BT8932D

Audio Player Microcontroller

Versions: 0.0.5
2024.4.3

Declaration

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Revision History

Date	Version	Comments	Revised by
2023-11-9	0.0.1	First draft	Leo
2023-12-7	0.0.2	Modify RAM value	Leo
2023-12-26	0.0.3	Update audio DAC parameters and audio ADC parameters	Leo
2024-03-06	0.0.4	Modify the content of Product Features	Leo
2024-04-03	0.0.5	Modify I/O drive current parameters	Leo

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Table of Contents

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1 Product Features

CPU and Flexible IO

- High performance 32bit RISC-V processor Core with DSP instruction
- RISC-V typical speed: 140MHz
- Program memory: internal 16M bit flash
- Internal 320KB RAM for data and program
- Flexible GPIO pins with Programmable pull-up and pull-down resistors
- Support GPIO wakeup or interrupt

Bluetooth Radio

- Compliant with Bluetooth V5.4 + BR + EDR + BLE specification （QDID：207169）;
- Maximum TX output power +10.5dBm;
- RX Sensitivity with -94.5dBm @2M EDR;
- Support TWS communication with balance-efficiency Power consumption;
- Support TWS Master-slave switch;

Audio Interface

- High performance stereo DAC with 104dB SNR, support differential mode and VCMBUF mode;
- High performance mono ADC with 102dB SNR;
- One channel MIC amplifier input;
- Support flexible audio EQ adjust;
- Support Sample rate 8, 11.025, 12, 16, 22.05, 32, 44.1, 48, 88.2,96, 176.4 and 192KHz;
- One channel stereo Analog MUX;

Applications

- Bluetooth TWS Headset;

Peripheral and Interfaces

- Support AI DNN ENC noise reduction;
- Support Neural network Processing Unit (NPU);
- Support MPEG-1/2/3; AAC, SBC high quality decode;
- Support Low power Touch Key;
- Support Low power enter ear detect;
- 32-bit normal timer x 3; multi-function 32-bit timer x 3;
- WatchDog;
- Full-duplex normal UART x 3; high speed UART with CTS/RTS x 1;
- Master/Slave SPI x2;
- Master/Slave IIS x1;
- Master/Slave IIC x1;
- IR controller;
- SD Card Host controller x 1;
- Full speed USB 2.0 HOST/DEVICE controller x1;
- 10-bit SARADC x 11;
- Integrate IRTC;
- Build in PMU, such as charger/buck/LDO;

Package

- QFN32 4*4

Temperature

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

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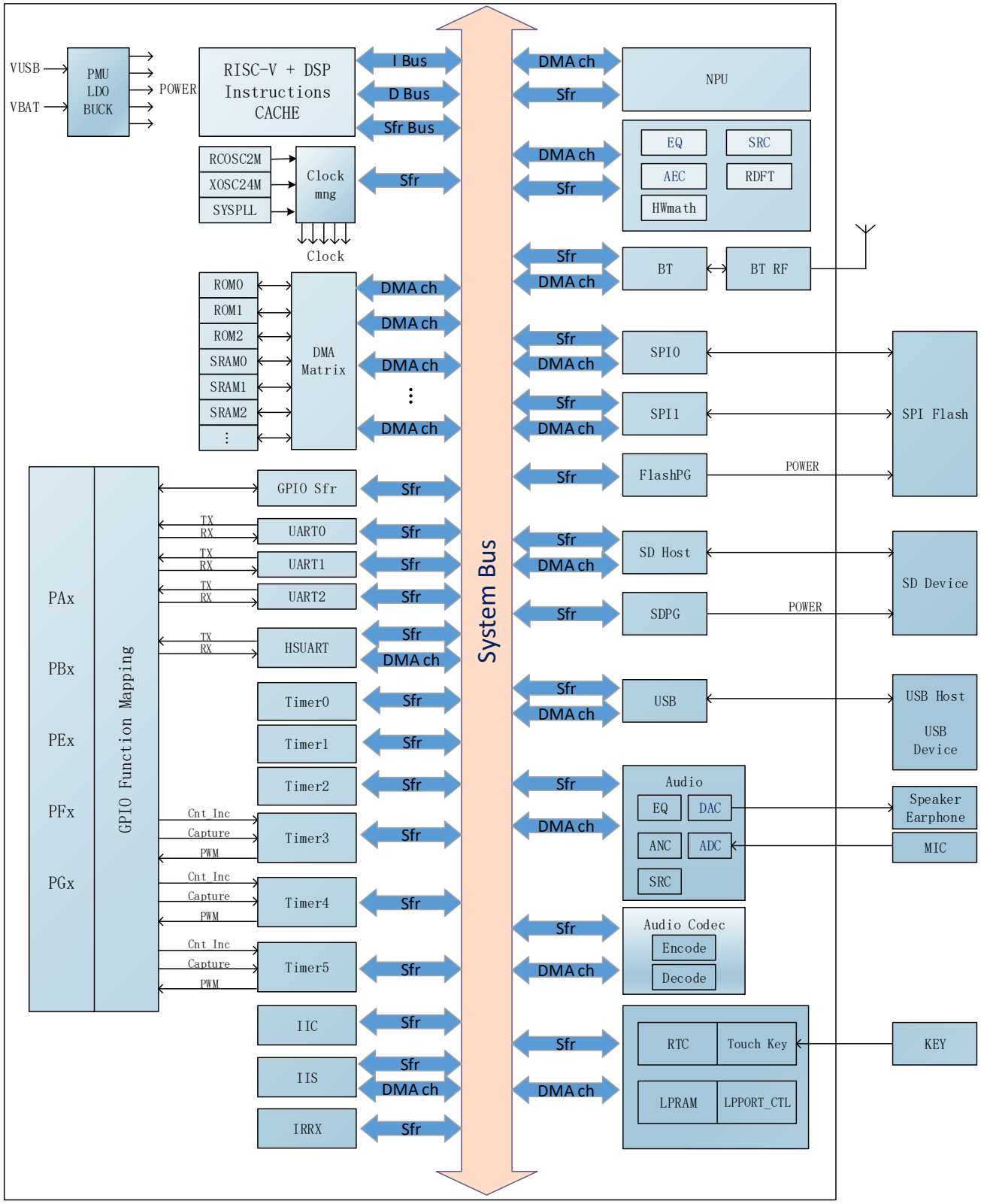
2 Block diagram



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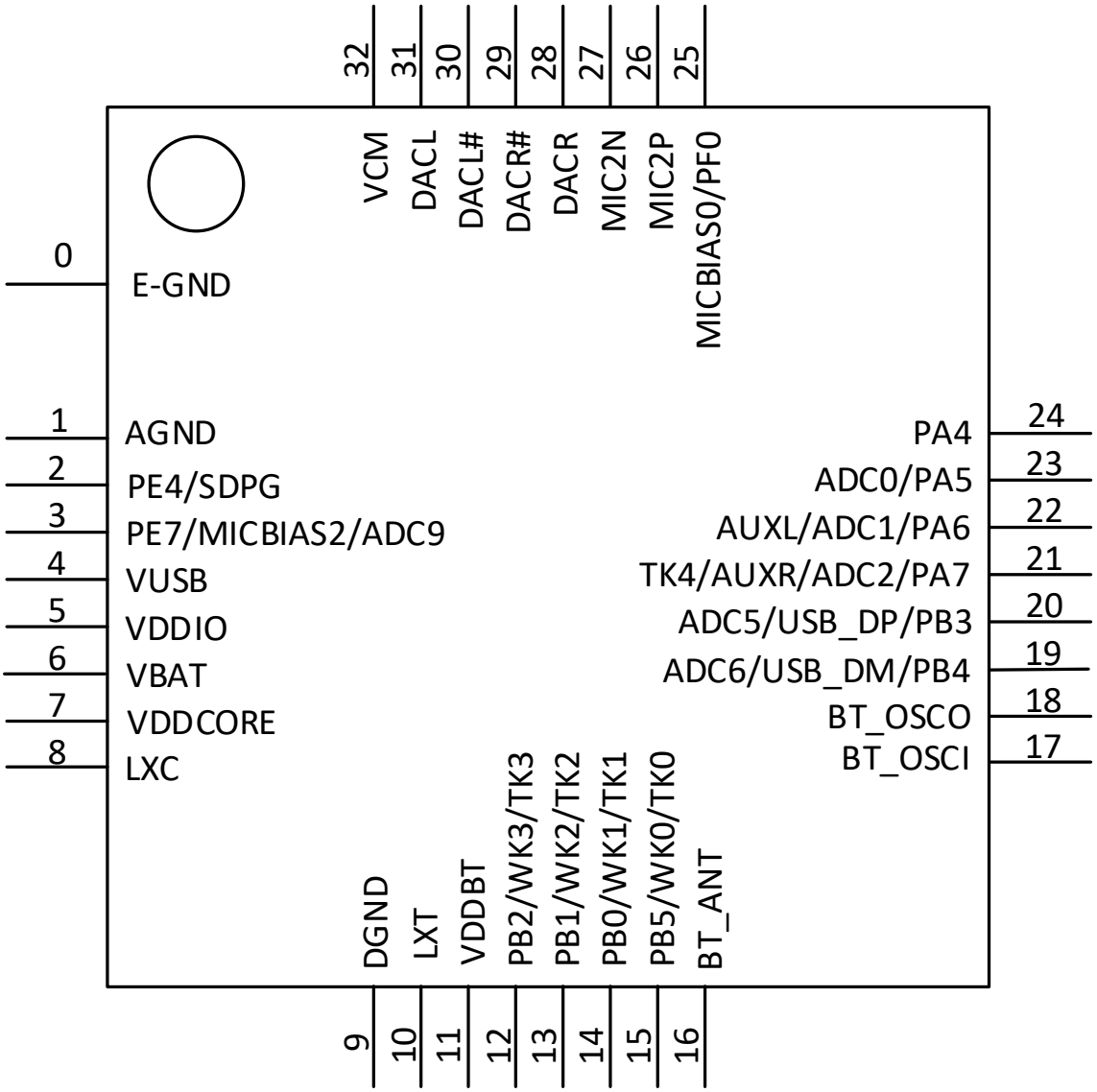
3 Package Definition

3.1 Pin Assignment



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3.2 Pin Descriptions

Table 3-1 QFN32 pin description

Pin No.	Name	Type	Drive(mA)	Function
0	E-GND	GND	/	E-pad
1	AGND	GND	/	DAC Ground
2	PE4 / SDPG	I/O	8/32	SD Power Gate IISMCLK-G2 INT1-G2 PWM5-G2 PE4
3	PE7 / MICBIAS2 / ADC9	I/O	8/32	MICBIAS2-300R ADC9 AUXR0 SDDAT0-G3 SPI1DO/SPI1DATA-G4 IISDO/DAT-G2 IIC_DAT-G5 TX0-G4 TX2-G1 HSTRX-G4 INT3-G1 PWM2-G3 TMR4CAP_G1/IR_G8 PE7
4	VUSB	PWR	/	VUSB power input
5	VDDIO	PWR	/	VDDIO power output
6	VBAT	PWR	/	VBAT power input
7	VDDCORE	PWR	/	VDDCORE power
8	LXC	PWR	/	Buck inductor interface for VDDCORE
9	DGND	GND	/	Digital Ground
10	LXT	PWR	/	Buck inductor interface for BT
11	VDDBT	PWR	/	BT power
12	PB2 / WK3 / TK3	I/O	8/32	WK3 Touch3 ADC4 SDDAT0-G2 SPI1DO/SPI1DATA-G3 IISDO/DAT-G3 IIC_DAT-G3 TX0-G2 TX2-G2 HSTRX-G2 INT2-G0 PWM0-G2 PB2

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13	PB1 / WK2 / TK2	I/O	8/32	WK2 Touch2 ADC3 SDCLK-G2 SPI1CLK-G3 IISLRCLK-G3 IIC_CLK-G3/G4 RX0-G2 RX2-G2 HSTRX-G7 INT1-G0 FMOSC-G4 PWM5-G1 TMR3CAP_G4/IR_G4 PB1
14	PB0 / WK1 / TK1	I/O	8/32	WK1 Touch1 ADC11 SDCMD-G2 SPI1DI-G3/SPI2W_DI01-G3 IISSCLK-G3 IIC_DAT-G4 INT6-G0 FMOSC-G3 PWM4-G1 TMR3CAP_G3/IR_G3 PB0
15	PB5 / WK0 / TK0	I/O	8/32	10S Reset WK0 Touch0 ADC12 SPI1DI-G1 SPI2W_DIO1-G1 IISDI-G3 INT5-G0 PWM3-G2 PB5
16	BT_ANT	A	/	BT ANT
17	BT_OSCI	A	/	24M OSC input
18	BT_OSCO	A	/	24M OSC output
19	PB4 / USBDM / ADC6	I/O	8/32	USBDM ADC6 SDDAT0-G4/G6 SPI1DO/SPI1DATA-G1 IISMCLK-G3 IIC_DAT-G7 RX0-G3 HSTRX-G8 INT4-G0 FMOSC-G7 PWM2-G2 PB4
20	PB3 / USBDP / ADC5	I/O	8/32	USBDP ADC5 SDDAT0-G5/SDCMD-G6 SPI1CLK-G1 IISDI-G1 IIC_CLK-G7

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				TX0-G3 HSTRX-G3 INT3-G0 PWM1-G2 PB3
21	PA7/ADC2/AUXR/TK4	I/O	8/32	SD Update interface ADC2 AUXR1 SDDAT0-G1 SPI1DO/SPI1DATA-G2 IISDO/DAT-G1 IIC_DAT-G1 TX0-G1 TX1-G1 HSTRX-G1 INT0-G0 PWM3-G1 PA7
22	PA6/ADC1/AUXL	I/O	8/32	ADC1 AUXL1 SDCLK-G1/G4/G5/G6 SPI1CLK-G2 IISLRCLK-G1 IIC_CLK-G1/G2 RX0-G1 RX1-G1 HSTRX-G6 INT0-G1 FMOSC-G2 PWM2-G1 TMR3CAP_G2/IR_G2 PA6
23	PA5/ADC0	I/O	8/32	ADC0 SDCMD-G1/G4/G5 SPI1DI-G2 IISSCLK-G1 IIC_DAT-G2 RTS INT0-G2 FMOSC-G1 PWM1-G1 TMR3CAP_G1/IR_G1 PA5
24	PA4	I/O	8/32	IISMCLK-G1 CTS INT0-G3 PWM0-G1 PA4
25	PF0/MICBIAS0	I/O	8/32	MICBIAS0 ADC10 IIC_CLK-G8 TX1-G2 HSTRX-G5 INT3-G2 PWM3-G3 TMR5CAP_G1/IR_G9 PF0
26	MIC2P	A	/	Microphone2 positive input
27	MIC2N	A	/	Microphone2 negative input

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28	DACR	A	/	DAC Right Channel
29	DACR#	A	/	DAC differential R#
30	DACL#	A	/	DAC differential L#
31	DACL	A	/	DAC Left Channel
32	VCM	PWR	/	DAC VCM

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

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4 Characteristics

4.1 PMU Parameters

Table 4-1 PMU voltage input Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VUSB	Charger Voltage input	4.6	5.0	5.5	V	
VBAT	Voltage input	3.0	3.7	4.5	V	

Table 4-2 3.3V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDIO	3.3V LDO voltage output	2.4	3.3	3.6	V	Light Loading condition Step 0.1v
△VVDDIO	Output Mismatch 1-sigma	-	17	-	mV	VDDIO=3.3v
ILOAD	Maximum output current	-	-	150	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	750	mA	@VBAT=3.8v

Table 4-3 1.25V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDBT/BT_AVDD	1.25V LDO voltage output	0.85	1.25	1.6	V	Light Loading condition Step 0.05v
△VVDDBT	Output Mismatch 1-sigma	-	9	-	mV	VDDBT=1.25v
ILOAD	Maximum output current	-	-	100	mA	@VBAT=3.0v
ISC	Short Circuit Current Limit	-	-	300	mA	@VBAT=3.8v

Table 4-4 1.1V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDCORE	1.1V LDO voltage output	0.7	1.1	1.475	V	Light Loading condition Step 0.025v
△VVDDCORE	Output Mismatch 1-sigma	-	6	-	mV	VDDCORE=1.1v
ILOAD	Maximum output current	-	-	75	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	300	mA	@VBAT=3.8v

Table 4-5 1.25V BUCK Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDBT	1.25V BUCK voltage output	0.85	1.25	1.6	V	Light Loading condition Step=0.05v
△VVDDBT	Output Mismatch 1-sigma	-	6	-	mV	VDDBT=1.25v
ILOAD	Maximum output current	-	-	360	mA	@VBAT=3.8v
ISC	Short Circuit Current Limit	-	-	360	mA	@VBAT=3.8v

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Table 4-6 1.1V BUCK Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDCORE	1.1V BUCK voltage output	0.7	1.1	1.475	V	Light Loading condition Step=0.025v
△VVDDCORE	Output Mismatch 1-sigma	-	6	-	mV	VDDCORE=1.1v
ILOAD	Maximum output current	-	-	360	mA	@VBAT=3.8v
ISC	Short Circuit Current Limit	-	-	360	mA	@VBAT=3.8v

4.2 IO Parameters

Table 4-6 I/O Parameters

GPIO—Electrical Characteristics							
Symbol	Description	Related GPIO	Min	Typical	Max	Units	Conditions
VIL	Low-level input voltage		-0.3		1.27	V	VDDIO=3.3V
VIH	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
RPUP0	Internal pull-up resister 0		8	10	12	KΩ	
RPUP1	Internal pull-up resister 1		0.24	0.3	0.36	KΩ	
RPUP2	Internal pull-up resister 2		160	200	240	KΩ	
RPDN0	Internal pull-down resister 0		8	10	12	KΩ	
RPDN1	Internal pull-down resister 1		0.24	0.3	0.36	KΩ	
RPDN2	Internal pull-down resister 2		160	200	240	KΩ	

Table 4-7 Internal Resistor Characteristics

Port	General Output	High Drive	Internal Pull-Up Resistor（Ω）	Internal Pull-Down Resistor (Ω)	Comment
PA4-PA7 PB0-PB5 PE0, PE5-PE7 PF0-PF1 PG0-PG5	8mA	32mA	300/10K/200K	300/10K/200K	Internal pull-up/pull-down resistance accuracy +/-20%
PE4	8mA	32mA	10K	10K	

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4.3 Audio DAC Parameters

Table 4-8 Audio DAC Normal Mode Parameters

Mode	Sym	Characteristics	Min	Typ	Max	Unit	Conditions
Differential Mode	SNR		-	104.1	-	dB	VCM cap=1uF VDDDAC cap=NC simulation with 32Ω loading Fin=1KHz
	THD+N		-	-93	-	dB	VCM cap=1uF VDDDAC cap=NC simulation with 32Ω loading Fin=1KHz
	Max Output Range		-	-2.4		dBV	32ohm Loading
VCMBUF Mode	SNR			96.2		dB	VCM cap=1uF VDDDAC cap=NC simulation with 32Ω loading Fin=1KHz
	THD+N			-77.6		dB	VCM cap=1uF VDDDAC cap=NC simulation with 32Ω loading Fin=1KHz
	Max Output Range			-8.6		dBV	32ohm Loading

Table 4-9 Audio DAC Expanded Mode Parameters

Mode	Sym	Characteristics	Min	Typ	Max	Unit	Conditions
Differential Mode	SNR		-	104	-	dB	VCM cap=1uF VDDDAC cap=NC simulation with 32Ω loading Fin=1KHz
	THD+N		-	-95	-	dB	VCM cap=1uF VDDDAC cap=NC simulation with 32Ω loading Fin=1KHz
	Output Range	Maximum output voltage	-	0		dBV	32ohm Loading@VCM=1.2V
VCMBUF Mode	SNR			102.7		dB	VCM cap=1uF VDDDAC cap=NC simulation with 32Ω loading Fin=1KHz

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Mode	Sym	Characteristics	Min	Typ	Max	Unit	Conditions
	THD+N			-72.5		dB	VCM cap=1uF VDDDAC cap=NC simulation with 32Ω loading Fin=1KHz
	Output Range			-1.9		dBV	32ohm Loading@VCM=1.2V

4.4 Audio ADC Parameters

Table 4-10 Audio ADC Parameters

Mode	Sym	Characteristics	Min	Typ	Max	Unit	Conditions
ADC Mode	SNR		-	102	-	dB	VCM cap=NC VDDMIC cap=1uF tran noise simulation Input -2dBV @ Fin=1KHz
	THD+N		-	-97	-	dB	
	Input Range	Maximum input voltage	-	-2	-	dBVrms	
PGA + ADC DIFF Mode	PGA Gain		-6		42	dB	-6 / 0~42dB@step=3dB
	SNR			94		dB	VCM cap=NC VDDMIC cap=1uF diff input Input 0dBV @ Fin=1KHz PGA Gain=0dB
	THD+N			-86		dB	
	Input Range	Maximum input voltage	-	3	-	dBVrms	
PGA + ADC SINGLE Mode	PGA Gain		-6		42	dB	-6 / 0~42dB@step=3dB
	SNR			92		dB	VCM cap=NC VDDMIC cap=1uF single input Input 0dBV @ Fin=1KHz PGA Gain=0dB
	THD+N			-63		dB	
	Input Range	Maximum input voltage	-	1	-	dBVrms	

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4.5 BT Parameters

Table 4-11 BT Parameters

Characteristics	Min	Typical	Max	Unit	Conditions
Transmit Power	-	9	10.5	dBm	
RMS DEVM	-	5.5	-	%	Maximum TX power 2-DH5 packet
Peak DEVM	-	15	20	%	
EDR Relative Transmit Power	-	-0.2	-	dB	
Sensitivity @ Basic Rate	-	-94.5	-	dBm	BER=0.1%, using DH5 packet
Sensitivity @ EDR	-	-94.5	-	dBm	BER=0.01%, using 2-DH5 packet

4.6 Current Parameters

Table 4-12 Current Parameters

Mode	Characteristics	Min	Typ	Max	Unit	Conditions
With DC DC Buck Mode	TX RF Current @Pout = 0dBm		TBC		mA	VBAT=3.3V
	RX RF Current @Sensitivity level		TBC		mA	
	Supply Current @Sleep with RAM retention		TBC		uA	
	Supply Current @Deep sleep		TBC		uA	
	Supply Current @Power Down		TBC		uA	
	Supply Current @Sniff		TBC		uA	500ms interval
	Supply Current @Discoverable		TBC		uA	500ms interval
W/O DC DC LDO Mode	TX RF Current @Pout = 0dBm		TBC		mA	VBAT=3.3V
	RX RF Current @Sensitivity level		TBC		mA	
	Supply Current @ Sleep with RAM retention		TBC		uA	
	Supply Current @Deep sleep		TBC		uA	
	Supply Current @Power Down		TBC		uA	
	Supply Current @Sniff		TBC		uA	500ms interval
	Supply Current @Discoverable		TBC		uA	500ms interval

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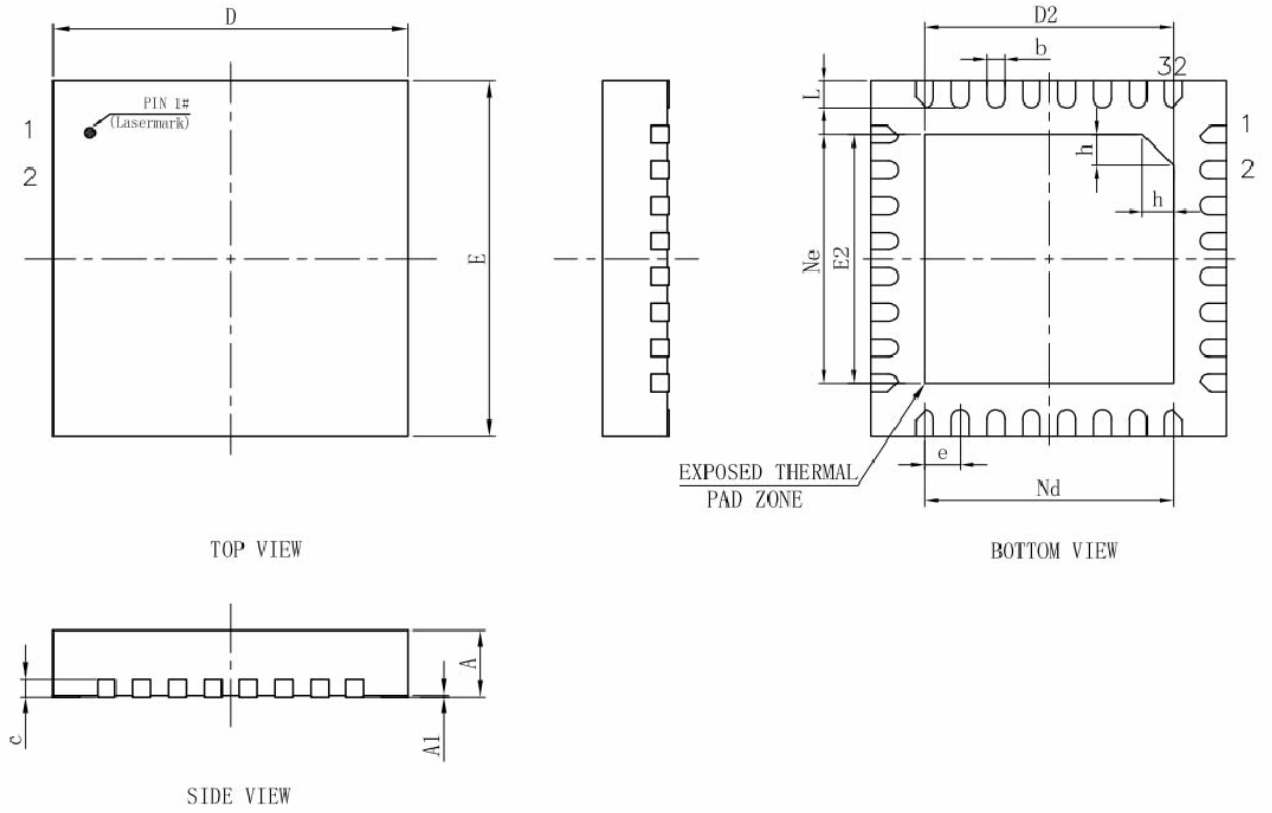
5 Package Information



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	3.90	4.00	4.10
D2	2.70	2.80	2.90
e	0.40BSC		
Ne	2.80BSC		
Nd	2.80BSC		
E	3.90	4.00	4.10
E2	2.70	2.80	2.90
L	0.25	0.30	0.35
h	0.30	0.35	0.40
L/F载体尺寸	122X122		

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