

Ultra Low Power Voltage Detector

FEATURES

- Ultra-Low Quiescent Current.
- 1.5V to 10.0V Input Voltage Operation.
- Flexible Detection Voltage Setting
0.1V Step in the Range of 1.6V to 6.0V
- High Detection Voltage Accuracy at $\pm 2.5\%$.
- Built-In Detection Voltage Hysteresis.
- Three Output Types: N-ch, P-ch and CMOS.
- Space Saving Packages: SOT89-3, SOT23-3 and SOT23-5.

APPLICATIONS

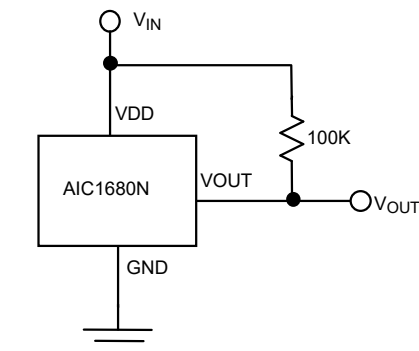
- Battery Checker for Battery-Operated Systems.
- CPU & Logic Circuit Reset.
- Memory Back-up Circuit.
- Level Discriminator.
- Power Failure Detector.

DESCRIPTION

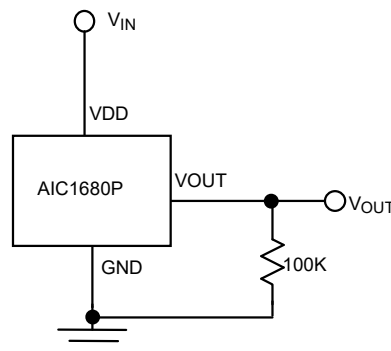
The AIC1680 is an accurate, ultra-low power consumption voltage detector IC, fabricated with advanced CMOS process. The AIC1680 consists of a comparator, a voltage reference unit, a resistor divider, two output drivers, and a hysteresis circuit.

The consumption current is so low that it can often be ignored when compared to the battery self-discharge current. The values of detection and hysteresis voltage are set internally and are accurately controlled by trimming techniques. There are three types of output: N-ch open-drain, P-ch open-drain, and CMOS. Three types of package, SOT89-3, SOT23-3 and SOT23-5, are available to save board space.

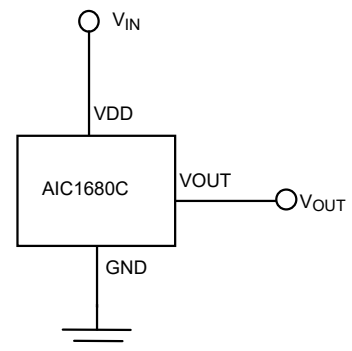
TYPICAL APPLICATION CIRCUIT



Voltage Level Indicator
(N-ch Open-Drain Output)



Voltage Level Indicator
(P-ch Open-Drain Output)



Voltage Level Indicator
(CMOS Output)

ORDERING INFORMATION

AIC1680X-XXXXXX

PACKING TYPE

TR: REEL

TB: TUBE

BG: BAG

PACKAGE TYPE

U: SOT23-3

X: SOT89-3

V: SOT23-5

G GREEN PACKAGE

DETECTION VOLTAGE

OPTIONAL

16: 1.6V

17: 1.7V

⋮

⋮

60: 6.0V

OUTPUT TYPE

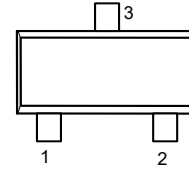
N: N-ch Open Drain

P: P-ch Open Drain

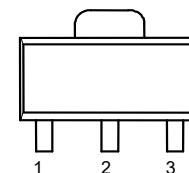
C: CMOS

PIN CONFIGURATION

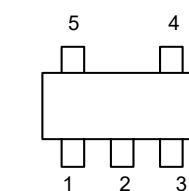
SOT23-3
TOP VIEW
1: VOUT
2: GND
3: VDD



SOT89-3
TOP VIEW
1: VOUT
2: VDD
3: GND



SOT23-5
TOP VIEW
1: VOUT
2: VDD
3: GND
4: NC
5: NC



Example: AIC1680N-24GUTR

→ N-ch open drain 2.4V version, in SOT23-3
Green Package & Tape & Reel Packing
Type

SOT23-3 Marking

Part No.	Marking
AIC1680N-16GU	U16NG
AIC1680P-16GU	U16PG
AIC1680C-16GU	U16CG
AIC1680N-17GU	U17NG
AIC1680P-17GU	U17PG
AIC1680C-17GU	U17CG
..... (0.1V INCREMENT)	

Part No.	Marking
AIC1680N-59GU	U59NG
AIC1680P-59GU	U59PG
AIC1680C-59GU	U59CG
AIC1680N-60GU	U60NG
AIC1680P-60GU	U60PG
AIC1680C-60GU	U60CG

● **SOT89-3 Marking**

Part No.	Marking
AIC1680N-16GX	X16NG
AIC1680P-16GX	X16PG
AIC1680C-16GX	X16CG
AIC1680N-17GX	X17NG
AIC1680P-17GX	X17PG
AIC1680C-17GX	X17CG
..... (0.1V INCREMENT)	

Part No.	Marking
AIC1680N-59GX	X59NG
AIC1680P-59GX	X59PG
AIC1680C-59GX	X59CG
AIC1680N-60GX	X60NG
AIC1680P-60GX	X60PG
AIC1680C-60GX	X60CG

● **SOT23-5 Marking**

Part No.	Marking
AIC1680N-16GV	V16NG
AIC1680P-16GV	V16PG
AIC1680C-16GV	V16CG
AIC1680N-17GV	V17NG
AIC1680P-17GV	V17PG
AIC1680C-17GV	V17CG
..... (0.1V INCREMENT)	

Part No.	Marking
AIC1680N-59GV	V59NG
AIC1680P-59GV	V59PG
AIC1680C-59GV	V59CG
AIC1680N-60GV	V60NG
AIC1680P-60GV	V60PG
AIC1680C-60GV	V60CG

■ **ABSOLUTE MAXIMUM RATINGS**

Supply Voltage (VDD)..... 10V

Output Voltage..... $V_{DD}-0.3$ to 10V

Output Current..... 20mA

Operating Temperature Range..... -40°C ~ 85°C

Storage Temperature Range..... - 65°C ~ 150°C

Junction Temperature..... 125°C

Lead Temperature (Soldering 10 sec) 260°C

Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

■ **TEST CIRCUIT**

Refer to "TYPICAL APPLICATION CIRCUIT".

■ ELECTRICAL CHARACTERISTICS

($T_A=25^{\circ}\text{C}$, unless otherwise specified.) (Note 1)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Detector Voltage		V_{DET}	0.975	1.0	1.025	V_{DET}
Detector Threshold Hysteresis		V_{HYS}	0.03	0.05	0.07	V_{DET}
Supply Current	$V_{DD}=2.0\text{V}$ $V_{DD}=3.0\text{V}$ $V_{DD}=4.5\text{V}$ $V_{DD}=6.0\text{V}$ $V_{DD}=10.0\text{V}$	I_{DD}		0.7 0.9 1.3 1.8 3.2	1.1 1.5 2.0 2.7 4.8	μA
Operation Voltage		V_{DD}	1.5		10	V
Output Current	$V_{DS}=0.5\text{V}, V_{DD}=2.4\text{V}$ $V_{DS}=0.5\text{V}, V_{DD}=3.6\text{V}$ $V_{DS}=0.5\text{V}, V_{DD}=4.6\text{V}$ $V_{DS}=0.5\text{V}, V_{DD}=6.0\text{V}$	$I_{OUT}(\text{Nch})$		3.24 5.85 7.74 10.44		mA
Output Current	$V_{DS}=-2.1\text{V}, V_{DD}=4.5\text{V}$	$I_{OUT}(\text{Pch})$	2	3.5		mA
Temperature Coefficiance				± 150		ppm/ $^{\circ}\text{C}$
Output Delay Time		T_{DELAY}			200	μS

Note 1: Specifications are production tested at $T_A=25^{\circ}\text{C}$. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

■ TYPICAL PERFORMANCE CHARACTERISTICS

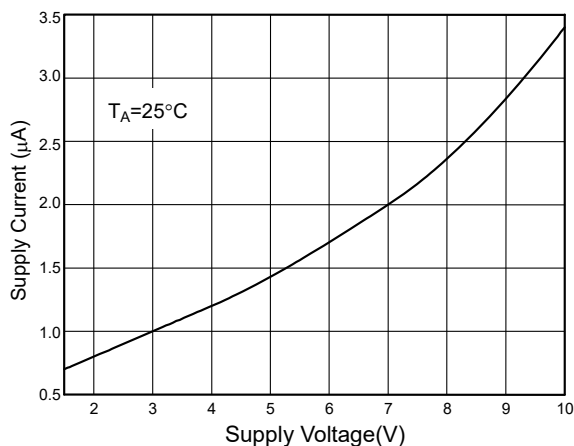
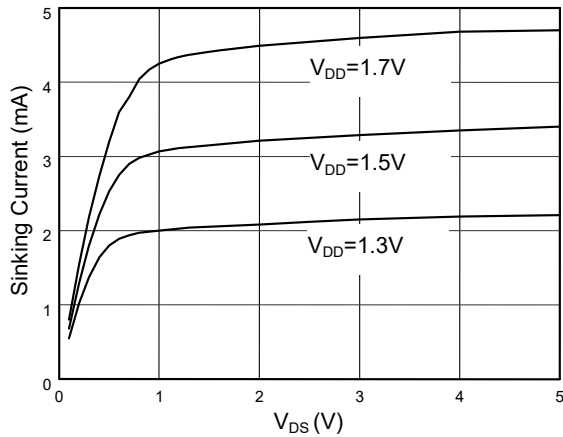
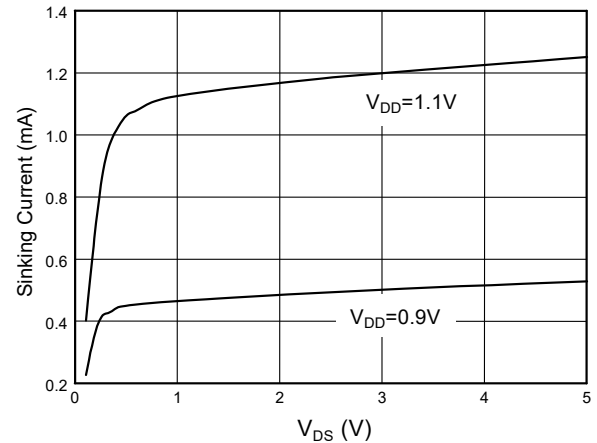
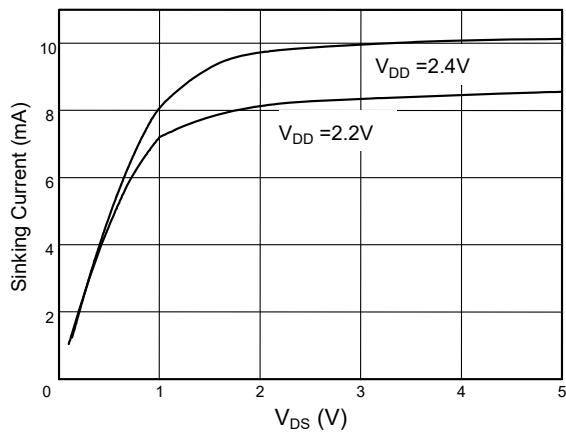
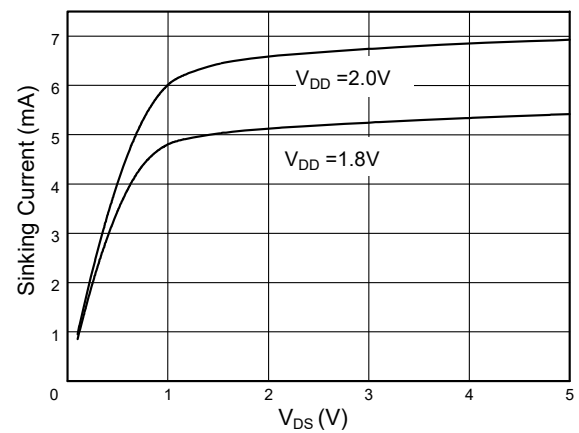
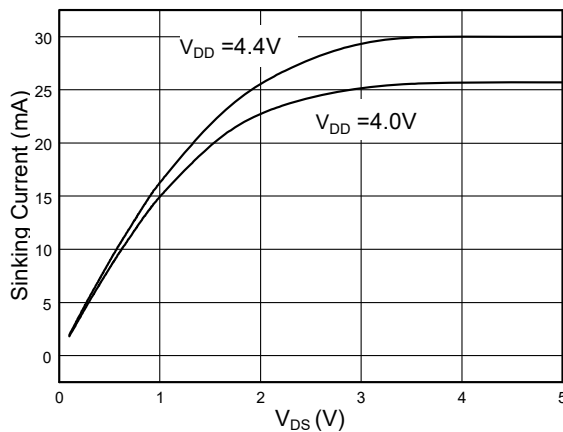
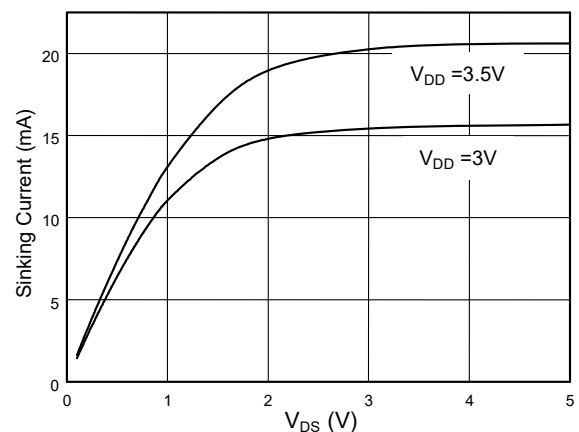


Fig. 1 Supply Current vs. Supply Voltage

■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

N-ch Driver Sinking Current vs. V_{DS}


Fig. 2 $V_{DET} = 1.8V$

Fig. 3 $V_{DET} = 1.8V$

Fig. 4 $V_{DET} = 2.5V$

Fig. 5 $V_{DET} = 2.5V$

Fig. 6 $V_{DET} = 4.5V$

Fig. 7 $V_{DET} = 4.5V$

■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

P-ch Driver Output Current vs. V_{DS}

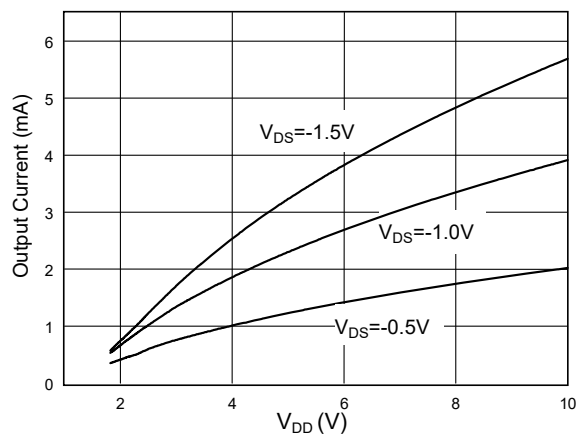


Fig. 8 $V_{DET}=1.8V$

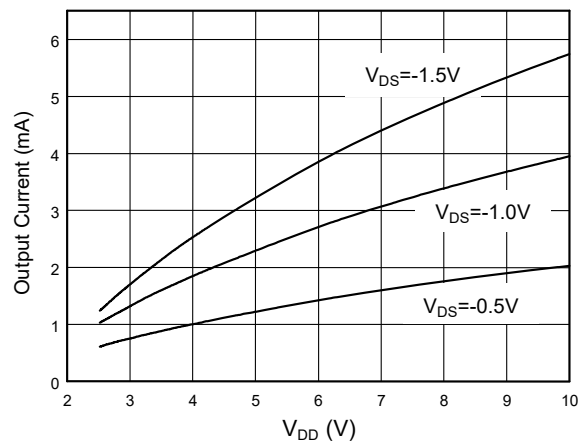


Fig. 9 $V_{DET}=2.5V$

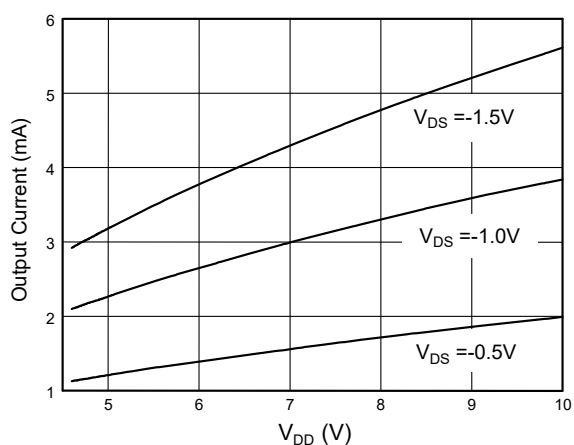
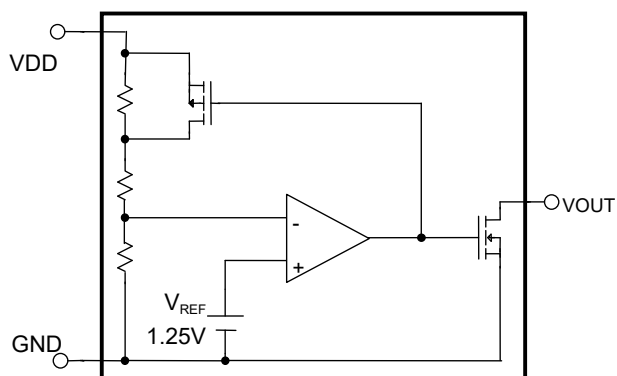
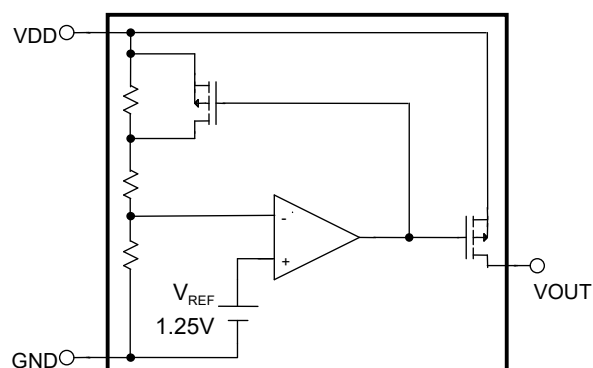


Fig. 10 $V_{DET}=4.5V$

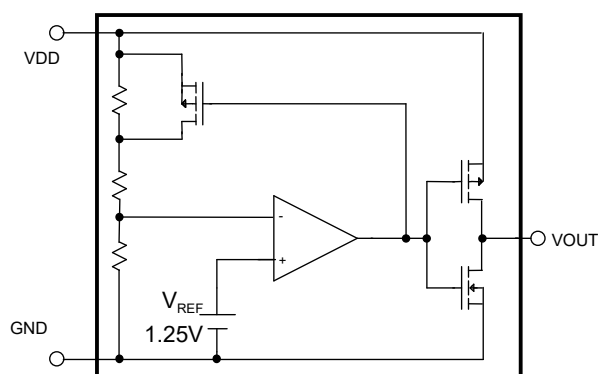
■ BLOCK DIAGRAMS



N-ch open drain output



P-ch open drain output



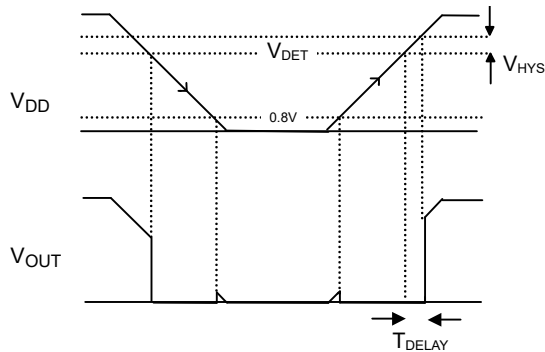
CMOS output

■ PIN DESCRIPTIONS

- VDD - Power Supply and Detected Voltage Input.
- GND - Ground.
- VOUT - Detector Output.

■ APPLICATION INFORMATION

The timing diagram of V_{DD} and V_{OUT} is shown as below:



The guaranteed minimum operation voltage of AIC1680 is 1.5V. As the supply voltage (V_{DD}) is reduced below 1.5V, the performance degrades, N-ch or P-ch driving capacity degrades, and the supply current decreases. AIC1680 isn't functioning when V_{DD} down to 0.8V.

■ APPLICATION EXAMPLE

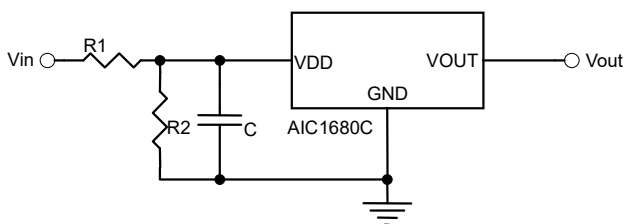


Fig.11 Detector threshold adjustable circuit

$$V_{DET-ADJ} = V_{DET} \frac{R1 + R2}{R2}$$

$$\text{Hysteresis Voltage} = V_{HYS} \frac{R1 + R2}{R2}$$

In some application, divided resistors are used to obtain detector threshold voltage as figure11 shown. If the value of resistor, $R1$, sets extremely large, voltage drop may occur resulting from the start-up current of IC, and detector threshold may oscillation.

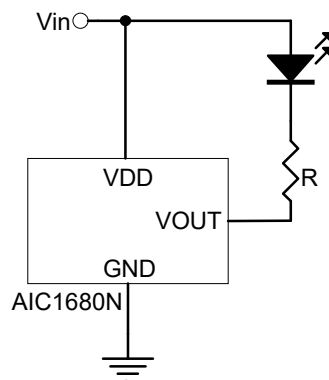


Fig.12 Voltage indicator circuit, lights when low power

APPLICATION EXAMPLE (Continued)

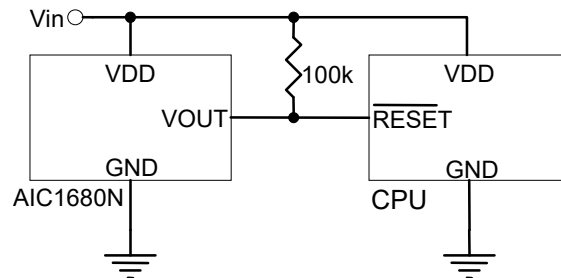


Fig.13 The input voltage of AIC1680 and CPU are the same

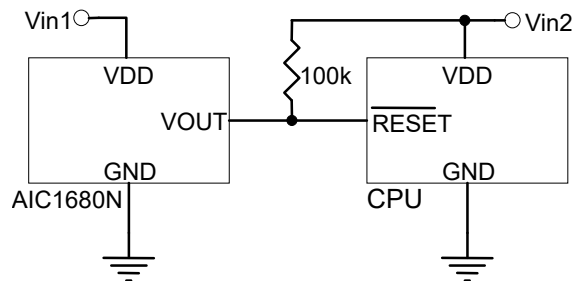


Fig.14 The input voltage of AIC1680 and CPU are not

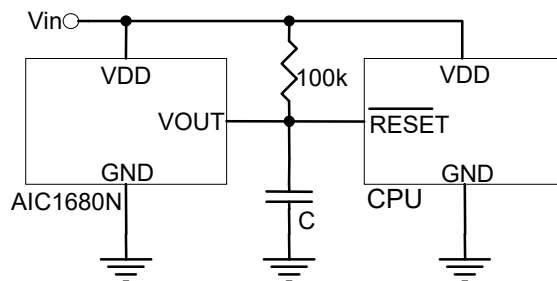


Fig.15 Output delay time-1

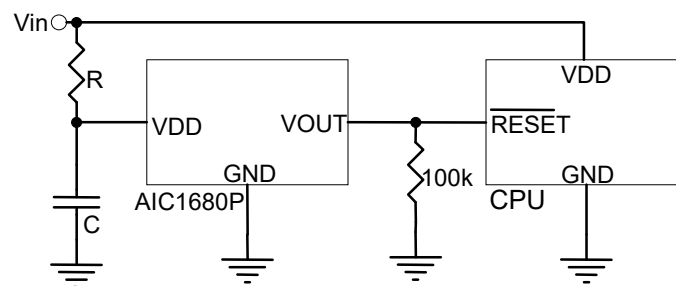
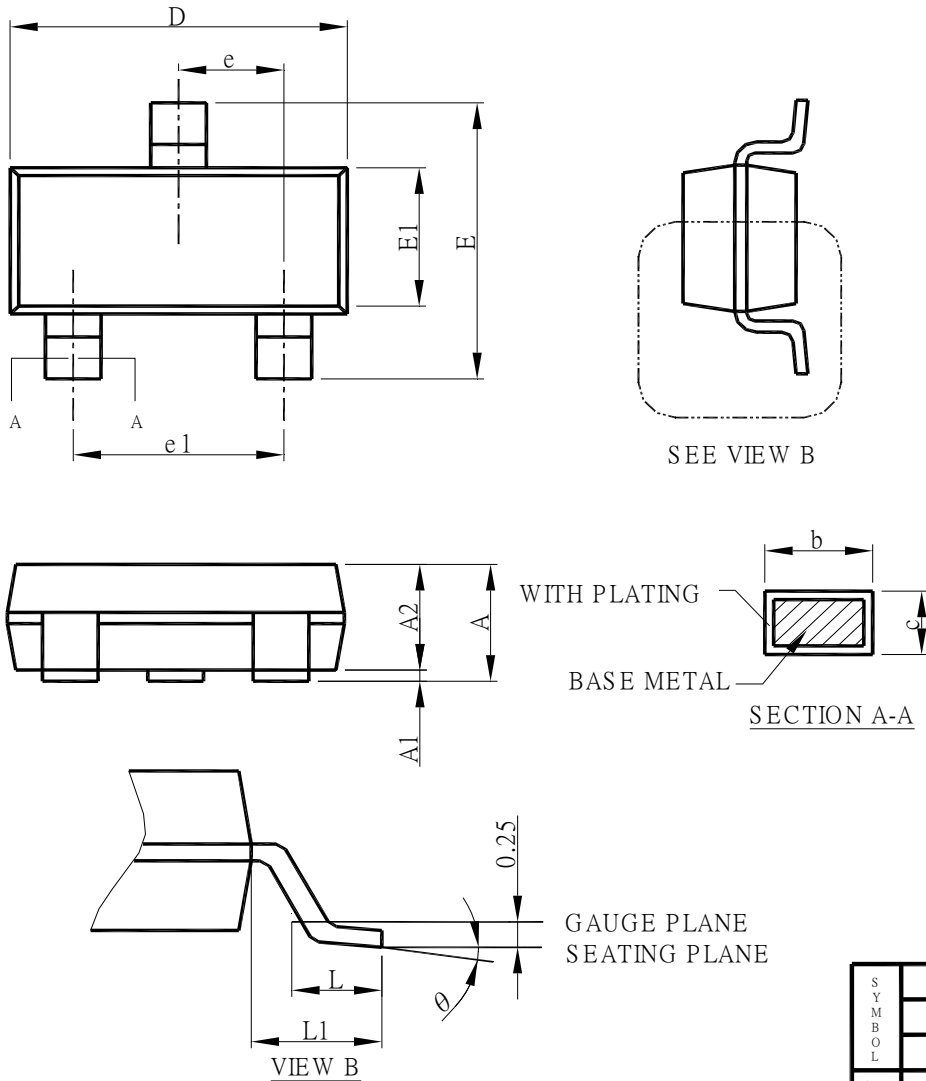


Fig.16 Output delay time-2

■ PHYSICAL DIMENSIONS (unit: mm)

● SOT23-3



Note: 1. Refer to JEDEC MO-178.

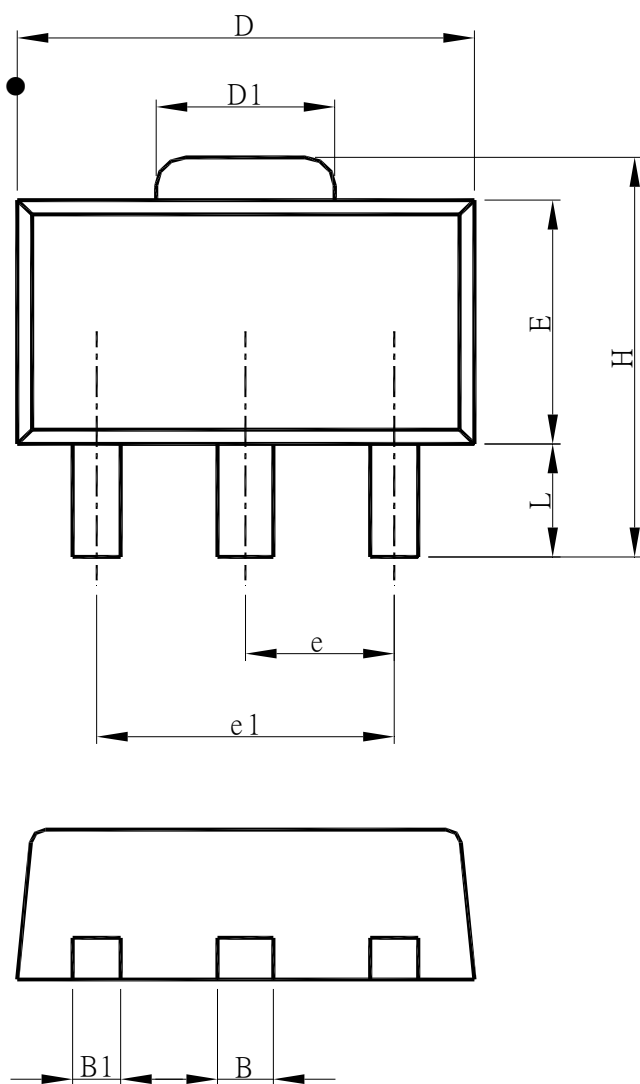
2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.

3. Dimension "E1" does not include inter-lead flash or protrusions.

4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

S Y M B O L	SOT23-3	
	MILLIMETERS	
	MIN.	MAX.
A	0.95	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.30	0.50
c	0.08	0.22
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60
L1	0.60 REF	
θ	0°	8°

● **SOT89-3**



S Y M B O L	SOT89-3	
	MILLIMETERS	
	MIN.	MAX.
A	1.40	1.60
B	0.44	0.56
B1	0.36	0.48
C	0.35	0.44
D	4.40	4.60
D1	1.50	1.83
E	2.29	2.60
e	1.50 BSC	
e1	3.00 BSC	
H	3.94	4.25
L	0.89	1.20

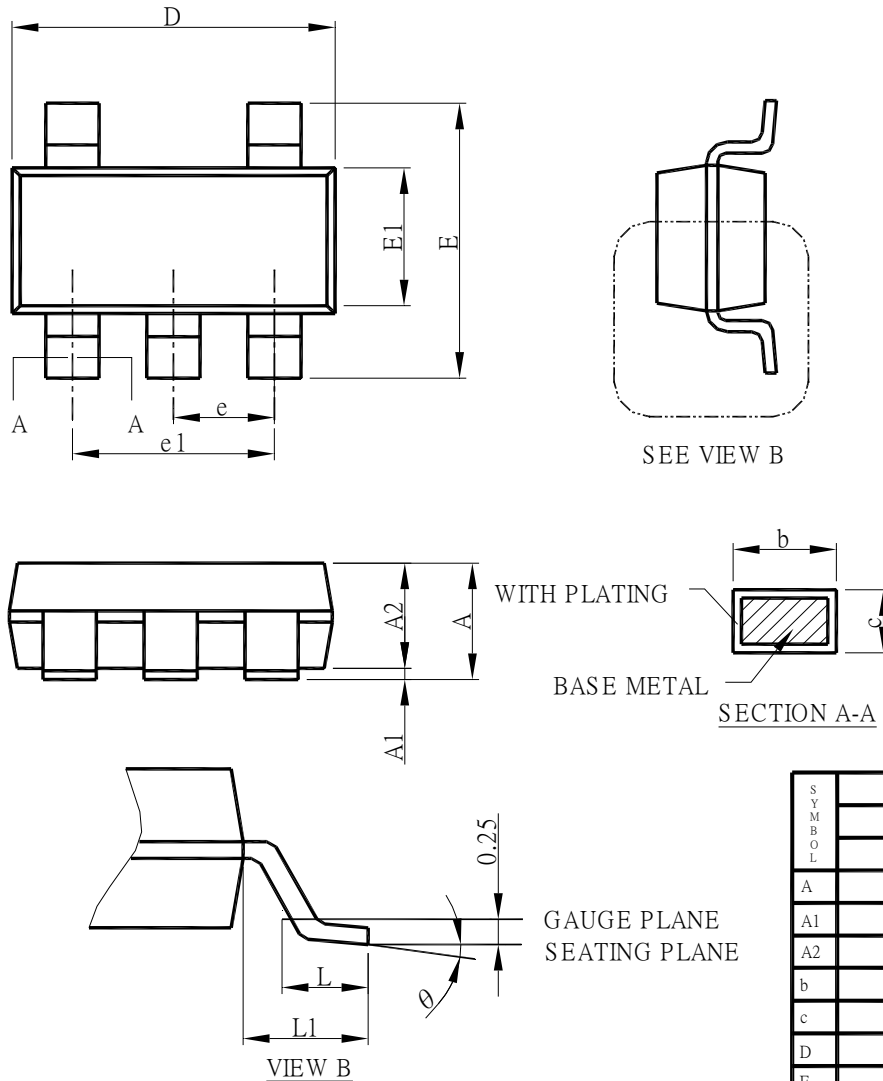
Note: 1. Refer to JEDEC TO-243AA.

2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.

3. Dimension "E" does not include inter-lead flash or protrusions.

4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

● **SOT23-5**



Note : 1. Refer to JEDEC MO-178AA.

2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.
3. Dimension "E1" does not include inter-lead flash or protrusions.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

SYMBOL	SOT23-5	
	MILLIMETERS	
	MIN.	MAX.
A	0.95	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.30	0.50
c	0.08	0.22
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60
L1	0.60 REF	
θ	0°	8°

Note:

Information provided by AIC is believed to be accurate and reliable. However, we cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in an AIC product; nor for any infringement of patents or other rights of third parties that may result from its use. We reserve the right to change the circuitry and specifications without notice.

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