SGS-THOMSON MICROELECTRONICS

L6217

STEPPER MOTOR DRIVER

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

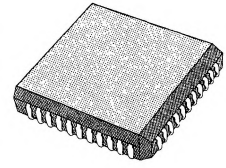
DESCRIPTION

The L6217 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 6 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 recirculation. To maintain the degree of accuracy required for micro-stepping 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.

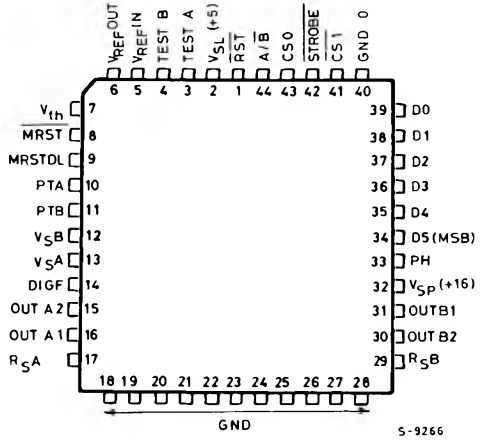
The L6217 is supplied in a 44 pin PLCC with 11 of the 44 pins used for heatsinking.



PLCC 44
(Plastic Chip-Carrier)

ORDER CODE : L6217

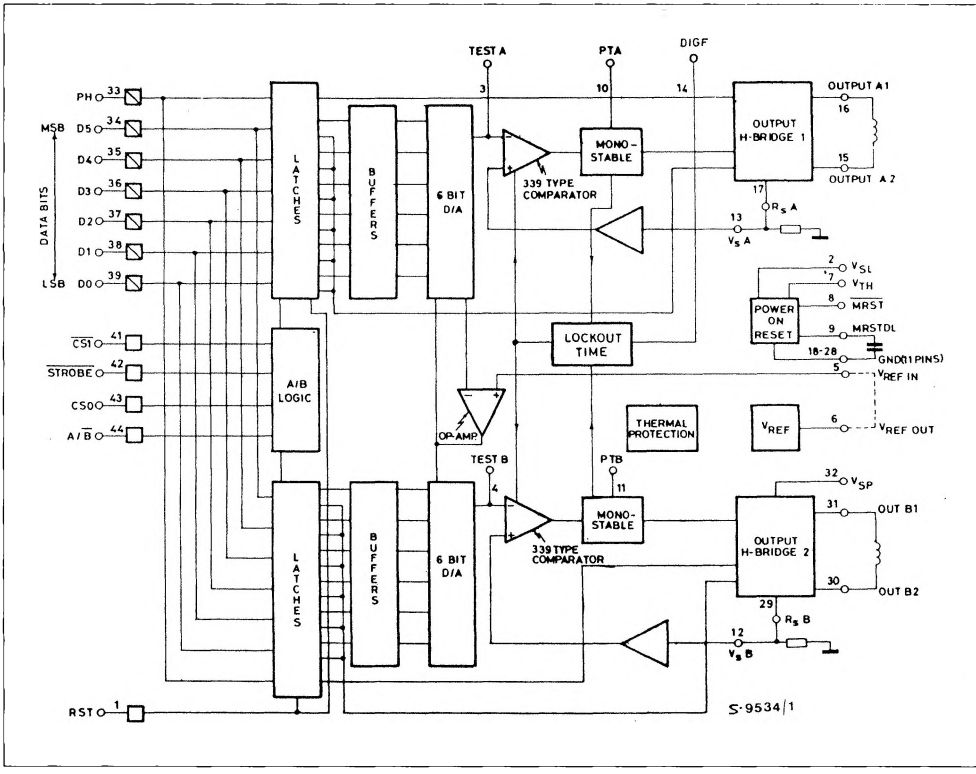
PIN CONNECTION (top view)



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 + 150	°C

BLOCK DIAGRAM



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal Impedance Junction-Case	Max.	10	°C/W
$R_{th\ j\text{-}amb}$	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.
38,39	D0 - D5	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	A/B	Channel select for input data. Pin 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	Strobe	Active low input latches input data (D0-D5 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	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_tA	Pulse time A, an external parallel RC network tied to ground defines T_{off} time for channel A. (T_{off} = 0.69 R2C2).
11	P_tB	Pulse time B, an external parallel RC network tied to ground defines toll time for channel B. (T_{off} = 0.69 R3C3).
5	$V_{ref\ In}$	Voltage applied to this point sets the reference for the D/A converter and threfore sets the maximum output current. (see equation 1, next two pages).
18 to 28	Gnd	Ground connection and also conducts heat to the P.C. board.
40	Gnd 0	Pin must be connected to ground.
2	V_{sl}	Logic Supply Voltage
32	V_{sp}	Motor Supply Voltage
16,15 31,30	Out A1 - A2 B1 - B2	H - Bridge outputs.
43,41	CS0, $\overline{CS1}$	Chip select inputs 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 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 KΩ resistor must be connected between this pin and ground.

ELECTRICAL CHARACTERISTICS (V_{cc} = 5.0 V, T_j = 25 °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/$\overline{B}$)

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 V			− 400	µA
I_{IH}	Input High Current	V_I = 2.4 V			10	µA

CURRENT CONTROL AND D TO A SECTION

V_{ref}	Reference Voltage	V_{CC} = 5.0 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} = 2.40 V R_{sense} = 2 Ω Data = 7 F (Hex)	225	252	277	mA
I_o	Output Matching	V_{ref} = 2.38 V			5	%

MONOSTABLE

T_{off}	Cutoff Time	R_t = 56 KΩ C_t = 820 pF	28		36	µs
T_d	Turn-off Delay			1		µs
I_{off}	Output Leakage Current	Data = 00 (Hex)			100	µA

RESET CIRCUITRY

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 V	7	10	14	µA
I_{si}	Delay Capacitor Discharge Current	V_C = 2.5 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 V			200	µA
V_{sat}	Output Saturation of Reset Out	I_O = 2 mA			0.4	V

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
SOURCE DIODE - TRANSISTOR PAIRS						
V_{sat}	Saturation Voltage	I_O = 400 mA		1.3	1.8	V
V_f	Diode Forward Voltage	I_O = 400 mA		0.8	1.2	V
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
$T_sA/\overline{B}(ST)$	$A/\overline{B}$ 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 :

$$I_{op} = \frac{V_{ref}}{4.69 \cdot R_{sense}} \cdot \frac{D}{64}$$

D = Input data (0 - 63)

When the input data is 00, the ouptut 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 2.5µs.

Figure 1 : Microstepping (typical application).

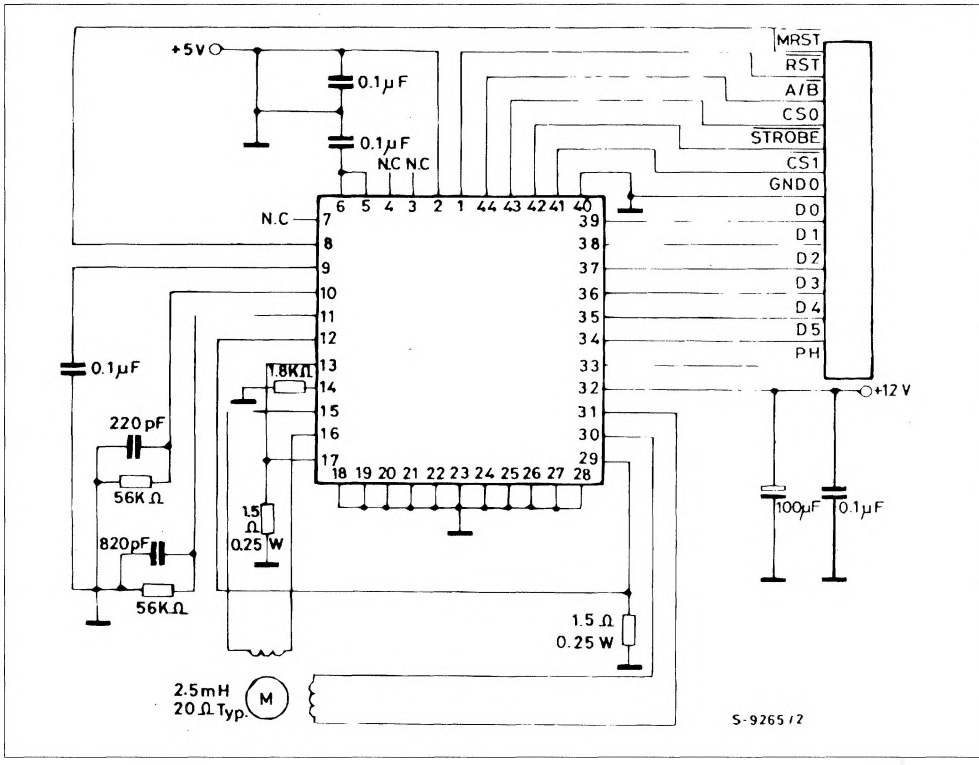


Figure 2 : Microcomputer Interface Timing.

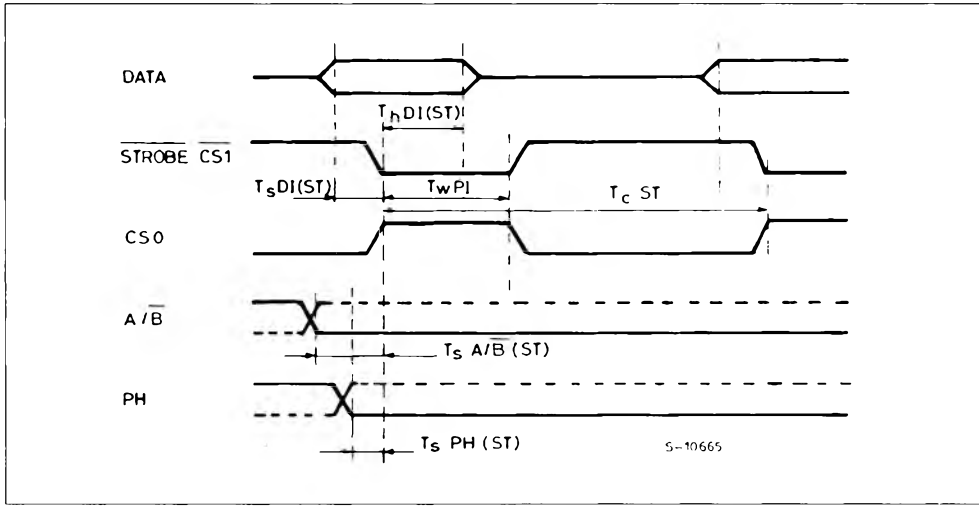


Figure 3 : T_d, T_{off} and $T_{lock\ out}$.

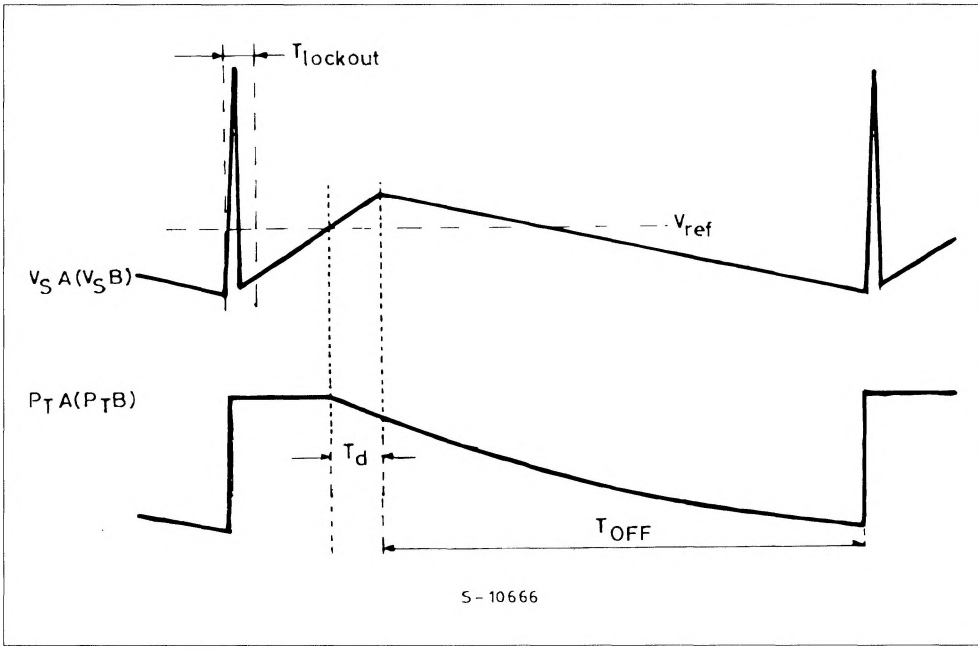


Figure 4 : Reset Waveforms.