



N 沟道增强型场效应晶体管

N-CHANNEL MOSFET

FHP60N1F10A/FHD60N1F10A

主要参数 MAIN CHARACTERISTICS

ID	60A
VDSS	100 V
Rdson-typ (@Vgs=10V)	10.2 mΩ
Qg-typ	37nC

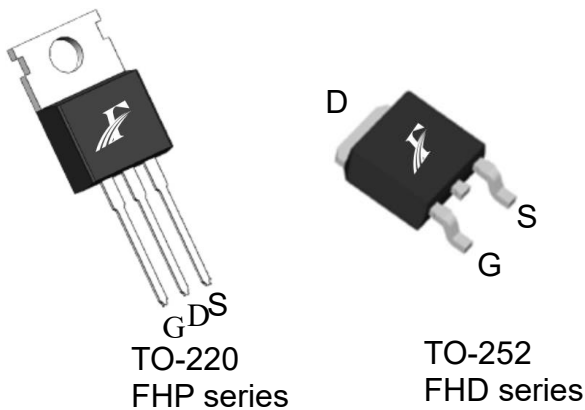
用途 APPLICATIONS

DC-DC电源	DC-DC power supplies
同步整流	Synchronous Rectification

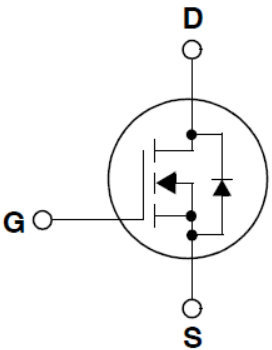
产品特性 FEATURES

低栅极电荷	Low gate charge
低 Crss (典型值 10pF)	Low Crss (typical10pF)
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
RoHS 产品	RoHS product
SGT 工艺	Shield Gate Trench process

封装形式 Package



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
		FHP60N1F10A	FHD60N1F10A	
最高漏极-源极直流电压 Drain-Source Voltage	V _{DS}	100		V
连续漏极电流* Drain Current -continuous *	I _D (T _C =25℃)	60		A
	I _D (T _C =100℃)	35		A
最大脉冲漏极电流 (注 1) Drain Current – pulse (note 1)	I _{DM}	240		A
最高栅源电压 Gate-Source Voltage	V _{GS}	±20		V
单脉冲雪崩能量 (注 2) Single Pulsed Avalanche Energy (note 2)	E _{AS}	112.5		mJ
雪崩电流 (注 1) Avalanche Current (note 1)	I _{AR}	15		A
重复雪崩能量 (注 1) Repetitive Avalanche Current (note 1)	E _{AR}	12		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℃)	120	70	W
	-Derate above 25℃	0.96	0.56	W/℃
最高结温及存储温度 Operating and Storage Temperature Range	T _J , T _{STG}	-55~+150		℃
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	T _L	260		℃

*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	100	-	-	V
击穿电压温度特性 Breakdown Voltage Temperature Coefficient	ΔBV _{DSS} /Δ T _J	I _D =250μA, referenced to 25℃	-	0.01	-	V/℃
零栅压下漏极漏电流 Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =100V, V _{GS} =0V, T _C =25℃	-	-	1	μA
		V _{DS} =80V, T _C =125℃	-	-	100	μA
栅极体漏电流 Gate-body leakage current	I _{GSS} (F/R)	V _{DS} =0V, V _{GS} =±20V	-	-	±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	-	4.0	V
静态导通电阻 Static Drain-Source On-Resistance	R _{DS(ON)}	V _{GS} =10V , I _D =30A	-	10.2	12	mΩ
正向跨导 Forward Transconductance	g _{fs}	V _{DS} = 20V, I _D =30A (note 4)	32	-	-	S
动态特性 Dynamic Characteristics						
输入电容 Input capacitance	C _{iss}	V _{DS} =50V, V _{GS} =0V, f=1.0MHz	-	1750	-	pF
输出电容 Output capacitance	C _{oss}		-	271	-	
反向传输电容 Reverse transfer capacitance	C _{rss}		-	10	-	
开关特性 Switching Characteristics						
延迟时间 Turn-On delay time	t _{d(on)}	V _{DD} =50V, I _D =30A, R _G =3Ω V _{GS} =10V (note 4, 5)	-	19	-	ns
上升时间 Turn-On rise time	t _r		-	36	-	ns
延迟时间 Turn-Off delay time	t _{d(off)}		-	45	-	ns
下降时间 Turn-Off Fall time	t _f		-	24	-	ns
栅极电荷总量 Total Gate Charge	Q _g	V _{DS} =50V , I _D =30A , V _{GS} =10V (note 4, 5)	-	37	-	nC
栅－源电荷 Gate-Source charge	Q _{gs}		-	10	-	nC
栅－漏电荷 Gate-Drain charge	Q _{gd}		-	22	-	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		-	-	60	A
正向最大脉冲电流 Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}		-	-	240	A
正向压降 Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} =0V, I _S =30A	-	-	1.2	V
反向恢复时间 Reverse recovery time	t _{rr}	V _{GS} =0V, I _S =30A, dI _F /dt=100A/μs (note 4)	-	33	-	ns
反向恢复电荷 Reverse recovery charge	Q _{rr}		-	54	-	nC

热特性 THERMAL CHARACTERISTIC

项目 Parameter	符号 Symbol	FHP60N1F10A	FHD60N1F10A	单位 Unit
结到管壳的热阻 Thermal Resistance, Junction to Case	Rth(j-c)	1.04	1.78	℃/W
结到环境的热阻 Thermal Resistance, Junction to Ambient	Rth(j-A)	62.5		℃/W

注释：
1：脉冲宽度由最高结温限制
2：L=1mH, V_G=10V, V_{DD}=48V, R_G=25 Ω,起始结温 T_J=25℃
3：I_{SD} ≤60A,di/dt ≤300A/μs,V_{DD}≤BV_{DSS},起始结温 T_J=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, V_G=10V, V_{DD}=48V, R_G=25 Ω,Starting T_J=25℃
3：I_{SD} ≤60A,di/dt ≤300A/μs,V_{DD}≤BV_{DSS}, Starting T_J=25℃
4：Pulse Test：Pulse Width ≤300μs,Duty Cycle≤2%
5：Essentially independent of operating temperature

Typical Operating Characteristics

Figure 1. Typical Output Characteristics

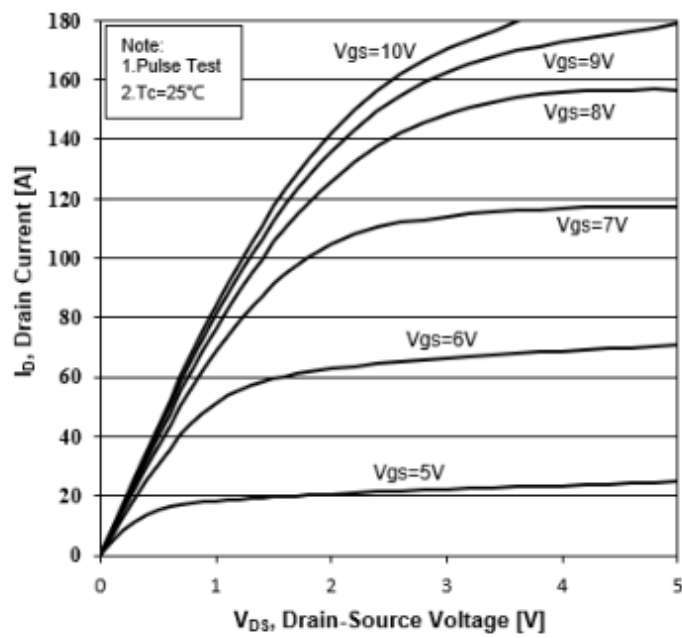


Figure 2. Typical Transfer Characteristics

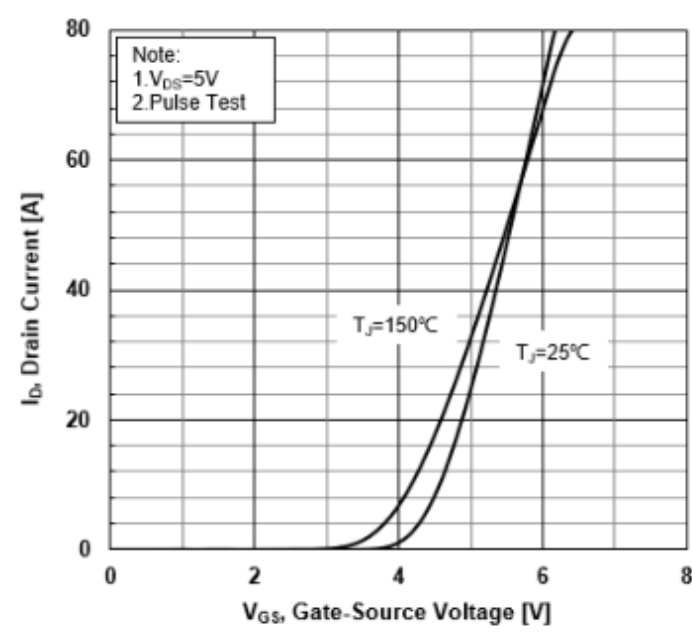


Figure 3. Source-Drain Diode Forward Characteristics

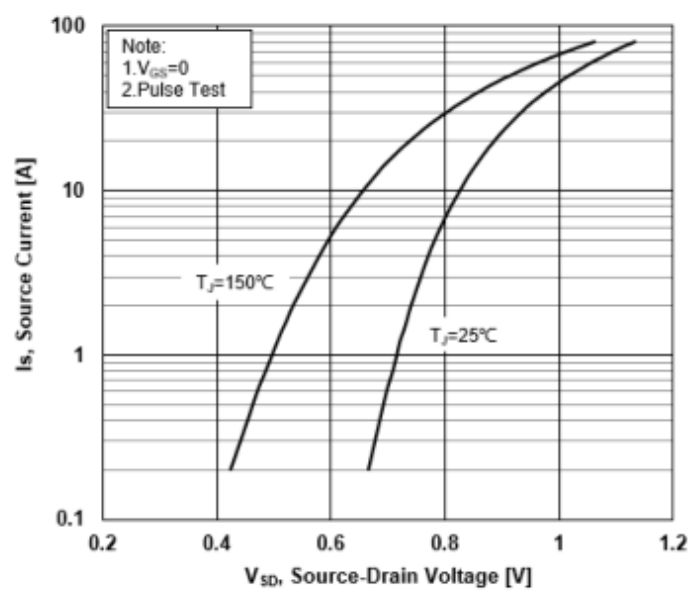


Figure 4. Drain-Source On-Resistance vs Drain Current

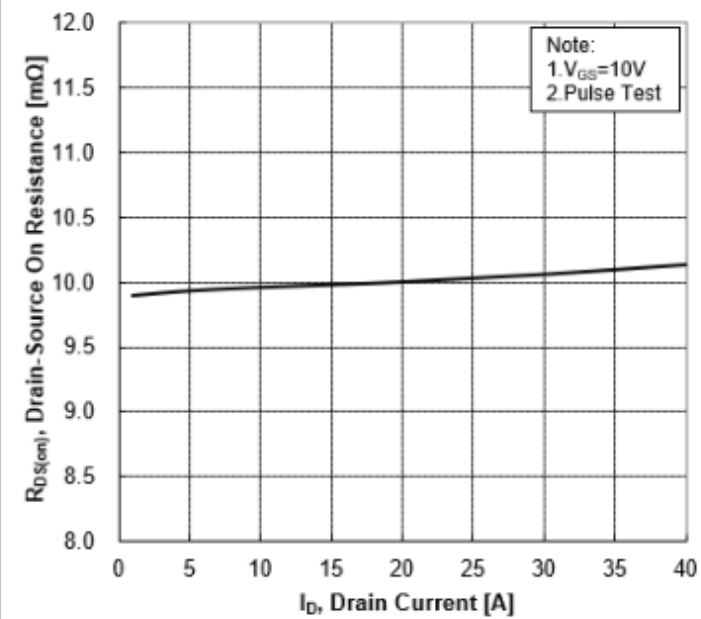


Figure 5. Normalized On-Resistance vs Junction Temperature

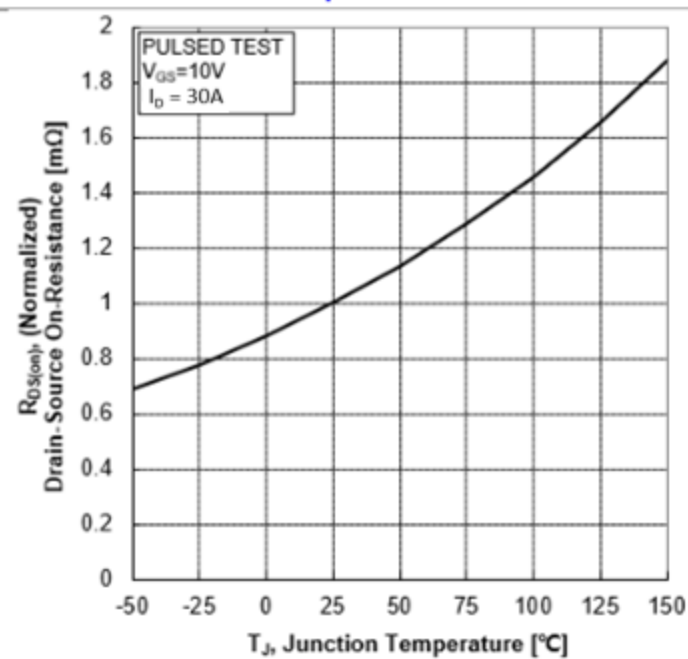
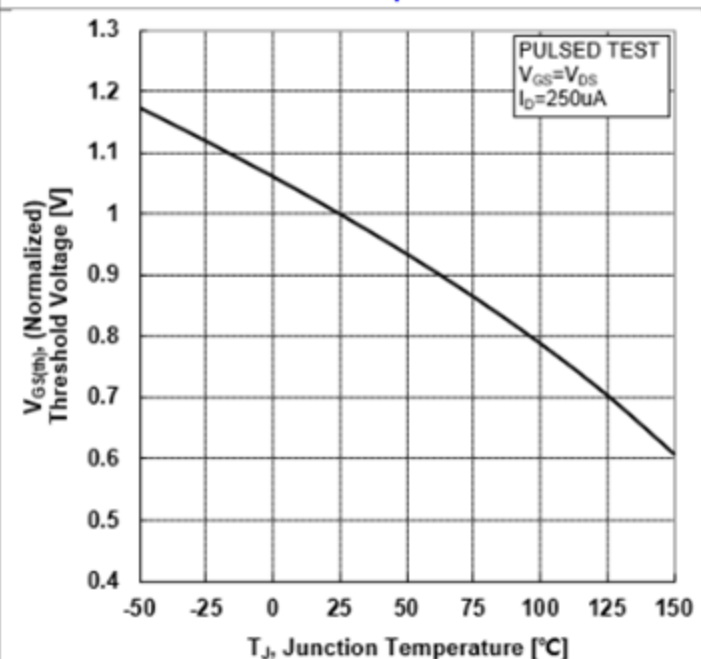
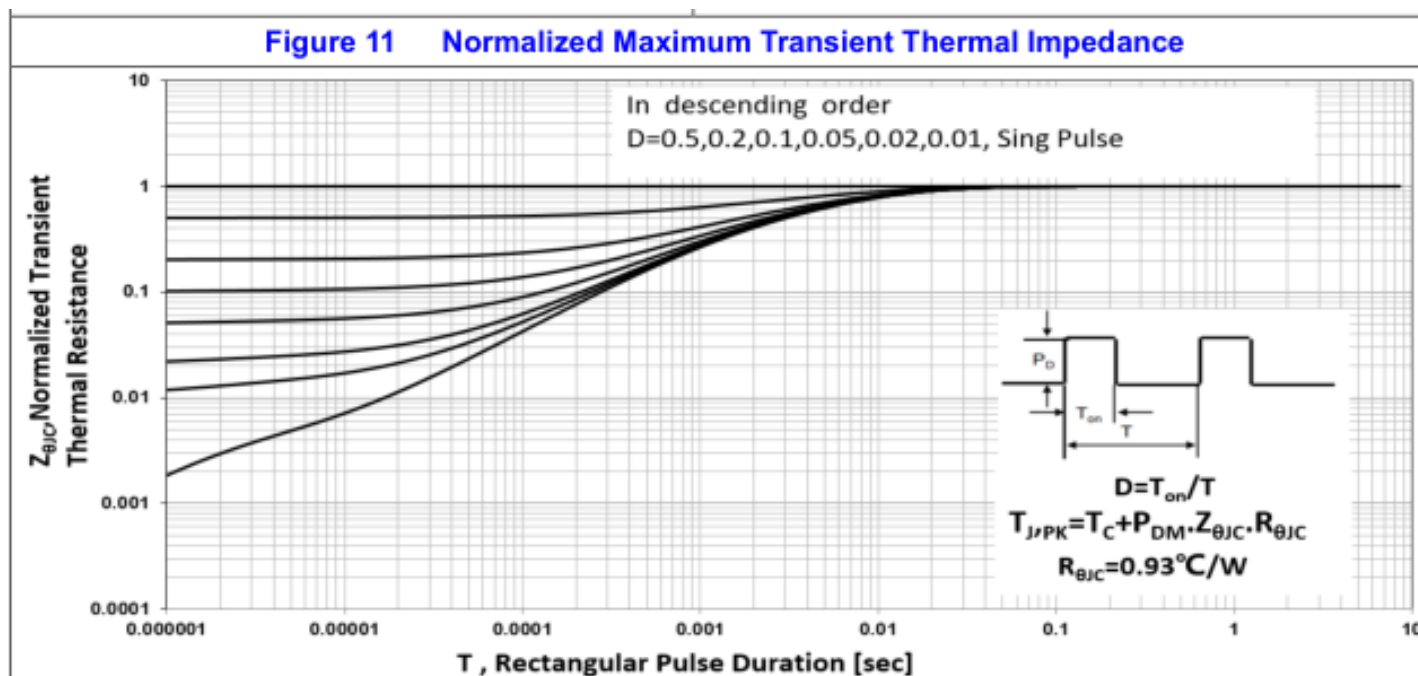
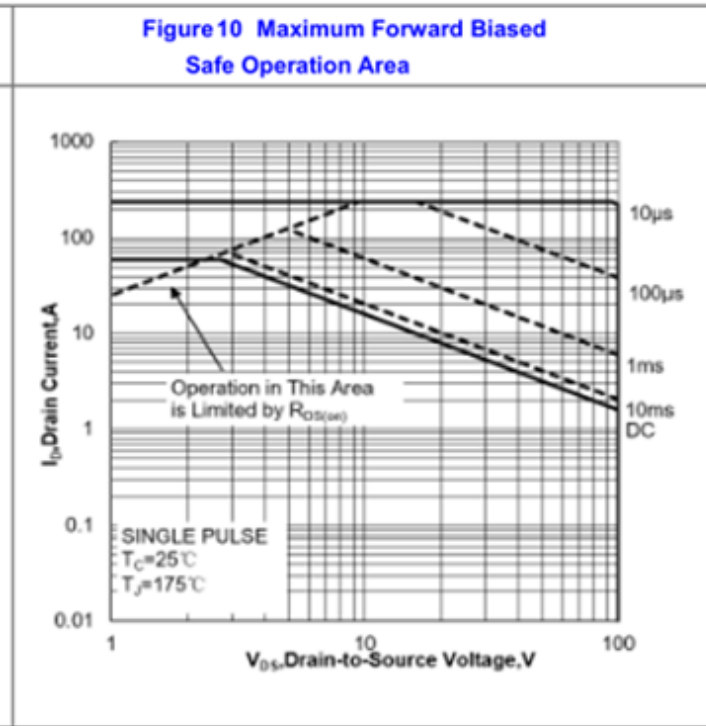
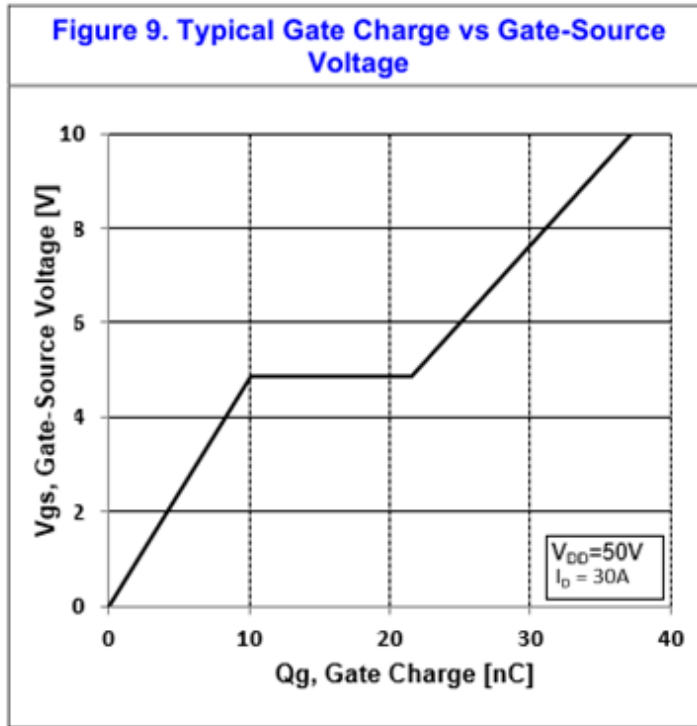
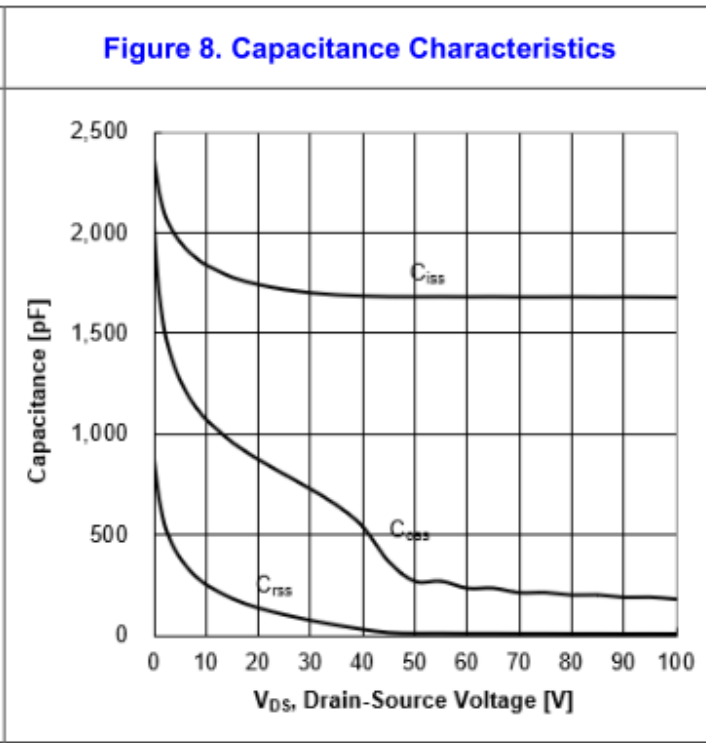
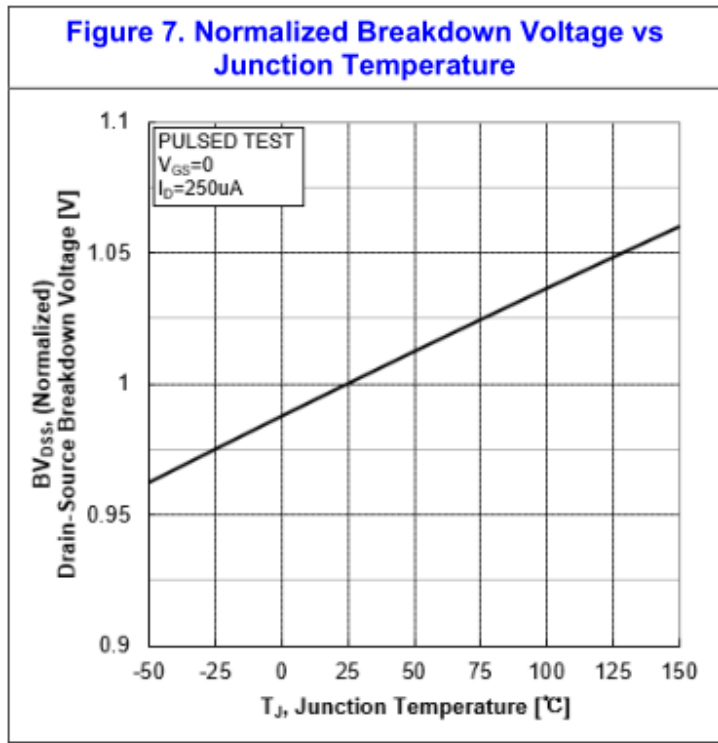


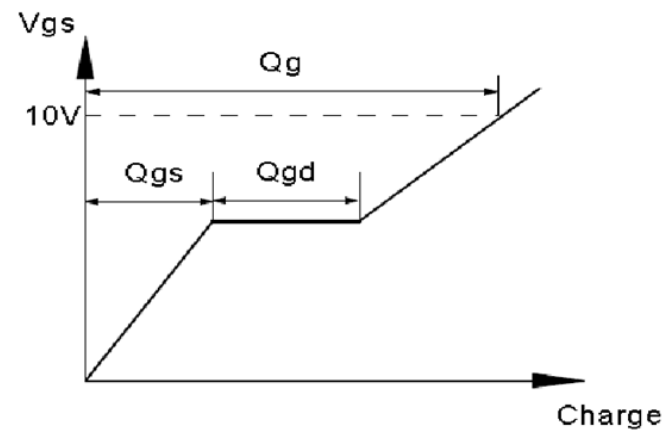
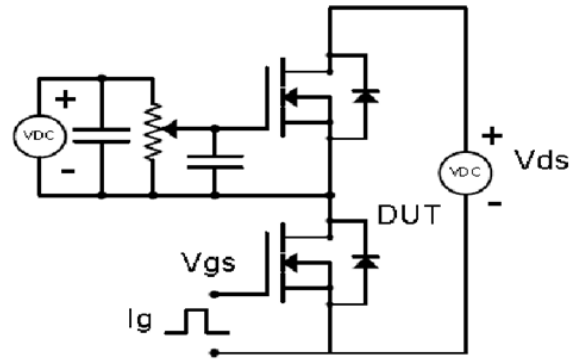
Figure 6. Normalized Threshold Voltage vs Junction Temperature





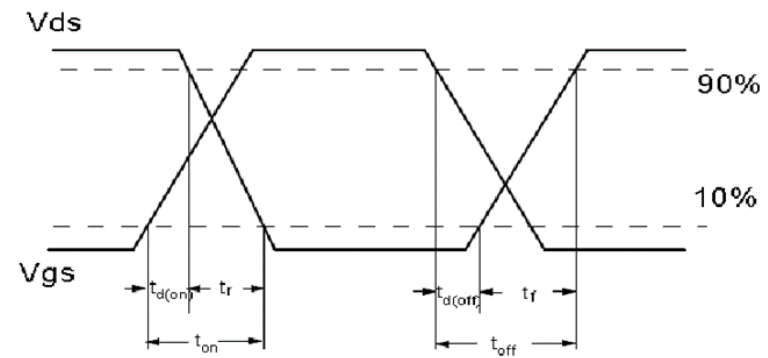
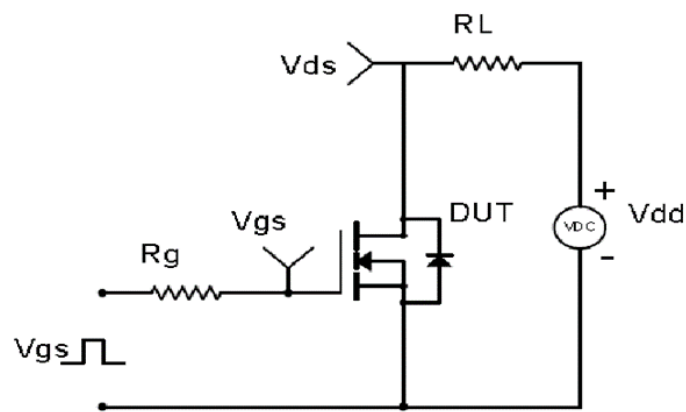
Test Circuit & Waveform

Gate Charge Test Circuit & Waveform

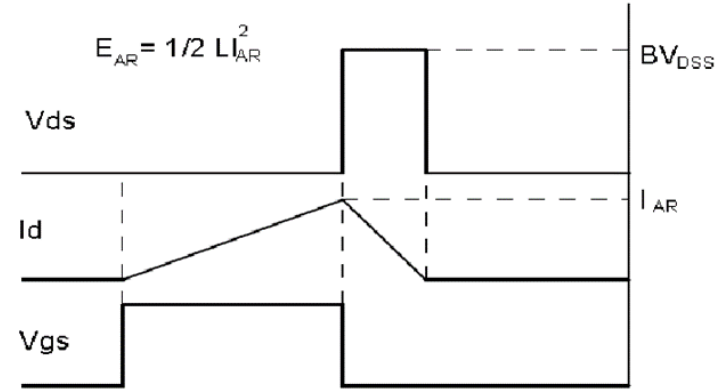
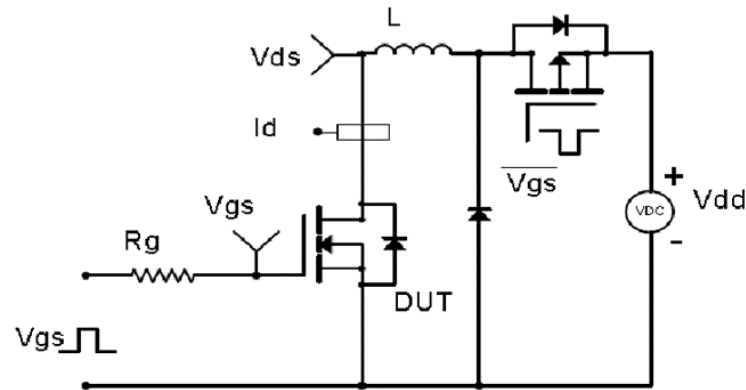


Resistive Switching Test Circuit & Waveforms

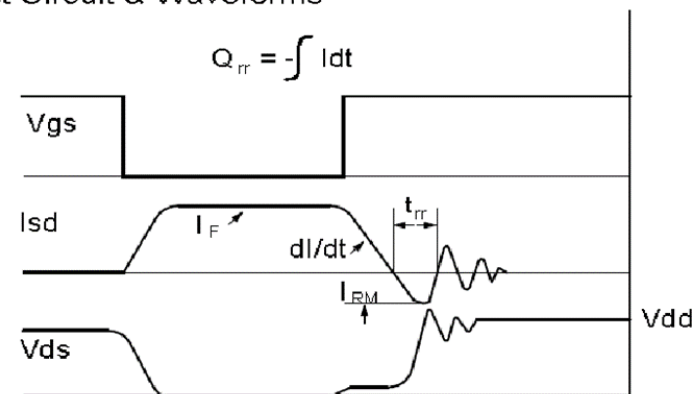
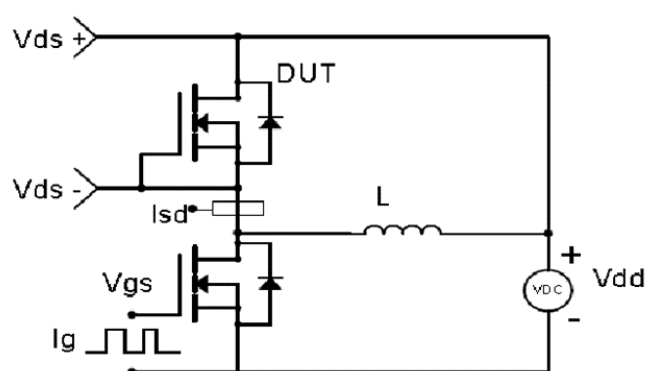
Resistive Switching Test Circuit & Waveforms



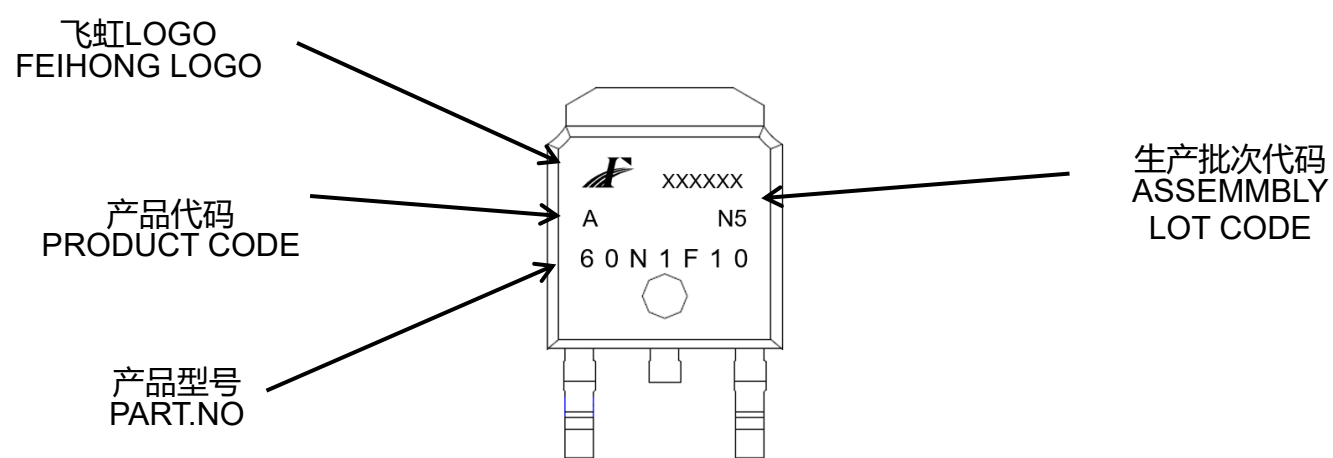
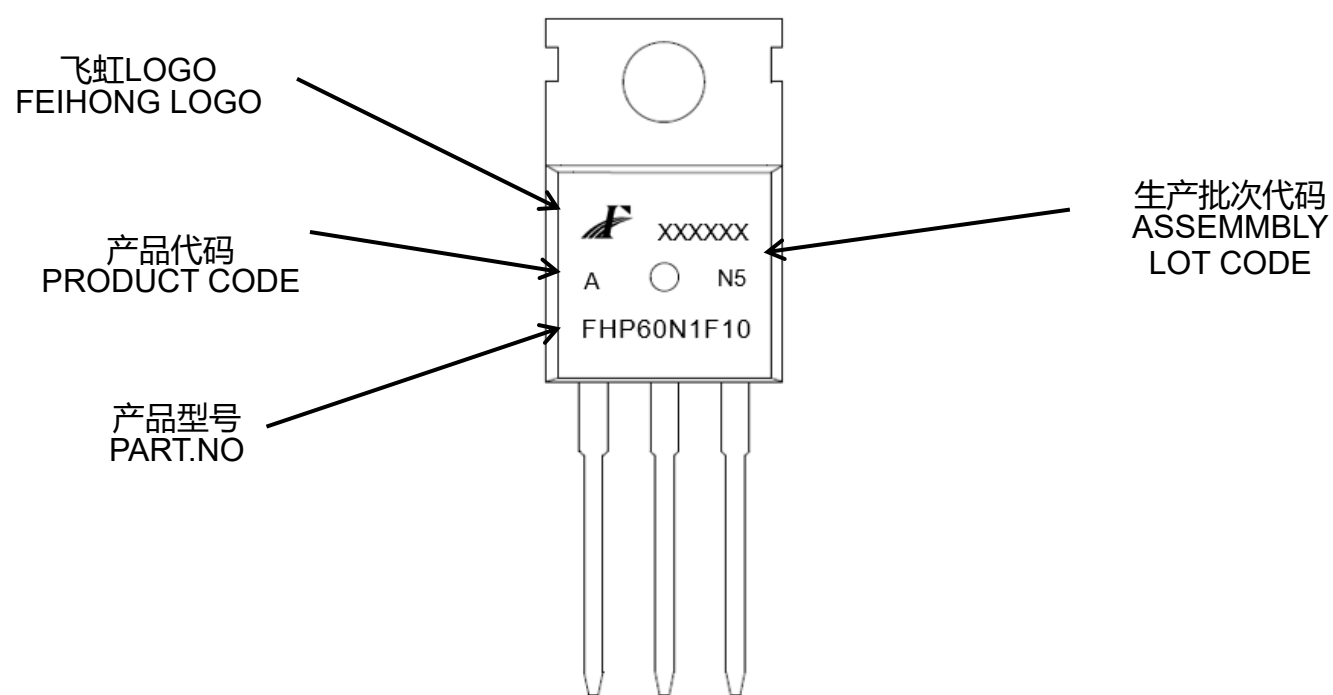
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



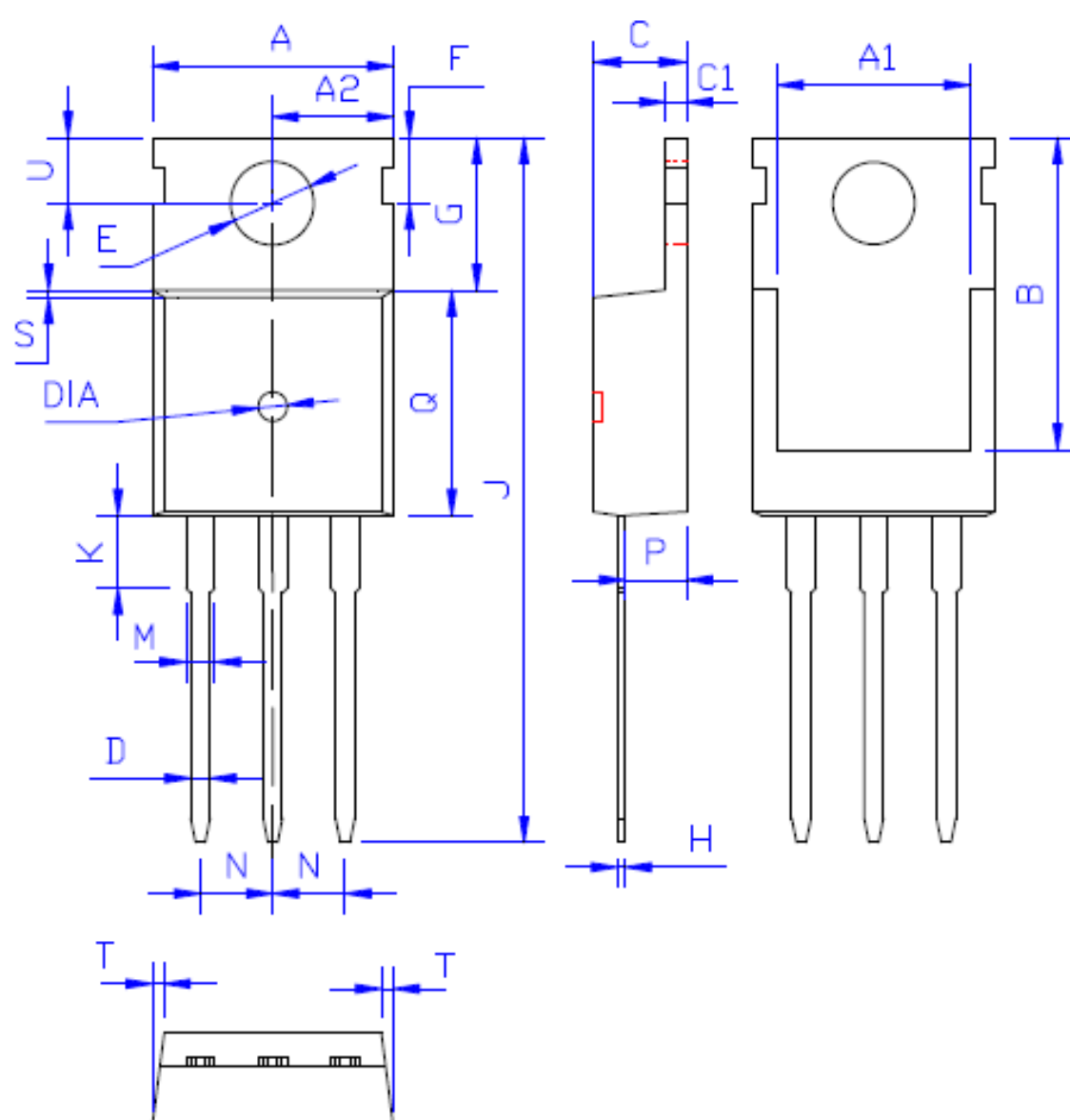
印记 Marking:



外形尺寸:

Package Dimension:

TO-220



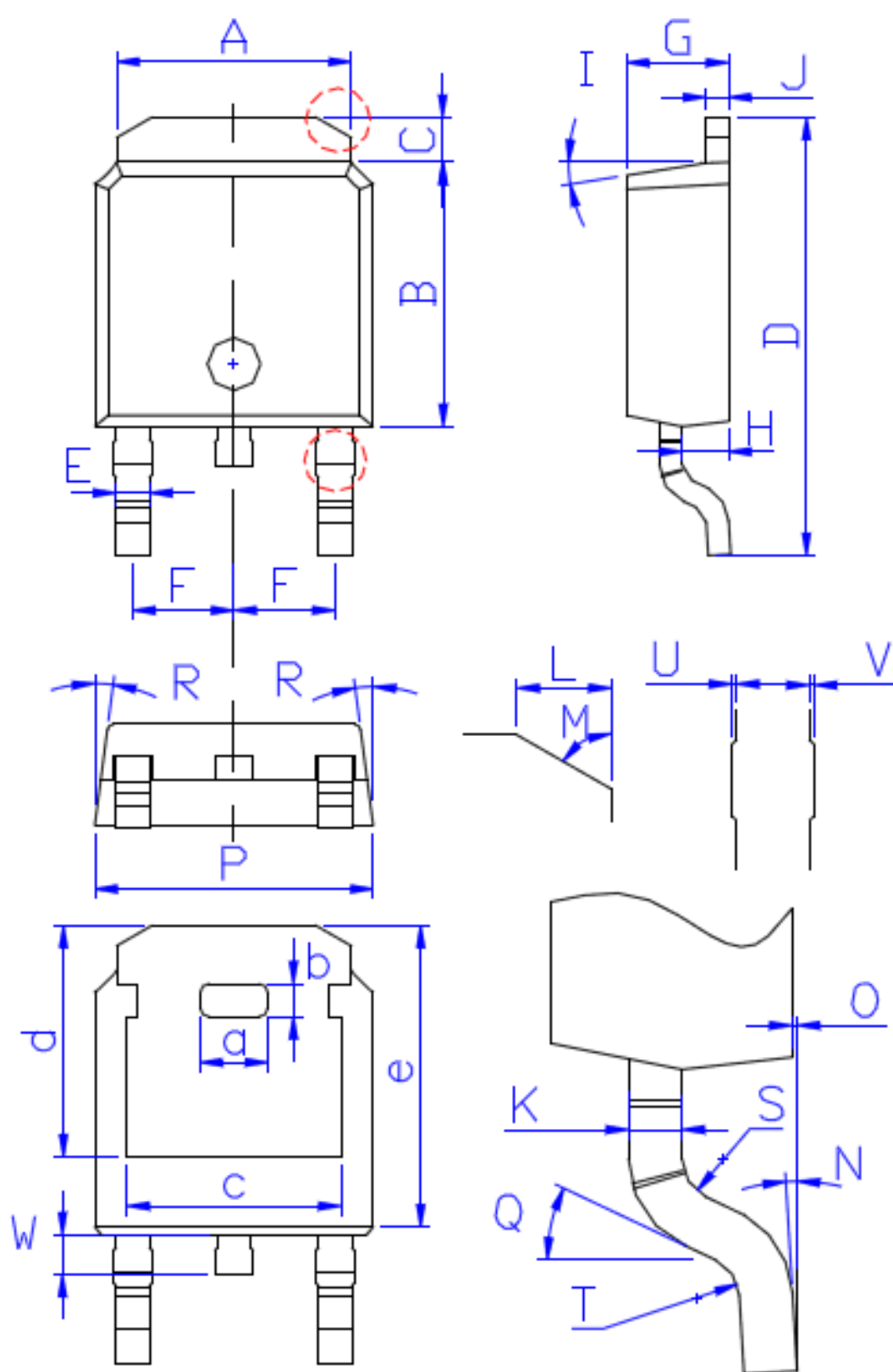
DIM	MILLIMETERS
A	10.00±0.30
A1	8.00±0.30
A2	5.00±0.30
B	13.20±0.40
C	4.50±0.20
C1	1.30±0.20
D	0.80±0.20
E	3.60±0.20
F	3.00±0.30
G	6.60±0.40
H	0.50±0.20
J	28.88±0.50
K	3.00±0.30
M	1.30±0.30
N	Typical 2.54
P	2.40±0.40
Q	9.20±0.40
S	0.25±0.15
T	0.25±0.15
U	2.80±0.30
DIA	宽 1.50±0.10 深 0.50 MAX

(Unit: mm)

外形尺寸:

Package Dimension:

TO-252



DIM	MILLIMETERS
A	5.34 ± 0.30
B	6.00 ± 0.30
C	1.05 ± 0.30
D	9.95 ± 0.30
E	0.76 ± 0.15
F	2.28 ± 0.15
G	2.30 ± 0.30
H	1.06 ± 0.30
I	$(4-10)^{\circ}$
J	0.51 ± 0.15
K	0.52 ± 0.15
L	0.80 ± 0.30
M	60°
N	$(0-10)^{\circ}$
O	0.05 ± 0.05
P	6.60 ± 0.30
Q	25°
R	$(4-8.5)^{\circ}$
S	R0.40
T	R0.40
U	0.05 ± 0.05
V	0.05 ± 0.05
W	0.90 ± 0.30
a	1.80 ± 0.30
b	0.75 ± 0.30
c	4.85 ± 0.30
d	5.30 ± 0.30
e	6.90 ± 0.30

(Units: mm)