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# LB1936V

Monolithic Digital IC

## 1-2 Phase Excitation Stepper Motor Driver

### Overview

The LB1936V is a 2-phase bipolar drive stepper motor driver IC that supports low-voltage drive. The LB1936V'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 LB1936V is optimal for the stepper motor drive in scanners, digital cameras, and printers.

### Features

- Low saturation voltage forward/reverse motor driver ( $V_{O\ sat} = 0.25V$  at  $I_O = 200mA$ )
- Two 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
- Miniature package (SSOP16 : 225mil)

### Specifications

**Absolute Maximum Ratings** at  $T_a = 25^\circ C$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\ max}$		-0.3 to +10.5	V
	$V_S\ max$		-0.3 to +10.5	V
Maximum output voltage	$V_{OUT\ max}$		$V_S + V_{SF}$	V
Maximum input voltage	$V_{IN\ max}$		-0.3 to +8.0	V
Ground pin source current	$I_{GND\ max}$	Per channel	800	mA
Allowable power dissipation	$P_d\ max$	When mounted on a circuit board *	740	mW
Operating temperature	$T_{opr}$		-20 to +85	$^\circ C$
Storage temperature	$T_{stg}$		-40 to +150	$^\circ C$

\* 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.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

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## Allowable Operating Range at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	$V_{CC}$		2.5 to 9.5	V
	$V_S$		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

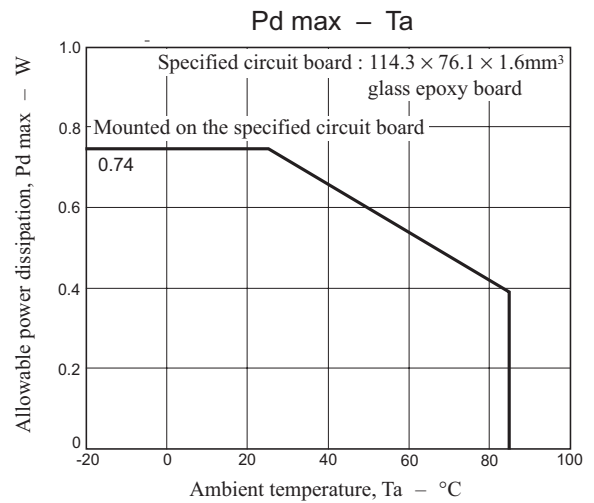
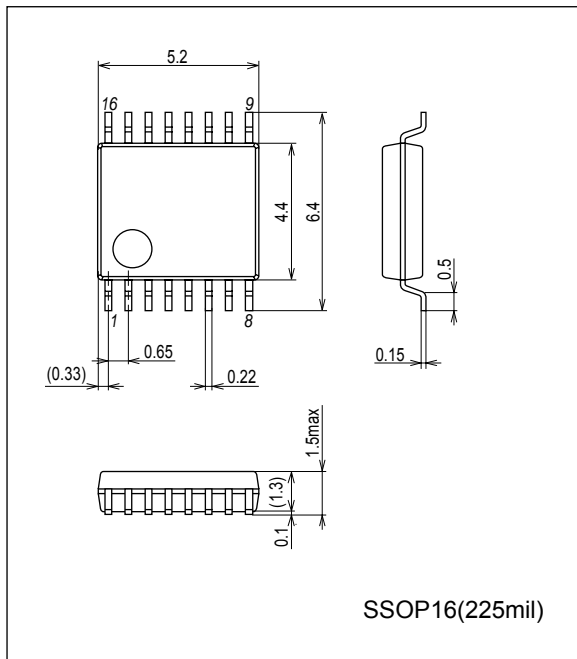
## Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = V_S = 5\text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
$V_{CC}$ system power supply current	$I_{CC0}$	$IN1 = IN2 = IN3 = IN4 = 0\text{V}$		0.1	1	$\mu\text{A}$
	$I_{CC1}$	$IN1 = IN3 = 3\text{V}$ , $IN2 = IN4 = 0\text{V}$		10	16	mA
VS system power supply current	$I_{S0}$	$IN1 = IN2 = IN3 = IN4 = 0\text{V}$		0.1	1	$\mu\text{A}$
	$I_{S1}$	$IN1 = IN3 = 3\text{V}$ , $IN2 = IN4 = 0\text{V}$		12	19	mA
Output saturation voltage	$V_{OUT1}$	$V_{CC} = V_S = 3\text{V}$ to $7.5\text{V}$ , $V_{IN} = 3\text{V}$ or $0\text{V}$ , $I_{OUT} = 200\text{mA}$ (High and low side)	-	0.25	0.4	V
	$V_{OUT2}$	$V_{CC} = V_S = 4\text{V}$ to $7.5\text{V}$ , $V_{IN} = 3\text{V}$ or $0\text{V}$ , $I_{OUT} = 400\text{mA}$ (High and low side)	-	0.5	0.8	V
Input current	$I_{IN}$	$V_{IN} = 5\text{V}$		150	200	$\mu\text{A}$
<b>Spark killer diode</b>						
Reverse current	$I_{S(leak)}$				30	$\mu\text{A}$
Forward voltage	$V_{SF}$	$I_{OUT} = 400\text{mA}$			1.7	V

## Package Dimensions

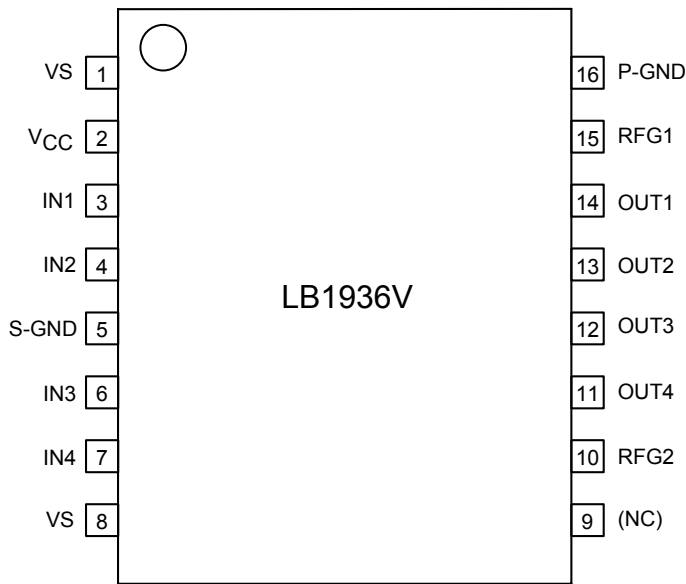
unit:mm (typ)

3178B



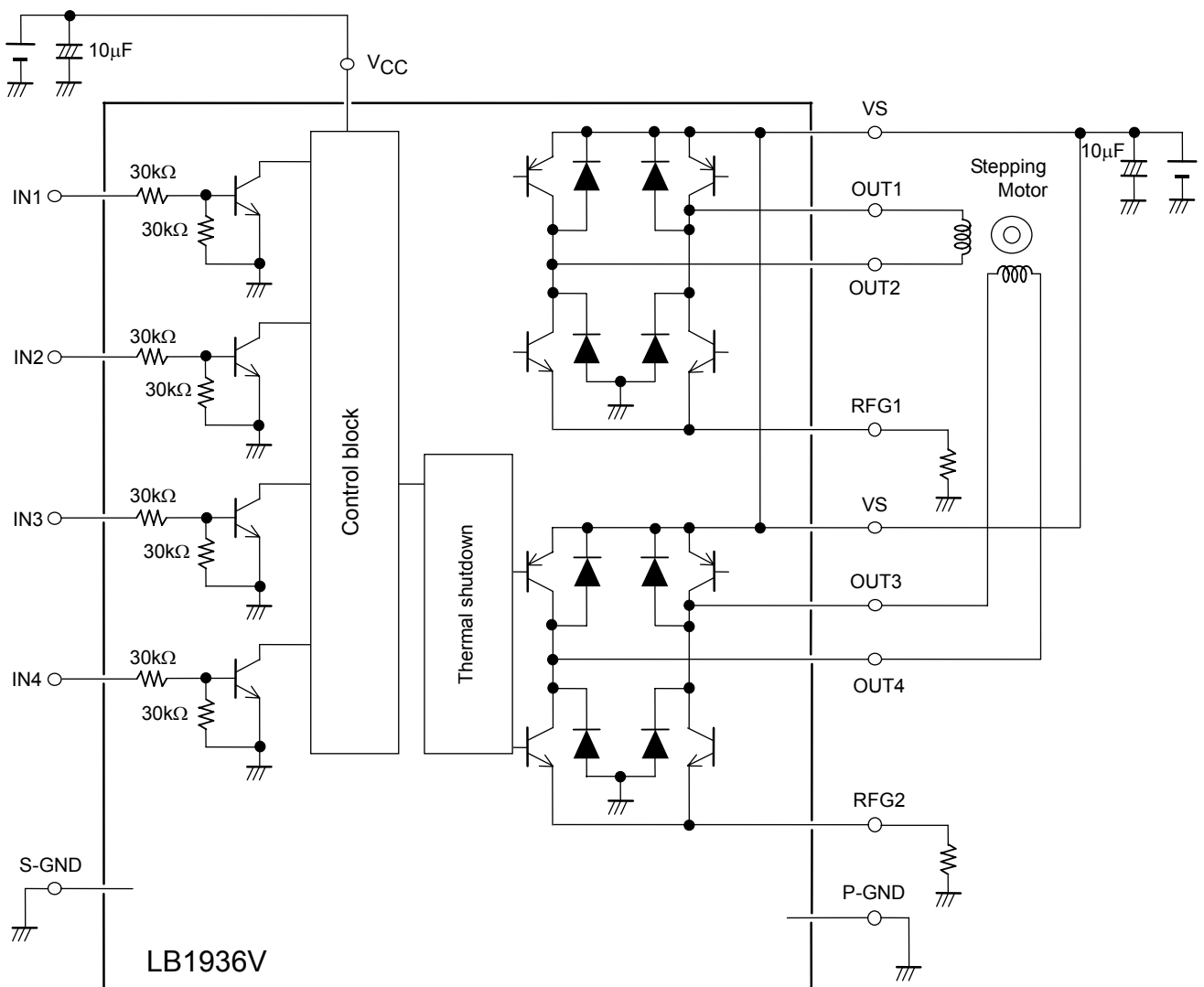
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## Pin Assignment



Top view

## Block Diagram



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## Truth Table

IN1	IN2	IN3	IN4	OUT1	OUT2	OUT3	OUT4	Output mode
L	L	-		off	off	-		(1)
L	H			(2)				
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 : 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)'

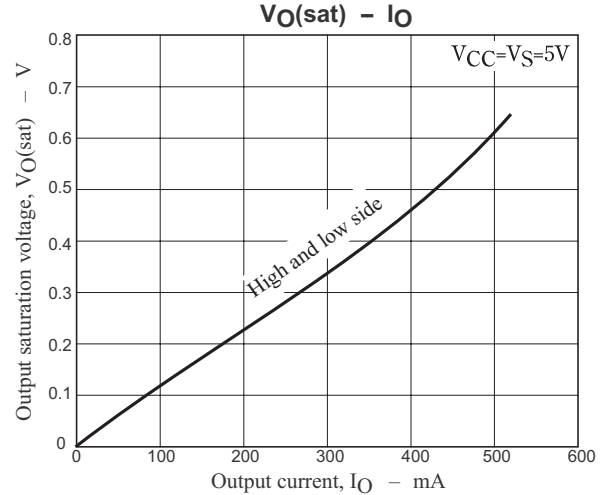
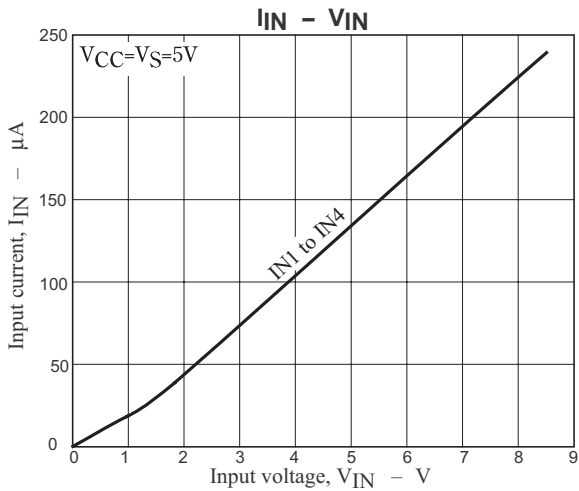
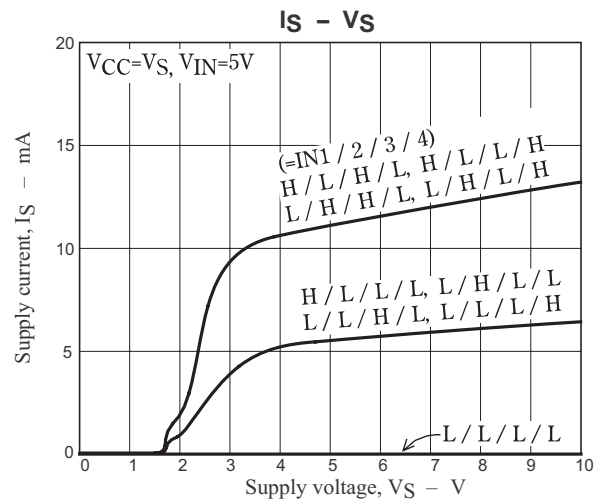
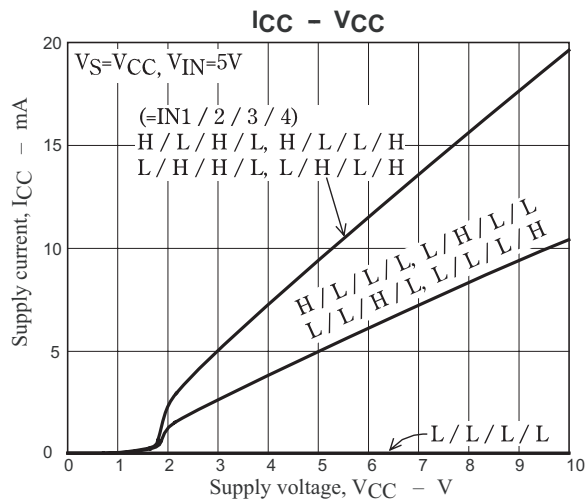
When switching from (1): Undefined (Either (4) or (4)')

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

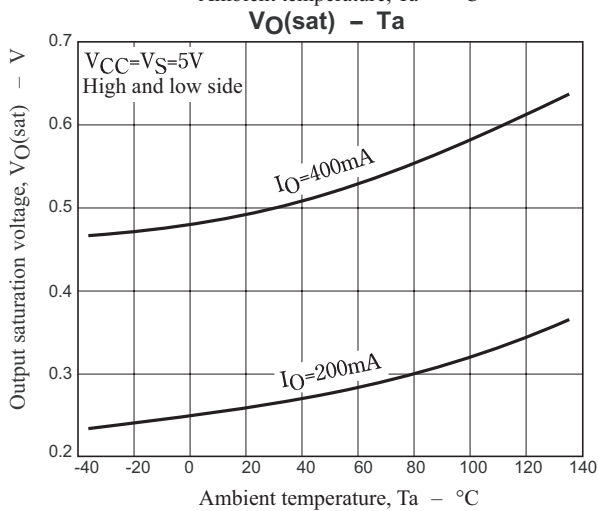
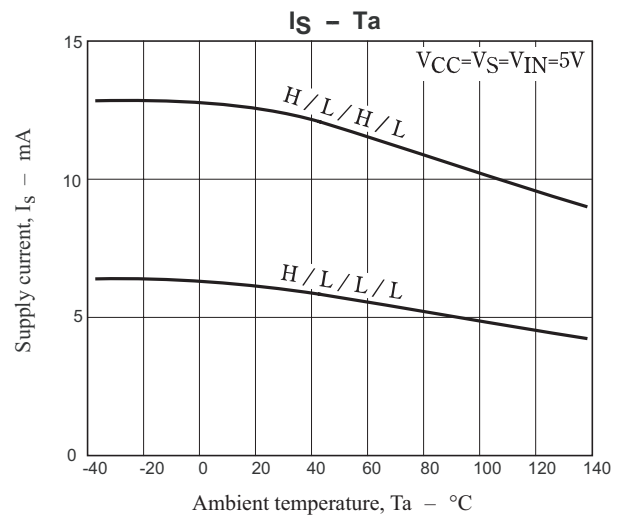
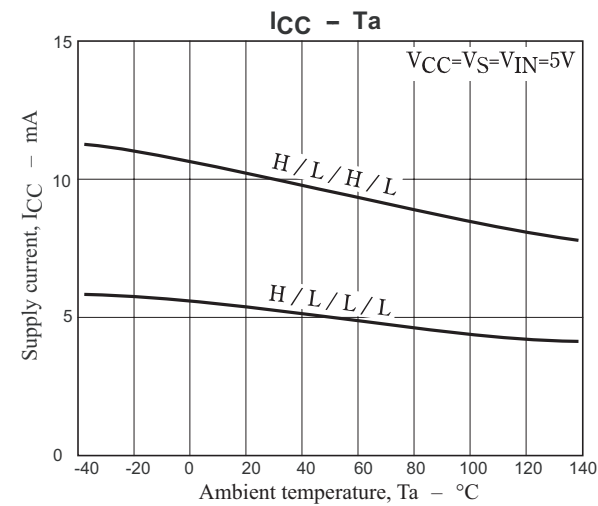
When switching from (6): (8)

When switching from (7): (8)'

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



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## ORDERING INFORMATION

Device	Package	Shipping (Qty / Packing)
LB1936V-MPB-E	SSOP16 (225mil) (Pb-Free)	90 / Fan-Fold
LB1936V-TLM-E	SSOP16 (225mil) (Pb-Free)	2000 / Tape & Reel

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