

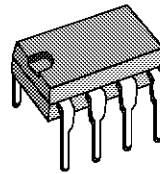
## SPEED REGULATOR FOR DC MOTORS

- MATCHING FLEXIBILITY TO MOTORS WITH VARIOUS CHARACTERISTICS
- BUILT-IN CURRENT LIMIT
- ON-CHIP 1.2V REFERENCE VOLTAGE
- STARTING CURRENT: 0.5 A @ 2.5V
- REFLECTION COEFFICIENT  $K = 20$

### DESCRIPTION

The TDA1154 is a monolithic integrated circuit intended for speed regulation of permanent magnet dc motors used in record players, tape recorders, cassette recorders and toys.

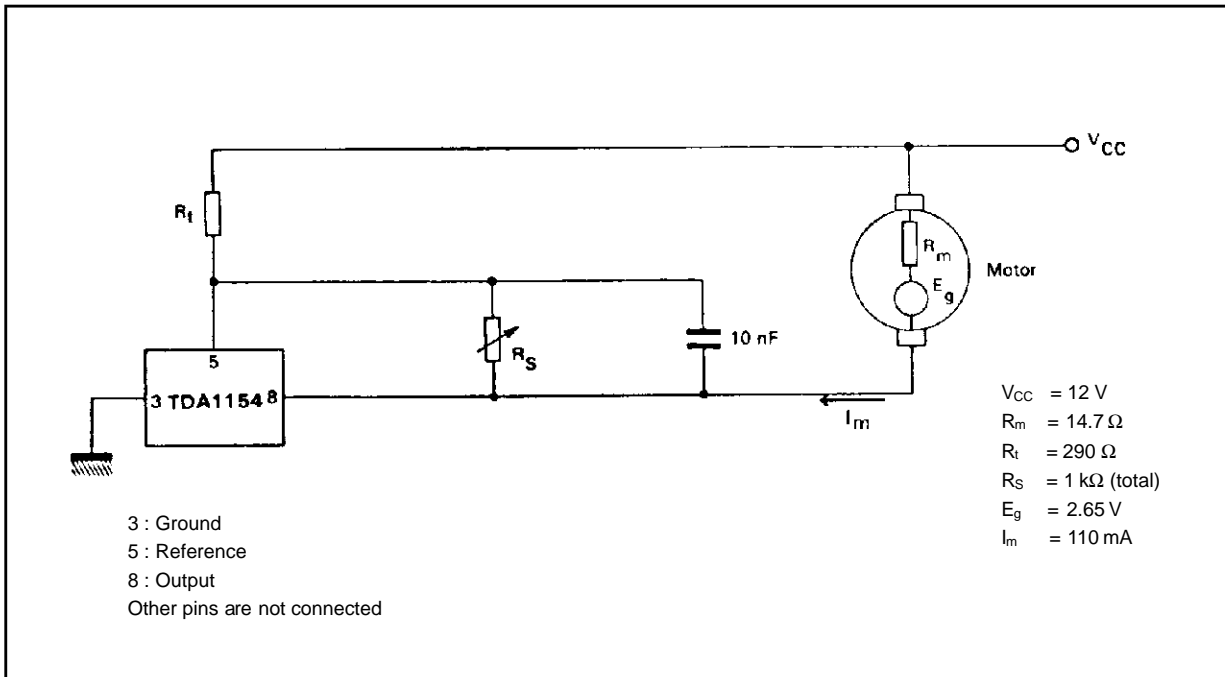
The circuit offers an excellent speed regulation with much higher power supply, temperature and load variations than conventional circuits built around discrete components.



Minidip

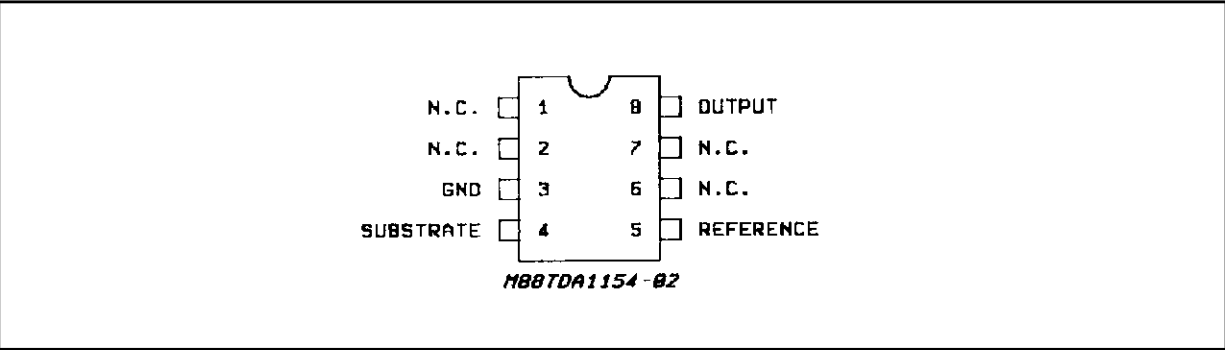
ORDERING NUMBER : TDA1154

Figure 1. Application circuit



TDA1154

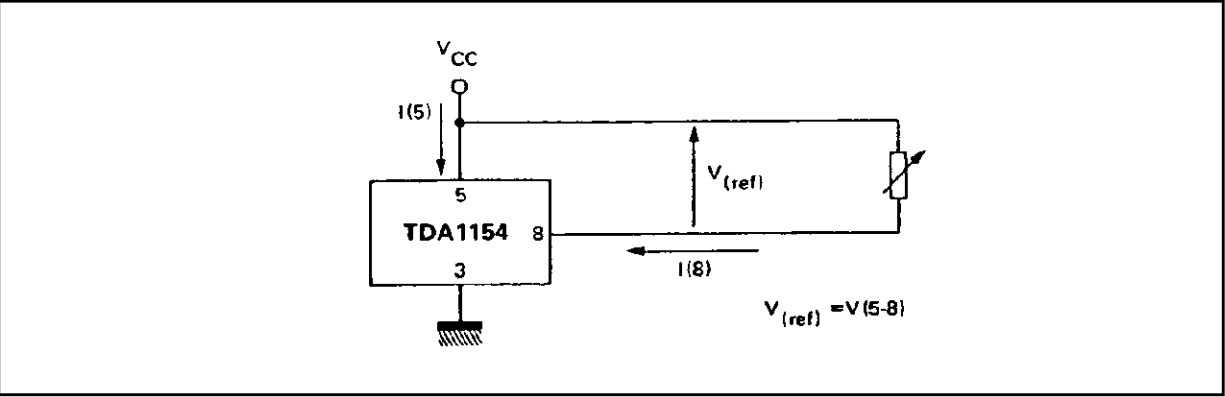
PIN CONNECTION (Top view)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage	20	V
$I_O$	Output current	1.2	A
$P_{tot}$	Power dissipation	(see curve)	W
$T_j$	Junction temperature	+150	°C
$T_{stg}$	Storage temperature range	-55 to +150	°C

Figure 2. Test circuit



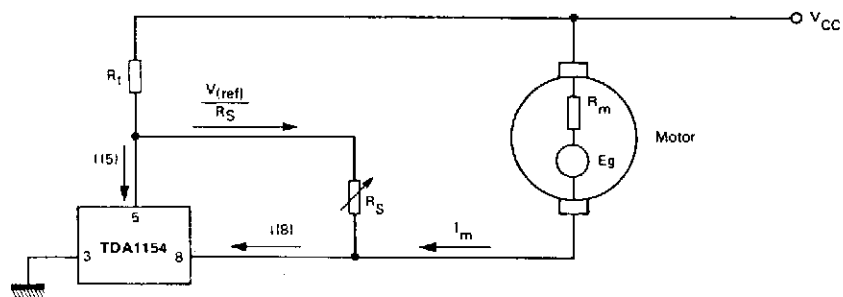
THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{th-j-amb}$	Thermal resistance junction-ambient	max 100	°C/W
$R_{th-j-pin\ 4}$	Thermal resistance junction-pin 4	max 70	°C/W

**ELECTRICAL CHARACTERISTICS**  $T_{amb} = +25^{\circ}\text{C}$  (Unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(ref)}$	Reference voltage	$V_{CC} = +6\text{V}$ $I(8) = 0.1\text{A}$	1.15	1.25	1.35	V
$\frac{\Delta V_{(ref)}}{V_{(ref)}} / \Delta T$	Reference voltage temperature coefficient	$V_{CC} = +6\text{V}$ $I(8) = 0.1\text{A}$ $T_{amb} = -20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$	-	0.02	-	%/ $^{\circ}\text{C}$
$\frac{\Delta V_{(ref)}}{V_{(ref)}} / \Delta V_{CC}$	Line regulator	$V_{CC} = +4\text{V}$ to $+18\text{V}$ $I(8) = 0.1\text{A}$	-	0.02	-	%/V
$\frac{\Delta V_{(ref)}}{V_{(ref)}} / \Delta I(8)$	Load regulator	$V_{CC} = +6\text{V}$ $I(8) = 25$ to $400\text{mA}$	-	0.009	-	%/mA
$V(5 - 3)$	Minimum supply voltage	$I(8) = 0.1\text{A}$ $\frac{\Delta V_{(ref)}}{V_{(ref)}} = -5\%$	2.5	-	-	V
$I(8)$	Starting current(*)	$\frac{\Delta V_{(ref)}}{V_{(ref)}} = -50\%$  $V_{CC} = +5\text{V}$ $V_{CC} = +2.5\text{V}$	1.2 0.5	- 0.8	- -	A
$I_o(5)$	Quiescent current on pin 5	$V_{CC} = +6\text{V}$ $I(8) = 100\mu\text{A}$	-	1.7	-	mA
K	$K = \frac{\Delta I(8)}{\Delta I(5)}$ reflection coefficient	$V_{CC} = +6\text{V}$ $I(8) = 0.1\text{A}$	18	20	22	
$\frac{\Delta K}{K} / \Delta V_{CC}$	K spread versus $V_{CC}$	$V_{CC} = +6\text{V}$ to $+18\text{V}$ $I(8) = 0.1\text{A}$	-	0.45	-	%/V
$\frac{\Delta K}{K} / \Delta I(8)$	K spread versus $I(8)$	$V_{CC} = +6\text{V}$ $I(8) = 25$ to $400\text{mA}$	-	0.005	-	%/mA
$\frac{\Delta K}{K} / \Delta T$	K spread versus temperature	$V_{CC} = +6\text{V}$ $I(8) = 0.1\text{A}$ $T_{amb} = +20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$	-	0.02	-	%/ $^{\circ}\text{C}$

(\*) An internal protection circuit reduces the current if the temperature of the junction increase:  $I(8) = 0.75\text{A}$  at  $T_j = +140^{\circ}\text{C}$

**OPERATING MODE****Figure 3**

The circuit maintains a 1.2V constant reference voltage between pins 5 and 8:

$$V(5 - 8) = V_{(ref)} = 1.2\text{V}$$

The current  $I(5)$  drawn by the circuit at pin 5 is

sum of two currents.

One is constant:  $I_o(5) = 1.7\text{mA}$  and the other is proportional to pin 8 current  $I(8)$ :

$$I(5) = I_o(5) + I(8)K(a) \quad (I_o(5) = 1.7\text{mA}, K = 20)$$

## TDA1154

If  $E_g$  and  $R_m$  are motor back electromotive force and motor internal resistance respectively, then:

$$E_g + R_m I_m = R_t \left[ I(5) + \frac{V_{(ref)}}{R_S} \right] + V_{(ref)} \quad (b)$$

From figure 2 it is seen that:

$$I(8) = I_m + \frac{V_{(ref)}}{R_S} \quad (c)$$

Substituting equations (a) and (c) into (b) yields:

$$E_g = I_m \left[ \frac{R_t}{K} - R_m \right] + \quad (1)$$

$$+ V_{(ref)} \left[ \frac{R_t}{R_S} \left( 1 + \frac{1}{K} \right) + 1 \right] + R_t I_o(5) \quad (d)$$

(2)

The motor speed will be independent of the resisting torque if  $E_g$  is also independent of  $I_m$ . Therefore, in order to determine the value of  $R_t$  term(1) in (d) must be zero:

$$R_t = K R_m \quad (K = 20)$$

If  $R_t > K R_m$ , an instability may occur as a result of overcompensation.

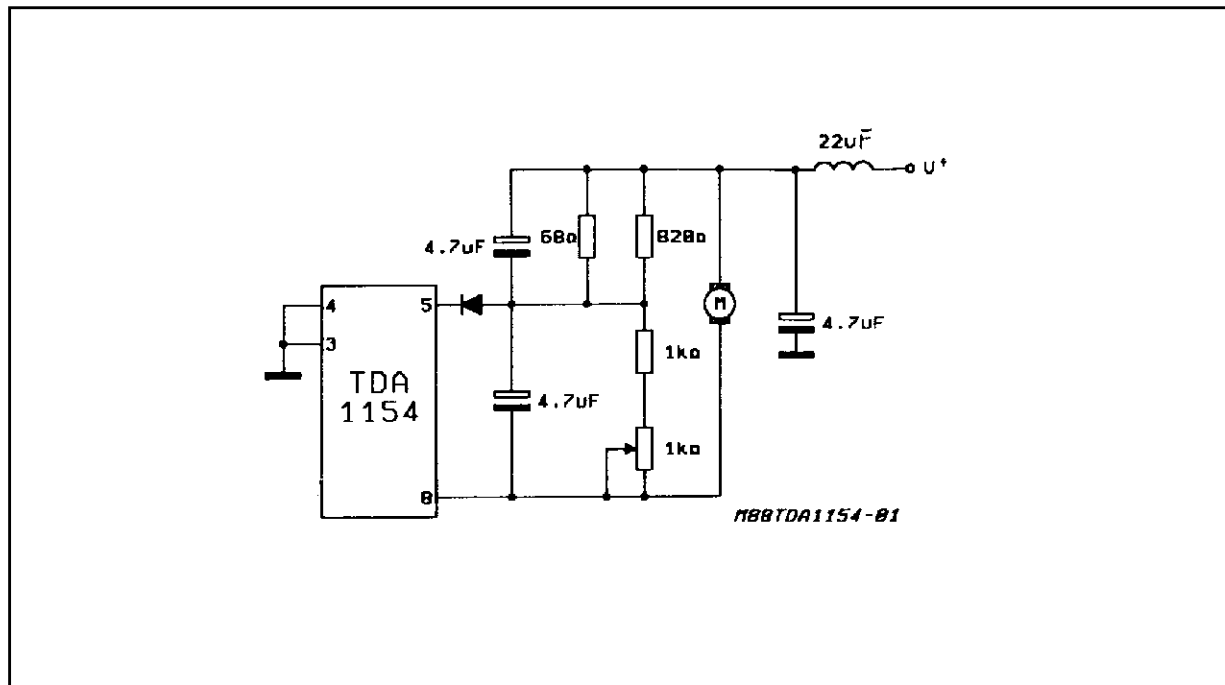
The value of  $R_S$  is determined by term (2) in (d) so as to obtain the back electromotive force ( $E_g$ ) corresponding to required motor speed:

$$R_S = R_t \frac{V_{(ref)} (1 + 1/K)}{E_g - V_{(ref)} - R_t I_o(5)} \equiv$$

$$\equiv R_t \frac{V_{(ref)}}{E_g - V_{(ref)} - R_t I_o(5)}$$

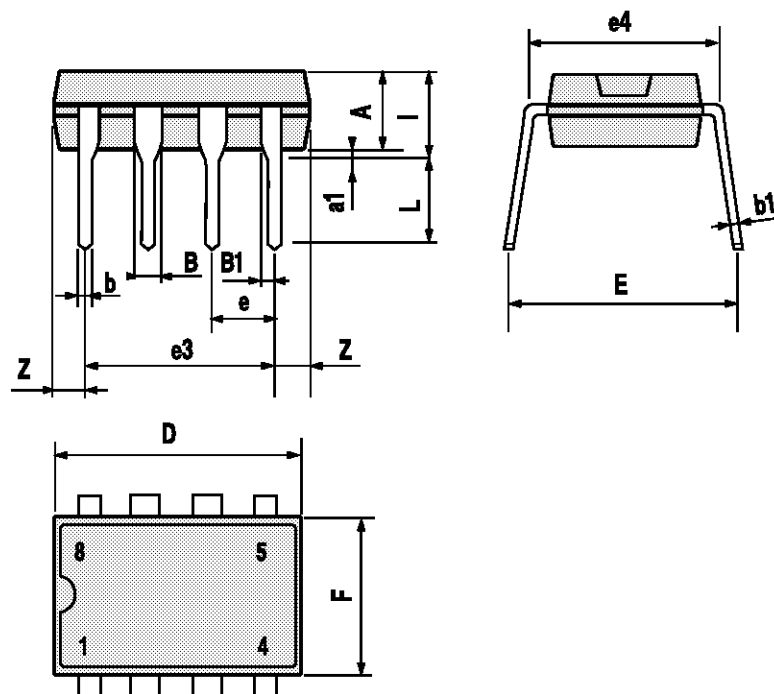
Where  $V_{(ref)} = 1.2V$  and  $I_o(5) = 1.7 mA$

Figure 4. Application circuit



## MINIDIP PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0.260
I			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060



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