

## 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 Vcc 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°C to 70°C and -40°C to +85°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

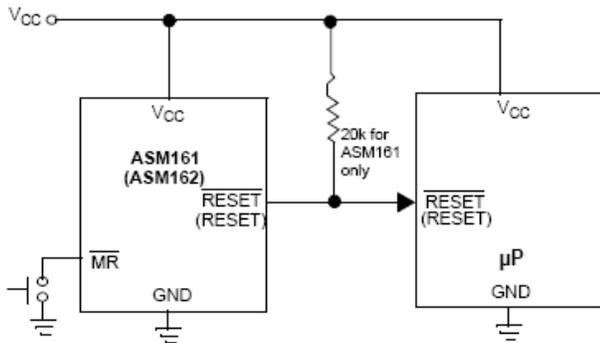
### Key Features

- 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 ASM811/812
- Small 4-Pin SOT-143 package
- Two temperature ranges: 0°C to 70°C and -40°C to +85°C

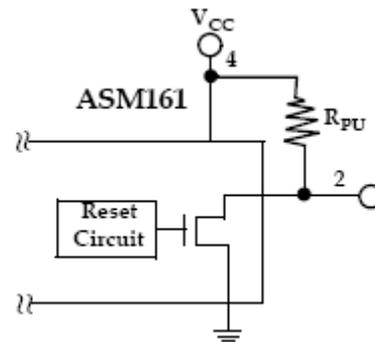
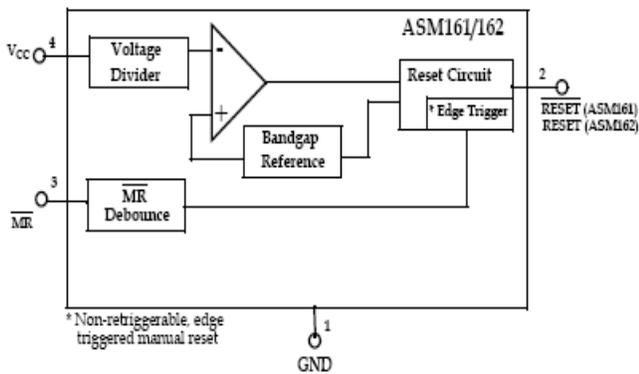
### Applications

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

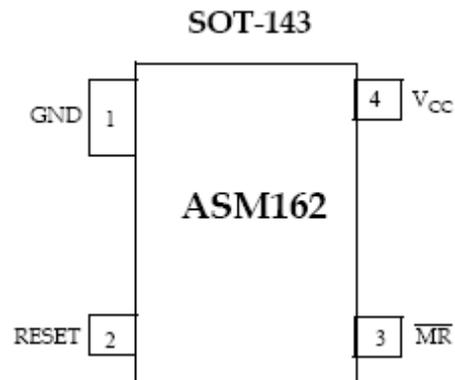
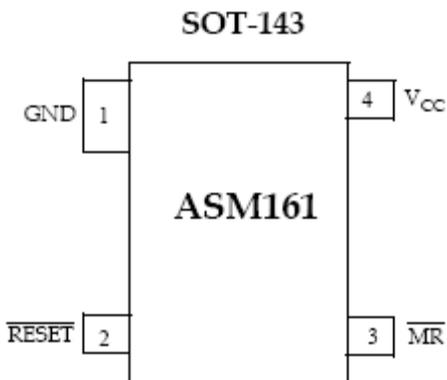
### Typical Operating Circuit



### Block Diagram



### Pin Configuration



RESET is open drain

## Pin Description

Pin #		Pin Name	Function
ASM161	ASM162		
1	1	GND	Ground.
2	-	$\overline{\text{RESET}}$	Active-LOW, open-drain reset output. $\overline{\text{RESET}}$ remains LOW while Vcc is below the reset threshold and for 800ms minimum after Vcc rises above the reset threshold. An external pull-up resistor is needed.
-	2	RESET	Active HIGH reset output. RESET remains HIGH while Vcc is below the reset threshold and for 800ms after Vcc 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	VCC	Power supply input voltage.

## Detailed Description

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 Vcc has risen above the reset threshold and is guaranteed to be no more than 2 seconds. The reset signal remains active as long as the monitored supply voltage is below the internal threshold voltage.

The ASM161 has an open-drain, active LOW  $\overline{\text{RESET}}$  output (which is guaranteed to be in the correct state for Vcc down to 1.1 V). The ASM161 uses an external pull-up resistor. Output leakage current is under 1 $\mu$ A. 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  $\overline{\text{MR}}$  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  $\overline{\text{MR}}$  input remains disabled for at least 49 $\mu$ S but not more than 122 $\mu$ S. This period is specified as  $t_{MRD}$ .

During the  $\overline{\text{MR}}$  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  $\overline{\text{MR}}$  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 20k $\Omega$  pull-up resistor.  $\overline{\text{MR}}$  can be left open if not used.

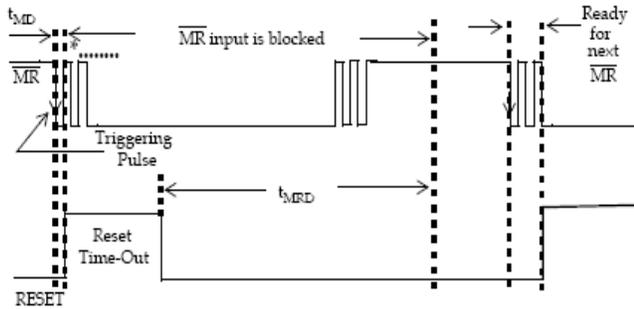


Figure 1: Manual Reset Timing

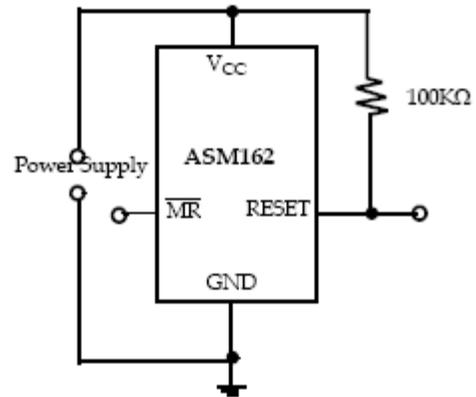


Figure 2: RESET valid with VCC under 1.1V

### Application Information

#### Glitch Resistance

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

#### Valid Reset with VCC under 1.1V

To ensure that logic inputs connected to the ASM162 RESET pin are in a known state when VCC 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
<b>Pin Terminal Voltage with Respect to Ground</b>			
V <sub>CC</sub>	-0.3	6.0	V
RESET, $\overline{\text{RESET}}$ and $\overline{\text{MR}}$	-0.3	V <sub>CC</sub> + 0.3	V
Input Current at V <sub>CC</sub> and $\overline{\text{MR}}$		20	mA
Rate of Rise at V <sub>CC</sub>		100	V/μs
Power Dissipation (T <sub>A</sub> = 70°C)		320	mW
Operating Temperature Range	-40	85	°C
Storage Temperature Range	-65	160	°C
Lead Temperature (soldering, 10 sec)		300	°C
ESD rating			
	HBM	2	KV
	MM	200	V

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**

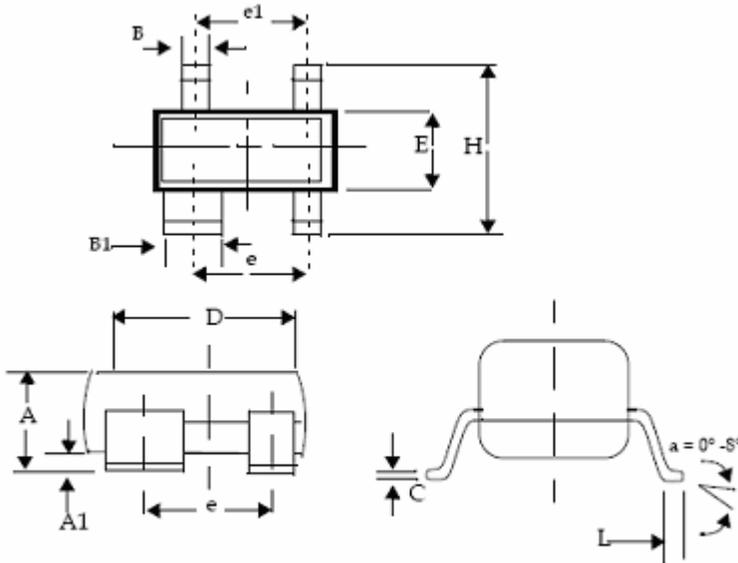
Unless otherwise noted,  $V_{CC}$  is over the full range and  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$  for ASM161/162 X C and  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$  for ASM161/162 X E devices. Typical values at  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$  for L/M/J devices,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

Parameter	Symbol	Conditions	Min	TYP	Max	Unit
Input Voltage (VCC) Range	VCC	$T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$	1.1		5.5	V
Supply Current (Unloaded)	ICC	$V_{CC} < 5.5\text{V}$ L/M/J		6	15	$\mu\text{A}$
		$V_{CC} < 3.6\text{V}$ R/S/T		4.5	10	
Reset Threshold	VTH	L Devices	$T_A = 25^\circ\text{C}$ Note 1	4.56 4.50	4.63 4.75	V
		M devices	$T_A = 25^\circ\text{C}$ Note 1	4.31 4.25	4.38 4.50	
		J devices	$T_A = 25^\circ\text{C}$ Note 1	3.93 3.89	4.00 4.10	
		T devices	$T_A = 25^\circ\text{C}$ Note 1	3.04 3.00	3.08 3.15	
		S devices	$T_A = 25^\circ\text{C}$ Note 1	2.89 2.85	2.93 3.00	
		R devices	$T_A = 25^\circ\text{C}$ Note 1	2.59 2.55	2.63 2.70	
Reset Threshold Temp Coefficient	TCVTH			30		ppm/ $^\circ\text{C}$
VCC to reset delay		$V_{CC} = V_{TH}$ to $(V_{TH} - 100\text{mV})$		20		$\mu\text{S}$
Reset Pulse Width	trPW	$T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$	800	1400	2000	ms
		$T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$	600		2240	
MR Minimum Pulse Width	tMR		10			$\mu\text{S}$
MR Glitch Immunity				100		ns
MR to RESET Propagation Delay				0.5		$\mu\text{S}$
MR Input Threshold	V <sub>IH</sub>	$V_{CC} > V_{TH}(\text{MAX})$ , L/M/J devices	2.3			V
	V <sub>IL</sub>				0.8	V
	V <sub>IH</sub>	$V_{CC} > V_{TH}(\text{MAX})$ , R/S/T devices	0.7V <sub>CC</sub>			V
	V <sub>IL</sub>				0.25V <sub>CC</sub>	V
MR Delay to MR Retrigger	tMRD	$T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$	48	85	122	$\mu\text{S}$
		$T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$		85		
MR pull-up resistance			10	20	30	k $\Omega$
Low RESET output voltage (ASM161)	VOL	$V_{CC} = V_{TH}$ min., $I_{SINK} = 1.2\text{mA}$ , ASM161 R/S/T			0.3	V
		$V_{CC} = V_{TH}$ min., $I_{SINK} = 3.2\text{mA}$ , ASM161 L/M/J			0.4	
		$V_{CC} > 1.1$ , $I_{SINK} = 50\mu\text{A}$			0.3	
RESET Output Voltage (ASM162)	VOL	$V_{CC} = V_{TH}$ max., $I_{SINK} = 1.2\text{mA}$ , ASM162 R/S/T			0.3	V
		$V_{CC} = V_{TH}$ max., $I_{SINK} = 3.2\text{mA}$ , ASM162 L/M/J			0.4	
HIGH RESET Output Voltage (ASM162)	VOH	$1.8 < V_{CC} < V_{TH}(\text{min.})$ , $I_{SOURCE} = 150\mu\text{A}$	0.8V <sub>CC</sub>			V
RESET Output Leakage Current (ASM161)	ILKG	$V_{DRAIN} < 6.0\text{V}$ , $0^\circ\text{C} < T_A < 70^\circ\text{C}$			1	$\mu\text{A}$

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 <sup>1</sup>	Reset Threshold (V)	Temperature (°C)	Pins-Package	Package Marking (LL Lot Code)
<b>Tin Lead Devices</b>				
ASM161LCUS/T	4.63	0 TO 70	4-SOT-143	TALL
ASM161MCUS/T	4.38	0 TO 70	4-SOT-143	TBLL
ASM161JCUS/T	4.00	0 TO 70	4-SOT-143	TCLL
ASM161TCUS/T	3.08	0 TO 70	4-SOT-143	TDLL
ASM161SCUS/T	2.93	0 TO 70	4-SOT-143	TELL
ASM161RCUS/T	2.63	0 TO 70	4-SOT-143	TFLL
ASM162LCUS/T	4.63	0 TO 70	4-SOT-143	TGLL
ASM162MCUS/T	4.38	0 TO 70	4-SOT-143	THLL
ASM162JCUS/T	4.00	0 TO 70	4-SOT-143	TILL
ASM162TCUS/T	3.08	0 TO 70	4-SOT-143	TJLL
ASM162SCUS/T	2.93	0 TO 70	4-SOT-143	TKLL
ASM162RCUS/T	2.63	0 TO 70	4-SOT-143	TLLL
ASM161LEUS/T	4.63	-40 TO 85	4-SOT-143	TMLL
ASM161MEUS/T	4.38	-40 TO 85	4-SOT-143	TNLL
ASM161JEUS/T	4.00	-40 TO 85	4-SOT-143	TOLL
ASM161TEUS/T	3.08	-40 TO 85	4-SOT-143	TPLL
ASM161SEUS/T	2.93	-40 TO 85	4-SOT-143	TQLL
ASM161REUS/T	2.63	-40 TO 85	4-SOT-143	TRLL
ASM162LEUS/T	4.63	-40 TO 85	4-SOT-143	TSLL
ASM162MEUS/T	4.38	-40 TO 85	4-SOT-143	TTLL
ASM162JEUS/T	4.00	-40 TO 85	4-SOT-143	TULL
ASM162TEUS/T	3.08	-40 TO 85	4-SOT-143	TVLL
ASM162SEUS/T	2.93	-40 TO 85	4-SOT-143	TWLL
ASM162REUS/T	2.63	-40 TO 85	4-SOT-143	TXLL
<b>Lead Free Devices</b>				
ASM161LCUSF/T	4.63	0 TO 70	4-SOT-143	MALL
ASM161MCUSF/T	4.38	0 TO 70	4-SOT-143	MBLL
ASM161JCUSF/T	4.00	0 TO 70	4-SOT-143	MCLL
ASM161TCUSF/T	3.08	0 TO 70	4-SOT-143	MDLL
ASM161SCUSF/T	2.93	0 TO 70	4-SOT-143	MELL
ASM161RCUSF/T	2.63	0 TO 70	4-SOT-143	MFLL
ASM162LCUSF/T	4.63	0 TO 70	4-SOT-143	MGLL
ASM162MCUSF/T	4.38	0 TO 70	4-SOT-143	MHLL
ASM162JCUSF/T	4.00	0 TO 70	4-SOT-143	MILL
ASM162TCUSF/T	3.08	0 TO 70	4-SOT-143	MJLL
ASM162SCUSF/T	2.93	0 TO 70	4-SOT-143	MKLL
ASM162RCUSF/T	2.63	0 TO 70	4-SOT-143	MLLL

Part Number <sup>1</sup>	Reset Threshold (V)	Temperature (°C)	Pins-Package	Package Marking (LL Lot Code)
ASM161LEUSF/T	4.63	-40 TO 85	4-SOT-143	MMLL
ASM161MEUSF/T	4.38	-40 TO 85	4-SOT-143	MNLL
ASM161JEUSF/T	4.00	-40 TO 85	4-SOT-143	MOLL
ASM161TEUSF/T	3.08	-40 TO 85	4-SOT-143	MPLL
ASM161SEUSF/T	2.93	-40 TO 85	4-SOT-143	MQLL
ASM161REUSF/T	2.63	-40 TO 85	4-SOT-143	MRLL
ASM162LEUSF/T	4.63	-40 TO 85	4-SOT-143	MSLL
ASM162MEUSF/T	4.38	-40 TO 85	4-SOT-143	MTLL
ASM162JEUSF/T	4.00	-40 TO 85	4-SOT-143	MULL
ASM162TEUSF/T	3.08	-40 TO 85	4-SOT-143	MVLL
ASM162SEUSF/T	2.93	-40 TO 85	4-SOT-143	MWLL
ASM162REUSF/T	2.63	-40 TO 85	4-SOT-143	MXLL

Notes:

- For parts to be packed in Tape and Reel, add "-T" at the end of the part number.
- PulseCore Semiconductor's lead free parts are RoHS compliant.



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