GENERAL DESCRIPTION

The MD1020 has a fully integrated radio transceiver and baseband processor for Bluetooth Low Energy. It can be used as an application processor as well as data pump in fully hosted systems.

The MD1020 contains an embedded Flash memory for storing Bluetooth profiles as well as custorm application code. The qualitied BLE protocol stack, stored in a dedicated Flash area, as well as the customer application software run on the embedded MCU processor.Low leakage Retention RAM is used to store all the sensitive data and connection information while in Deep Sleep mode.
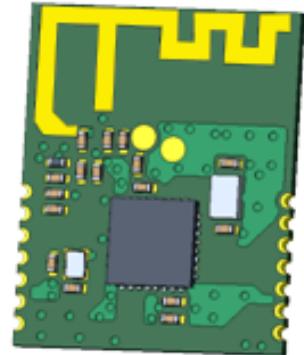
The BLE firmware includes the L2CAP service layer protocols, Secutiry Manager(SM), Attribute Protocol(ATT), the Generic Attribute Profile(GATT) and the Generic Access Profile(GAP). Furthermore, application profiles such as Proximity, Health Thermometer,Heart Rate, Blood Pressure,Glucose and Human Interface Device(HID) are supported.

The MD1020 SOC BLE chipset is the 32-bit microcontroller. It has many high-performance peripheral functions, such as general purpose I/O port, UARTs, SPI interfaces, I2C interfaces, PWM output, 12-bit ADC, Watchdog Timer, three 32-bit timers.

The MD1020 can run up to 52MHZ and operate at a wide voltage range of 2.2V~3.6V and temperature range of -40 ~ +80 Dgree C. The embedded FLASH size up to 256Kbytes and SRAM up to 16Kbytes. It also offers size configurable Data Flash(shared with program flash).

KEY PRODUCT FEATURES

- 2.4GHz RF transceiver(Compatible with BLE4.2)
- RX sensitivity:-90 dBm@1Mbps
- Programmable Tx output power 13dBm(Maximum), 8dBm(Typical).
- On board Antena.
- SMT interface with SPI,UART,I2C.
- General I/O, Analog ADC port
- MCU core up to 52MHz, 256KB FLASH,16KB SRAM
- ISP,IAP,ICP.

- Operation Temperature range：$-40℃~85℃$

- Operation voltage:2.2~3.6V,
- Built-IN LDO:2.2V ~3.6V. About 2uA @deep sleep mode,
- BOD:2.87/2.72/2.34/2.06V threshold level.
- LVR 1.7V threshold level
- ESD HBM pass +/-2KV
- 96-bit unique ID
- Typical applications to Smart home automation, wireless gramepads, tags,Remote control

1 Electrical Characteristics

All the parameters are accurate to the one decimal place.

1.1 Absolute Maximum Ratings

Table 1 Absolute maximum ratings

Symbol	Description	Parameter			Unit
		Min	Typ	Max	
VDD	VDD1/VDD2	-0.3	-	3.6	V
VI	Input voltage	-0.3	-	VDD	V
VO	Output voltage	VSS	-	VDD	V
TOP	Operating Temperature	-40	-	85	℃
TSTG	Storage Temperature	-40	-	125	℃

Note:

Exceeding one or more of the limiting values may cause permanent damage to MD1020. Caution: Electrostatic sensitive device, comply with protection rules when operating.

1.2 DC Electrical Characteristics

Table 2　Voltage and current

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VDD1/VDD2	Power Supply	2.2	3	3.6	V	TA=25℃
VSS	Ground	-	0	-	V	-
IDP_SLP_PAD	Deep sleep current	1.5	2	2.5	uA	MCU power down, SRAM maintain, HCLK and 32K RC off, wake up by　GPIO or RE- SET
IDP_SLP_RC	Deep sleep current	2	3	5	uA	MCU power down, SRAM maintain, HCLK off, 32K RC on
ITX,0dBm	Operating Current of TX mode	-	17	-	mA	0dBm output power
ITX,8dBm	Operating Current of TX mode	-	31	-	mA	8dBm output power
ITX,10dBm	Operating Current of TX mode	-	41	-	mA	10dBm output power
IRX	Operating Current of RX mode	-	16	-	mA	Maximum LNA Gain
VOH	Output high level voltage	VDD-0.3	-	VDD	V	-
VOL	Output low level voltage	VSS	-	VSS+0.3	V	-
VIH	Input high level voltage	2.0	3	3.6	V	-
VIL	Input low level voltage	VSS	-	VSS+0.3	V	-

1.3   16 MHz Crystal Oscillator Characteristics

Table 3   16M RC oscillator

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
FXTAL(16M)	Crystal oscillator frequency	-	-	16	-	MHz
ESR(16M)	Equivalent series resistance	-	-	-	80	Ω
ΔfXTAL(16M)	Crystal frequency tolerance	-	-20	-	20	ppm
VCLK(EXT)(16M)	External clock voltage	-	0.1	0.8	-	V
φN(EXTERNAL)16M	Phase noise	fC = 50 kHz in case of an external reference clock	-	-	-130	dBc/Hz

1.4   32 KHz Crystal Oscillator Characteristics

Table 4   32K RC oscillator

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VCLK(EXT)(32K)	External clock voltage	peak-peak voltage of external clock at XTAL32Kp, pin XTAL32Km floating. note: XTAL32Kp is internally AC coupled	0.1	0.2	1.5	V
fXTAL(32k)	Crystal oscillator frequency	frequency range for an external clock (for a crystal, use either 32.000 kHz or 32.768 kHz)	TBD	32.768	TBD	KHz
ESR(32k)	Equivalent series resistance	-	-	-	100	KΩ
ΔfXTAL(32k)	Crystal frequency tolerance (including aging)	Timing accuracy is dominated by crystal accuracy. A much smaller value is preferred	-250	-	250	ppm

1.5   Stable Low Frequency RCX Oscillator Characteristics

Table 5   Stable Low Frequency RCX Oscillator

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
fRC(RCX)	RCX oscillator frequency	default setting	-	32	-	Khz
ΔfRC(RCX)	RCX oscillator frequency drift	-	-500	-	500	ppm

1.6   AC Electrical Characteristics

Table 6   RF

Symbol	Condition	Min	Typ	Max	Unit
General frequency					
Fop	Operating frequency	2400	-	2483	MHz
PLLres	PLL Programming resolution	-	1	-	MHz
Fxtal	Crystal frequency	-	16	-	MHz
DR	Data rate	-	1	-	Mbps
Transmitter					
PRF	Output power	2	8	13	dBm
PRFC	Output Power Range	-16	-	13	dBm
PBW	20dB Bandwidth for Modulated Carrier at 1Mbps	950	-	1100	MHz
Spur2M	In-band 2M Spurious Emission	-	-	-26	dBm
Spur≥3M	In-band 3M or greater Spurious Emission	-	-	-36	dBm
MDR	Maximum drift rate	-	-	13	KHz/50us
FD	Frequency Deviation	225	-	275	KHz
Receiver					
RXmax	Maximum received signal at <0.1% BER	-	0	-	dBm
RXSENS	Sensitivity (0.1%BER) @1Mbps	-	-90	-	dBm
C/ICO	C/I Co-channel interference	-	11	-	dBc
C/I1M	Adjacent 1MHz interference	-	-2	-	dBc
C/I2M	Adjacent 2MHz interference	-	-22	-	dBc
C/I≥3M	Adjacent ≥ 3MHz interference	-	-38	-	dBc
C/Iimage	Image frequency interference	-	-12	-	dBc
C/Iimage±1M	Adjacent（1MHz）interference to in-band image frequency	-	-35	-	dBc
P_IMD	Intermodulation interference	-	-45	-	dBm
P_Blocking	Out-of-band Blocking interference	-30		-	dBm

Table 7   DPLL

Symbol	Parameter	Min	Typ	Max	Unit	Notes
VDD2	Power Supply	2.2	-	3.6	V	-
TA	Temperature	-40	-	85	℃	-
Fin	Input Clock frequency	-	12	-	MHz	-
		-	16	-	MHz	-
		-	24	-	MHz	-
FDPLL	Clock frequency	-	52	-	MHz	-

Symbol	Parameter	Min	Typ	Max	Unit	Notes
-	Resolution	-	10	-	Bit	-
VDD2	Power Supply	2.5(for VTOP=2.4V) 2.2(for VTOP=1.4V)	-	3.6	VDDA	-
ITOT	Operation Current	880	-	1600	uA	-
INL	Integral Nonlinearity Error	-	-	±2	LSB	
PCLK	System Clock	-	-	52	MHz	-
Fadc	Clock Frequency	-	-	26	MHz	-
FS	Sample Rate	-	-	1.625	MHz	-
Ts	Sample Time	7	-	-	PCLK	-
Th	Compare Time	25	-	-	PCLK	-
TCONV	Data Output cycle	32	50	170	PCLK	-
N	S-H counter	1	2	7	-	-
Vin	Analog input voltage	0.4 0.4	- -	2.4 1.4	V	-
Cin	Input Capacitance	-	10	-	pF	-
Rin	Input resistance	14.6	-	-	KΩ	See Note
Vref	ADC reference voltage	-	VBG	-	V	-
DATA	ADC Output	000	-	FFF	HEX	-
SFDR	Spurious Free Dynamic range	-	64	-	dB	-

Note:

$$Rin = \frac{EXTSMPT\text{<}9{:}0\text{>}(1+ADC\_CTL\text{<}19{:}16\text{>})}{f_{adc} \times C_{in} \times 1n\frac{V_{in}}{V_{in\text{-}V_{real}}}}$$

Table 9   LVR

Symbol	Parameter	Min	Typ	Max	Unit	Notes
VDD2	Power Supply	2.2	3	3.6	V	-
VLVR	Threshold Voltage	1.6	1.7	1.8	V	-

Table 10   BOD

Symbol	Parameter	Vout(V) 1→0	Vout(V) 0→1	Test Conditions	Notes
VBOD	Brown-Out Detector	1.93	2.06	BODEN=1 BODVL<1:0>=00	-
		2.20	2.34	BODEN=1 BODVL<1:0>=01	-
		2.55	2.72	BODEN=1 BODVL<1:0>=10	-
		2.82	2.87	BODEN=1 BODVL<1:0>=11	-

2 Pinouts definition
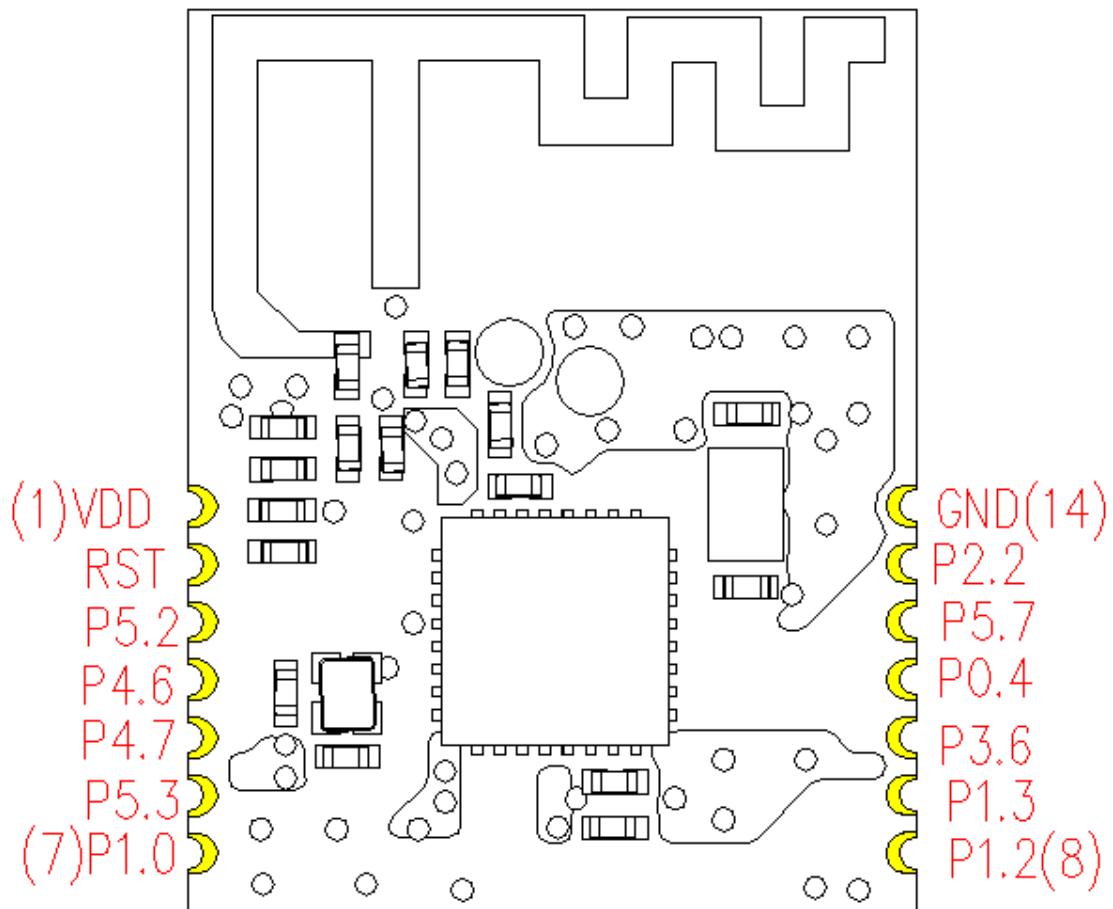
Fiture 1 pinouts definition

Table 11 MD1020 pinouts description

Pin Number	Pin Name	Pin Type	Description
1	VDD	P	SoC power supply VDD1 pin
2	RST	I	Reset pin
3	P5.2	I/O	General Purpose digital I/O pin
	INT1	I	External interrupt pin
	EXT_WAKEUP	I	External wake-up pin
4	P4.6	I/O	General Purpose digital I/O pin
	ICE_CLK	I	ICE clk input pin
	UART1_RXD	I	UART1 RX pin
	I2C0_SCL	I/O	I2C0 CLK pin
	SPI1_CLK	O	SPI1 CLK pin
	SPI2_CLK	I	SPI2 CLK pin
5	P4.7	I/O	General Purpose digital I/O pin
	ICE_DAT	I	Debug and program data pin
	UART1_TXD	O	UART1 TX pin
	I2C0_SDA	I/O	I2C0 data pin
	SPI1_SS	O	SPI1 SS pin
	SPI2_SS	I	SPI2 SS pin
6	P5.3	I/O	General Purpose digital I/O pin
	PWM0_CH2	O	PWM0 channel2 output pin
	ADC_CH0	AI	ADC channel0 analog input pin
	SPI1_MISO	I	SPI1 MISO pin
	SPI2_MISO	O	SPI2 MISO pin
7	P1.0	I/O	General Purpose digital I/O pin
	PWM0_CH3	O	PWM0 channel3 output pin
	ADC_CH1	AI	ADC channel1 analog input pin
	SPI1_MOSI	O	SPI1 MOSI pin
	SPI2_MOSI	I	SPI2 MOSI pin

| 8	P1.2	I/O	General Purpose digital I/O pin
	PWM0_CH0	O	PWM0 channel0 output pin
	UART1_CTS	I	UART1 CTS pin
	UART0_RXD	I	UART0 RX pin
	ADC_CH2	AI	ADC channel2 analog input pin
9	P1.3	I/O	General Purpose digital I/O pin
	PWM0_CH1	O	PWM0 channel1 output pin
	UART1_RTS	I	UART1 RTS pin
	UART0_TXD	O	UART0 TX pin
	ADC_CH3	AI	ADC channel3 analog input pin
10	P3.6	I/O	General Purpose digital I/O pin
	TM1_EXT	I	Timer1 external input pin
	SPI1_SS	O	SPI1 SS pin
	SPI3_SS	I	SPI3 SS pin
11	P0.4	I/O	General Purpose digital I/O pin
	PWM0_CH5	O	PWM0 channel5 output pin
	SPI0_SS	O	SPI0 SS pin
	SPI2_SS	I	SPI2 SS pin
12	P5.7	I/O	General Purpose digital I/O pin
	I2C0_SDA	I/O	I2C0 data pin
	PWM0_CH7	O	PWM0 channel7 output pin
	SPI1_MISO	I	SPI1 MISO pin
	SPI3_MISO	O	SPI3 MISO pin
13	P2.2	I/O	General Purpose digital I/O pin
	I2C1_SCL	I/O	I2C1 CLK pin
	PWM0_CH0	O	PWM0 channel0 output pin
	SPI1_CLK	O	SPI1 CLK pin
	SPI3_CLK	I	SPI3 CLK pin
14	GND	P	Ground pin

3 Application circuit
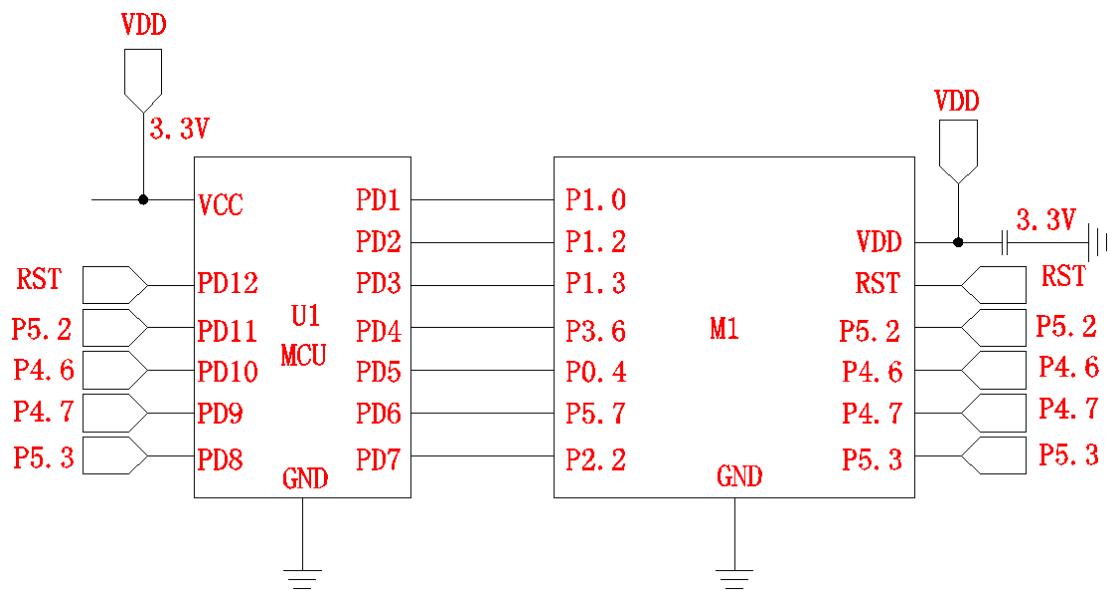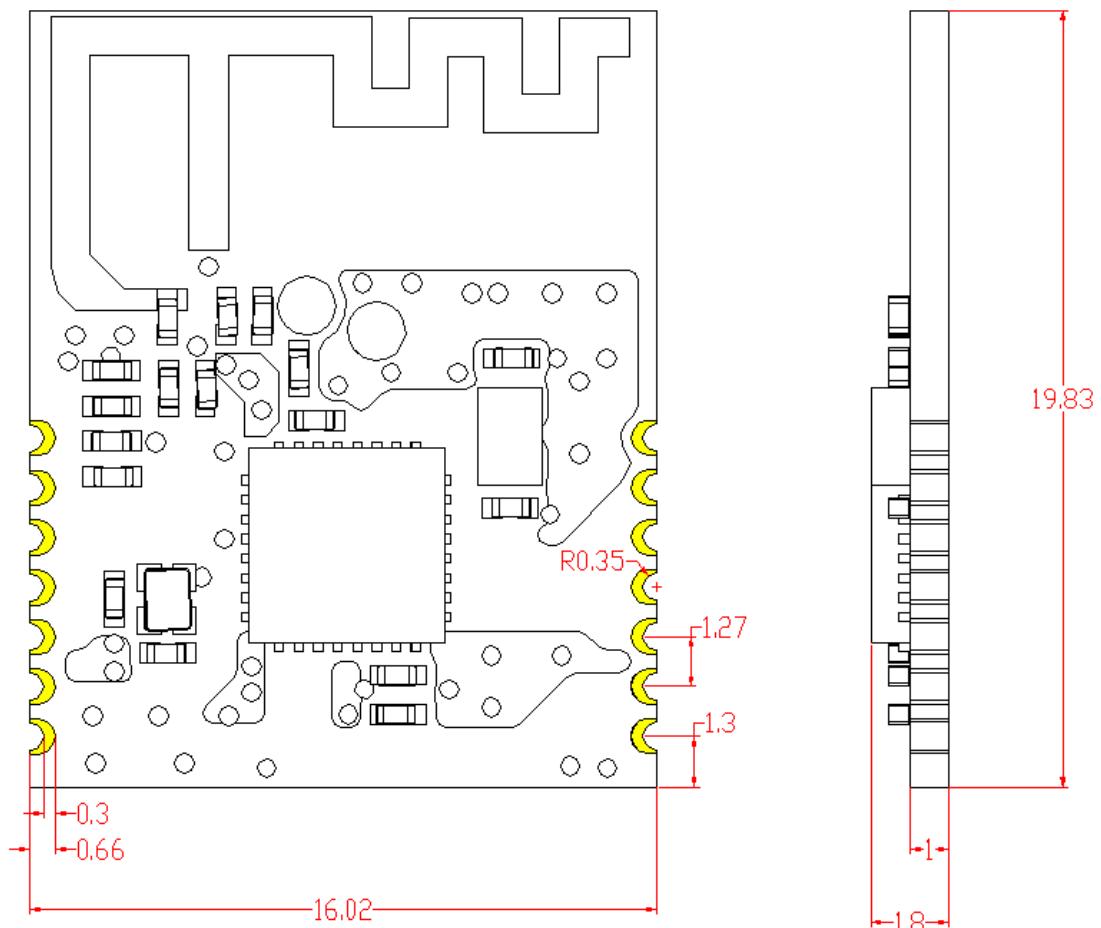
Figure 2 application circuit

4　Module outline diagram

Unit : mm

5   Contact us:

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