

To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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MOTOR SPEED REGULATORS

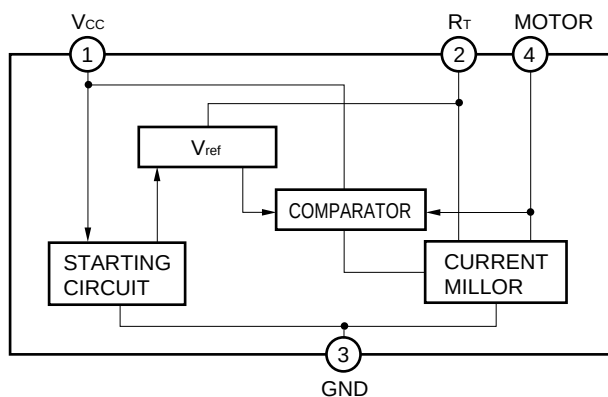
DESCRIPTION

The μ PC1470 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 quaise-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



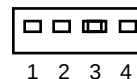
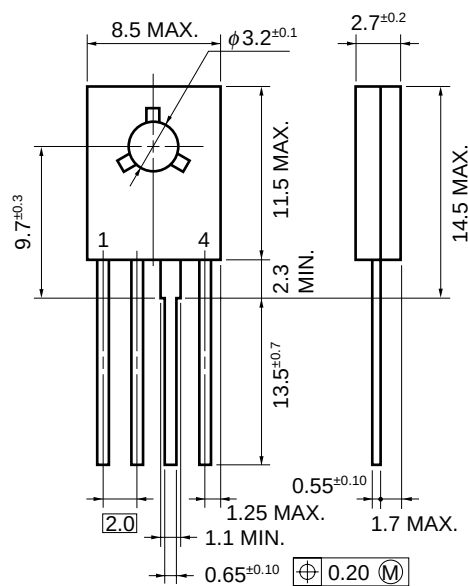
ORDERING INFORMATION

PART NUMBER

 μ PC1470H-X

PACKAGE DIMENSIONS

in millimeters



Connection Diagram

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

ABSOLUTE 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_A	-20 to +75	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to +150	$^\circ\text{C}$

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

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

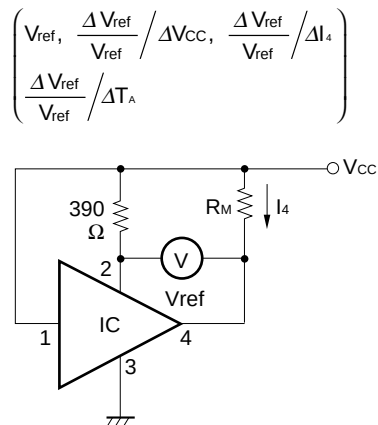
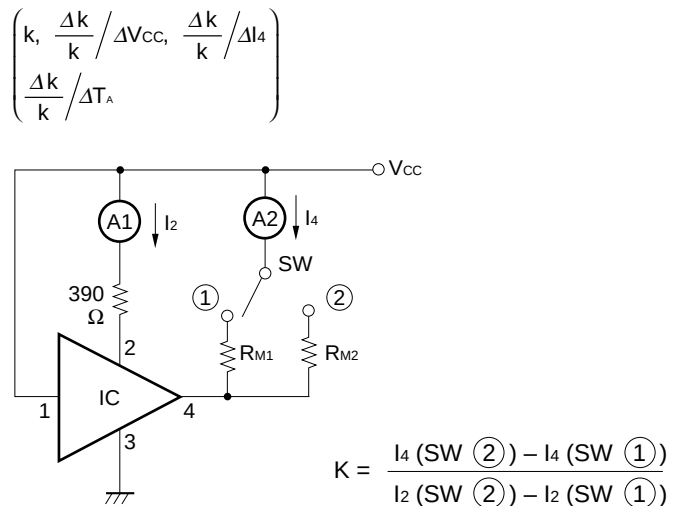
TEST CIRCUIT**Fig. 1****Fig. 2**

Fig. 3

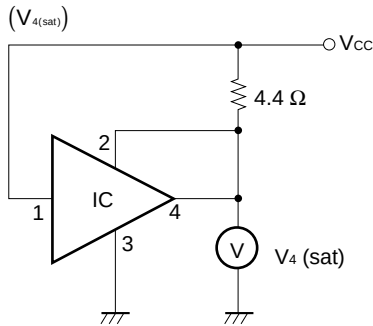
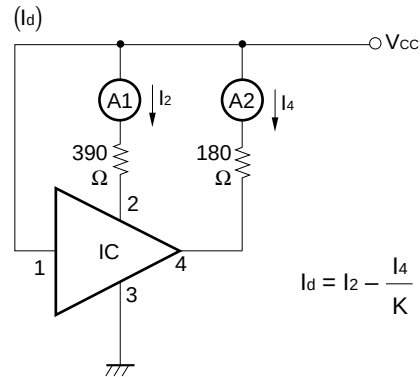
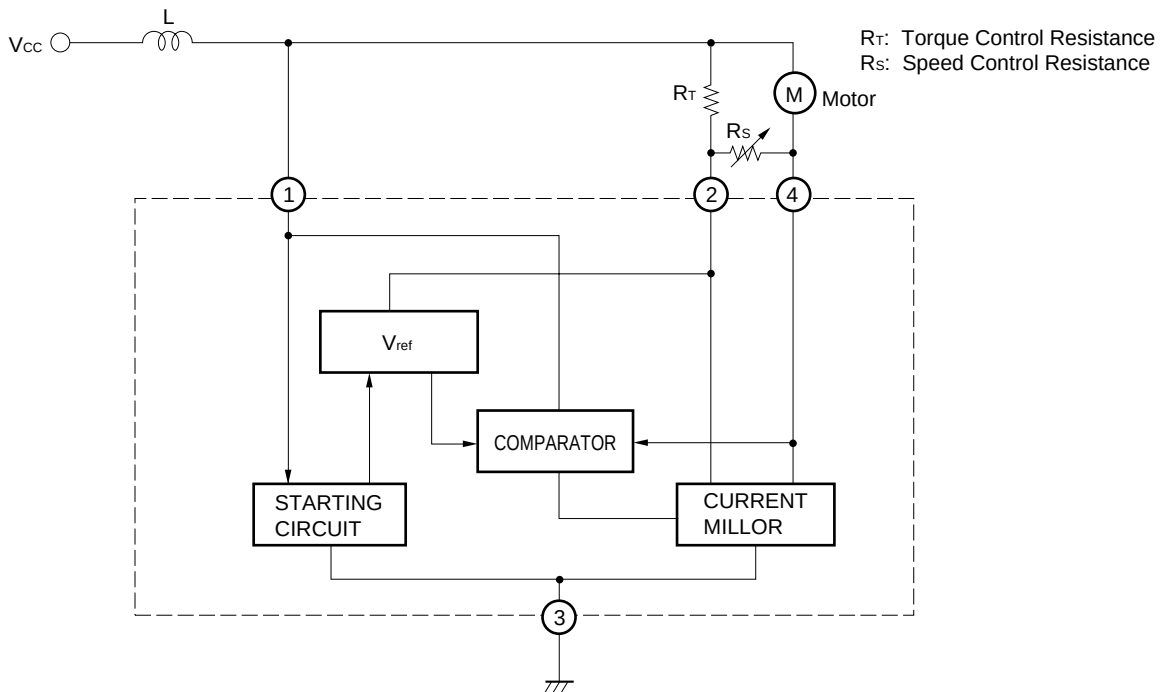


Fig. 4



APPLICATION INFORMATION



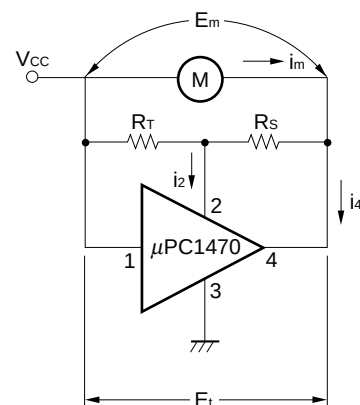
[BASIC EQUATION FOR THE MOTOR]

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

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

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 ($= i_4/i_2$)

$$\begin{aligned} V_{CC} &= 12 \text{ V} \\ R_m &= 19.5 \, \Omega \\ R_T &= 330 \, \Omega \\ R_S &= 1 \text{ k}\Omega \\ E_O &= 2.3 \text{ V} \\ K &= 20 \end{aligned}$$
$$R_{S \min.} = \frac{V_{ref} \cdot R_T}{E_O - V_{ref} - I_q \cdot R_T}$$

2. If $R_{T \max.} > K \cdot R_{m \min.}$, 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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