

## LM18298 Dual Full-Bridge Driver

### General Description

The LM18298 is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to gate the input control signals.

The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of a current sensing resistor. An additional supply input is provided to accommodate conventional logic supply voltages.

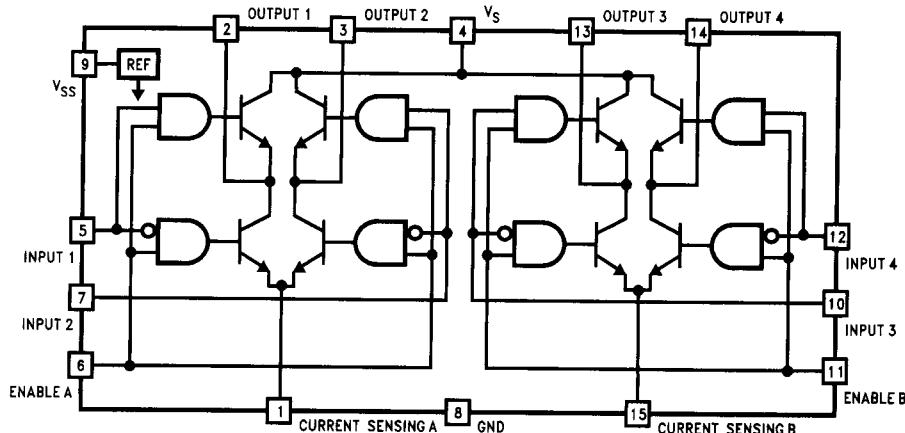
### Features

- Power supply voltage up to 46V
- 2A output per channel
- Low saturation voltage
- Thermal shutdown protection
- Logical "0" input voltage up to 1.5V (High noise immunity)
- Pin for pin replacement for L298N

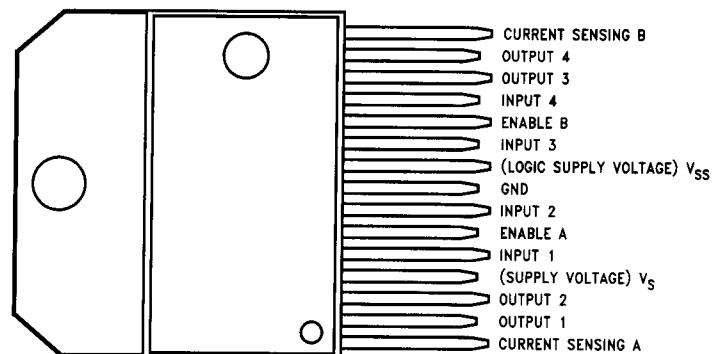
### Applications

- DC and stepper motor drivers
- Relay and solenoid drivers

### Block & Connection Diagrams



TL/H/9302-1



TL/H/9302-2

TO 220-15  
Order Number LM18298T  
NS Package Number TA15A

**Absolute Maximum Ratings** (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|   |            |
|---|------------|
| Main Supply (Pin 4)   | 50V        |
| Logic Supply (Pin 9)  | 7V         |
| Logic Inputs<br>(Pins 5, 6, 7, 10, 11, 12)                              | -0.3 to 7V |
| Peak Output Current (Per Channel)<br>Non-Repetitive ( $t = 100 \mu s$ ) | 3A         |
| Repetitive (80% duty cycle, $t_{ON} = 10 \text{ ms}$ )                  | 2.5A       |
| DC Operation  | 2A         |

|  |                 |
|--|-----------------|
| Sense Voltage (Pins 1, 15)               | -1 to +2.3V     |
| Power Dissipation (Note 2)               | 25W             |
| ESD Susceptibility (Note 3)              | 1 kV            |
| Lead Temperature (Soldering, 10 seconds) | 260°C           |
| Storage Temperature Range                | -65°C to +150°C |

**Operating Ratings**

|                                      |                 |
|--------------------------------------|-----------------|
| Junction Temperature Range ( $T_J$ ) | -40°C to +150°C |
| Main Supply (Pin 4)                  | 46V             |

**Electrical Characteristics**

$V_S = 42V$ ,  $V_{SS} = 5V$ ,  $I_O = 0A$ ,  $T_J = 25^\circ C$ ,  $L = 0V$ ,  $H = 5V$ , unless otherwise specified

| Symbol      | Parameter                                       | Conditions            | Typical<br>(Note 4) | Limit<br>(Note 5) | Units<br>(Limits) |
|-------------|---|-----------------------|---------------------|-------------------|-------------------|
| $V_S$       | Main Supply Voltage (Pin 4)                     |                       |                     | $V_{SS} + 2.5$    | V (min)           |
|             |   |                       |                     | 46                | V (max)           |
| $V_{SS}$    | Logic Supply Voltage (Pin 9)                    |                       |                     | 4.5               | V (min)           |
|             |   |                       |                     | 7                 | V (max)           |
| $I_S$       | Main Supply Quiescent Current<br>(Pin 4)        | Enable = H, Input = L | 9                   | 22                | mA (max)          |
|             |   | Enable = H, Input = H | 32                  | 70                |                   |
|             |   | Enable = L, Input = X |                     | 4                 |                   |
| $I_{SS}$    | Logic Supply Quiescent Current<br>(Pin 9)       | Enable = H, Input = L | 22                  | 36                | mA (max)          |
|             |   | Enable = H, Input = H | 6                   | 12                |                   |
|             |   | Enable = L, Input = X |                     | 6                 |                   |
| $V_{IL}$    | Low Level Input Voltage<br>(Pins 5, 7, 10, 12)  |                       |                     | -0.3              | V (min)           |
|             |   |                       |                     | 1.5               | V (max)           |
| $V_{IH}$    | High Level Input Voltage<br>(Pins 5, 7, 10, 12) |                       |                     | 2.3               | V (min)           |
|             |   |                       |                     | $V_{SS}$          | V (max)           |
| $I_{IL}$    | Low Level Input Current<br>(Pins 5, 7, 10, 12)  | Input = L             |                     | -10               | $\mu A$ (max)     |
| $I_{IH}$    | High Level Input Current<br>(Pins 5, 7, 10, 12) | Input = H             | 30                  | 100               | $\mu A$ (max)     |
| $V_{EN\ L}$ | Low Level Enable Voltage<br>(Pins 6, 11)        |                       |                     | -0.3              | V (min)           |
|             |   |                       |                     | 1.5               | V (max)           |
| $V_{EN\ H}$ | High Level Enable Voltage<br>(Pins 6, 11)       |                       |                     | 2.3               | V (min)           |
|             |   |                       |                     | $V_{SS}$          | V (max)           |
| $I_{EN\ L}$ | Low Level Enable Input Current<br>(Pins 6, 11)  | Enable = L            |                     | -10               | $\mu A$ (max)     |
| $I_{EN\ H}$ | High Level Enable Input Current<br>(Pins 6, 11) | Enable = H            | 30                  | 100               | $\mu A$ (max)     |

**Electrical Characteristics** (Continued)V<sub>S</sub> = 42V, V<sub>SS</sub> = 5V, I<sub>O</sub> = 0A, T<sub>J</sub> = 25°C, unless otherwise specified

| Symbol                  | Parameter   | Conditions  | Typical<br>(Note 4) | Limit<br>(Note 5) | Units<br>(Limits) |
|-------------------------|---|---|---------------------|-------------------|-------------------|
| V <sub>CE sat (H)</sub> | Source Saturation Voltage<br>(Pins 2, 3, 13, 14)                | I <sub>O</sub> = 1A                                 | 1.35                | 1.7               | V (max)           |
|                         |   | I <sub>O</sub> = 2A                                 | 2.0                 | 2.7               |                   |
| V <sub>CE sat (L)</sub> | Sink Saturation Voltage<br>(Pins 2, 3, 13, 14)                  | I <sub>O</sub> = 1A                                 | 1.2                 | 1.6               | V (max)           |
|                         |   | I <sub>O</sub> = 2A                                 | 1.7                 | 2.3               |                   |
| V <sub>CE sat</sub>     | Total Drop<br>V <sub>CE sat (H)</sub> + V <sub>CE sat (L)</sub> | I <sub>O</sub> = 1A                                 |                     | 3.2               | V (max)           |
|                         |   | I <sub>O</sub> = 2A                                 |                     | 4.9               |                   |
| V <sub>sense</sub>      | Sensing Voltage (Pins 1, 15)                                    | t ≤ 50 μs   |                     | -1                | V (min)           |
|                         |   | Continuous  |                     | -0.5              |                   |
|                         |   | Continuous  |                     | 2                 |                   |
| T <sub>1</sub>          | Source Current Turn-Off Delay                                   | 0.5 Input to 0.9 I <sub>O</sub> (Figure 2)          | 0.5                 |                   | μs                |
| T <sub>2</sub>          | Source Current Fall Time  | 0.9 I <sub>O</sub> to 0.1 I <sub>O</sub> (Figure 2) | 0.15                |                   | μs                |
| T <sub>3</sub>          | Source Current Turn-On Delay                                    | 0.5 Input to 0.1 I <sub>O</sub> (Figure 2)          | 1.3                 |                   | μs                |
| T <sub>4</sub>          | Source Current Rise Time  | 0.1 I <sub>O</sub> to 0.9 I <sub>O</sub> (Figure 2) | 0.85                |                   | μs                |
| T <sub>5</sub>          | Sink Current Turn-Off Delay                                     | 0.5 Input to 0.9 I <sub>O</sub> (Figure 3)          | 0.25                |                   | μs                |
| T <sub>6</sub>          | Sink Current Fall Time  | 0.9 I <sub>O</sub> to 0.1 I <sub>O</sub> (Figure 3) | 0.1                 |                   | μs                |
| T <sub>7</sub>          | Sink Current Turn-On Delay                                      | 0.5 Input to 0.1 I <sub>O</sub> (Figure 3)          | 1.3                 |                   | μs                |
| T <sub>8</sub>          | Sink Current Rise Time  | 0.1 I <sub>O</sub> to 0.9 I <sub>O</sub> (Figure 3) | 0.1                 |                   | μs                |
| f <sub>C</sub>          | Commutation Frequency   | I <sub>O</sub> = 2A                                 | 25                  |                   | kHz               |

**Note 1:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications do not apply when operating the device beyond its specified Operating Ratings.

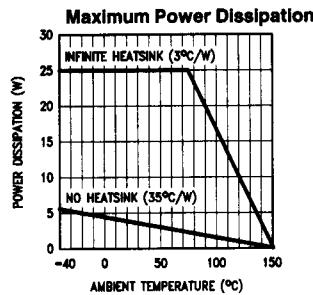
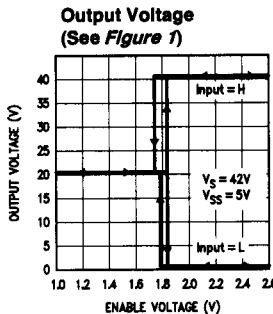
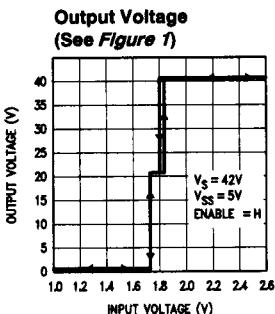
**Note 2:** The maximum power dissipation must be derated at elevated temperatures and is a function of T<sub>J max</sub>, θ<sub>JC</sub>, and T<sub>C</sub>. The maximum allowable power dissipation at any temperature is P<sub>D max</sub> = (T<sub>J max</sub> - T<sub>C</sub>)/θ<sub>JC</sub> or the number given in the Absolute Maximum Ratings, whichever is lower. The typical junction-to-case thermal resistance (θ<sub>JC</sub>) of the LM18298 is 3°C/W.

**Note 3:** Human body model, 100 pF discharged through a 1.5 kΩ resistor.

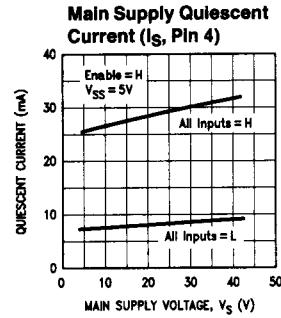
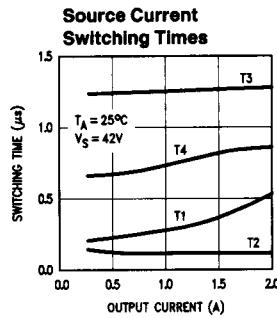
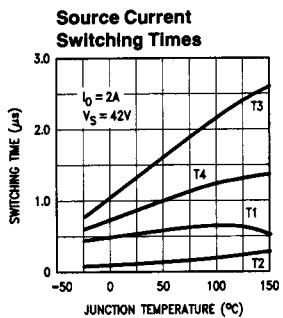
**Note 4:** Typicals are at 25°C and represent the most likely parametric norm.

**Note 5:** Limits are guaranteed and 100% tested.

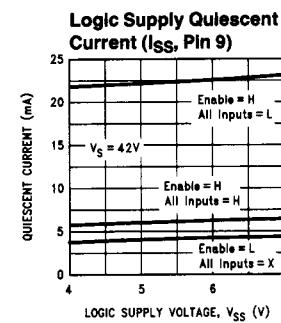
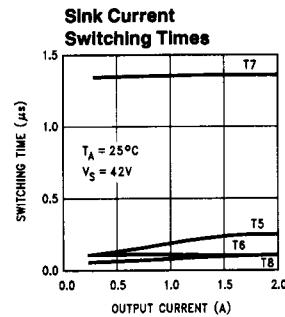
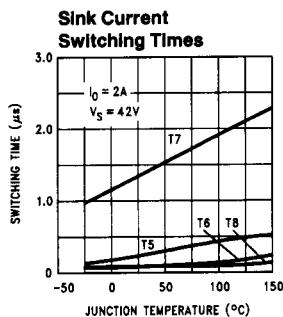
## Typical Performance Characteristics



TL/H/9302-3



TL/H/9302-12



TL/H/9302-13

## Test Circuits

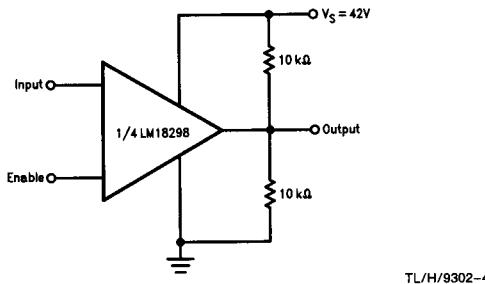


FIGURE 1. Input/Enable Threshold Test Circuit

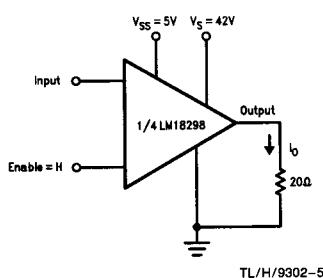


FIGURE 2(a). Source Current Switching Time Test Circuit

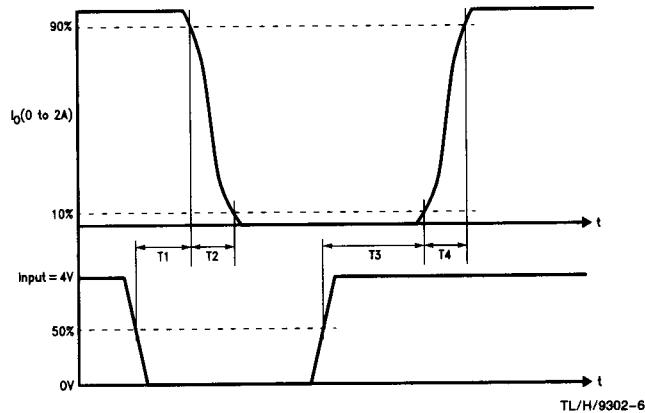


FIGURE 2(b). Source Current Switching Time Definitions

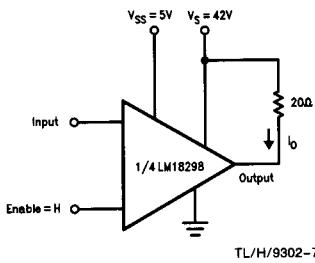


FIGURE 3(a). Sink Current Switching Time Test Circuit

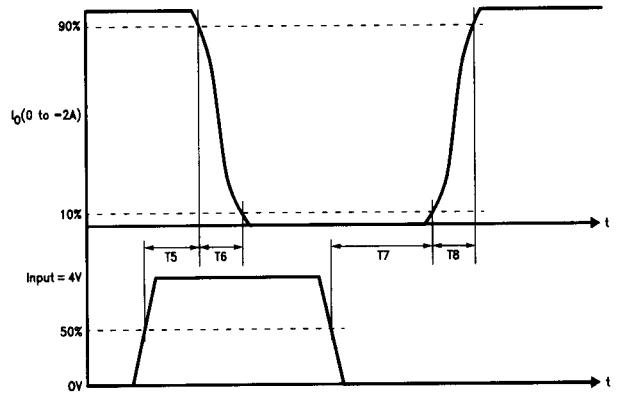
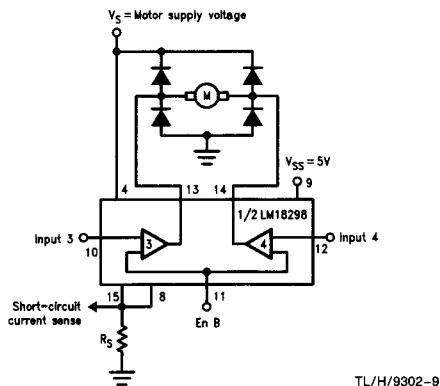
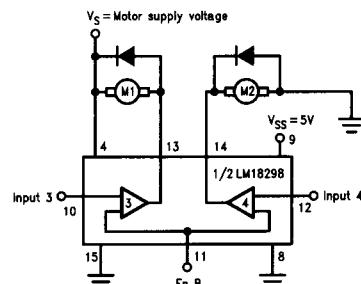


FIGURE 3(b). Sink Current Switching Time Definitions

## Applications Information



TL/H/9302-9



TL/H/9302-10

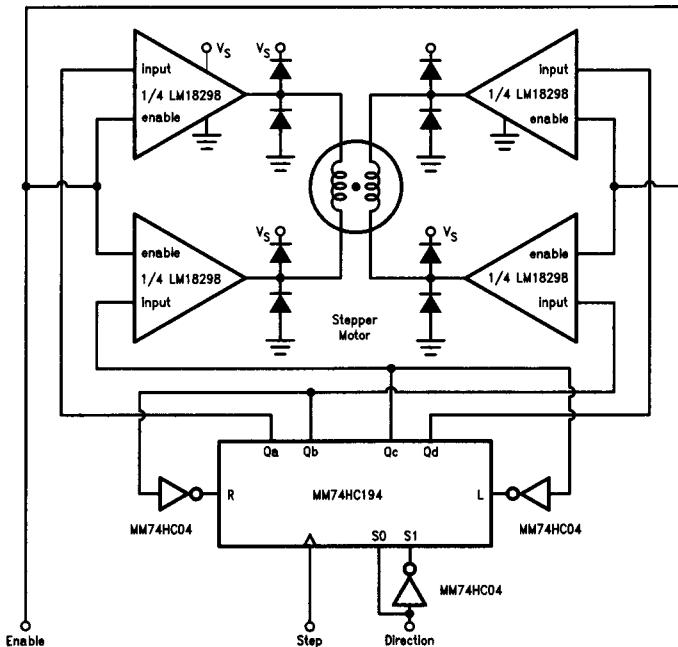
| Enable B | Inputs                         | Motor Direction  |
|----------|--------------------------------|------------------|
| H        | Input 3 = H, Input 4 = L       | Clockwise        |
|          | Input 3 = L, Input 4 = H       | Counterclockwise |
|          | Input 3 = Input 4              | Dynamic Braking  |
| L        | Input 3 = X, Input 4 = Input 3 | Coast to a Stop  |

L = Low H = High X = don't care  
FIGURE 4. Bidirectional DC Motor Control

| Enable B | Input 3 | Motor 1         | Input 4 | Motor 2         |
|----------|---------|-----------------|---------|-----------------|
| H        | H       | Dynamic Braking | H       | Run             |
| H        | L       | Run             | L       | Dynamic Braking |
| L        | X       | Coast to a Stop | X       | Coast to a Stop |

L = Low H = High X = Don't Care

FIGURE 5. 2-Motor Controller  
(Using both High- and Low-Side Driver Modes)



TL/H/9302-11

FIGURE 6. Two-Phase Bipolar Stepper Motor Control Circuit

### CLAMP DIODES

When driving inductive loads, diodes are necessary to clamp spikes at the LM18298 outputs. Clamp diodes must have a recovery time of 200 ns or better and a forward drop

of 1.2V or less at the rated load current. Typical devices are the MB346 (Microsemi Corp., Santa Ana, CA), and the V331X (Varo Semiconductor Inc., Garland, TX).