

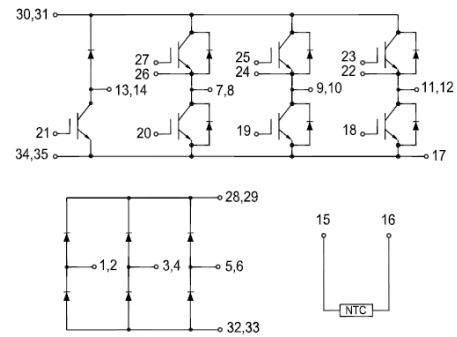
SYMT50PI120T6H-M

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	50	A
		T _C =25°C	100	A
I _{CM}	Peak Collector Current Repetitive	T _J =175°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 ($T_C=25^{\circ}\text{C}$ 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	5.6	6.6	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=50\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^{\circ}\text{C}$	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	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		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	$V_{CC}=600\text{V}$, $I_C=50\text{A}$, $R_{Gon}=15\Omega$, $V_{GE}=\pm 15\text{V}$, Inductive Load	$T_J=25^{\circ}\text{C}$		154		ns
			$T_J=125^{\circ}\text{C}$		169		
			$T_J=150^{\circ}\text{C}$		174		
t_r	Rise Time	$V_{CC}=600\text{V}$, $I_C=50\text{A}$, $R_{Gon}=15\Omega$, $V_{GE}=\pm 15\text{V}$, Inductive Load	$T_J=25^{\circ}\text{C}$		51		ns
			$T_J=125^{\circ}\text{C}$		54		
			$T_J=150^{\circ}\text{C}$		56		
$t_{d(off)}$	Turn-off Delay Time	$V_{CC}=600\text{V}$, $I_C=50\text{A}$, $R_{Goff}=15\Omega$, $V_{GE}=\pm 15\text{V}$, Inductive Load	$T_J=25^{\circ}\text{C}$		202		ns
			$T_J=125^{\circ}\text{C}$		216		
			$T_J=150^{\circ}\text{C}$		225		
t_f	Fall Time	$V_{CC}=600\text{V}$, $I_C=50\text{A}$, $R_{Goff}=15\Omega$, $V_{GE}=\pm 15\text{V}$, Inductive Load	$T_J=25^{\circ}\text{C}$		220		ns
			$T_J=125^{\circ}\text{C}$		379		
			$T_J=150^{\circ}\text{C}$		407		
E_{on}	Turn-on Switching Loss	$V_{CC}=600\text{V}$, $I_C=50\text{A}$, $R_{Gon}=15\Omega$, $V_{GE}=\pm 15\text{V}$, $di/dt=791\text{A}/\mu\text{s}$ ($T_J=150^{\circ}\text{C}$), Inductive Load	$T_J=25^{\circ}\text{C}$		3.37		mJ
			$T_J=125^{\circ}\text{C}$		5.10		
			$T_J=150^{\circ}\text{C}$		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°C), Inductive Load	T _J =25°C		2.42		mJ
			T _J =125°C		4.09		
			T _J =150°C		4.52		
Q _g	Total Gate Charge	V _{GE} =+15V...-15V	T _J =25°C		504		nC
R _{g internal}	Internal Gate Resistance		T _J =25°C		4		Ω
RBSOA	I _C =100A, V _{CC} =1050V, V _p =1200V, R _G =15Ω, V _{GE} =+15V to 0V, T _J =150°C			Trapezoid			
SC data	V _{CC} =600V, t _p =10us, V _{GE} =+/-15V, R _{Gon} =15ohm, R _{Goff} =15ohm, T _J =25°C				256		A
R _{θJC}	IGBT Thermal Resistance: Junction-To-Case				0.38		°C/W

Diode, Inverter

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

V _{RRM}	Repetitive Peak Reverse Voltage	1200	V
I _F	Diode Continuous Forward Current	50	A
I _{FM}	Peak FWD Current Repetitive	100	A

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

Symbol	Description	Conditions		Min	Typ	Max	Unit
V _{FM}	Forward Voltage	I _F =50A	T _J =25°C		1.40		V
			T _J =125°C		1.50		
			T _J =150°C		1.45		
t _{rr}	Reverse Recovery Time	I _F =50A, -diF/dt = 1197A/μs(T _J =150°C), V _R =600V, V _{GE} =-15V	T _J =25°C		318		ns
			T _J =125°C		539		
			T _J =150°C		554		
I _{rr}	Peak Reverse Recovery Current	I _F =50A, -diF/dt = 1197A/μs(T _J =150°C), V _R =600V, V _{GE} =-15V	T _J =25°C		57		A
			T _J =125°C		60		
			T _J =150°C		65		

Q _{rr}	Reverse Recovery Charge	I _F =50A, -diF/dt =1197A/μs(T _J =150℃), V _R =600V, V _{GE} =-15V	T _J =25℃		7.95		μC
			T _J =125℃		12.78		
			T _J =150℃		14.17		
E _{rec}	Reverse Recovery Energy		T _J =25℃		3.15		mJ
			T _J =125℃		5.21		
			T _J =150℃		6.05		
R _{θJC}	Diode Thermal Resistance: Junction-To-Case				0.51		℃/W

IGBT, Brake-Chopper

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

V _{CES}	Collector-Emitter Blocking Voltage	T _C =25℃	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}	Peak Collector Current Repetitive	T _J =150℃	50	A
t _{SC}	Short Circuit Withstand Time		>10	μs
P _D	Maximum Power Dissipation (IGBT)	T _C =25℃ T _{Jmax} =175℃	260	W

Electrical Characteristics of IGBT (T_C=25℃ 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	5.5	6.0	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =25A, V _{GE} =15V	T _J =25℃		1.90	2.20	V
			T _J =125℃		2.20		V
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℃				100	nA
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V, f=1MHz			3.40		nF
C _{res}	Reveres Transfer Capacitance				0.13		nF

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V, I_C=25A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^\circ C$		140		ns
			$T_J=125^\circ C$		140		
t_r	Rise Time	$V_{CC}=600V, I_C=25A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^\circ C$		45		ns
			$T_J=125^\circ C$		50		
$t_{d(off)}$	Turn-off Delay Time	$V_{CC}=600V, I_C=25A,$ $R_{Goff}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^\circ C$		165		ns
			$T_J=125^\circ C$		170		
t_f	Fall Time	$V_{CC}=600V, I_C=25A,$ $R_{Goff}=15\Omega, V_{GE}=\pm 15V,$ Inductive Load	$T_J=25^\circ C$		220		ns
			$T_J=125^\circ C$		330		
E_{on}	Turn-on Switching Loss	$V_{CC}=600V, I_C=25A,$ $R_{Gon}=15\Omega, V_{GE}=\pm 15V,$ $di/dt=556A/\mu s(T_J=125^\circ C),$ Inductive Load	$T_J=25^\circ C$		1.76		mJ
			$T_J=125^\circ C$		2.13		
E_{off}	Turn-off Switching Loss	$V_{CC}=600V, I_C=25A,$ $R_{Goff}=15\Omega, V_{GE}=\pm 15V,$ $du/dt=2760V/\mu s(T_J=125^\circ C),$ Inductive Load	$T_J=25^\circ C$		1.02		mJ
			$T_J=125^\circ C$		1.72		
Q_g	Total Gate Charge	$V_{GE}=+15V \dots -15V$	$T_J=25^\circ C$		120		nC
$R_{g \text{ internal}}$	Internal Gate Resistance		$T_J=25^\circ C$		0		Ω
RBSOA	$I_C=50A, V_{CC}=1050V, V_p=1200V, R_{Goff}=15\Omega, V_{GE}=+15V \text{ to } 0V, T_J=150^\circ C$			Trapezoid			
SCSOA	$V_{CC}=600V, V_{GE}=15V, T_J=150^\circ C$			10			μs
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case				0.52		$^\circ C/W$

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	25	A
I_{FM}	Peak FWD Current Repetitive	50	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 =25A	T _J =25℃		1.80	2.10	V
			T _J =125℃		2.00		
t _{rr}	Reverse Recovery Time	I _F =25A, -diF/dt =659A/μs(T _J =150℃), V _R =600V, V _{GE} =-15V	T _J =25℃		118		ns
			T _J =125℃		157		
I _{rr}	Peak Reverse Recovery Current		T _J =25℃	15		A	
			T _J =125℃	20			
Q _{rr}	Reverse Recovery Charge		T _J =25℃	1.05		μC	
			T _J =125℃	2.19			
E _{rec}	Reverse Recovery Energy		T _J =25℃	0.39		mJ	
			T _J =125℃	0.95			
R _{θJC}	Diode Thermal Resistance: Junction-To-Case				0.80		℃/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	$T_J=80^{\circ}\text{C}$	55	A
I_{RMSM}	Maximum RMS Current At Rectifier Output	$T_J=80^{\circ}\text{C}$	65	A
I_{FSM}	Surge Current @ $t_p=10\text{ms}$	$T_J=25^{\circ}\text{C}$	630	A
		$T_J=150^{\circ}\text{C}$	550	
I^2t	I^2t - Value	$T_J=25^{\circ}\text{C}$	1960	A^2s
		$T_J=150^{\circ}\text{C}$	1500	

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

Symbol	Description	Conditions		Min	Typ	Max	Unit
V _F	Forward Voltage	I _F =35 A	T _J =25°C		1.05		V
			T _J =125°C		0.98		
			T _J =150°C		0.97		
I _R	Reverse Current	V _R =1800V	T _J =25°C			1	mA
R _{θJC}	IGBT Thermal Resistance: Junction-To-Case				0.55		°C/W

Internal NTC-Thermistor Characteristics

R ₂₅	T _C =25°C	5		kΩ
ΔR/R	T _C =100°C, R ₁₀₀ =481Ω		±5	%
P ₂₅	T _C =25°C	50		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

Module

Symbol	Description	Conditions	Min	Typ	Max	Unit
V _{iso}	Isolation Voltage (All Terminals Shorted)	RMS, 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 _{θCS}	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

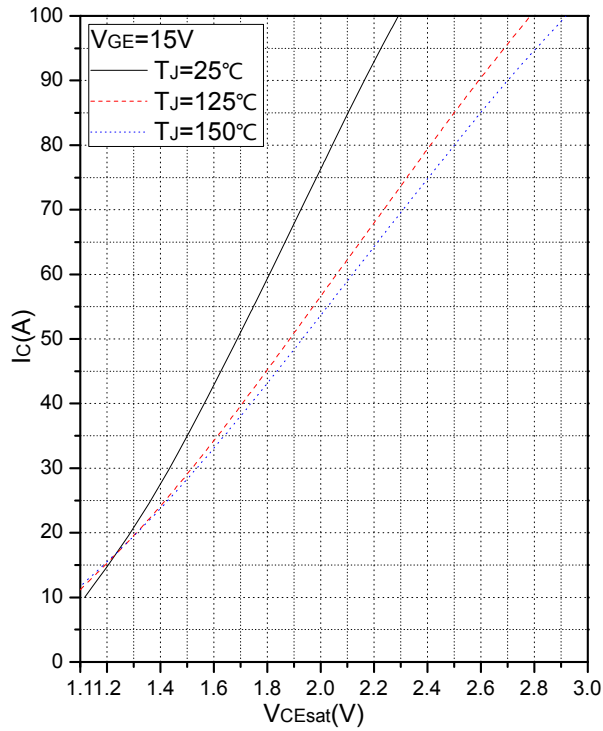


Fig.1 Typical Saturation Voltage Characteristics (Inverter)

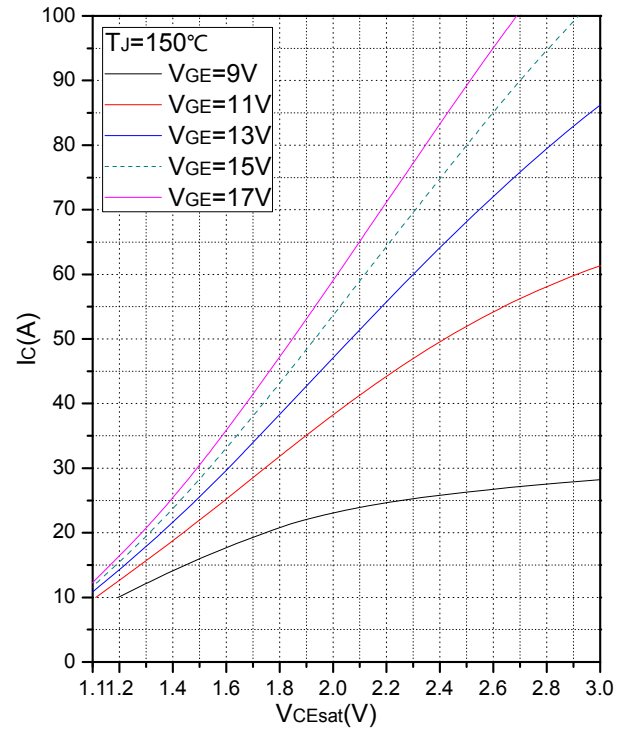


Fig.2 Typical Output Characteristics (Inverter)

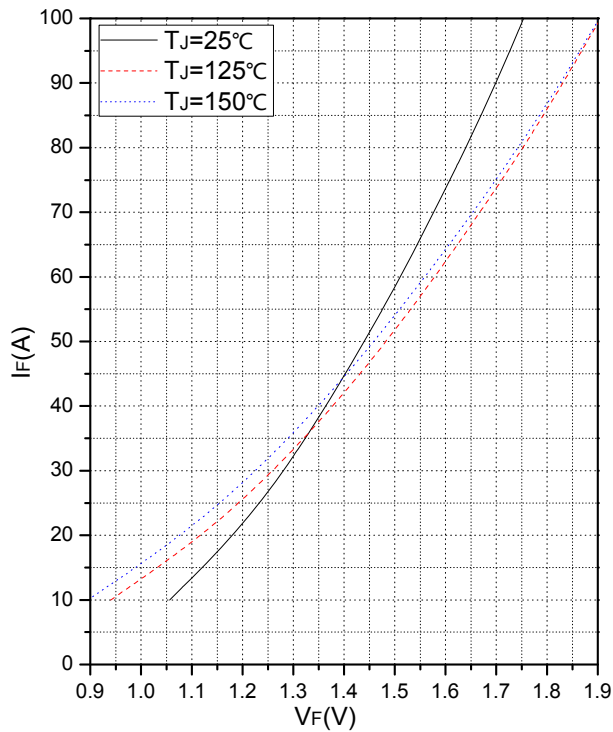


Fig.3 Forward Characteristics of FWD (Inverter)

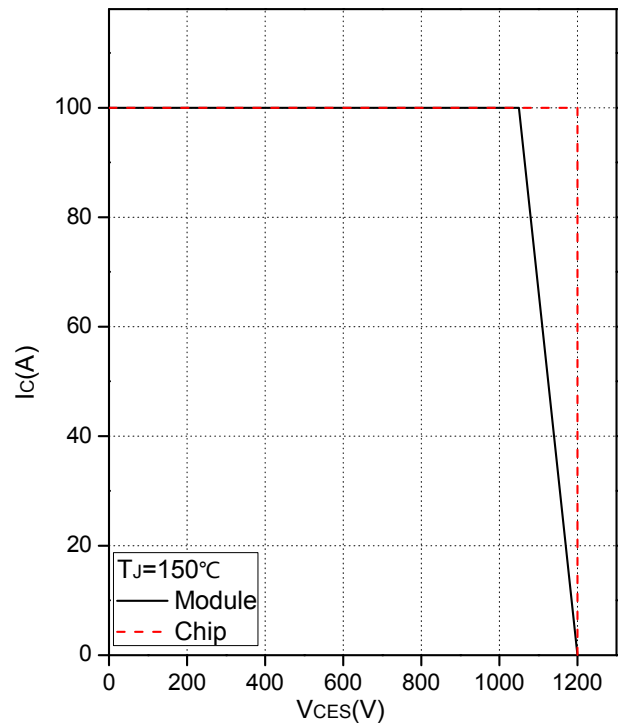


Fig.4 Reverse Bias Safe Operation Area (RBSOA)

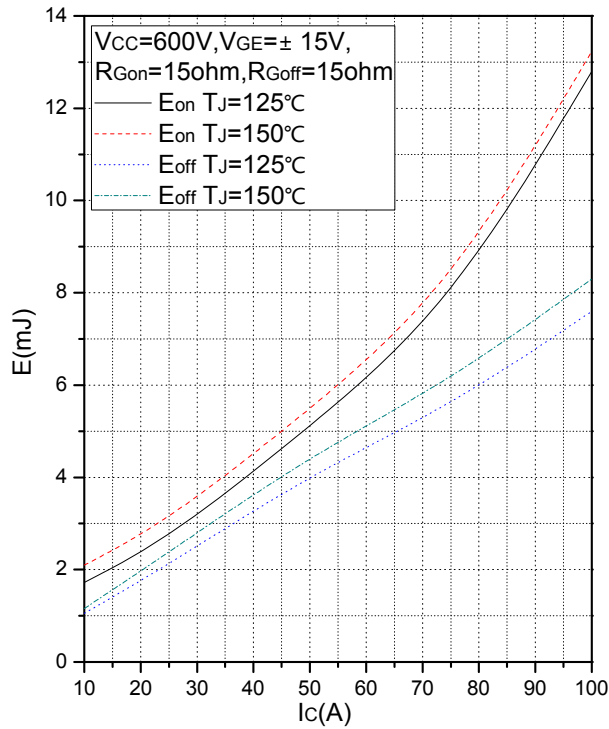


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

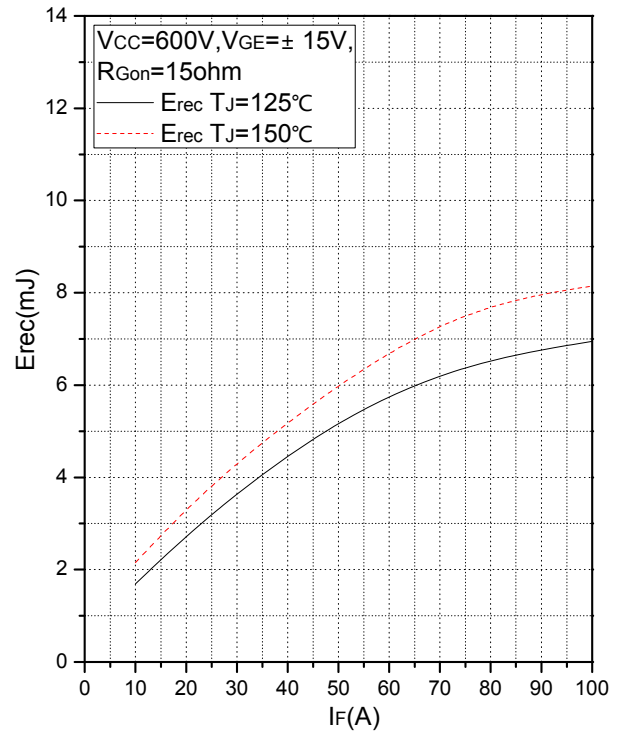


Fig.6 Typical Switching Loss vs. Forward Current (Inverter)

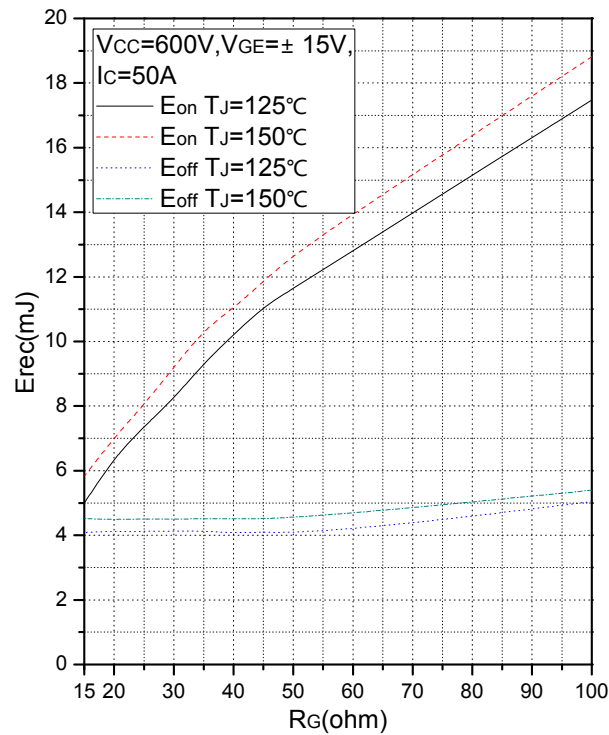


Fig.7 Typical Switching Loss vs. Gate Resistance (Inverter)

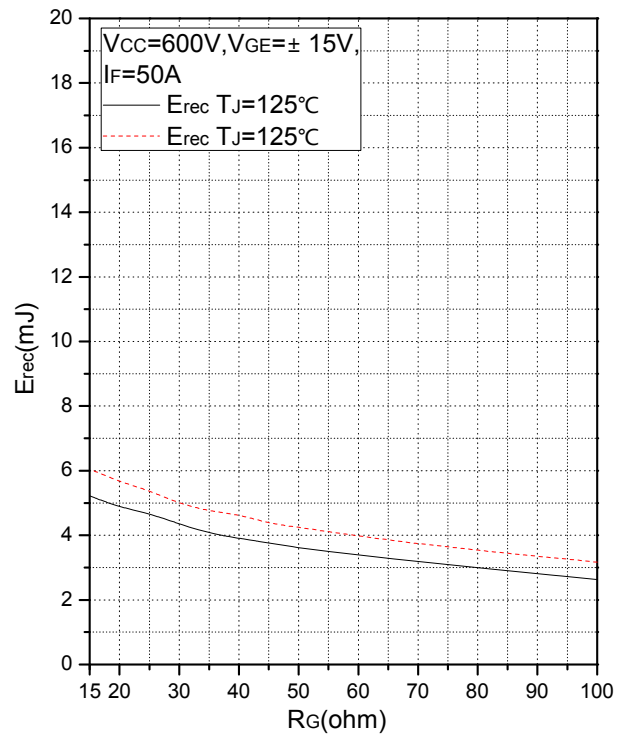


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

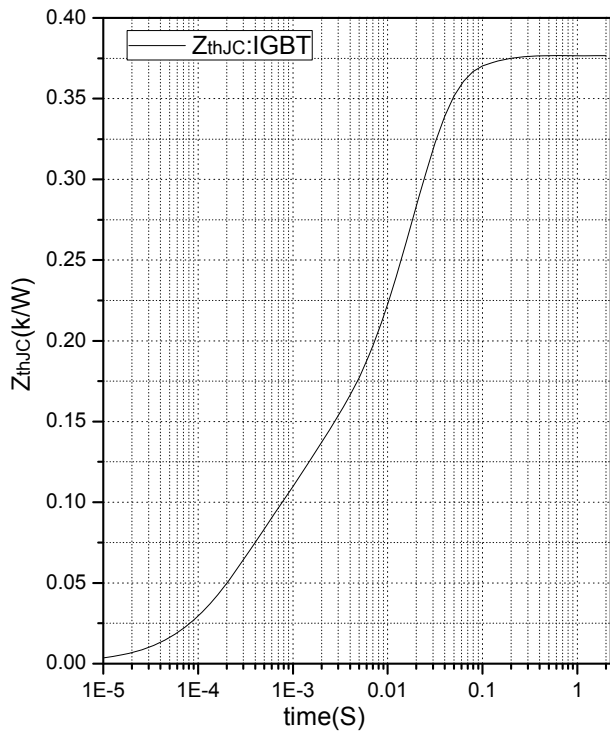


Fig.9 Transient Thermal Impedance (Inverter- IGBT)

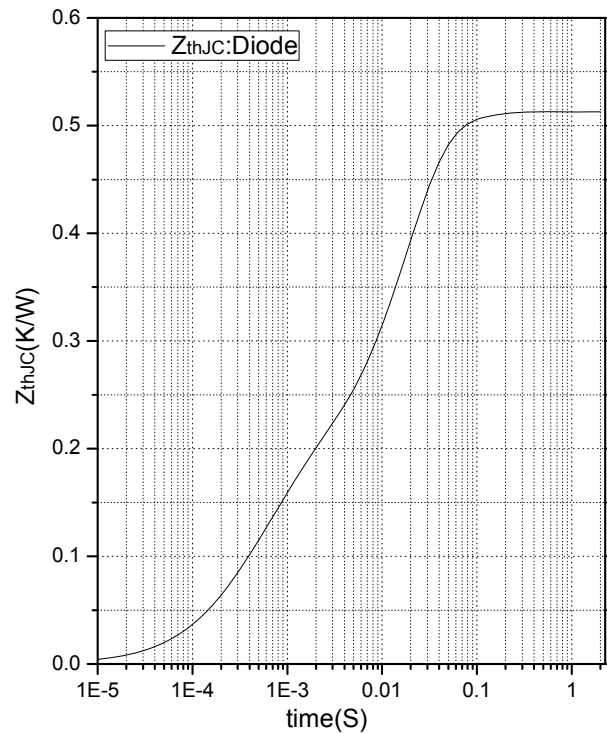


Fig.10 Transient Thermal Impedance (Inverter- Diode)

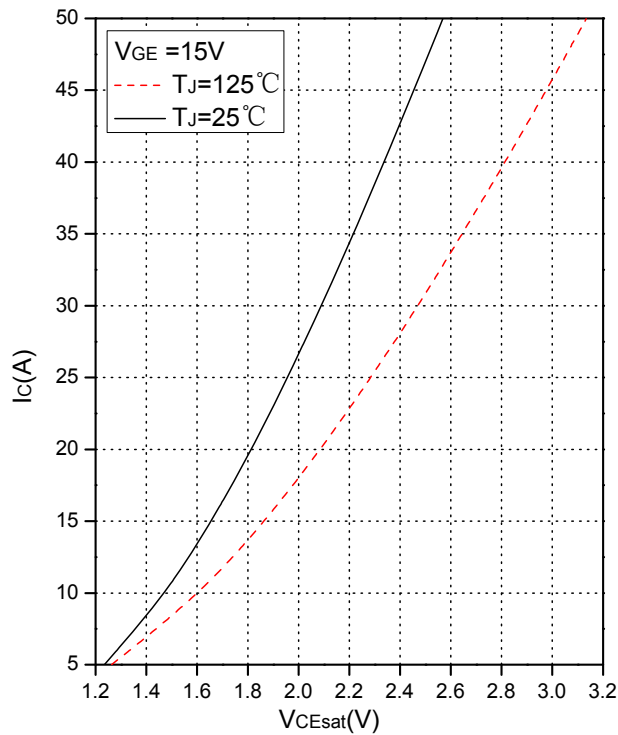


Fig.11 Typical Saturation Voltage Characteristics (Brake-Chopper)

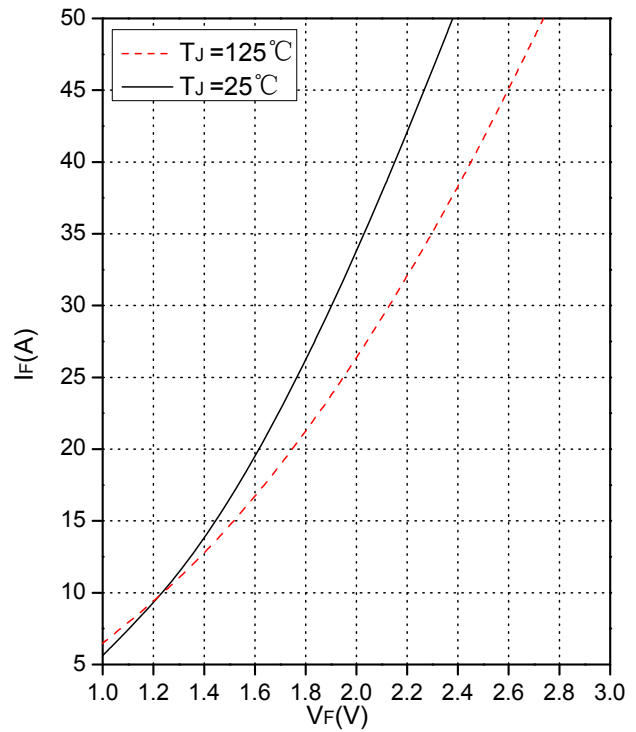


Fig.12 Forward Characteristics of Diode (Brake-Chopper)

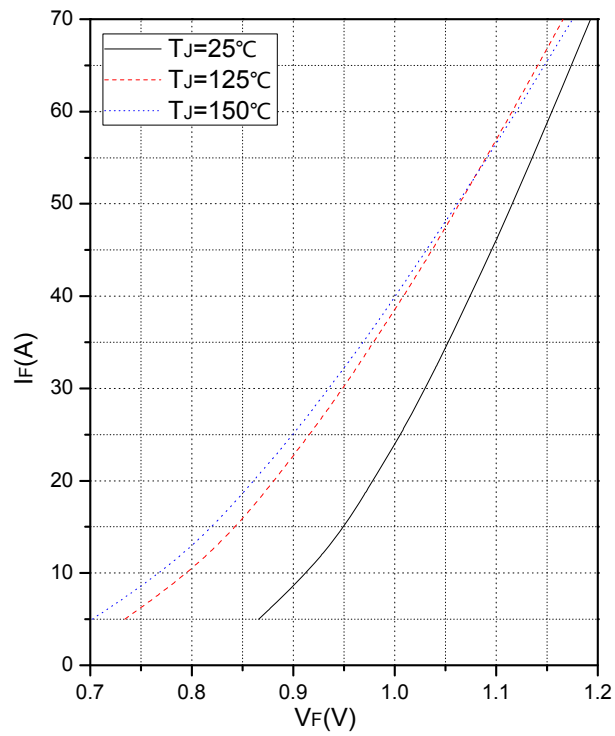


Fig.13 Forward Characteristics of Diode (Rectifier)

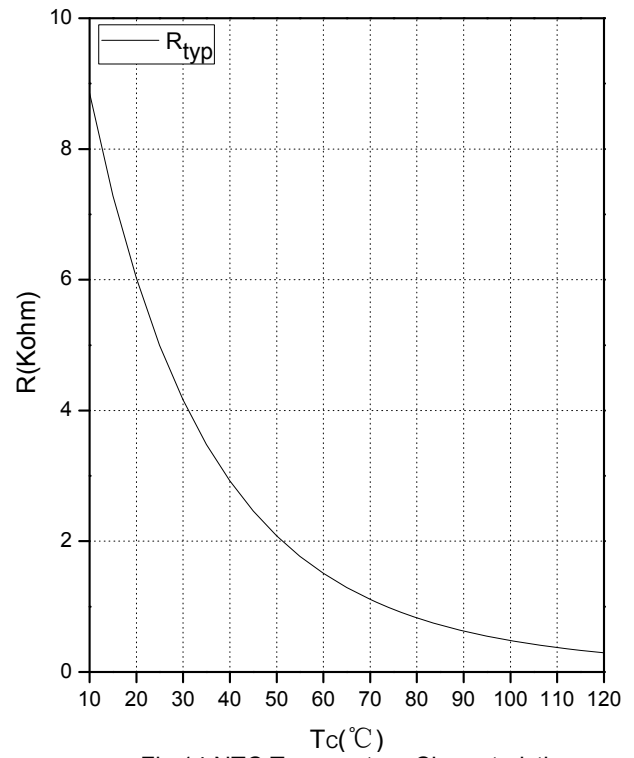


Fig.14 NTC Temperature Characteristics

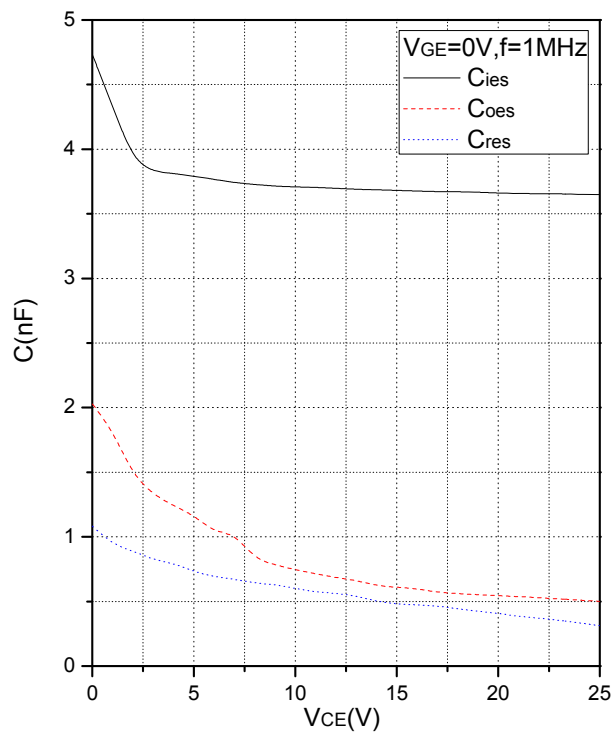
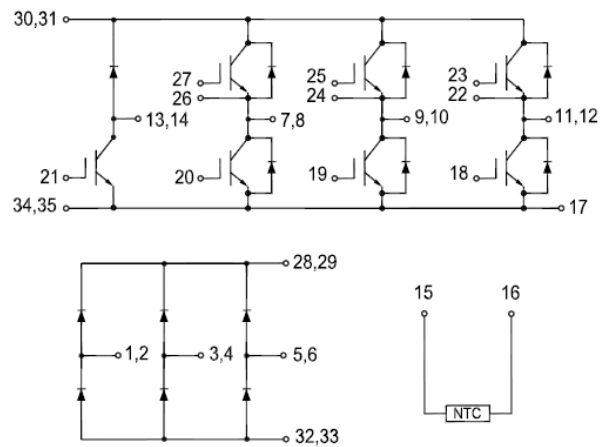


Fig.15 Capacitance Characteristics

Internal Circuit:



Package Outline (Unit: mm):

