



TT015N120EQ

主要参数 MAIN CHARACTERISTICS

I _C	15A
V _{CES}	1200V
V _{CE(SAT)-TYP}	1.60V

用途

- 逆变器

产品特性

- 低栅极电荷
- Trench FS 技术
- RoHS 产品

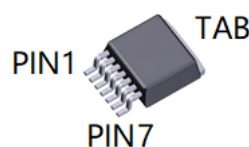
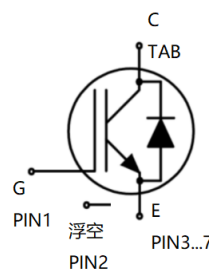
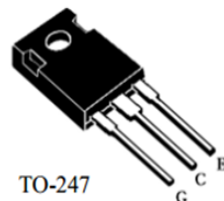
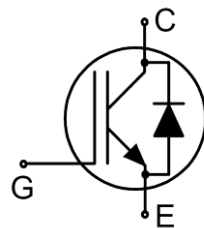
APPLICATIONS

- General purpose inverter

FEATURES

- Low gate charge
- Trench FS Technology
- RoHS product

封装 Package



TO-263-7L

订货信息 ORDER MESSAGE

订货型号 Order codes				印记 Marking	封装 Package
有卤-条管 Halogen-Tube	无卤-条管 Halogen-Free-Tube	有卤-编带 Halogen-Reel	无卤-编带 Halogen-Free-Reel		
N/A	TT015N120EQ-GE-BR	N/A	N/A	TT015N120EQ	TO-247
N/A	TT015N120EQ-SC-BR	N/A	TT015N120EQ-SC-AR	TT015N120EQ	TO-263-7L

绝对最大额定值 ABSOLUTE RATINGS ($T_c=25^\circ\text{C}$)

项 目 Parameter	符 号 Symbol	数 值 Value		单 位 Unit
		TO-247	TO-263-7L	
最高集电极-发射极直流电压 Collector-Emitter Voltage	V_{CE}	1200		V
*连续集电极电流 Collector Current-continuous $T_c=25^\circ\text{C}$ $T_c=100^\circ\text{C}$	I_C	30 15		A
最大脉冲集电极极电流 (注 1) Collector Current – pulse (note 1)	I_{CM}	45		
二极管正向测试电流 Diode RMS forward current $T_c=25^\circ\text{C}$ $T_c=100^\circ\text{C}$	I_F	30 15		
二极管正向脉冲电流 Diode pulse current	I_{FSM}	45		
二极管 I2T Diode I2T ($V_R = 0\text{ V}$, $t_p = 10\text{ ms}$, $T_{vj} = 150^\circ\text{C}$)	I2T	25	20	A
最高栅极发射极电压 Gate-Emitter Voltage	V_{GE}	± 20		V
Turn-off safe area 安全工作区	-	45		A
耗散功率 Power Dissipation	P_D $T_c=25^\circ\text{C}$	238	220	W
存储温度 Storage Temperature Range	T_{STG}	-55~+150		°C
结温 Junction Temperature Range	T_{Jmax}	-40~+175		
工作结温 Junction Temperature Range	T_{Jop}	-40~+150		
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	T_L	260		

*连续集电极电流由最高结温限制

*Collector current limited by maximum junction temperature

注释:

1: 脉冲宽度由最高结温限制

Notes:

1: Pulse width limited by maximum junction temperature



电特性 ELECTRICAL CHARACTERISTICS

项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
关态特性 Off –Characteristics						
集电极-发射极击穿电压 Collector-Emitter Voltage	BV_{CES}	$I_C=250\mu A, V_{GE}=0V$	1200	-	-	V
零栅压下集电极漏电流 Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^\circ C$	-	-	100	μA
		$V_{CE}=1200V, V_{GE}=0V, T_{vj}=150^\circ C$	-	-	2	mA
		$V_{CE}=1200V, V_{GE}=0V, T_{vj}=175^\circ C$	-	-	2	mA
正向栅极体漏电流 Gate-body leakage current,forward	I_{GESF}	$V_{CE}=0V, V_{GE}=20V$	-	-	150	nA
反向栅极体漏电流 Gate-body leakage current,reverse	I_{GESR}	$V_{CE}=0V, V_{GE}=-20V$	-	-	-150	nA
通态特性 On-Characteristics						
阈值电压 Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C=250\mu A$	4.5	-	6.5	V
饱和压降 Collector-Emitter saturation Voltage	V_{CESAT}	$V_{GE}=15V, I_C=15A, T_{vj}=25^\circ C$	-	1.6	2.1	
		$V_{GE}=15V, I_C=15A, T_{vj}=150^\circ C$	-	2.0	-	
		$V_{GE}=15V, I_C=15A, T_{vj}=175^\circ C$	-	2.1	-	
动态特性 Dynamic Characteristics						
输入电容 Input capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1.0MHz$	-	1260	-	pF
输出电容 Output capacitance	C_{oes}		-	78	-	
反向传输电容 Reverse transfer capacitance	C_{res}		-	41	-	
栅极电荷总量 Total Gate Charge	Q_g	$V_{CE}=960V, I_C=15A, V_{GE}=15V, T_{vj}=25^\circ C$	-	112	-	nC
栅极-发射极 Gate to emitter charge	Q_{ge}		-	8.8	-	
栅极-集电极 Gate to collector charge	Q_{gc}		-	80.7	-	
栅极电阻-Gate resistance	R_g	$f=1MHz, \text{open collector}$	-	0.5	-	Ω
短路电流-short current	I_{sc}	$V_{GE}=15V, V_{CE}=600V, t \leq 10\mu s$		75		A



电特性 ELECTRICAL CHARACTERISTICS

开关特性 Switching Characteristics						
项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最 小 Min	典 型 Typ	最 大 Max	单 位 Units
开启延迟时间 Turn-on delay time	td(on)	$V_{CE}=600V, I_C=15A, R_g=10\Omega$ $V_{GE}=15V$ $T_{vj}=25^\circ C$	-	20	-	ns
上升时间 Turn-on rise time	tr		-	30	-	
关断延迟时间 Turn-off delay time	td(off)		-	204	-	
下降时间 Turn-off Fall time	tf		-	252	-	
开通损耗 Turn-on energy	Eon	$T_{vj}=25^\circ C$	-	0.47	-	mJ
关断损耗 Turn-off energy	Eoff		-	1.3	-	
总开关损耗 Total switching energy	Etot		-	1.77	-	
开启延迟时间 Turn-on delay time	td(on)	$V_{CE}=600V, I_C=15A, R_g=10\Omega$ $V_{GE}=15V$ $T_{vj}=125^\circ C$	-	18	-	ns
上升时间 Turn-on rise time	tr		-	30	-	
关断延迟时间 Turn-off delay time	td(off)		-	290	-	
下降时间 Turn-off Fall time	tf		-	402	-	
开通损耗 Turn-on energy	Eon	$T_{vj}=125^\circ C$	-	0.5	-	mJ
关断损耗 Turn-off energy	Eoff		-	1.8	-	
总开关损耗 Total switching energy	Etot		-	2.3	-	
开启延迟时间 Turn-on delay time	td(on)	$V_{CE}=600V, I_C=15A, R_g=10\Omega$ $V_{GE}=15V$ $T_{vj}=175^\circ C$	-	18	-	ns
上升时间 Turn-on rise time	tr		-	30	-	
关断延迟时间 Turn-off delay time	td(off)		-	298	-	
下降时间 Turn-off Fall time	tf		-	462	-	
开通损耗 Turn-on energy	Eon	$T_{vj}=175^\circ C$	-	0.5	-	mJ
关断损耗 Turn-off energy	Eoff		-	2	-	
总开关损耗 Total switching energy	Etot		-	2.5	-	
反并联二极管特性及最大额定值 Anti-Parallel Diode Characteristics and Maximum Ratings						
正向压降 Diode Forward Voltage	VF	$V_{GE}=0V, I_F=15A, T_{vj}=25^\circ C$	-	1.85	2.2	V
		$V_{GE}=0V, I_F=15A, T_{vj}=150^\circ C$	-	1.55	-	
		$V_{GE}=0V, I_F=15A, T_{vj}=175^\circ C$	-	1.5	-	
反向恢复时间 Diode Reverse recovery time	trr	$V_{GE}=0V, V_R=600V, I_F=15A$ $dI_F/dt=200A/\mu s$ $T_{vj}=25^\circ C$	-	227	-	ns
反向恢复电荷 Diode Reverse recovery charge	Qrr		-	544	-	nC
反向恢复电流 Diode Reverse recovery Current	Irrm		-	6.6	-	A
电流变化率 Diode peak rate of fall of reverse recovery current during tb	dirr/dt			65		A/ μs



电特性 ELECTRICAL CHARACTERISTICS

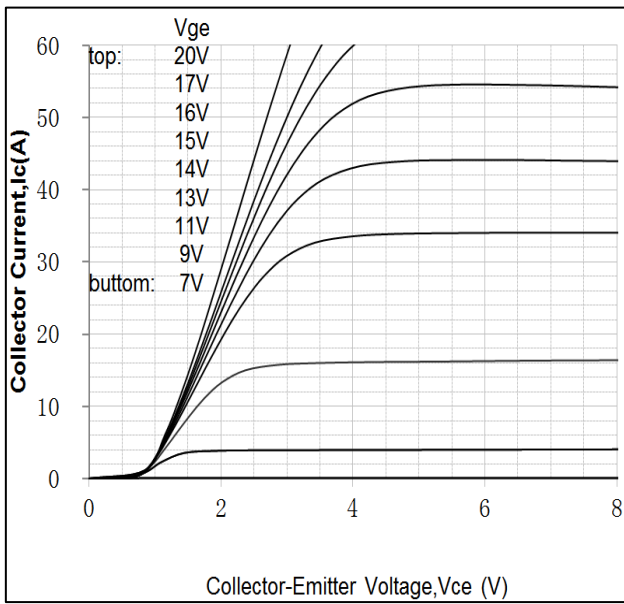
反并联二极管特性及最大额定值 Anti-Parallel Diode Characteristics and Maximum Ratings						
反向恢复时间 Diode Reverse recovery time	trr	V _{GE} =0V, V _R =600V I _F =15A d _I F/d _t =200A/μs T _{vj} =150°C	-	361	-	ns
反向恢复电荷 Diode Reverse recovery charge	Qrr		-	1800	-	nC
反向恢复电流 Diode Reverse recovery Current	Irrm		-	7.3	-	A
电流变化率 Diode peak rate of fall of reverse recovery current during tb	d _{irr} /dt		-	20	-	A/μs

项 目 Parameter	符 号 Symbol	最大 MAX		单 位 Unit
		TO-247	TO-263-7L	
结到管壳的热阻 Thermal Resistance, Junction to Case	Rth(j-c) IGBT	0.63	0.68	°C/W
	Rth(j-c) FWD	1.0	1.1	
结到环境的热阻 Thermal Resistance, Junction to Ambient	Rth(j-A)	40	62.5	

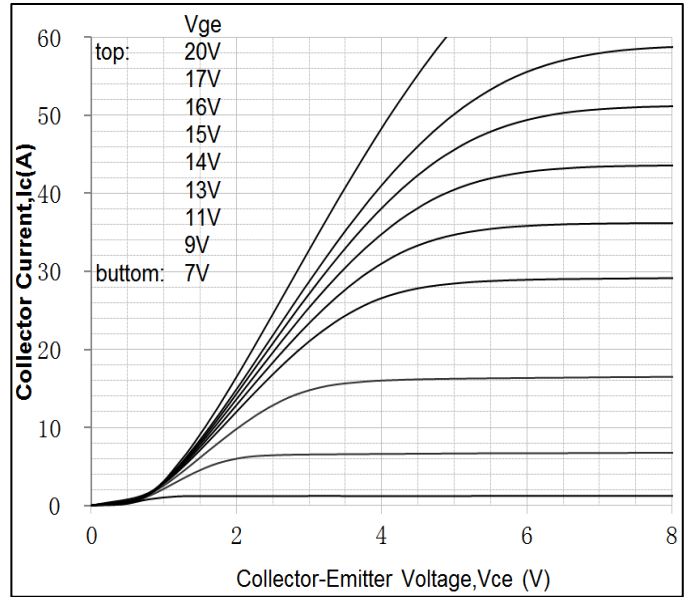


特征曲线 ELECTRICAL CHARACTERISTICS (curves)

Output Characteristics (25°C)

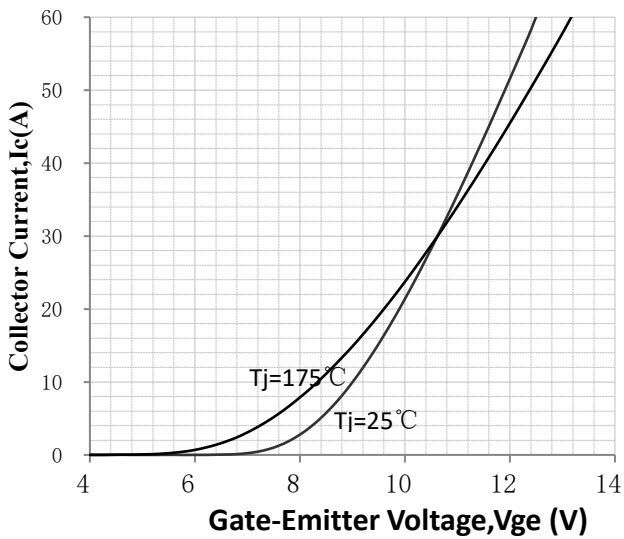


Output Characteristics (150°C)

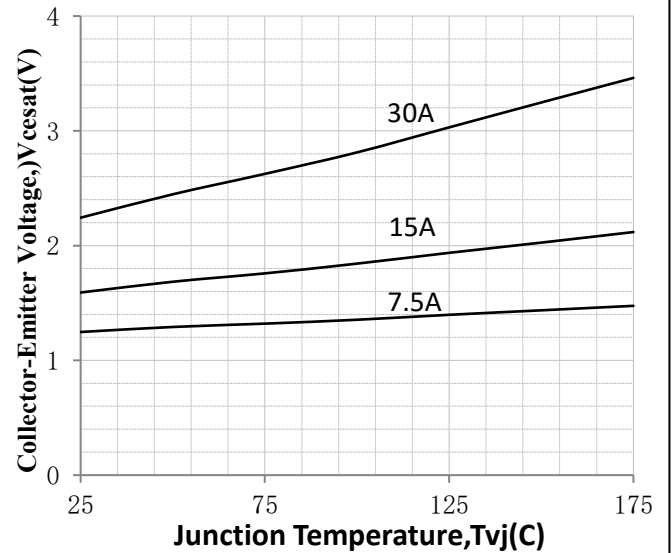


Transfer Characteristics

VCE=20 V



Vcesat vs. Tvj

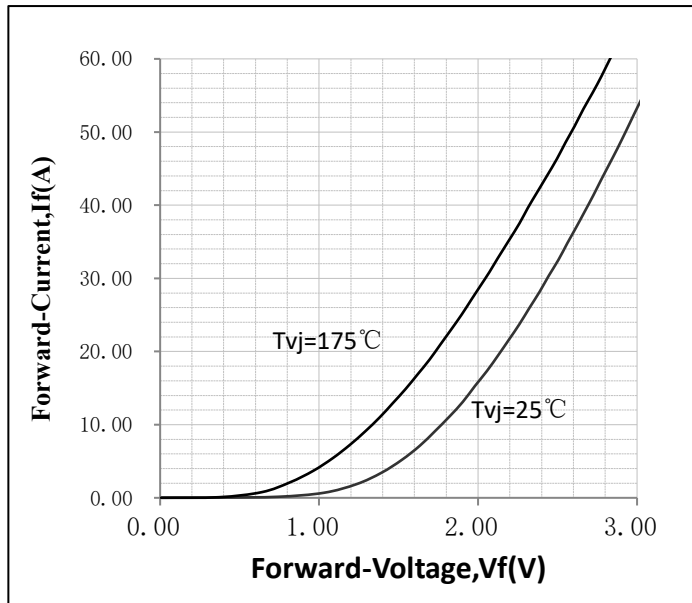
VGE=15V, $I_c=7.5$ A、15A、30A



特征曲线 ELECTRICAL CHARACTERISTICS (curves)

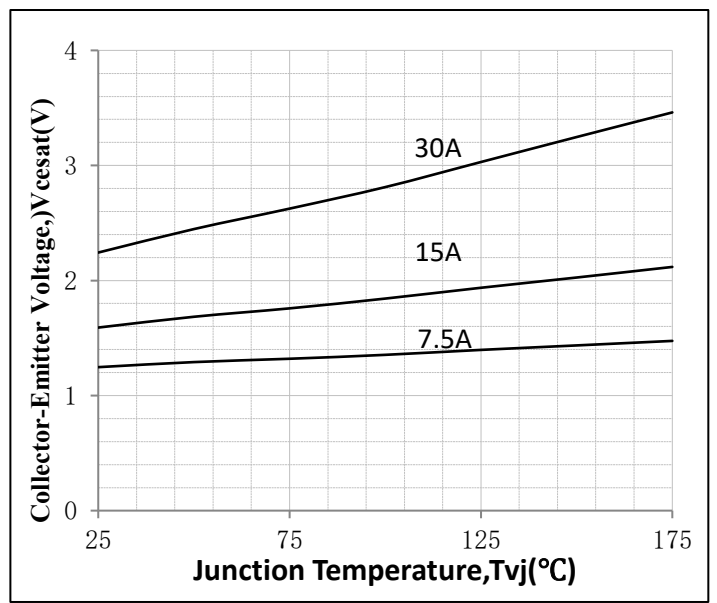
Diode Characteristic

Tvj=25°C、175°C



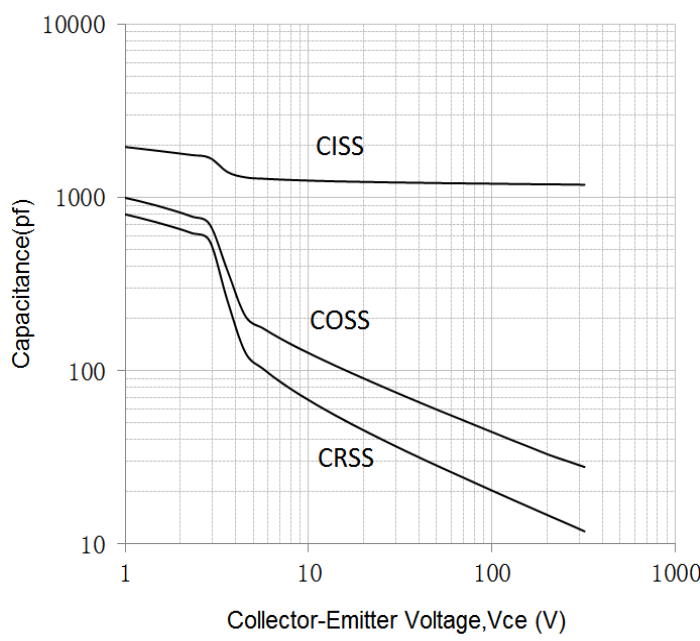
Vf vs. Tvj

Ic=7.5A、15A、30A



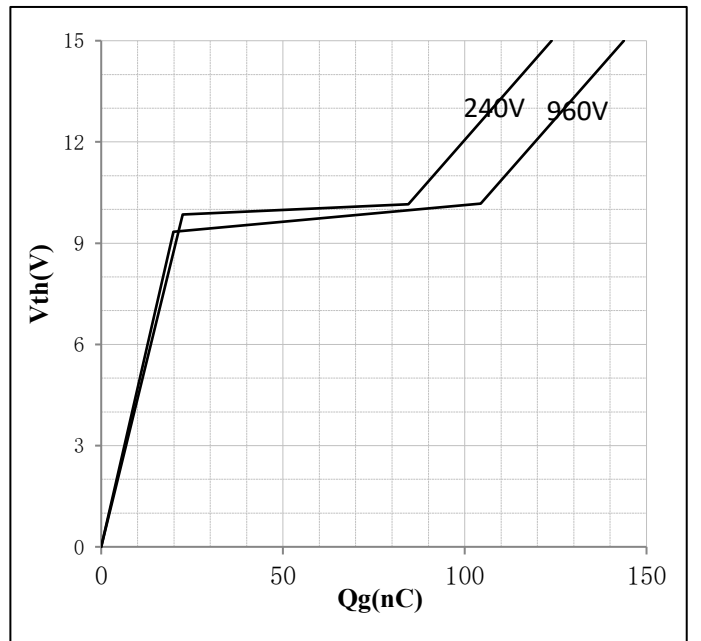
Capacitance Characteristic

f=1.0MHZ



Gate Charge Characteristics

VGE=15V, Ic=15A, VCE=240V/960V

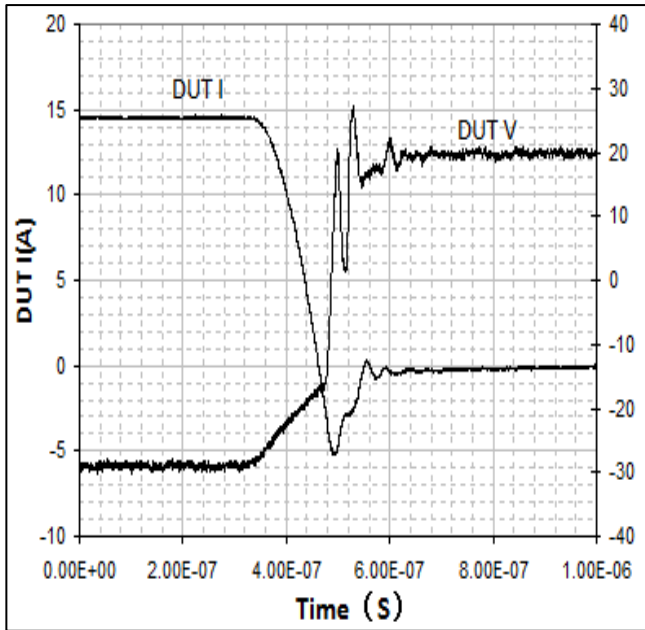




特征曲线 ELECTRICAL CHARACTERISTICS (curves)

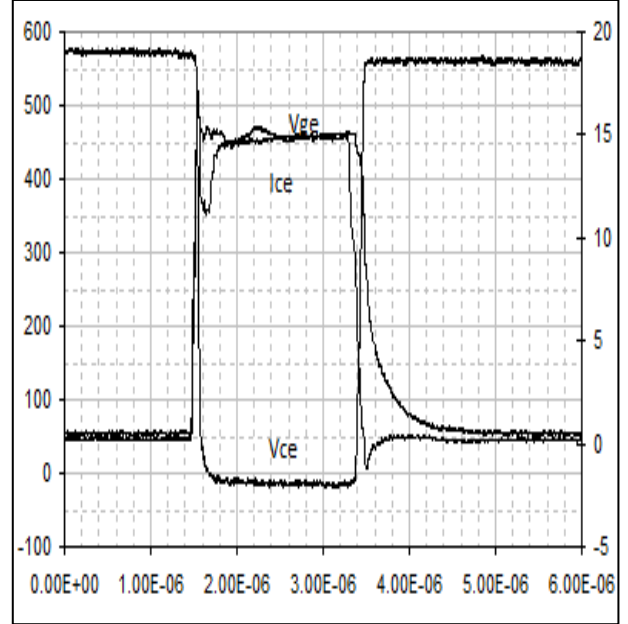
Diode Peak Reverse Recovery Current

$I_F=15A$ $T_{vj}=25^{\circ}C$



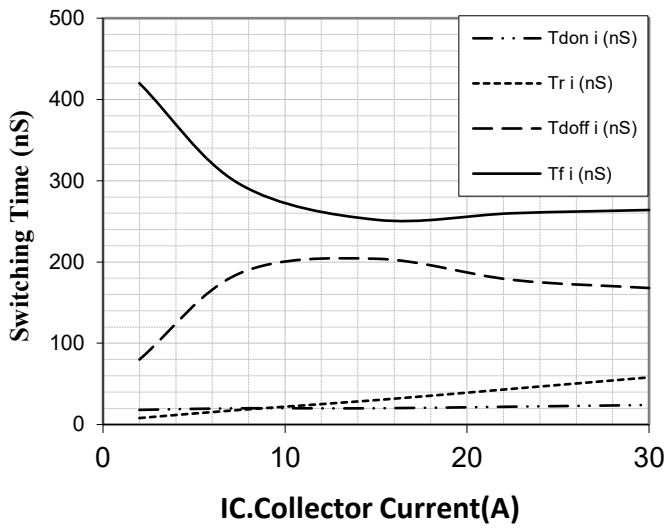
IGBT Switch

$V_{GE}=15V, I_c=15A, V_{CE}=600V, T_{vj}=25^{\circ}C$



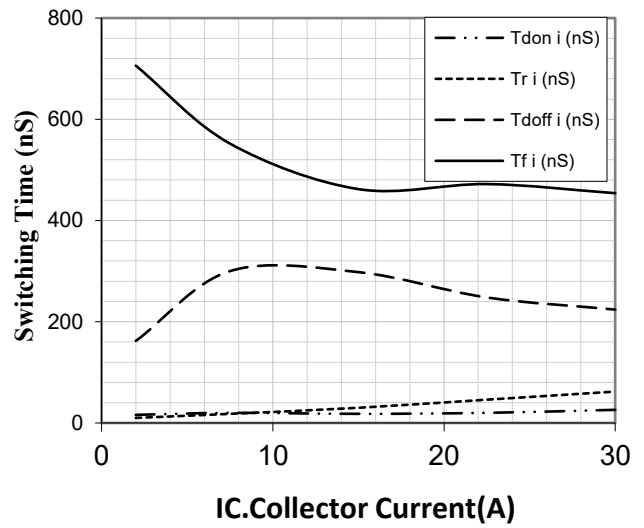
Switching Time vs. $I_C(25^{\circ}C)$

$V_{CE}=600V, V_{GE}=15V, R_G=10\Omega$



Switching Time vs. $I_C(175^{\circ}C)$

$V_{CE}=600V, V_{GE}=15V, R_G=10\Omega$

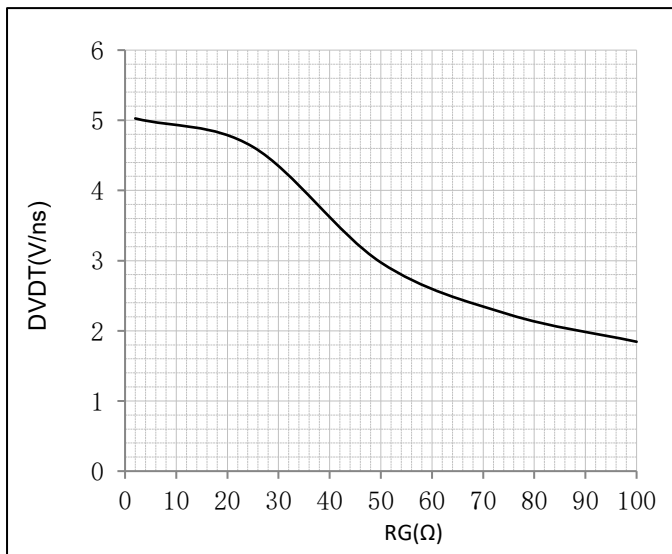




特征曲线 ELECTRICAL CHARACTERISTICS (curves)

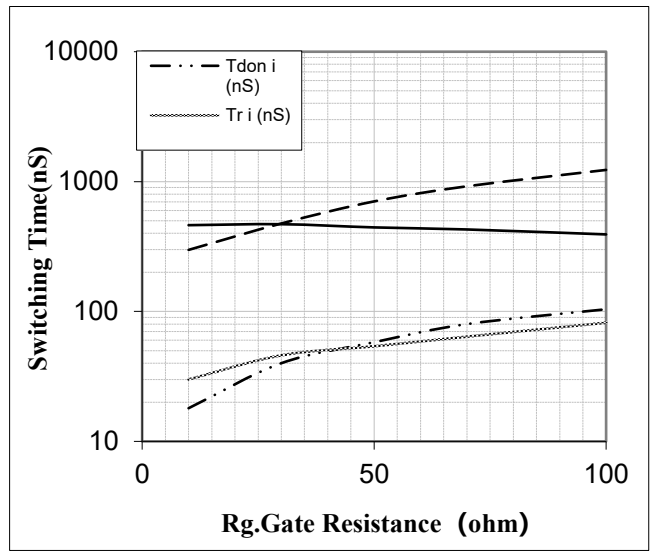
Dv/dt(Turn off) vs. Rg(25°C)

VGE=15V, VCE=600V



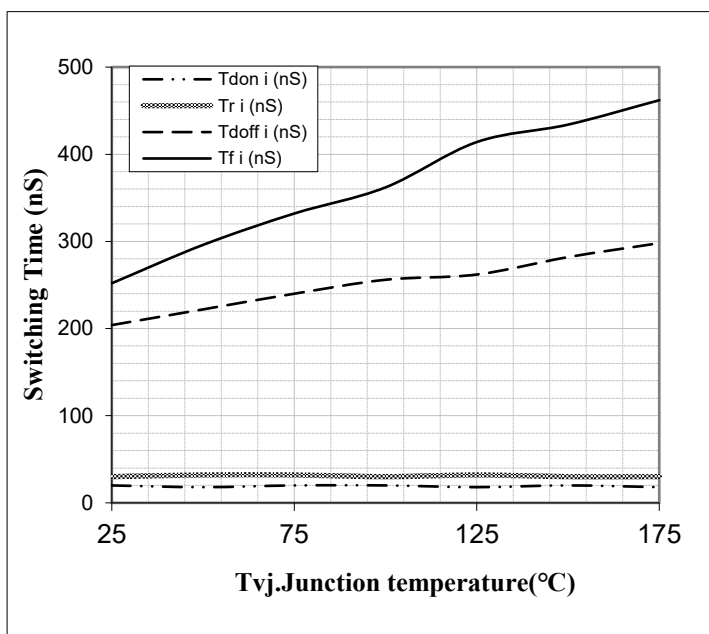
Switching Time vs. Rg(175°C)

VGE=15V, VCE=600V, IC=15A



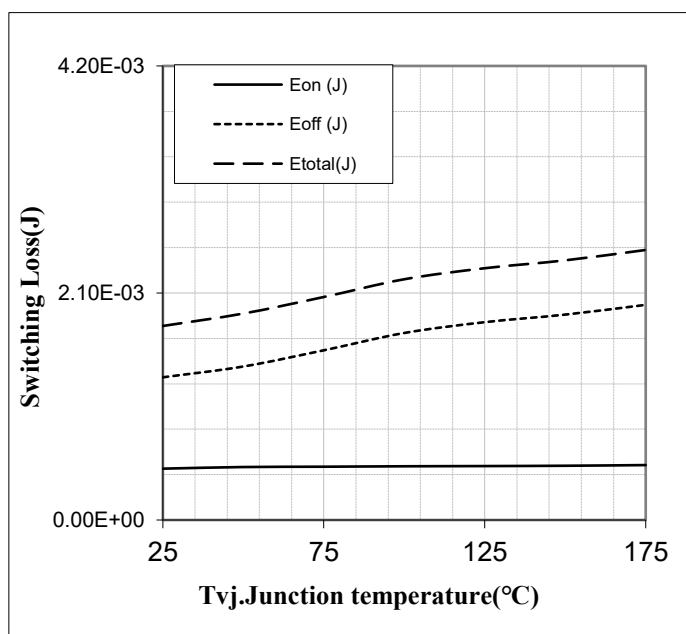
Switching Time vs. Tvj

VGE=15V, VCE=600V, IC=15A, Rg=10Ω



Switching Loss vs. Tvj

VGE=15V, VCE=600V, IC=15A, Rg=10Ω

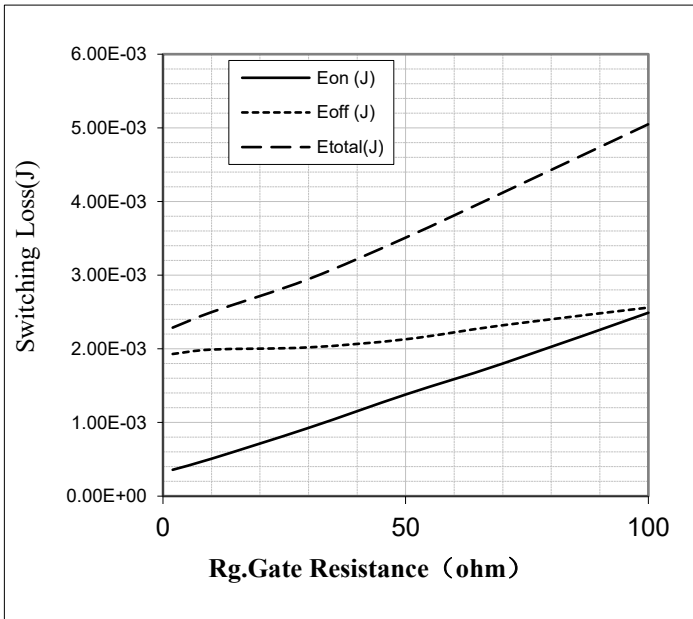




特征曲线 ELECTRICAL CHARACTERISTICS (curves)

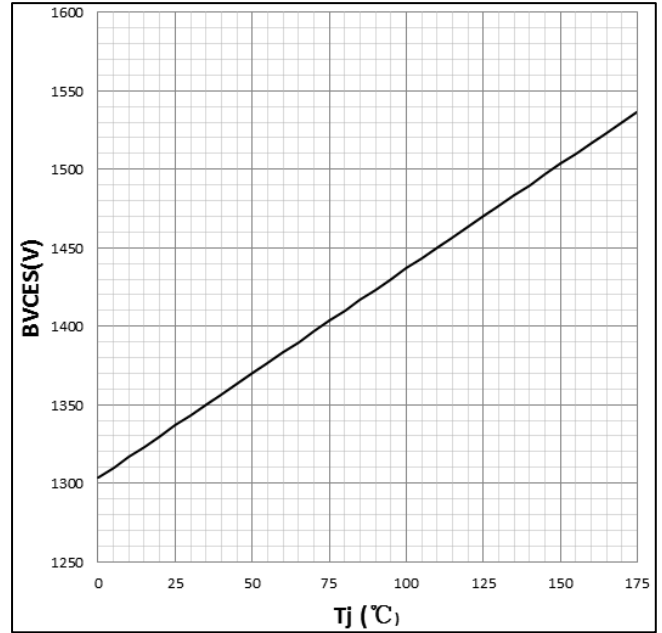
Switching Loss vs. Rg(175°C)

VGE=15V, VCE=600V, IC=15A



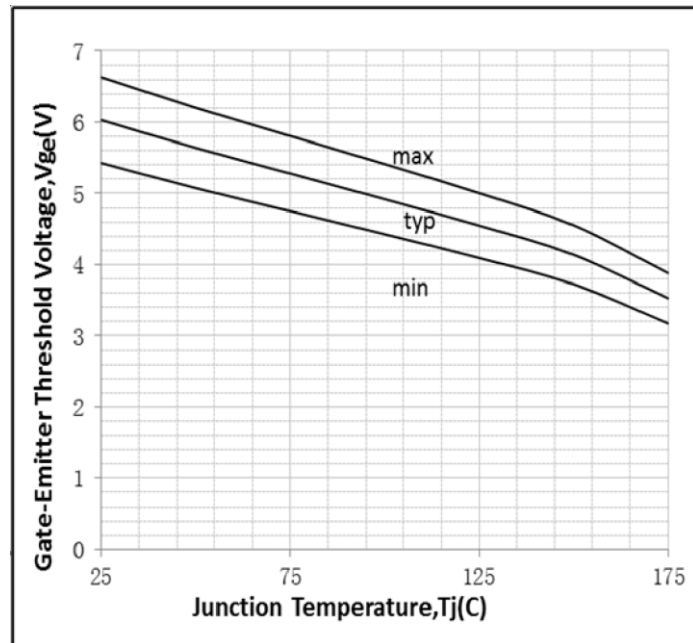
BVCES vs. Tvj

IC=250uA



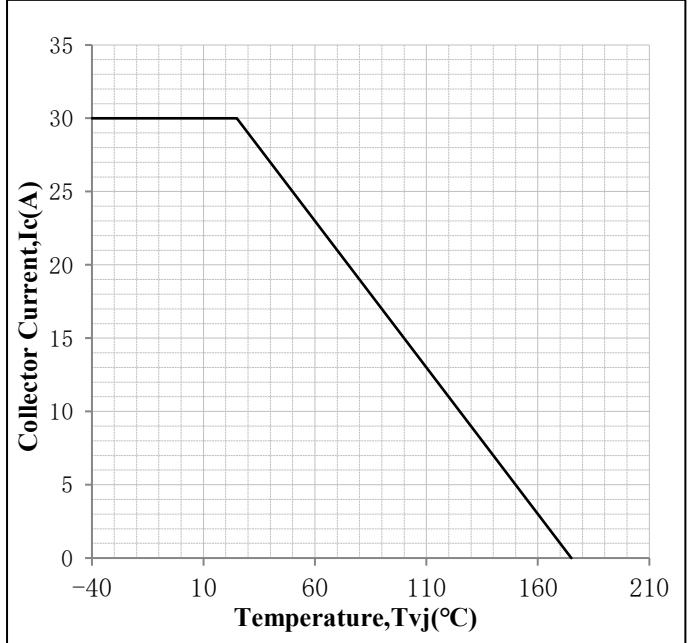
VTH vs. Tvj

IC=250uA



Collector current vs. case temperature

VGE=15V, Tvj ≤ 175°C

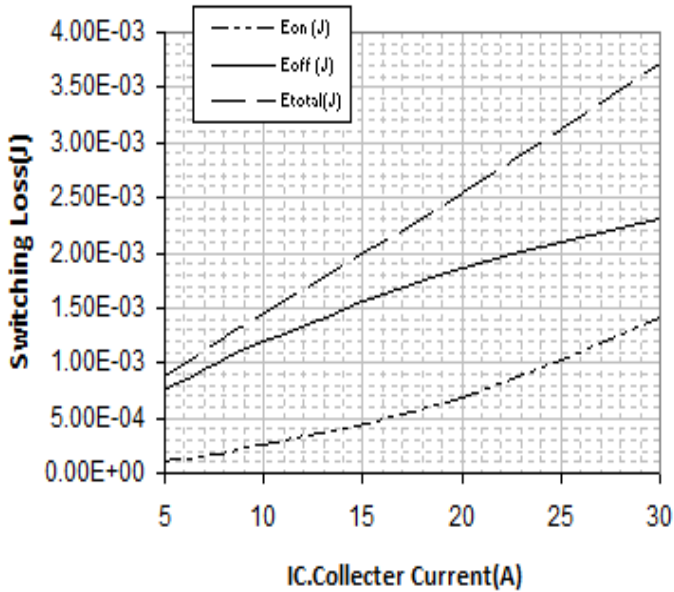




特征曲线 ELECTRICAL CHARACTERISTICS (curves)

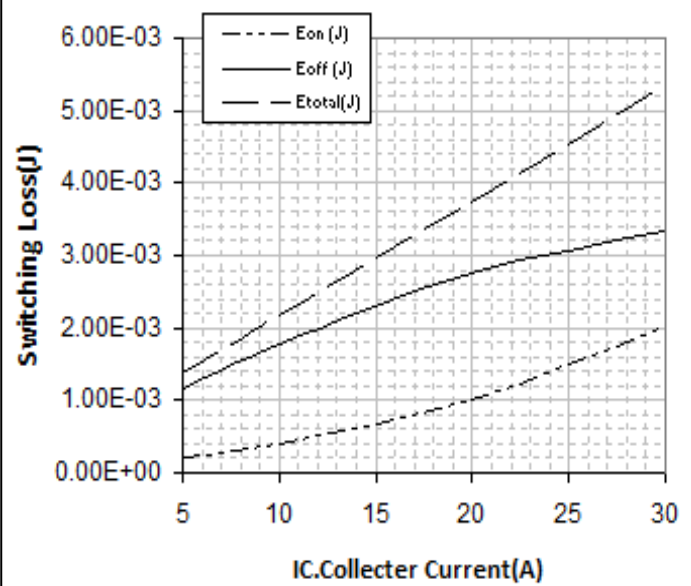
Switching Loss vs. IC(25°C)

VGE=15V,VCE=600V,RG=10Ω

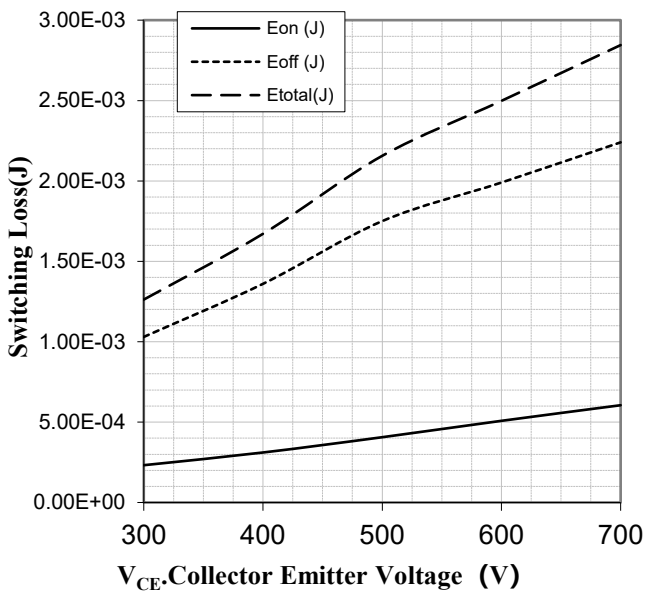


Switching Loss vs. IC(175°C)

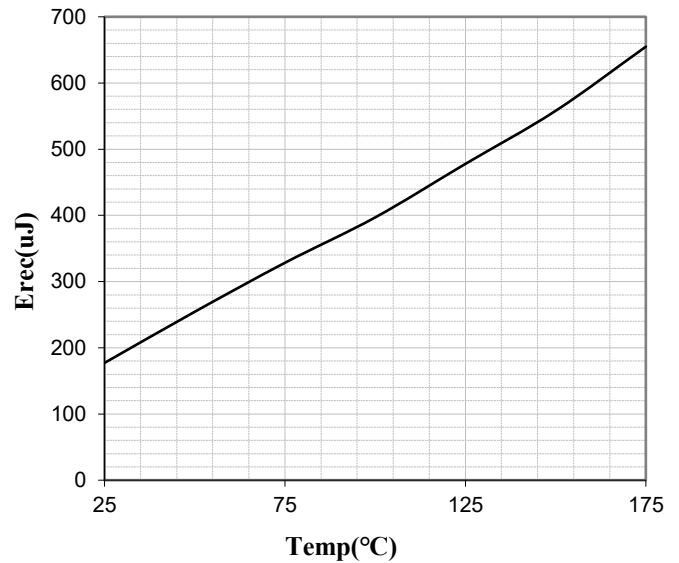
VGE=15V,VCE=600V,RG=10Ω



Switching Loss vs. VCE(175°C)



Erec 与 Tj 的曲线 VGE=15V,VCE=600V,RG=10Ω

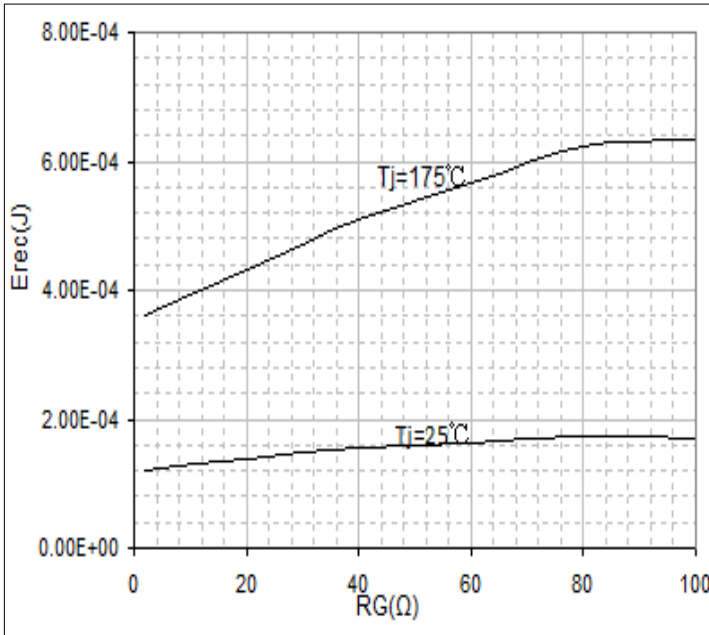




特征曲线 ELECTRICAL CHARACTERISTICS (curves)

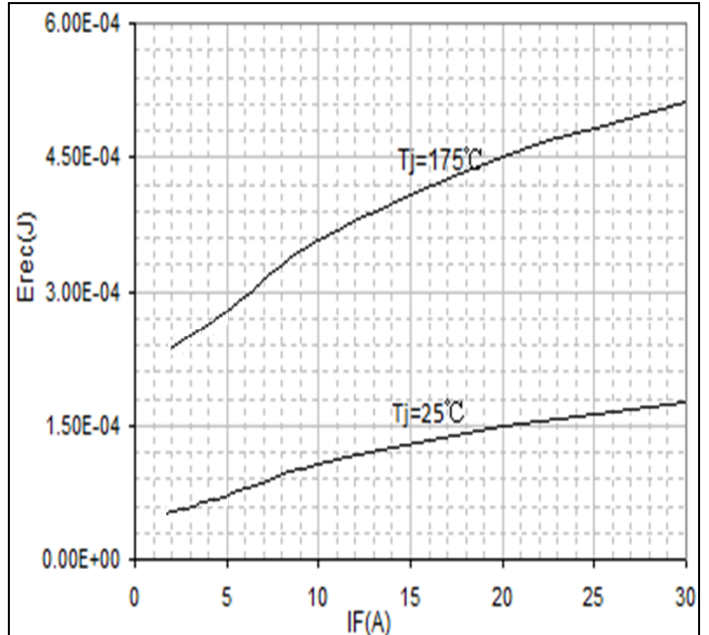
Erec 与 Rg 的曲线

VGE=15V,VCE=600V,RG=10Ω



Erec 与 If 的曲线

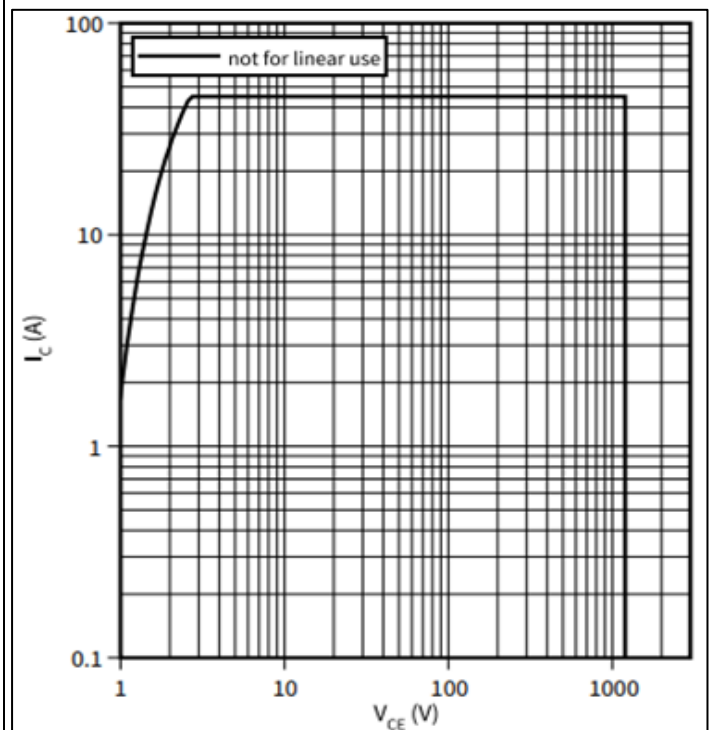
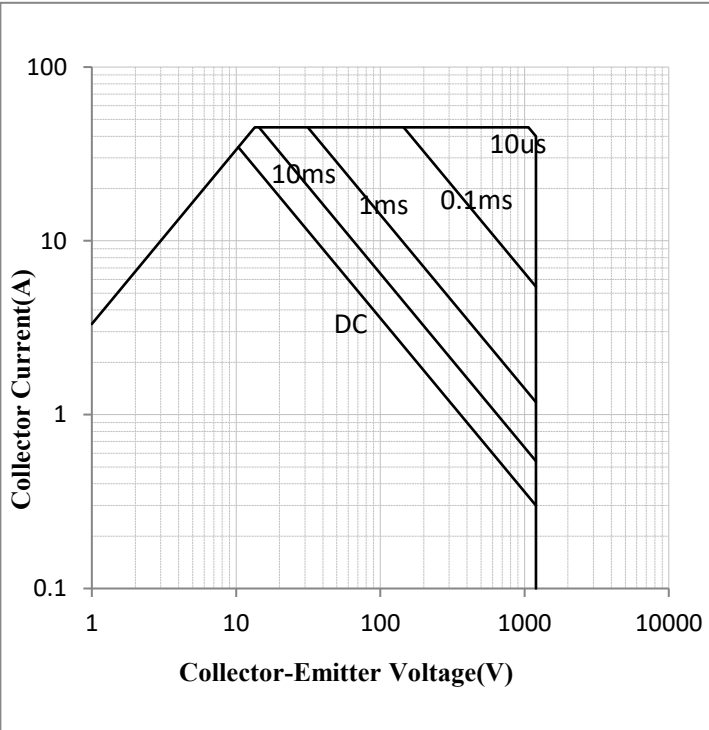
VGE=15V,VCE=600V,RG=10Ω



Forward Bias SOA

Reverse bias SOA

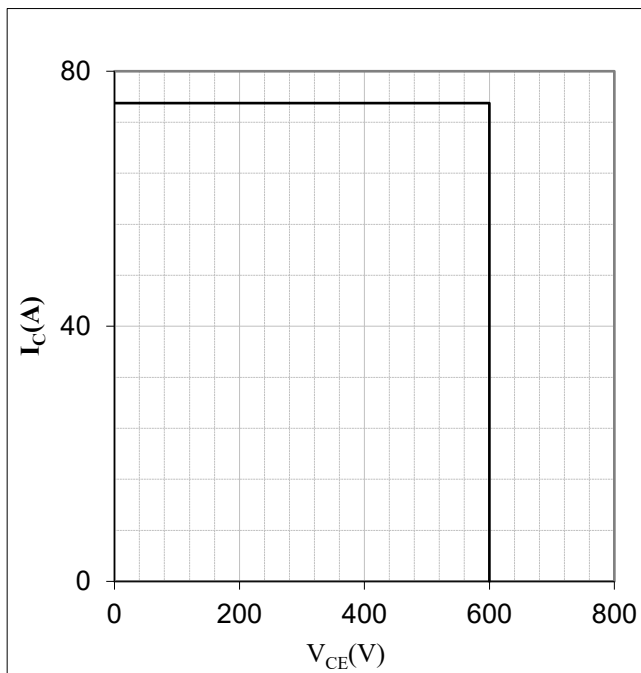
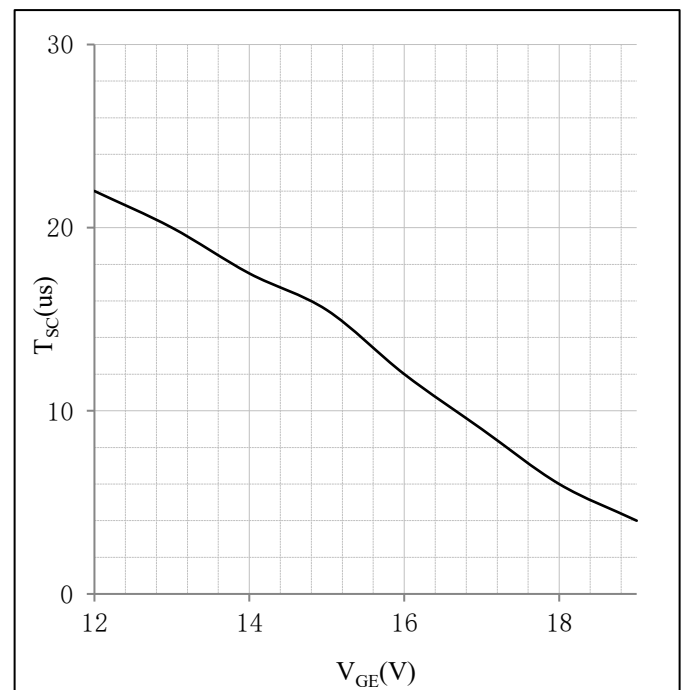
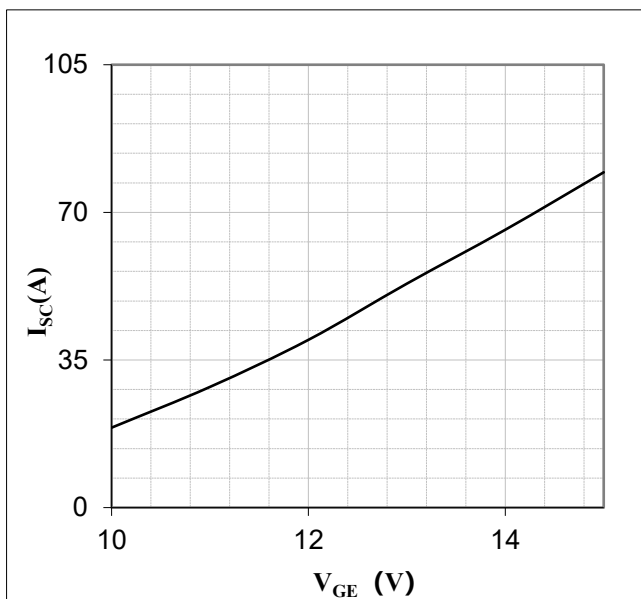
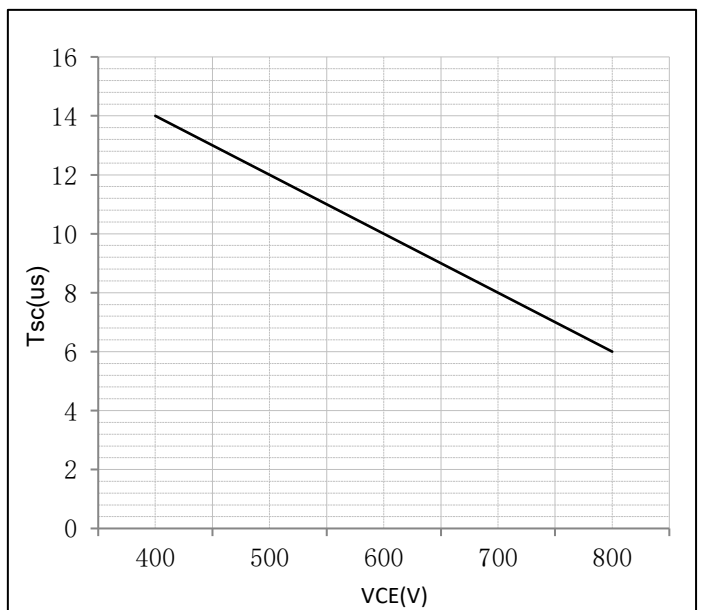
VGE=15V, Tvj ≤ 175°C





特征曲线 ELECTRICAL CHARACTERISTICS (curves)

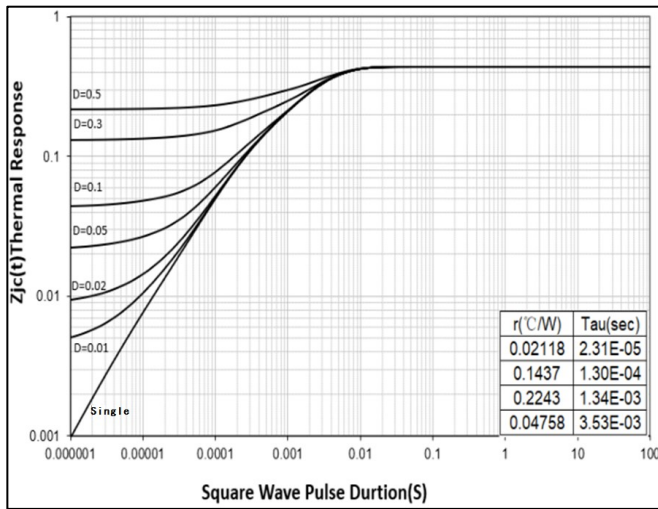
短路安全工作区

T_{sc} 与 V_{ge} 的曲线 (150°C, V_{CE}=600V)I_{sc} 与 V_{ge} 的曲线 (150°C, V_{CE}=600V)T_{sc} VS V_{CE} 的曲线 (150°C, V_{GE}=15V)

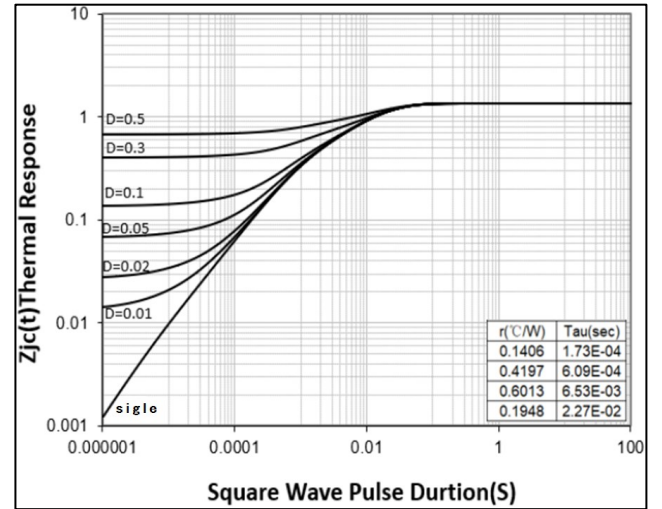


特征曲线 ELECTRICAL CHARACTERISTICS (curves)

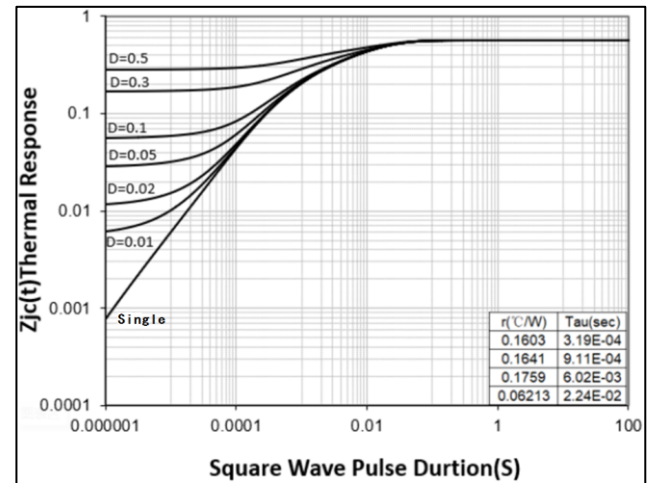
Normalized Transient Thermal Impedance for IGBT (TO-247)



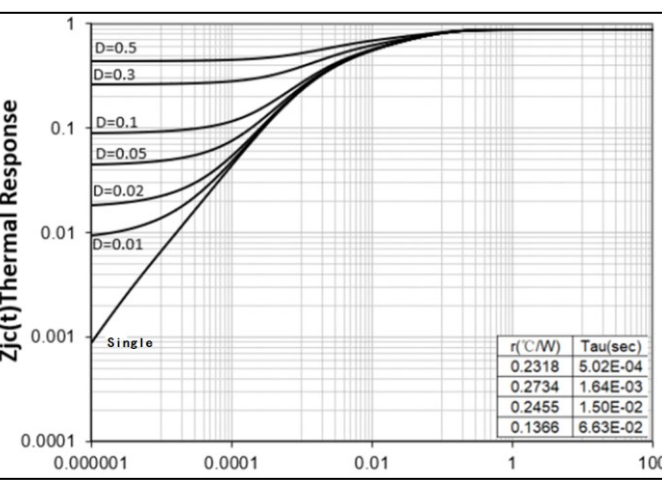
Normalized Transient Thermal Impedance for FRD (TO-247)



Normalized Transient Thermal Impedance for IGBT (TO-263-7L)



Normalized Transient Thermal Impedance for FRD (TO-263-7L)



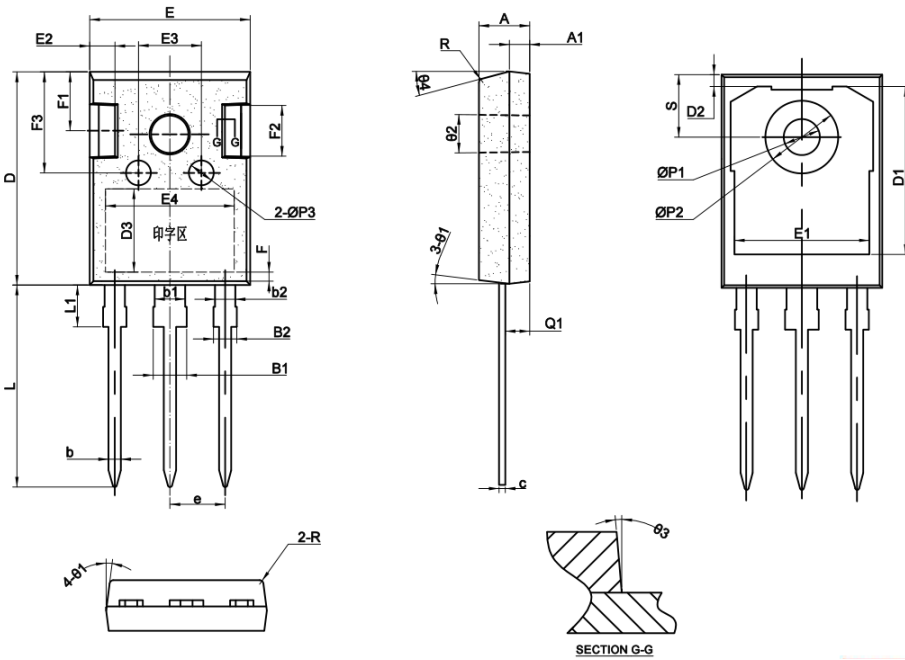


外形尺寸 PACKAGE MECHANICAL DATA

TO-247

重点尺寸: b、e、A、D、E。

单位 Unit : mm

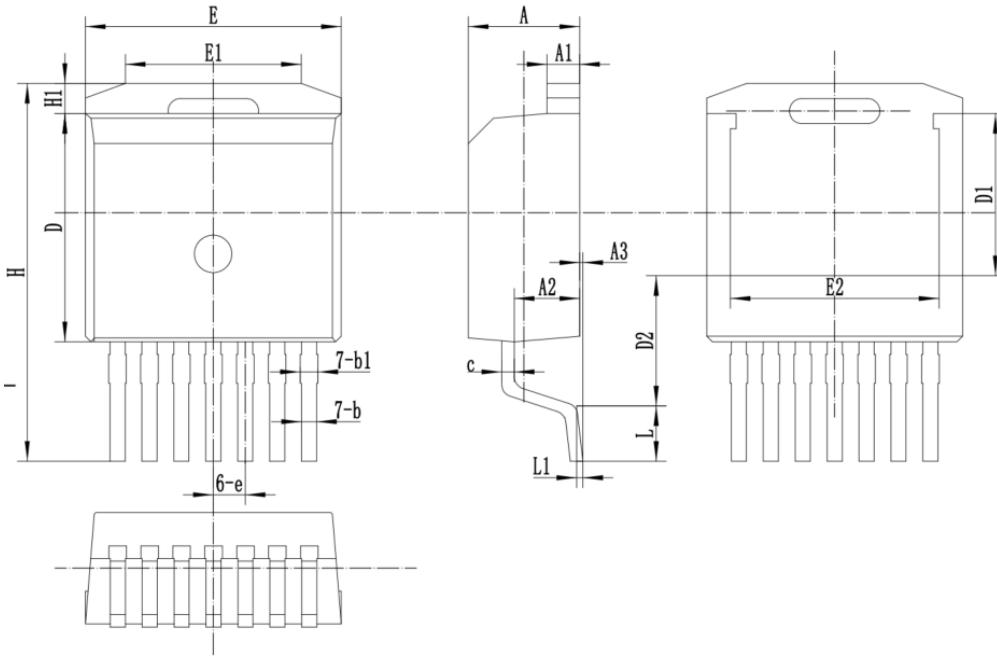


SYMBOL	MM		
	MIN	NOM	MAX
*A	4.90	5.00	5.10
A1	1.90	2.00	2.10
*b	1.15	1.20	1.25
b1	2.95	3.00	3.05
b2	1.95	2.00	2.05
*B1	3.00	3.10	3.20
*B2	2.00	2.10	2.20
*c	0.55	0.60	0.65
*D	20.90	21.00	21.10
D1	16.45	16.55	16.65
D2	1.07	1.17	1.27
D3	8.15	8.20	8.25
*E	15.70	15.80	15.90
E1	13.16	13.26	13.36
E2	2.40	2.50	2.60
E3	6.10	6.20	6.30
E4	12.70	12.80	12.90
F	0.75	0.85	0.95
F1	5.70	5.80	5.90
F2	4.90	5.00	5.10
F3	9.90	10.00	10.10
*e	5.39	5.44	5.49
*L	19.72	19.92	20.12
*L1	4.03	4.13	4.23
Ø1	5°	7°	9°
Ø2	1°	2°	3°
Ø4	13°	15°	17°
*ØP1	3.50	3.60	3.70
ØP2	7.09	7.19	7.29
ØP3	2.40	2.50	2.60
*Q1	2.31	2.41	2.51
S	6.05	6.15	6.25
R	0.30	0.40	0.50



外形尺寸 PACKAGE MECHANICAL DATA
TO-263-7L

单位 Unit : mm



SYMBOL	mm	
	MIN	MAX
A	4.10	4.70
A1	1.00	1.60
A2	2.30	2.90
A3	0.00	0.50
b	0.30	0.90
b1	0.40	1.00
c	0.25	0.75
D	8.80	9.40
D1	6.15	6.75
D2	5.18REF	
E	9.90	10.50
E1	7.00REF	
E2	7.75	8.85
e	1.27 REF	
H	14.35	15.70
H1	0.85	1.55
L	1.75	2.65
L1	0.00	0.50



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