µP Supervisory Circuit

General Description

The ASM161 and ASM162 are cost effective, low power supervisory circuits that monitor power supplies in microprocessor, microcontroller and digital systems. If the power supply drops below the reset threshold level, a reset is asserted and remains asserted for atleast 800ms after V_{CC} has risen above the reset threshold. An improved manual reset architecture gives the system designer additional flexibility.

The debounced manual reset input is negative edge triggered. The reset pulse period generated by a $\overline{MR}$ transition is a minimum of 800 ms and a maximum of 2 sec duration. In addition, The $\overline{MR}$ input signal is blocked for an additional 49µS minimum after the reset pulse ends. During the $\overline{MR}$ disable period, the microcontroller is guaranteed a time period free of additional manual reset signals. During this period DRAM contents can be refreshed or other critical system tasks undertaken. Low power consumption makes the ASM161/162 ideal for use in portable and battery operated equipments. With 3V supplies power consumption is 8µW typically and 30µW maximum. The ASM161 has an open-drain, active-LOW $\overline{RESET}$ output and requires an external pull-up resistor. The ASM162 has an active HIGH RESET output.

The ASM161/162 are offered in compact 4-pin SOT-143 packages. No external components are required to trim threshold voltage for monitoring different supply voltages. With six different factory set, reset, threshold ranges from 2.63V to 4.63V, the ASM161/162 are suitable for monitoring 5V, 3.6V and 3.0V supplies. The ASM161/162 are available in temperature ranges 0^0 to 70^0c and -40^0c to $+85^0$c.

Reset Threshold	
Part Suffix	**Voltage (V)**
L	4.63
M	4.38
J	4.00
T	3.08
S	2.93
R	2.63

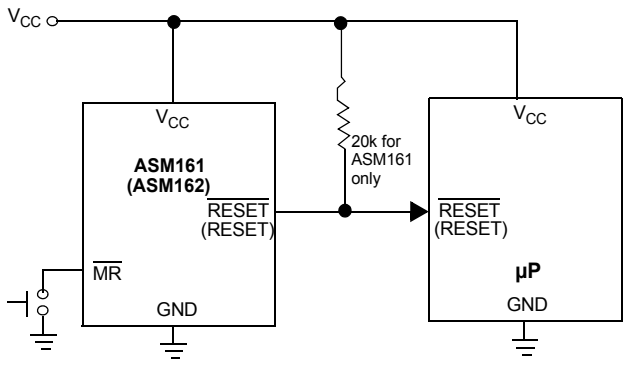
Key Features

- Edge triggered manual reset input
- single pulse output
- 49µS minimum $\overline{MR}$ disable period after reset
- CMOS/TTL logic or switch interface
- Debounced input
- Low supply current extends battery life
  - 6µA / 15µA typ/max at 5.5V
  - 4.5µA / 10µA typ/max at 3.6V
- Long reset period
  - 0.8 sec minimum, 2 sec maximum
- Two reset polarity options
  - ASM161: Active LOW, open-drain
  - ASM162: Active HIGH
- Pinout matches the AS811/812
- Small 4-Pin SOT-143 package
- Two temperature ranges: 0^0 to 70^0c and -40^0c to $+85^0$c

Applications

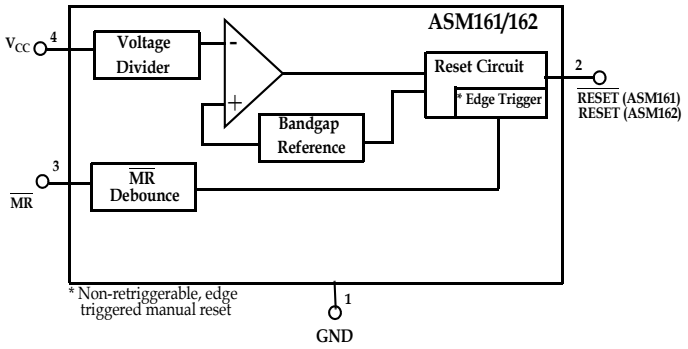
- PDAs
- Appliances
- Computers and embedded controllers
- Wireless communication systems
- Battery operated and intelligent instruments
- Automotive systems
- Safety systems

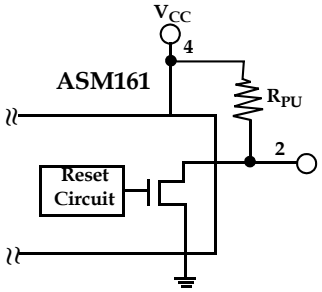
Typical Operating Circuit



rev 1.0

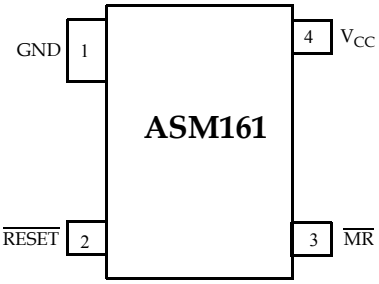
Block Diagram



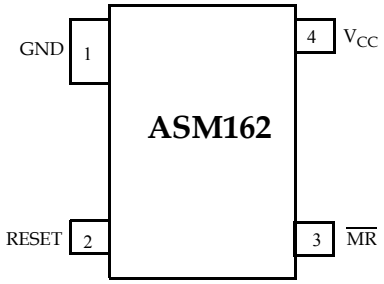


Pin Configuration

SOT-143



SOT-143



$\overline{\text{RESET}}$ is open drain

Pin Description

Pin #		Pin Name	Description
ASM161	ASM162		
1	1	GND	Ground.
2	-	$\overline{\text{RESET}}$	Active-LOW, open-drain reset output. $\overline{\text{RESET}}$ remains LOW while V_{CC} is below the reset threshold and for 800ms minimum after V_{CC} rises above the reset threshold. An external pull-up resistor is needed.
-	2	RESET	Active HIGH reset output. RESET remains HIGH while V_{CC} is below the reset threshold and for 800ms after V_{CC} rises above the reset threshold.
3	3	$\overline{\text{MR}}$	Manual reset input. A negative going edge transition on $\overline{\text{MR}}$ asserts reset. Reset remains asserted for one reset time-out period (800 ms min). This active-LOW input has an internal pull-up resistor. It can be driven from a TTL or CMOS logic line or shorted to ground with a switch. Leave open if unused.
4	4	V_{CC}	Power supply input voltage.

Detailed Descriptions

The reset function ensures the microprocessor is properly reset and powers up into a known condition after a power failure.

Reset Timing

A reset is generated whenever the supply voltage is below the threshold level ($V_{CC} < V_{TH}$). The reset duration is at least 800ms after V_{CC} has risen above the reset threshold and is guaranteed to be no more than 2 seconds. The rest signal remains active as long as the monitored supply voltage is below the internal threshold voltage.

The ASM161 has an open-drain, active LOW $\overline{RESET}$ output (which is guaranteed to be in the correct state for V_{CC} down to 1.1 V). The ASM161 uses an external pull-up resistor. Output leakage current is under 1µA. A high resistance value can be used to minimize current drain.

The ASM162 generates an active-HIGH RESET output.

Part Number	Reset Polarity
ASM161	LOW (use external pull-up resistor)
ASM162	HIGH

Manual Reset

The ASM161/162 have a unique manual reset circuit. A negative going edge transition on $\overline{MR}$ initiates the reset. A manual reset generates a single reset pulse of fixed length. The output-reset pulse remains asserted for the Reset Active Time-Out Period t_{RP} and then clears. Once the reset pulse is completed, the $\overline{MR}$ input remains disabled for at least 49µS but not more than 122µS. This period is specified as t_{MRD}.

During the $\overline{MR}$ disabled period, the microcontroller is guaranteed a time period free of new manual reset signals. This period can be used to refresh critical DRAM contents or other system tasks.

The $\overline{MR}$ pin must be taken HIGH and LOW again after the t_{MRD} period has been completed to initiate another reset pulse.

The manual reset input has an internal 20kΩ pull-up resistor. $\overline{MR}$ can be left open if not used.

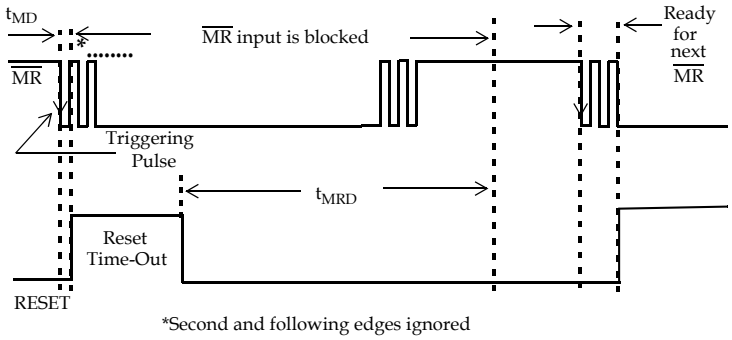


Figure 1: Manual Reset Timing

Application Information

Glitch Resistance

The ASM161/162 are relatively immune to short duration negative-going V_{CC} transients/glitches. A V_{CC} transient that goes 100mV below the reset threshold and lasts 20s or less will not typically cause a reset pulse.

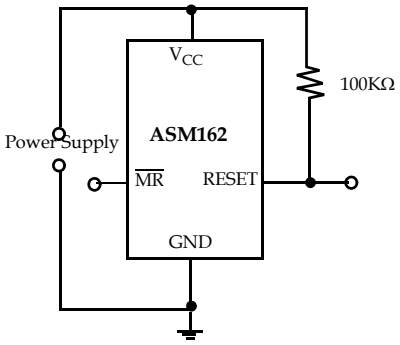


Figure 2: RESET valid with VCC under 1.1V

Valid Reset with VCC under 1.1V

To ensure that logic inputs connected to the ASM162 RESET pin are in a known state when V_{CC} is under 1.1V, a 100kΩ pull-down resistor at RESET is needed. The value is not critical.

This scheme does not work with the open-drain outputs of ASM161.

Absolute Maximum Ratings

Parameter	Min	Max	Unit
Pin Terminal Voltage with respect to Ground			
V_{CC}	-0.3	6.0	V
RESET, $\overline{\text{RESET}}$ and $\overline{\text{MR}}$	-0.3	V_{CC} + 0.3	V
Input Current at V_{CC} and MR		20	mA
Rate of Rise at V_{CC}		100	V/µs
Power Dissipation (T_A = 70°C)		320	mW
Operating Temperature Range	-40	85	°C
Storage Temperature Range	-65	160	°C
Lead Temperature (soldering, 10 sec)		300	°C
Note: These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability.			

Electrical Characteristics

Unless otherwise noted, V_{CC} is over the full range and TA = 0^0 to 70^0c for ASM161/162 X C and T_A = -40^0c to $+85^0$c for ASM161/162 X E devices. Typical values at T_A = 25^0c, V_{CC} = 5V for L/M/J devices, V_{CC} = 3.3V for T/S devices and V_{CC} = 3V for R devices

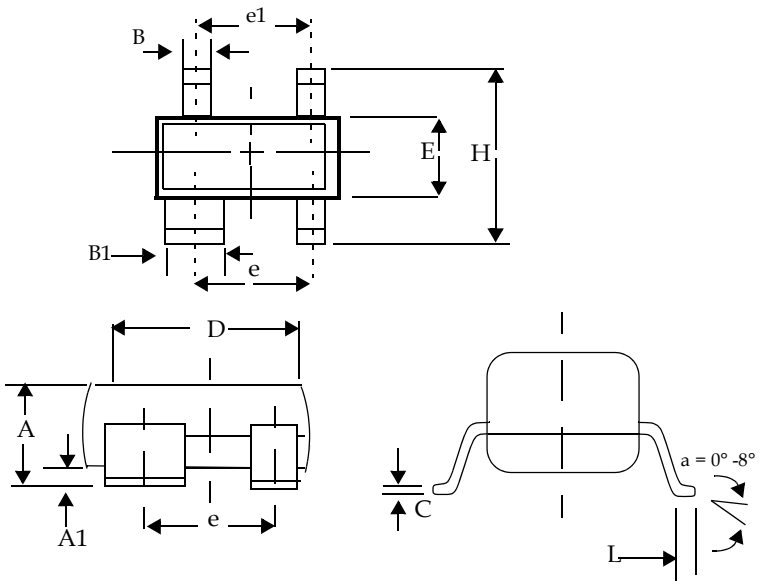
Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Input Voltage (V_{CC}) Range	V_{CC}	T_A = 0°C to 70°C		1.1		5.5	V
Supply Current (Unloaded)	I_{CC}	T_A = 0°C to 70°C, T_A = -40°C to +85°C	V_{CC} < 5.5V, L/M/J		6	15	µA
		T_A = 0°C to 70°C, T_A = -40°C to +85°C	V_{CC} < 3.6V, R/S/T		4.5	10	
Reset Threshold	V_{TH}	L Devices	T_A = 25°C	4.56	4.63	4.70	V
			Note 1	4.50		4.75	
		M devices	T_A = 25°C	4.31	4.38	4.45	
			Note 1	4.25		4.50	
		J devices	T_A = 25°C	3.93	4.00	4.06	
			Note 1	3.89		4.10	
		T devices	T_A = 25°C	3.04	3.08	3.11	
			Note 1	3.00		3.15	
		S devices	T_A = 25°C	2.89	2.93	2.96	
			Note 1	2.85		3.00	
		R devices	T_A = 25°C	2.59	2.63	2.66	
			Note 1	2.55		2.70	
Reset Threshold Temp Coefficient	T_{CVTH}				30		ppm/°C
V_{CC} to reset delay		V_{CC} = V_{TH} to (V_{TH} -100mV)			20		µS
Reset Pulse Width	t_{RPW}	T_A = 0°C to 70°C		800	1400	2000	ms
		T_A = -40°C to 85°C		560		2240	
$\overline{MR}$ Minimum Pulse Width	t_{MR}			10			µS
$\overline{MR}$ Glitch Immunity					100		ns
$\overline{MR}$ to RESET Propagation Delay	t_{MD}				0.5		µs

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
$\overline{MR}$ Input Threshold	V_{IH}	$V_{CC} > V_{TH}$(MAX), L/M/J devices	2.3			V
	V_{IL}				0.8	V
	V_{IH}	$V_{CC} > V_{TH}$(MAX), R/S/T devices	$0.7V_{CC}$			V
	V_{IL}				$0.25V_{CC}$	V
$\overline{MR}$ Delay to MR Retrigger	t_{MRD}	T_A = 0°C to 70°C	49	85	122	µS
		T_A = -40°C to 85°C		85		
MR pull-up resistance			10	20	30	KΩ
Low $\overline{RESET}$ output voltage (ASM161)	V_{OL}	$V_{CC} = V_{TH}$ min., I_{SINK} = 1.2mA, ASM161 R/S/T			0.3	V
		$V_{CC} = V_{TH}$ min., I_{SINK} = 3.2mA, ASM161 L/M/J			0.4	
		V_{CC} > 1.1, I_{SINK} = 50µA			0.3	
$\overline{RESET}$ Output Leakage Current (ASM161)	I_{LKG}	$V_{DRAIN} \leq$ 6.0V, 0°C $\leq T_A \leq$ 70°C			1	µA
Low $\overline{RESET}$ output voltage (ASM162)	V_{OL}	$V_{CC} = V_{TH}$ min., I_{SINK} = 1.2mA, ASM162 R/S/T			0.3	V
		$V_{CC} = V_{TH}$ min., I_{SINK} = 3.2mA, ASM162 L/M/J			0.4	
HIGH RESET Output Voltage (ASM162)	V_{OH}	$1.8<V_{CC}<V_{TH}$min., I_{SOURCE} = 150 µA	$0.8V_{CC}$			V

Notes: 1. Over operating temperature range.

Package Dimensions

Plastic SOT - 143 (4Pin)



Plastic SOT - 143 (4 pin)

	Inches		Millimeters	
	Min	**Max**	**Min**	**Max**
Plastic SOT-143 (4-Pin)				
A	0.031	0.047	0.787	1.194
A1	0.001	0.005	0.025	0.127
B	0.014	0.022	0.356	0.559
B1	0.030	0.038	0.762	0.965
C	0.0034	0.006	0.086	0.152
D	0.105	0.120	2.667	3.048
E	0.047	0.055	1.194	1.397
e	0.070	0.080	1.778	2.032
e1	0.071	0.079	1.803	2.007
H	0.082	0.098	2.083	2.489
L	0.004	0.012	0.102	0.305

Ordering Information

Part Number[1]	Reset Threshold (V)	Temperature Range (°C)	Pin-Package	Package Marking (XX Lot Code)
ASM161LCUS/T	4.63	0 TO 70	4-SOT-143	TAXX
ASM161MCUS/T	4.38	0 TO 70	4-SOT-143	TBXX
ASM161JCUS/T	4.00	0 TO 70	4-SOT-143	TCXX
ASM161TCUS/T	3.08	0 TO 70	4-SOT-143	TDXX
ASM161SCUS/T	2.93	0 TO 70	4-SOT-143	TEXX
ASM161RCUS/T	2.63	0 TO 70	4-SOT-143	TFXX
ASM162LCUS/T	4.63	0 TO 70	4-SOT-143	TGXX
ASM162MCUS/T	4.38	0 TO 70	4-SOT-143	THXX
ASM162JCUS/T	4.00	0 TO 70	4-SOT-143	TIXX
ASM162TCUS/T	3.08	0 TO 70	4-SOT-143	TJXX
ASM162SCUS/T	2.93	0 TO 70	4-SOT-143	TKXX
ASM162RCUS/T	2.63	0 TO 70	4-SOT-143	TLXX
ASM161LEUS/T	4.63	-40 TO 85	4-SOT-143	TMXX
ASM161MEUS/T	4.38	-40 TO 85	4-SOT-143	TNXX
ASM161JEUS/T	4.00	-40 TO 85	4-SOT-143	TOXX
ASM161TEUS/T	3.08	-40 TO 85	4-SOT-143	TPXX
ASM161SEUS/T	2.93	-40 TO 85	4-SOT-143	TQXX
ASM161REUS/T	2.63	-40 TO 85	4-SOT-143	TRXX
ASM162LEUS/T	4.63	-40 TO 85	4-SOT-143	TSXX
ASM162MEUS/T	4.38	-40 TO 85	4-SOT-143	TTXX
ASM162JEUS/T	4.00	-40 TO 85	4-SOT-143	TUXX
ASM162TEUS/T	3.08	-40 TO 85	4-SOT-143	TVXX
ASM162SEUS/T	2.93	-40 TO 85	4-SOT-143	TWXX
ASM162REUS/T	2.63	-40 TO 85	4-SOT-143	TXXX

Notes: 1. Tape and Reel packaging is indicated by the /T designation.

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