USB Freescale ZigBee Module 779
Operational Manual

Ten X Technology, Inc.

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Module Overview

The modules will communicate using a 2.4GHz carrier frequency. The modules will be capable of operating in a variety of computing environments to allow integration into a variety of systems. Along with the USB interface, the module will support a serial interface and will be capable of full operation. The following modes of operation will be supported:

- USB ZigBee Network mode – in this mode the USB interface is used to communicate to an on-board uP that is running a full ZigBee compliant IP stack

Safety Information

FCC

Any modifications to this product not expressly approved by Ten X Technology Inc. may violate the rules of the Federal Communications Commission and make operation of the product unlawful.

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.

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter

Industry Canada

This Class B digital apparatus complies with Canadian ICES-003.

HARDWARE

USB to UART Bridge (CP2103)

The CP2103 is a highly integrated USB-to-UART Bridge Controller providing a simple solution for updating RS-232/RS-485 designs to USB. The CP2103 includes a USB 2.0 full-speed function controller, USB transceiver, oscillator, EEPROM, and synchronous serial data bus (UART) with full modem control signals. The on-chip EEPROM may be used to customize the USB Vendor ID, Product ID, Product Description String, Power Descriptor, Device Release Number, and Device Serial Number as desired for OEM applications.

The CP2103 UART interface implements all RS-232/RS-485 signals, including control and

handshaking signals, but the design does not support hardware flow control.

Processor (MC9S08GT60)

The processor is a member of the low cost, high-performance HCS08 Family of 8-bit microcontroller units from Freescale. The chip has the following features:

- 8-MHz clock drives the processor
- 40-MHz internal clock for the CPU is derived from the 8-Mhz external clock
- 40-MHz HCS08 CPU (central processor unit)
- HC08 instruction set with added BGND instruction
- Background debugging system
- Breakpoint capability to allow single breakpoint setting during in-circuit debugging (plus two more breakpoints in on-chip debug module)
- Debug module contains two comparators, nine trigger modes, and an eight deep FIFO for storing change-of-flow addresses and event-only data. Debug module supports both tag and force breakpoints.
- Support for up to 32 interrupt/reset sources
- Power-saving modes: wait plus three stops
- System protection features:
  - — Optional computer operating properly (COP) reset
  - — Low-voltage detection with reset or interrupt
  - — Illegal opcode detection with reset
  - — Illegal address detection with reset (some devices don't have illegal addresses)

The MCU communicates with the USB Interfaces via the RS-232 connection. All commands from the Host Computer to the processor are via the USB bus, which are converted to RS-232 in the USB Interface and then passed to the processor. The processor then executes code that controls Radio chip.

The signal assignment on the Processor chip for the control of the Radio chip is defined in the following Table:

Processor Pin #	Processor pin Name	Function name
4	PTC2/SDA1	ATTENB signal to Radio
5	PTC3/SCL1	RXTXEN signal to Radio
6	PTC4	RSTB signal to Radio
10	PTE0/TXD1	RX signal from USB interface chip
11	PTE1/RXD1	TX signal to USB interface chip
13	PTE2/SS1	SPI Chip Select to Radio
16	PTE5/SPCLK1	SPI Clk to Radio
15	PTE4/MOSI1	SPI MOSI to Radio

14	PTE3/MISO1	SPI MISO from Radio
12	IRQ	Interrupt from Radio
20	PTD0/TPM1CH0	LED1
21	PTD1/TPM1CH1	LED2
23	PTD3/TPM2CH0	LED3
24	PTD4/TPM2CH1	LED4
31	PTB6/AD1P6	Antenna Control
47	PTG2/EXTAL	Input Clk to Chip
45	PTG0/BKG0/MS	BDM Programming Pin

Radio Chip (MC13192)

The MC13192 is a short range, low power, 2.4 GHz ISM band transceiver which contains a complete 802.15.4 physical layer (PHY) modem designed for the IEEE 802.15.4 wireless standard supporting star and mesh networking. When combined with the MC9S08GT60CFD microcontroller (MCU), the MC13192 provides a cost effective solution for short-range data links and networks. Interface with the MCU is accomplished utilizing a four-wire serial peripheral interface (SPI) connection. The software and processor can be scaled to fit the application from simple point-to-point proprietary systems to ZigBee™ networking.

The transceiver includes a low noise amplifier, 1.0 mW PA, VCO and full spread-spectrum encoding and decoding. The device supports 250 kbps O-QPSK data in 5.0 MHz channels, per the IEEE 802.15.4 standard. A Serial Peripheral Interface (SPI) is used for RX and TX data transfer and control to and from the MCU.

Features

- Recommended power supply range: 2.0 to 3.4 V (Set to 3.0v)
- 16 Channels
- EIRP -7.67 dBm (0.171 mW) maximum output power based on field strength
- Link Quality and Clear Channel Assessment capability
- Buffered Transmit and Receive Data Packet Random Access Memory (RAM)
- Supports 250 kbps O-QPSK Data in 5.0 MHz Channels and Full Spread-Spectrum Encode and Decode (Compatible with IEEE Standard 802.15.4)
- RX sensitivity of -92 dBm (Typical) at 1.0% Packet Error Rate
- Four timer comparators to reduce MCU resource requirements
- Clock output for use by MCU

• Seven General Purpose Input/Output ports (GPIO)

• Operating Temperature Range: -40°C to 85°C

Transmitter/Receive Overview

The MC13192 has differential RF inputs and outputs. These are connected to a chip baluns to convert to a 50-ohm transmission line interface to a single ended chip antenna. The output of the baluns are connected to a switch that selects transmit data to the antenna or receive data from the antenna. The switch is control by the signal ANTCTRL from the MCU.

Radio Receive Path Description

In the receive signal path, the RF input is converted to low IF In-phase and Quadrature (I & Q) signals through two down conversion stages. A Clear Channel Assessment (CCA) can be performed based on the baseband energy integrated over a specific time interval. The digital back end performs Differential Chip Detection (DCD), the correlator de-spreads the Direct Sequence Spread Spectrum (DSSS) Offset QPSK (O-QPSK) signal, determines the symbols and packets, and detects the data.

The preamble, SFD, and frame length are parsed and used. A two-byte FCS is calculated on the incoming data and is compared to the value appended to the transmitted data, generating a Cyclical Redundancy Check (CRC).

Radio Transmit Path Description

The transmit path is the exact reverse of the receive path. The data stored in RAM is retrieved or clocked in via the SPI, formed into packets per the 802.15.4 PHY, spread, and then up converted to the transmit frequency.

Transmit Power Adjustment

Table 3-2 shows the device power output versus SPI register settings for Register 12, Bits 7-6 and Register 12, Bits 5-4

PA Power Level Coarse Adjust Reg 0x12[7:6]	PA Power Level Fine Adjust Reg 0x12[5:4]	Typical Differential Power at Output Contact (dBm)
0	0	-16.6 (default)
0	1	-16.0
0	2	-15.3
0	3	-14.8
1	0	-8.8
1	1	-8.1
1	2	-7.5
1	3	-6.9

2	0	-1.0
2	1	-0.5
2	2	-0.0
2	3	0.4
3	0	2.1
3	1	2.8
3	2	3.5
3	3	3.6

MC13192 Power Output vs. SPI Settings (Register 12)

Interfacing With an MCU

The SPI connections to the MCU include IRQ, CE, MOSI, MISO and SPICLK. The SPI can run at any frequency of 8 MHz or less. The CLKO frequency is programmable via the SPI and is set to 8 MHZ. The ATTN line can be driven by a GPIO from the MCU and is used to wake up the RFIC from Doze or Hibernate modes. RXTXEN is used to initiate receive or transmit sequences under MCU control. The device reset (RST) is controlled through a connection to an MCU GPIO.

Clocks

The MC13192 uses a 16 MHz crystal oscillator as the reference oscillator for the system.

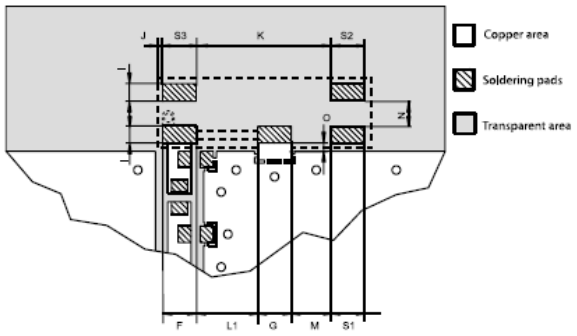
Antenna

The antenna is a SMD device that mounts on the module board.

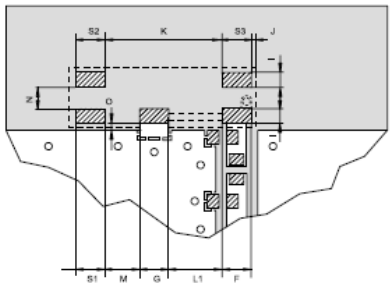
The Rufa antenna is intended for use with all 2.4 GHz applications. The antenna requires a groundplane i.e the module acts as an active part of the antenna. The module contains a complete ground plane except for area that is specified as keep out areas for the antenna. See Foot Print, Module uses the Left entry.

9. ANTENNA FOOT PRINT

Art no: 3030A5839-01 (Left)



Art no: 3030A5887-01 (Right)



G	F	S1	S2	S3	I	J	K	L1	M	N	O
Ground	Feed	Solder									
2.0±0.1	2.0±0.1	2.0±0.1			1.0±0.1	0.25±0.1	8.1±0.1	3.7±0.1	2.4±0.1	1.3±0.1	0.3±0.15
Dimensions in milimeters											