

**PRELIMINARY**  
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# M65831AP/FP

## DIGITAL ECHO (DIGITAL DELAY)

### DESCRIPTION

The M65831A is an IC developed for producing echo effects added to voice signals picked up by microphone for karaoke applications. The IC has the largest memory among the digital delay series. As it's design is aimed at high performance, it is best suited to provide radio cassette tape recorders and miniature unit audio system with quality echo function. Being pin compatible with the M65830CP / FP and M65843AP / FP, the M65831AP / FP is suitable for upgrading the series.

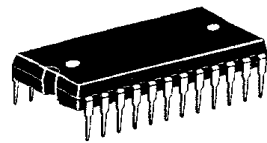
### FEATURES

- Built-in input / output filters, A-D and D-A converters, and memory realize a delay system with only a single chip
- Capable of composing low-noise and low-distortion delay system at low cost by ADM system  
 (No=-92dB typ, THD=0.5% typ)
- Control mode selections available from 2 kinds : easy mode using parallel data and microcomputer mode using serial data
- Sleep mode can be selected to stop IC functions
- Built-in automatic reset circuit

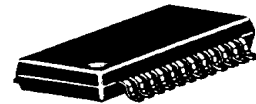
### RECOMMENDED OPERATING CONDITIONS

Supply voltage range ----- VCC,VDD=4.5 to 5.5V  
 Rated supply voltage ----- VCC,VDD=5.0V

### Outline

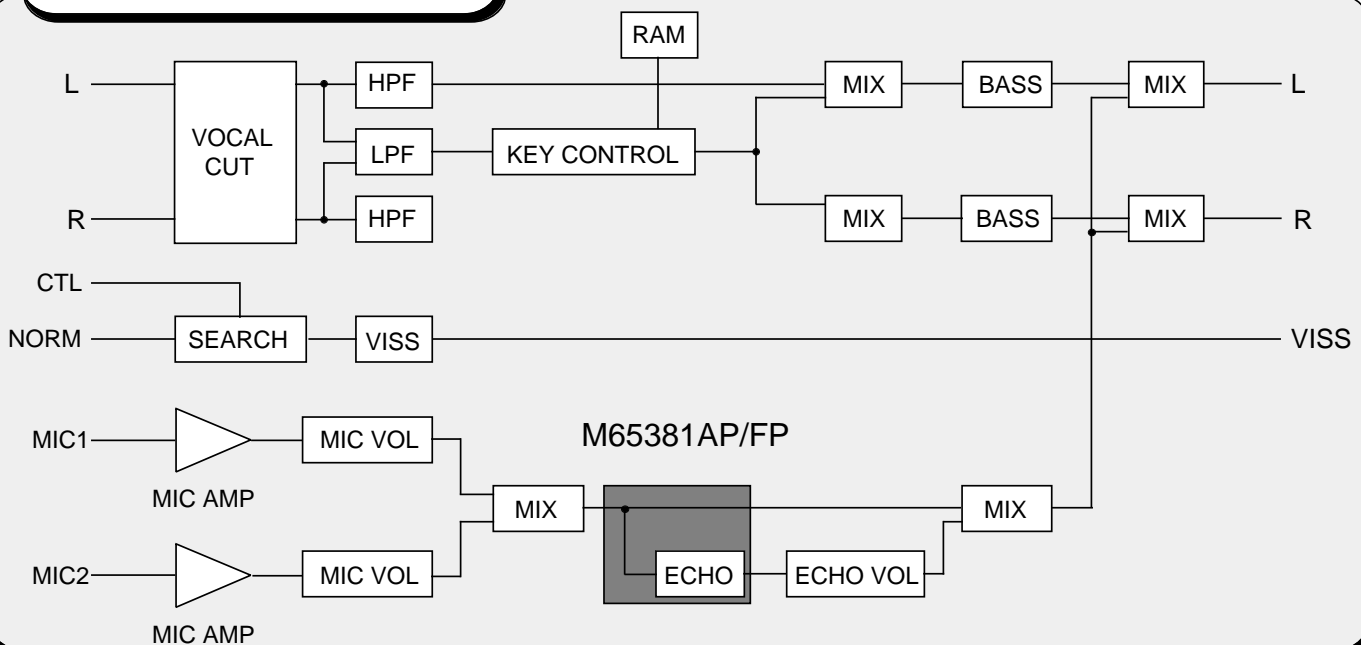


Outline 24P4 (AP)  
 2.54mm pitch 600mil DIP  
 (13.0mm X 31.1mm X 3.8mm)



Outline 24P2W-A(AFP)  
 1.27mm pitch 450mil SOP  
 (8.4mm X15.0mm X2.0mm)

### SYSTEM CONFIGURATION



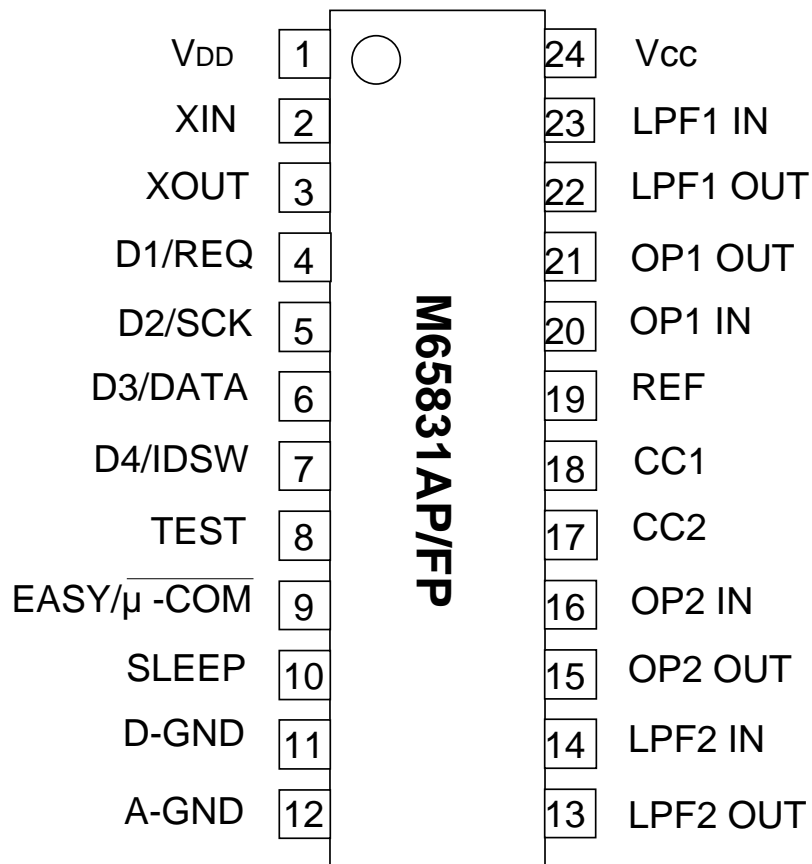
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## DIGITAL ECHO (DIGITAL DELAY)

### Pin Configuration

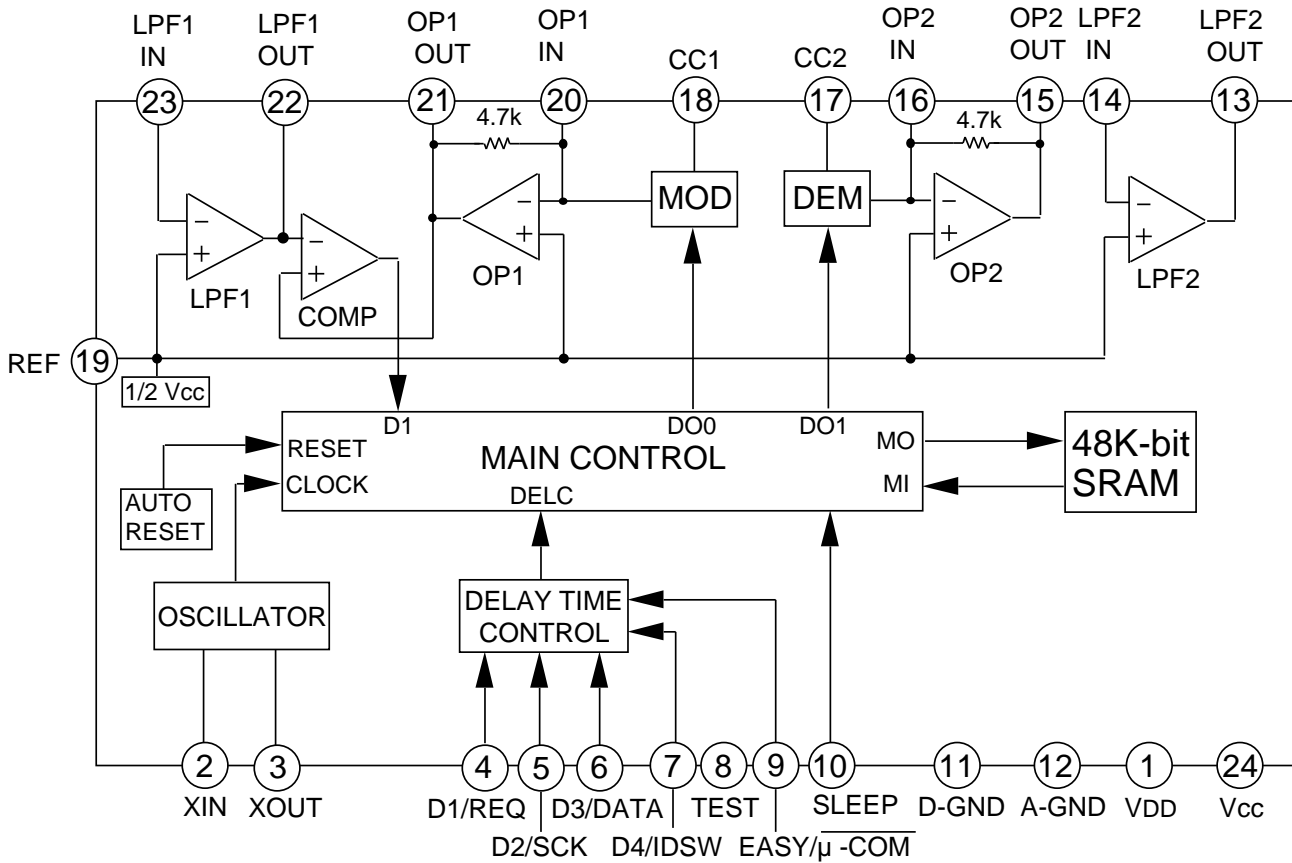


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## DIGITAL ECHO (DIGITAL DELAY)

### BLOCK DIAGRAM



Unit Resistance:

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## DIGITAL ECHO (DIGITAL DELAY)

### PIN DESCRIPTION

| No. | Symbol                      | Name                        | I/O | Function  |
|-----|-----------------------------|-----------------------------|-----|---|
| ①   | V <sub>DD</sub>             | Digital V <sub>DD</sub>     | —   | Supply voltage  |
| ②   | X <sub>IN</sub>             | Oscillator input            | I   |   |
| ③   | X <sub>OUT</sub>            | Oscillator output           | O   | Connects to 2MHz ceramic filter                             |
| ④   | D1/REQ                      | Delay1/Request              | I   | Easy mode:inputs D1 data<br>μ -COM mode:inputs request data |
| ⑤   | D2/SCK                      | Delay2/Shift clock          | I   | Easy mode:inputs D2 data<br>μ -COM mode:inputs shift clock  |
| ⑥   | D3/DATA                     | Delay3/Serial data          | I   | Easy mode:inputs D3 data<br>μ -COM mode:inputs serial data  |
| ⑦   | D4/IDSW                     | Delay4/ID switch            | I   | Easy mode:inputs D4 data<br>μ -COM mode:controls ID code    |
| ⑧   | TEST                        | Test                        | I   | L=normal mode   |
| ⑨   | EASY/ $\overline{\mu -COM}$ | Easy/ $\overline{\mu -COM}$ | I   | H=easy mode<br>L=μ -COM mode                                |
| ⑩   | SLEEP                       | Sleep                       | I   | H=sleep mode<br>L=normal mode                               |
| ⑪   | D GND                       | Digital GND                 | —   | Connects to analog GND at one point                         |
| ⑫   | A GND                       | Analog GND                  | —   | Connects to analog GND                                      |
| ⑬   | LPF2 OUT                    | Low pass filter2 output     | O   | Forms low pass filter with external C.R                     |
| ⑭   | LPF2 IN                     | Low pass filter2 input      | I   |   |
| ⑮   | OP2 OUT                     | OP-AMP2 output              | O   | Forms integrator with external C.R                          |
| ⑯   | OP2 IN                      | OP-AMP2 input               | I   |   |
| ⑰   | CC2                         | Current control 2           | —   |   |
| ⑱   | CC1                         | Current control 1           | —   |   |
| ⑲   | REF                         | Reference                   | —   | =1/2V <sub>CC</sub>   |
| ⑳   | OP1 IN                      | OP-AMP1 input               | I   | Forms integrator with external C.R                          |
| ㉑   | OP1 OUT                     | OP-AMP1 output              | O   |   |
| ㉒   | LPF1 OUT                    | Low pass filter1 output     | O   | Forms low pass filter with external C.R                     |
| ㉓   | LPF1 IN                     | Low pass filter1 input      | I   |   |
| ㉔   | V <sub>CC</sub>             | Analog V <sub>CC</sub>      | —   | Supply voltage  |

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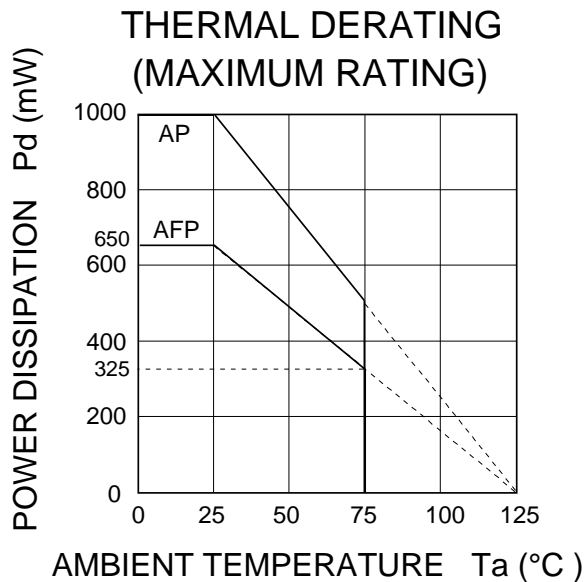
# M65831AP/FP

## DIGITAL ECHO (DIGITAL DELAY)

### ABSOLUTE MAXIMUM RATINGS

(V<sub>cc</sub>=5V, f=1kHz, V<sub>i</sub>=100mV<sub>rms</sub>, T<sub>a</sub>=25°C, unless otherwise noted)

| Symbol           | Parameter             | Conditions | Ratings  | Units |
|------------------|-----------------------|------------|----------|-------|
| V <sub>cc</sub>  | Supply voltage        |            | 6.5      | V     |
| I <sub>cc</sub>  | Circuit current       |            | 100      | mA    |
| P <sub>d</sub>   | Power dissipation     | M65831AP   | 1        | W     |
|                  |                       | M65831AFP  | 650      | mW    |
| T <sub>opr</sub> | Operating temperature |            | -20~+75  | °C    |
| T <sub>stg</sub> | Storage temperature   |            | -40~+125 | °C    |



### RECOMMENDED OPERATING CONDITIONS

| Symbol                           | Parameter          | Conditions | Limits             |     |                    | Units |
|----------------------------------|--------------------|------------|--------------------|-----|--------------------|-------|
|                                  |                    |            | Min                | Typ | Max                |       |
| V <sub>cc</sub>                  | Supply voltage     |            | 4.5                | 5   | 5.5                | V     |
| V <sub>DD</sub>                  | Supply voltage     |            | 4.5                | 5   | 5.5                | V     |
| V <sub>cc</sub> -V <sub>DD</sub> | Difference voltage |            | -0.3               | 0   | 0.3                | V     |
| f <sub>ck</sub>                  | Clock frequency    |            | 1                  | 2   | 3                  | MHz   |
| V <sub>IH</sub>                  | High input voltage |            | 0.7V <sub>DD</sub> |     | V <sub>DD</sub>    | V     |
| V <sub>IL</sub>                  | Low input voltage  |            | 0                  |     | 0.3V <sub>DD</sub> | V     |

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## DIGITAL ECHO (DIGITAL DELAY)

### ELECTRICAL CHARACTERISTICS

(Vcc=5V, f=1kHz, Vi=100mVrms, Ta=25°C, unless otherwise noted)

| Symbol | Parameter                      | Test conditions           | Limits    |      |      | Units |   |
|--------|--------------------------------|---------------------------|-----------|------|------|-------|---|
|        |                                |                           | Min       | Typ  | Max  |       |   |
| Icc    | Circuit current                | No signal                 | —         | 18.0 | 40.0 | mA    |   |
| Gv     | Voltage gain                   | RL=47k                    | -3.5      | -0.5 | 2.5  | dB    |   |
| Vomax  | Maximum output voltage         | THD=10%                   | 0.7       | 1    | —    | Vrms  |   |
| THD    | Output distortion              | 30kHz LPF                 | fs=500kHz | —    | 0.3  | 1.0   | % |
|        |                                |                           | fs=250kHz | —    | 0.5  | 1.5   |   |
| No     | Output noise voltage           | DIN-AUDIO<br>(fs=250kHz)  | —         | -92  | -75  | dBV   |   |
| SVRR   | Supply voltage rejection ratio | Vcc=-20dBV, f=100Hz       | —         | -40  | -25  | dB    |   |
| TMUTE  | Mute time                      | Upon changing Delay Time  | 508       | 528  | 548  | ms    |   |
|        |                                | Upon canceling Sleep Mode | 508       | 528  | 548  |       |   |
| Iccs   | Circuit current (Sleep mode)   | Sleep Mode                | —         | 14.0 | 30.0 | mA    |   |

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## DIGITAL ECHO (DIGITAL DELAY)

### OPERATION

#### 1) DELAY TIME

| D4 | D3 | D2 | D1 | fs  | Td    |
|----|----|----|----|-----|-------|
| L  | L  | L  | L  | 500 | 12.3  |
|    |    |    | H  |     | 24.6  |
|    |    | H  | L  |     | 36.9  |
|    |    |    | H  |     | 49.2  |
|    | H  | L  | L  |     | 61.4  |
|    |    |    | H  |     | 73.7  |
|    |    | H  | L  |     | 86.0  |
|    |    |    | H  |     | 98.3  |
| H  | L  | L  | L  | 250 | 110.6 |
|    |    |    | H  |     | 122.9 |
|    |    | H  | L  |     | 135.2 |
|    |    |    | H  |     | 147.5 |
|    | H  | L  | L  |     | 159.7 |
|    |    |    | H  |     | 172.0 |
|    |    | H  | L  |     | 184.3 |
|    |    |    | H  |     | 196.6 |

fs=sampling frequency(kHz)  
 Td=delay time(msec)

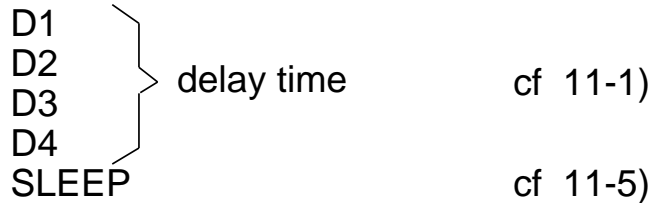
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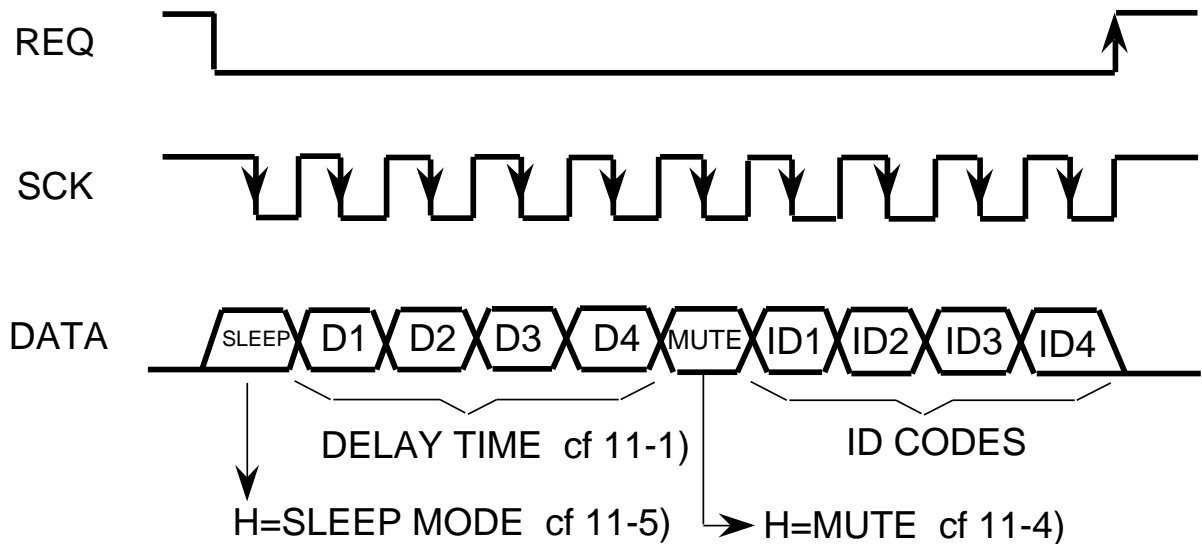
## DIGITAL ECHO (DIGITAL DELAY)

### 2) EASY MODE (EASY / $\overline{\mu\text{-COM}}=H$ )

D1,D2,D3,D4 and sleep are for easy mode



### 3) $\mu\text{-COM}$ MODE (EASY / $\overline{\mu\text{-COM}}=L$ )



TIMING DIAGRAM

This Timing chart shows that delay time is set by serial data from  $\mu\text{-COM}$ .

DATA signal is latched at the falling edge of SCK signal, the last ten data are set at the rising edge of REQ signal when ID codes are satisfied. \*

\* { ID1, ID3: L  
 ID2 : H  
 ID4 : equal to IDSW

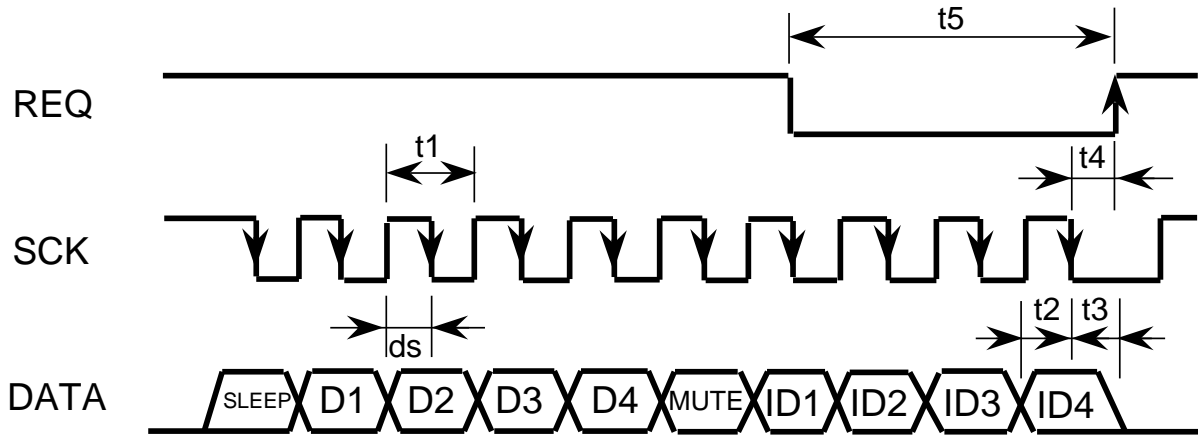


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## DIGITAL ECHO (DIGITAL DELAY)

### REQ,SCK,DATA INPUT TIMING



| Symbol | Parameter       | min | typ     | max | Units |
|--------|-----------------|-----|---------|-----|-------|
| $t_1$  | SCK pulse width | 250 | —       | —   | nsec  |
| $ds$   | SCK pulse duty  | —   | 50      | —   | %     |
| $t_2$  | DATA setup time | 100 | $t_1/2$ | —   | nsec  |
| $t_3$  | DATA hold time  | 100 | $t_1/2$ | —   | nsec  |
| $t_4$  | REQ hold time   | 100 | —       | —   | nsec  |
| $t_5$  | REQ pulse width | 250 | —       | —   | nsec  |

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## DIGITAL ECHO (DIGITAL DELAY)

### 4) MUTING

#### (1) Easy mode

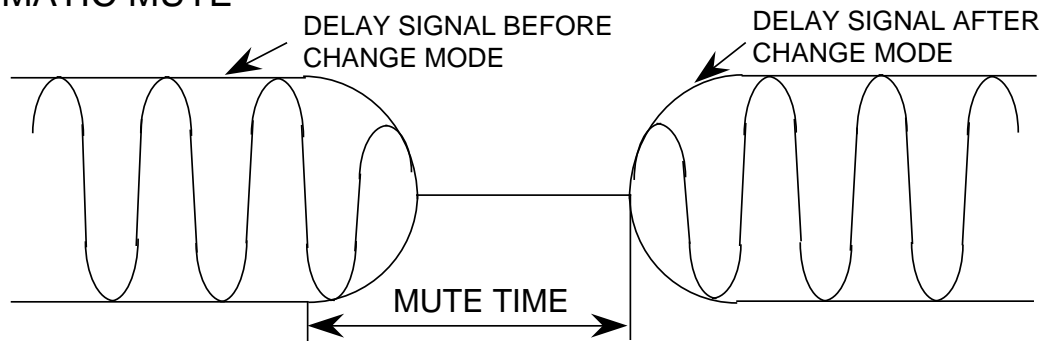
Automatic mute upon changing delay time, cancelling SLEEP mode and power-on.

#### (2) $\mu$ -COM mode

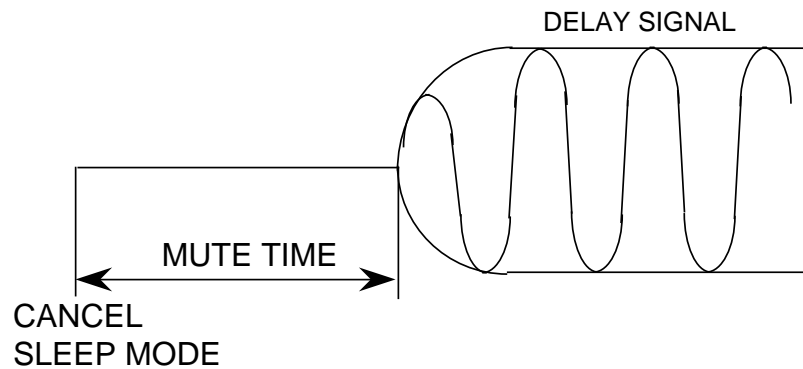
MUTE=H:mute

MUTE=L:automatic mute

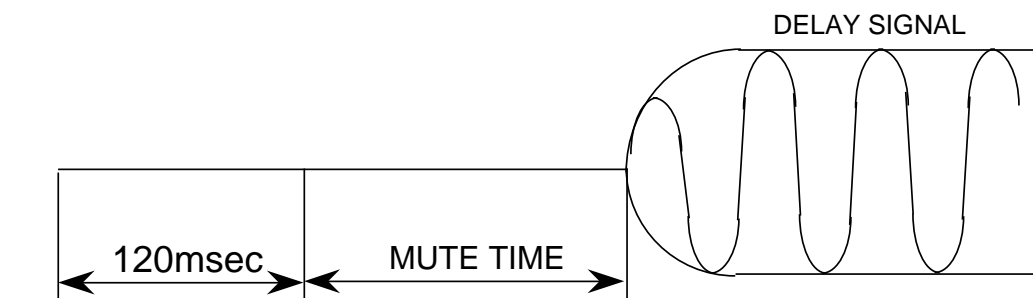
#### AUTOMATIC MUTE



(a) UPON CHANGING DELAY TIME



(b) UPON CANCELLING SLEEP MODE



(c) UPON POWER-ON

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## DIGITAL ECHO (DIGITAL DELAY)

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### 5) SLEEP MODE

SLEEP data is

( H:clock and RAM stop to reduce circuit current (SLEEP mode)  
L:normal operation

### 6) SYSTEM RESET

Automatically reset power-on. The reset time is about 120msec.

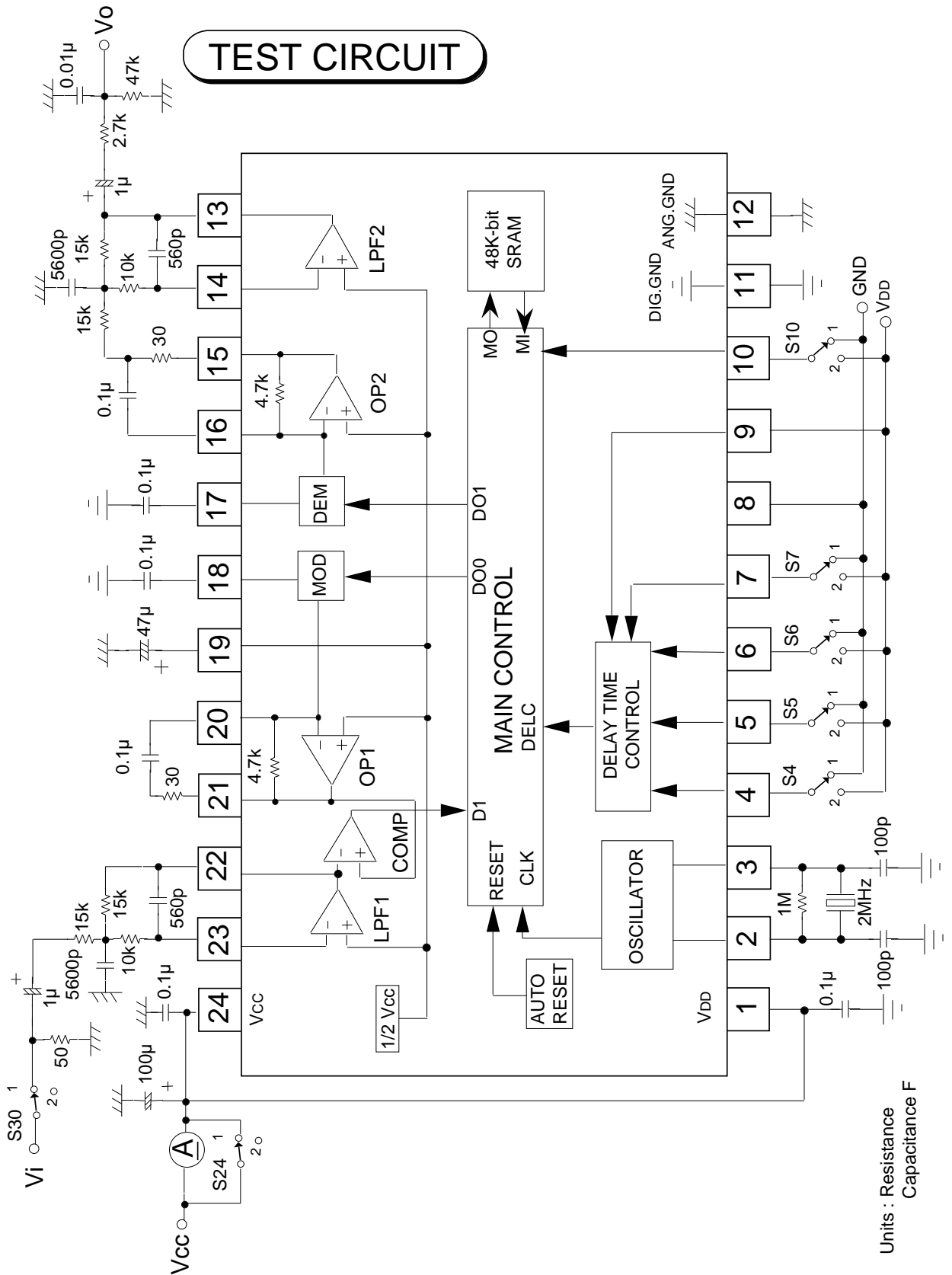
Delay time is set at 147.5msec.

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## DIGITAL ECHO (DIGITAL DELAY)

### TEST CIRCUIT



Units : Resistance  
 Capacitance F

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## DIGITAL ECHO (DIGITAL DELAY)

### TEST METHODS

Switch condition

\* 1 or 2

| No | Parameter                      | Sampling frequency | Symbol  | S 4                         | S 5 | S 6 | S 7 | S 10                        | S 24 | S 30 | notes                      |
|----|--------------------------------|--------------------|---------|-----------------------------|-----|-----|-----|-----------------------------|------|------|----------------------------|
| 1  | Current circuit                | —                  | Icc     | 1                           | 1   | 1   | 1   | 1                           | 2    | 2    | No signal                  |
| 2  | Voltage gain                   | 500kHz             | Gv1     | *                           | *   | *   | 1   | 1                           | 1    | 1    |                            |
|    |                                | 250kHz             | Gv2     | *                           | *   | *   | 2   | 1                           | 1    | 1    |                            |
| 3  | Delay time                     | 500kHz             | Tda     | 1                           | 1   | 1   | 1   | 1                           | 1    | 1    | cf. 11-1)                  |
|    |                                |                    | Tdb     | 2                           | 1   | 1   | 1   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdc     | 1                           | 2   | 1   | 1   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdd     | 2                           | 2   | 1   | 1   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tde     | 1                           | 1   | 2   | 1   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdf     | 2                           | 1   | 2   | 1   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdg     | 1                           | 2   | 2   | 1   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdh     | 2                           | 2   | 2   | 1   | ↓                           | ↓    | ↓    |                            |
|    |                                | 250kHz             | Tdi     | 1                           | 1   | 1   | 2   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdj     | 2                           | 1   | 1   | 2   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdk     | 1                           | 2   | 1   | 2   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdl     | 2                           | 2   | 1   | 2   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdm     | 1                           | 1   | 2   | 2   | ↓                           | ↓    | ↓    |                            |
|    |                                |                    | Tdn     | 2                           | 1   | 2   | 2   | ↓                           | ↓    | ↓    |                            |
| 4  | Output voltage (max)           | 500kHz             | Vomax 1 | *                           | *   | *   | 1   | 1                           | 1    | 1    | 30kHz L.P.F.<br>THD=10%    |
|    |                                | 250kHz             | Vomax 2 | *                           | *   | *   | 2   | 1                           | 1    | 1    |                            |
| 5  | Total harmonic distortion      | 500kHz             | THD 1   | *                           | *   | *   | 1   | 1                           | 1    | 1    | 30kHz L.P.F.               |
|    |                                | 250kHz             | THD 2   | *                           | *   | *   | 2   | 1                           | 1    | 1    |                            |
| 6  | Output noise voltage           | 250kHz             | No      | *                           | *   | *   | 2   | 1                           | 1    | 1    | DIN AUDIO<br>Vi=0mVrms     |
| 7  | Supply voltage rejection ratio | —                  | SVRR    | *                           | *   | *   | *   | 1                           | 1    | 2    | Vcc=-20dBv,<br>f=100Hz     |
| 8  | Mute time                      | —                  | MUTE T  | <sup>2</sup> ↓ <sub>1</sub> | *   | *   | *   | 1                           | 1    | 1    | Upon changing Delay Time   |
|    |                                | —                  | MUTE S  | *                           | *   | *   | *   | <sup>2</sup> ↓ <sub>1</sub> | 1    | 1    | Upon cancelling Sleep Mode |

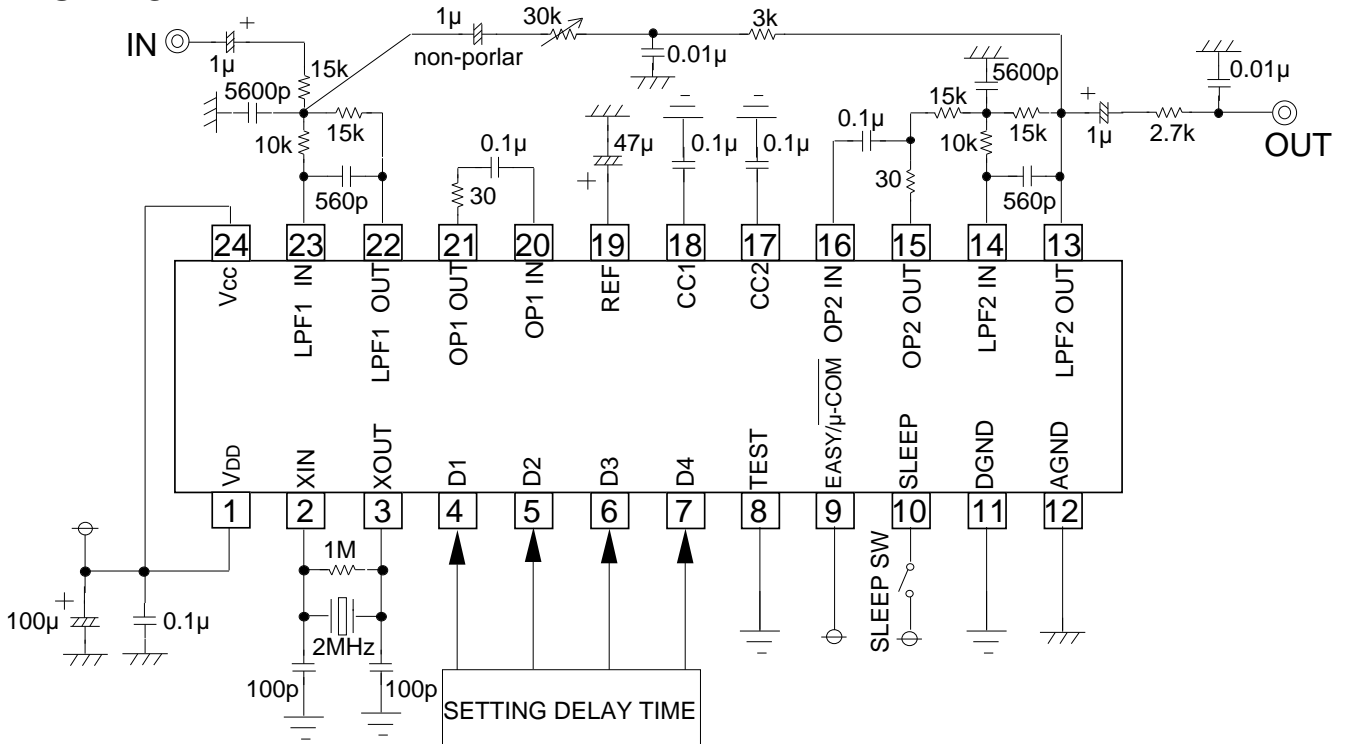
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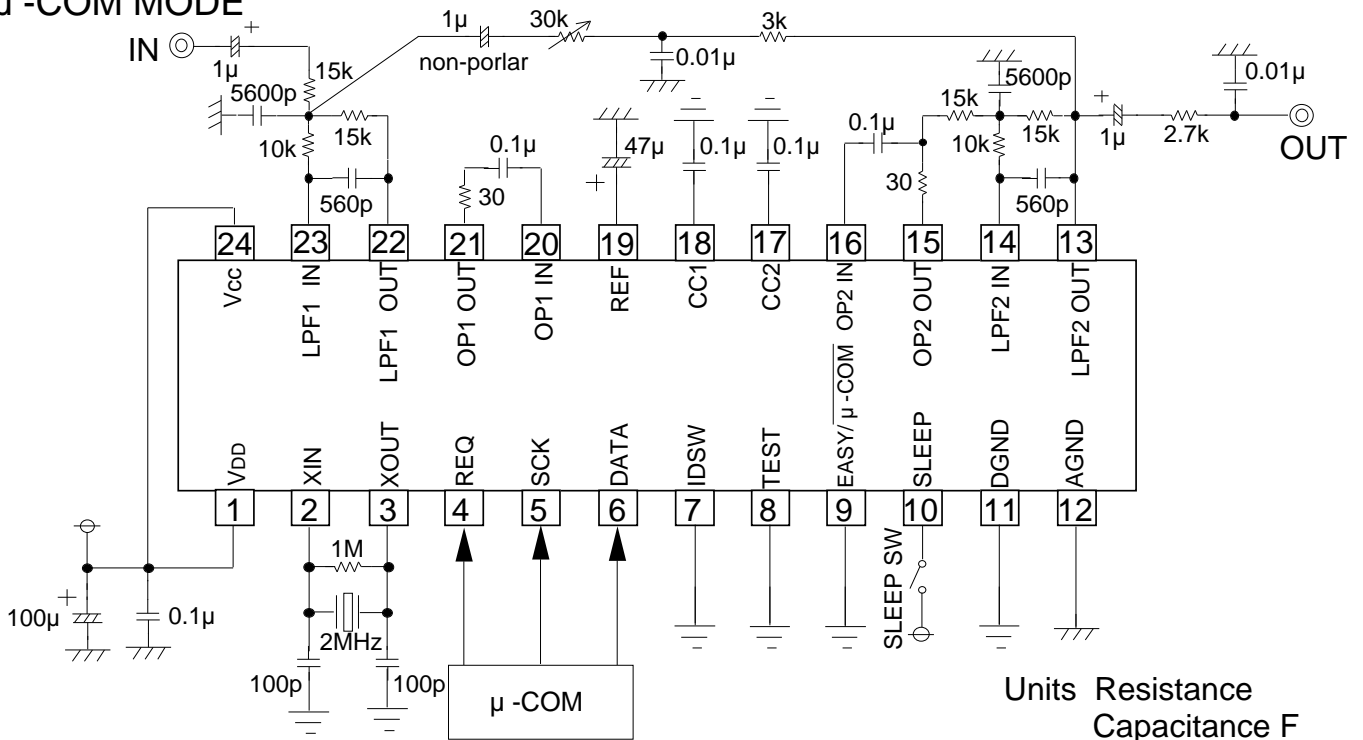
## DIGITAL ECHO (DIGITAL DELAY)

### APPLICATION EXAMPLE

#### 1.EASY MODE



#### 2.µ -COM MODE



Units Resistance  
 Capacitance F