

## 1.0 GENERAL DESCRIPTIONS

The MX93030A is an engine chip for Digital-Answering-Machine(DAM) with Bell 202 1200-baud FSK demodulator built-in.

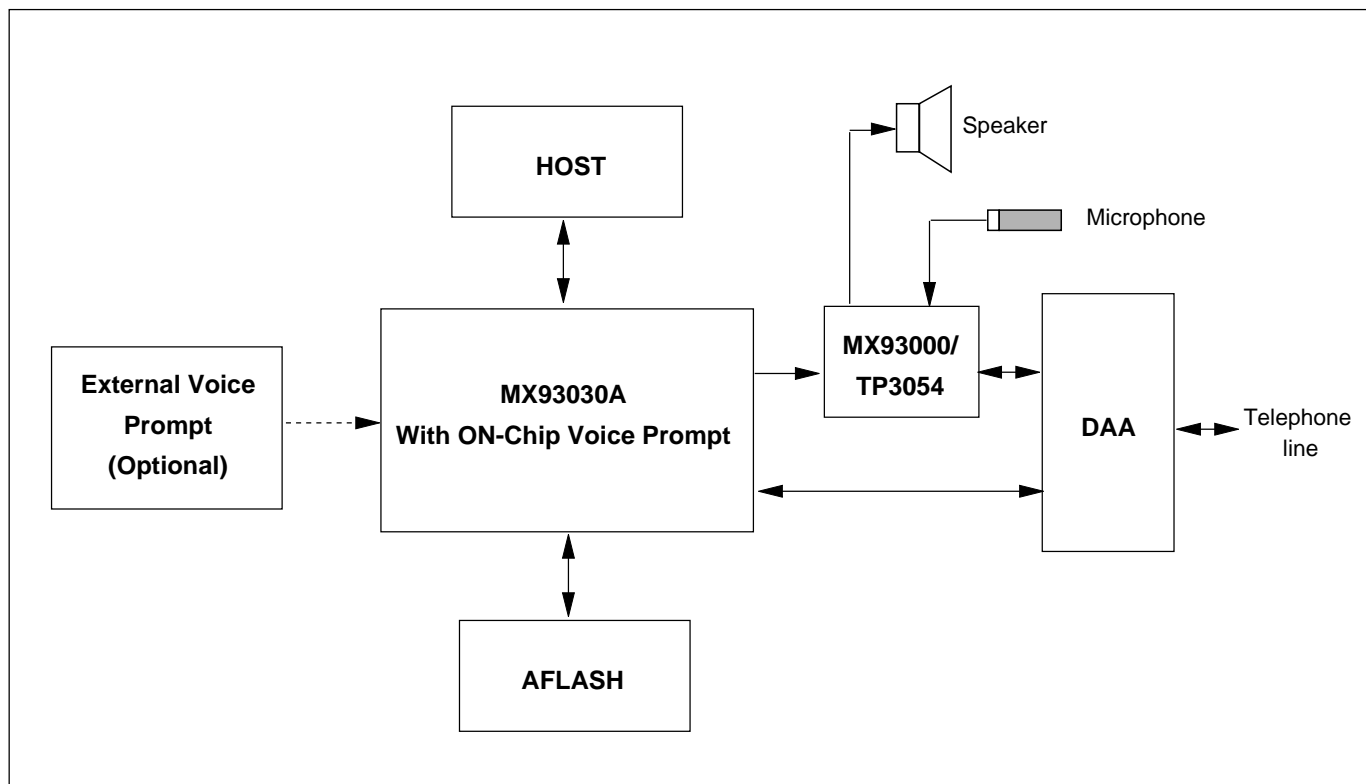
The MX93030A provides functional modules, including speech compression/decompression, telephone line signal processing, voice prompt, ARAM management and FSK demodulator.

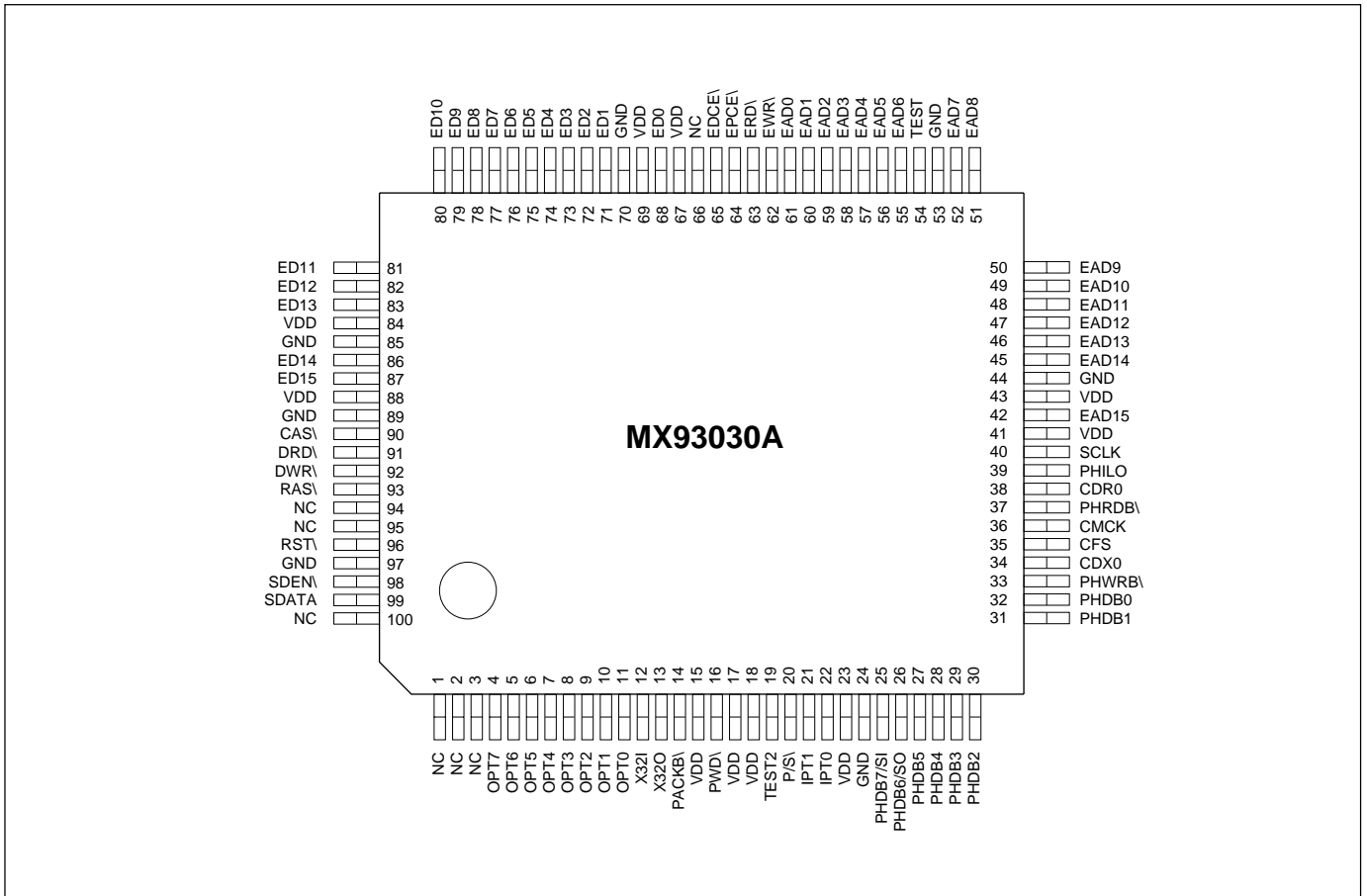
The MX93030A operates as a slave peripheral; that is controlled by an microcontroller via a 8 bits parallel or serial interface. The host activates the MX93030A by sending it command. The MX93030A executes the command and returns status response to the host.

## 2.0 FEATURES

- 4.8K bps compression rate with silence compression.
- Maximum 8 Personal Mail Supports (Separate 127 ICMs)
- DTMF generation and detection with near-end echo cancellation.
- Maskable internal voice prompt up to 40 seconds.
- 8-bit parallel & serial interface with host processor.
- ICM management
- ARAM management.
- MX93000 codec interface.
- Single 32.768KHz crystal oscillation
- Extended I/O supporting
- Demodulate Bell 202 asynchronous data and interpret the frame data according to Bell core CLASS feature.

## 3.0 BLOCK DIAGRAM



**4.0 PIN CONFIGURATIONS**


**5.0 PIN DESCRIPTIONS**

<b>SYMBOL</b>	<b>PIN TYPE</b>	<b>PIN NUMBER</b>	<b>DESCRIPTION</b>
VDD		23,41,43,67,69,84,88	5V power source
GND		24,44,53,70,85,89,97	Ground
RST\	I	96	Reset,Schmite-triggered
X32I		12	32.768KHz Crystal input
X32O	OA	13	32.768KHz Crystal output
TEST	I	54	Connect to Ground
TEST2	I	19	Connect to Ground
P/S\	I	20	Interface mode selection NC:parallel,GND:serial
PWD\	I	16	If Low, the MX93030A enter power save mode.
EAD0-ED15	OA	61-55,52-45,42	DSP address bus. VOP & ARAM
ED0-ED15	I/OA	68,71-83,86,87	DSP data bus. VOP & ARAM
EDCE\	OA	65	RAM VOP chip enable
EPCE\	OA	64	ROM VOP chip enable
ERD\	OA	63	VOP read control signal
EWR\	OA	62	NC
CAS\	OA	90	DRAM column address select.
RAS\	OA	93	DRAM row address select.
DRD\	OA	91	DRAM read control signal.
DWR\	OA	92	DRAM write control signal.

**\* CODEC INTERFACE**

<b>SYMBOL</b>	<b>PIN TYPE</b>	<b>PIN NUMBER</b>	<b>DESCRIPTION</b>
CFS	OA	35	Codec frame sync. 8KHz
CMCK	OA	36	Codec master clock. 1.536MHz
CDX0	OA	34	Codec data transmit
CDR0	I	38	Codec data receive
SDEN\	OB	98	MX93000 interface data enable
SDATA	OB	99	MX93000 interface data signal

**5.0 PIN DESCRIPTIONS(continued)****\*uP PARALLEL INTERFACE**

<b>SYMBOL</b>	<b>PIN TYPE</b>	<b>PIN NUMBER</b>	<b>DESCRIPTION</b>
PHILO	I	39	High/low byte select
PHRDB\ 	I	37	Host read control signal
PHWRB\ 	I	33	Host write control signal
PHDB(7:0)	B	25-32	Host data bus
PACKB\ 	OA	14	Response is ready

**\*uP SERIAL INTERFACE**

<b>SYMBOL</b>	<b>PIN TYPE</b>	<b>PIN NUMBER</b>	<b>DESCRIPTION</b>
SCLK	I	40	Synchronous clock
SI	I	25	Host serial data in
SO	O	26	Host serial data out

**\*EXTENDED OUTPUT PORT(8 PINS)**

<b>SYMBOL</b>	<b>PIN TYPE</b>	<b>PIN NUMBER</b>	<b>DESCRIPTION</b>
OPT0-7	OB	11-4	Output to pin.

**\*EXTENDED INPUT PORT(2 PINS)**

<b>SYMBOL</b>	<b>PIN TYPE</b>	<b>PIN NUMBER</b>	<b>DESCRIPTION</b>
IPT0-IPT1	I	22-21	IPT0 & IPT1 have internal pull-up resistor 32K $\Omega$

NOTE:OA=8mA, OB=16mA output current.  
Symbol with backslash is low active.

## 6.0 FUNCTIONAL DESCRIPTIONS

### HOST INTERFACE

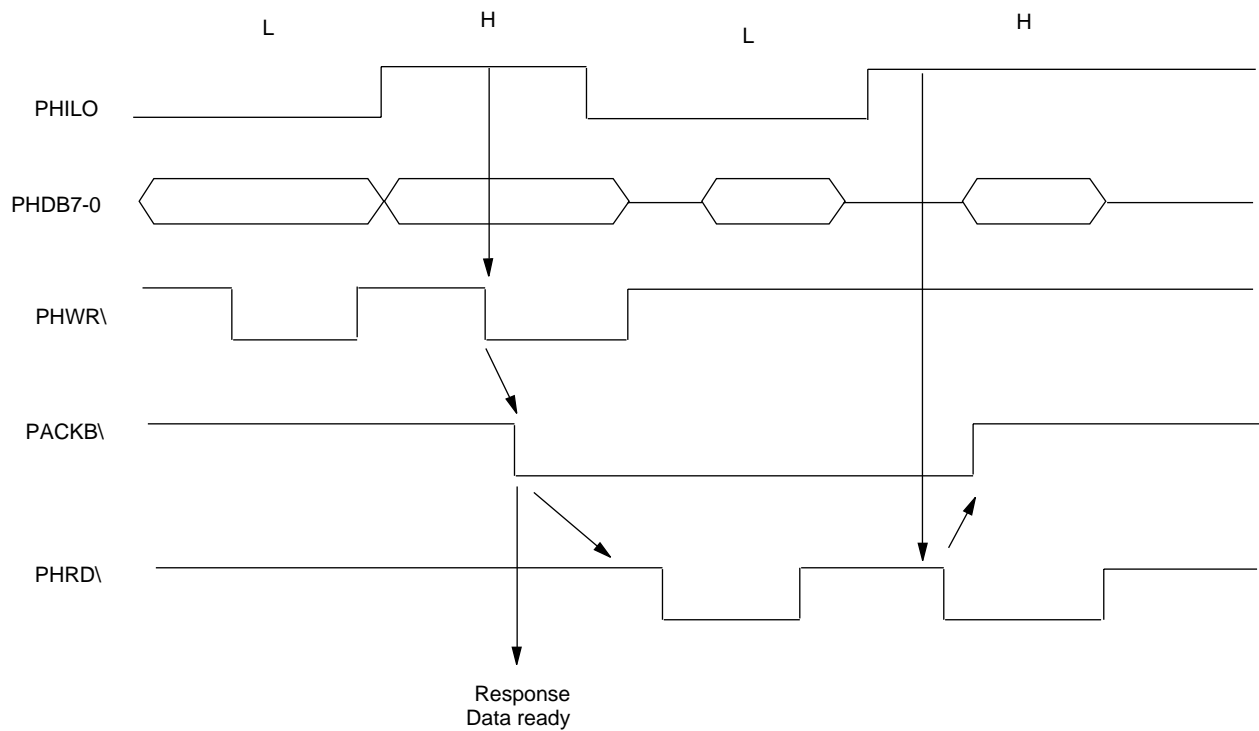
The command and response of the MX93030A is represented by an 16-bit code.

The MX93030A supports the synchronous serial and 8-bit parallel communication protocol with the host.

8-bit parallel:

The host can access PHDB(7:0) pins in two accesses selected by PHILO pin. When the host sets PHILO to low the host writes the low byte of the command to the register of DSP, and DSP does nothing but latches the data; While host sets PHILO to high, the host writes the high byte of the command to the register and then DSP executes the command.

PACKB\ is defaultly set to high. After finished the command, DSP returns the response by set the PACKB\ low to indicate host. When host has read the high byte of reponse, PACKB\ will be reset to high. Note that the host accesses this register by low byte first, and then high byte.

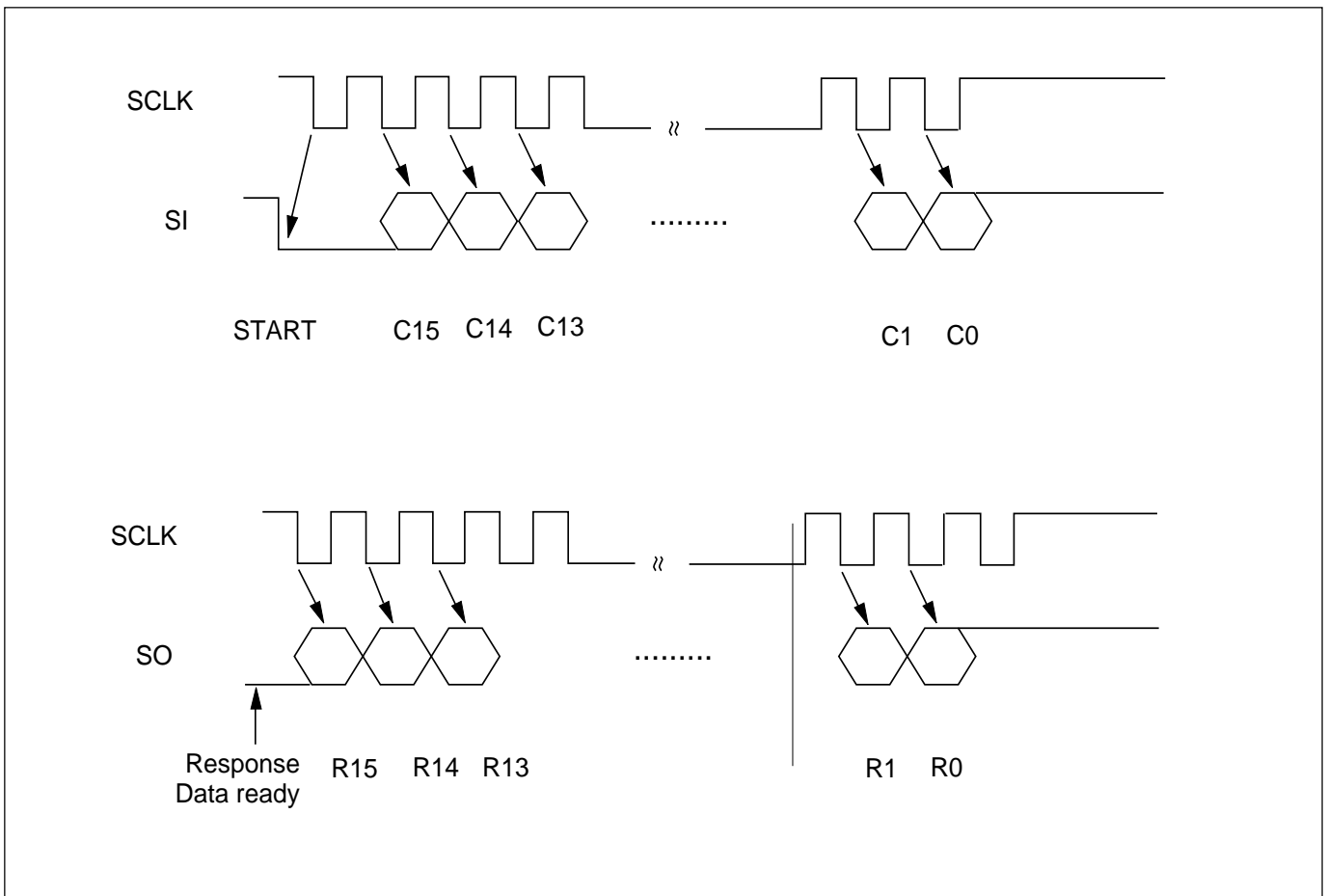


**Synchronous serial:**

The MX93030A supports the synchronous serial communication protocol. The microcontroller is the protocol master and provides the clock for the protocol. The MX93030A can stand clock rate of up to 16KHz.

The following signals are relative to the MX93030A.

A start bit(0) on SI signals DSP that a command will be issued. C15(MSB) is transmitted first. After the command is received and executed, the DSP set SO low to inform host that status is ready. The host should read the response from SO, after that the SO will be reset to high.



## 6. FUNCTIONAL DESCRIPTIONS(continued)

### ARAM MANAGEMENT

ARAM types and specifications supported by the MX93030A are as follows:

1. ARAM type :

- 64K x 16
- 128K x 8, 128K x 16
- 256K x 4, 256K x 8, 256K x 16
- 512K x 2, 512K x 4, 512K x 8, 512K x 12, 512K x 16
- 1M x 1, 1M x 2, 1M x 4, 1M x 8, 1M x 12, 1M x 16
- 2M x 1, 2M x 2, 2M x 3, 2M x 4, 2M x 8, 2M x 12, 2M x 16
- 4M x 1, 4M x 2, 4M x 3, 4M x 4, 4M x 8, 4M x 12, 4M x 16
- 8M x 1, 8M x 2, 8M x 3, 8M x 4, 8M x 8, 8M x 12, 8M x 16
- 16M x 1, 16M x 2, 16M x 3, 16M x 4, 16M x 8, 16M x 12, 16M x 16

2. 4M bits & larger density ARAM specifications :

- ARAM speed is not less than 120 ns.
- ARAM refresh use CAS-BEFORE-RAS mode.
- The number of column address line is greater than or equal to 4.
- There are no failed bit in first 16 rows.
- ARAM is separated to 16384 clusters, one bit of one cluster being failed will be a bad cluster.
- DC/AC characteristics are the same as those of standard DRAM.
  - Maximum input/output leakage current is 2 uA.
  - Maximum stand-by current is 2mA.

### Voice Message Recording and Storage

The MX93030A provides a high quality 4.8 kbps speech compression technique with silence compression to permit over 14 minutes of speech storage in each 4M bit of memory device.

The chip supports up to 127 variable length incoming and outgoing messages that are labeled as Msg ID 1 to 127. Although ICM could range from Msg 1 to 127, Msg IDs 127 to 121 are the only places for outgoing messages (OGM) storage so that the recovery of old OGM are easier to maintain. The Msg IDs of incoming messages are labeled chronologically and rearranged automatically after recording or deleting. ICM with Msg ID 1 is the oldest recorded incoming message.

During recording, the MX93030A also monitors the telephone line signal to detect the presence of DTMF, Call progress Tone and Continuous Tone and responses to

the HOST. The HOST can stop recording, and delete the last n\*400 or n\*200 ms from the memory using a Record Stop command with assigned Tail Cut Factor.

The MX93030A can generate a desired tone during recording voice message, which allows the application such as two-way recording. During recording, Record Pause function is provided.

The recording voice signal, received through the CODEC input, is transmitted back to the CODEC output by the MX93030A. This Loop-Back function can be disabled by the host in the personal mail command.

### Announcement (ANNC) Record

The MX93030A provides flexible recording ways for outgoing message. The HOST can select to delete the old ANNC before a new one is recorded or to abort the new ANNC record without losing the old ANNC.

### New/Old Message

For the HOST to manipulate incoming messages more handily, the MX93030A keeps an internal record of the ICM to identify the new/old status of messages. Before playback, the status of ICM is considered as "new". All incoming messages that have been played could change their status to "old" by issuing Real Del bit on DELETE command. After Real Del is issued, all new/old ICM Msg IDs will be rearranged. The functions, Play-new or Delete-all-old messages, are provided by the MX93030A in the command set.

### Message Playback

Random access for playback of any new message or message with specified Msg ID is supported by the MX93030A. During playback, the MX93030A also monitors the telephone line signals, and Play Pause function is provided. The MX93030A is able to fast-forward the playback of a recorded message, and the playing speed will be up to 33%.

## Message Deletion

The MX93030A provides two ways to delete recorded ICMs. One is the two-step method -- the combination of Del Mark on Play command and Real Del on Delete command, and the other is the immediate method -- Delete command. The two-step method enables the HOST to handle the deletion more flexibly, while the immediate method deletes a specified message directly.

## Voice Prompt

For high-quality Voice Prompt playback, the MX93030A utilizes the built-in speech decoder and an internal ROM or/and external EPROM/ROM to store the vocabulary. The chip also supports up to a 62-Kword external EPROM/ROM that allows minimum 3.44 minutes of voice prompt storage. The combination of internal (lower part) and external (upper part) voice prompt is allowed. The vocabulary supports up to 255 phrases. Given a phrase number in the Voice Prompt command from the control program, the MX93030A outputs the corresponding utterances to the Codec interface.

The starting address of voice prompt data could be located at data address 0800hex or program address 8000hex.

During playback of the voice prompt, the MX93030A monitors the telephone line signals.

## Time Keeping

There is a timer clock in the MX93030A. The HOST can issue Set Time and Get Time commands to get time services. The clock also supports system to stamp time to the recorded incoming messages.

## DTMF Detection

For remote control operation of the answering machine, the MX93030A monitors the incoming telephone line signal to detect the presence of DTMF signal.

## Tone Generation

Up to double tones can be generated by the MX93030A. The levels and frequencies are programmable by the HOST.

## Call Progress Tone Detection

The MX93030A supports the detection of call progress tones within the band of 300-640 Hz for the incoming telephone line signal. The tone detector is implemented with a bandpass filter. Indication of the presence of call progress tones is responded to the HOST, and could be used to terminate recording.

## Near End Echo Cancellation

The MX93030A implements a near end echo canceller in software to enhance the detection of DTMF and Call Progress Tone during Playback and Voice Prompt mode.

## Vox Detection (Digital Voice Activated Recording)

The speech detection is implemented in the DAM chip to indicate whether the recording signal level is above the Vox threshold. If the HOST sets the Vox Record bit on Initial command, the recording of the speech would start when the voice activity is detected. The HOST has to set Vox threshold by issuing command mode 13. Hexadecimal numbers for Vox threshold are listed in Table 6.

## Query and Report

The MX93030A is capable of reporting to the HOST about the query of the current status, such as the number of recorded messages, the number of new messages, the number of old messages, the available recording time, the status of recorded message.

## Personal Mail

The MX93030A supports up to 8 mailboxes that may be used for personal mail application. Each mailbox has its own ICM/MEMO Msg ID. Before recording or playing messages, the HOST should set the corresponding mailbox number first with Personal Mail command.

## Speed Dial Telephone Number Storage

The MX93030A can store up to 63 sets for telephone number storage. For the AFLASH memory, each set supports 13bytes. For ARAM memory, each set supports 14bytes. These memory could be also used for other special purpose.



## Caller ID

The MX93030A provides a caller ID mode command to demodulate the FSK data transmitted from the central office to the subscriber. This FSK data should conform to 1200 Baud Bell 202 protocol and may contain the date, time and the phone number and name of calling party.

The MX93030A offers two kinds of output on decoding FSK data. One is the cooked data mode, which presents the valid sequence output to be calling name, phone number, time and date. The other is the raw data mode, which output the data streams including the header information, alternate 1 and 0, and mark, which precedes the calling information. All the cooked data are buffered in internal memory of MX93030A; while the raw data should be read out by the HOST on real time basis.

In cooked data mode, the MX93030A decodes the input and interprets the frame data according to the requirements of Bellcore CLASS feature.

The MX93030A reflects the related flags on response word to show the channel signal status and the validity of current FSK data. The carrier\_detected flag (CD) indicates a valid carrier is present on the line and may be used for a signaling of the starting or ending of FSK bit streams. The ERR flag shows the decoded data is not correct, which is caused of wrong checksum detected or buffer overflowed. The data\_ready flag (DR) is set when a FSK data is output. The end\_of\_frame flag (EOF) shows a complete frame of FSK cooked data is read out.

## Power Down

With the power of backup batteries, the MX93030A is capable of keeping messages and data stored in the ARAM during power failure. In power down mode, the MX93030A will run at a lower clock rate to reduce power consumption and keep refreshing the ARAM.

## 7.0 OPERATION DESCRIPTION

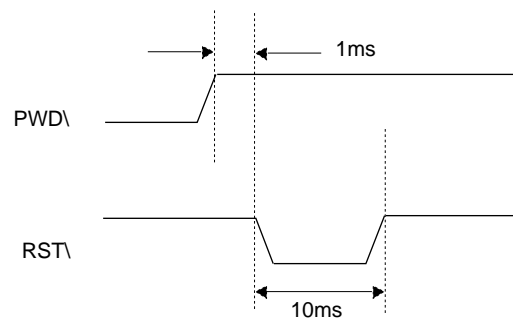
### INITIAL PROCEDURE

When the system is powered up, the input PWD\ (pin 15) signal should go high followed by the input RST\ (pin 96) pulse that should be low at least 10 ms long. After reset, the MX93030A identifies itself to be in cold or warm stage by comparing the system checksum and responds to each situation as follows:

1. The system checksum remains unchanged -- warm start, which means messages in ARAM and data in internal SRAM are kept correct by backup batteries during power down. In this case, the MX93030A restores all the previous conditions and system parameters.
2. The system checksum is changed -- cold start, which means the messages and data have been lost before the system is powered up. Then, the MX93030A will initialize all the system parameters to their default values.

After completing the above system initialization, the MX93030A is ready and indicates the HOST by setting PACK\ or SO low. The HOST should poll the indication to read the response first, then send the vocabulary configuration command to MX93030A and check the response status. If needed, the HOST should set the parameter by sending the relative command.

### Power-up Reset Timing



**MODES OF OPERATION**

After reset, the MX93030A is normally in Idle mode and keeps polling command from the HOST. When a command is issued by HOST, the system will enter the new mode. For some of the mode, the system will return to Idle mode after operation is completed. While other modes, Record, Playback, Line Monitor, Voice Prompt, and Telephone numbers, require Stop or Idle command to return to Idle mode.

The MX93030A supports 16 modes of operation, that are listed as follows:

Command	Mode Name
0	Idle
1	Record
2	Play
3	Message status
4	Tone Generation
5	Line Monitor
6	Delete Message
7	Set Time/OPT0-7/Voice Prompt/ Silence Threshold
8	Get TIME/OPT/IPT
9	Initial & Test Memory
10	Get Record Message status
11	Voice Prompt
12	Voice Activity
13	Personal Mail
14	Telephone Number
15	Caller ID

**DESCRIPTION OF MODES OF OPERATION****RECORD**

When Record command is received from the HOST, the MX93030A performs speech compression, stores the message and monitors telephone line. If the Vox Record bit had been set to 1 on Initial & Test command, recording of the speech will start upon the voice activity detected, else the MX93030A starts recording immediately after Record command is received.

Clearing Marked Record (bit 8-10) to 0, if it is recording ICM. When recording OGM, the HOST should set Marked Record (bit 8-10) to desired number other than 0 as OGM ID.

Setting bit 5 (Annc Del) to 1 on Initial & Test command, the HOST can choose to delete the old announcement before a new one is recorded. But in this case, Mark Fail(bit 11) on Record Command is inhibited. If that bit is cleared to 0, the new announcement recording can be aborted without losing the old announcement by issuing Mark Fail (bit 11) on Record command.

During recording, the HOST can pause the recording by setting Pause (bit 7) to 1 and resume recording by clearing that bit. Line Monitoring will continue during pause.

The HOST can stop recording by setting Stop (bit 6) to 1, and delete the last n\*400 ms or n\*200 ms from the memory by using a Record command with assigned Tail Cut Factor (bit 0-5).

While system memory is full, the MX93030A will stop message recording, show the status in response word (bit 7, Mfull), not perform line monitoring, but still remain in Record mode.

During Record mode, the HOST can instruct the MX93030A to generate a tone by issuing the Tone generation command. Setting Stop bit on Tone Generation command or Record command will stop tone generating.

In recording, all commands will be ignored except Idle Record, Get time/OPT/IPT, Set time/OPT0-7/Voice Prompt/Silence threshold and Tone Generation.

The MX93030A will terminate Record mode and return to Idle mode when Stop bit or mark fail bit on Record command is set to 1 or Idle command is issued.

Note: The MX93030A supports up to 127 incoming and outgoing messages recording which are labeled as Msg ID 1-127. The Msg IDs of incoming message are labeled chronologically and rearranged automatically after recording. Although ICM could range from Msg 1 to 127, Msg IDs 127 to 121 are the only place for outgoing message storage. So, it is strongly suggested that the HOST should keep an upper bound of the number of ICM. (For example, upper bound of ICM=127 - maximum OGM number that will be applied in user's specification.) If the power supply of MX93030A is off, the current recording message will be discarded.

## PLAY

When Play command is received from the HOST, the MX93030A performs message playback and line monitoring. The Msg ID (bit 0-6) is set by the HOST to specify which message to play. To playback new message (non-played one), set Play New (bit 10) to 1, then the MX93030A will search to play the non\_played message with specified Msg ID. During playing, the HOST can pause playback by setting Pause (bit 8) to 1 and resume playing from the same point by clearing that bit. Line Monitoring will continue during pause. To fast playback a recorded message, set Fast Play (bit 11) to 1 and the playing speed will be up to 33%.

To delete and stop the playing message, the HOST can set Del Mark (bit 7) on play command. After being tagged a Del Mark, the marked message is not really deleted until a Real Del (bit 8) on Delete command is issued. The Real Del command not only deletes the messages that have been tagged a Del Mark but also changes the status of those ICMs that have been played to old. The ICMs that have not been played before are regarded as "new". After Real Del is issued, all new/old ICM Msg IDs will be rearranged.

For the HOST, it is used to issuing the Real Del after the user terminates the manner of playback.

The response word contains the information of tones detected from the line, playing time spent (bit 8-15) and End of play flag (bit 6), which indicates the end of the current message. When the Play\_End bit is 1, the MX93030A stops playback but still remains in Play mode.

The MX93030A will respond to the Play\_End flag if the HOST wants to play invalid or nonexistent messages.

In playing, all commands will be ignored except Idle Play, Get time/OPT/IPT, Set time/OPT0-7/Voice prompt/Silence threshold and Tone Generation.

The MX93030A will terminate Play mode and return to Idle mode when Stop bit or Del Mark bit is set to 1 on Play command or Idle command is issued.

## MESSAGE STATUS

In this mode, there are four request codes for the HOST to get message information:

1. Get the number of recorded message (request code=0)
2. Get the number of new message (request code=1)
3. Get the number of old message (request code=2)
4. Get the available recording time with unit of second (request code=3).

The result will be reported in the response word.

## TONE GENERATOR

In this mode, up to double tones can be generated by the MX93030A. By the setting of CODE the frequency may be programmable or default.

CODE	FREQUENCY
000	PROGRAMMABLE F1/F2
001	800 HZ
010	900 HZ
011	1000 HZ
100	1200 HZ
101	1500 HZ
110	1800 HZ
111	2100 HZ

Programmable frequency :  
CODE(BIT8-10) on command is 000.

The tone levels and frequencies are programmable and controlled by the HOST. All the parameters are defined by the sequence of three Tone Generation commands. The first command defines the output gains in bit 0-3 for the 1st tone, and bit 4-7 for the 2nd tone. Each tone can be programmed from 0 dB (gain code 0000) to -28 dB (gain code 1110) with 2 dB resolution. The frequencies are defined in the second and third commands with the following relationship:

$$\text{frequency code} = \text{desired frequency (Hz)} * 8.19$$

$$f(n) = 32767 * \cos(2 * \pi * f\_code * n / (8000 * 8.19))$$

where  $f\_code$  is the input frequency code,  $n$  is sequence index and 8000 is the sampling rate

For single tone, Codec outputs the signal  $s(n)$ :  
 $s(n) = gain * f(n)$

For dual tone, Codec outputs the signal  $s(n)$ :  
 $s(n) = 0.5 * (gain1 * f1(n) + gain2 * f2(n))$

To generate a single tone, the gain code of the other tone should be set to 1111. The MX93030A starts tone generation only after receiving the third command.

Default frequency :  
 CODE (bit8-10) on command is not 000. The output frequency is specified by the code. The MX93030A starts tone generation after receiving the first command which defines the gain in bit 0-3.

The MX93030A will terminate tone generation when Start/Stop bit is set to 0 on Tone Generation command.

## LINE MONITOR

In this mode the MX93030A monitors the telephone line signal for the detection of DTMF, Call Progress Tone, Vox, and/or Continuous Tone. The MX93030A keeps monitoring the line until Stop bit is set to 1.

The MX93030A returns to the HOST a response word that reflects the flag of Call Progress Tone, Vox, Continuous Tone and the index of DTMF signal that has been detected:

INDEX	DTMF CODE
0	No Tone
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	*
B	0
C	#

The MX93030A will terminate Line Monitor mode and return to Idle mode when Stop bit is set to 1 on Line Monitor command, or Idle command is issued.

## DELETE MESSAGE

This mode provides an immediate way to delete messages as follows:

1. To delete a specified message, set its Msg ID in bit 0-6 and clear bit 11, 10, 8 and 7 to zero.
2. To delete all old ICM, set Del\_All\_Old (bit 7) to 1 and clear bit 11, 8 to zero. (Bit 0-6 is ignored)
3. To delete a specified new ICM, set Del\_New\_Msg (bit 10) to 1, give the New Msg ID in bit 0-6, clear bit 11, 8 and 7 to zero.
4. To erase the Del Mark from a specified ICM (Del Mark is a tag set on Play command for real deletion), set Del\_Mark\_Clr (bit 11) to 1, give the Msg ID in bit 0-6 and clear bit 10, 8 and 7 to zero.
5. To delete message that has Del Mark tag, set Real Del (bit 8) to 1 and clear bit 11, 10 and 7 to zero.

If the HOST deletes invalid or nonexistent messages, an error flag will show on bit 0 of the response word.

## SET TIME/OPT0-7/VOICE PROMPT/SILENCE THRESHOLD

In this mode the HOST can set the current time, output port 7-0, voice configuration and silence threshold. The time information includes second, minute, hour and week. The timer in the MX93030A will be used to stamp time and day to the recorded message.

1. To set second, put the data in bit 0-7 and use request code (bit 8-11) 0000.
2. To set minute, put the data in bit 0-7 and use request code (bit 8-11) 0001.
3. To set hour, put the data in bit 0-7 and use request code (bit 8-11) 0010.
4. To set week, put the data in bit 0-7 and use request code (bit 8-11) 0011.
5. To set OPT 0-7, put the output data in bit 0-7 and use request code (bit 8-11) 0100.
6. To set link index, put the data in bit 0-7 and use request code (bit 8-11) 0101.

7.To configure voice prompt, put data in bit0-1 and use request code(bit 8-11) 0110.

The responded status includes internal voice prompt test result, external voice prompt test result, external voice prompt location and data unit.

8.To set silence threshold, use request code (bit 8-11) 0111.

9.To set MX93000, put the control data in bit 0-7, specify register in bit 8-10 and set bit 11 to 1.

### GET TIME/OPT/IPT

In this mode the HOST can get the current time from the internal timer clock of the MX93030A. The time information includes second, minute, hour and week.

- 1.To get second, use request code (bit 8-11) 0000.
- 2.To get minute, use request code (bit 8-11) 0001.
- 3.To get hour, use request code (bit 8-11) 0010.
- 4.To get week, use request code (bit 8-11) 0011.
- 5.To get OPT 0-15, use request code (bit 8-11) 0100.
- 6.To get OPT 0-15, use request code (bit 8-11) 0101.
- 7.To get IPT 0-7, use request code (bit 8-11) 0110.

The requested data will be reported in the response word.

### INITIAL & TEST MEMORY

In this mode there are 6 functions for the HOST to define:

#### 1.Momory Initialization

The HOST can initialize the ARAM/AFLASH by Mem. Init. (bit 0) to 1. This function is normally used after first power-up of the system. The HOST must send this command to the MX93030A in order to format MEMORY. The MX93030A performs MEMORY formatting to determine the MEMORY size (address space and bit width) and detect the good/bad memory unit of MEMORY. The response word reported to the HOST contains the information of MEMORY bit size (bit 0-3), MEMORY address size (bit 4-7), MEMORY good/bad status (bit 8) and MEMORY good rate (bit9-15). If the examination in the initialization shows that the MEMORY quality meets the

pre-defined specification, the MX93030A responds 1 in G/B status bit. It will take 37 seconds to do complete ARAM initialization or 7.6 seconds to do fast ARAM initialization.

After initialization, all messages in the MEMORY are lost.

#### 2.ARAM Pattern Check

The MX93030A allows the HOST to check the status of MEMORY by setting the Mem. Check (bit 1) on this command. By checking the patterns, produced in Initialization MEMORY mode and stored in MEMORY, the MX93030A can identify the current MEMORY status to be good or bad.

#### 3.Line On/Off

The HOST should set Line-On (bit 3) to 1 if the system is logged in from telephone line; and clear that bit to 0 if in local keypad operation. Failing to set this bit properly will degrade the performance of echo cancellation.

#### 4. Vox On/Off Record

If the HOST turns on the Vox Record function (by setting bit 4 to one) on this command, speech recording will start upon the voice activity detected, else recording will start immediately after Record command is issued.

#### 5.Announcememt Deletion

By setting bit 5 (Annc Del) to 1 on this command, the HOST can choose to delete the old announcement before recording a new one. If that bit is cleared to 0, the old announcement is not deleted until the new announcement recording is completed. With this option, the new announcement recording can be aborted without losing the old announcement by issuing Mark Fail (bit 11) on Record command.

#### 6.Condition of message change to old

When the Real Del (bit 8) on Delete command is issued, the ICMs could be changed their status to old under the following conditions.

a.New/Old sel (bit 6) is set to 1 and the ICMs have been ever played.

b.New/Old sel (bit 6) is cleared to 0 and the ICMs have been played end.

## GET RECORD MESSAGE

In this mode, there are ten request codes for the HOST to get the related information about a specified message.

Given the Msg ID (bit 0-6) and New\_Msg flag (bit 7), the MX93030A can provide message recording time, recording length, attribute and Del Mark status according to the Request Code (bit 8-11) as follows:

1. Get the recording time -- second. (Request Code = 0000)
2. Get the recording time -- minute. (Request Code = 0001)
3. Get the recording time -- hour. (Request Code = 0010)
4. Get the recording time -- week. (Request Code = 0011)
5. Get the recording length (sec). (Request Code = 0100)
6. Get the timer status. (Request Code = 0101)  
The response word is 1 if the MX93030A internal timer has been set before with Set Time/OPT0-7/Voice Prompt/Silence Threshold command. Otherwise, the response word is 0.
7. Get the message attribute. (Request Code = 0110) To show the specified message is of MEMO type (response word = 1) or ICM type (response word = 0)
8. Get the Del Mark status. (Request Code = 0111) To show the specified message has been tagged a Del Mark (response word = 1) or not (response word = 0)
9. Get the template Old Mark status. (Request Code = 1000) To show the specified message which has been tagged a temp. Old Mark (response word = 1) or not (response word = 0)
10. Get the link index, that stored in message.
11. Write link index to specified message.
12. Check OGM existence. (Request Code = 1111) Use this command to show whether an OGM with the Msg ID is recorded (response word = 1) or not (response word = 0).

All the results are reported in the response word.

## VOICE PROMPT

In this mode the MX93030A plays back a speech segment that the corresponding phrase number is given in command bit 0-7. Up to 255 speech segments, previously stored in an external ROM/EPROM, are provided by the MX93030A and pronounced using the speech decompression algorithm. The HOST can pause the playback by setting PS (bit 8) to 1 or resume from pause by clearing PS bit to 0. Fast forward playback of voice prompt is also provided by setting Fast Play (bit 11) to 1. During Voice Prompt mode, the MX93030A keeps monitoring the line signal and sends the results in response word to the HOST.

The MX93030A will terminate Voice Prompt mode and return to Idle mode when Stop bit is set to 1 on Voice Prompt Generation command, or Idle command is issued.

## VOICE ACTIVITY

In this mode the HOST can set the VOX threshold in bit 0-11. The Hexadecimal numbers for VOX level are listed in Table 6.

## SET LOOP-BACK/PERSONAL MAIL

Three functions are provided in this command shown as follows:

### 1. Set the personal mailbox number

In this mode the HOST can select one out of eight mailboxes (setting in bit 0-2) for recording messages, playing recorded message and retrieving message time. Each mail box manages its own messages and Msg IDs. The default mailbox is number 0.

### 2. Set the recording message attribute

Before recording a message, the HOST can set the attribute of that message to be MEMO or ICM. Clear bit 3 to zero to identify a recorded message as an ICM or set bit 3 to one to identify a recorded message as a MEMO.

Make sure to set the desired mailbox before issuing the message related commands such as Record, Play, Delete Message and Get message Time.

### 3. Set the loop back function

Before recording a message, the Host should set the recording signal loop back function to be enabled or

disabled. Clear LB (bit4) to zero for transmitting back the signal that is received through the codec input. Set LB (bit4) to one for disabling the received signal to be transmitted back to codec.

## TELEPHONE NUMBER

In this mode the HOST can write/read telephone number to/from the MX93030A with the sequence of telephone number command as follows:

1. Write telephone number to the MX93030A.

The first command defines the telephone record ID (bit 0-5) and set W/R (bit 10) to zero.

Following command specifies the one-byte to be stored under that ID.

While the current record ID is full, the MX93030A will show the status in response word (bit0, FULL)

The MX93030A will terminate telephone number mode and return to Idle mode when stop (bit 9) is set to 1 on telephone number command or Idle command.

2. Read telephone number from the MX93030A.

The first command defines the telephone record ID (bit 0-5) and set W/R (bit 10) to one. The telephone data will be shown on the response word.

Following command shows the one-byte data on the response on the HOST.

The response word contains the byte-data (bit 0-7) and Read End (bit 8). When the Read End bit is 1, the byte-data is invalid.

The MX93030A will terminate telephone number mode and return to Idle mode when stop (bit 9) is set to 1 on Telephone Number command or Idle command.

## CALLER ID

The MX93030A is capable of FSK demodulation and frame data interpretation according to the requirements of Bellcore CLASS feature. When start\_bit (bit 0) of Caller ID command is set to 0 from the HOST, the MX93030A starts to perform FSK demodulation. The Host could specify the data output mode by setting bit 8 to be raw data (=0) or cooked data (=1). If output mode is

selected to be cooked data, the HOST should further specify the parameter to be read out by setting the desired request code.

In cooked data mode, there are fifteen request codes for the HOST to get different caller ID parameters.

1. Message type (request code=0000).
2. Message length (request code=0001).
3. Parameter length of Date & Time (request code=0010)
4. Date & Time (request code=0011).
5. Parameter\_length of Directory Number (request code=0100).
6. Directory Number (DN) (request code=0101).
7. Parameter length of Reason for absence of DN (request code=0110).
8. Reason for absence of DN (request code=0111).
9. Parameter length of Caller Name (request code=1000).
10. Caller Name (request code=1001).
11. Parameter length of Reason for absence of name (request code=1010).
12. Reason of absence of Caller Name (request code=1011).
13. Checksum (request code=1100).
14. Parameter length/visual indicator.
15. Visual indicator.

The MX93030A responds the requested data on low byte of response word and reflects the related flags on high byte of response word. The CD flag (bit 15) indicates a valid carrier is present on the line. The ERR flag (bit 14) shows the decoded data is not correct due to wrong checksum detected or buffer overflowed. The DR flag (bit 13) is set when a valid FSK data of current frame is output. The EOF flag (bit 12) shows one complete frame of FSK cooked data is read out.

The raw data is generated on real time basis. Although the demodulator output is buffered by the MX93030A, the HOST should read out the raw data byte at least every 6 ms to prevent buffer overflow. If the HOST selects raw data mode, the request code on command word (bit 4-7) is neglected. All the cooked data parameters are buffered in the internal memory of MX93030A until other commands are issued by the HOST. When the next bit streams are coming, the previously buffered parameters will be lost.

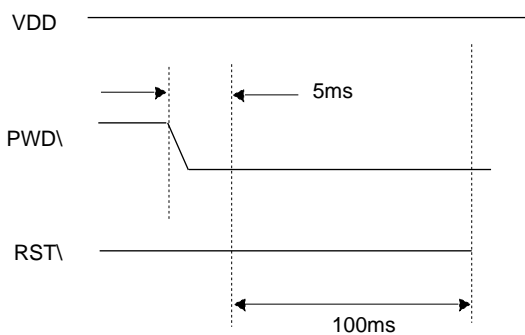
The MX93030A will return to Idle mode when an Idle command is issued.

**POWER-DOWN****ARAM mode:**

When power failure happens, the PWD $\bar{\text{}}$  should go low at least 5 ms and RST $\bar{\text{}}$  should be high at least 100 ms for the MX93030A to terminate any operating mode and enter power-down mode.

To keep the ARAM and internal RAM data correct during power failure, a battery backed 5V DC supply is needed to be connected to the MX93030A and ARAM.

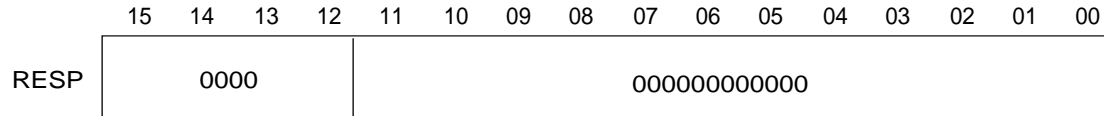
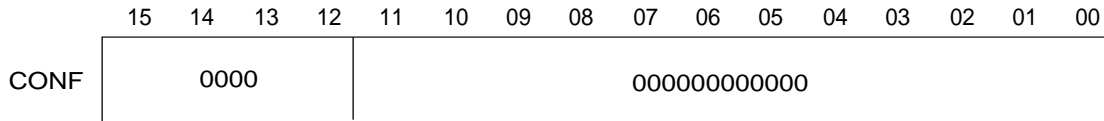
While in power-down mode, the MX93030A will not respond to any command from the HOST, refreshing ARAM is continued and system runs with low crystal 32768 Hz to save backup power.

**POWER DOWN TIMING (ARAM)**

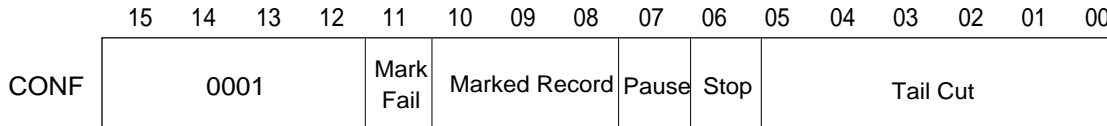


## 8.0 COMMAND FORMAT AND PROTOCOL

### 8.0 IDLE MODE



### 8.1 RECORD MODE



Tail Cut -- cut tail in 200/400 ms unit.

Stop -- 1:stop recording and tail cut.

Pause -- 1:to pause recording

0:to continue recording

Marked Record -- recording to special message record 127~121.

Marked record is not for normal recording message; they are reserved for announcement.

000 -- not a marked record

001 -- message record 127(7FH)

010 -- message record 126(7EH)

011 -- message record 125(7DH)

100 -- message record 124(7CH)

101 -- message record 123(7BH)

110 -- message record 122(7AH)

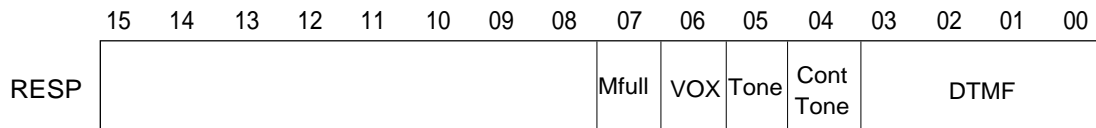
111 -- message record 121(79H)

Mark Fail -- 1:to recover original announcement message and stop record.

While Ann\_del (bit-5) on Initial & Test Memory command is 0 and Record mode is stopped.

note:While Ann\_del (bit-5) on Initial & Test Memory command is set to 1,

The Mark Fail function is inhibited.



DTMF -- the index of DTMF which is detected in the process of recording

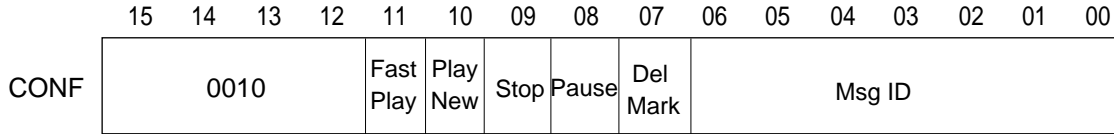
DTMF	0	1	2	3	4	5	6	7	8	9	A	B	C
CODE	NO	1	2	3	4	5	6	7	8	9	*	0	#

Cont tone -- 1 : the continue energy is detected.

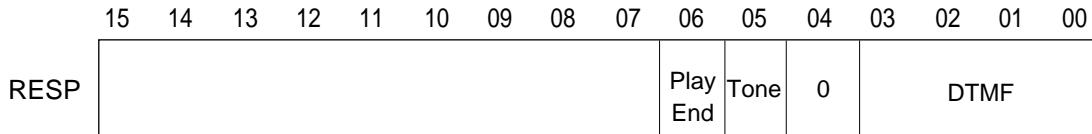
Tone -- 1 : the call progress tone (300~640 Hz)is detected.

VOX -- 1 : the speech power level is under VOX threshold.

Mfull -- 1: memory full, no further recording is possible.

**8.2 PLAY MODE**


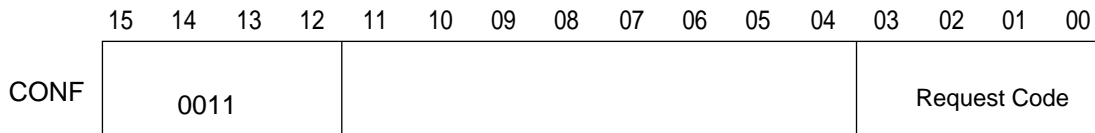
Msg ID -- 1~127:message ID which is assigned for playing  
 Del Mark -- 1:stop playing and tag a del mark to that message  
 Pause -- 1:pause playing  
           0:continue playing  
 Stop -- 1:stop playing  
 Play New -- 1:search to play the new messages.  
             0:search to play all messages.  
 Fast play -- 1:playing speed will be up to 33%.  
             0:normal speed.



DTMF -- the index of DTMF which is detected in the process of playing.

DTMF	0	1	2	3	4	5	6	7	8	9	A	B	C
CODE	NO	1	2	3	4	5	6	7	8	9	*	0	#

Tone -- 1:the call progress tone(300~640Hz)is detected.  
 Play End -- 1:end of playing the message.

**8.3 MESSAGE STATUS MODE**

**REQUEST CODE:**

REQUEST CODE	STATUS	DATA
0000	number of total recorded messages	00 ~ 127
0001	number of new messages	00 ~ 127
0010	number of old messages	00 ~ 127
0011	available time to record (sec.)	00 ~ 65535

**8.4 TONE GENERATION MODE**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	0100				start/ stop	CODE			Gain2			Gain1				

Gain1, Gain2 -- +3 dbm ~ -25 dbm, 2 db step down from 0.

Start/Stop -- "1" start to generate tone

"0" stop generating tone

CODE -- tone generation by specified or default.

the gain of default tone is specified by Gain1.

CODE	FUNCTION
000	SPECIFY F2/F1
001	800 Hz
010	900 Hz
011	1000 Hz
100	1200 Hz
101	1500 Hz
110	1800 Hz
111	2100 Hz

**\*SPECIFY F1,F2 TONE START**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	0100				1	000			Gain2			Gain1				
RESP	0100				1	000			Gain2			Gain1				
CONF	F1															
RESP	F1															
CONF	F2															
RESP	F2															

Note:F1,F2=Target frequency \*8.19

**\*DEFAULT TONE START**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	0100				1	---			1111			Gain 1				
RESP	0100				1	---			1111			Gain 1				

**\*TONE STOP**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	0100				0	000			0000			0000				
RESP	0100				0	000			0000			0000				

**8.5 LINE MONITOR MODE**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	0101				00000000000											STOP

STOP -- "0" start to monitor line.  
 "1" stop monitoring line.

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
RESP										VOX	Tone	Cont Tone	DTMF			

DTMF -- the index of DTMF which is detected in the process of line monitoring

DTMF	0	1	2	3	4	5	6	7	8	9	A	B	C
CODE	NO	1	2	3	4	5	6	7	8	9	*	0	#

Cont tone -- 1 : the continue energy is detected.  
 Tone -- 1 : the call progress tone (300~640 Hz) is detected.  
 VOX -- 1 : the speech power level is under VOX threshold.

**8.6 DELETE MESSAGE MODE**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00	
CONF	0110				Del Mark CLR	Del New MSG	0	Real Del	Del All Old	Msg ID							

Msg ID -- 1~127 ICM/MEMO to be deleted.  
 Del Mark Clr -- 1 : clear the del mark of the specified message in ARAM mode.  
 Real Del -- 1 : actually delete the message that has del mark;  
 at the same time, tag the old mark to the message that has been played back.  
 Del New MSG -- 1 : search to delete the specified message of all new messages  
 0 : search to delete the specified message of all messages  
 Del All Old -- 1:delete all old message which have been played; MSG ID is don't care.

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
RESP	0110				00000000000											E

E -- "0" :indicate ok  
 "1" :indicate invalid message

**8.7 SET TIME/OPT0-7/VOICE PROMPT/SILENCE THRESHOLD MODE**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	0111				Request Code				Data							

RESP	0111															
------	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**REQUEST CODE:**

REQUEST CODE	FUNCTION	DATA
0000	SECOND	00-3BH
0001	MINUTE	00-3BH
0010	HOUR	00-17H
0011	WEEK	00-06H
0100	OPT7-0	00-FFH
0101*	LINK INDEX	00-FFH
0110	VOICE PROMPT CONFIG	00-03H
0111	SILENCE THRESHOLD	00-0FH
1aaa*	MX93000(A) CMD.	00-FFH

Note : (i) For adjusting silence threshold, please refer to TABLE 7  
(ii) aaa\* specify register of MX93000(A)  
(iii) CID Index\* --- send A9xx command to retrieve CID index from message xx.

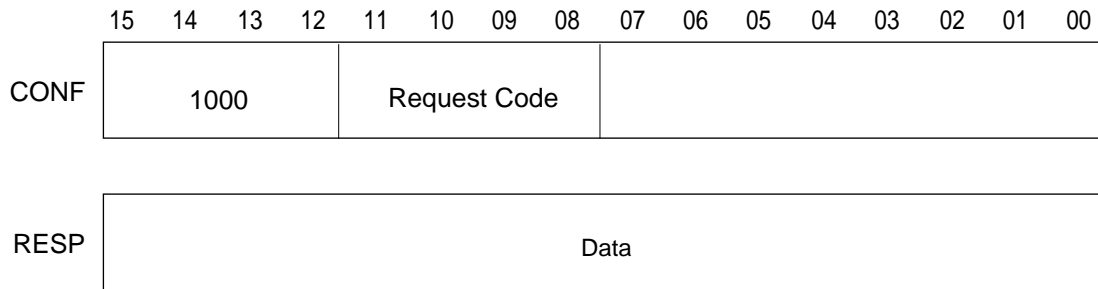
**\* VOP CONFIG :**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	0111				0110				000000				EVOP	IVOP		

IVOP -- 1:internal voice prompt select and test.  
EVOP -- 1:external voice prompt select and test.

RESP	0111				00000000				EVOP	EVOP	EVOP	IVOP
									UNIT	ADDR	STATUS	STATUS

IVOP STATUS -- 1:test ok  
0:test fail  
EVOP STATUS -- 1:test ok  
0:test fail  
EVOP ADDR -- 1:program sapce 8000H.  
0:data space 800H.  
EVOP UNIT -- 1:word  
0:byte

**8.8 GET TIME/OPT/IPT MODE**

**REQUEST CODE:**

REQUEST CODE	FUNCTION	DATA
0000	SECOND	00~3BH
0001	MINUTE	00~3BH
0010	HOUR	00~17H
0011	WEEK	00~06H
0100	OPT 7-0	00~XXFFH
0110	IPT 1-0	00~03H

**8.9 INITIAL AND TEST MEMORY MODE**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	1001				000			Old Ena	Tail Cut Unit	new/ old sel.	ANNC DEL	vox on/off	Line ON/ OFF	Fast Mem Init.	Mem. check	Mem. Init.

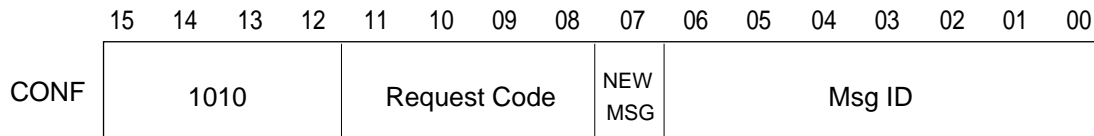
- Mem. Init. -- 1:re-initialize memory.
- Mem. check -- 1:ARAM good/bad check.
- Fast Mem Init. -- 1:fast ARAM initialization.  
0:normal ARAM initialization.
- Line on/off -- 1:in remote line operation  
0:not in remote line operation
- VOX on/off -- 1:on;start to record, while vox level is over threshold.  
0:off;immediately start to record.
- ANNC DEL -- 1:delete old ANNC before New ANNC is recorded.  
0: delete old ANNC after New ANNC is recorded.
- new/old sel. (set the judgement point of message new/old attributes)  
1:message which has ever been played.  
0:message which has been played end.
- Tail Cut Unit(set the tail cut unit)--  
1:200 ms  
0:400 ms
- Old Ena-- 1:disable to set old mark  
0:enable to set old mark (the setting is according to new/old sel. bit6).

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
RESP	MEMORY GOOD RATE							G/B	MEMORY SIZE				MEMORY BITS			

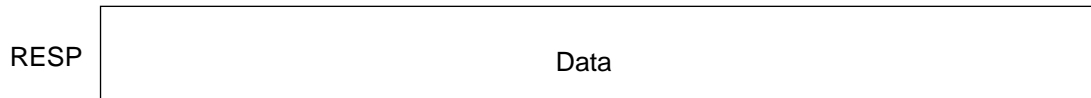
- MEMORY GOOD RATE --0~100
- G/B --1:Memory good rate is over 75%  
--0:Memory good rate is under 75%

MEMORY SIZE		MEMORY BITS	
0001	64 K	0001	1
0010	128 K	0010	2
0011	256 K	0011	3
0100	512 K	0100	4
0101	1 M	1000	8
0110	2 M	1100	12
0111	4 M	1111	16
	1000		8 M
		1001	16 M



**8.10 GET RECORD MESSAGE STATUS MODE**


NEW MSG -- 1:the MSG ID is related to new messages.  
 0:the MSG ID is related to total messages.



REQUEST CODE	FUNCTION	DATA
0000	SECOND	00~3BH
0001	MINUTE	00~3BH
0010	HOUR	00~17H
0011	WEEK	00~06H
0100	RECORD TIME	00~EFH
0101	TIMER STATUS	1:timer has been set 0:default timer
0110	ICM/MEMO	1:MEMO record 0:ICM record
0111	DEL MARK STATUS	1:has del mark 0:no del mark
1000	OLD MARK STATUS	1:has old mark 0:no old mark
1001	GET LINK INDEX	00~FFH
1010	WRITE LINK INDEX (specified by 75xx) To specify MSGID	MSGID=1~127
1111	OGM EXIST(79H~7FH)	1:OGM exist 0:OGM not exist

NOTE: This mode can only get all the information of the specific ICM (In-Coming Message). The information of the OGM (Output-Going Message) can not be got by this mode.

**8.11 VOICE PROMPT MODE**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	1011				FAST PLAY	0	STOP	Pause	PHRASE NUMBER							

PHRASE NUMBER -- voice phrase number (1~255) which is assigned for playing.

Pause--1:to pause playing

0:to continue playing

Stop--1:stop playing

Fast Play--1:playing speed will be up to 33%

0:normal speed

Please refer to Table 11 for internal vocabulary.

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
RESP	1011000								0	PLAY END	Tone	0	DTMF			

DTMF -- the index of DTMF which is detected in the process of playing

DTMF	0	1	2	3	4	5	6	7	8	9	A	B	C
CODE	NO	1	2	3	4	5	6	7	8	9	*	0	#

Tone -- 1 : the call progress tone (300~640 Hz)is detected.

Play end -- 1:end of playing the message.

**8.12 VOICE ACTIVITY MODE**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	1100				VOX LEVEL											

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
RESP	1100				VOX LEVEL											

Adjust VOX Level, please refer to TABLE 6

**8.13 PERSONAL MAIL MODE**

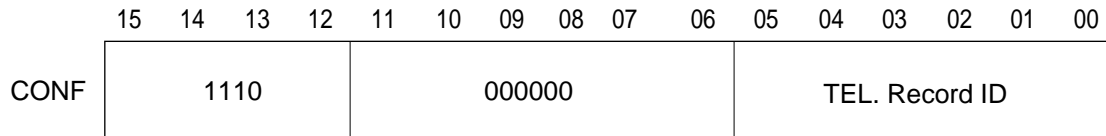
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
CONF	1101				0000000							LB	MEMO /ICM	PERSONAL MAIL		

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
RESP																

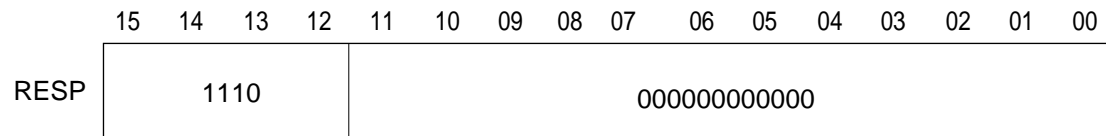
PERSONAL MAIL-- Select the specified mail box; default is 0.  
 Only the messages in the specified mail box can be operated  
 by other modes(PLAY,RECORD,...etc.)

MEMO/ICM -- 1:Set the attribute of the recorded message to be MEMO  
 0:Set the attribute of the recorded message to be ICM

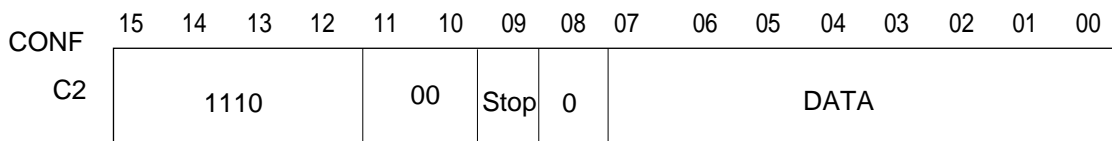
LB -- 1:loop back disable  
 0:loop back enable(default)

**8.14 TELEPHONE NUMBER MODE**
**WRITE TELEPHONE NUMBER**


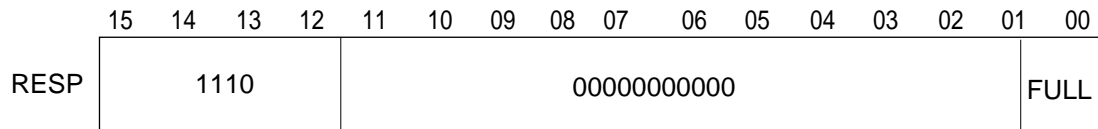
TEL. Record ID -- 1~3FH,each telephone record has 14 bytes.



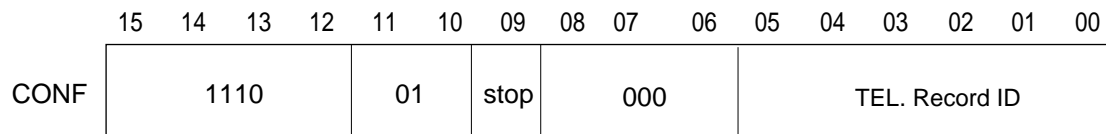
note: if TEL. Record ID=0 or memory bad , the RESP is FFFFH and return to Idle mode.



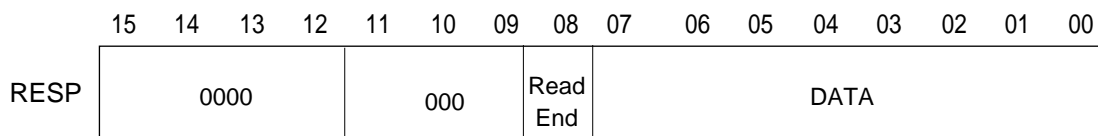
Stop -- 1:stop this command mode.



FULL -- 1:the telephone record is full

**READ TELEPHONE NUMBER**


stop -- 1:stop reading data



Read End -- 1:End of the current Tel. Record ID and the followed DATA is invalid

Note:if Tel. Record ID = 0 , this mode will be stopped and RESP=FFFFH

**8.15 CALLER ID**

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
COMMAND	1111				000			OUTPUT MODE	REQUEST CODE			000			START\	

OUTPUT MODE :

=0 RAW DATA

=1 COOKED DATA

REQUEST CODE : (if in cooked data mode, to specify the data frame to be read out)

=0000 Message type(4,6,80,82)

=0001 Message length (Bytes)

=0010 Parameter length Data & time (Byte)

=0011 Date & time

=0100 Parameter length/Directory number (byte)

=0101 Directory number

=0110 Parameter length/Reason for absence of DN

=0111 Reason for absence of DN

=1000 Parameter length/Caller Name

=1001 Caller Name

=1010 Parameter length/Reason for absence of name

=1011 Reason of absence of caller Name

=1100 Checksum

=1101 Parameter length/visual indicator

=1110 Visual indicator

SRART\:

=0 START/CONTINUE CALLER\_ID DECODING

=1 STOP CALLER\_ID DECODING AND RESET DECODER DATA

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
RESP	CD	ERR	DR	EOF	0000			FSK DATA BYTE								

CD:

=0 Carrier not detected

=1 Carrier detected

ERR:

=0 Check sum is correct/Raw data buffer not full

=1 Check sum error/Raw data buffer overflow

DR:

=0 FSK data byte of current frame is not ready

=1 FSK data byte of current frame is ready no response word bit 0-7

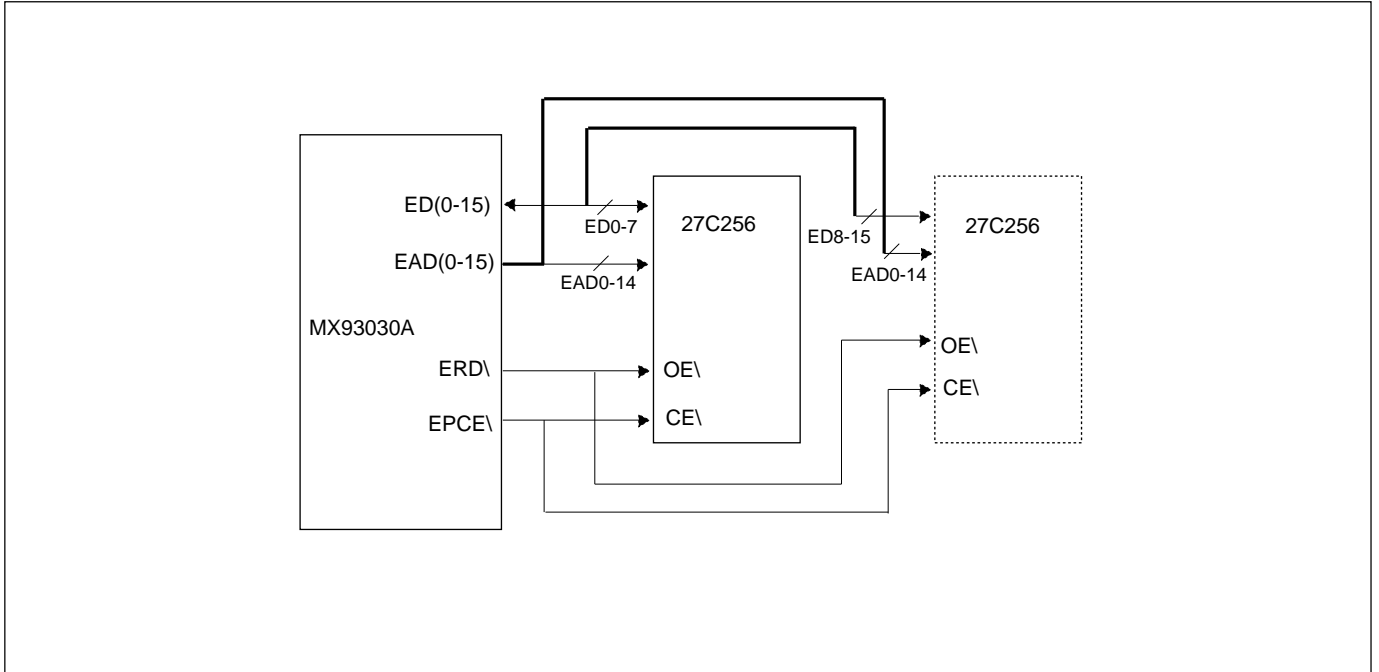
EOF:

=0 Not the end of frame

=1 End of frame

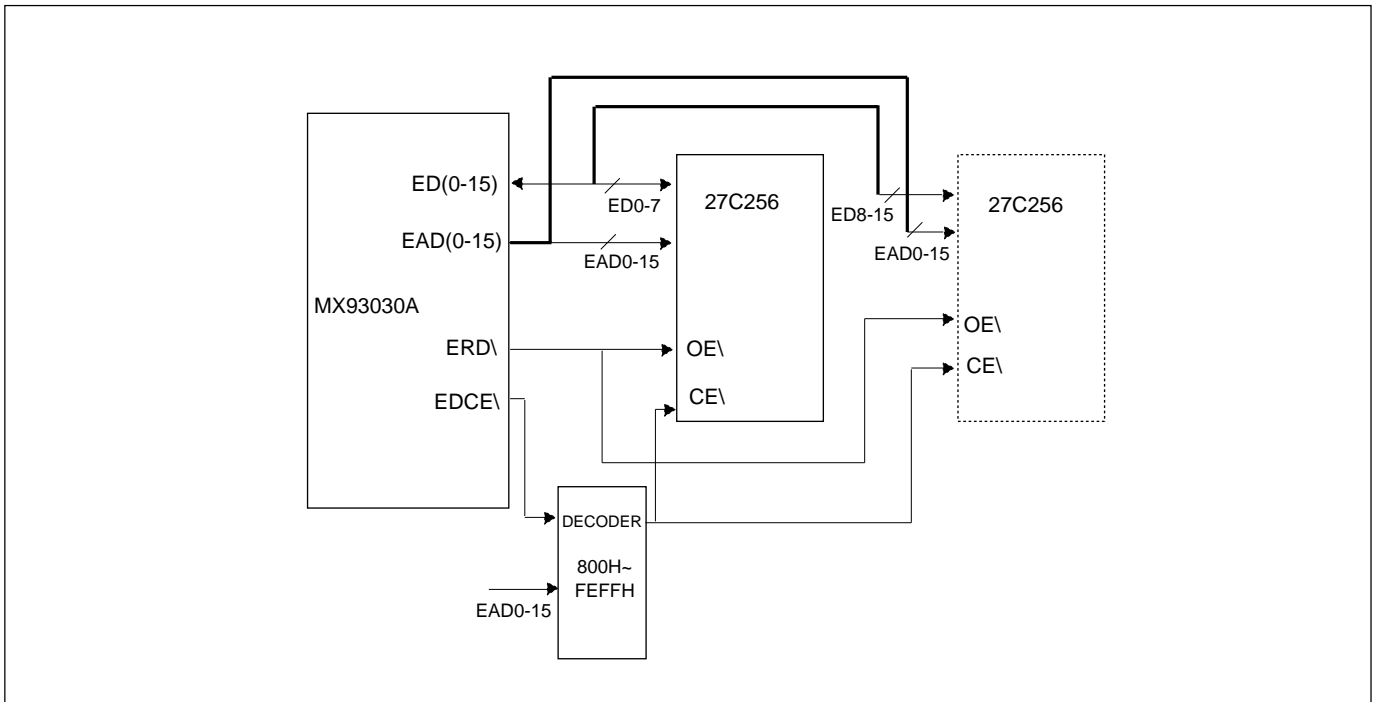
**VOICE PROMPT EPROM/ROM INTERFACE --- LOCATION 8000H**

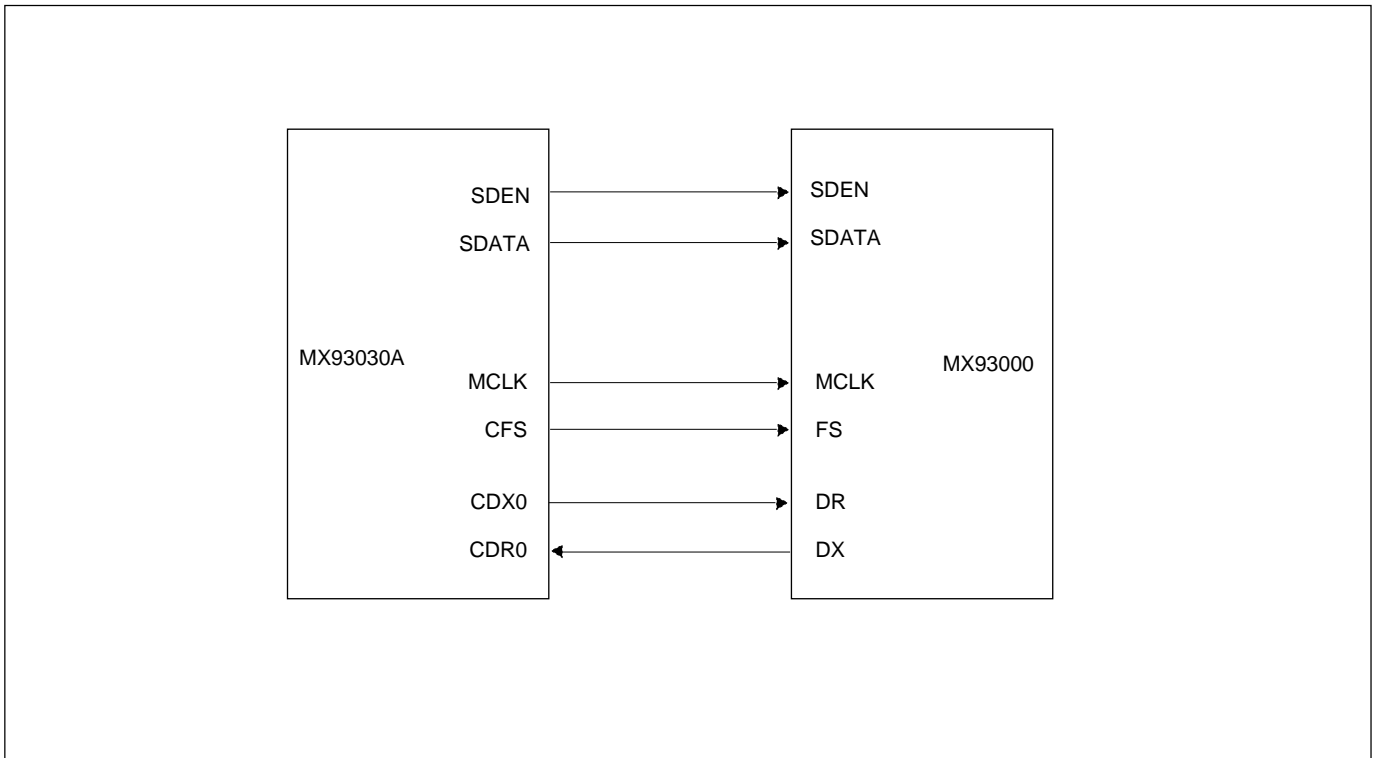
The interface allows to read data from 8000h to FFFFh using 8bits or 16bits program memory bus

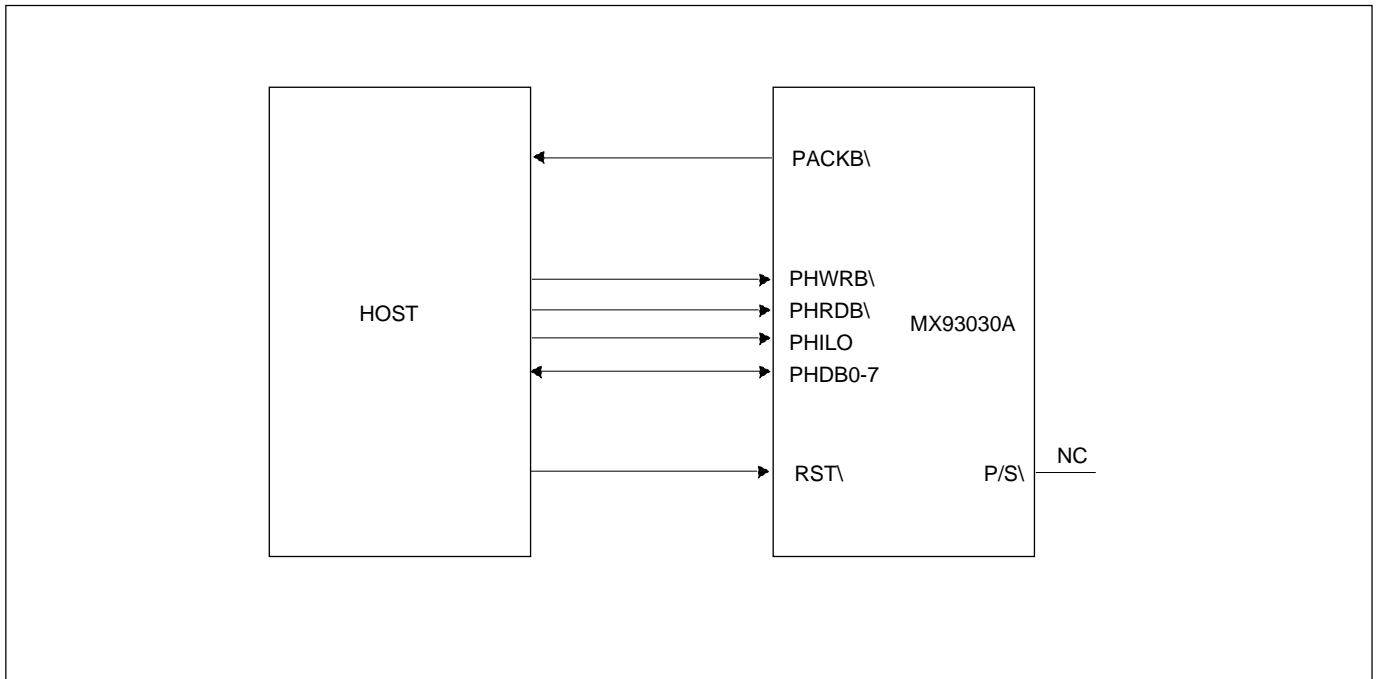
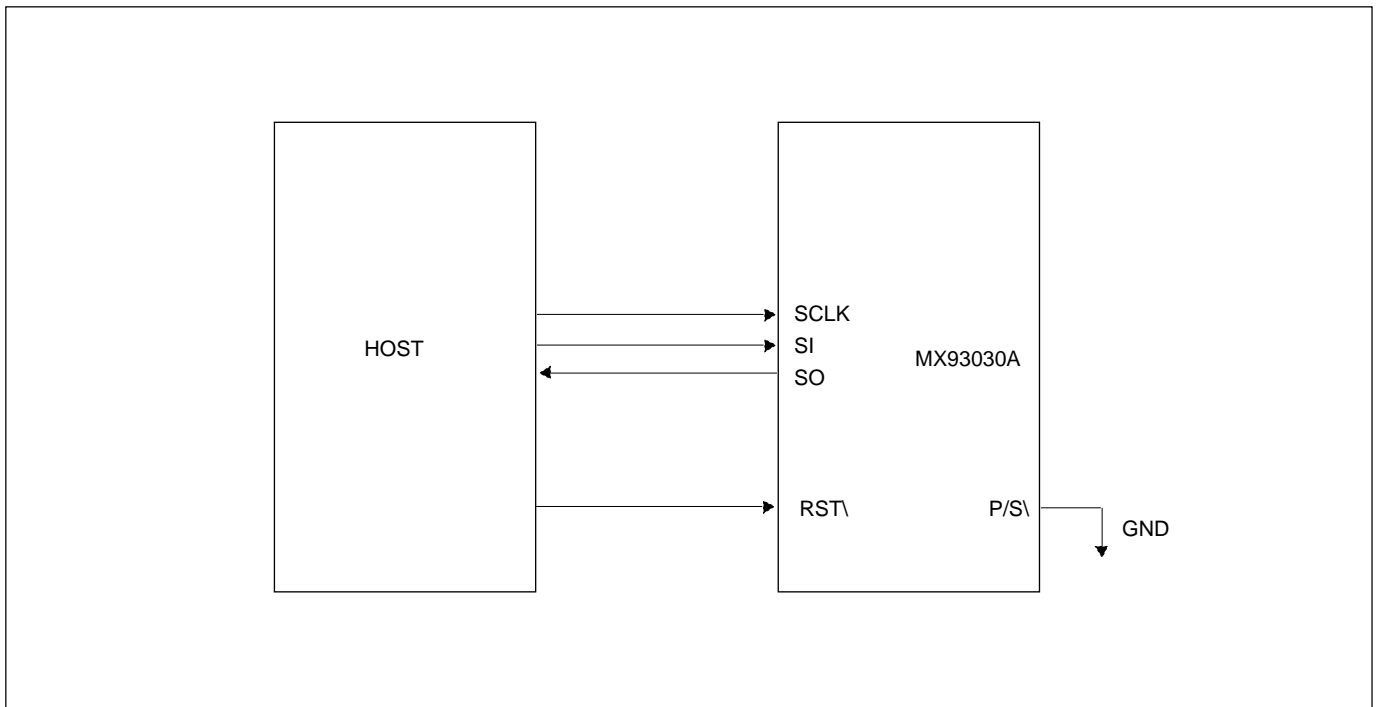


**VOICE PROMPT EPROM/ROM INTERFACE --- LOCATION 800H-FEFFFH**

The interface allows to read data from 800h to FEFFFh using 8bits or 16bits program memory bus



**CODEC INTERFACE**

**HOST PARALLEL INTERFACE****HOST SERIAL INTERFACE**



**TABLE 1 : PERFORMANCE TEST FOR TONE DETECTION**

(noiseless) Power(dB)	0	-3	-6	-10	-20	-30	-33	-36	-39
p2p(volt)	5	3.54	2.5	1.58	.5	.158	.112	.079	.056
280Hz	x	x	x	x	x	x	x	x	x
300Hz	ok	ok	ok	ok	ok	ok	ok	x	x
400Hz	ok	ok	ok	ok	ok	ok	ok	ok	x
500Hz	ok	ok	ok	ok	ok	ok	ok	ok	x
600Hz	ok	ok	ok	ok	ok	ok	ok	ok	x
640Hz	ok	ok	ok	ok	ok	ok	ok	x	x
670Hz	x	x	x	x	x	x	x	x	x
480+620 Hz	ok	ok	ok	ok	ok	ok	x	x	x
350+440 Hz	ok	ok	ok	ok	ok	ok	x	x	x

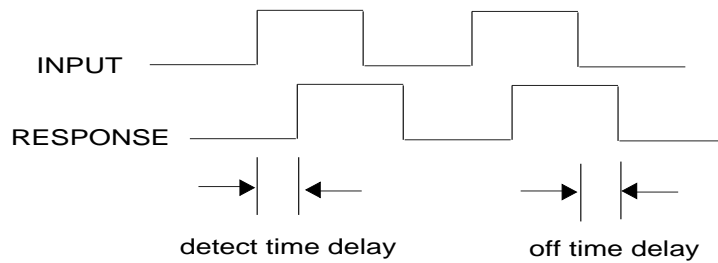
\* 0 dB is defined as the Vrms of maximum codec input

\*\* The maximum peak-to-peak voltage (P2P) of Codec input is assumed to be 5V

SNR(dB)	40	25	12
	detect time delay / off time delay (ms)		
300Hz	50 / 40	55 / 40	65 / 40
400Hz	40 / 40	40 / 40	45 / 45
500Hz	40 / 40	40 / 40	45 / 45
640Hz	45 / 40	45 / 40	60 / 35
480+620	40 / 40	45 / 40	50 / 40
350+440	45 / 40	45 / 40	55 / 40

\* 0 dB is defined as the  $V_{rms}$  of maximum codec input

\*\* the detect/off time delay is defined as follows



**TABLE 2 : RESOLUTION TEST FOR DUAL TONE (FREQUENCY DETECTABLE RANGE)**

RANGE / POWER	-4 dB	-25 dB
(300 + F2 Hz)	F2 > 320 Hz	F2 > 320 Hz
(640 + F2 Hz)	F2 < 620 Hz	F2 < 620 Hz

**TABLE 3 : THD DISTORTION TEST FOR DUAL TONE (DISTORTION TOLERANCE)**

INPUT / POWER	-4 dB	-25 dB
(300 + 320 Hz)	> 10 dB	> 10 dB
(640 + 620 Hz)	> 10 dB	> 10 dB

\* 0 dB is defined as the Vrms of maximum codec input

**TABLE 4 : CALL PROGRESS TONE DETECTOR CHARACTERISTICS**

PARAMETER	MIN	TYP	MAX	UNIT
Detection level *	-30			dB
Rejection level			-37	dB
Frequency range	300		640	Hz
Noise tolerance			-12	dB
THD tolerance			-10	dB
Rejection Frequency range	< 280 Hz	or	>670Hz	
Minimum signal duration accept	50 ms			
Maximum response time	50 ms			

\* 0 dB is defined as the Vrms of maximum codec input

**TABLE 5 : DTMF CHARACTERISTICS**

PARAMETER	MIN	TYP	MAX	UNIT
DTMF Signal level for detection*	-43		0	dB
DTMF Twist (High/Low Tone)		+/-9		dB
DTMF Noise Tolerance		-10		dB
DTMF Tone duration accept	50			ms
DTMF interdigit pause accept	50			ms
DTMF Frequency deviation accept limit		+/-1.5		%
DTMF Frequency deviation reject limit		+/-3		%
Tone Generator level	- 25		+ 3	dB
Tone Generator frequency accuracy		± 0.1		%
Tone Generator level accuracy		± 0.5		dB

\* 0 dB is defined as the vrms of maximum codec input

**TABLE 6. VOX THRESHOLD \***

dB	VOX_LEVEL
-9	0ef5
-10	0d55
-11	0be5
-12	0a95
-13	0975
-14	0875
-15	0ef4
-16	0d54
-17	0be4
-18	0a94
-19	0974
-20	0874
-21	0ef3
-22	0d53
-23	0be3
-24	0a93
-25	0973
-26	0873
-27	0783
-28	06b3
-29	05f3
-30	0553
-31	04c3
-32	0433
-33	03c3
-34	0363
-35	0303
-36	02b3
-37	0263
-38	0223
-39	01e3
-40	01b3
-41	04c2
-42	0442
-43	03c2
-44	0362
-45	0302
-46	02b2
-47	0262
-48	0222
-49	01e2
-50	01b2
-51	0301
-52	02b1
-53	0261
-54	0221
-55	01e1
-56	01b1
-57	0300
-58	02b0
-59	0260
-60	0220
-61	01e0
-62	01b0

**TABLE 7. SILENCE THRESHOLD LEVEL**

SILENCE LEVEL	dB
1	-87
2	-81
3	-75
4	-69
5	-63
6	-57
7	-51
8	-45
9	-39
10	-33
11	-27
12	-21
13	-15
14	-9
15	-3

0 dB: maximum input of sinusoidal wave

\* 0 dB is defined as the vrms of maximum Codec input.

**TABLE 8. ECHO CANCELLER PERFORMANCE \***

<b>Test Description</b>	
Final Echo Return Loss Improvement (ERLI) (Singletalk mode)	> 28 dB
Maximum tail length	12 ms
CONVERGENCE RATE (SINGLETALK MODE) 500ms after initialization with cleared register and with near-end signal set to zero at initialization time	> 28 dB
Infinite Return Loss Convergence Return Echo Loss Improvement 500ms after echo path is interrupted	> 28 dB

\* test signals : band-limited white-noise(300-3400Hz)

**TABLE 9. BELL 202 FSK DEMODULATOR PERFORMANCE**

<b>PARAMETER</b>	<b>MIN</b>	<b>TYP</b>	<b>MAX</b>	<b>UNIT</b>
FSK detector Sensitivity		-45		dBm
Carrier Detect Acquisition Time		20		ms
End of Data to Carrier Detect Low	10			ms
Bit Error rate @Level -10dBm SNR 15dB flat channel		10 <sup>-5</sup>		1/sample

**TABLE 10: MAXIMUM COMMAND RESPONSE TIME --- ARAM 1Mx4**

<b>COMMAND</b>	<b>MAX. RESP TIME(ms)</b>
RECORD MODE	12
STOP(with tail cut)	52
PLAY MODE	14
MESSAGE NUMBER	18
AVAILABLE TIME	52
TONE GENERATOR MODE	1
LINE MONITOR MODE	5
DELETE ONE MESSAGE MODE	30
DELETE ALL OLD MESSAGE	760
SET TIME/OPT/VOICE/SILENCE MODE	1
GET TIME/OPT/IPT MODE	1
INITIALIZE ARAM (FAST/NORMAL)	7600/37000
ARAM GOOD/BAD CHECK	3
GET RECORD MESSAGE MODE	12
VOICE PROMPT MODE	4
SET VOICE ACTIVITY MODE	1
SET PERSONAL MODE	1
TEL. NUMBER MODE	10
CALLER ID MODE	1

**TABLE 11 : INTERNAL VOCABULARY**

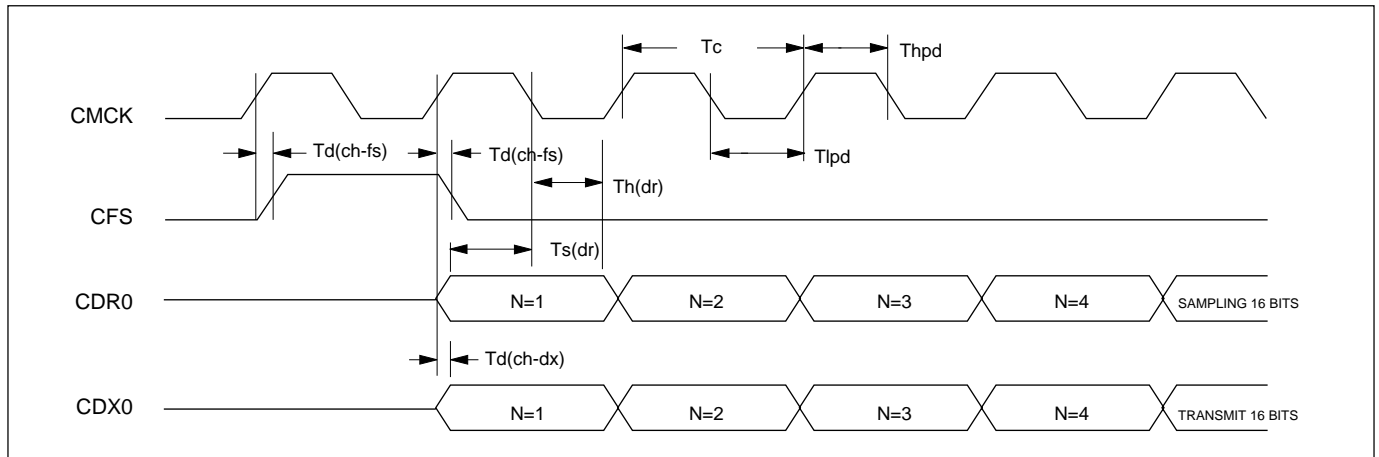
<b>INDEX</b>	<b>WORD</b>	<b>INDEX</b>	<b>WORD</b>
01H	ONE	21H	PLEASE
02H	TWO	22H	LEAVE A
03H	THREE	23H	ANSWER MACHINE
04H	FOUR	24H	ON
05H	FIVE	25H	OFF
06H	SIX	26H	CALL IN FROM
07H	SEVEN	27H	DELETE
08H	EIGHT	28H	JANUARY
09H	NINE	29H	FEBRUARY
0AH	TEN	2AH	MARCH
0BH	ELEVEN	2BH	APRIL
0CH	TWELVE	2CH	MAY
0DH	THIR	2DH	JUNE
0EH	FOUR	2EH	JULY
0FH	FIF	2FH	AUGUST
10H	TEEN	30H	SEPTEMBER
11H	TWEN	31H	OCTOBER
12H	TEE	32H	NOVEMBER
13H	TH	33H	DECEMBER
14H	A.M.	34H	FIRST
15H	P.M.	35H	SECOND
16H	YOU HAVE	36H	THIRD
17H	NO	37H	ALERT
18H	MESSAGE	38H	TY
19H	MESSAGES	39H	MONDAY
1AH	OH	3AH	TUSEDAY
1BH	HUNDRED	3BH	WEDNESDAY
1CH	NEW	3CH	THURSDAY
1DH	END OF	3DH	FRIDAY
1EH	MEMORY	3EH	SATURDAY
1FH	IS	3FH	SUNDAY
20H	FULL		



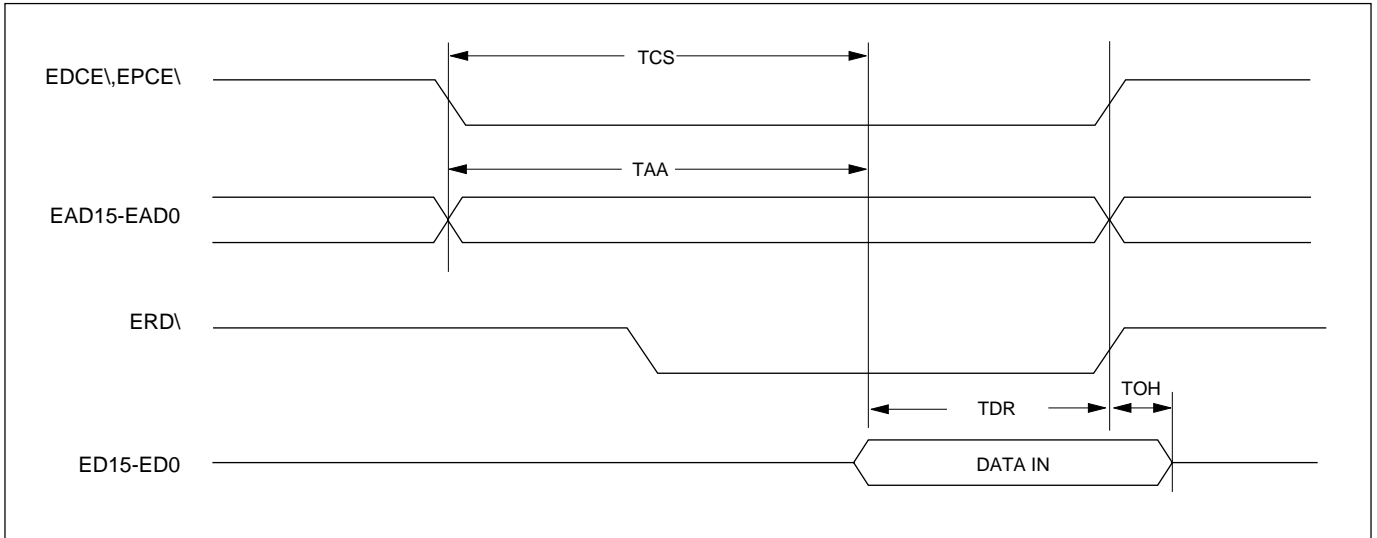
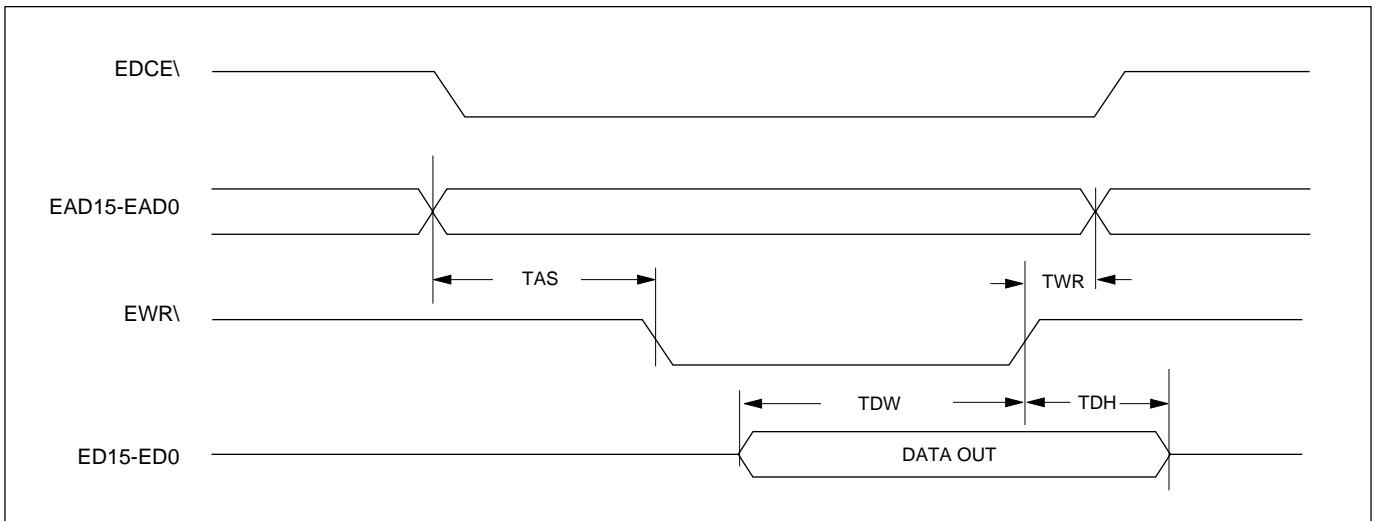
**DC CHARACTERISTICS:** TA = 0 to 70°C, VCC = 5V ± 10%

Storage temperature range : -55°C - 150°C

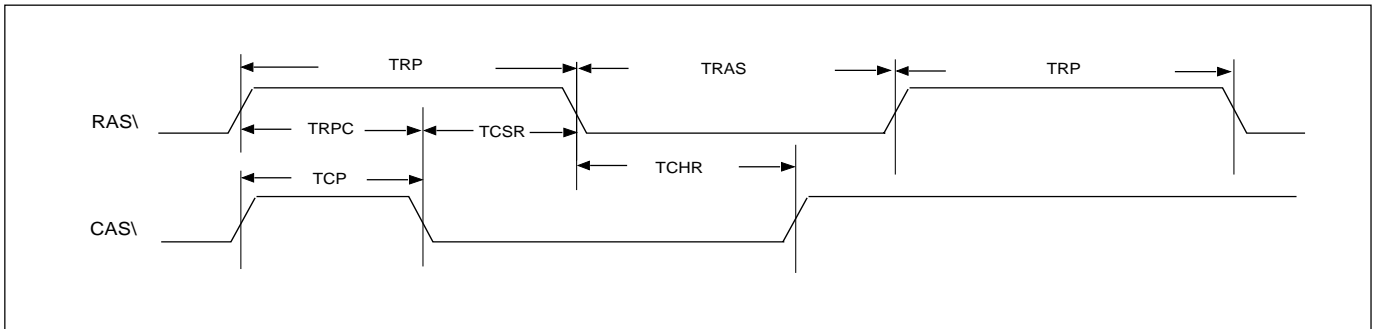
SYMBOL	PARAMETER	CONDITION	MIN	TYPE	MAX	UNIT
VCC	Supply voltage		4.5	5	5.5	V
GND	Ground			0		V
TTL LEVEL INPUT(IT)						
VIH	Input high voltage		2.0			V
VIL	Input low voltage				0.8	V
SCHMITT TRIGGER INPUT(IS)						
VIH	Input high voltage		0.7*VCC			V
VIL	Input low voltage				0.3*VCC	V
8mA OUTPUT(OA)						
VOH	Output high voltage	IOH=-8mA	2.4			V
VOL	Output low voltage	IOL= 8mA			0.4	V
16mA OUTPUT(OB)						
VOH	Output high voltage	IOH=-16mA	2.4			V
VOL	Output low voltage	IOL=16mA			0.4	V
SUPPLY CURRENT						
ICC	NORMAL			45	70	mA
ICC	POWER DOWN			3	6	mA

**CODEC TRANSMIT AND RECEIVE TIMING**


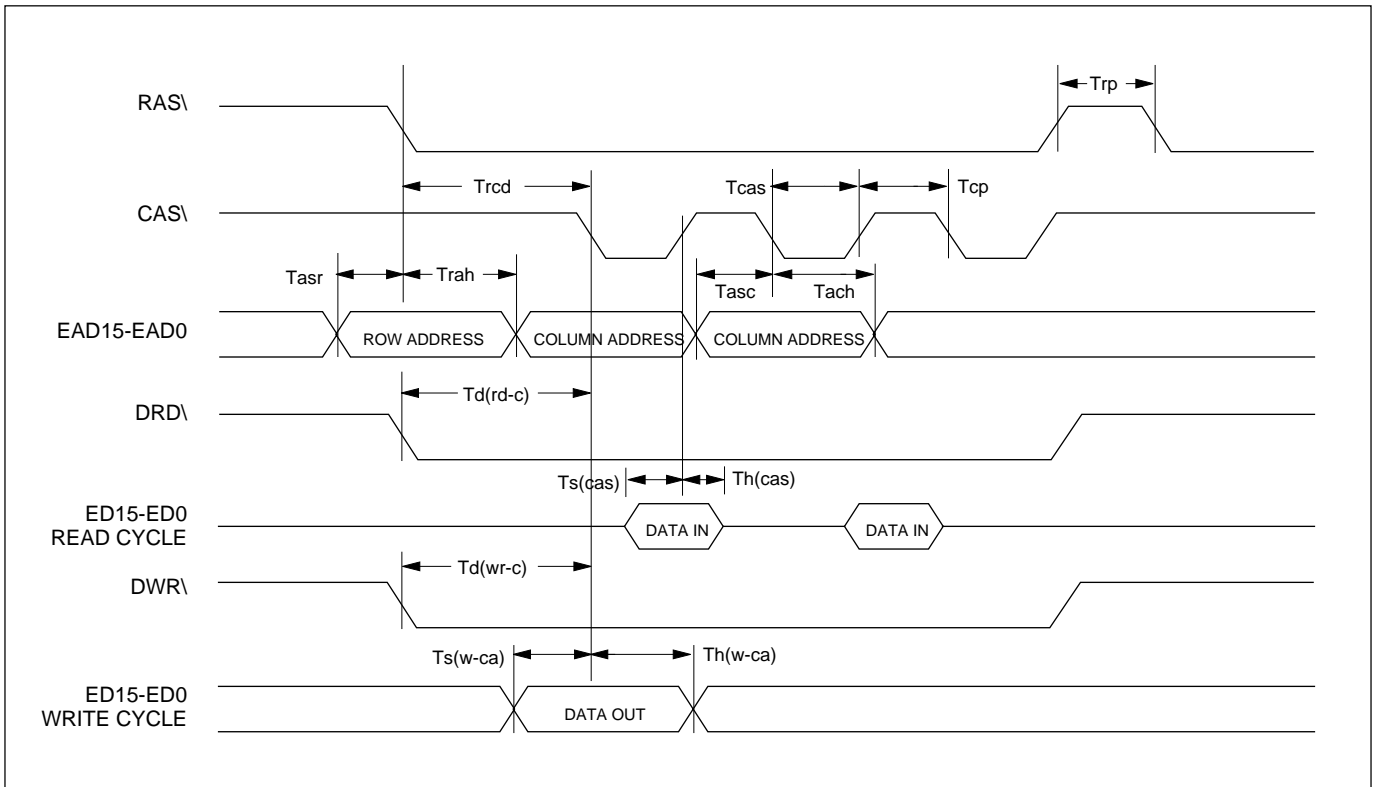
SYMBOL	PARAMETER	MIN	NOM	MAX	UNIT
Tc	CMCK cycle time		650		ns
Tlpad	CMCK low pulse duration	315		335	ns
Thpad	CMCK high pulse duration	315		335	ns
Td (ch-fs)	CMCK to CFS delay time			20	ns
Td (ch-dx)	CMCK rising edge to CDX0 valid			10	ns
Ts (dr)	CDR0 set-up time before CMCK falling edge	10			ns
Th (dr)	CDR0 hold time after CMCK falling edge	10			ns

**FLASH/ROM READ TIMING**

**FLASH WRITE TIMING**


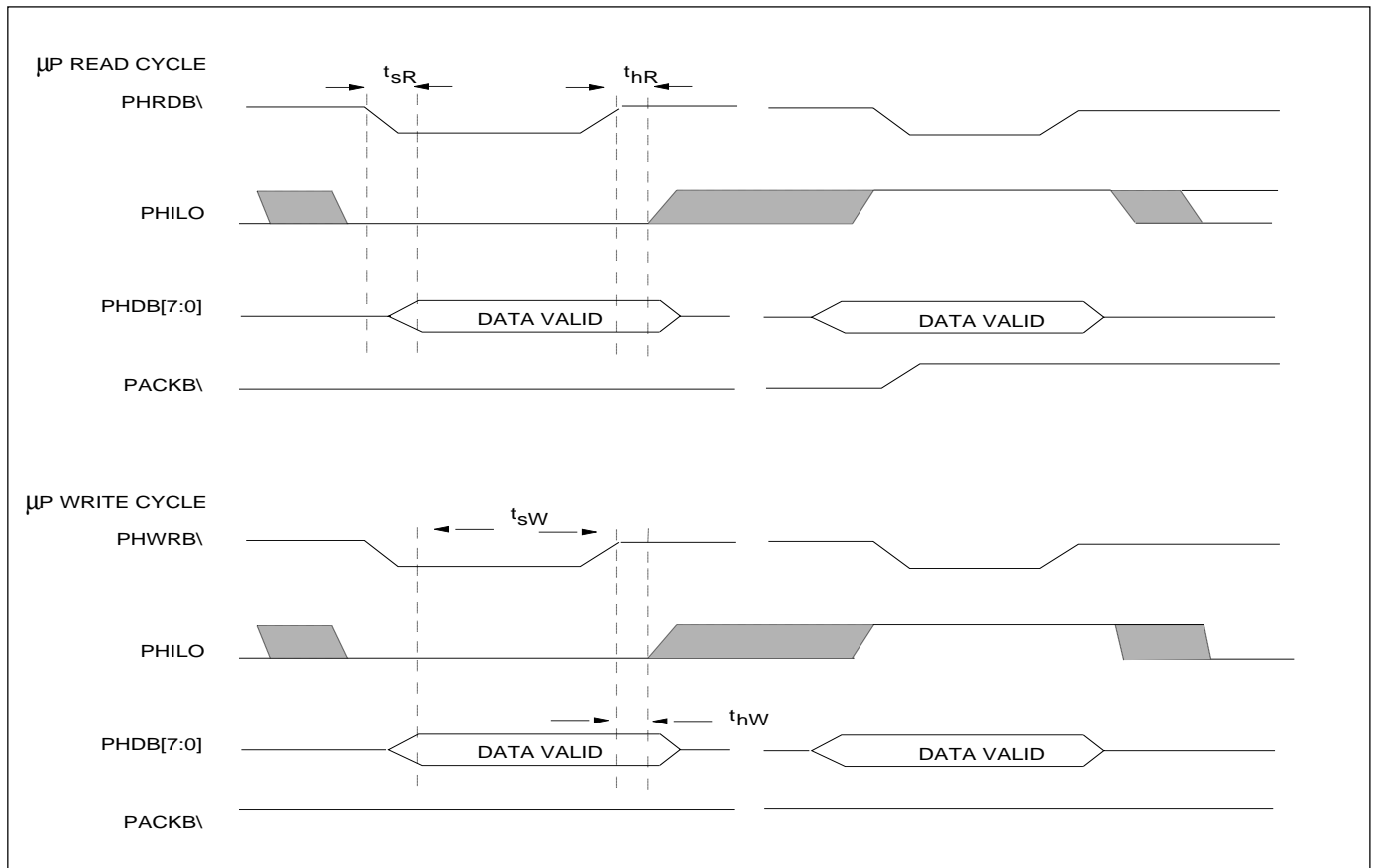
SYMBOL	PARAMETER	MIN	NOM	MAX	UNIT
TCS	Chip select access time			245	ns
TAA	Address access time			245	ns
TDR	Data read setup time	12			ns
TOH	Data hold from end of read	0			ns
TAS	Address setup time	0		5	ns
TDW	Data to EWR\ low overlap			12	ns
TDH	Data hold from end of write	0			ns
TWR	Write recovery time	0			ns

**CAS\ BEFORE RAS\ REFRESH TIMING**


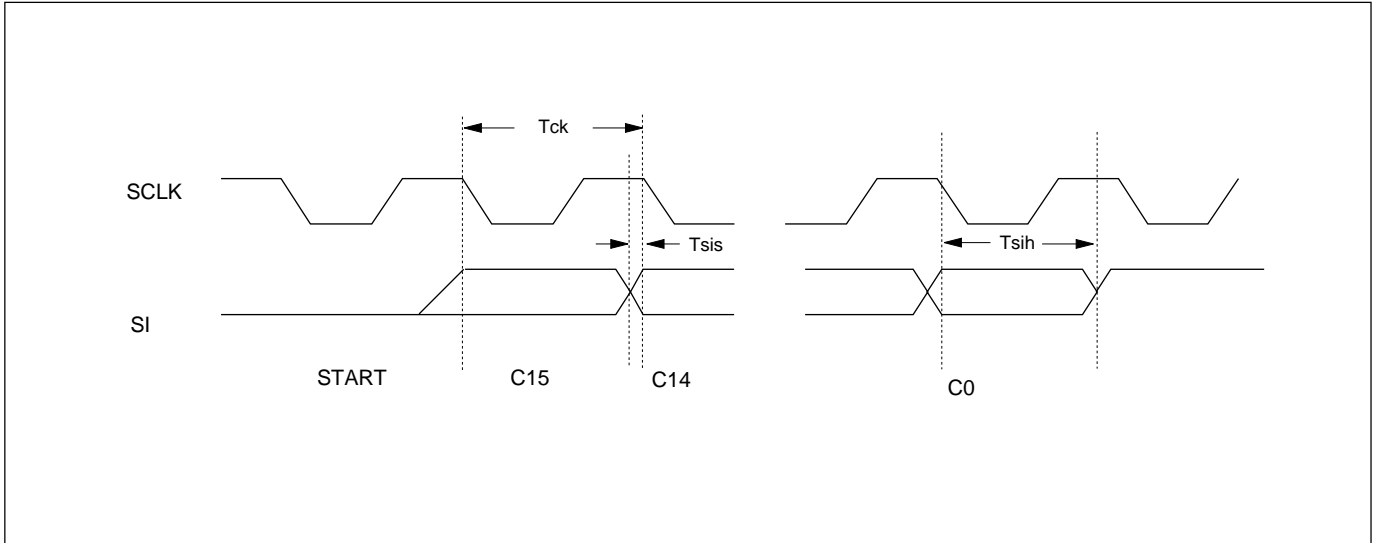
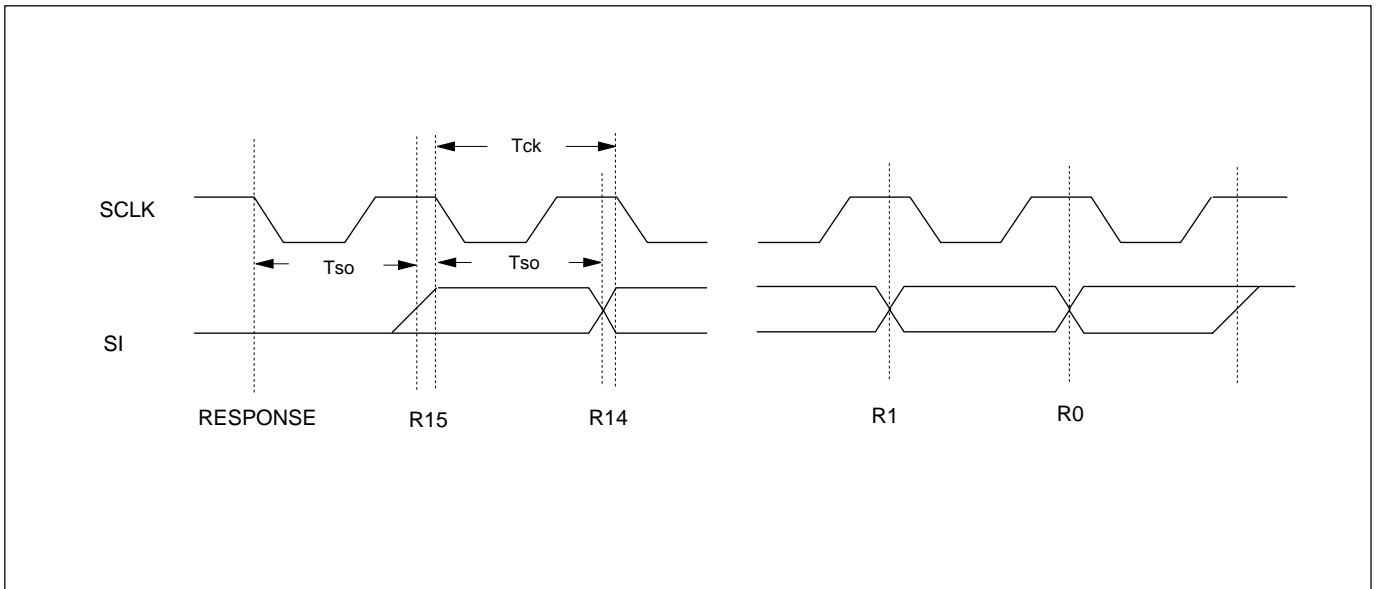
<b>SYMBO</b>	<b>PARAMETER</b>	<b>MIN</b>	<b>NOM</b>	<b>MAX</b>	<b>UNIT</b>
TRP	RAS\ precharge time	77.5			ns
TRPC	RAS\ to CAS\ precharge time	62			ns
TCP	CAS\ precharge time		31		ns
TCSR	CAS\ set-up time (CBR cycle)		15.5		ns
TCHR	CAS\ hold time (CBR cycle)	62			ns
TRAS	RAS\ pulse width	108.5			ns

**DRAM READ/WRITE TIMING**


SYMBO	PARAMETER	MIN	NOM	MAX	UNIT
Trp	RAS\ precharge time	77.5			ns
Trcd	RAS\ to CAS\ delay time		62		ns
Tcas	CAS\ low pulse duration		140		ns
Tcp	CAS\ precharge time		31		ns
Tasr	Row address set-up time	0			ns
Trah	Row address hold time	31			ns
Tasc	Column address setup time	0			ns
Tach	Column address hold time	31			ns
Td(rd-c)	DRD\ low to CAS\ low	0			ns
Td(wr-c)	DWR\ low to CAS\ low	0			ns
Ts(cas)	Data set-up time before CAS\ high	20			ns
Th(cas)	Data hold time after CAS\ high	0			ns
	Ts(w-ca)	Data set-up time before CAS\ low		0	
		ns			
Th(w-ca)	Data hold time after CAS\ low	46.5			ns

**μP PARALLEL INTERFACE TIMING**

**μP PARALLEL INTERFACE TIMING**

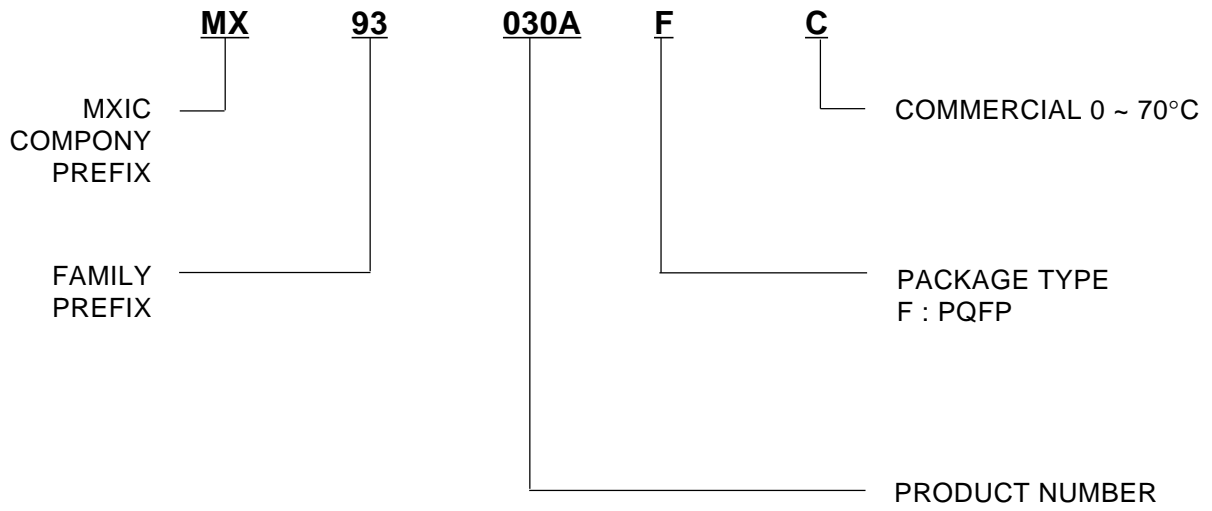
SYMBO	PARAMETER	MIN	NOM	MAX	UNIT
$t_{sR}$	Host read access time		50		ns
$t_{hR}$	Read data hold time	5			ns
$t_{sW}$	Write data set up time	20			ns
$t_{hW}$	Write data hold time	10			ns

**uP SERIAL INTERFACE TIMING**
**uP WRITE CYCLE**

**uP READ CYCLE**

**uP SERIAL INTERFACE TIMING**

SYMBO	PARAMETER	MIN	NOM	MAX	UNIT
Tck	SCLK cycle time	62			us
Tsis	SI data set up time	2			us
Tsih	SI data hold time	60			us
Tso	SO data access time	60			us

ORDERING INFORMATION

PART NO.	PACKAGE
MX93030AFC	PQFP

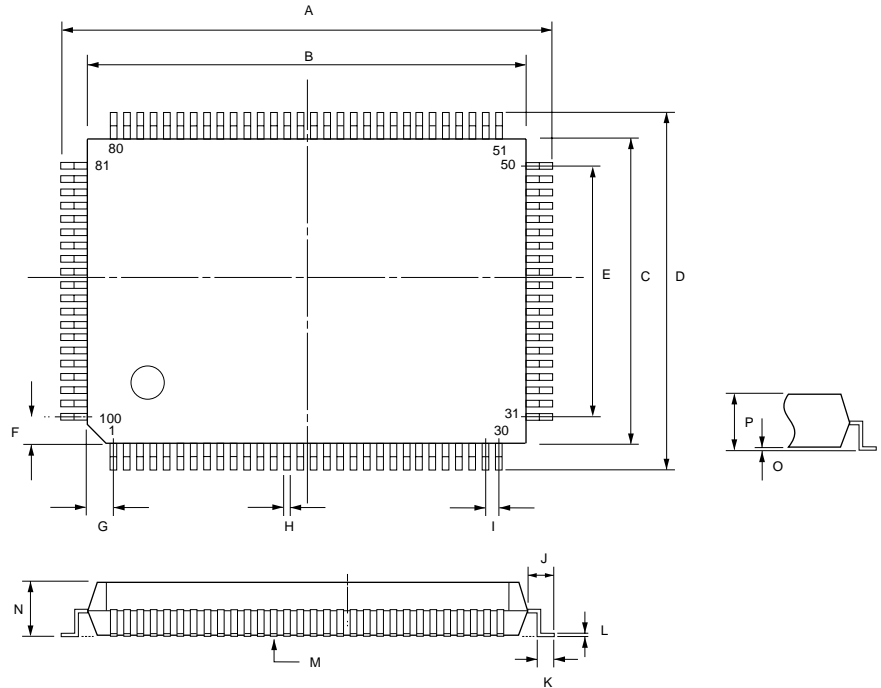




**PACKAGE INFORMATION**  
**100-PIN PQFP**

ITEM	MILLIMETERS	INCHES
A	24.80 ± .40	.976 ± .016
B	20.00 ± .13	.787 ± .005
C	14.00 ± .13	.551 ± .005
D	18.80 ± .40	.740 ± .016
E	12.35 [REF]	.486 [REF]
F	.83 [REF]	.033 [REF]
G	.58 [REF]	.023 [REF]
H	.30 [Typ.]	.012 [Typ.]
I	.65 [Typ.]	.026 [Typ.]
J	2.40 [Typ.]	.094 [Typ.]
K	1.20 [Typ.]	.047 [Typ.]
L	.15 [Typ.]	.006 [Typ.]
M	.10 max.	.004 max.
N	2.75 ± .15	.108 ± .006
O	.10 min.	.004 min.
P	3.30 max.	.130 max.

**NOTE:** Each lead centerline is located within .25mm(.01 inch) of its true position [TP] at a maximum material condition.



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