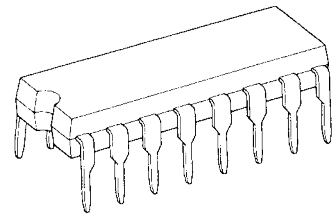
TOSHIBA Bipolar Linear Integrated Circuit

TA8492P

3-Phase Full-Wave Brushless DC Motor Driver IC

The TA8492P is a 3-phase, full-wave, supply voltage-control motor driver IC.

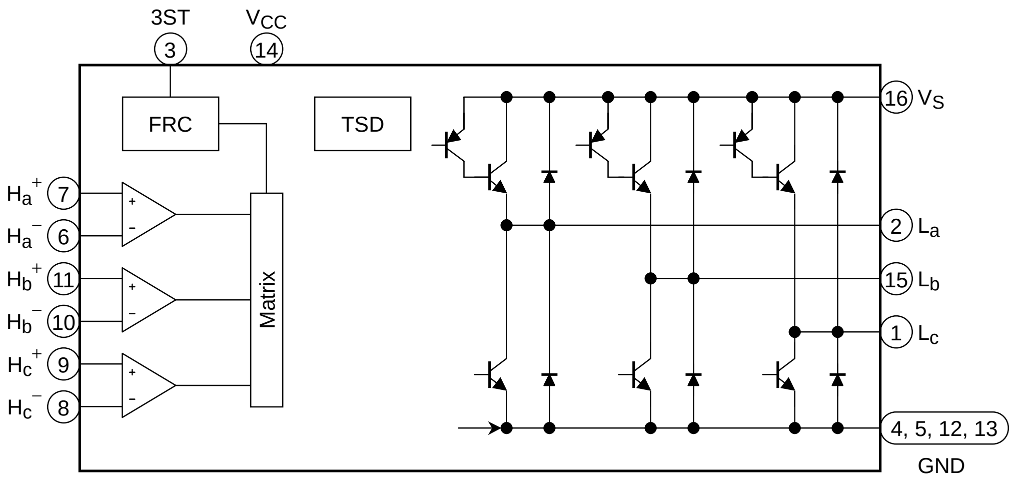


Weight: 1.11 g (typ.)

Features

- Output current: $I_{O\ (max)}$ = 1.5 A
- Supply voltage control motor driver
- CW/CCW/STOP function
- Operating voltage range: $V_{CC\ (opr.)}$ = 7~18 V
  $V_{S\ (opr.)}$ = 0~18 V

Block Diagram



Pin Function

Pin No.	Symbol	Function
1	L_c	c-phase drive output pin
2	L_a	a-phase drive output pin
3	3ST	Switching CW/CCW/Stop
4	GND	—
5	GND	—
6	H_a^-	a-phase negative hall signal input pin
7	H_a^+	a-phase positive hall signal input pin
8	H_c^-	c-phase negative hall signal input pin
9	H_c^+	c-phase positive hall signal input pin
10	H_b^-	b-phase negative hall signal input pin
11	H_b^+	b-phase positive hall signal input pin
12	GND	—
13	GND	—
14	V_{CC}	Supply voltage pin for control circuits
15	L_b	b-phase drive output pin
16	V_S	Supply voltage pin for output circuit

Function

FRS	Hall Input			Output		
	H_a	H_b	H_c	L_a	L_b	L_c
Foward	1	0	1	L	H	M
	1	0	0	L	M	H
	1	1	0	M	L	H
	0	1	0	H	L	M
	0	1	1	H	M	L
	0	0	1	M	H	L
Reverse	1	0	1	H	L	M
	1	0	0	H	M	L
	1	1	0	M	H	L
	0	1	0	L	H	M
	0	1	1	L	M	H
	0	0	1	M	L	H
Stop	1	0	1	High Impedance		
	1	0	0			
	1	1	0			
	0	1	0			
	0	1	1			
	0	0	1			

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_S	20	V
	V_{CC}	20	V
Output current	I_O	1.5	A
Power dissipation	P_D	1.4 (Note 1)	W
		2.7 (Note 2)	
Operating temperature	T_{opr}	−30~85	°C
Storage temperature	T_{stg}	−55~150	°C

Note 1: Not mounted on the PCB

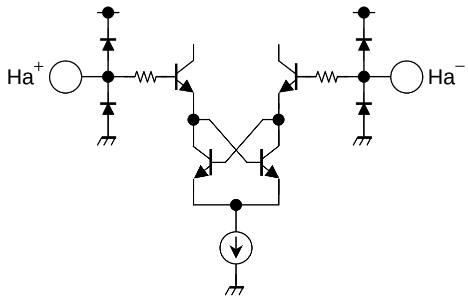
Note 2: Mounted on the PCB (PCB area: 50 × 50 × 0.8 mm cu area: over 60%)

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

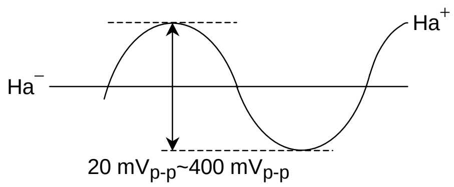
Characteristics		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Supply current		I_{CC-1}	1	V_{CC} = 12 V, 3ST: GND, V_S: Open	—	5.0	7.0	mA
		I_{CC-2}		V_{CC} = 18 V, 3ST: GND, V_S: Open	—	6.0	9.0	
		I_{CC-3}		Stop (3ST = V_{CC})	—	2.5	4	
Output saturation voltage	Upper	$V_{SAT (U)}$	2	I_O = 1 A (source current)	—	1.35	1.7	V
	Lower	$V_{SAT (L)}$	3	I_O = 1 A (sink current)	—	0.4	0.6	
Output leak current	Upper	$I_{L (U)}$	4	V_S = 20 V	—	—	50	μA
	Lower	$I_{L (L)}$	5	V_S = 20 V	—	—	50	
Hall Amp.	Input sensitivity	V_H	6	—	20	—	400	mV_{p-p}
	Common mode input voltage range	V_{CMRH}	7	—	2	—	V_{CC} − 3.5	V
CW/CCW control operation voltage	Stop	V_{STP}	6	—	V_{CC} − 0.4	—	V_{CC}	V
	CW	V_{FW}		—	2.5	—	6.5	
	CCW	V_{RV}		—	0	—	0.4	
Thermal shut-down operating temperature		T_{SD}	—	—	—	160	—	°C

Functional Description

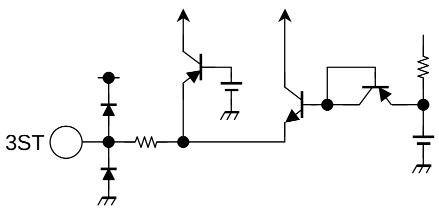
- Hall amp. circuit



The Hall amp is a high-gain amp. The input sensitivity is 20 mV_{p-p} (min). Make sure that the input amplitude does not exceed 400 mV_{p-p}.
The common mode voltage V_{CMRH} = 2.0 to V_{CC} − 3.5 V.

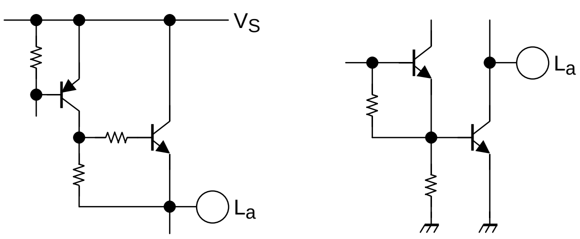


- CW/CCW/Stop control circuit



In Reverse mode, the control input (3ST) voltage range is V_{RV} = 0 to 0.4 V. However, keep the voltage as close to the IC GND as possible (see the application circuit diagram).
Similarly, in Stop mode, keep the voltage as close to the IC V_{CC} as possible.
In Forward mode, Toshiba recommend the input voltage be V_{CC}/2.

- Output circuit



The output circuit uses voltage control where the upper and lower output transistors are saturated and the output current is controlled by the V_S voltage. To reduce switching noise, connect a snubber capacitor to the output circuit.

- Thermal shut-down circuit

The circuit turns off output when T_j = 160°C (typ.) (according to design specification)

Handling Precautions

(CW/CCW/Stop control circuit)

a) At 3ST input, because the input voltage ranges for V_{RV} (Reverse mode) and V_{STP} (Stop mode) are narrow, make sure no impedance is caused between the IC V_{CC} and GND pins. Do not connect an input resistor to the 3ST pin because it causes voltage offset.

b) When controlling the rotation direction using 3ST input, switch the direction from Reverse to Stop mode or vice versa with $V_S = 0$ V, because punch-through current may be generated at output.

(Hall amp. circuit)

A Hall IC input amplitude of over 400 $mV_{p\text{-}p}$ causes an output function error. Make sure the amplitude is within the specified range.

(Output circuit)

Utmost care is necessary in the design of the output fine, V_S, V_{CC} and GND line since IC may be destroyed due to short-circuit between output air contamination fault, or fault by improper grounding

External parts

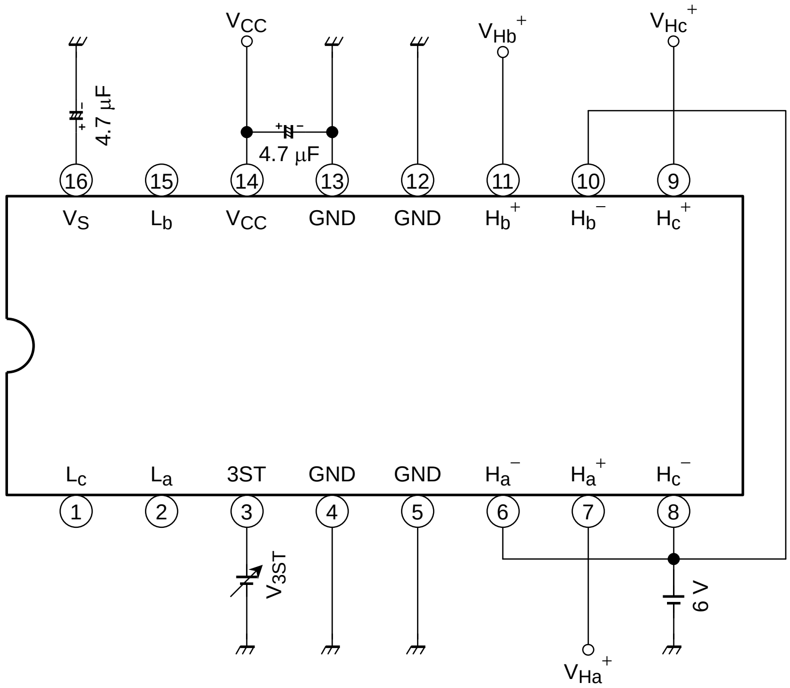
Symbol	Function	Recommended Value	Remarks
C_1	Power supply line oscillation prevention	4.7 μF	—
C_2	Power supply line oscillation prevention	4.7 μF	—
C_3	Output noise reduction	4.7 μF	(Note 3)
R_1	Hall bias	—	(Note 4)

Note 3: Set an appropriate value depending on the motor and use conditions.
Set an appropriate value so that the Hall IC output common mode input voltage and amplitude fall within the specified ranges in the Electrical Characteristics table.

Note 4: Be sure to set this bias so that the Hall element output amplitude and common mode input voltage fall within the ranges specified in the table of electrical characteristic.

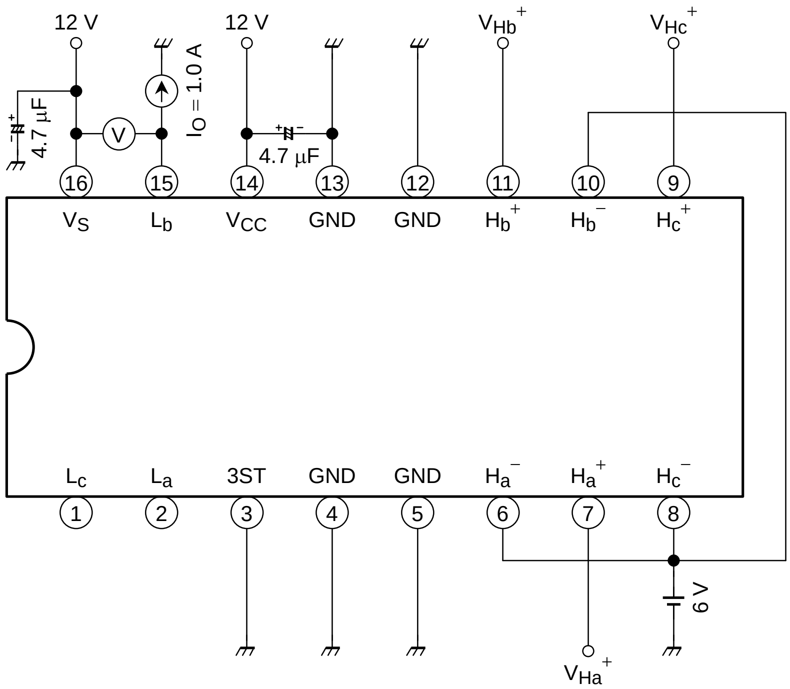
Test circuit

1. I_{CC1}, I_{CC2}, I_{CC3}



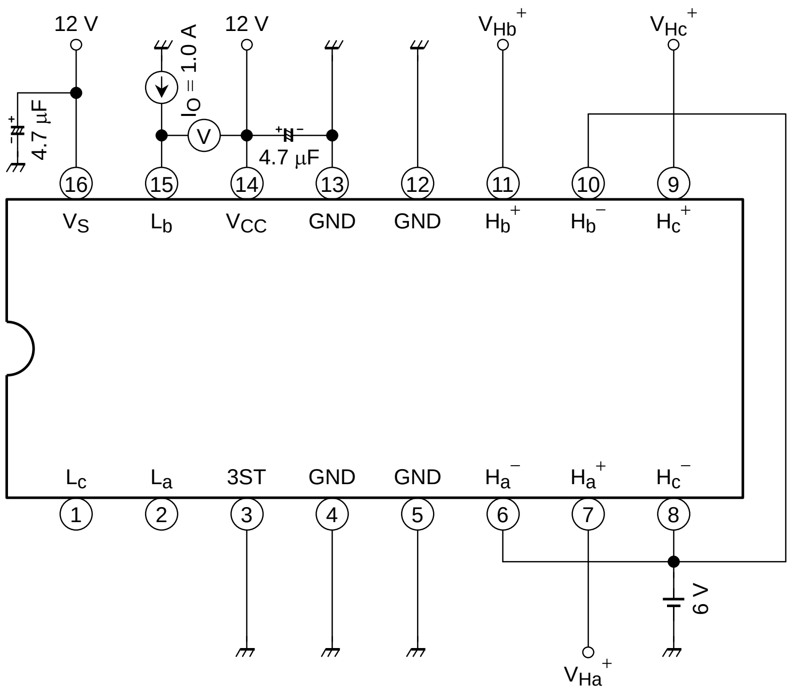
- I_{CC1}: Input V_{Ha}^{+}, V_{Hb}^{+}, V_{Hc}^{+} (6.01 V/5.99 V). V_{CC} = 12 V/V_{3ST} = GND
- I_{CC2}: Input V_{Ha}^{+}, V_{Hb}^{+}, V_{Hc}^{+} (6.01 V/5.99 V). V_{CC} = 18 V/V_{3ST} = GND
- I_{CC3}: Input V_{Ha}^{+}, V_{Hb}^{+}, V_{Hc}^{+} (6.01 V/5.99 V). V_{CC} = 12 V/V_{3ST} = V_{CC}

2. $V_{SAT\ (U)}$



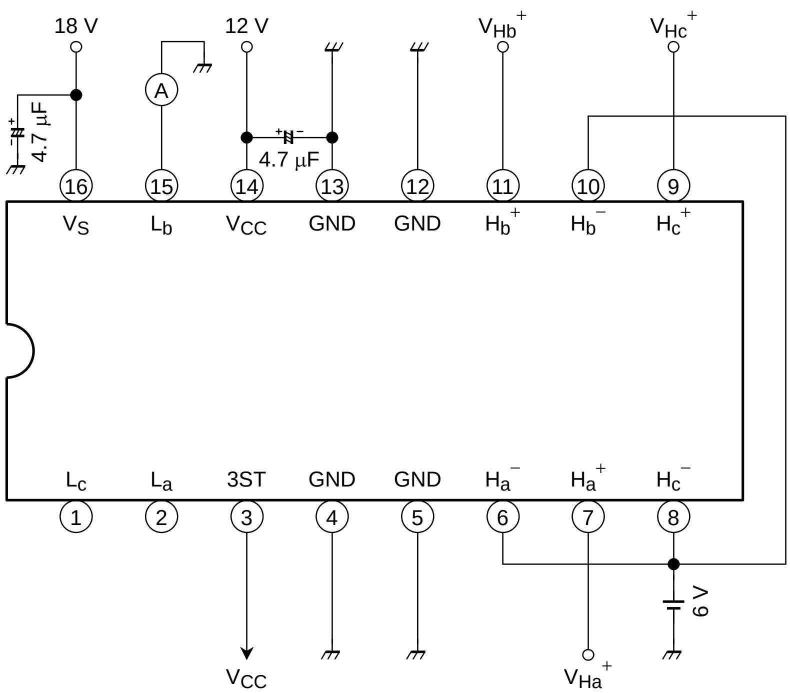
- $V_{SAT\ (U)}$: Input V_{Ha}^{+}, V_{Hb}^{+}, V_{Hc}^{+} (6.01 V/5.99 V), check that the output function is at High level, then measure phases a, b, and c.

3. $V_{SAT\ (L)}$



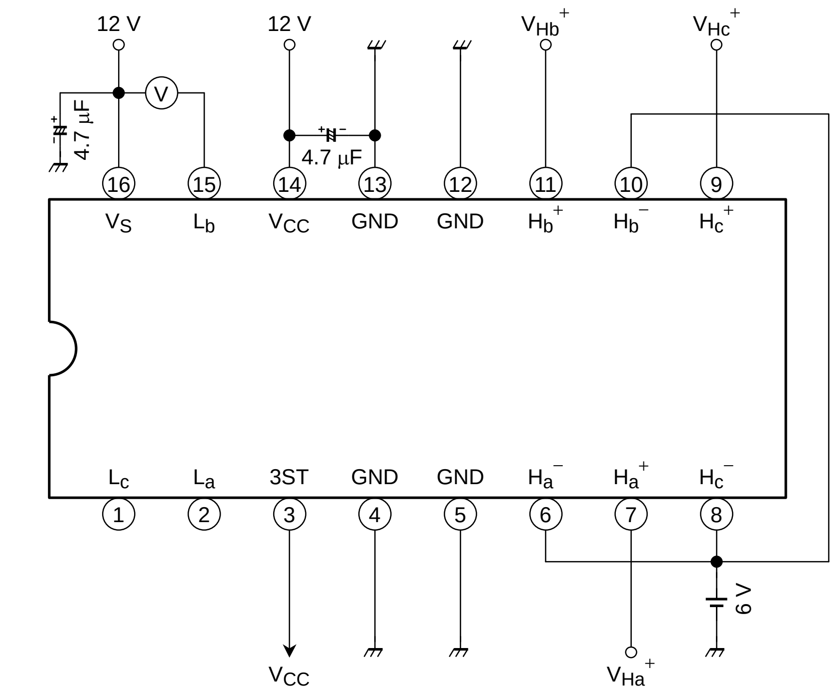
- $V_{SAT\ (L)}$: Input V_{Ha}^+, V_{Hb}^+, V_{Hc}^+ (6.01 V/5.99 V) and check output function is "L".
  (a-phase, b-phase, c-phase)

4. $I_{L\ (U)}$



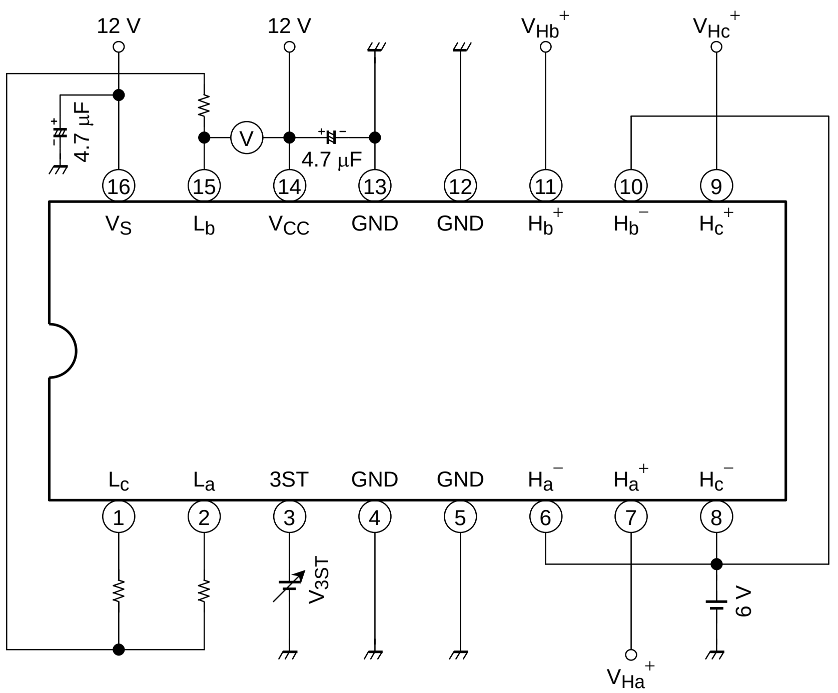
- $I_{L\ (U)}$: Check output function is high impedance at 3ST = V_{CC}.
  (a-phase, b-phase, c-phase)

5. $I_{L\ (L)}$



- $I_{L\ (L)}$: Check output function is high impedance at 3ST = V_{CC}.
  (a-phase, b-phase, c-phase)

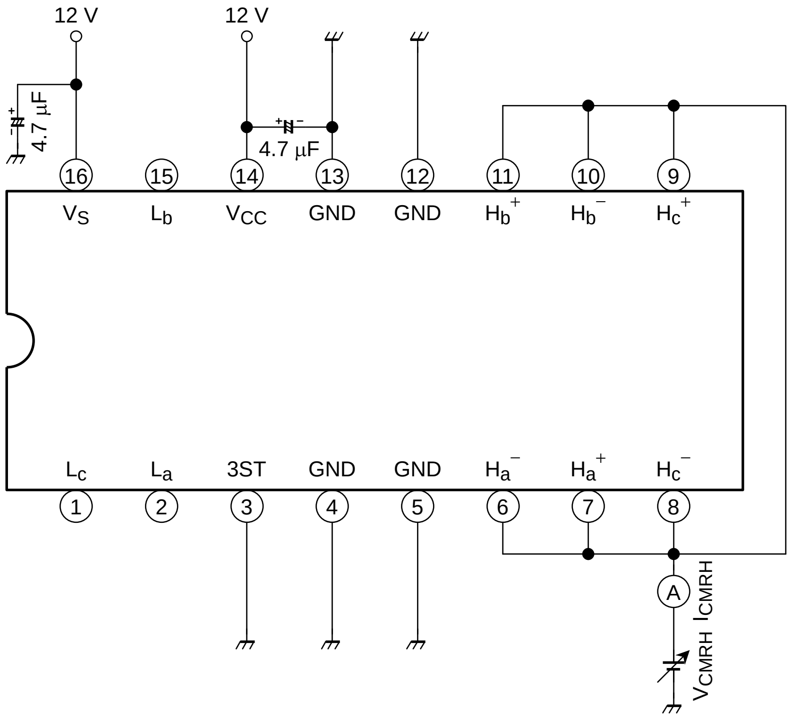
6. V_H, V_{STP}, V_{FW}, V_{RV}



- V_H: Input V_{Ha}^+, V_{Hb}^+, V_{Hc}^+ (6.01 V/5.99 V) and check output function.
  (a-phase, b-phase, c-phase) AT V_{3ST} = GND.
- V_{STP}: When V_{3ST} is 8.5 V, input V_{Ha}^+, V_{Hb}^+, V_{Hc}^+ (6.01 V/5.99 V), fix the output function, then check that the output function is at high impedance.
- V_{FW}: Input V_{Ha}^+, V_{Hb}^+, V_{Hc}^+ (6.01 V/5.99 V) and check output function is forward mode.
  AT V_{3ST} = 2.5 V/6.5 V.

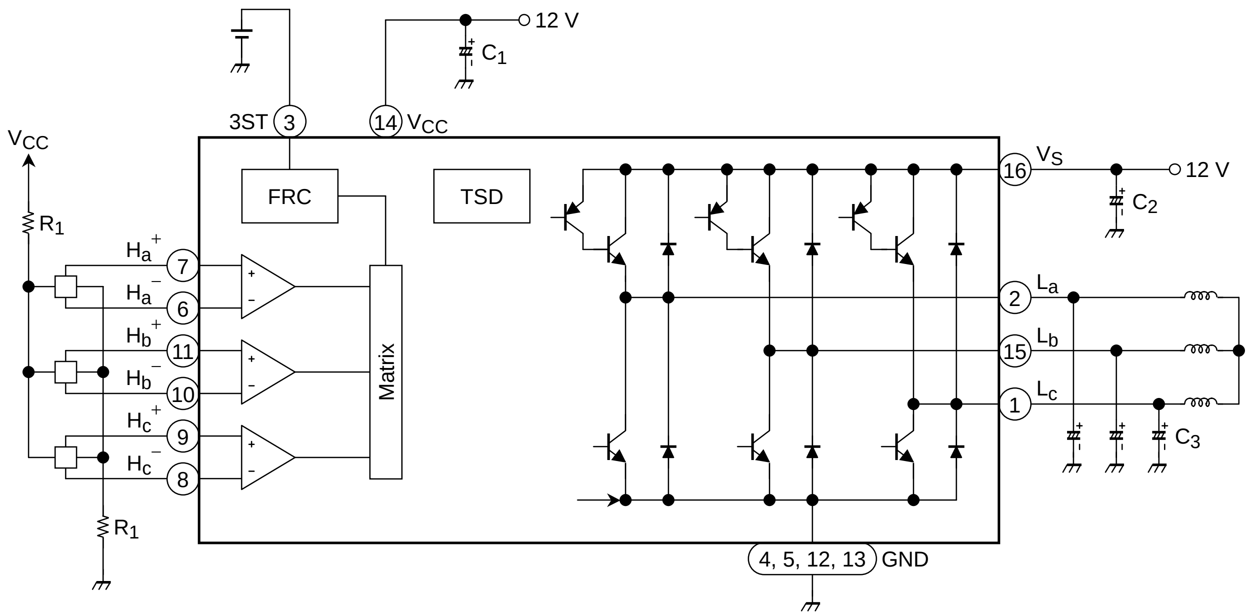
- V_{RV}: Input V_{Ha}^{+}, V_{Hb}^{+}, V_{Hc}^{+} (6.01 V/5.99 V) and check output function is reverse mode.
  AT V_{3ST} = 0.4 V.

7. V_{CMRH}

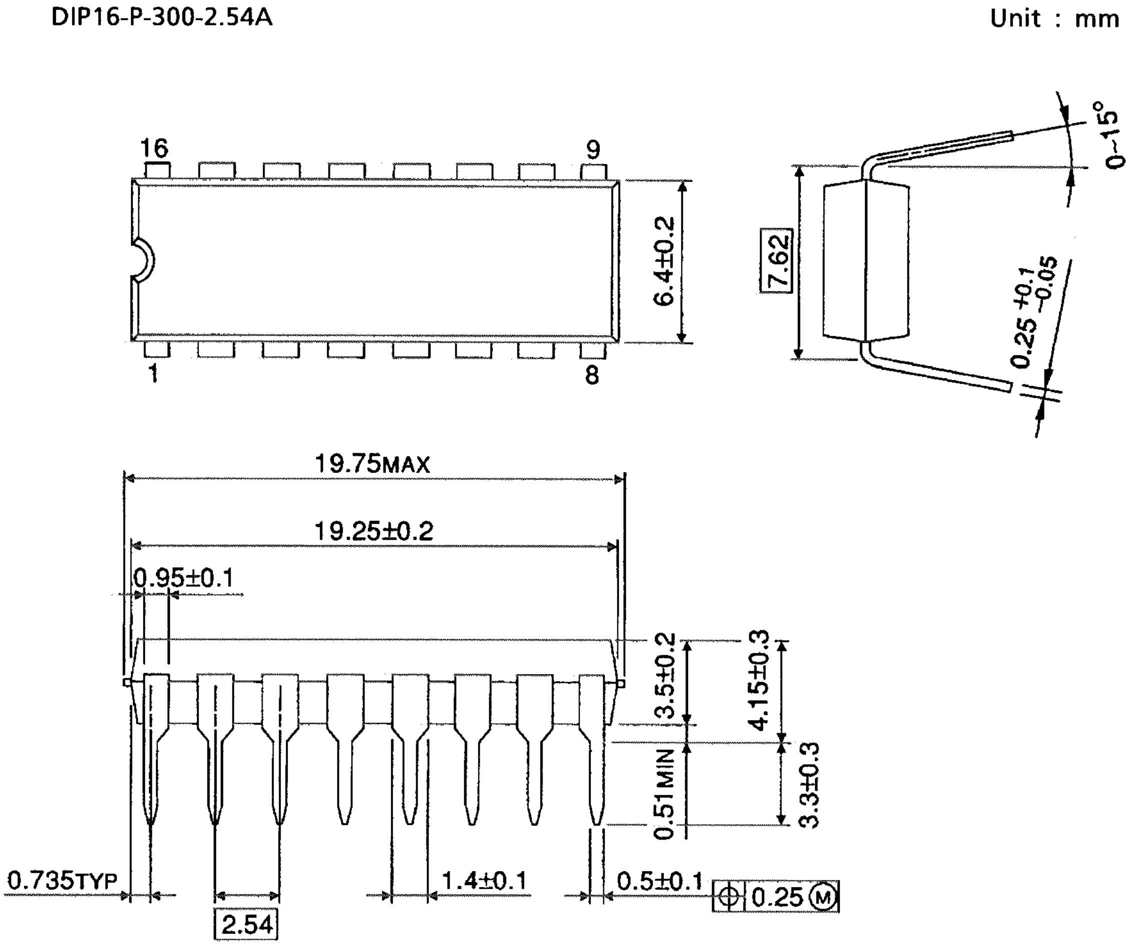


- V_{CMRH}: Measure the I_{CMRH} gap between V_{CMRH} = 2 V and 8.5 V.

Application Circuit



Package Dimensions



Weight: 1.11 g (typ.)

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