

# BlueFan BT680F/E/T BLE 5 Module

## Features

- Standalone or used with a host MCU by UART interface/HCI Commands
- Hybrid Castellated/LGA pins, easier prototyping, easier production
- Toshiba SOC, built-in Cortex M0 processor
- Masked-ROM:
  - Boot program
  - HCI/Extended HCI command
  - Control API for GATT/SM layer
  - API for hardware control
- RAM: retention, 144 KB (user area RAM, 76 KB).
- Flash:128 KB
- Bluetooth RF analog core, baseband digital core and integrated antenna
- Transmitter power +8 dBm;
- Receiver sensitivity at 1Mbps: -95 dBm.
- Receiver sensitivity at 125 Kbps: -105 dBm.
- Bluetooth Low Energy (BLE) V5 GATT profile with OTA (Over The Air) support.
- Bluetooth SIG certified BLE 5 stacks embedded in mask-ROM.
- Up to18 General Purpose IOs to be configured by firmware:
  - SPI interface,
  - I<sup>2</sup>C interface
  - UART interface, 9600bps to 921.6 Kbps
  - Up to 2 wake up interfaces
  - Up to 5 ADC channels (1 for internal monitoring of VDD).
  - Up to 4 PWM channels
- On board 32 MHz main clock
- External 32.768 kHz sleep clock
- Operation voltage: 1.9V-3.6V
- Peak current consumption, 11.5 mA (+8 dBm TX, 2 Mbps PHY)
- Deep sleep mode, <0.1uA
  - Operation Temperature: -40°C to +85°C
- Sizes: 15x20.8x1.9mm;
- Hybrid pins: 16 castellated and 24 LGA pins
- Integrated shield to resist EMI
- FCC ID: X8WBT680
- Industrial Canada ID: 4100A-BT680

## Applications:

- Access Points
- Industrial Control
- Medical
- Scanners
- iOS and Android devices
- Wireless sensors
- Cable replacement
- Instrumentation
- Automobile
- Sports
- Proximity

## Ordering Information:

| module           | BT680F            | BT680T            | BT680TA           | BT680E         |
|------------------|-------------------|-------------------|-------------------|----------------|
| SoC              | TC35680FSG-002    | TC35681FSG-002    | TC35681FSG-002    | TC35680FSG-002 |
| RAM              | 144KB             | 144KB             | 144KB             | 144KB          |
| Flash            | 128KB             | 0                 | 0                 | 128KB          |
| Op.temp.         | -40°C to +85°C    | -40°C to +85°C    | -40°C to +125°C   | -40°C to +85°C |
| antenna          | PCB trace         | PCB trace         | PCB trace         | u.FL           |
| Range, meters    | 3000M at 125 Kbps | 3000M at 125 Kbps | 3000M at 125 Kbps |                |
| Evaluation board | EV-BT680F         | EV-BT680TA        | EV-BT680TA        | EV-BT680E      |
| Availability     | Production        | Production        | Production        | Production     |

# BlueFan BT680F/E/T BLE 5 Module

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# BlueFan BT680F/E/T BLE 5 Module

## 1. Introduction

BlueFan modules are Bluetooth Smart module using Toshiba SoC. Toshiba SoC provides Bluetooth™ HCI (Host Control Interface) function specified in Bluetooth™ Core Specifications. The HCI function allows BlueFan to be connected to an external host processor for Bluetooth applications.

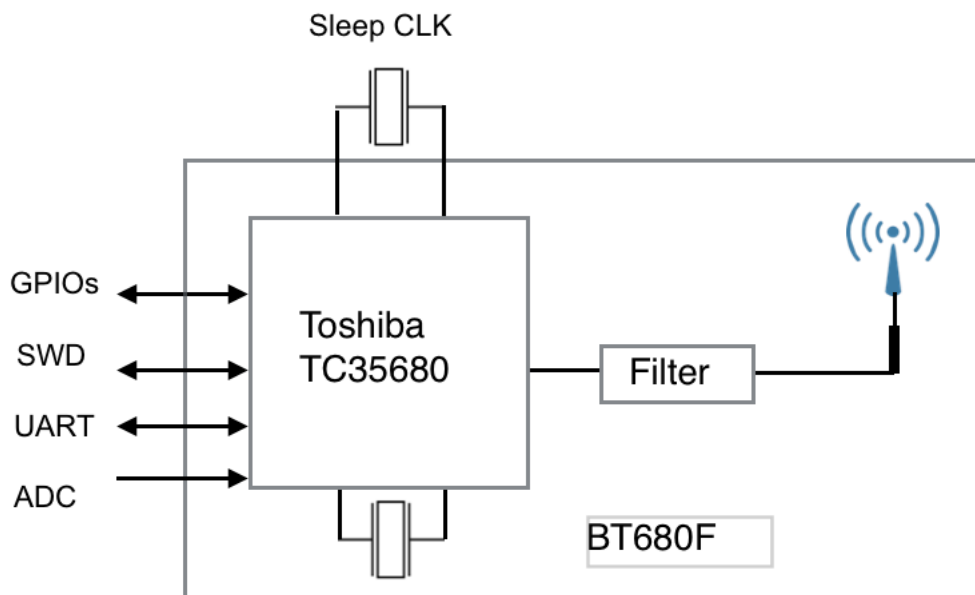
Bluetooth stacks and GATT 5 profiles are embedded with OTA support.

BT680F modules work in standalone alone mode without a host processor. An SWD (Serial Wire Debug) 2-wire interface is available for firmware development.

## 2. Product Features

### BT680F with PCB trace antenna

The following is a block diagram of BT680F. It operates in standalone mode or with a host processor. A 32MHz main clock crystal is on board. A 32.768 KHz crystal can be added on the main board to provide precise sleep clock in sleep mode. This module can be wake up by an external signal. Printed antenna is integrated. Co-existence connection with WiFi is provided.



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  - Boot program
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## BlueFan BT680F/E/T BLE 5 Module

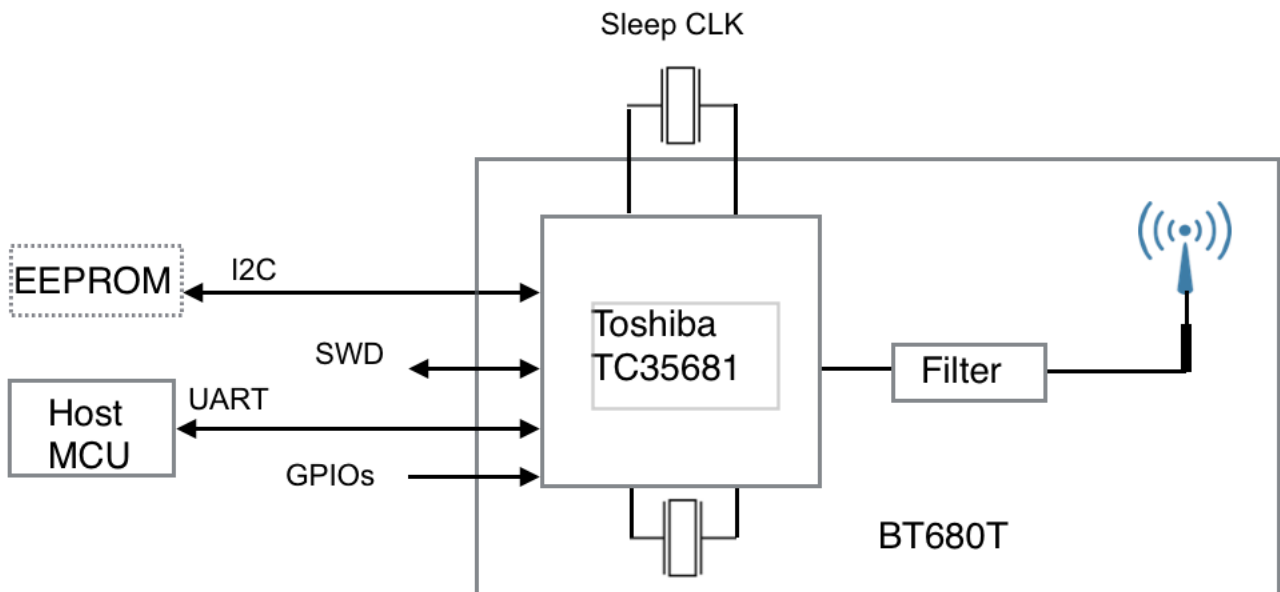
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- Operation Temperature: -40°C to +85°C
- Sizes: 15x20.8x1.9mm;
- Hybrid pins: 16 castellated and 24 LGA pins
- Integrated shield to resist EMI

### BT680E with an u.FL Connector for External Antenna

BT680E has the same specifications as BT680F except the integrated PCB trace antenna is replaced with an u.FL connector for external antenna.

### BT680T Communicating with a Host MCU Using HCI Commands

BT680T specifications are the same as that of BT680F except flash memory size. A host MCU sends HCI commands to manage operation of BT680T. BT680T can work in standalone mode by adding an external serial EEPROM.



Sister module BT680TA is identical to BT680T except automobile temperature components are used.

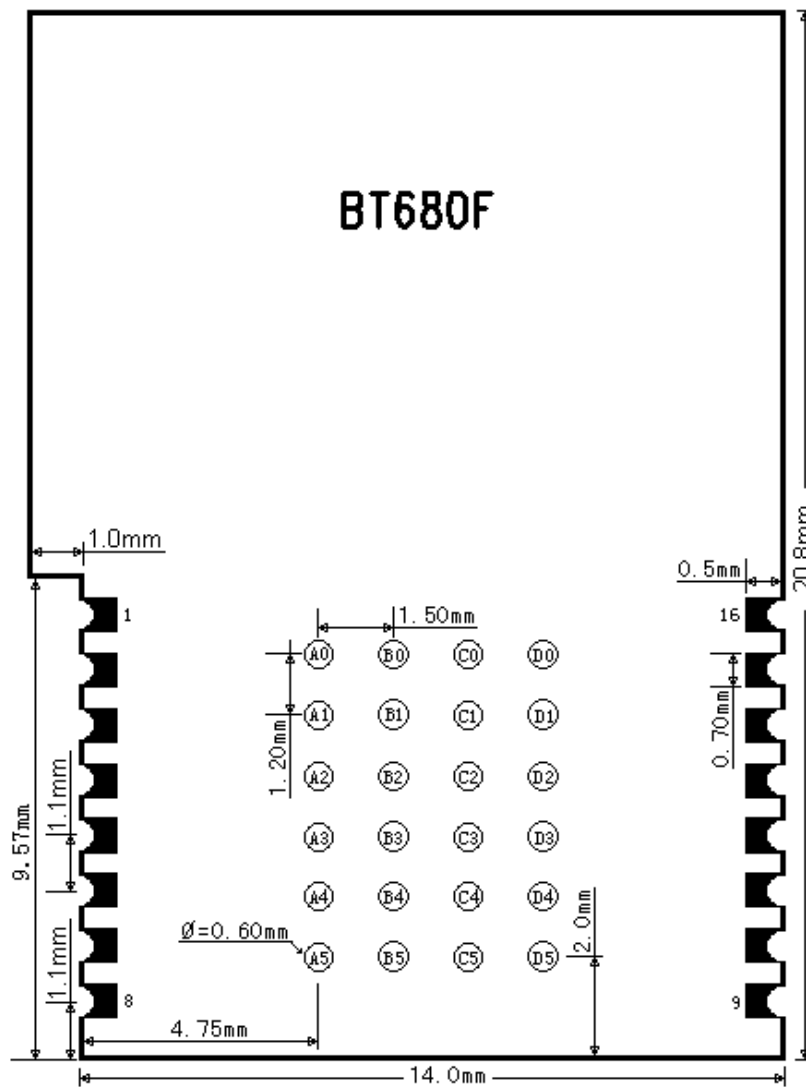
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## 3. Hardware Description

### Module Footprint Drawing

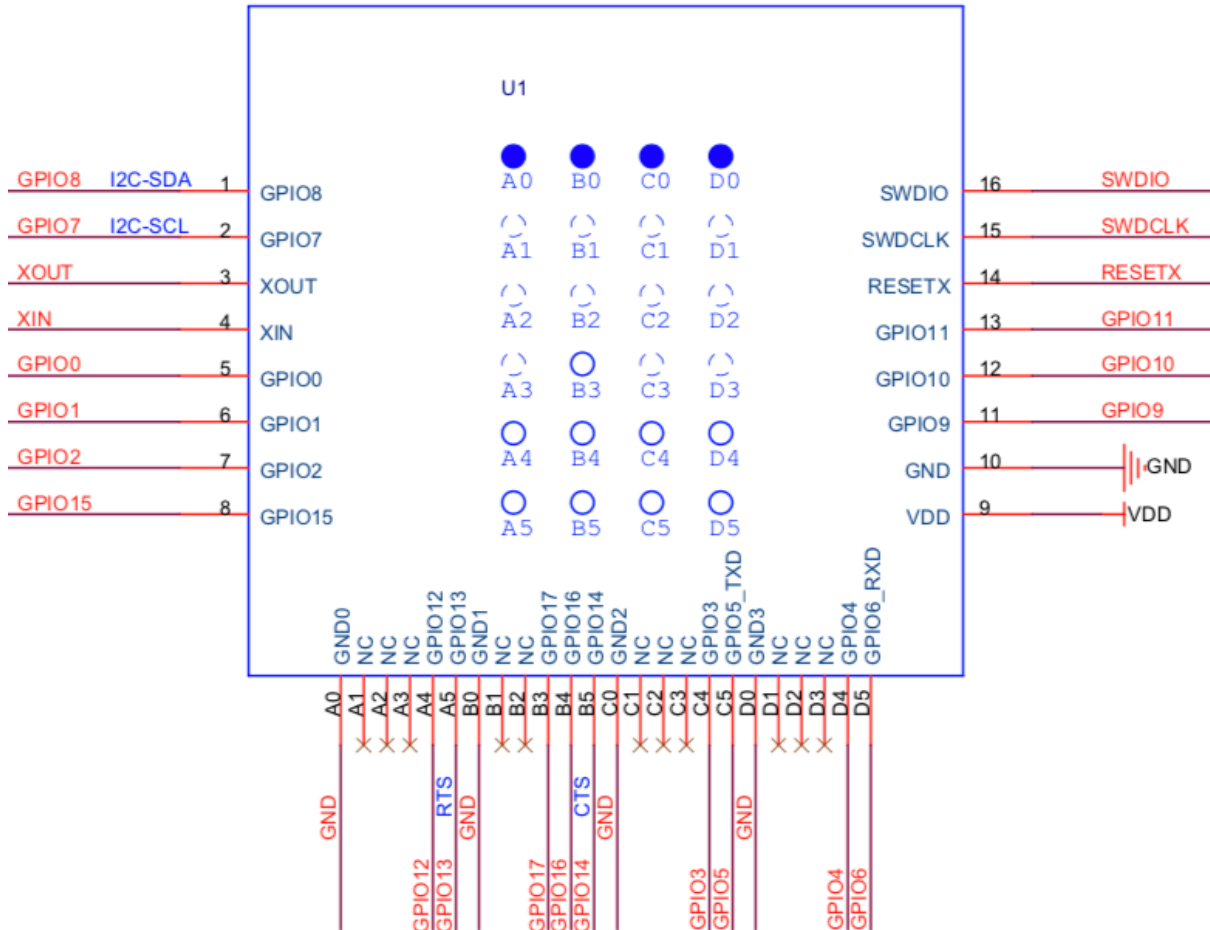
A mechanical drawing is shown below.



# BlueFan BT680F/E/T BLE 5 Module

## BT680F Pin Assignments

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# BlueFan BT680F/E/T BLE 5 Module

## Pin Functions

BT680F module has 16 castellated pins for product needing limited GPIOs and additional 24 Land Grid Array (LGA) pins.

All Toshiba TC35680-FSG GPIO pins are accessible. GPIO pins can be configured by firmware as UART, SPI, I<sup>2</sup>C, ADC, or PWM pins. The followings are configurable examples. For additional examples of configuration, please refer to Toshiba data sheets.

| Pin | pin name | Descriptions                                      |
|-----|----------|---------------------------------------------------|
| 1   | GPIO8    | GPIO8, configured as I2C-SDA on evaluation board. |
| 2   | GPIO7    | GPIO7, configured as I2C-SCL on evaluation board  |
| 3   | XOUT     | Connection for external 32.768 kHz sleep clock    |
| 4   | XIN      | Connection for external 32.768 kHz sleep clock    |
| 5   | GPIO0    | GPIO 0                                            |
| 6   | GPIO1    | GPIO 1                                            |
| 7   | GPIO2    | GPIO 2 or PWM 1                                   |
| 8   | GPIO15   | GPIO 15                                           |
| 9   | VDD      | VDD, 1.9 to 3.6V DC power supply                  |
| 10  | GND      | Ground                                            |
| 11  | GPIO9    | GPIO 9 or ADC 3                                   |
| 12  | GPIO10   | GPIO 10 or ADC 4                                  |
| 13  | GPIO11   | GPIO 11 or SPI-DOUT 2 or I2C-SCL 2.               |
| 14  | RESETX   | Hardware reset input, low to reset.               |
| 15  | SWDCLK   | Serial Wire Debug clock pin                       |
| 16  | SWDIO    | Serial Wire Debug data pin                        |
| A0  | GND0     | Ground                                            |
| A1  | NC       |                                                   |
| A2  | NC       |                                                   |
| A3  | NC       |                                                   |
| A4  | GPIO12   | GPIO 12 or SPI-DIN 2 or I2C-SCL 2                 |
| A5  | GPIO13   | GPIO 13 or SPI-SCS 2 or UART 1 RTSX               |
| B0  | GND1     | Ground                                            |
| B1  | NC       |                                                   |
| B2  | NC       |                                                   |

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| Pin | pin name  | Descriptions                         |
|-----|-----------|--------------------------------------|
| B3  | GPIO17    | GPIO 17 or UART 2 RX                 |
| B4  | GPIO16    | GPIO 16 or UART 2 TX                 |
| B5  | GPIO14    | GPIO 14 or SPI-SCLK 2 or UART 1 CTSX |
| C0  | GND2      | Ground                               |
| C1  | NC        |                                      |
| C2  | NC        |                                      |
| C3  | NC        |                                      |
| C4  | GPIO3     | GPIO or PWM 2                        |
| C5  | GPIO5-TXD | GPIO 5 or UART 1 TX                  |
| D0  | GND3      | Ground                               |
| D1  | NC        |                                      |
| D2  | NC        |                                      |
| D3  | NC        |                                      |
| D4  | GPIO4     | GPIO 4 or PWM 3                      |
| D5  | GPIO6-RXD | GPIO 6 or UART 1 RX                  |

# BlueFan BT680F/E/T BLE 5 Module

## Example of GPIO Functions

The following shows examples of possible GPIO. For details about combination of settings, refer to Toshiba software application notes.

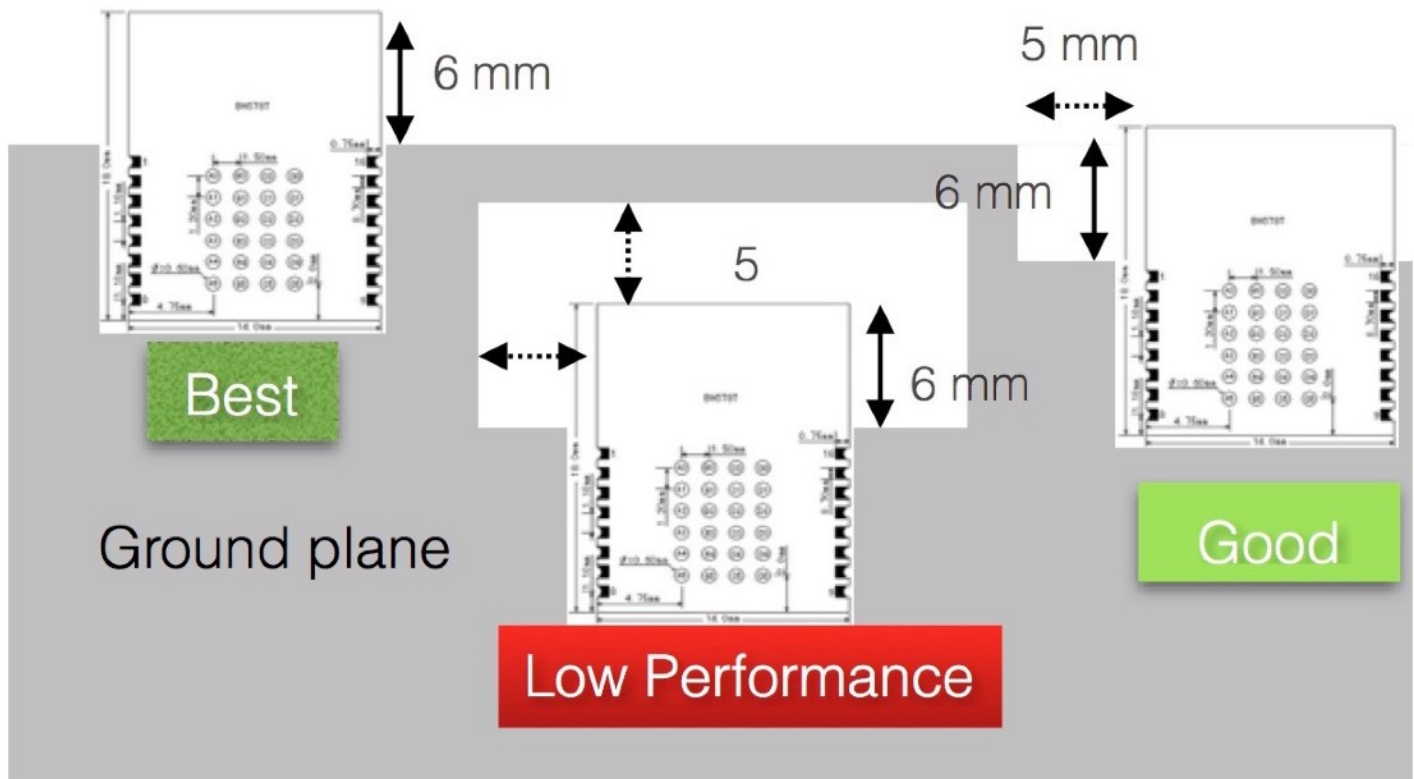
|        | Example 1  | Example 2  | Example 3  | Example 4  | Example 5 |
|--------|------------|------------|------------|------------|-----------|
| GPIO0  | GPIO0      | GPIO0      | GPIO0      | GPIO0      | GPIO0     |
| GPIO1  | GPIO 1     | GPIO 1     | GPIO 1     | GPIO 1     | GPIO 1    |
| GPIO2  | PWM 1      | PWM 1      | PWM 1      | GPIO 2     | GPIO 2    |
| GPIO3  | PWM2       | PWM2       | PWM2       | SPI-DOUT1  | GPIO3     |
| GPIO4  | PWM3       | PWM3       | PWM3       | SPI-DOUT2  | GPIO4     |
| GPIO5  | UART1-TX   | UART1-TX   | UART1-TX   | UART1-TX   | UART1-TX  |
| GPIO6  | UART1-RX   | UART1-RX   | UART1-RX   | UART1-RX   | UART1-RX  |
| GPIO7  | UART1-RTSX | UART1-RTSX | I2C-SCL1   | SPI-SCS1   | I2C-SCL1  |
| GPIO8  | UART1-CTSX | UART1-CTSX | I2C-SDA1   | SPI-SCLK1  | I2C-SDA1  |
| GPIO9  | ADC3       | ADC3       | ADC3       | ADC3       | GPIO 9    |
| GPIO10 | ADC4       | ADC4       | ADC4       | ADC4       | GPIO 10   |
| GPIO11 | SPI-DOUT2  | I2C-SCL2   | GPIO 11    | I2C-SCL 2  | GPIO 11   |
| GPIO12 | SPI-DIN2   | I2C-SDA2   | GPIO 12    | I2C-SDA2   | GPIO12    |
| GPIO13 | SPI-SCS2   | GPIO13     | UART1-RTSX | UART1-RTSX | GPIO13    |
| GPIO14 | SPI-SCLK2  | GPIO14     | UART1-CTSX | UART1-CTSX | GPIO14    |
| GPIO15 | GPIO15     | GPIO15     | GPIO15     | GPIO15     | GPIO15    |
| GPIO16 | UART2-TX   | GPIO16     | GPIO16     | GPIO16     | GPIO16    |
| GPIO17 | UART2-RX   | GPIO17     | GPIO17     | GPIO17     | GPIO17    |

# BlueFan BT680F/E/T BLE 5 Module

## Mounting BT680F on the Host PCB

The following figure shows recommended mounting of BT680F module on the host PCB.

- For the best Bluetooth range performance, the antenna area of module shall extend 6 mm outside the edge of host PCB board, or 6 mm outside the edge of a ground plane.
- The next choice is to place module on a corner of host PCB, the antenna area shall extend 6mm from the edge of ground plane. Ground plane shall be at least 5 mm from the edge of the antenna area of module.
- Bluetooth range performance is degraded if a module is placed in the middle of the host PCB.



1. Module extends 6 mm from edge or ground plane of the host PCB board.
2. No ground plane on all layers for at least 5mm from edge of module. Longer distance for longer Bluetooth range.

For the best Bluetooth range performance, keep all external metal at least 30mm from the antenna area.

# BlueFan BT680F/E/T BLE 5 Module

## 4. Hardware Interfaces

### Bluetooth Interfaces

BT680F Series with an integrated PCB trace antenna or u. FL connector for an external antenna; RF analog, baseband hardware, embedded firmware in ROM of TC35680, provide complete supports of Bluetooth Low Energy (BLE) interfaces.

Bluetooth Core Specification features supported and not supported by BT680F Series are in the table below.

| BT Core Spec. | Description                                                 | Notes         |
|---------------|-------------------------------------------------------------|---------------|
| v4.0 features | Central                                                     | Supported     |
|               | Peripheral                                                  | Supported     |
|               | Multi Profile/point                                         | Supported     |
|               | Connection Updates                                          | Supported     |
|               | Random Address                                              | Supported     |
|               | WhiteList                                                   | Supported     |
|               | Security Property (Just Works)                              | Supported     |
|               | Security Property (PassKey Entry)                           | Supported     |
|               | Security Property (OBB)                                     | Supported     |
|               | Security Property (Numeric Comparison)                      | Supported     |
|               | GATT-Client                                                 | Supported     |
|               | GATT-Server                                                 | Supported     |
|               | Broadcaster                                                 | Supported     |
|               | Observer                                                    | Supported     |
| v4.1 features | Low Duty Cycle Directed Advertising                         | Supported     |
|               | 32-bit UUID support in LE                                   | Supported     |
|               | LE L2CAP Connection Oriented Channel Support                | Not Supported |
|               | LE Privacy v1.1                                             | Supported     |
|               | Connection Parameter Request Procedure                      | Supported     |
|               | Extended Reject Indication                                  | Supported     |
|               | Slave-initiated Features Exchange                           | Supported     |
|               | LE Ping                                                     | Supported     |
|               | Act as LE Master and LE Slave at the same time              | Supported     |
|               | Act as LE Slave to more than one LE Master at the same time | Supported     |
| v4.2 features | LE Data Packet Length Extension                             | Supported     |
|               | LE Secure Connections                                       | Supported     |
|               | Link Layer Privacy                                          | Not Supported |

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| BT Core Spec. | Description                                 | Notes     |
|---------------|---------------------------------------------|-----------|
|               | Link Layer Extended Scanner Filter Policies | Supported |
| v5 features   | 2Msym/s OHY for LE                          | Supported |
|               | High Duty Cycle Non-Connectable Advertising | Supported |
|               | LE Advertising Extensions                   | Supported |
|               | Channel Selection Algorithm #2              | Supported |

Bluetooth transmission power is selectable from +8, +7, +6, 0,-6, and -20 dBm.

The RSSI of reception block has an accuracy of +/- 2 dB (typical) for an input signal between -90 and -10 dBm.

## Reset

A RC circuit is on board to reset Toshiba processor on powering up. A host processor can reset module by setting RESETX pin low.

## UART Features

Depending on firmware setting, BT680F supports with 2 channels of UART. Channel 1 has flow control (TX1, RX1, CTS1, RTS1). Channel 2 doesn't have flow control.

- Default baud rate 115.2Kbps; programmable baud rate:9600 bps to 921.6 Kbps.
- Full duplex start-stop synchronization data transfer (RX, TX).
- Data format:
  - LSB first
  - 1 start bit
  - 8 data bit
  - 1 stop bit
  - No parity bit
- Error detection:
  - Receiver timeout error
  - Receiver overrun error
  - Receiver frame error
- The interval of transmit to transmit, insert the duration of 12 characters or more. Interval can be changed by the command.
- Host wake-up function.

In host mode, BlueFan module communicates commands, status, and data with a host CPU through UART interfaces. The UART interfaces are shared with GPIO pins, and during boot process after a reset, module firmware assigns UART functions to the GPIOs.

## Flow Control Function

BlueFan module UART interface uses flow control function by hardware signal, Transmit flow control (CTS<sub>X</sub>) and receive flow control (RTS<sub>X</sub>). Above Figure shows signals input and output direction .

CTS<sub>X</sub> input signal is used for UART transmitting. Low input indicates close of the preparation of the other party to receive data and module executes UART transmitting data if there is data for transmission. In case of input high level, module stops transmitting by UART frame.

# BlueFan BT680F/E/T BLE 5 Module

RTSX input signal is used for UART receiving. Low output indicates request data transmission to UART transmit side device of the other party. module outputs Low level from RTSX when being able to receive data and prepares to receive data. Response time of UART transmitting and receiving for flow control signal depends on baud rate and internal process status of frame. It is from 1 frame to 4 frames.

Response time of UART transmitting and receiving for flow control signal depends on baud rate and internal process status of frame. It is from 1 frame to 4 frame.

## Error Detect Function

Module UART interface has 3 kinds of error functions.

- Receiver timeout error
- Receiver over run error
- Receiver frame error

Receiver timeout error reports as an error if the receiver frame interval counted by internal timer is equal to or greater than a predetermined time

Receiver over run error is reported if UART internal receive frame buffer is overflowed.

Receiver frame error is reported if it fails to recognize the unit frame.

## SPI Interface

Features SPI interface.

- Utilize VDDIO power supply
- SPI interface:
  - Chip select: 2 channels
  - Chip select polarity: High-active, Low-active
  - Serial clock master operation: Polarity and phase are adjustable
  - Serial clock frequency: 8 kHz to 16 MHz
  - Serial data transfer mode: MSB-first or LSB first

## I<sup>2</sup>C interface

Features of I<sup>2</sup>C interface

- Utilize VDDIO power supply
- Operation mode: I<sup>2</sup>C bus master
- Serial clock frequency: standard mode(100 kHz maximum), fast mode (100 to 400 kHz).
- Output mode: Open drain, CMOS output
- Device address format: 7 bit address, 10 bit address is not supported.

## Pulse Width Modulation Interface

Features of PWM interface.

- Utilize VDDIO power supply
- Pulse generation function
- Selectable source clock, 16 MHz or 32.768 kHz
- 12 bit clock division setting, divider up to 1/4096: 8Hz to 16.384kHz for 32.768 kHz clock;
- Divider up to 1/16777216, 0.954 Hz to 8MHz for 16 MHz clock.
- It can mask the pulse output with 1 second period, 50 ms unit width (rhythm function).
- The interrupt can be generated in synchronization with the cycle of 1 second rhythm pattern.
- It can switch the pulse output to Low/High active

# BlueFan BT680F/E/T BLE 5 Module

- Duty of pulse output is adjustable.
- Each PWM output can be synchronized by the pulse output synchronization function.

## Analog to Digital Converter

BT680F has 6 channels of 12 bit ADC for battery monitoring and analog inputs from external sensors.

- Utilize VDDIO power supply
- 1 internal input channel (ADC 0) for VBAT voltage monitoring.
- 5 channels for analog inputs, shared with GPIOs
- Maximum conversion rate is 1 MS/s
- 10-bit by default, 12-bit selectable

The ADC has up to 12-bit conversion accuracy and can work for input voltage from 0V to 3.6V (VDD). ADC channel 0 is connected to the VDDCORE2, whose voltage level is 1.2V, an IC internal voltage. When a battery is used as power source, the reference voltage can slide over time because the battery is connected as reference voltage.

AD converted data can be calculated by CPU into voltage values because the channel 0 is supplied with 1.2V to its input.

Input voltage of ADC 1 to ADC 5 = (conversion result of ADCn/conversion result of ADC0) x1.2V

## 5. BlueFan Module Specifications

### Absolute Maximum Ratings

|                      | Symbol      | Minimun | Maximum           |
|----------------------|-------------|---------|-------------------|
| Power supply         | VBAT, VDDIO | -0.3V   | +3.9V             |
| IO pin input voltage | VIN         | -0.3V   | VDDIO+0.3V, <3.9V |
| IO pin input current | IIN         | -10mA   | +10mA             |
| Storage temperature  | Tstg        | -40°C   | +125 °C           |
| Input power          | RFIO        |         | +10 dBm           |

# BlueFan BT680F/E/T BLE 5 Module

## Recommended Operating Conditions

|   |                                                | Min | Typ | Max |    |
|---|------------------------------------------------|-----|-----|-----|----|
| 1 | Power supply voltage (BT680F)                  | 1.9 | 3.0 | 3.6 | V  |
| 2 | Power supply voltage (BT680T)                  | 1.8 | 3.0 | 3.6 | V  |
| 3 | Maximum ambient operating temperature (BT680F) | -40 | 25  | 85  | °C |
| 4 | Maximum ambient operating temperature (BT680T) | -40 | 25  | 125 | °C |

## Current Consumption

| Parameters                 | Condition                                             | Min | Typ  | Max | mA |
|----------------------------|-------------------------------------------------------|-----|------|-----|----|
| Digital operation          |                                                       |     | 0.8  |     | mA |
| Flash read                 |                                                       |     | 2.4  |     | mA |
| Flash write                |                                                       |     | 15.6 |     | mA |
| Receiving data             | 1 Mbps                                                |     | 5.1  |     | mA |
| Receiving data             | 2 Mbps                                                |     | 5.5  |     | mA |
| Transmitting data          | Output power = 0 dBm, 1 Mbps                          |     | 6.0  |     | mA |
| Transmitting data          | Output power = 0 dBm, 2 Mbps                          |     | 6.5  |     | mA |
| Transmitting data          | Output power = 0 dBm, 1 Mbps                          |     | 11.0 |     | mA |
| Transmitting data          | Output power = +8 dBm, 2 Mbps                         |     | 11.5 |     | mA |
| Low power, with connection | 32 MHz disabled, 32.768KHz enabled (sleep mode)       |     | 2.5  |     | uA |
| Low power, no connection   | 32 MHz disabled, 32.768KHz enabled (back up mode)     |     | 2.4  |     | uA |
| Low power, no connection   | 32 MHz disabled, 32.768KHz disabled (deep sleep mode) |     | 0.05 |     | uA |

# BlueFan BT680F/E/T BLE 5 Module

## 6. System Operation

Two operation options on starting up.

- Control module by an external MCU, or HCI (Host Control Interface) mode.
- Control module by user application program in module, or standalone mode.

### Setting Operation Mode

| Operation Mode | GPIO 1 | SWDIO | Purpose                                         |
|----------------|--------|-------|-------------------------------------------------|
| User-App mode  | H      | —     | Execute user program, including AT command mode |
| HCI Mode       | L      | H     | Control module by a host MCU                    |
| Test Mode      | L      | L     | Inhibit                                         |

### Standalone Mode

When user-app mode or standalone mode is selected, user program in internal flash is loaded to internal RAM during boot-up sequence. Then, the applications are executed. To build a standalone system, both the wireless protocol and the user application can be handled by the embedded Cortex M0. The masked-ROM has Bluetooth low energy protocol stack and API for hardware control. They can be used by the user program.

Application programs are developed and compiled in a Windows PC and downloaded into flash ROM of module.

### HCI Mode

On HCI mode, module receives control commands from the host MCU by the UART interface. Default baud rate of UART is 115200. Program codes are stored in masked-ROM. No firmware development or programming of flash memory is required for BT680F operating in HCI mode.

HCI command evaluation software are available for Windows PC and MAC. Sample scripts for setting up communication to an iOS or Android device is available. HCI command control flow can be developed on Windows PC or MAC before porting onto the target MCU.

# BlueFan BT680F/E/T BLE 5 Module

## 7. Module Evaluation Board

A development/evaluation board is available for each module. A quick and easy way to evaluate a module, e.g., BT680F is to use a Windows PC or a MAC as the host processor. Connect the evaluation board to a PC or a MAC with an USB cable.

### Evaluation Software for Windows PC

Evaluation software for Windows PC can be download from the following link.

<https://dl.dropboxusercontent.com/u/54939426/BlueFanHClwin.rar>

After unzipping, it becomes an executable file. You need to OPEN from a MENU for the first time. Then, you can double click the icon to open.

### Evaluation Software for MAC

Evaluation software for MAC can be download from the following link.

<https://dl.dropboxusercontent.com/u/54939426/BlueFanHClmac.zip>

After unzipping, it becomes an executable file. You need to OPEN from a MENU for the first time. Then, you can double click the icon to open

### Android OS App

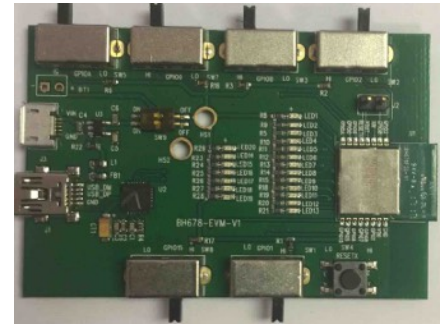
Android OS apps to evaluate communication via SPP and BLE can be downloaded from Google Play Store by searching for [BlueFan](#). This is a basic app for proving communication between a PC/MAC, a BlueFan module, and an Android device.

Source codes for this Android app is available for user of BlueFan evaluation board. Please contact Fanstel.

### iOS App

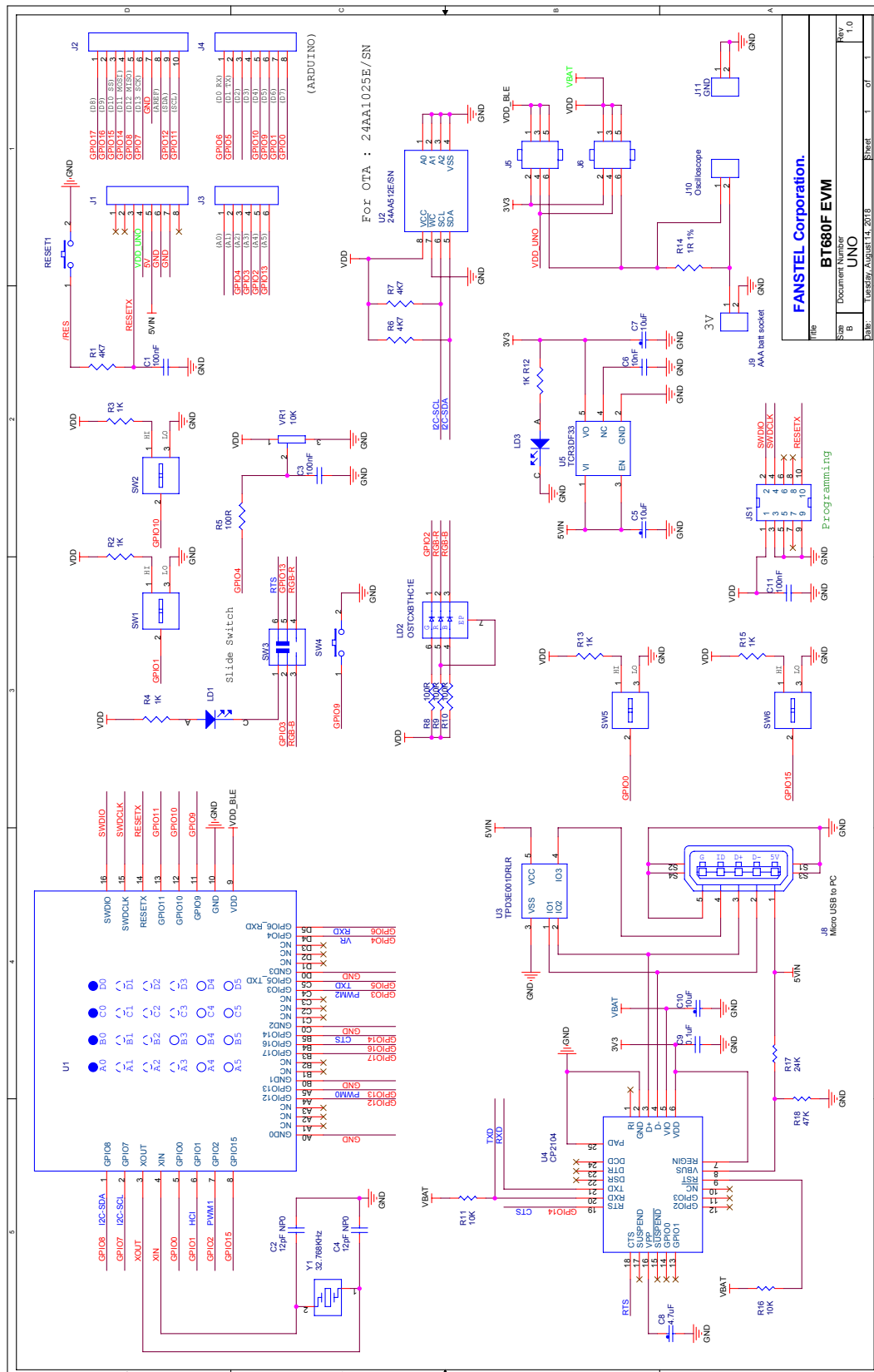
iOS apps to evaluate communication via BLE can be downloaded from Apple App Store by searching for [BlueFan](#). This is a basic app for proving communication between a PC/MAC, a BlueFan module, and an Android device.

Source codes for this iOS app is available for user of BlueFan evaluation board. Please contact Fanstel.



# BlueFan BT680F/E/T BLE 5 Module Evaluation Board Schematics

Version 1.00, June 2019



# BlueFan BT680F/E/T BLE 5 Module

## Battery Powered Products

Current consumption is important for battery-powered product. If a 32.768 kHz crystal is installed, main clock can be disabled in sleep mode to reduce power consumption. If you need to reduce sleep mode power consumption, add a crystal and two capacitors to the SLPXOIN and SLPXOOUT pins.

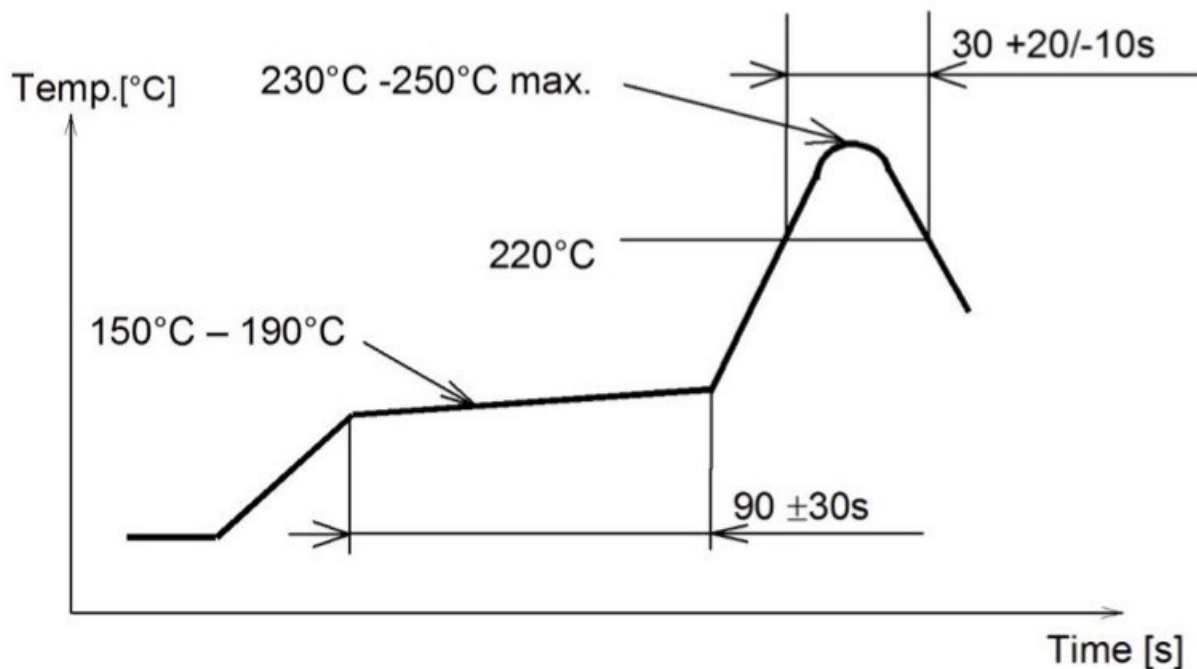
## 8. FCC

(1) the module should not installed and operated simultaneously with other radios except additional RF exposure was evaluated and meeting FCC requirement for simultaneously transmission.

(2) Antenna used should be limited to (Dipole) type with equal or lesser antenna gain.

## 9. Soldering Temperature-Time Profile for Re-Flow Soldering

Maximum number of cycles for re-flow is 2. No opposite side re-flow is allowed due to module weight.



## 10. Cautions and Packaging

### Cautions

Failure to follow the guidelines set forth in this document may result in degrading of the product's functions and damage to the product.

### Design Notes

- (1) Follow the conditions written in this specification, especially the control signals of this module.
- (2) The supply voltage has to be free of AC ripple voltage (for example from a battery or a low noise regulator output). For noisy supply voltages, provide a decoupling circuit (for example a ferrite in series connection and a bypass capacitor to ground of at least 47uF directly at the module).
- (3) This product should not be mechanically stressed when installed.

## BlueFan BT680F/E/T BLE 5 Module

- (4)Keep this product away from heat. Heat is the major cause of decreasing the life of these products.
- (5)Avoid assembly and use of the target equipment in conditions where the products' temperature may exceed the maximum tolerance.
- (6)The supply voltage should not be exceedingly high or reversed. It should not carry noise and/or spikes.
- (7)Keep this product away from other high frequency circuits.

### Notes on Antenna and PCB Layout

- (1)Don't use a module with internal antenna inside a metal case.
- (2)Use a module with external antenna inside a metal case. Antenna must be outside of a metal case.
- (3)For PCB layout:
  - Avoid running any signal line below module whenever possible,
  - No ground plane below antenna,
  - If possible, cut-off the portion of main board PCB below antenna.

### Installation Notes

- (1)Reflow soldering is possible twice based on the time-temperature profile in this data sheets. Set up the temperature at the soldering portion of this product according to this reflow profile.
- (2)Carefully position the products so that their heat will not burn into printed circuit boards or affect the other components that are susceptible to heat.
- (3)Carefully locate these products so that their temperatures will not increase due to the effects of heat generated by neighboring components.
- (4)If a vinyl-covered wire comes into contact with the products, then the cover will melt and generate toxic gas, damaging the insulation. Never allow contact between the cover and these products to occur.
- (5)This product should not be mechanically stressed or vibrated when reflowed.
- (6)If you want to repair your board by hand soldering, please keep the conditions of this chapter.
- (7)Do not wash this product.
- (8)Refer to the recommended pattern when designing a board.
- (9)Pressing on parts of the metal cover or fastening objects to the metal will cause damage to the unit.
- (10)For more details on LGA (Land Grid Array) soldering processes refer to the application note.

### Usage Condition Notes

- (1)Take measures to protect the unit against static electricity. If pulses or other transient loads (a large load applied in a short time) are applied to the products, check and evaluate their operation before assembly on the final products.

## BlueFan BT680F/E/T BLE 5 Module

- (2) Do not use dropped products.
- (3) Do not touch, damage or soil the pins.
- (4) Follow the recommended condition ratings about the power supply applied to this product.
- (5) Electrode peeling strength: Do not add pressure of more than 4.9N when soldered on PCB
- (6) Pressing on parts of the metal cover or fastening objects to the metal cover will cause damage.
- (7) These products are intended for general purpose and standard use in general electronic equipment, such as home appliances, office equipment, information and communication equipment.

### Storage Notes

- (1) The module should not be stressed mechanically during storage.
- (2) Do not store these products in the following conditions or the performance characteristics of the product, such as RF performance will be adversely affected:
  - Storage in salty air or in an environment with a high concentration of corrosive gas.
  - Storage in direct sunlight
  - Storage in an environment where the temperature may be outside the range specified.
  - Storage of the products for more than one year after the date of delivery storage period.
- (3) Keep this product away from water, poisonous gas and corrosive gas.
- (4) This product should not be stressed or shocked when transported.
- (5) Follow the specification when stacking packed crates (max. 10).

### Safety Conditions

These specifications are intended to preserve the quality assurance of products and individual components. Before use, check and evaluate the operation when mounted on your products. Abide by these specifications, without deviation when using the products. These products may short-circuit. If electrical shocks, smoke, fire, and/or accidents involving human life are anticipated when a short circuit occurs, then provide the following failsafe functions, as a minimum.

- (1) Ensure the safety of the whole system by installing a protection circuit and a protection device.
- (2) Ensure the safety of the whole system by installing a redundant circuit or another system to prevent a dual fault causing an unsafe status.

### Other Cautions

- (1) This specification sheet is copyrighted. Reproduction of this data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices.
- (2) Do not use the products for other purposes than those listed.

## BlueFan BT680F/E/T BLE 5 Module

- (3) Be sure to provide an appropriate failsafe function on your product to prevent an additional damage that may be caused by the abnormal function or the failure of the product.
- (4) This product has been manufactured without any ozone chemical controlled under the Montreal Protocol.
- (5) These products are not intended for other uses, other than under the special conditions shown below. Before using these products under such special conditions, check their performance and reliability under the said special conditions carefully to determine whether or not they can be used in such a manner.
- In liquid, such as water, salt water, oil, alkali, or organic solvent, or in places where liquid may splash.
  - In direct sunlight, outdoors, or in a dusty environment
  - In an environment where condensation occurs.
  - In an environment with a high concentration of harmful gas.
- (6) If an abnormal voltage is applied due to a problem occurring in other components or circuits, replace these products with new products because they may not be able to provide normal performance even if their electronic characteristics and appearances appear satisfactory.
- (7) When you have any question or uncertainty, contact Fanstel.

### Packaging

Production modules are delivered in reel, 1000 modules in each reel.

# BlueFan BT680F/E/T BLE 5 Module

## Revision History

- June 2019, Ver. 1.00: Initial release



Version 1.00, June 2019

# BlueFan BT680F/E/T BLE 5 Module

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