



## 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.

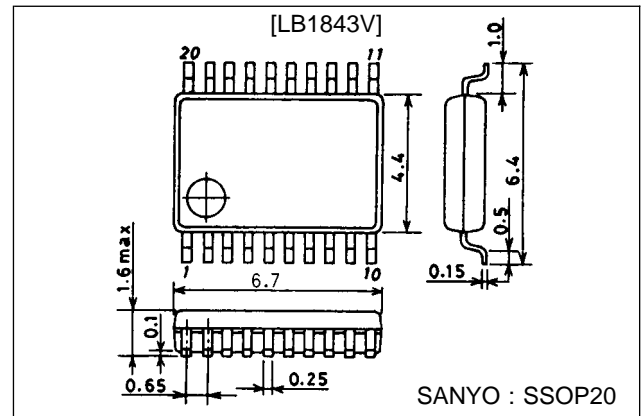
## Features

- Output current limiter and detector built in
- Low-saturation voltage bidirectional bridge circuit built in:  $V_{O\text{sat}} = 0.40 \text{ V typ. at } 400 \text{ mA}$
- Practically no current drain ( $0.1 \mu\text{A}$  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 $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC \text{ max}}$		10.5	V
Maximum output current	$I_m \text{ max}$		800	mA
Applied input voltage	$V_{IN}$		-0.3 to +10	V
Allowable power dissipation	$P_d \text{ max}$	With board ( $50 \times 35 \times 1.6 \text{ mm}^3$ )	800	mW
Operating temperature	$T_{opr}$		-20 to +80	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +150	$^\circ\text{C}$

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

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

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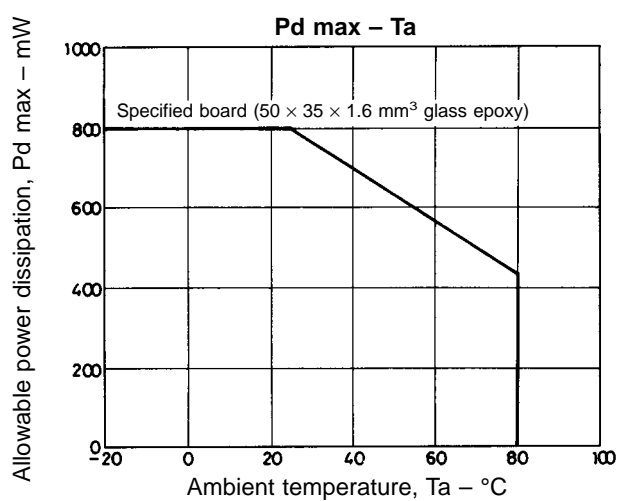
### Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 7.2\text{ V}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Supply current	$I_{CC0}$	During standby		0.1	10	$\mu\text{A}$
	$I_{CC1}$	During bidirectional operation, no load		9	13	$\text{mA}$
	$I_{CC2}$	During braking		12	18	$\text{mA}$
Output saturation voltage	$V_{sat1}$	$I_O = 200\text{ mA}$ (upper side + lower side)		0.20	0.30	$\text{V}$
	$V_{sat2}$	$I_O = 400\text{ mA}$ (upper side + lower side)		0.40	0.60	$\text{V}$
Reference voltage	$V_{ref}$	$I_{Vref} = 1\text{ mA}$	1.85	2.0	2.15	$\text{V}$
Set output current	$I_{limit}$	Resistance between $V_{CC}$ and $V_M = 1\ \Omega$ , when LIR = 2 V	165	185	205	$\text{mA}$
Input current	$I_{IN}$	$V_{IN} = 5\text{ V}$		90	150	$\mu\text{A}$
RD saturation voltage	$V_{RDSat}$	$I_O = 1\text{ mA}$			0.3	$\text{V}$

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

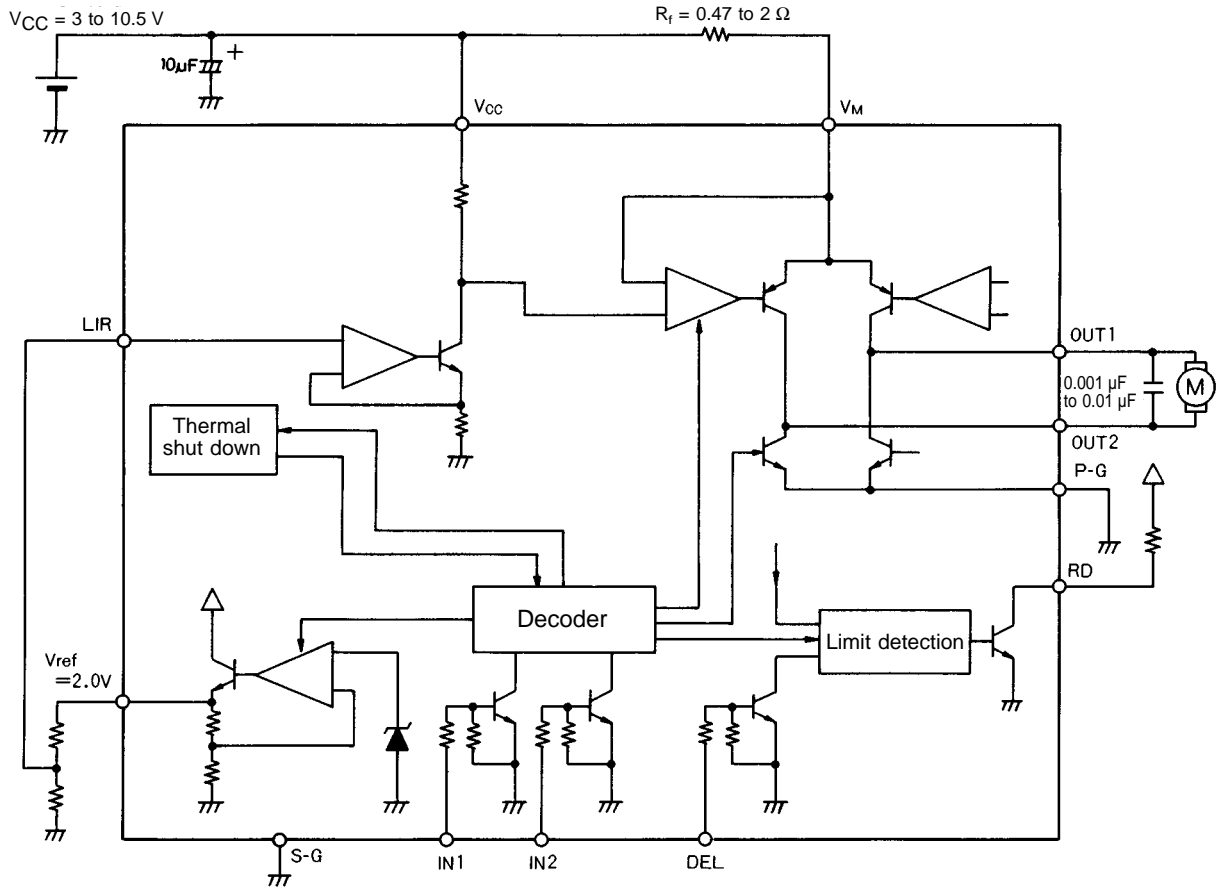
$$I_{limit} = V_{LIR}/10R_f \text{ (A)}$$

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

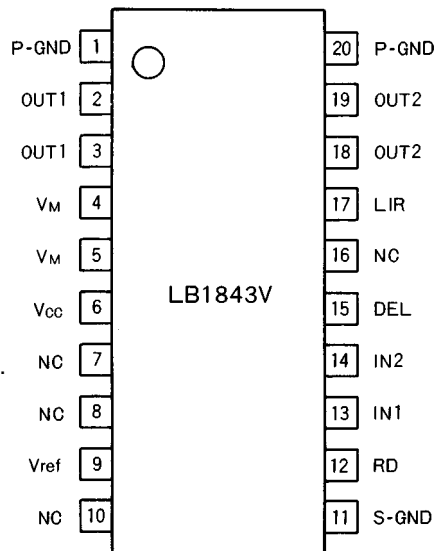


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## Block Diagram and Sample Application Circuit



## Pin Assignment



- Notes:
- Connect both VM 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.

Top view

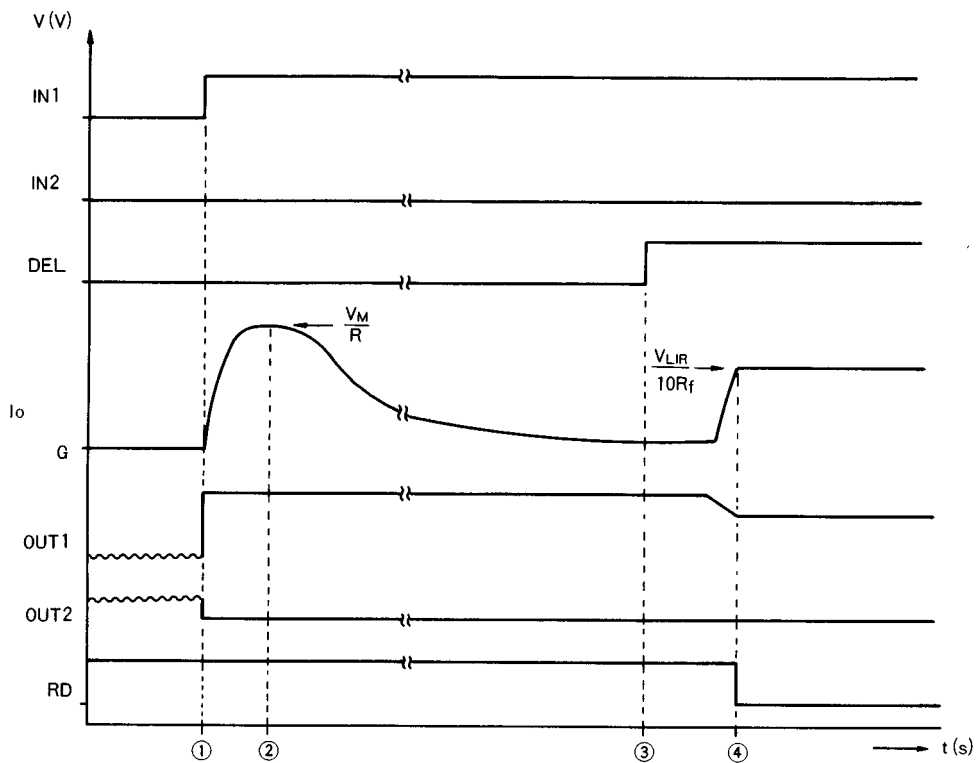
**Truth Table**

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 ( $R_L = R\Omega$ ) 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:

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

**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.

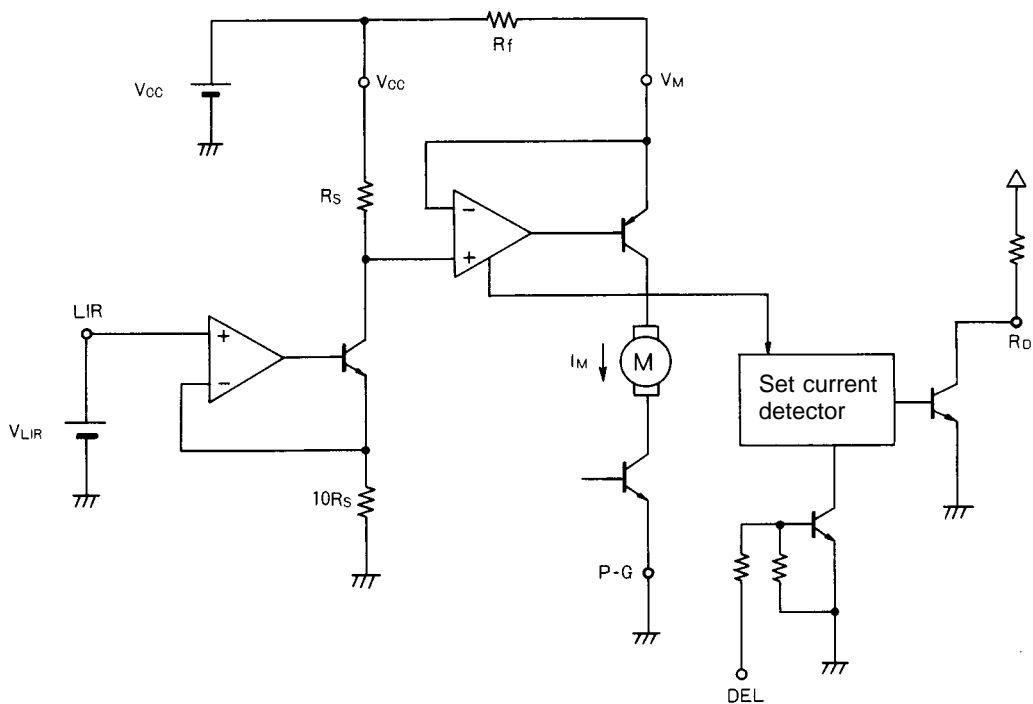
(2) When DEL = low

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.

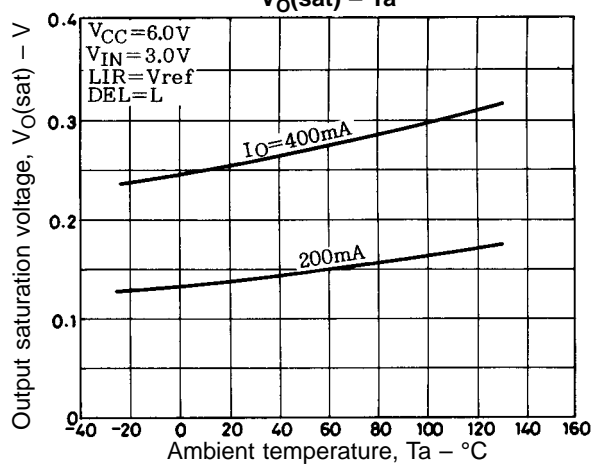
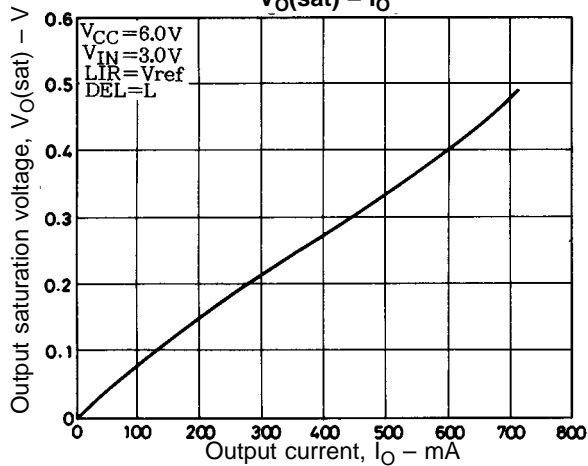
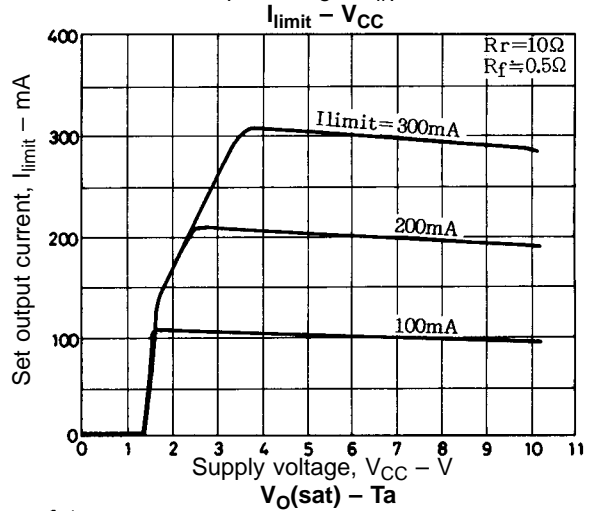
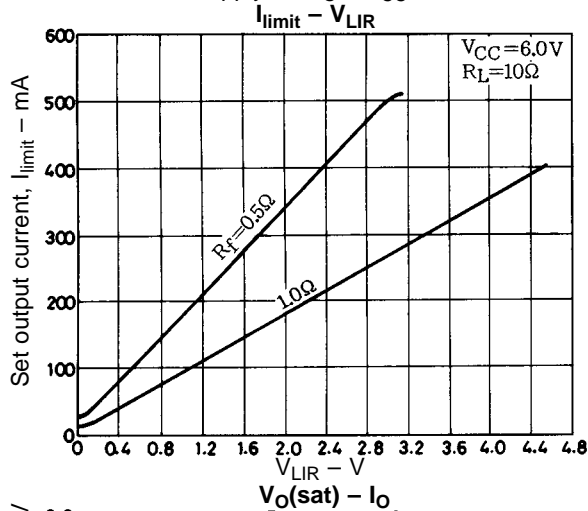
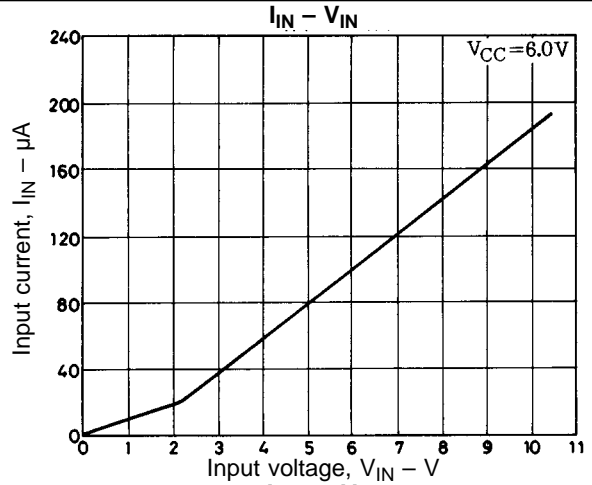
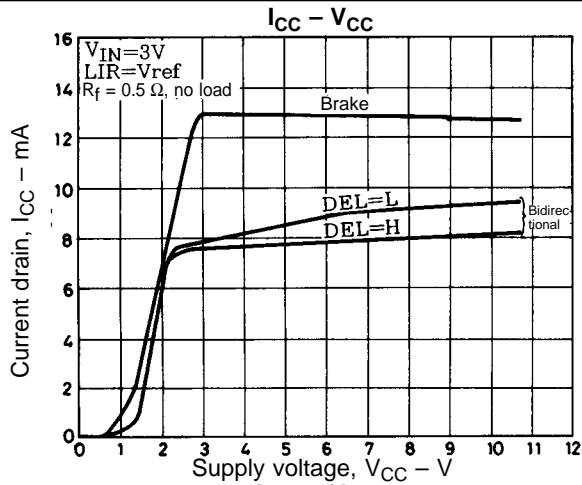
The following table summarizes the states described above.

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

**Output Current Limiter and Set Current Detector Block Diagram**



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