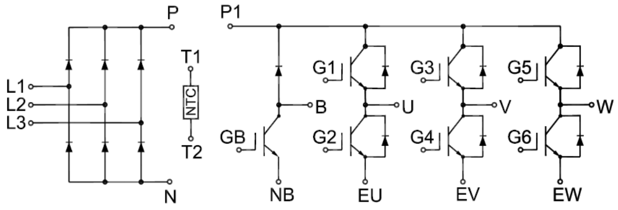
SYMT10PI120B3H

IGBT Module Preliminary Data

Features:

Circuit Diagram



- Trench & Field Stop 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

Applications:

- Industrial Inverters
- Servo Applications

IGBT, Inverter

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

V_{CES}	Collector-Emitter Blocking Voltage	T_J=25℃	1200	V
V_{GES}	Gate-Emitter Voltage		±20	V
I_C	Continuous Collector Current	T_C=100℃	10	A
		T_C=25℃	20	A
I_{CM}	Peak Collector Current Repetitive	tp=1ms	20	A
P_D	Maximum Power Dissipation per IGBT	T_C=25℃, T_{Jmax}=175℃	158	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}, T_J=25℃		5.0	5.7	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=10A, V_{GE}=15V	T_J=25℃		1.85	2.00	V
			T_J=125℃		2.10		V
			T_J=150℃		2.15		V
I_{CES}	Collector-Emitter Leakage Current	V_{GE}=0V, V_{CE}=V_{CES}, T_J=25℃				100	uA
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, T_J=25℃			972		pF
C_{oes}	Output Capacitance				43		
C_{res}	Reverse Transfer Capacitance				12		

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=600V, I_C=10A, R_{Gon}=68Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		71		ns
			T_J=125℃		84		
			T_J=150℃		93		
t_r	Rise Time		T_J=25℃		52		ns
			T_J=125℃		61		
			T_J=150℃		65		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=600V, I_C=10A, R_{Goff}=68Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		166		ns
			T_J=125℃		172		
			T_J=150℃		172		
t_f	Fall Time		T_J=25℃		382		ns
			T_J=125℃		546		
			T_J=150℃		573		
E_{on}	Turn-on Switching Loss	V_{CC}=600V, I_C=10A, R_{Gon}=68Ω, V_{GE}=±15V, di/dt=145A/μs (T_J=150℃), Inductive Load	T_J=25℃		2.2		mJ
			T_J=125℃		2.5		
			T_J=150℃		2.6		

E_{off}	Turn-off Switching Loss	V_{CC}=600V, I_C=10A, R_{Goff}=68Ω, V_{GE}=±15V, du/dt=1532V/μs (T_J=150℃), Inductive Load	T_J=25℃		0.3		mJ
			T_J=125℃		0.6		
			T_J=150℃		0.7		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		340		nC
$R_{g\ internal}$	Internal Gate Resistor		T_J=25℃		0		Ω
I_{SC}	V_{CC}=600V, V_{GE}=±15V, tp=10us, R_{Gon}=68Ω, R_{Goff}=68Ω, T_J=125℃				53		A
$R_{θJC}$	Thermal Resistance: Junction-To-Case (per IGBT)					0.95	℃/W

Diode, Inverter

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

V_{RRM}	Repetitive Peak Reverse Voltage	T_J=25℃	1200	V
I_F	Diode Continuous Forward Current	T_C=100℃	10	A
I_{FM}	Repetitive Peak Forward Current	tp=1ms	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℃		1.70		V
			T_J=125℃		1.80		
			T_J=150℃		1.80		
t_{rr}	Reverse Recovery Time	I_F=10A, -diF/dt=208A/μs(T_J=150℃), V_{rr}=600V, V_{GE}=-15V	T_J=25℃		279		ns
			T_J=125℃		305		
			T_J=150℃		392		
I_{rr}	Peak Reverse Recovery Current		T_J=25℃		6.6		A
			T_J=125℃		7.2		
			T_J=150℃		8.4		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		1.05		μC
			T_J=125℃		1.46		
			T_J=150℃		1.91		

E_{rec}	Reverse Recovery Energy	I_F=10A, -diF/dt=208A/μs(T_J=150℃), V_{rr}=600V, V_{GE}=-15V	T_J=25℃		0.18		mJ
			T_J=125℃		0.25		
			T_J=150℃		0.43		
$R_{θJC}$	Thermal Resistance: Junction-To-Case (per Diode)					1.28	℃/W

IGBT, Brake-Chopper

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

V_{CES}	Collector-Emitter Blocking Voltage	T_J=25℃	1200	V
V_{GES}	Gate-Emitter Voltage		±20	V
I_C	Continuous Collector Current	T_C=100℃	10	A
		T_C=25℃	20	A
I_{CM}	Peak Collector Current Repetitive	tp=1ms	20	A
P_D	Maximum Power Dissipation per IGBT	T_C=25℃, T_{Jmax}=175℃	158	W

Electrical Characteristics of IGBT (TC=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}, T_J=25℃		5.0	5.7	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=10A, V_{GE}=15V	T_J=25℃		1.85	2.00	V
			T_J=125℃		2.10		V
			T_J=150℃		2.15		V
I_{CES}	Collector-Emitter Leakage Current	V_{GE}=0V, V_{CE}=V_{CES}, T_J=25℃				100	uA
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, T_J=25℃			972		pF
C_{oes}	Output Capacitance				43		
C_{res}	Reverse Transfer Capacitance				12		

Switching Characteristics

$t_{d(on)}$	Turn-on Delay Time	V_{CC}=600V, I_C=10A, R_{Gon}=68Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		71		ns
			T_J=125℃		84		
			T_J=150℃		93		
t_r	Rise Time		T_J=25℃		52		ns
			T_J=125℃		61		
			T_J=150℃		65		
$t_{d(off)}$	Turn-off Delay Time	V_{CC}=600V, I_C=10A, R_{Goff}=68Ω, V_{GE}=±15V, Inductive Load	T_J=25℃		166		ns
			T_J=125℃		172		
			T_J=150℃		172		
t_f	Fall Time		T_J=25℃		382		ns
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			T_J=125℃		2.5		
			T_J=150℃		2.6		
E_{off}	Turn-off Switching Loss	V_{CC}=600V, I_C=10A, R_{Goff}=68Ω, V_{GE}=±15V, du/dt=1532V/μs (T_J=150℃), Inductive Load	T_J=25℃		0.3		mJ
			T_J=125℃		0.6		
			T_J=150℃		0.7		
Q_g	Total Gate Charge	V_{GE}=+15V…-15V	T_J=25℃		340		nC
$R_{g\ internal}$	Internal Gate Resistor		T_J=25℃		0		Ω
I_{SC}	V_{CC}=600V, V_{GE}=±15V, tp=10us, R_{Gon}=68Ω, R_{Goff}=68Ω, T_J=125℃				53		A
$R_{\theta JC}$	Thermal Resistance: Junction-To-Case (per IGBT)					0.95	℃/W

Diode, Brake-Chopper

Maximum Rated Values (T$_C$=25℃ unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	T_J=25℃	1200	V
I_F	Diode Continuous Forward Current	T_C=100℃	10	A
I_{FM}	Repetitive Peak Forward Current	tp=1ms	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℃		1.70		V
			T_J=125℃		1.80		
			T_J=150℃		1.80		
t_{rr}	Reverse Recovery Time	I_F=10A, -diF/dt=208A/μs(T_J=150℃), V_{rr}=600V, V_{GE}=-15V	T_J=25℃		279		ns
			T_J=125℃		305		
			T_J=150℃		392		
I_{rr}	Peak Reverse Recovery Current		T_J=25℃		6.6		A
			T_J=125℃		7.2		
			T_J=150℃		8.4		
Q_{rr}	Reverse Recovery Charge		T_J=25℃		1.05		μC
			T_J=125℃		1.46		
			T_J=150℃		1.91		
E_{rec}	Reverse Recovery Energy		T_J=25℃		0.18		mJ
			T_J=125℃		0.25		
			T_J=150℃		0.43		
$R_{\theta JC}$	Thermal Resistance: Junction-To-Case (per Diode)					1.28	℃/W

Diode, Rectifier
Maximum Rated Values (T$_C$=25℃unless otherwise specified)

V_{RRM}	Repetitive Peak Reverse Voltage	T_J=25℃	1600	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	T_J=80℃	20	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	T_J=80℃	30	A
I_{FSM}	Surge Current @t_p=10ms	T_J=25℃	300	A
		T_J=125℃	250	
I^2t	I^2t - value	T_J=25℃	450	A^2s
		T_J=125℃	312	

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

Symbol	Description	Conditions		Min.	Typ.	Max.	Units
V_F	Forward Voltage	I_F=10A	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)					1.07	℃/W

Internal NTC-Thermistor Characteristics

R_{25}	T_C=25℃	5		kΩ
△R/R	T_C=100℃, R_{100}=465Ω		±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, f=50Hz, 30s	4500			V
Internal Isolation			Al_2O_3			
T_J	Maximum Junction Temperature				175	℃
T_{JOP}	Maximum Operating Junction Temperature Range		-40		+150	℃
T_{stg}	Storage Temperature		-40		+150	℃
CTI	Comparative Tracking Index		200			
$R_{\theta CS}$	Case-To-Sink Thermally (Conductive Grease Applied)				0.08	℃/W
M	Mounting Screw:M4		1.5		1.8	N·m
G	Weight			23		g

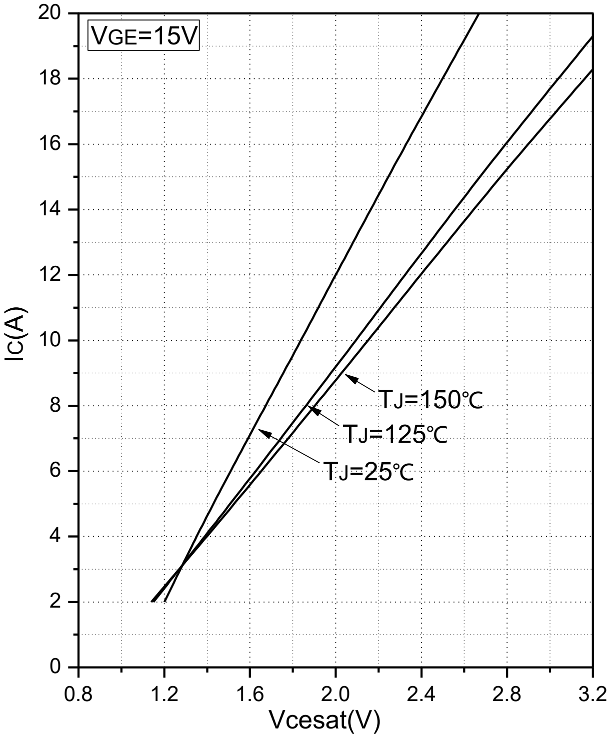


Fig.1 Typical Saturation Voltage Characteristics

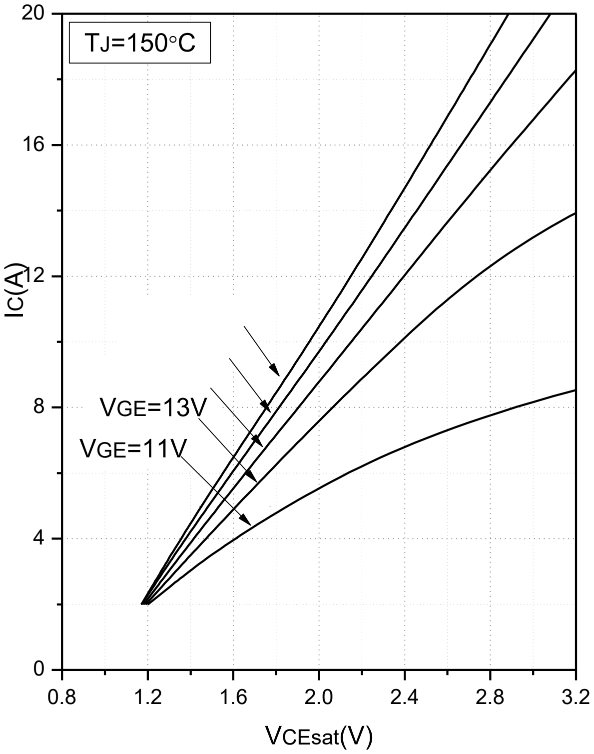


Fig.2 Typical Output Characteristics

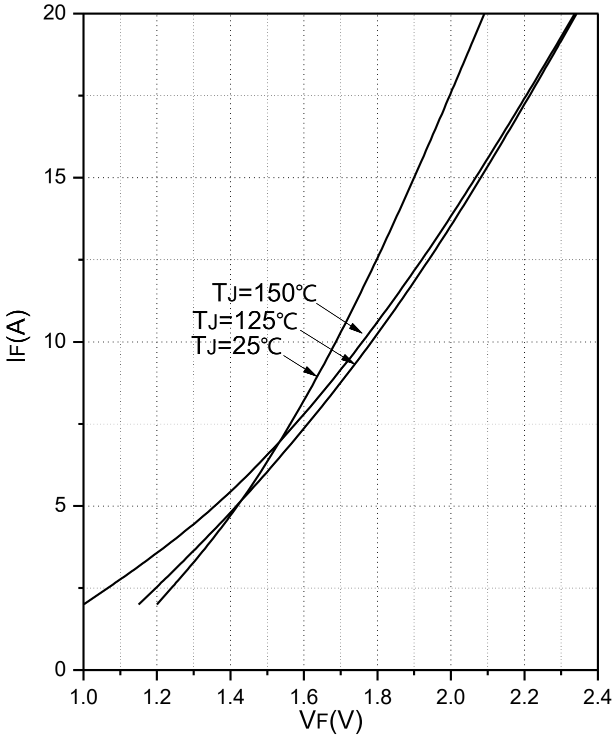


Fig.3 Forward Characteristics of Diode (Inverter)

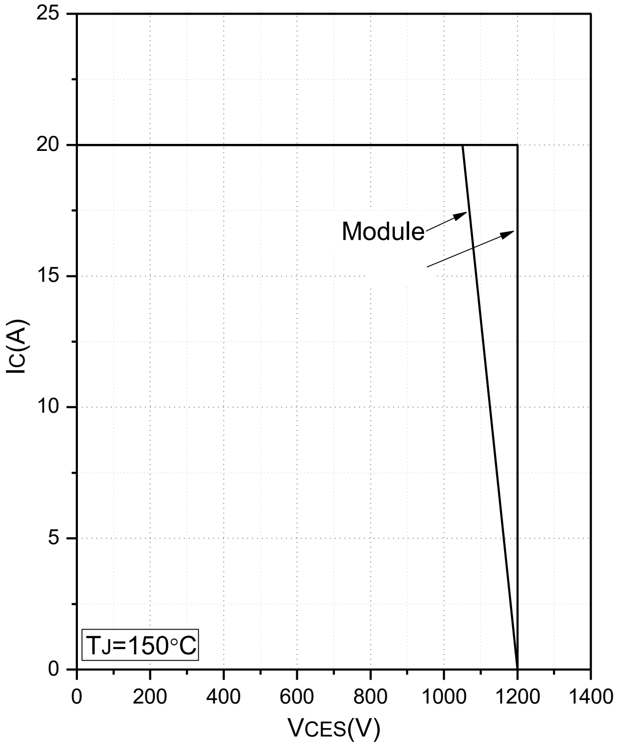


Fig.4 Reverse Bias Safe Operation Area (RBSOA) (Inverter)

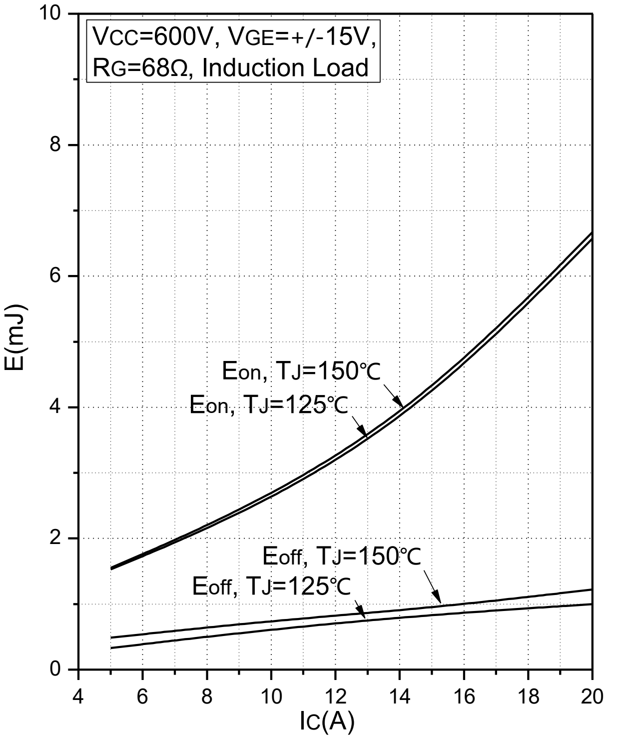


Fig.5 Typical Switching Loss vs. Collector Current (Inverter)

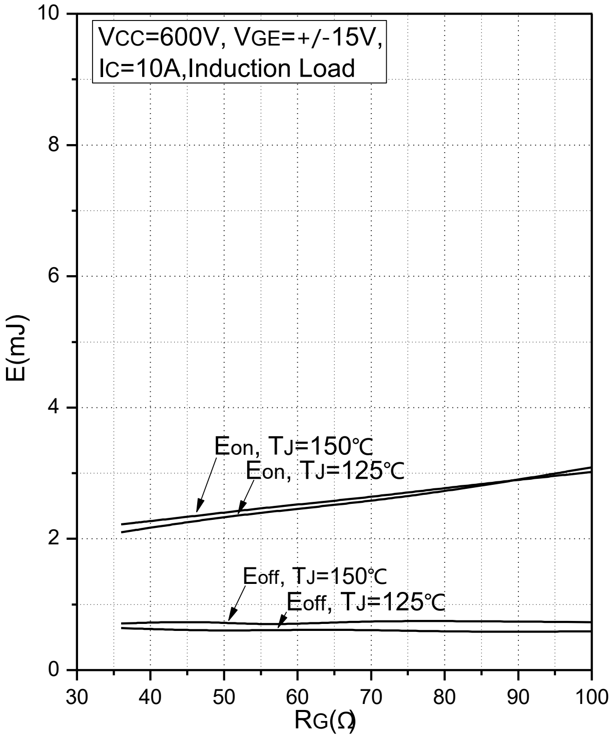


Fig.6 Typical Switching Loss vs. Gate Resistance (Inverter)

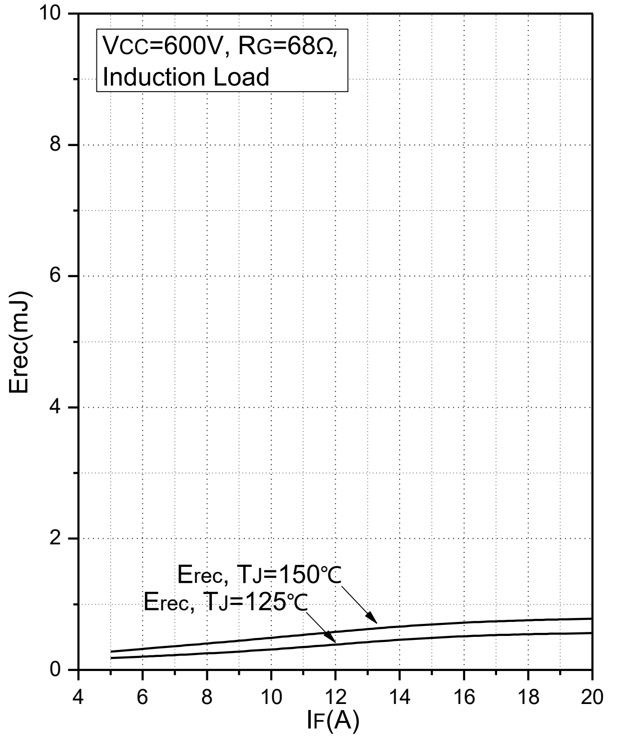


Fig.7 Typical Switching Loss vs. Forward Current (Inverter)

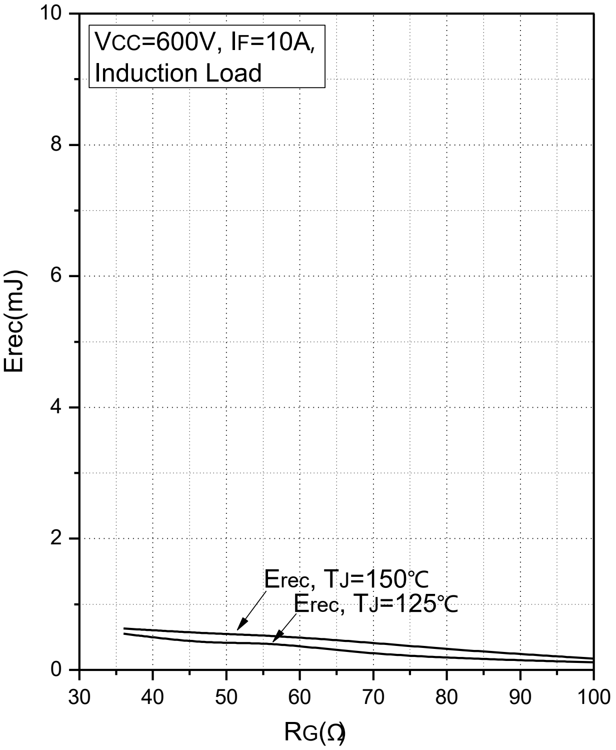


Fig.8 Typical Switching Loss vs. Gate Resistance (Inverter)

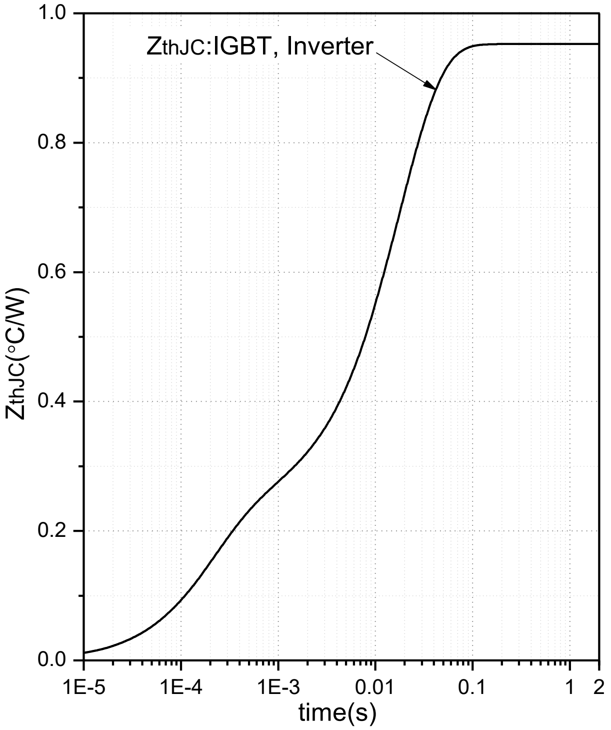


Fig.9 Transient Thermal Impedance (Inverter-IGBT)

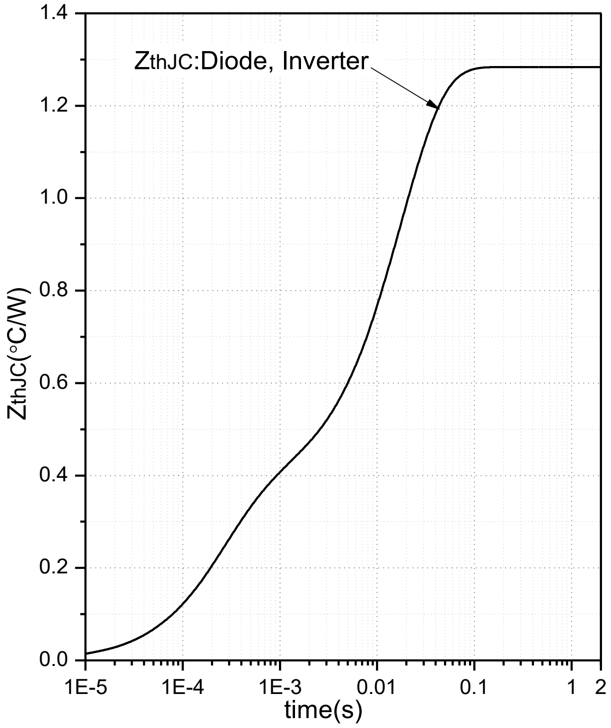
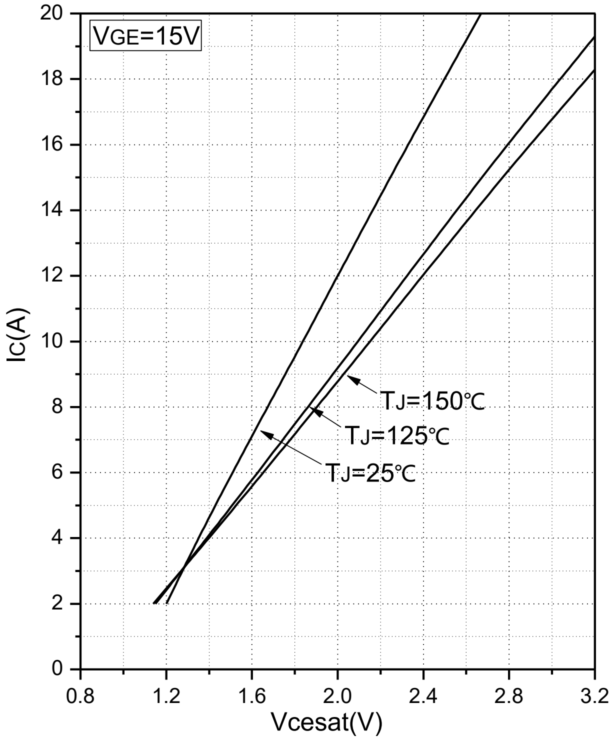


Fig.10 Transient Thermal Impedance (Inverter-Diode)



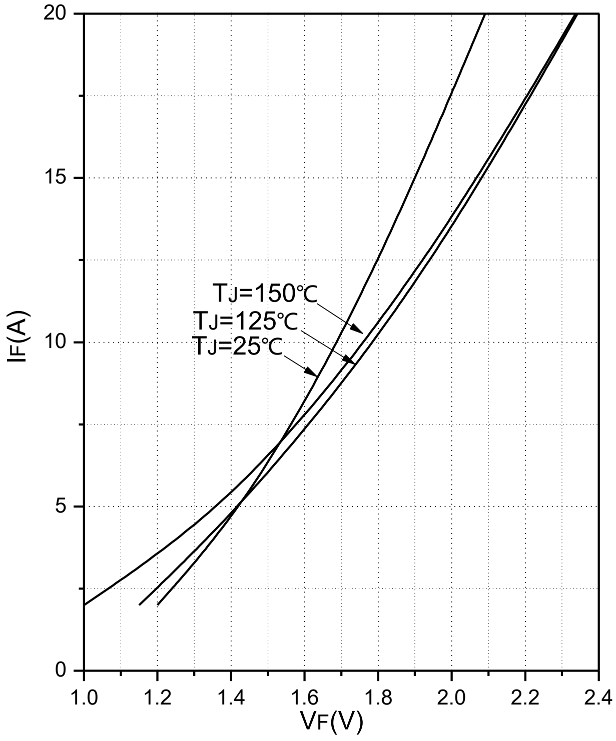


Fig.11 Typical Saturation Voltage Characteristics (Brake-Chopper) Fig.12 Forward Characteristics of Diode (Brake-Chopper)

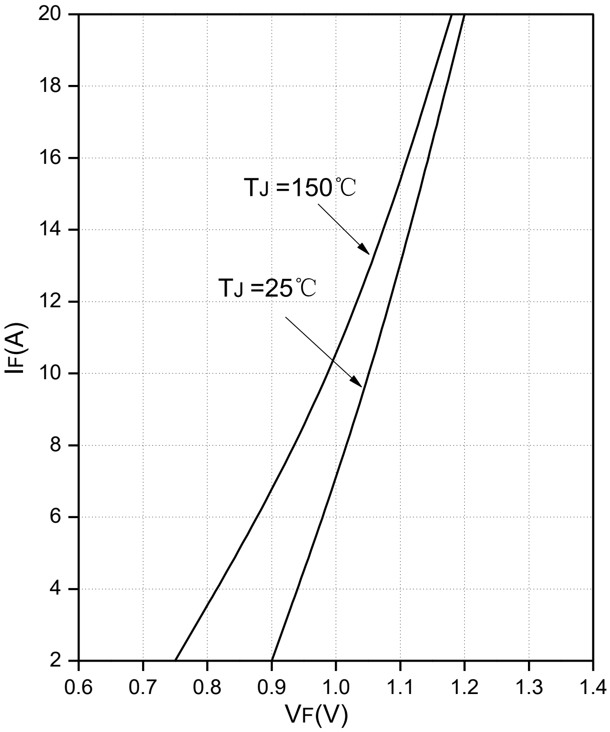


Fig.13 Forward Characteristics of Diode (Rectifier)

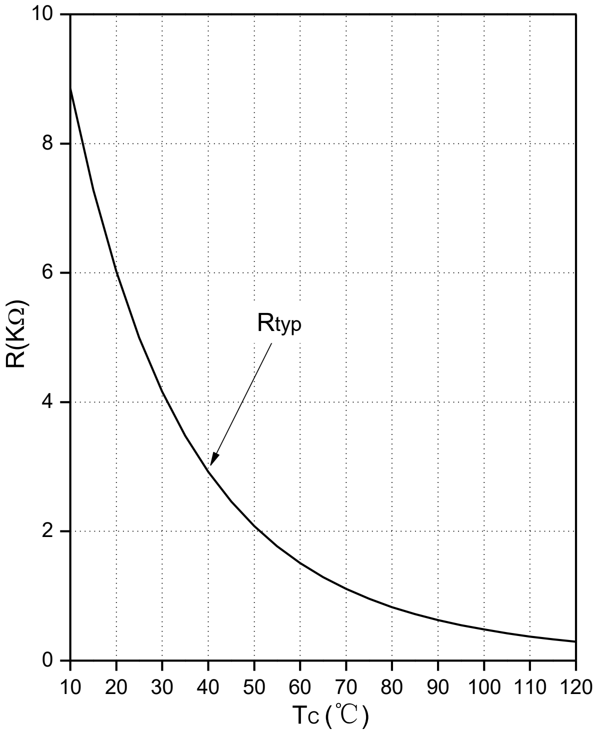
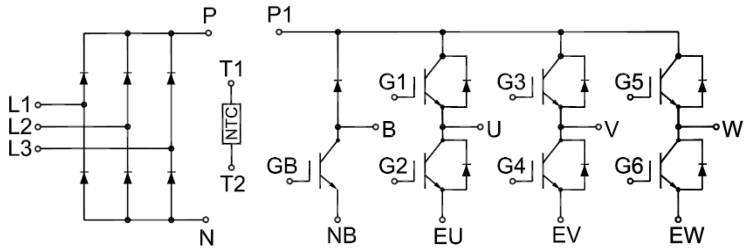
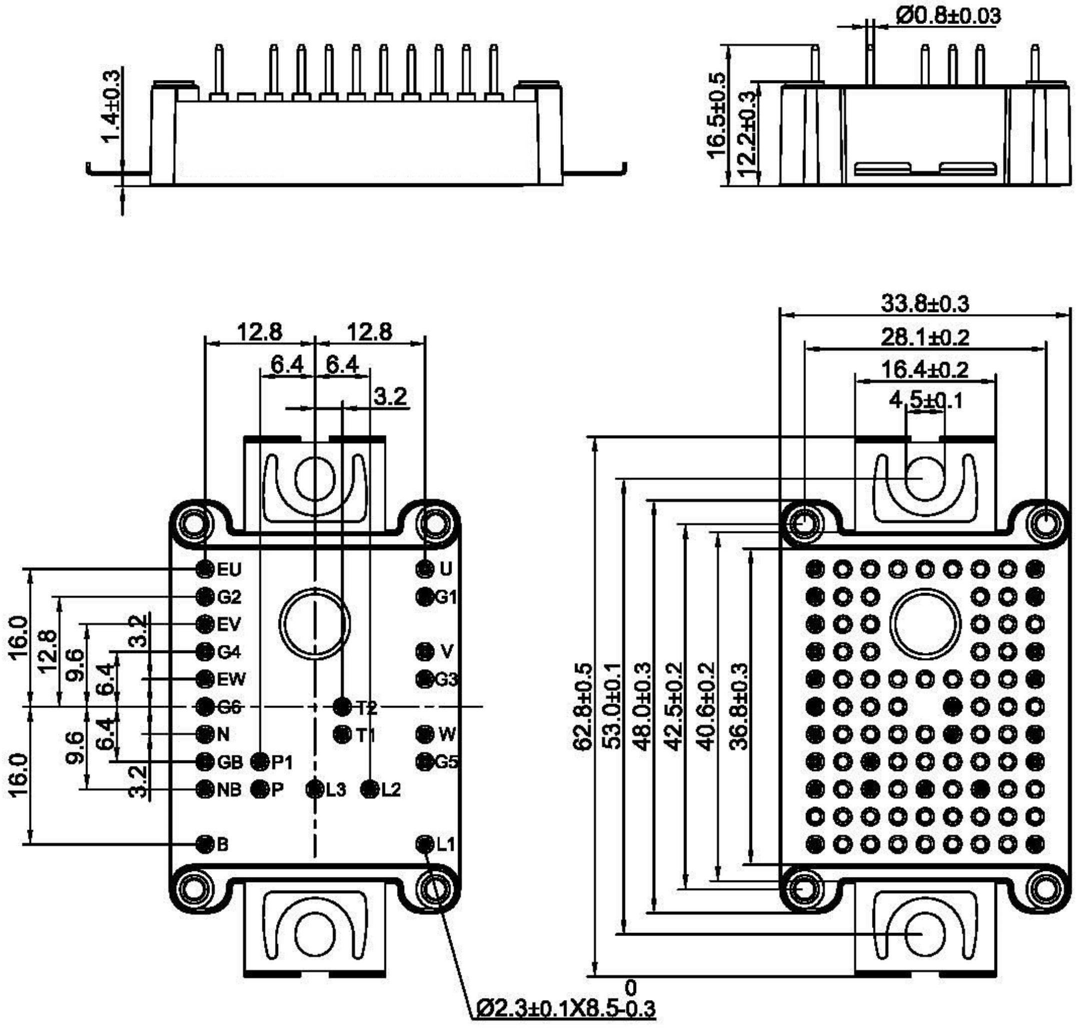


Fig.14 NTC Temperature Characteristics

Internal Circuit:



Package Outline (Unit: mm):



Pinpositions with tolerance of ⌖ Ø 0.4