M54685L

Bi-DIRECTIONAL MOTOR DRIVER WITH GOVERNOR

DESCRIPTION

The M54685L 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} = 4.5 – 14V)
- Possible direct driving with TTL, PMOS and CMOS outputs
- Small outline (10-pin SIP)
- Built-in clamp diode
- Low output saturation voltage (large voltage across motors)
- Large output current drive ($I_{O(max)}$ = 500mA)
- Provided with brake functions
- Built-in thermal shutdown protection circuit

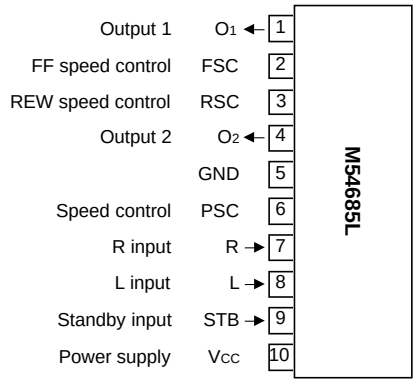
APPLICATION

Micro-cassette for phone-answering machine, tape deck, radio cassette, and other sound equipment, and VTR and general consumption appliances

FUNCTION

The M54685L is an IC that can control the forward rotation, reverse rotation and speed of small DC brush motor.
For the basic operation of this IC, output modes are selected, as shown in the logic truth table at right, by applying appropriate TTL-level input to R, L and STB inputs.
The PLAY mode is a mode where speed is controllable and is used to control the speed of motor by using two resistances, R_T and R_S, as shown in the application example. R_T and R_S are generally given by the following formulae:
$R_T = K \cdot R_a$ (K: current proportional constant, R_a: Motor armature resistance)
$R_S = K_a \cdot N/IB$ (N: rotating speed, K_a: Motor generation constant, IB: PSC bias current)
FSC and RSC are pins to connect resistance that restricts the rotating speed in FF and PLAY.

PIN CONFIGURATION (TOP VIEW)

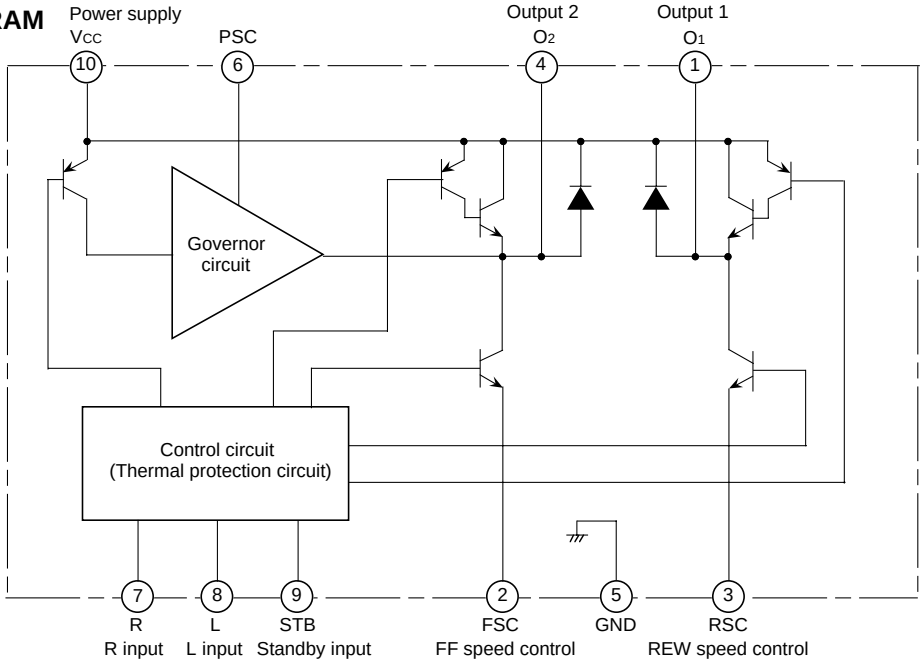


Outline 10P5

LOGIC TRUTH TABLE

R	L	STB	Mode
L	L	H	High speed forward rotation (FF)
L	H	H	GOVERNOR forward rotation (PLAY)
H	L	H	High speed reverse rotation (REW)
H	H	H	Brake
—	—	L	Standby

BLOCK DIAGRAM



PIN FUNCTION NAME

Pin No.	Pin name	Name
①	O_1	Output pin for motor driving
②	FSC	Fast forward rotating speed adjustment pin
③	RSC	Fast reverse rotating speed adjustment pin
④	O_2	Output pin for motor driving
⑤	GND	Ground
⑥	PSC	Governor forward rotation speed control pin
⑦	R	Output mode selection input pin
⑧	L	Output mode selection input pin
⑨	STB	Standby input pin (power save function)
⑩	V_{CC}	Power supply

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

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		-0.5 – 16	V
V_I	Input voltage		-0.5 – V_{CC}	V
V_O	Output voltage		-0.5 – V_{CC}+2.5	V
I_{Op}	Allowable motor rush current	t_{ON}≤5sec, duty of 10% or less	±500 (Note 1)	mA
I_O	Continuous output current	However, P_d must not exceed the maximum rating	±200	mA
P_d	Power dissipation	T_a = 50˚C, when mounted in glass epoxy board	1.2	W
T_{opr}	Operating temperature		-20 – 75	˚C
T_{stg}	Storage temperature		-40 – 125	˚C

Note 1: When mode is switched to FF or REW mode, up to 1.0A is allowed as sink current (I_{OL}) with t_{ON}≤100ms.

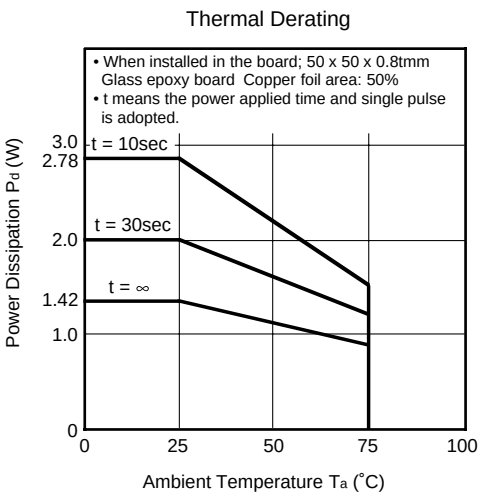
RECOMMENDED OPERATING CONDITION (Ta = 25˚C, unless otherwise noted)

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_{CC}	Supply voltage	4.5	6.0	14	V
V_{IH}	“H” input voltage	2.0		V_{CC}	V
V_{IL}	“L” input voltage	0		0.4	V

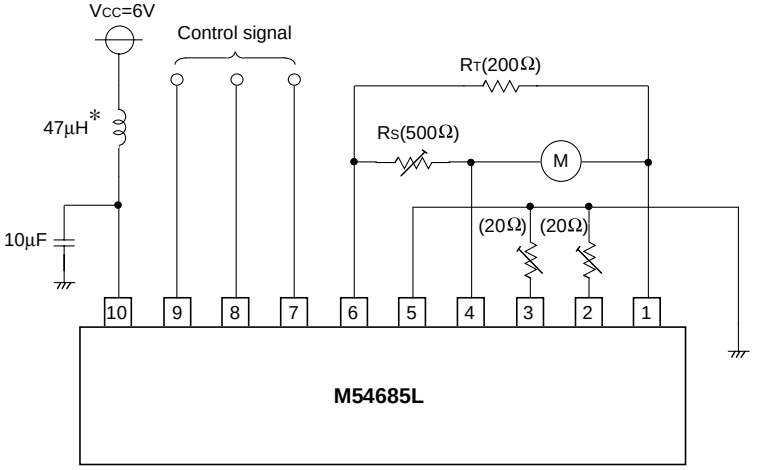
ELECTRICAL CHARACTERISTICS (Ta = 25˚C, Vcc = 6V, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
I_{IH}	"H" input current	V_{IH} = 5V	0.1	0.22	0.4	mA
I_{IL}	"L" input current	V_{IL} = 0V	0	0	10	μA
V_{OH}	"H" output voltage	FF, REV mode I_O = -150mA	V_{CC}-1.1	V_{CC}-0.9	V_{CC}-0.7	V
		PLAY mode I_O = -150mA	V_{CC}-1.1	V_{CC}-0.9	V_{CC}-0.7	
V_{OL}	"L" output voltage	FF, REV mode I_O =150mA	0.1	0.2	0.4	V
		PLAY mode R_a = 5Ω		1.2	2	
V_{ref}	Reference voltage		0.85	1.00	1.15	V
I_B	Bias current			1.3	1.8	mA
K	Current proportional constant	ΔI_{O2} = 40mA	35	40	45	—
$\frac{\Delta V_{ref}}{V_{ref}} / \Delta V_{CC}$	Voltage characteristic (1)	V_{CC} = 4.5 – 14V		0.1		%/V
$\frac{\Delta K}{K} / \Delta V_{CC}$	Voltage characteristic (2)	V_{CC} = 4.5 – 14V, ΔI_{O2} = 40mA		0.2		%/V
$\frac{\Delta V_{ref}}{V_{ref}} / \Delta I_{O2}$	Current characteristic (1)	I_{O2} = 50 – 200mA		0.02		%/mA
$\frac{\Delta K}{K} / \Delta I_{O2}$	Current characteristic (2)	I_{O2} = 50 – 200mA		0.01		%/mA
$\frac{\Delta V_{ref}}{V_{ref}} / \Delta T_a$	Temperature characteristic (1)	T_a = -20 – 75˚C		0.01		%/˚C
$\frac{\Delta K}{K} / \Delta T_a$	Temperature characteristic (2)	T_a = -20 – 75˚C, ΔI_{O2} = 40mA		0.01		%/˚C
$I_{CC(S)}$	Standby supply current	V_{CC} = 16V		0	100	μA
I_{CC}	Supply current	FF, REV mode Output OPEN		17	35	mA
		PLAY mode Output OPEN		5.0	7.0	
		Brake mode Output OPEN		30	60	

TYPICAL CHARACTERISTICS



APPLICATION EXAMPLE



* Insert, if necessary.

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.