

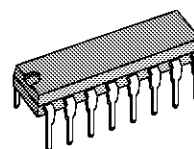
STEPPER MOTOR DRIVER

- 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

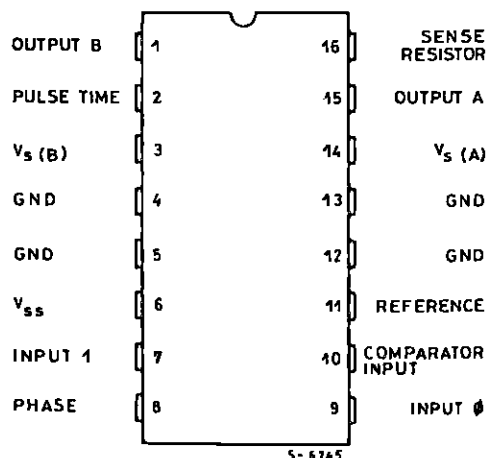
The TEA3717 is a bipolar monolithic integrated circuit intended to control and drive the current in one winding of a bipolar stepper motor. The circuit consists of an LS-TTL compatible logic input, a current sensor, a monostable and an output stage with built-in protection diodes. Two TEA3717 and a few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

POWERDIP 12 + 2 + 2



ORDER CODE : TEA3717DP

PIN CONNECTION (top view)



Symbol	Parameter	Min.	Typ.	Max.	Unit
I _{CC}	Supply Current	–	–	25	mA
V _{IH}	High Level Input Voltage - Logic Inputs	2.0	–	–	V
V _{IL}	Low Level Input Voltage - Logic Inputs	–	–	0.8	V
I _{IH}	High Level Input Current - Logic Input (V _I = + 2.4V)	–	–	20	μA
I _{IL}	Low Level Input Current - Logic Inputs (V _I = + 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
I _{CO}	Comparator Input Current	– 20	–	20	μA
I _{off}	Output Leakage Current (I ₀ = 1, I ₁ = 1) T _{amb} = + 25°C T _{amb} = + 70°C, V _S = 40V, V _{SS} = 5V	– –	– 100	100 200	μA
V _{sat}	Total Saturation Voltage Drop (I ₀ = 500mA)	–	–	4.0	V
P _{tot}	Total Power Dissipation I ₀ = 500mA, f _s = 30kHz I ₀ = 800mA, f _s = 30kHz	– –	1.8 3.7	2.3 –	W
t _{off}	Cut off Time (see figure 1 and 2, V _{mm} = + 10V, t _{on} ≥ 5μs)	25	30	35	μs
t _d	Turn off Delay (see figure 1 and 2, T _{amb} = + 25°C, dV _C /dt ≥ 50mV/μs)	–	1.6		μs

The diagram illustrates the timing relationship between the VMEbus master/slave interface signals and the V_E signal.

Top Graph: Normalized Signals

- Y-axis:** normalized
- X-axis:** time
- Signals:**
 - A square wave representing $VMA - VMB$ or $VMB - VMA$.
 - A trapezoidal signal representing V_E .
- Parameters:**
 - t_{on} : On-time of the square wave.
 - t_{off} : Off-time of the square wave.
 - t_d : Delay time from the falling edge of the square wave to the falling edge of the trapezoidal signal.
 - V_{CH} : High-level voltage of the trapezoidal signal.
 - V_{CM} : Mid-level voltage of the trapezoidal signal.
 - V_{CL} : Low-level voltage of the trapezoidal signal.
- Equation:**

$$f_s = \frac{1}{t_{on} + t_{off}}$$

FUNCTIONAL DESCRIPTION

The circuit is intended 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

PHASE – This input determines the direction of current flow in the winding, depending on the motor connections. The signal is fed through a Schmidt-trigger 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 .

I_0 and I_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 (R_S), 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

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, t_{off} , which is determined by the timing components R_t and C_t .

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

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

If a new trigger signal should occur during t_{off} , 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 power supplied 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 power-on 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).

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

Figure 3

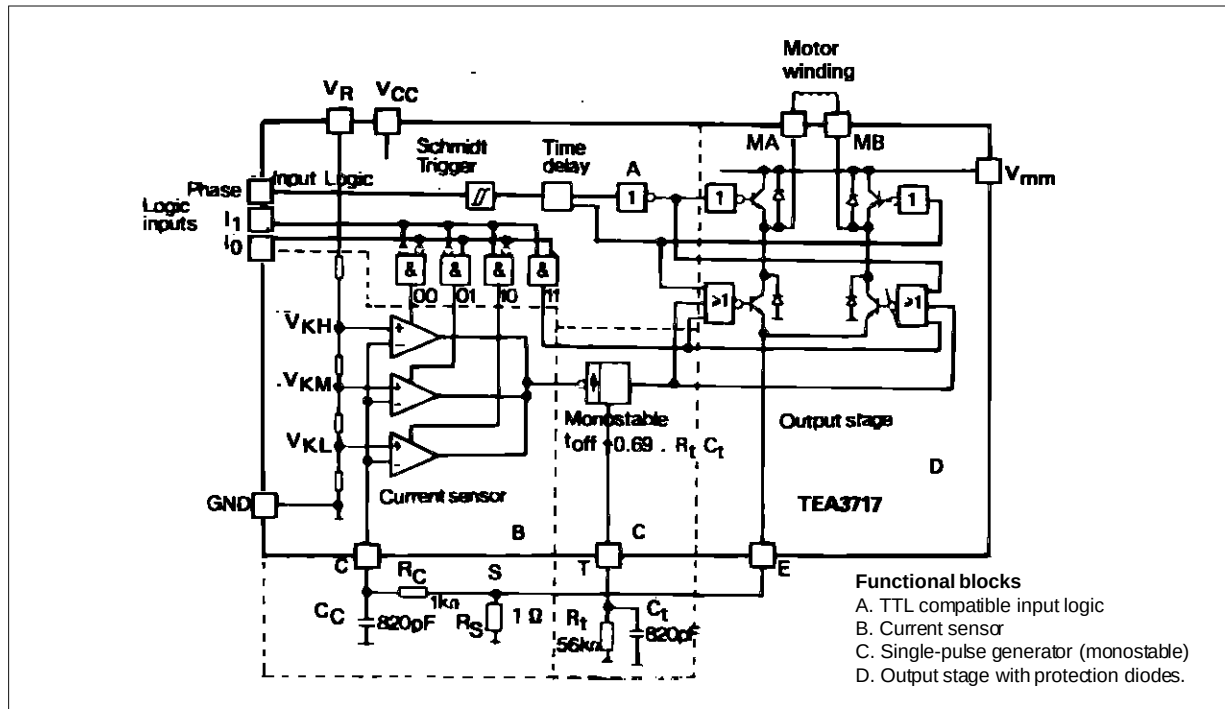


Figure 4 : Typical Sink Saturation Voltage versus Output Current

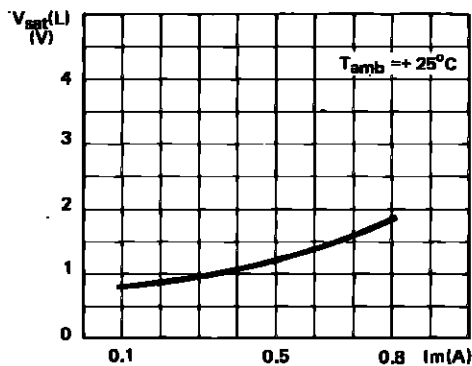


Figure 5 : Typical Source Saturation Voltage versus Output Current

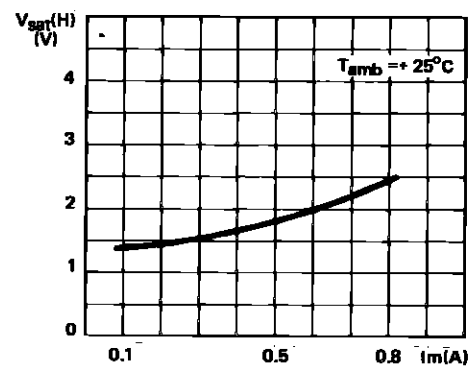
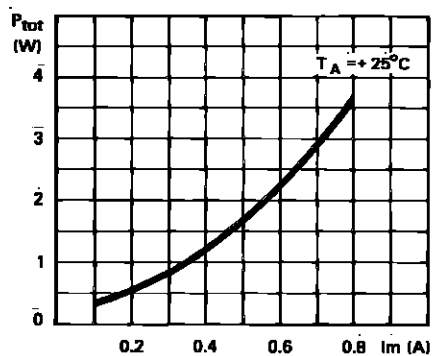
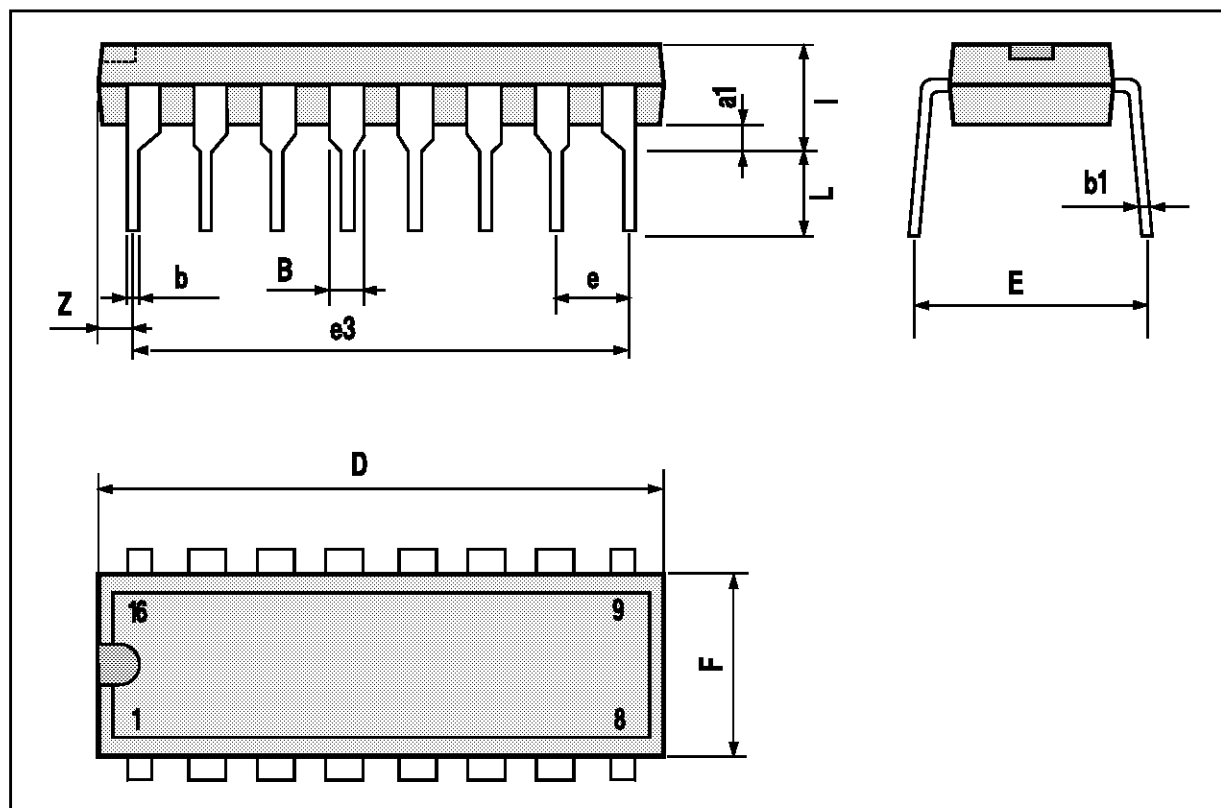


Figure 6 : Typical Power Losses versus Output Current



POWERDIP 16 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	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	
e		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



Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1994 SGS-THOMSON Microelectronics - All Rights Reserved

SGS-THOMSON Microelectronics GROUP OF COMPANIES

Australia - Brazil - France - Germany - Hong Kong - Italy - Japan - Korea - Malaysia - Malta - Morocco - The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.