

STEPPER MOTOR DRIVER

- MICROSTEPPING
- BIPOLAR OUTPUT CURRENT UP TO 400 mA
- LOW SATURATION VOLTAGE
- BUILT-IN FAST RECOVERY DIODES
- OUTPUT CURRENT DIGITALLY PROGRAMMABLE
- 7 BIT D/A CONVERTERS SET OUTPUT CURRENT
- THERMAL SHUTDOWN

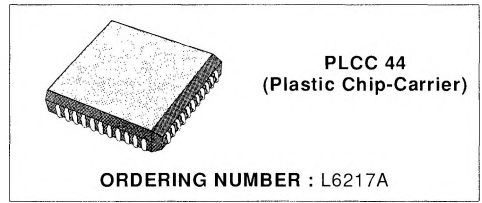
DESCRIPTION

The L6217A is a monolithic IC that controls and drives both phases of a Bipolar Stepper Motor with PWM control of the phase current. The output current level of each phase is programmed by a 7 bit D/A converter so that the device may be used in full-step, half-step and micro-step applications. The inputs for the D/A converters and the phase inputs to select the direction of current flow are latched to minimize the interface to a microprocessor.

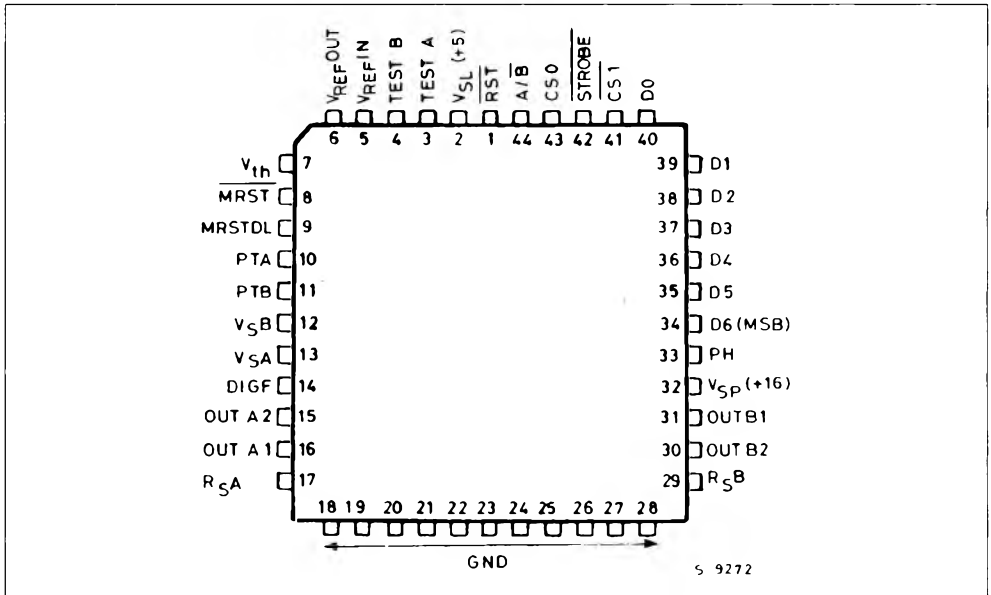
The power section of the device is a dual H-Bridge drive with internal clamp diodes for current circulation. To maintain the degree of accuracy required for microstepping, the motor current is internally sensed and compared to the output of the D/A converter.

A monostable, programmed by an RC network sets the motor current decay time.

The L6217A is supplied in a 44 pin in PLCC with 11 of the 44 pins used for heatsinking.



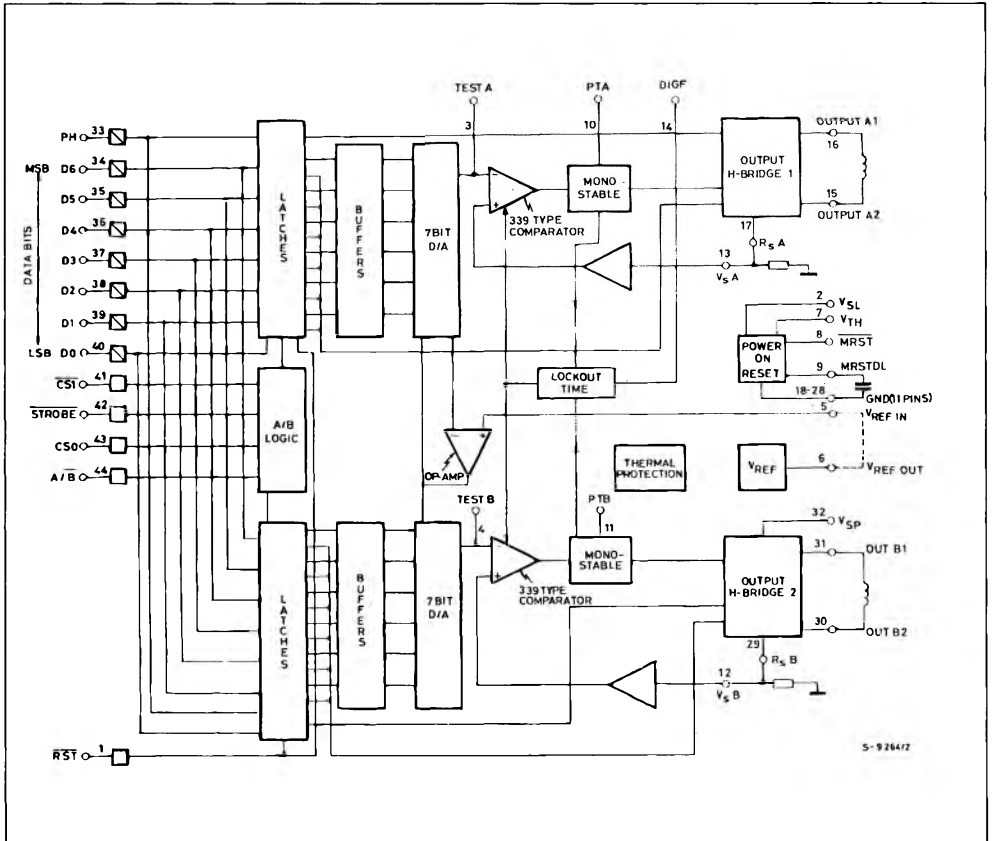
CONNECTION DIAGRAM (top view)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{Si}	Logic Supply Voltage	7	V
V_{Sp}	Motor Supply Voltage	18	V
V_I	Logic Input Voltage	6	V
V_{Ref}	Reference Input Voltage	V_{Si}	V
I_o	Output Peak Current	500	mA
T_j	Operating Junction Temperature	150	°C
T_{stg}	Storage Temperature	- 55 to + 15	°C

BLOCK DIAGRAM



THERMAL DATA

$R_{th\ j-case}$	Thermal Impedance Junction-case	Max	10	°C/W
$R_{th\ j-amb}$	Thermal Impedance Junction-ambient	Max	80	°C/W

PIN FUNCTION DESCRIPTION

N°	Name	Function
1	$\overline{R_{st}}$	Active low input resets the D/A latches to 0 and disables the output.
40, 34	D0-D6	Data inputs for the D/A converter. (D0 = LSB) For a data input of 00, the corresponding outputs are held in the off state.
44	$\overline{A/B}$	Channel select for input data. Pin $\overline{A/B}$ selects channel A when high.
33	PH	Logic input selects direction of current flow in output bridge from A1 (B1) to A2 (B2) for PH = 1.
42	$\overline{\text{Strobe}}$	Active low input latches input data (D0, D6 and PH) into input latch.
9	MRST DL	The capacitor on this pin programs the power on reset delay according to the formula : $T_{DR} = (0.35) (C) 10^6$
8	$\overline{\text{MRST}}$	Power-on reset circuit output. (micro reset signal). This output remains low from power on until the delay capacitor has charged past the delay threshold.
10	P ₁ A	Pulse time A, an external parallel RC network tied to ground defines t_{off} time for channel A. ($T_{off} = 0.69 RC$).
11	P ₁ B	Pulse time B, an external parallel RC network tied to ground defines t_{off} time for channel B. ($T_{off} = 0.69 RC$).
5	$V_{ref in}$	Voltage applied to this points sets the reference for the D/A converter and therefore sets the maximum output current.
18 to 28	Gnd	Ground connection and also conduct heat to the P.C. board.
2	V_{si}	Logic Supply Voltage
32	V_{sp}	Motor Supply Voltage
16, 15 31, 30	Out A1-A2 B1-B2	H-Bridge Outputs.
43, 41	$\overline{CS0}$, $\overline{CS1}$	Chip select inputs $\overline{CS0}$ is active high, $\overline{CS1}$ is active low.
17, 29	$R_{sA} - R_{sB}$	Sense resistor from this pin to ground set the peak output current.
13, 12	$V_{sA} - V_{sB}$	Analog inputs for sensing the motor current, separate inputs are provides to allow filtering of the sense voltage if required.
3,4	Test A & B	These pins are for testing of D/A outputs.
6	$V_{ref out}$	2.5 V Band Gap Reference
7	V_{th}	Reset Threshold Voltage
14	DIGF	Can be used to modify the internal comparator lockout time. In microstepping typical application a 1.8 K Ω resistor must be connected between this pin and ground.

ELECTRICAL CHARACTERISTICS ($V_{CC} = 5.0\text{ V}$, $T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{sp}	Motor Supply Voltage		8		16	V
V_{si}	Logic Supply Voltage		4.75		5.25	V

LOGIC INPUTS ($D0$ - $D6$, $CS0$, $\overline{CS1}$, PH , \overline{RST} and A/B)

V_{IL}	Input Low Voltage				0.8	V
V_{IH}	Input High Voltage		2		V_{si}	V
I_{IL}	Input Low Current	$V_I = 0.4\text{ V}$			- 400	μA
I_{IH}	Input High Current	$V_I = 2.4\text{ V}$			10	μA

CURRENT CONTROL AND D TO A SECTION

V_{ref}	Reference Voltage	$V_{CC} = 5.0\text{ V}$	2.45	2.50	2.55	V
V_{rin}	Reference Input Range		2.0		3.0	V
	Monotonicity of D to A		- 0.5		+ 0.5	LSB
	Linearity of D to A		- 1		+ 1	LSB
I_{op}	Peak Output Current (gain of current loop)	$V_{ref} = 2.38\text{ V}$ $R_{sense} = 2\ \Omega$ Data = 7 F (Hex)	225	252	277	mA
I_o	Ouptut Matching	$V_{ref} = 2.38\text{ V}$			5	%

MONOSTABLE

T_{off}	Cutoff Time	$R_f = 56\text{ K}\Omega$ $C_f = 820\text{ pF}$	28		36	μs
T_d	Turn-off Delay			1		μs
I_{off}	Ouptut Leakage Current	Data = 00 (Hex)			100	μA

RESET CIRCUITY

V_{th}	Reset Threshold Voltage		3.9	4.1	4.3	V
	Reset Threshold Hysteresis		70	100		mV
I_{so}	Delay Capacitor Charging Current	$V_C = 2.5\text{ V}$	7	10	14	μA
I_{si}	Delay Capacitor Discharge Current	$V_C = 2.5\text{ V}$	10			mA
V_{dth}	Delay Threshold Voltage		3.25	3.5	3.75	V
V_{dhys}	Hysteresis Voltage on Delay Threshold		70	100		mV
I_{ol}	Output Leakage Current	$V_O = 5\text{ V}$			200	μA
V_{sat}	Output Saturation of Reset Out	$I_O = 2\text{ mA}$			0.4	V

SOURCE DIODE - TRANSISTOR PAIRS

V_{sat}	Saturation Voltage	$I_O = 400\text{ mA}$		1.3	1.8	V
V_f	Diode Forward Voltage	$I_O = 400\text{ mA}$		0.8	1.2	V

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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SINK DIODE - TRANSISTOR PAIRS

V_{sat}	Saturation Voltage	$I_O = 400$ mA		1.1	1.5	V
V_f	Diode Forward Voltage	$I_O = 400$ mA		0.6	1.0	V

AC CHARACTERISTICS

$T_{sDI}(ST)$	DI to Strobe ↓ Setup Time		100			ns
$T_{hDI}(ST)$	DI to Strobe ↓ Hold Time		500			ns
T_{wPI}	Pulse Width Low		600			ns
T_{cST}	Strobe Setup Time		2.5			μs
$T_{sA/B}(ST)$	A/B to Strobe ↓ Setup Time		100			ns
$T_{sPH}(ST)$	PH to Strobe ↓ Setup Time		100			ns

CIRCUIT OPERATION

The current control section of the L6217A is a pulse width modulated control that senses the motor current. When the motor current reaches the peak programmed current the comparator will trigger the monostable turning off the upper transistors. After the t_{off} time equal to $0.69 RC$ the upper drivers are enabled again.

The peak current is given by the equation :

$$I_{op} = \frac{V_{ref}}{4.69 \cdot R_{sense}} \cdot \frac{D}{128}$$

D = Input data (0 - 7F H)

When the input data is 00, the output stages are disabled by internal logic so that the output current decays rapidly to zero.

An internal generated lockout time avoids the use of an external RC network between the sensing resistor (R_{sA} , R_{sB}) and the corresponding input (V_{sA} , V_{sB}), by disabling the comparator sensing during the lockout time. This time is typically $2.5 \mu s$.

Figure 1 : Microstepping Typical Application.

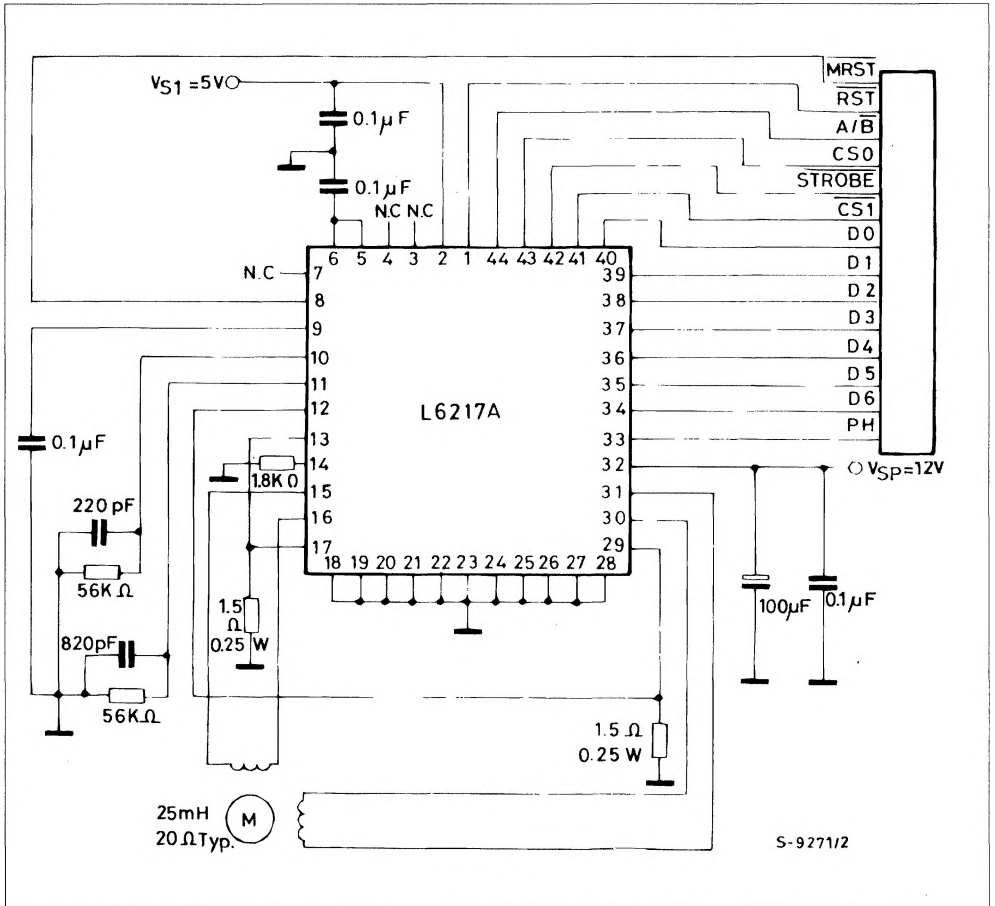


Figure 2 : Microcomputer Interface Timing.

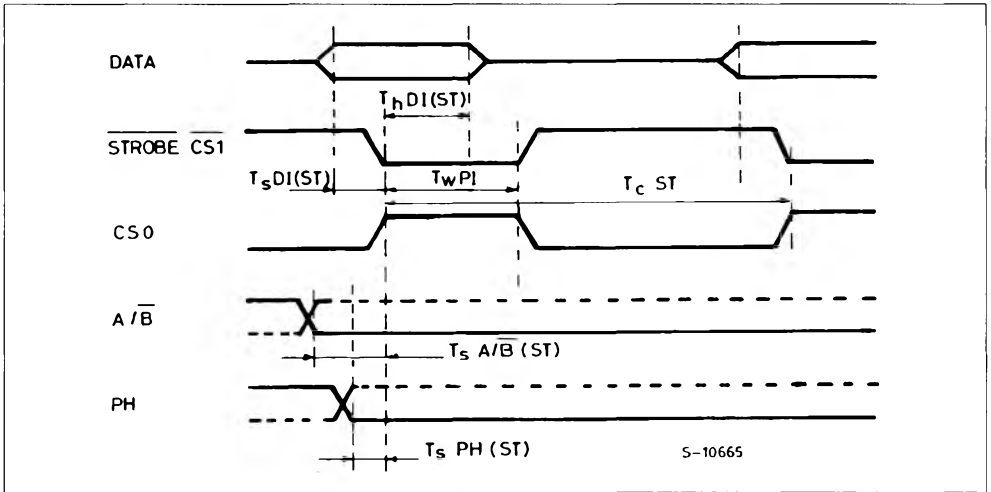


Figure 3 : T_d , T_{OFF} and $T_{lockout}$.

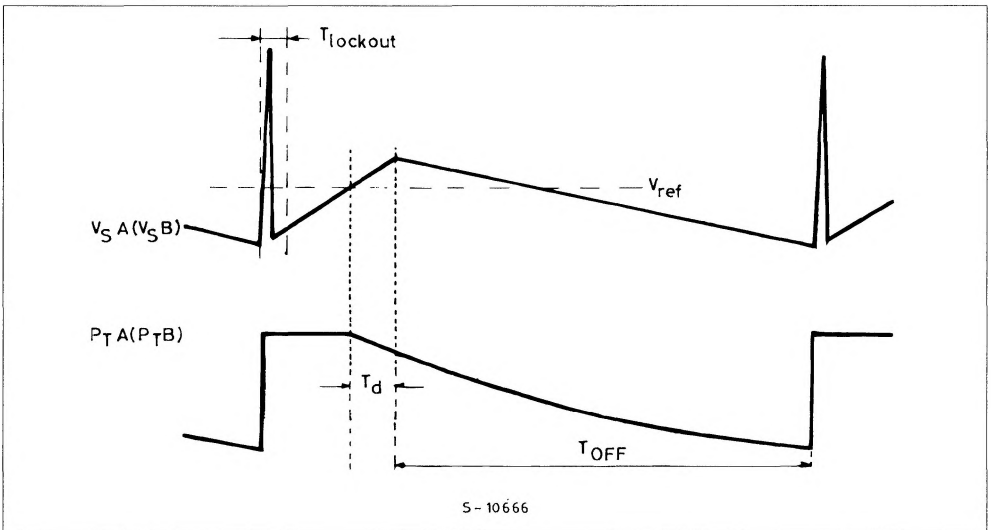


Figure 4 : Reset Waveforms.

