



# BIPOLAR ANALOG INTEGRATED CIRCUIT

## $\mu$ PC1043C

### MOTOR CONTROL CIRCUIT

### SILICON MONOLITHIC BIPOLAR INTEGRATED CIRCUIT

The  $\mu$ PC1043C is a silicon monolithic integrated circuit developed by NEC for Frequency Generator DC Motor speed control of Hi-Fi player and VTR etc.

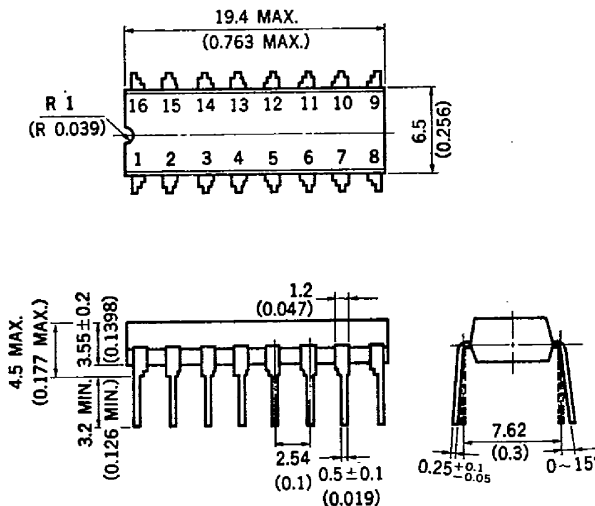
The package is 16-Pin plastic Dual In-Line Package.

#### FEATURES

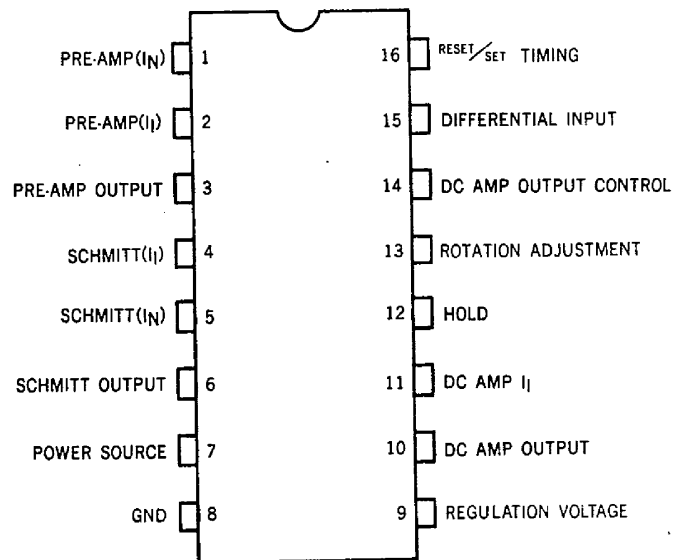
- Operating at wide range supply voltage.  
( $V_{CC} = 9$  to  $28$  V)
- Available for wide range FG. Servomotor.  
( $f = 20$  to  $3\ 000$  Hz)  
( $v_{in} = 1$  to  $2\ 000$  mV<sub>p-p</sub>)
- Applicable for any kind of motors by choosing the external power transistor.

#### PACKAGE DIMENSIONS

in millimeters (inches)



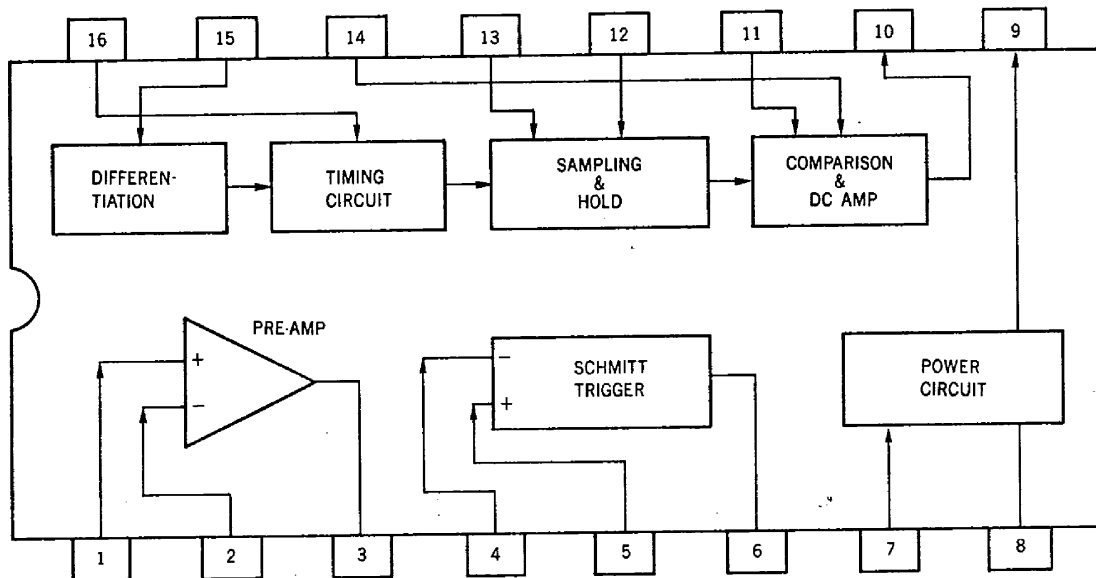
#### CONNECTION DIAGRAM (Top View)



NEC cannot assume any responsibility for any circuits shown or represent that they are free from patent infringement.

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**BLOCK DIAGRAM (Top View)**



**ABSOLUTE MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )**

Supply Voltage	$V_{CC}$	15*	V
Circuit Current	$I_{CC}$	100	mA
Power Dissipation ( $T_a = 75^\circ\text{C}$ )	$P_D$	350	mW
Operating Temperature Range	$T_{opt}$	-20 to +75	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-40 to +125	$^\circ\text{C}$

\* Power source directly applied to No. 7 pin.

**RECOMMENDED OPERATING CONDITIONS**

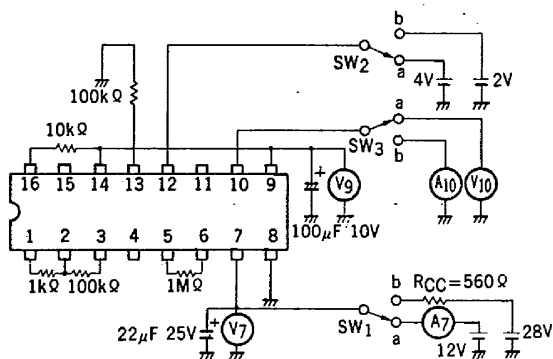
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage ( $R_{CC} = 0$ )	$V_{CC1}$	9	12	15	V
Supply Voltage ( $R_{CC} = 560 \Omega$ )	$V_{CC2}$	19	24	28	V
FG Frequency	$f_{ref}$	20		3000	Hz
PRE-AMP Voltage Gain	$A_V$	20		60	dB
Threshold Voltage	$V_{TH}$	$\pm 20$		$\pm 200$	mV
Operating Temperature Range	$T_{opt}$	-20		+60	$^\circ\text{C}$

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

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Circuit Current	I <sub>CC</sub>	4	7	10	mA	Non-signal input, Output current = 0
Regulation Voltage	V <sub>g</sub>	5.1	5.7	6.3	V	Voltage at No. 9 pin
Maximum Output Voltage	V <sub>O max.</sub>	3.5	4.25		V	Output Current = 0
Maximum Output Current	I <sub>O max.</sub>	8	12	17	mA	Output Voltage = 0
Shunt Regulation Voltage	V <sub>7ON</sub>	15	16.3	18	V	V <sub>CC</sub> = 28 V, R <sub>CC</sub> = 560 Ω
PRE-AMP Voltage Gain	A <sub>vo</sub>	75	84		dB	f = 100 Hz Test Circuit - 2 S.G. output terminated 700 mV <sub>r.m.s.</sub>
Rotation Temperature Coefficient	ΔN <sub>A</sub>		0	0.02	%/°C	V <sub>CC</sub> = 28 V, R <sub>CC</sub> = 560 Ω T <sub>a</sub> = -20 to +60 °C Rotation N <sub>max.</sub> - N <sub>min.</sub> /N(25 °C)/80 °C
Rotation Coefficient Input Voltage	ΔN <sub>V</sub>		0	0.02	%/V	Variation of Rotation at V <sub>CC</sub> = 19 to 28 V, R <sub>CC</sub> = 560 Ω
Rotation Drift	ΔN <sub>T</sub>		0	0.1	%	Variation of Rotation 10 s to 30 min. after V <sub>CC</sub> on at V <sub>CC</sub> = 24 V, R <sub>CC</sub> = 560 Ω
Output Ripple Voltage	v <sub>o</sub>		20	35	mV <sub>p-p</sub>	Test Circuit - 4
Schmitt Noise Voltage	V <sub>TN</sub>		0	0.7	V <sub>p-p</sub>	Test Circuit - 5
ON Resistance	R <sub>Q48 ON</sub>		100	300	Ω	Test Circuit - 6

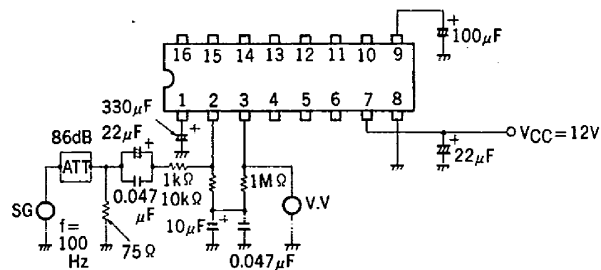
**TEST CIRCUIT - 1**

( $I_{CC}$ ,  $V_9$ ,  $V_0$  max,  $I_0$  max,  $V_7$  ON)



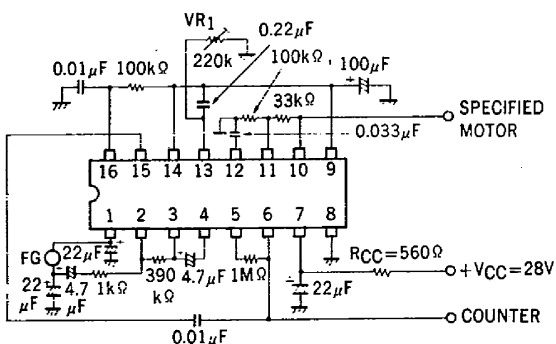
ITEM	SWITCH			MEASUREMENT POINT
	SW1	SW2	SW3	
$I_{CC}$	a	a	a	A7
$V_9$	a	a	a	V9
$V_0$ max.	a	b	a	V10
$I_0$ max.	a	b	b	A10
$V_7$ ON	b	a	a	V7

**TEST CIRCUIT - 2 ( $A_{VO}$ )**



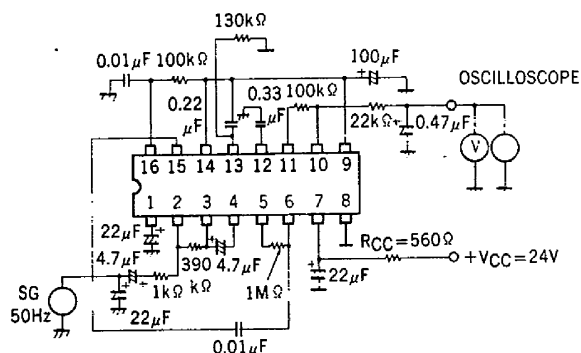
\*SG Output Impedance = 75 Ω  
 \*ATT Input Output Impedance = 75 Ω

**TEST CIRCUIT - 3 ( $\Delta N_A$ ,  $\Delta N_V$ ,  $\Delta N_T$ )**



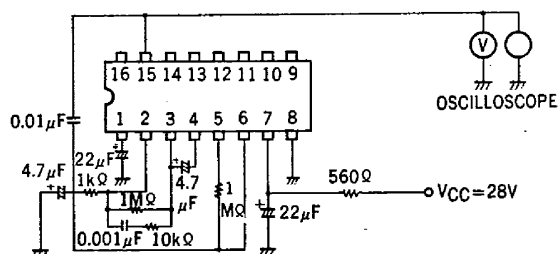
\*Adjust VR1 so that the measured value by counter becomes 20 ms.

**TEST CIRCUIT - 4 ( $v_0$ )**

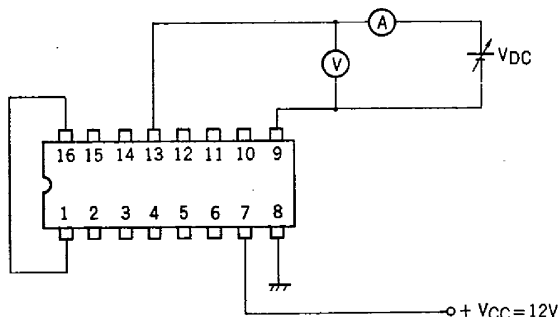


\*Adjust SG frequency to obtain 1.4 to 1.5 V DC Voltage on NO. 10 pin, and then measure with oscilloscope.

**TEST CIRCUIT - 5 ( $V_{TN}$ )**

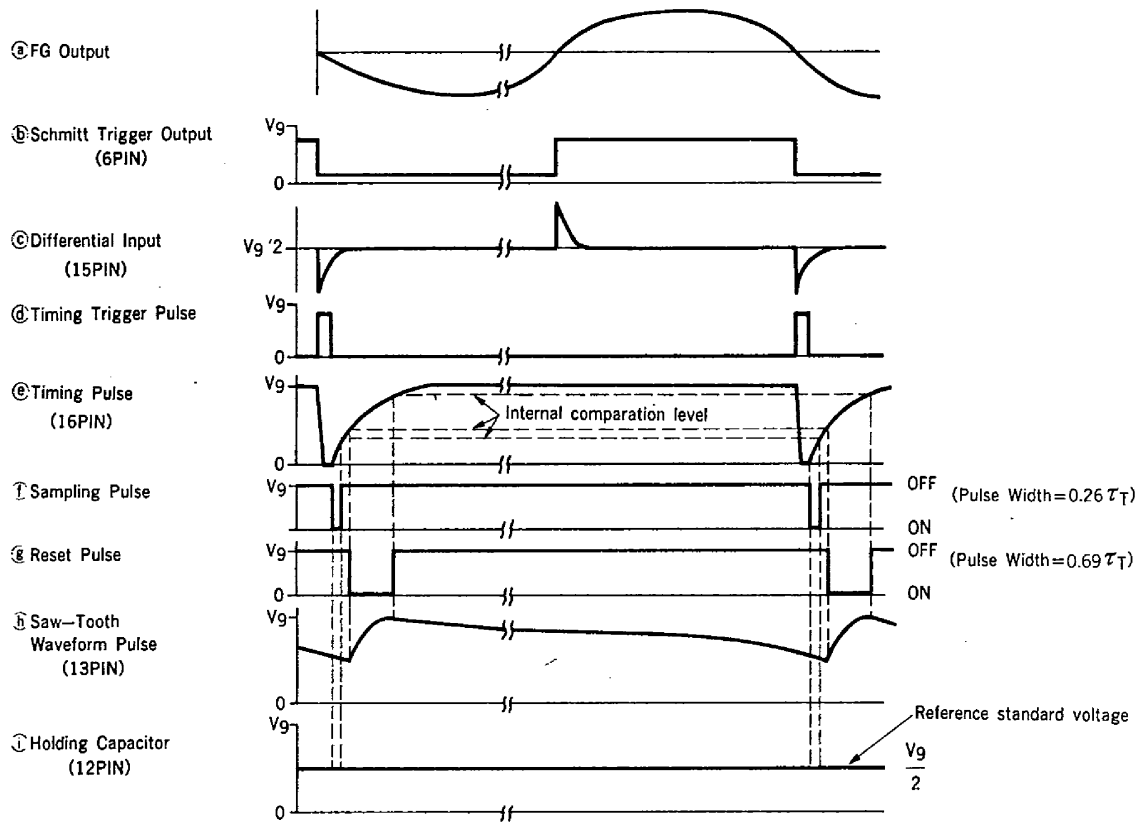


**TEST CIRCUIT - 6 ( $R_{Q48}$  ON)**

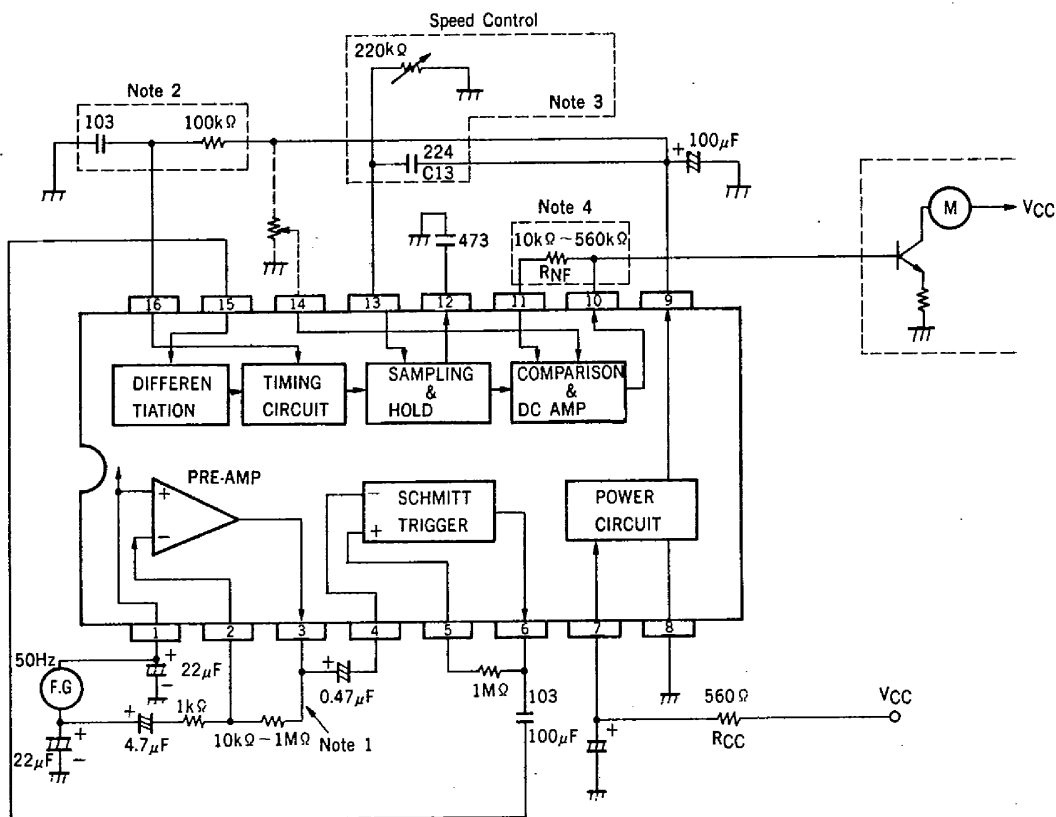


\*Adjust  $V_{DC}$  to obtain voltage of 1.5 V between NO. 13 and NO. 9 pin, measure current, and calculate by  $V(1.5 V) A$ .

$\mu$ PC1043C TIMING CHART



APPLICATION CIRCUIT



Note 1: Set preamplifier gain so that about 2 V<sub>p-p</sub> voltage is obtained here.

Note 2: Setting timing time constant τ<sub>16</sub> on No. 16 pin.

$$\tau_{16} = \frac{1}{f_{ref}} \times 0.05 \dots \dots (5\% \text{ of FG period})$$

Note 3: Setting time constant τ<sub>13</sub> on No. 13 pin for waveform generator.

$$\tau_{13} = \frac{1}{f_{ref} \cdot -\ln 0.5} = C_{13} \cdot R_{13}$$

C<sub>13</sub> can be obtained by the formula.

$$C_{13} \leq \frac{0.69 \cdot \tau_{16}}{3000}$$

Note 4: DC amplifier gain is determined as shown below.

$$A_V = \frac{R_{NF}}{6.8 \times 10^3}$$

$$V_{CC} = 24 \text{ V}$$

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