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 ±2.5%.
- Built-In Detection Voltage Hysteresis.
- Three Output Types: N-ch, P-ch and CMOS.
- Space Saving Packages: TO-92, SOT-89, SOT-23 and SOT23-5.

APPLICATIONS

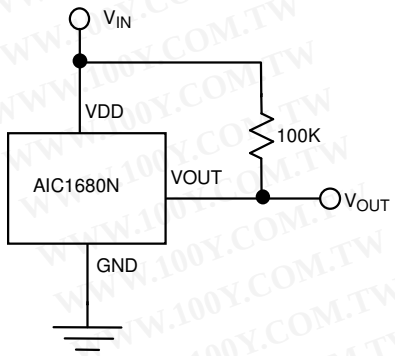
- Battery Checker for Battery-Operated Systems.
- CPU & Logic Circuit Reset.
- Memory Back-up Circuit.
- Level Discriminator.
- Power Failure Detector.

DESCRIPTION

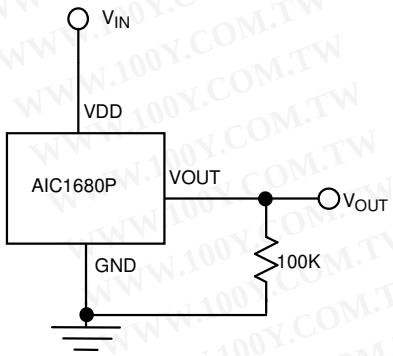
The AIC1680 is an accurate, ultra-low power consumption voltage detector IC, fabricated with advanced CMOS process. The AIC1680 consists of a comparator, a voltage reference unit, a resistor divider, two output drivers, and a hysteresis circuit.

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. Four types of package, TO-92, SOT-89, SOT-23 and SOT-23-5, are available to save board space.

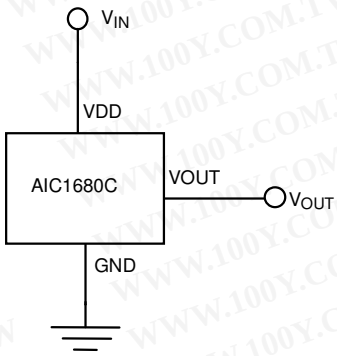
TYPICAL APPLICATION CIRCUIT



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



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



Voltage Level Indicator
(CMOS Output)

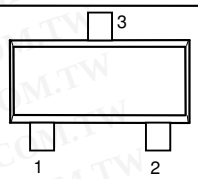
■ ORDERING INFORMATION

AIC1680X-XXXXXX

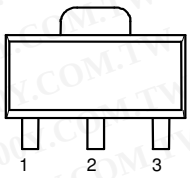
- PACKING TYPE
  - TR: TAPE & REEL
  - TB: TUBE
  - BG: BAG
- PACKAGE TYPE
  - U: SOT-23
  - X: SOT-89
  - Z: TO-92
  - V: SOT-23-5
- C: COMMERCIAL
  - P: LEAD FREE COMMERCIAL
  - G GREEN PACKAGE
- DETECTION VOLTAGE
  - OPTIONAL
  - 16: 1.6V
  - 17: 1.7V
  - :
  - :
  - 60: 6.0V
- OUTPUT TYPE
  - N: N-ch Open Drain
  - P: P-ch Open Drain
  - C: CMOS

PIN CONFIGURATION

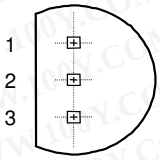
SOT-23
TOP VIEW
1: VOUT
2: GND
3: VDD



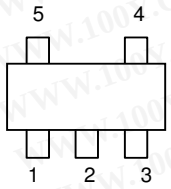
SOT-89
TOP VIEW
1: VOUT
2: VDD
3: GND



TO-92
TOP VIEW
1: VOUT
2: VDD
3: GND



SOT-23-5
TOP VIEW
1: VOUT
2: VDD
3: GND
4: NC
5: NC



Example: AIC1680N-16CUTR

→ N-ch open drain 1.6V version, in SOT-23 Package & Tape & Reel Packing Type

AIC1680P-33PXTR

→ P-ch open drain 3.3V version, in Lead Free SOT-89 Package & Tape & Reel Packing Type

- **SOT-23 Marking**

Part No.	CU	PU	GU
AIC1680N-16XU	U16N	U16NP	U16NG
AIC1680P-16XU	U16P	U16PP	U16PG
AIC1680C-16XU	U16C	U16CP	U16CG
AIC1680N-17XU	U17N	U17NP	U17NG
AIC1680P-17XU	U17P	U17PP	U17PG
AIC1680C-17XU	U17C	U17CP	U17CG
……. (0.1V INCREMENT)			

Part No.	CU	PU	GU
AIC1680N-59XU	U59N	U59NP	U59NG
AIC1680P-59XU	U59P	U59PP	U59PG
AIC1680C-59XU	U59C	U59CP	U59CG
AIC1680N-60XU	U60N	U60NP	U60NG
AIC1680P-60XU	U60P	U60PP	U60PG
AIC1680C-60XU	U60C	U60CP	U60CG

- **SOT-89 Marking**

Part No.	CX	PX	GX
AIC1680N-16XX	X16N	X16NP	X16NG
AIC1680P-16XX	X16P	X16PP	X16PG
AIC1680C-16XX	X16C	X16CP	X16CG
AIC1680N-17XX	X17N	X17NP	X17NG
AIC1680P-17XX	X17P	X17PP	X17PG
AIC1680C-17XX	X17C	X17CP	X17CG
…… (0.1V INCREMENT)			

Part No.	CX	PX	GX
AIC1680N-59XX	X59N	X59NP	X59NG
AIC1680P-59XX	X59P	X59PP	X59PG
AIC1680C-59XX	X59C	X59CP	X59CG
AIC1680N-60XX	X60N	X60NP	X60NG
AIC1680P-60XX	X60P	X60PP	X60PG
AIC1680C-60XX	X60C	X60CP	X60CG

- **SOT-23-5 Marking**

Part No.	CV	PV	GV
AIC1680N-16XV	V16N	V16NP	V16NG
AIC1680P-16XV	V16P	V16PP	V16PG
AIC1680C-16XV	V16C	V16CP	V16CG
AIC1680N-17XV	V17N	V17NP	V17NG
AIC1680P-17XV	V17P	V17PP	V17PG
AIC1680C-17XV	V17C	V17CP	V17CG
…… (0.1V INCREMENT)			

Part No.	CV	PV	GV
AIC1680N-59XV	V59N	V59NP	V59NG
AIC1680P-59XV	V59P	V59PP	V59PG
AIC1680C-59XV	V59C	V59CP	V59CG
AIC1680N-60XV	V60N	V60NP	V60NG
AIC1680P-60XV	V60P	V60PP	V60PG
AIC1680C-60XV	V60C	V60CP	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°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}=2.0V	I_{DD}		0.7	1.1	µA
	V_{DD}=3.0V			0.9	1.5	
	V_{DD}=4.5V			1.3	2.0	
	V_{DD}=6.0V			1.8	2.7	
	V_{DD}=10.0V			3.2	4.8	
Operation Voltage		V_{DD}	1.5		10	V
Output Current	V_{DS}=0.5V, V_{DD}=2.4V	I_{OUT} (Nch)		3.24		mA
	V_{DS}=0.5V, V_{DD}=3.6V			5.85		
	V_{DS}=0.5V, V_{DD}=4.6V			7.74		
	V_{DS}=0.5V, V_{DD}=6.0V			10.44		
Output Current	V_{DS}=-2.1V, V_{DD}=4.5V	I_{OUT} (Pch)	2	3.5		mA
Temperature Coefficience				±150		ppm/°C
Output Delay Time		T_{DELAY}			200	µS

Note 1: Specifications are production tested at T_A=25°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

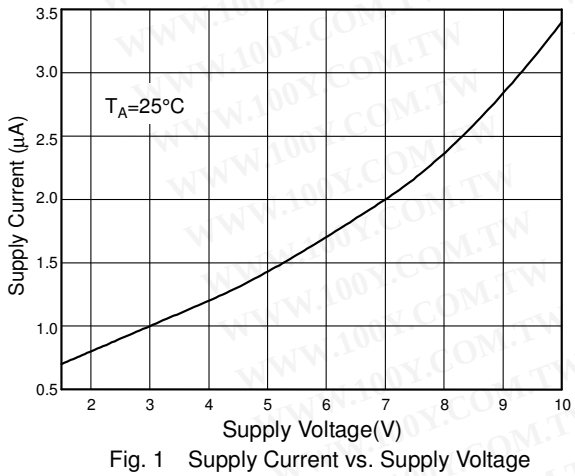


Fig. 1 Supply Current vs. Supply Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

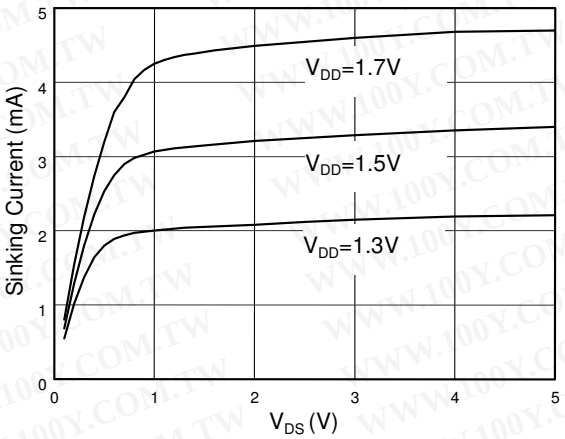


Fig. 2 V_{DET}=1.8V

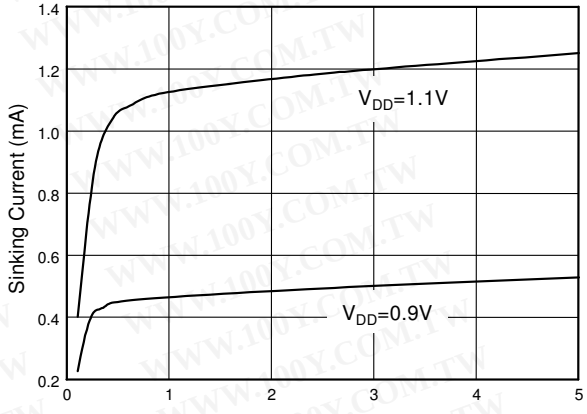


Fig. 3 V_{DET}=1.8V

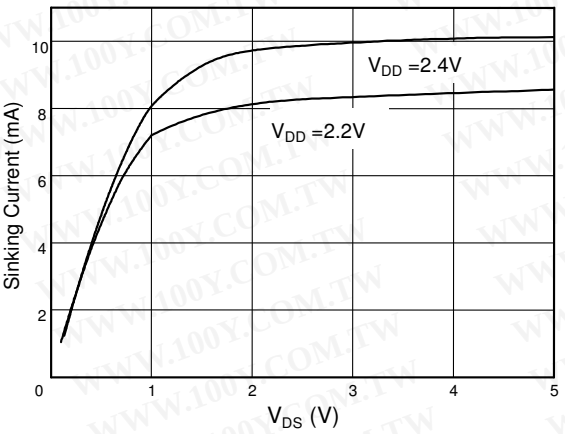


Fig. 4 V_{DET}=2.5V

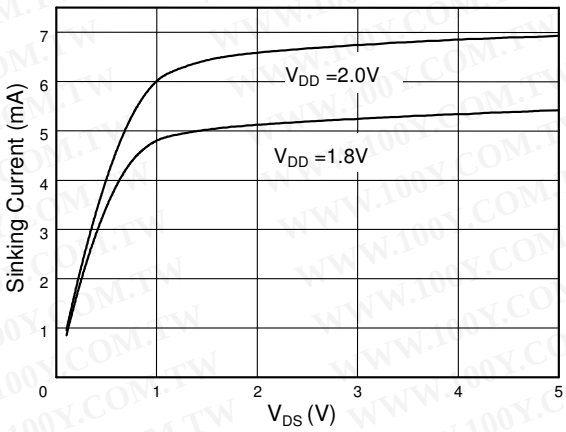


Fig. 5 V_{DET}=2.5V

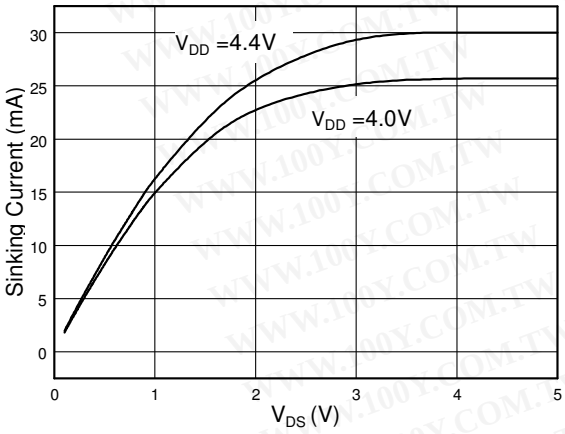


Fig. 6 V_{DET}=4.5V

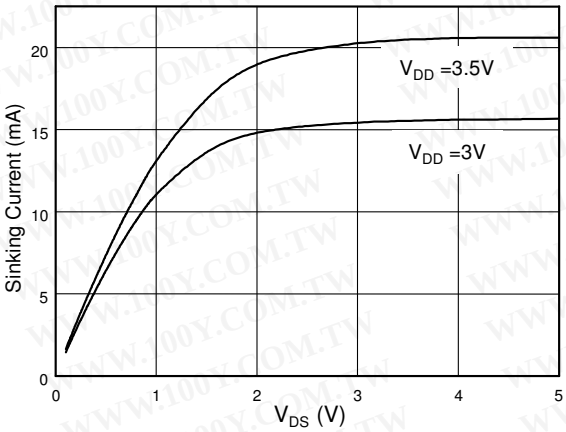


Fig. 7 V_{DET}=4.5V

■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

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

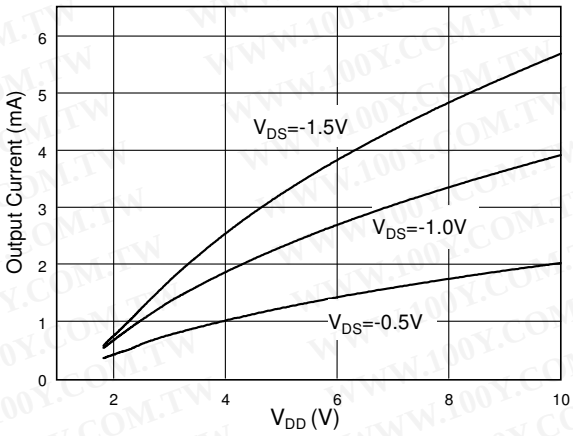


Fig. 8 V_{DET}=1.8V

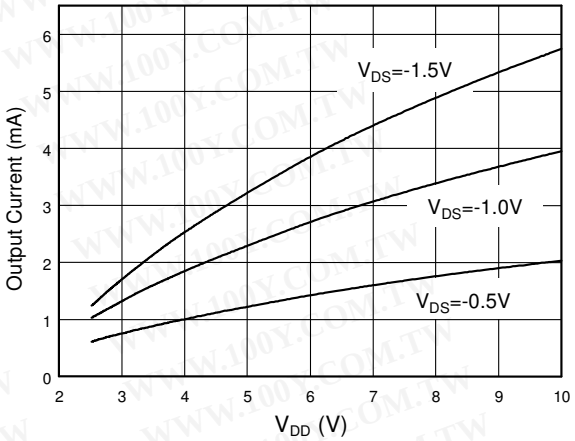


Fig. 9 V_{DET}=2.5V

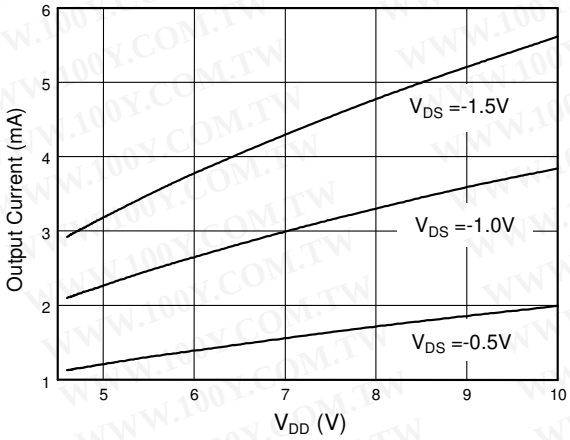
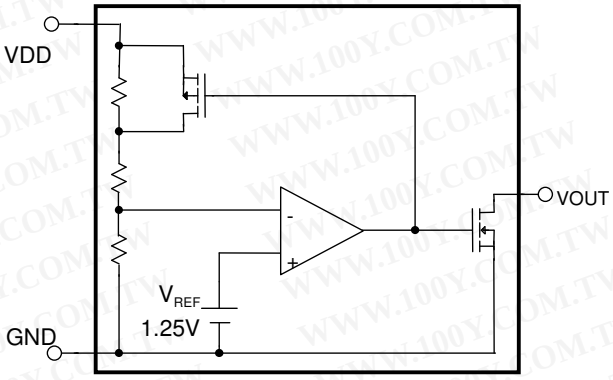
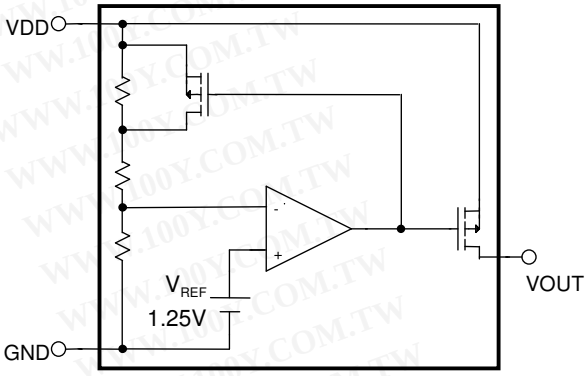


Fig. 10 V_{DET}=4.5V

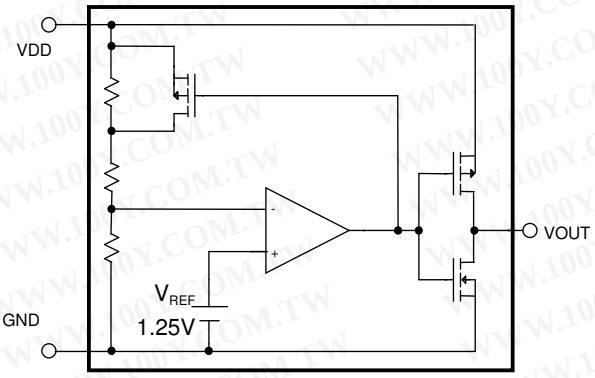
BLOCK DIAGRAMS



N-ch open drain output



P-ch open drain output



CMOS output

PIN DESCRIPTIONS

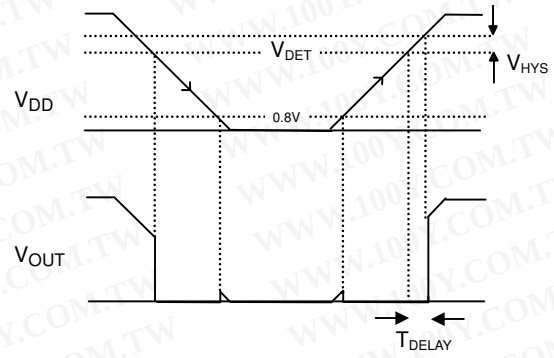
VDD - Power Supply and Detected Voltage Input.

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

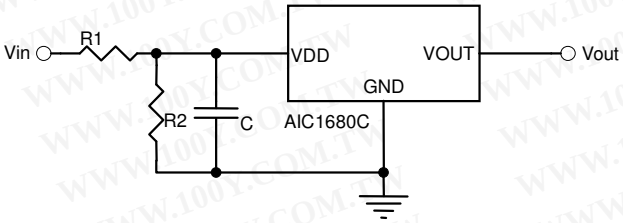


Fig.11 Detector threshold adjustable circuit

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

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

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

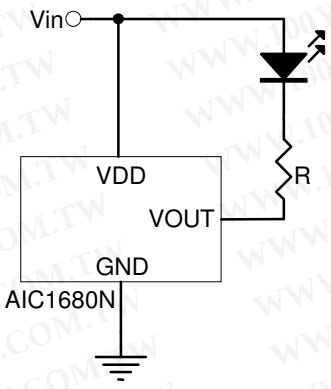


Fig.12 Voltage indicator circuit, lights when low power

APPLICATION EXAMPLE (Continued)

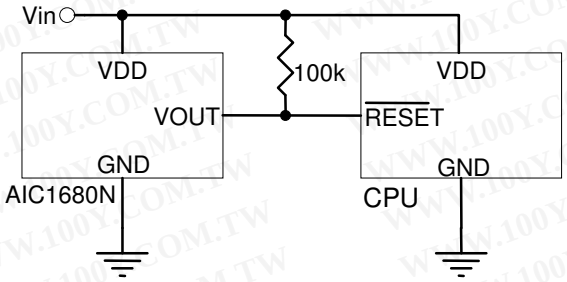


Fig.13 The input voltage of AIC1680 and CPU are the same

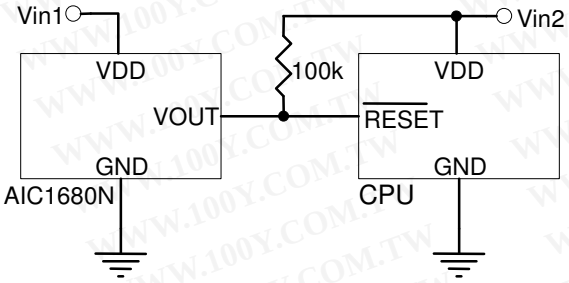


Fig.14 The input voltage of AIC1680 and CPU are not equal

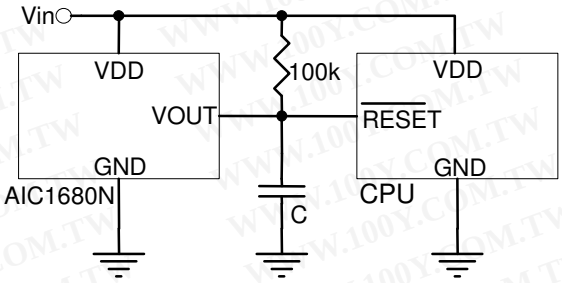


Fig.15 Output delay time-1

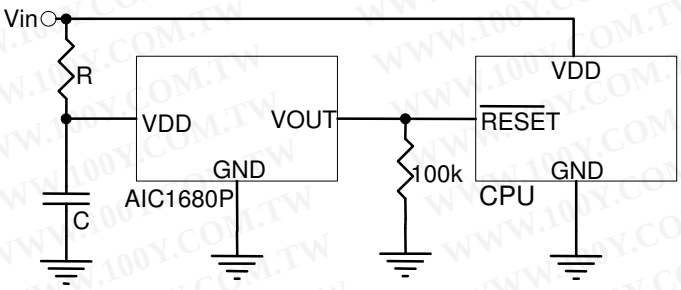
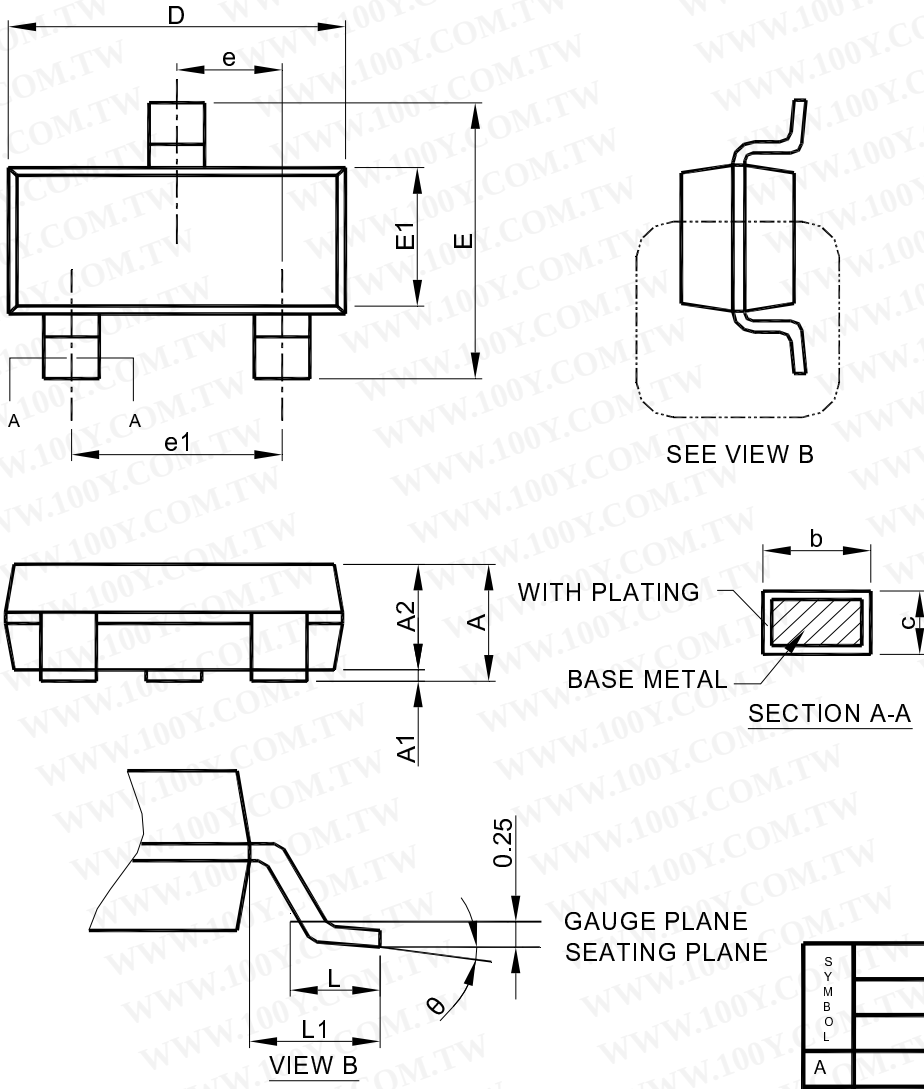


Fig.16 Output delay time-2

PHYSICAL DIMENSIONS (unit: mm)

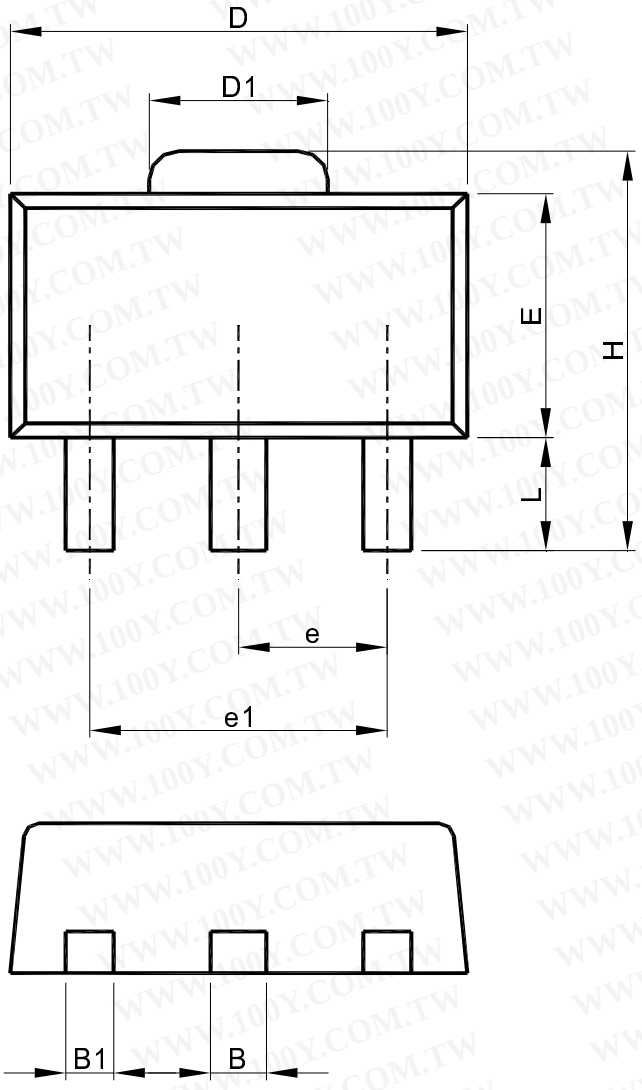
- **SOT-23**



SYMBOL	SOT-23	
	MILLIMETERS	
	MIN.	MAX.
A	0.95	1.45
A1	0.05	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: 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.

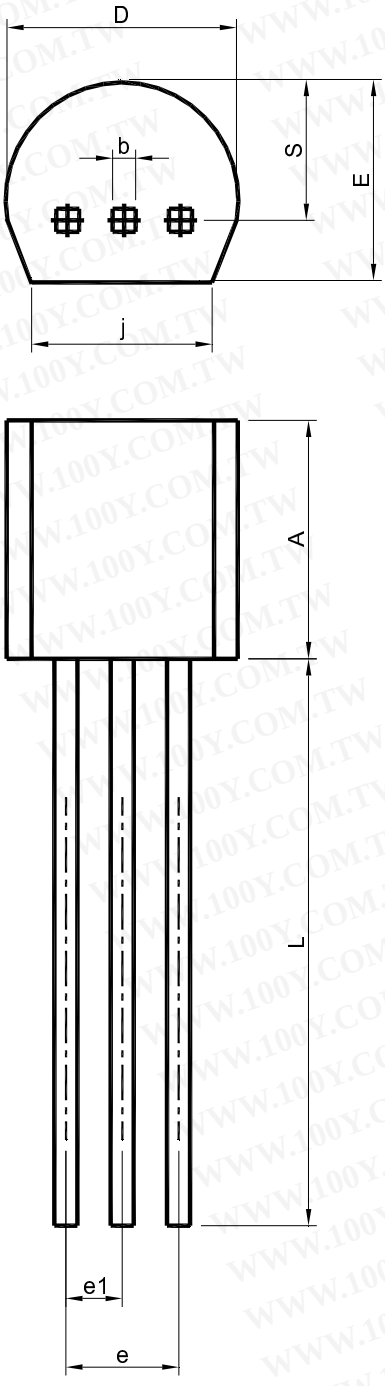
- **SOT-89**



SYMBOL	SOT-89	
	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.

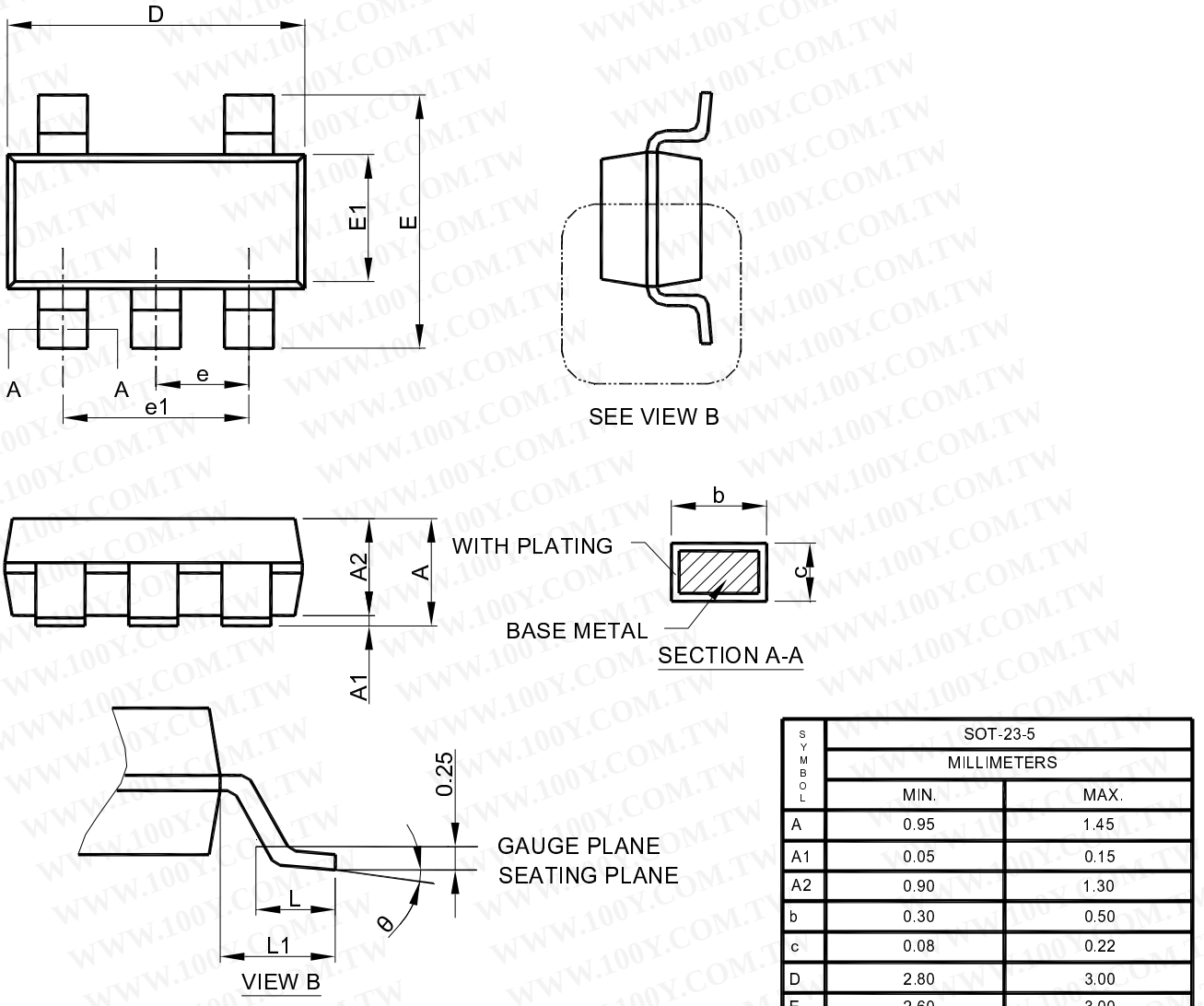
- **TO-92**



SYMBOL	TO-92	
	MILLIMETERS	
	MIN.	MAX.
A	4.32	5.33
b	0.36	0.47
D	4.45	5.20
E	3.18	4.19
e	2.42	2.66
e1	1.15	1.39
j	3.43	
L	12.70	
S	2.03	2.66

Note: 1. Refer to JEDEC TO-226.
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 "A" does not include inter-lead flash or protrusions.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

- **SOT-23-5**



SYMBOL	SOT-23-5	
	MILLIMETERS	
	MIN.	MAX.
A	0.95	1.45
A1	0.05	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	
q	0°	8°

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.

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.

Life Support Policy: AIC does not authorize any AIC product for use in life support devices and/or systems. Life support devices or systems are devices or systems which, (I) are intended for surgical implant into the body or (ii) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.