FR801xHTechnical Specifications

Bluetooth low energy SOC chip supporting SIG MESH

Version Number:v1.1.5

release date:2023.07

FREQCHIP
富 芮 坤

Table of contents

sheet

illustration

Overview

FR801xHThe series of chips are aimed atSOC(System on Chip), easy to

Rapidly develop low-power Bluetooth chips. Based onFreqchipBluetooth

Intelligent firmware and protocol stack support, fully compatible with BluetoothV5.1 （LE

mode) protocol. At the same time, users can use the chip's built-inARM

CorteM3Embedded32High-performance microcontroller to develop various applications

sequence.

Bluetooth Smart firmware includesL2CAPService layer protocol, security manager

（SM), Attribute Protocol (ATT), Common Attributes Configuration File

(GATT) and Generic Access Profile (GAP). In addition,

Supports application profiles such as proximity, health thermometer, heart rate

rate, blood pressure, blood sugar, human interface device (HID) and SDK (including

Drivers, OS-API, etc.). The SDK also integrates

SIG Mesh protocol for the program.

Using Freqchip's innovative technology, PMU (lithium battery charger)

+ LDO), QSPI FLASH ROM with XIP mode, I2C,

UART, GPIO, ADC, PWM are integrated into one chip, providing customers with

supply:

- Competitive power consumption

- Stable Bluetooth connection

- Very lowBOMcost

characteristic

CPU and Memory

- CPU

  - built-in32BitARM Cortex-M3Kernel, support

  Hold the highest48MHzClock frequency

- Memory

  - 256KB/512KB/1MB Flash

  User software and data storage

  - 48KB SRAM

  - 128KB ROM

    - BOOTStartup Code

    - Controller(controller)Protocol Stack

- ROMfirmware

  - BLE Profile & Protocol: GATT, LM, LC

  - APIdrive

  - SIG MESHProtocol Stack

Bluetooth

- BluetoothV5.1 LEstandard

- support2M/1M/500K/125KData Rate

Power Management

- integratedDC-DC,LDO

Digital Interface

- GeneralGPIO

- Timer

- Efuse 128bit

- SPIM

- SPIS

- UART （FIFOdepth16/32)

- SPI/QSPI

- I2C (FIFOdepth8/32)

- PWM

- PDM

Analog interface

- 8aisle10-bit SAR ADC

Working conditions

- Working environment temperature: -40℃ ~ +105℃

Application Areas

- Smart Keyboard and Mouse

- Smart Wear

- Smart Lock

- Smart Home

- Internet of Things

- SIG Meshapplication

Ordering Information

model	Ambient temperature	FLASHcapacity	Encapsulation	size
FR8012HB	-40°C ~ +105°C	256KB	SOP16	10.0×3.9×1.5, 1.2pitch
FR8012HAS	-40°C ~ +105°C	512KB	SOP16	10.0×3.9×1.5, 1.2pitch
FR8012HAQ	-40°C ~ +105°C	512KB	QFN32	4.0×4.0×0.75, 0.4pitch
FR8012HAQ-J	-40°C ~ +105°C	512KB	QFN32	4.0×4.0×0.85, 0.4pitch
FR8016HA	-40°C ~ +105°C	512KB	QFN32	4.0×4.0×0.75, 0.4pitch
FR8016HD	-40°C ~ +105°C	1MB	QFN32	4.0×4.0×0.85, 0.4pitch
FR8018HA	-40°C ~ +105°C	512KB	QFN48	6.0×6.0×0.75, 0.4pitch
FR8018HD	-40°C ~ +105°C	1MB	QFN48	6.0×6.0×0.75, 0.4pitch

1. System Overview

1.1Functional Block Diagram
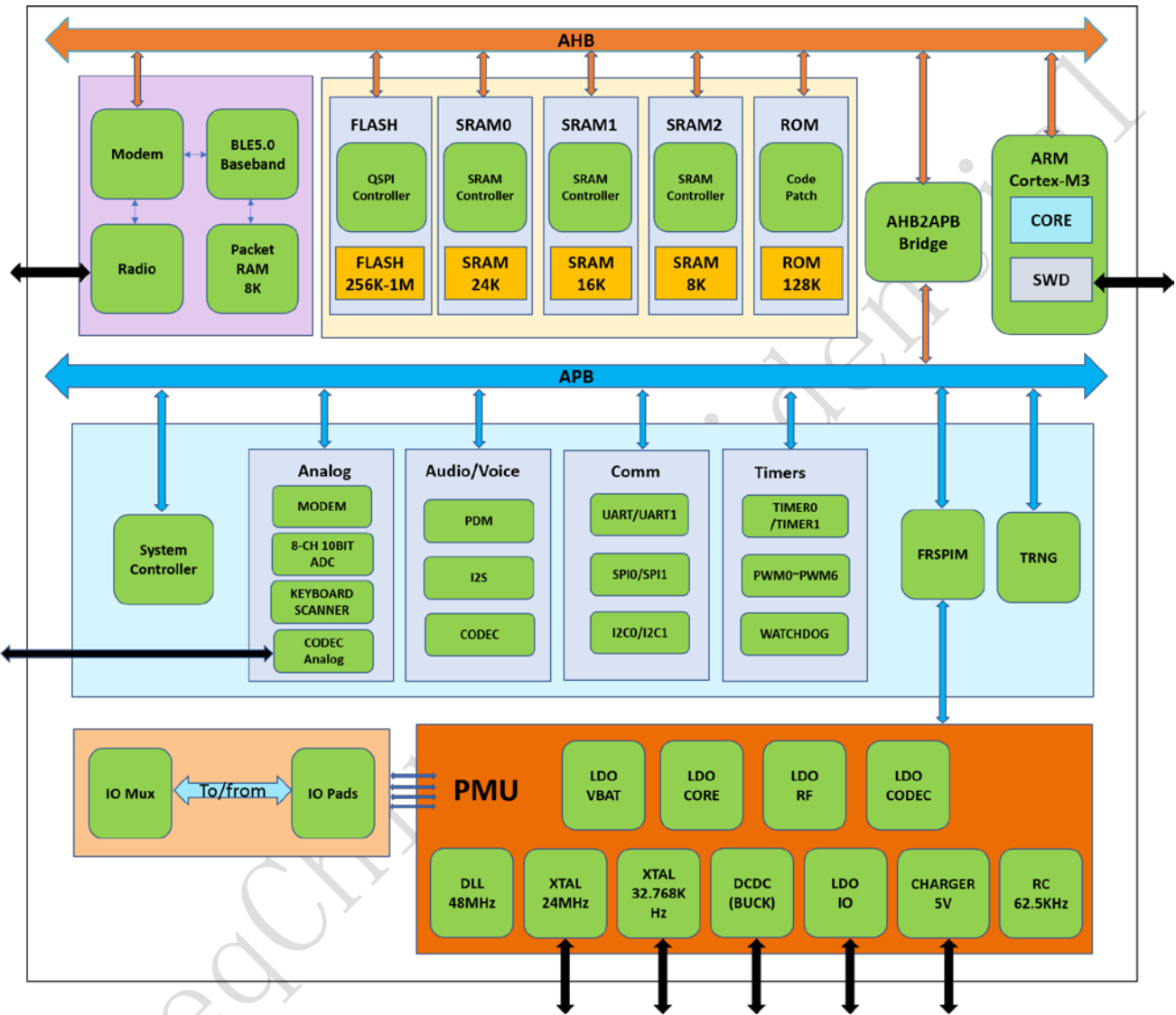
picture1-1Functional Block Diagram

1.2 Hardware Resources

FR801xHThe hardware resources of each model in the series are shown in the following table:

sheet1-1 FR801xHHardware Resources

Series	Part NO.	FLASH(KB)	RAM (KB)	GPIO	Timer	RTC	UART	I2C	SPI	QSPI	I2S	ADC	Charge	LVD	PDM	AES	TRNG
FR801xH	FR8012HB	256	48	7	2	√	2	2	1	-	1	3ch	-	√	1	AES-128	1
	FR8012HAS	512	48	7	2	√	2	2	1	-	1	3ch	-	√	1	AES-128	1
	FR8012HAQ	512	48	15	2	√	2	2	1	-	1	4ch	√	√	1	AES-128	1
	FR8012HAQ-J	512	48	19	2	√	2	2	1	-	1	4ch	√	√	1	AES-128	1
	FR8016HA	512	48	15+2[1]	2	√	2	2	1	-	1	4ch	√	√	1	AES-128	1
	FR8016HD	1024	48	19+2[1]	2	√	2	2	1	-	1	4ch	√	√	1	AES-128	1
	FR8018HA	512	48	30	2	√	2	2	1	-	1	4ch	√	√	1	AES-128	1
	FR8018HD	1024	48	30	2	√	2	2	1	-	1	4ch	√	√	1	AES-128	1

1.3Bluetooth RF transceiver

- Built-in antenna impedance matching circuit (50Ω impedance matching in both transmit and receive modes)

- conform toBluetooth v5.1 LEstandard

- Up to 10dBm transmit power

- Sensitivity -92~-95dBm

- Internal integrated channel filter

- Built-in digital demodulator for improved sensitivity and co-channel rejection

- Real-time digitized RSSI value

1.4Bluetooth controller

- Supports all device types, including: Broadcaster, Central, Observer, Peripheral (Broadcaster, Central, Observer, Peripheral)

- Supports all packet types, including: broadcast, data, control (Advertising / Data / Control)

- Support encryption (AES/CCM)

- Support bit stream processing (CRC, Whitening)

- Support frequency hopping calculation

- Support baseband power down during protocol idle period

1.5Peripheral Interface Unit

- UART interface can be used for debugging and AT command mode

- I2C interface supports external EEPROM, and other common devices such as accelerometers, etc.

- Up to 30 general purpose IO ports, all can be set to interrupt mode

- Universal 10-bit ADC interface, supports key mode and other analog inputs

- 6aislePWMController

- Multi-channel general purpose programmable timer

- Tracking abnormal watchdog circuit

1.6Power Management Unit

- Support power-on reset

- On-chip high-efficiency switching power supply, supports direct connection of lithium batteries to the chip, input voltage 1.8v to 4.3v, output voltage programmable

- On-chip low dropout (LDO) linear regulator for powering internal digital, RF, and analog circuits

- Power management unit supports software shutdown and hardware wake-up

- Power-on reset unit supports low voltage detection

- Built-in supply voltage detection function

1.7Charge Management Unit

Charging process:

Insert the charger (ie, VCHG is powered on), connect the lithium battery to the VBAT terminal, and the charger detects the voltage value of the VBAT terminal. If the voltage of the VBAT terminal is detected,

When the voltage is lower than the trickle charge to constant current charge switching voltage (hereinafter referred to as the trickle charge threshold voltage), the charger will first charge the battery with a trickle charge current of 0.1C.

The battery is charged until the battery voltage reaches the trickle charge threshold voltage, and then the battery voltage is charged to the charge cut-off voltage with a 1.0C constant current charge current.

After reaching the charge cut-off voltage, the charging current gradually decreases. When the charging current decreases to the charge cut-off current, the charger completely stops charging the battery.

If the charger detects that the VBAT voltage drops to 0.15V lower than the charge cut-off voltage, the charger will charge the battery again with a constant current.

electricity.

In another case, the charger is inserted and the lithium battery is connected to the VBAT terminal. If the charger detects that the VBAT terminal voltage is higher than the trickle charge threshold voltage,

When the voltage is lowered, the Charger will enter the constant current charging mode to start the charging process. The subsequent charging status is exactly the same as the first case mentioned above.

Module features:

- Supports Li-ion/Li-polymer battery charging

- Built-in low voltage detection (LVD)

- Programmable charge current, fast charging supports up to 200mA charge current without external components

- Trickle charge current: M = 0.10/0.15/0.20/0.25 times the constant current charge current, configurable through registers

- Trickle charge threshold voltage: 2.7/2.8/2.9/3.0V

- Constant current charging current: up to 300mA, configurable through register

- Charging cut-off voltage: 4.1V~4.4V, configurable through register, 50mV level

- Charge cut-off current: N = 0.10/0.15/0.20/0.25 times the constant current charge current, configurable through registers

- Recharge voltage: When VBAT is detected to be 0.15V lower than the charge cut-off voltage, the recharge mechanism will be triggered.

The charging process curve is shown in the figure1-2As shown:
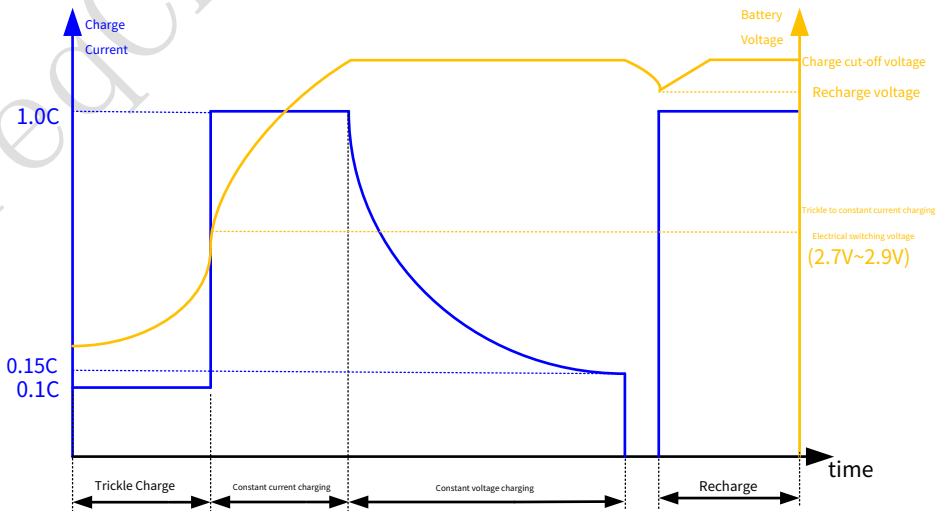
picture1-2Charging curve diagram

2.   Hardware Information

2.1Package definition

2.1.1 FR8012HBPins layout
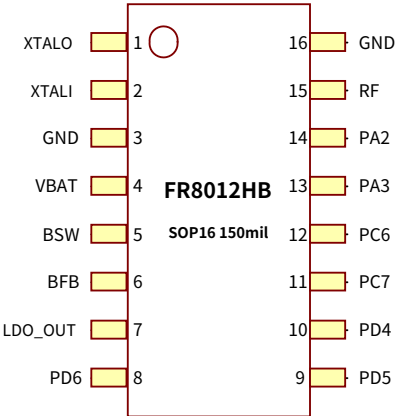
picture2-1 FR8012HBPin layout diagram

2.1.2 FR8012HASTube Foot layout
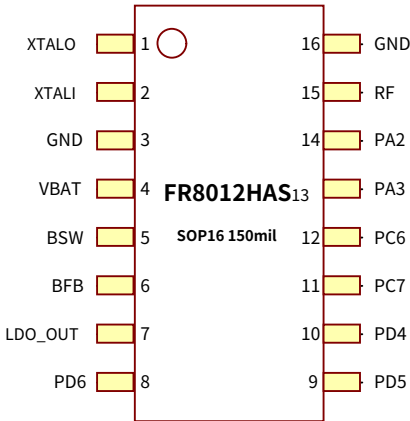
picture2-2 FR8012HASPin layout diagram

2.1.3 FR8012HAQPin Layout

PA6 PA7 PA0 PA1 PA2 PA3 PC5 PC6

32 31 30 29 28 27 26 25

PA4 1	twenty four PC7
PA5 2	twenty three PD4
LED2 3	twenty two PD5
LED1 4	twenty one PD6
RF 5	20 PD7
GND 6	19 LDO_OUT
XTALO 7	18 BFB
XTALI 8	17 BSW

FR8012HAQ

QFN32 4x4

GND PAD

9 10 11 12 13 14 15 16

NC NC NC NC NC RSTP VCHG VBAT
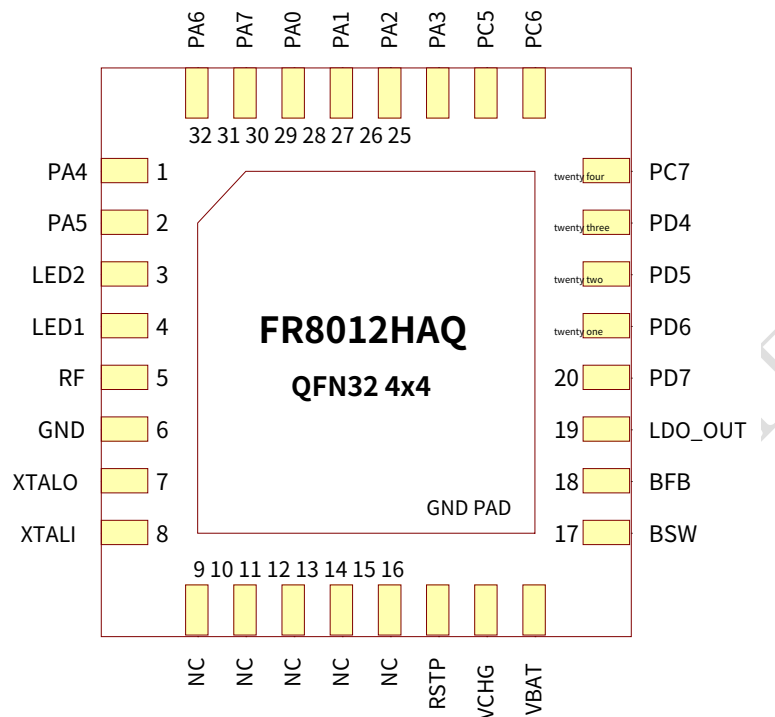
picture2-3 FR8012HAQPin layout diagram

2.1.4 FR8012HAQ-JPin Layout

PA6 PA7 PA0 PA1 PA2 PA3 PC5 PC6

32 31 30 29 28 27 26 25

PA4 1	twenty four PC 7
PA5 2	twenty three PD4
LED2 3	twenty two PD5
LED1 4	twenty one PD6
RF 5	20 PD7
GND 6	19 LDO_OUT
XTALO 7	18 BFB
XTALI 8	17 BSW

FR8012HAQ-J

QFN32 4x4

GND PAD

9 10 11 12 13 14 15 16

PB5 PB7 PD0 PD1 N/A RSTP VCHG VBAT
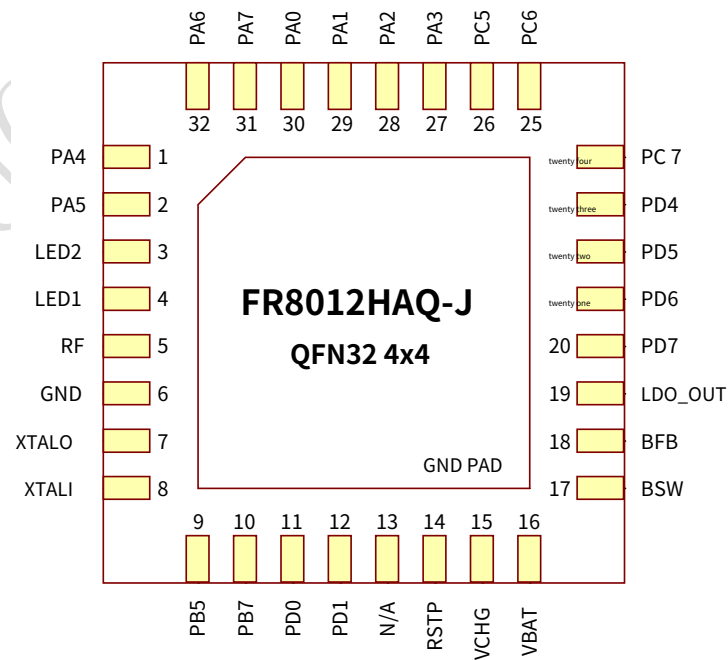
picture2-4 FR8012HAQ-JPin layout diagram

2.1.5 FR8016HAPin Layout
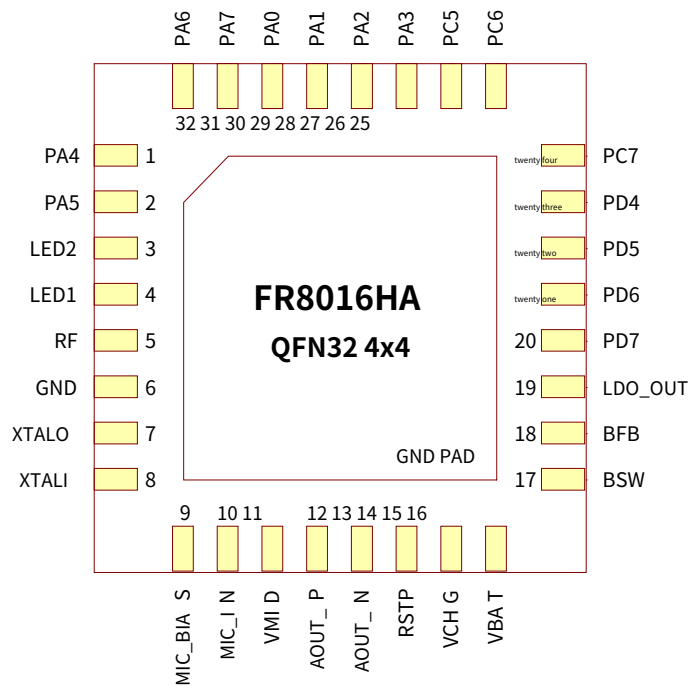
picture2-5 FR8016HAPin layout diagram

2.1.6 FR8016HDPin Layout
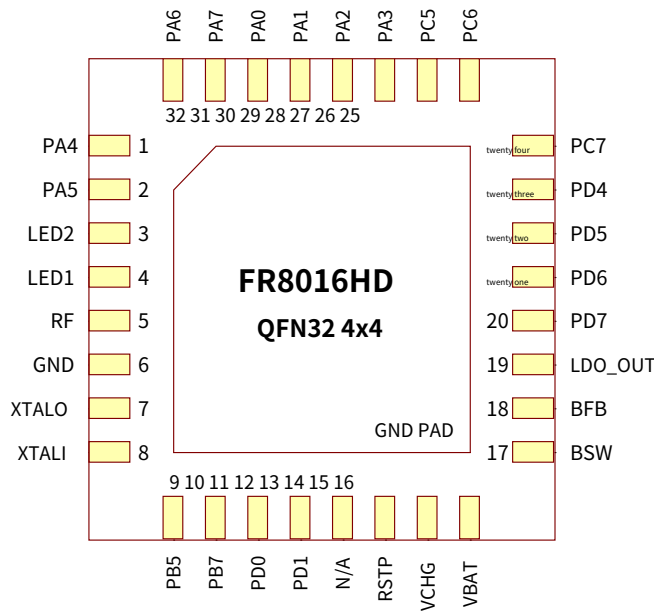
picture2-6 FR8016HDPin layout diagram

2.1.7 FR8018HA/FR8018HDPin Layout
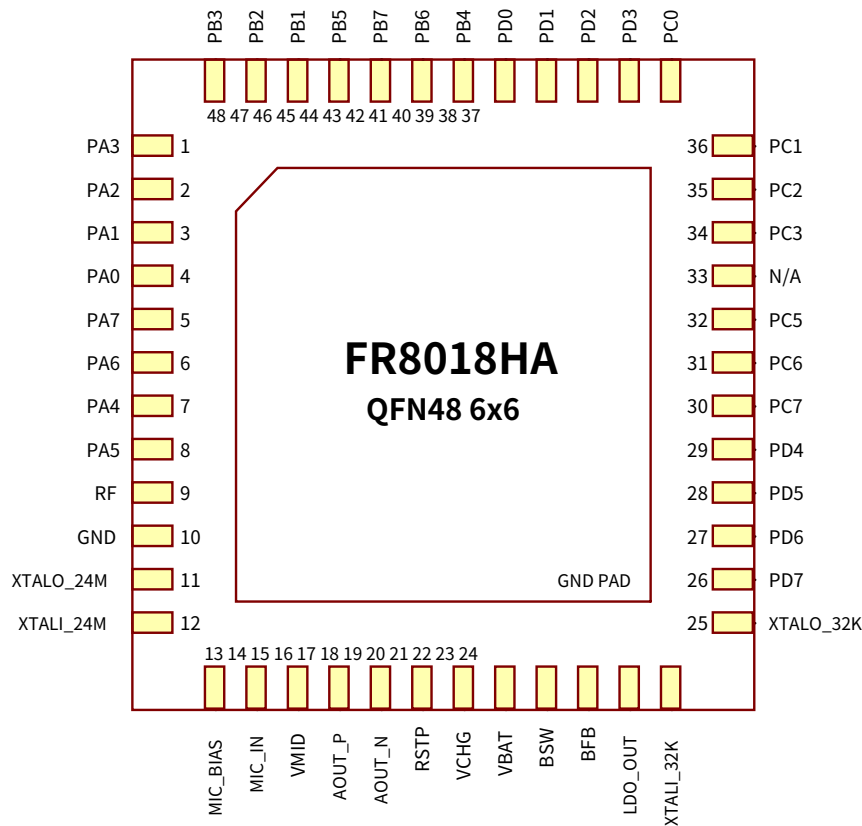
picture2-7 FR8018HA/FR8018HDPin layout diagram

2.2Package size

2.2.1 FR8012HB/FR8012HASSize parameters
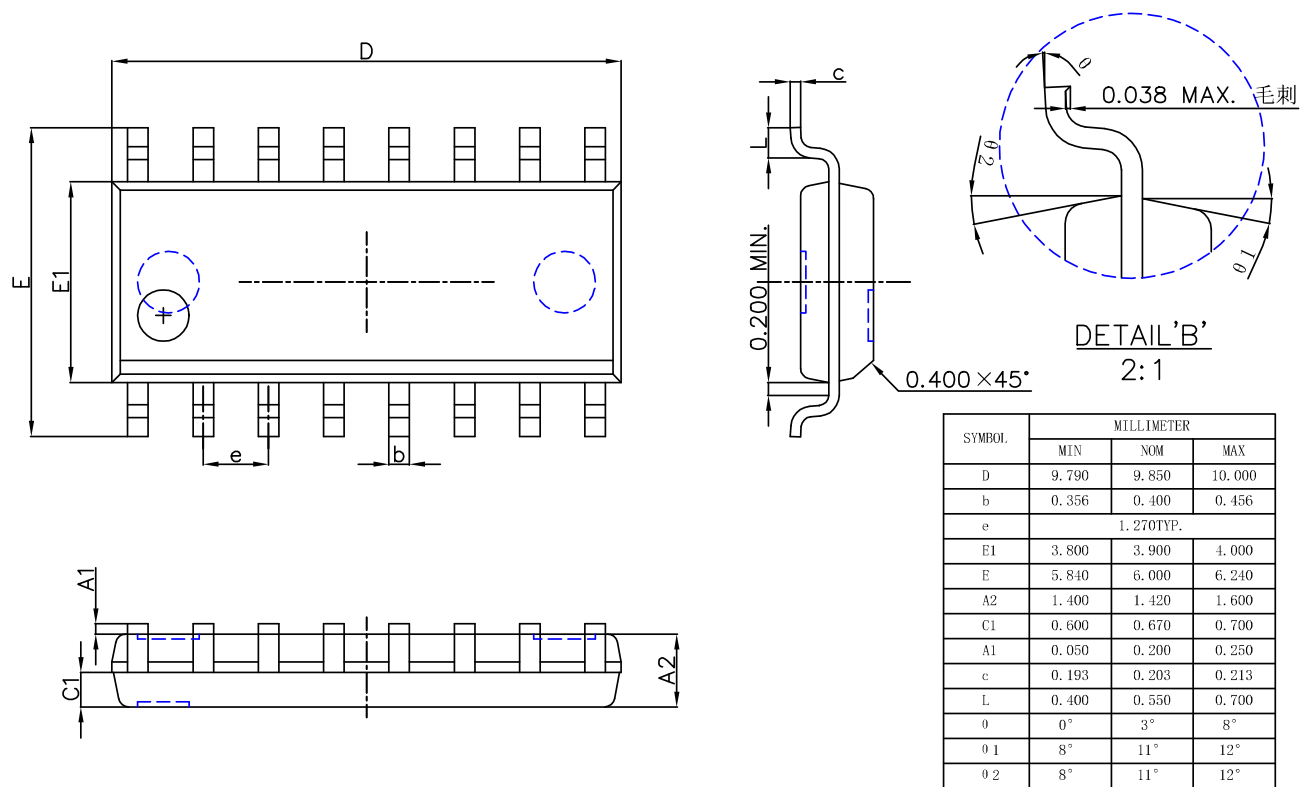
picture2-8 FR8012HB/FR8012HASPackage Dimensions

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
D	9.790	9.850	10.000
b	0.356	0.400	0.456
e	1.270TYP.		
E1	3.800	3.900	4.000
E	5.840	6.000	6.240
A2	1.400	1.420	1.600
C1	0.600	0.670	0.700
A1	0.050	0.200	0.250
c	0.193	0.203	0.213
L	0.400	0.550	0.700
θ	0°	3°	8°
$\theta 1$	8°	11°	12°
$\theta 2$	8°	11°	12°

2.2.2 FR8012HAQ/ FR8012HAQ-J/ FR8016HA/ FR8016HDSize parameters

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
	0.80	0.85	0.90
	0.85	0.90	0.95
A1	0	0.02	0.05
b	0.15	0.20	0.25
b1	0.14REF		
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 Carrier Size	122X122		

TOP VIEW

SIDE VIEW

EXPOSED THERMAL PAD ZONE

BOTTOM VIEW
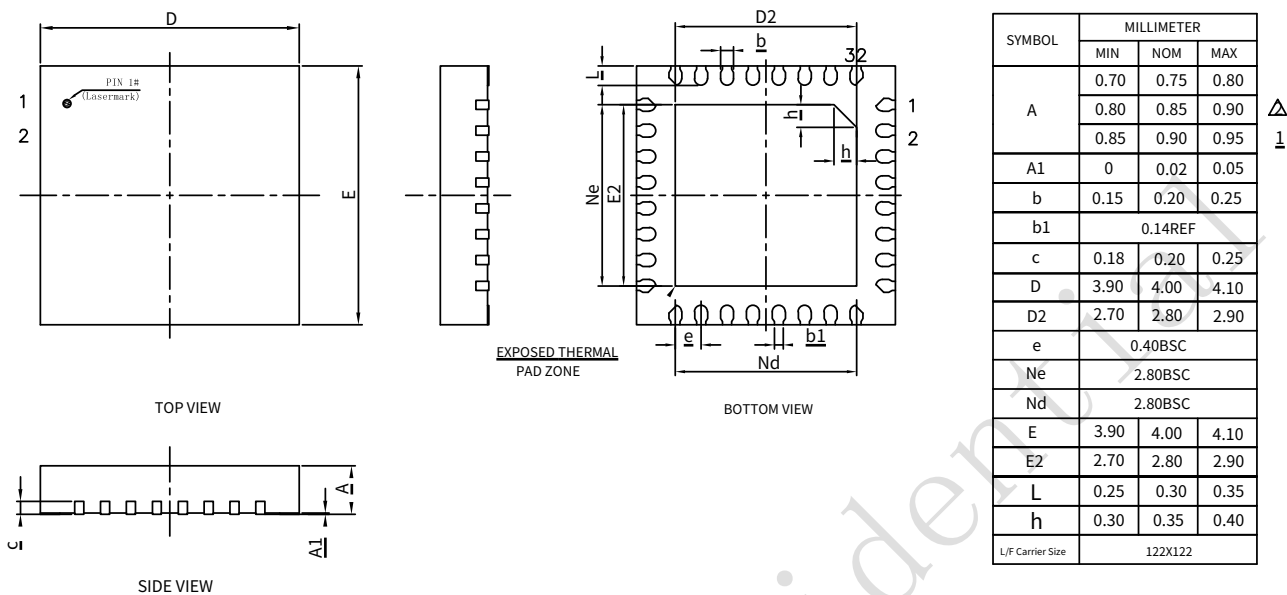
picture2-9 FR8012HAQ/FR8012HAQ-J/FR8016HA/FR8016HDPackage Dimensions

2.2.3 FR8018HA/FR8018HDSize parameters

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.23
D	5.90	6.00	6.10
D2	4.10	4.20	4.30
e	0.40BSC		
Ne	4.40BSC		
Nd	4.40BSC		
E	5.90	6.00	6.10
E2	4.10	4.20	4.30
L	0.35	0.40	0.45
h	0.30	0.35	0.40
L/F载体尺寸(MIL)	177*177		

EXPOSED THERMAL PAD ZONE

BOTTOM VIEW
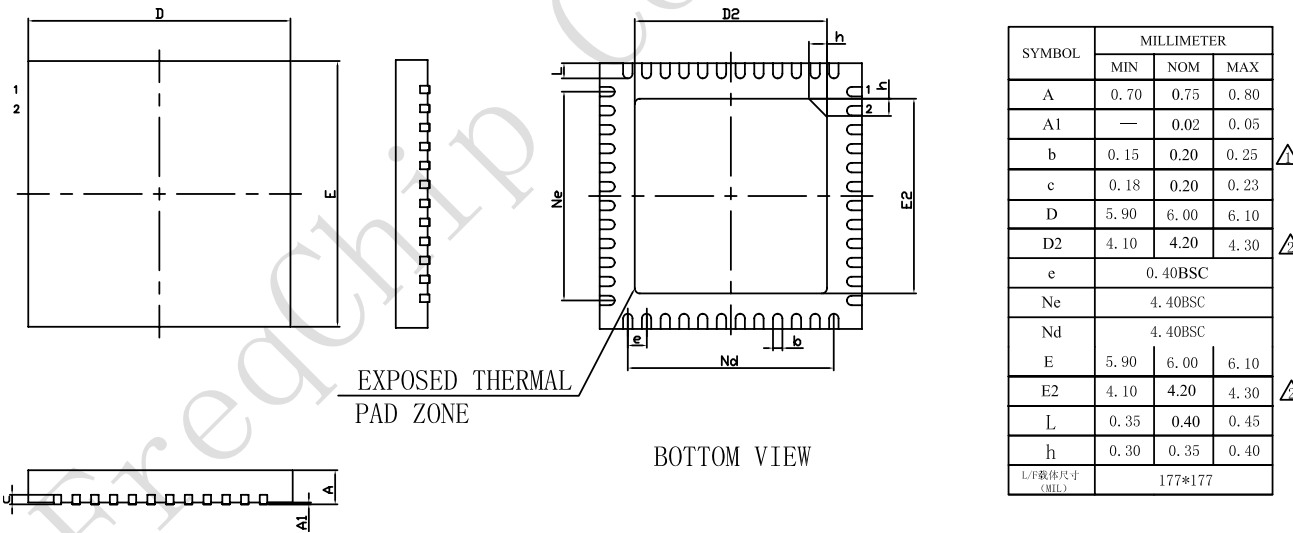
picture2-10 FR8018HA/FR8018HDPackage Dimensions

2.3   Pin Description

FR801xHSeries isCMOSThe floating of the input signal will cause unstable operation of the device and abnormal current consumption.

Or pull-down resistors should be used appropriately for input or bidirectional pins.

sheet2-1Pin-related abbreviations

type	illustrate
I	Digital Input
O	Digital Output
AI	Analog Input
AO	Analog Output
IO	Bidirectional digital interface
OD	Open drain interface
PWR	power supply
GND	land

2.3.1 FR8012HB/FR8012HASPin Description

sheet2-2 FR8012HB/FR8012HASPin Description

Pin Number		Pin Name	type	Pin Description
FR8012HB	FR8012HAS			
1		XTALO	AO	Crystal output
2		XTALI	AI	Crystal input
3		GND	GND	land
4		VBAT	PWR	Power Input
5		BSW	AO	DC/DCOutput
6		BFB	AI	DC/DCFeedback input
7		LDO_OUT	PWR	Internal LDO output
8		PD6	I/O	PD6/SCL1/I2SDOUT/PWM0/SSPDOUT/URXD0/URXD1/CLKOUT/PDMCLK/PWM1/ADC2
9		PD5	I/O	PD5/SDA0/I2SFRM/PWM5/SSPCSN/UTXD0/UTXD1/ANTCTL0/PDMDAT/PWM4/ADC1
10		PD4	I/O	PD4/SCL0/I2SCLK/PWM4/SSPCLK/URXD0/URXD1/ANTCTL0/PDMCLK/PWM5/ADC0
11		PC7	I/O	PC7/SDA1/I2SDIN/PWM5/SSPDIN/UTXD0/UTXD1/SWDIO/PDMDAT/PWM4
12		PC6	I/O	PC6/SCL1/I2SDOUT/PWM4/SSPDOUT/URXD0/URXD1/SWTCK/PDMCLK/PWM5

Pin Number		Pin Name	type	Pin Description
FR8012HB	FR8012HAS			
13		PA3	I/O	PA3/SDA1/I2SDIN/PWM3/SSPDIN/UTXD0/UTXD1/ANTCTL1/PDMDAT/PWM2
14		PA2	I/O	PA2/SCL1/I2SDOUT/PWM2/SSPDOUT/URXD0/URXD1/ANTCTL0/PDMCLK/PWM3
15		RF	AI/O	Antenna input and output
16		GND	GND	land

2.3.2 FR8012HAQ/FR8012HAQ-J/FR8016HA/FR8016HDPin Description

sheet2-3 FR8012HAQ/FR8012HAQ-J/FR8016HA/FR8016HDPin Description

Pin Number				Pin Name	type	Pin Description
FR8012HAQ	FR8012HAQ-J	FR8016HA	FR8016HD			
1	1	1	1	PA4	I/O	PA4/SCL0/I2SCLK/PWM4/SSPCLK/URXD0/URXD1/CLKOUT/PDMCLK/PWM5
2	2	2	2	PA5	I/O	PA5/SDA0/I2SFRM/PWM5/SSPCSN/UTXD0/UTXD1/ANTCTL1/PDMDAT/PWM4
3	3	3	3	LED2	O	LED2 output control
4	4	4	4	LED1	O	LED1 output control
5	5	5	5	RF	AI/O	Antenna input and output
6	6	6	6	GND	GND	land
7	7	7	7	XTALO	AO	Crystal output
8	8	8	8	XTALI	AI	Crystal input
9	-	-	-	NC	-	Not connected
-	-	9	-	MIC_BIAS	AO	Microphone bias output
-	9	-	9	PB5	I/O	PB5/SDA0/I2SFRM/PWM5/SSPCSN/UTXD0/UTXD1/ANTCTL0/PDMDAT/PWM4
10	-	-	-	NC	-	Not connected

Pin Number						
FR8012HAQ	FR8012HAQ-J	FR8016HA	FR8016HD	Pin Name	type	Pin Description
-	-	10	-	MIC_IN	AI	Microphone Input
-	10	-	10	PB7	I/O	PB7/SDA1/I2SDIN/PWM3/SSPDIN/UTXD0/UTXD1/CLKOUT/PDMDAT/PWM2
11	-	-	-	NC	-	Not connected
-	-	11	-	VMID	AI	Audio CODEC common mode voltage input
-	11	-	11	PD0	I/O	PD0/SCL0/I2SCLK/PWM0/SSPCLK/URXD0/URXD1/BLETX/PDMCLK/PWM1
12	-	-	-	NC	-	Not connected
-	-	12	-	AOUT_P	AO	Audio Output+
-	12	-	12	PD1	I/O	PD1/SDA0/I2SFRM/PWM1/SSPCSN/UTXD0/UTXD1/BLERX/PDMDAT/PWM0
13	13	-	13	NC	-	Not connected
-	-	13	-	AOUT_N	AO	Audio Output -
14	14	14	14	RSTP	AI	Chip reset
15	15	15	15	VCHG	PWR	Charge management power supply voltage input
16	16	16	16	VBAT	PWR	Power Input
17	17	17	17	BSW	AO	DC/DCOutput
18	18	18	18	BFB	AI	DC/DCFeedback input
19	19	19	19	LDO_OUT	AO	Internal LDO output
20	20	20	20	PD7	I/O	PD7/SDA1/I2SDIN/PWM1/SSPDIN/UTXD0/UTXD1/ANTCTL1/PDMDAT/PWM0/ADC3
twenty one	twenty one	twenty one	twenty one	PD6	I/O	PD6/SCL1/I2SDOUT/PWM0/SSPDOUT/URXD0/URXD1/CLKOUT/PDMCLK/PWM1/ADC2
twenty two	twenty two	twenty two	twenty two	PD5	I/O	PD5/SDA0/I2SFRM/PWM5/SSPCSN/UTXD0/UTXD1/ANTCTL0/PDMDAT/PWM4/ADC1
twenty three	twenty three	twenty three	twenty three	PD4	I/O	PD4/SCL0/I2SCLK/PWM4/SSPCLK/URXD0/URXD1/ANTCTL0/PDMCLK/PWM5/ADC0
twenty four	twenty four	twenty four	twenty four	PC7	I/O	PC7/SDA1/I2SDIN/PWM5/SSPDIN/UTXD0/UTXD1/SWDIO/PDMDAT/PWM4

Pin Number				Pin Name	type	Pin Description
FR8012HAQ	FR8012HAQ-J	FR8016HA	FR8016HD			
25	25	25	25	PC6	I/O	PC6/SCL1/I2SDOUT/PWM4/SSPDOUT/URXD0/URXD1/SWTCK/PDMCLK/ PWM5
26	26	26	26	PC5	I/O	PC5/SDA0/I2SFRM/PWM5/SSPCSN/UTXD0/UTXD1/SWV/PDMDAT/PWM 4
27	27	27	27	PA3	I/O	PA3/SDA1/I2SDIN/PWM3/SSPDIN/UTXD0/UTXD1/ANTCTL1/PDMDAT/ PWM2
28	28	28	28	PA2	I/O	PA2/SCL1/I2SDOUT/PWM2/SSPDOUT/URXD0/URXD1/ANTCTL0/PDMC LK/ PWM3
29	29	29	29	PA1	I/O	PA1/SDA1/I2SDIN/PWM3/SSPDIN/UTXD0/UTXD1/ANTCTL1/PDMDAT/ PWM2
30	30	30	30	PA0	I/O	PA0/SCL0/I2SCLK/PWM0/SSPCLK/URXD0/URXD1/CLKOUT/PDMCLK/P WM1
31	31	31	31	PA7	I/O	PA7/SDA1/I2SDIN/PWM1/SSPDIN/UTXD0/UTXD1/ANTCTL0/PDMDAT/ PWM0
32	32	32	32	PA6	I/O	PA6/SCL1/I2SDOUT/PWM0/SSPDOUT/URXD0/URXD1/CLKOUT/PDMCL K/ PWM1

2.3.3 FR8018HA/FR8018HDPin Description

sheet2-4 FR8018HA/FR8018HDPin Description

| Pin Number		Pin Name	type	Pin Description
FR8018HA	FR8018HD			
1		PA3	DIO	SDA1/I2SDIN/PWM3_P/SSPDIN/UTXD0/UTXD1/ANTCTL1/PDMDAT/ PWM2_N
2		PA2	DIO	SCL1/I2SDOUT/PWM2_P/SSPDOUT/URXD0/URXD1/ANTCTL0/PDM CLK/PWM3_N

Pin Number		Pin Name	type	Pin Description
FR8018HA	FR8018HD			
3		PA1	DIO	SDA0/I2SFRM/PWM1_P/SSPCSN/UTXD0/UTXD1/ANTCTL0/PDMDAT/PWM0_N
4		PA0	DIO	SCL0/I2SCLK/PWM0_P/SSPCLK/URXD0/URXD1/CLKOUT/PDMCLK/PWM1_N
5		PA7	DIO	SDA1/I2SDIN/PWM1_P/SSPDIN/UTXD0/UTXD1/ANTCTL0/PDMDAT/PWM0_N
6		PA6	DIO	SCL1/I2SDOUT/PWM0_P/SSPDOUT/URXD0/URXD1/CLKOUT/PDMCLK/PWM1_N
7		PA4	DIO	SCL0/I2SCLK/PWM4_P/SSPCLK/URXD0/URXD1/CLKOUT/PDMCLK/PWM5_N
8		PA5	DIO	SDA0/I2SFRM/PWM5_P/SSPCSN/UTXD0/UTXD1/ANTCTL1/PDMDAT/PWM4_N
9		RF	AIO	Antenna input and output
10		GND	GND	land
11		XTALO_24M	AO	24MHzCrystal output
12		XTALI_24M	AI	24MHzCrystal input
13		MIC_BIAS	AO	Microphone bias output
14		MIC_IN	AI	Microphone Input
15		VMID	AI	Audio CODEC common mode voltage input
16		AOUT_P	AO	Audio Output+
17		AOUT_N	AO	Audio Output -
18		RSTP	AI	Chip reset pin, high effective
19		VCHG	PWR	Charge management power supply voltage input
20		VBAT	PWR	Power Input
twenty one		BSW	AO	DC/DCOutput
twenty two		BFB	AI	DC/DCFeedback input
twenty three		LDO_OUT	AO	Internal LDO output
twenty four		XTALI_32K	AI	32KHzCrystal input
25		XTALO_32K	AO	32KHzCrystal output
26		PD7	DIO	SDA1/I2SDIN/PWM1_P/SSPDIN/UTXD0/UTXD1/ANTCTL1/PDMDAT/PWM0_N/ADC3
27		PD6	DIO	SCL1/I2SDOUT/PWM0_P/SSPDOUT/URXD0/URXD1/CLKOUT/PDMCLK/PWM1_N/ADC2

Pin Number FR8018HA FR8018HD	Pin Name	type	Pin Description
28	PD5	DIO	SDA0/I2SFRM/PWM5_P/SSPCSN/UTXD0/UTXD1/ANTCTL0/PDMDAT/PWM4_N/ADC1
29	PD4	DIO	SCL0/I2SCLK/PWM4_P/SSPCLK/URXD0/URXD1/ANTCTL0/PDMCLK/PWM5_N/ADC0
30	PC7	DIO	SDA1/I2SDIN/PWM5_P/SSPDIN/UTXD0/UTXD1/SWDIO/PDMDAT/PWM4_N
31	PC6	DIO	SCL1/I2SDOUT/PWM4_P/SSPDOUT/URXD0/URXD1/SWTCK/PDMCLK/PWM5_N
32	PC5	DIO	SDA0/I2SFRM/PWM5_P/SSPCSN/UTXD0/UTXD1/SWV/PDMDAT/PWM4_N
33	N/A	N/A	Not connected
34	PC3	DIO	SDA1/I2SDIN/PWM3_P/SSPDIN/UTXD0/UTXD1/SWV/PDMDAT/PWM2_N
35	PC2	DIO	SCL1/I2SDOUT/PWM2_P/SSPDOUT/URXD0/URXD1/SWV/PDMCLK/PWM3_N
36	PC1	DIO	SDA0/I2SFRM/PWM1_P/SSPCSN/UTXD0/UTXD1/SWV/PDMDAT/PWM0_N
38	PD3	DIO	SDA1/I2SDIN/PWM3_P/SSPDIN/UTXD0/UTXD1/WLANRX/PDMDAT/PWM2_N
37	PC0	DIO	SCL0/I2SCLK/PWM0_P/SSPCLK/URXD0/URXD1/SWV/PDMCLK/PWM1_N
39	PD2	DIO	SCL1/I2SDOUT/PWM2_P/SSPDOUT/URXD0/URXD1/WLANTX/PDMCLK/PWM3_N
40	PD1	DIO	SDA0/I2SFRM/PWM1_P/SSPCSN/UTXD0/UTXD1/BLERX/PDMDAT/PWM0_N
41	PD0	DIO	SCL0/I2SCLK/PWM0_P/SSPCLK/URXD0/URXD1/BLETX/PDMCLK/PWM1_N
42	PB4	DIO	SCL0/I2SCLK/PWM4_P/SSPCLK/URXD0/URXD1/CLKOUT/PDMCLK/PWM5_N
43	PB6	DIO	SCL1/I2SDOUT/PWM2_P/SSPDOUT/URXD0/URXD1/ANTCTL1/PDMCLK/PWM3_N
44	PB7	DIO	SDA1/I2SDIN/PWM3_P/SSPDIN/UTXD0/UTXD1/CLKOUT/PDMDAT/PWM2_N

| Pin Number FR8018HA FR8018HD	Pin Name	type	Pin Description
45	PB5	DIO	SDA0/I2SFRM/PWM5_P/SSPCSN/UTXD0/UTXD1/ANTCTL0/PDMDAT/PWM4_N
46	PB1	DIO	SDA0/I2SFRM/PWM1_P/SSPCSN/UTXD0/UTXD1/BLERX/PDMDAT/PWM0_N
47	PB2	DIO	SCL1/I2SDOUT/PWM2_P/SSPDOUT/URXD0/URXD1/WLANTX/PDMCLK/PWM3_N
48	PB3	DIO	SDA1/I2SDIN/PWM3_P/SSPDIN/UTXD0/UTXD1/WLANRX/PDMDAT/PWM2_N

2.4Application Reference Schematic
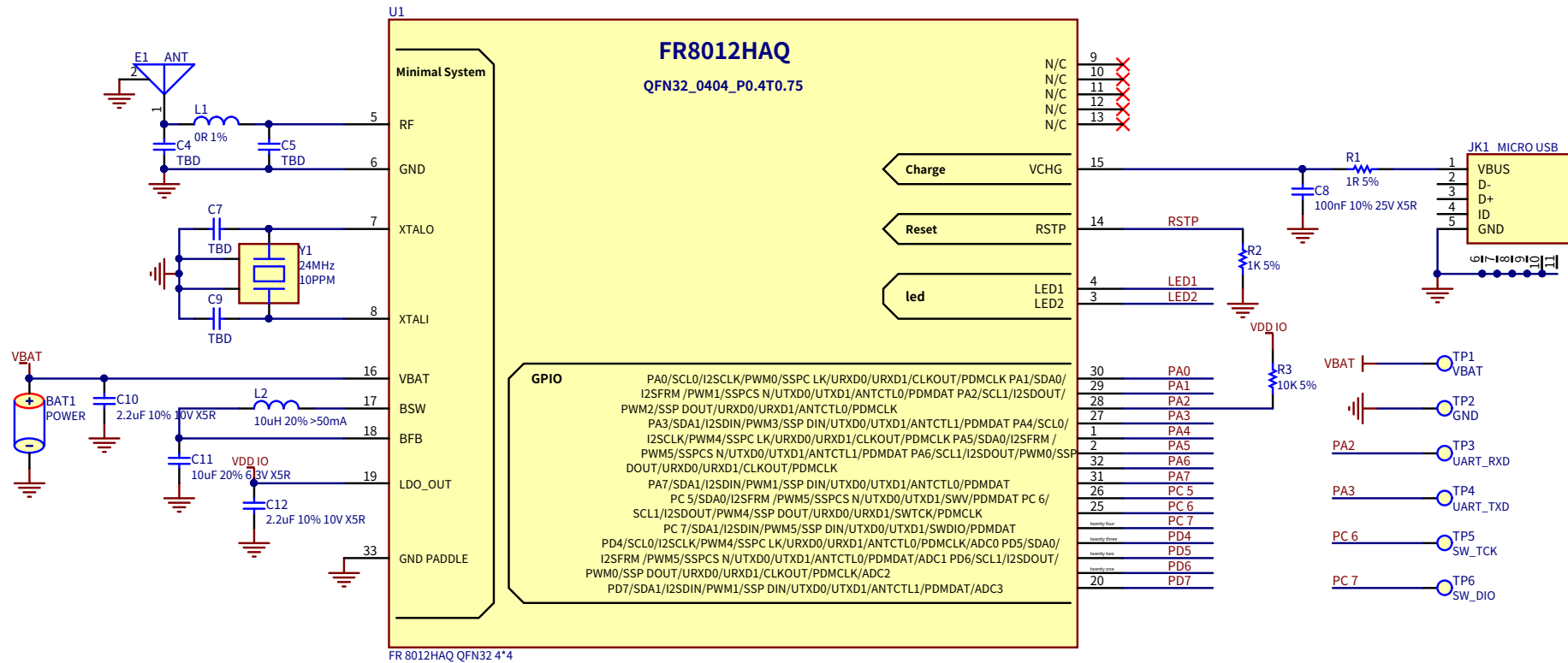
2.4.1 FR8012HBSchematic
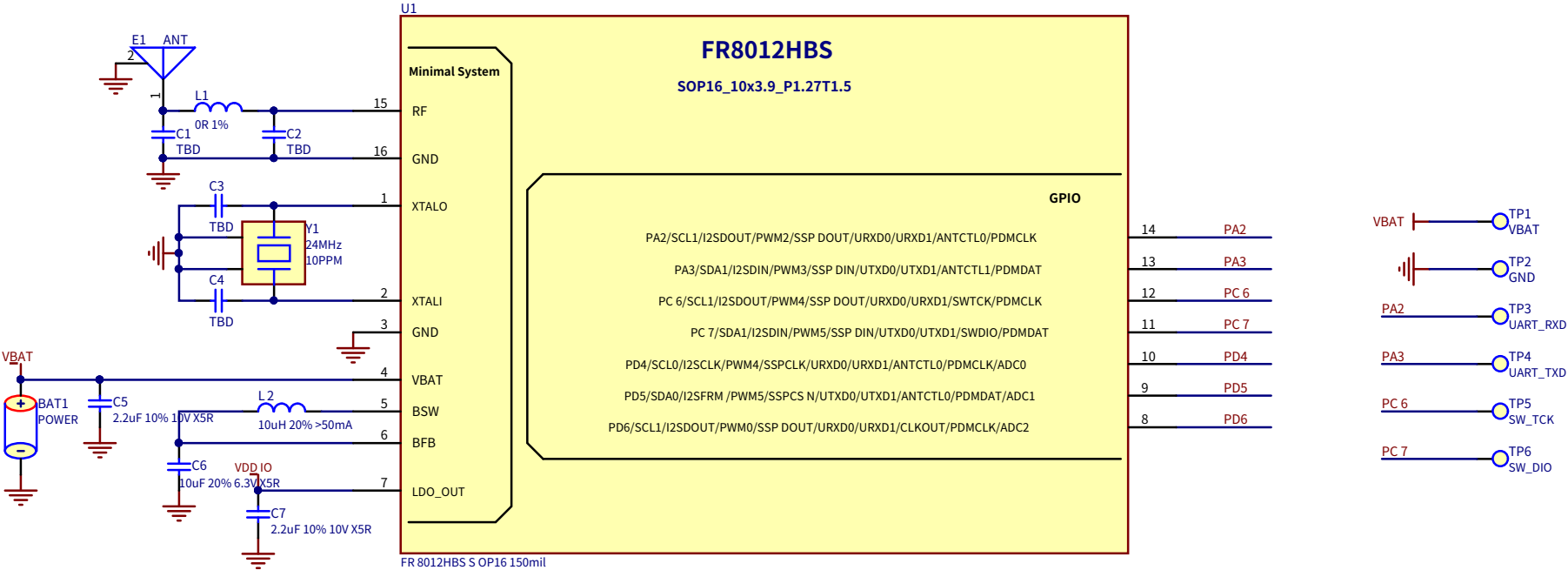
picture2-11 FR8012HBReference Schematic
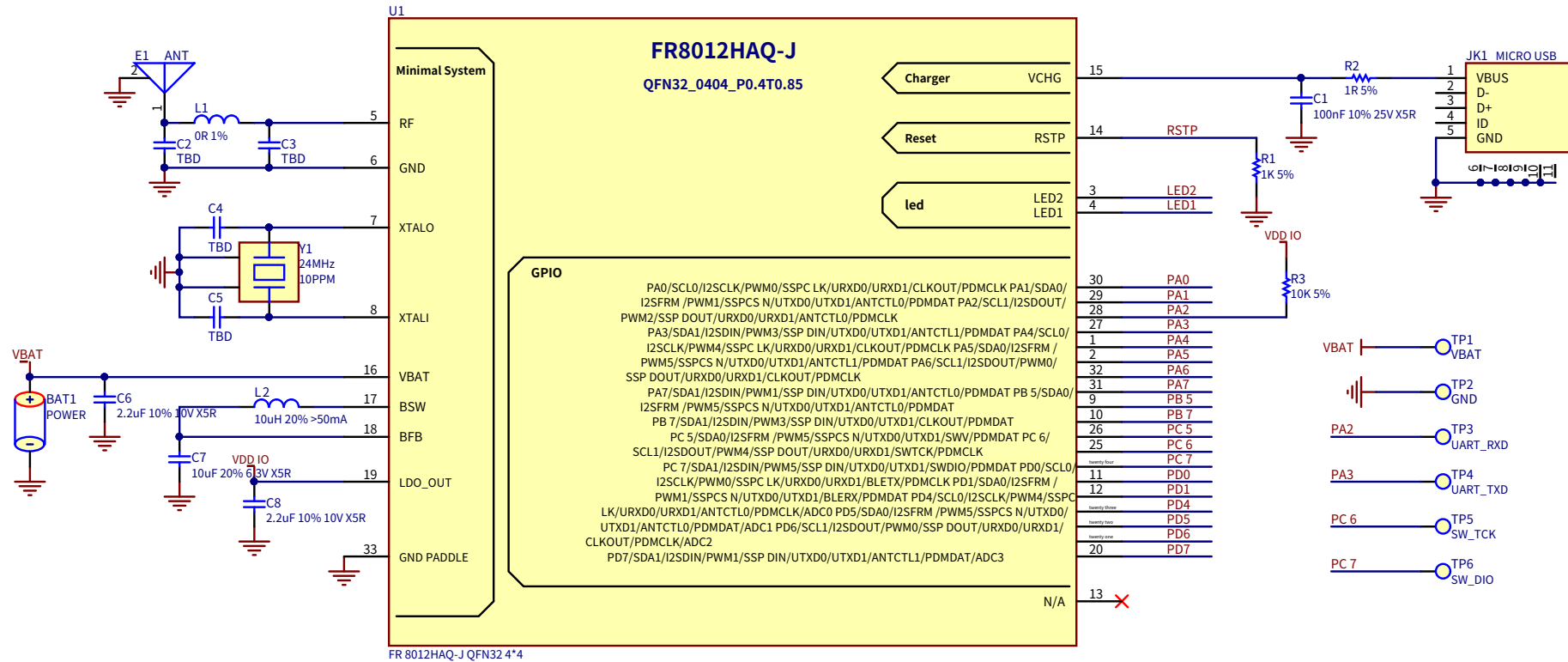
2.4.2 FR8012HASSchematic
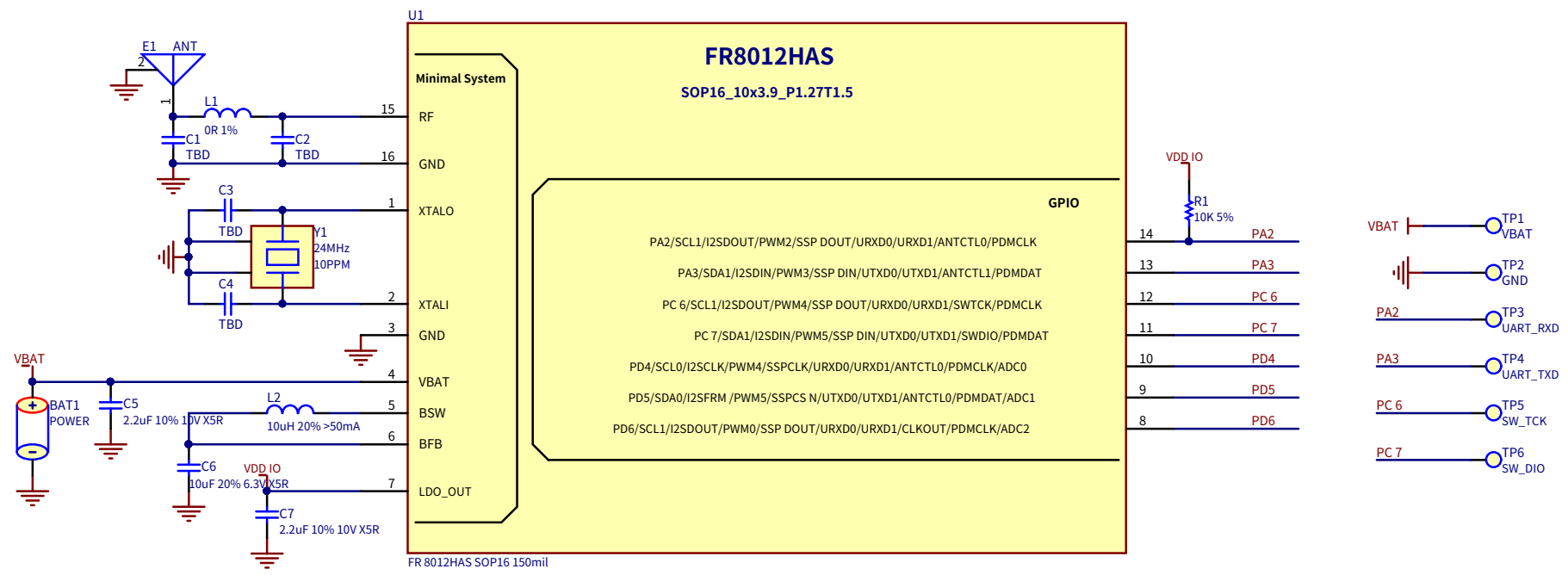
picture2-12 FR8012HASReference Schematic
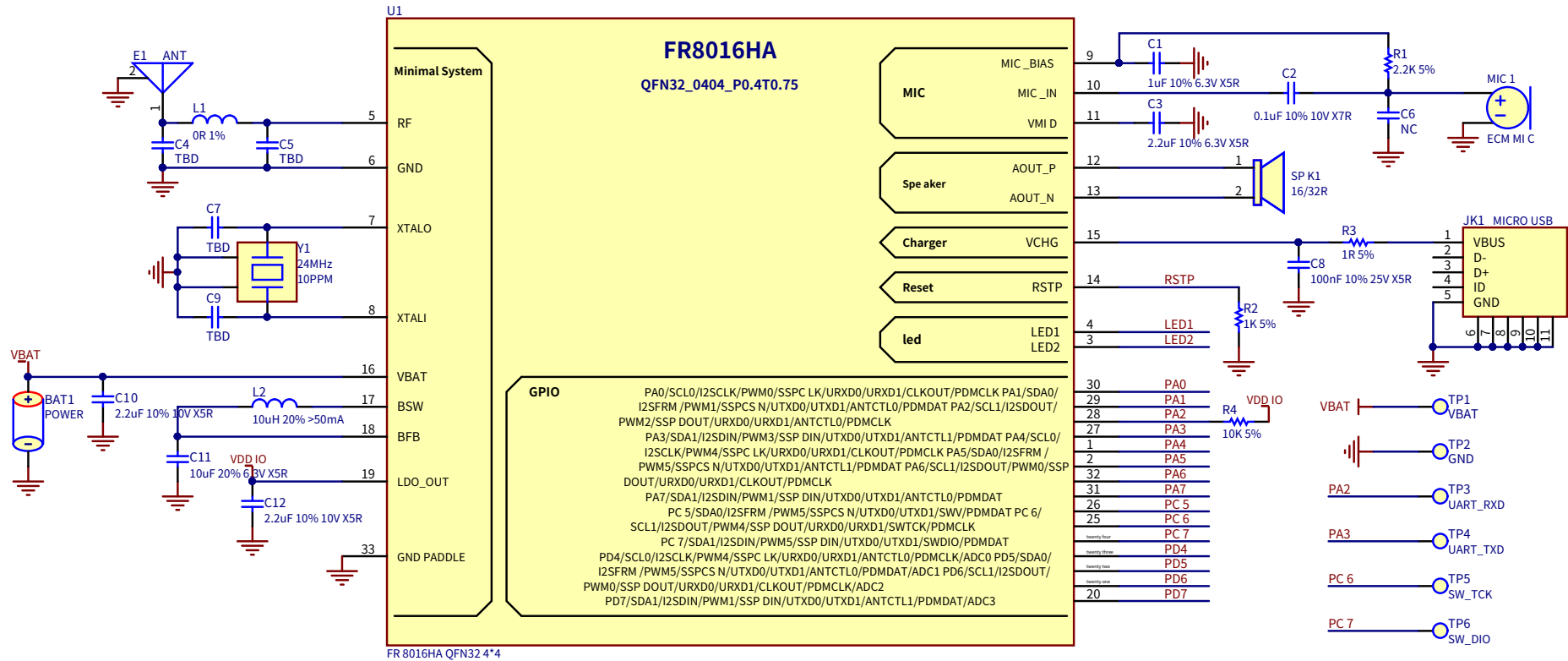
2.4.3 FR8012HAQSchematic

picture2-13 FR8012HAQReference Schematic
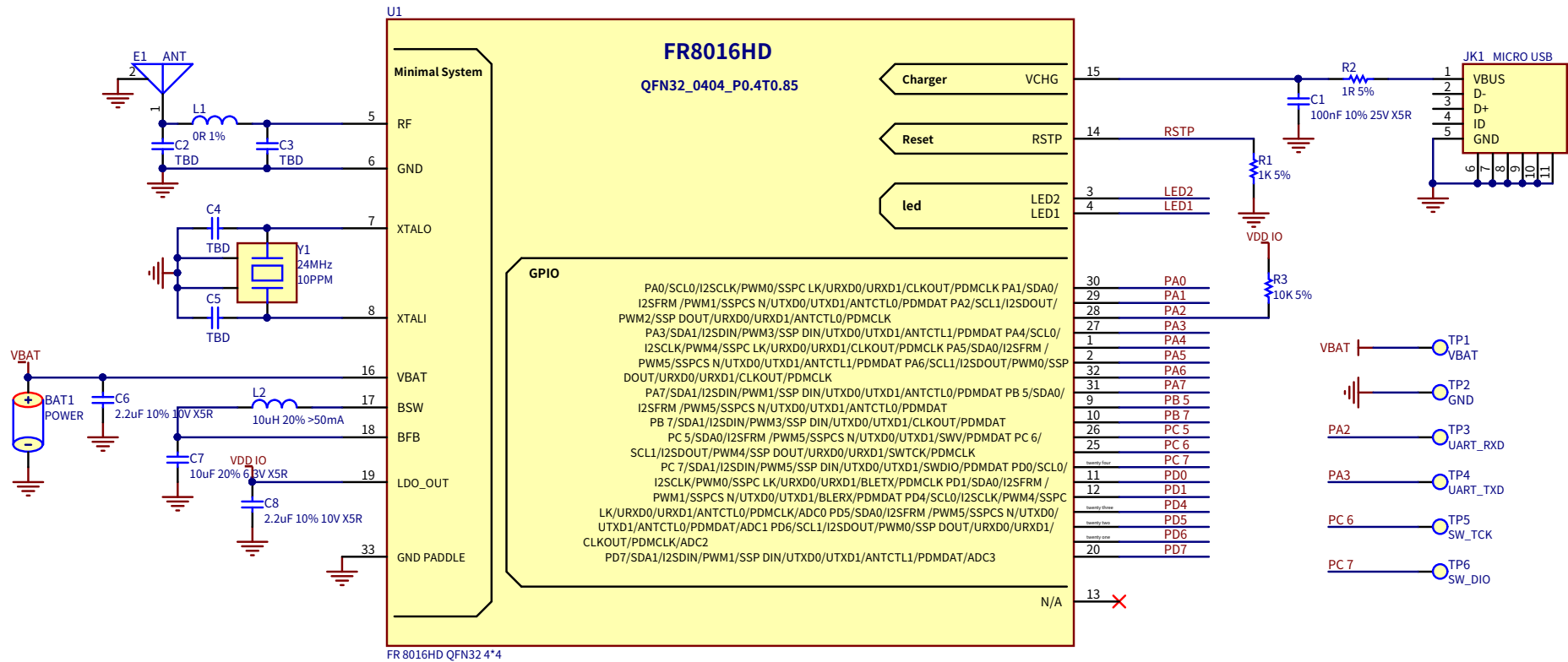
2.4.4 FR8012HAQ-JSchematic

picture2-14 FR8012HAQ-JReference Schematic
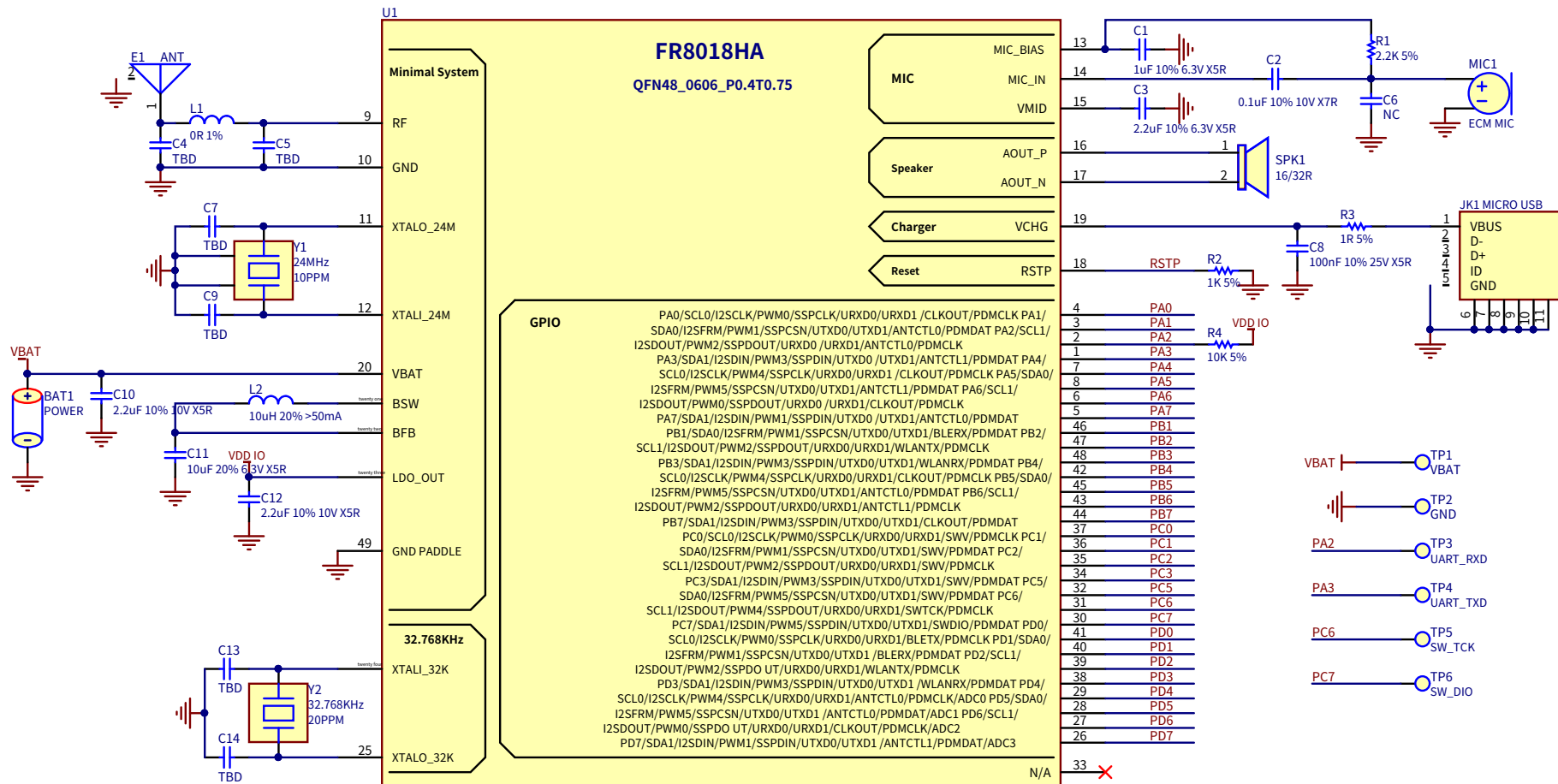
2.4.5 FR8016HASchematic

picture2-15 FR8016HAReference Schematic

2.4.6 FR8016HDSchematic

picture2-16 FR8016HDReference Schematic

2.4.7 FR8018HA/FR8018HDSchematic

picture2-17 FR8018HA/FR8018HDReference Schematic

3. Electrical Characteristics

3.1Extreme working parameters

Stresses beyond absolute maximum ratings may cause permanent damage to the device.

sheet3-1Limit parameters

scope		Minimum	Maximum	unit
Operating temperature		- 40	125	°C
Core voltage		0.9	1.3	V
I/OVoltage	LDO_OUT	1.6	3.3	V
Supply voltage	VBAT	1.8	4.3	V
	VCHG	4.75	5.25	V

3.2Recommended working conditions

sheet3-2Recommended working conditions

Recommended working conditions		Minimum	Typical Value	Maximum	unit
Operating temperature range		- 40	20	105	°C
Core Voltage		0.9	1.2	1.3	V
I/OVoltage	LDO_OUT	1.6	2.9	3.3	V
Supply voltage	VBAT	1.8	3.3	4.3	V
Charger voltage	VCHG	4.75	5	5.25	V

3.3Power consumption parameters

sheet3-3Power consumption parameters

Working Mode	average value	Maximum	unit
TX peak current (0dB)		8	mA
RX peak current		9.7	mA
Sleep current (including48K retention RAM)	6.1		µA
Shutdown Current(power off mode)	2.7		µA

3.4AudioCODECparameter

sheet3-4AudioCODECparameter

Digital to Analog Converter (mono)					
parameter	condition	Minimum	Typical Value	Maximum	unit
Conversion accuracy	-	-	-	20	Bits
Sampling rate(Fs)*	Synchronous clock signal	8		48	kHz
Signal-to-Noise Ratio (SNR)	Fin=1kHz B/W=20Hz—20KHz A-Weighted THD_N<0.01% Fs(8K,16K,32K,44.1K,48K)		92		dB
Digital Gain	Digital gain resolution = 1/48dB	- 48		32	dB
Analog Gain	Analog gain resolution = 3dB	0		- 30	dB
Output voltage full scale	VDDA=2.9V		1500		mV
Stopband Attenuation		65			dB

Analog-to-digital converter (mono)					
parameter	condition	Minimum	Typical Value	Maximum	unit
Conversion accuracy	-	-	-	16	Bits
Sampling rate (Fs)*	Synchronous clock signal	8		48	kHz
Signal-to-Noise Ratio (SNR)	Weighting		79		dB
	Unweighted		79		dB
Digital Gain	Digital gain resolution = 1/48dB	- 48		32	dB
Analog Gain	Analog gain resolution = 3dB	0		30	dB

3.5Clock related parameters

sheet3-5Clock related parameters

parameter	Minimum	Typical Value	Maximum	unit
Clock frequency	twenty four	twenty four	twenty four	MHz
CLLoad Capacitance	-	9	12	pF
tolerance	-	+/-10	-	ppm
Dynamic resistance	-	-	60	R
Parallel capacitor	-	-	2	pF

3.6 ESDparameter

sheet3-6 ESDparameter

Chip Pins	Human body discharge model (HBM)	Charging Device Mode(CDM)
RF	±2000V	±2000V
XTALI	±2000V	±2000V
XTALO	±2000V	±2000V
OTHERS	±2000V	±2000V

Abbreviations

Abbreviations	Descriptions
AEC	Echo Canceller
AGC	Automatic gain compensation
ANS	Background noise suppression function
ADC	Analog-to-digital converter
DAC	Digital to Analog Converter
GPIO	General purpose input and output
MIC	microphone
PMU	Power Management Unit
OSC	Crystal Oscillator
PA	Power Amplifier
SoC	System on Chip

contact information

Company: Shanghai Furuikun Microelectronics Co., Ltd.

Address: Bibo Road, China (Shanghai) Pilot Free Trade Zone912alley8Number501-Aroom

Phone: +86-21-5027-0080

Website: www.freqchip.com

Sales Email: sales@freqchip.com

Document mailbox: docs@freqchip.com .

Version Revision

Version Number	release date	summary
V1.0	2022.11.1	First edition
V1.1	2022.12.29	ReviseARM Cortex-M3Kernel Features renewESDParameter information
V1.1.4	2023.8.3	IncreaseFR8012HAQ-J, add charging module information
V1.1.5	2023.9.18	deleteUSB OTG