# MC34064, MC33064, NCV33064

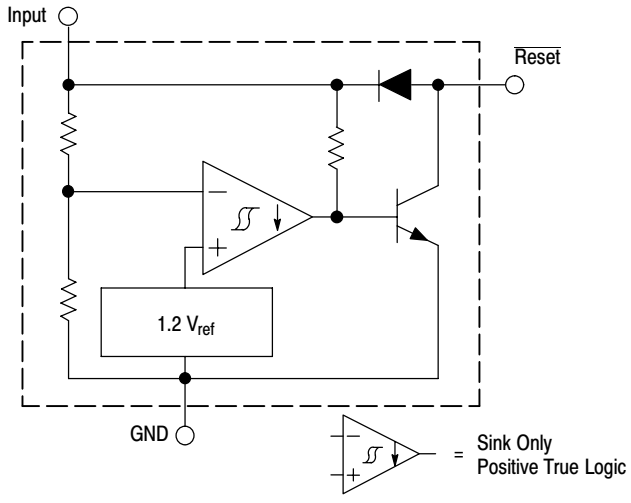
# Undervoltage Sensing Circuit

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-92, micro size TSOP−5, 8−pin SOIC−8 and Micro8™ surface mount packages. The NCV device is packaged in SOIC−8 and TO−92.

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

**Features**

- 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−92, TSOP−5, SOIC−8 and Micro8 Surface Mount Packages
- Pb−Free Packages are Available
- NCV Prefix for Automotive and Other Applications Requiring Site and Control Changes



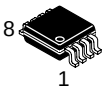

This device contains 21 active transistors.

**Figure 1. Representative Block Diagram**

**ON Semiconductor®**

**http://onsemi.com**

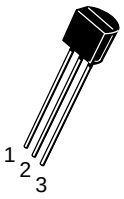

**SOIC−8**
**D SUFFIX**
**CASE 751**




**Micro8**
**DM SUFFIX**
**CASE 846A**


**TSOP−5**
**SN SUFFIX**
**CASE 483**

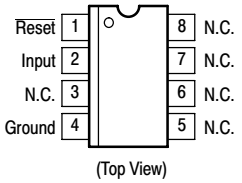
Pin 1. Ground
2. Input
3. $\overline{\text{Reset}}$
4. NC
5. NC




**TO−92**
**P SUFFIX**
**CASE 29**

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

**PIN CONNECTIONS**




(Top View)

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

**DEVICE MARKING INFORMATION**

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

**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 2) | $I_{Sink}$ | Internally Limited | mA |
| Clamp Diode Forward Current, Reset to Input Pin (Note 2) | $I_F$ | 100 | mA |
| Power Dissipation and Thermal Characteristics<br>P Suffix, Plastic Package<br>Maximum Power Dissipation @ $T_A$ = 25°C<br>Thermal Resistance, Junction−to−Air<br>D Suffix, Plastic Package<br>Maximum Power Dissipation @ $T_A$ = 25°C<br>Thermal Resistance, Junction−to−Air<br>DM Suffix, Plastic Package<br>Maximum Power Dissipation @ $T_A$ = 25°C<br>Thermal Resistance, Junction−to−Air | <br><br>$P_D$<br>$R_{\theta JA}$<br><br>$P_D$<br>$R_{\theta JA}$<br><br>$P_D$<br>$R_{\theta JA}$ | <br><br>625<br>200<br><br>625<br>200<br><br>520<br>240 | <br><br>mW<br>°C/W<br><br>mW<br>°C/W<br><br>mW<br>°C/W |
| Operating Junction Temperature | $T_J$ | +150 | °C |
| Operating Ambient Temperature<br>MC34064<br>MC33064<br>NCV33064 | $T_A$ | <br>0 to +70<br>−40 to +85<br>−40 to +125 | °C |
| Storage Temperature Range | $T_{stg}$ | −65 to +150 | °C |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. 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 3 and 4] unless otherwise noted.)

| Characteristics | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **COMPARATOR** | | | | | |
| Threshold Voltage<br>High State Output ($V_{in}$ Increasing)<br>Low State Output ($V_{in}$ Decreasing)<br>Hysteresis | <br>$V_{IH}$<br>$V_{IL}$<br>$V_H$ | <br>4.5<br>4.5<br>0.01 | <br>4.61<br>4.59<br>0.02 | <br>4.7<br>4.7<br>0.05 | V |
| **$\overline{\text{RESET}}$ OUTPUT** | | | | | |
| Output Sink Saturation<br>($V_{in}$ = 4.0 V, $I_{Sink}$ = 8.0 mA)<br>($V_{in}$ = 4.0 V, $I_{Sink}$ = 2.0 mA)<br>($V_{in}$ = 1.0 V, $I_{Sink}$ = 0.1 mA) | $V_{OL}$ | <br>−<br>−<br>− | <br>0.46<br>0.15<br>− | <br>1.0<br>0.4<br>0.1 | V |
| 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, Reset to Input Pin ($I_F$ = 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 |

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

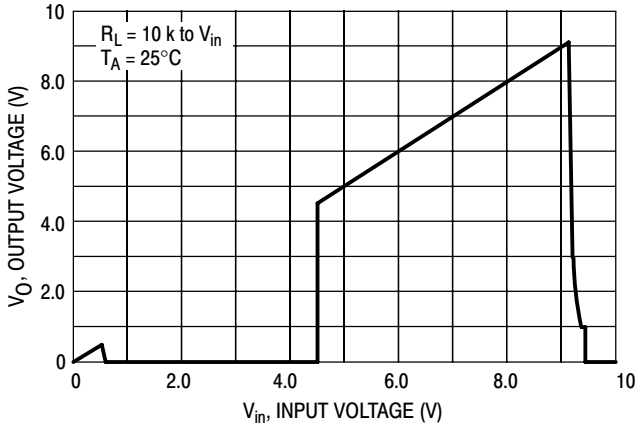



**Figure 2. $\overline{\text{Reset}}$ Output Voltage versus Input Voltage**

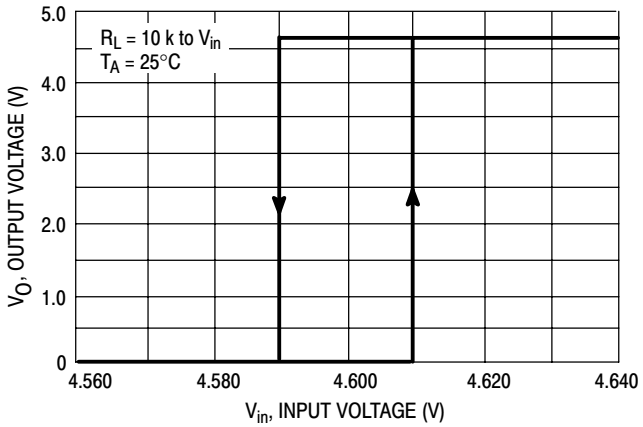



**Figure 3. $\overline{\text{Reset}}$ Output Voltage versus Input Voltage**

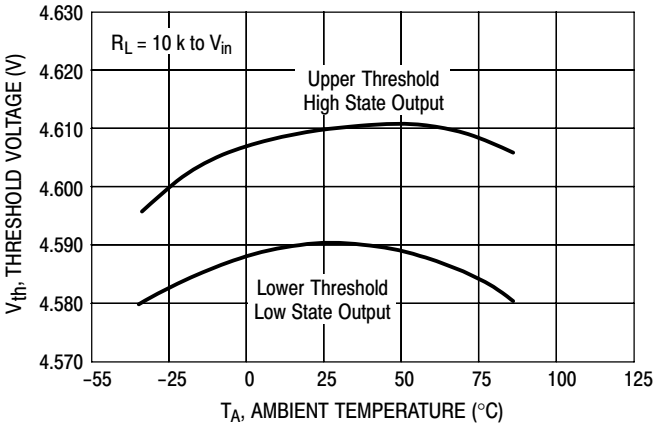



**Figure 4. Comparator Threshold Voltage versus Temperature**

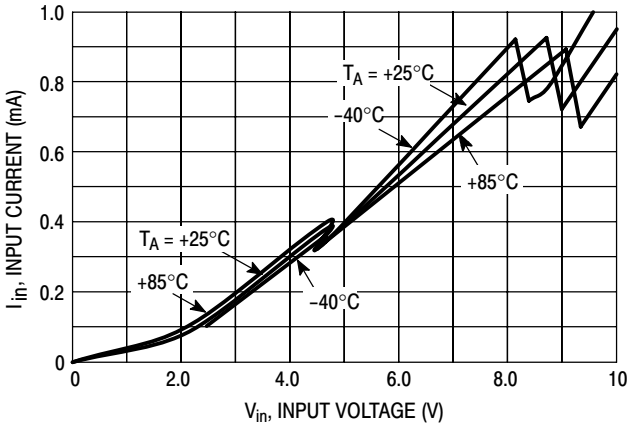



**Figure 5. Input Current versus Input Voltage**

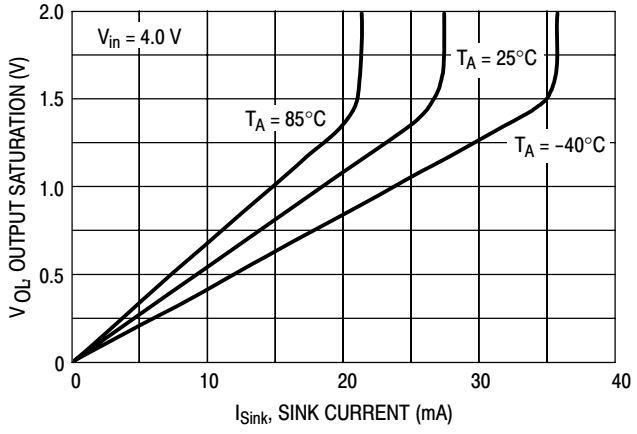



**Figure 6. $\overline{\text{Reset}}$ Output Saturation versus Sink Current**

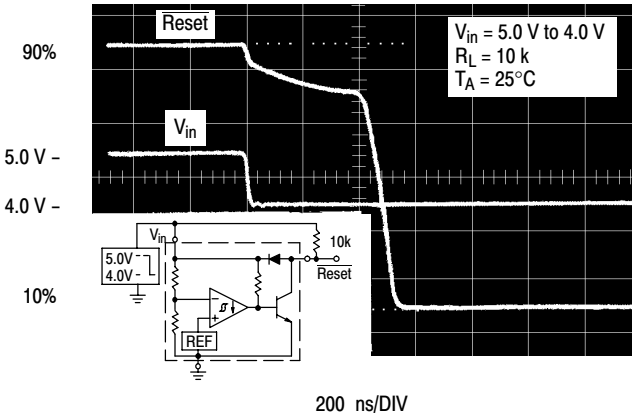



**Figure 7. $\overline{\text{Reset}}$ Delay Time**

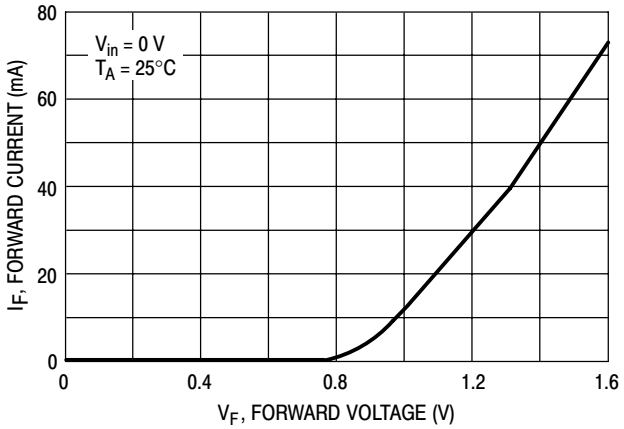



**Figure 8. Clamp Diode Forward Current versus Voltage**

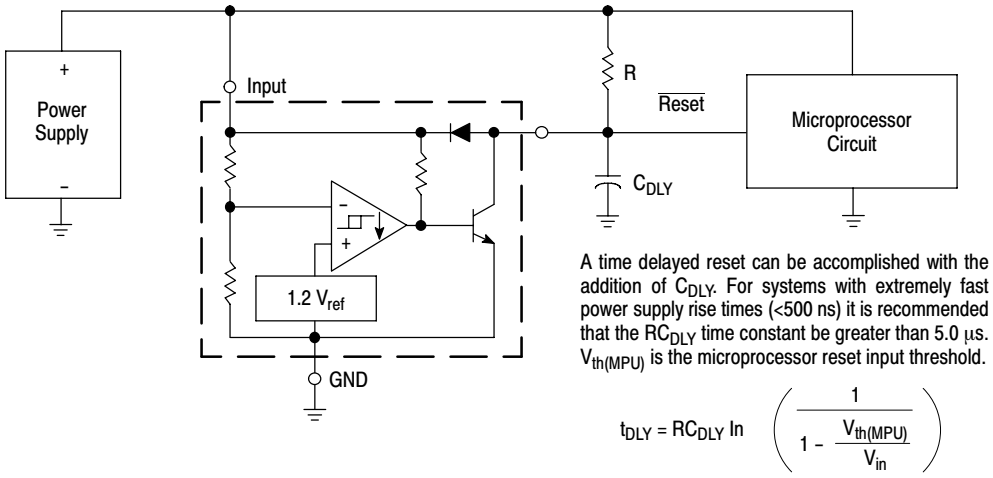
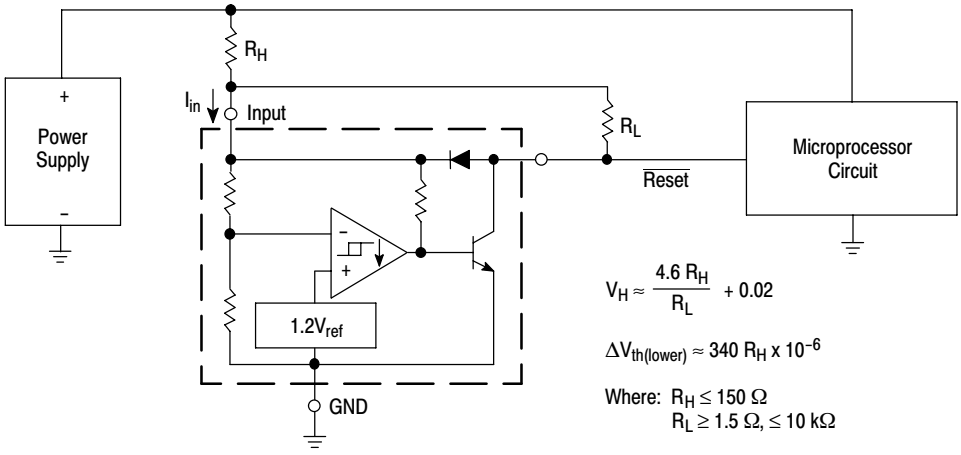



**Figure 9. Low Voltage Microprocessor Reset**




**TEST DATA**

| $V_H$ (mV) | $\Delta V_{th}$ (mV) | $R_H$ (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 |

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.

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

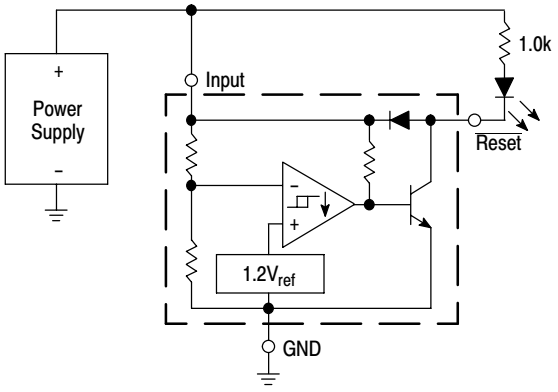



**Figure 11. Voltage Monitor**

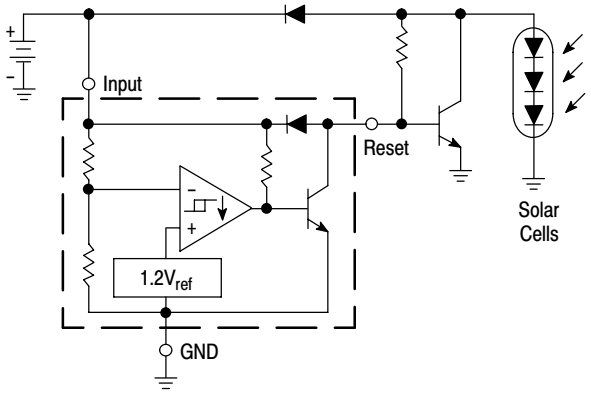
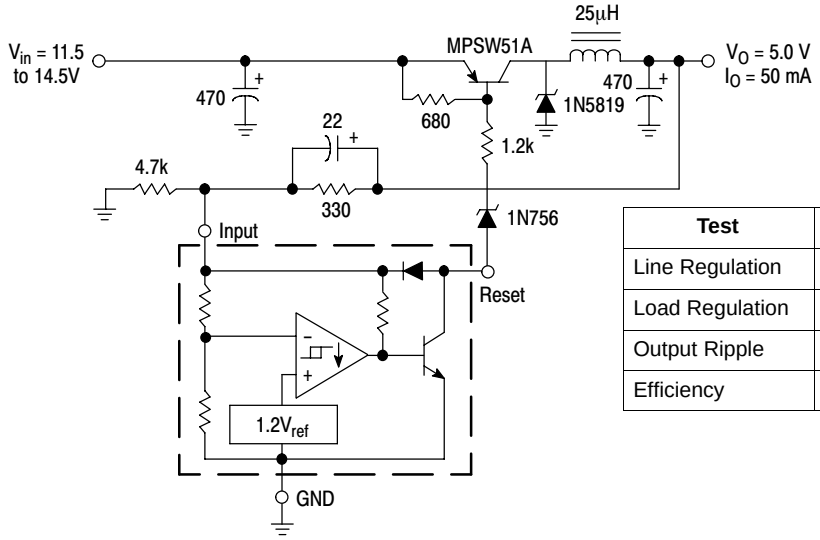
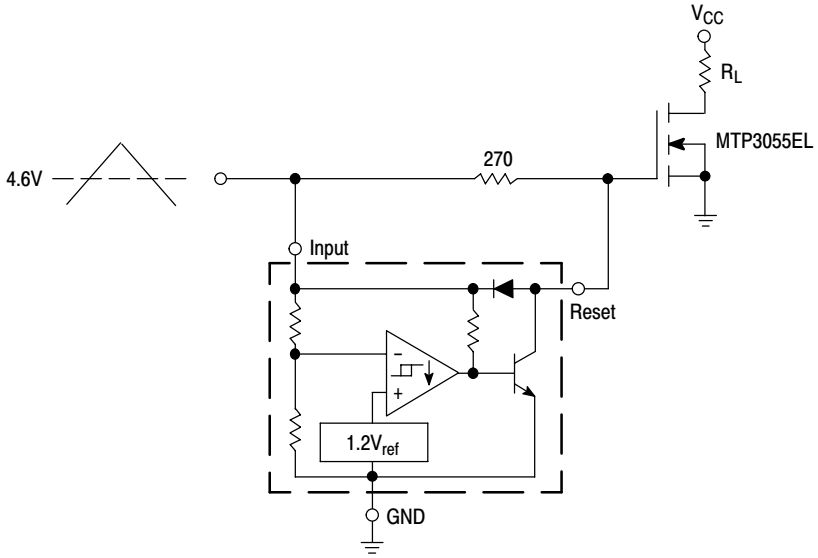



**Figure 12. Solar Powered Battery Charger**




| 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 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 $L^2$ MOSFET.

**Figure 14. MOSFET Low Voltage Gate Drive Protection**

**ORDERING INFORMATION**

| Device | Operating Temperature Range | Package | Shipping† |
|---|---|---|---|
| MC34064D−005 | $T_A$ = 0°C to +70°C | SOIC−8 | 98 Units / Rail |
| MC34064D−005G | | SOIC−8 (Pb−Free) | |
| MC34064D−5R2 | | SOIC−8 | 2500 Units/ Tape & Reel |
| MC34064D−5R2G | | SOIC−8 (Pb−Free) | |
| MC34064DM−5R2 | | Micro8 | 4000 Units / Tape & Reel |
| MC34064DM−5R2G | | Micro8 (Pb−Free) | |
| MC34064P−005 | | TO−92 | 2000 Units / Bag |
| MC34064P−005G | | TO−92 (Pb−Free) | |
| MC34064P−5RA | | TO−92 | 2000 Units / Tape & Reel |
| MC34064P−5RAG | | TO−92 (Pb−Free) | |
| MC34064P−5RP | | TO−92 | 2000 Units / Ammo Pack |
| MC34064P−5RPG | | TO−92 (Pb−Free) | |
| MC34064P−5RM | | TO−92 | |
| MC34064P−5RMG | | TO−92 (Pb−Free) | |
| MC34064SN−5T1 | | TSOP−5 | 3000 Units / Tape & Reel |
| MC34064SN−5T1G | | TSOP−5 (Pb−Free) | |
| MC33064D−005 | $T_J$ = −40°C to +85°C | SOIC−8 | 98 Units / Rail |
| MC33064D−005G | | SOIC−8 (Pb−Free) | |
| MC33064D−5R2 | | SOIC−8 | 2500 Units / Tape & Reel |
| MC33064D−5R2G | | SOIC−8 (Pb−Free) | |
| MC33064DM−5R2 | | Micro8 | 4000 Units / Tape & Reel |
| MC33064DM−5R2G | | Micro8 (Pb−Free) | |
| MC33064P−005 | | TO−92 | 2000 Units / Bag |
| MC33064P−005G | | TO−92 (Pb−Free) | |
| MC33064P−5RA | | TO−92 | 2000 Units / Tape & Reel |
| MC33064P−5RAG | | TO−92 (Pb−Free) | |
| MC33064P−5RP | | TO−92 | 2000 Units / Ammo Pack |
| MC33064P−5RPG | | TO−92 (Pb−Free) | |
| MC33064SN−5T1 | | TSOP−5 | 3000 Units / Tape & Reel |
| MC33064SN−5T1G | | TSOP−5 (Pb−Free) | |

†For information on tape and reel specifications, including part orientation and tape sizes, pleaserefer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

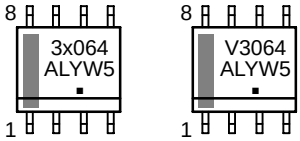
**ORDERING INFORMATION**

| Device | Operating Temperature Range | Package | Shipping† |
|---|---|---|---|
| NCV33064D−5R2* | $T_A$ = −40°C to +125°C | SOIC−8 | 2500 Units / Tape & Reel |
| NCV33064D−5R2G* | | SOIC−8 (Pb−Free) | |
| NCV33064P−5RA* | | TO−92 | 2000 Units / Tape & Reel |
| NCV33064P−5RAG* | | TO−92 (Pb−Free) | |
| NCV33064P−5RP* | | TO−92 | 2000 Units / Ammo Pack |
| NCV33064P−5RPG* | | TO−92 (Pb−Free) | |
| NCV33064DM−5R2* | | Micro8 | 4000 Units / Tape & Reel |
| NCV33064DM−5R2G* | | Micro8 (Pb−Free) | |

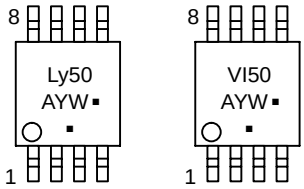
†For information on tape and reel specifications, including part orientation and tape sizes, pleaserefer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
*NCV33064: $T_{low}$ = −40°C, $T_{high}$ = +125°C. Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.

**MARKING DIAGRAMS**

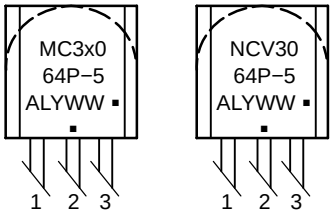
**SOIC−8**
**D SUFFIX**
**CASE 751**



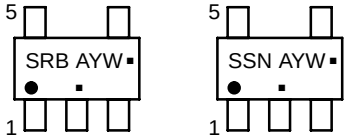

**Micro8**
**DM SUFFIX**
**CASE 846A**




**TO−92**
**P SUFFIX**
**CASE 29**




**TSOP−5**
**SN SUFFIX**
**CASE 483**



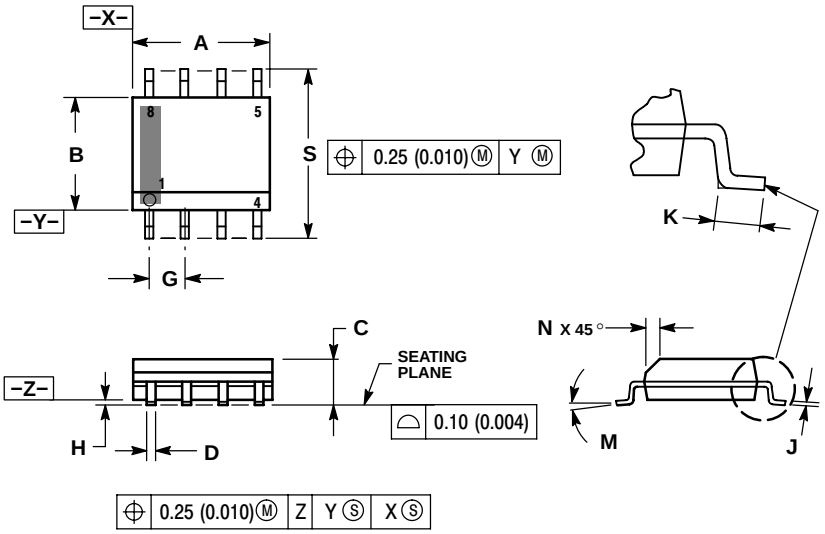

**MC34064** **MC33064**

x = 3 or 4
y = C or I
A = Assembly Location
L = Wafer Lot
Y = Year
W, WW = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

## PACKAGE DIMENSIONS

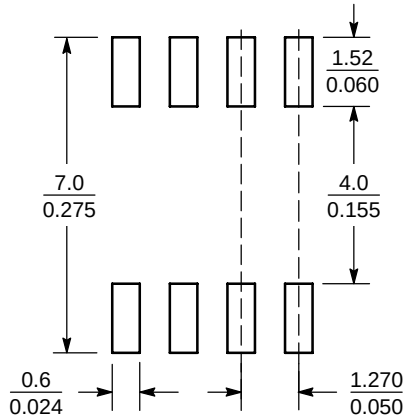
**SOIC−8**
**D SUFFIX**
PLASTIC PACKAGE
CASE 751−07
ISSUE AG




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.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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 |

## SOLDERING FOOTPRINT*

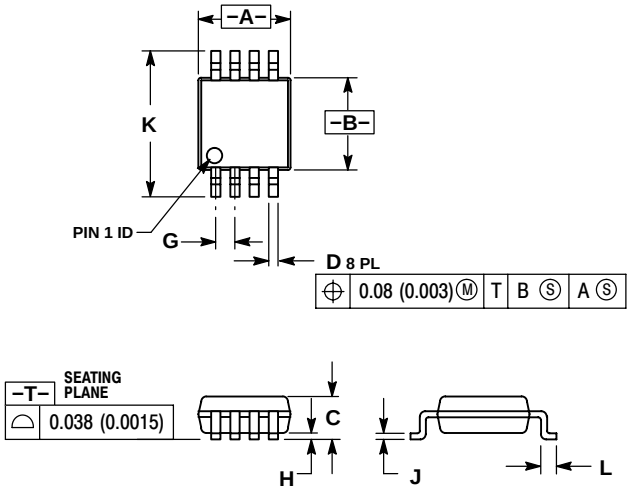



SCALE 6:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## PACKAGE DIMENSIONS

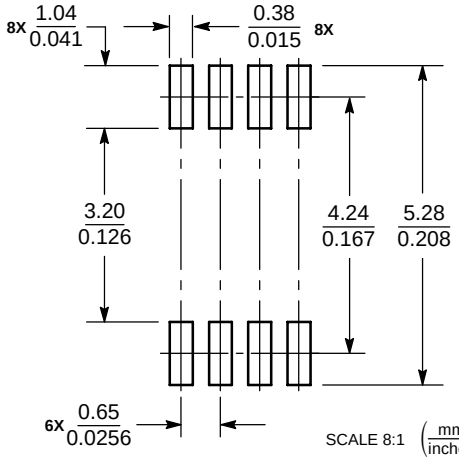
**Micro8**
**DM SUFFIX**
PLASTIC PACKAGE
CASE 846A−02
ISSUE F




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.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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 |

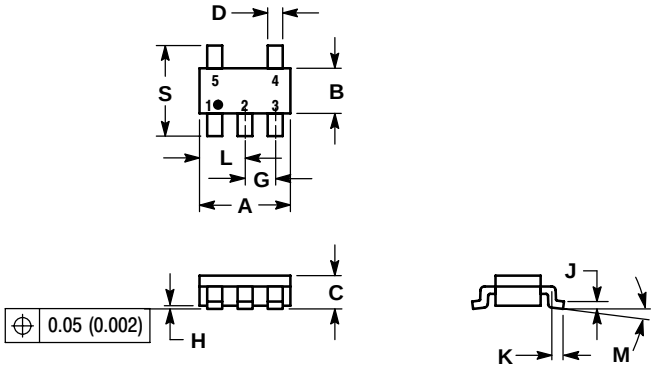
## SOLDERING FOOTPRINT*




*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## PACKAGE DIMENSIONS

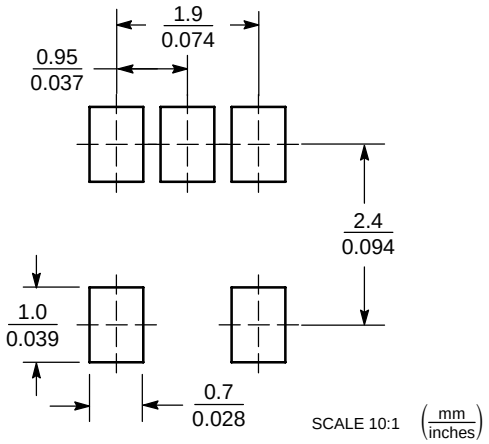
**TSOP−5**
**SN SUFFIX**
PLASTIC PACKAGE
CASE 483−02
ISSUE E




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.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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 |

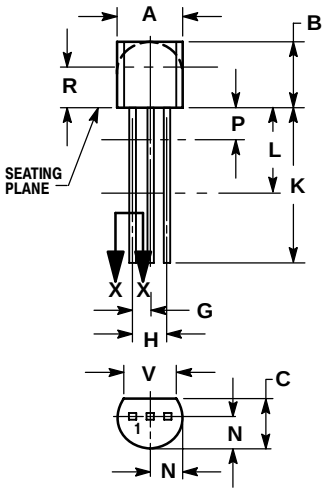
## SOLDERING FOOTPRINT*

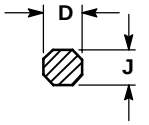



*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## PACKAGE DIMENSIONS

**TO−92**
**P SUFFIX**
PLASTIC PACKAGE
CASE 29−11
ISSUE AL




**SECTION X−X**

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.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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 | --- |

Micro8 is a trademark of International Rectifier.



**PUBLICATION ORDERING INFORMATION**

**LITERATURE FULFILLMENT**:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
**Phone**: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
**Fax**: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
**Email**: orderlit@onsemi.com

**N. American Technical Support**: 800−282−9855 Toll Free USA/Canada

**Japan**: ON Semiconductor, Japan Customer Focus Center
2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
**Phone**: 81−3−5773−3850

**ON Semiconductor Website**: http://onsemi.com

**Order Literature**: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.

**MC34064/D**