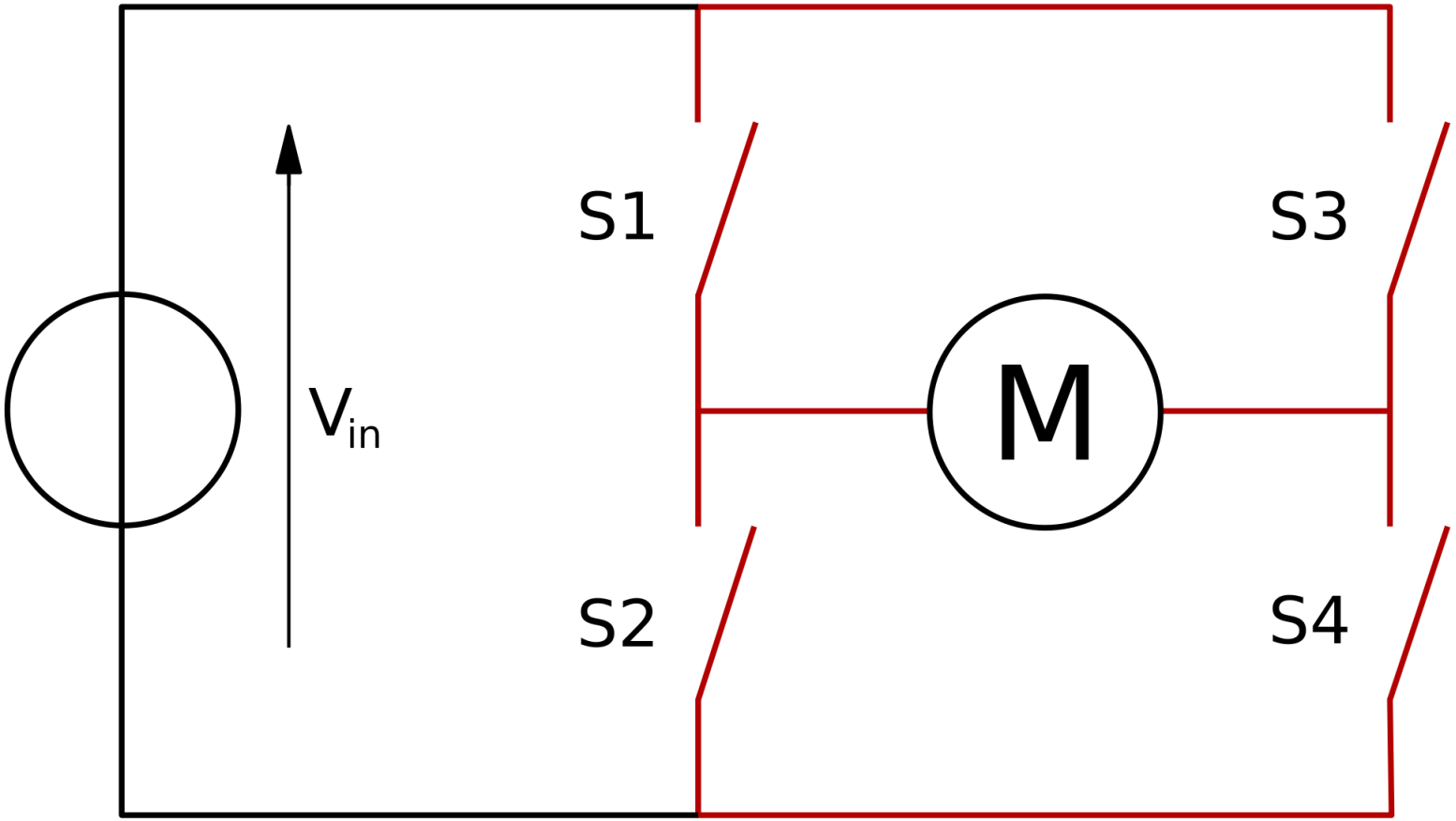
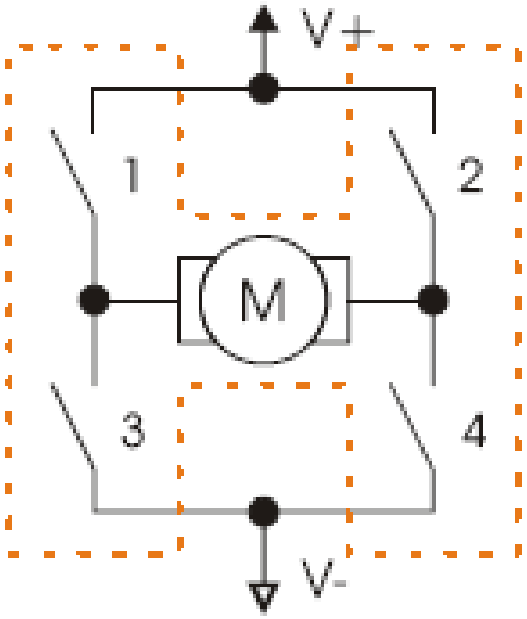
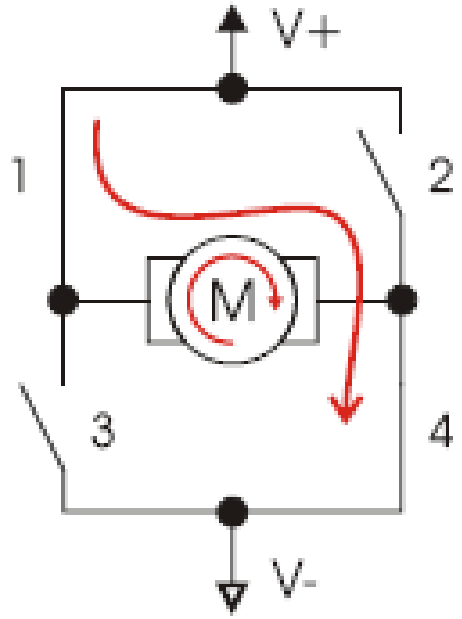
L293

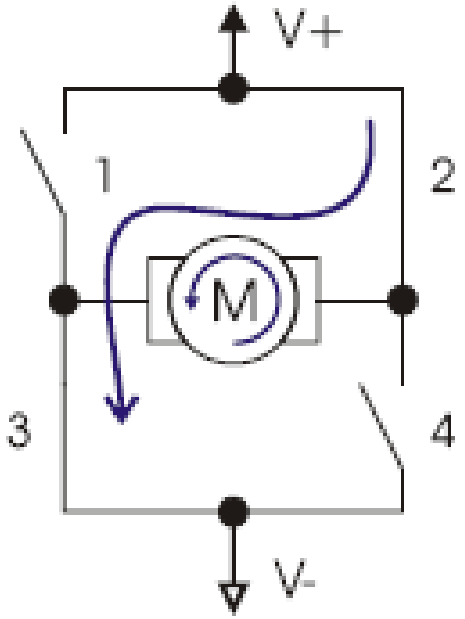
H Bridge


S1
S3
M
V_{in}
S2
S4

H-Bridge. Change rotation







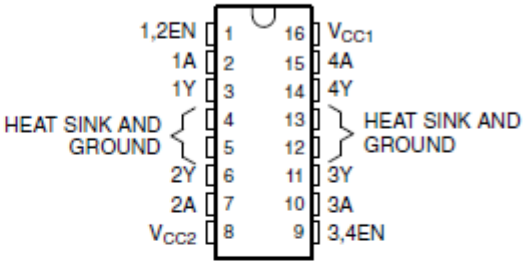
Data sheet

L293, L293D
QUADRUPLE HALF-H DRIVERS

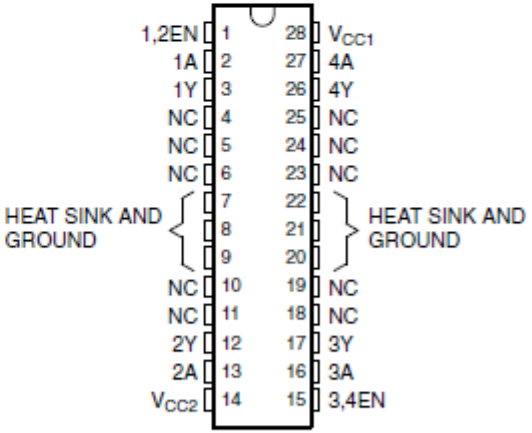
SLRS009C – SEPTEMBER 1986 – REVISED NOVEMBER 2004

- **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**
- **Functionally Similar to 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)**

L293 . . . N OR NE PACKAGE
L293D . . . NE PACKAGE
(TOP VIEW)



L293 . . . DWP PACKAGE
(TOP VIEW)



description/ordering information

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.

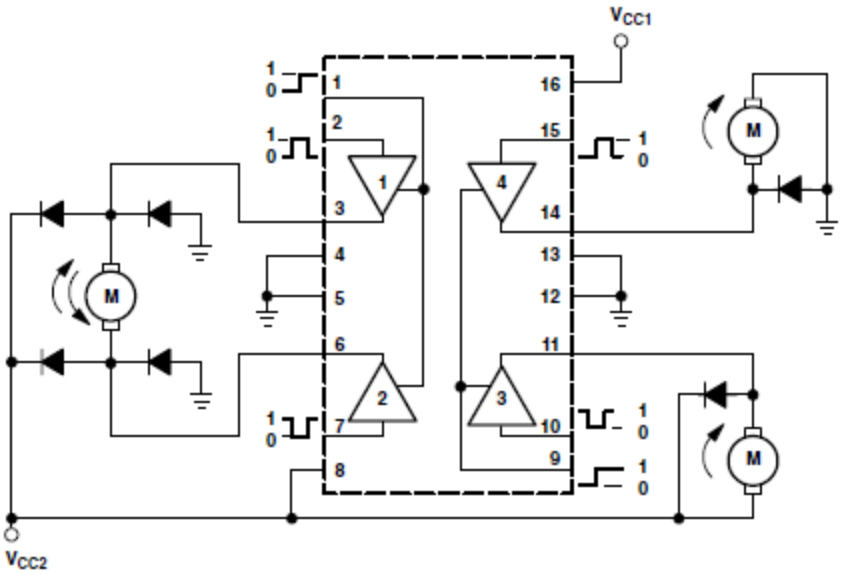
description/ordering information (continued)

On the L293, external high-speed output clamp diodes should be used for inductive transient suppressio

A V_{CC1} terminal, separate from V_{CC2}, is provided for the logic inputs to minimize device power dissipatio

The L293and L293D are characterized for operation from 0°C to 70°C.

block diagram



NOTE: Output diodes are internal in L293D.

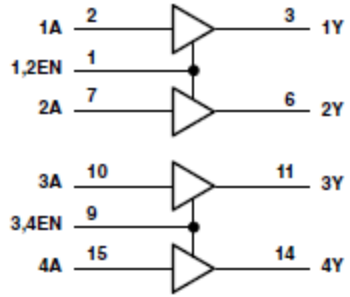
FUNCTION TABLE
(each driver)

INPUTS†		OUTPUT
A	EN	Y
H	H	H
L	H	L
X	L	Z

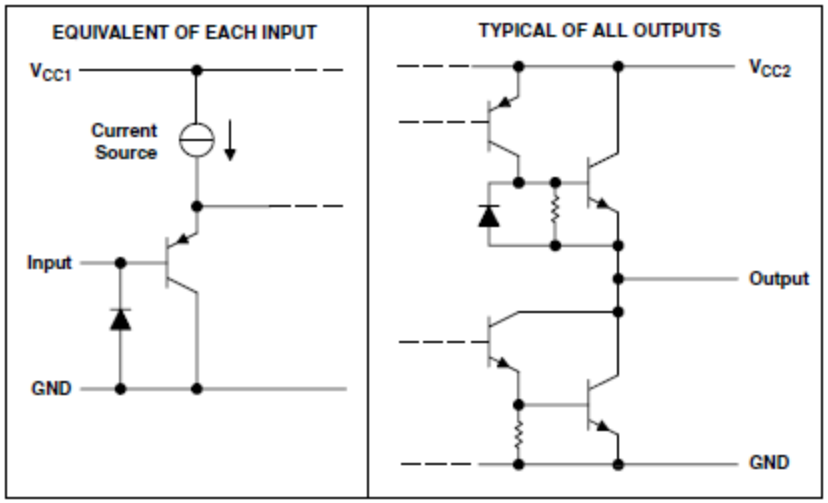
H = high level, L = low level, X = irrelevant,
Z = high impedance (off)

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

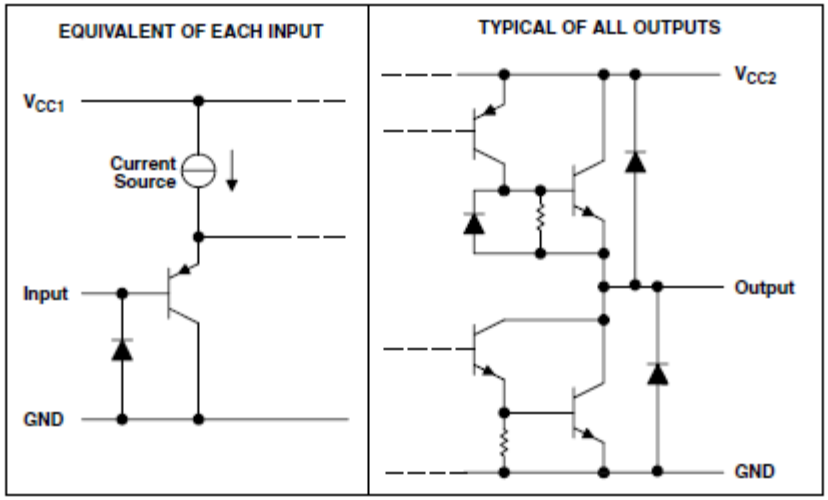
logic diagram



schematics of inputs and outputs (L293)



schematics of inputs and outputs (L293D)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{CC1} (see Note 1)	36 V
Output supply voltage, V_{CC2}	36 V
Input voltage, V_I	7 V
Output voltage range, V_O	–3 V to V_{CC2} + 3 V
Peak output current, I_O (nonrepetitive, t ≤ 5 ms): L293	±2 A
Peak output current, I_O (nonrepetitive, t ≤ 100 µs): L293D	±1.2 A
Continuous output current, I_O: L293	±1 A
Continuous output current, I_O: L293D	±600 mA
Package thermal impedance, θ_{JA} (see Notes 2 and 3): DWP package	TBD°C/W
N package	67°C/W
NE package	TBD°C/W
Maximum junction temperature, T_J	150°C
Storage temperature range, T_{stg}	–65°C to 150°C

† 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. Maximum power dissipation is a function of $T_J(max)$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) – T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.

APPLICATION INFORMATION

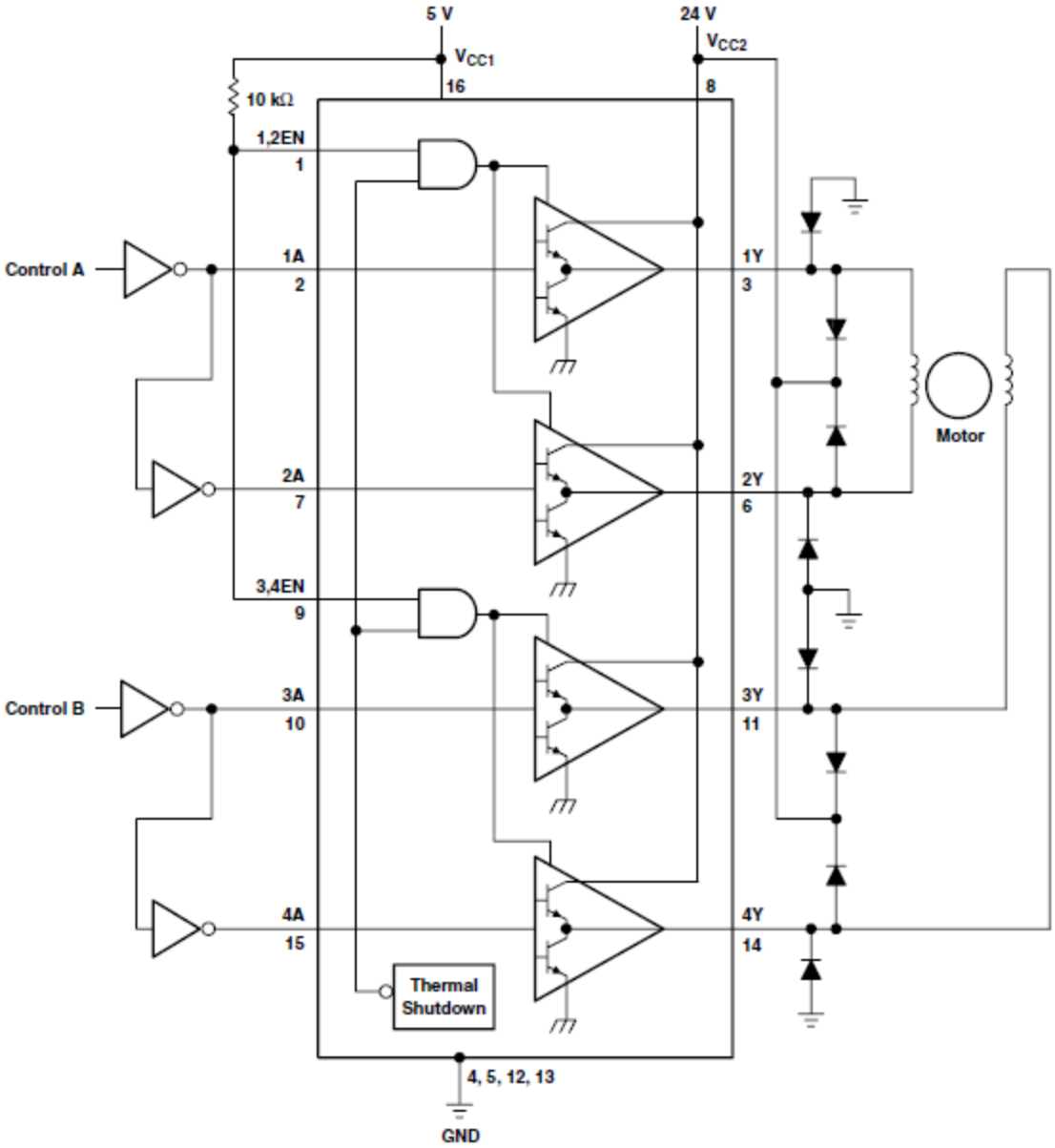


Figure 2. Two-Phase Motor Driver (L293)

APPLICATION INFORMATION

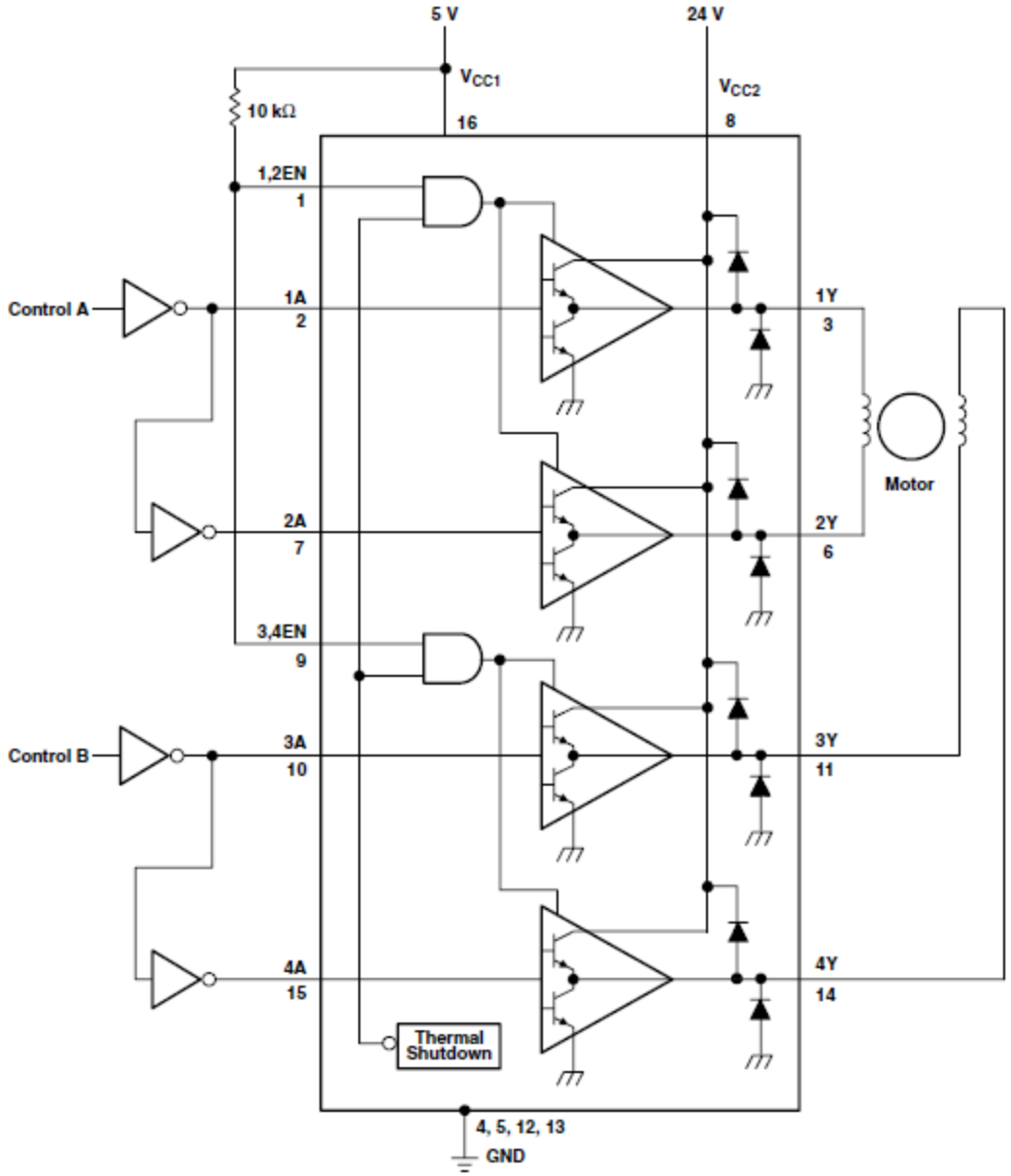


Figure 3. Two-Phase Motor Driver (L293D)

APPLICATION INFORMATION

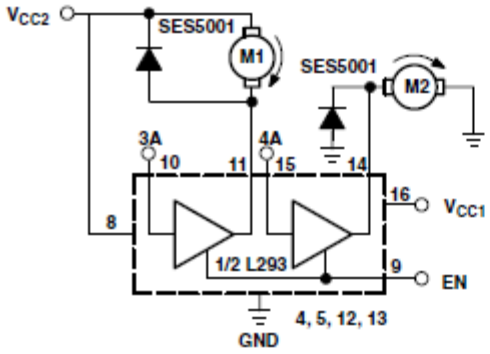


Figure 4. DC Motor Controls (connections to ground and to supply voltage)

EN	3A	M1	4A	M2
H	H	Fast motor stop	H	Run
H	L	Run	L	Fast motor stop
L	X	Free-running motor stop	X	Free-running motor stop

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

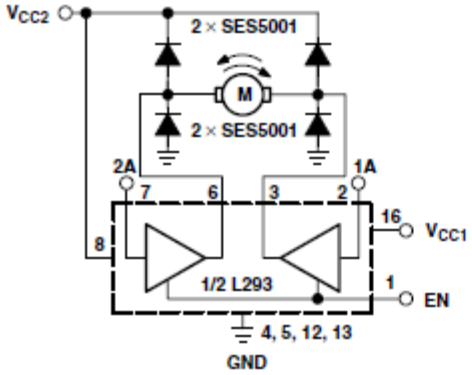


Figure 5. Bidirectional DC Motor Control

EN	1A	2A	FUNCTION
H	L	H	Turn right
H	H	L	Turn left
H	L	L	Fast motor stop
H	H	H	Fast motor stop
L	X	X	Fast motor stop

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

APPLICATION INFORMATION

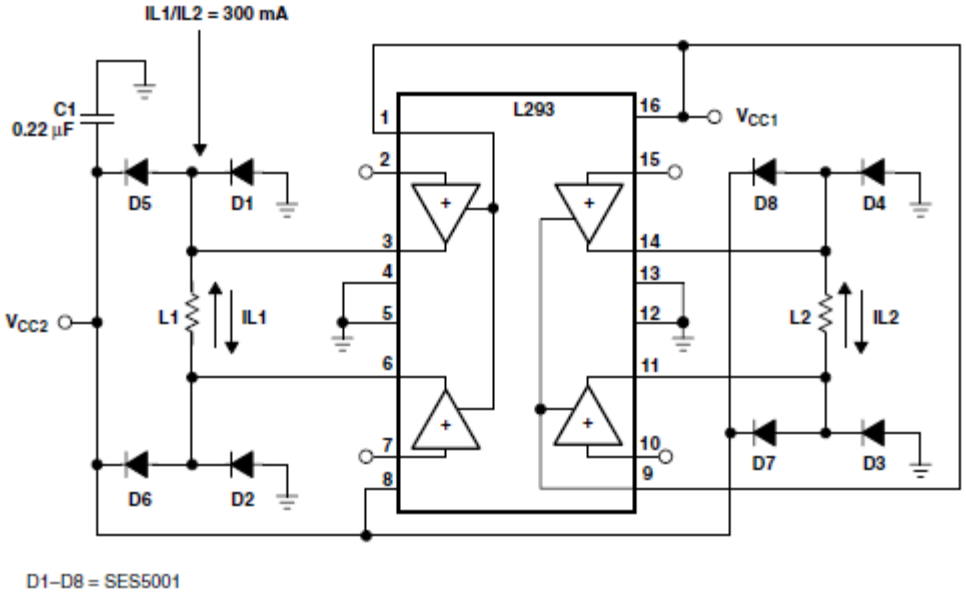


Figure 6. Bipolar Stepping-Motor Control

mounting instructions

The Rthj-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 heat sink.

Figure 9 shows the maximum package power P_{TOT} and the θ_{JA} as a function of the side l of two equal square copper areas having a thickness of 35 µm (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 exceed 12 seconds.

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

APPLICATION INFORMATION

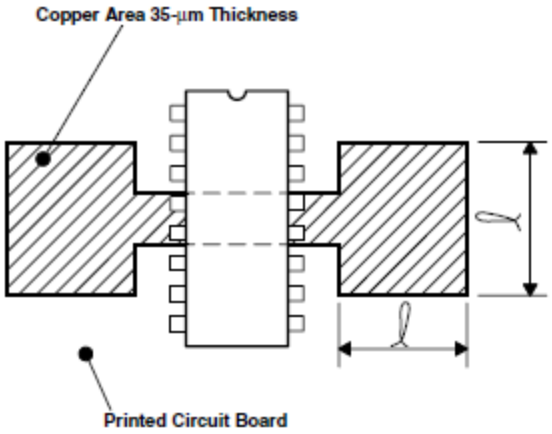


Figure 7. Example of Printed Circuit Board Copper Area (used as heat sink)

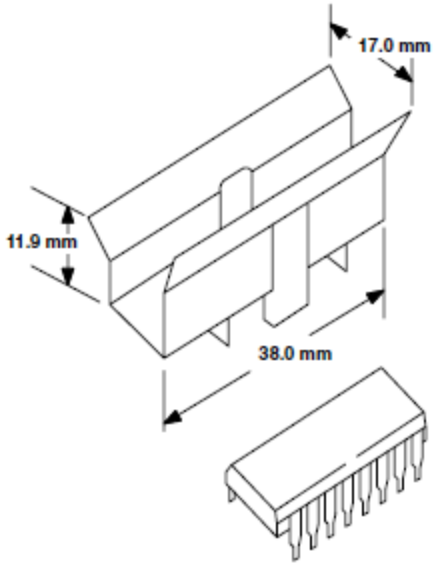
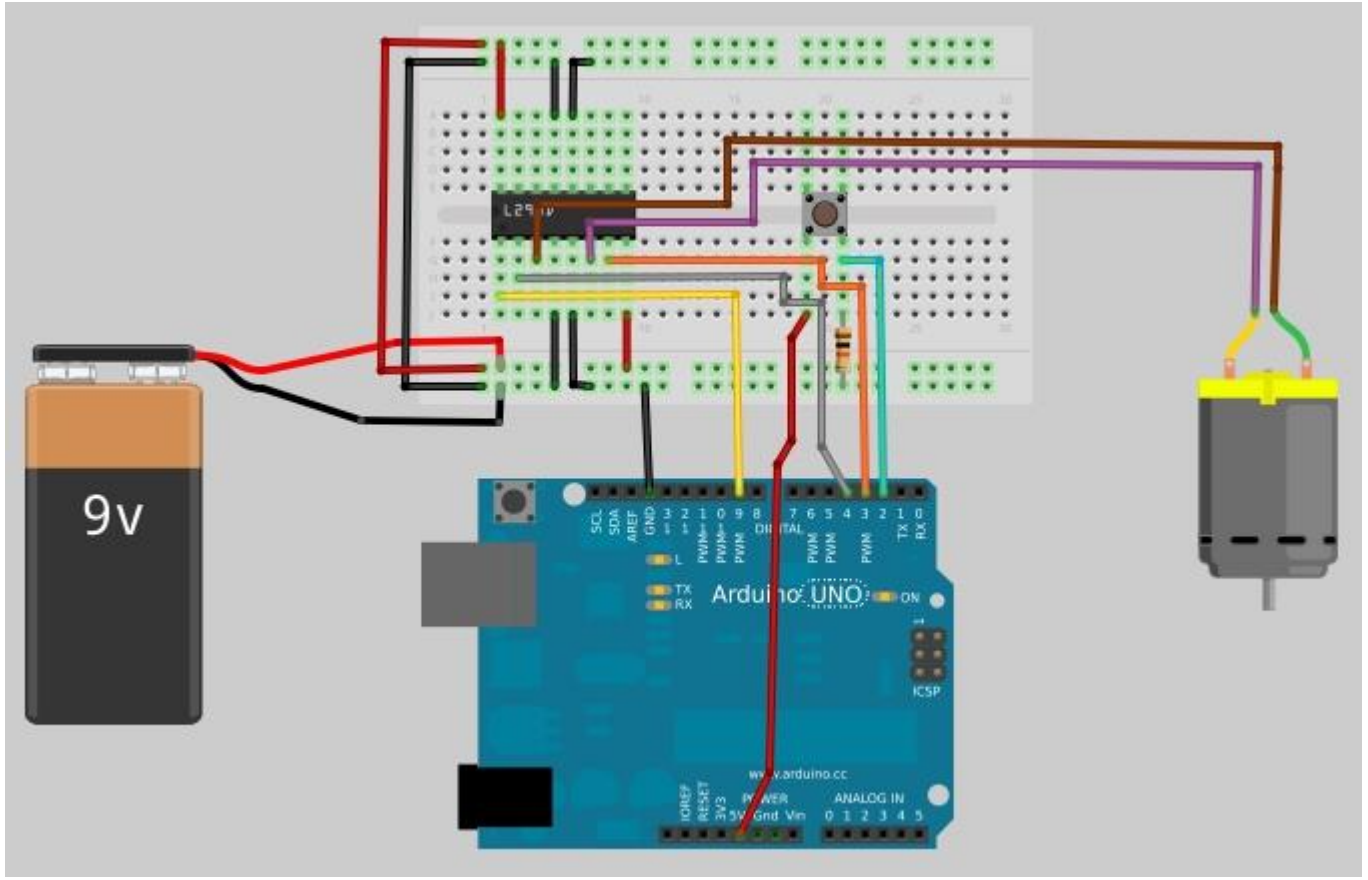


Figure 8. External Heat Sink Mounting Example (θ_{JA} = 25°C/W)

L293D H Bridge DC motor controller with Arduino

Pin 1	Pin 2		
High	Low	High	Turn clockwise
High	High	Low	Turn anti-clockwise
High	Low	Low	Stop
High	High	High	Stop
Low	Not applicable	Not applicable	Stop

Turn on your circuit and the motor will rotate to one direction. Press the button and the motor will rotate to the other side.



Upload this code:

```
int switchPin = 2; // switch input
int motor1Pin1 = 3; // pin 2 on L293D
int motor1Pin2 = 4; // pin 7 on L293D
int enablePin = 9; // pin 1 on L293D
void setup() {
   // set the switch as an input:
   pinMode(switchPin, INPUT);
   // set all the other pins you're using as outputs:
   pinMode(motor1Pin1, OUTPUT);
   pinMode(motor1Pin2, OUTPUT);
   pinMode(enablePin, OUTPUT);
   // set enablePin high so that motor can turn on:
   digitalWrite(enablePin, HIGH);
}
```

```
void loop() {
   // if the switch is high, motor will turn on one direction:
   if (digitalRead(switchPin) == HIGH) {
      digitalWrite(motor1Pin1, LOW); // set pin 2 on L293D low
      digitalWrite(motor1Pin2, HIGH); // set pin 7 on L293D high
   }
   // if the switch is low, motor will turn in the opposite direction:
   else {
      digitalWrite(motor1Pin1, HIGH); // set pin 2 on L293D high
      digitalWrite(motor1Pin2, LOW); // set pin 7 on L293D low
   }
}
```

Ref.: ***http://garagelab.com/profiles/blogs/tutorial-l293d-h-bridge-dc-motor-controller-with-arduino***

End