19-1695; Rev 2; 12/05

Quad Voltage Monitor in µMAX Package

General Description

The MAX6338 quad voltage monitor is capable of monitoring up to four supplies without any external components. A variety of factory-trimmed threshold voltages and supply tolerances are available to optimize the MAX6338 for specific applications. The selection includes input options for monitoring +5.0V, +3.3V, +3.0V, +2.5V, +1.8V, and -5.0V voltages. An additional high-input impedance comparator option can be used as an adjustable voltage monitor, general-purpose comparator, or digital level translator.

Each of the monitored voltages is available with trip thresholds to support power-supply tolerances of either 5% or 10% below the nominal voltage. An internal bandgap reference ensures accurate trip thresholds across the extended (-40°C to +85°C) operating temperature range.

The MAX6338 consumes 25µA (typ) supply current and operates with supply voltages from +2.5V to +5.5V. An internal undervoltage lockout circuit forces all four digital outputs low when V_{CC} drops below the minimum operating voltage. The four digital outputs all have weak internal pull-ups to V_{CC}, allowing wire-ORed connection. Each input threshold voltage has an independent output.

The MAX6338 is available in a 10-pin µMAX® package.

Applications

Telecommunications

High-End Printers

Desktop and Notebook Computers

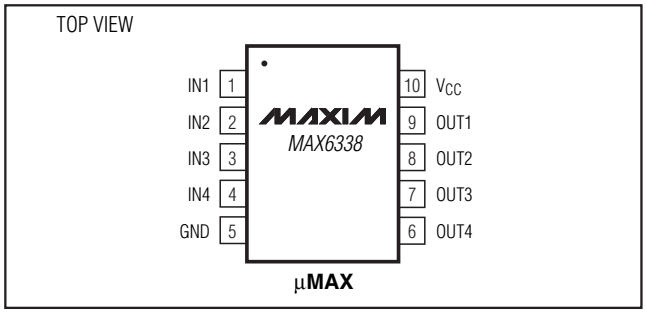
Data Storage Equipment

Networking Equipment

Industrial Equipment

Set-Top Boxes

Pin Configuration



µMAX is a registered trademark of Maxim Integrated Products, Inc.

Features

- **Monitors Four Voltages (Factory Programmed or User Adjustable)**
  +5.0V, +3.3V, +3.0V, +2.5V, +1.8V, -5.0V (nominal) or User-Adjustable Settings
- **Low 25µA Supply Current**
- **Four Independent, Open-Drain, Active-Low Outputs**
- **+2.5V to +5.5V Supply Voltage Range**
- **Guaranteed from -40°C to +85°C**
- **No External Components Required**
- **Small 10-Pin µMAX Package**

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX6338_UB*	-40°C to +85°C	10 µMAX

**Insert the desired letter from the Selector Guide into the blank to complete the part number.*

Devices are available in both leaded and lead-free packaging. Specify lead free by adding the + symbol at the end of the part number when ordering.

Selector Guide

PART	NOMINAL INPUT VOLTAGE				
	IN1 (V)	IN2 (V)	IN3 (V)	IN4 (V)	SUPPLY TOLERANCE (%)
MAX6338AUB	5	3.3	2.5	Adj*	10
MAX6338BUB	5	3.3	2.5†	Adj*	5
MAX6338CUB	5	3.3	1.8	Adj*	10
MAX6338DUB	5	3.3	1.8†	Adj*	5
MAX6338EUB	5	3.0	2.5	Adj*	10
MAX6338FUB	5	3.0	2.5†	Adj*	5
MAX6338GUB	5	3.0	1.8	Adj*	10
MAX6338HUB	5	3.0	1.8†	Adj*	5
MAX6338IUB	5	3.3	2.5	1.8	10
MAX6338JUB	5	3.3	2.5†	1.8†	5
MAX6338KUB	Adj*	3.3	2.5	Adj*	10
MAX6338LUB	Adj*	3.3	2.5†	Adj*	5
MAX6338MUB	5	3.0	Adj*	-5	10
MAX6338NUB	5	3.0	Adj*	-5	5
MAX6338OUB	5	3.3	Adj*	-5	10
MAX6338PUB	5	3.3	Adj*	-5	5

**Adjustable voltage based on +1.23V internal threshold. External threshold voltage can be set using an external resistor-divider.*
† Nominal input voltages for 1.8V and 2.5V are specified for 10% tolerances

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

Quad Voltage Monitor in µMAX Package

ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (with respect to GND)
V_{CC} .....-0.3V to +6V
Output Voltages (OUT_).....-0.3V to +6V
Input Voltages (IN_) (except -5V).....-0.3V to +6V
Input Voltage (-5V input) .....-6V to +0.3V
Continuous OUT_ Current.....20mA

Continuous Power Dissipation (T_A = +70°C)
10-pin µMAX (derate 5.6mW/°C above +70°C) 444mW
Operating Temperature Range .....-40°C to +85°C
Storage Temperature Range .....-65°C to +150°C
Junction Temperature.....+150°C
Lead Temperature (soldering, 10s) .....+300°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

(V_{CC} = +2.5V to +5.5V, T_A= -40°C to +85°C, unless otherwise noted. Typical values are at T_A= +25°C and V_{CC} = +5V, unless otherwise noted.) (Note 1)

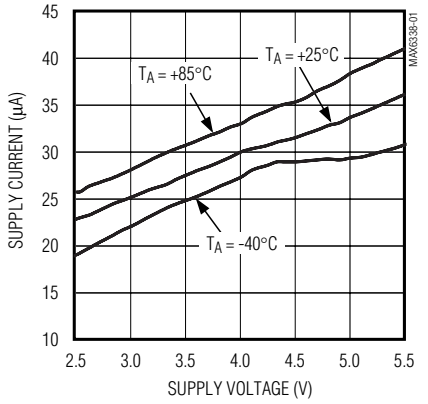
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage Range	V_{CC}		+2.5		+5.5	V
Supply Current	I_{CC}	V_{CC} = +3V		25	50	µA
		V_{CC} = +5V		35	65	
Input Current (Note 2)	$I_{IN_}$	$V_{IN_}$ = input threshold voltage (+1.8V, +2.5V, +3.0V, +3.3V, +5.0V)		25	40	µA
		$V_{IN_}$ = 0 to V_{CC} (input threshold voltage =1.23V)	-0.1		+0.1	
		$V_{IN_}$ = -5V (input threshold voltage = -5V)		-10	-20	
+5.0V (-5%) Threshold	V_{TH}	V_{IN} decreasing	4.5	4.63	4.75	V
+5.0V (-10%) Threshold	V_{TH}	V_{IN} decreasing	4.25	4.38	4.50	V
+3.3V (-5%) Threshold	V_{TH}	V_{IN} decreasing	3.0	3.08	3.15	V
+3.3V (-10%) Threshold	V_{TH}	V_{IN} decreasing	2.85	2.93	3.00	V
+3.0V (-5%) Threshold	V_{TH}	V_{IN} decreasing	2.7	2.78	2.85	V
+3.0V (-10%) Threshold	V_{TH}	V_{IN} decreasing	2.55	2.63	2.70	V
+2.5V (-10%) Threshold	V_{TH}	V_{IN} decreasing	2.13	2.19	2.25	V
+1.8V (-10%) Threshold	V_{TH}	V_{IN} decreasing	1.53	1.58	1.62	V
-5.0V (+5%) Threshold	V_{TH}	V_{IN} increasing	-4.75	-4.63	-4.50	V
-5.0V (+10%) Threshold	V_{TH}	V_{IN} increasing	-4.5	-4.38	-4.25	V
Adjustable Threshold	V_{TH}	V_{IN} decreasing	1.20	1.23	1.26	V
Threshold Voltage Temperature Coefficient				60		ppm/°C
Threshold Hysteresis	V_{THYST}			0.3		%
Propagation Delay	t_{pd}	$V_{IN_}$ = V_{TH} to (V_{TH} - 50mV) or V_{TH} to (V_{TH} - 50mV)		20		µs
Output Low Voltage	V_{OL}	V_{CC} = 5V, I_{SINK} = 2mA			0.4	V
		V_{CC} = 2.5V, I_{SINK} = 1.2mA			0.4	
		V_{CC} = 1V, I_{SINK} = 50µA			0.4	
Output High Voltage	V_{OH}	V_{CC} > 2.5V, I_{SOURCE} = 6µA (minimum)	0.8 x V_{CC}			V

Note 1: 100% production tested at +25°C. Overtemperature limits guaranteed by design.
Note 2: Guaranteed by design.

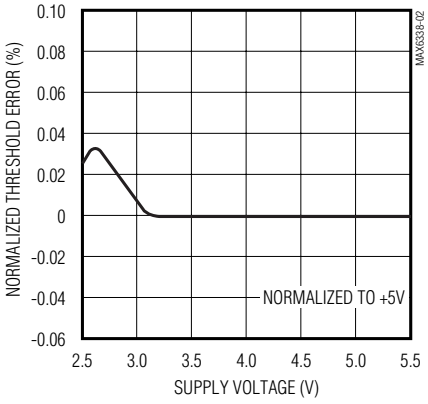
Typical Operating Characteristics

(V_{CC} = +5V, T_A = +25°C, unless otherwise noted.)

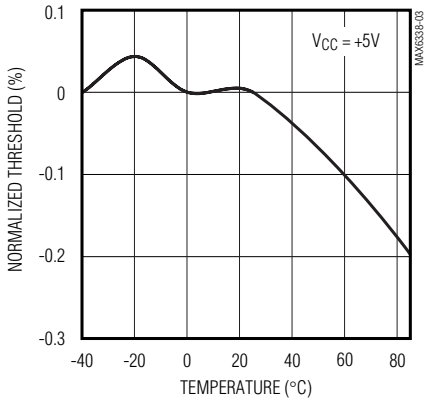
SUPPLY CURRENT vs. SUPPLY VOLTAGE



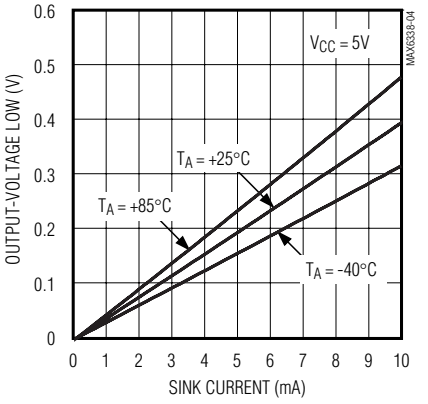
NORMALIZED THRESHOLD ERROR vs. SUPPLY VOLTAGE



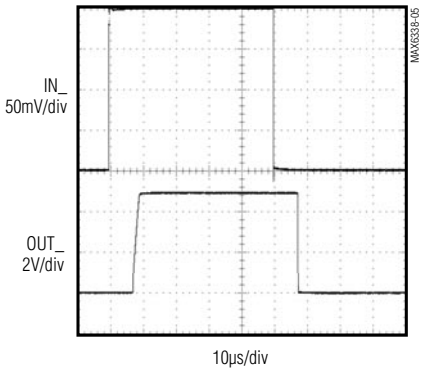
NORMALIZE THRESHOLD vs. TEMPERATURE



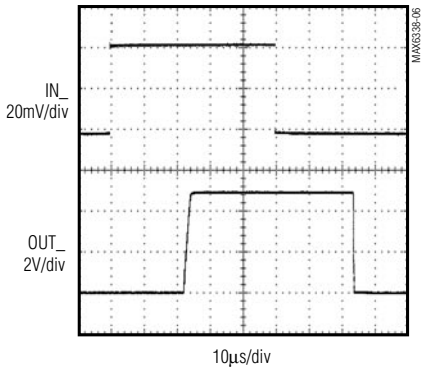
OUTPUT-VOLTAGE LOW vs. SINK CURRENT



PROPAGATION DELAY (WITH 100mV OVERDRIVE)



PROPAGATION DELAY (WITH 20mV OVERDRIVE)



Quad Voltage Monitor in µMAX Package

Pin Description

PIN	NAME	FUNCTION
1	IN1	Input Voltage 1. See the *Selector Guide* for monitored voltages.
2	IN2	Input Voltage 2. See the *Selector Guide* for monitored voltages.
3	IN3	Input Voltage 3. See the *Selector Guide* for monitored voltages.
4	IN4	Input Voltage 4. See the *Selector Guide* for monitored voltages.
5	GND	Ground
6	OUT4	Output 4. OUT4 goes low when V_{IN4} falls below its absolute threshold. OUT4 is open drain with a 10µA internal pullup to V_{CC}.
7	OUT3	Output 3. OUT3 goes low when V_{IN3} falls below its absolute threshold. OUT3 is open drain with a 10µA internal pullup to V_{CC}.
8	OUT2	Output 2. OUT2 goes low when V_{IN2} falls below its absolute threshold. OUT2 is open drain with a 10µA internal pullup to V_{CC}.
9	OUT1	Output 1. OUT1 goes low when V_{IN1} falls below its absolute threshold. OUT1 is open drain with a 10µA internal pullup to V_{CC}.
10	V_{CC}	Power Supply. Connect V_{CC} to a +2.5V to +5.5V supply. An undervoltage lockout circuit forces all OUT_ pins low when V_{CC} drops below 2.5V.

Detailed Description

The MAX6338 is a low-power (25µA), quad voltage monitor designed for multivoltage systems. Preset voltage options for +5.0V, +3.3V, +3.0V, +2.5V, +1.8V, and -5.0V make these quad monitors ideal for applications such as telecommunications, desktop and notebook computers, high-end printers, data storage equipment, and networking equipment.

The MAX6338 has an internally trimmed threshold that minimizes or eliminates the need for external components. The four open-drain outputs have weak (10µA) internal pullups to V_{CC}, allowing them to interface easily with other logic devices. The MAX6338 can monitor power supplies with either 5% or 10% tolerance specifications, depending on the selected version. An additional high-input-impedance comparator option can be used as an adjustable voltage monitor, general-purpose comparator, or digital level translator.

The weak internal pullups can be overdriven by external pullups to any voltage from 0 to +5.5V. Internal circuitry prevents current flow from the external pullup voltage to V_{CC}. The outputs can be wire-ORed for a single "power good" signal.

The MAX6338 has either one or two auxiliary inputs and two or three factory-programmed threshold voltages, or four fixed voltages. The inverting input of all comparators is connected to a 1.23V bandgap reference for all positive voltages. The noninverting terminals are accessible through internal resistive voltage-dividers with preset factory threshold voltages. In the case of auxiliary (AUX) input, the positive terminal of the comparator is accessible directly for setting the threshold for the monitored voltage.

When any of the inputs (IN1–IN4) are higher than the threshold level, the output is high. The output goes low as the input drops below the threshold voltage monitor. The undervoltage lockout circuitry remains active and the outputs remain low with V_{CC} down to 1V (Figure 1).

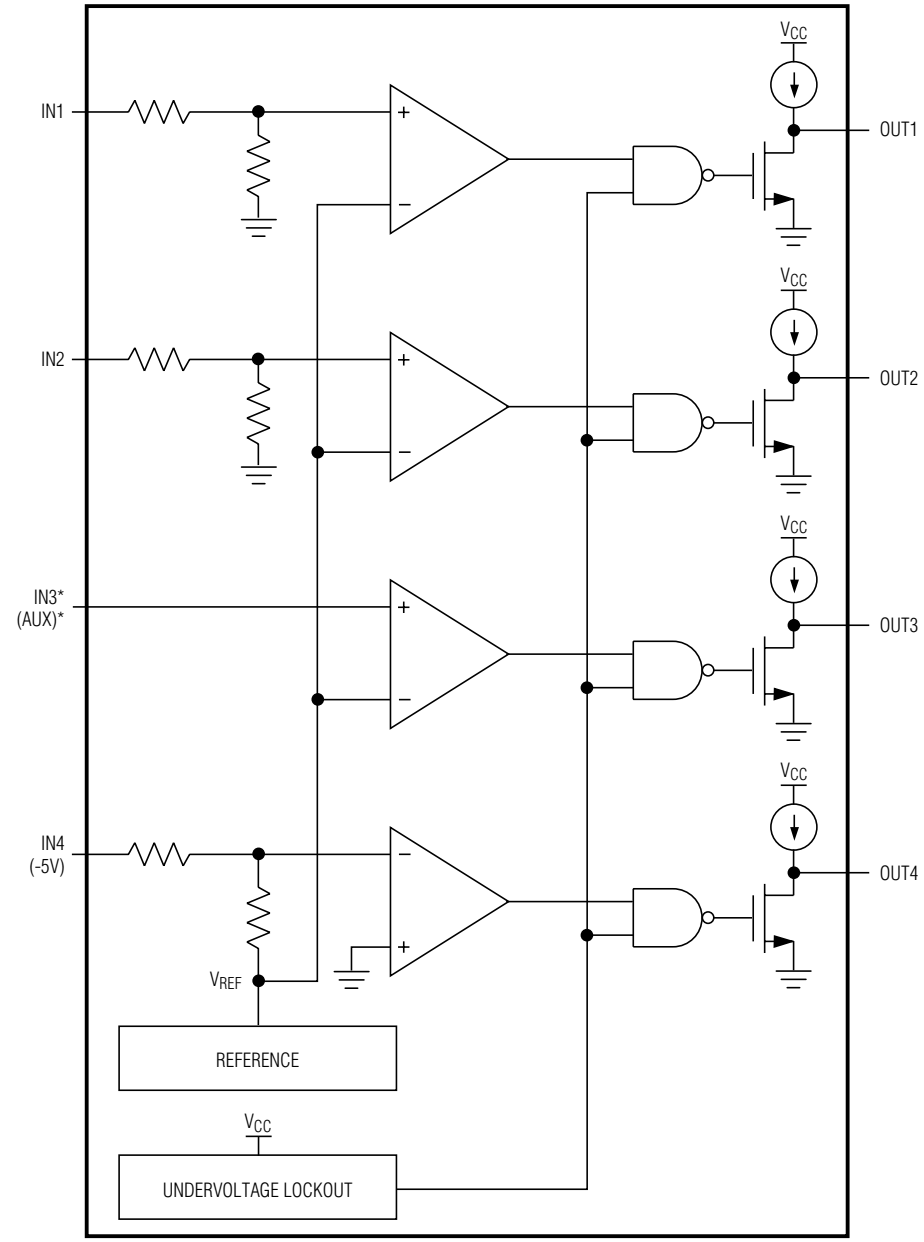
Applications Information

Hysteresis

When the voltage on one comparator input is at or near the voltage on the other input, ambient noise generally causes the comparator output to oscillate. The most common way to eliminate this problem is through hysteresis. When the two comparator input voltages are equal, hysteresis causes one comparator input voltage to move quickly past the other, thus taking the input out of the region where oscillation occurs. Standard comparators require hysteresis to be added through the use of external resistors. The external resistive network usually provides a positive feedback to the input in order to cause a jump in the threshold voltage when

MAXIM

MAX6338M/N/O/P



*SEE *AUXILIARY INPUT* SECTION.

Figure 1. Functional Diagram

Quad Voltage Monitor in µMAX Package

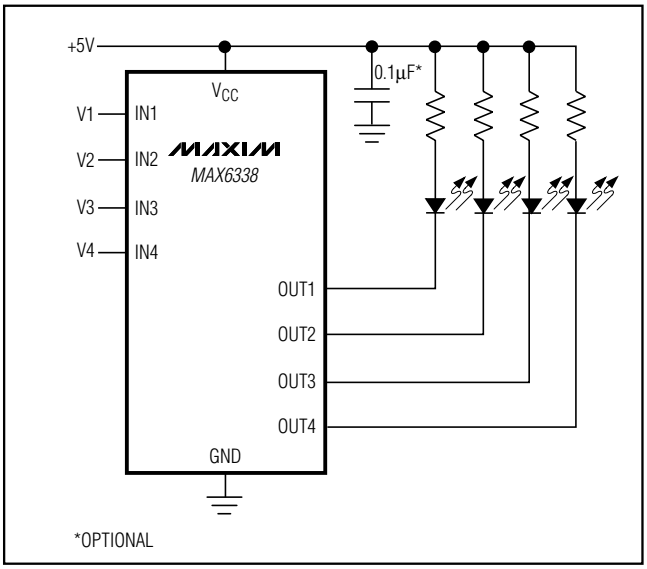


Figure 2. Quad Undervoltage Detector with LED Indicators

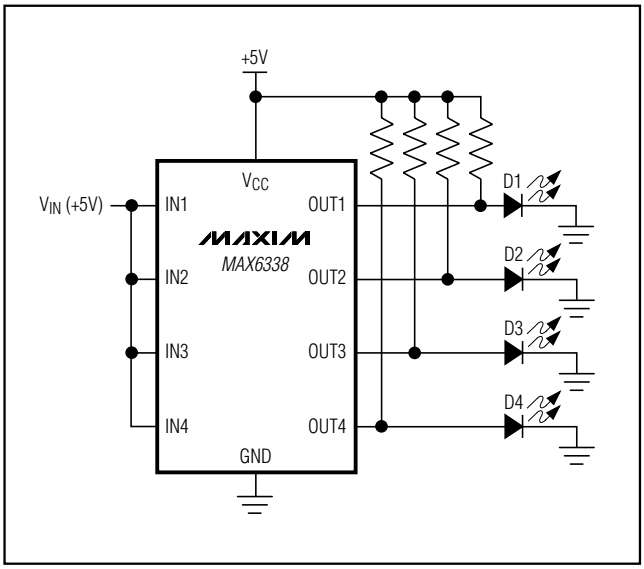


Figure 3. V_{CC} Bar Graph Monitoring

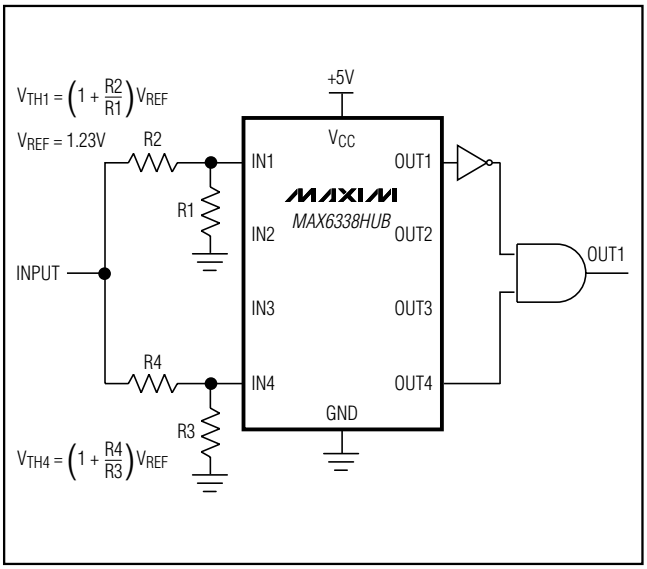


Figure 4. Window Detection

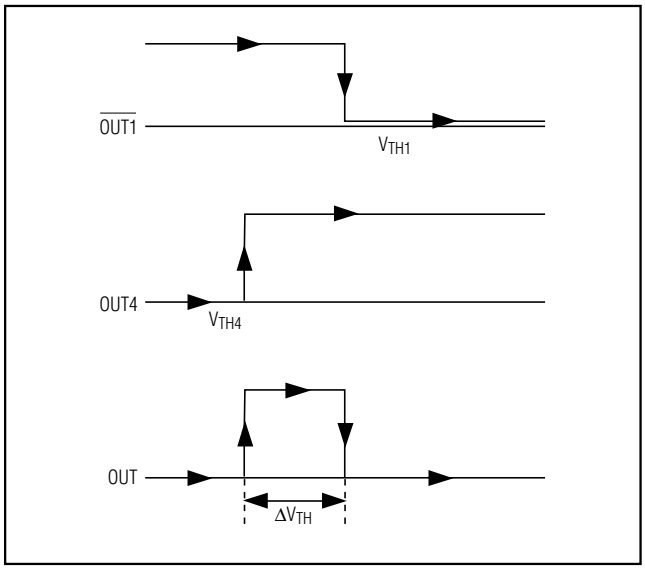


Figure 5. Output Response of Window Detector Circuit

output toggles in one direction or the other. These resistors are not required when using the MAX6338 because hysteresis is built into the device. MAX6338 hysteresis is typically 0.3%.

Undervoltage Detection Circuit

The open-drain outputs of the MAX6338 can be configured to detect an undervoltage condition. Figure 2 shows a configuration where a low at a comparator output indicates an undervoltage condition, which in turn causes an LED to light.

The MAX6338 can also be used in applications such as system supervisory monitoring, multivoltage level detection, and V_{CC} bar graph monitoring (Figure 3).

Window Detection

A window detector circuit uses two auxiliary inputs in a configuration such as the one shown in Figure 4. External resistors R1–R4 set the two threshold voltages (V_{TH1} and V_{TH4}) of the window detector circuit. Window width (ΔV_{TH}) is the difference between the threshold voltages (Figure 5).

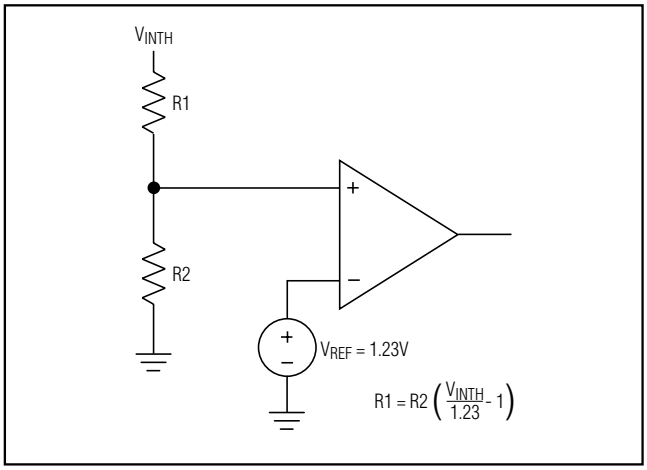


Figure 6. Setting the Auxiliary Monitor

Auxiliary Input

The adjustable voltage monitor is comparable to an internal reference of 1.23V as shown in Figure 6. To set the desired trip level of monitored supply, V_{INTH}, choose: R1 = R2 [(V_{INTH} / 1.23) - 1)]. For example, for a voltage detection at 4.5V (assume R2 = 100kΩ), R1 = 265kΩ.

Unused Inputs

The unused inputs (except the auxiliary) are internally connected to ground through the lower resistors of the threshold-setting resistor pairs. The auxiliary (AUX) input, however, must be connected to either ground or V_{CC} if unused.

Power-Supply Bypassing and Grounding

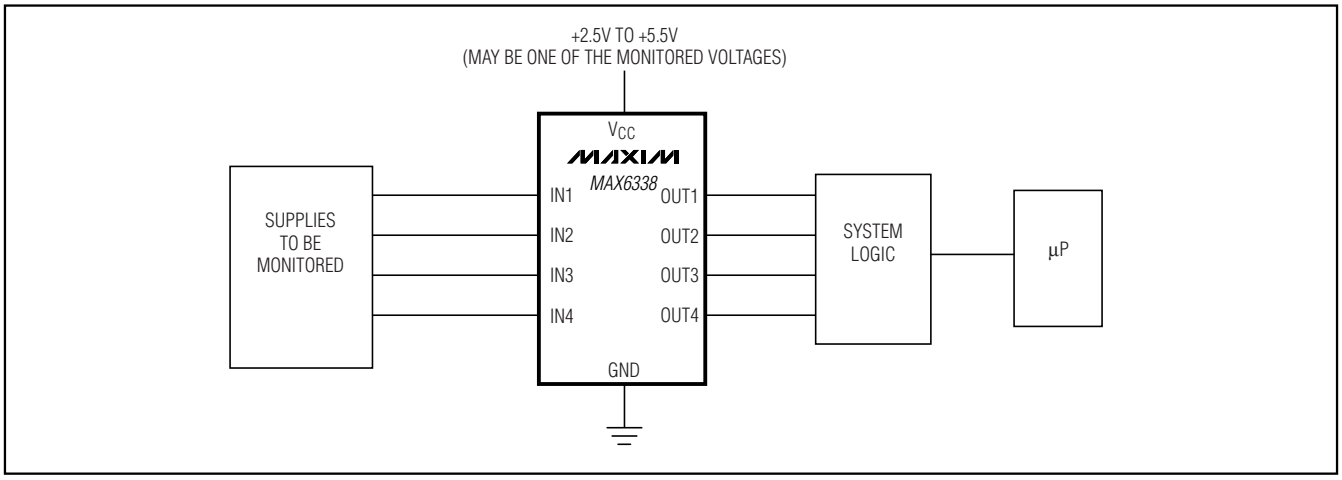
The MAX6338 operates from a single +2.5V to +5.5V supply. In noisy applications, connect a 0.1µF capacitor on the supply voltage line close to V_{CC} pin for bypassing.

Chip Information

TRANSISTOR COUNT: 620

PROCESS: BiCMOS

Typical Operating Circuit

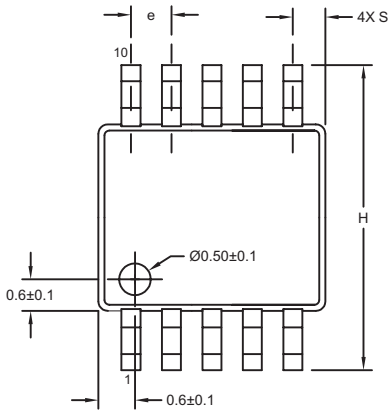


Quad Voltage Monitor in µMAX Package

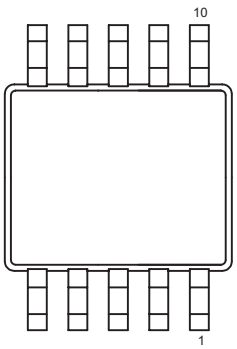
Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

10LUMAX.EPS

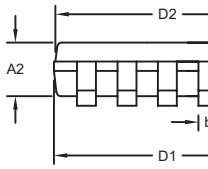


TOP VIEW

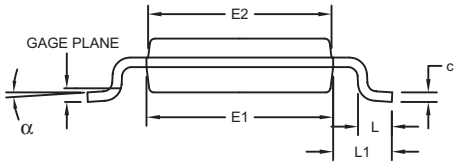


BOTTOM VIEW

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	-	0.043	-	1.10
A1	0.002	0.006	0.05	0.15
A2	0.030	0.037	0.75	0.95
D1	0.116	0.120	2.95	3.05
D2	0.114	0.118	2.89	3.00
E1	0.116	0.120	2.95	3.05
E2	0.114	0.118	2.89	3.00
H	0.187	0.199	4.75	5.05
L	0.0157	0.0275	0.40	0.70
L1	0.037 REF		0.940 REF	
b	0.007	0.0106	0.177	0.270
e	0.0197 BSC		0.500 BSC	
c	0.0035	0.0078	0.090	0.200
S	0.0196 REF		0.498 REF	
α	0°	6°	0°	6°



FRONT VIEW



SIDE VIEW

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. CONTROLLING DIMENSION: MILLIMETERS.
4. MEETS JEDEC MO-187C-BA.

DALLAS SEMICONDUCTOR MAXIM

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, 10L uMAX/uSOP

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0061	I	1/1

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