

## PUSH-PULL FOUR CHANNEL DRIVERS

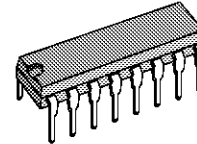
- OUTPUT CURRENT 1A PER CHANNEL
- PEAK OUTPUT CURRENT 2A PER CHANNEL (non repetitive)
- INHIBIT FACILITY
- HIGH NOISE IMMUNITY
- SEPARATE LOGIC SUPPLY
- OVERTEMPERATURE PROTECTION

### DESCRIPTION

The L293B and L293E are quad push-pull drivers capable of delivering output currents to 1A per channel. Each channel is controlled by a TTL-compatible logic input and each pair of drivers (a full bridge) is equipped with an inhibit input which turns off all four transistors. A separate supply input is provided for the logic so that it may be run off a lower voltage to reduce dissipation.

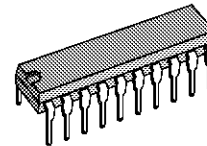
Additionally, the L293E has external connection of sensing resistors, for switchmode control.

The L293B and L293E are package in 16 and 20-pin plastic DIPs respectively ; both use the four center pins to conduct heat to the printed circuit board.



DIP16

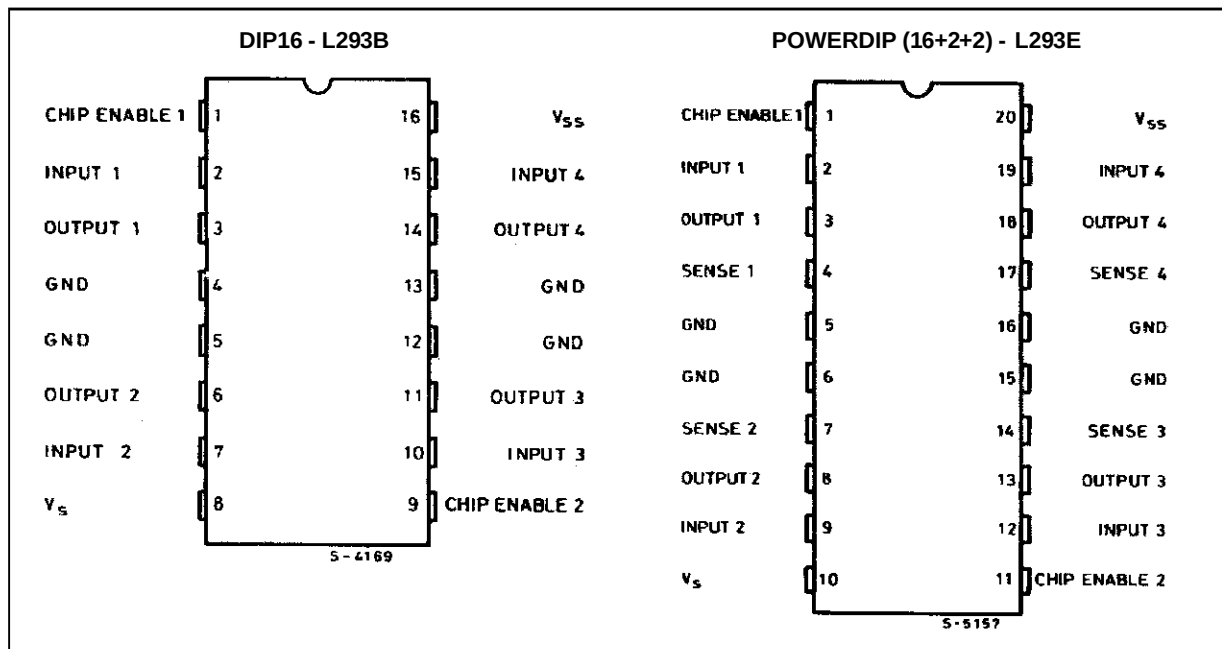
ORDERING NUMBER : L293B



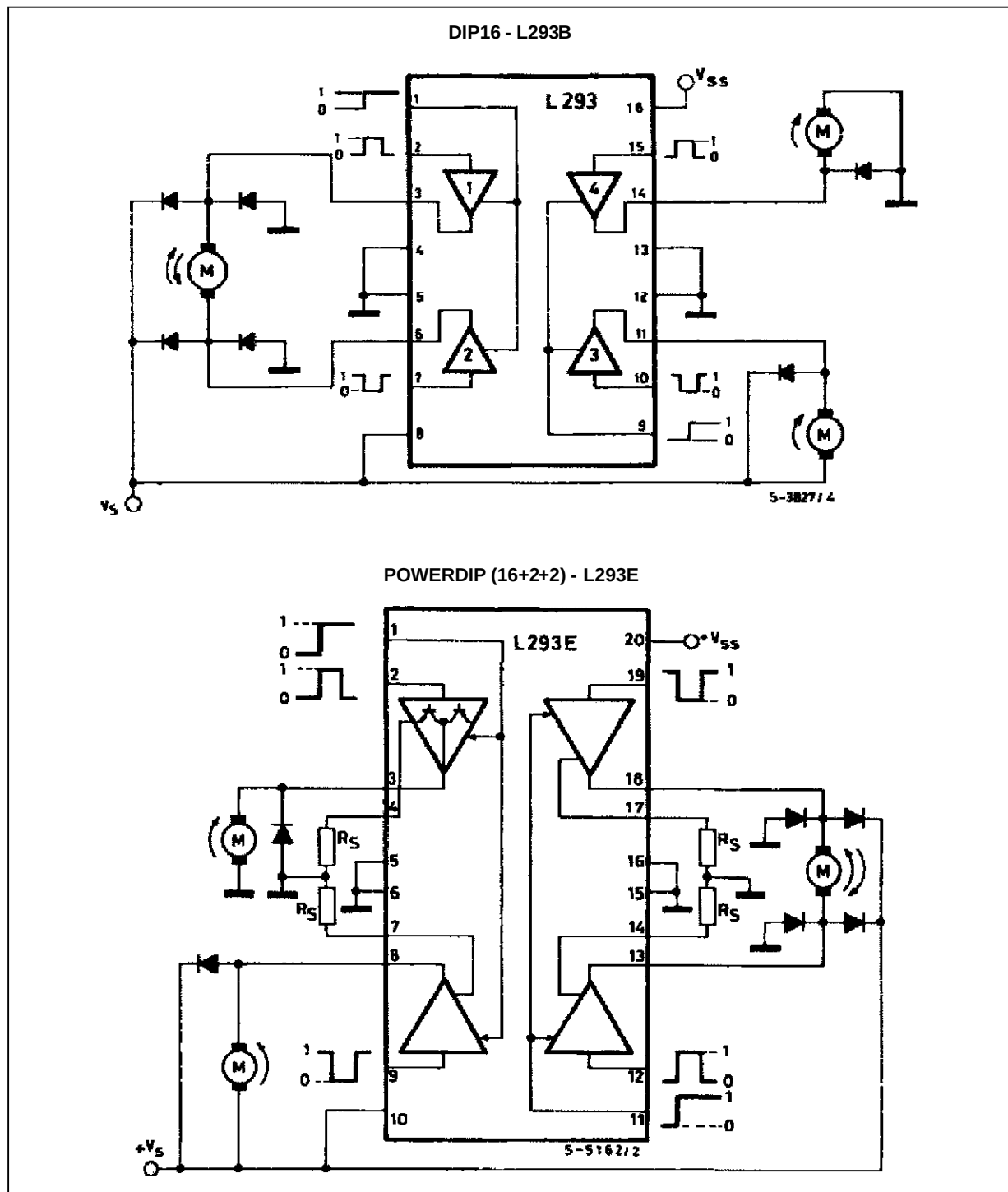
POWERDIP (16 + 2 + 2)

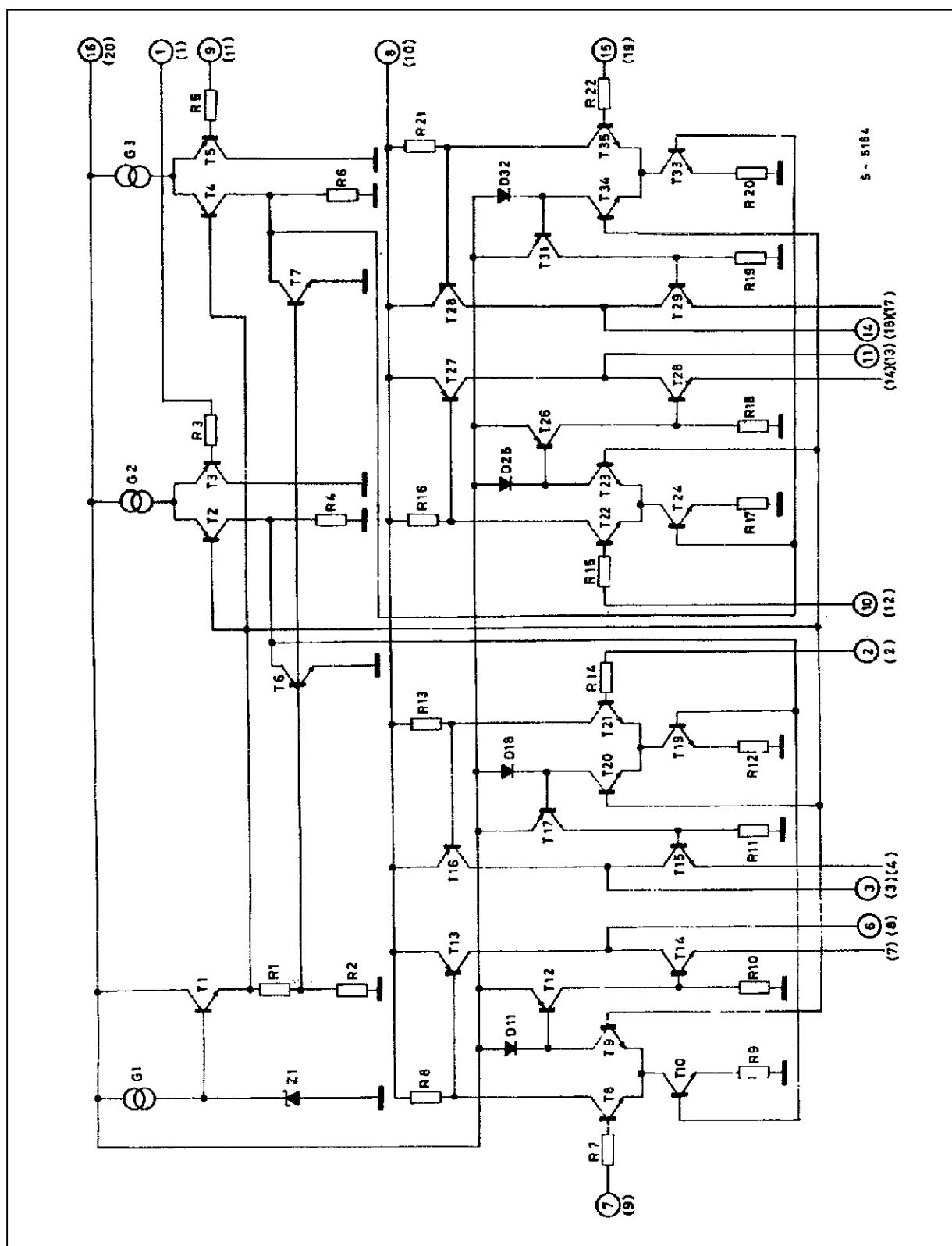
ORDERING NUMBER : L293E

### PIN CONNECTIONS



BLOCK DIAGRAMS





O Pins of L293

( ) Pins of L293E.

## L293B - L293E

### ABSOLUTE MAXIMUM RATINGS

| Symbol         | Parameter                                                       | Value       | Unit             |
|----------------|-----------------------------------------------------------------|-------------|------------------|
| $V_S$          | Supply Voltage                                                  | 36          | V                |
| $V_{SS}$       | Logic Supply Voltage                                            | 36          | V                |
| $V_i$          | Input Voltage                                                   | 7           | V                |
| $V_{inh}$      | Inhibit Voltage                                                 | 7           | V                |
| $I_{out}$      | Peak Output Current (non repetitive t = 5ms)                    | 2           | A                |
| $P_{tot}$      | Total Power Dissipation at $T_{ground-pins} = 80^\circ\text{C}$ | 5           | W                |
| $T_{stg}, T_j$ | Storage and Junction Temperature                                | -40 to +150 | $^\circ\text{C}$ |

### THERMAL DATA

| Symbol           | Parameter                                | Value | Unit               |
|------------------|------------------------------------------|-------|--------------------|
| $R_{th\ j-case}$ | Thermal Resistance Junction-case Max.    | 14    | $^\circ\text{C/W}$ |
| $R_{th\ j-amb}$  | Thermal Resistance Junction-ambient Max. | 80    | $^\circ\text{C/W}$ |

### ELECTRICAL CHARACTERISTICS

For each channel,  $V_S = 24\text{V}$ ,  $V_{SS} = 5\text{V}$ ,  $T_{amb} = 25^\circ\text{C}$ , unless otherwise specified

| Symbol       | Parameter                                | Test Conditions                                                                         | Min.       | TYp.           | Max.           | Unit          |
|--------------|------------------------------------------|-----------------------------------------------------------------------------------------|------------|----------------|----------------|---------------|
| $V_S$        | Supply Voltage                           |                                                                                         | $V_{SS}$   |                | 36             | V             |
| $V_{SS}$     | Logic Supply Voltage                     |                                                                                         | 4.5        |                | 36             | V             |
| $I_S$        | Total Quiescent Supply Current           | $V_i = L$ $I_o = 0$ $V_{inh} = H$<br>$V_i = H$ $I_o = 0$ $V_{inh} = H$<br>$V_{inh} = L$ |            | 2<br>16        | 6<br>24<br>4   | mA            |
| $I_{SS}$     | Total Quiescent Logic Supply Current     | $V_i = L$ $I_o = 0$ $V_{inh} = H$<br>$V_i = H$ $I_o = 0$ $V_{inh} = H$<br>$V_{inh} = L$ |            | 44<br>16<br>16 | 60<br>22<br>24 | mA            |
| $V_{iL}$     | Input Low Voltage                        |                                                                                         | -03.       |                | 1.5            | V             |
| $V_{iH}$     | Input High Voltage                       | $V_{SS} \leq 7\text{V}$<br>$V_{SS} > 7\text{V}$                                         | 2.3<br>2.3 |                | $V_{SS}$<br>7  | V             |
| $I_{iL}$     | Low Voltage Input Current                | $V_{iL} = 1.5\text{V}$                                                                  |            |                | -10            | $\mu\text{A}$ |
| $I_{iH}$     | High Voltage Input Current               | $2.3\text{V} \leq V_{iH} \leq V_{SS} - 0.6\text{V}$                                     |            | 30             | 100            | $\mu\text{A}$ |
| $V_{inhL}$   | Inhibit Low Voltage                      |                                                                                         | -0.3       |                | 1.5            | V             |
| $V_{inhH}$   | Inhibit High Voltage                     | $V_{SS} \leq 7\text{V}$<br>$V_{SS} > 7\text{V}$                                         | 2.3<br>2.3 |                | $V_{SS}$<br>7  | V             |
| $I_{inhL}$   | Low Voltage Inhibit Current              | $V_{inhL} = 1.5\text{V}$                                                                |            | -30            | -100           | $\mu\text{A}$ |
| $I_{inhH}$   | High Voltage Inhibit Current             | $2.3\text{V} \leq V_{inhH} \leq V_{SS} - 0.6\text{V}$                                   |            |                | $\pm 10$       | $\mu\text{A}$ |
| $V_{CEsatH}$ | Source Output Saturation Voltage         | $I_o = -1\text{A}$                                                                      |            | 1.4            | 1.8            | V             |
| $V_{CEsatL}$ | Sink Output Saturation Voltage           | $I_o = 1\text{A}$                                                                       |            | 1.2            | 1.8            | V             |
| $V_{SENS}$   | Sensing Voltage (pins 4, 7, 14, 17) (**) |                                                                                         |            |                | 2              | V             |
| $t_r$        | Rise Time                                | $0.1$ to $0.9 V_o$ (*)                                                                  |            | 250            |                | ns            |
| $t_f$        | Fall Time                                | $0.9$ to $0.1 V_o$ (*)                                                                  |            | 250            |                | ns            |
| $t_{on}$     | Turn-on Delay                            | $0.5 V_i$ to $0.5 V_o$ (*)                                                              |            | 750            |                | ns            |
| $t_{off}$    | Turn-off Delay                           | $0.5 V_i$ to $0.5 V_o$ (*)                                                              |            | 200            |                | ns            |

\* See figure 1

\*\* Referred to L293E

### TRUTH TABLE

| $V_i$ (each channel) | $V_o$            | $V_{inh}^{(\infty)}$ |
|----------------------|------------------|----------------------|
| H                    | H                | H                    |
| L                    | L                | H                    |
| H                    | X <sup>(*)</sup> | L                    |
| L                    | X <sup>(*)</sup> | L                    |

(\*) High output impedance

(\*\*) Relative to the considerate channel

Figure 1 : Switching Timers

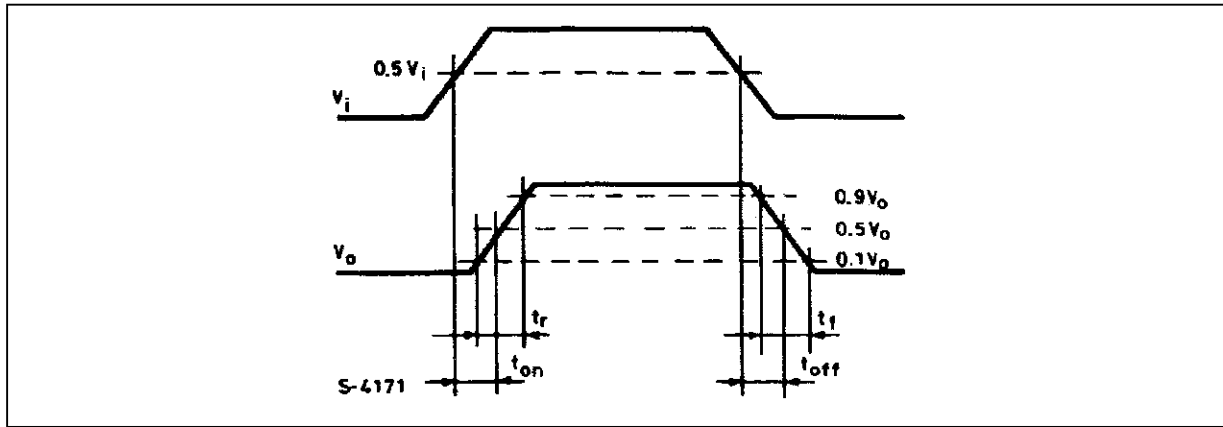


Figure 2 : Saturation voltage versus Output Current

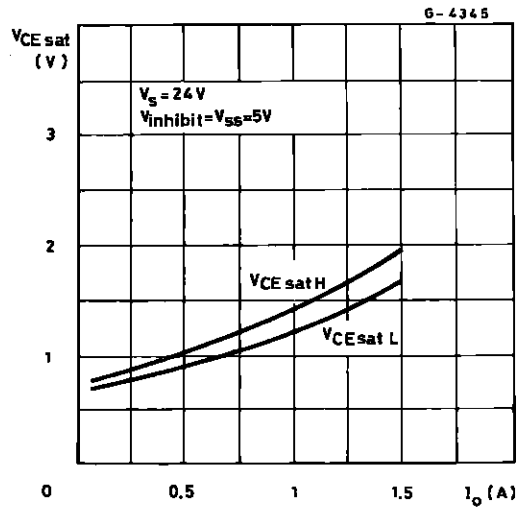


Figure 4 : Sink Saturation Voltage versus Ambient Temperature

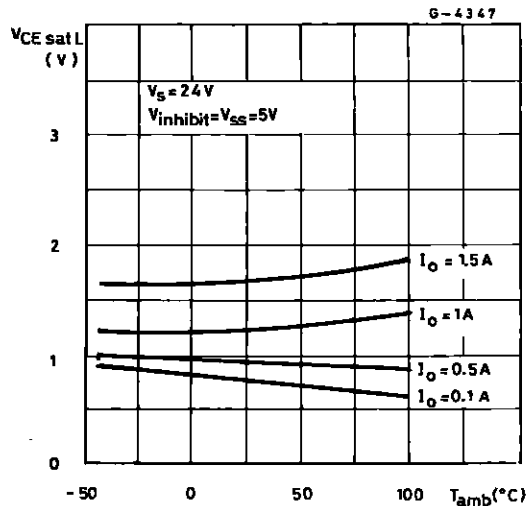


Figure 3 : Source Saturation Voltage versus Ambient Temperature

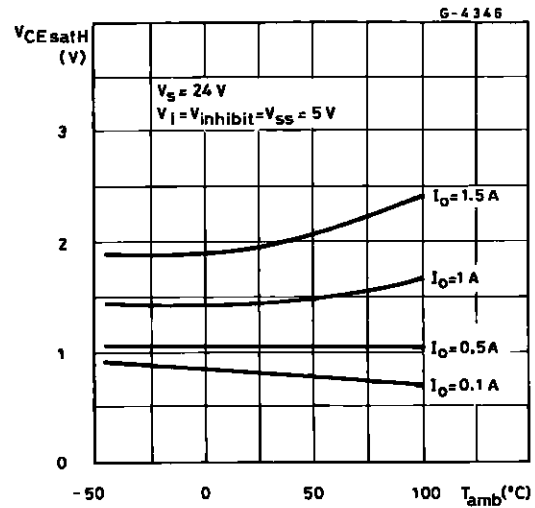
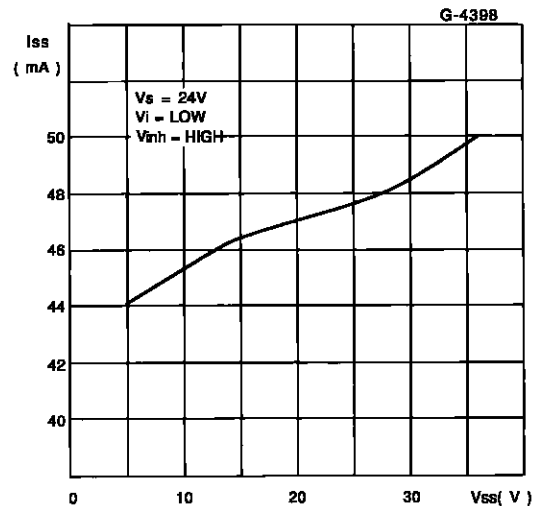
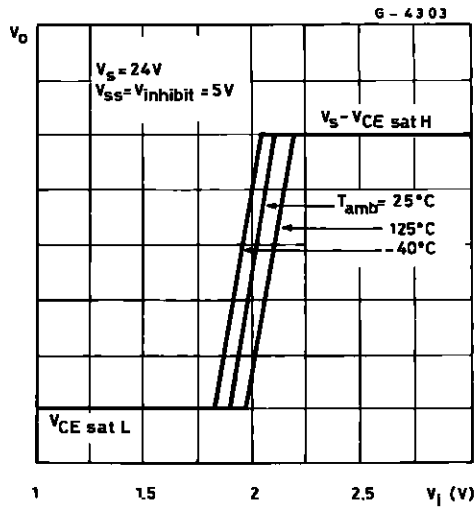


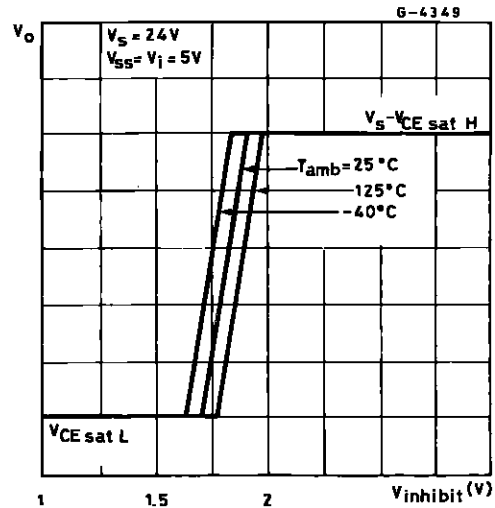
Figure 5 : Quiescent Logic Supply Current versus Logic Supply Voltage



**Figure 6 :** Output Voltage versus Input Voltage

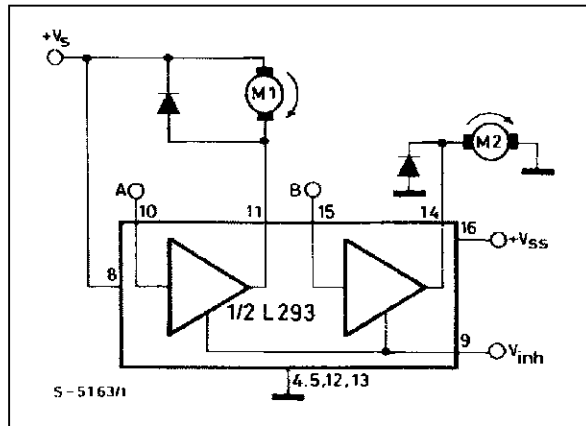


**Figure 7 :** Output Voltage versus Inhibit Voltage



## APPLICATION INFORMATION

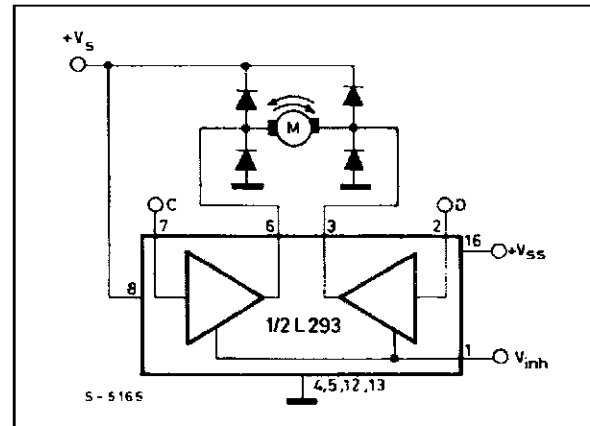
**Figure 8 :** DC Motor Controls  
(with connection to ground and to the supply voltage)



| V <sub>inh</sub> | A | M1                      | B | 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 9 :** Bidirectional DC Motor Control



| Inputs               | Function      |                         |
|----------------------|---------------|-------------------------|
| V <sub>inh</sub> = H | C = H ; D = L | Turn Right              |
|                      | C = L ; D = H | Turn Left               |
|                      | C = D         | Fast Motor Stop         |
| V <sub>inh</sub> = L | C = X ; D = X | Free Running Motor Stop |

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

Figure 10 : Bipolar Stepping Motor Control

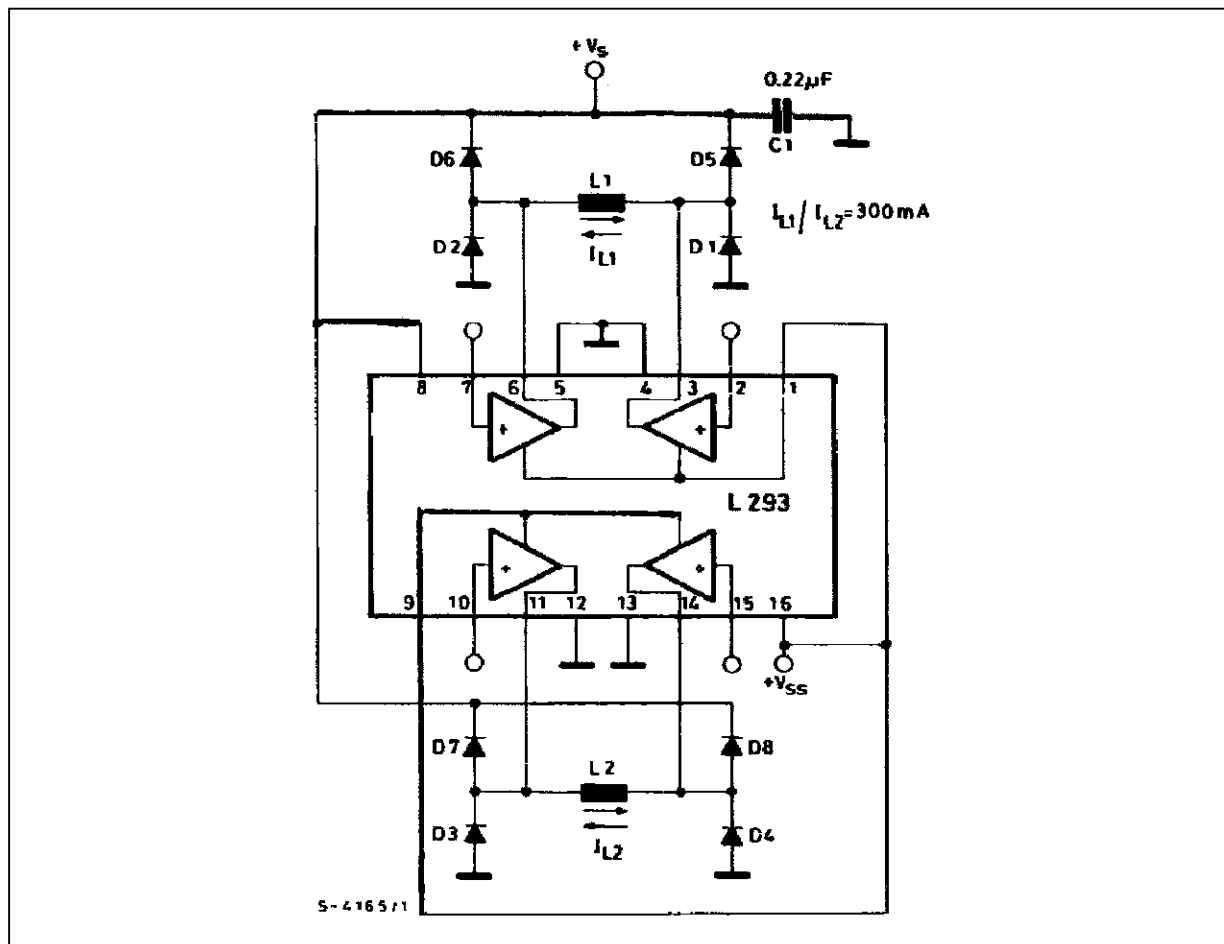
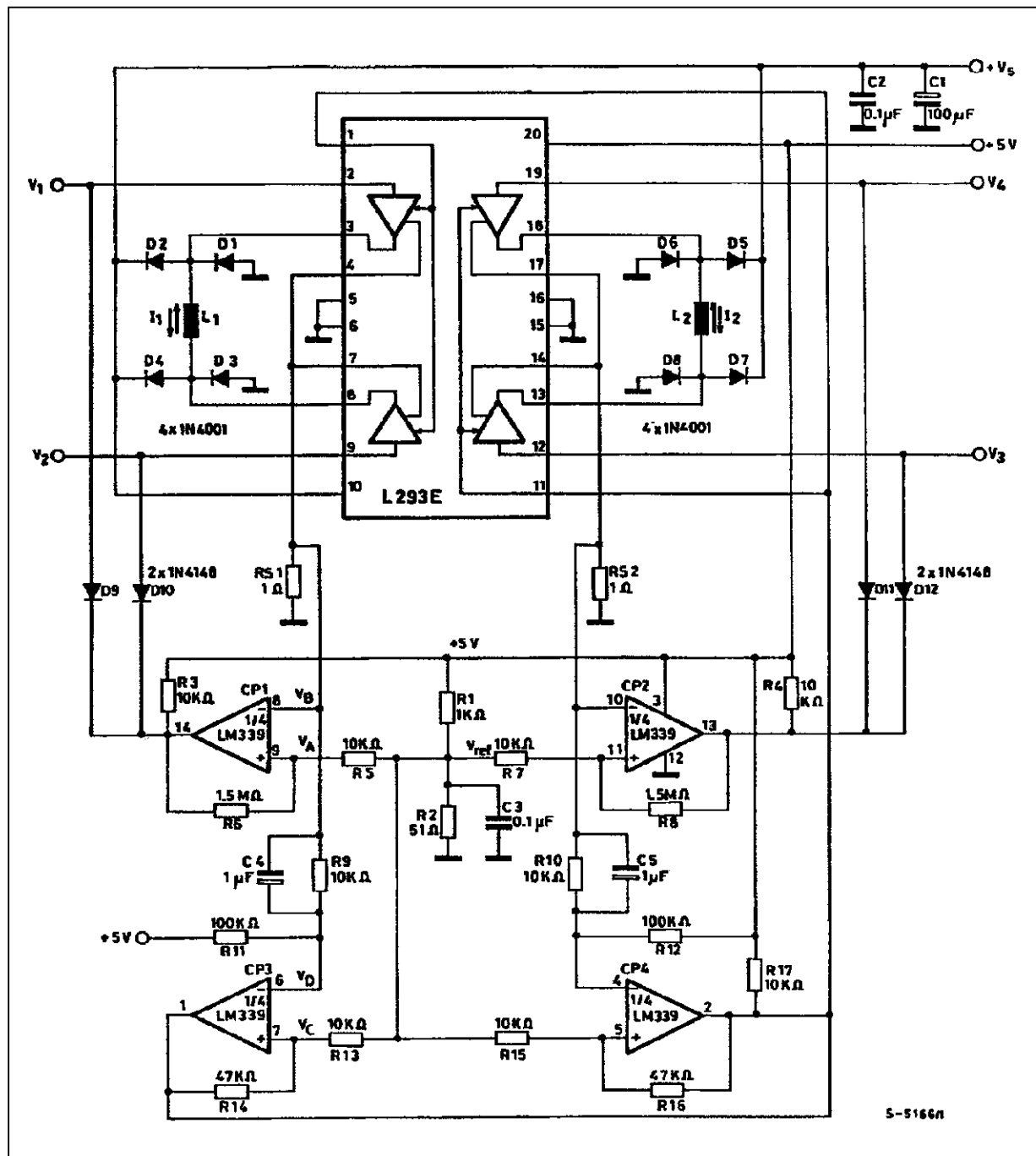


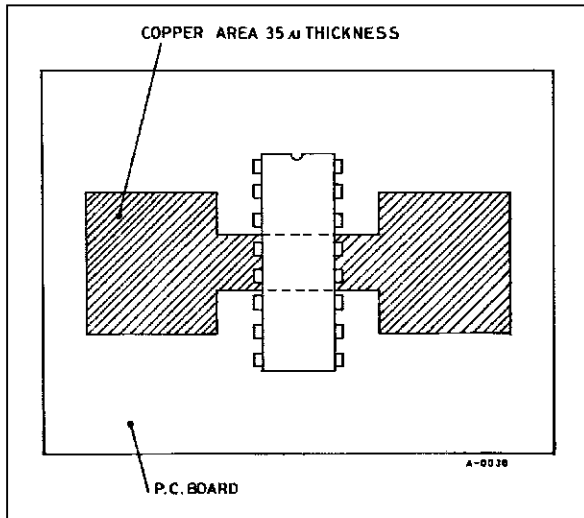
Figure 11 :Stepping Motor Driver with Phase Current Control and Short Circuit Protection



**MOUNTING INSTRUCTIONS**

The  $R_{th j-amb}$  of the L293B and the L293E can be reduced by soldering the GND pins to a suitable copper area of the printed circuit board as shown in figure 12 or to an external heatsink (figure 13).

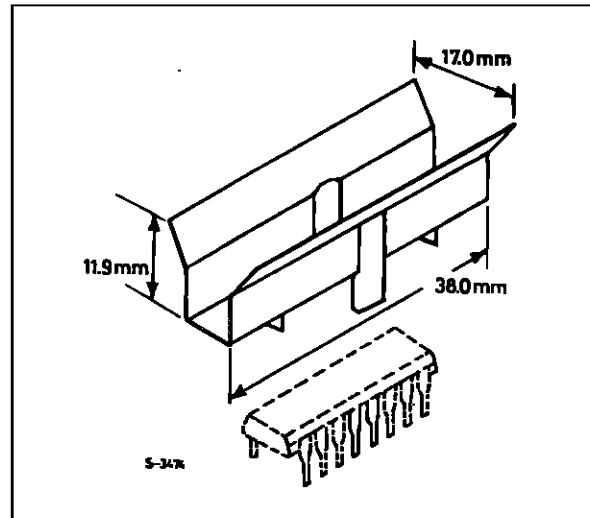
**Figure 12** :Example of P.C. Board Copper Area which is Used as Heatsink



During soldering the pins temperature must not exceed  $260^{\circ}\text{C}$  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 13** :External Heatsink Mounting Example ( $R_{th} = 30^{\circ}\text{C/W}$ )

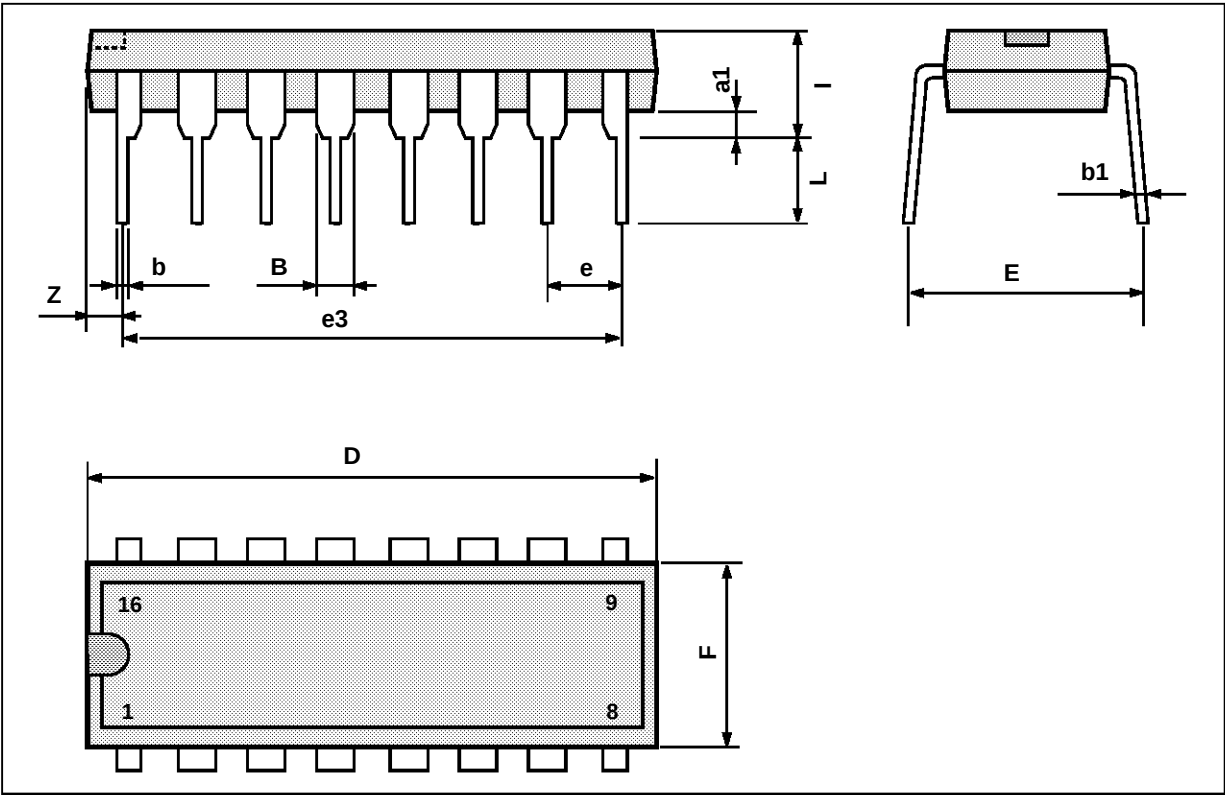


L293B - L293E

DIP16 PACKAGE MECHANICAL DATA

| Dimensions | Millimeters |       |      | Inches |       |       |
|------------|-------------|-------|------|--------|-------|-------|
|            | Min.        | Typ.  | Max. | Min.   | Typ.  | Max.  |
| a1         | 0.51        |       |      | 0.020  |       |       |
| B          | 0.77        |       | 1.65 | 0.030  |       | 0.065 |
| b          |             | 0.5   |      |        | 0.020 |       |
| b1         |             | 0.25  |      |        | 0.010 |       |
| D          |             |       | 20   |        |       | 0.787 |
| E          |             | 8.5   |      |        | 0.335 |       |
| e          |             | 2.54  |      |        | 0.100 |       |
| e3         |             | 17.78 |      |        | 0.700 |       |
| F          |             |       | 7.1  |        |       | 0.280 |
| i          |             |       | 5.1  |        |       | 0.201 |
| L          |             | 3.3   |      |        | 0.130 |       |
| Z          |             |       | 1.27 |        |       | 0.050 |

DIP16PW.TBL

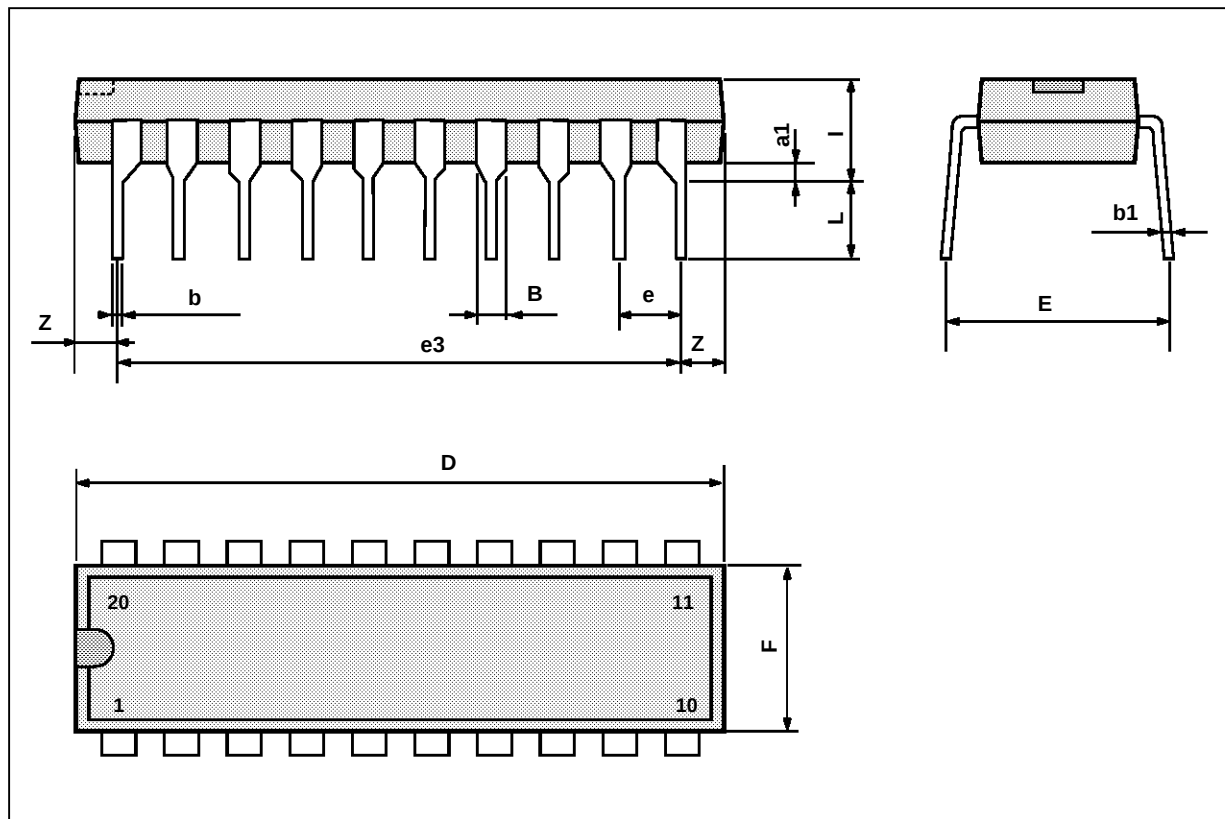


PMDIP16W.EPS

POWERDIP (16+2+2) PACKAGE MECHANICAL DATA

| Dimensions | Millimeters |       |      | Inches |       |       |
|------------|-------------|-------|------|--------|-------|-------|
|            | Min.        | Typ.  | Max. | Min.   | Typ.  | Max.  |
| a1         | 0.51        |       |      | 0.020  |       |       |
| B          | 0.85        |       | 1.4  | 0.033  |       | 0.055 |
| b          |             | 0.5   |      |        | 0.020 |       |
| b1         | 0.38        |       | 0.5  | 0.015  |       | 0.020 |
| D          |             |       | 24.8 |        |       | 0.976 |
| E          |             | 8.8   |      |        | 0.346 |       |
| e          |             | 2.54  |      |        | 0.100 |       |
| e3         |             | 22.86 |      |        | 0.900 |       |
| F          |             |       | 7.1  |        |       | 0.280 |
| i          |             |       | 5.1  |        |       | 0.201 |
| L          |             | 3.3   |      |        | 0.130 |       |
| Z          |             |       | 1.27 |        |       | 0.050 |

DIP20PW.TBL



PMDIP20WEPS

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