

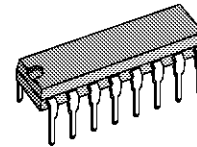
STEPPER MOTOR DRIVER

- 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

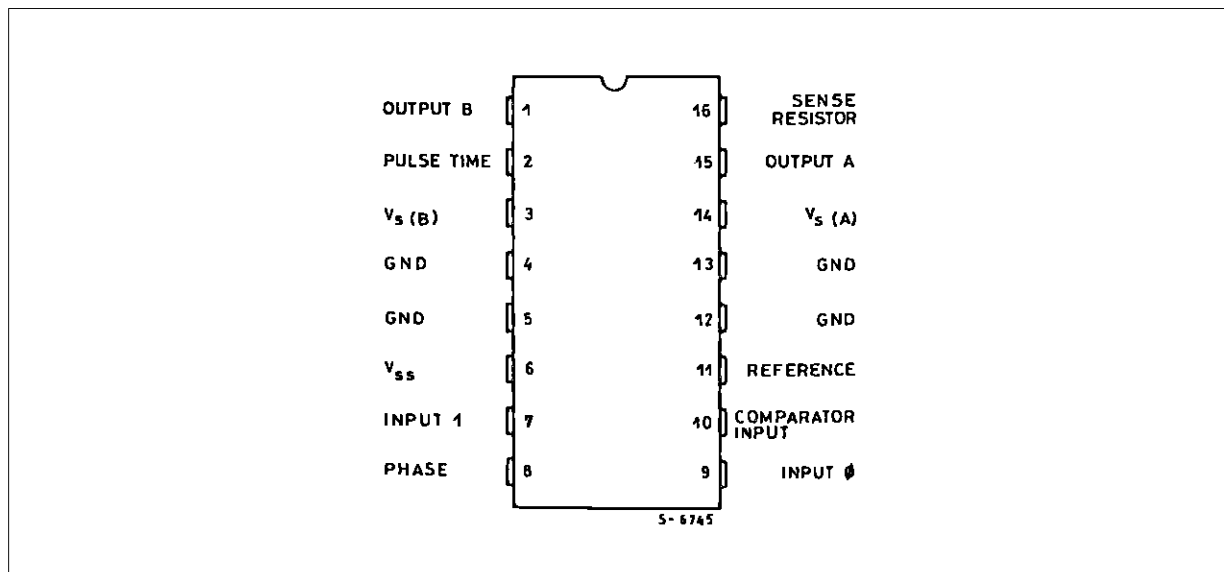
The TEA3717 is a bipolar monolithic integrated circuit intended to control and drive the current in one winding of a bipolar stepper motor. The circuit consists of an LS-TTL compatible logic input, a current sensor, a monostable and an output stage with built-in protection diodes. Two TEA3717 and a few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

POWERDIP 12 + 2 + 2

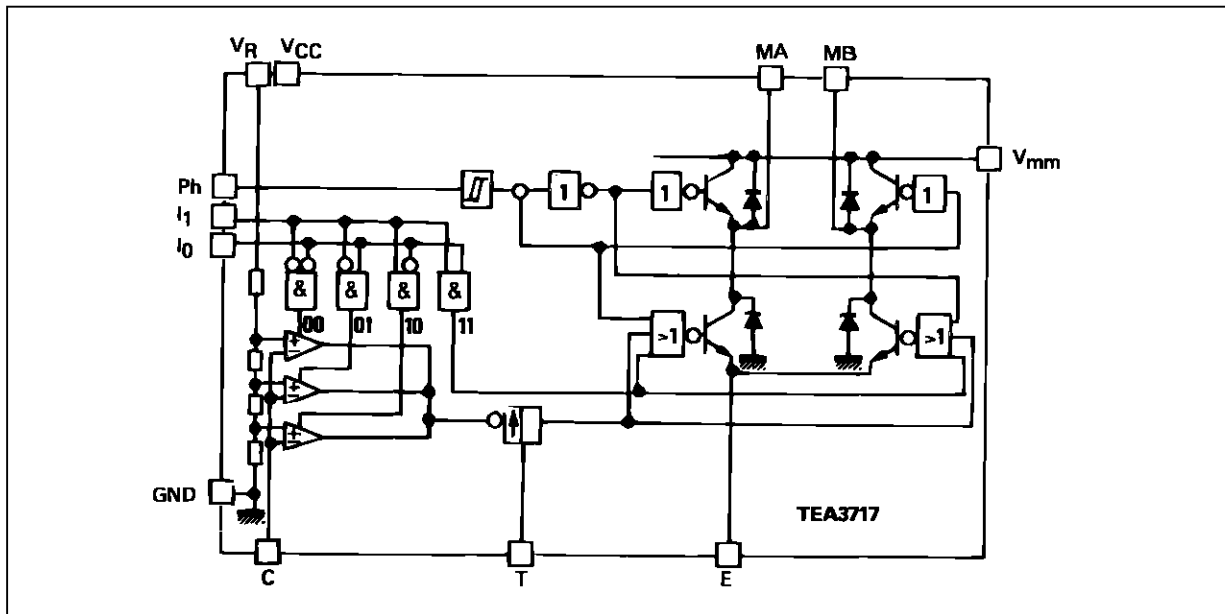


ORDER CODE : TEA3717DP

PIN CONNECTION (top view)



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
V_{in} V_{in} V_V	Input Voltage Logic Inputs Analog Inputs Reference Input	- 0.5 to 6 V_{CC} 15	V
I_{in} I_{in}	Input Current Logic Inputs Analog Inputs	- 10 - 10	mA
I_O	Output Current	± 1	A
T_j	Junction Temperature	+ 150	$^{\circ}C$
T_{stg}	Storage Temperature Range	- 55 to + 150	$^{\circ}C$
T_{oper}	Operating Ambient Temperature Range	0 to + 70	$^{\circ}C$

THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{th(j-c)}$	Maximum Junction-pins Thermal Resistance	11	$^{\circ}C/W$
$R_{th(j-a)}$	Maximum Junction-ambient Thermal Resistance	45*	$^{\circ}C/W$

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

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage	4.75	5	5.25	V
V_{mm}	Supply Voltage	10	-	40	V
I_o	Output Current	0.020	-	0.8	A
T_{amb}	Ambient Temperature	0	-	70	$^{\circ}C$
t_r	Rise Time, Logic Inputs	-	-	2	μs
t_f	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.	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 ($V_R = + 5.0V$), $I_o = 0, I_1 = 0$ $I_o = 1, I_1 = 0$ $I_o = 0, I_1 = 1$	390 230 65	420 250 80	440 270 90	mV
I_{CO}	Comparator Input Current	– 20	–	20	μA
I_{off}	Output Leakage Current ($I_o = 1, I_1 = 1$) $T_{amb} = + 25^{\circ}C$ $T_{amb} = + 70^{\circ}C, V_S = 40V, V_{SS} = 5V$	– –	– 100	100 200	μA
V_{sat}	Total Saturation Voltage Drop ($I_o = 500mA$)	–	–	4.0	V
P_{tot}	Total Power Dissipation $I_o = 500mA, f_s = 30kHz$ $I_o = 800mA, f_s = 30kHz$	– –	1.8 3.7	2.3 –	W
t_{off}	Cut off Time (see figure 1 and 2, $V_{mm} = + 10V, t_{on} \geq 5\mu s$)	25	30	35	μs
t_d	Turn off Delay (see figure 1 and 2, $T_{amb} = + 25^{\circ}C, dV/dt \geq 50mV/\mu s$)	–	1.6	–	μs

Figure 1 (see note)

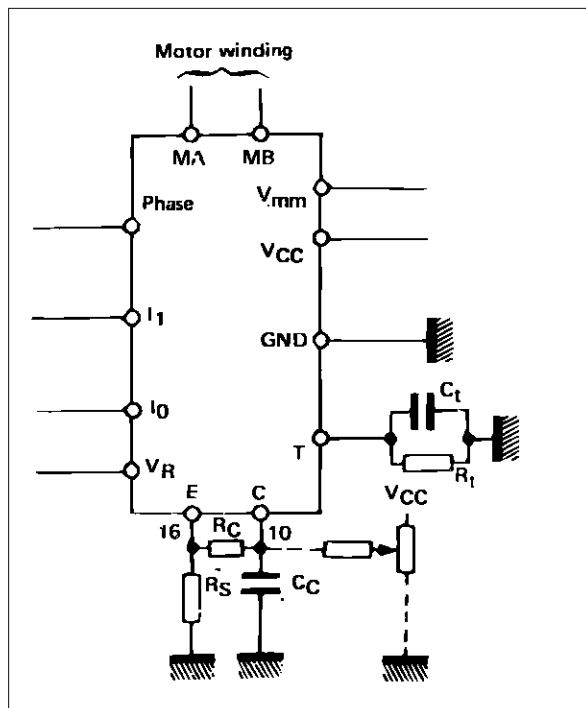
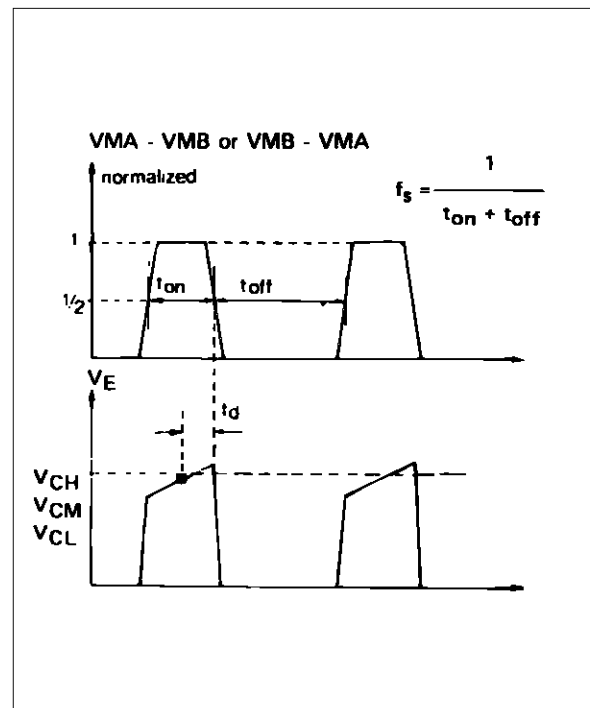


Figure 2.



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
 $R_C = 1 \text{ k}\Omega$
 $C_C = 820 \text{ pF}$, ceramic
 $R_t = 56 \text{ k}\Omega$
 $C_t = 820 \text{ pF}$, ceramic

Figure 3

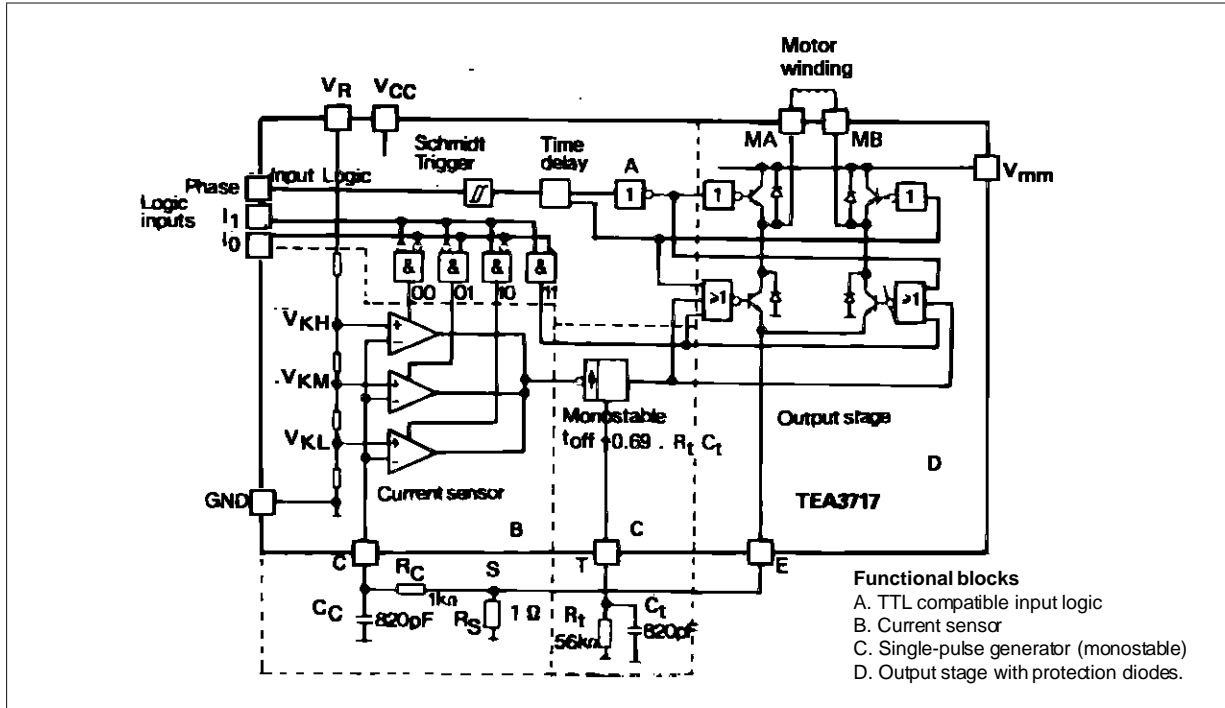


Figure 4 : Typical Sink Saturation Voltage versus Output Current

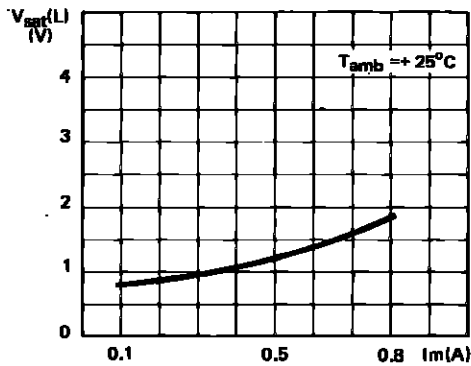


Figure 5 : Typical Source Saturation Voltage versus Output Current

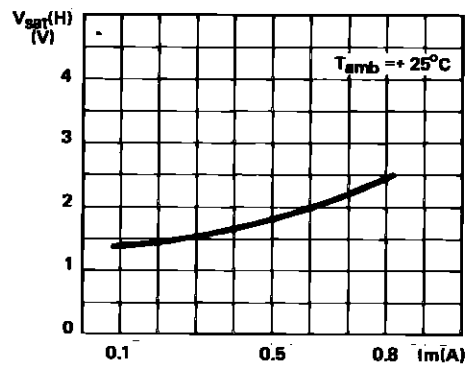
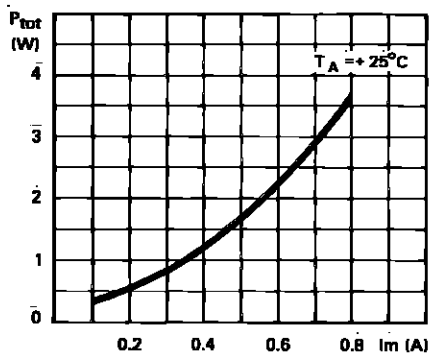


Figure 6 : Typical Power Losses versus Output Current



TYPICAL APPLICATION

Figure 7 : Serial Printer Carriage Drive.

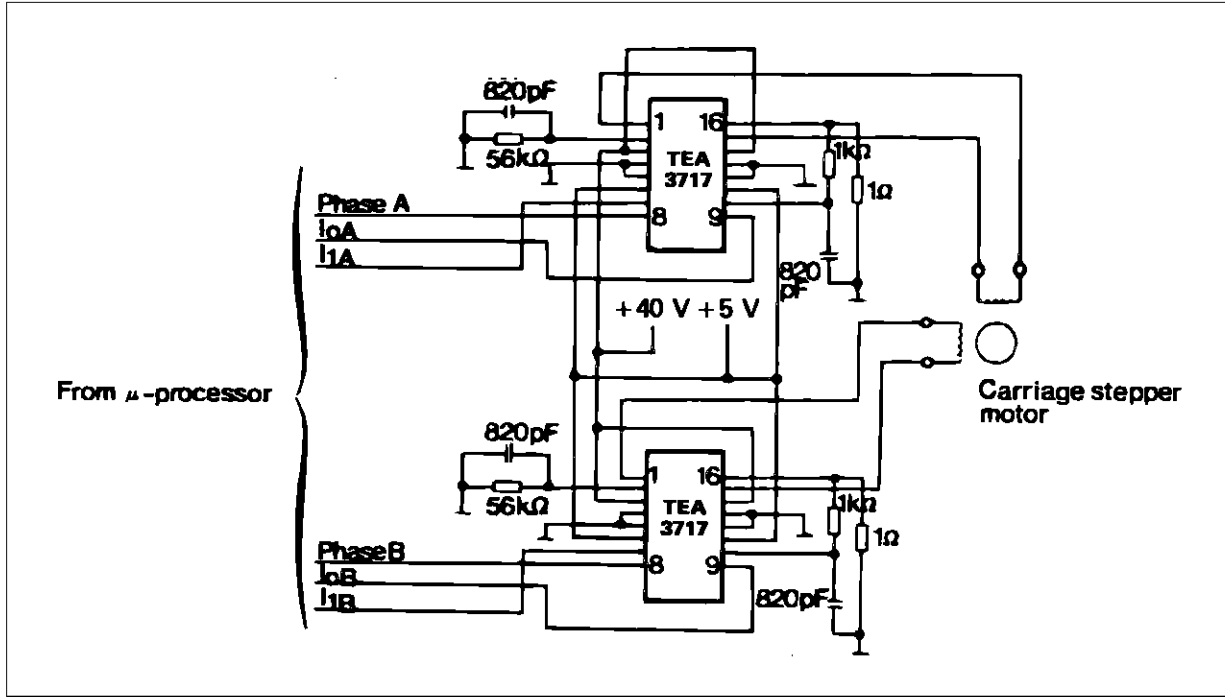
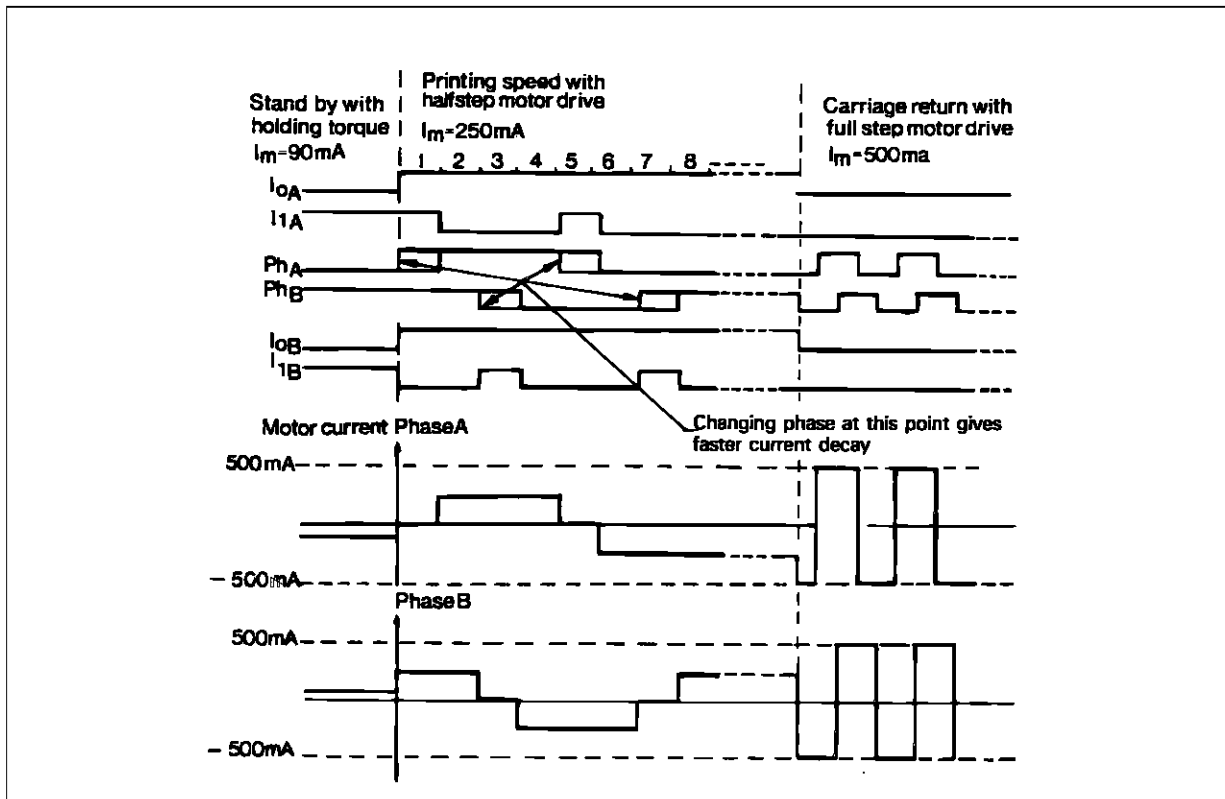
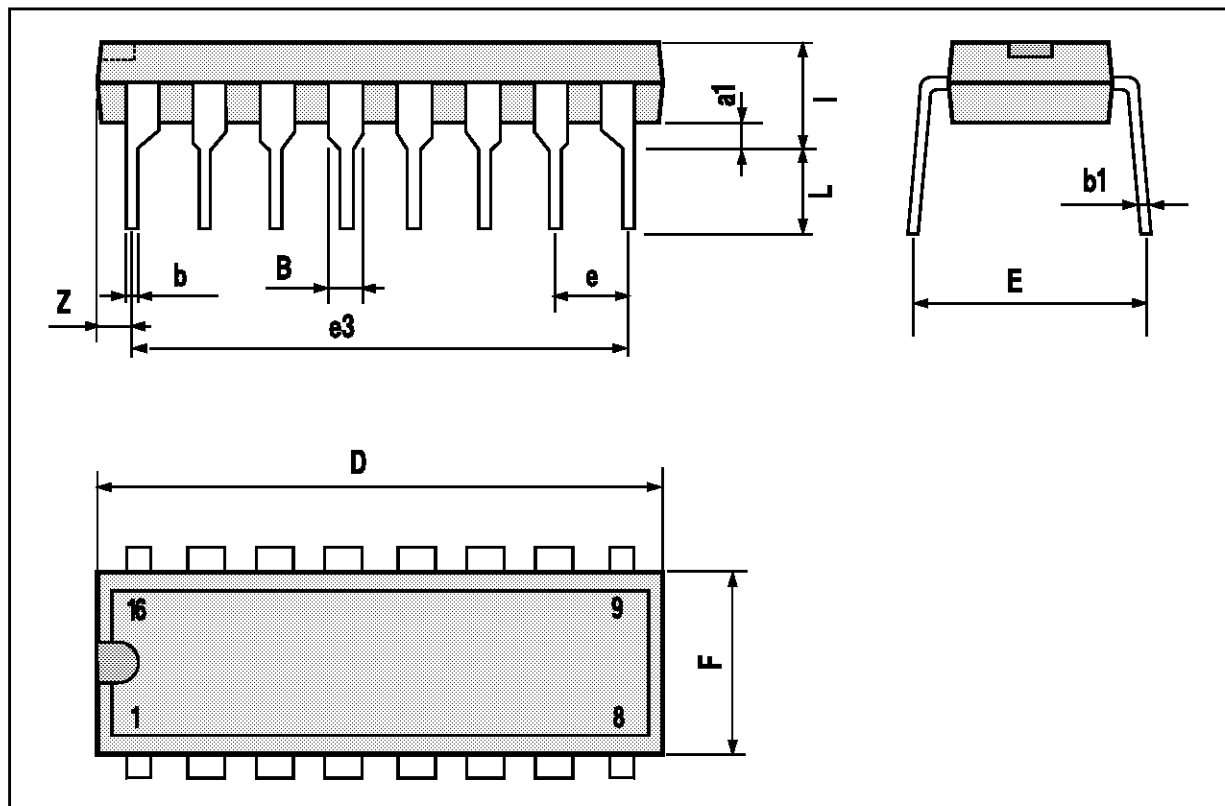


Figure 8 : Principal Operating Sequence.



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



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