



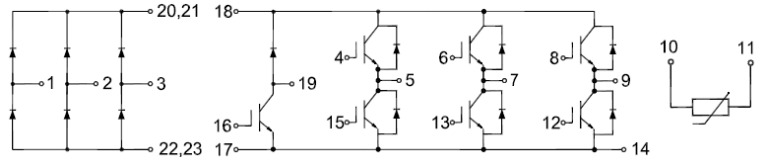
GT40PI120T5H-T4

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



Applications:

- Auxiliary Inverters
- Servo Drives
- Motor Drives

IGBT, Inverter

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

V_{CES}	Collector-Emitter Blocking Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C=100^\circ\text{C}$	40	A
		$T_C=25^\circ\text{C}$	80	A
I_{CM}	Peak Collector Current Repetitive	$t_p=1\text{ms}$	80	A
P_D	Maximum Power Dissipation (IGBT)	$T_C=25^\circ\text{C}$ $T_{Jmax}=175^\circ\text{C}$	300	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 =1.5mA, V _{CE} =V _{GE} , T _J =25°C	5.0	5.7	6.5	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =40A, V _{GE} =15V	T _J =25°C	1.90	2.30	V
			T _J =125°C	2.40		
			T _J =150°C	2.50		
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			200	nA
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=100kHz, T _J =25°C		2.19		nF
C _{oes}	Output Capacitance			0.19		
C _{res}	Reverse Transfer Capacitance			0.04		

Switching Characteristics

t _{d(on)}	Turn-on Delay Time	V _{CC} =600V, I _C =40A, R _{Gon} =36Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		114		ns
			T _J =125℃		126		
			T _J =150℃		130		
t _r	Rise Time		T _J =25℃		88		ns
			T _J =125℃		96		
			T _J =150℃		102		
t _{d(off)}	Turn-off Delay Time		T _J =25℃		338		ns
			T _J =125℃		362		
			T _J =150℃		364		
t _f	Fall Time	T _J =25℃		90		ns	
		T _J =125℃		110			
		T _J =150℃		114			
E _{on}	Turn-on Switching Loss	V _{CC} =600V, I _C =40A, R _{Gon} =36Ω, V _{GE} =±15V, di/dt=385A/μs(T _J =150℃), Inductive Load	T _J =25℃		3.7		mJ
		T _J =125℃		4.1			
		T _J =150℃		4.3			



E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =40A, R _{Goff} ≈36Ω, V _{GE} =±15V, du/dt=3855V/μs(T _J =150°C), Inductive Load	T _J =25°C		2.3		mJ
			T _J =125°C		2.5		
			T _J =150°C		2.9		
Q _g	Total Gate Charge	V _{GE} =-15V...+15V	T _J =25°C		457		nC
R _{G(int)}	Internal Gate Resistor		T _J =25°C		0		Ω
I _{SC}	V _{CC} =600V, V _{GE} =±15V, t _p =10us, T _J =150°C				162		A
R _{θJC}	Thermal Resistance: Junction-to-Case (per IGBT)					0.50	°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	40	A
I _{FM}	Peak Diode Current Repetitive	t _p =1ms	80	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 =40A	T _J =25℃		1.70		V
			T _J =125℃		1.85		
			T _J =150℃		1.85		
I _{rr}	Peak Reverse Recovery Current	I _F =40A, di/dt=432A/μs(T _J =150℃), V _{rr} =600V, V _{GE} =-15V	T _J =25℃		24.3		A
			T _J =125℃		25.4		
			T _J =150℃		25.8		
t _{rr}	Reverse Recovery Time		T _J =25℃		174		ns
			T _J =125℃		190		
			T _J =150℃		208		
Q _{rr}	Reverse Recovery Charge		T _J =25℃		2.2		μC
			T _J =125℃		2.4		
			T _J =150℃		2.8		



E _{rec}	Reverse Recovery Energy	I _F =40A, di/dt=432A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =-15V	T _J =25°C		0.17		mJ
			T _J =125°C		0.18		
			T _J =150°C		0.20		
R _{θJC}	Thermal Resistance: Junction-to-Case (per Diode)					0.79	°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	T _C =100°C	25	A
		T _C =25°C	50	A
I _{CM}	Repetitive Peak Collector Current	t _P =1ms	50	A
P _D	Maximum Power Dissipation per IGBT	T _C =25°C T _{Jmax} =175°C	235	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	5.6	6.5	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =25A, V _{GE} =15V	T _J =25°C		1.75	2.10	V
			T _J =125°C		2.10		
			T _J =150°C		2.20		
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				200	nA
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=100kHz			1.64		nF
C _{oes}	Output Capacitance				0.44		
C _{res}	Reverse Transfer Capacitance				0.02		



Switching Characteristics

t _{d(on)}	Turn-on Delay Time	V _{CC} =600V, I _C =25A, R _{Gon} =20Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		57		ns
			T _J =125℃		58		
			T _J =150℃		68		
t _r	Rise Time		T _J =25℃		55		ns
			T _J =125℃		58		
			T _J =150℃		60		
t _{d(off)}	Turn-off Delay Time		T _J =25℃		208		ns
			T _J =125℃		211		
			T _J =150℃		214		
t _f	Fall Time	T _J =25℃		76		ns	
		T _J =125℃		223			
		T _J =150℃		225			
E _{on}	Turn-on Switching Loss	T _J =25℃		3.1		mJ	
		T _J =125℃		3.8			
		T _J =150℃		4.1			
E _{off}	Turn-off Switching Loss	T _J =25℃		2.1		mJ	
		T _J =125℃		2.4			
		T _J =150℃		2.5			
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25℃		400		nC
R _{G(int)}	Internal Gate Resistor		T _J =25℃		0		Ω
I _{SC}	V _{CC} =600V, V _{GE} =+/-15V, T _J =25℃				100		A
R _{θJC}	Thermal Resistance: Junction-to-Case (per IGBT)					0.63	℃/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	$T_C=100^\circ C$	15	A
I_{FM}	Diode Maximum Forward Current	$t_p=1ms$	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		V
			T _J =125°C		1.80		
			T _J =150°C		1.80		
t _{rr}	Reverse Recovery Time	I _F =15A, -diF/dt=145A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =-15V	T _J =25°C		262		ns
			T _J =125°C		472		
			T _J =150°C		491		
I _{rr}	Peak Reverse Recovery Current		T _J =25°C		15.4		A
			T _J =125°C		16.2		
			T _J =150°C		17.3		
Q _{rr}	Reverse Recovery Charge		T _J =25°C		2.0		μC
			T _J =125°C		3.4		
			T _J =150°C		3.5		
E _{rec}	Reverse Recovery Energy		T _J =25°C		0.6		mJ
			T _J =125°C		1.1		
			T _J =150°C		1.2		
R _{θJC}	Thermal Resistance: Junction-to-Case (per Diode)					1.54	°C/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	$T_C=80^\circ\text{C}$	55	A
I_{RMSM}	Maximum RMS Current At Rectifier Output	$T_C=80^\circ\text{C}$	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 Characteristics of Diode (T_C=25°C unless otherwise specified)

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _F	Forward Voltage	I _F =40A	T _J =25°C		1.10		V
			T _J =125°C		1.05		
I _R	Reverse Current	V _R =1600V	T _J =25°C			1	mA
R _{θJC}	Thermal Resistance: Junction-to-Case (per Diode)					0.56	°C/W

Internal NTC-Thermistor Characteristics

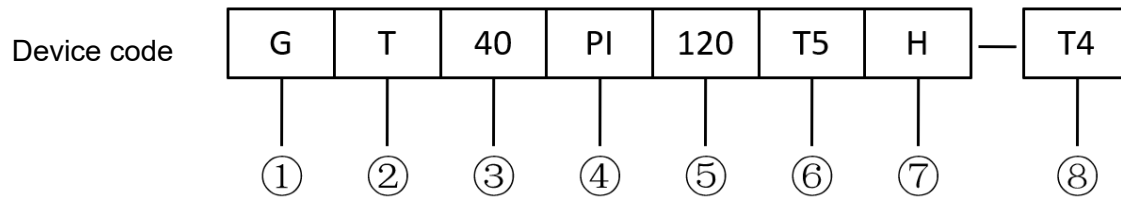
Symbol	Conditions	Min.	Typ.	Max.	Units
R ₂₅	T _C =25°C		5		kΩ
ΔR/R	T _C =100°C, R ₁₀₀ =465Ω	-5		5	%
P ₂₅	T _C =25°C			10	mW
B _{25/50}	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15K))]$		3380		K
B _{25/80}	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15K))]$		3440		K
B _{25/100}	$R_2 = R_{25} \exp[B_{25/100}(1/T_2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

Module

Symbol	Description		Min.	Typ.	Max.	Units
V _{iso}	Isolation Voltage (All Terminals Shorted)	f=50Hz, 1minute	2500			V
T _J	Maximum Junction Temperature				175	°C
T _{JOP}	Maximum Operating Junction Temperature Range		-40		+150	°C
T _{stg}	Storage Temperature		-40		+125	°C
CTI	Comparative Tracking Index		200			
R _{θCS}	Case-to-Sink Thermally (Conductive Grease Applied)				0.04	°C/W
T	Mounting Screw:M5		3.0		6.0	N·m
G	Weight			190		g



Ordering Information Table



- ① - IGBT Module
- ② - Trench & Field Stop IGBT
- ③ - Rated Current (40=40A)
- ④ - Circuit Configuration (Power Integrated)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)
- ⑧ - Internal Control Code

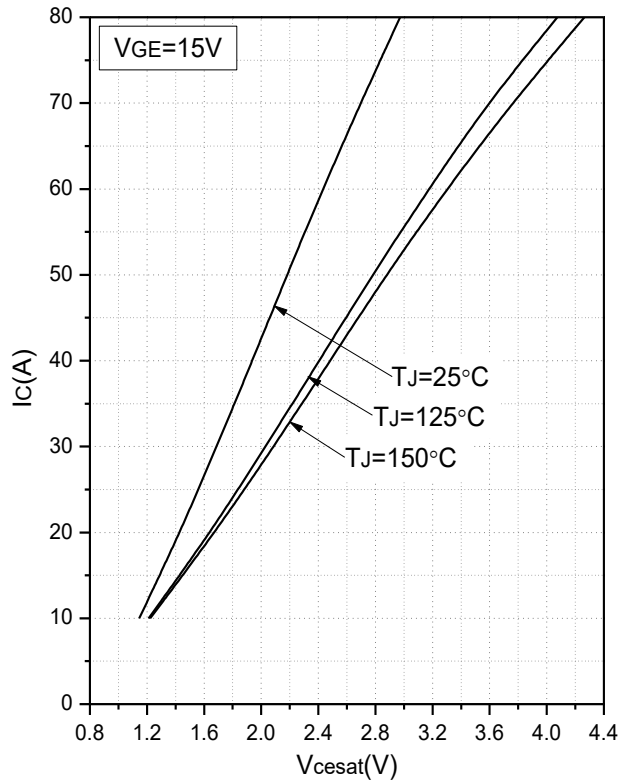


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

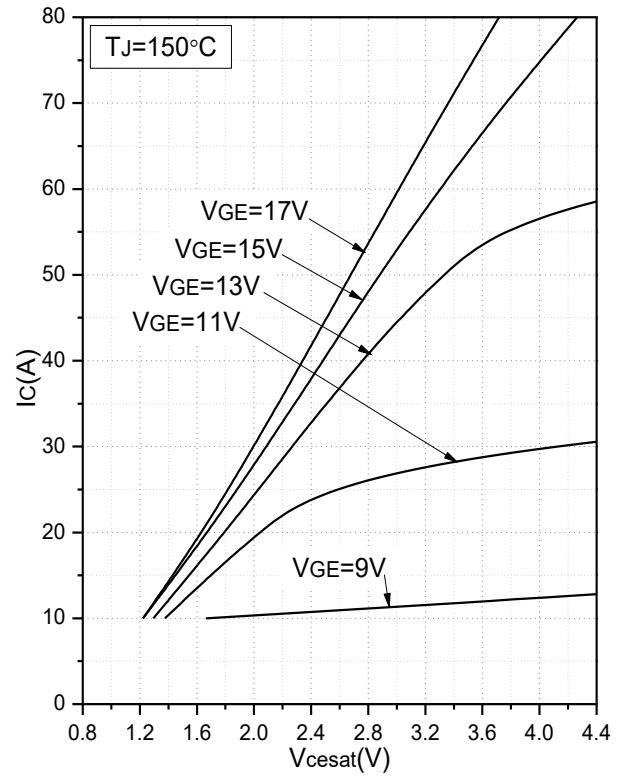


Fig.2 Typical Output Characteristics (Inverter)

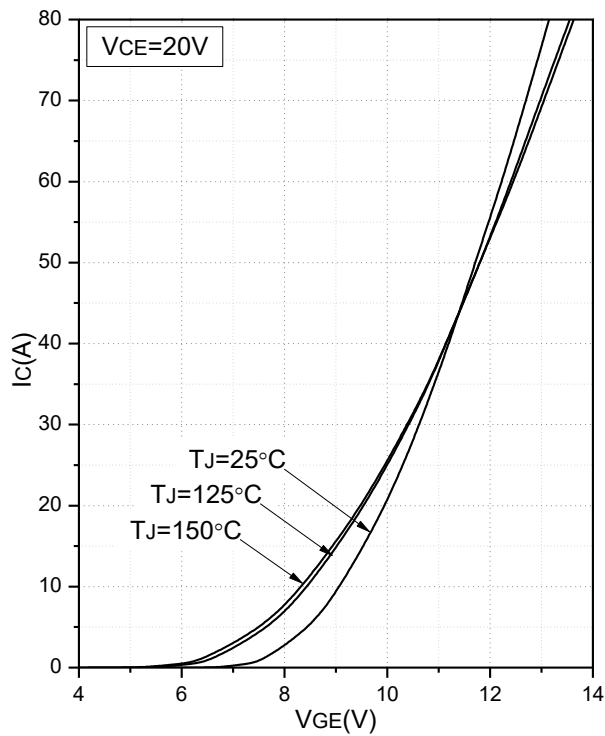


Fig.3 Transfer Characteristics (Inverter)

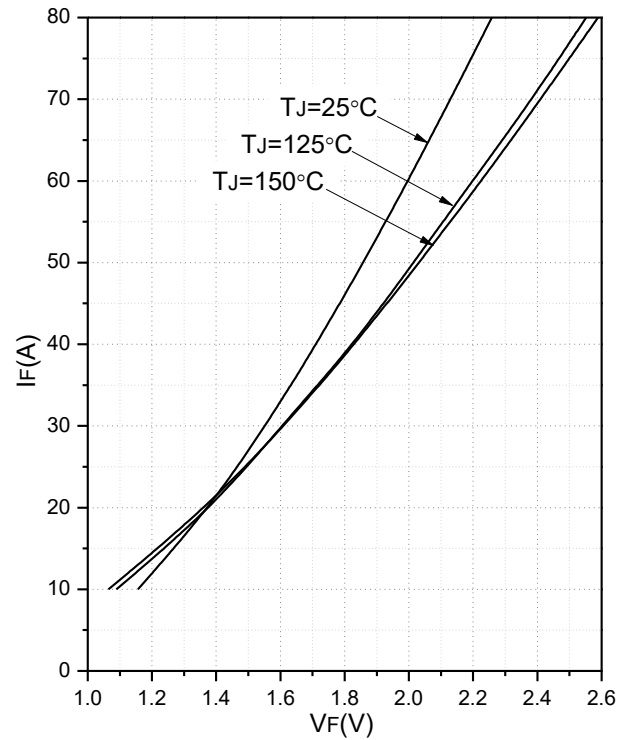


Fig.4 Forward Characteristics of Diode (Inverter)

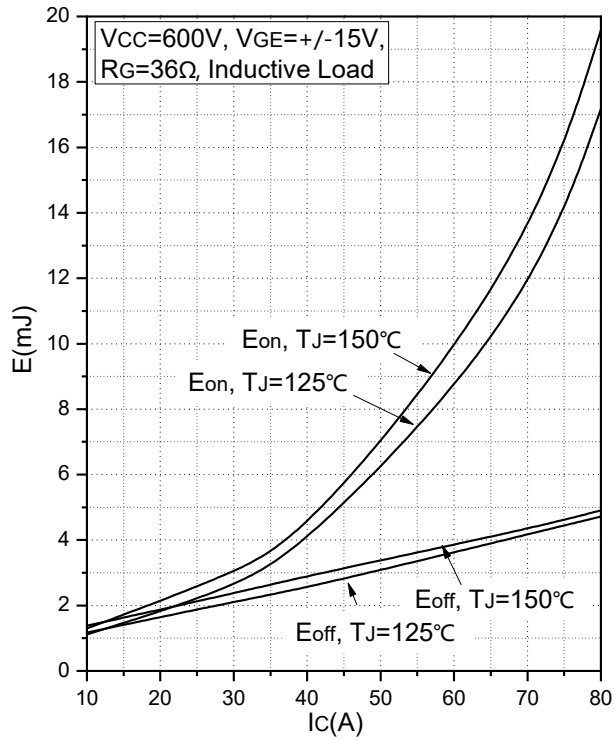


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

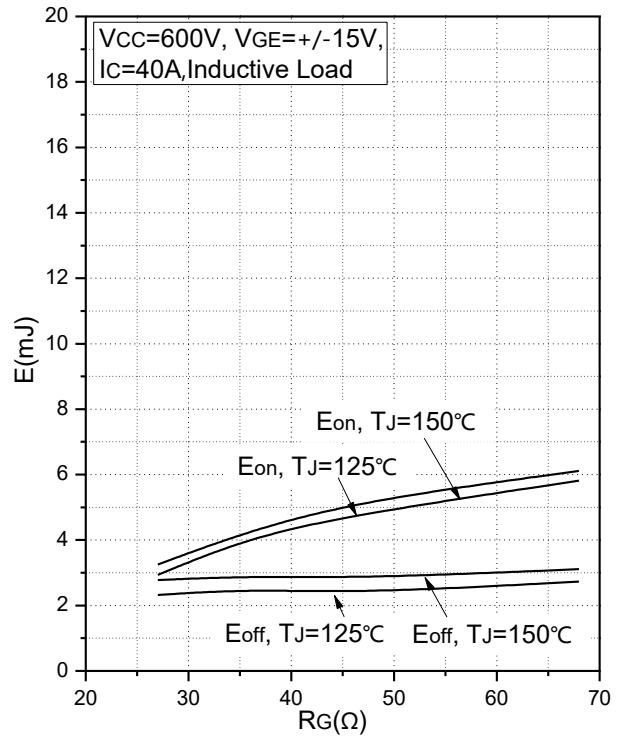


Fig.6 Typical Switching Loss vs. Gate Resistance (Inverter)

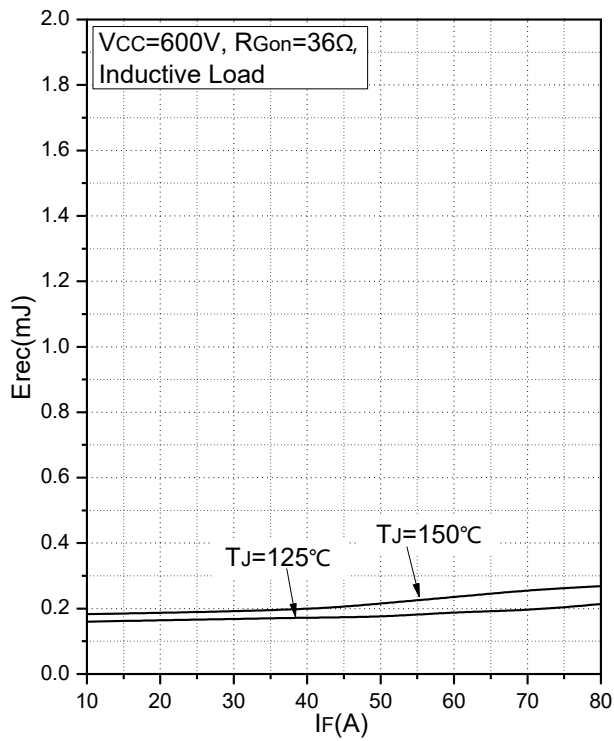


Fig.7 Typical Switching Loss vs. Forward Current (Inverter)

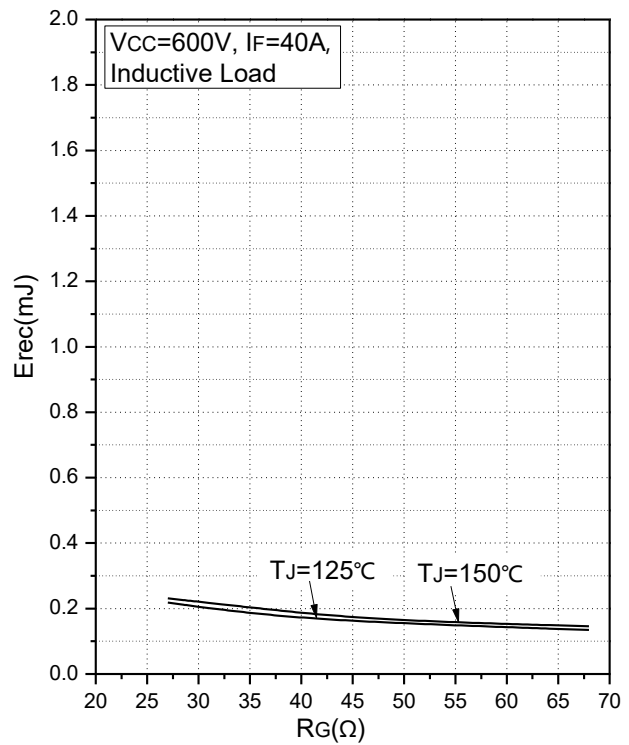


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

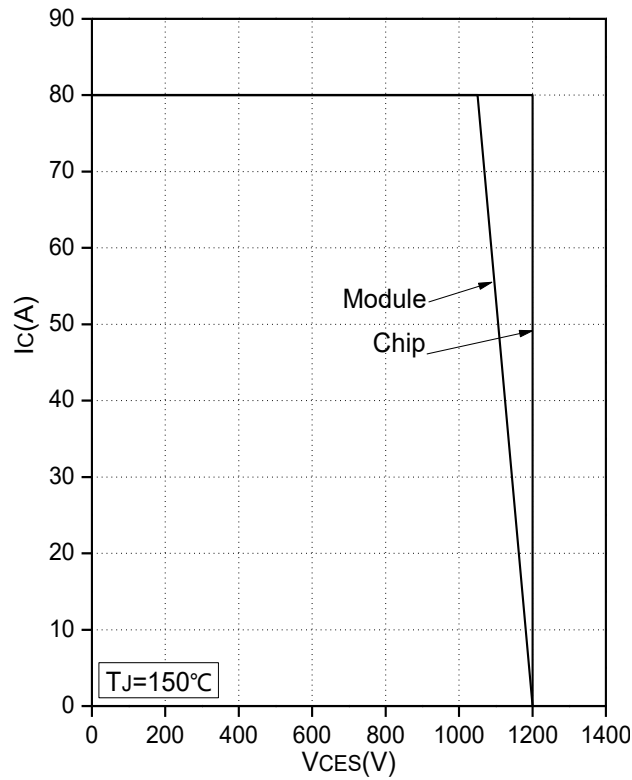


Fig.9 Reverse Bias Safe Operation Area (RBSOA)

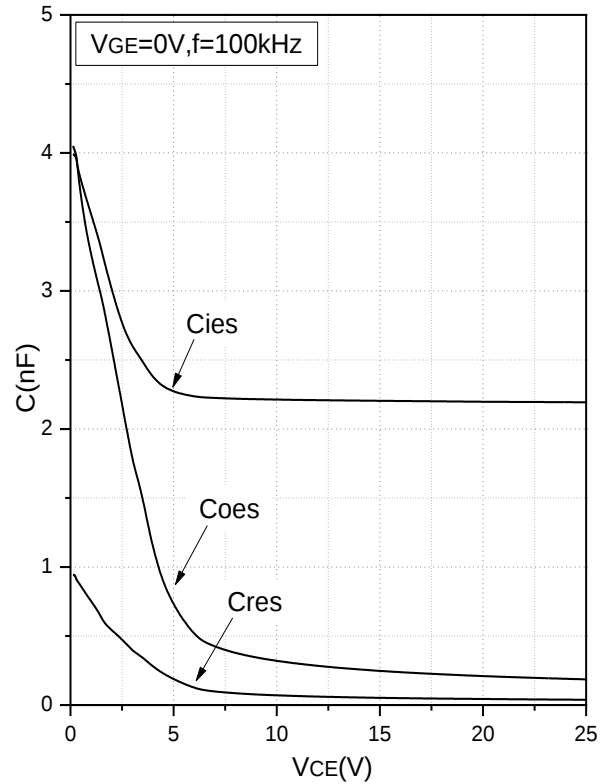


Fig.10 Capacitance Characteristics

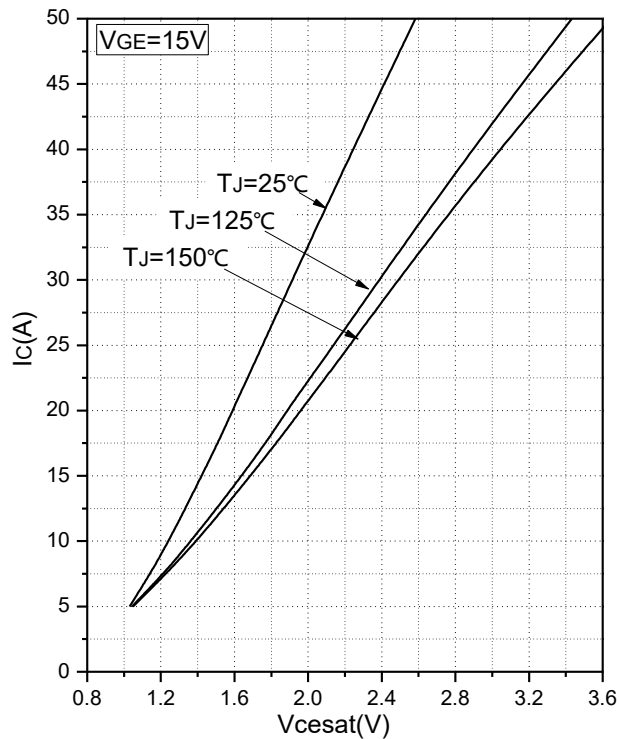


Fig.11 Typical Saturation Voltage Characteristics (Brake-Chopper)

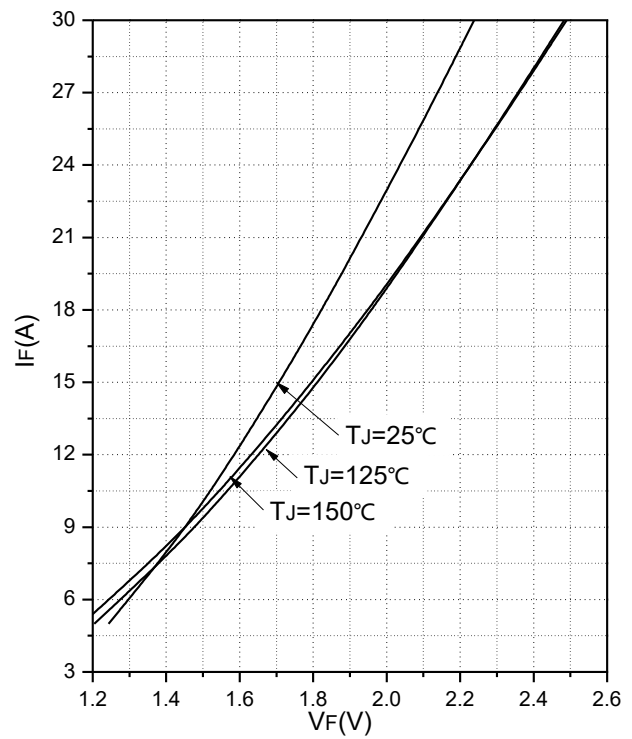


Fig.12 Forward Characteristics of Diode (Brake-Chopper)

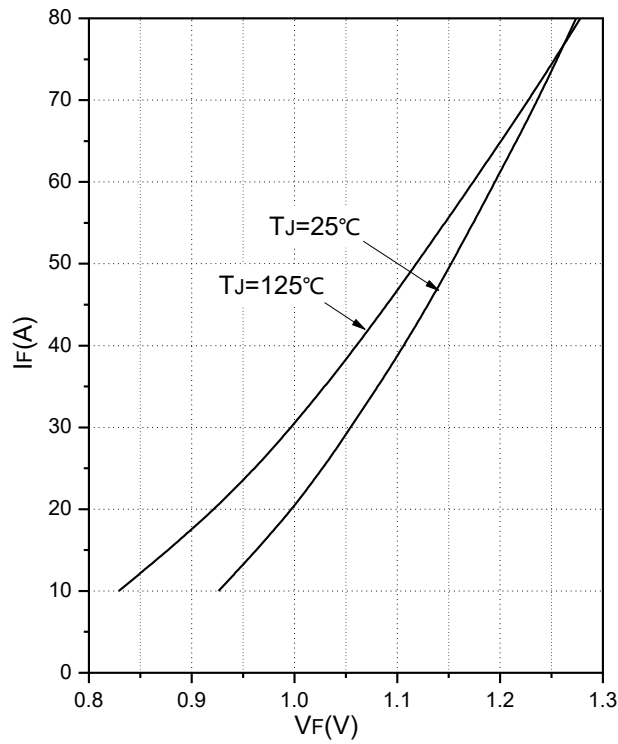


Fig.13 Forward Characteristics of Diode (Rectifier)

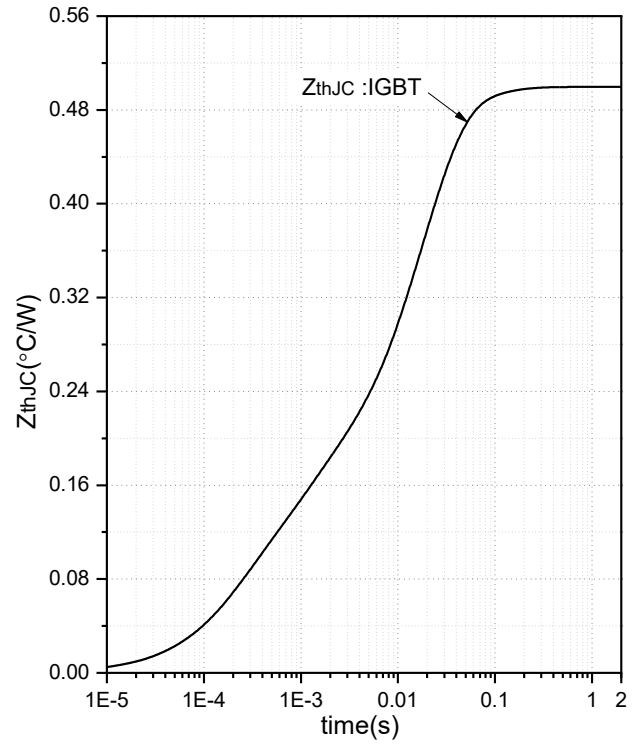


Fig.14 Transient Thermal Impedance (Inverter-IGBT)

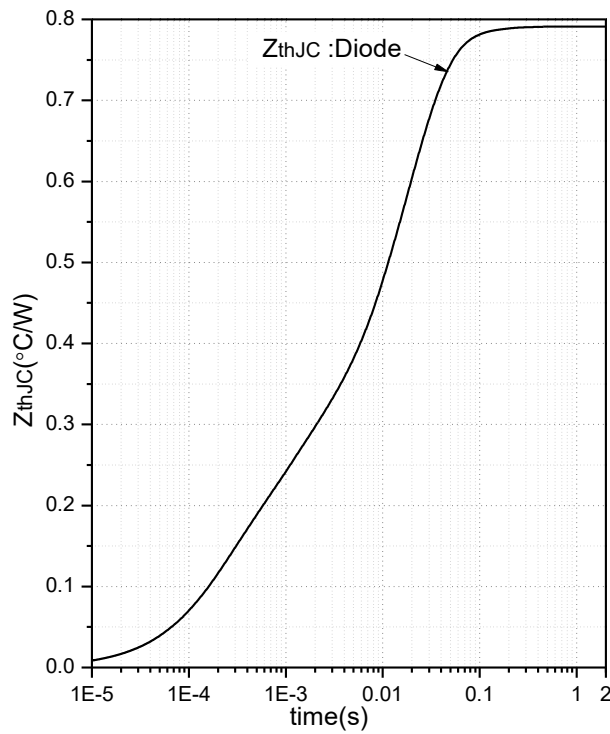


Fig.15 Transient Thermal Impedance (Inverter-Diode)

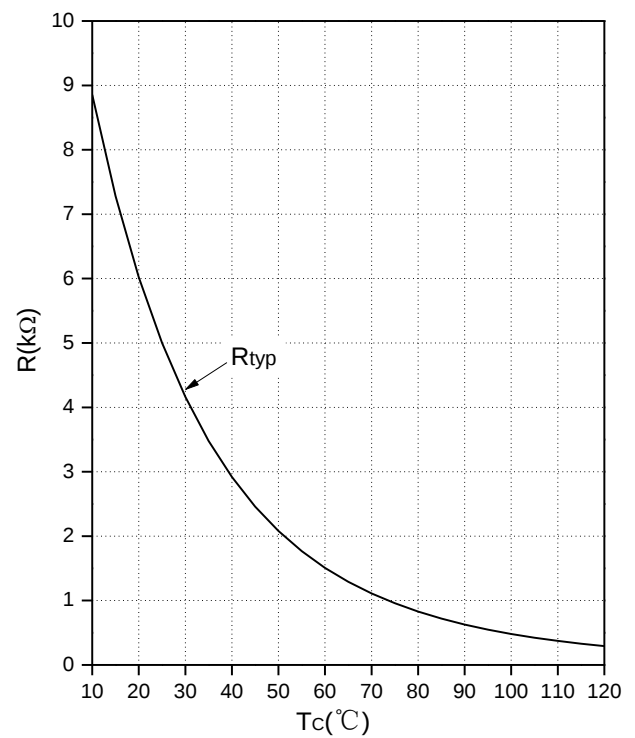
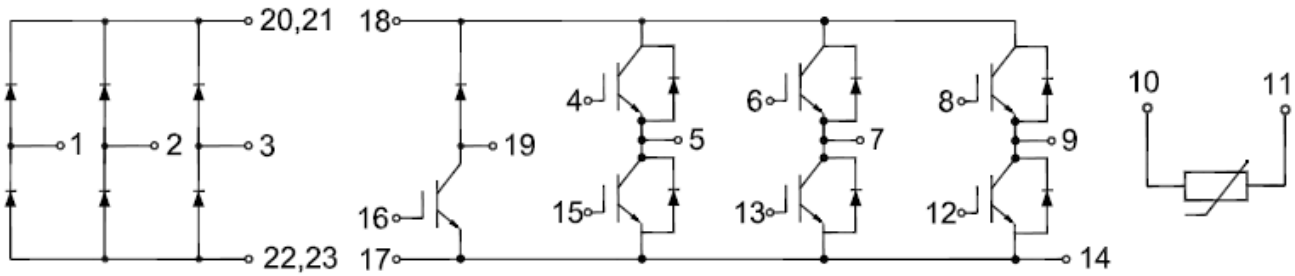


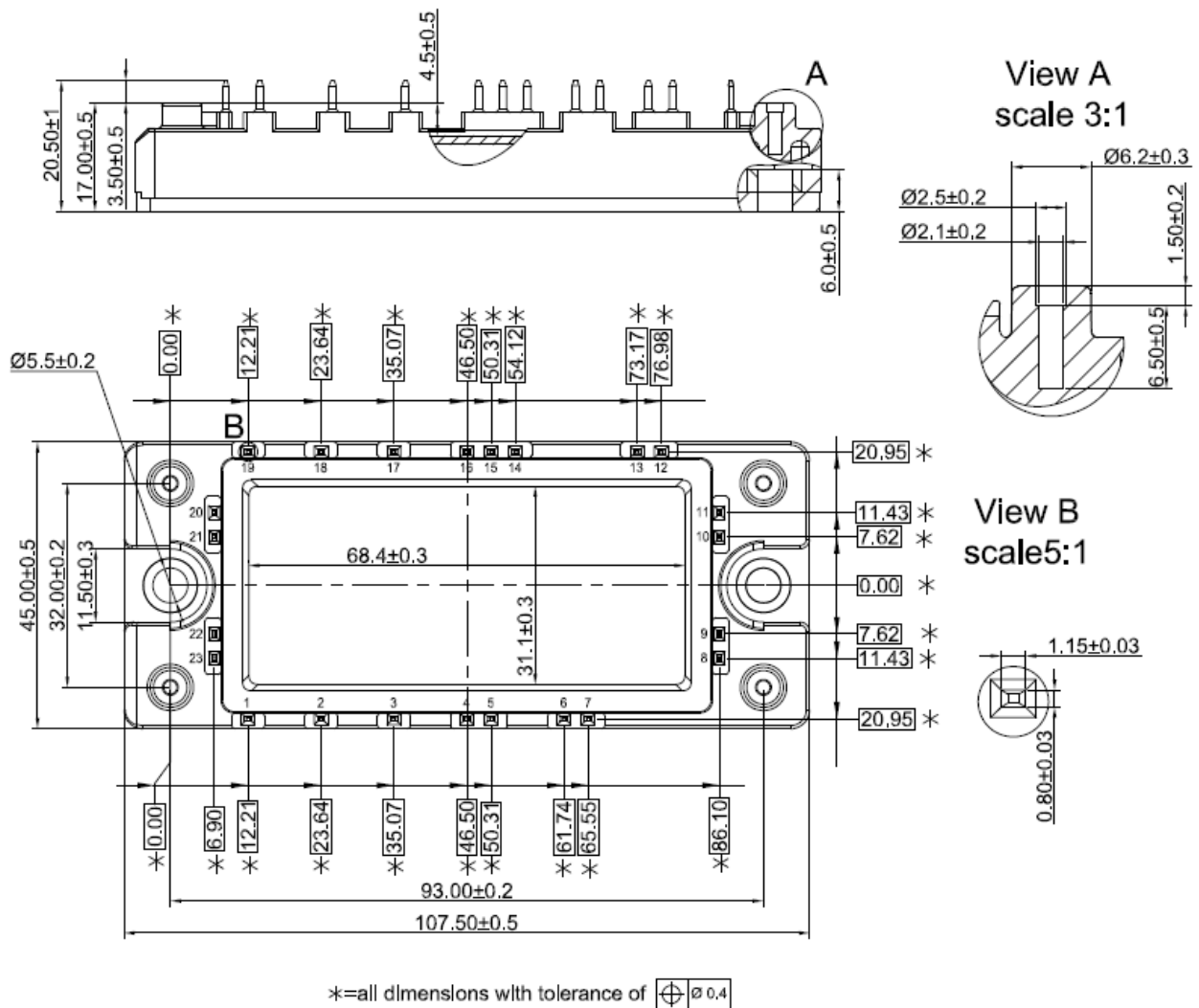
Fig.16 NTC Temperature Characteristics



Internal Circuit



Package Outline (Unit: mm):





Revision	Notes
01	Initial Release

Announcement

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