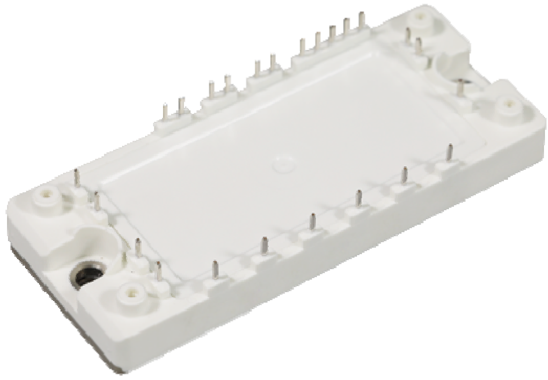
GK50PI60T5H

IGBT 模块/IGBT Module

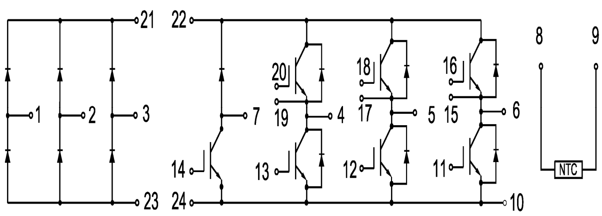


特性：

- 短路承受时间 >10μs
- 低开关损耗
- 低饱和压降: $V_{CE\,(sat)}$ = 1.80V @ I_C = 50A ,T_C=25℃
- 100% RBSOA 测试 （2 倍额定电流）
- 低杂散电感
- 无铅模块，符合 RoHS 要求

Features：

- Short Circuit Rated >10μs
- Low Saturation Voltage: $V_{CE\,(sat)}$ = 1.80V @ I_C = 50A ,T_C=25℃
- Low Switching Loss
- 100% RBSOA Tested（2×Ic）
- Low Stray Inductance
- Lead Free, Compliant with RoHS Requirement



应用：

- 工业变频器
- 伺服应用

Applications：

- Industrial Inverters
- Servo Applications

IGBT, 逆变器 / IGBT,Inverter
最大额定值 / Maximum Rated Values

V_{CES}	集电极-发射极电压 Collector-Emitter Blocking Voltage		600	V
V_{GES}	门极一发射极电压 Gate-Emitter Voltage		±20	V
I_C	集电极直流电流 Continuous Collector Current	T_C = 80℃,	50	A
		T_C = 25℃	100	A
$I_{CM(1)}$	集电极脉冲电流 Peak Collector Current Repetitive	T_J = 150℃	100	A
t_{SC}	短路承受时间 Short Circuit Withstand Time		>10	μs
P_D	单 IGBT 最大耗散功率 Maximum Power Dissipation (IGBT)	T_C = 25℃ T_{Jmax}=150℃	250	W

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IGBT的电气特性Electrical Characteristics of IGBT (T_J = 25℃)

静态特性/ Static characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{GE(th)}$	门极－发射极阈值电压 Gate-Emitter Threshold Voltage	I_C = 1 mA, V_{CE} = V_{GE}		3.0	4.5	5.0	V
$V_{CE(sat)}$	集电极－发射极饱和电压 Collector-Emitter Saturation Voltage	I_C = 50 A, V_{GE} = 15V	T_J = 25℃		1.80	2.10	V
			T_J = 125℃		2.00		V
I_{CES}	集电极－发射极漏电流 Collector-Emitter Leakage Current	V_{GE} = 0V, V_{CE} = V_{CES}, T_J = 25℃				1	mA
I_{GES}	门极－发射极漏电流 Gate-Emitter Leakage Current	V_{GE} = ±20V, V_{CE} = 0V, T_J = 25℃				200	nA
C_{ies}	输入电容 Input Capacitance	V_{CE} = 25V, V_{GE} = 0V , f = 1MHz			3.0		nF
C_{oes}	输出电容 Output Capacitance				0.35		nF

开关特性/Switching Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$t_{d(on)}$	开通延迟时间 Turn-on Delay Time	V_{CC} = 300V,I_C = 50A, R_G = 30 Ω,V_{GE} = ±15V, 感性负载 Inductive Load	T_J = 25℃		110		ns
			T_J = 125℃		100		
t_r	上升时间 Rise Time		T_J = 25℃		75		ns
			T_J = 125℃		80		
$t_{d(off)}$	关断延迟时间 Turn-off Delay Time		T_J = 25℃		220		ns
			T_J = 125℃		240		
t_f	下降时间 Fall Time		T_J = 25℃		90		ns
			T_J = 125℃		110		
E_{on}	开通损耗 Turn-on Switching Loss		T_J = 25℃		0.68		mJ
			T_J = 125℃		0.78		
E_{off}	关断损耗 Turn-off Switching Loss		T_J = 25℃		0.75		mJ
			T_J = 125℃		0.92		
Q_g	门极充电电量 Total Gate Charge		T_J = 25℃		260		nC
RBSOA	安全工作区 RBSOA	I_C=100A,V_{CC}=480V,Vp=600V, Rg = 15Ω, V_{GE}=+15V to 0V, T_J =150°C			梯形 Trapezoid		
SCSOA	短路安全工作区 SCSOA	V_{CC} = 300V, V_{GE} = 15V, T_J = 150℃		10			μs
$R_{\theta JC}$	单 IGBT 芯片与外壳间热阻 Junction-To-Case (IGBT)				0.506		℃/W

二极管,逆变器 / Diode, Inverter

最大额定值 / Maximum Rated Values

V_{RRM}	反向重复峰值电压 Repetitive peak reverse voltage	600	V
I_F	二极管正向直流电流 Diode Continuous Forward Current	50	A
I_{FM}	二极管正向脉冲电流 Peak FWD Current Repetitive	100	A

二极管的电气特性/Electrical Characteristics of FWD

V_{FM}	正向压降 Forward Voltage	I_F = 50 A , V_{GE} = 0V	T_J = 25℃		1.40	1.60	V
			T_J = 125℃		1.40		
I_{rr}	反向恢复峰值电流 Peak Reverse Recovery Current	I_F = 50A, di/dt =840A/μs, V_{rr} = 300V, V_{GE} = -15V	T_J = 25℃		30		A
			T_J = 125℃		40		
Q_{rr}	反向恢复充电电量 Reverse Recovery Charge		T_J = 25℃		2.4		μC
			T_J = 125℃		3.6		
E_{rec}	反向恢复损耗（每脉冲） Reverse Recovery Energy		T_J = 25℃		0.25		mJ
			T_J = 125℃		0.70		
$R_{\theta JC}$	二极管芯片与外壳间热阻 Junction-To-Case Diode				1.196		℃/W

IGBT, 制动-斩波器 / IGBT, Brake-Chopper

最大额定值 / Maximum Rated Values

V_{CES}	集电极-发射极电压 Collector-Emitter Blocking Voltage		600	V
V_{GES}	门极一发射极电压 Gate-Emitter Voltage		±20	V
I_C	集电极直流电流 Continuous Collector Current	T_C = 80℃,	30	A
		T_C = 25℃	60	A
$I_{CM(1)}$	集电极脉冲电流 Peak Collector Current Repetitive	T_J = 150℃	60	A
t_{SC}	短路承受时间 Short Circuit Withstand Time		>10	μs
P_D	单 IGBT 最大耗散功率 Maximum Power Dissipation (IGBT)	T_C = 25℃ T_{Jmax}=150℃	190	W

IGBT的电气特性Electrical Characteristics of IGBT (T_J = 25℃)

静态特性/ Static characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{GE(th)}$	门极－发射极阈值电压 Gate-Emitter Threshold Voltage	I_C = 1 mA, V_{CE} = V_{GE}		3.0	4.5	5.0	V
$V_{CE(sat)}$	集电极－发射极饱和电压 Collector-Emitter Saturation Voltage	I_C = 30 A, V_{GE} = 15V	T_J = 25℃		1.80	2.10	V
			T_J = 125℃		2.00		V
I_{CES}	集电极－发射极漏电流 Collector-Emitter Leakage Current	V_{GE} = 0V, V_{CE} = V_{CES}, T_J = 25℃				1	mA
I_{GES}	门极－发射极漏电流 Gate-Emitter Leakage Current	V_{GE} = ±20V, V_{CE} = 0V, T_J = 25℃				200	nA
C_{ies}	输入电容 Input Capacitance	V_{CE} = 25V, V_{GE} = 0V , f = 1MHz			1.90		nF
C_{oes}	输出电容 Output Capacitance				0.25		nF

开关特性/Switching Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$t_{d(on)}$	开通延迟时间 Turn-on Delay Time	V_{CC} = 300V,I_C = 30A, R_G =20 Ω,V_{GE} = ±15V, 感性负载 Inductive Load	T_J = 25℃		65		ns
			T_J = 125℃		60		
t_r	上升时间 Rise Time		T_J = 25℃		50		ns
			T_J = 125℃		50		
$t_{d(off)}$	关断延迟时间 Turn-off Delay Time		T_J = 25℃		120		ns
			T_J = 125℃		130		
t_f	下降时间 Fall Time		T_J = 25℃		100		ns
			T_J = 125℃		140		
E_{on}	开通损耗 Turn-on Switching Loss		T_J = 25℃		0.25		mJ
			T_J = 125℃		0.38		
E_{off}	关断损耗 Turn-off Switching Loss		T_J = 25℃		0.28		mJ
			T_J = 125℃		0.44		
Q_g	门极充电电量 Total Gate Charge		T_J = 25℃		150		nC
RBSOA	安全工作区 RBSOA	I_C=60A,V_{CC}=480V,Vp=600V, Rg = 15Ω, V_{GE}=+15V to 0V, T_J =150°C			梯形 Trapezoid		
SCSOA	短路安全工作区 SCSOA	V_{CC} = 300V, V_{GE} = 15V, T_J = 150℃		10			μs
$R_{θJC}$	单 IGBT 芯片与外壳间热阻 Junction-To-Case (IGBT)				0.667		℃/W

二极管，制动-斩波器 / Diode, Brake-Chopper

最大额定值 / Maximum Rated Values

V_{RRM}	反向重复峰值电压 Repetitive peak reverse voltage	600	V
I_F	二极管正向直流电流 Diode Continuous Forward Current	30	A
I_{FM}	二极管正向脉冲电流 Peak FWD Current Repetitive	60	A

二极管的电气特性/Electrical Characteristics of FWD

V_{FM}	正向压降 Forward Voltage	I_F = 30A , V_{GE} = 0V	T_J = 25℃		1.40	1.60	V
			T_J = 125℃		1.40		
I_{rr}	反向恢复峰值电流 Peak Reverse Recovery Current	I_F = 30A, di/dt = 960A/μs, V_{rr} = 300V, V_{GE} = 15V	T_J = 25℃		30		A
			T_J = 125℃		35		
Q_{rr}	反向恢复充电电量 Reverse Recovery Charge		T_J = 25℃		1.5		μC
			T_J = 125℃		2.4		
E_{rec}	反向恢复损耗（每脉冲） Reverse Recovery Energy		T_J = 25℃		0.1		mJ
			T_J = 125℃		0.30		
$R_{\theta JC}$	二极管芯片与外壳间热阻 Junction-To-Case Diode				1.631		℃/W

二极管,整流器 / Diode, Rectifier

V_{RRM}	反向重复峰值电压 Repetitive peak reverse voltage	T_J =25℃	1200	V
I_{FRMSM}	最大正向均方根电流(每芯片) Maximum RMS forward current per chip	T_C =80℃	50	A
I_{RMSM}	最大整流器输出均方根电流 Maximum RMS current at rectifier output	T_C =80℃	60	A
I_{FSM}	正向浪涌电流@t_p=10 ms Surge Current @t_p=10 ms	T_J =25℃	420	A
		T_J =150℃	350	
I^2t	I^2t -值 I^2t - value	T_J =25℃	900	A^2s
		T_J =150℃	650	

二极管的电气特性/Electrical Characteristics of Diode

V_F	正向电压 Forward voltage	I_F = 50 A ,	T_J =25℃	1.2		V
			T_J =150℃	1.1		
$R_{\theta JC}$	二极管芯片与外壳间热阻 Junction-To-Case Diode			0.690		℃/W

负温度系数热敏电阻 / NTC-Thermistor

特征值/Characteristic values

R_{25}	T_C =25℃	5		kΩ
△R/R	T_C =100℃，R_{100} =481Ω		±5	%
P_{25}	T_C =25℃	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

模块 / Module

V_{iso}	绝缘测试电压 Isolation Voltage(All Terminals Shorted)	f = 50Hz, 1minute		2500		V
T_J	最大结温 Maximum Junction Temperature			150		℃
T_{JOP}	最大工作结温范围 Maximum Operating Junction Temperature Range			-40 +150		℃
T_{stg}	储藏温度 Storage Temperature			-40 +125		℃
$R_{\theta CS}$	使用导热脂时外壳与散热器间热阻 Case-To-Sink (Conductive Grease Applied)			0.1		℃/W
M	散热器安装螺钉:M5 Mounting Screw:M5		3.0		5.0	N·m
G	重量 Weight			200		g

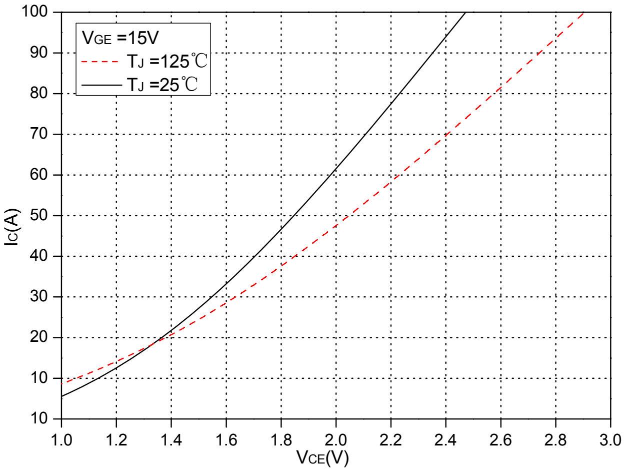

Fig.1 典型的饱和电压特性(逆变器)
Typical Saturation Voltage Characteristics (Inverter)

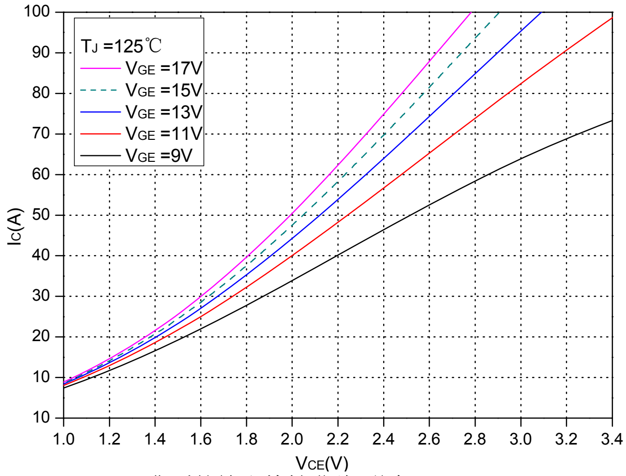

Fig.2 典型的输出特性曲线(逆变器)
Typical Output Characteristics (Inverter)

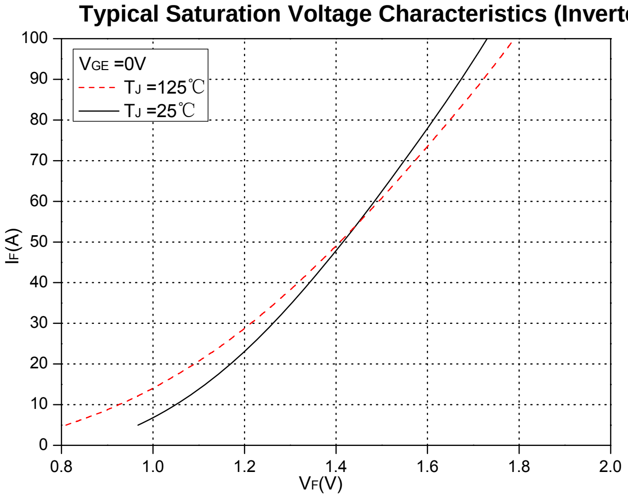

Fig.3 二极管的正向特性(逆变器)
Forward Characteristics of FWD (Inverter)

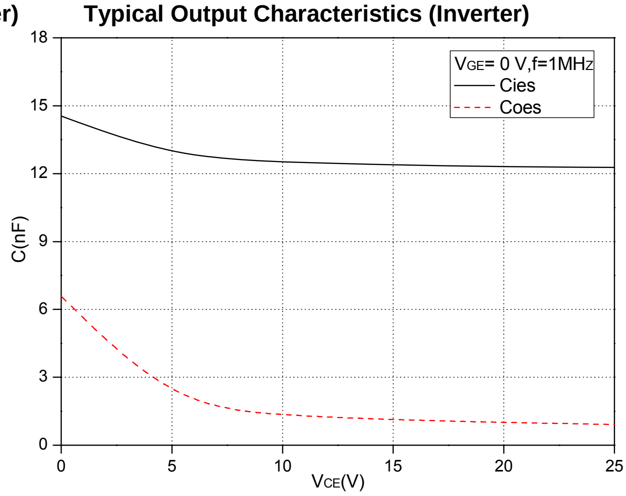

Fig.4 电容特性
Capacitance Characteristics

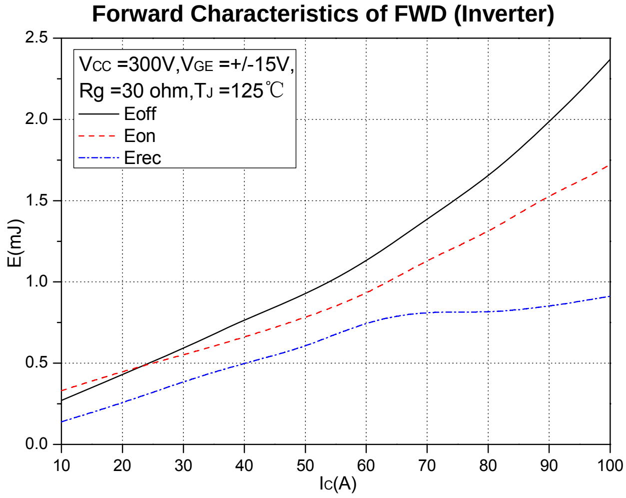

Fig.5 典型的开关损耗与集电极电流 (逆变器)
Typical Switching Loss vs. Collector Current (Inverter)

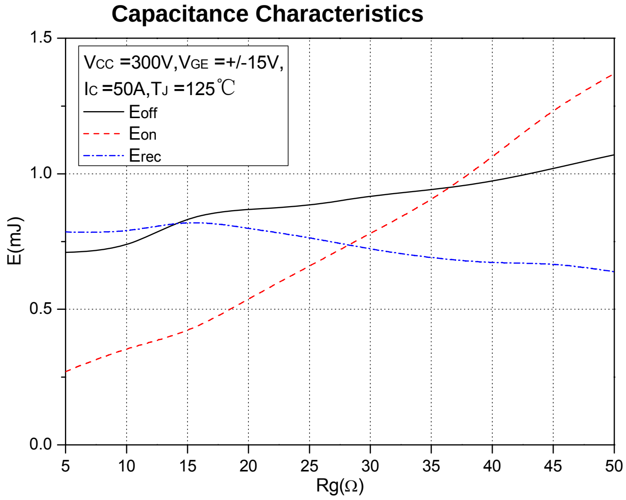

Fig.6 典型的开关损耗与栅极电阻(逆变器)
Typical Switching Loss vs. Gate Resistance(Inverter)

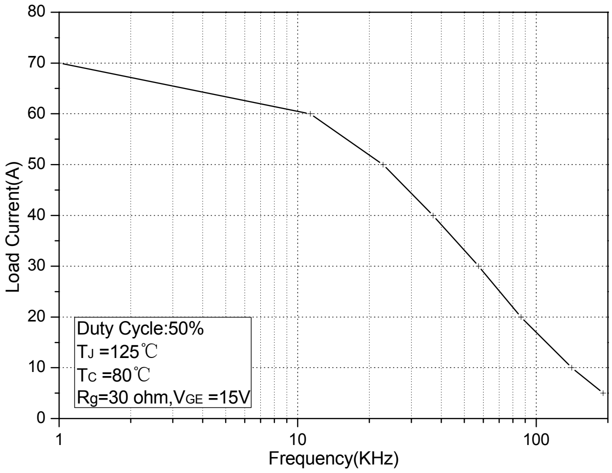

Fig.7 典型的负载电流与频率的关系(逆变器)
Typical Load Current vs. Frequency (Inverter)

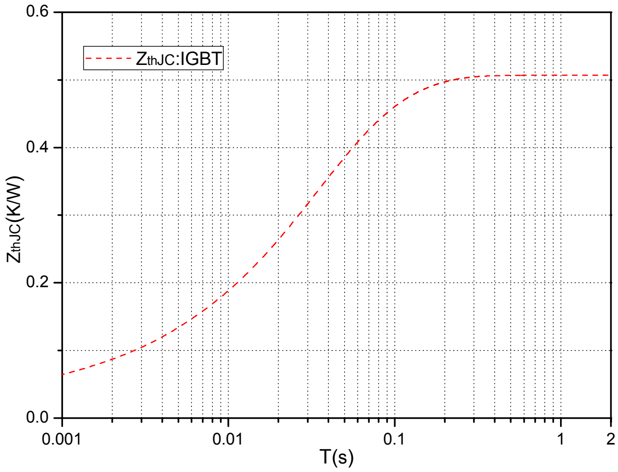

Fig.8 瞬态热阻抗 IGBT (Inverter)
Transient thermal impedance IGBT (Inverter)

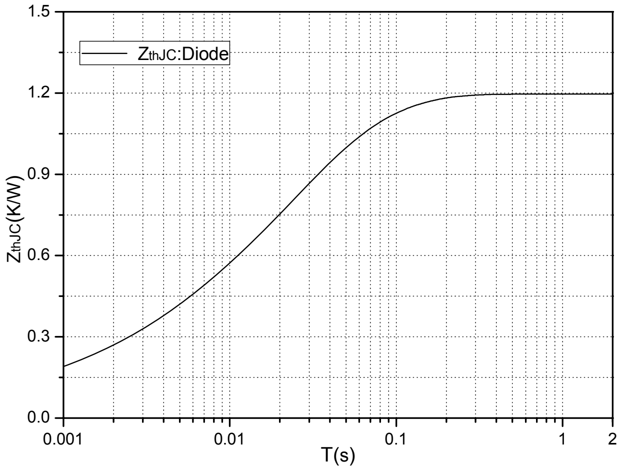

Fig.9 瞬态热阻抗二极管(Inverter)
Transient thermal impedance Diode (Inverter)

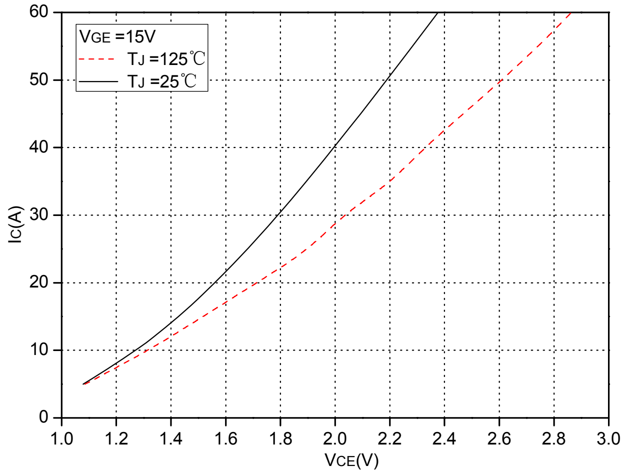

Fig.10 典型的饱和电压特性(制动-斩波器)
Typical Saturation Voltage Characteristics(Brake-Chopper)

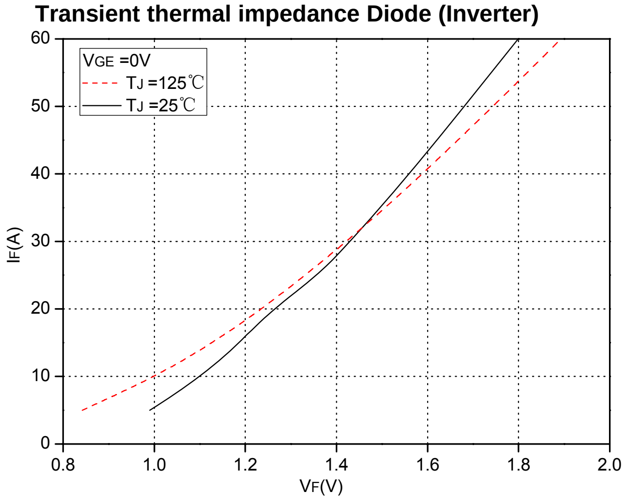

Fig.11 二极管的正向特性(制动-斩波器)
Forward Characteristics of FWD(Brake-Chopper)

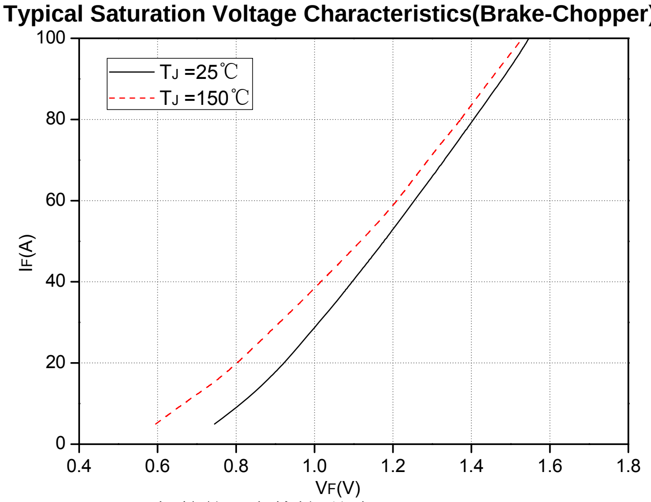

Fig.12 二极管的正向特性(整流器)
Forward Characteristics of Diode **(Rectifier)**

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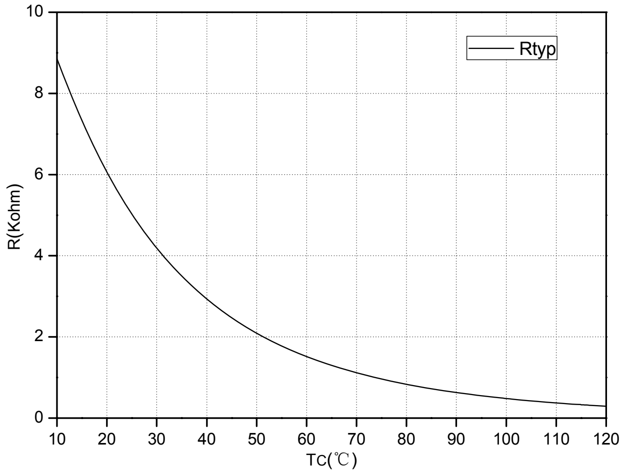


Fig.13 热敏电阻温度特性
NTC Temperature characteristics

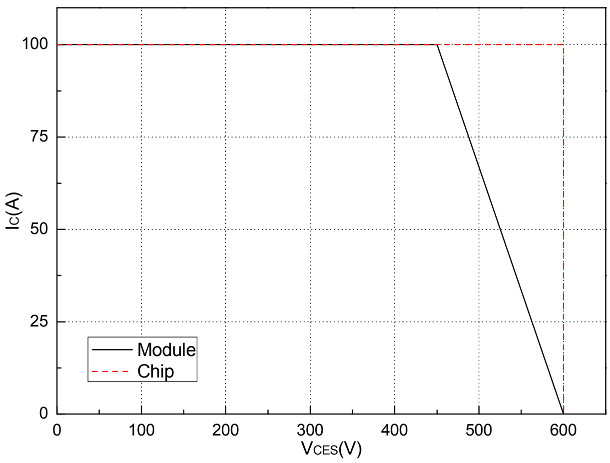
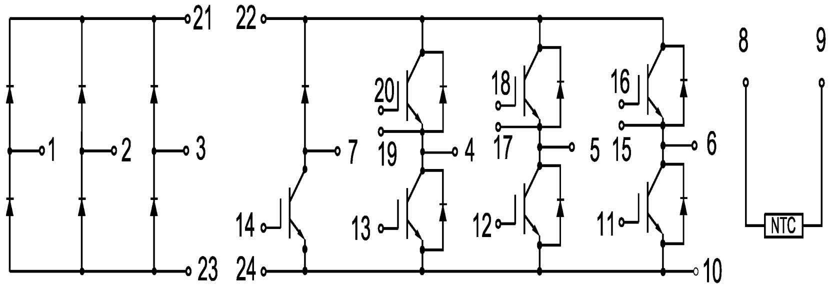
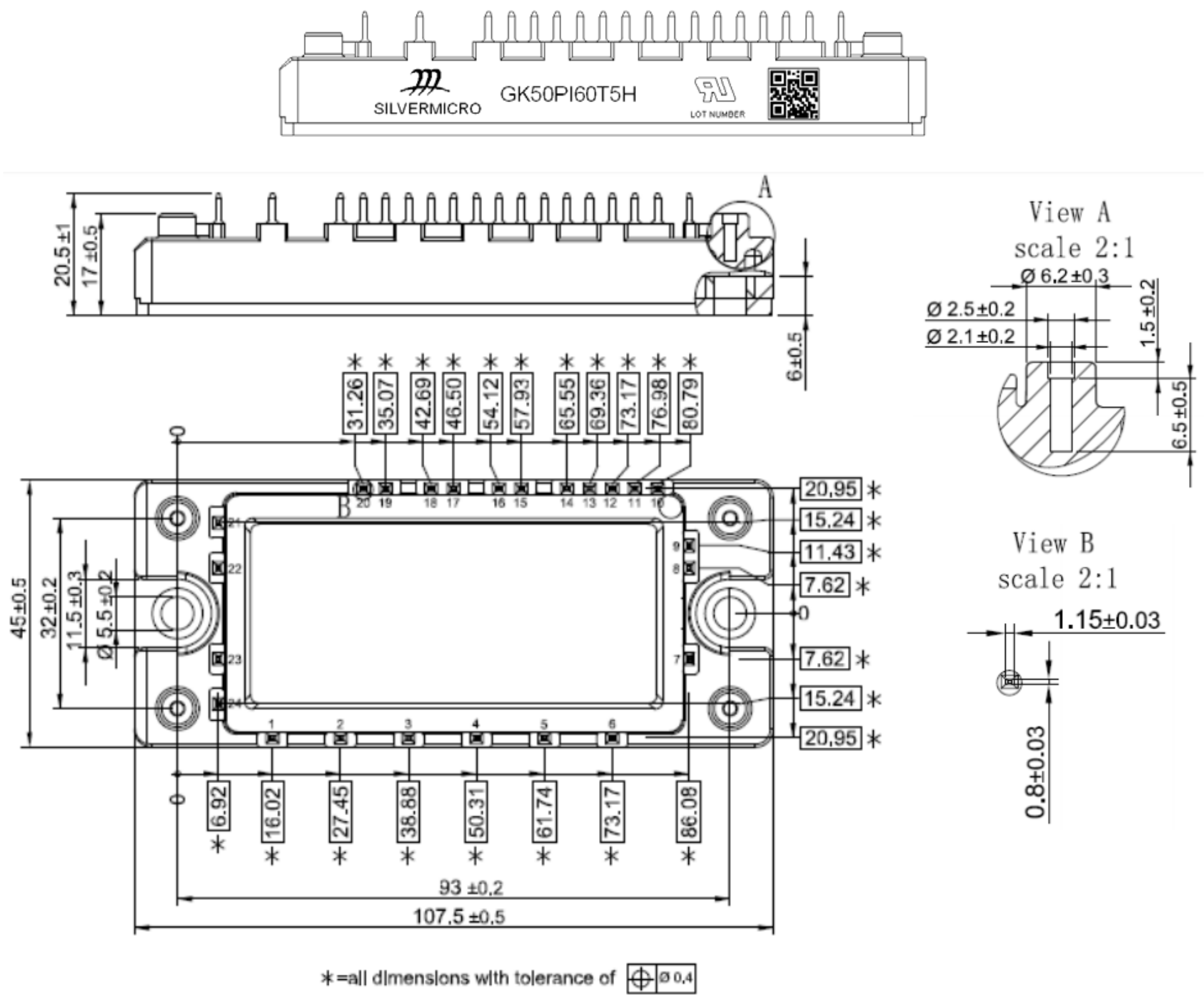


Fig.14 反向偏置安全工作区**(RBSOA)**
Reverse Bias Safe Operation Area (RBSOA)

内部电路 / Internal Circuit:



封装（单位：mm）/ Package Outline (Unit: mm):



Date	Revision	Notes
07/07/2019	A	Final Version

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