• Featuring Unitrode L293 and L293D
  Products Now From Texas Instruments
• Wide Supply-Voltage Range: 4.5 V to 36 V
• Separate Input-Logic Supply
• Internal ESD Protection
• Thermal Shutdown
• High-Noise-Immunity Inputs
• Functional Replacements for SGS L293 and SGS L293D
• Output Current 1 A Per Channel (600 mA for L293D)
• Peak Output Current 2 A Per Channel (1.2 A for L293D)
• Output Clamp Diodes for Inductive Transient Suppression (L293D)

description

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600 mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input is high, the associated drivers are enabled and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

On the L293, external high-speed output clamp diodes should be used for inductive transient suppression. A VCC1 terminal, separate from VCC2, is provided for the logic inputs to minimize device power dissipation.

The L293 and L293D are characterized for operation from 0°C to 70°C.

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.
NOTE: Output diodes are internal in L293D.

Texas Instruments Available Options

<table>
<thead>
<tr>
<th>TA</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°C to 70°C</td>
<td>L293NE L293DNE</td>
</tr>
</tbody>
</table>

Unitrade Products from Texas Instruments Available Options

<table>
<thead>
<tr>
<th>TA</th>
<th>Packaged Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°C to 70°C</td>
<td>L293DWP L293DDWP L293N L293DN</td>
</tr>
</tbody>
</table>

The DWP package is available taped and reeled. Add the suffix TR to device type (e.g., L293DWPTR).
**FUNCTION TABLE**

*(each driver)*

<table>
<thead>
<tr>
<th>INPUTS†</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Y</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>X</td>
<td>Z</td>
</tr>
</tbody>
</table>

H = high level, L = low level, X = irrelevant, Z = high impedance (off)

† In the thermal shutdown mode, the output is in the high-impedance state, regardless of the input levels.

**logic diagram**

**schematics of inputs and outputs (L293)**

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**Texas Instruments**

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schematics of inputs and outputs (L293D)

**Absolute Maximum Ratings**

- **Supply voltage**, $V_{CC1}$ (see Note 1): 36 V
- **Output supply voltage**, $V_{CC2}$: 36 V
- **Input voltage**, $V_I$: –3 V to $V_{CC2} + 3$ V
- **Output voltage range**, $V_O$: –3 V to $V_{CC2} + 3$ V
- **Peak output current**, $I_O$ (nonrepetitive, $t \leq 5$ ms): L293: ±2 A
  - L293D: ±1.2 A
- **Continuous output current**, $I_O$: L293: ±1 A
  - L293D: ±600 mA
- **Continuous total dissipation** at (or below) 25°C free-air temperature (see Notes 2 and 3): 2075 mW
- **Maximum junction temperature**, $T_J$: 150°C
- **Lead temperature**, 1.6 mm (1/16 inch) from case for 10 seconds: 260°C
- **Storage temperature range**, $T_{stg}$: –65°C to 150°C

Note: Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

**Notes:**
1. All voltage values are with respect to the network ground terminal.
2. For operation above 25°C free-air temperature, derate linearly at the rate of 16.6 mW/°C.
3. For operation above 25°C case temperature, derate linearly at the rate of 71.4 mW/°C. Due to variations in individual device electrical characteristics and thermal resistance, the built-in thermal overload protection may be activated at power levels slightly above or below the rated dissipation.
### recommended operating conditions

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>MIN</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;IH&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;IL&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T&lt;sub&gt;A&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

### electrical characteristics, V<sub>CC1</sub> = 5 V, V<sub>CC2</sub> = 24 V, T<sub>A</sub> = 25°C

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;OH&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;OL&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;IH&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;IL&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;CC1&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;CC2&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### switching characteristics, V<sub>CC1</sub> = 5 V, V<sub>CC2</sub> = 24 V, T<sub>A</sub> = 25°C

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>L293NE, L293DNE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&lt;sub&gt;PLH&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>T&lt;sub&gt;PHL&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>T&lt;sub&gt;TLH&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>T&lt;sub&gt;THL&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>

† The algebraic convention, in which the least positive (most negative) designated minimum, is used in this data sheet for logic voltage levels.
PARAMETER MEASUREMENT INFORMATION

NOTES:  
A. \( C_L \) includes probe and jig capacitance.  
B. The pulse generator has the following characteristics: \( t_r \leq 10 \text{ ns}, t_f \leq 10 \text{ ns}, t_w = 10 \mu\text{s}, \text{PRR} = 5 \text{ kHz}, Z_O = 50 \Omega \).

Figure 1. Test Circuit and Voltage Waveforms
Figure 2. Two-Phase Motor Driver (L293)
Figure 3. Two-Phase Motor Driver (L293D)
APPLICATION INFORMATION

Figure 4. DC Motor Controls
(connections to ground and to supply voltage)

Figure 5. Bidirectional DC Motor Control

<table>
<thead>
<tr>
<th>EN</th>
<th>3A</th>
<th>M1</th>
<th>4A</th>
<th>M2</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>H</td>
<td>Fast motor stop</td>
<td>H</td>
<td>Run</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
<td>Run</td>
<td>L</td>
<td>Fast motor stop</td>
</tr>
<tr>
<td>L</td>
<td>X</td>
<td>Free-running motor stop</td>
<td>X</td>
<td>Free-running motor stop</td>
</tr>
</tbody>
</table>

L = low, H = high, X = don't care
mounting instructions

The $R_{th,j-amp}$ of the L293 can be reduced by soldering the GND pins to a suitable copper area of the printed circuit board or to an external heatsink.

Figure 9 shows the maximum package power $P_{TOT}$ and the $\theta_{JA}$ as a function of the side $L$ of two equal square copper areas having a thickness of 35 $\mu$m (see Figure 7). In addition, an external heat sink can be used (see Figure 8).

During soldering, the pin temperature must not exceed 260°C, and the soldering time must not be longer than 12 seconds.

The external heatsink or printed circuit copper area must be connected to electrical ground.
APPLICATION INFORMATION

Copper Area 35-µm Thickness

Printed Circuit Board

Figure 7. Example of Printed Circuit Board Copper Area (used as heat sink)

Figure 8. External Heat Sink Mounting Example ($\theta_{JA} = 25^\circ$C/W)
APPLICATION INFORMATION

MAXIMUM POWER AND JUNCTION VS THERMAL RESISTANCE

Figure 9

MAXIMUM POWER DISSIPATION VS AMBIENT TEMPERATURE

Figure 10
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