



AiP706 Microprocessor Reset Circuit with Watchdog Controller

Product Specification

Specification Revision History:

Version	Date	Description
2020-07-A1	2020-07	New
2021-09-A2	2021-09	Add Selection Table and Modify Ordering Information
2022-01-A3	2022-01	Modify Ordering Information



1、 General Description

The AiP706 microprocessor (μP) supervisory circuit reduce the complexity and number of components required to monitor power-supply and battery functions in μP systems. The device significantly improves system reliability and accuracy compared to separate ICs or discrete components.

The AiP706 provides four functions:

- 1) A reset output during power-up, power-down, and brownout conditions.
- 2) An independent watchdog output that goes low if the watchdog input has not been toggled within 1.6 seconds.
- 3) A 1.25V threshold detector for power-fail warning, low-battery detection, or for monitoring a power supply other than +5V.
- 4) An active-low manual-reset input.

The AiP706, except an active-high reset is substituted for the watchdog timer.

Two supply-voltage monitor levels are available: The AiP706 generates a reset pulse below 4.40V.

Features:

- Guaranteed RESET Valid at $V_{\text{CC}}=1\text{V}$
- Precision Supply-Voltage Monitor
4.40V in AiP706
- 200ms Reset Pulse Width
- Debounced TTL/CMOS-Compatible Manual-Reset Input
- Independent Watchdog Timer—1.6s Timeout
- Voltage Monitor for Power-Fail or Low-Battery Warning
- Packaging information: DIP8/SOP8

Selection Table:

Name	Model Number	Reset Threshold
AiP706	AiP706L	4.65V
	AiP706M	4.40V
	AiP706J	4.00V
	AiP706T	3.08V
	AiP706S	2.93V
	AiP706R	2.63V

**Ordering Information:****Tube packing specifications:**

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP706LDA8.TB	DIP8	AiP706L	50 PCS/tube	40 tube/box	2000 PCS/box	Dimensions of plastic enclosure: 9.2mm×6.4mm Pin spacing: 2.54mm
AiP706MDA8.TB	DIP8	AiP706M	50 PCS/tube	40 tube/box	2000 PCS/box	Dimensions of plastic enclosure: 9.2mm×6.4mm Pin spacing: 2.54mm
AiP706JDA8.TB	DIP8	AiP706J	50 PCS/tube	40 tube/box	2000 PCS/box	Dimensions of plastic enclosure: 9.2mm×6.4mm Pin spacing: 2.54mm
AiP706TDA8.TB	DIP8	AiP706T	50 PCS/tube	40 tube/box	2000 PCS/box	Dimensions of plastic enclosure: 9.2mm×6.4mm Pin spacing: 2.54mm
AiP706SDA8.TB	DIP8	AiP706S	50 PCS/tube	40 tube/box	2000 PCS/box	Dimensions of plastic enclosure: 9.2mm×6.4mm Pin spacing: 2.54mm
AiP706RDA8.TB	DIP8	AiP706R	50 PCS/tube	40 tube/box	2000 PCS/box	Dimensions of plastic enclosure: 9.2mm×6.4mm Pin spacing: 2.54mm
AiP706LSA8.TB	SOP8	AiP706L	100 PCS/tube	100 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm
AiP706MSA8.TB	SOP8	AiP706M	100 PCS/tube	100 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm



AiP706JSA8.TB	SOP8	AiP706J	100 PCS/tube	100 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm
AiP706TSA8.TB	SOP8	AiP706T	100 PCS/tube	100 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm
AiP706SSA8.TB	SOP8	AiP706S	100 PCS/tube	100 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm
AiP706RSA8.TB	SOP8	AiP706R	100 PCS/tube	100 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm

Reel packing specifications:

Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP706LSA8.TR	SOP8(1)	AiP706L	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706MSA8.TR	SOP8(1)	AiP706M	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706JSA8.TR	SOP8(1)	AiP706J	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706TSA8.TR	SOP8(1)	AiP706T	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706SSA8.TR	SOP8(1)	AiP706S	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706RSA8.TR	SOP8(1)	AiP706R	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm



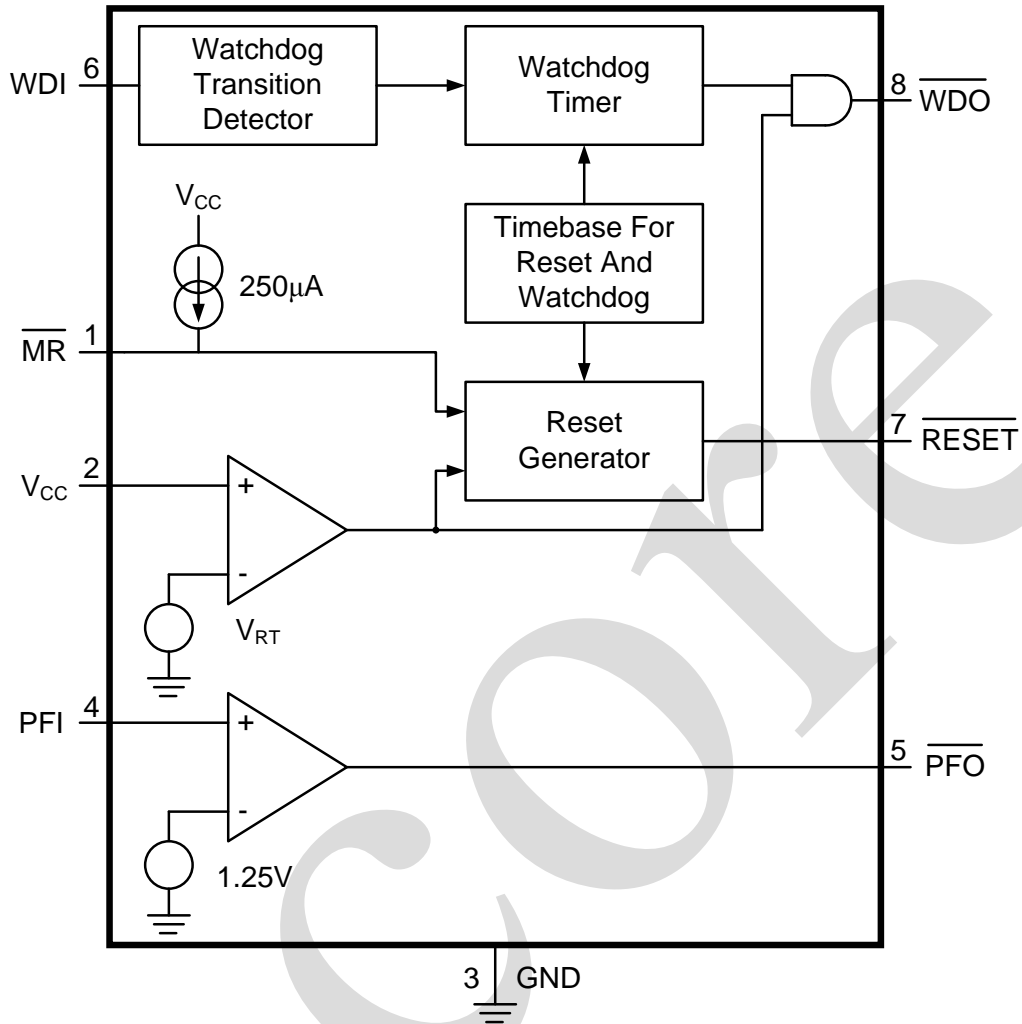
AiP706LSA8.TR	SOP8(2)	AiP706L	2500PCS/reel	5000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706MSA8.TR	SOP8(2)	AiP706M	2500PCS/reel	5000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706JSA8.TR	SOP8(2)	AiP706J	2500PCS/reel	5000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706TSA8.TR	SOP8(2)	AiP706T	2500PCS/reel	5000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706SSA8.TR	SOP8(2)	AiP706S	2500PCS/reel	5000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm
AiP706RSA8.TR	SOP8(2)	AiP706R	2500PCS/reel	5000PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing:1.27mm

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.

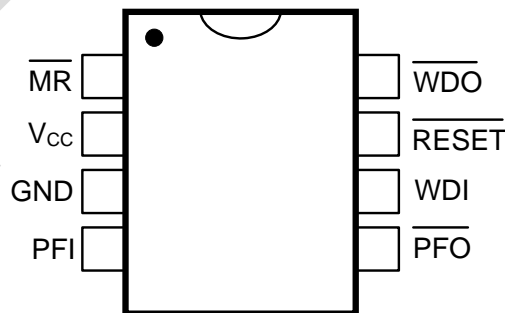


2、Block Diagram And Pin Description

2.1、Block Diagram



2.1、Pin Configurations





2.2、Pin Description

Pin No.	Pin Name	Description
1	$\overline{\text{MR}}$	Manual-Reset Input triggers a reset pulse when pulled below 0.8V. This active-low input has an internal 250 μ A pull-up current. It can be driven from a TTL or CMOS logic line as well as shorted to ground with a switch.
2	V_{CC}	+5V Supply Input
3	GND	0V Ground Reference for all signals
4	PFI	Power-Fail Voltage Monitor Input. When PFI is less than 1.25V, $\overline{\text{PFO}}$ goes low. Connect PFI to GND or V_{CC} when not used.
5	$\overline{\text{PFO}}$	Power-Fail Output goes low and sinks current when PFI is less than 1.25V; otherwise $\overline{\text{PFO}}$ stays high.
6	WDI	Watchdog Input. If WDI remains high or low for 1.6sec, the internal watchdog timer runs out and $\overline{\text{WDO}}$ goes low. Floating WDI or connecting WDI to a high-impedance three-state buffer disables the watchdog feature. The internal watchdog timer clears whenever reset is asserted, WDI is three-stated, or WDI sees a rising or falling edge.
7	$\overline{\text{RESET}}$	Active-Low Reset Output pulses low for 200ms when triggered, and stays low whenever V_{CC} is below the reset threshold. It remains low for 200ms after V_{CC} rises above the reset threshold or $\overline{\text{MR}}$ goes from low to high (Figure 1). A watchdog timeout will not trigger $\overline{\text{RESET}}$ unless $\overline{\text{WDO}}$ is connected to $\overline{\text{MR}}$.
8	$\overline{\text{WDO}}$	Watchdog Output pulls low when the internal watchdog timer finishes its 1.6sec count and does not go high again until the watchdog is cleared. $\overline{\text{WDO}}$ also goes low during low-line conditions. Whenever V_{CC} is below the reset threshold, $\overline{\text{WDO}}$ stays low; however, unlike $\overline{\text{RESET}}$, $\overline{\text{WDO}}$ does not have a minimum pulse width. As soon as V_{CC} rises above the reset threshold, $\overline{\text{WDO}}$ goes high with no delay.

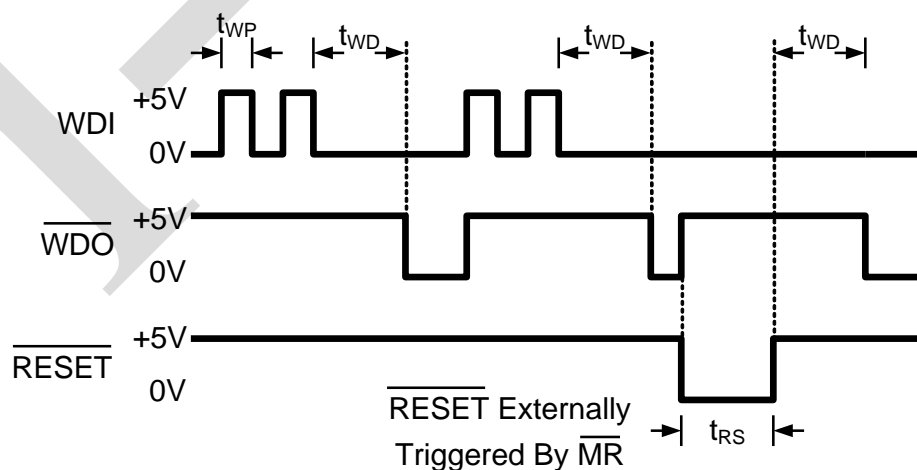


Figure 1. AiP706 Watchdog Timing



3、Electrical Parameter

3.1、Absolute Maximum Ratings

($T_{amb}=25^{\circ}C$, unless otherwise specified)

Characteristic	Symbol	Conditions	Value	Unit	
supply voltage	V_{CC}	-	-0.3 to 6.0	V	
input voltage	V_I	[1]	-0.3 to $V_{CC}+0.3$	V	
supply current	I_{CC}	-	20	mA	
ground current	I_{GND}	-	20	mA	
output current	I_O	-	20	mA	
operating temperature	T_{amb}	-	-40 to +85	$^{\circ}C$	
storage temperature	T_{stg}	-	-65 to +150	$^{\circ}C$	
power Dissipation	P_D	DIP	727	mW	
		SOP	471	mW	
soldering temperature	T_L	10s	DIP	245	$^{\circ}C$
			SOP	250	$^{\circ}C$

Note: [1] The input voltage limits on PFI and MR can be exceeded if the input current is less than 10mA.

3.2、Electrical Characteristics

($T_{amb}=-40^{\circ}C$ to $+85^{\circ}C$, $V_{CC}=4.75V$ to $5.5V$ for AiP706L; $V_{CC}=4.5V$ to $5.5V$ for AiP706M; $V_{CC}=4.07V$ to $5.5V$ for AiP706J; $V_{CC}=3.14V$ to $5.5V$ for AiP706T; $V_{CC}=2.95V$ to $5.5V$ for AiP706S; $V_{CC}=2.68V$ to $5.5V$ for AiP706R, unless otherwise noted.)

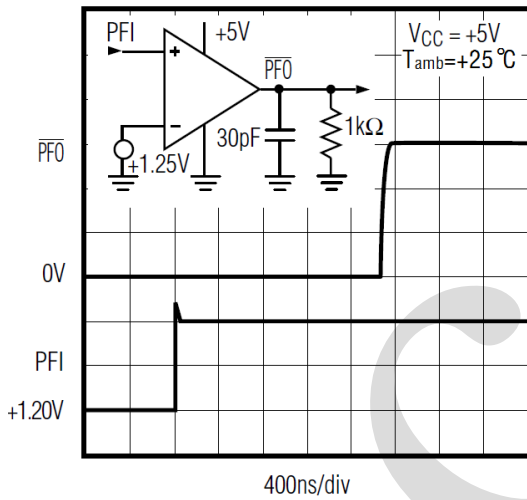
Parameter	Symbo	Conditions	Min.	Typ.	Max.	Unit	
supply voltage	V_{CC}	-	1.0	-	5.5	V	
supply current	I_{SUPPLY}	-	-	50	150	μA	
reset threshold	V_{RT}	AiP706L	4.50	4.65	4.75	V	
		AiP706M	4.25	4.40	4.50	V	
		AiP706J	3.91	4.00	4.07	V	
		AiP706T	3.02	3.08	3.14	V	
		AiP706S	2.85	2.93	2.95	V	
		AiP706R	2.56	2.63	2.68	V	
reset threshold hysteresis	-	AiP706L, M	-	40	-	mV	
		AiP706J	-	34	-	mV	
		AiP706T, S	-	25	-	mV	
		AiP706R	-	22	-	mV	
reset pulse width	t_{RS}	-	120	200	280	ms	
RESET output voltage	-	$I_{SOURCE}=800\mu A$	$V_{CC}-1.5$	-	-	V	
		$I_{SINK}=3.2mA$	-	-	0.4	V	
		$V_{CC}=1V, I_{SINK}=50\mu A$	-	-	0.3	V	
watchdog timeout period	t_{WD}	-	1.00	1.60	2.25	s	
WDI pulse width	t_{WP}	$V_{IL}=0.4V, V_{IH}=V_{CC}$	70	-	-	ns	
WDI input threshold	-	$V_{CC}=5V$	Low	-	-	0.8	V
			High	3.5	-	-	V
		$V_{RST(MAX)}<V_{CC}<3.6V$	Low	-	-	0.8	V
			High	$0.7V_{CC}$	-	-	V
WDI input current	-	$WDI=V_{CC}$	-	50	150	μA	



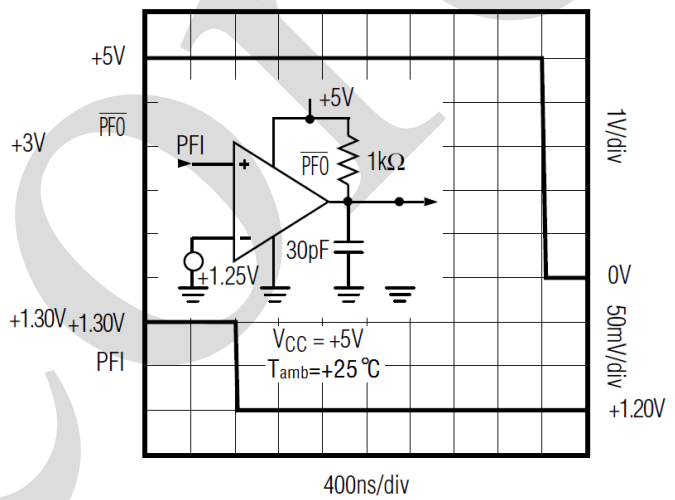
		WDI=0V	-150	-50	-	μA
WDO output voltage	-	I _{SOURCE} =800μA	V _{CC} -1.5	-	-	V
		I _{SINK} =1.2mA	-	-	0.4	V
MR pull-up current	-	MR =0V	100	-	600	μA
MR pulse width	t _{MR}	-	250	-	-	ns
MR input threshold	Low	T _{amb} =25°C	-	-	0.8	V
	High		2.0	-	-	V
MR to reset out delay	t _{MD}	-	-	-	350	ns
PFI input threshold	-	V _{CC} =5V	1.18	1.25	1.30	V
PFI input current	-	-	-	0.20	-	nA
PFO output voltage	-	I _{SOURCE} =800μA	V _{CC} -1.5	-	-	V
		I _{SINK} =3.2mA	-	-	0.4	V

4、Characteristic Curve

POWER-FAIL COMPARATOR DE-ASSERTION RESPONSE TIME



POWER-FAIL COMPARATOR ASSERTION RESPONSE TIME





5、Function Description

5.1、Reset Output

A microprocessor's (μP 's) reset input starts the μP in a known state. Whenever the μP is in an unknown state, it should be held in reset. The AiP706 asserts reset during power-up and prevent code execution errors during power-down or brownout conditions.

On power-up, once V_{CC} reaches 1V, $\overline{\text{RESET}}$ is a guaranteed logic low of 0.4V or less. As V_{CC} rises, $\overline{\text{RESET}}$ stays low. When V_{CC} rises above the reset threshold, an internal timer releases $\overline{\text{RESET}}$ after about 200ms. $\overline{\text{RESET}}$ pulses low whenever V_{CC} dips below the reset threshold, i.e. brownout condition. If brownout occurs in the middle of a previously initiated reset pulse, the pulse continues for at least another 140ms. On power-down, once V_{CC} falls below the reset threshold, $\overline{\text{RESET}}$ stays low and is guaranteed to be 0.4V or less until V_{CC} drops below 1V.

5.2、Watchdog Timer

The AiP706 watchdog circuit monitors the μP 's activity. If the μP does not toggle the watchdog input (WDI) within 1.6sec and WDI is not three-stated, $\overline{\text{WDO}}$ goes low. As long as $\overline{\text{RESET}}$ is asserted or the WDI input is three-stated, the watchdog timer will stay cleared and will not count. As soon as reset is released and WDI is driven high or low, the timer will start counting. Pulses as short as 50ns can be detected.

Typically, $\overline{\text{WDO}}$ will be connected to the non-maskable interrupt input (NMI) of a μP . When V_{CC} drops below the reset threshold, $\overline{\text{WDO}}$ will go low whether or not the watchdog timer has timed out yet. Normally this would trigger an NMI interrupt, but $\overline{\text{RESET}}$ goes low simultaneously, and thus overrides the NMI interrupt.

If WDI is left unconnected, $\overline{\text{WDO}}$ can be used as a low-line output. Since floating WDI disables the internal timer, $\overline{\text{WDO}}$ goes low only when V_{CC} falls below the reset threshold, thus functioning as a low-line output.

The AiP706 has a watchdog timer and a $\overline{\text{RESET}}$ output.

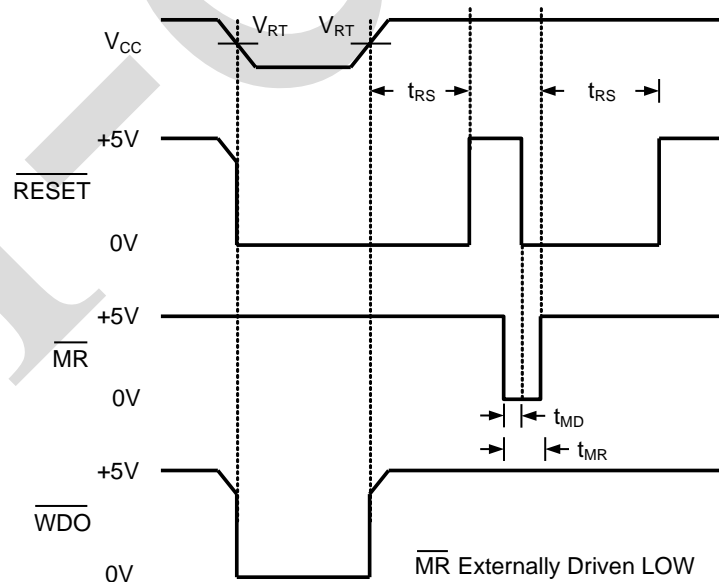


Figure 2. AiP706 $\overline{\text{RESET}}$, $\overline{\text{MR}}$, and $\overline{\text{WDO}}$ Timing with WDI Three-Styled.



5.3、 Manual Reset

The manual-reset input ($\overline{\text{MR}}$) allows reset to be triggered by a pushbutton switch. The switch is effectively debounced by the 140ms minimum reset pulse width. $\overline{\text{MR}}$ is TTL/CMOS logic compatible, so it can be driven by an external logic line. $\overline{\text{MR}}$ can be used to force a watchdog timeout to generate a reset pulse in the AiP706. Simply connect $\overline{\text{WDO}}$ to $\overline{\text{MR}}$.

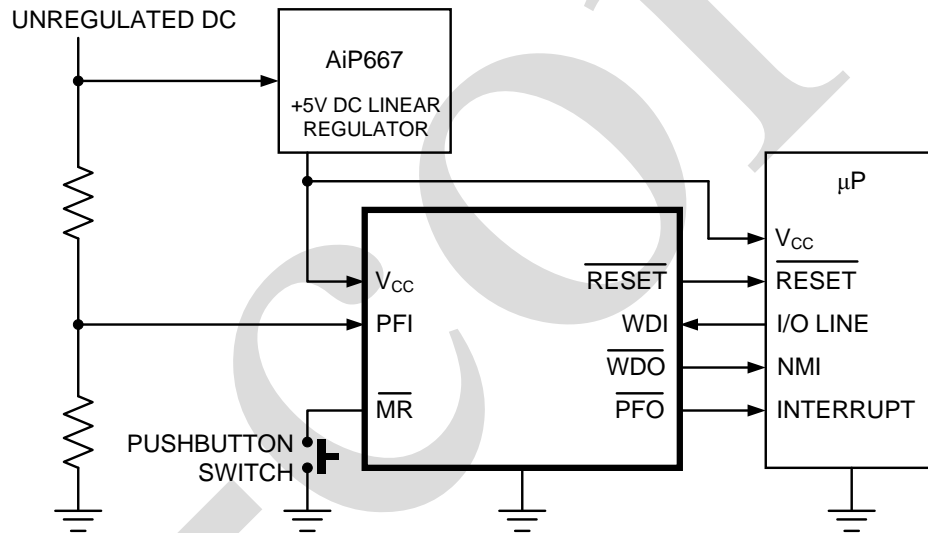
5.4、 Power-Fail Comparator

The power-fail comparator can be used for various purposes because its output and non-inverting input are not internally connected. The inverting input is internally connected to a 1.25V reference.

To build an early-warning circuit for power failure, connect the PFI pin to a voltage divider (see Typical Operating Circuit). Choose the voltage divider ratio so that the voltage at PFI falls below 1.25V just before the +5V regulator drops out. Use $\overline{\text{PFO}}$ to interrupt the μP so it can prepare for an orderly power-down.

6、 Typical Application Circuit And Application Note

6.1、 Typical Operating Circuit





6.2. Ensuring a Valid RESET Output Down to $V_{CC}=0V$

When V_{CC} falls below 1V, the AiP706 \overline{RESET} output no longer sinks current—it becomes an open circuit. High-impedance CMOS logic inputs can drift to undetermined voltages if left undriven. If a pull-down resistor is added to the \overline{RESET} pin as shown in Figure 3, any stray charge or leakage currents will be drained to ground, holding \overline{RESET} low. Resistor value (R1) is not critical. It should be about 100k Ω , large enough not to load \overline{RESET} and small enough to pull \overline{RESET} to ground.

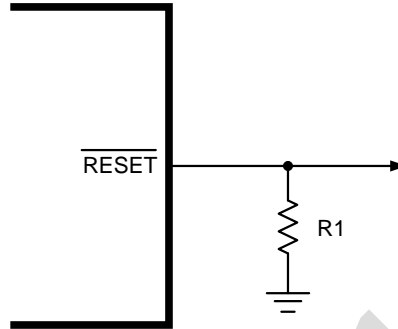
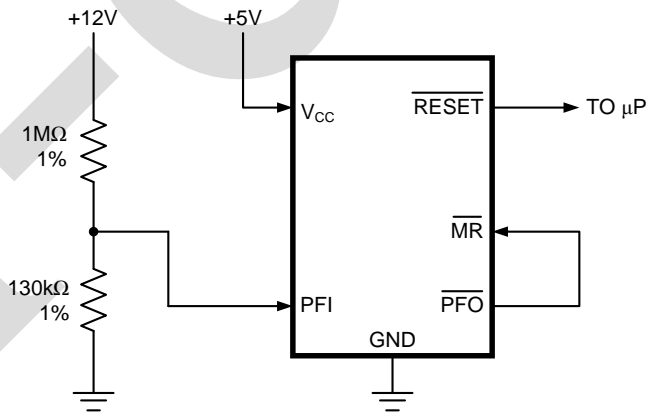


Figure 3. RESET Valid to Ground Circuit

6.3. Monitoring Voltages Other Than the Unregulated DC Input

Monitor voltages other than the unregulated DC by connecting a voltage divider to PFI and adjusting the ratio appropriately. If required, add hysteresis by connecting a resistor (with a value approximately 10 times the sum of the two resistors in the potential divider network) between PFI and \overline{PFO} . A capacitor between PFI and GND will reduce the power-fail circuit’s sensitivity to high-frequency noise on the line being monitored. \overline{RESET} can be asserted on other voltages in addition to the +5V V_{CC} line. Connect \overline{PFO} to \overline{MR} to initiate a \overline{RESET} pulse when PFI drops below 1.25V. Figure 4 shows the AiP706 configured to assert \overline{RESET} when the +5V supply falls below the reset threshold, or when the +12V supply falls below approximately 11V.



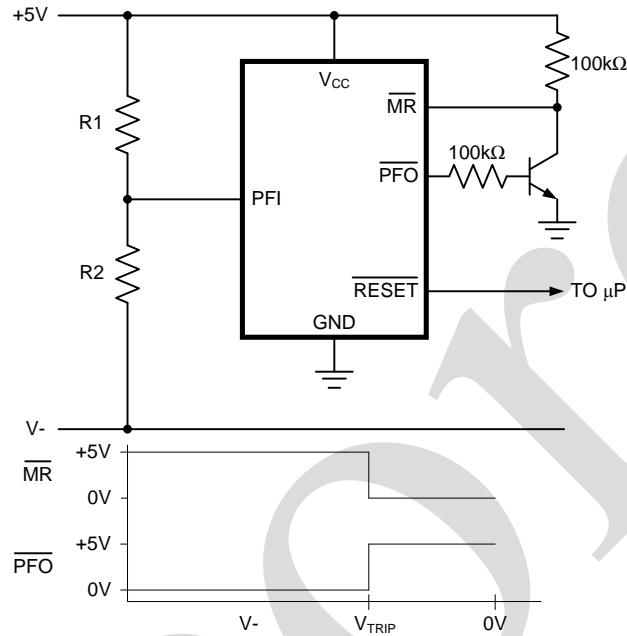
Parameter	Min	Typ	Max	Unit
+12V Reset Threshold at +25°C	10.67	10.87	11.50	V

Figure 4. Monitoring Both +5V and +12V



6.4. Monitoring a Negative Voltage

The power-fail comparator can also monitor a negative supply rail (Figure 5). When the negative rail is good (a negative voltage of large magnitude), $\overline{\text{PFO}}$ is low, and when the negative rail is degraded (a negative voltage of lesser magnitude), $\overline{\text{PFO}}$ is high. By adding the resistors and transistor as shown, a high $\overline{\text{PFO}}$ triggers reset. As long as $\overline{\text{PFO}}$ remains high, the AiP706 will keep reset asserted ($\overline{\text{RESET}} = \text{low}$). Note that this circuit's accuracy depends on the PFI threshold tolerance, the V_{CC} line, and the resistors.



$$\frac{5-1.25}{R1} = \frac{1.25-V_{TRIP}}{R2}, V_{TRIP} < 0$$

Figure 5. Monitoring a Negative Voltage



6.5、 Interfacing to μ Ps with Bidirectional Reset Pins

μ Ps with bidirectional reset pins can contend with the AiP706 $\overline{\text{RESET}}$ output. If, for example, the $\overline{\text{RESET}}$ output is driven high and the μ P wants to pull it low, indeterminate logic levels may result. To correct this, connect a $4.7\text{k}\Omega$ resistor between the $\overline{\text{RESET}}$ output and the μ P reset I/O, as in Figure 6. Buffer the $\overline{\text{RESET}}$ output to other system components.

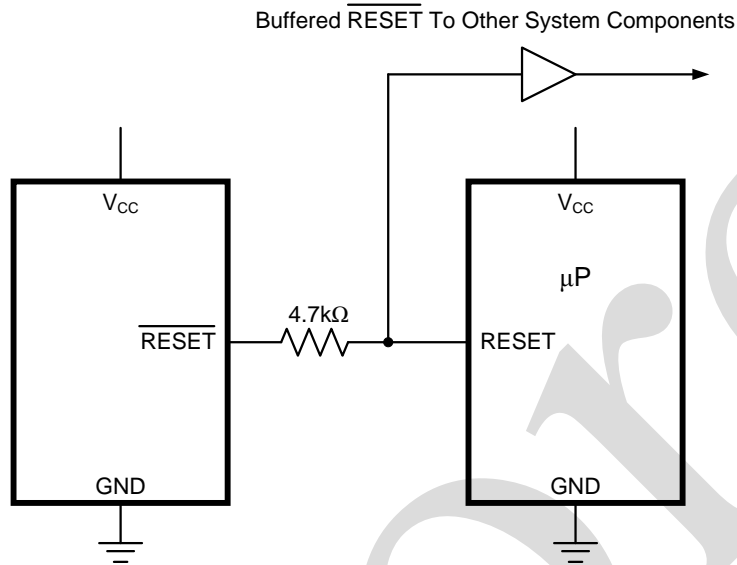
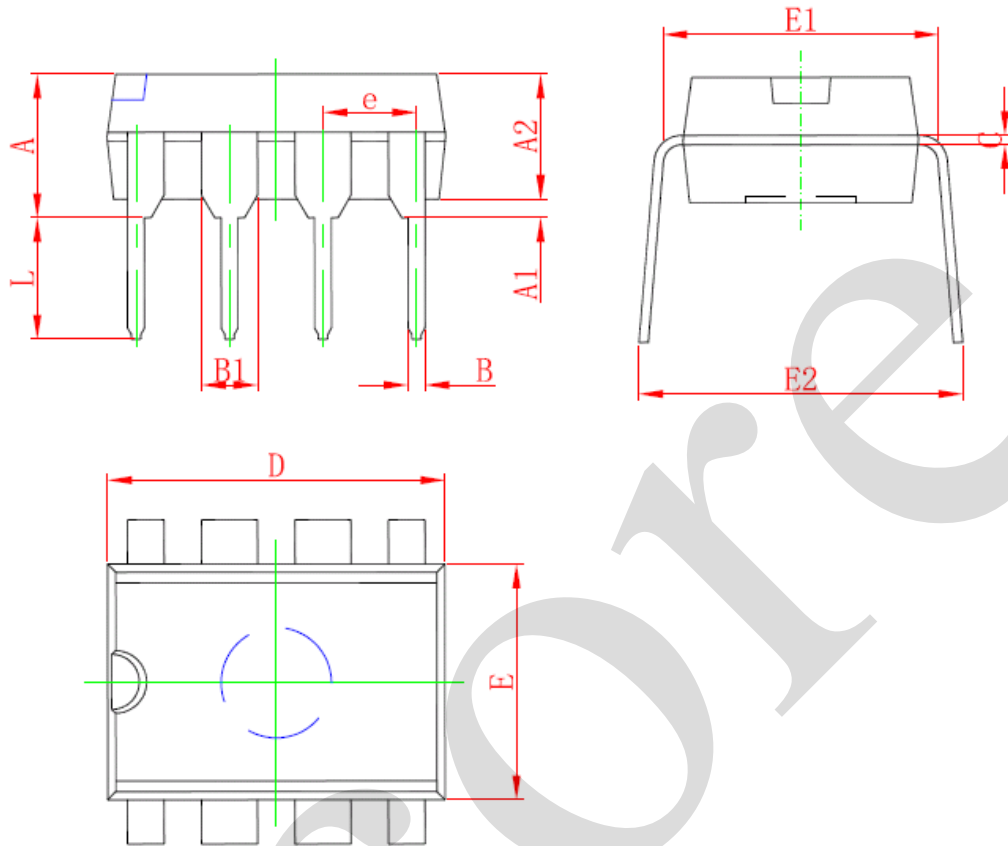


Figure 6. Interfacing to μ Ps with Bidirectional Reset I/O



7、Package Information

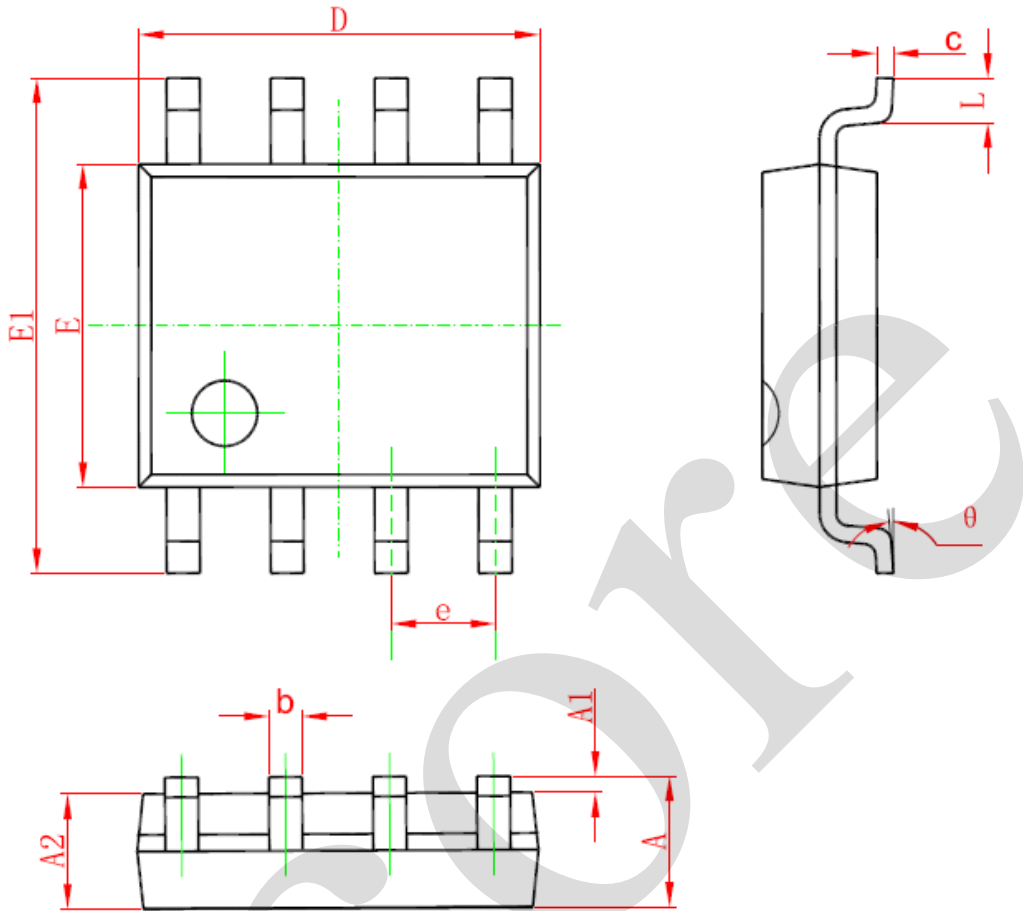
7.1、DIP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524 (BSC)		0.060 (BSC)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540 (BSC)		0.100 (BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354



7.2、SOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



8、 Statements And Notes

8.1、 The name and content of Hazardous substances or Elements in the product

Part name	Hazardous substances or Elements									
	Lead and lead compounds	Mercury and mercury compounds	Cadmium and cadmium compounds	Hexavalent chromium compounds	Polybrominated biphenyls	Polybrominated biphenyl ethers	Dibutyl phthalate	Butylbenzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
Lead frame	○	○	○	○	○	○	○	○	○	○
Plastic resin	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
The lead	○	○	○	○	○	○	○	○	○	○
Plastic sheet installed	○	○	○	○	○	○	○	○	○	○
explanation	○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. ×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements.									

8.2、 Notion

Recommended carefully reading this information before the use of this product;

The information in this document are subject to change without notice;

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