LB1937T

Monolithic Digital IC

1-2 Phase Excitation Stepping Motor Driver

ON Semiconductor®

http://onsemi.com

Overview

The LB1937T is a 2-phase bipolar drive stepping motor driver IC that supports low-voltage drive and can drive two stepping motors at the same time. The LB1937T's miniature package and minimal number of external components reduces the required mounting area. It also provides high-efficiency motor drive and can reduce circuit current consumption. Since it provides a current detection pin and supports PWM control input, it can be used to implement current chopper control at the system level. The LB1937T is optimal for the stepping motors used for lens drive in digital cameras, printers, and movie cameras.

Functions and Features

- Low saturation voltage forward/reverse motor driver (V_O sat = 0.3V at I_O = 200mA)
- Four H-bridge channels
- Wide usable voltage range (Allowable voltage range: 2.5V to 9.5V, absolute maximum rating: 10.5V)
- Supports PWM input (Low power consumption can be achieved in slow delay mode that uses IN1/IN2 = H/H logic.)
- Motor (coil) current detection pin
- Built-in thermal shutdown circuit
- Thin form factor miniature package (TSSOP24)

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Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		-0.3 to +10.5	V
	VS max		-0.3 to +10.5	V
Maximum output voltage	V_{OUT} max		VS+ VSF	V
Input voltage	V_{IN} max		-0.3 to +8.0	V
Ground pin source current	IGND max	Per channel	800	mA
Allowable power dissipation	Pd max	When mounted on a circuit board *	1100	mW
Operating temperature	Topr		-30 to +85	°C
Storage temperature	Tstg		-40 to +150	°C

* Specified circuit board : $114.3 \times 76.1 \times 1.6mm^3$, glass epoxy

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Allowable Operating Range at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		2.5 to 9.5	V
	VS		2.5 to 9.5	
High-level input voltage	V_{IH}		2.0 to 7.5	V
Low-level input voltage	V_{IL}		-0.3 to 0.7	V

Electrical Characteristics at Ta = 25°C, V_{CC} = VS = 5V

Parameter	Symbol	Conditions	Ratings min	Ratings typ	Ratings max	Unit
V_{CC} system power supply current	$I_{CC}0$	IN1 to IN8 = 0V		0.1	5	μA
	$I_{CC}1$	IN1 = IN3 = 3V		10	16	mA
VS system power supply current	IS0	IN1 to IN8 = 0V		0.1	5	μA
	IS1	IN1 = IN3 = 3V		13	19	mA
Output saturation voltage	$V_{OUT}1$	V_{CC} = VS = 3V to 7.5V, V_{IN} = 3V or 0V, I_{OUT} = 200mA (High and low side)		0.3	0.4	V
	$V_{OUT}2$	V_{CC} = VS = 4V to 7.5V, V_{IN} = 3V or 0V, I_{OUT} = 400mA (High and low side)		0.6	0.8	V
Input current	I_{IN}	V_{IN} = 5V		150	200	μA
Spark killer diode						
Reverse current	IS(leak)				30	μA
Forward voltage	VSF	I_{OUT} = 400mA			1.7	V

Package Dimensions

unit:mm (typ)

3260A
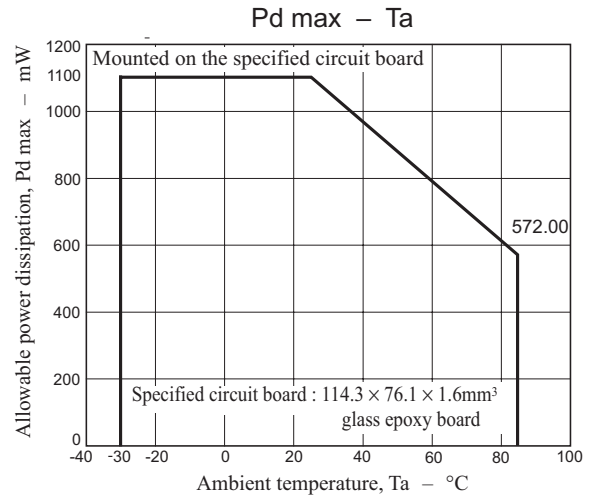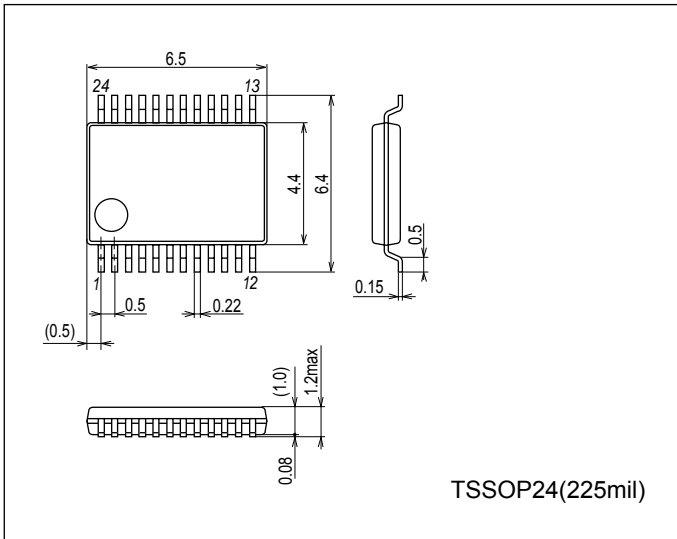
6.5

24   13

4.4

6.4

0.5

0.15

1   12

0.5   0.22

(0.5)

(1.0)

1.2max

0.08

TSSOP24(225mil)

Pd max − Ta

Mounted on the specified circuit board

572.00

Specified circuit board : $114.3 \times 76.1 \times 1.6mm^3$
glass epoxy board

Allowable power dissipation, Pd max − mW

Ambient temperature, Ta − °C

Pin Assignment

		LB1937T		
VS	1		24	P-GND
V_{CC}	2		23	(NC)
IN1	3		22	OUT1
IN2	4		21	OUT2
IN3	5		20	OUT3
IN4	6		19	OUT4
S-GND	7		18	P-GND
IN5	8		17	OUT5
IN6	9		16	OUT6
IN7	10		15	OUT7
IN8	11		14	OUT8
VS	12		13	P-GND

Top view

Block Diagram

Top view
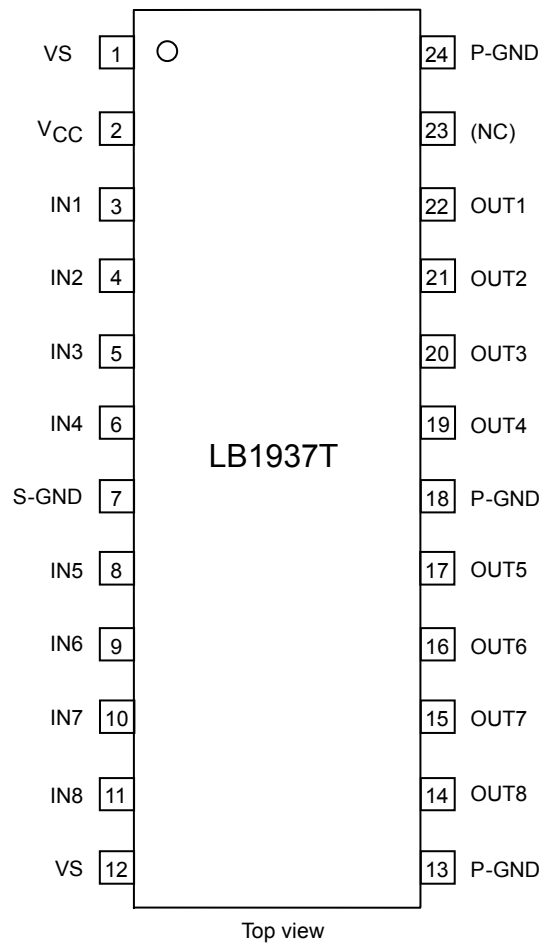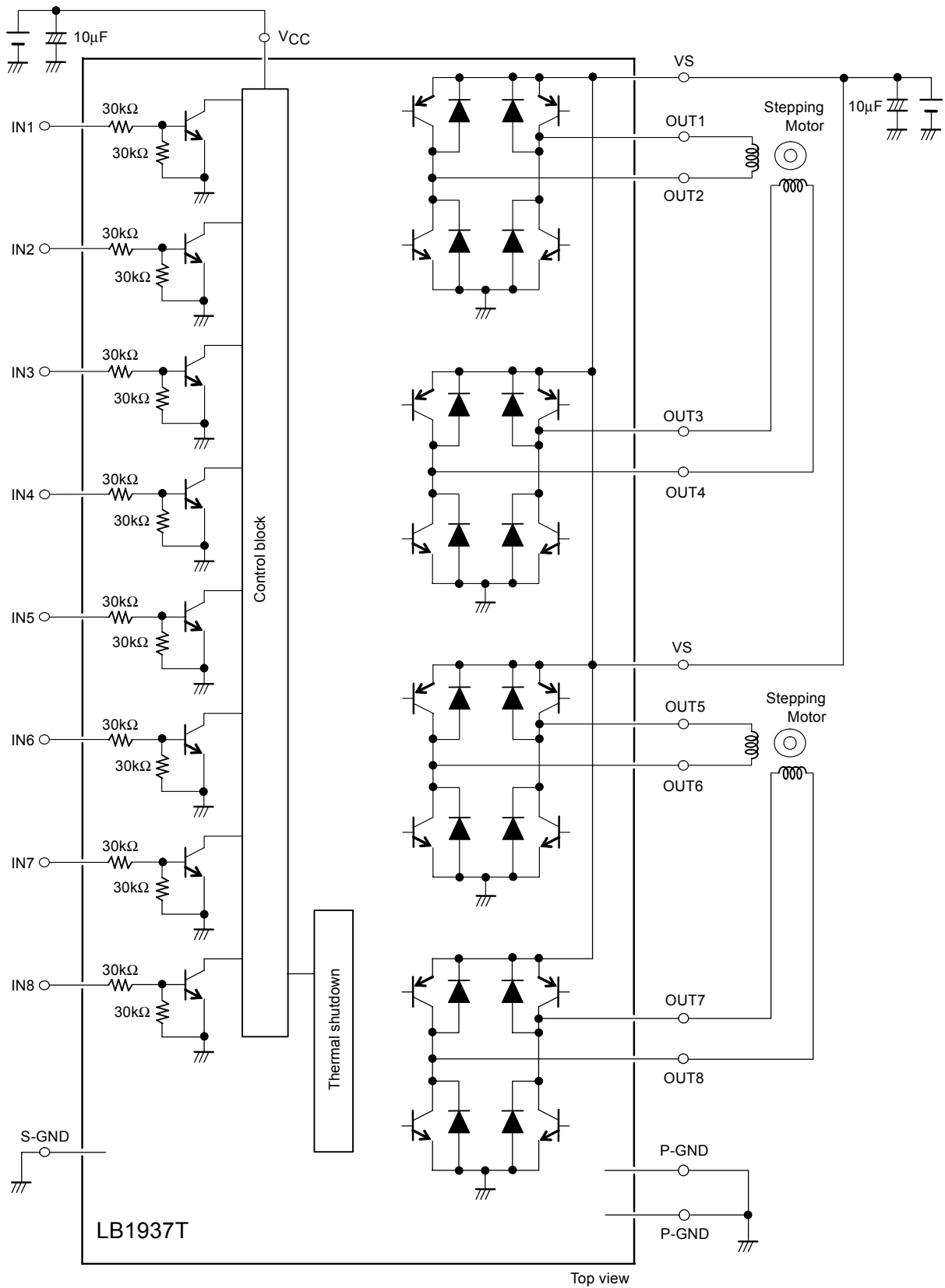
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Truth Table

IN1	IN2	IN3	IN4	IN5	IN6	IN7	IN8	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7	OUT8	Output mode
						Input						Output				
L	L							off	off							(1)
L	H							L	H							(2)
H	L							H	L							(3)
H	H							off	H							(4)
(*)	(*)							H	off							(4)'
		L	L							off	off					(5)
		L	H							L	H					(6)
		H	L							H	L					(7)
		H	H							off	H					(8)
		(*)	(*)							H	off					(8)'
				L	L							off	off			(11)
				L	H							L	H			(12)
				H	L							H	L			(13)
				H	H							off	H			(14)
				(*)	(*)							H	off			(14)'
						L	L							off	off	(15)
						L	H							L	H	(16)
						H	L							H	L	(17)
						H	H							off	H	(18)
						(*)	(*)							H	off	(18)'

L : low, H : high

*:   The output logic mode when IN1/IN2 = H/H is determined by the immediately preceding IN1/IN2 mode.

The post-switching output modes will be as follows.

When switching from (2): (4)

When switching from (3): (4)'

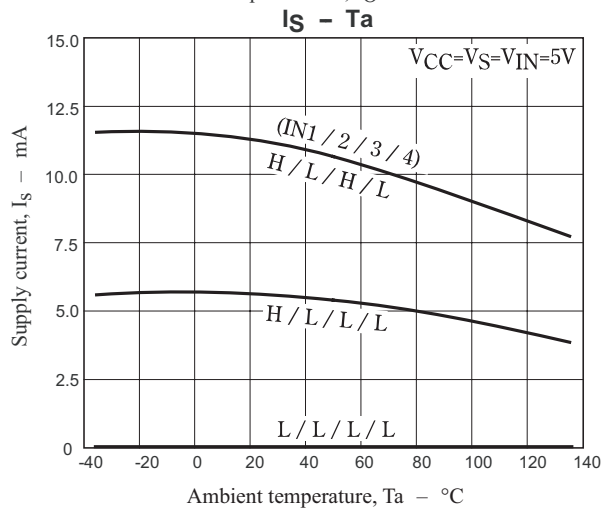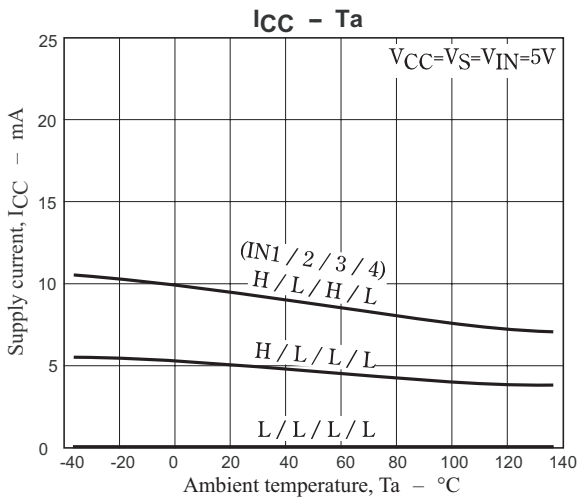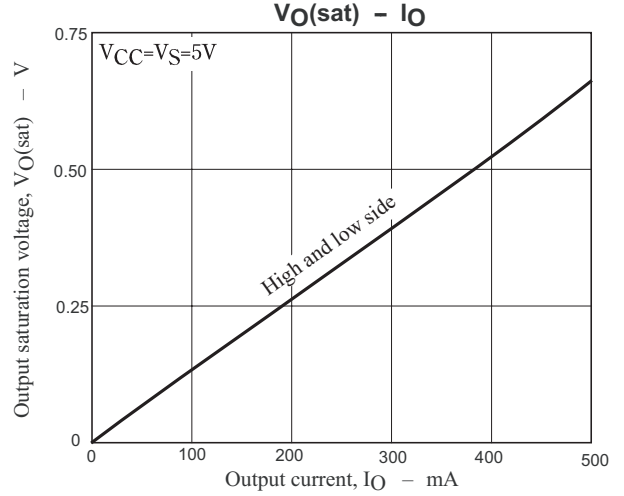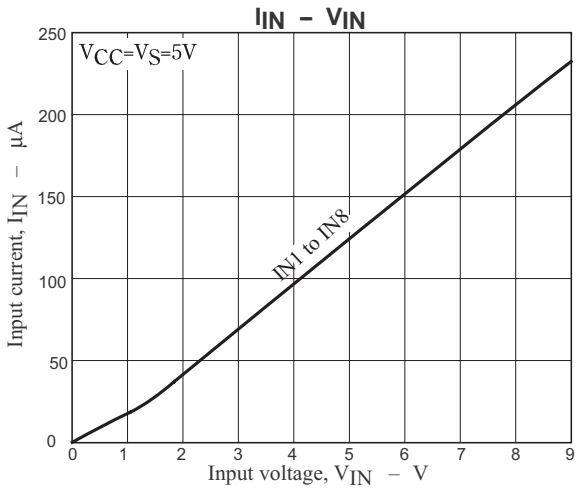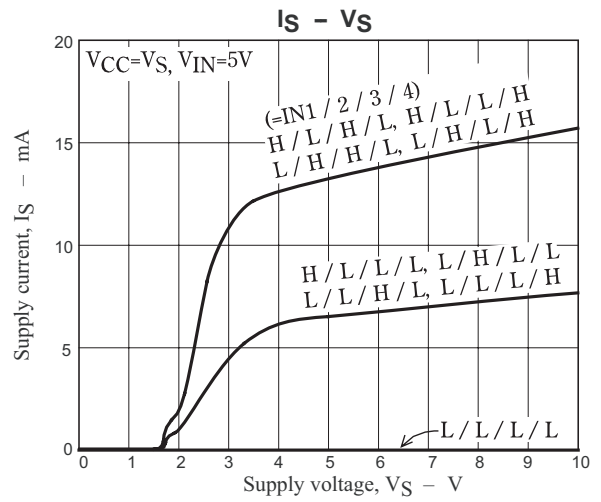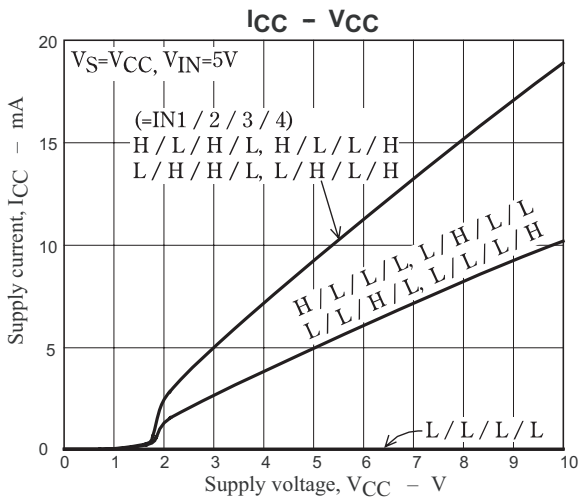When switching from (1): Undefined (Either (4) or (4)')

The modes when IN3/IN4 = H/H operate similarly as described below.

When switching from (6): (8)

When switching from (7): (8)'

When switching from (5): Undefined (Either (8) or (8)')

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I_{CC} – V_{CC}

$V_S=V_{CC}$, $V_{IN}=5V$

Supply current, I_{CC} – mA

(=IN1 / 2 / 3 / 4)
H / L / H / L, H / L / L / H
L / H / H / L, L / H / L / H

H / L / L / L, L / H / L / L
L / L / H / L, L / L / L / H

L / L / L / L

Supply voltage, V_{CC} – V

I_S – V_S

$V_{CC}=V_S$, $V_{IN}=5V$

Supply current, I_S – mA

(=IN1 / 2 / 3 / 4)
H / L / H / L, H / L / L / H
L / H / H / L, L / H / L / H

H / L / L / L, L / H / L / L
L / L / H / L, L / L / L / H

L / L / L / L

Supply voltage, V_S – V

I_{IN} – V_{IN}

$V_{CC}=V_S=5V$

Input current, I_{IN} – μA

IN1 to IN8

Input voltage, V_{IN} – V

$V_O(sat)$ – I_O

$V_{CC}=V_S=5V$

Output saturation voltage, $V_O(sat)$ – V

High and low side

Output current, I_O – mA

I_{CC} – Ta

$V_{CC}=V_S=V_{IN}=5V$

Supply current, I_{CC} – mA

(IN1 / 2 / 3 / 4)
H / L / H / L

H / L / L / L

L / L / L / L

Ambient temperature, Ta – °C

I_S – Ta

$V_{CC}=V_S=V_{IN}=5V$

Supply current, I_S – mA

(IN1 / 2 / 3 / 4)
H / L / H / L

H / L / L / L

L / L / L / L

Ambient temperature, Ta – °C

$V_O(sat)$ – Ta

$V_{CC}=V_S=5V$
High and low side

Output saturation voltage, $V_O(sat)$ – V

$I_O=400mA$

$I_O=200mA$

Ambient temperature, Ta – °C

No.7231-6/7