

# XNM6N60T

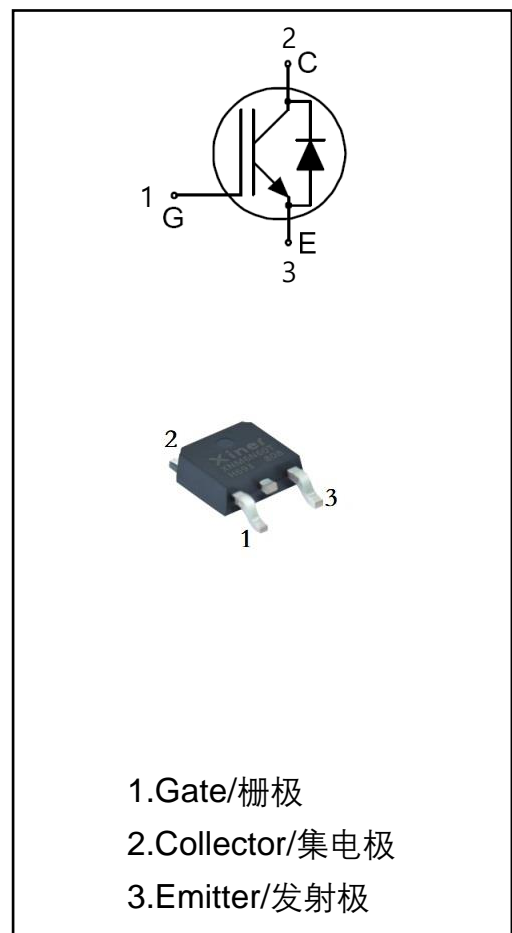
## 600V/6A 沟槽栅场截止型 IGBT

### 产品特点/PRODUCT FEATURES

- 先进的沟槽栅+场截止技术  
Advanced Trench+FS IGBT technology
- 超低饱和压降  
Low Collector-Emitter Saturation voltage
- 反并快恢复二极管  
With anti-parallel fast recovery diode
- 最高结温  $T_J = 175\text{ }^\circ\text{C}$   
Maximum junction temperature:  $T_J = 175\text{ }^\circ\text{C}$

### 应用领域/APPLICATIONS

- 电机控制器  
Motor control



### 关键性能和封装信息/Key Performance and Package Parameters

Type	$V_{CE}$	$I_C$	$V_{CEsat}, T_{vj}=25^\circ\text{C}$	$T_{vjmax}$	Package
XNM6N60T	600V	6A	2.1V	175°C	TO-252

深圳芯能半导体技术有限公司  
Shenzhen invsemi technology co,ltd

[IGBT\\_IPM\\_PIM\\_HVIC\\_深圳芯能半导体技术有限公司 \(invsemi.com\)](http://invsemi.com)

## 额定值、热阻 Ratings & Thermal Resistance

### 最大额定值/ Maximum Ratings

符号/Symbol	参数/Parameter	条件/Condition	值/Value	单位/Unit
$V_{CES}$	集电极-发射极电压 Collector-to-emitter voltage	$T_{vj}=25^{\circ}C$	600	V
$I_C$	集电极连续直流电流 DC Collector current	$T_C = 25^{\circ}C$	12	A
		$T_C = 100^{\circ}C$	6	
$I_{CRM}^{①}$	集电极可重复脉冲电流 Pulsed Collector current	$T_{vj} \leq 175^{\circ}C$	18	A
$I_F$	二极管连续直流电流 Diode continuous forward current	$T_C = 25^{\circ}C$	12	A
		$T_C = 100^{\circ}C$	6	
$I_{FRM}^{①}$	二极管可重复脉冲电流 Diode pulsed current	$T_{vj} \leq 175^{\circ}C$	18	A
$V_{GES}$	栅极-发射极峰值电压 Gate to emitter voltage	$T_{vj}=25^{\circ}C$	$\pm 30$	V
$t_{sc}$	短路耐量 Short circuit withstand time	$V_{GE}=15V, V_{CC} \leq 400V$ $T_{vj}=25^{\circ}C$	5	$\mu s$
$P_{tot}$	总耗散功率 Power dissipation	$T_C = 25^{\circ}C$	68	W
$T_{vj}$	可工作结温 Operating Junction Temperature	—	-40~+ 175	$^{\circ}C$
$T_{stg}$	储存温度 Storage Temperature Range	—	-50~ + 150	$^{\circ}C$

① 脉宽受限于最高结温/Pulse width limited by  $T_{vjmax}$

### 热阻/Thermal Resistance

符号/Symbol	参数/Parameter	最大值/Max.Value	单位/Unit
$R_{th(J-C)}$	IGBT 芯片到底板热阻 IGBT thermal resistance Junction-to-Case	2.2	K/W
$R_{th(J-C)}$	二极管芯片到底板热阻 FRD thermal resistance Maximum Junction-to-Case	2.4	K/W
$R_{th(J-A)}$	结到环境热阻 Thermal resistance Junction-to-Ambient	100	K/W

## 电气特性 Electrical Characteristic

### 静态电气特性/Static Electrical Characteristic

符号 Symbol	参数 Parameter	测试条件 Test conditions	Value值			单位 Units
			Min	Typ	Max	
$V_{(BR)CES}$	集电极-发射极击穿电压 Collector - Emitter breakdown voltage	$V_{GE}=0V, I_C=0.2mA, T_{vj}=25^{\circ}C$	600	—	—	V
$V_{CE(sat)}$	集电极-发射极饱和压降 Collector-Emitter Saturation voltage	$V_{GE}=15V, I_C=6A, T_{vj}=25^{\circ}C$	—	2.1	2.6	V
		$V_{GE}=15V, I_C=6A, T_{vj}=175^{\circ}C$	—	2.3	—	
$V_{GE(th)}$	门极开启阈值电压 Gate threshold voltage	$V_{GE}=V_{CE}, I_C=1mA, T_{vj}=25^{\circ}C$	4.5	5.85	6.2	V
$V_F$	二极管正向导通压降 Diode Forward Voltage	$V_{GE}=0V, I_F=6A, T_{vj}=25^{\circ}C$	—	1.4	1.9	V
		$V_{GE}=0V, I_F=6A, T_{vj}=175^{\circ}C$	—	1.2	—	
$I_{GES}$	门极-发射极漏电流 Gate to Emitter Leakage current	$V_{GE}=\pm 30V, V_{CE}=0V, T_{vj}=25^{\circ}C$	—	—	$\pm 100$	nA
$I_{CES}$	集电极-发射极漏电流 Zero gate voltage collector current	$V_{CE}=600V, V_{GE}=0V, T_{vj}=25^{\circ}C$	—	—	50	$\mu A$
$R_{Gin}$	内部门极电阻 Integrated gate resistor	—	—	0	—	$\Omega$

### 动态电气特性/Dynamic Electrical Characteristic

符号 Symbol	参数 Parameter	测试条件 Test conditions	Value值			单位 Units
			Min	Typ	Max	
$C_{ies}$	输入电容 Input capacitance	$V_{GE} = 0V, V_{CE} = 25V,$ $f = 1MHz, T_{vj} = 25^{\circ}C$	—	339	—	pF
$C_{oes}$	输出电容 Output capacitance		—	20	—	
$C_{res}$	反向传输电容 Reverse transfer capacitance		—	7.4	—	
$Q_g$	门极电量 Total gate charge	$I_C = 6A, V_{CE} = 480V,$ $V_{GE} = 15V, T_{vj} = 25^{\circ}C$	—	19	—	nC
$Q_{ge}$	门极-发射极电量 Gate to emitter charge		—	3	—	
$Q_{gc}$	门极-集电极电量 Gate to collector charge		—	10	—	

## 开关特性、感性负载 Switching Characteristic Inductive Load

### IGBT 特性/IGBT Characteristic

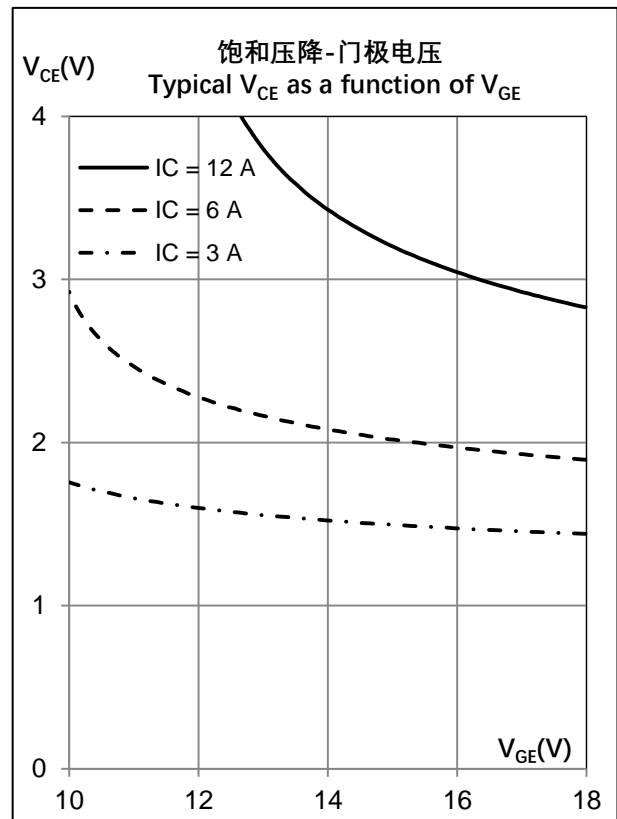
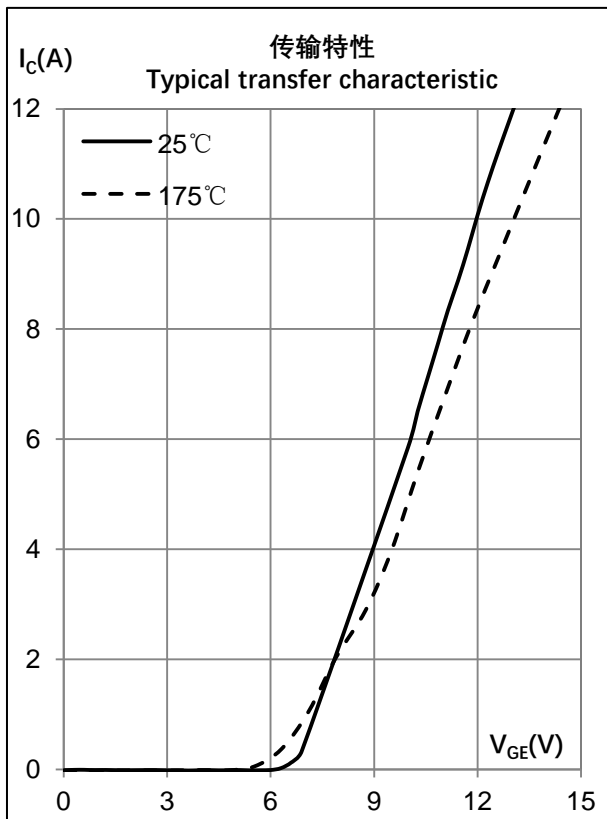
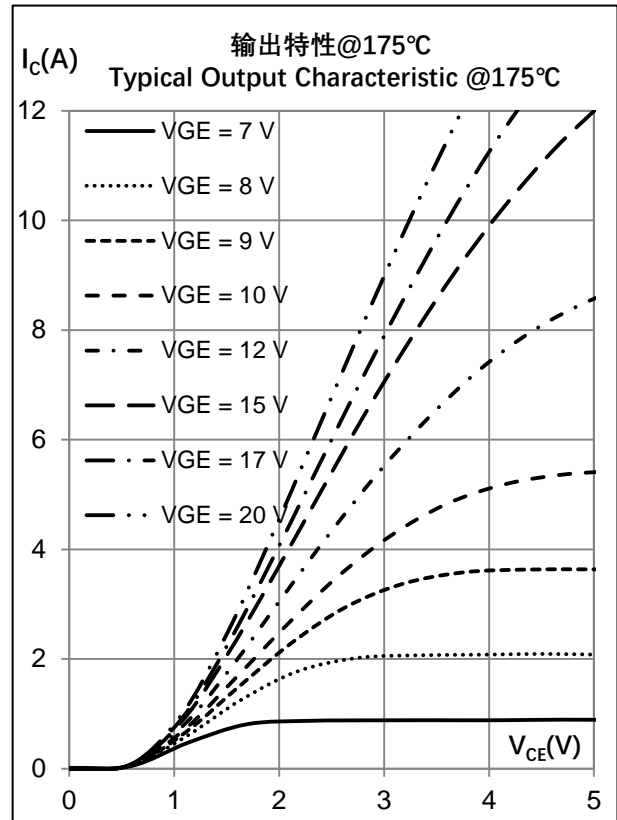
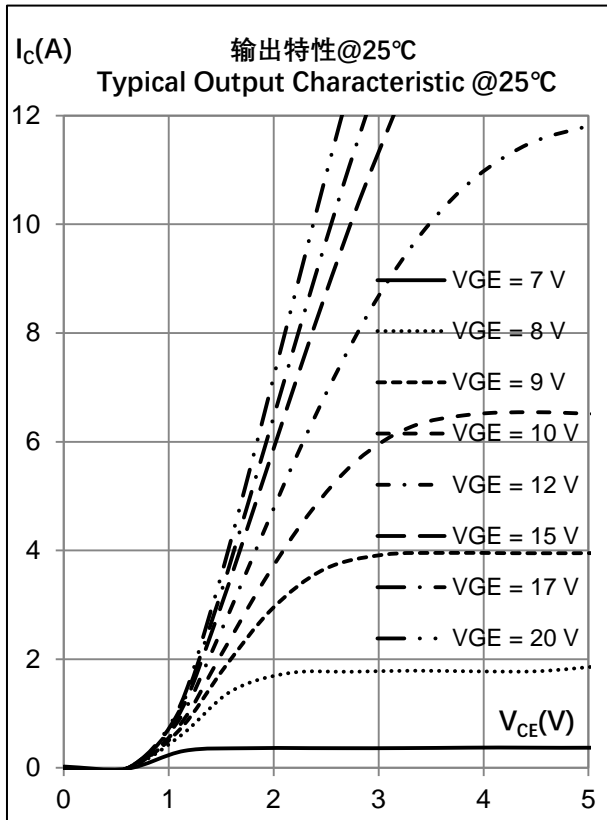
符号 Symbol	参数 Parameter	测试条件 Test conditions	值Value			单位 Units	
			Min	Typ	Max		
T <sub>d(on)</sub>	开启延迟时间 Turn-On Delay Time	V <sub>CC</sub> =400V I <sub>C</sub> =6A R <sub>G(on)</sub> =20Ω R <sub>G(off)</sub> =20Ω C=0nF V <sub>GE</sub> =15V L <sub>load</sub> =400μH	T <sub>vj</sub> =25°C	—	16	—	ns
			T <sub>vj</sub> =175°C	—	17	—	
T <sub>r</sub>	上升时间 Rise time		T <sub>vj</sub> =25°C	—	16	—	ns
			T <sub>vj</sub> =175°C	—	20	—	
T <sub>d(off)</sub>	关闭延迟时间 Turn-Off Delay Time		T <sub>vj</sub> =25°C	—	33	—	ns
			T <sub>vj</sub> =175°C	—	34	—	
t <sub>f</sub>	下降时间 Turn-Off Fall Time		T <sub>vj</sub> =25°C	—	89	—	ns
			T <sub>vj</sub> =175°C	—	122	—	
E <sub>on</sub>	单次开启损耗 Turn-on switch loss		T <sub>vj</sub> =25°C	—	107	—	μJ
			T <sub>vj</sub> =175°C	—	241	—	
E <sub>off</sub>	单次关闭损耗 Turn-off switch loss	T <sub>vj</sub> =25°C	—	105	—	μJ	
		T <sub>vj</sub> =175°C	—	133	—		

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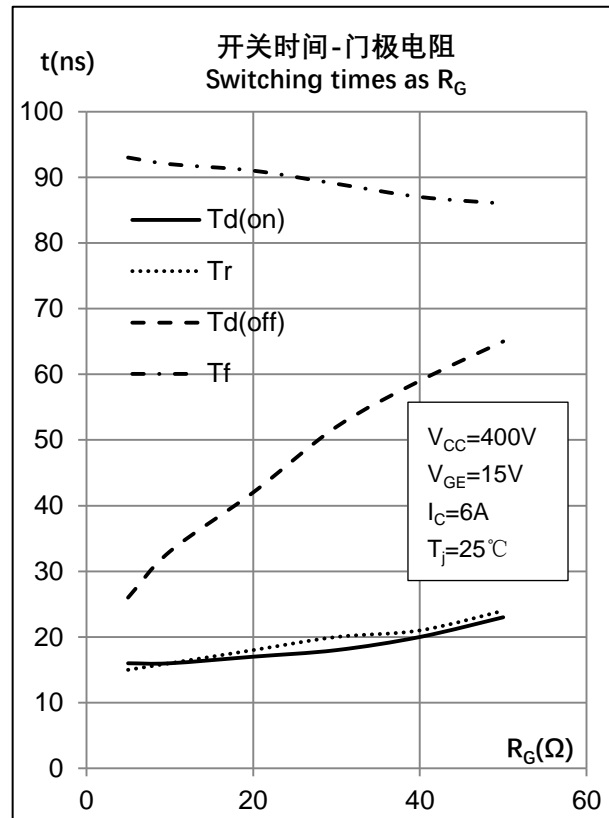
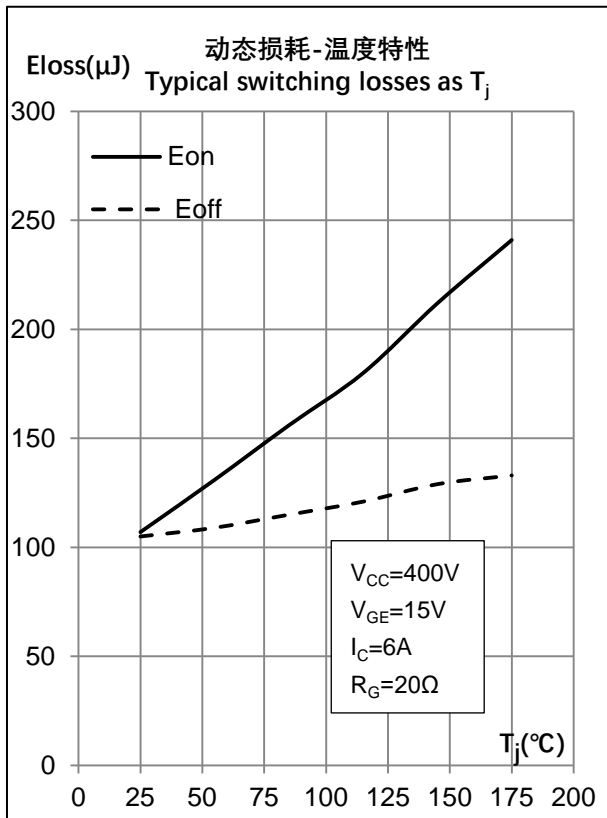
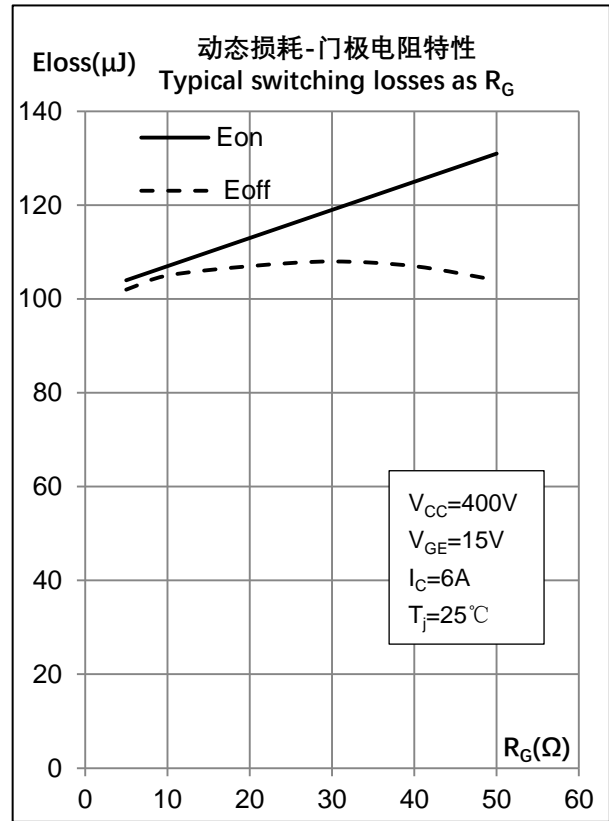
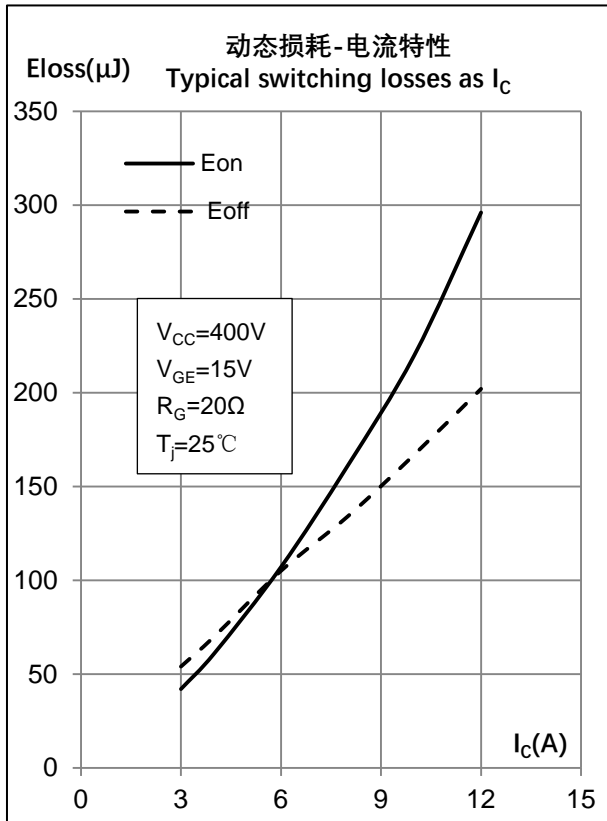
### 二极管特性/Diode Characteristic

符号 Symbol	参数 Parameter	测试条件 Test conditions	值Value			单位 Units	
			Min	Typ	Max		
t <sub>rr</sub>	二极管反向恢复时间 Diode Reverse Recovery Time	I <sub>F</sub> = 6A V <sub>R</sub> =400V di <sub>F</sub> /dt=-410A/μs	T <sub>vj</sub> =25°C	—	78	—	ns
			T <sub>vj</sub> =175°C	—	232	—	
Q <sub>rr</sub>	二极管反向恢复电量 Diode Reverse Recovery Charge		T <sub>vj</sub> =25°C	—	121	—	nC
			T <sub>vj</sub> =175°C	—	468	—	
I <sub>rrm</sub>	反向恢复峰值电流 Peak reverse recovery current		T <sub>vj</sub> =25°C	—	4.8	—	A
			T <sub>vj</sub> =175°C	—	6.5	—	
di <sub>rr</sub> /dt	恢复下降电流最大电流变化率 Peak rate of i <sub>rr</sub>		T <sub>vj</sub> =25°C	—	127	—	A/μs
			T <sub>vj</sub> =175°C	—	56	—	
E <sub>rec</sub>	二极管反向恢复损耗 Diode Reverse Recovery loss		T <sub>vj</sub> =25°C	—	19	—	μJ
			T <sub>vj</sub> =175°C	—	92	—	

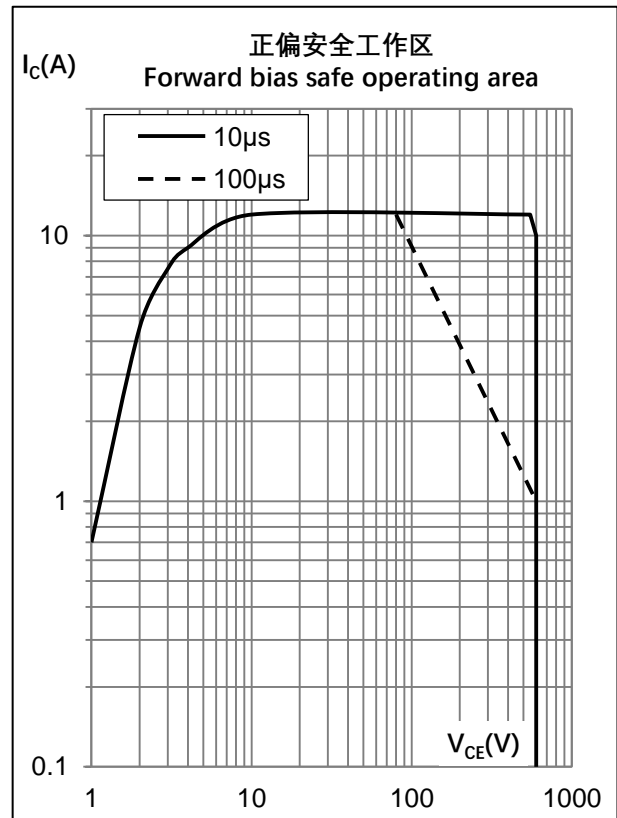
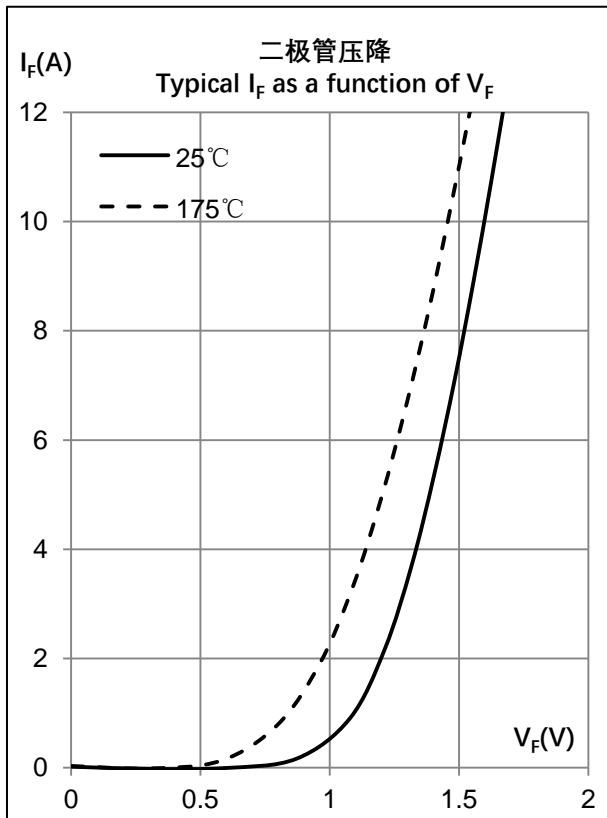
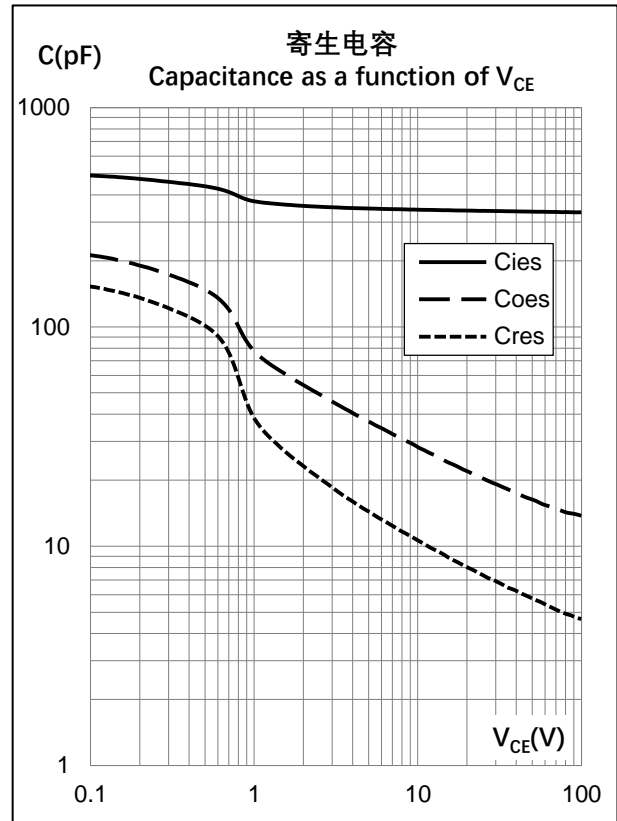
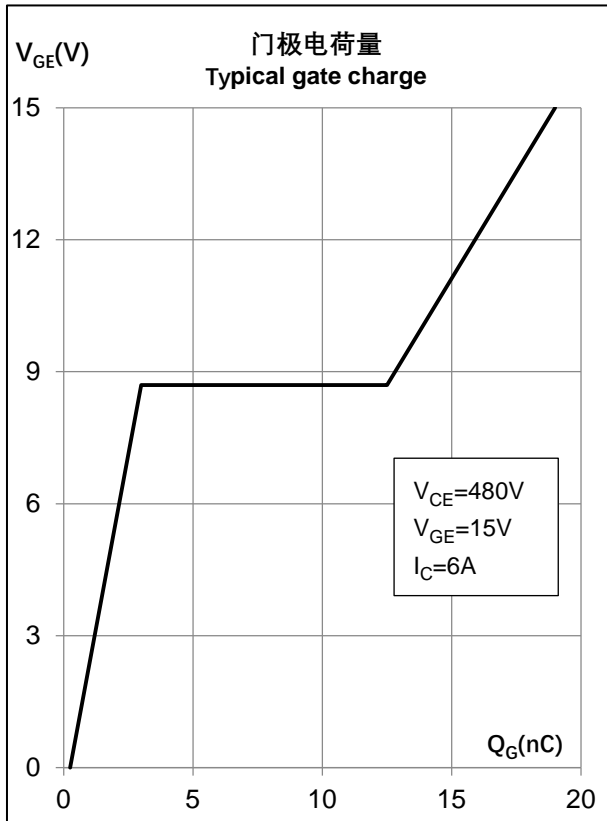
## 特征曲线 Characteristic Curve



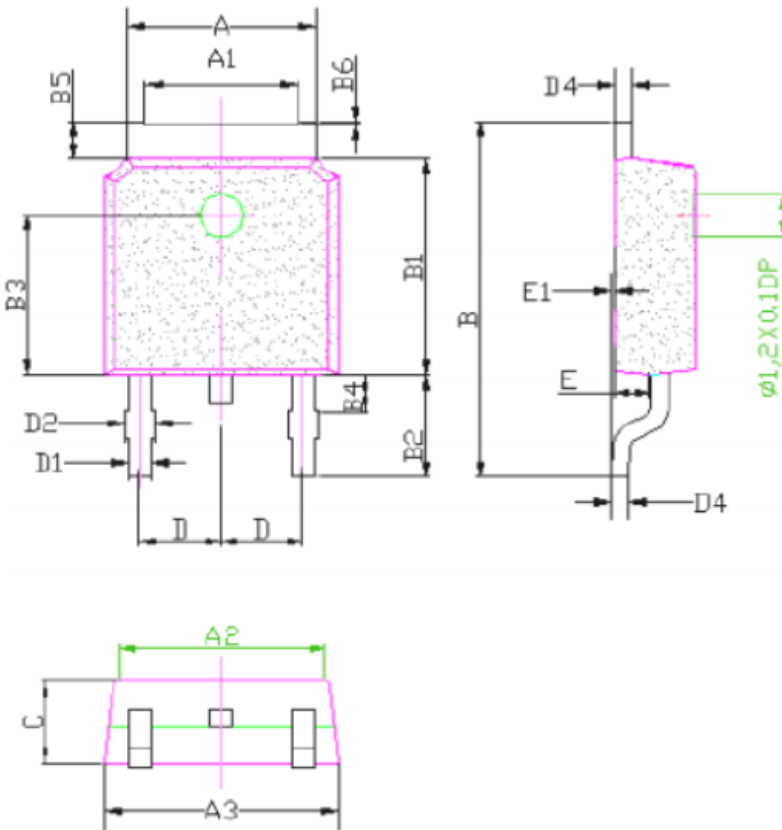
## 特征曲线 Characteristic Curve



## 特征曲线 Characteristic Curve



## TO-252 封装数据 TO-252 Package Data



DIM	MILLIMETERS
A	5.33±0.2
A1	4.33±0.2
A2	5.78±0.1
A3	6.6±0.2
B	10±0.5
B1	6.1±0.3
B2	2.85±0.5
B3	4.5±0.25
B4	1±0.1
B5	1.05±0.1
B6	0.1±0.05
C	2.3±0.2
D	2.286±0.05
D1	0.62±0.15
D2	0.5±0.15
D3	0.5±0.15
D4	0.5±0.15
E	1.01±0.2
E1	0.1±0.05

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