STAND-ALONE/PARALLEL INTERFACE PRODUCTS

Operational Modes

The Operational Mode option of ISD single-chip voice record/playback devices adds flexibility and utility to the system designer. The Operational Mode control bits allow simple cascade operation, automated looping on first message, automated power-down for the ISD2500, and other functions that simplify many designs. The use of each bit of the Operational Mode is explained in this chapter with some suggested applications.

The ISD1000A, ISD1100, ISD1200, and ISD1400 devices have eight address bit inputs with 256 possible address combinations. The first 160 of these addresses are used for direct access to message locations in the ISD1000A and ISD1400 series. The first 80 addresses are used for direct access in the ISD1100 and ISD1200 series. The last 64 possible addresses are used for Operational Mode operations in all of the above devices. These are where the address map shows both addresses A6 (pin 9) and A7 (pin 10) tied HIGH. These pins are the MSB (Most Significant Bits) for this series. Complete address maps for all the ISD device series are discussed in the "Basic Addressing" section and illustrated in the "Address Segment Resolution" section under Application Information.

In the ISD2560/75/90/120 devices the first 600 (of 1024 possible) addresses are used for direct access to message locations. The last 256 are used for Operational Mode operations. These are where the address map shows both addresses A8 (pin 9) and A9 (pin 10) tied HIGH. These same pins are the MSB for this series also. The ISD2500 series address map is discussed in the "Basic Addressing" chapter and illustrated in the "Address Segment Resolution" under Application Information.

In the following discussion of Operational Modes, it is always assumed that the MSB pins are tied HIGH to enable an Operational Mode cycle.

There are two important considerations in use of the Operational Mode.

- First, all Operational Mode operations start initially at address 0, or the beginning of the ISD device's message space.

  Later operations may start at other address locations, if the proper Operational Mode bit is set. However, in most cases, when the device is changed from Playback to Record, from Record to Playback, or a Power-Down cycle is executed, the internal address pointer is always reset to 0.

- Second, the Operational Mode bits DO NOT LATCH. An Operational Mode operation is executed anytime $\overline{CE}$ goes LOW and the MSB addresses are HIGH. If the next $\overline{CE}$ operation finds one or both of these bits LOW, a message address operation is executed. This means Playback or Record (according to the state of the Playback/Record pin) begins at whatever message address is loaded into the address pins. The state of any previous Operational Mode is lost.

NOTE The following listed Operational Modes apply to all ISD single-chip voice record/playback devices unless otherwise noted.

NOTE "AN" (where N is the mode number) refers to the ISD1000A, ISD1100, ISD1200, or ISD1400. "MN" refers to the ISD2500.

ADDRESS BIT A0/M0 (PIN 1)—MESSAGE CUEING (ISD1000A/ISD2500)

The Message Cueing Operational Mode (formerly fast forward) allows an ISD device user to rapidly access messages without knowing their physical addresses. It is only necessary to know the relative location of a message to find it. This mode is normally used with bit A4 consecutive addressing option.

An example of how to use this mode is shown in the following paragraphs:

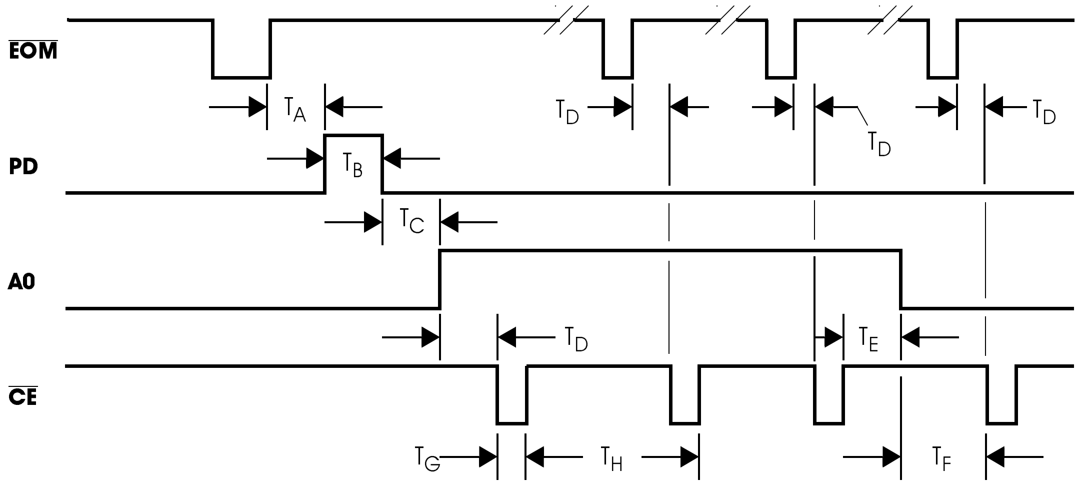
1. First set $\overline{CE}$ HIGH, $P/\overline{R}$ LOW and PD LOW. In addition the address inputs should be set up for Operational Mode and the A4 bit HIGH. All other address bits should be LOW.
2. Record the first message by holding $\overline{CE}$ LOW for several seconds. End the first message by bringing $\overline{CE}$ back HIGH.
3. Record a second message in the same manner. Since the A4 Consecutive Addressing Operational Mode is selected, the internal address will NOT be reset. This second message will be placed immediately after the first message. Its physical address falls at the beginning of the first row of the message array following the set EOM that marks the end of the first message.
4. Record a third message in the same manner. There are now three sequential messages recorded in the device.

Recover only the third message in the following manner:

1. Change the $P/\overline{R}$ input HIGH to place the device in Playback Mode. Leave Operational Mode set with A4 HIGH and additionally change A0 to HIGH. The ISD device is now ready to access messages using the Message Cueing Option.
2. Pulse $\overline{CE}$ LOW for 10 μs or less. Note that this time is critical. This operation will begin the Message Cueing function by rapidly scanning through the EOM bit memory. The device advances through the memory at 800 times normal speed with the audio output stages disabled. If the $\overline{CE}$ signal is still LOW when a set EOM bit is found, it will be ignored. A 10 μs $\overline{CE}$ pulse width means that an EOM located in the next row can be found and no EOM bits will be skipped.
3. After the first $\overline{CE}$ pulse and EOM bit, the internal address counter in the device will be pointing at the beginning of the second message. Again pulse $\overline{CE}$ LOW for 10 μs. The internal address counter is now pointing at the beginning of the third message.
4. Change the A0 address bit to a LOW. A momentary LOW pulse of $\overline{CE}$ will now cause the device to Playback the third message through the speaker at normal speed. It will cease Playback when a set EOM is found (assuming $\overline{CE}$ is back HIGH).

NOTE *Figure 1 and Table 1 show the timing for a representative example Message Cueing situation. In the example, a previous message has just ended. The user now wants to play the fourth message. To do this, the system must give three $\overline{CE}$ pulses with A0 HIGH and a fourth with A0 LOW, waiting for the $\overline{EOM}$ pulse between each $\overline{CE}$ pulse.*

Figure 1: Message Cueing Timing Diagram



NOTE: *A4/M4 HIGH.*

ADDRESS BIT A0 (PIN 1)—MESSAGE CUEING (ISD1100, ISD1200, ISD1400)

The basic operation of this Operational Mode is similar to that of the ISD1000A/ISD2500 series and allows the same capability.

Table 1: Message Cueing Values (8 Khz Sample Rate Device)

Time	Min.	Max
T_A	0	
T_B	12.5 msec	
T_C	0	
T_D (T_{SET})	300 nsec	
T_E	0	
T_F (T_{SET})	300 nsec	
T_G (T_{CE})	100 nsec	10 μsec
T_H	variable	
$T_C + T_D$	25 msec	

The following demonstration assumes three messages are pre-recorded into the device as in the previous example. We wish to play the third message:

1. With PLAYL, PLAYE, REC all HIGH, the address inputs are set up in Operational Mode (A6 and A7 HIGH) with A0 and A4 HIGH.
2. Pulse PLAYE LOW to begin the Operational Mode sequence

NOTE Minimum PLAYE pulse width is approximately 300 ns. The "fast forward" operation will stop at a set EOM even if PLAYE is held LOW).

The ISD1100, ISD1200, and ISD1400 devices will advance through memory at 800 times normal speed and stop at the first set EOM bit found in memory.

3. This operation is repeated a second time. When this operation is finished, the internal address counter is pointing at the beginning of the third message.
4. Change A0 to LOW and pulse PLAYE LOW to playback the third message at normal speed.

NOTE For the ISD1100 only. Since the A6 and A7 pins are pulled HIGH by on-chip resistors, it is only necessary to control A0 through A5 when an Operational Mode is desired. The A6 and A7 pins may be left floating.

ADDRESS BIT A1/M1 (PIN 2) (ISD1000A, ISD2500)—EOM MARKER DELETE CONTROL

The A1 Operational Mode allows sequentially recorded individual messages to be combined into a single message with only one EOM bit set at the end of the final message. Operationally, this option inhibits the increment of the internal address counter at the end of a Record operation. An example of how this might be used follows:

1. Set up for Record as explained previously in Operational Mode with the A4 and A1 mode bits HIGH. Change $\overline{CE}$ to LOW and record for a few seconds ending the record process by taking $\overline{CE}$ back HIGH.
2. At this time, the internal address counter of the device remains pointing at the beginning of the final row in the first message in the storage array. Part or most of this row has been recorded with analog data from the first message but it was not filled past the ending boundary of that row. An EOM bit has been set at the appropriate place in the EOM memory indicating where the first message ended.
3. With A4 and A1 remaining HIGH in Operational Mode, a new Record cycle is begun by changing $\overline{CE}$ to a LOW. Since the address counter is still pointing at the ending row of the storage array, this last row is erased and re-recorded by this second message. At the same time, the previously set EOM bit (written at the end of the first message) is also erased. End the Record of this second message by changing $\overline{CE}$ back HIGH.
4. The address and control lines of the device can now be changed to do a normal Playback at the beginning of the memory. The two previously recorded messages will Playback as one message with only one EOM bit set at the end of the second message.

NOTE The analog data written into the last row in the storage array of the first message will be lost.

ADDRESS BIT A1 (PIN 2) (ISD1100, ISD1200, ISD1400)—EOM MARKER DELETE CONTROL

This Operational Mode operates similar to that in the ISD1000A and ISD2500 devices. When A1 and A4 are held HIGH in Operational Mode, subsequent EOM bits will be over written by a new Record cycle. The final EOM bit will remain. The only difference between ISD1000A/ISD2500 functionality and the operation of this mode with the ISD1100, ISD1200, and ISD1400 devices are that the Record operation is controlled with the single $\overline{REC}$ pin.

ADDRESS BIT A2 (PIN 3) (ISD1000A ONLY)—EOM CONTROL

The $\overline{EOM}$ output of the ISD1000A series of devices performs a dual role. When playing back messages not ending with memory full, $\overline{EOM}$ pulses LOW for 12.5 ms to indicate an end-of-message mark has been found. $\overline{EOM}$ goes LOW and stays LOW when the device is in Record or Playback and fills the message memory (message overflow). If chip enable is HIGH, Playback will stop at that point. If address bit A2 is set in Operational Mode, the EOM indication is turned off. This mode does not work in the ISD2500 series devices because there are separate output pins for $\overline{EOM}$ and $\overline{OVF}$. Also, this mode does not work in the ISD1100, ISD1200, and ISD1400 devices because their Overflow condition looks identical to an EOM.

ADDRESS BIT A3/M3 (PIN 4) (ISD1000A, ISD2500)—CONTINUOUS PLAYBACK CONTROL OR LOOPING

Some applications require the continuous repeat of a message for an extended period. The A3 Operational Mode bit allows the automatic Playback repeat of the message located at the beginning of the ISD1000A or ISD2500 series message space. This continues as long as the $\overline{CE}$ pin is held LOW. **The only exception to this operation is that the message to be repeated cannot totally fill the ISD1000A.** The ISD2500 can loop with a message that completely fills its message space.

Example: It is desired to repeat a 10-second message. The 10-second message is first recorded into the ISD1000A or ISD2500 causing an EOM mark to be written at that ending point. Next, the A7, A6, and A3 address bits are strapped HIGH (A9[1], A8 and A3 are strapped HIGH in the ISD2500). With power-down LOW and P/R HIGH, taking CE LOW will cause the message to begin playing. When the end-of-message mark is reached, the status of the CE pin is read. If it is LOW, the message immediately begins playing again. While CE is LOW, the message will repeat; if CE is taken HIGH during the Playback of a message, the message will complete, then stop.

This Operational Mode may also be used to perform looping record in the ISD2500. To accomplish this, a normal Record cycle is begun with A9, A8 and A3 held HIGH. Recording will start at the beginning of memory and continue to the end of memory. At this point, the internal address counters of the ISD2500 will reset and recording will begin anew at the beginning of memory. This operation will continue as long as CE is held LOW.

ADDRESS BIT A3 (PIN 4) (ISD1100, ISD1200, ISD1400)—CONTINUOUS PLAYBACK CONTROL/LOOPING

This Operational Mode is initiated by a negative transition on PLAYE pin with A7, A6 and A3 held HIGH. Then PLAYE is brought back HIGH. Looping will continue indefinitely with all three control pins (PLAYL, PLAYE, REC) held HIGH.

To stop the looping, PLAYL pin is momentarily taken LOW, then back HIGH. As long as A7, A6 and A3 remain HIGH, a new Playback loop will begin with the next negative transition on the PLAYE pin.

Another way to control looping is to use the PLAYL pin alone. Taking this pin LOW begins the looping and it continues until the pin is taken HIGH again. This is a continuous control rather than the pulsed control of the previous paragraph.

As in the ISD2500, this same operation will work with a Record cycle. As long as REC is held LOW in this Operational Mode, recording will loop and continue.

ADDRESS BIT A4/M4 (PIN 5) (ISD1000A, ISD2500)—MESSAGE START POINTER RESET—CONSECUTIVE ADDRESSING

When this bit is HIGH in Operational Mode, the internal address pointer that controls the location of the start of Record or Playback is only reset LOW when the Record/Playback Mode is changed or a power-down cycle is executed. For example, assume two or more messages are recorded in an ISD device. With bits A4, A6 and A7 set HIGH (A8 and A9 for ISD2500), a Playback cycle executed by a LOW going CE pulse (with CE immediately returning HIGH) will proceed with Playback of the first message. It will stop when the EOM mark is found at the end of that message. Since the device is in the A4 Operational Mode, the next chip enable will start Playback of the second message. If the user wants to hear the first message again, a power-down positive going pulse of at least 12.5 ms will reset the message address pointer.

NOTE *A momentary change of state of the Record/Playback input will not reset the message address pointer. A falling CE must occur after the state change. If the user tries to reset the message pointer using a Record cycle the first message will be erased.*

The A4 bit works the same during a Record cycle, except that the chip enable is level activated instead of edge activated (chip enable is always level activated during Record). At the end of each Record cycle, the message start pointer will be left at the beginning of the next message space to be recorded.

1. *The 2 MSBs for the ISD2560/75/90/120 are A9 and A8. For the ISD2532/40/48/64 they are A8 and A7.*

NOTE There is no way to record a message following another message (using Operational Mode) if the message start pointer has been reset. Sequential messages must be recorded without changing to Playback or executing a power-down cycle.

ADDRESS BIT A4 (PIN 5) (ISD1100, ISD1200, ISD1400) – MESSAGE START POINTER RESET (CONSECUTIVE ADDRESSING)

This mode operates in ISD1100, ISD1200, and ISD1400 device series identical to the operation in other ISD voice storage products. As long as A4 is held HIGH in Operational Mode, the internal address counter will not be reset with subsequent Record or Playback operations. If a Playback cycle is followed by a Record cycle, the address counter *will not* be reset. The new message will be recorded directly after the last message played.

The internal address counter can be reset in this mode by momentarily changing A4 from HIGH to LOW and back HIGH during the device's static powered down state.

ADDRESS BIT A5/M5 (PIN 6) (ISD1000A & ISD2500 ONLY)—CE LEVEL ACTIVATED

The default mode of the ISD devices is for $\overline{\text{CE}}$ to be edge activated on Playback and level activated on Record. Normal Playback is begun with $\overline{\text{CE}}$ pulsed LOW and will end when an EOM mark is encountered. With bit A5 HIGH in Operational Mode, $\overline{\text{CE}}$ becomes level activated during Playback. If address bits A7, A6, and A5 are all HIGH, a falling $\overline{\text{CE}}$ will start Playback at the beginning of the message space and will continue while $\overline{\text{CE}}$ is LOW. If $\overline{\text{CE}}$ is taken back HIGH, the Playback will stop and a second $\overline{\text{CE}}$ going LOW will restart Playback at the beginning of the message. Additionally, bit A4 can also be taken HIGH. $\overline{\text{CE}}$ activation starts Playback at the message beginning and if $\overline{\text{CE}}$ is later taken HIGH, message Playback will immediately cease. If $\overline{\text{CE}}$ is now taken back LOW, Playback will resume at the point at which it just stopped.

NOTE As long as $\overline{\text{CE}}$ is LOW, EOM marks will be ignored. If the Playback (or Record) proceeds into the overflow condition, a power-down cycle is required before any additional Record or Playback operation can begin.

This mode is not available in the ISD1100, ISD1200, and ISD1400 series devices.

ADDRESS BIT M6 (PIN 7) (ISD2500 ONLY) – ISD2500 PUSH-BUTTON MODE

In the ISD2500 series of devices there is an additional Operational Mode, not available in other ISD series devices. This is the Push-Button Mode that is provided for a very simple, minimum part count, application. When this mode is selected the functionality of three pins change to alternate uses. Pin 23, $\overline{\text{CE}}$, becomes Start/Pause and is activated by a LOW going pulse. Pin 24, PD, becomes Stop/Reset and is activated by a HIGH going pulse. Pin 25, $\overline{\text{EOM}}$, becomes RUN, with an active HIGH indication. (See the ISD2500 series data sheets for illustrations of how to use this mode with a microcontroller.)

Table 2: Push-Button Mode Control Pins for ISD2500

Pin Number	Pin Name	Changes for Push-Button Mode
Pin 23	$\overline{\text{CE}}$	Becomes $\overline{\text{START}}$ or $\overline{\text{PAUSE}}$ (–edge activated)
Pin 24	PD	Becomes STOP + RESET (+level activated)
Pin 25	$\overline{\text{EOM}}$	Becomes RUN to drive LED
Pin 22	$\overline{\text{OVF}}$	Remains the same

Start/Pause is used to start the device in either the Record or Playback Mode, depending upon the state of pin 27. Applying a LOW pulse here will begin the operation that will continue until it reaches the end of the chip, an EOM marker (in the Playback Mode), the Stop/Reset pin is pulsed HIGH, or the Start/Pause pin is pulsed again.

In the Record Mode, beginning at address 0, a series of messages can be recorded by pressing the Start/Pause button multiple times. Each *odd* numbered press of the button starts the next message. Each *even* press of the button stops the current message being recorded. The next message is then recorded at the beginning of the next address row when the button is pressed again. If no further messages are desired, or the end of the chip has been reached, pressing the Stop/Reset button will stop any recording in progress, record an EOM marker, and reset the address counter to 0.

In the Playback Mode, each time Start/Pause is pressed, the next message will be played. It will stop when it reaches the EOM marker and wait for the next command.

In the Push-Button Mode pin 25, $\overline{\text{EOM}}$, becomes RUN. This is an active HIGH signal that is true whenever a Record or Play operation is in progress. It is designed to drive a low-power LED as an indicator. It will indicate whether the last push of the Start/Pause button started an operation or paused one.

One important feature of the Push-Button Mode is that the ISD2500 device automatically enters the Power-Down Mode at the end of each operation *without* losing the message start pointer value. This means that the next operation will begin at the desired location. It is not reset by automatic power-down as it is on the ISD1000A devices when put into power-down with the PD pin.

Several descriptions of Push-Button Mode operations follow to help the user understand how to use these functions. These operations are illustrated in the State Diagram Flow Chart diagram found in Figure 3 that follows these descriptions, and shows each possible state of the ISD2500 device and what state it can transition to next.

POWER-UP CONDITION

The numbers in square brackets [] in Figure 3 indicate the current position of the operation in the State Diagram.

Number [1] indicates the power-up condition. Pushing the Stop button at this point does nothing.

RECORD

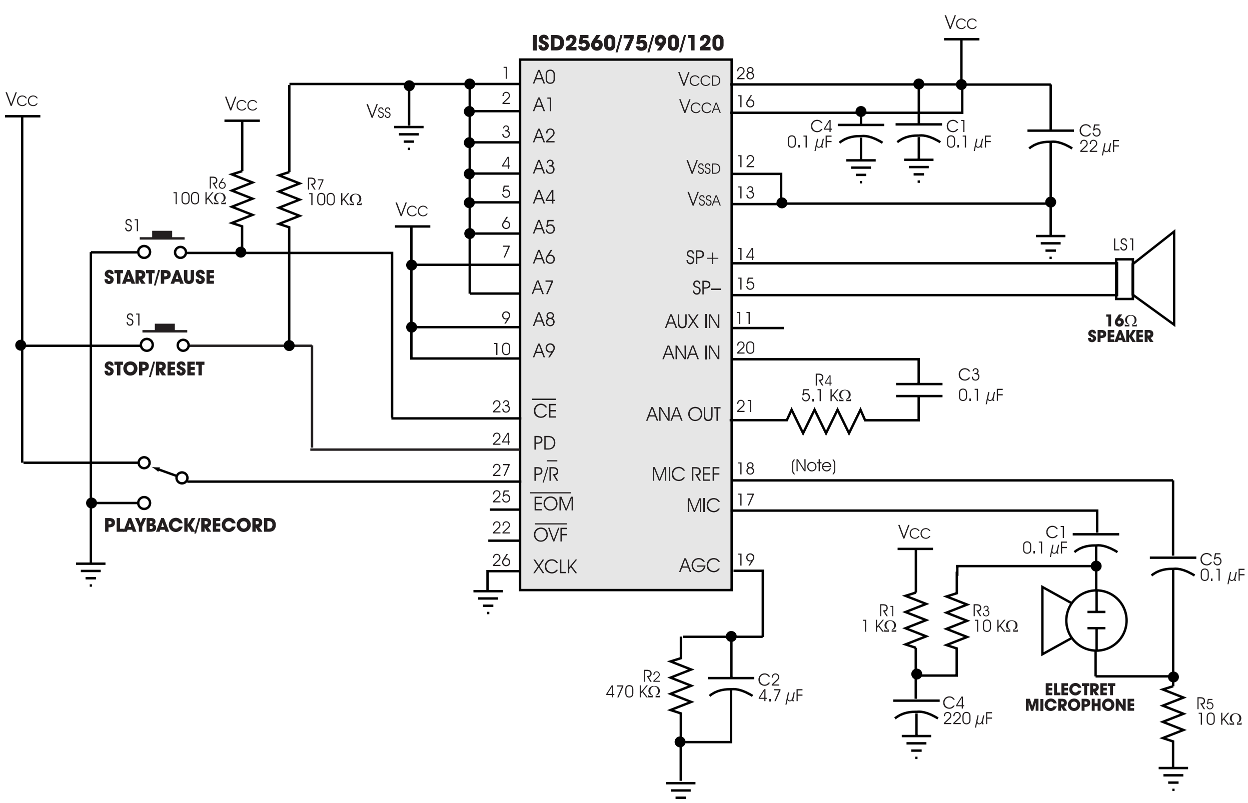
Setting the P/$\overline{\text{R}}$ to a 0 and then pressing the Start/Pause button starts the chip recording from address 000. [2] This recording will stop for three reasons: [5] The recording can reach the end of the chip and overflow. [3] It can be paused by hitting the Start/Pause button again. [4] One could hit the Stop button.

If the recording had stopped because of overflow [5], pressing the Start/Pause button again will not do anything. Hitting the Stop button will reset the address counter to 000. [1] The chip is ready for any new operation. Or, switching P/$\overline{\text{R}}$ to a 1 and hitting Start/Pause will start the chip playing from the beginning of the chip. [6]

If the recording stopped because the Stop button was pressed, an EOM is set and then the address counter is reset. The chip returns to step [1], ready for the next operation.

If the recording had stopped because of Start/Pause being pressed, it finishes recording and writes an EOM, [3], then three choices are available. Pressing the Start/Pause button again, the chip resumes recording from the beginning of the next row. [2] Pressing Stop resets the address counter and returns the chip to step [1] to await the next operation. Or, switching P/$\overline{\text{R}}$ to a 1 and pressing Start/Pause will start the chip playing from the beginning of the chip. [6]

Figure 2: Application Example—Push-Button Mode



RECORD-TO-PLAY

From either state [3] or [5], switching P/R̄ to a 1 and hitting Start/Pause will reset the address counter and start the chip playing from the beginning. [6] If, during the recording, P/R̄ had been switched to a 1 and Start/Pause had been pressed, the pause will be from the Record Mode, setting an EOM bit. The next Start/Pause will then play from address 0.

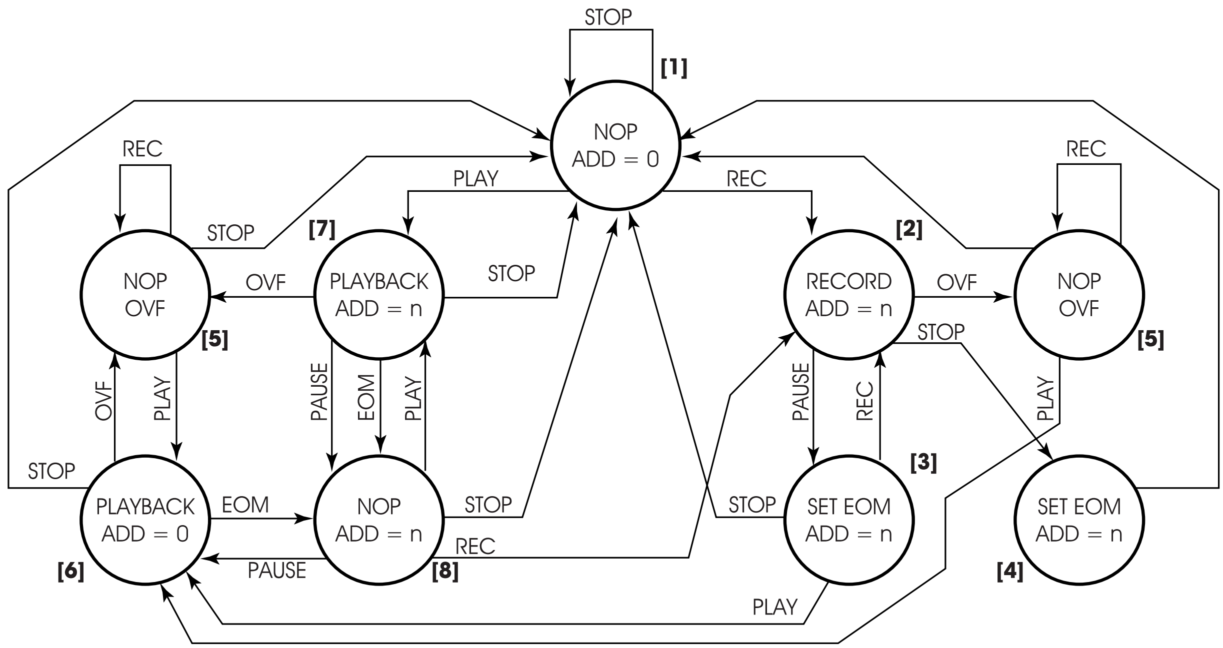
PLAYBACK

From position [1], if P/R̄ had been a 1, and Start/Pause had been pushed, the chip would have begun playing from the beginning of the chip, address 000. [7] Playback would continue until one of four conditions was reached. (1) The message can reach the end of the chip and overflow. [5] (2) It can be paused by pressing the Start/Pause button again. [8] (3) One could press the Stop button. [1] (4) The message could reach an EOM bit. [8] If, while playing the message, P/R̄ had been switched to a 0 and Start/Pause had been pressed, the chip will pause from the Play Mode. Then, if the Start/Pause is pressed with P/R̄ = 0, a Record will start from the present position. If P/R̄ = 1, a normal play will resume.

(1) If the chip reached overflow [5], pressing Start/Pause again will reset the address counter and the chip will begin to play from the beginning again. [6] (State [6] is very similar to state [7] except that the address counter has been reset. EOM and "Pause" send it to state [8] as they do from state [7]. Stop goes back to state [1] and OVF̄ goes back to state [5].)

If, instead of pressing Start/Pause again from [5], one presses "Stop," the address counter would reset and the chip would return to state [1]. It would not play, and would await the next operation. Switching P/R̄ to a 0 and pressing Start/Pause at the overflow will not do anything. The chip will remain in state [5].

Figure 3: ISD2500 Series Push-Button Mode State Diagram Flow Chart



(2) If the message had stopped because the Start/Pause button had been pressed [8], it does not reset the address counter. Three choices are available from state [8]: First, pressing Start/Pause again will make the chip resume [7] from the beginning of the row. Second, pressing Stop will reset the address counter and return the chip to state [1] awaiting the next operation. The third choice is to change from Play to Record [2] as explained in the following section.

(3) If the message had stopped because the Stop button had been pressed, the address counter was reset and the chip returned to state [1], ready for the next operation.

(4) Stopping for the EOM also places the chip in state [8], similar to pressing the Start/Pause while playing. The address counter is not reset. Instead, it is incremented to the beginning of the next row. This is slightly different from the pause that puts the counter at the beginning of the current row. Unless the pause occurred during the very last scan, in which case it will go to the beginning of the next row]

PLAY-TO-RECORD

Switching P/$\overline{R}$ to a 0 from state [8] and hitting Start/Pause will make the chip begin recording. This is without resetting the address counter from where it stopped playing. [2] This puts a new message on the chip, following the ones, or portions thereof, that were already played back. Note that it might be significant if state [8] was entered from the EOM or "Pause" as to where the recording will begin.

SOME SIMPLE ONE LINERS

- Pressing Stop from any state resets the entire chip, returning it to state [1].
- Pressing Start/Pause when playing or recording will pause the operation, pressing it again will resume that same operation.
- Pause in Record Mode will plant EOM bits *each* time. (Unless M1, delete EOM is set HIGH also.)
- Setting M1 true in the Push-Button Mode will mean that the pause EOM bits will be erased upon resuming Record. Only the last one at the end of the Record operation will remain.

(Going from [3] to [1] or [6] leaves the EOM in place.)

- EOM bits in playback will pause the chip [8]. Each time you press Start/Pause plays the next message.
- The EOM is not erased when going from [8] to [2] with M1 true.
- In the Push-Button Record Mode the $\overline{CE}$ (Start/Pause) button does not need to be held down for the duration of the recording.
- Switching P/$\overline{R}$ to the opposite state during an operation, then pressing Start/Pause does not change the normal pause operation.
- When the Start/Pause is pressed to resume an operation it initiates the current state of P/$\overline{R}$ independently of the state of P/$\overline{R}$ when the part was paused.

STATE DIAGRAM FLOW CHART DEFINITIONS

The lines represent a push-button action, an end of message or an overflow:

$\overline{REC}$ = P/$\overline{R}$ = 0 from NOP operation with Start/Pause = Negative Pulse

PAUSE (from $\overline{REC}$) = P/$\overline{R}$ = x from $\overline{REC}$ with Start/Pause = Negative Pulse

PLAY = P/$\overline{R}$ = 1 from NOP operation with Start/Pause = Negative Pulse

PAUSE (from PLAY) = P/$\overline{R}$ = x from PLAY with Start/Pause = Negative Pulse

STOP = P/$\overline{R}$ = x, $\overline{CE}$ = x, PD = Positive Pulse

The circles represent an operation:

NOP = No Operation

PLAYBACK = Playback starting at ADD = Previous operation or 0

RECORD = Record starting at ADD = Previous operation or 0

$\overline{OVF}$ = Overflow

(add = n) = current operation will start at the ending address location of the previous operation.

COMBINING OPERATIONAL MODE BITS

Some Operational Mode bit functions can be combined to give maximum flexibility to using the ISD devices. As mentioned in the discussions above, some modes are not applicable for Record operations and some combinations of bits are inherently unusable. For instance, the A0 fast forward bit cannot be used with the A5 $\overline{CE}$ level activation bit. Common sense will in most cases show what combinations will work. If in doubt, check the data sheet or try their operation.

OPERATIONAL MODE SUMMARY

ISD1000A:
Modes A0 through A5.

ISD1100, ISD1200, and ISD1400:
Mode A0, A1, A3 and A4.

ISD2500:
Modes M0, M1, M3 through M6.