

**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-89-3.

**Features**

- Low Current Consumption:  
 $I_{CCL}=300\mu\text{A}$  Typical  
 $I_{CCH}=30\mu\text{A}$  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

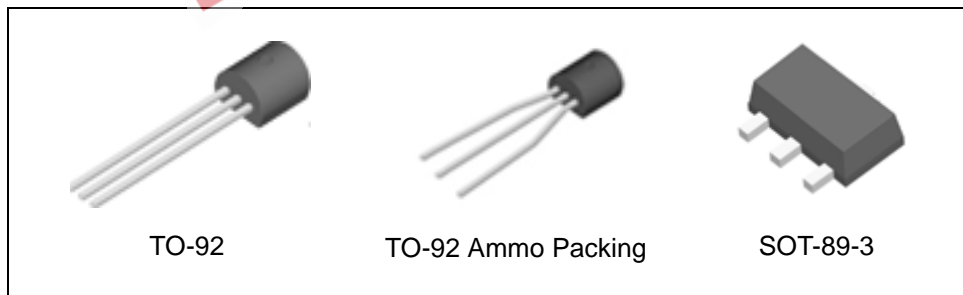


Figure 1. Package Types of AZ70XX



**VOLTAGE DETECTOR**

**AZ70XX**

**Pin Configuration**

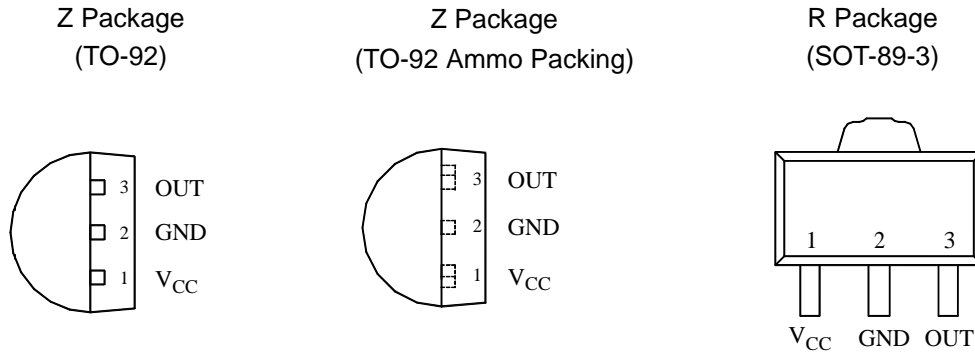


Figure 2. Pin Configuration of AZ70XX (Top View)

**Functional Block Diagram**

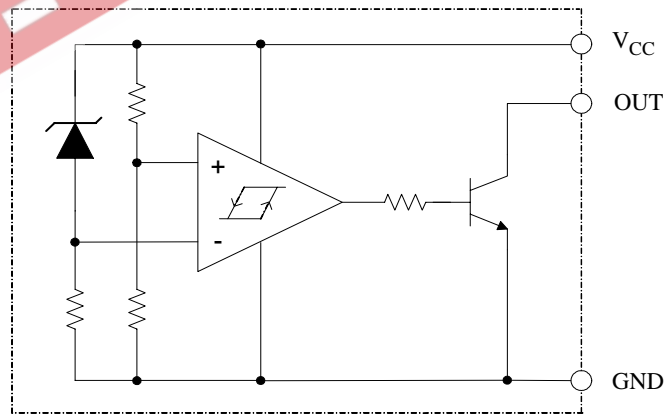


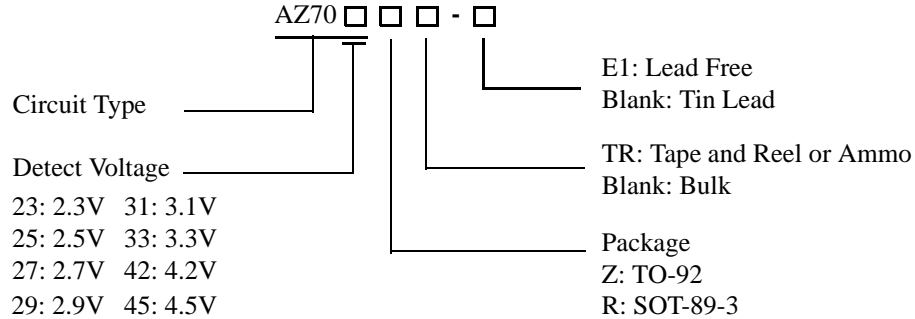
Figure 3. Functional Block Diagram of AZ70XX



**VOLTAGE DETECTOR**

**AZ70XX**

**Ordering Information**



Package	Temperature Range	Detect Voltage	Part Number		Marking ID		Packing Type
			Tin Lead	Lead Free	Tin Lead	Lead Free	
TO-92	-40 to 85°C	2.3V	AZ7023Z	AZ7023Z-E1	AZ7023Z	AZ7023Z-E1	Bulk
			AZ7023ZTR	AZ7023ZTR-E1	AZ7023Z	AZ7023Z-E1	Ammo
		2.5V	AZ7025Z	AZ7025Z-E1	AZ7025Z	AZ7025Z-E1	Bulk
			AZ7025ZTR	AZ7025ZTR-E1	AZ7025Z	AZ7025Z-E1	Ammo
		2.7V	AZ7027Z	AZ7027Z-E1	AZ7027Z	AZ7027Z-E1	Bulk
			AZ7027ZTR	AZ7027ZTR-E1	AZ7027Z	AZ7027Z-E1	Ammo
		2.9V	AZ7029Z	AZ7029Z-E1	AZ7029Z	AZ7029Z-E1	Bulk
			AZ7029ZTR	AZ7029ZTR-E1	AZ7029Z	AZ7029Z-E1	Ammo
		3.1V	AZ7031Z	AZ7031Z-E1	AZ7031Z	AZ7031Z-E1	Bulk
			AZ7031ZTR	AZ7031ZTR-E1	AZ7031Z	AZ7031Z-E1	Ammo
		3.3V	AZ7033Z	AZ7033Z-E1	AZ7033Z	AZ7033Z-E1	Bulk
			AZ7033ZTR	AZ7033ZTR-E1	AZ7033Z	AZ7033Z-E1	Ammo
		4.2V	AZ7042Z	AZ7042Z-E1	AZ7042Z	AZ7042Z-E1	Bulk
			AZ7042ZTR	AZ7042ZTR-E1	AZ7042Z	AZ7042Z-E1	Ammo
		4.5V	AZ7045Z	AZ7045Z-E1	AZ7045Z	AZ7045Z-E1	Bulk
			AZ7045ZTR	AZ7045ZTR-E1	AZ7045Z	AZ7045Z-E1	Ammo
SOT-89-3	-40 to 85°C	2.3V	AZ7023RTR	AZ7023RTR-E1	7023R	E723	Tape & Reel
		2.5V	AZ7025RTR	AZ7025RTR-E1	7025R	E725	Tape & Reel
		2.7V	AZ7027RTR	AZ7027RTR-E1	7027R	E727	Tape & Reel
		2.9V	AZ7029RTR	AZ7029RTR-E1	7029R	E729	Tape & Reel
		3.1V	AZ7031RTR	AZ7031RTR-E1	7031R	E731	Tape & Reel
		3.3V	AZ7033RTR	AZ7033RTR-E1	7033R	E733	Tape & Reel
		4.2V	AZ7042RTR	AZ7042RTR-E1	7042R	E742	Tape & Reel
		4.5V	AZ7045RTR	AZ7045RTR-E1	7045R	E745	Tape & Reel

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

**VOLTAGE DETECTOR****AZ70XX****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit
Supply Voltage	$V_{CC}$	-0.3 to 20	V
Power Dissipation (Package Limitations, $T_A=25^{\circ}\text{C}$ )	$P_D$	TO-92 Package: 400	mW
		SOT-89-3 Package: 500	
Operating Junction Temperature	$T_J$	150	$^{\circ}\text{C}$
Storage Temperature Range	$T_{STG}$	-65 to 150	$^{\circ}\text{C}$

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	$^{\circ}\text{C}$



**VOLTAGE DETECTOR**

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**Electrical Characteristics**

T<sub>A</sub>=25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Detect Voltage	V <sub>DET</sub>	R <sub>L</sub> =200Ω (Note 2)  V <sub>OL</sub> ≤ 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 <sub>OL</sub>	V <sub>CC</sub> =V <sub>DET</sub> (min)-0.05V R <sub>L</sub> =200Ω (Note 2)			0.4	V	
Output Leakage Current	I <sub>OH</sub>	V <sub>CC</sub> =15V			0.1	μA	
Hysteresis Voltage	V <sub>HYS</sub>	R <sub>L</sub> =200Ω (Note 2)	30	50	100	mV	
Detect Voltage Temperature Coefficient	$\frac{\Delta V_{DET}}{V_{DET}} \times \Delta T$	R <sub>L</sub> =200Ω (Note 2)		±0.01		% /°C	
Circuit Current at On Time	I <sub>CCL</sub>	V <sub>CC</sub> =V <sub>DET</sub> (min)-0.05V		300	500	μA	
Circuit Current at Off Time	I <sub>CCH</sub>	V <sub>CC</sub> =5.25V		30	50	μA	
Minimum Operating Voltage	V <sub>OPR</sub>	R <sub>L</sub> =200Ω (Note 2) V <sub>OL</sub> ≤ 0.4V		0.8		V	
“L” Transmission Delay Time	tpHL	V <sub>CC</sub> changed from 5.25V to V <sub>DET</sub> (min)-0.05V, R <sub>L</sub> =1.0KΩ, C <sub>L</sub> =100p (Note 3)		10		μs	
“H” Transmission Delay Time	tpLH	V <sub>CC</sub> changed from V <sub>DET</sub> (min)-0.05V to 5.25V, R <sub>L</sub> =1.0KΩ, C <sub>L</sub> =100p (Note 3)		15		μs	
Output Current at On Time	I <sub>OL I</sub>	V <sub>CC</sub> =V <sub>DET</sub> (min)-0.05V T <sub>A</sub> =25°C (Note 4)	20			mA	
	I <sub>OL II</sub>	V <sub>CC</sub> =V <sub>DET</sub> (min)-0.05V T <sub>A</sub> =-40 to 85 °C (Note 4)	16				

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".



**VOLTAGE DETECTOR**

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**Electrical Characteristics (Continued)**

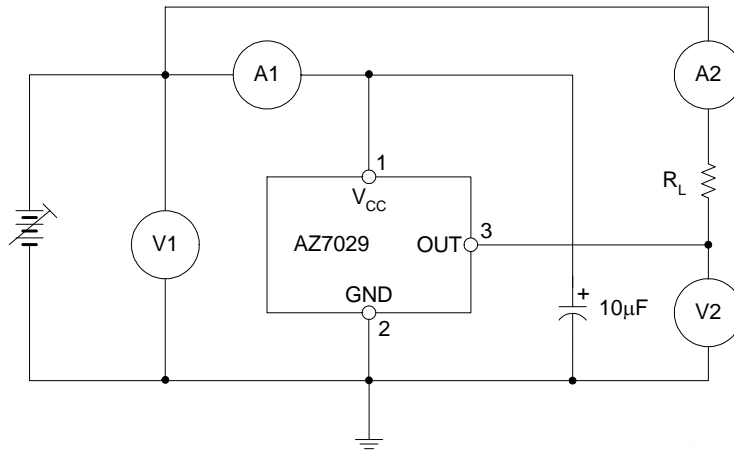


Figure 4. Test Circuit 1

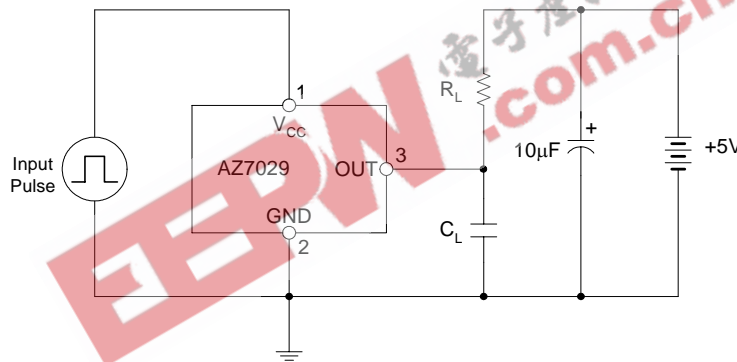


Figure 5. Test Circuit 2

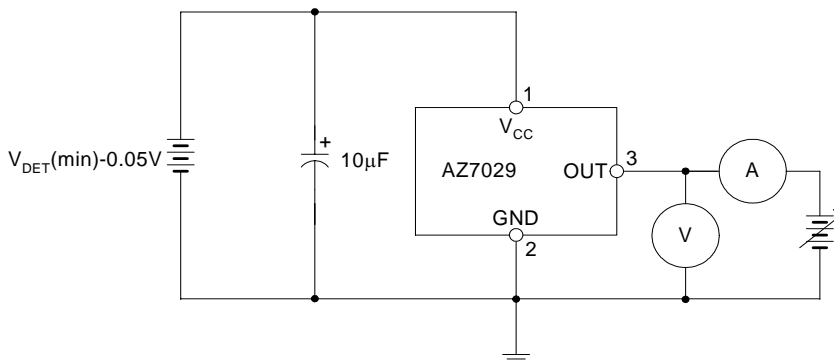


Figure 6. Test Circuit 3



**VOLTAGE DETECTOR**

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**Typical Performance Characteristics**

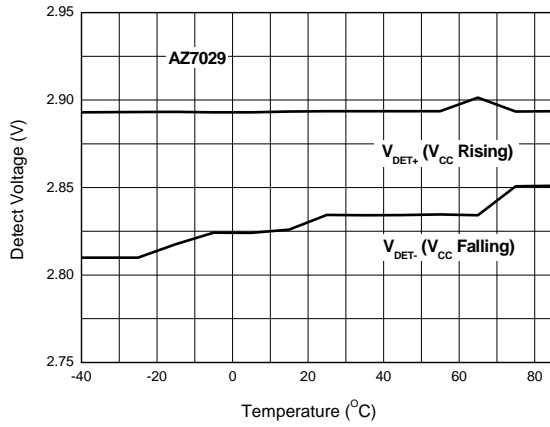


Figure 7. Detect Voltage vs. Temperature

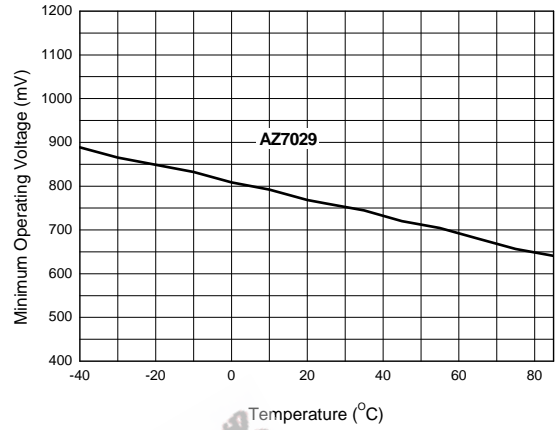


Figure 8. Minimum Operating Voltage vs. Temperature

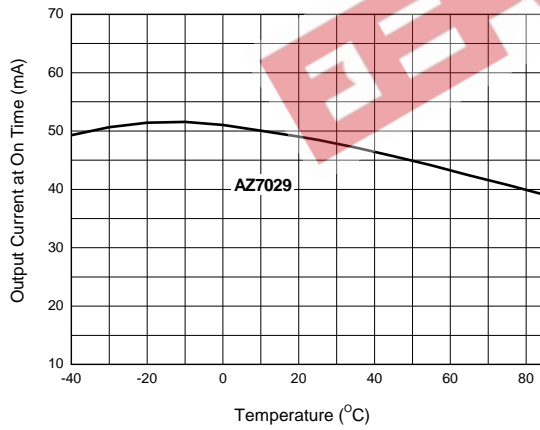


Figure 9. Output Current at On Time vs. Temperature

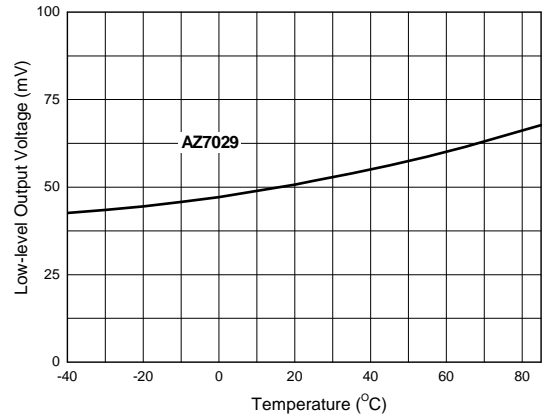


Figure 10. Low-level Output Voltage vs. Temperature



**VOLTAGE DETECTOR**

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**Typical Performance Characteristics (Continued)**

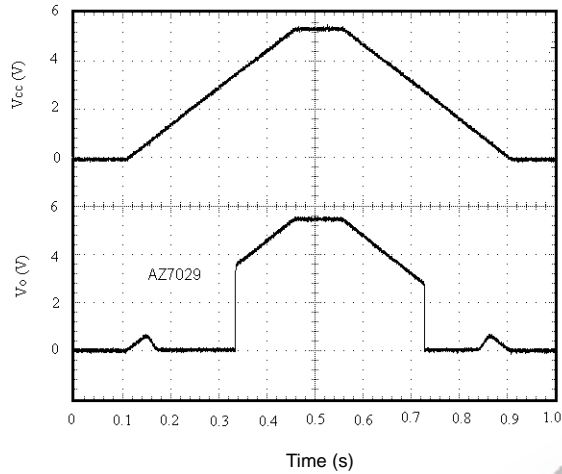


Figure 11. Output Voltage Dynamic Response when  $V_{CC}$  Increases and Decreases

**Operating Diagram**

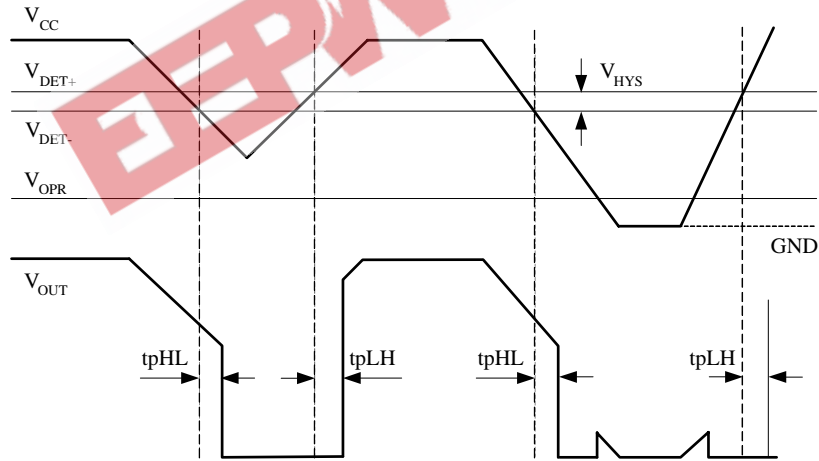


Figure 12. AZ70XX Timing Waveform (Note 5)

Note 5: Detect voltage:  $V_{DET-}$

Hysteresis voltage ( $V_{HYS}$ ):  $V_{DET+} - V_{DET-}$

Release voltage:  $V_{DET+}$

Minimum operating voltage:  $V_{OPR}$



**VOLTAGE DETECTOR****AZ70XX****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  $t_{pHL}$ . 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  $t_{pLH}$ ,  $V_{OUT}$  will be in its logic high state.

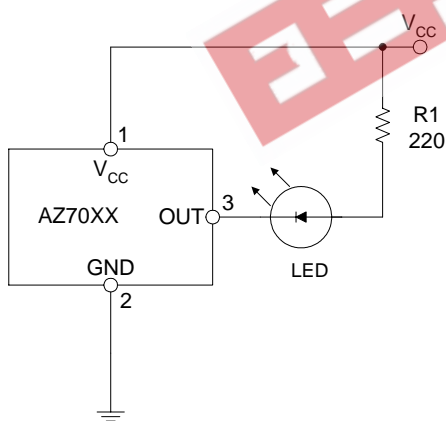
**Typical Applications**

Figure 13. Low Voltage Indicator

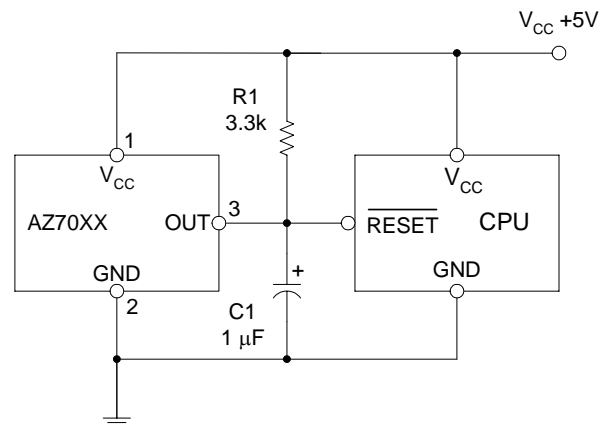


Figure 14. CPU Resetting Circuit



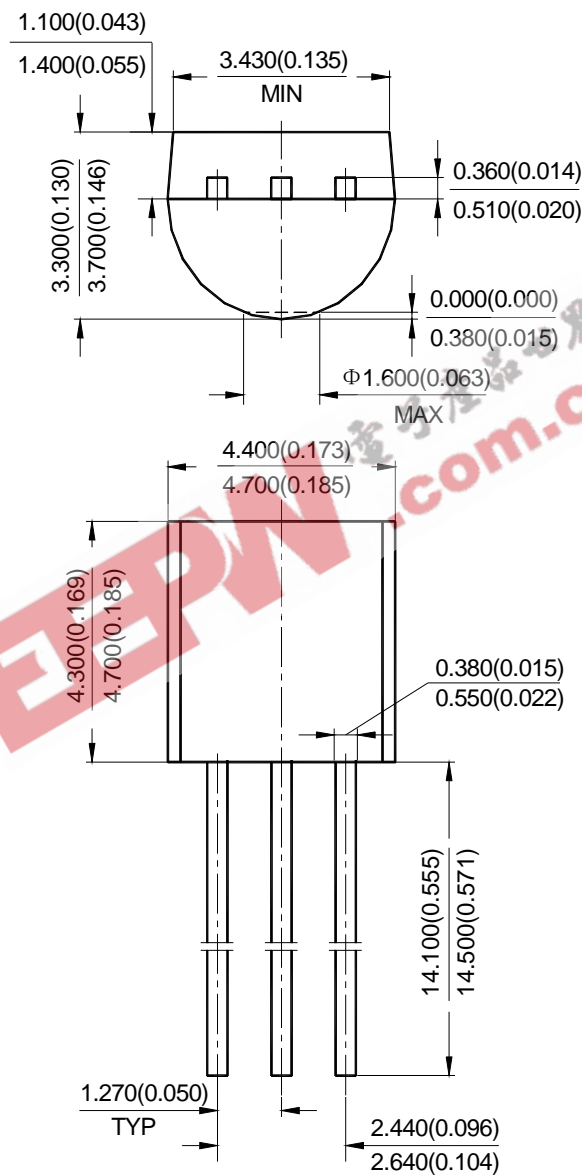
**VOLTAGE DETECTOR**

**AZ70XX**

**Mechanical Dimensions**

**TO-92**

**Unit: mm(inch)**





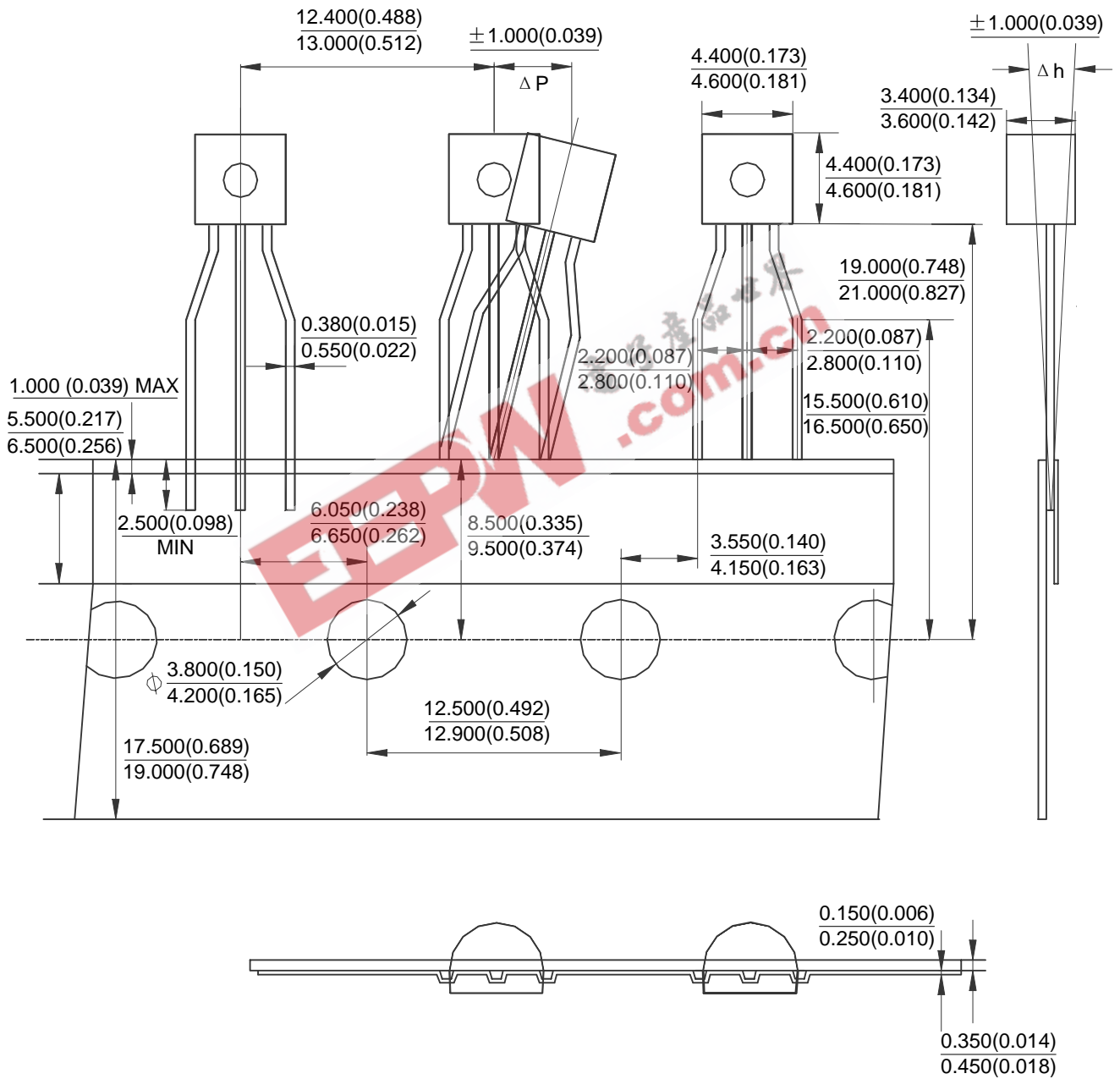
**VOLTAGE DETECTOR**

**AZ70XX**

**Mechanical Dimensions (Continued)**

**TO-92 Ammo Packing**

**Unit: mm(inch)**







BCD Semiconductor Manufacturing Limited

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