



LM18293

Four Channel Push-Pull Driver

General Description

The LM18293 is designed to drive DC loads up to one amp. Typical applications include driving such inductive loads as solenoids, relays and stepper motors along with driving switching power transistors and use as a buffer for low level logic signals. The four inputs accept standard TTL and DTL levels for ease of interfacing. Two enable pins are provided that also accept the standard TTL and DTL levels. Each enable controls 2 channels and when an enable pin is disabled (tied low), the corresponding outputs are forced to the TRI-STATE® condition. If the enable pins are not connected (i.e., floating), the circuit will function as if it has been enabled. Separate pins are provided for the main power supply (pin 8), and the logic supply (pin 16). This allows a lower voltage to be used to bias up the logic resulting in reduced power dissipation. The chip is packaged in a specially de-

signed 16 pin power DIP. The 4 center pins of this package are tied together and form the die paddle inside the package. This provides much better heat sinking capability than most other DIP packages available. The device is capable of operating at voltages up to 36 volts.

Features

- 1A output current capability per channel
- Pin for pin replacement for L293B
- Special 16 pin power DIP package
- 36 volt operation
- Internal thermal overload protection
- Logical "0" input voltage up to 1.5 volts results in high noise immunity

Typical Connection

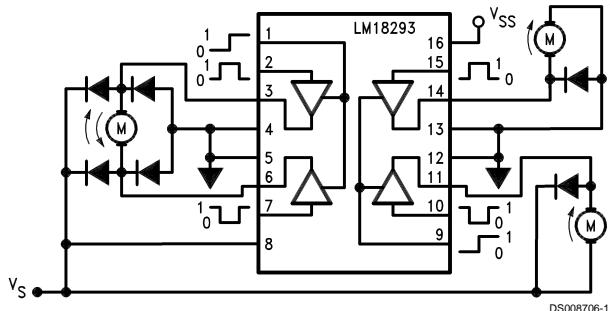


FIGURE 1. Application circuit showing bidirectional and on/off control of a single DC motor using two outputs and unidirectional on/off function of two DC motors using a single output each.

Order Number LM18293N

NS Package Number N16A

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Absolute Maximum Ratings (Note 1)

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

| | | | |
|---|-----|--|--------------------|
| Output Drive Supply Voltage (V_S) | 36V | Junction Temperature (T_J) | +150°C |
| Logic Supply Voltage (V_{SS}) | 36V | Thermal Resistance Junction to Case (θ_{JC}) | 14°C/W |
| Input Voltage (V_I) | 7V | Thermal Resistance Junction to Ambient (θ_{JA}) | 80°C/W |
| Enable Voltage (V_E) | 7V | Internal Power Dissipation | Internally Limited |
| Peak Output Current (Non-Repetitive $t = 5$ ms) | 2A | Operating Temperature Range | -40°C to +125°C |
| | | Storage Temperature Range | -65°C to +150°C |
| | | Lead Temperature (Solder 10 seconds) | 260°C |

Electrical Characteristics

$V_S = 24V$, $V_{SS} = 5V$, $T = 25^\circ C$, $L = 0.4V$, $H = 3.5V$, each channel, unless otherwise noted

| Symbol | Parameter | Conditions | Typical | Tested Limit (Note 2) | Design Limit (Note 3) | Units |
|---------------------|---|--|----------------|-------------------------------------|-----------------------|--------------------------------------|
| V_S | Main Supply (Pin 8) | Maximum Supply Voltage | | 36 | | Vmax |
| V_{SS} | Logic Supply (Pin 16) | Minimum Logic Supply Voltage | | 4.5 | | Vmin |
| | | Maximum Logic Supply Voltage | | 36 | | Vmax |
| I_S | Total Quiescent Supply Current | $V_I = L$ $I_O = 0$ $V_E = H$ $V_I = H$ $I_O = 0$ $V_E = H$ $V_E = L$ | 2 16 4 | 6 24 4 | | mAmax mAmax mAmax |
| I_{SS} | Total Quiescent Logic Supply Current (pin 16) | $V_I = L$ $I_O = 0$ $V_E = H$ $V_I = H$ $I_O = 0$ $V_E = H$ $V_E = L$ | 44 16 16 | 60 22 24 | | mAmax mAmax mAmax |
| V_I | Input Voltage | Min Value of Low Max Value of Low Min Value of High Max Value of High ($V_{SS} \leq 7$) Max Value of High ($V_{SS} > 7$) | | -0.3 1.5 2.3 V_{SS} 7 | | Vmin Vmax Vmin Vmax Vmax |
| I_I | Input Current | $V_I = L$ $V_I = H$ | 30 | -10 100 | | μ Amax μ Amax |
| V_E | Enable Voltage (Pins 1, 9) | Min Value of Low Max Value of Low Min Value of High Max Value of High ($V_{SS} \leq 7$) Max Value of High ($V_{SS} > 7$) | | -0.3 1.5 2.3 V_{SS} 7 | | Vmin Vmax Vmin Vmax Vmax |
| I_E | Enable Current | $V_E = L$ $V_E = H$ | -30 | -100 ± 10 | | μ Amax μ Amax |
| V_{CE} sat Top | Source Saturation Voltage | $I_o = -1$ amp | 1.4 | 1.8 | | Vmax |
| V_{CE} sat Bottom | Sink Saturation Voltage | $I_o = 1$ amp | 1.2 | 1.8 | | Vmax |
| t_r | Rise Time | 10%–90% V_o | 250 | | | ns |
| t_f | Fall Time | 90%–10% V_o | 250 | | | ns |
| t_{on} | Turn-On Delay | 50% V_I to 50% V_o | 450 | | | ns |
| t_{off} | Turn-Off Delay | 50% V_I to 50% V_o | 200 | | | ns |

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Electrical specifications do not apply when operating the device beyond its rated operating conditions.

Note 2: Tested limits are guaranteed and 100% production tested.

Note 3: Design limits are guaranteed (but not 100% production tested) over the full supply and temperature range. These limits are not used to calculate outgoing quality levels.

Connection Diagram

| | | | |
|----------------|---|----|-----------------|
| ENABLE 1 | 1 | 16 | V _{SS} |
| INPUT 1 | 2 | 15 | INPUT 4 |
| OUTPUT 1 | 3 | 14 | OUTPUT 4 |
| GROUND | 4 | 13 | GROUND |
| GROUND | 5 | 12 | GROUND |
| OUTPUT 2 | 6 | 11 | OUTPUT 3 |
| INPUT 2 | 7 | 10 | INPUT 3 |
| V _S | 8 | 9 | ENABLE 2 |

DS008706-2

Enable 1 activates outputs 1 & 2
Enable 2 activates outputs 3 & 4

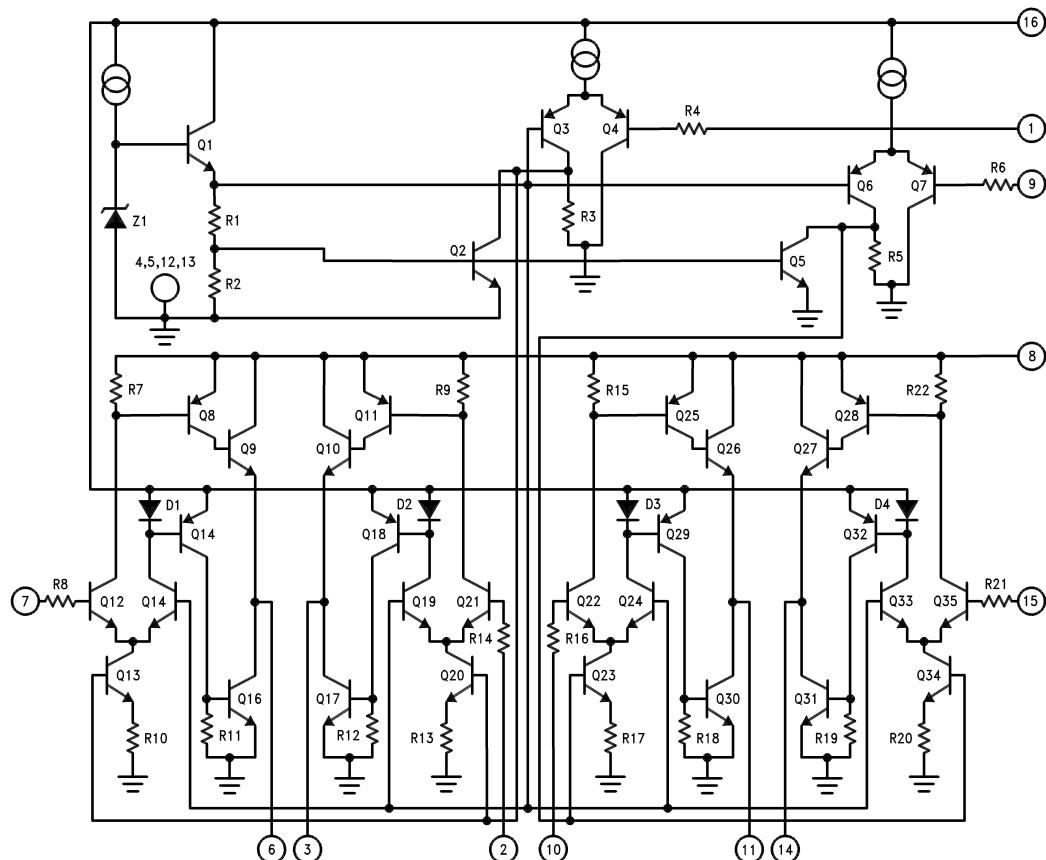
TABLE 1. Input/Output Truth Table

| V _E (**) | V _I (Each Channel) | V _O |
|---------------------|-------------------------------|----------------|
| H | H | H |
| H | L | L |
| L | H | X (*) |
| L | L | X (*) |

(*) High output impedance.

(**) Relative to the pertinent channel.

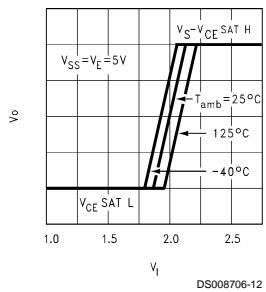
Simplified Schematic



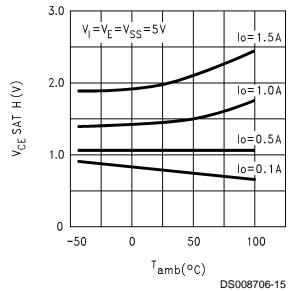
DS008706-3

Typical Performance Characteristics

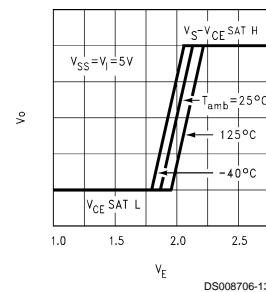
Output Voltage vs.
Input Voltage



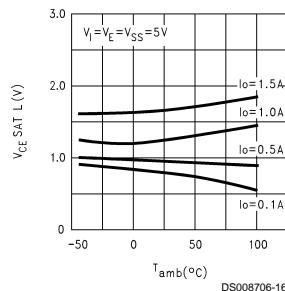
Source Saturation Voltage
vs. Ambient Temperature



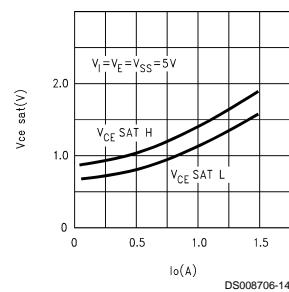
Output Voltage vs.
Enable Voltage



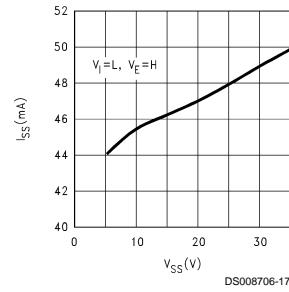
Sink Saturation Voltage
vs. Ambient Temperature



Saturation Voltage vs.
Output Current



Quiescent Logic Supply
Current vs.
Logic Supply Voltage



Typical Applications

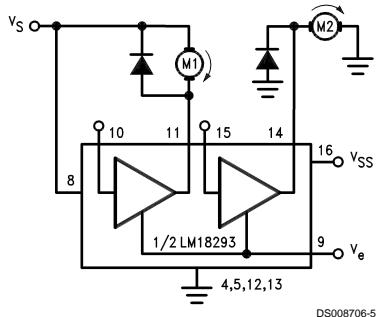


FIGURE 2. DC motor controls (with connections to ground and to the supply voltages)

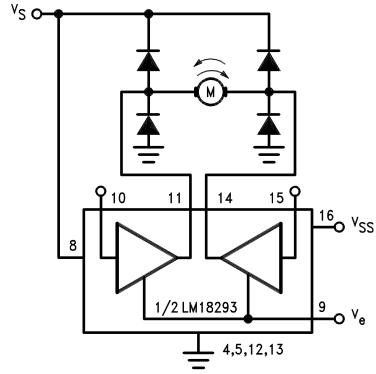


FIGURE 3. Bidirectional DC motor control

TABLE 2. DC Motor Controls

| V_E | Pin 10 | Pin 15 | M1 | M2 |
|-------|--------|--------|-------------------------|-------------------------|
| H | H | H | Fast Motor Stop | Run |
| H | H | L | Fast Motor Stop | Fast Motor Stop |
| H | L | H | Run | Run |
| H | L | L | Run | Fast Motor Stop |
| L | X | X | Free Running Motor Stop | Free Running Motor Stop |

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

Bipolar Stepping Motor Control (see Figure 4)

TABLE 4. Full Step Sequencing (Note 4)

| V_{IN} 1 | V_{IN} 2 | Step |
|------------|------------|------|
| L | L | 1 |
| L | H | 2 |
| H | H | 3 |
| H | L | 4 |
| L | L | 1 |

Note 4: V_E 1 and V_E 2 = H

TABLE 3. Bidirectional DC Motor Control

| Inputs | | Function |
|-----------|-----------------|-------------------------|
| $V_E = H$ | Pin 10 = H | Turn CW |
| | Pin 15 = L | |
| | Pin 10 = L | Turn CCW |
| | Pin 15 = H | |
| $V_E = L$ | Pin 10 = Pin 15 | Fast Motor Stop |
| | Pin 10 = X | Free Running Motor Stop |
| | Pin 15 = X | Motor Stop |

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

TABLE 5. Half Step Sequencing

| V_E 1 | V_E 2 | V_{IN} 1 | V_{IN} 2 | Step |
|---------|---------|------------|------------|------|
| H | L | L | X | 1 |
| H | H | L | L | 2 |
| L | H | X | L | 3 |
| H | H | H | L | 4 |
| H | L | H | X | 5 |
| H | H | H | H | 6 |
| L | H | X | H | 7 |
| H | H | L | H | 8 |
| H | L | L | X | 1 |

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

Bipolar Stepping Motor Control

(see Figure 4) (Continued)

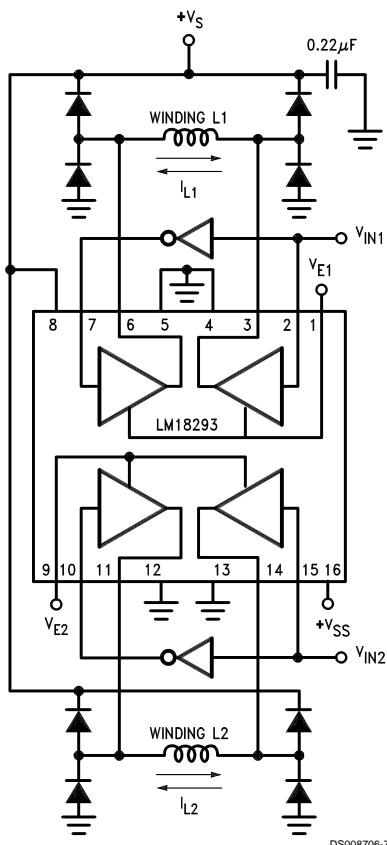


FIGURE 4. Motor Control Block Diagram

Mounting Instructions

The junction to ambient thermal resistance of the LM18293 can be reduced by soldering the ground pins to a suitable copper area of the printed circuit board or to an external heatsink. The graph of Figure 7 which shows the maximum power dissipated and junction to ambient thermal resistance as a function of the side "L" of two equal square copper areas having a thickness of 35μ , as in Figure 6, illustrates this. In addition, it is possible to use an external heatsink (see Figure 5). During soldering the pins temperature must not exceed 230°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.

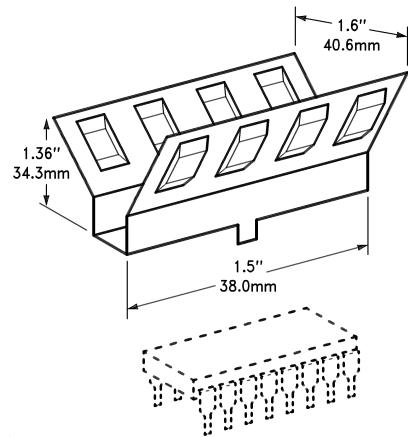


FIGURE 5. Staver External Heat-sink

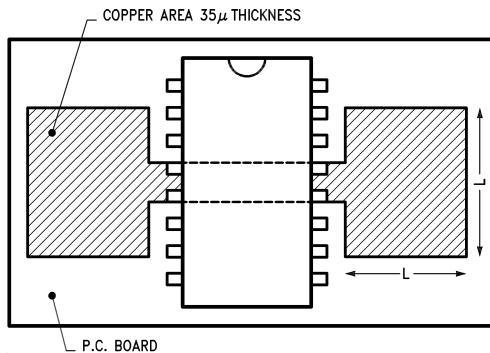


FIGURE 6. PCB Thermal Layout

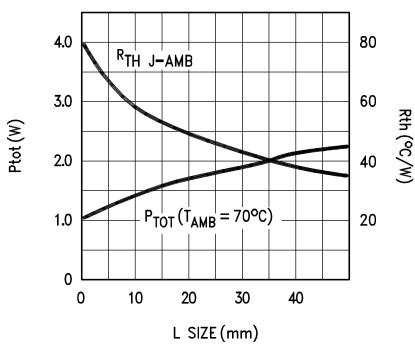


FIGURE 7. Maximum Power Dissipated and Junction to Ambient Thermal Resistance vs. Size

Mounting Instructions (Continued)

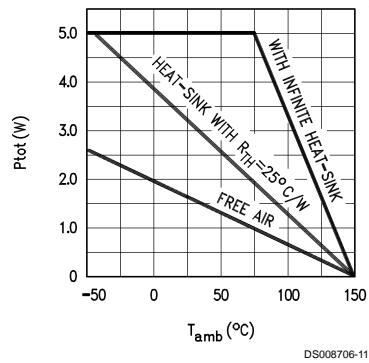
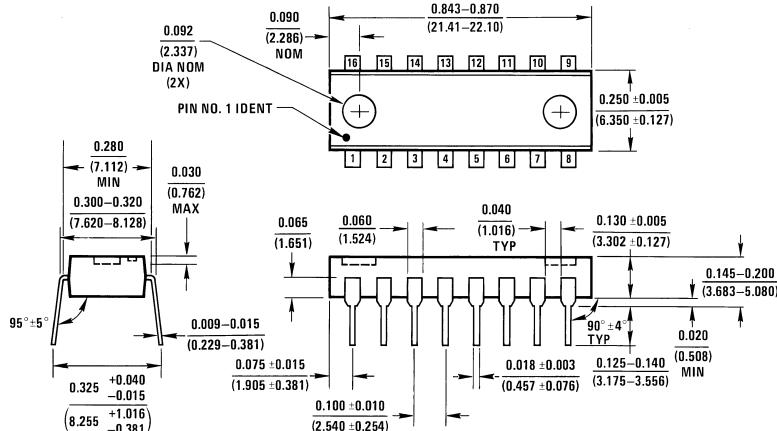


FIGURE 8. Maximum Allowable Power Dissipation vs Ambient Temperature

LM18293 Four Channel Push-Pull Driver

Physical Dimensions inches (millimeters) unless otherwise noted



N16A (REV E)

Molded Dual-In-Line Package (N)

Order Number LM18293N

NS Package Number N16A

LIFE SUPPORT POLICY

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