

# 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: TO-92, SOT-89, SOT-23 and SOT23-5.

## APPLICATIONS

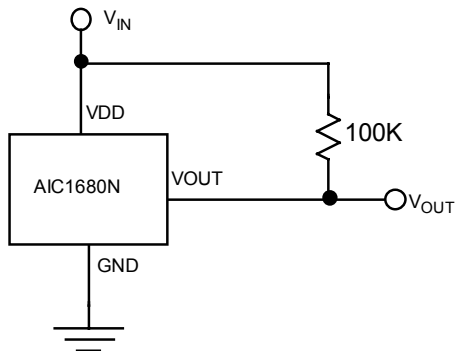
- Battery Checker for Battery-Operated Systems.
- CPU & Logic Circuit Reset.
- Memory Back-up Circuit.
- Level Discriminator.
- Power Failure Detector.

## 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.

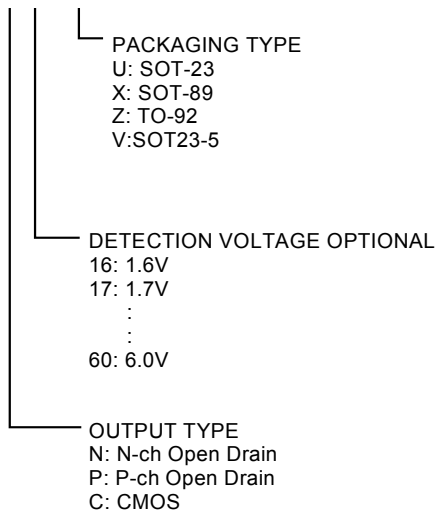
## TYPICAL APPLICATION CIRCUIT

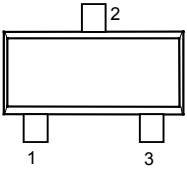
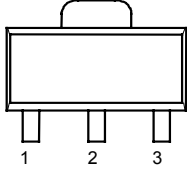
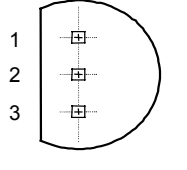
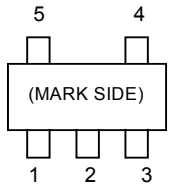


Voltage Level Indicator (N-ch Open-Drain Output)

## ORDERING INFORMATION

AIC1680XXXCX



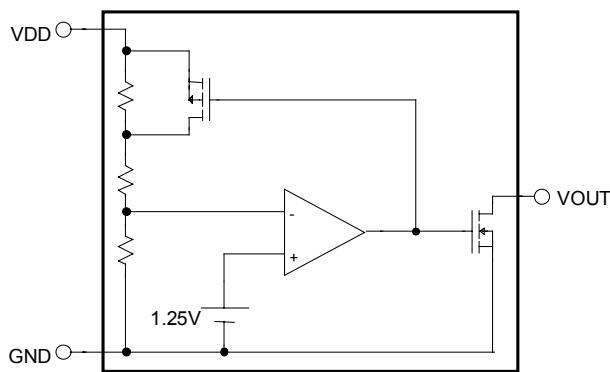
| ORDER NUMBER            | PIN CONFIGURATION   |
|-------------------------|---|
| AIC1680CU<br>(SOT-23)   | FRONT VIEW<br>1: VOUT<br>2: VDD<br>3: GND<br>                                    |
| AIC1680CX<br>(SOT-89)   | FRONT VIEW<br>1: VOUT<br>2: VDD<br>3: GND<br>                                    |
| AIC1680CZ<br>(TO-92)    | FRONT VIEW<br>1: VOUT<br>2: VDD<br>3: GND<br>                                    |
| AIC1680CV<br>(SOT-23-5) | FRONT VIEW<br>1: VOUT<br>2: VDD<br>3: GND<br>4: NC<br>5: NC<br>(MARK SIDE)<br> |

## ABSOLUTE MAXIMUM RATINGS

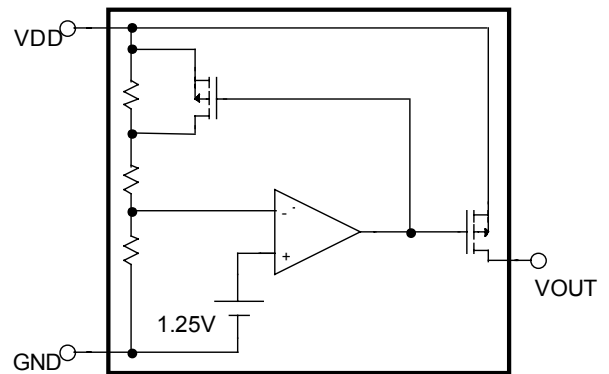
|   |                             |
|---|-----------------------------|
| Supply Voltage .....                      | 10V                         |
| Output Voltage .....                      | V <sub>SS</sub> -0.3 to 10V |
| Operating Temperature Range .....         | -30°C ~ 80°C                |
| Storage Temperature Range .....           | -65°C ~ 150°C               |
| Lead Temperature (Soldering) 10 sec. .... | 260°C                       |
| Output Current .....                      | 20mA                        |

**ELECTRICAL CHARACTERISTICS** (Test Conditions :  $T_a=25^{\circ}\text{C}$ )

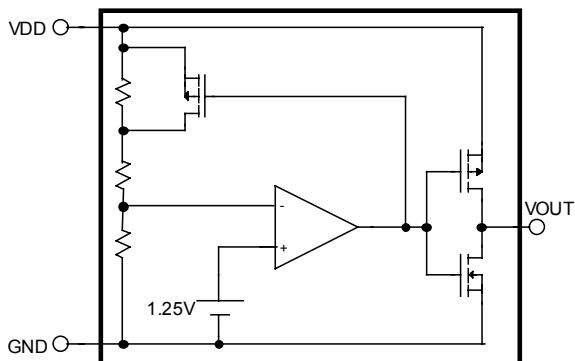
| SYMBOL                | PARAMETER                     | TEST CONDITIONS  | MIN   | TYP                             | MAX                             | UNIT                    |
|-----------------------|-------------------------------|--|-------|---------------------------------|---------------------------------|-------------------------|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

**BLOCK DIAGRAM**


N-ch open drain output



P-ch open drain output



CMOS output

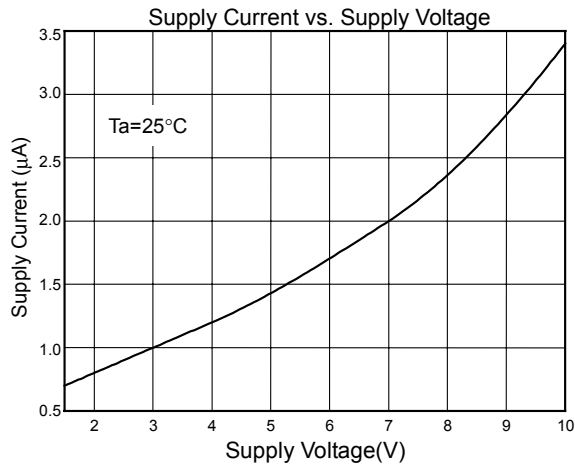
## PIN DESCRIPTIONS

$V_{DD}$ : Power Supply and Detected Voltage Input.

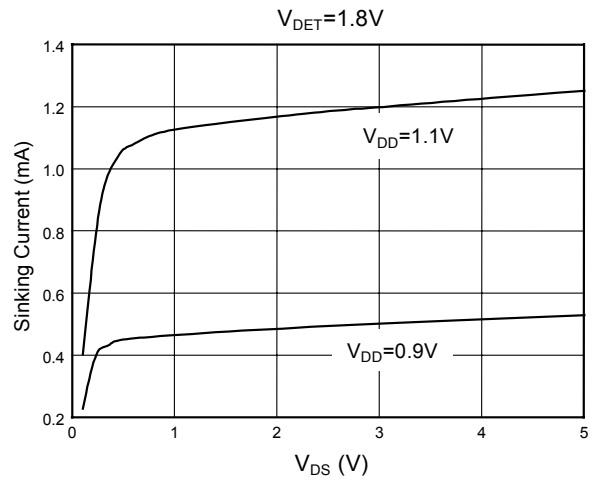
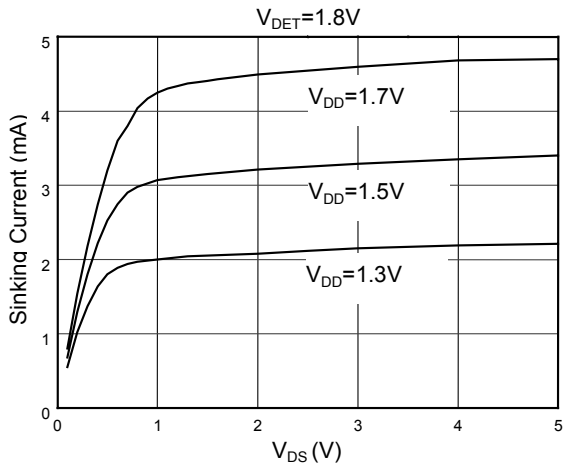
GND: Ground.

$V_{out}$ : Detector Output

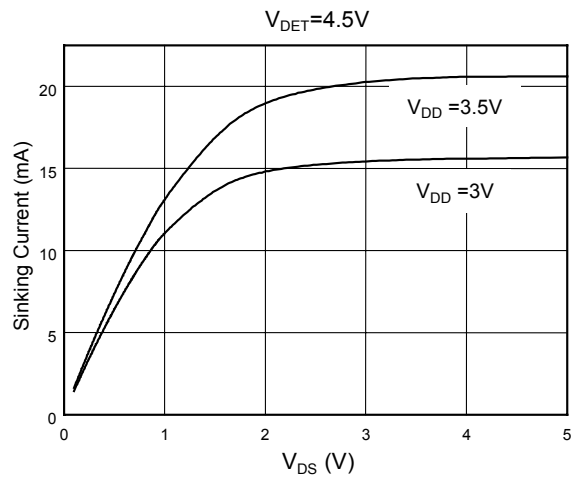
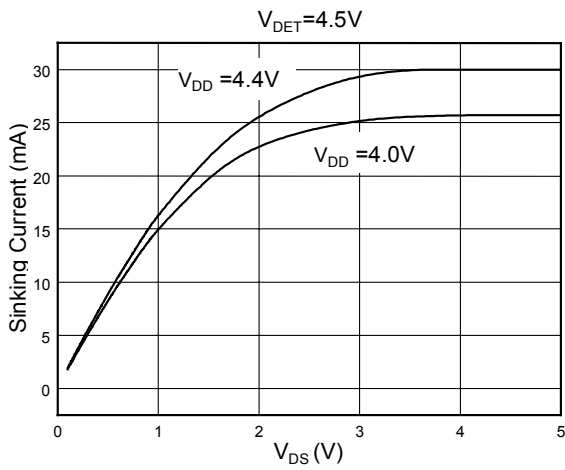
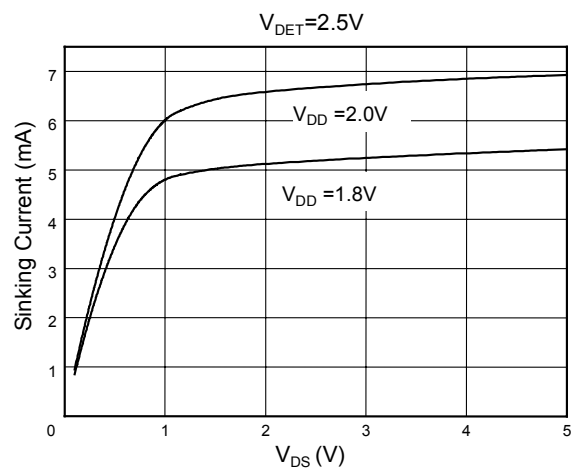
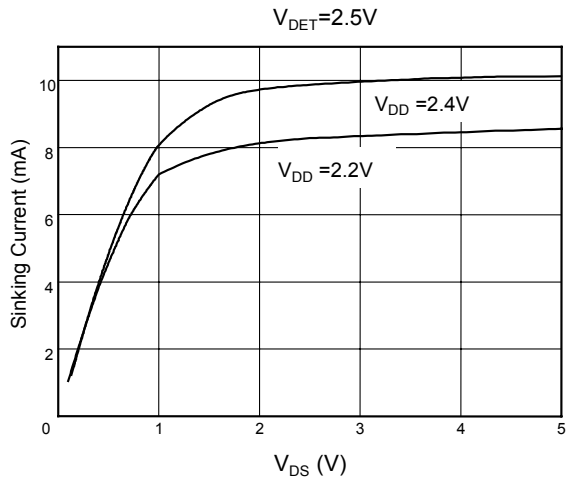
## TYPICAL PERFORMANCE CHARACTERISTICS



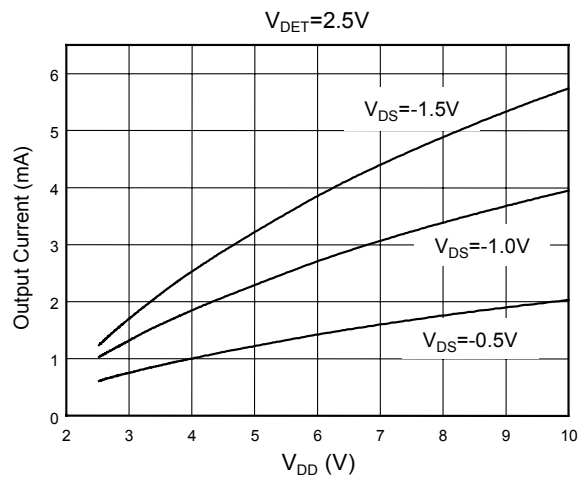
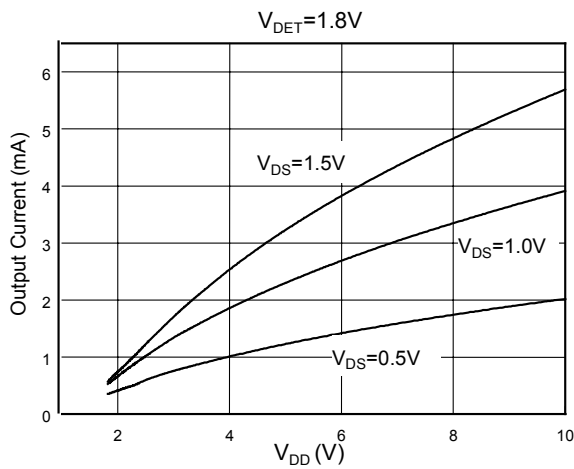
### N-ch Driver Sinking Current vs. $V_{DS}$



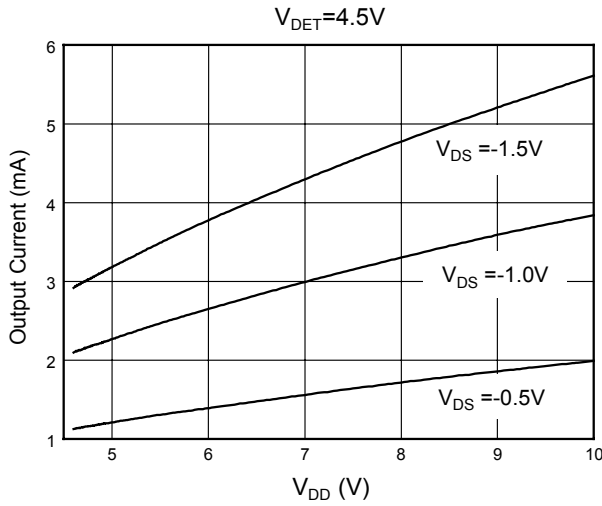
**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**



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



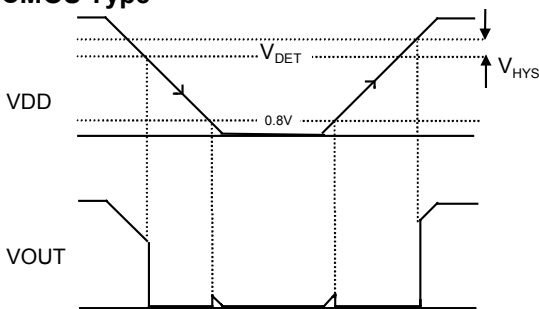
**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**



**APPLICATION INFORMATIONS**

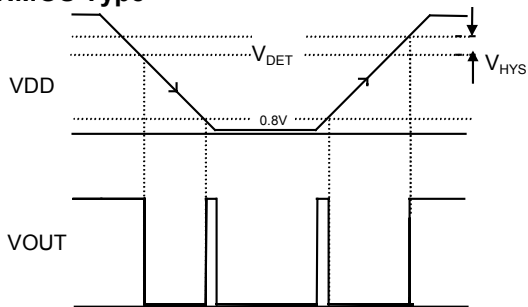
The timing diagram of VDD and V<sub>OUT</sub> is shown in below:

**CMOS Type**



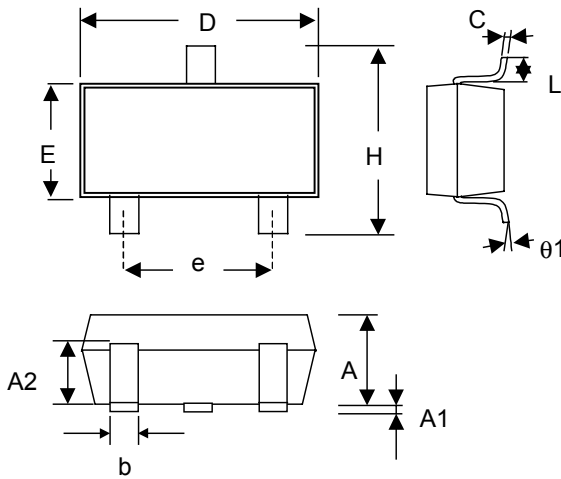
The guaranteed minimum operation voltage is 1.5V. As the supply voltage(VDD) is reduced below 1.5V, the performance degrades, N-ch or P-ch driving capacity degrades, and the supply current decreases. AIC1680 isn't functioning when VDD down to 0.8V.

**NMOS Type**



**■ PHYSICAL DIMENSIONS**

- SOT-23 (unit: mm)



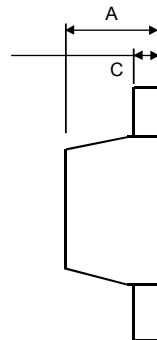
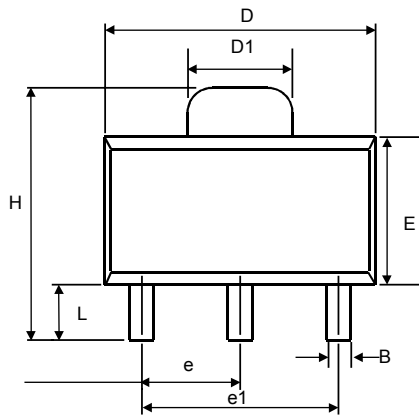
| SYMBOL     | MIN        | MAX  |
|------------|------------|------|
| A          | 1.00       | 1.30 |
| A1         | —          | 0.10 |
| A2         | 0.70       | 0.90 |
| b          | 0.35       | 0.50 |
| C          | 0.10       | 0.25 |
| D          | 2.70       | 3.10 |
| E          | 1.40       | 1.80 |
| e          | 1.90 (TYP) |      |
| H          | 2.60       | 3.00 |
| L          | 0.37       | —    |
| $\theta 1$ | 1°         | 9°   |

- SOT-23 Marking

| Part No.                  | Marking |
|---------------------------|---------|
| AIC1680-N16CU             | U16N    |
| AIC1680-P16CU             | U16P    |
| AIC1680-C16CU             | U16C    |
| AIC1680-N17CU             | U17N    |
| AIC1680-P17CU             | U17P    |
| AIC1680-C17CU             | U17C    |
| .....<br>(0.1V INCREMENT) |         |

| Part No.      | Marking |
|---------------|---------|
| AIC1680-N59CU | U59N    |
| AIC1680-P59CU | U59P    |
| AIC1680-C59CU | U59C    |
| AIC1680-N60CU | U60N    |
| AIC1680-P60CU | U60P    |
| AIC1680-C60CU | U60C    |

● **SOT-89 (unit: mm)**



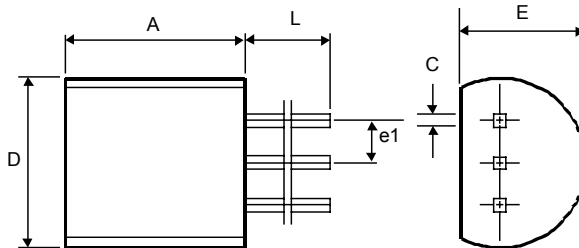
| SYMBOL | MIN         | MAX  |
|--------|-------------|------|
| A      | 1.40        | 1.60 |
| B      | 0.36        | 0.48 |
| C      | 0.35        | 0.44 |
| D      | 4.40        | 4.60 |
| D1     | 1.62        | 1.83 |
| E      | 2.29        | 2.60 |
| e      | 1.50 (TYP.) |      |
| e1     | 3.00 (TYP.) |      |
| H      | 3.94        | 4.25 |
| L      | 0.89        | 1.20 |

● **SOT-89 Marking**

| Part No.                  | Marking |
|---------------------------|---------|
| AIC1680-N16CX             | X16N    |
| AIC1680-P16CX             | X16P    |
| AIC1680-C16CX             | X16C    |
| AIC1680-N17CX             | X17N    |
| AIC1680-P17CX             | X17P    |
| AIC1680-C17CX             | X17C    |
| .....<br>(0.1V INCREMENT) |         |

| Part No.      | Marking |
|---------------|---------|
| AIC1680-N59CX | X59N    |
| AIC1680-P59CX | X59P    |
| AIC1680-C59CX | X59C    |
| AIC1680-N60CX | X60N    |
| AIC1680-P60CX | X60P    |
| AIC1680-C60CX | X60C    |

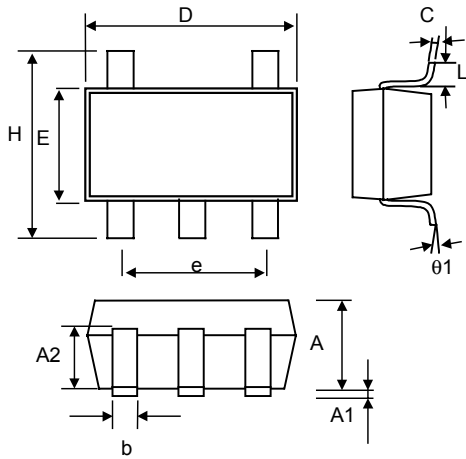
● **TO-92 (unit: mm)**



| SYMBOL | MIN         | MAX  |
|--------|-------------|------|
| A      | 4.32        | 5.33 |
| C      | 0.38 (TYP.) |      |
| D      | 4.40        | 5.20 |
| E      | 3.17        | 4.20 |
| e1     | 1.27 (TYP.) |      |
| L      | 12.7        | -    |



● **SOT-23-5 (unit: mm)**



| SYMBOL     | MIN        | MAX  |
|------------|------------|------|
| A          | 1.00       | 1.30 |
| A1         | —          | 0.10 |
| A2         | 0.70       | 0.90 |
| b          | 0.35       | 0.50 |
| C          | 0.10       | 0.25 |
| D          | 2.70       | 3.10 |
| E          | 1.40       | 1.80 |
| e          | 1.90 (TYP) |      |
| H          | 2.60       | 3.00 |
| L          | 0.37       | —    |
| $\theta 1$ | 1°         | 9°   |

● **SOT-23-5 Marking**

| Part No.                  | Marking |
|---------------------------|---------|
| AIC1680-N16CV             | V16N    |
| AIC1680-P16CV             | V16P    |
| AIC1680-C16CV             | V16C    |
| AIC1680-N17CV             | V17N    |
| AIC1680-P17CV             | V17P    |
| AIC1680-C17CV             | V17C    |
| .....<br>(0.1V INCREMENT) |         |

| Part No.      | Marking |
|---------------|---------|
| AIC1680-N59CV | V59N    |
| AIC1680-P59CV | V59P    |
| AIC1680-C59CV | V59C    |
| AIC1680-N60CV | V60N    |
| AIC1680-P60CV | V60P    |
| AIC1680-C60CV | V60C    |