

XNF6N60T

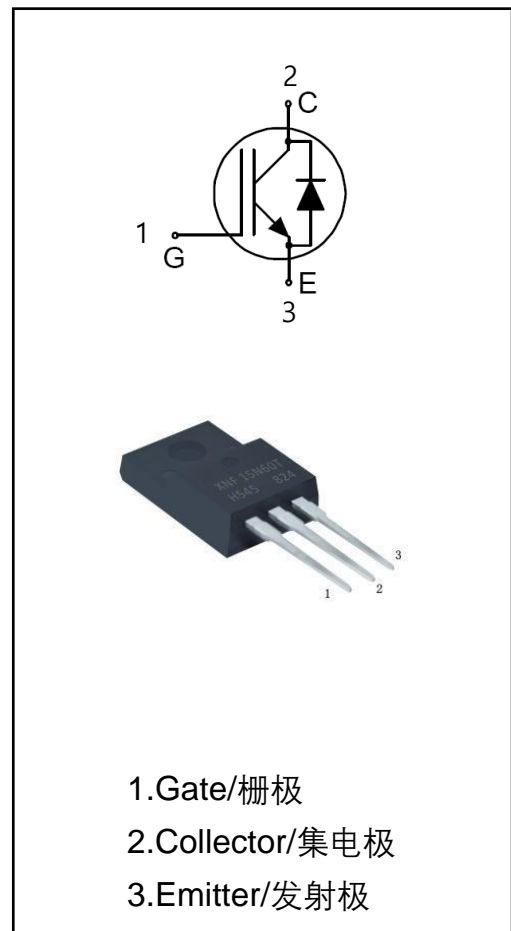
600V/6A 沟槽栅场截止型 IGBT

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
XNF6N60T	600V	6A	2V	175°C	TO-220F

深圳芯能半导体技术有限公司
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[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	$T_{vj}=25^{\circ}\text{C}$	600	V
I_C	集电极连续直流电流 DC Collector current	$T_C = 25^{\circ}\text{C}$	12	A
		$T_C = 100^{\circ}\text{C}$	6	
$I_{CRM}^{①}$	集电极可重复脉冲电流 Pulsed Collector current	$T_{vj} \leq 175^{\circ}\text{C}$	18	A
I_F	二极管连续直流电流 Diode continuous forward current	$T_C = 25^{\circ}\text{C}$	12	A
		$T_C = 100^{\circ}\text{C}$	6	
$I_{FRM}^{①}$	二极管可重复脉冲电流 Diode pulsed current	$T_{vj} \leq 175^{\circ}\text{C}$	18	A
V_{GES}	栅极-发射极峰值电压 Gate to emitter voltage	$T_{vj}=25^{\circ}\text{C}$	± 30	V
t_{sc}	短路耐量 Short circuit withstand time	$V_{GE}=15\text{V}, V_{CC} \leq 400\text{V}$ $T_{vj}=25^{\circ}\text{C}$	5	μs
P_{tot}	总耗散功率 Power dissipation	$T_C = 25^{\circ}\text{C}$	30	W
T_{vj}	可工作结温 Operating Junction Temperature	—	-40~+ 175	$^{\circ}\text{C}$
T_{stg}	储存温度 Storage Temperature Range	—	-50~ + 150	$^{\circ}\text{C}$

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	5	K/W
$R_{th(J-C)}$	二极管芯片到底板热阻 FRD thermal resistance Maximum Junction-to-Case	5.2	K/W
$R_{th(J-A)}$	结到环境热阻 Thermal resistance Junction-to-Ambient	80	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	2.4	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	$V_{GE}=V_{CE}, I_C=1mA, T_{vj}=25^{\circ}C$	4.8	5.75	6.3	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	$V_{GE}=\pm 30V, V_{CE}=0V, T_{vj}=175^{\circ}C$	—	—	± 100	nA
I_{CES}	集电极-发射极漏电流 Zero gate voltage collector current	$V_{CE}=600V, V_{GE}=0V, T_{vj}=175^{\circ}C$	—	—	300	μA
R_{Gin}	内部门极电阻 Integrated gate resistor	—	—	0	—	Ω

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

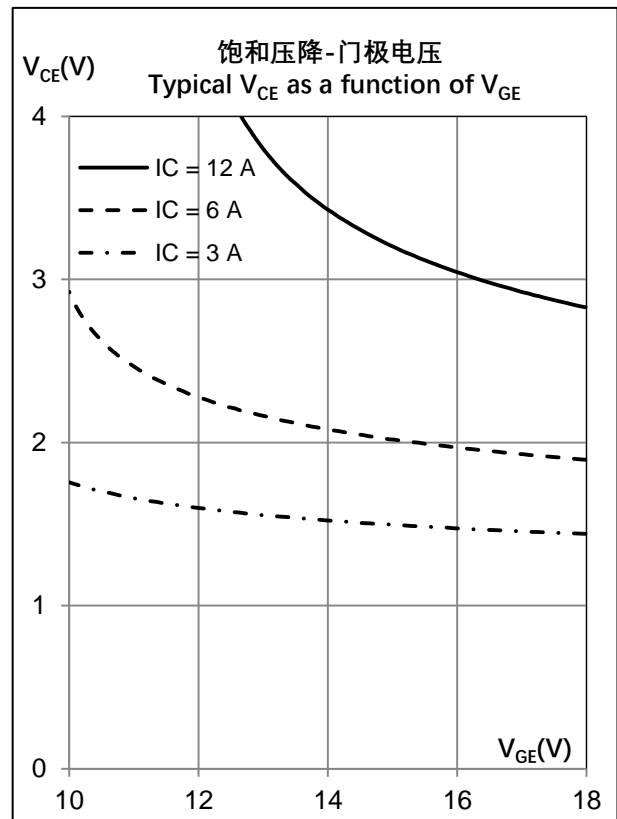
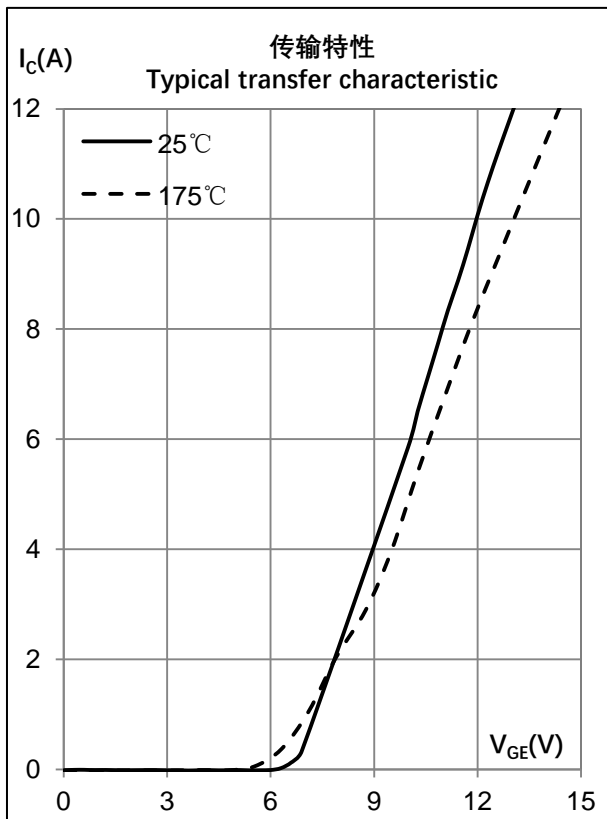
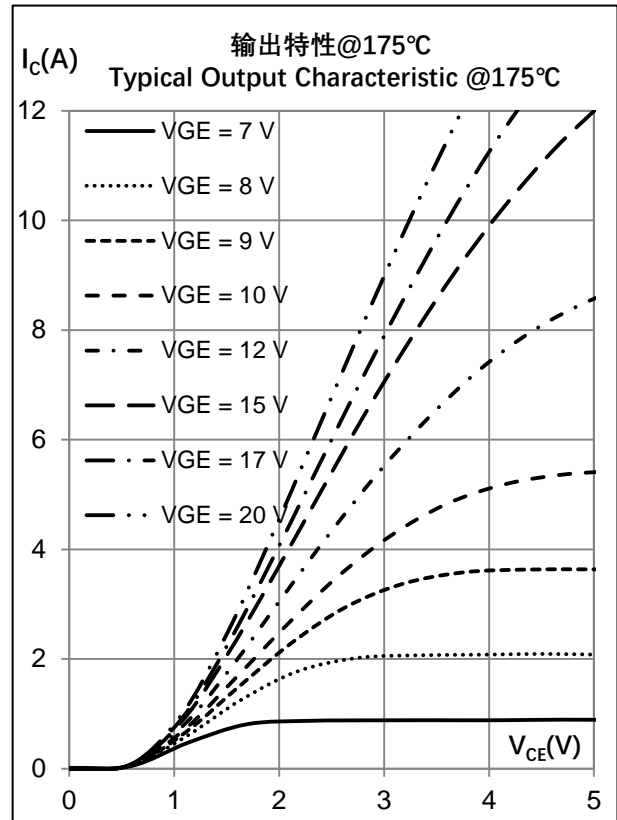
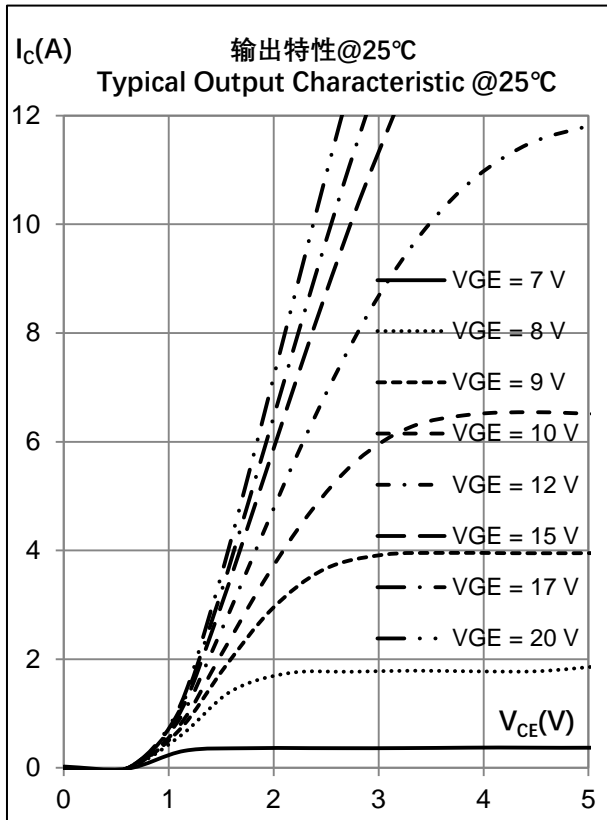
符号 Symbol	参数 Parameter	测试条件 Test conditions	值Value			单位 Units	
			Min	Typ	Max		
T _{d(on)}	开启延迟时间 Turn-On Delay Time	V _{CC} =400V I _C =6A R _{G(on)} =20Ω R _{G(off)} =20Ω C=0nF V _{GE} =15V L _{load} =400μH	T _{vj} =25°C	—	16	—	ns
			T _{vj} =175°C	—	17	—	
T _r	上升时间 Rise time		T _{vj} =25°C	—	16	—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

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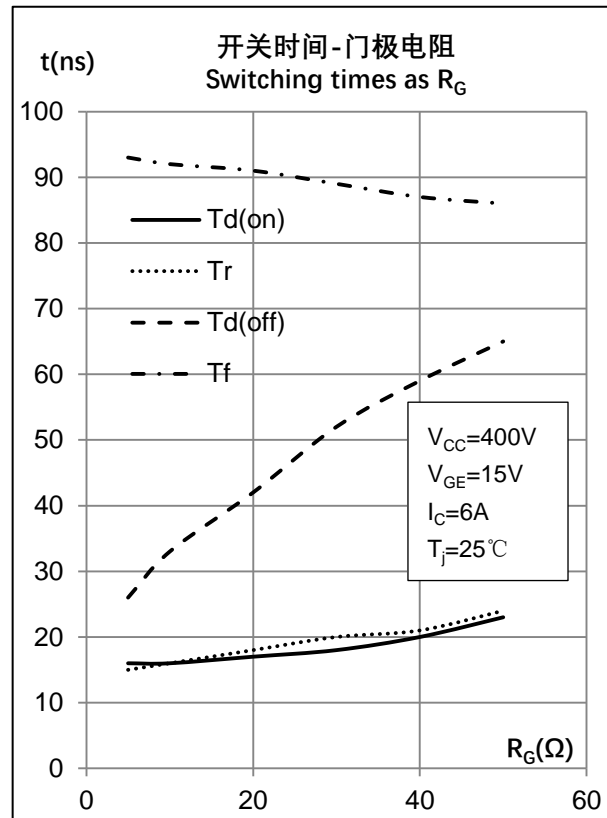
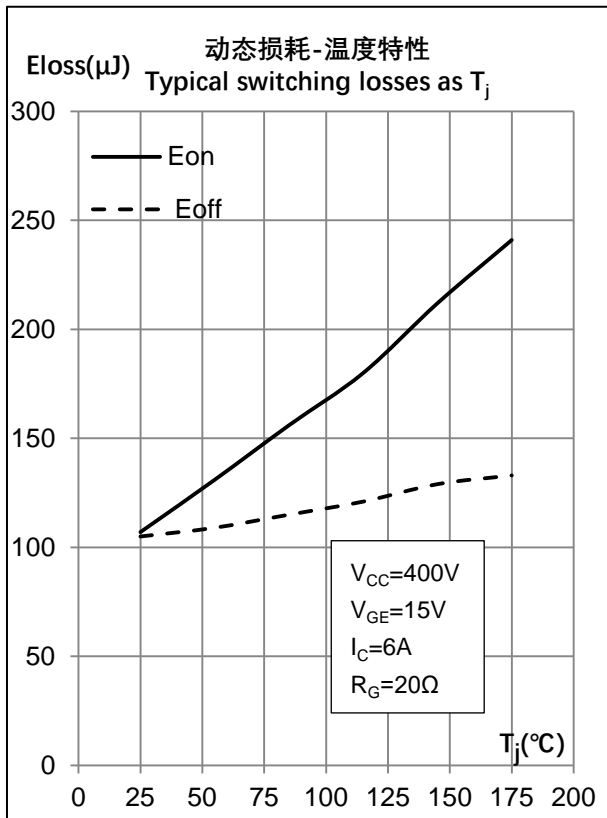
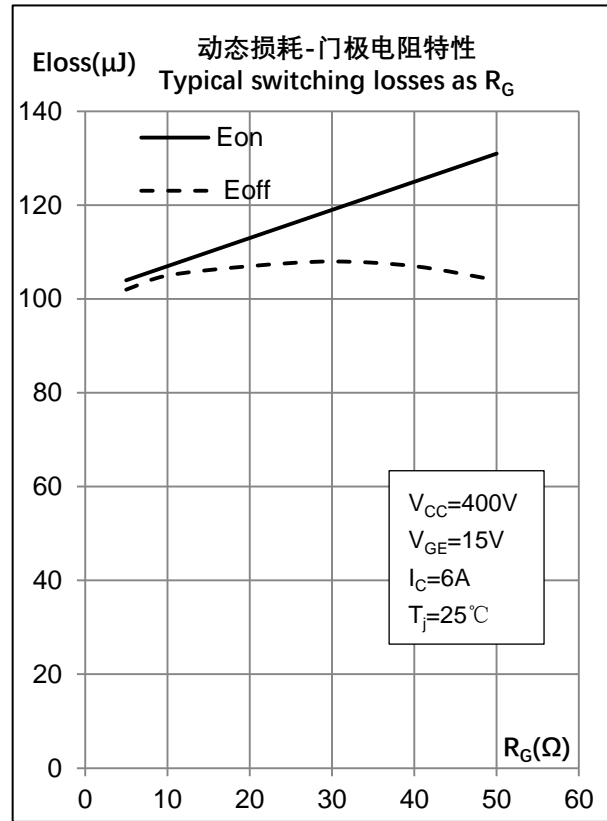
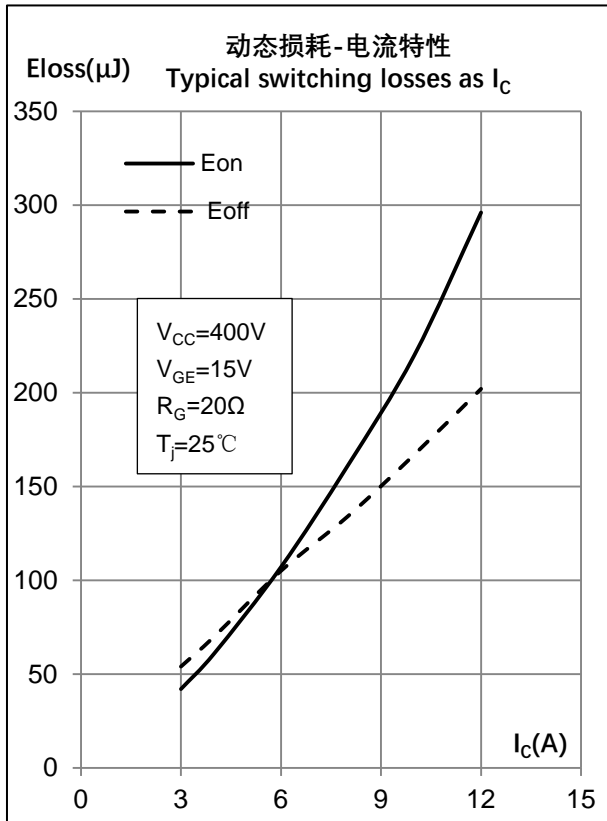
二极管特性/Diode Characteristic

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

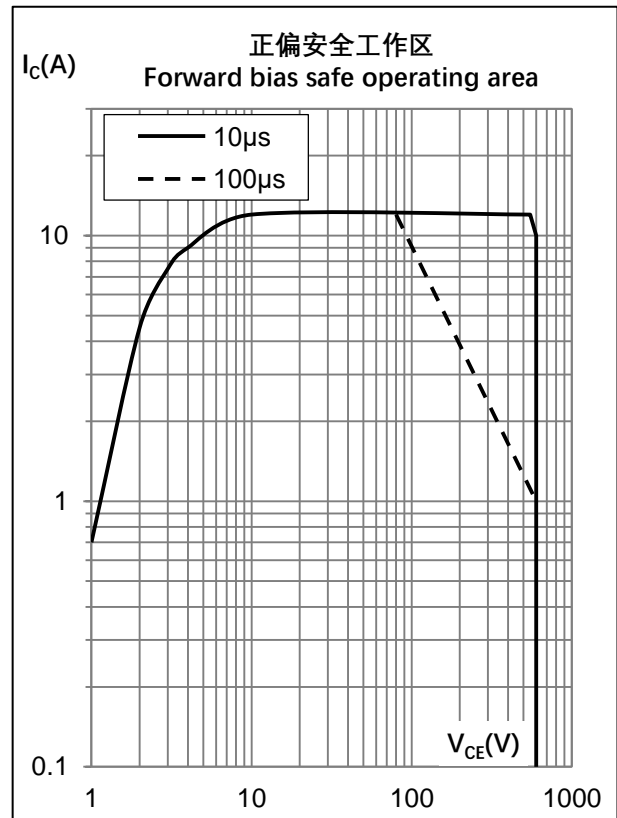
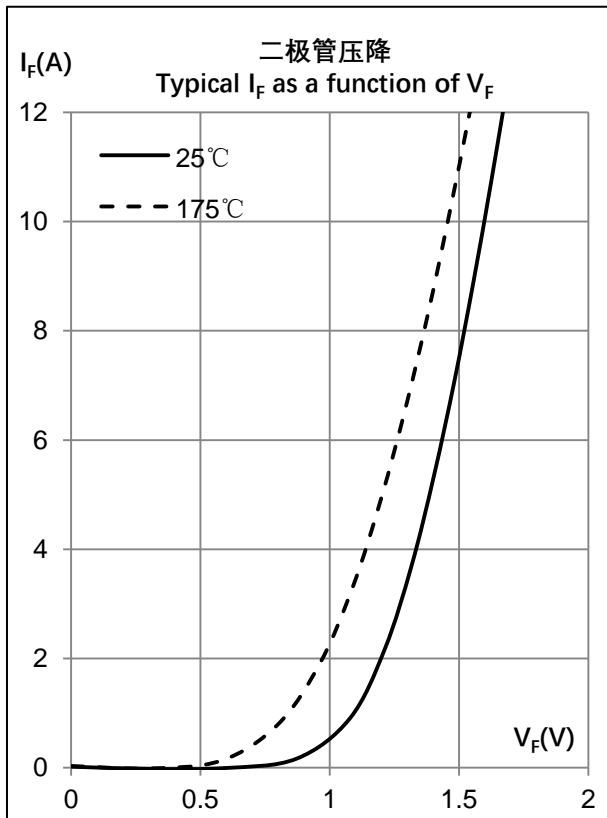
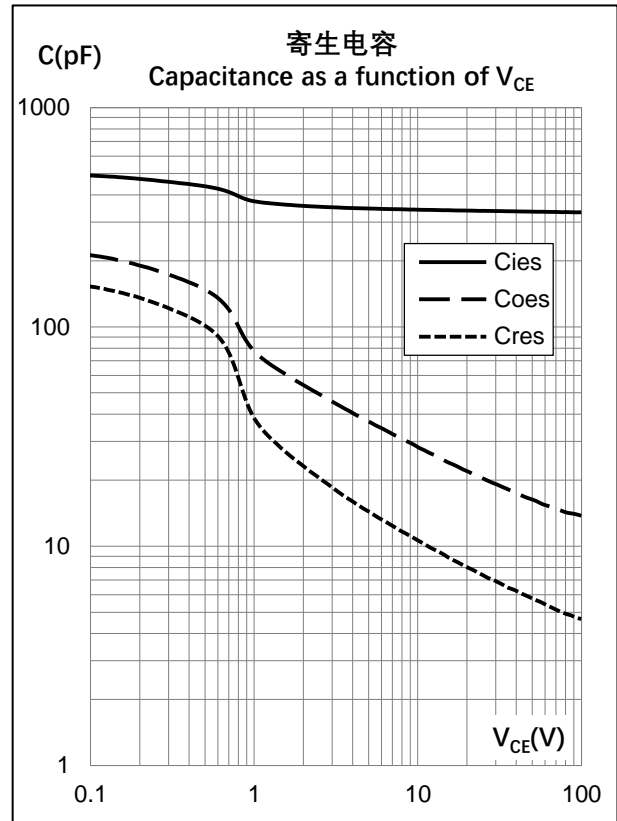
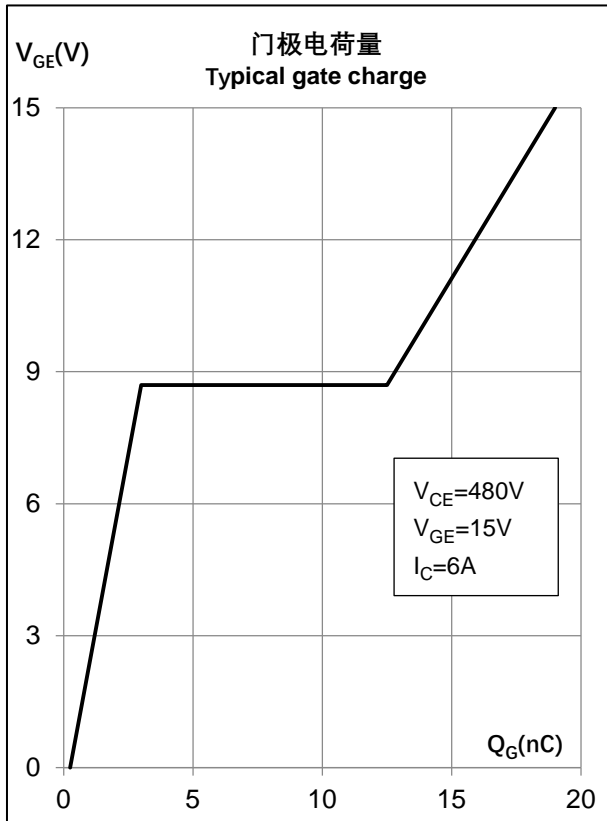
特征曲线 Characteristic Curve



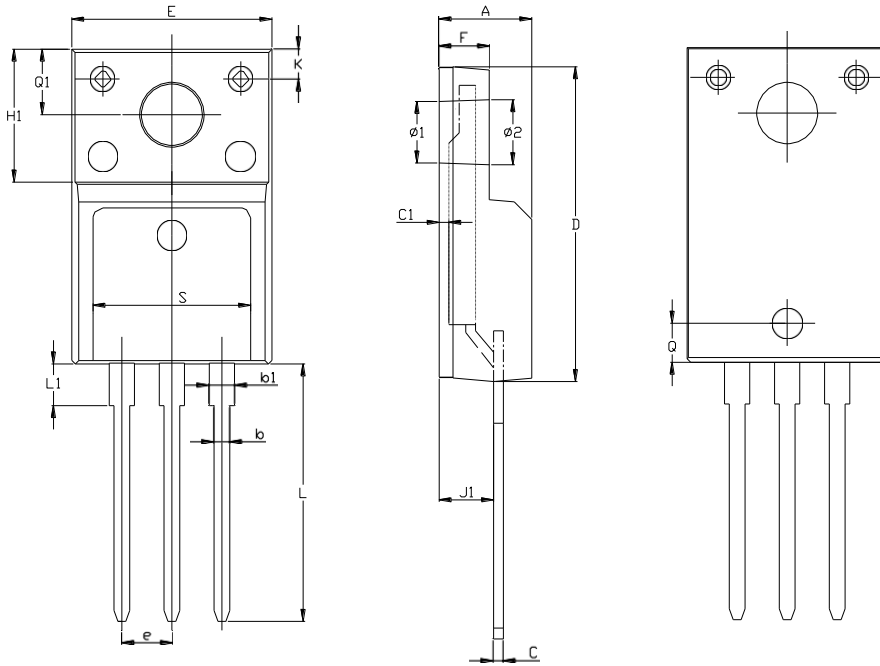
特征曲线 Characteristic Curve



特征曲线 Characteristic Curve



TO-220F 封装数据 TO-220F Package Data



DIM	MIM(mm)	MAX(mm)
A	4.53	4.93
b	0.71	0.91
b1	1.15	1.39
C / C1	0.45	0.6
D	15.67	16.07
E	9.96	10.36
F	2.34	2.74
H1	6.5	6.9
J	0.32	0.43
J1	2.56	2.96
K	1.9	2.1
e	2.54 BSC	
Q	1.9	2.1
Q1	3.1	3.5
S	7.9	8.1
L	12.78	13.18
L1	1.9	2.3
Ø1	3.08	3.28
Ø2	3.35	3.55

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