MOTOROLA
SEMICONDUCTORS
P.O. BOX 20912 • PHOENIX, ARIZONA 85036

MC34064
MC33064

Product Preview

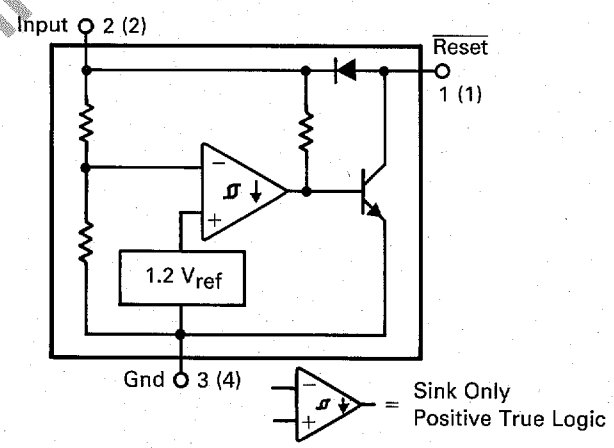
UNDERVOLTAGE SENSING CIRCUIT

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 volt input with low standby current. These devices are packaged in 3-pin TO-226AA and 8-pin surface mount packages.

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

- Trimmed-In-Package Temperature Compensated Reference
- 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 Volt Input
- Low Standby Current
- Economical TO-226AA and Surface Mount Packages

REPRESENTATIVE BLOCK DIAGRAM

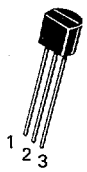


Pin numbers adjacent to terminals are for the 3-pin TO-226AA package.
Pin numbers in parenthesis are for the D suffix SO-8 package.

UNDERVOLTAGE SENSING CIRCUIT

SILICON MONOLITHIC INTEGRATED CIRCUIT

P SUFFIX
PLASTIC PACKAGE
CASE 29-04



PIN 1. $\overline{\text{RESET}}$
2. INPUT
3. GROUND

D SUFFIX
PLASTIC PACKAGE
CASE 751-02
SO-8

PIN 1. $\overline{\text{RESET}}$
2. INPUT
3. N.C.
4. GROUND
5. N.C.
6. N.C.
7. N.C.
8. N.C.

ORDERING INFORMATION

Device	Temperature Range	Package
MC34064D-5	0°C to +70°C	Plastic SO-8
MC34064P-5		Plastic TO-226AA
MC33064D-5	−40°C to +85°C	Plastic SO-8
MC33064P-5		Plastic 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	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
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

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].

Characteristic	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

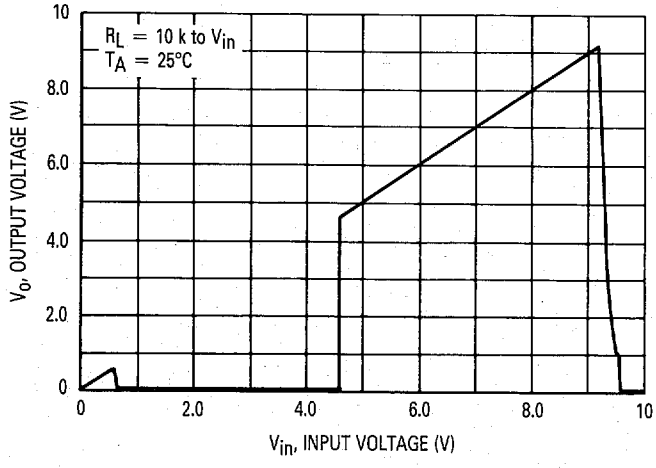


FIGURE 2 — $\overline{\text{RESET}}$ OUTPUT VOLTAGE versus INPUT VOLTAGE

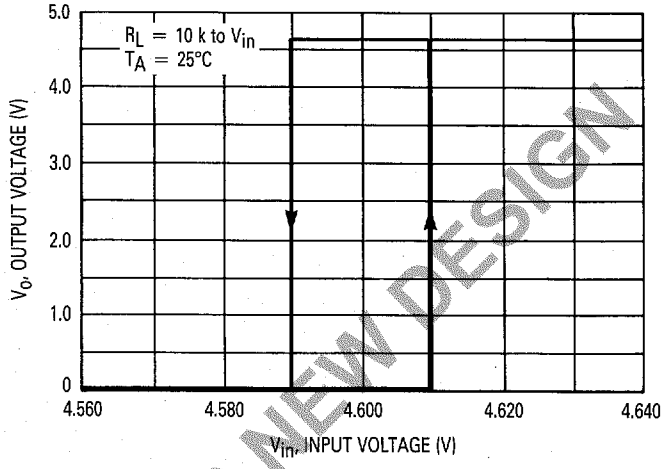


FIGURE 3 — COMPARATOR THRESHOLD VOLTAGE versus TEMPERATURE

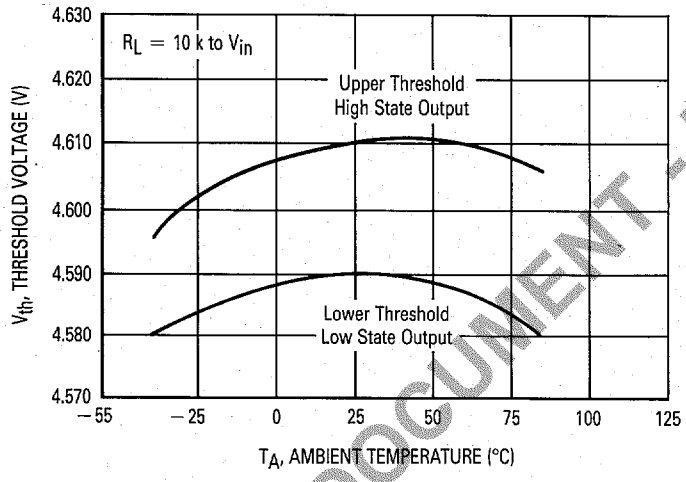


FIGURE 4 — INPUT CURRENT versus INPUT VOLTAGE

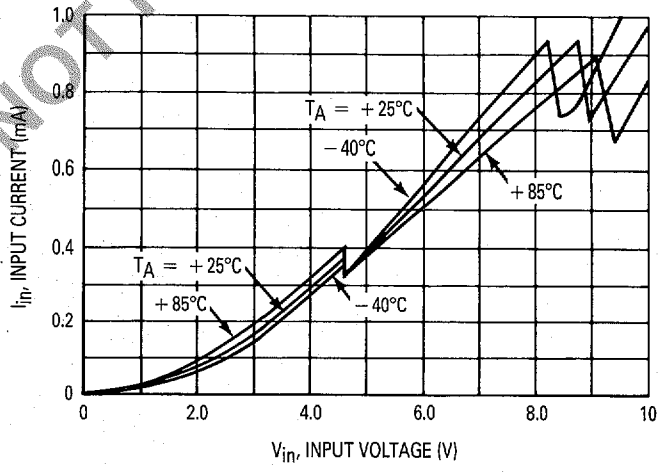


FIGURE 5 — $\overline{\text{RESET}}$ OUTPUT SATURATION versus SINK CURRENT

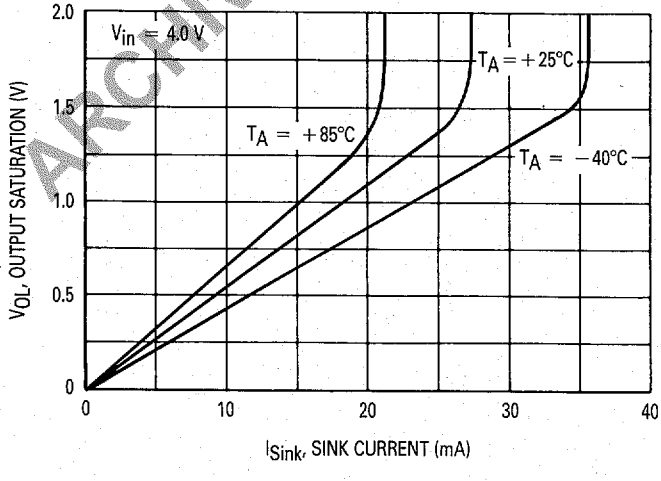


FIGURE 6 — CLAMP DIODE FORWARD CURRENT versus VOLTAGE

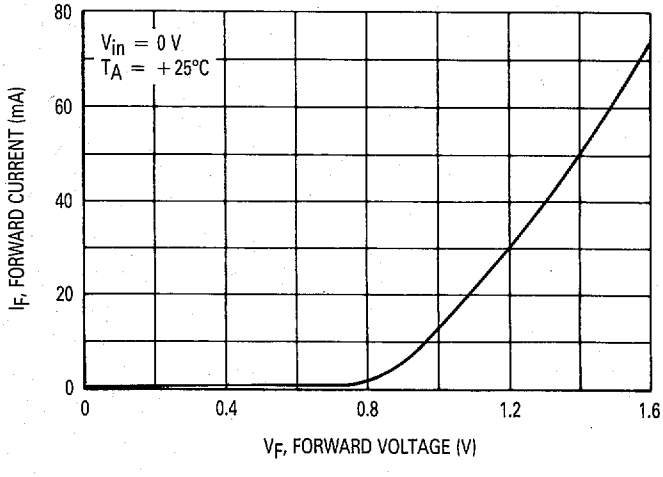
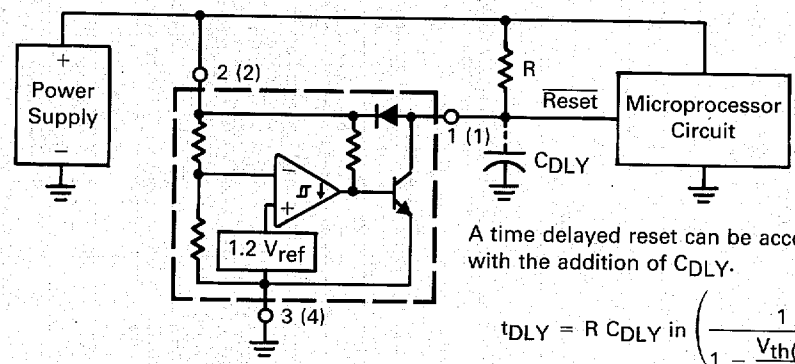


FIGURE 7 — LOW VOLTAGE MICROPROCESSOR RESET



A time delayed reset can be accomplished with the addition of C_{DLY}.

$$t_{DLY} = R\,C_{DLY}\,\text{in}\left(\frac{1}{1 - \frac{V_{th(MPU)}}{V_{in}}}\right)$$

FIGURE 8 — VOLTAGE MONITOR

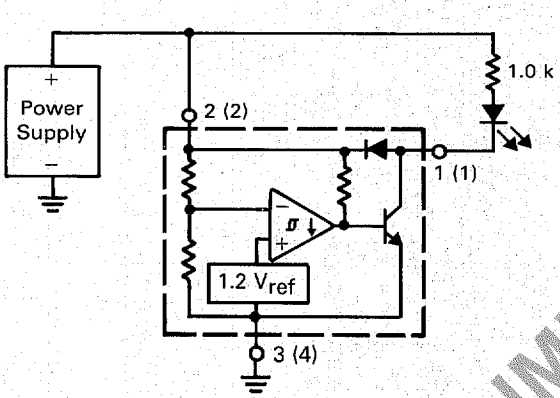


FIGURE 9 — SOLAR POWERED BATTERY CHARGER

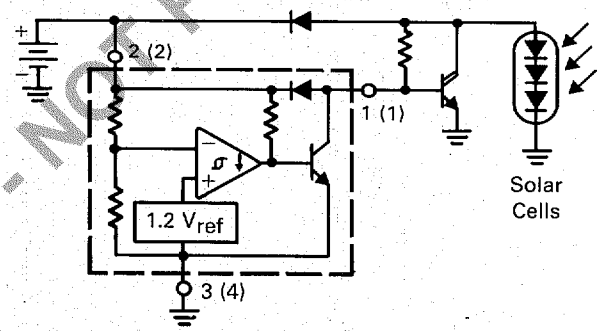
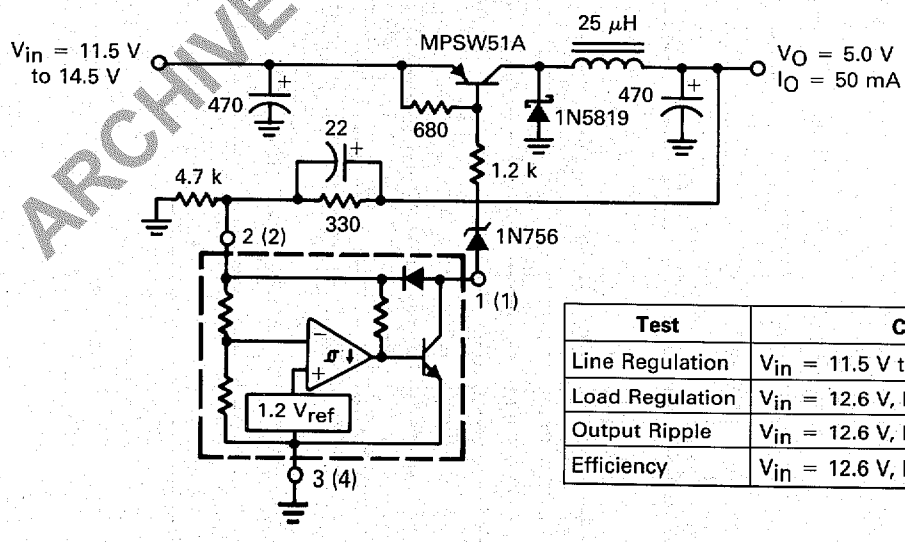
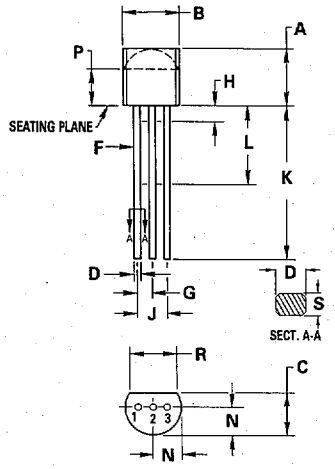


FIGURE 10 — LOW POWER SWITCHING REGULATOR



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 mV_{p-p}
Efficiency	V_{in} = 12.6 V, I_O = 50 mA	77%

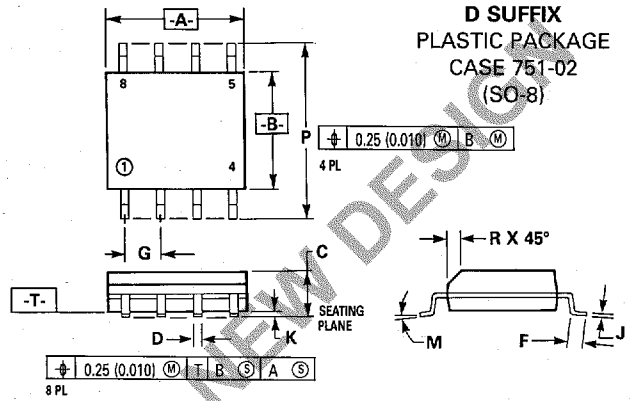
OUTLINE DIMENSIONS



P SUFFIX
PLASTIC PACKAGE
CASE 29-04

NOTES:
1. CONTOUR OF PACKAGE BEYOND ZONE "P" IS UNCONTROLLED.
2. DIM "F" APPLIES BETWEEN "H" AND "L". DIM "D" & "S" APPLIES BETWEEN "L" & 12.70mm (0.5") FROM SEATING PLANE. LEAD DIM IS UNCONTROLLED IN "H" & BEYOND 12.70mm (0.5") FROM SEATING PLANE.
3. CONTROLLING DIM: INCH.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.32	5.33	0.170	0.210
B	4.45	5.20	0.175	0.205
C	3.18	4.19	0.125	0.165
D	0.41	0.55	0.016	0.022
F	0.41	0.48	0.016	0.019
G	1.15	1.39	0.045	0.055
H	—	2.54	—	0.100
J	2.42	2.66	0.095	0.105
K	12.70	—	0.500	—
L	6.35	—	0.250	—
N	2.04	2.66	0.080	0.105
P	2.93	—	0.115	—
R	3.43	—	0.135	—
S	0.39	0.50	0.015	0.020



D SUFFIX
PLASTIC PACKAGE
CASE 751-02
(SO-8)

NOTES:
1. DIMENSIONS "A" AND "B" ARE DATUMS AND "T" IS A DATUM SURFACE.
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
3. CONTROLLING DIM: MILLIMETER.
4. DIMENSION "A" AND "B" DO NOT INCLUDE MOLD PROTRUSION.
5. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

MOTOROLA *Semiconductor Products Inc.*

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MC34064
MC33064

Advance Information

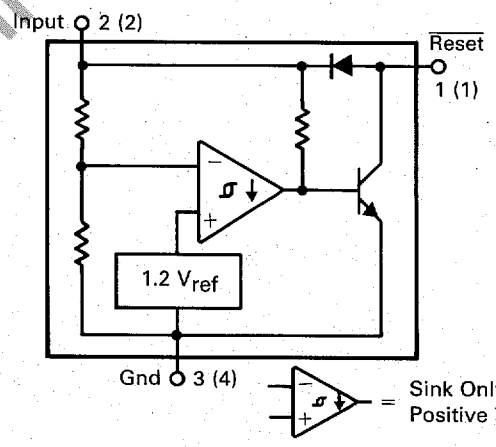
UNDERVOLTAGE SENSING CIRCUIT

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 volt input with low standby current. These devices are packaged in 3-pin TO-226AA and 8-pin surface mount packages.

Applications include direct monitoring of the 5.0 volt 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 Volt Input
- Low Standby Current
- Economical TO-226AA and SO-8 Surface Mount Packages

REPRESENTATIVE BLOCK DIAGRAM

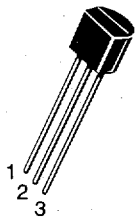


Pin numbers adjacent to terminals are for the 3-pin TO-226AA package.
Pin numbers in parenthesis are for the D suffix SO-8 package.

UNDERVOLTAGE SENSING CIRCUIT

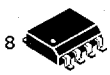
SILICON MONOLITHIC INTEGRATED CIRCUIT

P SUFFIX
PLASTIC PACKAGE
CASE 29-04
TO-226AA



PIN 1. RESET
2. INPUT
3. GROUND

D SUFFIX
PLASTIC PACKAGE
CASE 751-03
SO-8



PIN 1. RESET
2. INPUT
3. N.C.
4. GROUND
5. N.C.
6. N.C.
7. N.C.
8. N.C.

ORDERING INFORMATION

Device	Temperature Range	Package
MC34064D-5	0°C to +70°C	Plastic SO-8
MC34064P-5		Plastic TO-226AA
MC33064D-5	−40°C to +85°C	Plastic SO-8
MC33064P-5		Plastic TO-226AA

This document contains information on a new product. Specifications and information herein are subject to change without notice.

ADI1483
(Replaces NP220)

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
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

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].

Characteristic	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 T_{high} = +70°C for MC34064
   = −40°C for MC33064 = +85°C for MC33064

FIGURE 1 — $\overline{\text{RESET}}$ OUTPUT VOLTAGE versus INPUT VOLTAGE

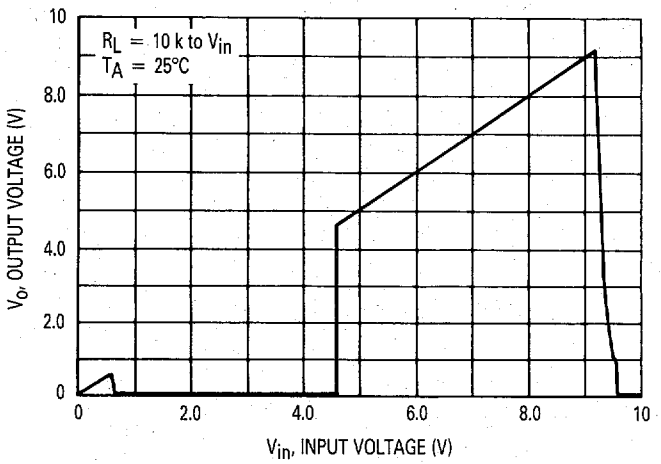


FIGURE 2 — $\overline{\text{RESET}}$ OUTPUT VOLTAGE versus INPUT VOLTAGE

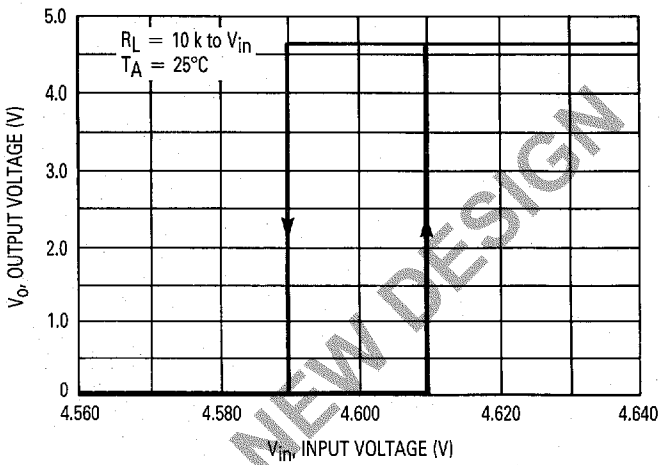


FIGURE 3 — COMPARATOR THRESHOLD VOLTAGE versus TEMPERATURE

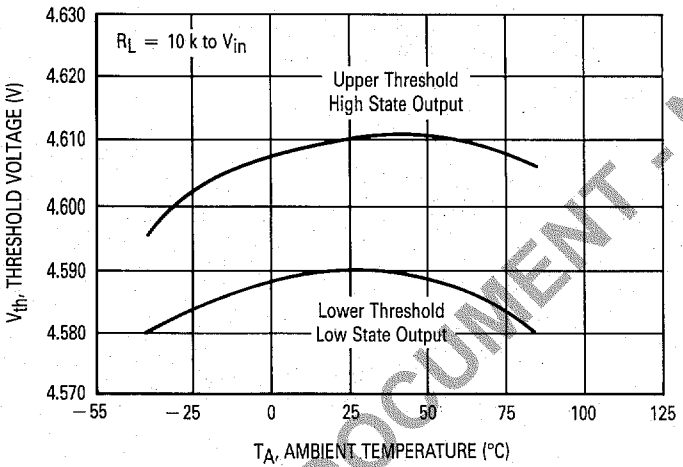


FIGURE 4 — INPUT CURRENT versus INPUT VOLTAGE

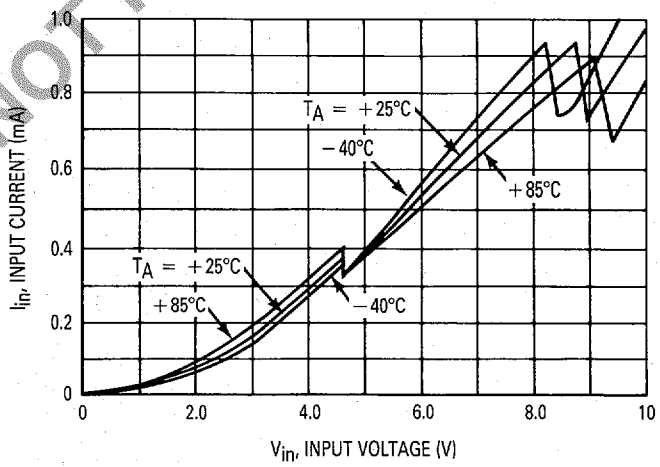


FIGURE 5 — $\overline{\text{RESET}}$ OUTPUT SATURATION versus SINK CURRENT

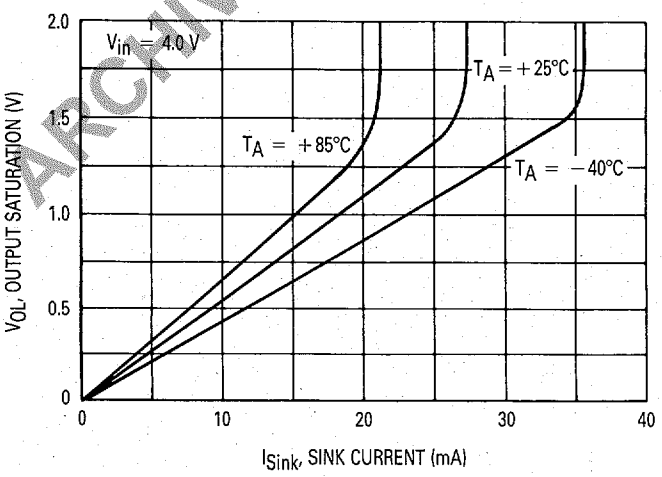


FIGURE 6 — $\overline{\text{RESET}}$ DELAY TIME

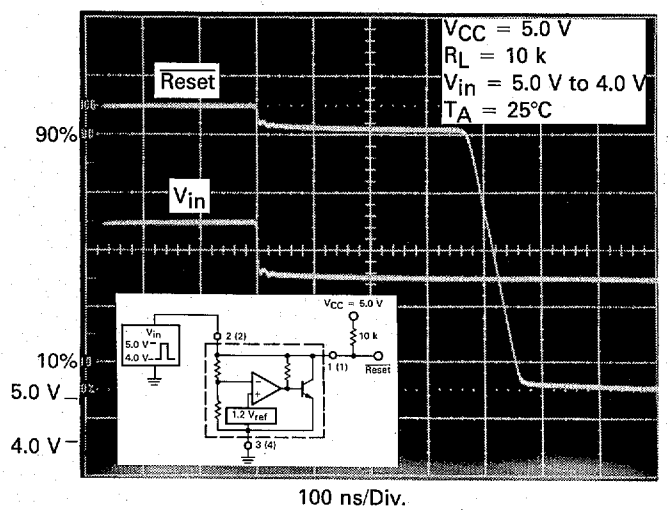


FIGURE 7 — CLAMP DIODE FORWARD CURRENT versus VOLTAGE

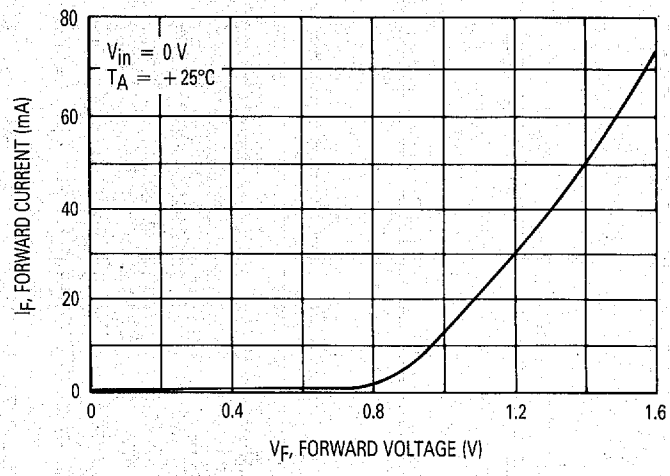
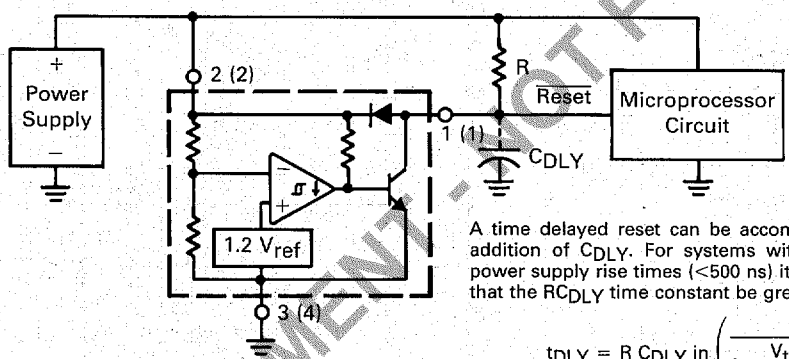


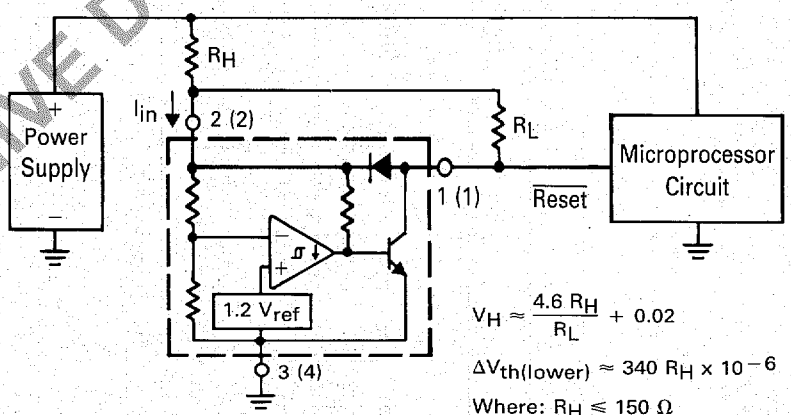
FIGURE 8 — LOW VOLTAGE MICROPROCESSOR RESET



A time delayed reset can be accomplished with the addition of C_{DLY}. For systems with extremely fast power supply rise times (<500 ns) it is recommended that the RC_{DLY} time constant be greater than 5.0 μs.

$$t_{DLY} = R\,C_{DLY}\,\ln\left(\frac{1}{1 - \frac{V_{th(MPU)}}{V_{in}}}\right)$$

FIGURE 9 — LOW VOLTAGE MICROPROCESSOR RESET WITH ADDITIONAL HYSTERESIS



$$V_H \approx \frac{4.6\,R_H}{R_L} + 0.02$$

$$\Delta V_{th(lower)} \approx 340\,R_H \times 10^{-6}$$

Where: $R_H \leq 150\ \Omega$
$R_L \geq 1.5\ k\Omega, \leq 10\ k\Omega$

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 10 — VOLTAGE MONITOR

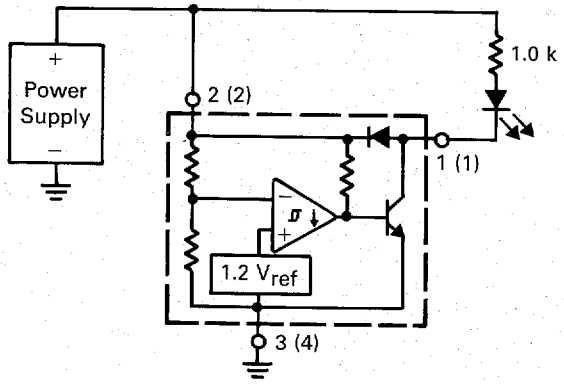


FIGURE 11 — SOLAR POWERED BATTERY CHARGER

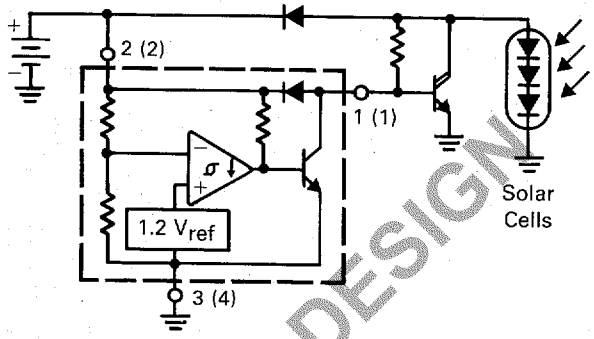
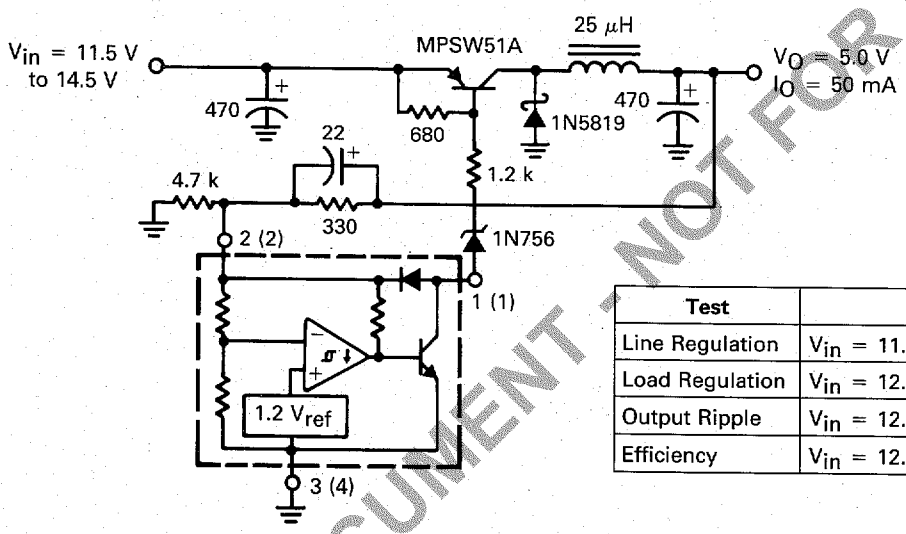
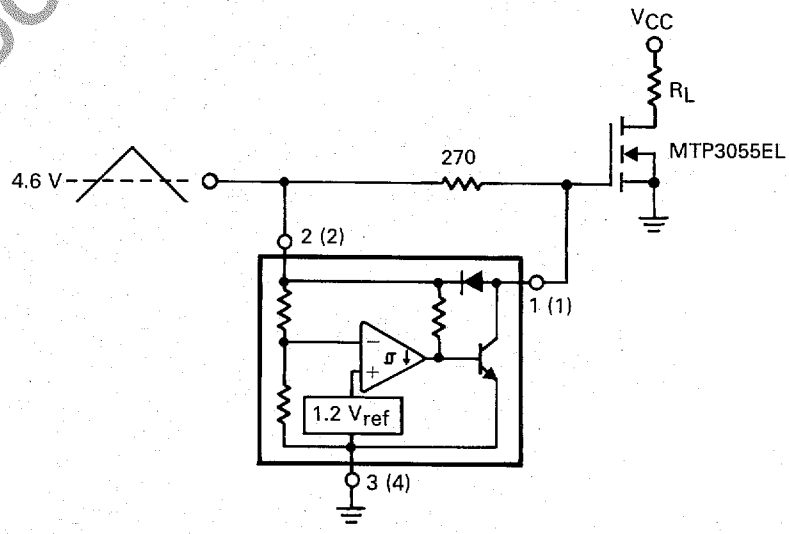


FIGURE 12 — LOW POWER SWITCHING REGULATOR



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 mV_{p-p}
Efficiency	V_{in} = 12.6 V, I_O = 50 mA	77%

FIGURE 13 — MOSFET LOW-VOLTAGE GATE DRIVE PROTECTION

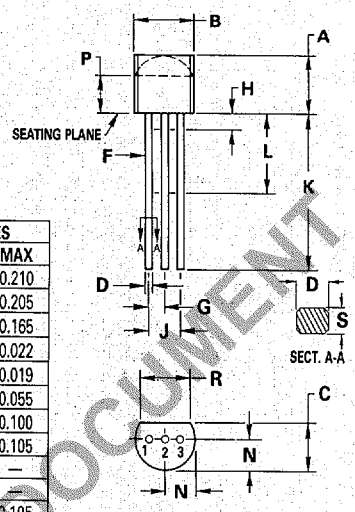


Overheating of the logic level power MOSFET due to insufficient gate voltage can be prevented with the above circuit. When the input signal is below the 4.6 volt threshold of the MC34064, it's output grounds the gate of the L^2 MOSFET.

OUTLINE DIMENSIONS

P SUFFIX
PLASTIC PACKAGE
CASE 29-04

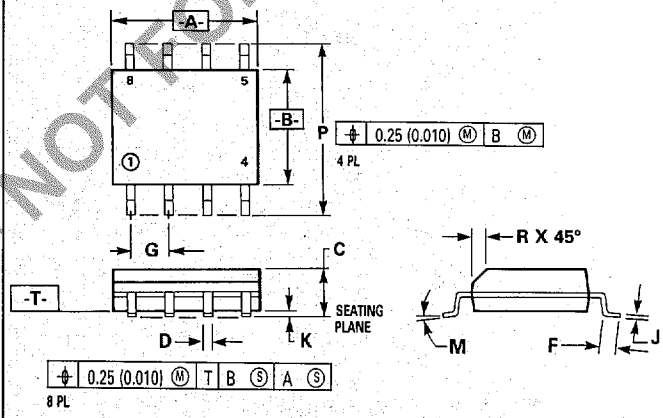
NOTES:
1. CONTOUR OF PACKAGE BEYOND ZONE "P" IS UNCONTROLLED.
2. DIM "F" APPLIES BETWEEN "H" AND "L". DIM "D" & "S" APPLIES BETWEEN "L" & 12.70mm (0.5") FROM SEATING PLANE. LEAD DIM IS UNCONTROLLED IN "H" & BEYOND 12.70mm (0.5") FROM SEATING PLANE.
3. CONTROLLING DIM: INCH.



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	4.32	5.33	0.170	0.210
B	4.45	5.20	0.175	0.205
C	3.18	4.19	0.125	0.165
D	0.41	0.55	0.016	0.022
F	0.41	0.48	0.016	0.019
G	1.15	1.39	0.045	0.055
H	—	2.54	—	0.100
J	2.42	2.66	0.095	0.105
K	12.70	—	0.500	—
L	6.35	—	0.250	—
N	2.04	2.66	0.080	0.105
P	2.93	—	0.115	—
R	3.43	—	0.135	—
S	0.39	0.50	0.015	0.020

D SUFFIX
PLASTIC PACKAGE
CASE 751-03
(SO-8)

NOTES:
1. DIMENSIONS "A" AND "B" ARE DATUMS AND "T" IS A DATUM SURFACE.
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
3. CONTROLLING DIM: MILLIMETER.
4. DIMENSION "A" AND "B" DO NOT INCLUDE MOLD PROTRUSION.
5. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.18	0.25	0.007	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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