# **LV8548MC**

## **Monolithic Linear IC**

# 12V Low Saturation Voltage Drive Forward/Reverse Motor Driver

# ON Semiconductor®

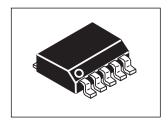
http://onsemi.com

## Overview

The LV8548MC is a 2-channel low saturation voltage forward/reverse motor driver IC. It is optimal for motor drive in 12V system products and can drive either two DC motors, one DC motor using parallel connection, or it can drive a stepper motor in Full-step and Half-step.

# **Function**

- DMOS output transistor adoption (Upper and lower total RON= $1\Omega$  typ)
- For one power supply (The control system power supply is unnecessary.)
- Our motor driver IC, LB1948MC, and compatible pin
- It is possible to connect it in parallel (parallel, connected operation of drive ch).
- The compact package (SOIC10) is adopted.
- V<sub>CC</sub> max=20v, I<sub>O</sub> max=1A
- Current consumption 0 when standing by
- Built-in brake function



SOIC10

# **Specifications**

# **Absolute Maximum Ratings** at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum power supply voltage	V <sub>CC</sub> max	VCC	-0.3 to +20	V
Output impression voltage	VOUT	OUT1 , OUT2 , OUT3 , OUT4	-0.3 to +20	V
Input impression voltage	VIN	IN1 , IN2 , IN3 , IN4	-0.3 to +6	V
GND pin outflow current	IGND	Per ch	1.0	Α
Allowable Power dissipation	Pd max	*	1.0	W
Operating temperature	Topr		-30 to +85	°C
Storage temperature	Tstg		-40 to +150	°C

<sup>\*:</sup> When mounted on the specified printed circuit board (57.0mm × 57.0mm × 1.6mm), glass epoxy, both sides

Caution 1) Absolute maximum ratings represent the value which cannot be exceeded for any length of time.

Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details.

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.

### **Recommendation Operating Conditions** at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	VCC	VCC	4.0 to 16	٧
Input "H" level voltage	V <sub>IN</sub> H	INIA INIO INIO INIA	+1.8 to +5.5	V
Input "L" level voltage	V <sub>IN</sub> L	IN1 , IN2 , IN3 , IN4	-0.3 to +0.7	V

### **ORDERING INFORMATION**

See detailed ordering and shipping information on page 11 of this data sheet.

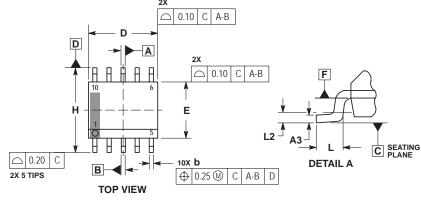
# **Electrical Characteristics** at Ta = 25°C, $V_{CC} = 12$ V

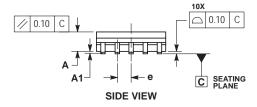
Develope	Courselle ad	Conditions	Ratings			l lait	
Parameter	Symbol	Conditions	min	typ	max	Unit	
Power supply voltage	I <sub>CC</sub> 0	Standby mode IN1=IN2=IN3=IN4="LOW"			1	μΑ	
	I <sub>CC</sub> 1	It is "High" from IN1 as for either of IN4. Load opening		1.7	2.3	mA	
Input current					65	μΑ	
Thermal shutdown operating temperature			150	180	210	°C	
Width of temperature hysteria	ΔTtsd	d Design certification		40		°C	
Low voltage protection function operation voltage	n function VthV <sub>CC</sub>		3.3	3.5	3.65	V	
Release voltage	Vthret		3.55	3.8	3.95	V	
Output ON resistance RON IOUT (Upper and lower total)		I <sub>OUT</sub> =1.0A	0.7	1	1.25	Ω	
Output leak current	l <sub>O</sub> leak	V <sub>O</sub> =16V			10	μΑ	
Diode forward voltage	VD	ID=1.0A		1.0	1.2	V	

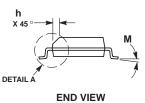
# **Package Dimensions**



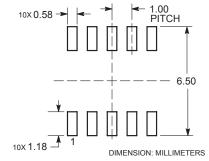
CASE 751BQ-01 ISSUE A







### RECOMMENDED SOLDERING FOOTPRINT\*



<sup>\*</sup>For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

- NOTES:

  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

  2. CONTROLLING DIMENSION: MILLIMETERS.

  3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.10mm TOTAL IN EXCESS OF 'b' AT MAXIMUM MATERIAL CONDITION.

  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15mm PER SIDE. DIMENSIONS D AND E ARE DETERMINED AT DATUM F.

  5. DIMENSIONS A AND B ARE TO BE DETERMINED AT DATUM F.

  6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

	MILLIMETERS				
DIM	MIN	MAX			
Α	1.25	1.75			
A1	0.10	0.25			
A3	0.17	0.25			
b	0.31	0.51			
D	4.80	5.00			
E	3.80	4.00			
е	1.00 BSC				
Н	5.80	6.20			
h	0.37 REF				
L	0.40	1.27			
L2	0.25 BSC				
M	0° 8'				

### **GENERIC MARKING DIAGRAM\***



XXXXX = Specific Device Code

= Assembly Location Α

= Wafer Lot L

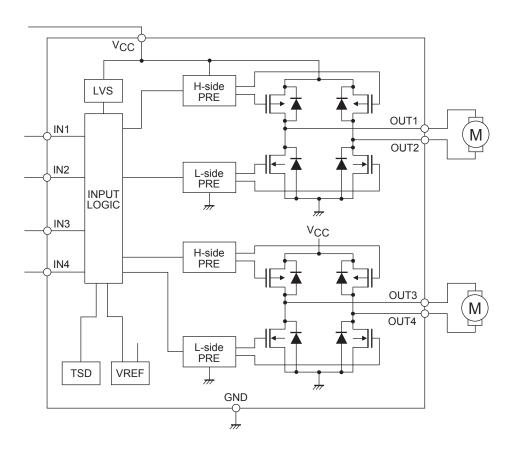
= Year W = Work Week

= Pb-Free Package

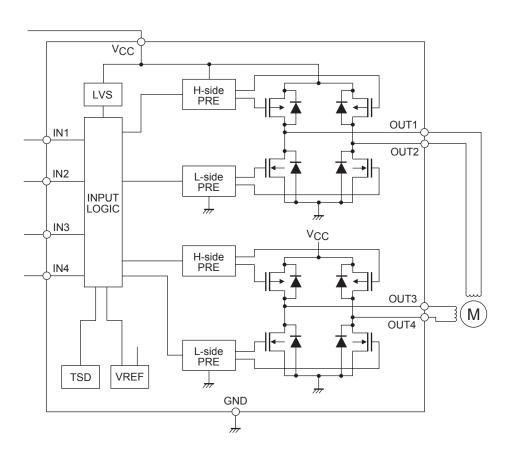
<sup>\*</sup>This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G", may or not be present.

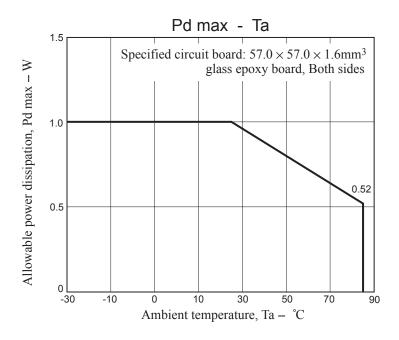
# **Block Diagram**

# 1. At two DC motor drive

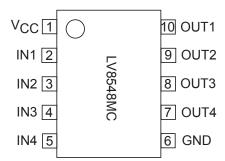


# 2. At one stepper motor drive





# **Pin Assignment**



# Pin function

Pin No.	Pin name	Pin function	Equivalent Circuit
1	Vcc	Power-supply voltage pin.  V <sub>CC</sub> voltage is impressed. The permissible operation voltage is from 4.0 to 16.0(V). The capacitor is connected for stabilization for GND pin (6pin).	
2	IN1	Motor drive control input pin.  Driving control input pin of OUT1 (10pin) and OUT2 (9pin). It combines with IN2 pin (3pin) and it fights desperately. The digital input it, range of the "L" level input is 0 to 0.7(V), range of the "H" level input is from 1.8 to 5.5(V). PWM can be input. Pull-down resistance 100(kΩ) is built into in the pin. It becomes a standby mode because all IN1, IN2, IN3, and IN4 pins are made "L", and the circuit current can be adjusted to 0.	
3	IN2	Motor drive control input pin.  Driving control input pin of OUT1 (10pin) and OUT2 (9pin). It combines with IN1 pin (2pin) and it uses it. PWM can be input. With built-in pull-down resistance.	1kΩ 40kΩ W 100kΩ
4	IN3	Motor drive control input pin.  Driving control input pin of OUT3 (8pin) and OUT4 (7pin). It combines with IN4 pin (5pin) and it uses it. PWM can be input. With built-in pull-down resistance.	<i>III</i>
5	IN4	Motor drive control input pin.  Driving control input pin of OUT3 (8pin) and OUT4 (7pin). It combines with IN3 pin (4pin) and it uses it. PWM can be input. With built-in pull-down resistance.	
6	GND	Ground pin.	
7	OUT4	Driving output pin. The motor coil is connected between terminal OUT3 (8pin).	Vçc
8	OUT3	Driving output pin. The motor coil is connected between terminal OUT4 (7pin).	OUT1 OUT2
9	OUT2	Driving output pin. The motor coil is connected between terminal OUT1 (10pin).	OUT1 (OUT3) OUT2 (OUT4)
10	OUT1	Driving output pin. The motor coil is connected between terminal OUT2 (9pin).	<u>""</u>

# **Operation explanation**

# 1. DCM output control logic

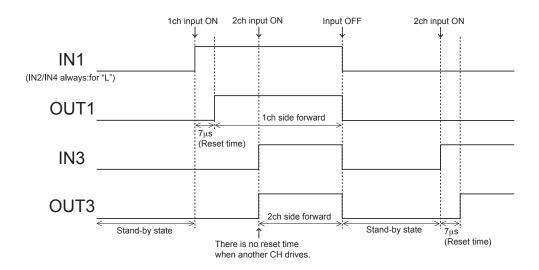
Input		Output			Remarks				
IN1	IN2	IN3	IN4	OUT1	OUT2	OUT3	OUT4	Remarks	
L	L	L	L	OFF	OFF	OFF	OFF	Stand-by	
L	L			OFF	OFF				Stand-by
Н	L			Н	L			1CH	Forward
L	Н			L	Н			ЮП	Reverse
Н	Н			L	L			Brake	
		L	L			OFF	OFF		Stand-by
		Н	L			Н	L	2CH	Forward
		L	Н			L	Н	2011	Reverse
		Н	Н			L	L		Brake

# **LV8548MC**

# 2. About the switch time from the stand-by state to the state of operation

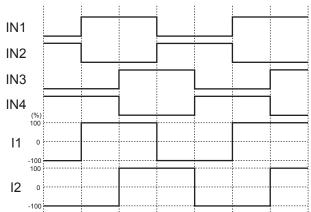
When IN1, IN2, IN3, IN4 are "L", this IC has completely stopped operating. After the time of reset of about 7µs of an internal setting, it shifts to a prescribed output status corresponding to the state of the input when the signal enters the input terminal.

Reset of about 7µs doesn't hang even if the motor is driven from the stand-by state when either CH drives and the output becomes an output status corresponding to the state of the input. As for full power TR between the reset time, turning off is maintained.

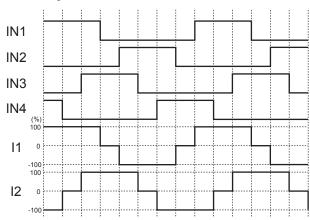


3. Example of current wave type in each excitation mode when stepper motor parallel input is controlled.

• Full-step mode



• Half-step mode



### 4. Thermal shutdown function

The thermal shutdown circuit is incorporated and the output is turned off when junction temperature Tj exceeds 180°C. As the temperature falls by hysteresis, the output turned on again (automatic restoration).

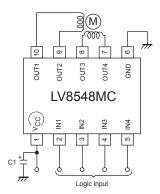
The thermal shutdown circuit does not guarantee the protection of the final product because it operates when the temperature exceed the junction temperature of Tjmax=150°C.

$$TSD = 180^{\circ}C \text{ (typ)}$$

$$\Delta$$
TSD = 40°C (typ)

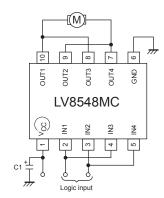
# **Application Circuit Example**

- 1. Example of applied circuit when two DC motor driving
- 2. Example of applied circuit when one stepper motor driving



3. Example of applied circuit when connecting it in parallel

The use likened to H bridge 1ch is shown possible in the figure below by connecting IN1 with IN3, IN2 with IN4, OUT1 with OUT3, OUT2, and OUT4. (IO max=2.0A, Upper and lower total  $R_{ON}$ =0.5 $\Omega$ )



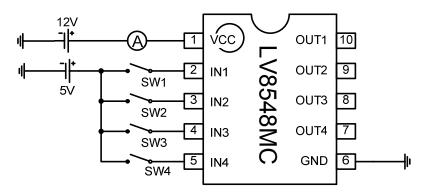
\* Bypass capacitor (C1) connected between  $V_{CC}$ -GND of all examples of applied circuit recommends the electric field capacitor of  $0.1\mu A$  to  $10\mu A$ .

Confirm there is no problem in operation in the state of the motor load including the temperature property about the value of the capacitor.

Mount the position where the capacitor is mounted on nearest IC.

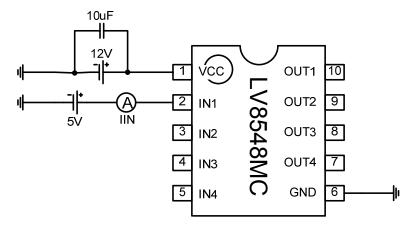
# Measurement connection diagram

(1) Current consumption when standing by ICC0 Current consumption ICC1



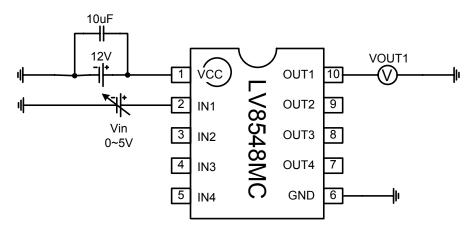
 $\label{eq:continuous} \begin{aligned} &\text{Measure I}_{CC}0 \text{ with all SW OFF.} \\ &\text{Measure I}_{CC}1 \text{ with any of the SW1-4 ON.} \end{aligned}$ 

# (2) Input current I<sub>IN</sub>



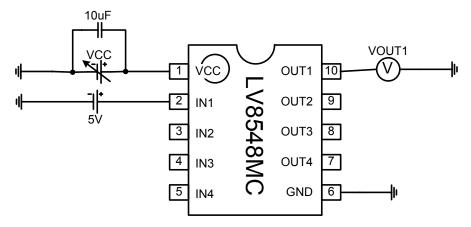
This is about the measurement of IN1 pin. Measure the other IN2-4 pins as is this case.

# (3) Input "H" level voltage VINH



Measure the Vin value at the time VOUT1 changes to "H" while varying Vin 0-5V. This is about the measurement of IN1 pin. Measure the other IN2-4 pins as is this case.

# (4) Low voltage protection function operation voltage VthV<sub>CC</sub> / Release voltage Vthret

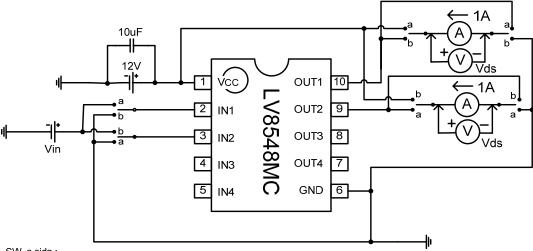


Low voltage protection function Operation voltage : VCC=12V to 0V Release voltage : VCC=0V to 12V

To measure the operating voltage of the reduced voltage protection, measure the VCC value at the time VOUT1 becomes "L" while varying VCC from 12V to 0V.

To measure the release voltage of the reduced voltage protection, measure the VCC value at the time VOUT1 becomes "H" while varying VCC from 0V to 12V.

# (5) Output ON resistance Ron



SW\_a side :

OUT1 Upper-side/OUT2 Lower-side OUT3 Upper-side/OUT4 Lower-side

SW\_b side :

OUT1 Lower-side/OUT2 Upper-side OUT3 Lower-side/OUT4 Upper-side

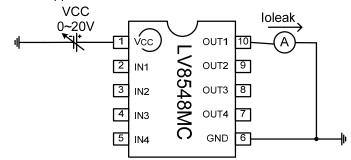
Measure OUT1 upper side and OUT2 lower side FET with the SW set to "a".

Measure OUT1 lower side and OUT2 upper side FET with the SW set to "b".

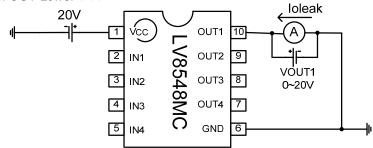
Measure OUT3 and OUT4 as are the cases of OUT1 and OUT2.

# (6) Output leak current Ioleak

# <Each OUT Upper-side>



# <Each OUT Lower-side>

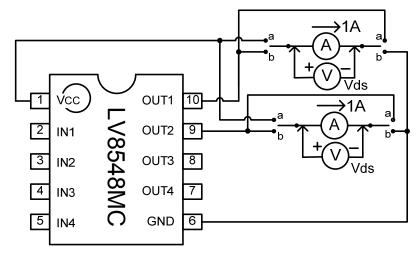


To measure the upper FET output leak current, set the OUT to 0V and measure the OUT current while varying VCC from 0 to 20V.

To measure the lower FET output leak current, set the VCC to 20V and measure the OUT current while varying OUT from 0 to 20V.

This is about the measurement of OUT1 pin. Measure the other OUT2-4 pins as is this case.

# (7) Diode forward voltage VD



SW\_a side : Each OUT Upper-side SW\_b side : Each OUT Lower-side

Measure OUT1 and OUT2 upper FET with the SW set to "a". Measure OUT1 and OUT2 lower FET with the SW set to "b".

Measure OUT3 and OUT4 as are the cases/connections of OUT1 and OUT2.

# **LV8548MC**

# ORDERING INFORMATION

Device	Package	Shipping (Qty / Packing)
LV8548MC-AH	SOIC10 (Pb-Free / Halogen Free)	2500 / Tape & Reel
LV8548MC-BH	SOIC10 (Pb-Free / Halogen Free)	2500 / Tape & Reel
LV8548MCZ-AH	SOIC10 (Pb-Free / Halogen Free)	2500 / Tape & Reel

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