

6427525 N E C ELECTRONICS INC

05E 23088 D

BIPOLAR ANALOG INTEGRATED CIRCUIT **μ PC1470H**

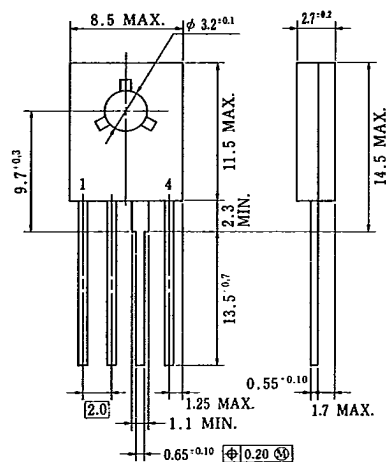
T-77-21

MOTOR SPEED REGULATORS**DESCRIPTION**

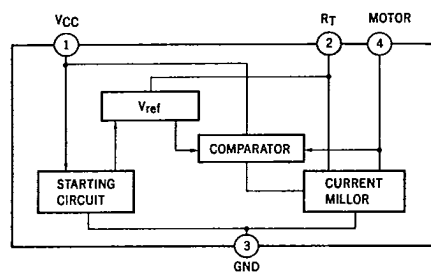
The μ PC1470H is a monolithic integrated circuit intended as speed regulators for DC motors of record players, tape and cassette recorders etc. The device is packaged in a new developed 4-lead quasse-TO-126 plastic case.

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)

P41HP-200B

BLOCK DIAGRAM

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 μ PC1470H
05E 23089 DABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

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	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to +150	$^\circ\text{C}$
		$t \leq 5s$	

T-77-21

RECOMMENDED OPERATING CONDITION

Supply Voltage Range	V_{CC}	3.5 to 16	V
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ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{ V}$)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS*
Reference Voltage	V_{ref}	1.10	1.27	1.40	V	$I_4 = 10\text{ mA}$ Fig. 1
Quiescent Current	I_d	0.5	0.8	1.2	mA	$R_M = 180\ \Omega$ Fig. 4
Reflection Coefficient	k	18	20	22		$R_{M1} = 44\ \Omega$, $R_{M2} = 33\ \Omega$ Fig. 2
Saturation Voltage	$V_4(\text{sat})$		1.5	2.0	V	$V_{CC} = 4.2\text{ V}$, $R_M = 4.4\ \Omega$ Fig. 3
	$\frac{\Delta k}{k} / \Delta V_{CC}$		0.4		%/V	$I_4 = 100\text{ mA}$, $V_{CC} = 6.3 \sim 16\text{ V}$ Fig. 2
Line Regulation	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta V_{CC}$		0.06		%/V	$I_4 = 100\text{ mA}$, $V_{CC} = 6.3 \sim 16\text{ V}$ Fig. 1
	$\frac{\Delta k}{k} / \Delta I_M$		-0.02		%/mA	$I_4 = 30 \sim 200\text{ mA}$ Fig. 2
Load Regulation	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta I_M$		-0.02		%/mA	$I_4 = 30 \sim 200\text{ mA}$ Fig. 1
	$\frac{\Delta k}{k} / \Delta T_a$		0.01		%/ $^\circ\text{C}$	$I_4 = 100\text{ mA}$, $T_a = -20 \sim +75^\circ\text{C}$ Fig. 2
Temperature Coefficient	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta T_a$		0.01		%/ $^\circ\text{C}$	$I_4 = 100\text{ mA}$, $T_a = -20 \sim +75^\circ\text{C}$ Fig. 1

* Pulse Test : $PW \leq 10\text{ ms}$, Duty Cycle $\leq 2\%$

TEST CIRCUIT

Fig. 1

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

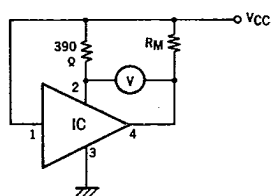
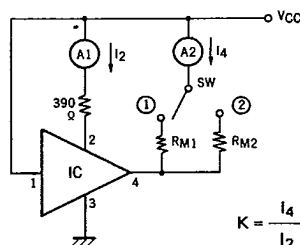


Fig. 2

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



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

μPC1470H

6427525 N E C ELECTRONICS INC

05E 23090 D

T-77-21

Fig. 3

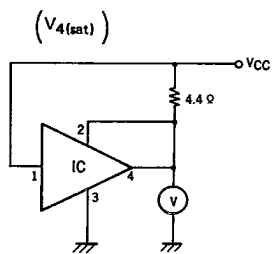
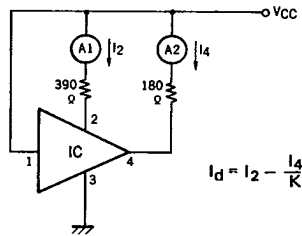
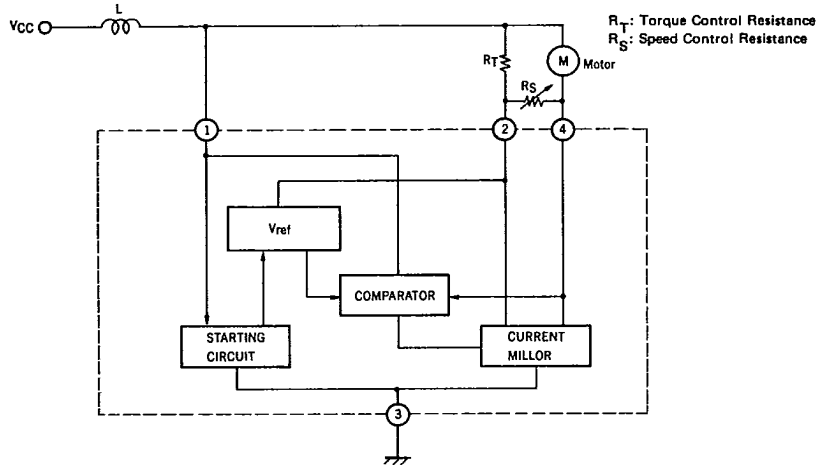


fig. 4

**APPLICATION INFORMATION****[BASIC EQUATION FOR THE MOTOR]**

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

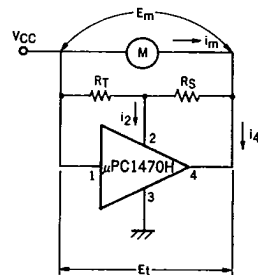
$$E_t = V_{ref} + R_T \left(\frac{1}{K} i_4 + i_q + \frac{V_{ref}}{R_S} \right)$$

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

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

$$\text{They also give: } E_m = E_o + R_m i_m$$

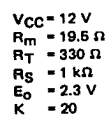
$$\begin{cases} E_o = V_{ref} \left\{ 1 + \frac{R_T}{R_S} \left(1 + \frac{1}{K} \right) \right\} + R_T i_q \\ R_m = \frac{R_T}{K} \end{cases}$$



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

μPC1470H
05E 23091 D

T-77-21


$$R_{Smin.} = \frac{V_{ref} \cdot R_T}{E_o - V_{ref} - I_q \cdot R_T}$$

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

5