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# PAN1760A

## Bluetooth Low Energy Module Product Specification

Rev. 1.3



## Overview

The PAN1760A is Panasonic's next generation Bluetooth module with the industry's lowest power Bluetooth Low Energy SoC.

## Features

- Small 15.6 mm x 8.7 mm x 1.9 mm SMD module
- Same form factor and pinout as PAN1026, PAN1760, and PAN1761
- Bluetooth Low Energy 4.2 compliant
- Embedded 256 kB flash memory and 192 kB internal RAM
- 83 kB RAM available for user application
- AT Command mode, Host mode, Stand-Alone mode
- Standard SIG BLE profiles as well as SPPoverBLE profile
- UART (2x), SPI & I2C interface, PWM output (4x), ADC (5 ext, 1 int), 17 programmable I/O
- ARM Cortex-M0 processor with Single Wire Debug (SWD) interface

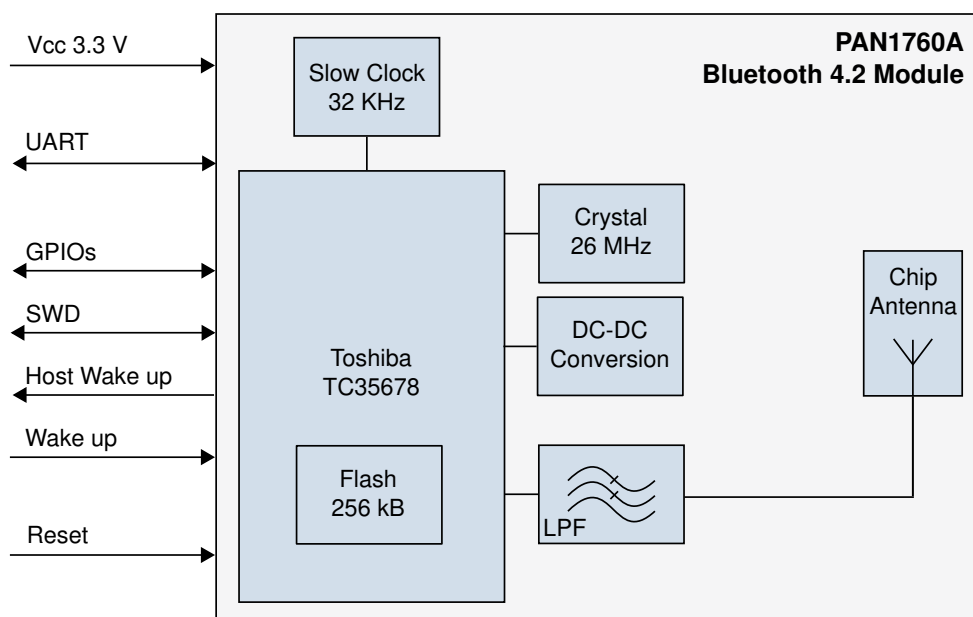
## Bluetooth

- GAP central and peripheral support for LE
- GATT, SMP, and SDB support for LE
- Over-the-Air firmware update
- Support for Scatternet/Mesh network
- BT 4.2 secure connections support through Elliptic-Curve-DH Cryptography
- AES-128 hardware encryption (FIPS-approved)
- Frequent changing of device address (improved privacy, reduced tracking ability)
- Larger packet sizes (more efficient application and network layer security)

## Characteristics

- Receiver sensitivity -93 dBm typ.
- Output power 0 dBm maximum setting
- Power supply 1.8 V to 3.6 V single operation voltage
- Transmit and receive 3.3 mA Tx/Rx peak power consumption
- Low Power 50 nA Deep Sleep mode
- Operating temperature range -40 °C to +85 °C

## Block Diagram



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- Improper use of the Engineering Sample.

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# 1 About This Document



## 1.1 Purpose and Audience

This Product Specification provides details on the functional, operational, and electrical characteristics of the Panasonic PAN1760A module. It is intended for hardware design, application, and Original Equipment Manufacturers (OEM) engineers. The product is referred to as “the PAN1760A” or “the module” within this document.

## 1.2 Revision History

Revision	Date	Modifications/Remarks
0.1	23.05.2017	1st preliminary version
0.2	12.06.2017	Editorial review
1.0	12.06.2017	First published version
1.1	03.11.2017	Added MIC ID for Japanese Radio Law Added Bluetooth ID for Bluetooth Certification
1.2	18.04.2018	Added chapter “Restricted End Use”
1.3	25.07.2018	Changed the default UART CTS and RTS Pads

## 1.3 Use of Symbols

Symbol	Description
	<b>Note</b> Indicates important information for the proper use of the product. Non-observance can lead to errors.
	<b>Attention</b> Indicates important notes that, if not observed, can put the product's functionality at risk.
⇒ [chapter number] [chapter title]	<b>Cross reference</b> Indicates crossreferences within the document. <b>Example:</b> Description of the symbols used in this document ⇒ <a href="#">1.3 Use of Symbols</a> .

## 1.4 Related Documents

Please refer to the Panasonic website for related documents ⇒ [7.2.2 Product Information](#).

## 2 Overview

The PAN1760A is Panasonic's next generation Bluetooth module with the industry's lowest power Bluetooth Low Energy SoC.

The module is based on Toshiba's single chip TC35678 Bluetooth semiconductor device with embedded Toshiba Bluetooth 4.2 LE stack and embedded flash for the user application in stand-alone operation. Peak power consumption of only 3.6 mA in Tx and Rx mode allows advanced wireless functionalities in IoT, medical, and industrial applications without compromising battery life. Mandatory and optional Bluetooth 4.2 features are supported.

The PAN1760A can either be operated in AT-Command or Host mode for very simple integration of Bluetooth connectivity into existing products, or in Stand-Alone mode.

In Stand-Alone mode, with 256 kB flash memory and 83 kB RAM for user application, the PAN1760A can be used for many applications without the need for an external processor, saving cost, complexity, and space.

Older versions of the PAN1760, the PAN1761, and the PAN1026 share the same footprint.

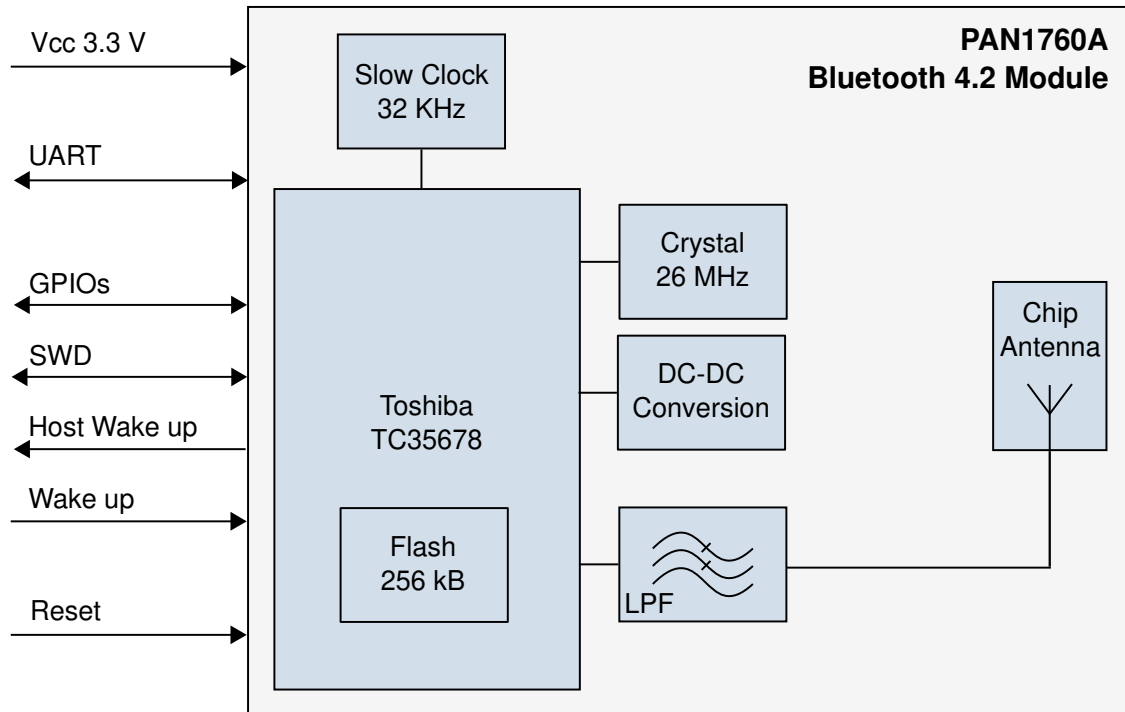
Only minor code changes are required when migrating from PAN1026 or PAN1760. Previously developed software (Bluetooth Low Energy profiles and applications) can be easily migrated with a minimal effort.

FCC, IC, and CE approval are in preparation.

Please refer to the Panasonic website for related documents ⇒ [7.2.2 Product Information](#).

Further information on the variants and versions ⇒ [7.1 Ordering Information](#).

## 2.1 Block Diagram



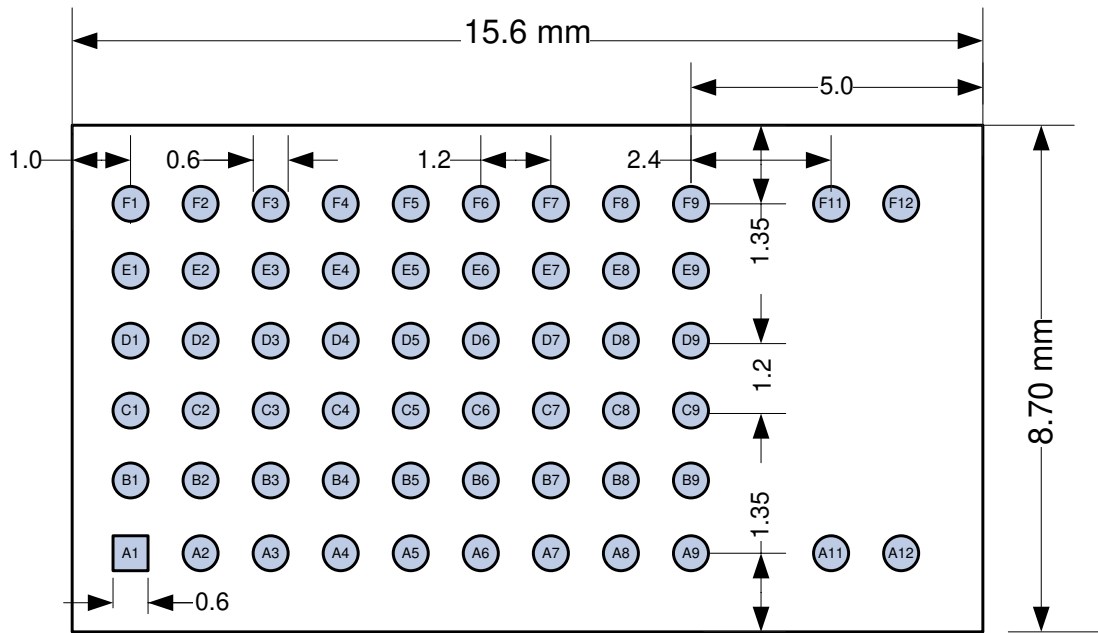
Total capacitor value: 2.4  $\mu$ F +/-10 %  
 Total inductance: 10  $\mu$ H +/-10 %  
 Total resistance: 100 K $\Omega$  +/-10 %



## 2.2 Pin Configuration

### Pin Assignment

Top View



### Pin Functions

No	Pin Name	Pin Type	Description
A1	GND	Ground Pin	Connect to ground
A2	GPIO3	Digital I/O	
A3	RESET	Digital Input	Reset, active low
A4	NC	NC	Not connected
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	GPIO9	Digital I/O	
B2	GPIO4	Digital I/O	

No	Pin Name	Pin Type	Description
B3	NC	NC	Not connected, leave open
B4	NC	NC	Not connected, leave open
B5	GPIO7/UART CTS	Digital I/O	UART CTS
B6	GPIO8/UART RTS	Digital I/O	UART RTS
B7	GPIO25	Digital I/O	
B8	NC	NC	Not connected, leave open
B9	NC	NC	Not connected, leave open
C1	NC	NC	Not connected, leave open
C2	NC	NC	Not connected, leave open
C3	GPIO10	Digital I/O	
C4	SWDIO	JTAG	
C5	SWDCLK	JTAG	
C6	GPIO1	Digital I/O	
C7	NC	NC	Not connected, leave open
C8	GND	Ground Pin	Connect to ground
C9	GND	Ground Pin	Connect to ground
D1	NC	NC	Not connected, leave open
D2	NC	NC	Not connected, leave open
D3	NC	NC	Not connected, leave open
D4	GPIO0/WakeUp0	Digital I/O	
D5	NC	NC	Not connected, leave open
D6	GPIO15/WakeUp1	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	GPIO12/SDA	Digital I/O	I2C interface
E2	GPIO11/SCL	Digital I/O	I2C interface
E3	NC	NC	Not connected, leave open
E4	NC	NC	Not connected, leave open
E5	SLPXOIN	Digital Input	32 kHz clock input, leave open
E6	GPIO6/UARTRXD	Digital Input	UART RXD

No	Pin Name	Pin Type	Description
E7	NC	NC	Not connected, leave open
E8	GND	Ground Pin	Connect to ground
E9	GND	Ground Pin	Connect to ground
F1	GND	Ground Pin	Connect to ground
F2	NC	NC	Not connected, leave open
F3	NC	NC	Not connected, leave open
F4	NC	NC	Not connected, leave open
F5	GPIO14	Digital Input	
F6	GPIO2	Digital I/O	
F7	GPIO5/UARTTXD	Digital Output	UART TX
F8	GPIO13	Digital Output	
F9	GND	Ground Pin	Connect to ground
F11	GND	Ground Pin	Connect to ground
F12	GND	Ground Pin	Connect to ground

### Minimal configuration

- VCC
- GND
- UART Rx, Tx, no flow control

## 2.3 UART Interface


- Default baud rate: 115 200 bps
- Data format: 8N1, LSB first
- Rx, Tx, no flow control

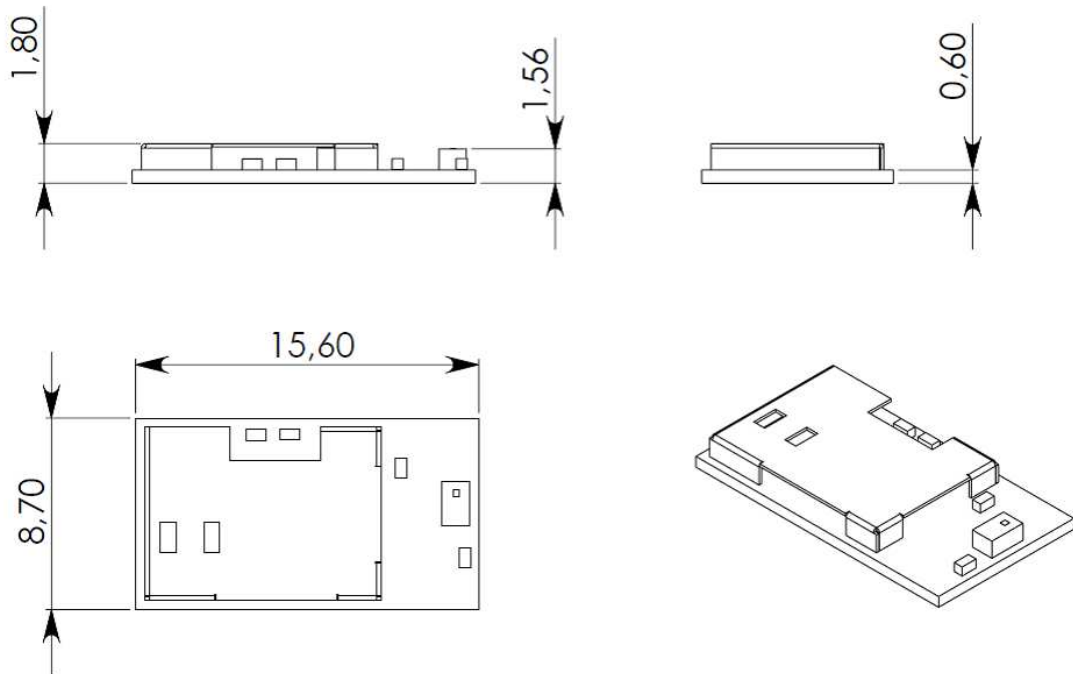
## 2.4 Bluetooth Features

- GAP central and peripheral support for LE
- GATT, SMP, and SDB support for LE
- Over-the-Air firmware update
- Support for Scatternet/Mesh network
- BT 4.2 secure connections support through Elliptic-Curve-DH Cryptography
- AES-128 hardware encryption (FIPS-approved)
- Frequent changing of device address (improved privacy, reduced tracking ability)
- Larger packet sizes (more efficient application and network layer security)

### 3 Detailed Description

#### 3.1 Dimensions

 All dimensions are in millimeters.

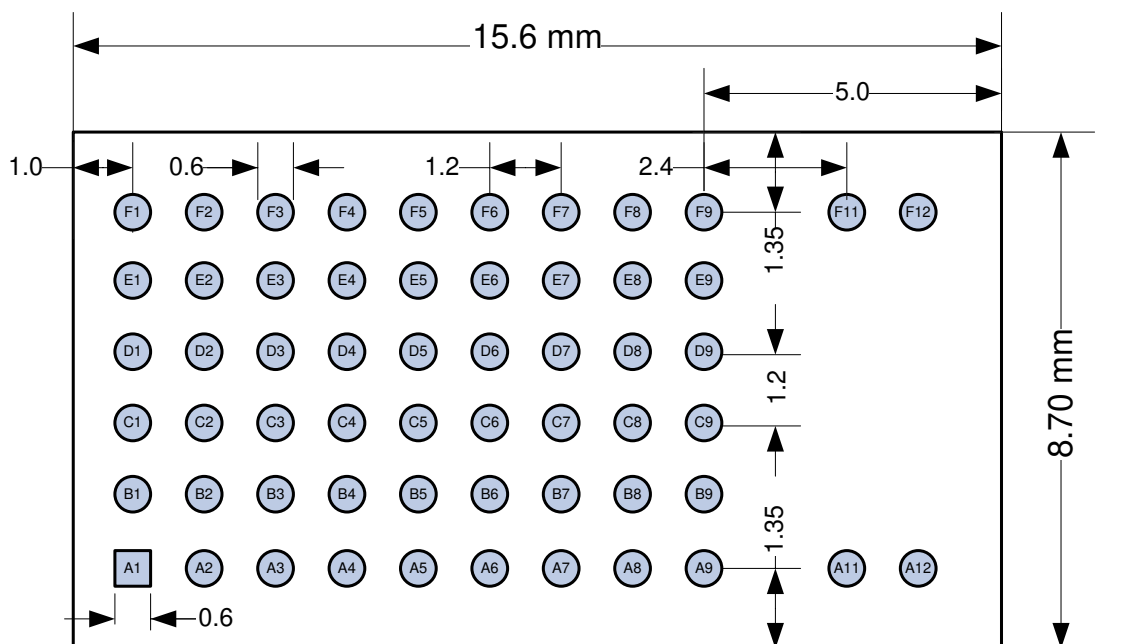


No.	Item	Dimension	Tolerance	Remark
1	Width	8.70	± 0.20	
2	Length	15.60	± 0.20	
3	Height	1.80	± 0.20	With case

### 3.2 Footprint

 The outer dimensions have a tolerance of  $\pm 0.2$  mm.

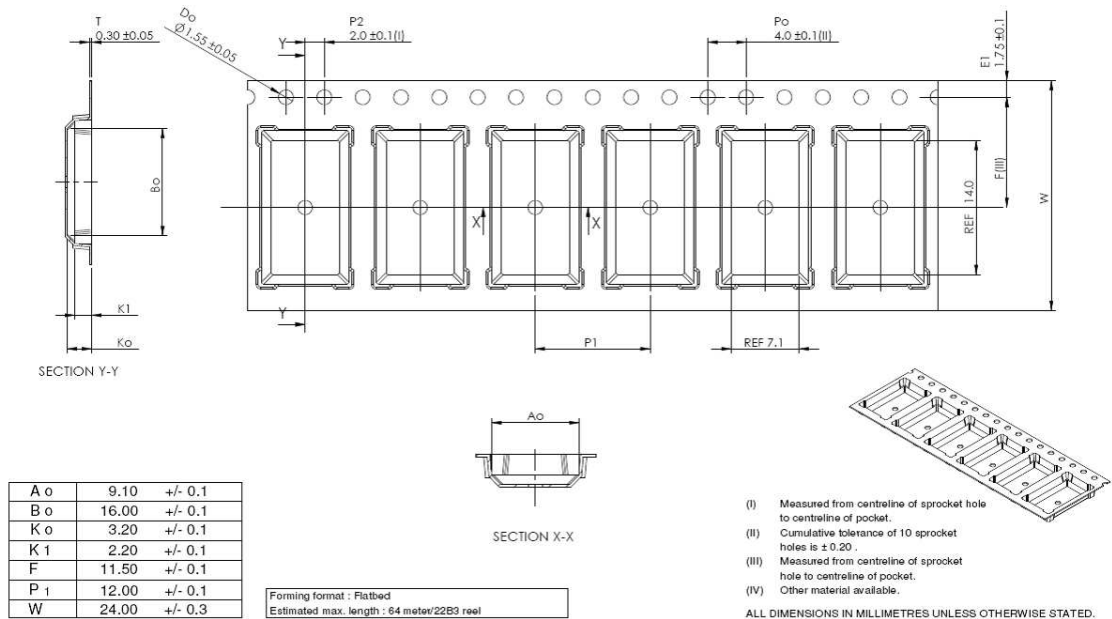
Top View



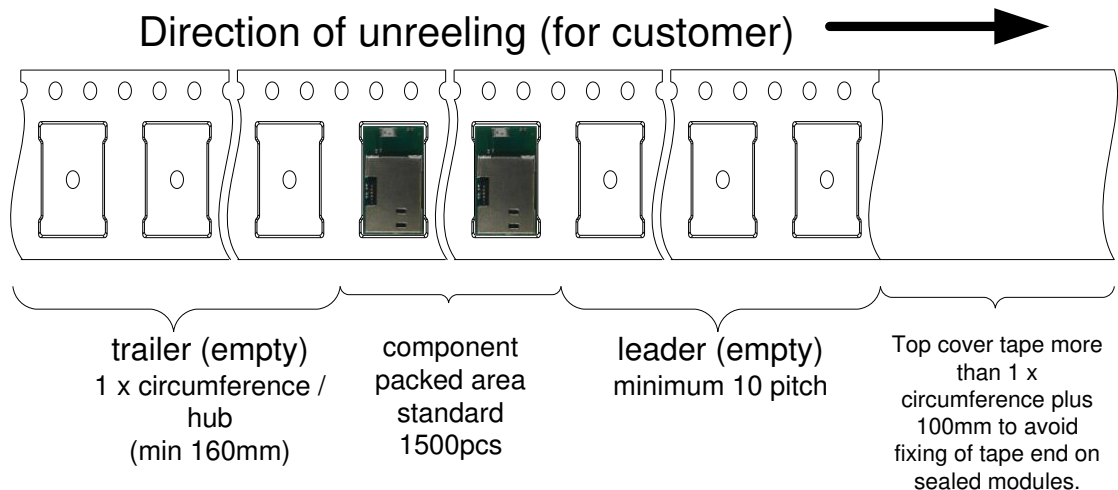
### 3.3 Packaging

The product is a mass production status product and will be delivered in the package described below.

#### 3.3.1 Tape Dimensions



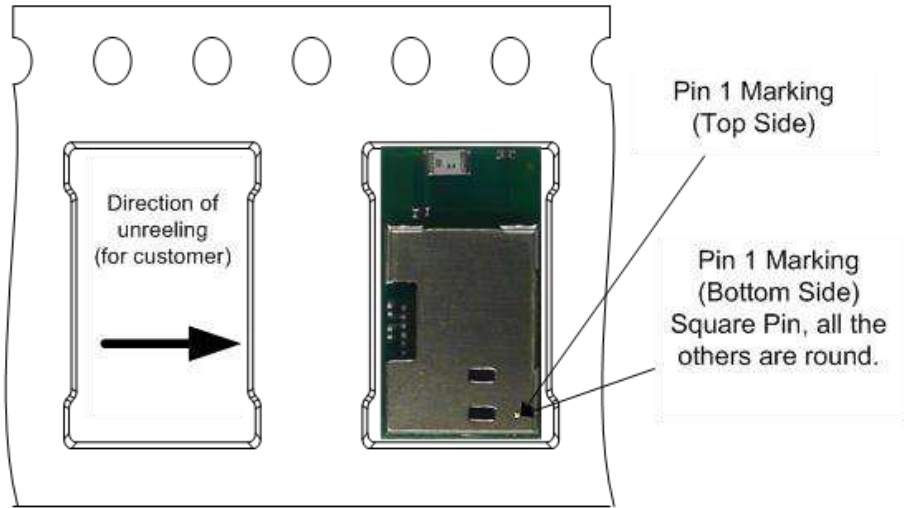
#### 3.3.2 Packing in Tape



Empty spaces in the component packed area shall be less than two per reel and those spaces shall not be consecutive.

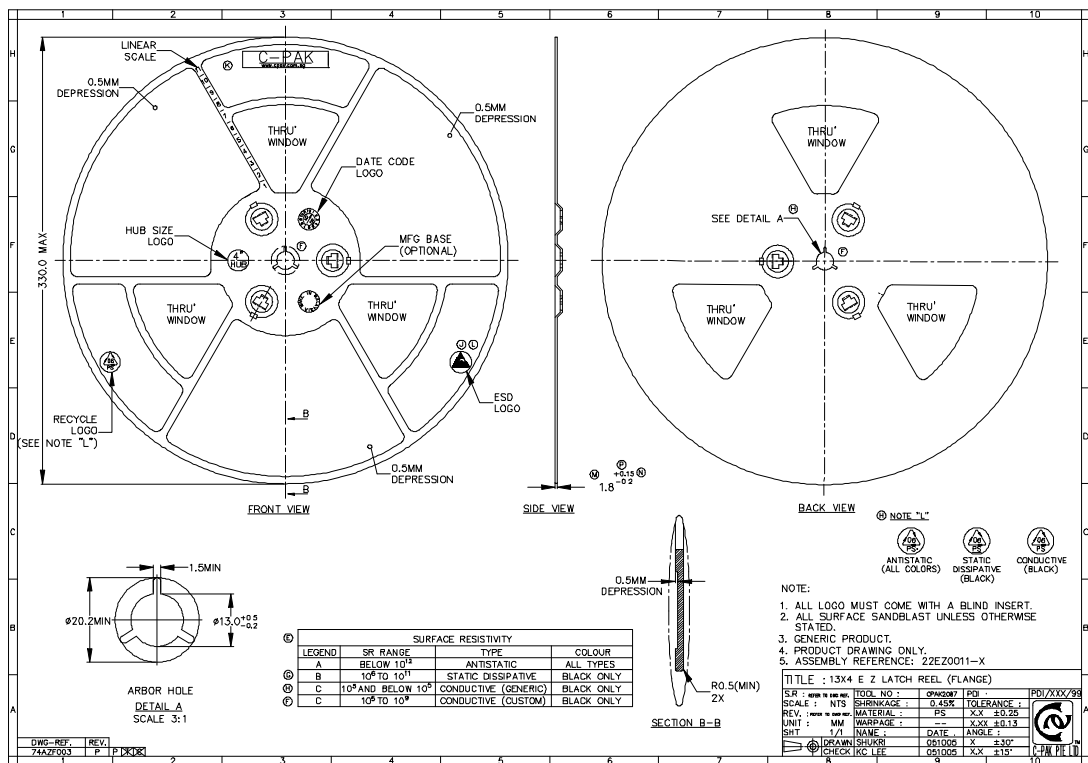
The top cover tape shall not be found on reel holes and it shall not stick out from the reel.

### 3.3.3 Component Direction



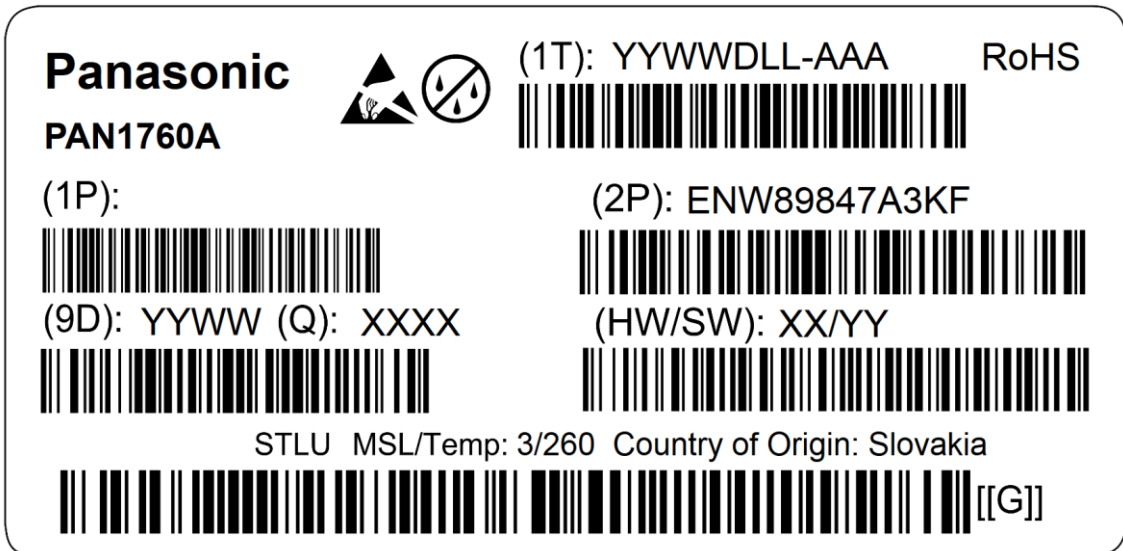
100730-PAN1720.vsd

### 3.3.4 Reel Dimension



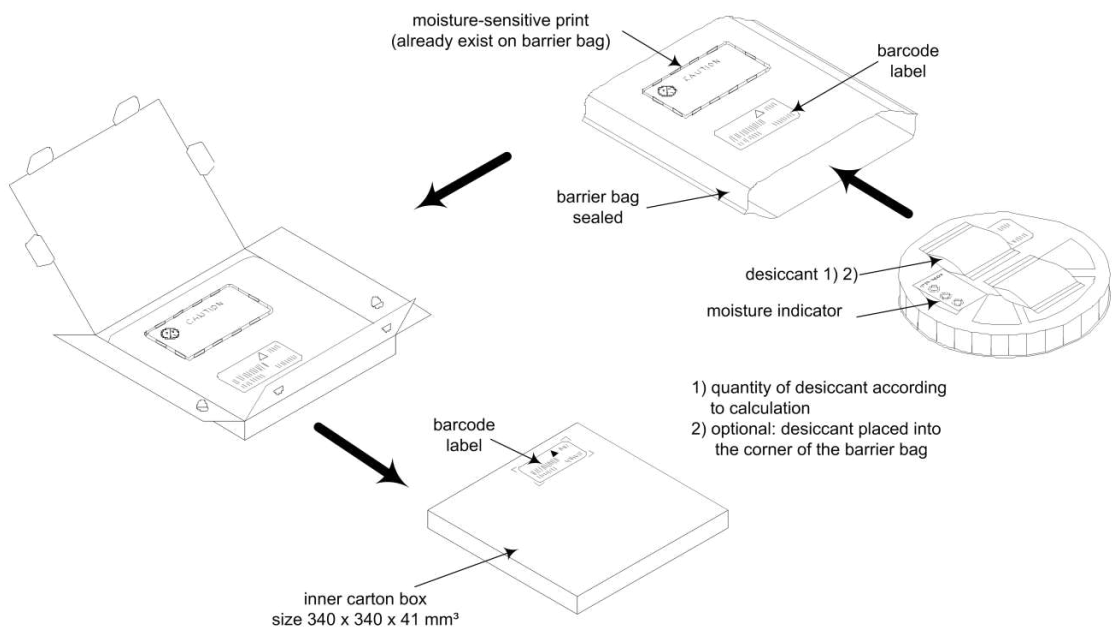
### 3.3.5 Package Label

#### Example



(1T)	Lot code
(1P)	Customer order number, if applicable
(2P)	Order number
(9D)	Date code
(Q)	Quantity
(HW/SW)	Hardware/software version

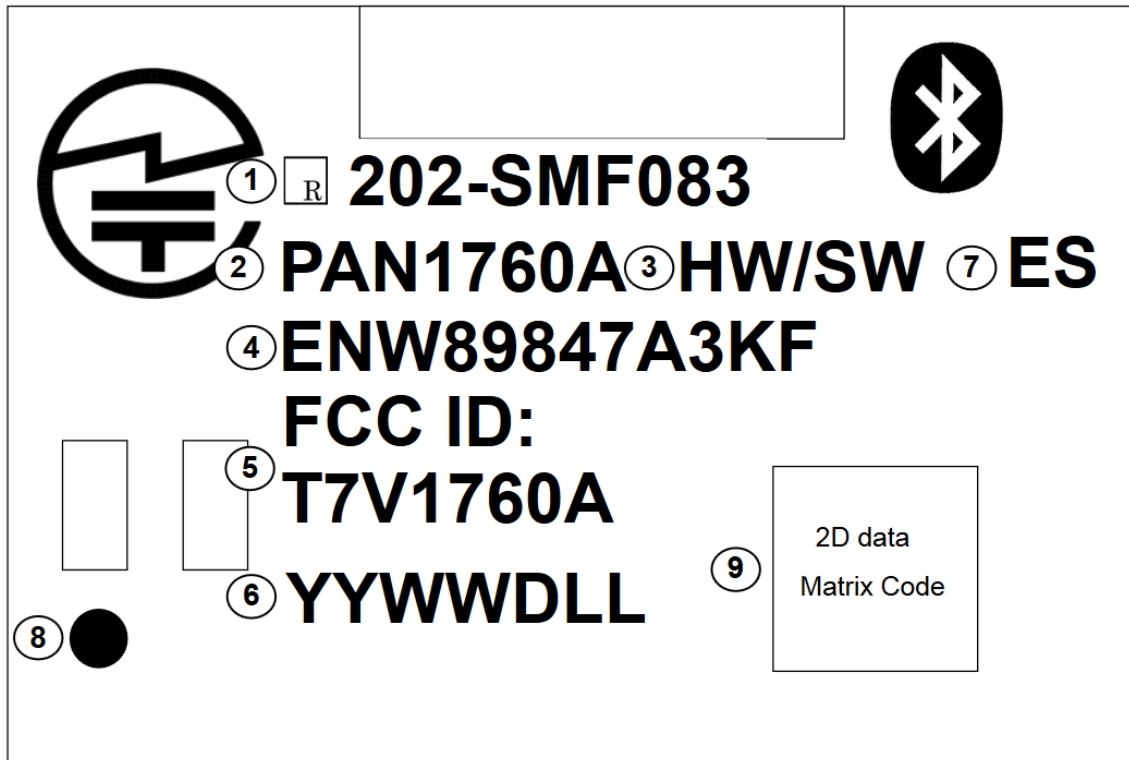
### 3.3.6 Total Package





### 3.4 Case Marking

#### Example



- 1 MIC ID
- 2 Brand name
- 3 Hardware/software version
- 4 Order number
- 5 FCC ID
- 6 Lot code
- 7 Engineering Sample marking, if applicable
- 8 Marking for Pin 1
- 9 2D barcode, for internal usage only

## 4 Specification



All specifications are over temperature and process, unless indicated otherwise.

### 4.1 Default Test Conditions



Temperature: 25 ± 10 °C  
 Humidity: 40 to 85 % RH  
 Supply Voltage: 3.3 V

### 4.2 Absolute Maximum Ratings



The maximum ratings may not be exceeded under any circumstances, not even momentarily or individually, as permanent damage to the module may result.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
T <sub>STOR</sub>	Storage temperature		-40		+125	°C
V <sub>ESD</sub>	ESD robustness	All pads, according to human body model (HBM), JEDEC STD 22, method A114			1 000	V
		According to charged device model (CDM), JEDEC STD 22, method C101			500	V
P <sub>RF</sub>	RF input level				+10	dBm
V <sub>DIG</sub>	Voltage on any digital pins		-0.3		VDD + 0.3	V

### 4.3 Recommended Operating Conditions



The maximum ratings may not be exceeded under any circumstances, not even momentarily or individually, as permanent damage to the module may result.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
T <sub>A</sub>	Ambient operating temperature range		-40		+85	°C
V <sub>DD</sub>	3V3 Supply voltage		1.8	3.3	3.6	V

### 4.4 Current Consumption



The current consumption depends on the user scenario and on the setup and timing in the power modes.

Assume V<sub>DD</sub> = 3.3 V, T<sub>amb</sub> = 25 °C, if nothing else stated.

Parameter	Condition	Min.	Typ.	Max.	Units
Transmit Peak Current			3.3		mA
Receive Peak Current			3.3		mA
Deep Sleep mode			50		nA

## 4.5 Bluetooth

Parameter	Condition	Min.	Typ.	Max.	Units
Operation frequency range		2 402		2 480	MHz
Channel spacing	BLE		2		MHz
Output Power	Maximum setting, measured at dual ended 50 Ω.		0		dBm
Sensitivity			-93		dBm

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
1	Spurious emissions	Conducted measurement with a 50 Ω dual-ended load. Complies with EN 300 328, EN 300 440 class 2, FCC CFR47, Part 15 and ARIB STD-T-66.		<-30		dBm

## 4.6 Reliability Tests

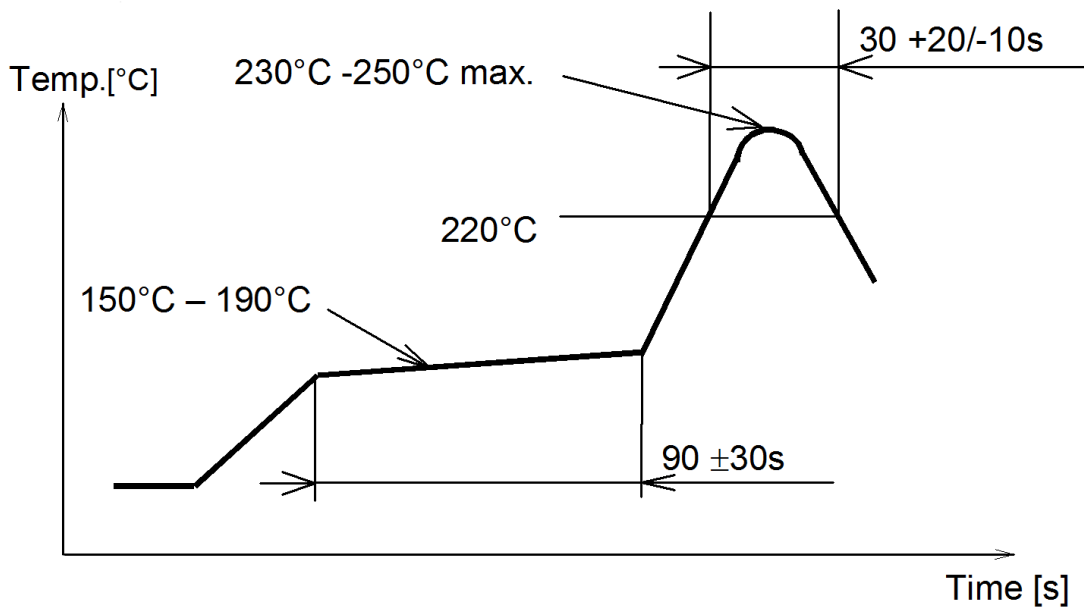
The measurement should be done after the test device has been exposed to room temperature and humidity for one hour.

No.	Item	Limit	Condition
1	Vibration test	Electrical parameter should be in specification	<ul style="list-style-type: none"> <li>• Freq.: 10~50 Hz; Amplitude: 1.5 mm; 20 min./cycle, 1 hrs. each of XYZ axis</li> <li>• Freq.: 30~100 Hz, 6G; 20 min./cycle, 1 hrs. each of XYZ axis</li> </ul>
2	Shock test	See above	Dropped onto hard wood from a height of 50 cm for 3 times
3	Heat cycle test	See above	-40 °C for 30 min. and +85 °C for 30 min.; each temperature 300 cycles
4	Moisture test	See above	+60 °C, 90 % RH, 300 h
5	Low temperature test	See above	-40 °C, 300 h
6	High temperature test	See above	+85 °C, 300 h

## 4.7 Recommended Soldering Profile



- Reflow permissible cycle: 2
- Opposite side reflow is prohibited due to module weight
- More than 75 percent of the soldering area shall be coated by solder
- The soldering profiles should be adhered to in order to prevent electrical or mechanical damage
- Soldering profile assumes lead-free soldering



## 5 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.

### 5.1 Design Notes

1. Follow the conditions written in this specification, especially the control signals of this module.
2. The supply voltage must 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 47 uF directly at the module).
3. This product should not be mechanically stressed when installed.
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 product's 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.
8. Refer to the recommended pattern when designing a board.

### 5.2 Installation Notes

1. Reflow soldering is possible twice based on the conditions set forth in [⇒ 4.7 Recommended Soldering Profile](#). 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. To repair the board by hand soldering, follow the conditions set forth in this chapter.
7. Do not wash this product.
8. Pressing on parts of the metal cover or fastening objects to the metal will cause damage to the unit.

### 5.3 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.
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 4.9 N 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.

### 5.4 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, such as Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, or NO<sub>x</sub>,
  - Storage in direct sunlight,
  - Storage in an environment where the temperature may be outside the range of 5 °C to 35 °C, or where the humidity may be outside the 45 to 85 percent range,
  - Storage of the products for more than one year after the date of delivery storage period: Please check the adhesive strength of the embossed tape and soldering after 6 months of storage.
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).

### 5.5 Safety Cautions

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, 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 single fault causing an unsafe status.

## 5.6 Other Cautions

1. Do not use the products for other purposes than those listed.
2. Be sure to provide an appropriate fail-safe function on your product to prevent any additional damage that may be caused by the abnormal function or the failure of the product.
3. This product has been manufactured without any ozone chemical controlled under the Montreal Protocol.
4. These products are not intended for uses other than under the special conditions shown below. Before using these products under such special conditions, carefully check their performance and reliability under the said special conditions 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 (e. g. salty air, HCl, Cl<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, and NO<sub>x</sub>).
5. 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.
6. When you have any question or uncertainty, contact Panasonic.

## 5.7 Life Support Policy

This Panasonic Industrial Devices Europe GmbH product is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Panasonic customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Panasonic Industrial Devices Europe GmbH for any damages resulting.



## 5.8 Restricted End Use

This Panasonic Industrial Devices Europe GmbH product is not designed for any restricted activity that supports the development, production, handling usage, maintenance, storage, inventory or proliferation of any weapons or military use.

Transfer, export, re-export, usage or reselling of this product to any destination, end user or any end use prohibited by the European Union, United States or any other applicable law is strictly prohibited.

## 6 Regulatory and Certification Information

### 6.1 Federal Communications Commission (FCC) for US

#### 6.1.1 FCC Notice



The PAN1760A including the antennas, which are listed in ⇒ [6.1.5 Approved Antenna List](#), complies with Part 15 of the FCC Rules.

The device meets the requirements for modular transmitter approval as detailed in FCC public Notice DA00-1407. The transmitter 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.

#### 6.1.2 Caution



The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Panasonic Industrial Devices Europe GmbH may void the user's authority to operate the equipment.



This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

There is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help