

# NCP5351

## 4 A Synchronous Buck Power MOSFET Driver

The NCP5351 is a dual MOSFET gate driver optimized to drive the gates of both high-side and low-side Power MOSFETs in a Synchronous Buck converter. The NCP5351 is an excellent companion to multiphase controllers that do not have integrated gate drivers, such as ON Semiconductor's CS5323, CS5305 or CS5307. This architecture provides a power supply designer the flexibility to locate the gate drivers close to the MOSFETs.

The 4.0 A drive capability makes the NCP5351 ideal for minimizing switching losses in MOSFETs with large input capacitance. Optimized internal, adaptive nonoverlap circuitry further reduces switching losses by preventing simultaneous conduction of both MOSFETs.

The floating top driver design can accommodate MOSFET drain voltages as high as 25 V. Both gate outputs can be driven low, and supply current reduced to less than 25  $\mu$ A, by applying a low logic level to the Enable (EN) pin. An undervoltage lockout function ensures that both driver outputs are low when the supply voltage is low, and a thermal shutdown function provides the IC with overtemperature protection.

The NCP5351 is pin-to-pin compatible with the SC1205 and is available in a standard SO-8 package and thermally enhanced DFN10.

### Features

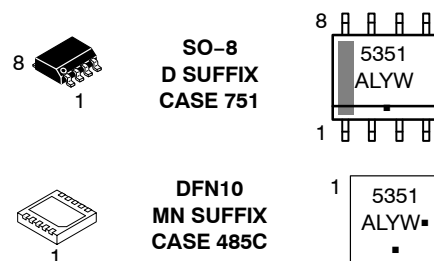
- 4.0 A Peak Drive Current
- Rise and Fall Times < 15 ns Typical into 6000 pF
- Propagation Delay from Inputs to Outputs < 20 ns
- Adaptive Nonoverlap Time Optimized for Large Power MOSFETs
- Floating Top Driver Accommodates Applications Up to 25 V
- Undervoltage Lockout to Prevent Switching when the Input Voltage is Low
- Thermal Shutdown Protection Against Overtemperature
- < 1.0 mA Quiescent Current – Enabled
- 25  $\mu$ A Quiescent Current – Disabled
- Internal TG to DRN Pulldown Resistor Prevents HV Supply-Induced Turn On of High-Side MOSFET
- Pb-Free Package is Available



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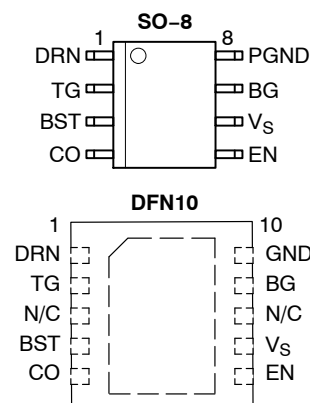
### MARKING DIAGRAMS



A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 12 of this data sheet.

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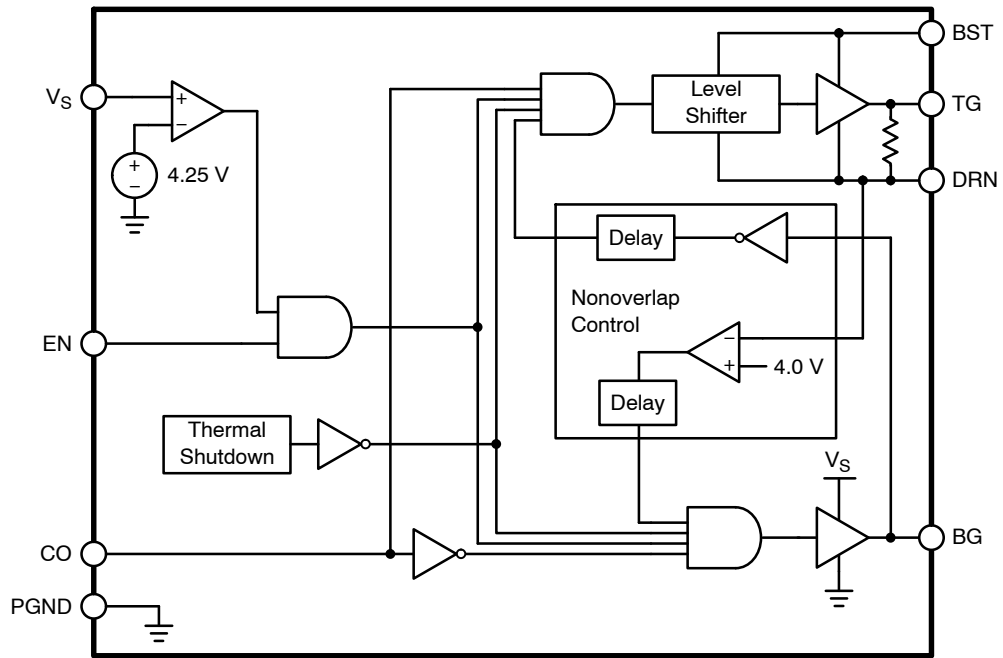


Figure 1. Block Diagram

Table 1. Input-Output Truth Table

| EN | CO | DRN     | TG | BG |
|----|----|---------|----|----|
| L  | X  | X       | L  | L  |
| H  | L  | < 3.0 V | L  | H  |
| H  | H  | < 3.0 V | H  | L  |
| H  | L  | > 5.0 V | L  | L  |
| H  | H  | > 5.0 V | H  | L  |

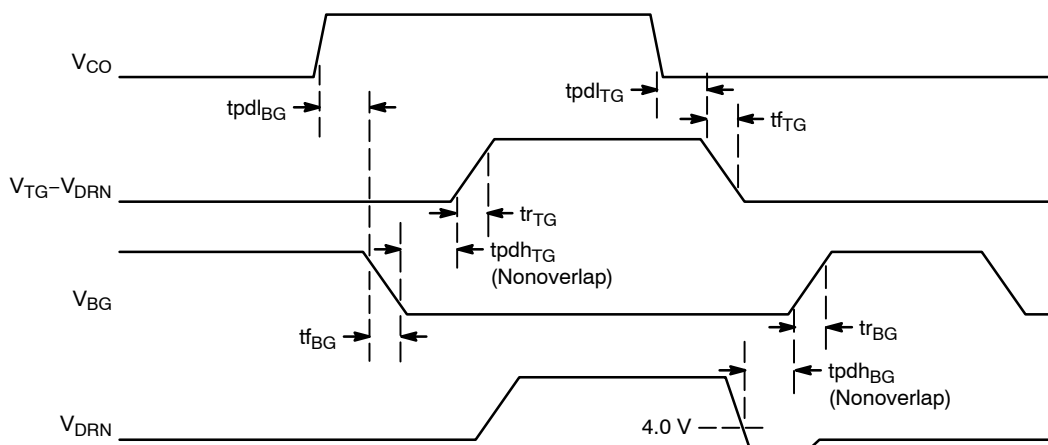


Figure 2. Timing Diagram

# NCP5351

## PACKAGE PIN DESCRIPTION

| Pin Number |        | Pin Symbol | Description                                                                                                                                                                                                                     |
|------------|--------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SO-8       | DFN-10 |            |                                                                                                                                                                                                                                 |
| 1          | 1      | DRN        | The switching node common to the high and low-side FETs. The high-side (TG) driver and supply (BST) are referenced to this pin.                                                                                                 |
| 2          | 2      | TG         | Driver output to the high-side MOSFET gate.                                                                                                                                                                                     |
| 3          | 4      | BST        | Bootstrap supply voltage input. In conjunction with a Schottky diode to $V_S$ , a 0.1 $\mu\text{F}$ to 1.0 $\mu\text{F}$ ceramic capacitor connected between BST and DRN develops supply voltage for the high-side driver (TG). |
| 4          | 5      | CO         | Logic level control input produces complementary output states – no inversion at TG; inversion at BG.                                                                                                                           |
| –          | 3, 8   | N/C        | Not Connected.                                                                                                                                                                                                                  |
| 5          | 6      | EN         | Logic level enable input forces TG and BG low, and supply current to 10 $\mu\text{A}$ when EN is low.                                                                                                                           |
| 6          | 7      | $V_S$      | Power supply input. A 0.1 $\mu\text{F}$ to 1.0 $\mu\text{F}$ ceramic capacitor should be connected from this pin to PGND.                                                                                                       |
| 7          | 9      | BG         | Driver output to the low-side (synchronous rectifier) MOSFET gate.                                                                                                                                                              |
| 8          | –      | PGND       | Ground.                                                                                                                                                                                                                         |
| –          | 10     | GND        | Ground.                                                                                                                                                                                                                         |

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## MAXIMUM RATINGS – SO-8

| Rating                                                                                                        | Value                | Unit         |
|---------------------------------------------------------------------------------------------------------------|----------------------|--------------|
| Operating Junction Temperature, $T_J$                                                                         | Internally Limited   | °C           |
| Package Thermal Resistance: SO-8<br>Junction-to-Case, $R_{\theta JC}$<br>Junction-to-Ambient, $R_{\theta JA}$ | 45<br>165            | °C/W<br>°C/W |
| Storage Temperature Range, $T_S$                                                                              | -65 to 150           | °C           |
| Lead Temperature Soldering:<br>Reflow: (SMD styles only) (Note 1)<br>Pb-Free                                  | 230 peak<br>260 peak | °C           |
| MSL Rating                                                                                                    | 1                    | -            |

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.

NOTE: This device is ESD sensitive. Use standard ESD precautions when handling.

1. 60 seconds maximum above 183°C.

## MAXIMUM RATINGS – DFN-10

| Rating                                                                       | Symbol    | Value           | Unit |
|------------------------------------------------------------------------------|-----------|-----------------|------|
| Thermal Resistance, Junction-to-Air                                          | $R_{JA}$  | 68.5            | °C/W |
| Operating Ambient Temperature Range                                          | $T_A$     | -30 to 85       | °C   |
| ESD Withstand Voltage<br>Human Body Model (Note 2)<br>Machine Model (Note 2) | $V_{ESD}$ | > 2500<br>> 150 | V    |
| Moisture Sensitivity                                                         | MSL       | Level 1         |      |
| Storage Temperature Range                                                    | $T_{stg}$ | -55 to 150      | °C   |
| Junction Operating Temperature                                               | $T_J$     | -30 to 125      | °C   |

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.

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

Human Body Model, 100 pF discharge through a 1.5 k $\Omega$  following specification JESD22/A114.

Machine Model, 200 pF discharged through all pins following specification JESD22/A115.

Latchup as per JESD78 Class II: > 100 mA.

## MAXIMUM RATINGS

| Pin Symbol | Pin Name                                    | $V_{MAX}$                      | $V_{MIN}$                                          | $I_{SOURCE}$                            | $I_{SINK}$                              |
|------------|---------------------------------------------|--------------------------------|----------------------------------------------------|-----------------------------------------|-----------------------------------------|
| $V_S$      | Main Supply Voltage Input                   | 6.3 V                          | -0.3 V                                             | NA                                      | 4.0 A Peak (< 100 $\mu$ s)<br>250 mA DC |
| BST        | Bootstrap Supply Voltage Input              | 25 V wrt/PGND<br>6.3 V wrt/DRN | -0.3 V wrt/DRN                                     | NA                                      | 4.0 A Peak (< 100 $\mu$ s)<br>250 mA DC |
| DRN        | Switching Node<br>(Bootstrap Supply Return) | 25 V                           | -1.0 V DC<br>-5.0 V for 100 ns<br>-6.0 V for 20 ns | 4.0 A Peak (< 100 $\mu$ s)<br>250 mA DC | NA                                      |
| TG         | High-Side Driver Output<br>(Top Gate)       | 25 V wrt/PGND<br>6.3 V wrt/DRN | -0.3 V wrt/DRN                                     | 4.0 A Peak (< 100 $\mu$ s)<br>250 mA DC | 4.0 A Peak (< 100 $\mu$ s)<br>250 mA DC |
| BG         | Low-Side Driver Output<br>(Bottom Gate)     | 6.3 V                          | -0.3 V                                             | 4.0 A Peak (< 100 $\mu$ s)<br>250 mA DC | 4.0 A Peak (< 100 $\mu$ s)<br>250 mA DC |
| CO         | TG & BG Control Input                       | 6.3 V                          | -0.3 V                                             | 1.0 mA                                  | 1.0 mA                                  |
| EN         | Enable Input                                | 6.3 V                          | -0.3 V                                             | 1.0 mA                                  | 1.0 mA                                  |
| PGND       | Ground                                      | 0 V                            | 0 V                                                | 4.0 A Peak (< 100 $\mu$ s)<br>250 mA DC | NA                                      |

NOTE: All voltages are with respect to PGND except where noted.

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**ELECTRICAL CHARACTERISTICS** ( $0^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ;  $V_S = 5.0\text{ V}$ ;  $4.0\text{ V} < V_{\text{BST}} < 25\text{ V}$ ;  $V_{\text{EN}} = V_S$ ; unless otherwise noted)

| Parameter | Test Conditions | Min | Typ | Max | Unit |
|-----------|-----------------|-----|-----|-----|------|
|-----------|-----------------|-----|-----|-----|------|

## DC OPERATING SPECIFICATIONS POWER SUPPLY

|                                               |                                                                              |   |     |    |               |
|-----------------------------------------------|------------------------------------------------------------------------------|---|-----|----|---------------|
| $V_S$ Quiescent Current, Operating            | $V_{\text{CO}} = 0\text{ V}$ , $4.5\text{ V}$ ; No output switching          | – | 1.0 | –  | mA            |
| $V_{\text{BST}}$ Quiescent Current, Operating | $V_{\text{CO}} = 0\text{ V}$ , $4.5\text{ V}$ ; No output switching          | – | 50  | –  | $\mu\text{A}$ |
| Quiescent Current, Non-Operating              | $V_{\text{EN}} = 0\text{ V}$ ; $V_{\text{CO}} = 0\text{ V}$ , $4.5\text{ V}$ | – | –   | 25 | $\mu\text{A}$ |

## Undervoltage Lockout

|                 |                          |      |      |      |    |
|-----------------|--------------------------|------|------|------|----|
| Start Threshold | $\text{CO} = 0\text{ V}$ | 4.05 | 4.25 | 4.48 | V  |
| Hysteresis      | $\text{CO} = 0\text{ V}$ | –    | 275  | –    | mV |

## CO INPUT CHARACTERISTICS

|                    |                           |     |   |     |               |
|--------------------|---------------------------|-----|---|-----|---------------|
| High Threshold     | –                         | 2.0 | – | –   | V             |
| Low Threshold      | –                         | –   | – | 0.8 | V             |
| Input Bias Current | $0 < V_{\text{CO}} < V_S$ | –   | 0 | 1.0 | $\mu\text{A}$ |

## EN INPUT CHARACTERISTICS

|                    |                                         |     |   |     |               |
|--------------------|-----------------------------------------|-----|---|-----|---------------|
| High Threshold     | Both outputs respond to CO              | 2.0 | – | –   | V             |
| Low Threshold      | Both outputs are low, independent of CO | –   | – | 0.8 | V             |
| Input Bias Current | $0 < V_{\text{EN}} < V_S$               | –   | 0 | 10  | $\mu\text{A}$ |

## THERMAL SHUTDOWN

|                            |   |   |     |   |                    |
|----------------------------|---|---|-----|---|--------------------|
| Overtemperature Trip Point | – | – | 170 | – | $^{\circ}\text{C}$ |
| Hysteresis                 | – | – | 30  | – | $^{\circ}\text{C}$ |

## HIGH-SIDE DRIVER

|                              |                                                                                                                                                                                            |   |      |   |          |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|---|----------|
| Peak Output Current          | –                                                                                                                                                                                          | – | 4.0  | – | A        |
| Output Resistance (Sourcing) | Duty Cycle $< 2.0\%$ , Pulse Width $< 100\ \mu\text{s}$ , $T_J = 125^{\circ}\text{C}$ , $V_{\text{BST}} - V_{\text{DRN}} = 4.5\text{ V}$ , $V_{\text{TG}} = 4.0\text{ V} + V_{\text{DRN}}$ | – | 0.5  | – | $\Omega$ |
| Output Resistance (Sinking)  | Duty Cycle $< 2.0\%$ , Pulse Width $< 100\ \mu\text{s}$ , $T_J = 125^{\circ}\text{C}$ , $V_{\text{BST}} - V_{\text{DRN}} = 4.5\text{ V}$ , $V_{\text{TG}} = 0.5\text{ V} + V_{\text{DRN}}$ | – | 0.42 | – | $\Omega$ |

## LOW-SIDE DRIVER

|                              |                                                                                                                                               |   |      |   |          |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---|------|---|----------|
| Peak Output Current          | –                                                                                                                                             | – | 4.0  | – | A        |
| Output Resistance (Sourcing) | Duty Cycle $< 2.0\%$ , Pulse Width $< 100\ \mu\text{s}$ , $T_J = 125^{\circ}\text{C}$ , $V_S = 4.5\text{ V}$ , $V_{\text{BG}} = 4.0\text{ V}$ | – | 0.6  | – | $\Omega$ |
| Output Resistance (Sinking)  | Duty Cycle $< 2.0\%$ , Pulse Width $< 100\ \mu\text{s}$ , $T_J = 125^{\circ}\text{C}$ , $V_S = 4.5\text{ V}$ , $V_{\text{BG}} = 0.5\text{ V}$ | – | 0.42 | – | $\Omega$ |

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**ELECTRICAL CHARACTERISTICS (continued)** ( $0^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ;  $V_S = 5.0\text{ V}$ ;  $4.0\text{ V} < V_{\text{BST}} < 25\text{ V}$ ;  $V_{\text{EN}} = V_S$ ,  $C_{\text{LOAD}} = 5.7\text{ nF}$ ; unless otherwise noted.)

| Parameter | Test Conditions | Min | Typ | Max | Unit |
|-----------|-----------------|-----|-----|-----|------|
|-----------|-----------------|-----|-----|-----|------|

## AC OPERATING SPECIFICATIONS HIGH-SIDE DRIVER

|                                                            |                                                                                |    |     |    |    |
|------------------------------------------------------------|--------------------------------------------------------------------------------|----|-----|----|----|
| Rise Time                                                  | $V_{\text{BST}} - V_{\text{DRN}} = 5.0\text{ V}$ , $T_J = 125^{\circ}\text{C}$ | –  | 8.0 | 16 | ns |
| Fall Time                                                  | $V_{\text{BST}} - V_{\text{DRN}} = 5.0\text{ V}$ , $T_J = 125^{\circ}\text{C}$ | –  | 14  | 21 | ns |
| Propagation Delay Time,<br>TG Going High (Nonoverlap Time) | $V_{\text{BST}} - V_{\text{DRN}} = 5.0\text{ V}$ , $T_J = 125^{\circ}\text{C}$ | 30 | 45  | 60 | ns |
| Propagation Delay Time,<br>TG Going Low                    | $V_{\text{BST}} - V_{\text{DRN}} = 5.0\text{ V}$ , $T_J = 125^{\circ}\text{C}$ | –  | 18  | 37 | ns |

## LOW-SIDE DRIVER

|                                                                |                             |    |    |    |    |
|----------------------------------------------------------------|-----------------------------|----|----|----|----|
| Rise Time                                                      | $T_J = 125^{\circ}\text{C}$ | –  | 10 | 15 | ns |
| Fall Time                                                      | $T_J = 125^{\circ}\text{C}$ | –  | 12 | 20 | ns |
| Propagation Delay Time,<br>BG Going High (Non-Overlap<br>Time) | $T_J = 125^{\circ}\text{C}$ | 25 | 55 | 80 | ns |
| Propagation Delay Time,<br>BG Going Low                        | $T_J = 125^{\circ}\text{C}$ | –  | 10 | 18 | ns |

## UNDERVOLTAGE LOCKOUT

|               |                                                                                                                                                                                                     |   |     |   |               |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|---|---------------|
| $V_S$ Rising  | $V_{\text{EN}} = V_S$ , $\text{CO} = 0\text{ V}$ , $dV_S/dt > 1.0\text{ V}/\mu\text{s}$ , from $4.0\text{ V}$ to $4.5\text{ V}$ , time to $\text{BG} > 1.0\text{ V}$ , $T_J = 125^{\circ}\text{C}$  | – | 30  | – | $\mu\text{s}$ |
| $V_S$ Falling | $V_{\text{EN}} = V_S$ , $\text{CO} = 0\text{ V}$ , $dV_S/dt < -1.0\text{ V}/\mu\text{s}$ , from $4.5\text{ V}$ to $4.0\text{ V}$ , time to $\text{BG} < 1.0\text{ V}$ , $T_J = 125^{\circ}\text{C}$ | – | 500 | – | $\mu\text{s}$ |

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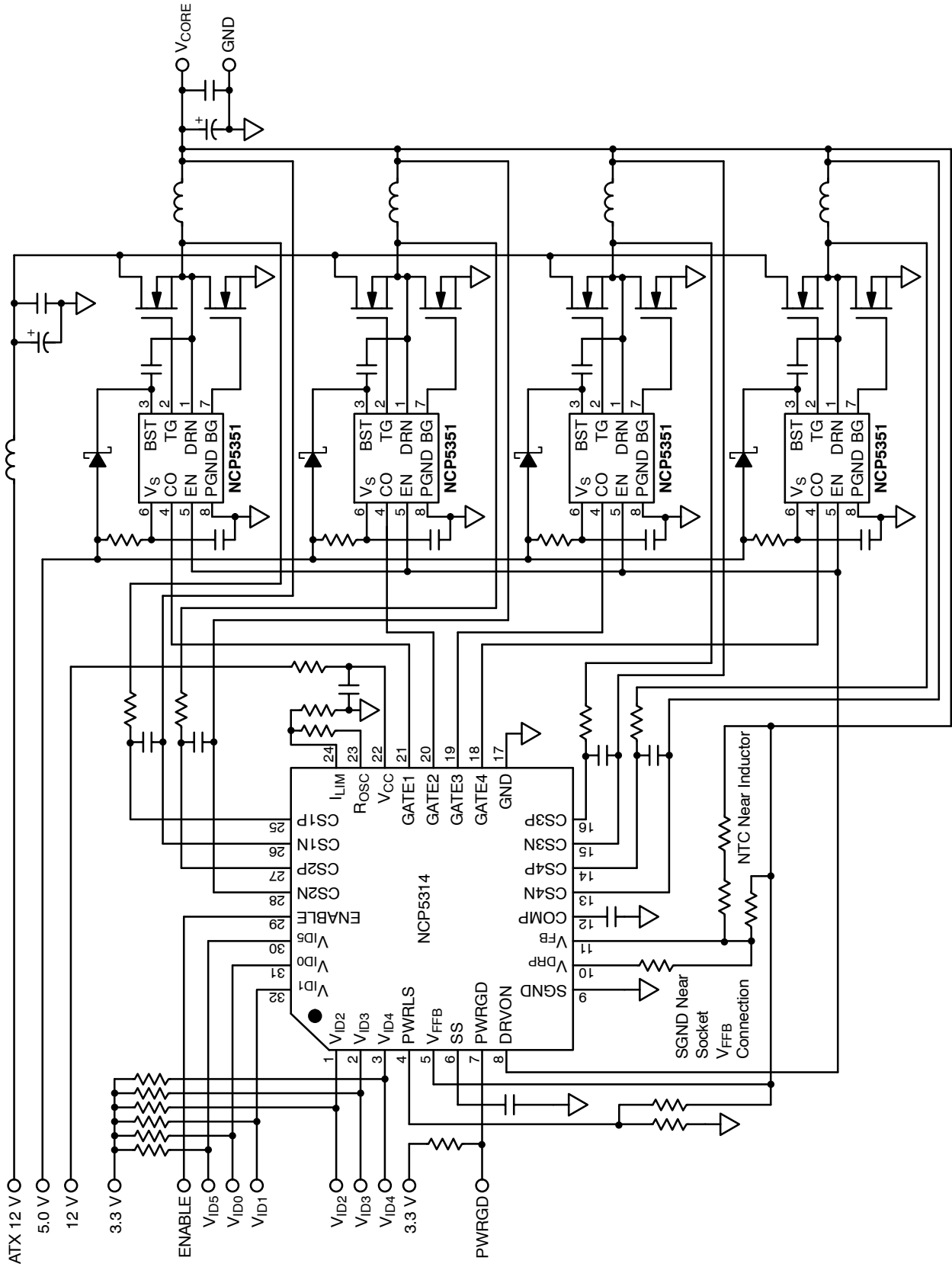


Figure 3. Application Diagram

APPLICATIONS INFORMATION

Theory Of Operation

Enable Pin

The Enable Pin (EN) is controlled by a logic level input. With a logic level high on the EN pin, the output states of the drivers are controlled by applying a logic level voltage to the CO pin. With a logic level low both gates are forced low. By bringing both gates low when disabling, the output voltage is prevented from ringing below ground, which could potentially cause damage to the microprocessor or the device being powered.

Undervoltage Lockout

The TG and BG are held low until  $V_S$  reaches 4.25 V during startup. The CO pin takes control of the gates' states when the  $V_S$  threshold is exceeded. If  $V_S$  decreases 300 mV below threshold, the output gate will be forced low and remain low until  $V_S$  rises above startup threshold.

Adaptive Nonoverlap

The Adaptive Nonoverlap prevents a condition where the top and bottom MOSFETs conduct at the same time and short the input supply. When the top MOSFET is turning off,

the drain (switch node) is sampled and the BG is disabled for a fixed delay time ( $tpdh_{BG}$ ) after the drain drops below 4 V, thus eliminating the possibility of shoot-through. When the bottom MOSFET is turning off, TG is disabled for a fixed delay ( $tpdh_{TG}$ ) after BG drops below 2.0 V. (See Figure 2 for complete timing information).

Layout Guidelines

When designing any switching regulator, the layout is very important for proper operation. The designer should follow some simple layout guidelines when incorporating gate drivers in their designs. Gate drives experience high di/dt during switching and the inductance of gate drive traces should be minimized. Gate drive traces should be kept as short and wide as practical and should have a return path directly below the gate trace. The use of a ground plane is a desirable way to return ground signals. Also, component location will make a difference. The boost and the  $V_S$  capacitor are the most critical and should be placed as close as possible to the driver IC pins, as shown in Figure 4(a), C21 and C17.

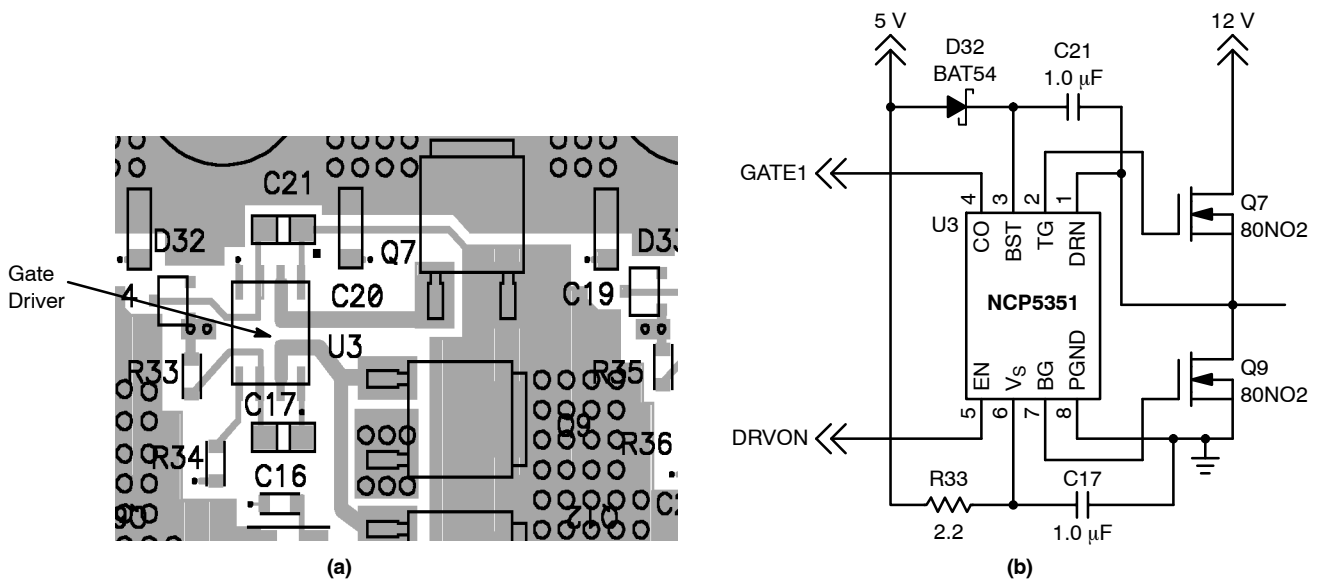
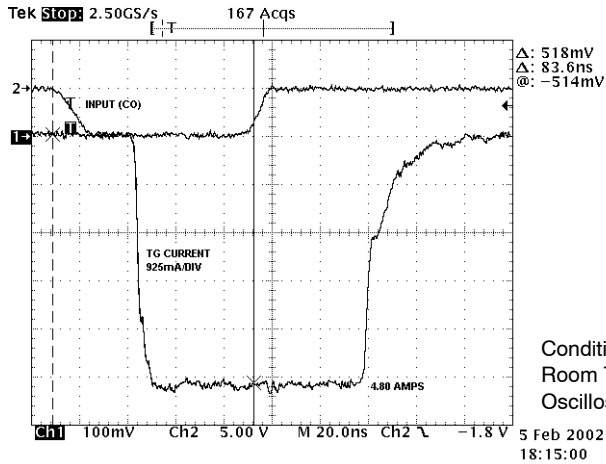


Figure 4. Proper Layout (a), Component Selection (b)



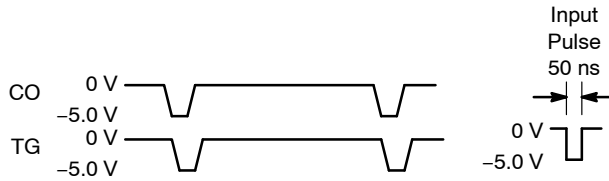
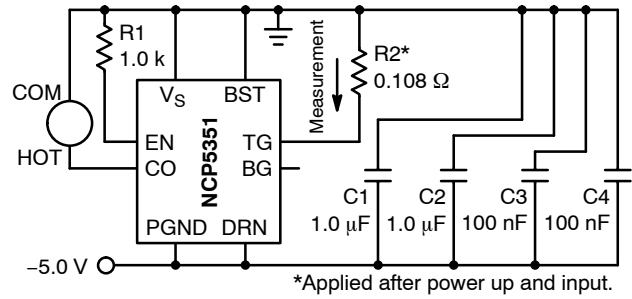
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## TYPICAL PERFORMANCE CHARACTERISTICS

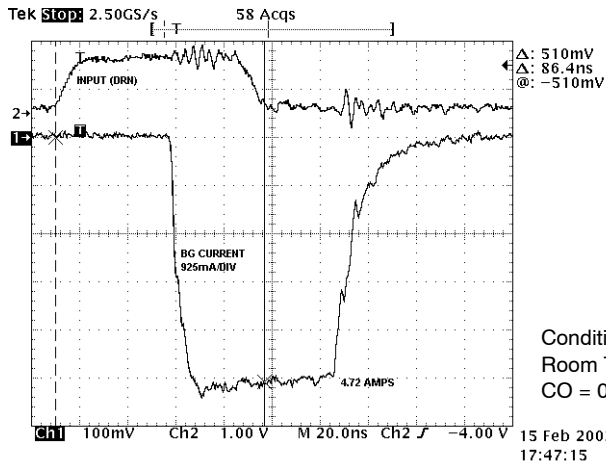


Conditions: BST - DRN = 5.0 V;  
 Room Temperature;  
 Oscilloscope referenced to  $V_S$  (5.0 V).

**Figure 5. Top Gate Sinking Current from 0.108 Ω**

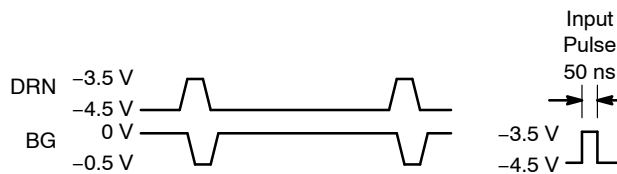
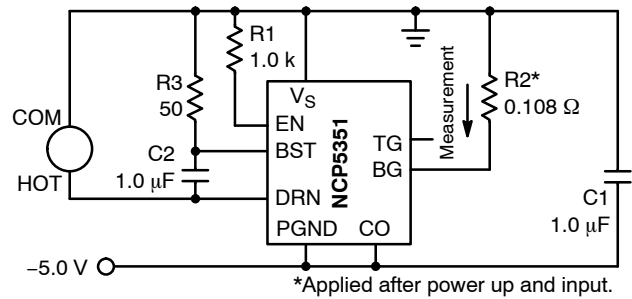


**Figure 6. Top Gate Sinking**



Conditions:  $V_S$  = 5.0 V;  
 Room Temperature;  
 CO = 0 V.

**Figure 7. Bottom Gate Sinking Current from 0.108 Ω**



**Figure 8. Bottom Gate Sinking**

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## TYPICAL PERFORMANCE CHARACTERISTICS

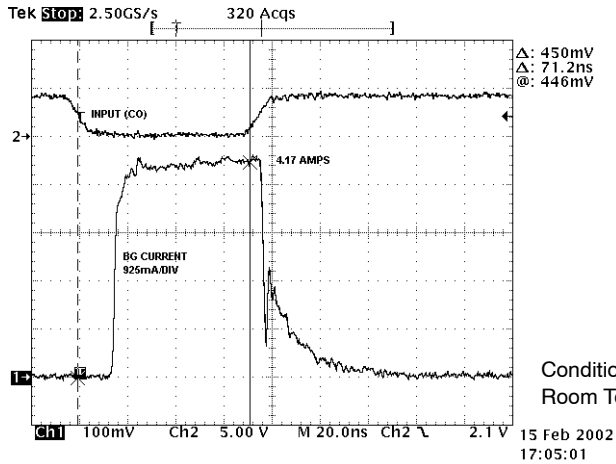


Figure 9. Bottom Gate Sourcing Current into  $0.108\ \Omega$

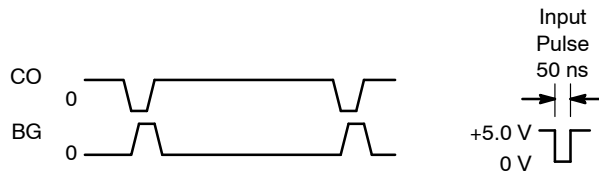
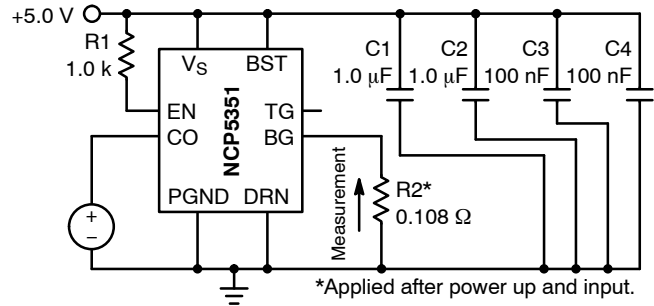


Figure 10. Bottom Gate Sourcing

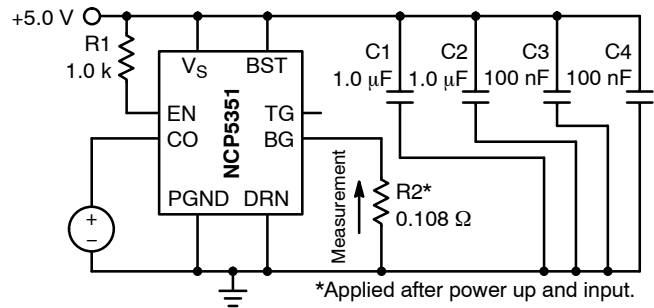
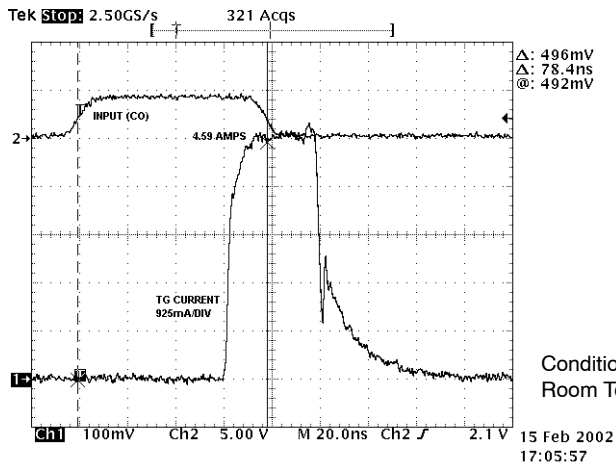


Figure 11. Top Gate Sourcing Current into  $0.108\ \Omega$

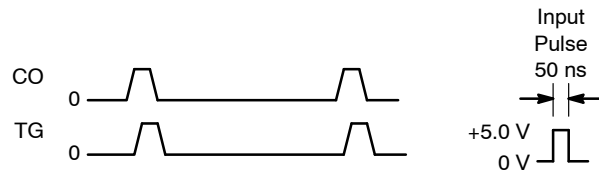


Figure 12. Top Gate Sourcing

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## TYPICAL PERFORMANCE CHARACTERISTICS

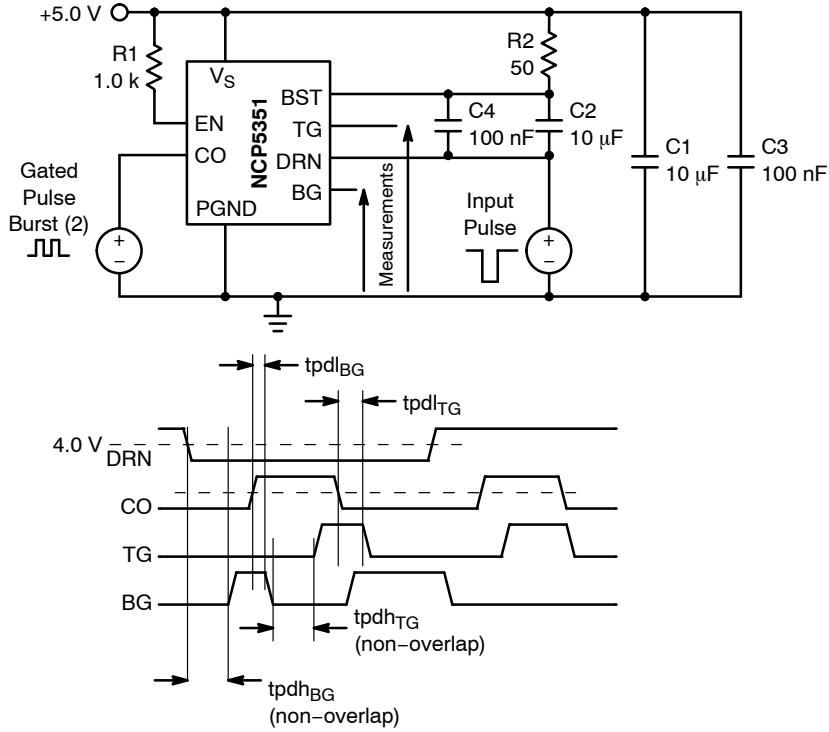
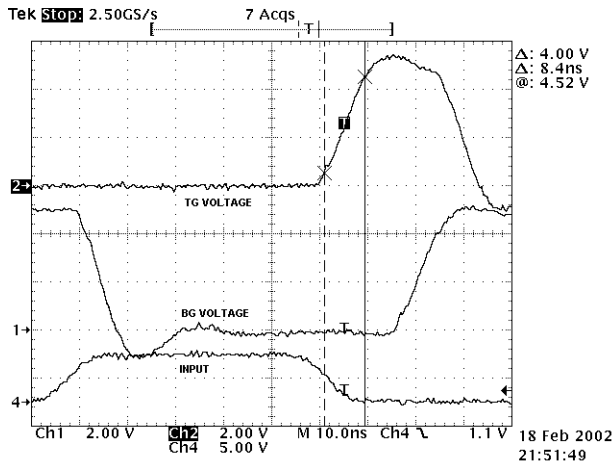
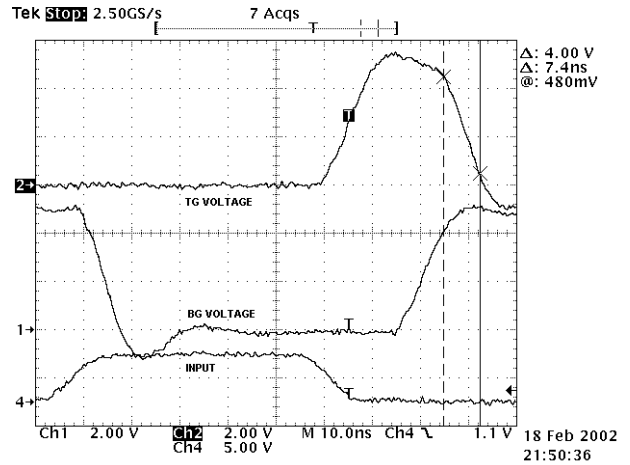


Figure 13. Nonoverlap Test Configuration



Conditions:  $V_S = 5.0\text{ V}$ ;  $BST - DRN = 5.0\text{ V}$ ;  $C_{LOAD} = 5.7\text{ nF}$ ; Room Temperature.

Figure 14. Top Gate Rise Time

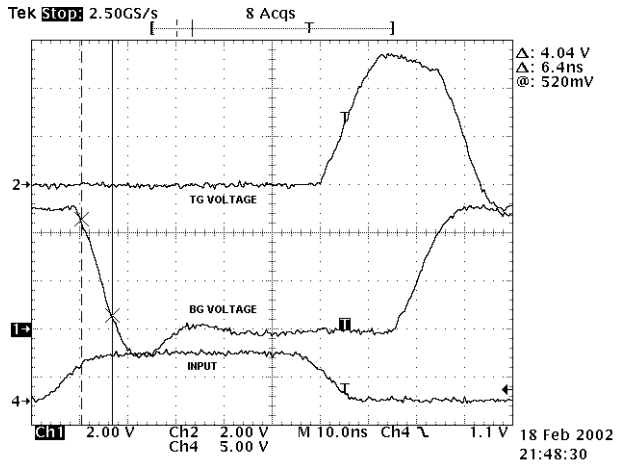


Conditions:  $V_S = 5.0\text{ V}$ ;  $BST - DRN = 5.0\text{ V}$ ;  $C_{LOAD} = 5.7\text{ nF}$ ; Room Temperature.

Figure 15. Top Gate Fall Time

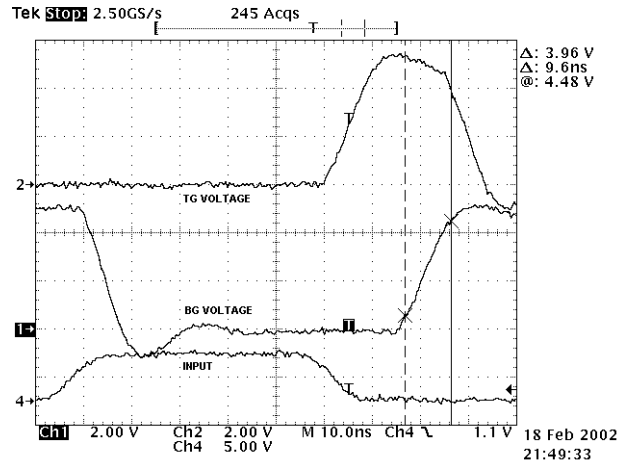
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## TYPICAL PERFORMANCE CHARACTERISTICS



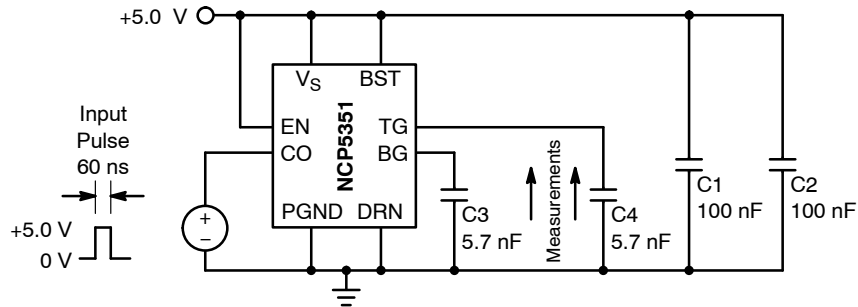
Conditions:  $V_S = 5.0\text{ V}$ ;  $BST - DRN = 5.0\text{ V}$ ;  $C_{LOAD} = 5.7\text{ nF}$ ; Room Temperature.

**Figure 16. Bottom Gate Fall Time**



Conditions:  $V_S = 5.0\text{ V}$ ;  $BST - DRN = 5.0\text{ V}$ ;  $C_{LOAD} = 5.7\text{ nF}$ ; Room Temperature.

**Figure 17. Bottom Gate Rise Time**



**Figure 18. Bottom Gate and Top Gate Rise/Fall Time Test**

## ORDERING INFORMATION

| Device       | Package             | Shipping†          |
|--------------|---------------------|--------------------|
| NCP5351D     | SOIC-8              | 98 Units / Rail    |
| NCP5351DG    | SOIC-8<br>(Pb-Free) | 98 Units / Rail    |
| NCP5351DR2   | SOIC-8              | 2500 / Tape & Reel |
| NCP5351DR2G  | SOIC-8<br>(Pb-Free) | 2500 / Tape & Reel |
| NCP5351MNR2  | DFN10               | 2500 / Tape & Reel |
| NCP5351MNR2G | DFN10<br>(Pb-Free)  | 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.

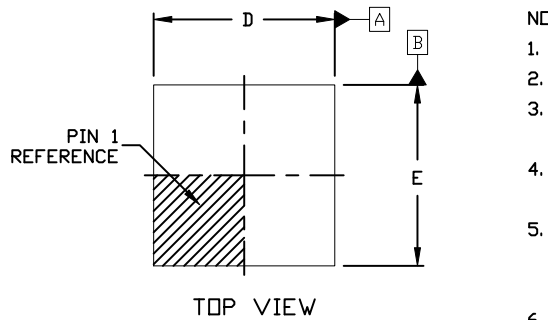
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 2:1

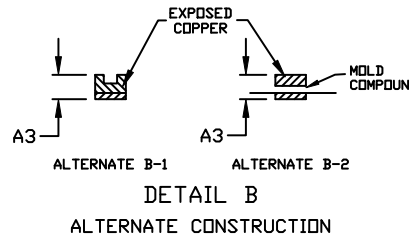
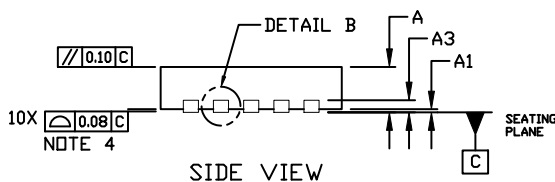
## DFN10, 3x3, 0.5P CASE 485C ISSUE F

DATE 16 DEC 2021

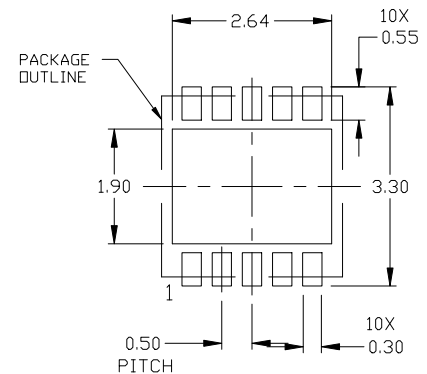
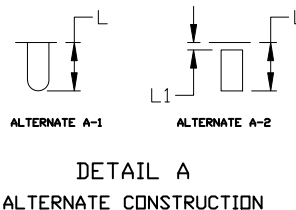
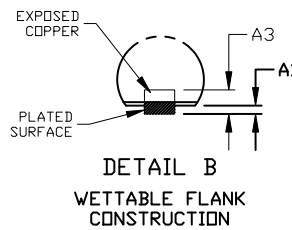
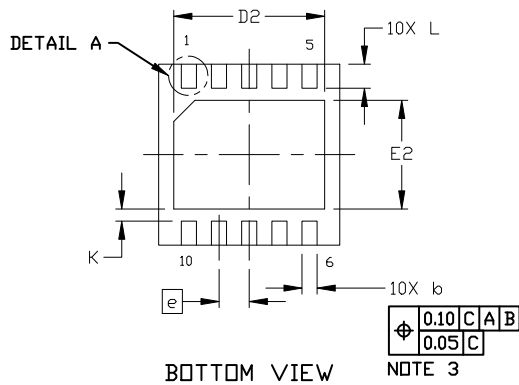


### NOTES:

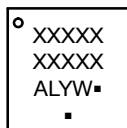
1. DIMENSION AND TOLERANCING PER ASME Y14.5, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION *b* APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. TERMINAL *b* MAY HAVE MOLD COMPOUND MATERIAL ALONG SIDE EDGE. MOLD FLASH MAY NOT EXCEED 30 MICRONS ONTO BOTTOM SURFACE OF TERMINAL.
6. FOR DEVICE OPN CONTAINING W OPTION, DETAIL A AND DETAIL B ALTERNATE CONSTRUCTIONS ARE NOT APPLICABLE. WETTABLE FLANK CONSTRUCTION IS DETAIL B AS SHOWN ON SIDE VIEW OF PACKAGE.



| DIM      | MILLIMETERS |      |      |
|----------|-------------|------|------|
|          | MIN.        | NOM. | MAX. |
| A        | 0.80        | 0.90 | 1.00 |
| A1       | 0.00        | ---  | 0.05 |
| A3       | 0.20 REF    |      |      |
| <i>b</i> | 0.18        | 0.23 | 0.30 |
| D        | 2.90        | 3.00 | 3.10 |
| D2       | 2.40        | 2.50 | 2.60 |
| E        | 2.90        | 3.00 | 3.10 |
| E2       | 1.70        | 1.80 | 1.90 |
| <i>e</i> | 0.50 BSC    |      |      |
| K        | 0.20 REF    |      |      |
| L        | 0.30        | 0.40 | 0.50 |
| L1       | ---         | ---  | 0.03 |



### GENERIC MARKING DIAGRAM\*



- XXXXX = Specific Device Code
- A = Assembly Location
- L = Wafer Lot
- 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.

### 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.

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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



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.

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

## GENERIC MARKING DIAGRAM\*



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



XXXXXX = 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.

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

## STYLES ON PAGE 2

|                  |             |                                                                                                                                                                                  |
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**SOIC-8 NB**  
**CASE 751-07**  
**ISSUE AK**

DATE 16 FEB 2011

- |                                                                                                                                                                                                                   |                                                                                                                                                                                                          |                                                                                                                                                                                                    |                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>STYLE 1:<br/> PIN 1. EMITTER<br/> 2. COLLECTOR<br/> 3. COLLECTOR<br/> 4. EMITTER<br/> 5. EMITTER<br/> 6. BASE<br/> 7. BASE<br/> 8. EMITTER</p>                                                                 | <p>STYLE 2:<br/> PIN 1. COLLECTOR, DIE, #1<br/> 2. COLLECTOR, #1<br/> 3. COLLECTOR, #2<br/> 4. COLLECTOR, #2<br/> 5. BASE, #2<br/> 6. EMITTER, #2<br/> 7. BASE, #1<br/> 8. EMITTER, #1</p>               | <p>STYLE 3:<br/> PIN 1. DRAIN, DIE #1<br/> 2. DRAIN, #1<br/> 3. DRAIN, #2<br/> 4. DRAIN, #2<br/> 5. GATE, #2<br/> 6. SOURCE, #2<br/> 7. GATE, #1<br/> 8. SOURCE, #1</p>                            | <p>STYLE 4:<br/> PIN 1. ANODE<br/> 2. ANODE<br/> 3. ANODE<br/> 4. ANODE<br/> 5. ANODE<br/> 6. ANODE<br/> 7. ANODE<br/> 8. COMMON CATHODE</p>                                                                           |
| <p>STYLE 5:<br/> PIN 1. DRAIN<br/> 2. DRAIN<br/> 3. DRAIN<br/> 4. DRAIN<br/> 5. GATE<br/> 6. GATE<br/> 7. SOURCE<br/> 8. SOURCE</p>                                                                               | <p>STYLE 6:<br/> PIN 1. SOURCE<br/> 2. DRAIN<br/> 3. DRAIN<br/> 4. SOURCE<br/> 5. SOURCE<br/> 6. GATE<br/> 7. GATE<br/> 8. SOURCE</p>                                                                    | <p>STYLE 7:<br/> PIN 1. INPUT<br/> 2. EXTERNAL BYPASS<br/> 3. THIRD STAGE SOURCE<br/> 4. GROUND<br/> 5. DRAIN<br/> 6. GATE 3<br/> 7. SECOND STAGE Vd<br/> 8. FIRST STAGE Vd</p>                    | <p>STYLE 8:<br/> PIN 1. COLLECTOR, DIE #1<br/> 2. BASE, #1<br/> 3. BASE, #2<br/> 4. COLLECTOR, #2<br/> 5. COLLECTOR, #2<br/> 6. EMITTER, #2<br/> 7. EMITTER, #1<br/> 8. COLLECTOR, #1</p>                              |
| <p>STYLE 9:<br/> PIN 1. EMITTER, COMMON<br/> 2. COLLECTOR, DIE #1<br/> 3. COLLECTOR, DIE #2<br/> 4. EMITTER, COMMON<br/> 5. EMITTER, COMMON<br/> 6. BASE, DIE #2<br/> 7. BASE, DIE #1<br/> 8. EMITTER, COMMON</p> | <p>STYLE 10:<br/> PIN 1. GROUND<br/> 2. BIAS 1<br/> 3. OUTPUT<br/> 4. GROUND<br/> 5. GROUND<br/> 6. BIAS 2<br/> 7. INPUT<br/> 8. GROUND</p>                                                              | <p>STYLE 11:<br/> PIN 1. SOURCE 1<br/> 2. GATE 1<br/> 3. SOURCE 2<br/> 4. GATE 2<br/> 5. DRAIN 2<br/> 6. DRAIN 2<br/> 7. DRAIN 1<br/> 8. DRAIN 1</p>                                               | <p>STYLE 12:<br/> PIN 1. SOURCE<br/> 2. SOURCE<br/> 3. SOURCE<br/> 4. GATE<br/> 5. DRAIN<br/> 6. DRAIN<br/> 7. DRAIN<br/> 8. DRAIN</p>                                                                                 |
| <p>STYLE 13:<br/> PIN 1. N.C.<br/> 2. SOURCE<br/> 3. SOURCE<br/> 4. GATE<br/> 5. DRAIN<br/> 6. DRAIN<br/> 7. DRAIN<br/> 8. DRAIN</p>                                                                              | <p>STYLE 14:<br/> PIN 1. N-SOURCE<br/> 2. N-GATE<br/> 3. P-SOURCE<br/> 4. P-GATE<br/> 5. P-DRAIN<br/> 6. P-DRAIN<br/> 7. N-DRAIN<br/> 8. N-DRAIN</p>                                                     | <p>STYLE 15:<br/> PIN 1. ANODE 1<br/> 2. ANODE 1<br/> 3. ANODE 1<br/> 4. ANODE 1<br/> 5. CATHODE, COMMON<br/> 6. CATHODE, COMMON<br/> 7. CATHODE, COMMON<br/> 8. CATHODE, COMMON</p>               | <p>STYLE 16:<br/> PIN 1. EMITTER, DIE #1<br/> 2. BASE, DIE #1<br/> 3. EMITTER, DIE #2<br/> 4. BASE, DIE #2<br/> 5. COLLECTOR, DIE #2<br/> 6. COLLECTOR, DIE #2<br/> 7. COLLECTOR, DIE #1<br/> 8. COLLECTOR, DIE #1</p> |
| <p>STYLE 17:<br/> PIN 1. VCC<br/> 2. V2OUT<br/> 3. V1OUT<br/> 4. TXE<br/> 5. RXE<br/> 6. VEE<br/> 7. GND<br/> 8. ACC</p>                                                                                          | <p>STYLE 18:<br/> PIN 1. ANODE<br/> 2. ANODE<br/> 3. SOURCE<br/> 4. GATE<br/> 5. DRAIN<br/> 6. DRAIN<br/> 7. CATHODE<br/> 8. CATHODE</p>                                                                 | <p>STYLE 19:<br/> PIN 1. SOURCE 1<br/> 2. GATE 1<br/> 3. SOURCE 2<br/> 4. GATE 2<br/> 5. DRAIN 2<br/> 6. MIRROR 2<br/> 7. DRAIN 1<br/> 8. MIRROR 1</p>                                             | <p>STYLE 20:<br/> PIN 1. SOURCE (N)<br/> 2. GATE (N)<br/> 3. SOURCE (P)<br/> 4. GATE (P)<br/> 5. DRAIN<br/> 6. DRAIN<br/> 7. DRAIN<br/> 8. DRAIN</p>                                                                   |
| <p>STYLE 21:<br/> PIN 1. CATHODE 1<br/> 2. CATHODE 2<br/> 3. CATHODE 3<br/> 4. CATHODE 4<br/> 5. CATHODE 5<br/> 6. COMMON ANODE<br/> 7. COMMON ANODE<br/> 8. CATHODE 6</p>                                        | <p>STYLE 22:<br/> PIN 1. I/O LINE 1<br/> 2. COMMON CATHODE/VCC<br/> 3. COMMON CATHODE/VCC<br/> 4. I/O LINE 3<br/> 5. COMMON ANODE/GND<br/> 6. I/O LINE 4<br/> 7. I/O LINE 5<br/> 8. COMMON ANODE/GND</p> | <p>STYLE 23:<br/> PIN 1. LINE 1 IN<br/> 2. COMMON ANODE/GND<br/> 3. COMMON ANODE/GND<br/> 4. LINE 2 IN<br/> 5. LINE 2 OUT<br/> 6. COMMON ANODE/GND<br/> 7. COMMON ANODE/GND<br/> 8. LINE 1 OUT</p> | <p>STYLE 24:<br/> PIN 1. BASE<br/> 2. EMITTER<br/> 3. COLLECTOR/ANODE<br/> 4. COLLECTOR/ANODE<br/> 5. CATHODE<br/> 6. CATHODE<br/> 7. COLLECTOR/ANODE<br/> 8. COLLECTOR/ANODE</p>                                      |
| <p>STYLE 25:<br/> PIN 1. VIN<br/> 2. N/C<br/> 3. REXT<br/> 4. GND<br/> 5. IOUT<br/> 6. IOUT<br/> 7. IOUT<br/> 8. IOUT</p>                                                                                         | <p>STYLE 26:<br/> PIN 1. GND<br/> 2. dv/dt<br/> 3. ENABLE<br/> 4. ILIMIT<br/> 5. SOURCE<br/> 6. SOURCE<br/> 7. SOURCE<br/> 8. VCC</p>                                                                    | <p>STYLE 27:<br/> PIN 1. ILIMIT<br/> 2. OVLO<br/> 3. UVLO<br/> 4. INPUT+<br/> 5. SOURCE<br/> 6. SOURCE<br/> 7. SOURCE<br/> 8. DRAIN</p>                                                            | <p>STYLE 28:<br/> PIN 1. SW_TO_GND<br/> 2. DASIC_OFF<br/> 3. DASIC_SW_DET<br/> 4. GND<br/> 5. V_MON<br/> 6. VBULK<br/> 7. VBULK<br/> 8. VIN</p>                                                                        |
| <p>STYLE 29:<br/> PIN 1. BASE, DIE #1<br/> 2. EMITTER, #1<br/> 3. BASE, #2<br/> 4. EMITTER, #2<br/> 5. COLLECTOR, #2<br/> 6. COLLECTOR, #2<br/> 7. COLLECTOR, #1<br/> 8. COLLECTOR, #1</p>                        | <p>STYLE 30:<br/> PIN 1. DRAIN 1<br/> 2. DRAIN 1<br/> 3. GATE 2<br/> 4. SOURCE 2<br/> 5. SOURCE 1/DRAIN 2<br/> 6. SOURCE 1/DRAIN 2<br/> 7. SOURCE 1/DRAIN 2<br/> 8. GATE 1</p>                           |                                                                                                                                                                                                    |                                                                                                                                                                                                                        |

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