# NCP4620

# 150 mA, 10 V, Low Dropout Regulator

The NCP4620 is a CMOS Linear voltage regulator with 150 mA output current capability. The device is capable of operating with input voltages up to 10 V, with high output voltage accuracy and low temperature−drift coefficient. The NCP4620 is easy to use, with output current fold−back protection and a thermal shutdown circuit included. A Chip Enable function is included to save power by lowering supply current.

### Features

- Operating Input Voltage Range: 2.6 V to 10 V
- Output Voltage Range: 1.2 V to 6.0 V (available in 0.1 V steps)
- Output Voltage Accuracy: ±1.0%
- Low Supply Current: 23 μA
- Low Dropout: 165 mV ($I_{OUT}$ = 100 mA, $V_{OUT}$ = 3.3 V)
  400 mV ($I_{OUT}$ = 150 mA, $V_{OUT}$ = 2.8 V)
- High PSRR: 70 dB at 1 kHz
- Line Regulation 0.02%/V Typ
- Current Fold Back Protection
- Thermal Shutdown Protection
- Stable with Ceramic Capacitors
- Available in SC−70 and SOT23 Packages
- These are Pb−Free Devices*

### Typical Applications

- Battery products powered by 2 Lithium Ion cells
- Networking and Communication Equipment
- Cameras, DVRs, STB and Camcorders
- Toys, industrial applications

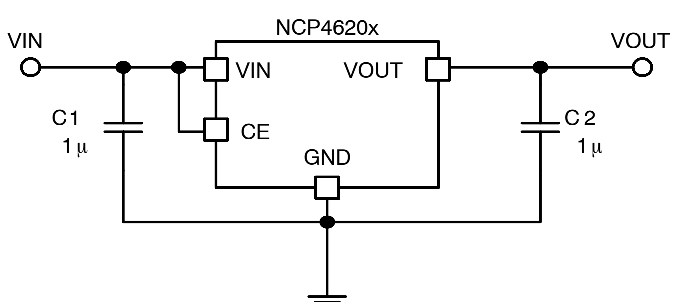


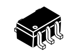

**Figure 1. Typical Application Schematic**

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

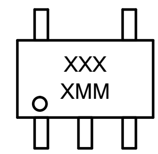
**ON Semiconductor™**

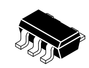
**http://onsemi.com**

**MARKING DIAGRAMS**

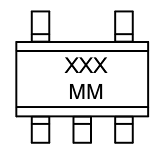


**SC−70**
**CASE 419A**



**SOT−23−5**
**CASE 1212**




XXXX, XXX= Specific Device Code
MM = Date Code

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 14 of this data sheet.

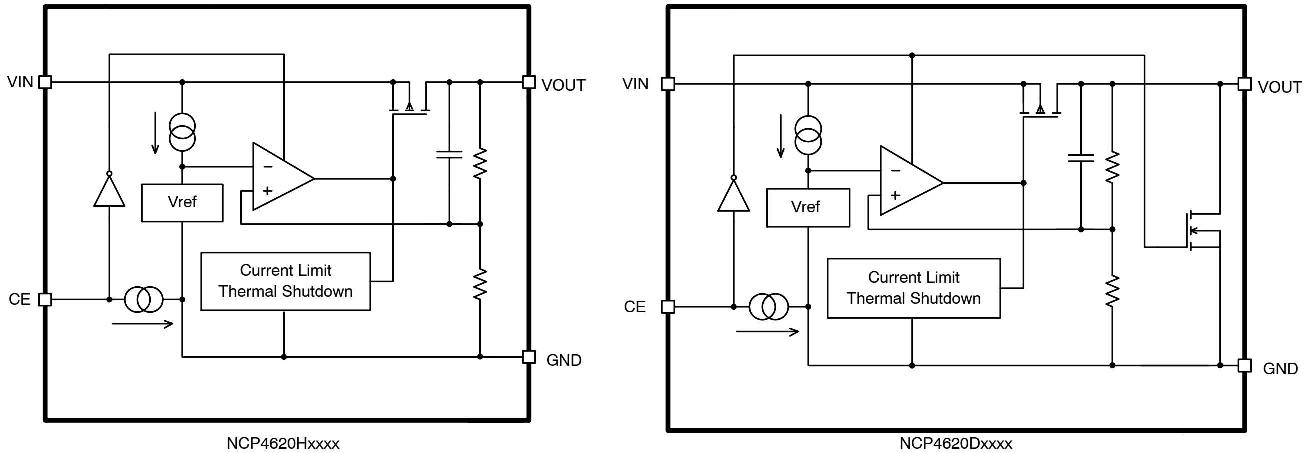



**Figure 2. Simplified Schematic Block Diagram**

## PIN FUNCTION DESCRIPTION

| Pin No. SC−70 | Pin No. SOT23 | Pin Name | Description |
|---|---|---|---|
| 5 | 1 | VIN | Input pin |
| 3 | 2 | GND | Ground |
| 1 | 3 | CE | Chip enable pin (Active “H”) |
| 4 | 5 | VOUT | Output pin |
| 2 | 4 | NC | No connection |

## ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Input Voltage (Note 1) | $V_{IN}$ | 12.0 | V |
| Output Voltage | $V_{OUT}$ | −0.3 to $V_{IN}$ + 0.3 | V |
| Chip Enable Input | $V_{CE}$ | 12.0 | V |
| Output Current | $I_{OUT}$ | 165 | mA |
| Power Dissipation − SC−70 | $P_D$ | 380 | mW |
| Power Dissipation − SOT23 | | 420 | |
| Operating Temperature | $T_A$ | −40 to +85 | °C |
| Maximum Junction Temperature | $T_J$ | +150 | °C |
| Storage Temperature | $T_{STG}$ | −55 to +125 | °C |
| ESD Capability, Human Body Model (Note 2) | $ESD_{HBM}$ | 2000 | V |
| ESD Capability, Machine Model (Note 2) | $ESD_{MM}$ | 200 | V |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Refer to ELECTRICAL CHARACTERISTIS and APPLICATION INFORMATION for Safe Operating Area.
2. This device series incorporates ESD protection and is tested by the following methods:
   ESD Human Body Model tested per AEC−Q100−002 (EIA/JESD22−A114)
   ESD Machine Model tested per AEC−Q100−003 (EIA/JESD22−A115)
   Latchup Current Maximum Rating tested per JEDEC standard: JESD78.

## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Characteristics, SOT23<br>Thermal Resistance, Junction−to−Air | $R_{\theta JA}$ | 238 | °C/W |
| Thermal Characteristics, SC−70<br>Thermal Resistance, Junction−to−Air | $R_{\theta JA}$ | 263 | °C/W |

**ELECTRICAL CHARACTERISTICS** $-40°C \le T_A \le 85°C$; $V_{IN} = V_{OUT(NOM)} + 1$ V; $I_{OUT} = 1$ mA, $C_{IN} = C_{OUT} = 0.47$ μF, unless otherwise noted. Typical values are at $T_A = +25°C$.

| Parameter | Test Conditions | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Operating Input Voltage | | | $V_{IN}$ | 2.6 | | 10 | V |
| Output Voltage | $T_A = +25°C$ | $V_{OUT} > 1.5$ V<br>$V_{OUT} \le 1.5$ V | $V_{OUT}$ | x0.99<br>−15 | | x1.01<br>15 | V<br>mV |
| | $-40°C \le T_A \le 85°C$ | $V_{OUT} > 1.5$ V<br>$V_{OUT} \le 1.5$ V | | x0.974<br>−40 | | x1.023<br>35 | V<br>mV |
| Output Voltage Temp. Coefficient | $-40°C \le T_A \le 85°C$ | | | | ±80 | | ppm/°C |
| Line Regulation | $V_{OUT(NOM)}$ + 0.5 V or 2.6 V (whichever is higher) $\le V_{IN} \le 10$ V | | $Line_{Reg}$ | | 0.02 | 0.2 | %/V |
| Load Regulation | $I_{OUT}$ = 0.1 mA to 150 mA | | $Load_{Reg}$ | | 5 | 40 | mV |
| Dropout Voltage | $I_{OUT}$ = 150 mA | $1.2 V \le V_{OUT} < 1.3$ V<br>$1.3 V \le V_{OUT} < 1.5$ V<br>$1.5 V \le V_{OUT} < 1.8$ V<br>$1.8 V \le V_{OUT} < 2.3$ V<br>$2.3 V \le V_{OUT} < 3.0$ V<br>$3.0 V \le V_{OUT} < 4.0$ V<br>$4.0 V \le V_{OUT} < 6.0$ V | $V_{DO}$ | | <br><br><br><br>0.40<br>0.30<br>0.25 | 1.40<br>1.30<br>1.10<br>0.80<br>0.58<br>0.48<br>0.40 | V |
| Output Current | | | $I_{OUT}$ | 150 | | | mA |
| Short Current Limit | $V_{OUT}$ = 0 V | | $I_{SC}$ | | 40 | | mA |
| Quiescent Current | | | $I_Q$ | | 23 | 40 | μA |
| Standby Current | $V_{IN}$ = 10 V, $V_{CE}$ = 0 V, $T_A$ = 25°C | | $I_{STB}$ | | 0.1 | 1.0 | μA |
| CE Pin Threshold Voltage | CE Input Voltage “H” | | $V_{CEH}$ | 1.7 | | | V |
| | CE Input Voltage “L” | | $V_{CEL}$ | | | 0.8 | |
| CE Pull Down Current | | | $I_{CEPD}$ | | 0.3 | | μA |
| Power Supply Rejection Ratio | $V_{IN} = V_{OUT}$ + 1 V or 3.0 V whichever is higher, $\Delta V_{IN} = 0.2\ V_{pk-pk}$, $I_{OUT}$ = 30 mA, f = 1 kHz | | PSRR | | 70 | | dB |
| Output Noise Voltage | f = 10 Hz to 100 kHz, $I_{OUT}$ = 30 mA, $V_{OUT}$ = 1.5 V, $V_{IN}$ = 2.6 V | | $V_N$ | | 90 | | $\mu V_{rms}$ |
| Low Output N−ch Tr. On Resistance | $V_{IN}$ = 7 V, $V_{CE}$ = 0 V | | $R_{LOW}$ | | 250 | | Ω |
| Thermal Shutdown Temperature | | | $T_{TSD}$ | | 165 | | °C |
| Thermal Shutdown Release | | | $T_{TSR}$ | | 110 | | °C |

## TYPICAL CHARACTERISTICS

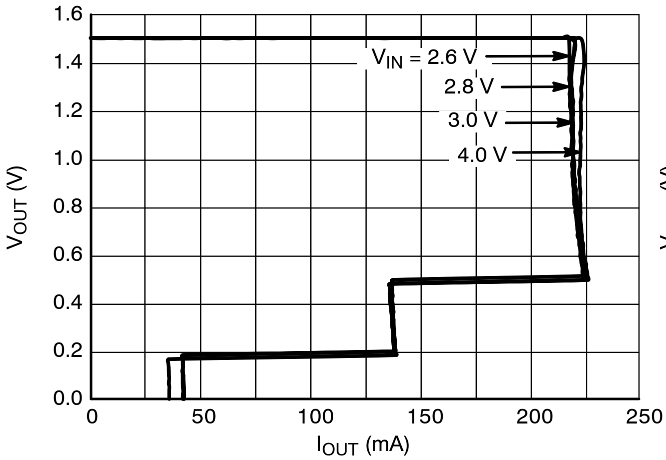



**Figure 3. Output Voltage vs. Output Current 1.5 V Version ($T_J$ = 25°C)**

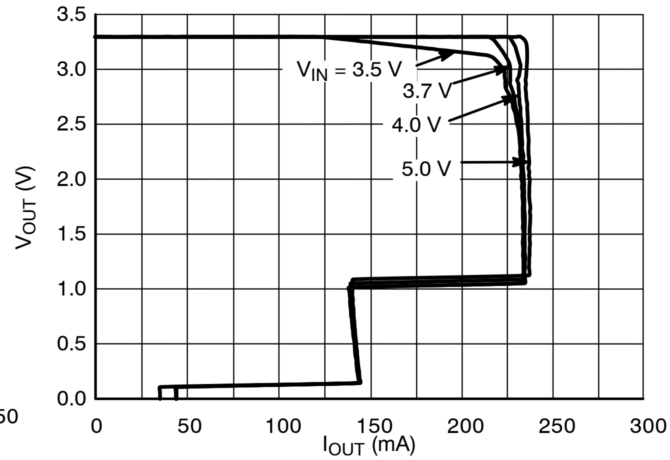



**Figure 4. Output Voltage vs. Output Current 3.3 V Version ($T_J$ = 25°C)**

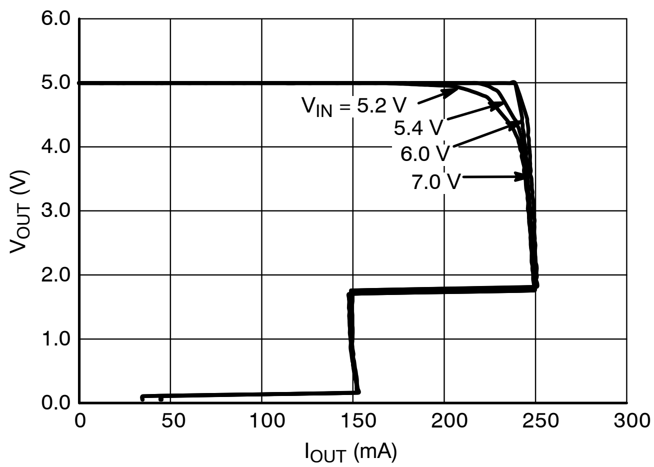



**Figure 5. Output Voltage vs. Output Current 5.0 V Version ($T_J$ = 25°C)**

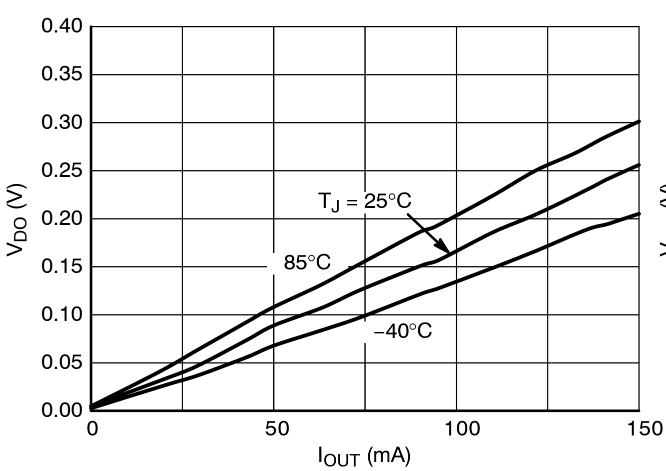



**Figure 6. Dropout Voltage vs. Output Current 3.3 V Version**

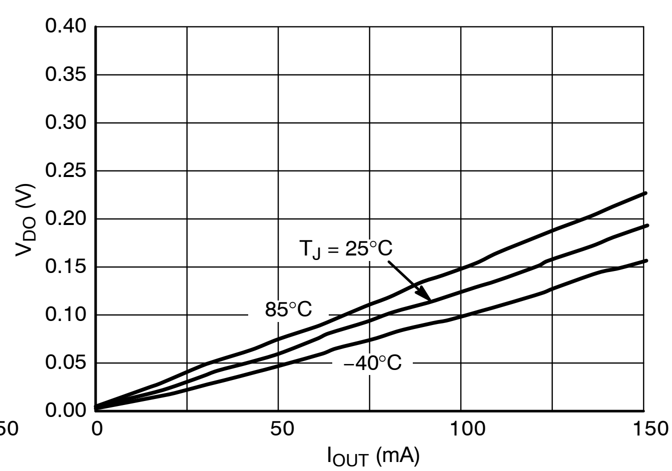



**Figure 7. Dropout Voltage vs. Output Current 5.0 V Version**

## TYPICAL CHARACTERISTICS

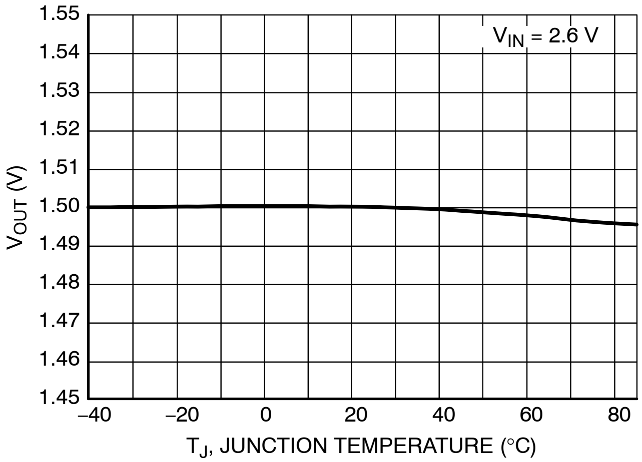



**Figure 8. Output Voltage vs. Temperature, 1.5 V Version**

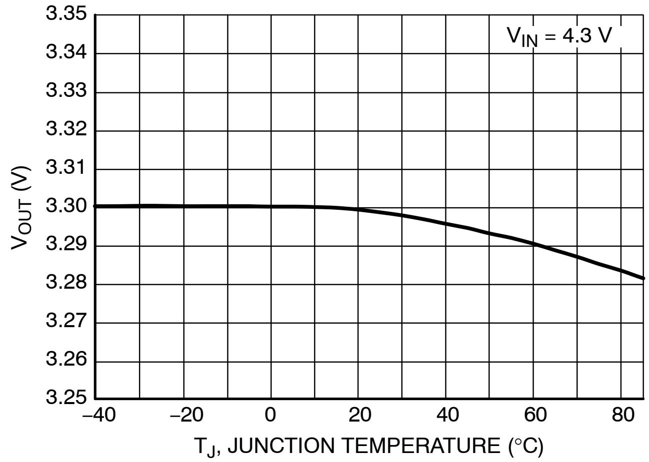



**Figure 9. Output Voltage vs. Temperature, 3.3 V Version**

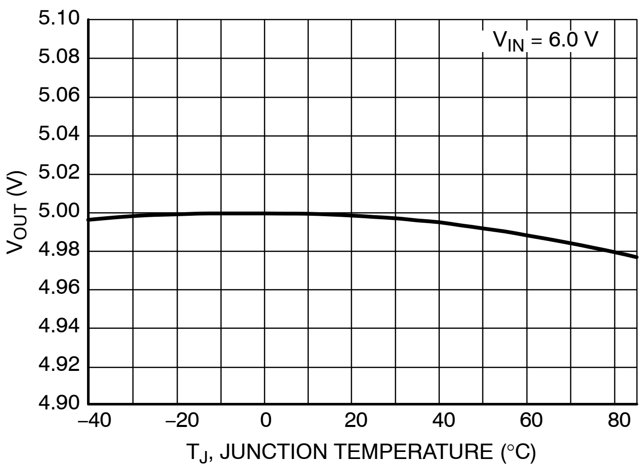



**Figure 10. Output Voltage vs. Temperature, 5.0 V Version**

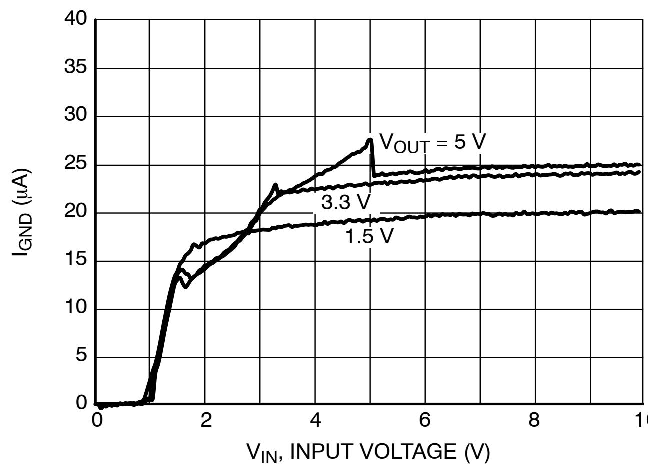



**Figure 11. Supply Current vs. Input Voltage**

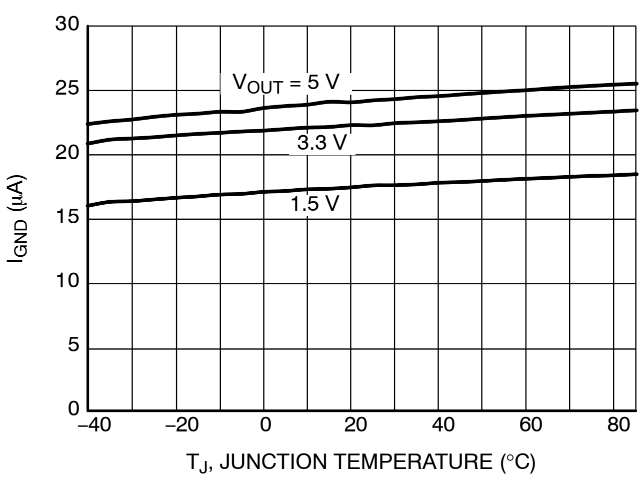



**Figure 12. Supply Current vs. Temperature**

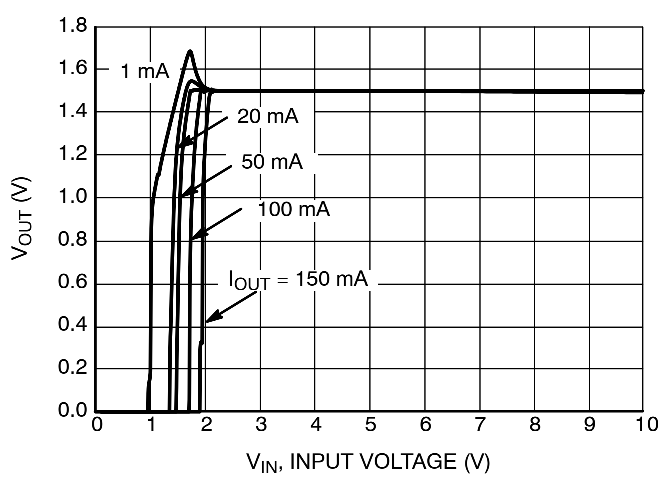



**Figure 13. Output Voltage vs. Input Voltage, 1.5 V Version**

## TYPICAL CHARACTERISTICS

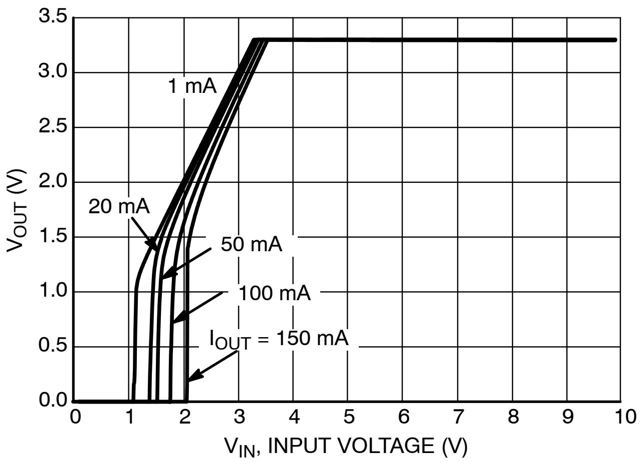



**Figure 14. Output Voltage vs. Input Voltage, 3.3 V Version**

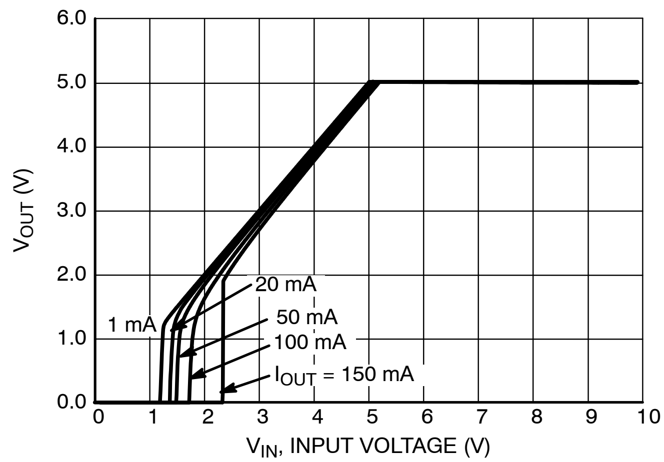



**Figure 15. Output Voltage vs. Input Voltage, 5.0 V Version**

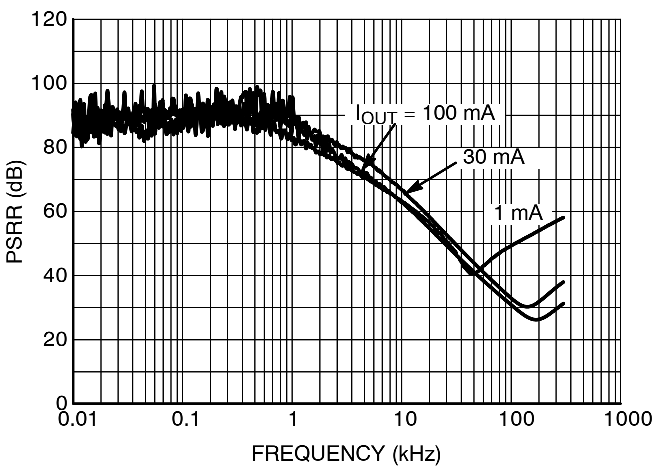



**Figure 16. PSRR, 1.5 V Version, $V_{IN}$ = 3.5 V**

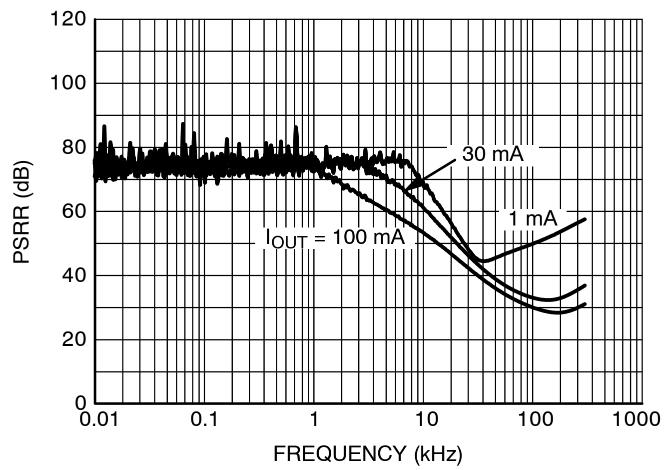



**Figure 17. PSRR, 3.3 V Version, $V_{IN}$ = 5.3 V**

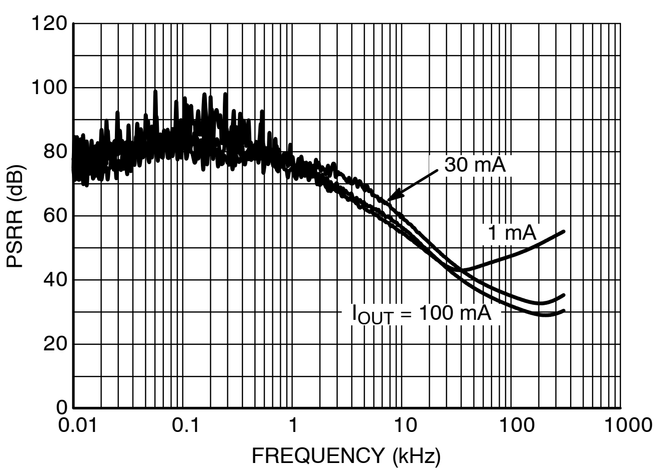



**Figure 18. PSRR, 5.0 V Version, $V_{IN}$ = 7.0 V**

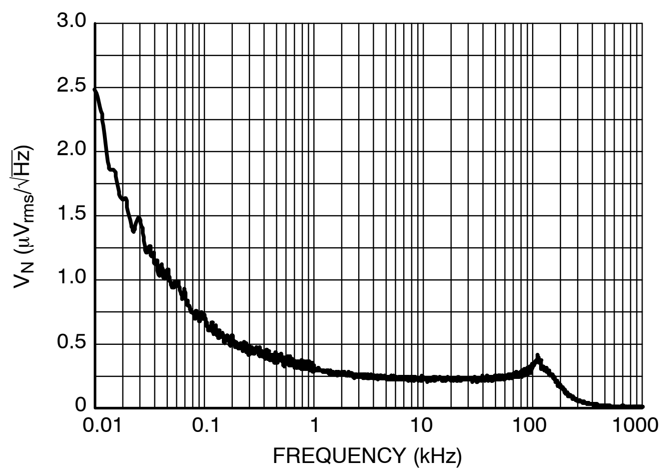



**Figure 19. Output Voltage Noise, 1.5 V Version, $V_{IN}$ = 2.6 V, $I_{OUT}$ = 30 mA**

## TYPICAL CHARACTERISTICS

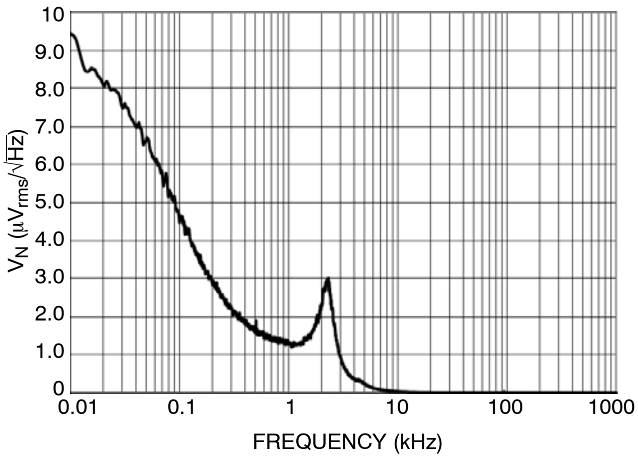



**Figure 20. Output Voltage Noise, 3.3 V Version, $V_{IN}$ = 4.3 V, $I_{OUT}$ = 30 mA**

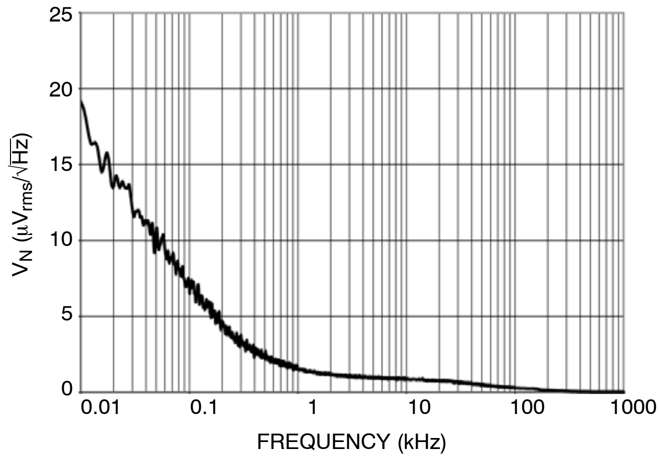



**Figure 21. Output Voltage Noise, 5.0 V Version, $V_{IN}$ = 6.0 V, $I_{OUT}$ = 30 mA**

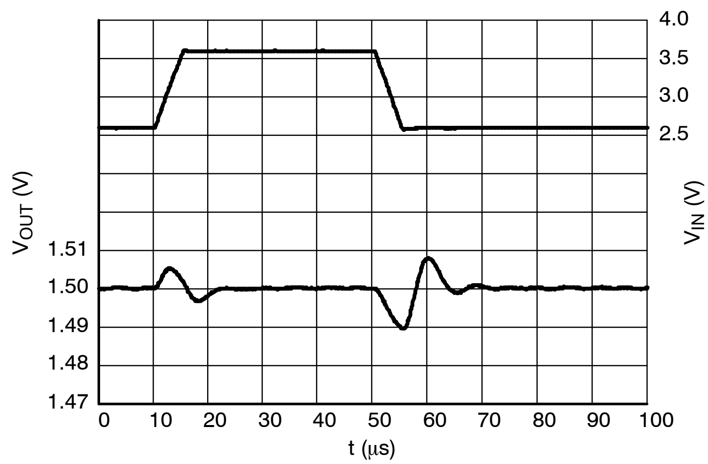



**Figure 22. Line Transients, 1.5 V Version, $t_R = t_F$ = 5 μs, $I_{OUT}$ = 30 mA**

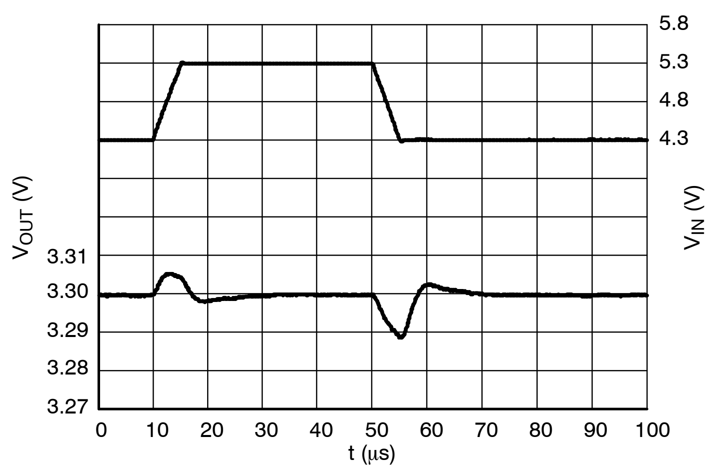



**Figure 23. Line Transients, 3.3 V Version, $t_R = t_F$ = 5 μs, $I_{OUT}$ = 30 mA**

## TYPICAL CHARACTERISTICS

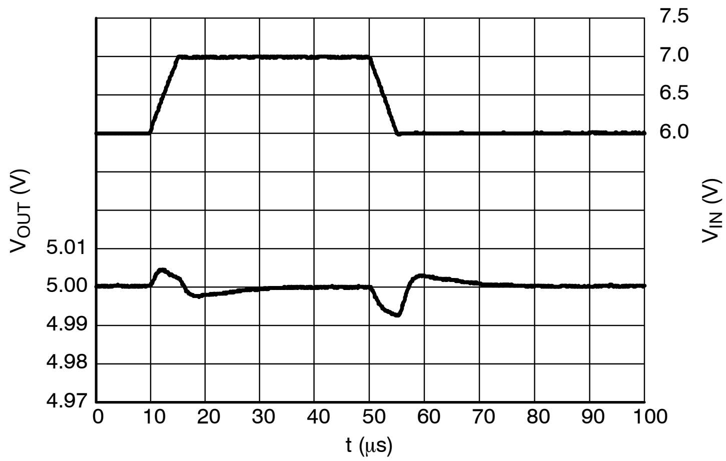



**Figure 24. Line Transients, 5.0 V version, $t_R = t_F = 5\ \mu s$, $I_{OUT} = 30$ mA**

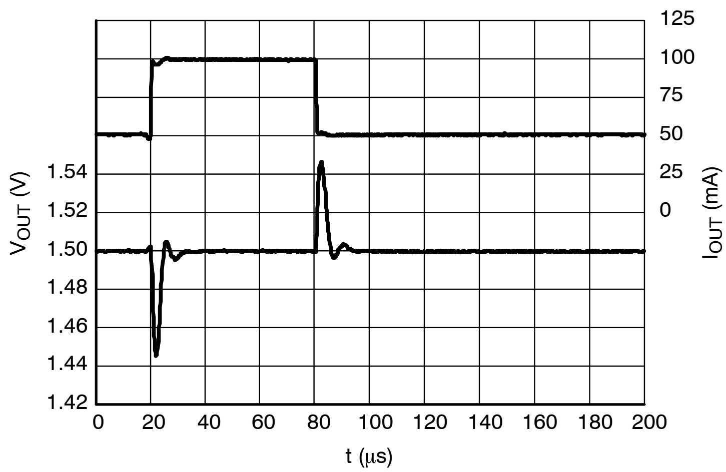



**Figure 25. Load Transients, 1.5 V Version, $I_{OUT}$ = 50 – 100 mA, $t_R = t_F = 0.5\ \mu s$, $V_{IN} = 2.6$ V**

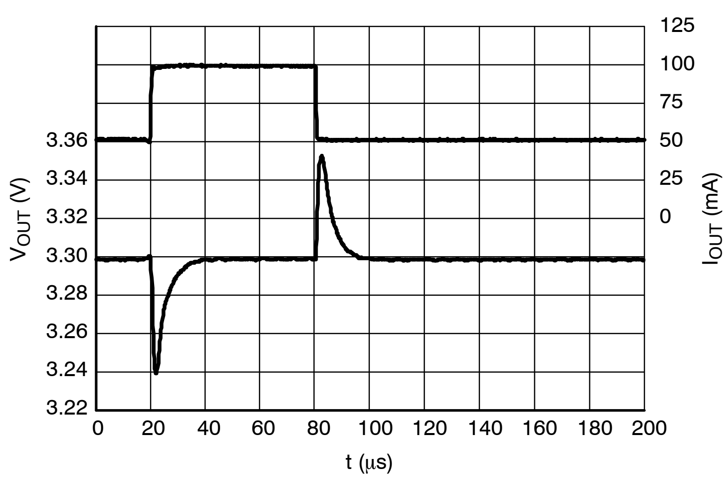



**Figure 26. Load Transients, 3.3 V Version, $I_{OUT}$ = 50 – 100 mA, $t_R = t_F = 0.5\ \mu s$, $V_{IN} = 4.3$ V**

## TYPICAL CHARACTERISTICS

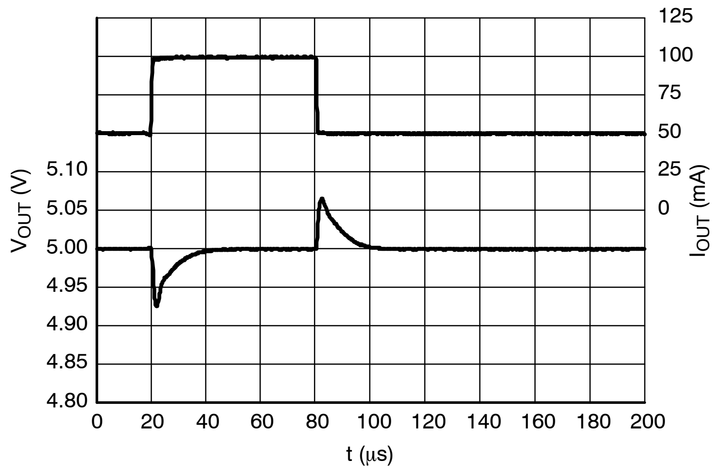



**Figure 27. Load Transients, 5.0 V Version, $I_{OUT}$ = 50 – 100 mA, $t_R = t_F$ = 0.5 μs, $V_{IN}$ = 6.0 V**

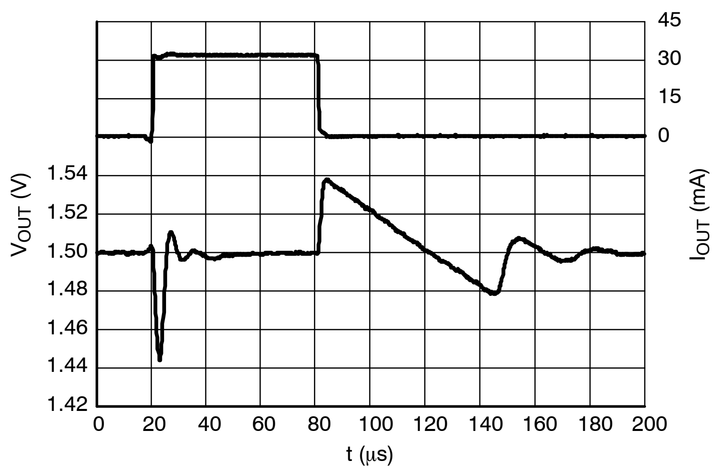



**Figure 28. Load Transients, 1.5 V Version, $I_{OUT}$ = 1 – 30 mA, $t_R = t_F$ = 0.5 μs, $V_{IN}$ = 2.6 V**

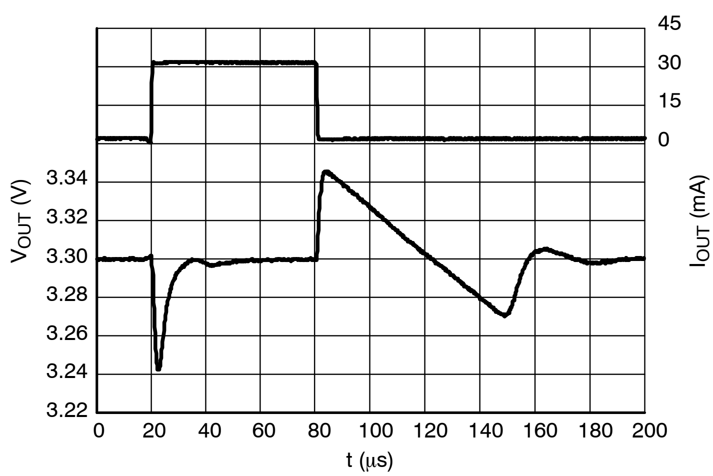



**Figure 29. Load Transients, 3.3 V Version, $I_{OUT}$ = 1 – 30 mA, $t_R = t_F$ = 0.5 μs, $V_{IN}$ = 4.3 V**

## TYPICAL CHARACTERISTICS

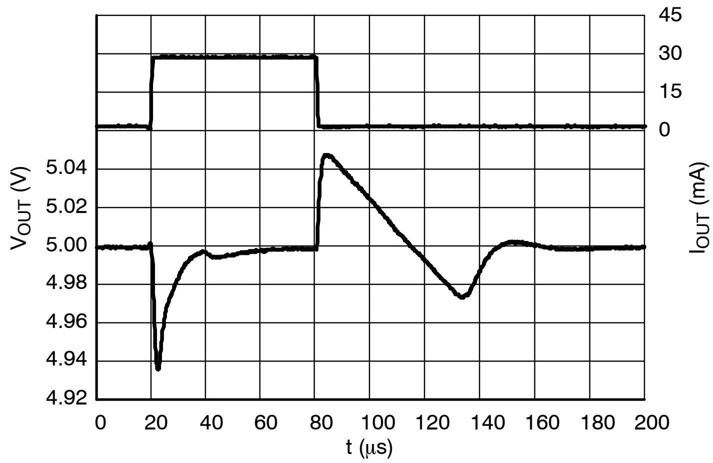



**Figure 30. Load Transients, 5.0 V Version,**
**$I_{OUT}$ = 1 – 30 mA, $t_R = t_F$ = 0.5 μs, $V_{IN}$ = 6.0 V**

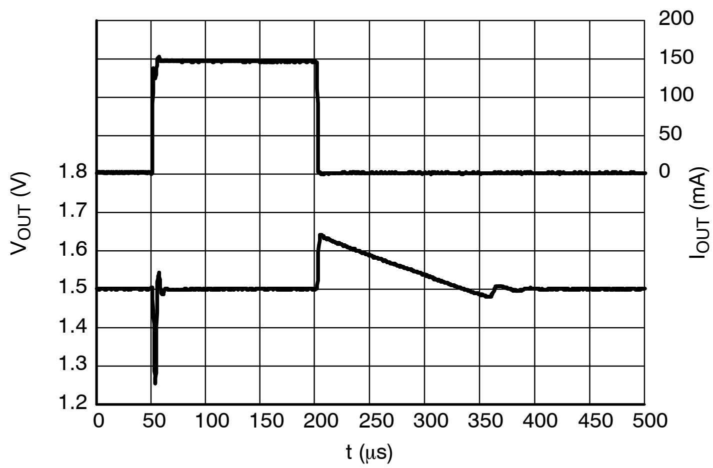



**Figure 31. Load Transients, 1.5 V Version,**
**$I_{OUT}$ = 1 – 150 mA, $t_R = t_F$ = 0.5 μs, $V_{IN}$ = 2.6 V**

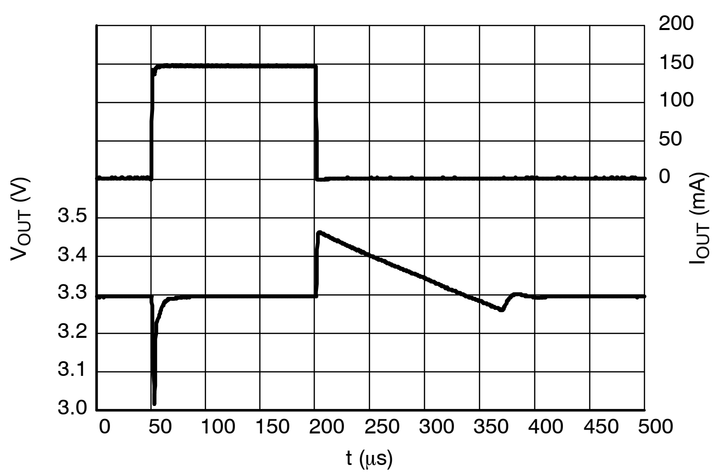



**Figure 32. Load Transients, 3.3 V Version,**
**$I_{OUT}$ = 1 – 150 mA, $t_R = t_F$ = 0.5 μs, $V_{IN}$ = 3.8 V**

## TYPICAL CHARACTERISTICS

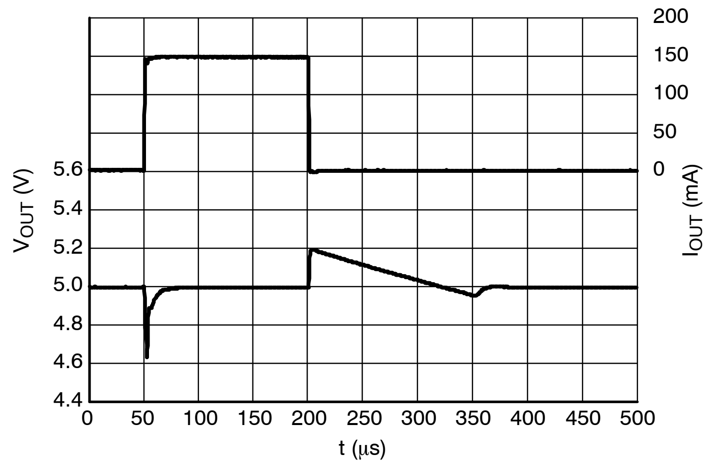



**Figure 33. Load Transients, 5.0 V Version, $I_{OUT}$ = 1 – 150 mA, $t_R$ = $t_F$ = 0.5 μs, $V_{IN}$ = 6.0 V**

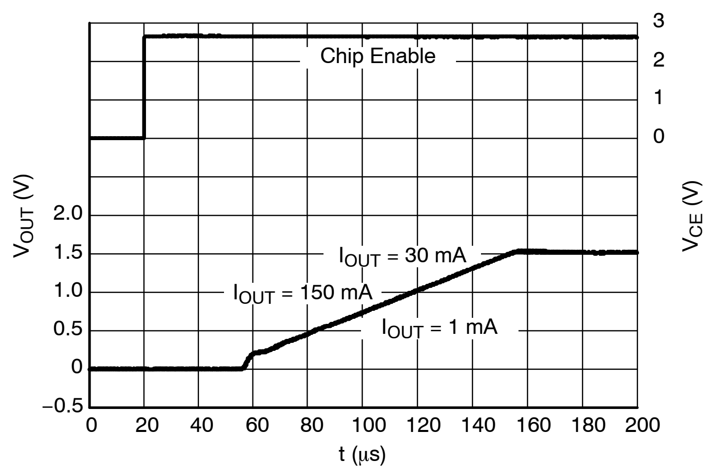



**Figure 34. Start−up, 1.5 V Version, $V_{IN}$ = 2.6 V**

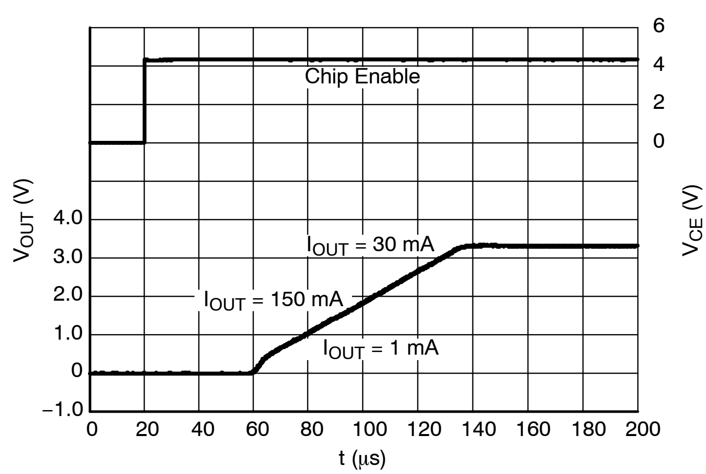



**Figure 35. Start−up, 3.3 V Version, $V_{IN}$ = 4.3 V**

## TYPICAL CHARACTERISTICS

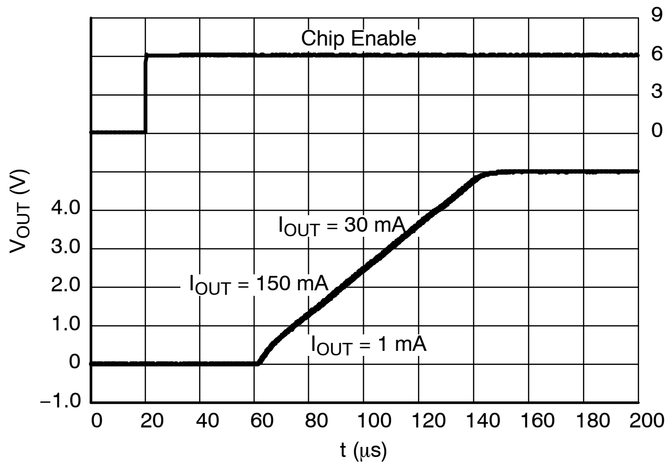



**Figure 36. Start−up, 5.0 V Version, $V_{IN}$ = 6.0 V**

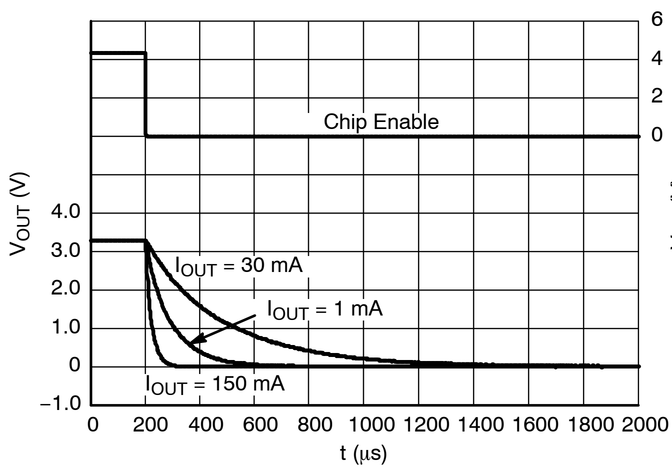



**Figure 37. Shutdown, 3.3 V Version D, $V_{IN}$ = 4.3 V**

## APPLICATION INFORMATION

A typical application circuit for NCP4620 series is shown in Figure 38.

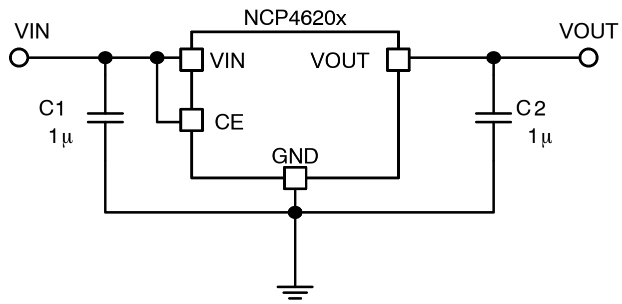



**Figure 38. Typical Application Schematic**

### Input Decoupling Capacitor (C1)

A 1 µF ceramic input decoupling capacitor should be connected as close as possible to the input and ground pin of the NCP4620. Higher values and lower ESR improves line transient response.

### Output Decoupling Capacitor (C2)

A 1 µF ceramic output decoupling capacitor is enough to achieve stable operation of the IC. If a tantalum capacitor is used, and its ESR is high, loop oscillation may result. The capacitors should be connected as close as possible to the output and ground pins. Larger values and lower ESR improves dynamic parameters.

### Enable Operation

The enable pin CE may be used for turning the regulator on and off. The IC is switched on when a high level voltage is applied to the CE pin. The enable pin has an internal pull down current source. If the enable function is not needed connect CE pin to VIN.

### Output Discharger

The D version includes a transistor between VOUT and GND that is used for faster discharging of the output capacitor. This function is activated when the IC goes into disable mode.

### Thermal

As a power across the IC increase, it might become necessary to provide some thermal relief. The maximum power dissipation supported by the device is dependent upon board design and layout. Mounting pad configuration on the PCB, the board material, and also the ambient temperature affect the rate of temperature increase for the part. When the device has good thermal conductivity through the PCB the junction temperature will be relatively low in high power dissipation applications.

### PCB layout

Make the VIN and GND line as large as practical. If their impedance is high, noise pickup or unstable operation may result. Connect capacitors C1 and C2 as close as possible to the IC, and make wiring as short as possible.

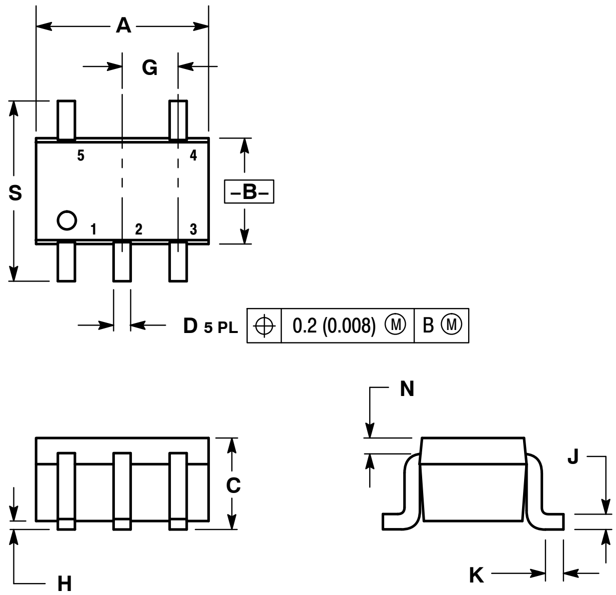
## ORDERING INFORMATION

| Device | Nominal Output Voltage | Description | Marking | Package | Shipping† |
|---|---|---|---|---|---|
| NCP4620DSN30T1G | 3.0 V | Auto discharge | JBX | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620DSN33T1G | 3.3 V | Auto discharge | KBA | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620DSN45T1G | 4.5 V | Auto discharge | KBN | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620DSN50T1G | 5.0 V | Auto discharge | KBT | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620HSN15T1G | 1.5 V | Standard | JAE | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620HSN33T1G | 3.3 V | Standard | KAA | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620HSN50T1G | 5.0 V | Standard | KAT | SOT−23 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620DSQ18T1G | 1.8 V | Auto discharge | AD08 | SC−70 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620HSQ12T1G | 1.2 V | Standard | AC01 | SC−70 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620HSQ15T1G | 1.5 V | Standard | AC05 | SC−70 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620HSQ18T1G | 1.8 V | Standard | AC08 | SC−70 (Pb−Free) | 3000 / Tape & Reel |
| NCP4620HSQ25T1G | 2.5 V | Standard | AC16 | SC−70 (Pb−Free) | 3000 / 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.
*To order other package and voltage variants, please contact your ON Semiconductor sales representative.

## PACKAGE DIMENSIONS

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

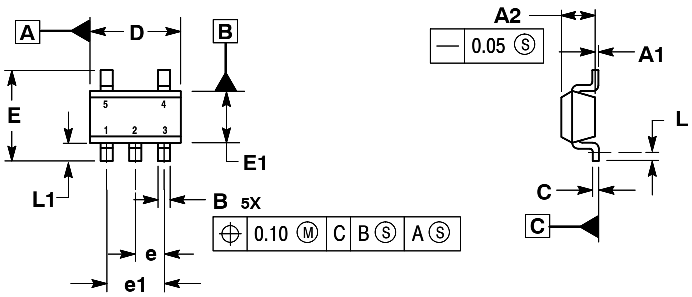



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A−01 OBSOLETE. NEW STANDARD 419A−02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| | 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 |

## PACKAGE DIMENSIONS

**SOT−23**
CASE 1212−01
ISSUE O




NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DATUM C IS A SEATING PLANE.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A1 | 0.00 | 0.10 |
| A2 | 1.00 | 1.30 |
| B | 0.30 | 0.50 |
| C | 0.10 | 0.25 |
| D | 2.80 | 3.00 |
| E | 2.50 | 3.10 |
| E1 | 1.50 | 1.80 |
| e | 0.95 BSC | |
| e1 | 1.90 BSC | |
| L | 0.20 | --- |
| L1 | 0.45 | 0.75 |



**PUBLICATION ORDERING INFORMATION**

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