

# NCV7721

## Dual Half-Bridge Driver with Parallel Input Control

The NCV7721 is a fully protected Dual Half-Bridge Driver designed specifically for automotive and industrial motion control applications. The two half-bridge drivers have independent control. This allows for high side, low side, and H-Bridge control. H-Bridge control provides forward, reverse, brake, and high impedance states (with EN = low).

The drivers are controlled via logic level inputs.

The device is available in a SOIC-14 package.

### Features

- 2 High-side and 2 Low-side Drivers Connected as Half-bridges
- 500 mA [typ], 1.1 A [max] Drivers
  - ♦  $R_{DS(on)} = 0.8 \Omega$  (typ),  $1.7 \Omega$  (max)
- Internal Free-wheeling Diodes
- Parallel Input Logic Control
- Ultra Low Quiescent Current in Sleep Mode,  $1 \mu A$  for  $V_S$  and  $V_{CC}$
- Compliance with 5 V and 3.3 V Systems
- Overvoltage and Undervoltage Lockout
- Fault Reporting for Underload, Overcurrent and Thermal Shutdown
- 3 A Current Limit
- Internally Fused Leads in SOIC-14 for Better Thermal Performance
- ESD Protection up to 6 kV
- This is a Pb-Free Device

### Applications

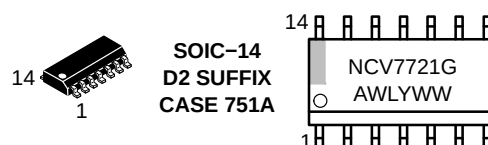
- Automotive
- Industrial
- DC Motor Management



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### MARKING DIAGRAM



NCV7721G = Specific Device Code

A = Assembly Location

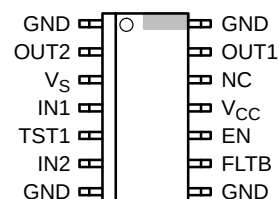
WL = Wafer Lot

Y = Year

WW = Work Week

G = Pb-Free Package

### PIN CONNECTIONS



### ORDERING INFORMATION

| Device       | Package           | Shipping†          |
|--------------|-------------------|--------------------|
| NCV7721D2R2G | SOIC-14 (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.

# NCV7721

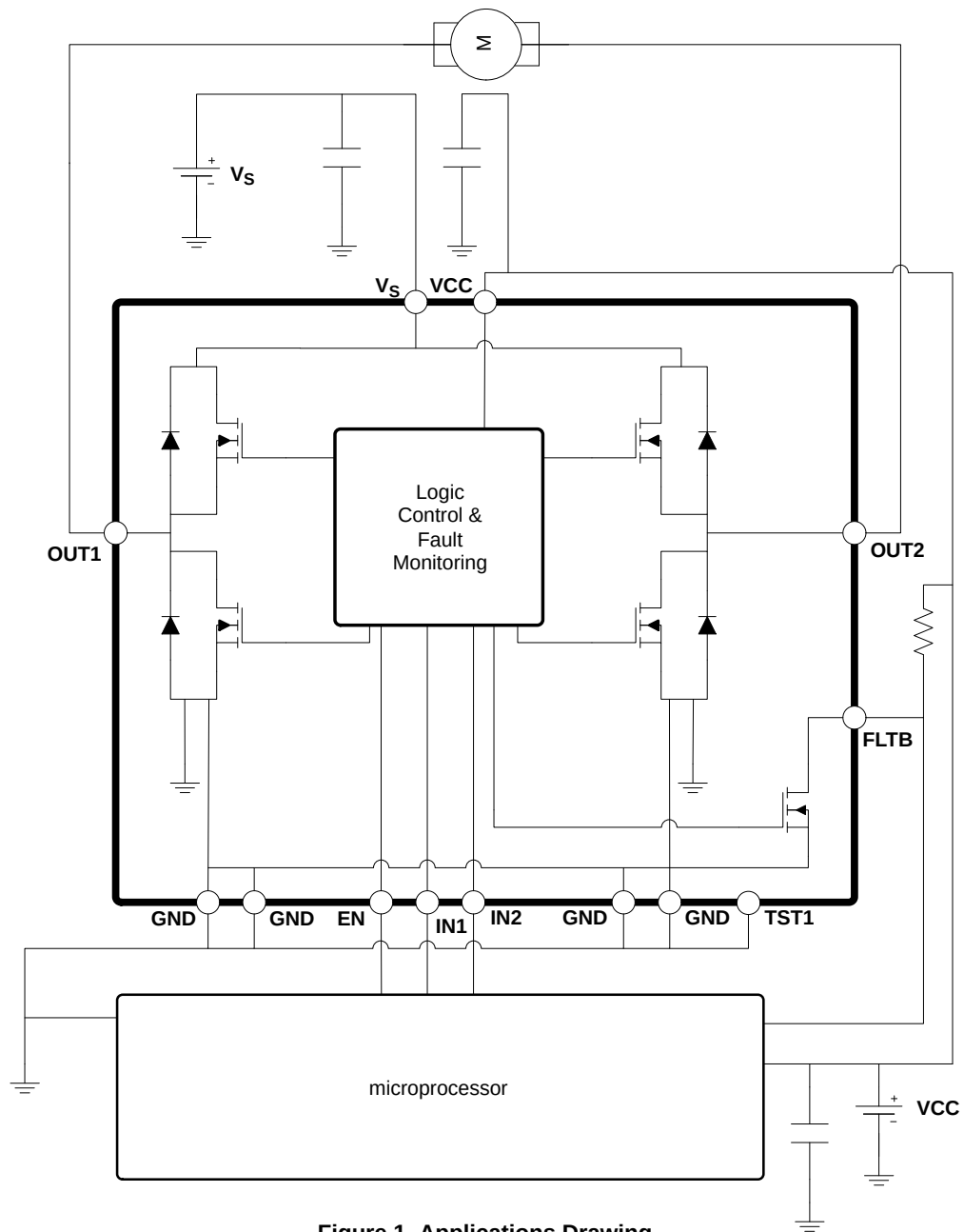


Figure 1. Applications Drawing

# NCV7721

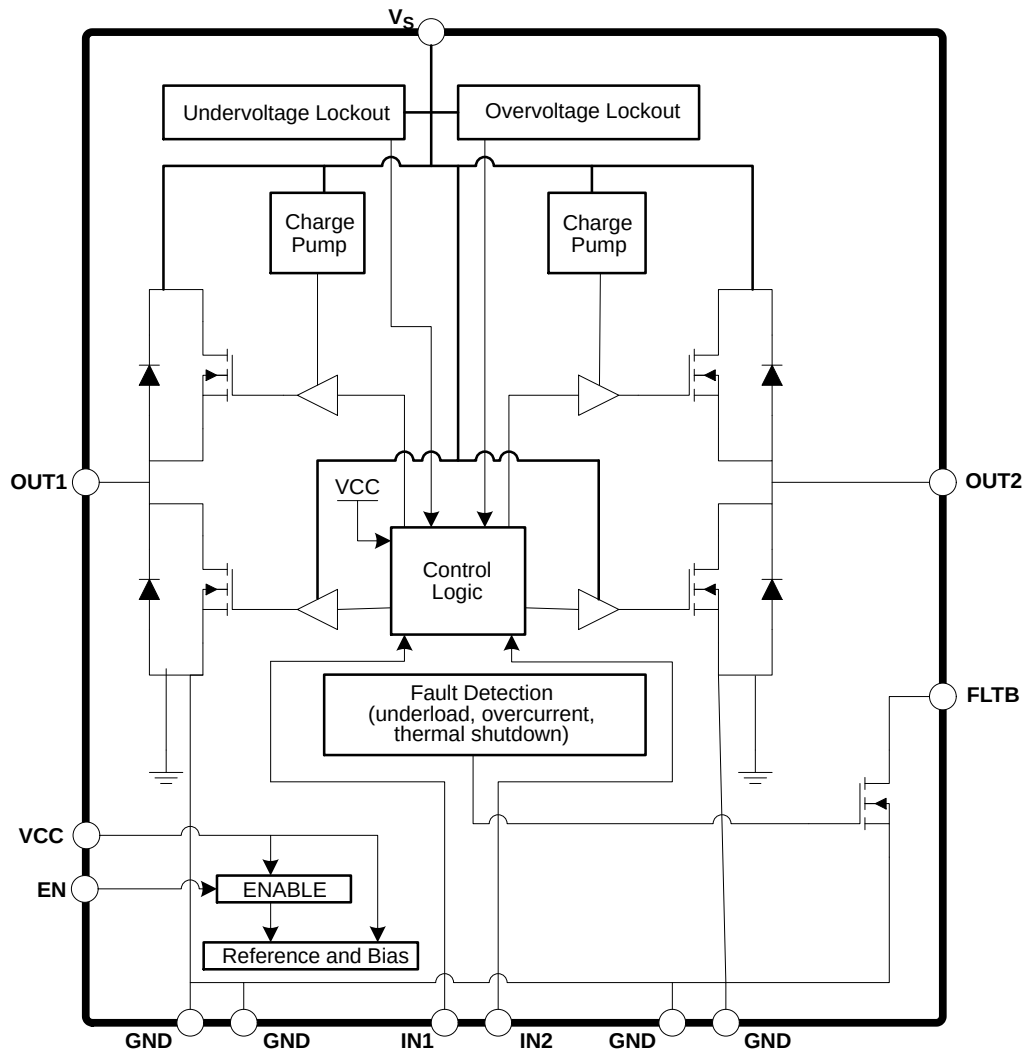


Figure 2. Block Diagram

Table 1. PIN FUNCTION DESCRIPTION

| SSIC-14 Fused Package |                 |                                                                                     |
|-----------------------|-----------------|-------------------------------------------------------------------------------------|
| Pin #                 | Symbol          | Description                                                                         |
| 1                     | GND*            | Ground. Connect all grounds together.                                               |
| 2                     | OUT2            | Half Bridge Output 2.                                                               |
| 3                     | V <sub>S</sub>  | Power Supply input for the output driver and internal supply voltage.               |
| 4                     | IN1             | Logic level input for OUT1.                                                         |
| 5                     | TST1            | Test pin (ground pin).                                                              |
| 6                     | IN2             | Logic level input for OUT2.                                                         |
| 7                     | GND*            | Ground. Connect all grounds together.                                               |
| 8                     | GND*            | Ground. Connect all grounds together.                                               |
| 9                     | FLT             | Fault Bar. Faults are reported (low) for underload, overload, and thermal shutdown. |
| 10                    | EN              | Enable. A high enables the device.                                                  |
| 11                    | V <sub>CC</sub> | Power supply input for internal logic.                                              |
| 12                    | NC              | No Connection.                                                                      |
| 13                    | OUT1            | Half Bridge Output 1.                                                               |
| 14                    | GND*            | Ground. Connect all grounds together.                                               |

\*Pins 1, 7, 8 and 14 are internally shorted together. It is recommended to also short these pins externally.

**Table 2. MAXIMUM RATINGS** (Voltages are with respect to device substrate.)

| Rating                                                                              | Value                              | Unit |
|-------------------------------------------------------------------------------------|------------------------------------|------|
| Power Supply Voltage ( $V_S$ )<br>DC<br>AC, $t < 500$ ms, $I_{VS} > -2$ A           | -0.3 to 40<br>-1                   | V    |
| Output Pin OUTx<br>DC<br>AC, $t < 500$ ms, $I_{VS} > -2$ A                          | -0.3 to 40<br>-1                   | V    |
| Pin Voltage<br>(IN1, IN2, EN, VCC)<br>(FLTb)                                        | -0.3 to 5.5<br>-0.3 to (VCC + 0.3) | V    |
| Output Current (OUTx)<br>DC<br>AC, 50 ms pulse, 1s period                           | -1.8 to 1.8<br>-4.0 to 4.0         | A    |
| Electrostatic Discharge, Human Body Model<br>( $V_S$ , OUT1, OUT2) (Note 3)         | 6                                  | kV   |
| Electrostatic Discharge, Human Body Model<br>All other pins (Note 3)                | 2                                  | kV   |
| Electrostatic Discharge, Machine Model<br>All pins                                  | 200                                | V    |
| Moisture Sensitivity Level                                                          | MSL3                               | –    |
| Operating Junction Temperature, $T_J$                                               | -40 to 150                         | °C   |
| Storage Temperature Range                                                           | -55 to 150                         | °C   |
| Peak Reflow Soldering Temperature: Lead-free<br>60 to 150 seconds at 217°C (Note 4) | 260 peak                           | °C   |

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

| Thermal Parameters                                                   | Test Conditions (Typical Value) |                          | Unit |
|----------------------------------------------------------------------|---------------------------------|--------------------------|------|
| 14 Pin Fused SOIC Package                                            | Min-pad board<br>(Note 1)       | 1" pad board<br>(Note 2) |      |
| Junction-to-Lead ( $\psi_{JL8}$ , $\Psi_{JL8}$ ) or Pins 1, 7, 8, 14 | 23                              | 22                       | °C/W |
| Junction-to-Ambient ( $R_{\theta JA}$ , $\theta_{JA}$ )              | 122                             | 83                       | °C/W |

- 1-oz copper, 67 mm<sup>2</sup> copper area, 0.062" thick FR4.
- 1-oz copper, 645 mm<sup>2</sup> copper area, 0.062", thick FR4.
- This device series incorporates ESD protection and is characterized by the following methods:  
ESD HBM according to AEC-Q100-002 (EIA/JESD22-A114)  
ESD MM according to AEC-Q100-003 (EIA/JESD22-A115)
- For additional information, see or download ON Semiconductor's Soldering and Mounting Techniques Reference Manual, SOLDERRM/D, and Application Note AND8003/D.

**Table 3. ELECTRICAL CHARACTERISTICS**

( $-40^{\circ}\text{C} \leq T_J \leq 150^{\circ}\text{C}$ ,  $5.5\text{ V} < V_S < 40\text{ V}$ ,  $3.15\text{ V} < V_{CC} < 5.25\text{ V}$ ,  $EN = V_{CC}$ , unless otherwise specified.)

| Characteristic                                       | Conditions                                                                                                                                                                               | Min        | Typ         | Max        | Unit               |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|------------|--------------------|
| <b>GENERAL</b>                                       |                                                                                                                                                                                          |            |             |            |                    |
| Supply Current ( $V_S$ )<br>Sleep Mode (Note 5)      | $V_S = 13.2\text{ V}$ , $OUTx = 0\text{ V}$<br>$EN = IN1 = IN2 = 0\text{ V}$<br>$0\text{ V} < V_{CC} < 5.25\text{ V}$<br>$T_J = -40^{\circ}\text{C}$ to $85^{\circ}\text{C}$             | –          | 1.0         | 5.0        | $\mu\text{A}$      |
|                                                      | $V_S = 13.2\text{ V}$ , $OUTx = 0\text{ V}$<br>$EN = IN1 = IN2 = 0\text{ V}$<br>$0\text{ V} < V_{CC} < 5.25\text{ V}$<br>$T_J = 25^{\circ}\text{C}$                                      | –          | –           | 2.0        | $\mu\text{A}$      |
| Supply Current ( $V_S$ )<br>Active Mode              | $EN = V_{CC}$ , $5.5\text{ V} < V_S < 35\text{ V}$<br>No Load                                                                                                                            | –          | 2.0         | 4.0        | mA                 |
| Supply Current ( $V_{CC}$ )<br>Sleep Mode (Note 6)   | $EN = IN1 = IN2 = 0\text{ V}$<br>$T_J = -40^{\circ}\text{C}$ to $85^{\circ}\text{C}$                                                                                                     | –          | 0.1         | 2.5        | $\mu\text{A}$      |
| Supply Current ( $V_{CC}$ )<br>Active Mode           | $EN = V_{CC}$                                                                                                                                                                            | –          | 1.5         | 3.0        | mA                 |
| VCC Power-On_Reset Threshold                         |                                                                                                                                                                                          | –          | 2.55        | 2.90       | V                  |
| $V_S$ Undervoltage Detection Threshold<br>Hysteresis | $V_S$ decreasing                                                                                                                                                                         | 3.7        | 4.1         | 4.5        | V                  |
|                                                      |                                                                                                                                                                                          | 100        | 365         | 450        | mV                 |
| $V_S$ Overvoltage Detection Threshold<br>Hysteresis  | $V_S$ increasing                                                                                                                                                                         | 33.0       | 36.5        | 40.0       | V                  |
|                                                      |                                                                                                                                                                                          | 1.0        | 2.5         | 4.0        | mV                 |
| Thermal Shutdown Threshold (Note 4)                  |                                                                                                                                                                                          | 155        | 175         | 195        | $^{\circ}\text{C}$ |
| <b>OUTPUTS</b>                                       |                                                                                                                                                                                          |            |             |            |                    |
| Output Rds(on) (Source)                              | $I_{out} = -500\text{ mA}$                                                                                                                                                               | –          | –           | 1.7        | $\Omega$           |
| Output Rds(on) (Sink)                                | $I_{out} = 500\text{ mA}$                                                                                                                                                                | –          | –           | 1.7        | $\Omega$           |
| Source Leakage Current<br>Sum of $OUT1$ and $OUT2$   | $OUTx = 0\text{ V}$ , $V_S = 40\text{ V}$ , $EN = 0\text{ V}$<br>$IN1 = IN2 = 0\text{ V}$<br>$0\text{ V} < V_{CC} < 5.25\text{ V}$<br>$\text{Sum}(I(OUTx))$                              | –5.0       | –           | –          | $\mu\text{A}$      |
|                                                      | $OUTx = 0\text{ V}$ , $V_S = 40\text{ V}$ , $EN = 0\text{ V}$<br>$IN1 = IN2 = 0\text{ V}$<br>$0\text{ V} < V_{CC} < 5.25\text{ V}$ , $T_J = 25^{\circ}\text{C}$<br>$\text{Sum}(I(OUTx))$ | –1.0       | –           | –          | $\mu\text{A}$      |
| Sink Leakage Current                                 | $OUTx = V_S = 40\text{ V}$ , $EN = 0\text{ V}$<br>$IN1 = IN2 = 0\text{ V}$<br>$0\text{ V} < V_{CC} < 5.25\text{ V}$                                                                      | –          | –           | 300        | $\mu\text{A}$      |
|                                                      | $OUTx = V_S = 13.2\text{ V}$ , $EN = 0\text{ V}$<br>$IN1 = IN2 = 0\text{ V}$<br>$0\text{ V} < V_{CC} < 5.25\text{ V}$ , $T_J = 25^{\circ}\text{C}$                                       | –          | –           | 10         | $\mu\text{A}$      |
| Under Load Detection Threshold<br>Source<br>Sink     |                                                                                                                                                                                          | –17<br>2.0 | –7.0<br>7.0 | –2.0<br>17 | mA                 |
| Power Transistor Body Diode Forward Voltage          | $I_f = 500\text{ mA}$                                                                                                                                                                    | –          | 0.9         | 1.3        | V                  |

**Table 3. ELECTRICAL CHARACTERISTICS**

( $-40^{\circ}\text{C} \leq T_J \leq 150^{\circ}\text{C}$ ,  $5.5\text{ V} < V_S < 40\text{ V}$ ,  $3.15\text{ V} < V_{CC} < 5.25\text{ V}$ ,  $\text{EN} = V_{CC}$ , unless otherwise specified.)

| Characteristic                             | Conditions                                                                                                                           | Min      | Typ         | Max         | Unit          |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|-------------|-------------|---------------|
| <b>OVERCURRENT</b>                         |                                                                                                                                      |          |             |             |               |
| Overcurrent Shutdown Threshold (OUTHx)     | $V_{CC} = 5\text{ V}$ , $V_S = 13.2\text{ V}$                                                                                        | -2.0     | -1.45       | -1.1        | A             |
| Overcurrent Shutdown Threshold (OUTLx)     | $V_{CC} = 5\text{ V}$ , $V_S = 13.2\text{ V}$                                                                                        | 1.1      | 1.45        | 2.0         | A             |
| <b>CURRENT LIMIT</b>                       |                                                                                                                                      |          |             |             |               |
| Current Limit (OUTHx)                      | $V_{CC} = 5\text{ V}$ , $V_S = 13.2\text{ V}$                                                                                        | -5.0     | -3.0        | -2.0        | A             |
| Current Limit (OUTLx)                      | $V_{CC} = 5\text{ V}$ , $V_S = 13.2\text{ V}$                                                                                        | 2.0      | 3.0         | 5.0         | A             |
| <b>LOGIC INPUTS (EN, IN1, IN2)</b>         |                                                                                                                                      |          |             |             |               |
| Input Threshold                            | High<br>Low                                                                                                                          | 2.0<br>- | -<br>-      | -<br>0.8    | V             |
| Input Hysteresis                           |                                                                                                                                      | 100      | 400         | 800         | mV            |
| Pulldown Resistance                        |                                                                                                                                      | 50       | 125         | 250         | k $\Omega$    |
| Input Capacitance                          |                                                                                                                                      | -        | 10          | 15          | pF            |
| <b>LOGIC OUTPUT (FLTB)</b>                 |                                                                                                                                      |          |             |             |               |
| Output Low                                 | $I_{\text{FLTB}} = 1.25\text{ mA}$<br>$I_{\text{FLTB}} = 10\text{ mA}$                                                               | -<br>-   | 0.08<br>0.6 | 0.25<br>1.1 | V             |
| Output Leakage                             | $\text{EN} = 5\text{ V}$ , $0\text{ V} < \text{FLTB} < V_{CC}$                                                                       | -        | -           | 1           | $\mu\text{A}$ |
| <b>TIMING SPECIFICATIONS</b>               |                                                                                                                                      |          |             |             |               |
| Under Load Detection Time                  |                                                                                                                                      | 200      | 350         | 600         | $\mu\text{s}$ |
| Overcurrent Shutdown Delay Time            | $V_S = 13.2\text{ V}$ , $R_{\text{load}} = 25\text{ }\Omega$                                                                         | 10       | 25          | 50          | $\mu\text{s}$ |
| High Side Turn-on Time                     | $V_S = 13.2\text{ V}$ , $R_{\text{load}} = 25\text{ }\Omega$                                                                         | -        | 7.5         | 15          | $\mu\text{s}$ |
| High Side Turn-off Time                    | $V_S = 13.2\text{ V}$ , $R_{\text{load}} = 25\text{ }\Omega$                                                                         | -        | 3.0         | 6.0         | $\mu\text{s}$ |
| Low Side Turn-on Time                      | $V_S = 13.2\text{ V}$ , $R_{\text{load}} = 25\text{ }\Omega$                                                                         | -        | 6.5         | 15          | $\mu\text{s}$ |
| Low Side Turn-off Time                     | $V_S = 13.2\text{ V}$ , $R_{\text{load}} = 25\text{ }\Omega$                                                                         | -        | 3.0         | 6.0         | $\mu\text{s}$ |
| High Side Rise Time                        | $V_S = 13.2\text{ V}$ , $R_{\text{load}} = 25\text{ }\Omega$                                                                         | -        | 5.0         | 10          | $\mu\text{s}$ |
| High Side Fall Time                        | $V_S = 13.2\text{ V}$ , $R_{\text{load}} = 25\text{ }\Omega$                                                                         | -        | 2.0         | 5.0         | $\mu\text{s}$ |
| Low Side Rise Time                         | $V_S = 13.2\text{ V}$ , $R_{\text{load}} = 25\text{ }\Omega$                                                                         | -        | 1.0         | 3.0         | $\mu\text{s}$ |
| Low Side Fall Time                         | $V_S = 13.2\text{ V}$ , $R_{\text{load}} = 25\text{ }\Omega$                                                                         | -        | 1.0         | 3.0         | $\mu\text{s}$ |
| NonOverlap Time                            | High Side Turn-off to Low Side Turn-on                                                                                               | 1.0      | -           | -           | $\mu\text{s}$ |
| NonOverlap Time                            | Low Side Turn-off to High Side Turn on                                                                                               | 1.0      | -           | -           | $\mu\text{s}$ |
| Enable Turn-on Time<br>(high-side driver)  | $\text{INx} = \text{high}$ , $R_{\text{load}} = 25\text{ }\Omega$ to GND<br>EN going high through 50% to OUTx going high through 50% | -        | 50          | -           | $\mu\text{s}$ |
| Enable Turn-on Time<br>(low-side driver)   | $\text{INx} = \text{low}$ , $R_{\text{load}} = 25\text{ }\Omega$ to $V_S$<br>EN going high through 50% to OUTx going low through 50% | -        | 50          | -           | $\mu\text{s}$ |
| Enable Turn-off Time<br>(high-side driver) | $\text{INx} = \text{high}$ , $R_{\text{load}} = 25\text{ }\Omega$ to GND<br>EN going low through 50% to OUTx going low through 50%   | -        | 2.5         | -           | $\mu\text{s}$ |
| Enable Turn-off Time<br>(low-side driver)  | $\text{INx} = \text{low}$ , $R_{\text{load}} = 25\text{ }\Omega$ to $V_S$<br>EN going low through 50% to OUTx going high through 50% | -        | 2.5         | -           | $\mu\text{s}$ |

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

TYPICAL CHARACTERISTICS

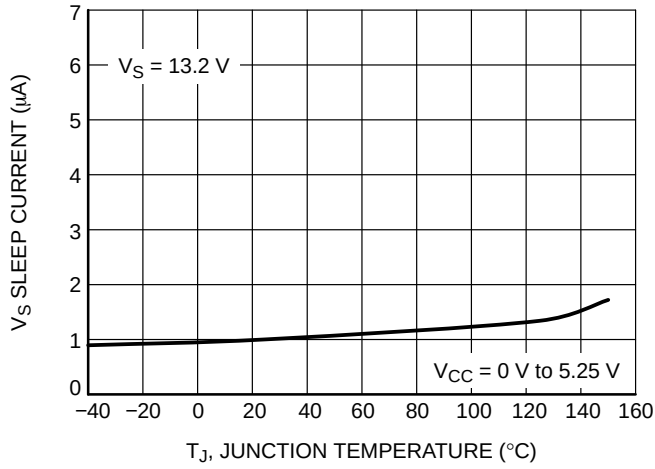


Figure 3. V<sub>S</sub> Sleep Supply Current vs. Temperature

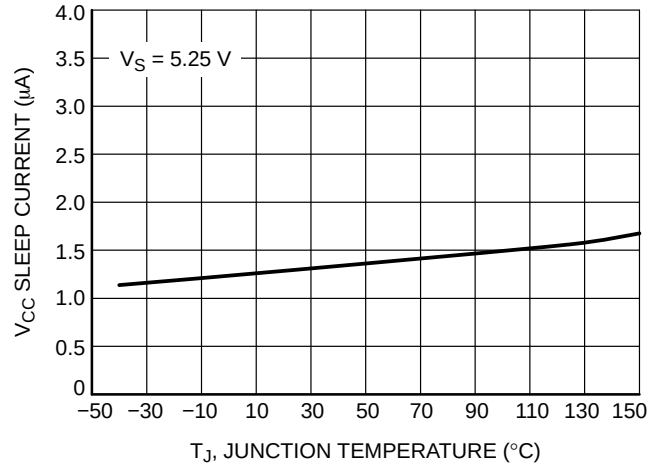


Figure 4. V<sub>CC</sub> Sleep Supply Current vs. Temperature

TYPICAL CHARACTERISTICS

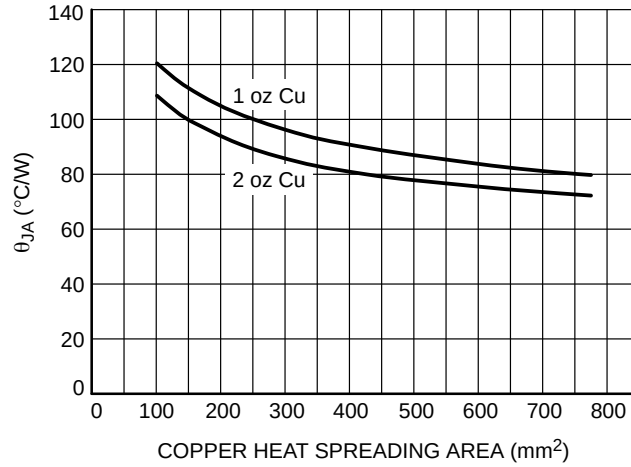


Figure 5.  $\theta_{JA}$  vs. Copper Spreader Area, 14 Lead SON (fused leads)

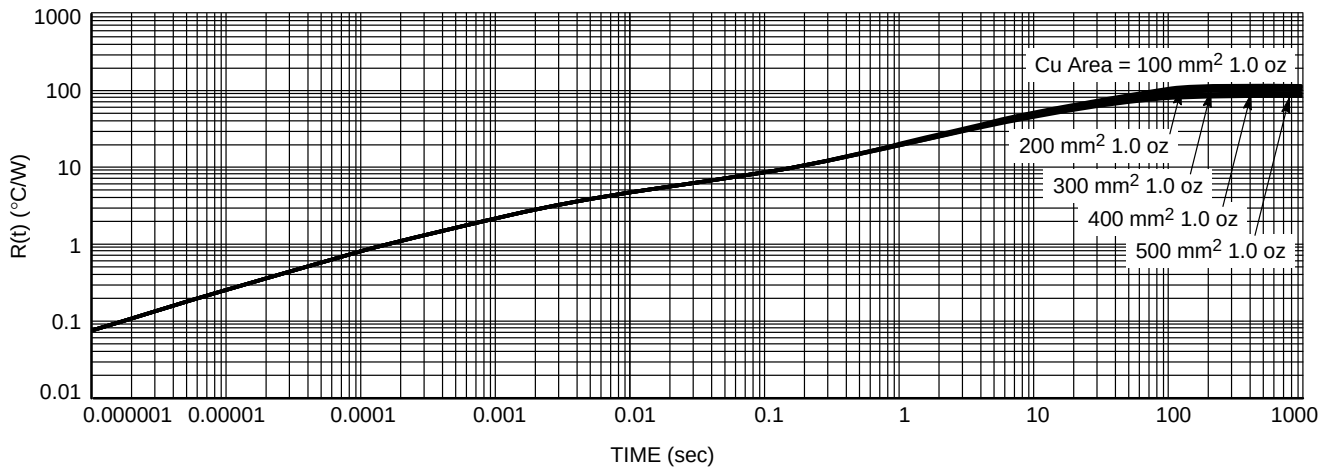


Figure 6. Transient Thermal Response to a Single Pulse 1 oz Copper (Log-Log)

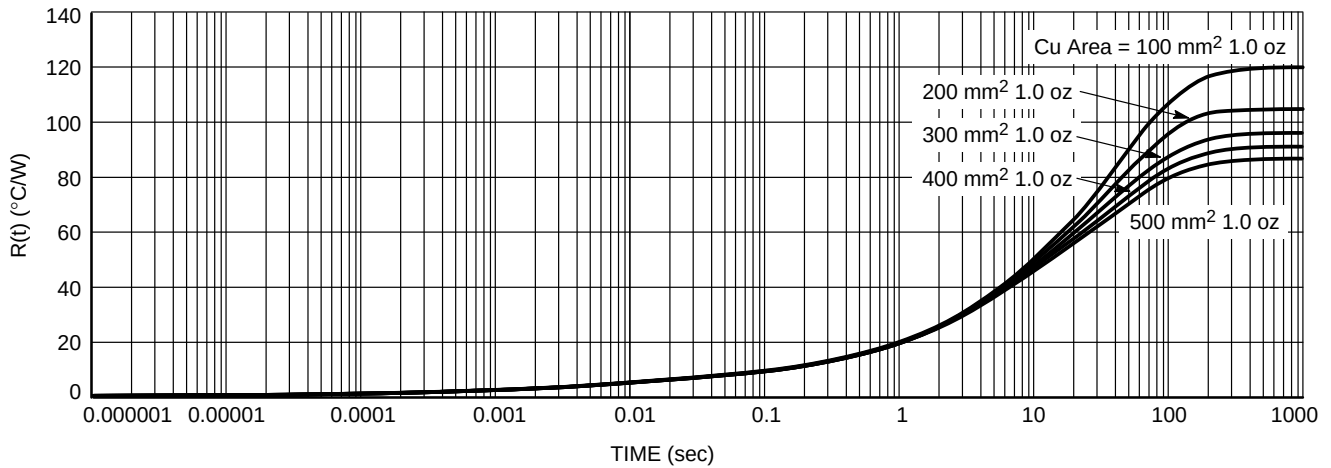


Figure 7. Transient Thermal Response to a Single Pulse 1 oz Copper (Semi-Log)



## DETAILED OPERATING DESCRIPTION

**General**

The NCV7721 Dual Half Bridge Driver provides drive capability for 2 Half-Bridge configurations. Each output drive is characterized for a 500 mA load with capability up to 1.1 A (min overvoltage shutdown threshold). Strict adherence to the integrated circuit die temperature is necessary, with a maximum die temperature of 150°C. Output drive control is handled via the parallel input control pins (IN1 & IN2). A single open Drain output reports underload, overload, and thermal shutdown faults.

An Enable function (EN) provides a low quiescent sleep current mode when the device is not being utilized. A resistor pulldown is provided on EN, IN1, and IN2 to insure a predictive state (low) in the event of a detached input signal.

**Power Up/Down Control (Undervoltage Detection)**

A feature incorporated in the NCV7721 is an undervoltage lockout circuit that prevents the output drivers from turning on unintentionally. VCC and  $V_S$  are monitored for undervoltage conditions supporting a smooth turn-on transition. All drivers are initialized in the off (high impedance) condition, and will remain off during a VCC or  $V_S$  undervoltage condition. This allows power up sequencing of VCC and  $V_S$  up to the user. Hysteresis in the UVLO circuits results in glitch free operation during power up/down.

**Overvoltage Shutdown**

Overvoltage lockout monitors the voltage on the  $V_S$  pin. When the overvoltage voltage threshold is breached (36.5 V [typ]), all outputs will turn off and remain off until  $V_S$  is out of overvoltage. A typical voltage hysteresis of 2.5 V eliminates the possibility of oscillation at the shutdown threshold.

**H-Bridge Driver Configuration**

The NCV7721 has the flexibility of controlling each half bridge driver independently through the IN1 and IN2 logic input pins. This allows for high-side, low side and H-Bridge control. H-bridge control provides forward, reverse, brake and high impedance states.

**Overvoltage Clamping – Driving Inductive Loads**

Each output is internally clamped to ground and  $V_S$  by internal freewheeling diodes. The diodes have ratings that complement the FETs they protect. A flyback event from

driving an inductive load causes the voltage on the output to rise up. Once the voltage rises higher than  $V_S$  by a diode voltage (body diode of the high-side driver), the energy in the inductor will dissipate through the diode to  $V_S$ . If a reverse battery diode is used in the system, care must be taken to insure the power supply capacitor is sufficient to dampen any increase in voltage to  $V_S$  caused by the current flow through the body diode so that it is below 40 V. Negative transients will momentarily occur when a high-side driver driving an inductive load is turned off. This will be clamped by an internal diode from the output pin (OUT1 or OUT2) to the IC ground.

**Current Limit**

OUTx current is limited per the Current Limit electrical parameter for each driver. The magnitude of the current has a minimum specification of 2 A at VCC = 5 V and  $V_S$  = 13.2 V. The output is protected for high power conditions during Current Limit by thermal shutdown and the Overcurrent Detection shutdown function. Overcurrent Detection shutdown protects the device during current limit because the Overcurrent threshold is below the Current Limit threshold. The Over current Detection Shutdown Control Timer is initiated at the Overcurrent Shutdown Threshold which starts before the Current Limit is reached.

Note: High currents will cause a rise in die temperature. Devices will not be allowed to turn on if the die temperature exceeds the thermal shutdown temperature.

**Overcurrent Shutdown**

Effected outputs will turn off when the Overcurrent Shutdown Threshold has been breached for the Overcurrent Shutdown Delay Time. FLTb will report a low and the driver will latch off. The driver can only be turned back on by a toggle of the EN pin or a power on reset of VCC.

**Overcurrent Detection Shut Down Timer**

There are two protection mechanisms for output current, overcurrent and current limit.

1. Current Limit – Maximum current for OUT1 and OUT2.
2. Overcurrent Detection – Threshold at which timer starts.

Figure 8 shows the typical performance of a part which has exceeded the 1.45 A (typ) Overcurrent Detection threshold and started the shutdown timer.

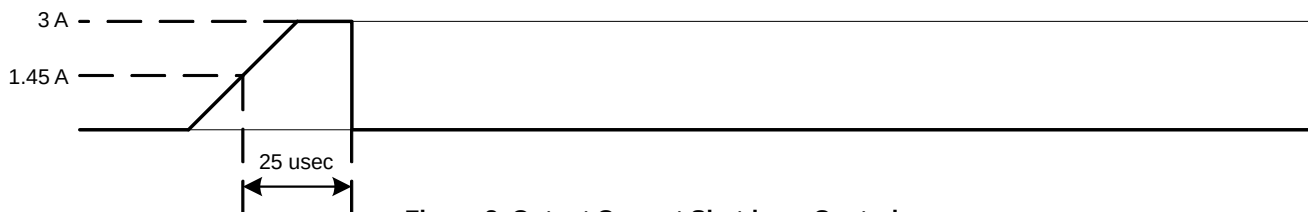


Figure 8. Output Current Shutdown Control

### Underload Detection

The underload detection circuit monitors the current from each output driver. A minimum load current (this is the maximum open circuit detection threshold) is required when the drivers are turned on. If the underload detection threshold has been detected continuously for more than the underload delay time, FLT\_B will report a low. There is no change to the driver condition (remains in the active state). The fault can be cleared by a toggle of the EN pin or a power on reset of VCC.

The NCV7721 uses a global underload timer. An underload condition starts the global under load delay timer. If

under load occurs in another channel after the global timer has been started, the delay for any subsequent underload will be the remainder of the initially started timer. The timer runs continuously with any persistent underload condition and will impact the time for multi underload situations. Figures 9 and 10 highlight the timing conditions for an underload state where the global timer is reset (discontinuous time) and the conditions where the global timer is not reset (continuous time).

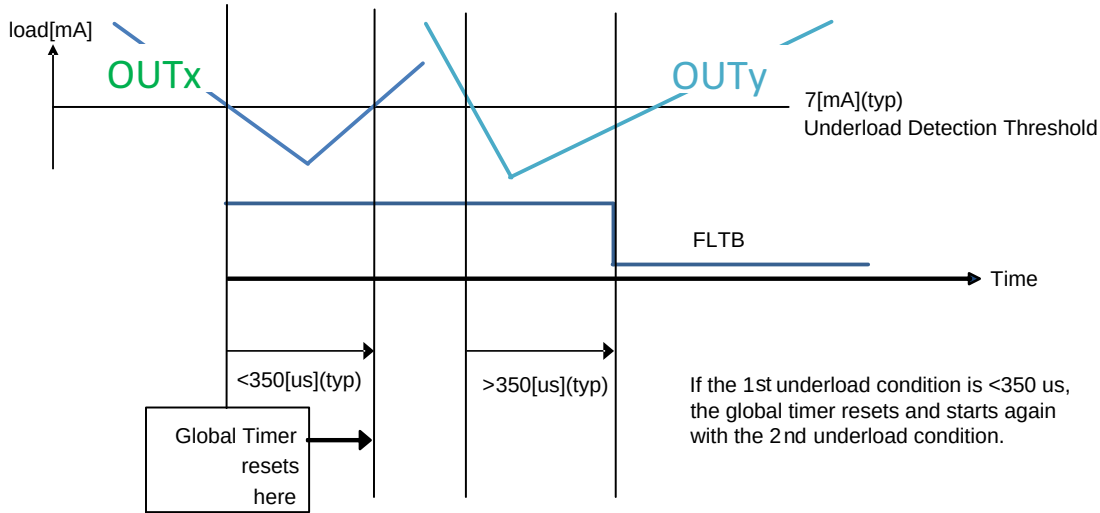


Figure 9. Underload Discontinuous Time

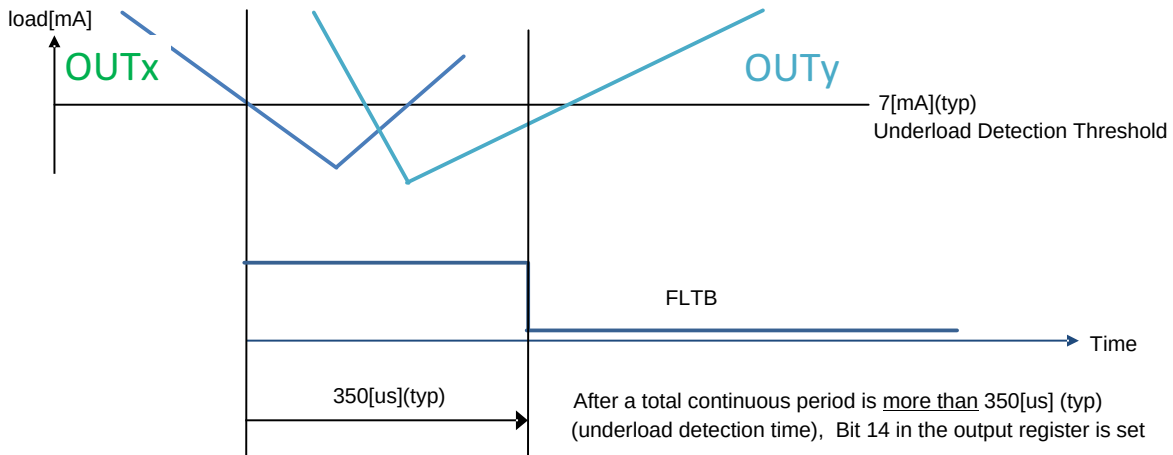


Figure 10. Underload Continuous Time

**ENABLE**

A single enable input (EN) provides on and off control for the two half-bridge outputs and activation of the fault reporting FLTB pin. The EN input has a logic level input threshold. A high on EN enables both outputs (OUT1 & OUT2). The outputs will become active in the state which is represented by the respective input pins (IN1 & IN2).

**Input Control**

IN1 & IN2 are both logic level inputs which are active with EN high. A low on IN1 or IN2 with EN high activates the low-side drivers of OUT1 or OUT2. A high on IN1 or IN2 with EN high activates the high-side drivers of OUT1 or OUT2.

**Fault Reporting**

Fault reporting is carried out through the open-drain FLTB pin. A pull-up resistor is required for operation. The FLTB pin has a maximum voltage of 5.5 V. In normal operation, FLTB reports a high signal. During a fault, the FLTB pin will go low and stay low. FLTB reporting is cleared by a toggle of the EN input or a power-on reset of VCC.

There are 3 faults reported by FLTB

1. Underload
2. Overcurrent

**3. Thermal Shutdown**

Undervoltage lockout and overvoltage lockout are **NOT** reported on FLTB.

**Thermal Shutdown**

Thermal Shutdown uses one common sensor for each HS and LS transistor pair. If the IC temperature reaches Over Temperature Shutdown, all drivers are latched off and FLTB will report a low. It can be reset only after the part cools below the shutdown temperature, including thermal hysteresis. The driver can be turned back on by a toggle of the EN pin or a power on reset of VCC.

**Table 4. LOGIC TABLE**

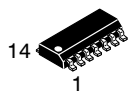
| EN | IN1 | IN2 | OUT1 | OUT2 |
|----|-----|-----|------|------|
| 0  | 0   | 0   | Off  | Off  |
| 0  | 0   | 1   | Off  | Off  |
| 0  | 1   | 0   | Off  | Off  |
| 0  | 1   | 1   | Off  | Off  |
| 1  | 0   | 0   | Low  | Low  |
| 1  | 0   | 1   | Low  | High |
| 1  | 1   | 0   | High | Low  |
| 1  | 1   | 1   | High | High |

**Table 5. FAULT TABLE**

| Fault            | FLTB | Driver Condition During Fault                    | Driver Condition after Parameters Within Specified Limits | FLTB Clear Requirement |
|------------------|------|--------------------------------------------------|-----------------------------------------------------------|------------------------|
| No Fault         | High | Output Driver on                                 | Output Driver on                                          | N/A                    |
| Underload (7 mA) | Low  | unchanged                                        | unchanged                                                 | EN toggle or VCC POR   |
| Overcurrent      | Low  | Offending Driver is latched off after 25 $\mu$ s | Offending Driver is latched off                           | EN toggle or VCC POR   |
| Thermal Shutdown | Low  | All Drivers latched off at 175°C                 | All Drivers latched off                                   | EN toggle or VCC POR   |

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

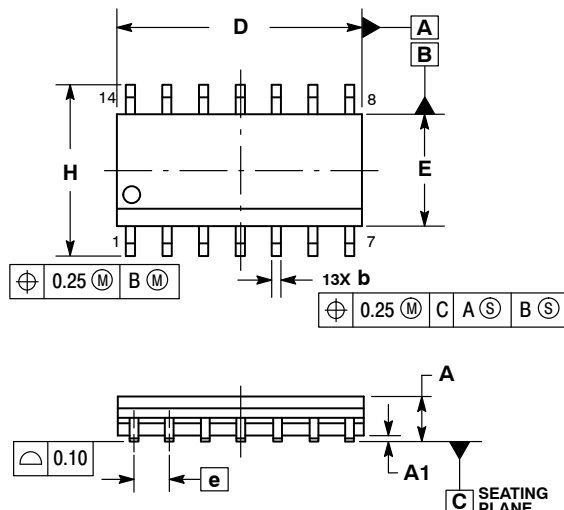
ON Semiconductor®



SCALE 1:1

SOIC-14 NB  
CASE 751A-03  
ISSUE L

DATE 03 FEB 2016

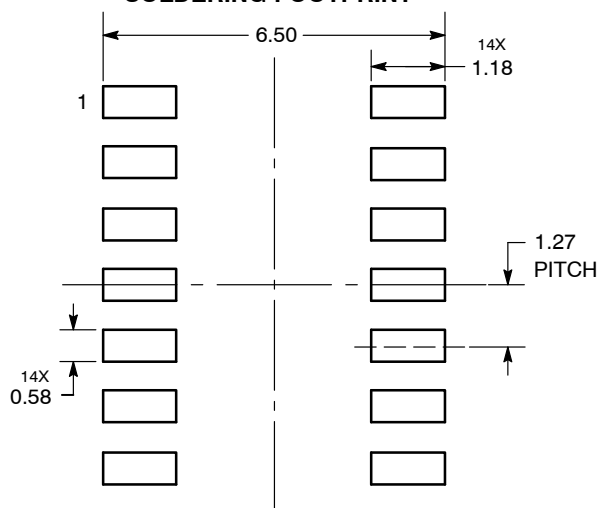


## NOTES:

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

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

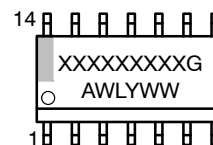
## SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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

## GENERIC MARKING DIAGRAM\*



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

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

STYLES ON PAGE 2

|                  |             |                                                                                                                                                                                     |
|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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**ISSUE L**

**DATE 03 FEB 2016**

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

**STYLE 2:**  
CANCELLED

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

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

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

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

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

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

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