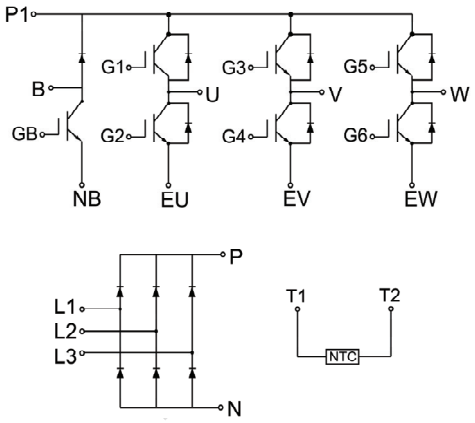
SYMT25PI120B9H

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：

- Motor Drives
- Air Conditioning
- Auxiliary Inverters

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℃	25	A
		T_C=25℃	50	A
I_{CM}	Repetitive Peak Collector Current	T_J=175℃	50	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=175℃	309	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	5.6	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=25A, V_{GE}=15V	T_J=25℃		1.70	1.90	V
			T_J=125℃		1.95		
			T_J=150℃		2.00		
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			2.42		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	V_{CC}=600V, I_C=25A, R_{Gon}=20Ω, V_{GE}=±15V, di/dt=548A/μs (T_J=150℃) Inductive Load	T_J=25℃		2.14		mJ
			T_J=125℃		2.76		
			T_J=150℃		2.97		

E_{off}	Turn-off Switching Loss	V_{CC}=600V, I_C=25A, R_{Goff}=20Ω,V_{GE}=±15V, du/dt=2299V/μs (T_J=150℃) Inductive Load	T_J=25℃		1.97		mJ
			T_J=125℃		3.22		
			T_J=150℃		3.54		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		129		nC
RBSOA	I_C=50A,V_{CC}=1050V,Vp=1200V,R_{Goff}=20Ω, V_{GE}=+15V to 0V, T_J=150°C			Trapezoid			
SC Data	Vcc=600V, tp=10us, V_{GE}=+/-15V, R_{Gon}=20Ω, R_{Goff}=20Ω, T_J=125℃				90		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-to-Case(per IGBT)					0.485	℃/W

Diode, Inverter

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

V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	25	A
I_{FM}	Diode Maximum Forward Current	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		
t_{rr}	Reverse Recovery Time	I_F=25A, -diF/dt=695A/μs(T_J=150℃), V_{rr}=600V, V_{GE}=-15V	T_J=25℃		213		ns
			T_J=125℃		441		
			T_J=150℃		458		
I_{rr}	Peak Reverse Recovery Current		T_J=25℃		24.4		A
			T_J=125℃		29.1		
			T_J=150℃		30.3		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		2.60		μC
			T_J=125℃		4.97		
			T_J=150℃		5.52		

E_{rec}	Reverse Recovery Energy	I_F=25A, -diF/dt=695A/μs(T_J=150℃), V_{rr}=600V, V_{GE}=-15V	T_J=25℃		0.85		mJ
			T_J=125℃		1.95		
			T_J=150℃		2.18		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-to-Case(per Diode)					0.622	℃/W

IGBT, Brake-Chopper

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℃	25	A
		T_C=25℃	50	A
I_{CM}	Repetitive Peak Collector Current	T_J=175℃	50	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	T_C=25℃ T_{Jmax}=175℃	309	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	5.6	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=25A, V_{GE}=15V	T_J=25℃		1.70	1.90	V
			T_J=125℃		1.95		
			T_J=150℃		2.00		
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			2.42		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	V_{CC}=600V, I_C=25A, R_{Gon}=20Ω, V_{GE}=±15V, di/dt=548A/μs (T_J=150℃) Inductive Load	T_J=25℃		2.14		mJ
			T_J=125℃		2.76		
			T_J=150℃		2.97		
E_{off}	Turn-off Switching Loss	V_{CC}=600V, I_C=25A, R_{Goff}=20Ω,V_{GE}=±15V, du/dt=2299V/μs (T_J=150℃) Inductive Load	T_J=25℃		1.97		mJ
			T_J=125℃		3.22		
			T_J=150℃		3.54		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		129		nC
RBSOA	I_C=50A,V_{CC}=1050V,Vp=1200V,R_{Goff}=20Ω, V_{GE}=+15V to 0V, T_J=150°C			Trapezoid			
SC Data	Vcc=600V, tp=10us, V_{GE}=+/-15V, R_{Gon}=20Ω, R_{Goff}=20Ω, T_J=125℃				90		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-to-Case(per IGBT)					0.485	℃/W

Diode, Brake-Chopper

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

V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	10	A
I_{FM}	Diode Maximum Forward Current	20	A

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_{FM}	Forward Voltage	I_F=10A	T_J=25℃		1.80		V
			T_J=125℃		1.90		
			T_J=150℃		1.85		
t_{rr}	Reverse Recovery Time	I_F=10A, -diF/dt=388A/μs(T_J=150℃), V_{rr}=600V, V_{GE}=-15V	T_J=25℃		133		ns
			T_J=125℃		182		
			T_J=150℃		186		
I_{rr}	Peak Reverse Recovery Current		T_J=25℃		10.0		A
			T_J=125℃		14.0		
			T_J=150℃		14.7		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		1.12		μC
			T_J=125℃		1.43		
			T_J=150℃		1.57		
E_{rec}	Reverse Recovery Energy		T_J=25℃		0.3		mJ
			T_J=125℃		0.7		
			T_J=150℃		0.8		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-to-Case(per Diode)					1.157	℃/W

Diode, Rectifier

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

V_{RRM}	Repetitive Peak Reverse Voltage	T_J=25℃	1900	V
I_F	Diode Continuous Forward Current	T_J=25℃	15	A
I_{FRMSM}	Maximum RMS Forward Current per Chip	T_J=80℃	25	A
I_{FSM}	Surge Current @t_p=10ms	T_J=25℃	320	A
		T_J=125℃	240	
I^2t	I^2t - value	T_J=25℃	512	A^2s
		T_J=125℃	288	

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_F	Forward Voltage	I_F=15A	T_J=25℃		1.05		V
			T_J=125℃		1.00		
I_R	Reverse Current	V_R=1200V	T_J=25℃			1	mA
$R_{\theta JC}$	Diode Thermal Resistance: Junction-to-Case (per Diode)					0.726	℃/W

Internal NTC-Thermistor Characteristics

R_{25}	T_C=25℃	5		kΩ
△R/R	T_C=100℃, R_{100}=481Ω		±5	%
P_{25}	T_C=25℃	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, 50Hz,1minute		2500		V
Internal Isolation				ZTA Ceramic		
d_{creep}	Creepage Distance: Terminal to Heatsink			11.5		mm
	Creepage Distance: Terminal to Terminal			6.3		mm
d_{clear}	Clearance Distance: Terminal to Heatsink			10		mm
	Clearance Distance: Terminal to Terminal			5		mm
L_{SCE}	Stray Inductance Module			30		nH
T_J	Maximum Junction Temperature				175	℃
T_{JOP}	Maximum Operating Junction Temperature Range		-40		+150	℃
T_{stg}	Storage Temperature		-40		+125	℃
CTI	Comparative Tracking Index			200		
$R_{\theta CS}$	Case-to-Sink Thermally (Conductive Grease Applied)				0.05	℃/W
M	Mounting Screw:M4		1.5		1.8	N·m
G	Weight			40		g

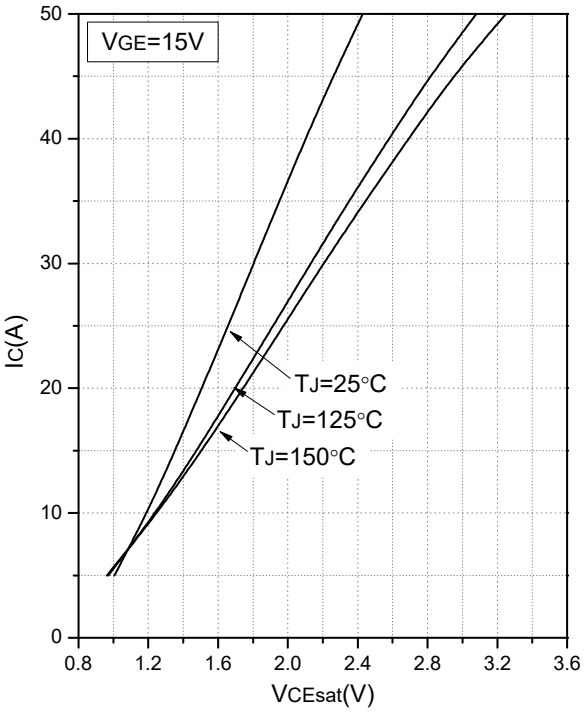


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

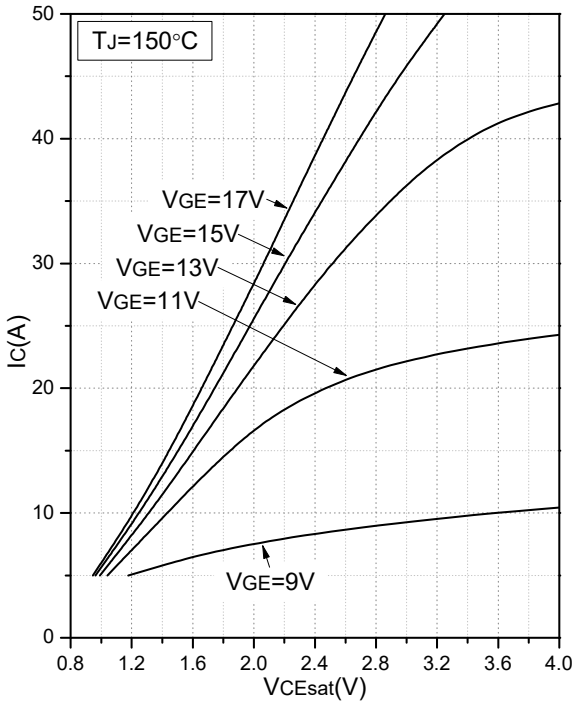


Fig.2 Typical Output Characteristics (Inverter)

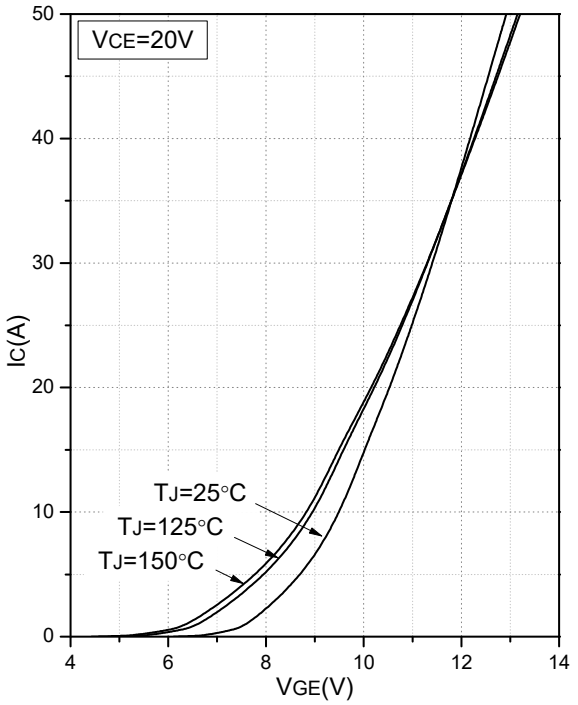


Fig.3 Transfer Characteristic (Inverter)

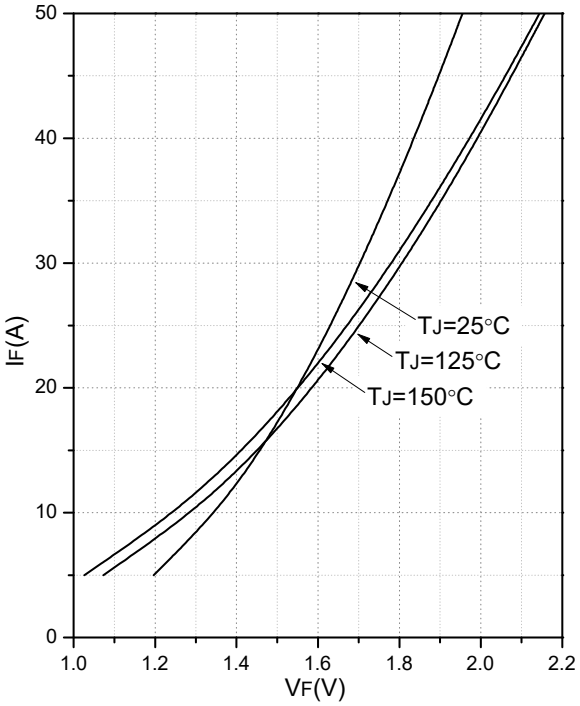


Fig.4 Forward Characteristics of Diode (Inverter)

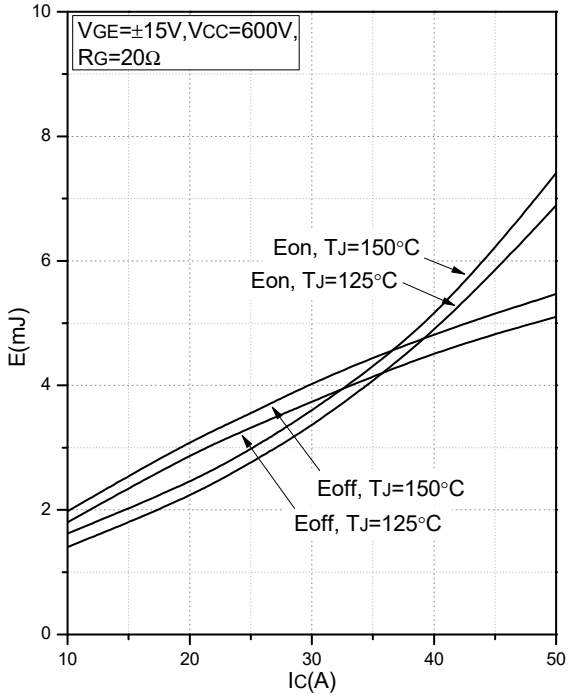


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

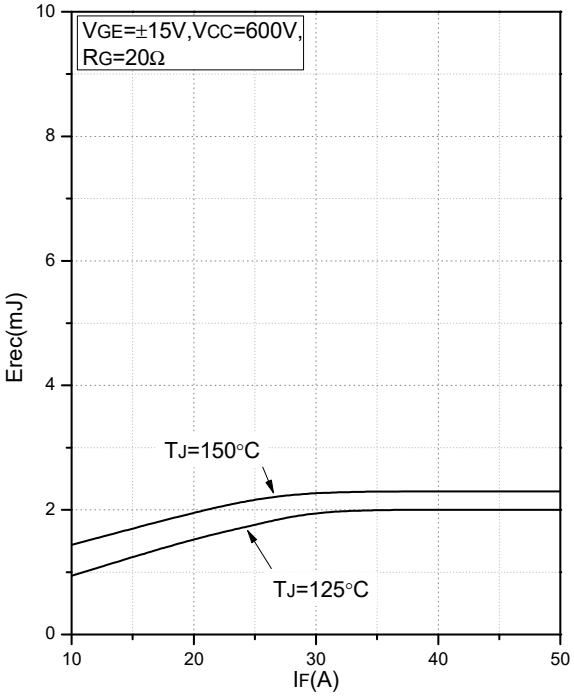


Fig.6 Typical Switching Loss vs. Forward Current (Inverter)

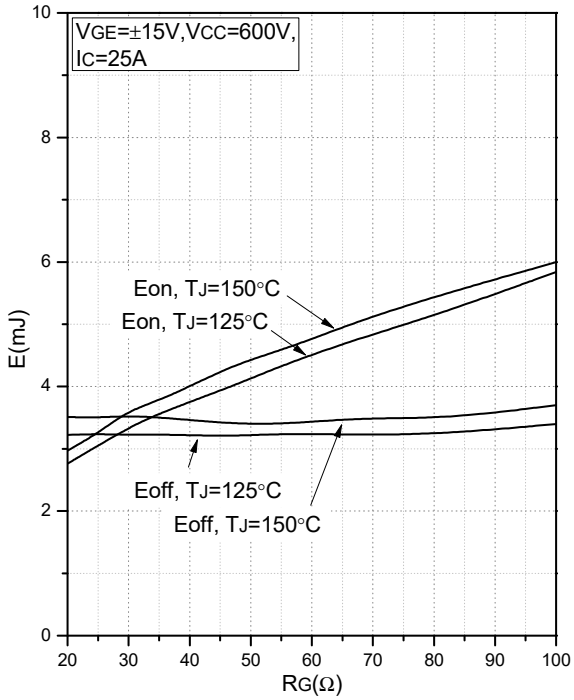


Fig.7 Typical Switching Loss vs. Gate Resistance (Inverter)

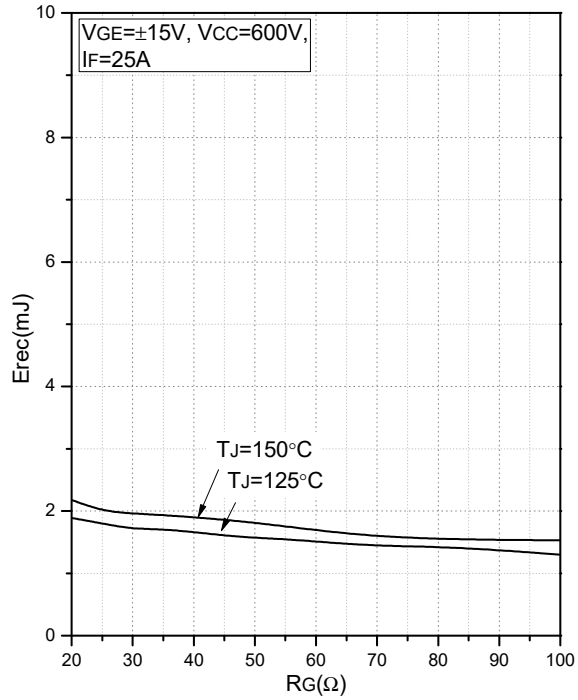


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

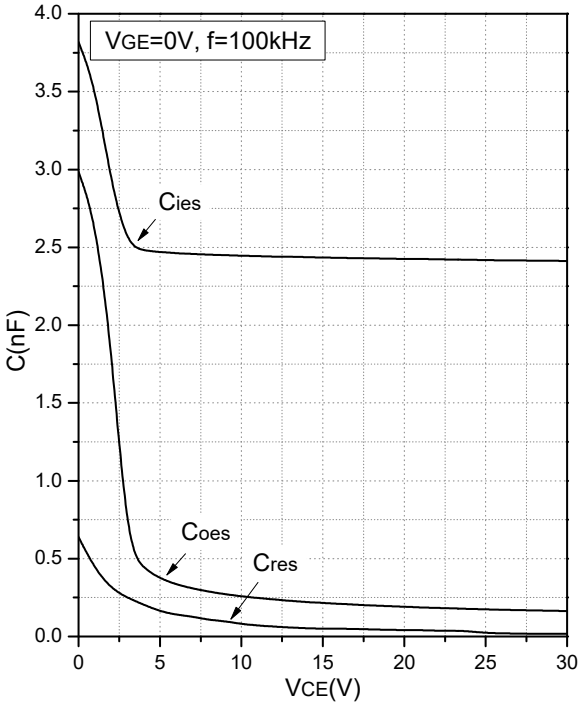


Fig.9 Capacitance Characteristics (Inverter)

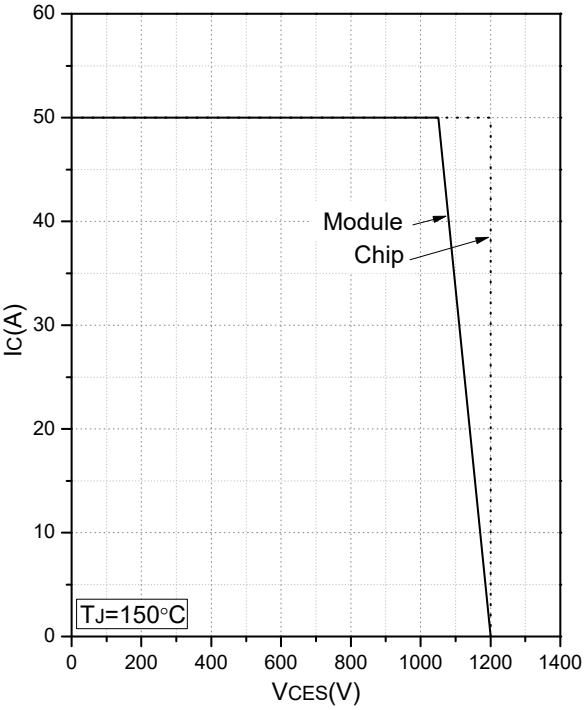


Fig.10 Reverse Bias Safe Operation Area (Inverter)

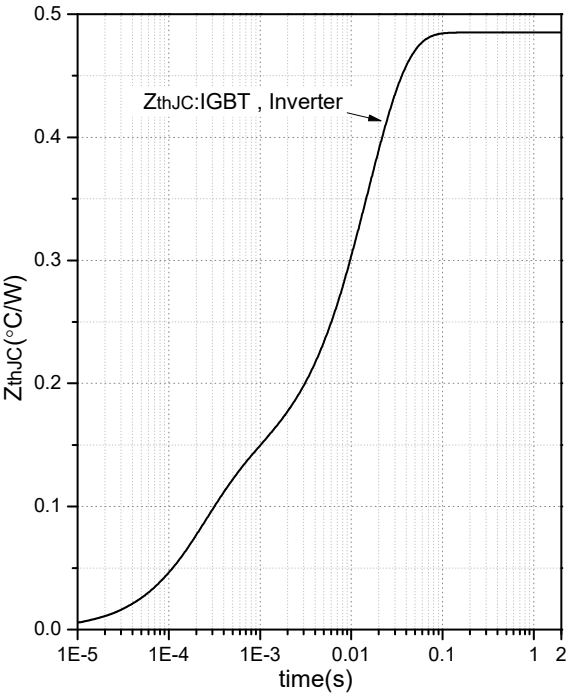


Fig.11 Transient Thermal Impedance IGBT (Inverter)

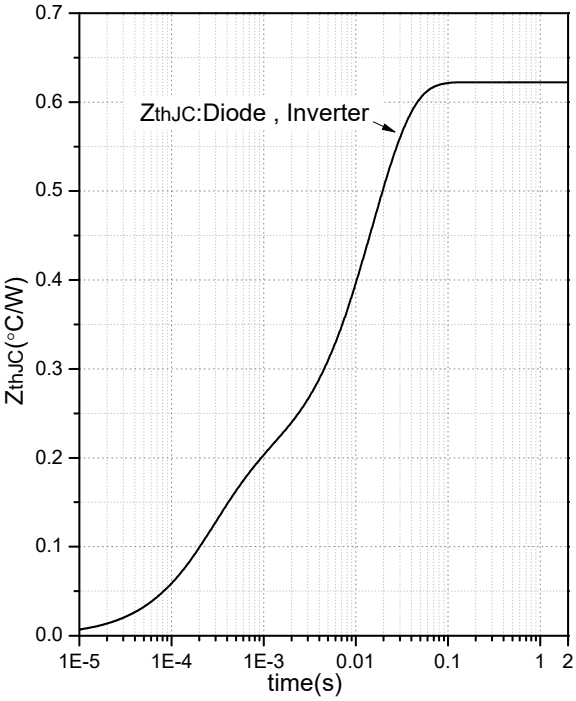


Fig.12 Transient Thermal Impedance Diode (Inverter)

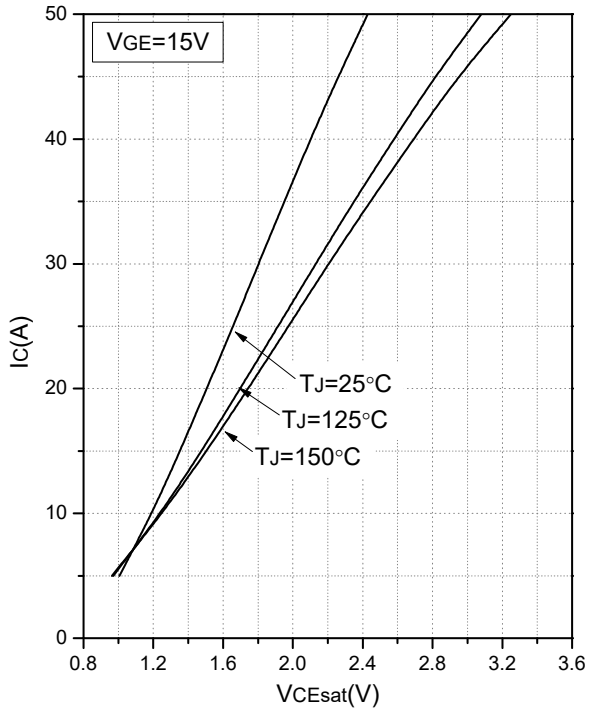


Fig.13 Typical Saturation Voltage Characteristics (Brake-Chopper)

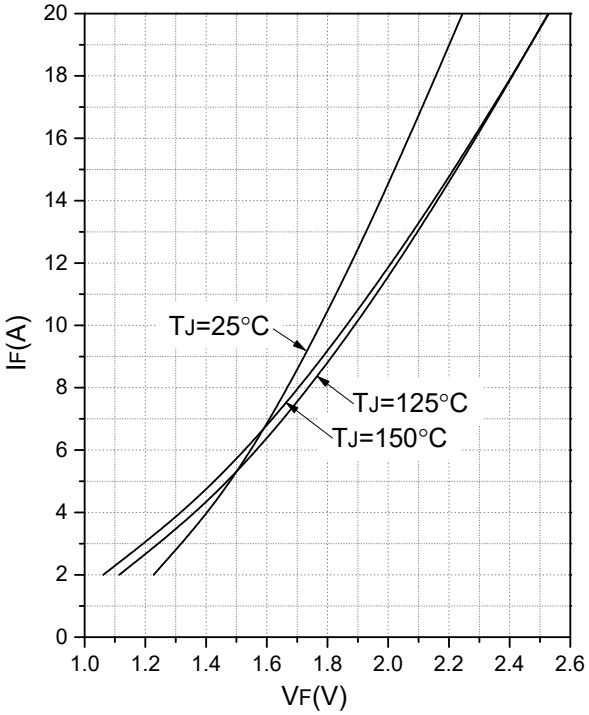


Fig.14 Forward Characteristics of Diode (Brake-Chopper)

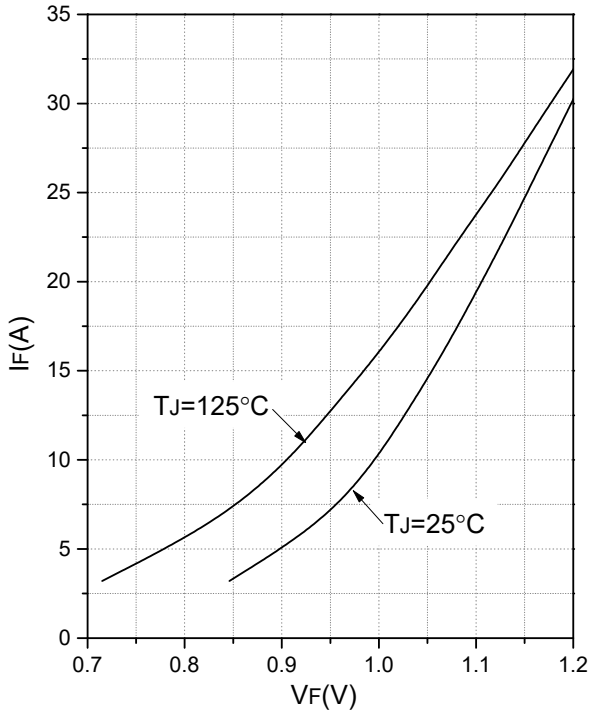


Fig.15 Forward Characteristics of Diode (Rectifier)

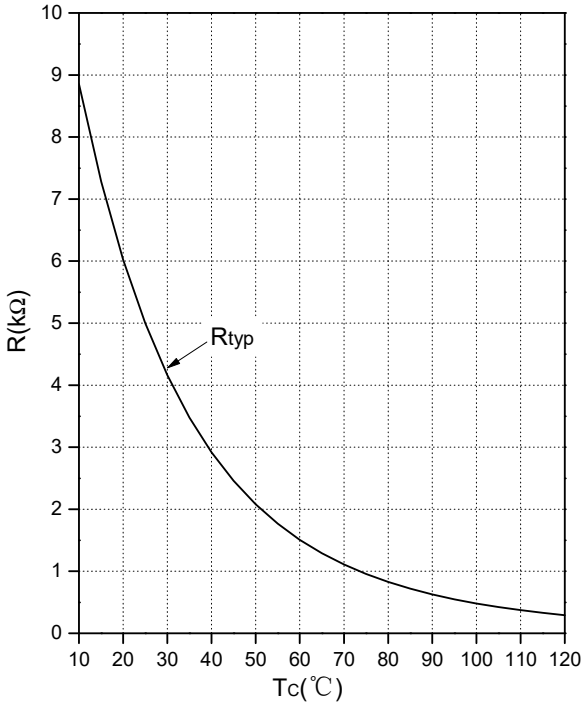
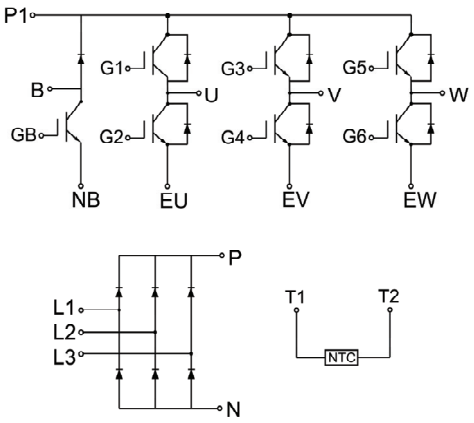


Fig.16 NTC Temperature Characteristics

Internal Circuit



Package Outline (Unit: mm):