



ITM-D3F1

IEEE 2.4GHz 1T1R Wi-Fi with BLE v5.0 IoT Module Datasheet

V1.0

Revision History

Date	Revision Content	Revised By	Version
2019/02/01	- Initial released (Preliminary)	Jim Leng	0.1
2019/05/06	- Pin define changed	Jim Leng	0.2
2019/05/09	- Pin define changed	Jim Leng	0.21
2020/08/28	- Operating power range modified	Jim Leng	1.0

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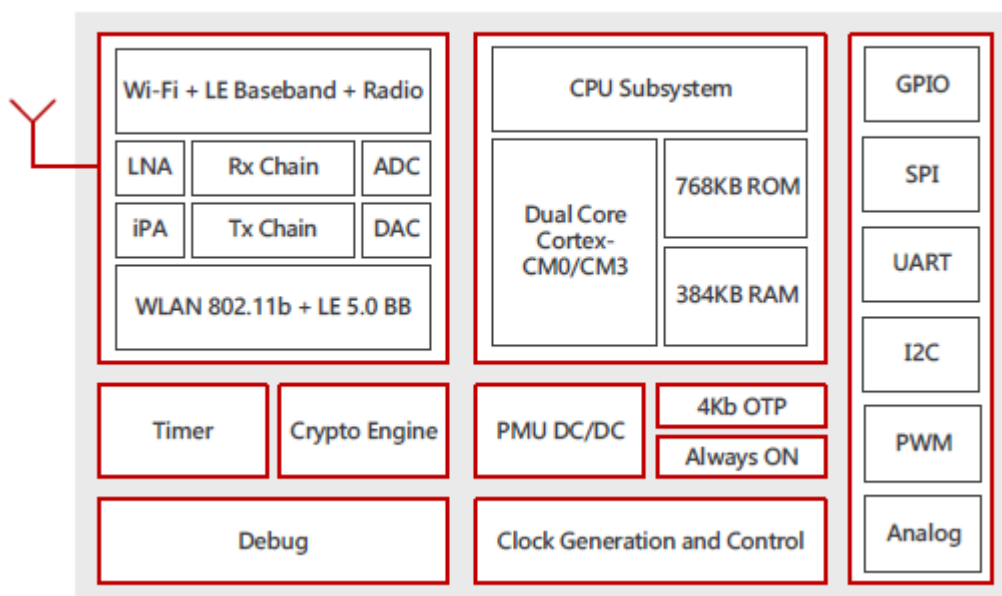
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1. General Description

iTM-D3F1 module features a fully integrated 2.4GHz radio transceiver and baseband processor for Wi-Fi 802.11b and Bluetooth® Smart applications. It can be used as a standalone application-specific communication processor or as a wireless data link in hosted MCU systems where ultra-low power is critical. It supports flexible memory architecture for storing profiles, stacks and custom application codes, and can be updated using Over-The-Air (OTA) technology. Qualified Bluetooth Smart protocol stack and Wi-Fi TCP/IP stack are stored in a dedicated ROM.

iTM-D3F1 module uses OPULINKS OPL1000 SoC. It is equipped with dual processors, ARM® Cortex®-M0 and M3, for handling different processes. All software runs on the ARM® Cortex®-M0 processor while more intensive application-specific activities run on the ARM® Cortex®-M3 processor. iTM-D3F1 can be connected to any external MCU through SPI, I2C or UART interfaces and sensors or other devices through GPIOs. The transceiver interfaces directly to the antenna and is fully compliant with the Wi-Fi 802.11b and Bluetooth 5.0 BLE standards. With integrated antenna switch, RF balun, power amplifier (PA) and low noise amplifier (LNA), the OPL1000 allows both Wi-Fi and Bluetooth Smart to minimize PCB design area and external component requirement. The block diagram for OPL1000 is shown as below.

OPL1000 Block Diagram



2. Features

- Processors
 - ARM® Cortex®-M3 Application Processor
 - ARM® Cortex®-M0 Link Controller
- Wi-Fi
 - 802.11b up to 11Mbps
 - Supports STA mode
 - WPA/WPA2 security supported
 - Automatic beacon scanning and discovery
 - Built-in TCP/IP stack
 - Integrated dual power amplifiers: low (-2 dBm), high (+10 dBm)
- Bluetooth Smart
 - Compliant with Bluetooth 5.0 BLE specifications with 2Mbps rate capability
 - Slave mode support
 - Adaptive Frequency Hopping (AFH)
 - All GATT-based profiles supported
 - Built-in BLE stack
 - Max. 8 concurrent BLE connections supported
 - 2 to 12 dBm transmit output power
 - -93 dBm receive sensitivity
- Memories
 - 4kb One-Time-Programmable (OTP) memory
 - 384 kB System SRAM
 - 768 kB ROM
- HW Crypto Engine
 - AES-128/256 bits Encryption
 - P-192/256 ECDH (Elliptic Curve Diffie-Hellman) Key Generation
 - SHA2
 - TRNG

- Power Management
 - Integrated Buck DC-DC converter
 - Supports coin cell and alkaline battery
- Clock
 - Built-in low power 32KHz RC oscillator and support optional 32KHz crystal.
 - Optional external 32 kHz crystal (± 150 ppm max) and built-in low power oscillator
- General purpose, capture and sleep timers
- FW OTA (Over-The-Air) update support
- Digital Interfaces
 - General purpose I/Os: 24
 - Two UARTs with hardware flow control up to 3Mbps
 - Three SPI+™ interfaces
 - One I2C bus at 100 kHz, 400 kHz
- Analog Interfaces
 - 10-bit Auxiliary ADC inputs up to 16 channels
 - 6 GPIO pins with 16mA driving capability
 - 6 PWMs
- Radio Transceiver
 - Fully integrated dual-mode 2.4 GHz CMOS transceiver
 - Single wire antenna: no external matching and no external T/R switch required
- Current Consumption
 - Real Time Clock (RTC) mode with always-on domain alive < 5uA
 - Deep sleep current ~ 3 uA
 - Timed sleep current ~4 uA

3. General Specification

3.1 Voltages

3.1.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.3	3.6	V

3.1.2 Recommended Operating Ratings

Test conditions: At room temperature				
Symbol	Min.	Typ.	Max.	Unit
VBAT	2.7	3.3	3.6	V

Note: The I/O voltage of ITM-D3F1 is same as VBAT.

Test conditions: At operating temperature 0°C ~70°C				
Symbol	Min.	Typ.	Max.	Unit
VBAT	2.7	3.3	3.6	V

3.2 Wi-Fi RF Specification (RX)

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2412		2484	MHz
RX Sensitivity 11b @ 8% PER	- 1Mbps			-83	dBm
	- 11Mbps			-76	dBm
Maximum Receive Level	802.11b	-15			dBm

3.3 Wi-Fi RF Specification (TX)

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2412		2484	MHz
Output Power	802.11b	--	10	--	dBm
@EVM	802.11b / 11Mbps	--	-20	--	dB

3.4 Power Consumption

WiFi only:

TX Mode: (Continuous)	115 mA (802.11b/11M/10dBm)
RX Mode:	17.5 mA (802.11b/11M)
Associated Idle	1.0 mA @DTIM=1
	400 uA @DTIM=3
Deep Sleep Mode	30 uA
Timer Sleep Mode	50 uA

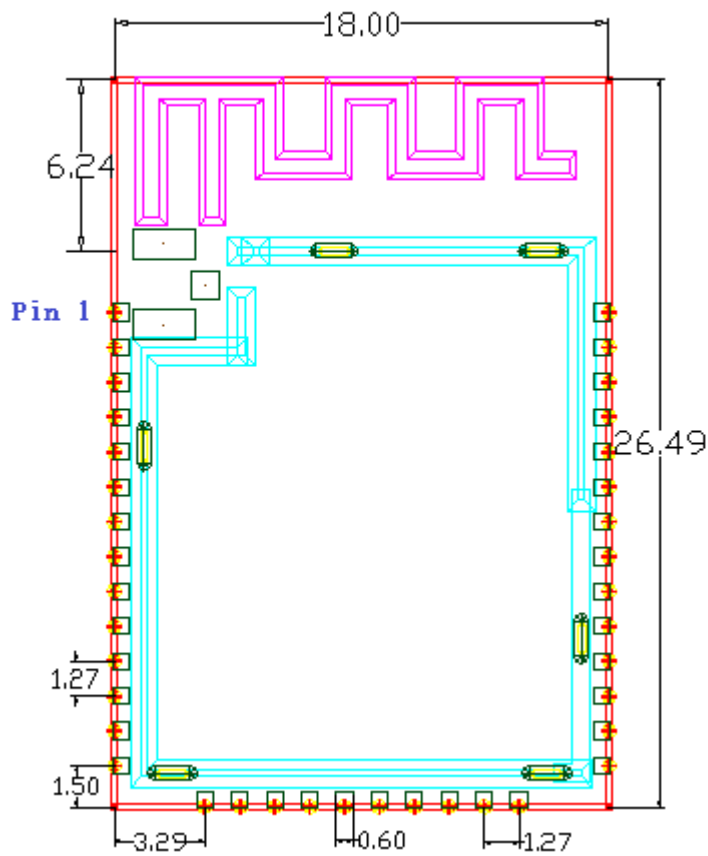
Bluetooth Smart:

TX Mode: (Continuous)	63 mA (10 dBm)
	12 mA (0 dBm)
RX Mode:	12 mA

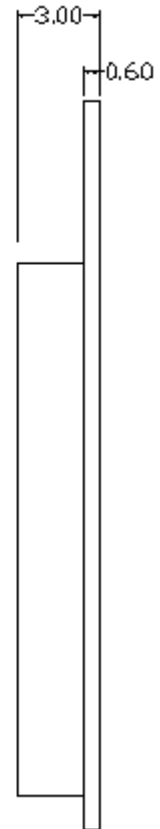
4. Pin Assignments

4.1 PCB Pin Outline

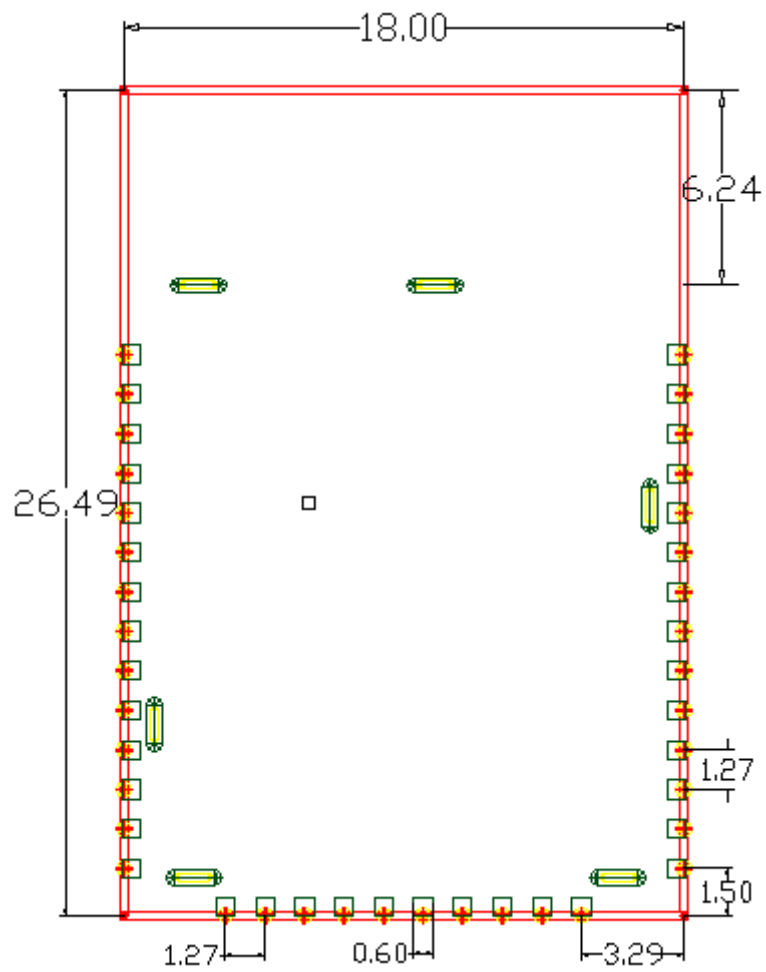
< TOP VIEW >



< SIDE VIEW >



< BOTTOM VIEW >



4.2 Pin Definition

Pin No.r	Pin-Define	Type	Description
1	GND	P	Ground
2	VBAT	P	Main Power Supply Input 3.3V
3	CHIP_EN	I	Active High to Enable Whole Module
4	NC	—	NC
5	NC	—	NC
6	GPIO2	I/O	General Purpose Input/Output
7	GPIO3	I/O	General Purpose Input/Output
8	XTAL32-I	I	External 32.768KHz Crystal Input Pin
9	XTAL32-O	O	External 32.768KHz Crystal Output Pin
10	GPIO4	I/O	General Purpose Input/Output
11	GPIO5	I/O	General Purpose Input/Output
12	UART1_RTS_N / GPIO6	I/O	UART Request to Send (default) / General Purpose Input/Output
13	GPIO23	I/O	General Purpose Input/Output
14	UART1_CTS_N / GPIO7	I/O	UART Clear to Send (default) / General Purpose Input/Output
15	GND	GND	Ground
16	NC	—	NC
17	SPI0_IO2 / GPIO16	I/O	SPI Input/Output (default) / General Purpose Input/Output
18	SPI0_IO3 / GPIO17	I/O	SPI Input/Output (default) / General Purpose Input/Output
19	SPI0_CS / GPIO12	I/O	SPI Chip Select (default) / General Purpose Input/Output
20	SPI0_CLK / GPIO13	I/O	SPI Serial Clock (default) / General Purpose Input/Output
21	SPI0_IO0 / GPIO14	I/O	SPI Input/Output (default) / General Purpose Input/Output
22	SPI0_IO1 / GPIO15	I/O	SPI Input/Output (default) / General Purpose Input/Output
23	UART1_TXD / GPIO8	I/O	UART Serial Data Transmit for SYSLOG (default) / General Purpose Input/Output
24	UART1_RXD / GPIO9	I/O	UART Serial Data Receive for SYSLOG (default) / General Purpose Input/Output

25	I2C_SCL / GPIO10	I/O	I2C Serial Clock Line (default) / General Purpose Input/Output
26	I2C_SDA / GPIO11	I/O	I2C Serial Data Line (default) / General Purpose Input/Output
27	NC	—	NC
28	NC	—	NC
29	NC	—	NC
30	GPIO18 / PWM5	I/O	General Purpose Input/Output / Pulse-Width Modulated O/P
31	GPIO19 / PWM4	I/O	General Purpose Input/Output / Pulse-Width Modulated O/P
32	NC	—	NC
33	GPIO20 / PWM3	I/O	General Purpose Input/Output / Pulse-Width Modulated O/P
34	CMD_UART_RX / GPIO1	I/O	UART Serial Data Receive for command (default) / General Purpose Input/Output
35	CMD_UART_TX / GPIO0	I/O	UART Serial Data Transmit for command (default) / General Purpose Input/Output
36	GPIO21 / PWM2	I/O	General Purpose Input/Output / Pulse-Width Modulated O/P
37	GPIO22 / PWM1	I/O	General Purpose Input/Output / Pulse-Width Modulated O/P
38	GND	P	GND

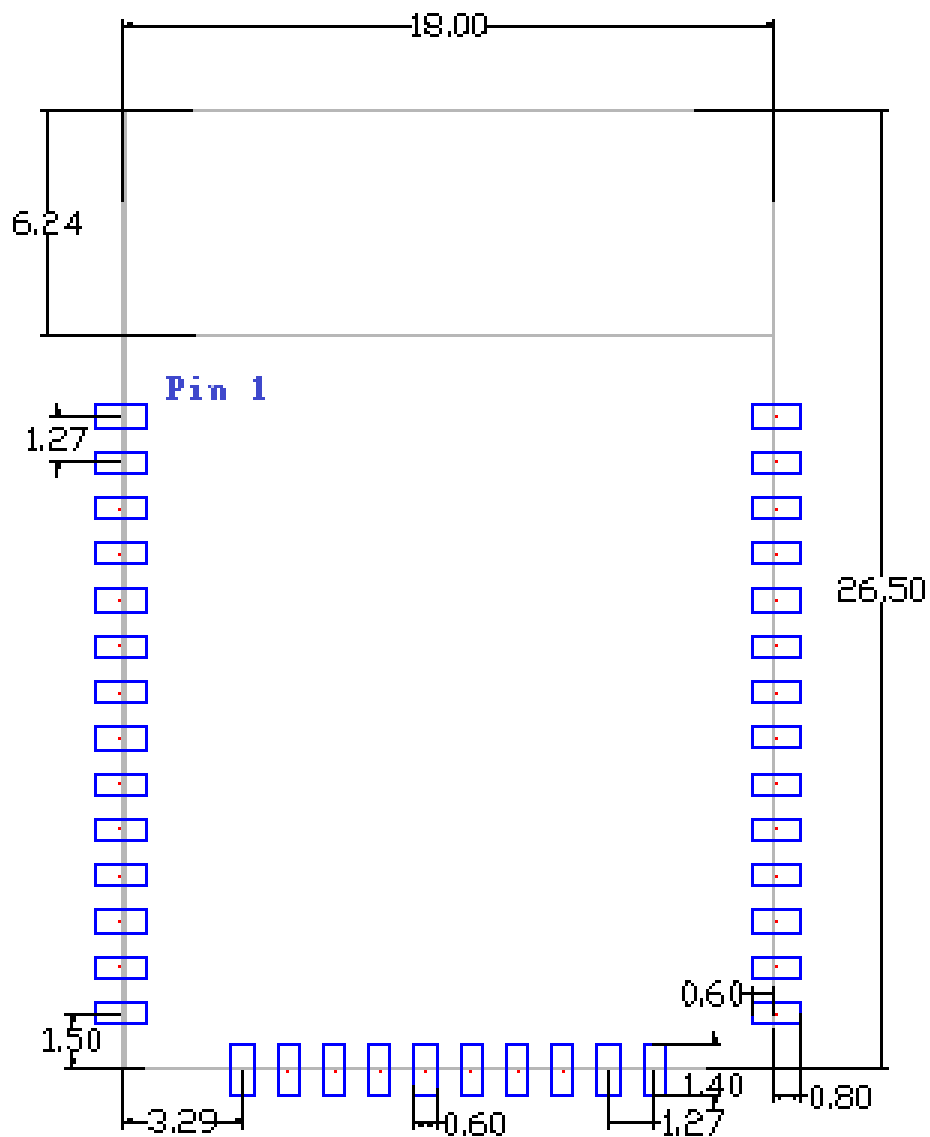
- **GPIO 2~11 can be programmed as ADC input pin**

5. Dimensions

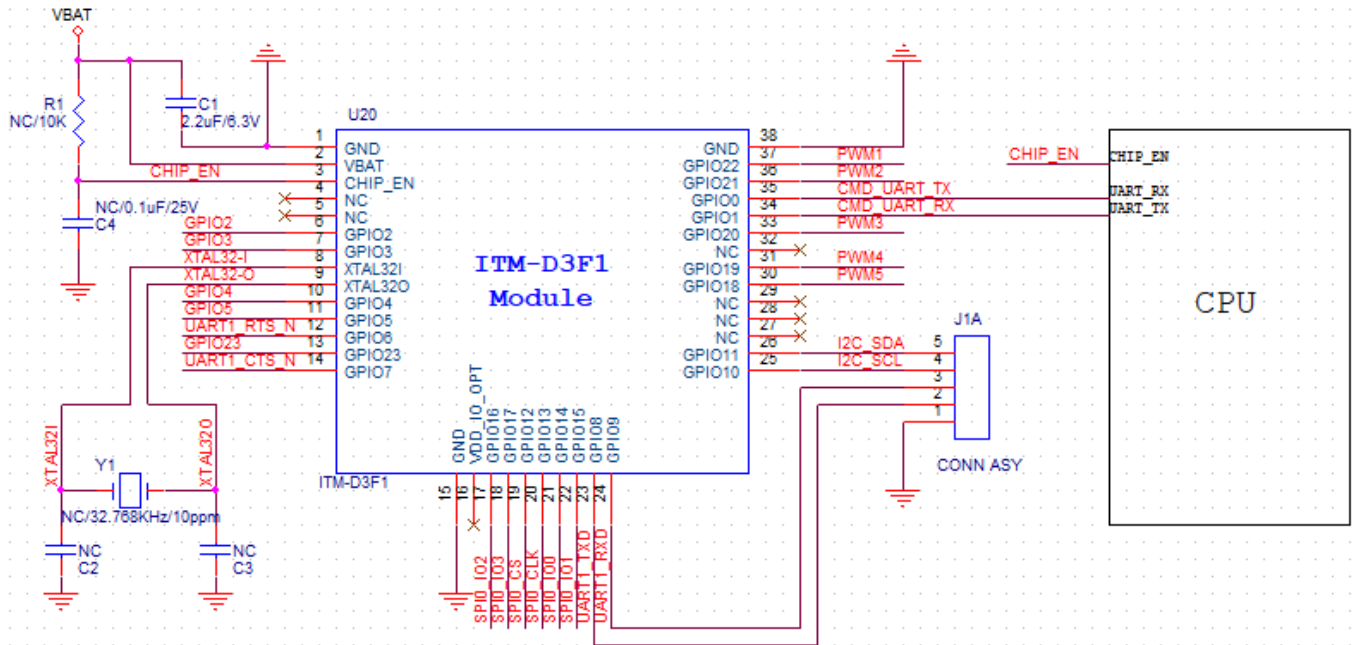
5.1 Layout Recommendation

(Unit: mm)

< TOP VIEW >



6. Reference Design



7. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤ 2 times

