F1MC20S

Data Sheet

Confidential / Preliminary Documentation

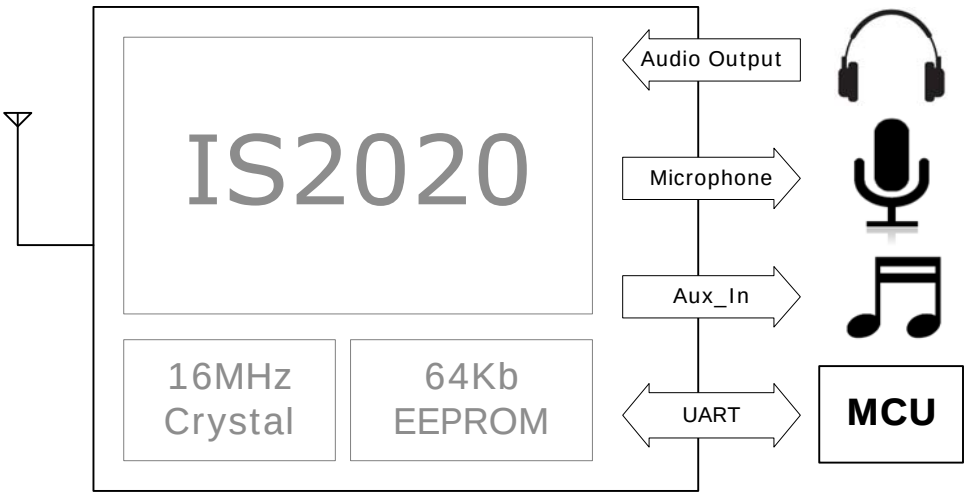
Revision v1.0

1. General

1.1 overview

This specification covers Bluetooth module (class-2) which complies with Bluetooth specification version 4.1+ EDR and integrates RF & Baseband controller in small package. This Module has deployed Microchip's IS2020 chipset.

All detailed specification including pin-outs and electrical specification may be changed without notice.



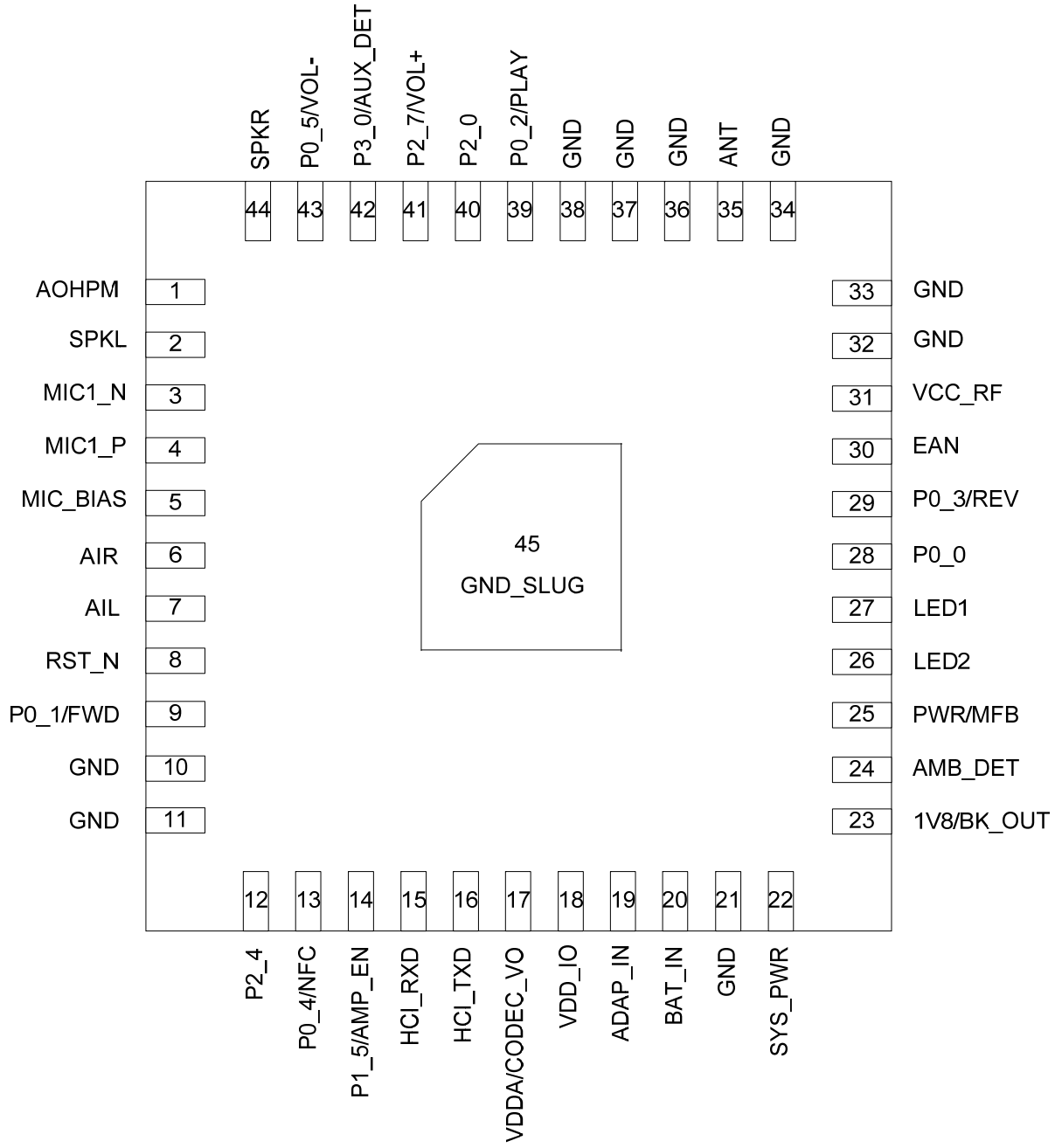
1.2 Features

- Complete, Fully Certified, Embedded 2.4 GHz Bluetooth® Version 4.1 Module
- Support 64 kb/s A-Law or μ-Law PCM format, or CVSD (Continuous Variable Slope Delta Modulation) for SCO channel operation
- 20 bit DAC and 16 bit ADC codec
- 98dB SNR DAC playback
- Integrate 3V, 1.8V configurable switching regulator and LDO
- Built-in Lithium-ion battery charger (up to 350mA)
- Simple, UART interface & Multiple I/O pins for control and status
- A line-in port for external audio input
- Two LED drivers
- High speed HCI-UART (Universal Asynchronous Receiver Transmitter) interface (up to 921600bps)
- Noise & Echo suppression
- Environmentally friendly, RoHS compliant
- Competitive Size (14.5mm x 14.5mm x 2mm : QFN 44Pin).

1.3 Application

- High Quality Stereo Wireless Headsets
- High Quality Mono Headsets
- Hands-Free Car Kits
- Bluetooth sound bar
- Bluetooth stereo speaker phone

1.4 Pin-out Diagram



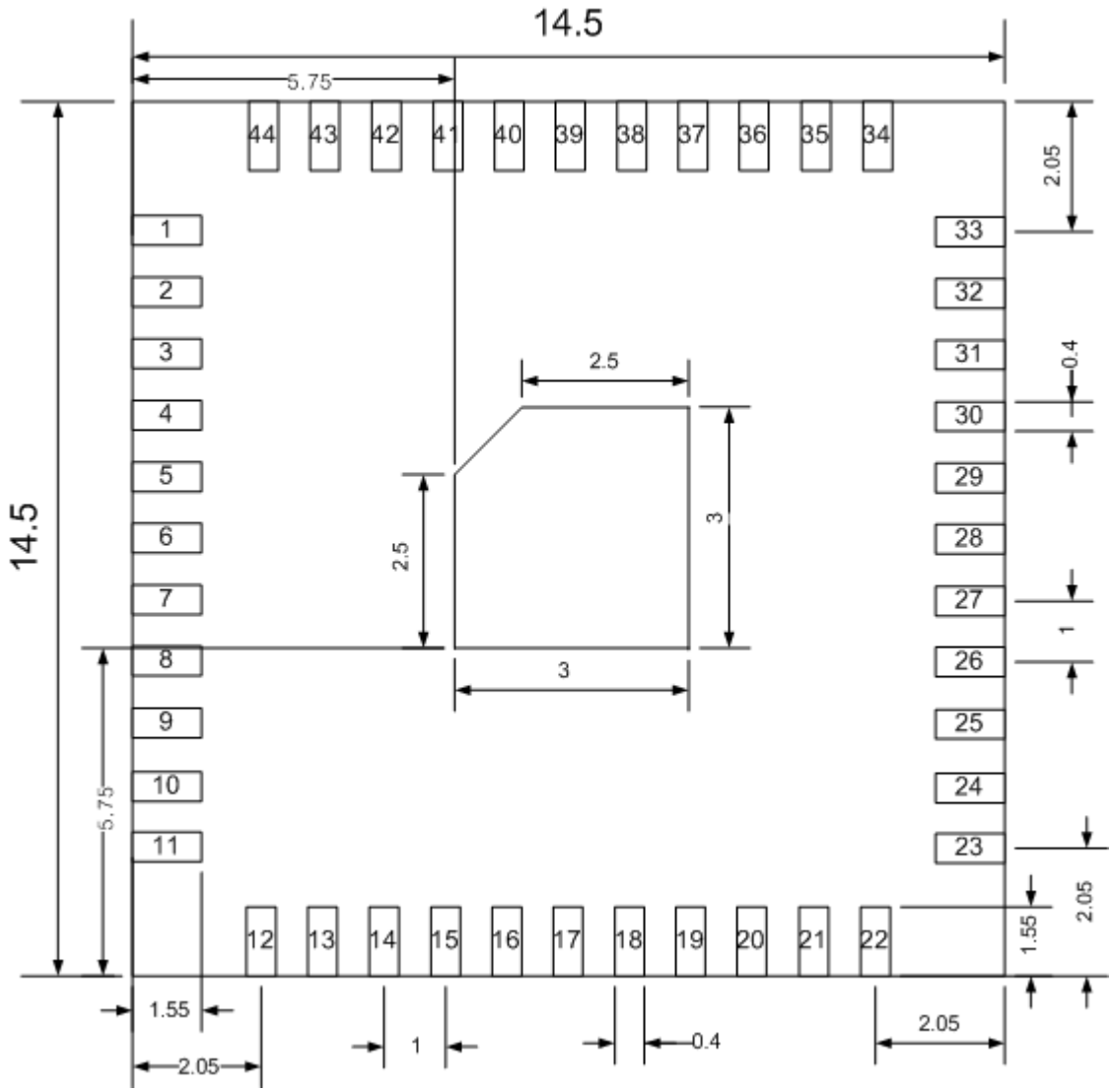
1.5 Device Terminal Functions

Pin	Pin Name	Pin Type	Description
1	AOHPM	O	Headphone common mode output/sense input.
2	SPKL	O	L-channel analog headphone output
3	MIC1_N	I	Mic 1 mono differential analog negative input
4	MIC1_P	I	Mic 1 mono differential analog positive input
5	MIC_BIAS	P	Electric microphone biasing voltage
6	AIR	I	R-channel single-ended analog inputs
7	AIL	I	L-channel single-ended analog inputs
8	RST_N	I	System Reset Pin, Low: reset
9	P0_1/FWD	I/O	IO pin, default pull-high input (Note 1) 1. FWD key when class 2 RF (default), active low. 2. Class1 TX Control signal of external RF T/R switch, active high.
10	GND	P	Ground Pin
11	GND	P	Ground Pin
12	P2_4	I	IO pin, default pull-high input System Configuration, L: Boot Mode with P2_0 low combination
13	P0_4/NFC	I/O	IO pin, default pull-high input. (Note 1) 1. NFC detection pin, active low. 2. Out_Ind_0
14	P1_5/AMP_EN	I/O	IO pin, default pull-high input (Note 1) 1. NFC detection pin, active low. 2. Out_Ind_0 3. Slide Switch Detector, active low. 4. Buzzer Signal Output
15	HCI_RXD	I	HCI-UART RX data
16	HCI_TXD	O	HCI-UART TX data
17	VDDA/CODEC_VO	P	Positive power supply/reference voltage for CODEC, no need to add power to this pin.
18	VDD_IO	P	Power output , no need to add power to this pin
19	ADAP_IN	P	5V Power adaptor input
20	BAT_IN	P	3.3V~4.2V Li-Ion battery input

Pin	Pin Name	Pin Type	Description
21	GND	P	Ground Pin
22	SYS_PWR	P	System Power Output BAT mode: 3.3~4.2V Adapter mode: 4.0V
23	1V8/BK_OUT	P	1.8V buck output, no need to add power to this pin
24	AMB_DET	TBD	TBD
25	PWR/MFB	I	1. Power key when in off mode 2. UART_RX_IND: MCU use to wakeup BT (Note 1)
26	LED2	I	LED Driver 2
27	LED1	I	LED Driver 1
28	P0_0	I/O	IO pin, default pull-high input (Note 1) 1. Slide Switch Detector, active low. 2. UART TX_IND, active low.
29	P0_3/REV	I/O	IO pin, default pull-high input (Note 1) 1. REV key (default), active low. 2. Buzzer Signal Output 3. Out_Ind_1 4. Class1 RX Control signal of external RF T/R switch, active high.
30	EAN	I	Embedded ROM/External Flash enable H: Embedded; L: External Flash
31	VCC_RF	P	1.28V RF LDO output, no need to add power to this pin.
32	GND	P	Ground Pin
33	GND	P	Ground Pin
34	GND	P	Ground Pin
35	ANT	I/O	RF RTX path
36	GND	P	Ground Pin
37	GND	P	Ground Pin
38	GND	P	Ground Pin
39	P0_2/PLAY	I	IO pin, default pull-high input (Note 1) Play/Pause key (default), active low.

Pin	Pin Name	Pin Type	Description
40	P2_0	I	IO pin, default pull-high input System Configuration, H: Application L: Baseband(IBDK Mode)
41	P2_7/VOL+	I	IO pin, default pull-high input (Note 1) Volume up key (default), active low.
42	P3_0/AUX_DET	I	IO pin, default pull-high input (Note 1) Line-in Detector (default), active low.
43	P0_5/VOL-	I	IO pin, default pull-high input (Note 1) Volume down (default), active low.
44	SPKR	O	R-channel analog headphone output

1.6 Module Dimension



2. Characteristics

2.1 Electrical Characteristics

Absolute Maximum Ratings

Parameter		Minimum	Maximum
Storage temperature		-65°C	150°C
Operating temperature range		-20°C	70°C
Supply voltage	BAT_IN ADAP_IN	0V 0V	4.3V 7.0V

Recommended Operating Conditions

Parameter		Minimum	Typical	Maximum
Operating temperature range		-20°C	25°C	70°C
Supply voltage	BAT_IN ADAP_IN	3.0V 4.5V	3.7V 5.0V	4.2V 5.5V

I/O and Reset Level

Parameter	Minimum	Typical	Maximum	Unit
I/O Supply Voltage (VDD_IO)	2.7	3.0	3.3	V
I/O Voltage Levels				
VIL input logic levels low	-0.3		0.8	V
VIH input logic levels high	2.0		3.6	V
VOL output logic levels low			0.4	V
VOH output logic levels high	2.4			V
RESET				
$V_{TH,RES}$ threshold voltage		1.6		V

Note:
(1) VDD_IO voltage is programmable by EEPROM parameters.
(2) These parameters are characterized but not tested in manufacturing.

LED Driver

Parameter	Minimum	Typical	Maximum	Unit
Open-drain Voltage	4.5	5.0	5.5	V
Programmable Current Range		3	4.5	mA
Intensity Control				step
Current Step				mA
Power Down Open-drain Current		3		μA
Shutdown Current		10		μA

Note:
(1) Test condition: SAR_VDD=1.8V, temperature=25 °C.
(2) These parameters are characterized but not tested in manufacturing.

Battery Charger

Parameter		Minimum	Typical	Maximum	Unit
ADAP_IN Input Voltage		4.5	5.0	5.5	V
Supply current to charger only			3	4.5	mA
Maximum Battery Fast Charge Current Note: ENX2=0	Headroom > 0.7V (ADAP_IN=5V)	170	200	240	mA
	Headroom = 0.3V (ADAP_IN=4.5V)	160	180	240	mA
Maximum Battery Fast Charge Current Note: ENX2=1	Headroom > 0.7V (ADAP_IN=5V)	330	350	420	mA
	Headroom = 0.3V (ADAP_IN=4.5V)	180	220	270	mA
Trickle Charge Voltage Threshold			3		V
Battery Charge Termination Current, (% of Fast Charge Current)			10		%

Note:
(1) Headroom = VADAP_IN – VBAT
(2) ENX2 is not allowed to be enabled when VADAP_IN – VBAT > 2V
(3) These parameters are characterized but not tested in manufacturing.

AUDIO CODEC ANALOGUE TO DIGITAL CONVERTER

T= 25℃, V_{dd}=3.0V, 1KHz sine wave input, Bandwidth = 20Hz~20KHz				
Parameter (Condition)	Minimum	Typical	Maximum	Unit
Resolution			16	Bits
Output Sample Rate	8		48	KHz
Signal to Noise Ratio Note: 1 (SNR @MIC or Line-in mode)		88		dB
Digital Gain	-54		4.85	dB
Digital Gain Resolution		2 ~ 6		dB
MIC Boost Gain		20		dB
Analog Gain			60	dB
Analog Gain Resolution		2.0		dB
Input full-scale at maximum gain (differential)		4		mV_{rms}
Input full-scale at minimum gain (differential)		800		mV_{rms}
3dB bandwidth		20		KHz
Microphone mode (input impedance)		24		KΩ
THD+N (microphone input) @30mVrms input		0.02		%

Note:
(1) f_{in}=1KHz, B/W=20~20KHz, A-weighted, THD+N < 1%, 150mV_{pp} input
(2) These parameters are characterized but not tested in manufacturing.

AUDIO CODEC DIGITAL TO ANALOGUE CONVERTER

T= 25℃, V_{dd}=3.0V, 1KHz sine wave input, Bandwidth = 20Hz~20KHz					
Parameter (Condition)		Minimum	Typical	Maximum	Unit
Over-sampling rate			128		f_s
Resolution		16		20	Bits
Output Sample Rate		8		48	KHz
Signal to Noise Ratio Note: 1 (SNR @cap-less mode) for 48kHz			96		dB
Signal to Noise Ratio Note: 1 (SNR @single-end mode) for 48kHz			98		dB
Digital Gain		-54		4.85	dB
Digital Gain Resolution			2 ~ 6		dB
Analog Gain		-28		3	dB
Analog Gain Resolution			1		dB
Output Voltage Full-scale Swing (AVDD=2.8V)		495	742.5		mV_{rms}
Maximum Output Power (16Ω load)			34.5		mW
Maximum Output Power (32Ω load)			17.2		mW
Allowed Load	Resistive	8	16	O.C.	Ω
	Capacitive			500	pF
THD+N (16Ω load)				0.05	%
Signal to Noise Ratio (SNR @ 16Ωload)				96	dB

Note:
(1) f_{in}=1KHz, B/W=20~20KHz, A-weighted, THD+N < 0.01%, 0dBFS signal, Load=100KΩ
(2) These parameters are characterized but not tested in manufacturing.

TRANSMITTER SECTION FOR BDR AND EDR

Parameter	Minimum	Typical	Maximum	Unit
Maximum RF transmit power		3.0	4.0	dBm
EDR/BDR Relative transmit power	-4	-1.2	1	dB

Note:
The RF Transmit power is calibrated during production using MP Tool software and MT8852 Bluetooth Test equipment.
Test condition: VCC_RF= 1.28V, temperature=25 °C.

RECEIVER SECTION FOR BDR AND EDR

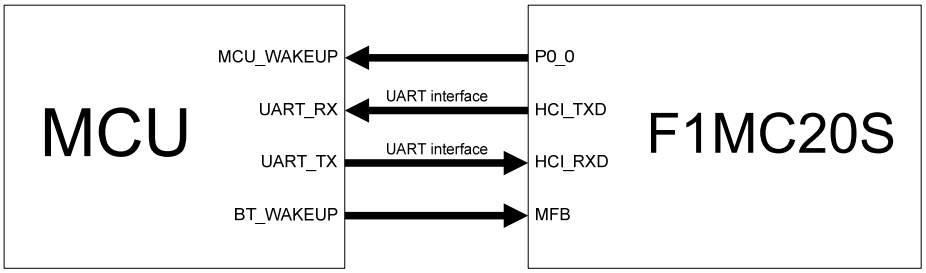
Parameter	Modulation	Minimum	Typical	Maximum	Unit
Sensitivity at 0.1% BER	GFSK		-90		dBm
Sensitivity at 0.01% BER	π/4 DQPSK		-91		dBm
	8DPSK		-82		dBm

Note:
(1) Test condition: VCC_RF= 1.28V, temperature=25 °C.
(2) These parameters are characterized but not tested in manufacturing.

3. Terminal Description

3.1 UART

F1MC20S support UART command set to make an external MCU to control module.
Here is the connection interface between F1MC20S and MCU.



MCU can control module by UART interface and wakeup module by PWR pin. F1MC20S provide wakeup MCU function by connect to P0_0 pin of module.

“UART Command Set” document provide all function which module support and UI tool will help you to set up your system support UART command.

For more detail description, please reference “UART_CommandSet_v154” document and “IS20XXS_UI” tool.

4. Revision History

Revision	Date	Change Descriptions	Issued by
Rev 1.0	2016-07-17	Initial release	Inkel

5. Application Schematic

Application Schematic