



GT40RFF120T5H

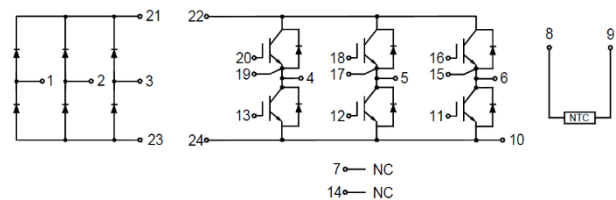
IGBT Module

Preliminary Data

Features:

- Field Stop Trench Gate 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:

- Industrial Inverters
- Servo Applications

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 ($T_C=25^{\circ}\text{C}$ 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	5.8	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		
			T _J =150℃		2.20		
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} =±15V, 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		
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	$V_{CC}=600V, I_C=40A,$ $R_{Goff}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		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, tp=10μs, R _{Gon} =36Ω, R _{Goff} =36Ω, T _J =25°C				148		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}	Diode Maximum Forward Current	tp=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		
t _{rr}	Reverse Recovery Time	I _F =40A, -diF/dt=830A/μs(T _J =150℃), V _{rr} =600V, V _{GE} =-15V	T _J =25℃		164		ns
			T _J =125℃		186		
			T _J =150℃		186		
I _{rr}	Peak Reverse Recovery Current		T _J =25℃		53.7		A
			T _J =125℃		62.5		
			T _J =150℃		63.8		
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, -diF/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}	Diode Thermal Resistance: Junction-to-Case (per Diode)					0.68	°C/W

Diode, Rectifier

Maximum Rated Values (T_C=25°C unless otherwise specified)

V _{RRM}	Repetitive Peak Reverse Voltage	T _J =25°C	1800	V
I _{FRMSM}	Maximum RMS Forward Current per Chip	T _J =80°C	55	A
I _{RMSM}	Maximum RMS Current at Rectifier Output	T _J =80°C	65	A
I _{FSM}	Surge Current @t _p =10ms	T _J =25°C	630	A
		T _J =150°C	550	
I ² t	I ² t - value	T _J =25°C	1960	A ² s
		T _J =150°C	1500	

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V _F	Forward Voltage	I _F =35A	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}	Diode 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

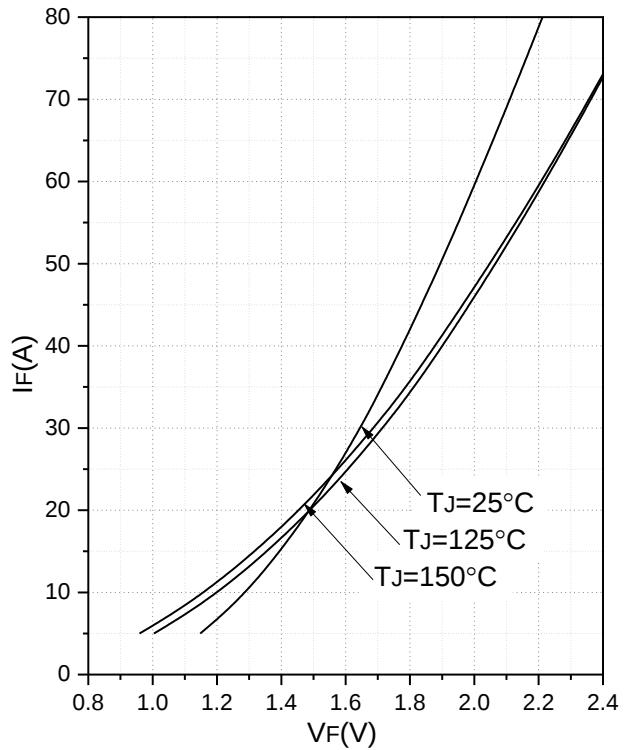
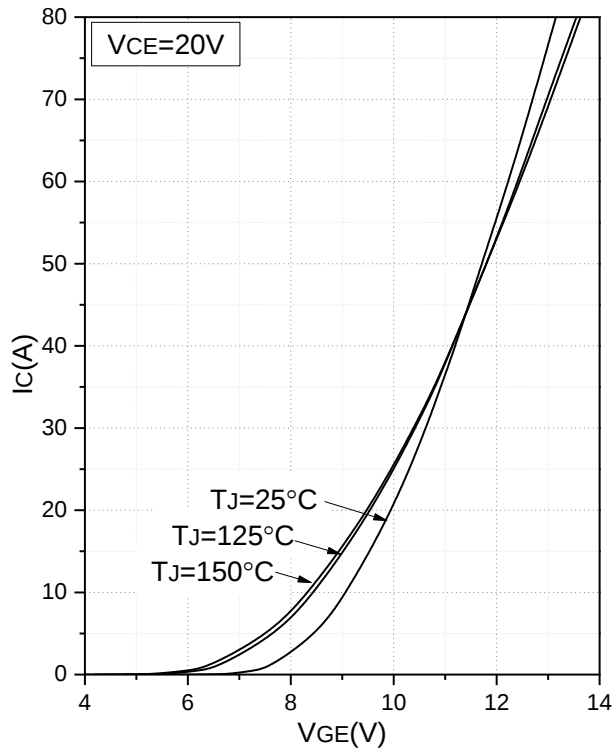
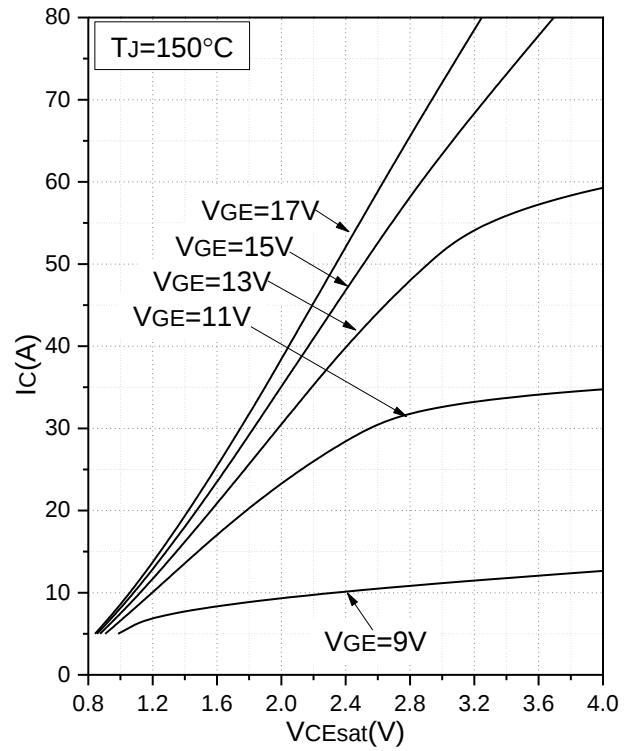
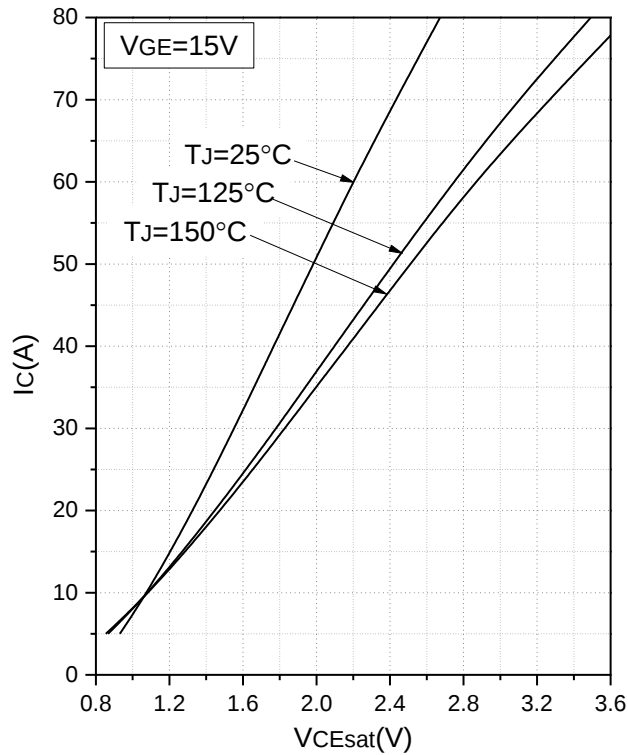
Symbol	Description		Min.	Typ.	Max.	Units
V _{iso}	Isolation Voltage (All Terminals Shorted)	RMS, f=50Hz, 30s	4500			V
T _J	Maximum Junction Temperature				175	°C
T _{JOP}	Maximum Operating Junction Temperature Range		-40		+150	°C
T _{stg}	Storage Temperature		-40		+150	°C
CTI	Comparative Tracking Index		200			
R _{θCS}	Case-to-Sink Thermally (Conductive Grease Applied)				0.04	°C/W
M	Mounting Screw:M5		3.0		6.0	N·m
G	Weight			190		g

Ordering Information Table

Device code

G	T	40	RFF	120	T5	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: RFF (Rectifier +Full Bridge)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)



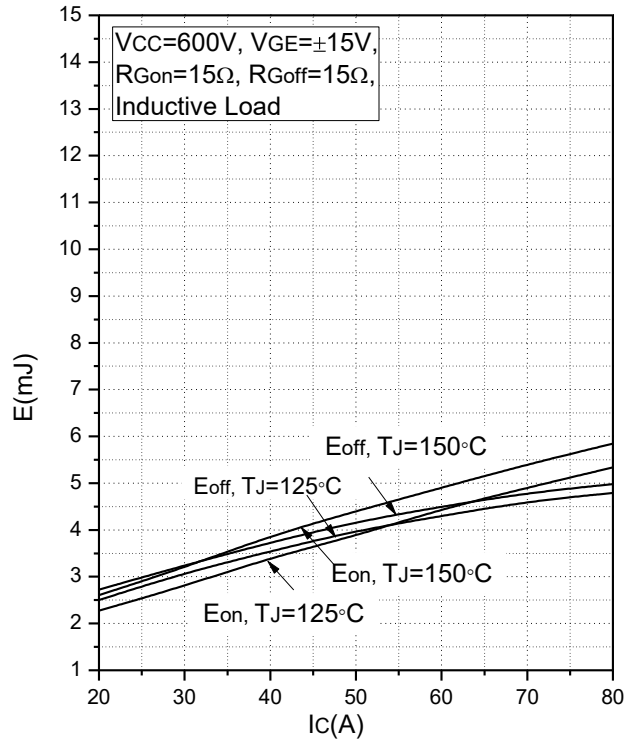


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

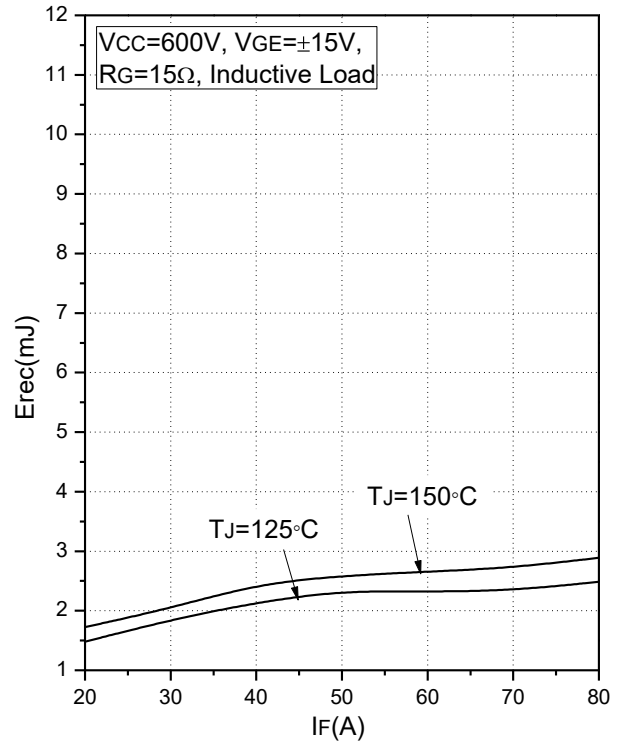


Fig.6 Typical Switching Loss vs. Forward Current (Inverter)

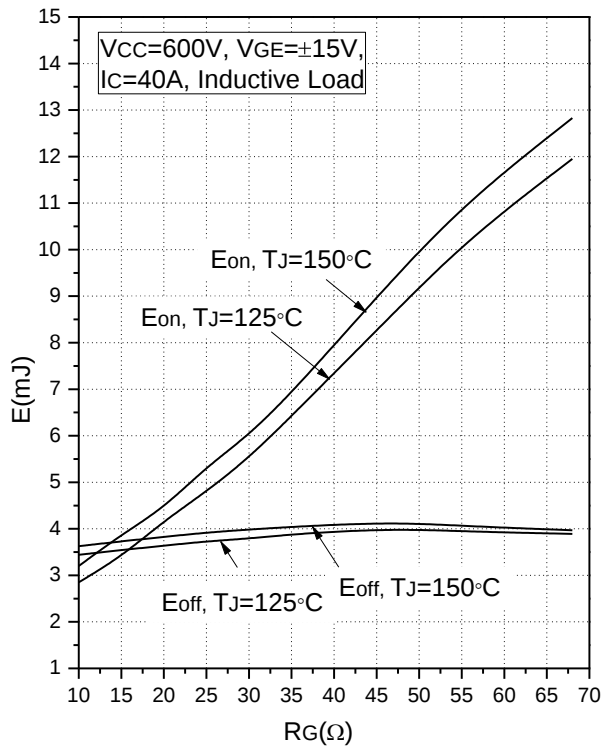


Fig.7 Typical Switching Loss vs. Gate Resistance (Inverter)

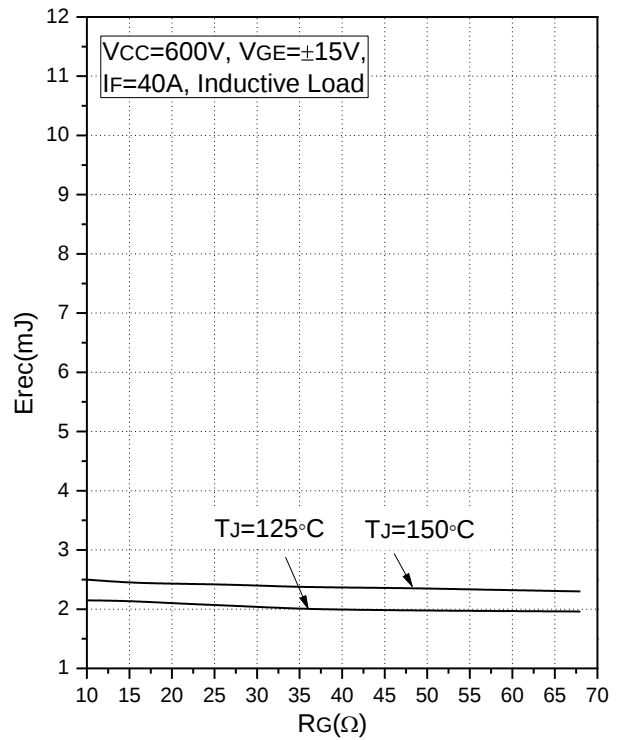


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

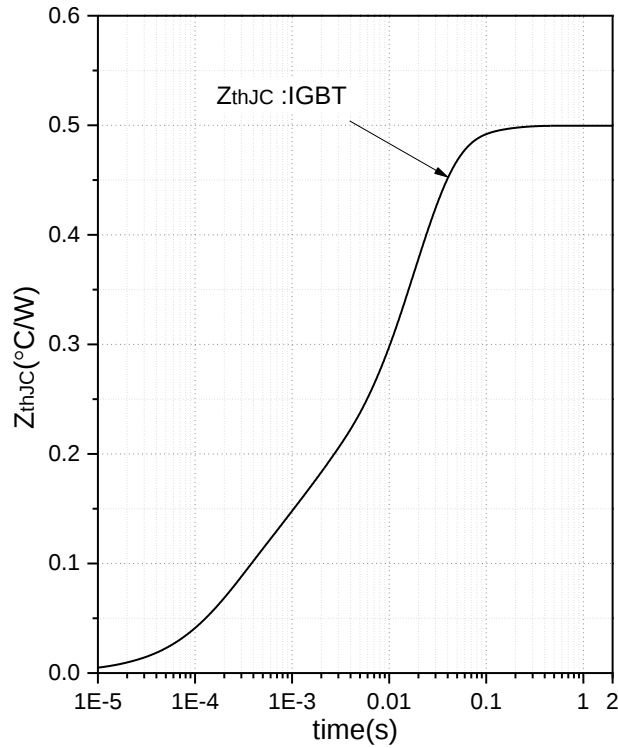


Fig.9 Transient Thermal Impedance (Inverter-IGBT)

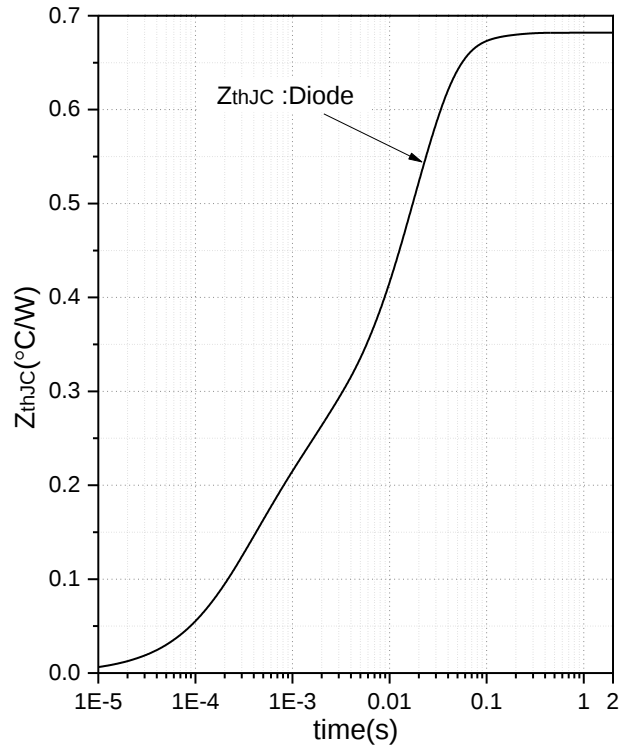


Fig.10 Transient Thermal Impedance (Inverter-Diode)

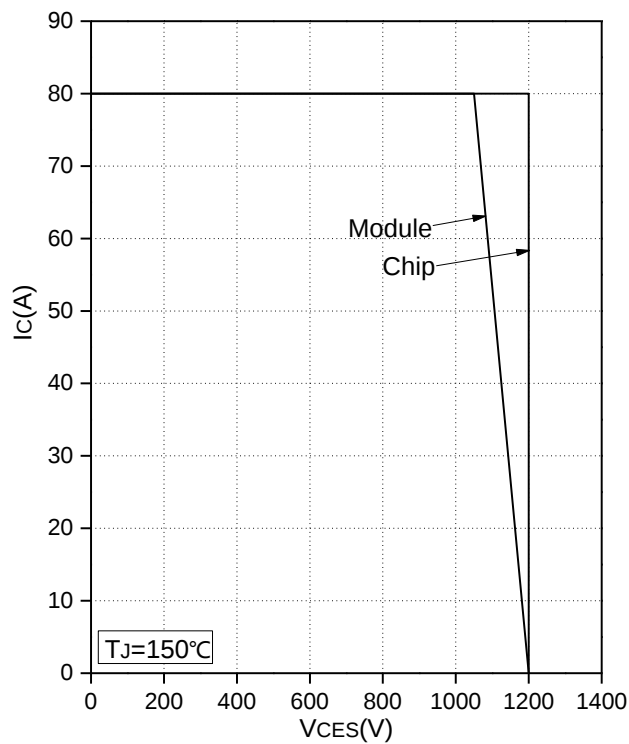


Fig.11 Reverse Bias Safe Operation Area (RBSOA)

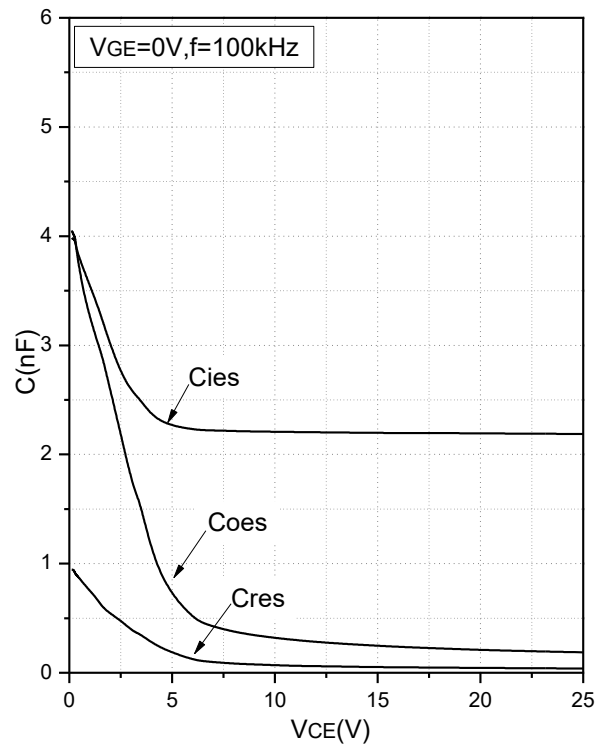


Fig.12 Capacitance Characteristics

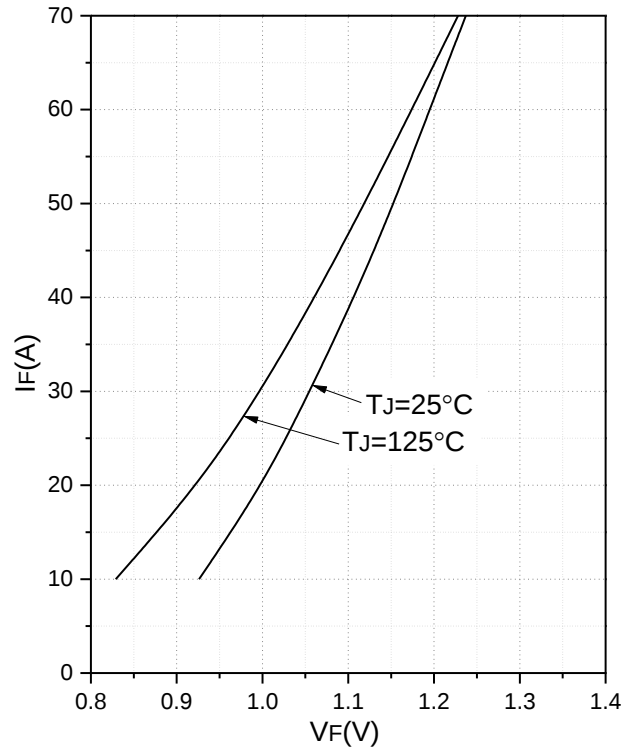


Fig.13 Forward Characteristics of Diode (Rectifier)

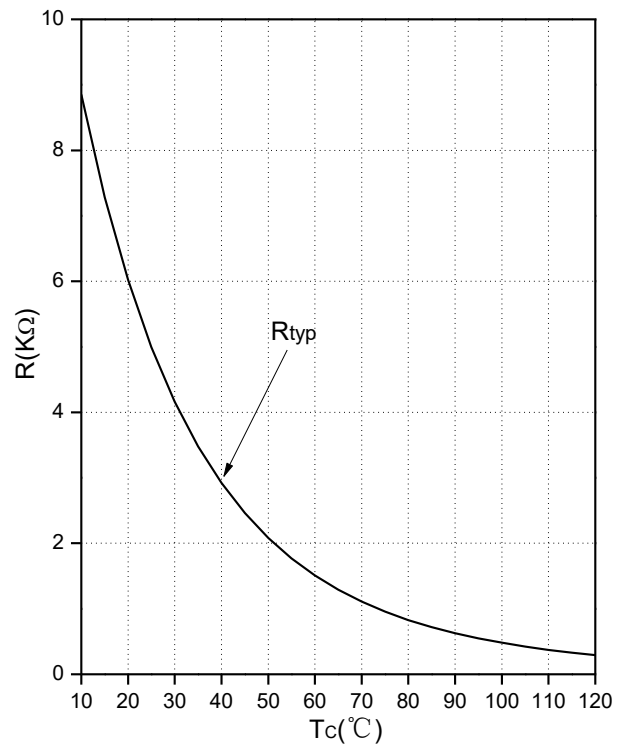
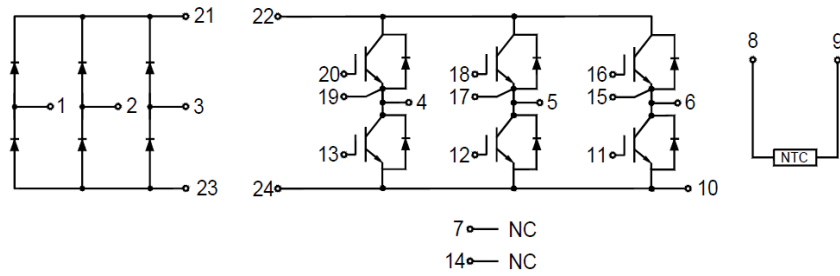


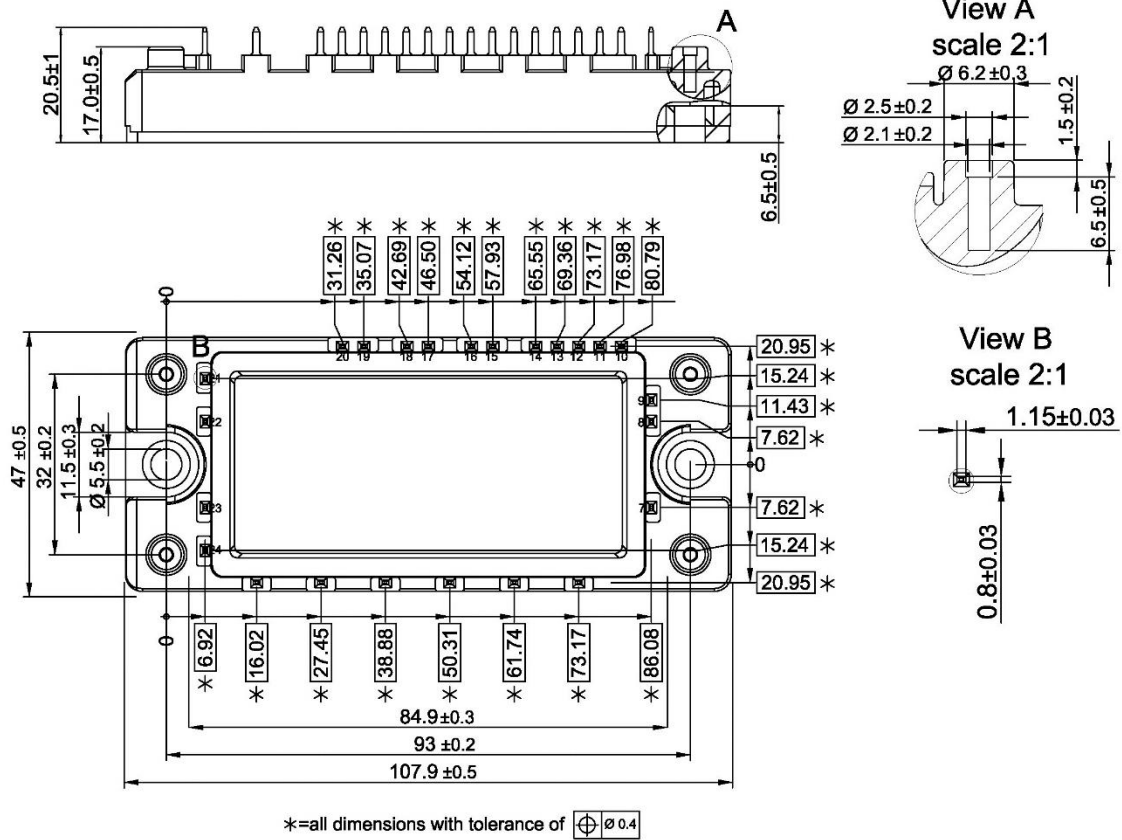
Fig.14 NTC Temperature Characteristics



Internal Circuit



Package Outlines (Unit: mm):





Revision	Notes
01	Initial Release

Announcement

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