M54644BL

BI-DIRECTIONAL MOTOR DRIVER

DESCRIPTION

The M54644BL is a semiconductor IC capable of directly driving a smallsize bi-directional motor for forward/reverse rotation.

FEATURES

- Wide operating voltage range (Vcc = 4V to 16V)
- Low output saturation voltage (large voltage across motor)
- Built-in clamp diode
- Large output current drive (Io (max) = ±2A)
- With brake function
- Built-in thermal protector circuit

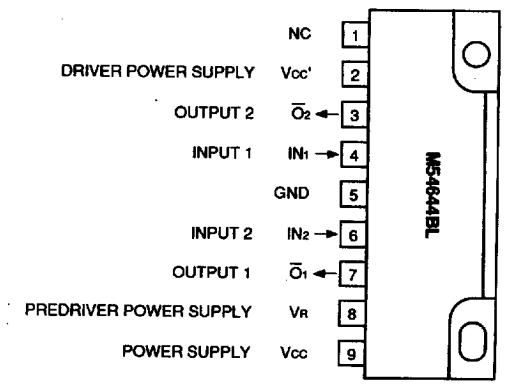
APPLICATION

Commercial-use equipment, audio such as tape recorder or radio cassette recorder.

FUNCTIONAL DESCRIPTION

The M54644BL consists of input circuits, a control circuit, output circuits, a thermal protector circuit and a constant current circuit.
As given in the logic truth table, the basic operations include determination of status of outputs $\overline{O_1}$ and $\overline{O_2}$ in correspondence with inputs IN_1 and IN_2, and four operational controls of forward rotation, reverse rotation, brake and stop of a motor.
Normally, the V_R pin is a power supply for predrive but can be used as a pin for controlling the level of "H" output voltage (application example 4).
The IC is provided with a built-in thermal protector circuit. If the chip temperature (junction temperature) is 125°C or over, the circuit operation is stopped to protect the IC. For normal use, the power dissipation should not be exceeded.

PIN CONFIGURATION (TOP VIEW)



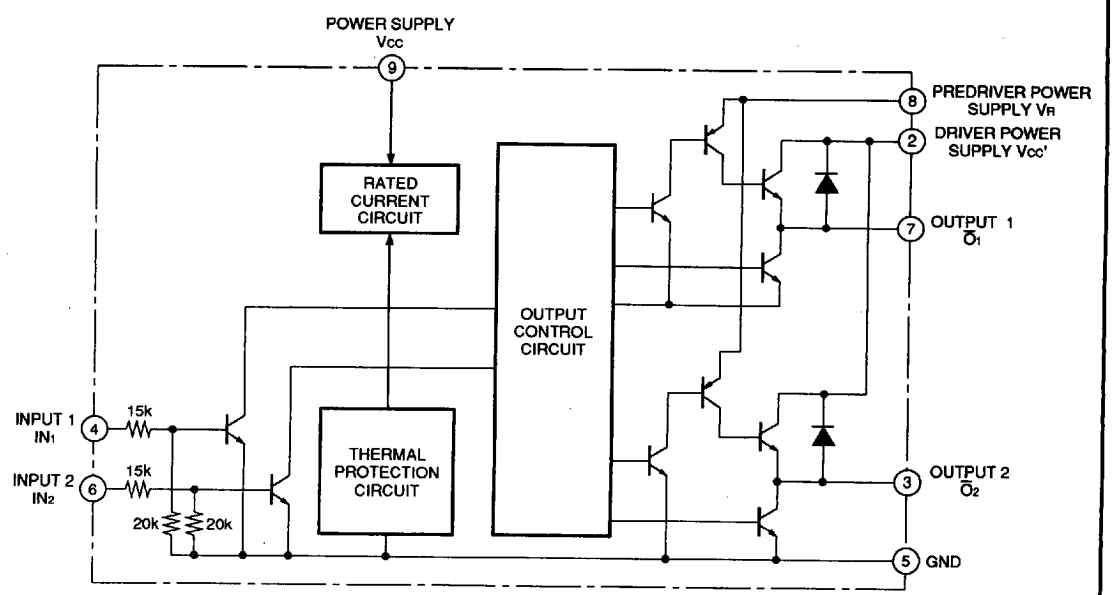
Outline 9P9

NC : NO CONNECTION

LOGIC TRUTH TABLE

INPUT		OUTPUT		NOTE
IN_1	IN_2	$\overline{O_1}$	$\overline{O_2}$	
L	L	OFF	OFF	Open
H	L	H	L	ex.Forward
L	H	L	H	ex.Reverse
H	H	L	L	Braking

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta=25℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		-0.5 to +16	V
V_{CC}'	Driver supply voltage	With an external heat sink ($30cm^2 \times 1.5mm$)	-0.5 to +24	V
V_R	Control voltage		-0.5 to +24	V
V_I	Input voltage	$V_I < V_{CC}$	0 to 7	V
V_O	Output voltage		-0.5 to V_{CC}'+2.5	V
$I_{O(max)}$	Peak output current	top≦100ms:Repetitive cycle 5sec max	±2	A
I_O	Continuous output current	With an external heat sink ($30cm^2 \times 1.5mm$)	±600	mA
P_d	Power dissipation		1.54	W
T_{opr}	Operating temperature		-10 to +75	℃
T_{stg}	Storage temperature		-55 to +125	℃

RECOMMENDED OPERATING CONDITIONS (Ta=25℃, unless otherwise noted)

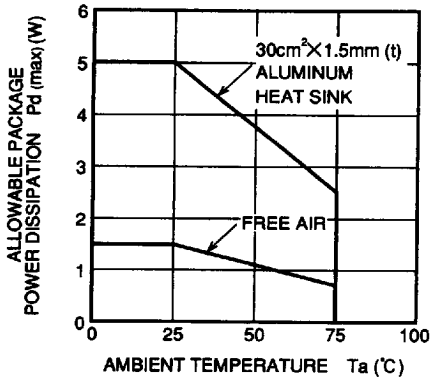
Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	Supply voltage		4	5	16	V
I_O	Continuous output current	With an external heat sink ($30cm^2 \times 1.5mm$)			±500	mA
V_{IH}	"H" Input voltage		2.0		V_{CC}	V
V_{IL}	"L" Input voltage		0		0.4	V
t_B	Motor braking interval		10	100		ms
T_{shut}	Thermal shutdown temperature		125	150		℃
V_R	Control voltage		0		V_{CC}'	V

ELECTRICAL CHARACTERISTICS (Ta=25℃, unless otherwise noted)

Symbol	Parameter	Test conditions		Limits			Unit
				Min.	Typ.	Max.	
$I_{O(leak)}$	Output leak current	V_{CC}=16V, V_{CC}'=V_R=24V V_{I1}=V_{I2}=0.4V, V_O=0V or 24V				±100	μA
V_{OH}	"H" Output saturation voltage	V_{CC}=V_{CC}'=V_R=16V I_O=-500mA (V_{I1}=0.4V, V_{I2}=2.0V) or (V_{I1}=2.0V, V_{I2}=0.4V)		14.5	15.2		V
V_{OL}	"L" Output saturation voltage	V_{CC}=V_{CC}'=V_R=16V (V_{I1}=0.4V, V_{I2}=2.0V) or (V_{I1}=2.0V, V_{I2}=0.4V)	I_O=200mA		0.1	0.4	V
			I_O=500mA		0.18	1.4	
I_I	Input current	V_{CC}=V_{CC}'=V_R=16V V_I=2.0V		50	90	120	μA
I_{CC}	Supply current	V_{CC}=16V, V_{CC}'=V_R=16V V_{I1}=V_{I2}=0V Output open			2.6	5	mA
		V_{CC}=16V, V_{CC}'=V_R=16V Output open (V_{I1}=0.4V, V_{I2}=2.0V) or (V_{I1}=2.0V, V_{I2}=0.4V)			8	15	
		V_{CC}=16V, V_{I1}=V_{I2}=2.0V V_{CC}=V_R=16V Output open			14	25	
I_R	Control pin input current	V_{CC}=16V, V_{CC}'=V_R=16V (V_{I1}=0.4V, V_{I2}=2.0V) or (V_{I1}=2.0V, V_{I2}=0.4V)			0.2	1.0	mA

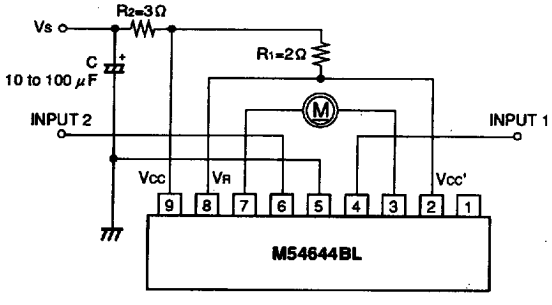
TYPICAL CHARACTERISTICS

THERMAL DERATING (MAXIMUM RATING)

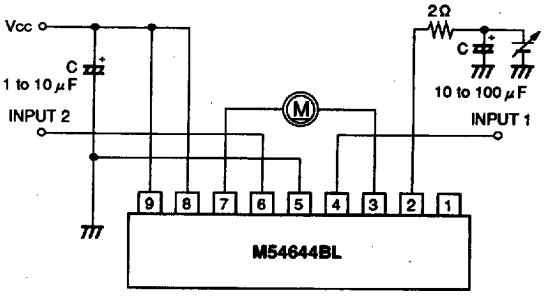


APPLICATION EXAMPLES

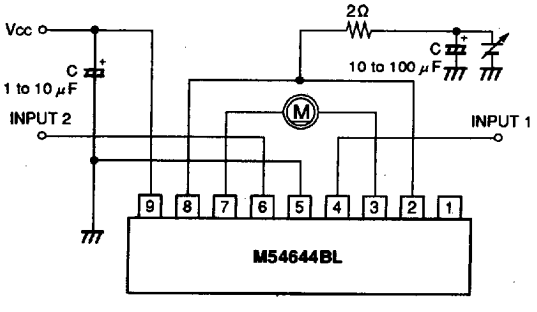
1) Motor speed control by Vcc, Vcc' and VR



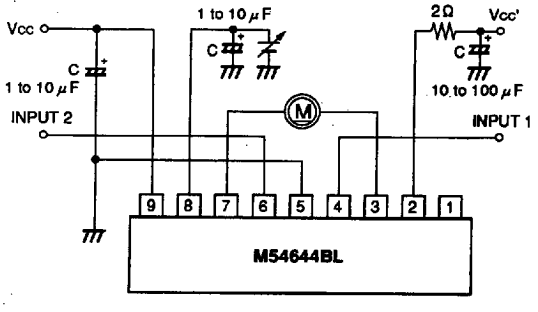
2) Motor speed control by the Vcc'



3) Motor speed control by the VR and Vcc'



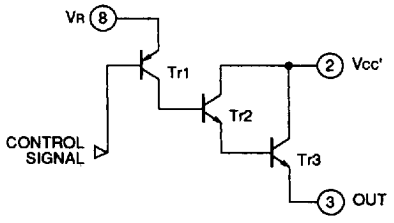
4) Motor speed control by the VR



PRECAUTIONS FOR APPLICATION

1. Output voltage control method

The output control circuit by pin No.8 is as shown at right. Voltage about 1.4V lower than that at pin No.8 is output ("H" side).
$V_{OH} \fallingdotseq V_R - V_{sat}(Tr1) - V_{BE}(Tr2) - V_{BE}(Tr3)$
However, when V_R is 1.4V or below, V_{OH}=0V.



2. Allowable power dissipation

The allowable power dissipation (Pd) of IC is calculated as follows:
$Pd \fallingdotseq Vcc \times Icc + Io \times \{(Vcc' - V_{OH}) + V_{OL}\}$
In design, do not exceed the maximum allowable power dissipation indicated in the thermal derating diagram.
Remember that If rush current flows repeatedly, the power dissipation becomes small.

3. Thermal shut-down

A thermal breaker is built in the circuit to prevent thermal destruction when overpower is applied.
The function works when the IC chip temperature goes to 150℃ (min. 125℃), placing the IC in the output OPEN mode. When the temperature goes down to 100℃ (max. 125℃), the function is reset.

- The thermal protection of the IC may not work depending on an abnormal condition (such as oscillation, low supply voltage or output short). When using the function, check its operation in the packaged state.
  If the motor has a large counter electromotive force at a braking time, etc., the internal parasitic Di may malfunction.
  If fly-back current of 1A or more flows, put a shottkey Di between the output and the GND.
  Remember that the IC has an about 10 μs delay in output switching for high-speed applications such as PWM.

4. Notice

As far as motor control and driver IC's are concerned, some possibilities are considered for these IC's to cause such unexpected cases as fire or smoke if they are used beyond its ratings in datasheet or used, even transiently, under the overload conditions. So your action will be highly appreciated to fully look into the rating limits and the using conditions before you use these IC's.
And if these IC's are to be used under the conditions out of our specifications, please never fail to give us a contact as to under what conditions they are used.