Supply Voltage Supervisor w/Watchdog Input and Manual Reset

UM706xS *SOP8*
UM708xS *SOP8*

General Description

The UM706xS/UM708xS series are cost effective system power supply supervisory circuits designed to monitor the power supplies in digital systems.
The UM706xS provides power-supply monitoring circuitry that generates a reset output during power-up, power-down, and brownout conditions. The reset output remains operational with V_{CC} as low as 1V. Independent watchdog monitoring circuitry is also provided. This is activated if the watchdog input has not been toggled within 1.6 seconds. In addition, there is a 1.25V threshold detector for power-fail warning, low battery detection, or to monitor an additional power supply. An active low debounced manual reset input is also included.
The UM708xS is the same as the UM706xS, except an active-high reset is substituted for the watchdog timer. All parts are available in a small outline SOP8 package.

Applications

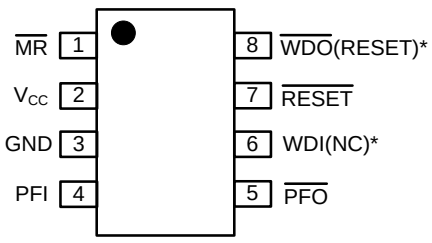
- Applications using DSPs, Microcontrollers or Microprocessors
- Programmable Controls
- Computers
- Embedded System
- Industrial Equipments
- Intelligent Instrument
- Wireless Communications Systems

Features

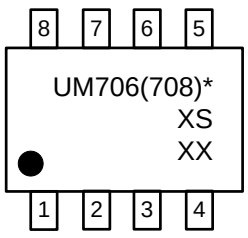
- Wide Operation Voltage Range of 1V to 5.5V
- Correct Logic Output Guaranteed to V_{CC}=1.0V
- Precision Supply-Voltage Monitor: 2.63V, 2.93V, 3.08V,4.38V,4.63V
- 200ms Reset Pulse Width
- Independent Watchdog Timer-1.6s Timeout (UM706xS)
- Active-high Reset Output (UM708xS)
- Voltage Monitor for Power-Fail or Low-Battery Warning
- Temperature Range: -40℃ to +85℃
- Supply Current of 80μA (Typ.)

Pin Configurations

Top View



UM706xS
( )* for UM708xS



XX: Week Code
( )* for UM708xS

Ordering Information

Part Number	Top Marking	RESET Threshold (V)	Timeout Period (ms)	Package Type
UM706LS	UM706LS	4.63	240	SOP8
UM706MS	UM706MS	4.38	240	
UM706TS	UM706TS	3.08	240	
UM706SS	UM706SS	2.93	240	
UM706RS	UM706RS	2.63	240	
UM708LS	UM708LS	4.63	240	
UM708MS	UM708MS	4.38	240	
UM708TS	UM708TS	3.08	240	
UM708SS	UM708SS	2.93	240	
UM708RS	UM708RS	2.63	240	

Typical Application Circuit

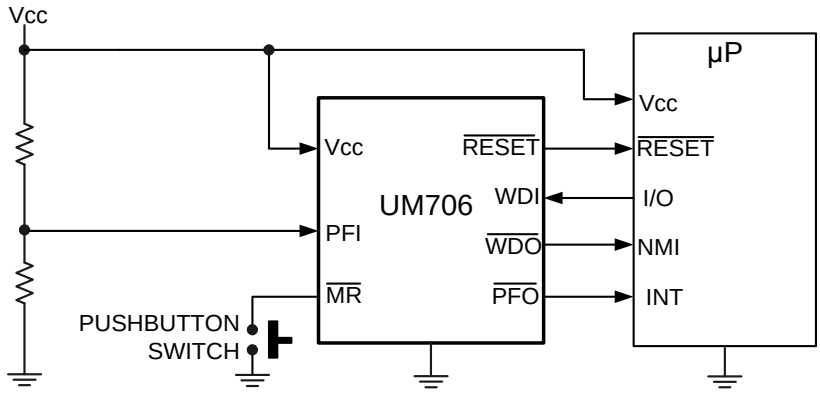


Figure 1. UM706xS Application Circuit

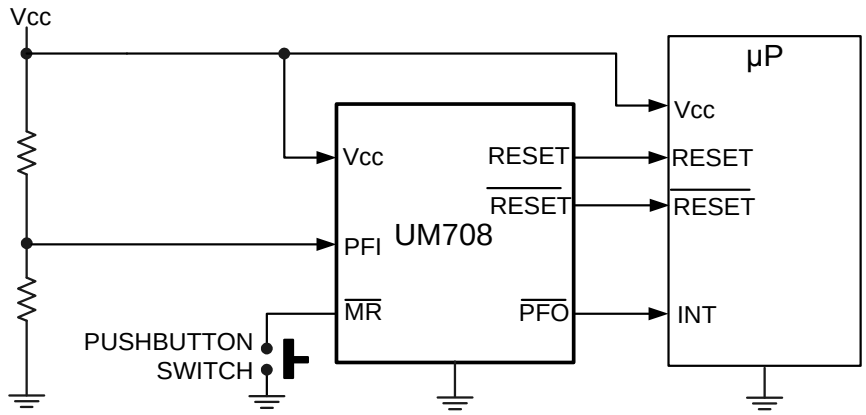


Figure 2. UM708xS Application Circuit

Pin Description

Pin Number	Pin Name		Function
1	$\overline{MR}$		Manual-Reset Input triggers a reset pulse when pulled below 0.8V. This active-low input has an internal 250μA 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}		Supply Input
3	GND		Ground Reference for all signals.
4	PFI		Power-Fail Voltage Monitor Input. When PFI is less than 1.25V, $\overline{PFO}$ goes low. Connect PFI to GND or V_{CC} when not used.
5	$\overline{PFO}$		Power-Fail Output goes low and sinks current when PFI is less than 1.25V; otherwise $\overline{PFO}$ stays high.
6	UM706	WDI	Watchdog Input. If WDI remains either high or low for longer than the watchdog timeout period, the $\overline{WDO}$ goes low. The timer resets with each transition at the WDI input. Either a high-to-low or a low-to-high transition clears the counter. The internal timer is also cleared whenever reset is asserted.
	UM708	NC	No Connect
7	$\overline{RESET}$		Active-Low Reset Output pulses low for 200ms when trigged, 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 $\overline{MR}$ goes from Low to High.
8	UM706	$\overline{WDO}$	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. $\overline{WDO}$ also goes low during low-line conditions. Whenever V_{CC} is below the reset threshold, $\overline{WDO}$ stays low; however, unlike $\overline{RESET}$, $\overline{WDO}$ does not have a minimum pulse width. As soon as V_{CC} rises above the reset threshold, $\overline{WDO}$ goes high with no delay.
	UM708	RESET	Active-High Reset Output is the inverse of $\overline{RESET}$. Whenever RESET is high, $\overline{RESET}$ is low, and vice versa.

Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.3 to +6.0	V
	RESET, $\overline{RESET}$ (push-pull)	-0.3 to V_{CC} +0.3	V
I_{CC}	Input Current, V_{CC}	20	mA
I_O	Output Current, RESET, $\overline{RESET}$	20	mA
	Rate of Rise, V_{CC}	100	V/μs
P_D	Continuous Power Dissipation	471	mW
T_J	Operating Junction Temperature	-40 to +105	℃
T_{STG}	Storage Temperature Range	-65 to +150	℃
	Lead Temperature (soldering, 10s)	300	℃

Note 1: Stresses beyond those listed under "Absolute maximum Ratings" may cause permanent damage to the device.

Electrical Characteristics

V_{CC} = full range, T_A = -40℃ to +85℃, unless otherwise noted. Typical values are at T_A =+25℃, V_{CC} = 5V for L/M versions, V_{CC} = 3.3V for T/S versions, and V_{CC} = 3V for R version. (Note 2)

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
V_{CC}	V_{CC} Range	T_A=0℃ to + 70℃		1.0		5.5	V
		T_A=-40℃ to + 85℃		1.2		5.5	
I_{CC}	Supply Current	T_A=-40℃ to + 85℃			80	150	μA
V_{TH}	Reset Threshold	UM706L/ UM708L	T_A=+25℃	4.56	4.63	4.70	V
			T_A=-40℃ to + 85℃	4.50		4.75	
		UM706M/ UM708M	T_A=+25℃	4.31	4.38	4.45	
			T_A=-40℃ to + 85℃	4.25		4.50	
		UM706T/ UM708T	T_A=+25℃	3.04	3.08	3.11	
			T_A=-40℃ to + 85℃	3.00		3.15	
		UM706S/ UM708S	T_A=+25℃	2.89	2.93	2.96	
			T_A=-40℃ to + 85℃	2.85		3.00	
		UM706R/ UM708R	T_A=+25℃	2.59	2.63	2.66	
			T_A=-40℃ to + 85℃	2.55		2.70	
	Reset Threshold Hysteresis				40		mV
t_{RS}	Reset Pulse Width			140	200	280	ms

Note 2: Production testing done at T_A = +25℃; limits over temperature guaranteed by design only.

Electrical Characteristics (Continued)

V_{CC} = full range, T_A = -40℃ to +85℃, unless otherwise noted. Typical values are at T_A =+25℃, V_{CC} = 5V for L/M versions, V_{CC} = 3.3V for T/S versions, and V_{CC} = 3V for R version. (Note 2)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{OL}	RESET /$\overline{\text{RESET}}$ Output Voltage Low	I_{SINK}=1.2mA, (for R/S/T versions)			0.3	V
		I_{SINK}=3.2mA, (for L/M versions)			0.4	
		V_{CC} = 1.2V, I_{SINK} = 100μA			0.3	
V_{OH}	RESET/ $\overline{\text{RESET}}$ Output Voltage High	I_{SOURCE} = 800μA	V_{CC}-1.5			V
	$\overline{\text{MR}}$ Pull-Up Current	$\overline{\text{MR}}$=0V	100	250	600	μA
t_{MR}	$\overline{\text{MR}}$ Pulse Width		150			ns
	$\overline{\text{MR}}$ Input Threshold, Low				0.8	V
	$\overline{\text{MR}}$ Input Threshold, High		2.0			V
t_{MD}	$\overline{\text{MR}}$ to Reset Out Delay				250	ns
	PFI Input Threshold	V_{CC}=5V	1.20	1.25	1.30	V
	PFI Input Current		-25	0.01	+25	nA
	$\overline{\text{PFO}}$ Output Voltage	I_{SOURCE}=800μA	Vcc-1.5			V
		I_{SINK}=3.2mA			0.4	
Watchdog function for UM706						
t_{WD}	Watchdog Timeout Period		1.0	1.6	2.25	s
t_{WP}	WDI Pulse Width	V_{IL}=0.4V,V_{IH}=0.8Vcc	50			ns
	WDI Input Threshold Low	V_{CC}=5V			0.8	V
	WDI Input Threshold High	V_{CC}=5V	3.5			V
	WDI Input Current	WDI=V_{CC}		50	150	μA
		WDI=0V	-150	-50		
	WDO Output Voltage High	I_{SOURCE}=800μA	Vcc-1.5			V
	WDO Output Voltage Low	I_{SINK}=1.2mA			0.4	V

Note 2: Production testing done at T_A = +25℃; limits over temperature guaranteed by design only.

Block Diagram

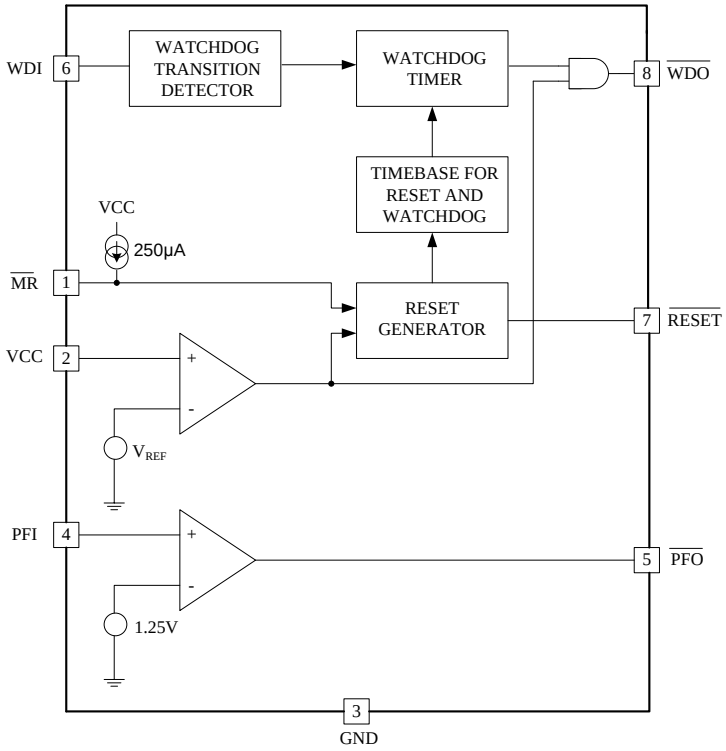


Figure 3. UM706xS Block Diagram

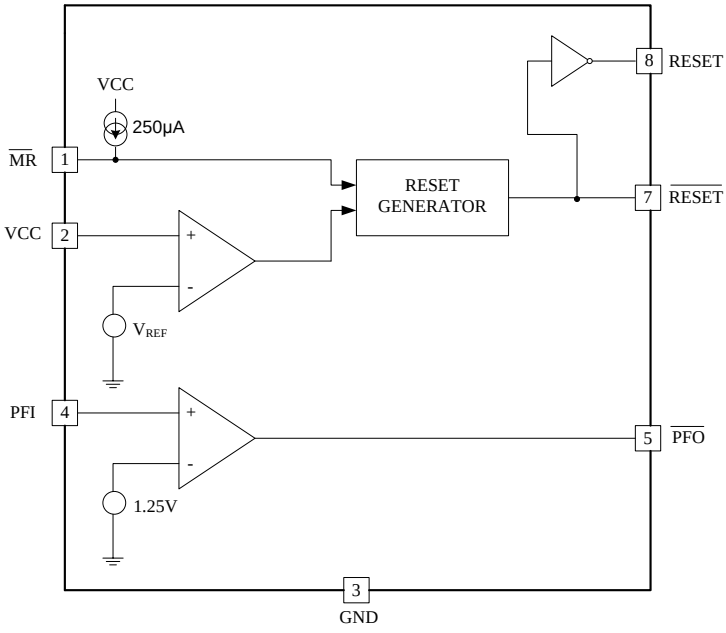
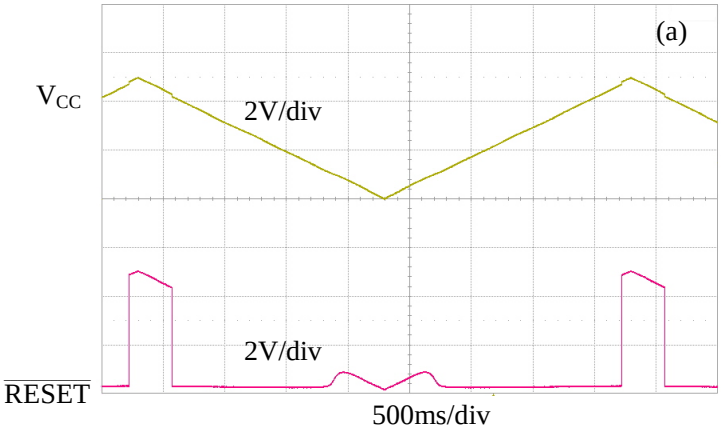


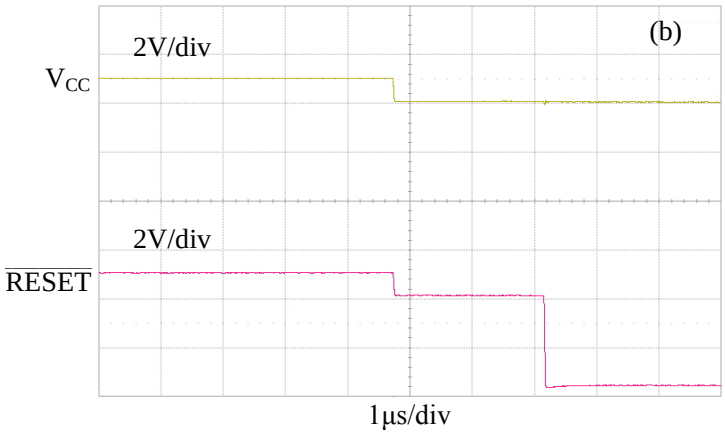
Figure 4. UM708xS Block Diagram

Typical Operating Characteristics

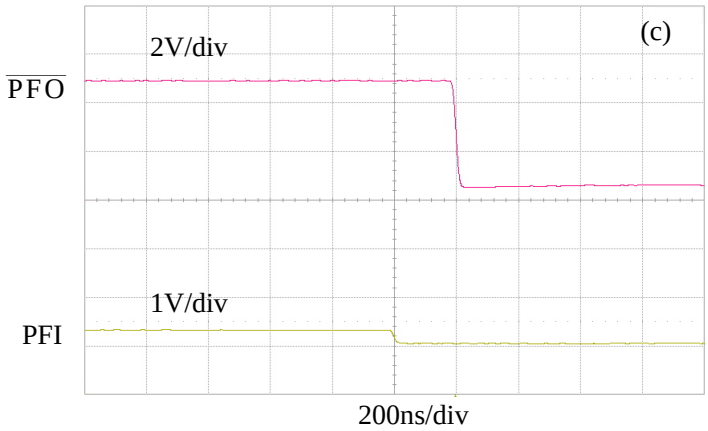
$\overline{\text{RESET}}$ Output Voltage vs. Supply Voltage



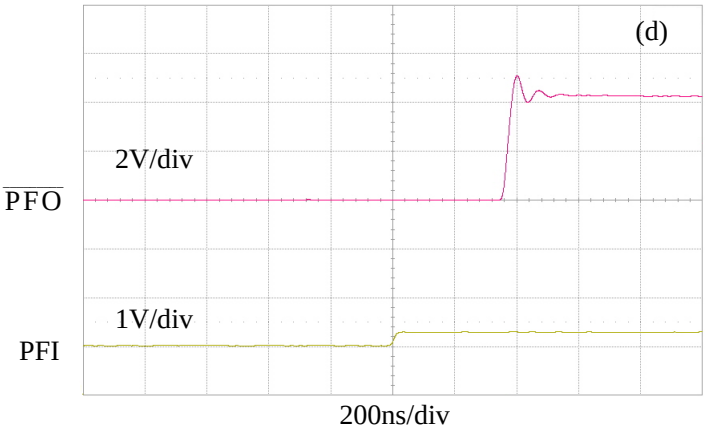
$\overline{\text{RESET}}$ Response Time

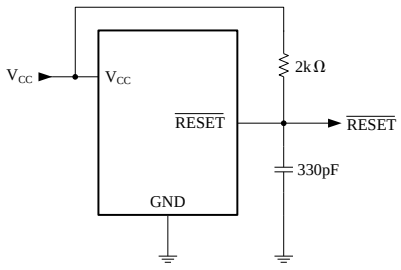


Power-fail Comparator Assertion Response Time

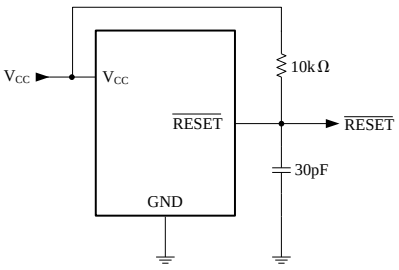


Power-fail Comparator De-assertion Response Time





(a)



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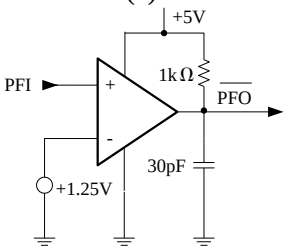

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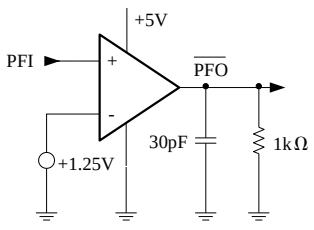
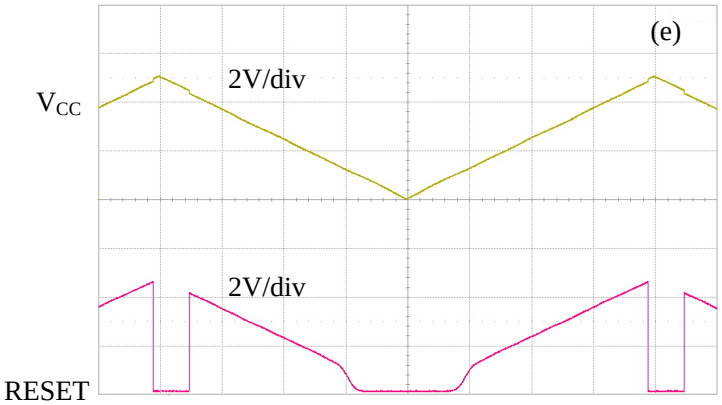


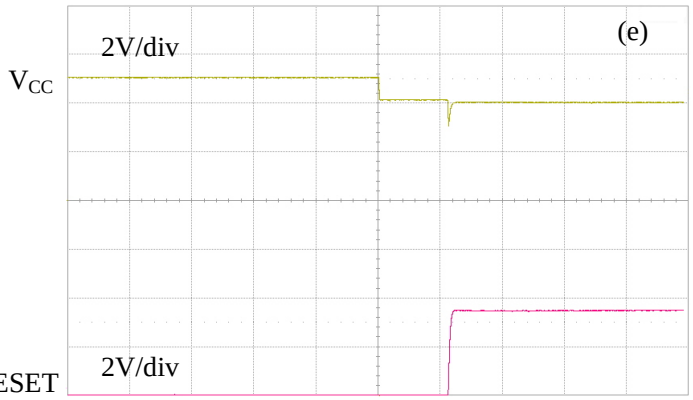
(d)

Typical Operating Characteristics

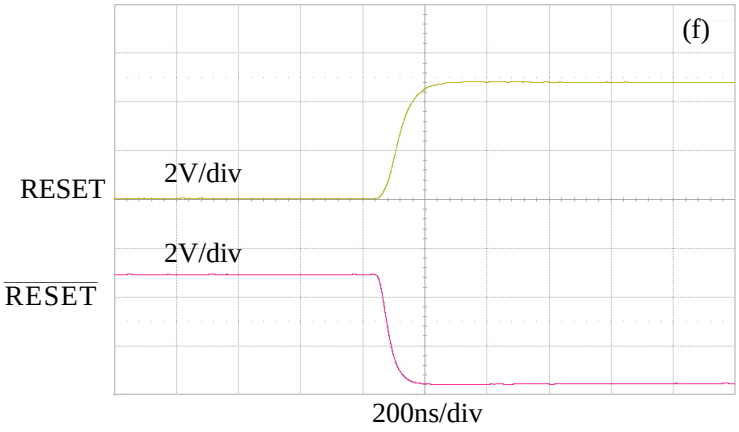
RESET Output Voltage vs. Supply Voltage



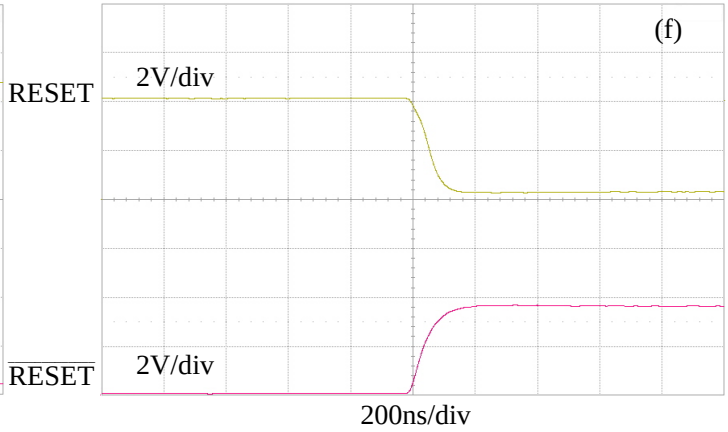
RESET Response Time

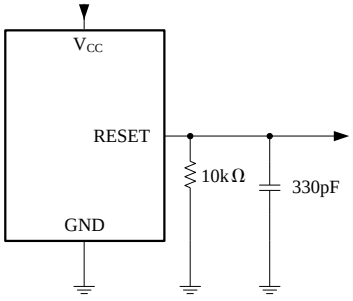


RESET, $\overline{\text{RESET}}$ Assertion



RESET, $\overline{\text{RESET}}$ De-assertion





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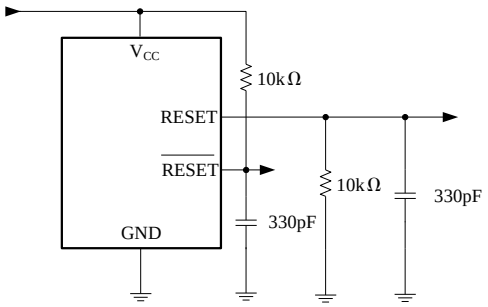


(f)

Detailed Description

Power-Fail Reset

The reset output provides a reset signal to the microprocessor whenever the V_{CC} input is below the threshold. An internal timer holds the reset output active for 200ms after the voltage on V_{CC} rises above the threshold. This is intended as a power-on reset signal for the microprocessor. It allows time for both the power supply and the microprocessor to stabilize after power-up. If a power supply brownout or interruption occurs, the reset line is similarly activated and remains active for 200ms after the supply recovers. If another interruption occurs during an active reset period, the reset timeout period continues for an additional 200ms.

The reset output is guaranteed to remain valid with V_{CC} as low as 1V. This ensures that the microprocessor is held in a stable shutdown condition as the power supply starts up.

The UM706xS provides an active low $\overline{\text{RESET}}$ signal while the UM708xS provides an active high RESET signal as well as active low $\overline{\text{RESET}}$ signal.

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 driver, choose the voltage divider ratio so that the voltage at PFI falls below 1.25V just before the regulator drops out. Use $\overline{\text{PFO}}$ to interrupt the μP so it can prepare for an orderly power-down.

Manual Reset

The Manual-Reset input ($\overline{\text{MR}}$) allows reset to be trigged 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. If unused, $\overline{\text{MR}}$ input can be tied high or left floating.

Watchdog Timer

The UM706xS watchdog timer circuit is used to monitor the activity of the microprocessor to check that it is not stalled in an indefinite loop. An output line on the processor is used to toggle the watchdog input (WDI). If this line is not toggled within 1.6sec, $\overline{\text{WDO}}$ goes low. $\overline{\text{WDO}}$ is connected to the non-maskable interrupt input (NMI) of a μP. Therefore, if the watchdog timer times out, an interrupt is generated. The interrupt service routine is used to rectify the problem.

The watchdog timer is cleared either by a high-to-low or by a low-to-high transition on WDI. Pulses as narrow as 50ns are detected. The timer is also cleared by RESET/$\overline{\text{RESET}}$ going active. Therefore, the watchdog timeout period begins after reset goes inactive.

When V_{CC} falls below the reset threshold, $\overline{\text{WDO}}$ is forced low whether or not the watchdog timer has timed out. Normally, this generates an interrupt, but it is overridden by RESET/$\overline{\text{RESET}}$ going active.

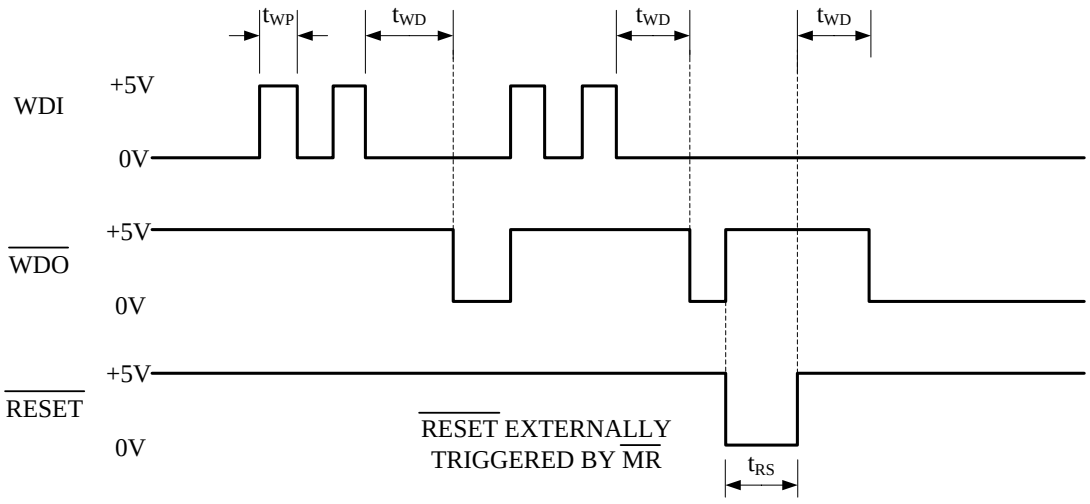


Figure 5. Watchdog and Reset Timing

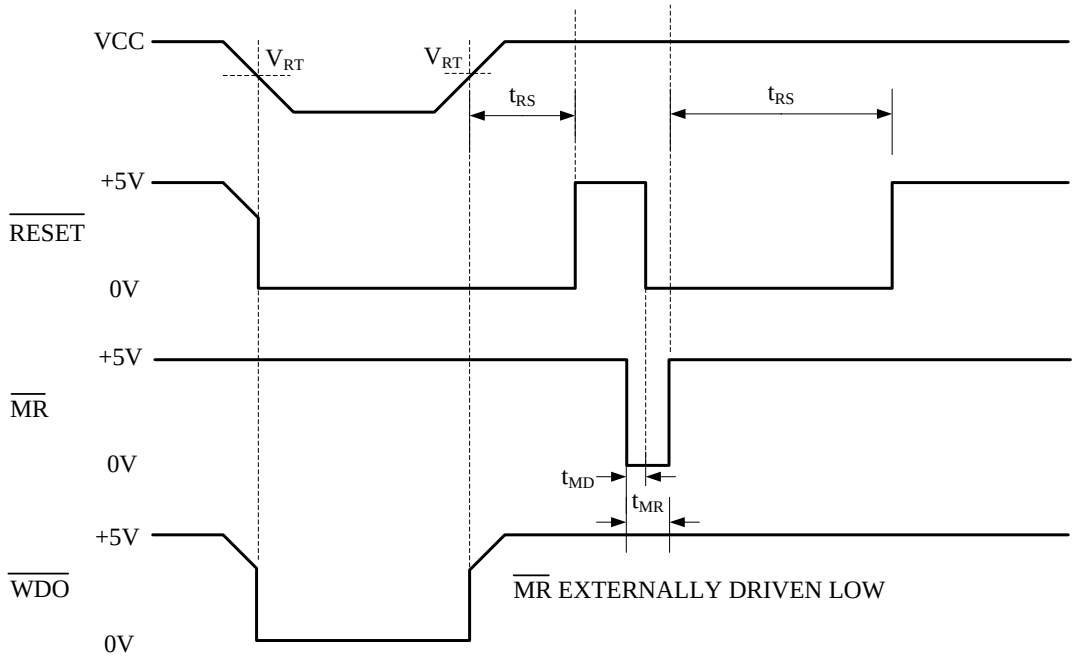


Figure 6. Reset, Manual Reset and Watchdog Timing

Applications Information

Valid $\overline{\text{RESET}}$ below 1V V_{CC}

The UM706xS/UM708xS are guaranteed to provide a valid reset level with V_{CC} as low as 1V. When V_{CC} falls below 1V, the internal transistor does not have sufficient drive to hold it on so the voltage on $\overline{\text{RESET}}$ is no longer held at 0V. If a pull-down resistor is added to the $\overline{\text{RESET}}$ pin as shown in Figure 7, any stray charge or leakage current will be drained to ground, holding $\overline{\text{RESET}}$ low. Resistor value (R1) is not critical. It should be about 100kΩ, large enough not to load $\overline{\text{RESET}}$ and small enough to pull $\overline{\text{RESET}}$ to ground.

Monitoring Additional Supply Levels

It is possible to use the power-fail comparator to monitor a second supply as shown in figure 8. The two sensing resistors, R1 and R2, are selected such that the voltage on PFI drops below 1.25V at the minimum acceptable input supply. The $\overline{\text{PFO}}$ output can be connected to the $\overline{\text{MR}}$ input so that a reset is generated when the supply drops out of tolerance. In this case, if either supply drops out of tolerance, a reset is generated.

Monitoring a Negative Voltage

The power-fail comparator can also monitor a negative supply rail (Figure 9). 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, theUM706xS/UM708xS will keep reset asserted ($\overline{\text{RESET}}$ = low, RESET = high). Note that this circuit's accuracy depends on the PFI threshold tolerance, the V_{CC} line, and the resistors.

Microprocessor with Bidirectional Reset

To prevent contention for microprocessors with a bidirectional reset line, a current limiting resistor is to be inserted between the $\overline{\text{RESET}}$ output pin and the microprocessor reset pin. This limits the current to a safe level if there are conflicting output reset levels. A suitable resistor value is 4.7kΩ. I f the reset output is required for other uses, it should be buffered as shown in figure 10.

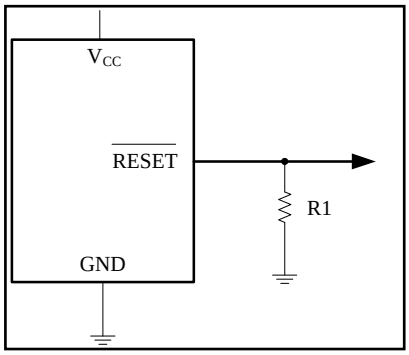


Figure 7. Reset Valid to Ground Circuit

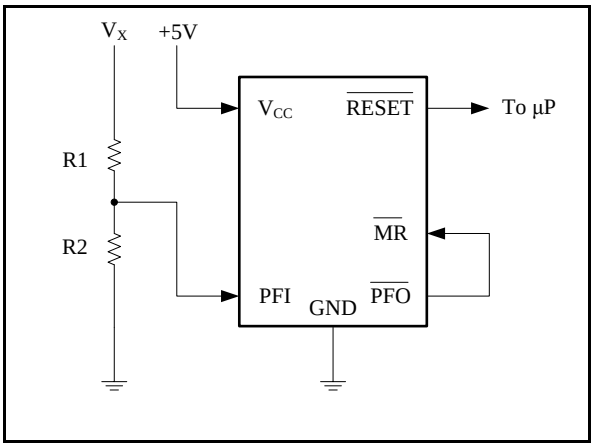


Figure 8. Monitoring an Additional Supply V_X

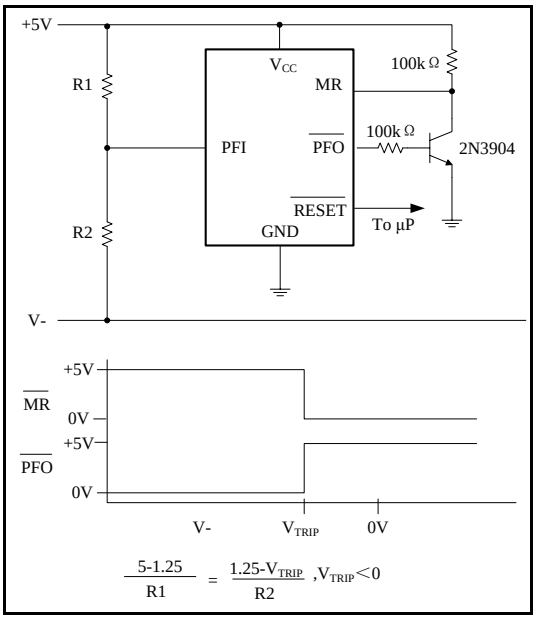


Figure 9. Monitoring a Negative Voltage

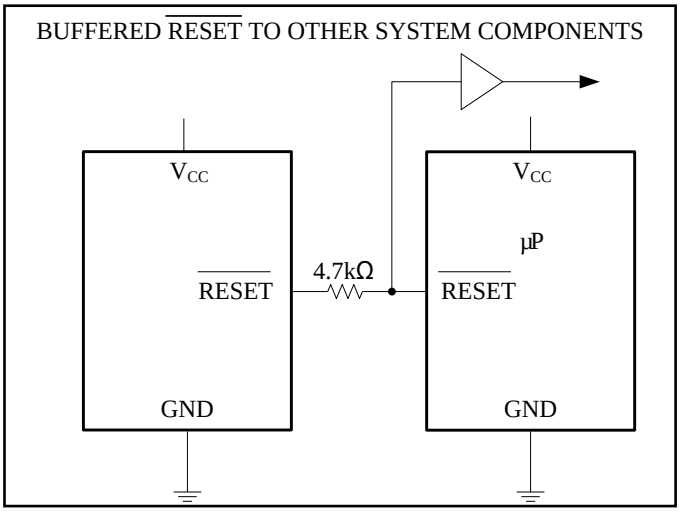
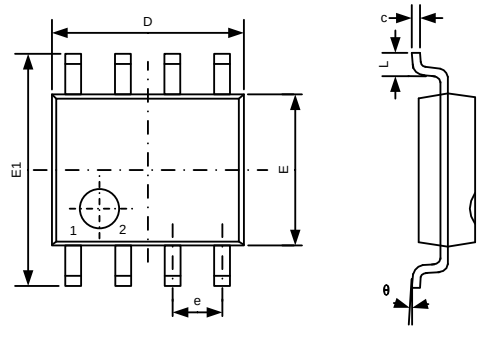


Figure 10. Bidirectional Reset I/O

Package Information

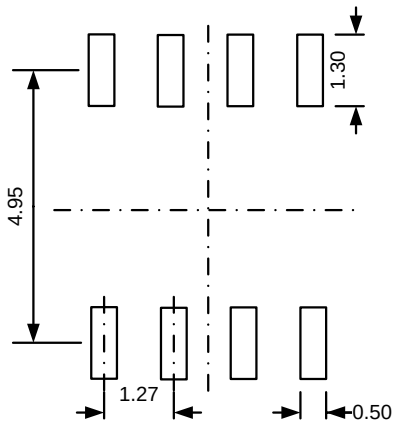
UM706xS SOP8

Outline Drawing



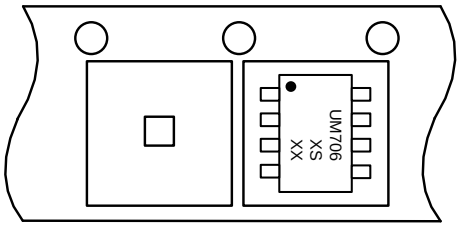
DIMENSIONS				
Symbol	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.33	0.51	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0 °	8 °	0 °	8 °

Land Pattern



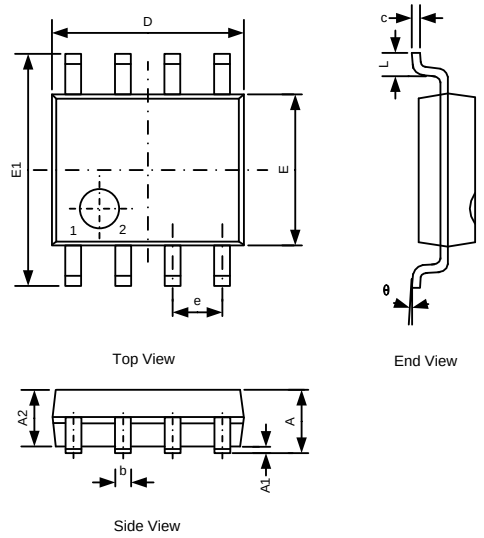
NOTES:
1. Compound dimension: 4.90×3.90；
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



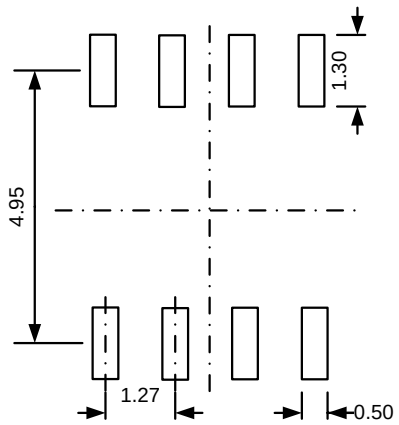
UM708xS SOP8

Outline Drawing



Symbol	DIMENSIONS			
	MILLIMETERS		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	0.33	0.51	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 °

Land Pattern



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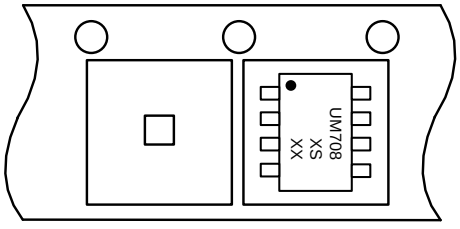
Tape and Reel Orientation



IMPORTANT NOTICE

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