

## Low Power $\mu$ P Supervisor Circuits

### General Description

The ASM705 / 706 / 707 / 708 and ASM813L are cost effective CMOS supervisor circuits that monitors power-supply and battery voltage level, and  $\mu$ P/ $\mu$ C operation.

The family offers several functional options. Each device generates a reset signal during power-up, power-down and during brownout conditions. A reset is generated when the supply drops below 4.65V (ASM705/707/813L) or 4.40V (ASM706/708). For 3V power supply applications, refer to the ASM705P/R/S/T data sheet. In addition, the ASM705/706/813L feature a 1.6 second watchdog timer. The ASM707/708 have both active-HIGH and active-LOW reset outputs but no watchdog function. The ASM813L has the same pin-out and functions as the ASM705 but has an active-HIGH reset output. A versatile power-fail circuit has a 1.25V threshold, useful in low battery detection and for monitoring non-5V supplies. All devices have a manual reset ( $\overline{\text{MR}}$ ) input. The watchdog timer output will trigger a reset if connected to  $\overline{\text{MR}}$ .

All devices are available in 8-pin DIP, SO and MicroSO packages.

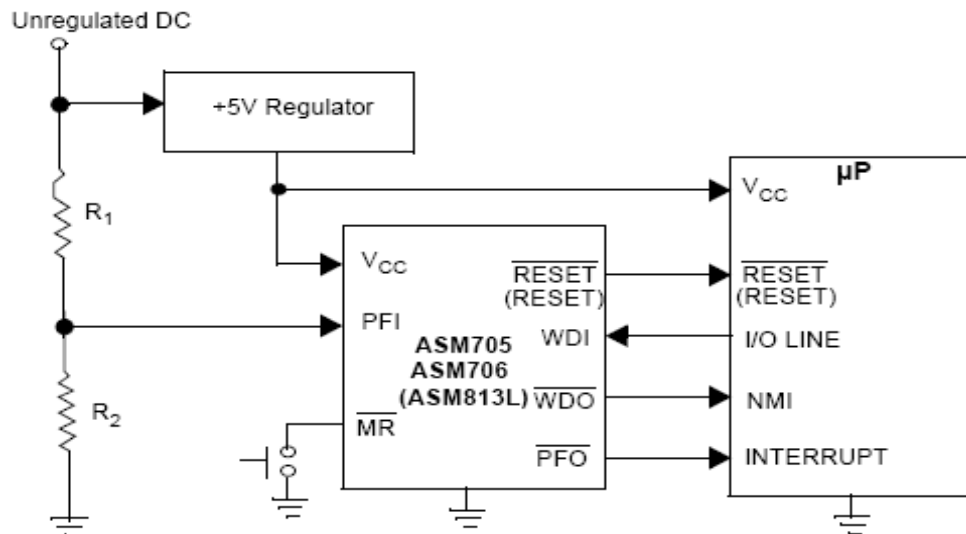
### Features

- Precision power supply monitor
  - 4.65V threshold (ASM705/707/813L)
  - 4.40V threshold (ASM706/708)
- Debounced manual reset input
- Voltage monitor
  - 1.25V threshold
  - Battery monitor / Auxiliary supply monitor
- Watchdog timer (ASM705/706/813L)
- 200ms reset pulse width
- Active HIGH reset output (ASM707/708/813L)
- MicroSO package

### Application

- Computers and embedded controllers
- Portable/Battery-operated systems
- Intelligent instruments
- Wireless communication systems
- PDAs and hand-held equipment
- Automotive Systems
- Safety Systems

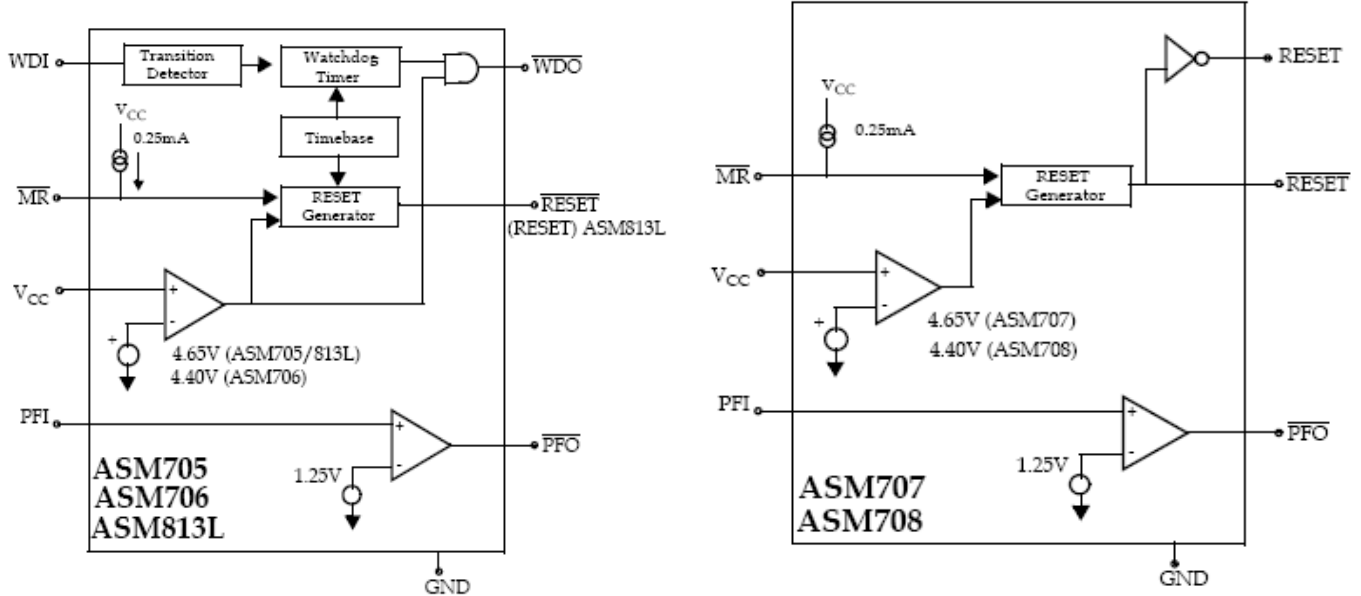
### Typical Operating Circuit



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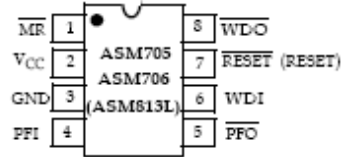
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**Block Diagram**

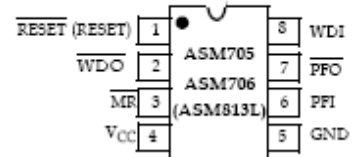
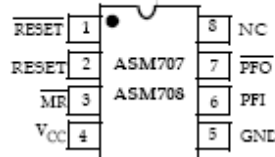


**Pin Configuration**

**DIP/SO**



**MicroSO**



Pin Description

Pin Number						Name	Function
ASM705/706		ASM707/708		ASM813L			
DIP/SO	MicroSO	DIP/SO	MicroSO	DIP/SO	MicroSO		
1	3	1	3	1	3	$\overline{\text{MR}}$	Manual reset input. The active LOW input triggers a reset pulse. A 250 $\mu\text{A}$ pull-up current allows the pin to be driven by TTL/CMOS logic or shorted to ground with a switch.
2	4	2	4	2	4	$V_{\text{CC}}$	+5V power supply input.
3	5	3	5	3	5	GND	Ground reference for all signals.
4	6	4	6	4	6	PFI	Power-fail input voltage monitor. With PFI less than 1.25V, $\overline{\text{PFO}}$ goes LOW. Connect PFI to Ground or $V_{\text{CC}}$ when not in use.
5	7	5	7	5	7	$\overline{\text{PFO}}$	Power-fail output. The output is active LOW and sinks current when PFI is less than 1.25V.
6	8	-	-	6	8	WDI	Watchdog input. WDI controls the internal watchdog timer. A HIGH or LOW signal for 1.6sec at WDI allows the internal timer to run-out, setting WDO LOW. The watchdog function is disabled by floating WDI or by connecting WDI to a high impedance three-state buffer. The internal watchdog timer clears when: RESET is asserted; WDI is three-stated ; or WDI sees a rising or falling edge.
-	-	6	8	-	-	NC	Not Connected.
7	1	7	1	-	-	RESET	Active LOW reset output. Pulses LOW for 200ms when triggered, and stays LOW whenever $V_{\text{CC}}$ is below the reset threshold. RESET remains LOW for 200ms after $V_{\text{CC}}$ rises above the reset threshold or MR goes from LOW to HIGH. A watchdog timeout will not trigger RESET unless WDO is connected to MR.
8	2	-	-	8	2	$\overline{\text{WDO}}$	Watchdog output. WDO goes LOW when the 1.6 second internal watchdog timer times-out and does not go HIGH until the watchdog is cleared. In addition, when $V_{\text{CC}}$ falls below the reset threshold, $\overline{\text{WDO}}$ goes LOW. Unlike RESET, WDO does not have a minimum pulse width and as soon as $V_{\text{CC}}$ exceeds the reset threshold, WDO goes HIGH with no delay.
-	-	8	2	7	1	RESET	Active HIGH reset output. The inverse of RESET. The ASM813L only has a RESET output.

## Detailed Description

A proper reset input enables a microprocessor / microcontroller to start in a known state. ASM70X and ASM813L assert reset to prevent code execution errors during power-up, power-down and brown-out conditions.

### RESET/RESET Timing

The RESET/RESET signals are designed to start a  $\mu\text{P}/\mu\text{C}$  in a known state or return the system to a known state.

The ASM707/708 have two reset outputs, one active-HIGH RESET and one active-LOW  $\overline{\text{RESET}}$  output. The ASM813L has only an active-HIGH output.  $\overline{\text{RESET}}$  is simply the complement of RESET.

$\overline{\text{RESET}}$  is guaranteed to be LOW with  $V_{\text{CC}}$  above 1.2V. During a power-up sequence,  $\overline{\text{RESET}}$  remains low until the supply rises above the threshold level, either 4.65V or 4.40V. RESET goes high approximately 200ms after crossing the threshold.

During power-down,  $\overline{\text{RESET}}$  goes LOW as  $V_{\text{CC}}$  falls below the threshold level and is guaranteed to be under 0.4V with  $V_{\text{CC}}$  above 1.2V.

In a brownout situation where  $V_{\text{CC}}$  falls below the threshold level, RESET pulses low. If a brown-out occurs during an already initiated reset, the pulse will continue for a minimum of 140ms.

### Power Failure Detection With Auxiliary Comparator

All devices have an auxiliary comparator with 1.25V trip point and uncommitted output (PFO) and noninverting input (PFI). This comparator can be used as a supply voltage monitor with an external resistor voltage divider. The attenuated voltage at PFI should be set just below the 1.25 threshold. As the supply level falls, PFI is reduced causing the PFO output to transit LOW. Normally PFO interrupts the processor so the system can be shut down in a controlled manner.

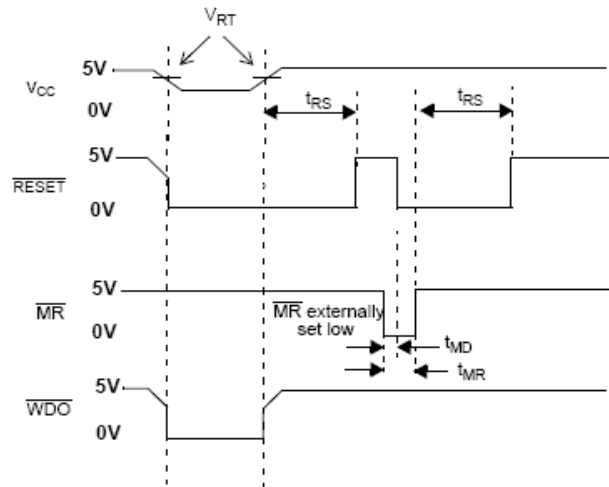


Figure 1: WDI Three-state operation

### Manual Reset ( $\overline{\text{MR}}$ )

The active-LOW manual reset input is pulled high by a 250 $\mu\text{A}$  pull-up current and can be driven low by CMOS/TTL logic or a mechanical switch to ground. An external debounce circuit is unnecessary since the 140ms minimum reset time will debounce mechanical pushbutton switches.

By connecting the watchdog output ( $\overline{\text{WDO}}$ ) and  $\overline{\text{MR}}$ , a watchdog timeout forces  $\overline{\text{RESET}}$  to be generated. The ASM813L should be used when an active-HIGH RESET is required.

### Watchdog Timer

The watchdog timer available on the ASM705/706/813L monitors  $\mu\text{P}/\mu\text{C}$  activity. An output line on the processor is used to toggle the WDI line. If this line is not toggled within 1.6 seconds, the internal timer puts the watchdog output, WDO, into a LOW state. WDO will remain LOW until a toggle is detected at WDI.

If WDI is floated or connected to a three-stated circuit, the watchdog function is disabled, meaning, it is cleared and not counting. The watchdog timer is also disabled if RESET is asserted. When RESET becomes inactive and the WDI input sees a high or low transition as short as 50ns, the watchdog timer will begin a 1.6 second countdown. Additional transitions at WDI will reset the watchdog timer and initiate a new countdown sequence.

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$\overline{WDO}$  will also become LOW and remain so, whenever the supply voltage,  $V_{CC}$ , falls below the device threshold level.  $\overline{WDO}$  goes HIGH as soon as  $V_{CC}$  transitions above the threshold. There is no minimum pulse width for  $\overline{WDO}$  as there is for the RESET outputs. If  $\overline{WDI}$  is floated,  $\overline{WDO}$  essentially acts as a low-power output indicator.

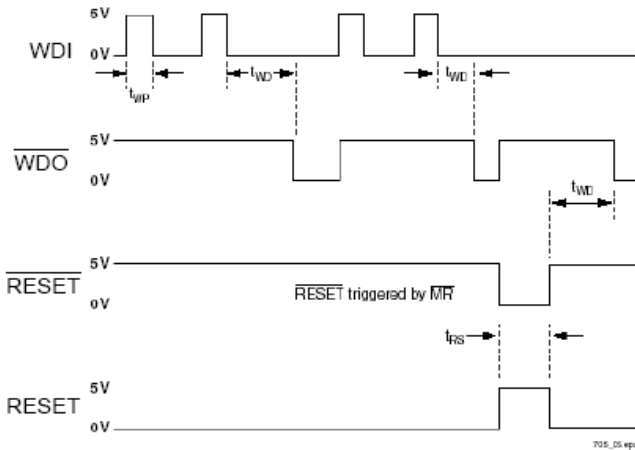


Figure 2: Watchdog Timing

### Application Information

#### Ensuring That $\overline{RESET}$ is Valid Down to $V_{CC} = 0V$

When  $V_{CC}$  falls below 1.1V, the ASM705-708  $\overline{RESET}$  output no longer pulls down; it becomes indeterminate. To avoid the possibility that stray charges build up and force  $\overline{RESET}$  to the wrong state, a pull-down resistor should be connected to the  $\overline{RESET}$  pin, thus draining such charges to ground and holding  $\overline{RESET}$  low. The resistor value is not critical. A 100k $\Omega$  resistor will pull  $\overline{RESET}$  to ground without loading it.

#### Bi-directional Reset Pin Interfacing

The ASM705/6/7/8 can interface with  $\mu P/\mu C$  bi-directional reset pins by connecting a 4.7k $\Omega$  resistor in series with the  $\overline{RESET}$  output and the  $\mu P/\mu C$  bi-directional  $\overline{RESET}$  pin.

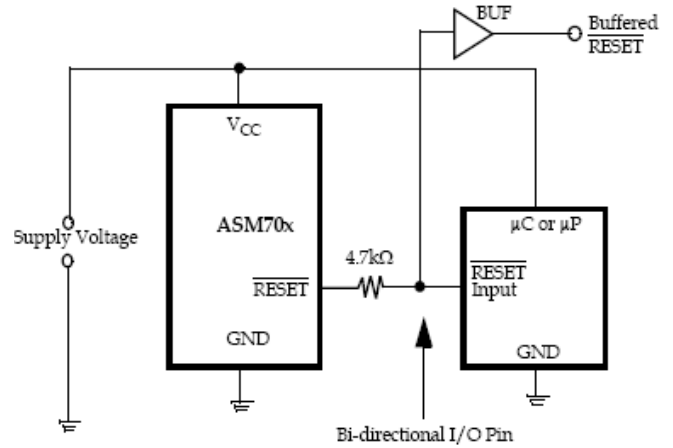


Figure 3: Bi-directional Reset Pin Interfacing

#### Monitoring Voltages Other Than $V_{CC}$

The ASM705-708 can monitor voltages other than  $V_{CC}$  using the Power Fail circuitry. If a resistive divider is connected from the voltage to be monitored to the Power Fail input (PFI), the  $\overline{PFO}$  will go LOW if the voltage at PFI goes below 1.25V reference. Should hysteresis be desired, connect a resistor (equal to approximately 10 times the sum of the two resistors in the divider) between the PFI and  $\overline{PFO}$  pins. A capacitor between PFI and GND will reduce circuit sensitivity to input high-frequency noise. If it is desired to assert a  $\overline{RESET}$  for voltages other than  $V_{CC}$  then the  $\overline{PFO}$  output is to be connected to the  $\overline{MR}$ .

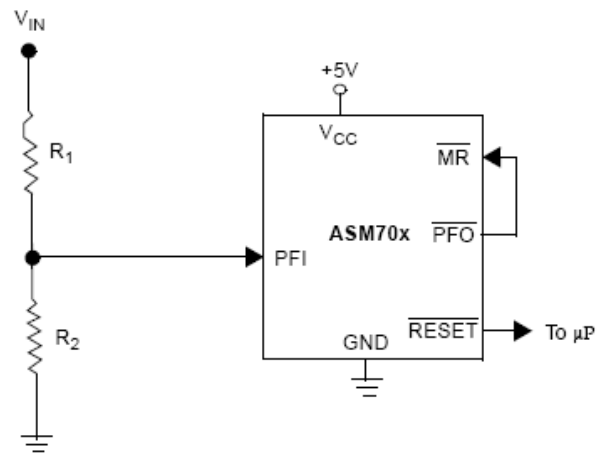


Figure 4: Monitoring +5V and an additional supply  $V_{IN}$

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**Monitoring a Negative Voltage**

The Power-Fail circuitry can also monitor a negative supply rail. When the negative rail is OK,  $\overline{\text{PFO}}$  will be LOW, and when the negative rail is failing (not negative enough),  $\overline{\text{PFO}}$  goes HIGH (the opposite of when positive voltages are monitored). To trigger a reset, these outputs need to be inverted: adding the resistors and transistor as shown achieves this. The  $\overline{\text{RESET}}$  output will then have the same sense as for positive voltages: good = HIGH, bad = LOW. It should be noted that this circuit's accuracy depends on the Vcc line, the PFI threshold tolerance, and the resistors.

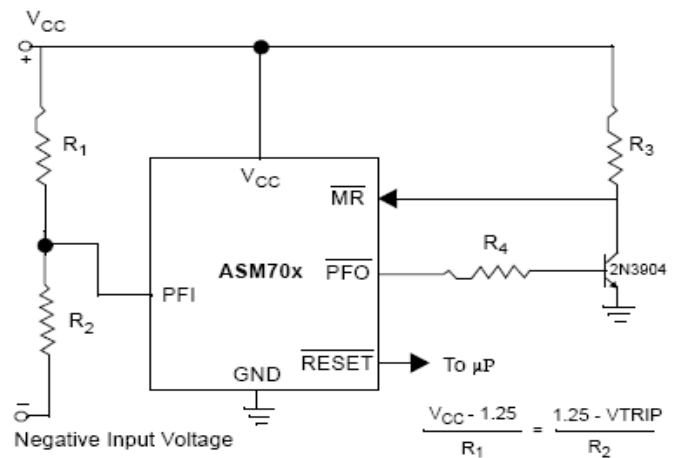


Figure 5: Monitoring a negative voltage

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**Absolute Maximum Ratings**

Parameter	Min	Max	Unit
<b>Pin Terminal Voltage with Respect to Ground</b>			
VCC	-0.3	6.0	V
All other inputs <sup>1</sup>	-0.3	VCC + 0.3	V
Input Current at VCC and GND		20	mA
Output Current: All outputs		20	mA
Rate of Rise at VCC		100	V/μs
Plastic DIP Power Dissipation (Derate 9mW/°C above 70°C)		700	mW
SO Power Dissipation (Derate 5.9mW/°C above 70°C)		470	mW
MicroSO Power Dissipation (Derate 4.1mW/°C above 70°C)		330	mW
<b>Operating Temperature Range</b>			
ASM705E/706E/707E/708E/813LE	-40	+85	°C
ASM705C/706C/707C/708C/813LC	0	70	°C
Storage Temperature Range	-65	160	°C
Lead Temperature (Soldering 10sec)		300	°C
ESD rating			
	HBM	2	KV
	MM	200	V
<p>Note:</p> <p>1. The input voltage limits of PFI and <math>\overline{MR}</math> can be exceeded if the input current is less than 10mA. These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability.</p>			

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### Electrical Characteristics

Unless otherwise noted, specifications are over the operating temperature range and VCC supply voltages are 2.7V to 5.5V (ASM706P,ASM708R), 3.0 V to 5.5V (ASM706/708S), 3.15V to 5.5V (ASM706/708T) and 4.1V to 5.5.V (ASM706/708J)

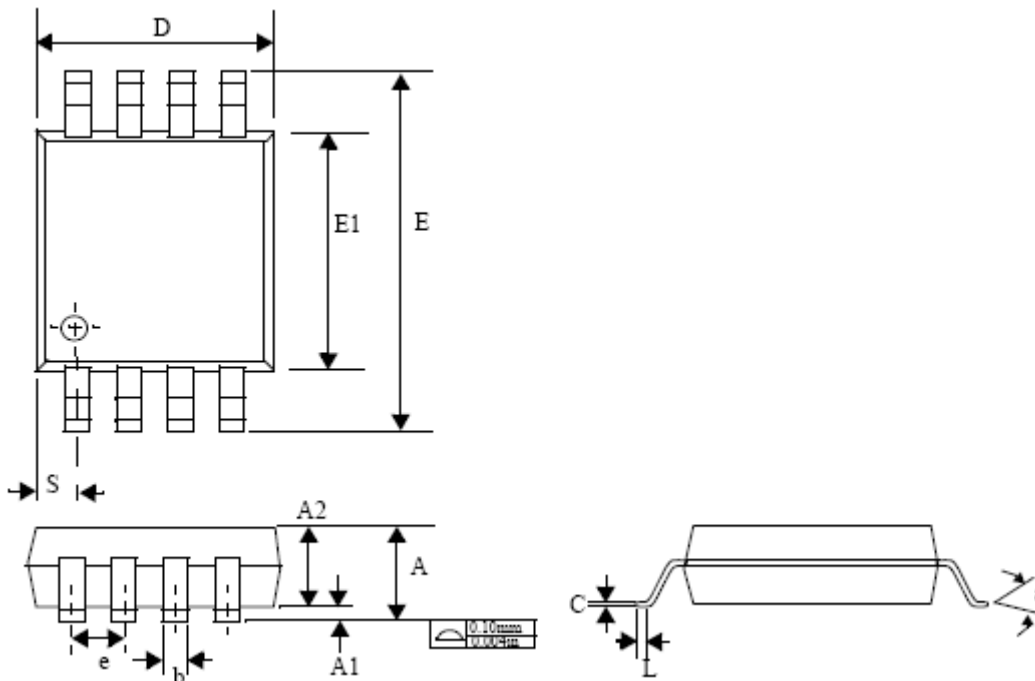
Parameter	SYMBOL	Test Conditions	Min	TYP	Max	Unit
Operating Voltage Range	V <sub>CC</sub>	ASM705/6/7/8C	1.2		5.5	V
		ASM813L	1.1		5.5	
		ASM705/6/7/8E, ASM813E	1.2		5.5	
Supply Current	I <sub>CC</sub>	ASM705/706C/813LC		75	140	μA
		ASM705E/706E/813LE		75	140	
		ASM707C/708C		50	140	
		ASM707E/708E		50	140	
RESET Threshold	V <sub>RT</sub>	ASM705/707/813L, Note 1	4.50	4.65	4.75	V
		ASM706/708 Note 1	4.25	4.40	4.50	
RESET Threshold Hysteresis		Note 1		40		mV
RESET Pulse Width	t <sub>RS</sub>	Note 1	140	200	280	ms
MR Pulse Width	t <sub>MR</sub>		0.15			μs
MR to RESET Out Delay	t <sub>MD</sub>	Note 1			0.25	μs
MR Input Threshold	V <sub>IH</sub>		2.0			V
	V <sub>IL</sub>				0.8	
MR Pullup current		MR = 0V	100	250	600	μA
RESET Output Voltage		I <sub>SOURCE</sub> = 800μA	V <sub>CC</sub> - 1.5			V
		I <sub>SINK</sub> = 3.2mA			0.4	
		ASM705/6/7/8, V <sub>CC</sub> = 1.2V, I <sub>SINK</sub> = 100μA			0.3	
RESET Output Voltage		ASM707/8/813L, I <sub>SOURCE</sub> = 800μA	V <sub>CC</sub> - 1.5			V
		ASM707/8, I <sub>SINK</sub> = 1.2mA			0.4	
		ASM813L, I <sub>SINK</sub> = 3.2mA			0.4	
		ASM813L, V <sub>CC</sub> = 1.2V, I <sub>SOURCE</sub> = 4μA		0.9		
Watchdog Timeout Period	t <sub>WD</sub>	ASM705/6/813L	1.00	1.60	2.25	S
WDI Pulse Width	t <sub>WP</sub>	V <sub>IL</sub> = 0.4V, V <sub>IH</sub> = 0.8V <sub>CC</sub> ,	50			ns
WDI Input Threshold	V <sub>IH</sub>	ASM705/706/813L, V <sub>CC</sub> = 5V	3.5		0.8	V
	V <sub>IL</sub>					
WDI Input Current		ASM705/6/813L, WDI = V <sub>CC</sub>	-150	50	150	μA
		ASM705/6/813L, WDI = 0V		-50		
WDO Output Voltage	V <sub>OH</sub>	ASM705/6/813L, I <sub>SOURCE</sub> = 800μA	V <sub>CC</sub> - 1.5			V
	V <sub>OL</sub>	ASM705/6/813L, I <sub>SINK</sub> = 1.2mA			0.4	
PFI Input Threshold		V <sub>CC</sub> = 5V	1.2	1.25	1.3	V
PFI Input Current			-25	0.01	25	nA
PFO Output Voltage	V <sub>OH</sub>	I <sub>SOURCE</sub> = 800μA	V <sub>CC</sub> - 1.5			V
	V <sub>OL</sub>	I <sub>SINK</sub> = 3.2mA			0.4	

Notes 1: RESET (ASM705/6/7/8), RESET(ASM707/8, ASM813L)



Package Dimensions

8-Pin MicroSO

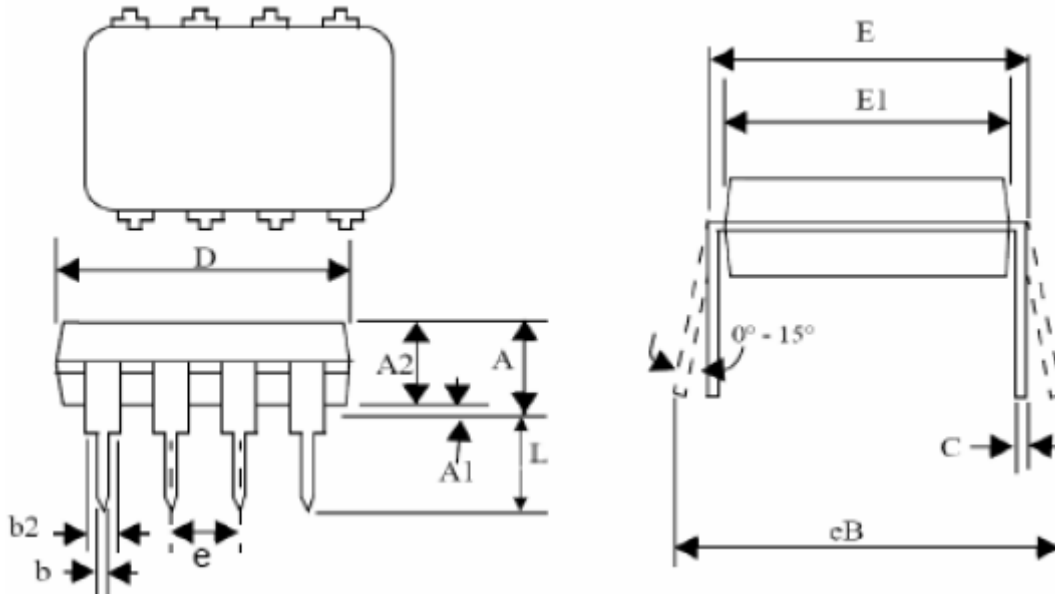


	Inches		Millimeteres	
	Min	Max	Min	Max
A	0.032	0.044	0.81	1.10
A1	0.002	0.006	0.05	0.15
A2	0.030	0.038	0.76	0.97
b	0.012 BSC		0.30 BSC	
C	0.004	0.008	0.10	0.20
D	0.114	0.122	2.90	3.10
e	0.0256 BSC		0.65 BSC	
E	0.184	0.200	4.67	5.08
E1	0.114	0.122	2.90	3.10
L	0.016	0.026	0.41	0.66
S	0.0206 BSC		0.52 BSC	
a	0°	6°	0°	6°

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Package Dimensions (contd)

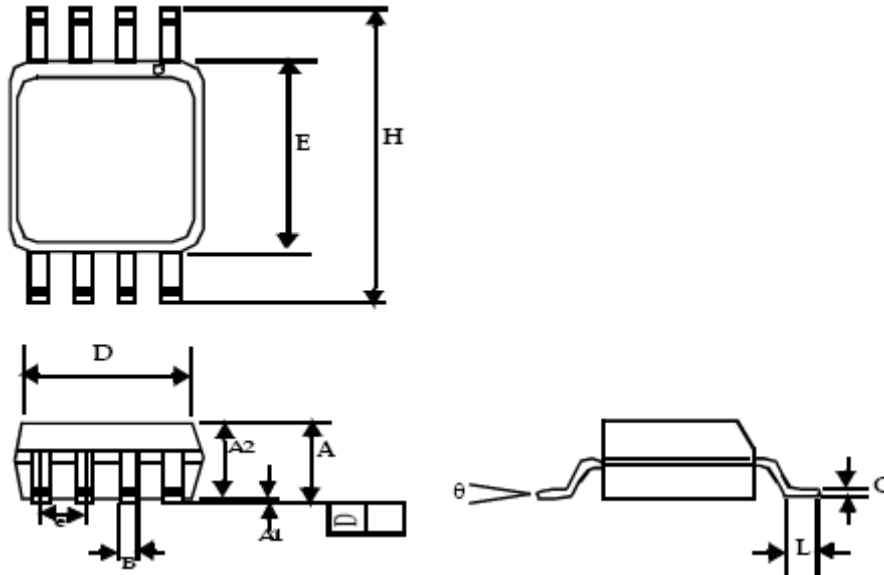
Plastic DIP (8-Pin)



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A		0.210		5.33
A1	0.015		0.38	
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.36	0.56
b2	0.045	0.070	1.14	1.78
C	0.008	0.014	0.20	0.36
D	0.355	0.400	9.02	10.16
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.10 BSC		2.54 BSC	
eB		0.430		10.92
L	0.115	0.150	2.92	3.81

Package Dimensions (contd)

SO (8-Pin)



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A1	0.004	0.010	0.10	0.25
A	0.053	0.069	1.35	1.75
A2	0.049	0.059	1.25	1.50
B	0.012	0.020	0.31	0.51
C	0.007	0.010	0.18	0.25
D	0.193 BSC		4.90 BSC	
E	0.154 BSC		3.91 BSC	
e	0.050 BSC		1.27 BSC	
H	0.236 BSC		6.00 BSC	
L	0.016	0.050	0.41	1.27
θ	0°	8°	0°	8°

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Ordering Codes

Part Number	Reset Threshold	Temperature	Pins-Package	Package Marking
<b>TIN - LEAD DEVICES</b>				
<b>ASM705 Active LOW Reset, Watchdog Output And Manual RESET</b>				
ASM705CPA	4.65	0°C to +70 °C	8-Plastic DIP	ASM705CPA
ASM705CSA	4.65	0°C to +70 °C	8-SO	ASM705CSA
ASM705CUA	4.65	0°C to +70 °C	8-MicroSO	ASM705CUA
ASM705EPA	4.65	-40°C to +85°C	8-Plastic DIP	ASM705EPA
ASM705ESA	4.65	-40°C to +85°C	8-SO	ASM705ESA
ASM705EUA	4.65	-40°C to +85°C	8-MicroSO	ASM705EUA
<b>ASM706 Active LOW Reset, Watchdog Output And Manual RESET</b>				
ASM706CPA	4.40	0°C to +70 °C	8-Plastic DIP	ASM706CPA
ASM706CSA	4.40	0°C to +70 °C	8-SO	ASM706CSA
ASM706CUA	4.40	0°C to +70 °C	8-MicroSO	ASM706CUA
ASM706EPA	4.40	-40°C to +85°C	8-Plastic DIP	ASM706EPA
ASM706ESA	4.40	-40°C to +85°C	8-SO	ASM706ESA
<b>ASM707 Active LOW &amp; HIGH Reset with Manual RESET</b>				
ASM707CPA	4.65	0°C to +70 °C	8-Plastic DIP	ASM707CPA
ASM707CSA	4.65	0°C to +70 °C	8-SO	ASM707CSA
ASM707CUA	4.65	0°C to +70 °C	8-MicroSO	ASM707CUA
ASM707EPA	4.65	-40°C to +85°C	8-Plastic DIP	ASM707EPA
ASM707ESA	4.65	-40°C to +85°C	8-SO	ASM707ESA
<b>ASM708Active LOW &amp; HIGH Reset with Manual RESET</b>				
ASM708CPA	4.40	0°C to +70 °C	8-Plastic DIP	ASM708CPA
ASM708CSA	4.40	0°C to +70 °C	8-SO	ASM708CSA
ASM708CUA	4.40	0°C to +70 °C	8-MicroSO	ASM708CUA
ASM708EPA	4.40	-40°C to +85°C	8-Plastic DIP	ASM708EPA
ASM708ESA	4.40	-40°C to +85°C	8-SO	ASM708ESA
<b>ASM813L Active HIGH Reset, Watchdog Output And Manual RESET</b>				
ASM813LCPA	4.65	0°C to +70 °C	8-Plastic DIP	ASM813LCPA
ASM813LCSA	4.65	0°C to +70 °C	8-SO	ASM813LCSA
ASM813LCUA	4.65	0°C to +70 °C	8-MicroSO	ASM813LCUA
ASM813LEPA	4.65	-40°C to +85°C	8-Plastic DIP	ASM813LEPA
ASM813LESA	4.65	-40°C to +85°C	8-SO	ASM813LESA

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Ordering Codes

Part Number	Reset Threshold	Temperature	Pins-Package	Package Marking
<b>LEAD FREE DEVICES</b>				
<b>ASM705 Active LOW Reset, Watchdog Output And Manual RESET</b>				
ASM705CPAF	4.65	0°C to +70 °C	8-Plastic DIP	ASM705CPAF
ASM705CSAF	4.65	0°C to +70 °C	8-SO	ASM705CSAF
ASM705CUAF	4.65	0°C to +70 °C	8-MicroSO	ASM705CUAF
ASM705EPAF	4.65	-40°C to +85°C	8-Plastic DIP	ASM705EPAF
ASM705ESAF	4.65	-40°C to +85°C	8-SO	ASM705ESAF
ASM705EUAF	4.65	-40°C to +85°C	8-MicroSO	ASM705EUAF
<b>ASM706 Active LOW Reset, Watchdog Output And Manual RESET</b>				
ASM706CPAF	4.40	0°C to +70 °C	8-Plastic DIP	ASM706CPAF
ASM706CSAF	4.40	0°C to +70 °C	8-SO	ASM706CSAF
ASM706CUAF	4.40	0°C to +70 °C	8-MicroSO	ASM706CUAF
ASM706EPAF	4.40	-40°C to +85°C	8-Plastic DIP	ASM706EPAF
ASM706ESAF	4.40	-40°C to +85°C	8-SO	ASM706ESAF
<b>ASM707 Active LOW &amp; HIGH Reset with Manual RESET</b>				
ASM707CPAF	4.65	0°C to +70 °C	8-Plastic DIP	ASM707CPAF
ASM707CSAF	4.65	0°C to +70 °C	8-SO	ASM707CSAF
ASM707CUAF	4.65	0°C to +70 °C	8-MicroSO	ASM707CUAF
ASM707EPAF	4.65	-40°C to +85°C	8-Plastic DIP	ASM707EPAF
ASM707ESAF	4.65	-40°C to +85°C	8-SO	ASM707ESAF
<b>ASM708 Active LOW &amp; HIGH Reset with Manual RESET</b>				
ASM708CPAF	4.40	0°C to +70 °C	8-Plastic DIP	ASM708CPAF
ASM708CSAF	4.40	0°C to +70 °C	8-SO	ASM708CSAF
ASM708CUAF	4.40	0°C to +70 °C	8-MicroSO	ASM708CUAF
ASM708EPAF	4.40	-40°C to +85°C	8-Plastic DIP	ASM708EPAF
ASM708ESAF	4.40	-40°C to +85°C	8-SO	ASM708ESAF
<b>ASM813L Active HIGH Reset, Watchdog Output And Manual RESET</b>				
ASM813LCPAF	4.65	0°C to +70 °C	8-Plastic DIP	ASM813LCPAF
ASM813LCSAF	4.65	0°C to +70 °C	8-SO	ASM813LCSAF
ASM813LCUAF	4.65	0°C to +70 °C	8-MicroSO	ASM813LCUAF
ASM813LEPAF	4.65	-40°C to +85°C	8-Plastic DIP	ASM813LEPAF
ASM813LESASF	4.65	-40°C to +85°C	8-SO	ASM813LESASF

Note:  
For parts to be packed in Tape and Reel, add "-T" at the end of the part number.

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rev 1.6

**Feature Summary**

	ASM705	ASM706	ASM707	ASM708	ASM813L
Power fail detector	◆	◆	◆	◆	◆
Brownout detection	◆	◆	◆	◆	◆
Manual RESET input	◆	◆	◆	◆	◆
Power-up/down RESET	◆	◆	◆	◆	◆
Watchdog Timer	◆	◆			◆
Active HIGH RESET output			◆	◆	◆
Active LOW RESET output	◆	◆	◆	◆	
RESET Threshold (V)	4.65	4.40	4.65	4.40	4.65



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ASM813L  
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