

TEA3717

STEPPER MOTOR DRIVER

POWERDIP 12 + 2 + 2

ORDER CODE : TEA3717DP

- HALF-STEP AND FULL-STEP MODE
- BIPOLAR DRIVE OF STEPPER MOTOR FOR MAXIMUM MOTOR PERFORMANCE
- BUILT-IN PROTECTION DIODES
- WIDE RANGE OF CURRENT CONTROL 5 TO 1000 mA
- WIDE VOLTAGE RANGE 10 TO 45 V
- DESIGNED FOR UNSTABILIZED MOTOR SUPPLY VOLTAGE
- CURRENT LEVELS CAN BE SELECTED IN STEPS OR VARIED CONTINUOUSLY

DESCRIPTION

The TEA3717 is a bipolar monolithic integrated circuit intended to control and drive the current in one winding of a bipolar stepper motor. The circuit consists of an LS-TTL compatible logic input, a current sensor, a monostable and an output stage with builtin protection diodes. Two TEA3717 and a few external components form a complete control and drive unit for LS-TTL or microprocessor-controlled stepper motor systems.

PIN CONNECTION (top view)





TEA3717

SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{mm}	Power Supply Voltage (pins 14, 3)	45	V
V _{CC}	Logic Supply Voltage (pin 6)	7	V
Vin Vin Vv	Input Voltage Logic Inputs Analog Inputs Reference Input	– 0.5 to 6 V _{CC} 15	V
l _{in} I _{in}	Input Current Logic Inputs Analog Inputs	- 10 - 10	mA
lo	Output Current	± 1	A
Tj	Junction Temperature	+ 150	°C
T _{stg}	Storage Temperature Range	- 55 to + 150	°C
T _{oper}	Operating Ambiant Temperature Range	0 to + 70	°C

THERMAL DATA

Symbol	Parameter	Value	Unit
R _{th (j-c)}	Maximum Junction-pins Thermal Resistance	11	°C/W
R _{th (j-a)}	Maximum Junction-ambient Thermal Resistance	45*	°C/W

Soldered on a 35 mm thick 20 cm³ PC board copper area

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min.	Тур.	Max.	Unit
V _{CC}	Supply Voltage	4.75	5	5.25	V
V _{mm}	Supply Voltage	10	-	40	V
lo	Output Current	0.020	-	0.8	А
T _{amb}	Ambient Temperature	0	-	70	°C
tr	Rise Time, Logic Inputs		Ι	2	μs
tr	Fall Time, Logic Inputs	-	_	2	μs



ELECTRICAL CHARACTERISTICS

 $V_{CC} = 5V, \pm 5\%, V_{mm} = +10V$ to $+40V, T_{amb} = 0^{\circ}C$ to $+70^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Min.	Тур.	Max.	Unit
Icc	Supply Current	_	_	25	mA
VIH	High Level Input Voltage - Logic Inputs	2.0	_	-	V
VIL	Low Level Input Voltage - Logic Inputs	_	_	0.8	V
Ιн	High Level Input Current - Logic Input (VI = + 2.4V)	_	-	20	μA
Ι _{ΙL}	Low Level Input Current - Logic Inputs ($V_1 = + 0.4V$)	- 0.4	_	_	mA
V _{CH} V _{CM} V _{CL}	Comparator Threshold Voltage (V _R = + 5.0V), $I_0 = 0, I_1 = 0$ $I_0 = 1, I_1 = 0$ $I_0 = 0, I_1 = 1$	390 230 65	420 250 80	440 270 90	mV
Ico	Comparator Input Current	- 20	_	20	μA
l _{off}	Output Leakage Current ($I_0 = 1, I_1 = 1$) $T_{amb} = +25^{\circ}C$ $T_{amb} = +70^{\circ}C, V_S = 40V, V_{SS} = 5V$		100	100 200	μA
V _{sat}	Total Saturation Voltage Drop ($I_0 = 500$ mA)	_	_	4.0	V
P _{tot}	Total Power Dissipation $I_o = 500 \text{mA}, f_s = 30 \text{kHz}$ $I_o = 800 \text{mA}, f_s = 30 \text{kHz}$		1.8 3.7	2.3	W
t _{off}	Cut off Time (see figure 1 and 2, $V_{mm} = + 10V$, $t_{on} \ge 5\mu s$)	25	30	35	μs
t _d	Turn off Delay (see figure 1 and 2, $T_{amb} = + 25^{\circ}C$, $dVC/dt \ge 50mV/\mu s$)	_	1.6		μs

Figure 1 (see note)







FUNCTIONAL DESCRIPTION

The circuit is intented to drive a bipolar constant current through one motor winding. The constant current is generated through switch mode regulation.

There is a choice of three different current levels with the two logic inputs I_0 and I_1 . The current can also be switched off completely.

INPUT LOGIC

If any of the logic inputs is left open, the circuit will treat it as a high level input.

I ₀	I 1	Current Level
H	H	No Current
L	H	Low Current
H	L	Medium Current
L	L	Maximum Current

 $\label{eq:PHASE-This input determines the direction of current flow in the winding, depending on the motor connections. The signal is fed through a Schmidttrigger for noise immunity, and through a time delay in order to guarantee that no short-circuit occurs in the output stage during phase-shift. High level on the PHASE-input causes the motor current flow from M_A through the winding to M_B.$

 l_0 and l_1 – The current level in the motor winding is selected with these inputs. The values of the different current levels are determined by the reference voltage V_R together with the value of the sensing resistor $R_S.$

CURRENT SENSOR

This part contains a current sensing resistor (Rs), a low pass filter (R_C, C_C) and three comparators. Only one comparator is active at a time. It is activated by the input logic according to the current level chosen with signals I_0 and I_1 . The motor current flows through the sensing resistor R_S. When the current has increased so that the voltage across R_S becomes higher than the reference voltage on the

Note : $R_S = 1 \Omega$, inductance free

- $R_c = 1 k\Omega$
- $C_c = 820 \, pF$, ceramic
- $R_t = 56 k\Omega$ $C_t = 820 pF$, ceramic

other comparator input, the comparator output goes high, which triggers the pulse generator and its output goes high during a fixed pulse time (t_{off}), thus switching off the power feed to the motor winding, and causing the motor current to decrease during t_{off} .

SINGLE-PULSE GENERATOR

The pulse generator is a monostable triggered on the positive going edge of the comparator output. The monostable output is high during the pulse time, toff, which is determined by the timing components R_t and C_t .

$$t_{off} = 0.69 \cdot R_t C_t$$

The single pulse switches off the power feed to the motor winding, causing the winding current to decrease during $t_{\text{off.}}$

If a new trigger signal should occur during $t_{\text{off}},\,\text{it}$ is ignored.

OUTPUT STAGE

The output stage contains four Darlington transistors and four diodes, connected in an H-bridge. The two sinking transistors are used to switch the powersupplied to the motor winding, thus driving a constant current through the winding.

It should be noted however, that it is not permitted to short circuit the outputs.

V_{CC}, V_{mm}, V_R

The circuit will stand any order of turn-on or turn-off of the supply voltages V_{SS} and V_S . Normal dV/dt values are then assumed.

Preferably, V_{R} should be tracking V_{CC} during poweron and power-off.

ANALOG CONTROL

The current levels can be varied continuously either if V_R is varied or with a circuit varying the voltage fed into the comparator terminal (see fig.1).











Figure 6 : Typical Power Losses versus Output Current



Figure 5 : Typical Source Saturation Voltage versus Output Current





TYPICAL APPLICATION

Figure 7 : Serial Printer Carriage Drive.



Figure 8 : Principal Operating Sequence.





DIM.	mm			inch			
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
a1	0.51			0.020			
В	0.85		1.40	0.033		0.055	
b		0.50			0.020		
b1	0.38		0.50	0.015		0.020	
D			20.0			0.787	
E		8.80			0.346		
е		2.54			0.100		
e3		17.78			0.700		
F			7.10			0.280	
I			5.10			0.201	
L		3.30			0.130		
Z			1.27			0.050	

POWERDIP 16 PACKAGE MECHANICAL DATA



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