MIC845

Micro-Power Comparator / Battery Monitor

Teeny™

General Description

The MIC845 is a precision micro-power voltage comparator with an on-chip 2.55V reference voltage source.

Intended for voltage monitoring applications, the MIC845 can be used with an external resistor divider to detect a wide range of voltages, or without external resistors to directly monitor voltages with its high input impedance CMOS input.

The MIC845 incorporates a voltage reference and comparator with fixed internal hysteresis. When the 2.55V internal threshold is crossed, the output switches polarity.

MIC845 is available with a push-pull or open-drain output stage. The push-pull output stage is configured for both active high or active low output; the open-drain output stage is only configured active high.

Supply current is extremely low (typically 1µA), making it ideal for portable applications.

MIC845 is supplied in Micrel's Teeny™ 5-lead SC-70 package.

Data sheets and support documentation can be found on Micrel's web site at www.micrel.com.
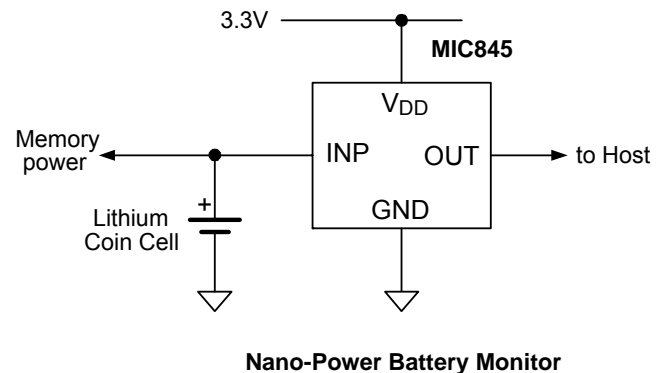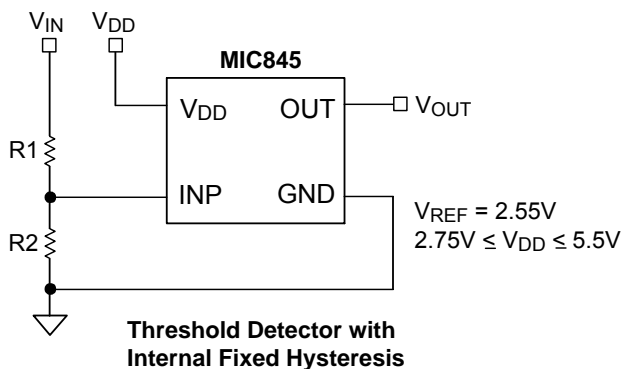
Features

- Extremely low 1µA supply current (typical)
- 2.55V on chip reference
- ±2% voltage threshold accuracy
- Optimized for PDAs, cellular telephones, pagers, and other battery-powered devices
- Open-drain output can be pulled up to 6V regardless of supply voltage
- 5-lead SC-70 package

Applications

- PDAs
- Pagers
- Cordless phones
- Portable electronics
- Motherboards
- Bladed servers

Typical Applications

V_{REF} = 2.55V
2.75V ≤ V_{DD} ≤ 5.5V

Threshold Detector with Internal Fixed Hysteresis

Nano-Power Battery Monitor

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July 2005

M9999-070505
(408) 955-1690

Ordering Information

Part Number				Temperature Range	Package
Standard	**Marking**	**Pb-Free**	**Marking***		
MIC845HBC5	B19	MIC845HYC5	<u>B19</u>	–40° to +85°C	SC-70
MIC845LBC5	B20	MIC845LYC5	<u>B20</u>	–40° to +85°C	SC-70
MIC845NBC5	B21	MIC845NYC5	<u>B21</u>	–40° to +85°C	SC-70

***Note:** Underscore on device marking indicates Pb-Free packaging.

Pin Configuration
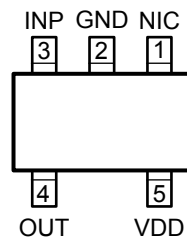
SC-70-5 (C5)

(TOP VIEW)

Pin Description

Pin Number	Pin Name	Pin Function
1	NIC	No Internal Connection. A signal applied to this pin will have no effect on device operation.
2	GND	Ground
3	INP	Input: Analog input to the comparator. When $V_{INP} > V_{REF} + V_{HYST}$, V_{OUT} is asserted, and the condition is held until $V_{INP} < V_{REF}$.
4	OUT ("N" Version)	Output: Active-high, open-drain output. This output is low when $V_{INP} < V_{REF}$, indicating a low voltage input. The output is high when $V_{INP} > V_{REF} + V_{HYST}$.
	OUT ("H" Version)	Output: Active-high, Push-pull output. This output is low when $V_{INP} < V_{REF}$, indicating a low voltage condition. The output is high when $V_{INP} > V_{REF} + V_{HYST}$.
	OUT ("L" Version)	Output: Active-low, Push-pull output. This output is high when $V_{INP} < V_{REF}$, indicating a low voltage condition. The output is low when $V_{INP} > V_{REF} + V_{HYST}$.
5	VDD	Power Supply (Input): Independent supply input for internal circuitry.

Absolute Maximum Ratings[1]

Supply Voltage (V_{DD}) ....-0.3V to +6V
Input Voltage (V_{INP})..................................-0.3V to +6V
Output Current (I_{OUT}).. 20mA
Junction Temperature (T_J).............. –40°C to +125°C
Storage Temperature (T_s)............... –65°C to +150°C
Lead Temperature (soldering, 5 sec.) ....260°C
ESD Rating[3] 3kV

Operating Ratings[2]

Supply voltage (V_{DD}) .... +2.75V to +5.5V
Input Voltage..-0.3 to 6V
Ambient Temperature (T_A)............... –40°C to +85°C
Junction to Ambient Thermal Resistance:
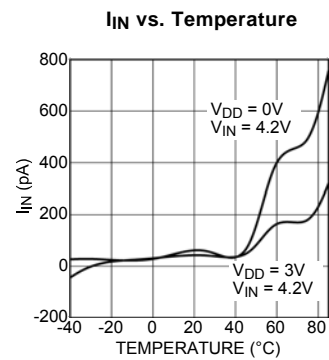   SC-70 (θ_{JA})... 450°C/W

Electrical Characteristics

2.75V < V_{DD} < 5.5V; T_A = 25°C, **Bold** values indicate –40°C$\leq$ T_A $\leq$ +85°C, unless noted.

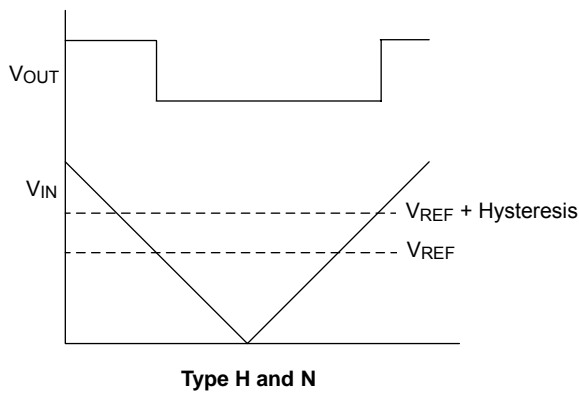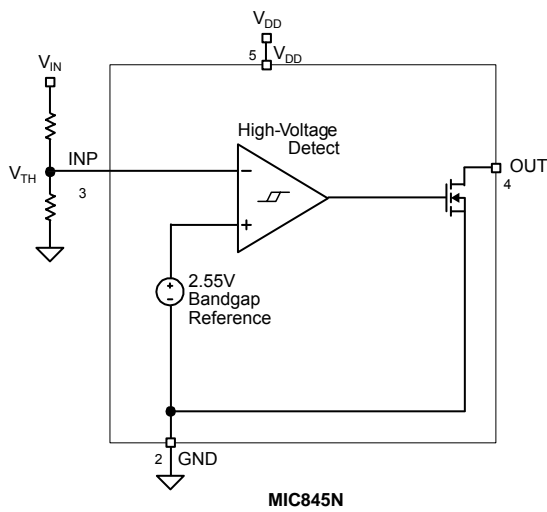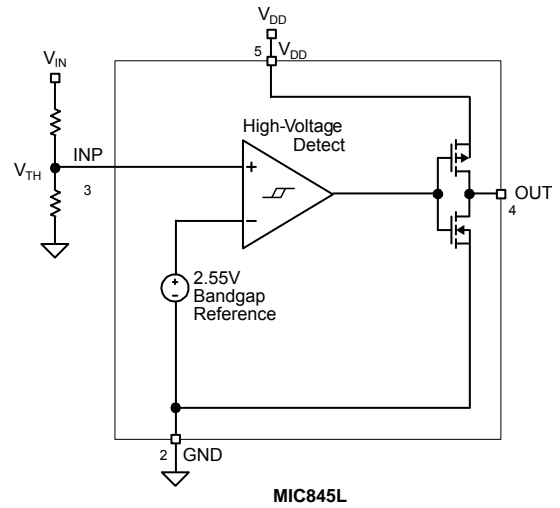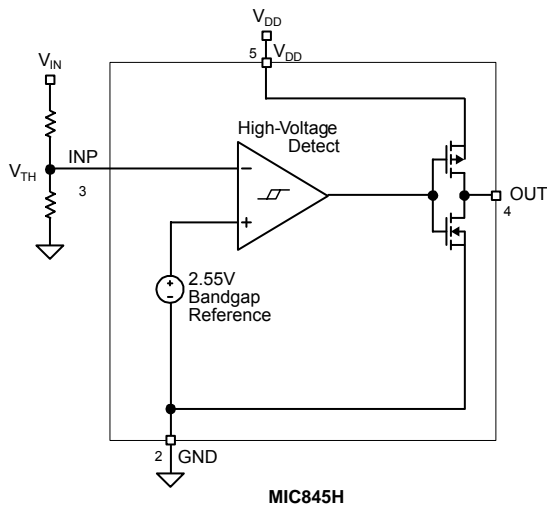| Parameter	Parameter	Conditions	Min	Typ.	Max	Units
I_{DD}	Supply Current	No load on output		1	**3**	µA
I_{INP}	Input Leakage Current	V_{DD} = 5.5V, V_{INP} = 0V		.005	**10**	nA
I_{INP_PD}	Input Leakage Current in power down	V_{DD} = 0V **(note 4)**, V_{INP} = 5.5V		.005	**10**	nA
V_{REF}	V_{REF}	–40°C to 85°C	**2.50**	2.55	**2.60**	V
V_{HYST}	Comparator Hysteresis		**8**	25	**40**	mV
V_{OUT}	Output Voltage, 'N'	I_{SINK} = 1.6mA, VDD ≥ 2.75V			**0.3**	V
V_{OUT}	Output Voltage, 'L' and 'H'	I_{SINK} = 1.6mA, VDD ≥ 2.75V			**0.3**	V
		I_{SOURCE} = 500µA, VDD ≥ 2.75V	**0.95 × V_{DD}**	0.99 × V_{DD}		V
t_D	Propagation Delay	V_{INP} = 2.7V to 2.4V		12	**39**	µs
		V_{INP} = 2.4V to 2.7V		8	**26**	µs

Notes:

1. Exceeding the absolute maximum rating may damage the device.

2. The device is not guaranteed to function outside its operating rating.

3. Devices are ESD sensitive. Handling precautions recommended. Human body model: 1.5k in series with 100pF.

4. VDD is tied to Gnd, not left floating.

Typical Characteristics

I_{DD} vs. Temperature

$$V_{DD} = 4.5V$$
$$V_{IN} = 0V$$

$$V_{DD} = 0V$$
$$V_{IN} = 4.5V$$

I_{DD} (nA) vs. TEMPERATURE (°C)

I_{IN} vs. Temperature

$$V_{DD} = 0V$$
$$V_{IN} = 4.5V$$

$$V_{DD} = 4.5V$$
$$V_{IN} = 0V$$

I_{IN} (pA) vs. TEMPERATURE (°C)

I_{DD} vs. Temperature

$$V_{DD} = 3V$$
$$V_{IN} = 4.2V$$

$$V_{DD} = 0V$$
$$V_{IN} = 4.2V$$

I_{DD} (nA) vs. TEMPERATURE (°C)

I_{IN} vs. Temperature

$$V_{DD} = 0V$$
$$V_{IN} = 4.2V$$

$$V_{DD} = 3V$$
$$V_{IN} = 4.2V$$

I_{IN} (pA) vs. TEMPERATURE (°C)

Block Diagrams

MIC845H

MIC845L

MIC845N

Type H and N

Type L
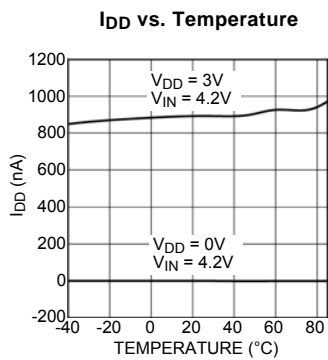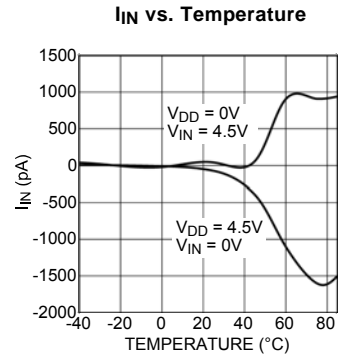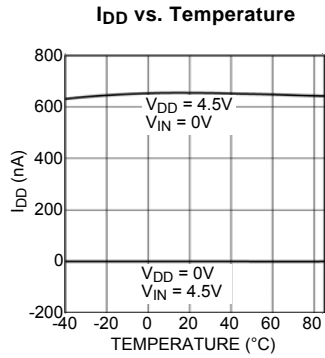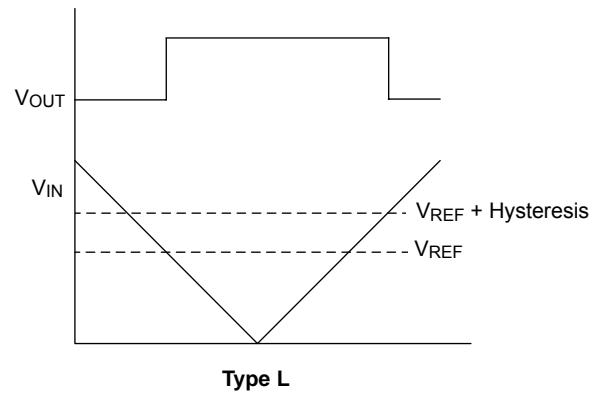
Application Information

Output

The MIC845N output is an open-drain MOSFET, so most applications will require a pull-up resistor. It is recommended that the value of this resistor not exceed 470kΩ, otherwise PCB leakages may begin to dominate and give a false output indication.

The output of "N" type devices may be pulled up as high as 6V regardless of the IC's supply voltage, without damage to the IC.

The "H" and "L" versions of MIC845 have push-pull output stages, no pull-up resistors are required. The maximum output voltage of the "H" and "L" versions is V_{DD}.
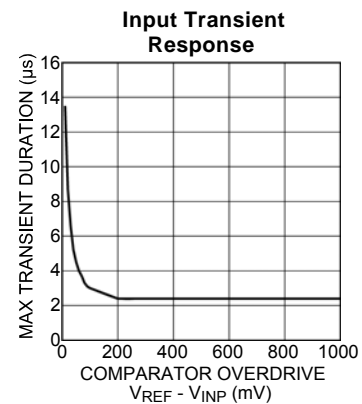
Input

MIC845 has been designed to present an almost infinite input resistance at its INP pin making it ideal for monitoring lithium coin cell and back-up batteries. In applications where the 'battery low' voltage is 2.55V, MIC845's INP pin may be tied directly to the cell's positive terminal without any additional circuitry.

MIC845's input may be subjected to voltages as high as 6V, steady-state, without any adverse effects, regardless of the IC's supply voltage. This applies even if the supply voltage is zero. This permits a situation wherein the IC's supply is turned off, but an input volta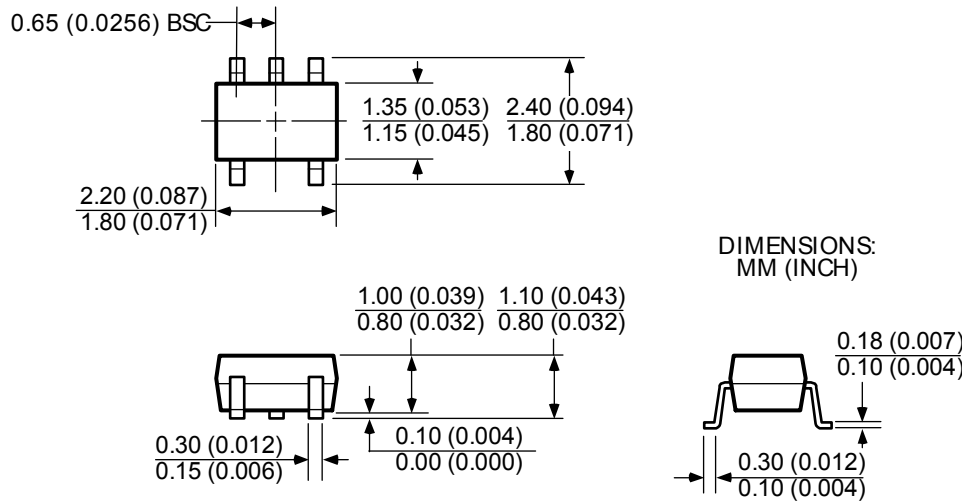ge is still present. Under such conditions, there will be no conduction from INP to V_{DD} or any circuitry internal to MIC845.

Input Transients

MIC845 is inherently immune to very short negative-going "glitches." Very brief transients may exceed the V_{INP} threshold without tripping the output. As shown in the figure below, the narrower the transient, the deeper the threshold overdrive that will be ignored by the MIC845. The graph represents the typical allowable transient duration for a given amount of threshold overdrive that will not generate an output.

Input Transient Response

MAX TRANSIENT DURATION (µs) vs COMPARATOR OVERDRIVE $V_{REF} - V_{INP}$ (mV)

Package Information

0.65 (0.0256) BSC

1.35 (0.053)   2.40 (0.094)
1.15 (0.045)   1.80 (0.071)

2.20 (0.087)
1.80 (0.071)

DIMENSIONS:
MM (INCH)

1.00 (0.039)   1.10 (0.043)
0.80 (0.032)   0.80 (0.032)

0.18 (0.007)
0.10 (0.004)

0.30 (0.012)
0.15 (0.006)

0.10 (0.004)
0.00 (0.000)

0.30 (0.012)
0.10 (0.004)

SC-70-5 (C5)

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