

L298N 是专用驱动集成电路，属于 H 桥集成电路，与 L293D 的差别是其输出电流增大，功率增强。其输出电流为 2A，最高电流 4A，最高工作电压 50V，可以驱动感性负载，如大功率直流电机，步进电机，电磁阀等，特别是其输入端可以与单片机直接相联，从而很方便地受单片机控制。当驱动直流电机时，可以直接控制步进电机，并可以实现电机正转与反转，实现此功能只需改变输入端的逻辑电平。为了避免电机对单片机的干扰，本模块加入光耦，进行光电隔离，从而使系统能稳定可靠的工作。

本模块具有体积小，控制方便的特点。采用此模块定会使您的电机控制自如，可以应对需要大功率步进电机的题目。

本模块具有 6 个指示灯，能指示步进电机的控制运行状态，便于步进电机初学者学习步进的编程，同时在教学中，也便于演示步进的运行状态。

本模块可控制两相、三相、四相的步进电机。

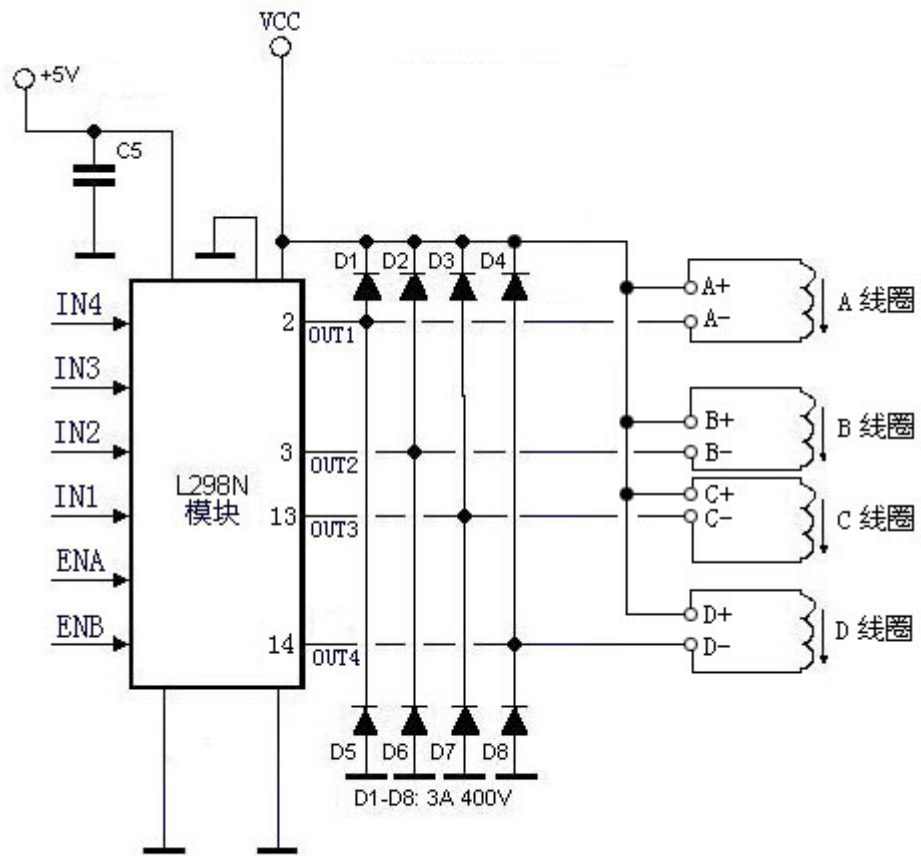
使用说明：

板上的 EN1 与 EN2 为高电平时有效，这里的电平指的是 TTL 电平。EN1 为 IN1 和 IN2 的使能端，EN2 为 IN3 和 IN4 的使能端。POWER 接直流电源，注意正负，电源正端为 VCC，电源地为 GND。

步进电机控制逻辑如下所示，其中 A、B、C、D 为步进电机的四个线圈，为 1 表示有电流通过，为 0 表示没有电流流过。线圈连线图如下图所示（以四相步进电机为例）。

| EN1 EN2 IN4 IN3 IN2 IN1 | A B C D |
|-------------------------|---------|
| 1 0 0 0 0 1 | 1 0 0 0 |
| 1 0 0 0 1 0 | 0 1 0 0 |
| 0 1 0 1 0 0 | 0 0 1 0 |
| 0 1 1 0 0 0 | 0 0 0 1 |

原理图：

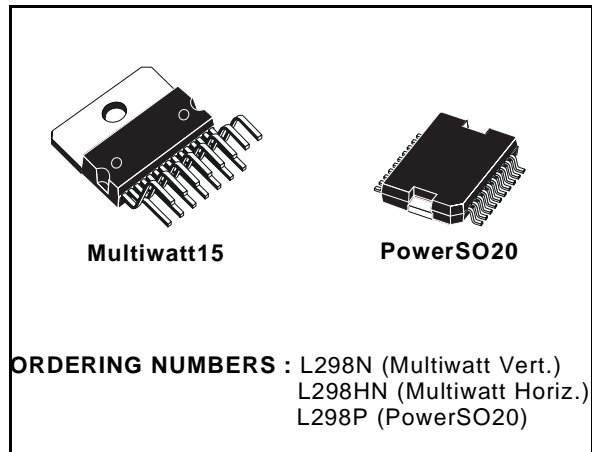


DUAL FULL-BRIDGE DRIVER

- OPERATING SUPPLY VOLTAGE UP TO 46 V
- TOTAL DC CURRENT UP TO 4 A
- LOW SATURATION VOLTAGE
- OVERTEMPERATURE PROTECTION
- LOGICAL "0" INPUT VOLTAGE UP TO 1.5 V (HIGH NOISE IMMUNITY)

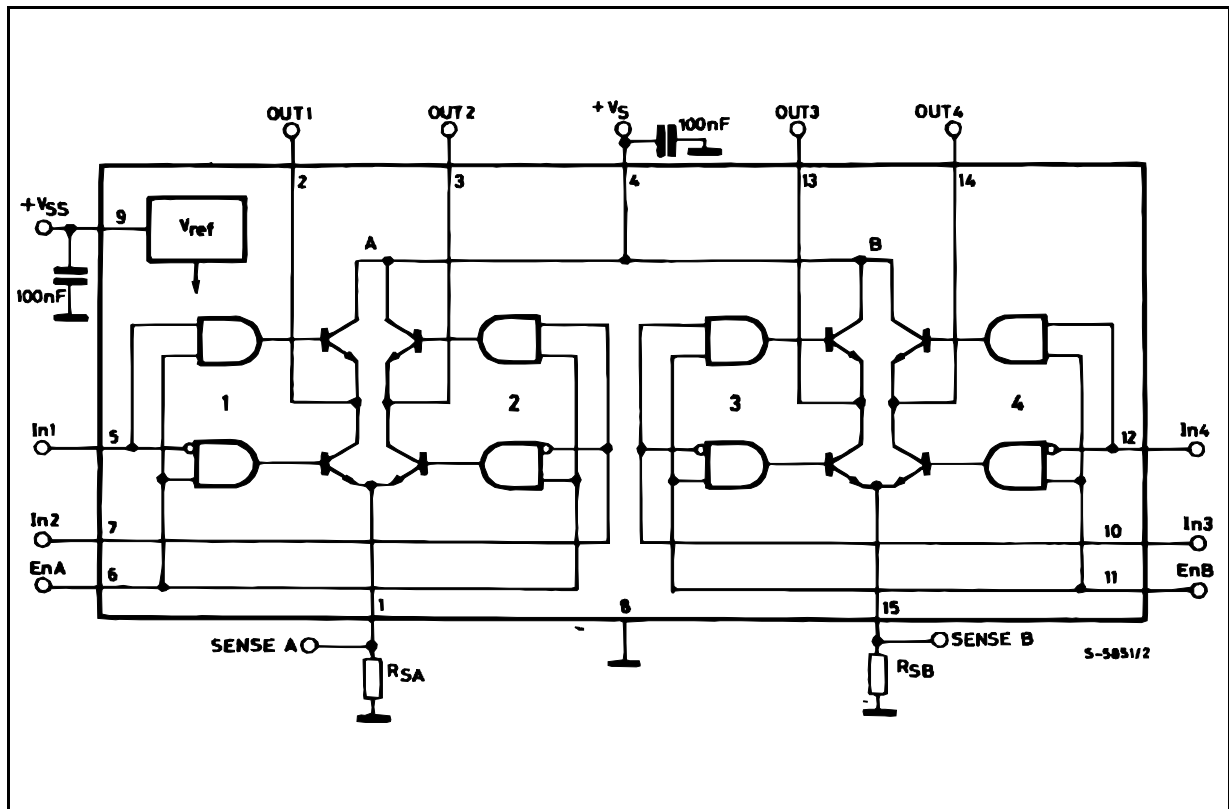
DESCRIPTION

The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It 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 enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the con-



nection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

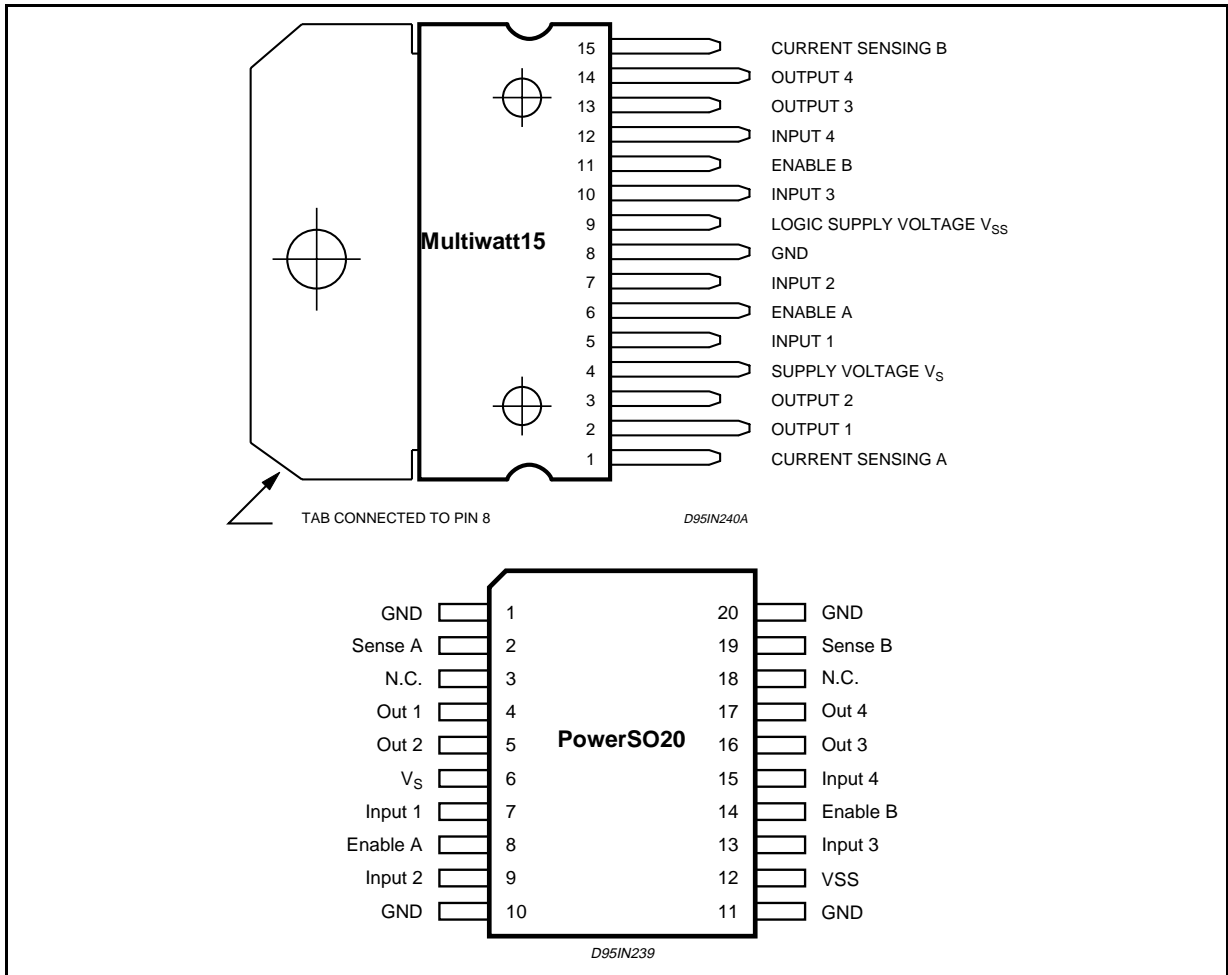
BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|----------------|---|------------|------------|
| V_S | Power Supply | 50 | V |
| V_{SS} | Logic Supply Voltage | 7 | V |
| V_I, V_{en} | Input and Enable Voltage | -0.3 to 7 | V |
| I_O | Peak Output Current (each Channel) | | |
| | - Non Repetitive ($t = 100\mu s$) | 3 | A |
| | - Repetitive (80% on -20% off; $t_{on} = 10ms$) | 2.5 | A |
| | -DC Operation | 2 | A |
| V_{sens} | Sensing Voltage | -1 to 2.3 | V |
| P_{tot} | Total Power Dissipation ($T_{case} = 75^\circ C$) | 25 | W |
| T_{op} | Junction Operating Temperature | -25 to 130 | $^\circ C$ |
| T_{stg}, T_j | Storage and Junction Temperature | -40 to 150 | $^\circ C$ |

PIN CONNECTIONS (top view)



THERMAL DATA

| Symbol | Parameter | | PowerSO20 | Multiwatt15 | Unit |
|-----------------|-------------------------------------|------|-----------|-------------|--------------|
| $R_{th j-case}$ | Thermal Resistance Junction-case | Max. | - | 3 | $^\circ C/W$ |
| $R_{th j-amb}$ | Thermal Resistance Junction-ambient | Max. | 13 (*) | 35 | $^\circ C/W$ |

(*) Mounted on aluminum substrate



PIN FUNCTIONS (refer to the block diagram)

| MW.15 | PowerSO | Name | Function |
|--------|------------|--------------------|---|
| 1;15 | 2;19 | Sense A; Sense B | Between this pin and ground is connected the sense resistor to control the current of the load. |
| 2;3 | 4;5 | Out 1; Out 2 | Outputs of the Bridge A; the current that flows through the load connected between these two pins is monitored at pin 1. |
| 4 | 6 | V _s | Supply Voltage for the Power Output Stages. A non-inductive 100nF capacitor must be connected between this pin and ground. |
| 5;7 | 7;9 | Input 1; Input 2 | TTL Compatible Inputs of the Bridge A. |
| 6;11 | 8;14 | Enable A; Enable B | TTL Compatible Enable Input: the L state disables the bridge A (enable A) and/or the bridge B (enable B). |
| 8 | 1,10,11,20 | GND | Ground. |
| 9 | 12 | V _{SS} | Supply Voltage for the Logic Blocks. A100nF capacitor must be connected between this pin and ground. |
| 10; 12 | 13;15 | Input 3; Input 4 | TTL Compatible Inputs of the Bridge B. |
| 13; 14 | 16;17 | Out 3; Out 4 | Outputs of the Bridge B. The current that flows through the load connected between these two pins is monitored at pin 15. |
| – | 3;18 | N.C. | Not Connected |

ELECTRICAL CHARACTERISTICS (V_S = 42V; V_{SS} = 5V, T_j = 25°C; unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|------------------------|--|---|----------------------|------------|-----------------|----------|
| V _S | Supply Voltage (pin 4) | Operative Condition | V _{IH} +2.5 | | 46 | V |
| V _{SS} | Logic Supply Voltage (pin 9) | | 4.5 | 5 | 7 | V |
| I _S | Quiescent Supply Current (pin 4) | V _{en} = H; I _L = 0 V _i = L V _i = H | | 13 50 | 22 70 | mA mA |
| | | V _{en} = L V _i = X | | | 4 | mA |
| I _{SS} | Quiescent Current from V _{SS} (pin 9) | V _{en} = H; I _L = 0 V _i = L V _i = H | | 24 7 | 36 12 | mA mA |
| | | V _{en} = L V _i = X | | | 6 | mA |
| V _{iL} | Input Low Voltage (pins 5, 7, 10, 12) | | –0.3 | | 1.5 | V |
| V _{iH} | Input High Voltage (pins 5, 7, 10, 12) | | 2.3 | | V _{SS} | V |
| I _{iL} | Low Voltage Input Current (pins 5, 7, 10, 12) | V _i = L | | | –10 | μA |
| I _{iH} | High Voltage Input Current (pins 5, 7, 10, 12) | V _i = H ≤ V _{SS} – 0.6V | | 30 | 100 | μA |
| V _{en} = L | Enable Low Voltage (pins 6, 11) | | –0.3 | | 1.5 | V |
| V _{en} = H | Enable High Voltage (pins 6, 11) | | 2.3 | | V _{SS} | V |
| I _{en} = L | Low Voltage Enable Current (pins 6, 11) | V _{en} = L | | | –10 | μA |
| I _{en} = H | High Voltage Enable Current (pins 6, 11) | V _{en} = H ≤ V _{SS} – 0.6V | | 30 | 100 | μA |
| V _{CEsat} (H) | Source Saturation Voltage | I _L = 1A I _L = 2A | 0.95 | 1.35 2 | 1.7 2.7 | V V |
| V _{CEsat} (L) | Sink Saturation Voltage | I _L = 1A (5) I _L = 2A (5) | 0.85 | 1.2 1.7 | 1.6 2.3 | V V |
| V _{CEsat} | Total Drop | I _L = 1A (5) I _L = 2A (5) | 1.80 | | 3.2 4.9 | V V |
| V _{sens} | Sensing Voltage (pins 1, 15) | | –1 (1) | | 2 | V |

ELECTRICAL CHARACTERISTICS (continued)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|-------------------------------|--|------|------|------|------|
| T ₁ (V _i) | Source Current Turn-off Delay | 0.5 V _i to 0.9 I _L (2); (4) | | 1.5 | | μs |
| T ₂ (V _i) | Source Current Fall Time | 0.9 I _L to 0.1 I _L (2); (4) | | 0.2 | | μs |
| T ₃ (V _i) | Source Current Turn-on Delay | 0.5 V _i to 0.1 I _L (2); (4) | | 2 | | μs |
| T ₄ (V _i) | Source Current Rise Time | 0.1 I _L to 0.9 I _L (2); (4) | | 0.7 | | μs |
| T ₅ (V _i) | Sink Current Turn-off Delay | 0.5 V _i to 0.9 I _L (3); (4) | | 0.7 | | μs |
| T ₆ (V _i) | Sink Current Fall Time | 0.9 I _L to 0.1 I _L (3); (4) | | 0.25 | | μs |
| T ₇ (V _i) | Sink Current Turn-on Delay | 0.5 V _i to 0.9 I _L (3); (4) | | 1.6 | | μs |
| T ₈ (V _i) | Sink Current Rise Time | 0.1 I _L to 0.9 I _L (3); (4) | | 0.2 | | μs |
| f _c (V _i) | Commutation Frequency | I _L = 2A | | 25 | 40 | KHz |
| T ₁ (V _{en}) | Source Current Turn-off Delay | 0.5 V _{en} to 0.9 I _L (2); (4) | | 3 | | μs |
| T ₂ (V _{en}) | Source Current Fall Time | 0.9 I _L to 0.1 I _L (2); (4) | | 1 | | μs |
| T ₃ (V _{en}) | Source Current Turn-on Delay | 0.5 V _{en} to 0.1 I _L (2); (4) | | 0.3 | | μs |
| T ₄ (V _{en}) | Source Current Rise Time | 0.1 I _L to 0.9 I _L (2); (4) | | 0.4 | | μs |
| T ₅ (V _{en}) | Sink Current Turn-off Delay | 0.5 V _{en} to 0.9 I _L (3); (4) | | 2.2 | | μs |
| T ₆ (V _{en}) | Sink Current Fall Time | 0.9 I _L to 0.1 I _L (3); (4) | | 0.35 | | μs |
| T ₇ (V _{en}) | Sink Current Turn-on Delay | 0.5 V _{en} to 0.9 I _L (3); (4) | | 0.25 | | μs |
| T ₈ (V _{en}) | Sink Current Rise Time | 0.1 I _L to 0.9 I _L (3); (4) | | 0.1 | | μs |

- 1) Sensing voltage can be -1 V for t ≤ 50 μsec; in steady state V_{sens} min ≥ -0.5 V.
- 2) See fig. 2.
- 3) See fig. 4.
- 4) The load must be a pure resistor.

Figure 1 : Typical Saturation Voltage vs. Output Current.

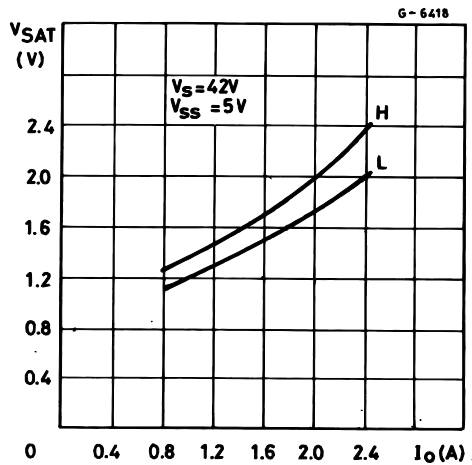
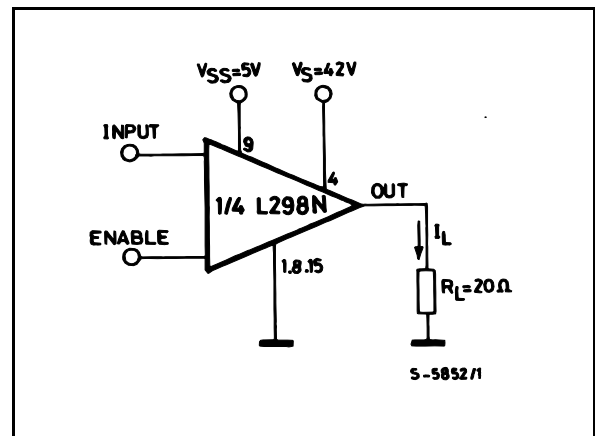


Figure 2 : Switching Times Test Circuits.



Note : For INPUT Switching, set EN = H
 For ENABLE Switching, set IN = H

Figure 3 : Source Current Delay Times vs. Input or Enable Switching.

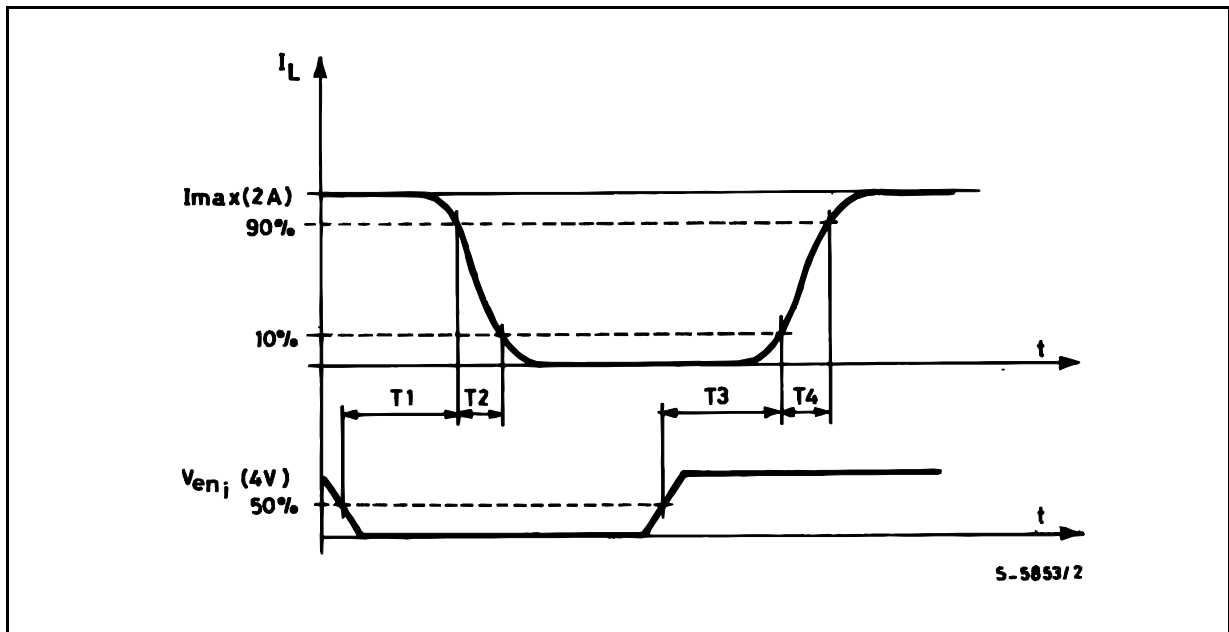
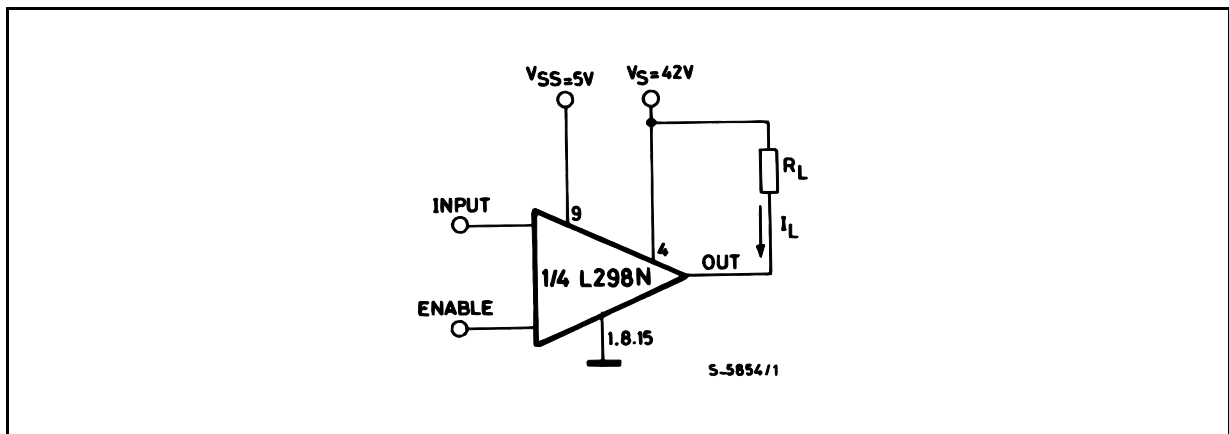


Figure 4 : Switching Times Test Circuits.



Note : For INPUT Switching, set EN = H
For ENABLE Switching, set IN = L

Figure 5 : Sink Current Delay Times vs. Input 0 V Enable Switching.

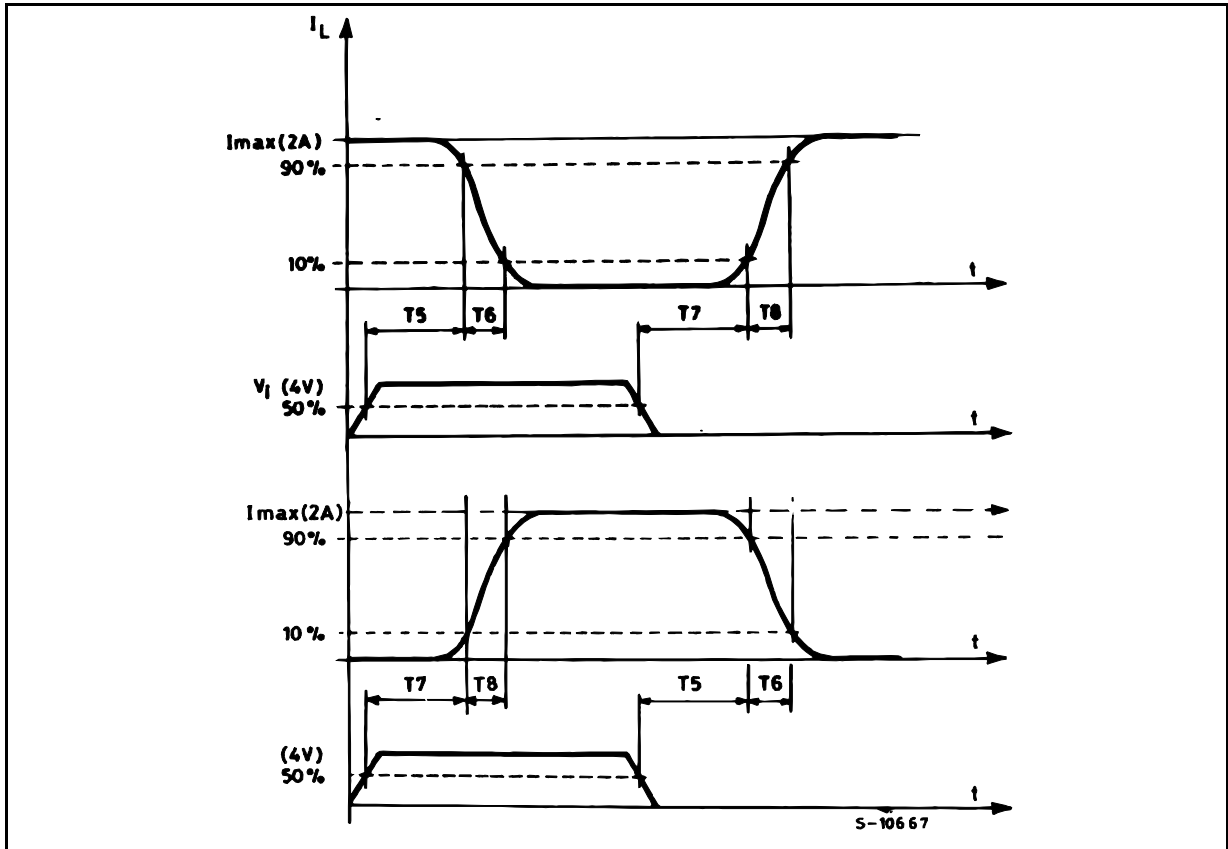


Figure 6 : Bidirectional DC Motor Control.

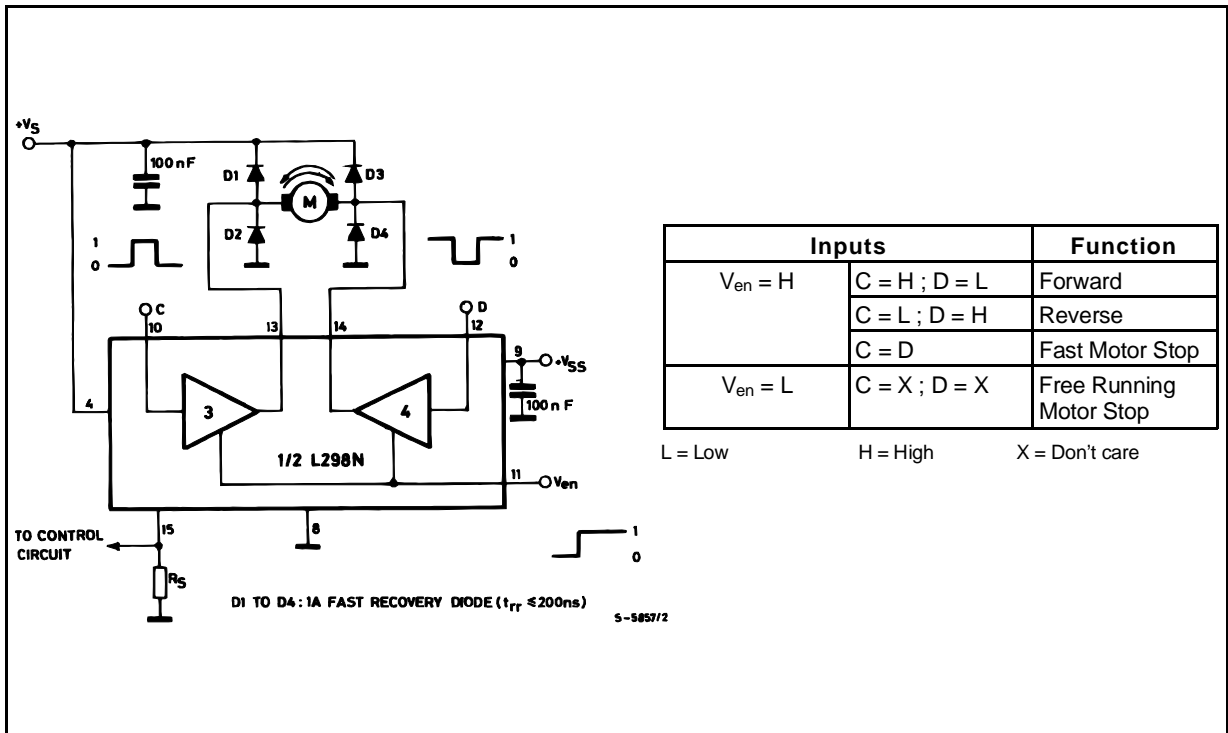
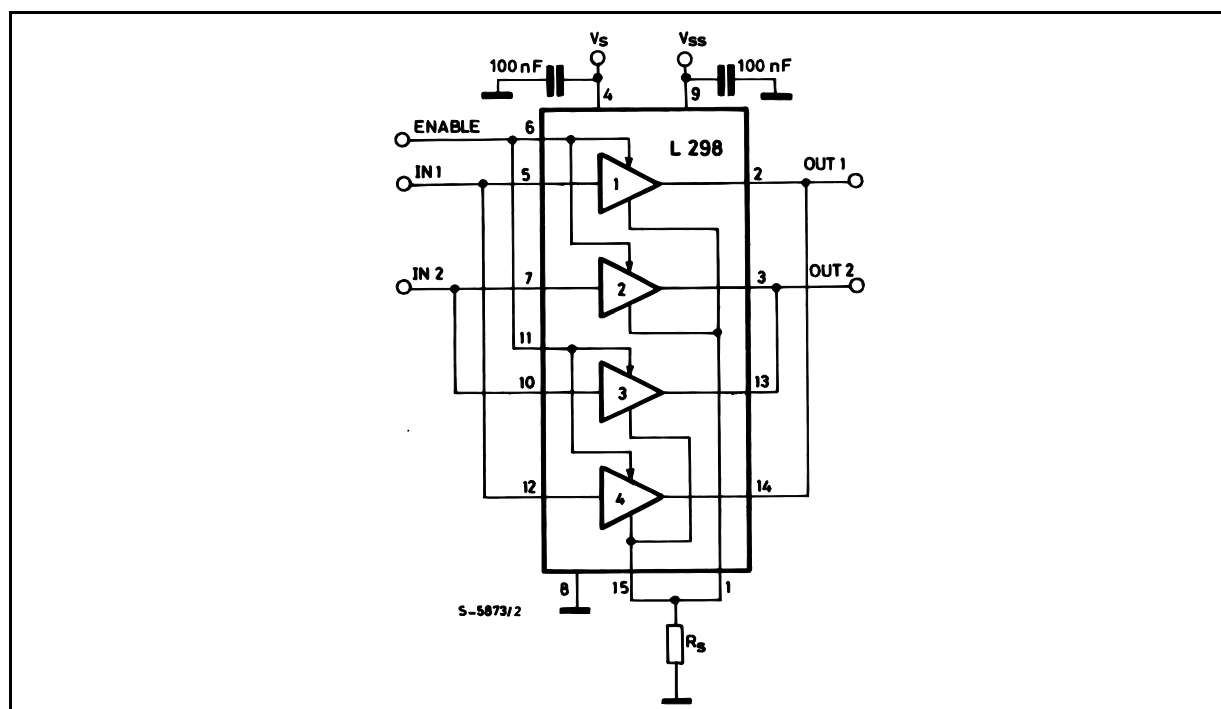


Figure 7 : For higher currents, outputs can be paralleled. Take care to parallel channel 1 with channel 4 and channel 2 with channel 3.



APPLICATION INFORMATION (Refer to the block diagram)

1.1. POWER OUTPUT STAGE

The L298 integrates two power output stages (A; B). The power output stage is a bridge configuration and its outputs can drive an inductive load in common or differenzial mode, depending on the state of the inputs. The current that flows through the load comes out from the bridge at the sense output : an external resistor (R_{SA} ; R_{SB} .) allows to detect the intensity of this current.

1.2. INPUT STAGE

Each bridge is driven by means of four gates the input of which are In1 ; In2 ; EnA and In3 ; In4 ; EnB. The In inputs set the bridge state when The En input is high ; a low state of the En input inhibits the bridge. All the inputs are TTL compatible.

2. SUGGESTIONS

A non inductive capacitor, usually of 100 nF, must be foreseen between both Vs and Vss, to ground, as near as possible to GND pin. When the large capacitor of the power supply is too far from the IC, a second smaller one must be foreseen near the L298.

The sense resistor, not of a wire wound type, must be grounded near the negative pole of Vs that must be near the GND pin of the I.C.

Each input must be connected to the source of the driving signals by means of a very short path.

Turn-On and Turn-Off : Before to Turn-ON the Supply Voltage and before to Turn it OFF, the Enable input must be driven to the Low state.

3. APPLICATIONS

Fig 6 shows a bidirectional DC motor control Schematic Diagram for which only one bridge is needed. The external bridge of diodes D1 to D4 is made by four fast recovery elements ($t_{tr} \leq 200$ nsec) that must be chosen of a VF as low as possible at the worst case of the load current.

The sense output voltage can be used to control the current amplitude by chopping the inputs, or to provide overcurrent protection by switching low the enable input.

The brake function (Fast motor stop) requires that the Absolute Maximum Rating of 2 Amps must never be overcome.

When the repetitive peak current needed from the load is higher than 2 Amps, a paralleled configuration can be chosen (See Fig.7).

An external bridge of diodes are required when inductive loads are driven and when the inputs of the IC are chopped ; Schottky diodes would be preferred.

This solution can drive until 3 Amps In DC operation and until 3.5 Amps of a repetitive peak current.

On Fig 8 it is shown the driving of a two phase bipolar stepper motor ; the needed signals to drive the inputs of the L298 are generated, in this example, from the IC L297.

Fig 9 shows an example of P.C.B. designed for the application of Fig 8.

Figure 8 : Two Phase Bipolar Stepper Motor Circuit.

This circuit drives bipolar stepper motors with winding currents up to 2 A. The diodes are fast 2 A types.

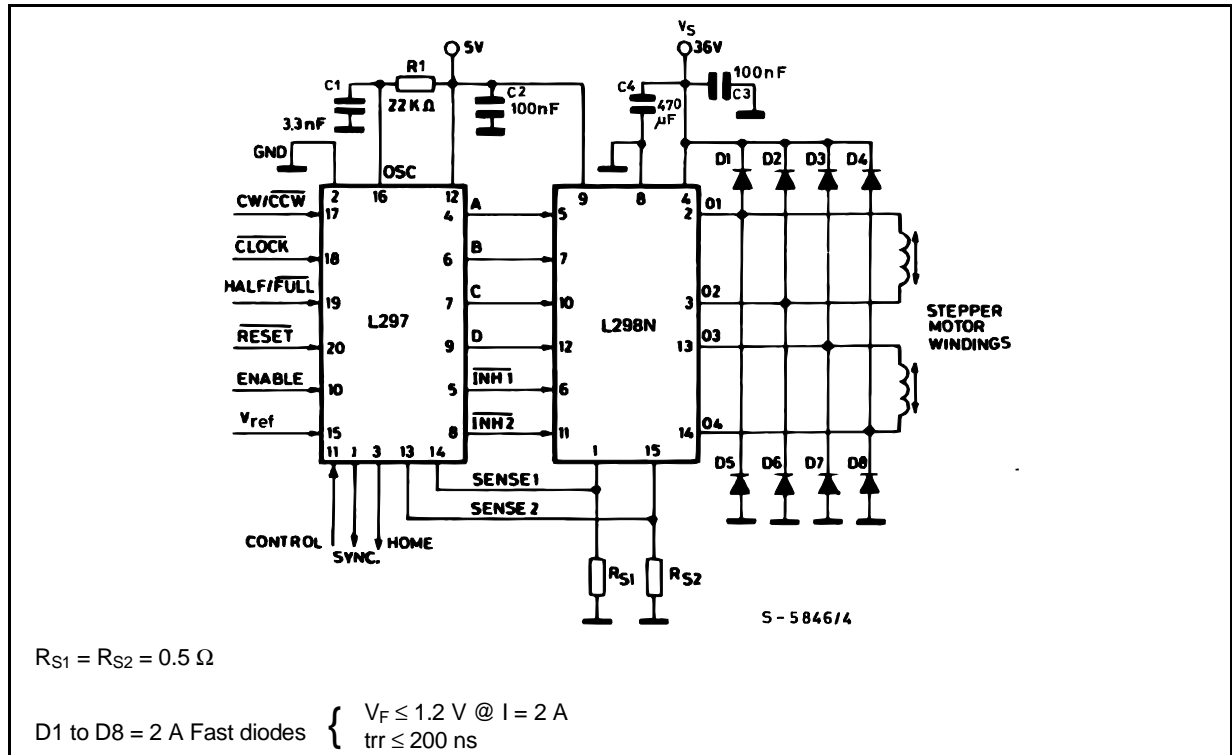


Fig 10 shows a second two phase bipolar stepper motor control circuit where the current is controlled by the I.C. L6506.

Figure 9 : Suggested Printed Circuit Board Layout for the Circuit of fig. 8 (1:1 scale).

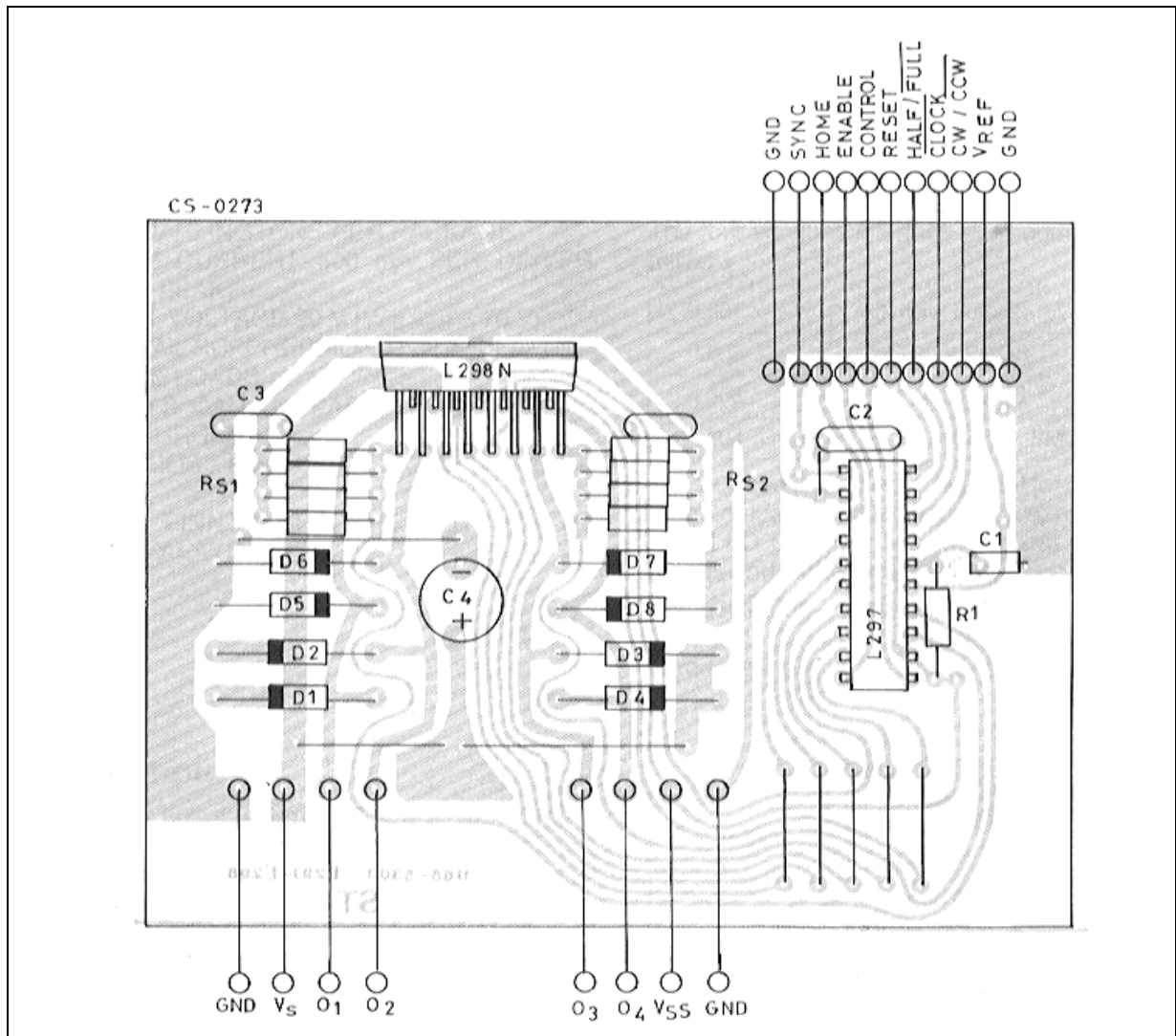
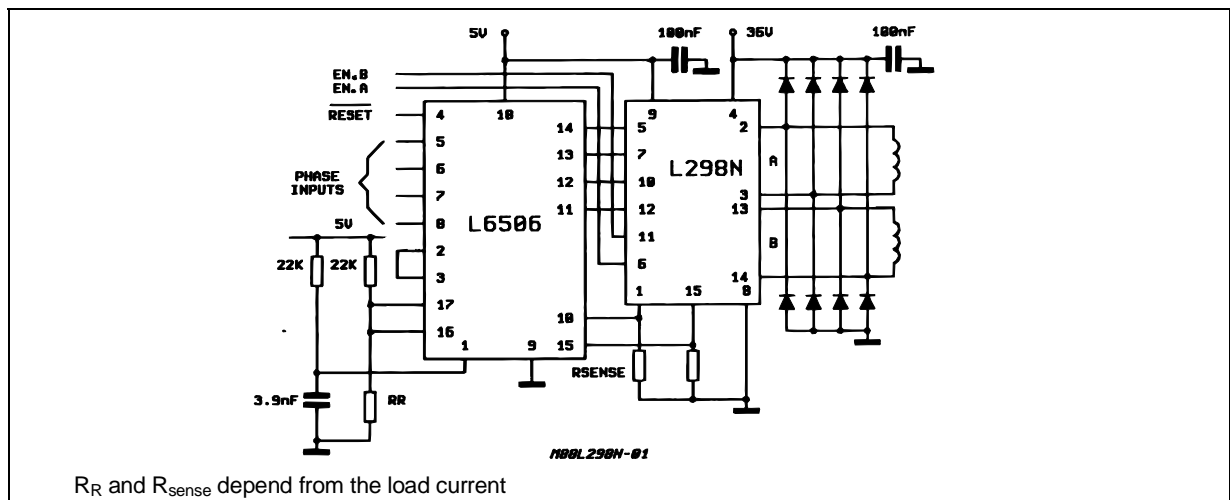
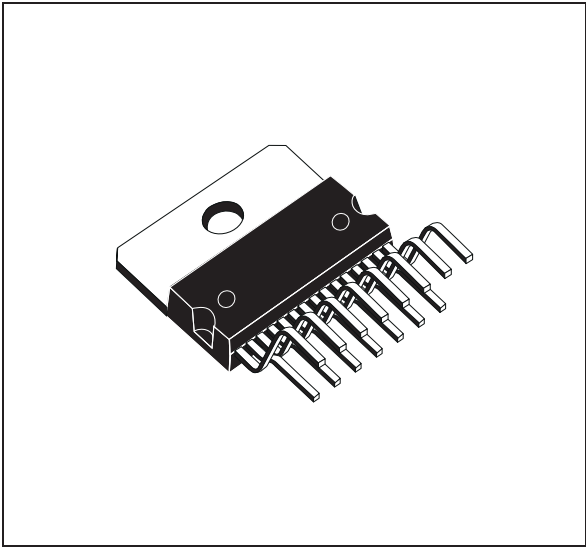


Figure 10 : Two Phase Bipolar Stepper Motor Control Circuit by Using the Current Controller L6506.

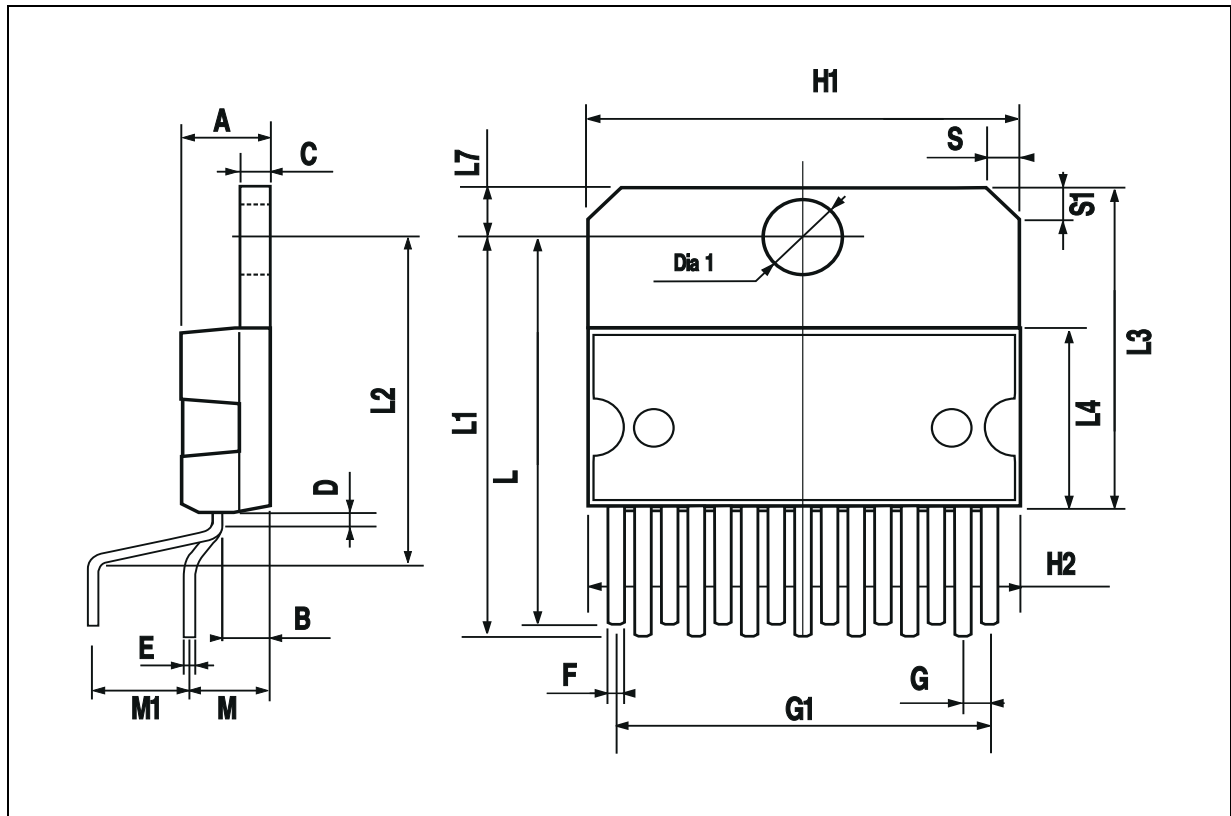


| DIM. | mm | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 5 | | | 0.197 |
| B | | | 2.65 | | | 0.104 |
| C | | | 1.6 | | | 0.063 |
| D | | 1 | | | 0.039 | |
| E | 0.49 | | 0.55 | 0.019 | | 0.022 |
| F | 0.66 | | 0.75 | 0.026 | | 0.030 |
| G | 1.02 | 1.27 | 1.52 | 0.040 | 0.050 | 0.060 |
| G1 | 17.53 | 17.78 | 18.03 | 0.690 | 0.700 | 0.710 |
| H1 | 19.6 | | | 0.772 | | |
| H2 | | | 20.2 | | | 0.795 |
| L | 21.9 | 22.2 | 22.5 | 0.862 | 0.874 | 0.886 |
| L1 | 21.7 | 22.1 | 22.5 | 0.854 | 0.870 | 0.886 |
| L2 | 17.65 | | 18.1 | 0.695 | | 0.713 |
| L3 | 17.25 | 17.5 | 17.75 | 0.679 | 0.689 | 0.699 |
| L4 | 10.3 | 10.7 | 10.9 | 0.406 | 0.421 | 0.429 |
| L7 | 2.65 | | 2.9 | 0.104 | | 0.114 |
| M | 4.25 | 4.55 | 4.85 | 0.167 | 0.179 | 0.191 |
| M1 | 4.63 | 5.08 | 5.53 | 0.182 | 0.200 | 0.218 |
| S | 1.9 | | 2.6 | 0.075 | | 0.102 |
| S1 | 1.9 | | 2.6 | 0.075 | | 0.102 |
| Dia1 | 3.65 | | 3.85 | 0.144 | | 0.152 |

OUTLINE AND MECHANICAL DATA

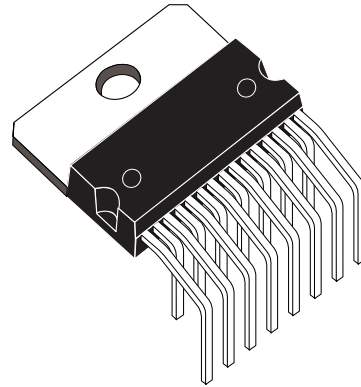


Multiwatt15 V

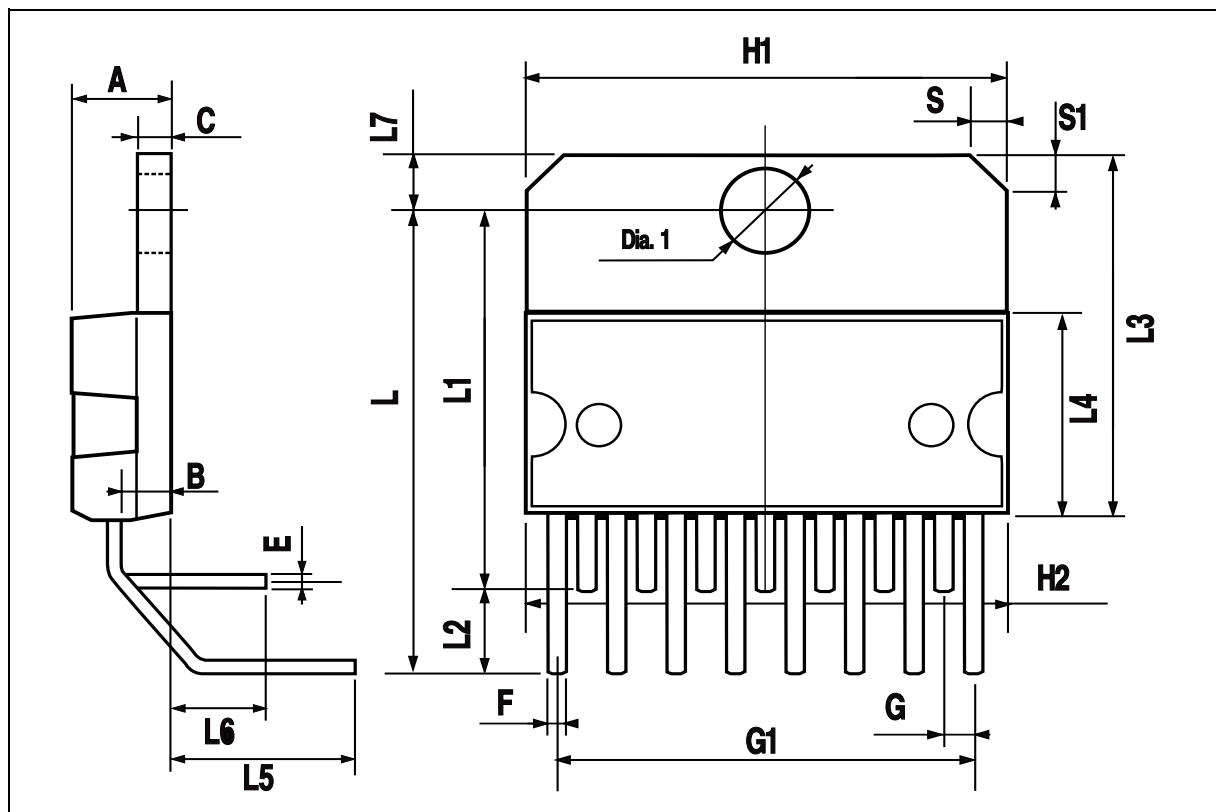


| DIM. | mm | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 5 | | | 0.197 |
| B | | | 2.65 | | | 0.104 |
| C | | | 1.6 | | | 0.063 |
| E | 0.49 | | 0.55 | 0.019 | | 0.022 |
| F | 0.66 | | 0.75 | 0.026 | | 0.030 |
| G | 1.14 | 1.27 | 1.4 | 0.045 | 0.050 | 0.055 |
| G1 | 17.57 | 17.78 | 17.91 | 0.692 | 0.700 | 0.705 |
| H1 | 19.6 | | | 0.772 | | |
| H2 | | | 20.2 | | | 0.795 |
| L | | 20.57 | | | 0.810 | |
| L1 | | 18.03 | | | 0.710 | |
| L2 | | 2.54 | | | 0.100 | |
| L3 | 17.25 | 17.5 | 17.75 | 0.679 | 0.689 | 0.699 |
| L4 | 10.3 | 10.7 | 10.9 | 0.406 | 0.421 | 0.429 |
| L5 | | 5.28 | | | 0.208 | |
| L6 | | 2.38 | | | 0.094 | |
| L7 | 2.65 | | 2.9 | 0.104 | | 0.114 |
| S | 1.9 | | 2.6 | 0.075 | | 0.102 |
| S1 | 1.9 | | 2.6 | 0.075 | | 0.102 |
| Dia1 | 3.65 | | 3.85 | 0.144 | | 0.152 |

OUTLINE AND MECHANICAL DATA



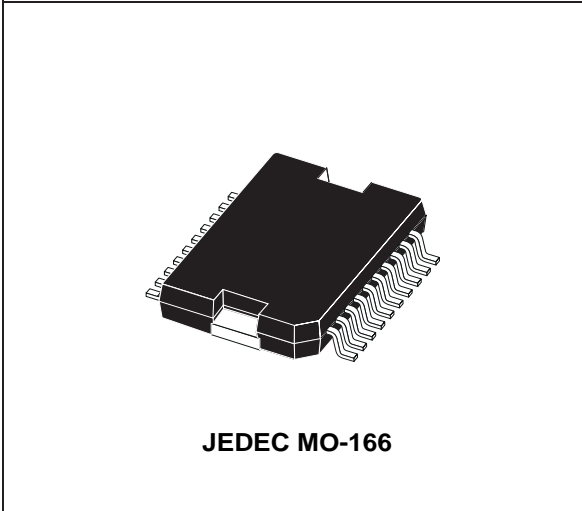
Multiwatt15 H



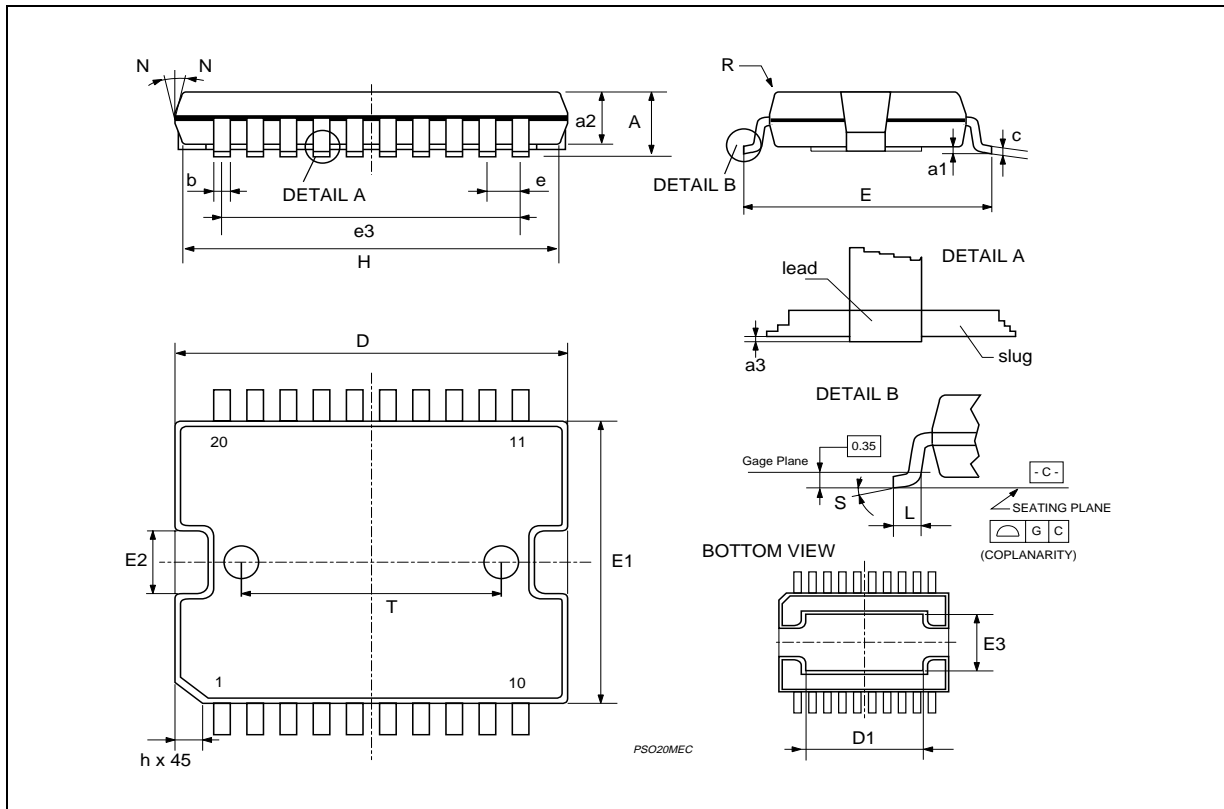
| DIM. | mm | | | inch | | |
|--------|------------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 3.6 | | | 0.142 |
| a1 | 0.1 | | 0.3 | 0.004 | | 0.012 |
| a2 | | | 3.3 | | | 0.130 |
| a3 | 0 | | 0.1 | 0.000 | | 0.004 |
| b | 0.4 | | 0.53 | 0.016 | | 0.021 |
| c | 0.23 | | 0.32 | 0.009 | | 0.013 |
| D (1) | 15.8 | | 16 | 0.622 | | 0.630 |
| D1 | 9.4 | | 9.8 | 0.370 | | 0.386 |
| E | 13.9 | | 14.5 | 0.547 | | 0.570 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 11.43 | | | 0.450 | |
| E1 (1) | 10.9 | | 11.1 | 0.429 | | 0.437 |
| E2 | | | 2.9 | | | 0.114 |
| E3 | 5.8 | | 6.2 | 0.228 | | 0.244 |
| G | 0 | | 0.1 | 0.000 | | 0.004 |
| H | 15.5 | | 15.9 | 0.610 | | 0.626 |
| h | | | 1.1 | | | 0.043 |
| L | 0.8 | | 1.1 | 0.031 | | 0.043 |
| N | 10° (max.) | | | | | |
| S | 8° (max.) | | | | | |
| T | | 10 | | | 0.394 | |

(1) "D and F" do not include mold flash or protrusions.
 - Mold flash or protrusions shall not exceed 0.15 mm (0.006").
 - Critical dimensions: "E", "G" and "a3"

OUTLINE AND MECHANICAL DATA



PowerSO20



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