

# XNS40N60T

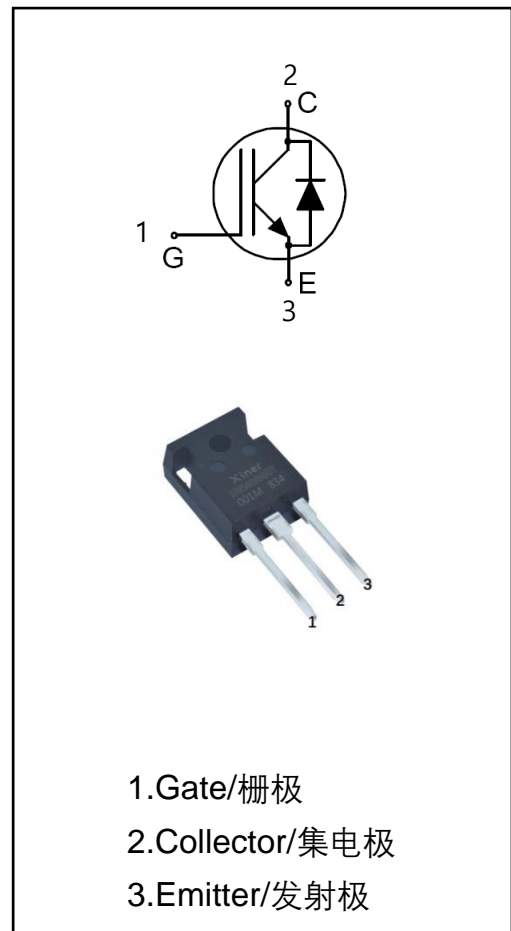
## 600V/40A 沟槽栅场截止型 IGBT

### 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
XNS40N60T	600V	40A	1.85V	175°C	TO-247-3

## 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	$T_C = 25^{\circ}\text{C}$	80	A
		$T_C = 100^{\circ}\text{C}$	40	
$I_{CRM}^{①}$	集电极可重复脉冲电流 Pulsed drain current, $t_p$ limited by $T_{vjmax}$	$T_{vj} \leq 175^{\circ}\text{C}$	160	A
$I_F$	二极管连续直流电流 Diode continuous forward current	$T_C = 25^{\circ}\text{C}$	80	A
		$T_C = 100^{\circ}\text{C}$	40	
$I_{FRM}^{①}$	二极管可重复脉冲电流 Diode pulsed current, $t_p$ limited by $T_{vjmax}$	$T_{vj} \leq 175^{\circ}\text{C}$	160	A
$V_{GES}$	栅极-发射极峰值电压 Gate to emitter voltage	$T_{vj}=25^{\circ}\text{C}$	$\pm 30$	V
$t_{sc}$	短路耐量 Short circuit withstand time	$V_{GE}=15\text{V}, V_{CC} \leq 400\text{V}$ $T_{vj}=25^{\circ}\text{C}$	10	$\mu\text{s}$
$P_{tot}$	总耗散功率 Power dissipation	$T_C = 25^{\circ}\text{C}$	260	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	0.57	K/W
$R_{th(J-C)}$	二极管芯片到底板热阻 FRD thermal resistance Maximum Junction-to-Case	1.1	K/W
$R_{th(J-A)}$	结到环境热阻 Thermal resistance Junction-to-Ambient	40	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	$V_{GE}=0V, I_C=1mA, T_{vj}=25^{\circ}C$	600	—	—	V
$V_{CE(sat)}$	集电极-发射极饱和压降 Collector-Emitter Saturation voltage	$V_{GE}=15V, I_C=40A, T_{vj}=25^{\circ}C$	—	1.85	2.1	V
		$V_{GE}=15V, I_C=40A, T_{vj}=175^{\circ}C$	—	2.2	—	
$V_{GE(th)}$	门极开启阈值电压 Gate threshold voltage	$V_{GE}=V_{CE}, I_C=4mA, T_{vj}=25^{\circ}C$	5	5.6	6.5	V
$V_F$	二极管正向导通压降 Diode Forward Voltage	$V_{GE}=0V, I_F=40A, T_{vj}=25^{\circ}C$	1	1.4	1.8	V
		$V_{GE}=0V, I_F=40A, T_{vj}=175^{\circ}C$	—	1.1	—	
$I_{GES}$	门极-发射极漏电流 Gate to Emitter Leakage current	$V_{GE}=20V, V_{CE}=0V, T_{vj}=175^{\circ}C$	—	—	200	nA
$I_{CES}$	集电极-发射极漏电流 Zero gate voltage collector current	$V_{CE}=600V, V_{GE}=0V, T_{vj}=175^{\circ}C$	—	—	400	$\mu A$
$R_{Gin}$	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	$V_{GE}=0V, V_{CE}=25V,$ $f=1MHz, T_{vj}=25^{\circ}C$	—	2440	—	pF
$C_{oes}$	输出电容 Output capacitance		—	186	—	
$C_{res}$	反向传输电容 Reverse transfer capacitance		—	69	—	
$Q_g$	门极电量 Total gate charge	$I_C=40A, V_{CE}=480V,$ $V_{GE}=15V, T_{vj}=25^{\circ}C$	—	144	—	nC
$Q_{ge}$	门极-发射极电量 Gate to emitter charge		—	17	—	
$Q_{gc}$	门极-集电极电量 Gate to collector charge		—	74	—	
$I_{sc}$	短路电流 Short circuit collector current	$T_{vj}=25^{\circ}C, V_{CE}=400V,$ $V_{GE}=15V$	—	180	—	A

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

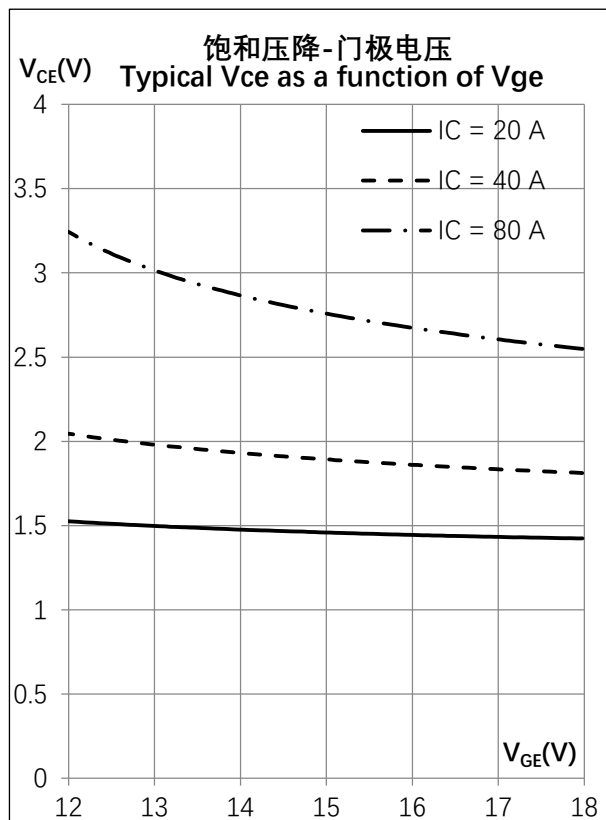
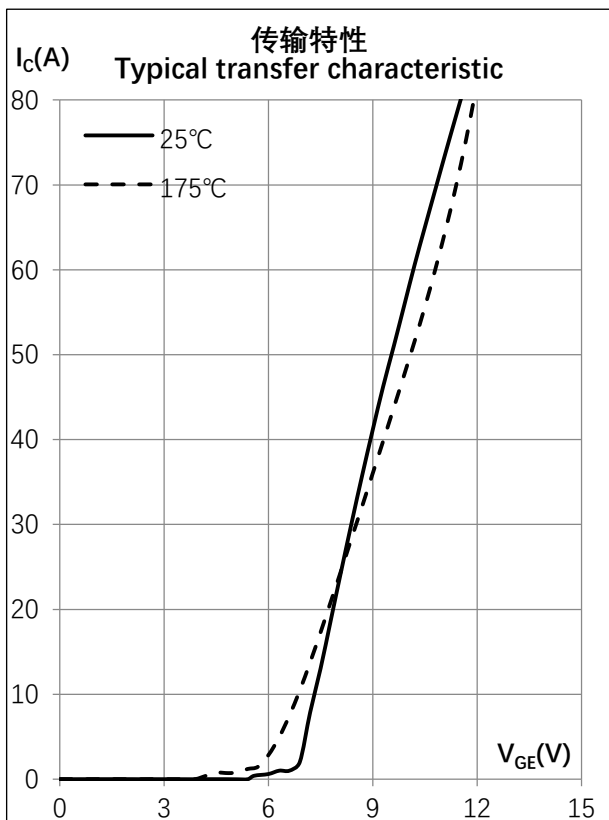
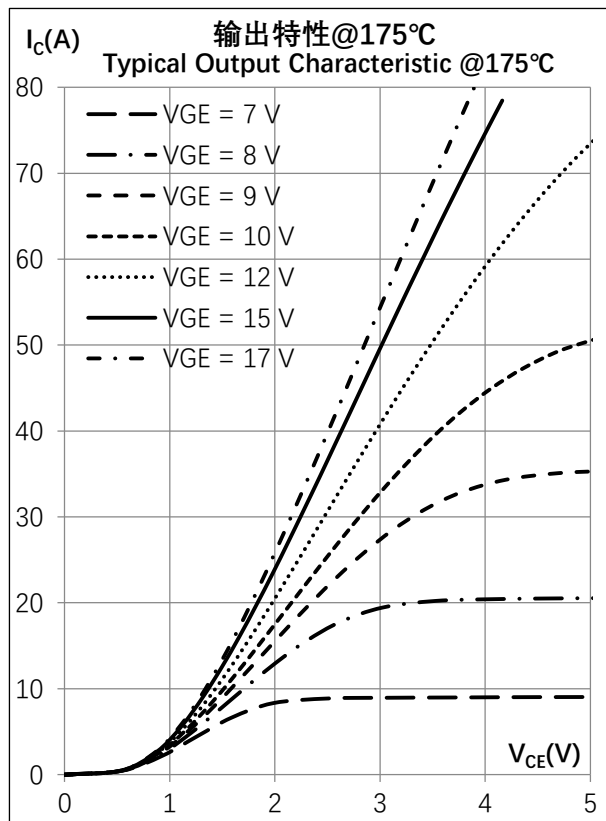
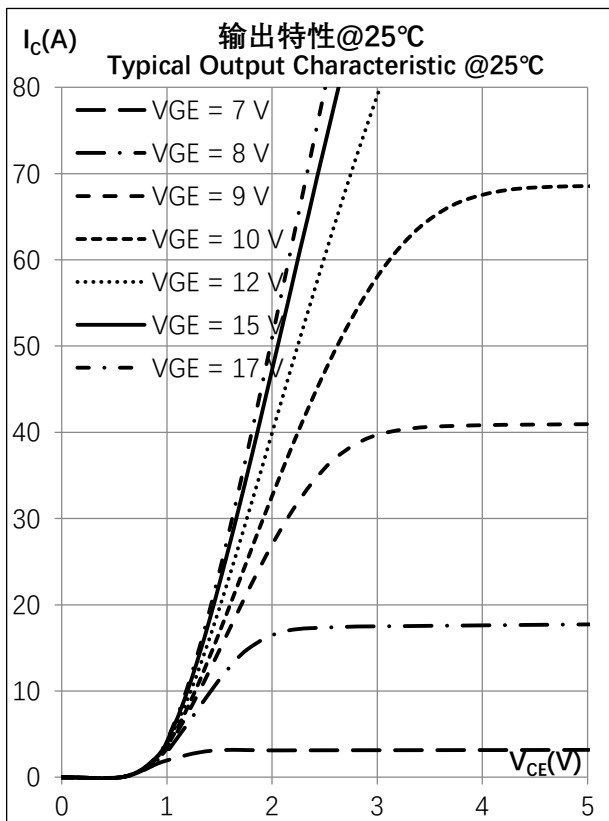
### IGBT 特性\IGBT Characteristic

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	$V_{CC}=400V$ $I_C=40A$ $R_{G(on)}=20\Omega$ $R_{G(off)}=20\Omega$ $C=0nF$ $V_{GE}=15V$ $L_{load}=150\mu H$	$T_{vj}=25^\circ C$	—	43	—	ns
			$T_{vj}=175^\circ C$	—	40	—	
$T_r$	上升时间 Rise time		$T_{vj}=25^\circ C$	—	36	—	ns
			$T_{vj}=175^\circ C$	—	40	—	
$T_{d(off)}$	关闭延迟时间 Turn-Off Delay Time		$T_{vj}=25^\circ C$	—	331	—	ns
			$T_{vj}=175^\circ C$	—	355	—	
$t_f$	下降时间 Turn-Off Fall Time		$T_{vj}=25^\circ C$	—	46	—	ns
			$T_{vj}=175^\circ C$	—	39	—	
$E_{on}$	单次开启损耗 Turn-on switch loss		$T_{vj}=25^\circ C$	—	1.3	—	mJ
			$T_{vj}=175^\circ C$	—	2.6	—	
$E_{off}$	单次关闭损耗 Turn-off switch loss	$T_{vj}=25^\circ C$	—	1.3	—	mJ	
		$T_{vj}=175^\circ C$	—	1.4	—		

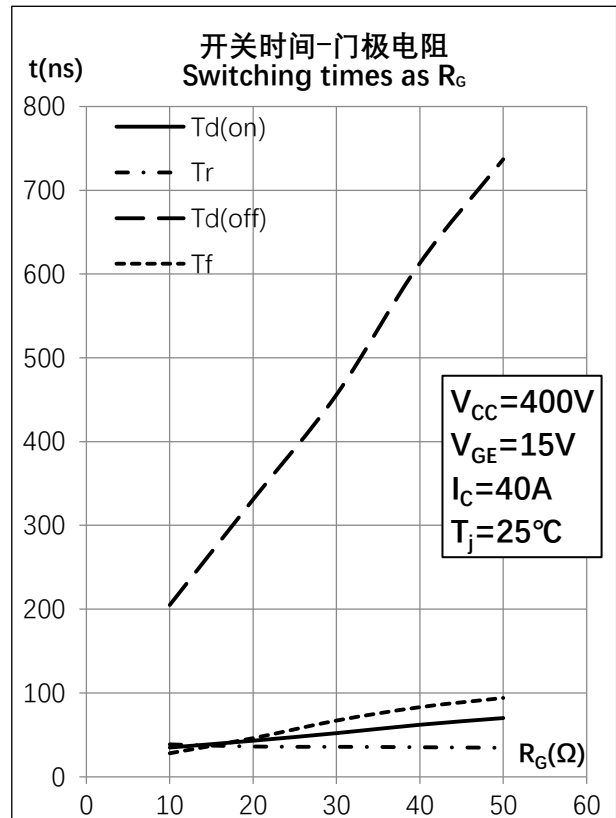
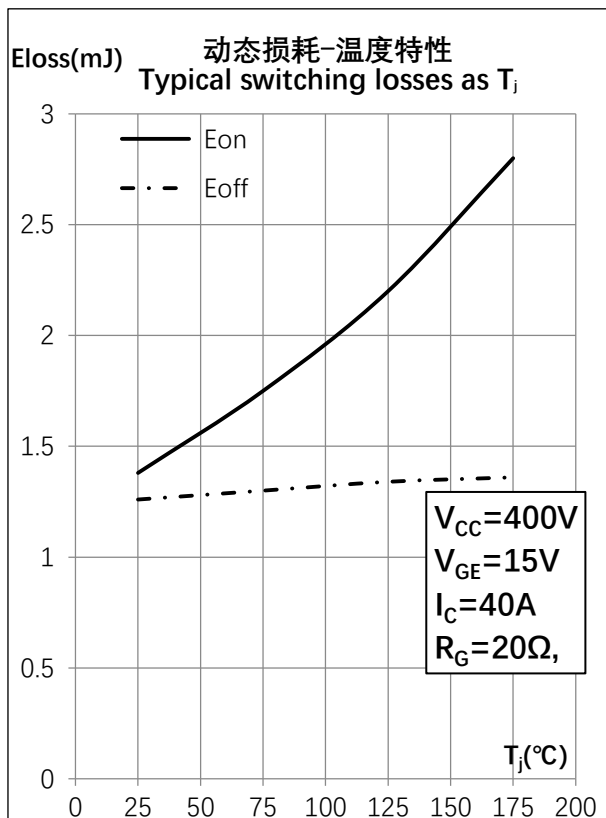
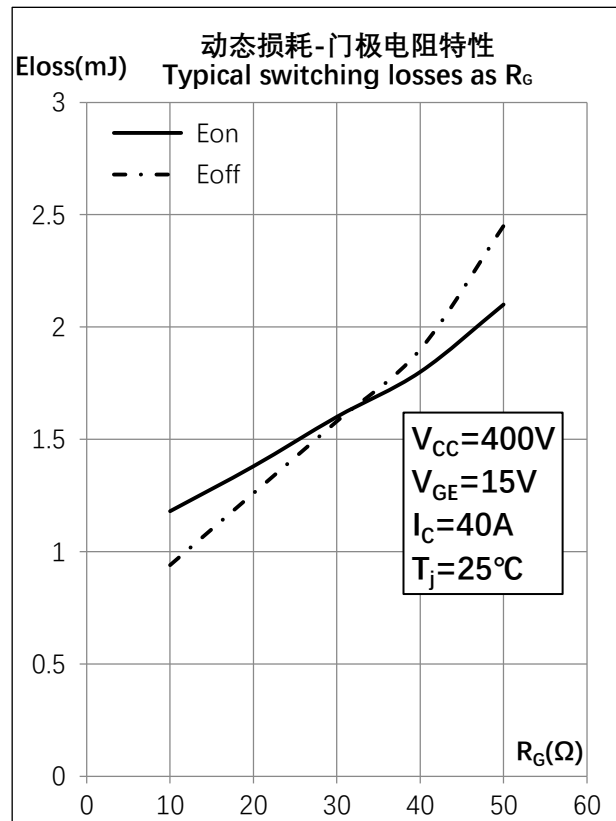
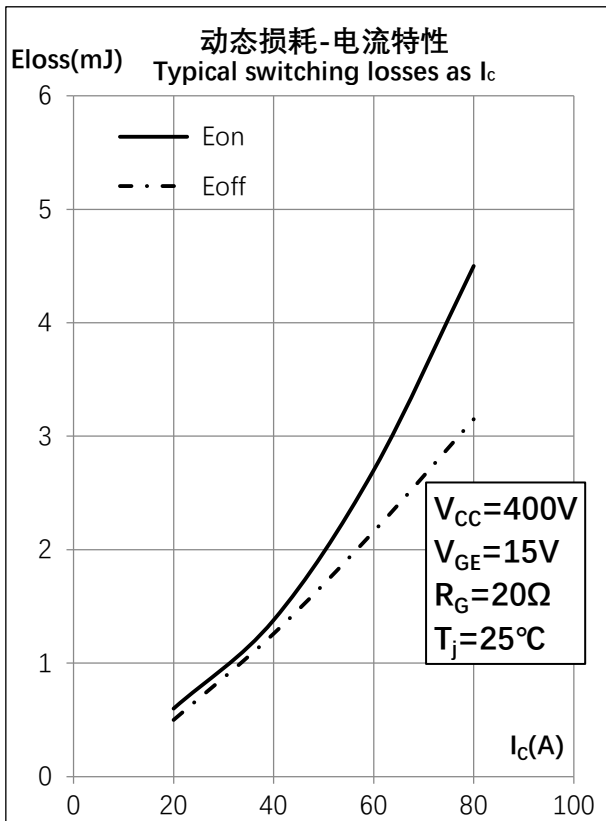
### 二极管特性\Diode Characteristic

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	$I_F = 40A$ $V_R=400V$ $di_F/dt=-500A/\mu s$	$T_{vj}=25^\circ C$	—	125	—	ns
			$T_{vj}=175^\circ C$	—	214	—	
$Q_{rr}$	二极管反向恢复电量 Diode Reverse Recovery Charge		$T_{vj}=25^\circ C$	—	0.9	—	$\mu C$
			$T_{vj}=175^\circ C$	—	3.6	—	
$I_{rrm}$	反向恢复峰值电流 Peak reverse recovery current		$T_{vj}=25^\circ C$	—	14	—	A
			$T_{vj}=175^\circ C$	—	28	—	
$di_{rr}/dt$	恢复下降电流最大电流变化率 Peak rate of $i_{rr}$		$T_{vj}=25^\circ C$	—	225	—	A/ $\mu s$
			$T_{vj}=175^\circ C$	—	262	—	
$E_{rec}$	二极管反向恢复损耗 Diode Reverse Recovery loss		$T_{vj}=25^\circ C$	—	130	—	$\mu J$
			$T_{vj}=175^\circ C$	—	550	—	

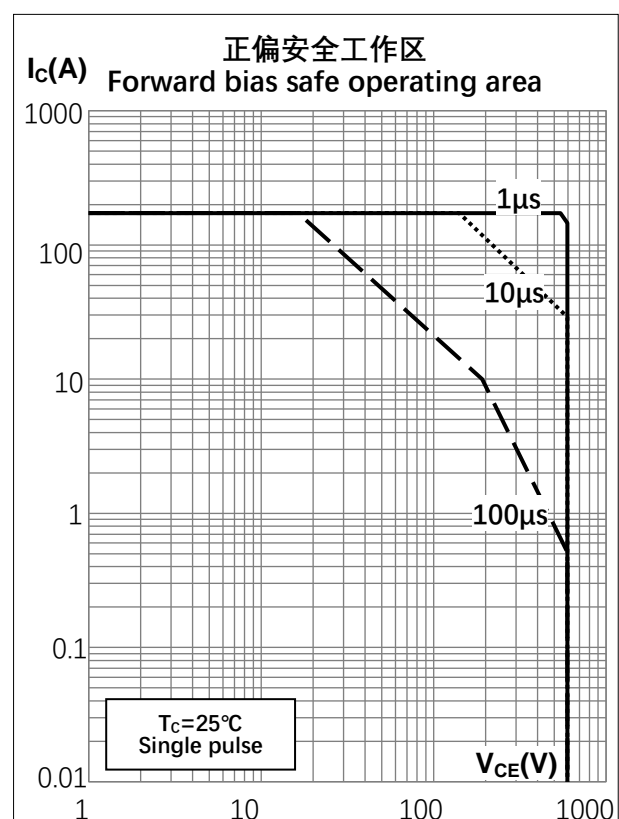
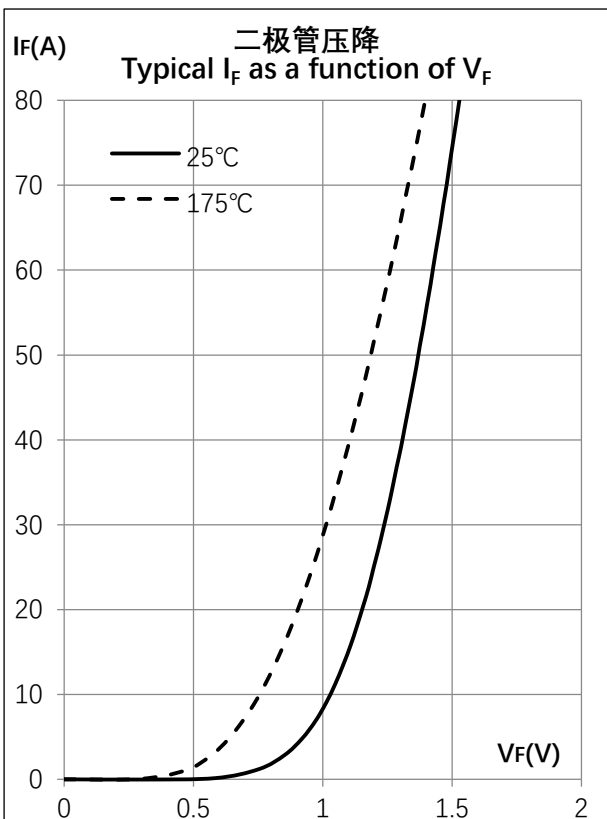
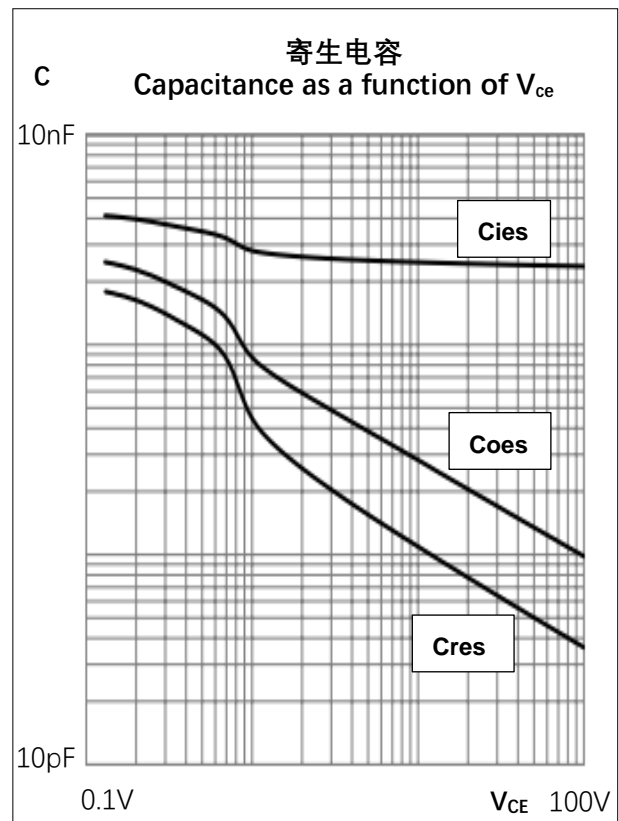
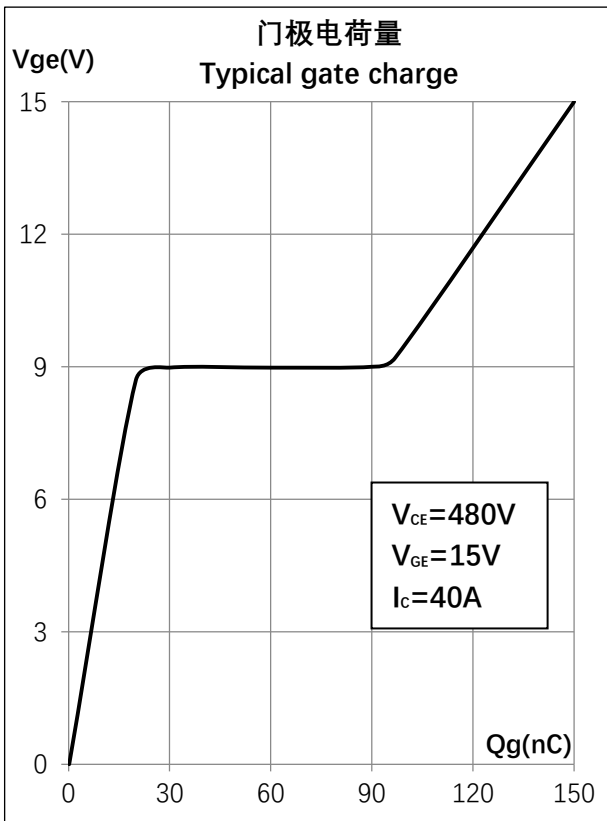
## 特征曲线 Characteristic Curve



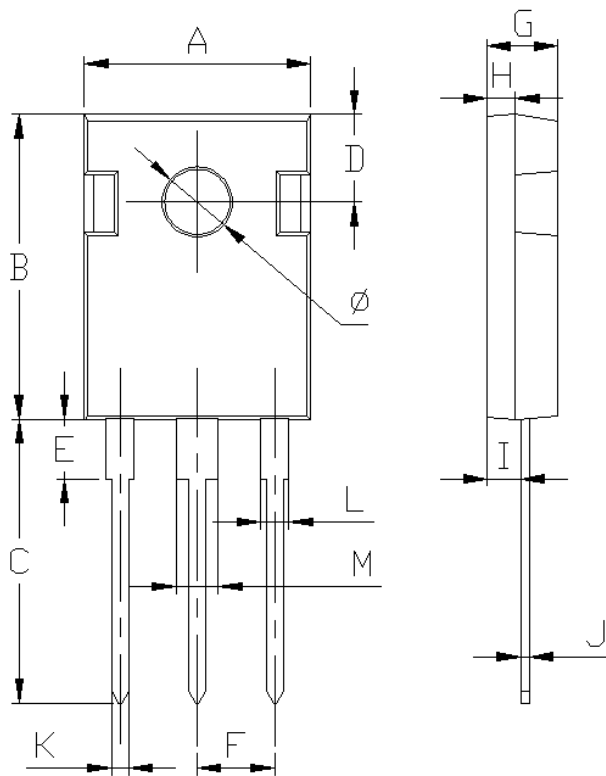
## 特征曲线 Characteristic Curve



## 特征曲线 Characteristic Curve



TO-247-3 封装数据  
TO-247-3 Package Data



DIM	MILLIMETERS	
	MIN	MAX
A	15.75	15.85
B	20.9	21.05
C	19.85	20.05
D	5.75	5.85
E	4.15	4.25
F	5.44BSC.	
G	4.95	5.05
H	1.97	2.03
I	2.35	2.45
J	0.6	0.65
K	1.17	1.25
L	1.95	2.05
M	2.85	3.11
$\phi$	3.5	3.7

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