LM8364 Micropower Undervoltage Sensing Circuits

Check for Samples: LM8364

FEATURES

- **Extremely Low Quiescent Current: 0.65µA, at V_{IN} = 2.87V**
- **High Accuracy Threshold Voltage (±2.5%)**
- **Open Drain Output**
- **Input Voltage Range: 1V to 6V**
- **Surface Mount Package (5-Pin SOT-23)**
- **Pin for Pin Compatible with MC33464**

APPLICATIONS

- **Low Battery Detection**
- **Microprocessor Reset Controller**
- **Power Fail Indicator**
- **Battery Backup Detection**

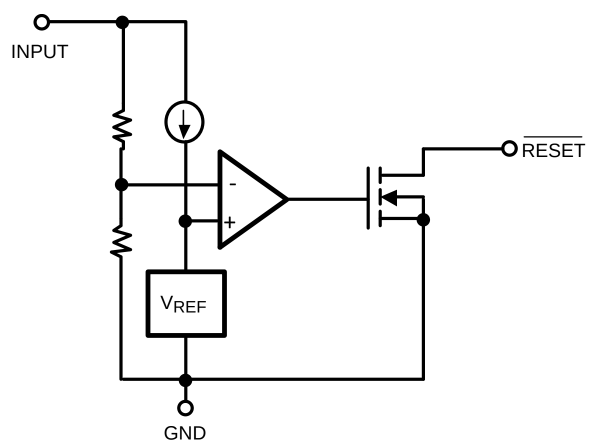
DESCRIPTION

The LM8364 series are micropower undervoltage sensing circuits that are ideal for use in battery powered microprocessor based systems, where extended battery life is a key requirement.

A range of threshold voltages from 2.0V to 4.5V are available with an active low open drain output. These devices feature a very low quiescent current of 0.65µA typical. The LM8364 series features a highly accurate voltage reference, a comparator with precise thresholds and built-in hysterisis to prevent erratic reset operation, and ensured Reset operation down to 1.0V with extremely low standby current.

These devices are available in the space saving SOT-23 5-pin surface mount package. For other undervoltage thresholds and output options, please contact Texas Instruments.

Functional Block Diagram



Connection Diagram

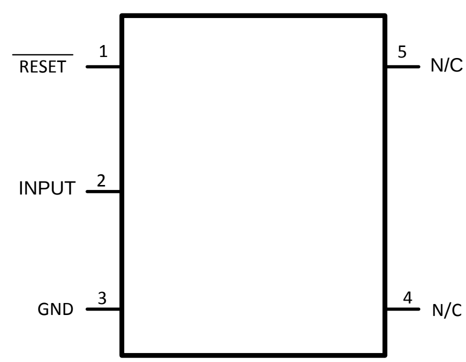


Figure 1. 5-Pin SOT-23 Top View

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings (1) (2)

Supply Voltage		−0.3V to 6.5V
$\overline{\text{RESET}}$ Output Voltage		−0.3V to 6.5V
$\overline{\text{RESET}}$ Output Current		70mA
Storage Temperature Range		−65°C to 150°C
Mounting Temp.	Lead Temp (Soldering, 10 sec)	260°C
Junction Temperature		125°

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured. For ensured specifications and the test conditions, see the Electrical Characteristics.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.

Operating Ratings (1)

Temperature Range	−40°C to 85°C
Thermal Resistance to ambient (θ_{JA})	265°C/W
ESD Tolerance	
Human Body Model	2000V
Machine Model	200V

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured. For ensured specifications and the test conditions, see the Electrical Characteristics.

Electrical Characteristics

Unless otherwise specified, all limits ensured for T_A = 25°C.

Symbol	Parameter	Conditions	Min (1)	Typ (2)	Max (1)	Units
V_{DET-}	Detector Threshold Voltage	High to Low State Output (V_{IN} Decreasing)				V
		20 Suffix	1.950	2.0	2.050	
		27 Suffix	2.633	2.7	2.767	
		30 Suffix	2.925	3.0	3.075	
		32 Suffix	3.120	3.2	3.280	
		45 Suffix	4.388	4.5	4.613	
V_{HYS}	Detector Threshold Hysteresis	V_{IN} Increasing				V
		20 Suffix	0.060	0.100	0.140	
		27 Suffix	0.081	0.135	0.189	
		30 Suffix	0.090	0.150	0.210	
		32 Suffix	0.096	0.160	0.224	
		45 Suffix	0.135	0.225	0.315	
ΔVdet/ΔT	Detector Threshold Voltage Temperature Coefficient			±100		PPM/°C
V_{OL}	$\overline{\text{RESET}}$ Output Voltage Low State	(Open Drain Output: I_{SINK} = 1mA)		0.25	0.5	V
I_{OL}	$\overline{\text{RESET}}$ Output Sink Current	V_{IN} = 1.5V, V_{OL} = 0.5V	1.0	2.5		mA
V_{IN}	Operating Input Voltage Range		1.0		6.0	V

(1) All limits are ensured by testing or statistical analysis.
(2) Typical values represent the most likely parametric norm

Electrical Characteristics (continued)

Unless otherwise specified, all limits ensured for T_A = 25°C.

Symbol	Parameter	Conditions	Min (1)	Typ (2)	Max (1)	Units
I_{IN}	Quiescent Input Current	20 Suffix				μA
		V_{IN} = 1.9V		0.55	0.8	
		V_{IN} = 4.0V		0.70	1.3	
		27 Suffix				
		V_{IN} = 2.6V		0.62	0.9	
		V_{IN} = 4.7V		0.75	1.3	
		30 Suffix				
		V_{IN} = 2.87V		0.65	0.9	
		V_{IN} = 5.0V		0.77	1.3	
		32 Suffix				
		V_{IN} = 3.08V		0.66	0.9	
		V_{IN} = 5.20V		0.79	1.3	
		45 Suffix				
		V_{IN} = 4.34V		0.70	1.0	
		V_{IN} = 6.0		0.85	1.4	
t_p	Propagation Delay Time Figure 7			60	300	μs

Typical Performance Characteristics

Input Current vs. Input Voltage LM8364BALMF45

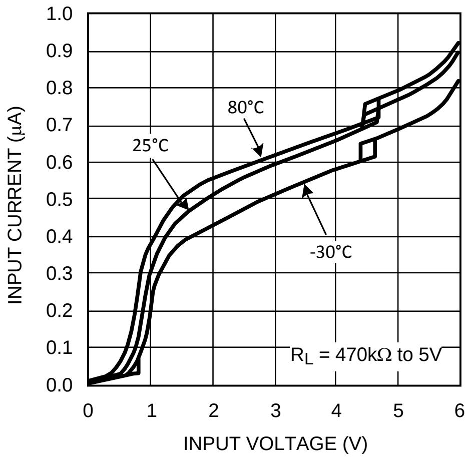


Figure 2.

Reset Output Voltage vs. Input Voltage LM8364BALMF45

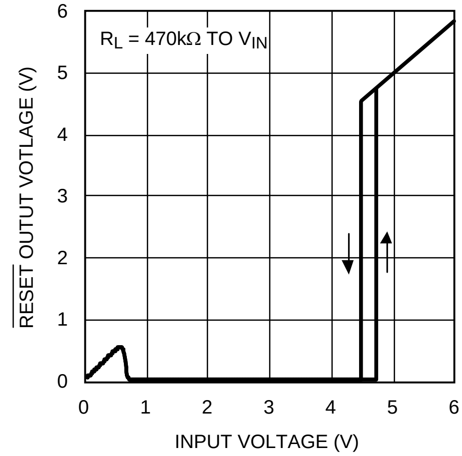


Figure 3.

Reset Output Sink Current vs. Input Voltage LM8364BALMF45

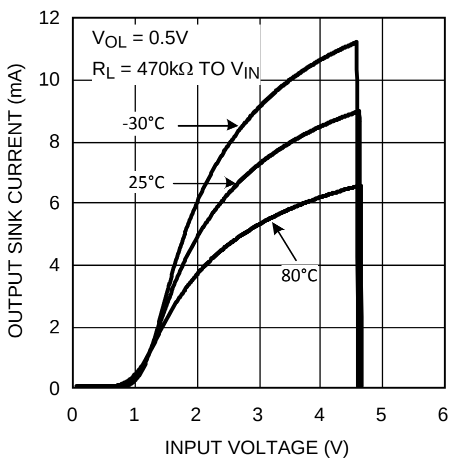


Figure 4.

Reset Output Sink Current vs. Output Voltage LM8364BALMF45

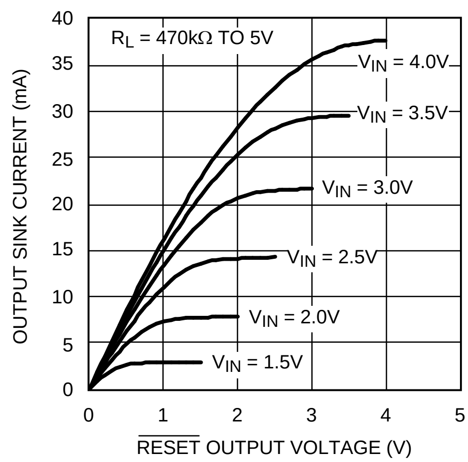


Figure 5.

Detector Threshold Voltage vs. Temperature LM8364BALMF45

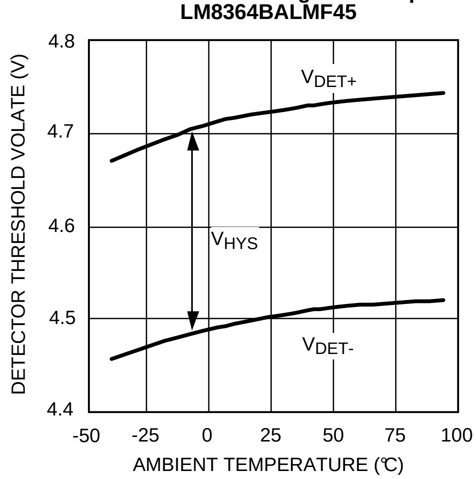


Figure 6.

APPLICATION NOTES

The propagation delay time for the LM8364 is measured using a 470kΩ pull-up resistor connected to from the $\overline{\text{RESET}}$ output pin to 5V in addition to a 10pF capacitive load connected from the same pin to GND. Figure 7 shows the timing diagram for the measurement for the propagation delay. V_{DET+} is equal to the sum of the detector threshold, V_{DET-}, and the built in hysteresis, V_{HYS}.

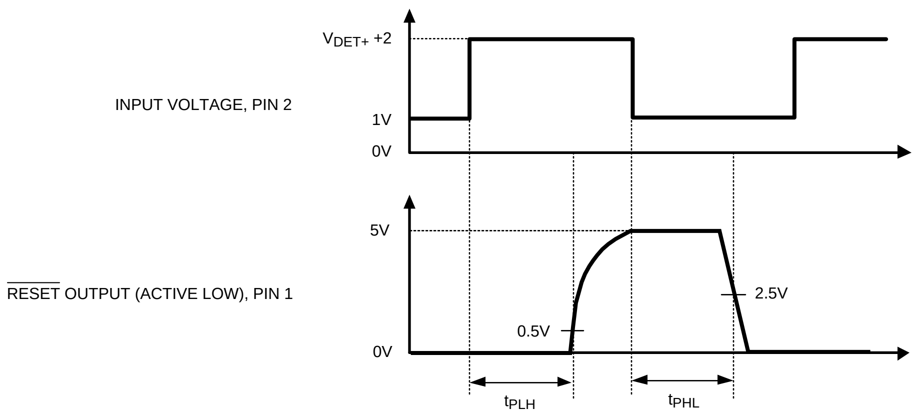


Figure 7. Propagation Delay Timing Diagrams

The LM8364 ultra-low current voltage detector was designed to monitor voltages and to provide an indication when the monitored voltage, V_{IN}, dropped below a precisely trimmed threshold voltage. This characteristic is displayed in the typical operating timing diagram below. V_{IN} is the voltage that is being monitored and a pull up resistor is connected from the $\overline{\text{RESET}}$ output pin to V_{IN}. V_{IN} is at some value above V_{DET+} and then begins to decrease. Since this is an Active Low device the $\overline{\text{RESET}}$ output is pulled High through the pull-up resistor and tracks V_{IN} until V_{IN} crosses the trimmed threshold V_{DET-}. At this point the LM8364 recognizes that V_{IN} is now in a fault condition and the output immediately changes to the Logic Low State. The $\overline{\text{RESET}}$ output will remain in this low state until V_{IN} increases above the threshold $V_{DET-} + V_{HYS}$. This point is also known as V_{DET+} as indicated earlier. This built-in hysteresis has been added to the design to help prevent erratic reset operation when the input voltage crosses the threshold.

The LM8364 has a wide variety of applications that can take advantage of its precision and low current consumption to monitor Input voltages even though it was designed as a reset controller in portable microprocessor based systems. It is a very cost effective and space saving device that will protect your more expensive investments of microprocessors and other devices that need a specified supply voltage for proper operation.

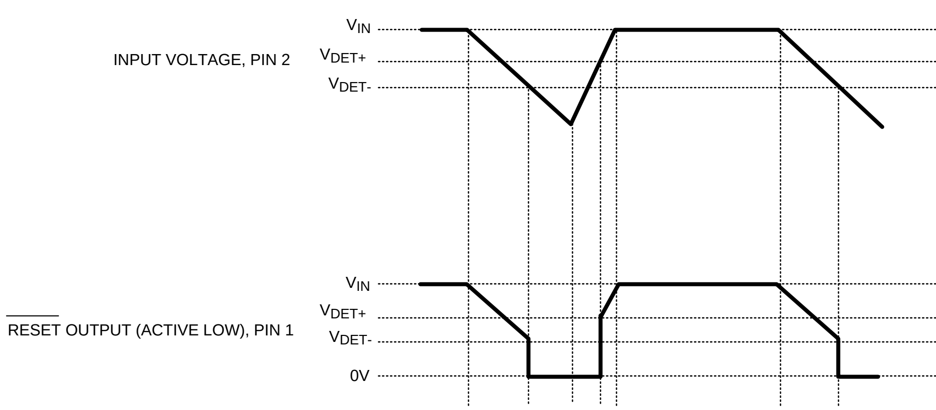


Figure 8. Timing Waveforms

Typical Applications

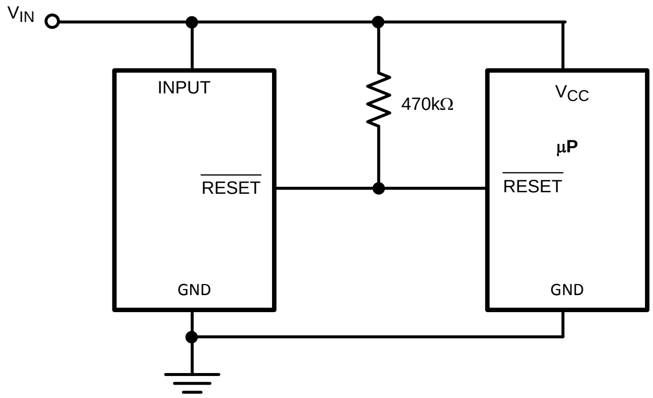


Figure 9. Microprocessor Reset Circuit

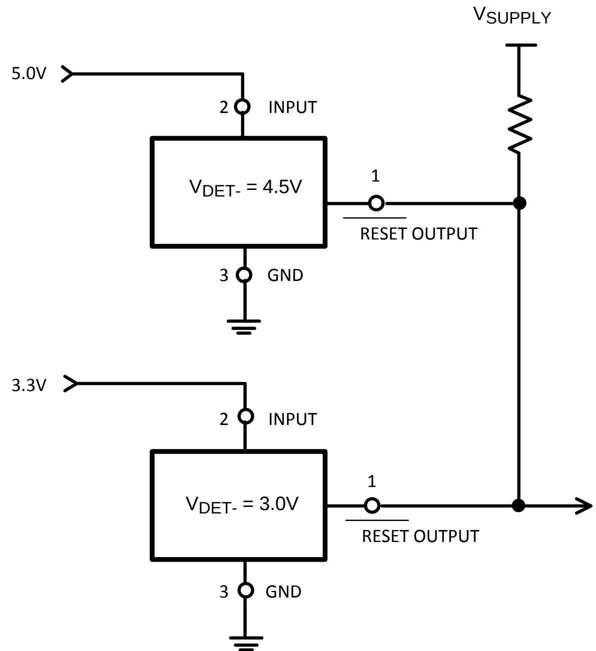
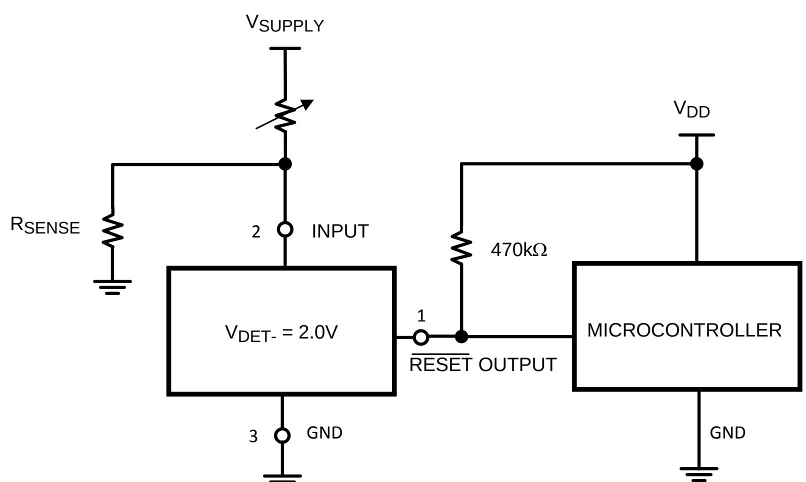


Figure 10. Dual Power Supply Undervoltage Supervision



THIS CIRCUIT MONITORS THE CURRENT AT THE LOAD. AS CURRENT FLOW THROUGH THE LOAD, A VOLTAGE DROP WITH RESPECT TO GROUND APPEARS ACROSS R_{SENSE} WHERE $V_{SENSE} = I_{LOAD} * R_{SENSE}$. THE FOLLOWING CONDITIONS APPLY:

IF:	THEN:
$I_{LOAD} < V_{DET-} / R_{SENSE}$	$\overline{\text{RESET}}$ OUTPUT = 0V
$I_{LOAD} \geq (V_{DET-} + V_{HYS})/R_{SENSE}$	$\overline{\text{RESET}}$ OUTPUT = V_{DD}

Figure 11. Microcontroller System Load Sensing

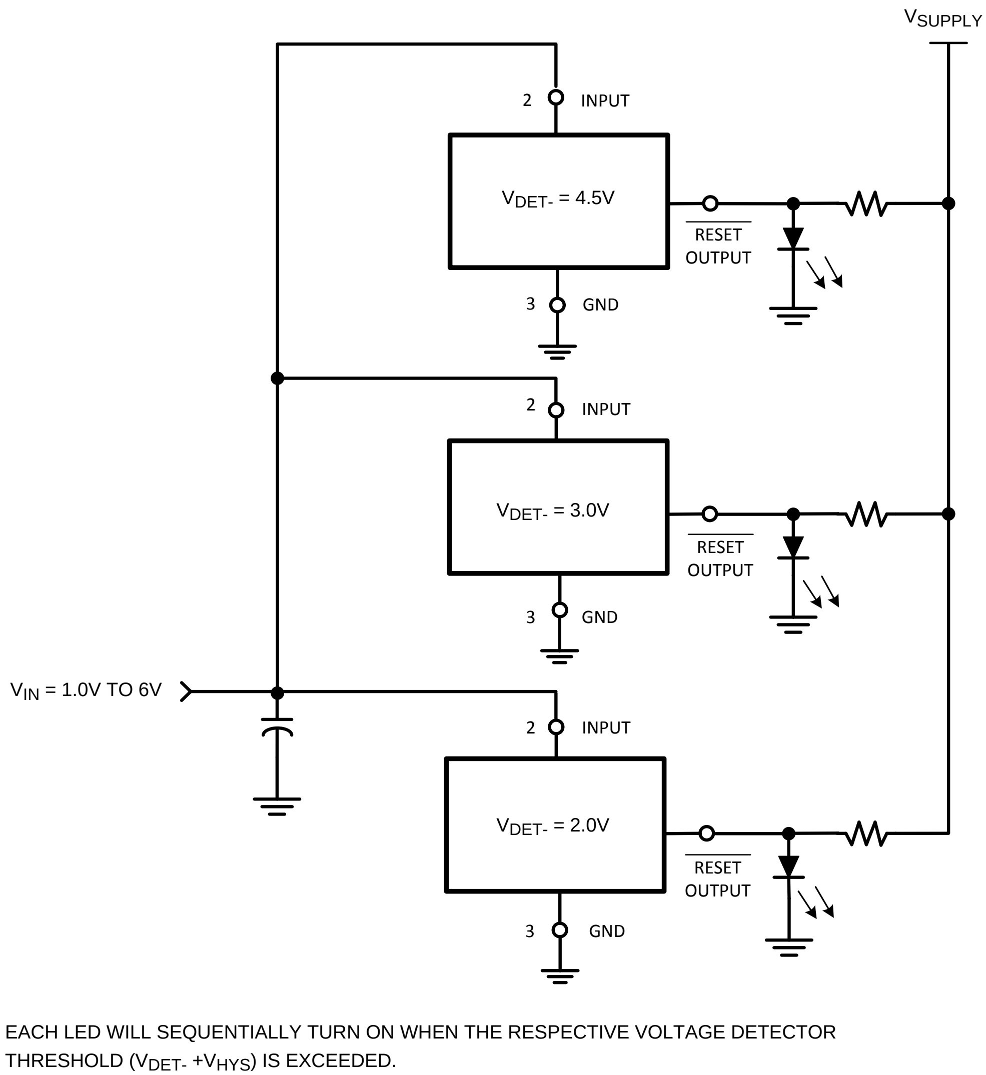


Figure 12. LED Bar Graph Voltage Monitor

REVISION HISTORY

Changes from Revision A (April 2013) to Revision B	Page
• Changed layout of National Data Sheet to TI format	7

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