

# BIPOLAR ANALOG INTEGRATED CIRCUIT

## $\mu$ PC1350C

### 450mW AF POWER AMPLIFIER WITH PRE AMPLIFIER AND ALC CIRCUIT SILICON BIPOLAR MONOLITHIC INTEGRATED CIRCUIT

#### DESCRIPTION

The  $\mu$ PC1350C is a silicon monolithic integrated circuit designed for an audio power amplifier application at 6 volts power supply.

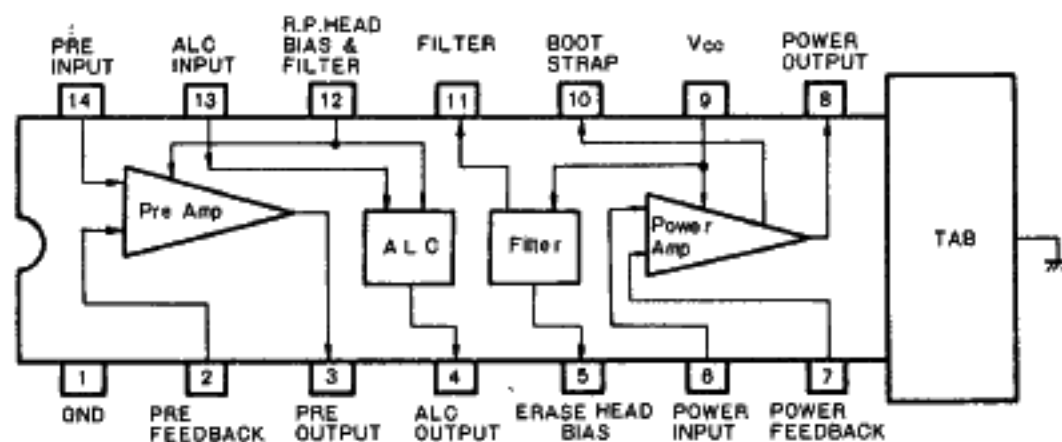
The device contains a high gain low noise preamplifier, an automatic level control (ALC) and a high gain low distortion power amplifier.

The perfect audio circuit of a cassette tape recorder is obtained with the device.

#### FEATURES

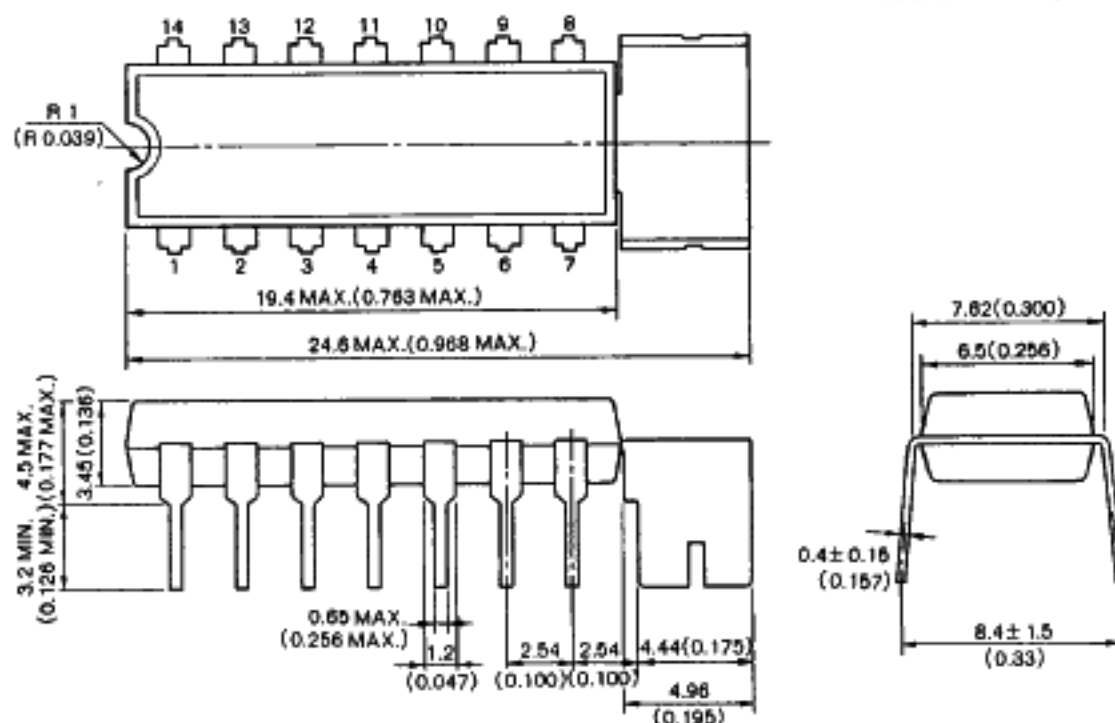
- All functions of a preamplifier, an ALC circuit and a power amplifier are encapsulated in a 14-pins dual in-line package with heat sink TAB.
- Low noise, especially low pulsive noise.
- Power amplifier stage has high gain, high output power and low distortion characteristics.
- Preamplifier stage has high gain and low distortion characteristics.
- Wide ALC range: output voltage change 1.8 V TYP., ALC range 60 dB TYP.
- Wide supply operating voltage range:  $V_{CC} = 3.5$  to 10 V
- Low spurious radiation when driven to output clipping level.

#### BLOCK DIAGRAM



# PACKAGE DIMENSIONS AND CONNECTION DIAGRAM (Top View)

in millimeters (inches)



| Pin No. | Electrical Connections | Pin No. | Electrical Connections  |
|---------|------------------------|---------|-------------------------|
| 1       | GND                    | 8       | Power; Output           |
| 2       | Pre.; Feedback         | 9       | Power Supply VCC        |
| 3       | Pre.; Output           | 10      | Boot Strap              |
| 4       | ALC Output             | 11      | Filter                  |
| 5       | Erase; Head Bias       | 12      | R.P. Head Bias & Filter |
| 6       | Power; Input           | 13      | ALC Input               |
| 7       | Power; Feedback        | 14      | Pre.; Input             |

## ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

|                       |           |             |    |
|-----------------------|-----------|-------------|----|
| Supply Voltage (DC)   | VCC1      | 12          | V  |
| Supply Voltage (AC)   | VCC2      | 10          | V  |
| Circuit Current       | ICC(peak) | 500         | mA |
| Package Dissipation   | PD        | 2.4*        | W  |
| Operating Temperature | Topt      | -20 to +75  | °C |
| Storage Temperature   | Tstg      | -40 to +125 | °C |

\* Mounted and soldered on a 50 mm x 50 mm copper foil of a printed circuit board (XXX3 grade).

# RECOMMENDED CONDITIONS ( $T_a = 25^\circ\text{C}$ )

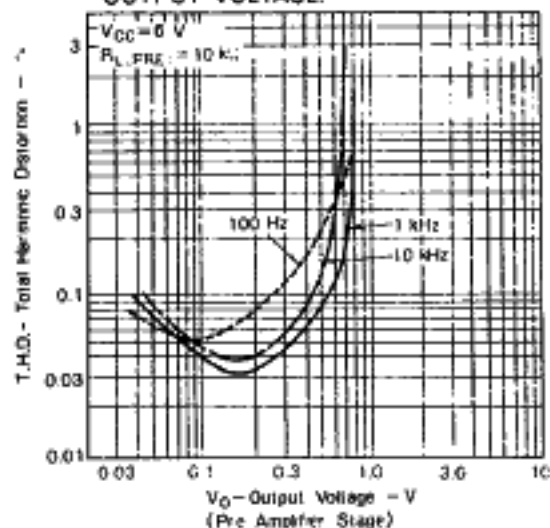
|                          |             |
|--------------------------|-------------|
| Operating Supply Voltage | 6 V         |
| Supply Voltage Range     | 3.5 to 10 V |

## ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ , $V_{CC} = 6\text{ V}$ , $f = 1\text{ kHz}$ , $NAB$ , $R_L(\text{pre}) = 10\text{ k}\Omega$ , $R_L(\text{power}) = 8\text{ }\Omega$ )

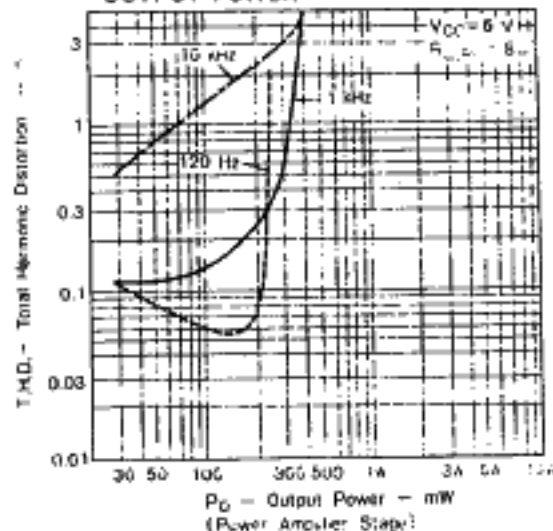
| CHARACTERISTIC            | SYMBOL    | MIN. | TYP. | MAX. | UNIT              | TEST CONDITIONS                                                  |
|---------------------------|-----------|------|------|------|-------------------|------------------------------------------------------------------|
| [OVER ALL CHARACTERISTIC] |           |      |      |      |                   |                                                                  |
| Circuit Current           | $I_{CC}$  | 10   | 20   | 33   | mA                | NO SIGNAL                                                        |
| Output Power              | $P_o$     | 400  | 450  | —    | mW                | $V_R \rightarrow \text{MAX.}$ T.H.D. = 10 %                      |
| Total Harmonic Distortion | T.H.D.    | —    | 0.8  | 2.0  | %                 | $V_R \rightarrow \text{MAX.}$ $P_o = 50\text{ mW}$               |
| Output Noise Level        | NL1       | —    | 10   | 23   | mV <sub>rms</sub> | Using P. head as an $R_G$ .<br>$V_R \rightarrow \text{MAX.}$     |
| ALC Characteristic        | ALC1      | —    | 1.8  | 9    | dB                | $V_i = -70 \sim -40\text{ dBm}$ $R_L' = 56\text{ }\Omega$        |
| ALC Range                 | ALC2      | —    | 60   | —    | dB                | T.H.D. $\leq 3\%$ $R_L' = 56\text{ }\Omega$                      |
| [PRE AMPLIFIER STAGE]     |           |      |      |      |                   |                                                                  |
| Open Loop Voltage Gain    | $A_{v01}$ | 55   | 65   | —    | dB                | $R_L(\text{pre}) = 10\text{ k}\Omega$ $V_o = 0.3\text{ V}_{rms}$ |
| Voltage Gain              | $A_{v2}$  | —    | 30.8 | —    | dB                | NAB $V_o = 0.3\text{ V}_{rms}$                                   |
| Maximum Output Voltage    | $V_{OM}$  | —    | 0.8  | —    | V <sub>rms</sub>  | $R_L(\text{pre}) = 10\text{ k}\Omega$ T.H.D. = 1 %               |
| Input Impedance           | $R_{i1}$  | 20   | —    | —    | k $\Omega$        |                                                                  |
| [POWER AMPLIFIER STAGE]   |           |      |      |      |                   |                                                                  |
| Open Loop Voltage Gain    | $A_{v02}$ | 70   | 81   | —    | dB                | $P_o = 50\text{ mW}$                                             |
| Voltage Gain              | $A_{v2}$  | —    | 46.8 | —    | dB                | $P_o = 50\text{ mW}$                                             |
| Output Noise Level        | NL2       | —    | 0.4  | 2.0  | mV <sub>rms</sub> | $V_R \rightarrow \text{MIN.}$ ( $R_G = 0$ )                      |
| Input Impedance           | $R_{i2}$  | 20   | 28   | —    | k $\Omega$        |                                                                  |

# TYPICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ , TEST CIRCUIT)

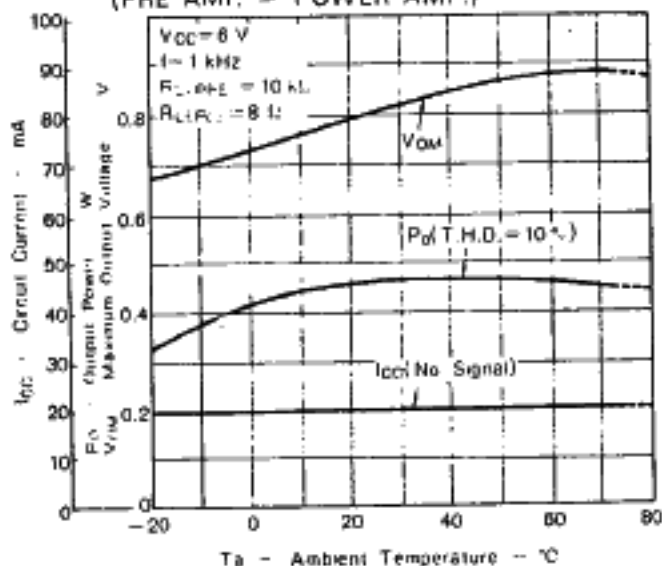
TOTAL HARMONIC DISTORTION vs. OUTPUT VOLTAGE.



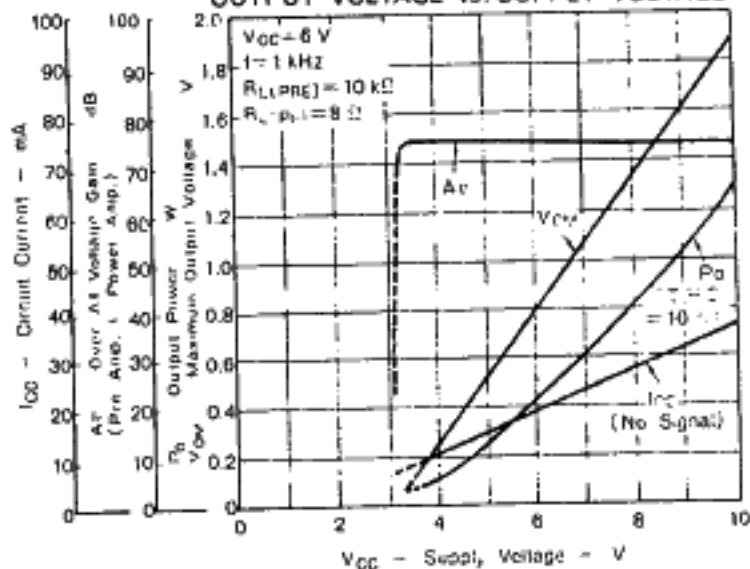
TOTAL HARMONIC DISTORTION vs. OUTPUT POWER.



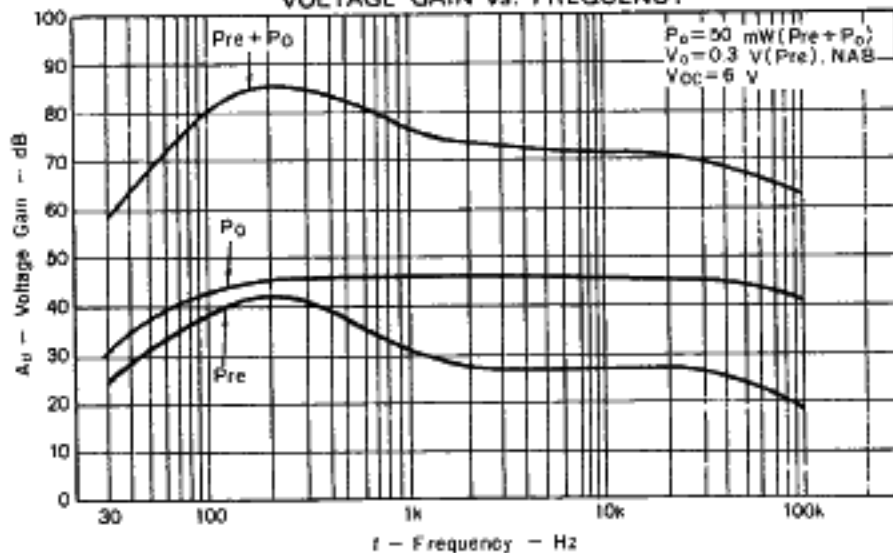
CIRCUIT CURRENT, OUTPUT POWER, MAXIMUM OUTPUT VOLTAGE GAIN vs. AMBIENT TEMPERATURE (PRE AMP. - POWER AMP.)

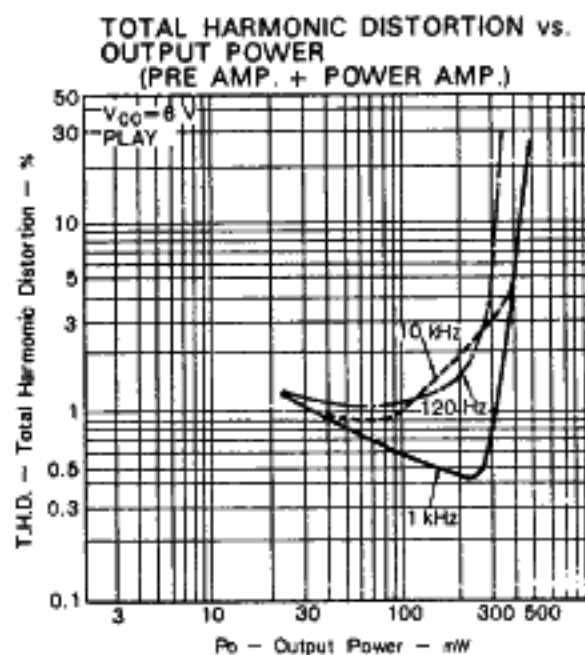


CIRCUIT CURRENT, OVER ALL VOLTAGE GAIN, OUTPUT POWER, MAXIMUM OUTPUT VOLTAGE vs. SUPPLY VOLTAGE

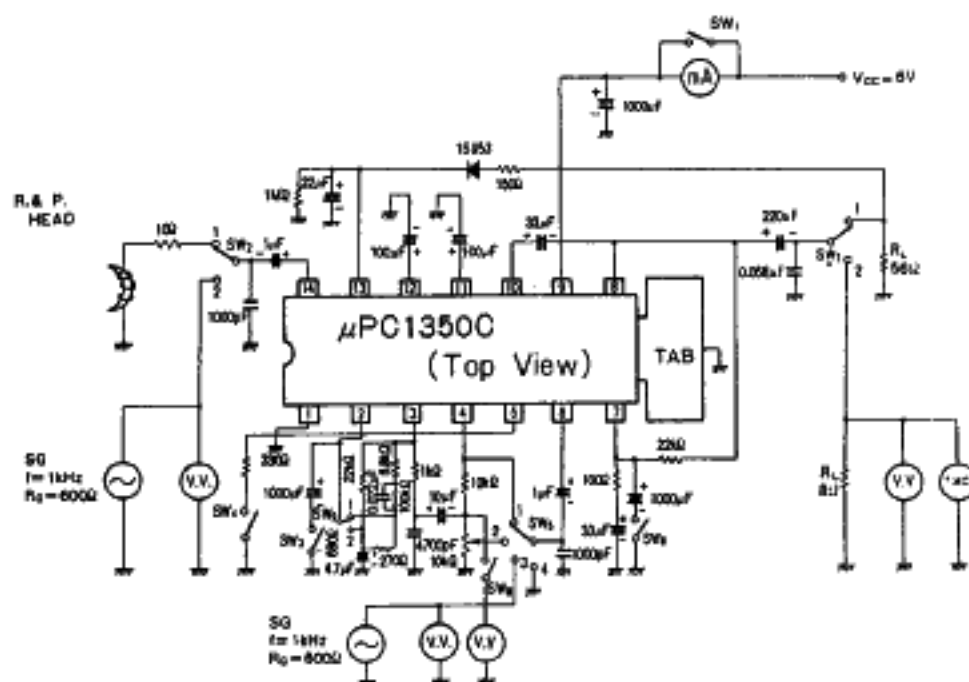


VOLTAGE GAIN vs. FREQUENCY

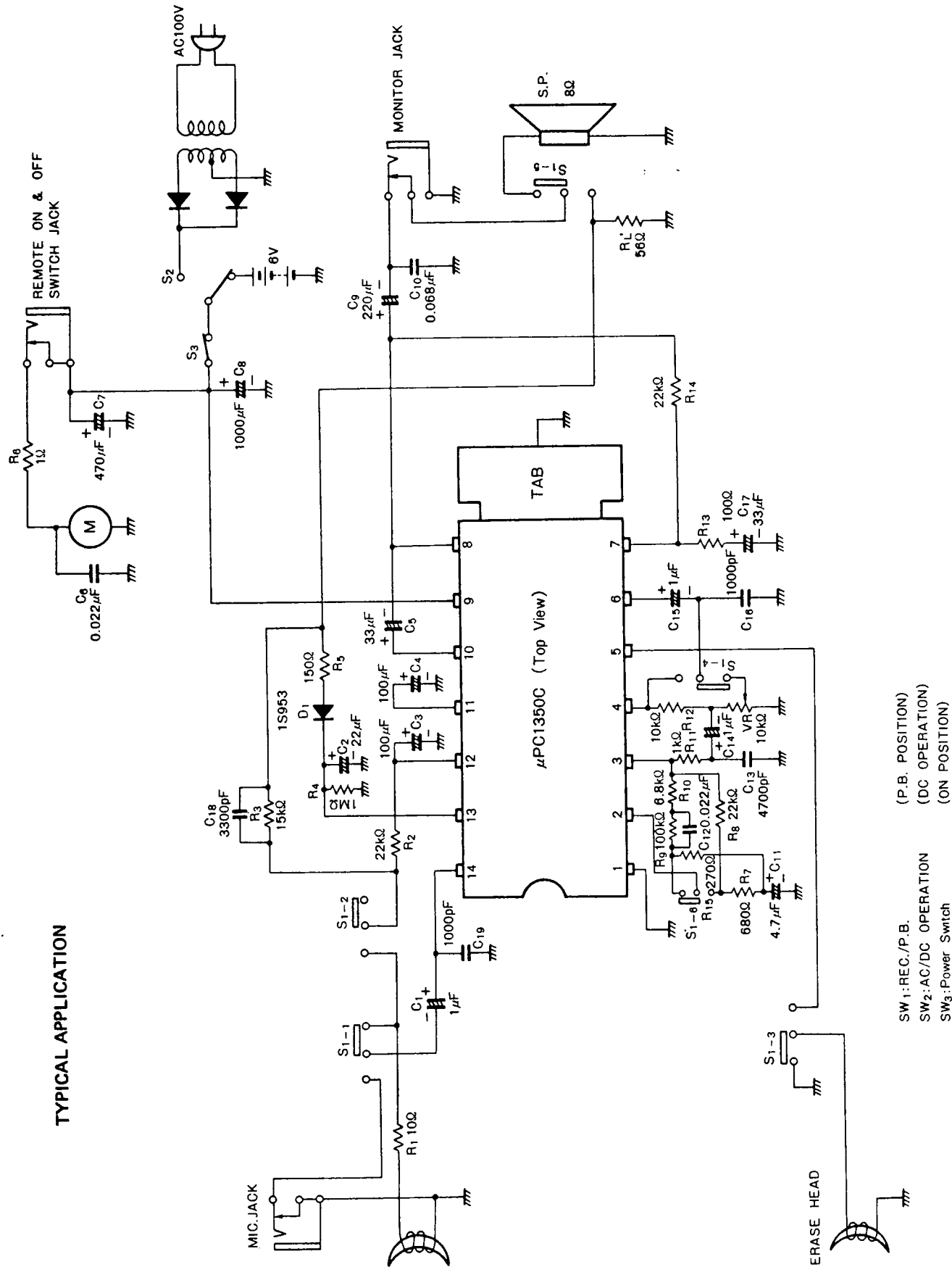




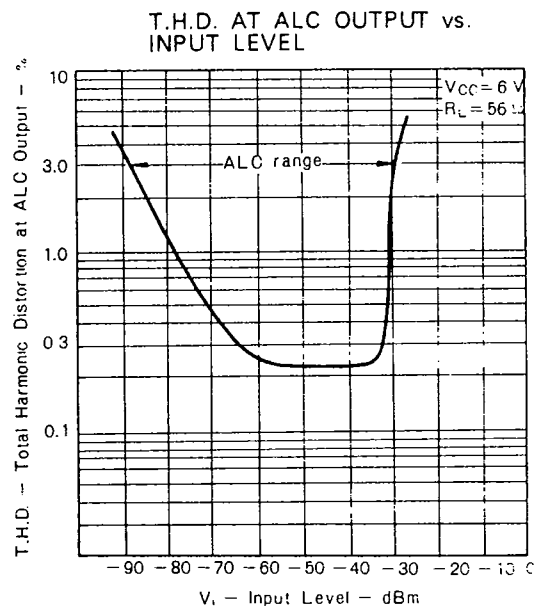
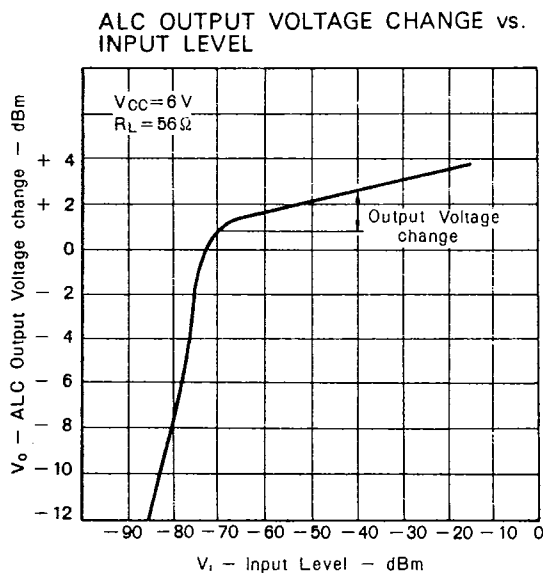
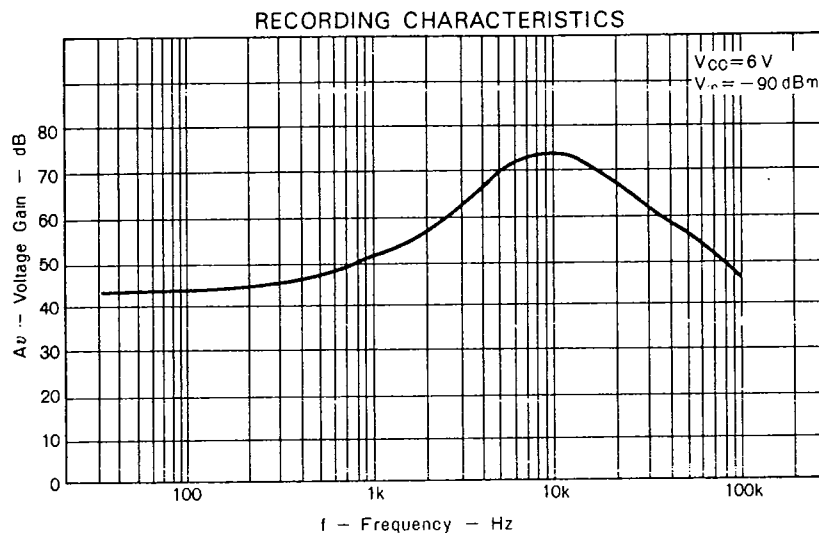
| ITEM   | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 | SW9 |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ICC    | OFF | 1   | OFF | ON  | 2   | OFF | 2   | OFF | 1   |
| Po     | ON  | 2   | OFF | OFF | 2   | OFF | 2   | OFF | 1   |
| T.H.D. | ON  | 2   | OFF | OFF | 2   | OFF | 2   | OFF | 1   |
| NL1    | ON  | 1   | OFF | OFF | 2   | OFF | 2   | OFF | 1   |
| ALC    | ON  | 2   | OFF | OFF | 1   | OFF | 1   | OFF | 2   |
| Av01   | ON  | 2   | ON  | OFF | 4   | OFF | 2   | ON  | 2   |
| Av02   | ON  | 1   | OFF | OFF | 3   | ON  | 2   | OFF | 2   |
| NL2    | ON  | 1   | OFF | OFF | 4   | OFF | 2   | OFF | 2   |



## TYPICAL APPLICATION



TYPICAL CHARACTERISTICS (Ta = 25 °C, TYPICAL APPLICATION CIRCUIT)

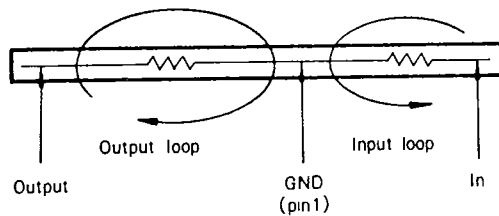


**NOTES FOR USE**

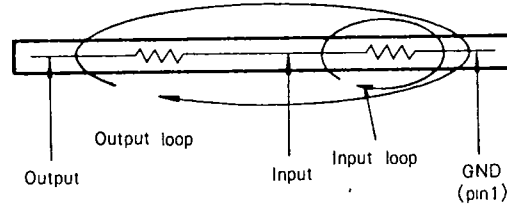
1. About capacitor C10  
To avoid parasitic oscillation at power amplifier stage, apply the suitable capacitor as C10 as follows.  
For a cassette tape recorder, a ceramic capacitor or a Mylar capacitor can be used equally.  
For a cassette tape recorder with radio, use a Mylar capacitor. If a ceramic capacitor is used, a parasitic oscillation may occur caused by feed back as radiation from the capacitor to an RF stage.
2. About recovery time at recording  
A recovery time depends on a time constant of a capacity value of C2 and a parallel value of R4 and an input impedance of IC at pin 13.  
The recovery time can be adjusted by R4 value.

## PRINTED CIRCUIT BOARD DESIGN CONSIDERATION

1. Use the widest possible printed foil for a power supply and a ground.
2. The earthing point of C8, C10 and an output terminal should be located as close as possible to the earthing (ground) pins (pin 1 and TAB).
3. One-point earthing is ideal, but if this is impossible, keep the input loop out of the output loop.



(good example)



(bad example)