Undervoltage Sensing Circuit

MC34064
MC33064

UNDERVOLTAGE SENSING CIRCUIT

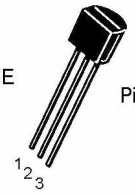
SEMICONDUCTOR
TECHNICAL DATA

The MC34064 is an undervoltage sensing circuit specifically designed for use as a reset controller in microprocessor-based systems. It offers the designer an economical solution for low voltage detection with a single external resistor. The MC34064 features a trimmed-in-package bandgap reference, and a comparator with precise thresholds and built-in hysteresis to prevent erratic reset operation. The open collector reset output is capable of sinking in excess of 10 mA, and operation is guaranteed down to 1.0 V input with low standby current. These devices are packaged in 3-pin TO-226AA, 8-pin SO–8 and Micro–8 surface mount packages.

Applications include direct monitoring of the 5.0 V MPU/logic power supply used in appliance, automotive, consumer and industrial equipment.

- Trimmed-In-Package Temperature Compensated Reference
- Comparator Threshold of 4.6 V at 25°C
- Precise Comparator Thresholds Guaranteed Over Temperature
- Comparator Hysteresis Prevents Erratic Reset
- Reset Output Capable of Sinking in Excess of 10 mA
- Internal Clamp Diode for Discharging Delay Capacitor
- Guaranteed Reset Operation with 1.0 V Input
- Low Standby Current
- Economical TO–226AA, SO–8 and Micro–8 Surface Mount Packages

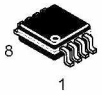
P SUFFIX
PLASTIC PACKAGE
CASE 29
(TO–226AA)

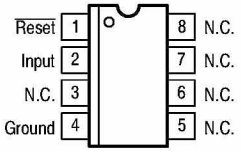


Pin 1. $\overline{\text{Reset}}$
2. Input
3. Ground

D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO–8)

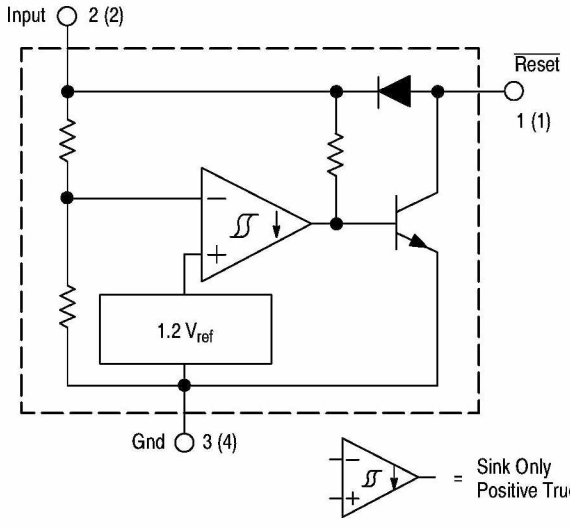
DM SUFFIX
PLASTIC PACKAGE
CASE 846A
(Micro–8)





(Top View)

Representative Block Diagram



Pin numbers adjacent to terminals are for the 3–pin TO–226AA package.
Pin numbers in parenthesis are for the 8–lead packages.

This device contains 21 active transistors.

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC34064D–5	T_A = 0° to +70°C	SO–8
MC34064DM–5		Micro–8
MC34064P–5		TO–226AA
MC33064D–5	T_A = – 40° to +85°C	SO–8
MC33064DM–5		Micro–8
MC33064P–5		TO–226AA

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Input Supply Voltage	V_{in}	–1.0 to 10	V
$\overline{\text{Reset}}$ Output Voltage	V_O	10	V
$\overline{\text{Reset}}$ Output Sink Current (Note 1)	I_{Sink}	Internally Limited	mA
Clamp Diode Forward Current, Pin 1 to 2 (Note 1)	I_F	100	mA
Power Dissipation and Thermal Characteristics			
P Suffix, Plastic Package			
Maximum Power Dissipation @ T_A = 25°C	P_D	625	mW
Thermal Resistance, Junction–to–Air	$R_{\theta JA}$	200	°C/W
D Suffix, Plastic Package			
Maximum Power Dissipation @ T_A = 25°C	P_D	625	mW
Thermal Resistance, Junction–to–Air	$R_{\theta JA}$	200	°C/W
DM Suffix, Plastic Package			
Maximum Power Dissipation @ T_A = 25°C	P_D	520	mW
Thermal Resistance, Junction–to–Air	$R_{\theta JA}$	240	°C/W
Operating Junction Temperature	T_J	+150	°C
Operating Ambient Temperature	T_A		°C
MC34064		0 to +70	
MC33064		–40 to +85	
Storage Temperature Range	T_{stg}	–65 to +150	°C

NOTE: ESD data available upon request.

ELECTRICAL CHARACTERISTICS (For typical values T_A = 25°C, for min/max values T_A is the operating ambient temperature range that applies [Notes 2 and 3] unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
COMPARATOR					
Threshold Voltage					V
High State Output (V_{in} Increasing)	V_{IH}	4.5	4.61	4.7	
Low State Output (V_{in} Decreasing)	V_{IL}	4.5	4.59	4.7	
Hysteresis	V_H	0.01	0.02	0.05	
$\overline{\text{RESET}}$ OUTPUT					
Output Sink Saturation	V_{OL}				V
(V_{in} = 4.0 V, I_{Sink} = 8.0 mA)		–	0.46	1.0	
(V_{in} = 4.0 V, I_{Sink} = 2.0 mA)		–	0.15	0.4	
(V_{in} = 1.0 V, I_{Sink} = 0.1 mA)		–	–	0.1	
Output Sink Current (V_{in}, $\overline{\text{Reset}}$ = 4.0 V)	I_{Sink}	10	27	60	mA
Output Off-State Leakage (V_{in}, $\overline{\text{Reset}}$ = 5.0 V)	I_{OH}	–	0.02	0.5	μA
Clamp Diode Forward Voltage, Pin 1 to 2 (I_F = 10 mA)	V_F	0.6	0.9	1.2	V
TOTAL DEVICE					
Operating Input Voltage Range	V_{in}	1.0 to 6.5	–	–	V
Quiescent Input Current (V_{in} = 5.0 V)	I_{in}	–	390	500	μA

NOTES: 1. Maximum package power dissipation limits must be observed.
2. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.
3. T_{low} = 0°C for MC34064, –40°C for MC33064 T_{high} = +70°C for MC34064, +85°C for MC33064

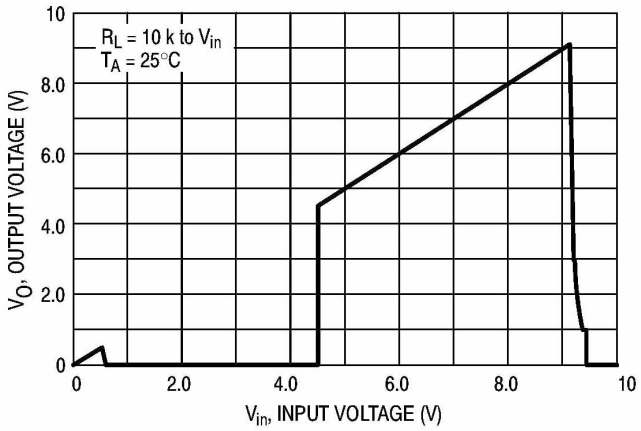


Figure 1. $\overline{\text{Reset}}$ Output Voltage versus Input Voltage

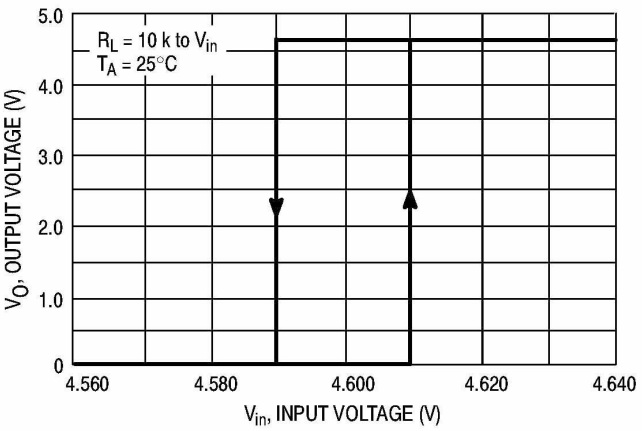


Figure 2. $\overline{\text{Reset}}$ Output Voltage versus Input Voltage

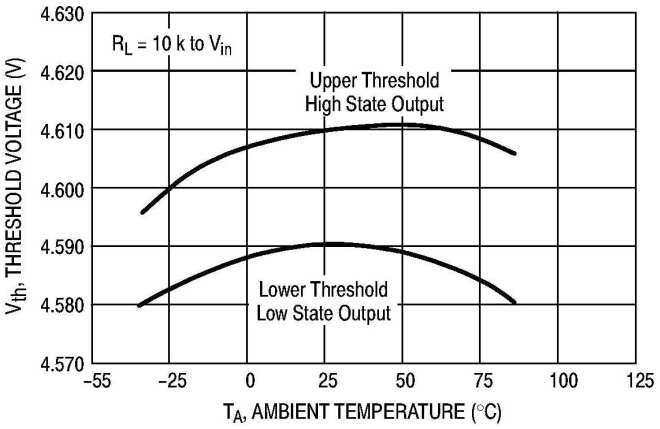


Figure 3. Comparator Threshold Voltage versus Temperature

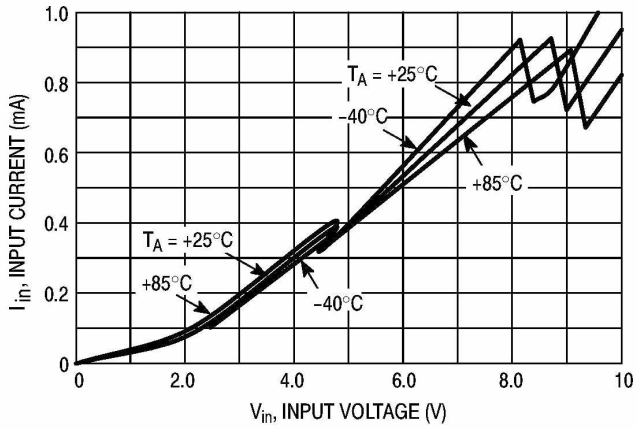


Figure 4. Input Current versus Input Voltage

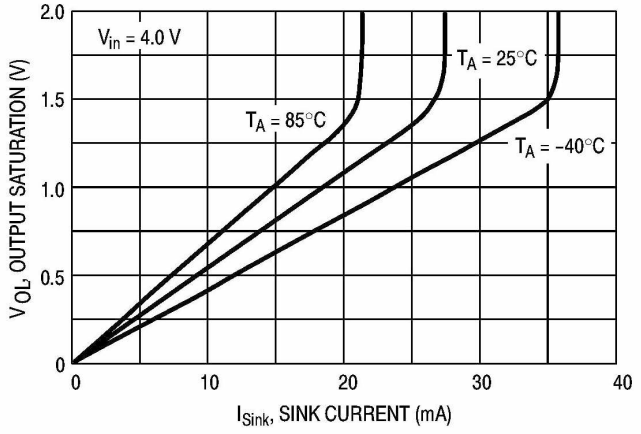


Figure 5. $\overline{\text{Reset}}$ Output Saturation versus Sink Current

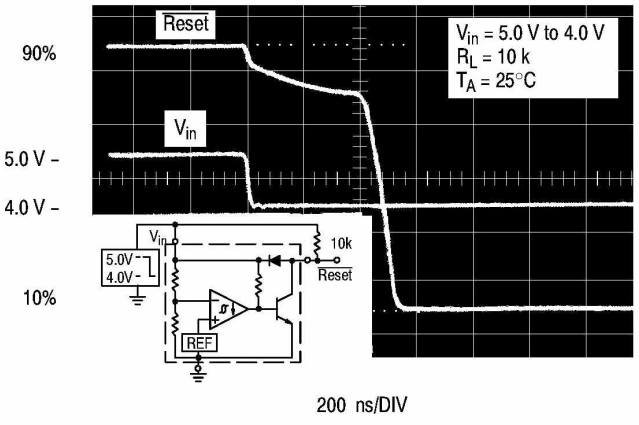


Figure 6. $\overline{\text{Reset}}$ Delay Time

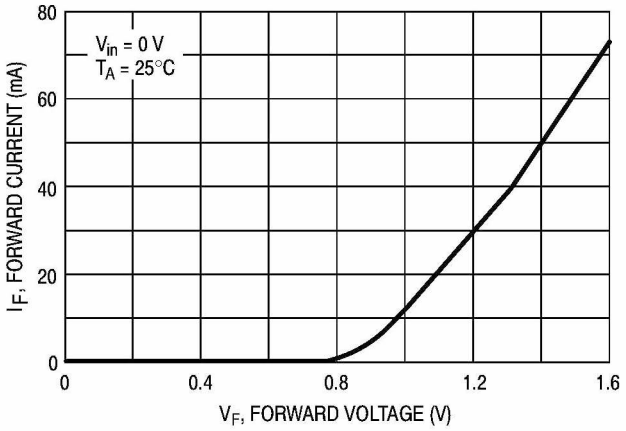


Figure 7. Clamp Diode Forward Current versus Voltage

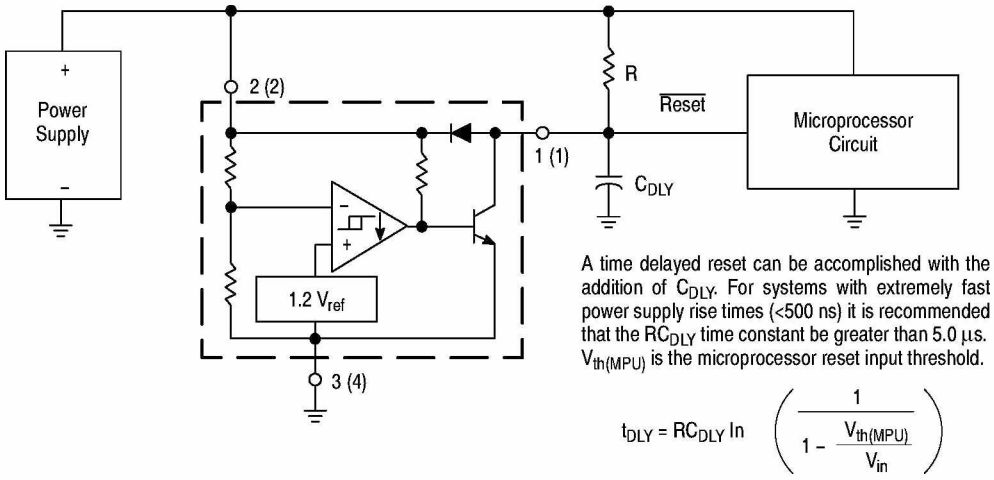
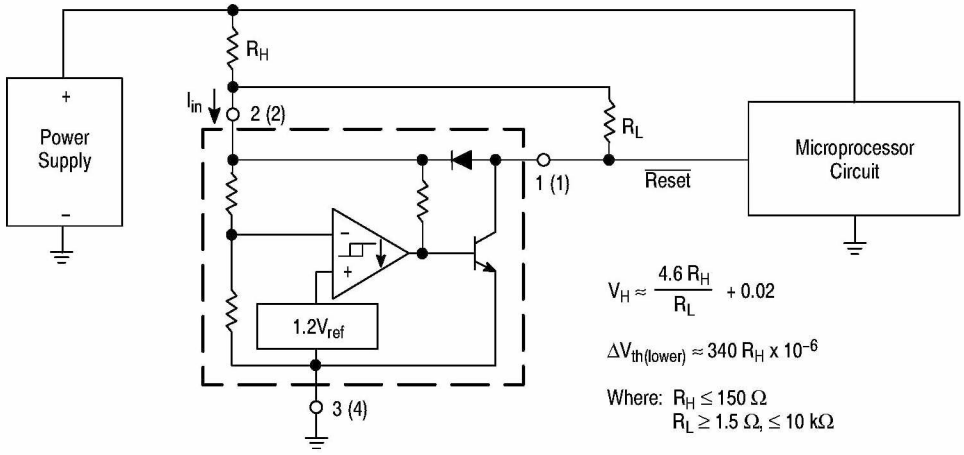


Figure 8. Low Voltage Microprocessor Reset



Comparator hysteresis can be increased with the addition of resistor R_H. The hysteresis equation has been simplified and does not account for the change of input current I_{in} as V_{CC} crosses the comparator threshold (Figure 4). An increase of the lower threshold $\Delta V_{th(lower)}$ will be observed due to I_{in} which is typically 340 μA at 4.59 V. The equations are accurate to ±10% with R_H less than 150 Ω and R_L between 1.5 kΩ and 10 kΩ.

Test Data			
V_H (mV)	ΔV_{th} (mV)	R_H (Ω)	R_L (kΩ)
20	0	0	0
51	3.4	10	1.5
40	6.8	20	4.7
81	6.8	20	1.5
71	10	30	2.7
112	10	30	1.5
100	16	47	2.7
164	16	47	1.5
190	34	100	2.7
327	34	100	1.5
276	51	150	2.7
480	51	150	1.5

Figure 9. Low Voltage Microprocessor Reset with Additional Hysteresis

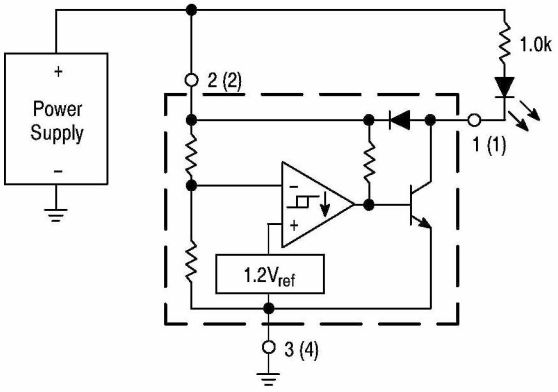


Figure 10. Voltage Monitor

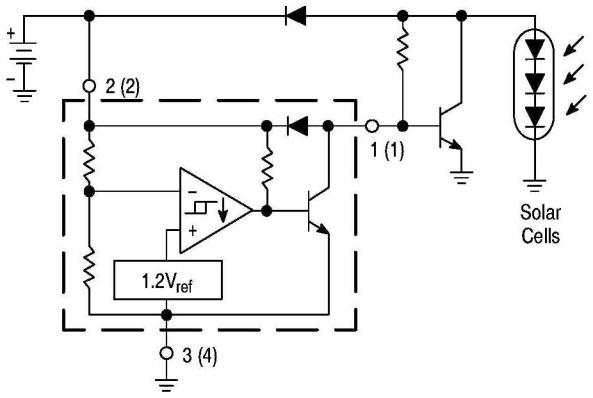
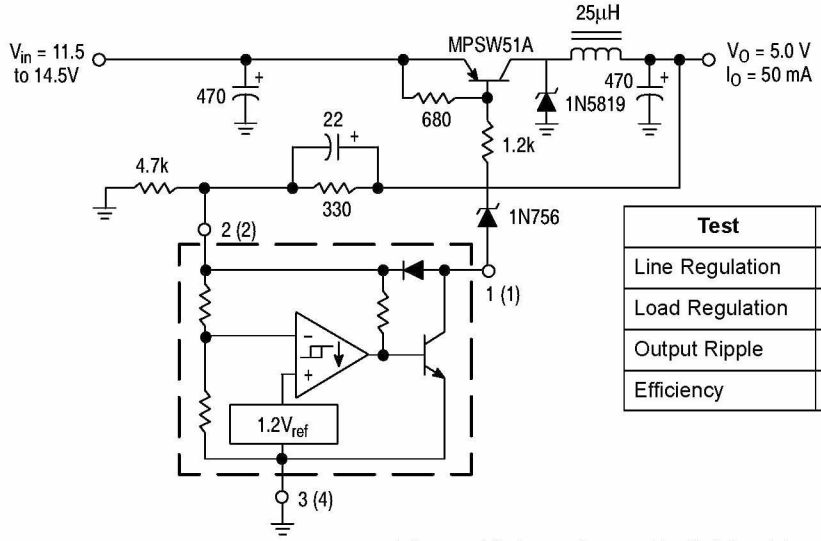
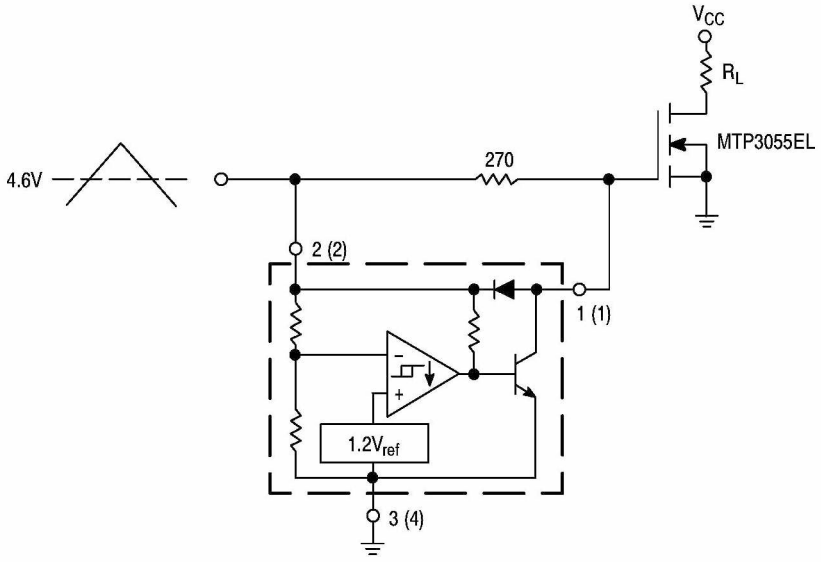


Figure 11. Solar Powered Battery Charger



Test	Conditions	Results
Line Regulation	V_{in} = 11.5 V to 14.5 V, I_O = 50 mA	35 mV
Load Regulation	V_{in} = 12.6 V, I_O = 0 mA to 50 mA	12 mV
Output Ripple	V_{in} = 12.6 V, I_O = 50 mA	60 mVpp
Efficiency	V_{in} = 12.6 V, I_O = 50 mA	77%

Figure 12. Low Power Switching Regulator



Overheating of the logic level power MOSFET due to insufficient gate voltage can be prevented with the above circuit. When the input signal is below the 4.6 V threshold of the MC34064, its output grounds the gate of the L^2 MOSFET.

Figure 13. MOSFET Low Voltage Gate Drive Protection