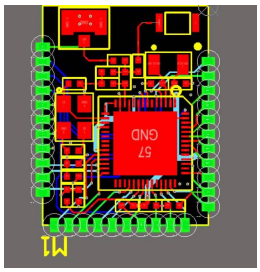
Bluetooth BLE V4.2 single mode module

Model: BLEM-42S



Application:

- **Computer peripherals and I/O devices**
  - Mouse
  - Keyboard
  - Multi-touch trackpad
- **Interactive entertainment devices**
  - Remote control
  - 3D Glasses
  - Gaming controller
- **Personal Area Networks**
  - Health/fitness sensor and monitor devices
  - Medical devices
  - Key-fobs + wrist watch
- **Remote control toys**

Module Description

■ Bluetooth 4.2 qualified single-mode module

■ Module size: 14.52 mm ×19.20 mm × 2.00 mm

■ 256-KB flash memory, 32-KB SRAM memory

■ Up to 23 GPIOs configurable as open drain high/low, pull-up/pull-down, HI-Z analog, HI-Z digital, or strong output

■ Industrial temperature range: –40 ℃ to +85 ℃

■ 32-bit processor (0.9 DMIPS/MHz) with single-cycle 32-bit multiply, operating at up to 48 MHz

■ Watchdog timer with dedicated internal low-speed oscillator (ILO)

■ Two-pin SWD for programming

■ Antenna: Chip (default), U.FL or RF-out (Option)

Power Consumption

■ TX output power: –18 dbm to +3 dbm

■ Received signal strength indicator (RSSI) with 1-dB resolution
■ TX current consumption of 15.6 mA (radio only, 0 dbm)
■ RX current consumption of 16.4 mA (radio only)
■ Low-power mode support
❒ Deep Sleep: 1.3 µA with watch crystal oscillator (WCO) on
❒ Hibernate: 150 nA with SRAM retention
❒ Stop: 60 nA with XRES wakeup

Figure 1. Module Mechanical Drawing

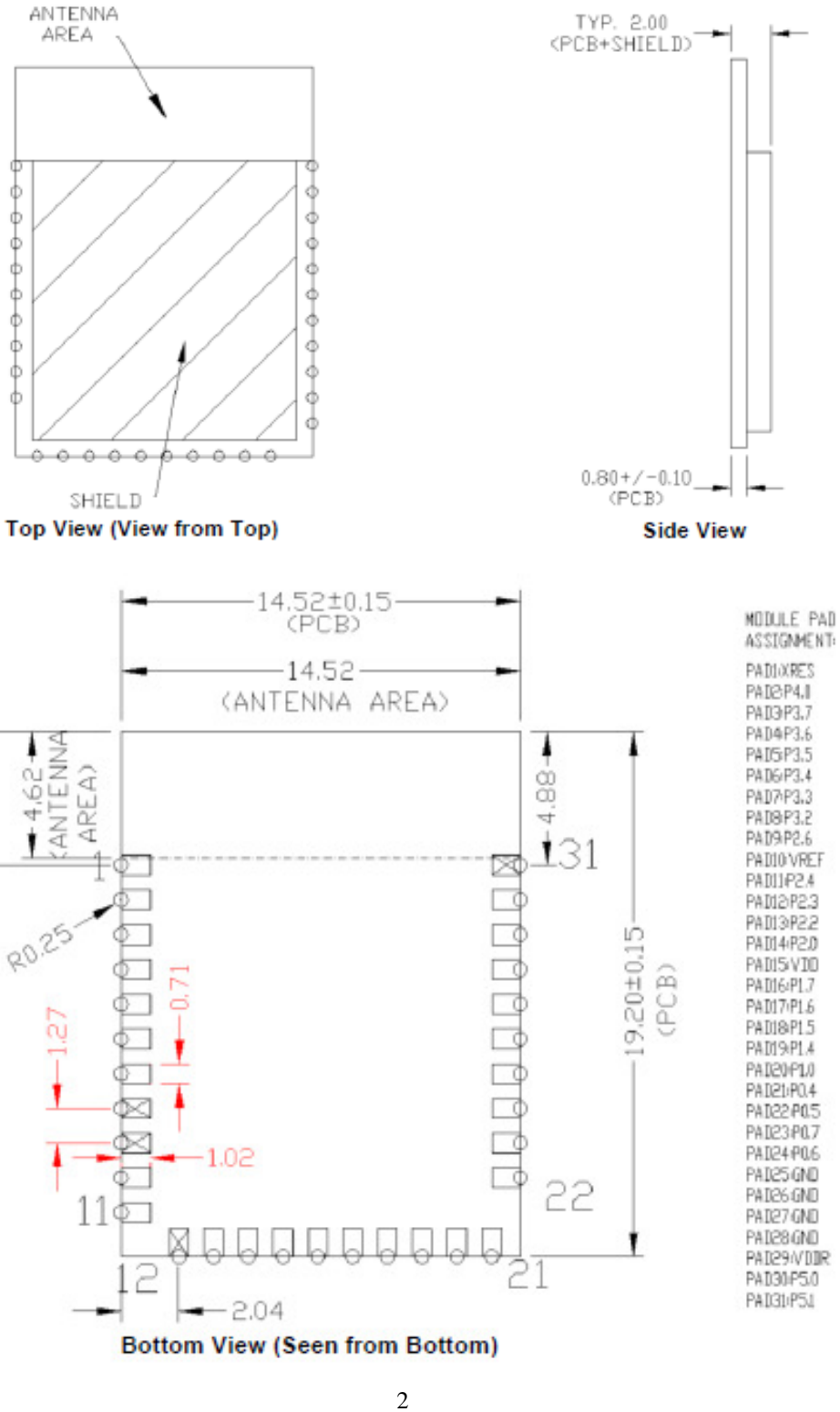


Table 2. Solder Pad Connection Description

Name	Connections	Connection Type	Pad Length Dimension	Pad Width Dimension	Pad Pitch
SP	31	Solder Pads	1.02 mm	0.71 mm	1.27 mm

Figure 2. Solder Pad Dimensions (Seen from Bottom)

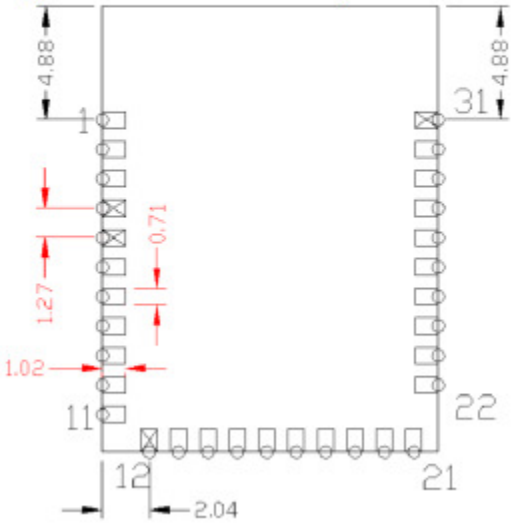
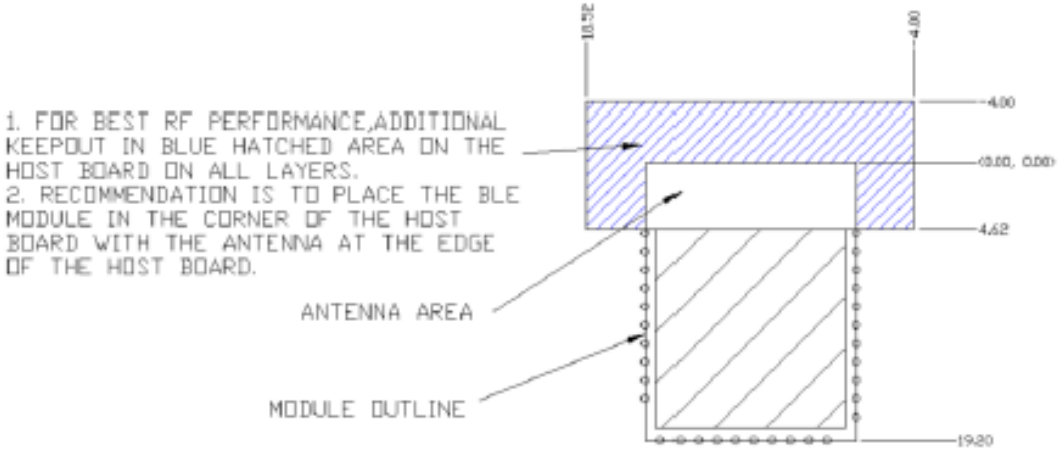
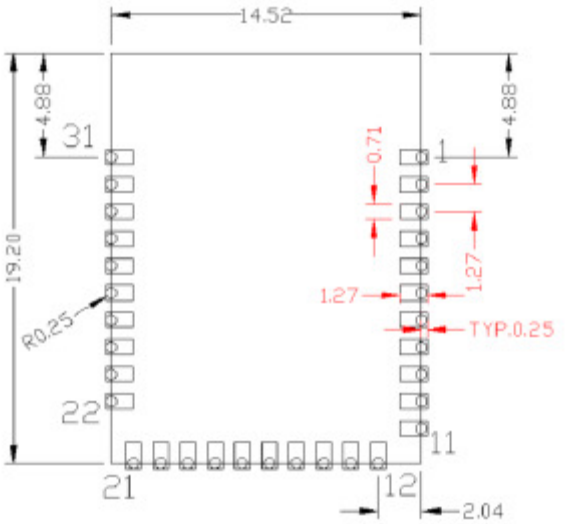


Figure 3. Recommended Host PCB Keep Out Area Around the Antenna



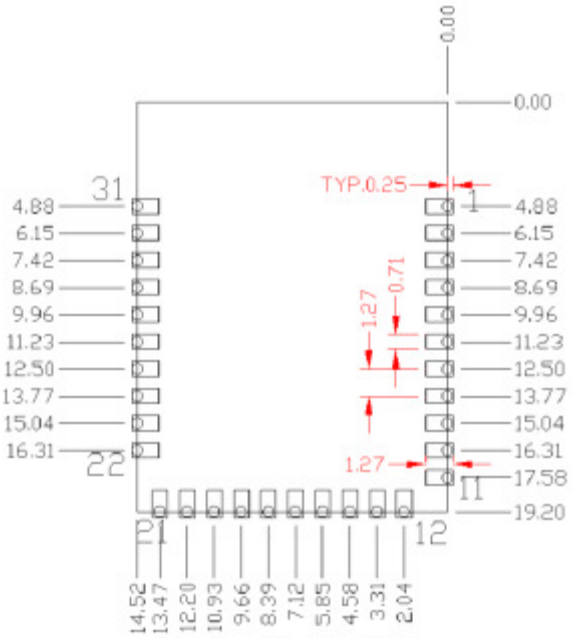
Host PCB Keep Out Area Around Trace Antenna

Figure 4. Host Layout Pattern for CYBLE-01201X-X0



Top View (On Host PCB)

Figure 5. Module Pad Location from Origin



Top View (On Host PCB)

Table 3. Module Solder Pad Location

Solder Pad (Center of Pad)	Location (X,Y) from Origin (mm)	Dimension from Origin (mils)
1	(0.39, 4.88)	(15.35, 192.13)
2	(0.39, 6.15)	(15.35, 242.13)
3	(0.39, 7.42)	(15.35, 292.13)
4	(0.39, 8.69)	(15.35, 342.13)
5	(0.39, 9.96)	(15.35, 392.13)
6	(0.39, 11.23)	(15.35, 442.13)
7	(0.39, 12.50)	(15.35, 492.13)
8	(0.39, 13.77)	(15.35, 542.13)
9	(0.39, 15.04)	(15.35, 592.13)
10	(0.39, 16.31)	(15.35, 642.13)
11	(0.39, 17.58)	(15.35, 692.13)
12	(2.04, 18.82)	(80.31, 740.94)
13	(3.31, 18.82)	(130.31, 740.94)
14	(4.58, 18.82)	(180.31, 740.94)
15	(5.85, 18.82)	(230.31, 740.94)
16	(7.12, 18.82)	(280.31, 740.94)
17	(8.39, 18.82)	(330.31, 740.94)
18	(9.66, 18.82)	(380.31, 740.94)
19	(10.93, 18.82)	(430.31, 740.94)
20	(12.20, 18.82)	(480.31, 740.94)
21	(13.47, 18.82)	(530.31, 740.94)
22	(14.14, 16.31)	(556.69, 642.12)
23	(14.14, 15.04)	(556.69, 592.12)
24	(14.14, 13.77)	(556.69, 542.12)
25	(14.14, 12.50)	(556.69, 492.12)
26	(14.14, 11.23)	(556.69, 442.12)
27	(14.14, 9.96)	(556.69, 392.12)
28	(14.14, 8.69)	(556.69, 342.12)
29	(14.14, 7.42)	(556.69, 292.12)
30	(14.14, 6.15)	(556.69, 242.12)
31	(14.14, 4.88)	(556.69, 192.12)

Figure 6. Solder Pad Reference Location

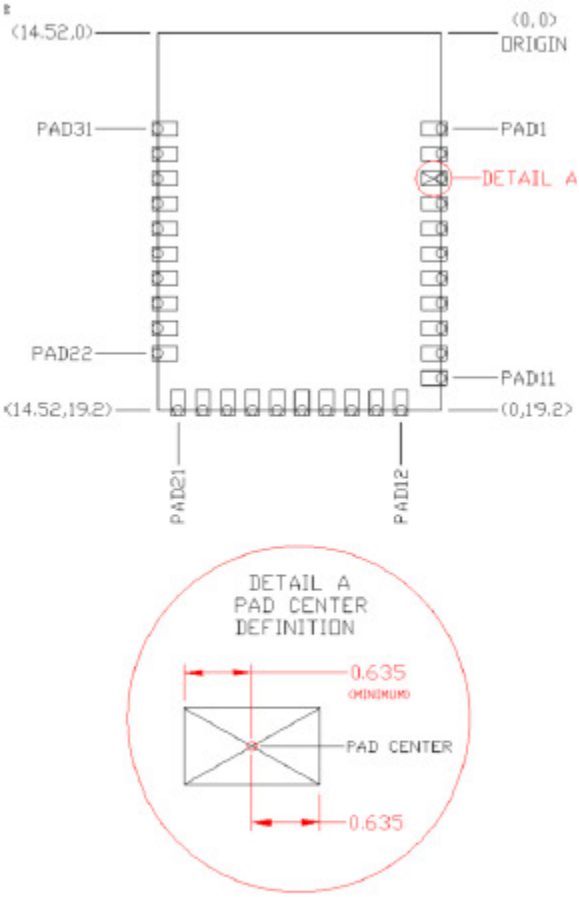


Table 4. Solder Pad Connection Definitions

Solder Pad Number	Device Port Pin	UART	SPI	I²C	TCPWM[2]	Cap-Sense	WCO Out	ECO Out	LCD	SWD	GPIO
1	XRES	External Reset Hardware Connection Input									
2	P4.0[3]	✓(SCB1_RTS)	✓(SCB1_MOSI)		✓(TCPWM0_P)	✓(C_{MOD})			✓		✓
3	P3.7	✓(SCB1_CTS)			✓(TCPWM3_N)	✓(Sensor)	✓		✓		✓
4	P3.6	✓(SCB1_RTS)			✓(TCPWM3_P)	✓(Sensor)			✓		✓
5	P3.5	✓(SCB1_TX)		✓(SCB1_SCL)	✓(TCPWM2_N)	✓(Sensor)			✓		✓
6	P3.4	✓(SCB1_RX)		✓(SCB1_SDA)	✓(TCPWM2_P)	✓(Sensor)			✓		✓
7	P3.3	✓(SCB0_CTS)			✓(TCPWM1_N)	✓(Sensor)			✓		✓
8	P3.2	✓(SCB0_RTS)			✓(TCPWM1_P)	✓(Sensor)			✓		✓
9	P2.6					✓(Sensor)			✓		✓
10	VREF	Reference Voltage Input (Optional)									
11	P2.4					✓(Sensor)			✓		✓
12	P2.3					✓(Sensor)	✓		✓		✓
13	P2.2		✓(SCB0_SS3)			✓(Sensor)			✓		✓
14	P2.0		✓(SCB0_SS1)			✓(Sensor)			✓		✓
15	V_{DD}	Digital Power Supply Input (1.8 to 5.5V)									
16	P1.7	✓(SCB0_CTS)	✓(SCB0_SCLK)		✓(TCPWM3_N)	✓(Sensor)			✓		✓
17	P1.6	✓(SCB0_RTS)	✓(SCB0_SS0)		✓(TCPWM3_P)	✓(Sensor)			✓		✓
18	P1.5	✓(SCB0_TX)	✓(SCB0_MISO)	✓(SCB0_SCL)	✓(TCPWM2_N)	✓(Sensor)			✓		✓
19	P1.4	✓(SCB0_RX)	✓(SCB0_MOSI)	✓(SCB0_SDA)	✓(TCPWM2_P)	✓(Sensor)			✓		✓
20	P1.0				✓(TCPWM0_P)	✓(Sensor)			✓		✓
21	P0.4	✓(SCB0_RX)	✓(SCB0_MOSI)	✓(SCB0_SDA)	✓(TCPWM1_P)	✓(Sensor)		✓	✓		✓
22	P0.5	✓(SCB0_TX)	✓(SCB0_MISO)	✓(SCB0_SCL)	✓(TCPWM1_N)	✓(Sensor)			✓		✓
23	P0.7	✓(SCB0_CTS)	✓(SCB0_SCLK)		✓(TCPWM2_N)	✓(Sensor)			✓	✓(SWDCLK)	✓
24	P0.6	✓(SCB0_RTS)	✓(SCB0_SS0)		✓(TCPWM2_P)	✓(Sensor)			✓	✓(SWDIO)	✓
25	GND[4]	Ground Connection									
26	GND[4]	Ground Connection									
27	GND[4]	Ground Connection									
28	GND[4]	Ground Connection									
29	V_{DDR}	Radio Power Supply (1.9V to 5.5V)									
30	P5.0	✓(SCB1_RX)	✓(SCB1_SS0)	✓(SCB1_SDA)	✓(TCPWM3_P)	✓(Sensor)			✓		✓
31	P5.1	✓(SCB1_TX)	✓(SCB1_SCLK)	✓(SCB1_SCL)	✓(TCPWM3_N)	✓(Sensor)		✓	✓		✓

Serial port reference design:

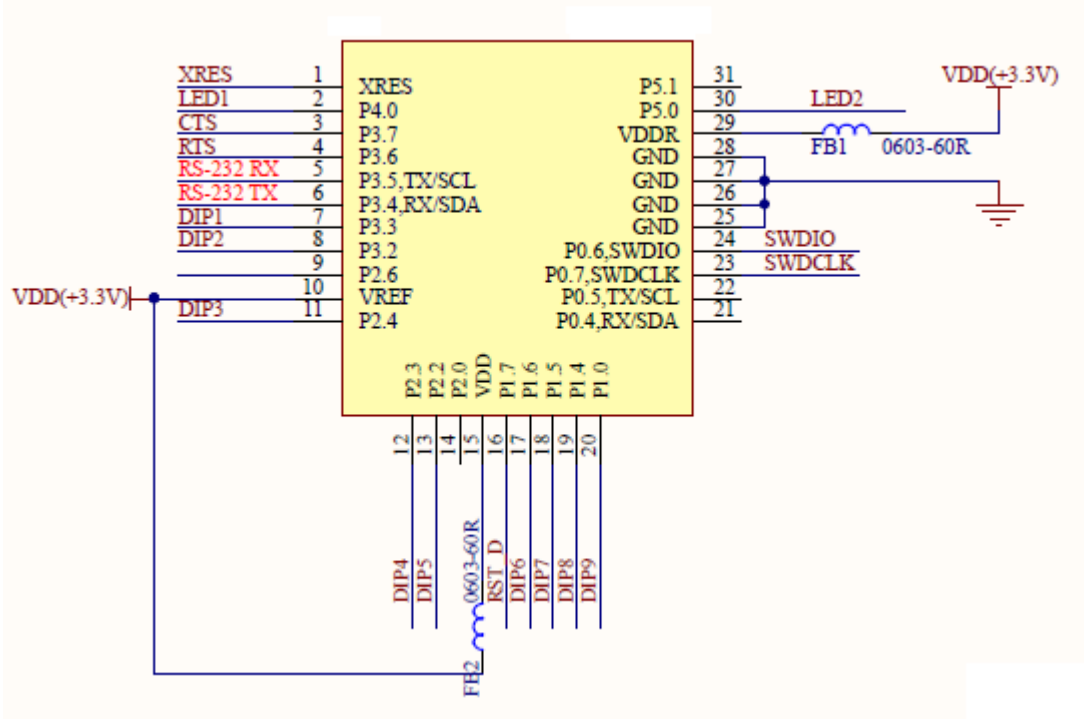
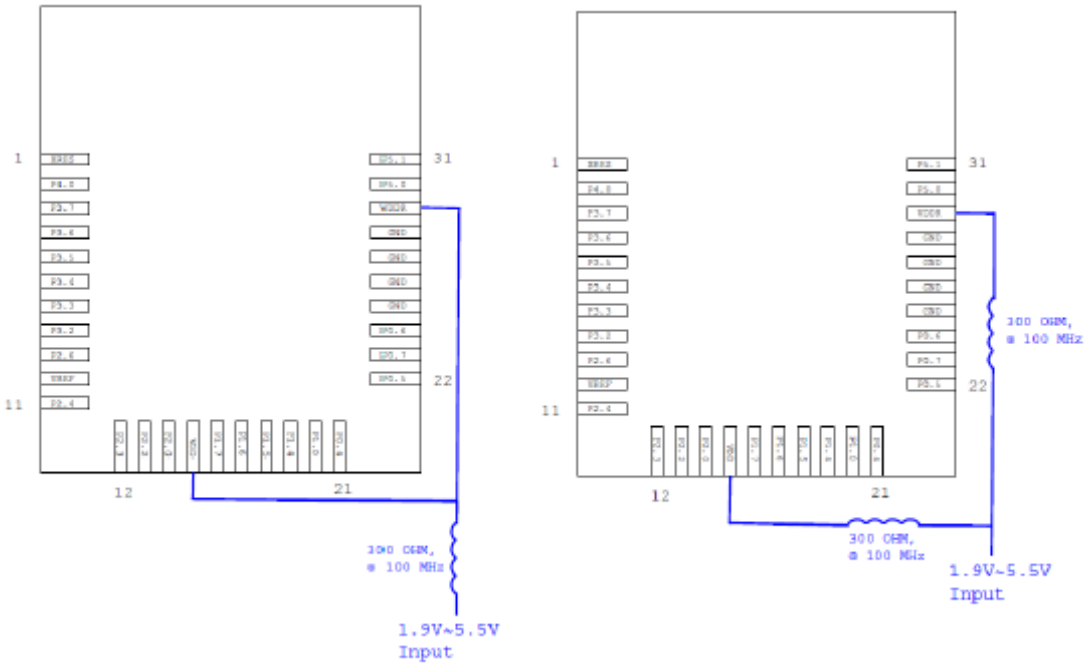


Figure 7. Recommended Host Schematic Options for a Single Supply Option



Single Ferrite Bead Option **Two Ferrite Bead Option**

Figure 8. Recommended Host Schematic for an Independent Supply Option

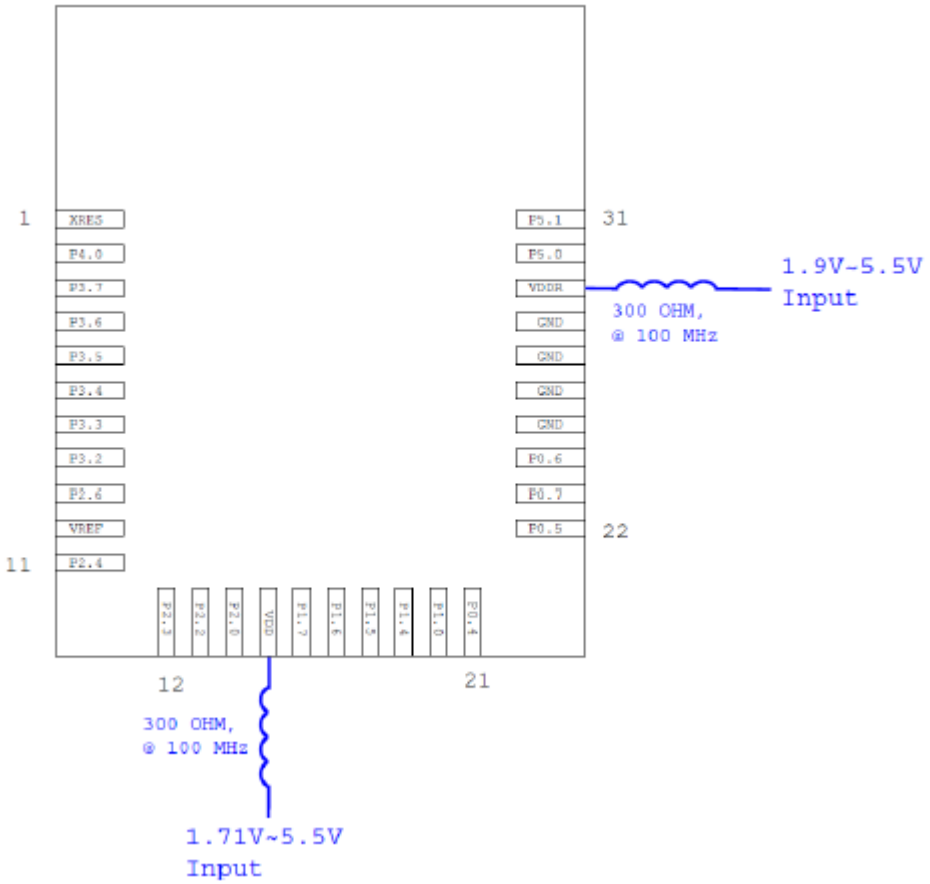


Figure 9. Schematic Diagram

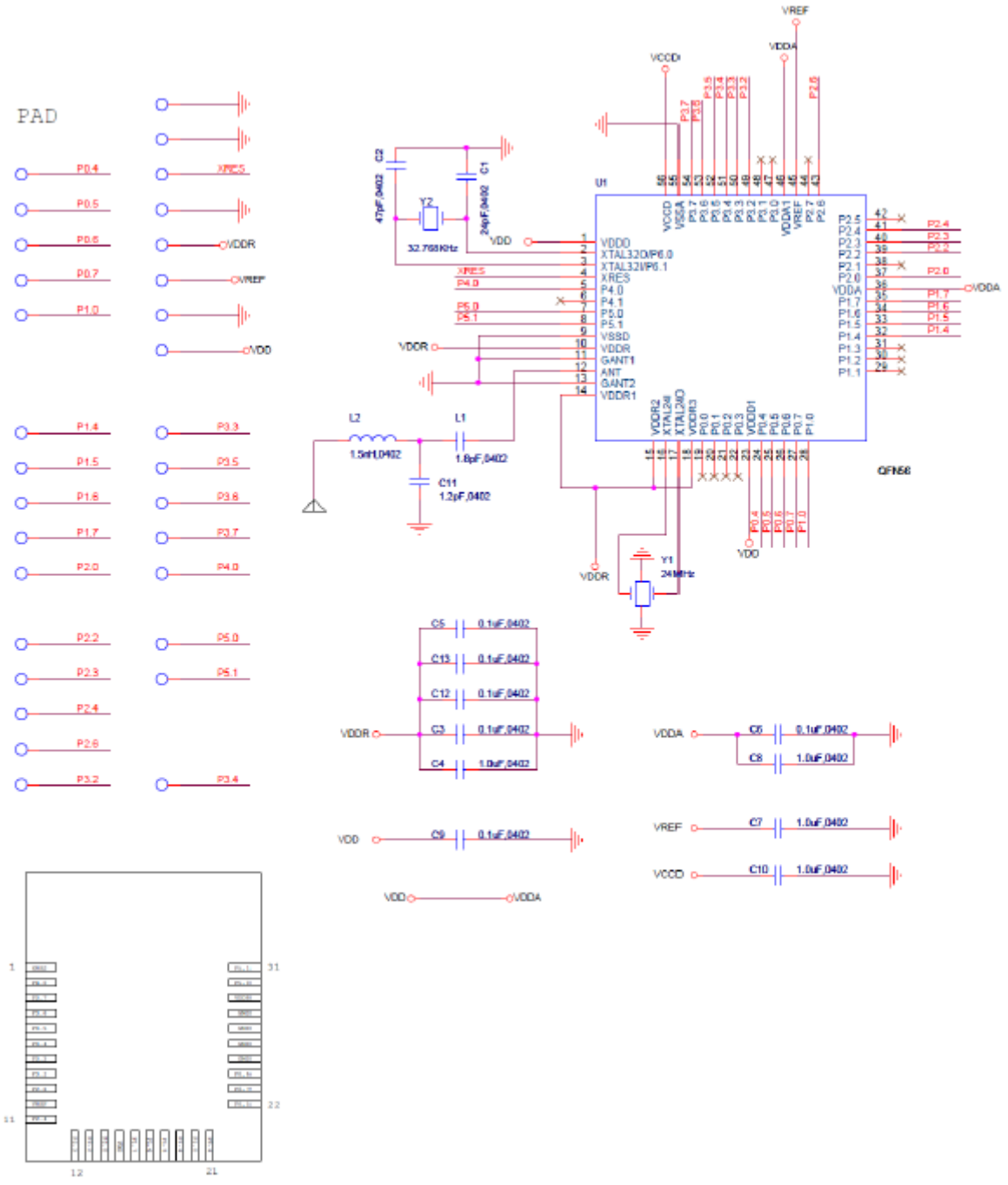


Table 6. Trace Antenna Specifications

Item	Description
Frequency Range	2400 – 2500 MHz
Peak Gain	0.5 dBi typical
Average Gain	-0.5 dBi typical
Return Loss	10 dB minimum

Electrical Specification

Table 7. Absolute Maximum Ratings

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
V_{DDD_ABS}	Analog, digital, or radio supply relative to V_{SS} (V_{SSD} = V_{SSA})	–0.5	–	6	V	Absolute maximum
V_{CCD_ABS}	Direct digital core voltage input relative to V_{SSD}	–0.5	–	1.95	V	Absolute maximum
V_{DD_RIPPLE}	Maximum power supply ripple for V_{DD} and V_{DDR} input voltage	–	–	100	mV	3.0V supply Ripple frequency of 100 kHz to 750 kHz
V_{GPIO_ABS}	GPIO voltage	–0.5	–	V_{DD} +0.5	V	Absolute maximum
I_{GPIO_ABS}	Maximum current per GPIO	–25	–	25	mA	Absolute maximum
$I_{GPIO\_Injection}$	GPIO injection current: Maximum for $V_{IH} > V_{DD}$ and minimum for $V_{IL} < V_{SS}$	–0.5	–	0.5	mA	Absolute maximum current injected per pin
LU	Pin current for latch up	–200		200	mA	–

Table 8. RF Performance Characteristics

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
RF_O	RF output power on ANT	–18	0	3	dBm	Configurable via register settings
RX_S	RF receive sensitivity on ANT	–	–87	–	dBm	Guaranteed by design simulation
F_R	Module frequency range	2400	–	2480	MHz	–
G_P	Peak gain	–	0.5	–	dBi	–
G_{Avg}	Average gain	–	–0.5	–	dBi	–
RL	Return loss	–	–10.5	–	dB	–

Table 9. DC Specifications

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
V_{DD1}	Power supply input voltage	1.8	–	5.5	V	With regulator enabled
V_{DD2}	Power supply input voltage unregulated	1.71	1.8	1.89	V	Internally unregulated supply
V_{DDR1}	Radio supply voltage (radio on)	1.9	–	5.5	V	–
V_{DDR2}	Radio supply voltage (radio off)	1.71	–	5.5	V	–
Active Mode, V_{DD} = 1.71 V to 5.5 V						
I_{DD3}	Execute from flash; CPU at 3 MHz	–	1.7	–	mA	T = 25 °C, V_{DD} = 3.3 V
I_{DD4}	Execute from flash; CPU at 3 MHz	–	–	–	mA	T = –40 °C to 85 °C
I_{DD5}	Execute from flash; CPU at 6 MHz	–	2.5	–	mA	T = 25 °C, V_{DD} = 3.3 V
I_{DD6}	Execute from flash; CPU at 6 MHz	–	–	–	mA	T = –40 °C to 85 °C
I_{DD7}	Execute from flash; CPU at 12 MHz	–	4	–	mA	T = 25 °C, V_{DD} = 3.3 V

Table 9. DC Specifications (continued)

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
I_{DD8}	Execute from flash; CPU at 12 MHz	–	–	–	mA	T = –40 °C to 85 °C
I_{DD9}	Execute from flash; CPU at 24 MHz	–	7.1	–	mA	T = 25 °C, V_{DD} = 3.3 V
I_{DD10}	Execute from flash; CPU at 24 MHz	–	–	–	mA	T = –40 °C to 85 °C
I_{DD11}	Execute from flash; CPU at 48 MHz	–	13.4	–	mA	T = 25 °C, V_{DD} = 3.3 V
I_{DD12}	Execute from flash; CPU at 48 MHz	–	–	–	mA	T = –40 °C to 85 °C
Sleep Mode, V_{DD} = 1.8 to 5.5 V						
I_{DD13}	IMO on	–	–	–	mA	T = 25 °C, V_{DD} = 3.3 V, SYSCLK = 3 MHz
Sleep Mode, V_{DD} and V_{DDR} = 1.9 to 5.5 V						
I_{DD14}	ECO on	–	–	–	mA	T = 25 °C, V_{DD} = 3.3 V, SYSCLK = 3 MHz
Deep-Sleep Mode, V_{DD} = 1.8 to 3.6 V						
I_{DD15}	WDT with WCO on	–	1.5	–	µA	T = 25 °C, V_{DD} = 3.3 V
I_{DD16}	WDT with WCO on	–	–	–	µA	T = –40 °C to 85 °C
I_{DD17}	WDT with WCO on	–	–	–	µA	T = 25 °C, V_{DD} = 5 V
I_{DD18}	WDT with WCO on	–	–	–	µA	T = –40 °C to 85 °C
Deep-Sleep Mode, V_{DD} = 1.71 to 1.89 V (Regulator Bypassed)						
I_{DD19}	WDT with WCO on	–	–	–	µA	T = 25 °C
I_{DD20}	WDT with WCO on	–	–	–	µA	T = –40 °C to 85 °C
Hibernate Mode, V_{DD} = 1.8 to 3.6 V						
I_{DD27}	GPIO and reset active	–	150	–	nA	T = 25 °C, V_{DD} = 3.3 V
I_{DD28}	GPIO and reset active	–	–	–	nA	T = –40 °C to 85 °C
Hibernate Mode, V_{DD} = 3.6 to 5.5 V						
I_{DD29}	GPIO and reset active	–	–	–	nA	T = 25 °C, V_{DD} = 5 V
I_{DD30}	GPIO and reset active	–	–	–	nA	T = –40 °C to 85 °C
Stop Mode, V_{DD} = 1.8 to 3.6 V						
I_{DD33}	Stop-mode current (V_{DD})	–	20	–	nA	T = 25 °C, V_{DD} = 3.3 V
I_{DD34}	Stop-mode current (V_{DDR})	–	40	—	nA	T = 25 °C, V_{DDR} = 3.3 V
I_{DD35}	Stop-mode current (V_{DD})	–	–	–	nA	T = –40 °C to 85 °C
I_{DD36}	Stop-mode current (V_{DDR})	–	–	–	nA	T = –40 °C to 85 °C, V_{DDR} = 1.9 V to 3.6 V
Stop Mode, V_{DD} = 3.6 to 5.5 V						
I_{DD37}	Stop-mode current (V_{DD})	–	–	–	nA	T = 25 °C, V_{DD} = 5 V
I_{DD38}	Stop-mode current (V_{DDR})	–	–	–	nA	T = 25 °C, V_{DDR} = 5 V
I_{DD39}	Stop-mode current (V_{DD})	–	–	–	nA	T = –40 °C to 85 °C
I_{DD40}	Stop-mode current (V_{DDR})	–	–	–	nA	T = –40 °C to 85 °C

Table 10. AC Specifications

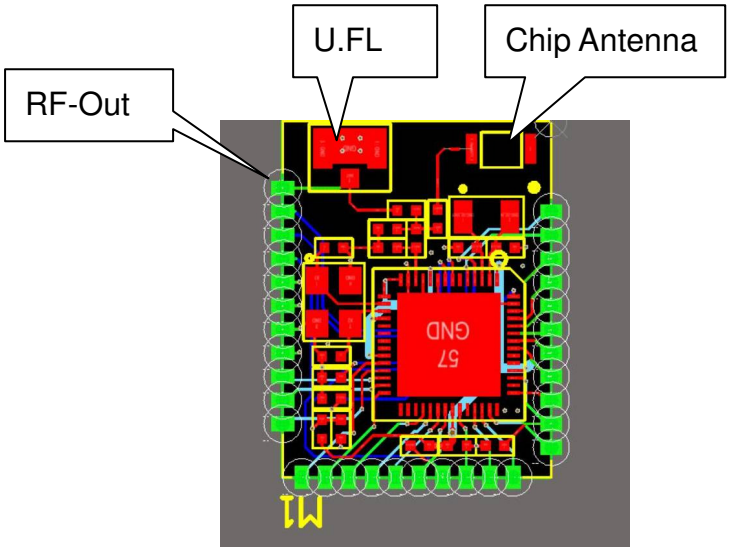
Parameter	Description	Min	Typ	Max	Units	Details/Conditions
F_{CPU}	CPU frequency	DC	–	48	MHz	1.71 V ≤ V_{DD} ≤ 5.5 V
T_{SLEEP}	Wakeup from Sleep mode	–	0	–	µs	Guaranteed by characterization
$T_{DEEPSLEEP}$	Wakeup from Deep-Sleep mode	–	–	25	µs	24-MHz IMO. Guaranteed by characterization
$T_{HIBERNATE}$	Wakeup from Hibernate mode	–	–	2	ms	Guaranteed by characterization
T_{STOP}	Wakeup from Stop mode	–	–	2	ms	XRES wakeup

Table 11. Environmental Conditions

Description	Minimum Specification	Maximum Specification
Operating temperature	-40 °C	85 °C
Operating humidity (relative, non-condensation)	5%	85%
Thermal ramp rate	–	3 °C/minute
Storage temperature	–40 °C	85 °C
Storage temperature and humidity	–	85 ° C at 85%
ESD: Module integrated into system Components[8]	–	15 kV Air 2.2 kV Contact

Antenna Option: Please choose one type

1. Chip antenna (Model: BLEM-42S)
2. U.FL connector (Option) (Model: BLEM-42S-U)
3. RF-Out pin (Option) (Model: BLEM-42S-R)



Remark: All contents are subject to change without prior notice.

Ubiquitous Connect

UConnect International CO., LTD.
Add: 11F.-5, No.88, Zhongshan Rd., Zhongli City, Taoyuan County 320, Taiwan
Tel: +886-3-4275890
Fax: +886-3-4275913
E-Mail: Sales@uconnect.com.tw
Web: www.uconnect.com.tw