characteristics of FWD

Symbol	Description	Conditions		Min	Typ	Max	Unit
V _{FM}	Forward Voltage	I _F = 40A	T _J =25℃		2.00		V
			T _J =125℃		2.15		
			T _J =150℃		2.15		
t _{rr}	Reverse Recovery Time	I _F =40A, -diF /dt =615A/μs,(T _J =150℃) V _{rr} = 600V, V _{GE} = -15V	T _J =25℃		387		ns
			T _J =125℃		600		
			T _J =150℃		623		
I _{rr}	Peak Reverse Recovery Current		T _J =25℃		16.2		A
			T _J =125℃		21.2		
			T _J =150℃		22.5		
Q _{rr}	Reverse Recovery Charge		T _J =25℃		2.52		μC
			T _J =125℃		4.74		
			T _J =150℃		5.53		

E _{rec}	Reverse Recovery Energy	I _F =40A, -diF /dt =615A/μs,(T _J =150℃) V _{rr} = 600V, V _{GE} = -15V	T _J =25℃		0.53		mJ
			T _J =125℃		1.26		
			T _J =150℃		1.62		
R _{θJC}	Diode Thermal Resistance: Junction-To-Case (per leg)				0.68		℃/W

IGBT, Brake-Chopper Maximum Rated Values

V_{CES}	Collector-Emitter Blocking Voltage	$T_J=25^\circ C$	1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C=100^\circ C$	15	A
		$T_C=25^\circ C$	30	A
I_{CM}	Repetitive Peak Collector Current	$t_p=1ms$	30	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	$T_C=25^\circ C$ $T_{Jmax}=175^\circ C$	170	W

Electrical Characteristics of IGBT

Static Characteristics

Symbol	Description	Conditions	Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1mA$, $V_{CE}=V_{GE}$, $T_J=25^\circ C$	5.0	5.6	6.5	V
$V_{CESat(Terminal)}$	Collector-Emitter Saturation Voltage	$I_C=15A$, $V_{GE}=15V$	$T_J=25^\circ C$	1.90		V
			$T_J=125^\circ C$	2.20		V
			$T_J=150^\circ C$	2.30		
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	$V_{CE}=25V$, $V_{GE}=0V$, $f=100kHz$, $T_J=25^\circ C$		1.14		nF
C_{oes}	Output Capacitance			0.16		nF
C_{res}	Reverse Transfer Capacitance			0.04		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 600V, I_C = 15A,$ $R_{Gon} = 36\Omega, V_{GE} = \pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		76		ns	
			$T_J=125^{\circ}C$		73			
			$T_J=150^{\circ}C$		72			
t_r	Rise Time		$T_J=25^{\circ}C$		34		ns	
			$T_J=125^{\circ}C$		40			
			$T_J=150^{\circ}C$		40			
$t_{d(off)}$	Turn-off Delay Time	$V_{CC} = 600V, I_C = 15A,$ $R_{Goff} = 36\Omega, V_{GE} = \pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		118		ns	
			$T_J=125^{\circ}C$		136			
			$T_J=150^{\circ}C$		136			
t_f	Fall Time		$T_J=25^{\circ}C$		331		ns	
			$T_J=125^{\circ}C$		407			
			$T_J=150^{\circ}C$		409			
E_{on}	Turn-on Switching Loss	$T_J=25^{\circ}C$		1.51		mJ		
		$T_J=125^{\circ}C$		1.75				
		$T_J=150^{\circ}C$		1.79				
E_{off}	Turn-off Switching Loss	$T_J=25^{\circ}C$		0.88		mJ		
		$T_J=125^{\circ}C$		1.17				
		$T_J=150^{\circ}C$		1.27				
Q_g	Total Gate Charge	$V_{GE}=+15V...-15V$				85		nC
RBSOA	$I_C=30A, V_{CC}=1050V, V_p=1200V, R_G= 36\Omega, V_{GE}=+15V \text{ to } 0V, T_J =150^{\circ}C$				Trapezoid			
SCSOA	$V_{CC}=600V, t_p=10\mu s, V_{GE}=\pm 15V, R_G= 36\Omega, T_J =125^{\circ}C$					75		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(per leg)					0.88		$^{\circ}C/W$

Diode, Brake-Chopper Maximum Rated Values

V_{RRM}	Repetitive Peak Reverse Voltage	$T_J = 25^\circ C$	1200	V
I_F	Diode Continuous Forward Current		10	A
I_{FM}	Diode Maximum Forward Current	$t_p = 1ms$	20	A

Electrical Characteristics of FWD

Symbol	Description	Conditions		Min	Typ	Max	Unit
$V_{FM(terminal)}$	Forward Voltage	$I_F=10A$	$T_J=25^{\circ}C$		1.80		V
			$T_J=125^{\circ}C$		1.90		
			$T_J=150^{\circ}C$		1.90		
t_{rr}	Reverse Recovery Time	$I_F=10A$, -diF/dt=252A/μs($T_J=150^{\circ}C$) $V_R= 600V$, $V_{GE} = -15V$	$T_J=25^{\circ}C$		381		ns
			$T_J=125^{\circ}C$		490		
			$T_J=150^{\circ}C$		494		
I_{rr}	Peak Reverse Recovery Current		$T_J=25^{\circ}C$		9.02		A
			$T_J=125^{\circ}C$		11.52		
			$T_J=150^{\circ}C$		10.43		
Q_{rr}	Reverse Recovery Charge		$T_J=25^{\circ}C$		1.34		μC
			$T_J=125^{\circ}C$		2.12		
			$T_J=150^{\circ}C$		2.58		
E_{rec}	Reverse Recovery Energy		$T_J=25^{\circ}C$		0.47		mJ
			$T_J=125^{\circ}C$		0.85		
			$T_J=150^{\circ}C$		1.12		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case (per leg)				1.45		°C/W

Diode, Rectifier

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

V_{RRM}	Repetitive Peak Reverse Voltage	$T_J=25^{\circ}C$	1800	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	$T_J=80^{\circ}C$	50	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	$T_J=80^{\circ}C$	60	A
I_{FSM}	Surge Current @ $t_p=10$ ms	$T_J=25^{\circ}C$	420	A
		$T_J=150^{\circ}C$	350	
I^2t	I^2t - value	$T_J=25^{\circ}C$	900	A^2s
		$T_J=150^{\circ}C$	650	

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

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_F	Forward Voltage	$I_F=25\text{A}$	$T_J=25^{\circ}\text{C}$	1.10		V
			$T_J=125^{\circ}\text{C}$	1.05		
			$T_J=150^{\circ}\text{C}$	1.00		
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)	2500			V
L_{sCE}	Stray Inductance Module		60		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

Ordering Information Table

Device code	G	T	40	PI	120	T5	H
	①	②	③	④	⑤	⑥	⑦

- ① - IGBT Module
- ② - Trench & Field Stop IGBT IGBT
- ③ - Rated Current (40=40A)
- ④ - Circuit Configuration: PI (Power Integrated)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)

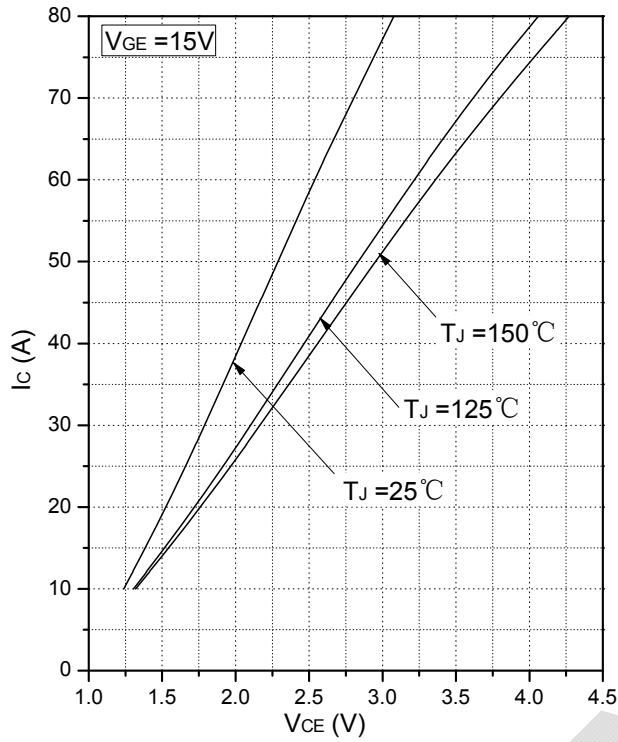


Fig.1 Typical Saturation Voltage Characteristics

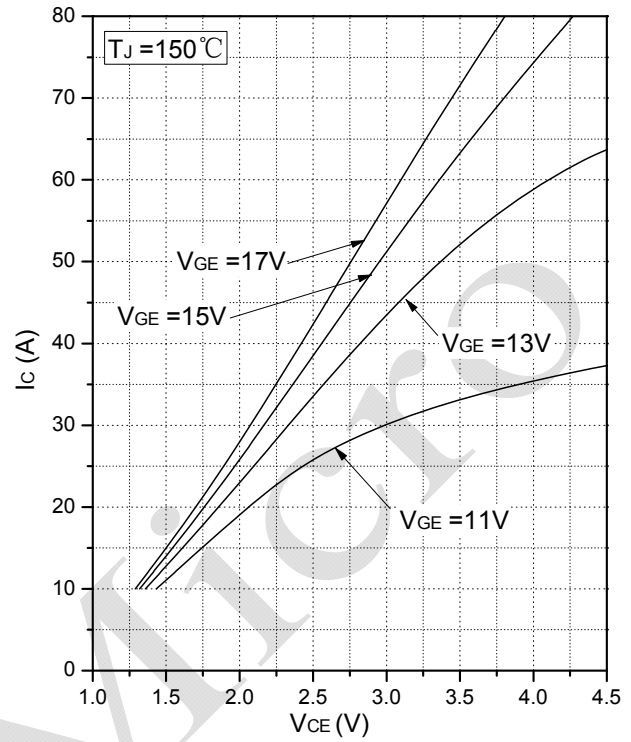


Fig.2 Typical Output Characteristics

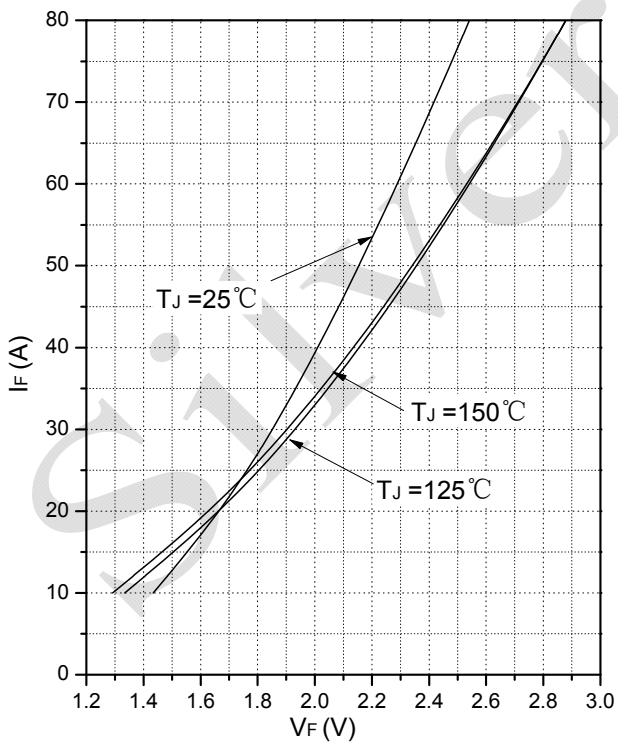


Fig.3 Forward Characteristics of Diode

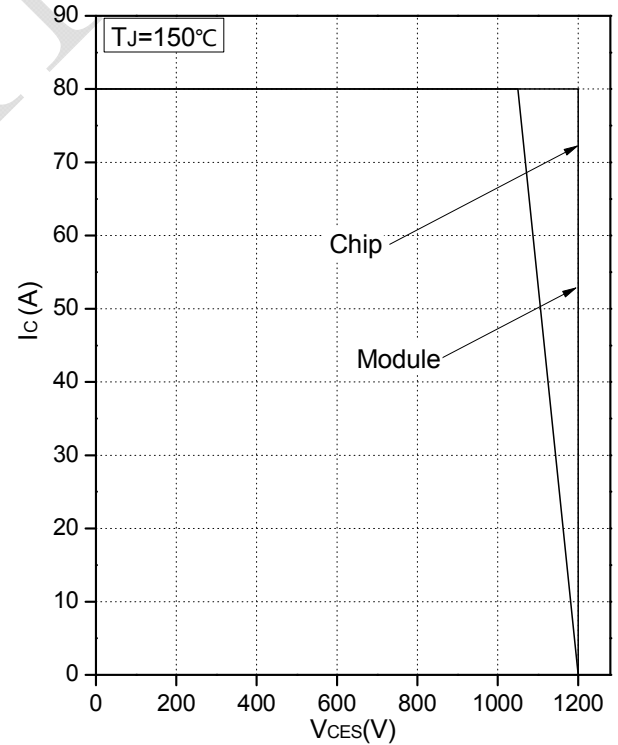


Fig.4 Reverse Bias Safe Operation Area (RBSOA)

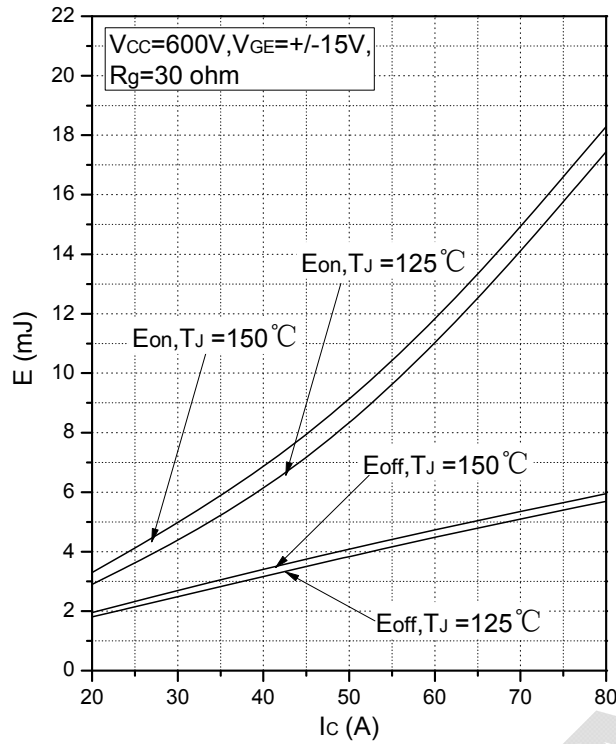


Fig.5 Typical Switching Loss vs. Collector Current

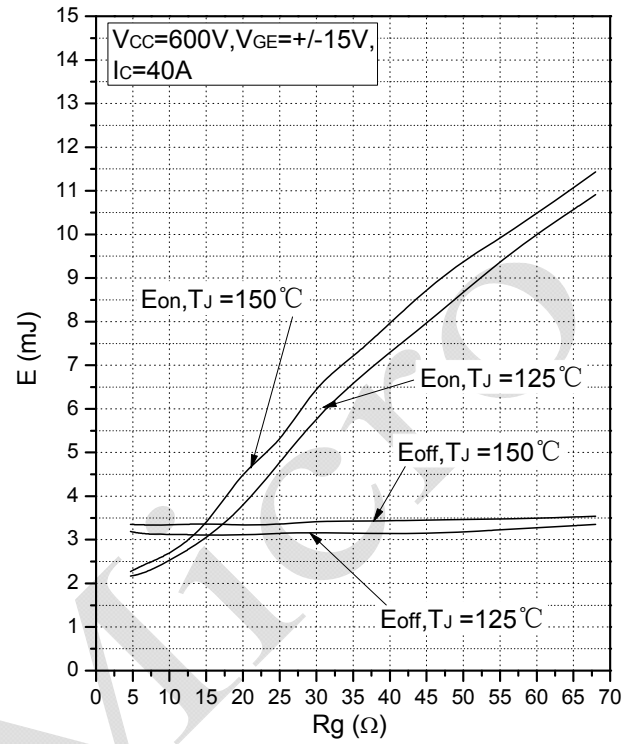


Fig.6 Typical Switching Loss vs. Gate Resistance

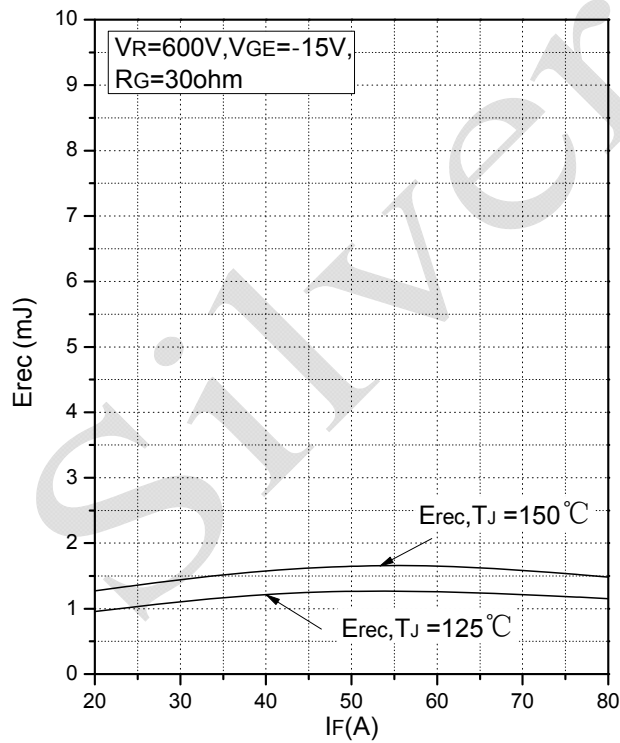


Fig.7 Typical Switching Loss vs. Forward Current

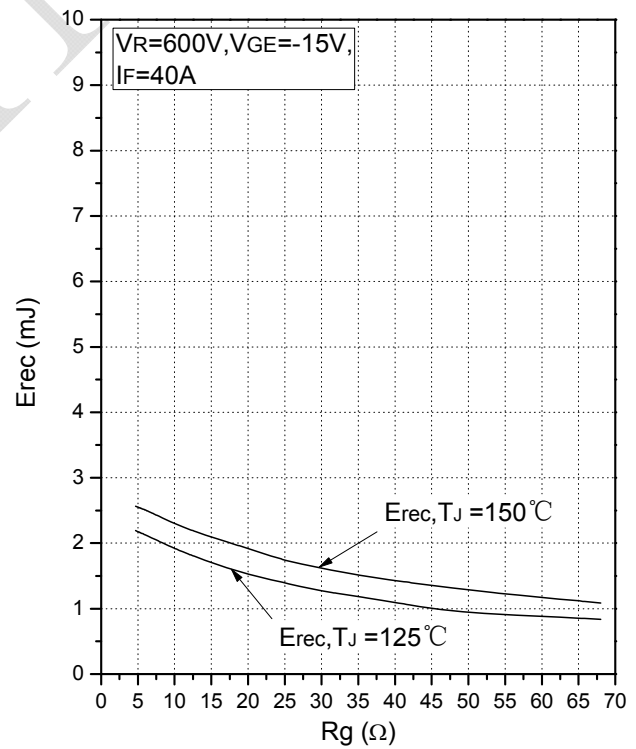
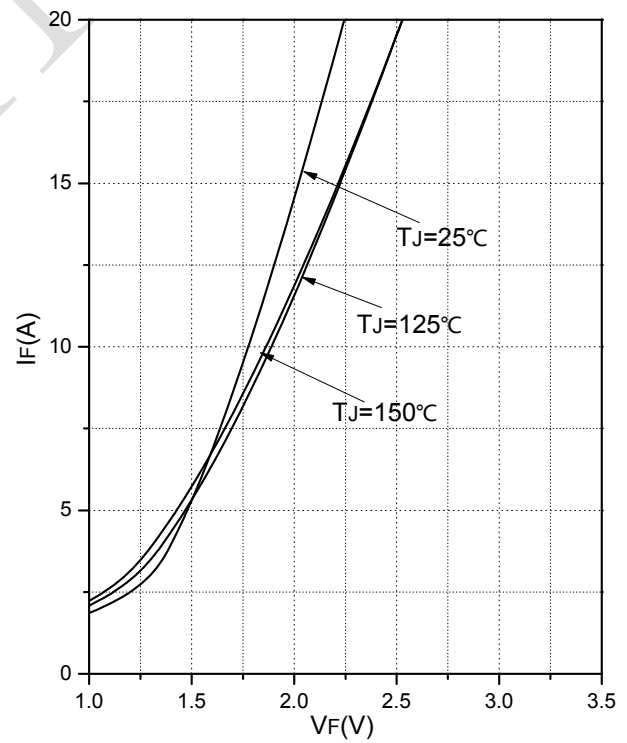
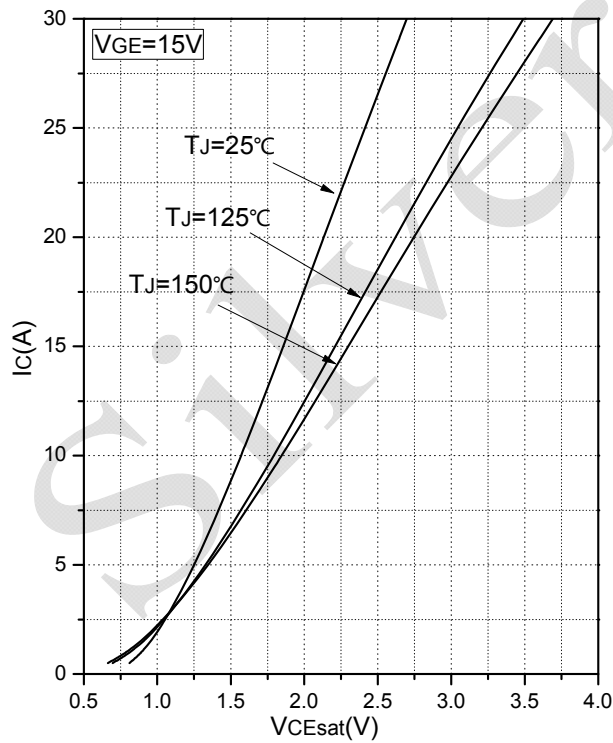
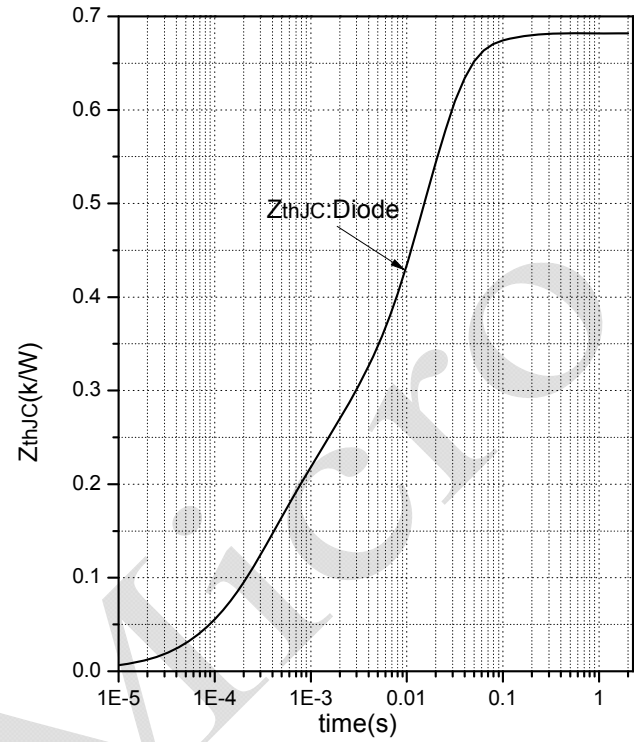
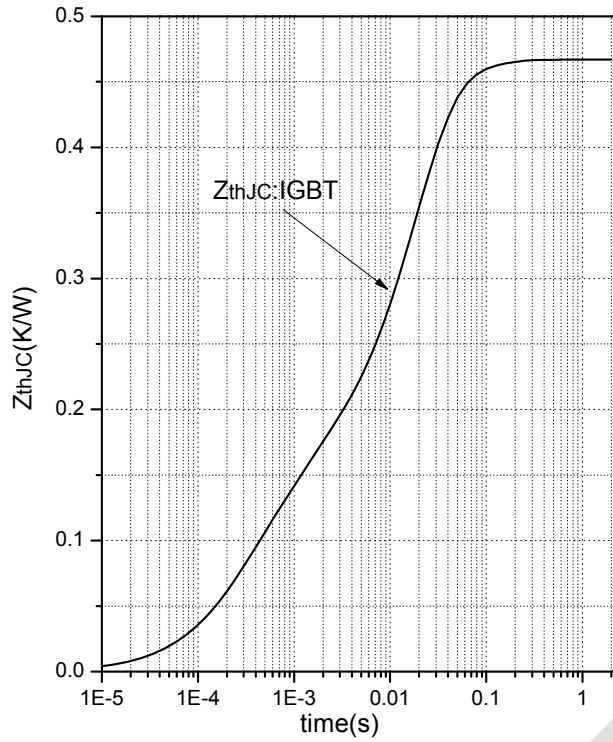


Fig.8 Typical Switching Loss vs. Gate Resistance



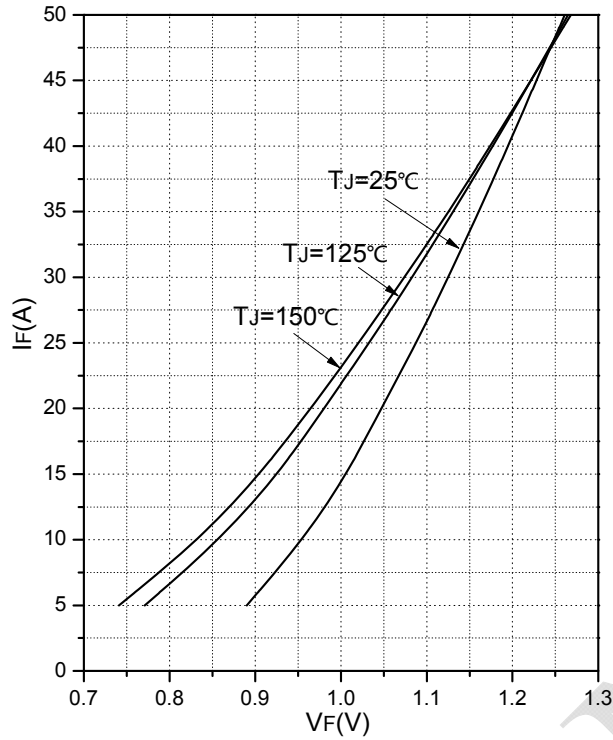


Fig.13 Forward Characteristics of Diode (Rectifier)

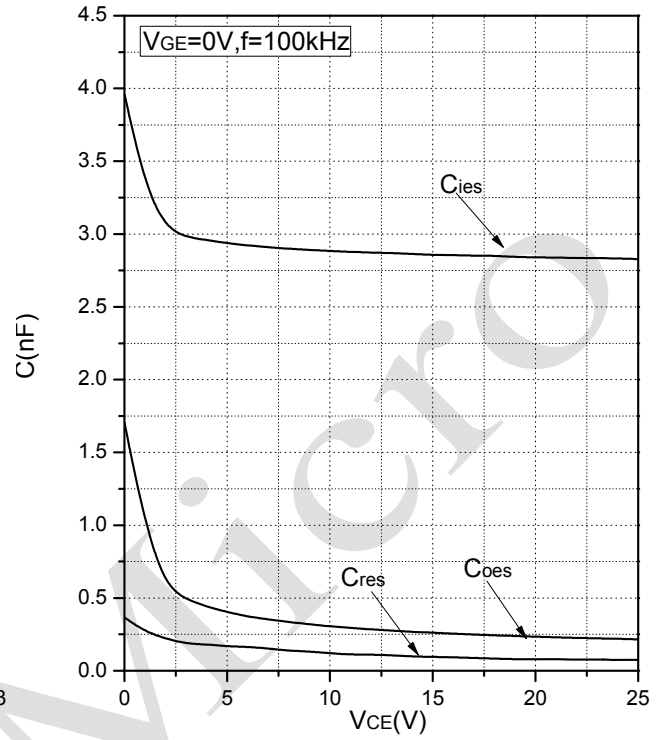


Fig.14 Capacitance Characteristics

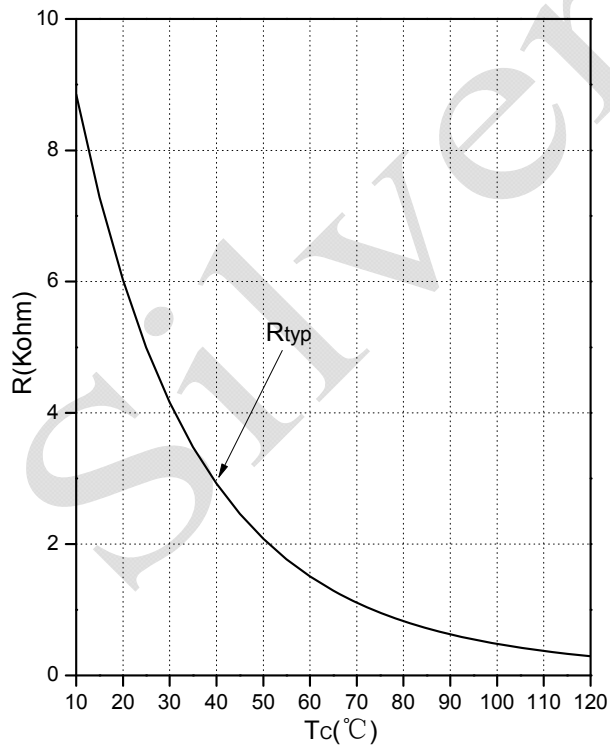
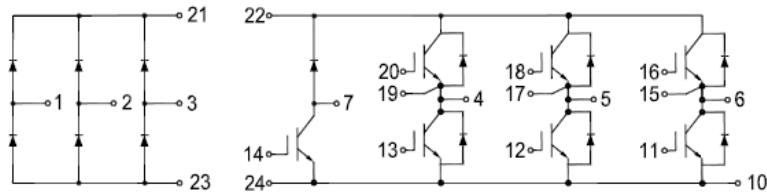
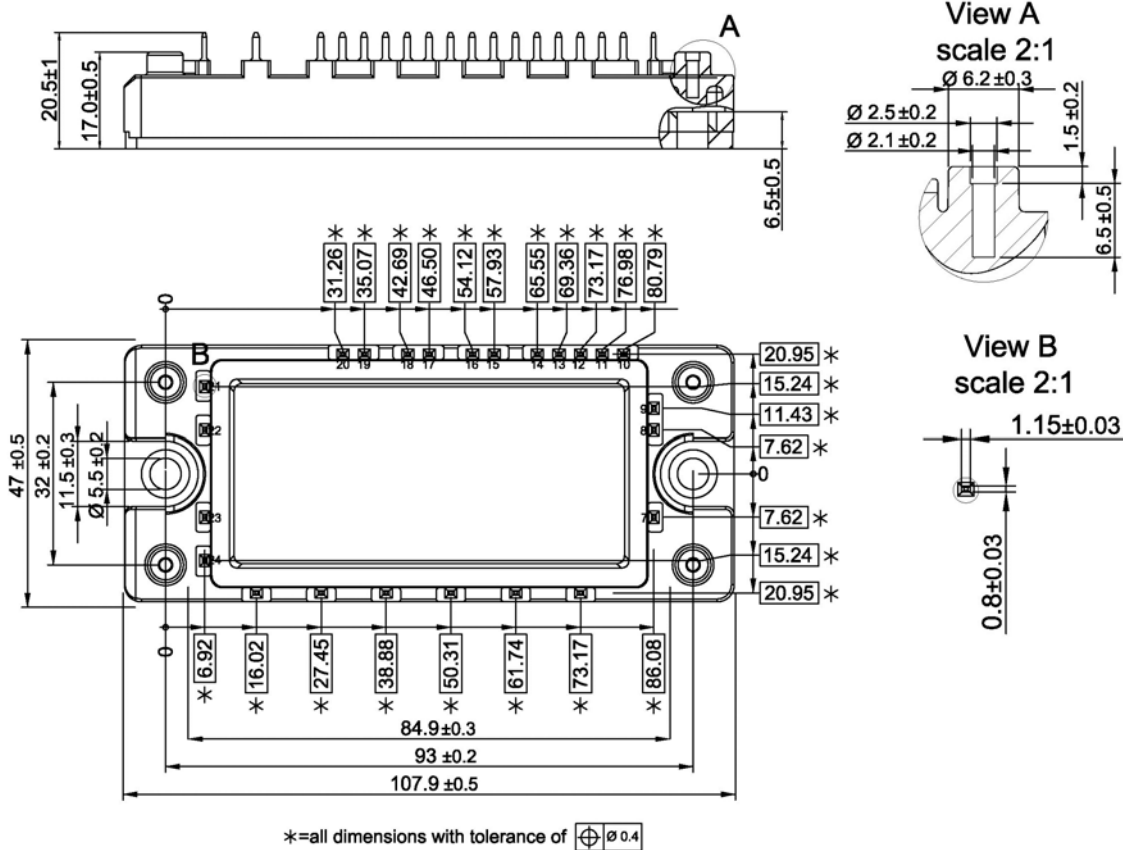


Fig.15 NTC Temperature Characteristics

Internal Circuit:



Package Outline (Unit: mm):



Date	Revision	Notes
04/14/2020	A	Final Version
07/07/2022	B	Revised Electrical Characteristic Values

Announcement

Information in this document is believed to be accurate and reliable. However, NJSME does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

Right to Make Changes

NJSME reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

The datasheet with “REV.” + “Arabic numerals” is based on engineering data for initial reference purpose only.

The released datasheet would be issued with “REV.” + “alphabet characters”.