

# UTC 1470

# LINEAR INTEGRATED CIRCUIT

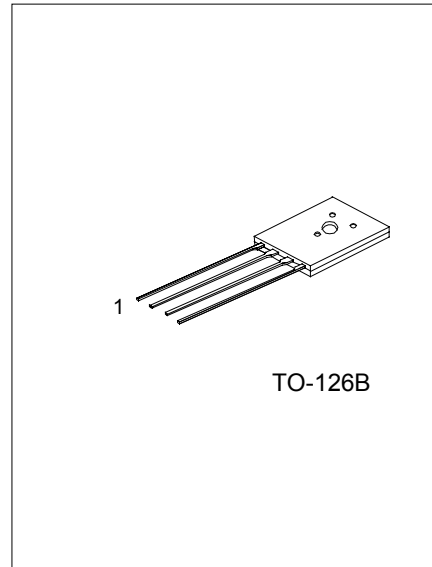
## MOTOR SPEED REGULATORS

### DESCRIPTION

The UTC 1470 is a monolithic integrated circuit intended as speed regulators for DC motors of record players, tape and cassette recorders etc .

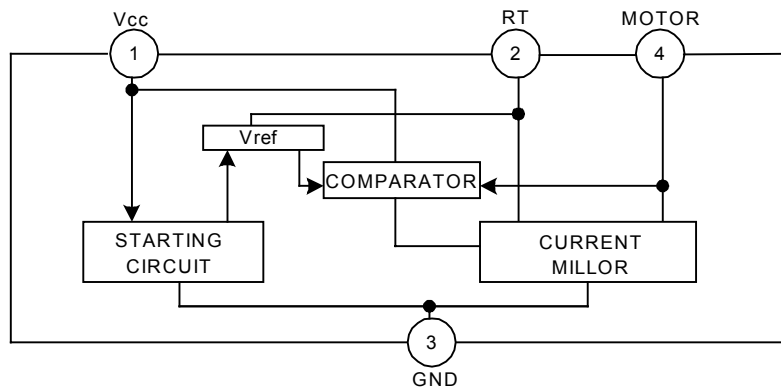
### FEATURES

- \*Excellent Versatility in use.
- \*High Output current.
- \*Low Quiescent current.
- \*Low Reference voltage.
- \*Excellent parameters stability versus temperature.
- \*Excellent characteristic at low supply voltage.



1: Vcc 2: Rt 3: GND 4: MOTOR

### BLOCK DIAGRAM



### ABSOLUTE MAXIMUM RATINGS ( Ta=25°C )

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	Vcc	18	V
Circuit Current	I <sub>4</sub>	2*	A
Package Dissipation	PD	1.2	W
Operating Temperature	Topt	-20 ~ +75	°C
Storage Temperature	TSTG	-40 ~ +150	°C
		*t ≤ 5s	

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## RECOMMENDED OPERATING CONDITION

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage Range	V <sub>cc</sub>	3.5 ~ 16	V

## ELECTRICAL CHARACTERISTICS (T<sub>a</sub>=25°C, V<sub>cc</sub>=12V)

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference Voltage	V <sub>ref</sub>	I <sub>4</sub> =10mA (Fig.1)	1.10	1.27	1.40	V
Quiescent Current	I <sub>d</sub>	R <sub>M</sub> =180Ω (Fig.4)	0.5	0.8	1.2	mA
Reflection Coefficient	k	R <sub>M1</sub> =44Ω, R <sub>M2</sub> =33Ω (Fig.2)	18	20	22	
Saturation Voltage	V <sub>4(sat)</sub>	V <sub>cc</sub> =4.2V, R <sub>M</sub> =4.4Ω (Fig.3)		1.5	2.0	V
	$\frac{\Delta k}{k} / \Delta V_{cc}$	I <sub>4</sub> =100mA, V <sub>cc</sub> =6.3~16V (Fig.2)		0.4		%/V
Line Regulation	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta V_{cc}$	I <sub>4</sub> =100mA, V <sub>cc</sub> =6.3~16V (Fig.1)		0.06		%/V
	$\frac{\Delta k}{k} / \Delta I_M$	I <sub>4</sub> =30~200mA (Fig.2)		-0.02		%/mA
Load Regulation	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta I_M$	I <sub>4</sub> =30~200mA (Fig.1)		-0.02		%/mA
	$\frac{\Delta k}{k} / \Delta T_a$	I <sub>4</sub> =100mA, T <sub>a</sub> =-20~+75°C (Fig.2)		0.01		%/°C
Temperature Coefficient	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta T_a$	I <sub>4</sub> =100mA, T <sub>a</sub> =-20~+75°C (Fig.1)		0.01		%/°C

\*Pulse Test::PW≤10ms,Duty cycle≤2%

## TEST CIRCUIT

Fig.1

$$\left( V_{ref}, \frac{\Delta V_{ref}}{V_{ref}} / \Delta V_{cc}, \frac{\Delta V_{ref}}{V_{ref}} / \Delta I_4, \frac{\Delta V_{ref}}{V_{ref}} / \Delta T_a \right)$$

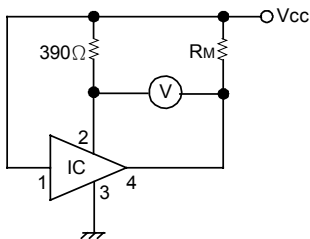
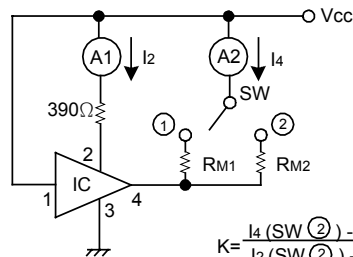


Fig.2

$$\left( k, \frac{\Delta k}{k} / \Delta V_{cc}, \frac{\Delta k}{k} / \Delta I_4, \frac{\Delta k}{k} / \Delta T_a \right)$$



$$K = \frac{I_4(SW \text{ ②}) - I_4(SW \text{ ①})}{I_2(SW \text{ ②}) - I_2(SW \text{ ①})}$$

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Fig.3 (V4(sat))

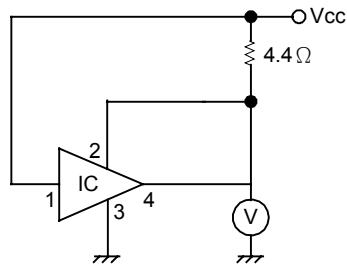
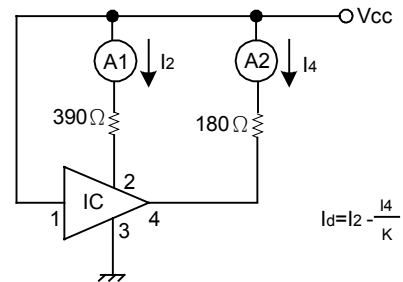
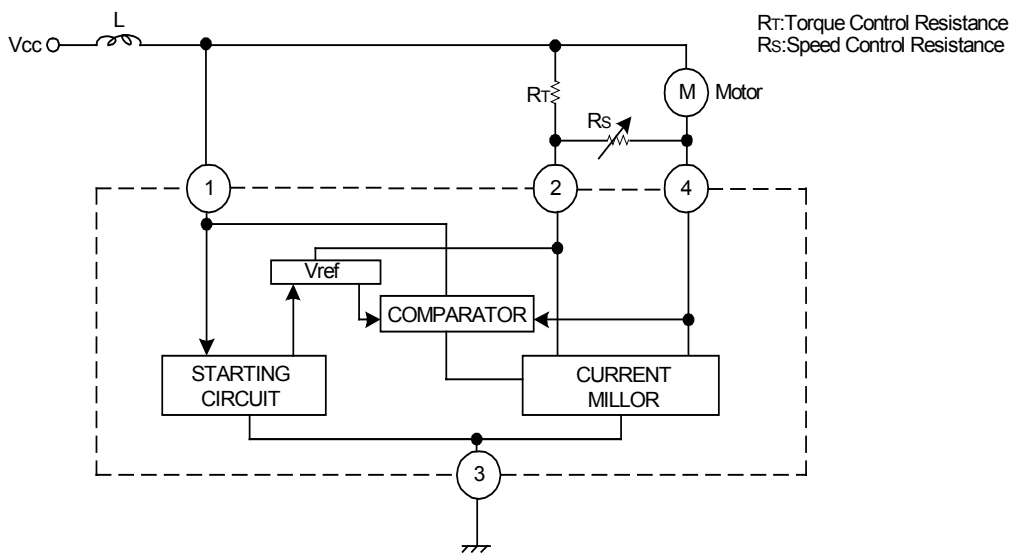


Fig.4 (Id)



## APPLICATION INFORMATION



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## BASIC EQUATION FOR MOTOR

$$\begin{cases} E_t = V_{ref} + R_T (i_2 + \frac{V_{ref}}{R_s}) \\ i_2 = \frac{1}{K} i_4 + i_q \\ i_4 = i_m + \frac{V_{ref}}{R_s} \end{cases}$$

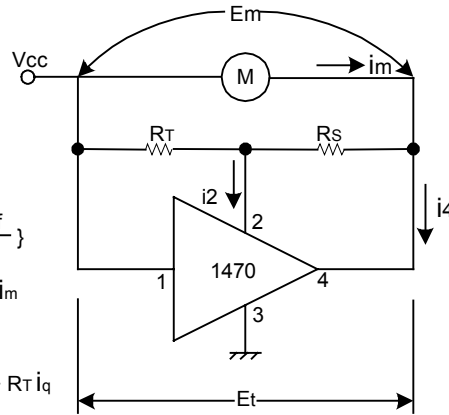
$$E_t = V_{ref} + R_T (\frac{1}{K} i_4 + i_q + \frac{V_{ref}}{R_s})$$

$$E_t = V_{ref} + R_T \{ \frac{1}{K} (i_m + \frac{V_{ref}}{R_s}) + i_q + \frac{V_{ref}}{R_s} \}$$

$$E_t = V_{ref} \{ 1 + \frac{R_T}{R_s} (1 + \frac{1}{K}) \} + R_T i_q + \frac{R_T}{K} i_m$$

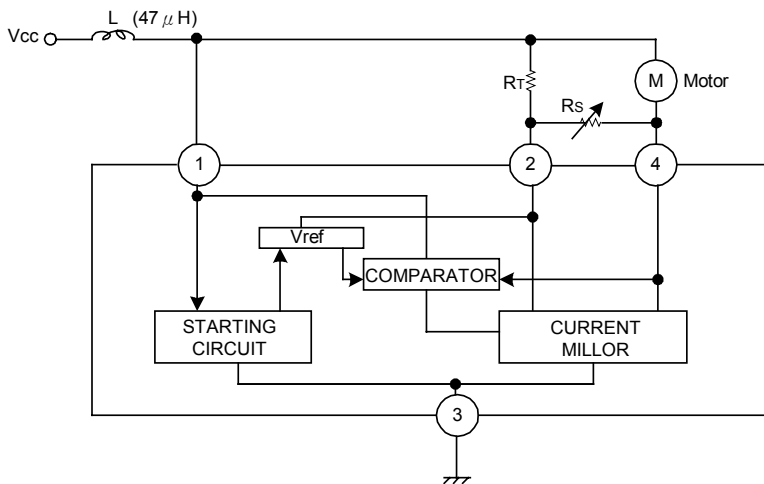
They also give :  $E_m = E_o + R_m i_m$

$$\begin{cases} E_o = V_{ref} \{ 1 + \frac{R_T}{R_s} (1 + \frac{1}{K}) \} + R_T i_q \\ R_m = \frac{R_T}{K} \end{cases}$$



(  $E_o$  : Back Electromotive Force  
 $R_m$  : internal Resistance (of the Motor)  
 $K$  : Reflection Coefficient =  $(i_4 / i_2)$ )

## APPLICATION CIRCUIT



$V_{cc} = 12V$   
 $R_m = 19.5 \Omega$   
 $R_T = 330 \Omega$   
 $R_s = 1k \Omega$   
 $E_o = 2.3V$   
 $K = 20$

Note 1. The motor speed can be adjusted by the variable resistor  $R_s$ .

$$R_{smin} = \frac{V_{ref} \cdot R_T}{E_o - V_{ref} - i_q \cdot R_T}$$

Note 2. If  $R_{Tmax} > K \cdot R_{min}$ , instability of the motor may occur.

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