Ordering number: EN 4385B

Monolithic Digital IC

LB1843V

Low-saturation, current-controlled bidirectional motor driver

An ON Semiconductor Company

Overview

The LB1843V is a low-saturation bidirectional motor driver with output current limitation and detection functions. This design is ideal for controlling the loading motor in a video camera.

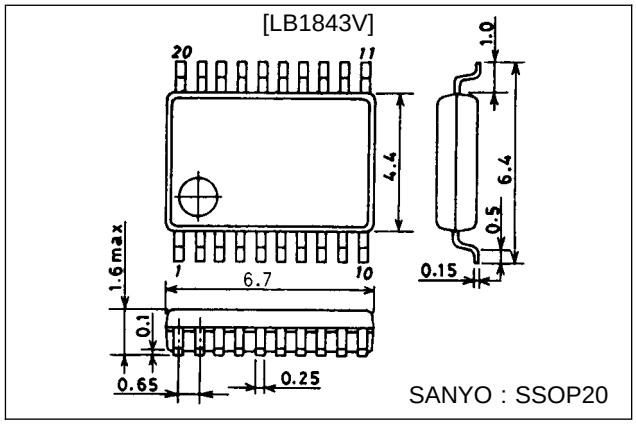
Features

- Output current limiter and detector built in
- Low-saturation voltage bidirectional bridge circuit built in: $V_O$sat = 0.40 V typ. at 400 mA
- Practically no current drain (0.1 µA or less) in standby mode
- Input-linked reference voltage built in
- Thermal shutdown circuit built in
- Requires little space, since few external components are needed and the IC is contained in a small SSOP-20 package

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 board (50 × 35 × 1.6 mm^3)	800	mW
Operating temperature	Topr		–20 to +80	°C
Storage temperature	Tstg		–40 to +150	°C

Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		3.0 to 9.0	V
V_M voltage	V_M		2.2 to V_{CC}	V
High-level input voltage	V_{IH}		3.0 to 9.0	V
Low-level input voltage	V_{IL}		–0.3 to +0.7	V
LIR input voltage	V_{LIR}		0.5 to V_{CC}–1.0	V
Output current limitation	I_{limit}		50 to 350	mA

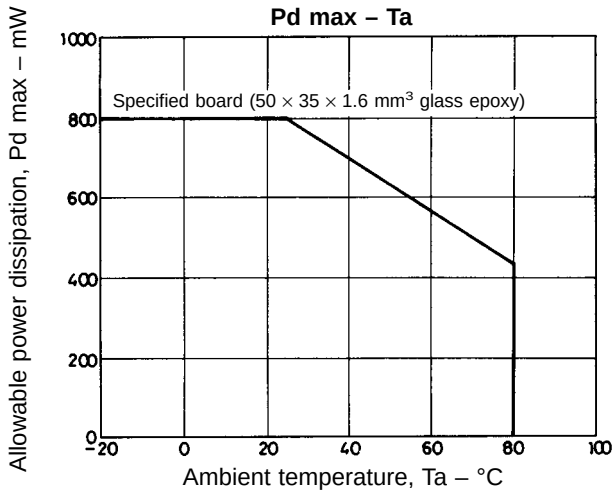
Electrical Characteristics at Ta = 25°C, V_{CC} = 7.2 V

Parameter	Symbol	Conditions	min	typ	max	Unit
Supply current	$I_{CC}0$	During standby		0.1	10	μA
	$I_{CC}1$	During bidirectional operation, no load		9	13	mA
	$I_{CC}2$	During braking		12	18	mA
Output saturation voltage	Vsat1	I_O = 200 mA (upper side + lower side)		0.20	0.30	V
	Vsat2	I_O = 400 mA (upper side + lower side)		0.40	0.60	V
Reference voltage	Vref	$I_V$ref = 1 mA	1.85	2.0	2.15	V
Set output current	I_{limit}	Resistance between V_{CC} and V_M = 1 Ω, when LIR = 2 V	165	185	205	mA
Input current	I_{IN}	V_{IN} = 5 V		90	150	μA
RD saturation voltage	V_{RD}sat	I_O = 1 mA			0.3	V

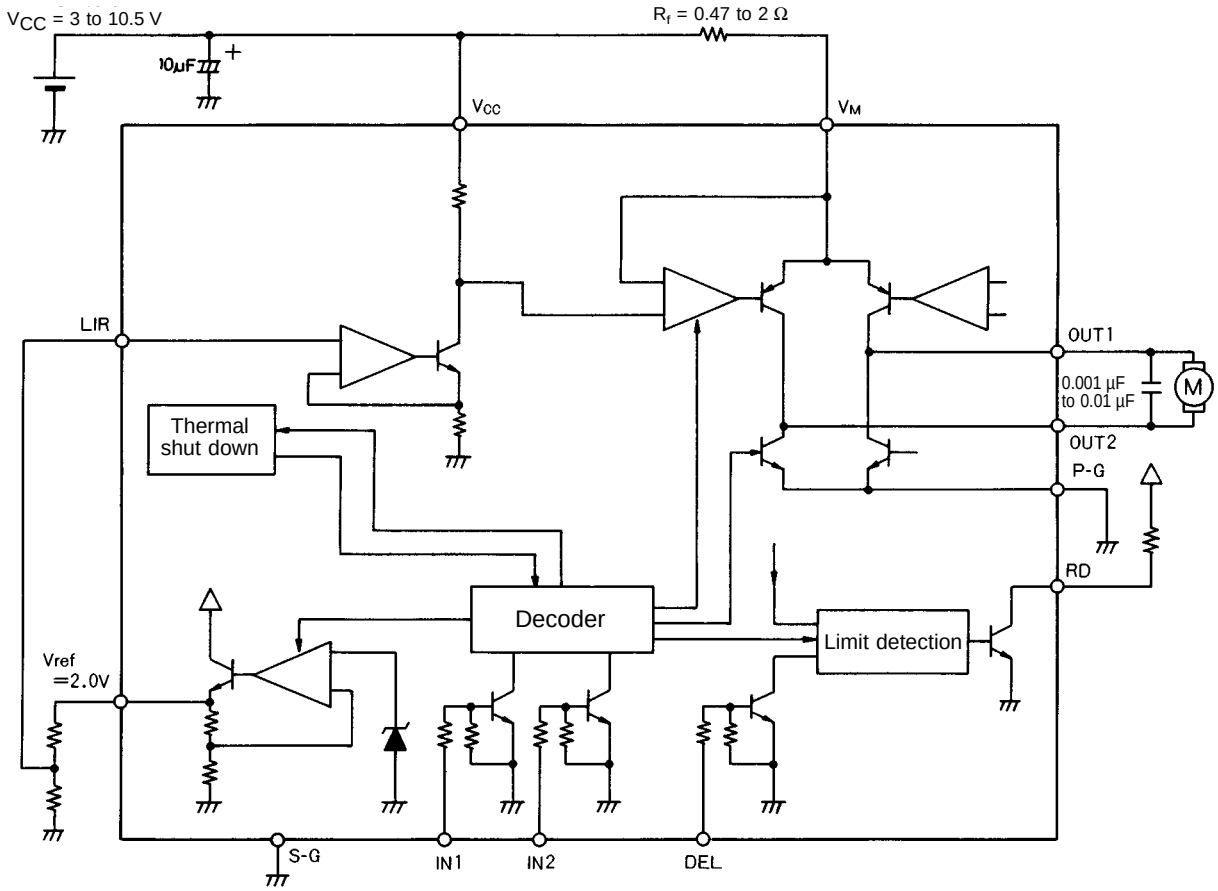
Output current limit is determined by the following equation (R_f is the sensing resistance between V_{CC} and V_M):

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

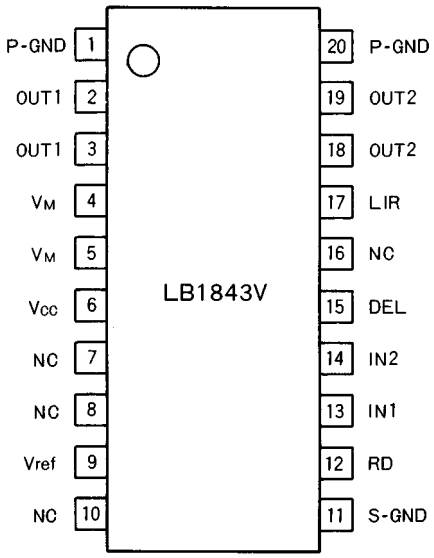
The input range for V_{LIR} is 0.5 to V_{CC}–1.0 (V)



Block Diagram and Sample Application Ciruit



Pin Assignment



Top view

Notes:
- Connect both V_M pins (motor power supply/sensing pins).
- Connect both P-GND pins (motor power supply GND pins).
- Connect S-GND (control power supply GND pin) to the microcontroller's GND.

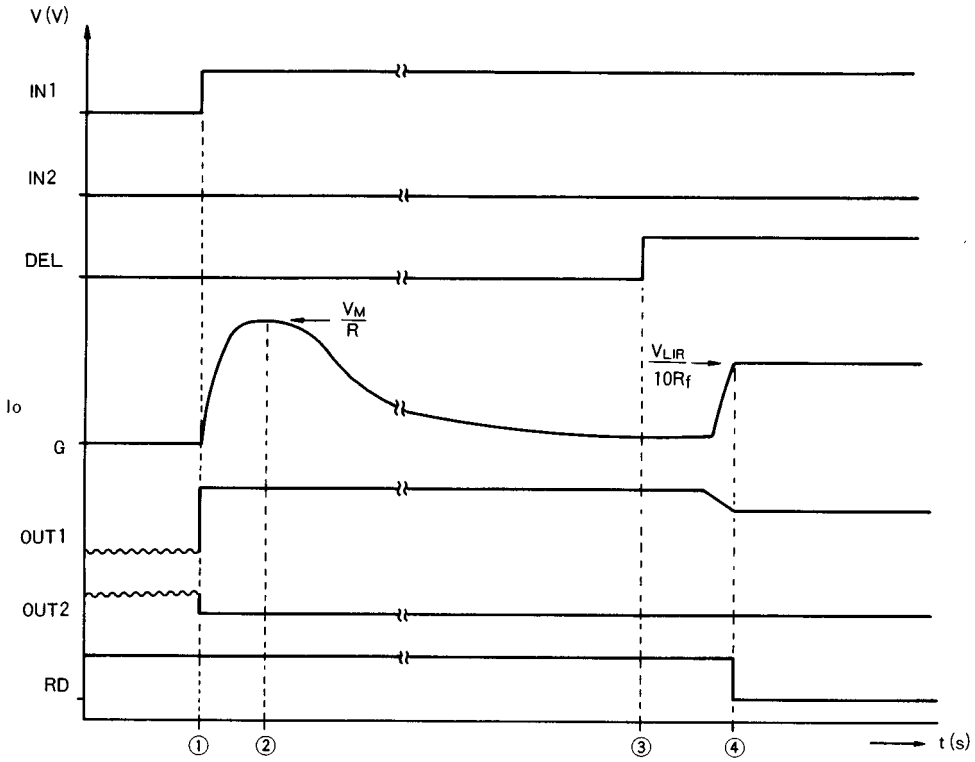
Truth Table

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

Output Current Limitation and Detector Output

DEL	OUT output	RD
H	Limit	L
	Non-limit	Off
L	Saturated	Off

Sample Application Timing Chart



Sample application timing chart

① Connect a DC motor (R_L = RΩ) between OUT1 and OUT2, and with the RD pin pulled up, input a forward rotation signal (IN1 = high, IN2 = low).
Because the output is used in the saturated state at startup, set the DEL input to low.

② The DC motor starts up, and the startup current ($I_{ST} = V_M/R$) flows to the motor.

③ The DC motor rotates in the normal state. At this point, set the DEL input to high.

④ If the DC motor locks, the motor current I_M increases to the point of I_{limit} (= $V_{LIR}/(10R_f)$), the output current limiter operates to limit the output current. At the same time, RD is output low from the set current detection circuit.

Reference voltage (Vref)

The Vref output is linked to the input; if either IN1 or IN2 is high, the reference voltage is output.

Output current limiter

The schematic for the output current limiter is shown below.
The output set current is set according to the reference voltage V_{LIR} applied to the LIR pin. When V_{LIR} is applied, 1/10 of that voltage is generated at both ends of R_S in the diagram; this voltage is input on the positive (+) side of the current setting amplifier.
The motor current I_M generates voltage equal to ($I_M \times R_f$) at both ends of the external resistor R_f. This voltage is input to the negative (–) side of the same amplifier, and the differential amplifier functions and the output transistors are driven so that these inputs become equal.
The set current value in this instance is determined by the following equation:

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

Set current detector

(1) When DEL = high
If the motor current I_M has not reached the set current I_{limit}, the input voltage on the negative (–) side of the amplifier is greater than the input voltage on the positive (+) side. As a result, the drive current increases and the output PNP transistors reach the saturation state. If this state is detected, the detection signal is sent to the set current detector, and the RD output goes high.
If the motor current I_M reaches the set current I_{limit}, the output PNP transistor enters the controlled state, and the RD output goes low.

(2) When DEL = low
Because the operation of the current setting amplifier is cancelled when a low signal is input to the DEL pin, the output PNP transistors reach the saturation state and the RD output goes high, just as in the case described above.
The following table summarizes the states described above.

DEL	OUT	RD
H	limit	L
	Non-limit (saturated)	H
L	Saturated	H

Output Current Limiter and Set Current Detector Block Diagram