



GTS10PI120B3H

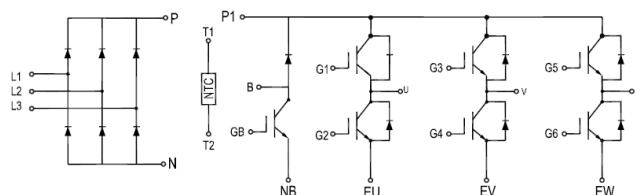
IGBT Module

Preliminary Data

Features:

- Trench & Field Stop IGBT
- Short Circuit Rated $>10\mu\text{s}$
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested ($2 \times I_c$)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement

Circuit Diagram



Applications:

- Industrial Inverters
- Servo Applications

IGBT, Inverter

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

V_{CES}	Collector-Emitter Blocking Voltage	$T_J=25^\circ\text{C}$	1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_c	Continuous Collector Current	$T_c=100^\circ\text{C}$	10	A
		$T_c=25^\circ\text{C}$	20	A
I_{CM}	Peak Collector Current Repetitive	$t_p=1\text{ms}$	20	A
P_D	Maximum Power Dissipation per IGBT	$T_c=25^\circ\text{C}, T_{Jmax}=175^\circ\text{C}$	158	W



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	$I_C=1\text{mA}$, $V_{CE}=V_{GE}$, $T_J=25^{\circ}\text{C}$	5.00	5.70	6.50	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=10\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^{\circ}\text{C}$	1.85	2.00	V
			$T_J=125^{\circ}\text{C}$	2.10		V
			$T_J=150^{\circ}\text{C}$	2.15		V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0\text{V}$, $V_{CE}=V_{CES}$, $T_J=25^{\circ}\text{C}$			100	μA
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	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_J=25^{\circ}\text{C}$		972		pF
C_{oes}	Output Capacitance			43		
C_{res}	Reverse Transfer Capacitance			12		

Switching Characteristics

t _{d(on)}	Turn-on Delay Time	V _{CC} =600V, I _C =10A, R _{Gon} =68Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		71		ns
			T _J =125℃		84		
			T _J =150℃		93		
t _r	Rise Time		T _J =25℃		52		ns
			T _J =125℃		61		
			T _J =150℃		65		
t _{d(off)}	Turn-off Delay Time	V _{CC} =600V, I _C =10A, R _{Goff} =68Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		166		ns
			T _J =125℃		172		
			T _J =150℃		172		
t _f	Fall Time		T _J =25℃		382		ns
			T _J =125℃		573		
			T _J =150℃		546		
E _{on}	Turn-on Switching Loss	V _{CC} =600V, I _C =10A, R _{Gon} =68Ω, V _{GE} =±15V, di/dt=145A/μs (T _J =150℃), Inductive Load	T _J =25℃		2.2		mJ
			T _J =125℃		2.5		
			T _J =150℃		2.6		



E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =10A, R _{Goff} =68Ω, V _{GE} =±15V, du/dt=1532V/μs (T _J =150°C), Inductive Load	T _J =25°C		0.3		mJ
			T _J =125°C		0.6		
			T _J =150°C		0.7		
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25°C		340		nC
R _{g internal}	Internal Gate Resistor		T _J =25°C		0		Ω
I _{SC}	V _{CC} =600V, V _{GE} =±15V, tp=10us, R _{Gon} =68Ω, R _{Goff} =68Ω, T _J =125°C				53		A
R _{θJC}	Thermal Resistance: Junction-To-Case (per IGBT)					0.95	°C/W

Diode, Inverter

Maximum Rated Values (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	T _C =100°C	10	A
I _{FM}	Repetitive Peak Forward Current	tp=1ms	20	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 =10A	T _J =25℃		1.70		V
			T _J =125℃		1.80		
			T _J =150℃		1.80		
t _{rr}	Reverse Recovery Time	I _F =10A, -diF/dt=208A/μs(T _J =150℃), V _{rr} =600V, V _{GE} =-15V	T _J =25℃		279		ns
			T _J =125℃		305		
			T _J =150℃		392		
I _{rr}	Peak Reverse Recovery Current		T _J =25℃		6.6		A
			T _J =125℃		7.2		
			T _J =150℃		8.4		
Q _{rr}	Reverse Recovery Charge		T _J =25℃		1.05		μC
			T _J =125℃		1.46		
			T _J =150℃		1.91		



E _{rec}	Reverse Recovery Energy	I _F =10A, -diF/dt=208A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =-15V	T _J =25°C		0.18		mJ
			T _J =125°C		0.25		
			T _J =150°C		0.43		
R _{θJC}	Thermal Resistance: Junction-To-Case (per Diode)					1.28	°C/W

IGBT, Brake-Chopper

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

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	10	A
		T _C =25°C	20	A
I _{CM}	Peak Collector Current Repetitive	tp=1ms	20	A
P _D	Maximum Power Dissipation per IGBT	T _C =25°C, T _{Jmax} =175°C	158	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} , T _J =25°C		5.00	5.70	6.50	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =10A, V _{GE} =15V	T _J =25°C		1.85	2.00	V
			T _J =125°C		2.10		V
			T _J =150°C		2.15		V
I _{CES}	Collector-Emitter Leakage Current	V _{GE} =0V, V _{CE} =V _{CES} , T _J =25°C				100	uA
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, T _J =25°C			972		pF
C _{oes}	Output Capacitance				43		
C _{res}	Reverse Transfer Capacitance				12		



Switching Characteristics

t _{d(on)}	Turn-on Delay Time	V _{CC} =600V, I _C =10A, R _{Gon} =68Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		71		ns	
			T _J =125℃		84			
			T _J =150℃		93			
t _r	Rise Time		T _J =25℃		52		ns	
			T _J =125℃		61			
			T _J =150℃		65			
t _{d(off)}	Turn-off Delay Time		V _{CC} =600V, I _C =10A, R _{Goff} =68Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		166		ns
				T _J =125℃		172		
				T _J =150℃		172		
t _f	Fall Time	T _J =25℃			382		ns	
		T _J =125℃			573			
		T _J =150℃			546			
E _{on}	Turn-on Switching Loss	T _J =25℃			2.2		mJ	
		T _J =125℃			2.5			
		T _J =150℃			2.6			
E _{off}	Turn-off Switching Loss	T _J =25℃		0.3		mJ		
		T _J =125℃		0.6				
		T _J =150℃		0.7				
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25℃		340		nC	
R _{g internal}	Internal Gate Resistor		T _J =25℃		0		Ω	
I _{SC}	V _{CC} =600V, V _{GE} =±15V, tp=10us, R _{Gon} =68Ω, R _{Goff} =68Ω, T _J =125℃				53		A	
R _{θJC}	Thermal Resistance: Junction-To-Case (per IGBT)					0.95	℃/W	

Diode, Brake-Chopper

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

V_{RRM}	Repetitive Peak Reverse Voltage	$T_J=25^\circ C$	1200	V
I_F	Diode Continuous Forward Current	$T_C=100^\circ C$	10	A
I_{FM}	Repetitive Peak Forward Current	$t_p=1ms$	20	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 =10A	T _J =25℃		1.70		V
			T _J =125℃		1.80		
			T _J =150℃		1.80		
t _{rr}	Reverse Recovery Time	I _F =10A, -diF/dt=208A/μs(T _J =150℃), V _{rr} =600V, V _{GE} =-15V	T _J =25℃		279		ns
			T _J =125℃		305		
			T _J =150℃		392		
I _{rr}	Peak Reverse Recovery Current		T _J =25℃		6.6		A
			T _J =125℃		7.2		
			T _J =150℃		8.4		
Q _{rr}	Reverse Recovery Charge		T _J =25℃		1.05		μC
			T _J =125℃		1.46		
			T _J =150℃		1.91		
E _{rec}	Reverse Recovery Energy		T _J =25℃		0.18		mJ
			T _J =125℃		0.25		
			T _J =150℃		0.43		
R _{θJC}	Thermal Resistance: Junction-To-Case (per Diode)					1.28	℃/W

Diode, Rectifier

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

V _{RRM}	Repetitive Peak Reverse Voltage	T _J =25°C	1600	V
I _F	Diode Continuous Forward Current	T _J =25°C	10	A
I _{FRMSM}	Maximum RMS Forward Current per Chip	T _J =80°C	20	A
I _{RMSM}	Maximum RMS Current at Rectifier Output	T _J =80°C	30	A
I _{FSM}	Surge Current @t _p =10ms	T _J =25°C	300	A
		T _J =125°C	250	
I ² t	I ² t - value	T _J =25°C	450	A ² s
		T _J =125°C	312	



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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _F	Forward Voltage	I _F =10A	T _J =25°C		1.05		V
			T _J =125°C		1.00		
I _R	Reverse Current	V _R =1200V	T _J =25°C			1	mA
R _{θJC}	Diode Thermal Resistance: Junction-To-Case (per Diode)					1.07	°C/W

Internal NTC-Thermistor Characteristics

R ₂₅	T _C =25°C	5		kΩ
ΔR/R	T _C =100°C, R ₁₀₀ =465Ω		±5	%
P ₂₅	T _C =25°C	10		mW
B _{25/50}	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15K))]$	3380		K
B _{25/80}	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15K))]$	3440		K
B _{25/100}	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298.15K))]$	3545		K

Module

Symbol	Description		Min.	Typ.	Max.	Units
V _{iso}	Isolation Voltage (All Terminals Shorted)	RMS, f=50Hz, 30s	4500			V
Internal Isolation			Al ₂ O ₃			
T _J	Maximum Junction Temperature				175	°C
T _{JOP}	Maximum Operating Junction Temperature Range		-40		+150	°C
T _{stg}	Storage Temperature		-40		+150	°C
CTI	Comparative Tracking Index		200			
R _{θCS}	Case-To-Sink Thermally (Conductive Grease Applied)				0.08	°C/W
M	Mounting Screw:M4		1.5		1.8	N·m
G	Weight			23		g



Ordering Information Table

Device code	G	TS	10	PI	120	B3	H
	①	②	③	④	⑤	⑥	⑦

- ① - IGBT Module
- ② - Trench, Low Switching Losses IGBT
- ③ - Rated Current (10=10A)
- ④ - Circuit Configuration: (Power Integrated)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)

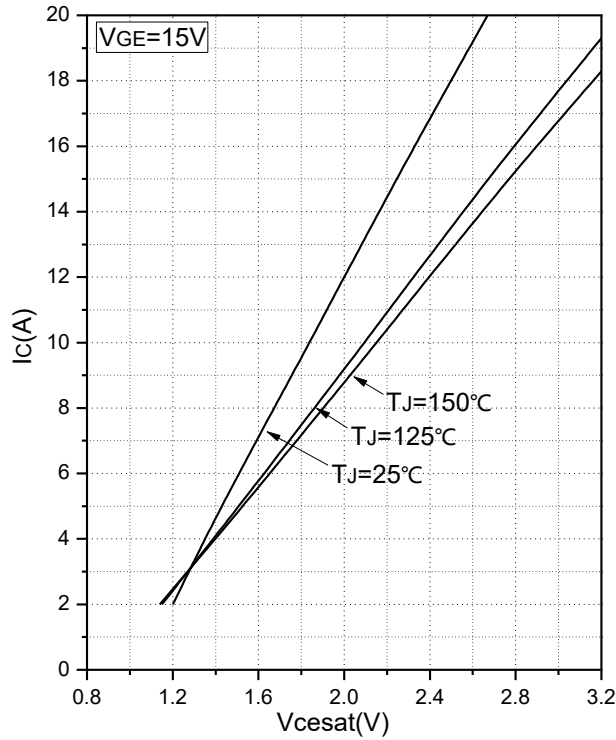


Fig.1 Typical Saturation Voltage Characteristics

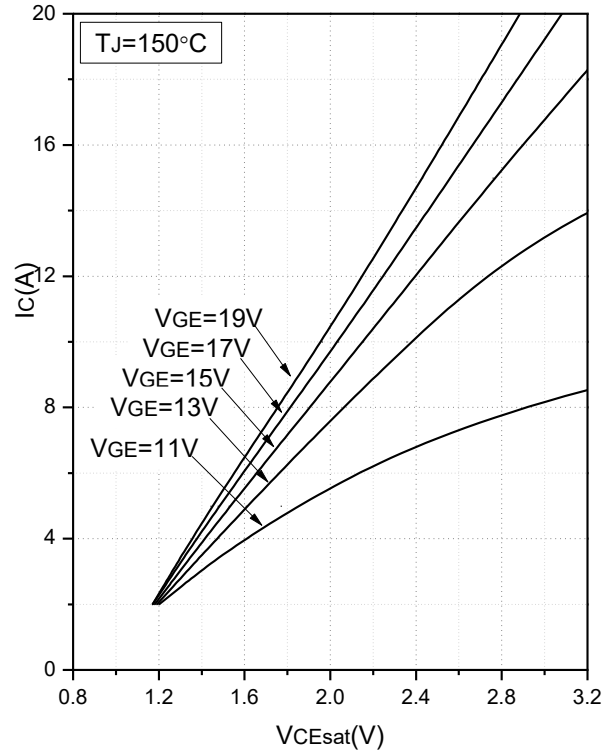


Fig.2 Typical Output Characteristics

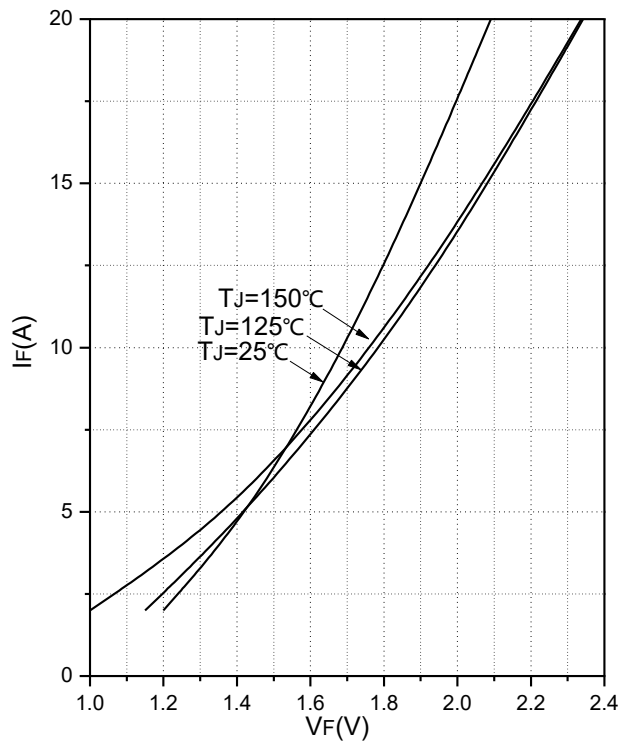


Fig.3 Forward Characteristics of Diode (Inverter)

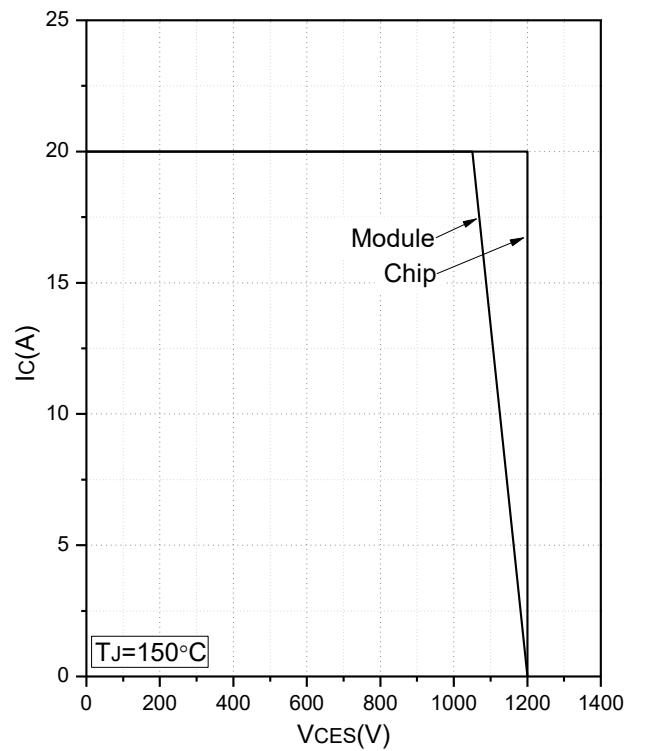


Fig.4 Reverse Bias Safe Operation Area (RBSOA) (Inverter)

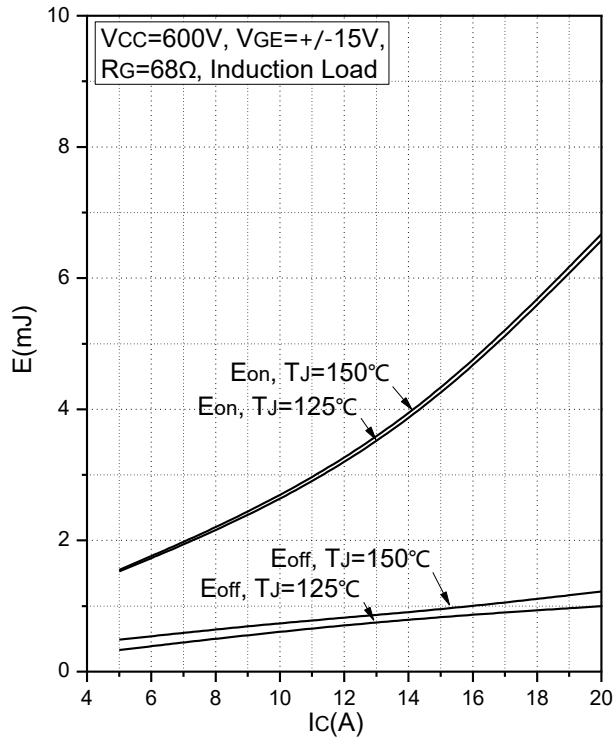


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

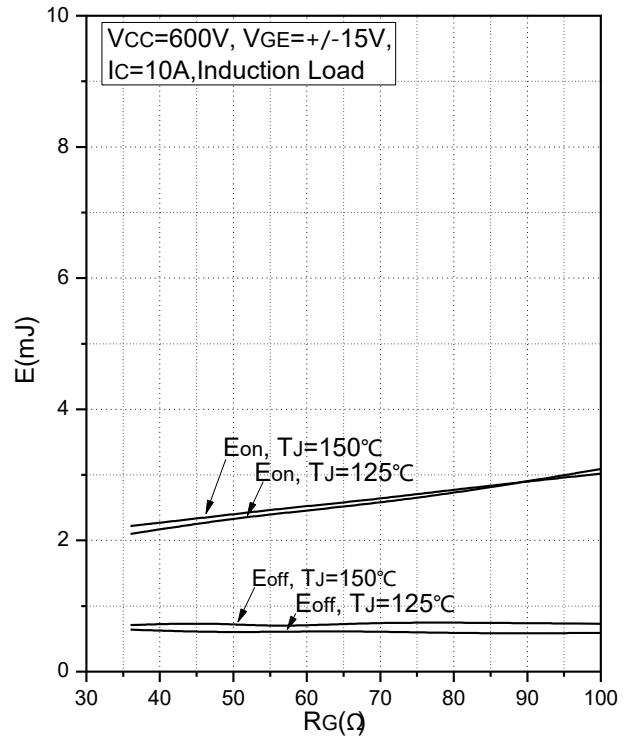


Fig.6 Typical Switching Loss vs. Gate Resistance (Inverter)

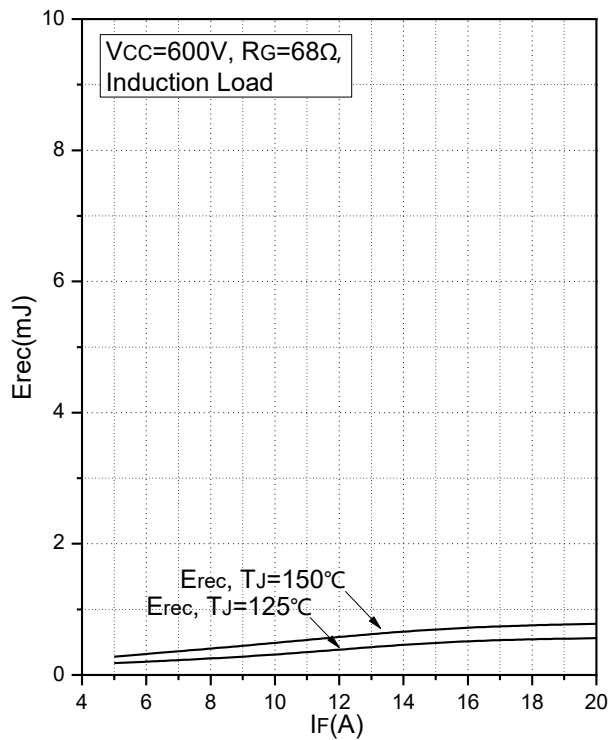


Fig.7 Typical Switching Loss vs. Forward Current (Inverter)

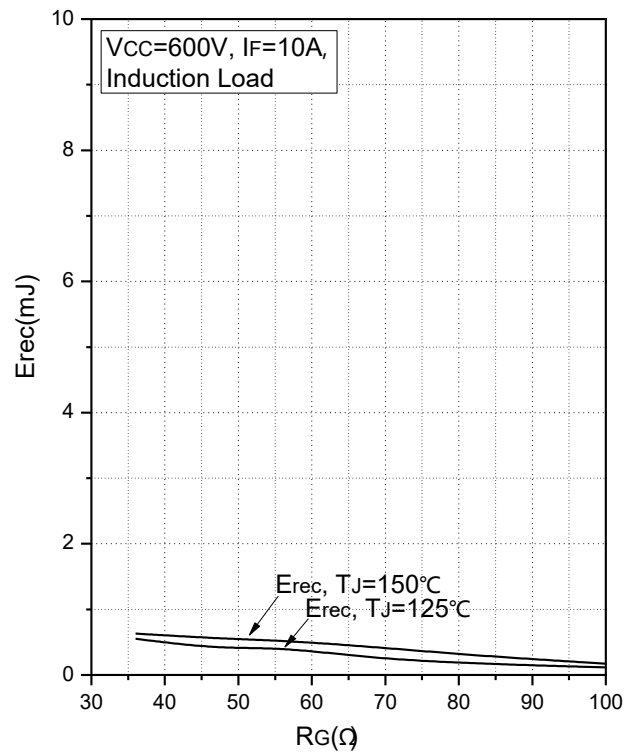


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

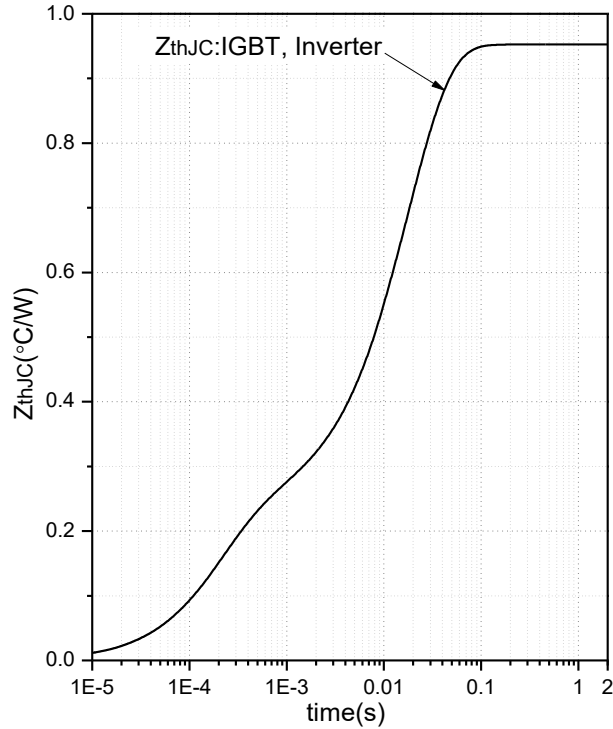


Fig.9 Transient Thermal Impedance (Inverter-IGBT)

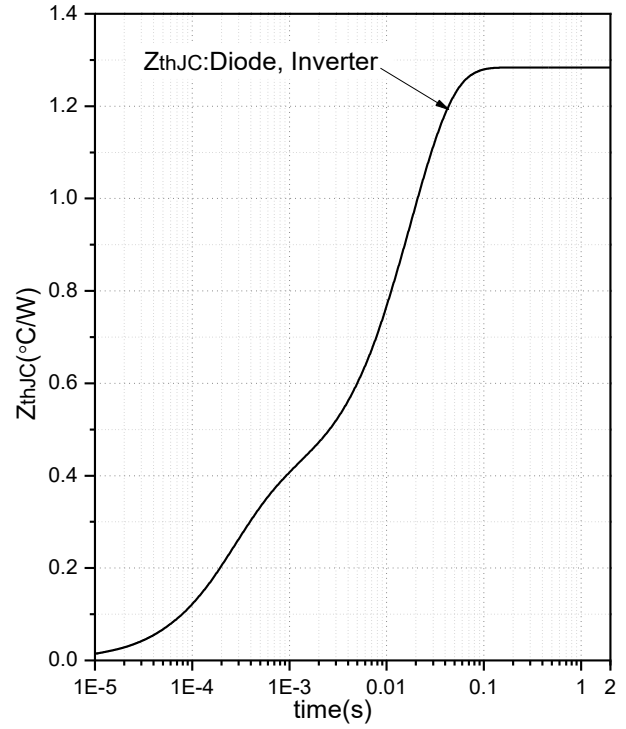


Fig.10 Transient Thermal Impedance (Inverter-Diode)

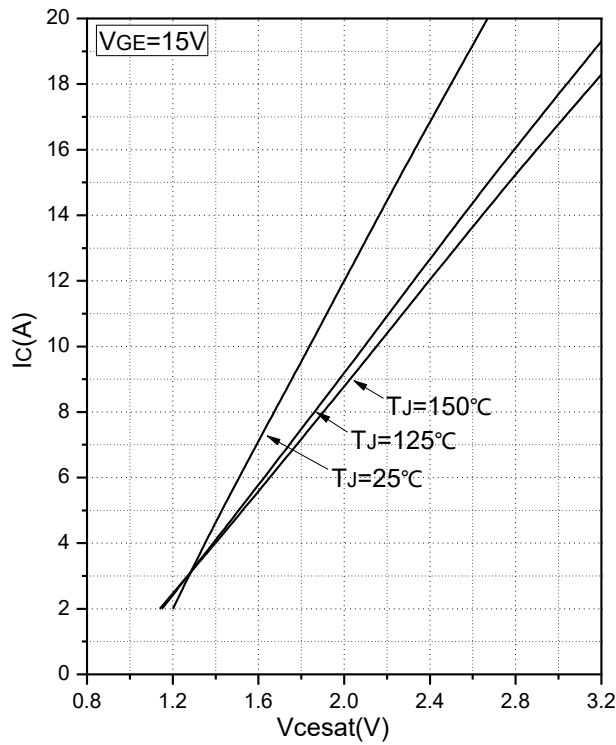


Fig.11 Typical Saturation Voltage Characteristics (Brake-Chopper)

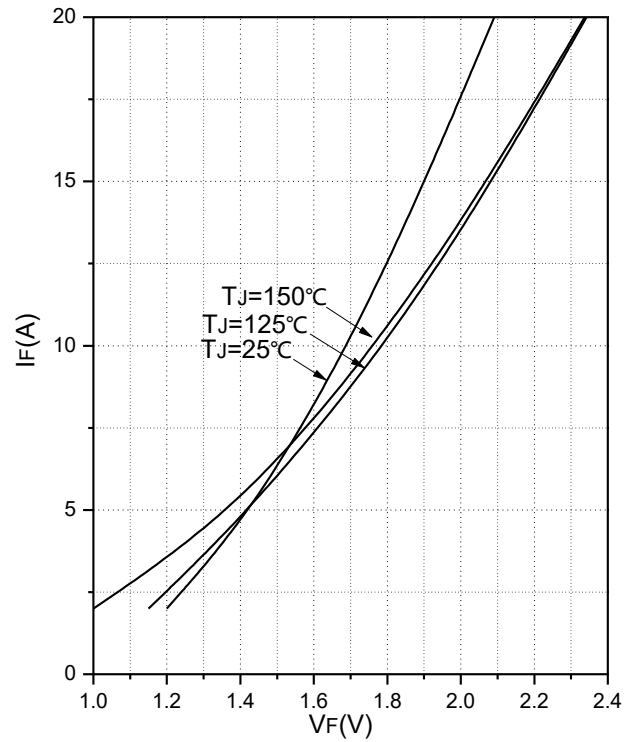


Fig.12 Forward Characteristics of Diode (Brake-Chopper)

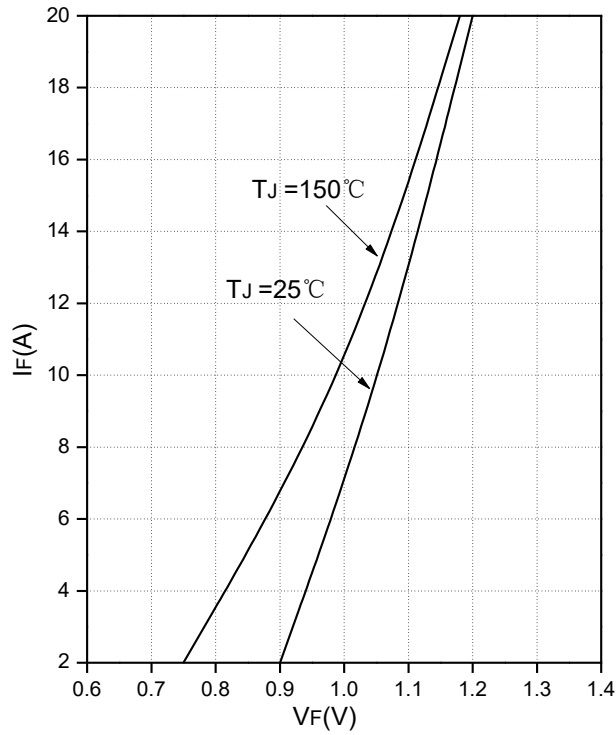


Fig.13 Forward Characteristics of Diode (Rectifier)

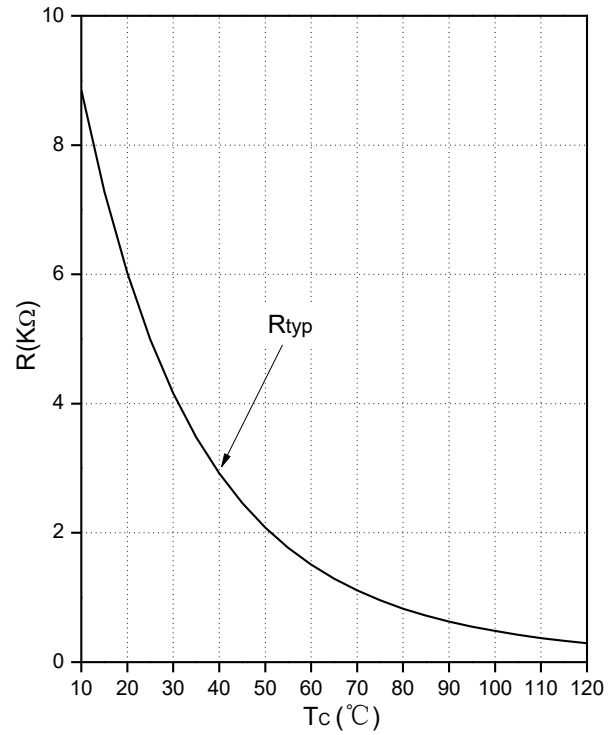
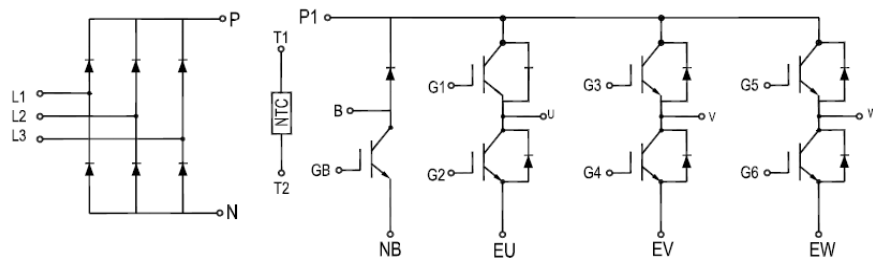


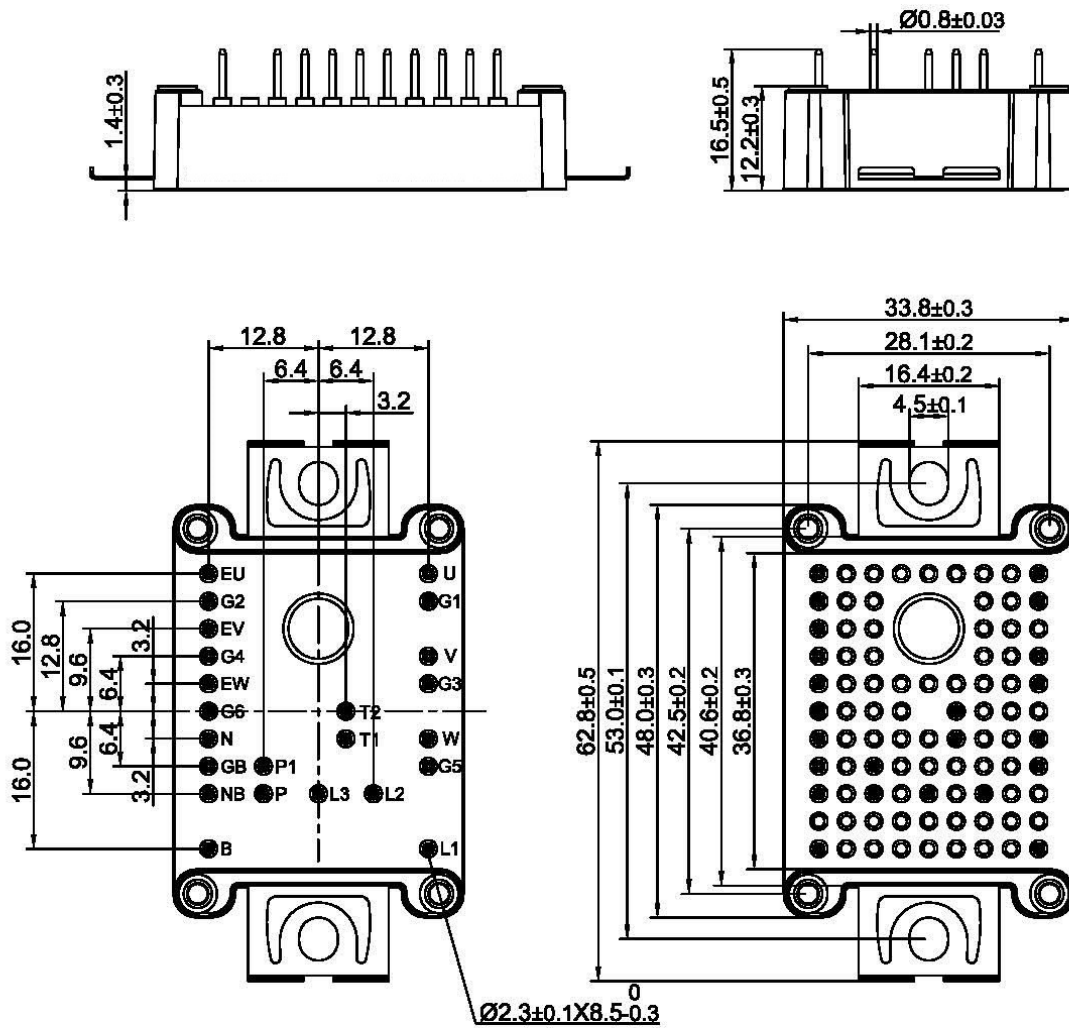
Fig.14 NTC Temperature Characteristics



Internal Circuit:



Package Outline (Unit: mm):



Pinpositions with tolerance of $\oplus \ominus \varnothing 0.4$



Date	Revision	Notes
07/03/2024	01	Initial Release

Announcement

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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”.