



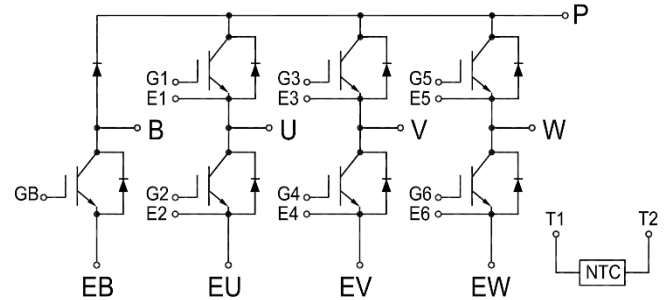
GT40FB120C7H

IGBT Module

Preliminary Data

Features:

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



Applications:

- Industrial Inverters
- Industrial Drivers

IGBT, Inverter Maximum Rated Values

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	40	A
		T _C =25°C	80	A
I _{CM}	Peak Collector Current Repetitive	t _p =1ms	80	A
P _D	Maximum Power Dissipation (IGBT)	T _C =25°C T _{Jmax} =175°C	288	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	$V_{GE}=\pm 20V, V_{CE}=0V, T_J=25^{\circ}C$			± 200	nA
C_{ies}	Input Capacitance	$V_{CE}=25V, V_{GE}=0V, f=100kHz, T_J=25^{\circ}C$		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	$V_{CC}=600V, I_C=40A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		92		ns
			$T_J=125^{\circ}C$		93		
			$T_J=150^{\circ}C$		94		
t_r	Rise Time		$T_J=25^{\circ}C$		46		ns
			$T_J=125^{\circ}C$		50		
			$T_J=150^{\circ}C$		50		
$t_{d(off)}$	Turn-off Delay Time		$T_J=25^{\circ}C$		183		ns
			$T_J=125^{\circ}C$		185		
			$T_J=150^{\circ}C$		189		
t_f	Fall Time	$T_J=25^{\circ}C$		258		ns	
		$T_J=125^{\circ}C$		310			
		$T_J=150^{\circ}C$		315			
E_{on}	Turn-on Switching Loss	$V_{CC}=600V, I_C=40A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ $di/dt=720A/\mu s(T_J=150^{\circ}C),$ Inductive Load	$T_J=25^{\circ}C$		3.29		mJ
		$T_J=125^{\circ}C$		3.40			
		$T_J=150^{\circ}C$		3.87			



E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =40A, R _{Goff} =15Ω, V _{GE} =±15V, du/dt=921V/μs(T _J =150°C), Inductive Load	T _J =25°C		3.01		mJ
			T _J =125°C		3.54		
			T _J =150°C		3.73		
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
SCSOA	V _{CC} =600V, V _{GE} =±15V, t _p =10μs, R _{Gon} =56Ω, R _{Goff} =56Ω, T _J =25°C				175		A
R _{θJC}	Thermal Resistance: Junction-to-Case (per IGBT)					0.52	°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 FWD 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℃		1.80		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)					0.72	°C/W

IGBT, Brake-Chopper

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

V_{CES}	Collector-Emitter Blocking Voltage	$T_J=25^\circ C$	1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C=100^\circ C$	25	A
		$T_C=25^\circ C$	50	A
I_{CM}	Peak Collector Current Repetitive	$t_p=1ms$	50	A
P_D	Maximum Power Dissipation (IGBT)	$T_C=25^\circ C$ $T_{Jmax}=175^\circ C$	225	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	5.6	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=25A$, $V_{GE}=15V$	$T_J=25^\circ C$		1.70	1.90	V
			$T_J=125^\circ C$		1.90		
			$T_J=150^\circ C$		2.00		
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	$V_{GE}=\pm 20V$, $V_{CE}=0V$, $T_J=25^\circ C$				± 200	nA
C_{ies}	Input Capacitance	$V_{CE}=25V$, $V_{GE}=0V$, $f=100kHz$, $T_J=25^\circ C$			1.65		nF
C_{oes}	Output Capacitance				0.17		
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℃		102		ns	
			T _J =125℃		99			
			T _J =150℃		99			
t _r	Rise Time		T _J =25℃		39		ns	
			T _J =125℃		39			
			T _J =150℃		37			
t _{d(off)}	Turn-off Delay Time		V _{CC} =600V, I _C =25A, R _{Goff} =20Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		138		ns
				T _J =125℃		147		
				T _J =150℃		145		
t _f	Fall Time	T _J =25℃			494		ns	
		T _J =125℃			723			
		T _J =150℃			728			
E _{on}	Turn-on Switching Loss	T _J =25℃			2.53		mJ	
		T _J =125℃			3.12			
		T _J =150℃			3.36			
E _{off}	Turn-off Switching Loss	V _{CC} =600V, I _C =25A, R _{Goff} =20Ω, V _{GE} =±15V, du/dt=1287V/μs (T _J =150℃) Inductive Load	T _J =25℃		1.77		mJ	
		T _J =125℃		2.87				
		T _J =150℃		3.15				
Q _g	Total Gate Charge	V _{GE} =-15V...+15V	T _J =25℃		129		nC	
R _{g internal}	Internal Gate Resistor		T _J =25℃		0		Ω	
SCSOA	V _{CC} =600V, V _{GE} =±15V, R _G =32Ω, T _J =25℃				103		A	
R _{θJC}	Thermal Resistance: Junction-to-Case (per IGBT)					0.67	℃/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 ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _{FM}	Forward Voltage	I _F =10A	T _J =25°C		1.70		V
			T _J =125°C		1.80		
			T _J =150°C		1.80		
I _{rr}	Peak Reverse Recovery Current	I _F =10A, -di _F /dt=208A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =-15V	T _J =25°C		6.6		A
			T _J =125°C		7.2		
			T _J =150°C		8.4		
t _{rr}	Reverse Recovery Time		T _J =25°C		279		ns
			T _J =125°C		305		
			T _J =150°C		392		
Q _{rr}	Reverse Recovery Charge		T _J =25°C		1.05		μC
			T _J =125°C		1.46		
			T _J =150°C		1.91		
E _{rec}	Reverse Recovery Energy		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)					1.57	°C/W

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

V_{RRM}	Repetitive Peak Reverse Voltage	$T_J=25^{\circ}\text{C}$	1200	V
I_F	Diode Continuous Forward Current	$T_C=100^{\circ}\text{C}$	10	A
I_{FM}	Repetitive Peak Forward Current	$t_p=1\text{ms}$	20	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 =10A	T _J =25°C		1.70		V
			T _J =125°C		1.80		
			T _J =150°C		1.80		
I _{rr}	Peak Reverse Recovery Current	I _F =10A, -di _F /dt=208A/μs(T _J =150°C), V _{rr} =600V, V _{GE} =-15V	T _J =25°C		6.6		A
			T _J =125°C		7.2		
			T _J =150°C		8.4		
t _{rr}	Reverse Recovery Time		T _J =25°C		279		ns
			T _J =125°C		305		
			T _J =150°C		392		
Q _{rr}	Reverse Recovery Charge		T _J =25°C		1.05		μC
			T _J =125°C		1.46		
			T _J =150°C		1.91		
E _{rec}	Reverse Recovery Energy		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)					1.57	°C/W

Internal NTC-Thermistor Characteristics

Symbol	Conditions	Min.	Typ.	Max.	Units
R_{25}	$T_C=25^\circ\text{C}$		5		k Ω
$\Delta R/R$	$T_C=100^\circ\text{C}$, $R_{100}=465\Omega$	-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 _{iso}	Isolation Voltage (All Terminals Shorted)	f=50Hz, 30s	4500			V
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		225			
R _{θCS}	Case-To-Sink Thermally (Conductive Grease Applied)				0.05	°C/W
T	Mounting Screw:M4		1.5		2.0	N·m
G	Weight			31		g

Ordering Information Table

Device code	G	T	40	FB	120	C7	H
	①	②	③	④	⑤	⑥	⑦

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

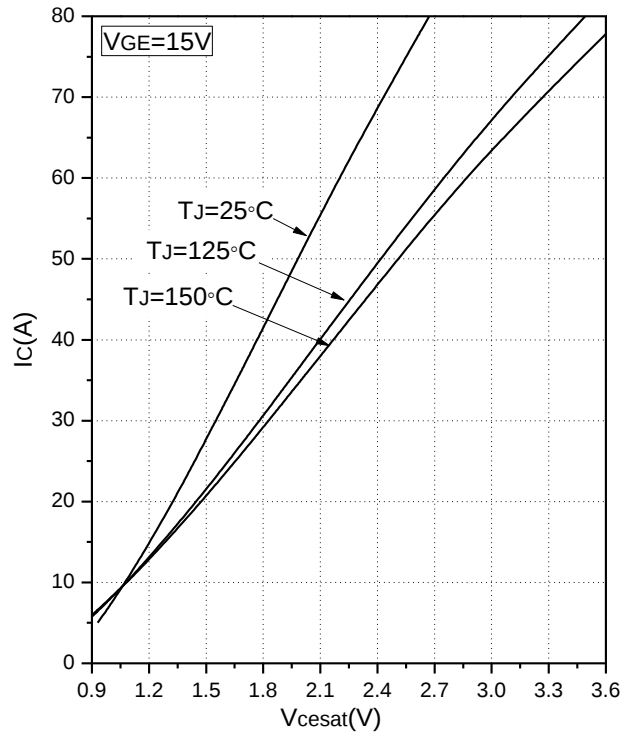


Fig.1 Typical Saturation Voltage Characteristics(Inverter)

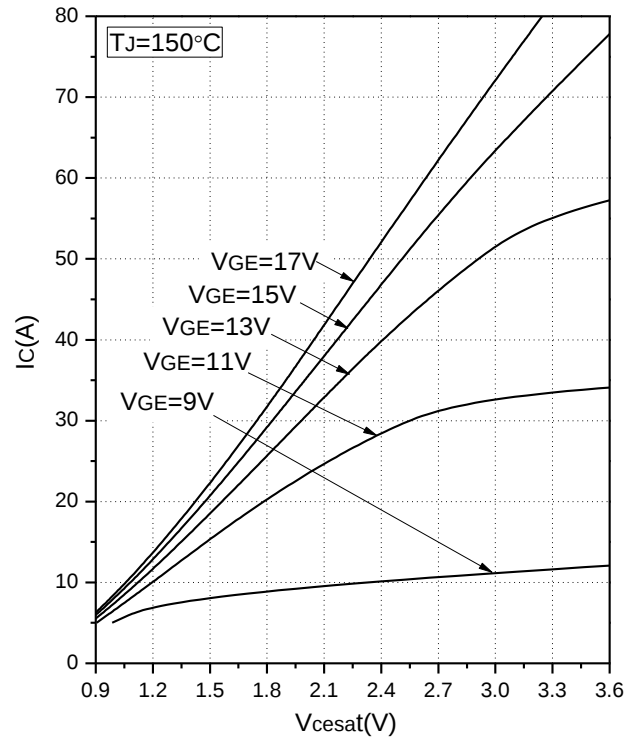


Fig.2 Typical Output Characteristics (Inverter)

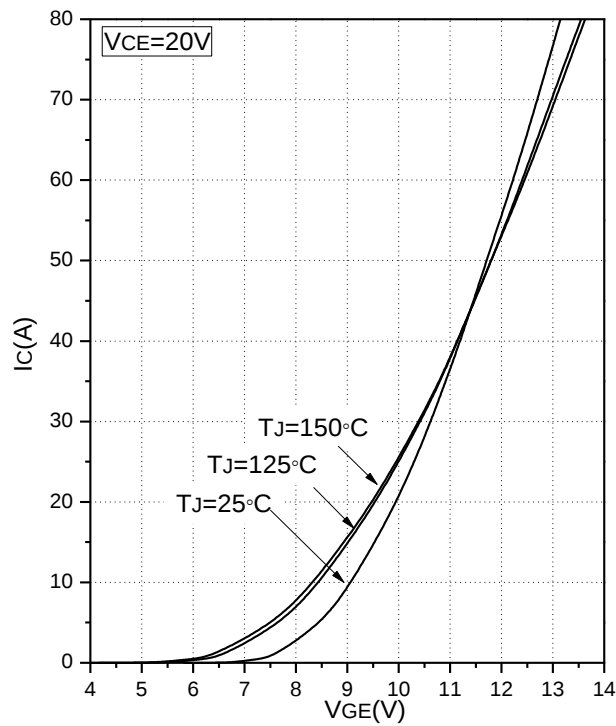


Fig.3 Transfer Characteristics(Inverter)

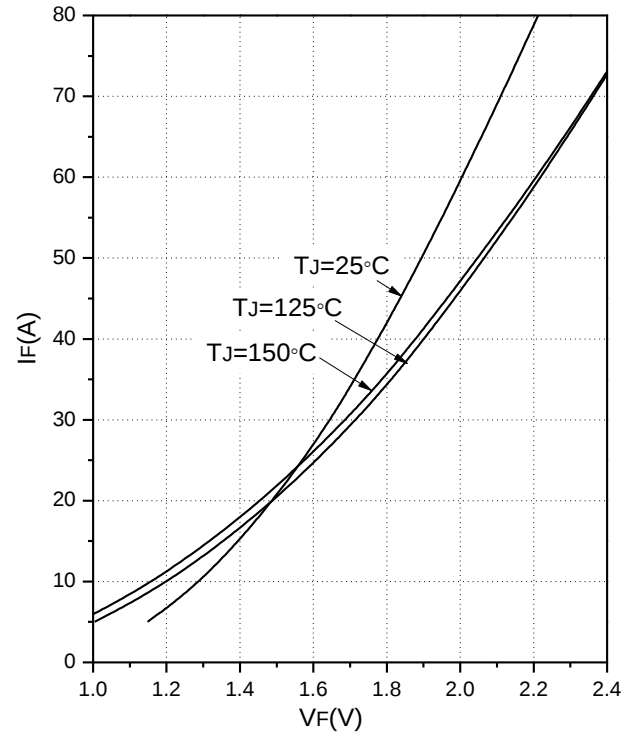
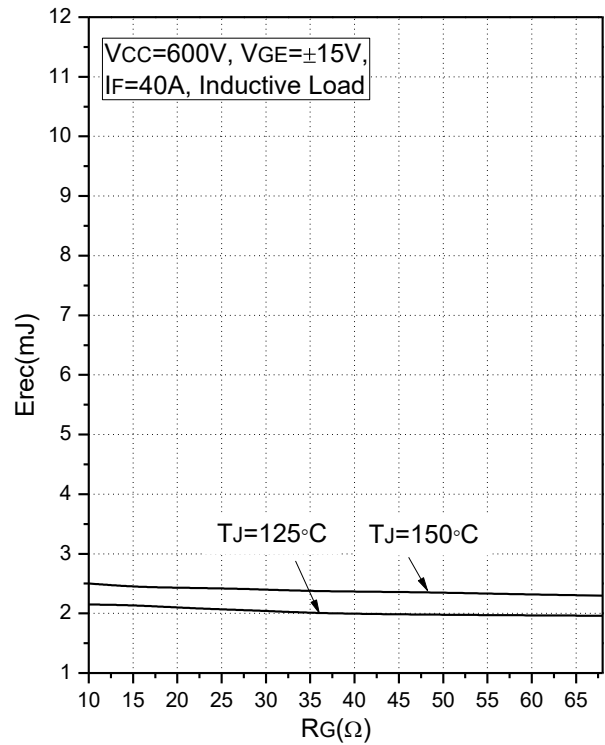
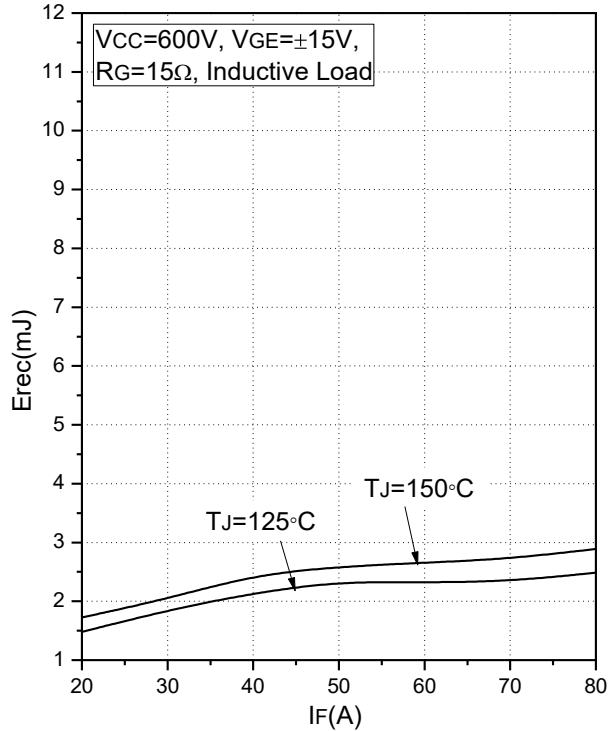
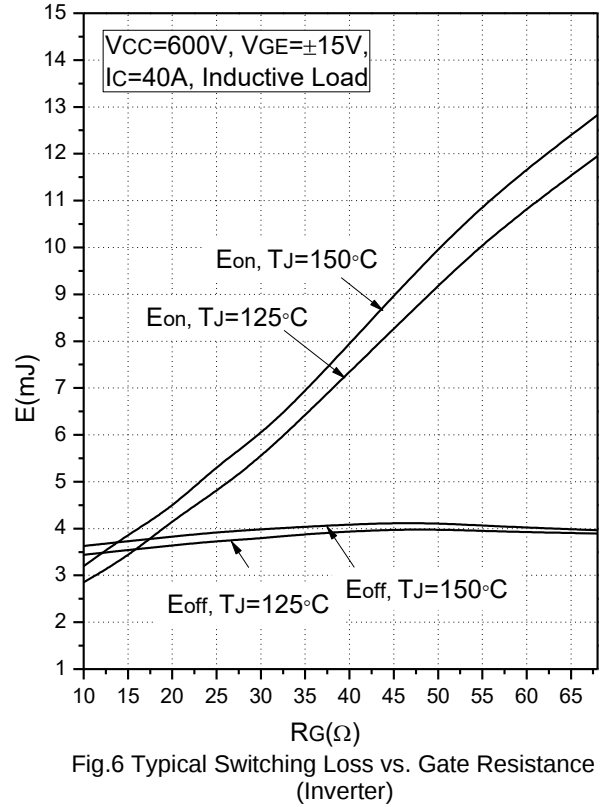
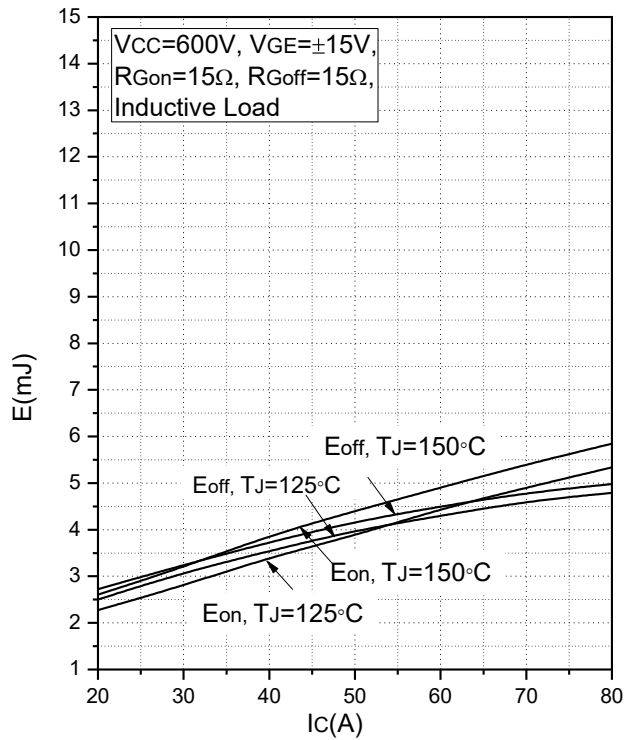
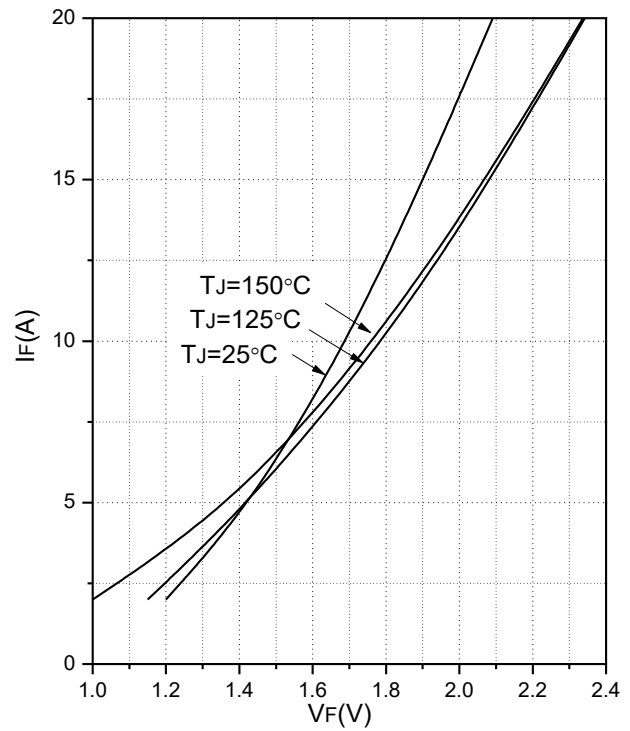
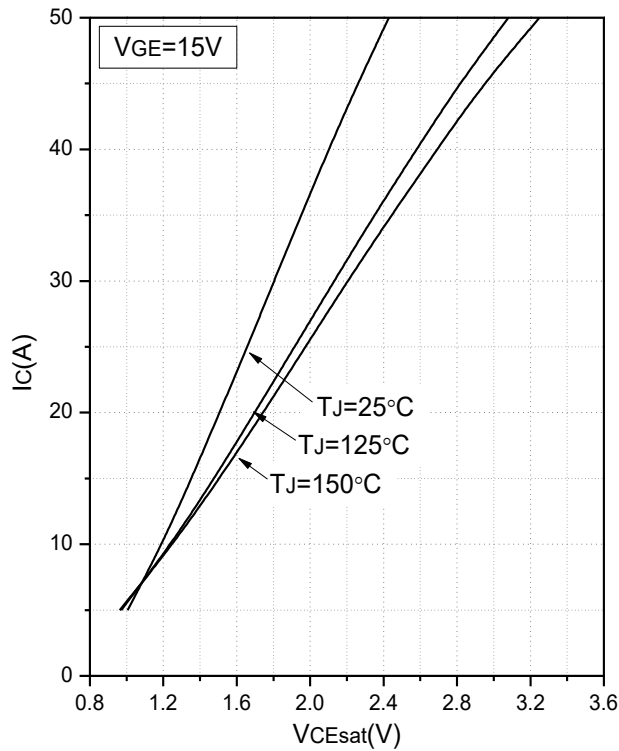
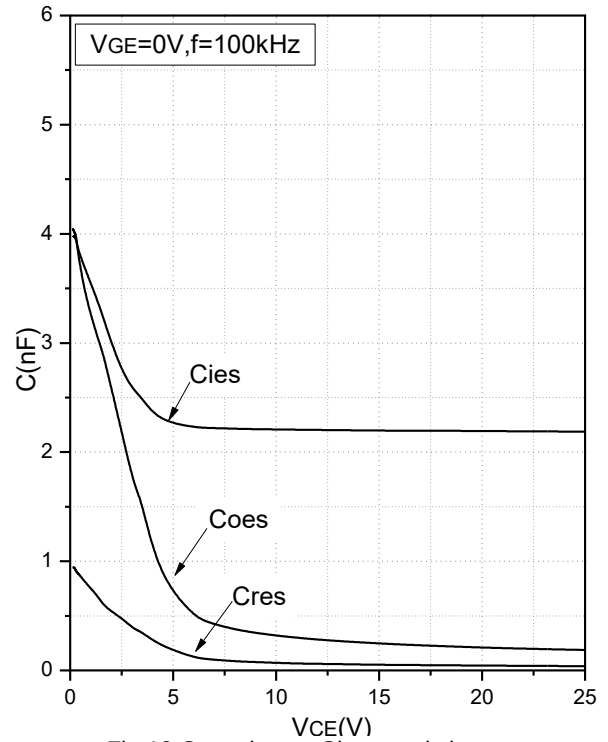
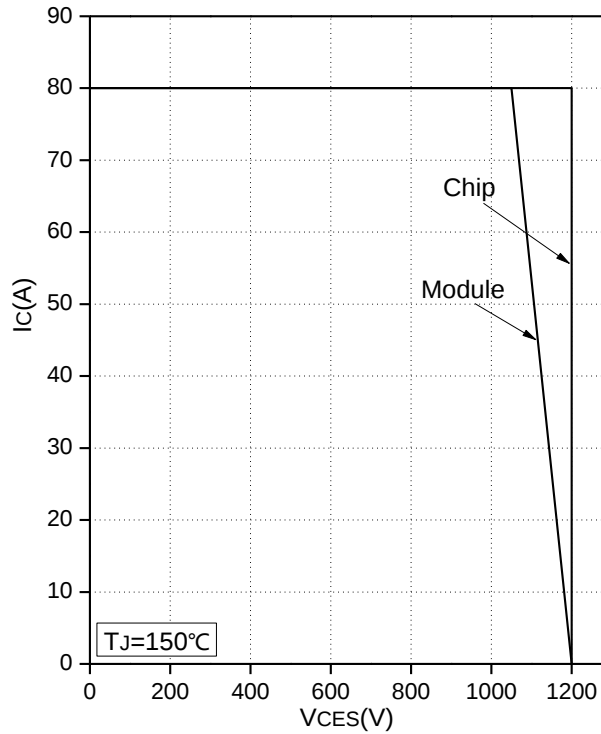


Fig.4 Forward Characteristics of Diode (Inverter)





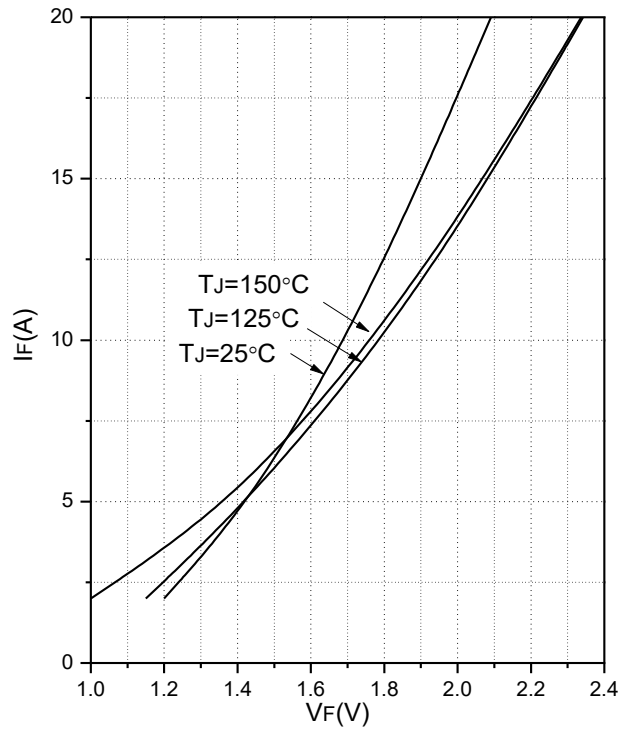


Fig.13 Forward Characteristics of Diode
(Reverse Diode)

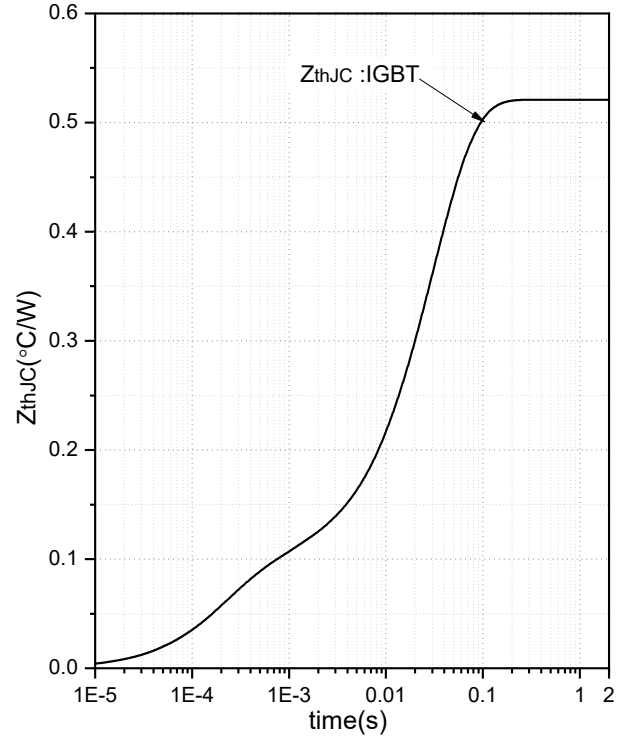


Fig.14 Transient Thermal Impedance
(Inverter-IGBT)

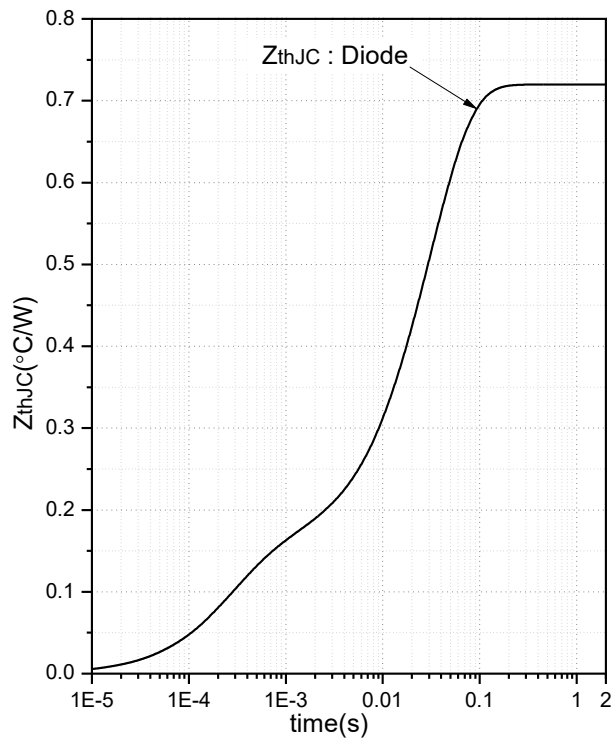


Fig.15 Transient Thermal Impedance
(Inverter-Diode)

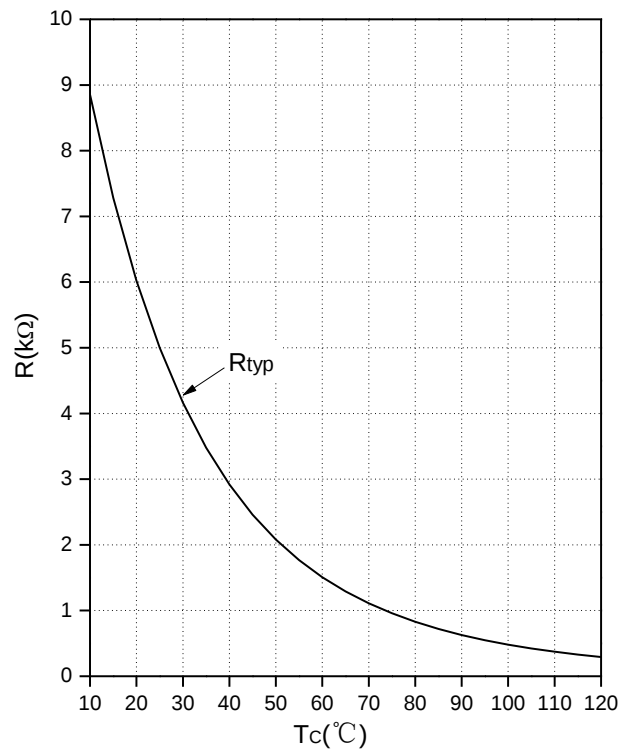
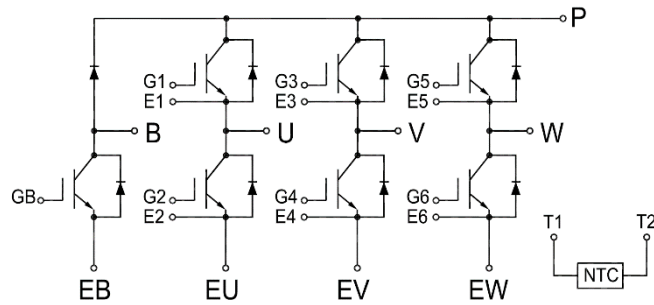


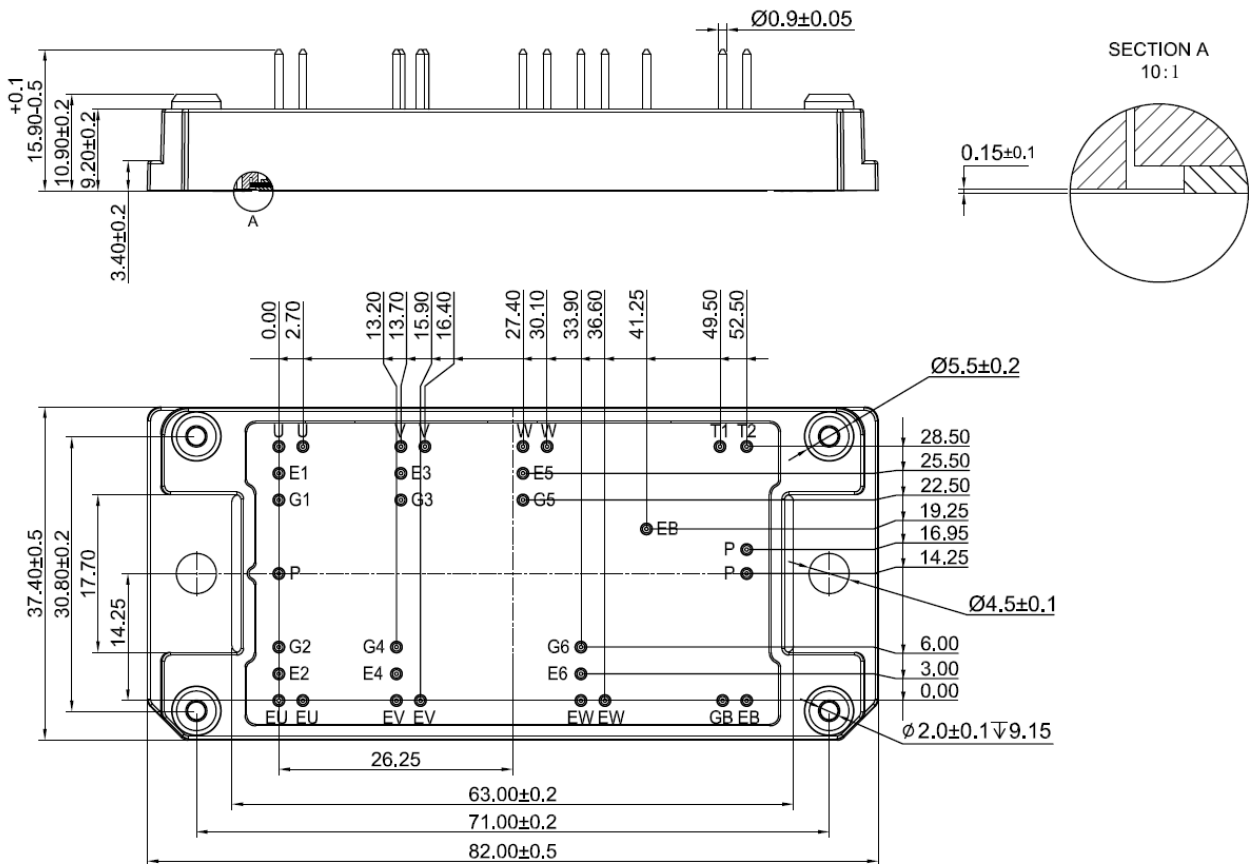
Fig.16 NTC Temperature Characteristics



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”.