



GT40FB120A1H

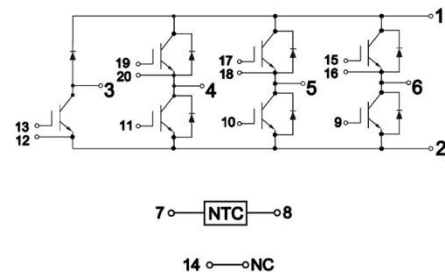
IGBT Module

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:

- Motor Drives
- Air Conditioning
- Servo Drives
- UPS

IGBT, Inverter Maximum Rated Values

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	$T_C=100^{\circ}\text{C}$	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)	$T_C=25^{\circ}\text{C}$ $T_{Jmax}=175^{\circ}\text{C}$	358	W



Electrical Characteristics of IGBT

Static Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1mA, V_{CE}=V_{GE}, T_J=25^{\circ}C$	5.0	5.8	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=40A, V_{GE}=15V$	$T_J=25^{\circ}C$	1.80	2.10	V
			$T_J=125^{\circ}C$	2.10		
			$T_J=150^{\circ}C$	2.20		
I_{CES}	Collector-Emitter Leakage Current	$V_{GE}=0V, V_{CE}=V_{CES}, T_J=25^{\circ}C$			1	mA
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=\pm 20V, V_{CE}=0V, T_J=25^{\circ}C$			± 100	nA
C_{ies}	Input Capacitance	$V_{CE}=25V, V_{GE}=0V, f=100kHz, T_J=25^{\circ}C$		3.44		nF
C_{oes}	Output Capacitance			0.51		
C_{res}	Reverse Transfer Capacitance			0.32		

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		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℃		2.48		mJ
		T _J =125℃		2.68			
		T _J =150℃		3.05			



E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =40A, R _{Goff} =15Ω, V _{GE} =±15V, du/dt=2880V/μs(T _J =150°C), Inductive Load	T _J =25°C		3.21		mJ
			T _J =125°C		3.77		
			T _J =150°C		3.97		
Q _g	Total Gate Charge	V _{GE} =-15V...+15V	T _J =25°C		457		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} =56Ω, R _{Goff} =56Ω, T _J =25°C				175		A
R _{θJC}	Thermal Resistance: Junction-to-Case (per IGBT)					0.419	°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		40	A
I _{FM}	Peak FWD Current Repetitive	tp=1ms	80	A

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _{FM}	Forward Voltage	I _F =40A	T _J =25℃		1.80	2.10	V
			T _J =125℃		1.90		
			T _J =150℃		1.90		
I _{rr}	Peak Reverse Recovery Current	I _F =40A, di/dt=830A/μs(T _J =150℃), V _{rr} =600V, V _{GE} =-15V	T _J =25℃		53.7		A
			T _J =125℃		62.5		
			T _J =150℃		63.8		
t _{rr}	Reverse Recovery Time		T _J =25℃		164		ns
			T _J =125℃		186		
			T _J =150℃		186		
Q _{rr}	Reverse Recovery Charge		T _J =25℃		4.53		μC
			T _J =125℃		6.31		
			T _J =150℃		6.54		



E _{rec}	Reverse Recovery Energy	I _F =40A, di/dt=830A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =-15V	T _J =25°C		1.56		mJ
			T _J =125°C		2.14		
			T _J =150°C		2.45		
R _{θJC}	Thermal Resistance: Junction-to-Case (per Diode)					0.584	°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	15	A
		T _C =25°C	30	A
I _{CM}	Peak Collector Current Repetitive	t _p =1ms	30	A
P _D	Maximum Power Dissipation (IGBT)	T _C =25°C T _{Jmax} =175°C	199	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		5.0	5.9	6.8	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =15A, V _{GE} =15V	T _J =25°C		1.85	2.10	V
			T _J =125°C		2.05		
			T _J =150°C		2.15		
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			1.45		nF
C _{oes}	Output Capacitance				0.10		
C _{res}	Reverse Transfer Capacitance				0.06		



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℃		154		ns
			T _J =125℃		140		
			T _J =150℃		115		
t _r	Rise Time		T _J =25℃		95		ns
			T _J =125℃		95		
			T _J =150℃		102		
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℃		166		
			T _J =150℃		166		
t _f	Fall Time		T _J =25℃		331		ns
			T _J =125℃		422		
			T _J =150℃		416		
E _{on}	Turn-on Switching Loss	V _{CC} =600V, I _C =15A, R _{Gon} =68Ω, V _{GE} =±15V, di/dt=117A/μs(T _J =150℃), Inductive Load	T _J =25℃		3.25		mJ
			T _J =125℃		4.01		
			T _J =150℃		4.38		
E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =15A, R _{Goff} =68Ω, V _{GE} =±15V, du/dt=1963V/μs(T _J =150℃), Inductive Load	T _J =25℃		0.76		mJ
			T _J =125℃		1.16		
			T _J =150℃		1.27		
Q _g	Total Gate Charge	V _{GE} =-15V...+15V	T _J =25℃		363		nC
SCSOA	V _{CC} =600V, V _{GE} =±15V, R _G =68Ω, T _J =150℃			10			μs
R _{θJC}	Thermal Resistance: Junction-to-Case (per IGBT)					0.753	℃/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		15	A
I_{FM}	Peak FWD Current Repetitive	$t_p=1ms$	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		1.90		V
			T _J =125°C		2.05		
			T _J =150°C		2.00		
I _{rr}	Peak Reverse Recovery Current	I _F =15A, di/dt=174A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =-15V	T _J =25°C		15.6		A
			T _J =125°C		20.6		
			T _J =150°C		16.3		
t _{rr}	Reverse Recovery Time		T _J =25°C		241		ns
			T _J =125°C		249		
			T _J =150°C		276		
Q _{rr}	Reverse Recovery Charge		T _J =25°C		0.89		μC
			T _J =125°C		1.34		
			T _J =150°C		1.38		
E _{rec}	Reverse Recovery Energy		T _J =25°C		0.12		mJ
			T _J =125°C		0.13		
			T _J =150°C		0.14		
R _{θJC}	Thermal Resistance: Junction-to-Case (per Diode)					1.127	°C/W

Internal NTC-Thermistor Characteristics

Symbol	Description	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



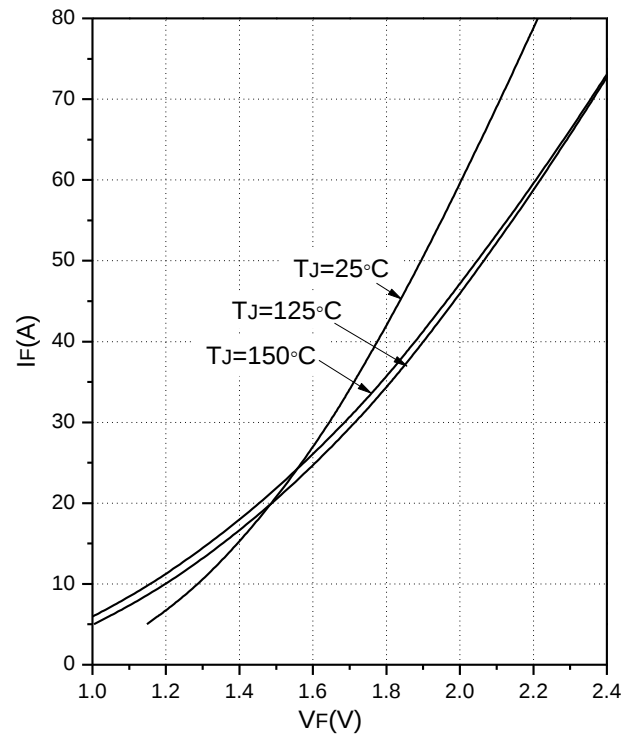
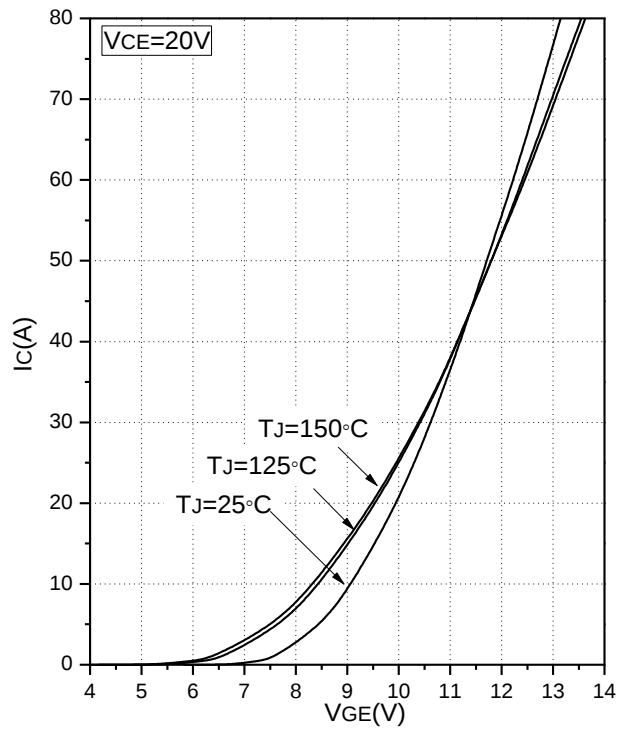
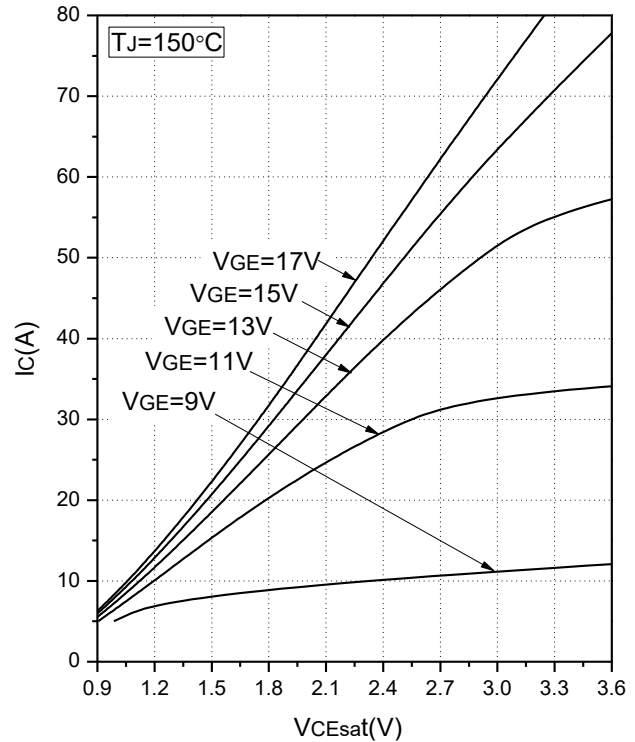
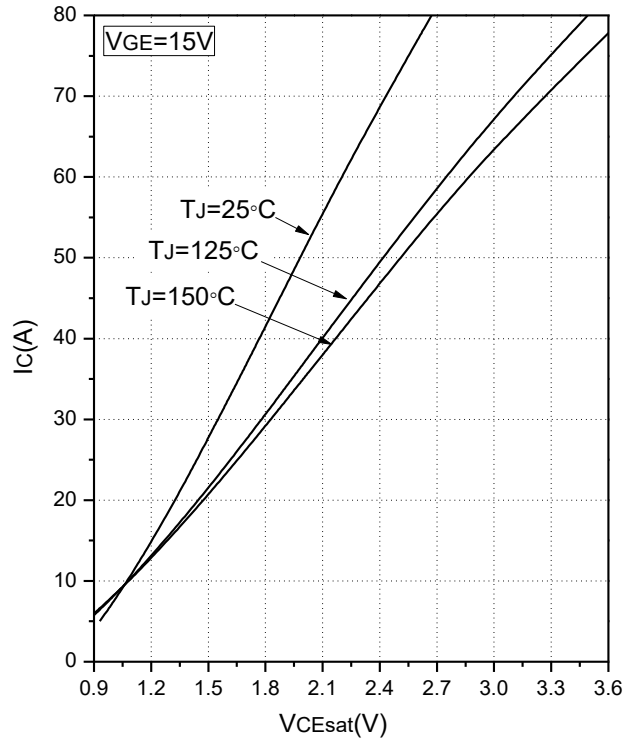
Module

Symbol	Description	Min.	Typ.	Max.	Units
V _{IOS}	Isolation Voltage (All Terminals Shorted)	AC Test Voltage, t=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)			0.06	°C/W
M	Mounting Screw:M3	0.75		1.20	N·m
G	Weight		30		g

Ordering Information Table

Device code	G	T	40	FB	120	A1	H
	①	②	③	④	⑤	⑥	⑦

- ① - IGBT Module
- ② - Trench, Low Switching Losses IGBT
- ③ - Rated Current (40=40A)
- ④ - Circuit Configuration (FB=Seven Pack)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)



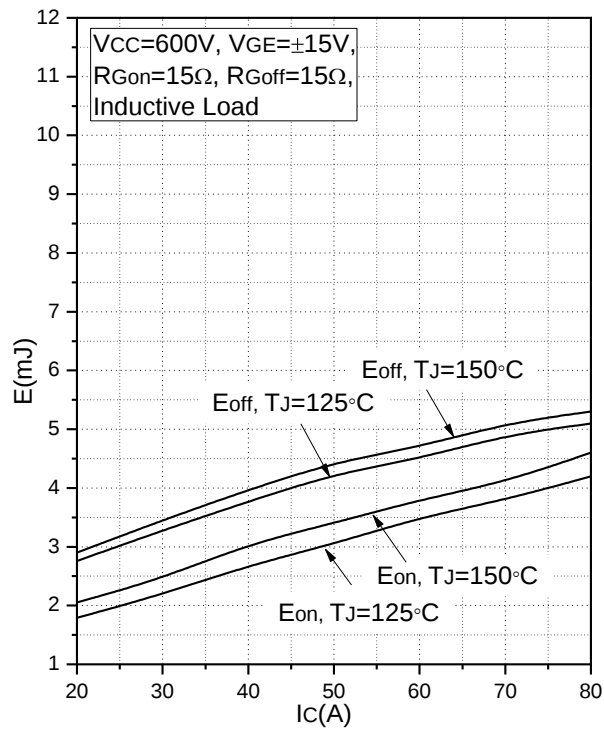


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

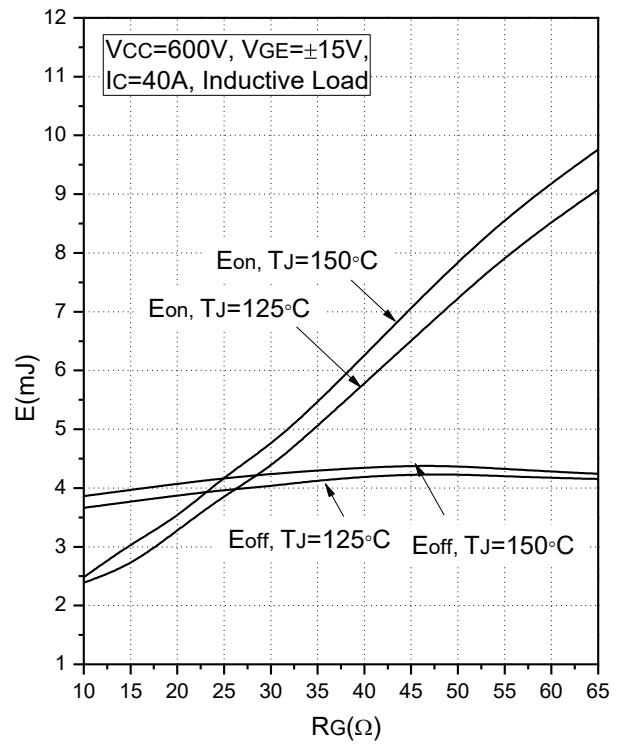


Fig.6 Typical Switching Loss vs. Gate Resistance (Inverter)

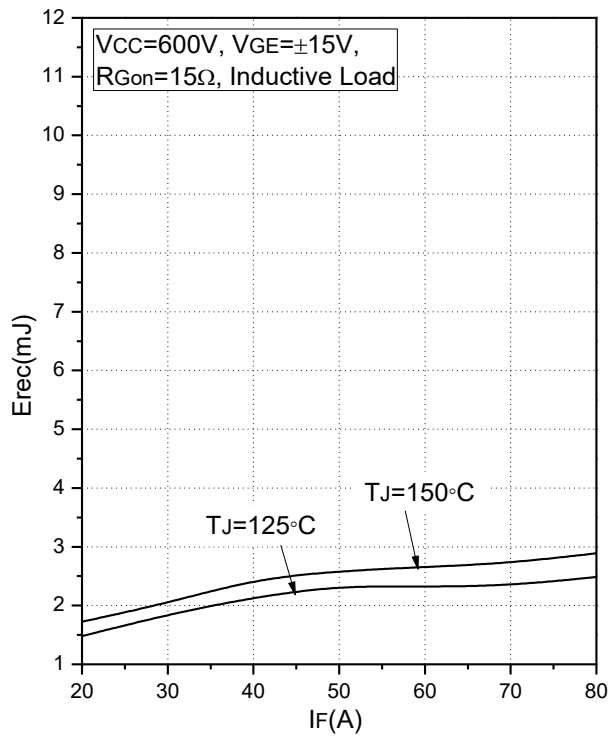


Fig.7 Typical Switching Loss vs. Forward Current (Inverter)

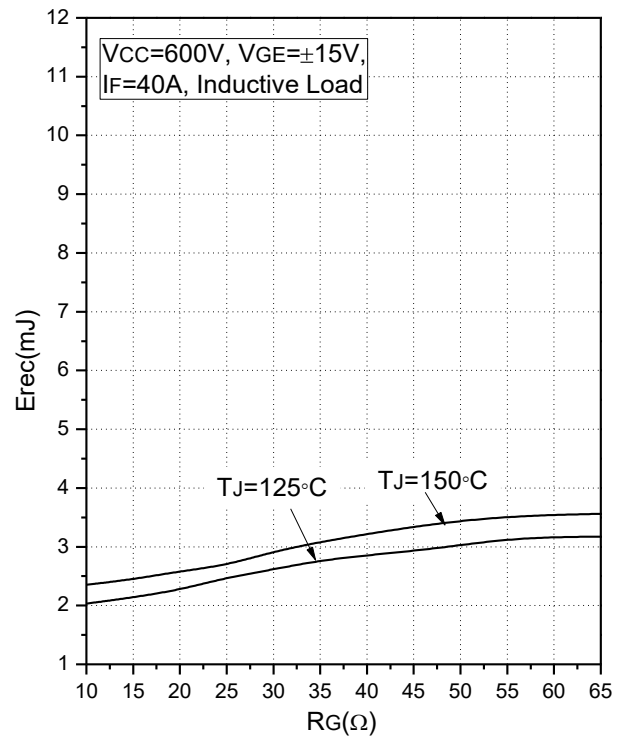


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

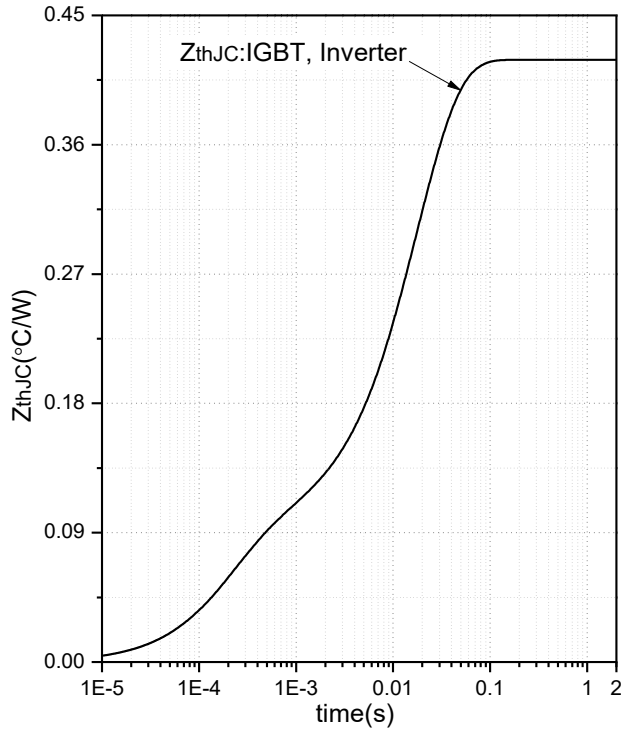


Fig.9 Transient Thermal Impedance (Inverter)

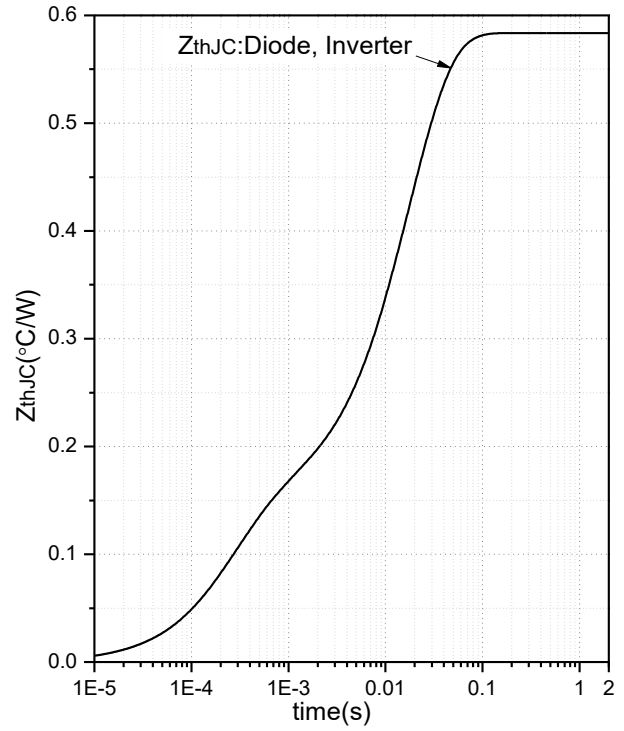


Fig.10 Transient Thermal Impedance (Inverter)

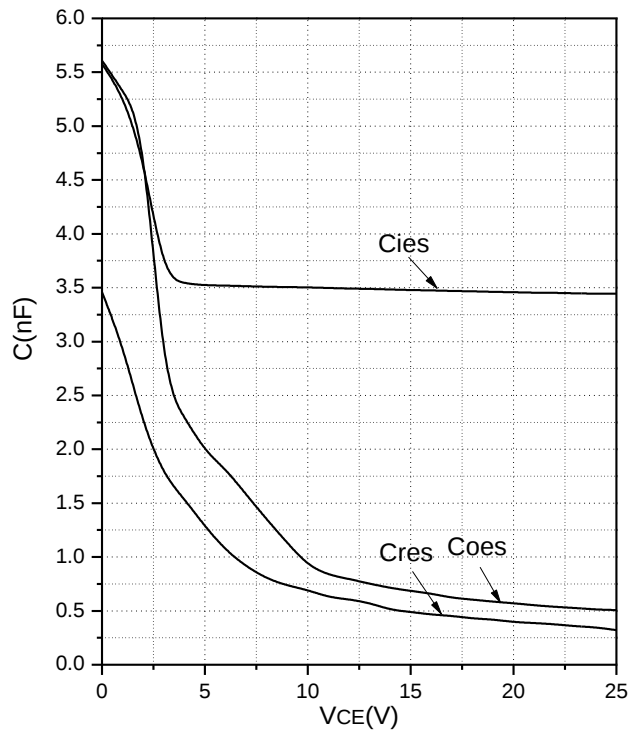


Fig.11 Capacitance Characteristics (Inverter)

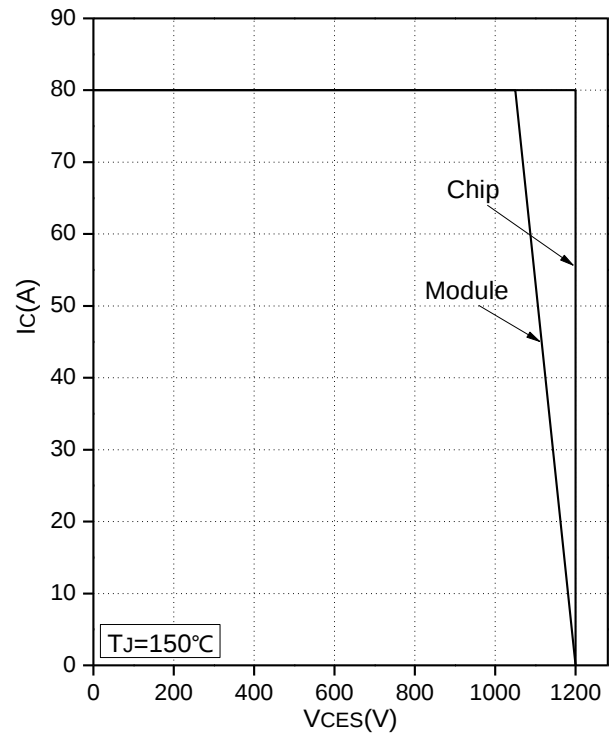


Fig.12 Reverse Bias Safe Operation Area (RBSOA) (Inverter)

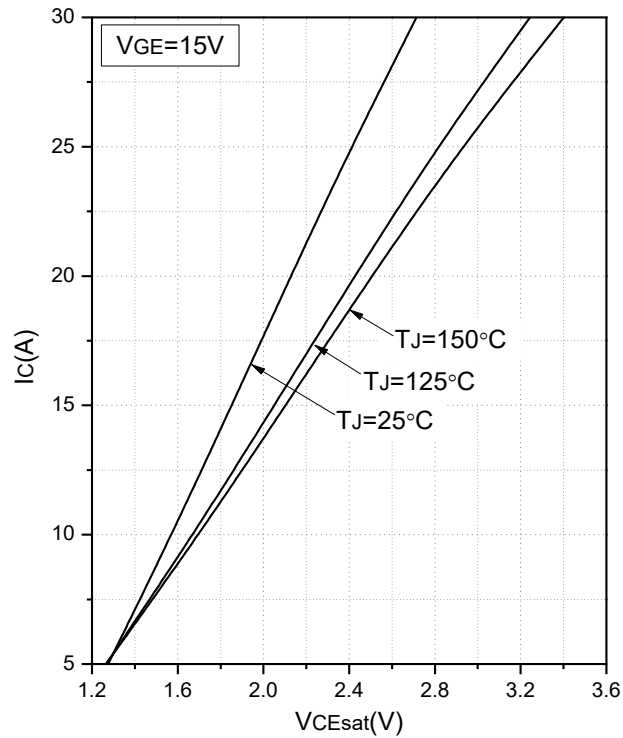


Fig.13 Typical Saturation Voltage Characteristics (Brake-Chopper)

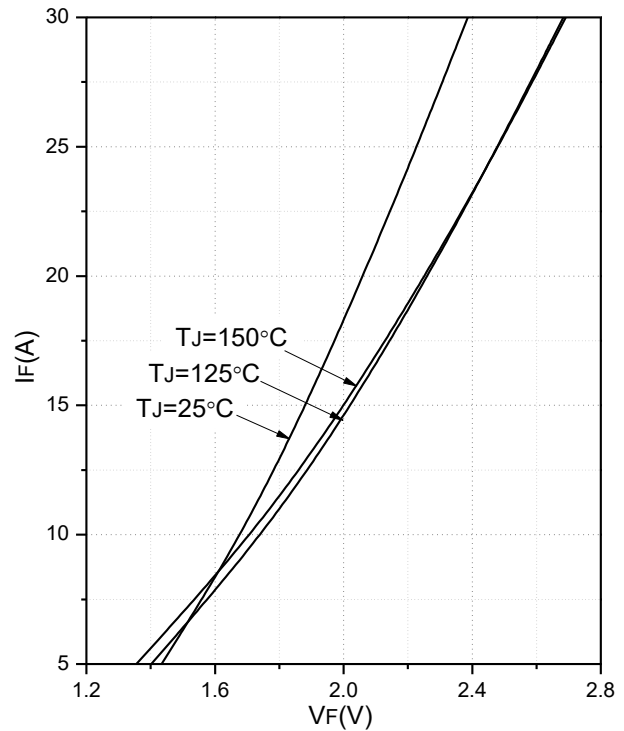


Fig.14 Forward Characteristics of Diode (Brake-Chopper)

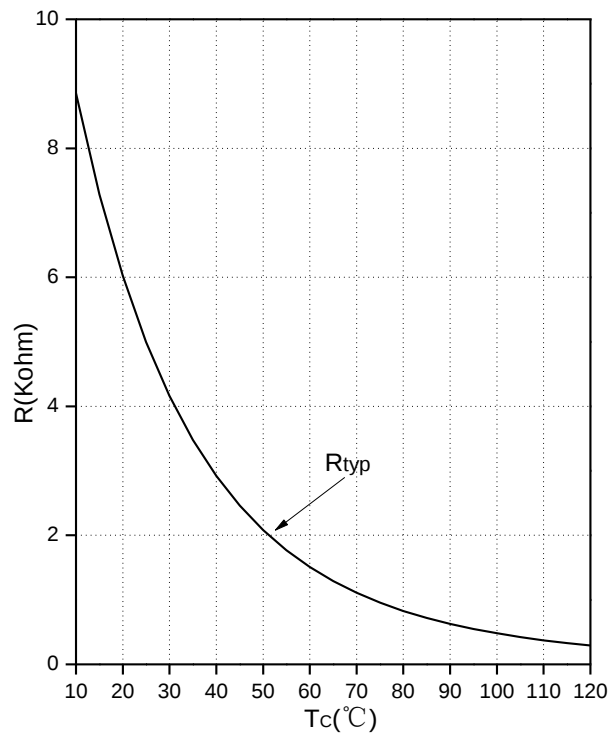
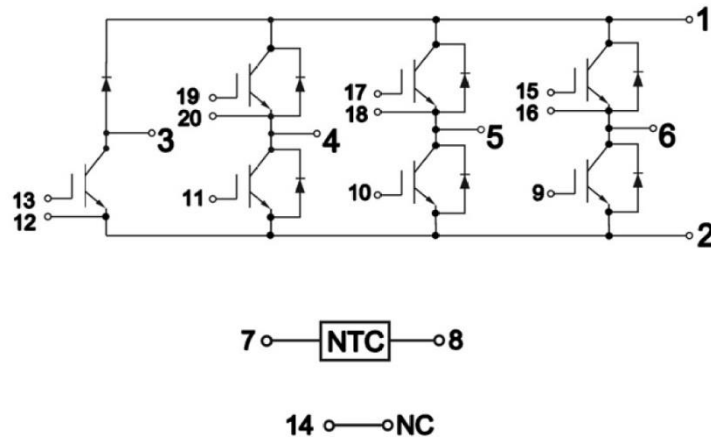


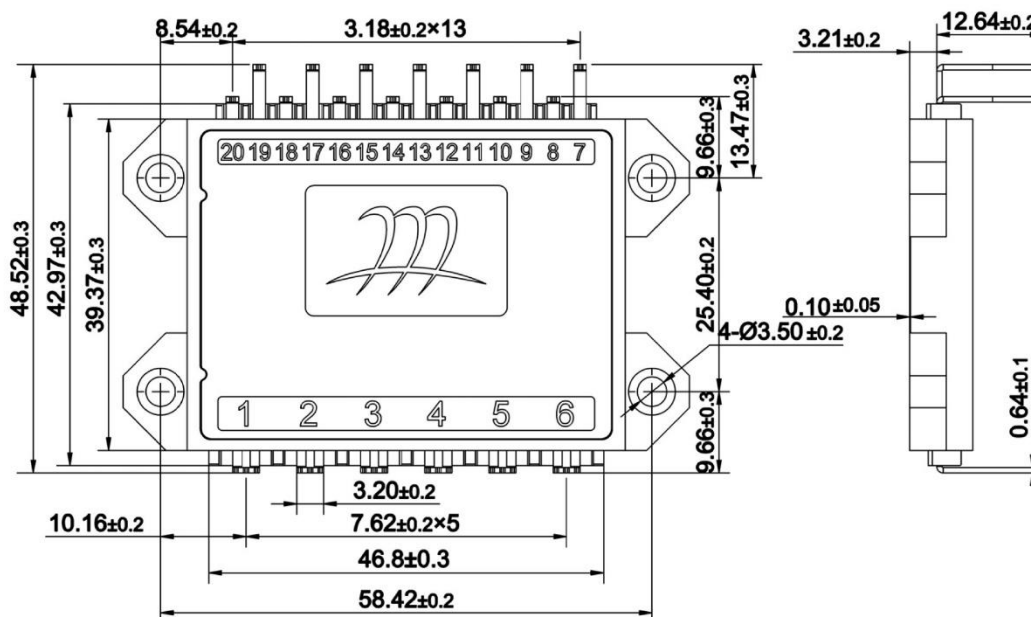
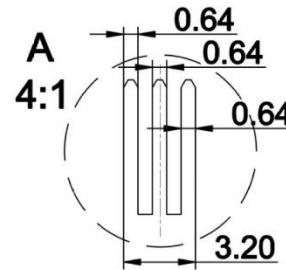
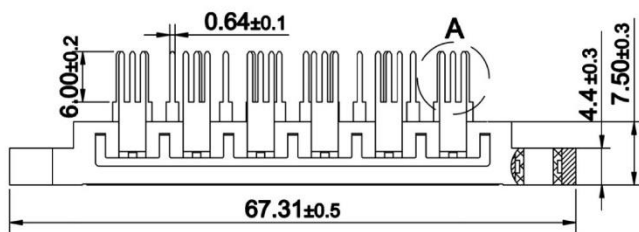
Fig.15 NTC Temperature Characteristics



Internal Circuit:



Package Outline (Unit: mm):





Date	Revision	Notes
01/15/2024	01	Initial Release
05/15/2024	02	Update Outlines

Announcements

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