# VOLTAGE DETECTOR AZ70XX

## General Description

The AZ70XX series ICs are under voltage detectors with a built in voltage threshold and low power consumption. The AZ70XX are specifically designed to accurately monitor power supplies.

The AZ70XX use a precision on-chip voltage reference and a comparator to measure the input operating voltage. These ICs can accurately reset the system after detecting voltage at the time of switching power on and instantaneous power off in various CPU systems and other logic systems. The detect voltage thresholds are 2.3V/2.5V/2.7V/2.9V/3.1V/3.3V/4.2V/4.5V for AZ7023/25/27/29/31/33/42/45 respectively. Built in hysteresis helps to prevent erratic operation in the presence of noise.

The AZ70XX series are available in 2 standard packages: TO-92 (bulk or ammo packing) and SOT-89.

## Features

- Low Current Consumption:
  $I_{CCL}$=300μA Typical
  $I_{CCH}$=30μA Typical
- Low Minimum Operating Voltage for Output Resetting: 0.8V Typical
- Built in Hysteresis Voltage: 50mV Typical
- Open Collector Output
- Extended Temperature Range: -40 to 85°C

## Applications

- Low Battery Voltage Detector
- Power Fail Indicator
- Processor Reset Generator
- Battery Backup Control
- Home Electric Appliances

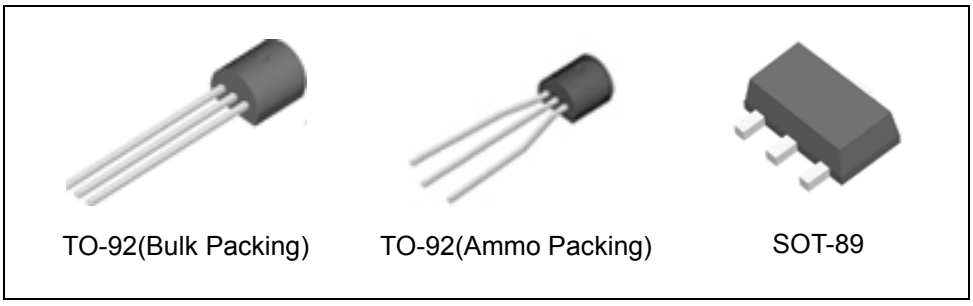



Figure 1. Package Types of AZ70XX

## Pin Configuration

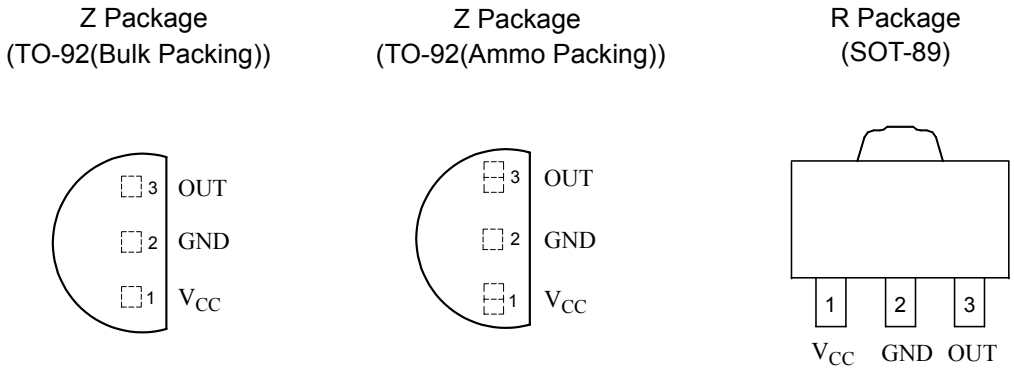



Figure 2. Pin Configuration of AZ70XX (Top View)

## Functional Block Diagram

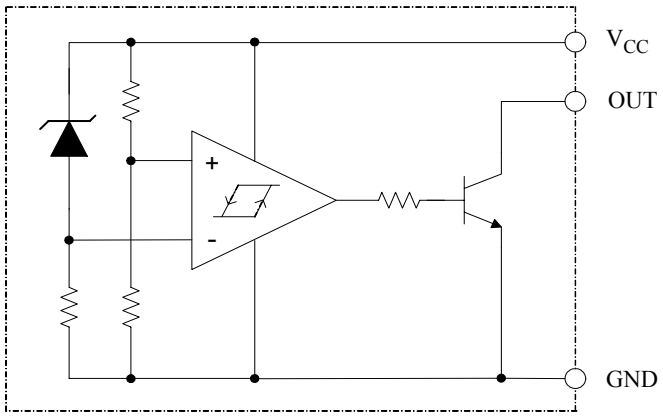
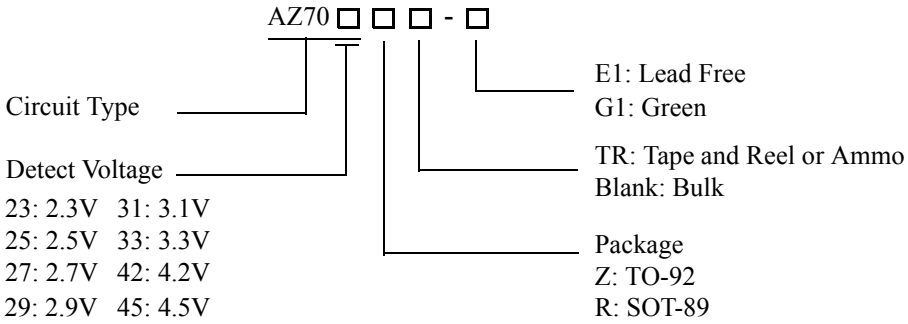



Figure 3. Functional Block Diagram of AZ70XX

## Ordering Information




| Package | Temperature Range | Detect Voltage | Part Number | | Marking ID | | Packing Type |
|---|---|---|---|---|---|---|---|
| | | | Lead Free | Green | Lead Free | Green | |
| TO-92 | -40 to 85°C | 2.3V | AZ7023Z-E1 | AZ7023Z-G1 | AZ7023Z-E1 | AZ7023Z-G1 | Bulk |
| | | | AZ7023ZTR-E1 | AZ7023ZTR-G1 | AZ7023Z-E1 | AZ7023Z-G1 | Ammo |
| | | 2.5V | AZ7025Z-E1 | AZ7025Z-G1 | AZ7025Z-E1 | AZ7025Z-G1 | Bulk |
| | | | AZ7025ZTR-E1 | AZ7025ZTR-G1 | AZ7025Z-E1 | AZ7025Z-G1 | Ammo |
| | | 2.7V | AZ7027Z-E1 | AZ7027Z-G1 | AZ7027Z-E1 | AZ7027Z-G1 | Bulk |
| | | | AZ7027ZTR-E1 | AZ7027ZTR-G1 | AZ7027Z-E1 | AZ7027Z-G1 | Ammo |
| | | 2.9V | AZ7029Z-E1 | AZ7029Z-G1 | AZ7029Z-E1 | AZ7029Z-G1 | Bulk |
| | | | AZ7029ZTR-E1 | AZ7029ZTR-G1 | AZ7029Z-E1 | AZ7029Z-G1 | Ammo |
| | | 3.1V | AZ7031Z-E1 | AZ7031Z-G1 | AZ7031Z-E1 | AZ7031Z-G1 | Bulk |
| | | | AZ7031ZTR-E1 | AZ7031ZTR-G1 | AZ7031Z-E1 | AZ7031Z-G1 | Ammo |
| | | 3.3V | AZ7033Z-E1 | AZ7033Z-G1 | AZ7033Z-E1 | AZ7033Z-G1 | Bulk |
| | | | AZ7033ZTR-E1 | AZ7033ZTR-G1 | AZ7033Z-E1 | AZ7033Z-G1 | Ammo |
| | | 4.2V | AZ7042Z-E1 | AZ7042Z-G1 | AZ7042Z-E1 | AZ7042Z-G1 | Bulk |
| | | | AZ7042ZTR-E1 | AZ7042ZTR-G1 | AZ7042Z-E1 | AZ7042Z-G1 | Ammo |
| | | 4.5V | AZ7045Z-E1 | AZ7045Z-G1 | AZ7045Z-E1 | AZ7045Z-G1 | Bulk |
| | | | AZ7045ZTR-E1 | AZ7045ZTR-G1 | AZ7045Z-E1 | AZ7045Z-G1 | Ammo |
| SOT-89 | -40 to 85°C | 2.3V | AZ7023RTR-E1 | AZ7023RTR-G1 | E723 | G70A | Tape & Reel |
| | | 2.5V | AZ7025RTR-E1 | AZ7025RTR-G1 | E725 | G70G | Tape & Reel |
| | | 2.7V | AZ7027RTR-E1 | AZ7027RTR-G1 | E727 | G70B | Tape & Reel |
| | | 2.9V | AZ7029RTR-E1 | AZ7029RTR-G1 | E729 | G70C | Tape & Reel |
| | | 3.1V | AZ7031RTR-E1 | AZ7031RTR-G1 | E731 | G70H | Tape & Reel |
| | | 3.3V | AZ7033RTR-E1 | AZ7033RTR-G1 | E733 | G70D | Tape & Reel |
| | | 4.2V | AZ7042RTR-E1 | AZ7042RTR-G1 | E742 | G70E | Tape & Reel |
| | | 4.5V | AZ7045RTR-E1 | AZ7045RTR-G1 | E745 | G70F | Tape & Reel |

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

## Absolute Maximum Ratings (Note 1)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | -0.3 to 20 | V |
| Power Dissipation (Package Limitations, $T_A$=25°C) | $P_D$ | TO-92 Package: 400 | mW |
| | | SOT-89 Package: 500 | |
| Operating Junction Temperature | $T_J$ | 150 | °C |
| Storage Temperature Range | $T_{STG}$ | -65 to 150 | °C |

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under"Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

## Recommended Operating Conditions

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | | 18 | V |
| Operating Temperature Range | $T_A$ | -40 | 85 | °C |

## Electrical Characteristics

$T_A$=25°C, unless otherwise specified.

| Parameter | Symbol | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Detect Voltage | $V_{DET}$ | $R_L$=200Ω (Note 2)<br>$V_{OL}$ ≤ 0.4V | AZ7023R/Z | 2.15 | 2.3 | 2.45 | V |
| | | | AZ7025R/Z | 2.35 | 2.5 | 2.65 | |
| | | | AZ7027R/Z | 2.55 | 2.7 | 2.85 | |
| | | | AZ7029R/Z | 2.75 | 2.9 | 3.05 | |
| | | | AZ7031R/Z | 2.95 | 3.1 | 3.25 | |
| | | | AZ7033R/Z | 3.15 | 3.3 | 3.45 | |
| | | | AZ7042R/Z | 4.05 | 4.2 | 4.35 | |
| | | | AZ7045R/Z | 4.35 | 4.5 | 4.65 | |
| Low-level Output Voltage | $V_{OL}$ | $V_{CC}$=$V_{DET}$(min)-0.05V<br>$R_L$=200Ω (Note 2) | | | | 0.4 | V |
| Output Leakage Current | $I_{OH}$ | $V_{CC}$=18V | | | | 0.1 | μA |
| Hysteresis Voltage | $V_{HYS}$ | $R_L$=200Ω (Note 2) | | 30 | 50 | 100 | mV |
| Detect Voltage Temperature Coefficient | $\Delta V_{DET}/(V_{DET} \times \Delta T)$ | $R_L$=200Ω (Note 2) | | | ±0.01 | | % /°C |
| Circuit Current at On Time | $I_{CCL}$ | $V_{CC}$=$V_{DET}$(min)-0.05V | | | 300 | 500 | μA |
| Circuit Current at Off Time | $I_{CCH}$ | $V_{CC}$=5.25V | | | 30 | 50 | μA |
| Minimum Operating Voltage | $V_{OPR}$ | $R_L$=200Ω (Note 2)<br>$V_{OL}$ ≤ 0.4V | | | 0.8 | | V |
| "L" Transmission Delay Time | tpHL | $V_{CC}$ changed from 5.25V to $V_{DET}$(min)-0.05V, $R_L$=1.0KΩ, $C_L$=100p (Note 3) | | | 10 | | μs |
| "H" Transmission Delay Time | tpLH | $V_{CC}$ changed from $V_{DET}$(min)-0.05V to 5.25V, $R_L$=1.0KΩ, $C_L$=100p (Note 3) | | | 15 | | μs |
| Output Current at On Time | $I_{OL}$ Ⅰ | $V_{CC}$=$V_{DET}$(min)-0.05V<br>$T_A$=25°C (Note 4) | | 20 | | | mA |
| | $I_{OL}$ Ⅱ | $V_{CC}$=$V_{DET}$(min)-0.05V<br>$T_A$=-40 to 85 °C (Note 4) | | 16 | | | |
| Thermal Resistance (Junction to Case) | $\theta_{JC}$ | TO-92 | | | 72 | | °C/W |
| | | SOT-89 | | | 74 | | |

Note 2: See test circuit 1 and Figure 12.
Note 3: See test circuit 2 and Figure 12.
Note 4: See test circuit 3. Adjusting the regulative power source until the reading value of voltage meter V is 0.4V, the reading value of current meter A is defined as "Output Current at On Time".

## Electrical Characteristics (Continued)

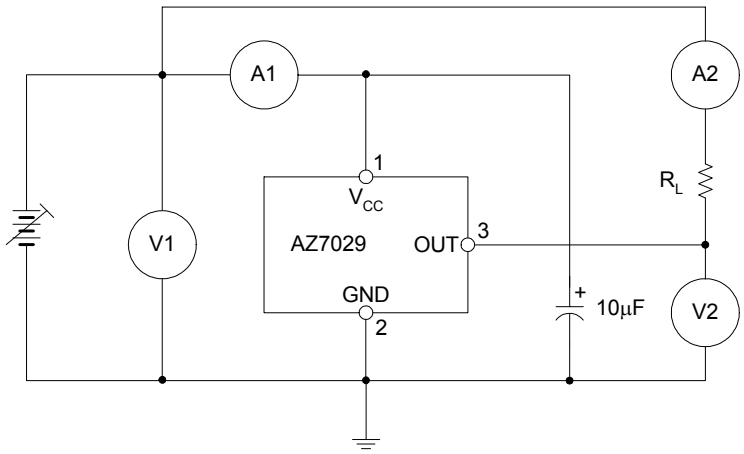



Figure 4. Test Circuit 1

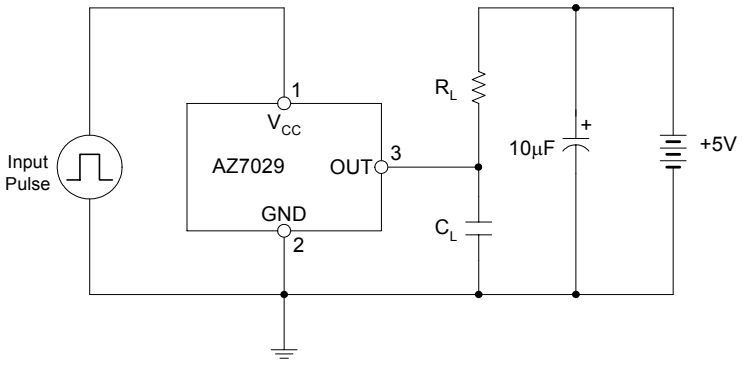



Figure 5. Test Circuit 2

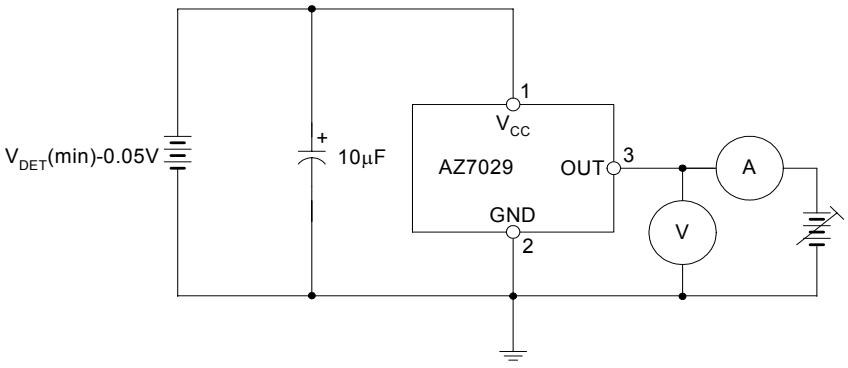



Figure 6. Test Circuit 3

## Typical Performance Characteristics

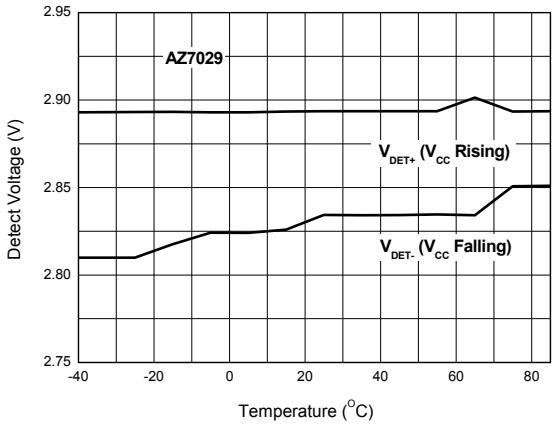



Figure 7. Detect Voltage vs. Temperature

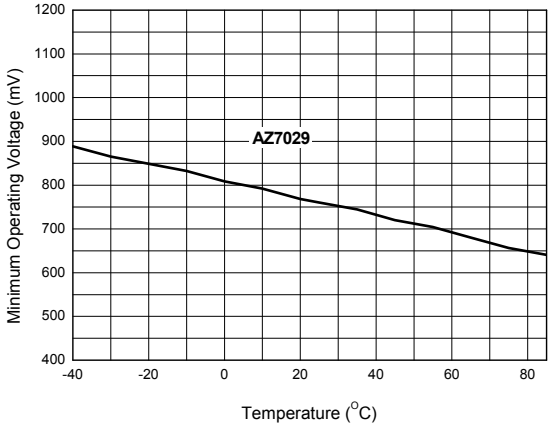



Figure 8. Minimum Operating Voltage vs. Temperature

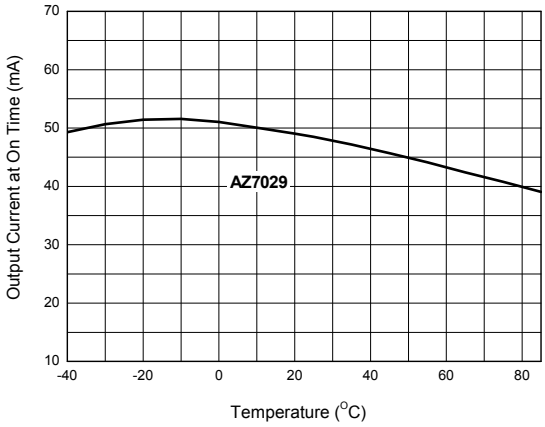



Figure 9. Output Current at On Time vs. Temperature

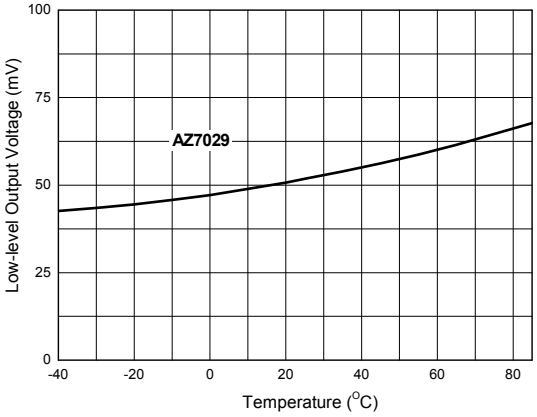



Figure 10. Low-level Output Voltage vs. Temperature

## Typical Performance Characteristics (Continued)

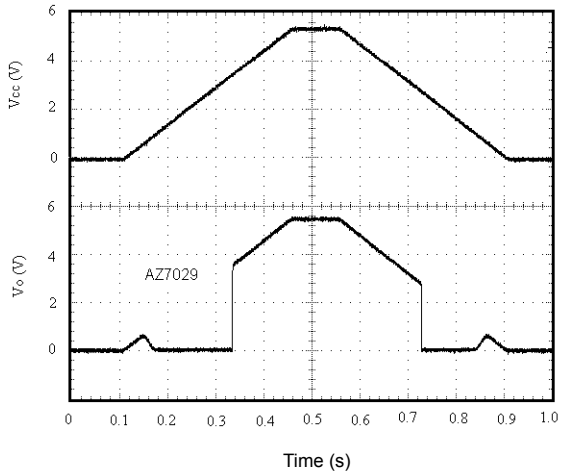



Figure 11. Output Voltage Dynamic Response when $V_{CC}$ Increases and Decreases

## Operating Diagram

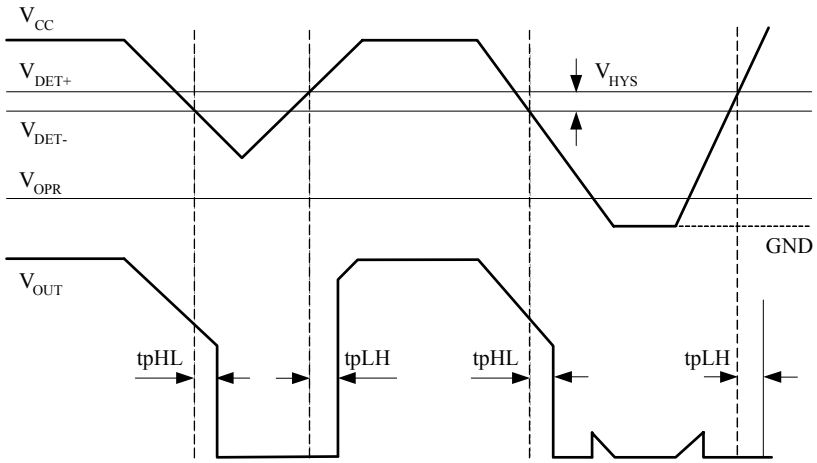



Figure 12. AZ70XX Timing Waveform (Note 5)

Note 5: Detect voltage: $V_{DET-}$
Release voltage: $V_{DET+}$
Hysteresis voltage ($V_{HYS}$): $V_{DET+}$-$V_{DET-}$
Minimum operating voltage: $V_{OPR}$

## Operating Diagram (Continued)

Figure 12 is a typical timing waveform for AZ70XX. In normal steady-state operation when $V_{CC}>V_{DET-}$, the output will be in a logic high state and $V_{OUT}$ is dependent upon the voltage that the pull-up resistor connected to.

Here is some explanations for AZ70XX's operation.

**1.** When the input voltage $V_{CC}$ falls below $V_{DET-}$, the output will pull down to logic low after a delay time of tpHL. In general, at rated output current and $V_{CC}$, $V_{OUT}$ can be pulled down to a voltage as low as within 0.4V from GND. (See the Electrical Characteristics section). The voltage level $V_{DET-}$ means the detect voltage.

**2.** The output, $V_{OUT}$, will stay valid until $V_{CC}$ falls below the minimum operating voltage, $V_{OPR}$ (0.8V typical). Below minimum operating voltage, the output is undefined.

**3.** During power-up, $V_{OUT}$ will remain undefined until $V_{CC}$ rises above $V_{OPR}$, at which time the output will become valid. $V_{OUT}$ will be in its active low state while $V_{OPR}<V_{CC}<V_{DET+}$ ($V_{DET+}=V_{DET-}+V_{HYS}$). $V_{DET+}$ is the release voltage. $V_{HYS}$ means the hysteresis voltage and is the difference voltage between the $V_{DET+}$ and $V_{DET-}$.

**4.** When $V_{CC}$ rises above $V_{DET+}$, the output will be in its inactive state. After a delay time of tpLH, $V_{OUT}$ will be in its logic high state .

## Typical Applications

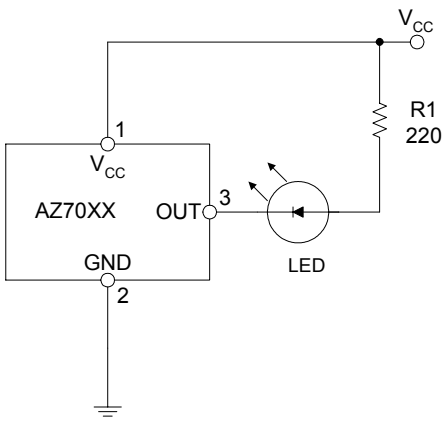



Figure 13. Low Voltage Indicator

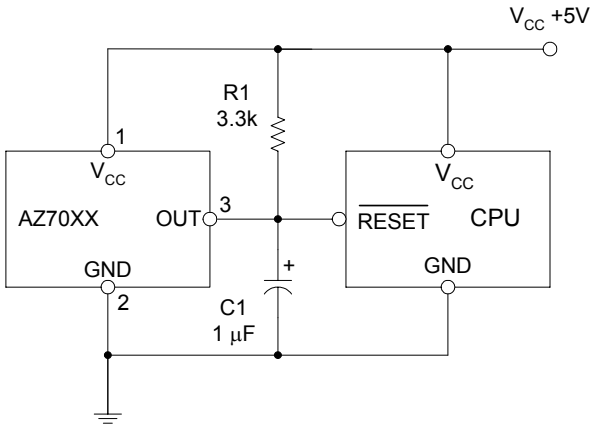
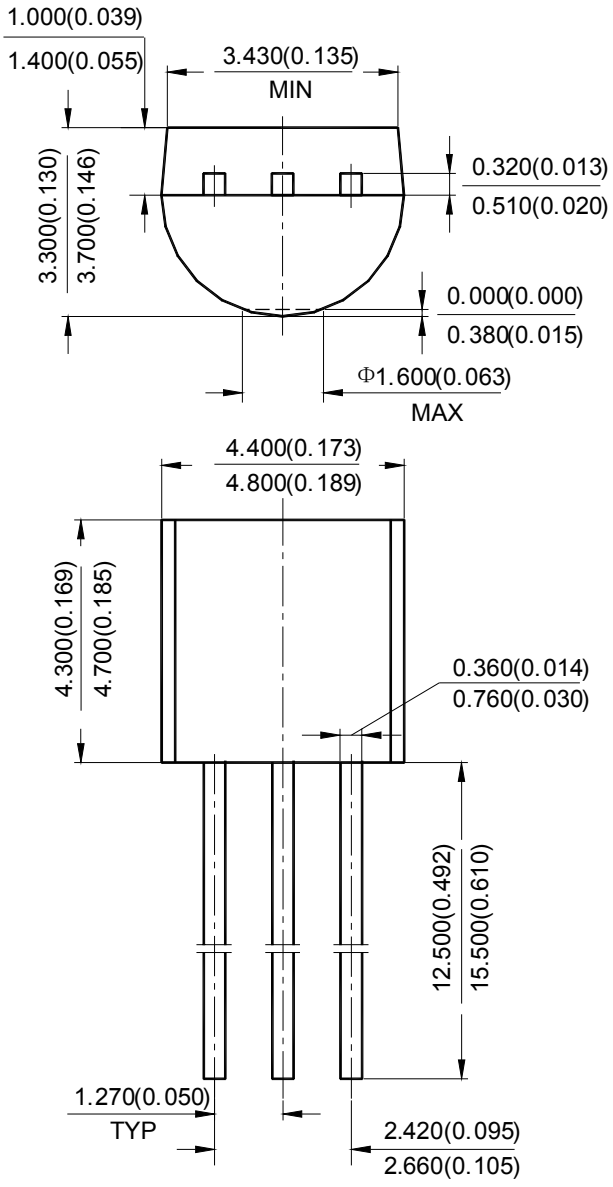



Figure 14. CPU Resetting Circuit

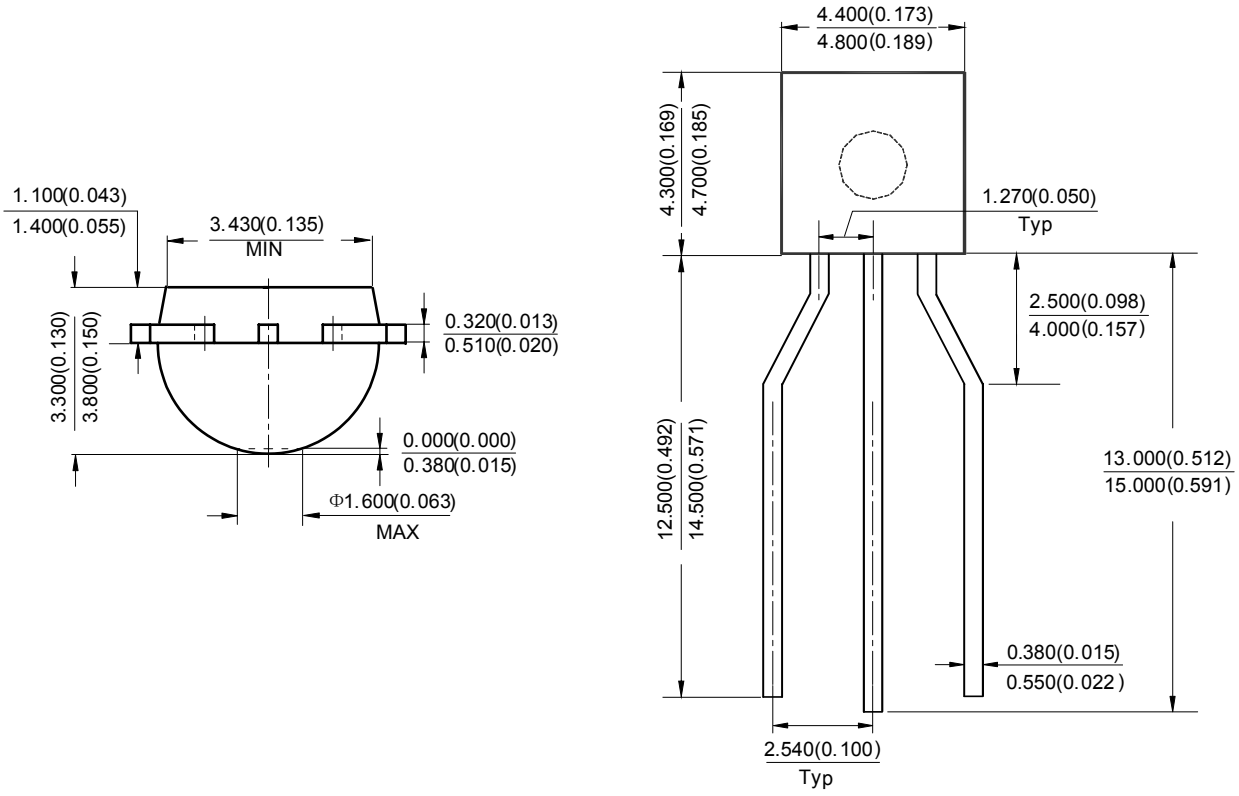
## Mechanical Dimensions

**TO-92(Bulk Packing)** **Unit: mm(inch)**



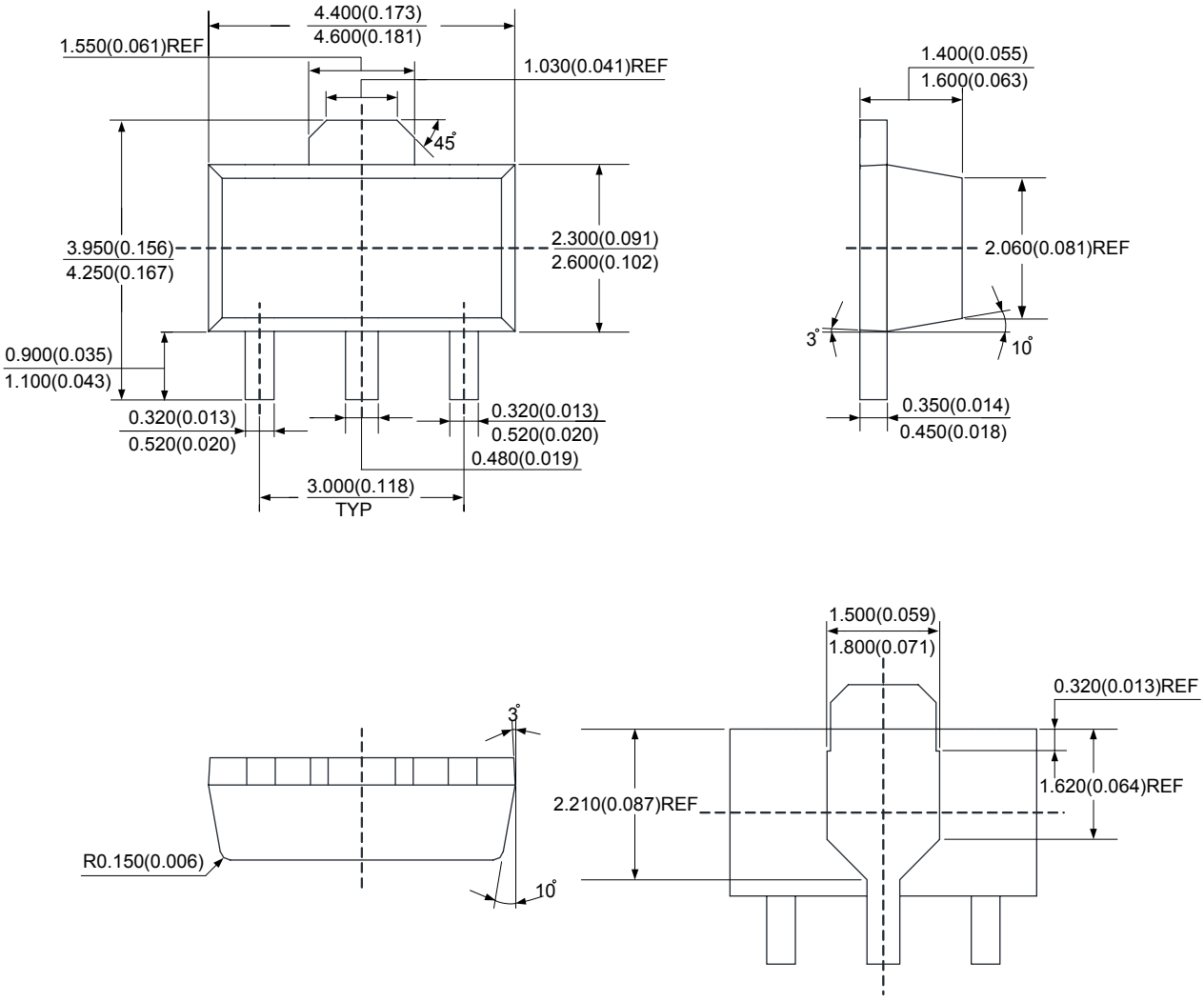
## Mechanical Dimensions (Continued)

**TO-92(Ammo Packing)** **Unit: mm(inch)**



## Mechanical Dimensions (Continued)

**SOT-89** **Unit: mm(inch)**



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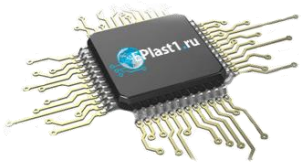
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

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