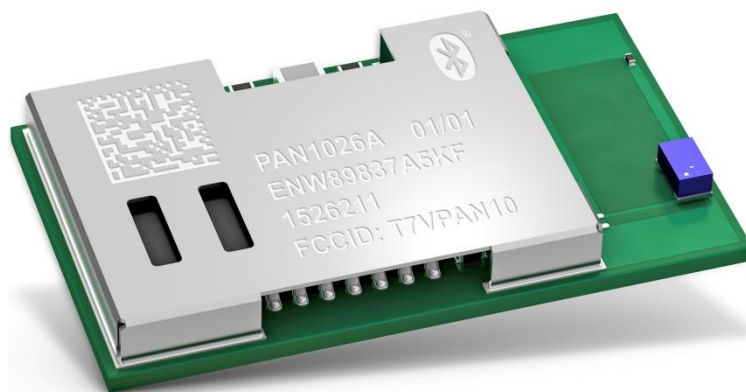


# PAN1026A

## Basic Data Rate and Low Energy Module Design Guide

Rev. 1.0



## Overview

The PAN1026A is a Class 2 Bluetooth 4.2 Basic Data Rate and Low Energy module for easy implementation of Bluetooth functionality into various electronic devices.

## Features

- Bluetooth 4.2 Basic Data Rate (BR) and Low Energy (LE)
- Embedded SPP profile
- Embedded GATT profile
- High-level API commands
- Bluetooth 4.2 (LE) embedded GATT profile with high level API commands, compatible with Toshiba reference BLE profiles
- Operational temperature range -40 to +85 °C
- Operational voltage 2.7 V to 3.6 V +/-10 %
- Power consumption Tx: 46 mA
- Dimensions 15.6 mm x 8.7 mm x 1.9 mm
- Output power 4 dBm
- -88 dBm sensitivity
- Integrated high speed crystal oscillator (26 MHz)

## New Features

- Increased (2.5 x) BLE data transfer rates through extended MTU size (64 bytes to 160 bytes)
- More complex BLE profiles possible through extended GATT functionality
- Data base pool, number of services and characteristics, data flow control
- Fast SPP classic connection/disconnection times
- Interlaced inquiry/page scan and extended inquiry response
- Transmission (Tx) power control
- Improved PER (peak-error-rate) for BLE traffic
- Integration of BT 4.2 secure connecting feature implementing ECDH technology

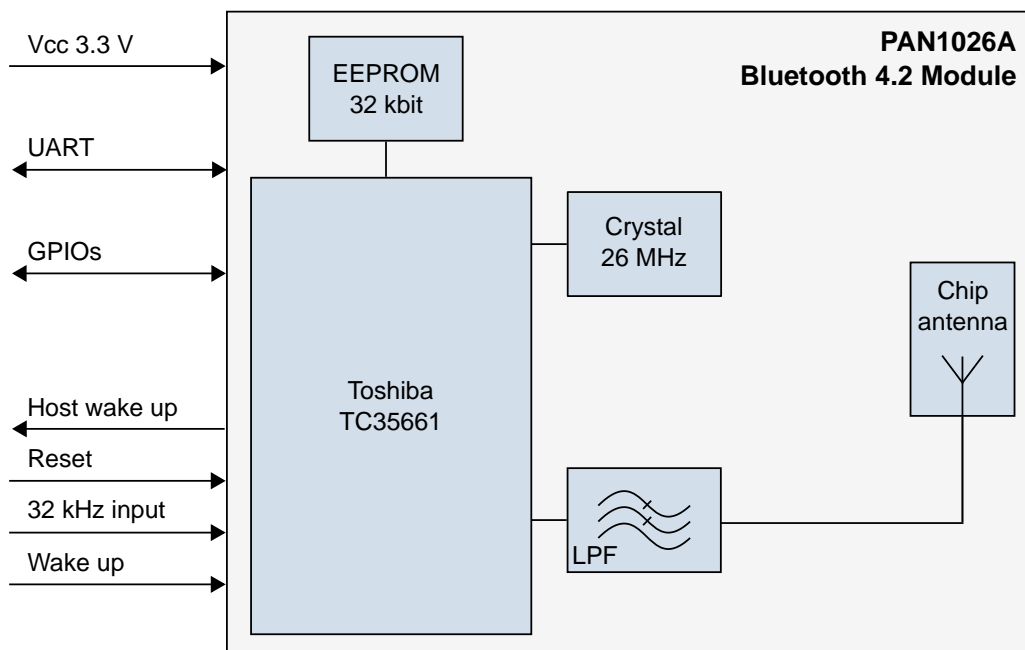
## Bluetooth

- GAP support for SPP
- GAP peripheral and broadcast support for LE
- GATT server and client mode support for LE
- GAP central and observer not supported for LE

## Interfaces

- UART, GPIO (10 input/output pins), wake-up control pins

## Block Diagram



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# 1 About This Document

## 1.1 Purpose and Audience

This Design Guide applies to the Bluetooth development platform PAN1026A USB.

The intention is to enable our customers to easily and fast integrate our module PAN1026A in their product.




This Design Guide describes the hardware and gives useful hints.

It is intended for hardware and software engineers. The product is referred to as “the PAN1026A” or “the module” within this document.

## 1.2 Revision History

Revision	Date	Modifications/Remarks
1.0	2018-09-28	Update layout and structure changes

## 1.3 Use of Symbols

Symbol	Description
	<p><b>Note</b></p> <p>Indicates important information for the proper use of the product. Non-observance can lead to errors.</p>
	<p><b>Attention</b></p> <p>Indicates important notes that, if not observed, can put the product's functionality at risk.</p>
	<p><b>Tip</b></p> <p>Indicates useful information designed to facilitate working with the module.</p>
⇒ [chapter number] [chapter title]	<p><b>Cross reference</b></p> <p>Indicates cross references within the document.</p> <p><b>Example:</b> Description of the symbols used in this document ⇒ <a href="#">1.3 Use of Symbols</a>.</p>
✓	<p><b>Requirement</b></p> <p>Indicates a requirement that must be met before the corresponding tasks can be completed.</p>
→	<p><b>Result</b></p> <p>Indicates the result of a task or the result of a series of tasks.</p>
<b>This font</b>	<p><b>GUI text</b></p> <p>Indicates fixed terms and text of the graphical user interface.</p> <p><b>Example:</b> Click <b>Save</b>.</p>

Symbol	Description
<b>Menu &gt; Menu item</b>	<b>Path</b> Indicates a path, e.g. to access a dialog. <b>Example:</b> In the menu, select <b>File &gt; Setup page</b> .
This font	<b>File names, messages, user input</b> Indicates file names or messages and information displayed on the screen or to be selected or entered by the user. <b>Examples:</b> pan1760.c contains the actual module initialization. The message Failed to save your data is displayed. Enter the value Product 123.
[ Key ]	<b>Key</b> Indicates a key on the keyboard, e.g. [ F10 ].

## 1.4 Related Documents

Please refer to the Panasonic website for related documents ⇒ [6.2.2 Product Information](#).

## 2 Overview

The PAN1026A is based on Toshiba's single-chip TC35661 Bluetooth semiconductor device with an embedded Toshiba Bluetooth SIG certified stack. The PAN1026A is a highly-integrated Dual Mode Bluetooth controller that delivers high-speed operation at ultra-low power consumption. An embedded SPP (Serial Port Profile of Bluetooth Classic) and a GATT (Generic Attribute Profile of Bluetooth LE) stack are integrated. The module significantly reduces external component count and power consumption in applications requiring support of Bluetooth 4.2 standards. EDR (Enhanced Data Rate) and Central mode are not supported. Details about iAP integration can be provided on request. The integrated EEPROM has a Panasonic MAC address and it can be used to store link keys.

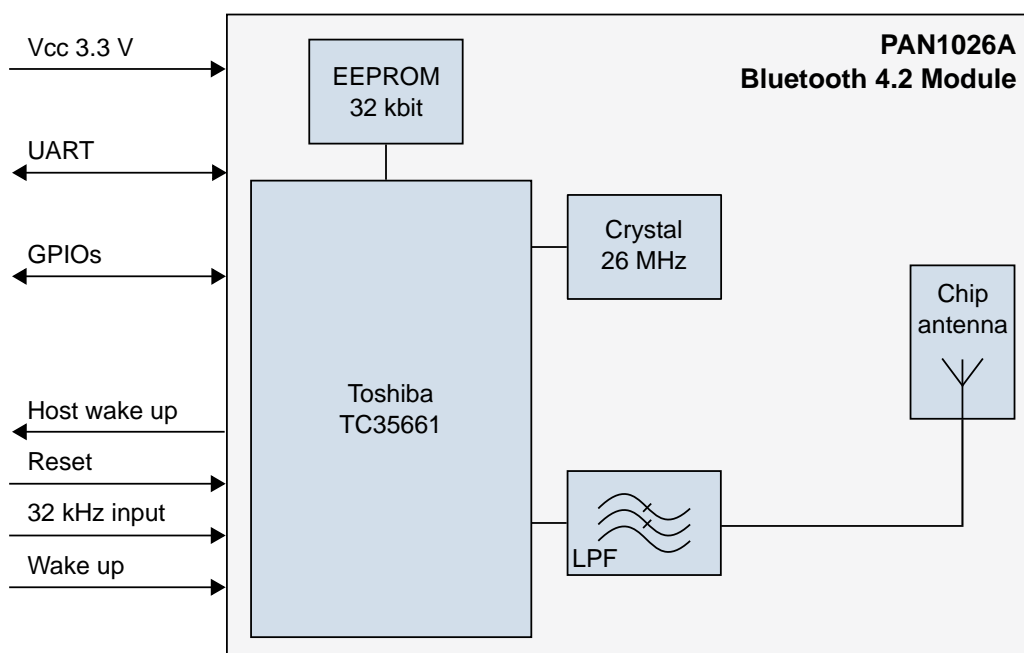
The module allows for serving both legacy Bluetooth Classic and Bluetooth Low Energy connections with rapid connection and disconnection, needed by a wide range of applications, all at a small form factor. Compared to the PAN1026, the PAN1026A has additional features for secure connections via Bluetooth LE, and it is fully backwards compatible. Next to increased low energy transfer speed, transmission power can also be controlled.

The PAN1026A module is manufactured in a small 15.6 mm x 8.7 mm x 1.9 mm SMD package with a shielded case and it is qualified according to the Bluetooth 2.1 and Bluetooth 4.2 standards.

Please refer to the Panasonic website for related documents ⇒ [6.2.2 Product Information](#).

Further information on the variants and versions ⇒ [6.1 Ordering Information](#).

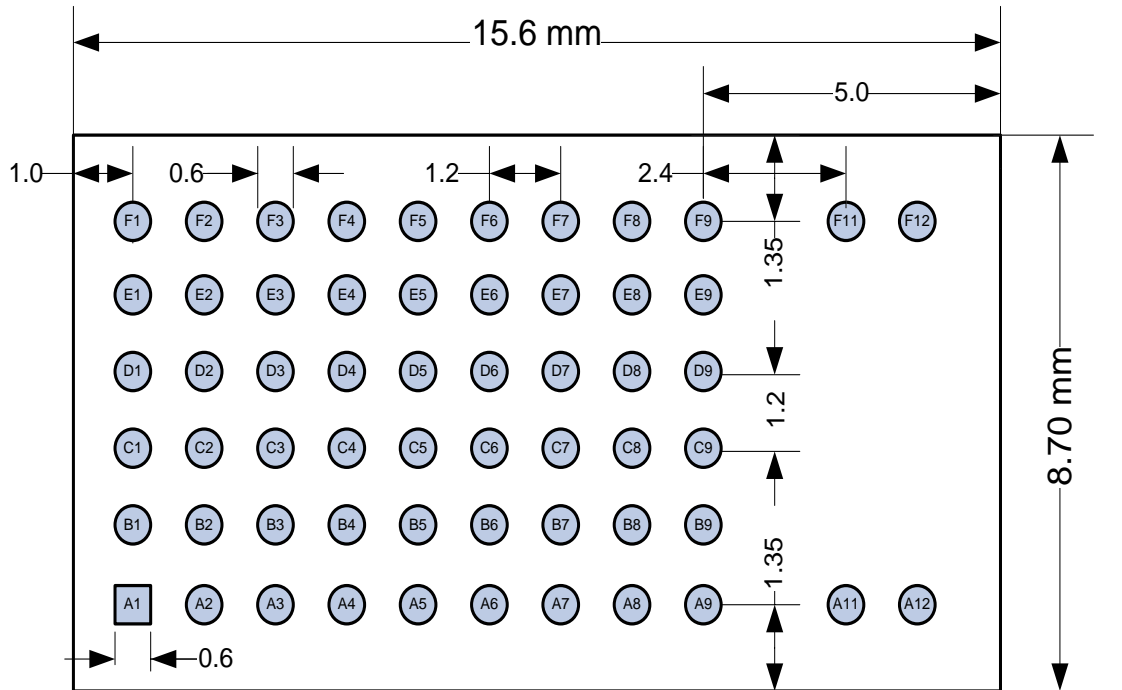
### 2.1 Block Diagram



## 2.2 Pin Configuration

### Pin Assignment

Top View



### Pin Functions

No	Pin Name	Pin Type	Description
A1	GND	Ground Pin	Connect to ground
A2	NC	NC	Not connected, leave open
A3	Reset	Digital Input	Reset, active low
A4	VCC	Power	analog/digital power supply connection
A5	VCC	Power	analog/digital power supply connection
A6	VCC	Power	analog/digital power supply connection
A7	GND	Ground Pin	Connect to ground
A8	NC	NC	Not connected
A9	GND	Ground Pin	Connect to ground
A11	GND	Ground Pin	Connect to ground
A12	GND	Ground Pin	Connect to ground
B1	NC	NC	Not connected, leave open



No	Pin Name	Pin Type	Description
B2	GPIO 11	Digital I/O	
B3	GPIO 10	Digital I/O	
B4	NC	NC	Not connected, leave open
B5	NC	NC	Not connected, leave open
B6	NC	NC	Not connected, leave open
B7	NC	NC	Not connected, leave open
B8	NC	NC	Not connected, leave open
B9	NC	NC	Not connected, leave open
C1	GPIO 17	Digital I/O	
C2	GPIO 13	Digital I/O	
C3	GPIO 12	Digital I/O	
C4	NC	NC	Not connected, leave open
C5	NC	NC	Not connected, leave open
C6	GPIO 04	Digital I/O	Commonly used for sleep mode <i>Host wake up</i> signal from host
C7	GPIO 05	Digital I/O	
C8	GND	Ground Pin	Connect to ground
C9	GND	Ground Pin	Connect to ground
D1	GPIO 18	Digital I/O	
D2	GPIO 16	Digital I/O	
D3	GPIO 01	Digital I/O	Commonly used for sleep mode <i>Status</i> signal to host
D4	GPIO 00	Digital I/O	Commonly used for sleep mode <i>Request wake up</i> signal to host
D5	NC	NC	Not connected, leave open
D6	GPIO 03	Digital I/O	
D7	GND	Ground Pin	Connect to ground
D8	GND	Ground Pin	Connect to ground
D9	ANT	RF-Signal	Antenna pin (not connected for standard version)
E1	SDA	Digital I/O	Internal I <sup>2</sup> C interface, connect to test pin
E2	SCL	Digital I/O	Internal I <sup>2</sup> C interface, connect to test pin
E3	GND	Ground Pin	Connect to ground
E4	NC	NC	Not connected, leave open
E5	CLKREQ	Digital Output	Active high once crystal frequency is stable
E6	UART RXD	Digital Input	UART RXD
E7	GPIO 02	Digital I/O	

No	Pin Name	Pin Type	Description
E8	GND	Ground Pin	Connect to ground
E9	GND	Ground Pin	Connect to ground
F1	GND	Ground Pin	Connect to ground
F2	EEPROM_WP	Digital Input	Internal EEPROM Write Protect (active high)
F3	GND	Ground Pin	Connect to ground
F4	GND	Ground Pin	Connect to ground
F5	UART CTS	Digital Input	UART CTS
F6	SLEEPCLK	Digital Input	Input clock for 32.768 KHz
F7	UARTTXD	Digital Output	UART TX
F8	UARTRTS	Digital Output	UART RTS
F9	GND	Ground Pin	Connect to ground
F11	GND	Ground Pin	Connect to ground
F12	GND	Ground Pin	Connect to ground

## 2.3 UART Interface

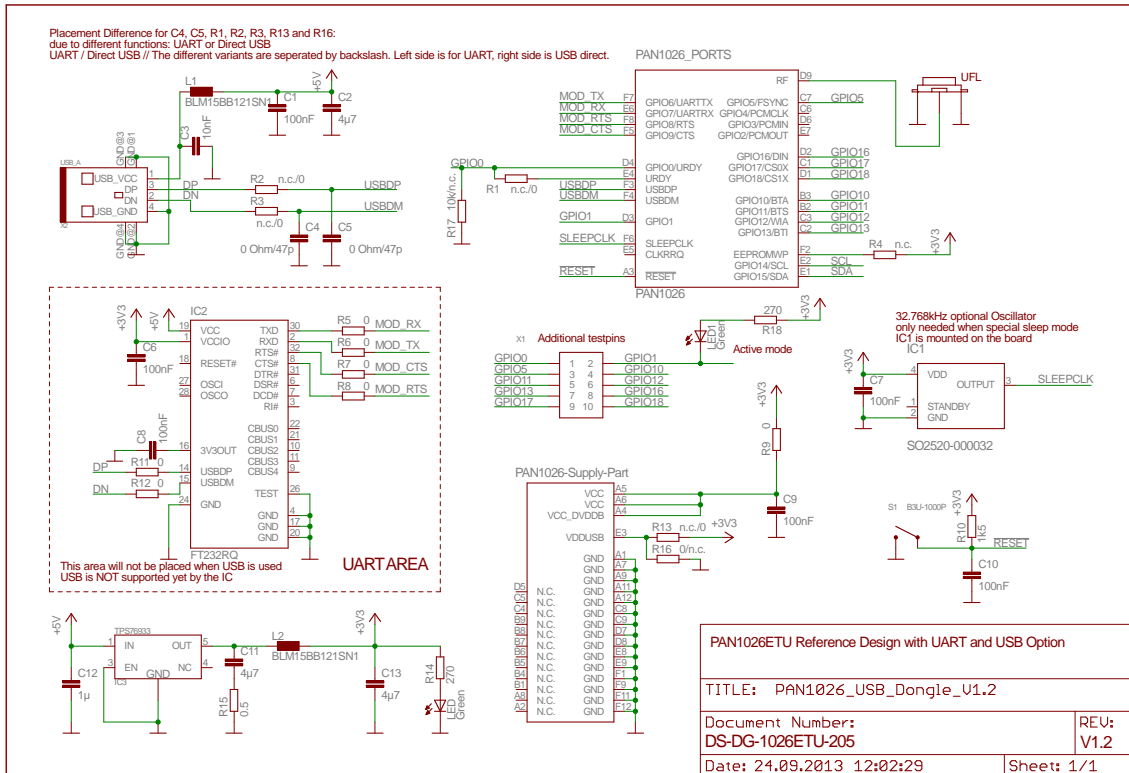
- Full-duplex 4-wire data transfer: RX, TX, RTS, CTS
- Programmable baud rate: 2 400 bps to 4.33 Mbps
- Default baud rate: 115 200 bps
- Data format: 8N1, LSB first
- Error detection: Character timeout, Overrun error, Framing error

## 2.4 Bluetooth Features

- Bluetooth 4.2 with SPP and GATT
- GAP support for SPP
- GATT server and client mode supported for LE
- Class 2 TX power w/o external PA (improved link robustness)
- Excellent link budget (up to 91 dB), enabling long-range applications
- GAP peripheral support for LE

### 3 Reference Design

#### 3.1 USB Evaluation Kit Schematic



#### 3.2 Placement Recommendations



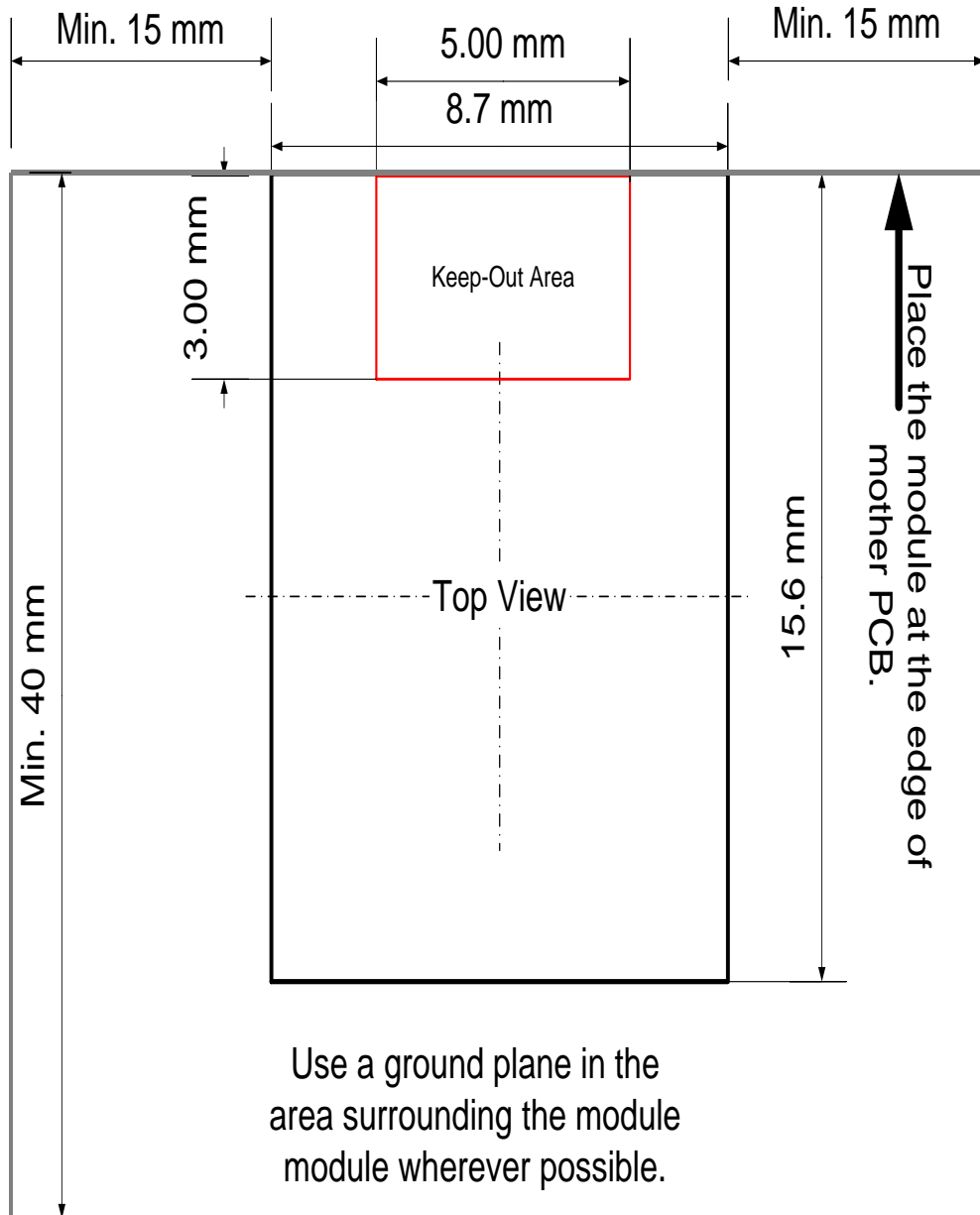
##### Antenna Keep-Out Area

Do not place any ground plane under the red marked restricted antenna area in any layer! This would be affecting the performance of the chip antenna in a critical manner.

The following conditions must be met:

- ✓ Keep this product away from heat. Heat is the major cause of decreasing the life of these products.
- ✓ Keep this product away from other high frequency circuits.

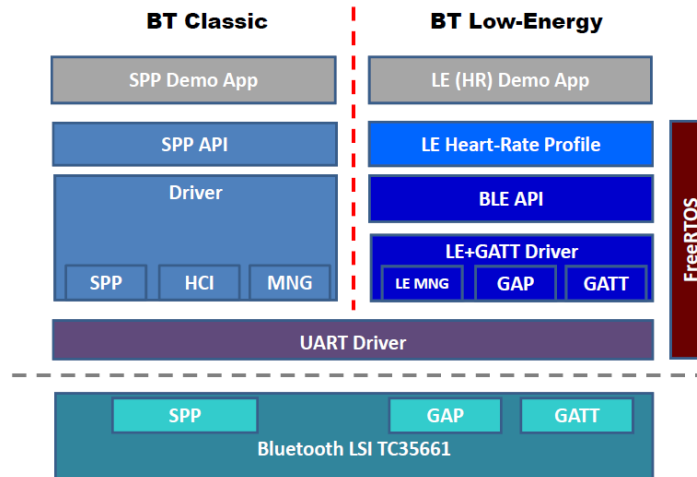
← If possible place the module in the center of mother PCB. →



Dimensions are in mm.

## 4 Software Related Documents Summary

### 4.1 Predefined High Level APIs



Make use of the easy-to-use High-Level SPP and Bluetooth Low Energy API for PAN1026A setup, connect and data transfer in an easy way. Driver layer provide access to the entire function set of the module. SPP and Bluetooth Low Energy application example is available on Toshiba CortexM3 MCU with FreeRTOS integration.

High Level SPP APIs are sufficient for communication with a remote SPP device.

With the LE+GATT Driver the use of PAN1026A Command Interface is simplified. It encapsulates Chiron LE MNG, GAP and GATT Commands in one.

	High Level SPP APIs	High Level BLE APIs
<b>Documentation</b>	<ul style="list-style-type: none"> <li>SPP API Specification</li> <li>SPP Driver Specification</li> <li>SPP Application Note</li> </ul>	<ul style="list-style-type: none"> <li>BLE API Specification</li> <li>LE+GATT Driver Specification</li> <li>LE Heart-Rate Profile Application Note</li> </ul>
<b>Software</b>	<ul style="list-style-type: none"> <li>SPP Application example source code</li> <li>SPP API as source code</li> <li>SPP drivers as source code</li> <li>Project files for Toshiba</li> <li>TMPM395 MCU</li> </ul>	<ul style="list-style-type: none"> <li>LE Application example source code</li> <li>LE Heart-Rate Profile example source code</li> <li>BLE API source code</li> <li>LE+GATT driver source code</li> <li>Project files for Toshiba TMPM369 MCU</li> </ul>

## 4.2 Unique Mac/Bluetooth Address

The PAN1026A has a preprogrammed address in the EEPROM that needs to be copied into the RAM during the initialization. Therefore three TCU commands need to be used. Below is an example with the individual address `00 13 43 00 00 1A`

1. Enter the address:

```
01 08 FC 0B 00 A0 00 00 00 14 5B FF 02 03 01
```

→ The result is:

```
04 FF 0A 08 00 A0 00 00 00 14 5B 00 00
```

2. Read BT address from E2PROM:

```
01 08 FC 10 00 A1 00 00 00 14 88 FF 10 06 A0 01 01 06 02 00
```

→ The result is:

```
04 FF 11 08 00 A1 00 00 00 14 88 00 10 06 00 13 43 00 00 1A
```

3. Set BD address into RAM:

```
01 13 10 06 1A 00 00 43 13 00
```

→ The result is:

```
04 0E 04 04 13 10 00
```




The "red" BT address is original and needs to be byte switched to write into the RAM of the module to be visible in an BT inquiry as example.

## 5 USB Evaluation Kit

PAN1026A USB (easy-to-use) is a development platform for PAN1026A BLE dual module to implement Bluetooth functionality into various electronic devices.

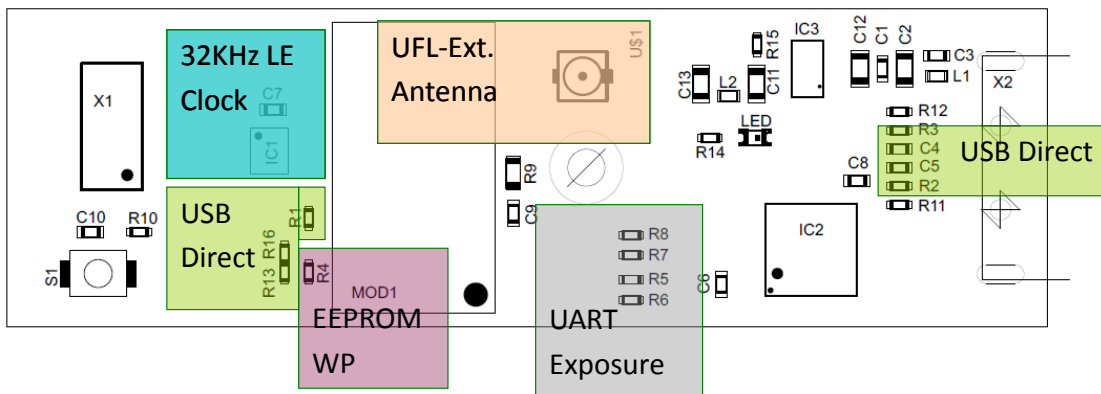
The PAN1026A USB is intended for evaluation purpose and can be used together with EasySPP and EasyBLE Software.

The API, a very useful abstracted tool is described on the Toshiba website.




For further details on additional options and services please refer to  
 ⇒ [6.2.1 Contact Us](#).

### 5.1 Overview for the USB Evaluation Board Options



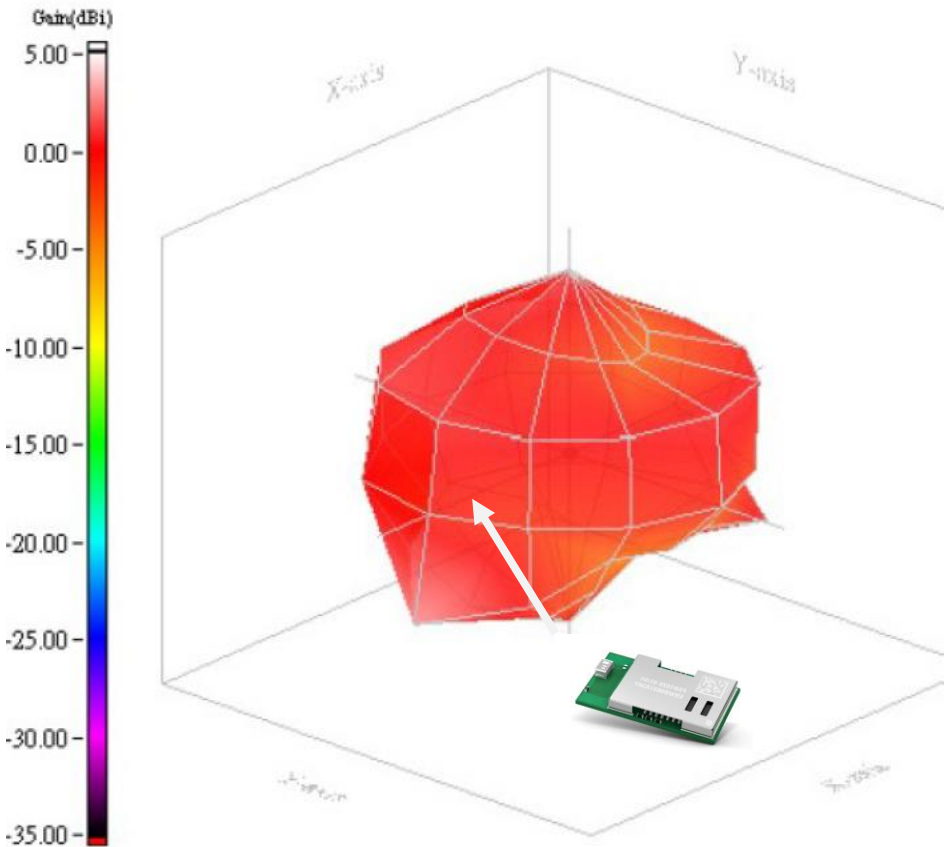
#### Options

1. UFL-External Antenna
2. USB Direct
3. Low Power Clock
4. EPROM Write Protect
5. UART Exposure



UFL-external antenna connector can be used if the cap next to the modules shield is moved (de-soldered, soldered) to the other (free) pin.

### 5.2 Radiation Pattern





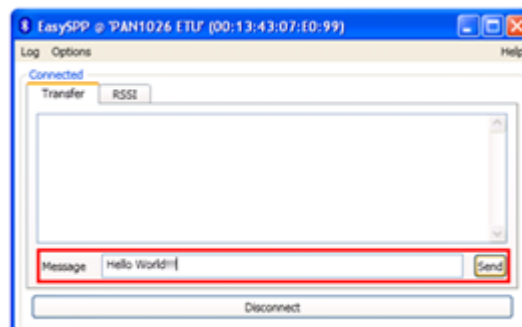
## 5.3 Recommended Tools

### EasySPP

The following requirements must be met:

- ✓ Microsoft .NET framework (version 4) which can be downloaded from the Microsoft website

Easy SPP is the first step to get familiar with the TCU commands. The issued commands can be copied and then ported to any microcontroller. HyperTerminal is not recommended to use because the commands are in binary format.



### Easy BLE

This tool has the same intention as the EasySPP and shows some example BLE profiles e. g. heart rate sensor. It can be used together with various of the shelf apps running on iPhone and Android phones supporting Bluetooth 4.0. One example is “Wahoo Utility” which is available in the Apples iTunes App Store.

Easy BLE documentation includes an application example how to connect PAN1026A USB stick and an iOS device.

## 5.4 Development of Applications

Please contact your local sales office for customized development of your individual application  
⇒ [6.2.1 Contact Us](#).



Please note that the individual MAC address is stored in the EEPROM and has to be loaded into the RAM after each start-up.

The following tools are recommended: IAR, J-Link debugger.

The BMSKTOPASM369BT(kc) Starter Kit makes it possible to quickly and easily evaluate Toshiba's Bluetooth® Dual Mode LSI TC35661-5xx in combination with Toshiba CortexM3 MCU as host MCU. It is made to execute the Toshiba Bluetooth Driver software and debug user application code via an embedded J-Link debugger interface. The TMPM369DFG Microcontroller offers embedded Ethernet, CAN, USB host, USB device and RS-232 connectivity.

### **Starter Kit Content:**

- Toshiba TOPAS369BT Board
- Segger J-Link JTAG/SWD Emulator with USB interface
- J-Link 19-pin Cortex-M Adapter
- USB Cable
- Rapid Start-Up Guide

## 6 Appendix

### 6.1 Ordering Information

#### Variants and Versions

Order Number	Brand Name	Description	MOQ <sup>1</sup>
ENW89837AYKF <sup>2</sup>	PAN1026-ETU	PAN1026ETU Development Kit (includes 2 USB sticks)	1
ENW89837A5KF <sup>2</sup>	PAN1026A	Bluetooth BT4.2 Basic Data Rate and Low Energy module	1 500

---

<sup>1</sup> Abbreviation for Minimum Order Quantity (MOQ). The default MOQ for mass production is 1 500 pieces, fewer only on customer demand. Samples for evaluation can be delivered at any quantity via the distribution channels.

<sup>2</sup> Samples are available on customer demand.

## 6.2 Contact Details

### 6.2.1 Contact Us

Please contact your local Panasonic Sales office for details on additional product options and services:

For Panasonic Sales assistance in the **EU**, visit

<https://eu.industrial.panasonic.com/about-us/contact-us>

Email: [wireless@eu.panasonic.com](mailto:wireless@eu.panasonic.com)

For Panasonic Sales assistance in **North America**, visit the Panasonic “Sales & Support” website to find assistance near you at

<https://na.industrial.panasonic.com/distributors>

Please visit the **Panasonic Wireless Technical Forum** to submit a question at

<https://forum.na.industrial.panasonic.com>

### 6.2.2 Product Information

Please refer to the Panasonic Wireless Connectivity website for further information on our products and related documents:

For complete Panasonic product details in the **EU**, visit

<http://pideu.panasonic.de/products/wireless-modules.html>

For complete Panasonic product details in **North America**, visit

<http://www.panasonic.com/rfmodules>