



N 沟道增强型场效应晶体管

N-CHANNEL MOSFET

FHP40N25W/FHF40N25W/FHA40N25W

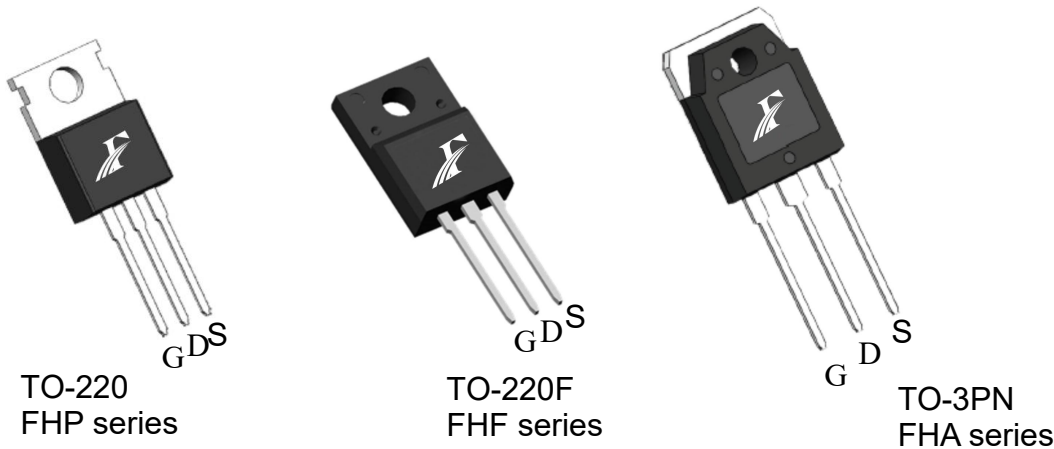
主要参数 MAIN CHARACTERISTICS

ID	40A
VDSS	250V
Rdson-typ (@Vgs=10V)	68mΩ
Qg-typ	62nC

用途 APPLICATIONS

高频开关电源	High efficiency switch mode power supplies
60V直流输入逆变器	DC 60V input inverter
储能电源	Energy storage power
音响功放	Audio power amplifier

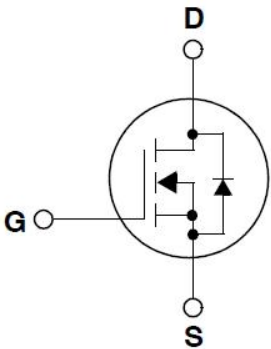
封装形式 Package



产品特性 FEATURES

低栅极电荷	Low gate charge
低 Crss (典型值 2.5pF)	Low Crss (typical 2.5pF)
开关速度快	Fast switching
100%经过雪崩测试	100% avalanche tested
100%经过热阻测试	100% DVDS tested
100%经过 Rg 测试	100% Rg tested
高抗 dv/dt 能力	Improved dv/dt capability
RoHS 产品	RoHS product

等效电路 Equivalent Circuit



绝对最大额定值 ABSOLUTE RATINGS (Tc=25℃)

项目 Parameter	符号 Symbol	数值 Value			单位 Unit
		FHP40N25W	FHF40N25W	FHA40N25W	
最高漏极—源极直流电压 Drain-Source Voltage	V _{DS}	250			V
连续漏极电流* Drain Current -continuous *	I _D (T _C =25℃)	40			A
	I _D (T _C =100℃)	26			A
最大脉冲漏极电流 (注 1) Drain Current – pulse (note 1)	I _{DM}	160			A
最高栅源电压 Gate-Source Voltage	V _{GS}	±30			V
单脉冲雪崩能量 (注 2) Single Pulsed Avalanche Energy (note 2)	E _{AS}	312			mJ
雪崩电流 (注 1) Avalanche Current (note 1)	I _{AR}	25			A
重复雪崩能量 (注 1) Repetitive Avalanche Current (note 1)	E _{AR}	30			mJ
二极管反向恢复最大电压变化速率 (注 3) Peak Diode Recovery dv/dt (note 3)	dv/dt	5.0			V/ns
耗散功率 Power Dissipation	P _D (T _C =25℃)	198	62	310	W
	-Derate above 25℃	1.6	0.5	2.78	W/℃
最高结温及存储温度 Operating and Storage Temperature Range	T _J , T _{STG}	150, -55 to 150			℃
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	T _L	300			℃

*漏极电流由最高结温限制

*Drain current 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						
漏－源击穿电压 Drain-Source Voltage	BV _{DSS}	I _D =250μA, V _{GS} =0V	250	300	-	V
击穿电压温度特性 Breakdown Voltage Temperature Coefficient	ΔBV _{DSS} /Δ T _J	I _D =250μA, referenced to 25℃	-	0.25	-	V/℃
零栅压下漏极漏电流 Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =250V,V _{GS} =0V, T _C =25℃	-	-	1	μA
		V _{DS} =200V, T _C =125℃	-	-	100	μA
栅极体漏电流 Gate-body leakage current	I _{GSS} (F/R)	V _{DS} =0V, V _{GS} =±30V	-	-	±100	nA
通态特性 On-Characteristics						
阈值电压 Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D =250μA	2.0	3.0	4.0	V
静态导通电阻 Static Drain-Source On-Resistance	R _{DS(ON)}	V _{GS} =10V , I _D =20A	-	68	80	mΩ
正向跨导 Forward Transconductance	g _{fs}	V _{DS} = 40V, I _D =20A (note 4)	-	20	-	S
动态特性 Dynamic Characteristics						
栅极电阻 Gate resistance	R _g	f = 1.0MHz	-	1.1	-	Ω
输入电容 Input capacitance	C _{iss}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz	-	3700	-	pF
输出电容 Output capacitance	C _{oss}		-	360	-	
反向传输电容 Reverse transfer capacitance	C _{rss}		-	2.5	-	
开关特性 Switching Characteristics						
延迟时间 Turn-On delay time	t _{d(on)}	V _{DS} =125V, I _D =40A, R _G =15Ω V _{GS} =10V (note 4, 5)	-	80	-	ns
上升时间 Turn-On rise time	t _r		-	620	-	ns
延迟时间 Turn-Off delay time	t _{d(off)}		-	140	-	ns
下降时间 Turn-Off Fall time	t _f		-	183	-	ns
栅极电荷总量 Total Gate Charge	Q _g	V _{DS} =200V , I _D =40A , V _{GS} =10V (note 4, 5)	-	62	-	nC
栅－源电荷 Gate-Source charge	Q _{gs}		-	22	-	nC
栅－漏电荷 Gate-Drain charge	Q _{gd}		-	16	-	nC
漏－源二极管特性及最大额定值 Drain-Source Diode Characteristics and Maximum Ratings						
正向最大连续电流 Maximum Continuous Drain -Source Diode Forward Current	I _S		-	-	40	A
正向最大脉冲电流 Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}		-	-	160	A
正向压降 Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} =0V, I _S =40A	-	-	1.2	V
反向恢复时间 Reverse recovery time	t _{rr}	V _{GS} =0V, I _S =40A ,dI _F /dt=100A/μs (note 4)	-	230	-	ns
反向恢复电荷 Reverse recovery charge	Q _{rr}		-	2.15	-	μC

热特性 THERMAL CHARACTERISTIC

项目 Parameter	符号 Symbol	FHP40N25W	FHF40N25W	FHA40N25W	单位 Unit
结到管壳的热阻 Thermal Resistance, Junction to Case	Rth(j-c)	0.8	2.0	0.36	℃/W
结到环境的热阻 Thermal Resistance, Junction to Ambient	Rth(j-A)	62.5	62.5	40	℃/W

注释:

- 1: 脉冲宽度由最高结温限制
- 2: L=1mH, IAS=25A, VDD=50V, RG=25 Ω,起始结温 TJ=25℃
- 3: ISD ≤40A,di/dt ≤100A/μs,VDD≤BV_{DSS},起始结温 TJ=25℃
- 4: 脉冲测试: 脉冲宽度 ≤300μs,占空比≤2%
- 5: 基本与工作温度无关

Notes:

- 1: Pulse width limited by maximum junction temperature
- 2: L=1mH, IAS=25A, VDD=50V, RG=25 Ω ,Start TJ=25℃;
- 3: ISD ≤40A,di/dt ≤100A/μs,VDD≤BV_{DSS}, Starting TJ=25℃
- 4: Pulse Test: Pulse Width ≤300μs,Duty Cycle≤2%
- 5: Essentially independent of operating temperature

特性曲线

(ELECTRICAL CHARACTERISTICS (curves))

Figure 1a Safe Operating Area (TO-220)

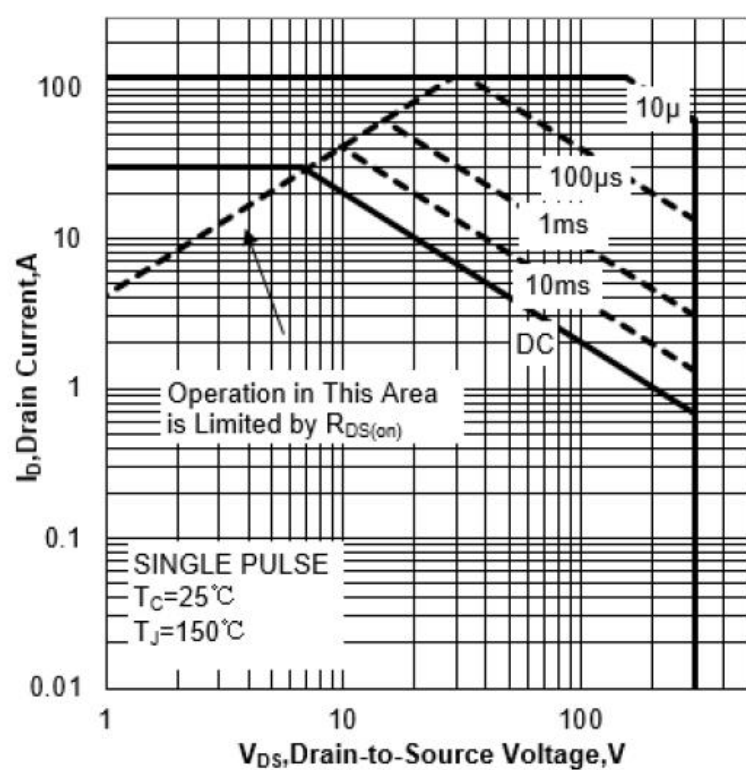


Figure 1b Safe Operating Area (TO-220F)

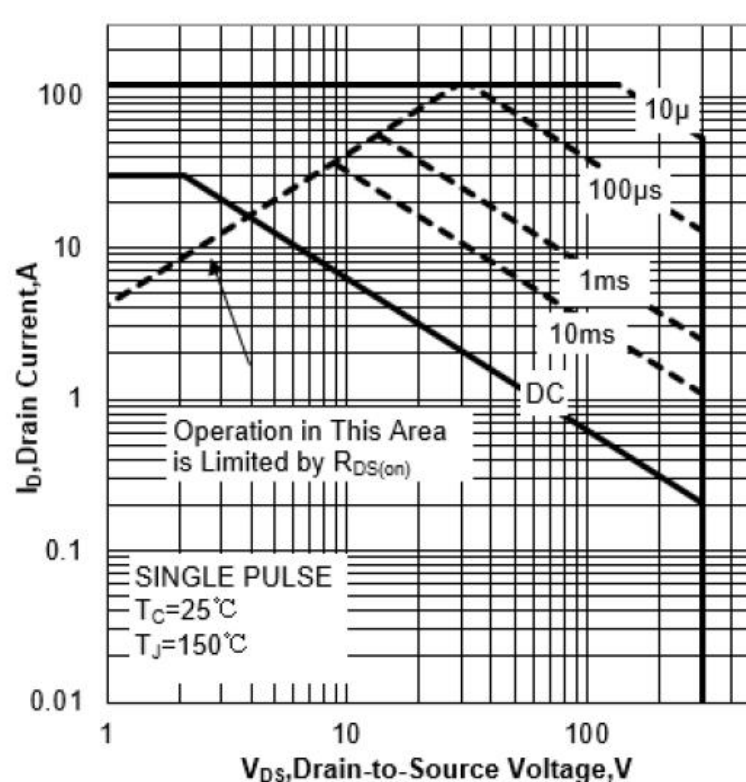


Figure 1c Safe Operating Area (TO-3PN)

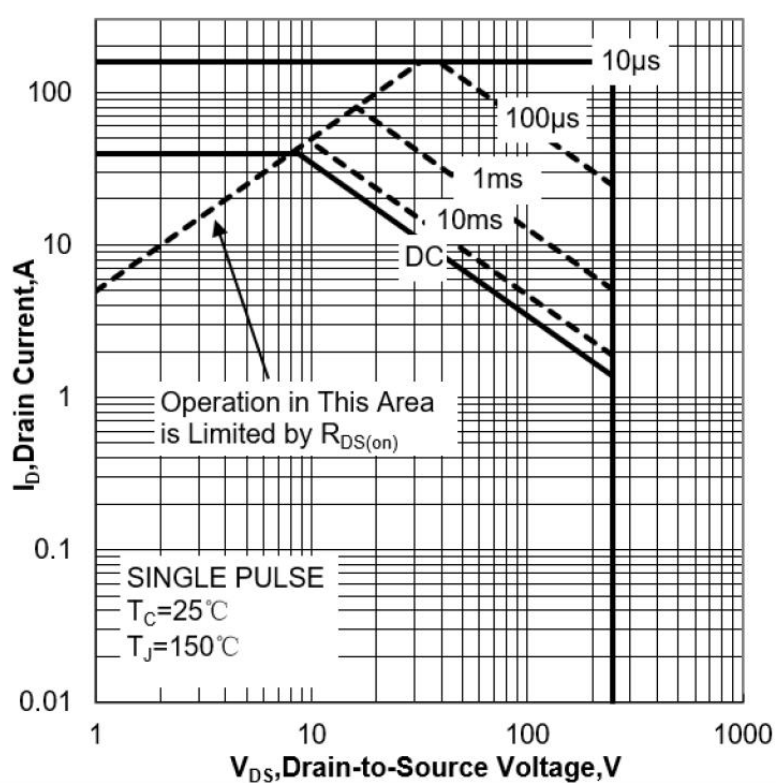


Figure 2a Power Dissipation (TO-220)

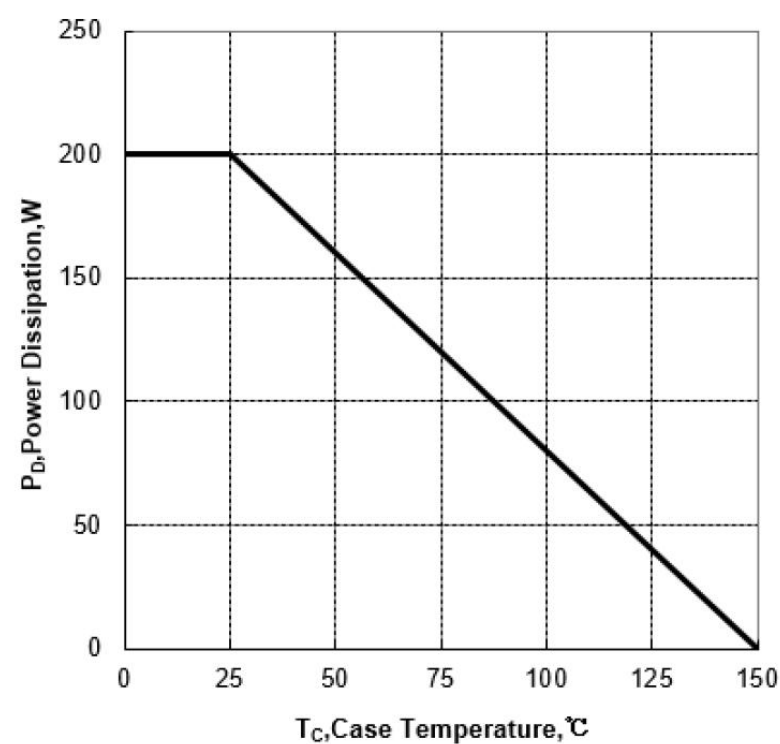


Figure 2b Power Dissipation (TO-220F)

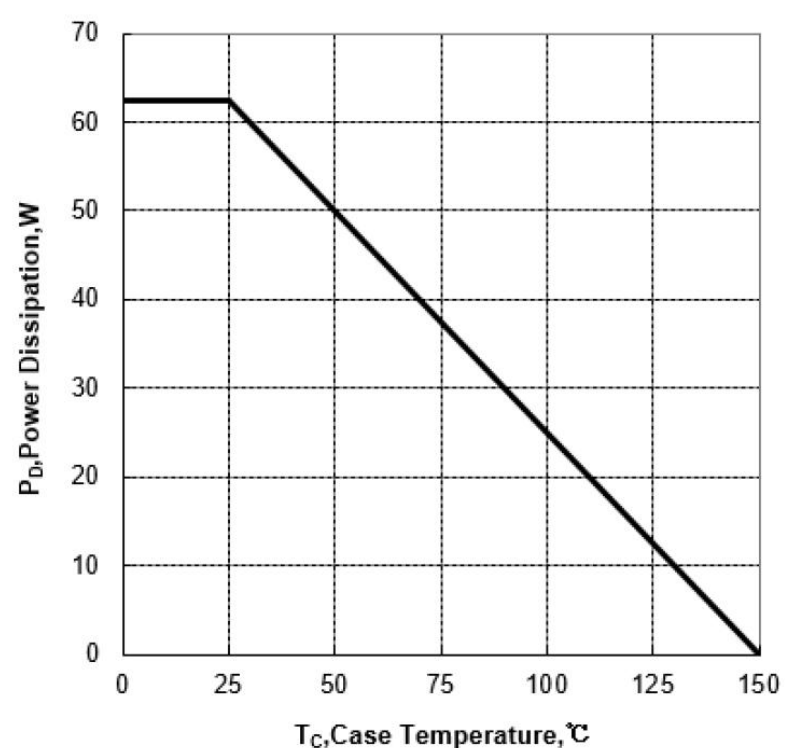


Figure 2c Power Dissipation (TO-3PN)

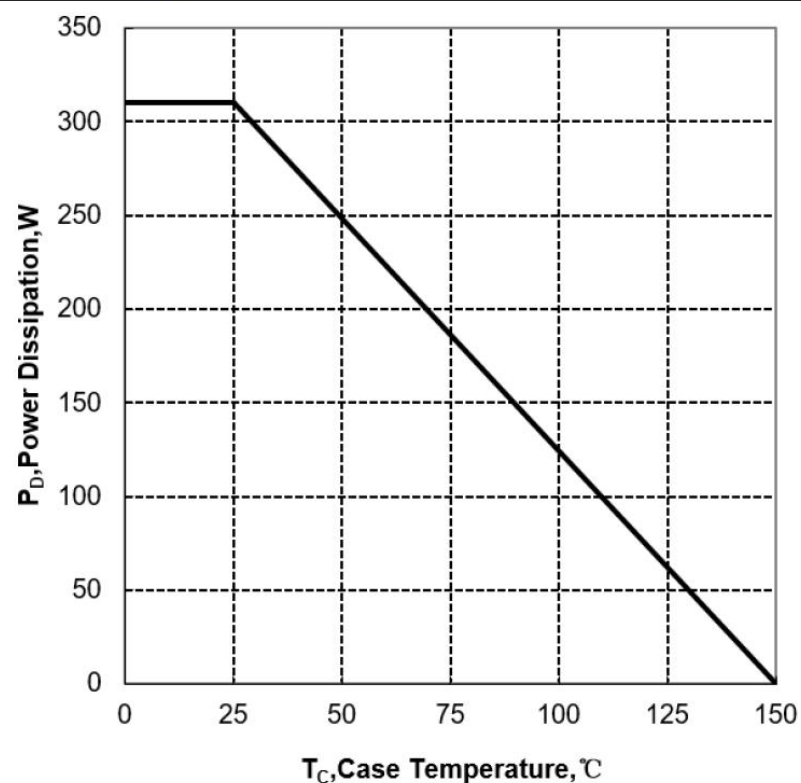


Figure 3a Max Thermal Impedance (TO-220)

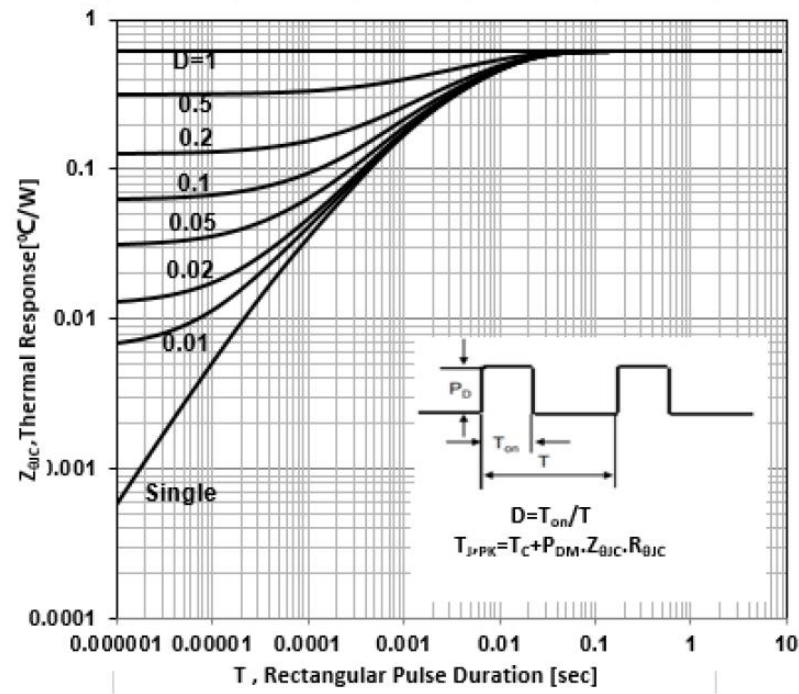


Figure 3b Max Thermal Impedance (TO-220F)

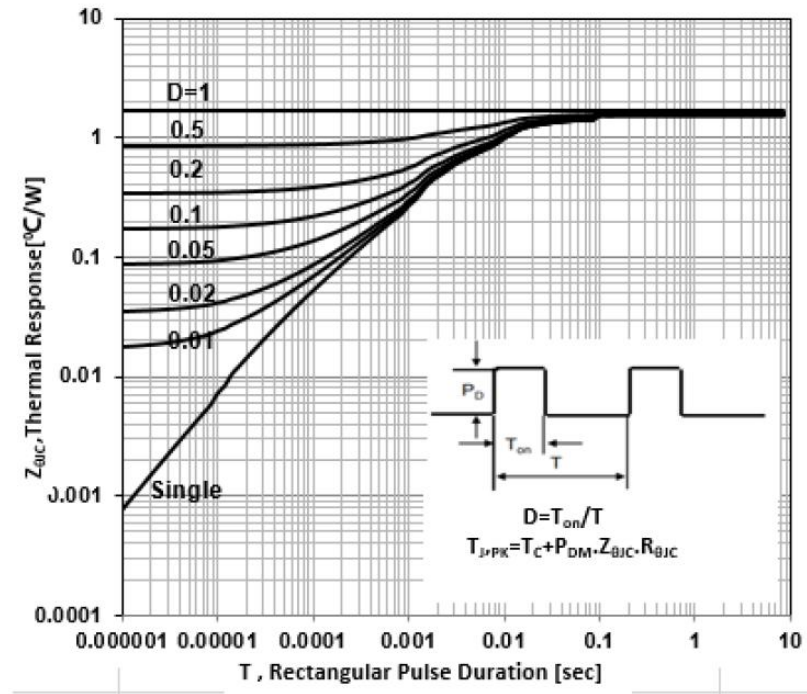


Figure 3C Max Thermal Impedance(TO-3PN)

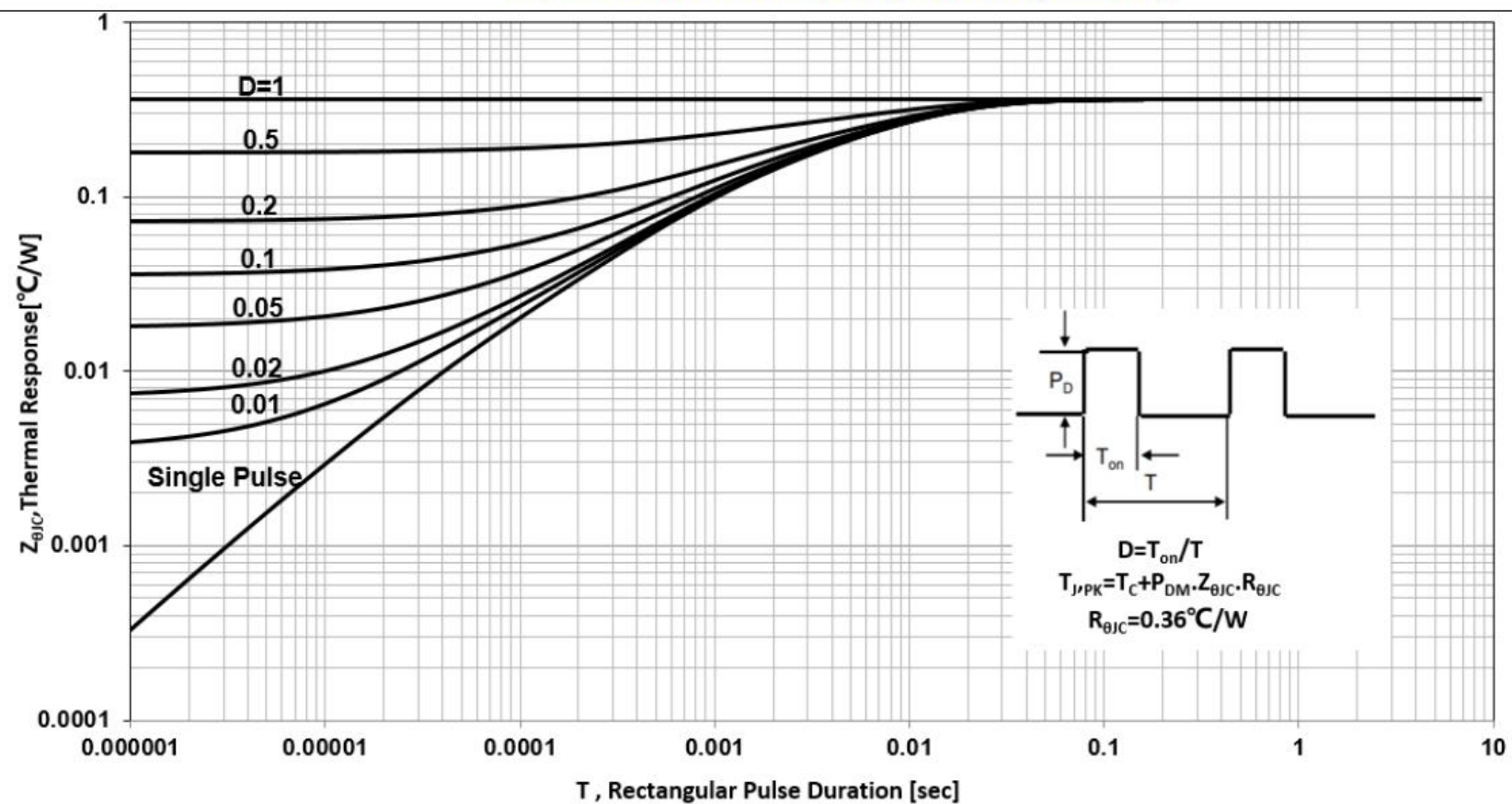


Figure 4 Typical Output Characteristics

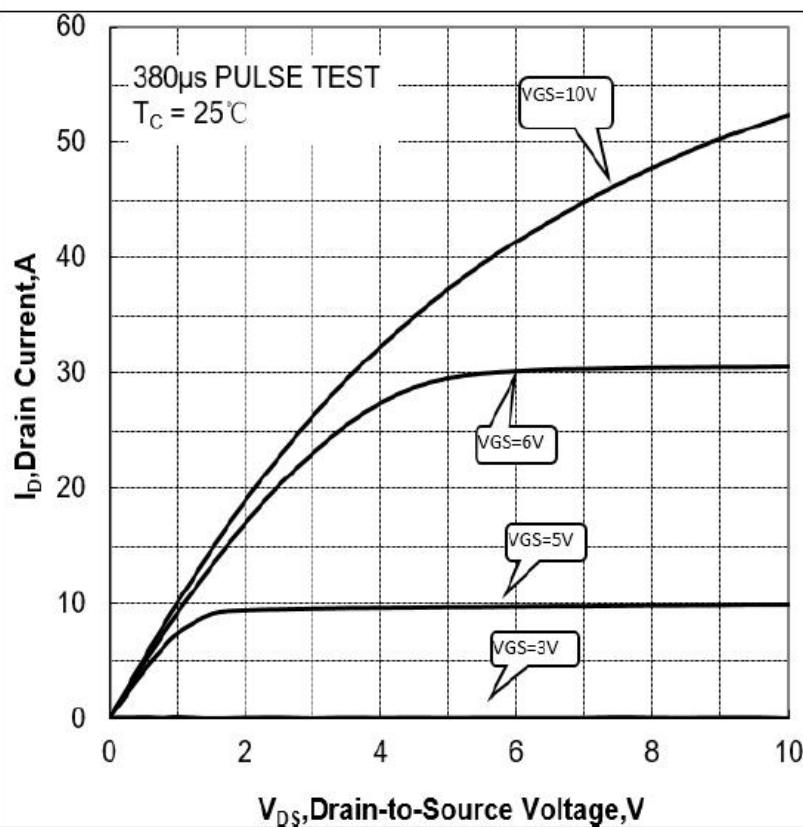


Figure 5 Typical Transfer Characteristics

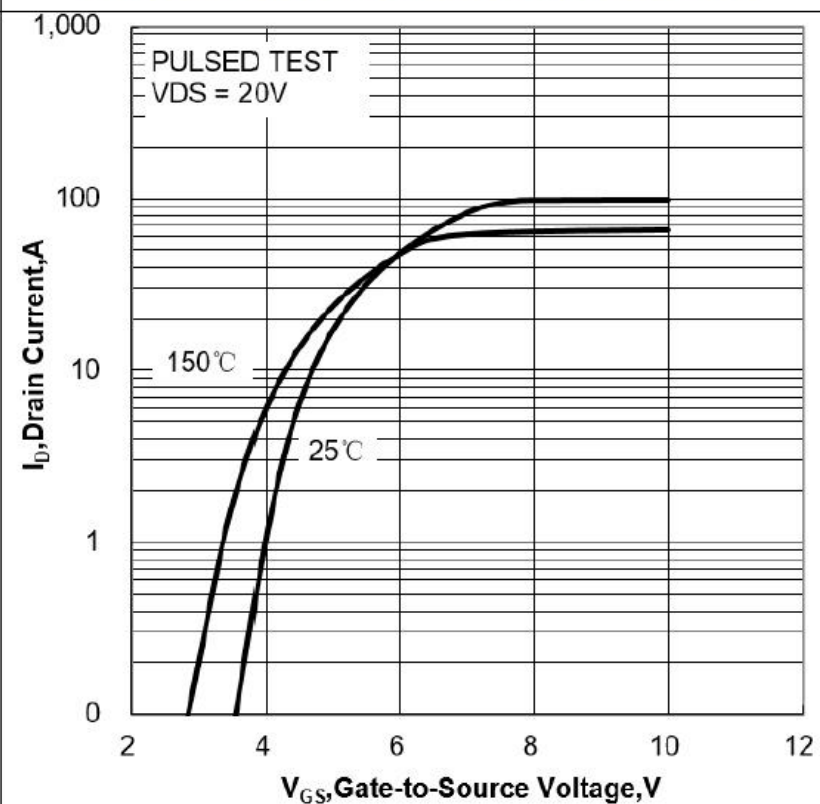


Figure 6 Typical Drain to Source ON Resistance vs Drain Current

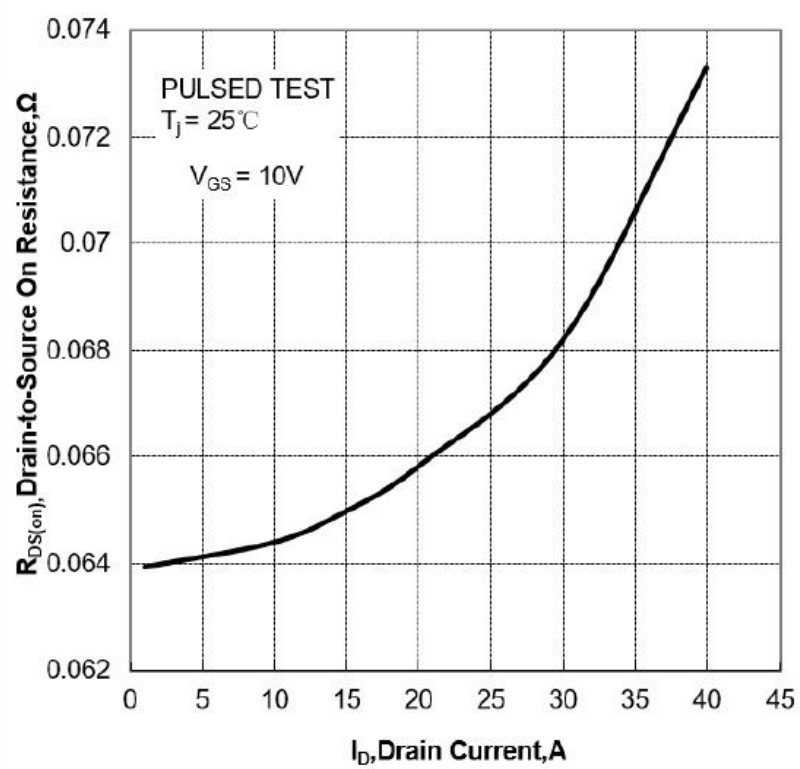


Figure 7 Typical Drain to Source on Resistance vs Junction Temperature

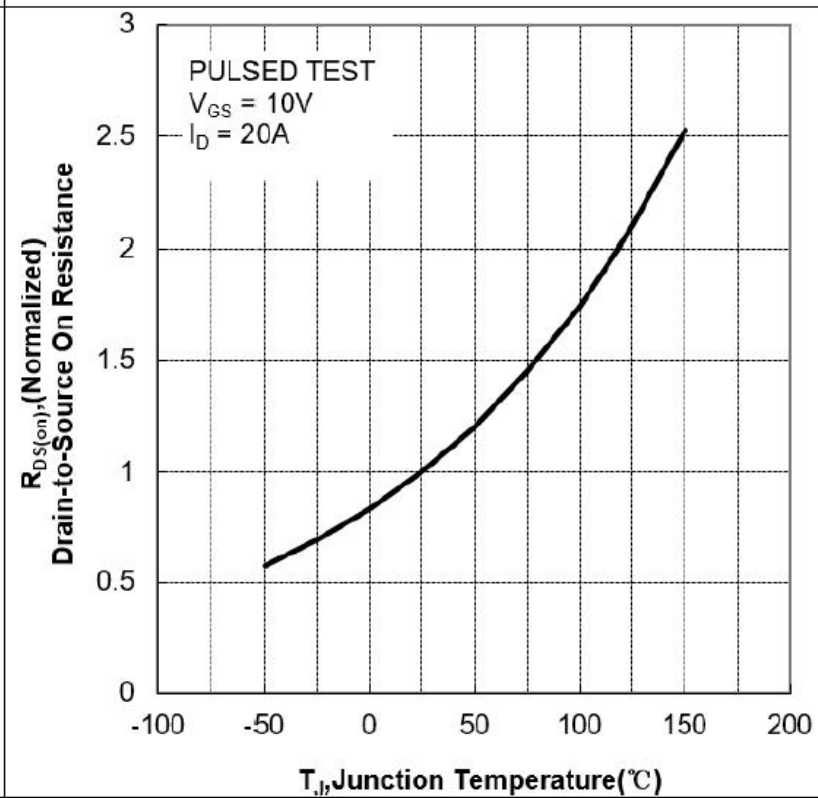


Figure 8 Typical Threshold Voltage vs Junction Temperature

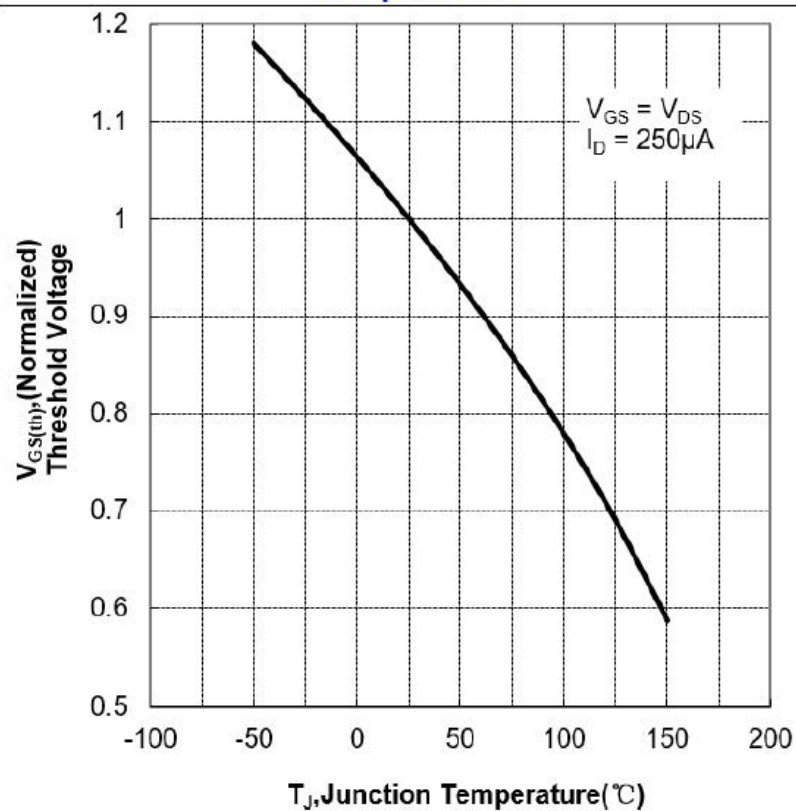


Figure 9 Typical Breakdown Voltage vs Junction Temperature

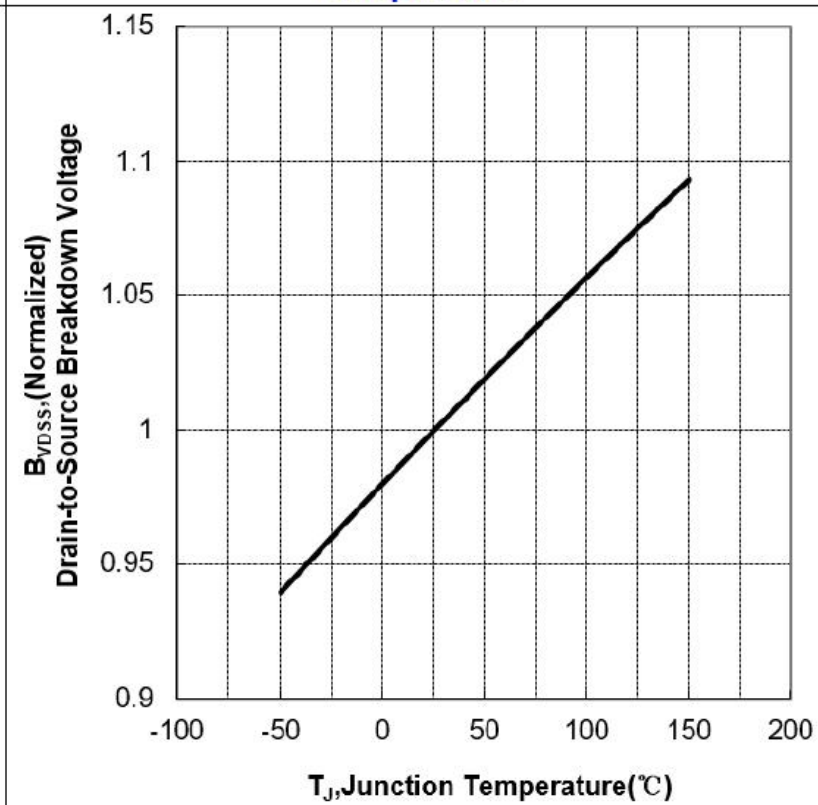


Figure 10 Typical Capacitance vs Drain to Source Voltage

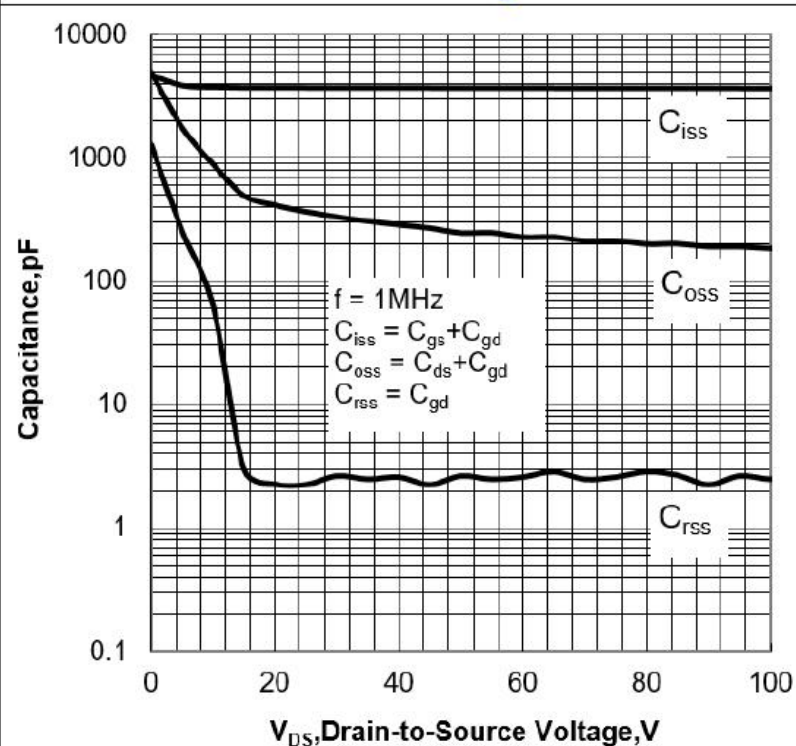
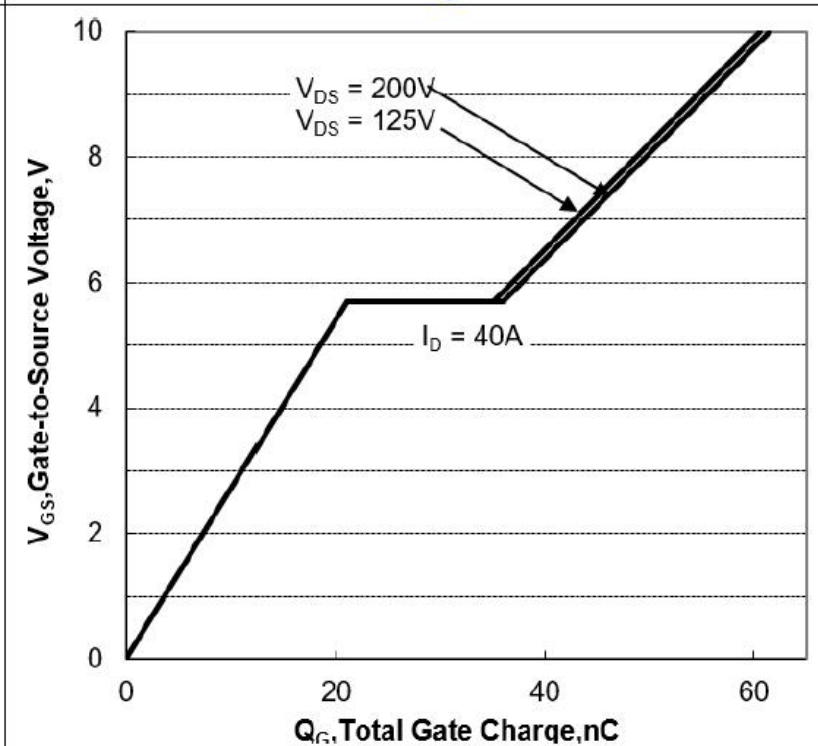
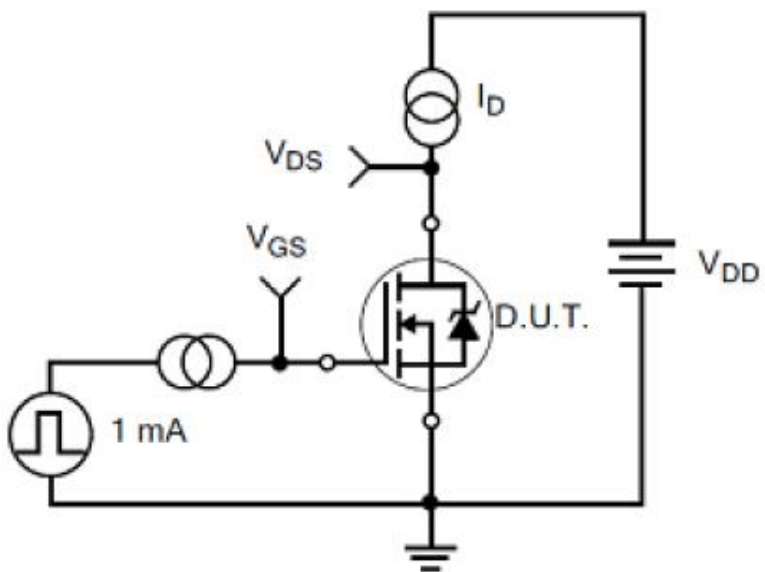
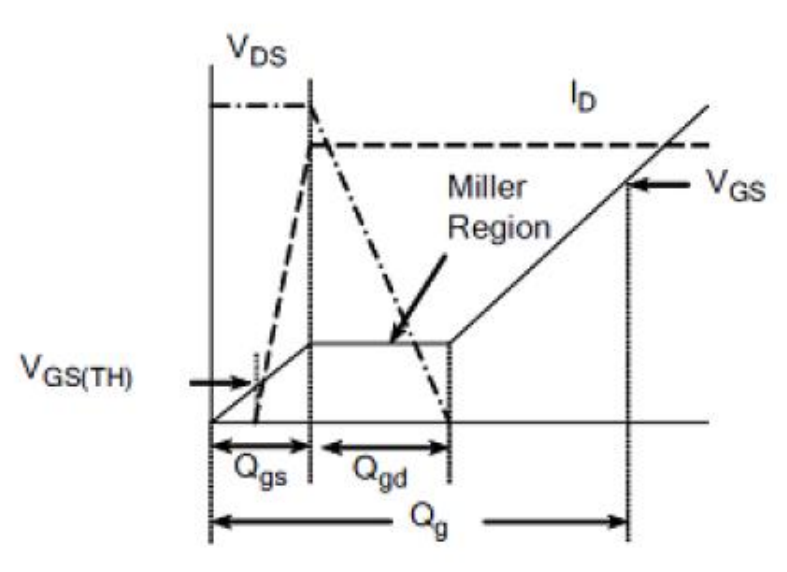
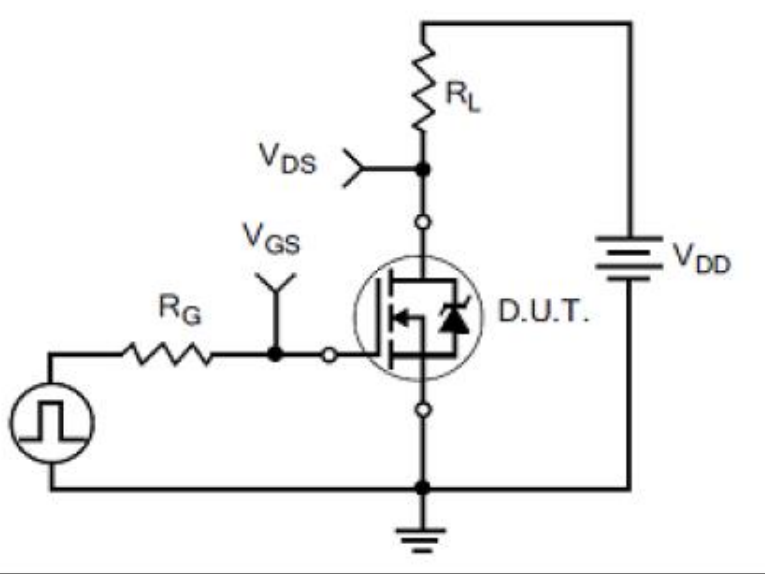
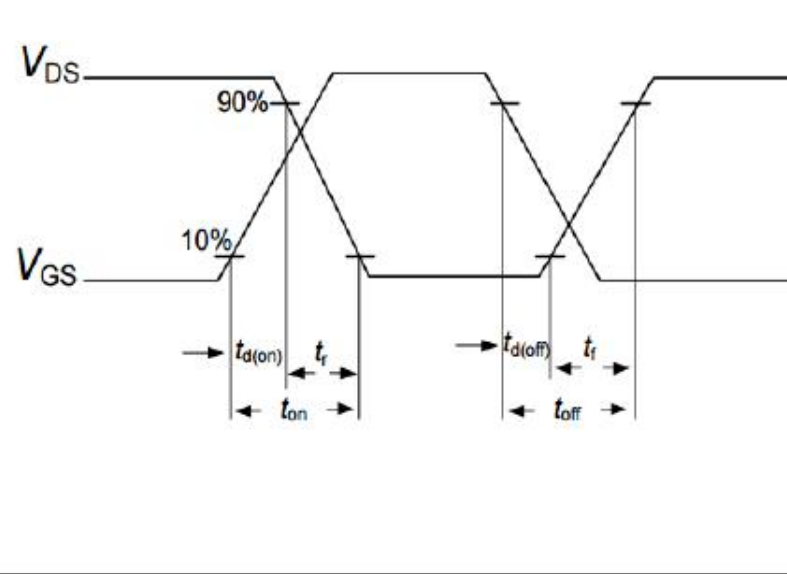
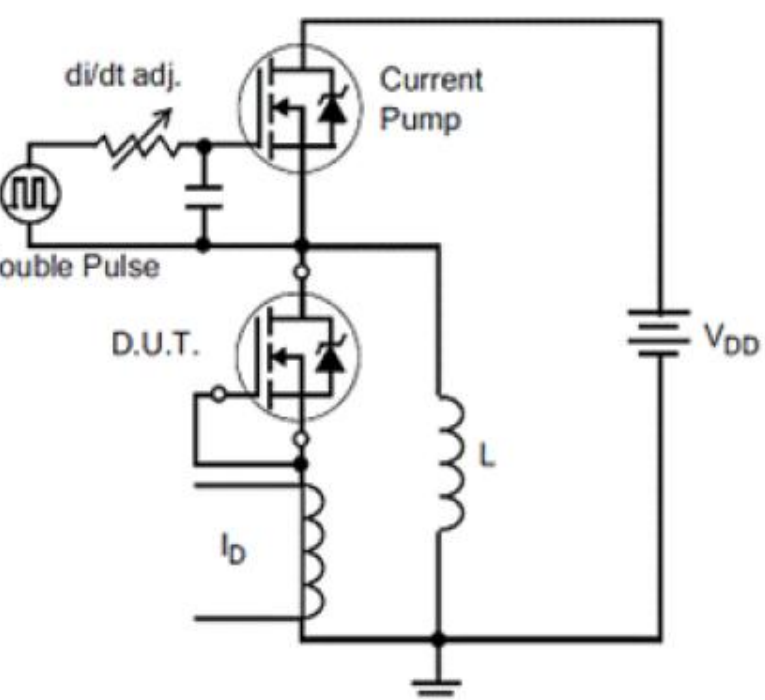
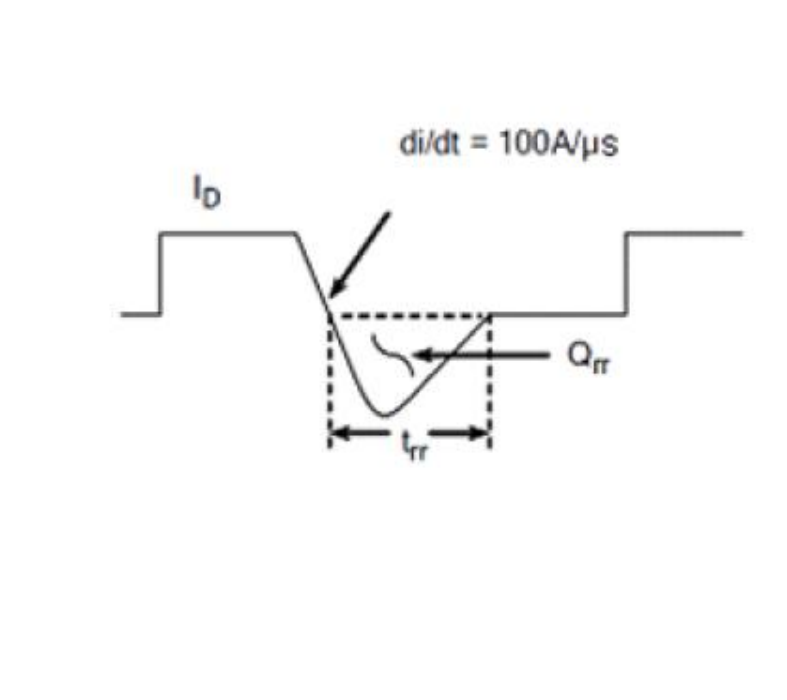
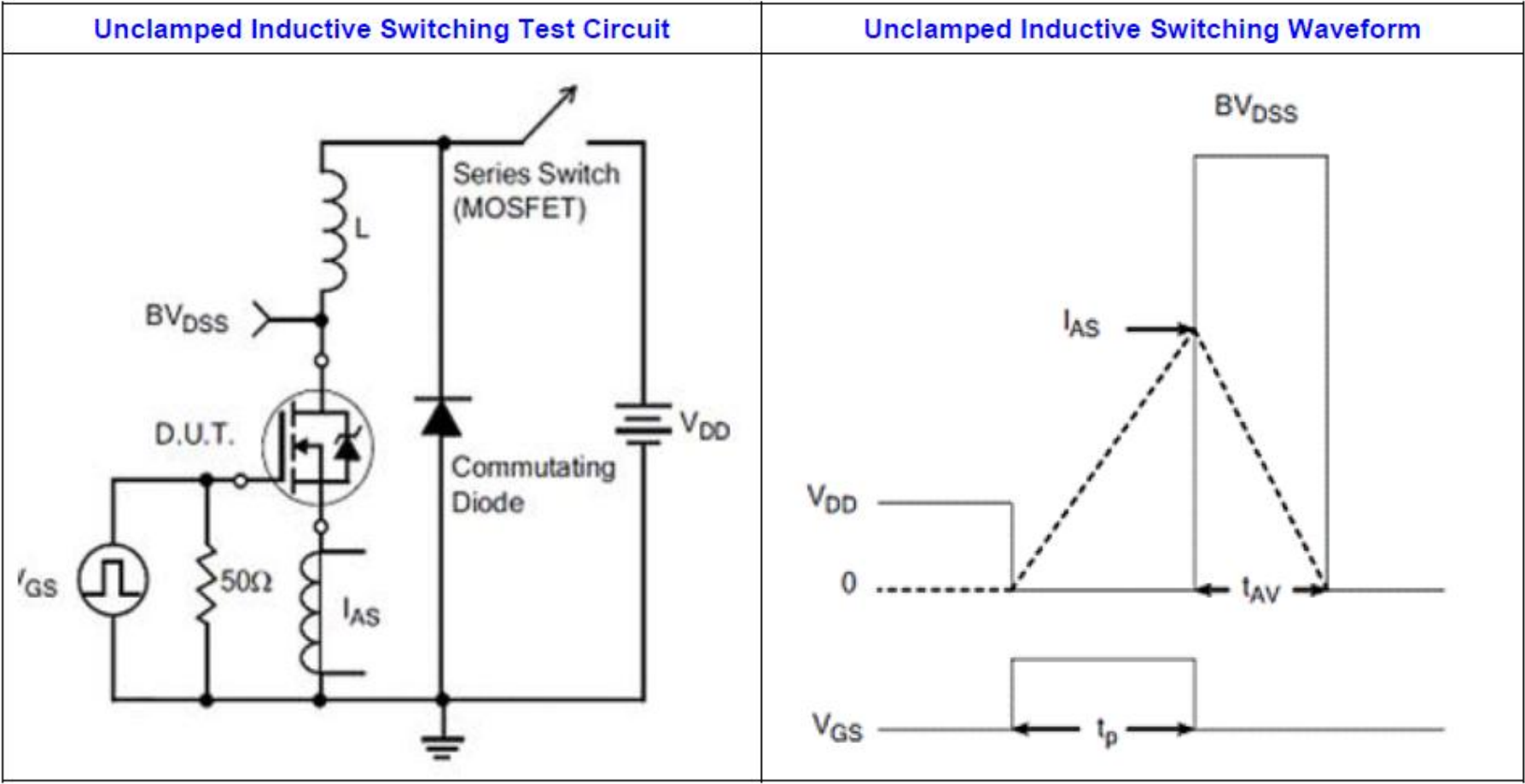


Figure 11 Typical Gate Charge vs Gate to Source Voltage

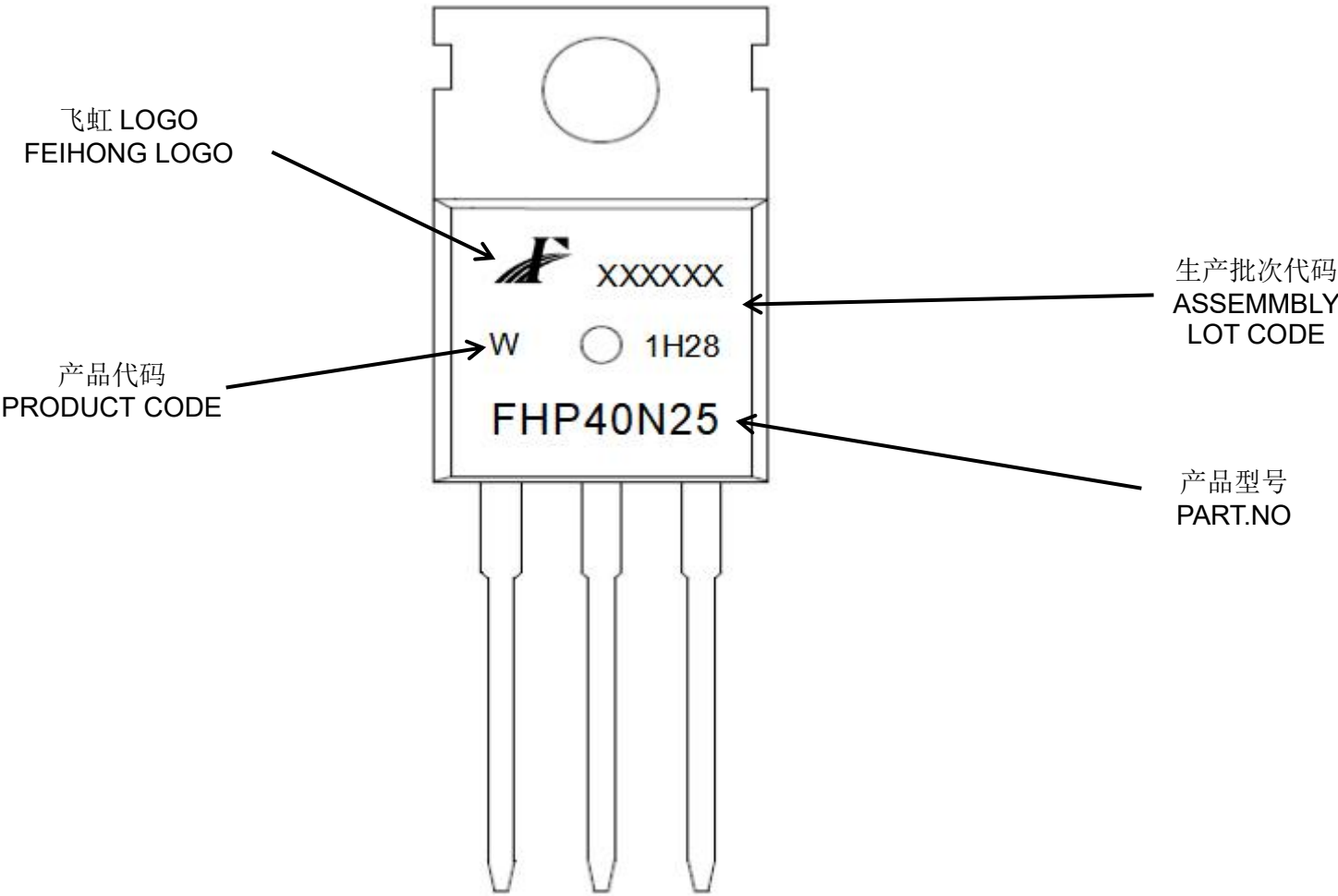


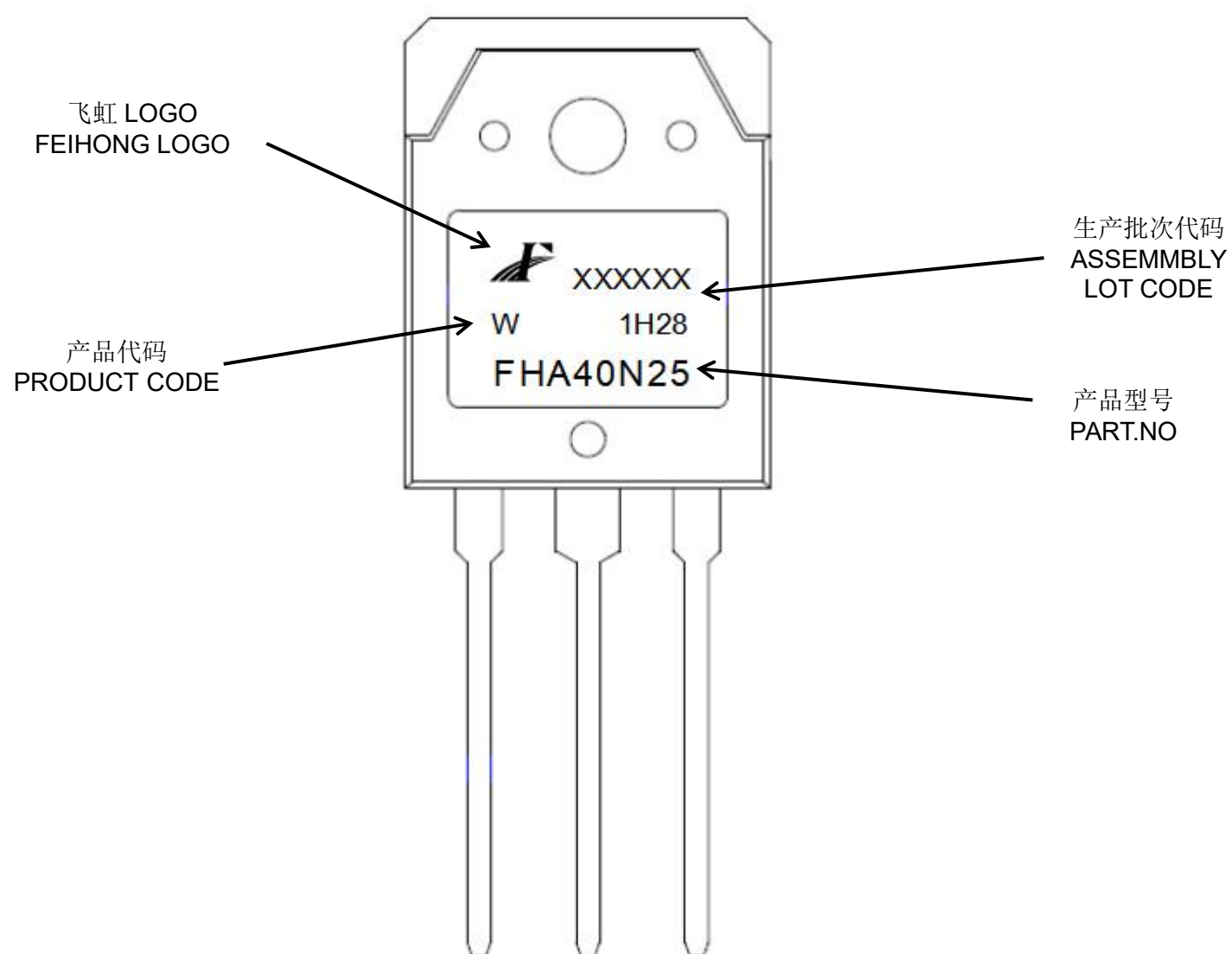
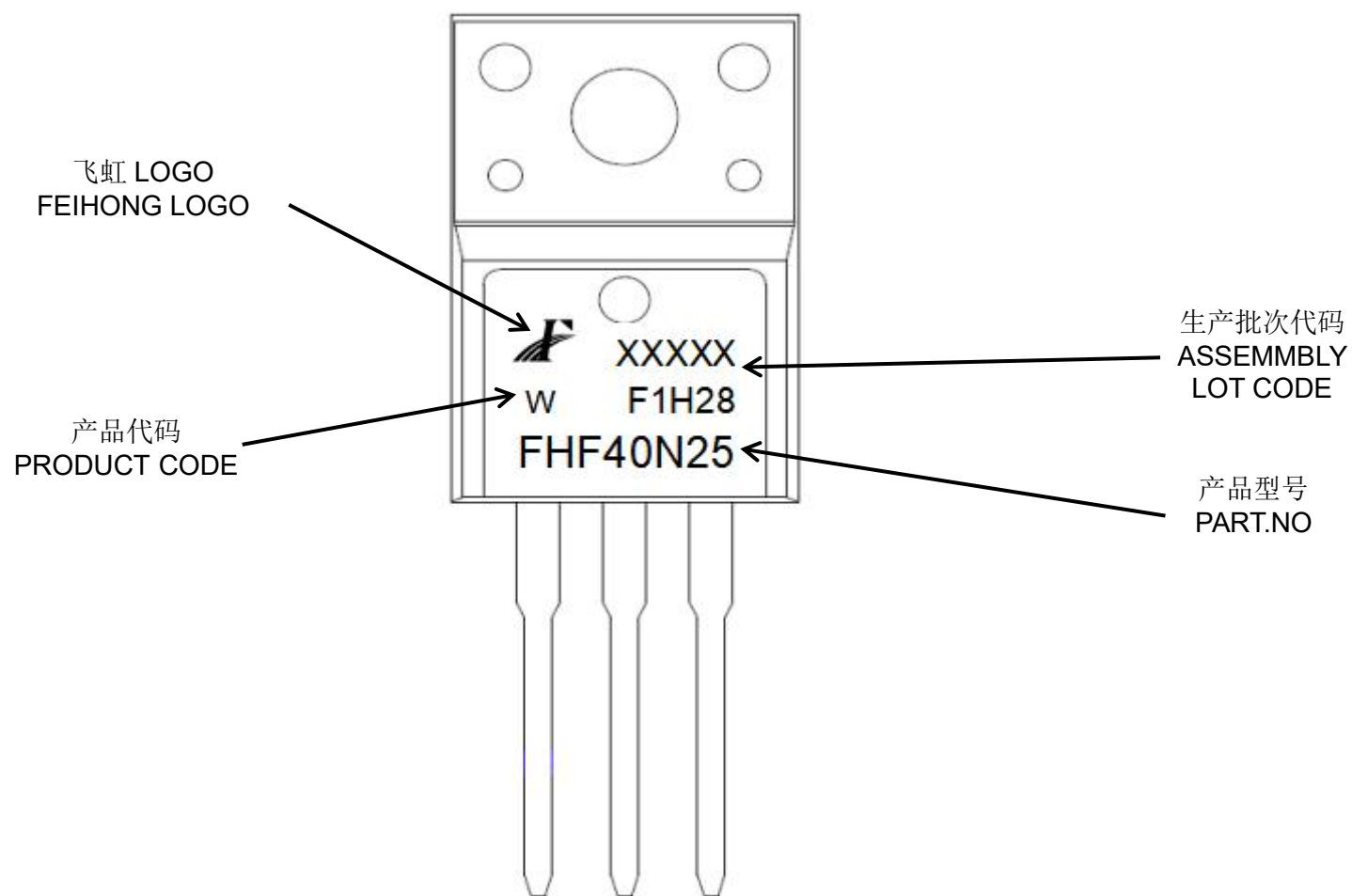
Test Circuit and Waveform

Gate Charge Test Circuit	Gate Charge Waveforms
 The diagram shows a MOSFET (D.U.T.) in a common-source configuration. The gate is driven by a 1 mA current source. The drain is connected to a load resistor and a drain current source I_D. The supply voltage is V_{DD}. The gate voltage is V_{GS} and the drain voltage is V_{DS}.	 The diagram shows the relationship between V_{GS} and V_{DS} during switching. The Miller Region is indicated. The gate charge regions are labeled Q_{gs}, Q_{gd}, and Q_g. The threshold voltage $V_{GS(TH)}$ is also shown.
Resistive Switching Test Circuit	Resistive Switching Waveforms
 The diagram shows a MOSFET (D.U.T.) in a common-source configuration. The gate is driven by a current source I_G through a resistor R_G. The drain is connected to a load resistor R_L and a drain current source I_D. The supply voltage is V_{DD}. The gate voltage is V_{GS} and the drain voltage is V_{DS}.	 The diagram shows the switching waveforms for V_{DS} and V_{GS}. The turn-on delay $t_{d(on)}$, rise time t_r, and turn-off delay $t_{d(off)}$ are indicated. The gate voltage V_{GS} transitions between 10% and 90% levels.
Diode Reverse Recovery Test Circuit	Diode Reverse Recovery Waveform
 The diagram shows a MOSFET (D.U.T.) in a common-source configuration. The gate is driven by a current source I_G through a resistor R_G. The drain is connected to a load resistor R_L and a drain current source I_D. The supply voltage is V_{DD}. The gate voltage is V_{GS} and the drain voltage is V_{DS}. A diode is connected in parallel with the load resistor. The diode reverse recovery time t_{rr} is indicated.	 The diagram shows the diode reverse recovery waveform. The diode current I_D is shown during the reverse recovery phase. The reverse recovery time t_{rr} and the reverse recovery charge Q_{rr} are indicated. The di/dt is specified as $100A/\mu s$.



印记 Marking:

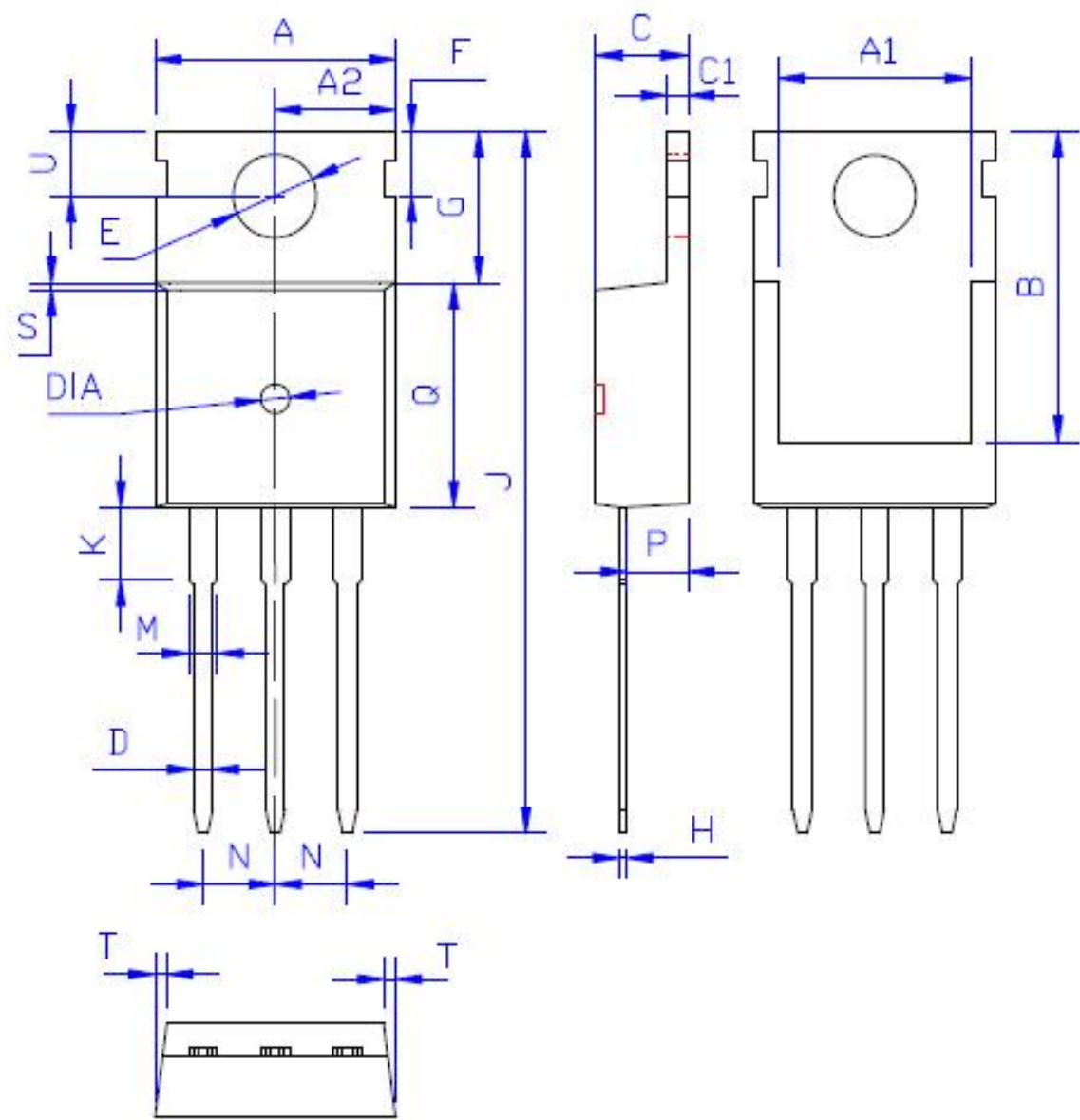




外形尺寸:

Package Dimension:

TO-220



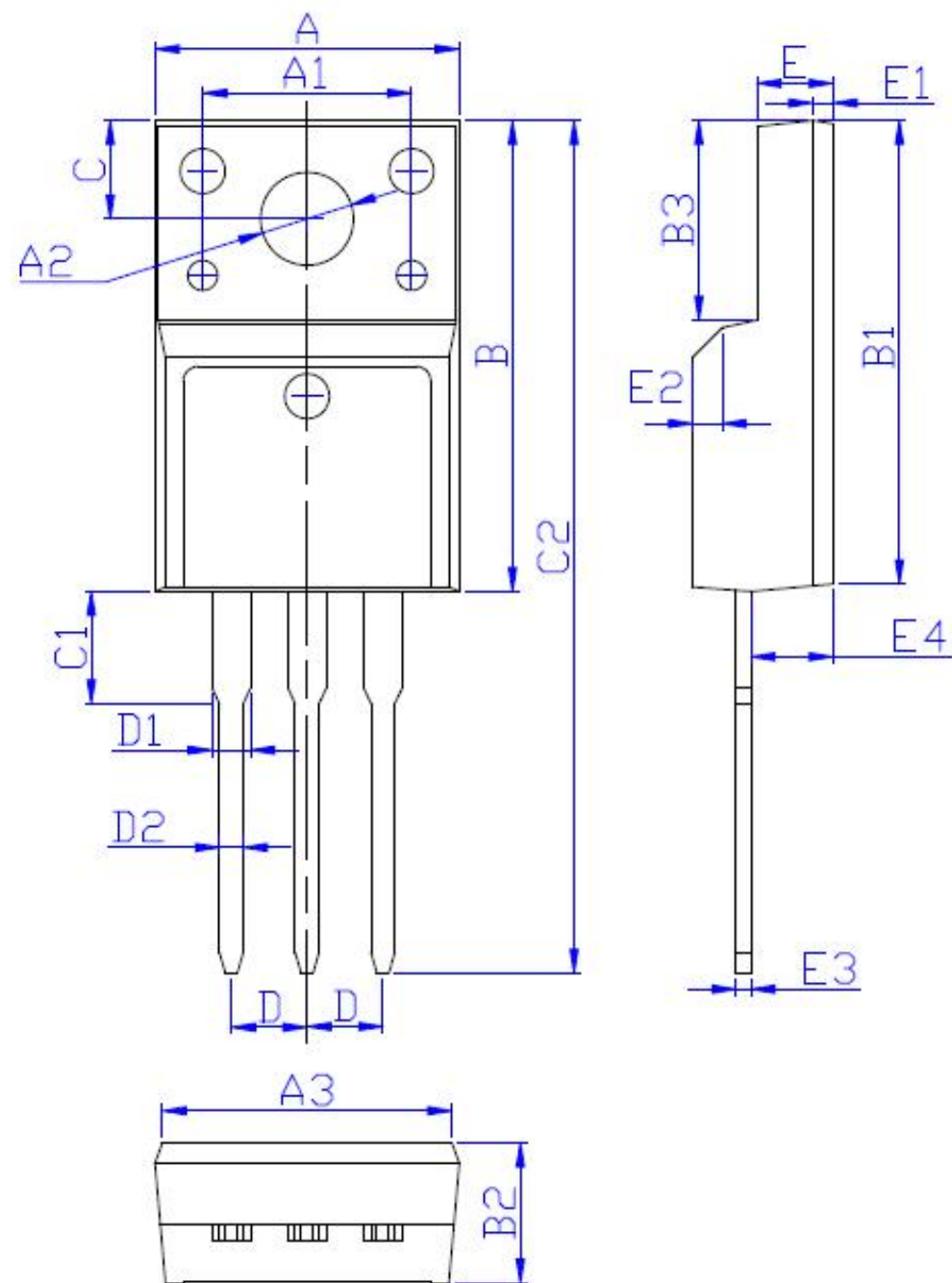
DIM	MILLIMETERS
A	10.00±0.30
A1	8.00±0.30
A2	5.00±0.30
B	13.20±0.40
C	4.50±0.20
C1	1.30±0.20
D	0.80±0.20
E	3.60±0.20
F	3.00±0.30
G	6.60±0.40
H	0.50±0.20
J	28.88±0.50
K	3.00±0.30
M	1.30±0.30
N	Typical 2.54
P	2.40±0.40
Q	9.20±0.40
S	0.25±0.15
T	0.25±0.15
U	2.80±0.30
DIA	宽 1.50±0.10 深 0.50 MAX

(Unit: mm)

外形尺寸:

Package Dimension:

TO-220F



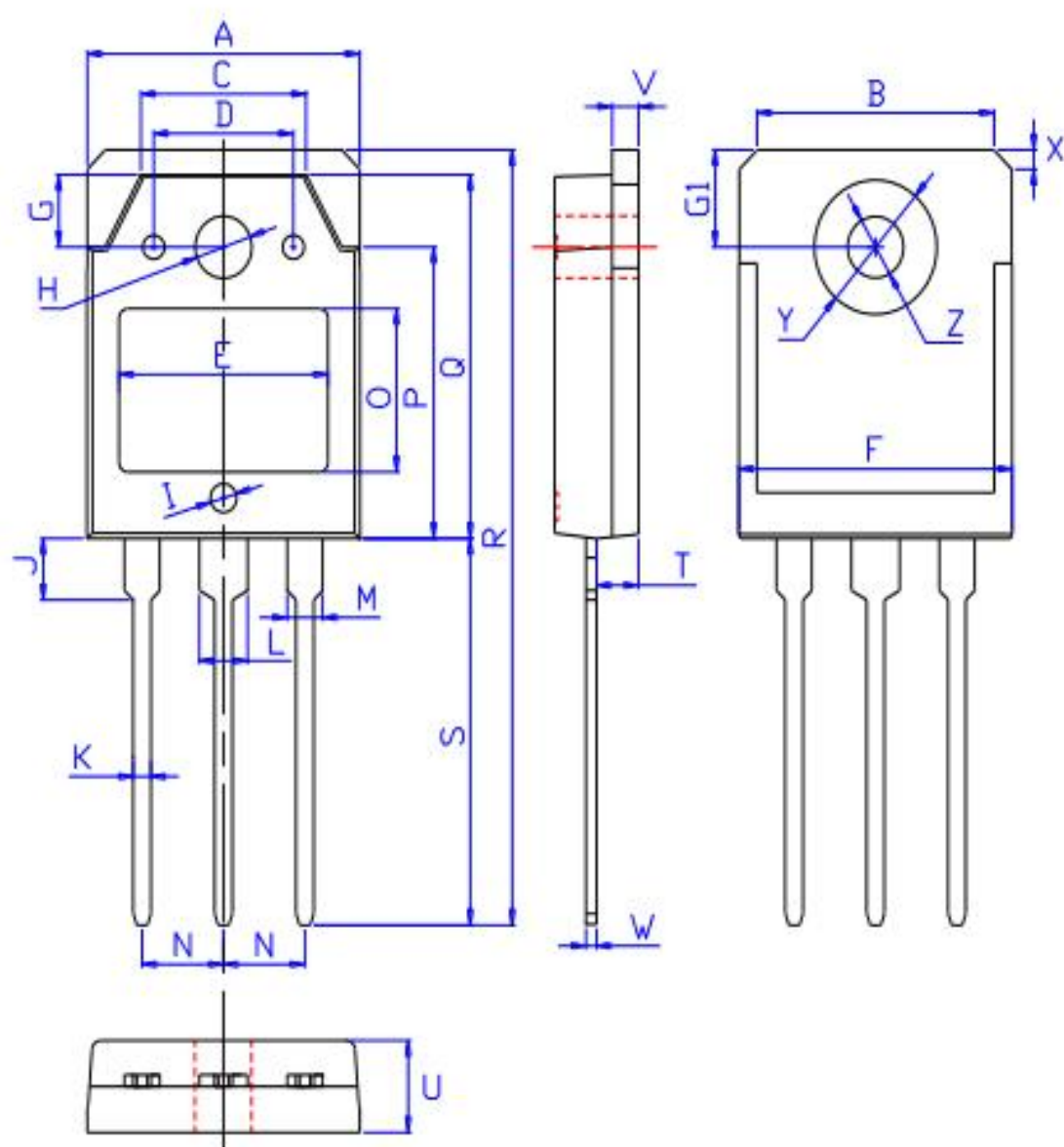
DIM	MILLIMETERS
A	10.16±0.30
A1	7.00±0.20
A2	3.12±0.20
A3	9.70±0.30
B	15.90±0.50
B1	15.60±0.50
B2	4.70±0.30
B3	6.70±0.30
C	3.30±0.25
C1	3.25±0.30
C2	28.70±0.50
D	Typical 2.54
D1	1.47 (MAX)
D2	0.80±0.20
E	2.55±0.25
E1	0.70±0.25
E2	1.0×45°
E3	0.50±0.20
E4	2.75±0.30

(Unit:mm)

外形尺寸:

Package Dimension:

TO-3PN



DIM	MILLIMETERS
A	15.60±0.30
B	13.60±0.30
C	9.50±0.30
D	8.00±0.30
E	11.85±0.30
F	15.65±0.30
G	3.80±0.30
G1	5.00±0.30
H	φ 3.50±0.30
I	φ 1.50±0.30 深 0.15±0.15
J	3.20±0.30
K	1.00±0.15
L	3.10±0.15
M	2.10±0.15
N	5.45±0.30
O	8.40±0.30
P	13.90±0.30
Q	18.70±0.30
R	40.00±0.60
S	20.00±0.40
T	2.40±0.30
U	4.80±0.30
V	1.50±0.15
W	0.60±0.15
X	1.80±0.40
Y	7.00±0.30
Z	3.20±0.30

(Units: mm)