Capstone Design Course

Lecture-14: Voice Record/Playback Chip

By

Syed Masud Mahmud, Ph.D.

Copyright © 2003 by Syed Masud Mahmud
Single Chip Voice Record/Playback Device

Figure: ISD2560/75/90/120 Device Block Diagram

- Internal Clock
- Timing
- Sampling Clock
- 5-Pole Active Antialiasing Filter
- Analog Transceivers
  - 480K Cell Nonvolatile Multilevel Storage Array
  - Decoders
    - Automatic Gain Control (AGC)
    - Power Conditioning
    - Address Buffers
    - Device Control

- ChipCorder® TECHNOLOGY BY ISD
480K Nonvolatile Storage Array

5-Pole Active Antialiasing Filter

Sampling Clock

Analog Transceivers

480K Cell Nonvolatile Multilevel Storage Array

Decoders
## Sampling Rates for Different Voice Chips

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Duration (Seconds)</th>
<th>Input Sample Rate (KHz)</th>
<th>Typical Filter Pass Band (KHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISD2560</td>
<td>60</td>
<td>8.0</td>
<td>3.4</td>
</tr>
<tr>
<td>ISD2575</td>
<td>75</td>
<td>6.4</td>
<td>2.7</td>
</tr>
<tr>
<td>ISD2590</td>
<td>90</td>
<td>5.3</td>
<td>2.3</td>
</tr>
<tr>
<td>ISD25120</td>
<td>120</td>
<td>4.0</td>
<td>1.7</td>
</tr>
</tbody>
</table>
Microphone and Analog Input

- XCLK
- ANA IN
- ANA OUT
- MIC
- MIC REF
- AGC

- Internal Clock
- 5-Pole Active Antialiasing Filter
- Pre-Amp
- Automatic Gain Control (AGC)
Microphone and AGC Circuits
Analog In/Out and Speaker Circuit
Power Circuit
Device Control Signals

Power Down Input (PD)

- When not recording or playing back, the input on PD should be high to keep the voice chip in low power mode.
Playback/Record Input (P/R*)

\[ P/R = 1 \quad \text{Playback Mode} \]
\[ P/R = 0 \quad \text{Recording Mode} \]
Chip Enable Input (CE*)

Chip Enable Input (CE)

\[ CE = 0 \quad \text{Chip is Enable for Recording and Playback} \]
\[ CE = 1 \quad \text{Chip is not enabled.} \]
Overflow Output (OVF*)

- This output signal becomes low at the end of memory space, indicating memory has been filled.
- This Pin can be used to cascade several voice chips together to increase record/playback durations.
An end of message marker is automatically inserted at the end of each recorded message.

When playing back, this output (EOM*) pulses low at the end of each message.
## End of Message Pulse Width

<table>
<thead>
<tr>
<th>EOM Pulse Width</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ISD2560</td>
<td>12.5 msec</td>
</tr>
<tr>
<td>ISD2575</td>
<td>15.625 msec</td>
</tr>
<tr>
<td>ISD2590</td>
<td>18.75 msec</td>
</tr>
<tr>
<td>ISD25120</td>
<td>25.0 msec</td>
</tr>
</tbody>
</table>
Address Lines

Decoders

480K Cell
Nonvolatile
Multilevel Storage
Array

Address Buffers

A0 A1 A2 A3 A4 A5 A6 A7 A8 A9
### Address Lines A8 and A9

<table>
<thead>
<tr>
<th>A9</th>
<th>A8</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>x</td>
<td>A0 through A7 are used as address lines. They indicate the starting address of a message.</td>
</tr>
<tr>
<td>x</td>
<td>0</td>
<td>A0 through A7 are used as address lines. They indicate the starting address of a message.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>A0 through A7 indicate mode bits for different operational modes (M0 through M6).</td>
</tr>
</tbody>
</table>

There are 600 valid addresses ($000$ through $257$) in ISD2560/75/90/120 Voice Chip.
How many addresses to use for each second of voice?

- If you have a 120-sec chip, then for each second of voice you need 5 addresses ($600/120 = 5$).
- But, if you have a 60-sec chip, then for each second of voice you need 10 addresses ($600/60 = 10$).
- To be on the safe side, use 1.5-sec storage for every word to be stored in the chip.
- For long phrases use more storage space.
A setup for storing 64 Words (Four addresses are used for each word.)

<table>
<thead>
<tr>
<th>PD5</th>
<th>PD4</th>
<th>PD3</th>
<th>PD2</th>
<th>PD1</th>
<th>PD0</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Record the first word here.</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Record the second word here.</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Record the third word here.</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>...</td>
</tr>
</tbody>
</table>
A setup for storing 32 Words (Eight addresses are used for each word).

<table>
<thead>
<tr>
<th>PD4</th>
<th>PD3</th>
<th>PD2</th>
<th>PD1</th>
<th>PD0</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Record the first word here.</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Record the second word here.</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Record the third word here.</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Recording A Message

- If S1 is pressed then do the following else do nothing. (Note: You must start talking as soon as you press S1)
- Make PD = 0 and P/R* = 0
- Send an address through PD0, PD1, . . PD4.
- Make CE* = 0.
- Make PD = 1 and CE* = 1 as soon as S1 is released.
Playing Back A Message

- If S2 is pressed then do the following else do nothing.
  - Make PD = 0 and P/R* = 1
  - Send an address through PD0, PD1, . . PD4.
  - Make CE* = 0.
  - Make PD = 1 and CE* = 1 when EOM* become low.
In the finished product, keep only the Play Switch and tie P/R* line to Vcc.

1. If S2 is pressed then make PD=0 and send an address through PD0, PD1, ... PD4.
2. Make CE* = 0.
3. Make PD = 1 and CE* = 1 when EOM* become low.
4. Repeat steps 1 through 3 if multiple words are to be played.