

GT50PI120T6H-T4

IGBT Module

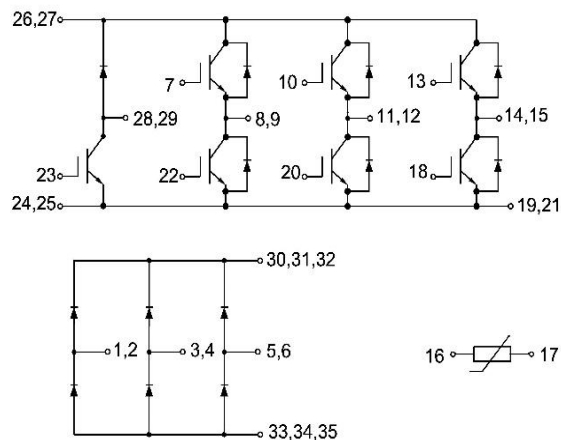
Features:

- $V_{CES}=1200V$ $I_C=50A$ Trench & Field Stop IGBT Module
- Short Circuit Capability
- Low Switching Loss
- 100% RBSOA Tested($2 \times I_C$)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement

Applications:

- Auxiliary Inverters
- Motor Drives
- Servo Drives

Circuit Diagram



Type	Package	Marking
GT50PI120T6H-T4	T6	GT50PI120T6H-T4

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 Limited by T_{Jmax}	$T_C=90^\circ C$	50	A
		$T_C=25^\circ C$	100	A
I_{CM}	Peak Collector Current Repetitive	T_p limited by T_{Jmax}	100	A
P_D	Maximum Power Dissipation (IGBT)	$T_C=25^\circ C$, $T_{Jmax}=175^\circ C$	390	W

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

Static Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.7\text{mA}$, $V_{CE}=V_{GE}$	4.9	5.7	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=50\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^{\circ}\text{C}$	1.73	2.10	V
			$T_J=125^{\circ}\text{C}$	2.15		V
			$T_J=175^{\circ}\text{C}$	2.35		V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0\text{V}$, $V_{CE}=1200\text{V}$, $T_J=25^{\circ}\text{C}$			1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=20\text{V}$, $V_{CE}=0\text{V}$, $T_J=25^{\circ}\text{C}$			200	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$		5410		pF
C_{oes}	Output Capacitance			692		pF
C_{res}	Reverse Transfer Capacitance			56		pF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V, I_C=50A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		85		ns
			$T_J=125^{\circ}C$		87		
			$T_J=175^{\circ}C$		82		
t_r	Rise Time		$T_J=25^{\circ}C$		34		ns
			$T_J=125^{\circ}C$		36		
			$T_J=175^{\circ}C$		40		
$t_{d(off)}$	Turn-off Delay Time		$T_J=25^{\circ}C$		209		ns
			$T_J=125^{\circ}C$		239		
			$T_J=175^{\circ}C$		252		
t_f	Fall Time	$T_J=25^{\circ}C$		151		ns	
		$T_J=125^{\circ}C$		190			
		$T_J=175^{\circ}C$		228			
E_{on}	Turn-on Switching Loss	$V_{CC}=600V, I_C=50A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ $di/dt=1000A/\mu s(T_J=175^{\circ}C)$ Inductive Load	$T_J=25^{\circ}C$		4.2		mJ
		$T_J=125^{\circ}C$		5.8			
		$T_J=175^{\circ}C$		6.7			

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E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =50A, R _{Goff} =15Ω, V _{GE} =±15V, du/dt=5700V/μs(T _J =175°C) Inductive Load	T _J =25°C		3.3		mJ
			T _J =125°C		4.3		
			T _J =175°C		4.7		
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25°C		301		nC
T _{SC}	V _{CC} =600V, V _{GE} =±15V, T _J =175°C ^{note1}					10	us
R _{θJC}	IGBT Thermal Resistance: Junction-to-Case (per IGBT)					0.384	°C/W
R _{θCS}	IGBT Thermal Resistance: Case-to-Sink (per IGBT) (per IGBT, λ _{grease} = 1 W/(m · K))				0.195		°C/W

note1: Short circuit withstand time cannot exceed 10us under specified condition

Diode, Inverter

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

V _{RRM}	Repetitive Peak Reverse Voltage	T _J =25°C	1200	V
I _F	Diode Continuous Forward Current		50	A
I _{FM}	Diode Maximum Forward Current	t _p =1ms	100	A

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _{FM}	Forward Voltage	I _F =50A	T _J =25°C		1.66	2.00	V
			T _J =125°C		1.78		
			T _J =175°C		1.74		
t _{rr}	Reverse Recovery Time	I _F =50A, -diF/dt=1200A/μs(T _J =175°C), V _R =600V, V _{GE} =-15V	T _J =25°C		292		ns
			T _J =125°C		461		
			T _J =175°C		581		
I _{rr}	Peak Reverse Recovery Current		T _J =25°C		40		A
			T _J =125°C		42		
			T _J =175°C		44		
Q _{rr}	Reverse Recovery Charge		T _J =25°C		4.5		μC
			T _J =125°C		8.1		
			T _J =175°C		10.3		

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E _{rec}	Reverse Recovery Energy	I _F =50A, -diF/dt=1200A/μs(T _J =175°C), V _R =600V, V _{GE} =-15V	T _J =25°C		1.6		mJ
			T _J =125°C		3.2		
			T _J =175°C		4.1		
R _{θJC}	Diode Thermal Resistance: Junction-to-Case (per Diode)					0.708	°C/W
R _{θCS}	Diode Thermal Resistance: Case-to-Sink (per Diode, λ _{grease} = 1 W/(m • K))				0.360		°C/W

IGBT, Brake-Chopper

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 Limited by T _{Jmax}	T _C =100°C	25	A
		T _C =25°C	50	A
I _{CM}	Peak Collector Current Repetitive	T _p limited by T _{Jmax}	50	A
P _D	Maximum Power Dissipation (IGBT)	T _C =25°C, T _{Jmax} =175°C	230	W

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

Static Characteristics

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _{GE(th)}	Gate-Emitter Threshold Voltage	I _C =1mA, V _{CE} =V _{GE}		5.0	5.8	6.6	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =25A, V _{GE} =15V	T _J =25°C		1.76	2.20	V
			T _J =125°C		2.15		V
			T _J =175°C		2.35		V
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V, V _{CE} =1200V, T _J =25°C				1	mA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =20V, V _{CE} =0V, T _J =25°C				200	nA
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=100kHz			1600		pF
C _{oes}	Output Capacitance				426		pF
C _{res}	Reverse Transfer Capacitance				36		pF

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Switching Characteristics

t _{d(on)}	Turn-on Delay Time	V _{CC} =600V, I _C =25A, R _{Gon} =36Ω, V _{GE} =±15V, Inductive Load	T _J =25°C		58		ns
			T _J =125°C		53		
			T _J =175°C		52		
t _r	Rise Time		T _J =25°C		35		ns
			T _J =125°C		39		
			T _J =175°C		43		
t _{d(off)}	Turn-off Delay Time	V _{CC} =600V, I _C =25A, R _{Goff} =36Ω, V _{GE} =±15V, Inductive Load	T _J =25°C		190		ns
			T _J =125°C		205		
			T _J =175°C		217		
t _f	Fall Time		T _J =25°C		129		ns
			T _J =125°C		173		
			T _J =175°C		187		
E _{on}	Turn-on Switching Loss	V _{CC} =600V, I _C =25A, R _{Gon} =36Ω, V _{GE} =±15V, di/dt=460A/μs(T _J =175°C) Inductive Load	T _J =25°C		2.6		mJ
			T _J =125°C		3.1		
			T _J =175°C		3.3		
E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =25A, R _{Goff} =36Ω, V _{GE} =±15V, du/dt=6800V/μs(T _J =175°C) Inductive Load	T _J =25°C		1.5		mJ
			T _J =125°C		1.8		
			T _J =175°C		2.0		
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25°C		155		nC
T _{SC}	V _{CC} =600V, V _{GE} =±15V, T _J =175°C ^{note2}					10	us
R _{θJC}	IGBT Thermal Resistance: Junction-to-Case (per IGBT)					0.633	°C/W
R _{θCS}	IGBT Thermal Resistance: Case-to-Sink (per IGBT) (per IGBT, λ _{grease} = 1 W/(m • K))				0.322		°C/W

note2: Short circuit withstand time cannot exceed 10us under specified condition

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Diode, Brake-Chopper

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

V_{RRM}	Repetitive Peak Reverse Voltage	$T_J=25^{\circ}\text{C}$	1200	V
I_F	Diode Continuous Forward Current		15	A
I_{FM}	Diode Maximum Forward Current	$t_p=1\text{ms}$	30	A

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units	
V _{FM}	Forward Voltage	I _F =15A	T _J =25°C		1.70	2.05	V	
			T _J =125°C		1.82			
			T _J =175°C		1.77			
t _{rr}	Reverse Recovery Time	I _F =15A, -diF/dt=530A/μs(T _J =175°C), V _R =600V, V _{GE} =-15V	T _J =25°C		300		ns	
			T _J =125°C		437			
			T _J =175°C		560			
I _{rr}	Peak Reverse Recovery Current		T _J =25°C		13.2		A	
			T _J =125°C		13.6			
			T _J =175°C		14.0			
Q _{rr}	Reverse Recovery Charge		T _J =25°C		1.5		μC	
			T _J =125°C		2.5			
			T _J =175°C		3.2			
E _{rec}	Reverse Recovery Energy		T _J =25°C		0.5		mJ	
			T _J =125°C		1.0			
			T _J =175°C		1.3			
R _{θJC}	Diode Thermal Resistance: Junction-to-Case (per Diode)					1.496	°C/W	
R _{θCS}	Diode Thermal Resistance: Case-to-Sink (per Diode, λ _{grease} = 1 W/(m • K))				0.760		°C/W	

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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	$T_J=80^{\circ}\text{C}$	55	A
I_{RMSM}	Maximum RMS Forward Current at Rectifier Output	$T_J=80^{\circ}\text{C}$	80	A
I_{FSM}	Surge Current @ $t_p=10\text{ms}$	$T_J=25^{\circ}\text{C}$	630	A
		$T_J=150^{\circ}\text{C}$	500	
I^2t	I^2t - value	$T_J=25^{\circ}\text{C}$	1980	A^2s
		$T_J=150^{\circ}\text{C}$	1250	

Electrical Characteristic values ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_F	Forward Voltage	$I_F=50\text{A}$	$T_J=25^{\circ}\text{C}$		1.22		V
			$T_J=150^{\circ}\text{C}$		1.21		
I_R	Reverse Current	$V_R=1600\text{V}$	$T_J=25^{\circ}\text{C}$			1	mA
$R_{\theta JC}$	Thermal Resistance: Junction-to-Case (per Diode)					0.559	$^{\circ}\text{C}/\text{W}$
$R_{\theta CS}$	Diode Thermal Resistance: Case-to-Sink (per Diode, $\lambda_{\text{grease}} = 1 \text{ W}/(\text{m} \cdot \text{K})$)				0.284		$^{\circ}\text{C}/\text{W}$

Internal NTC-Thermistor Characteristics

Symbol	Conditions	Min.	Typ.	Max.	Units.
R_{25}	$T_C=25^{\circ}\text{C}$		5		$\text{k}\Omega$
$\Delta R/R$	$T_C=100^{\circ}\text{C}$, $R_{100}=465\Omega$	-5		+5	%
P_{25}	$T_C=25^{\circ}\text{C}$			10	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
$B_{25/100}$	$R_2=R_{25} \exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		3545		K

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Module

Symbol	Description	Min.	Typ.	Max.	Units
V _{iso}	Isolation Voltage (All Terminals Shorted)	RMS, f=50Hz, 60s			V
T _J	Maximum Junction Temperature	-40		175	°C
T _{JOP}	Maximum Operating Junction Temperature Range ^{note3}	-40		150	°C
T _{stg}	Storage Temperature	-40		125	°C
CTI	Comparative Tracking Index	200			
T	Mounting Screw:M5	3		6	N·m
G	Weight		300		g

note3: T_{JOP}> 150°C is only allowed for operation at overload conditions.

Ordering Information Table

Device code	G	T	50	PI	120	T6	H	-	T4
	①	②	③	④	⑤	⑥	⑦		⑧

- ① - IGBT Module
- ② - Field Stop Trench Gate IGBT
- ③ - Rated Current (50=50A)
- ④ - Circuit Configuration:PI (Power Integrated)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)
- ⑧ - Internal Control Code



Characteristic diagram

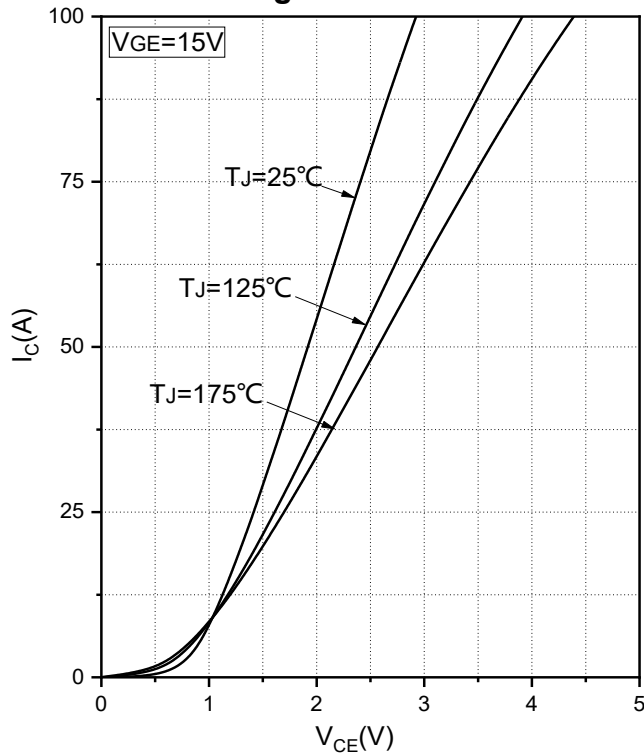


Fig.1 Typical Saturation Voltage Characteristics(Inverter)

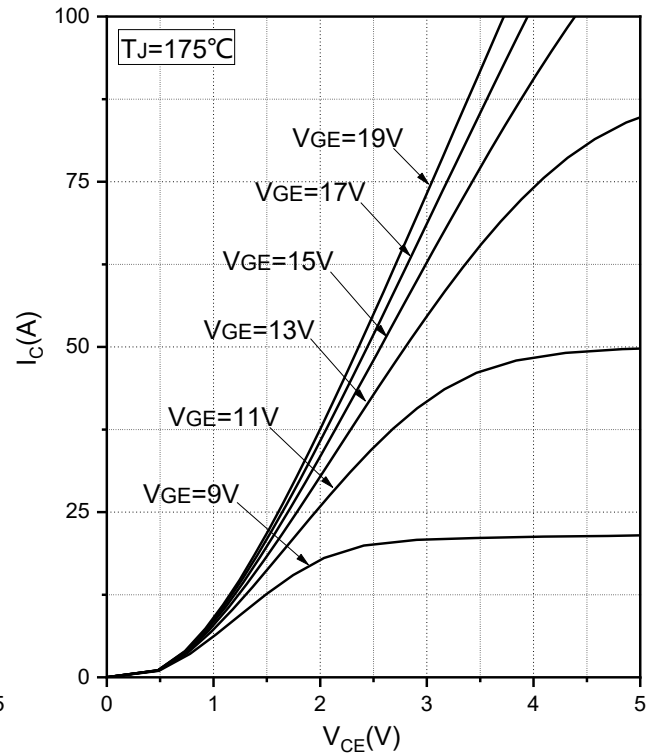


Fig.2 Typical Output Characteristics(Inverter)

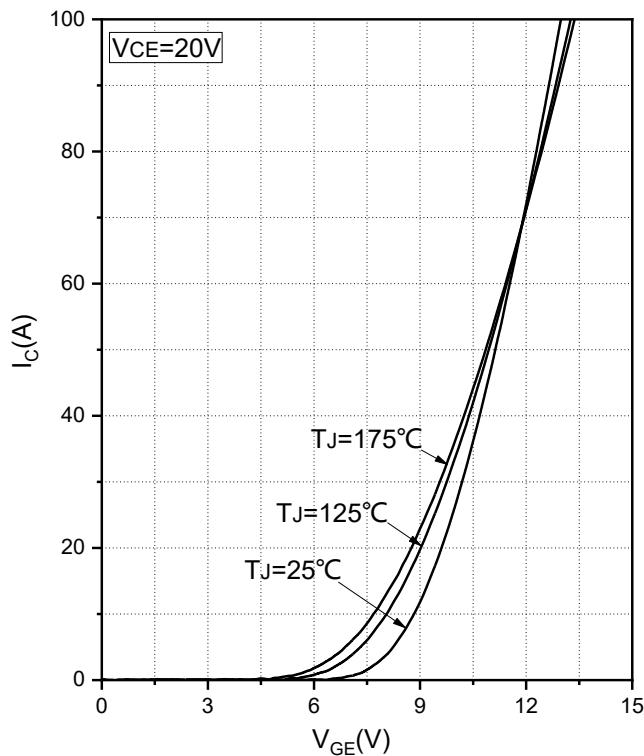


Fig.3 Transfer Characteristic(Inverter)

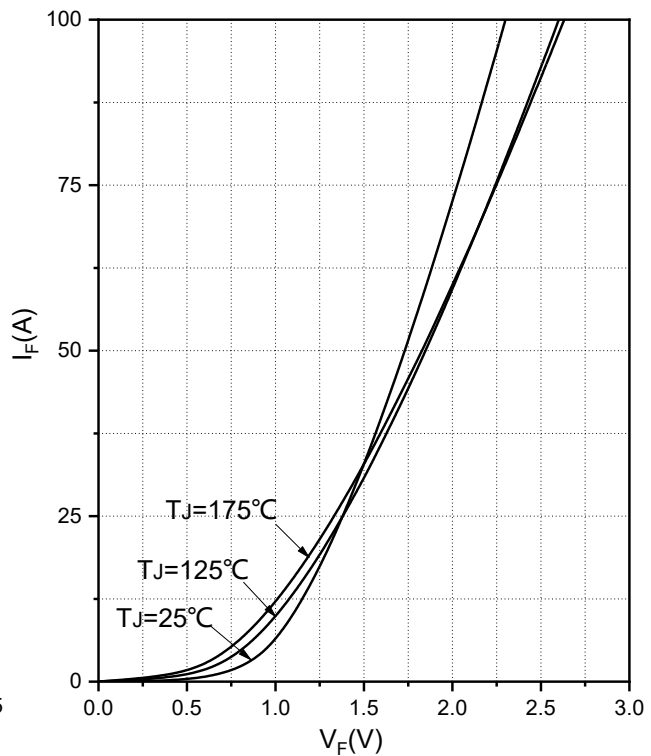


Fig.4 Forward Characteristics of Diode(Inverter)

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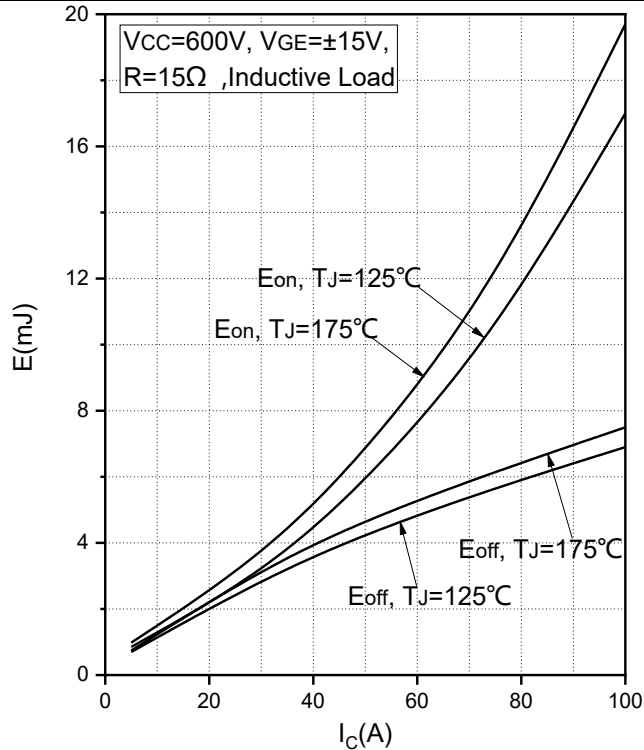


Fig.5 Typical Switching Loss vs. Collector Current(Inverter)

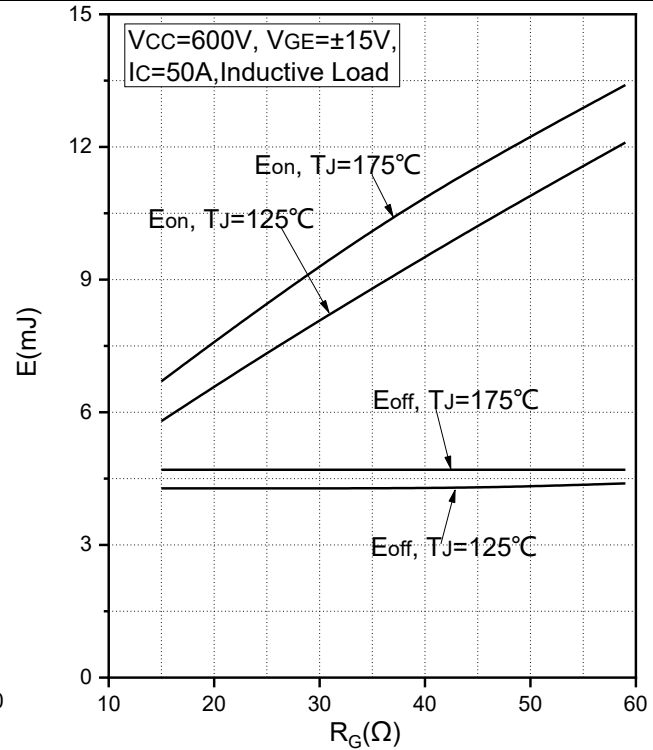


Fig.6 Typical Switching Loss vs. Gate Resistance(Inverter)

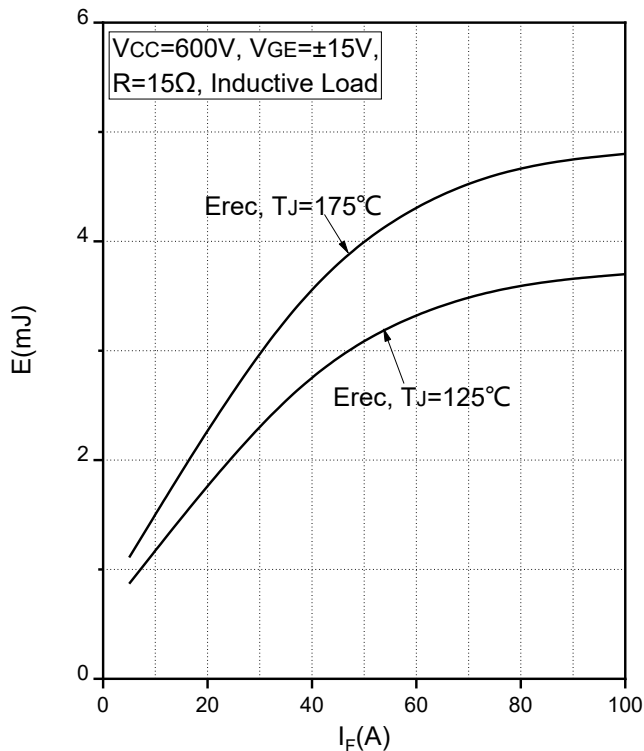


Fig.7 Typical Switching Loss vs. Forward Current(Inverter)

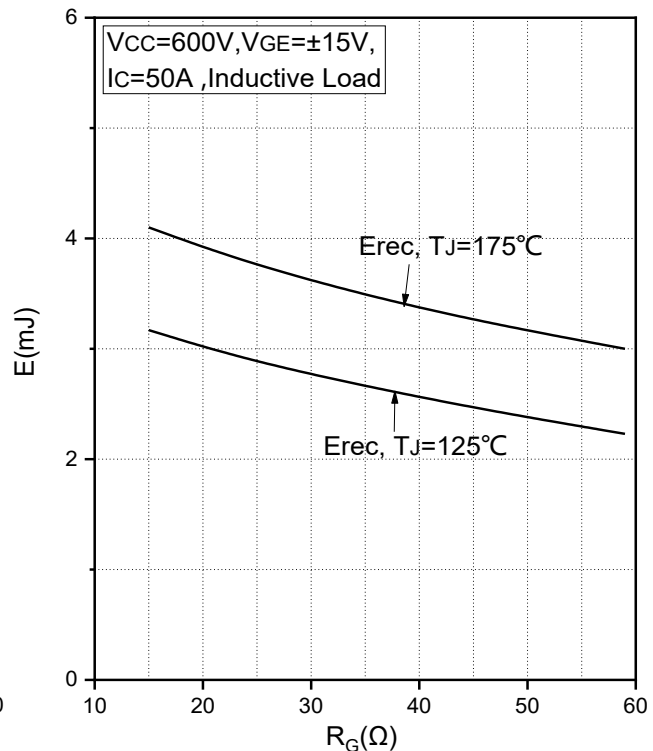


Fig.8 Typical Switching Loss vs. Gate Resistance(Inverter)

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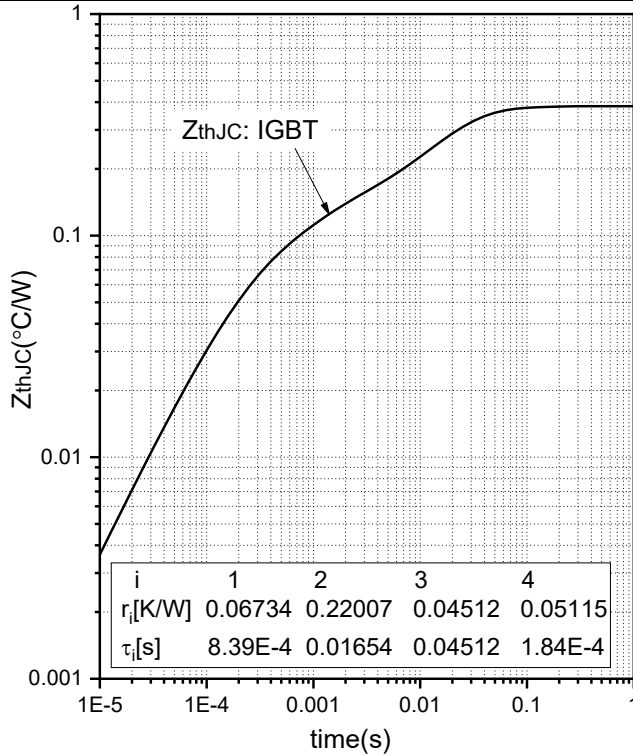


Fig.9 Transient Thermal Impedance (Inverter IGBT)

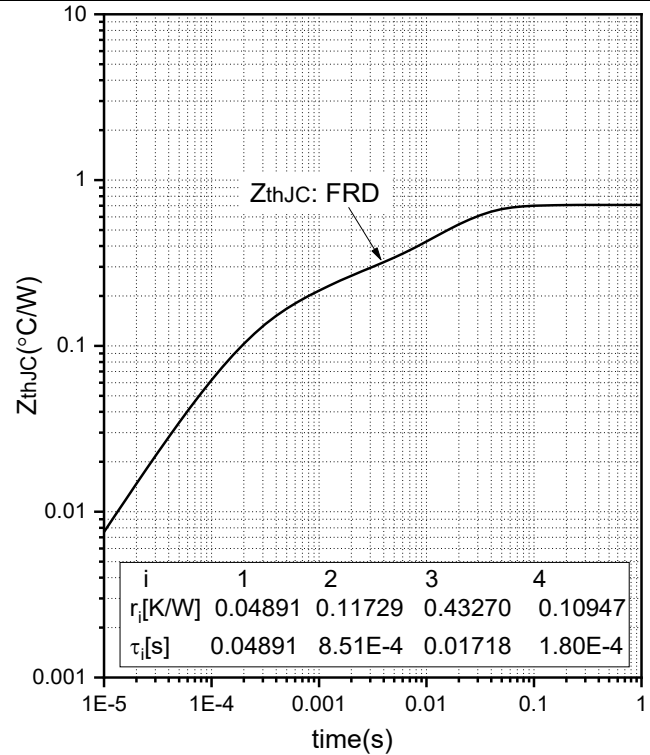


Fig.10 Transient Thermal Impedance (Inverter Diode)

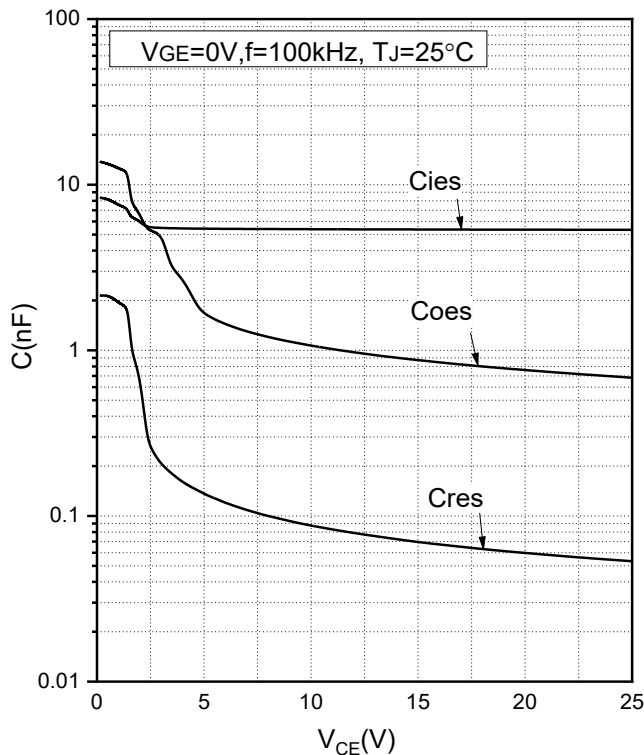


Fig.11 Capacitance Characteristics(Inverter)

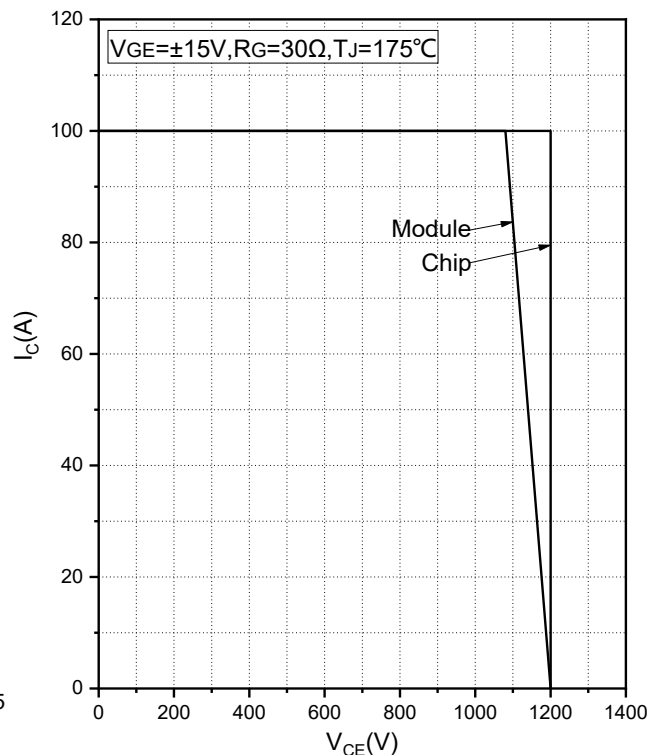
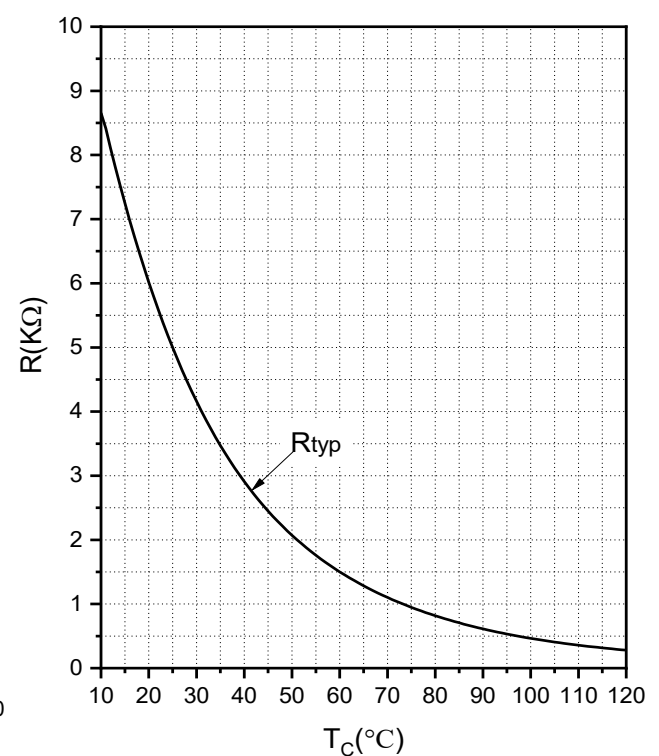
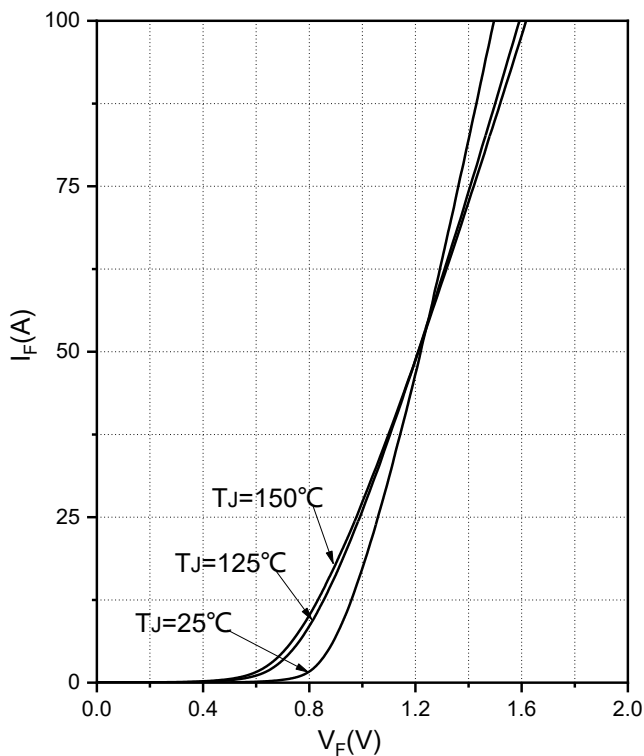
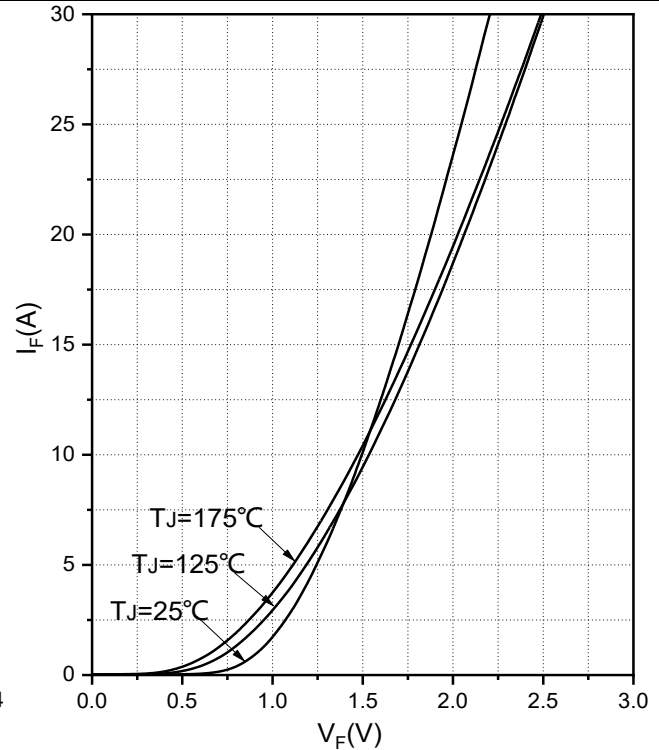
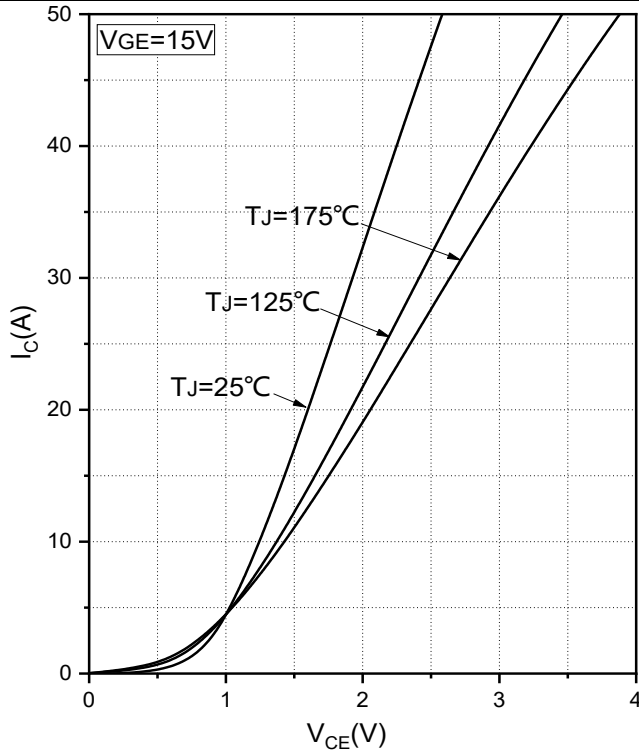


Fig.12 Reverse Bias Safe Operation Area (RBSOA) (Inverter)

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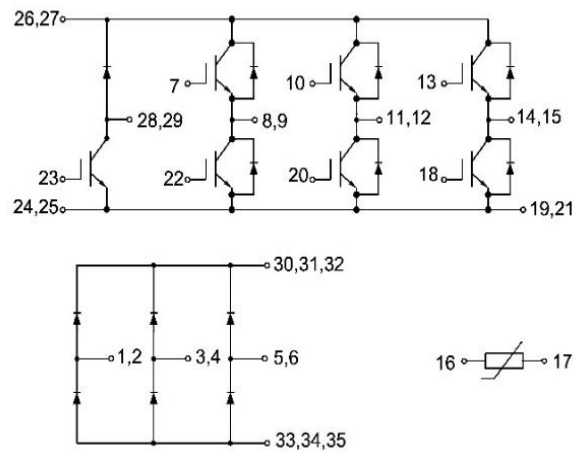


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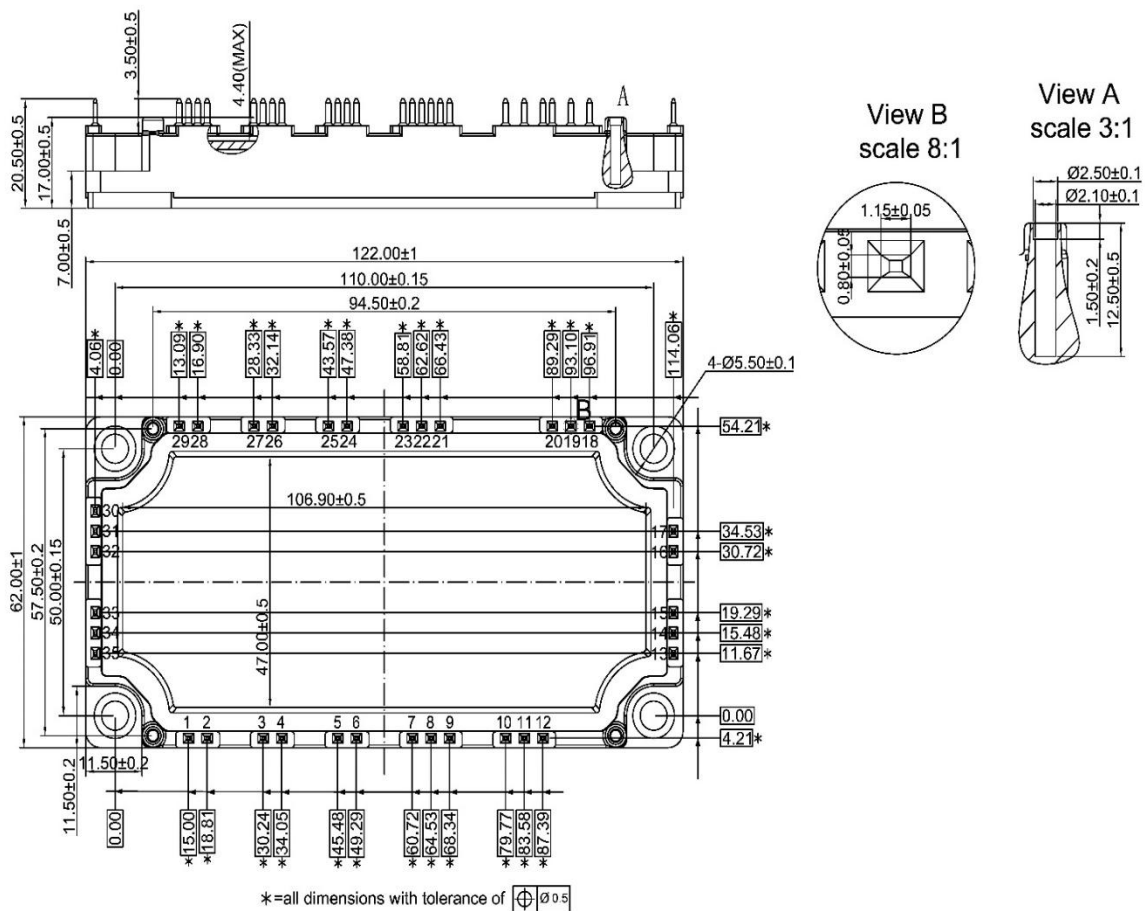
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Internal Circuit:



Package Outline (Unit: mm):



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Revision	Notes
A	Fina Datasheet Initial Release

Announcement

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