# Operational Amplifier, Zero-Drift, 10 μV Offset, 0.07 μV/°C

# NCS333A, NCV333A, NCS2333, NCV2333, NCS4333, NCV4333, NCS333

The NCS333/2333/4333 family of zero−drift op amps feature offset voltage as low as 10 μV over the 1.8 V to 5.5 V supply voltage range. The zero−drift architecture reduces the offset drift to as low as 0.07 μV/°C and enables high precision measurements over both time and temperature. This family has low power consumption over a wide dynamic range and is available in space saving packages. These features make it well suited for signal conditioning circuits in portable, industrial, automotive, medical and consumer markets.

### Features

- Gain−Bandwidth Product:
  - 270 kHz (NCx2333)
  - 350 kHz (NCx333, NCx333A, NCx4333)
- Low Supply Current: 17 μA (typ at 3.3 V)
- Low Offset Voltage:
  - 10 μV max for NCS333, NCS333A
  - 30 μV max for NCV333A, NCx2333 and NCx4333
- Low Offset Drift: 0.07 μV/°C max for NCS333/A
- Wide Supply Range: 1.8 V to 5.5 V
- Wide Temperature Range: −40°C to +125°C
- Rail−to−Rail Input and Output
- Available in Single, Dual and Quad Packages
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable

### Applications

- Automotive
- Battery Powered/ Portable Application
- Sensor Signal Conditioning
- Low Voltage Current Sensing
- Filter Circuits
- Bridge Circuits
- Medical Instrumentation

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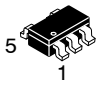
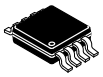



**SOT23−5**
**SN SUFFIX**
**CASE 483**

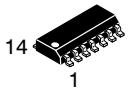

**SC70−5**
**SQ SUFFIX**
**CASE 419A**


**UDFN8**
**MU SUFFIX**
**CASE 517AW**

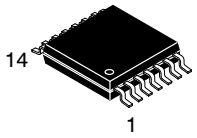


**MSOP−8**
**DM SUFFIX**
**CASE 846A−02**


**SOIC−8**
**D SUFFIX**
**CASE 751**




**SOIC−14**
**D SUFFIX**
**CASE 751A**




**TSSOP−14 WB**
**DT SUFFIX**
**CASE 948G**

## DEVICE MARKING INFORMATION

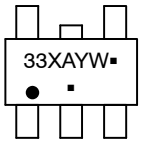
See general marking information in the device marking section on page 2 of this data sheet.

## ORDERING INFORMATION

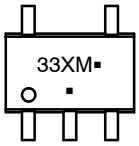
See detailed ordering and shipping information on page 3 of this data sheet.

## DEVICE MARKING INFORMATION

**Single Channel Configuration**
**NCS333, NCS333A, NCV333A**

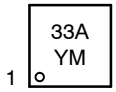



TSOP−5/SOT23−5
CASE 483

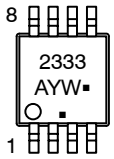



SC70−5
CASE 419A

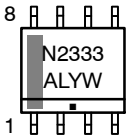
**Dual Channel Configuration**
**NCS2333, NCV2333**




UDFN8, 2x2, 0.5P
CASE 517AW

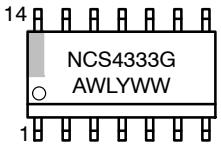



Micro8/MSOP8
CASE 846A−02

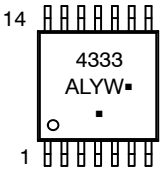



SOIC−8
CASE 751

**Quad Channel Configuration**
**NCS4333, NCV4333**




SOIC−14
CASE 751A



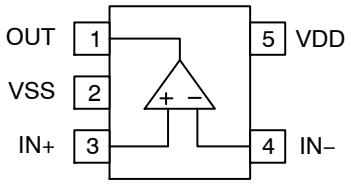

TSSOP−14
CASE 948G

| | |
|---|---|
| X | = Specific Device Code<br>E = NCS333 (SOT23−5)<br>H = NCS333 (SC70−5)<br>G = NCS333A (SOT23−5)<br>K = NCS333A (SC70−5)<br>M = NCV333A (SOT23−5)<br>N = NCV333A (SC70−5) |
| A | = Assembly Location |
| Y | = Year |
| W | = Work Week |
| M | = Date Code |
| G or ▪ | = Pb−Free Package |

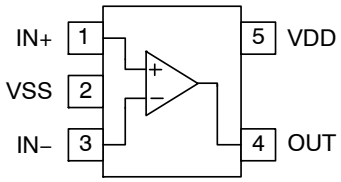
(Note: Microdot may be in either location)

## PIN CONNECTIONS

**Single Channel Configuration**
**NCS333, NCS333A, NCV333A**

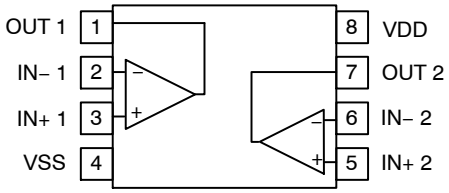



SOT23–5 / TSOP–5




SC70–5 / SC–88–5 / SOT–353–5

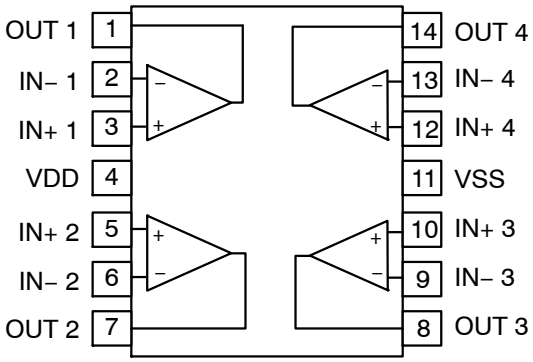
**Dual Channel Configuration**
**NCS2333, NCV2333**




UDFN8* / Micro8 / SOIC–8

*The exposed pad of the UDFN8 package can be floated or connected to VSS.

**Quad Channel Configuration**
**NCS4333, NCV4333**




SOIC–14 / TSSOP–14

### ORDERING INFORMATION

| Channels | Device | Package | Shipping † |
|---|---|---|---|
| Single | NCS333SN2T1G | SOT23–5 / TSOP–5 | 3000 / Tape & Reel |
| | NCS333ASN2T1G | | 3000 / Tape & Reel |
| | NCS333SQ3T2G | SC70–5 / SC–88–5 / SOT–353–5 | 3000 / Tape & Reel |
| | NCS333ASQ3T2G | | 3000 / Tape & Reel |
| Dual | NCS2333MUTBG | UDFN8 | 3000 / Tape & Reel |
| | NCS2333DR2G | SOIC–8 | 3000 / Tape & Reel |
| | NCS2333DMR2G | MICRO–8 | 4000 / Tape & Reel |
| Quad | NCS4333DR2G | SOIC–14 | 2500 / Tape & Reel |
| | NCS4333DTBR2G (In Development*) | TSSOP–14 | 2500 / Tape & Reel |

***Automotive Qualified***

| Channels | Device | Package | Shipping † |
|---|---|---|---|
| Single | NCV333ASN2T1G | SOT23–5 / TSOP–5 | 3000 / Tape & Reel |
| | NCV333ASQ3T2G | SC70–5 / SC–88–5 / SOT–353–5 | 3000 / Tape & Reel |
| Dual | NCV2333DR2G | SOIC–8 | 3000 / Tape & Reel |
| | NCV2333DMR2G | MICRO–8 | 4000 / Tape & Reel |
| Quad | NCV4333DR2G | SOIC–14 | 2500 / Tape & Reel |
| | NCV4333DTBR2G (In Development*) | TSSOP–14 | 2500 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
*Contact local sales office for more information.

## ABSOLUTE MAXIMUM RATINGS

Over operating free−air temperature, unless otherwise stated.

| Parameter | Rating | Unit |
|---|---|---|
| Supply Voltage | 7 | V |
| **INPUT AND OUTPUT PINS** | | |
| Input Voltage (Note 1) | (VSS) − 0.3 to (VDD) + 0.3 | V |
| Input Current (Note 1) | ±10 | mA |
| Output Short Circuit Current (Note 2) | Continuous | |
| **TEMPERATURE** | | |
| Operating Temperature Range | −40 to +125 | °C |
| Storage Temperature Range | −65 to +150 | °C |
| Junction Temperature | +150 | °C |
| **ESD RATINGS** (Note 3) | | |
| Human Body Model (HBM) | ±4000 | V |
| Machine Model (MM) | ±200 | V |
| Charged Device Model (CDM) | ±2000 | V |
| **OTHER RATINGS** | | |
| Latch−up Current (Note 4) | 100 | mA |
| MSL | Level 1 | |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Input terminals are diode−clamped to the power−supply rails. Input signals that can swing more than 0.3 V beyond the supply rails should be current limited to 10 mA or less
2. Short−circuit to ground.
3. This device series incorporates ESD protection and is tested by the following methods:
   ESD Human Body Model tested per JEDEC standard JS−001 (AEC−Q100−002)
   ESD Machine Model tested per JEDEC standard JESD22−A115 (AEC−Q100−003)
   ESD Charged Device Model tested per JEDEC standard JESD22−C101 (AEC−Q100−011)
4. Latch−up Current tested per JEDEC standard: JESD78.

## THERMAL INFORMATION (Note 5)

| Parameter | Symbol | Package | Value | Unit |
|---|---|---|---|---|
| Thermal Resistance, Junction to Ambient | $\theta_{JA}$ | SOT23−5 / TSOP5 | 290 | °C/W |
| | | SC70−5 / SC−88−5 / SOT−353−5 | 425 | |
| | | Micro8 / MSOP8 | 298 | |
| | | SOIC−8 | 250 | |
| | | UDFN8 | 228 | |
| | | SOIC−14 | 216 | |
| | | TSSOP−14 | 155 | |

5. As mounted on an 80x80x1.5 mm FR4 PCB with 650 $mm^2$ and 2 oz (0.07 mm) thick copper heat spreader. Following JEDEC JESD/EIA 51.1, 51.2, 51.3 test guidelines

## RECOMMENDED OPERATING CONDITIONS

| Parameter | | Symbol | Range | Unit |
|---|---|---|---|---|
| Supply Voltage ($V_{DD}$ − $V_{SS}$) | | $V_S$ | 1.8 to 5.5 | V |
| Specified Operating Temperature Range | NCS333 | $T_A$ | −40 to 105 | °C |
| | NCx333A, NCx2333, NCx4333 | | −40 to 125 | |
| Input Common Mode Voltage Range | | $V_{ICMR}$ | $V_{SS}$−0.1 to $V_{DD}$+0.1 | V |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

**ELECTRICAL CHARACTERISTICS:** $V_S$ = 1.8 V to 5.5 V
At $T_A$ = +25°C, $R_L$ = 10 kΩ connected to midsupply, $V_{CM}$ = $V_{OUT}$ = midsupply, unless otherwise noted.
**Boldface** limits apply over the specified operating temperature range, guaranteed by characterization and/or design.

| Parameter | Symbol | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **INPUT CHARACTERISTICS** | | | | | | | |
| Offset Voltage | $V_{OS}$ | $V_S$ = +5 V | NCS333, NCS333A | | 3.5 | 10 | μV |
| | | | NCV333A, NCx2333, NCx4333 | | 6.0 | 30 | |
| Offset Voltage Drift vs Temp | $\Delta V_{OS}/\Delta T$ | NCS333, NCS333A | | | **0.03** | **0.07** | μV/°C |
| | | NCV333A, $V_S$ = 5 V | | | **0.03** | **0.14** | |
| | | NCx2333, $V_S$ = 5 V | | | **0.04** | **0.07** | |
| | | NCx4333, $V_S$ = 5 V | | | **0.095** | **0.19** | |
| Offset Voltage Drift vs Supply | $\Delta V_{OS}/\Delta V_S$ | NCS333, NCS333A | Full temperature range | | **0.32** | **5** | μV/V |
| | | NCV333A | $T_A$ = +25°C | | 0.40 | 5 | |
| | | | Full temperature range | | | **8** | |
| | | NCx2333, NCx4333 | $T_A$ = +25°C | | 0.32 | 5 | |
| | | | Full temperature range | | | **12.6** | |
| Input Bias Current (Note 6) | $I_{IB}$ | $T_A$ = +25°C | NCS333, NCx333A | | ±60 | ±200 | pA |
| | | | NCx2333, NCx4333 | | ±60 | ±400 | |
| | | Full temperature range | | | **±400** | | |
| Input Offset Current (Note 6) | $I_{OS}$ | $T_A$ = +25°C | NCS333, NCx333A | | ±50 | ±400 | pA |
| | | | NCx2333, NCx4333 | | ±50 | ±800 | |
| Common Mode Rejection Ratio (Note 7) | CMRR | $V_S$ = 1.8 V | | | 111 | | dB |
| | | $V_S$ = 3.3 V | | | 118 | | |
| | | $V_S$ = 5.0 V | NCS333, NCS333A, NCx2333, NCx4333 | 106 | 123 | | |
| | | | NCV333A | 103 | 123 | | |
| | | $V_S$ = 5.5 V | | | 127 | | |
| Input Resistance | $R_{IN}$ | Differential | | | 180 | | GΩ |
| | | Common Mode | | | 90 | | |
| Input Capacitance | $C_{IN}$ | NCS333 | Differential | | 2.3 | | pF |
| | | | Common Mode | | 4.6 | | |
| | | NCx2333, NCx4333, NCx333A | Differential | | 4.1 | | |
| | | | Common Mode | | 7.9 | | |
| **OUTPUT CHARACTERISTICS** | | | | | | | |
| Open Loop Voltage Gain (Note 6) | $A_{VOL}$ | $V_{SS}$ + 100 mV < $V_O$ < $V_{DD}$ − 100 mV | | **106** | 145 | | dB |
| Open Loop Output Impedance | $Z_{out-OL}$ | f = UGBW, $I_O$ = 0 mA | | | 300 | | Ω |
| Output Voltage High, Referenced to $V_{DD}$ | $V_{OH}$ | $T_A$ = +25°C | | | 10 | 50 | mV |
| | | Full temperature range | | | | **70** | |
| Output Voltage Low, Referenced to $V_{SS}$ | $V_{OL}$ | $T_A$ = +25°C | | | 10 | 50 | mV |
| | | Full temperature range | | | | **70** | |

6. Guaranteed by characterization and/or design
7. Specified over the full common mode range: $V_{SS}$ − 0.1 < $V_{CM}$ < $V_{DD}$ + 0.1

**ELECTRICAL CHARACTERISTICS:** $V_S$ = 1.8 V to 5.5 V
At $T_A$ = +25°C, $R_L$ = 10 kΩ connected to midsupply, $V_{CM}$ = $V_{OUT}$ = midsupply, unless otherwise noted.
**Boldface** limits apply over the specified operating temperature range, guaranteed by characterization and/or design.

| Parameter | Symbol | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **OUTPUT CHARACTERISTICS** | | | | | | | |
| Output Current Capability | $I_O$ | Sinking Current | NCS333 | | 25 | | mA |
| | | | NCx333A, NCx2333, NCx4333 | | 11 | | |
| | | Sourcing Current | | | 5.0 | | |
| Capacitive Load Drive | $C_L$ | | | See Figure 13 | | | |
| **NOISE PERFORMANCE** | | | | | | | |
| Voltage Noise Density | $e_N$ | $f_{IN}$ = 1 kHz | | | 62 | | nV / $\sqrt{Hz}$ |
| Voltage Noise | $e_{P-P}$ | $f_{IN}$ = 0.1 Hz to 10 Hz | | | 1.1 | | $\mu V_{PP}$ |
| | | $f_{IN}$ = 0.01 Hz to 1 Hz | | | 0.5 | | |
| Current Noise Density | $i_N$ | $f_{IN}$ = 10 Hz | | | 350 | | fA / $\sqrt{Hz}$ |
| Channel Separation | | NCx2333, NCx4333 | | | 135 | | dB |
| **DYNAMIC PERFORMANCE** | | | | | | | |
| Gain Bandwidth Product | GBWP | $C_L$ = 100 pF | NCS333, NCx333A, NCx4333 | | 350 | | kHz |
| | | | NCx2333 | | 270 | | |
| Gain Margin | $A_M$ | $C_L$ = 100 pF | | | 18 | | dB |
| Phase Margin | $\phi_M$ | $C_L$ = 100 pF | | | 55 | | ° |
| Slew Rate | SR | G = +1 | | | 0.15 | | V/μs |
| **POWER SUPPLY** | | | | | | | |
| Power Supply Rejection Ratio | PSRR | NCS333, NCS333A | Full temperature range | **106** | 130 | | dB |
| | | NCx2333, NCx4333, NCV333A | $T_A$ = +25°C | 106 | 130 | | |
| | | | Full temperature range | **98** | | | |
| Turn−on Time | $t_{ON}$ | $V_S$ = 5 V | | | 100 | | μs |
| Quiescent Current (Note 8) | $I_Q$ | NCS333, NCS333A, NCx2333, NCx4333 | 1.8 V ≤ $V_S$ ≤ 3.3 V | | 17 | 25 | μA |
| | | | | | | **27** | |
| | | | 3.3 V < $V_S$ ≤ 5.5 V | | 21 | 33 | |
| | | | | | | **35** | |
| | | NCV333A | 1.8 V ≤ $V_S$ ≤ 3.3 V | | 20 | 30 | |
| | | | | | | **35** | |
| | | | 3.3 V < $V_S$ ≤ 5.5 V | | 28 | 40 | |
| | | | | | | **45** | |

8. No load, per channel

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## TYPICAL CHARACTERISTICS

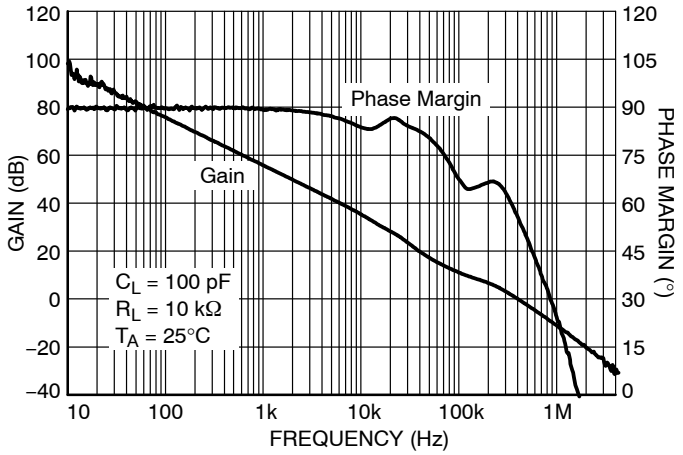



**Figure 1. Open Loop Gain and Phase Margin vs. Frequency**

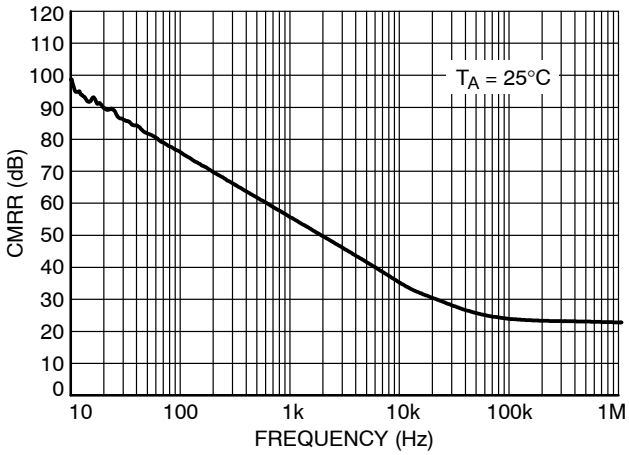



**Figure 2. CMRR vs. Frequency**

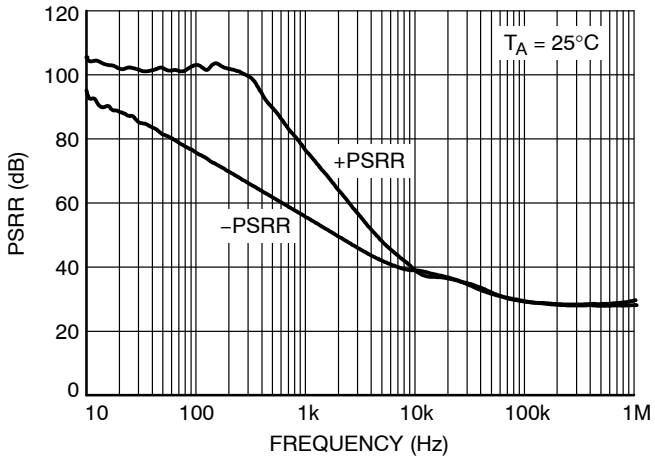



**Figure 3. PSRR vs. Frequency**

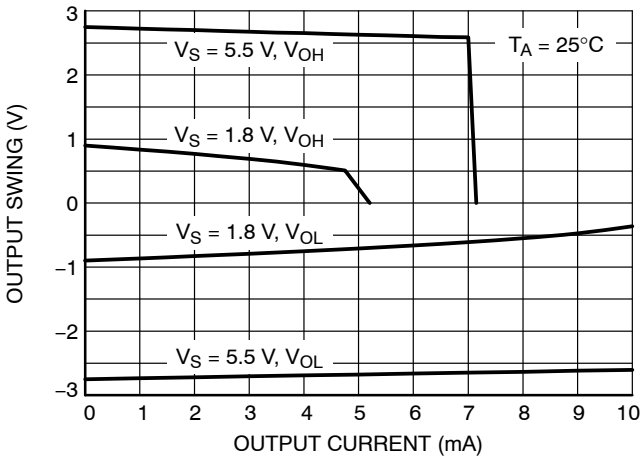



**Figure 4. Output Voltage Swing vs. Output Current**

## TYPICAL CHARACTERISTICS

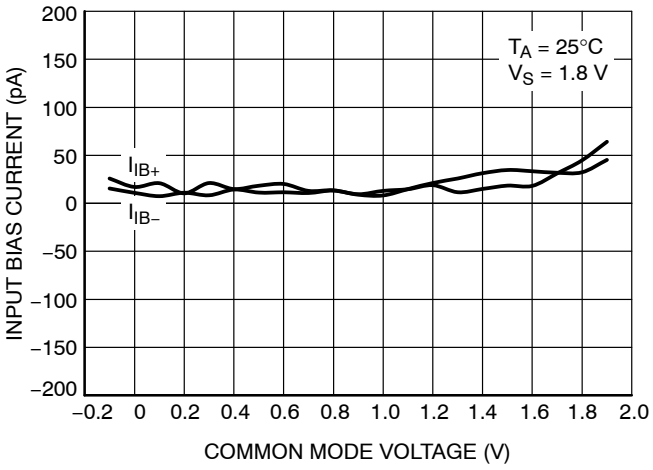



**Figure 5. Input Bias Current vs. Common Mode Voltage**

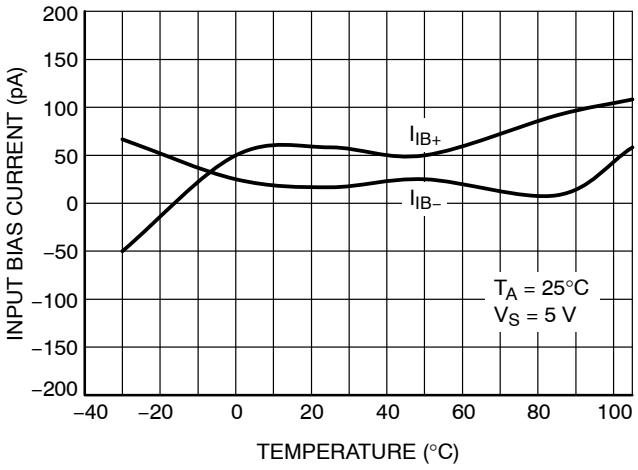



**Figure 6. Input Bias Current vs. Temperature**

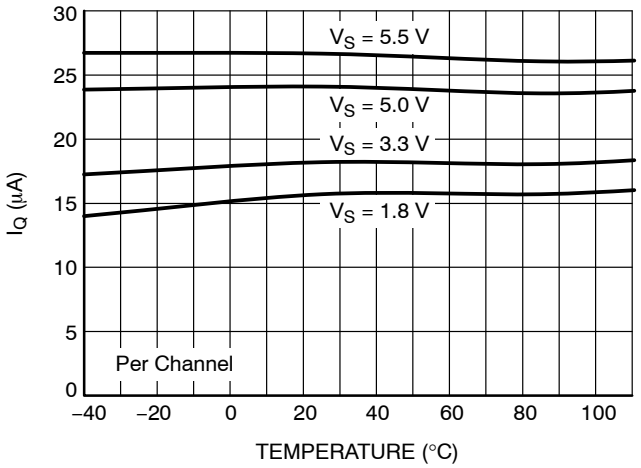



**Figure 7. Quiescent Current vs. Temperature**

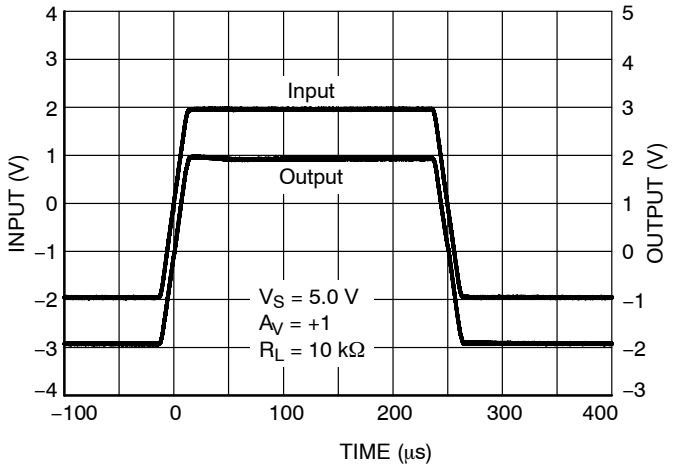



**Figure 8. Large Signal Step Response**

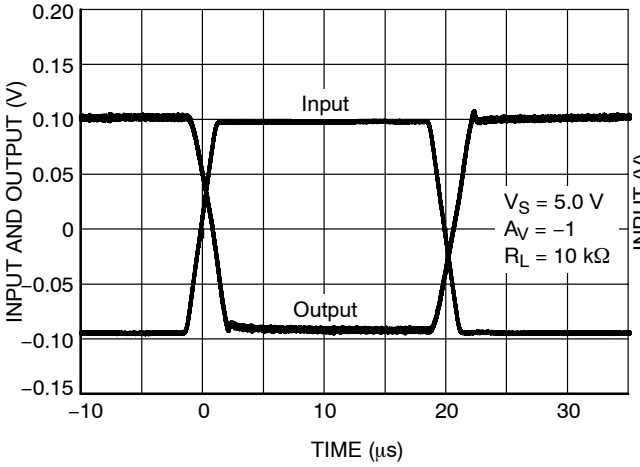



**Figure 9. Small Signal Step Response**

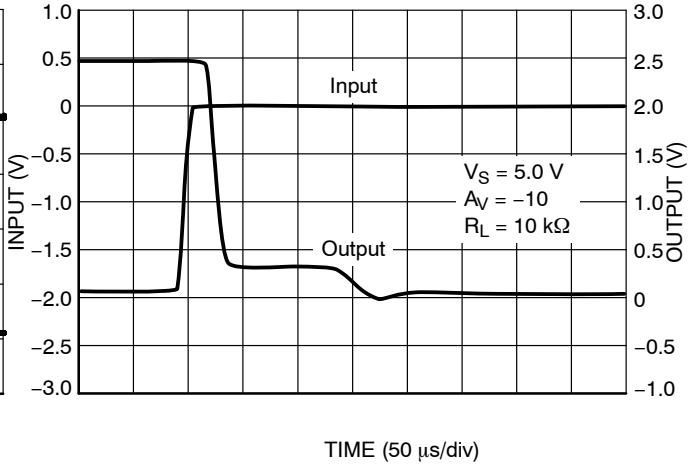



**Figure 10. Positive Overvoltage Recovery**

## TYPICAL CHARACTERISTICS

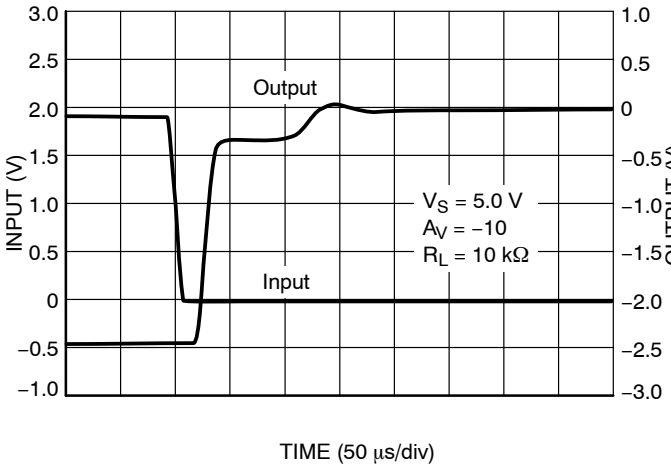



**Figure 11. Negative Overvoltage Recovery**

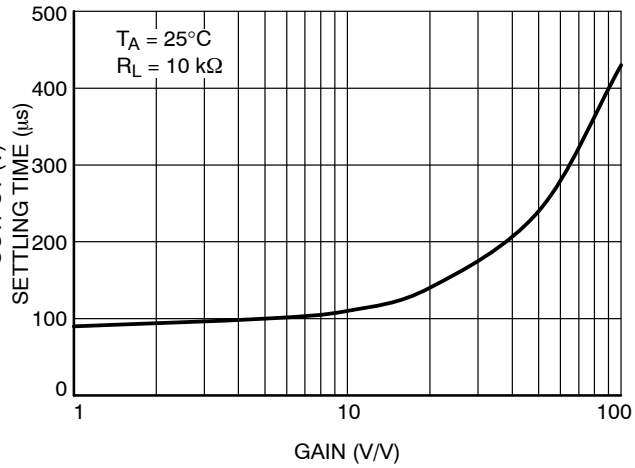



**Figure 12. Setting Time to 0.1% vs. Closed−Loop Gain**

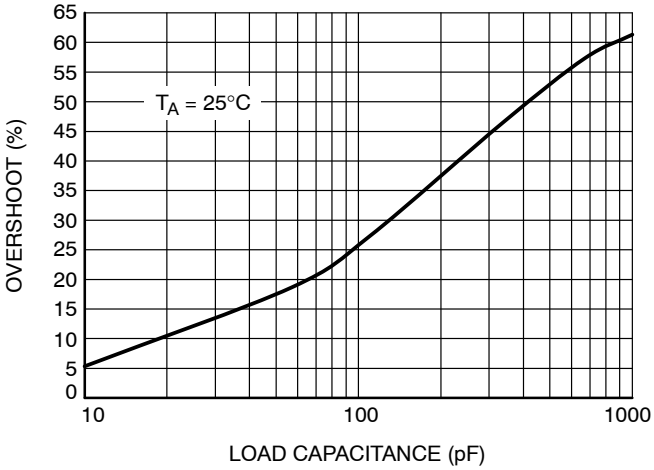



**Figure 13. Small−Signal Overshoot vs. Load Capacitance**

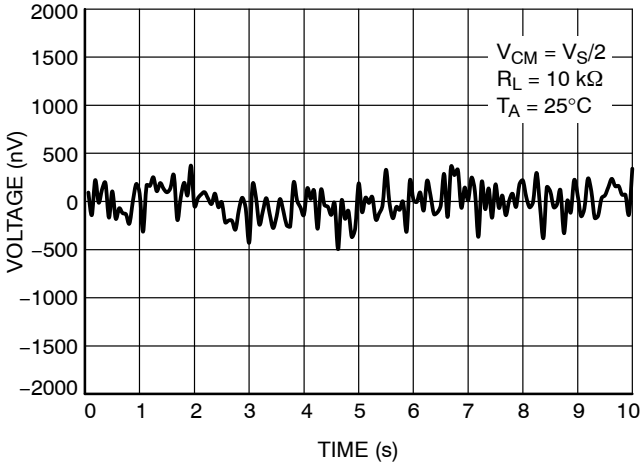



**Figure 14. 0.1 Hz to 10 Hz Noise**

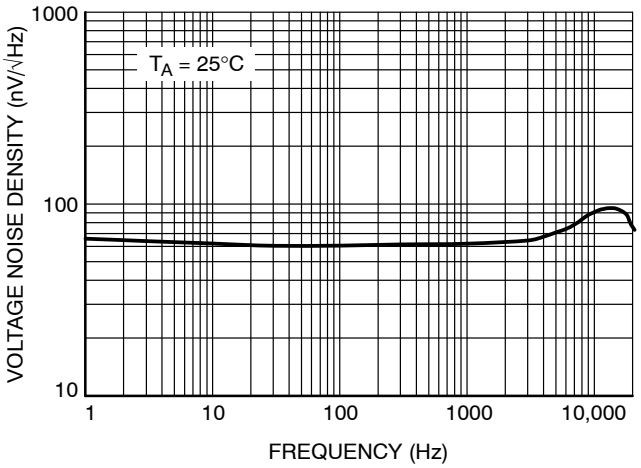



**Figure 15. Voltage Noise Density vs. Frequency**

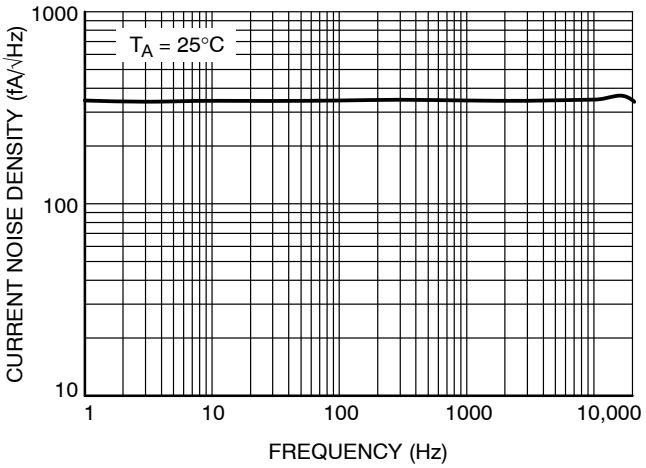



**Figure 16. Current Noise Density vs. Frequency**

## APPLICATIONS INFORMATION

### OVERVIEW

The NCS333, NCS333A, NCS2333, and NCS4333 precision op amps provide low offset voltage and zero drift over temperature. The input common mode voltage range extends 100 mV beyond the supply rails to allow for sensing near ground or VDD. These features make the NCS333 series well−suited for applications where precision is required, such as current sensing and interfacing with sensors.

NCS333 series of precision op amps uses a chopper−stabilized architecture, which provides the advantage of minimizing offset voltage drift over temperature and time. The simplified block diagram is shown in Figure 17. Unlike the classical chopper architecture, the chopper stabilized architecture has two signal paths.

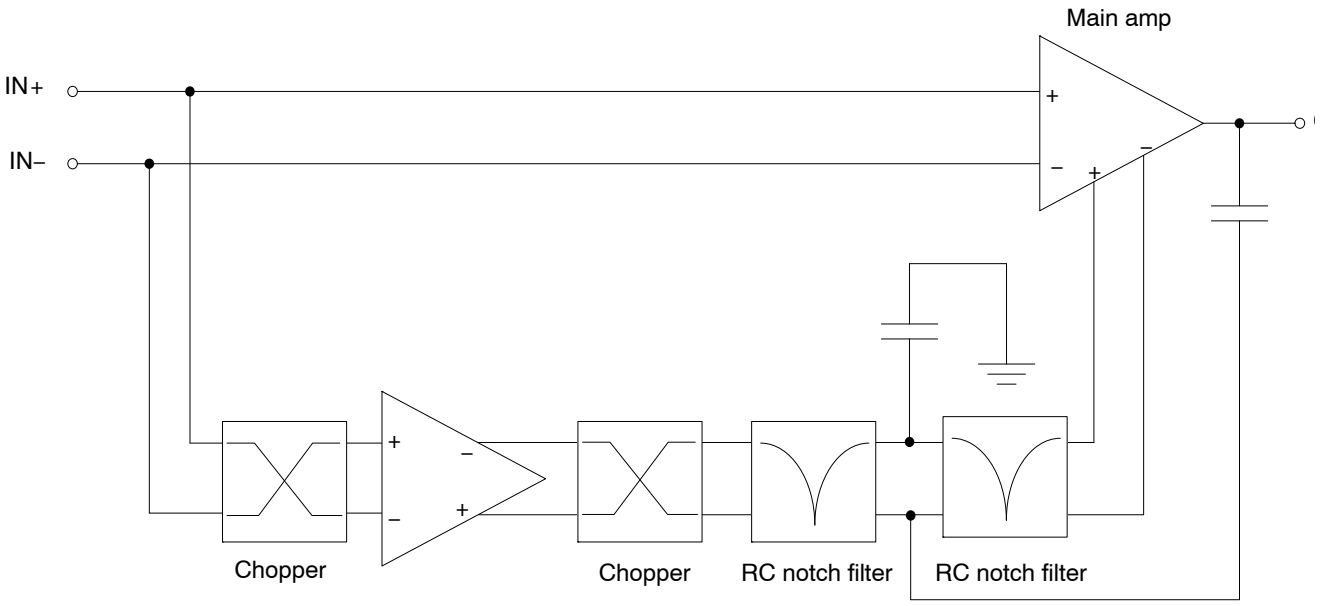



**Figure 17. Simplified NCS333 Block Diagram**

In Figure 17, the lower signal path is where the chopper samples the input offset voltage, which is then used to correct the offset at the output. The offset correction occurs at a frequency of 125 kHz. The chopper−stabilized architecture is optimized for best performance at frequencies up to the related Nyquist frequency (1/2 of the offset correction frequency). As the signal frequency exceeds the Nyquist frequency, 62.5 kHz, aliasing may occur at the output. This is an inherent limitation of all chopper and chopper−stabilized architectures. Nevertheless, the NCS333 op amps have minimal aliasing up to 125 kHz and low aliasing up to 190 kHz when compared to competitor parts from other manufacturers. ON Semiconductor's patented approach utilizes two cascaded, symmetrical, RC notch filters tuned to the chopper frequency and its fifth harmonic to reduce aliasing effects.

The chopper−stabilized architecture also benefits from the feed−forward path, which is shown as the upper signal path of the block diagram in Figure 17. This is the high speed signal path that extends the gain bandwidth up to 350 kHz. Not only does this help retain high frequency components of the input signal, but it also improves the loop gain at low frequencies. This is especially useful for low−side current sensing and sensor interface applications where the signal is low frequency and the differential voltage is relatively small.

## APPLICATION CIRCUITS

### Low−Side Current Sensing

Low−side current sensing is used to monitor the current through a load. This method can be used to detect over−current conditions and is often used in feedback control, as shown in Figure 18. A sense resistor is placed in series with the load to ground. Typically, the value of the sense resistor is less than 100 mΩ to reduce power loss across the resistor. The op amp amplifies the voltage drop across the sense resistor with a gain set by external resistors R1, R2, R3, and R4 (where R1 = R2, R3 = R4). Precision resistors are required for high accuracy, and the gain is set to utilize the full scale of the ADC for the highest resolution.

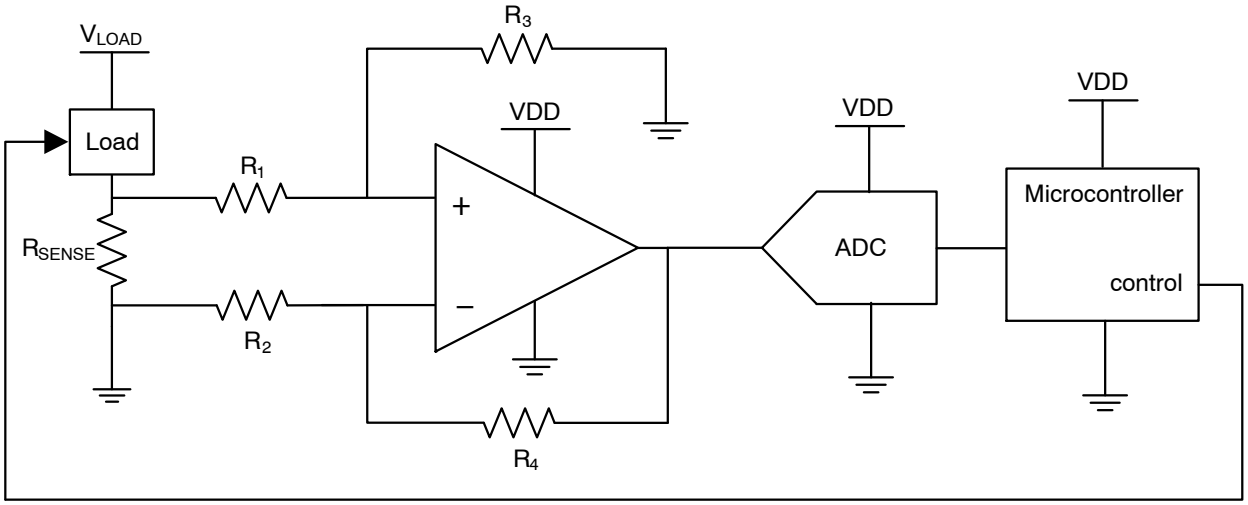



**Figure 18. Low−Side Current Sensing**

### Differential Amplifier for Bridged Circuits

Sensors to measure strain, pressure, and temperature are often configured in a Wheatstone bridge circuit as shown in Figure 19. In the measurement, the voltage change that is produced is relatively small and needs to be amplified before going into an ADC. Precision amplifiers are recommended in these types of applications due to their high gain, low noise, and low offset voltage.

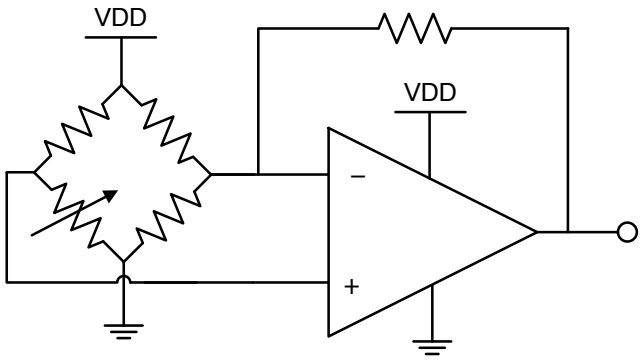



**Figure 19. Bridge Circuit Amplification**

### EMI Susceptibility and Input Filtering

Op amps have varying amounts of EMI susceptibility. Semiconductor junctions can pick up and rectify EMI signals, creating an EMI−induced voltage offset at the output, adding another component to the total error. Input pins are the most sensitive to EMI. The NCS333 op amp family integrates low−pass filters to decrease sensitivity to EMI.

### General Layout Guidelines

To ensure optimum device performance, it is important to follow good PCB design practices. Place 0.1 μF decoupling capacitors as close as possible to the supply pins. Keep traces short, utilize a ground plane, choose surface−mount components, and place components as close as possible to the device pins. These techniques will reduce susceptibility to electromagnetic interference (EMI). Thermoelectric effects can create an additional temperature dependent offset voltage at the input pins. To reduce these effects, use metals with low thermoelectric−coefficients and prevent temperature gradients from heat sources or cooling fans.

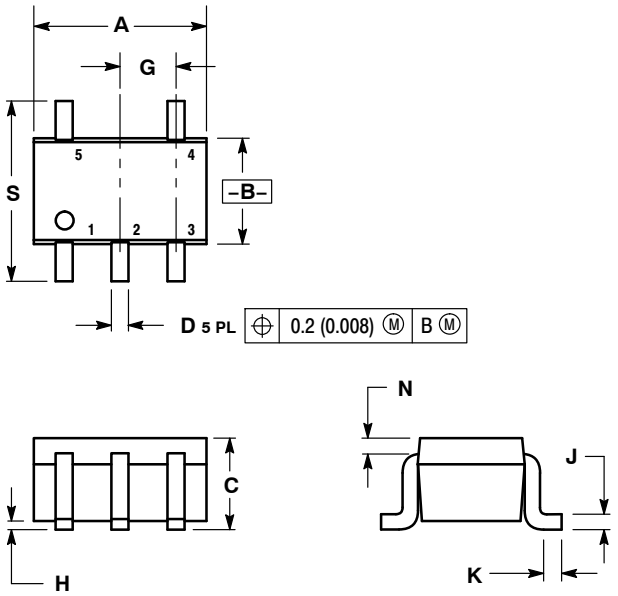
### UDFN8 Package Guidelines

The UDFN8 package has an exposed leadframe die pad on the underside of the package. This pad should be soldered to the PCB, as shown in the recommended soldering footprint in the Package Dimensions section of this datasheet. The center pad can be electrically connected to VSS or it may be left floating. When connected to VSS, the center pad acts as a heat sink, improving the thermal resistance of the part.

**SC−88A (SC−70−5/SOT−353)**
CASE 419A−02
ISSUE L

**SCALE 2:1**

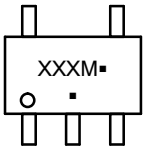
DATE 17 JAN 2013




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A−01 OBSOLETE. NEW STANDARD 419A−02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.071 | 0.087 | 1.80 | 2.20 |
| B | 0.045 | 0.053 | 1.15 | 1.35 |
| C | 0.031 | 0.043 | 0.80 | 1.10 |
| D | 0.004 | 0.012 | 0.10 | 0.30 |
| G | 0.026 BSC | | 0.65 BSC | |
| H | --- | 0.004 | --- | 0.10 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |
| K | 0.004 | 0.012 | 0.10 | 0.30 |
| N | 0.008 REF | | 0.20 REF | |
| S | 0.079 | 0.087 | 2.00 | 2.20 |

## GENERIC MARKING DIAGRAM*

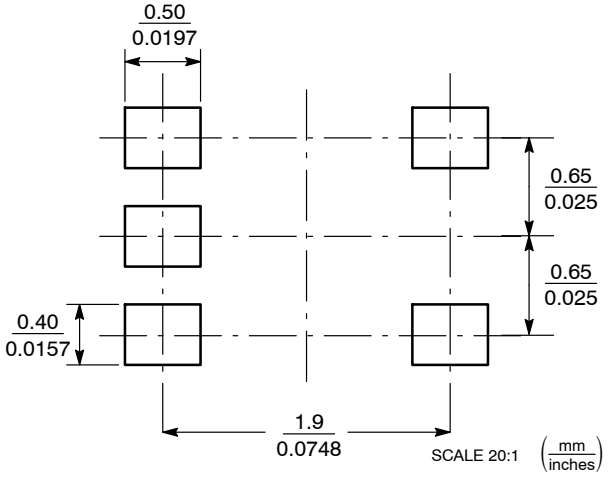



XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This infomration is generic. Please refer to device data sheet for actual part marking.

## SOLDER FOOTPRINT




STYLE 1:
PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 2:
PIN 1. ANODE
2. EMITTER
3. BASE
4. COLLECTOR
5. CATHODE

STYLE 3:
PIN 1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

STYLE 4:
PIN 1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

STYLE 5:
PIN 1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

STYLE 6:
PIN 1. EMITTER 2
2. BASE 2
3. EMITTER 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

STYLE 7:
PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 8:
PIN 1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. EMITTER

STYLE 9:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

| ISSUE | REVISION | DATE |
|---|---|---|
| C | CONVERTED FROM PAPER DOCUMENT TO ELECTRONIC. REQ. BY N LAFEBRE. | 20 JUN 1998 |
| D | CONVERTED FROM MOTOROLA TO ON SEMICONDUCTOR. ADDED STYLE 5. REQ. BY E. KIM. | 24 JUL 2000 |
| E | ADDED STYLES 6 & 7. REQ. BY S. BACHMAN. | 03 AUG 2000 |
| F | DELETED DIMENSION V, WAS 0.3−0.44MM/0.012−0.016IN. REQ. BY G. KWONG. | 14 JUN 2001 |
| G | ADDED STYLE 8, REQ. BY S. CHANG; ADDED STYLE 9, REQ. BY S. BACHMAN; ADDED NOTE 4, REQ. BY S. RIGGS | 25 JUN 2003 |
| H | CHANGED STYLE 6. REQ. BY C. LIM | 28 APR 2005 |
| J | CHANGED TITLE DESCRIPTION. REQ. BY B. LOFTS. | 31 AUG 2005 |
| K | CORRECTED TITLE AND DESCRIPTION TO SC−88A (SC−70−5/SOT−353). CORRECTED MARKING DIAGRAM. REQ. BY D. TRUHITTE. | 13 JUL 2010 |
| L | ADDED SOLDER FOOTPRINT. REQ. BY I. MARIANO. | 17 JAN 2013 |
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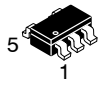
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

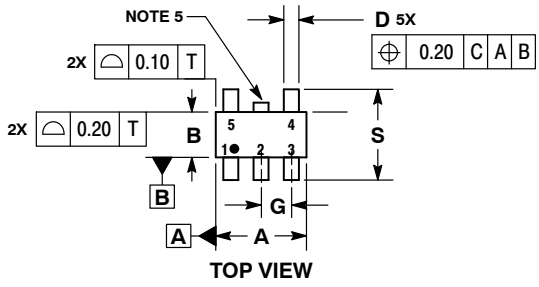
ON Semiconductor®



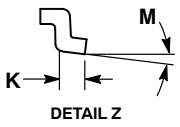

SCALE 2:1

**TSOP−5**
CASE 483
ISSUE N

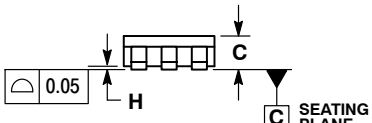
DATE 12 AUG 2020



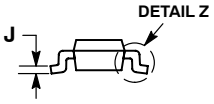

TOP VIEW




DETAIL Z




SIDE VIEW

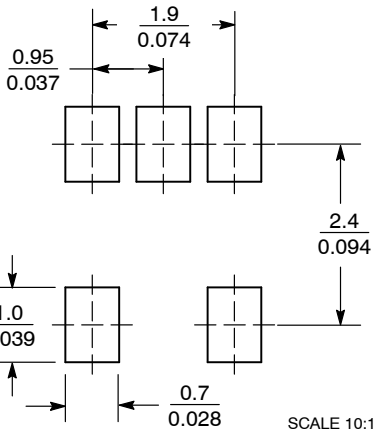



END VIEW

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION A.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 2.85 | 3.15 |
| B | 1.35 | 1.65 |
| C | 0.90 | 1.10 |
| D | 0.25 | 0.50 |
| G | 0.95 BSC | |
| H | 0.01 | 0.10 |
| J | 0.10 | 0.26 |
| K | 0.20 | 0.60 |
| M | 0 ° | 10 ° |
| S | 2.50 | 3.00 |

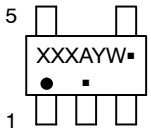
### SOLDERING FOOTPRINT*



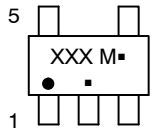

SCALE 10:1 (mm / inches)

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

### GENERIC MARKING DIAGRAM*




**Analog**




**Discrete/Logic**

XXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package

XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

| DOCUMENT NUMBER: | 98ARB18753C | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
|---|---|---|
| DESCRIPTION: | TSOP−5 | PAGE 1 OF 1 |

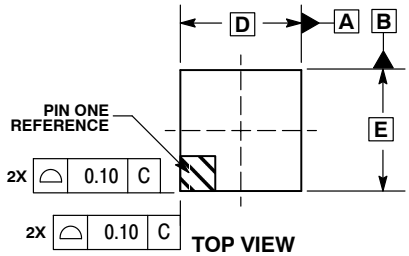
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

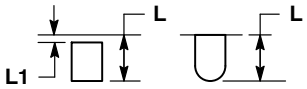
ON Semiconductor®

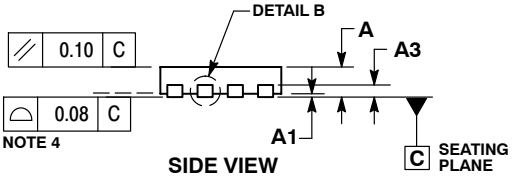
SCALE 2:1

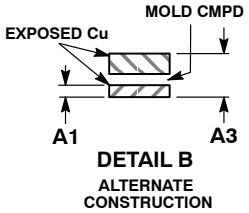
**UDFN8, 2x2**
CASE 517AW
ISSUE A

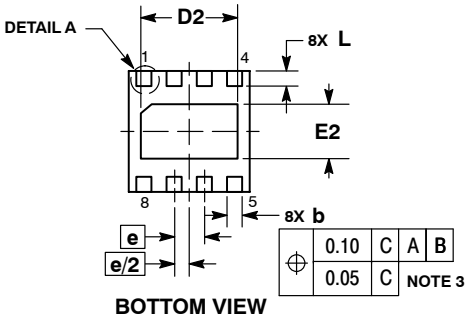
DATE 13 NOV 2015



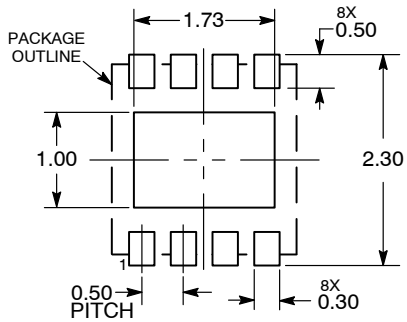




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINALS AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. FOR DEVICE OPN CONTAINING W OPTION, DETAIL B ALTERNATE CONSTRUCTION IS NOT APPLICABLE.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 0.45 | 0.55 |
| A1 | 0.00 | 0.05 |
| A3 | 0.13 REF | |
| b | 0.18 | 0.30 |
| D | 2.00 BSC | |
| D2 | 1.50 | 1.70 |
| E | 2.00 BSC | |
| E2 | 0.80 | 1.00 |
| e | 0.50 BSC | |
| L | 0.20 | 0.45 |
| L1 | ––– | 0.15 |

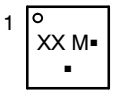
### RECOMMENDED SOLDERING FOOTPRINT*




DIMENSIONS: MILLIMETERS

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

### GENERIC MARKING DIAGRAM*




XX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98AON34462E** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
| **DESCRIPTION:** | **UDFN8, 2X2** | **PAGE 1 OF 1** |

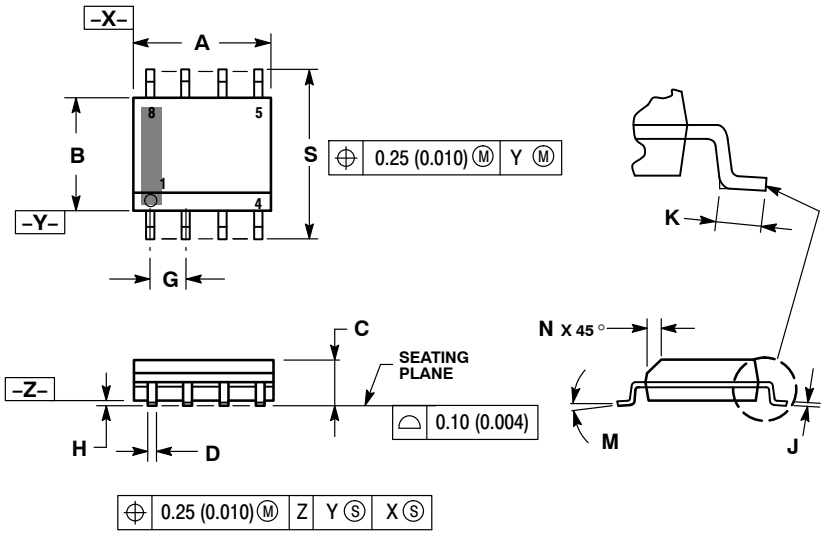
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

ON Semiconductor®

**SCALE 1:1**

**SOIC−8 NB**
CASE 751−07
ISSUE AK

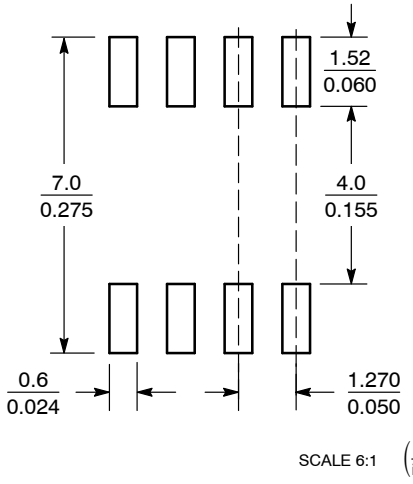
DATE 16 FEB 2011




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.

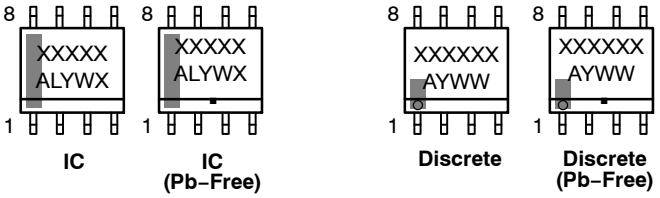
| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 4.80 | 5.00 | 0.189 | 0.197 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.053 | 0.069 |
| D | 0.33 | 0.51 | 0.013 | 0.020 |
| G | 1.27 BSC | | 0.050 BSC | |
| H | 0.10 | 0.25 | 0.004 | 0.010 |
| J | 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*




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

### GENERIC MARKING DIAGRAM*




XXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

**STYLES ON PAGE 2**

| | | | |
|---|---|---|---|
| **DOCUMENT NUMBER:** | **98ASB42564B** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. | |
| **DESCRIPTION:** | **SOIC−8 NB** | | **PAGE 1 OF 2** |

**SOIC−8 NB**
CASE 751−07
ISSUE AK

DATE 16 FEB 2011

STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. COLLECTOR
4. EMITTER
5. EMITTER
6. BASE
7. BASE
8. EMITTER

STYLE 2:
PIN 1. COLLECTOR, DIE, #1
2. COLLECTOR, #1
3. COLLECTOR, #2
4. COLLECTOR, #2
5. BASE, #2
6. EMITTER, #2
7. BASE, #1
8. EMITTER, #1

STYLE 3:
PIN 1. DRAIN, DIE #1
2. DRAIN, #1
3. DRAIN, #2
4. DRAIN, #2
5. GATE, #2
6. SOURCE, #2
7. GATE, #1
8. SOURCE, #1

STYLE 4:
PIN 1. ANODE
2. ANODE
3. ANODE
4. ANODE
5. ANODE
6. ANODE
7. ANODE
8. COMMON CATHODE

STYLE 5:
PIN 1. DRAIN
2. DRAIN
3. DRAIN
4. DRAIN
5. GATE
6. GATE
7. SOURCE
8. SOURCE

STYLE 6:
PIN 1. SOURCE
2. DRAIN
3. DRAIN
4. SOURCE
5. SOURCE
6. GATE
7. GATE
8. SOURCE

STYLE 7:
PIN 1. INPUT
2. EXTERNAL BYPASS
3. THIRD STAGE SOURCE
4. GROUND
5. DRAIN
6. GATE 3
7. SECOND STAGE Vd
8. FIRST STAGE Vd

STYLE 8:
PIN 1. COLLECTOR, DIE #1
2. BASE, #1
3. BASE, #2
4. COLLECTOR, #2
5. COLLECTOR, #2
6. EMITTER, #2
7. EMITTER, #1
8. COLLECTOR, #1

STYLE 9:
PIN 1. EMITTER, COMMON
2. COLLECTOR, DIE #1
3. COLLECTOR, DIE #2
4. EMITTER, COMMON
5. EMITTER, COMMON
6. BASE, DIE #2
7. BASE, DIE #1
8. EMITTER, COMMON

STYLE 10:
PIN 1. GROUND
2. BIAS 1
3. OUTPUT
4. GROUND
5. GROUND
6. BIAS 2
7. INPUT
8. GROUND

STYLE 11:
PIN 1. SOURCE 1
2. GATE 1
3. SOURCE 2
4. GATE 2
5. DRAIN 2
6. DRAIN 2
7. DRAIN 1
8. DRAIN 1

STYLE 12:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

STYLE 13:
PIN 1. N.C.
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

STYLE 14:
PIN 1. N−SOURCE
2. N−GATE
3. P−SOURCE
4. P−GATE
5. P−DRAIN
6. P−DRAIN
7. N−DRAIN
8. N−DRAIN

STYLE 15:
PIN 1. ANODE 1
2. ANODE 1
3. ANODE 1
4. ANODE 1
5. CATHODE, COMMON
6. CATHODE, COMMON
7. CATHODE, COMMON
8. CATHODE, COMMON

STYLE 16:
PIN 1. EMITTER, DIE #1
2. BASE, DIE #1
3. EMITTER, DIE #2
4. BASE, DIE #2
5. COLLECTOR, DIE #2
6. COLLECTOR, DIE #2
7. COLLECTOR, DIE #1
8. COLLECTOR, DIE #1

STYLE 17:
PIN 1. VCC
2. V2OUT
3. V1OUT
4. TXE
5. RXE
6. VEE
7. GND
8. ACC

STYLE 18:
PIN 1. ANODE
2. ANODE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. CATHODE
8. CATHODE

STYLE 19:
PIN 1. SOURCE 1
2. GATE 1
3. SOURCE 2
4. GATE 2
5. DRAIN 2
6. MIRROR 2
7. DRAIN 1
8. MIRROR 1

STYLE 20:
PIN 1. SOURCE (N)
2. GATE (N)
3. SOURCE (P)
4. GATE (P)
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

STYLE 21:
PIN 1. CATHODE 1
2. CATHODE 2
3. CATHODE 3
4. CATHODE 4
5. CATHODE 5
6. COMMON ANODE
7. COMMON ANODE
8. CATHODE 6

STYLE 22:
PIN 1. I/O LINE 1
2. COMMON CATHODE/VCC
3. COMMON CATHODE/VCC
4. I/O LINE 3
5. COMMON ANODE/GND
6. I/O LINE 4
7. I/O LINE 5
8. COMMON ANODE/GND

STYLE 23:
PIN 1. LINE 1 IN
2. COMMON ANODE/GND
3. COMMON ANODE/GND
4. LINE 2 IN
5. LINE 2 OUT
6. COMMON ANODE/GND
7. COMMON ANODE/GND
8. LINE 1 OUT

STYLE 24:
PIN 1. BASE
2. EMITTER
3. COLLECTOR/ANODE
4. COLLECTOR/ANODE
5. CATHODE
6. CATHODE
7. COLLECTOR/ANODE
8. COLLECTOR/ANODE

STYLE 25:
PIN 1. VIN
2. N/C
3. REXT
4. GND
5. IOUT
6. IOUT
7. IOUT
8. IOUT

STYLE 26:
PIN 1. GND
2. dv/dt
3. ENABLE
4. ILIMIT
5. SOURCE
6. SOURCE
7. SOURCE
8. VCC

STYLE 27:
PIN 1. ILIMIT
2. OVLO
3. UVLO
4. INPUT+
5. SOURCE
6. SOURCE
7. SOURCE
8. DRAIN

STYLE 28:
PIN 1. SW_TO_GND
2. DASIC_OFF
3. DASIC_SW_DET
4. GND
5. V_MON
6. VBULK
7. VBULK
8. VIN

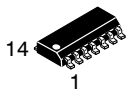
STYLE 29:
PIN 1. BASE, DIE #1
2. EMITTER, #1
3. BASE, #2
4. EMITTER, #2
5. COLLECTOR, #2
6. COLLECTOR, #2
7. COLLECTOR, #1
8. COLLECTOR, #1

STYLE 30:
PIN 1. DRAIN 1
2. DRAIN 1
3. GATE 2
4. SOURCE 2
5. SOURCE 1/DRAIN 2
6. SOURCE 1/DRAIN 2
7. SOURCE 1/DRAIN 2
8. GATE 1

| | | | |
|---|---|---|---|
| **DOCUMENT NUMBER:** | **98ASB42564B** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. | |
| **DESCRIPTION:** | **SOIC−8 NB** | | **PAGE 2 OF 2** |

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

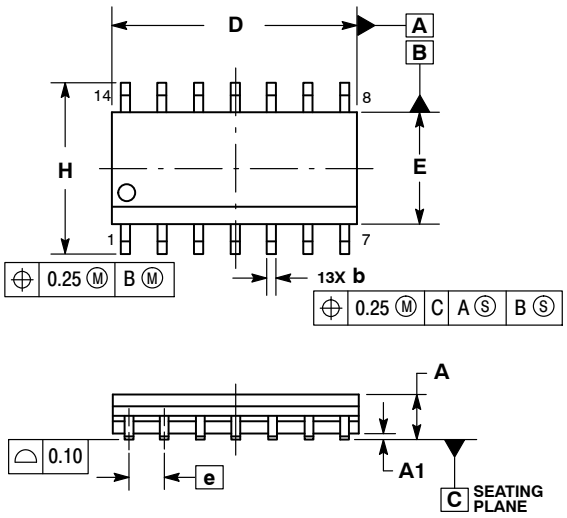
ON Semiconductor®

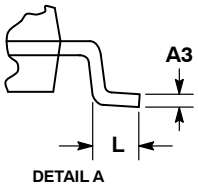


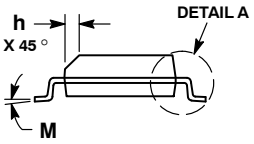

SCALE 1:1

**SOIC−14 NB**
CASE 751A−03
ISSUE L

DATE 03 FEB 2016



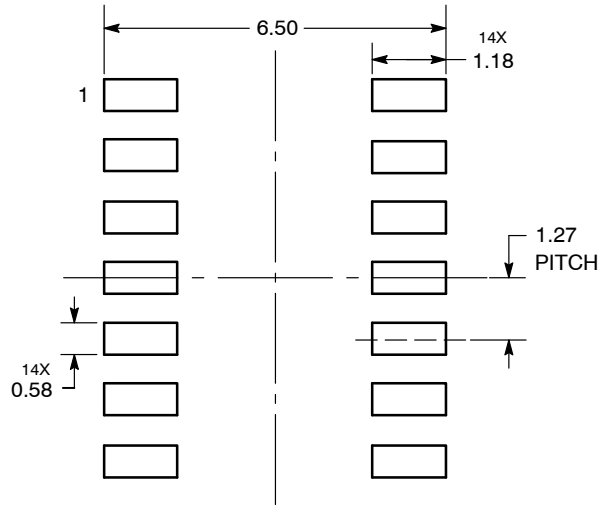




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | 0.054 | 0.068 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| A3 | 0.19 | 0.25 | 0.008 | 0.010 |
| b | 0.35 | 0.49 | 0.014 | 0.019 |
| D | 8.55 | 8.75 | 0.337 | 0.344 |
| E | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| H | 5.80 | 6.20 | 0.228 | 0.244 |
| h | 0.25 | 0.50 | 0.010 | 0.019 |
| L | 0.40 | 1.25 | 0.016 | 0.049 |
| M | 0 ° | 7 ° | 0 ° | 7 ° |

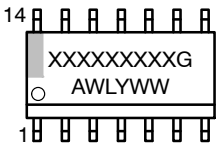
### SOLDERING FOOTPRINT*




DIMENSIONS: MILLIMETERS

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

### GENERIC MARKING DIAGRAM*




XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

**STYLES ON PAGE 2**

| | | | |
|---|---|---|---|
| DOCUMENT NUMBER: | 98ASB42565B | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. | |
| DESCRIPTION: | SOIC−14 NB | | PAGE 1 OF 2 |

**SOIC−14**
CASE 751A−03
ISSUE L

DATE 03 FEB 2016

STYLE 1:
PIN 1. COMMON CATHODE
2. ANODE/CATHODE
3. ANODE/CATHODE
4. NO CONNECTION
5. ANODE/CATHODE
6. NO CONNECTION
7. ANODE/CATHODE
8. ANODE/CATHODE
9. ANODE/CATHODE
10. NO CONNECTION
11. ANODE/CATHODE
12. ANODE/CATHODE
13. NO CONNECTION
14. COMMON ANODE

STYLE 2:
CANCELLED

STYLE 3:
PIN 1. NO CONNECTION
2. ANODE
3. ANODE
4. NO CONNECTION
5. ANODE
6. NO CONNECTION
7. ANODE
8. ANODE
9. ANODE
10. NO CONNECTION
11. ANODE
12. ANODE
13. NO CONNECTION
14. COMMON CATHODE

STYLE 4:
PIN 1. NO CONNECTION
2. CATHODE
3. CATHODE
4. NO CONNECTION
5. CATHODE
6. NO CONNECTION
7. CATHODE
8. CATHODE
9. CATHODE
10. NO CONNECTION
11. CATHODE
12. CATHODE
13. NO CONNECTION
14. COMMON ANODE

STYLE 5:
PIN 1. COMMON CATHODE
2. ANODE/CATHODE
3. ANODE/CATHODE
4. ANODE/CATHODE
5. ANODE/CATHODE
6. NO CONNECTION
7. COMMON ANODE
8. COMMON CATHODE
9. ANODE/CATHODE
10. ANODE/CATHODE
11. ANODE/CATHODE
12. ANODE/CATHODE
13. NO CONNECTION
14. COMMON ANODE

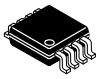
STYLE 6:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. ANODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE

STYLE 7:
PIN 1. ANODE/CATHODE
2. COMMON ANODE
3. COMMON CATHODE
4. ANODE/CATHODE
5. ANODE/CATHODE
6. ANODE/CATHODE
7. ANODE/CATHODE
8. ANODE/CATHODE
9. ANODE/CATHODE
10. ANODE/CATHODE
11. COMMON CATHODE
12. COMMON ANODE
13. ANODE/CATHODE
14. ANODE/CATHODE

STYLE 8:
PIN 1. COMMON CATHODE
2. ANODE/CATHODE
3. ANODE/CATHODE
4. NO CONNECTION
5. ANODE/CATHODE
6. ANODE/CATHODE
7. COMMON ANODE
8. COMMON ANODE
9. ANODE/CATHODE
10. ANODE/CATHODE
11. NO CONNECTION
12. ANODE/CATHODE
13. ANODE/CATHODE
14. COMMON CATHODE

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

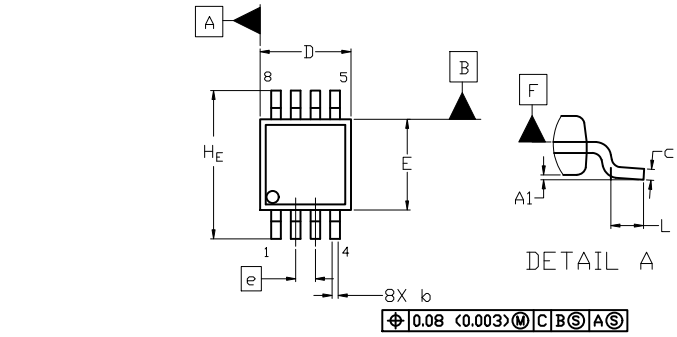
ON Semiconductor®

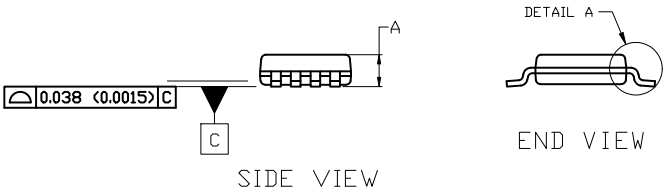


**SCALE 2:1**

**Micro8**
CASE 846A−02
ISSUE K

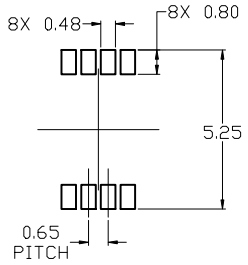
DATE 16 JUL 2020




NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.10 mm IN EXCESS OF MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 mm PER SIDE. DIMENSION E DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 mm PER SIDE. DIMENSIONS D AND E ARE DETERMINED AT DATUM F.
5. DATUMS A AND B ARE TO BE DETERMINED AT DATUM F.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

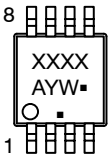



RECOMMENDED
MOUNTING FOOTPRINT

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

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | --- | --- | 1.10 |
| A1 | 0.05 | 0.08 | 0.15 |
| b | 0.25 | 0.33 | 0.40 |
| c | 0.13 | 0.18 | 0.23 |
| D | 2.90 | 3.00 | 3.10 |
| E | 2.90 | 3.00 | 3.10 |
| e | 0.65 BSC | | |
| $H_E$ | 4.75 | 4.90 | 5.05 |
| L | 0.40 | 0.55 | 0.70 |

### GENERIC MARKING DIAGRAM*




XXXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

STYLE 1:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

STYLE 2:
PIN 1. SOURCE 1
2. GATE 1
3. SOURCE 2
4. GATE 2
5. DRAIN 2
6. DRAIN 2
7. DRAIN 1
8. DRAIN 1

STYLE 3:
PIN 1. N-SOURCE
2. N-GATE
3. P-SOURCE
4. P-GATE
5. P-DRAIN
6. P-DRAIN
7. N-DRAIN
8. N-DRAIN

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98ASB14087C** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
| **DESCRIPTION:** | **MICRO8** | **PAGE 1 OF 1** |

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Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

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