

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

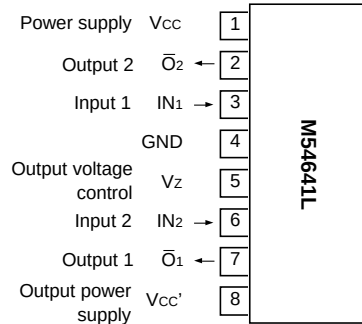
The M54641 is an IC for driving a smallsize bi-directional motor that rotates in both forward and reverse directions. Giving signal to inputs IN₁ and IN₂ outputs the signal of the same phase to output pins O₁ and O₂. That is, giving high-level signal to input IN₁ and low-level signal to input IN₂ sets output $\overline{O_1}$ to high-level and output $\overline{O_2}$ to low-level. Connection of a motor between output pins $\overline{O_1}$ and $\overline{O_2}$ uses $\overline{O_1}$ as an output current source and $\overline{O_2}$ as an output current sink to rotate the motor. In addition, giving the reverse signal to inputs IN₁ and IN₂ sets $\overline{O_1}$ and $\overline{O_2}$ to low-level and high-level, respectively, resulting in rotating the motor reversely. However, when both IN₁ and IN₂ are set to “H”, both $\overline{O_1}$ and $\overline{O_2}$ 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 Vz pin, the output "H" voltage does not rise over the Zener voltage and the motor rotates at constant speed.

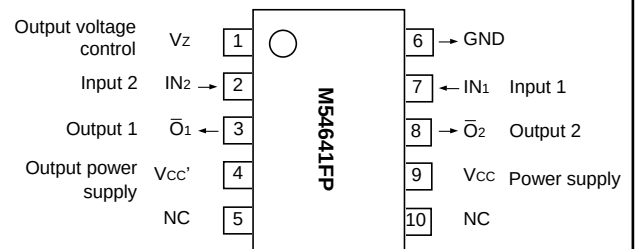
If the Vz pin is connected to the output power supply Vcc pin, the rotating speed of the motor can be varied by varying the Vcc voltage.

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)



Outline 8P5



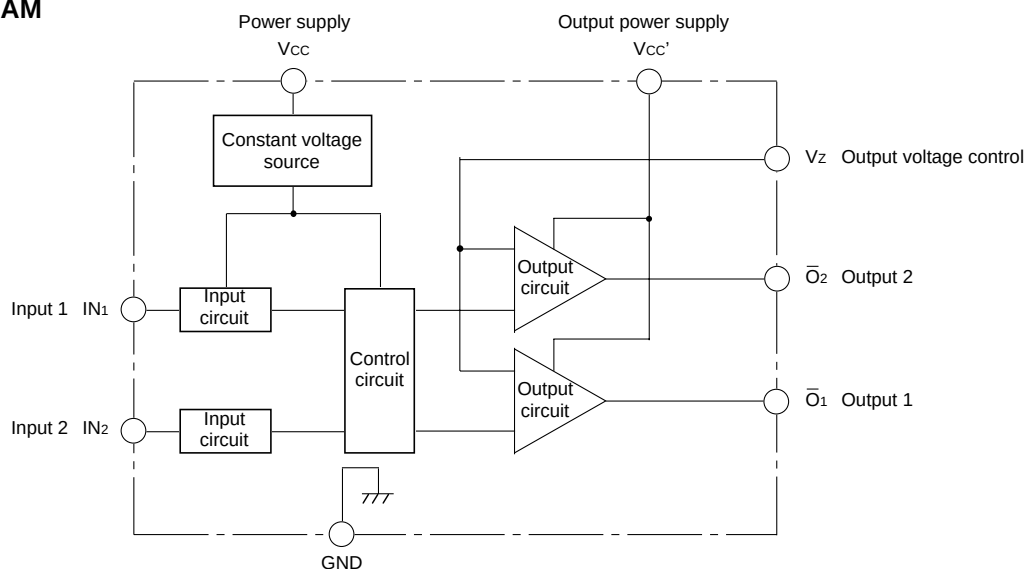
Outline 10P2-C

NC: no connection

LOGIC TRUTH TABLE

Input		Output		Remarks
IN ₁	IN ₂	$\overline{O}_1$	$\overline{O}_2$	
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

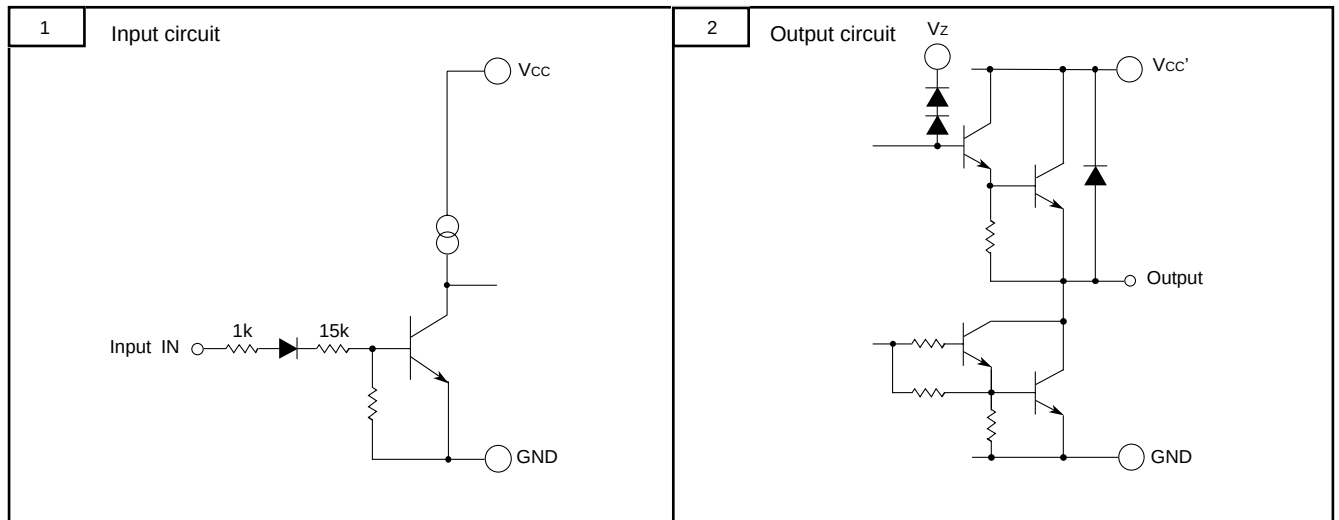
BLOCK DIAGRAM



BI-DIRECTIONAL MOTOR DRIVER WITH BRAKE FUNCTION

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 (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
Vcc	Supply voltage		-0.5 – +12	V
Vcc'	Output Supply voltage		-0.5 – +20	V
Vi	Input voltage	Vi < Vcc	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	±800	mA
Io	Continuous output current		±150	mA
Pd	Power dissipation	Ta = 60°C(M54641L)	570	mW
Tj	Junction temperature		100	°C
Topr	Operating temperature		-10 – 60	°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	5	10	V
Io	Output current				±100	mA
ViH	“H” input voltage		3.0		Vcc	V
ViL	“L” input voltage		0		0.6	V
ts	Motor braking interval		10	100		ms
Ts	Operation temperature of thermal protection circuit (junction temperature)		100	120		°C

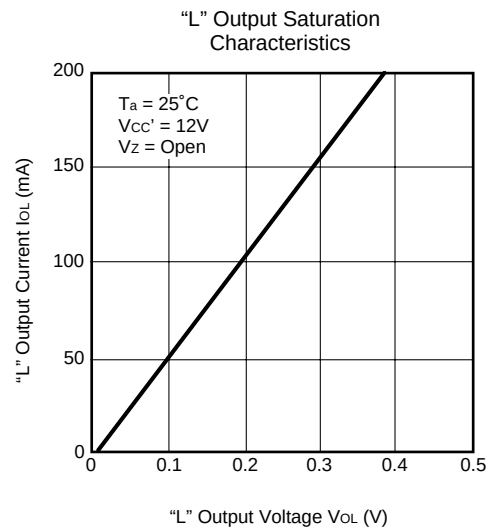
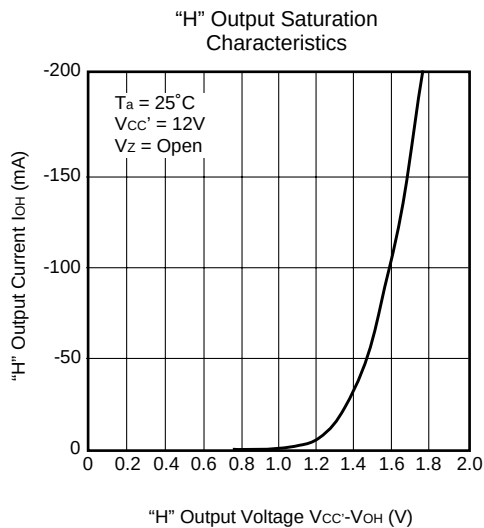
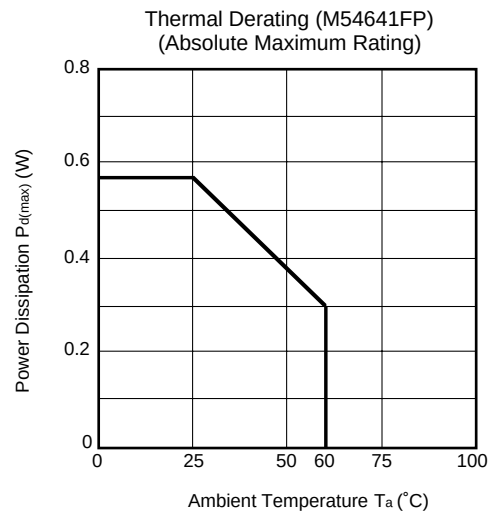
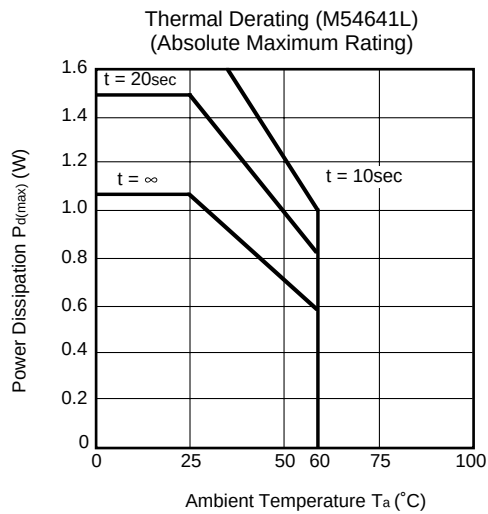
M54641L/FP

Bi-DIRECTIONAL MOTOR DRIVER WITH BRAKE FUNCTION

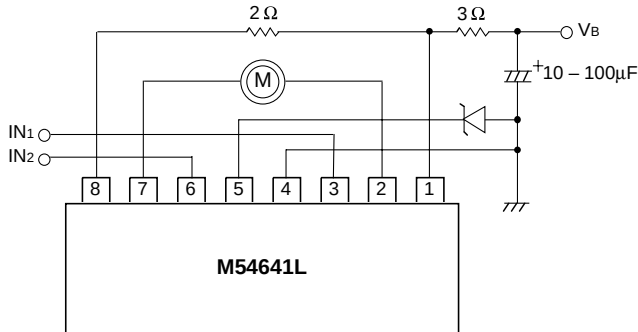
ELECTRICAL CHARACTERISTICS (Ta=25°C, Vcc = 5V, unless otherwise noted)

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	
Vo1-02	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	Vi = 3V Vi = 5V	Output open	100	180	μA
					240	380	
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



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.

