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# NCP4629

## 500 mA, Wide Input Range, LDO Linear Voltage Regulator

The NCP4629 is a CMOS 500 mA LDO linear voltage regulator which features a high input voltage range while maintaining a low quiescent current. Several protection features like current limiting and thermal shutdown are fully integrated to create a versatile and robust device. A high maximum input voltage (36 V) and wide temperature range ( $-40^{\circ}\text{C}$  to  $105^{\circ}\text{C}$ ) makes the NCP4629 an ideal choice for high power industrial applications.

### Features

- Operating Input Voltage Range: 4 V to 24 V
- Output Voltage Range: 3.0 to 12.0 V (available in 0.1 V steps)
- $\pm 2\%$  Output Voltage Accuracy
- Output Current: min. 500 mA ( $V_{\text{IN}} = V_{\text{OUT}} + 1 \text{ V}$ )
- Line Regulation: 0.05%/V
- Current Limit Circuit
- Thermal Shutdown Circuit
- Available in SOT-89-5 and DPAK5 Package
- These are Pb-Free Devices

### Typical Applications

- Home appliances, industrial equipment
- Cable boxes, satellite receivers, entertainment systems
- Car audio equipment, navigation systems
- Notebook adaptors, LCD TVs, cordless phones and private LAN systems
- Office equipment: copiers, printers, facsimiles, scanners, projectors, monitors

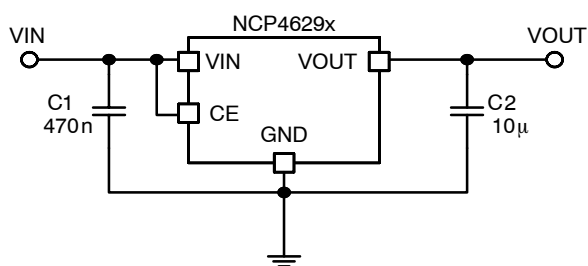


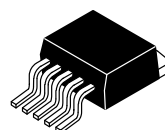
Figure 1. Typical Application Schematic



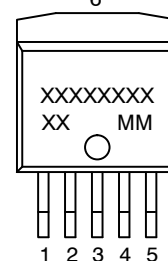
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### MARKING DIAGRAMS



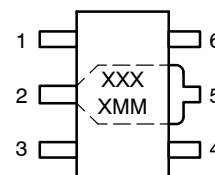
**DPAK-5  
CASE 369AE**



Heatsink surface shown as terminal 6  
is internally connected to Pin 3



**SOT-89 5  
CASE 528AB**



Heatsink surface shown as terminal 6  
is internally connected to Pin 2

XXXXX = Specific Device Code  
MM = Date Code

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 13 of this data sheet.

# NCP4629

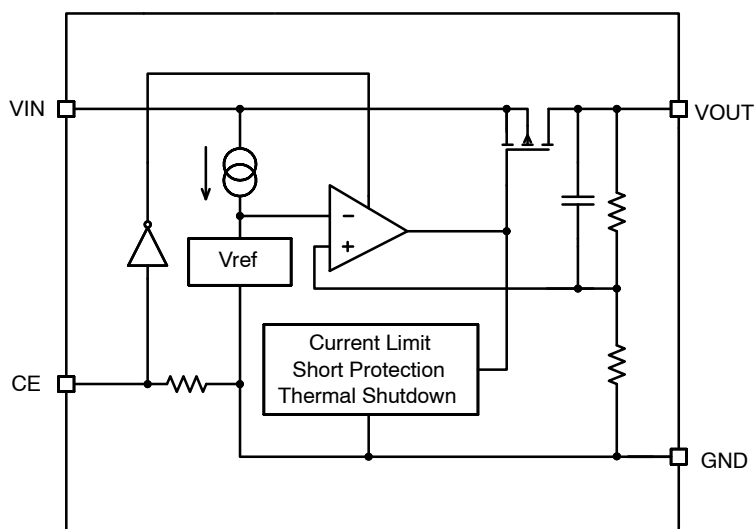


Figure 2. Simplified Schematic Block Diagram

## PIN FUNCTION DESCRIPTION

| Pin No.<br>SOT-89 | Pin No.<br>DPAK | Pin Name | Description                                                                        |
|-------------------|-----------------|----------|------------------------------------------------------------------------------------|
| 1                 | 1               | VIN      | Input pin                                                                          |
| 2                 | 2               | GND*     | Ground pin, all ground pins must be connected together when it is mounted on board |
| 3                 | 3               | GND*     | Ground pin, all ground pins must be connected together when it is mounted on board |
| 4                 | 4               | CE       | Chip enable pin ("H" active)                                                       |
| 5                 | 5               | VOUT     | Output pin                                                                         |
| 6                 |                 | GND      | Heatsink surface is internally connected to Pin 2 – GND                            |
|                   | 6               | GND      | Heatsink surface is internally connected to Pin 3 – GND                            |

\*Pin no.2 – GND and pin no.3 – GND of SOT-89 and DPAK-5 packages must be wired to the GND line when it is mounted on board.

## ABSOLUTE MAXIMUM RATINGS

| Rating                                    | Symbol      | Value                    | Unit |
|-------------------------------------------|-------------|--------------------------|------|
| Input Voltage                             | $V_{IN}$    | -0.3 to 36               | V    |
| Output Voltage                            | $V_{OUT}$   | -0.3 to $V_{IN} \leq 36$ | V    |
| Chip Enable Input                         | $V_{CE}$    | -0.3 to $V_{IN} \leq 36$ | V    |
| Power Dissipation SOT-89-5                | $P_D$       | 900                      | mW   |
| Power Dissipation DPAK-5                  |             | 1900                     |      |
| Junction Temperature                      | $T_J$       | -40 to 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.

- Duration time = 200 ms
- 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)  
Latch-up Current Maximum Rating tested per JEDEC standard: JESD78.

# NCP4629

## THERMAL CHARACTERISTICS

| Rating                                                                 | Symbol          | Value | Unit                 |
|------------------------------------------------------------------------|-----------------|-------|----------------------|
| Thermal Characteristics, SOT-89<br>Thermal Resistance, Junction-to-Air | $R_{\theta JA}$ | 111   | $^{\circ}\text{C/W}$ |
| Thermal Characteristics, DPAK<br>Thermal Resistance, Junction-to-Air   | $R_{\theta JA}$ | 53    | $^{\circ}\text{C/W}$ |

## ELECTRICAL CHARACTERISTICS $T_A = 25^{\circ}\text{C}$

| Parameter                            | Test Conditions                                                                                                                  | Symbol                      | Min           | Typ       | Max           | Unit                          |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|-----------|---------------|-------------------------------|
| Operating Input Voltage              |                                                                                                                                  | $V_{IN}$                    | 4             |           | 24            | V                             |
| Output Voltage                       | $V_{IN} = V_{OUT} + 1\text{ V}$ , $I_{OUT} = 100\text{ mA}$                                                                      | $V_{OUT}$                   | $\times 0.98$ |           | $\times 1.02$ | V                             |
| Output Voltage Temp. Coefficient     | $V_{IN} = V_{OUT} + 2\text{ V}$ , $I_{OUT} = 100\text{ }\mu\text{A}$ , $T_A = -40$ to $105^{\circ}\text{C}$                      |                             |               | $\pm 100$ |               | $\text{ppm}/^{\circ}\text{C}$ |
| Line Regulation                      | $V_{IN} = V_{OUT} + 1\text{ V}$ to $24\text{ V}$ , $I_{OUT} = 10\text{ mA}$                                                      | $\text{LineReg}$            |               | 0.05      | 0.10          | %/V                           |
| Load Regulation                      | $V_{IN} = V_{OUT} + 2\text{ V}$ , $I_{OUT} = 0.1\text{ mA}$ to $200\text{ mA}$                                                   | $\text{LoadReg}$            |               | 25        | 60            | mV                            |
| Dropout Voltage                      | $I_{OUT} = 200\text{ mA}$                                                                                                        | $V_{DO}$                    |               | 0.135     | 0.225         | V                             |
|                                      | $3.0\text{ V} \leq V_{OUT} < 5.0\text{ V}$                                                                                       |                             |               | 0.115     | 0.180         |                               |
|                                      | $5.0\text{ V} \leq V_{OUT} < 9.0\text{ V}$                                                                                       |                             |               | 0.095     | 0.155         |                               |
|                                      | $8.0\text{ V} \leq V_{OUT} \leq 12.0\text{ V}$                                                                                   |                             |               |           |               |                               |
| Output Current                       | $V_{IN} = V_{OUT} + 1\text{ V}$                                                                                                  | $I_{OUT}$                   | 500           |           |               | mA                            |
| Short Current Limit                  | $V_{OUT} = 0\text{ V}$                                                                                                           | $I_{SC}$                    |               | 65        |               | mA                            |
| Quiescent Current                    | $V_{IN} = V_{OUT} + 1\text{ V}$ , $V_{IN} = V_{CE}$                                                                              | $I_Q$                       |               | 70        | 130           | $\mu\text{A}$                 |
| Standby Current                      | $V_{IN} = 24\text{ V}$ , $V_{CE} = 0\text{ V}$                                                                                   | $I_{STB}$                   |               | 0.1       | 1             | $\mu\text{A}$                 |
| CE Pin Threshold Voltage             | CE Input Voltage "H"                                                                                                             | $V_{CEH}$                   | 2.0           |           | $V_{IN}$      | V                             |
|                                      | CE Input Voltage "L"                                                                                                             | $V_{CEL}$                   | 0             |           | 0.4           |                               |
| Thermal Shutdown Temperature         |                                                                                                                                  | $T_{SD}$                    |               | 160       |               | $^{\circ}\text{C}$            |
| Thermal Shutdown Release Temperature |                                                                                                                                  | $T_{SR}$                    |               | 135       |               | $^{\circ}\text{C}$            |
| Power Supply Rejection Ratio         | $V_{IN} = V_{OUT} + 2.0\text{ V}$ ,<br>$\Delta V_{IN\_PK-PK} = 0.5\text{ V}$ ,<br>$I_{OUT} = 100\text{ mA}$ , $f = 1\text{ kHz}$ | $V_{OUT} \leq 6.0\text{ V}$ |               | 60        |               | dB                            |
|                                      |                                                                                                                                  | $V_{OUT} > 6.0\text{ V}$    |               | 50        |               |                               |
| Output Noise Voltage                 | $V_{OUT} = 5.0\text{ V}$ , $I_{OUT} = 30\text{ mA}$ , $f = 10\text{ Hz}$ to $100\text{ kHz}$                                     | $V_{NOISE}$                 |               | 125       |               | $\mu\text{V}_{rms}$           |

TYPICAL CHARACTERISTICS

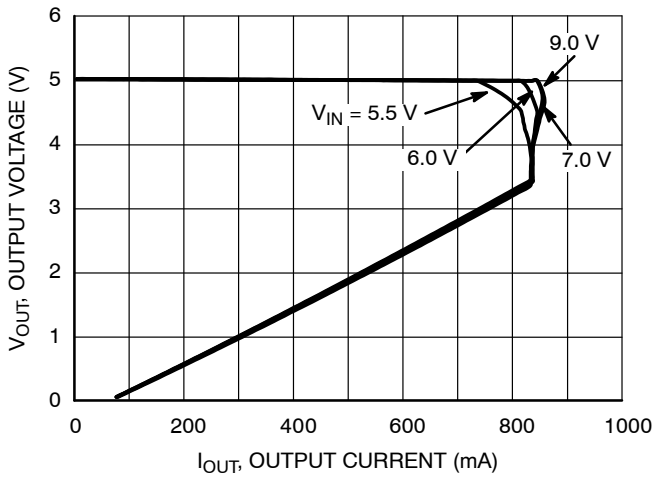


Figure 3. Output Voltage vs. Output Current,  
 $V_{OUT} = 5\text{ V}$

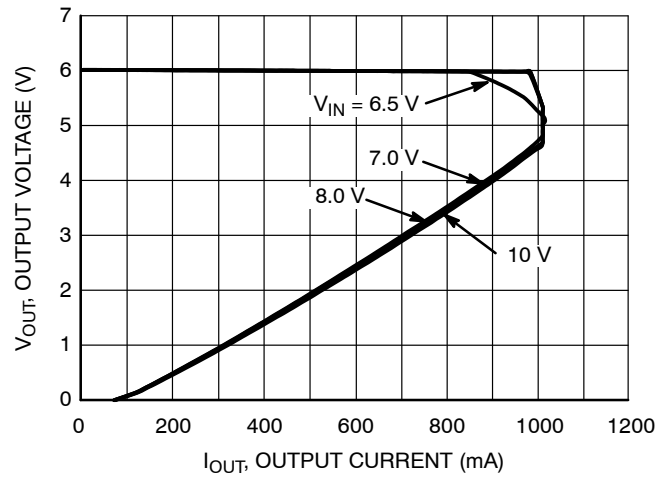


Figure 4. Output Voltage vs. Output Current,  
 $V_{OUT} = 6\text{ V}$

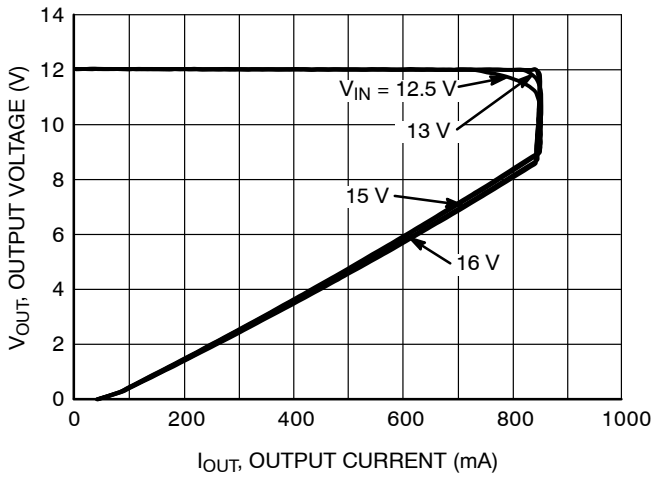


Figure 5. Output Voltage vs. Output Current,  
 $V_{OUT} = 12\text{ V}$

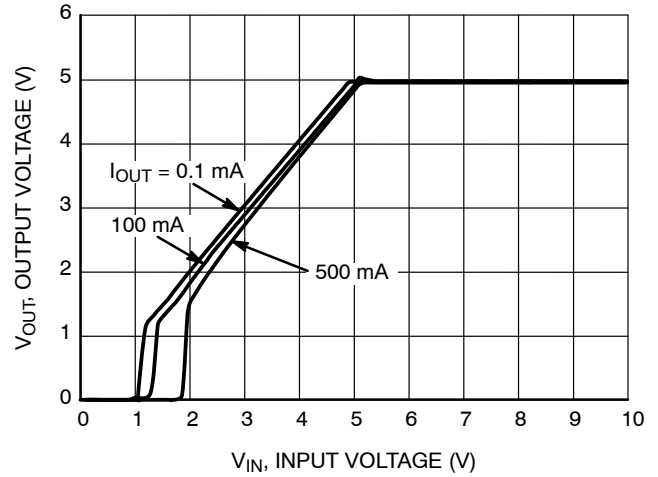


Figure 6. Output Voltage vs. Input Voltage,  
 $V_{OUT} = 5\text{ V}$

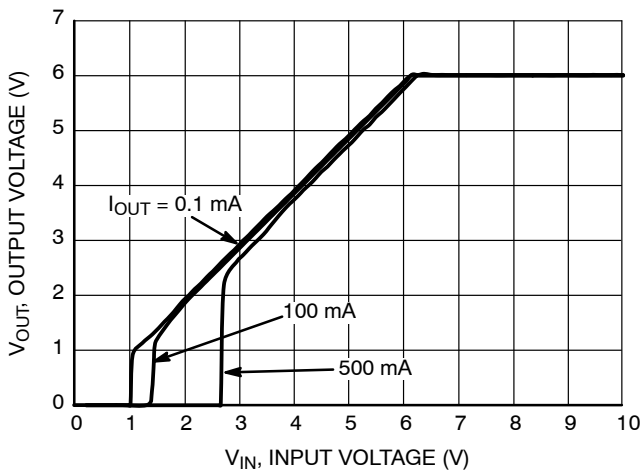


Figure 7. Output Voltage vs. Input Voltage,  
 $V_{OUT} = 6\text{ V}$

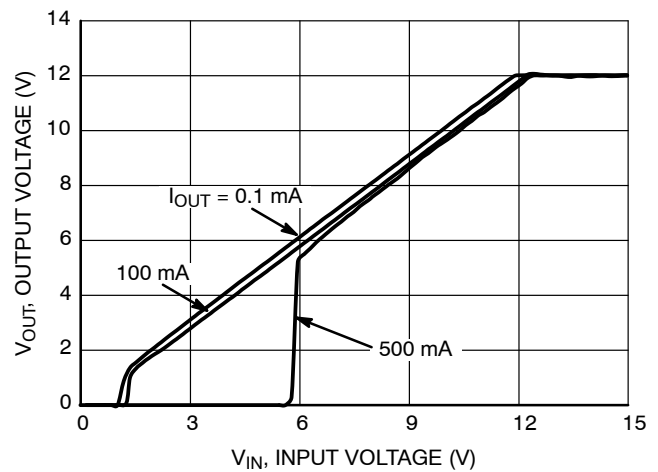


Figure 8. Output Voltage vs. Input Voltage,  
 $V_{OUT} = 12\text{ V}$

TYPICAL CHARACTERISTICS

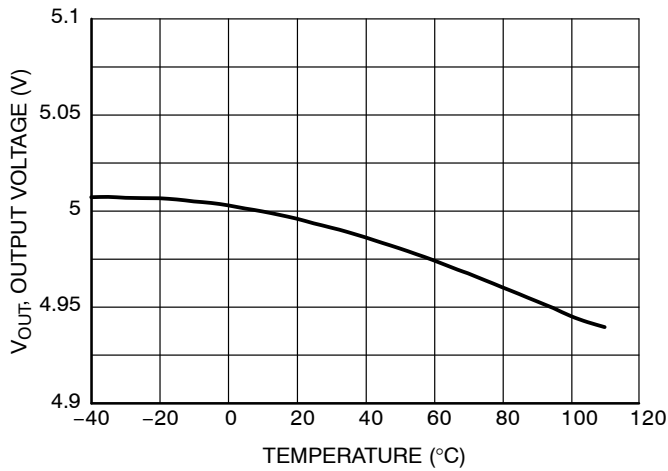


Figure 9. Output Voltage vs. Temperature,  
 $V_{OUT} = 5\text{ V}$

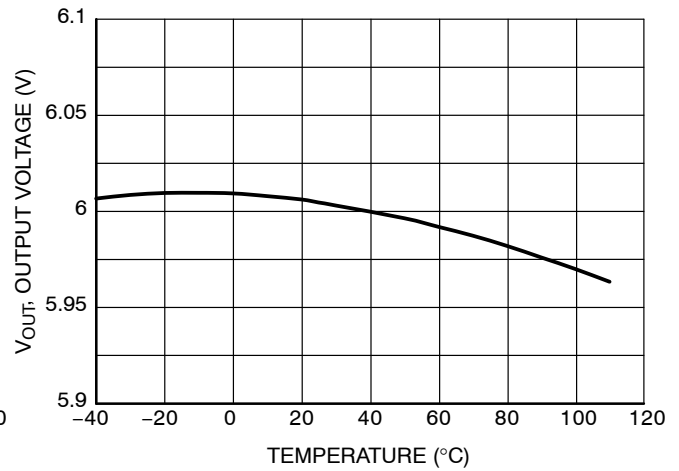


Figure 10. Output Voltage vs. Temperature,  
 $V_{OUT} = 6\text{ V}$

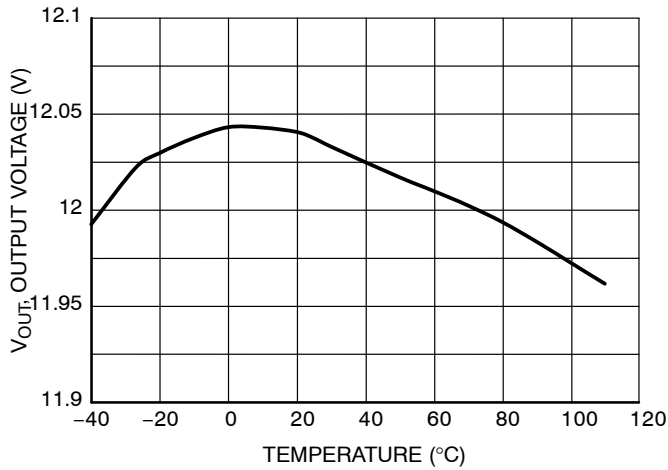


Figure 11. Output Voltage vs. Temperature,  
 $V_{OUT} = 12\text{ V}$

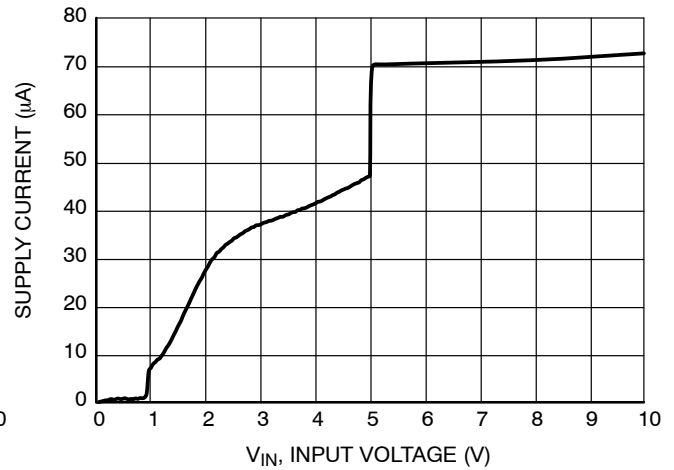


Figure 12. Supply Current vs. Input Voltage,  
 $V_{OUT} = 5\text{ V}$

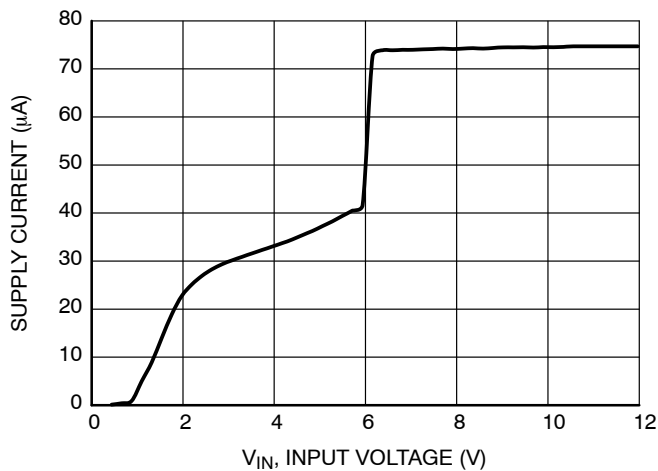


Figure 13. Supply Current vs. Input Voltage,  
 $V_{OUT} = 6\text{ V}$

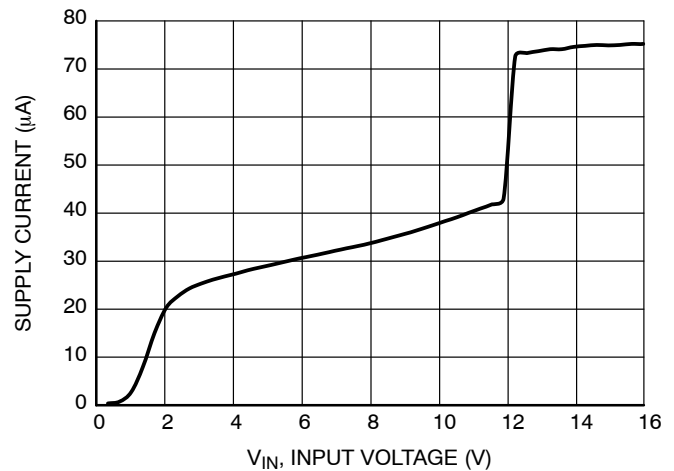


Figure 14. Supply Current vs. Input Voltage,  
 $V_{OUT} = 12\text{ V}$

TYPICAL CHARACTERISTICS

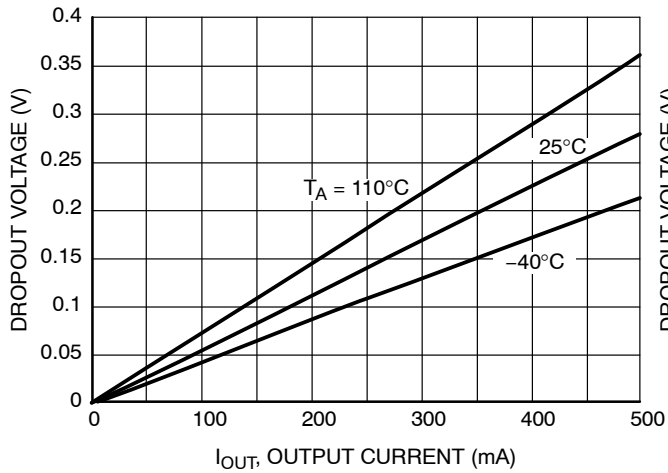


Figure 15. Dropout Voltage vs. Input Current,  
 $V_{OUT} = 5\text{ V}$

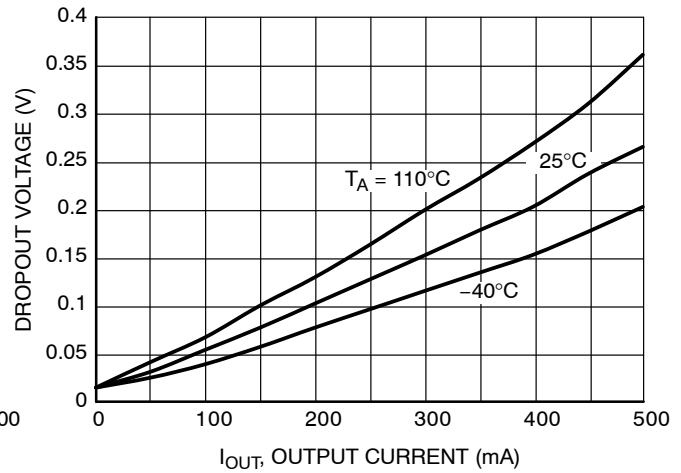


Figure 16. Dropout Voltage vs. Input Current,  
 $V_{OUT} = 6\text{ V}$

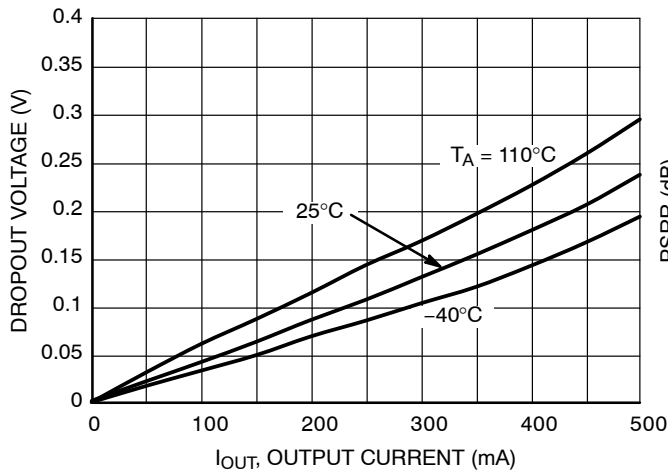


Figure 17. Dropout Voltage vs. Input Current,  
 $V_{OUT} = 12\text{ V}$

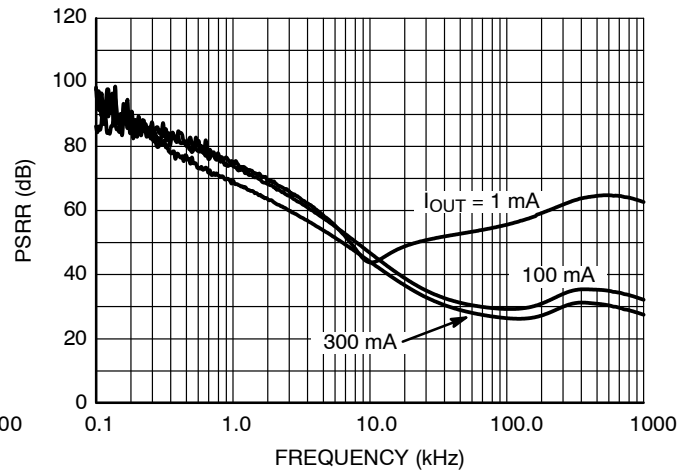


Figure 18. Ripple Rejection vs. Frequency,  
 $V_{OUT} = 5\text{ V}$

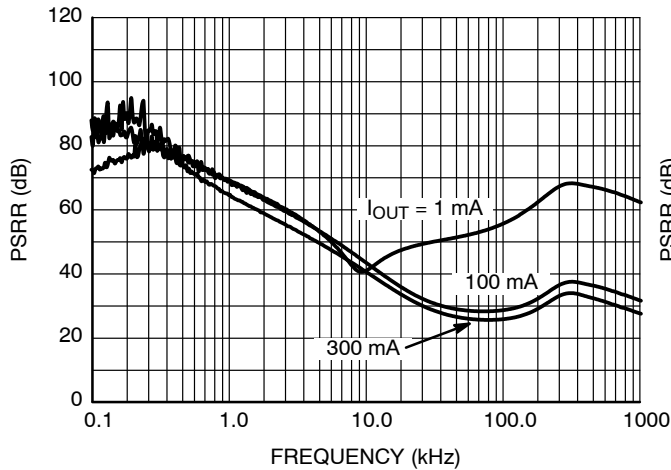


Figure 19. Ripple Rejection vs. Frequency,  
 $V_{OUT} = 6\text{ V}$

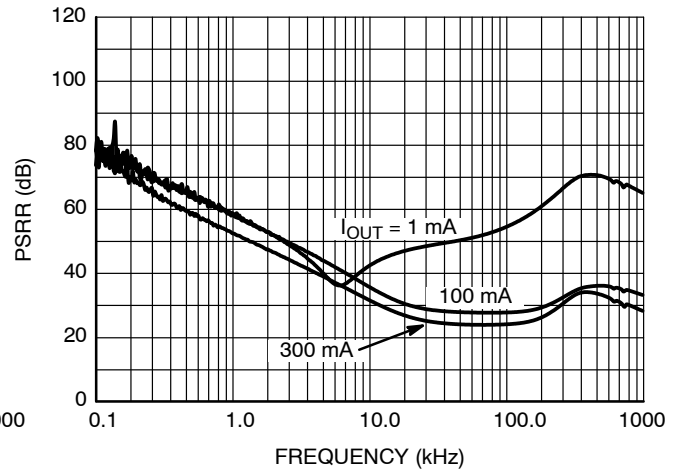
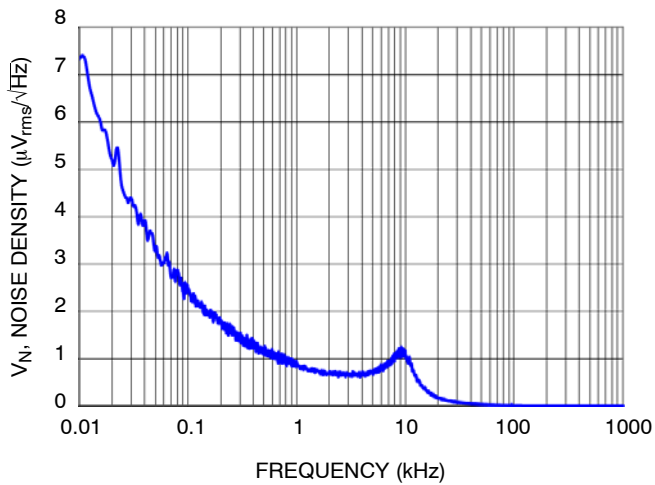
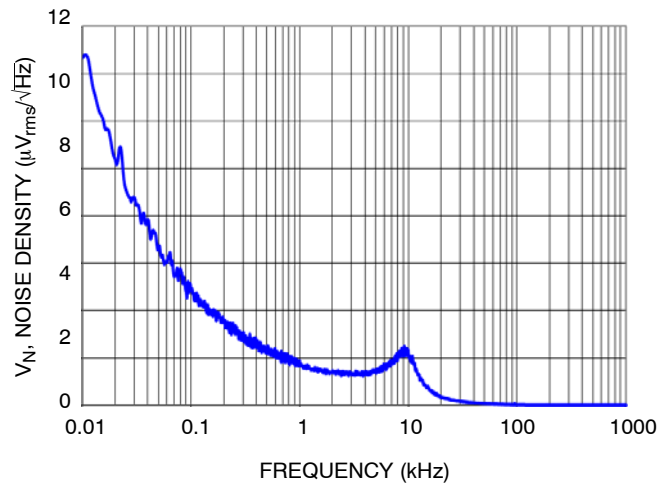


Figure 20. Ripple Rejection vs. Frequency,  
 $V_{OUT} = 12\text{ V}$

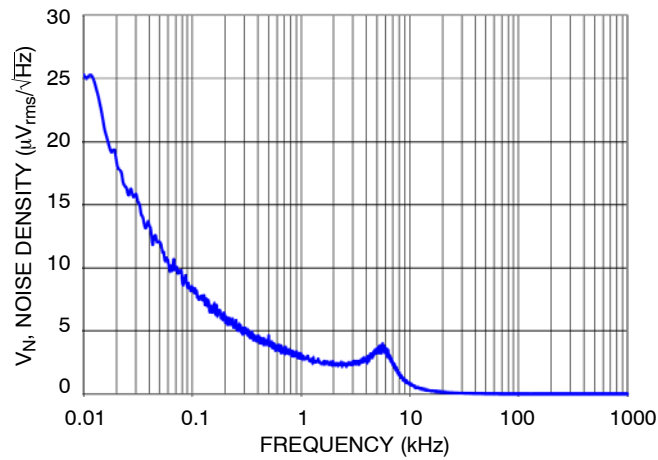
TYPICAL CHARACTERISTICS



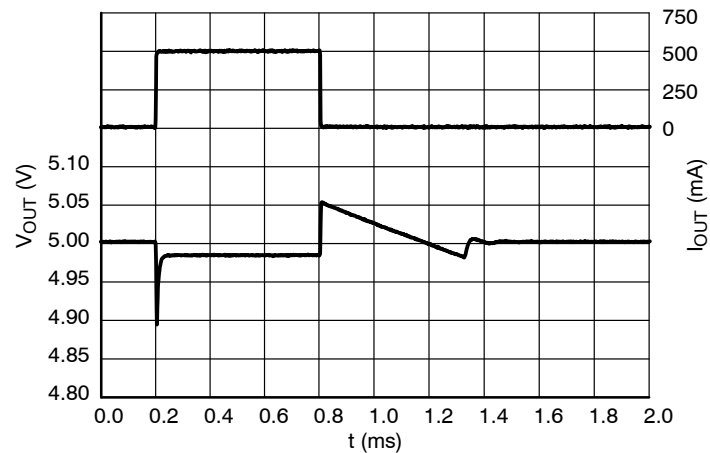
**Figure 21. Output Noise Density,  $V_{OUT} = 5\text{ V}$ ,  
 $V_{IN} = 6.0\text{ V}$ ,  $I_{OUT} = 30\text{ mA}$**



**Figure 22. Output Noise Density,  $V_{OUT} = 6\text{ V}$ ,  
 $V_{IN} = 7.0\text{ V}$ ,  $I_{OUT} = 30\text{ mA}$**



**Figure 23. Output Noise Density,  $V_{OUT} = 12\text{ V}$ ,  
 $V_{IN} = 13\text{ V}$ ,  $I_{OUT} = 30\text{ mA}$**



**Figure 24. Load Transient Response at Output  
Current Step 1 mA to 500 mA,  $V_{OUT} = 5\text{ V}$**



TYPICAL CHARACTERISTICS

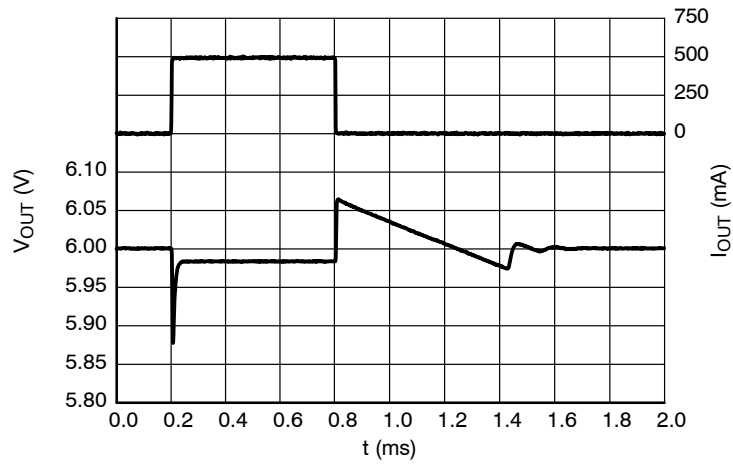


Figure 25. Load Transient Response at Output Current Step 1 mA to 500 mA,  $V_{OUT} = 6\text{ V}$

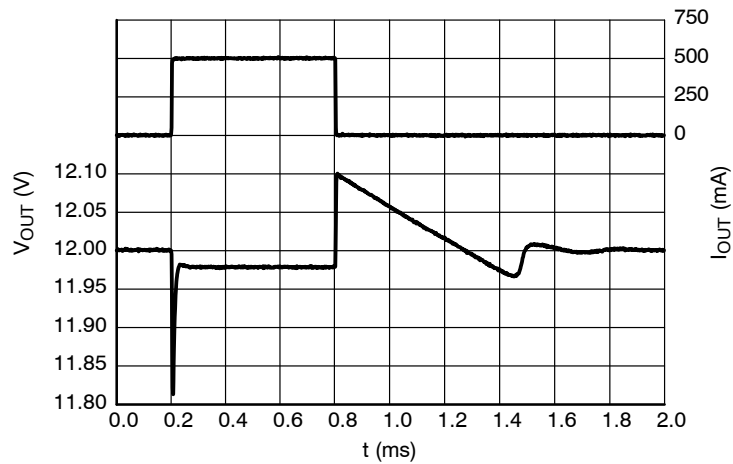


Figure 26. Load Transient Response at Output Current Step 1 mA to 500 mA,  $V_{OUT} = 12\text{ V}$

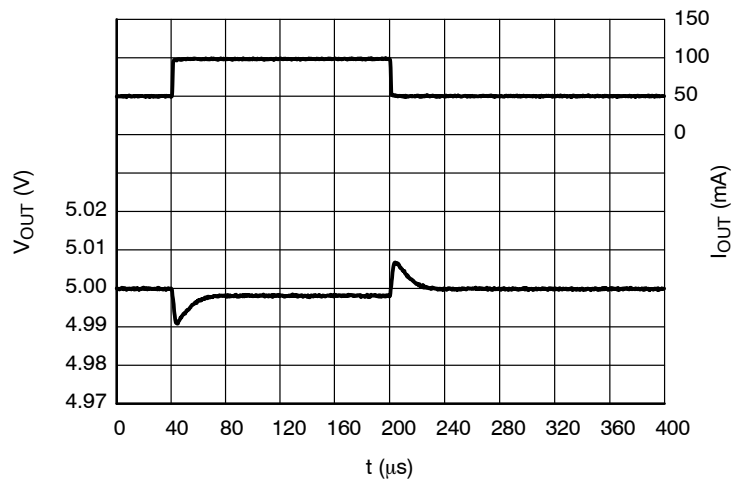
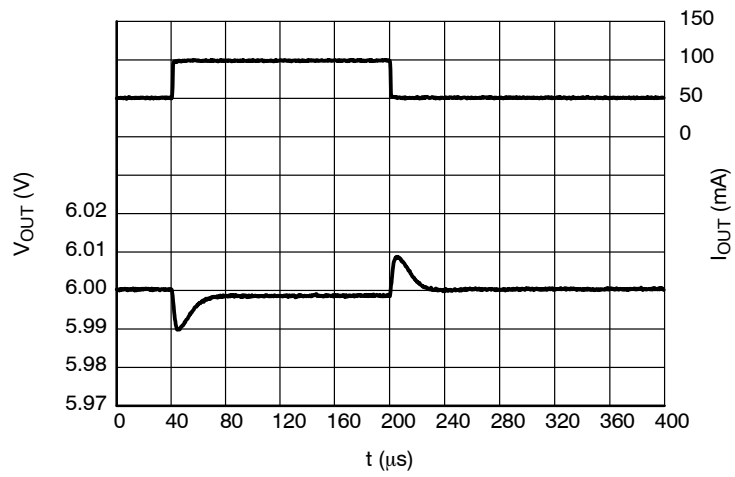
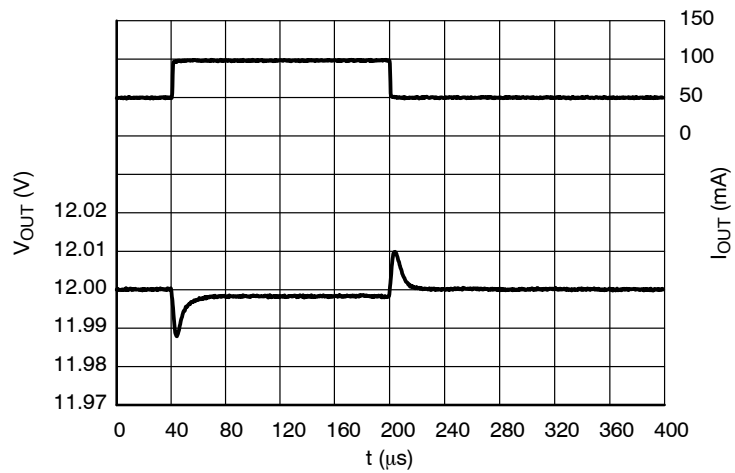


Figure 27. Load Transient Response at Output Current Step 50 mA to 100 mA,  $V_{OUT} = 5\text{ V}$

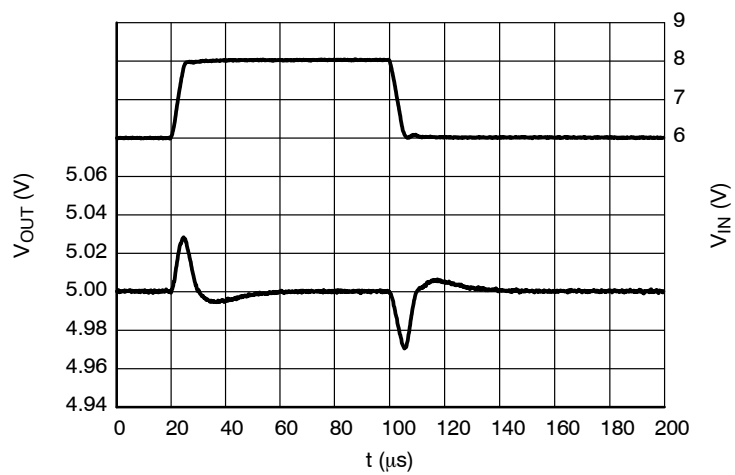
## TYPICAL CHARACTERISTICS



**Figure 28. Load Transient Response at Output Current Step 50 mA to 100 mA,  $V_{OUT} = 6$  V**



**Figure 29. Load Transient Response at Output Current Step 50 mA to 100 mA,  $V_{OUT} = 12$  V**



**Figure 30. Line Transient Response,  $V_{OUT} = 5$  V**

# NCP4629

## TYPICAL CHARACTERISTICS

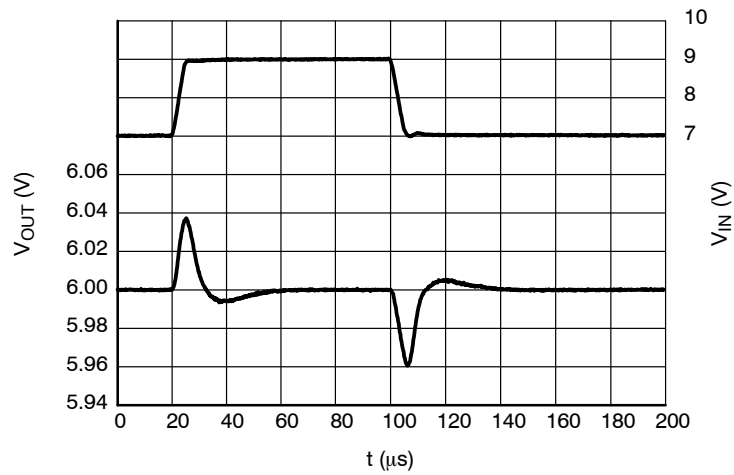


Figure 31. Line Transient Response,  $V_{OUT} = 6\text{ V}$

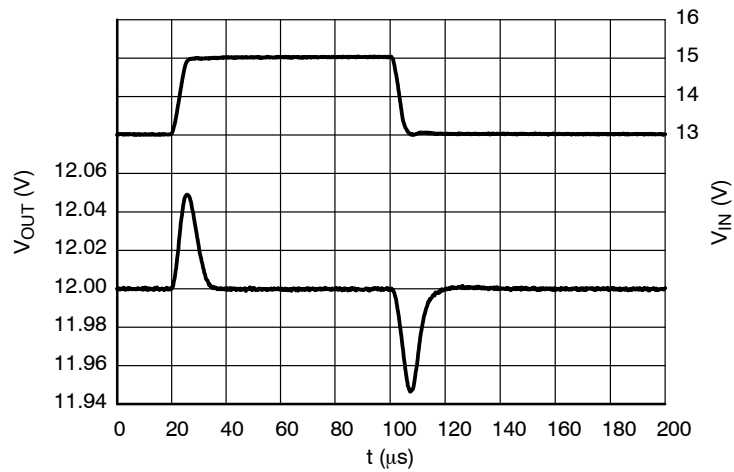


Figure 32. Line Transient Response,  
 $V_{OUT} = 12\text{ V}$

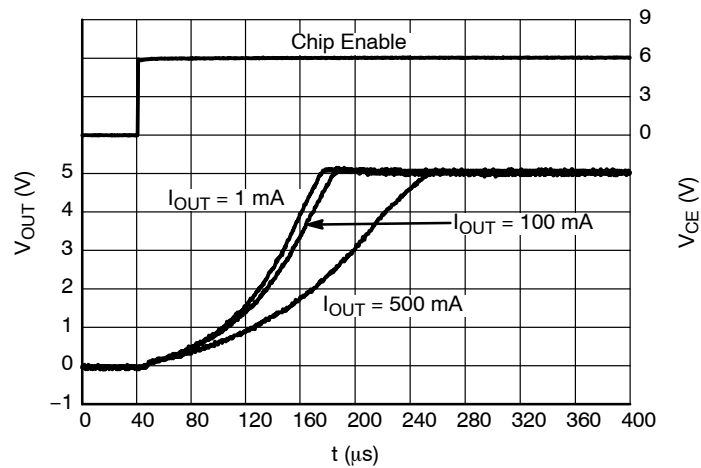


Figure 33. Turn-on Behavior with CE,  
 $V_{OUT} = 5\text{ V}$

## TYPICAL CHARACTERISTICS

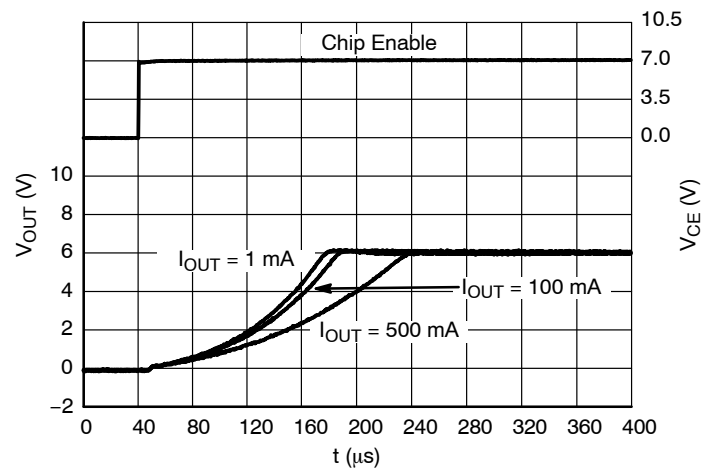


Figure 34. Turn-on Behavior with CE,  
 $V_{OUT} = 6\text{ V}$

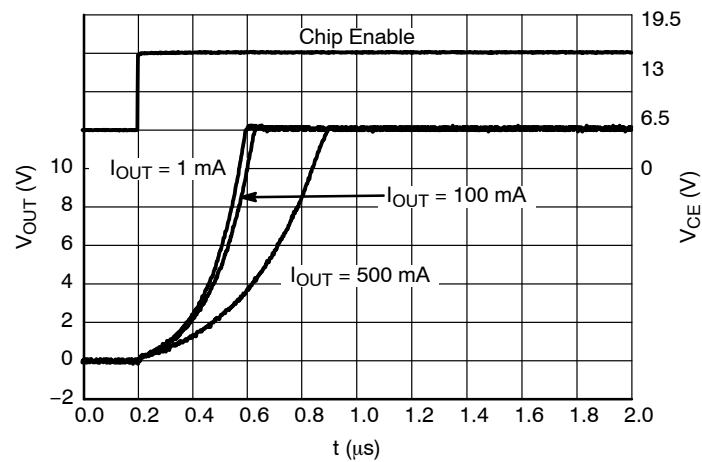


Figure 35. Turn-on Behavior with CE,  
 $V_{OUT} = 12\text{ V}$

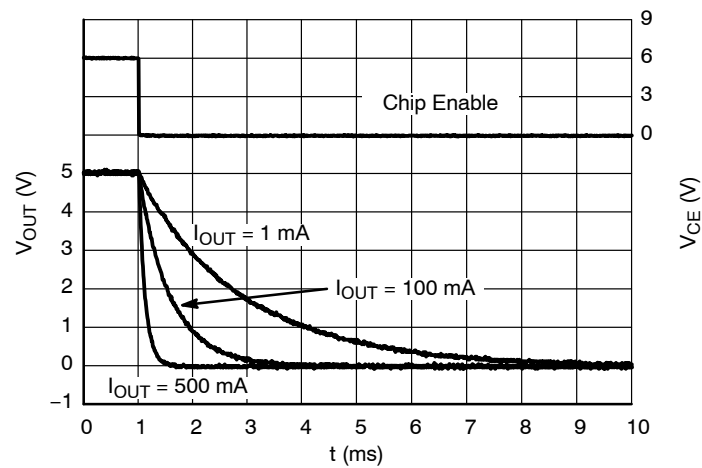


Figure 36. Turn-off Behavior with CE,  
 $V_{OUT} = 5\text{ V}$

TYPICAL CHARACTERISTICS

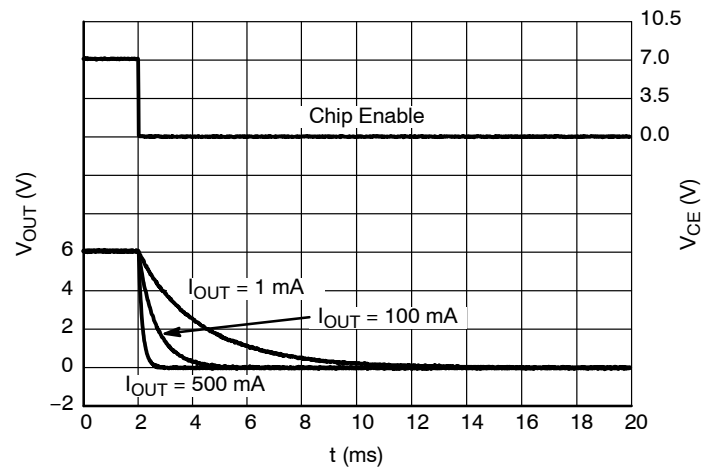


Figure 37. Turn-off Behavior with CE,  
 $V_{OUT} = 6\text{ V}$

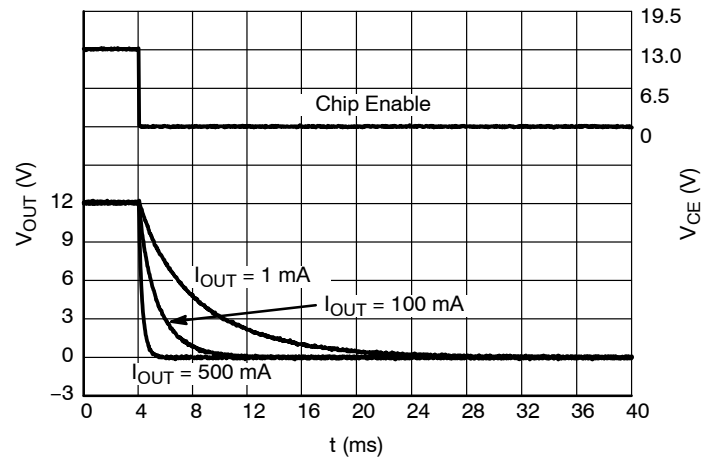


Figure 38. Turn-off Behavior with CE,  
 $V_{OUT} = 12\text{ V}$

## APPLICATION INFORMATION

A typical application circuit for NCP4629 series is shown in Figure 39.

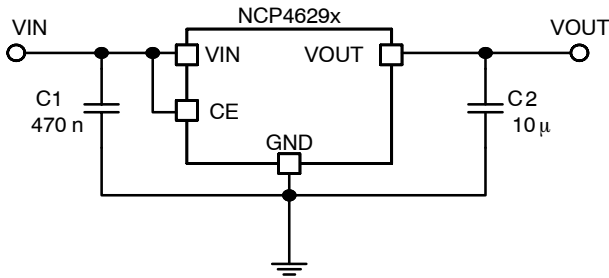


Figure 39. Typical Application Schematic

When VOUT voltage could be higher than VIN voltage it is necessary to use protective diode D1. If there is possibility that VOUT voltage could be negative then it is necessary to use schottky diode D2. See Figure 40 for details. Do not force the voltage to the VOUT pin.

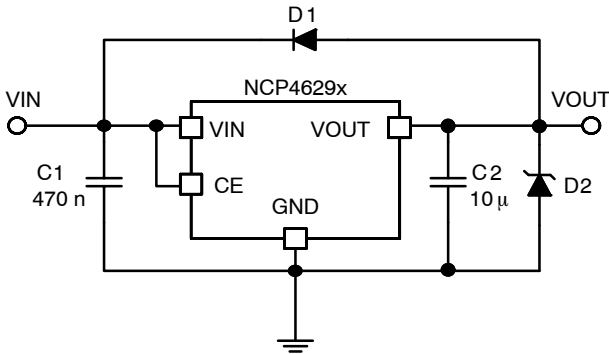


Figure 40. Typical Application Schematic with Protective Diodes

#### Input Decoupling Capacitor (C1)

A 470 nF ceramic input decoupling capacitor should be connected as close as possible to the input and ground pin of the NCP4629. Higher values and lower ESR improves line transient response.

#### Output Decoupling Capacitor (C2)

A 10 μF ceramic output decoupling capacitor is sufficient to achieve stable operation of the IC. If tantalum capacitor is used, and its ESR is high, the loop oscillation may result. The capacitor should be connected as close as possible to the output and ground pin. 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.

#### 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.

The IC includes internal thermal shutdown circuit that stops operation of regulator, if junction temperature is higher than 160°C. After that, when junction temperature decreases below 135°C, the operation of voltage regulator would restart. While high power dissipation condition is, the regulator starts and stops repeatedly and protects itself against overheating.

#### PCB layout

Pins number 2 and 3 must be wired to the GND plane while it is mounted on board. Make VIN and GND lines sufficient. 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†          |
|------------------|------------------------|-------------|---------|------------------|--------------------|
| NCP4629HDT050T5G | 5.0 V                  | Enable High | C1J050B | DPAK-5 (Pb-Free) | 3000 / Tape & Reel |
| NCP4629HDT060T5G | 6.0 V                  | Enable High | C1J060B | DPAK-5 (Pb-Free) | 3000 / Tape & Reel |
| NCP4629HDT120T5G | 12.0 V                 | Enable High | C1J120B | DPAK-5 (Pb-Free) | 3000 / Tape & Reel |

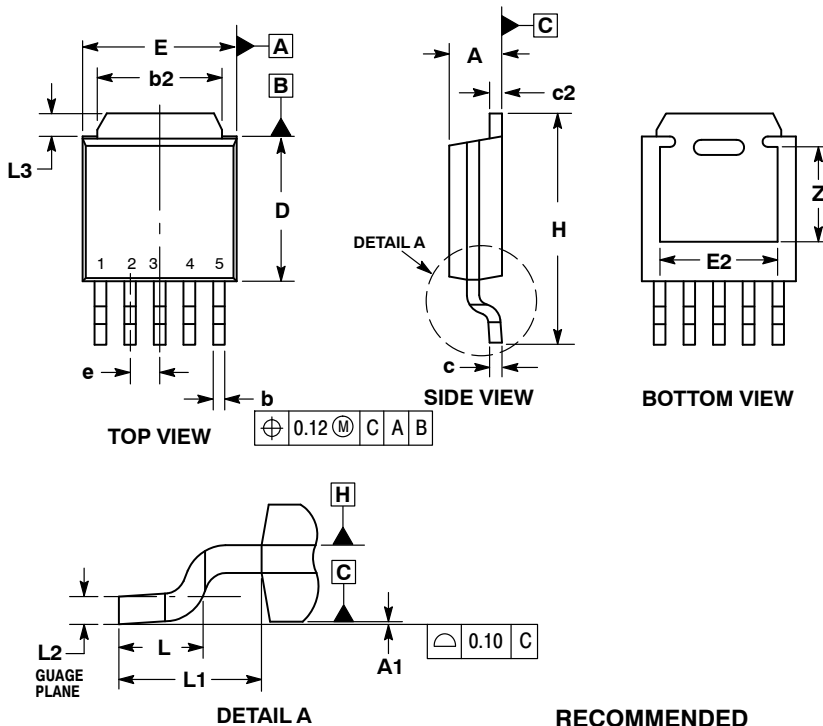
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*To order other package and voltage variants, please contact your ON Semiconductor sales representative.

# NCP4629

## PACKAGE DIMENSIONS

### DPAK-5 (TO-252, 5 LEAD) CASE 369AE ISSUE O

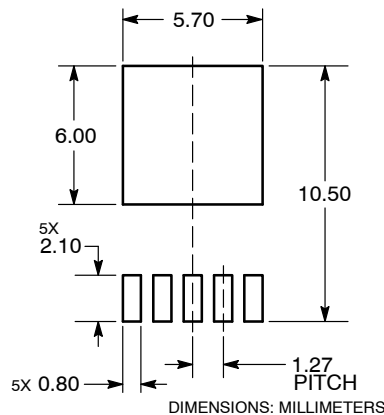


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. THERMAL PAD CONTOUR OPTIONAL, WITHIN DIMENSIONS b3, E2, L3 AND Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15mm PER SIDE. THESE DIMENSIONS TO BE MEASURED AT DATUM H.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

| DIM | MILLIMETERS |       |
|-----|-------------|-------|
|     | MIN         | MAX   |
| A   | 2.10        | 2.50  |
| A1  | 0.00        | 0.13  |
| b   | 0.40        | 0.60  |
| b2  | 5.14        | 5.54  |
| c   | 0.40        | 0.60  |
| c2  | 0.40        | 0.60  |
| D   | 5.90        | 6.30  |
| E   | 6.40        | 6.80  |
| E2  | 5.04 REF    |       |
| e   | 1.27 BSC    |       |
| H   | 9.60        | 10.20 |
| L   | 1.39        | 1.78  |
| L1  | 2.50        | 2.90  |
| L2  | 0.51 BSC    |       |
| L3  | 0.90        | 1.30  |
| Z   | 2.74 REF    |       |

#### RECOMMENDED SOLDERING FOOTPRINT\*

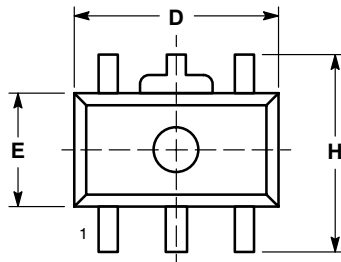


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

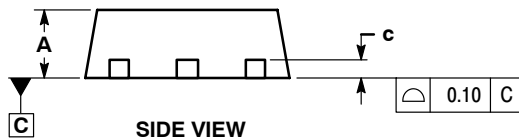
# NCP4629

## PACKAGE DIMENSIONS

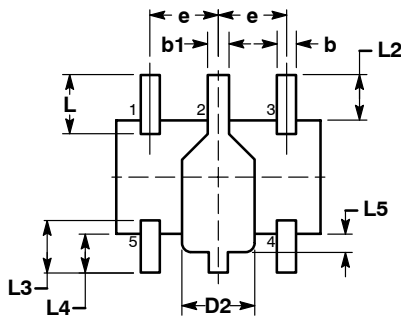
### SOT-89, 5 LEAD CASE 528AB ISSUE O



TOP VIEW



SIDE VIEW



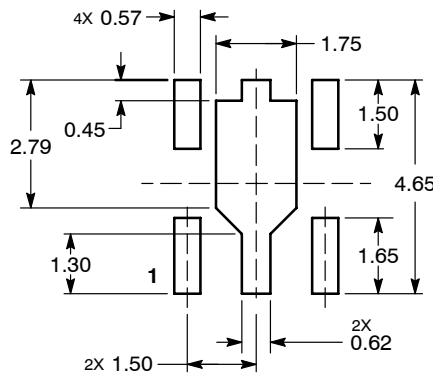
BOTTOM VIEW

#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. LEAD THICKNESS INCLUDES LEAD FINISH.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. DIMENSIONS L, L2, L3, L4, L5, AND H ARE MEASURED AT DATUM PLANE C.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 1.40        | 1.60 |
| b   | 0.32        | 0.52 |
| b1  | 0.37        | 0.57 |
| c   | 0.30        | 0.50 |
| D   | 4.40        | 4.60 |
| D2  | 1.40        | 1.80 |
| E   | 2.40        | 2.60 |
| e   | 1.40        | 1.60 |
| H   | 4.25        | 4.45 |
| L   | 1.10        | 1.50 |
| L2  | 0.80        | 1.20 |
| L3  | 0.95        | 1.35 |
| L4  | 0.65        | 1.05 |
| L5  | 0.20        | 0.60 |

#### RECOMMENDED MOUNTING 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.

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