

# M54544AL

Bi-DIRECTIONAL MOTOR DRIVER  
WITH BRAKE FUNCTION AND THERMAL SHUT DOWN FUNCTION

## DESCRIPTION

The M54544AL is a semiconductor integrated circuit that is capable of directly driving a smallsize bi-directional motor rotating in both forward and reverse directions.

## FEATURES

- Wide range of operating voltage ( $V_{CC}=4 - 16V$ )
- Possible direct driving with TTL, PMOS and CMOS IC outputs
- Low output saturation voltage (large voltage across motors)
- Built-in clamp diode
- Large output current drive ( $I_{O(max)}=\pm 1.5A$ )
- Provided with brake function
- Built-in thermal shutdown protection circuit

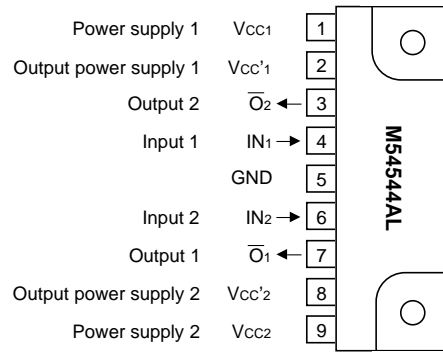
## APPLICATION

Sound equipment such as tape deck and radio cassette, VTR, and other general consumer appliances

## FUNCTION

The M54544AL is an IC for driving a smallsize bi-directional motor that rotates in both forward and reverse directions. When both inputs 1 and 2 are set to low-level, outputs 1 and 2 are set to "OFF". When input 1 is set to high-level and input 2 is set to low-level, output 1 is set to high-level and output 2 is set to low-level (forward rotation status). When input 1 is set to low-level and input 2 is set to high-level, output 1 is set to low-level and output 2 is set to high-level (reverse rotation). When both inputs 1 and 2 are set to high-level, both outputs 1 and 2 are set to low-level (brake status). The power supply ( $V_{CC}$ ) to the control circuit and the power supply ( $V_{CC}'$ ) for output are independently provided. The rotating speed of the motor can be therefore changed by using  $V_{CC}$  and  $V_{CC}'$  as different power supplies and by making  $V_{CC}$  or  $V_{CC}'$  variable. If the motor resistance is high (light load and small driving current: tens of mA), and  $V_{CC}$  is larger than  $V_{CC}'$ , current does not flow backward from the  $V_{CC}$  pin to  $V_{CC}'$  pin.

## PIN CONFIGURATION (TOP VIEW)

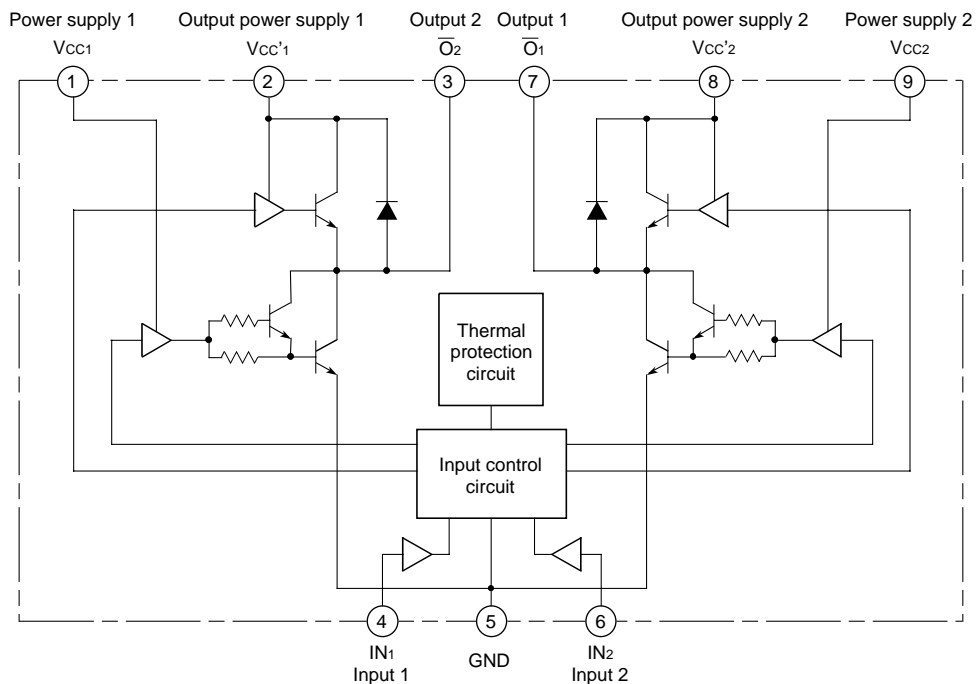


In addition, built-in thermal protection circuit protects the IC from thermal destruction in case of abnormal condition such as motor blocking.

## LOGIC TRUTH TABLE

Input		Output		Remarks
IN <sub>1</sub>	IN <sub>2</sub>	$\bar{O}_1$	$\bar{O}_2$	
L	L	"OFF" state	"OFF" state	No operation of IC
H	L	H	L	ex Forward rotation
L	H	L	H	Reverse rotation
H	H	L	L	Brake

## BLOCK DIAGRAM



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## ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
Vcc(1)	Supply voltage(1)		-0.5 – +16	V
Vcc(2)	Supply voltage(2)	With an external heat sink (3000mm <sup>2</sup> x 1.5mm)	-0.5 – +20	V
Vcc'	Output supply voltage		-0.5 – +16	V
Vi	Input voltage		0 – Vcc	V
Vo	Output voltage		-0.5 – Vcc'+2.5	V
Io(max)	Allowable motor rush current	top=10ms : cycle time 0.2Hz or less	±1.5	A
Io(1)	Continuous output current(1)		±330	mA
Io(2)	Continuous output current(2)	With an external heat sink (3000mm <sup>2</sup> x 1.5mm)	±600	mA
Pd	Power dissipation	Ta=75°C	1.15	W
Topr	Operating temperature		-10 – 75	°C
Tstg	Storage temperature		-55 – 125	°C

## RECOMMENDED OPERATING CONDITION (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
Vcc	Supply voltage		4	12	15	V
Io	Output current				±300	mA
VIH	"H" input voltage		2		Vcc	V
VIL	"L" input voltage		0		0.4	V
tB	Motor braking interval		10	100		ms
tj(shut)	Thermal shutdown temperature	Vcc ≥ 7V		150		°C

## ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise noted)

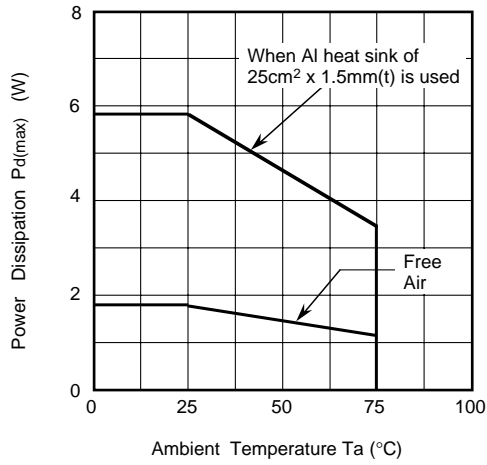
Symbol	Parameter	Test conditions		Limits			Unit	
				Min.	Typ.	Max.		
Io(leak)	Output leak current	Vcc=Vcc'=20V Vi1=Vi2=0V	Vo=20V Vo=0V			100 -100	μA	
VOH(1)	"H" output saturation voltage(1)	Vcc=Vcc'=12V	Vi1=2V Vi2=0V	IOH(1)=-200mA IOH(1)=-500mA	10.8 10.7	11.2 11.1	V	
VOH(2)	"H" output saturation voltage(2)	Vcc=Vcc'=12V	Vi1=0V Vi2=2V	IOH(2)=-200mA IOH(2)=-500mA	10.8 10.7	11.2 11.1	V	
VOL(1)	"L" output saturation voltage(1)	Vcc=Vcc'=12V	Vi1=0V Vi2=2V Vi1=Vi2=2V	IoL(1)=200mA IoL(1)=500mA		0.2 0.95 0.95	0.5 1.35 1.35	V
VOL(2)	"L" output saturation voltage(2)	Vcc=Vcc'=12V	Vi1=2V Vi2=0V Vi1=Vi2=2V	IoL(2)=200mA IoL(2)=500mA		0.2 0.95 0.95	0.5 1.35 1.35	V
IiH(1)	"H" input current(1)	Vcc=Vcc'=12V, Vi1=2V, Vi2=0V			50		120	μA
IiH(2)	"H" input current(2)	Vcc=Vcc'=12V, Vi1=0V, Vi2=2V			50		120	μA
Icc	Supply current	Vcc=Vcc'=16V Output open	Vi1=2V, Vi2=0V Vi1=0V, Vi2=2V Vi1=Vi2=2V Vi1=Vi2=0V				15 20 4	mA

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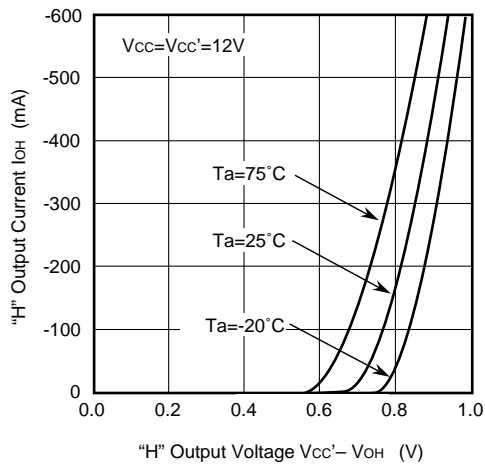
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## TYPICAL CHARACTERISTICS

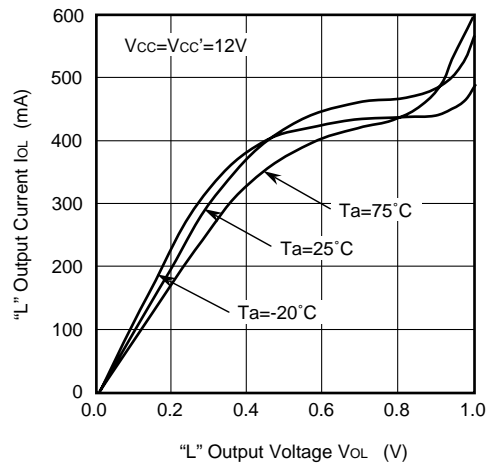
Thermal Derating (Absolute Maximum Rating)



"H" Output Saturation Characteristics



"L" Output Saturation Characteristics



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## CAUTIONS

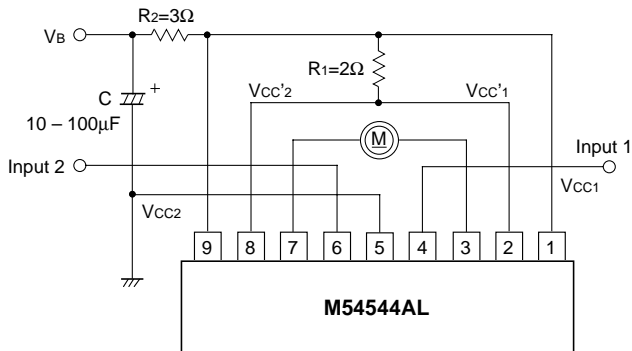
Since the thermal protection function of this IC may not work in abnormal status (oscillation, low supply voltage, output short-circuit, etc.), check the operation in the IC installation status when using this function.

When the motor back electromotive force is large with the brakes applied, for example, malfunction may occur in internal parasitic Di. If flyback current of 1A or more flows, add Schottky Di to the portion between the output and the GND.

When the IC is used at a high speed for PWM, etc., note that switching of output results in delay of approx. 10 $\mu$ s.

## APPLICATION EXAMPLES

1) When Vcc and Vcc' are used as the same power supply



2) When Vcc is used as a fixed power supply and Vcc' is used as a variable power supply

