

[AX2210-UM-100]



AX2210

8-bit CMOS Microcontroller

User Manual

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AX2210 8-bit CMOS Microcontroller



High performance 8-bit MCU

- DC-48MHz operation
- Compatible with 8051
- All instructions are single-cycle except branching instructions
- Two data pointer for indirect addressing

Program Memory and Data Memory

- 48K Bytes ROM
- 24K Bytes RAM
- 32K Bytes OTP
- 256 Bytes DRAM share with RAM

Interrupt Feature

- 16 Vectored interrupts
- External wake up/interrupt on 4 GPIOs
- 2 Levels interrupt priority

Flexible I/O

- 29 GPIO pins
- All GPIO pins can be programmable as input or output individually
- All GPIO pins are internal pull-up /pull-down selectable individually
- CMOS/TTL level Schmitt triggered input

Digital Peripheral Feature

- Two multi-function 8-bit timers, support Capture and PWM mode
- Two multi-function 16-bit timers, support Capture and PWM mode
- Watchdog
- One full-duplex UART
- MPEG-1, MPEG-2, MPEG-2.5 Audio Layer 1,2,3 decoder. Bit rate 8-448Kbps, 8-48KHz, CBR/VBR/ABR
- MP3 Encode
- MP3 Recording. Bit rate <= 128Kbps
- IIS controller
- Two SPI, support DMA
- One EMI controller, use for external memory access

- SD Card Host controller
- CRC controller for CRC16 calculation
- One IR controller
- Full speed USB2.0 host/device controller
- One RTCC
- MIC AGC

Analog Peripheral Features

- One 32 KHz Crystal Oscillator
- One internal RC oscillator
- Full speed USB 2.0 PHY
- 48MHz PLL-based clock generator
- 16-bit Stereo DAC
- 16-bit δ - Σ ADC
- 8 Channels 10-bit ADC
- One class A/B Amplifier
- MIC Amplifier/Bias
- 2 channels AMUX
- 2 channels 4 levels Low Voltage Detector
- Power-on reset
- Two LDO: 5V to 1.8V, 5V to 3.3V

Power Supply

- VDDLDO is 3.2V to 5.5V
- VDDIO is 3.0V to 3.6V
- VDDCORE is 1.6V to 2.0V

Program and Debug Support

- In-System Programming (ISP) support
- In-System Debugging (ISD) support

Packages

- LQFP48
- SOP28
- DIE form

Temperature

- Operating temperature: -40°C to +85°C
- Storage temperature: -65°C to +150°C

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1 PRODUCT OVERVIEW

1.1 Description

AX2210 is an 8051 Compatible high performance mixed signal 8-bit microcontroller. It integrates advanced digital and analog peripherals to suit for a variety of applications. For digital peripherals, it supports a variety of digital interfaces including UART, EMI SPI and four timers, integrates an USB 2.0 full speed Host/Device controller and a MP3 Decoder/Encoder Engine, etc. For analog peripherals, it integrates RCOSC, DAC, ADC, PLL, LVD, XOSC and LDO. The microcontroller employs an advanced architecture and compatible with standard 8051 with throughput up to 48 MIPS. All instructions are single-cycled except program branching.

The MP3 Decoder Engine can decode MPEG-1, MPEG-2, MPEG-2.5 Audio Layer 1, 2, 3 decoder under 24 MHz.

AX2210 has 48K-byte (24K x 16) IROM, 32K-byte OTP (32K x 8), 16K-byte (8K x 16) IRAM, 8K-byte (4Kx16) RAM2 and 3936 x 24-bit Decode RAM (DECRAM) for MP3 decoder. IROM, IRAM and part of DECRAM can be used as program memory. Part of IROM, DECRAM and IRAM can be used as data memory.

The USB 2.0 Host/Device controller FIFO is shared with IRAM. It supports USB2.0 full speed.

Flexible I/O with different programmable capabilities like pull-up, pull-down or wake-up allows AX2210 to suit different I/O requirements in the market.

In order to support portable applications and reduce power consumption, three low-power saving modes are added: IDLE mode, HOLD mode and SLEEP mode.

1.2 System Architecture

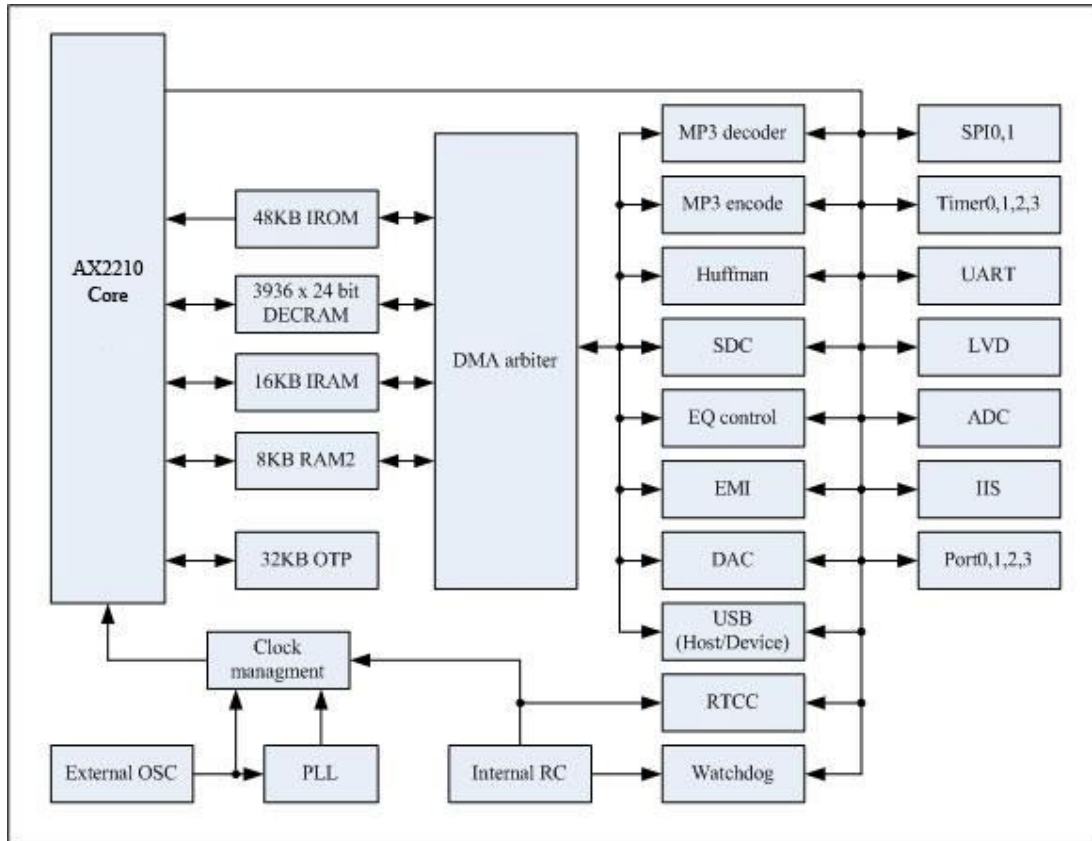


Figure 1-1 AX2210 architecture

2 PIN Definitions

2.1 Part Numbering

AX2210

2.2 Packages

LQFP48 and SOP28

2.3 Pin Assignment

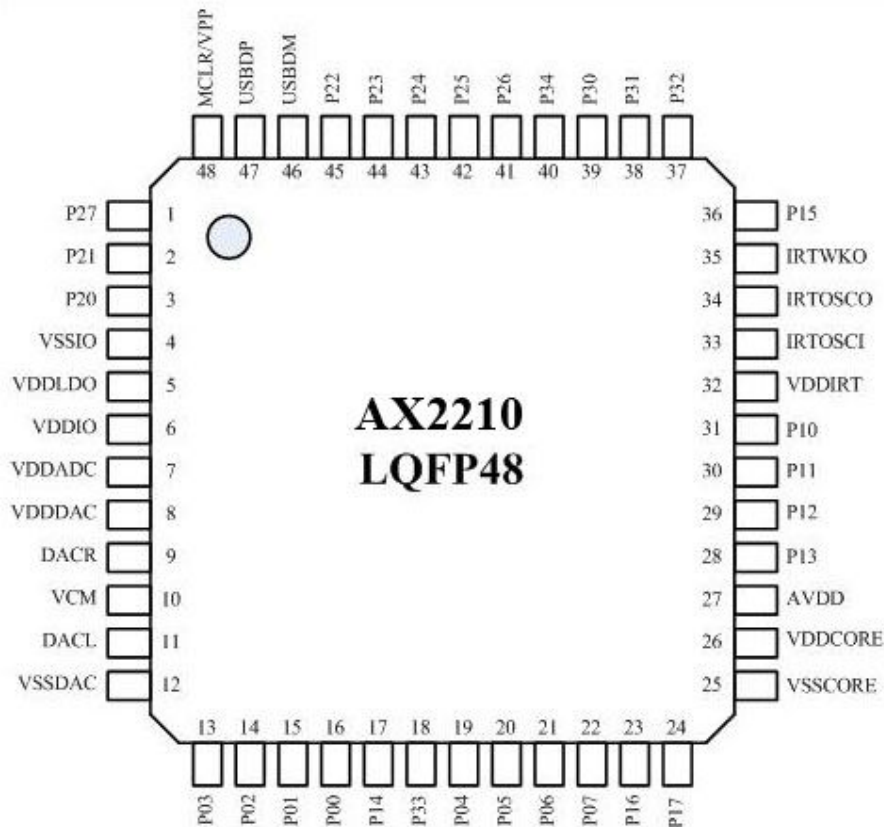


Figure 2-1 Pin assignment for LQFP48

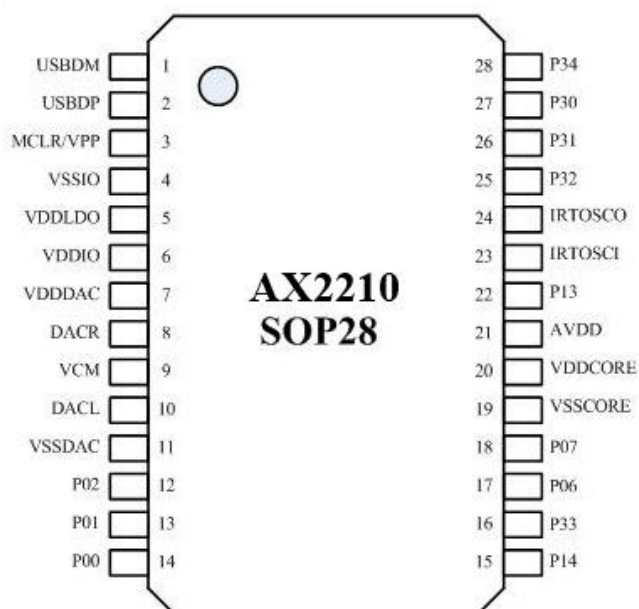


Figure 2-2 Pin assignment for SOP28

2.4 Pin Descriptions

Figure 2-1 shows the pin assignments of LQFP48 package. Table 2-1 shows the pin descriptions of LQFP48 package.

Figure 2-2 shows the pin assignments of SOP28 package. Table 2-2 shows the pin descriptions of SOP28 package.

Table 2-1 LQFP48 pin description

Pin No.	Name	Type	Function	Other Function
1	P27	I/O	GPIO	PPD7: Parallel Port Data 7 SPI0DOUT0: SPI0 Data output 0
2	P21	I/O	GPIO	PPD1: Parallel Port Data 1 IISDI0: IIS Data input 0
3	P20	I/O	GPIO	PPD0: Parallel Port Data 0 IISBCLK: IIS BCLK
4	VSSIO	P	IO Ground	
5	VDDLDO	P	LDO Power	
6	VDDIO	P	IO Power	
7	VDDADC	P	ADC Power	
8	VDDDAC	P	DAC Power	

9	DACR	O	DAC Right Channel	
10	VCM	O	DAC Bandgap voltage reference	
11	DACL	O	DAC Left Channel	
12	VSSDAC	P	DAC Ground	
13	P03	I/O	MICIN0 / AUXL0	
14	P02	I/O	MININ1 / AUXR0	
15	P01	I/O	GPIO AUXR1 ADC5	SDDATA2: SD Data 2 UARTTX1: UART TX1
16	P00	I/O	GPIO AUXL1 ADC4	SDDATA1: SD Data 1 UARTRX1: UART RX1 SPI0DI2: SPI0 Data input 0
17	P14	I/O	GPIO SDDATA3: SD Data 3	T3PWM: Timer3 PWM Output T3CAP: Timer3 Capture Pin SPI0DOUT2: SPI0 Data output 2
18	P33	I/O	GPIO ADC0/LVD detect	32K/system clock/XOSC12M output
19	P04	I/O	GPIO ADC2 Port Interrupt/Wakeup	T1PWM: Timer1 PWM Output SPI1DOUT: SPI1 Data Output SPI0DOUT1: SPI0 Data Output 1
20	P05	I/O	GPIO ADC3 Port Interrupt/Wakeup	T0CAP: Timer0 Capture Pin SPI1CLK: SPI1 Clock SPI0CLK1: SPI0 Clock1
21	P06	I/O	GPIO ADC1	SPI1DI: SPI1 Data Input SPI0DI1: SPI0 Data Input
22	P07	I/O	GPIO IR Input Port Interrupt/Wakeup	T1CAP: Timer1 Capture Pin
23	P16	I/O	GPIO AM input REFCLK: IIS Reference clock	UARTTX0: UART Data Out 0 T2PWM: Timer2 PWM Output T2CAP: Timer2 Capture Pin
24	P17	I/O	GPIO FM Input IISWS: IIS WS	T2CKIN: Timer2 Clock In
25	VSSCORE	P	Digital Ground	
26	VDDCORE	P	Digital Power	
27	AVDD	P	IO Power	
28	P13	I/O	GPIO	DP: Debug Pin

29	P12	I/O	GPIO	
30	P11	I/O	GPIO	
31	P10	I/O	GPIO	PPWR: Parallel Port Write
32	VDDIRT	P	IRT 1.5V IO Power	
33	IRTOSCI	I	IRTC 32K Oscillator Input	
34	IRTOSCO	O	IRTC 32K Oscillator Output	
35	IRTWKO	O	IRTC Wake up Output	
36	P15	I/O	GPIO	T3CKIN: Timer3 Clock In
37	P32	I/O	GPIO	SDDATA0: SD Data 0
38	P31	I/O	GPIO	SDCMD: SD Command
39	P30	I/O	GPIO	SDCLK: SD Clock
40	P34	I/O	GPIO XOSC12I Port Interrupt/Wakeup	T0PWM: Timer0 PWM Output UARTRX0:UART Data In 0 SPI0CLK2: SPI0 Clock2
41	P26	I/O	GPIO XOSC12O	PPD6: Parallel Port Data 6 SPI0CLK0: SPI0 CLK 0
42	P25	I/O	GPIO	PPD5: Parallel Port Data 5 SPI0DIN0: SPI0 Data input 0
43	P24	I/O	GPIO	PPD4: Parallel Port Data 4 IISDO1:IIS Data output1
44	P23	I/O	GPIO	PPD3: Parallel Port Data 3 IISDI1:IIS Data input 1
45	P22	I/O	GPIO	PPD2: Parallel Port Data 2 IISDO0:IIS Data output0
46	USBDM	I/O	USB Negative Input/output	
47	USBDP	I/O	USB Positive Input/output	
48	MCLR/VPP	I	Master Clear, Low Active	OTP Programming Power

Table 2-2 SOP28 pin description

Pin No.	Name	Type	Function	Other Function
1	USBDM	I/O	USB Negative Input/output	USBDM
2	USBDP	I/O	USB Positive Input/output	USBDP
3	MCLR/VPP	I	Master Clear, Low Active	DP: Debug Pin
4	VSSIO	P	IO Ground	
5	VDDLDO	P	LDO Power	

6	VDDIO	P	IO Power	
7	VDDDAC	P	DAC & ADC Power	
8	DACR	O	DAC Right Channel	
9	VCM	O	DAC Bandgap voltage reference	SDCLK: SD Clock
10	DACL	O	DAC Left Channel	SDCMD: SD Command
11	VSSDAC	P	DAC Ground	SDDATA0: SD Data 0
12	P02	I/O	MININ1 / AUXR0	
13	P01	I/O	GPIO AUXR1 ADC5	SDDATA2: SD Data 2 UARTTX1: UART TX1
14	P00	I/O	GPIO AUXL1 ADC4	SDDATA1: SD Data 1 UARTRX1: UART RX1 SPI0DI2:SPI0 Data input 0
15	P14	I/O	GPIO SDDATA3: SD Data 3	T3PWM: Timer3 PWM Output T3CAP: Timer3 Capture Pin SPI0DOUT2: SPI0 Data output 2
16	P33	I/O	GPIO ADC0/LVD detect	32K/system clock/XOSC12M output
17	P06	I/O	GPIO ADC1	SPI1DI: SPI1 Data Input SPI0DI1:SPI0 Data Input
18	P07	I/O	GPIO IR Input Port Interrupt/Wakeup	T1CAP: Timer1 Capture Pin
19	VSSCORE	P	Digital Ground	
20	VDDCORE	P	Digital Power	
21	AVDD	P	IO Power	
22	P13	I/O	GPIO	DP: Debug Pin
23	IRTOSCI	I	IRTC 32K Oscillator Input	
24	IRTOSCO	O	IRTC 32K Oscillator Output	
25	P32	I/O	GPIO	SDDATA0: SD Data 0
26	P31	I/O	GPIO	SDCMD: SD Command
27	P30	I/O	GPIO	SDCLK: SD Clock
28	P34	I/O	GPIO XOSC12I Port Interrupt/Wakeup	T0PWM: Timer0 PWM Output UARTRX0:UART Data In 0 SPI0CLK2: SPI0 Clock2

3 Characteristics

3.1 LDO Parameters

Table 24-1

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
V _{in}	LDO input voltage	3.2	5.0	5.5	V	
V _{out1.8}	1.8V output voltage	-	1.75	-	V	
V _{out3.3}	3.3V output voltage	-	3.3	-	V	
I _{out1.8}	1.8V output current	-	-	100	mA	
I _{out3.3}	3.3V output current	-	-	200	mA	

Temperature: -40°C~85 °C

3.2 PLL Parameters

Table 24-2

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
F _I	Frequency input	-	32.768	-	KHz	
F _{OUT1}	Frequency output	-	48	-	MHz	
T _{LOCK}	PLL locked time				us	

Temperature: -40°C~85 °C

3.3 I/O Parameters

Table 24-3

Symbol	Description	Min	Typ	Max	Units	Conditions
V _{IL}	Low-Level input voltage	-	-	45% * VDDIO	V	VDDIO = 3.3V
V _{IH}	High-level input voltage	60% * VDDIO	-	-	V	VDDIO = 3.3V
R _{PUP0}	Internal pull-up resistor 0		10		KΩ	VDDIO = 3.3V
R _{PUP1}	Internal pull-up resistor 1		500		Ω	VDDIO = 3.3V
R _{PDN0}	Internal pull-down resistor 0		10		KΩ	VDDIO = 3.3V
R _{PDN1}	Internal pull-down resistor 1		3.3		KΩ	VDDIO = 3.3V
R _{PDN2}	Internal pull-down resistor 2		200		Ω	VDDIO = 3.3V
R _{PDN3}	Internal pull-down resistor 3		500		Ω	VDDIO = 3.3V

I_{LEVEL0}	Level0 current driving	-	-	8	mA	
I_{LEVEL1}	Level1 current driving	-	-	24	mA	

Temperature: 25 °C

3.4 OSC Parameters

Table 24-4

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
FIN_{RT32K}	RT32KOSC input	-	32.768	-	KHz	
$FOUT_{RC}$	RC output	-	1	-	MHz	

Temperature: -40°C~85 °C

3.5 Audio DAC Parameters

Table 24-5

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	78	-	dB	
THD+N		-	-60	-	dB	No loading
PWR_{AB}	ClassAB AMP power output	-	-	20	mW	16ohm, single channel
V_{PP}	Maximum output voltage	-	-	2.2	V	

Temperature: 25 °C

3.6 Audio ADC Parameters

Table 24-5

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	62	-	dB	1.4V VPP

Temperature: 25 °C

3.7 Audio Recording Parameters

Table 24-5

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	70	-	dB	
THD+N		-	63	-		

Sample rate		22.05	44.1	-	K	
Bit rate		-	-	128	KBps	
Frequency range		0	16	-	K	

Temperature: 25 °C, Recording supported format: MPEG 1/2/2.5, layer III

3.8 Current Parameters

Table 24-6

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
Istop	Stop current	-	220	-	uA	Temperature: 25 °C
Isleep	Sleep current	-	220	-	uA	Temperature: 25 °C
Ipd	VDDLDO power down current	-	5.5	7.0	uA	Temperature: -40°C~85 °C

3.9 USB PHY Parameters

Table 24-6

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
RDM _{PUP}	DM pull-up resistor	-	120	-	KΩ	
RDP _{PUP}	DP pull-up resistor	-	1.5	-	KΩ	
RDM _{PDN}	DM pull-up resistor	-	15	-	KΩ	
RDP _{PDN}	DP pull-up resistor	-	15	-	KΩ	

4 Appendix I Revision History

Date	Version	Comment	Revised by
2011-09-05	0.0.1	First version	Erica Cheong

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