AP8048A Datasheet

Audio Application Processor

(ARM Cortex-M3 based)

Rev0.4

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Revision History

Date	Revision	Description
	V0.1	Initial
2013-10-21	V0.2	Change chip name
2013-11-4	V0.3	Change pin name
2013-11-13	V0.4	Modify features

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1. Overview

A highly integrated SOC for Audio application processing, AP8048A integrates ARM Cortex-M3 MCU, Bluetooth stack, MP3/WMA/FLAC decoder, MP2 encoder, OTG, SD/MMC card controller, SARADC, Audio DAC, Audio ADC, segment LED display driver, RTC and IR decoder in a single chip, AP8048A offers low power consumption, flexible and more powerful Bluetooth Audio player solution.

1.1 Features

- Embedded ARM Cortex-M3, running @ 96MHz
- Support 2-wired debug port
- Built-in 128K byte SRAM
- Support booting from SPI-flash and the firmware can be updated through SD or USB disk
- Provide code encryption mechanism in external flash
- Embedded Bluetooth stack, supporting A2DP, AVRCP, Hand Free protocol
- OTG 2.0 full-speed controller
- SD/MMC card controller
- Built-in MP2/MP3/WMA/FLAC(8/16/24bit)/WAV(IMA-ADPCM and raw PCM) decoder
- Built-in MP2 encoder
- Built-in super bass sound effect
- Built-in echo generator
- Built-in parametric EQ
- Support FAT16/FAT32 file system
- Embedded 20-bit Audio DAC and 16-bit Audio ADC
- Built-in Capless Earphone driver
- Built-in MIC amplify block with AGC
- Support 2 pairs of auxiliary audio input
- Embedded SARADC
- Embedded RTC
- Embedded NVM to save external EEPROM
- Support segment LED display
- Embedded tone generator
- Support IR control
- GPIO for various purposes

- Embedded LDO

2. Pin Description

AP8048A is a CMOS device. Floating level on input signals causes unstable device operation and abnormal current consumption. Pull-up or Pull-down resistors should be used appropriately for input or bidirectional pins.

Notation	Description
I	Input
O	Output
I/O	Bidirectional
PWR	Power
GND	Ground

2.1 Pin Description

Table 1 Pin Description

Pin name	Pin #	Type	Description
			Audio CODEC interface pins
DAC_R	8	AO	audio right channel output
DAC_L	9	AO	audio left channel output
DACVMID	7	AI	Internal voltage reference
MICIN	11	AI	MIC input
			GPIO/MCU IO pins
GPIO_A[10]	20	I/O	GPIO PORT, bank A
GPIO_A[25:13]	33:21	I/O	GPIO PORT, bank A
GPIO_B[8:5]	37:34	I/O	GPIO PORT, bank B
GPIO_B[20]	39	I/O	GPIO PORT, bank B
GPIO_B[29:22]	47:40	I/O	GPIO PORT, bank B
GPIO_B[31]	48	I/O	GPIO PORT, bank B
GPIO_C[2]	1	I/O	GPIO PORT, bank C
GPIO_C[14:11]	5:2	I/O	GPIO PORT, bank C
			CLK pins
XIN	12	I	32.768KHz Crystal oscillator input for PLL
XOUT	13	O	32.768KHz Crystal oscillator output for PLL
			Power/Ground pins
DVSS	19	GND	ground for digital
LDOIN	15	PWR	LDO power in
LDO33O	14	PWR	LDO 3.3V out
LDO12O	17	PWR	LDO 1.2V out
IOVDD	38	PWR	IO 3.3V
DCOVDD	18	PWR	power for PLL

DACVDD	10	PWR	power for DAC
DACAVSS	6	GND	ground for DAC
			MISC pins
POWER_KEY	16	I	Power Key

3. Package

3.1 Package Diagram

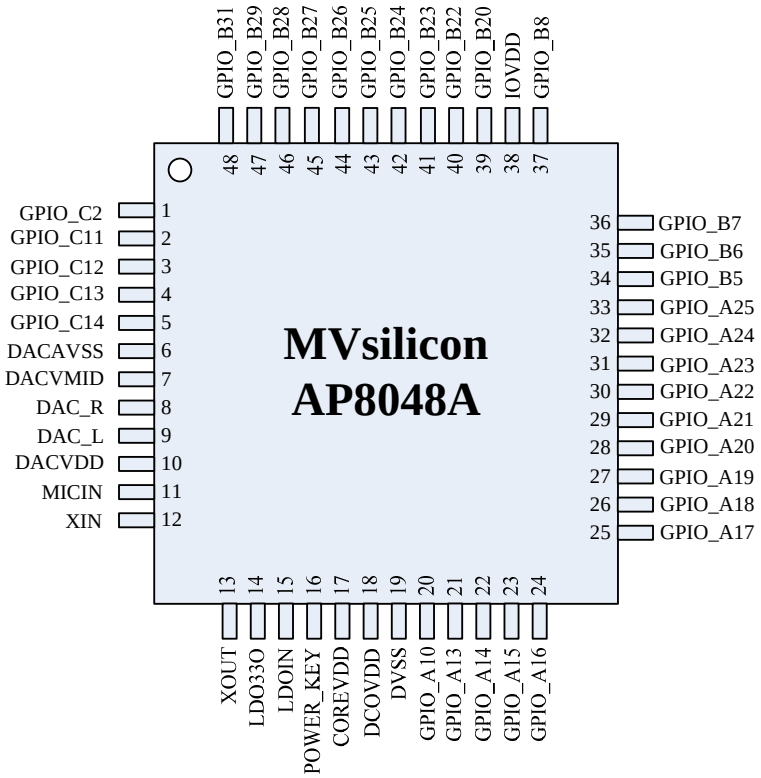


Figure 1 Package Diagram (LQFP48-7x7mm / TOP View)

3.2 Package Dimension Parameter

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.60
A1	0.05	0.15	0.25
A2	1.30	1.40	1.50
A3	0.54	0.64	0.74
b	0.19	—	0.27
b1	0.18	0.20	0.23
c	0.13	—	0.18
c1	0.12	0.13	0.14
D	8.80	9.00	9.20
D1	6.80	7.00	7.20
E	8.80	9.00	9.20
E1	6.80	7.00	7.20
e		0.50BSC	
L	0.35	0.50	0.65
L1		1.00BSC	
θ	0	—	8°

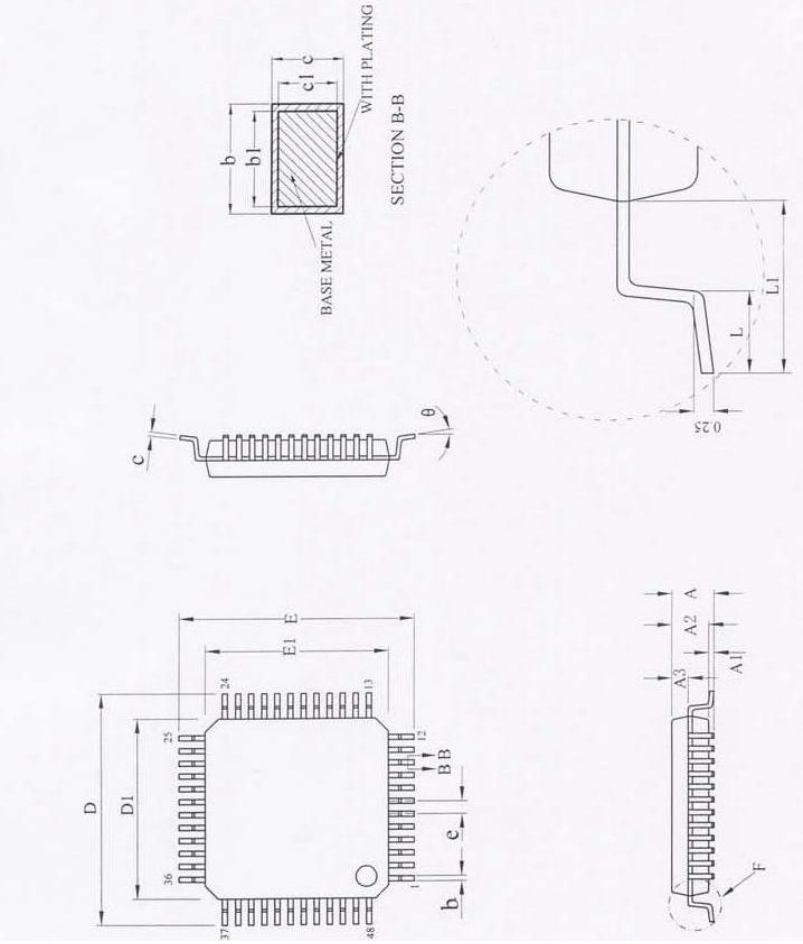


Figure 2 LQFP48-7x7mm Package Dimension Parameter

4. Electrical Specification

4.1 Absolute Maximum Ratings (Note 1)

Table 2 Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Storage Temperature	TEMP_STG	-65 to 150	C

4.2 Recommended Operating Conditions

Table 3 Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Power Supply Voltage (LDO)	VCC_LDO	3.35		5	V
IO Input Voltage	VIN	0		3.6	V
Operating Free Air Temperature	TEMP_OPR	-40		85	C

4.3 Electrical Characteristics

Table 4 Electrical Characteristics

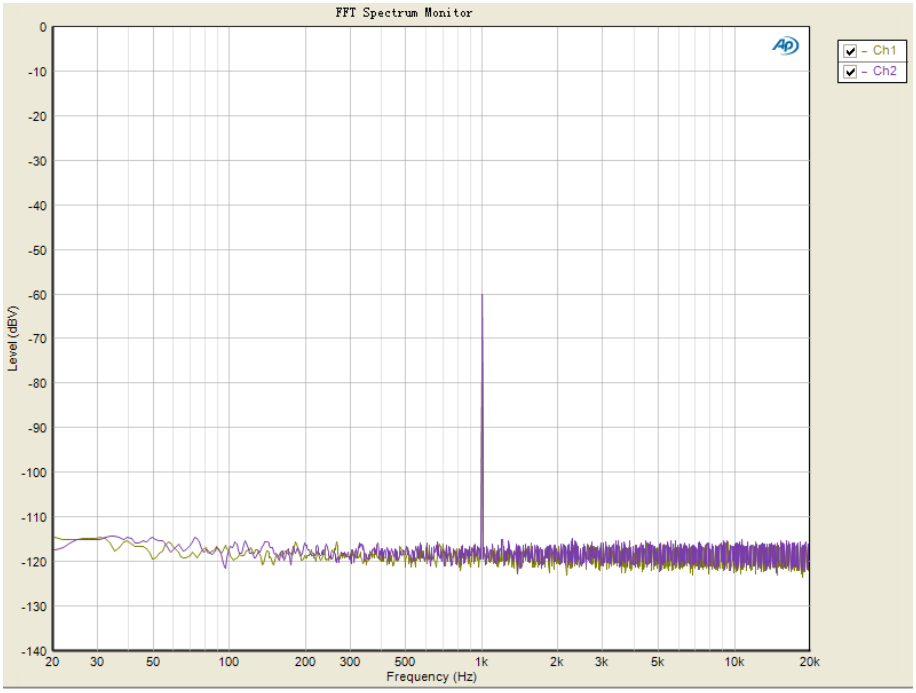
Symbol	Parameter	Condition	Min	Typ	Max	Unit
VIH	Input High Voltage		1.6		3.6	V
VIL	Input Low Voltage		-0.3		1.4	V
VOH	Output high voltage	@IOH=2mA	3.0			V
VOL	Output low voltage	@IOL=2mA			0.3	V
IL	Input leakage current		-10		10	uA
P_PLAY current	Current consumption when playing	Playing mode		30		mA
RTC current	Current consumption for RTC & NVM			16		uA

4.4 Audio Performance

Table 5 Audio DAC Performance

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Dynamic Range	No Filter		93.6/93.6		dB
	With A-Weighted Filter		95/95		dB
Signal-to-Noise Ratio	No Filter		95.5/95.6		dB
	With A-Weighted Filter		98/98		dB
THD+N	Peak THD+N (@0dBFS)		-81/-81		dB
	0dBFS		-75/-75		dB

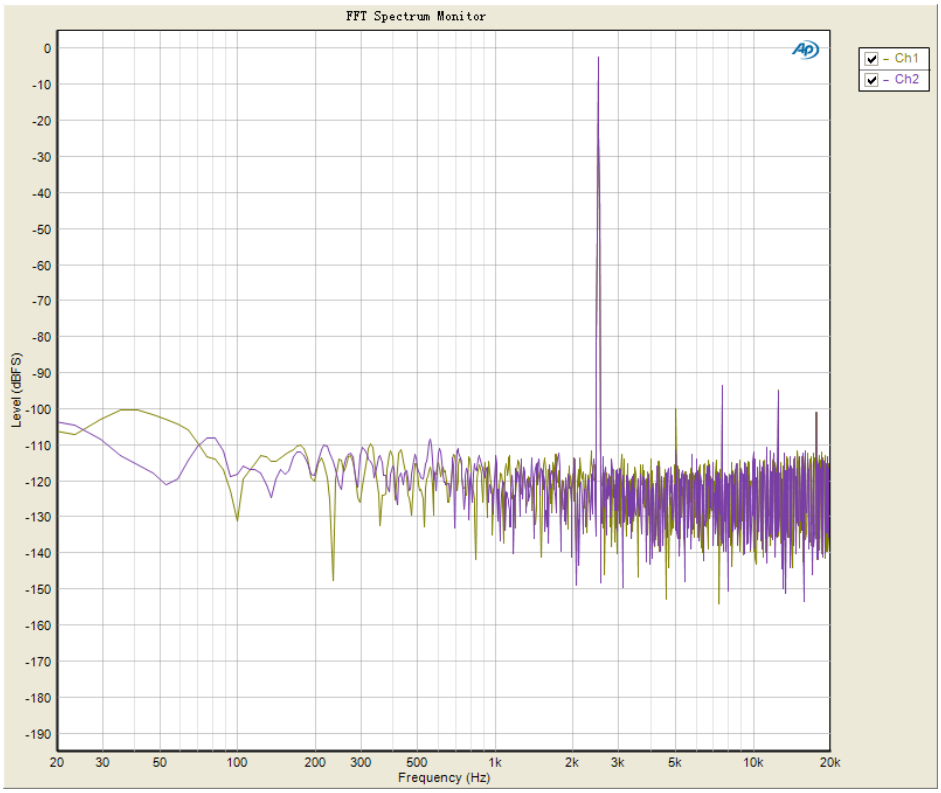
Frequency Response			0.06		dBV
Output Swing			0.993		Vrms
Inter-channel Gain Mismatch			0.003		dB
Volume Control Step			TBD		dB
Volume Control Range			TBD		dB
Group Delay			80		us
Inter-channel Phase Deviation			0.01		degree
Crosstalk			-99/-98		dB



The measured output audio spectrum when the output is at -60 dBV

Table 6 Linein Channel Characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Dynamic Range	No Filter		88/88		dB
	With A-Weighted Filter		90/90		dB
Signal-to-Noise Ratio	No Filter		88/88		dB
	With A-Weighted Filter		90/90		dB
THD+N	Peak THD+N (@-2.4dBFS)		-84/-84		dB
Volume Control Step			TBD		dB
Volume Control Range			TBD		dB
Group Delay			26		fs
Power Consumption			7.6		mW
Power Supply Rejection Ratio	1kHz, 300mVrms		55		dB



The measured audio spectrum when the analog input is at -2.6 dBV

Table 7 FM Channel Characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Dynamic Range	No Filter		86		dB
	With A-Weighted Filter				dB
Signal-to-Noise Ratio	No Filter		85		dB
	With A-Weighted Filter				dB
THD+N	Peak THD+N (@-12dBFS)		-75		dB
Group Delay			26		fs
Power Consumption			7.6		mW
Power Supply Rejection Ratio	1kHz, 300mVrms		55		dB

Table 8 MIC Channel Characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Dynamic Range	No Filter		87.5/87.5		dB
	With A-Weighted Filter		90/90		dB
Signal-to-Noise Ratio	No Filter		85.5/85.5		dB
	With A-Weighted Filter		88.5/88.5		dB
THD+N	Peak THD+N (@-2dBFS)		-82/-82		dB
Group Delay			26		fs
Crosstalk			TBD		dB
Power Consumption			7.6		mW

Power Supply Rejection Ratio	1kHz, 300mVrms		55		dB

Note:

1. “Absolute Maximum Ratings” are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits.

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