LV8548MC

Motor Driver, Forward/Reverse, Low Saturation Voltage, 12V

ON Semiconductor®
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Overview

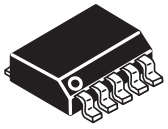
The LV8548MC is a 2-channel low saturation voltage forward/reverse motor driver IC. It is optimal for motor drive in 12V system products and can drive either two DC motors, one DC motor using parallel connection, or it can drive a stepper motor in Full-step and Half-step.

Features

- DMOS output transistor adoption
  (Upper and lower total RON=1Ω typ)
- V_{CC} max=20v, I_O max=1A
- 4V to 16V Operating supply voltage range
  (The control system power supply is unnecessary.)
- The compact package (SOIC10) is adopted.
- Pin compatible with LB1948MC
- Current consumption 0 when standby mode
- It is possible to connect in parallel
  (parallel connection of drive channel)
- Built-in brake function

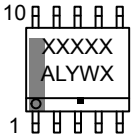
Typical Applications

- Refrigerator
- Flatbed Scanner, Document Scanner
- POS Printer, Label Printer
- PoE Point of sales Terminal
- Clothes Dryer
- Vacuum cleaner
- Time Recorder



SOIC10

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G”, may or not be present.

ORDERING INFORMATION

Ordering Code:
LV8548MC-AH

Package
SOIC10
(Pb-Free / Halogen Free)

Shipping (Qty / packing)
2500 / Tape & Reel

† For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
http://www.onsemi.com/pub_link/Collateral/BRD8011-D.PDF

Specifications

Absolute Maximum Ratings at Ta = 25°C (Note 1)

Parameter	Symbol	Conditions	Ratings	Unit
Maximum power supply voltage	V_{CC} max	VCC	-0.3 to +20	V
Output impression voltage	VOUT	OUT1 , OUT2 , OUT3 , OUT4	-0.3 to +20	V
Input impression voltage	V_{IN}	IN1 , IN2 , IN3 , IN4	-0.3 to +6	V
GND pin outflow current	IGND	Per ch	1.0	A
Allowable Power dissipation	Pd max	(Note 2)	1.0	W
Operating temperature	Topr		-30 to +85	°C
Storage temperature	Tstg		-40 to +150	°C

1. Stresses exceeding those listed in the Absolute Maximum Rating table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.
2. When mounted on the specified printed circuit board (57.0mm ×57.0mm × 1.6mm), glass epoxy, both sides

Recommendation Operating Conditions at Ta = 25°C (Note 3)

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	V_{CC}	VCC	4.0 to 16	V
Input “H” level voltage	$V_{IN}H$	IN1 , IN2 , IN3 , IN4	+1.8 to +5.5	V
Input “L” level voltage	$V_{IN}L$		-0.3 to +0.7	V

3. Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

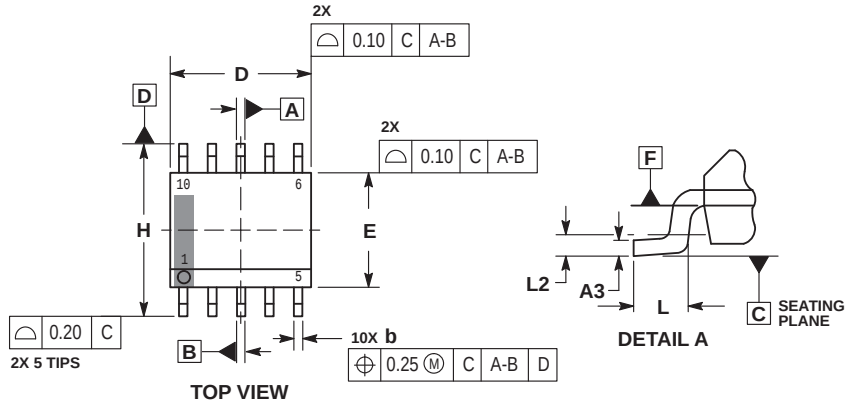
Electrical Characteristics at Ta = 25°C, V_{CC} = 12V (Note 4)

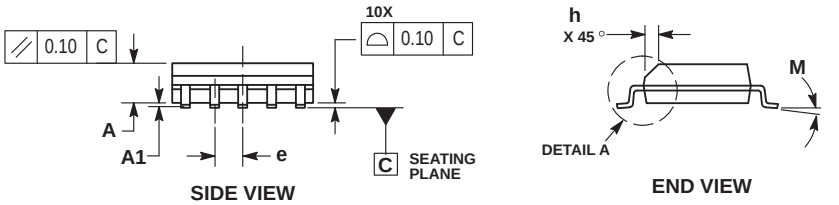
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Power supply voltage	$I_{CC}0$	Standby mode IN1=IN2=IN3=IN4=”LOW”			1	μA
	$I_{CC}1$	It is "High" from IN1 as for either of IN4. Load opening		1.7	2.3	mA
Input current	I_{IN}	V_{IN}=5V	35	50	65	μA
Thermal shutdown operating temperature	Ttsd	Design certification	150	180	210	°C
Width of temperature hysteria	ΔTtsd	Design certification		40		°C
Low voltage protection function operation voltage	VthV_{CC}		3.3	3.5	3.65	V
Release voltage	Vthret		3.55	3.8	3.95	V
Output ON resistance (Upper and lower total)	R_{ON}	I_{OUT}=1.0A	0.7	1	1.25	Ω
Output leak current	$I_O$leak	V_O=16V			10	μA
Diode forward voltage	VD	ID=1.0A		1.0	1.2	V

4. Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

Package Dimensions

SOIC−10 NB
CASE 751BQ−01
ISSUE A

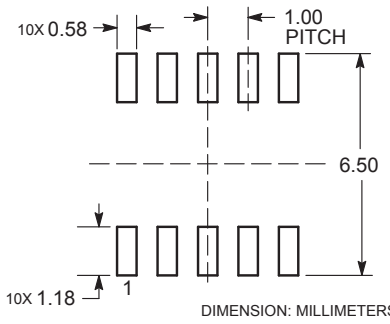




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.10mm TOTAL IN EXCESS OF 'b' AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, 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
A	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
e	1.00 BSC	
H	5.80	6.20
h	0.37 REF	
L	0.40	1.27
L2	0.25 BSC	
M	0°	8°

RECOMMENDED SOLDERING FOOTPRINT*

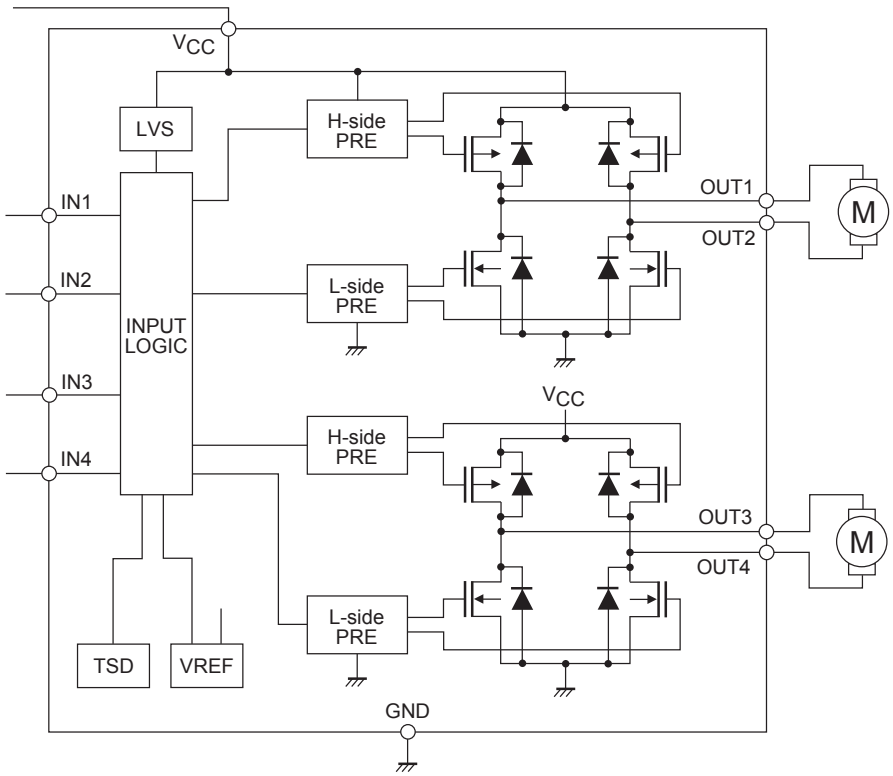


DIMENSION: MILLIMETERS

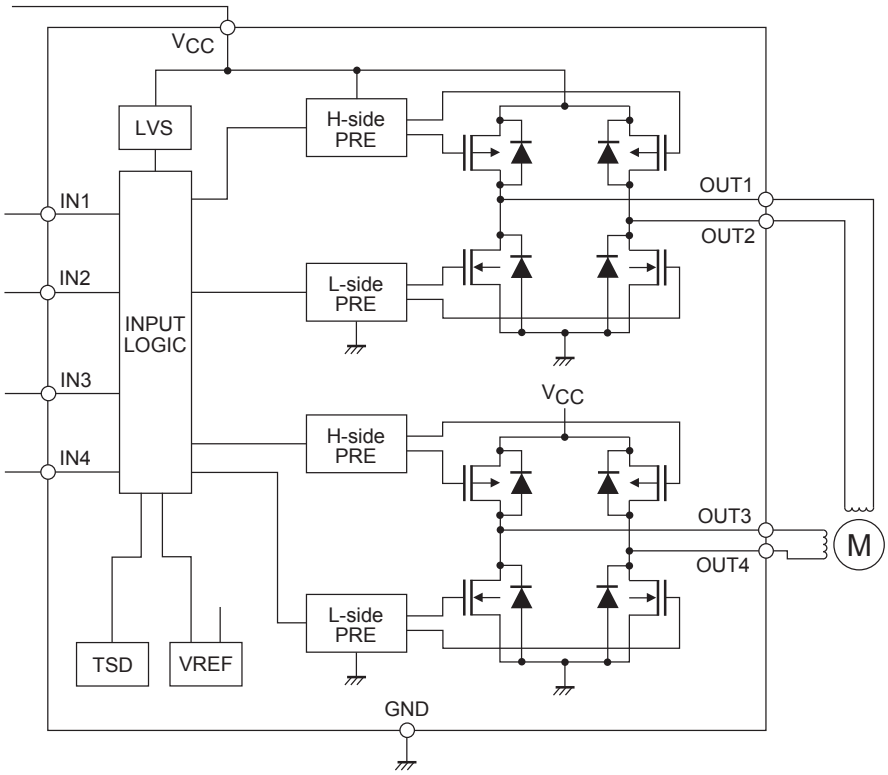
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

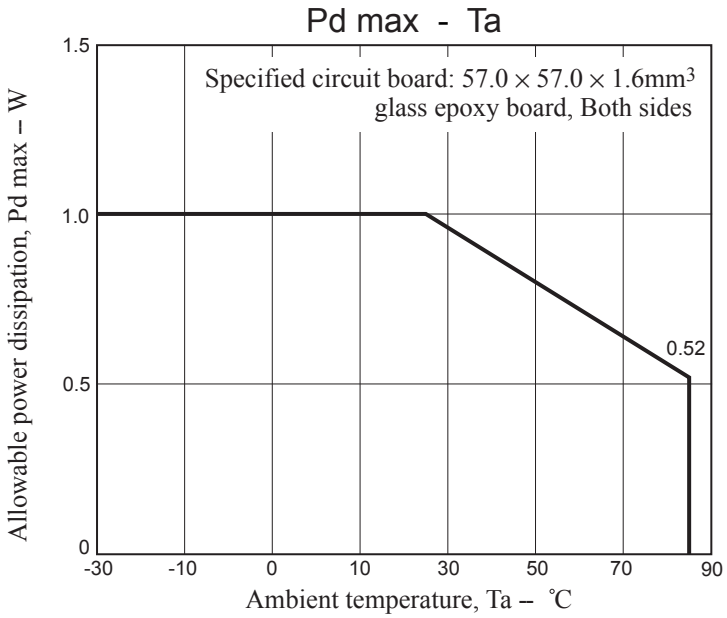
Block Diagram

1. At two DC motor drive

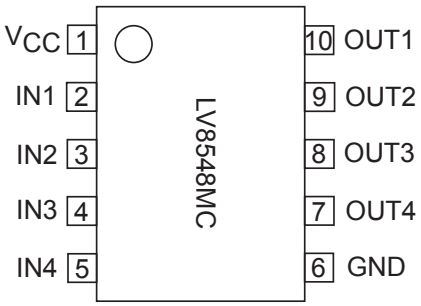


2. At one stepper motor drive

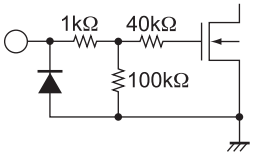
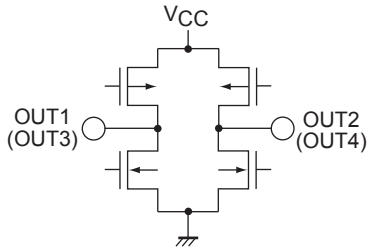




Pin Assignment



Pin function

Pin No.	Pin name	Pin function	Equivalent Circuit
1	V_{CC}	Power-supply voltage pin. V_{CC} 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 is used in combination with IN2 pin (3pin). For the digital input, range of the "L" level is 0 to 0.7(V), range of the "H" level 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 is used in combination with IN1 pin (2pin). PWM can be input. With built-in pull-down resistance.	
4	IN3	Motor drive control input pin. Driving control input pin of OUT3 (8pin) and OUT4 (7pin). It is used in combination with IN4 pin (5pin). PWM can be input. With built-in pull-down resistance.	
5	IN4	Motor drive control input pin. Driving control input pin of OUT3 (8pin) and OUT4 (7pin). It is used in combination with IN3 pin (4pin). 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).	
8	OUT3	Driving output pin. The motor coil is connected between terminal OUT4 (7pin).	
9	OUT2	Driving output pin. The motor coil is connected between terminal OUT1 (10pin).	
10	OUT1	Driving output pin. The motor coil is connected between terminal OUT2 (9pin).	

Operation explanation

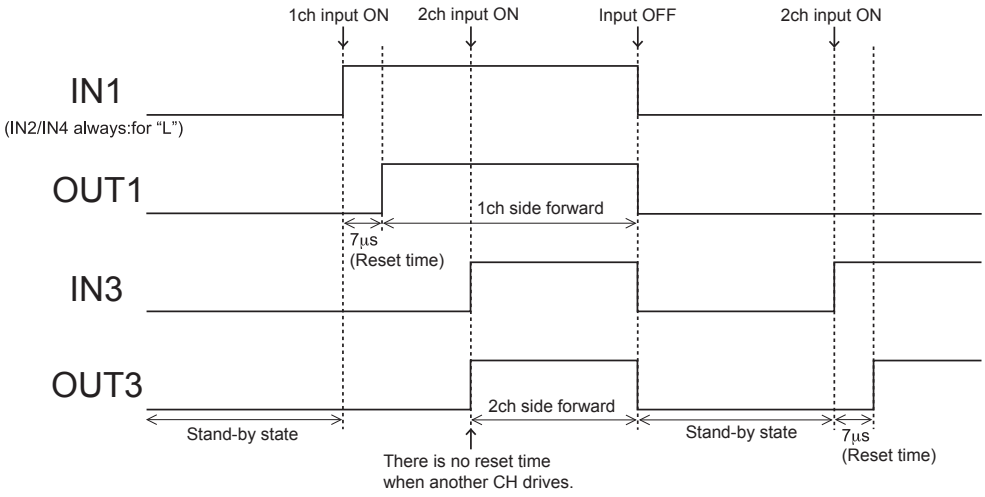
1. DCM output control logic

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

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

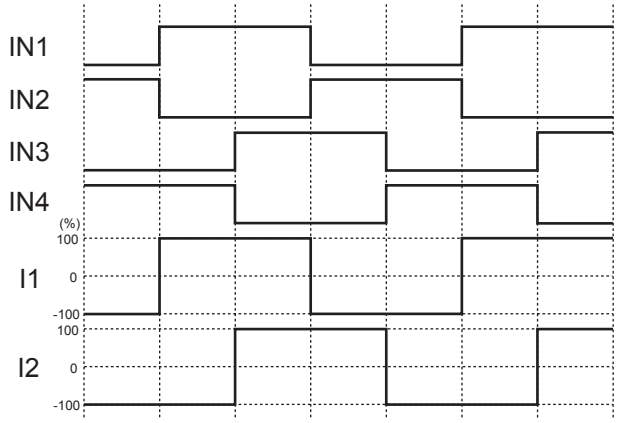
When IN1, IN2, IN3, IN4 are "L", this IC has completely stopped operating. After the time of reset of about 7μs of an internal setting, it shifts to a prescribed output status corresponding to the state of the input when the signal enters the input terminal.

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.

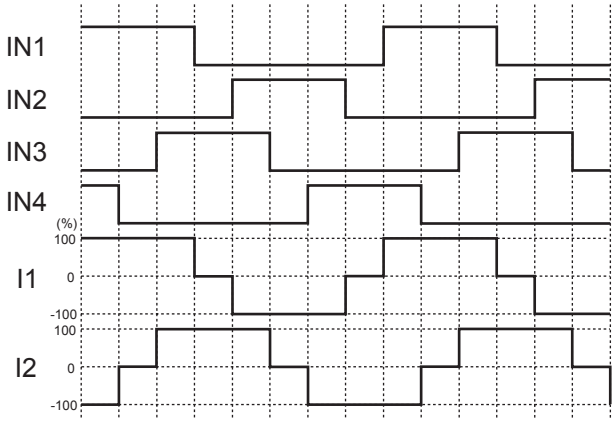


3. Example of current wave type in each excitation mode when stepper motor parallel input is controlled.

• 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).

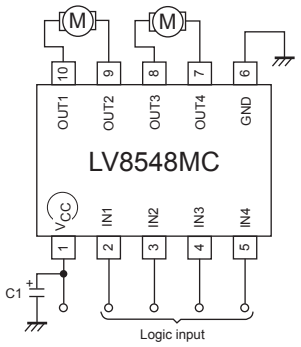
The thermal shutdown circuit does not guarantee the protection of the final product because it operates when the temperature exceed the junction temperature of Tjmax=150°C.

TSD = 180°C (typ)

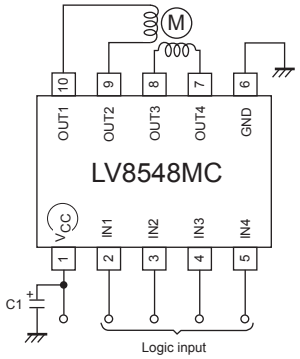
ΔTSD = 40°C (typ)

Application Circuit Example

1. Example of applied circuit when two DC motor driving

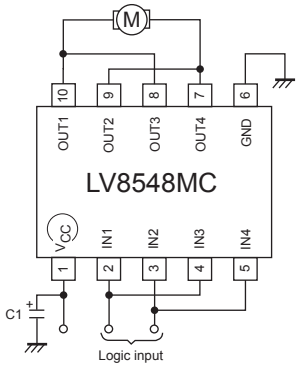


2. Example of applied circuit when one stepper motor driving



3. Example of applied circuit when connecting it in parallel

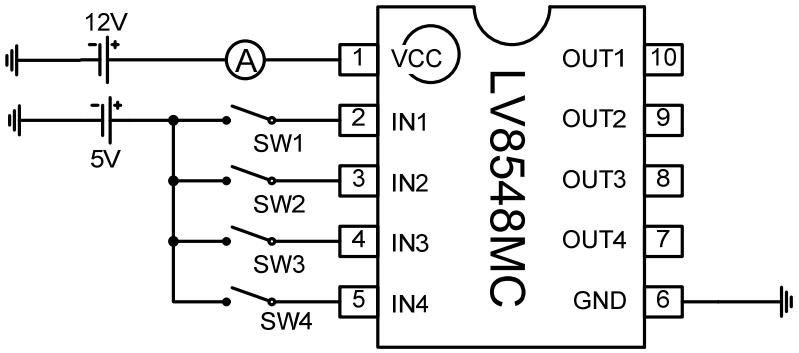
The use likened to H bridge 1ch is shown possible in the figure below by connecting IN1 with IN3, IN2 with IN4, OUT1 with OUT3, OUT2, and OUT4. (I_O max=2.0A, Upper and lower total R_{ON}=0.5Ω)



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

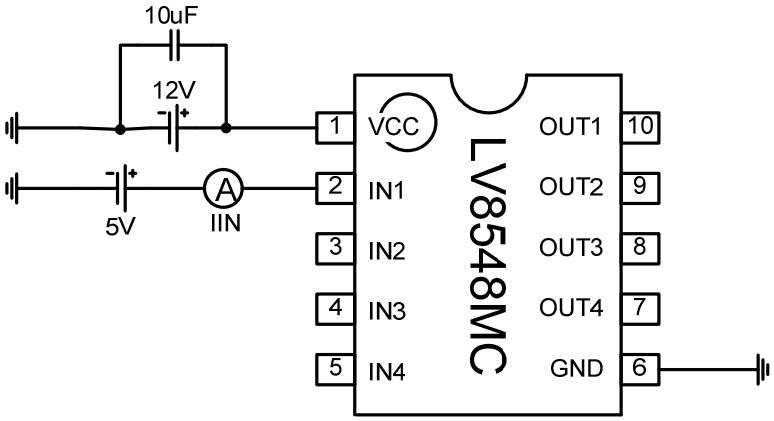
Measurement connection diagram

(1) Current consumption when standing by $I_{CC}0$
Current consumption $I_{CC}1$



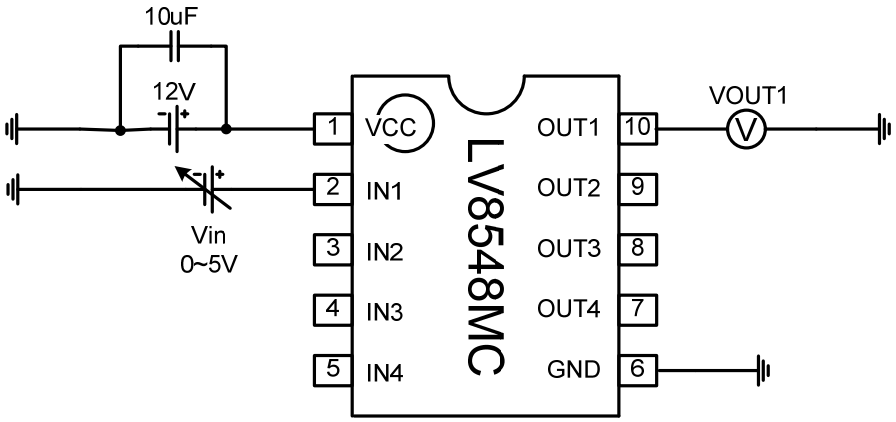
Measure $I_{CC}0$ with all SW OFF.
Measure $I_{CC}1$ with any of the SW1-4 ON.

(2) Input current I_{IN}



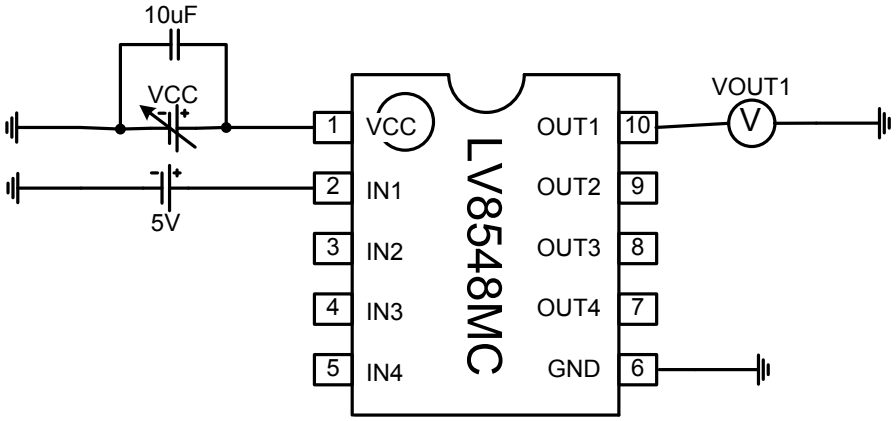
This is about the measurement of IN1 pin. Measure the other IN2-4 pins as is this case.

(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.

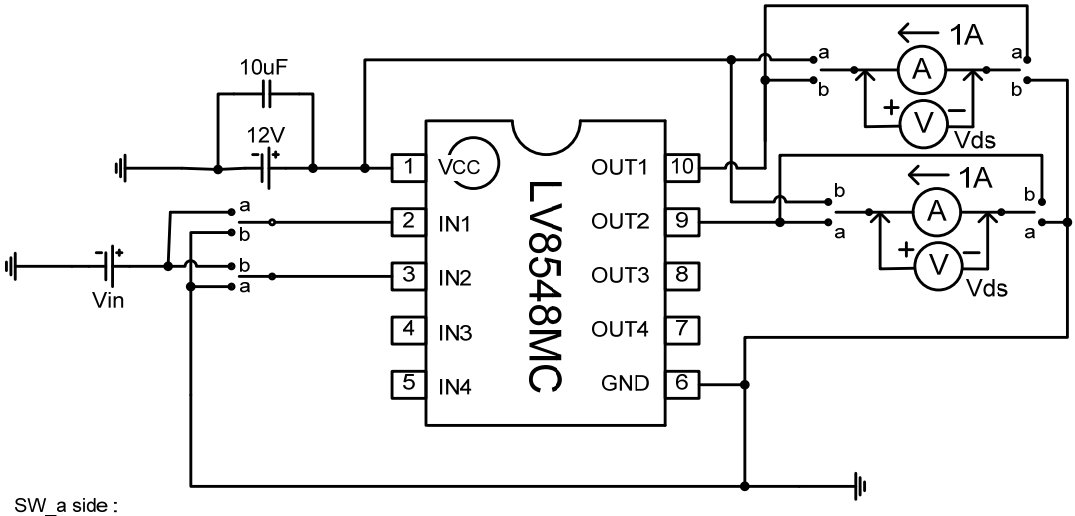
(4) Low voltage protection function operation voltage VthV$_{CC}$ / Release voltage Vthret



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

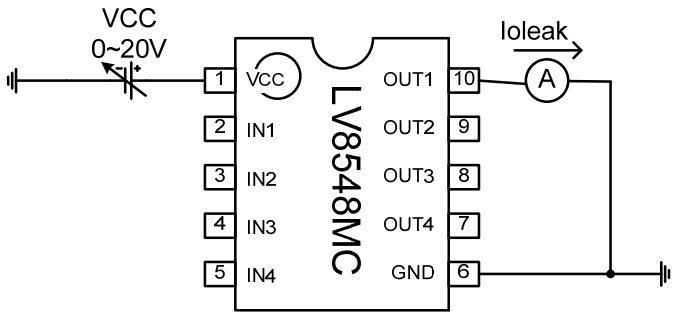


SW_a side :
OUT1 Upper-side/OUT2 Lower-side
OUT3 Upper-side/OUT4 Lower-side
SW_b side :
OUT1 Lower-side/OUT2 Upper-side
OUT3 Lower-side/OUT4 Upper-side

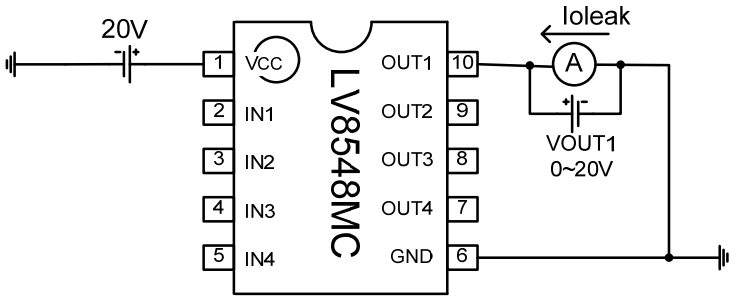
Measure OUT1 upper side and OUT2 lower side FET with the SW set to "a".
Measure OUT1 lower side and OUT2 upper side FET with the SW set to "b".
Measure OUT3 and OUT4 as are the cases of OUT1 and OUT2.

(6) Output leak current Ioleak

<Each OUT Upper-side>

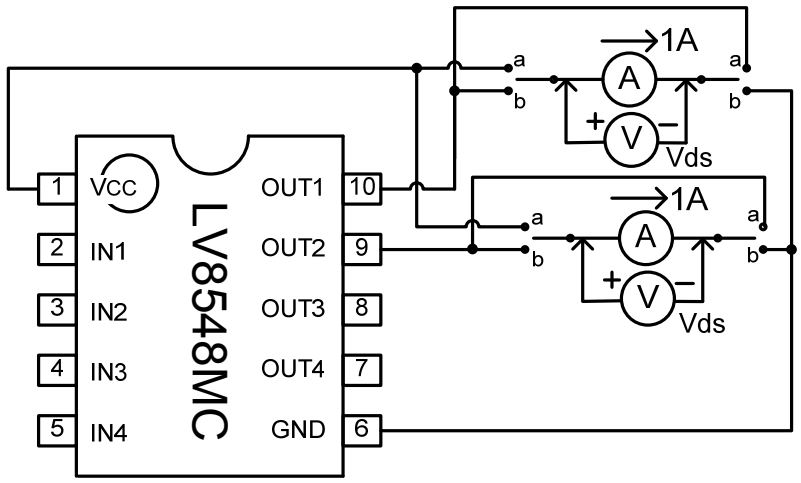


<Each OUT Lower-side>



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.

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