

# NCP3335

## High Accuracy Ultra-low Iq, 500 mA Low Dropout Regulator

The NCP3335 is a high performance low dropout regulator that entails all the required features for consumer electronics and encompasses a unique design technology that allows for a high accuracy of  $\pm 0.9\%$  over line and load regulation. This device operates using a minimum output capacitance and is guaranteed to be stable using any type of capacitor.

With output voltage options at 2.5 V, 2.85 V, and 3.3 V, delivering 500 mA of current, this device is offered in a Micro8 package. It contains thermal protection, current limitation and is lead free.

### Features

- High Accuracy Over Line and Load ( $\pm 0.9\%$  at  $25^\circ\text{C}$ )
- Ultra Low Dropout Voltage
- Low Noise
- Low Shutdown Current
- Low Dropout Voltage
- 2.6 V to 12 V Supply Range
- Thermal Shutdown Protection
- Current Limitation
- Minimum Output Capacitance of 1.0  $\mu\text{F}$  Required for Stability
- Stable with Any Type of Capacitor (including MLCC)
- No Minimum Output Current Required for Stability
- Available in 2.5 V, 2.85 V, and 3.3 V Output Voltages (Please contact factory for other voltage options)
- These are Pb-Free Devices

### Applications

- PCMCIA Card
- Cellular Phones
- Camcoders and Cameras
- Networking Systems, DSL/Cable Modems
- Cable Set-Top Box
- MP3/CD Players
- DSP Supply



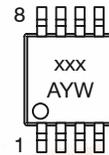
ON Semiconductor®

<http://onsemi.com>



Micro8™  
DMR2 SUFFIX  
CASE 846A

### MARKING DIAGRAM



- Pin 1,2.  $V_{out}$   
3. Sense Pin  
4. GND  
5. NR  
6.  $\overline{SD}$  (Shutdown Pin)  
7,8.  $V_{in}$

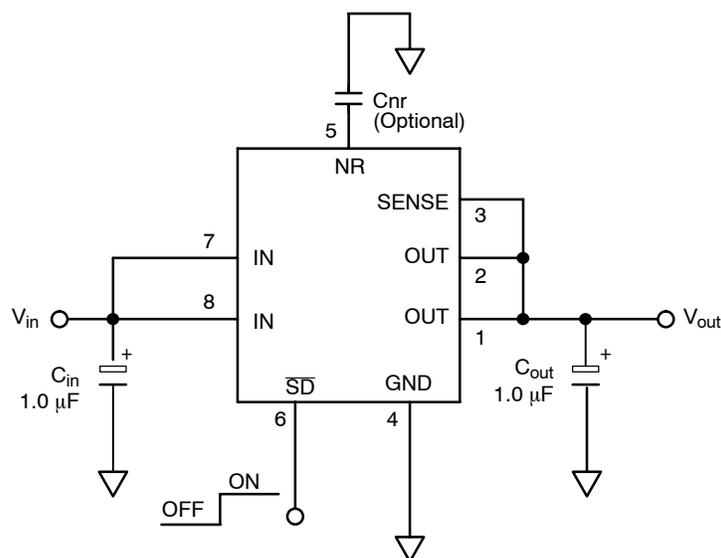
- xxx = LHX for 2.5 V  
= LHY for 2.85 V  
= LHZ for 3.3 V  
A = Assembly Location  
Y = Year  
W = Work Week

### ORDERING INFORMATION

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



## NCP3335



**Figure 1. Typical Application Schematic**

### PIN FUNCTION DESCRIPTION

| Pin No. | Pin Name        | Description   |
|---------|-----------------|---|
| 1, 2    | $V_{out}$       | Regulated output voltage. Bypass to ground with $C_{out} \geq 1.0 \mu F$ .    |
| 3       | SENSE           | For output voltage sensing, connect to Pins 1 and 2.                          |
| 4       | GND             | Power Supply Ground   |
| 5       | NR              | Noise Reduction Pin. This is an optional pin used to further reduce noise.    |
| 6       | $\overline{SD}$ | Shutdown pin. When not in use, this pin should be connected to the input pin. |
| 7, 8    | $V_{in}$        | Power Supply Input Voltage  |

### ABSOLUTE MAXIMUM RATINGS

| Rating   | Symbol          | Value                  | Unit          |
|--|-----------------|------------------------|---------------|
| Input Voltage  | $V_{in}$        | -0.3 to +16            | V             |
| Output Voltage   | $V_{out}$       | -0.3 to $V_{in} + 0.3$ | V             |
| Shutdown Pin Voltage   | $V_{sh}$        | -0.3 to +16            | V             |
| Thermal Characteristics<br>Thermal Resistance, Junction-to-Air | $R_{\theta JA}$ | 238                    | $^{\circ}C/W$ |
| Operating Junction Temperature Range                           | $T_J$           | -40 to +150            | $^{\circ}C$   |
| Storage Temperature Range                                      | $T_{stg}$       | -50 to +150            | $^{\circ}C$   |

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.

NOTE: This device series contains ESD protection and exceeds the following tests:

Human Body Model (HBM) JESD 22-A114-B

Machine Model (MM) JESD 22-A115-A

## NCP3335

### ELECTRICAL CHARACTERISTICS – 2.5 V ( $V_{out} = 2.5$ V typical, $V_{in} = 2.9$ V, $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ , unless otherwise noted)

| Characteristic  | Symbol                                       | Min            | Typ                    | Max                                | Unit                                    |
|---|--|----------------|------------------------|------------------------------------|---|
| Output Voltage (Accuracy)<br>$V_{in} = 2.9$ V to $6.5$ V, $I_{load} = 0.1$ mA to $500$ mA, $T_J = 25^{\circ}\text{C}$   | $V_{out}$                                    | -0.9%<br>2.477 | 2.5                    | +0.9%<br>2.523                     | V                                       |
| Output Voltage (Accuracy)<br>$V_{in} = 2.9$ V to $6.5$ V, $I_{load} = 0.1$ mA to $500$ mA, $T_J = 0^{\circ}\text{C}$ to $+85^{\circ}\text{C}$   | $V_{out}$                                    | -1.4%<br>2.465 | 2.5                    | +1.4%<br>2.535                     | V                                       |
| Output Voltage (Accuracy), (Note 1)<br>$V_{in} = 2.9$ V to $6.5$ V, $I_{load} = 0.1$ mA to $500$ mA, $T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$  | $V_{out}$                                    | -1.5%<br>2.462 | 2.5                    | +1.5%<br>2.538                     | V                                       |
| Line Regulation<br>$V_{in} = 2.9$ V to $6.5$ V, $I_{load} = 0.1$ mA   | LineReg                                      |                | 0.04                   |                                    | mV/V                                    |
| Load Regulation<br>$V_{in} = 2.9$ V, $I_{load} = 0.1$ mA to $500$ mA  | LoadReg                                      |                | 0.04                   |                                    | mV/mA                                   |
| Dropout voltage<br>$I_{load} = 500$ mA (Note 2)<br>$I_{load} = 300$ mA (Note 2)<br>$I_{load} = 50$ mA<br>$I_{load} = 0.1$ mA  | $V_{DO}$                                     |                |                        | 340<br>230<br>110<br>10            | mV                                      |
| Peak Output Current   | $I_{pk}$                                     | 500            | 700                    |                                    | mA                                      |
| Thermal Shutdown  | $T_J$  |                | 160                    |                                    | $^{\circ}\text{C}$                      |
| Ground Current<br>In Regulation<br>$I_{load} = 500$ mA (Note 2)<br>$I_{load} = 300$ mA (Note 2)<br>$I_{load} = 50$ mA<br>$I_{load} = 0.1$ mA<br><br>In Dropout<br>$V_{in} = 2.4$ V, $I_{load} = 0.1$ mA<br><br>In Shutdown<br>$S_D = 0$ V | $I_{GND}$<br><br><br><br><br><br>$I_{GNDsh}$ |                | 9.0<br>4.6<br>0.8<br>– | 14<br>7.5<br>2.5<br>190<br><br>500 | mA<br><br><br><br><br><br>$\mu\text{A}$ |
| Output Noise<br>$C_{nr} = 0$ nF, $I_{load} = 500$ mA, $f = 10$ Hz to $100$ kHz, $C_{out} = 10$ $\mu\text{F}$<br>$C_{nr} = 10$ nF, $I_{load} = 500$ mA, $f = 10$ Hz to $100$ kHz, $C_{out} = 10$ $\mu\text{F}$                             | $V_{noise}$                                  |                | 56<br>35               |                                    | $\mu\text{Vrms}$<br>$\mu\text{Vrms}$    |
| Shutdown<br>Threshold Voltage ON<br>Threshold Voltage OFF   |  | 2.0            |                        | 0.4                                | V<br>V                                  |
| $\overline{SD}$ Input Current, $V_{SD} = 0$ V to $0.4$ V or $V_{SD} = 2.0$ V to $V_{in}$  | $I_{SD}$                                     |                | 0.07                   | 1.0                                | $\mu\text{A}$                           |
| Output Current In Shutdown Mode, $V_{out} = 0$ V  | $I_{OSD}$                                    |                | 0.07                   | 1.0                                | $\mu\text{A}$                           |

- For proper operation below  $T_J = 0^{\circ}\text{C}$ , please refer to typical graphs.
- $T_A$  must be greater than  $0^{\circ}\text{C}$ .

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### ELECTRICAL CHARACTERISTICS – 2.85 V ( $V_{out} = 2.85$ V typical, $V_{in} = 3.25$ V, $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ , unless otherwise noted)

| Characteristic   | Symbol                                       | Min            | Typ                    | Max                                | Unit                                       |
|--|--|----------------|------------------------|------------------------------------|--|
| Output Voltage (Accuracy)<br>$V_{in} = 3.25$ V to $6.85$ V, $I_{load} = 0.1$ mA to $500$ mA, $T_J = 25^{\circ}\text{C}$  | $V_{out}$                                    | -0.9%<br>2.824 | 2.85                   | +0.9%<br>2.876                     | V  |
| Output Voltage (Accuracy)<br>$V_{in} = 3.25$ V to $6.85$ V, $I_{load} = 0.1$ mA to $500$ mA, $T_J = 0^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  | $V_{out}$                                    | -1.4%<br>2.810 | 2.85                   | +1.4%<br>2.890                     | V  |
| Output Voltage (Accuracy) (Note 3)<br>$V_{in} = 3.25$ V to $6.85$ V, $I_{load} = 0.1$ mA to $500$ mA, $T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$  | $V_{out}$                                    | -1.5%<br>2.807 | 2.85                   | +1.5%<br>2.893                     | V  |
| Line Regulation<br>$V_{in} = 3.25$ V to $6.85$ V, $I_{load} = 0.1$ mA  | $Line_{Reg}$                                 |                | 0.04                   |                                    | mV/V                                       |
| Load Regulation<br>$V_{in} = 3.25$ V, $I_{load} = 0.1$ mA to $500$ mA  | $Load_{Reg}$                                 |                | 0.04                   |                                    | mV/mA                                      |
| Dropout voltage<br>$I_{load} = 500$ mA<br>$I_{load} = 300$ mA<br>$I_{load} = 50$ mA<br>$I_{load} = 0.1$ mA   | $V_{DO}$                                     |                |                        | 340<br>230<br>110<br>10            | mV   |
| Peak Output Current  | $I_{pk}$                                     | 500            | 700                    |                                    | mA   |
| Thermal Shutdown   | $T_J$  |                | 160                    |                                    | $^{\circ}\text{C}$                         |
| Ground Current<br>In Regulation<br>$I_{load} = 500$ mA (Note 4)<br>$I_{load} = 300$ mA<br>$I_{load} = 50$ mA<br>$I_{load} = 0.1$ mA<br><br>In Dropout<br>$V_{in} = 2.75$ V, $I_{load} = 0.1$ mA<br><br>In Shutdown<br>$SD = 0$ V | $I_{GND}$<br><br><br><br><br><br>$I_{GNDsh}$ |                | 9.0<br>4.6<br>0.8<br>– | 14<br>7.5<br>2.5<br>190<br><br>500 | mA<br><br><br><br><br>$\mu\text{A}$        |
| Output Noise<br>$C_{nr} = 0$ nF, $I_{load} = 500$ mA, $f = 10$ Hz to $100$ kHz, $C_{out} = 10$ $\mu\text{F}$<br>$C_{nr} = 10$ nF, $I_{load} = 500$ mA, $f = 10$ Hz to $100$ kHz, $C_{out} = 10$ $\mu\text{F}$                    | $V_{noise}$                                  |                | 61<br>40               |                                    | $\mu\text{V}_{rms}$<br>$\mu\text{V}_{rms}$ |
| Shutdown<br>Threshold Voltage ON<br>Threshold Voltage OFF  |  | 2.0            |                        | 0.4                                | V<br>V                                     |
| $S_D$ Input Current, $V_{SD} = 0$ V to $0.4$ V or $V_{SD} = 2.0$ V to $V_{in}$   | $I_{SD}$                                     |                | 0.07                   | 1.0                                | $\mu\text{A}$                              |
| Output Current In Shutdown Mode, $V_{out} = 0$ V   | $I_{OSD}$                                    |                | 0.07                   | 1.0                                | $\mu\text{A}$                              |

3. For proper operation below  $T_J = 0^{\circ}\text{C}$ , please refer to typical graphs.

4.  $T_A$  must be greater than  $0^{\circ}\text{C}$ .

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### ELECTRICAL CHARACTERISTICS – 3.3 V ( $V_{out} = 3.3$ V typical, $V_{in} = 3.7$ V, $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ , unless otherwise noted)

| Characteristic   | Symbol                                       | Min            | Typ                                     | Max                                       | Unit   |
|--|--|----------------|---|---|--|
| Output Voltage (Accuracy)<br>$V_{in} = 3.7$ V to $7.3$ V, $I_{load} = 0.1$ mA to $500$ mA, $T_J = 25^{\circ}\text{C}$  | $V_{out}$                                    | -0.9%<br>3.270 | 3.3                                     | +0.9%<br>3.330                            | V  |
| Output Voltage (Accuracy)<br>$V_{in} = 3.7$ V to $7.3$ V, $I_{load} = 0.1$ mA to $500$ mA, $T_J = 0^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  | $V_{out}$                                    | -1.4%<br>3.254 | 3.3                                     | +1.4%<br>3.346                            | V  |
| Output Voltage (Accuracy)<br>$V_{in} = 3.7$ V to $7.3$ V, $I_{load} = 0.1$ mA to $500$ mA, $T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$   | $V_{out}$                                    | -1.5%<br>3.250 | 3.3                                     | +1.5%<br>3.350                            | V  |
| Line Regulation<br>$V_{in} = 3.7$ V to $7.3$ V, $I_{load} = 0.1$ mA  | LineReg                                      |                | 0.04                                    |   | mV/V   |
| Load Regulation<br>$V_{in} = 3.7$ V, $I_{load} = 0.1$ mA to $500$ mA   | LoadReg                                      |                | 0.04                                    |   | mV/mA  |
| Dropout Voltage<br>$I_{load} = 500$ mA<br>$I_{load} = 300$ mA<br>$I_{load} = 50$ mA<br>$I_{load} = 0.1$ mA   | $V_{DO}$                                     |                |   | 340<br>230<br>110<br>10                   | mV   |
| Peak Output Current  | $I_{pk}$                                     | 500            | 700                                     |   | mA   |
| Thermal Shutdown   | $T_J$  |                | 160                                     |   | $^{\circ}\text{C}$   |
| Ground Current<br>In Regulation<br>$I_{load} = 500$ mA (Note 5)<br>$I_{load} = 300$ mA<br>$I_{load} = 50$ mA<br>$I_{load} = 0.1$ mA<br><br>In Dropout<br>$V_{in} = 3.2$ V, $I_{load} = 0.1$ mA<br><br>In Shutdown<br>$S_D = 0$ V | $I_{GND}$<br><br><br><br><br><br>$I_{GNDsh}$ |                | 9.0<br>4.6<br>0.8<br>–<br><br>–<br>0.07 | 14<br>7.5<br>2.5<br>190<br><br>500<br>1.0 | mA<br><br><br><br><br>$\mu\text{A}$<br><br><br><br><br>$\mu\text{A}$ |
| Output Noise<br>$C_{nr} = 0$ nF, $I_{load} = 500$ mA, $f = 10$ Hz to $100$ kHz, $C_{out} = 10$ $\mu\text{F}$<br>$C_{nr} = 10$ nF, $I_{load} = 500$ mA, $f = 10$ Hz to $100$ kHz, $C_{out} = 10$ $\mu\text{F}$                    | $V_{noise}$                                  |                | 69<br>46                                |   | $\mu\text{V}_{rms}$<br>$\mu\text{V}_{rms}$                           |
| Shutdown<br>Threshold Voltage ON<br>Threshold Voltage OFF  |  | 2.0            |   | 0.4                                       | V<br>V   |
| $S_D$ Input Current, $V_{SD} = 0$ V to $0.4$ V or $V_{SD} = 2.0$ V to $V_{in}$   | $I_{SD}$                                     |                | 0.07                                    | 1.0                                       | $\mu\text{A}$  |
| Output Current In Shutdown Mode, $V_{out} = 0$ V   | $I_{OSD}$                                    |                | 0.07                                    | 1.0                                       | $\mu\text{A}$  |

5.  $T_A$  must be greater than  $0^{\circ}\text{C}$ .

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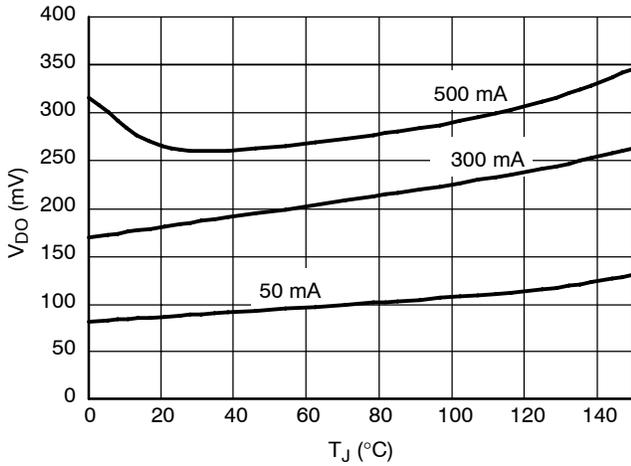


Figure 2. Dropout Voltage vs. Temperature

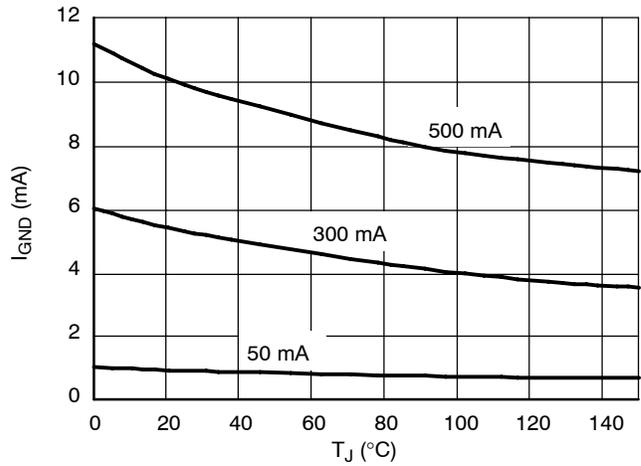


Figure 3. Ground Current vs. Temperature

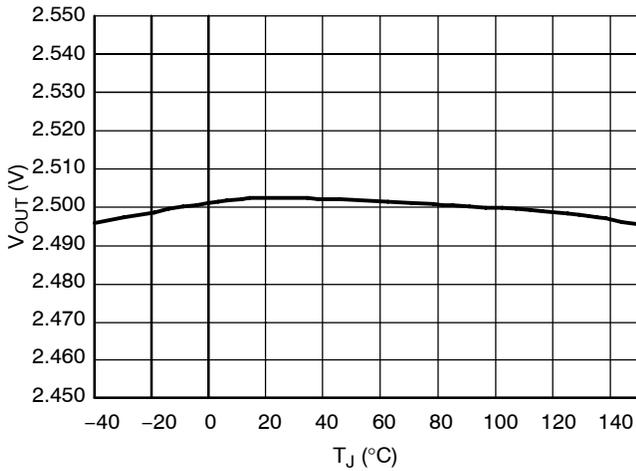


Figure 4. Output Voltage vs. Temperature

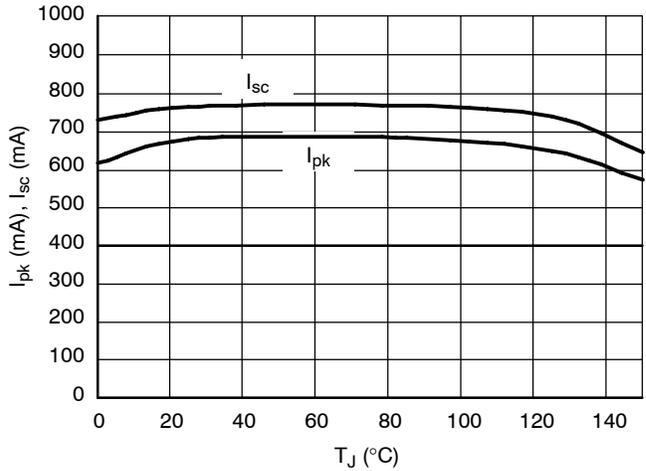


Figure 5. Peak and Short Current vs. Temperature

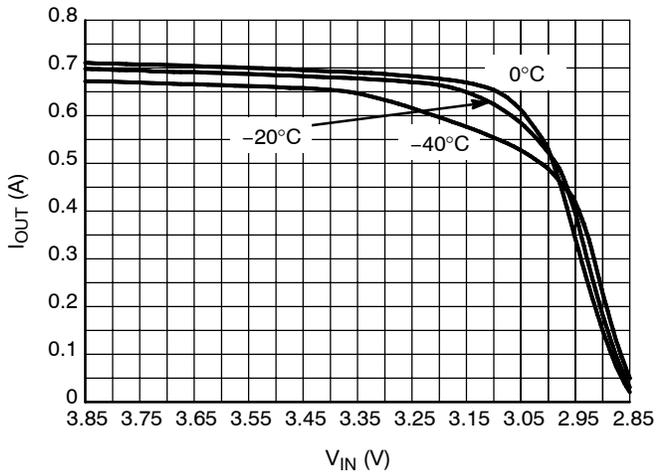


Figure 6. Output Current Capability for the 2.85 V Version

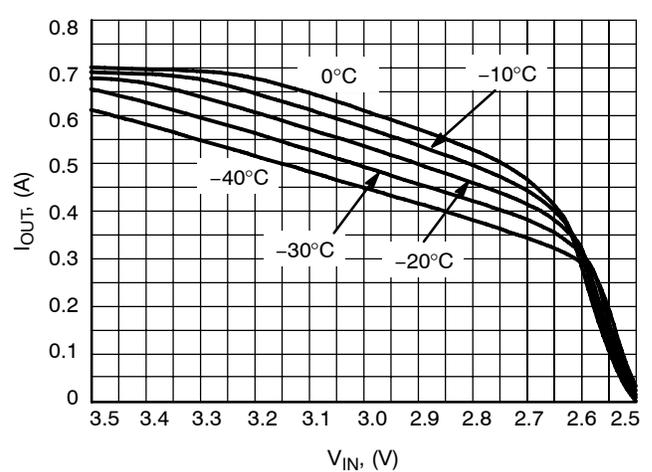
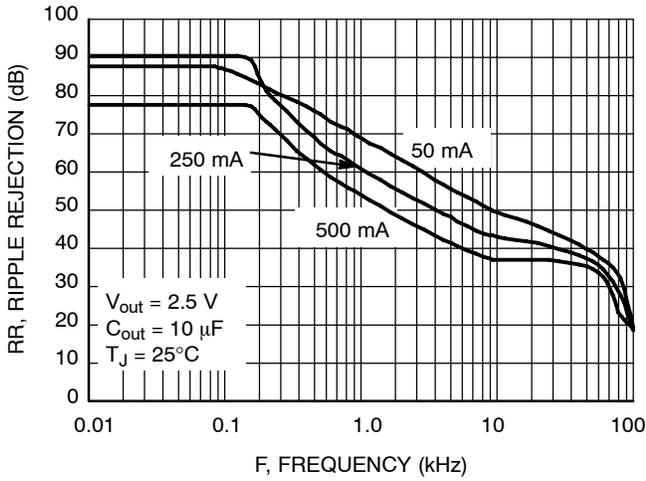
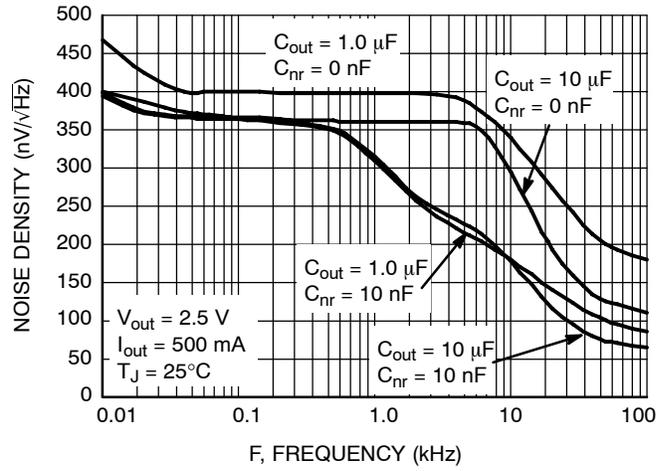


Figure 7. Output Current Capability for the 2.5 V Version

## NCP3335



**Figure 8. Ripple Rejection vs. Frequency**



**Figure 9. Output Noise Density**

### ORDERING INFORMATION

| Device          | Nominal Output Voltage | Package             | Shipping <sup>†</sup> |
|-----------------|------------------------|---------------------|-----------------------|
| NCP3335DMR2250G | 2.5 V                  | Micro8<br>(Pb-Free) | 4000 / Tape & Reel    |
| NCP3335DMR2285G | 2.85 V                 | Micro8<br>(Pb-Free) | 4000 / Tape & Reel    |
| NCP3335DMR2330G | 3.3 V                  | Micro8<br>(Pb-Free) | 4000 / Tape & Reel    |

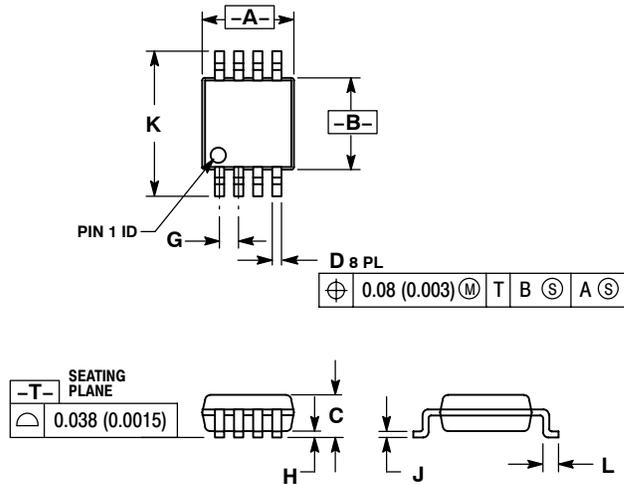
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*Please contact factory for other voltage options.

# NCP3335

## PACKAGE DIMENSIONS

Micro8  
CASE 846A-02  
ISSUE F

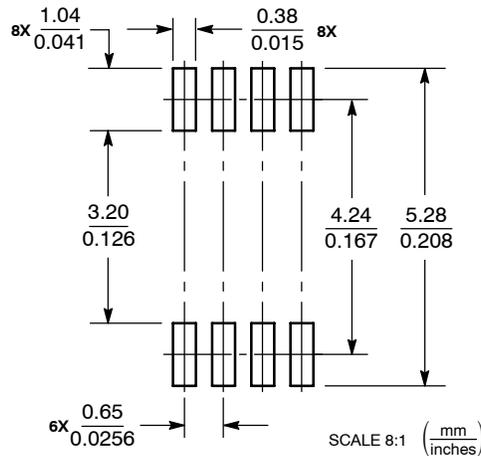


### NOTES:

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.

| 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 |

### 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.

The products described herein NCP3335, may be covered by one or more of the following U.S. patents; 5,920,184, 5,966,004, and 5,834,926. There may be other patents pending.

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