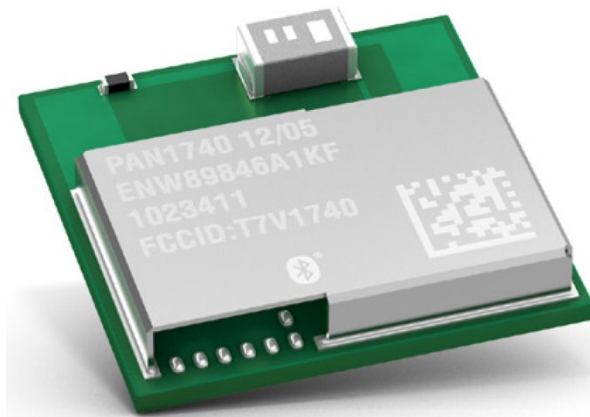**Panasonic**

Wireless Modules

PAN1740

Bluetooth Low Energy Module

Product Specification

Rev. 1.8

Overview

The PAN1740 is a short-range BLE single mode module used for the implementation of Bluetooth functionality into various electronic devices.

Features

- Pre-programmed BT/MAC address
- Includes 16 MHz and 32 768 kHz crystal calibrated up to 1 ppm
- Single-mode Bluetooth Smart System-on-Chip
- Programmable ARM CORTEX M0 CPU
- Autonomous BTLE stand-alone operation
- Bluetooth v4.1 (LE) embedded GATT profile – Low Energy single mode
- Small 9.0 mm x 9.5 mm x 1.8 mm SMD package with antenna
- Less than a few µA in low power modes
- Integrated shielding to resist EMI
- No external components needed

Characteristics

- Peak power consumption 4.9 mA Rx and Tx
- Link budget 93 dBm (Rx sensitivity -93, Tx 0 dBm)
- Operating temperature range -40 °C to +85 °C

Block Diagram
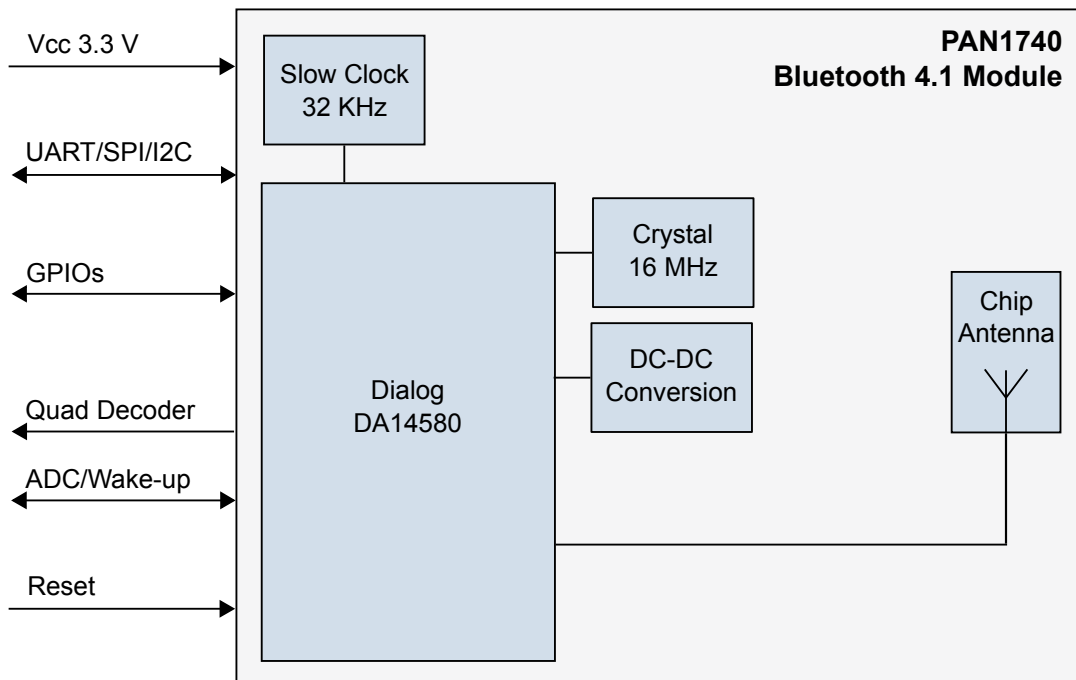
By purchase of any of the products described in this document the customer accepts the document's validity and declares their agreement and understanding of its contents and recommendations. Panasonic reserves the right to make changes as required at any time without notification. Please consult the most recently issued Product Specification before initiating or completing a design.

This Product Specification does not lodge the claim to be complete and free of mistakes.

Engineering Samples (ES)

If Engineering Samples are delivered to the customer, these samples have the status "Engineering Samples". This means that the design of this product is not yet concluded. Engineering Samples may be partially or fully functional, and they may differ from the published Product Specification.

Engineering Samples are not qualified and they are not to be used for reliability testing or series production.

Disclaimer

The customer acknowledges that samples may deviate from the Product Specification and may bear defects due to their status of development and the lack of qualification mentioned above.

Panasonic rejects any liability or product warranty for Engineering Samples. In particular, Panasonic disclaims liability for damages caused by:

- The use of the Engineering Sample other than for evaluation purposes, particularly the installation or integration in another product to be sold by the customer,
- Deviation or lapse in function of the Engineering Sample,
- Improper use of the Engineering Sample.

Panasonic Industrial Devices Europe GmbH disclaims any liability for consequential and incidental damages. In case of any queries regarding the Engineering Samples, please contact your local sales partner or the related product manager.

Table of Contents

1 About This Document

1.1 Purpose and Audience

This Product Specification provides details on the functional, operational, and electrical characteristics of the Panasonic PAN1740 module. It is intended for hardware design, application, and Original Equipment Manufacturer (OEM) engineers. The product is referred to as "the PAN1740" or "the module" within this document.

1.2 Revision History

Revision	Date	Modifications/Remarks
0.1	February 2014	1st preliminary version.
0.2	April 2014	Included Bluetooth 4.1 compliance.
0.3	June 2014	Formating Table 5. Updated Key Features.
1.0	October 2014	Final Specification incl. DoC.
1.1	December 2014	Changed tolerances in chapter 11 Module Dimension.
1.2	April 2015	Added nntrinsic safety values.
1.3	January 2016	Editorial changes.
1.4	October 2016	Updated EU regulatory chapter. Changed VCC to VBAT3V.
1.5	June 2017	Updated EU regulatory chapter to RED.
1.6	June 2017	New layout and document structure
1.7	November 2017	Added MIC ID for Japanese Radio Law
1.8	January 2018	Added order information for Evaluation Tools

1.3 Use of Symbols

Symbol	Description
(i)	**Note** Indicates important information for the proper use of the product. Non-observance can lead to errors.
⚠	**Attention** Indicates important notes that, if not observed, can put the product's functionality at risk.
⇨ [chapter number] [chapter title]	**Cross reference** Indicates cross references within the document. **Example:** Description of the symbols used in this document ⇨ 1.3 Use of Symbols.

1.4 Related Documents

Please refer to the Panasonic website for related documents ⇨ 7.2.2 Product Information.

2 Overview

The PAN1740 is a short-range BLE single mode module used for the implementation of Bluetooth functionality into various electronic devices. The PAN1740 is fully-compliant with the Bluetooth V4.1 standard. It includes dedicated hardware for Link Layer implementation of Bluetooth®Smart and interface controllers for enhanced connectivity capabilities.

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
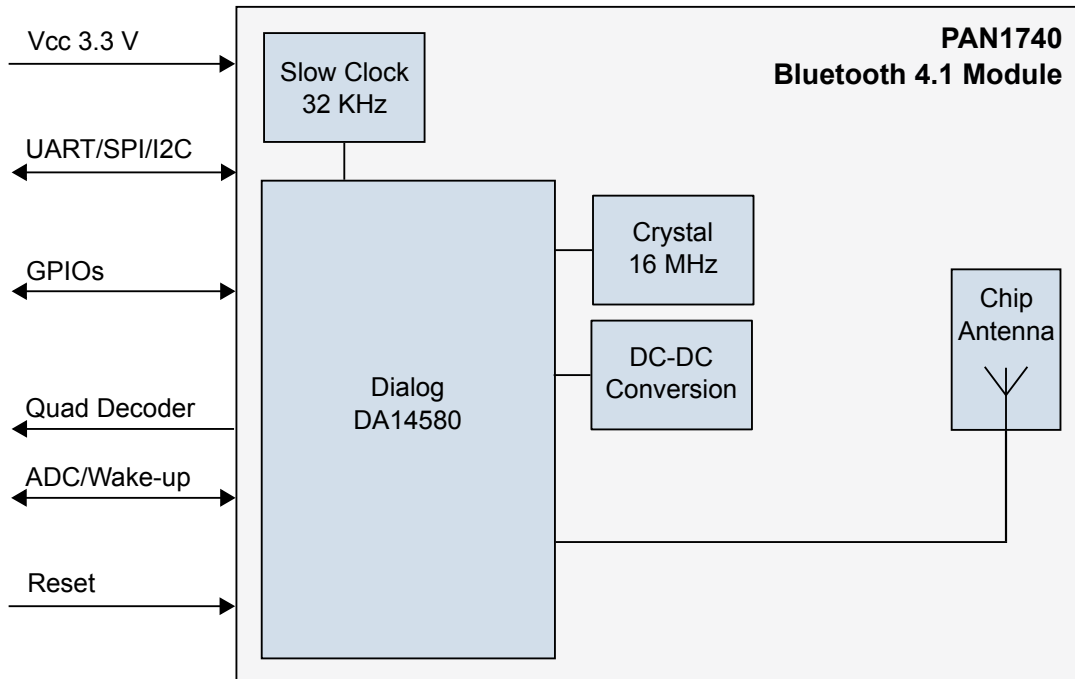
Total capacity shall not exceed 2.5 µF.

The total inductance shall not exceed 2.5 µH.

There is no resistor value in this design.

2.2 Bluetooth IC
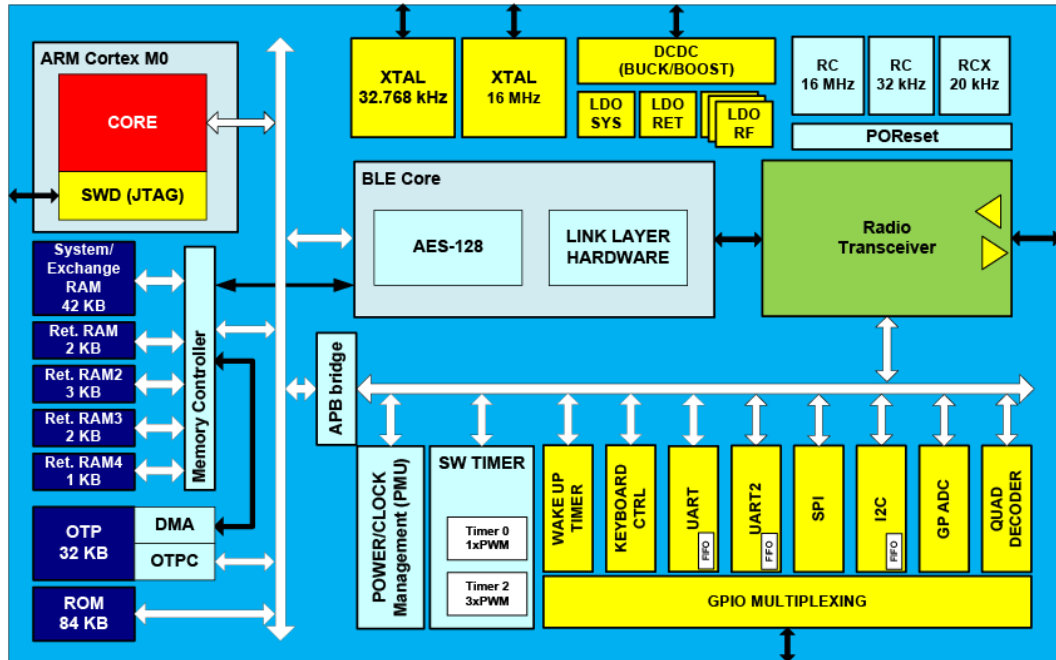
2.3 System Overview

The PAN1740 contains the following internal blocks:

- ARM Cortex M0 CPU
- Bluetooth Smart

2.3.1 ARM Cortex M0 CPU

The Cortex-M0 processor is a 32-bit Reduced Instruction Set Computing (RISC) processor with a von Neumann architecture (single bus interface). It uses an instruction set called Thumb, which was first supported in the ARM7TDMI processor; however, several newer instructions from the ARMv6 architecture and a few instructions from the Thumb-2 technology are also included. Thumb-2 technology extended the previous Thumb instruction set to allow all operations to be carried out in one CPU state. The instruction set in Thumb-2 includes both 16-bit and 32-bit instructions; most instructions generated by the C compiler use the 16-bit instructions, and the 32-bit instructions are used when the 16-bit version cannot carry out the required operations. This results in high code density and avoids the overhead of switching between two instruction sets.

In total, the Cortex-M0 processor supports 56 base instructions, although some instructions can have more than one form. While the instruction set is small, the Cortex-M0 processor is highly capable because the Thumb instruction set is highly optimized.

2.3.2 Bluetooth Smart

BLE Core

The BLE (Bluetooth Low Energy) core is a qualified Bluetooth v4.1 baseband controller compatible with Bluetooth Smart specification and it is in charge of packet encoding- decoding and frame scheduling.

- Bluetooth Smart Specifications compliant according to the Specification of the Bluetooth System, v4.1, Bluetooth SIG.
- All device classes are supported -- Broadcast, Central, Observer, Peripheral)
- All packet types (Advertising / Data / Control)
- Encryption (AES / CCM)
- Bit stream processing (CRC, Whitening)
- FDMA / TDMA / events formatting and synchronization
- Frequency Hopping calculation
- Operating clock with internal 16 MHz
- Low power modes with internal 32.678 kHz
- Supports power down of the baseband during the protocol's idle periods.
- Advanced High performance Bus (AHB) Slave interface for register file access.
- AHB Slave interface for Exchange Memory access of CPU via BLE core.
- AHB Master interface for direct access of BLE core to Exchange Memory space

Smart Snippets

The PAN1740 is available together with Dialog's SmartSnippetsTM Bluetooth Software platform which includes a qualified Bluetooth Smart single-mode stack on chip.

Numerous Bluetooth Smart profiles for consumer wellness, sport, fitness, security and proximity applications are supplied as standard, while additional customer profiles can be developed and added as needed.

The SmartSnippetsTM software development environment is based on KeilTM 's uVision mature tools and contains example application code for both embedded and hosted modes.
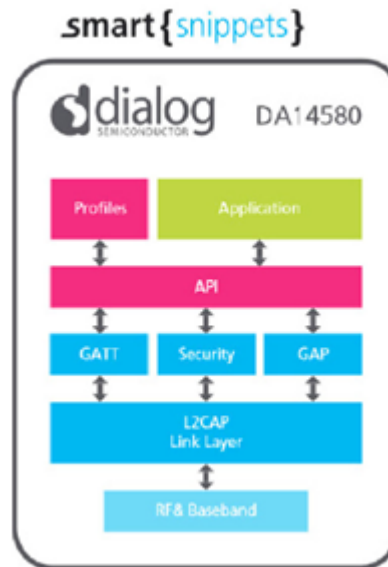
Memory

The following memories are part of the PAN1740's internal blocks:

- **ROM**. This is a 84 kB ROM containing the Bluetooth Smart protocol stack as well as the boot code sequence.
- **OTP**. This is a 32 kB One-Time Programmable memory array, used to store the application code as well as Bluetooth Smart profiles. It also contains the system configuration and calibration data.
- **System SRAM**. This is a 42 kB system SRAM (Sys-RAM) which is primarily used for mirroring the program code from the OTP when the system wakes/powers up. It also serves as Data RAM for intermediate variables and various data that the protocol requires. Optionally, it can be used as extra memory space for the BLE TX and RX data structures.
- **Retention RAMs**. These are 4 special low leakage SRAM cells (2 kB + 2 kB + 3 kB + 1 kB) used to store various data of the Bluetooth Smart protocol as well as the system's global variables and processor stack when the system goes into Deep Sleep mode. Storage of this data ensures secure and quick configuration of the BLE Core after the system wakes up. Every cell can be powered on or off according to the application needs for retention area when in Deep Sleep mode.

Functional Modes

The PAN1740 is optimized for embedded applications such as health monitoring, sports measuring, human interaction devices, etc. Customers are able to develop and test their own applications. Upon completion of development, the application code can be programmed into the OTP.

In general, the system has three functional modes of operation:

- **Development Mode**. During this phase application code is developed using the ARM Cortex M0 SW environment. The compiled code is then downloaded into the System RAM

or any Retention RAMs by means of SWD (JTAG) or any serial interface (e.g. UART). Address 0x00 is remapped to the physical memory that contains the code and the CPU is configured to reset and execute code from the remapped device. This mode enables application development, debugging and on-the-fly testing.

- **Normal Mode**. After the application is completed and verified, the code can be burned into the OTP. When the system boots/wakes up, the DMA of the OTP controller will automatically copy the program code from the OTP into the system RAM. Next, a SW reset will remap address 0x00 to the System RAM and code execution is started. Hence, in this mode, the system is autonomous, contains the required SW in OTP and is ready for integration into the final product.

- **Calibration Mode**. Programming the Bluetooth device address is completed in Calibration Mode.

Power Modes

There are four different power modes in the PAN1740:

- **Active Mode**. System is active and operates at full speed.

- **Sleep Mode**. No power gating has been programmed, the ARM CPU is idle, waiting for an interrupt. PD_SYS is on. PD_PER and PED_RAD depending on the programmed enabled value.

- **Extended Sleep Mode**. All power domains are off except for the PD_AON, the programmed PD_RRx and the PD_SR. Since the SysRAM retains its data, no OTP mirroring is required upon waking up the system.

- **Deep Sleep Mode**. All power domains are off except for the PD_AON and the programmed PD_RRx. This mode dissipates the minimum leakage power. However, since the SysRAM has not retained its data, an OTP mirror action is required upon waking up the system.

2.4 Pin Configuration

Pin Assignment

Top View
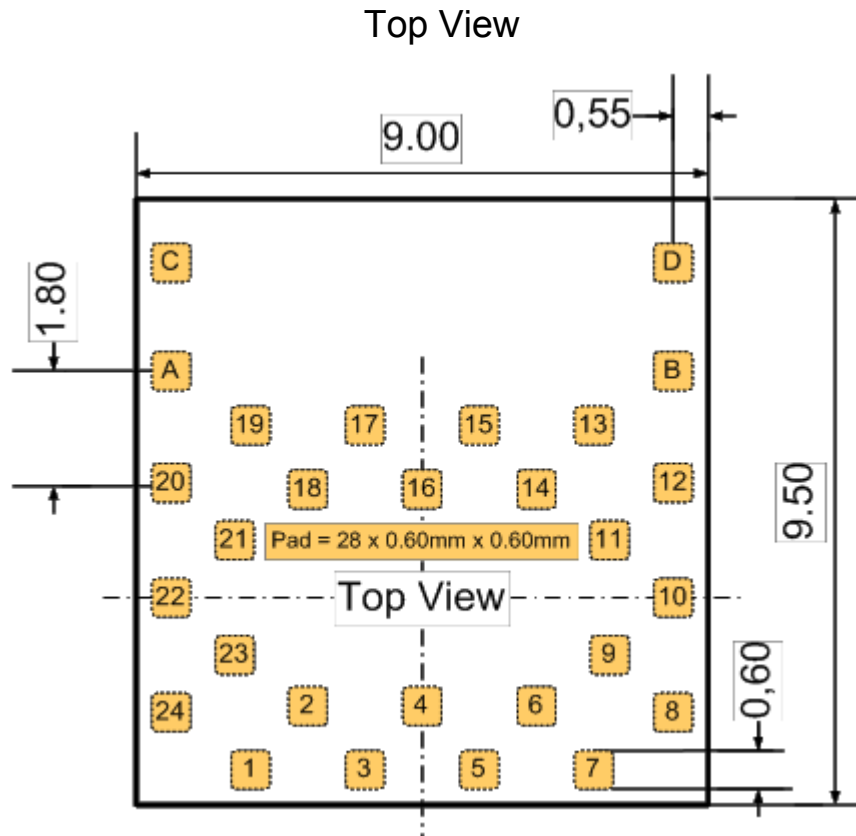
Pin Functions

No	Pin Name	Pin Type	Description
1	GND		
2	RST	I	INPUT. Reset signal (active high).
3	P0.7	IO	General purpose I/O port bit or alternate function nodes.
4	P0.6	IO	General purpose I/O port bit or alternate function nodes.
5	P0.5	IO	General purpose I/O port bit or alternate function nodes. UART RX[1]
6	P0.4	IO	General purpose I/O port bit or alternate function nodes. UART TX[1]
7	GND		

---

[1] Dependent on the software configuration the UART can be set also to any other IO.

No	Pin Name	Pin Type	Description
8	VBAT3V	AI	Power supply
9	P0.3	IO	General purpose I/O port bit or alternate function nodes. UART CTS[1]
10	P0.2	IO	General purpose I/O port bit or alternate function nodes. UART RTS[1]
11	P0.1	IO	General purpose I/O port bit or alternate function nodes.
12	P0.0	IO	General purpose I/O port bit or alternate function nodes.
13	n.c.		
14	VPP	AI	INPUT. This pin is used while OTP programming and testing.[2]
15	GND		
16	P1_4/SWCLK	IO	INPUT JTAG clock signal
17	GND		
18	P1_5/SW_DIO	IO	INPUT/OUTPUT. JTAG Data input/output.
19	GND		
20	GND		
21	P1.3	IO	General purpose I/O port bit or alternate function nodes.
22	P1.2	IO	General purpose I/O port bit or alternate function nodes.
23	P1.1	IO	General purpose I/O port bit or alternate function nodes.
24	P1.0	IO	General purpose I/O port bit or alternate function nodes.
A	GND		
B	GND		
C	GND		
D	GND		

For a more detailed description of the alternate function nodes please refer to the Dialog datasheet.

---

[2] Supply voltage on pin VPP during OTP programming is 6.8 V+/-0.25 V

2.5 Interfaces

2.5.1 UART

The UART is compliant to the industry-standard 16550 and is used for serial communication with a peripheral, modem (data carrier equipment, DCE) or data set. Data is written from a master (CPU) over the APB bus to the UART and it is converted to serial form and transmitted to the destination device. Serial data is also received by the UART and stored for the master (CPU) to read back. There is no DMA support on the UART block since its contains internal FIFOs. Both UARTs support hardware flow control signals (RTS, CTS, DTR, DSR).

Features

- 16 bytes Transmit and receive FIFOs.
- Hardware flow control support (CTS/RTS)
- Shadow registers to reduce software overhead and also include a software programmable reset
- Transmitter Holding Register Empty (THRE) interrupt mode
- IrDA 1.0 SIR mode supporting low power mode.
- Functionality based on the 16550 industry standard:
- Programmable character properties, such as number of data bits per character (5-8), optional
- parity bit (with odd or even select) and number of stop bits (1, 1.5 or 2)
- Line break generation and detection
- Prioritized interrupt identification
- Programmable serial data baud rate as calculated by the following: baud rate = (serial clock frequency)/(divisor).

2.5.2 SPI+

This interface supports a subset of the Serial Peripheral Interface SPI™. The serial interface can transmit and receive 8, 16 or 32 bits in master/slave mode and transmit 9 bits in master mode. The SPI+ interface has enhanced functionality with bidirectional 2x16-bit word FIFOs.

SPI™ is a trademark of Motorola, Inc.

Features

- Master and Slave mode
- 8 bit, 9 bit, 16 bit or 32 bit operation
- Clock speeds up to 16 MHz. Programmable output frequencies of SPI source clock divided by 1, 2, 4, 8
- SPI mode 0, 1, 2, 3 support. (clock edge and phase)
- Programmable SPI_DO idle level
- Maskable Interrupt generation
- Bus load reduction by unidirectional writes-only and reads-only modes.
- Built-in RX/TX FIFOs for continuous SPI bursts.

2.5.3 I^{2}C

The I^{2}C is a programmable control bus that provides support for the communications link between Integrated Circuits in a system. It is a simple two-wire bus with a software-defined protocol for system control, which is used in temperature sensors and voltage level translators to EEPROMs, general-purpose I/O, A/D and D/A converters.

Features

- Two-wire I^{2}C serial interface consists of a serial data line (SDA) and a serial clock (SCL)
- Two speeds are supported:
- Standard mode (0 to 100 Kb/s)
- Fast mode (<= 400 Kb/s)
- Clock synchronization
- 32 deep transmit/receive FIFOs
- Master transmit, Master receive operation
- 7- or 10-bit addressing
- 7- or 10-bit combined format transfers
- Bulk transmit mode
- Default slave address of 0x055
- Interrupt or polled-mode operation
- Handles Bit and Byte waiting at both bus speeds
- Programmable SDA hold time

2.5.4 General Purpose (GP) ADC

The PAN1740 is equipped with a high-speed ultra low power 10-bit general purpose Analog-to-Digital Converter (GPADC). It can operate in unipolar (single ended) mode as well as in bipolar (differential) mode. The ADC has its own voltage regulator (LDO) of 1.2 V, which represents the full scale reference voltage.

Features

- 10-bit dynamic ADC with 65 ns conversion time
- Maximum sampling rate 3.3 Msample/s
- Ultra low power (5 ¬µA typical supply current at 100 ksample/s)
- Single-ended as well as differential input with two input scales
- Four single-ended or two differential external input channels
- Battery monitoring function
- Chopper function
- Offset and zero scale adjust
- Common-mode input level adjust

2.5.5 Quadrature Decoders

This block decodes the pulse trains from a rotary encoder to provide the step and the direction of the movement of an external device. Three axes (X, Y, Z) are supported.

The integrated quadrature decoder can automatically decode the signals for the X, Y and Z axes of a HID input device, reporting step count and direction: the channels are expected to provide a pulse train with 90 degrees phase difference; depending on whether the reference channel is leading or lagging, the direction can be determined.

This block can be used for waking up the chip as soon as there is any kind of movement from the external device connected to it.

Features

- Three 16-bit signed counters that provide the step count and direction on each of the axes (X, Y, and Z)
- Programmable system clock sampling at maximum 16 MHz.
- APB interface for control and programming
- Programmable source from P0, P1 ports
- Digital filter on the channel inputs to avoid spikes

2.5.6 Keyboard Controller

The keyboard controller can be used for debouncing the incoming GPIO signals when implementing a keyboard scanning engine. It generates an interrupt to the CPU (KEYBR_IRQ). In parallel, five extra interrupt lines can be triggered by a state change on 32 selectable GPIOs (GPIOx_IRQ).

Features

- Monitors any of the 12 available GPIOs
- Generates a keyboard interrupt on key press or key release
- Implements debouncing time from 0 up to 63 ms
- Supports five separate interrupt generation lines from GPIO toggling

2.5.7 Input/Output Ports

The PAN1740 has software-configurable I/O pin assignment, organized into ports Port 0, Port1.

Features

- Port 0: 8 pins, Port 1: 6 pins (including SW_CLK and SWDIO)
- Fully programmable pin assignment
- Selectable Push-pull or open drain per pin
- Selectable 25 KOhm pull-up, pull-down resistors per pin
- Pull-up voltage VBAT3V (BUCK mode)
- Fixed assignment for analog pin ADC[3:0]
- Pins retain their last state when system enters the Extended or Deep Sleep mode.

2.5.8 Timers

For any software-related description please refer to the according Dialog document.

2.5.9 Reset

The PAN1740 comprises an RST pad which is active high. It contains an RC filter for spikes suppression with 400 kΩ and 2.8 pF for the resistor and the capacitor respectively. It also contains a 25 kΩ pulldown resistor. This pad should be connected to ground if not needed by the application. The typical latency of the RST pad is in the range of 2 µs.

3   Detailed Description

3.1   Dimensions

> (i) All dimensions are in millimeters.
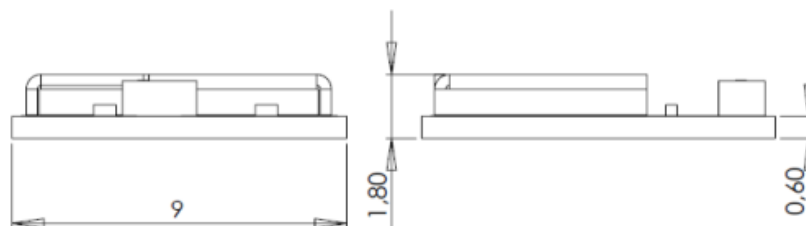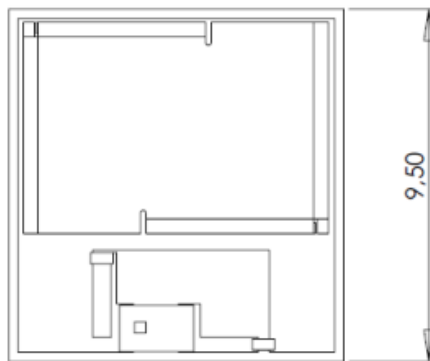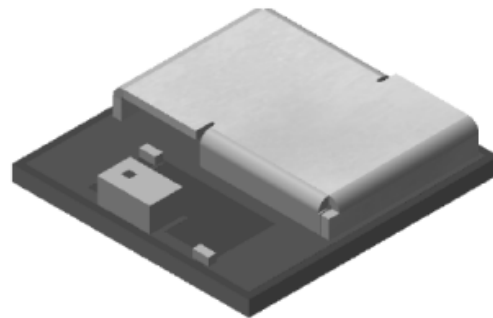
No.	Item	Dimension	Tolerance	Remark
1	Width	9.50	± 0.30	
2	Length	9.00	± 0.30	
3	Height	1.80	± 0.20	With case

3.2 Footprint

> (i)
> - The outer dimensions have a tolerance of ±0.2 mm.
> - The layout is symetric to center.
> - The inner pins (2, 4, 6, 9, 11, 14, 16, 18, 21, 23) are shifted to the center by 1 mm.

Top View
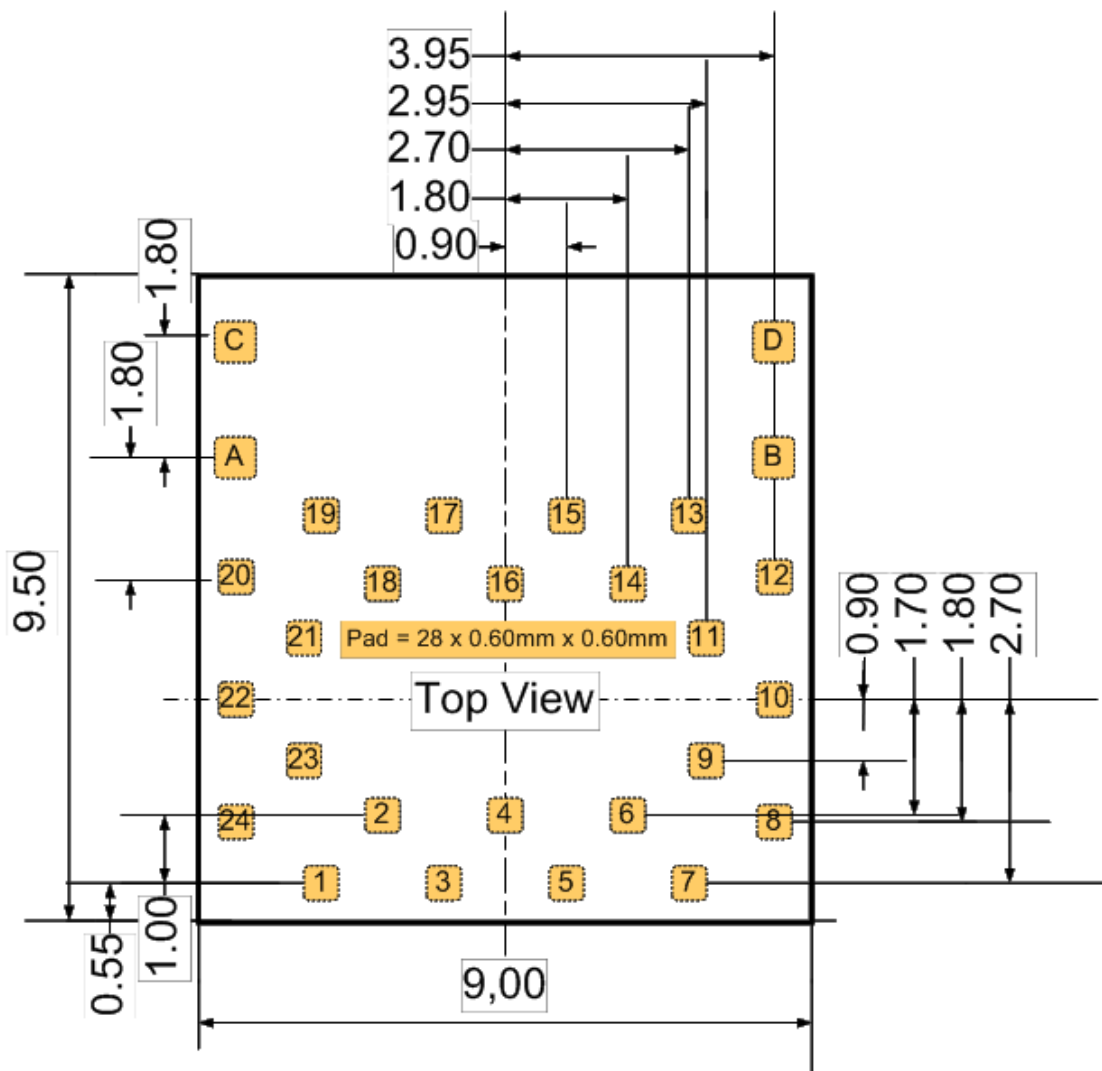
3.3 Packaging

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

3.3.1 Tape Dimensions

Ao	9.90	+/- 0.10
Bo	9.40	+/- 0.10
Ko	2.80	+/- 0.10
K1	2.00	+/- 0.10
F	7.50	+/- 0.10
P1	12.00	+/- 0.10
W	16.00	+/- 0.30

Tooling code: Flatbed - 9
Estimated Max Length: 72m per 22B3

(I) **Measured from centreline of sprocket hole** to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

3.3.2 Packing in Tape

Direction of unreeling (for customer)

trailer (empty)
1 x circumference /hub
(min 160mm)

component packed area
standard
1500pcs

leader (empty)
minimum 10 pitch

Top cover tape more than 1 x circumference plus 100mm to avoid fixing of tape end on sealed modules.

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

Direction of unreeling (for customer)

Pin 1 Marking (Top Side)

Pin 1 Marking (Bottom Side)
Circle r = 0.5 mm
on solder resist
near Pin 1
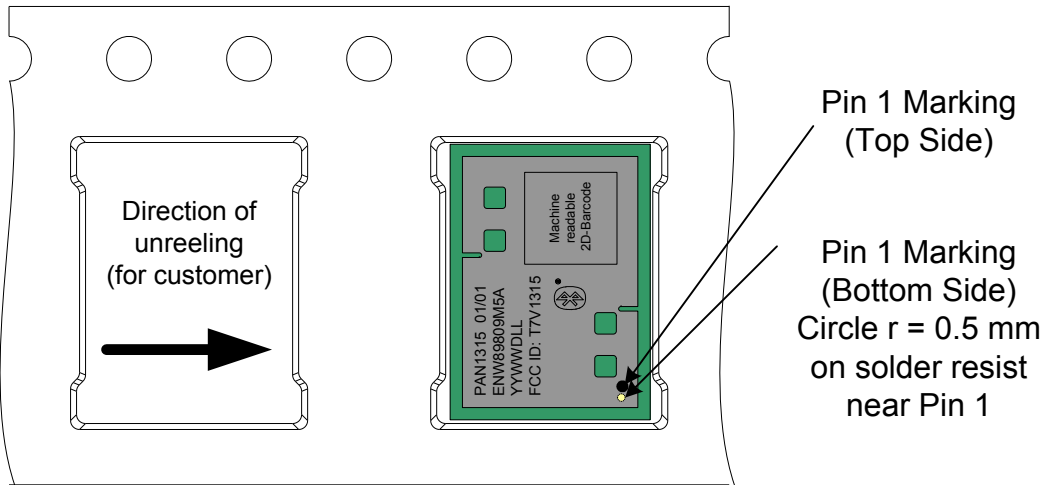
3.3.4 Reel Dimension
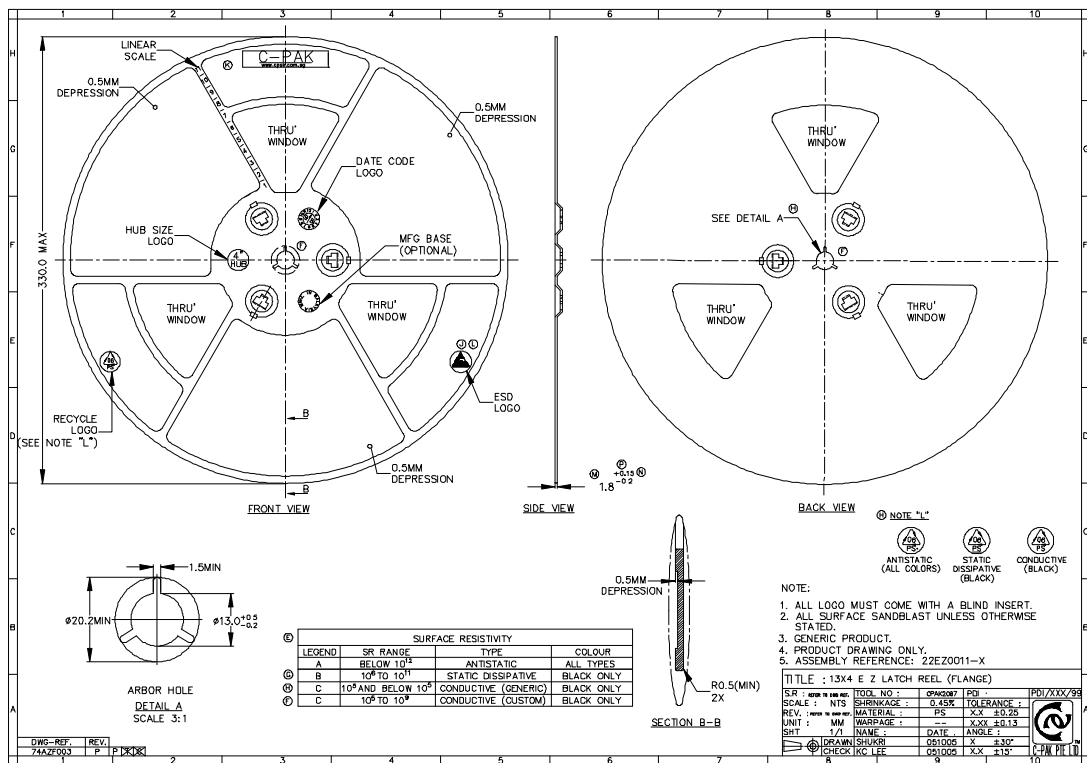
3.3.5 Package Label

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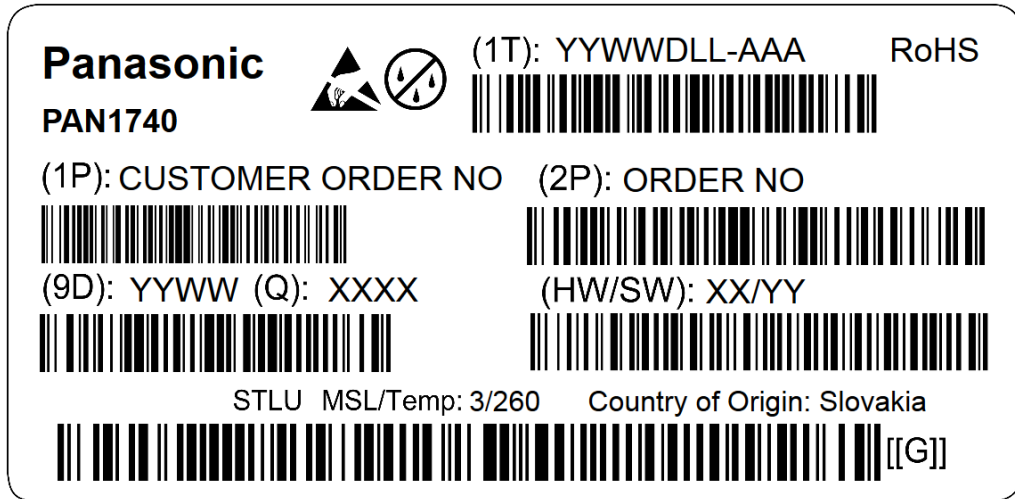
(1T)	Lot code
(1P)	Customer order number, if applicable
(2P)	Order number
(9D)	Date code
(Q)	Quantity
(HW/SW)	Hardware/software version

3.3.6 Total Package
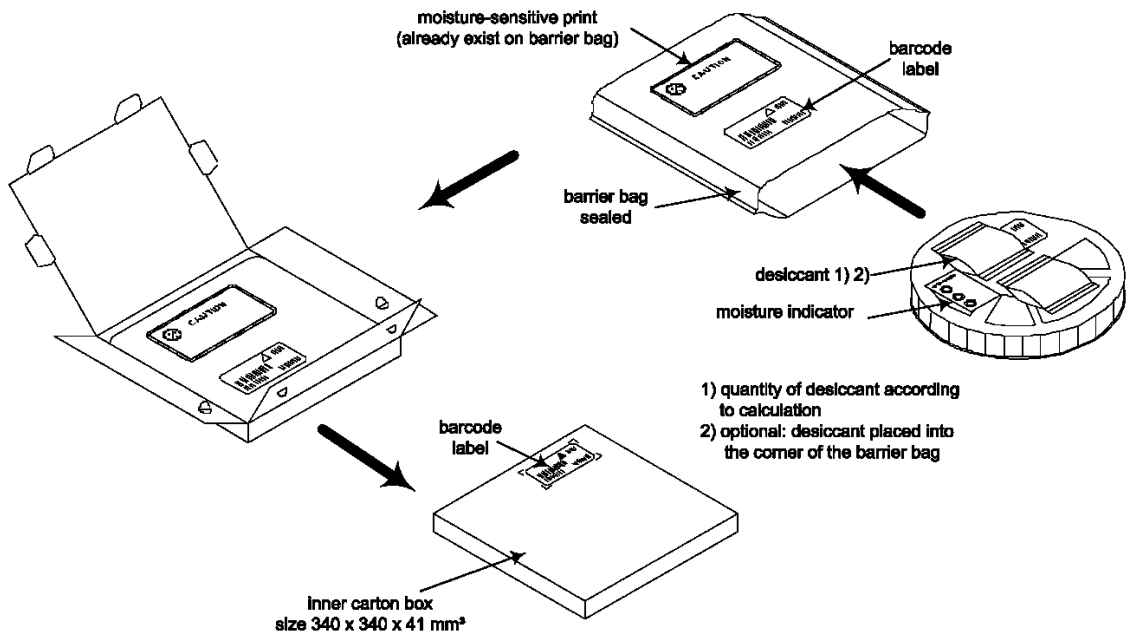
3.4 Case Marking

Example
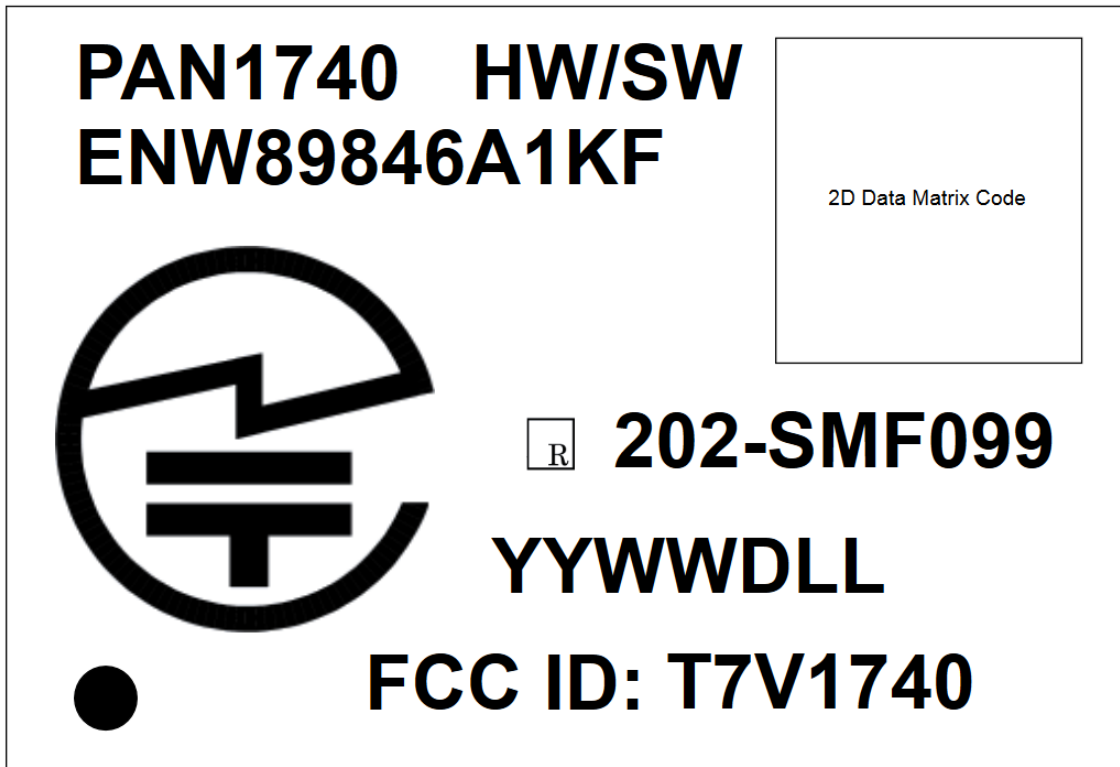
1	Brand name
2	Hardware/software version
3	Order number
4	Lot code
5	FCC ID
6	Marking for Pin 1

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.

> The BUCK mode of the DCDC can operate correctly with voltages in the range of 2.2 V upto 3.3 V. If the voltage drops below that, then the OTP might not be readable any more. However, if no OTP is used, then the system is able to further operate up to 1.8 V.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
$V_{PIN(LIM)}$ (default)	limiting voltage on a pin	Voltage between GND and VBAT3V	-0.1		VBAT3V + 0.2	V
T_{STG}	storage temperature		-50		150	°C
$t_{R(SUP)}$	supply rise time	Power supply rise time			100	ms
$V_{BAT(LIM)}$ (VBAT 3V)	limiting battery supply voltage	Supply voltage on VBAT3V in a buck-con- verter application, pin VBAT1V is connected to ground	1.8/2.2		3.45	V
$V_{ESD(HBM)}$	electrostatic discharge voltage (Human Body Model)				2 000	V

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
$V_{ESD(MM)}$	electrostatic discharge voltage (Machine Model)				175	V
$V_{ESD(CDM)}$	electrostatic discharge voltage (Charged Device Model)				500	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	Description	Conditions	Min.	Typ.	Max.	Unit
$V_{BAT}(VBAT3V)$	battery supply voltage	Supply voltage on VBAT3V in a buck-con- verter application, pin VBAT1V is connected to ground	2.35		3.3	V
$V_{PIN}(default)$	voltage on a pin	Voltage between GND and VBAT3V	0		3.3	V
T_A	ambient temperature		-40		85	°C
VPP	programming voltage	Supply voltage on pin VPP during OTP programming	6.55	6.8	7.05	V

4.4 DC Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Unit
$I_{BAT}(DP\_SLP)\_$ BUCK_1kB	battery supply current	Typical buck-application in deep-sleep with 1kB retention RAM active. VBAT3V = 3 V, running from RC32K oscillator at lowest frequency		0.4		µA
$I_{BAT}(DP\_SLP)\_$ BUCK_2kB	battery supply current	Typical buck-application in deep-sleep with 2kB retention RAM active. VBAT3V = 3 V (Note 3)		0.45		µA
$I_{BAT}(DP\_SLP)\_$ BUCK_8kB	battery supply current	Typical buck-application in deep-sleep with 8kB retention RAM active. VBAT3V = 3 V		0.6		µA

Symbol	Description	Conditions	Min.	Typ.	Max.	Unit
$I_{BAT}(EXT\_SLP)\_BUCK\_43KB$	battery supply current	Typical buck-application in extended-sleep mode with 42 kB (SysRAM) and 1 kB (RetRAM) retained		1.2		μA
$I_{BAT}(EXT\_SLP)\_BUCK\_50kB$	battery supply current	Typical buck-application in extended-sleep mode with 42 kB (SysRAM) and 8 kB (RetRAM) retained		1.4		μA
$I_{BAT}(ACT\_RX)\_BUCK$	battery supply current	Typical application with buck converter and receiver active, VBAT3V = 3.0 V		5.1		mA
$I_{BAT}(ACT\_TX)\_BUCK$	battery supply current	Typical application with buck converter and transmitter active, VBAT3V = 3.0 V		4.8		mA
$P_{BAT}(DP\_SLP)\_BUCK\_1kB$	battery power consumption	Typical boost-application in deep-sleep with 1 kB retention RAM active, running from RC32K oscillator		1.2		μW
$P_{BAT}(ACT\_RX)\_BUCK$	battery power consumption	Typical application with buck converter, receive mode		15.5		mW
$P_{BAT}(ACT\_TX)\_BUCK$	battery power consumption	Typical application with buck converter, transmit mode		14.3		mW

4.5 MHz Crystal Oscillator: Timing Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Unit
$t_{STA(XTAL)}(16M)$	crystal oscillator startup time		0.5	2	3	ms

4.6 32 kHz Crystal Oscillator: Timing Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Unit
$t_{STA(XTAL)}(32k)$	crystal oscillator startup time	Typical application, time until 1 000 clocks are detected		0.4		s

4.7 DC-DC Converter: DC Characteristics

Symbol	Description	Conditions	Min.	Typ.	Max.	Unit
$V_O(BUCK)$	output voltage	default settings		1.41		V

Symbol	Description	Conditions	Min.	Typ.	Max.	Unit
η_{CONV_MAX} (BUCK)	maximum conversion efficiency			86		%
$\Delta V_O/$ ΔV_I(BUCK)	line regulation	2.35 V < VBAT3V < 3.3 V	-2	0.7	2	%/V
$\Delta V_O/$ ΔI_L(BUCK)	load regulation	VBAT3V = 2.5 V	-0.2	-0.02	0.2	%/mA
V_{RPL}(BUCK)	ripple voltage	buck mode; RMS ripple voltage		5		mV

4.8 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	• Freq.: 10~50 Hz; Amplitude: 1.5 mm; 20 min./cycle, 1 hrs. each of XYZ axis • Freq.: 30~100 Hz, 6G; 20 min./cycle, 1 hrs. each of XYZ axis
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 temp. test	See above	+85 °C, 300 h

4.9 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
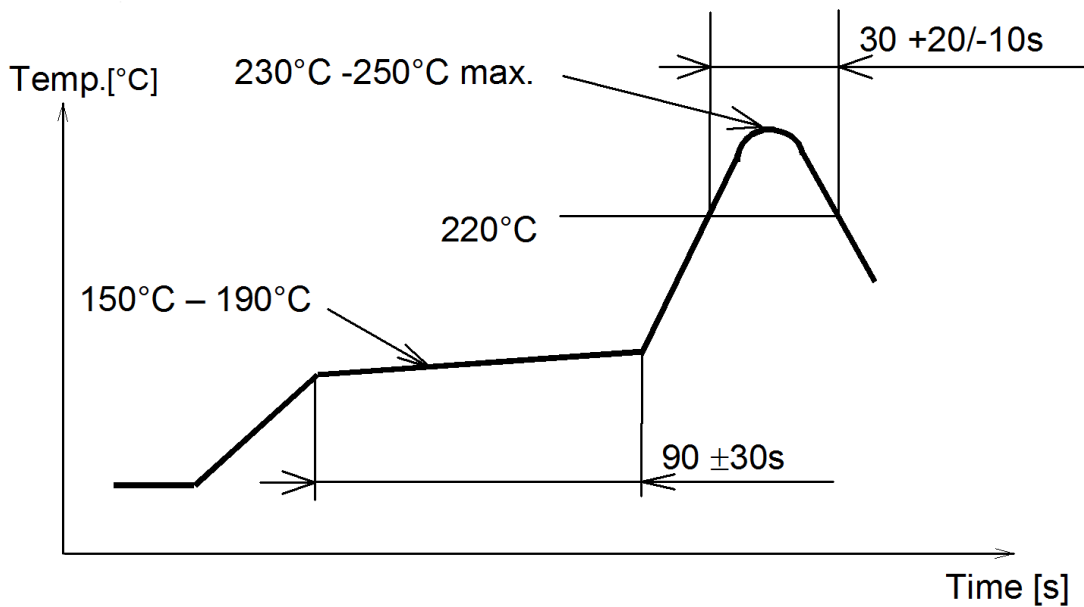
5   Cautions

> ⚠ 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 µF 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 ⇨ 4.9 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 befor 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_2, H_2S, NH_3, SO_2, or NOX,

    –   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, Cl2, SO2, H2S, NH3, and NOX).

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.

6 Regulatory and Certification Information

6.1 Federal Communications Commission (FCC) for US

6.1.1 FCC Notice

> The PAN1740 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.

However, 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

6.1.3 Label Requirements

> The OEM must ensure that FCC labelling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Panasonic FCC identifier for this product as well as the FCC Notice above.
>
> The FCC identifier is **FCC ID: T7V1740**.

This FCC identifier is valid for the PAN1740. The end product must in any case be labelled on the exterior with:

"Contains FCC ID: T7V1740"

6.1.4 Antenna Warning

This antenna warning refers to the test device with the model number PAN1740 ⇨ Chapter 7.1 Ordering Information

The device is tested with a standard SMA connector and with the antenna listed below. When integrated into the OEM's product, these fixed antennas require installation preventing end users from replacing them with non-approved antennas. Any antenna not in the following table must be tested to comply with FCC Section 15.203 for unique antenna connectors and with Section 15.247 for emissions. The FCC identifier for the device with the antenna listed in ⇨ 6.1.5 Approved Antenna List is the same **(FCC ID: T7V1740)**.

6.1.5 Approved Antenna List

Item	Part Number	Manufacturer	Frequency Band	Type	Gain (dBi)
1	LDA212G3110K	Murata	2.4 GHz	Chip antenna	+0.9
2	ANT2012	Yageo	2.4GHz	Chip-Antenna	+0.9

6.1.6 RF Exposure

> ⓘ To comply with FCC RF Exposure requirements, the OEM must ensure that only antennas from the Approved Antenna List are installed ⇨ 6.1.5 Approved Antenna List.
>
> The preceding statement must be included as a CAUTION statement in manuals for products operating with the approved antennas in the previous table to alert users on FCC RF Exposure compliance.
>
> Any notification to the end user of installation or removal instructions about the integrated radio module is not allowed.
>
> The radiated output power of the PAN1740 with a mounted ceramic antenna **(FCC ID: T7V1740)** is below the FCC radio frequency exposure limits. Nevertheless, the PAN1740 shall be used in such a manner that the potential for human contact during normal operation is minimized.
>
> End users may not be provided with the module installation instructions. OEM integrators and end users must be provided with transmitter operating conditions for satisfying RF exposure compliance.

6.2 Industry Canada Certification

English

The PAN1740 is licensed to meet the regulatory requirements of Industry Canada (IC).

License ID: **IC: 216Q-1740**

Manufacturers of mobile, fixed or portable devices incorporating this module are advised to clarify any regulatory questions and ensure compliance for SAR and/or RF exposure limits. Users can obtain Canadian information on RF exposure and compliance from www.ic.gc.ca.

This device has been designed to operate with the antennas listed in ⇨ 6.1.5 Approved Antenna List, having a maximum gain of +0.9 dBi. Antennas not included in this list or having a gain greater than +0.9 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms. The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Due to the model size, the IC identifier is displayed in the installation instruction only and it cannot be displayed on the module's label due to the limited size (8.7 x 15.6 mm).

French

PAN1740 est garanti conforme aux dispositions règlementaires d'Industry Canada (IC).

License: **IC: 216Q-1740**

Il est recommandé aux fabricants d'appareils fixes, mobiles ou portables de consulter la réglementation en vigueur et de vérifier la conformité de leurs produits relativement aux limites d'exposition aux rayonnements radiofréquence ainsi qu'au débit d'absorption spécifique maximum autorisé.

Des informations pour les utilisateurs sur la réglementation Canadienne concernant l'exposition aux rayonnements RF sont disponibles sur le site www.ic.gc.ca.

Ce produit a été développé pour fonctionner spécifiquement avec les antennes listées dans le tableau ⇨ 6.1.5 Approved Antenna List, présentant un gain maximum de 0.9 dBi. Des antennes autres que celles listées ici, ou présentant un gain supérieur à 0.9 dBi ne doivent en aucune circonstance être utilisées en combinaison avec ce produit. L'impédance des antennes compatibles est 50 Ohm. L'antenne utilisée avec ce produit ne doit ni être située à proximité d'une autre antenne ou d'un autre émetteur, ni être utilisée conjointement avec une autre antenne ou un autre émetteur.

En raison de la taille du produit, l'identifiant IC est fourni dans le manuel d'installation.

6.2.1   IC Notice

English

The device PAN1740 (⇨ 7.1 Ordering Information), including the antennas (⇨ 6.1.5 Approved Antenna List), complies with Canada RSS-GEN Rules. The device meets the requirements for modular transmitter approval as detailed in RSS-Gen.

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.

French

Le présent appareil PAN1740 (⇨ 7.1 Ordering Information), les antennes y compris (⇨ 6.1.5 Approved Antenna List), est conforme aux CNR-Gen d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage, et

2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

6.2.2 Labeling Requirements

English

Labeling Requirements

The OEM must ensure that IC labelling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Panasonic IC identifier for this product as well as the IC Notice above.

The IC identifier is:

IC: 216Q-1740

This IC identifier is valid for all PAN1740 modules ⇨ 7.1 Ordering Information. In any case, the end product must be labelled on the exterior with:

"Contains IC: 216Q-1740".

French

Obligations d'étiquetage

Les fabricants d'équipements d'origine (FEO) – en anglais Original Equipment Manufacturer (OEM) – doivent s'assurer que les obligations d'étiquetage IC du produit final sont remplies. Ces obligations incluent une étiquette clairement visible à l'extérieur de l'emballage externe, comportant l'identifiant IC du module Panasonic inclus, ainsi que la notification ci-dessus.

L' identifiant IC est:

IC: 216Q-1740

Cet identifiant est valide pour tous les modules PAN1740 ⇨ 7.1 Ordering Information. Dans tous les cas les produits finaux doivent indiquer sur leur emballage externe la mention suivante:

"Contient IC: 216Q-1740".

6.3 Japanese Radio Law Compliance

This device is granted pursuant to the Japanese Radio Law (電波法).

This device should not be modified (otherwise the granted designation number will become invalid).

The MIC ID is: [R]202-SMF099

6.4 European Conformity According to RED (2014/53/EU)

All modules described in this Product Specification comply with the standards according to the following LVD (2014/35/EU), EMC-D (2014/30/EU) together with the RED (2014/53/EU) articles:

3.1a Safety/Health:	EN60950-1:2006+A11:2009+A1:2010+A12:2011+AC:2011+A2:2013
	EN62311:2008
3.1b EMC:	EN 301 489-1 V2.1.1:2017-02
	EN 301 489-17 V3.1.1:2017-02
3.2 Radio:	EN 300 328 V2.1.1:2016-11

As a result of the conformity assessment procedure described in the 2014/53/EU Directive, the end customer equipment should be labelled as follows:

$$C\,E$$

PAN1740 in the specified reference design can be used in all countries of the European Economic Area (Member States of the EU, European Free Trade Association States [Iceland, Liechtenstein, Norway]), Monaco, San Marino, Andorra and Turkey.

6.5 Bluetooth

The final Bluetooth product needs to be created by using the following IDs:

	QDID	Declaration ID
Controller Subsystem	50800	B021655
Profile Subsystem	51591	B021941
Host SubSystem	51910	B021835

6.6 RoHS and REACH Declaration

The latest declaration of environmental compatibility (RoHS and REACH) for supplied products can be found on the Panasonic website in the "Downloads" section of the respective product ⇨ 7.2.2 Product Information.

7 Appendix

7.1 Ordering Information

Variants and Versions

Order Number	Brand Name	Description	MOQ[3]
ENW89846A1KF[4]	PAN1740	PAN1740 Bluetooth Low Energy Module	1 500

Evaluation Tools[5]

Order Number	Tool Name	Content	MOQ[3]
ENW89846AYKF	PAN1740 Kit	2 x USB-Stick	1
ENW89846AZKF	PAN1740 ETU	1x USB-Stick	1
ENW89849A1KF	PAN1740 Beacon w/o connector	1x Beacon (without Connector)	T&R: 150 loose: 1
ENW89849AZKF	PAN1740 Beacon w Connector	1x Beacon (with Connector)	T&R: 150 loose: 1
ENW89849AYKF	PAN1740 Experimenter Kit	5x Beacon (with Connector), 1x Dialog Pro Kit, 1x Adapter board for flat cable, 1x flat cable	1
ENW89846AWKF	PAN1740 Daughterboard	1x PAN1740 Daughter board	1
ENW89846AVKF	PAN1740 Dialog Pro Kit	1x Dialog Pro Kit (Motherboard), 3x PAN1740 Daughter board, 1x USB-Stick, 1x USB-Cable, Battery	1

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[3] 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.

[4] Samples are available on customer demand.

[5] For further information please visit our website (see 7.2.2).

7.2 Contact Details

7.2.1 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

For Panasonic Sales assistance in **North America**, visit the Panasonic Sales & Support Tool 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

7.2.2 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

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