

## LM18293 Four Channel Push Pull Driver

### General Description

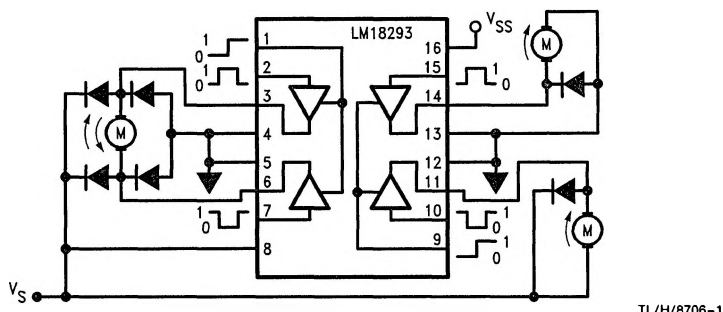
The LM18293 is designed to drive DC loads up to one amp. Typical applications include driving such inductive loads as solenoids, relays and stepper motors along with driving switching power transistors and use as a buffer for low level logic signals. The four inputs accept standard TTL and DTL levels 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<sup>®</sup> 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**

## Absolute Maximum Ratings

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

Output Drive Supply Voltage ( $V_S$ )	36V
Logic Supply Voltage ( $V_{SS}$ )	36V
Input Voltage ( $V_I$ )	7V
Enable Voltage ( $V_E$ )	7V

Peak Output Current (Non-Repetitive $t = 5 \text{ ms}$ )	2A
Junction Temperature ( $T_J$ )	+ 150°C
Thermal Resistance Junction to Case ( $\theta_{JC}$ )	14°C/W
Thermal Resistance Junction to Ambient ( $\theta_{JA}$ )	80°C/W
Internal Power Dissipation	Internally Limited
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

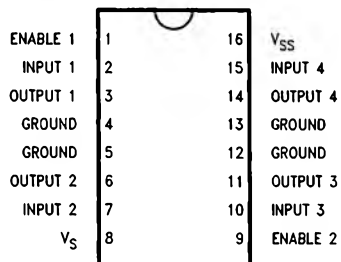
$V_S = 24V$ ,  $V_{SS} = 5V$ ,  $T = 25^\circ C$ ,  $L = 0.4V$ ,  $H = 3.5V$ , each channel, unless otherwise noted

Symbol	Parameter	Conditions	Typical	Tested Limit (Note 1)	Design Limit (Note 2)	Units
V <sub>S</sub>	Main Supply (Pin 8)	Maximum Supply Voltage		36		V <sub>max</sub>
V <sub>SS</sub>	Logic Supply (Pin 16)	Minimum Logic Supply Voltage Maximum Logic Supply Voltage		4.5 36		V <sub>min</sub> V <sub>max</sub>
I <sub>S</sub>	Total Quiescent Supply Current	V <sub>I</sub> = L    I <sub>O</sub> = 0    V <sub>E</sub> = H V <sub>I</sub> = H    I <sub>O</sub> = 0    V <sub>E</sub> = H V <sub>E</sub> = L	2 16	6 24 4		mA <sub>max</sub> mA <sub>max</sub> mA <sub>max</sub>
I <sub>SS</sub>	Total Quiescent Logic Supply Current (pin 16)	V <sub>I</sub> = L    I <sub>O</sub> = 0    V <sub>E</sub> = H V <sub>I</sub> = H    I <sub>O</sub> = 0    V <sub>E</sub> = H V <sub>E</sub> = L	44 16 16	60 22 24		mA <sub>max</sub> mA <sub>max</sub> mA <sub>max</sub>
V <sub>I</sub>	Input Voltage	Min Value of Low Max Value of Low Min Value of High Max Value of High (V <sub>SS</sub> ≤ 7) Max Value of High (V <sub>SS</sub> > 7)		−0.3 1.5 2.3 V <sub>SS</sub> 7		V <sub>min</sub> V <sub>max</sub> V <sub>min</sub> V <sub>max</sub> V <sub>max</sub>
I <sub>I</sub>	Input Current	V <sub>I</sub> = L V <sub>I</sub> = H	30	−10 100		μA <sub>max</sub> μA <sub>max</sub>
V <sub>E</sub>	Enable Voltage (Pins 1, 9)	Min Value of Low Max Value of Low Min Value of High Max Value of High (V <sub>SS</sub> ≤ 7) Max Value of High (V <sub>SS</sub> > 7)		−0.3 1.5 2.3 V <sub>SS</sub> 7		V <sub>min</sub> V <sub>max</sub> V <sub>min</sub> V <sub>max</sub> V <sub>max</sub>
I <sub>E</sub>	Enable Current	V <sub>E</sub> = L V <sub>E</sub> = H	−30	−100 ±10		μA <sub>max</sub> μA <sub>max</sub>
V <sub>CE sat Top</sub>	Source Saturation Voltage	I <sub>O</sub> = −1 amp	1.4	1.8		V <sub>max</sub>
V <sub>CE sat Bottom</sub>	Sink Saturation Voltage	I <sub>O</sub> = 1 amp	1.2	1.8		V <sub>max</sub>
t <sub>r</sub>	Rise Time	10%–90% V <sub>O</sub>	250			ns
t <sub>f</sub>	Fall Time	90%–10% V <sub>O</sub>	250			ns
t <sub>on</sub>	Turn-On Delay	50% V <sub>I</sub> to 50% V <sub>O</sub>	450			ns
t <sub>off</sub>	Turn-Off Delay	50% V <sub>I</sub> to 50% V <sub>O</sub>	200			ns

**Note 1: Tested limits are guaranteed and 100% production tested.**

**Note 2:** 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 activates outputs 1 & 2

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Enable 2 activates outputs 3 & 4

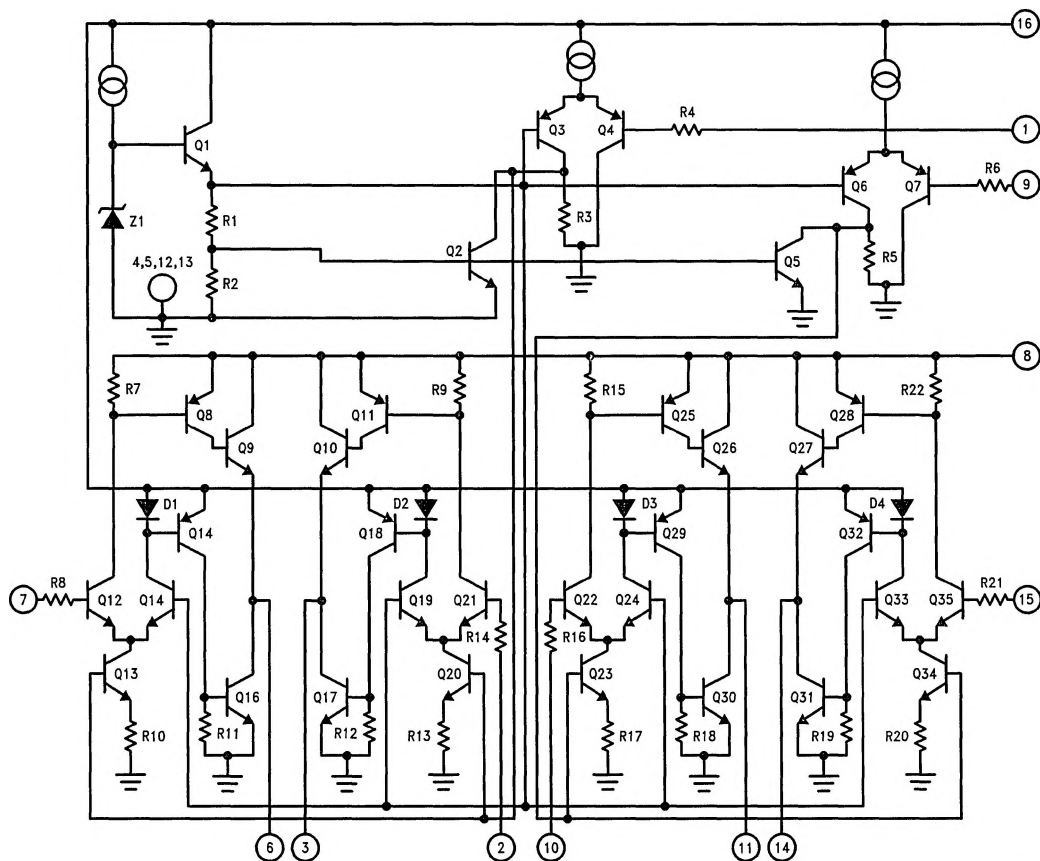
## Input/Output Truth Table

$V_E$ (**)	$V_I$ (Each Channel)	$V_O$
H	H	H
H	L	L
L	H	X (*)
L	L	X (*)

(\*) High output impedance.

(\*\*) Relative to the pertinent channel.

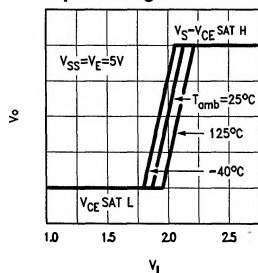
## Simplified Schematic



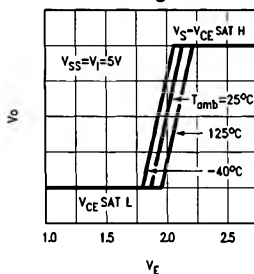
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# Typical Performance Characteristics $V_S$ In all cases = 24V

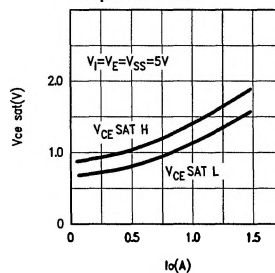
## Output Voltage vs. Input Voltage



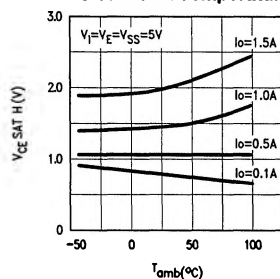
## Output Voltage vs. Enable Voltage



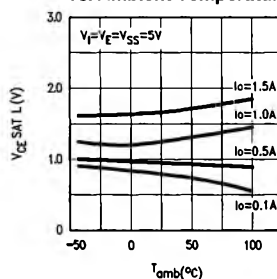
## Saturation Voltage vs. Output Current



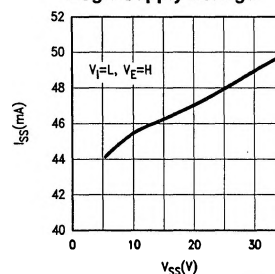
## Source Saturation Voltage vs. Ambient Temperature



## Sink Saturation Voltage vs. Ambient Temperature



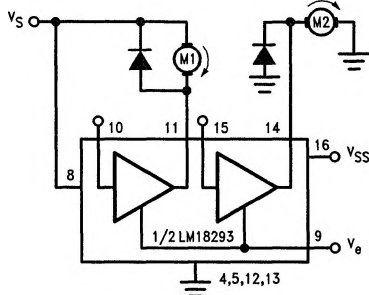
## Quiescent Logic Supply Current vs. Logic Supply Voltage



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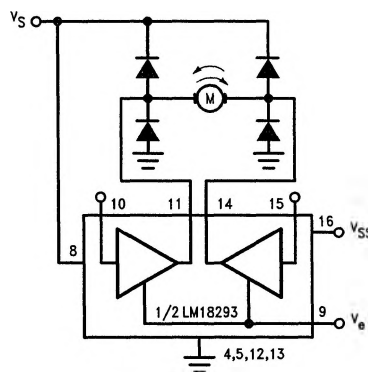
## Typical Applications

### DC motor controls (with connections to ground and to the supply voltages)



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### Bidirectional DC motor control



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$V_E$	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

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

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

# Bipolar Stepping Motor Control

## Step Sequencing Tables

### Full Step \*

V <sub>IN 1</sub>	V <sub>IN 2</sub>	Step
L	L	1
L	H	2
H	H	3
H	L	4
L	L	1

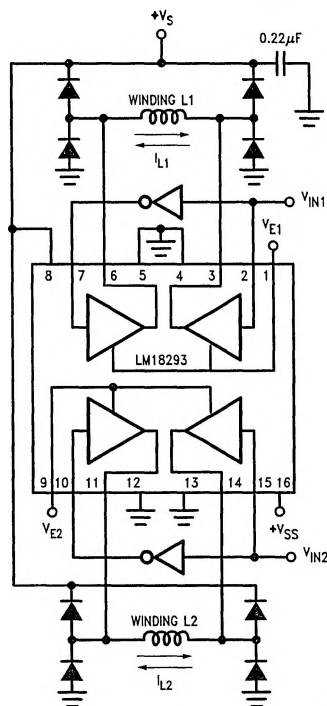
\*V<sub>E 1</sub> and V<sub>E 2</sub> = H

### Half Step

V <sub>E 1</sub>	V <sub>E 2</sub>	V <sub>IN 1</sub>	V <sub>IN 2</sub>	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

## Motor Control Block Diagram

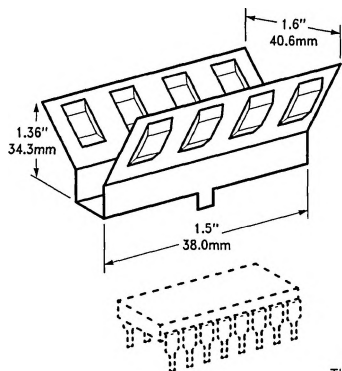


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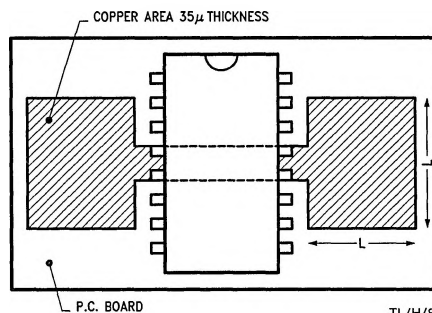
## Mounting Instructions

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 below, 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, illustrates this. In addition, it is possible to use an external heatsink (see illustration below). 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.

### Staver External Heat-sink

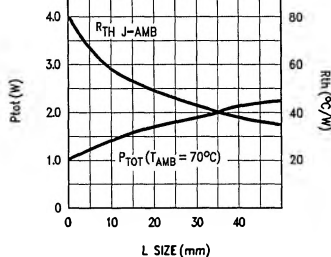


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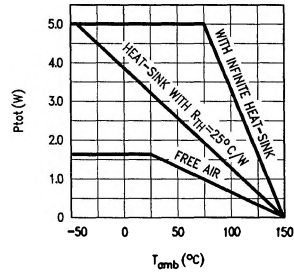
## Maximum power dissipated and junction to ambient thermal resistance vs. size



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## Mounting Instructions (Continued)

**Maximum allowable  
power dissipation  
vs. ambient temperature**



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