

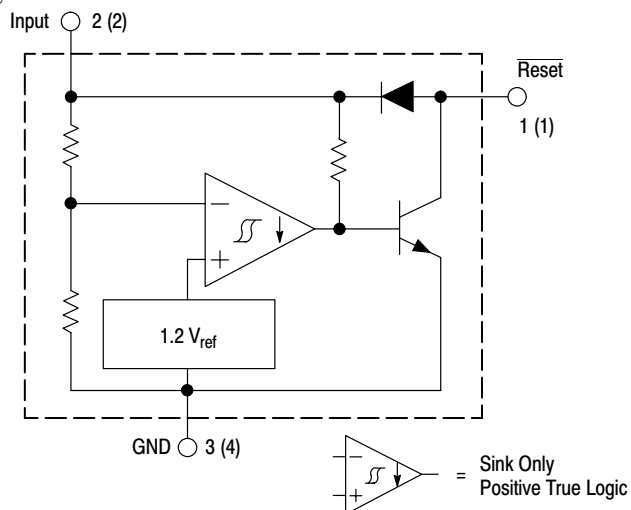
# MC34064, MC33064, NCV33064

## 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 V input with low standby current. The MC devices are packaged in 3-pin TO-226AA, micro size TSOP-5, 8-pin SO-8 and 8-pin SO-8 and Micro8 surface mount packages. The NCV device is packaged in SO-8 and TO-226AA.

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, TSOP-5, SO-8 and Micro8 Surface Mount Packages



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

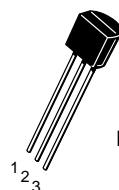
This device contains 21 active transistors.

**Figure 1. Representative Block Diagram**



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**TO-226AA  
P SUFFIX  
CASE 29**

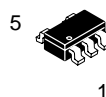
Pin 1.  $\overline{\text{Reset}}$   
2. Input  
3. Ground



**SO-8  
D SUFFIX  
CASE 751**



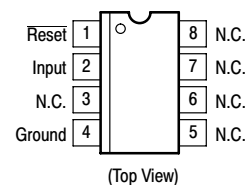
**Micro8  
DM SUFFIX  
CASE 846A**



**TSOP-5  
SN SUFFIX  
CASE 483**

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

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 7 of this data sheet.

# MC34064, MC33064, NCV33064

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Input Supply Voltage	$V_{in}$	-1.0 to 10	V
Reset Output Voltage	$V_O$	10	V
Reset Output Sink Current (Note 2)	$I_{Sink}$	Internally Limited	mA
Clamp Diode Forward Current, Pin 1 to 2 (Note 2)	$I_F$	100	mA
Power Dissipation and Thermal Characteristics P Suffix, Plastic Package Maximum Power Dissipation @ $T_A = 25^\circ\text{C}$ Thermal Resistance, Junction-to-Air D Suffix, Plastic Package Maximum Power Dissipation @ $T_A = 25^\circ\text{C}$ Thermal Resistance, Junction-to-Air DM Suffix, Plastic Package Maximum Power Dissipation @ $T_A = 25^\circ\text{C}$ Thermal Resistance, Junction-to-Air	$P_D$ $R_{\theta JA}$ $P_D$ $R_{\theta JA}$ $P_D$ $R_{\theta JA}$	625 200 625 200 520 240	mW $^\circ\text{C/W}$ mW $^\circ\text{C/W}$ mW $^\circ\text{C/W}$
Operating Junction Temperature	$T_J$	+150	$^\circ\text{C}$
Operating Ambient Temperature MC34064 MC33064 NCV33064	$T_A$	0 to +70 -40 to +85 -40 to +125	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +150	$^\circ\text{C}$

1. ESD data available upon request.

**ELECTRICAL CHARACTERISTICS** (For typical values  $T_A = 25^\circ\text{C}$ , for min/max values  $T_A$  is the operating ambient temperature range that applies [Notes 3 and 4] 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	

### RESET OUTPUT

Output Sink Saturation ( $V_{in} = 4.0\text{ V}$ , $I_{Sink} = 8.0\text{ mA}$ ) ( $V_{in} = 4.0\text{ V}$ , $I_{Sink} = 2.0\text{ mA}$ ) ( $V_{in} = 1.0\text{ V}$ , $I_{Sink} = 0.1\text{ mA}$ )	$V_{OL}$	- - -	0.46 0.15 -	1.0 0.4 0.1	V
Output Sink Current ( $V_{in}$ , $\overline{\text{Reset}} = 4.0\text{ V}$ )	$I_{Sink}$	10	27	60	mA
Output Off-State Leakage ( $V_{in}$ , $\overline{\text{Reset}} = 5.0\text{ V}$ )	$I_{OH}$	-	0.02	0.5	$\mu\text{A}$
Clamp Diode Forward Voltage, Pin 1 to 2 ( $I_F = 10\text{ mA}$ )	$V_F$	0.6	0.9	1.2	V

### TOTAL DEVICE

Operating Input Voltage Range	$V_{in}$	1.0 to 6.5	-	-	V
Quiescent Input Current ( $V_{in} = 5.0\text{ V}$ )	$I_{in}$	-	390	500	$\mu\text{A}$

- Maximum package power dissipation limits must be observed.
- Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.
- $T_{low} = 0^\circ\text{C}$  for MC34064       $T_{high} = +70^\circ\text{C}$  for MC34064  
      $-40^\circ\text{C}$  for MC33064       $+85^\circ\text{C}$  for MC33064  
      $-40^\circ\text{C}$  for NCV33064       $+125^\circ\text{C}$  for NCV33064
- NCV prefix is for automotive and other applications requiring site and change control.

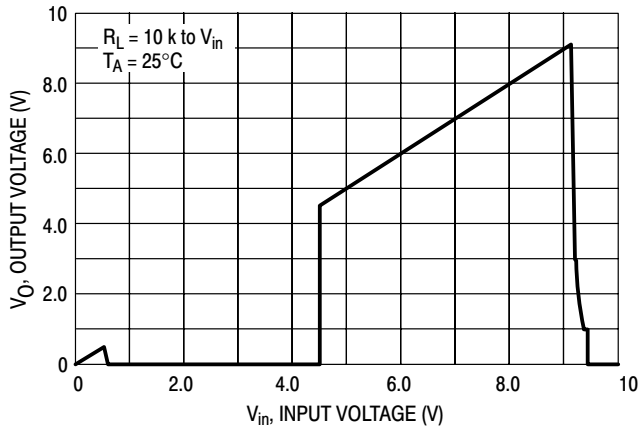


Figure 2. Reset Output Voltage versus Input Voltage

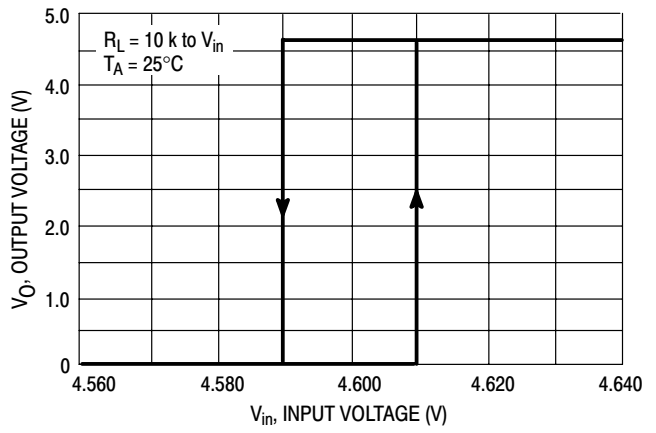


Figure 3. Reset Output Voltage versus Input Voltage

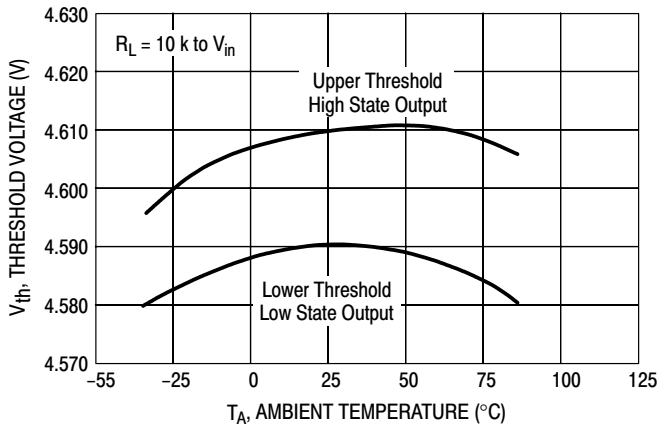


Figure 4. Comparator Threshold Voltage versus Temperature

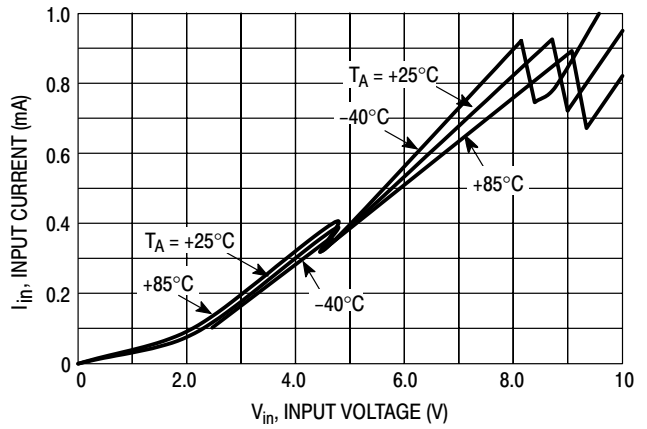


Figure 5. Input Current versus Input Voltage

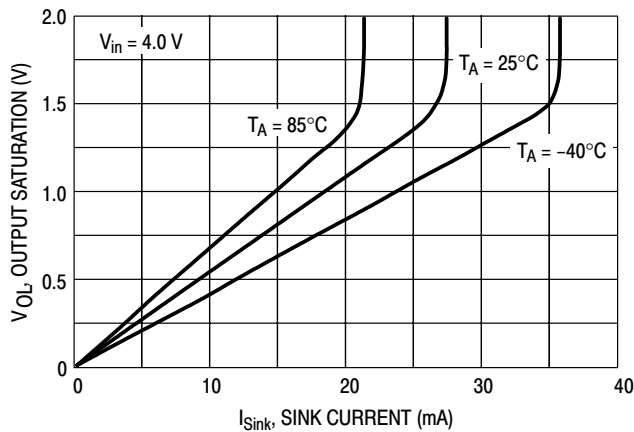


Figure 6. Reset Output Saturation versus Sink Current

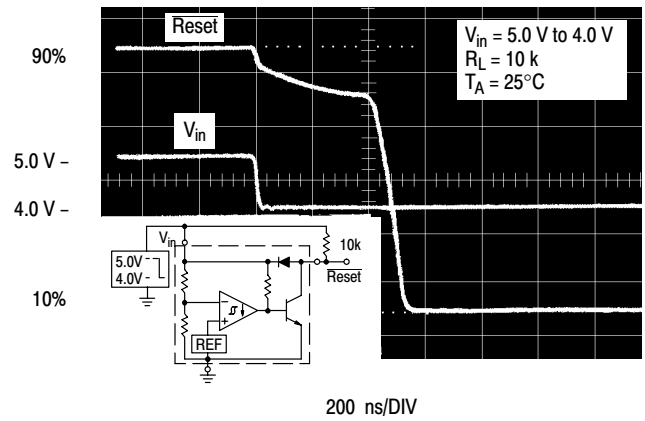
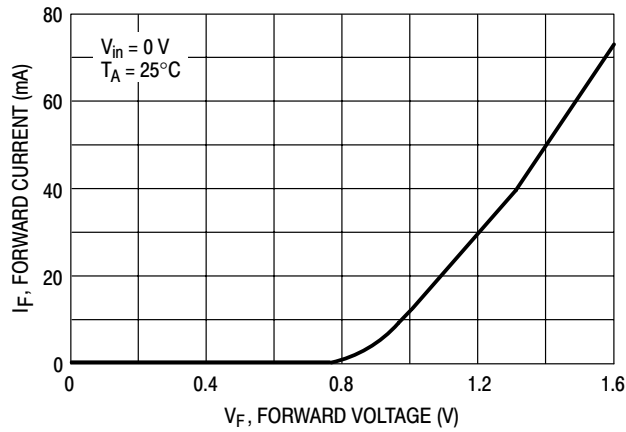
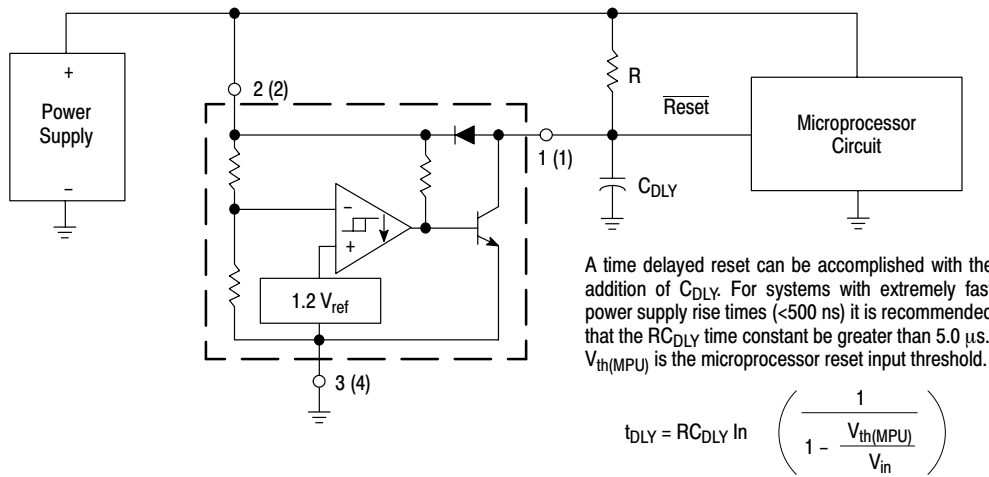


Figure 7. Reset Delay Time

# MC34064, MC33064, NCV33064

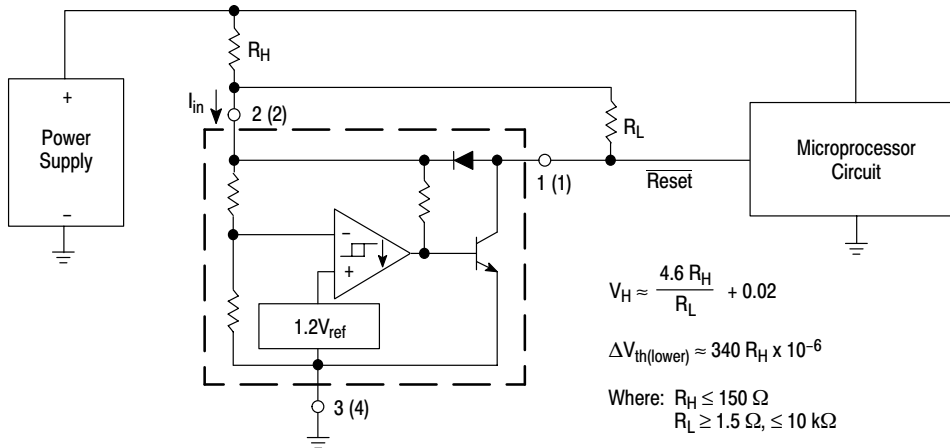


**Figure 8. Clamp Diode Forward Current versus Voltage**



**Figure 9. Low Voltage Microprocessor Reset**

### TEST DATA



$V_H$ (mV)	$\Delta V_{th}$ (mV)	$R_H$ ( $\Omega$ )	$R_L$ (k $\Omega$ )
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

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  $340 \mu A$  at  $4.59 V$ . The equations are accurate to  $\pm 10\%$  with  $R_H$  less than  $150 \Omega$  and  $R_L$  between  $1.5 k\Omega$  and  $10 k\Omega$ .

**Figure 10. Low Voltage Microprocessor Reset with Additional Hysteresis**

# MC34064, MC33064, NCV33064

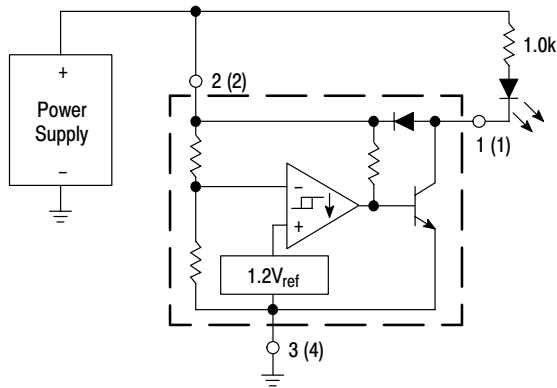


Figure 11. Voltage Monitor

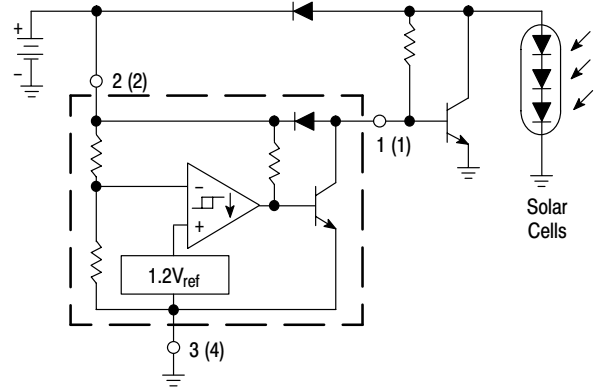
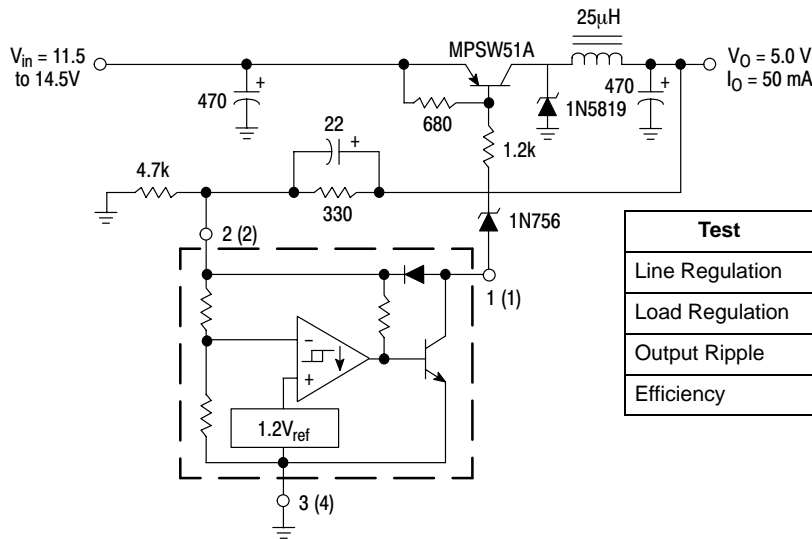
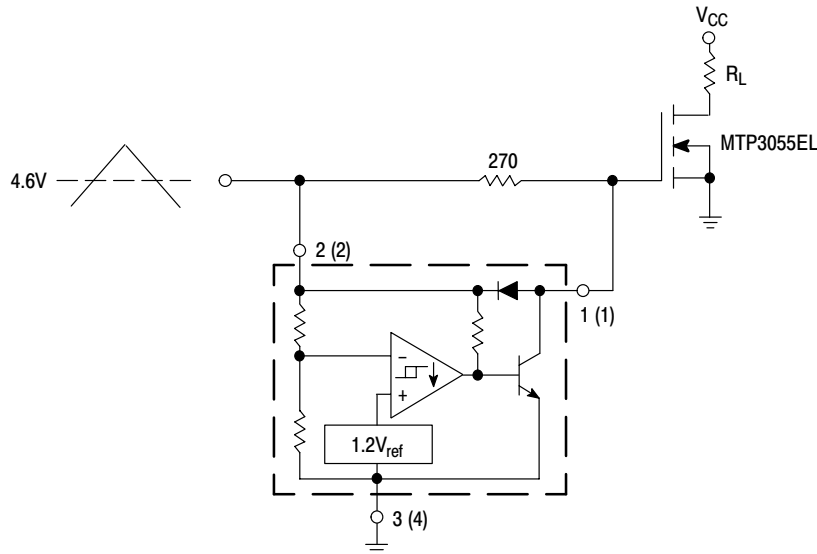


Figure 12. Solar Powered Battery Charger



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

Figure 13. 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<sup>2</sup> MOSFET.

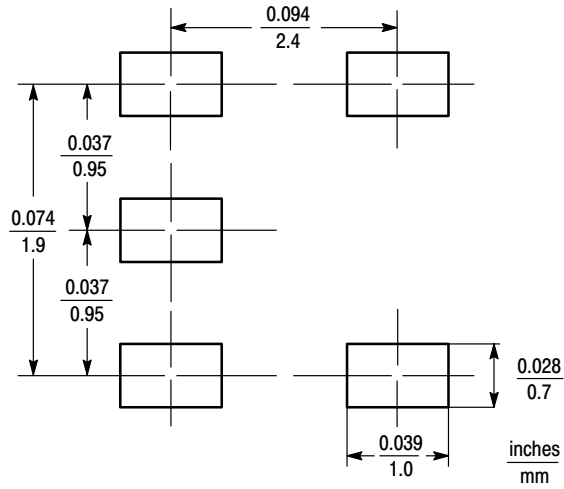
Figure 14. MOSFET Low Voltage Gate Drive Protection

# MC34064, MC33064, NCV33064

## MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection

interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



**TSOP-5**  
**(Footprint Compatible with SOT-23-5)**

# MC34064, MC33064, NCV33064

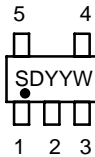
## ORDERING INFORMATION

Device	Operating Temperature Range	Package	Shipping
MC34064D-005	$T_A = 0^\circ\text{C to } +70^\circ\text{C}$	SO-8	98 Units / Rail
MC34064D-5R2		SO-8	2500 Units / Tape & Reel
MC34064DM-5R2		Micro8	4000 Units / Tape & Reel
MC34064P-005		TO-226AA	2000 Units / Bag
MC34064P-5RA		TO-226AA	2000 Units / Tape & Reel
MC34064P-5RP		TO-226AA	2000 Units / Ammo Pack
MC34064SN-5T1		TSOP-5	3000 Units / Tape & Reel
MC33064D-005	$T_J = -40^\circ\text{C to } +85^\circ\text{C}$	SO-8	98 Units / Rail
MC33064D-5R2		SO-8	2500 Units / Tape & Reel
MC33064DM-5R2		Micro8	4000 Units / Tape & Reel
MC33064P-005		TO-226AA	2000 Units / Bag
MC33064P-5RA		TO-226AA	2000 Units / Tape & Reel
MC33064P-5RP		TO-226AA	2000 Units / Ammo Pack
NCV33064D-5R2*	$T_A = -40^\circ\text{C to } +125^\circ\text{C}$	SO-8	2500 Units / Tape & Reel
NCV33064P-5RA*		TO-226AA	2000 Units / Tape & Reel
NCV33064P-5RP*		TO-226AA	2000 Units / Ammo Pack

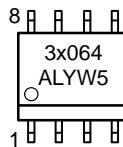
\*NCV33064:  $T_{low} = -40^\circ\text{C}$ ,  $T_{high} = +125^\circ\text{C}$ . Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.

## MARKING DIAGRAMS

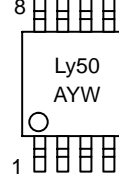
**TSOP-5  
SN SUFFIX  
CASE 483**



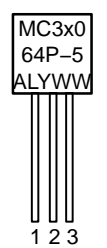
**SO-8  
D SUFFIX  
CASE 751**



**Micro8  
DM SUFFIX  
CASE 846A**



**TO-226AA  
P SUFFIX  
CASE 29**



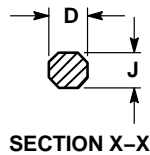
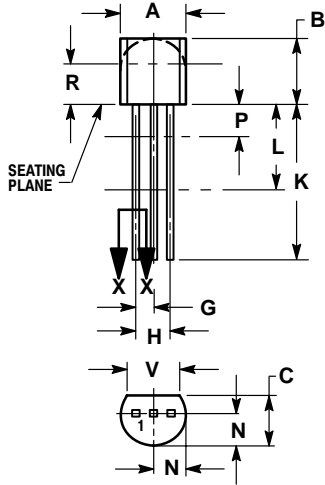
SDY = Device Code  
 x = 3 or 4  
 y = I or C  
 A = Assembly Location  
 WL, L = Wafer Lot  
 YY, Y = Year  
 WW, W = Work Week

\*This marking diagram also applies to NCV33064P.

# MC34064, MC33064, NCV33064

## PACKAGE DIMENSIONS

### P SUFFIX PLASTIC PACKAGE CASE 29-11 (TO-226AA) ISSUE AL

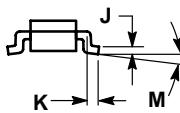
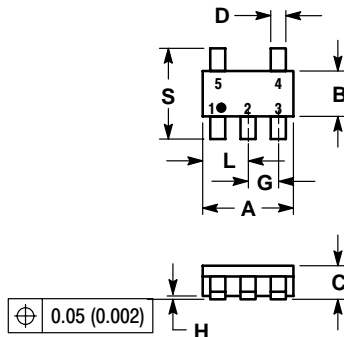


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.021	0.407	0.533
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	---	12.70	---
L	0.250	---	6.35	---
N	0.080	0.105	2.04	2.66
P	---	0.100	---	2.54
R	0.115	---	2.93	---
V	0.135	---	3.43	---

### SN SUFFIX PLASTIC PACKAGE CASE 483-02 ISSUE C



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. A AND B DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

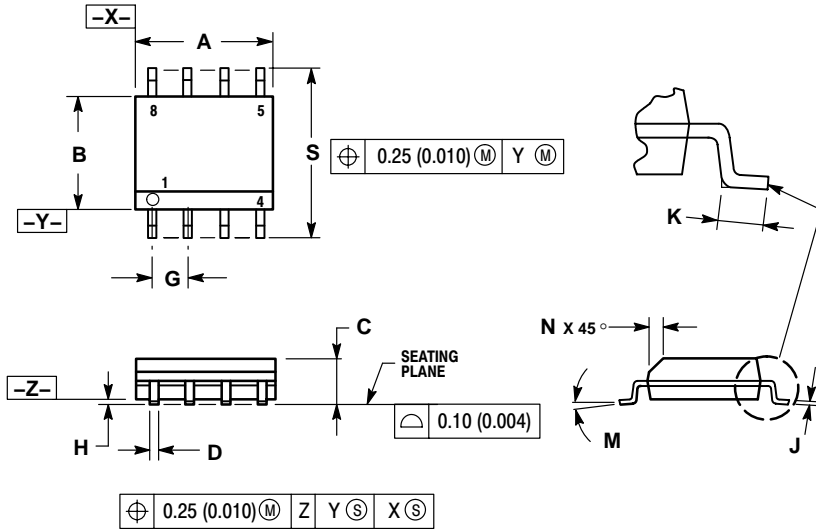
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.1142	0.1220
B	1.30	1.70	0.0512	0.0669
C	0.90	1.10	0.0354	0.0433
D	0.25	0.50	0.0098	0.0197
G	0.85	1.05	0.0335	0.0413
H	0.013	0.100	0.0005	0.0040
J	0.10	0.26	0.0040	0.0102
K	0.20	0.60	0.0079	0.0236
L	1.25	1.55	0.0493	0.0610
M	0	10	0	10
S	2.50	3.00	0.0985	0.1181



# MC34064, MC33064, NCV33064

## PACKAGE DIMENSIONS

**P SUFFIX**  
 PLASTIC PACKAGE  
 CASE 751-07  
 (SOIC-8 NB)  
 ISSUE AA

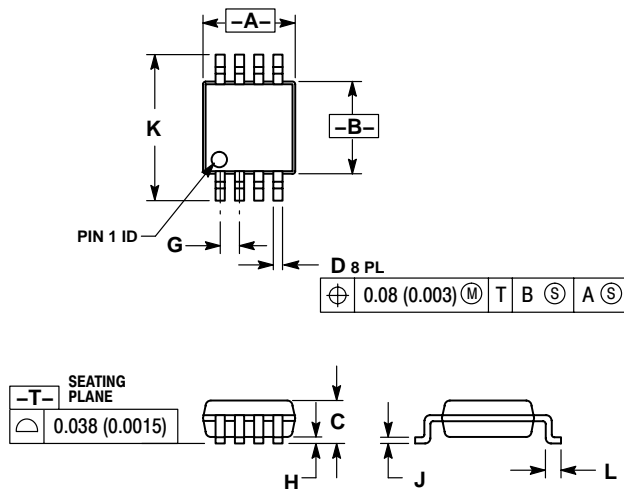


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244


**DM SUFFIX**  
 PLASTIC PACKAGE  
 CASE 846A-02  
 (Micro8)  
 ISSUE F



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. 846A-01 OBSOLETE, NEW STANDARD 846A-02.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	---	1.10	---	0.043
D	0.25	0.40	0.010	0.016
G	0.65 BSC		0.026 BSC	
H	0.05	0.15	0.002	0.006
J	0.13	0.23	0.005	0.009
K	4.75	5.05	0.187	0.199
L	0.40	0.70	0.016	0.028

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