DATA SHEET

RENESAS

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1470

MOTOR SPEED REGULATORS

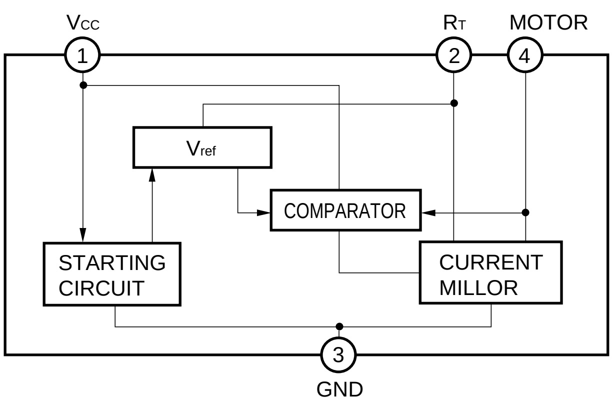
DESCRIPTION

The μPC1470 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

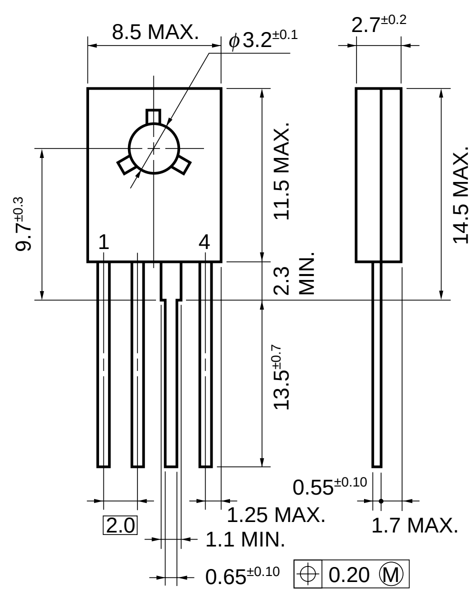
- Excellent versatility in use.
- High Output current.
- Low Quiescent current.
- Low Reference voltage.
- Excellent parameters stability versus temperature.
- Excellent characteristic at low supply voltage.

BLOCK DIAGRAM



PACKAGE DIMENSIONS

in millimeters



Connection Diagram
1. V_{CC}
2. R_T
3. GND
4. MOTOR

ORDERING INFORMATION

PART NUMBER

μPC1470H-X

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(Previous No. IC-1409)
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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_A	–20 to +75	°C
Storage Temperature	T_{stg}	–40 to +150	°C

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
Line Regulation	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta V_{CC}$		0.06		%/V	I_4 = 100 mA, V_{CC} = 6.3 to 16 V	Fig. 1
	$\frac{\Delta k}{k} / \Delta V_{CC}$		0.4		%/V	I_4 = 100 mA, V_{CC} = 6.3 to 16 V	Fig. 2
Load Regulation	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta I_4$		–0.02		%/mA	I_4 = 30 to 200 mA	Fig. 1
	$\frac{\Delta k}{k} / \Delta I_4$		–0.02		%/mA	I_4 = 30 to 200 mA	Fig. 2
Temperature Coefficient	$\frac{\Delta V_{ref}}{V_{ref}} / \Delta T_A$		0.01		%/°C	I_4 = 100 mA, T_A = –20 to +75 °C	Fig. 1
	$\frac{\Delta k}{k} / \Delta T_A$		0.01		%/°C	I_4 = 100 mA, T_A = –20 to +75 °C	Fig. 2

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

TEST CIRCUIT

Fig. 1

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

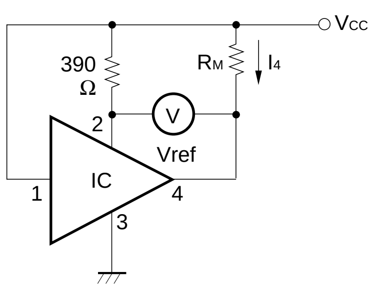
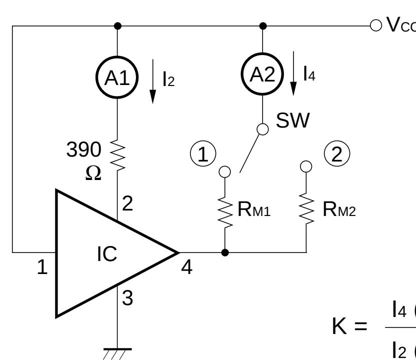


Fig. 2

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



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

Fig. 3

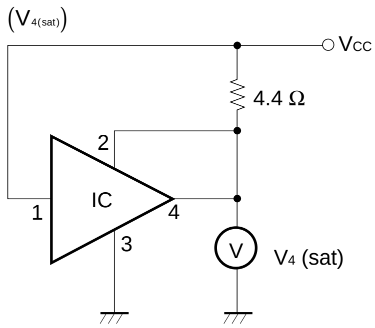
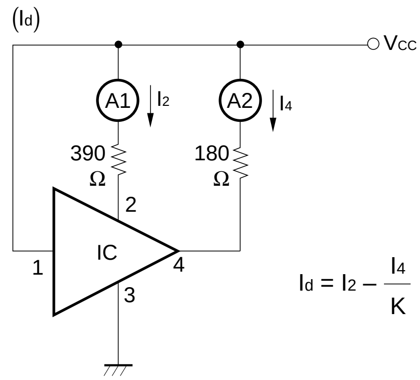
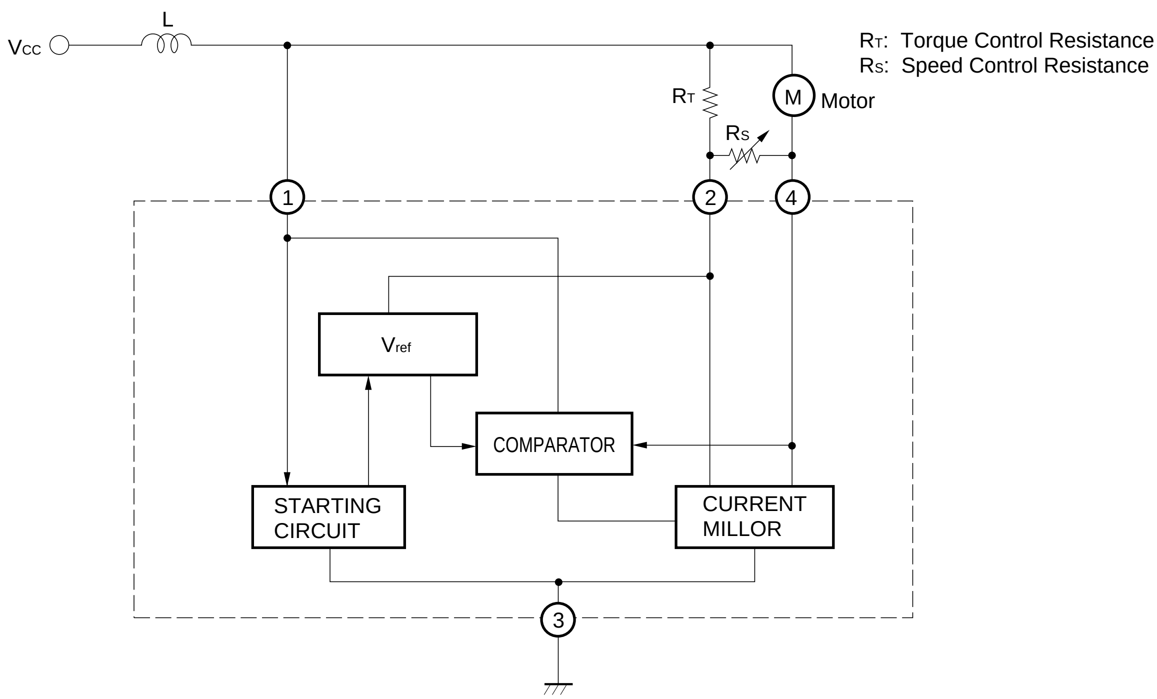


Fig. 4

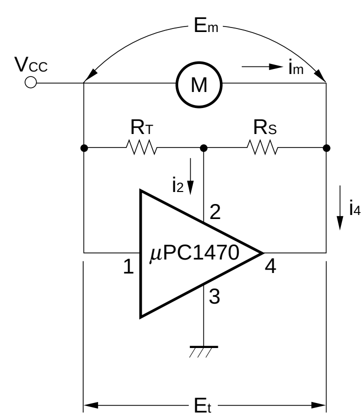


APPLICATION INFORMATION



[BASIC EQUATION FOR THE MOTOR]

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



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

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

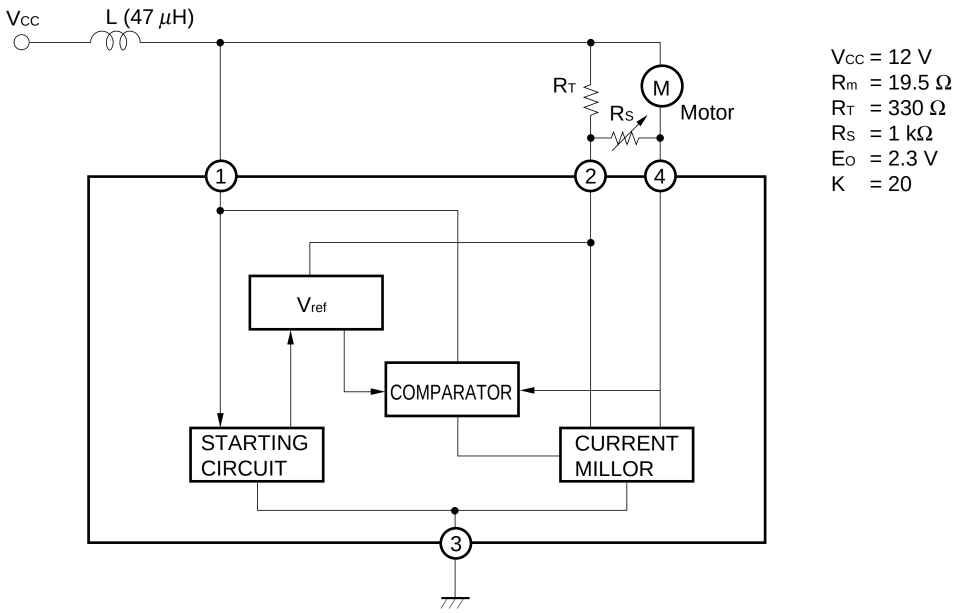
$$E_t = V_{ref}\left\{1 + \frac{R_T}{R_S}\left(1 + \frac{1}{K}\right)\right\} + R_T i_q + \frac{R_T}{K} i_m$$

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

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

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

APPLICATION CIRCUIT



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

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

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

REFERENCE

Document Name	Document No.
Quality grade on NEC semiconductor devices.	IEI-1209
Semiconductor device mounting technology manual.	IEI-1207
Semiconductor device package manual.	IEI-1213
Guide to quality assurance for semiconductor devices.	MEI-1202
Semiconductor selection guide.	MF-1134
NEC semiconductor device reliability/quality control system (Standard linear IC).	IEI-1212

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