Bluetrum Technology

AB5301A

Audio Player Microcontroller

Versions: 0.0.1

2018/09/27

Declaration

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Bluetrum Technology

Revision History

Date	Version	Comments	Revised by
2018-09-27	0.0.1	First draft	Leo

Table of Contents

1 **Product Features**

CPU and Flexible IO

- 32bit High performance CPU with DSP instruction
- Flexible GPIO pins with Programmable pull-up and pull-down resistors;
- Support GPIO wakeup or interrupt;

Bluetooth Radio

- Compliant to Bluetooth 5.0 and BLE specification (QDID: 115952);
- TX output power +2db in typical;
- RX Sensitivity with -90.5dBm @Basic Rate;

FM Tuner

- Support frequency band 76~108MHz;
- Auto search tuning;
- Programable de-emphasis(50/75uS);
- Receive signal strength indicator (RSSI);

Audio Interface

- Audio codec with 16bit stereo DAC and two channel 16bit ADC;
- Support flexible audio EQ adjust;
- Support Sample rate 8, 11.025, 12, 16, 22.05, 32, 44.1 and 48KHz;
- 4 channel Stereo Analog MUX;
- Two channel MIC amplifier input;
- High performance Stereo audio ADC with 90dB SNR;
- High performance Stereo audio DAC with 95dB SNR, with headphone amplifier output;

Peripheral and Interfaces

- Three 32-bit timers;
- Three multi-function 32-bit timers, support Capture and PWM mode;
- WatchDog;
- Three full-duplex UART;
- Two SPI;
- IR controller;
- SD Card Host controller;
- SPDIF receiver;
- Audio interface IIS;
- Full speed USB 2.0 HOST/DEVICE controller;
- Sixteen Channels 10-bit SARADC;
- Integrate IRTC;
- Build in PMU, such as charger/buck/LDO;

Package

- LQFP48;

Temperature

- Operating temperature: -40℃ to +85℃;
- Storage temperature: -65℃ to +150℃;
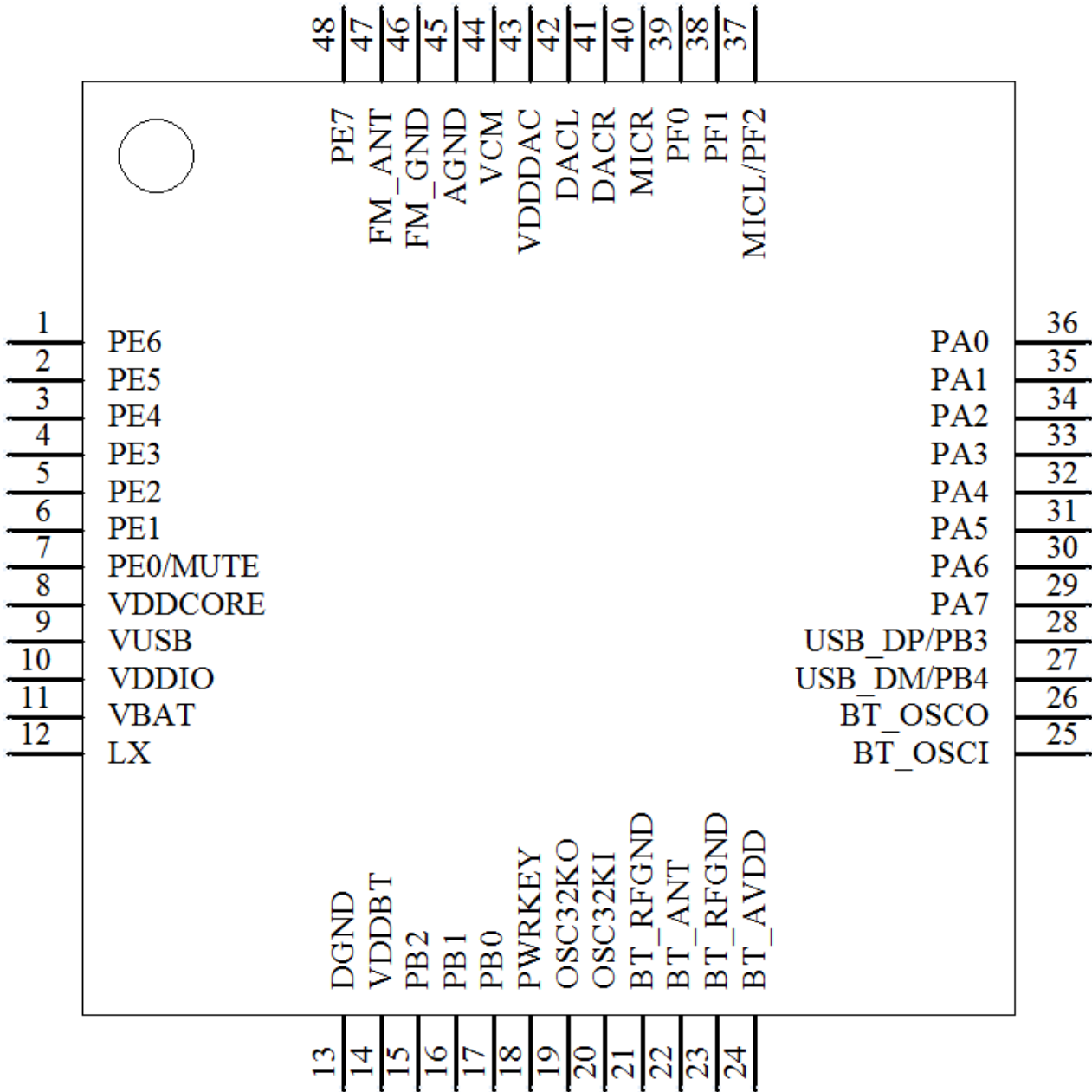
2 Package Definition

2.1 Pin Assignment

Figure 2-1 Pin assignment for LQFP48

2.2 **Pin Descriptions**

Table 2-1 LQFP48 pin description

Pin No.	Name	Type	Function
1	PE6	I/O	ADC8
			AUXL2
			SPDIF4
			SDCLK-G3
			SPI1CLK-G4
			RX0-G4
			HSTRX-G9
			FMOSC-G6
			LPWM2-G1
			TMR3CAP_G7/IR_G7
			PE6
2	PE5	I/O	ADC7
			SPDIF3
			SDCMD-G3
			SPI1DI-G4
			FMOSC-G5
			LPWM1-G1
			TMR3CAP_G6/IR_G6
			PE5
3	PE4	I/O	SPI0DI-G2
			SPI1DI-G6
			LPWM0-G1
			IISMCLK-G2
			PE4
4	PE3	I/O	SPI0CLK-G2
			SPI1CLK-G6
			TX2-G1
			PWM2-T5
			IISLRCLK-G2
			PE3
5	PE2	I/O	SPI0DO-G2
			SPI1DO-G6
			RX2-G1
			PWM1-T5
			IISSCLK-G2
			PE2
6	PE1	I/O	RX0-G6
			PWM0-T5
			IISDO-G2
			PE1
7	PE0	I/O	SPI0DI-G3

			TX0-G6
			LPWM2-G2
			IISDI-G2
			TMR3CAP_G5/IR_G5
			PE0
8	VDDCORE	PWR	VDDCORE power
9	VUSB	PWR	VUSB power input
10	VDDIO	PWR	VDDIO power output
11	VBAT	PWR	VBAT power input
12	LX	PWR	Buck inductor connect pin
13	DGND	GND	Digital Ground
14	VDDBT	PWR	BT power
15	PB2	I/O	ADC4
			AUXR1
			SDDAT0-G2
			SPI1DO-G3
			TX0-G2
			TX2-G2
			HSTRX-G2
			PWM2-T3
			PB2
16	PB1	I/O	ADC3
			FM/AM-G1
			AUXL1
			SDCLK-G2
			SPI1CLK-G3
			RX0-G2
			RX2-G2
			HSTRX-G7
			FMOSC-G4
			PWM1-T3
			TMR3CAP_G4/IR_G4
			PB1
17	PB0	I/O	FM/AM-G0
			SPDIF2
			SDCMD-G2
			SPI1DI-G3
			FMOSC-G3
			PWM0-T3
			TMR3CAP_G3/IR_G3
			PB0
18	PWRKEY	A	Power key input
19	OSC32KO	A	32K OSC output
20	OSC32KI	A	32K OSC input
21	BT_RFGND	GND	BT RF Ground
22	BT_ANT	A	BT ANT
23	BT_RFGND	GND	BT RF Ground
24	BT_AVDD	PWR	BT RF Power
25	BT_OSCI	A	26M OSC input
26	BT_OSCO	A	26M OSC output
27	USB_DM	I/O	ADC6

			USB DM
			SPI0CLK-G3
			RX0-G3
			PB4
28	USB_DP	I/O	ADC5
			USB DP
			SPI0DO-G3
			TX0-G3
			PB3
29	PA7	I/O	ADC2
			AUXR0
			SDDAT0-G1
			SPI1DO-G2
			TX0-G1
			TX1-G1
			HSTRX-G1
			PWM2-T4
			PA7
30	PA6	I/O	ADC1
			AUXL0
			SDCLK-G1
			SPI1CLK-G2
			RX0-G1
			RX1-G1
			HSTRX-G6
			FMOSC-G2
			PWM1-T4
			TMR3CAP_G2/IR_G2
			PA6
31	PA5	I/O	ADC0
			SDCMD-G1
			SPI1DI-G2
			FMOSC-G1
			PWM0-T4
			TMR3CAP_G1/IR_G1
			PA5
32	PA4	I/O	SPI1DO-G1
			TX1-G2
			IISMCLK-G1
			PA4
33	PA3	I/O	SPI1CLK-G1
			RX1-G2
			LPWM3-G3
			IISLRCLK-G1
			PA3
34	PA2	I/O	SPI1DI-G1

35	PA1	I/O	LPWM2-G3
			IISSCLK-G1
			PA2
			SPDIF1
			SPI1CLK-G1
			TX0-G5
			HSTRX-G5
			LPWM1-G3
			IISDO-G1
			PA1
36	PA0	I/O	SPDIF0
			RX0-G5
			HSTRX-G10
			LPWM0-G3
			IISDI-G1
			PA0
37	PF2/MICL	I/O	ADC10
			MICL
			SPI1DO-G5
			TX0-G7
			LPWM3-G2
			PF2
38	PF1	I/O	AUXR3
			SPI1CLK-G5
			PF1
39	PF0	I/O	AUXL3
			SPI1DI-G5
			PF0
40	MICR	A	MICR
41	DACR	A	DAC R
42	DACL	A	DAC L
43	VDDDAC	PWR	DAC power
44	VCM	PWR	DAC VCM
45	AGND	GND	DAC Ground
46	FM_GND	GND	FMRX Ground
47	FM_ANT	A	FMRX ANT
48	PE7	I/O	ADC9
			AUXR2
			SDDAT0-G3
			SPI1DO-G4
			TX0-G4
			HSTRX-G4
			LPWM3-G1
			TMR4CAP_G1/IR_G8
			PE7

Note: I/O: Digital input/output;   I : Digital input;   A : Analog Pin; PWR: Power Pin; GND: Ground.

3 Characteristics

3.1 PMU Parameters

Table 3-1 PMU voltage input Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VUSB	Charger Voltage input	3.0	5.0	5.0	V	
VBAT	Voltage input	3.0	3.7	5.0	V	

Table 3-2 3.3V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDIO	3.3V LDO voltage output	3.0	3.3	3.6	V	Light Loading condition
△VVDDIO	Output Mismatch 1-sigma	-	56	-	mV	VDDIO=3.3v
ILOAD	Maximum output current	-	-	150	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	300	mA	@VBAT=3.8v

Table 3-3 1.6V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDBT	1.6V LDO voltage output	-	1.6	-	V	Light Loading condition
△VVDDBT	Output Mismatch 1-sigma	-	27	-	mV	VDDBT=1.6v
ILOAD	Maximum output current	-	-	100	mA	@VBAT=3.0v
ISC	Short Circuit Current Limit	-	-	200	mA	@VBAT=3.8v

Table 3-4 1.2V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDCORE	1.2V LDO voltage output	-	1.2	-	V	Light Loading condition
△VVDDCORE	Output Mismatch 1-sigma	-	20	-	mV	VDDCORE=1.2v
ILOAD	Maximum output current	-	-	80	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	120	mA	@VBAT=3.8v

3.2 IO Parameters

Table 3-5 I/O Parameters

GPIO—Electrical Characteristics							
Symbol	Description	Related GPIO	Min	Typical	Max	Units	Conditions
V_{IL}	Low-level input voltage		-0.3		1.27	V	VDDIO=3.3V
V_{IH}	High-level input voltage		2.03		3.6	V	VDDIO=3.3V
Driver Ability 1	Output Driver Ability 1			32		mA	VDDIO=3.3V
Driver Ability 0	Output Driver Ability 0			8		mA	VDDIO=3.3V
R_{PUP0}	Internal pull-up resister 0		8	10	12	KΩ	
R_{PUP1}	Internal pull-up resister 1		0.24	0.3	0.36	KΩ	
R_{PUP2}	Internal pull-up resister 2		160	200	240	KΩ	
R_{PDN0}	Internal pull-down resister 0		8	10	12	KΩ	
R_{PDN1}	Internal pull-down resister 1		0.24	0.3	0.36	KΩ	
R_{PDN2}	Internal pull-down resister 2		160	200	240	KΩ	

3.3 **Audio DAC Parameters**

Table 3-6 Audio DAC Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	96	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Output -3dBV Fin=1KHz
THD+N		-	-86	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Output -3dBV with 10K loading Fin=1KHz
Output Range	Maximum output voltage	-	2.6		$V_{peak-peak}$	32ohm Loading

3.4 **Audio ADC Parameters**

Table 3-7 Audio ADC Parameters

| Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	90	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Input sine amplitude, 850mV RMS Fin=1KHz
THD+N		-	-87	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Input sine amplitude, 850mV RMS Fin=1KHz.
Input Range	Input sine wave peak amplitude	0		VCM	V	From aux input, aux 0db gain, VCM represent VCM voltage.

3.5 **BT Parameters**

Table 3-8 BT Parameters

Characteristics	Min	Typical	Max	Unit	Conditions
Maximum Transmit Power	-	2	-	dBm	
RMS DEVM	-	5.5	-	%	Maximum TX power 2-DH5 packet
Peak DEVM	-	12.5		%	
EDR Relative Transmit Power		-0.2		dB	
Sensitivity @ Basic Rate		-90.5		dBm	BER=0.1%, using DH5 packet
Sensitivity @ EDR		-89.5		dBm	BER=0.01%, using 2-DH5 packet

3.6 **Current Parameters**

Table 3-9 Current Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
IRTC	RTC mode current	-	4	-	uA	4.2V input, room temp.
Sleep	Sleep current	-	500	2000	uA	3.3V input, room temp

4 Package Information
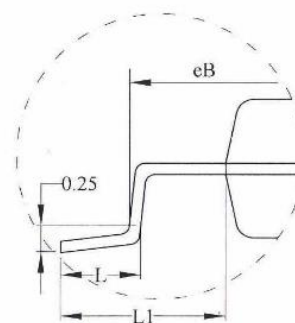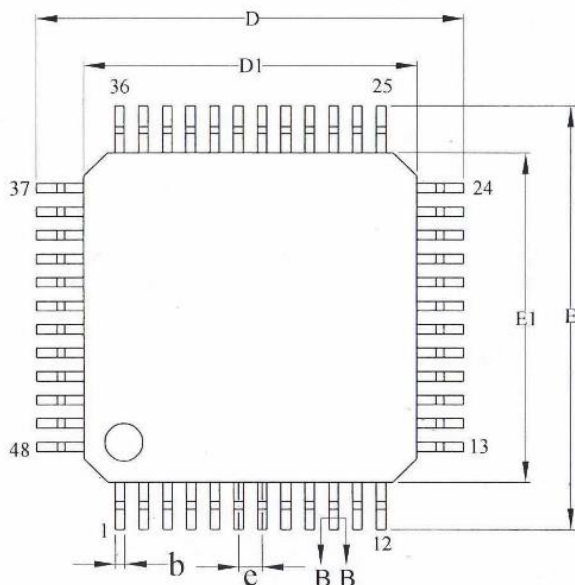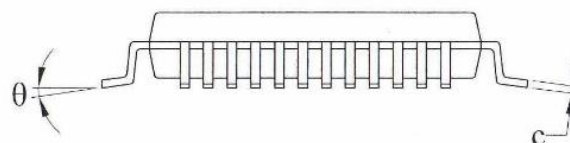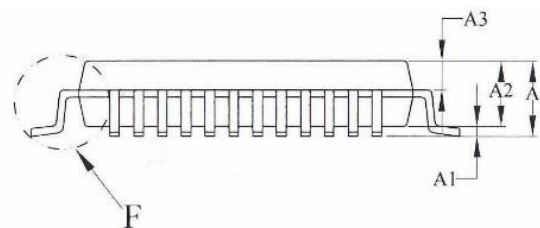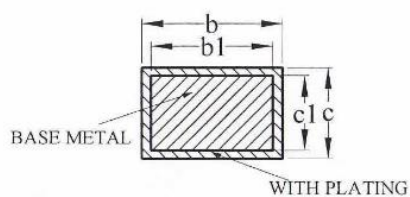
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
A3	0.59	0.64	0.69
b	0.18	—	0.26
b1	0.17	0.20	0.23
c	0.13	—	0.17
c1	0.12	0.13	0.14
D	8.80	9.00	9.20
D1	6.90	7.00	7.10
E	8.80	9.00	9.20
E1	6.90	7.00	7.10
eB	8.10	—	8.25
e	0.50BSC		
L	0.40	—	0.65
L1	1.00REF		
θ	0	—	7°