GT50PI120B9H

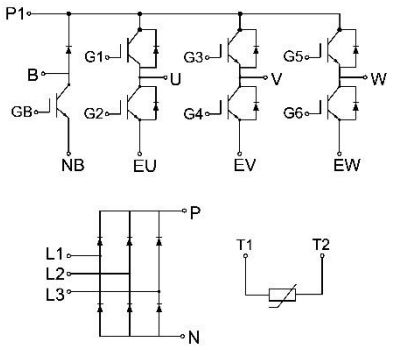
IGBT Module

Preliminary Data

Features:

- Field Stop Trench Gate 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 (T_C=25℃ 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℃	50	A
		T_C=25℃	100	A
I_{CM}	Peak Collector Current Repetitive	t_P=1ms	100	A
P_D	Maximum Power Dissipation (IGBT)	T_C=25℃ T_{Jmax}=175℃	472	W

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

Static Characteristics

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=1.7mA, V_{CE}=V_{GE}		5.0	5.6	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=50A, V_{GE}=15V	T_J=25℃		1.75	2.10	V
			T_J=125℃		2.20		V
			T_J=150℃		2.30		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			5.32		nF
C_{oes}	Output Capacitance				0.81		nF
C_{res}	Reveres Transfer Capacitance				0.34		nF

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℃		92		ns
			T_J=125℃		92		
			T_J=150℃		96		
t_r	Rise Time		T_J=25℃		54		ns
			T_J=125℃		56		
			T_J=150℃		56		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=600V, I_C=50A, R_{Goff}=15Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		222		ns
			T_J=125℃		256		
			T_J=150℃		272		
t_f	Fall Time		T_J=25℃		192		ns
			T_J=125℃		210		
			T_J=150℃		222		
E_{on}	Turn-on Switching Loss	V_{CC}=600V, I_C=50A, R_{Gon}=15Ω, V_{GE}=±15V, di/dt=767A/μs(T_J=150℃), Inductive Load	T_J=25℃		4.81		mJ
			T_J=125℃		6.16		
			T_J=150℃		7.48		

E_{off}	Turn-off Switching Loss	V_{CC}=600V, I_C=50A, R_{Goff}=15Ω, V_{GE}=±15V, du/dt=4951V/μs(T_J=150℃), Inductive Load	T_J=25℃		3.76		mJ
			T_J=125℃		4.21		
			T_J=150℃		5.30		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		2850		nC
$R_{G(int)}$	Internal Gate Resistor		T_J=25℃		3.4		Ω
I_{SC}	V_{CC}=600V, V_{GE}=+/-15V, tp=10us, R_{Gon}=47Ω, R_{Goff}=47Ω, T_J=150℃				209		A
$R_{\theta JC}$	Thermal Resistance: Junction-to-Case (per IGBT)					0.32	℃/W

Diode, Inverter

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

V_{RRM}	Repetitive Peak Reverse Voltage	T_J=25℃	1200	V
I_F	Diode Continuous Forward Current	T_C=100℃	50	A
I_{FM}	Peak Diode Current Repetitive	t_P=1ms	100	A

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_{FM}	Forward Voltage	I_F=50A	T_J=25℃		1.90		V
			T_J=125℃		2.05		
			T_J=150℃		2.05		
t_{rr}	Reverse Recovery Time	I_F=50A, -diF/dt=1096A/μs(T_J=150℃), V_R=600V, V_{GE}=-15V	T_J=25℃		161		ns
			T_J=125℃		174		
			T_J=150℃		175		
I_{rr}	Peak Reverse Recovery Current		T_J=25℃		55.8		A
			T_J=125℃		61.9		
			T_J=150℃		63.8		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		4.3		μC
			T_J=125℃		6.1		
			T_J=150℃		6.2		

E_{rec}	Reverse Recovery Energy	I_F=50A, -diF/dt=1096A/μs(T_J=150℃), V_R=600V, V_{GE}=-15V	T_J=25℃		1.75		mJ
			T_J=125℃		2.44		
			T_J=150℃		2.59		
$R_{\theta JC}$	Thermal Resistance: Junction-to-Case (per Diode)					0.58	℃/W

IGBT, Brake-Chopper

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

V_{CES}	Collector-Emitter Blocking Voltage	T_C=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	t_P=1ms	80	A
P_D	Maximum Power Dissipation (IGBT)	T_C=25℃, T_{Jmax}=175℃	358	W

Electrical Characteristics of IGBT (T_C=25℃ 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	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=40A, V_{GE}=15V	T_J=25℃		1.80	2.10	V
			T_J=125℃		2.10		V
			T_J=150℃		2.20		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			2.19		nF
C_{oes}	Output Capacitance				0.19		nF
C_{res}	Reveres Transfer Capacitance				0.04		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=600V, I_C=40A, R_{Gon}=15Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		92		ns
			T_J=125℃		93		
			T_J=150℃		94		
t_r	Rise Time		T_J=25℃		46		ns
			T_J=125℃		50		
			T_J=150℃		50		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=600V, I_C=40A, R_{Goff}=15Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		183		ns
			T_J=125℃		185		
			T_J=150℃		189		
t_f	Fall Time		T_J=25℃		258		ns
			T_J=125℃		310		
			T_J=150℃		315		
E_{on}	Turn-on Switching Loss	V_{CC}=600V, I_C=40A, R_{Gon}=15Ω, V_{GE}=±15V, di/dt=720A/μs(T_J=150℃), Inductive Load	T_J=25℃		3.30		mJ
			T_J=125℃		3.40		
			T_J=150℃		3.87		
E_{off}	Turn-off Switching Loss	V_{CC}=600V, I_C=40A, R_{Goff} =15Ω, V_{GE}=±15V, du/dt=922V/μs(T_J=150℃), Inductive Load	T_J=25℃		3.02		mJ
			T_J=125℃		3.54		
			T_J=150℃		3.73		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		457		nC
$R_{G(int)}$	Internal Gate Resistor		T_J=25℃		0		Ω
I_{SC}	V_{CC}=600V, V_{GE}=+/-15V, tp=10us, R_{Gon}=36Ω, R_{Goff}=36Ω, T_J=25℃				148		A
$R_{\theta JC}$	Thermal Resistance: Junction-to-Case (per IGBT)					0.42	℃/W

Diode, Brake-Chopper

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

V_{RRM}	Repetitive Peak Reverse Voltage	T_J=25℃	1200	V
I_F	Diode Continuous Forward Current	T_C=100℃	25	A
I_{FM}	Peak Diode Current Repetitive	t_P=1ms	50	A

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_{FM}	Forward Voltage	I_F=25A	T_J=25℃		1.65		V
			T_J=125℃		1.70		
			T_J=150℃		1.70		
I_{rr}	Peak Reverse Recovery Current	I_F=25A, -diF/dt=730A/μs(T_J=150℃), V_R=600V, V_{GE}=-15V	T_J=25℃		27.6		A
			T_J=125℃		32.0		
			T_J=150℃		32.7		
t_{rr}	Reverse Recovery Time		T_J=25℃		203		ns
			T_J=125℃		403		
			T_J=150℃		418		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		2.86		μC
			T_J=125℃		5.47		
			T_J=150℃		5.80		
E_{rec}	Reverse Recovery Energy		T_J=25℃		0.94		mJ
			T_J=125℃		2.15		
			T_J=150℃		2.39		
$R_{\theta JC}$	Thermal Resistance: Junction-to-Case (per Diode)					0.69	℃/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=10ms	T_J=25℃	300	A
		T_J=150℃	250	
I^2t	I^2t - Value	T_J=25℃	450	A^2s
		T_J=150℃	312	

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_F	Forward Voltage	I_F=25A	T_J=25℃		1.05		V
			T_J=125℃		1.00		
I_R	Reverse Current	V_R=1600V	T_J=25℃			1	mA
$R_{\theta JC}$	Diode Thermal Resistance: Junction-to-Case (per Diode)					0.62	℃/W

Internal NTC-Thermistor Characteristics

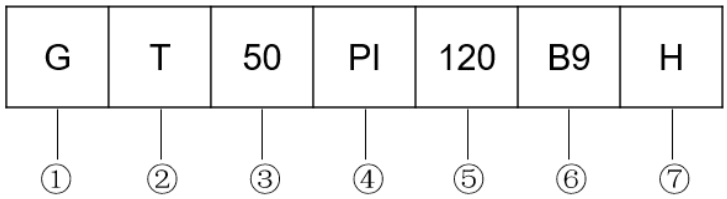
Symbol	Description	Min.	Typ.	Max.	Units
R_{25}	T_C=25℃		5		kΩ
△R/R	T_C=100℃, R_{100}=493Ω	-5		5	%
P_{25}	T_C=25℃			20	mW
$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
$B_{25/80}$	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$		3411		K
$B_{25/100}$	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$		3433		K

Module

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V_{iso}	Isolation Voltage (All Terminals Shorted)	f=50Hz, 30s		4500		V
T_J	Maximum Junction Temperature				175	℃
T_{JOP}	Maximum Operating Junction Temperature Range		-45		+150	℃
T_{stg}	Storage Temperature		-45		+150	℃
CTI	Comparative Tracking Index			200		
$R_{\theta CS}$	Case-to-Sink Thermally (Conductive Grease Applied)				0.05	℃/W
T	Mounting Screw:M4		1.5		1.8	N·m
G	Weight			40		g

Ordering Information Table

Device code



① - IGBT Module
② - Trench, Low Switching Losses 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)

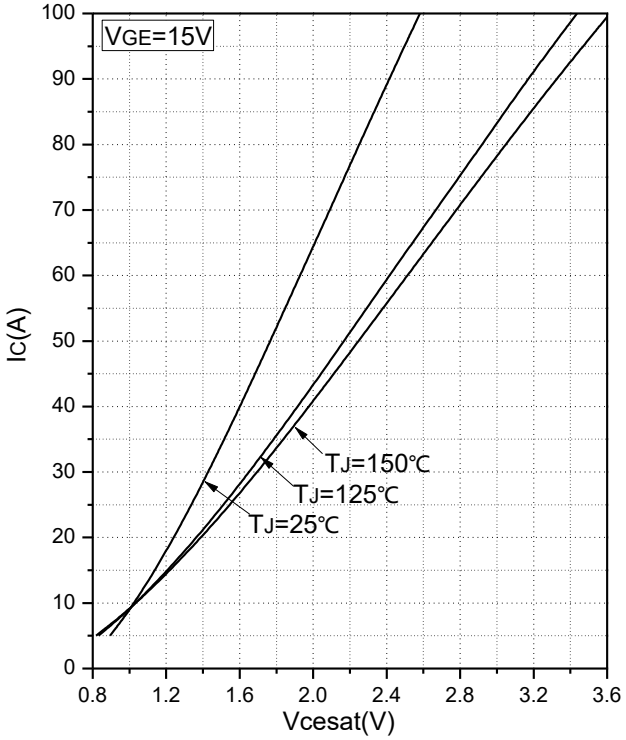


Fig.1 Typical Saturation Voltage Characteristics(Inverter)

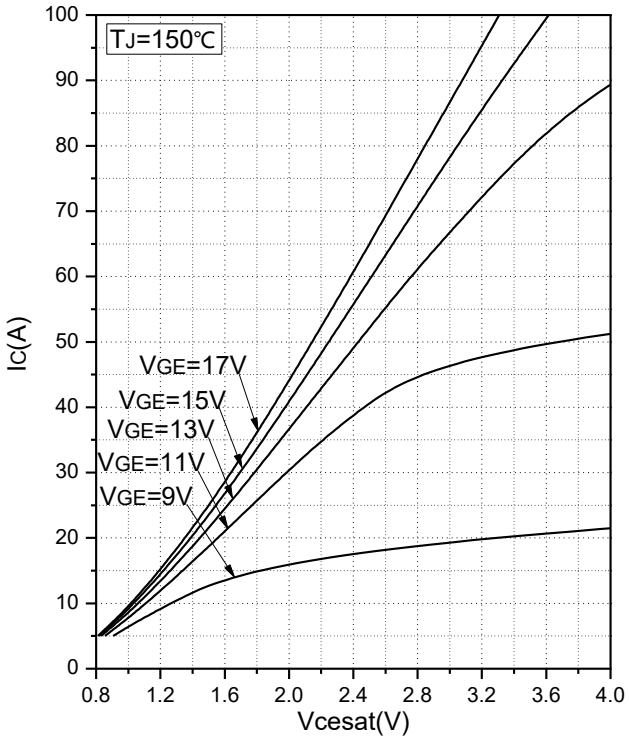


Fig.2 Typical Output Characteristics(Inverter)

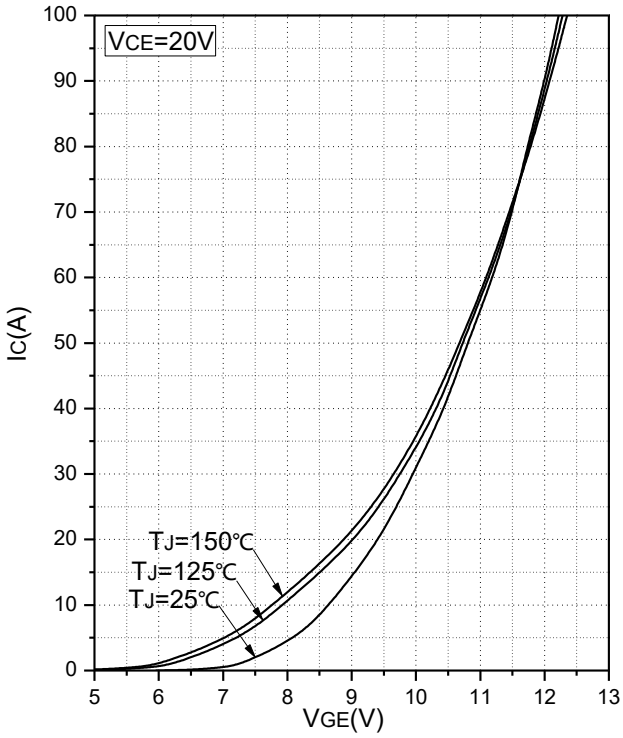


Fig.3 Transfer Characteristics(Inverter)

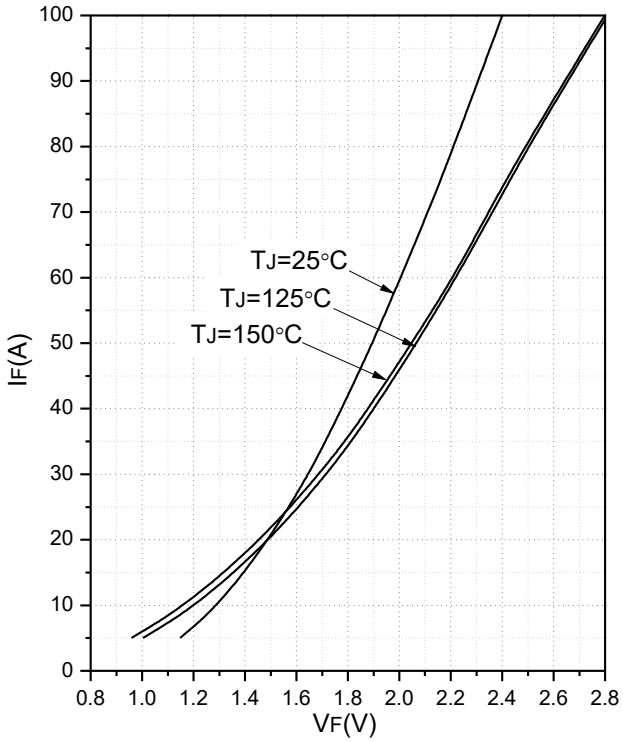


Fig.4 Forward Characteristics of Diode(Inverter)

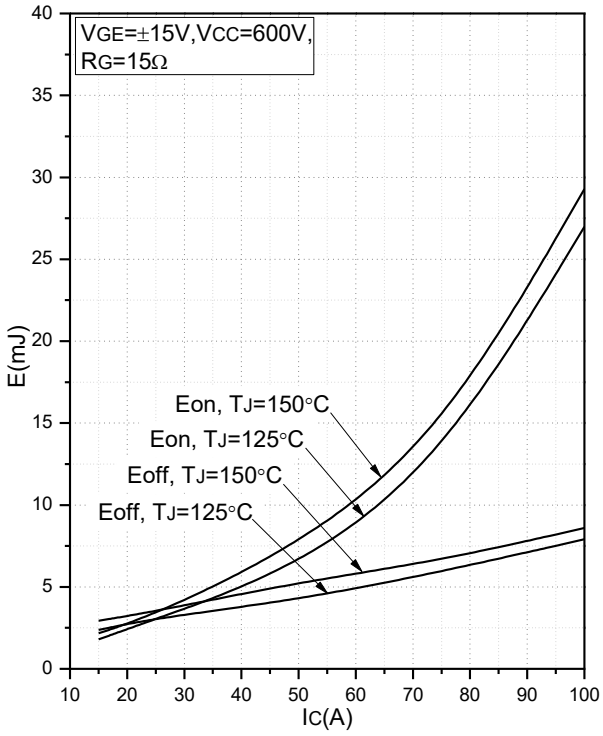


Fig.5 Typical Switching Loss vs. Collector Current(Inverter)

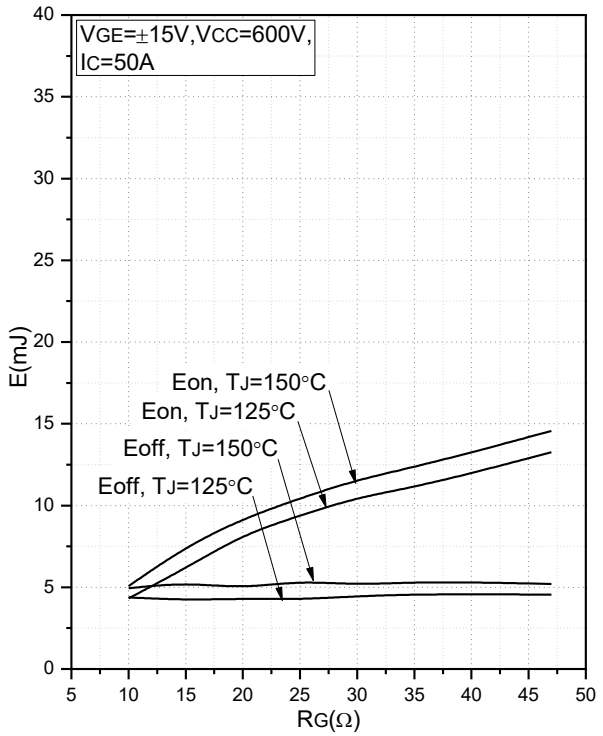


Fig.6 Typical Switching Loss vs. Gate Resistance(Inverter)

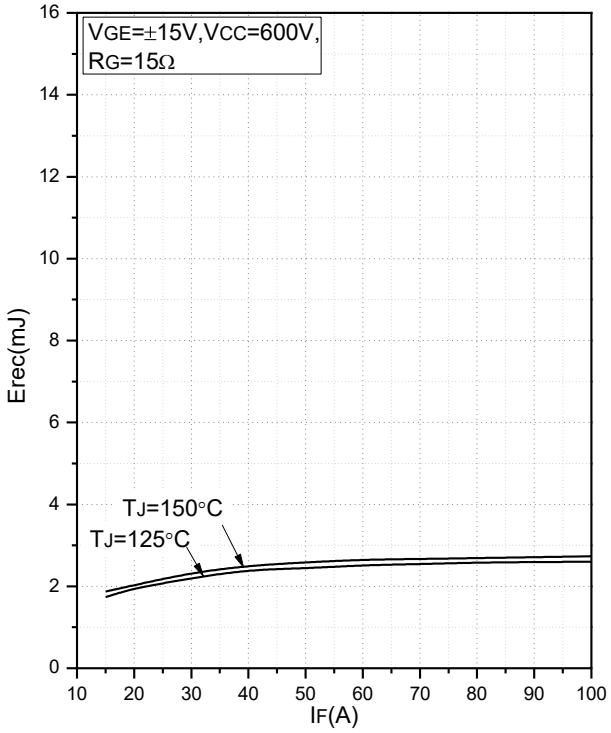


Fig.7 Typical Switching Loss vs. Forward Current(Inverter)

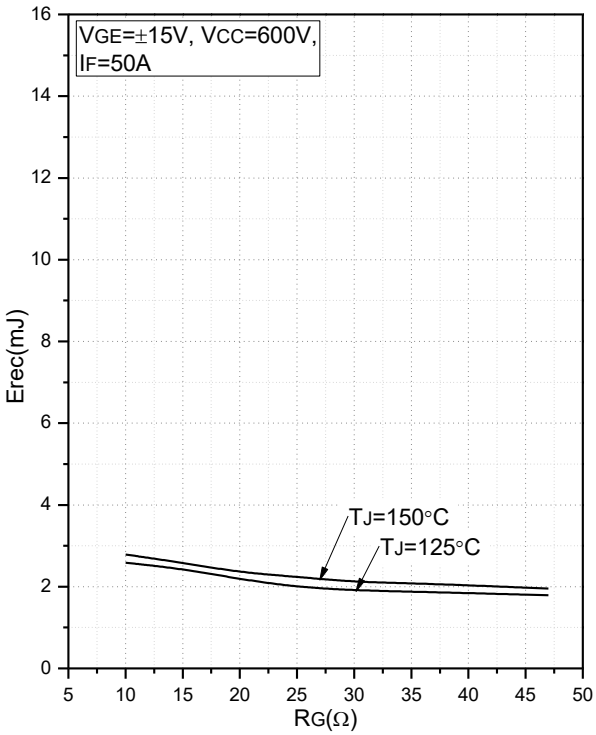


Fig.8 Typical Switching Loss vs. Gate Resistance(Inverter)

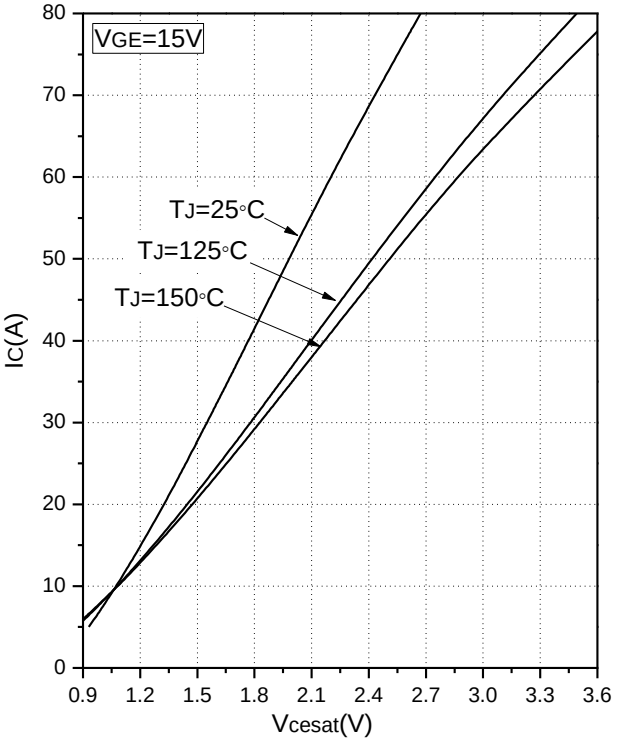


Fig.9 Typical Saturation Voltage Characteristics(Brake-Chopper)

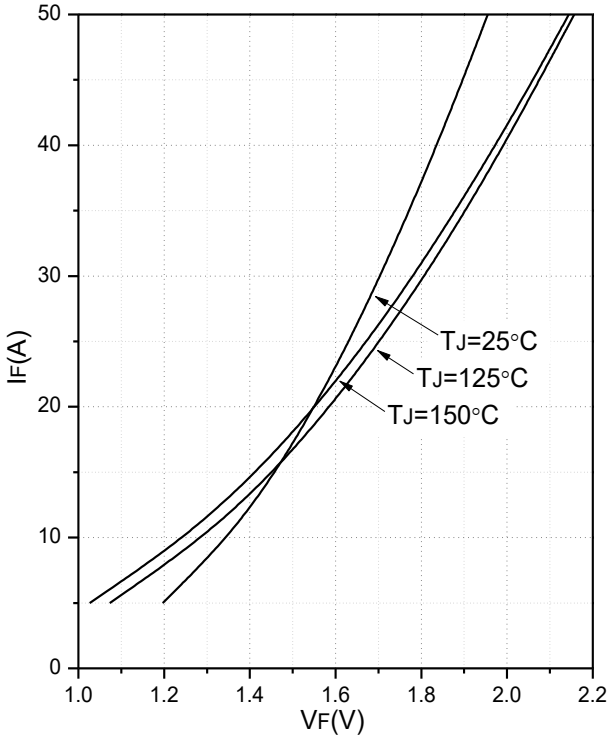


Fig.10 Forward Characteristics of Diode(Brake-Chopper)

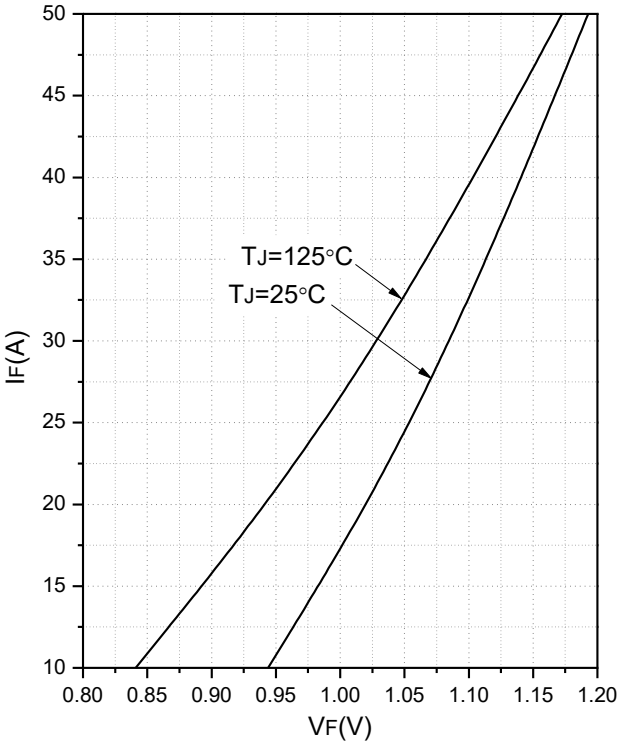


Fig.11 Forward Characteristics of Diode(Rectifier)

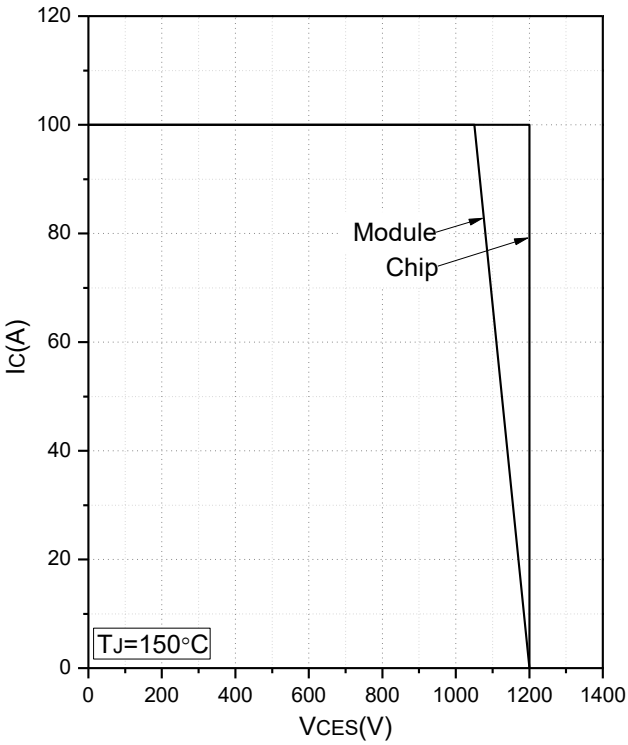


Fig.12 Reverse Bias Safe Operation Area (RBSOA)

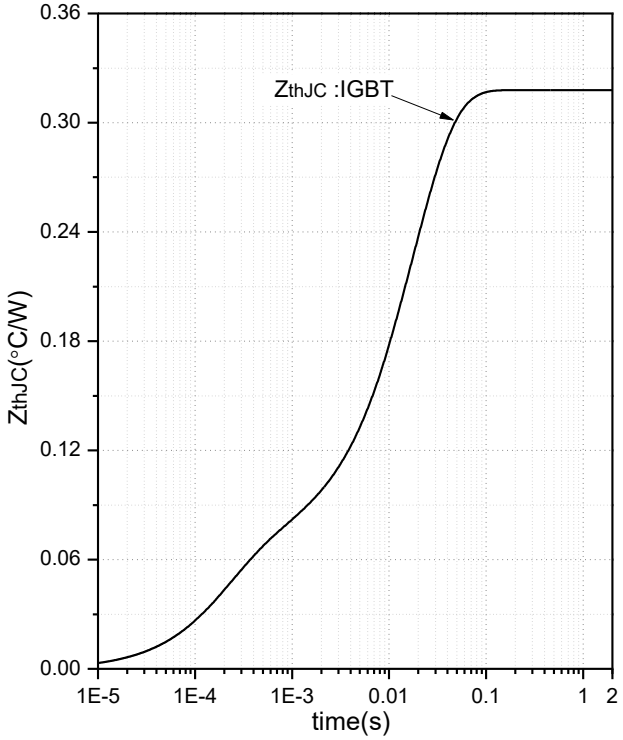


Fig.13 Transient Thermal Impedance(Inverter-IGBT)

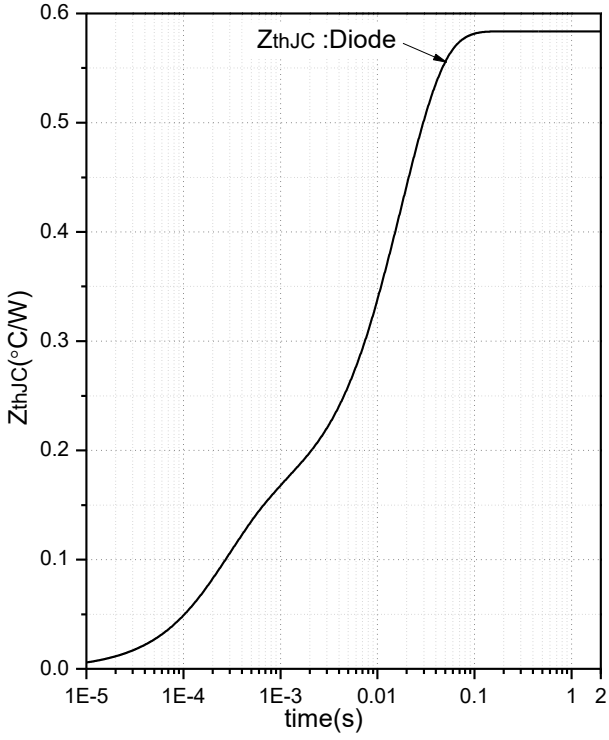


Fig.14 Transient Thermal Impedance(Inverter-Diode)

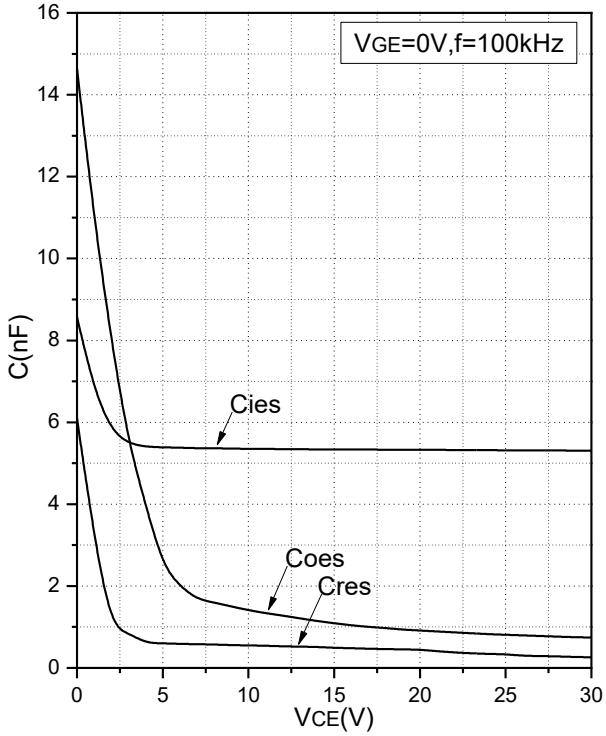


Fig.15 Capacitance Characteristics(Inverter)

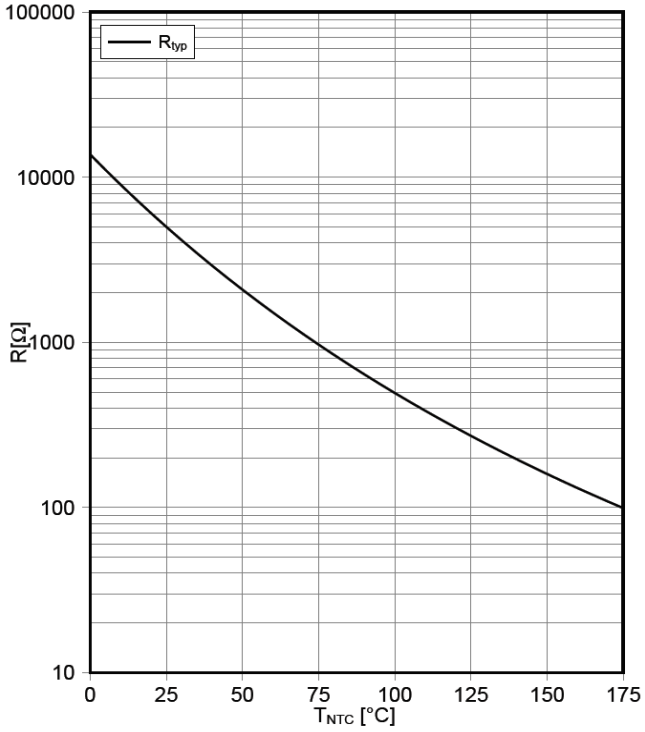
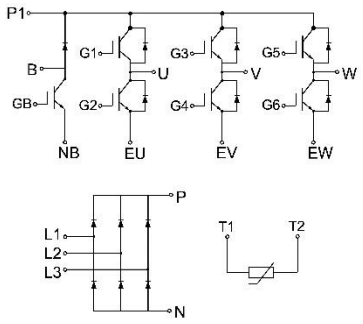
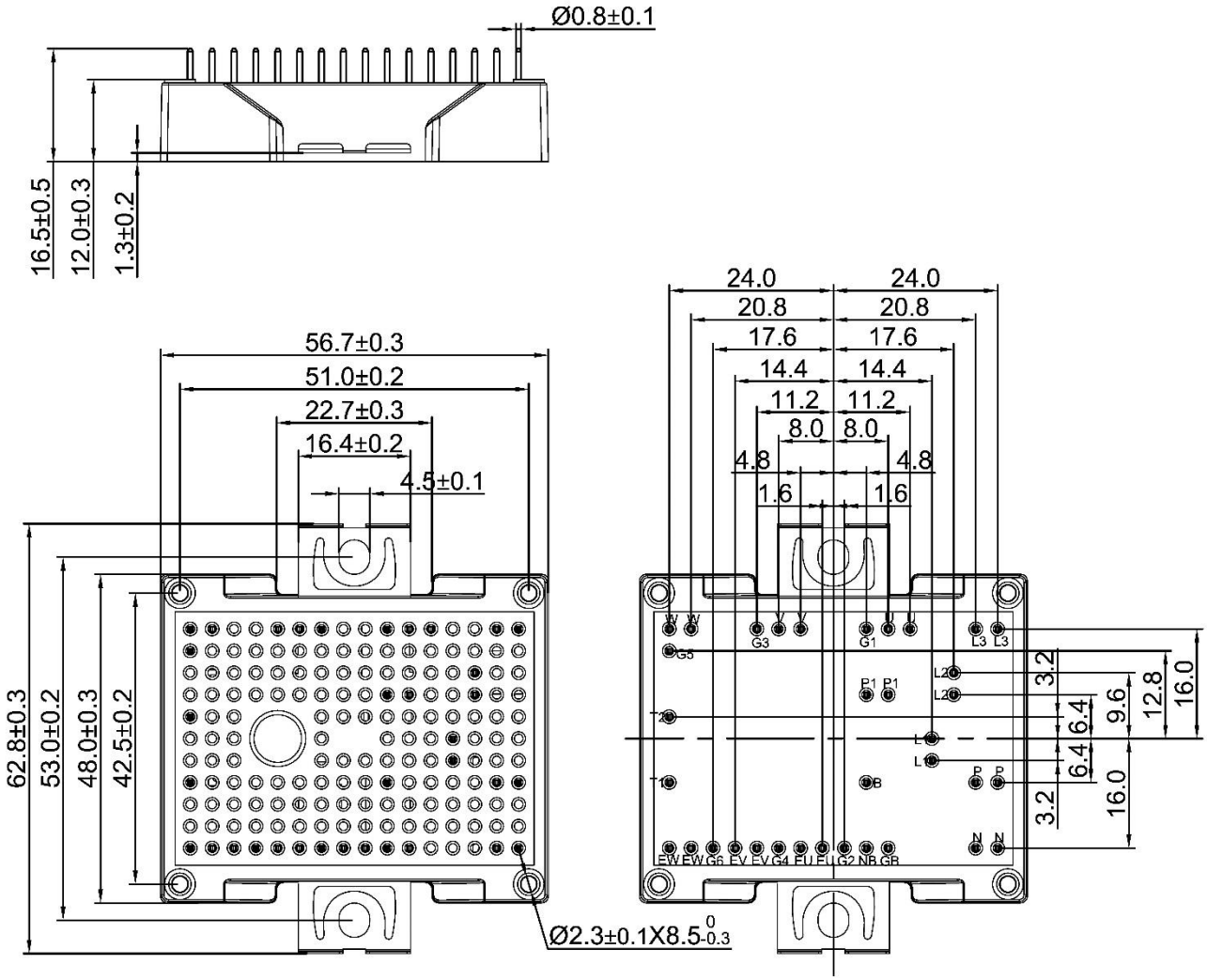


Fig.16 NTC Temperature Characteristics

Internal Circuit:



Package Outline (Unit: mm):



Revision	Notes
01	Initial Release
02	Update Internal NTC-Thermistor Characteristics
03	Updated Electrical Characteristic Parameter Values

Announcement

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