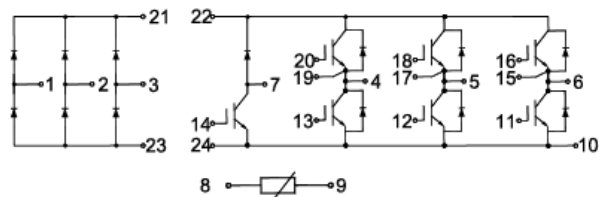


Circuit Diagram

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

Type	Package	Marking
GT50PI120T5H	T5	GT50PI120T5H

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}	$T_C=100^\circ C$	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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IGBT Module Datasheet



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	$I_C=2\text{mA}$, $V_{CE}=V_{GE}$	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} =15Ω, V _{GE} =±15V, Inductive Load	T _J =25°C		79		ns
			T _J =125°C		78		
			T _J =175°C		77		
t _r	Rise Time		T _J =25°C		30		ns
			T _J =125°C		36		
			T _J =175°C		38		
t _{d(off)}	Turn-off Delay Time		T _J =25°C		214		ns
			T _J =125°C		242		
			T _J =175°C		253		
t _f	Fall Time	T _J =25°C		191		ns	
		T _J =125°C		270			
		T _J =175°C		300			
E _{on}	Turn-on Switching Loss	V _{CC} =600V, I _C =50A, R _{Gon} =15Ω, V _{GE} =±15V, di/dt=1050A/μs(T _J =175°C) Inductive Load	T _J =25°C		3.4		mJ
		T _J =125°C		4.8			
		T _J =175°C		5.6			

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E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =50A, R _{Goff} =15Ω, V _{GE} =±15V, du/dt=5400V/μs(T _J =175°C) Inductive Load	T _J =25°C		3.7		mJ
			T _J =125°C		4.9		
			T _J =175°C		5.3		
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))				0.299		°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	tp=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		1.73		
t _{rr}	Reverse Recovery Time	I _F =50A, -diF/dt=1300A/μs(T _J =175°C), V _R =600V, V _{GE} =-15V	T _J =25°C		285		ns
			T _J =125°C		429		
			T _J =175°C		540		
I _{rr}	Peak Reverse Recovery Current		T _J =25°C		52		A
			T _J =125°C		51		
			T _J =175°C		52		
Q _{rr}	Reverse Recovery Charge		T _J =25°C		4.7		μC
			T _J =125°C		7.8		
			T _J =175°C		10.1		

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IGBT Module Datasheet



E _{rec}	Reverse Recovery Energy	I _F =50A, -diF/dt=1300A/μs(T _J =175°C), V _R =600V, V _{GE} =-15V	T _J =25°C		1.8		mJ
			T _J =125°C		3.3		
			T _J =175°C		4.2		
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))				0.551		°C/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 Limited by T_{Jmax}	$T_C=100^\circ C$	25	A
		$T_C=25^\circ C$	50	A
I_{CM}	Peak Collector Current Repetitive	T_p limited by T_{Jmax}	50	A
P_D	Maximum Power Dissipation (IGBT)	$T_C=25^\circ C$, $T_{Jmax}=175^\circ C$	230	W

Electrical Characteristics of IGBT ($T_C=25^\circ C$ 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	$I_C=25A$, $V_{GE}=15V$	$T_J=25^\circ C$		1.76	2.20	V
			$T_J=125^\circ C$		2.15		V
			$T_J=175^\circ C$		2.35		V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0V$, $V_{CE}=1200V$, $T_J=25^\circ C$				1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=20V$, $V_{CE}=0V$, $T_J=25^\circ C$				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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IGBT Module Datasheet



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		62		ns	
			T _J =125°C		58			
			T _J =175°C		52			
t _r	Rise Time		T _J =25°C		39		ns	
			T _J =125°C		44			
			T _J =175°C		47			
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		186		ns	
			T _J =125°C		203			
			T _J =175°C		212			
t _f	Fall Time		T _J =25°C		148		ns	
			T _J =125°C		186			
			T _J =175°C		220			
E _{on}	Turn-on Switching Loss	V _{CC} =600V, I _C =25A, R _{Gon} =36Ω, V _{GE} =±15V, di/dt=420A/μs(T _J =175°C) Inductive Load	T _J =25°C		2.5		mJ	
			T _J =125°C		2.9			
			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		1.4		mJ
				T _J =125°C		1.7		
				T _J =175°C		1.9		
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))				0.493		°C/W	

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

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IGBT Module Datasheet



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=480A/μs(T _J =175°C), V _R =600V, V _{GE} =-15V	T _J =25°C		335		ns	
			T _J =125°C		428			
			T _J =175°C		550			
I _{rr}	Peak Reverse Recovery Current		T _J =25°C		12		A	
			T _J =125°C		13			
			T _J =175°C		14			
Q _{rr}	Reverse Recovery Charge		T _J =25°C		1.4		μC	
			T _J =125°C		2.0			
			T _J =175°C		2.8			
E _{rec}	Reverse Recovery Energy		I _F =15A, -diF/dt=480A/μs(T _J =175°C), V _R =600V, V _{GE} =-15V	T _J =25°C		0.5		mJ
			T _J =125°C		0.8			
			T _J =175°C		1.2			
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))				1.165		°C/W	

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IGBT Module Datasheet



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	$T_J=25^{\circ}\text{C}$	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	$^{\circ}\text{C/W}$
$R_{\theta CS}$	Diode Thermal Resistance: Case-to-Sink (per Diode, $\lambda_{\text{grease}} = 1 \text{ W/(m} \cdot \text{K)}$)				0.435		$^{\circ}\text{C/W}$

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 2500			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:M6	3		6	N·m
G	Weight		190		g

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

Ordering Information Table

Device code	G	T	50	PI	120	T5	H
	①	②	③	④	⑤	⑥	⑦

- 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)



Characteristic diagram

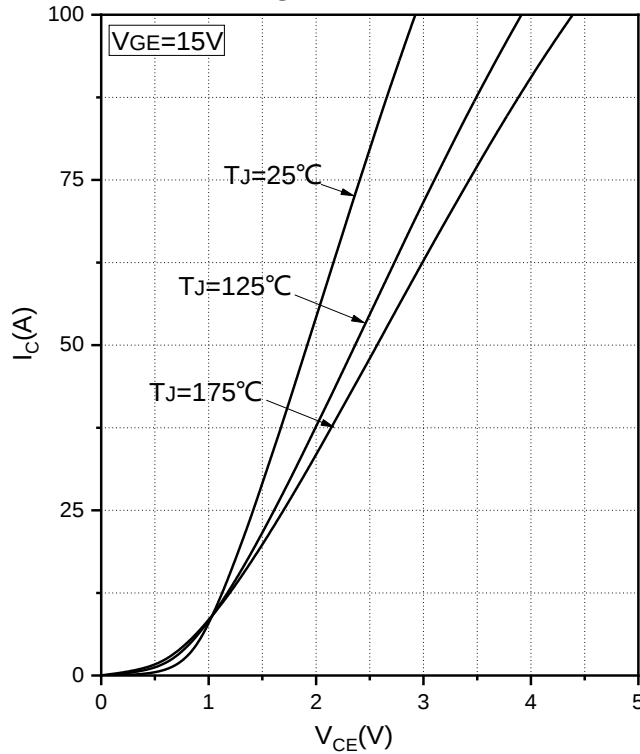


Fig.1 Typical Saturation Voltage Characteristics(Inverter)

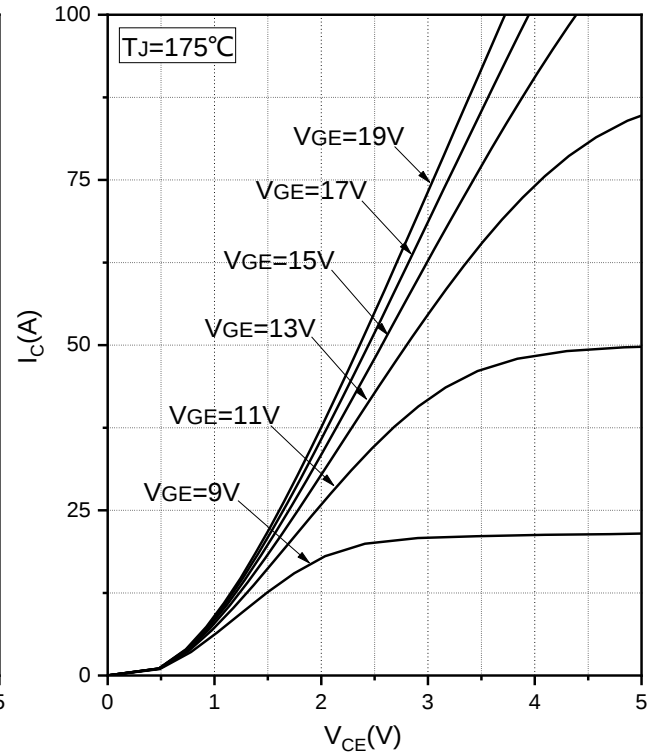


Fig.2 Typical Output Characteristics(Inverter)

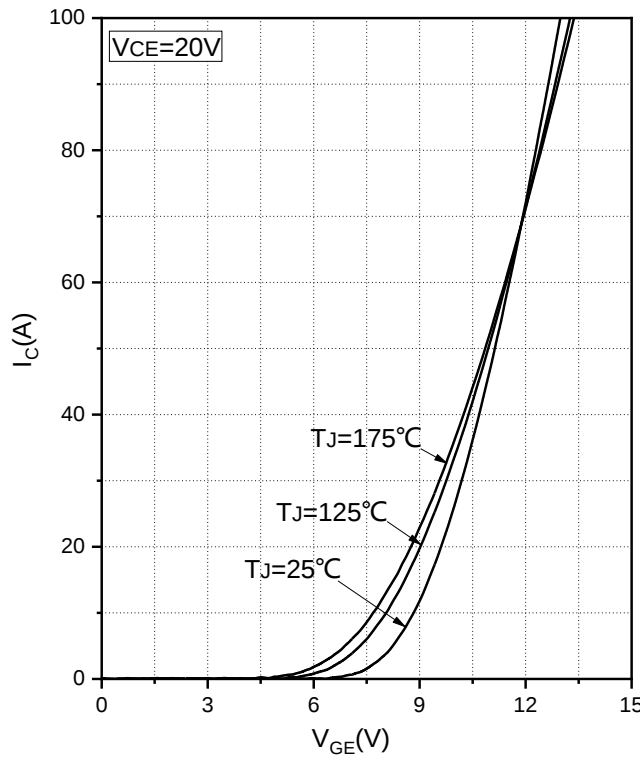


Fig.3 Transfer Characteristic(Inverter)

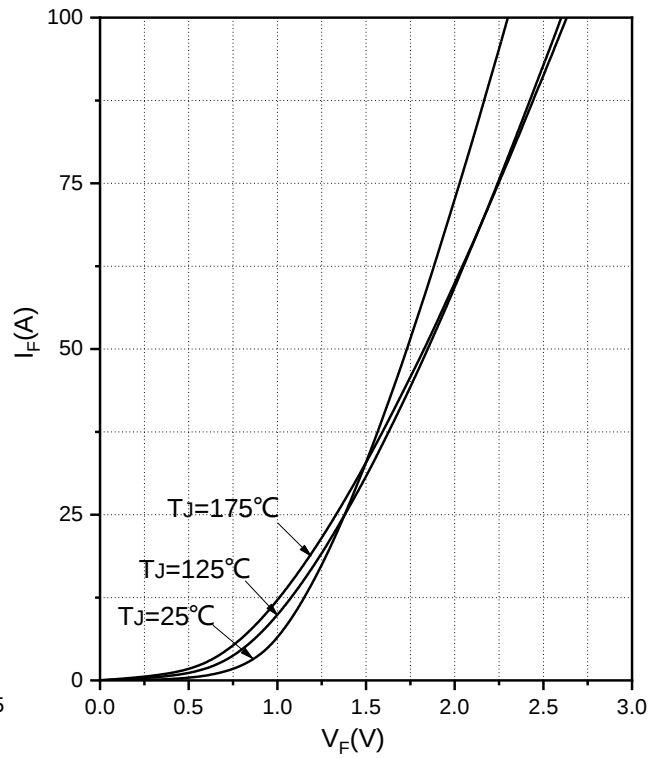


Fig.4 Forward Characteristics of Diode(Inverter)

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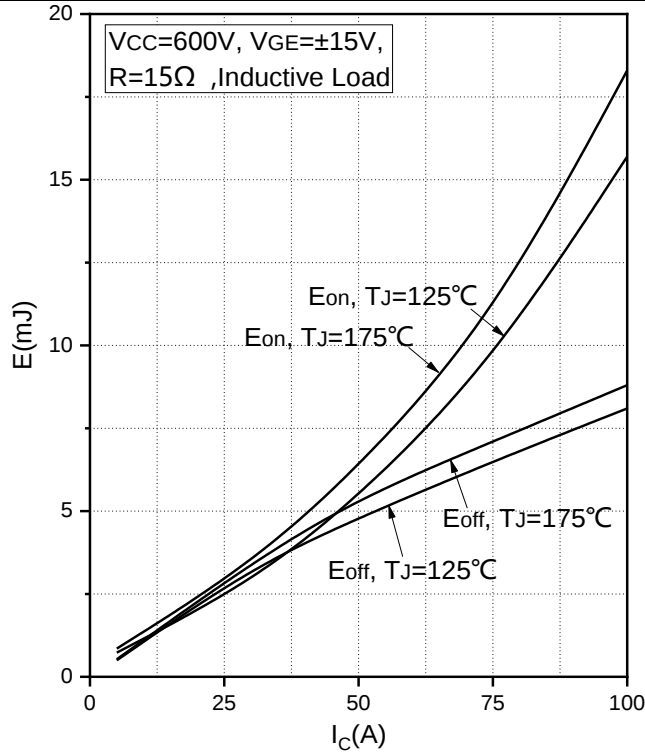


Fig.5 Typical Switching Loss vs. Collector Current(Inverter)

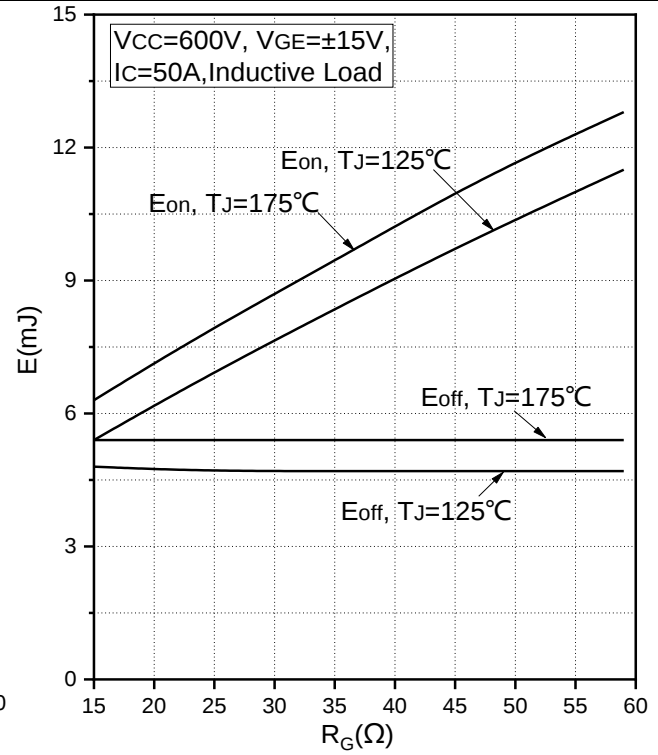


Fig.6 Typical Switching Loss vs. Gate Resistance(Inverter)

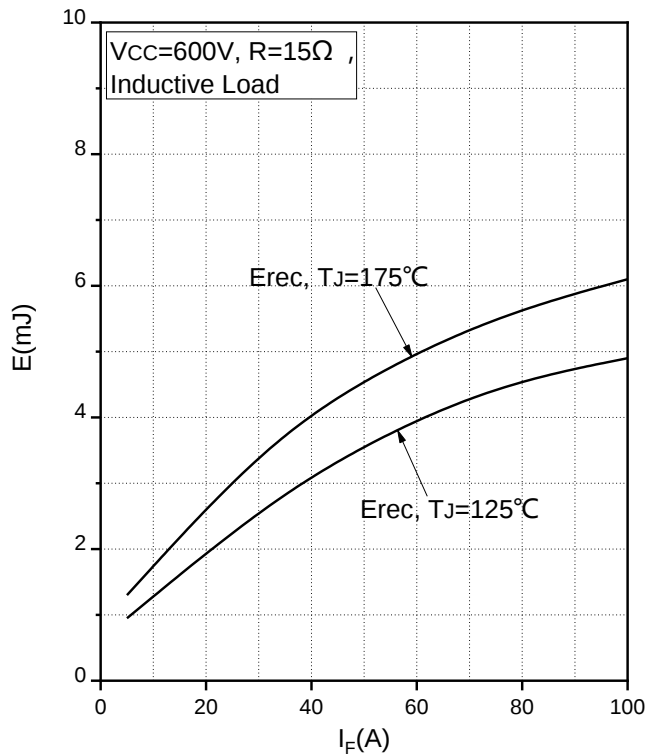


Fig.7 Typical Switching Loss vs. Forward Current(Inverter)

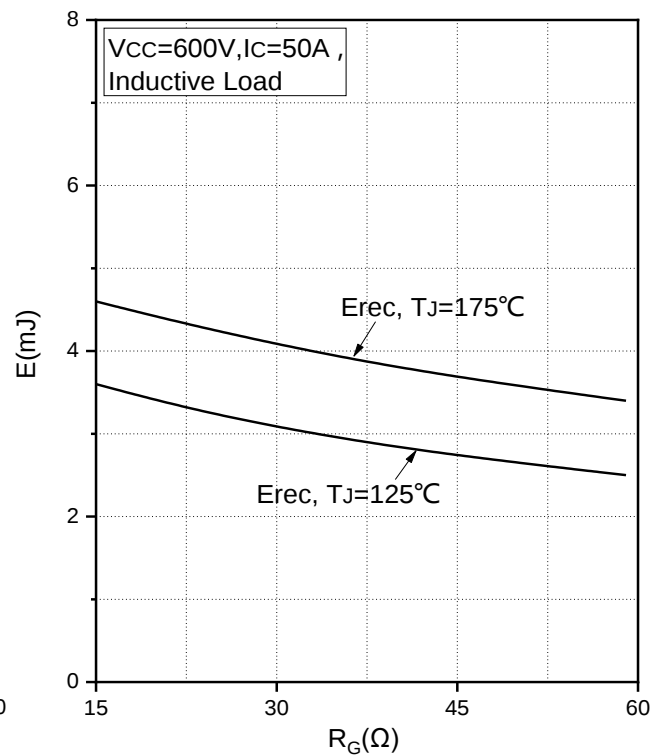


Fig.8 Typical Switching Loss vs. Gate Resistance(Inverter)

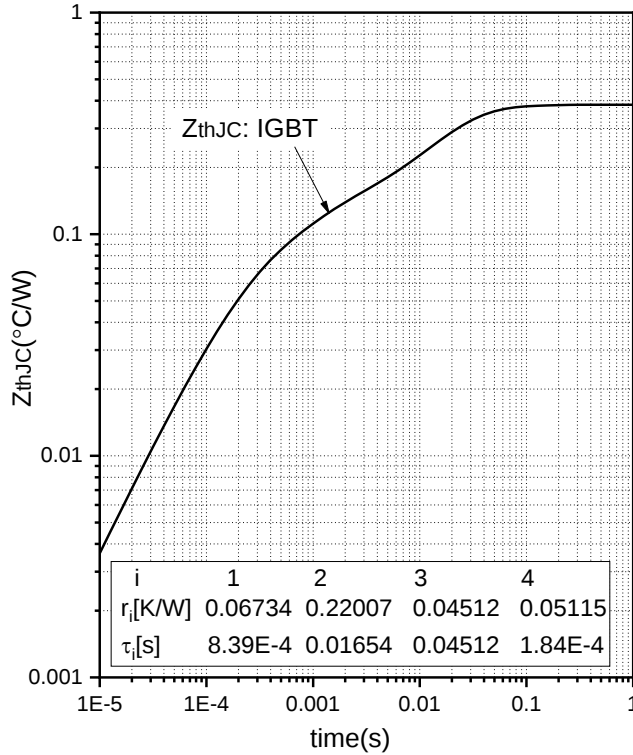


Fig.9 Transient Thermal Impedance (Inverter IGBT)

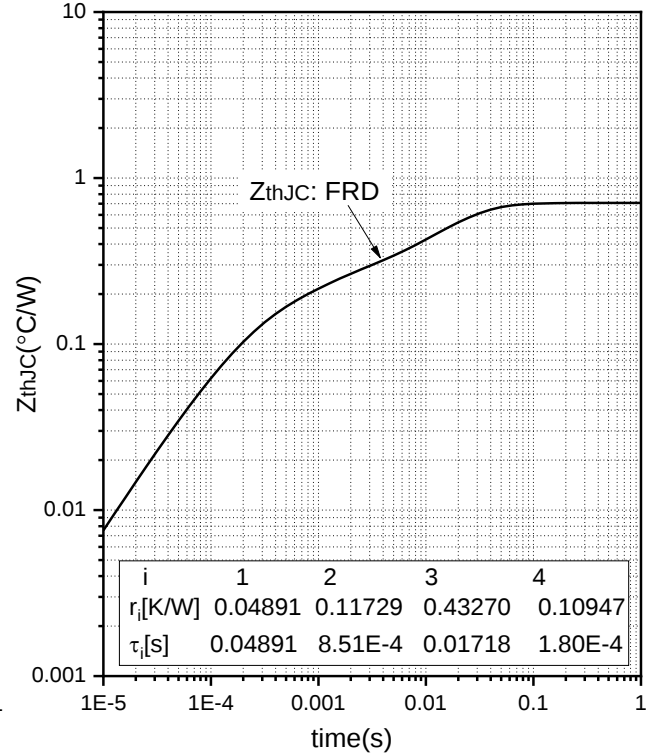


Fig.10 Transient Thermal Impedance (Inverter Diode)

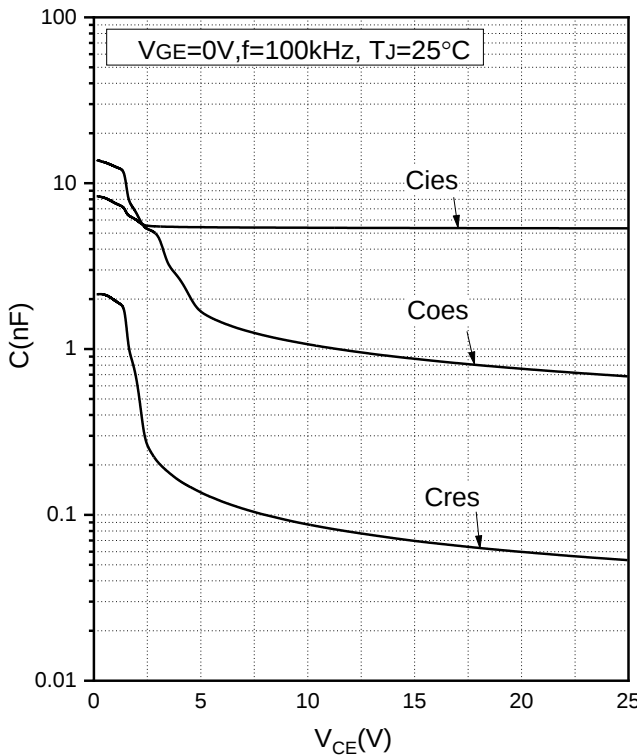


Fig.11 Capacitance Characteristics(Inverter)

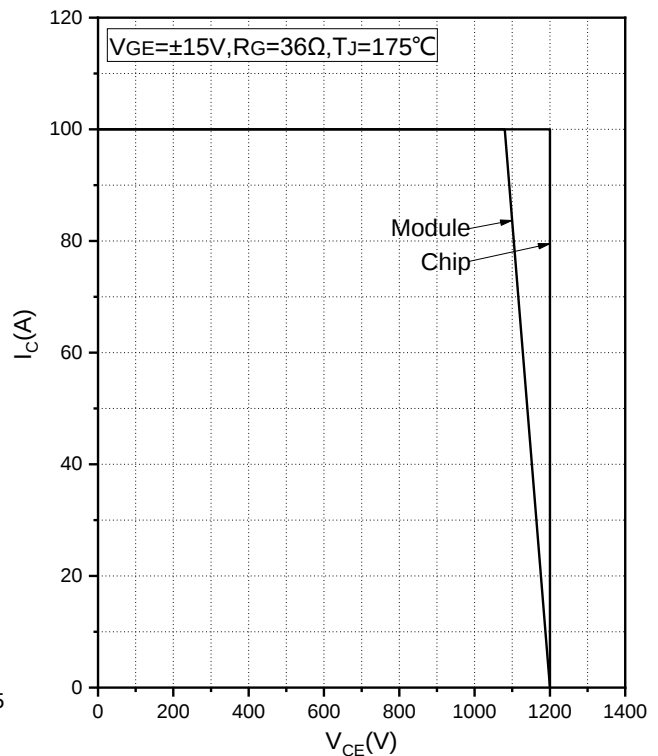


Fig.12 Reverse Bias Safe Operation Area (RBSOA) (Inverter)

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IGBT Module Datasheet

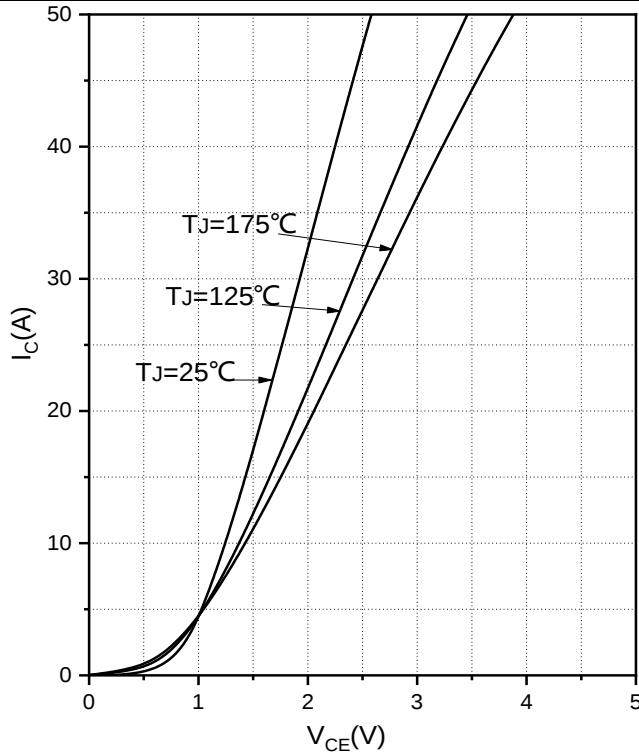


Fig.13 Typical Saturation Voltage Characteristics (Chopper)

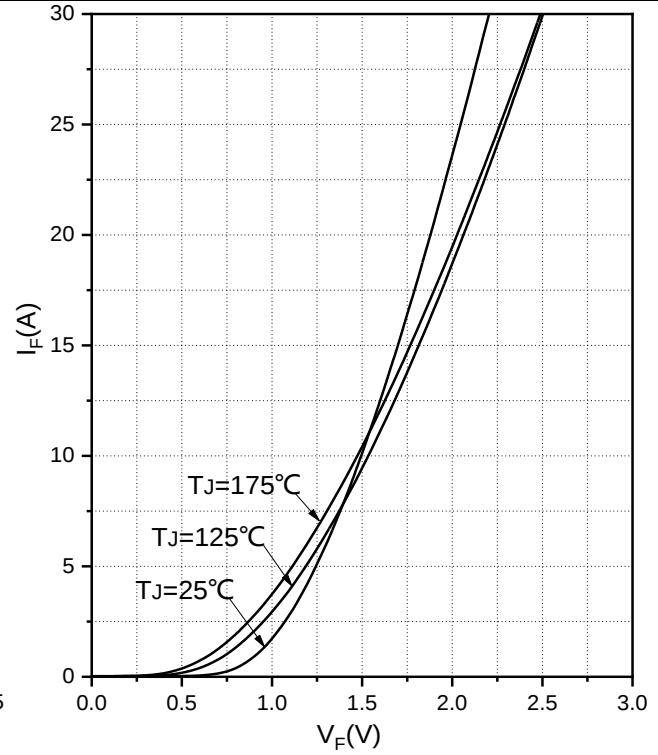


Fig.14 Forward Characteristics of Diode(Chopper)

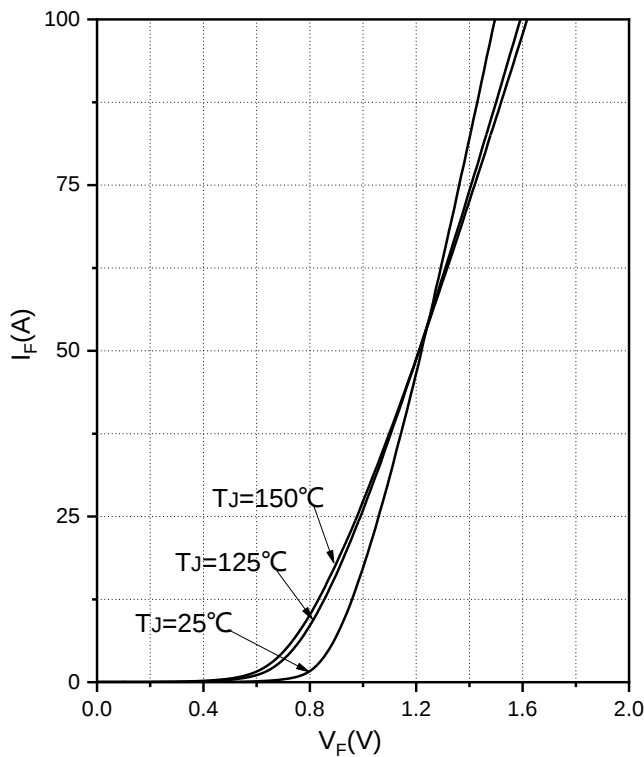


Fig.15 Forward Characteristics of Diode (Rectifier)

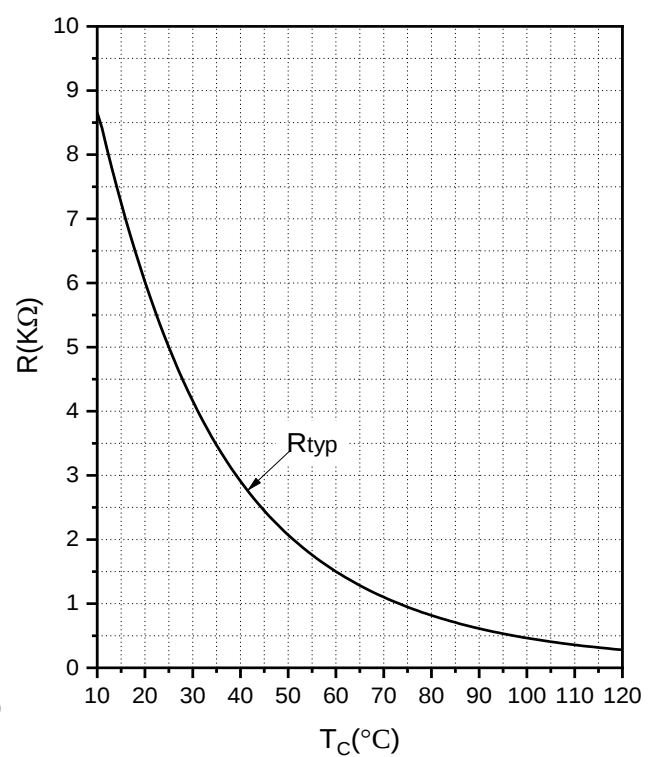


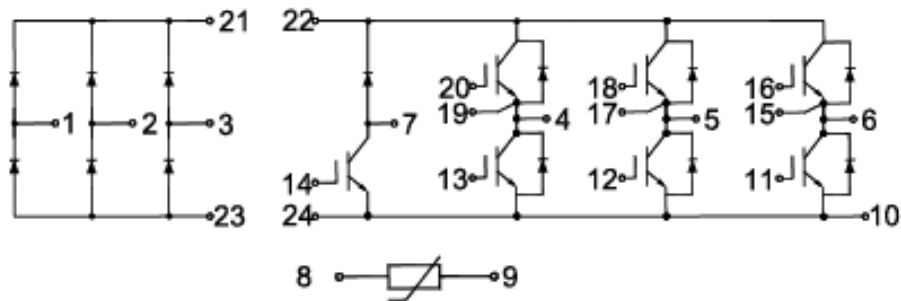
Fig.16 NTC Temperature Characteristics

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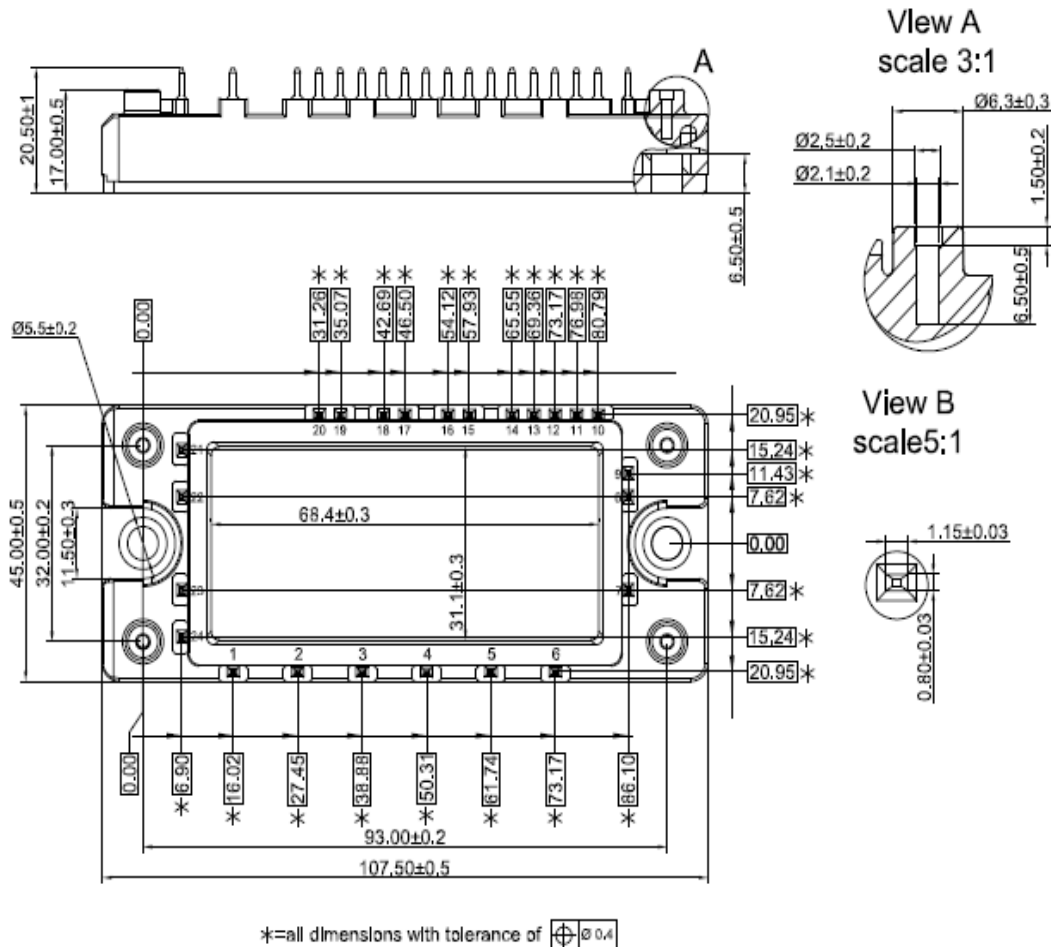
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Internal Circuit:



Package Outline (Unit: mm):



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IGBT Module Datasheet



Revision	Notes
A	Fina Datasheet Initial Release

Announcement

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