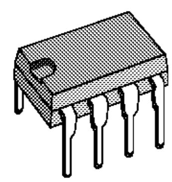
SGS-THOMSON MICROELECTRONICS

TDA1154

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



Minidip

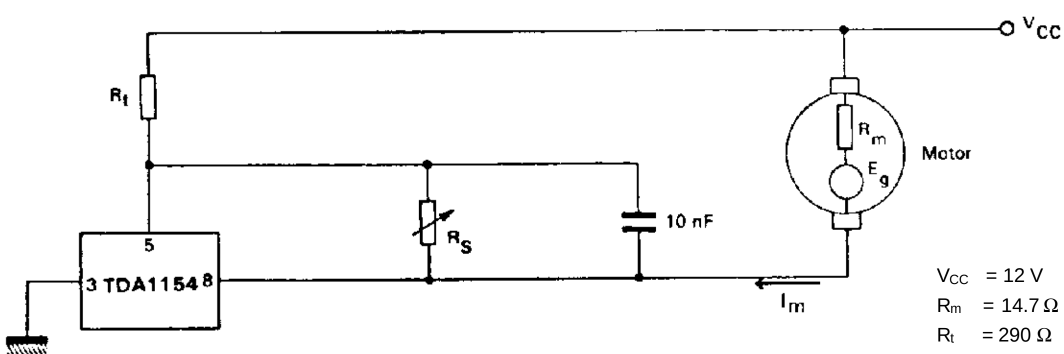
ORDERING NUMBER : TDA1154

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.

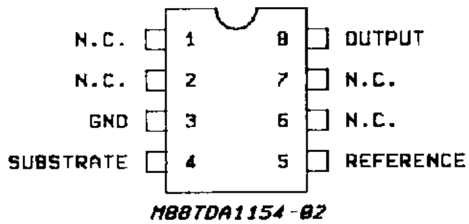
Figure 1. Application circuit



V_{CC} = 12 V
R_m = 14.7 Ω
R_t = 290 Ω
R_S = 1 kΩ (total)
E_g = 2.65 V
I_m = 110 mA

3 : Ground
5 : Reference
8 : Output
Other pins are not connected

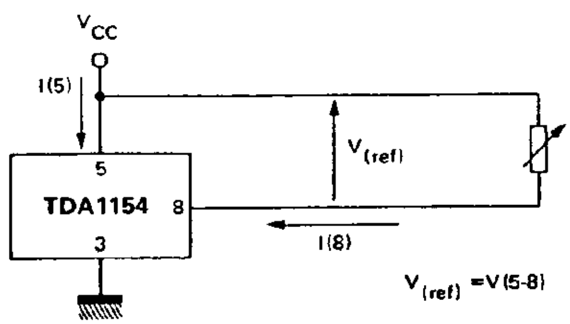
PIN CONNECTION (Top view)



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
$R_{th\text{-}j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W
$Rt_{hj\text{-}amb}$	Thermal resistance junction-pin 4	max	70	°C/W

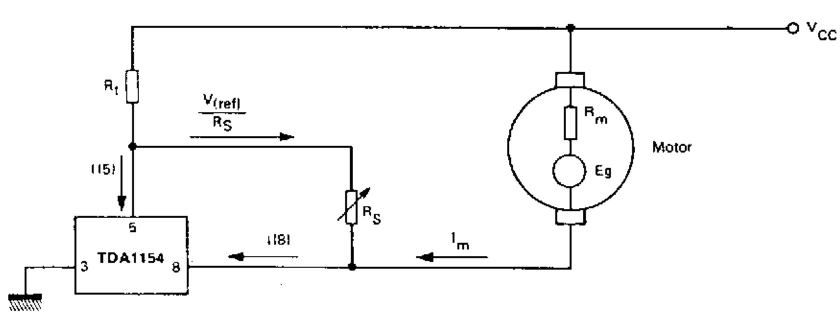
ELECTRICAL CHARACTERISTICS T_{amb} = +25 °C (Unless otherwise specified)

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

(*) An internal protection circuit reduces the current if the temperature of the junction increase: I(8) = 0.75A at T_j = +140 °C

OPERATING MODE

Figure 3



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

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

The current (I(5)) drawn by the circuit at pin 5 is sum of two currents.

One is constant: $I_O(5)$ = 1.7mA and the other is proportional to pin 8 current (I(8)):

$I(5) = I_O(5) + I(8)K$ (a) ($I_O(5)$ = 1.7mA, K = 20)

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:

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

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

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

$$+ V_{(ref)} \underbrace{\left[\frac{R_t}{R_s} \left(1 + \frac{1}{K} \right) + 1 \right]}_{(2)} + R_t I_O(5) \quad (d)$$

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:

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

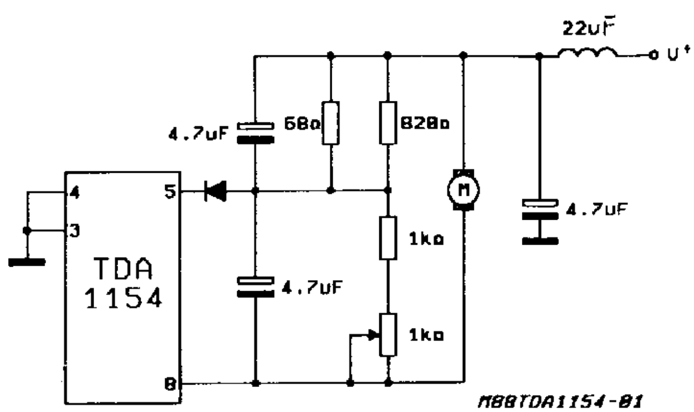
If $R_t > KR_m$, an instability may occur as a result of overcompensation.
The value of R_S is determinated by term (2) in (d) so as to obtain he back electromotive force (E_g) corresponding to required motor speed:

$$R_S = R_t \frac{V_{(ref)} \; (1 + 1/K)}{E_g - V_{(ref)} - R_t I_O(5)} \cong$$

$$\cong R_t \frac{V_{(ref)}}{E_g - V_{(ref)} - R_t I_O(5)}$$

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