# AP2302AI

## 20V N-Channel Enhancement Mode MOSFET

Description

The AP2302AI uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a

Battery protection or in other Switching application.
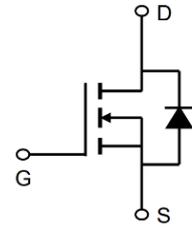
General Features

V_{DS} = 20V I_D =3.2A

$R_{DS(ON)}$ < 32mΩ @ V_{GS}=4.5V
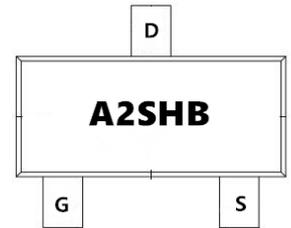
Application

Battery protection

Load switch

Uninterruptible power supply

Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP2302AI	SOT-23	A2SHB	3000

Absolute Maximum Ratings (T_C=25℃unless otherwise noted)

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	20	V
V_{GS}	Gate-Source Voltage	±12	V
I_D@T_A=25℃	Continuous Drain Current, V_{GS} @ 4.5V[1]	3.2	A
I_D@T_A=70℃	Continuous Drain Current, V_{GS} @ 4.5V[1]	2.8	A
I_{DM}	Pulsed Drain Current[2]	14.4	A
P_D@T_A=25℃	Total Power Dissipation[3]	1	W
T_{STG}	Storage Temperature Range	-55 to 150	℃
T_J	Operating Junction Temperature Range	-55 to 150	℃
$R_{\theta JA}$	Thermal Resistance Junction-ambient [1]	125	℃/W
$R_{\theta JC}$	Thermal Resistance Junction-Case[1]	80	℃/W

20V N-Channel Enhancement Mode MOSFET

Electrical Characteristics (T$_J$=25℃, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV$_{DSS}$	Drain-Source Breakdown Voltage	V$_{GS}$=0V , I$_D$=250uA	20	---	---	V
R$_{DS(ON)}$	Static Drain-Source On-Resistance[2]	V$_{GS}$=4.5V , I$_D$=3A	---	23	32	mΩ
		V$_{GS}$=2.5V , I$_D$=2A	---	29	35	
V$_{GS(th)}$	Gate Threshold Voltage	V$_{GS}$=V$_{DS}$, I$_D$ =250uA	0.4	0.7	1.2	V
I$_{DSS}$	Drain-Source Leakage Current	V$_{DS}$=16V , V$_{GS}$=0V , T$_J$=25℃	---	---	1	uA
		V$_{DS}$=16V , V$_{GS}$=0V , T$_J$=55℃	---	---	5	
I$_{GSS}$	Gate-Source Leakage Current	V$_{GS}$=±12V , V$_{DS}$=0V	---	---	±100	nA
gfs	Forward Transconductance	V$_{DS}$=5V , I$_D$=3A	---	10.5	---	S
Q$_g$	Total Gate Charge (4.5V)	V$_{DS}$=15V , V$_{GS}$=4.5V , I$_D$=3A	---	4.6	---	nC
Q$_{gs}$	Gate-Source Charge		---	0.7	---	
Q$_{gd}$	Gate-Drain Charge		---	1.5	---	
T$_{d(on)}$	Turn-On Delay Time	V$_{DD}$=10V , V$_{GS}$=4.5V , R$_G$=3.3Ω I$_D$=3A	---	1.6	---	ns
T$_r$	Rise Time		---	42	---	
T$_{d(off)}$	Turn-Off Delay Time		---	14	---	
T$_f$	Fall Time		---	7	---	
C$_{iss}$	Input Capacitance	V$_{DS}$=15V , V$_{GS}$=0V , f=1MHz	---	310	---	pF
C$_{oss}$	Output Capacitance		---	49	---	
C$_{rss}$	Reverse Transfer Capacitance		---	35	---	
I$_S$	Continuous Source Current[1,4]	V$_G$=V$_D$=0V , Force Current	---	---	3.6	A
V$_{SD}$	Diode Forward Voltage[2]	V$_{GS}$=0V , I$_S$=1A , T$_J$=25℃	---	---	1.2	V

Note :

1、The data tested by surface mounted on a 1 inch^2 FR-4 board with 2OZ copper.

2、The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3、The power dissipation is limited by 150℃ junction temperature

4、The data is theoretically the same as I$_D$ and I$_{DM}$, in real applications , should be limited by total power dissipation.

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Typical Characteristics
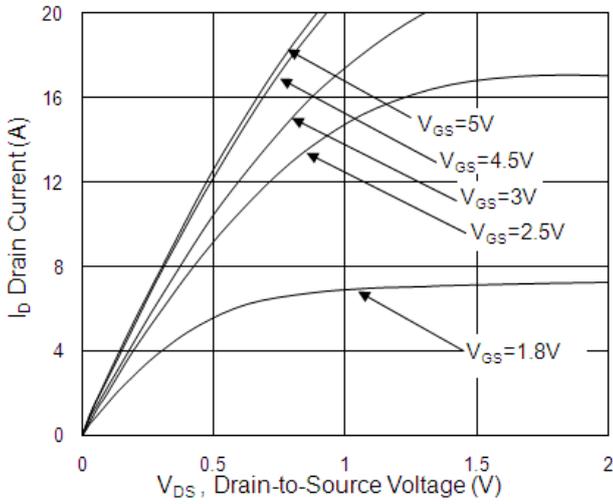
Fig.1 Typical Output Characteristics
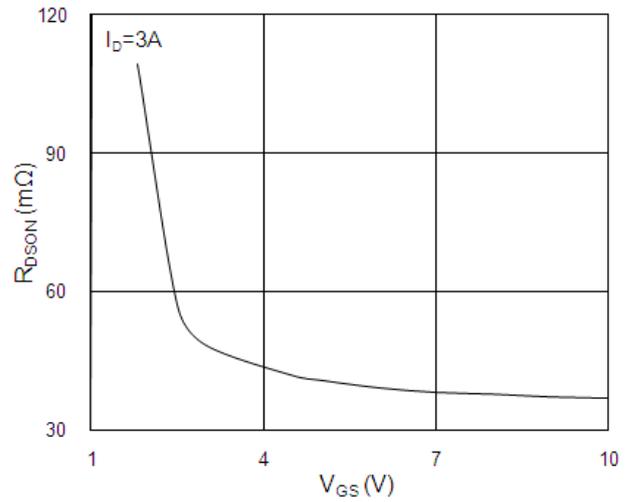
**Fig.2 On-Resistance vs. G-S Voltage**
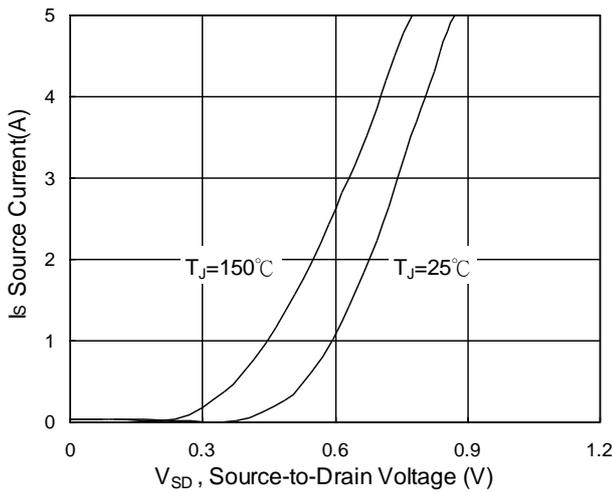
Fig.3 Source Drain Forward Characteristics
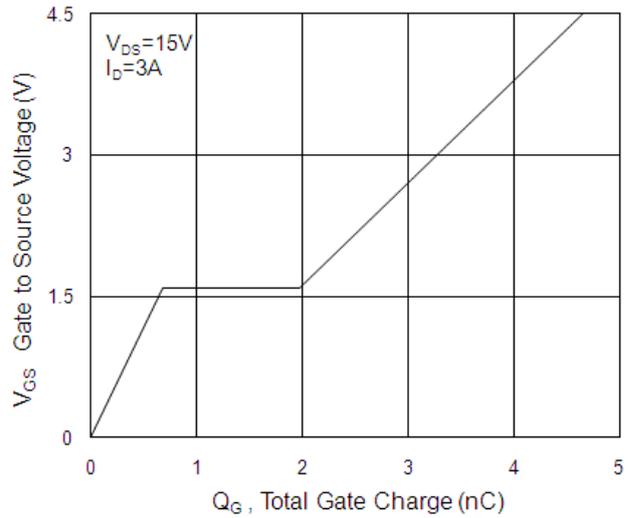
Fig.4 Gate-Charge Characteristics
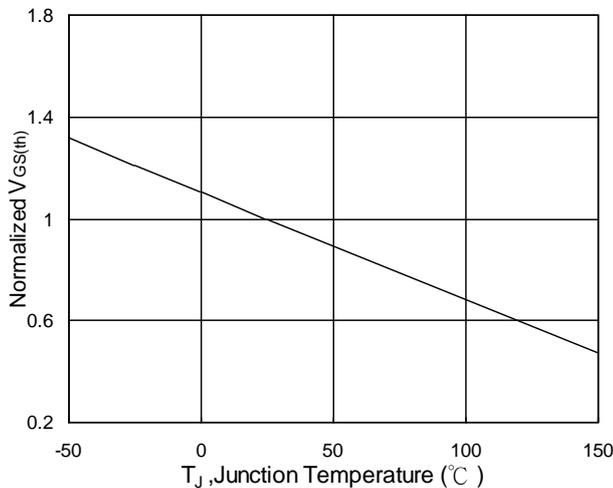
Fig.5 Normalized $V_{GS(th)}$ vs. T_J
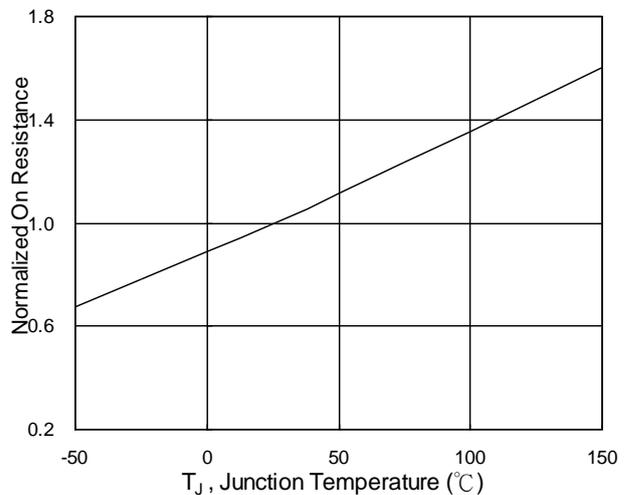
Fig.6 Normalized R_{DSON} vs. T_J
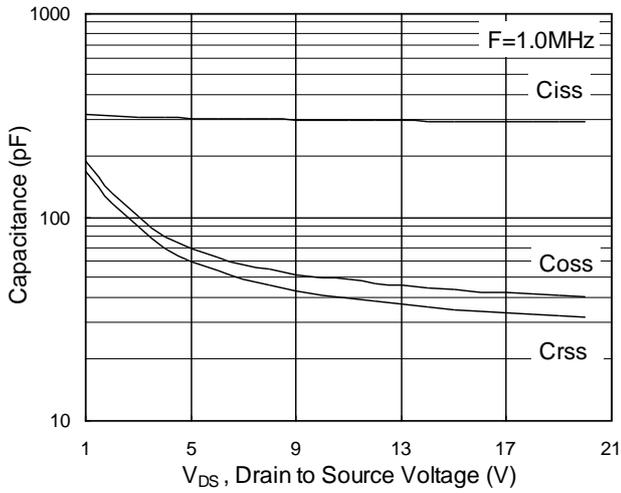
Fig.7 Capacitance
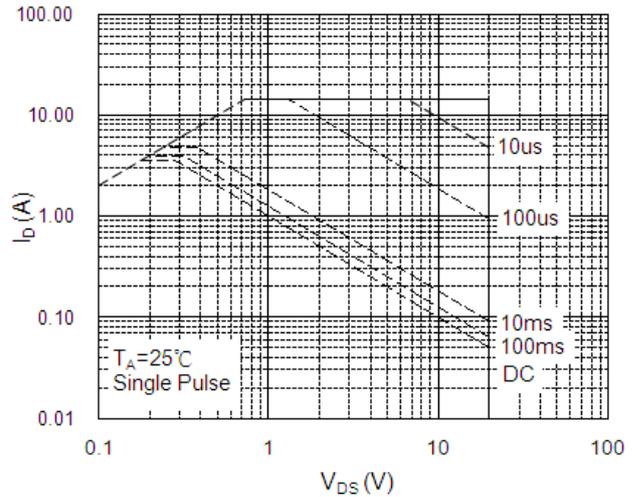
Fig.8 Safe Operating Area
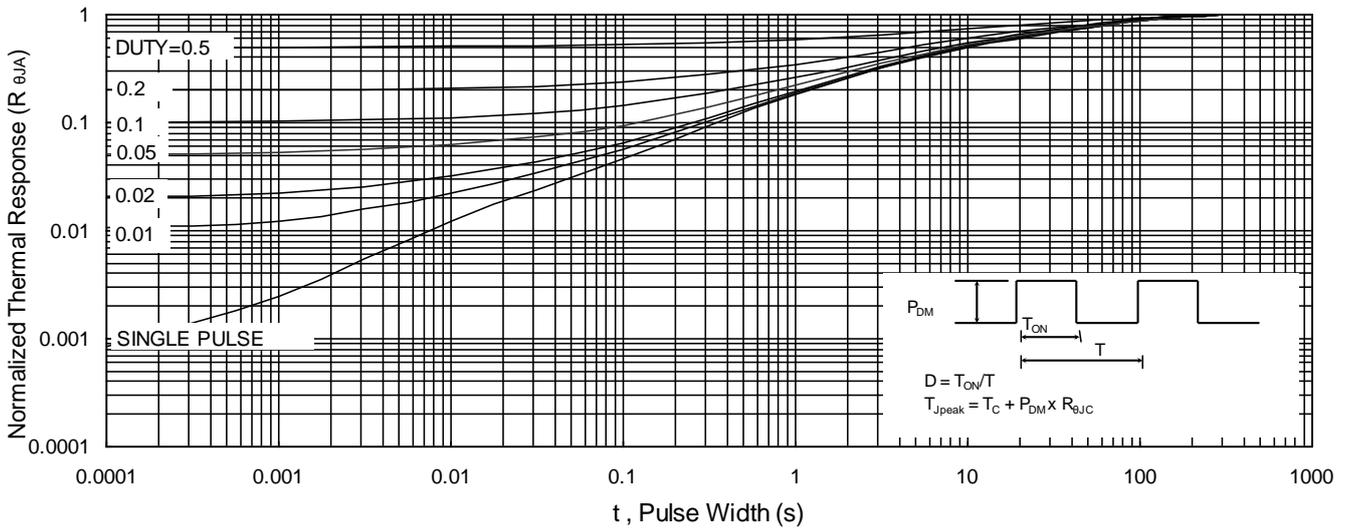
Fig.9 Normalized Maximum Transient Thermal Impedance

$$D = T_{ON}/T$$
$$T_{Jpeak} = T_C + P_{DM} \times R_{\theta JC}$$
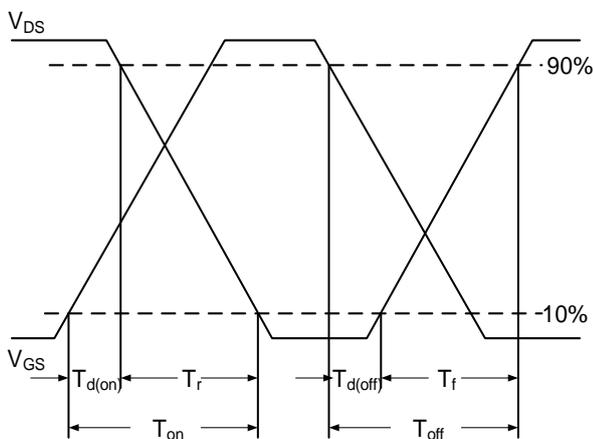
Fig.10 Switching Time Waveform
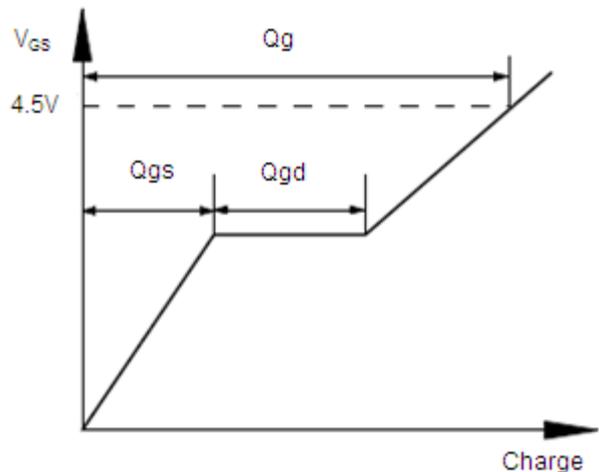
Fig.11 Gate Charge Waveform

Package Mechanical Data-SOT-23
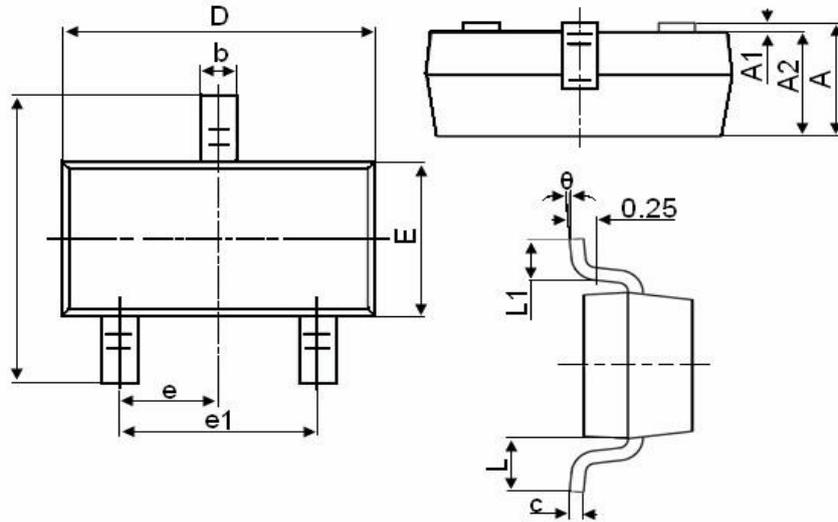
Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
θ	0°	8°

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Edition	Date	Change
Rve3.0	2017/6/1	Initial release
Rve3.1	2020/6/09	Reduce RDS(on)

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Test Report For 30PCS（30pcs 典型測試報告）

RDS-4.5V（mΩ）

RDS-4.5V（mΩ）

VDS(V)

VTH（V）
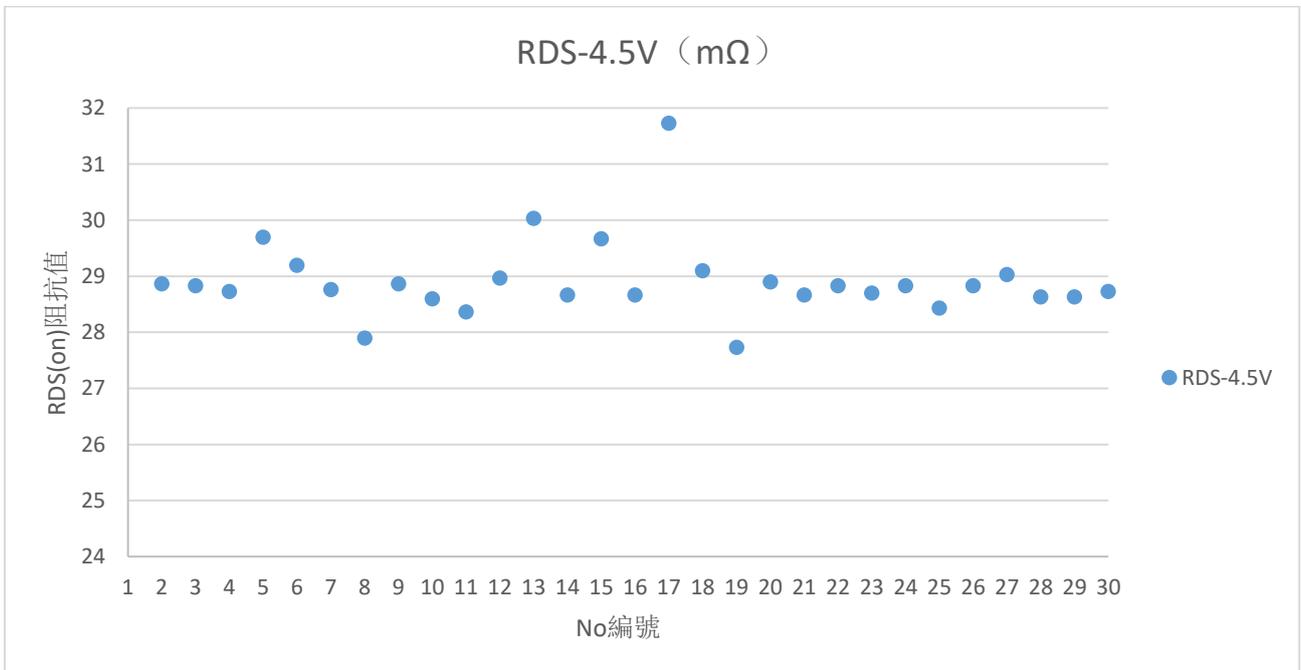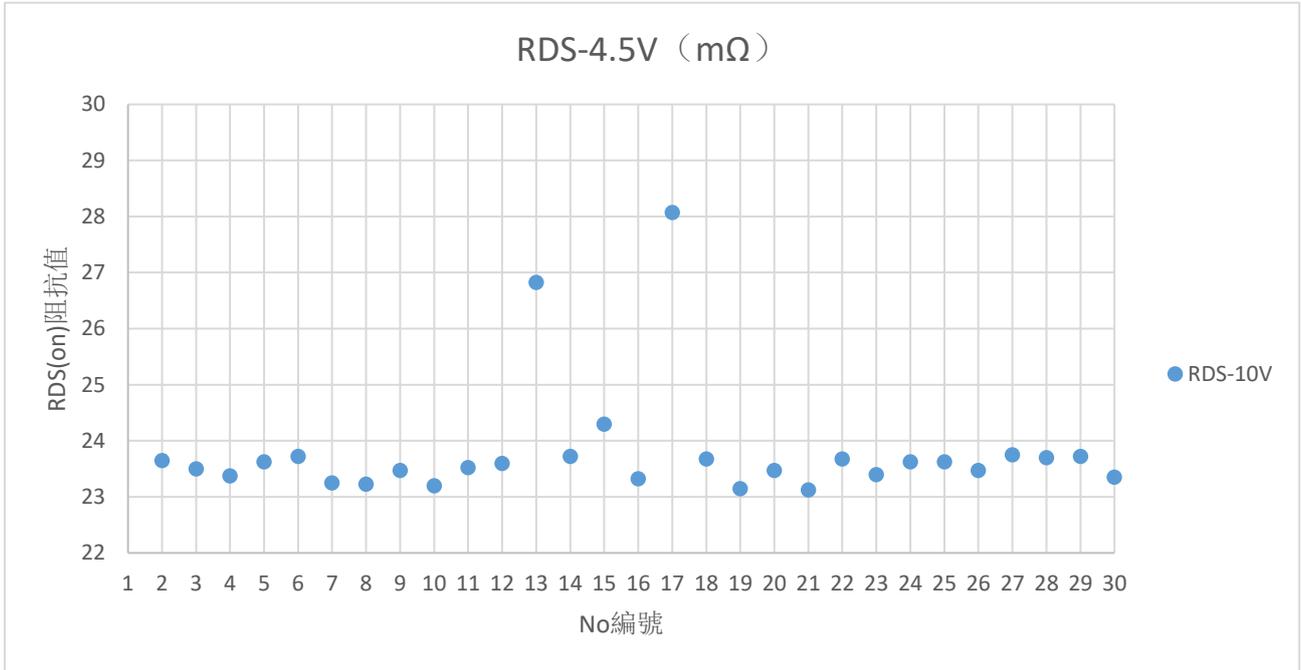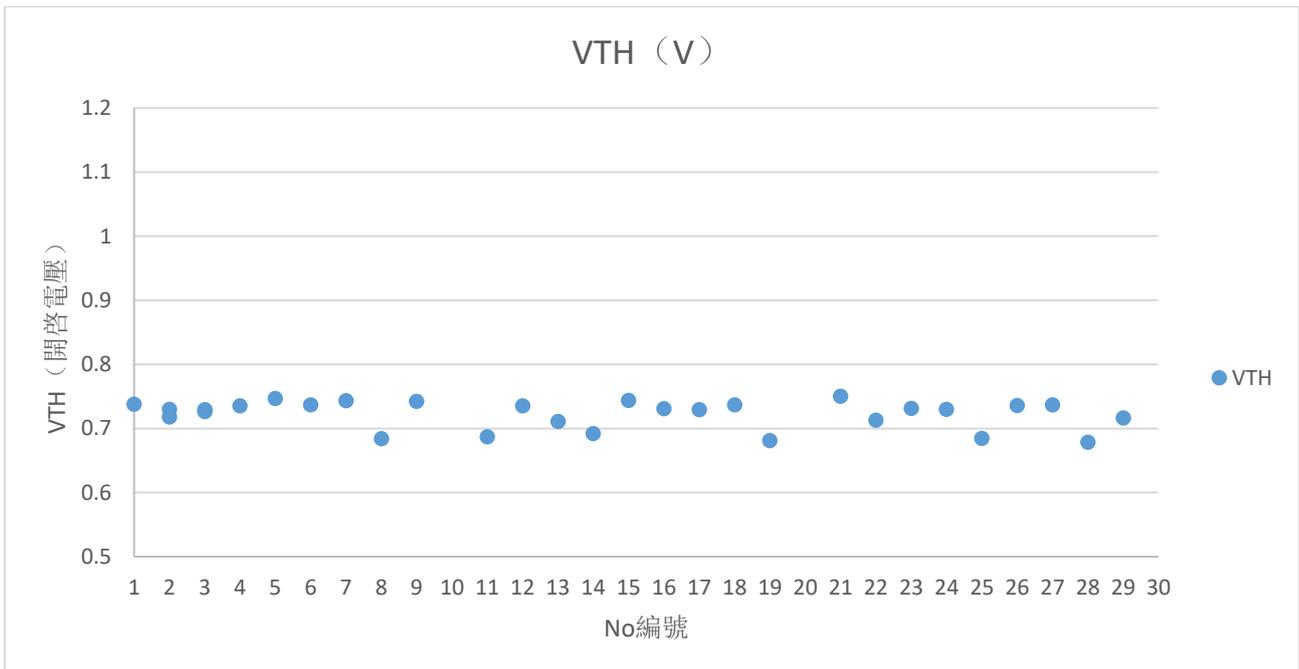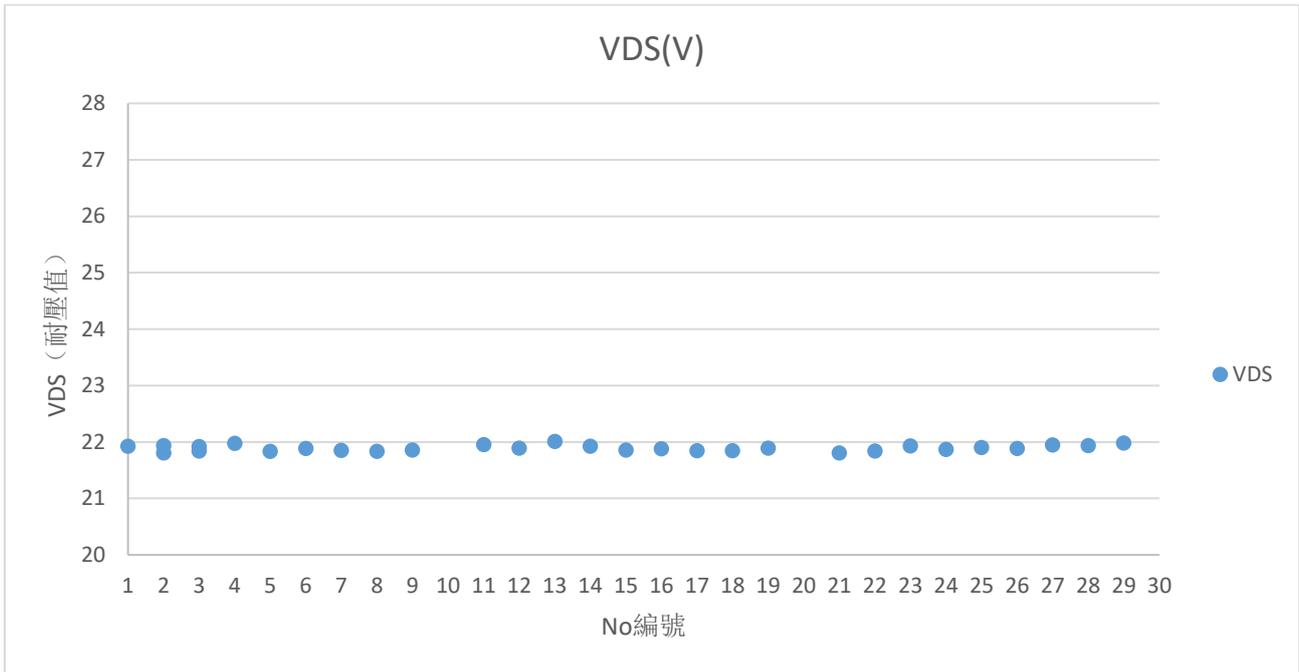
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