

# M54641L/FP

## Bi-DIRECTIONAL MOTOR DRIVER WITH BRAKE FUNCTION

### DESCRIPTION

The M54641 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 ( $V_{CC} = 4 - 10V, V_{CC'(max)} = 20V$ )
- Low output saturation voltage in stationary motor circuit (large voltage across motors)
- Built-in clamp diode
- Provided with output voltage control pin ( $V_z$ )
- Built-in thermal shutdown circuit ( $T_{j(shut)} = 120^\circ C$  standard)

### APPLICATION

Sound equipment such as tape deck and radio cassette, and VTR

### FUNCTION

The M54641 is an IC for driving a smallsize bi-directional motor that rotates in both forward and reverse directions. Giving signal to inputs  $IN_1$  and  $IN_2$  outputs the signal of the same phase to output pins  $\bar{O}_1$  and  $\bar{O}_2$ . That is, giving high-level signal to input  $IN_1$  and low-level signal to input  $IN_2$  sets output  $\bar{O}_1$  to high-level and output  $\bar{O}_2$  to low-level. Connection of a motor between output pins  $\bar{O}_1$  and  $\bar{O}_2$  uses  $\bar{O}_1$  as an output current source and  $\bar{O}_2$  as an output current sink to rotate the motor. In addition, giving the reverse signal to inputs  $IN_1$  and  $IN_2$  sets  $\bar{O}_1$  and  $\bar{O}_2$  to low-level and high-level, respectively, resulting in rotating the motor reversely.

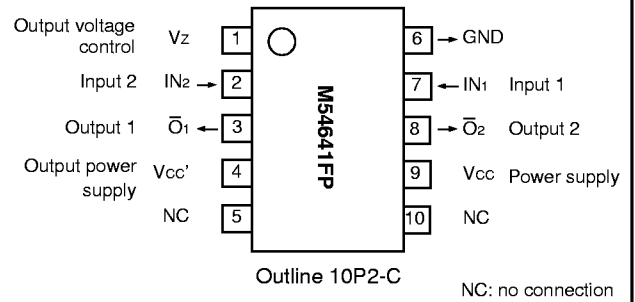
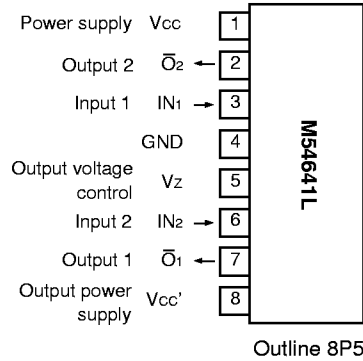
However, when both  $IN_1$  and  $IN_2$  are set to "H", both  $\bar{O}_1$  and  $\bar{O}_2$  are set to low-level, resulting in sudden stop of motor rotation. (Brake mode)

If the Zener diode of certain voltage, for example, is added to the  $V_z$  pin, the output "H" voltage does not rise over the Zener voltage and the motor rotates at constant speed.

If the  $V_z$  pin is connected to the output power supply  $V_{CC'}$  pin, the rotating speed of the motor can be varied by varying the  $V_{CC'}$  voltage.

The motor rush current and the current with the motor put in stationary status are as follows:  $I_{op(max)} = 800mA$  and  $I_{O(max)} = 150mA$ .

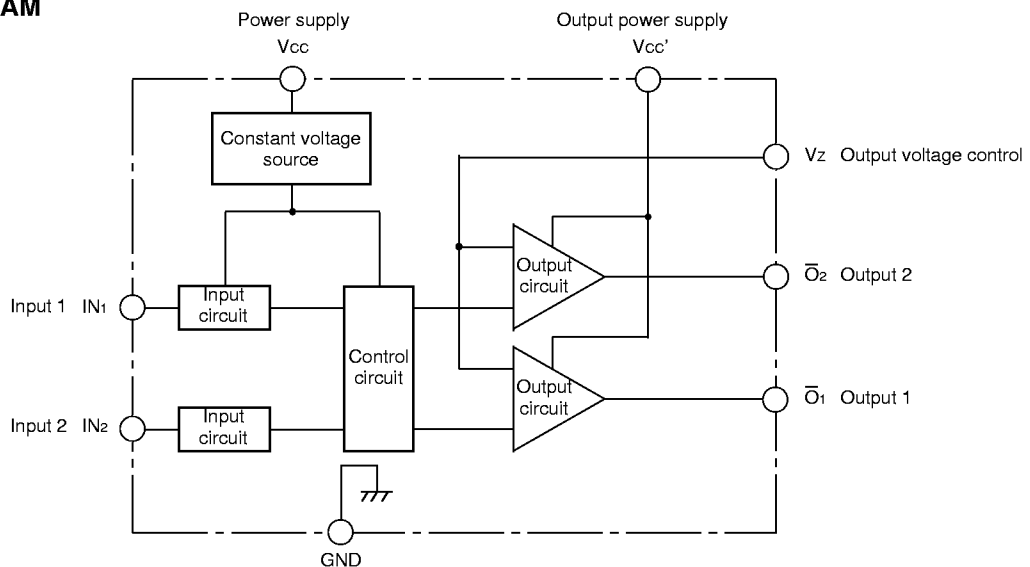
### PIN CONFIGURATION (TOP VIEW)



### LOGIC TRUTH TABLE

Input		Output		Remarks
$IN_1$	$IN_2$	$\bar{O}_1$	$\bar{O}_2$	
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

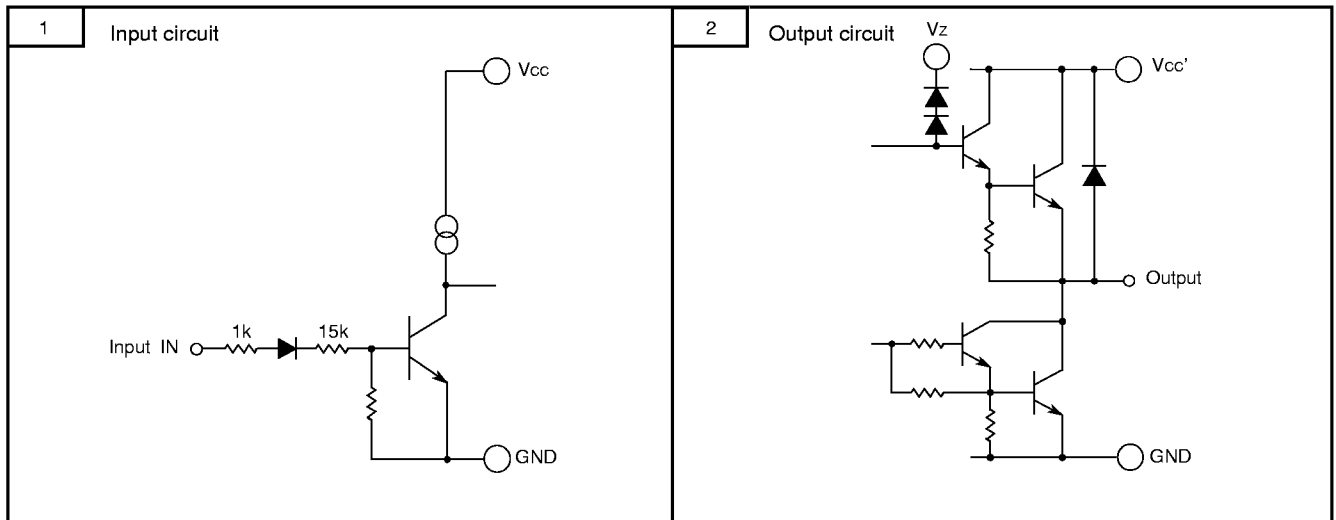
### BLOCK DIAGRAM



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Though the IC is equipped with a thermal shutdown circuit for prevention against thermal breaking, the threshold temperature is set to 100°C min. Set the driving current in such a way that this thermal shutdown circuit cannot operate during normal operation.

**INPUT/OUTPUT CIRCUIT**



**ABSOLUTE MAXIMUM RATINGS** ( $T_a=25^{\circ}\text{C}$ , unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>cc</sub>	Supply voltage		-0.5 – +12	V
V <sub>cc'</sub>	Output Supply voltage		-0.5 – +20	V
V <sub>i</sub>	Input voltage	$V_i < V_{cc}$	0 – V <sub>cc</sub>	V
V <sub>o</sub>	Output voltage		-0.5 – V <sub>cc</sub> +2.5	V
I <sub>O(max)</sub>	Allowable motor rush current	t <sub>OP</sub> = 10ms: cycle time 0.2Hz or less	±800	mA
I <sub>o</sub>	Continuous output current		±150	mA
P <sub>d</sub>	Power dissipation	T <sub>a</sub> = 60°C (M54641L)	570	mW
T <sub>j</sub>	Junction temperature		100	°C
T <sub>opr</sub>	Operating temperature		-10 – 60	°C
T <sub>stg</sub>	Storage temperature		-55 – 125	°C

**RECOMMENDED OPERATING CONDITION** ( $T_a = 25^{\circ}\text{C}$ , unless otherwise noted)

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V <sub>cc</sub>	Supply voltage		4	5	10	V
I <sub>o</sub>	Output current				±100	mA
V <sub>IH</sub>	“H” input voltage		3.0		V <sub>cc</sub>	V
V <sub>IL</sub>	“L” input voltage		0		0.6	V
t <sub>s</sub>	Motor braking interval		10	100		ms
T <sub>s</sub>	Operation temperature of thermal protection circuit (junction temperature)		100	120		°C

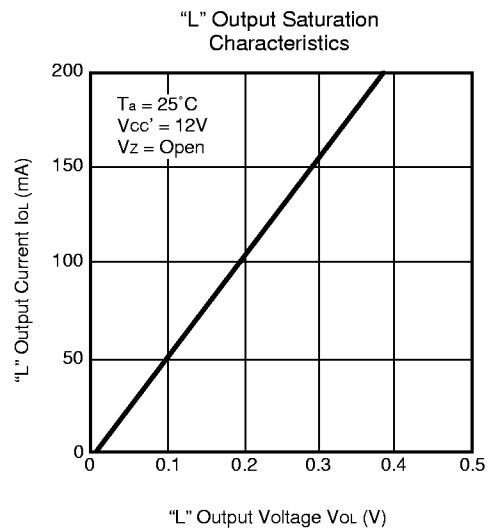
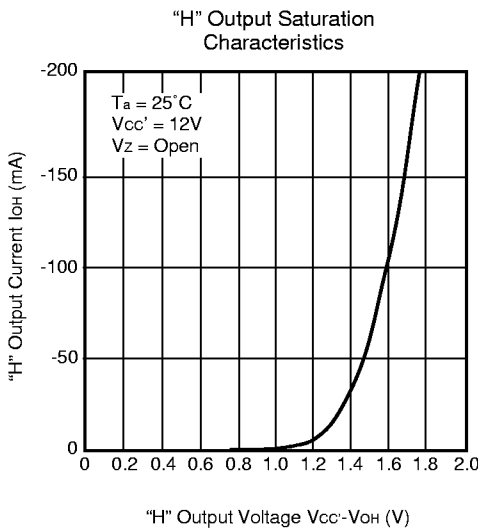
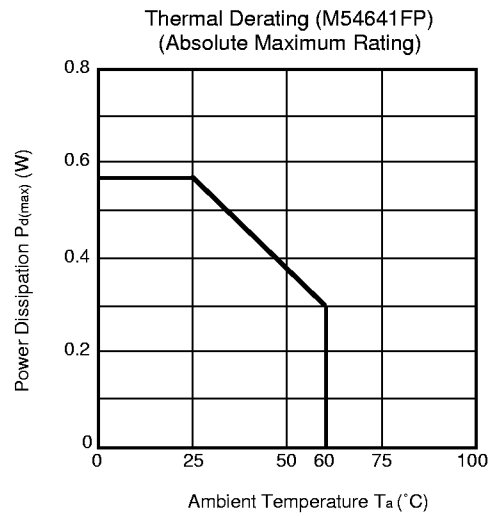
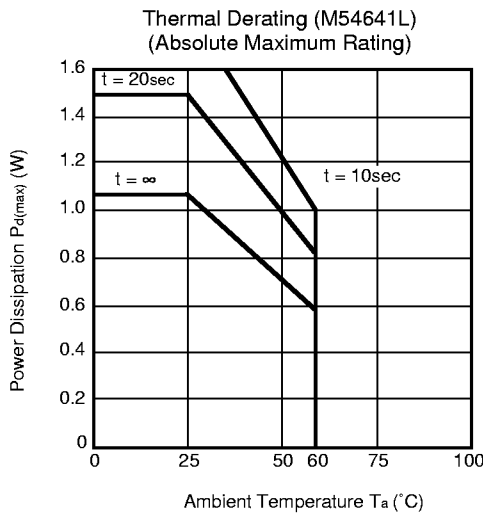
**M54641L/FP**

BI-DIRECTIONAL MOTOR DRIVER WITH BRAKE FUNCTION

**ELECTRICAL CHARACTERISTICS** (Ta=25°C, Vcc = 5V, unless otherwise noted)

Symbol	Parameter	Test conditions		Limits			Unit	
				Min.	Typ.	Max.		
Io(leak)	Output leak current	Vcc' = 20V Vz: Open	Vo = 20V			100	μA	
			Vo = 0V			-100		
VOH	"H" output saturation voltage	Vcc' = 12V Vz: Open	IOH = -50mA	10.2	10.5		V	
			IOH = -100mA	10.0	10.4			
VOL	"L" output saturation voltage	Vcc' = 12V Vz: Open	IOH = 50mA		0.1	0.3	V	
			IOH = 100mA		0.2	0.4		
VO1-O2	Voltage between outputs (1) and (2) (Voltage across Motor)	Vcc' = 12V Vz = 7V	Io = ±100mA	6.3	7.0	7.7	V	
Ii	Input voltage	Vcc' = 12V	Output open		VI = 3V	100	180	μA
					VI = 5V		240	
Icc	Supply current	Vcc = 10V Vcc' = 12V Output OPEN	In "OFF" state		1.2	3.0	mA	
			Forward rotation or reverse rotation		4.5	8.0		
			Braking		7.5	12.0		

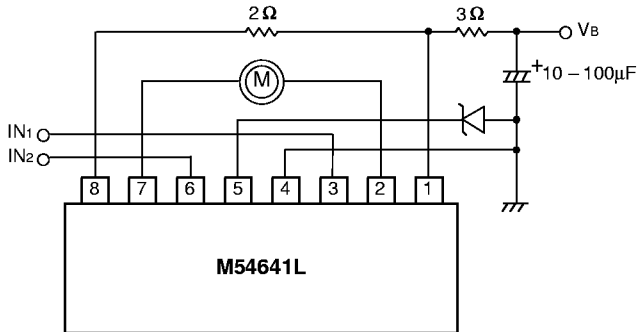
**TYPICAL CHARACTERISTICS** Condition • With basic installation (epoxy board of 5cm x 5cm x 0.8mm with copper foil on a single side)  
• t : Power apply time



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### APPLICATION EXAMPLE



### 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. 10μs.

