FR8018A Datasheet

Bluetooth Low Energy SOC

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DESCRIPTION

FR8018A is a SOC (system on chip) for rapid development of Bluetooth Low Energy related products. It contains Bluetooth V4.2 (LE Mode) fully compliant system with Freqchip designed firmware and software stack. Users can develop various applications based on embedded 32-bits high performance MCU.

With Freqchip's innovational technology, FR8018A integrates RF, CODEC, PMU, Baseband, SPI, IIC, UART, GPIO, ADC, PWM and 8*20 Keyboard scan train all in a single chip, which provides customer with:

1. competitive power consumption
2. stable connection
3. low-cost BOM

The Bluetooth Smart firmware includes the L2CAP service layer protocols, Security Manager (SM), Attribute Protocol (ATT), the Generic Attribute Profile (GATT) and the Generic Access Profile (GAP). Furthermore, application profiles such as Proximity, Health Thermometer, Heart Rate, Blood Pressure, Glucose, Human Interface Device (HID) and SDK (include drivers, OS API, etc.) are supported.

FEATURES

- Compliant with Bluetooth Specification V4.2 LE
- Embedded 32-bits Processor
  - 12~48Mhz speed
- Internal mask ROM, up to 78KB SRAM used for user code and data
- Internal 4M SPI Flash contains user space software and data
- Integrated Battery Charger
- Integrated DC-DC Regulator
- Mono Audio CODEC
- Interface:
  - GPIO
  - UART
  - SPI
  - I2C
  - PWM
  - I2S
  - LED
- ROM Software:
  - BLE Profile & Protocol: GATT, LM, LC, etc.
  - Driver API

APPLICATIONS

- voice remote control
- smart toy
- led control
- keyboard
- etc.

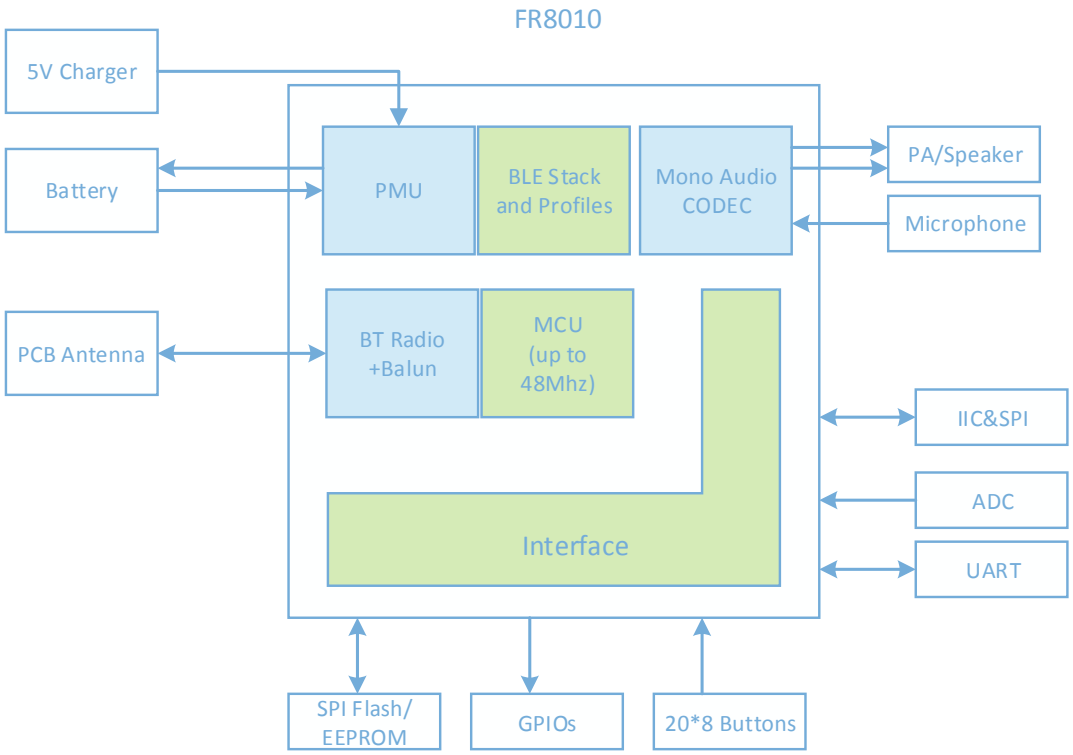
ORDERING INFORMATION

FR8018A -40°C ~ +105°C

QFN48, 6.0*6.0*0.75, 0.4pitch

1. Hardware Details

1.1 Block Diagram



1.2 Bluetooth Radio

- On-chip balun (50Ω impedance in TX and RX modes)
- No external trimming is required in production
- Qualified to Bluetooth v4.2 LE specification
- Up to 4dBm RF transmit power
- -90dBm receiver sensitivity
- Integrated channel filters
- Digital demodulator for improved sensitivity and co-channel rejection
- Real time digitized RSSI
- Fast AGC for enhanced dynamic range

1.3 Bluetooth Controller

- All device classes support (Broadcaster, Central, Observer, Peripheral)
- All packet types (Advertising / Data / Control)
- Encryption (AES / CCM)
- Bit stream processing (CRC, Whitening)
- Frequency hopping calculation
- Low power modes supporting internal 32.0 kHz or external 32.768 kHz
- Supports power down of the baseband during the protocol's idle periods

1.4 Audio Interface

- Embedded 16-bit Mono Audio CODEC
- DAC SNR 96dB, THD -86dB
- ADC SNR 84dB, THD -83dB
- DAC/ADC Support 8k/16k/44.1k/48kHz sample rate

1.5 Peripheral Interfaces

- UART port for Debugging and AT Commands
- IIC interface to support external EEPROM or other devices (like G-SENSOR)
- One more SPI interface to support other device (like OLED controller)
- Up to 28 general purpose IOs (28 IOs can be set in interrupt mode)
- General purpose 10-bits ADC used for ADKey and other analog input
- PWM controller
- Hardware LED controller
- General purpose programmable timer for various task
- Watchdog used for tracking unexpected exception

1.6 Integrated Power Control and Regulation

- Embedded Power-On-Reset
- Support ONKEY (switch or long press) power on and power off logic
- Low power 0.9v core voltage
- On-chip high efficiency switch-mode power supply, 2.5v to 4.2v input direct from battery and programmable output voltage
- On-chip Low Dropout (LDO) Linear Regulator for internal Digital, RF and Analog circuit
- Power management features include software shutdown and hardware wake-up

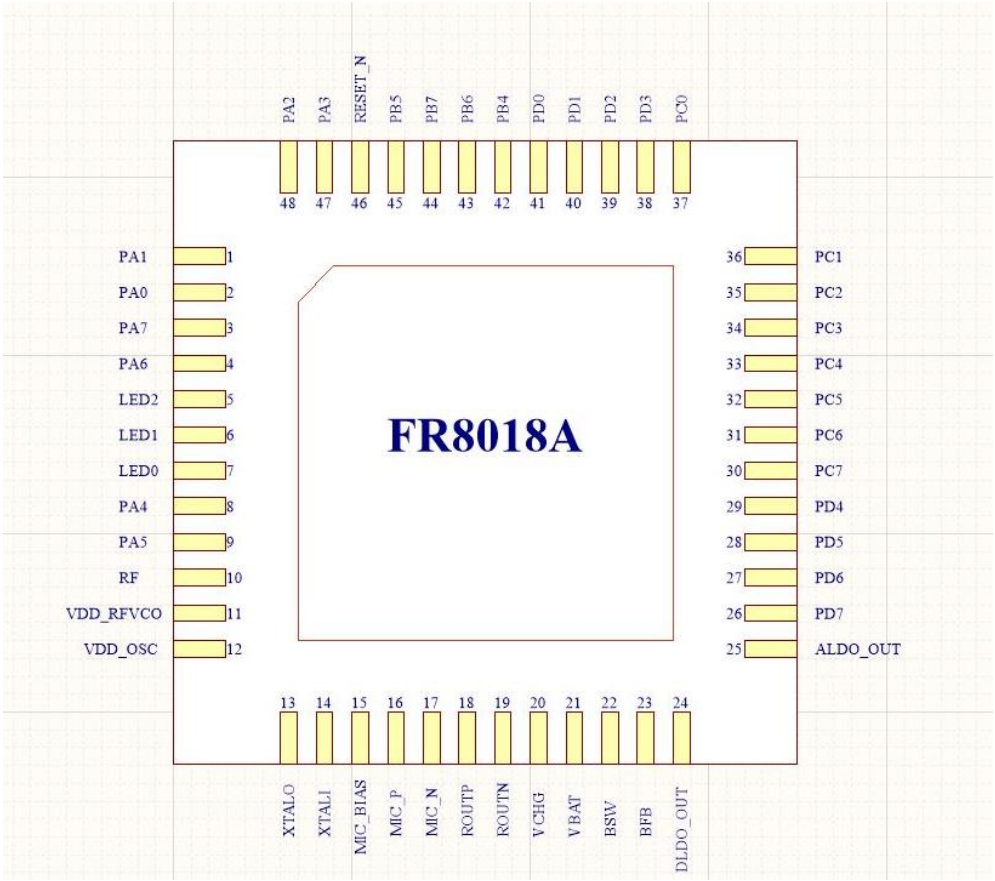
- Power-on-reset cell detects low supply voltage
- Internal voltage level detector

1.7 Battery Charger

- Lithium ion/Lithium polymer battery charger
- Embedded LVD(low voltage detect)
- Programmable charging current. Fast charging support up to 200mA with no external components

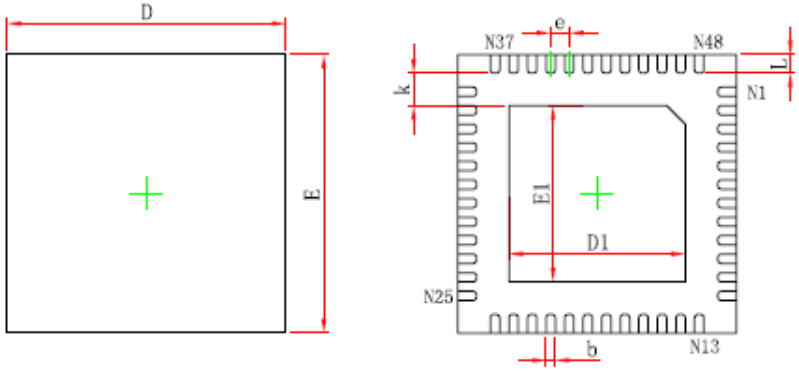
2. Package and Pin Information

2.1 Package



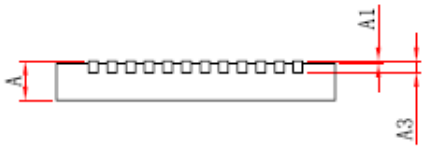
2.2 Package Physical Dimensions

QFNWB6×6-48L(P0.40T0.75/0.85) PACKAGE OUTLINE DIMENSIONS



Top View

Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	5.924	6.076	0.233	0.239
E	5.924	6.076	0.233	0.239
D1	3.700	3.900	0.146	0.154
E1	3.700	3.900	0.146	0.154
k	0.200MIN.		0.008MIN.	
b	0.150	0.250	0.006	0.010
e	0.400TYP.		0.016TYP.	
L	0.324	0.476	0.013	0.019

2.3 Pins Description

FR8018A is a CMOS device. Floating level on input signals will cause unstable device operation and abnormal current consumption. Pull-up or Pull-down resistors should be used appropriately for input or bidirectional pins.

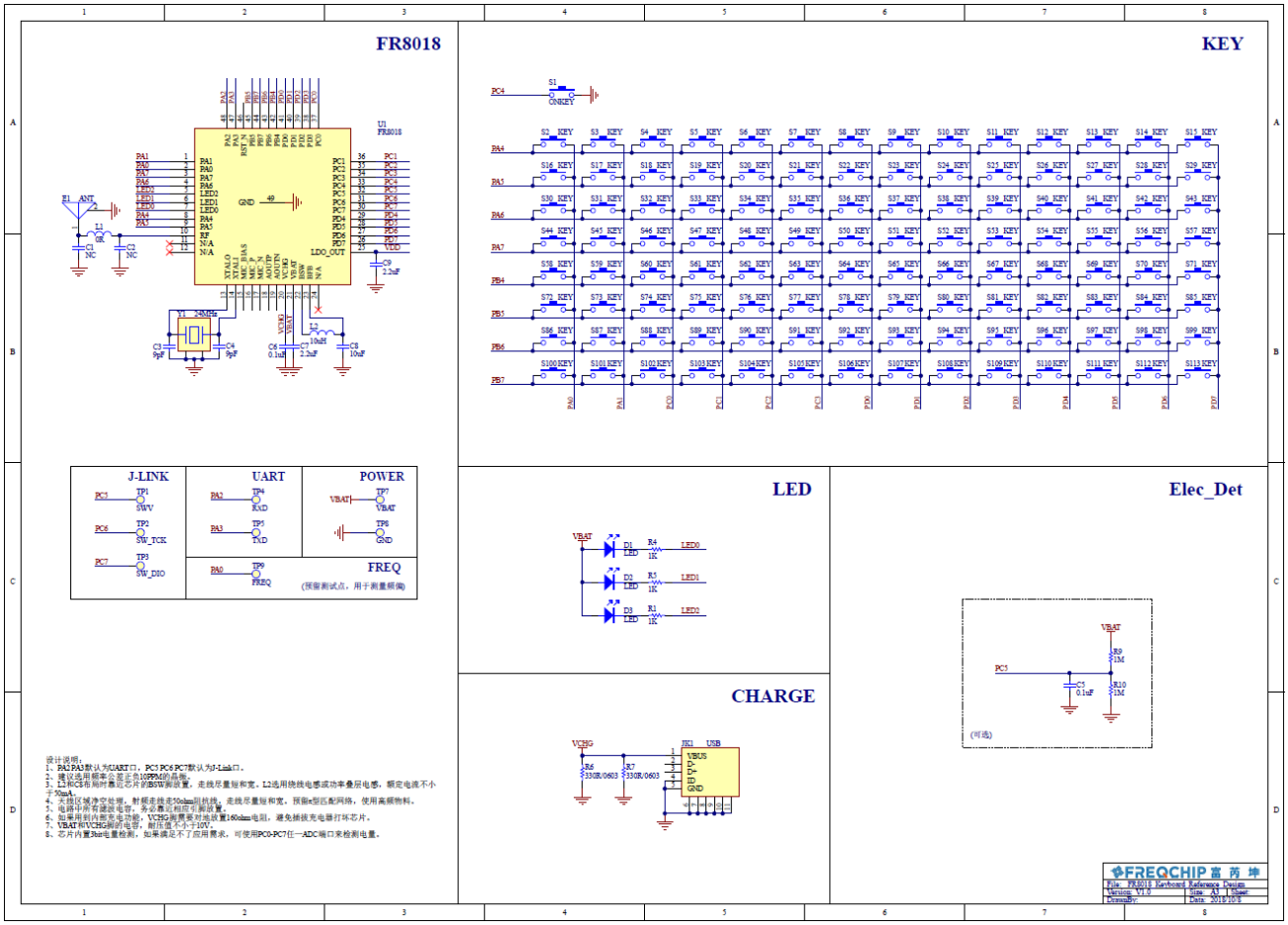
Notation	Description
I	Digital Input
O	Digital Output
AI	Analog input
AO	Analog output
IO	Bidirectional(digital)
OD	Open Drain
PWR	Power
GND	Ground

Pin name	Pin#	Type	Description
PORTA1	1	I/O	I2S_FRM/I2C0_DAT/ PWM1/ SPI0_CSN/ SPI1_CSN/ UART0_TX/UART1_TX/UART0_RTS/
PORTA0	2	I/O	I2S_CLK/I2C0_CLK/ PWM0/ SPI0_CLK/ SPI1_CLK/ UART0_RX/UART1_RX/UART0_CTS/CLK_OUT/
PORTA7	3	I/O	I2S_DIN/I2C1_DAT/PWM7/SSP1_DIN/SSP0_DIN/UART1_TXD /UART0_TXD/UART1_RTS/
PORTA6	4	I/O	I2S_DOUT/I2C1_CLK/PWM6/SSP1_DOUT/SSP0_DOUT/UART 1_RXD/UART0_RXD/UART1_CTS/
LED2	5	O	LED2 control output
LED1	6	O	LED1 control output
LED0	7	O	LED0 control output
PORTA4	8	I/O	I2S_CLK/I2C0_CLK/PWM4/SSP1_CLK/SSP0_CLK/UART0_RX D/UART1_RXD/UART0_CTS/
PORTA5	9	I/O	I2S_FRM/I2C0_DAT//PWM5/SSP1_CSN/SSP0_CSN/UART0_TX D/UART1_TXD/UART0_RTS/
RF	10	AI/O	RF input and output
VDD_RFVCO	11	AO	
VDD_OSC	12	AO	
XTALO	13	AO	crystal oscillator output
XTALI	14	AI	crystal oscillator input

MIC_BIAS	15	AO	MIC BIAS output
MIC_P	16	AI	Voice positive input
MIC_N	17	AI	Voice negative input
ROUTP	18	AO	The audio right channel positive output
ROUTN	19	AO	The audio right channel negative output
VCHG	20	PWR	Power supply for charger
VBAT	21	PWR	Positive power supply for DC/DC
BSW	22	AO	DC/DC output terminal
BFB	23	AI	DC/DC feedback input terminal
DLDO_OUT	24	AO	
AVDD	25	AO	Analog linear regulator output
PORTD7	26	I/O	I2C1_DAT/I2S_DIN/PWM7/SSP0_DIN/SSP1_DIN/UART1_TXD /UART0_TXD/UART1_RTS
PORTD6	27	I/O	I2C1_CLK/I2S_DOUT/PWM6/SSP0_DOUT/SSP1_DOUT/UART 1_RXD/UART0_RXD/UART1_CTS
PORTD5	28	I/O	I2C0_DAT/I2S_FRM/PWM5/SSP0_CSN/SSP1_CSN/UART0_TX D/UART1_TXD/UART0_RTS
PORTD4	29	I/O	I2C0_CLK/I2S_CLK/PWM4/SSP0_CLK/SSP1_CLK/UART0_RX D/UART1_RXD/UART0_CTS
PORTC7	30	I/O	I2S_DIN/I2C1_DAT/PWM7/SPI1_DIN/ SPI0_DIN/ UART1_TX/UART0_TX/ ADC7*
PORTC6	31	I/O	I2S_DOUT/I2C1_CLK/ PWM6/ SPI1_DOUT/ SPI0_DOUT/UART1_RX/UART0_RX/ ADC6*
PORTC5	32	I/O	I2S_FRM/I2C0_DAT/ PWM5/ SPI1_CSN/ SPI0_CSN/ UART0_TX/UART1_TX/ ADC5*
PORTC4	33	I/O	I2S_CLK/I2C0_CLK/ PWM4/ SPI1_CLK/ SPI0_CLK/ UART0_RX/UART1_RX/ ADC4*
PORTC3	34	I/O	I2C1_DAT/I2S_DIN/PWM3/SSP0_DIN/SSP1_DIN/UART1_TXD /UART0_TXD/ADC3*
PORTC2	35	I/O	I2C1_CLK/I2S_DOUT/PWM2/SSP0_DOUT/SSP1_DOUT/UART 1_RXD/UART0_RXD/ADC2*
PORTC1	36	I/O	I2C0_DAT/I2S_FRM/PWM1/SSP0_CSN/SSP1_CSN/UART0_TX D/UART1_TXD/ADC1*
PORTC0	37	I/O	I2C0_CLK/I2S_CLK/PWM0/SSP0_CLK/SSP1_CLK/UART0_RX D/UART1_RXD/ADC0*
PORTD3	38	I/O	I2C1_DAT/I2S_DIN/PWM3/SSP0_DIN/SSP1_DIN/UART1_TXD /UART0_TXD/UART1_RTS
PORTD2	39	I/O	I2C1_CLK/I2S_DOUT/PWM2/SSP0_DOUT/SSP1_DOUT/UART

			1_RXD/UART0_RXD/UART1_CTS
PORTD1	40	I/O	I2C0_DAT/I2S_FRM/PWM1/SSP0_CSN/SSP1_CSN/UART0_TXD/UART1_TXD/UART0_RTS
PORTD0	41	I/O	I2C0_CLK/I2S_CLK/PWM0/SSP0_CLK/SSP1_CLK/UART0_RXD/UART1_RXD/UART0_CTS
PORTB4	42	I/O	I2S_CLK/I2C0_CLK/PWM4/SSP1_CLK/SSP0_CLK/UART0_RXD/UART1_RXD/UART0_CTS
PORTB6	43	I/O	I2S_DOUT/I2C1_CLK/PWM6/SSP1_DOUT/SSP0_DOUT/UART1_RXD/UART0_RXD/UART1_CTS
PORTB7	44	I/O	I2S_DIN/I2C1_DAT/PWM7/SSP1_DIN/SSP0_DIN/UART1_TXD/UART0_TXD/UART1_RTS
PORTB5	45	I/O	I2S_FRM/I2C0_DAT/PWM5/SSP1_CSN/SSP0_CSN/UART0_TXD/UART1_TXD/UART0_RTS
RST_N	46	AI	Reset
PORTA3	47	I/O	I2S_DIN/I2C1_DAT/ PWM3/ SPI0_DIN/ SPI1_DIN/ UART1_TX/UART0_TX/UART1_RTS/
PORTA2	48	I/O	I2S_DOUT/I2C1_CLK/ PWM2/ SPI0_DOUT/ SPI1_DOUT/ UART1_RX/UART0_RX/UART1_CTS/

2.4 Application circuit



3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Continuous operation at or beyond these conditions may permanently damage the device.

Rating		Min	Max	Unit
Storage Temperature		-40	80	℃
Core Supply Voltage		0.9	1.3	V
I/O Voltage	ALDO_OUT	2.1	3.3	V
Supply Voltage	VBAT	2.5	4.3	V
	VCHG	4.75	5.25	V

3.2 Recommended Operating Conditions

Operating Condition		Min	Typ	Max	Unit
Operating Temperature Range		-40	20	85	℃
Core Supply Voltage		0.9	1.2	1.3	V
I/O Voltage	ALDO_OUT	2.1	2.9	3.3	V
Supply Voltage	VBAT	2.5	3.7	4.3	V
Charge input voltage	VCHG	4.75	5	5.25	V

3.3 Power Consumption

Operation Mode	Average	Maximum	Unit
TX peek current (0dB)		8	mA
RX peek current		9.7	mA
Deep sleep current (include 80K retention RAM)	16.7		μA
Deep sleep current (include 8K retention RAM)	7.2		μA
Power off	5.1		μA

3.4 Audio CODEC

Digital to Analogue Converter(Mono)					
PARAMETER	**CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNIT**
Resolution	-	-	-	20	Bits
Sampling frequency (Fs)*	The synchronized clock signal	8		48	kHz
SNR (Signal to Noise Ratio)	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
Analogue Gain	Analog Gain Resolution = 3dB	0		-30	dB
Output voltage fulls-cale	VDDA=2.9V		1500		mV
Stopband attenuation		65			dB

Analog to Digital Converter(Mono)					
PARAMETER	**CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNIT**
Resolution	-	-	-	16	Bits
Sampling frequency (Fs)*	The synchronized clock signal	8		48	kHz
Signal to Noise Ratio	A-weighted		79		dBFS
	W/O weighting		79		dBFS
Digital Gain	Digital Gain Resolution=1/48dB	-48		32	dB
Analogue Gain	Analog Gain Resolution = 3dB	0		30	dB

3.5 Crystal oscillator

CLOCK SOURCE	Min	Typ	Max	Unit
Main Crystal OSC(12M/24Mhz) for Bluetooth RF application				
Clock Frequency	24	24	24	MHz
Digital rim range		7.5		pf
Trim step size		0.1		pf
Tolerance		+-20		ppm
Note: XTAL Load capacitance = 7.5pf				

Contact Information

Website: www.freqchip.com
Sales Email: sales@freqchip.com
Phone: +86-21-5027-0080

Revision History

Feedback:

Freqchip welcomes feedback on this product and this document. If you have comments or suggestions, please send an email to doc@freqchip.com.

Reversion Number	Reversion Date	Description
V1.0	2018.08.30	Initial Version