Ordering number : ENN4384A

Monolithic Digital IC

LB1841V

Low-Saturation Current-Controlled Forward/Reverse Motor Driver

Overview

The LB1841V is a low-saturation current-controlled forward/reverse motor driver with provision for a constant voltage circuit using an external transistor and an output current limiter function. Its design is optimized for use in video camera loading motors.

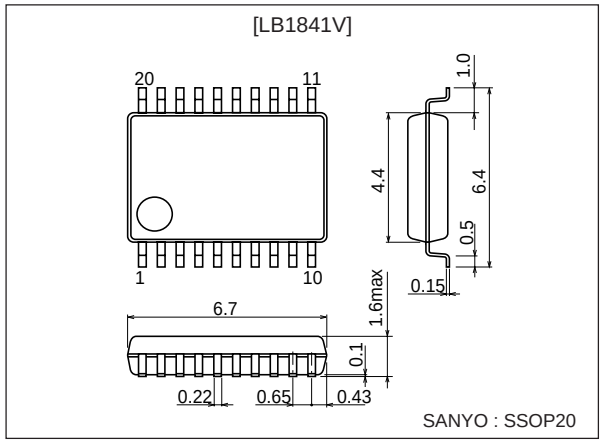
Features

- Built-in output current limiter and detector circuit
- Built-in low-saturation voltage forward/reverse bridge circuit: $V_O$sat = 0.40V typ. at 400 mA
- Little current drain in standby mode (up to 0.1 μA)
- Built-in low-saturation constant voltage circuit using an external pnp transistor
- Built-in reference voltage linked to input
- Built-in thermal shutdown circuit
- Low external parts count. Compact SSOP-20 package allows space saving design.

Package Dimensions

unit: mm

3179A-SSOP20



Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		10.5	V
Maximum output current	Im max		800	mA
Applied input voltage	V_{IN}		–0.3 to +10	V
Allowable power dissipation	Pd max	With substrate (50 × 35 × 1.6 mm³)	800	mW
Operating temperature	Topr		–20 to +80	°C
Storage temperature	Tstg		–40 to +150	°C

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Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	V_{CC}		3.0 to 9.0	V
Input High voltage	V_{IH}		3.0 to 9.0	V
Input Low voltage	V_{IL}		–0.3 to 0.7	V
SVR input voltage	V_{SVR}		1.0 to V_{CC}–0.2	V
LIR input voltage	V_{LIR}		0.5 to V_{CC}–1.0	V
Output current limiter	I_{limit}		50 to 350	mA

Electrical Characteristics at Ta = 25°C, V_{CC} = 7.2V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Power supply current	I_{CC} 0	In standby mode		0.1	10	µA
	I_{CC} 1	Forward/reverse No load		9	13	mA
	I_{CC} 2	In brake mode		12	18	mA
Output saturation voltage	Vsat 1	I_O = 200 mA (upper side + lower side)		0.20	0.30	V
	Vsat 2	I_O = 400 mA (upper side + lower side)		0.40	0.60	V
Reference voltage	Vref	I_{Vref} = 1 mA	1.85	2.0	2.15	V
Current limiter characteristics	I_{limit}	V_S-V_M resistance = 1Ω at LIR = 2V	165	185	205	mA
Input current	I_{IN}	V_{IN} = 5V		90	150	µA
PBC drive current	I_{PBC}				–10	mA
Vs output voltage	V_S			2.55×V_{SVR}		V
RD saturation voltage	V_{RD}sat	I_O = 1 mA			0.3	V

Constant-voltage output V_S is determined by the equation $V_S = 2.55 \times V_{SVR}$.

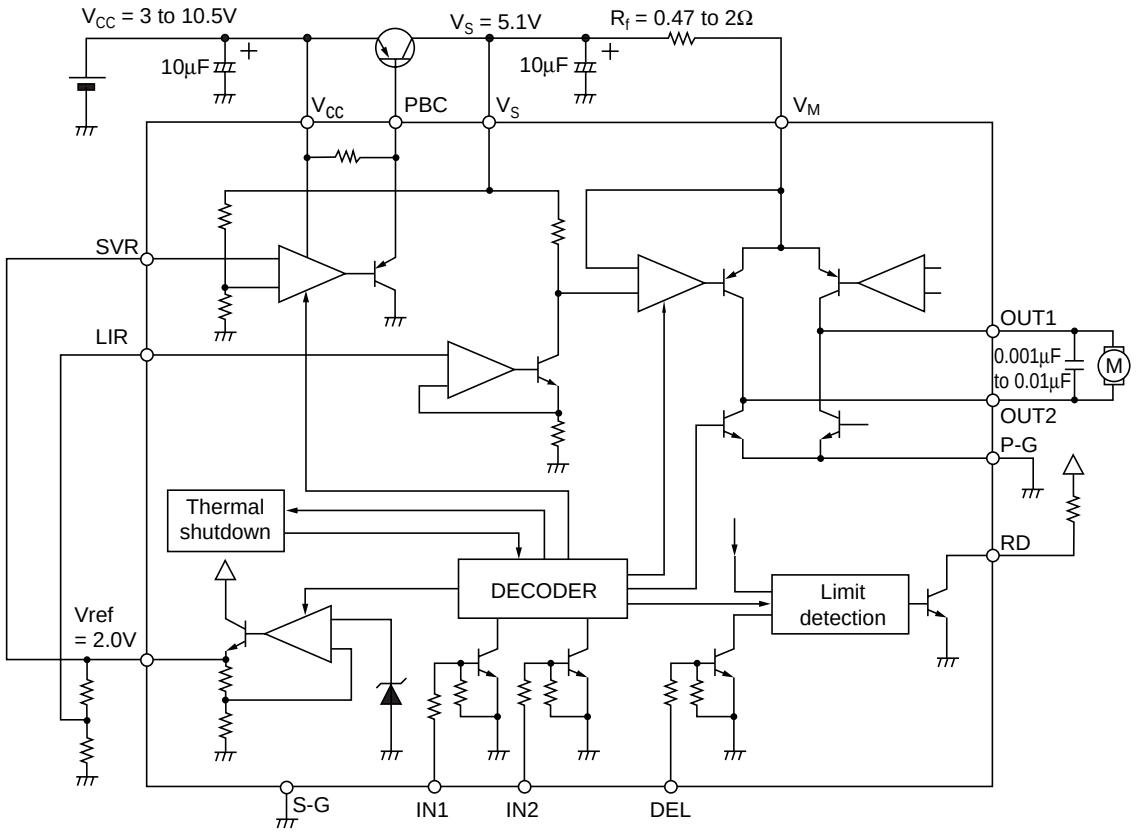
The input range of V_{SVR} is 1.0 to 4 V. When $V_S \geq V_{CC}$, the output will be saturated.

The output current limiter value is determined according to the following equation (R_f is a sensing resistor across V_S and V_M).

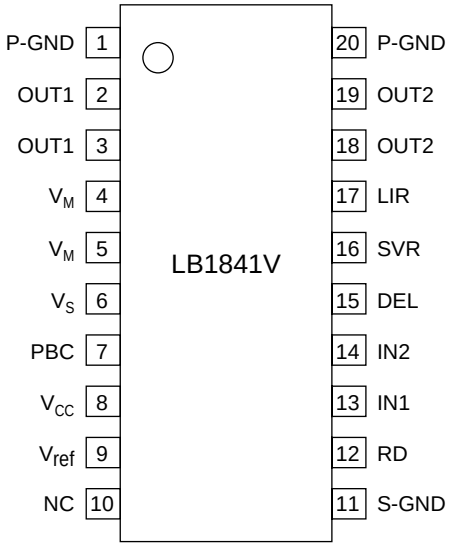
$$I\ limit = V_{LIR}/10\ R_f(A)$$

V_{LIR} input range is 0.5 to V_{CC} –1.0 (V).

Block Diagram and Sample Application Circuit



Pin Assignment



(Top view)

Note) • V_M (motor power supply/sensing pin) are both connected.
• P-GND (motor power supply GND pin) are both connected.
• S-GND (control power supply ground pin) is connected to microprocessor ground.

Truth Table

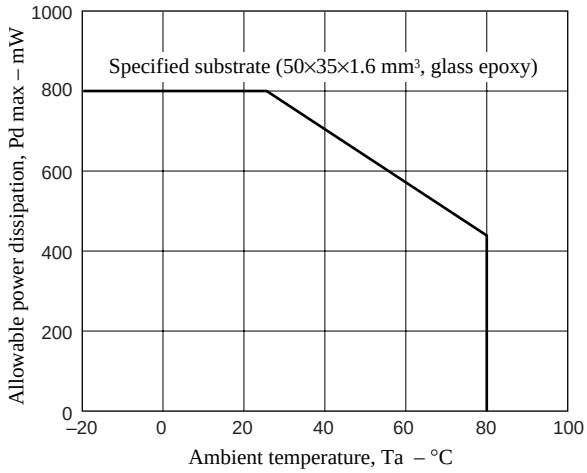
Bridge and V_S circuits

Input		Output			Mode
IN1	IN2	OUT1	OUT2	V_S	
L	L	off	off	off	Standby
H	L	H	L	H	Forward rotation
L	H	L	H	H	Reverse rotation
H	H	L	L	off	Brake

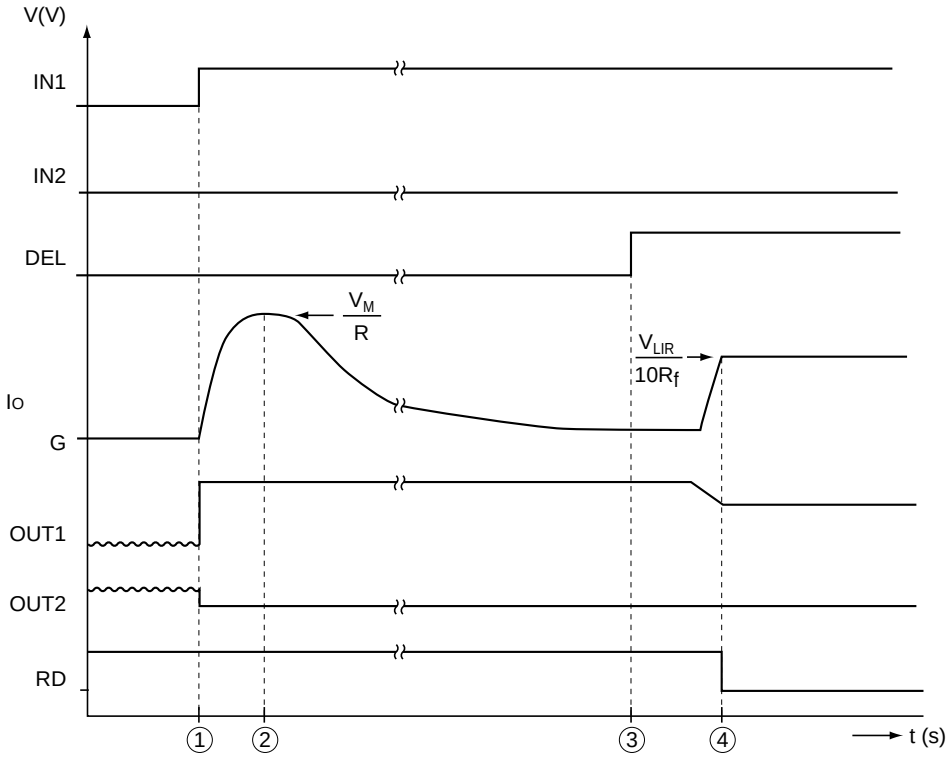
Output current limiter and detection output

DEL	OUT output	RD
H	limit	L
	Non-limit	off
L	Saturation	off

Pd max – Ta



Sample Application Timing Chart



• Sample Application timing chart

① Connect DC motor (R_L = RΩ) between OUT1 and OUT2, and input forward signal (IN1 = High, IN2 = Low) with RD pin in pull-up state.
Because output is saturated during startup, set DEL input to Low.

② DC motor starts and startup current ($I_{ST} = V_M/R$) flows through motor.

③ DC motor rotates in normal condition. At this point, set DEL input to High.

④ When DC motor locks up, motor current I_M increases. When it reaches I_{limit} ($=V_{LIR}/(10\ R_f)$), output current limiting circuit operates. At the same time, the set current detection circuit sets RD output to Low.

• Reference voltage Vref

The Vref output is linked to the input. When IN1 or IN2 is High, the reference voltage is output.

• Output current limiter circuitry

The circuit configuration is as shown in the separate diagram.

The output set current is determined by the reference voltage V_{LIR} applied to the LIR pin. When V_{LIR} is applied, 1/10 of the voltage occurs across R_S in the diagram. This voltage is input to the + side of the voltage setting amplifier.

The motor current I_M generates a voltage ($I_M \times R_f$) across the external resistor R_f. This voltage is input to the – side of the amplifier. The differential amplifier operates so as to make the two inputs equal, then the output transistor is driven.

The set current is determined by the following equation:

$$I_{limit} = V_{LIR}/(10R_f)\ [A]$$

• Set current detection circuit

(1) When DEL = High

When the motor current I_M is below the set current I_{limit}, the input voltage ($I_M \times R_f$) at the – side of the current setting amplifier is smaller than the input voltage at the + side (larger vs. ground). The drive current therefore increases and the output pnp transistor saturates. When this condition is detected, a signal is sent to the set current detection circuit and the RD output becomes High.

When the motor current I_M reaches the set current I_{limit}, the output pnp transistor is in the controlled state and the RD output becomes Low.

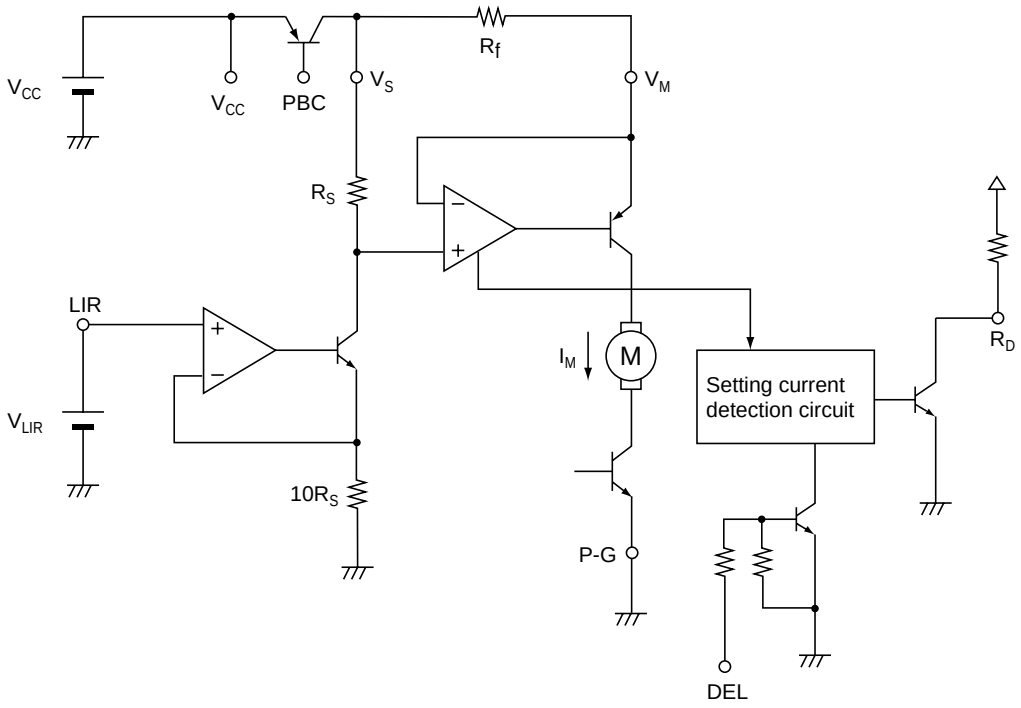
(2) When DEL = Low

When a Low signal is input to the DEL pin, operation of the current setting amplifier is canceled. Therefore as described above, the output transistor saturates and the RD output becomes High.

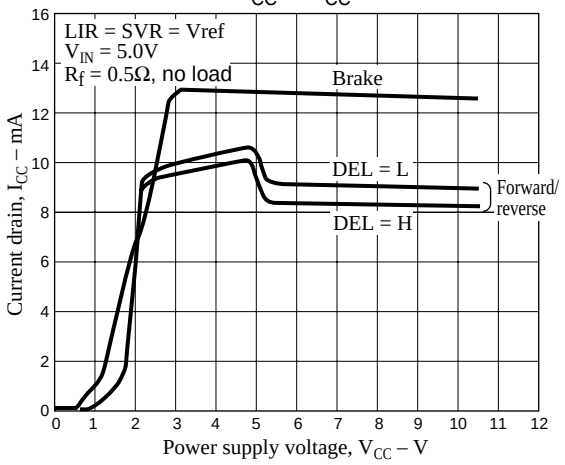
The above conditions are shown in the table below.

DEL	OUT	RD
H	limit	L
	Non-limit (saturation)	H
L	Saturation	H

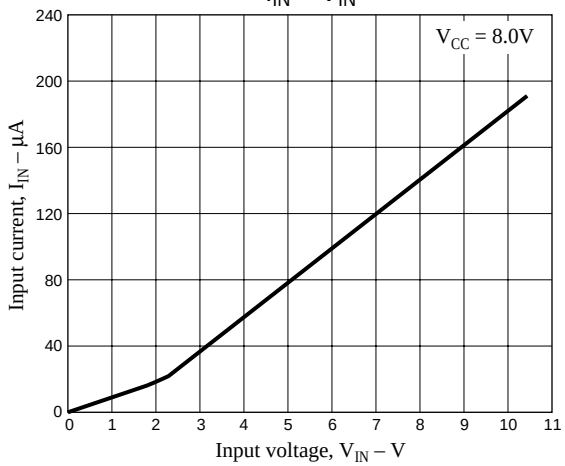
Output Current Limiter and Setting Current Detection Circuits Block Diagram



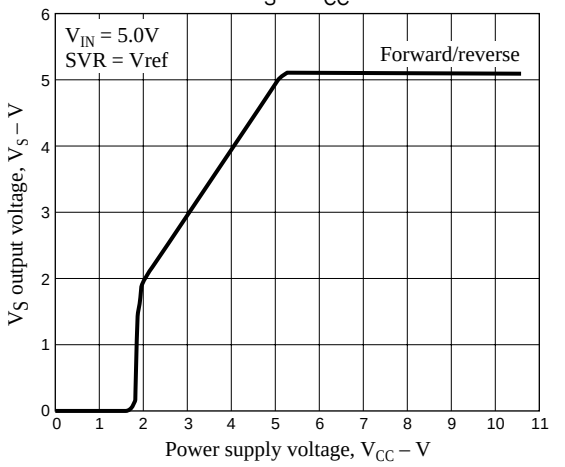
$I_{CC} - V_{CC}$



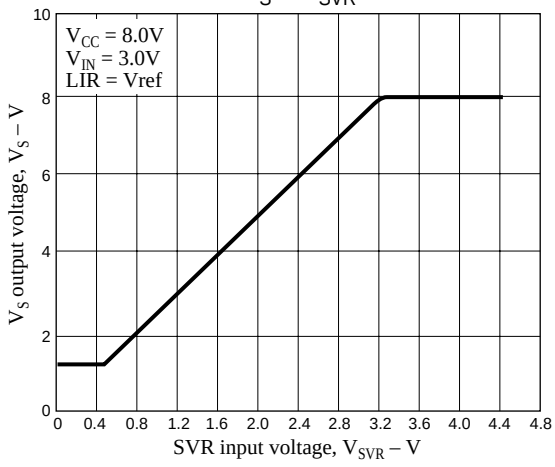
$I_{IN} - V_{IN}$



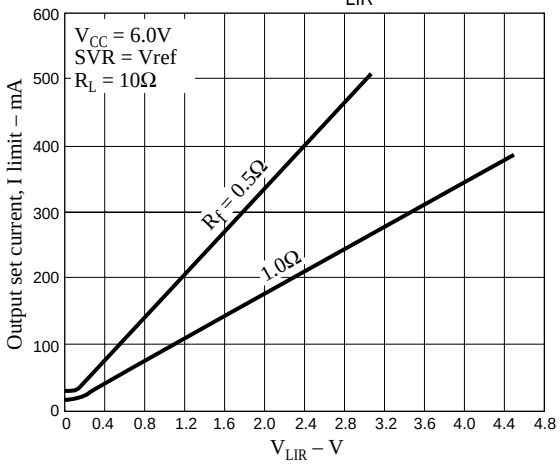
$V_S - V_{CC}$



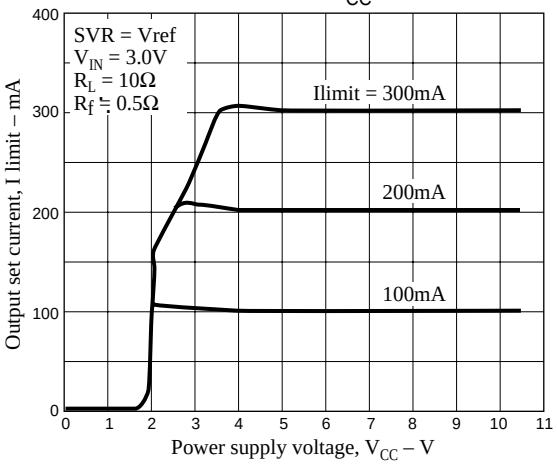
$V_S - V_{SVR}$



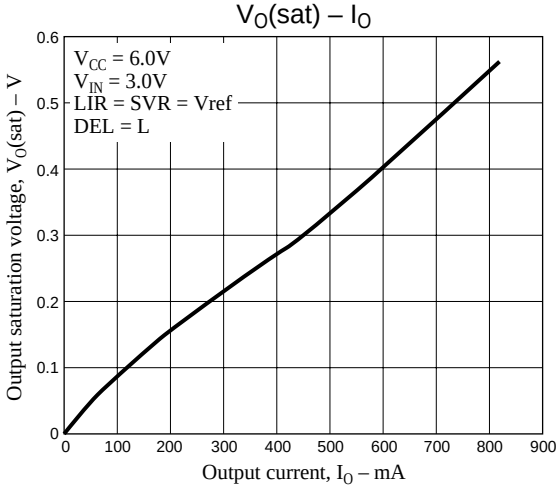
I limit – V_{LIR}



I limit – V_{CC}



$V_O(sat) - I_O$



$V_O(sat) - Ta$