BTS-TMD

User Manual

CONTENTS

Chapter 1

Introduction

The Terasic BTS-TMD is a Bluetooth version 2.1 module with SPP (Serial Port Profile) profile, small form factor and low power for users who want to equip wireless capability to their design.

1.1 Features

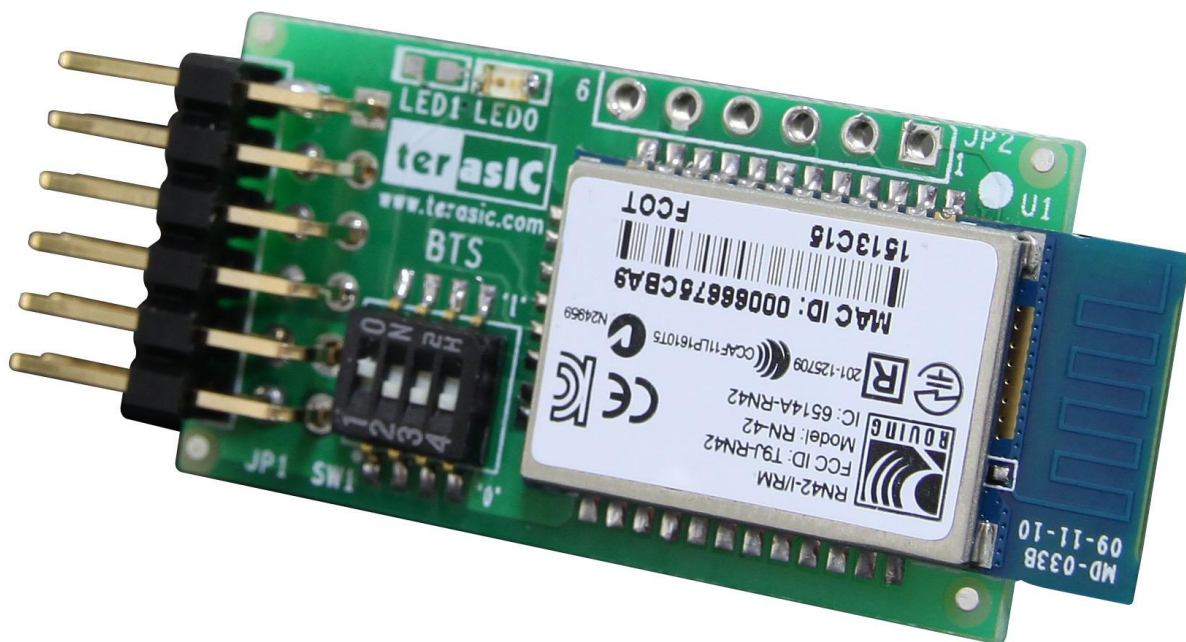**Figure 1-1** shows a photograph of the BTS-TMD.

Figure 1-1   Exterior View

The key features of the card are listed below:

- Fully qualified Bluetooth® version 2.1 module, supports version 2.1 + Enhanced Data Rate (EDR)
- Sustained SPP data rates: 240 Kbps (slave), 300 Kbps (master)
- HCI data rates: 1.5 Mbps sustained, 3.0 Mbps burst in HCI mode

1.2 Getting Help

Here is information of how to get help if you encounter any problem:

Terasic Technologies

Tel: +886-3-550-8800

Email: support@terasic.com

Architecture

This chapter provides information about architecture and block diagram of the BTS-TMD board.

2.1 Layout and Components

The picture of the Terasic BTS-TMD is shown in **Figure 2-1** and **Figure 2-2**. It depicts the layout of the board and indicates the locations of the connectors and key components.
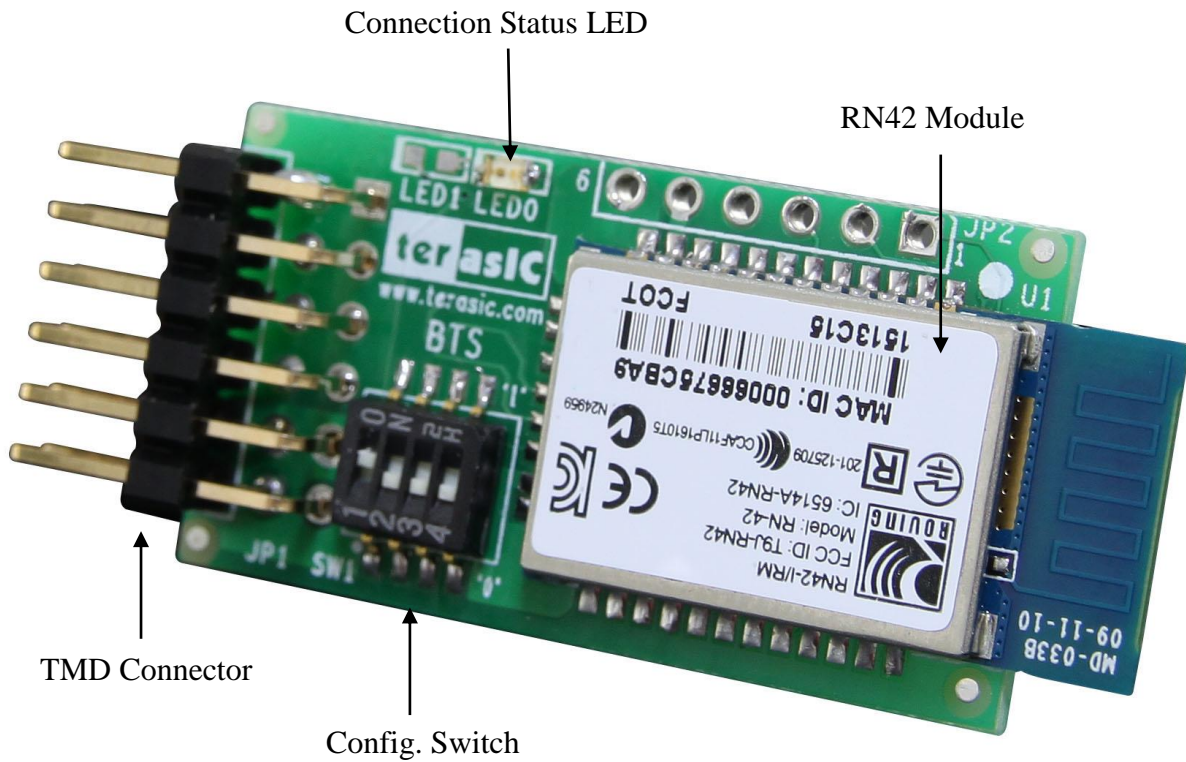

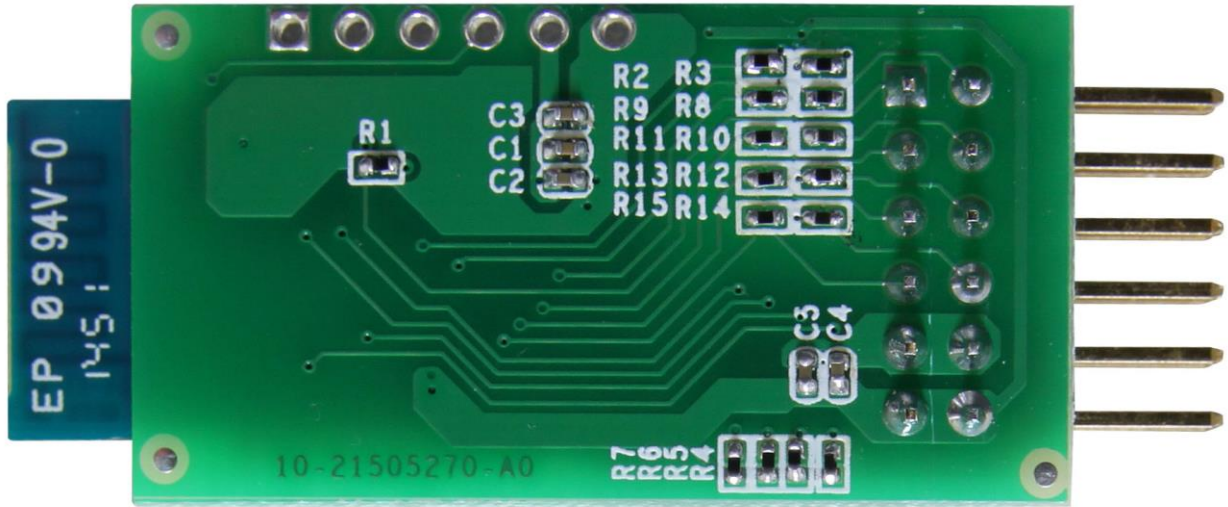**Figure 2-1   BTS-TMD and Component Diagram (top view)**

Figure 2-2 BTS-TMD and Component Diagram (bottom view)

2.2 Block Diagram of the BTS-TMD Board

Figure 2-3 shows the block diagram of the BTS-TMD card.
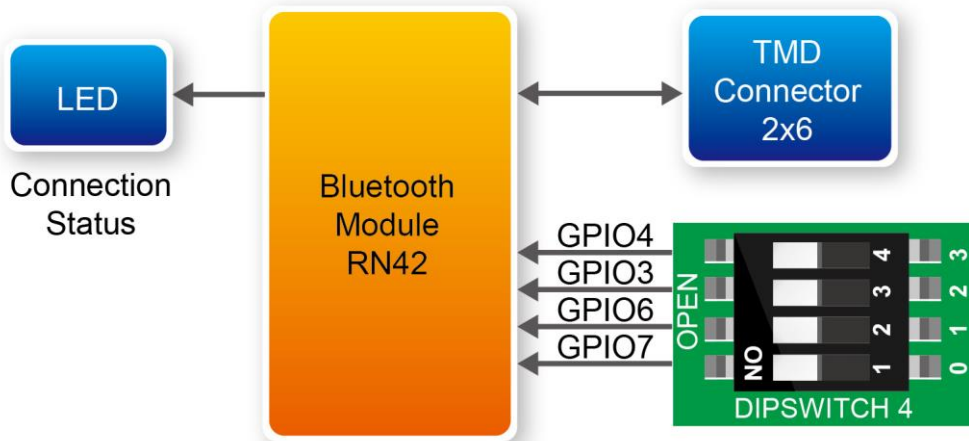
Figure 2-3 Block Diagram of BTS-TMD

Chapter 3

Board Components

This chapter describes the specifications of the on board components.

3.1 TMD Connector

This TMD connector is an interface to connect BTS-TMD and host/FPGA. And there is an UART interface and GPIOs on it, as show **Figure 3-1.**
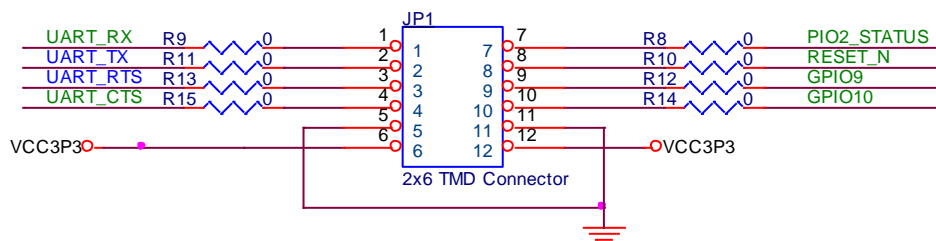

Figure 3-1 TMD Connector

Table 3-1 gives the wiring information of the TMD connector.

Table 3-1 Pin assignments and descriptions on TMD connector

Pin Numbers	Name	Description
1	UART_RX	UART Receive RN42 Input
2	UART_TX	UART Transmit RN42 Output
3	UART_RTS	UART RTS
4	UART_CTS	UART CTS
5	GND	PCB Ground
6	VCC3P3	3.3V Power Input
7	PIO2_STATUS	High when connected, low otherwise
8	RESET_N	Active-low reset
9	GPIO9	IO
10	GPIO10	IO
11	GND	PCB Ground
12	VCC3P3	3.3V Power Input

3.2 SWTICH

There is a dip-switch to configure this Bluetooth module, it is high level when switch to ON position, as show **Figure 3-2** and **Figure 3-3** as show the schematic view of SW1.
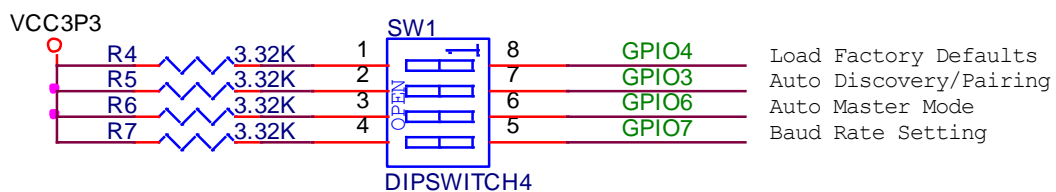

Figure 3-2 SW1

Figure 3-3 Schematic view of SW1

The functions of SW1 describe as below.

- GPIO4: This switch can be used to reset the module to its factory default settings, which is critical in situations where the module has been misconfigured. To reset the module to the factory defaults, GPIO4 should be high on power-up and then toggle low, high, low, high with a 1 second wait between the transitions.
- GPIO3: Move this switch to ON position (high level), it enables auto discovery feature.
- GPIO6: Move this switch to ON position (high level), it enables auto master mode.
- GPIO7: Move this switch to ON position (high level) it set baud-rate 9600 bps, otherwise 115k bps.

3.3 LED

There is an LED on board, it is driven by GPIO5, and it blinks at various speeds to indicate status (see Table 3-2). **Figure 3-24** shows the location of LED0.

Table 3-2 Connection Status

Connection Status	Description
Toggle at 1 Hz	The module is discoverable and waiting for a connection.
Toggle at 10 Hz	The module is in command mode.
Low	The module is connected to another device over Bluetooth.

Figure 3-2 LED0

Chapter 4

Design Example

This chapter shows how to connect the MAX 10 NEEK board and BTS-TMD Bluetooth module. The bundle communicates with a smart device via Bluetooth 2.1. The data retrieved from the humidity and temperature sensor HDC 1000 on MAX 10 NEEK board will be transmitted to the SPP (Serial Port Profile) software on the smart device via Bluetooth SPP protocol.
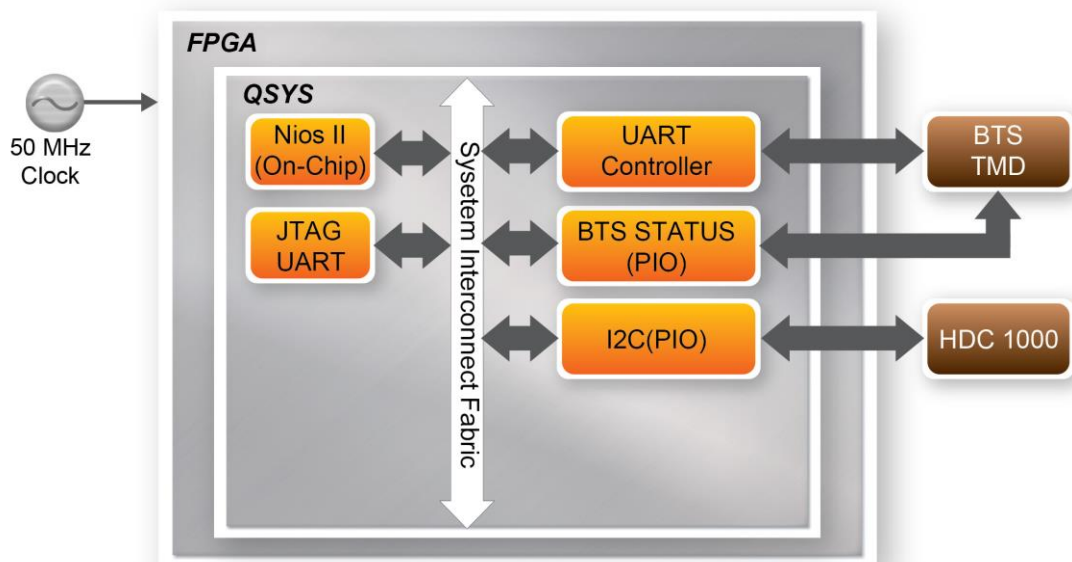
4.1 System Block Diagram

Figure 4-1 Block diagram of BTS-TMD demonstration

Figure 4-1 shows the system block diagram of this demonstration. The main Nios II program is stored in on-chip memory. The UART controller provides access for Nios II process to communicate with the BTS-TMD module via UART interface and transmit data. The BTS STATUS reads the connection status of BTS TMD. The I2C module reads the humidity and temperature of surrounding environment from the HDC 1000 chip via I2C protocol.

4.2 Command Mode

The BTS-TMD module uses RN-42 Bluetooth module form Microchip. The FPGA communicates with the module via UART and PIO interfaces. The UART interface is used to transmit data and send commands to the module. Users must send a special characters $$$ to the module to enter the Command Mode prior to sending commands. Users can exist Command Mode by sending another special characters --\r. For other command set, please refer to the user guide of RN-42. This demonstration does not exercise the Command Mode.

4.3 DIP Switch Setting

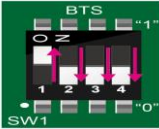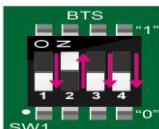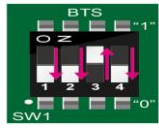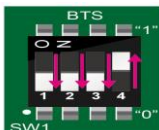The DIP switch setting in this demonstration is 0000 by default. For other settings, please refer to Table4.1.

Function	Switch(icon)	Switch(value)
Factory Reset		1000 (LSB->MSB)
Auto. Discovery/ Pairing		0100 (LSB->MSB)
Auto. Connect		0010 (LSB->MSB)
Baud Rate		0001 (LSB->MSB)

Table 4.1 BTS-TMD mode

- Factory Reset: Switch the LSB of the DIP switch three times when the module is powered up to reset and restore the factory setting, as shown in Figure4-2. The LED will keep flashing for a second to indicate the reset is complete.
- Auto. Discovery/Pairing: This mode can let users pair specific device classes only and filter out others, but it requires users to designate the device classes in Command Mode first.
- Auto. Connect: This mode will connect pre-defined address of Bluetooth device, but it requires users to assign the address in Command Mode first.
- Baud Rate Setting: The baud rate will be set from 115200 to 9660 in this mode.

Figure 4-2 Reset and restore the factory setting

For more setting details, please refer to the user guide of RN-42.

4.4 Android Smartphone

This demonstration uses Android smartphone as the Bluetooth device. The information about the humidity and temperature of MAX 10 NEEK board will be transmitted to the Android smartphone after the installation of Bluetooth related APK. If users would like to transmit other information or message, please refer to the Nios II program and modify the contents accordingly.

4.5 Demonstration Source Code

- Quartus project directory: BTS_TMD
- Nios II Eclipse project workspace: BTS_TMD/software

4.6 Demonstration Setup

1. Please make sure both Quartus II and USB-Blaster II driver are installed on the host PC.
2. Connect the BTS-TMD module to the TMD expansion header of MAX 10 NEEK board.
3. Connect USB cable to the USB-Blaster II connector (J8) on the MAX 10 NEEK board and the host PC.
4. Power on the MAX 10 NEEK board.
5. Locate the "*BTS_TMD\demo_batch*" folder. Execute "*test.bat*" to start the configuration and download the demo application to the FPGA. **Figure 4-3** shows the successful message after execution.
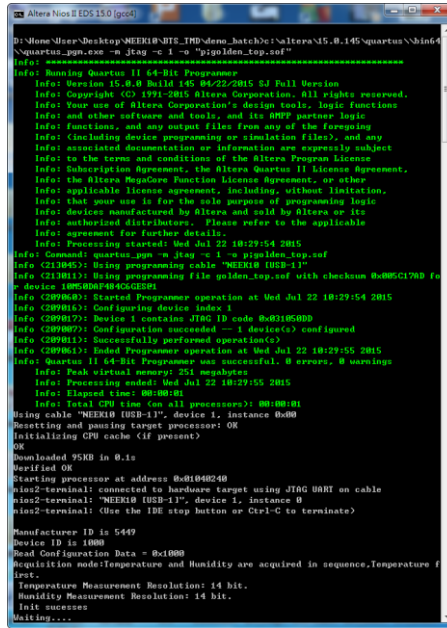
Figure 4-3 Launch the BTS-TMD demonstration from the "demo_batch" folder

6. Users can download and install the Bluetooth APK from the link below to perform associated test. https://play.google.com/store/apps/details?id=Qwerty.BluetoothTerminal

7. Press Task Navigation Key after the installation. Select Connect a device – Secure to start searching for Bluetooth device, as shown in **Figure4.4**. The BTS-TMD will appear as RNTB-XXXX (each and every BTS-TMD device comes with different combination of characters and numbers for the last-four digit).

Figure4.4 Connect a device - secure

If the connection is established successfully, the LED on BTS-TMD will stay ON. The data will be transmitted from the BTS-TMD to the smartphone, as shown in **Figure 4-5**.

Figure 4-5 The data gathered on a smartphone after executing the demonstration

Appendix

5.1 Revision History

Version	Change Log
V1.0	Initial Version (Preliminary)

5.2 Copyright Statement

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