

LA2800N



3061

Monolithic Linear IC

T-7S-07-15

Telephone Answering Machine

©2572

General Description

The LA2800N is a telephone answering machine-use bipolar IC that performs the basic functions required for telephone answering machine and has the microcomputer interfaces to control these functions. The LA2800N is housed in a 30-pin DIP shrink package.

The LA2800N can be used in conjunction with the LA4070 that contains the power amp for telephone answering machine, various drivers, and a 5V regulator to make up a telephone answering machine system.

Functions

- 1) Preamp for recording/playback x 2 (with ALC)  
(Recording: DC bias)
- 2) Microphone amp
- 3) Beep tone input amp
- 4) Analog switches for switchover of (1) to (3)
- 5) Voice detector
- 6) Zero-cross comparator for beep tone detection
- 7) CPC detector (CPC: Calling Party Control)
- 8) Line amp
- 9) Microcomputer interfaces

Features

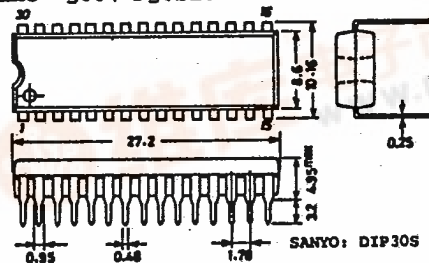
- . Since the basic functions required for telephone answering machine can be controlled by using a microcomputer, a unique telephone answering machine can be made available by preparing a software program.
- . The recording amp gain and DC bias current can be set independently by an external resistor.
- . Low distortion

Maximum Ratings at Ta=25°C

|                             |                     | unit           |
|-----------------------------|---------------------|----------------|
| Maximum Supply Voltage      | V <sub>CC</sub> max | 15 V           |
| Allowable Power Dissipation | Pdmax Ta≤70°C       | 400 mW         |
| Operating Temperature       | Topg                | -20 to +70 °C  |
| Storage Temperature         | Tstg                | -40 to +125 °C |

Continued on next page.

Case Outline 3061-D30SIC  
(unit:mm)



8067AT/5217KI, TS No.2572-1/9



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Continued from preceding page.

|                           |                 |  |     | unit |
|---------------------------|-----------------|--|-----|------|
| Allowable Flow-in Current | I <sub>18</sub> |  | 1.0 | mA   |
| Allowable Flow-in Current | I <sub>20</sub> |  | 1.0 | mA   |
| Allowable Flow-in Current | I <sub>22</sub> |  | 1.0 | mA   |
| Allowable Flow-in Current | I <sub>24</sub> |  | 1.0 | mA   |
| Allowable Flow-in Current | I <sub>25</sub> |  | 1.0 | mA   |
| Allowable Flow-in Current | I <sub>26</sub> |  | 1.0 | mA   |
| Allowable Flow-in Current | I <sub>27</sub> |  | 1.0 | mA   |
| Allowable Flow-in Current | I <sub>28</sub> |  | 1.0 | mA   |
| Allowable Flow-in Current | I <sub>29</sub> |  | 1.0 | mA   |
| Allowable Flow-in Current | I <sub>30</sub> |  | 1.0 | mA   |

Operating Conditions at Ta=25°C

|                            |                   |  |         | unit |
|----------------------------|-------------------|--|---------|------|
| Recommended Supply Voltage | V <sub>CC</sub>   |  | 9       | V    |
| Operating Voltage Range    | V <sub>CCOP</sub> |  | 7 to 12 | V    |

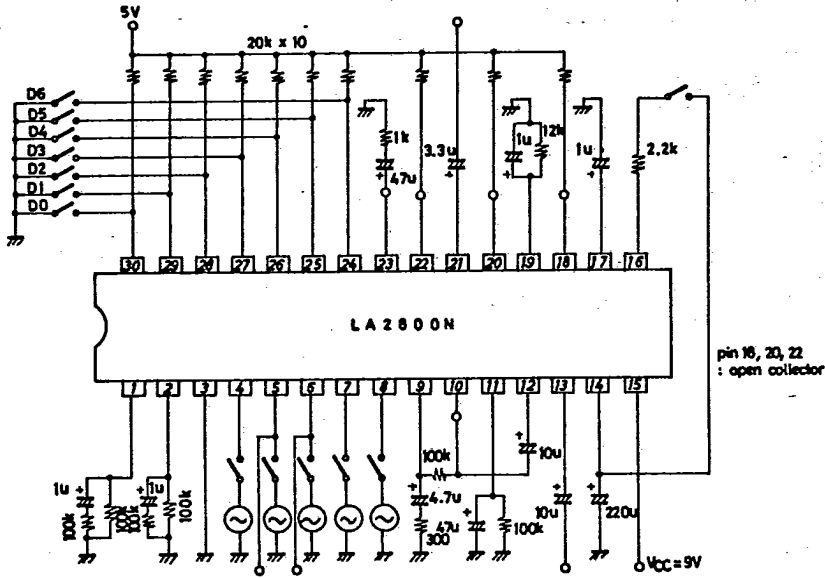
Operating Characteristics at Ta=25°C, V<sub>CC</sub>=9V

|  |                       |  | min  | typ  | max  | unit  |
|--|-----------------------|--|------|------|------|-------|
| [Preamp]                                       | OGM REC               |  |      |      |      |       |
| Voltage Gain                                   | V <sub>GC</sub>       | Closed loop -70dBs input,<br>Input pin7, Test pin10                                      | 47   | 49   | 51   | dB    |
| Total Harmonic Distortion                      | THD                   | Input -40dBs 1kHz, Input pin7,<br>Test pin10   | 0.5  | 1.0  |      | %     |
| ALC Turn Point                                 | V <sub>ALC</sub>      | Input pin7, Test pin10   | -58  | -54  | -50  | dB    |
| ALC Saturation Output Level                    | V <sub>OS</sub>       | Input -40dBs 1kHz, Input pin7,<br>Test pin10   | 453  | 570  | 718  | mVrms |
| Equivalent Input Noise Voltage                 | V <sub>NI</sub>       | Input short (2.2kohms<br>contained) FLAT, Test pin10                                     |      |      | 50   | uVrms |
| [REC Amp]                                      | OGM REC               |  |      |      |      |       |
| Voltage Gain                                   | V <sub>GR</sub>       | Pin1-GND, Z=50kohms,<br>Input pin12, Test pin5   | -6.8 | -3.8 | -0.8 | dB    |
| Output Bias Voltage                            |                       | Pin1-GND, Z=100kohms, Test pin5  | 1.1  | 1.8  | 2.3  | V     |
| [Line Amp]                                     | OGM OUT               |  |      |      |      |       |
| Voltage Gain                                   | V <sub>GL</sub>       | Input pin12, Test pin23  | 8    | 9.3  | 11   | dB    |
| Maximum Output Voltage                         | V <sub>OMAX</sub>     | Input pin12, Test pin23  | 2.0  |      |      | Vrms  |
| [Beep Tone Detector]                           | OGM PLAY              |  |      |      |      |       |
| Output Signal Duty Ratio                       | D·R                   | Pin 12 input -22dBs,<br>Input pin12, Test pin22  | 40   | 50   | 60   | %     |
| Output Terminal ON-State Voltage               | V <sub>SAT</sub>      | Pin 12 GND, 5V applied through<br>R=20kohms, Input pin12, Test pin22                     |      |      | 0.4  | V     |
| [Voice Detector]                               | OGM PLAY              |  |      |      |      |       |
| Sensitivity                                    | V <sub>VOICE LF</sub> | 1kHz, Pin 12 input -24dBs,<br>Input pin12, Test pin18                                    |      |      | 0.3  | V     |
|  | V <sub>VOICE HP</sub> | Pin12 input -28dBs,<br>Input pin12, Test pin18   | 4    |      | 6    | V     |
| Output Terminal ON-State Voltage               | V <sub>SAT</sub>      | 1V applied to pin17, 5V applied to<br>pin18 through R=20kohms<br>Input pin17, Test pin18 |      |      | 0.3  | V     |
| [Output Terminal ON-State Voltage]             |                       |  |      |      |      |       |
| Pin 20 (CPC Output) Voltage                    |                       | Pin21 GND, 5V applied to pin20<br>through R=20kohms, Test pin 20                         |      |      | 0.3  | V     |
| [Voltage Applied to Control Pin]               |                       |  |      |      |      |       |
| Voltage Applied to Control pin (Pins 24 to 30) | V <sub>H</sub>        | "1"=H level, Applied through<br>resistor   | 1    |      |      | V     |
|  | V <sub>L</sub>        | "0"=L level  |      |      | 0.3  | V     |

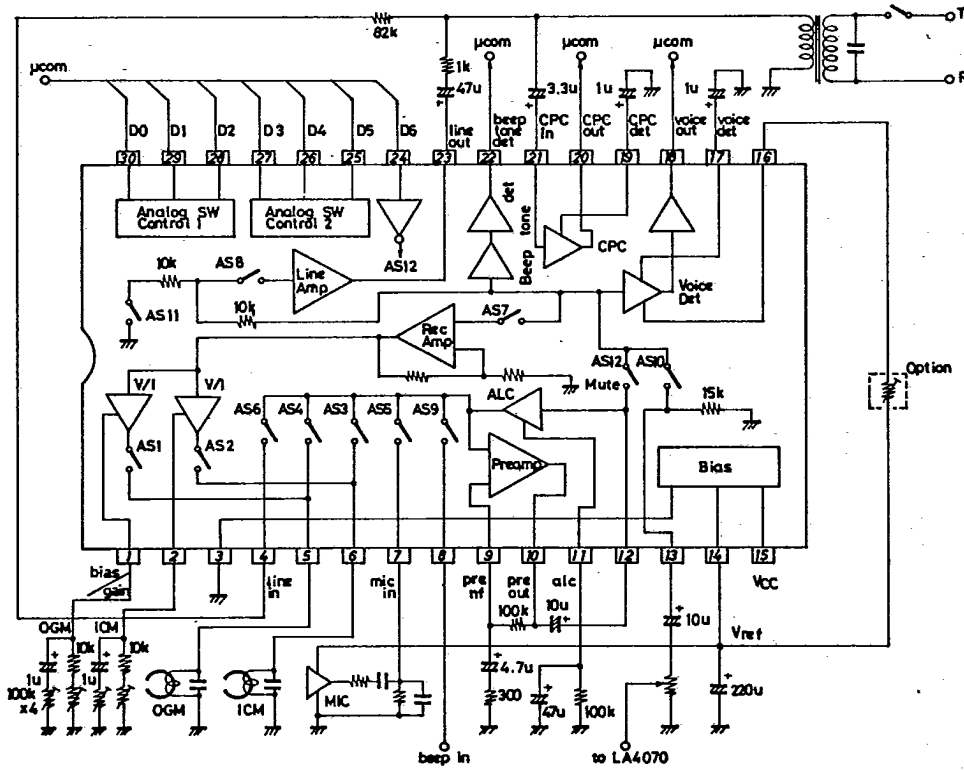
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Test Circuit



Equivalent Circuit Block Diagram



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**Mode Select** (On-chip switches AS1 to AS12 are controlled by D0 to D6.)  
 D0 to D6(pin30 to pin24): "1"="H"level, "0"="L"level  
 AS1 to AS12: "1"=ON, "0"=OFF

| D2,D1,D0 → AS1 to AS6, AS9 |    |    |    |     |     |     |     |     |     |     |
|----------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-----|
| MODE                       | D2 | D1 | D0 | AS1 | AS2 | AS3 | AS4 | AS5 | AS6 | AS9 |
| CLA                        | 0  | 0  | 0  | 0   | 0   | 1   | 0   | 0   | 0   | 0   |
| OGM REC                    | 0  | 0  | 1  | 1   | 0   | 0   | 0   | 1   | 0   | 0   |
| BEEP REC                   | 0  | 1  | 0  | 1   | 0   | 0   | 0   | 0   | 0   | 1   |
| OGM PLAY                   | 0  | 1  | 1  | 0   | 0   | 0   | 1   | 0   | 0   | 0   |
| PLAY                       | 0  | 0  | 0  | 0   | 0   | 1   | 0   | 0   | 0   | 0   |
| DICTIONATION REC           | 1  | 0  | 1  | 0   | 1   | 0   | 0   | 1   | 0   | 0   |
| OGM OUT                    | 0  | 1  | 1  | 0   | 0   | 0   | 1   | 0   | 0   | 0   |
| ICM REC                    | 1  | 1  | 1  | 0   | 1   | 0   | 0   | 0   | 1   | 0   |
| 2 WAY REC                  | 1  | 1  | 1  | 0   | 1   | 0   | 0   | 0   | 1   | 0   |
| CALL COUNTER OUT           | 0  | 1  | 0  | 1   | 0   | 0   | 0   | 0   | 0   | 1   |
| ICM OUT                    | 0  | 0  | 0  | 0   | 0   | 1   | 0   | 0   | 0   | 0   |
| ALARM                      | 0  | 1  | 0  | 1   | 0   | 0   | 0   | 0   | 0   | 1   |
| OGM CHANGE                 | 1  | 0  | 0  | 1   | 0   | 0   | 0   | 0   | 1   | 0   |
| LINE MUTE I                | 0  | 1  | 1  | 0   | 0   | 0   | 1   | 0   | 0   | 0   |
| LINE MUTE II               | 0  | 0  | 0  | 0   | 0   | 1   | 0   | 0   | 0   | 0   |
| REMOTE CONTROL SIGNAL MUTE | 0  | 0  | 0  | 0   | 0   | 1   | 0   | 0   | 0   | 0   |
| 2 WAY BEEP                 | 1  | 1  | 0  | 0   | 1   | 0   | 0   | 0   | 0   | 1   |

| D5,D4,D3 → AS8, AS10, AS7, AS11 |    |    |    |     |      |     |      |
|---------------------------------|----|----|----|-----|------|-----|------|
| MODE                            | D5 | D4 | D3 | AS8 | AS10 | AS7 | AS11 |
| CLA                             | 0  | 0  | 0  | 0   | 0    | 0   | 0    |
| OGM REC                         | 0  | 0  | 1  | 0   | 0    | 1   | 0    |
| BEEP REC                        | 0  | 0  | 1  | 0   | 0    | 1   | 0    |
| OGM PLAY                        | 0  | 1  | 0  | 0   | 1    | 0   | 0    |
| PLAY                            | 0  | 1  | 0  | 0   | 1    | 0   | 0    |
| DICTIONATION REC                | 0  | 0  | 1  | 0   | 0    | 1   | 0    |
| OGM OUT                         | 1  | 1  | 0  | 1   | 1    | 0   | 0    |
| ICM REC                         | 0  | 1  | 1  | 0   | 1    | 1   | 0    |
| 2 WAY REC                       | 0  | 0  | 1  | 0   | 0    | 1   | 0    |
| CALL COUNTER OUT                | 1  | 1  | 0  | 1   | 1    | 0   | 0    |
| ICM OUT                         | 1  | 1  | 0  | 1   | 1    | 0   | 0    |
| ALARM                           | 0  | 1  | 0  | 0   | 1    | 0   | 0    |
| OGM CHANGE                      | 0  | 1  | 1  | 0   | 1    | 1   | 0    |
| LINE AMP MUTE I, II             | 0  | 1  | 0  | 0   | 1    | 0   | 0    |
| REMOTE CONTROL SIGNAL MUTE      | 0  | 1  | 0  | 0   | 1    | 0   | 0    |
| 2 WAY BEEP                      | 1  | 1  | 1  | 1   | 1    | 1   | 1    |

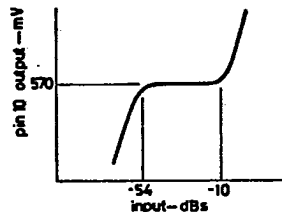
| D6 → AS12    |          |      |
|--------------|----------|------|
| MODE         | D6(MUTE) | AS12 |
| LINE IN MUTE | 0        | 1    |

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**Description of Equivalent Circuit Block Diagram**

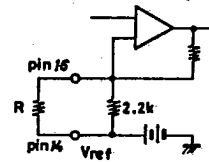
- 1) D1 to D6 (pin 30 to pin 24)  
Each pin can be driven by the microcomputer output. D0 to D2 switches and D3 to D5 switches are independent.
- 2) BIAS  
Provides Vref(pin 14) of approximately 4.2V.
- 3) Peramp  
Amplifies the input signal at pins 4 to 8. The open-loop gain characteristic of the amp is shown in Fig.G-6.
- 4) ALC  
The ALC operates in the input range of -54dBs to approximately -10dBs. The ALC saturation output level is 570mA. The ALC characteristic is shown in Fig.G-1



- 5) MUTE(AS12)  
Mutes the preamp output. When pin 24 is at "1" level, the AS12 opens.
- 6) Recamp  
Amp used for recording
- 7) V/I(pin1,pin2) recording current  
V/I conversion is made to draw the recording current for DC bias. The conversion gain and bias current can be changed arbitrarily by external constants connected to pin 1 and pin 2. When the OGM head and the ICM head have the same characteristics, the number of parts can be reduced by shorting pin 1 and pin 2.
- 8) Lineamp  
Buffer amp for line output
- 9) Beep tone det  
A microcomputer is used to identify the beep tone signal or remote control signal included in the pin 22 output.  
Zero-cross comparator for pin 12 input signal (V12)  
The duty ratio of the pin 22 output waveform is shown in Fig.G-3.



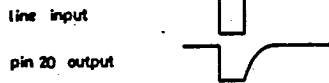
- 10) Voice det  
Detects the presence or absence of a call. Pin 12 input signal (V12) level detection  
 $V_{12} \geq -24\text{dBs}$ -----Pin 18 "L"  
Adjustment of detection level. R can be used to set the detection level. Refer to the figure shown right.  
The Voice detection sensitivity -  $V_{CC}$  characteristic is shown in Fig.G-4



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- 11) CPC det (Calling Party Control)  
Detects ON-hook of calling party.



The relation between peak value and pulse width of the line input signal that can be detected is shown in Fig.G-5

#### Mode Description

- 1) CLA (Clear): Input(pin 6), Output(pin 22)
  - . Standby mode
  - . BEEP tone usable for microcomputer control
- 2) OGM REC (Outgoing Message Rec.): Input(pin 7), Output(pins 5,22)
  - . Outgoing message recording
- 3) BEEP REC: Input(pin 8), Output(pins 5,22)
  - . BEEP signal recording before and after outgoing message
- 4) OGM PLAY: Input (pin 5), Output(pins 13,22)
  - . Outgoing message playback and check
- 5) PLAY: Input (pin 6), Output(pins 13,22)
  - . Incoming message playback
  - . Recorded dictation playback
- 6) DICT REC: Input(pin 7), Output(pins 6,22)
  - . MIC-used dictation recording (recording of message to family or brief message contents)
- 7) OGM OUT: Input(pin 5), Output (pins 13,22,23)
  - . Outgoing message line-output (at remote control operation mode, etc)
  - . Outgoing message playback
- 8) ICM REC (Incoming Message Rec.): Input(pin 4), Output(pins 6,13,22)
  - . Incoming message recording (remote-controlled from the place where you have gone)
  - . Recording of dictation sent from the place where you have gone
- 9) 2-WAY REC: Input(pin 4),Output(pins 6,22)
  - . Recording of both conversations while talking over the telephone
  - . Incoming message recording
- 10) CALL COUNTER OUT: Input (pin 8), Output(pins 13,22,23)
  - . Speaker-output and line-output of alarm sound
  - . Used when sending alarm sound at the end of outgoing message
  - . Possible to send back the call of you calling party to surprise such party by line-inputting to pin 8.
- 11) ICM OUT: Input(pin 6), Output(pins 13,22,23)
  - . Incoming message playback
  - . Listening to the incoming message through the telephone installed in the place where you have gone.
  - . Incoming message line-output
  - . Recorded dictation playback
- 12) ALARM: Input(pin 8), Output(pins 13,22)
  - . Speaker-output of alarm sound at the time of recording start
  - . Speaker-output of various kinds of signal
- 13) OGM CHANGE: Input (pin 4), Output (pins 5,13,22)
  - . Change of outgoing message by remote control from the place where you have gone
- 14) LINE MUTE I
  - . Same as OGM PLAY

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- 15) LINE MUTE II
  - . Same as PLAY
- 16) REMOTE CONTROL SIGNAL MUTE
  - . Same as PLAY
- 17) 2-WAY BEEP: Input(pin 8), Output(pins 6,13,22,23)
  - . Speaker-output of alarm sound and incoming message recording and also line-output to your calling party
  - . Your calling party is made known that the incoming message is being recorded.
  - . Line-output is down 6dB from line-output at other mode.
- 18) LINE IN MUTE: D6(pin 24)
  - . Output muting

|            |           |              |
|------------|-----------|--------------|
| D6(pin 24) | AS12      |              |
| 1(H level) | 0(open)   | MUTE         |
| 0(L level) | 1(closed) | MUTE release |

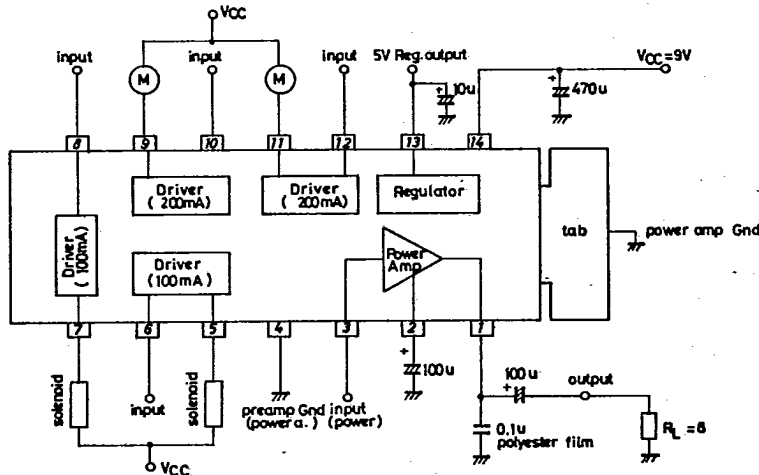
[Reference] General Description of LA4070

- Functions
- . Power amp ( $V_{CC}=9V, R_L=8\text{ohms}, P_o=0.5W$ )
  - . 5V regulator ( $I_{OUT}=70\text{mA max}$ )
  - . Driver (200mA max X 2, 100mA max X 2, with killer diode)

Case Outline: DIP-14T

| Main Characteristics      |   | min  | typ | max | unit |
|---------------------------|---|------|-----|-----|------|
| Power Amp Gain            | $f=1\text{kHz}, R_L=8\text{ohms}, R_g=600\text{ohms}$ | 20   | 22  | 24  | dB   |
| Power Amp Output          | THD=10%   |      | 0.5 |     | W    |
| Power Amp Distortion      | $P_o=0.2W$  |      | 0.5 | 1.5 | %    |
| Regulator Output Voltage  |   | 4.5  | 5.0 | 5.5 | V    |
| Regulator Output Current  |   |      |     | 70  | mA   |
| Driver (Active-low)       | $I_{OUT}=200\text{mA (Pins 9,11)}$                    | 0.35 | 0.5 |     | V    |
| Output Saturation Voltage | $I_{OUT}=100\text{mA (Pins 5,7)}$                     | 0.35 | 0.5 |     | V    |

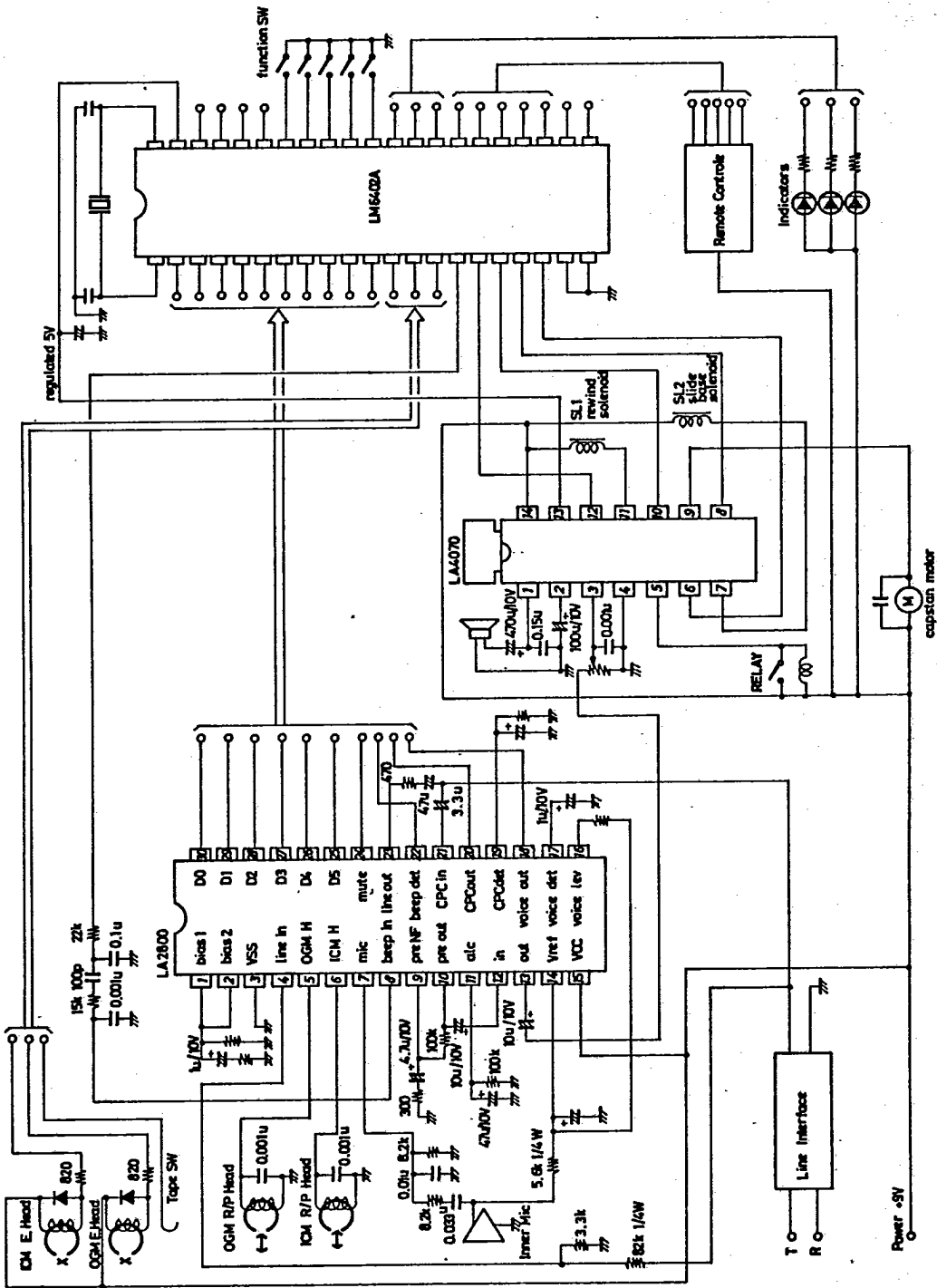
Equivalent Circuit Block Diagram



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Sample Application Circuit: LA2800N/LA4070





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Fig.G-1 Preamp ALC Characteristic, Distortion

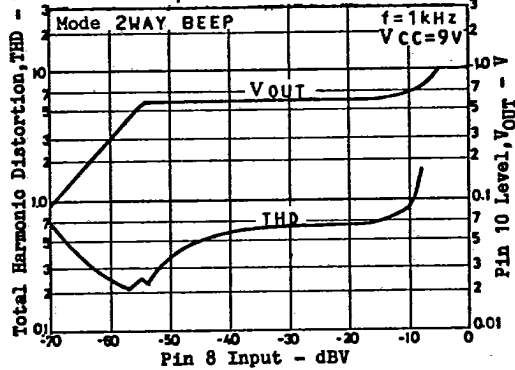


Fig.G-2 Input - Output Characteristic, Distortion

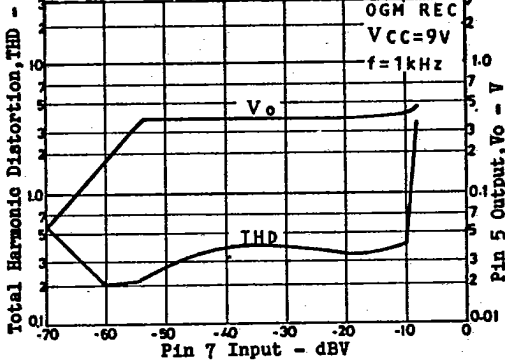


Fig.G-3 Beep Tone, Input - Duty Ratio

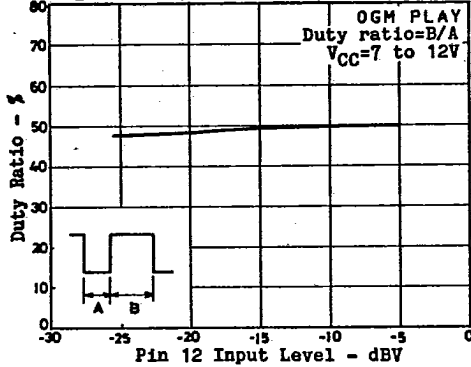


Fig.G-3 Beep Tone, VCC - Duty Ratio

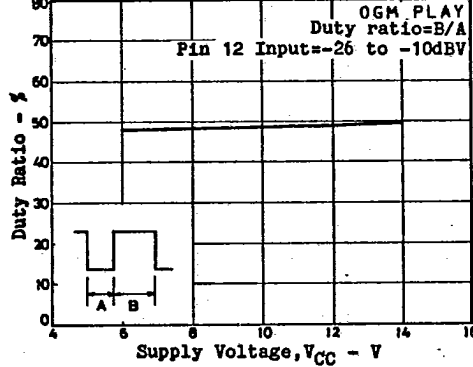


Fig.G-4 Voice Detector Detection Sensitivity

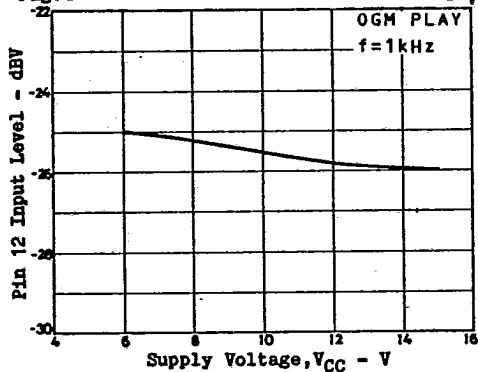


Fig.G-5 CPC Line Input - Response Pulse Width

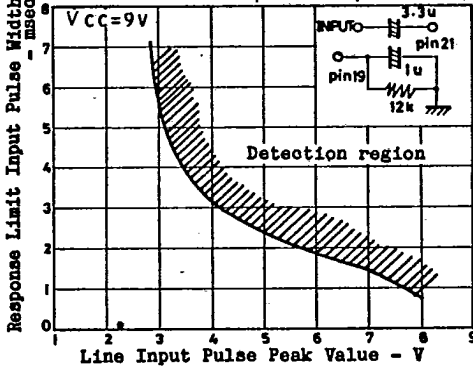


Fig.G-6 Preamp, f - VGO

