GT40PI120T5H

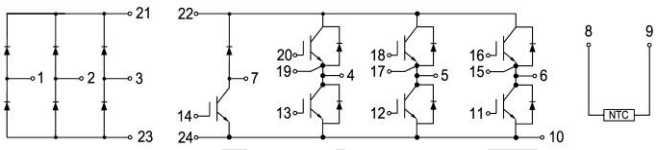
IGBT Module

Preliminary Data

Features:

- Trench & Field Stop IGBT
- Short Circuit Rated>10μs
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested(2×Ic)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement

Circuit Diagram



Applications：

- Industrial Inverters
- Servo Applications

IGBT, Inverter
Maximum Rated Values

V_{CES}	Collector-Emitter Blocking Voltage	T_J=25℃	1200	V
V_{GES}	Gate-Emitter Voltage		±20	V
I_C	Continuous Collector Current	T_C=100℃	40	A
		T_C=25℃	80	A
I_{CM}	Peak Collector Current Repetitive	tp=1ms	80	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=175℃	305	W

Electrical Characteristics of IGBT

Static Characteristics

Symbol	Description	Conditions		Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1mA, V_{CE}=V_{GE}, T_J=25℃		5.00	5.60	6.50	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=40A, V_{GE}=15V	T_J=25℃		2.00	2.30	V
			T_J=125℃		2.30		V
			T_J=150℃		2.40		V
I_{CES}	Collector-Emitter Leakage Current	V_{GE}=0V, V_{CE} =V_{CES}, T_J=25℃				1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}= ±20V, V_{CE}= 0V, T_J=25℃				200	nA
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f=100kHz, T_J=25℃			3.45		nF
C_{oes}	Output Capacitance				0.51		nF
C_{res}	Reverse Transfer Capacitance				0.04		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=600V, I_C=40A, R_{Gon}=30Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		136		ns
			T_J=125℃		132		
			T_J=150℃		147		
t_r	Rise Time		T_J=25℃		74		ns
			T_J=125℃		74		
			T_J=150℃		74		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=600V, I_C=40A, R_{Goff}=30Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		190		ns
			T_J=125℃		196		
			T_J=150℃		219		
t_f	Fall Time		T_J=25℃		219		ns
			T_J=125℃		427		
			T_J=150℃		484		
E_{on}	Turn-on Switching Loss	V_{CC}=600V, I_C=40A, R_{Gon}=30Ω, V_{GE}=±15V, di/dt=490A/μs (T_J=150℃) Inductive Load	T_J=25℃		4.06		mJ
			T_J=125℃		5.19		
			T_J=150℃		5.55		

E_{off}	Turn-off Switching Loss	V_{CC}=600V, I_C=40A, R_{Goff}=30Ω, V_{GE}=±15V, du/dt=3440V/μs (T_J=150℃) Inductive Load	T_J=25℃		1.99		mJ
			T_J=125℃		3.42		
			T_J=150℃		3.85		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		460		nC
RBSOA	I_C=80A, V_{CC}=1050V, Vp=1200V, R_G=30Ω, V_{GE}=+15V to 0V, T_J=150°C			Trapezoid			
I_{SC}	SC data	V_{CC}=600V, V_{GE}=±15V, R_G=51Ω, tp=10μs, T_J=125℃			128		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(per IGBT)					0.490	℃/W

Diode, Inverter
Maximum Rated Values

V_{RRM}	Repetitive Peak Reverse Voltage	T_J=25℃	1200	V
I_F	Diode Continuous Forward Current		40	A
I_{FM}	Repetitive Peak Forward Current	tp=1ms	80	A

Electrical Characteristics of FWD

Symbol	Description	Conditions		Min	Typ	Max	Unit
V_{FM}	Forward Voltage	I_F=40A	T_J=25℃		1.80	2.20	V
			T_J=125℃		2.00		
			T_J=150℃		2.00		
t_{rr}	Reverse Recovery Time	I_F=40A, -diF/dt=750A/μs(T_J=150℃) V_{rr}=600V, V_{GE}=-15V	T_J=25℃		297		ns
			T_J=125℃		586		
			T_J=150℃		611		
I_{rr}	Peak Reverse Recovery Current		T_J=25℃		29.4		A
			T_J=125℃		36.2		
			T_J=150℃		37.5		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		4.34		μC
			T_J=125℃		8.04		
			T_J=150℃		8.93		

E_{rec}	Reverse Recovery Energy	I_F=40A, -diF /dt=750A/μs(T_J=150℃) V_{rr}=600V, V_{GE}=-15V	T_J=25℃		1.51		mJ
			T_J=125℃		3.02		
			T_J=150℃		3.40		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case (per Diode)					0.682	℃/W

IGBT, Brake-Chopper
Maximum Rated Values

V_{CES}	Collector-Emitter Blocking Voltage	T_J=25℃	1200	V
V_{GES}	Gate-Emitter Voltage		±20	V
I_C	Continuous Collector Current	T_C=100℃	15	A
		T_C=25℃	30	A
I_{CM}	Repetitive Peak Collector Current	tp=1ms	30	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=175℃	174	W

Electrical Characteristics of IGBT

Static Characteristics

Symbol	Description	Conditions		Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1mA, V_{CE}=V_{GE}, T_J=25℃		5.0	5.6	6.5	V
V_{CEsat} (Terminal)	Collector-Emitter Saturation Voltage	I_C=15A, V_{GE}=15V	T_J=25℃		1.90	2.20	V
			T_J=125℃		2.20		V
			T_J=150℃		2.30		
I_{CES}	Collector-Emitter Leakage Current	V_{GE}=0V, V_{CE}=V_{CES}, T_J=25℃				1	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}= ±20V, V_{CE}= 0V, T_J=25℃				200	nA
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f=100kHz, T_J=25℃			1.12		nF
C_{oes}	Output Capacitance				0.03		nF
C_{res}	Reverse Transfer Capacitance				0.02		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=600V,I_C=15A, R_{Gon}=68Ω,V_{GE}=±15V, Inductive Load	T_J=25℃		134		ns
			T_J=125℃		132		
			T_J=150℃		127		
t_r	Rise Time		T_J=25℃		46		ns
			T_J=125℃		54		
			T_J=150℃		54		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=600V,I_C=15A, R_{Goff}=68Ω,V_{GE}=±15V, Inductive Load	T_J=25℃		158		ns
			T_J=125℃		167		
			T_J=150℃		171		
t_f	Fall Time		T_J=25℃		332		ns
			T_J=125℃		386		
			T_J=150℃		404		
E_{on}	Turn-on Switching Loss	V_{CC}=600V,I_C=15A, R_{Gon}=68Ω,V_{GE}=±15V, di/dt=225A/μs (T_J=150℃) Inductive Load	T_J=25℃		2.10		mJ
			T_J=125℃		2.36		
			T_J=150℃		2.43		
E_{off}	Turn-off Switching Loss	V_{CC}=600V,I_C=15A, R_{Goff}=68Ω,V_{GE}=±15V, du/dt=2075V/μs (T_J=150℃) Inductive Load	T_J=25℃		0.89		mJ
			T_J=125℃		1.22		
			T_J=150℃		1.25		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V			83		nC
RBSOA	I_C=30A,V_{CC}=1050V,Vp=1200V, R_G=68Ω, V_{GE}=+15V to 0V, T_J=150°C			Trapezoid			
I_{SC}	SC data	V_{CC}=600V, tp=10us, V_{GE}=±15V, R_G=36Ω, T_J=125℃			90		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(per leg)					0.864	℃/W

Diode, Brake-Chopper
Maximum Rated Values

V_{RRM}	Repetitive Peak Reverse Voltage	T_J=25℃	1200	V
I_F	Diode Continuous Forward Current		10	A
I_{FM}	Diode Maximum Forward Current	tp=1ms	20	A

Electrical Characteristics of Diode

Symbol	Description	Conditions		Min	Typ	Max	Unit
V_{FM} (Terminal)	Forward Voltage	I_F=10A	T_J=25℃		1.70	2.20	V
			T_J=125℃		1.80		
			T_J=150℃		1.80		
t_{rr}	Reverse Recovery Time	I_F=10A, -diF/dt=210A/μs(T_J=150℃) V_R=600V, V_{GE}= -15V	T_J=25℃		253		ns
			T_J=125℃		421		
			T_J=150℃		424		
I_{rr}	Peak Reverse Recovery Current		T_J=25℃		5.04		A
			T_J=125℃		6.72		
			T_J=150℃		7.03		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		0.90		μC
			T_J=125℃		1.65		
			T_J=150℃		1.74		
E_{rec}	Reverse Recovery Energy		T_J=25℃		0.31		mJ
			T_J=125℃		0.63		
			T_J=150℃		0.67		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case (per leg)					1.451	℃/W

Diode, Rectifier
Maximum Rated Values (T_C=25℃unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	T_J =25℃	1800	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	T_J =80℃	50	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	T_J =80℃	60	A
I_{FSM}	Surge Current @t_p=10 ms	T_J =25℃	420	A
		T_J =150℃	350	
I^2t	I²t - value	T_J =25℃	900	A^2s
		T_J =150℃	650	

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

Symbol	Description	Conditions		Min	Typ	Max	Unit
V_F	Forward Voltage	I_F=40A	T_J =25℃		1.20		V
			T_J =125℃		1.15		
			T_J =150℃		1.15		
I_R	Reverse Current	V_R=1600V	T_J =25℃			1	mA
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case					0.822	℃/W

Internal NTC-Thermistor Characteristics

Symbol	Description		Min.	Typ.	Max.	Units.
R_{25}	Rated Resistance	T_C=25℃		5		kΩ
△R/R	Deviation of R100	T_C=100℃，R_{100}=481Ω	-5		5	%
P_{25}	Power Dissipation	T_C=25℃			10	mW
$B_{25/50}$	B-Value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3380		K
$B_{25/80}$	B-Value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$		3440		K
$B_{25/100}$	B-Value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$		3545		K

Module

Symbol	Description		Min	Typ	Max	Unit
V_{iso}	Isolation Voltage (All Terminals Shorted)	RMS, f=50Hz, 30s	4500			V
Material of Module Baseplate				Copper		
Internal Isolation				Al2O3		
Creepage Distance				10.0		mm
Clearance				7.5		mm
L_{sCE}	Stray Inductance Module			60		nH
T_J	Maximum Junction Temperature				175	℃
T_{JOP}	Maximum Operating Junction Temperature Range		-40		+150	℃
T_{stg}	Storage Temperature		-40		+125	℃
CTI	Comparative Tracking Index		200			
$R_{\theta CS}$	Case-To-Sink Thermally (Conductive Grease Applied)				0.03	℃/W
M	Mounting Torque for Module Mounting	Screw M5--Mounting according to valid application note	3.0		5.0	N·m
G	Weight			190		g

Ordering Information Table

Device code

G	T	40	P1	120	T5	H
①	②	③	④	⑤	⑥	⑦

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

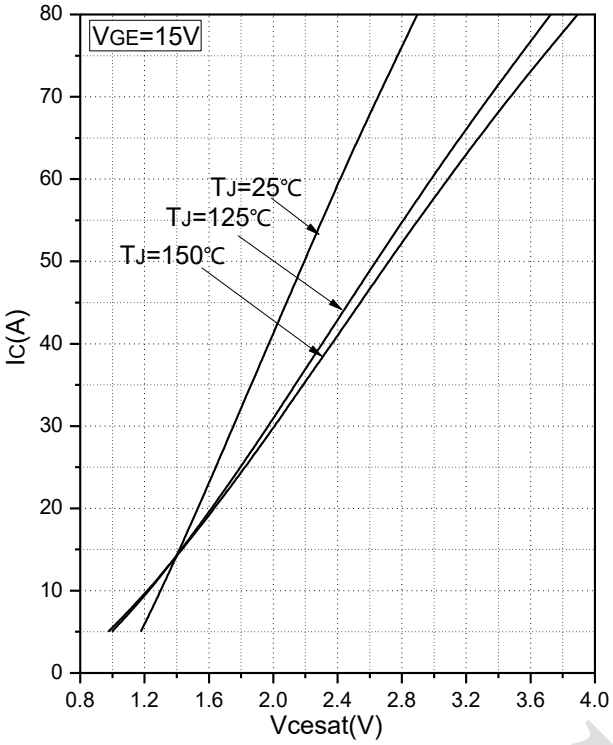


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

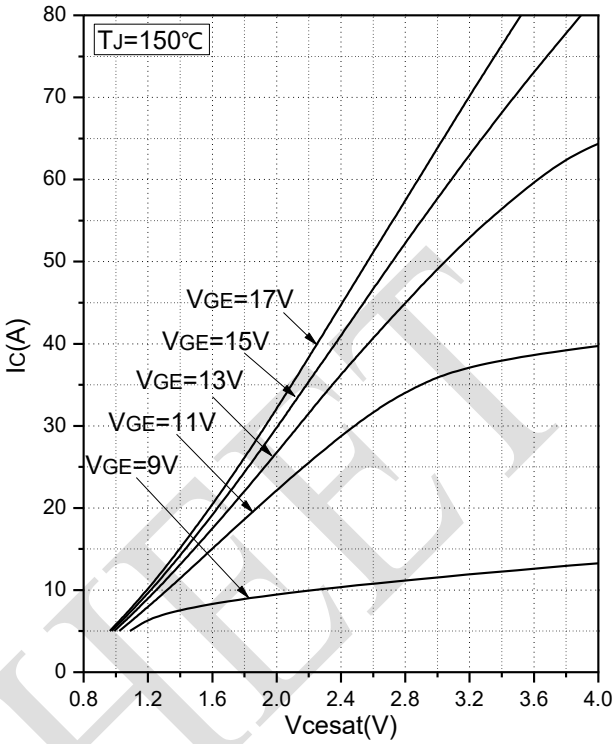


Fig.2 Typical Output Characteristics(Inverter)

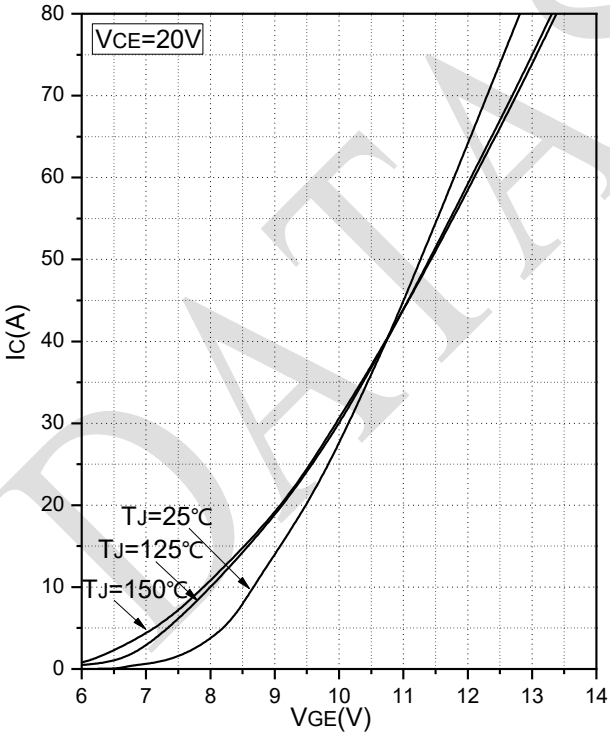


Fig.3 Transfer Characteristic (Inverter)

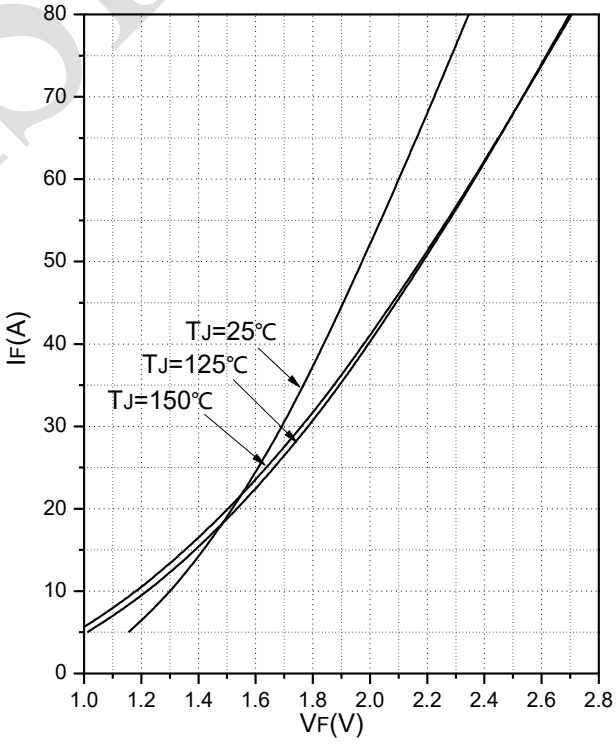


Fig.4 Forward Characteristics of Diode (Inverter)

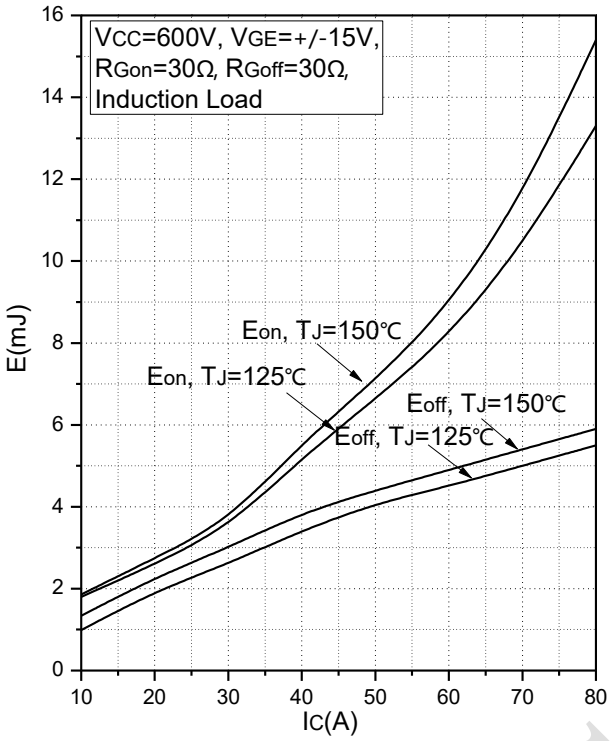


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

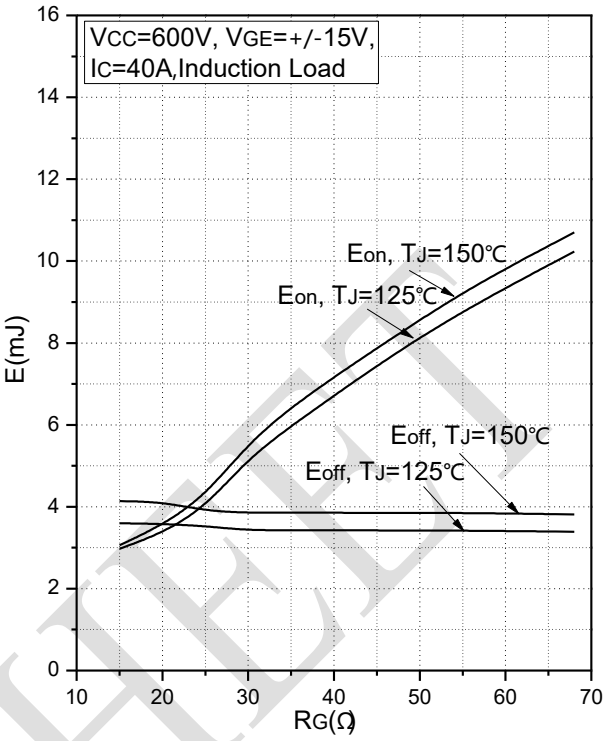


Fig.6 Typical Switching Loss vs. Gate Resistance (Inverter)

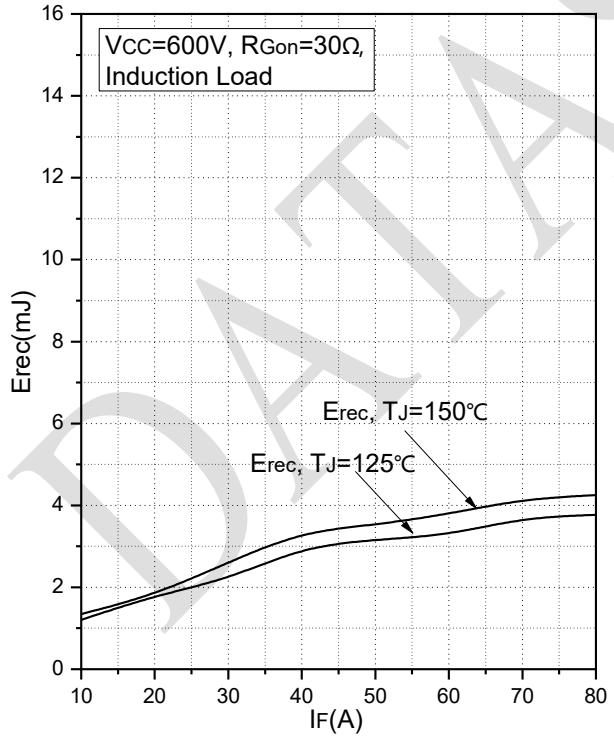


Fig.7 Typical Switching Loss vs. Forward Current (Inverter)

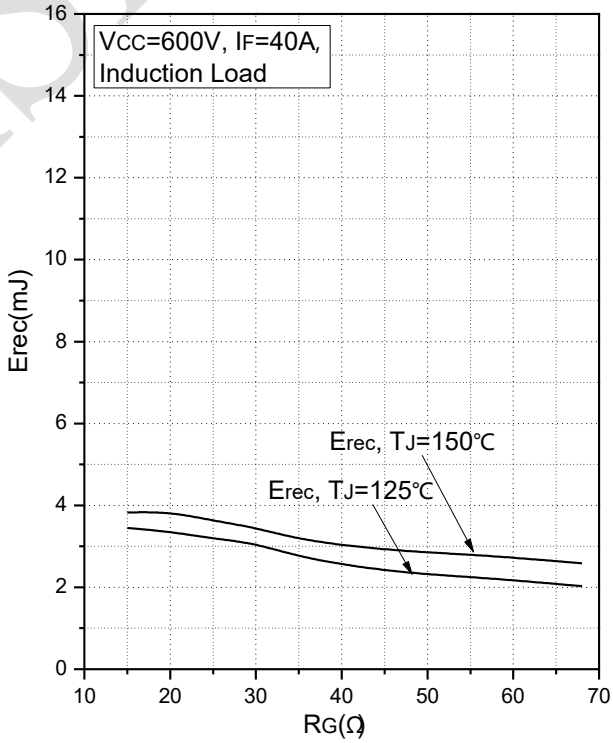


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

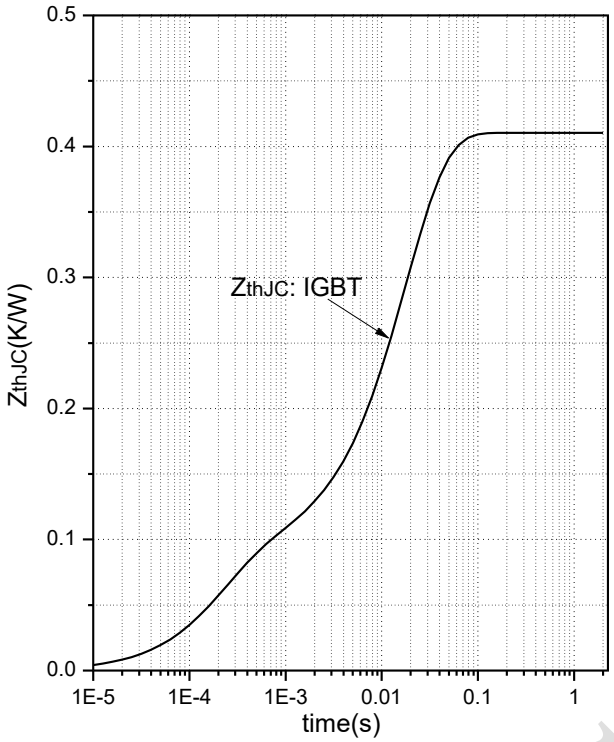


Fig.9 Transient Thermal Impedance (Inverter-IGBT)

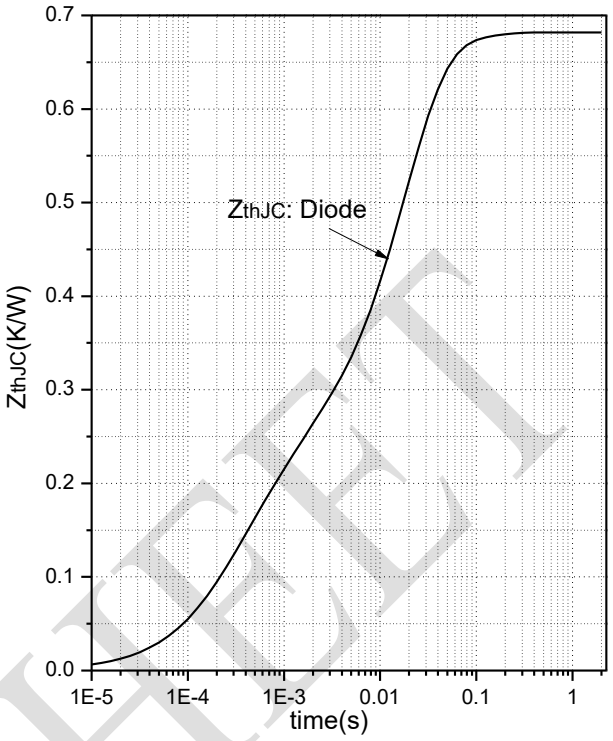


Fig.10 Transient Thermal Impedance (Inverter-Diode)

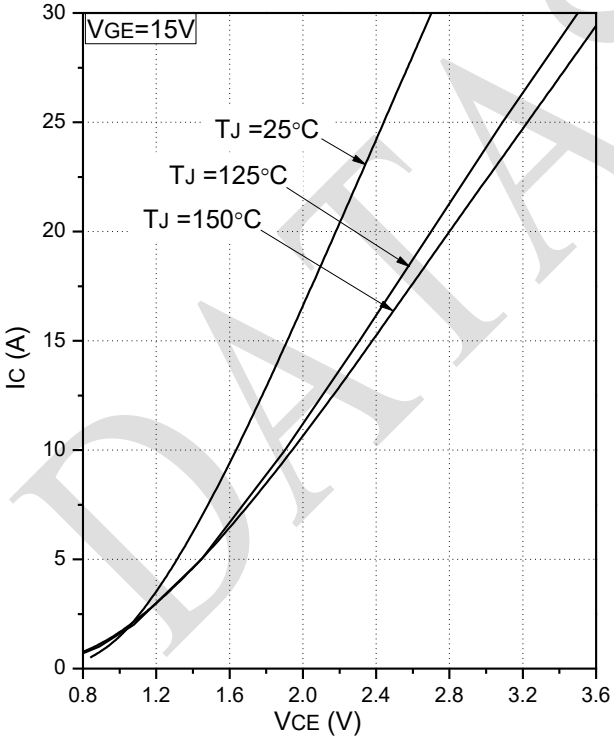


Fig.11 Typical Saturation Voltage Characteristics (Brake-Chopper)

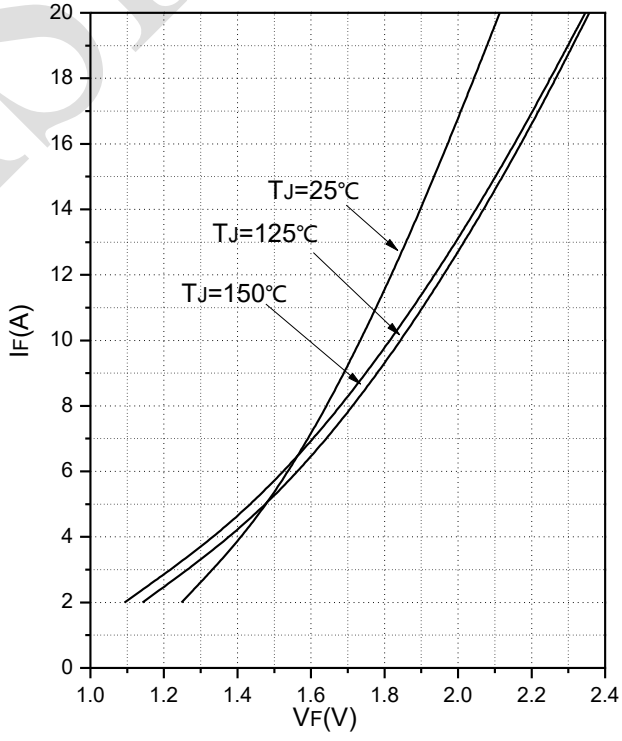


Fig.12 Forward Characteristics of Diode (Brake-Chopper)

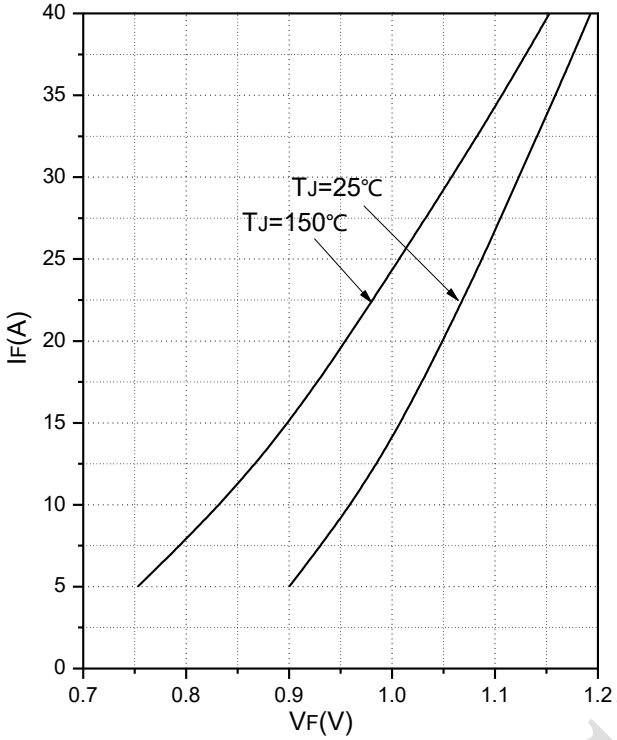


Fig.13 Forward Characteristics of Diode (Rectifier)

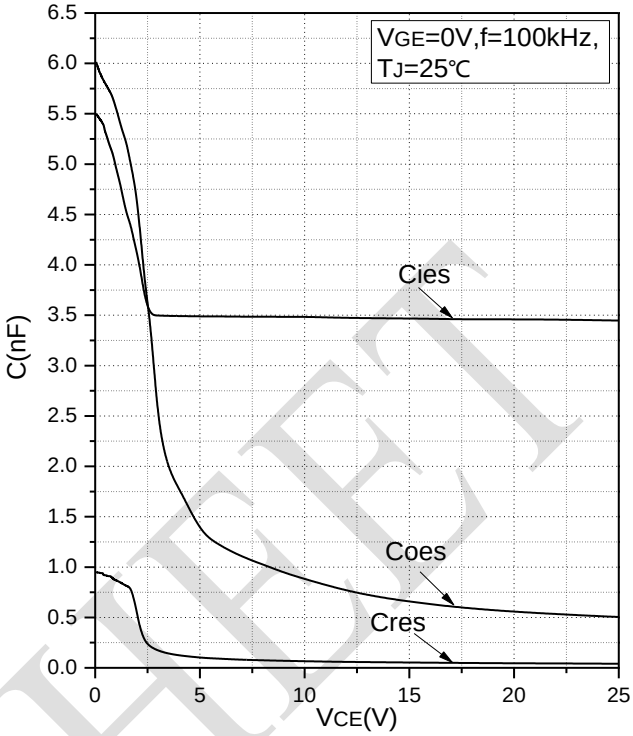


Fig.14 Capacitance Characteristics

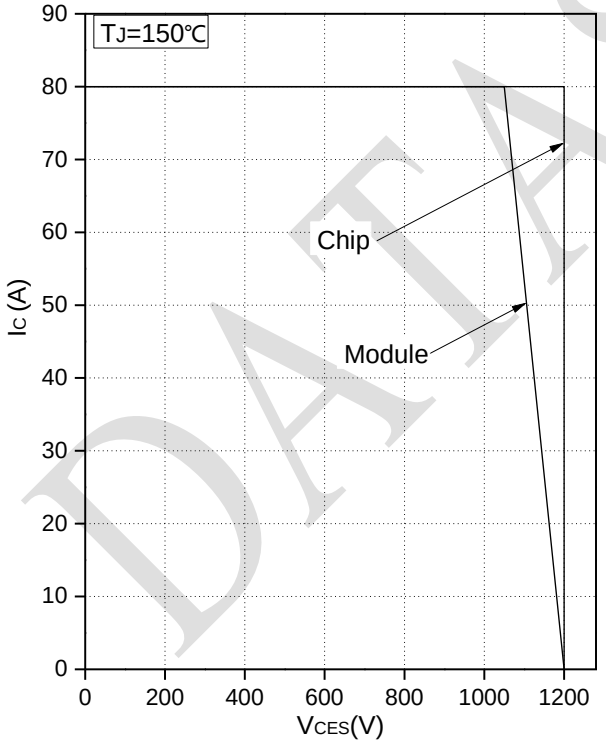


Fig.15 Reverse Bias Safe Operation Area (RBSOA)

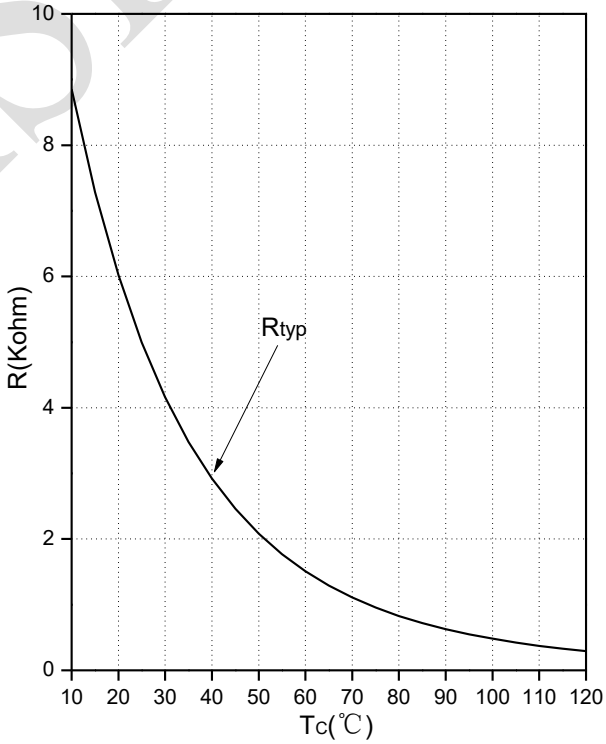
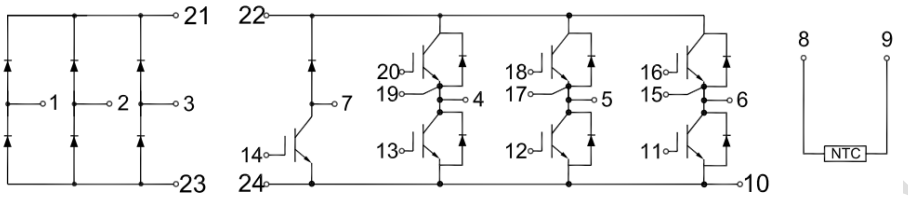
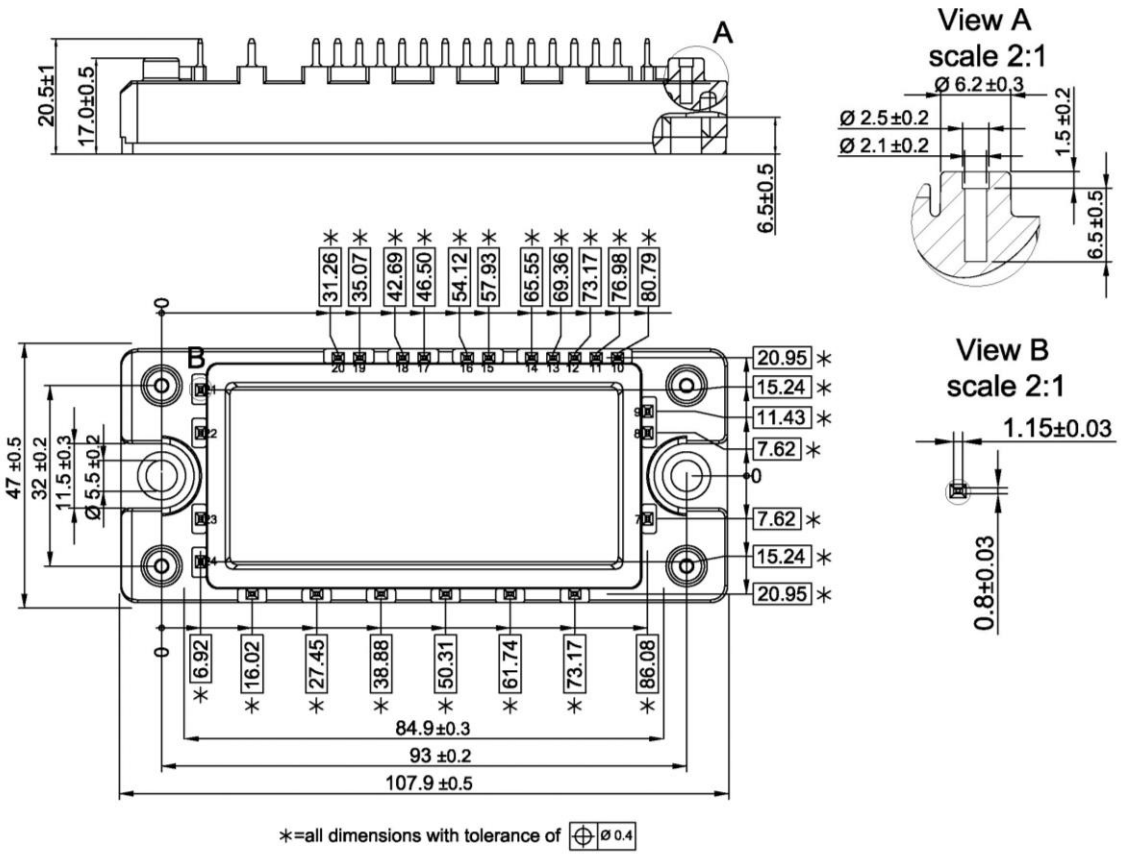


Fig.16 NTC Temperature Characteristics

Internal Circuit:



Package Outline (Unit: mm):



Date	Revision	Notes
04/19/2023	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”.