

#### DESCRIPTION

The MC33164-3 and MC34164-3 are undervoltage sensing circuits designed specifically for use as reset controllers in microprocessor-based systems. They offer the designer an economical, space efficient solution for low supply voltage detection when used in combination with a single pull-up resistor. Adding one capacitor offers the functionality of a programmable delay time after power

returns. The MC33164-3 and MC34164-3 consist of a temperature stable reference comparator with hysteresis, high-current clamping diode and an open collector output stage capable of sinking more than 6mA over the full temperature range. The MC33164-3 and MC34164-3's RESET output is specified to be fully functional at  $V_{IN} \geq 1V$ . See Product Highlight below.

#### KEY FEATURES

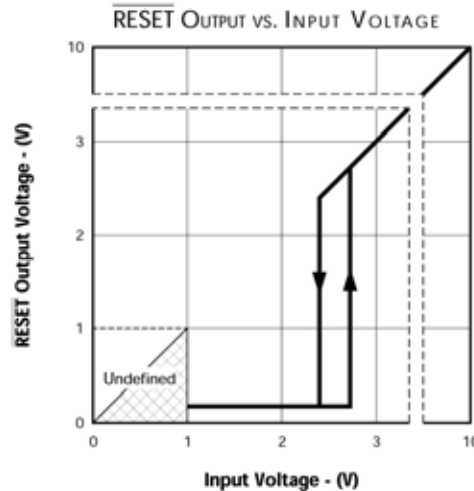
- Monitors +3.3V Supplies ( $V_T = 2.7V$  Typ)
- Outputs Fully Defined At  $V_{IN} \geq 1V$  (See Product Highlight)
- Ultra-Low Supply Current (13 $\mu$ A Max.)
- Temperature Compensated  $I_{CC}$  For Extremely Stable Current Consumption
- $\mu$ P Reset Delay Programmable With 1 External Resistor And Capacitor
- Comparator Hysteresis Prevents Output Oscillation (60mV Typ.)
- Electrically Compatible With Motorola MC34164-3
- Pin-to-Pin Compatible With Motorola MC34064 / MC34164

#### APPLICATIONS

- All Microprocessor Or Microcontroller Designs Using 3V/3.3V Supplies
- Simple 3V/3.3V Undervoltage Detection

**IMPORTANT:** For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>

#### PRODUCT HIGHLIGHT



#### PACKAGE ORDER INFO

$T_A$ (°C)	<b>DM</b> Plastic SOIC 8-Pin	<b>LP</b> Plastic TO-92 3-Pin
	RoHS Compliant / Pb-free Transition DC: 0440	RoHS Compliant / Pb-free Transition DC: 0509
0 to 70	MC34164-3DM	MC34164-3LP
-40 to 85	MC33164-3DM	MC33164-3LP

Note: Available in Tape & Reel. Append the letters "TR" to the part number. (i.e. MC34164-3DM-TR)

# MC33164-3/MC34164-3

## 3V UNDERVOLTAGE SENSING CIRCUIT

### PRODUCTION DATA SHEET

#### ABSOLUTE MAXIMUM RATINGS (Note 1)

Input Supply Voltage ( $V_{IN}$ ) .....	-1V to 12V
$\overline{RESET}$ Output Voltage ( $V_{OUT}$ ) .....	12V
Output Sink Current ( $I_{OL}$ ) .....	Internally Limited (mA)
Clamp Diode Forward Current ( $I_F$ ), Pin 1 to pin 2 .....	100mA
Operating Junction Temperature	
Plastic (DM, LP - Packages) .....	150°C
Storage Temperature Range .....	-65°C to 150°C
Lead Temperature (Soldering, 10 seconds) .....	300°C
Peak Package Solder Reflow Temp. (40 second max. exposure).....	260°C (+0, -5)

Note 1. Values beyond which damage may occur. All voltages are specified with respect to ground, and all currents are positive into the specified terminal.

#### THERMAL DATA

##### DM PACKAGE:

THERMAL RESISTANCE-JUNCTION TO AMBIENT, $\theta_{JA}$	165°C/W
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##### LP PACKAGE:

THERMAL RESISTANCE-JUNCTION TO AMBIENT, $\theta_{JA}$	156°C/W
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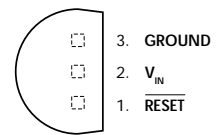
Junction Temperature Calculation:  $T_J = T_A + (P_D \times \theta_{JA})$ .  
 The  $\theta_{JA}$  numbers are guidelines for the thermal performance of the device/pc-board system.  
 All of the above assume no ambient airflow

#### PACKAGE PIN OUTS

$\overline{RESET}$	1	8	N.C.
$V_{IN}$	2	7	N.C.
N.C.	3	6	N.C.
GROUND	4	5	N.C.

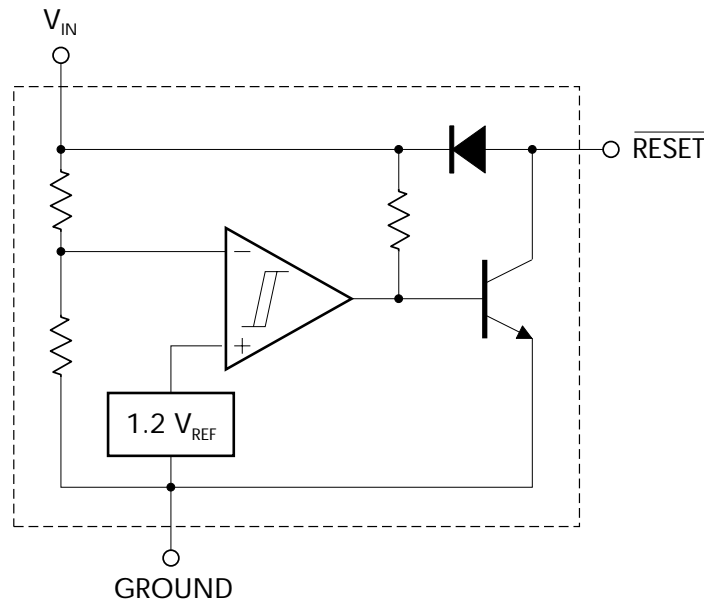
##### DM PACKAGE (Top View)

RoHS / Pb-free 100% Matte Tin Lead Finish



##### LP PACKAGE (Top View)

#### BLOCK DIAGRAM



## 3V UNDERVOLTAGE SENSING CIRCUIT

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#### RECOMMENDED OPERATING CONDITIONS (Note 2)

Parameter	Symbol	Recommended Operating Conditions			Units
		Min.	Typ.	Max.	
Input Supply Voltage	$V_{IN}$	1		10	V
RESET Output Voltage	$V_{OUT}$	-0.3		10	V
Clamp Diode Forward Current (Note 3)	$I_F$			100	mA
Operating Ambient Temperature Range:					
MC34164-3	$T_A$	0		70	°C
MC33164-3	$T_A$	-40		85	°C

Note 2. Range over which the device is guaranteed functional.

Note 3. Maximum junction temperature ratings must be observed.

#### ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, these specifications apply over the operating ambient temperatures of  $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$  for the MC34164-3 and  $-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$  for the MC33164-3. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

Parameter	Symbol	Test Conditions	MC33164-3 / 34164-3			Units
			Min.	Typ.	Max.	
<b>Comparator Section</b>						
Threshold Voltage						
High State Output	$V_{T+}$	$V_{IN}$ Increasing — 2.4V to 3.5V	2.55	2.71	2.8	V
Low State Output	$V_{T-}$	$V_{IN}$ Decreasing — 3.5V to 2.4V	2.55	2.65	2.8	V
Hysteresis	$V_H$	( $I_{OL} = 100\mu\text{A}$ )	0.03	0.06		V
<b>RESET Output Section</b>						
Output Low Level Saturation Voltage	$V_{OL}$	$V_{IN} = 2.4\text{V}, I_{OL} = 8.0\text{mA}$		0.15	1.0	V
		$V_{IN} = 2.4\text{V}, I_{OL} = 1.0\text{mA}$		0.04	0.4	V
		$V_{IN} = 1.0\text{V}, I_{OL} = 0.25\text{mA}$		0.02	0.3	V
Output Low Level Current	$I_{OL}$	$V_{IN}, \text{RESET} = 2.4\text{V}$	6.0	24	40	mA
Output Off-State Leakage	$I_{OH}$	$V_{IN}, \text{RESET} = 3.0\text{V}$		.02	0.5	$\mu\text{A}$
		$V_{IN}, \text{RESET} = 10\text{V}$		.02	1.0	$\mu\text{A}$
Clamp Diode Forward Voltage	$V_F$	Pin 1 to pin 2, $I_F = 5\text{mA}$	0.6	0.75	1.0	V
<b>Total Device</b>						
Supply Current	$I_{CC}$	$V_{IN} = 3.0\text{V}$		9	13	$\mu\text{A}$
		$V_{IN} = 6.0\text{V}$		21	30	$\mu\text{A}$

## GRAPH / CURVE INDEX

## Characteristic Curves

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2. POWER-UP  $\overline{\text{RESET}}$  VOLTAGE
3. POWER-DOWN  $\overline{\text{RESET}}$  VOLTAGE
4.  $\overline{\text{RESET}}$  OUTPUT VOLTAGE vs. INPUT VOLTAGE HYSTERESIS
5. THRESHOLD VOLTAGE vs. TEMPERATURE
6. THRESHOLD HYSTERESIS vs. TEMPERATURE
7. SUPPLY CURRENT vs. INPUT VOLTAGE
8. SUPPLY CURRENT vs. TEMPERATURE
9. LOW LEVEL OUTPUT CURRENT vs TEMPERATURE
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11. LOW LEVEL OUTPUT SATURATION VOLTAGE vs. TEMPERATURE
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3V UNDERVOLTAGE SENSING CIRCUIT

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CHARACTERISTIC CURVES

FIGURE 1. — INPUT VOLTAGE and  $\overline{\text{RESET}}$  OUTPUT VOLTAGE vs. TIME

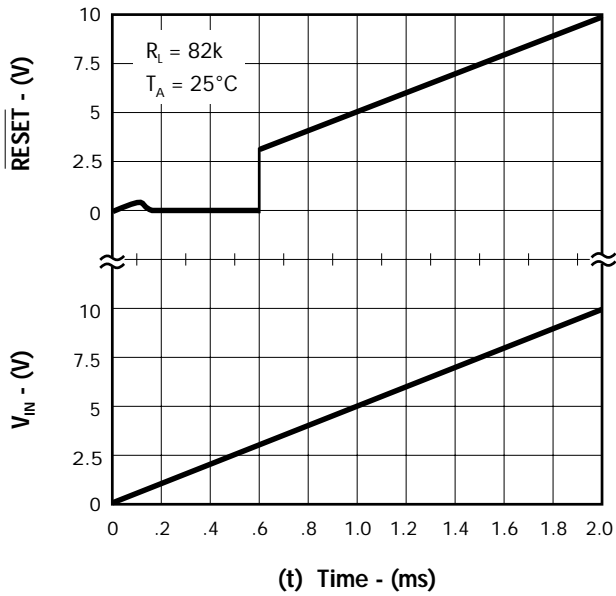


FIGURE 2. — POWER-UP  $\overline{\text{RESET}}$  VOLTAGE

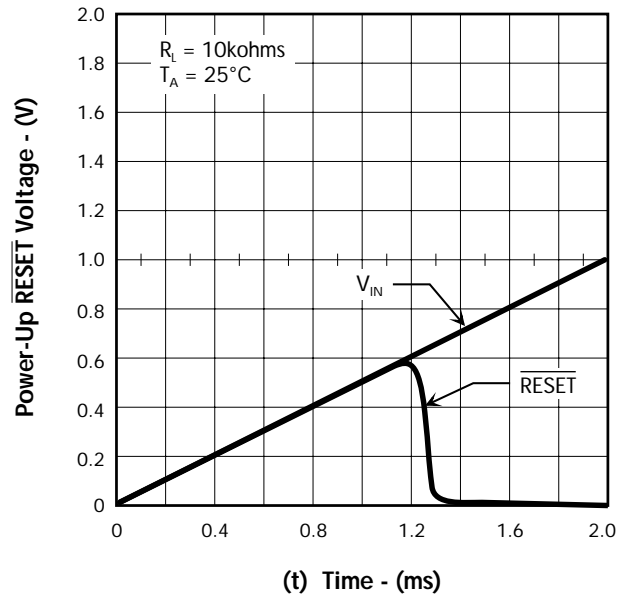


FIGURE 3. — POWER-DOWN  $\overline{\text{RESET}}$  VOLTAGE

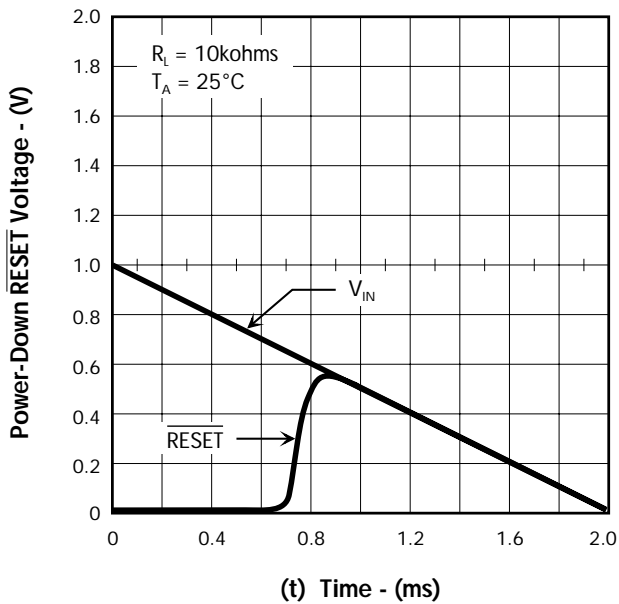
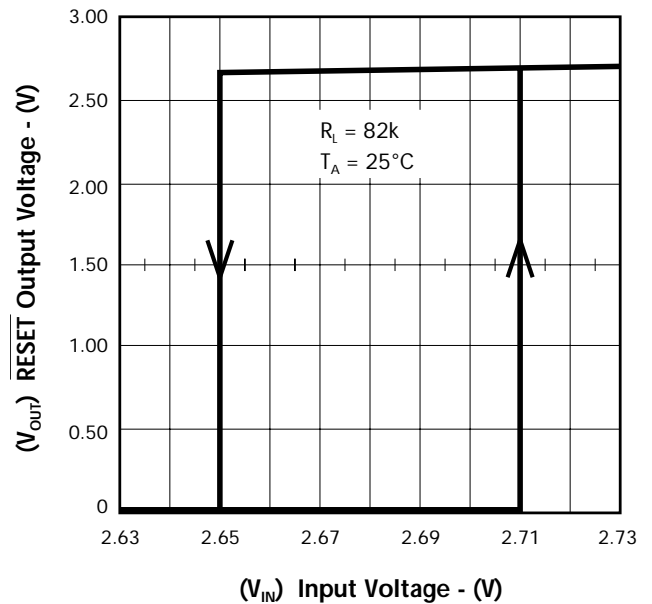


FIGURE 4. —  $\overline{\text{RESET}}$  OUTPUT VOLTAGE vs. INPUT VOLTAGE



#### CHARACTERISTIC CURVES

FIGURE 5. — THRESHOLD VOLTAGE vs. TEMPERATURE

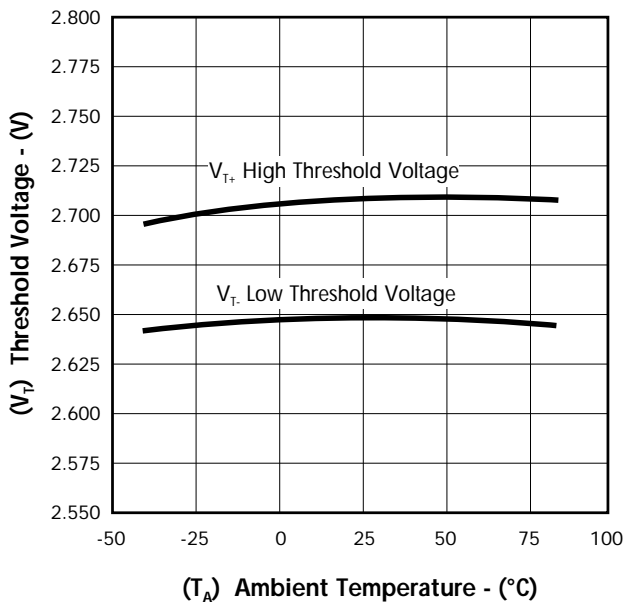


FIGURE 6. — THRESHOLD HYSTERESIS vs. TEMPERATURE

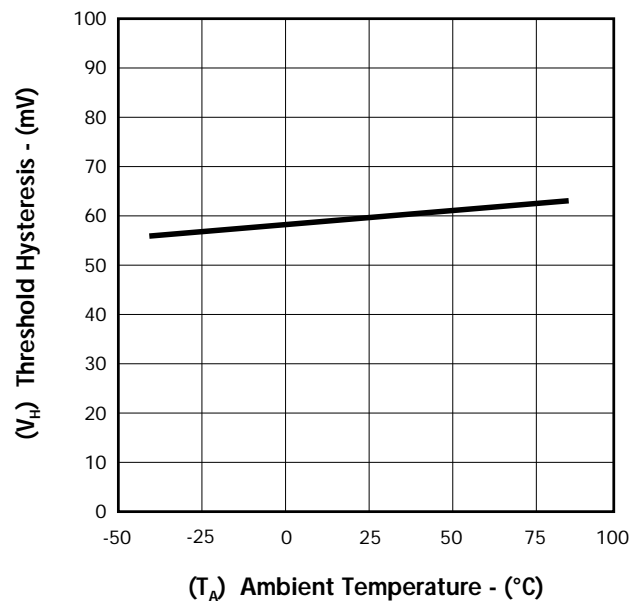


FIGURE 7. — SUPPLY CURRENT vs. INPUT VOLTAGE

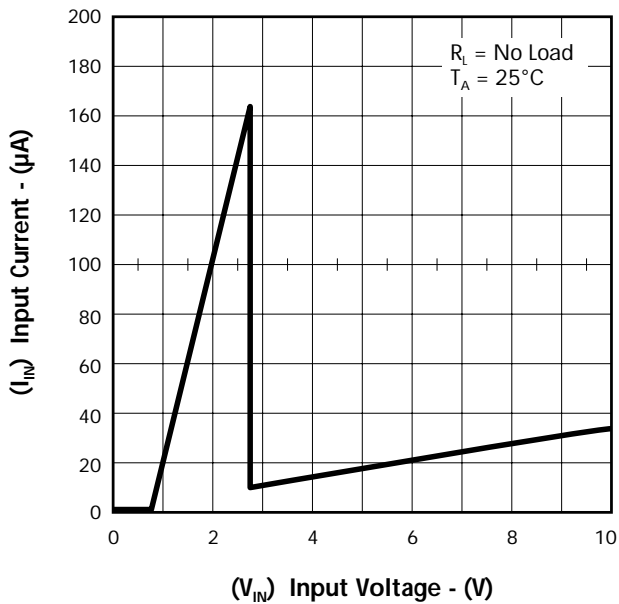
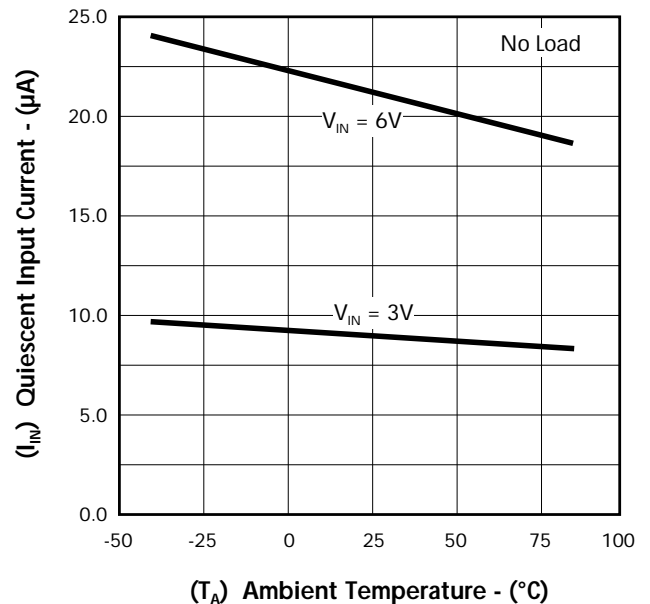


FIGURE 8. — SUPPLY CURRENT vs. TEMPERATURE



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CHARACTERISTIC CURVES

FIGURE 9. — LOW LEVEL OUTPUT CURRENT vs. TEMPERATURE

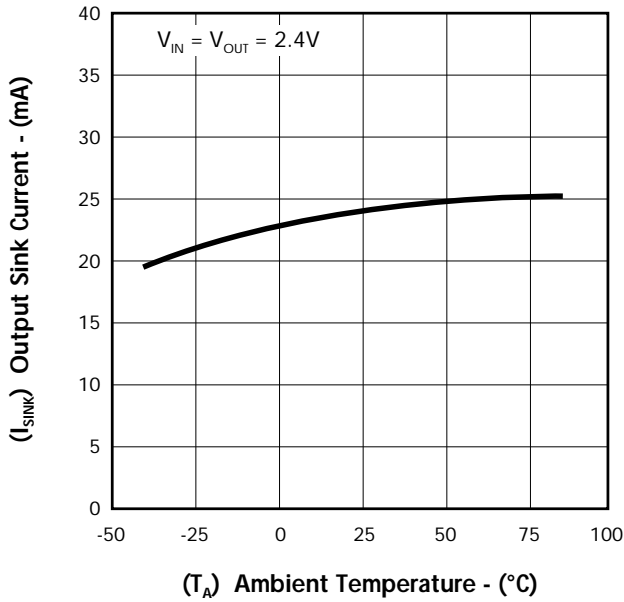


FIGURE 10. — LOW LEVEL OUTPUT SATURATION VOLTAGE vs. TEMPERATURE

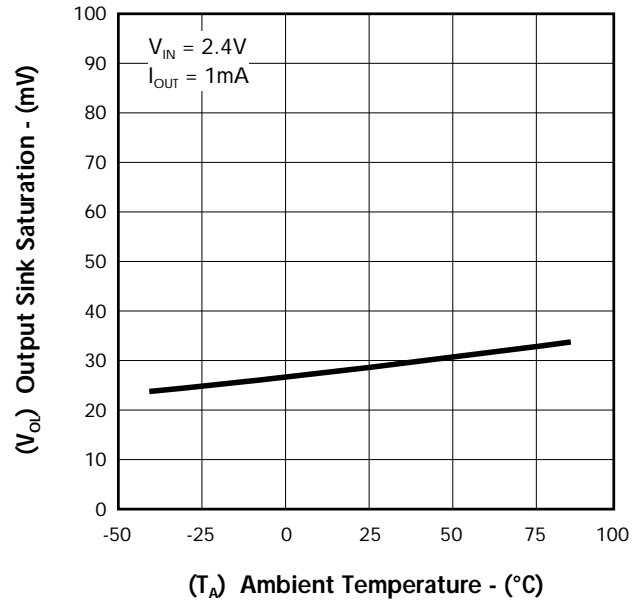


FIGURE 11. — LOW LEVEL OUTPUT SATURATION VOLTAGE vs. TEMPERATURE

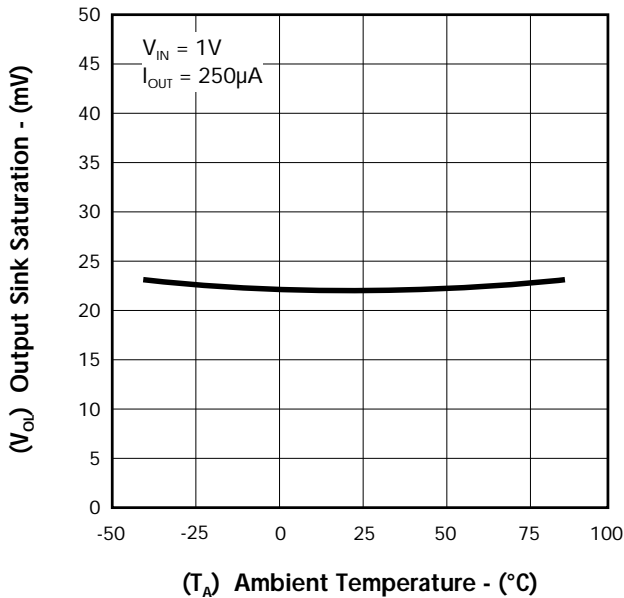
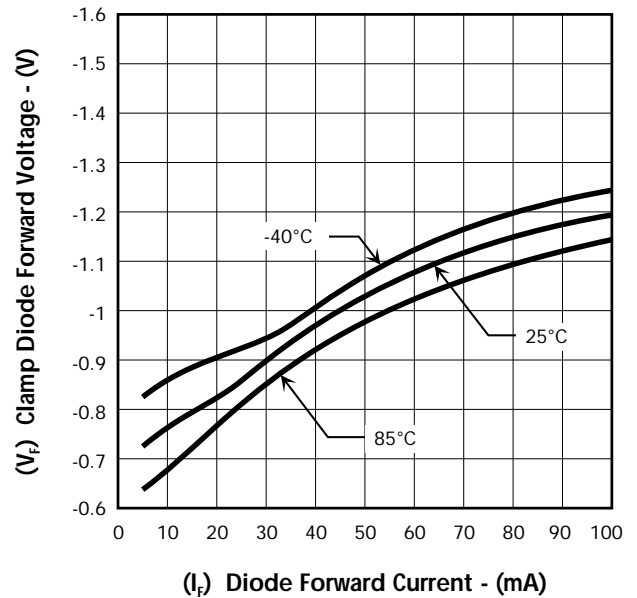


FIGURE 12. — CLAMP DIODE FORWARD VOLTAGE vs. FORWARD CURRENT



# MC33164-3/MC34164-3

## 3V UNDERVOLTAGE SENSING CIRCUIT

### PRODUCTION DATA SHEET

#### CHARACTERISTIC CURVES

FIGURE 13. — PROPAGATION DELAY — HIGH to LOW

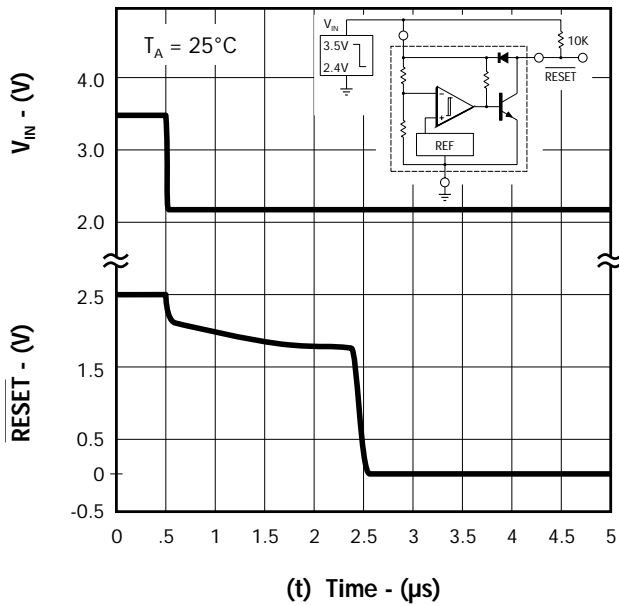


FIGURE 14. — PROPAGATION DELAY — LOW to HIGH

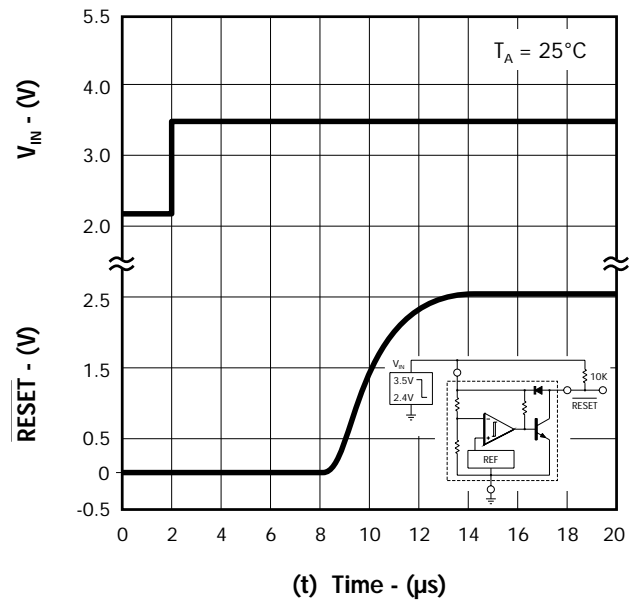
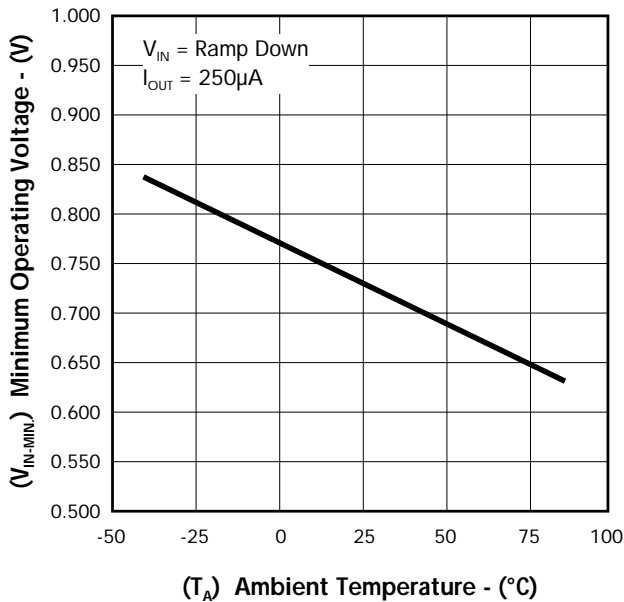


FIGURE 15. — MINIMUM OPERATING VOLTAGE OVER TEMPERATURE



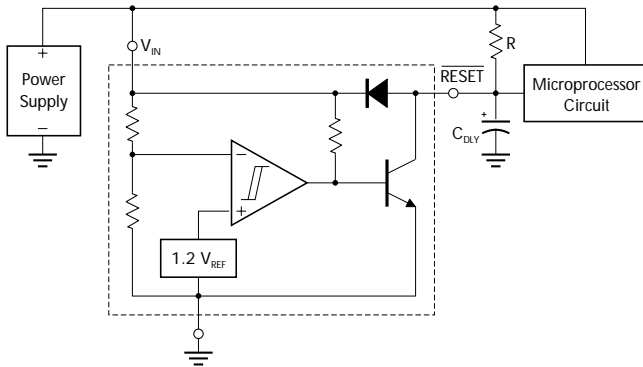


## 3V UNDERVOLTAGE SENSING CIRCUIT

### PRODUCTION DATA SHEET

#### TYPICAL APPLICATION CIRCUITS

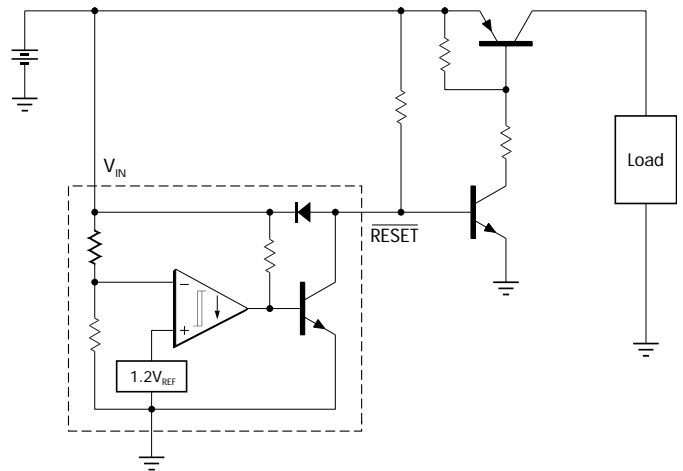
**FIGURE 16. — LOW VOLTAGE MICROPROCESSOR RESET**



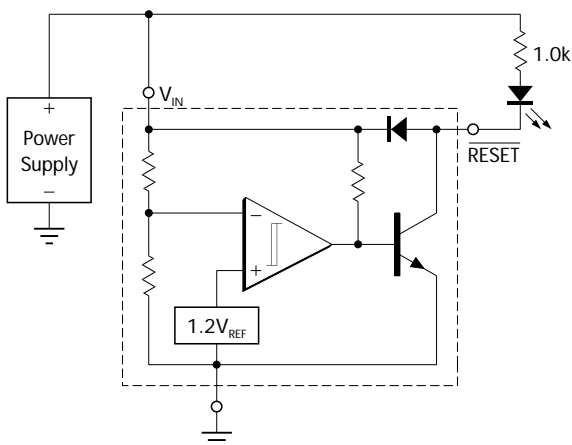
A time delayed reset can be accomplished with the addition of  $C_{DLY}$ . For systems with extremely fast power supply rise times ( $< 500\text{ns}$ ) it is recommended that the  $RC_{DLY}$  time constant be greater than  $5.0\mu\text{s}$ .  $V_{TH(MPU)}$  is the microprocessor reset input threshold.

$$t_{DLY} = R C_{DLY} \ln \left[ \frac{1}{1 - \frac{V_{TH(MPU)}}{V_{IN}}} \right]$$

**FIGURE 17. — SWITCHING THE LOAD OFF WHEN BATTERY REACHES BELOW 2.7V**

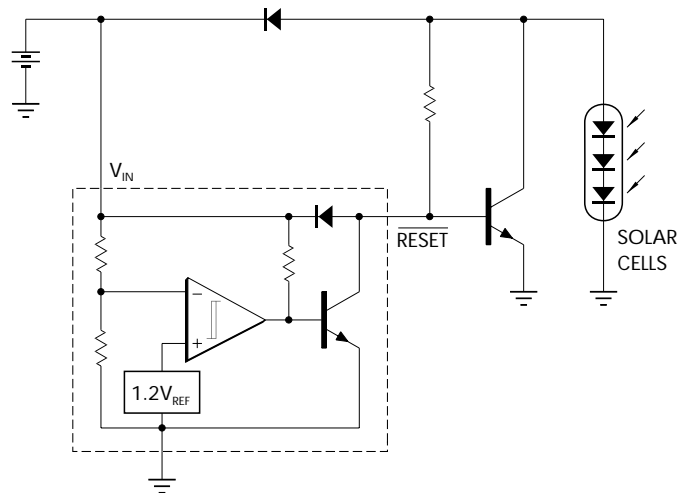


**FIGURE 18. — VOLTAGE MONITOR**



LED turns on when  $V_{IN} < 2.7\text{V}$  indicating Power Supply is low.

**FIGURE 20. — SOLAR POWERED BATTERY CHARGER**



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