



## MAX811 / 812

## 4-Pin $\mu$ P Voltage Monitors with Manual Reset Input

### General Description

The MAX811/MAX812 are low-power microprocessor ( $\mu$ P) supervisory circuits used to monitor power supplies in  $\mu$ P and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with 5V-powered or 3V-powered circuits. The MAX811/MAX812 also provide a debounced manual reset input.

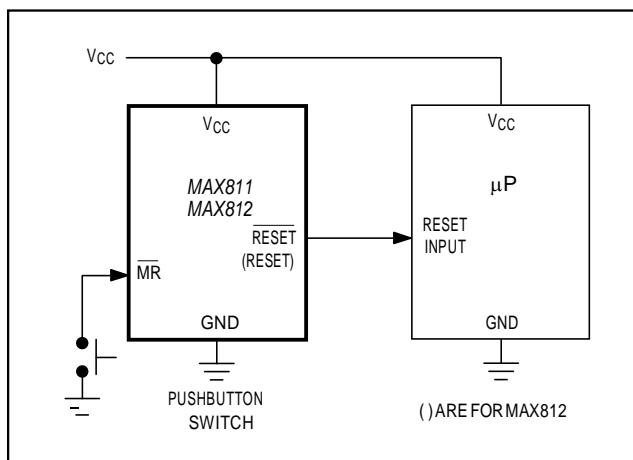
These devices perform a single function: They assert a reset signal whenever the VCC supply voltage falls below a preset threshold, keeping it asserted for at least 140ms after VCC has risen above the reset threshold. The only difference between the two devices is that the MAX811 has an active-low RESET output (which is guaranteed to be in the correct state for VCC down to 1V), while the MAX812 has an active-high RESET output. The reset comparator is designed to ignore fast transients on VCC. Reset thresholds are available for operation with a variety of supply voltages.

Low supply current makes the MAX811/MAX812 ideal for use in portable equipment. The devices come in a 4-pin SOT143 package.

### Applications

- Computers
- Controllers
- Intelligent Instruments
- Critical  $\mu$ P and  $\mu$ C Power Monitoring
- Portable/Battery-Powered Equipment

### Typical Operating Circuit



### Features

- ◆ Precision Monitoring of 3V, 3.3V, and 5V Power-Supply Voltages
- ◆ 6 $\mu$ A Supply Current
- ◆ 140ms Min Power-On Reset Pulse Width; RESET Output (MAX811), RESET Output (MAX812)
- ◆ Guaranteed Over Temperature
- ◆ Guaranteed RESET Valid to Vcc = 1V (MAX811)
- ◆ Power-Supply Transient Immunity
- ◆ No External Components
- ◆ 4-Pin SOT143 Package

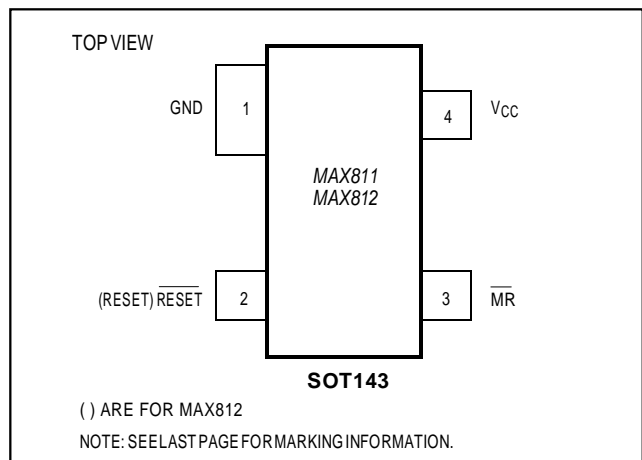
### Ordering Information

PART*	TEMP. RANGE	PIN-PACKAGE
MAX811_EUS-T	-40°C to +85°C	4 SOT143
MAX812_EUS-T	-40°C to +85°C	4 SOT143

\* This part offers a choice of five different reset threshold voltages. Select the letter corresponding to the desired nominal reset threshold voltage, and insert it into the blank to complete the part number.

RESET THRESHOLD	
SUFFIX	VOLTAGE (V)
L	4.63
M	4.38
T	3.08
S	2.93
R	2.63

### Pin Configuration



# 4-Pin $\mu P$ Voltage Monitors with Manual Reset Input

## ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (with respect to GND)

VCC .....-0.3V to 6.0V  
All Other Inputs.....-0.3V to (VCC + 0.3V)

Input Current, VCC, MR .....20mA

Output Current, RESET or RESET .....20mA

Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )

SOT143 (derate 4mW/ $^\circ\text{C}$  above  $+70^\circ\text{C}$ ) 320mW

Operating Temperature Range ..... $-40^\circ\text{C}$  to  $+85^\circ\text{C}$

Storage Temperature Range ..... $-65^\circ\text{C}$  to  $+160^\circ\text{C}$

Lead Temperature (soldering, 10sec) ..... $+300^\circ\text{C}$

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ELECTRICAL CHARACTERISTICS

(VCC = 5V for L/M versions, VCC = 3.3V for T/S versions, VCC = 3V for R version,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ , unless otherwise noted. Typical values are at  $T_A = +25^\circ\text{C}$ .) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS			
Operating Voltage Range	VCC	$T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$	1.0		5.5	V			
		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	1.2						
Supply Current	ICC	MAX81_L/M, VCC = 5.5V, IOUT = 0		6	15	$\mu\text{A}$			
		MAX81_R/S/T, VCC = 3.6V, IOUT = 0		2.7	10				
Reset Threshold	VTH	MAX81_L	$T_A = +25^\circ\text{C}$	4.54	4.63	4.72	V		
			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	4.50		4.75			
		MAX81_M	$T_A = +25^\circ\text{C}$	4.30	4.38	4.46			
			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	4.25		4.50			
		MAX81_T	$T_A = +25^\circ\text{C}$	3.03	3.08	3.14			
			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	3.00		3.15			
		MAX81_S	$T_A = +25^\circ\text{C}$	2.88	2.93	2.98			
			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	2.85		3.00			
		MAX81_R	$T_A = +25^\circ\text{C}$	2.58	2.63	2.68			
			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	2.55		2.70			
		Reset Threshold Tempco				30			ppm/ $^\circ\text{C}$
		VCC to Reset Delay (Note 2)		VOD = 125mV, MAX81_L/M		40			$\mu\text{s}$
VOD = 125mV, MAX81_R/S/T				20					
Reset Active Timeout Period	tRP	VCC = VTH(MAX)	140		560	ms			
MR Minimum Pulse Width	tMR		10			$\mu\text{s}$			
MR Glitch Immunity (Note 3)				100		ns			
MR to Reset Propagation Delay (Note 2)	tMD			0.5		$\mu\text{s}$			
MR Input Threshold	V <sub>IH</sub>	VCC > VTH(MAX), MAX81_L/M	2.3		0.8	V			
	V <sub>IL</sub>								
	V <sub>IH</sub>	VCC > VTH(MAX), MAX81_R/S/T	0.7 x VCC						
	V <sub>IL</sub>		0.25 x VCC						
MR Pull-Up Resistance			10	20	30	k $\Omega$			
RESET Output Voltage (MAX812)	VOH	ISOURCE = 150 $\mu\text{A}$ , 1.8V < VCC < VTH(MIN)	0.8VCC			V			
	VOL	MAX812R/S/T only, ISINK = 1.2mA, VCC = VTH(MAX)			0.3				
		MAX812L/M only, ISINK = 3.2mA, VCC = VTH(MAX)			0.4				

# 4-Pin $\mu P$ Voltage Monitors with Manual Reset Input

## ELECTRICAL CHARACTERISTICS (continued)

( $V_{CC} = 5V$  for L/M versions,  $V_{CC} = 3.3V$  for T/S versions,  $V_{CC} = 3V$  for R version,  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , unless otherwise noted. Typical values are at  $T_A = +25^{\circ}C$ .) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RESET Output Voltage (MAX811)	VOL	MAX811R/S/T only, $I_{SINK} = 1.2mA$ , $V_{CC} = V_{TH(MIN)}$			0.3	V
		MAX811L/M only, $I_{SINK} = 3.2mA$ , $V_{CC} = V_{TH(MIN)}$			0.4	
		$I_{SINK} = 50\mu A$ , $V_{CC} > 1.0V$			0.3	
	VOH	MAX811R/S/T only, $I_{SOURCE} = 500\mu A$ , $V_{CC} > V_{TH(MAX)}$	0.8VCC			
		MAX811L/M only, $I_{SOURCE} = 800\mu A$ , $V_{CC} > V_{TH(MAX)}$	VCC - 1.5			

**Note 1:** Production testing done at  $T_A = +25^{\circ}C$ , over temperature limits guaranteed by design using six sigma design limits.

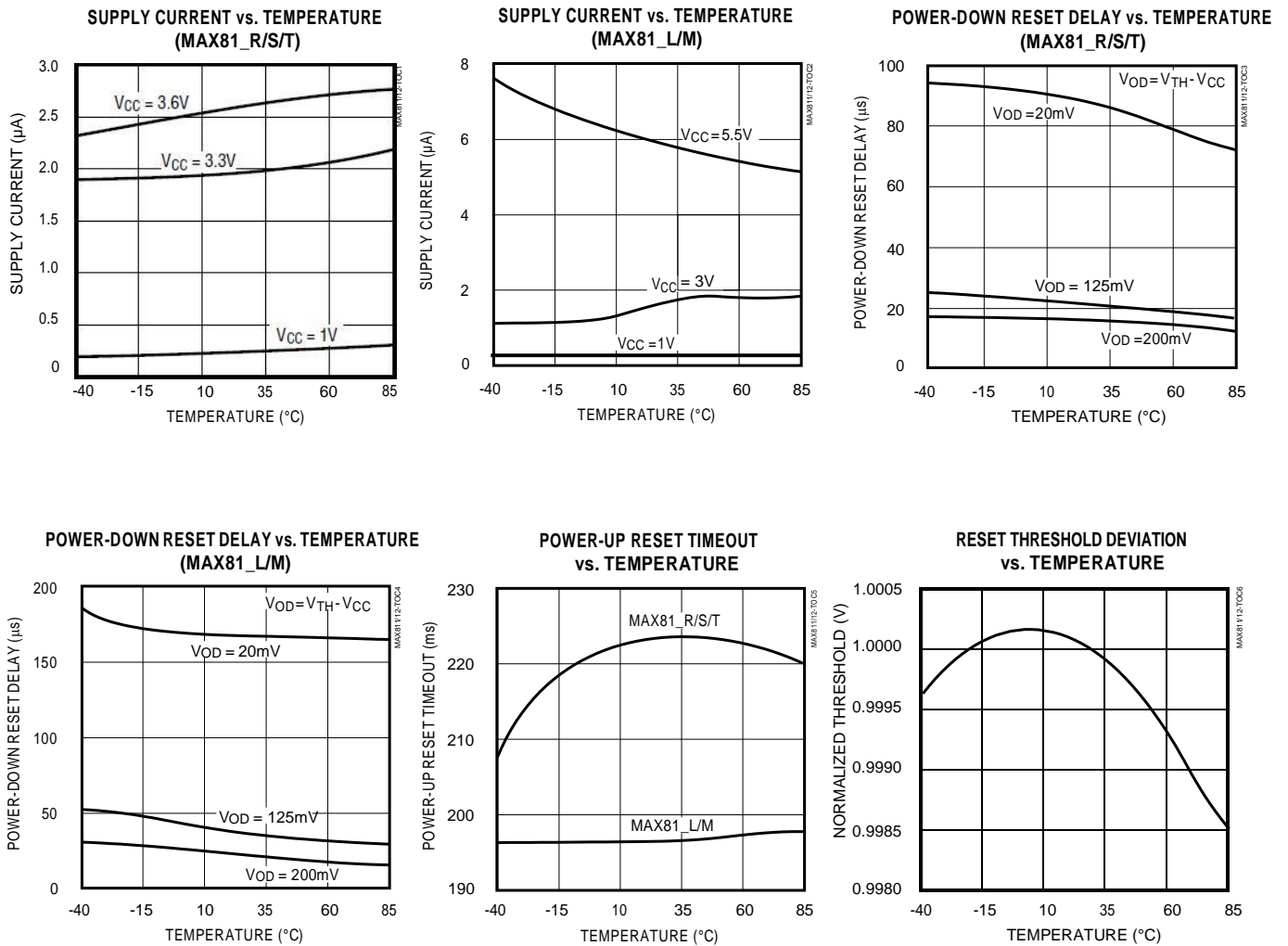
**Note 2:** RESET output for MAX811, RESET output for MAX812.

**Note 3:** "Glitches" of 100ns or less typically will not generate a reset pulse.

# 4-Pin $\mu$ P Voltage Monitors with Manual Reset Input

## Typical Operating Characteristics

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)



# 4-Pin $\mu$ P Voltage Monitors with Manual Reset Input

## Pin Description

PIN		NAME	FUNCTION
MAX811	MAX812		
1	1	GND	Ground
2	—	RESET	Active-Low Reset Output. RESET remains low while VCC is below the reset threshold or while MR is held low. RESET remains low for the Reset Active Timeout Period ( $t_{RP}$ ) after the reset conditions are terminated.
—	2	RESET	Active-High Reset Output. RESET remains high while VCC is below the reset threshold or while MR is held low. RESET remains high for Reset Active Timeout Period ( $t_{RP}$ ) after the reset conditions are terminated.
3	3	MR	Manual Reset Input. A logic low on MR asserts reset. Reset remains asserted as long as MR is low and for 180ms after MR returns high. This active-low input has an internal 20k $\Omega$ 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	+5V, +3.3V, or +3V Supply Voltage

## Detailed Description

### Reset Output

A microprocessor's ( $\mu$ P's) reset input starts the  $\mu$ P in a known state. These  $\mu$ P supervisory circuits assert reset to prevent code execution errors during power-up, power-down, or brownout conditions.

RESET is guaranteed to be a logic low for  $V_{CC} > 1V$ . Once  $V_{CC}$  exceeds the reset threshold, an internal timer keeps RESET low for the reset timeout period; after this interval, RESET goes high.

If a brownout condition occurs ( $V_{CC}$  dips below the reset threshold), RESET goes low. Any time  $V_{CC}$  goes below the reset threshold, the internal timer resets to zero, and RESET goes low. The internal timer starts after  $V_{CC}$  returns above the reset threshold, and RESET remains low for the reset timeout period.

The manual reset input (MR) can also initiate a reset. See the *Manual Reset Input* section.

The MAX812 has an active-high RESET output that is the inverse of the MAX811's RESET output.

### Manual Reset Input

Many  $\mu$ P-based products require manual reset capability, allowing the operator, a test technician, or external logic circuitry to initiate a reset. A logic low on MR asserts reset. Reset remains asserted while MR is low, and for the Reset Active Timeout Period ( $t_{RP}$ ) after MR returns high. This input has an internal 20k $\Omega$  pull-up resistor, so it can be left open if it is not used. MR can be driven with TTL or CMOS-logic levels, or with open-drain/collector outputs. Connect a normally open momentary switch from MR to GND to create a manual-reset function; external debounce circuitry is not required. If MR is driven from long cables or if the device is used in a noisy environment, connecting a 0.1 $\mu$ F capacitor from MR to ground provides additional noise immunity.

### Reset Threshold Accuracy

The MAX811/MAX812 are ideal for systems using a 5V  $\pm 5\%$  or 3V  $\pm 5\%$  power supply with ICs specified for 5V  $\pm 10\%$  or 3V  $\pm 10\%$ , respectively. They are designed to meet worst-case specifications over temperature. The reset is guaranteed to assert after the power supply falls out of regulation, but before power drops below the minimum specified operating voltage range for the system ICs. The thresholds are pre-trimmed and exhibit tight distribution, reducing the range over which an undesirable reset may occur.

# 4-Pin $\mu\text{P}$ Voltage Monitors with Manual Reset Input

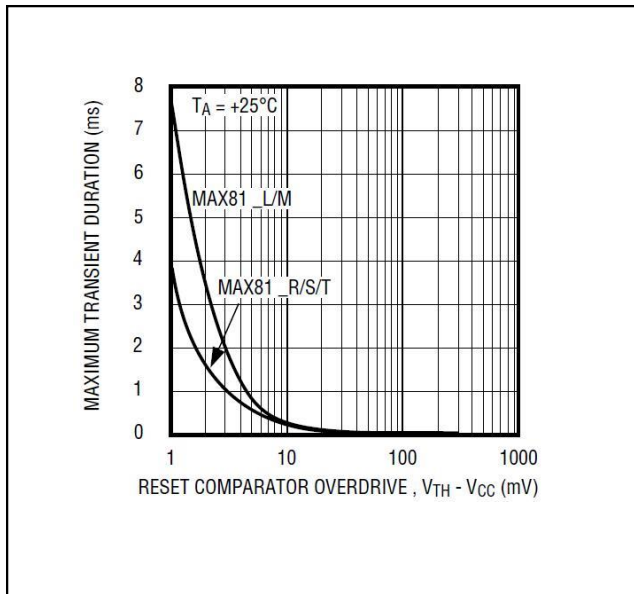


Figure 1. Maximum Transient Duration without Causing a Reset Pulse vs. Comparator Overdrive

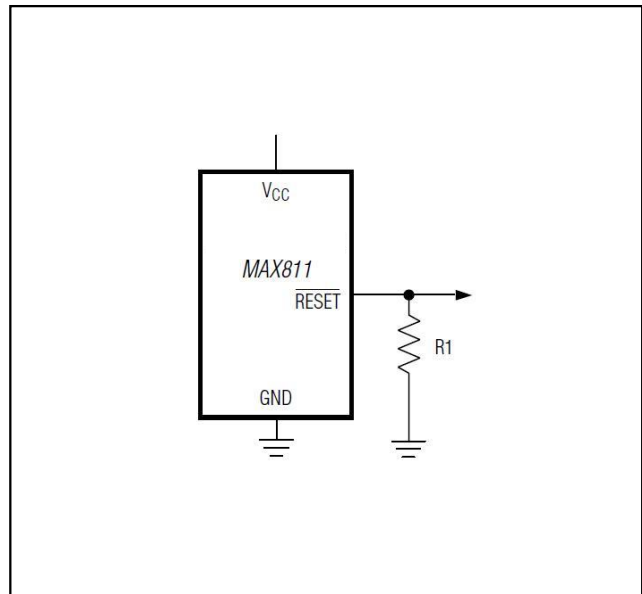


Figure 2. RESET Valid to  $V_{CC} = \text{Ground}$  Circuit

## Applications Information

### Negative-Going $V_{CC}$ Transients

In addition to issuing a reset to the  $\mu\text{P}$  during power-up, power-down, and brownout conditions, the MAX811/MAX812 are relatively immune to short duration negative-going  $V_{CC}$  transients (glitches).

Figure 1 shows typical transient durations vs. reset comparator overdrive, for which the MAX811/MAX812 do not generate a reset pulse. This graph was generated using a negative-going pulse applied to  $V_{CC}$ , starting above the actual reset threshold and ending below it by the magnitude indicated (reset comparator overdrive). The graph indicates the typical maximum pulse width a negative-going  $V_{CC}$  transient may have without causing a reset pulse to be issued. As the magnitude of the transient increases (goes farther below the reset threshold), the maximum allowable pulse width decreases. Typically, a  $V_{CC}$  transient that goes 125mV below the reset threshold and lasts 40 $\mu\text{s}$  or less (MAX81\_L/M) or 20 $\mu\text{s}$  or less (MAX81\_T/S/R) will not cause a reset pulse to be issued. A 0.1 $\mu\text{F}$  capacitor mounted as close as possible to  $V_{CC}$  provides additional transient immunity.

### Ensuring a Valid RESET Output

#### Down to $V_{CC} = 0\text{V}$

When  $V_{CC}$  falls below 1V, the MAX811 RESET output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS-logic inputs connected to the RESET output can drift to undetermined voltages. This presents no problem in most applications, since most  $\mu\text{P}$  and other circuitry is inoperative with  $V_{CC}$  below 1V. However, in applications where the RESET output must be valid down to 0V, adding a pull-down resistor to the RESET pin will cause any stray leakage currents to flow to ground, holding RESET low (Figure 2). R1's value is not critical; 100k $\Omega$  is large enough not to load RESET and small enough to pull RESET to ground.

A 100k $\Omega$  pull-up resistor to  $V_{CC}$  is also recommended for the MAX812 if RESET is required to remain valid for  $V_{CC} < 1\text{V}$ .

## 4-Pin $\mu$ P Voltage Monitors with Manual Reset Input

### **Interfacing to $\mu$ Ps with Bidirectional Reset Pins**

$\mu$ Ps with bidirectional reset pins (such as the Motorola 68HC11 series) can contend with the MAX811/MAX812 reset outputs. If, for example, the MAX811 RESET output is asserted high and the  $\mu$ P wants to pull it low, indeterminate logic levels may result. To correct such cases, connect a 4.7k $\Omega$  resistor between the MAX811 RESET (or MAX812 RESET) output and the  $\mu$ P reset I/O (Figure 3). Buffer the reset output to other system components.

### **Chip Information**

TRANSISTOR COUNT: 341

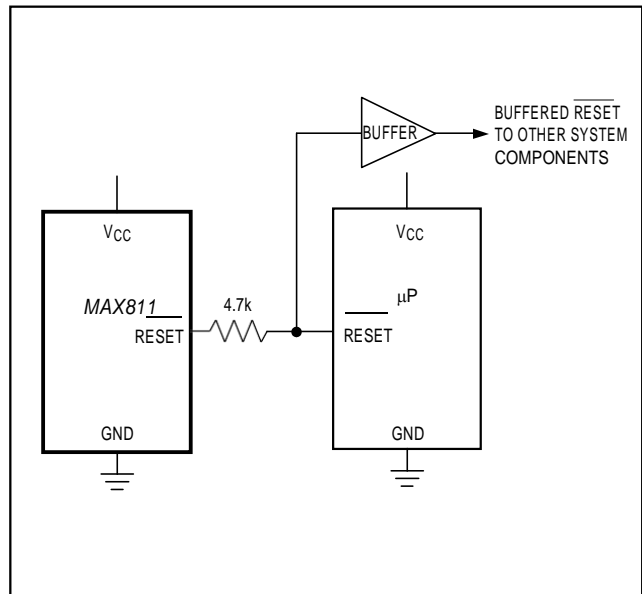
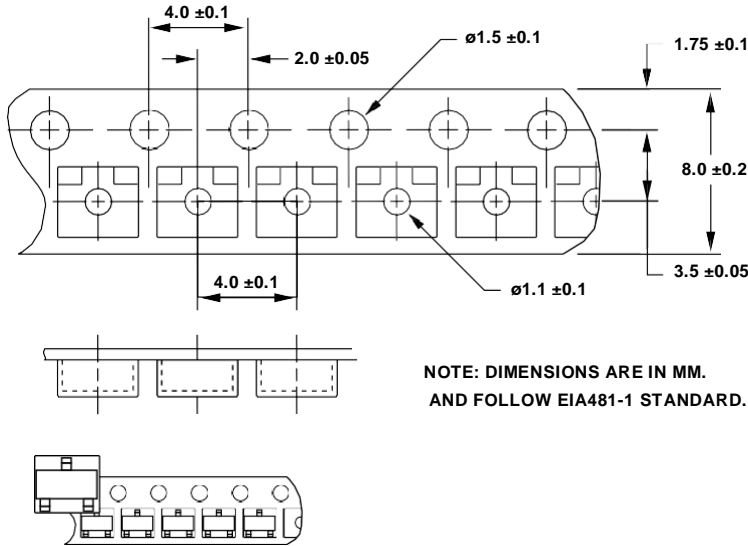


Figure 3. Interfacing to  $\mu$ Ps with Bidirectional Reset I/O

# 4-Pin $\mu$ P Voltage Monitors with Manual Reset Input

## Package Information



NOTE: DIMENSIONS ARE IN MM.  
AND FOLLOW EIA481-1 STANDARD.

MARKING INFORMATION†	
XX	LOT SPECIFIC CODE
XX	XX
AMAA or KABB	MAX811L
ANAA or KABC	MAX811M
APAA or KABD	MAX811T
AQAA or KABE	MAX811S
ARAA or KABF	MAX811R
ASAA or KABG	MAX812L
ATAA or KABH	MAX812M
AVAA or KABI	MAX812T
AWAA or KABJ	MAX812S
AXAA or KABK	MAX812R

† ICs MAY ALSO BE MARKED WITH FULL PART NAME: 811L, 811M...

DIM	INCL. S		M - M - RS	
	MTN	MAX	MTN	MAX
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
e1	0.071	0.079	1.803	2.007
e2	0.008	BSC	0.200	BSC
H	0.082	0.098	2.083	2.489
I	0.004	0.012	0.102	0.305
S	0.018	0.024	0.450	0.600
α	0°	8°	0°	8°

NOTES  
 1. D&E DO NOT INCLUDE MOLD FLASH  
 2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006")  
 3. CONTROLLING DIMENSION: MILLIMETER

TITLE:			
PACKAGE OUTLINE SOT-143, 4L			
APPROVAL	DOCUMENT CONTROL NO	REV	1/1
	21-0052	C	