Date	2024.03.18
Revision	1.1
Page	

PRODUCT APPROVAL DATASHEET

PRODUCT	Bluetooth Module V5.4 (LE audio)
MODEL NAME	F-3083
Our Part No	
CUSTOMER	

Checked By	Approved By	Company Seal

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Revision History

Version	Date	Revision Description
1.0	23/06/13	First release
1.1	24/03/18	Update paramaters

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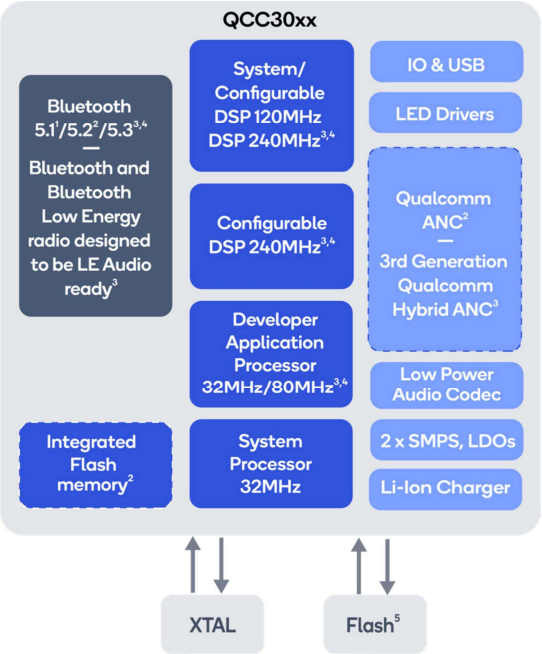
General Description

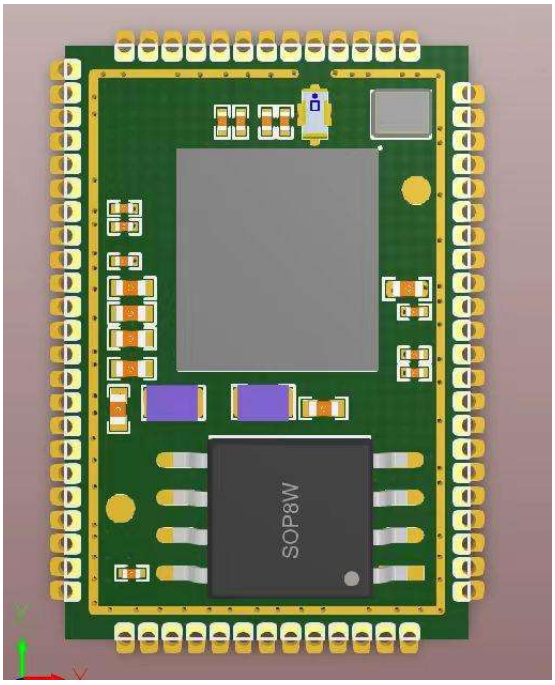
F-3083 is a fully integrated Bluetooth Module, It is based on Qualcomm QCC3083 chipset with specific interface design to meet customers electronics needs. F-3083 is compatible with Bluetooth specification ver5.4. It integrated RF Baseband controller, etc., a completed Bluetoth subsystem. F3083 supports SBC, AAC, LC3 andapt-X, apt-X HD, apt-X adaptive,aptx-LL, Qualcomm lossless audio Snapdragon Sound. Support LE audio Auracast, Unicast and MESH BT technologies.

Features

- Highly integrated SoC with extremely low-power design
- Support for digital assistants with minimal integration effort
- Fully programmable digital ANC[2,3]
- Support for aptX, aptX HD and aptX Adaptive[2,3,4]
- Lossless audio with Snapdragon Sound[3]
- Support for Qualcomm® cVc™ Echo Cancelling and Noise Suppression (ECNS)
- QCC3083 qualified to Bluetooth 5.4
- QCC3083 designed to integrate LE Audio use cases, works for Auracast and Unicast
- 2Mbps Bluetooth low energy (LE) support
- Variety of form factors, down to ultra-small 5.5mm x 5.5mm
- Dual core 32-bit processor application and Kalimba DSP Audio subsystem
- Embedded ROM + RAM (and integrated Flash with QCC3044)
- High-performance low power audio codec including stereo Class D and Class AB analog outputs
- 192kHz 24-bit I2S & SPDIF interfaces
- Flexible software platform with powerful new IDE support
- Integrated battery charger supporting internal mode (up to 200 mA) and external mode (up to 1.8 A)

QCC3083 Block Diagram





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Audio subsystem

- 32-bit Kalimba audio digital signal processor (or processing) (DSP) core with flexible clocking from 2 MHz to 240 MHz to enable optimization of performance vs. power consumption
- DSP executes code from ROM
- 384 KB program random access memory (RAM)
- 1024 KB data RAM **Application subsystem**
- Dual-core application subsystem 32/80 MHz operation
- 32-bit Firmware Processor (reserved for system use) executes:
  - Bluetooth upper stack
  - Profiles
  - House-keeping code
- 32-bit Developer Processor executes:
  - Developer applications
- Both cores execute code from external flash memory using QSPI clocked at 32 MHz or 80 MHz
- On-chip caches per core enable optimized performance and power consumption

Bluetooth subsystem

- Qualified to Bluetooth v5.4 specification including 2 Mbps Bluetooth Low Energy and Bluetooth Low Energy Isochronous Channels
- Qualcomm® Bluetooth High Speed Link
- Single ended antenna connection with on-chip balun and Tx/Rx switch
- Bluetooth, Bluetooth Low Energy, and mixed topologies supported
- Class 1 support

Li-ion battery charger

- Integrated battery charger supporting:
  - Internal mode (up to 200 mA)
  - External mode (up to 1.8 A)
- Variable float (or termination) voltage adjustable in 50 mV steps from 3.65 V to 4.4 V
- Thermal monitoring and management are available in application software
- Pre-charge to fast charge transition configurable at 2.5 V, 2.9 V, 3.0 V, and 3.1 V

Power management

- Integrated power management unit (PMU) to minimize external components
- QCC3083 VFBGA runs directly from a Li-ion, USB, or external supply (2.8 V to 6.5 V)
- Auto-switching between battery and USB (or other) charging source
- Power islands employed to optimize power consumption for variety of use-cases
- Dual switch-mode power supply (SMPS):
  - Automatic mode selection to minimize power consumption
  - 1.8 V SMPS generates power for both the device and off-chip circuits
  - Dedicated digital SMPS (output voltage changes automatically to minimize device power consumption)

Audio engine and digital audio interfaces

- 24-bit inter-integrated circuit sound (I^2S) interface with 1 input and 3 output channels
- Programmable audio master clock (MCLK)
- Sony/Philips digital interface (SPDIF): Two instances configurable as input or output
- Stereo analog outputs configurable as differential Class-AB headphone outputs or differential high efficiency Class-D outputs:
  - Class-AB signal-to-noise ratio (SNR): 120.0 dB typ (Quiet mode).
  - Class-AB total harmonic distortion plus noise (THD +N): -91.1 dB typ.
  - Class-D SNR: 105.1 dB typ.
  - Class-D THD+N: -90.1 dB typ.
- Quad analog inputs configurable as single ended line inputs or, unbalanced or balanced analog microphone inputs:
  - SNR differential: 99.2 dB typ.
  - THD+N differential: -95.0 dB typ.
- 1 microphone bias (single bias shared by four channels):
  - Crosstalk attenuation between two inputs using recommended application circuit: 80 dB typ.
- Digital microphone inputs with capability to interface up to 10 digital microphones
- Both analog-to-digital converter (ADC)s and DACs support sample rates of 8 kHz, 16 kHz, 32 kHz, 44.1 kHz, 48 kHz, 96 kHz. DACs also support 192 kHz and 384 kHz.

Peripherals and physical interfaces

- A universal asynchronous receiver transmitter (UART) interface
- 3 x Bit Serializers (programmable serial peripheral interface (SPI) and inter-integrated circuit interface (I^2C) hardware accelerator)
- 1 x USB interface:
  - A full speed USB (USB-FS) Device (12 Mbps)
- QSPI NOR flash interface
  - QSPI encryption to protect developer code and data
  - Encryption programmable with a 128-bit security key of original equipment manufacturer (OEM) choice stored in on-chip one-time programmable (OTP) memory
- Up to 53 programmable input/output (PIO) and 6 open drain/digital input light-emitting diode (LED) pads with pulse width modulation (PWM)

Package and compliance

- 134-ball 6.7 mm x 7.4 mm x 1.0 mm, 0.5 mm pitch VFBGA
- Green (restriction of hazardous substances (RoHS) compliant, and no antimony or halogenated flame retardants)

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Class-D DAC audio output

Parameter	Conditions	Min	Typ	Max	Unit
Input Sample Width	-	-	-	24	Bits
Input Sample Rate, Fsample	-	8	-	192	kHz
Max Power	0 dBFS, 32 Ω load -3 dBFS, 16 Ω load	-	-	30	mW
Load	-	16	32	30K	Ω
SNR	Fin = 1 kHz Fsample = 48 kHz Input amplitude = 0 dBFS Analog gain = 0 dB B/W = 20 Hz to 20 kHz A-Weighted 32 Ω load	-	105.1	-	dB
THD+N	Fin = 1 kHz Fsample = 48 kHz Input amplitude = 0 dBFS Analog gain = 0 dB B/W = 20 Hz to 20 kHz 32 Ω load	-	-90.1	-	dB
RMS noise	Fsample = 48 kHz Input amplitude = - 200 dBFS Analog gain = 0 dB B/W = 20 Hz to 20 kHz A-Weighted 32 Ω load	-	5.48	-	uVrms
Stereo separation (crosstalk)	-	80	-	-	dB
Max capacitive load	Per terminal to ground	-	-	100	pF

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Class-AB DAC audio output

Parameter	Conditions		Min	Typ	Max	Unit
Input Sample Width	-		-	-	24	Bits
Input Sample Rate, Fsample	-		8	-	192	kHz
Max Power	0 dBFS, 32 Ω load -3 dBFS, 16 Ω load		-	-	30	mW
Load	-		16	32	30K	Ω
SNR	Fin = 1 kHz Fsample = 48 kHz Input amplitude = 0 dBFS Analog gain = 0 dB B/W = 20 Hz to 20 kHz A-Weighted B- 32 Ω load	Analog gain (dB)	Min	Typ	Max	Unit
		0	-	104.8	-	dB
		-6	-	103.9	-	
		-12	-	100.4	-	
		0	-	120.0	-	
THD+N	Fin = 1 kHz Fsample = 48 kHz Input amplitude = 0 dBFS Analog gain = 0 dB B/W = 20 Hz to 20 kHz 32 Ω load	0	-	-91.1	-	dB
		-6		-91.7		
		-12		-91.3		
RMS noise	Fsample = 48 kHz Input amplitude = -200 dBFS B/W = 20 Hz to 20 kHz A-Weighted 32 Ω load	0	-	5.69	-	uVrms
		-6		3.18		
		-12		2.39		
	Quiet mode	0		<1		
Stereo separation (crosstalk)	-		80	-	-	dB

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High-quality (HQADC) single-ended audio input

Parameter	Conditions	Min	Typ	Max	Unit
Output Sample Width	-	-	-	24	Bits
Output Sample Rate, Fsample	-	8	-	96	kHz
Input level	-	-	-	2.4	V pk-pk
Input impedance	0 dB to 24 dB analog gain	-	20	-	kΩ
	27 dB to 39 dB analog gain	-	10	-	kΩ
SNR	fin = 1 kHz 48 kHz Fsample B/W = 20 Hz → 20 kHz A-Weighted THD+N<0.1% 2.4 V pk-pk input (0 dB gain)	-	99.1	-	dB
THD+N	fin = 1 kHz 48 kHz Fsample B/W = 20 Hz → 20 kHz 2.4 V pk-pk input (0 dB gain)	-	-91.4	-	dB
Analog gain	3 dB steps	0	-	39	dB
Stereo separation (crosstalk)	-	80	-	-	dB

High-quality (HQADC) differential audio input

Parameter	Conditions	Min	Typ	Max	Unit
Output Sample Width	-	-	-	24	Bits
Output Sample Rate, Fsample	-	8	-	96	kHz
Input level	-	-	-	2.4	V pk-pk
Input impedance	0 dB to 24 dB analog gain	-	20	-	kΩ
	27 dB to 39 dB analog gain	-	10	-	kΩ
SNR	fin = 1 kHz 48 kHz Fsample B/W = 20 Hz → 20 kHz A-Weighted 2.4 V pk-pk input (0 dB gain)	-	99.2	-	dB
THD+N	fin = 1 kHz 48 kHz Fsample B/W = 20 Hz → 20 kHz 2.4 V pk-pk input (0 dB gain)	-	-95	-	dB
Analog gain	3 dB steps	0	-	39	dB
Stereo separation (crosstalk)	-	80	-	-	dB

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5.3.5 Microphone bias

Parameter	Conditions	Min	Typ	Max	Unit
Output voltage (Tunable, step = 0.1 V)	-	1.5	-	2.1	V
Output current capability	-	0.07	-	6.0	mA
DC accuracy		-60	-	60	mV
Output noise	B/W = 20 Hz → 20 kHz Unweighted	4.5	5.1	7.3	μVrms
Crosstalk Between Microphones	Using recommended application circuit	-	80	-	dB
Load capacitance	From parasitic PCB routing and package	-	-	0.1	nF

	Min	Typ	Max	Unit
VDD_PADS supply	1.7	1.8	3.6	V
VIL input logic level low	-	-	0.25 x VDD_PADS	V
VIH input logic level high	0.625 x VDD_PADS	-	-	V
Drive current (configurable)	2, 4, 8, 12	4	-	mA
VOL output logic level low, at max rated drive	-	-	0.22 x VDD_PADS	V
VOH output logic level high, at max rated drive	0.75 x VDD_PADS	-	-	V
Strong pull (up & down)	50	70	125	kΩ
Weak pull (up & down)	729	1050	1350	kΩ

5.5 SYS_CTRL

SYS_CTRL, switching threshold	Min	Typ	Max	Unit
Rising threshold	1.6	-	-	V
Falling threshold	0	-	0.4	V

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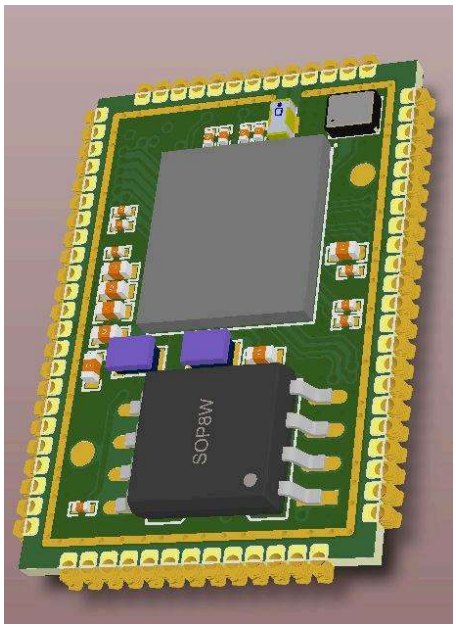
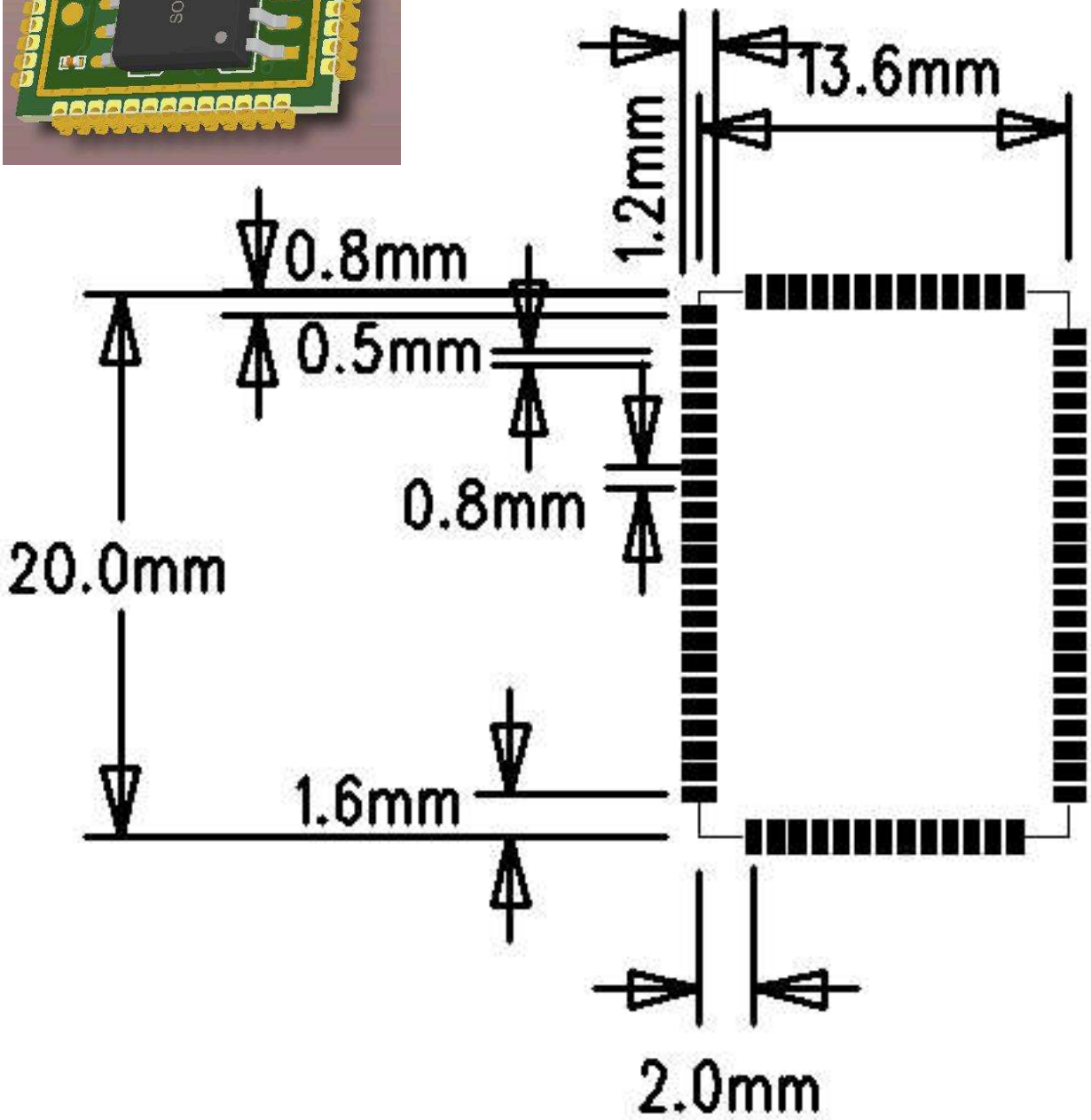
Dimension and Size

13.6*20*0.8mm





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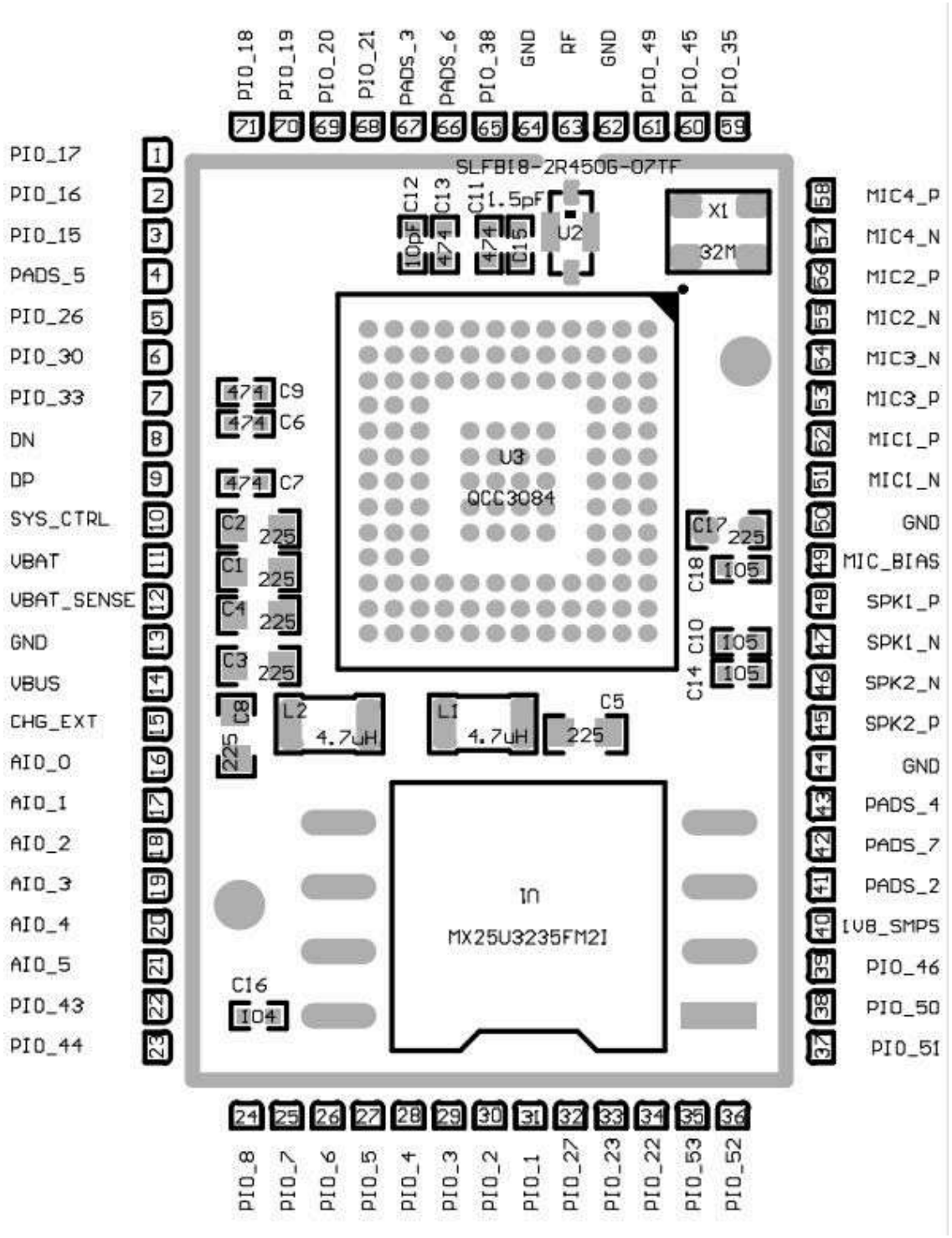

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Pin Descriptions 1

Pin #	Symbol Name	Initial Status	Descriptions
1	PIO_17	Weak pull-down	Programmable Input/Output Line
2	PIO_16	Weak pull-down	Programmable Input/Output Line
3	PIO_15	Strong pull-up	Programmable Input/Output Line
4	PADS_5		1.8 V/3.3 V PIO supply.
5	PIO_26	Strong pull-up	Programmable Input/Output Line
6	PIO_30	Strong pull-up	Programmable Input/Output Line
7	PIO_33	Strong pull-up	Programmable Input/Output Line
8	DN		USB Full Speed device D- I/O
9	DP		USB Full Speed device D+ I/O
10	SYS_CTRL		Typically connected to an ON/OFF push button. If power is present from the battery and/or charger, and software has placed the device in the OFF or DORMANT state, a button press boots the device. Also usable as a digital input in normal operation.
11	VBAT		Battery voltage input
12	VBAT_SENSE		Charger input sense pin after external mode sense-resistor. High impedance.
13	GND		GND
14	VBUS		VBUS
15	CHG_EXT		External charger transistor current control. Connect to base of external charger transistor as per application schematic.
16	AIO_0		General-purpose analog/digital input or open drain LED output.
17	AIO_1		General-purpose analog/digital input or open drain LED output.
18	AIO_2		General-purpose analog/digital input or open drain LED output.
19	AIO_3		General-purpose analog/digital input or open drain LED output.
20	AIO_4		General-purpose analog/digital input or open drain LED output
21	AIO_5		General-purpose analog/digital input or open drain LED output.
22	PIO_43	Weak pull-down	Programmable Input/Output Line
23	PIO_44	Strong pull-up	Programmable Input/Output Line
24	PIO_8	Weak pull-down	Programmable Input/Output Line
25	PIO_7	Strong pull-up	Programmable Input/Output Line
26	PIO_6	Strong pull-up	Programmable Input/Output Line
27	PIO_5	Weak pull-down	Programmable Input/Output Line
28	PIO_4	Weak pull-down	Programmable Input/Output Line
29	PIO_3	Strong pull-up	Programmable Input/Output Line
30	PIO_2	Weak pull-down	Programmable Input/Output Line
31	PIO_1	Strong pull-up	Programmable Input/Output Line
32	PIO_27	Strong pull-up	Programmable Input/Output Line
33	PIO_23	Weak pull-down	Programmable Input/Output Line
34	PIO_22	Weak pull-down	Programmable Input/Output Line
35	PIO_53	Weak pull-down	Programmable Input/Output Line
36	PIO_52	Weak pull-down	Programmable Input/Output Line

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Pin Descriptions 2

37	PIO_51	Weak pull-down	Programmable Input/Output Line
38	PIO_50	Weak pull-down	Programmable Input/Output Line
39	PIO_46	Weak pull-down	Programmable Input/Output Line
40	1V8_SMPS		1.8V Output
41	PADS_2		1.8 V/3.3 V PIO supply
42	PADS_7		1.8 V/3.4 V PIO supply
43	PADS_4		1.8 V/3.5 V PIO supply
44	GND		GND
45	SPK2_P		Headphone/speaker differential 2 output, positive.
46	SPK2_N		Headphone/speaker differential 2 output, negative
47	SPK1_N		Headphone/speaker differential 1 output, negative.
48	SPK1_P		Headphone/speaker differential 1 output, positive.
49	MIC_BLAS		Mic bias output.
50	GND		GND
51	MIC1_N		Microphone differential 1 input, negative.
52	MIC1_P		Microphone differential 1 input, positive.
53	MIC3_P		Microphone differential 3 input, positive.
54	MIC3_N		Microphone differential 3 input, negative
55	MIC2_N		Microphone differential 2 input, negative.
56	MIC2_P		Microphone differential 2 input, positive.
57	MIC4_N		Microphone differential 4 input, negative.
58	MIC4_P		Microphone differential 4 input, positive
59	PIO_35	Strong pull-down	Programmable Input/Output Line
60	PIO_45	Strong pull-up	Programmable Input/Output Line
61	PIO_49	Weak pull-down	Programmable Input/Output Line
62	GND		GND
63	RF		RF Output
64	GND		GND
65	PIO_38		Programmable Input/Output Line
66	PADS_6		1.8 V/3.3 V PIO supply
67	PADS_3		1.8 V/3.3 V PIO supply.
68	PIO_21	Weak pull-down	Programmable Input/Output Line
69	PIO_20	Strong pull-up	Programmable Input/Output Line
70	PIO_19	Weak pull-down	Programmable Input/Output Line
71	PIO_18	Strong pull-up	Programmable Input/Output Line

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Design notes:

In order to bet ter SNR, please pay at tent ion to the hardware des ign of PA, DC booster, DC/DC circuit and the module power ci rcui t to avoid inf luencing module.

The signal strength is depending on the environment of Bluetooth applicat ion, such as wood and metal will block the transmission signal to get the shorter transmission distance.

Because of metal will block the signal transmission, it is recommend not to use the metal housing.

PCB layout guideline:

no any copper existed in the antenna area of the module is the PCB antenna, the metal will weaken the funct ion of the antenna when the antenna module to the module board, following prohibited paving and walk the line.

If the module antenna next to the battery or metal, liquid crystal screen, loudspeaker, at least keep them away from antenna distance 15mm.

When layout the power supply line recommended star line, and to ensure that the Bluetooth module Power supply lines is better, and BT should be with the amplifier, power amplifier, MCU, separately, and the underside of the BT has no other interference.

Suggests the module antenna part floating on the floor, do not go around the antenna control line, power line, audio line, MIC interference lines;

If the module antenna near the row seats, Because of metal will block the signal transmission, it is recommended to use professional high-gain antenna.

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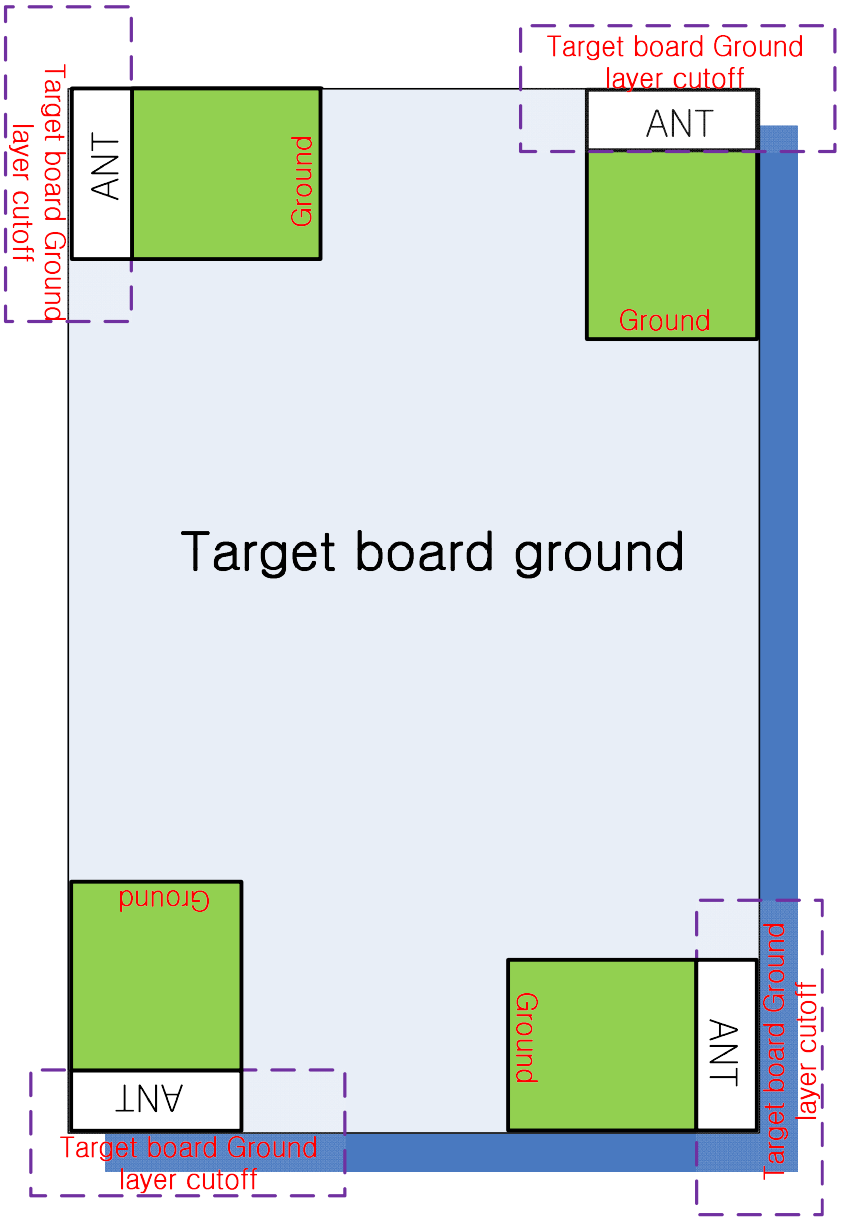
Module Position Guide and SMT profile

Ground must not exist around Antenna area.



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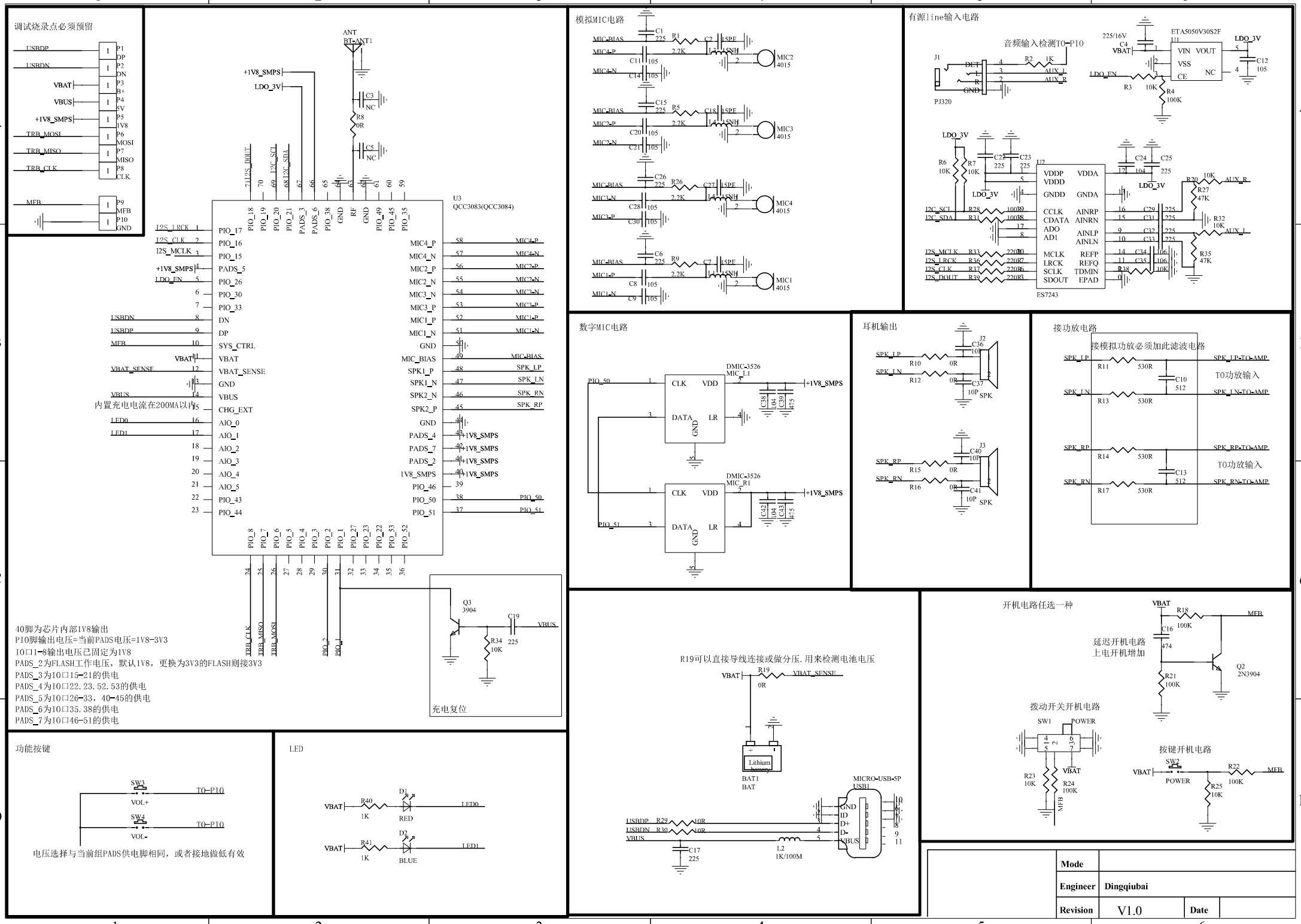
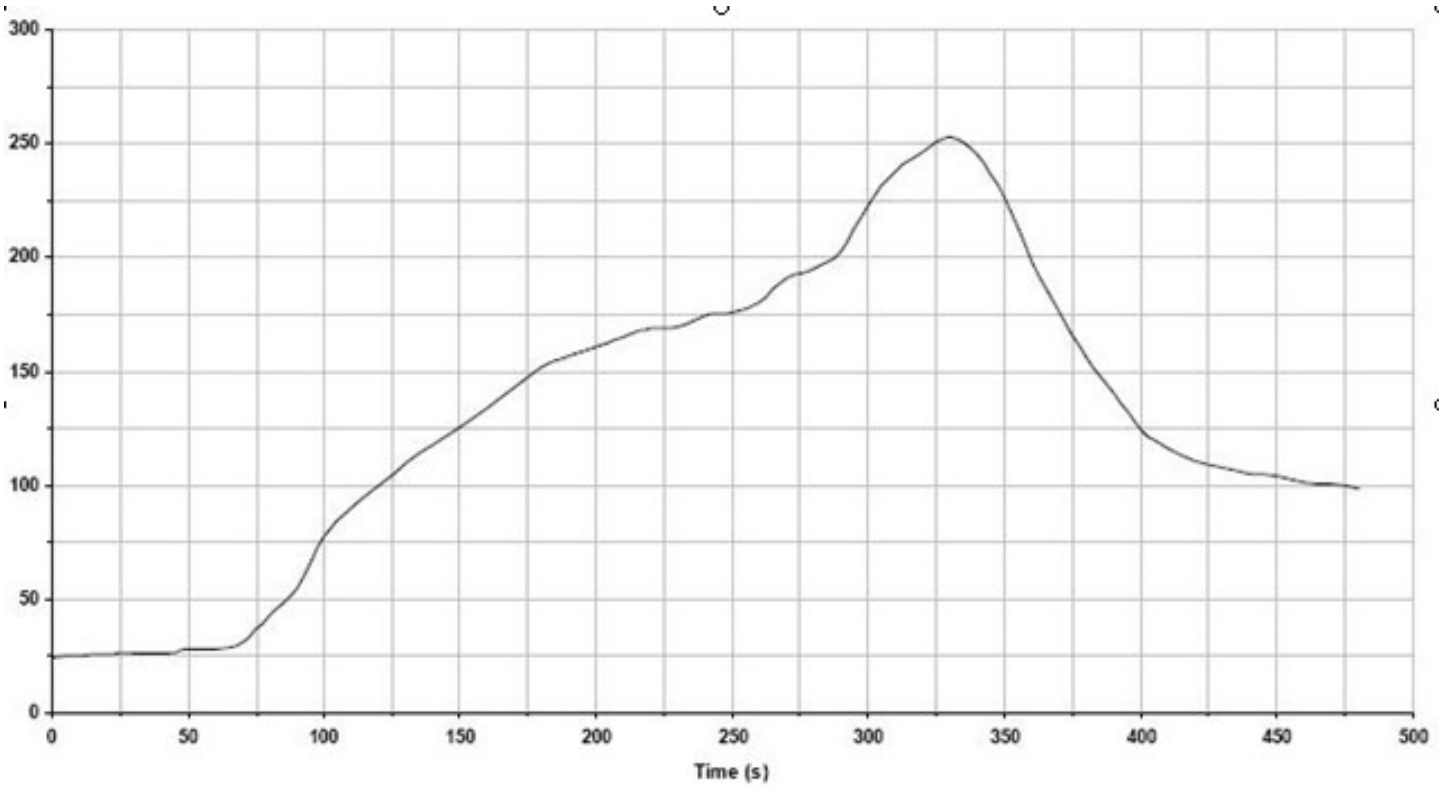

调试烧录点必须预留
USBDP
USBDN
VBAT
VBUS
+1V8_SMPS
TRB_MOSI
TRB_MISO
TRB_CLK
MFB
P1 DP
P2 DN
P3 B+
P4 5V
P5 1V8
P6 MOSI
P7 MISO
P8 CLK
P9 MFB
P10 GND
ANT
BT-ANT1
+1V8_SMPS
LDO_3V
C3 NC
R8 0R
C5 NC
U3
QCC3083(QCC3084)
I2S_LRCK
I2S_CLK
I2S_MCLK
+1V8_SMPS
LDO_EN
USBDN
USBDP
MFB
VBAT
VBAT_SENSE
VBUS
内置充电电流在200MA以内
LED0
LED1
PIO_17
PIO_16
PIO_15
PADS_5
PIO_26
PIO_30
PIO_33
DN
DP
SYS_CTRL
VBAT
VBAT_SENSE
GND
VBUS
CHG_EXT
AIO_0
AIO_1
AIO_2
AIO_3
AIO_4
AIO_5
PIO_43
PIO_44
MIC4_P
MIC4_N
MIC2_P
MIC2_N
MIC3_N
MIC3_P
MIC1_P
MIC1_N
GND
MIC_BIAS
SPK1_P
SPK1_N
SPK2_N
SPK2_P
GND
PADS_4
PADS_7
PADS_2
1V8_SMPS
PIO_46
PIO_50
PIO_51
TRB_CLK
TRB_MISO
TRB_MOSI
PIO_2
PIO_1
Q3
3904
C19
225
VBUS
R34
10K
充电复位
40脚为芯片内部1V8输出
PIO脚输出电压=当前PADS电压=1V8-3V3
IO口1-8输出电压已固定为1V8
PADS_2为FLASH工作电压，默认1V8，更换为3V3的FLASH则接3V3
PADS_3为IO口15-21的供电
PADS_4为IO口22.23.52.53的供电
PADS_5为IO口26-33，40-45的供电
PADS_6为IO口35.38的供电
PADS_7为IO口46-51的供电
模拟MIC电路
MIC-BIAS
MIC4-P
MIC4-N
MIC2-P
MIC2-N
MIC3-N
MIC3-P
MIC1-P
MIC1-N
MIC2
4015
MIC3
4015
MIC4
4015
MIC1
4015
有源line输入电路
音频输入检测TO-PIO
J1
PJ320
DET
L
R
GND
R2 1K
AUX_L
AUX_R
225/16V
C4
VBAT
ETA5050V30S2F
U1
VIN
VOUT
VSS
CE
NC
LDO_3V
C12
105
LDO_EN
R3 10K
R4 100K
LDO_3V
R6 10K
R7 10K
C22 225
C23 225
U2
VDDP
VDDD
GNDD
CCLK
CDATA
ADO
AD1
MCLK
LRCK
SCLK
SDOUT
VDDA
GNDA
AINRP
AINRN
AINLP
AINLN
REFP
REFQ
TDMIN
EPAD
ES7243
I2C_SCL
I2C_SDA
I2S_MCLK
I2S_LRCK
I2S_CLK
I2S_DOUT
R20 10K
AUX_R
R27 47K
R32 10K
AUX_L
R35 47K
数字MIC电路
PIO_50
PIO_51
DMIC-3526
MIC_L1
MIC_R1
CLK
VDD
DATA
LR
GND
+1V8_SMPS
C38 104
C39 475
C42 104
C43 475
耳机输出
J2
C36 10P
SPK_LP
SPK_LN
R10 0R
R12 0R
C37 10P
SPK
J3
C40 10P
SPK_RP
SPK_RN
R15 0R
R16 0R
C41 10P
接功放电路
接模拟功放必须加此滤波电路
SPK_LP
SPK_LN
SPK_RP
SPK_RN
R11 530R
R13 530R
R14 530R
R17 530R
C10 512
C13 512
SPK_LP-TO-AMP
SPK_LN-TO-AMP
SPK_RP-TO-AMP
SPK_RN-TO-AMP
TO功放输入
TO功放输入
R19可以直接导线连接或做分压.用来检测电池电压
VBAT
R19 0R
VBAT_SENSE
Lithium battery
BAT1
BAT
MICRO-USB-5P
USB1
GND
ID
D+
D-
VBUS
USBDP
USBDN
VBUS
R29 10R
R30 10R
C17 225
L2 1K/100M
开机电路任选一种
VBAT
R18 100K
MFB
C16 474
延迟开机电路
上电开机增加
Q2
2N3904
R21 100K
拨动开关开机电路
SW1
POWER
R23 10K
R24 100K
MFB
按键开机电路
SW2
POWER
R22 100K
R25 10K
功能按键
SW3
VOL+
TO-PIO
SW4
VOL-
TO-PIO
电压选择与当前组PADS供电脚相同，或者接地做低有效
LED
VBAT
R40 1K
D1
RED
LED0
VBAT
R41 1K
D2
BLUE
LED1
Mode
Engineer
Dingqiubai
Revision
V1.0
Date

Recommended reflow temperature



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FCC/IC Statements

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module. For 15 B (§15.107 and if applicable §15.109) compliance, the host manufacturer is required to show compliance with 15 while the module is installed and operating.

Furthermore the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has to apply the appropriate equipment authorization (e.g. Verification) for the new host device per definition in §15.101.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

The final host device, into which this RF Module is integrated" has to be labeled with an auxiliary label stating the FCC ID of the RF Module, such as "Contains FCC ID: 2AO2T-F3083

"This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:
(1)this device may not cause harmful interference, and
(2)this device must accept any interference received, including interference that may cause undesired operation."

"Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment."

the Integrator will be responsible to satisfy SAR/ RF Exposure requirements, when the module integrated into the host device.

The final host device, into which this RF Module is integrated" has to be labeled with an auxiliary label stating the IC of the RF Module, such as" Contains transmitter module IC: 33423-F3083
Le périphérique hôte final, dans lequel ce module RF est intégré "doit être étiqueté avec une étiquette auxiliaire indiquant le CI du module RF, tel que" Contient le module émetteur IC: 33423-F3083

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
(1) This device may not cause interference.
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) L' appareil ne doit pas produire de brouillage;
(2) L' appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d' en compromettre le fonctionnement.

Module statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

1) The radio elements have the radio frequency circuitry shielded.
2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.
3) The module contains power supply regulation on the module.
4) The module contains a permanently attached antenna.
5) The module demonstrates compliance in a stand-alone configuration.
6) The module is labeled with its permanently affixed FCC ID label.
7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.
8) The module complies with RF exposure requirements.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to

try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help

Co-location Warning:
This equipment could not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with the FCC multi-transmitter product procedures.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01
2.2 List of applicable FCC rules
FCC Part 15.247
2.3 Specific operational use conditions
This transmitter/module and its antenna(s) must not be co-located or operating in conjunction with any transmitter. This information also extends to the host manufacturer's instruction manual.
2.4 Limited module procedures
Not applicable
2.5 Trace antenna designs
It is "not applicable" as trace antenna which is not used on the module.
2.6 RF exposure considerations
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment can be used in portable exposure conditions.
The host product manufacturer would provide the above information to end users in their end-product manuals.

2.7 Antennas
FPC antenna; HT-T0228A-2.4G-V0, FPC Ant.,0dBi,2.402 GHz～2.480GHz
2.8 Label and compliance information
The end product must carry a physical label or shall use e-labeling followed KDB784748D01 and KDB 784748 stating "Contains Transmitter Module FCC ID: 2AO2T-F3083".
2.9 Information on test modes and additional testing requirements
For more information on testing, please contact the manufacturer.
2.10 Additional testing, Part 15 Subpart B disclaimer
The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuity.