

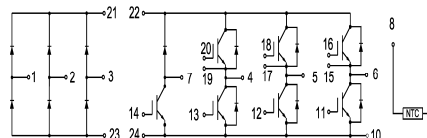
SYMTS25PI120T5H

IGBT Module



Features:

- Field Stop Trench Gate IGBT
- Short Circuit Rated $>10\mu\text{s}$
- Low Saturation Voltage
- Low Switching Loss
- 100% RBSOA Tested ($2\times I_c$)
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement



Applications:

- Industrial Inverters
- Servo Applications

IGBT, Inverter

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

V_{CES}	Collector-Emitter Blocking Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_c=80^\circ\text{C}$	25	A
		$T_c=25^\circ\text{C}$	50	A
I_{CM}	Repetitive Peak Collector Current	$T_J=150^\circ\text{C}$	50	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	$T_c=25^\circ\text{C}$ $T_{Jmax}=150^\circ\text{C}$	195	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	5.7	6.5	V
$V_{CEsat(Terminal)}$	Collector-Emitter Saturation Voltage	$I_C=25\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^{\circ}\text{C}$	1.70		V
			$T_J=125^{\circ}\text{C}$	2.10		V
			$T_J=150^{\circ}\text{C}$	2.20		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	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		2.23		nF
C_{oes}	Output Capacitance			0.36		nF
C_{res}	Reverse Transfer Capacitance			0.07		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	$T_J=25^{\circ}C$		107		ns
			$T_J=125^{\circ}C$		104		
			$T_J=150^{\circ}C$		103		
t_r	Rise Time		$T_J=25^{\circ}C$		22		ns
			$T_J=125^{\circ}C$		22		
			$T_J=150^{\circ}C$		23		
$t_{d(off)}$	Turn-off Delay Time	$V_{CC} = 600V, I_C = 25A,$ $R_{Goff} = 15\Omega, V_{GE} = \pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		195		ns
			$T_J=125^{\circ}C$		206		
			$T_J=150^{\circ}C$		209		
t_f	Fall Time		$T_J=25^{\circ}C$		194		ns
			$T_J=125^{\circ}C$		237		
			$T_J=150^{\circ}C$		249		
E_{on}	Turn-on Switching Loss	$V_{CC} = 600V, I_C = 25A,$ $R_{Gon} = 15\Omega, V_{GE} = \pm 15V,$ $di/dt=889A/\mu s$ ($T_J=150^{\circ}C$) Inductive Load	$T_J=25^{\circ}C$		1.59		mJ
			$T_J=125^{\circ}C$		2.04		
			$T_J=150^{\circ}C$		2.19		
E_{off}	Turn-off Switching Loss	$V_{CC} = 600V, I_C = 25A,$ $R_{Goff} = 15\Omega, V_{GE} = \pm 15V,$ $du/dt=1451V/\mu s$ ($T_J=150^{\circ}C$) Inductive Load	$T_J=25^{\circ}C$		0.56		mJ
			$T_J=125^{\circ}C$		0.83		
			$T_J=150^{\circ}C$		0.97		

Q_g	Total Gate Charge	$V_{GE}=+15V \dots -15V$		512		nC
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			
I_{sc}	SC Data	$V_{CC}=600V \text{ tp}=10\mu s \text{ } V_{GE}=\pm 15V, R_G=51\Omega, T_J=25^\circ C$		188		A
$R_{\theta JC}$	IGBT Thermal Resistance: Junction-To-Case(per leg)			0.64		$^\circ C/W$

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	25	A
I_{FM}	Diode Maximum Forward Current	50	A

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

Symbol	Description	Conditions		Min	Typ	Max	Unit
$V_{FM(terminal)}$	Forward Voltage	$I_F=25A$	$T_J=25^{\circ}C$		1.70		V
			$T_J=125^{\circ}C$		1.80		
			$T_J=150^{\circ}C$		1.70		
t_{rr}	Reverse Recovery Time	$I_F=25A,$ $-diF/dt=1090A/\mu s(T_J=150^{\circ}C)$ $V_R= 600V,$ $V_{GE} = -15V$	$T_J=25^{\circ}C$		242		ns
			$T_J=125^{\circ}C$		261		
			$T_J=150^{\circ}C$		265		
I_{rr}	Peak Reverse Recovery Current		$T_J=25^{\circ}C$		29.4		A
			$T_J=125^{\circ}C$		35.3		
			$T_J=150^{\circ}C$		37.2		
Q_{rr}	Reverse Recovery Charge		$T_J=25^{\circ}C$		2.85		μC
			$T_J=125^{\circ}C$		3.97		
			$T_J=150^{\circ}C$		4.32		
E_{rec}	Reverse Recovery Energy		$T_J=25^{\circ}C$		0.93		mJ
			$T_J=125^{\circ}C$		1.81		
			$T_J=150^{\circ}C$		2.19		
$R_{\theta JC}$	Diode Thermal Resistance: Junction-To-Case (per leg)				0.80		$^{\circ}C/W$

IGBT, Brake-Chopper

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

V_{CES}	Collector-Emitter Blocking Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Continuous Collector Current	$T_C=80^{\circ}\text{C}$	15	A
		$T_C=25^{\circ}\text{C}$	30	A
I_{CM}	Repetitive Peak Collector Current	$T_J=150^{\circ}\text{C}$	30	A
t_{SC}	Short Circuit Withstand Time		>10	μs
P_D	Maximum Power Dissipation per IGBT	$T_C=25^{\circ}\text{C}$ $T_{Jmax}=150^{\circ}\text{C}$	160	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	5.7	6.5	V
$V_{CESat(Terminal)}$	Collector-Emitter Saturation Voltage	$I_C=15\text{A}$, $V_{GE}=15\text{V}$	$T_J=25^{\circ}\text{C}$	1.60		V
			$T_J=125^{\circ}\text{C}$	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	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		1.67		nF
C_{oes}	Output Capacitance			0.26		nF
C_{res}	Reverse Transfer Capacitance			0.05		nF

Switching Characteristics

Switching Characteristics							
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 600V, I_C = 15A,$ $R_{Gon} = 20\Omega, V_{GE} = \pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		105		ns
			$T_J=125^{\circ}C$		96		
t_r	Rise Time		$T_J=25^{\circ}C$		26		ns
			$T_J=125^{\circ}C$		24		
$t_{d(off)}$	Turn-off Delay Time	$V_{CC} = 600V, I_C = 15A,$ $R_{Goff} = 20\Omega, V_{GE} = \pm 15V,$ Inductive Load	$T_J=25^{\circ}C$		192		ns
			$T_J=125^{\circ}C$		201		
t_f	Fall Time		$T_J=25^{\circ}C$		234		ns
			$T_J=125^{\circ}C$		260		

E _{on}	Turn-on Switching Loss	V _{CC} = 600V,I _C =15A, R _{Gon} = 20Ω,V _{GE} = ±15V, di/dt=498A/μs (T _J =125℃) Inductive Load	T _J =25℃		1.17		mJ
			T _J =125℃		1.31		
E _{off}	Turn-off Switching Loss	V _{CC} = 600V,I _C =15A, R _{Goff} = 20Ω,V _{GE} = ±15V, du/dt=2314V/μs (T _J =125℃) Inductive Load	T _J =25℃		0.29		mJ
			T _J =125℃		0.32		
Q _g	Total Gate Charge	V _{GE} =+15V...-15V			454		nC
RBSOA	I _C =30A,V _{CC} =1050V,V _p =1200V, R _{Goff} = 20Ω, V _{GE} =+15V to 0V, T _J =150℃			Trapezoid			
SCSOA	V _{CC} =600V, V _{GE} =15V, T _J =150℃			10			μs
R _{θJC}	IGBT Thermal Resistance: Junction-To-Case(per leg)				0.78		℃/W

Diode, Brake-Chopper

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

Symbol	Description	Conditions		Min	Typ	Max	Unit	
V _{FM(Terminal)}	Forward Voltage	I _F =15A	T _J =25°C		1.60		V	
			T _J =125°C		1.70			
t _{rr}	Reverse Recovery Time	I _F =15A, -diF/dt=488A/μs(T _J =125°C) V _R = 600V, V _{GE} = -15V	T _J =25°C		241		ns	
			T _J =125°C		261			
I _{rr}	Peak Reverse Recovery Current		T _J =25°C		21.9		A	
			T _J =125°C		24.7			
Q _{rr}	Reverse Recovery Charge		T _J =25°C		1.82		μC	
			T _J =125°C		2.37			
E _{rec}	Reverse Recovery Energy		I _F =15A, -diF/dt=488A/μs(T _J =125°C) V _R = 600V, V _{GE} = -15V	T _J =25°C		0.74		mJ
				T _J =125°C		1.28		
R _{θJC}	Diode Thermal Resistance: Junction-To-Case (per leg)				1.28		°C/W	

Diode, Rectifier

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

V_{RRM}	Repetitive Peak Reverse Voltage	$T_J = 25^{\circ}\text{C}$	1800	V
I_{FRMSM}	Maximum RMS Forward Current per Chip	$T_J = 80^{\circ}\text{C}$	35	A
I_{RMSM}	Maximum RMS Current at Rectifier Output	$T_J = 80^{\circ}\text{C}$	45	A
I_{FSM}	Surge Current @ $t_p=10$ ms	$T_J = 25^{\circ}\text{C}$	280	A
		$T_J = 150^{\circ}\text{C}$	250	
I^2t	I^2t - value	$T_J = 25^{\circ}\text{C}$	500	A^2s
		$T_J = 150^{\circ}\text{C}$	370	

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

V_F	Forward Voltage	$I_F = 25\text{A}$	$T_J = 25^{\circ}\text{C}$		1.10		V
			$T_J = 125^{\circ}\text{C}$		1.00		
			$T_J = 150^{\circ}\text{C}$		1.00		
I_R	Reverse Current	$V_R = 1600\text{V}$	$T_J = 25^{\circ}\text{C}$			1	mA
$R_{\theta JC}$	Junction-To-Case Diode				0.90		$^{\circ}\text{C/W}$

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		Min	Typ	Max	Unit
V _{iso}	Isolation Voltage (All Terminals Shorted)	f = 50Hz, 1minute	2500			V
L _{sCE}	Stray Inductance Module			60		nH
T _J	Maximum Junction Temperature				150	°C
T _{JOP}	Maximum Operating Junction Temperature Range		-40		+150	°C
T _{stg}	Storage Temperature		-40		+125	°C
CTI	Comparative Tracking Index		200			
R _{θCS}	Case-To-Sink Thermally (Conductive Grease Applied)			0.1		°C/W
T	Power Terminals Screw:M6		3.0		5.0	N·m
T	Mounting Screw:M5		3.0		5.0	N·m
G	Weight			200		g

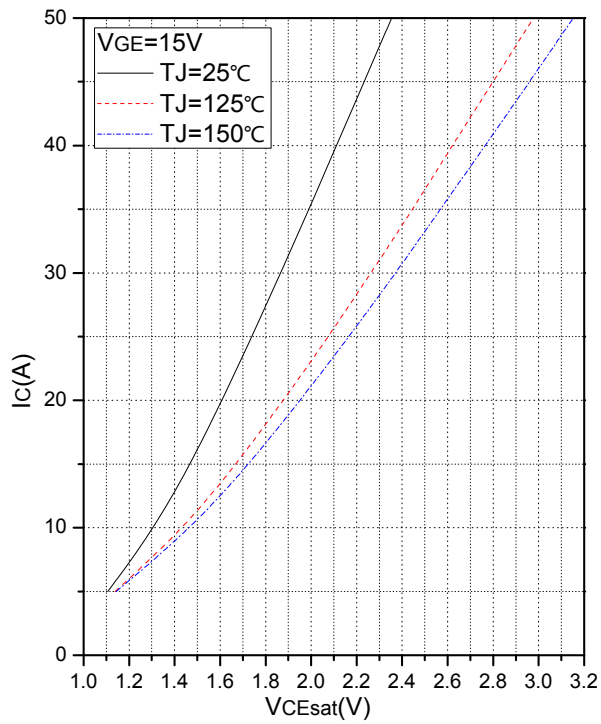


Fig.1 Typical Saturation Voltage Characteristics

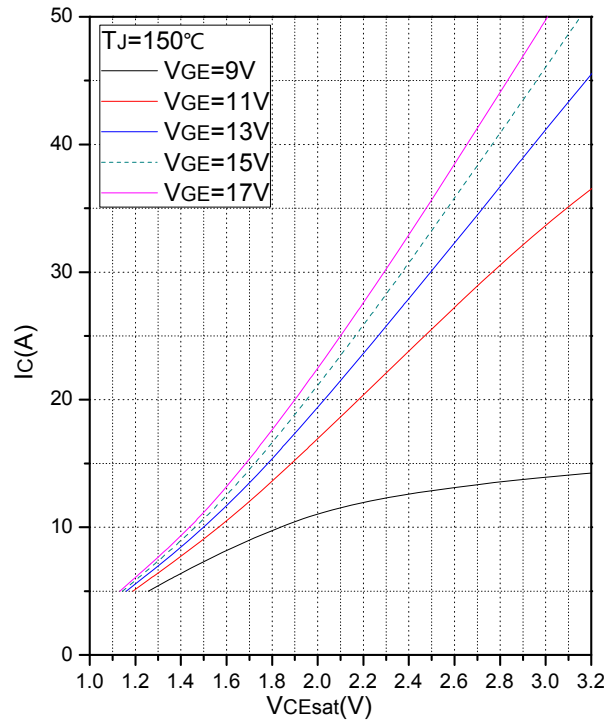


Fig.2 Typical Output Characteristics

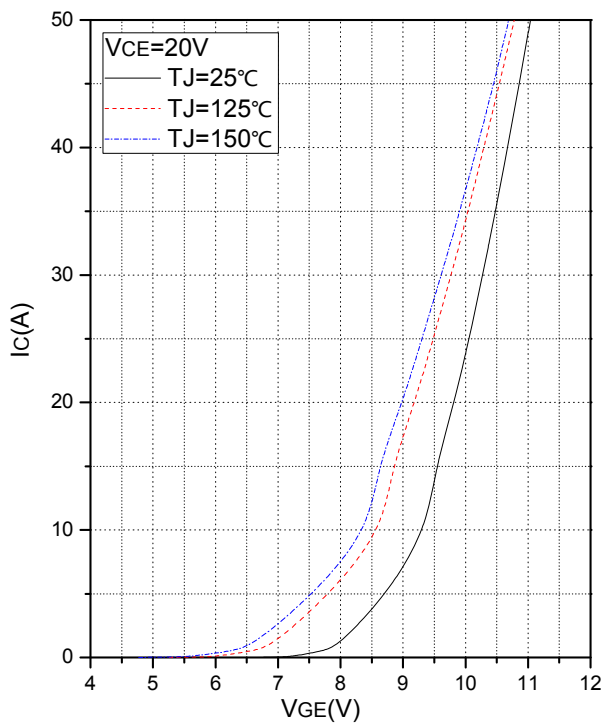


Fig.3 Transfer Characteristic

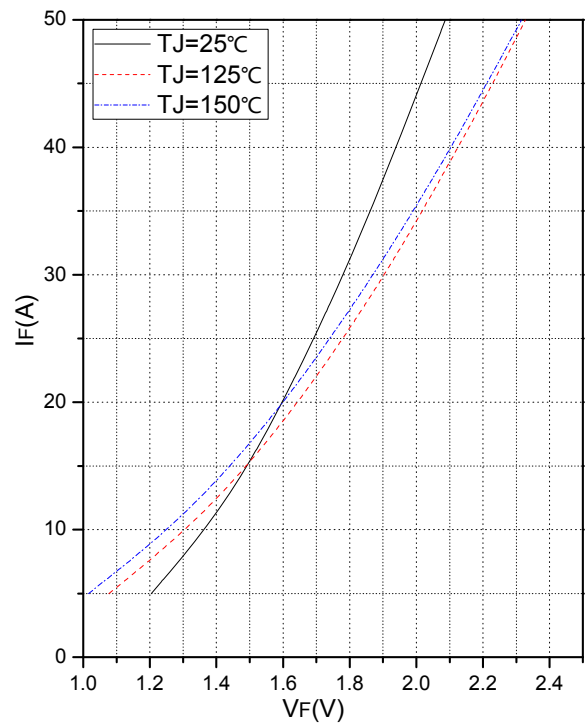


Fig.4 Forward Characteristics of FWD

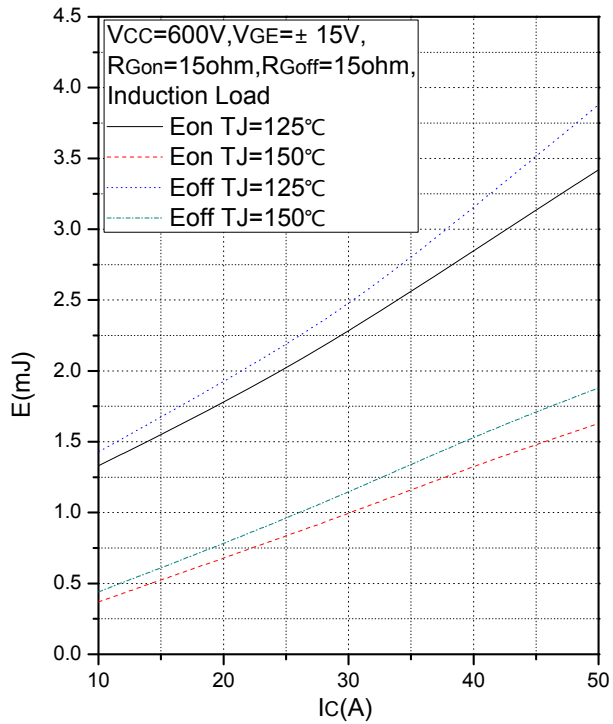


Fig.5 Typical Switching Loss vs. Collector Current

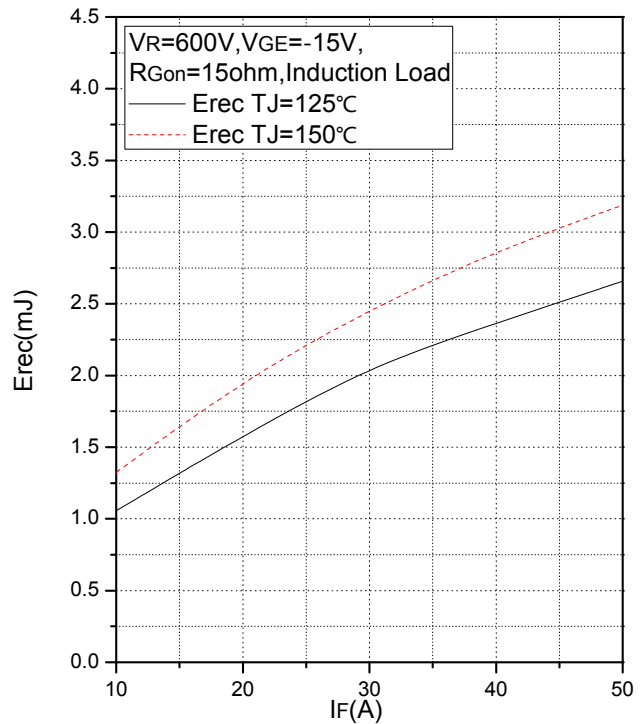


Fig.6 Typical Switching Loss vs. Forward Current

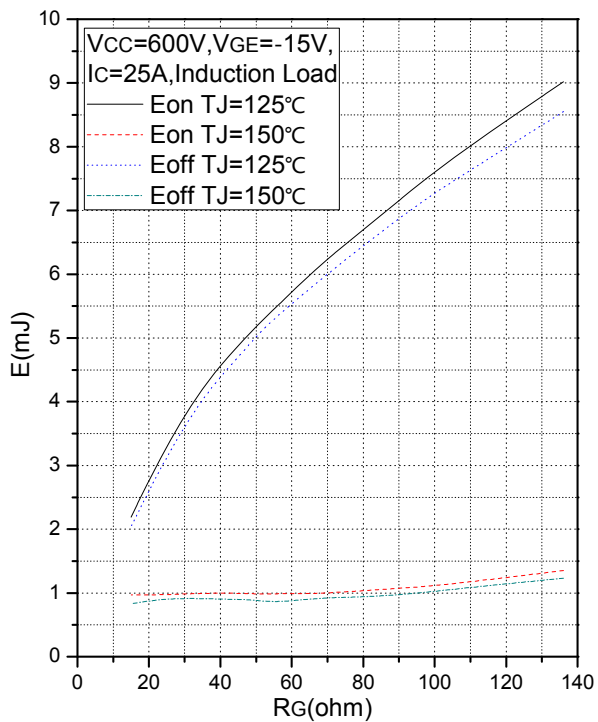


Fig.7 Typical Switching Loss vs. Gate Resistance

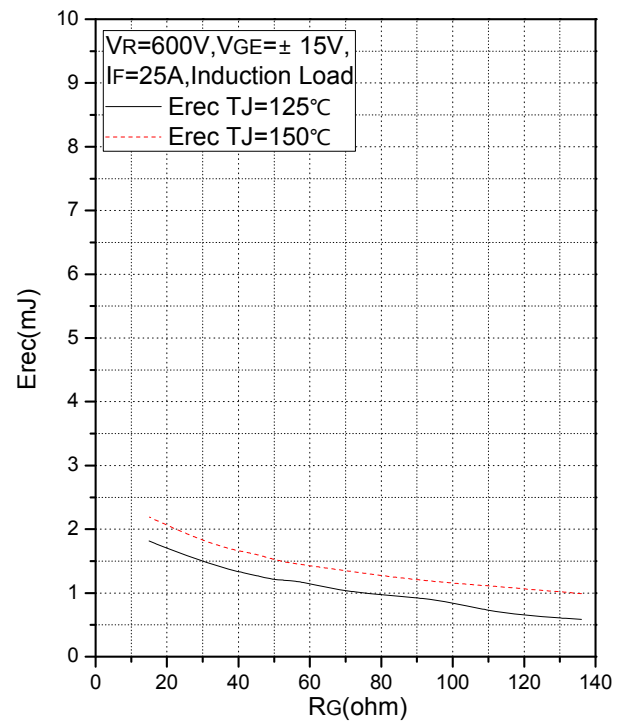


Fig.8 Typical Switching Loss vs. Gate Resistance

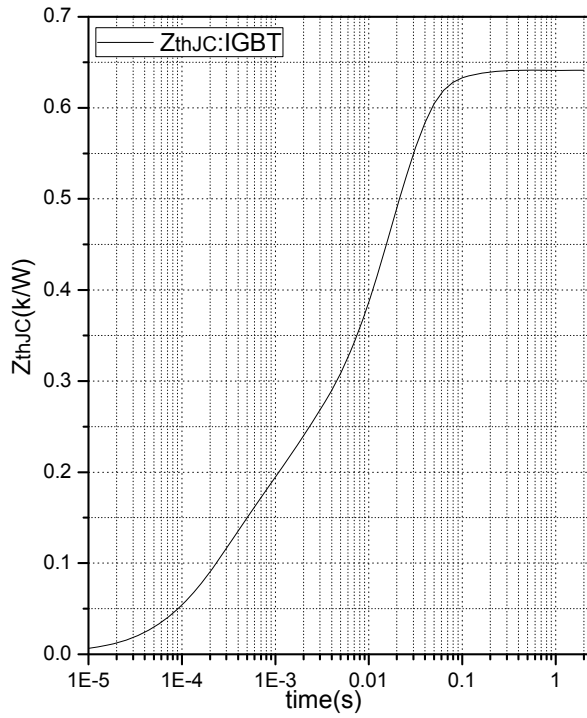


Fig.9 Transient Thermal Impedance (IGBT)

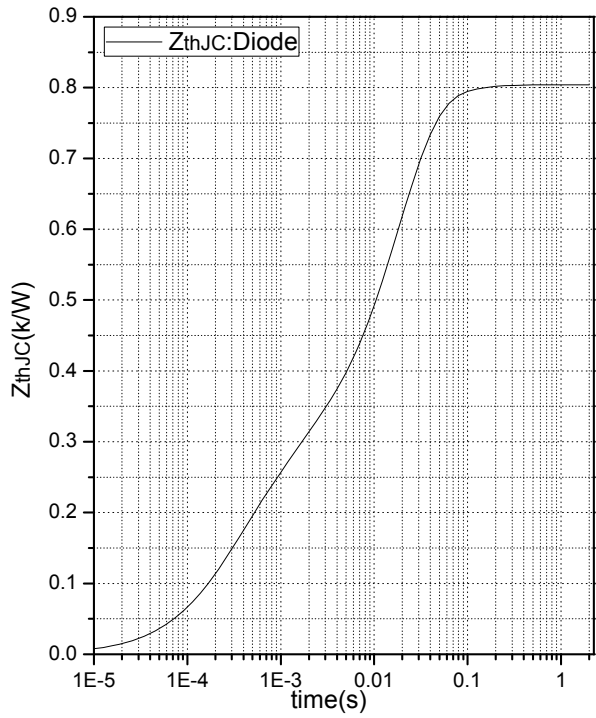


Fig.10 Transient Thermal Impedance (Diode)

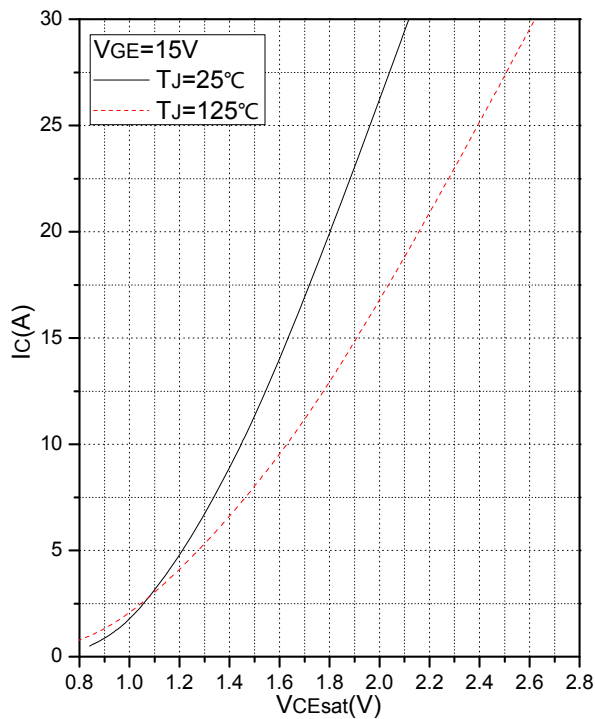


Fig.11 Typical Saturation Voltage Characteristics (Brake-Chopper)

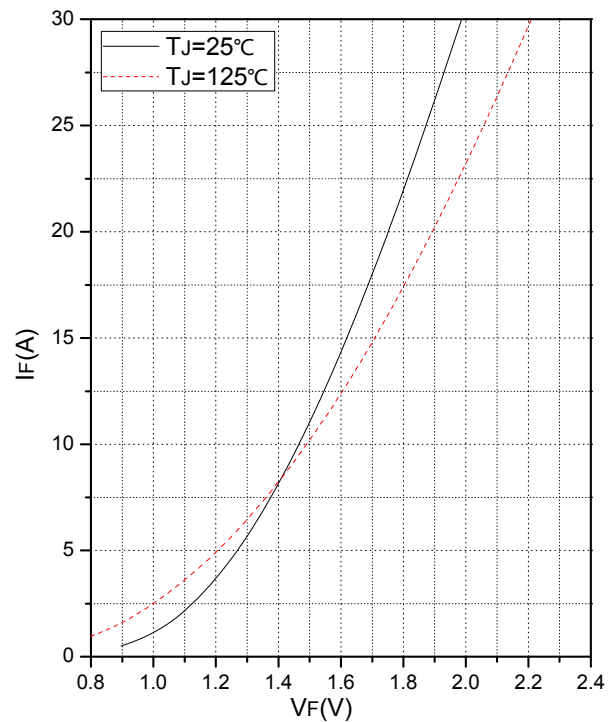


Fig.12 Forward Characteristics of Diode (Brake-Chopper)

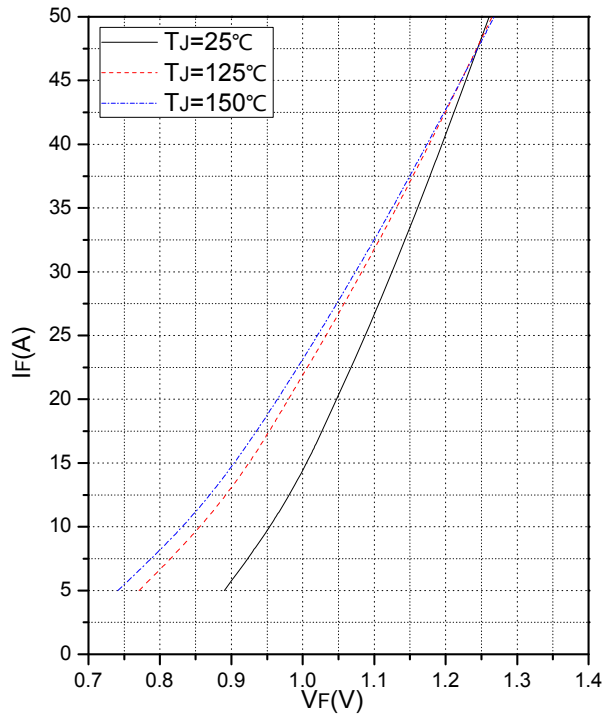


Fig.13 Forward Characteristics of Diode (Rectifier)

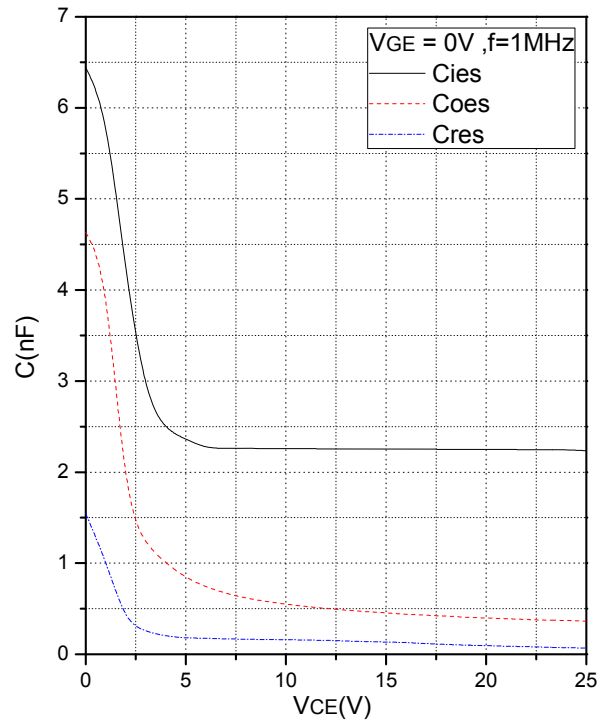


Fig.14 Capacitance Characteristics

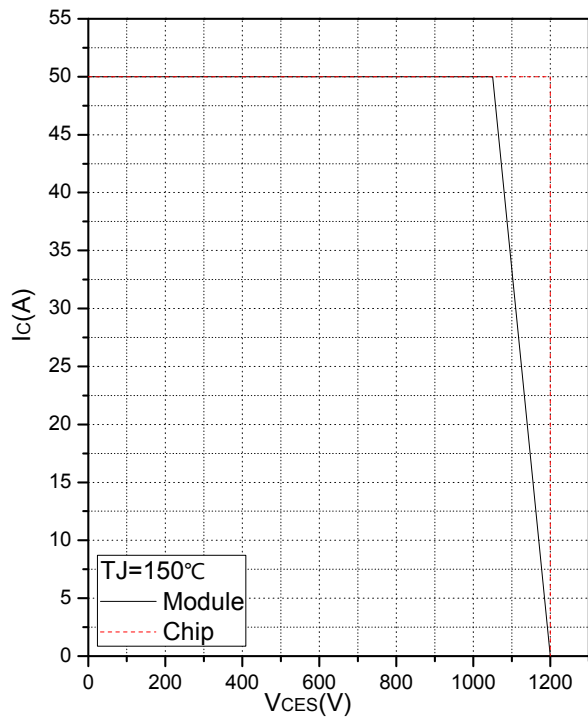


Fig.15 Reverse Bias Safe Operation Area (RBSOA)

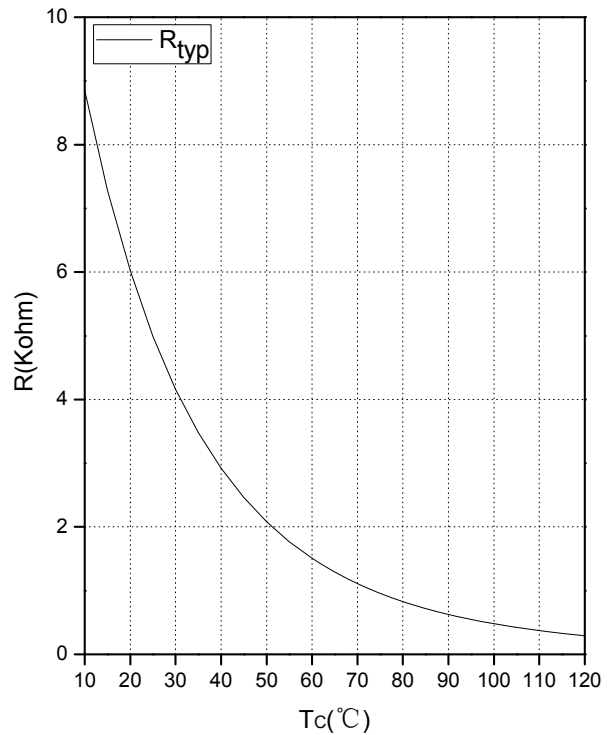
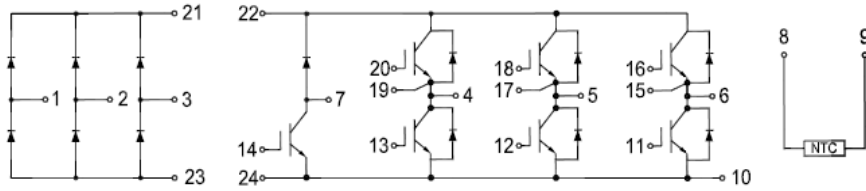


Fig.16 NTC Temperature Characteristics

Internal Circuit



Package Outline (Unit: mm):

