



# GT15PI120B2FH

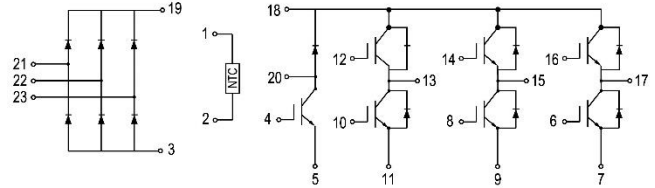
## IGBT Module

Preliminary Data

### Features:

- Field Stop Trench Gate IGBT
- Short Circuit Rated >10 $\mu$ s
- Low Switching Loss
- 100% RBSOA Tested(2 $\times$ I<sub>c</sub>)
- High Short Circuit Capability
- Positive Temperature Coefficient
- Lead Free, Compliant with RoHS Requirement

### Circuit Diagram



### Applications:

- Industrial Inverters
- Servo Applications

### IGBT, Inverter

Maximum Rated Values (T<sub>C</sub>=25°C unless otherwise specified)

V <sub>CES</sub>	Collector-Emitter Blocking Voltage		1200	V
V <sub>GES</sub>	Gate-Emitter Voltage		±20	V
I <sub>C</sub>	Continuous Collector Current	T <sub>C</sub> =100°C	15	A
		T <sub>C</sub> =25°C	30	A
I <sub>CM</sub>	Repetitive Peak Collector Current	T <sub>J</sub> =175°C	30	A
t <sub>sc</sub>	Short Circuit Withstand Time		>10	μs
P <sub>D</sub>	Maximum Power Dissipation per IGBT	T <sub>C</sub> =25°C, T <sub>Jmax</sub> =175°C	199	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	$I_C=1\text{mA}$ , $V_{CE}=V_{GE}$	5.00	5.90	6.50	V	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=15\text{A}$ , $V_{GE}=15\text{V}$	$T_J=25^\circ\text{C}$		1.85	2.00	V
			$T_J=125^\circ\text{C}$		2.05		V
			$T_J=150^\circ\text{C}$		2.10		V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{GE}=0\text{V}$ , $V_{CE}=V_{CES}$ , $T_J=25^\circ\text{C}$			1	mA	
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=\pm 20\text{V}$ , $V_{CE}=0\text{V}$ , $T_J=25^\circ\text{C}$			$\pm 100$	nA	
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}$ , $V_{GE}=0\text{V}$ , $f=100\text{kHz}$		1.45		nF	
$C_{oes}$	Output Capacitance			0.10		nF	
$C_{res}$	Reverse Transfer Capacitance			0.06		nF	

### Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600\text{V}$ , $I_C=15\text{A}$ , $R_{Gon}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load	$T_J=25^\circ\text{C}$		85		ns		
			$T_J=125^\circ\text{C}$		89				
			$T_J=150^\circ\text{C}$		92				
$t_r$	Rise Time		$V_{CC}=600\text{V}$ , $I_C=15\text{A}$ , $R_{Goff}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load	$T_J=25^\circ\text{C}$		50		ns	
				$T_J=125^\circ\text{C}$		52			
				$T_J=150^\circ\text{C}$		53			
$t_{d(off)}$	Turn-off Delay Time			$V_{CC}=600\text{V}$ , $I_C=15\text{A}$ , $R_{Goff}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load	$T_J=25^\circ\text{C}$		137		ns
					$T_J=125^\circ\text{C}$		146		
					$T_J=150^\circ\text{C}$		151		
$t_f$	Fall Time	$V_{CC}=600\text{V}$ , $I_C=15\text{A}$ , $R_{Goff}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ , Inductive Load			$T_J=25^\circ\text{C}$		222		ns
					$T_J=125^\circ\text{C}$		290		
					$T_J=150^\circ\text{C}$		428		
$E_{on}$	Turn-on Switching Loss		$V_{CC}=600\text{V}$ , $I_C=15\text{A}$ , $R_{Gon}=36\Omega$ , $V_{GE}=\pm 15\text{V}$ , $di/dt=232\text{A}/\mu\text{s}$ ( $T_J=150^\circ\text{C}$ ), Inductive Load		$T_J=25^\circ\text{C}$		2.35		mJ
					$T_J=125^\circ\text{C}$		3.03		
					$T_J=150^\circ\text{C}$		3.29		



E <sub>off</sub>	Turn-off Switching Loss	V <sub>CC</sub> =600V, I <sub>C</sub> =15A, R <sub>Goff</sub> =36Ω, V <sub>GE</sub> =±15V, du/dt=1984V/μs(T <sub>J</sub> =150°C), Inductive Load	T <sub>J</sub> =25°C	0.70	mJ
			T <sub>J</sub> =125°C	1.23	
			T <sub>J</sub> =150°C	1.28	
Q <sub>g</sub>	Total Gate Charge	V <sub>GE</sub> =+15V...-15V	T <sub>J</sub> =25°C	354	nC
R <sub>G</sub>	Internal Gate Resistance			0	Ω
RBSOA	I <sub>C</sub> =30A, V <sub>CC</sub> =1050V, V <sub>p</sub> =1200V, R <sub>G</sub> =36Ω, V <sub>GE</sub> =+15V to 0V, T <sub>J</sub> =150°C			Trapezoid	
SCSOA	V <sub>CC</sub> =600V, V <sub>GE</sub> =±15V, R <sub>Gon</sub> =36Ω, R <sub>Goff</sub> =36Ω, T <sub>J</sub> =125°C			10	μs
R <sub>θJC</sub>	Thermal Resistance: Junction-to-Case (per IGBT)			0.753	°C/W

## Diode, Inverter

### Maximum Rated Values (T<sub>C</sub>=25°C unless otherwise specified)

V <sub>RRM</sub>	Repetitive Peak Reverse Voltage	1200	V
I <sub>F</sub>	Diode Continuous Forward Current	15	A
I <sub>FM</sub>	Diode Maximum Forward Current	30	A

### Electrical Characteristics of Diode (T<sub>C</sub>=25°C unless otherwise specified)

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V <sub>FM</sub>	Forward Voltage	I <sub>F</sub> =15A	T <sub>J</sub> =25°C	1.90		V
			T <sub>J</sub> =125°C	2.05		
			T <sub>J</sub> =150°C	2.00		
t <sub>rr</sub>	Reverse Recovery Time		T <sub>J</sub> =25°C	154		ns
			T <sub>J</sub> =125°C	159		
			T <sub>J</sub> =150°C	206		
I <sub>rr</sub>	Peak Reverse Recovery Current	I <sub>F</sub> =15A, -diF/dt=344A/μs(T <sub>J</sub> =150°C), V <sub>rr</sub> =600V, V <sub>GE</sub> =-15V	T <sub>J</sub> =25°C	7.8		A
			T <sub>J</sub> =125°C	12.2		
			T <sub>J</sub> =150°C	12.8		
Q <sub>rr</sub>	Reverse Recovery Charge		T <sub>J</sub> =25°C	0.83		μC
			T <sub>J</sub> =125°C	1.22		
			T <sub>J</sub> =150°C	1.47		



E <sub>rec</sub>	Reverse Recovery Energy	I <sub>F</sub> =15A, -diF/dt=344A/μs(T <sub>J</sub> =150°C), V <sub>rr</sub> =600V, V <sub>GE</sub> =-15V	T <sub>J</sub> =25°C	0.10	mJ
			T <sub>J</sub> =125°C	0.15	
			T <sub>J</sub> =150°C	0.17	
R <sub>θJC</sub>	Thermal Resistance: Junction-To-Case (per Diode)			1.127	°C/W

## IGBT, Brake-Chopper Maximum Rated Values (T<sub>C</sub>=25°C unless otherwise specified)

V <sub>CES</sub>	Collector-Emitter Blocking Voltage		1200	V
V <sub>GES</sub>	Gate-Emitter Voltage		±20	V
I <sub>C</sub>	Continuous Collector Current	T <sub>C</sub> =100°C	15	A
		T <sub>C</sub> =25°C	30	A
I <sub>CM</sub>	Repetitive Peak Collector Current	T <sub>J</sub> =175°C	30	A
t <sub>sc</sub>	Short Circuit Withstand Time		>10	μs
P <sub>D</sub>	Maximum Power Dissipation per IGBT	T <sub>C</sub> =25°C T <sub>Jmax</sub> =175°C	199	W

## Electrical Characteristics of IGBT (T<sub>C</sub>=25°C unless otherwise specified)

### Static Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Units
V <sub>GE(th)</sub>	Gate-Emitter Threshold Voltage	I <sub>C</sub> =1mA, V <sub>CE</sub> =V <sub>GE</sub>	5.00	5.90	6.50	V
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	I <sub>C</sub> =15A, V <sub>GE</sub> =15V	T <sub>J</sub> =25°C	1.85	2.00	V
			T <sub>J</sub> =125°C	2.05		V
			T <sub>J</sub> =150°C	2.10		V
I <sub>CES</sub>	Collector-Emitter Leakage Current	V <sub>GE</sub> =0V, V <sub>CE</sub> =V <sub>CES</sub> , T <sub>J</sub> =25°C			1	mA
I <sub>GES</sub>	Gate-Emitter Leakage Current	V <sub>GE</sub> =±20V, V <sub>CE</sub> =0V, T <sub>J</sub> =25°C			±100	nA
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f=100kHz		1.45		nF
C <sub>oes</sub>	Output Capacitance			0.10		nF
C <sub>res</sub>	Reverse Transfer Capacitance			0.06		nF



Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V, I_C=15A, R_{Gon}=36\Omega, V_{GE}=\pm 15V, \text{ Inductive Load}$	$T_J=25^\circ C$	85	ns
			$T_J=125^\circ C$	89	
			$T_J=150^\circ C$	92	
$t_r$	Rise Time	$V_{CC}=600V, I_C=15A, R_{Gon}=36\Omega, V_{GE}=\pm 15V, \text{ Inductive Load}$	$T_J=25^\circ C$	50	ns
			$T_J=125^\circ C$	52	
			$T_J=150^\circ C$	53	
$t_{d(off)}$	Turn-off Delay Time	$V_{CC}=600V, I_C=15A, R_{Goff}=36\Omega, V_{GE}=\pm 15V, \text{ Inductive Load}$	$T_J=25^\circ C$	137	ns
			$T_J=125^\circ C$	146	
			$T_J=150^\circ C$	151	
$t_f$	Fall Time	$V_{CC}=600V, I_C=15A, R_{Goff}=36\Omega, V_{GE}=\pm 15V, \text{ Inductive Load}$	$T_J=25^\circ C$	222	ns
			$T_J=125^\circ C$	290	
			$T_J=150^\circ C$	428	
$E_{on}$	Turn-on Switching Loss	$V_{CC}=600V, I_C=15A, R_{Gon}=36\Omega, V_{GE}=\pm 15V, di/dt=232A/\mu s (T_J=150^\circ C), \text{ Inductive Load}$	$T_J=25^\circ C$	2.35	mJ
			$T_J=125^\circ C$	3.03	
			$T_J=150^\circ C$	3.29	
$E_{off}$	Turn-off Switching Loss	$V_{CC}=600V, I_C=15A, R_{Goff}=36\Omega, V_{GE}=\pm 15V, du/dt=1984V/\mu s (T_J=150^\circ C), \text{ Inductive Load}$	$T_J=25^\circ C$	0.70	mJ
			$T_J=125^\circ C$	1.23	
			$T_J=150^\circ C$	1.28	
$Q_g$	Total Gate Charge	$V_{GE}=+15V \dots -15V$	$T_J=25^\circ C$	354	nC
$R_G$	Internal Gate Resistance			0	$\Omega$
RBSOA	$I_C=30A, V_{CC}=1050V, V_p=1200V, R_G=36\Omega, V_{GE}=+15V \text{ to } 0V, T_J=150^\circ C$			Trapezoid	
SCSOA	$V_{CC}=600V, V_{GE}=\pm 15V, R_{Gon}=36\Omega, R_{Goff}=36\Omega, T_J=125^\circ C$			10	$\mu s$
$R_{\theta JC}$	Thermal Resistance: Junction-to-Case (per IGBT)			0.753	$^\circ C/W$

**Diode, Brake-Chopper**  
**Maximum Rated Values ( $T_C=25^\circ C$  unless otherwise specified)**

$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_F$	Diode Continuous Forward Current	15	A
$I_{FM}$	Diode Maximum Forward Current	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	$I_F=15A$	$T_J=25^\circ\text{C}$		1.90	V
			$T_J=125^\circ\text{C}$		2.05	
			$T_J=150^\circ\text{C}$		2.00	
$t_{rr}$	Reverse Recovery Time		$T_J=25^\circ\text{C}$		154	ns
			$T_J=125^\circ\text{C}$		159	
			$T_J=150^\circ\text{C}$		206	
$I_{rr}$	Peak Reverse Recovery Current	$I_F=15A,$ $-diF/dt=344A/\mu s(T_J=150^\circ\text{C}),$ $V_{rr}=600V,$ $V_{GE}=-15V$	$T_J=25^\circ\text{C}$		7.8	A
			$T_J=125^\circ\text{C}$		12.2	
			$T_J=150^\circ\text{C}$		12.8	
$Q_{rr}$	Reverse Recovery Charge		$T_J=25^\circ\text{C}$		0.83	$\mu\text{C}$
			$T_J=125^\circ\text{C}$		1.22	
			$T_J=150^\circ\text{C}$		1.47	
$E_{rec}$	Reverse Recovery Energy		$T_J=25^\circ\text{C}$		0.10	mJ
			$T_J=125^\circ\text{C}$		0.15	
			$T_J=150^\circ\text{C}$		0.17	
$R_{\theta JC}$	Thermal Resistance: Junction-To-Case (per Diode)				1.127	$^\circ\text{C/W}$

## Diode, Rectifier

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

$V_{RRM}$	Repetitive Peak Reverse Voltage	$T_J=25^\circ\text{C}$	1600	V
$I_F$	Diode Continuous Forward Current	$T_J=25^\circ\text{C}$	10	A
$I_{FRMSM}$	Maximum RMS Forward Current per Chip	$T_J=80^\circ\text{C}$	20	A
$I_{RMSM}$	Maximum RMS Current at Rectifier Output	$T_J=80^\circ\text{C}$	30	A
$I_{FSM}$	Surge Current @ $t_p=10\text{ms}$	$T_J=25^\circ\text{C}$	300	A
		$T_J=150^\circ\text{C}$	250	
$I^2t$	$I^2t$ - value	$T_J=25^\circ\text{C}$	450	$\text{A}^2\text{s}$
		$T_J=150^\circ\text{C}$	312	



## Electrical Characteristics of Diode (T<sub>C</sub>=25°C unless otherwise specified)

V <sub>F</sub>	Forward Voltage	I <sub>F</sub> =10A	T <sub>J</sub> =25°C		1.05	V
			T <sub>J</sub> =150°C		1.00	
I <sub>R</sub>	Reverse Current	V <sub>R</sub> =1600V	T <sub>J</sub> =25°C		1	mA
R <sub>θJC</sub>	Thermal Resistance: Junction-To-Case (per Diode)				0.944	°C/W

## Internal NTC-Thermistor Characteristics

R <sub>25</sub>	T <sub>C</sub> =25°C	22.7		kΩ
ΔR/R	T <sub>C</sub> =100°C, R <sub>100</sub> =1481Ω		±3	%
P <sub>25</sub>	T <sub>C</sub> =25°C	5		mW
B <sub>25/50</sub>	$R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15K))]$	3950		K
B <sub>25/80</sub>	$R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15K))]$	4000		K

## Module

Symbol	Description		Min.	Typ.	Max.	Units
V <sub>iso</sub>	Isolation Voltage (All Terminals Shorted)	RMS, f=50Hz, 30s	4500			V
T <sub>J</sub>	Maximum Junction Temperature				175	°C
T <sub>JOP</sub>	Maximum Operating Junction Temperature Range		-55		+150	°C
T <sub>stg</sub>	Storage Temperature		-55		+125	°C
CTI	Comparative Tracking Index		200			
R <sub>θCS</sub>	Case-To-Sink Thermally (Conductive Grease Applied)				0.09	°C/W
T	Mounting Screw:M4		1.0		1.2	N·m
G	Weight			25		g



## Ordering Information Table

Device code	G	T	15	PI	120	B2F	H
	①	②	③	④	⑤	⑥	⑦

- ① - IGBT Module
- ② - Trench, Low Switching Losses IGBT
- ③ - Rated Current (15=15A)
- ④ - Circuit Configuration (Power Integrated)
- ⑤ - Rated Voltage (120=1200V)
- ⑥ - Package Type
- ⑦ - Test Level (Pass the Important Reliability Test-Industrial Grade)



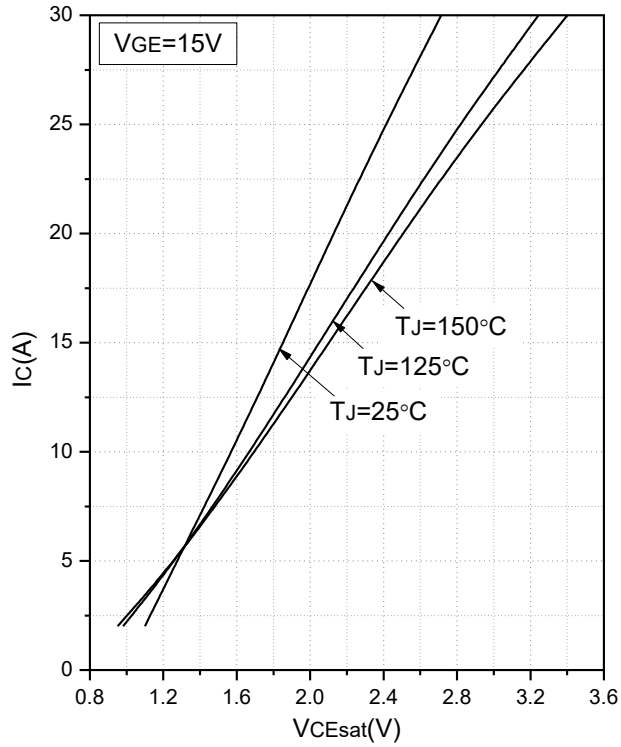


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

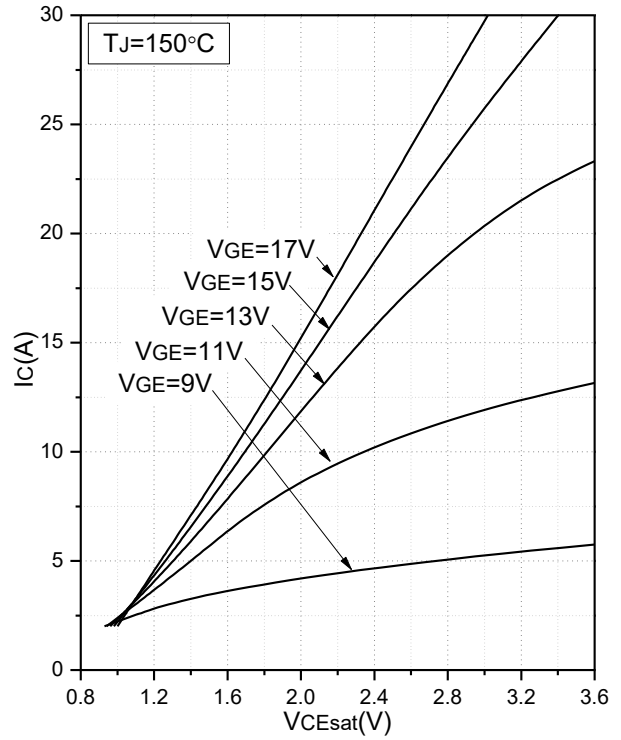


Fig.2 Typical Output Characteristics (Inverter)

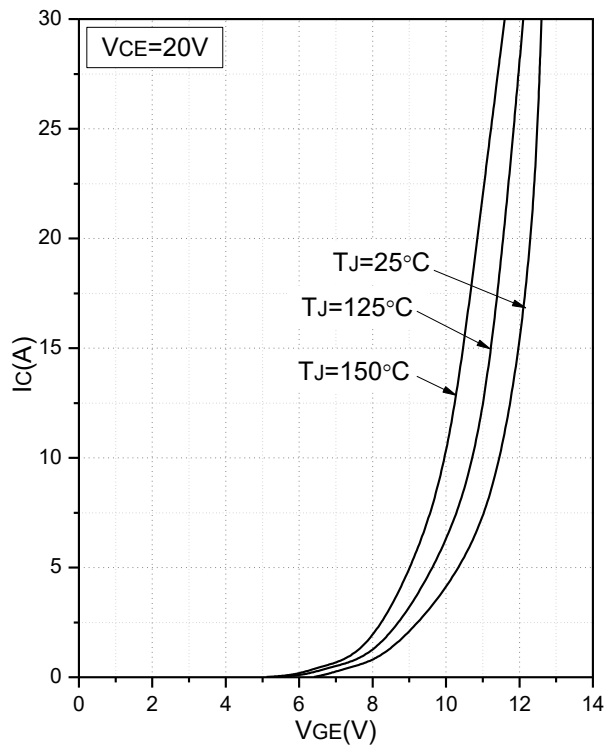


Fig.3 Transfer Characteristic (Inverter)

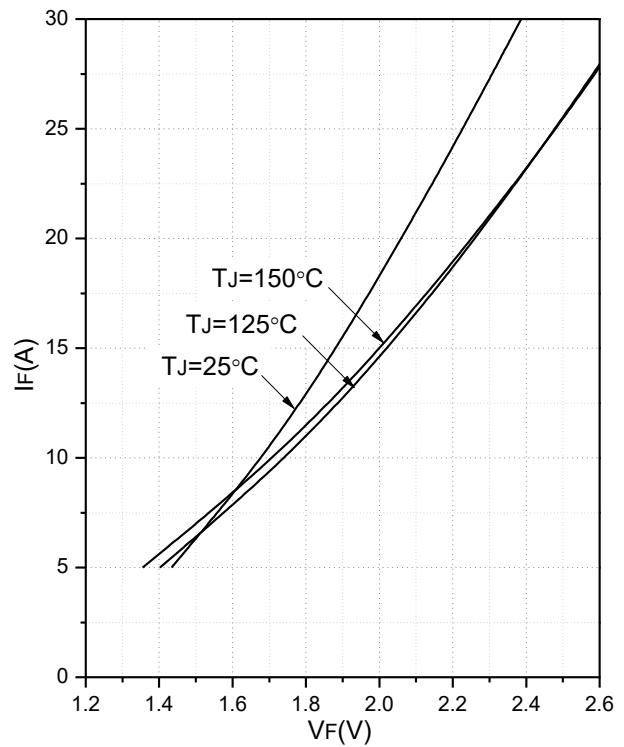
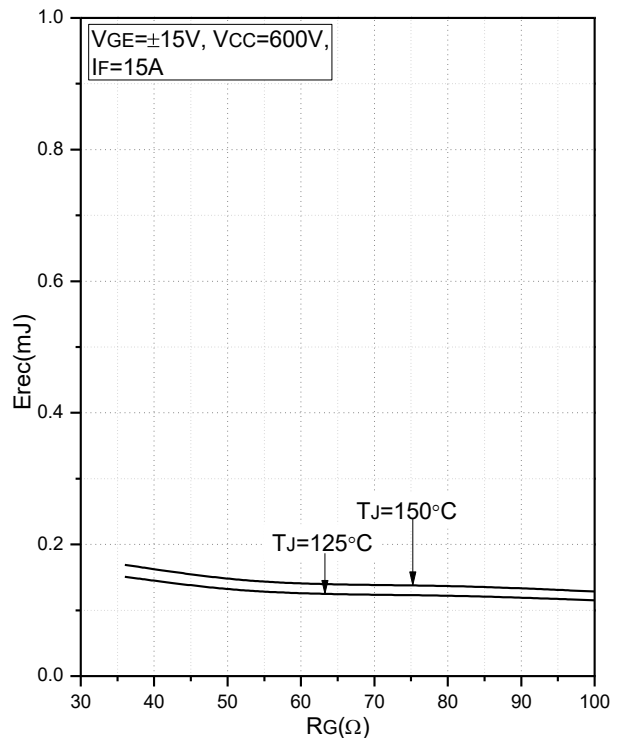
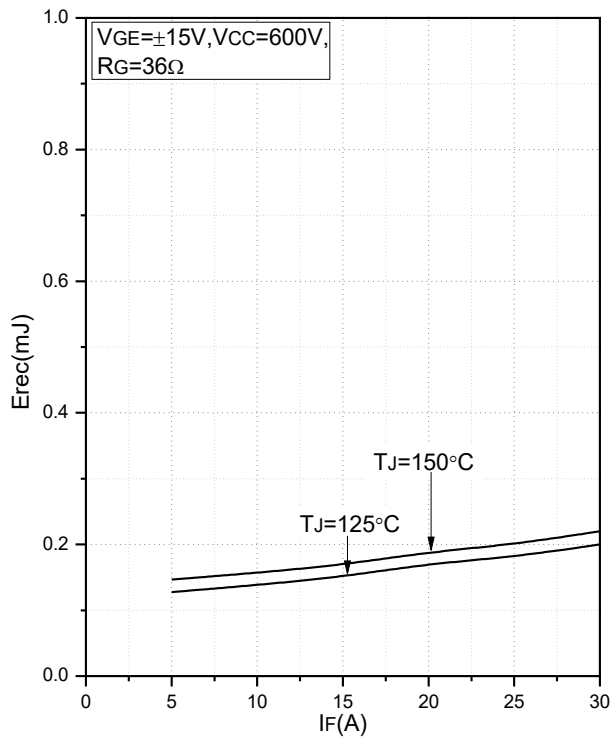
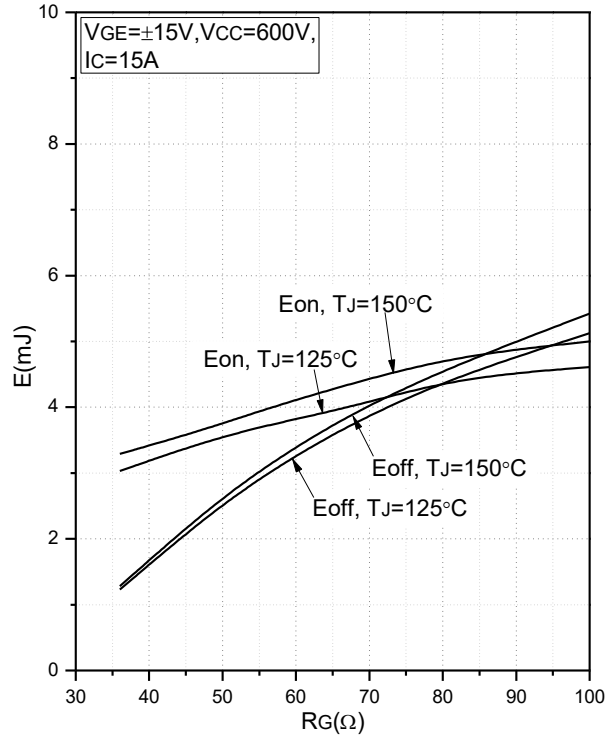
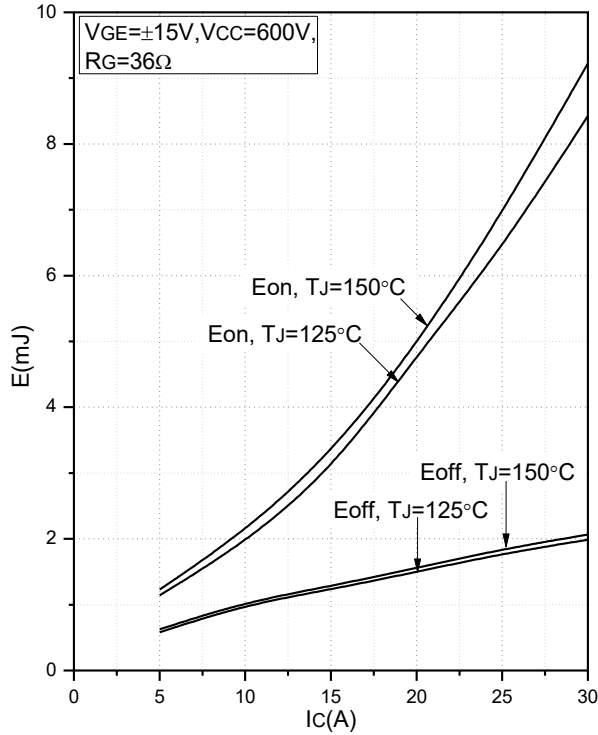


Fig.4 Forward Characteristics of Diode (Inverter)



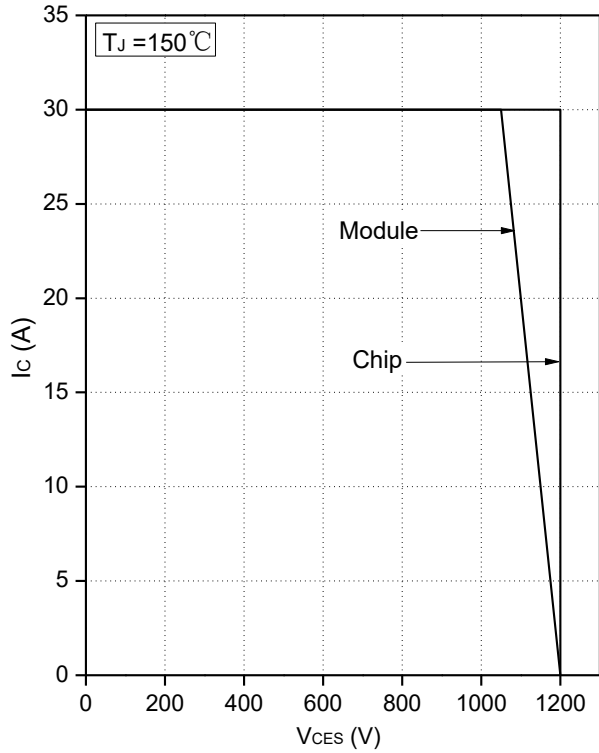


Fig.9 Reverse Bias Safe Operation Area (RBSOA)

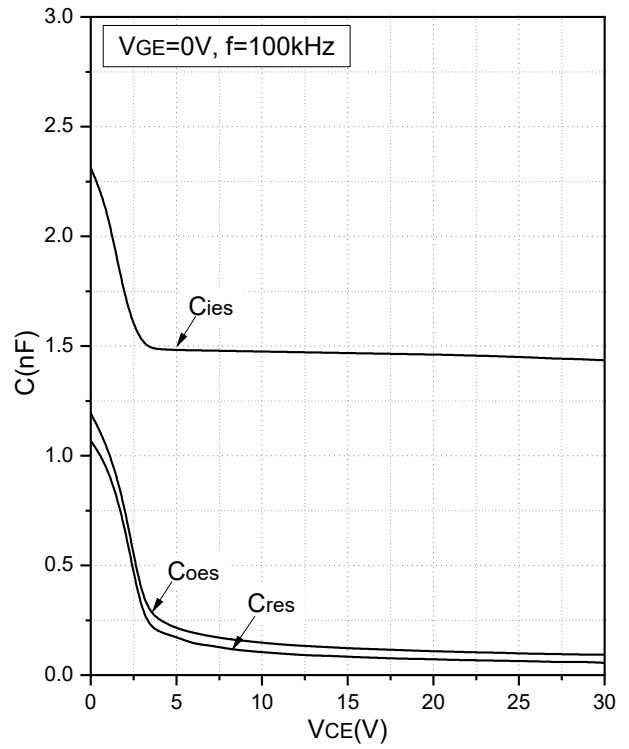


Fig.10 Capacitance Characteristics

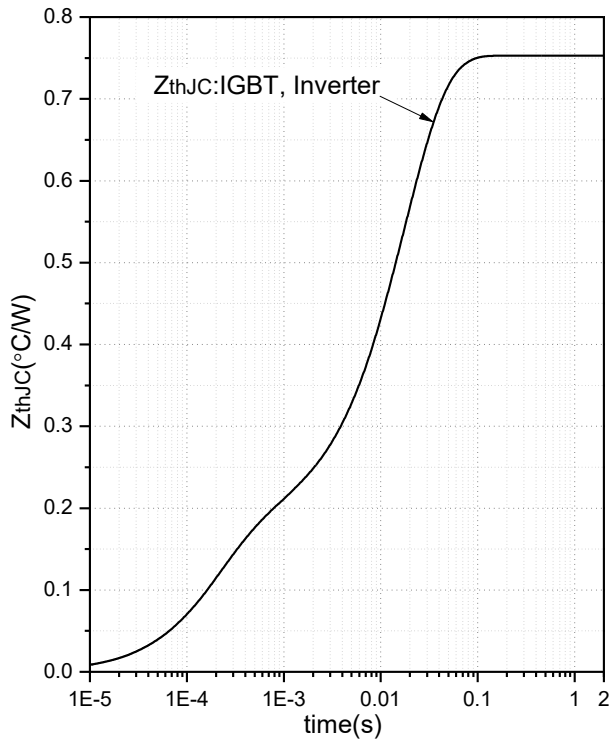


Fig.11 Transient Thermal Impedance IGBT (Inverter)

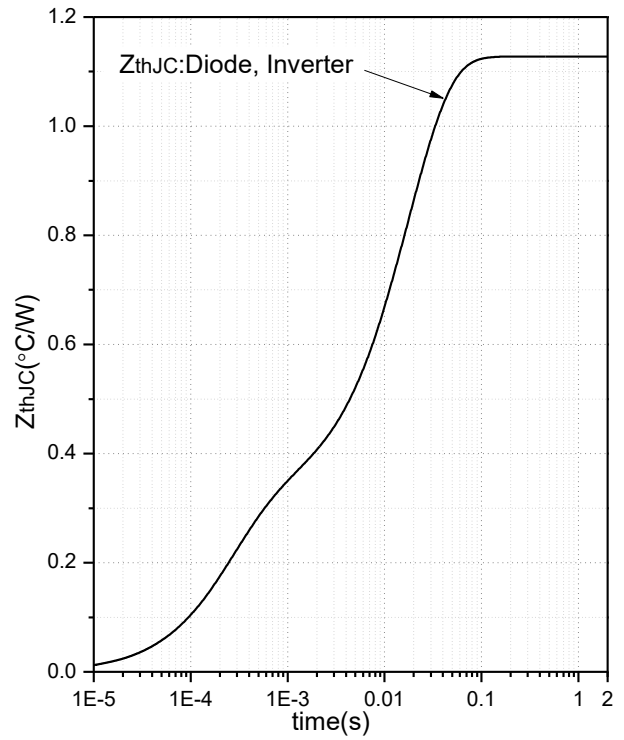


Fig.12 Transient Thermal Impedance Diode (Inverter)

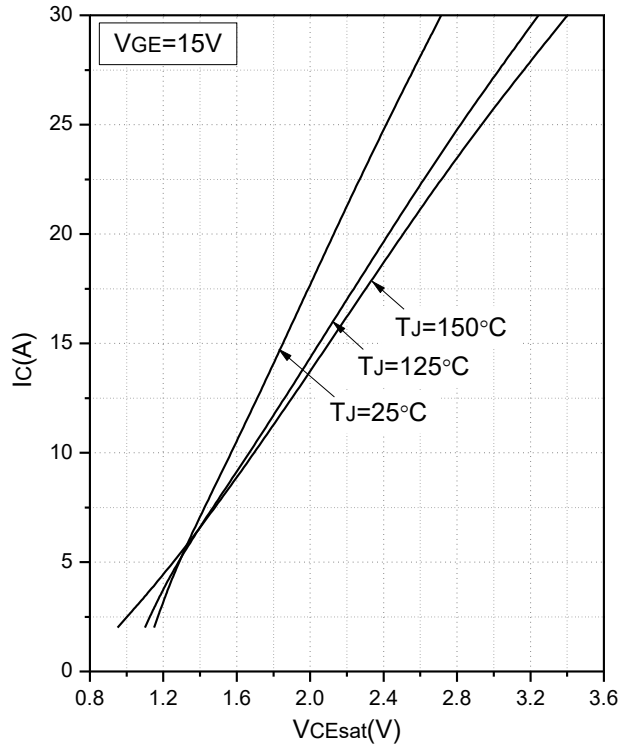


Fig.13 Typical Saturation Voltage Characteristics (Brake-Chopper)

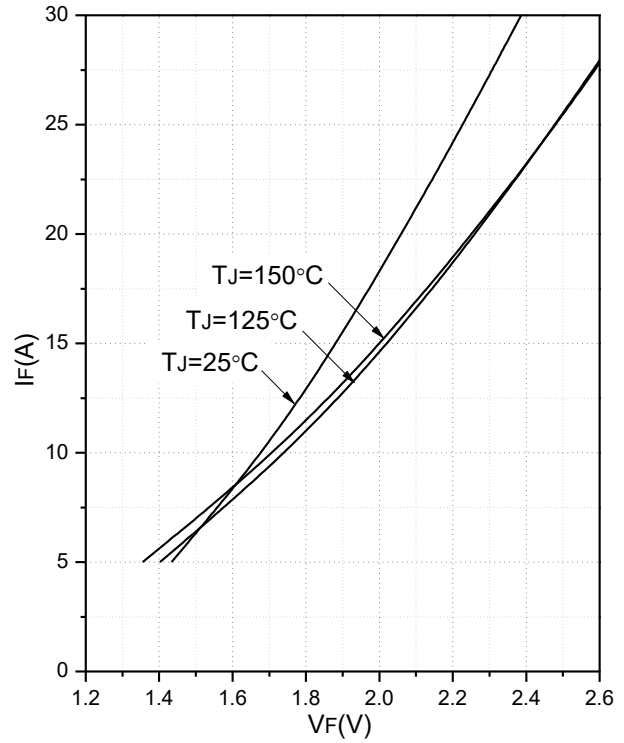


Fig.14 Forward Characteristics of Diode (Brake-Chopper)

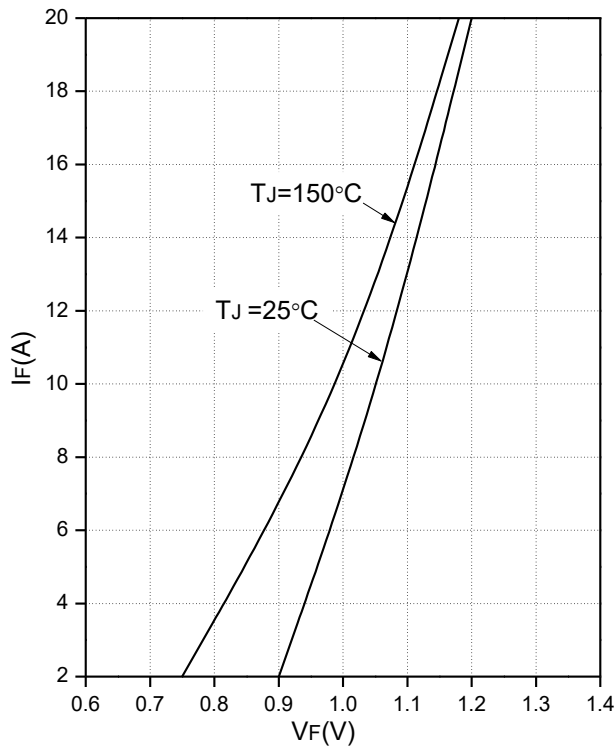


Fig.15 Forward Characteristics of Diode (Rectifier Diode)

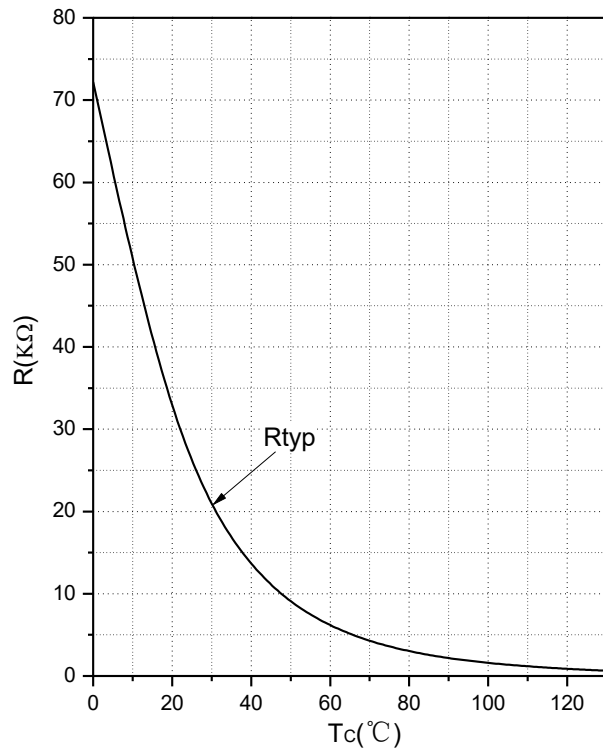
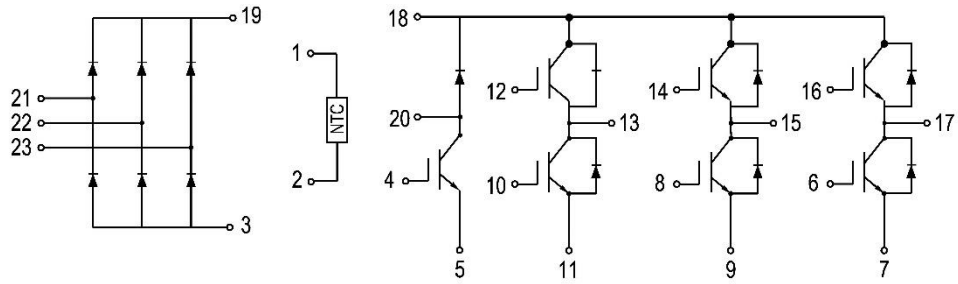


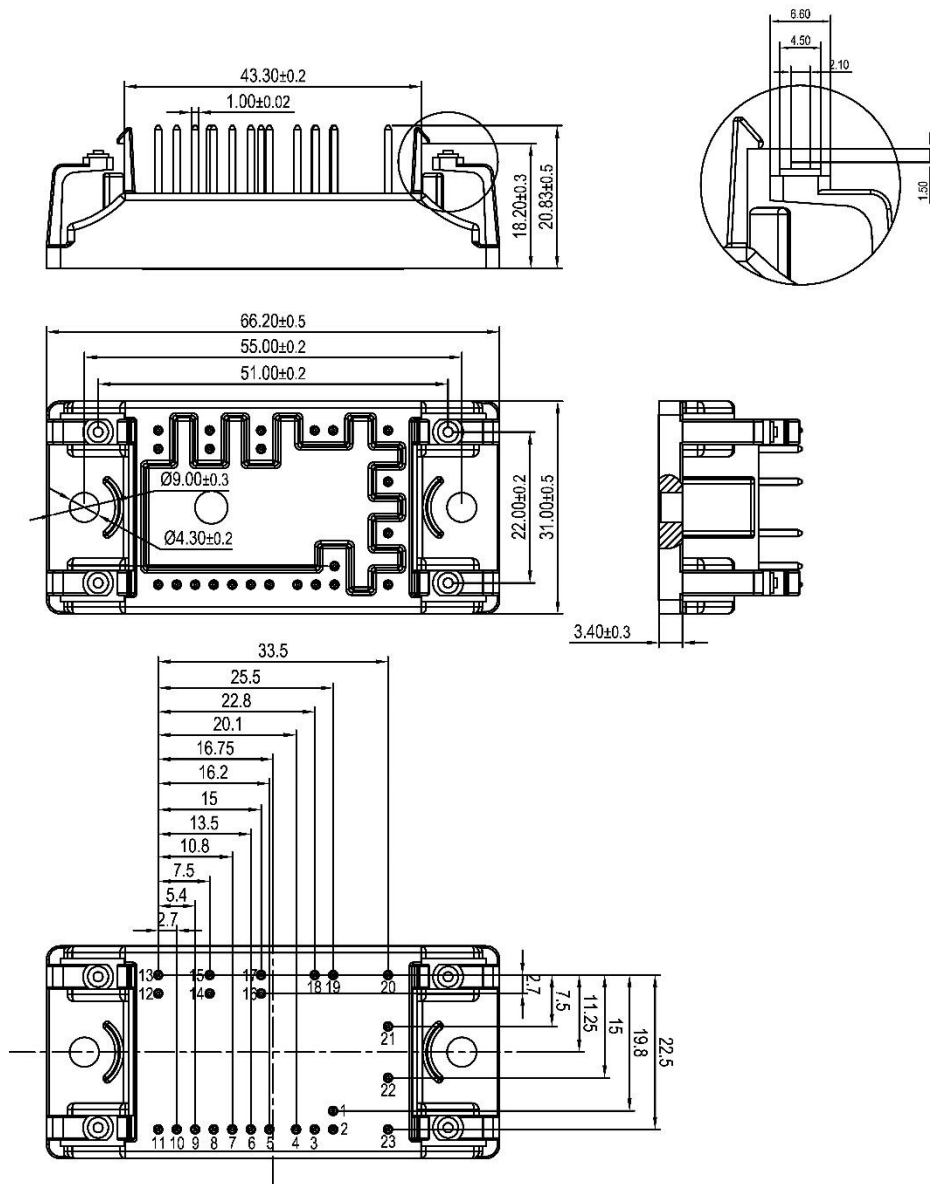
Fig.16 NTC Temperature Characteristics



## Internal Circuit



## Package Outline (Unit: mm):





Date	Revision	Notes
11/07/2023	01	Initial Release

## Announcement

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