

W9975D

G.723.1 Audio Codec

Version 0.3
April, 2001

1. GENERAL DESCRIPTION

The W9975D is a DSP based speech processor that performs speech compression and decompression functions. The W9975D can provide speech compression for H.324 and H.323 Video Phone, Internet Telephony, and IP Telephony products over standard PSTN or IP network. The compression algorithm complies with ITU-G.723.1 speech compression standard specified under H.324 and H.323. When the W9975D compresses and decompresses the sampled voice data according to the ITU-G.723.1 algorithm, the compressed data rates are either 6.3 or 5.3Kbps. G.711 is also implemented in this chip to ensure the compatibility with most VOIP applications. In addition to the speech compression and decompression functions, the W9975D also provides functions like electric echo cancellation (EEC), call progress tone generation, DTMF tone detection, DTMF tone generation, and half-duplex speaker phone functions. The host interface of the W9975D is the parallel interface (ECP), all commands must be sent through the simple host interface (ECP) to control the W9975D. The system's host processor provides activation and control of all the related functions of the W9975D.

The sampling rate for ITU-G.723.1 is 8K and support 5.3K/6.3K bit data rate. With the implementation of ITU-G.723.1, W9975D can deliver high quality speech in its associated applications. The W9975D has built-in Synchronous Serial Port, makes it easy to interface with external voice PCM CODEC. All these features make the W9975D suitable for the H.324 and H.323 related applications.

The W9975D is a 3.3V device with TTL-level compatible 3.3V only I/O, and is packaged in a 128-pin LQFP.

2. FEATURES

DSP CORE

- 30 MIPS 24-bit instruction, 16-bit integer data DSP core
- Internal one Instruction and two data access at one cycle
- Built-in two bank instruction ROM. 13Kx24 and 4Kx24
- Built-in 8Kx16 ROM and 4Kx16 SRAM for 1st way data access
- Built-in 2Kx16 ROM and 1Kx16 SRAM for 2nd way data access
- Low power consumption

CODEC Interface

- Synchronous serial port connecting external CODEC device for voice input and output

Host Interface

- IEEE 1284 parallel port with byte mode support for Host interface.

Compression algorithm

- Provides ITU-G.723.1 MP-MLQ(5.3K/6.3K bps) voice codec
- Provides G.711 PCM codec
- 8K voice sampling rate
- Provide Silence-Detection and Comfort-Noise-Generation

Other Features

- Electrical Echo Cancellation
- DTMF Tone Generation and Detection
- Call progress tone generation
- Half duplex speaker phone mode supported

Operation Frequency is 30MHz

3.3V Device with TTL-compatible 3.3V I/O

128L LQFP Package

3. PIN CONFIGURATION

The W9975D is packaged in a 128-pin LQFP. The pin configuration is shown in Figure 3.1

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4. PIN DESCRIPTION

The following signal types are used in these description.

- I Input pin
- IU Input pin with internal pull-up resistor
- B BI-direction input/output pin
- O Output pin
- AIO Analog input/output pin
- P Power supply pin
- G Ground pin

4.1 Pin Definition

LCD Interface

Pin Name	Pin Number	Type	Description
COM0-COM3	59-62	O	NC
SEG0-SEG24	63-76, 78-79, 81-89	O	NC
VLCD3	91	P	NC
VLCD2	92	I	NC
VLCD1	93	I	NC
DH2,DH1	94,95	I	NC
SIN / WCLK	56	I/O	NC
SOUT / WDATA	57	O	NC

GPIO Interface

Pin Name	Pin Number	Type	Description
PIO0	97	B	NC

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PIO1	98	B	NC
PIO2	99	B	NC
PIO3	100	B	NC
PIO4	101	B	NC
PIO5	103	B	NC
PIO6	104	B	NC
PIO7	106	B	NC
PIO[8:11]	107-110	B	NC

CODEC Interface

Pin Name	Pin Number	Type	Description
MCLK	49	O	NC
DR	50	I	Serial data received from CODEC
RFS	51	B	Receiver frame sync of CODEC serial port
SCLK	52	B	Serial clock of CODEC serial port
TFS	53	B	Transmitter frame sync of CODEC serial port
DT	54	O	Serial data transmitted to CODEC

Memory Interface

Pin Name	Pin Number	Type	Description
CD2# /Atmel#	118	IU	NC
CD1# /AMD#	118	B	NC
BUSY#	120	IU	NC
WAIT#	121	IU	NC

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VS#	123	I	NC
CF_RST /WP#	124	B	NC
REG# /ALE	125	O	NC
CE2# /CLE	126	O	NC
CE1#	127	O	NC
CE0#	128	B	NC
OE#	1	B	NC
WE#	2	B	NC
MA0-MA3	3,4,5,6	B	NC
MA4 /UP_DATA	8	B	NC
MA5 /UP_CLK	9	B	NC
MA6 /UP_REQ	11		NC
NFAUT	12	B	ECP port control signal
PE	13	B	ECP port control signal
SEL	14	B	ECP port control signal
BUSY	15	B	ECP port control signal
NACK	16	B	ECP port control signal
NSELI	17	B	ECP port control signal
NINIT	18	B	ECP port control signal
NAUFD	19	B	ECP port control signal
NSTB	20	B	ECP port control signal
PD0-7	21,22,23,25, 26,28,29,30	B	ECP port data signals
MD0-MD7	31,32,33,34, 25,26,28,30	B	NC, but MD0-MD4 must be pulled high externally

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	35,36,38,39		
MD8-15	41-49	B	NC

Miscellaneous

Pin Name	Pin Number	Type	Description
CLK32K, XTAL32	111,112	I O	Crystal pair for 32,768Hz
PWRF#	113	IU	NC
RESET#	114	I	Chip reset signal
CLKIN, XTAL	115,116	I O	Crystal pair for DSP operation

Power and Ground

Pin Name	Pin Number	Type	Description
VDD	10,27,40,55, 80,90,105, 122	P	Power supply +3.3V \pm 0.3V
VSS	7,24,37,58,77,9 6,102,119	G	Ground

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5. SYSTEM DIAGRAM

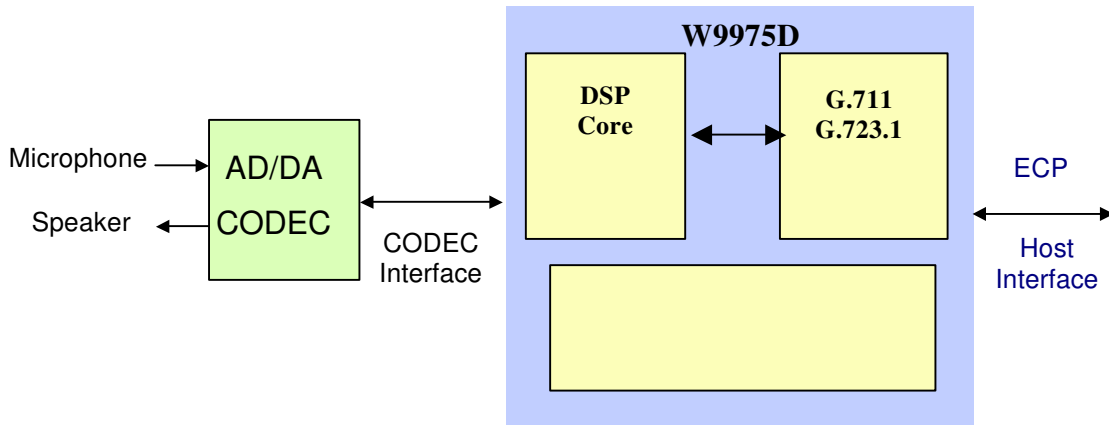


Figure 5.1 W9975D- Audio Codec System Diagram

6. SYSTEM Operation

Introduction

The W9975D is a powerful speech CODEC. It supports G.723.1, G.711 protocols. The W9975D also supports Electrical echo cancellation, DTMF tone generation, DTMF tone detection, and half duplex speaker phone functions.

DSP simplified description

The default operations modes of the W9975D are listed as follows:

- The default speech compression/decompression algorithm is ITU-G.723.1, both encode and decode are enabled.
- DTMF tone detection function is disabled.
- Electric Echo Cancellation (EEC) is enabled.
- EEC training in running mode is disabled.
- The default value of Play Back Volume is set to -4. (Divided by 16).
- The default value of Record Volume is set to 3 (Multiplied by 8).

IDLE state and RUN state

A state machine controls the program flow of the W9975D. There are two states in the state— one is the IDLE state, and the other one is the RUN state. The W9975D will enter the IDLE state after it is initialized. Commands can be issued to the W9975D in both states. All the commands can be issued to the W9975D in the IDLE state, but some commands cannot be issued in the RUN state. The reason is that the W9975D can only accept two-word commands in the RUN state.

DSP commands

The DSP engine in the W9975D executes all the commands; commands are listed in the following table.

Command	Value	Description	States that can accept the command
IDLE_CMD	0x0080	Enter the IDLE state (W9975D can accept all commands in the IDLE state)	IDLE, RUN
RUN_CMD	0x0081	Enter the RUN state.	IDLE, RUN
ENABLEEECTRAIN_CMD	0x0082	Enable EEC training.	IDLE, RUN
DISABLEEECTRAIN_CMD	0x0083	Disable EEC training.	IDLE, RUN
CODEC_CMD	0x0084	CODEC setting. Word 0: Command Word 1: Control register. Word 2: SCLKDIV Word 3: RFSDIV	IDLE
ENABLEENC_CMD	0x0085	Enable G.723 encoder.	IDLE, RUN
DISABLEENC_CMD	0x0086	Disable G.723 encoder.	IDLE, RUN
EECHANGOVER_CMD	0x0087	Word0: Command Word1: Hangover value – how many samples you want to delay after you detect double talk. Word0: Command. Word1: Bit 0: Bit rate – 0: 6.3 k bit/s 1: 5.3 k bit/s	IDLE, RUN
RECORD_CMD	0x0088	Bit 1: VAD -- 1: Enable -- 0: Disable Bit 2: High pass filter – 1: Enable -- 0: Disable Bit 3: Post filter – 1: Enable -- 0: Disable	IDLE, RUN
ENABLEDEC_CMD	0x0089	Enable G.723 decoder.	IDLE, RUN
DISABLEDEC_CMD	0x008A	Disable G.723 decoder.	IDLE, RUN
EECPower_CMD	0x008B	Word 0: Command Word 1: Power value – A value multiply by input (MIC) value, then compare with output (SPK) value, decide now is double talk or not.	IDLE, RUN
SETPROTOCOL_CMD	0x008C	Word 0: Command Word 1: protocol. – 0: RAW data 1: G.723 bit stream 2: G.711 U law bit stream 4: G.711 A law bit stream	IDLE, RUN
ENABLEHALF_CMD	0x008D	Enable half duplex	IDLE, RUN
DISABLEHALF_CMD	0x008E	Disable half duplex	IDLE, RUN
EECSUM_CMD	0x008F	Word 0: Command Word 1: EEC sum value – one of some values to detect that double talk finished or not.	IDLE, RUN

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RECORDVOLUME_CMD	0x0090	Set record volume shift value. Word 0: command. Word 1: value.	IDLE, RUN
PLAYBACKVOLUME_CMD	0x0091	Set play volume shift value. Word 0: command. Word 1: value.	IDLE, RUN
VOICETHRESHOLD_CMD	0x0092	Set voice threshold. A value is set to detect signal is noise or voice. Word 0: Command Word 1: value	
LBENABLE_CMD	0x0093	Enable loop back.	IDLE, RUN
LBDISABLE_CMD	0x0094	Disable loop back.	IDLE, RUN
EECENABLE_CMD	0x0095	Enable EEC.	IDLE, RUN
EECDISABLE_CMD	0x0096	Disable EEC.	IDLE, RUN
TONEGAIN_CMD	0x0097	Set tone generation gain shift value. Word 0: command. Word 1: gain shift value. Tone generation command. Word 0: command. Word 1: tone: 1: dial tone 2: dtmf tone 3: busy tone 4: ring tone.	IDLE, RUN
TOGEN_CMD	0x0098	Word 2: tone period. Word 3: tone silence period Word 4: number of tones you want to make. Max is 18. Word 5~13: if make DTMF tones, each byte imply a DTMF tone.	IDLE
CMD_99	0x0099		
DTMFENABLE_CMD	0x009A	Enable DTMF detection.	IDLE, RUN
DTMFDISABLE_CMD	0x009B	Disable DTMF detection.	IDLE, RUN
CMD_9C	0x009C		
EECTAP_CMD	0x009D		
DTMFSHIFT_CMD	0x009E	Set DTMF shift value. Word 0: command. Word 1: Shift value.	IDLE, RUN
DTMFPOWER_CMD	0x009F		

Driver functions description

Drivers are provided with the W9975D to simplify the use of the W9975D. User can use these drivers to speed up the program development cycle.

audIDLE: W9975D DSP enter IDLE state.
Parameter: None

audRUN: W9975D DSP enter RUN state. The W9975D must enter this state to perform encode/decode

functions.

Parameter: None

audEnableEECTrain: Enable dynamic EEC training.

Parameter: None

audDisableEECTrain: Disable dynamic EEC training.

Parameter: None

audSetCodec : to set CODEC parameters.

Parameter: Codec[3]

- [0]: Set control register of serial port 0
- [1]: SCLKDIV
- [2]: RFSDIV

audSetRecord : Set G723' s parameters.

Parameter: RecordValue

- Bit 0: bit rate – 0 6.3k, 1 5.3 k bit/s
- Bit 1: VAD – 0 disable, 1 enable
- Bit 2: High pass filter – 0 disable, 1 enable
- Bit 3: Post filter – 0 disable, 1 enable.

audEnableDTMF: Enable DTMF tone detection.

Parameter: None

audDisableDTMF: Disable DTMF tone detection

Parameter: None

audSetRecordVolume : Set record volume.

Parameter: iRecVol

- iRecVol is a shift value, that is you should give integer, like as -1, 0, 1 – if you give 1, it means multiply by 2, if you give -1, it means divide by 2 and so on.

audSetPlaybackVolume : Set play back volume.

Parameter: iPlayVol

- iPlayVol is a shift value, that is you should give integer, like as -1, 0, 1 – if you give 1, it means multiply by 2, if you give -1, it means divide by 2 and so on.

audEnableLoopback: Enable loop back testing

Parameter: None

audDisableLoopback: Disable loop back testing

Parameter: None

audEnableEEC: Enable EEC.

Parameter: None

audDisableEEC: Disable EEC

Parameter: None

audSetToneGain: Set tone volume for tone generation.

Parameter: iToneGain

- iToneGain: is a shift value, that is you should give integer, like as -1, 0, 1 – if you give 1, it

means multiply by 2, if you give -1, it means divide by 2 and so on.

audToneGen: Tone generation.

Parameter: atone[N]

- [0]: types of tone
- [1]: Tone period
- [2]: Silence period
- [3]: Tones – how many tones you want.
-- if user define tone
- [4]: Low frequency
- [5]: High frequency
- [6]: Low frequency level
- [7]: High frequency level
-- if DTMF tones
- [4]: two DTMF tones, high byte and low byte imply two different tones.
- [5]: Like as [4].
- ...
- [12]: Like as [4].

audDtmfScale: Set DTMF scale value. There may be

Parameter: iDtmfScale

- iDtmfScale: is a shift value, that is you should give integer, like as -1, 0, 1 – if you give 1, it means multiply by 2, if you give -1, it means divide by 2 and so on.

audEECHangover: Set EEC hangover value to decide how many samples you want to delay after you detect double talk.

Parameter: hangover.

- Hangover: how many samples you want to delay after you detect double talk.

audEECPower: Set EEC power value in order to multiply by input (MIC) value , then compare with output (SPK) value, decide now is double talk or not.

Parameter: Power

- Power: A value multiply by input (MIC) value , then compare with output (SPK) value, decide now is double talk or not.

audEECSum: Set EEC sum value, one of some values to detect that double talk finished or not.

Parameter: Sum

- Sum: One of some values to detect that double talk finished or not.

audSetProtocol: Decide what protocol you want.

Parameter: Protocol

- Protocol: 0 – RAW data, 1 – G723 bit stream, 2 – G711 u law bit stream, 4 – G711 a law bit stream.

audEnableHalf: Enable half duplex.

audDisableHalf: Disable half duplex.

AudSetVoiceThreshold: Set voice threshold.

Parameter: VoiceThreshold.

- VoiceThreshold: A value is set to detect voice or noise.

7. Package

The W9975D is packaged in a 128-L LQFP (14x20x1.4mm footprint 2.0mm) as shown below.

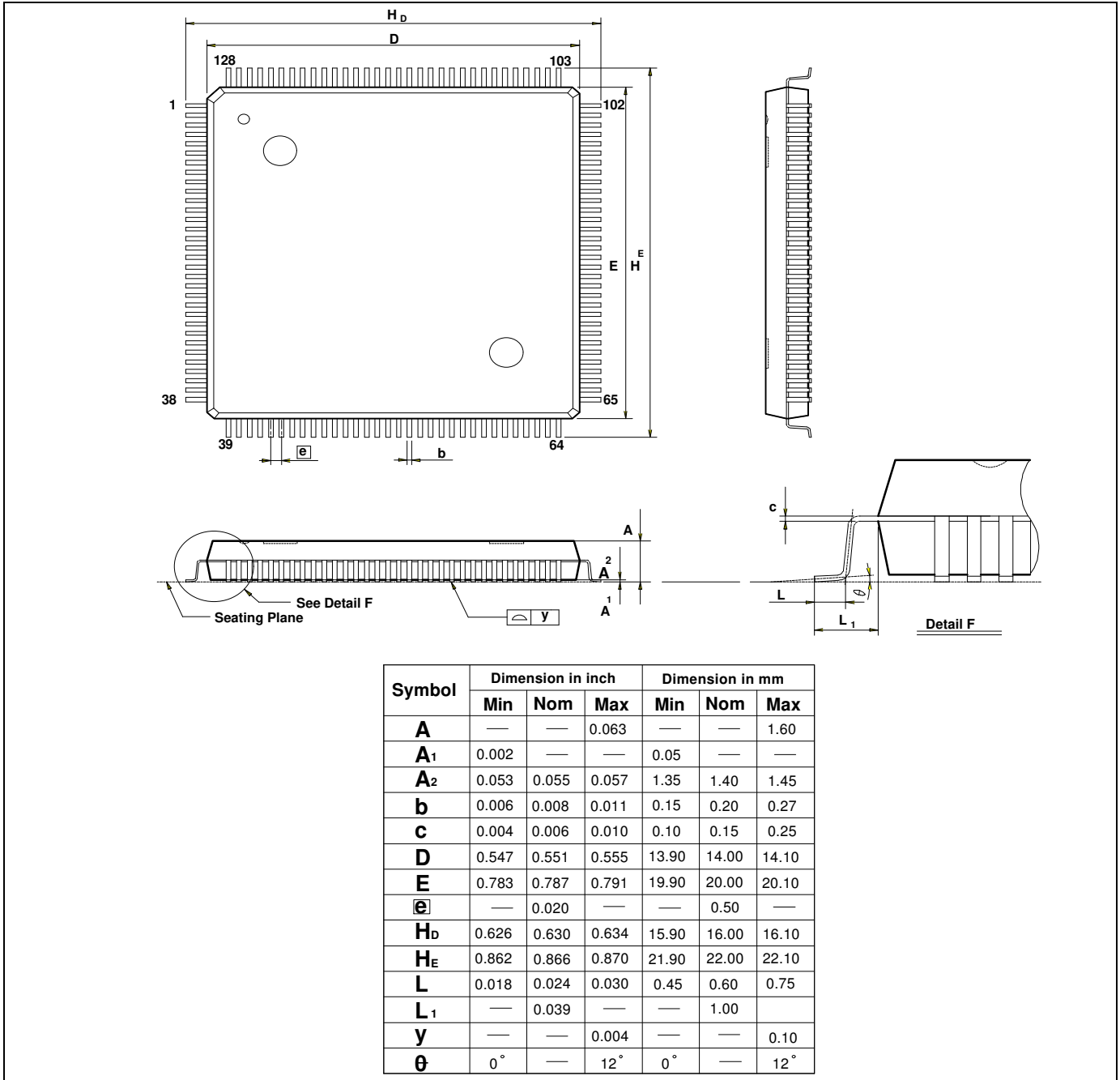


FIGURE OF 128L LQFP (14X20X1.4MM FOOTPRINT 2.0MM) DIMENSIONS

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