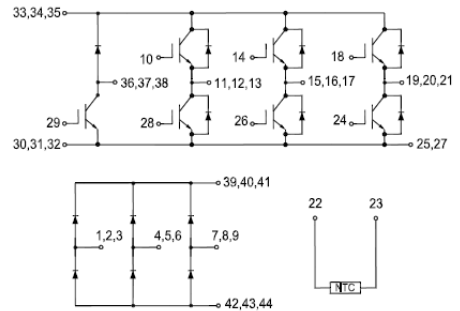


GT50PI120T6H-T4M

IGBT Module

Features:

- Field Stop Trench Gate 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 $^{\circ}$ C unless otherwise specified)

V _{CES}	Collector-Emitter Blocking Voltage		1200	V
V _{GES}	Gate-Emitter Voltage		\pm 20	V
I _C	Continuous Collector Current	T _C =100 $^{\circ}$ C	50	A
		T _C =25 $^{\circ}$ C	100	A
I _{CM}	Peak Collector Current Repetitive	T _J =175 $^{\circ}$ C	100	A
t _{SC}	Short Circuit Withstand Time		>10	μ s
P _D	Maximum Power Dissipation (IGBT)	T _C =25 $^{\circ}$ C T _{Jmax} =175 $^{\circ}$ C	398	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	$I_C=1\text{mA}$, $V_{CE}=V_{GE}$	5.0	5.6	6.6	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=50\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^\circ\text{C}$	1.70	2.00	V
			$T_J=125^\circ\text{C}$	1.90		V
			$T_J=150^\circ\text{C}$	1.90		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	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		3.65		nF
C_{oes}	Output Capacitance			0.50		nF
C_{res}	Reveres Transfer Capacitance			0.31		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600\text{V}$, $I_C=50\text{A}$, $R_{Gon}=15\Omega$, $V_{GE}=\pm 15\text{V}$, Inductive Load	$T_J=25^\circ\text{C}$	154		ns
			$T_J=125^\circ\text{C}$	169		
			$T_J=150^\circ\text{C}$	174		
t_r	Rise Time		$T_J=25^\circ\text{C}$	51		ns
			$T_J=125^\circ\text{C}$	54		
			$T_J=150^\circ\text{C}$	56		
$t_{d(off)}$	Turn-off Delay Time		$T_J=25^\circ\text{C}$	202		ns
			$T_J=125^\circ\text{C}$	216		
			$T_J=150^\circ\text{C}$	225		
t_f	Fall Time	$T_J=25^\circ\text{C}$	220		ns	
		$T_J=125^\circ\text{C}$	379			
		$T_J=150^\circ\text{C}$	407			
E_{on}	Turn-on Switching Loss	$V_{CC}=600\text{V}$, $I_C=50\text{A}$, $R_{Gon}=15\Omega$, $V_{GE}=\pm 15\text{V}$, $di/dt=791\text{A}/\mu\text{s}$ ($T_J=150^\circ\text{C}$), Inductive Load	$T_J=25^\circ\text{C}$	3.37		mJ
		$T_J=125^\circ\text{C}$	5.10			
		$T_J=150^\circ\text{C}$	5.53			

E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =50A, R _{Goff} =15Ω, V _{GE} =±15V, du/dt=3488V/μs (T _J =150°C), Inductive Load	T _J =25°C	2.42	mJ
			T _J =125°C	4.09	
			T _J =150°C	4.52	
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25°C	504	nC
R _{g internal}	Internal Gate Resistance		T _J =25°C	4	Ω
RBSOA	I _C =100A, V _{CC} =1050V, V _p =1200V, R _{Goff} =15Ω, V _{GE} =+15V to 0V, T _J =150°C			Trapezoid	
SC data	V _{CC} =600V, t _p =10us, V _{ge} =+/-15V, R _{Gon} =15ohm, R _{Goff} =15ohm, T _J =25°C			256	A
R _{θJC}	IGBT Thermal Resistance: Junction-To-Case			0.38	°C/W

Diode, Inverter Maximum Rated Values (T_C = 25°C unless otherwise specified)

V _{RRM}	Repetitive Peak Reverse Voltage	1200	V
I _F	Diode Continuous Forward Current	50	A
I _{FM}	Peak FWD Current Repetitive	100	A

Electrical Characteristics of FWD (T_C=25°C unless otherwise specified)

Symbol	Description	Conditions	Min	Typ	Max	Unit
V _{FM}	Forward Voltage	I _F =50A	T _J =25°C	1.40		V
			T _J =125°C	1.50		
			T _J =150°C	1.45		
t _{rr}	Reverse Recovery Time		T _J =25°C	318		ns
			T _J =125°C	539		
			T _J =150°C	554		
I _{rr}	Peak Reverse Recovery Current	I _F =50A, -diF/dt = 1197A/μs (T _J =150°C), V _R =600V, V _{GE} =-15V	T _J =25°C	57		A
			T _J =125°C	60		
			T _J =150°C	65		
Q _{rr}	Reverse Recovery Charge		T _J =25°C	7.95		μC
			T _J =125°C	12.78		
			T _J =150°C	14.17		

E _{rec}	Reverse Recovery Energy	I _F =50A, -diF/dt =1197A/μs(T _J =150°C), V _R =600V, V _{GE} =-15V	T _J =25°C	3.15	mJ
			T _J =125°C	5.21	
			T _J =150°C	6.05	
R _{θJC}	Diode Thermal Resistance: Junction-To-Case			0.51	°C/W

IGBT, Brake-Chopper Maximum Rated Values (T_C=25°C unless otherwise specified)

V _{CES}	Collector-Emitter Blocking Voltage	T _C =25°C	1200	V
V _{GES}	Gate-Emitter Voltage		±20	V
I _C	Continuous Collector Current	T _C =100°C	25	A
		T _C =25°C	50	A
I _{CM}	Peak Collector Current Repetitive	T _J =150°C	50	A
t _{SC}	Short Circuit Withstand Time		>10	μs
P _D	Maximum Power Dissipation (IGBT)	T _C =25°C T _{Jmax} =175°C	260	W

Electrical Characteristics of IGBT (T_C=25°C unless otherwise specified)

Static Characteristics

Symbol	Description	Conditions	Min	Typ	Max	Unit
V _{GE(th)}	Gate-Emitter Threshold Voltage	I _C =1 mA, V _{CE} =V _{GE}	5.0	5.5	6.0	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =25A, V _{GE} =15V	T _J =25°C	1.90	2.20	V
			T _J =125°C	2.20		V
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V, V _{CE} =V _{CES} , T _J =25°C			1	mA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =±20V, V _{CE} =0V, T _J =25°C			100	nA
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=1MHz		3.40		nF
C _{res}	Reveres Transfer Capacitance			0.13		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V, I_C=25A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^\circ C$	140	ns
			$T_J=125^\circ C$	140	
t_r	Rise Time	$V_{CC}=600V, I_C=25A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^\circ C$	45	ns
			$T_J=125^\circ C$	50	
$t_{d(off)}$	Turn-off Delay Time	$V_{CC}=600V, I_C=25A,$ $R_{Goff}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^\circ C$	165	ns
			$T_J=125^\circ C$	170	
t_f	Fall Time	$V_{CC}=600V, I_C=25A,$ $R_{Goff}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^\circ C$	220	ns
			$T_J=125^\circ C$	330	
E_{on}	Turn-on Switching Loss	$V_{CC}=600V, I_C=25A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ $di/dt=556A/\mu s(T_J=125^\circ C),$ Inductive Load	$T_J=25^\circ C$	1.76	mJ
			$T_J=125^\circ C$	2.13	
E_{off}	Turn-off Switching Loss	$V_{CC}=600V, I_C=25A,$ $R_{Goff}=15\Omega, V_{GE}=\pm 15V,$ $du/dt=2760V/\mu s(T_J=125^\circ C),$ Inductive Load	$T_J=25^\circ C$	1.02	mJ
			$T_J=125^\circ C$	1.72	
Q_g	Total Gate Charge	$V_{GE}=+15V \dots -15V$	$T_J=25^\circ C$	120	nC
RBSOA	$I_C=50A, V_{CC}=1050V, V_p=1200V, R_{Goff}=15\Omega, V_{GE}=+15V$ to 0V, $T_J=150^\circ C$			Trapezoid	
SCSOA	$V_{CC}=600V, V_{GE}=15V, T_J=150^\circ C$			10	μs
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case			0.52	$^\circ C/W$

Diode, Brake-Chopper 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	25	A
I_{FM}	Peak FWD Current Repetitive	50	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	$I_F=25\text{A}$	$T_J=25^\circ\text{C}$		1.80	2.10	V
			$T_J=125^\circ\text{C}$		2.00		
t_{rr}	Reverse Recovery Time	$I_F=25\text{A}$, $-diF/dt = 659\text{A}/\mu\text{s}(T_J=150^\circ\text{C})$, $V_R=600\text{V}$, $V_{GE}=-15\text{V}$	$T_J=25^\circ\text{C}$		118		ns
			$T_J=125^\circ\text{C}$		157		
I_{rr}	Peak Reverse Recovery Current		$T_J=25^\circ\text{C}$		15		A
			$T_J=125^\circ\text{C}$		20		
Q_{rr}	Reverse Recovery Charge		$T_J=25^\circ\text{C}$		1.05		μC
			$T_J=125^\circ\text{C}$		2.19		
E_{rec}	Reverse Recovery Energy		$T_J=25^\circ\text{C}$		0.39		mJ
			$T_J=125^\circ\text{C}$		0.95		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case			0.80		$^\circ\text{C}/\text{W}$	

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	$T_J=80^\circ\text{C}$	55	A
I_{RMSM}	Maximum RMS Current At Rectifier Output	$T_J=80^\circ\text{C}$	65	A
I_{FSM}	Surge Current @ $t_p=10\text{ ms}$	$T_J=25^\circ\text{C}$	630	A
		$T_J=150^\circ\text{C}$	550	
I^2t	I^2t - Value	$T_J=25^\circ\text{C}$	1960	A^2s
		$T_J=150^\circ\text{C}$	1500	

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

Symbol	Description	Conditions	Min	Typ	Max	Unit	
V_F	Forward Voltage	$I_F=35\text{ A}$	$T_J=25^\circ\text{C}$		1.05		V
			$T_J=125^\circ\text{C}$		0.98		
			$T_J=150^\circ\text{C}$		0.97		
I_R	Reverse Current	$V_R=1800\text{V}$	$T_J=25^\circ\text{C}$		1	mA	
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case			0.55		$^\circ\text{C/W}$	

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	Conditions	Min	Typ	Max	Unit
V_{iso}	Isolation Voltage (All Terminals Shorted)	$f = 50\text{Hz}$, 1minute	2500			V
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			V
$R_{\theta CS}$	Case-To-Sink Thermally (Conductive Grease Applied)			0.1		$^\circ\text{C/W}$
M	Power Terminals Screw:M5		3.0		5.0	N·m
G	Weight			300		g

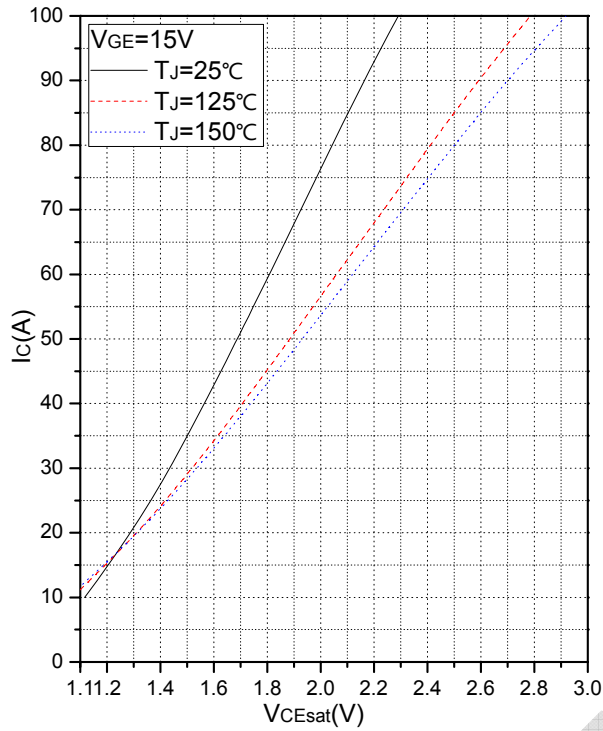


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

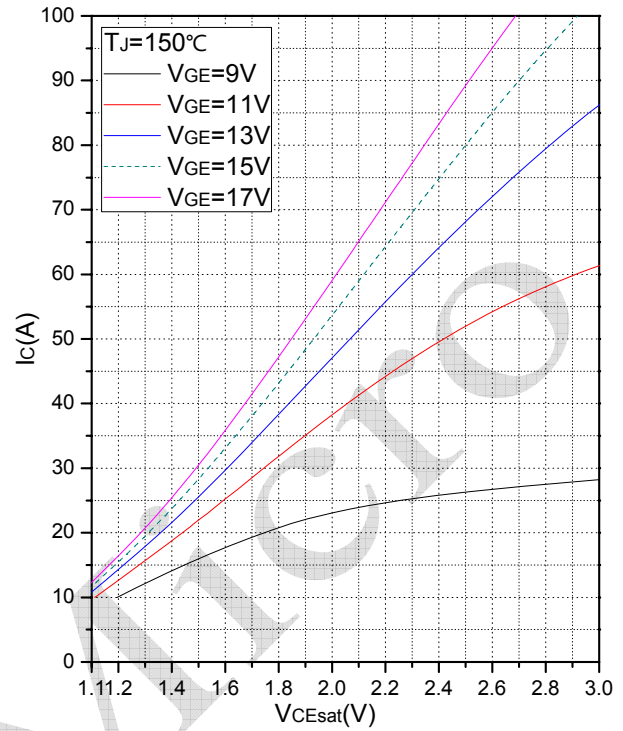


Fig.2 Typical Output Characteristics (Inverter)

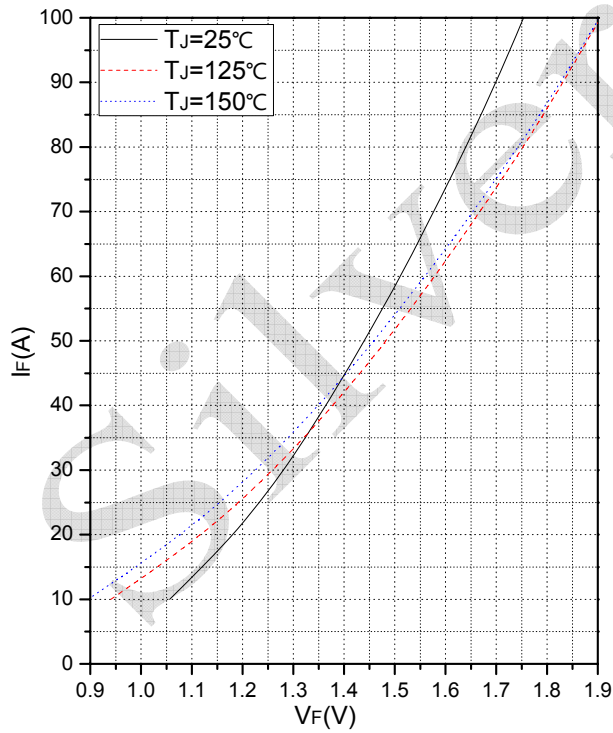


Fig.3 Forward Characteristics of FWD (Inverter)

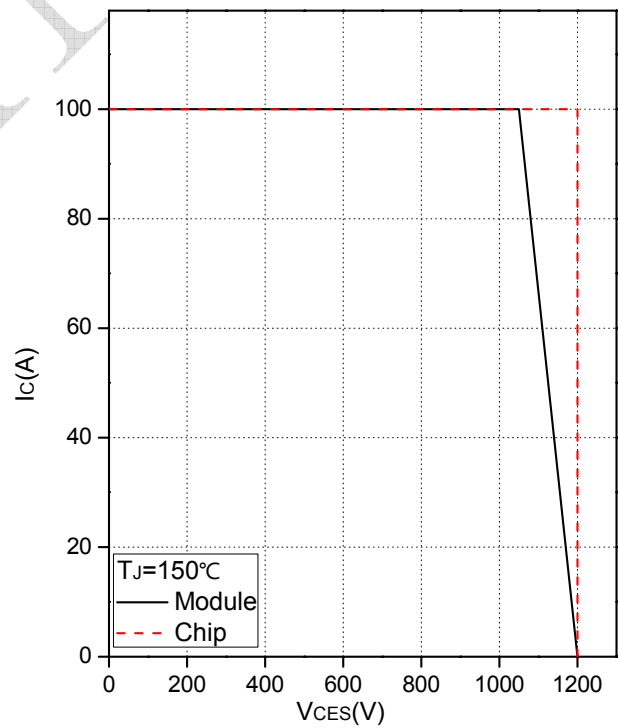


Fig.4 Reverse Bias Safe Operation Area (RBSOA)

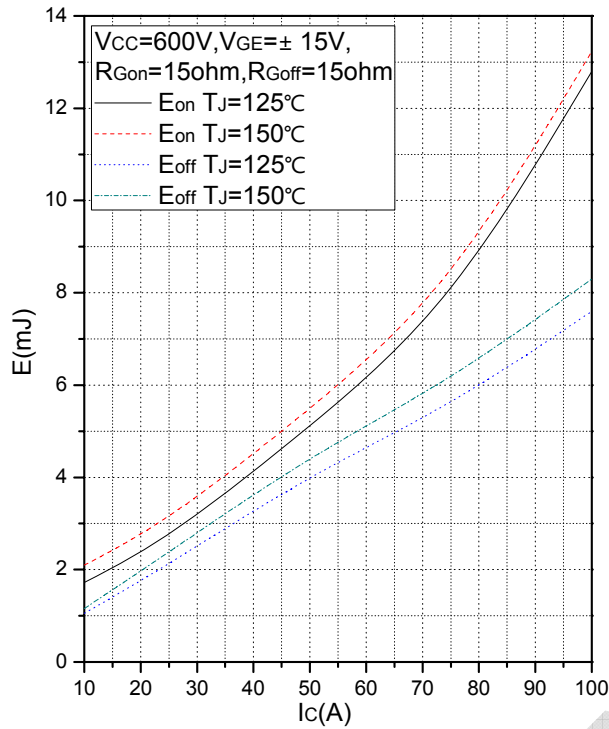


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

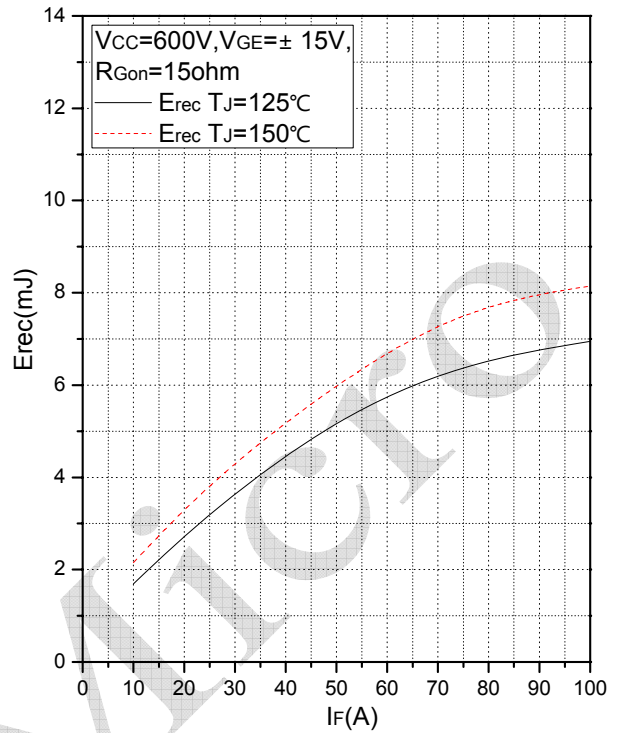


Fig.6 Typical Switching Loss vs. Forward Current (Inverter)

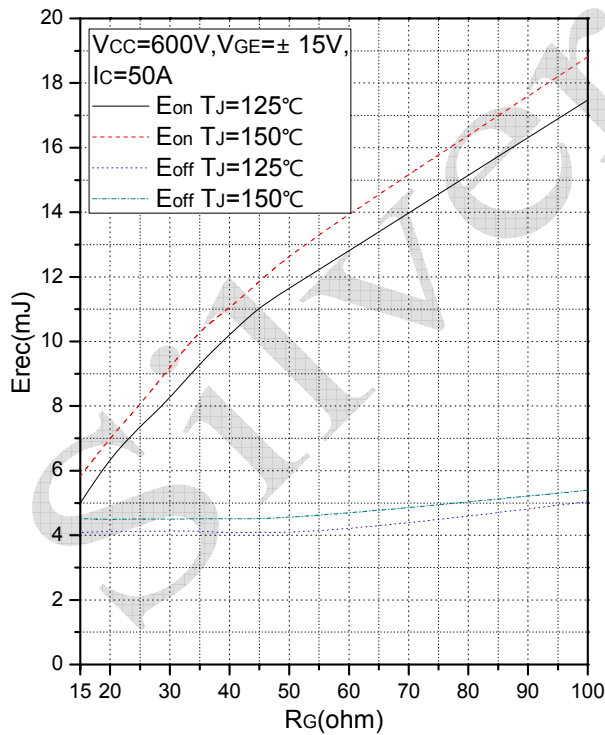


Fig.7 Typical Switching Loss vs. Gate Resistance (Inverter)

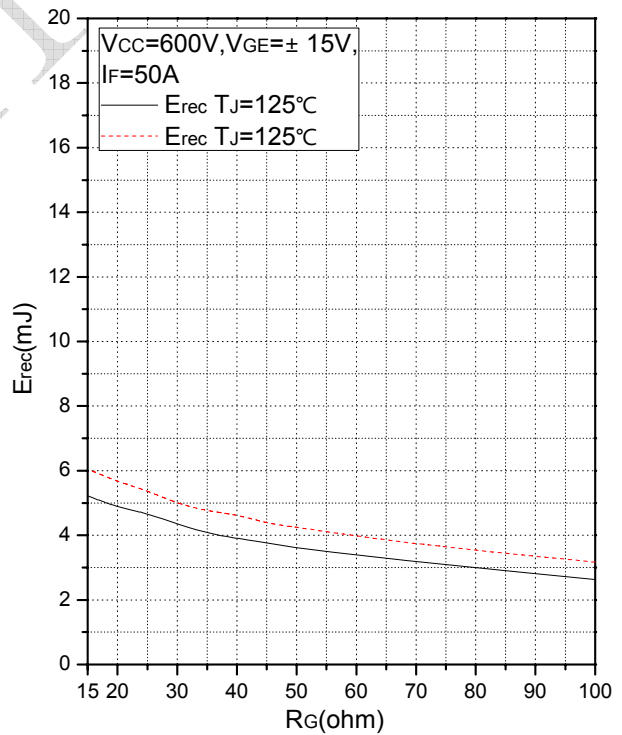


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

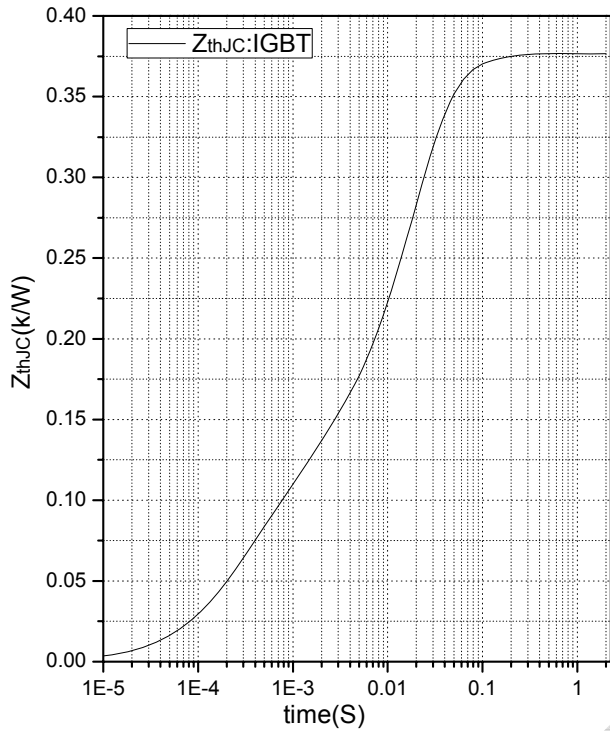


Fig.9 Transient Thermal Impedance (Inverter- IGBT)

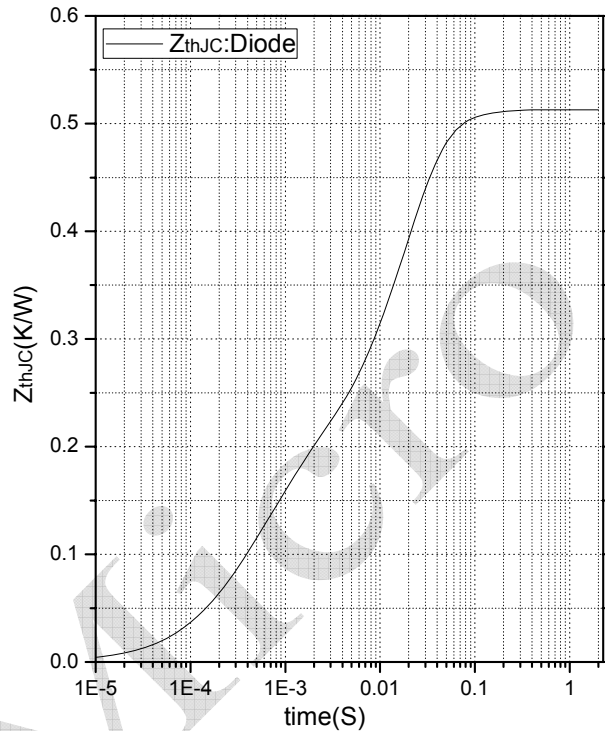


Fig.10 Transient Thermal Impedance (Inverter- Diode)

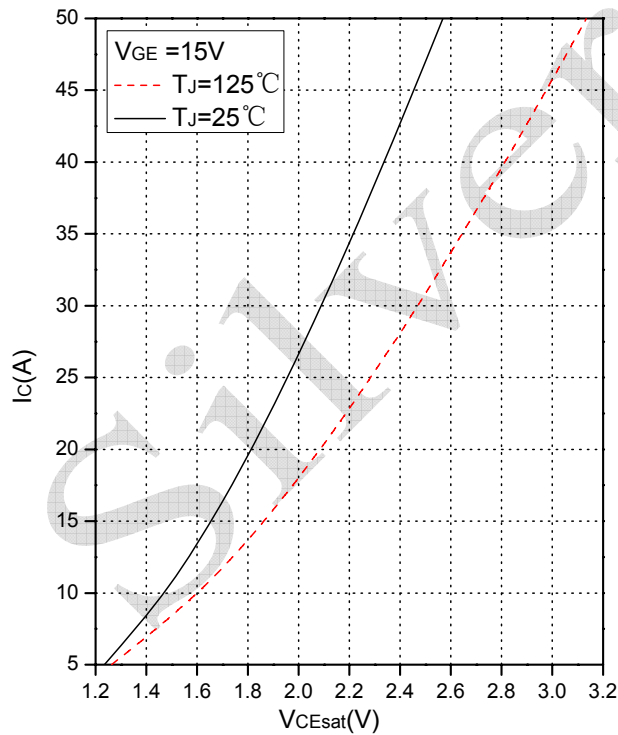


Fig.11 Typical Saturation Voltage Characteristics (Brake-Chopper)

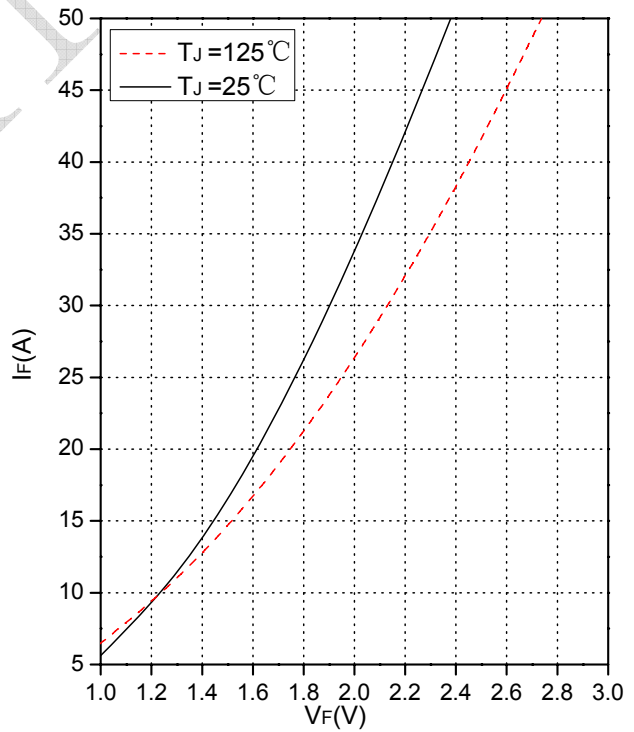


Fig.12 Forward Characteristics of FWD (Brake-Chopper)

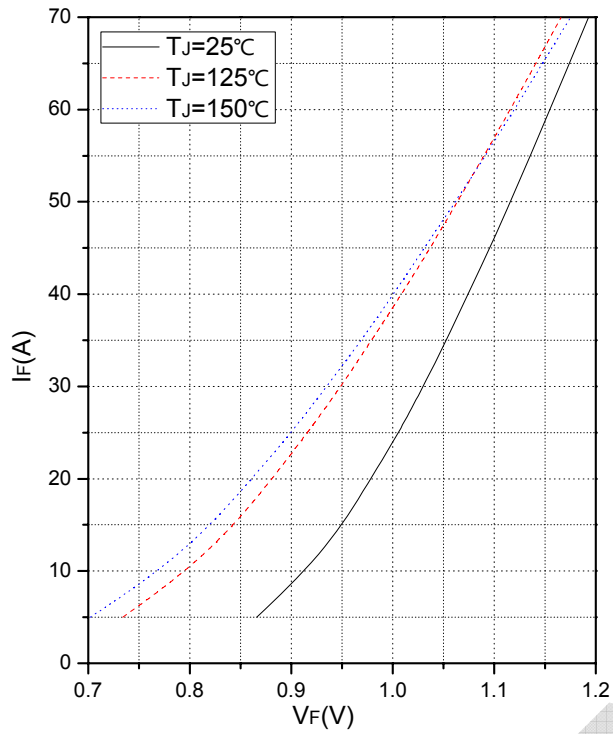


Fig.13 Forward Characteristics of Diode (Rectifier)

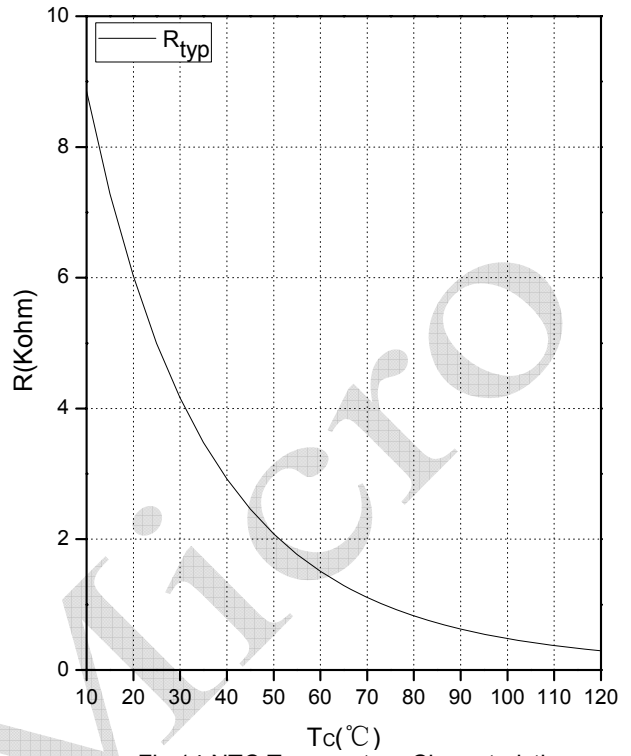


Fig.14 NTC Temperature Characteristics

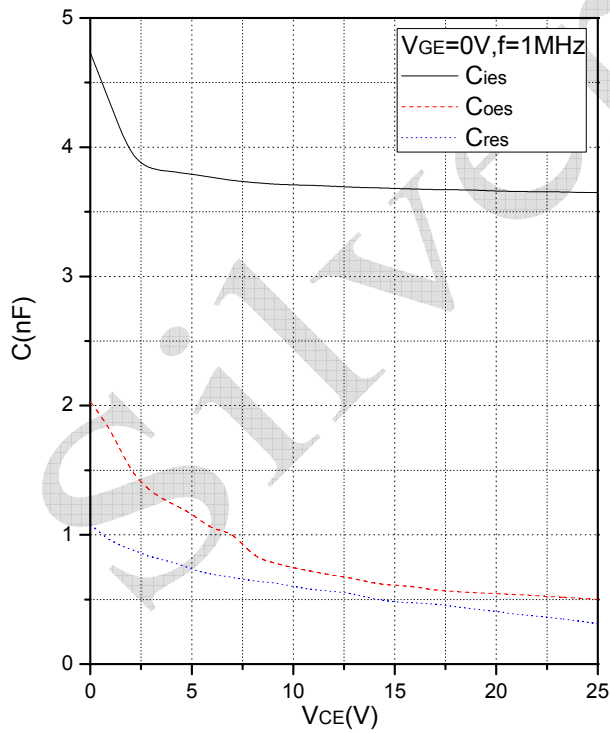
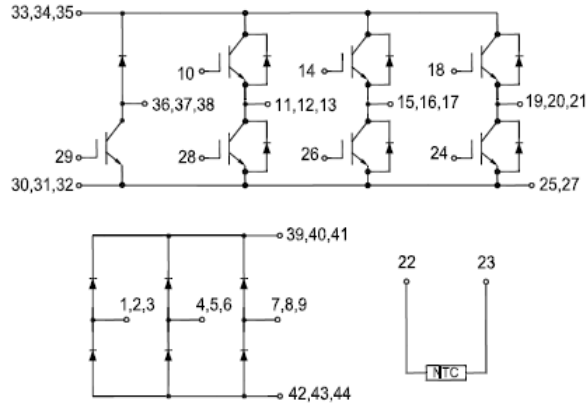
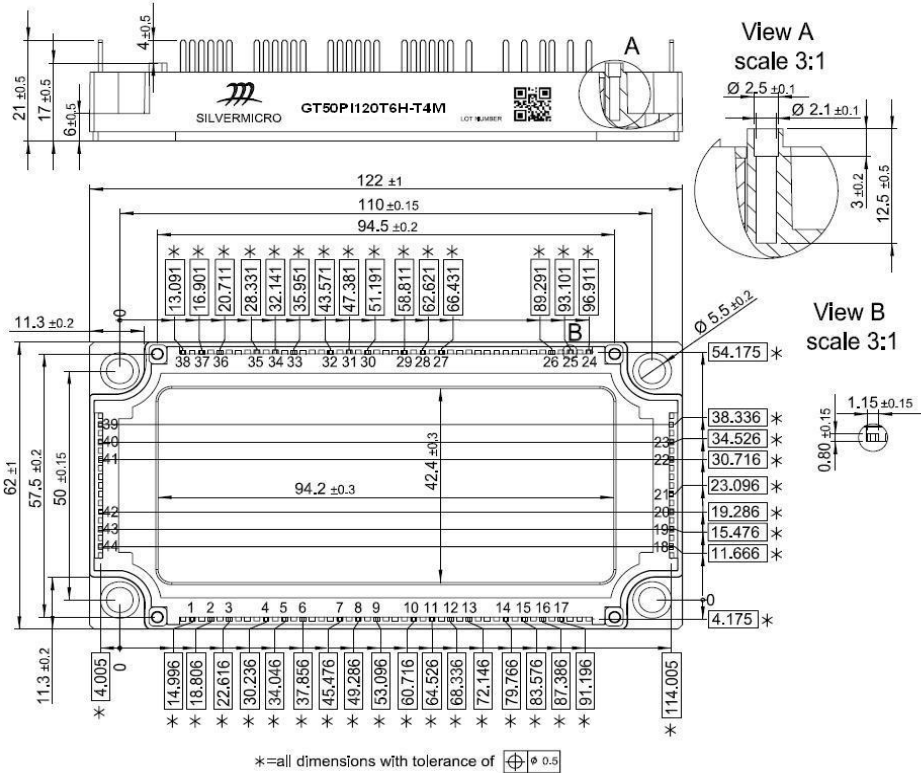


Fig.15 Capacitance Characteristics

Internal Circuit:



Package Outline (Unit: mm):



Date	Revision	Notes
09/12/2018	01	Initial release
09/12/2019	A	Final version

Announcement

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