

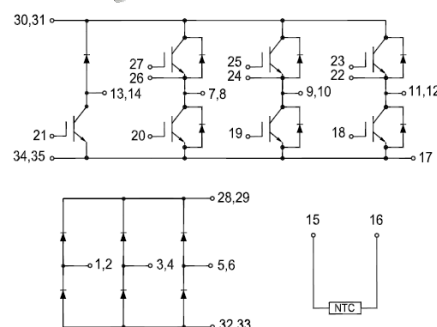
SYMT100PI120T6H-M

IGBT Module



Features:

- Field Stop Trench Gate IGBT
- Short Circuit Rated >10μs
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested (2×I_C)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement



Applications:

- Industrial Inverters
- Servo Applications

IGBT, Inverter

Maximum Rated Values(T_C=25°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°C	100	A
		T _C =25°C	200	A
I _{CM}	Peak Collector Current Repetitive	T _J =175°C	200	A
t _{SC}	Short Circuit Withstand Time		>10	μs
P _D	Maximum Power Dissipation (IGBT)	T _C =25°C T _{Jmax} =175°C	714	W

Electrical Characteristics of IGBT ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Static Characteristics

Symbol	Description	Conditions	Min	Typ	Max	Unit
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1\text{mA}$, $V_{CE}=V_{GE}$	5.0	5.5	6.6	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=100\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^{\circ}\text{C}$	1.70	2.00	V
			$T_J=125^{\circ}\text{C}$	1.90		V
			$T_J=150^{\circ}\text{C}$	1.90		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	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_J=25^{\circ}\text{C}$			200	nA
C_{ies}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		8.03		nF
C_{oes}	Output Capacitance			1.22		nF
C_{res}	Reveres Transfer Capacitance			0.59		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V, I_C=100A,$ $R_{Gon}=1\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		228		ns
			$T_J=125^{\circ}C$		250		
			$T_J=150^{\circ}C$		254		
t_r	Rise Time		$T_J=25^{\circ}C$		63		ns
			$T_J=125^{\circ}C$		67		
			$T_J=150^{\circ}C$		69		
$t_{d(off)}$	Turn-off Delay Time	$V_{CC}=600V, I_C=100A,$ $R_{Goff}=1\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		269		ns
			$T_J=125^{\circ}C$		279		
			$T_J=150^{\circ}C$		284		
t_f	Fall Time		$T_J=25^{\circ}C$		184		ns
			$T_J=125^{\circ}C$		291		
			$T_J=150^{\circ}C$		317		
E_{on}	Turn-on Switching Loss	$V_{CC}=600V, I_C=100A,$ $R_{Gon}=1\Omega, V_{GE}=\pm 15V,$ $di/dt=1387A/\mu s(T_J=150^{\circ}C),$ Inductive Load	$T_J=25^{\circ}C$		3.1		mJ
			$T_J=125^{\circ}C$		4.3		
			$T_J=150^{\circ}C$		4.8		

E_{off}	Turn-off Switching Loss	$V_{CC}=600V, I_C=100A,$ $R_{Goff}=1\Omega, V_{GE}=\pm 15V,$ $du/dt=4448V/\mu s(T_J=150^\circ C),$ Inductive Load	$T_J=25^\circ C$		5.28		mJ
			$T_J=125^\circ C$		8.33		
			$T_J=150^\circ C$		9.30		
Q_g	Total Gate Charge	$V_{GE}=\pm 15V \dots -15V$	$T_J=25^\circ C$		745		nC
$R_{g\ internal}$	Internal Gate Resistance		$T_J=25^\circ C$		7.5		Ω
RBSOA	$I_C=200A, V_{CC}=1050V, V_p=1200V, R_{Goff}=1\Omega, V_{GE}=\pm 15V \text{ to } 0V, T_J=150^\circ C$			Trapezoid			
SC data	$V_{CC}=600V, t_p=10\mu s, V_{GE}=\pm 15V, R_{Gon}=1\Omega, R_{Goff}=1\Omega, T_J=25^\circ C$				575		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case				0.21		$^\circ C/W$

Diode, Inverter

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	100	A
I_{FM}	Peak FWD Current Repetitive	200	A

Electrical Characteristics of FWD ($T_C=25^\circ C$ unless otherwise specified)

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_{FM}	Forward Voltage	$I_F=100A$	$T_J=25^\circ C$	1.70		V
			$T_J=125^\circ C$	1.80		
			$T_J=150^\circ C$	1.80		
t_{rr}	Reverse Recovery Time	$I_F=100A,$ $-di_F/dt = 1911A/\mu s(T_J=150^\circ C),$ $V_R=600V,$ $V_{GE}=-15V$	$T_J=25^\circ C$	260		ns
			$T_J=125^\circ C$	396		
			$T_J=150^\circ C$	454		
I_{rr}	Peak Reverse Recovery Current	$I_F=100A,$ $-di_F/dt = 1911A/\mu s(T_J=150^\circ C),$ $V_R=600V,$ $V_{GE}=-15V$	$T_J=25^\circ C$	92		A
			$T_J=125^\circ C$	104		
			$T_J=150^\circ C$	105		

Q _{rr}	Reverse Recovery Charge		T _J =25℃		10.2		μC
			T _J =125℃		16.8		
			T _J =150℃		19.2		
E _{rec}	Reverse Recovery Energy	I _F =100A, -diF/dt =1911A/μs(T _J =150℃), V _R =600V, V _{GE} =-15V	T _J =25℃		4.83		mJ
			T _J =125℃		7.92		
			T _J =150℃		9.13		
R _{θJC}	Diode Thermal Resistance: Junction-To-Case				0.34		℃/W

IGBT, Brake-Chopper

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

V _{CES}	Collector-Emitter Blocking Voltage	T _C =25°C	1200	V
V _{GES}	Gate-Emitter Voltage		±20	V
I _C	Continuous Collector Current	T _C =100°C	50	A
		T _C =25°C	100	A
I _{CM(1)}	Peak Collector Current Repetitive	T _J =150°C	100	A
t _{SC}	Short Circuit Withstand Time		>10	μs
P _D	Maximum Power Dissipation (IGBT)	T _C =25°C T _{Jmax} =175°C	398	W

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

Static Characteristics

Symbol	Description	Conditions	Min	Typ	Max	Unit
V _{GE(th)}	Gate-Emitter Threshold Voltage	I _C =1 mA, V _{CE} =V _{GE}	5.0	5.6	6.6	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =50A, V _{GE} =15V	T _J =25°C	1.70	2.00	V
			T _J =125°C	1.90		V
			T _J =150°C	1.90		
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			100	nA

C_{ies}	Input Capacitance	$V_{CE}=25V, V_{GE}=0V,$ $f=1MHz$		3.65		nF
C_{oes}	Output Capacitance			0.50		nF
C_{res}	Reveres Transfer Capacitance			0.31		nF

Switching Characteristics

t _{d(on)}	Turn-on Delay Time	V _{CC} =600V, I _C =50A, R _{Gon} =15Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		154		ns	
			T _J =125℃		169			
			T _J =150℃		174			
t _r	Rise Time		T _J =25℃		51		ns	
			T _J =125℃		54			
			T _J =150℃		56			
t _{d(off)}	Turn-off Delay Time	V _{CC} =600V, I _C =50A, R _{Goff} =15Ω, V _{GE} =±15V, Inductive Load	T _J =25℃		202		ns	
			T _J =125℃		216			
			T _J =150℃		225			
t _f	Fall Time		T _J =25℃		220		ns	
			T _J =125℃		379			
			T _J =150℃		407			
E _{on}	Turn-on Switching Loss	V _{CC} =600V, I _C =50A, R _{Gon} =15Ω, V _{GE} =±15V, di/dt=791A/μs(T _J =150℃), Inductive Load	T _J =25℃		3.37		mJ	
			T _J =125℃		5.10			
			T _J =150℃		5.53			
E _{off}	Turn-off Switching Loss		V _{CC} =600V, I _C =50A, R _{Goff} =15Ω, V _{GE} =±15V, du/dt=3488V/μs(T _J =150℃), Inductive Load	T _J =25℃		2.42		mJ
				T _J =125℃		4.09		
				T _J =150℃		4.52		
Q _g	Total Gate Charge	V _{GE} =+15V...-15V		T _J =25℃		504		nC
R _{g internal}	Internal Gate Resistance			T _J =25℃		4		Ω
RBSOA	I _C =100A, V _{CC} =1050V, V _p =1200V, R _{Goff} =15Ω, V _{GE} =+15V to 0V, T _J =150℃			Trapezoid				
SC data	V _{cc} =600V, t _p =10us, V _{ge} =+/-15V, R _{Gon} =15ohm, R _{Goff} =15ohm, T _j =25℃				297		A	
R _{θJC}	IGBT Thermal Resistance: Junction-To-Case				0.38		℃/W	

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

V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_F	Diode Continuous Forward Current	35	A
I_{FM}	Peak FWD Current Repetitive	70	A

Electrical Characteristics of FWD ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Description	Conditions		Min	Typ	Max	Unit	
V _{FM}	Forward Voltage	I _F =35A	T _J =25℃		1.90		V	
			T _J =125℃		2.00			
t _{rr}	Reverse Recovery Time	I _F =35A, -di _F /dt=816A/μs(T _J =125℃), V _{rr} =600V, V _{GE} =-15V	T _J =25℃		137		ns	
			T _J =125℃		269			
I _{rr}	Peak Reverse Recovery Current		T _J =25℃		20		A	
			T _J =125℃		25			
Q _{rr}	Reverse Recovery Charge		T _J =25℃		3.15		μC	
			T _J =125℃		5.05			
E _{rec}	Reverse Recovery Energy		T _J =25℃		1.24		mJ	
			T _J =125℃		2.12			
R _{θJC}	Diode Thermal Resistance: Junction-To-Case				0.70		℃/W	

Diode, Rectifier

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

V_{RRM}	Repetitive Peak Reverse Voltage	$T_J=25^{\circ}\text{C}$	1800	V
I_{FRMSM}	Maximum RMS Forward Current Per Chip	$T_J=80^{\circ}\text{C}$	130	A
I_{RMSM}	Maximum RMS Current At Rectifier Output	$T_J=80^{\circ}\text{C}$	180	A
I_{FSM}	Surge Current @ $t_p=10$ ms	$T_J=25^{\circ}\text{C}$	1500	A
		$T_J=150^{\circ}\text{C}$	1150	
I^2t	I^2t - Value	$T_J=25^{\circ}\text{C}$	11560	A^2s
		$T_J=150^{\circ}\text{C}$	6610	

Electrical Characteristics of Diode ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Description	Conditions		Min	Typ	Max	Unit
V_F	Forward Voltage	$I_F=85$ A	$T_J=25^{\circ}\text{C}$		1.00		V
			$T_J=125^{\circ}\text{C}$		0.90		
			$T_J=150^{\circ}\text{C}$		0.90		
I_R	Reverse Current	$V_R=1800\text{V}$	$T_J=25^{\circ}\text{C}$			1	mA
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case				0.29		$^{\circ}\text{C}/\text{W}$

Internal NTC-Thermistor Characteristics

R_{25}	$T_C=25^{\circ}\text{C}$	5		k Ω
$\Delta R/R$	$T_C=100^{\circ}\text{C}$, $R_{100}=481\Omega$		± 5	%
P_{25}	$T_C=25^{\circ}\text{C}$	50		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

Module

Symbol	Description	Conditions	Min	Typ	Max	Unit
V _{iso}	Isolation Voltage (All Terminals Shorted)	f = 50Hz, 1minute	2500			V
T _J	Maximum Junction Temperature				175	°C
T _{JOP}	Maximum Operating Junction Temperature Range		-40		+150	°C
T _{stg}	Storage Temperature		-40		+125	°C
CTI	Comparative Tracking Index		200			V
R _{eCS}	Case-To-Sink Thermally (Conductive Grease Applied)			0.1		°C/W
M	Power Terminals Screw:M5		3.0		5.0	N·m
G	Weight			300		g

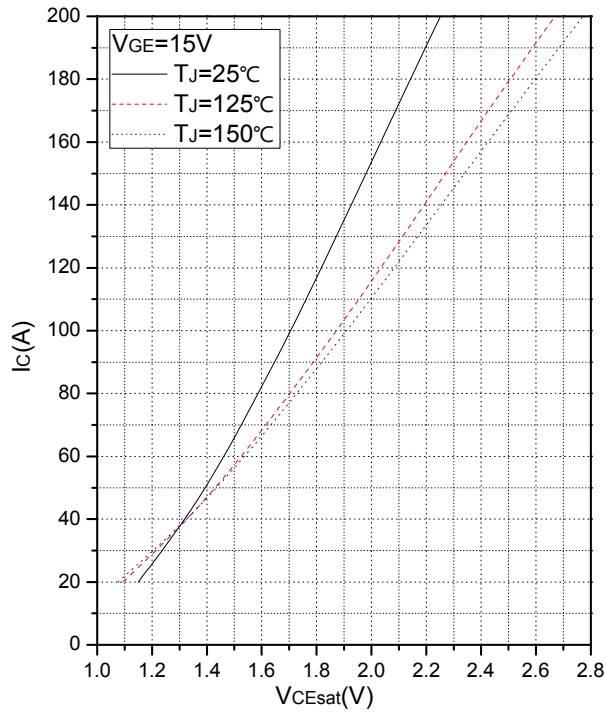


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

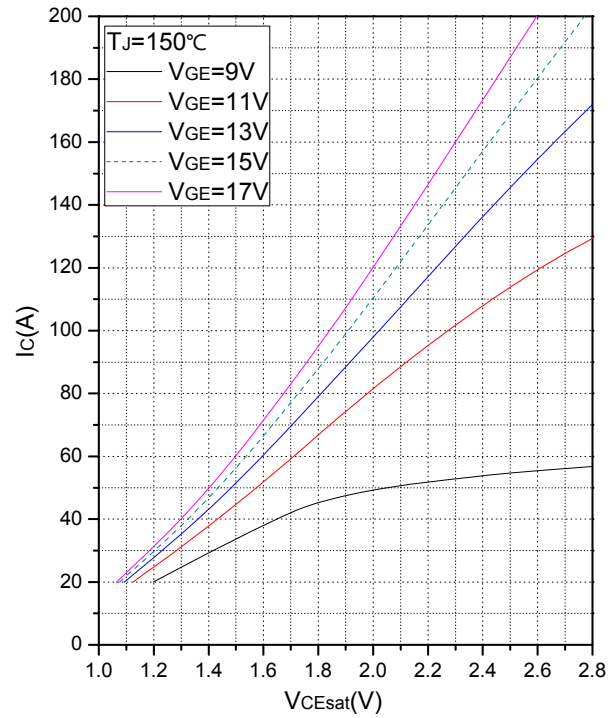


Fig.2 Typical Output Characteristics (Inverter)

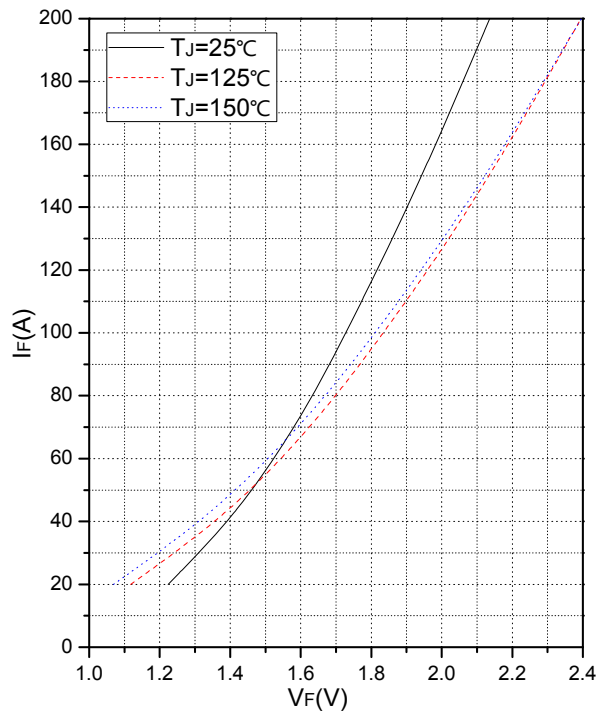


Fig.3 Forward Characteristics of FWD (Inverter)

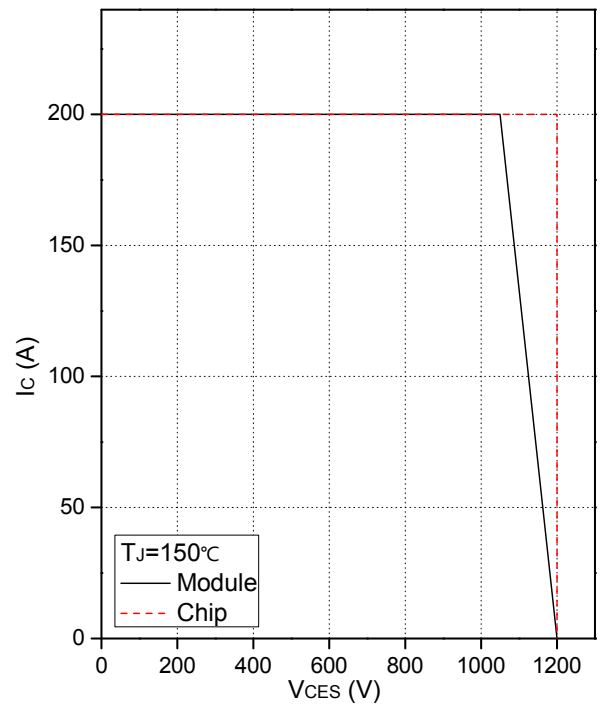


Fig.4 Reverse Bias Safe Operation Area (RBSOA)

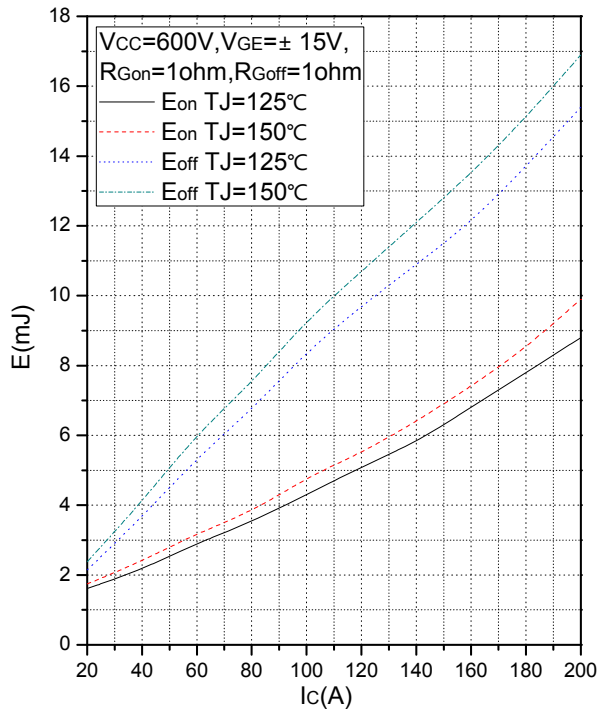


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

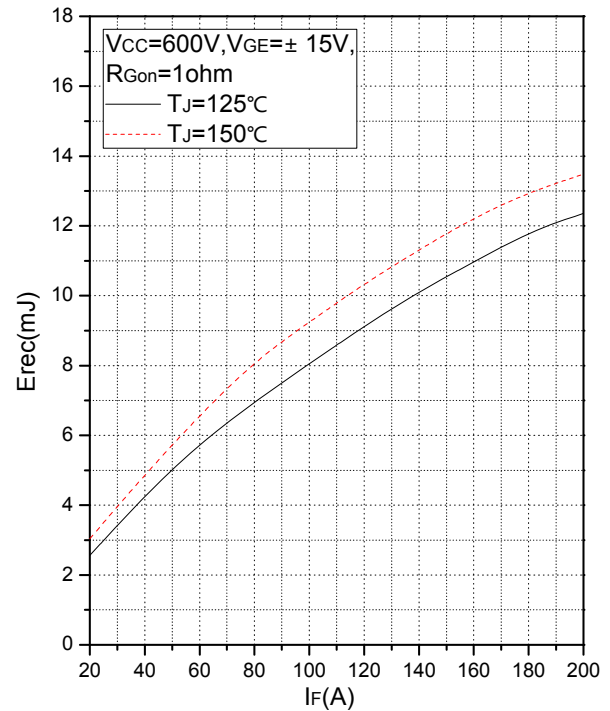


Fig.6 Typical Switching Loss vs. Forward Current (Inverter)

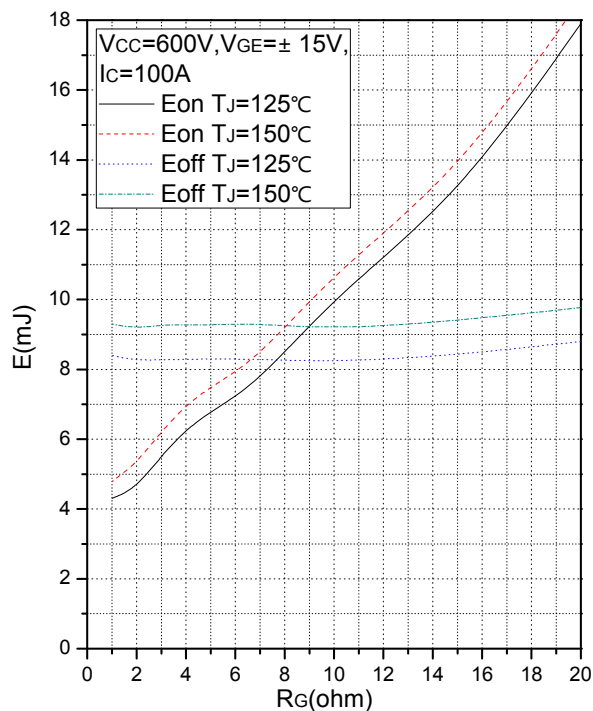


Fig.7 Typical Switching Loss vs. Gate Resistance (Inverter)

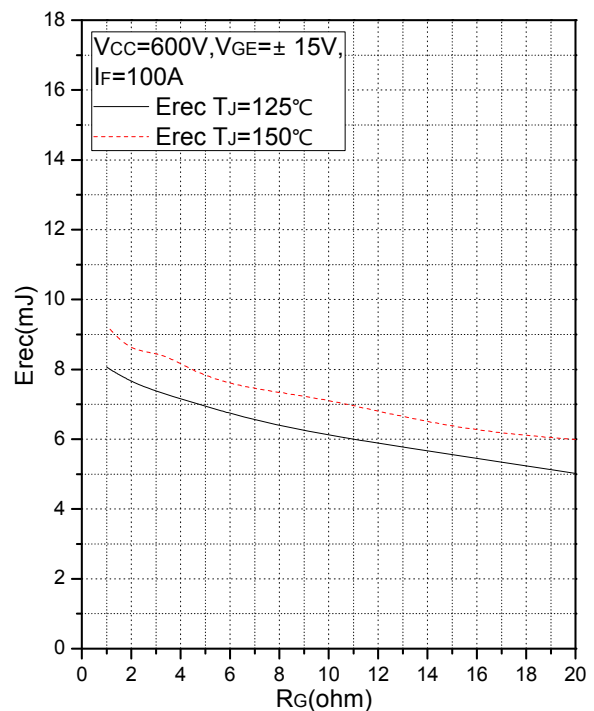


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

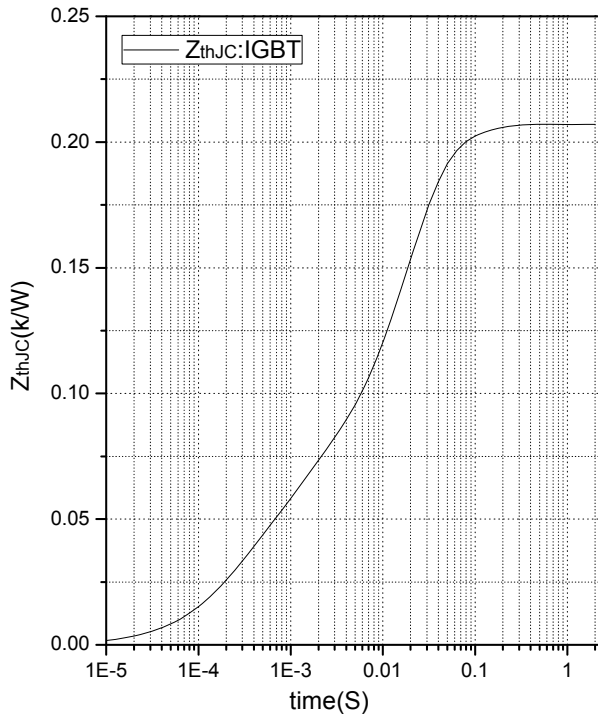


Fig.9 Transient Thermal Impedance (Inverter- IGBT)

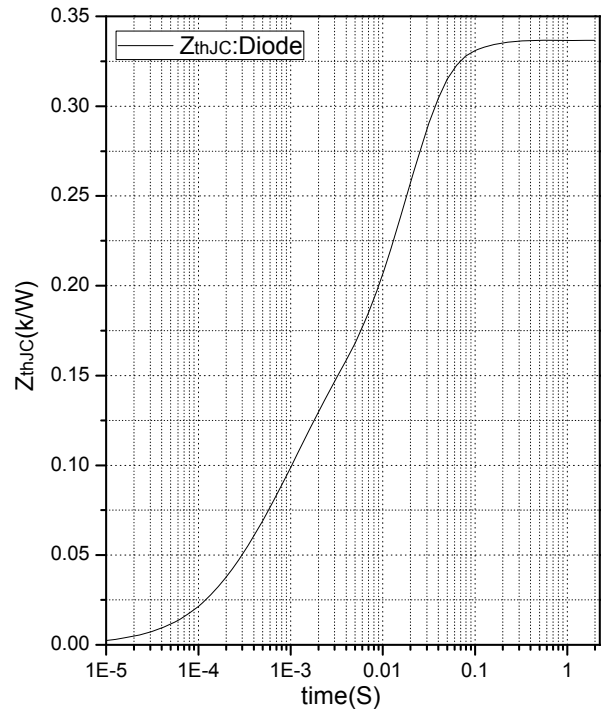


Fig.10 Transient Thermal Impedance (Inverter- Diode)

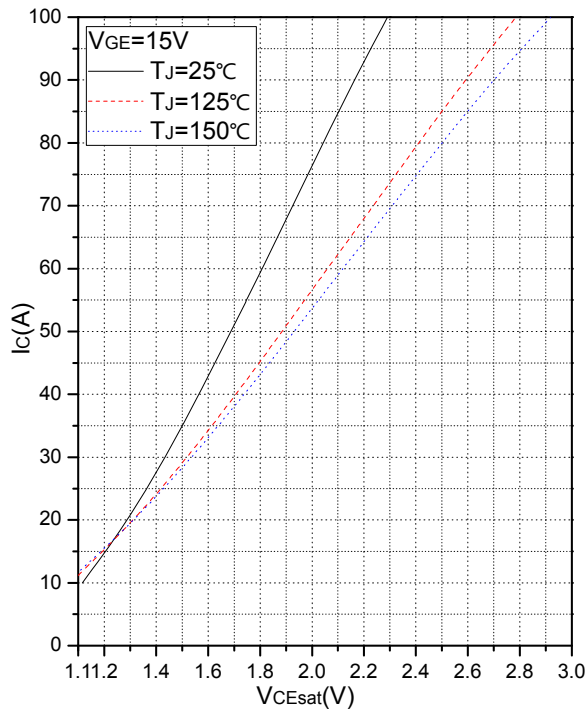


Fig.11 Typical Saturation Voltage Characteristics (Brake-Chopper)

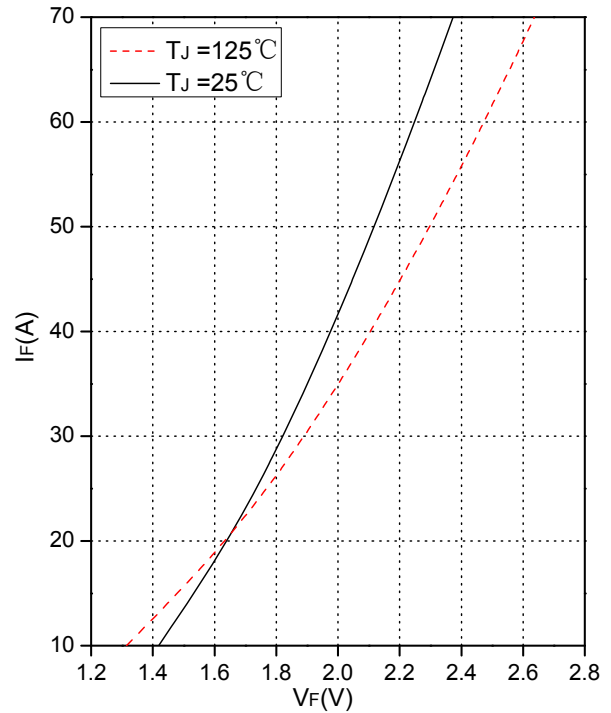


Fig.12 Forward Characteristics of FWD (Brake-Chopper)

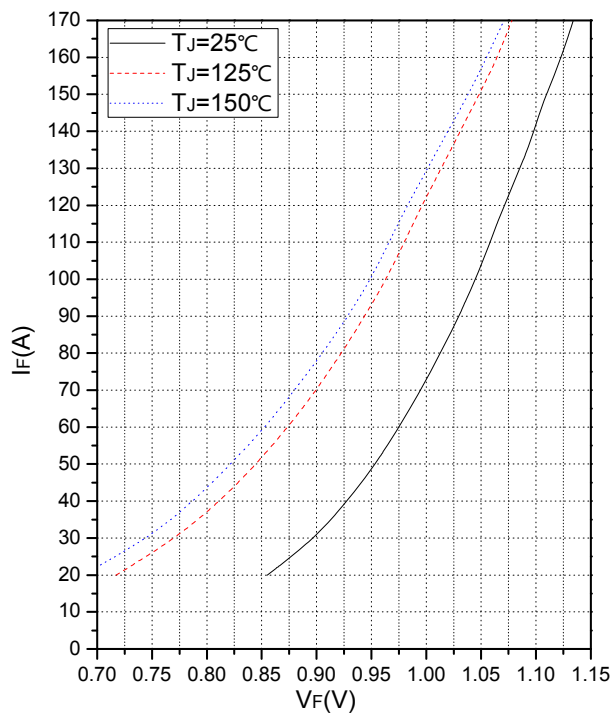


Fig.13 Forward Characteristics of Diode (Rectifier)

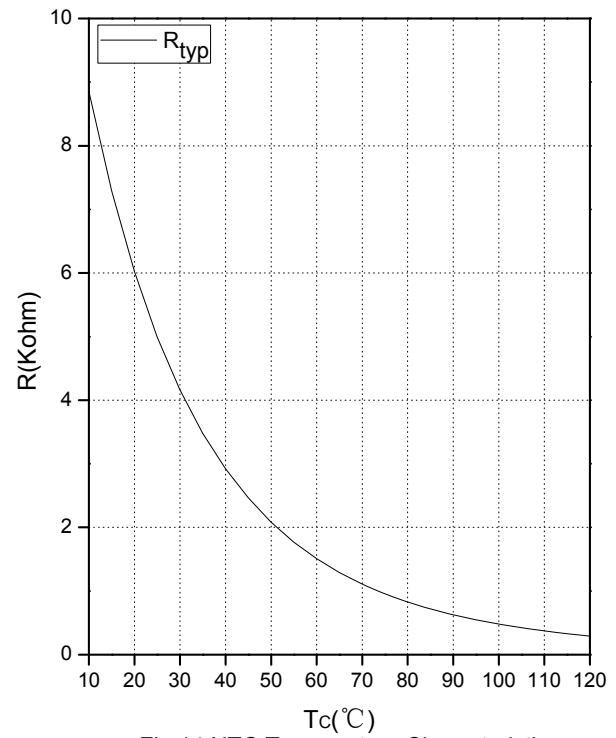


Fig.14 NTC Temperature Characteristics

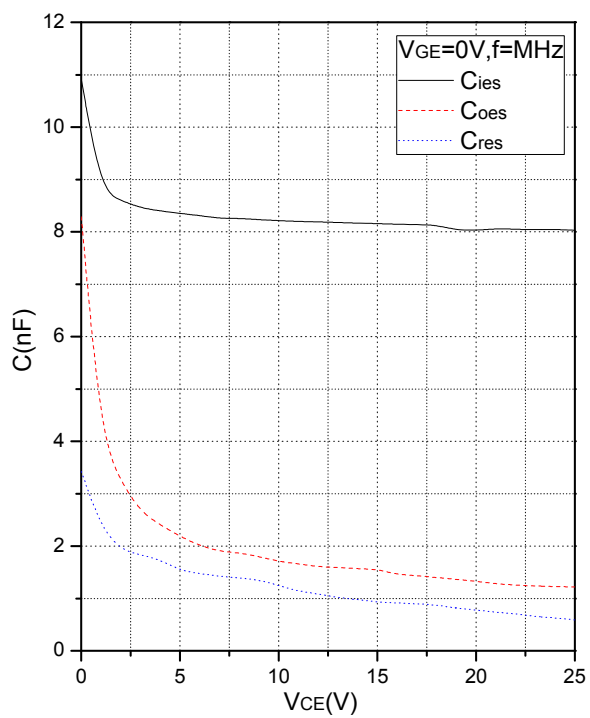
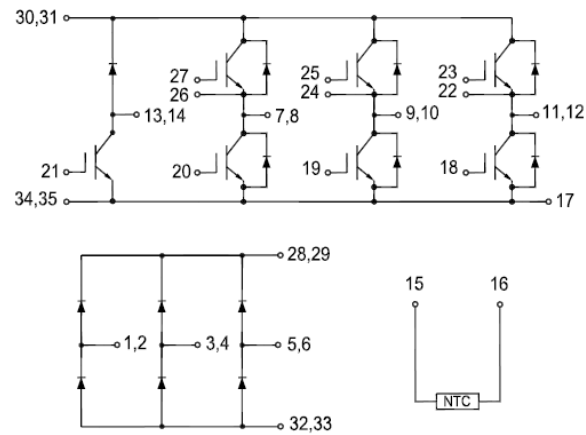


Fig.15 Capacitance Characteristics

Internal Circuit:



Package Outline (Unit: mm):

