MSM6309

ADPCM SPEECH PROCESSOR FOR SOLID STATE RECORDER SRAM INTERFACE

GENERAL DESCRIPTION

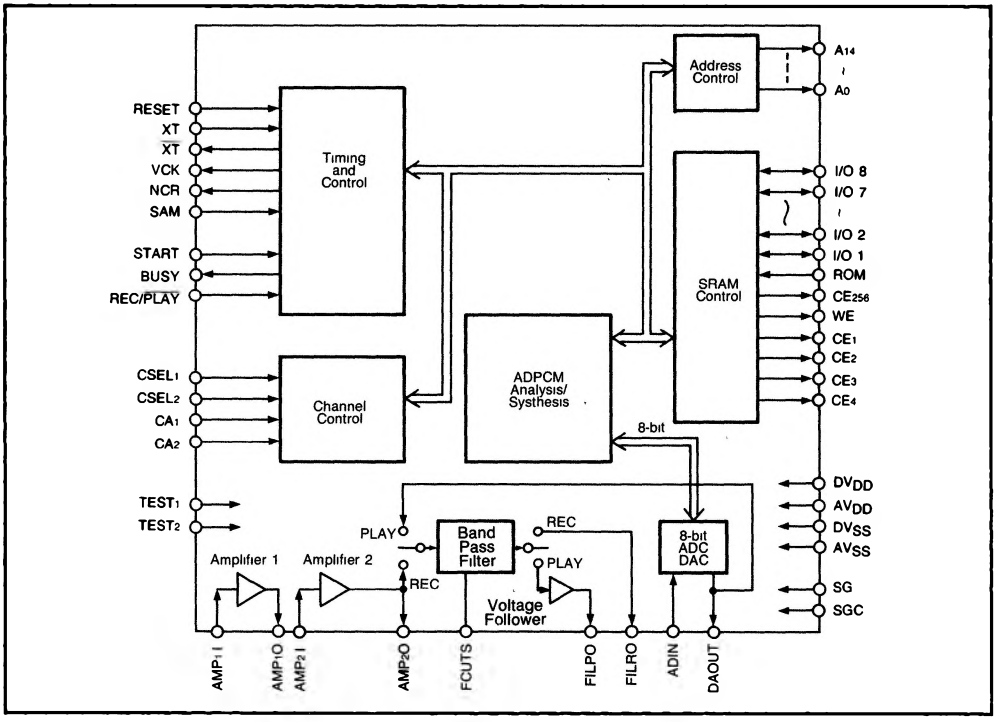
The Oki MSM6309 is a ADPCM speech processor LSI for solid state recording which is manufactured using Oki's low power CMOS silicon gate technology. 64K or 256K static RAM is used to store the ADPCM data.

The MSM6309 has internal LPF and amplifier for microphone. So, by connecting the microphone, speaker, speaker driving amplifier and SRAM, recording and playback of voice can be easily implemented in the same manner as a tape recorder.

FEATURES

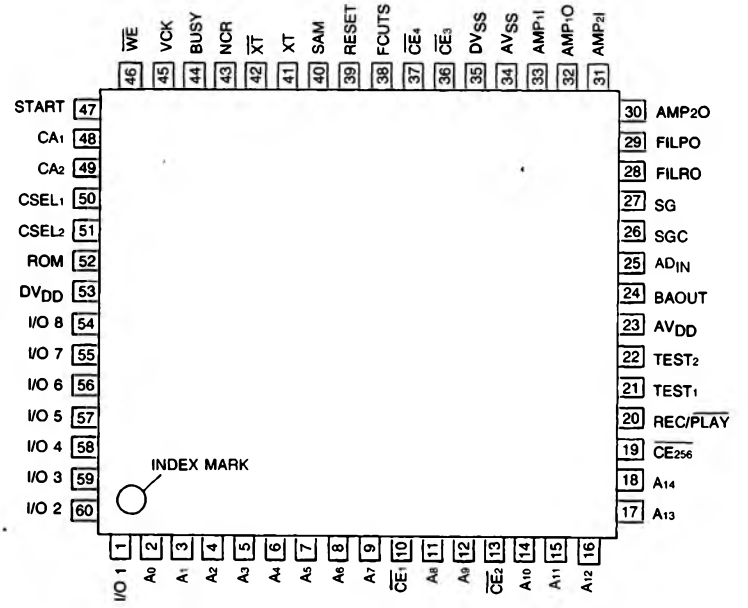
- 4-bit ADPCM algorithm
- Built-in 8-bit AD converter
- Built-in 8-bit DA converter
- Amplifier for microphone on chip
- LPF (Low Pass Filter) on chip
- Direct drive capability for SRAM: 64K 4 pcs
  or 256K
  1 pce
- Oscillation frequency: 4 MHz ~ 6 MHz
- Sampling frequency: 4 kHz, 8 kHz
  (@ 4 MHz)
- Recording phrase: 1, 2, 4 selectable
- Vocalization time: 16 sec maximum
  (@ 4 kHz)
- Supply voltage: +5 V
- 60 pin plastic flat package and

BLOCK DIAGRAM



PIN CONFIGURATION

60 pin Flat Package



ABSOLUTE MAXIMUM RATINGS

(V_{SS1} = V_{SS2} = 0V)

Parameter	Symbol	Condition	Value	Unit
Power Supply Voltage	V_{DD}	Ta = 25°C	−0.3 to 7.0	V
Input Voltage	V_{IN}	Ta = 25°C	−0.3 to V_{DD} + 0.3	V
Storage Temperature	T_{stg}	—	−55 to + 150	°C

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition	Value	Unit
Power Supply Voltage	V_{DD}	V_{SS1} = V_{SS2} = 0V	+3.5 to +6.0	V
Operating Temperature	T_{op}	—	−40 to +85	°C
Oscillation Frequency	f_{osc}	—	4.0 to 6.0	MHz

DC CHARACTERISTICS

V_{DD} = 4.5 to 5.5 V_{SS1} = V_{SS2} = 0V Ta = −40 ~ 85°C

Parameter	Symbol	Condition	Min	Typ	Max	Unit
"H" Input Voltage *1	V_{IH}	—	3.6	—	—	V
"H" Input Voltage *2	V_{IH}	—	0.8 × V_{DD}	—	—	V
"L" Input Voltage	V_{IL}	—	—	—	0.8	V
"H" Output Voltage	V_{OH}	I_{OH} = −40μA	4.2	—	—	V
"L" Output Voltage	V_{OL}	I_{OL} = 2mA	—	—	0.45	V
"H" Input Current	I_{IH1}	V_{IH} = V_{DD}	20	—	400	μA
"L" Input Current	I_{IL}	V_{IL} = V_{SS}	−10	—	—	μA

Note: *1 Apply to input terminals except XT
*2 Apply to XT terminal

PIN DESCRIPTION

Pin Symbol	Pin No.	I/O	Function
DV_{DD}	53	I	Degital power supply terminal
AV_{DD}	23	I	Analog power supply terminal
DV_{SS}	35	I	Degital ground terminal
AV_{SS}	34	I	Analog ground terminal
SG	27	I	Signal ground terminal Connect condenser for stabilization
SGC	26	I	Connect condenser for stabilization of SG
$AMP_{1}I$	33	I	Input terminal for amplifier 1
$AMP_{1}O$	32	O	Output terminal for amplifier 1
$AMP_{2}I$	31	I	Input terminal for amplifier 2
$AMP_{2}O$	30	O	Output terminal for amplifier 2 This terminal is connected to built-in LPF.
AD_{IN}	25	I	Voice input terminal
DA_{OUT}	24	O	Output of DA converter This terminal is connected to built-in LPF.
FILPO	29	O	Output of LPF Synthesized sound is output from this terminal.
FILRO	28	O	Output of LPF Analized sound, original sound is output from this terminal
RESET	39	I	By inputting "H" level, the inside of the circuit returns to the early stage, viz. stand-by stage
REC/$\overline{PLAY}$	20	I	Selection terminal for recording or playback "H" = recording
START	47	I	By inputting "H" level, recording or playback is started
BUSY	44	O	This terminal outputs "H" level during recording or playback
$CSEL_{1}$	50	I	Terminal for selecting number of recording phrase
$CSEL_{2}$	51	I	Same as above
CA_{1}	48	I	Terminal for specifying channels when selecting 2 phrases or 4 phrases
CA_{2}	49	I	Terminal for specifying channels when selecting 4 phrases
SAM	40	I	Terminal for determining the sampling frequency

PIN DESCRIPTION (continued)

Pin Symbol	Pin No.	I/O	Function
I/O 1	1	I/O	Input/output terminal for 4-bit ADPCM data
I/O 2	60	I/O	
I/O 3	59	I/O	
I/O 4	58	I/O	
I/O 5	57	I/O	
I/O 6	56	I/O	
I/O 7	55	I/O	
I/O 8	54	I/O	
A_0	2	O	Address terminals of SRAM
A_1	3	O	
A_2	4	O	
A_3	5	O	
A_4	6	O	
A_5	7	O	
A_6	8	O	
A_7	9	O	
A_8	11	O	
A_9	12	O	
A_{10}	14	O	
A_{11}	15	O	
A_{12}	16	O	
A_{13}	17	O	
A_{14}	18	O	
$\overline{CE_1}$	10	O	Control terminals for external 64K SRAM
$\overline{CE_2}$	13	O	
$\overline{CE_3}$	36	O	
$\overline{CE_4}$	37	O	
$\overline{CE_{256}}$	19	O	Control terminals for external 256K SRAM
$\overline{WE}$	46	O	Write enable signal to the SRAM device
ROM	52	I	Make "H" level when EPROM is equipped externally
XT	41	I	Crystal oscillator connector terminal
$\overline{XT}$	42	O	Same as above
VCK	45	O	Outputs sampling frequency
NCR	43	O	This terminal is used when playbacks contents of different channels continuously
F_{CUTS}	38	I	Terminal for selecting the cut-off frequency of the built-in LPF
TEST 1	21	I	Terminal for inhouse testing
TEST 2	22	I	Same as above

FUNCTIONAL DESCRIPTION

The number of recording words of MSM6309 is selectable either 1 word, 2 words or 4 words. When selecting 1 word, the maximum memory capacitance will be 256K bit. When selecting 2 words, each 128K bit is allocated to each channel. When selecting 4 words, each 64K bit is allocated to each channel. So each recording length is limited according to the capacitance of each SRAM.

1. Selection of the Number of Recording Words and the Way to Specify Channel ($CSEL_1$, $CSEL_2$, CA_1, CA_2)

$CSEL_2$	$CSEL_1$	Number of Words	CA_2	CA_1	Channel	Capacitance of Channel
L	—	4	L L H H	L H L H	CH_1 CH_2 CH_3 CH_4	64K bit
H	L	2	— —	L H	CH_1 CH_2	128K bit
H	H	1	—	—	CH_1	256K bit

2. How to Select the Sampling Frequency (SAM)

Following is the relationship between oscillation frequency and sampling frequency.

SAM	L	H
f_{samp}	f_{osc}/1024 (4 kHz)*	f_{osc}/512 (8 kHz)*

* When oscillation frequency is 4.096 kHz.

3. How to Select the Cut-off Frequency of LPF

The cut-off frequency of LPF is controlled by F_{CUTS} terminal. Please refer to the following chart.

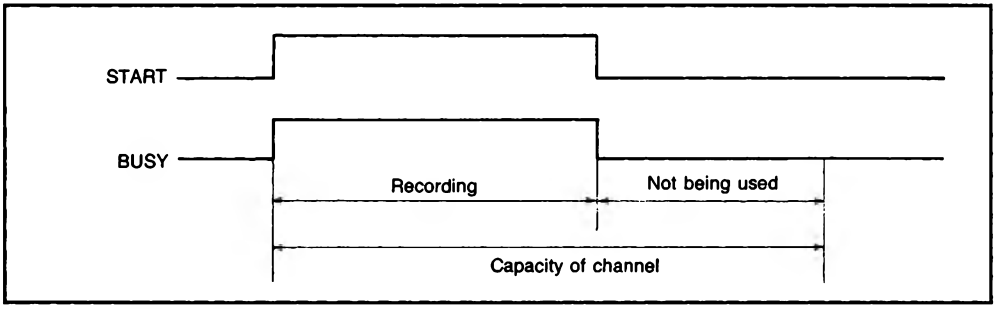
Voice Sampling		F_{CUTS}	
SAM	VCK (Hz)	"H"	"L"
L	4 K	2.3 K	1.95 K
H	8 K	3.8 K	2.9 K

When oscillation frequency is 4.096 kHz.

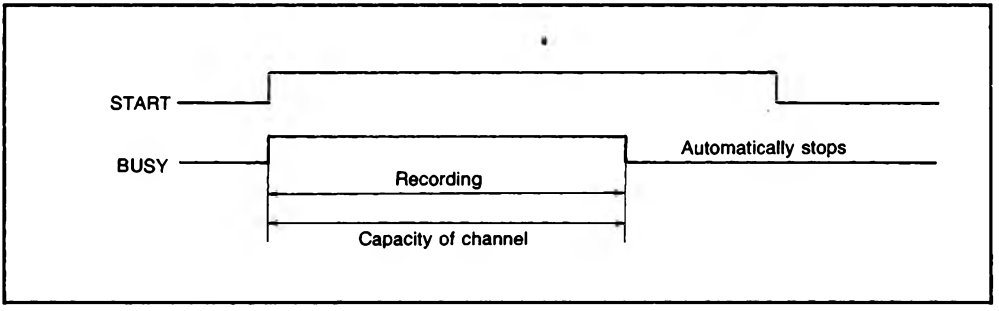
4. Function of REC/$\overline{\text{PLAY}}$ and Start Terminals

RECORDING

1. REC/$\overline{\text{PLAY}}$ = "H" When Recording Using Partial Memory Capacity of the Channel

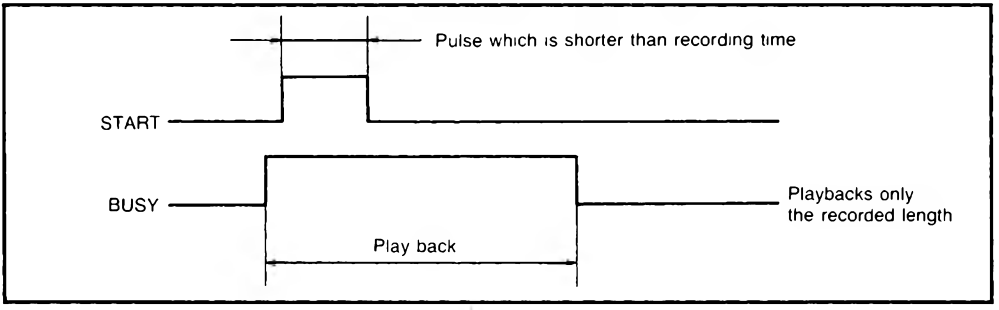


2. REC/$\overline{\text{PLAY}}$ = "H" When Recording Using Entire Memory Capacity of the Channel

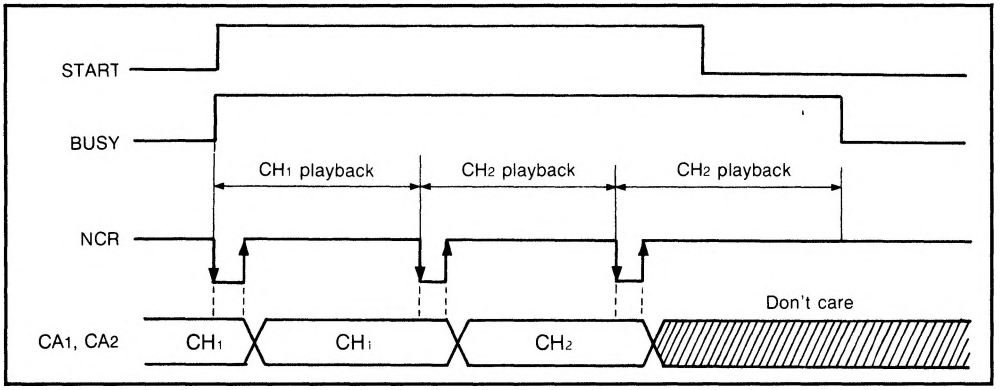


PLAYBACK

3. REC/$\overline{\text{PLAY}}$ = "L" to Playback the Recorded Contents Once



4. REC/$\overline{\text{PLAY}}$ = "L" to Playback the Recorded Content Repeatedly and Continuously



Continuous playback and repeated playback are made by maintaining start terminal at "H" level. Writing channel is done when NCR falls down, or the time when starts playbacking each word. So, changing channel is made by turning it with the time when NCR stands up.

5. Interval of Recording Time

As described up to now, by maintaning REC/$\overline{\text{PLAY}}$ terminal high, recording is made for the length of time the start terminal is high. Strictly speaking, recording time could be longer by the reason of the fact that the interval of recording time is for 4K bits.
The interval of recording time can be figured out by the following formula.

(The step of recording time) = 4K bit/(bit rate [K bit/sec])[sec]

EXAMPLE

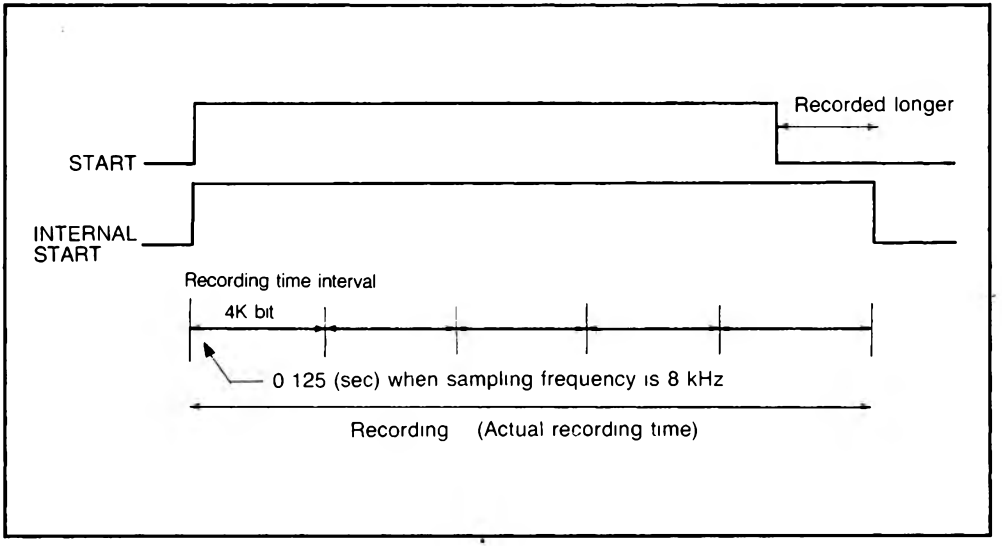
When sampling frequency is 8 kHz, bit rate is

4 bit × 8 kHz = 32K bit/sec.

The step of recording time is

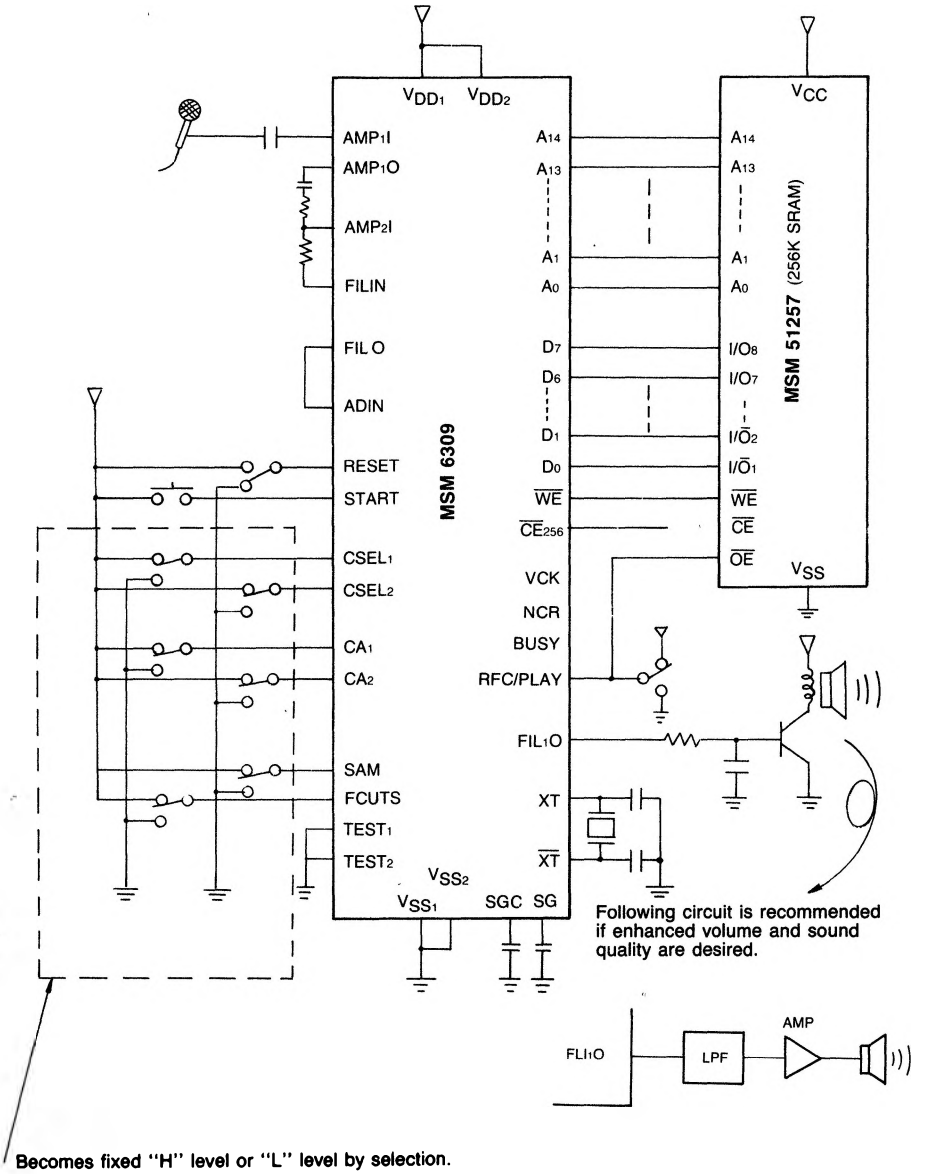
4 bit/32K bit/sec = 0.125 (sec)

So, the recording time becomes 0.125 msec longer at most.



APPLICATION CIRCUIT I

Interface with a single 256K SRAM



APPLICATION CIRCUIT II

Interface with 4 64K SRAMs