6427525 N E C ELECTRONICS INC 05E 23088 D

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1470H

T-77-21

MOTOR SPEED REGULATORS

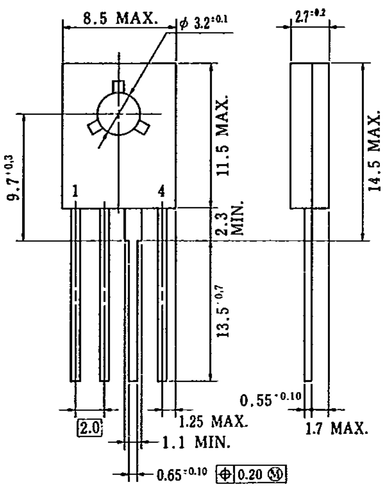
DESCRIPTION

The μPC1470H is a monolithic integrated circuit intended as speed regulators for DC motors of record players, tape and cassette recorders etc. The devices is packaged in a new developed 4-lead quase-TO-126 plastic case.

FEATURES

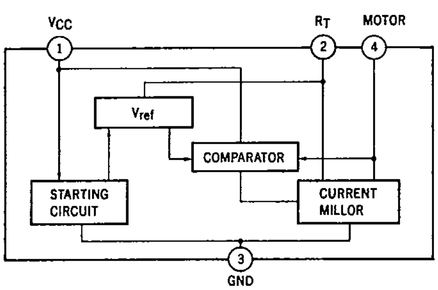
- Excellent versatility in use.
- High Output current.
- Low Quiescent current.
- Low Reference voltage.
- Excellent parameters stability versus temperature.
- Excellent characteristic at low supply voltage.

PACKAGE DIMENSIONS (Unit: mm)



P4HP-200B

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

Supply Voltage	V_{CC}	18	V
Circuit Current	I_4	2*	A
Package Dissipation	P_D	1.2	W
Operating Temperature	T_{opt}	−20 to +75	°C
Storage Temperature	T_{stg}	−40 to +150	°C

*t ≦ 5s

RECOMMENDED OPERATING CONDITION

Supply Voltage Range	V_{CC}	3.5 to 16	V

ELECTRICAL CHARACTERISTICS (T_a = 25 °C, V_{CC} = 12 V)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS*	
Reference Voltage	V_{ref}	1.10	1.27	1.40	V	I_4 = 10 mA	Fig. 1
Quiescent Current	I_d	0.5	0.8	1.2	mA	R_M = 180 Ω	Fig. 4
Reflection Coefficient	k	18	20	22		R_{M1} = 44 Ω, R_{M2} = 33 Ω	Fig. 2
Saturation Voltage	$V_{4\,(sat)}$		1.5	2.0	V	V_{CC} = 4.2 V, R_M = 4.4 Ω	Fig. 3
	$\frac{\Delta k}{k}/\Delta V_{CC}$		0.4		%/V	I_4 = 100 mA, V_{CC} = 6.3 ~ 16 V	Fig. 2
Line Regulation	$\frac{\Delta V_{ref}}{V_{ref}}/\Delta V_{CC}$		0.06		%/V	I_4 = 100 mA, V_{CC} = 6.3 ~ 16 V	Fig. 1
	$\frac{\Delta k}{k}/\Delta I_M$		−0.02		%/mA	I_4 = 30 ~ 200 mA	Fig. 2
Load Regulation	$\frac{\Delta V_{ref}}{V_{ref}}/\Delta I_M$		−0.02		%/mA	I_4 = 30 ~ 200 mA	Fig. 1
	$\frac{\Delta k}{k}/\Delta T_a$		0.01		%/°C	I_4 = 100 mA, T_a = −20 ~ +75 °C	Fig. 2
Temperature Coefficient	$\frac{\Delta V_{ref}}{V_{ref}}/\Delta T_a$		0.01		%/°C	I_4 = 100 mA, T_a = −20 ~ +75 °C	Fig. 1

* Pulse Test : PW ≦ 10 ms, Duty Cycle ≦ 2 %

TEST CIRCUIT

Fig. 1

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

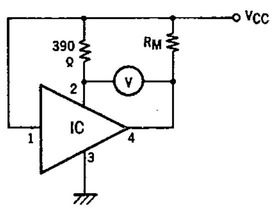
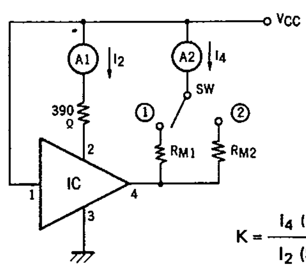


Fig. 2

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



$$K = \frac{I_4\,(SW②) - I_4\,(SW①)}{I_2\,(SW②) - I_2\,(SW①)}$$

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Fig. 3

$(V_{4(sat)})$

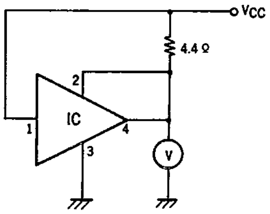
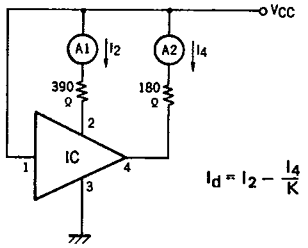


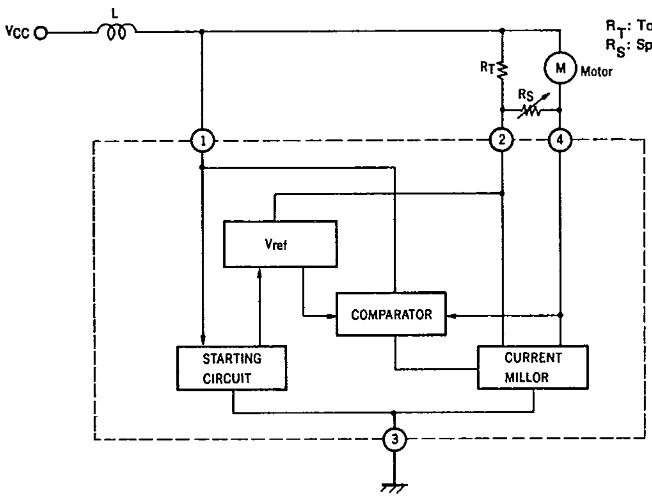
fig. 4

(I_d)



$I_d = I_2 - \frac{I_4}{K}$

APPLICATION INFORMATION



R_T: Torque Control Resistance
R_S: Speed Control Resistance

[BASIC EQUATION FOR THE MOTOR]

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

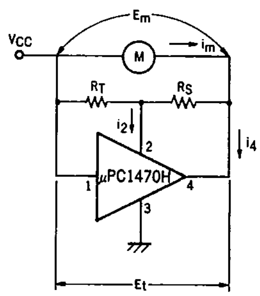
$$E_t = V_{ref} + R_T\,(\frac{1}{K} i_4 + i_q + \frac{V_{ref}}{R_S})$$

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

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

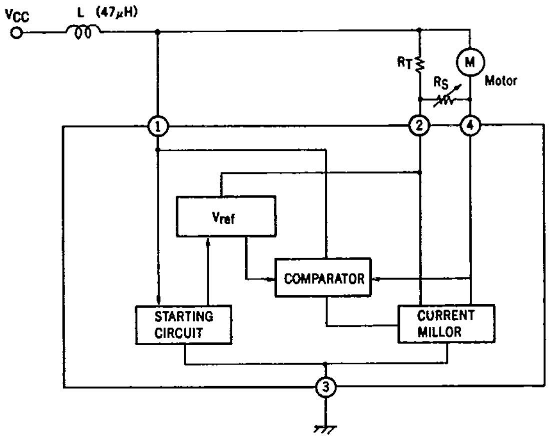
They also give: $E_m = E_o + R_m i_m$

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



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

APPLICATION CIRCUIT



V_{CC} = 12 V
R_m = 19.5 Ω
R_T = 330 Ω
R_S = 1 kΩ
E_o = 2.3 V
K = 20

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

$$R_{S\,min.} = \frac{V_{ref} \cdot R_T}{E_o - V_{ref} - I_q \cdot R_T}$$

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

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