L293
L293E

LINEAR INTEGRATED CIRCUITS

PRELIMINARY DATA

PUSH-PULL FOUR CHANNEL DRIVERS

The L293 and the L293E are monolithic integrated high voltage, high current four channel drivers in dual in-line plastic package with 16 leads and 20 leads respectively. They are designed to accept standard DTL or TTL input logic levels and drive inductive loads (such as relays, solenoids, DC and stepping motors) and switching power transistors.
Both are provided of complementary push-pull output stage, two inhibit inputs (which disable two channels each), and an additional supply inputs so that the logic circuitry may run at a lower voltage to reduce power dissipation.
In the L293E the emitters of the lower transistors of each push-pull stage are not internally grounded and the corresponding pins can be used for the connection of an external sensing resistor, making very easy switch-mode current control.
The main features of the L293 and of the L293E are:
- 1A output current capability per channel
- 2A peak output current (non-repetitive) per channel
- Inhibit facility
- Overtemperature protection
- Logical "0" input voltage up to 1.5V (high noise immunity).

The devices are assembled in new packages which have the four central pins connected together and used for heatsinking and grounding.

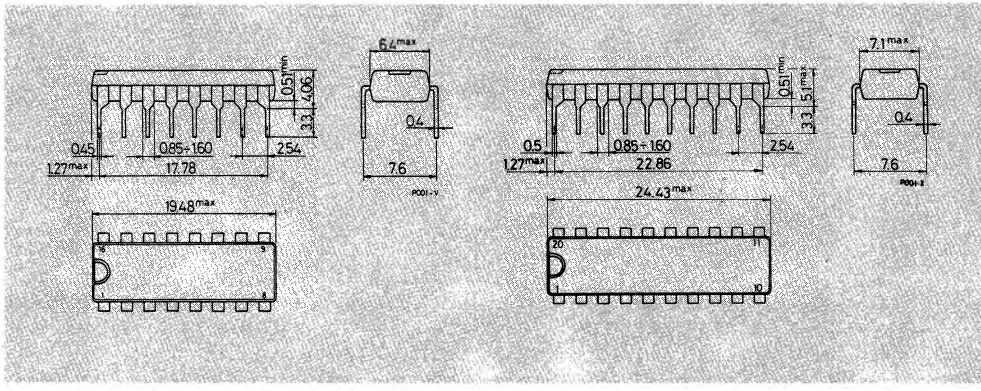
ABSOLUTE MAXIMUM RATINGS

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)	2	A
P_{tot}	Total power dissipation at $T_{ground-pins}$ = 80°C	5	W
T_{stg}, T_j	Storage and junction temperature	-40 to 150	°C

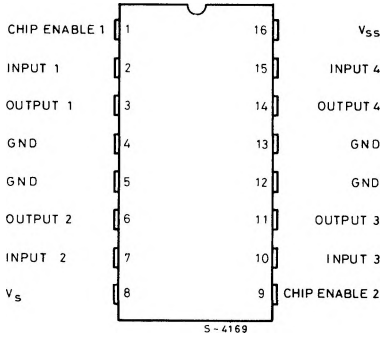
ORDERING NUMBERS: L293B (16 leads)
L293E (20 leads)

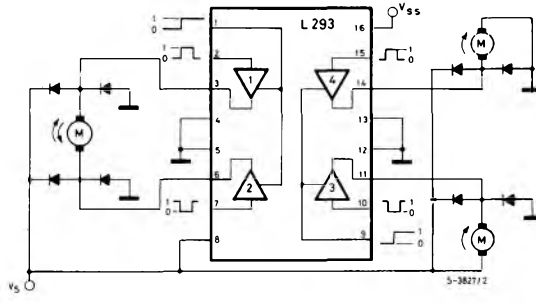
MECHANICAL DATA

Dimensions in mm

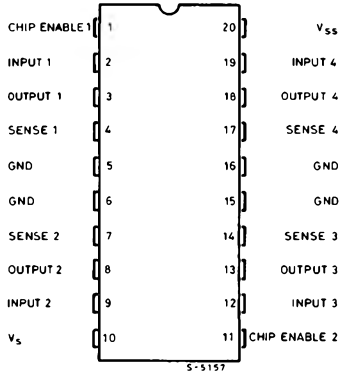


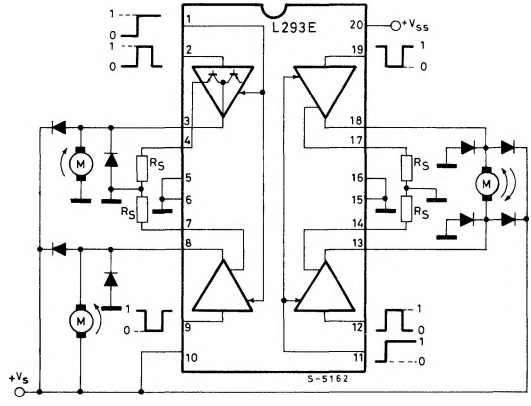
CONNECTION AND BLOCK DIAGRAM (L293)
(top view)



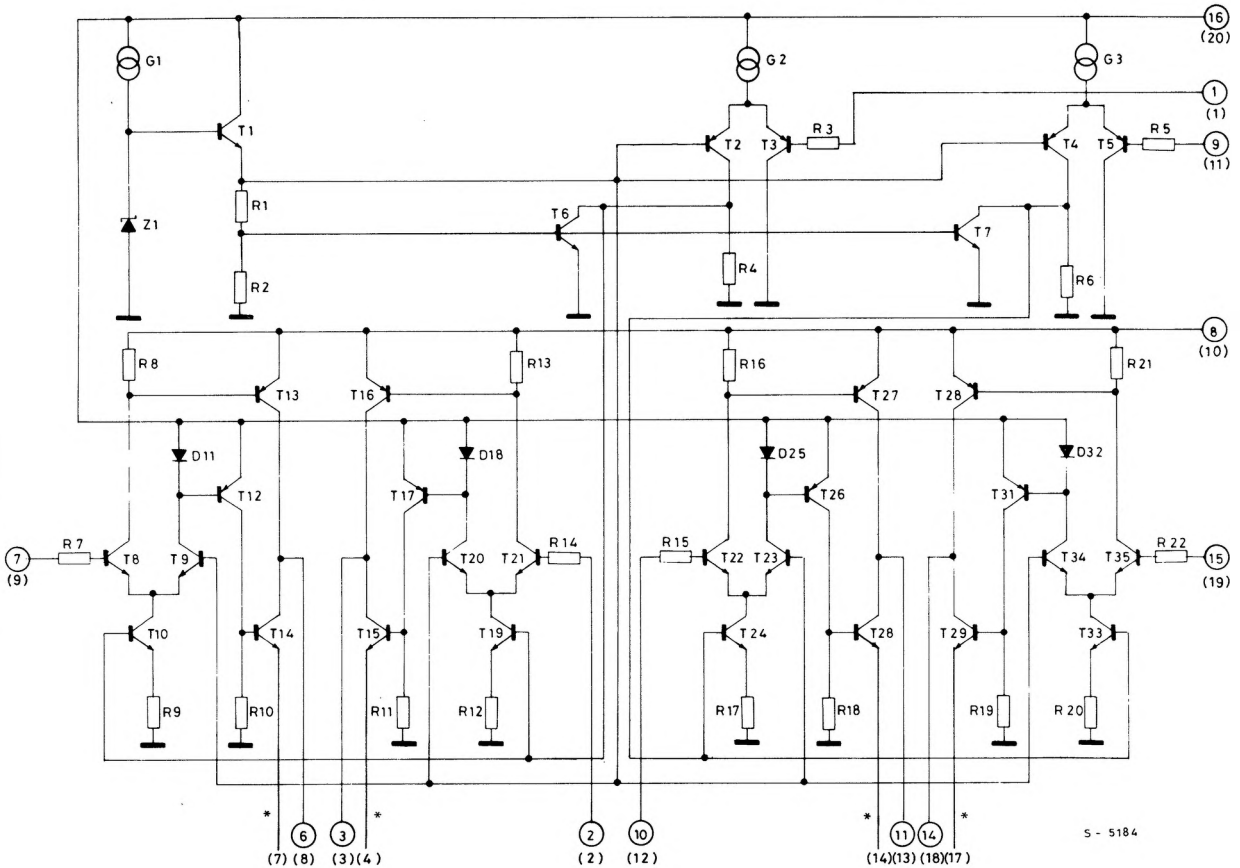


CONNECTION AND BLOCK DIAGRAM (L293E)
(top view)





SCHEMATIC DIAGRAM



(*) In the L293 these points are not externally available. They are internally connected to the ground (substrate).

○ Pins of L293 ( ) Pins of L293E

L293
L293E

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	14	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	80	°C/W

ELECTRICAL CHARACTERISTICS (For each channel, V_S= 24V, V_{SS}= 5V, T_{amb}= 25°C, unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_s	Supply voltage				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		2	6	mA
		V_i = H I_o = 0 V_{inh} = H		16	24	
		V_{inh} = L			4	
I_{ss}	Total quiescent logic supply current	V_i = L I_o = 0 V_{inh} = H		44	60	mA
		V_i = H I_o = 0 V_{inh} = H		16	22	
		V_{inh} = L		16	24	
V_{iL}	Input low voltage		-0.3		1.5	V
V_{iH}	Input high voltage	$V_{ss} \leq 7V$	2.3		V_{ss}	V
		$V_{ss} > 7V$	2.3		7	
I_{iL}	Low voltage input current	V_i = L			-10	μA
I_{iH}	High voltage input current	V_i = H		30	100	μA
V_{inhL}	Inhibit low voltage		-0.3		1.5	V
V_{inhH}	Inhibit high voltage	$V_{ss} \leq 7V$	2.3		V_{ss}	V
		$V_{ss} > 7V$	2.3		7	
I_{inhL}	Low voltage inhibit current			-30	-100	μA
I_{inhH}	High voltage inhibit current				± 10	μA
V_{CEsatH}	Source output saturation voltage	I_o = 1A		1.4	1.8	V
V_{CEsatL}	Sink output saturation voltage	I_o = -1A		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 (*)		450		ns
t_{off}	Turn-off delay	0.5 V_i to 0.5 V_o (*)		200		ns

(*) See fig. 1.

(**) Referred to L293E.

TRUTH TABLE

V_i (each channel)	V_o	$V_{inh.}$ (°°)
H	H	H
L	L	H
H	X (°)	L
L	X (°)	L

(°) High output impedance.
(°°) Relative to the considerate channel.

Fig. 1 - Switching times

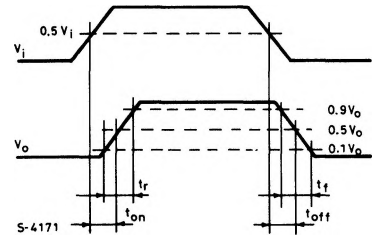


Fig. 2 - Saturation voltage vs. output current

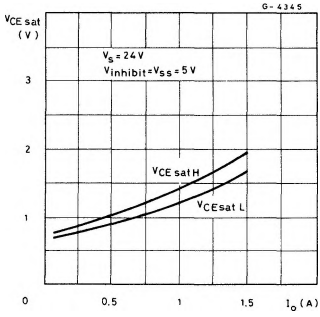


Fig. 3 - Source saturation voltage vs. ambient temperature

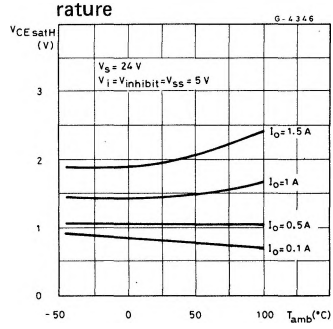


Fig. 4 - Sink saturation voltage vs. ambient temperature

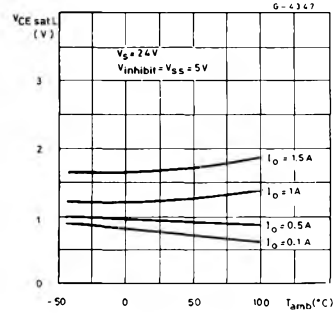


Fig. 5 - Quiescent logic supply current vs. logic supply voltage

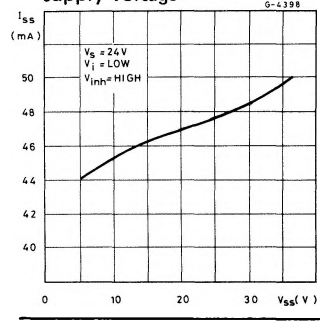


Fig. 6 - Output voltage vs. input voltage

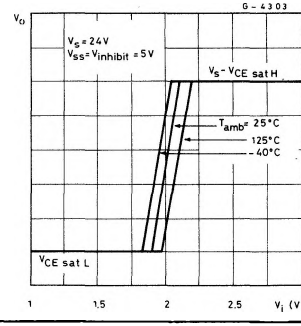
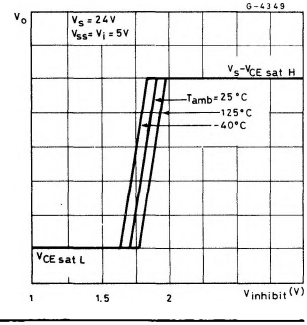
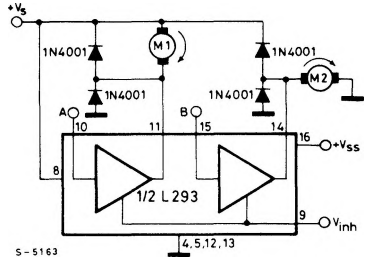


Fig. 7 - Output voltage vs. inhibit voltage



APPLICATION INFORMATION

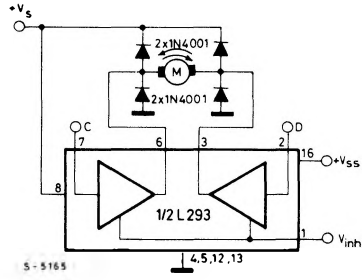
Fig. 8 - DC motor controls (with connection to ground and to the supply voltage)



V_{inh}	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

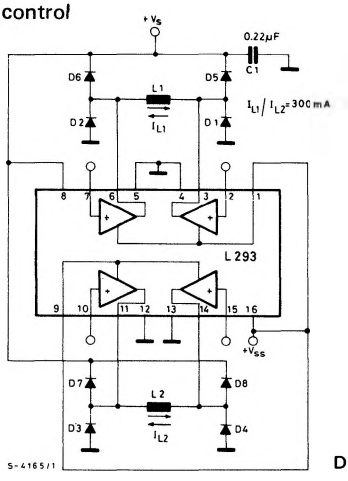
Fig. 9 - Bidirectional DC motor control



INPUTS		FUNCTION
V_{inh} = H	C = H; D = L	Turn right
	C = L; D = H	Turn left
	C = D	Fast motor stop
V_{inh} = L	C = X; D = X	Free running motor stop

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

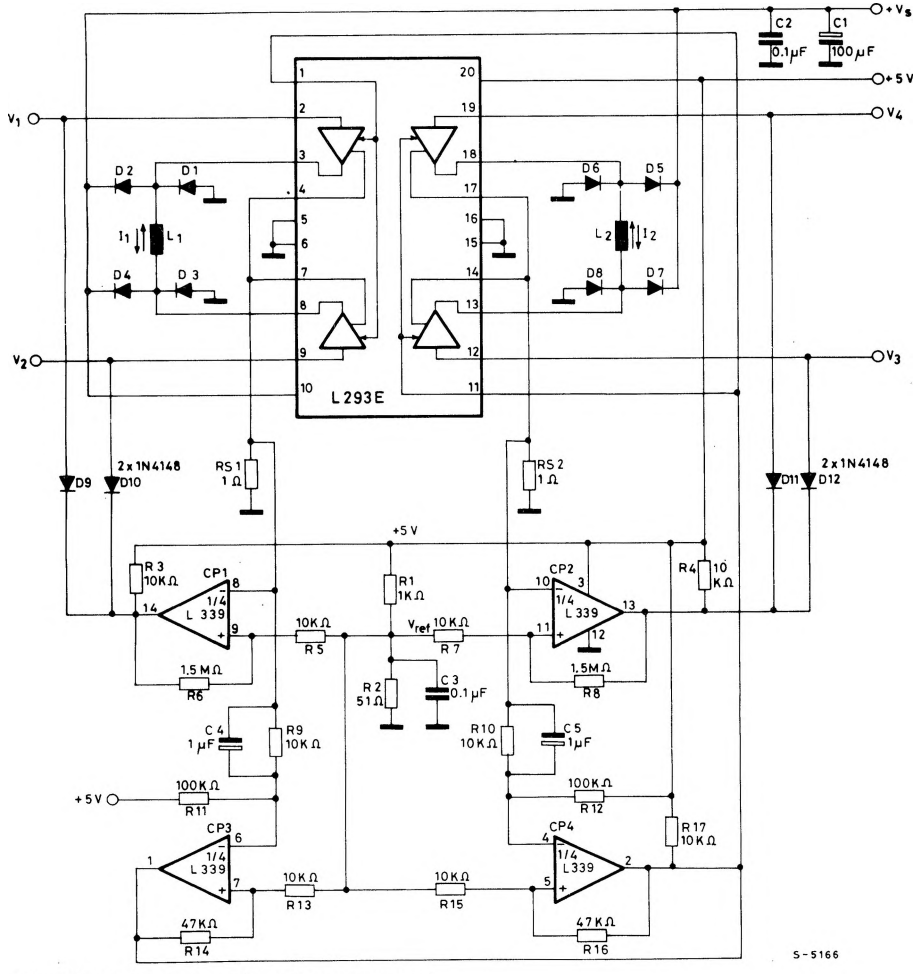
Fig. 10 - Bipolar stepping motor control



D1 - D8 = 1N4001

APPLICATION INFORMATION (continued)

Fig. 11 - Stepping motor driver with phase current control and short circuit protection



D1 ÷ D8 : 0.5A fast diodes (1N4001 or equivalent).

NOTE - For a more detailed description of the L293/L293E and its applications, refer to SGS-TECHNICAL NOTE TN.150.

MOUNTING INSTRUCTIONS

The $R_{thj-amb}$ of the L293 and the L293E can be reduced by soldering the GND pins to a suitable copper area of the printed circuit board or to an external heatsink.
The diagram of fig. 13 shows the maximum dissipable power P_{tot} and the $R_{thj-amb}$ as a function of the side "ℓ" of two equal square copper areas having a thickness of 35 μ (see fig. 12). In addition, it is possible to use an external heatsink (see fig. 14).
During soldering the pins temperature must not exceed 260°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.

Fig. 12 - Example of P.C. board copper area which is used as heatsink

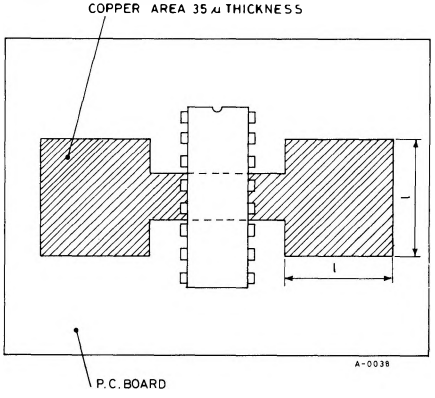


Fig. 13 - Max. dissipable power and junction to ambient thermal resistance vs. size "ℓ"

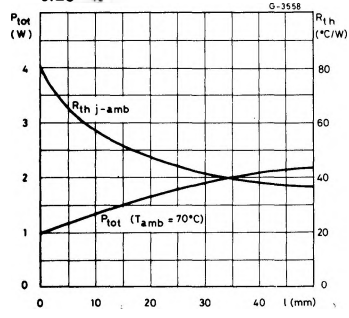


Fig. 14 - External heatsink mounting example (R_{th} = 30 °C/W)

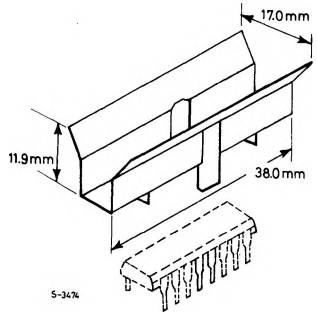


Fig. 15 - Maximum allowable power dissipation vs. ambient temperature