

Not Recommended for New Design: Various Bluetooth® RF Modules and Evaluation Kits

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About This Notice:	Please be advised that the following Panasonic Bluetooth RF Module Series are now designated as Not Recommended For New Design: PAN1760, PAN13x7, PAN13x6, PAN1323, PAN13x5A/B, PAN1x55.
Features:	Due to fast-paced technological improvements and limited market demand for the PAN1760, PAN13x7, PAN13x6, PAN1323, PAN13x5A/B and PAN1x55 Series, these parts are now designated as Not Recommended For New Design. For suggested replacements, please see attachment.
Effective Date:	Immediate
Affected Parts and/or Replacements:	See attached.
Datasheet(s):	See attached.
Notes:	Panasonic's policy and commitment to our customers as an RF Module manufacturer is to continue producing part numbers, or their direct replacements, for as long as there is demand in production volumes.

CLASSIFICATION	PRODUCT SPECIFICATION	No. DS-1760-2400-102	REV. 1.2
SUBJECT	CLASS 2 BLUETOOTH LOW ENERGY SINGLE MODE MODULE	PAGE	1 of 28
CUSTOMER'S CODE PAN1760	PANASONIC'S CODE ENW89847A1KF	DATE	20.06.2017

Product Specification

Applicant/Manufacturer Panasonic Industrial Devices Europe GmbH

Hardware Zeppelinstrasse 19
 21337 Lüneburg
 Germany

Applicant/Manufacturer Toshiba

Software

Software Version Please refer to chapter 21

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 without notification.

Power Electronics R&D Center Wireless Connectivity Panasonic Industrial Devices Europe GmbH	APPROVED genehmigt	CHECKED geprüft	DESIGNED erstellt
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1. SCOPE OF THIS DOCUMENT

This Product Specification applies to Panasonic's Class 2 Bluetooth®¹ low energy single mode module, series number: PAN1760.

2. KEY FEATURES

- Same form factor and footprint as PAN1026
- Bluetooth 4.0 (LE) embedded GATT profile with high level API commands, compatible to Toshiba reference BLE profiles
- Surface mount type 15.6 x 8.7 x 1.8 mm³
- Tx power 0 dBm, Rx sensitivity -90 dBm
- Compliant to BT 4.0 (extension to 4.1 under development)
- 32kB on-chip RAM for application software and driver
- 512kBit eeprom to download user program during start up
- Operation with external host or as host-less (stand alone)
- Standard SIG BLE and "SPP over BLE" profiles available
- Temperature Range from -40°C to +85°C
- 2 UART, I2C , SPI, GPIO (10 in/out), Wake-Up control pins, ADC(4 CH)

3. BLUETOOTH

The Bluetooth® SIG specifies two types of implementation: Bluetooth® Low Energy (LE) and Bluetooth® Basic Datarate (BR). Bluetooth low energy specification consumes just a fraction of the power of Basic Datarate devices, allowing the short-range wireless standard to extend to coin cell battery applications.

Note:

"The Bluetooth® word mark and logos are registered trademarks owned by the Bluetooth SIG, Inc. and any use of such marks by Panasonic is under license. Other trademarks and trade names are those of their respective owners."

4. APPLICATIONS FOR THE MODULE

- All Embedded Wireless Applications
- Wearable Devices
- Health Care, Medical Diagnostic Systems
- Mobile phone accessories
- Industrial Measurement and Diagnostics
- Devices where Power Consumption is critical

¹ Bluetooth is a registered trademark of the Bluetooth Special Interest Group.

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5. DESCRIPTION OF THE MODULE

The PAN1760 is a short-range, Class 2, BLE single mode module for implementing Bluetooth functionality into various electronic devices. A block diagram can be found in chapter 7.

The PAN1760 is a cost-effective, low-power, true system-on-chip (SoC) for Bluetooth low energy applications. It enables robust BLE central and peripheral nodes to be built with very low total bill-of-material costs. The PAN1760 combines an excellent RF transceiver programmable EEPROM memory, 32-KB RAM, and many other powerful supporting features and peripherals. The PAN1760 is suitable for systems where very low power consumption is required. Very low-power sleep modes are available. Short transition times between operating modes further enable low power consumption.

Panasonic PAN1760 offers an embedded and certified Bluetooth low energy protocol stack and BLE GATT profile inside the silicon device from Toshiba. The Bluetooth low energy protocol stack from Toshiba is a flexible and cost-effective single-mode Bluetooth low energy solution. Standard BLE or proprietary profiles are available for seamless integration into the application code.

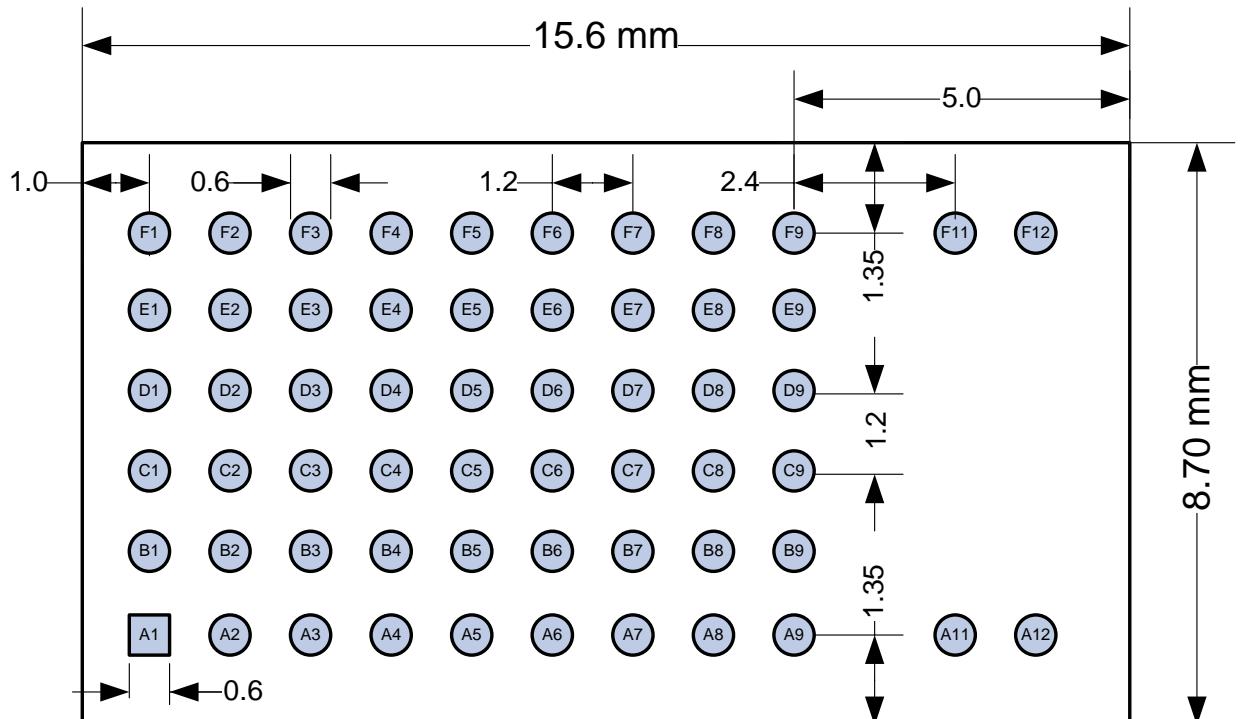
Please contact your local sales office for further details on additional options and services:

www.panasonic.com/rfmodules for the US,
http://industrial.panasonic.com/eu/i/29606/wireless_modules/wireless_modules.html for EU,
or write an e-mail to wireless@eu.panasonic.com.

6. DETAILED DESCRIPTION

6.1. PAN1760 TERMINAL LAYOUT

Top View, Application PCB

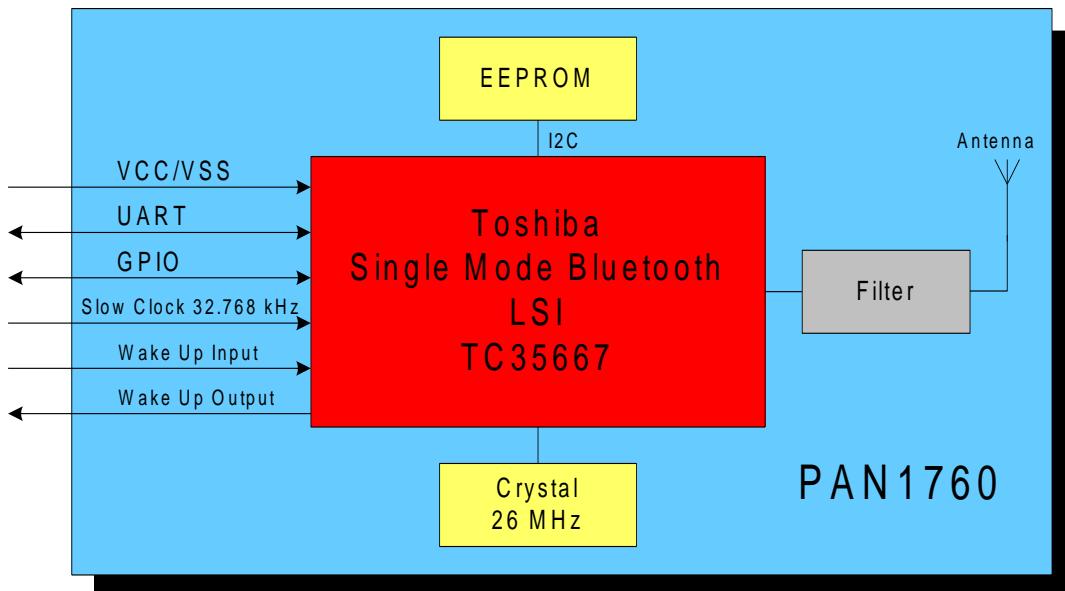


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No	PIN Name	Alternative PIN	Pin Type	Description
A1	GND		Ground Pin	Connect to Ground
A2	NC			Not Connected
A3	Reset		Digital Input	Reset, active-low
A4	VCC		Power	2V – 3.6V analog/digital power supply connection
A5	VCC		Power	2V – 3.6V analog/digital power supply connection
A6	VCC		Power	2V – 3.6V analog/digital power supply connection
A7	GND		Ground Pin	Connect to Ground
A8	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			Not Connected
B2	GPIO14		Digital I/O	
B3	GPIO11		Digital I/O	
B4	NC			Not Connected
B5	NC			Not Connected
B6	NC			Not Connected
B7	NC			Not Connected
B8	NC			Not Connected
B9	NC			Not Connected
C1	NC			Not Connected
C2	GPIO15	AIN2	Digital I/O	
C3	GPIO12		Digital I/O	
C4	NC			Not Connected
C5	NC			Not Connected
C6	GPIO9	PWM1	Digital I/O	
C7	GPIO10	PWM2	Digital I/O	
C8	GND		Ground Pin	Connect to Ground
C9	GND		Ground Pin	Connect to Ground
D1	NC			Not Connected
D2	NC			Not Connected
D3	GPIO1	AIN0	Digital I/O	
D4	Wakeup	GPIO0	Digital I/O	
D5	NC			Not Connected
D6	GPIO13		Digital I/O	
D7	GND		Ground Pin	Connect to Ground
D8	GND		Ground Pin	Connect to Ground
D9	NC			PAN1760 Not Connected/Placeholder for Antenna
E1	GPIO8	SDA	Digital I/O	Connected to internal EEPROM
E2	GPIO7	SCL	Digital I/O	Connected to internal EEPROM
E3	NC			Not Connected
E4	NC			Not Connected
E5	SLPXOIN		Clock In	32.768 KHz sleep clock input
E6	UART_RXD	GPIO4	Digital In	
E7	GPIO2	PWM0/AIN1	Digital I/O	
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 In	EEPROM write protect /active low
F3	NC			Not Connected
F4	NC			Not Connected
F5	GPIO6	UART_1-CTS/ UART2-RX	Digital In	Can be configured to UART2_RXD
F6	SLPXOOUT		Clock Out	32.768 KHz sleep clock output
F7	UART_TXD	GPIO3	Digital Out	
F8	GPIO5	UART1_RTS/ UART2-TX	Digital I/O	Can be configured to UART2_TXD
F9	GND		Ground Pin	Connect to Ground
F11	GND		Ground Pin	Connect to Ground
F12	GND		Ground Pin	Connect to Ground

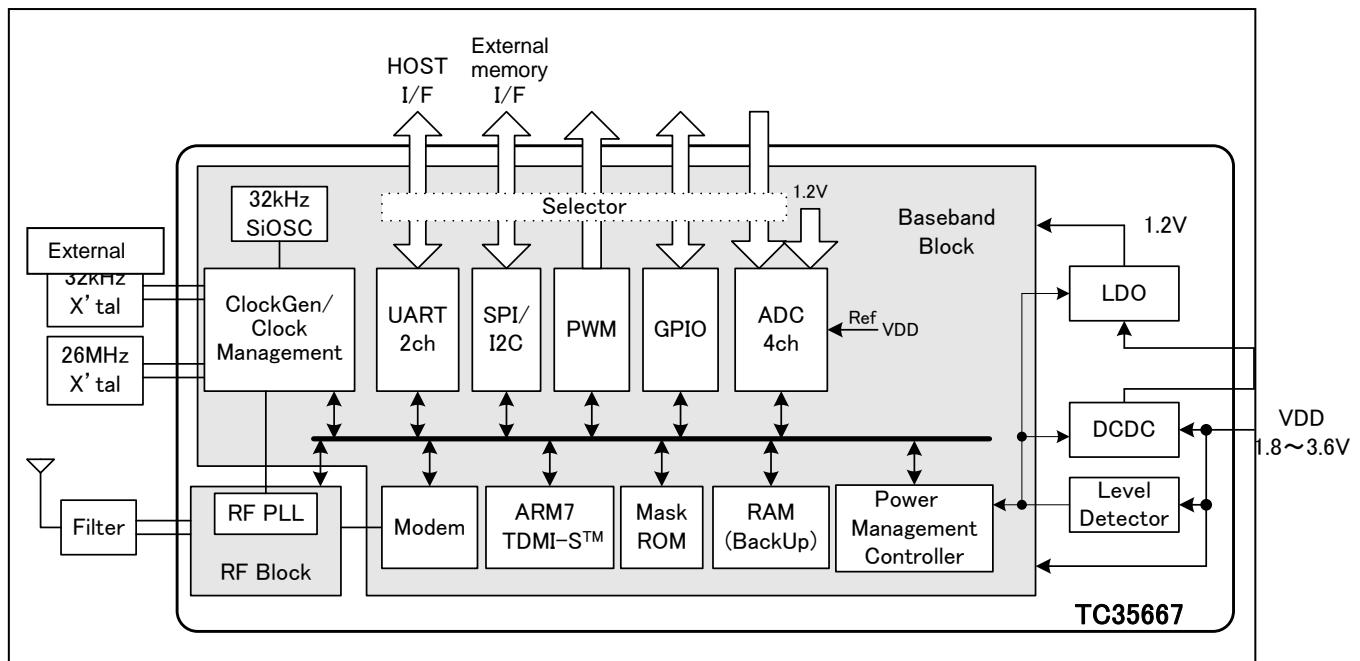
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7. PAN1760 BLOCK DIAGRAM



7.1. ENW89847A2KF

This model version does not contain an EEPROM. There is no Panasonic IEEE MAC address in the module. This version cannot be used for stand-alone operation until there will be connected an external memory.



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8. GPIO FUNCTION LIST

GPIO pins are assigned to UART or serial memory. Please refer to the firmware specification for further details.

Pin	Analog input	Function 1	Function 2	Function 3	Function 4	Function 5
GPIO0	-	GPIO1 Digital I/O	WakeUp Input	-	-	-
GPIO1	ADC0 Input	GPIO Digital I/O	-	-	-	-
GPIO2	ADC1 Input	GPIO Digital I/O	PWM0 Output	-	-	-
GPIO3_TEST	-	GPIO Digital I/O	UART1-TX Output	-	SPI-DOUT Output	UART2-TX Output
GPIO4	-	GPIO Digital I/O	UART1-RX Input	-	SPI-DIN Input	UART2-RX Input
GPIO5_Bmode	-	GPIO Digital I/O	UART1-RTSX Output	UART2-TX Output	SPI-SCS Output	UART1-TX Output
GPIO6	-	GPIO Digital I/O	UART1-CTSX Input	UART2-RX Input	SPI-SCLK Output	UART1-RX Input
GPIO7	-	GPIO Digital I/O	-	I2C-SCL Output	SPI-DOUT Output	-
GPIO8	-	GPIO Digital I/O	-	I2C-SDA I/O	SPI-DIN Input	-
GPIO9	-	GPIO Digital I/O	PWM1 Output	I2C-SCL Output	-	-
GPIO10	-	GPIO Digital I/O	PWM2 Output	I2C-SDA I/O	-	-
GPIO11~14	-	GPIO Digital I/O	-	-	-	-
GPIO15	ADC2 Input	GPIO Digital I/O	-	-	-	-

Pin name	Basic example	Example of UART1 + UART2 + I2C	Example of SPI + I2C	Example of UART + SPI + I2C
GPIO0	Wake Up	Wake Up	Wake Up	Wake Up
GPIO1	ADC-AIN0	ADC-AIN0	ADC-AIN0	ADC-AIN0
GPIO2	ADC-AIN1 / PWM0	ADC-AIN1 / PWM0	ADC-AIN1 / PWM0	ADC-AIN1 / PWM0
GPIO3	UART1-TX	UART1-TX	SPI-DOUT	UART1-TX
GPIO4	UART1-RX	UART1-RX	SPI-DIN	UART1-RX
GPIO5	UART1- RTSX	UART2-TX	SPI-SCS	SPI-SCS
GPIO6	UART1- CTSX	UART2-RX	SPI-SCLK	SPI-SCLK
GPIO7	I2C-SCL	I2C-SCL	I2C-SCL	SPI-DOUT
GPIO8	I2C-SDA	I2C-SDA	I2C-SDA	SPI-DIN
GPIO9	PWM1	PWM1	PWM1	I2C-SCL
GPIO10	PWM2	PWM2	PWM2	I2C-SDA
GPIO11-14	-	-	-	-
GPIO15	ADC-AIN2	ADC-AIN2	ADC-AIN2	ADC-AIN2

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9. Test Conditions

Measurements shall be made under operating free-air temperature range unless otherwise specified.

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

10. GENERAL DEVICE REQUIREMENTS AND OPERATION

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

10.1. ABSOLUTE MAXIMUM RATINGS

No	See ²	Value	Unit
Ratings Over Operating Free-Air Temperature Range			
1	Voltage on any digital pin	-0.3 to VDD+0.3	V
2	Operating ambient temperature range	-40 to 85	°C
3	Storage temperature range	-40 to 125	°C
4	Bluetooth RF inputs	10	dBm
5	ESD: All pads, according to human-body model, JEDEC STD 22, method A114 According to charged-device model, JEDEC STD 22, method C101	1000 500	V

10.2. RECOMMENDED OPERATING CONDITIONS

No	Rating	Min	Typ	Max	Unit
1	Power supply voltage	2.0	3.3	3.6	V
2	Maximum ambient operating temperature	-40		85	°C

² Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

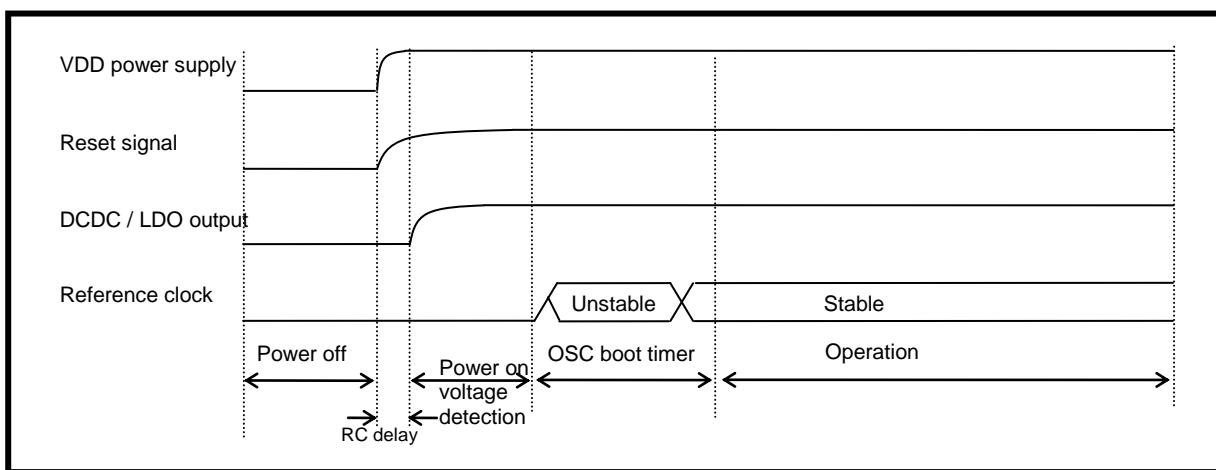
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10.3. POWER UP SEQUENCE

When the power is turned on, set reset signal to low (RESET=Low). After OSC is stable, release reset (RESET=High).

Crystal oscillator stabilizing time is about 2 msec, so define release time after sufficient evaluation.

When the power is turned off, set reset signal to low (RESET=Low).



10.4. PAN1760 CURRENT CONSUMPTION

The current consumption is dependent on the user scenario and the setup and timing in the low power modes. The total power consumption can be optimized by adjusting advertising and connection intervals. It also depends on the system configuration of the central device (typically mobile phone or BLE hub).

11. BLUETOOTH RF PERFORMANCE

11.1. PAN1760 BLUETOOTH CHARACTERISTICS

No	Characteristics	Condition	Min	Typ	Max	Unit
1	Operation frequency range		2402		2480	MHz
2	Channel spacing			2		MHz
3	Output Power	Maximum setting, measured at single ended 50ohm.		0		dBm
4	Sensitivity, High Gain Mode	High-gain mode, measured at single ended 50ohm.		-90.0		dBm

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12. SOLDERING TEMPERATURE-TIME PROFILE (FOR REFLOW SOLDERING)

12.1. FOR LEAD SOLDER

Recommended temp. profile for reflow soldering

Temp.[°C]

235°C max.

150 ±10°C

220 ±5°C
200°C

30 +20/-10s

90 ±30s

Time [s]

12.2. FOR LEADFREE SOLDER

Our used temp. profile for reflow soldering

Temp.[°C]

230°C -250°C max.

150°C – 190°C

220°C

30 +20/-10s

90 ±30s

Time [s]

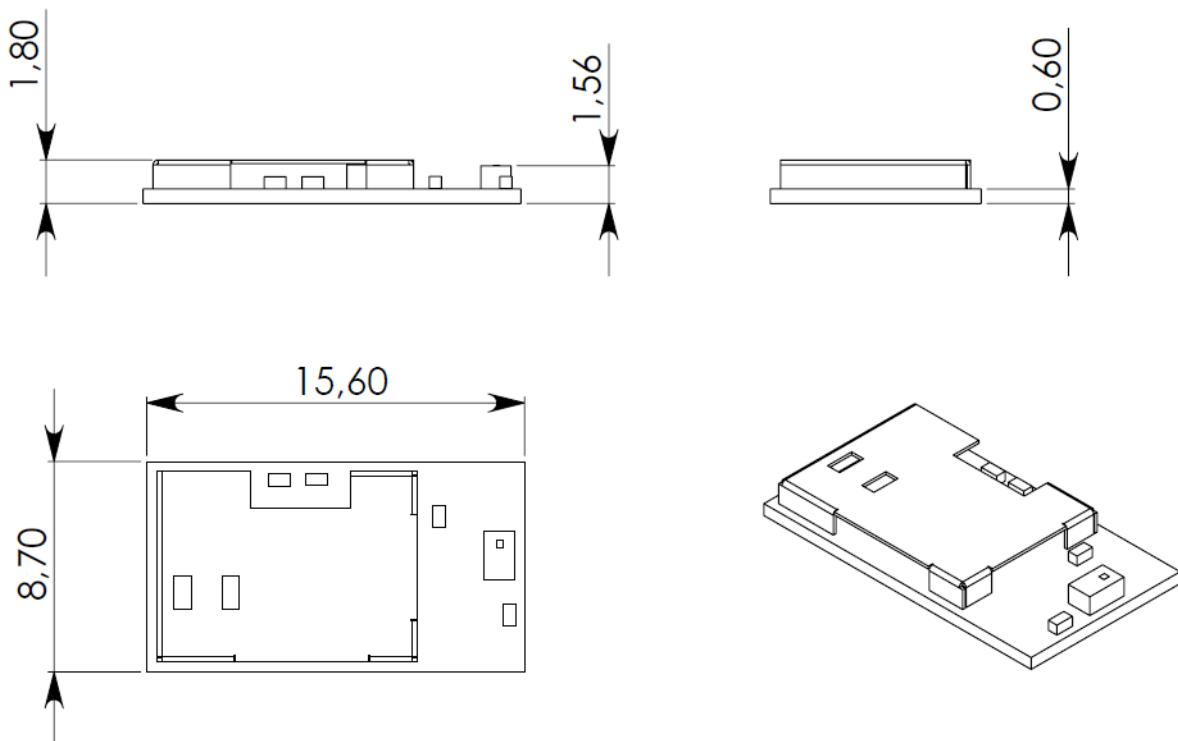
Reflow permissible cycle: 2

Opposite side reflow is prohibited due to module weight.

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13. PAN1760 MODULE DIMENSION

No.	Item	Dimension	Tolerance	Remark
1	Width	8.70	± 0.30	
2	Length	15.60	± 0.30	
3	Height	1.80	± 0.20	With case



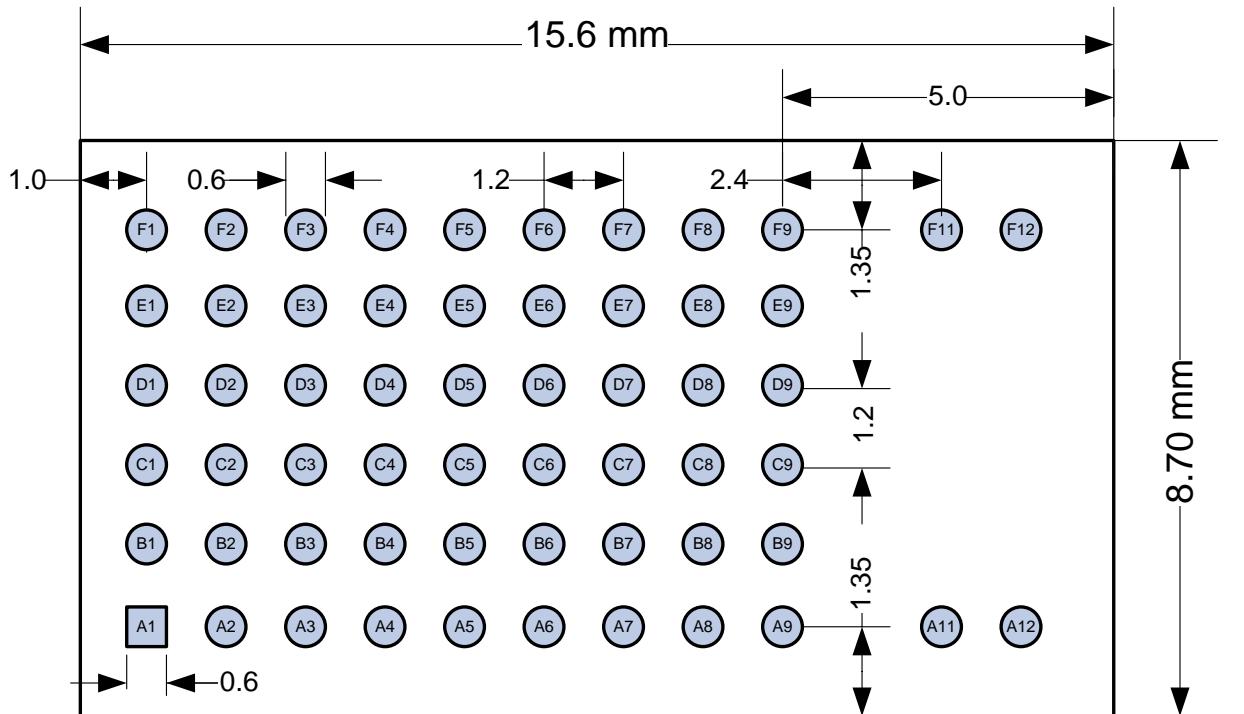
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14. PAN1760 FOOTPRINT OF THE MODULE

All dimensions are in millimeters.

The outer dimensions have a tolerance of $\pm 0.3\text{mm}$.

Top view, Application PCB



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15. CASE MARKING



No.	Remark
1	Marking for Pin 1 (Circle 0,15 mm)
2	2D-Code, for internal usage only and can be change without any notice
3	Marking definition see below

15.1. EXAMPLE FOR MARKING

P	A	N	1	7	6	0			H	W	/	S	W			
E	N	W	8	9	8	4	7	A	x	K	F					
Y	Y	W	W	D	L	L										
F	C	C	I	D	:		T	7	V	1	7	6	0			
I	C	:	Q	2	1	6	-	1	7	6	0					

15.2. MARKING DEFINITION

- (1) Pin1 marking
- (2) 2D code (Serial number)
- (3) Marking:

- PAN1760 (Model Name), HW/SW (Hardware/Software version)
- ENW89847A1KF (Part Number, refer to chapter 21 Ordering Information)
- Lot code (YearYear, WeekWeek, Day, LotLot)
- ES (Engineering Sample marking)

Note: For available Software Versions, refer to [1] PAN1760ETU Design-Guide and chapter 21 Ordering Information.

16. MECHANICAL REQUIREMENTS

No.	Item	Limit	Condition
1	Solderability	More than 75% of the soldering area shall be coated by solder	Reflow soldering with recommendable temperature profile
2	Resistance to soldering heat	It shall be satisfied electrical requirements and not be mechanical damage	See chapter 12.2

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17. DEVELOPMENT OF APPLICATIONS

For development support please refer to [1] PAN1760ETU Design-Guide.

18. RELIABILITY TESTS

The measurement should be done after being exposed to room temperature and humidity for 1 hour.

No.	Item	Limit	Condition
1	Vibration test	Electrical parameter should be in specification	a) Freq.:10~50Hz,Amplitude:1.5mm 20min. / cycle,1hrs. each of XYZ axis b) Freq.:30~100Hz, 6G 20min. / cycle,1hrs. each of XYZ axis
2	Shock test	the same as above	Dropped onto hard wood from height of 50cm for 3 times
3	Heat cycle test	the same as above	-40°C for 30min. And +85°C for 30min.; each temperature 300 cycles
4	Moisture test	the same as above	+60°C, 90% RH, 300h
5	Low temp. test	the same as above	-40°C, 300h
6	High temp. test	the same as above	+85°C, 300h

19. 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.

19.1. 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.
- (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.

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19.2. INSTALLATION NOTES

- (1) Reflow soldering is possible twice based on the conditions in chapter 15. 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) 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 Arrey) soldering processes refer to the application note.

19.3. USAGE CONDITIONS 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 4.9N 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.

19.4. 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 Cl₂, H₂S, NH₃, SO₂, or NO_x
 - Storage in direct sunlight
 - Storage in an environment where the temperature may be outside the range of 5°C

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to 35°C range, or where the humidity may be outside the 45 to 85% 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).

19.5. 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, 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 single fault causing an unsafe status.

19.6. OTHER CAUTIONS

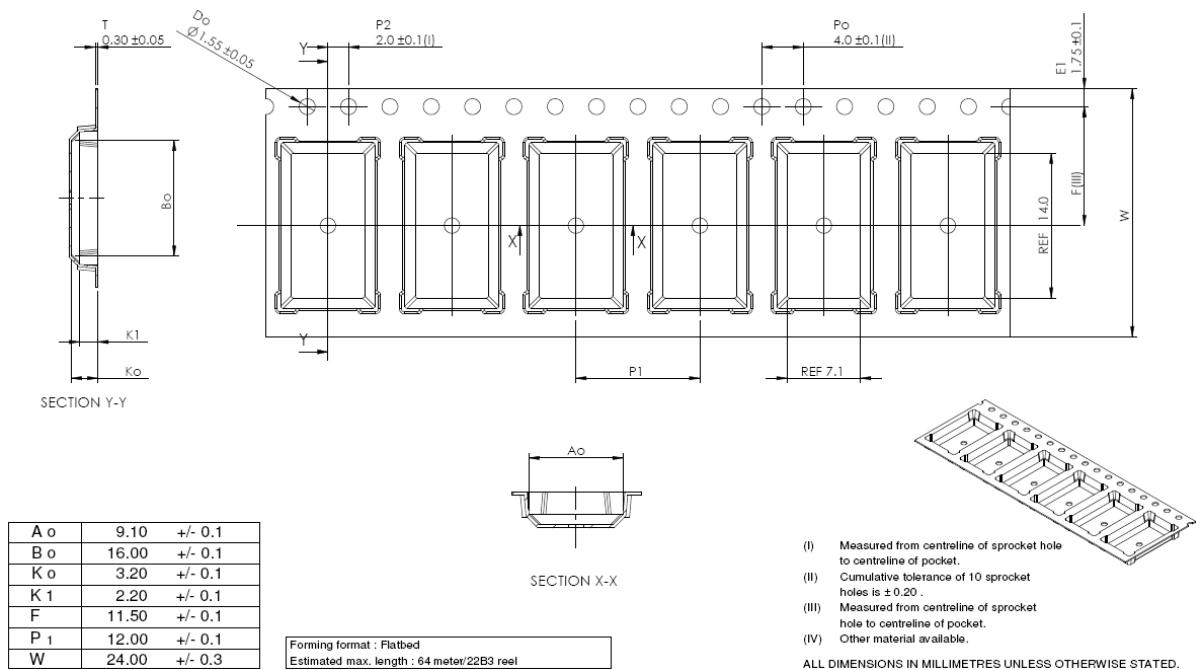
- (1) This specification sheet is copyrighted. Please do not disclose it to a third party.
- (2) Please do not use the products for other purposes than those listed.
- (3) Be sure to provide an appropriate fail-safe function on your product to prevent an additional damage that may be caused by the abnormal 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 (e.g. salty air, HCl, Cl₂, SO₂, H₂S, NH₃, and NO_x)
- (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 Panasonic.

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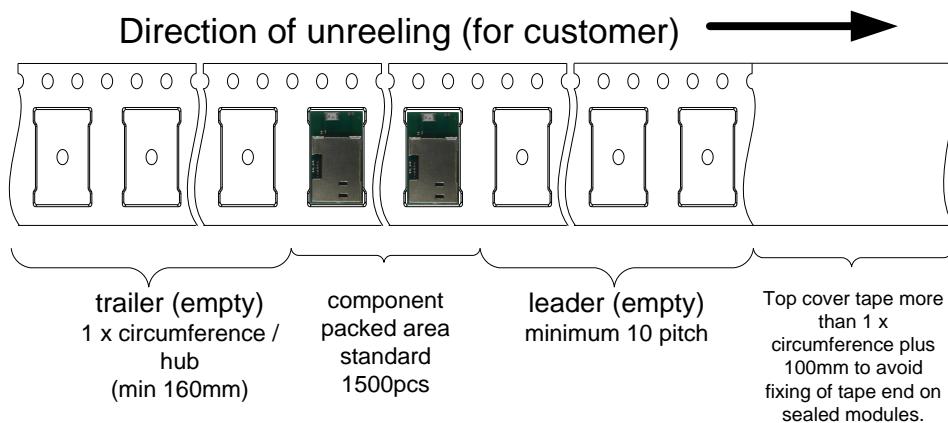
20. PACKAGING

If the product has mass production status, indicated in chapter 23, we will deliver the module in the package which are described below.

20.1. PAN1760 TAPE DIMENSION



20.2. PACKING IN TAPE

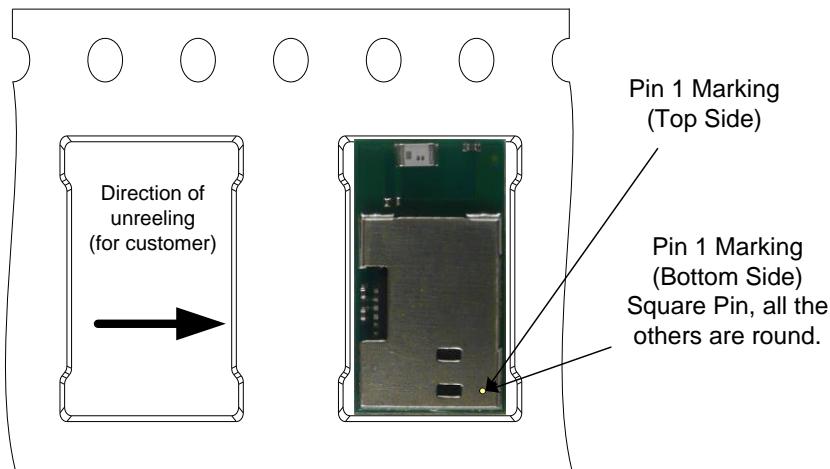


Empty spaces in component packed area shall be less than two per reel and those spaces shall not be consecutive.

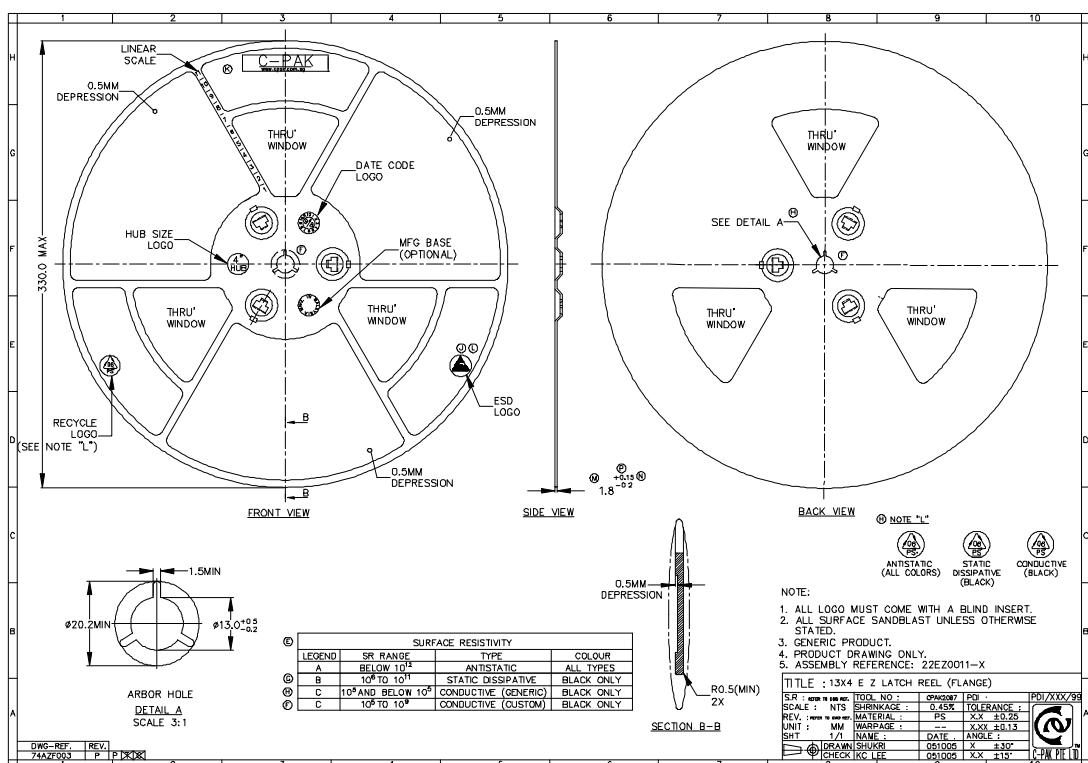
Top cover tape shall not be found on reel holes and shall not stick out from reel.

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20.3. COMPONENT DIRECTION



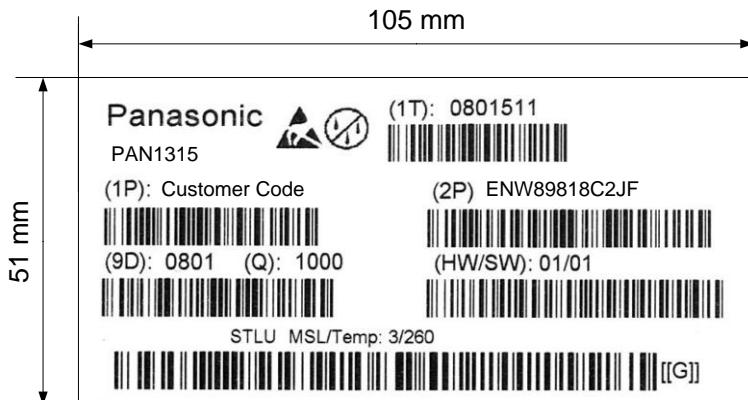
20.4. REEL DIMENSION



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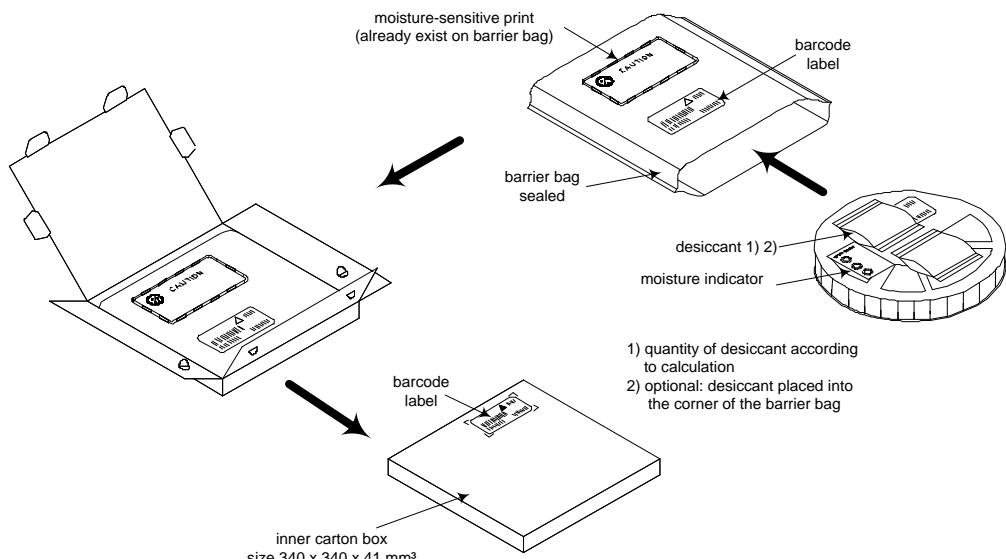
20.5. LABEL FOR PACKAGE

The picture shows an example from similar product.



- | | | |
|---------|---|---|
| (1T) | Lot code [YYWW DLL]
YY year
WW normal calendar week
D day
L line identifier, if more as one
L lot identifier per day | Example from above:
printed 08
printed 01
printed 5 (Friday)
printed 1
printed 1 |
| (1P) | Customer Order Code, if any, otherwise company name will be printed | |
| (2P) | Panasonic Order Code: ENW89847A1KF | |
| (9D) | Date code as [YYWW] | |
| (Q) | Quantity [XXXX], variable max. 1500 | |
| (HW/SW) | Hardware /Software Release
Hardware01 Indicates the HW revision.
Software 01 Indicates the SW revision. | |

20.6. TOTAL PACKAGE



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21. ORDERING INFORMATION

Ordering part number	Description	MOQ <small>Fehler! Verweisquelle konnte nicht gefunden werden.</small>
PAN1760 ENW89847A1KF	CLASS 2 Bluetooth single mode Module according BT-4.1. <i>Bluetooth®</i> smart device Software version 006	1500

Notes:

- 1) Abbreviation for Minimum Order Quantity (MOQ). The standard MOQ for mass production is 1500 pieces, fewer only on customer demand. Samples for evaluation can be delivered at any quantity via the distribution channels.
- 2) Samples are available on customer demand.

22. ROHS AND REACH DECLARATION

Hereby we declare to our best present knowledge based on declaration of our suppliers that this product follows the latest official RoHS and REACH Directive.

[RoHS and REACH Directive](#)

23. PRODUCT SPECIFICATION STATUS

This Product Specification contains the final specification.

Panasonic reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

Please consult the most recently issued Product Specification before initiating or completing a design.

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24. HISTORY FOR THIS DOCUMENT

Revision	Date	Modification / Remarks
0.1	January 2015	1 st preliminary version.
0.2	June 2015	Added IC ID.
0.3	December 2015	Added alternative PINs in PIN table. Added ENW89847A2KF (without EEPROM).
0.4	August 2016	Added Bluetooth QD ID.
1.1	November 2016	Change in sensitivity level and power supply voltage.
1.2	June 2017	Change in the EU regulatory chapter for RED.

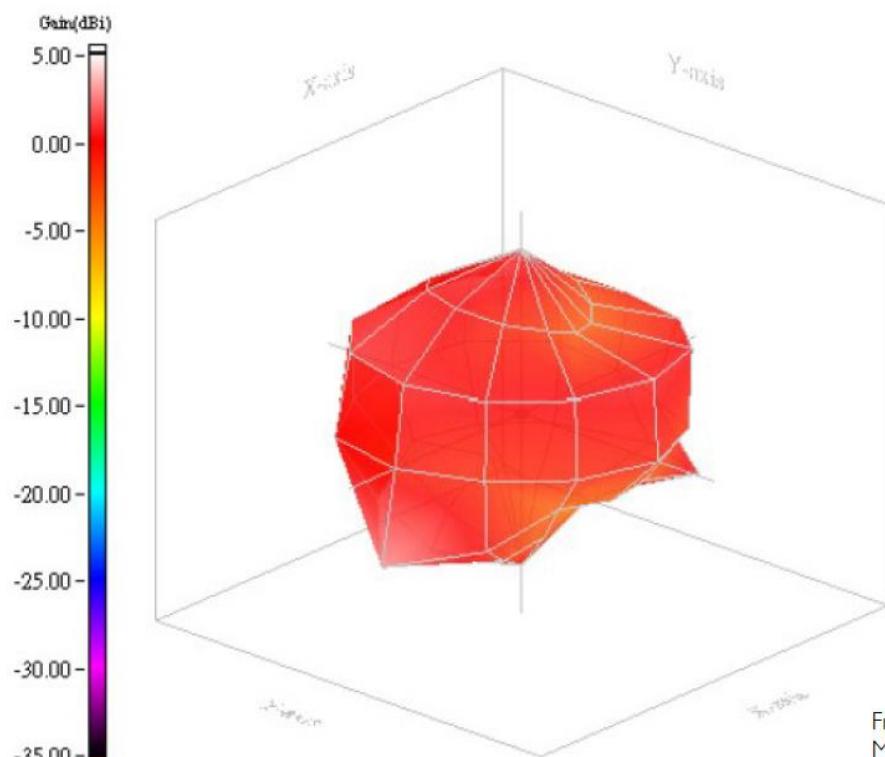
25. RELATED DOCUMENTS

For an update, please consult the relevant website:

- [1] PAN1760ETU Design-Guide
<http://www.pideu.panasonic.de>
- [2] Application Note Land Grid Array
<http://www.pideu.panasonic.de/pdf/184ext.pdf>
- [3] REACH and RoHS Certificate
<http://www.pideu.panasonic.de/pdf/182ext2.jpg>

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26. RADIATION PATTERN OF ANTENNA



Frequency = 2.45 GHz
 Max gain = 2.72dBi, at (120,0)
 MEG (mean effective gain) = -0.69 dBi
 Directivity (dB) = 3.88
 Efficiency = -1.16dB, 76.56 %

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27. GENERAL INFORMATION

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This product description does not lodge the claim to be complete and free of mistakes.

Please contact the related product manager in every case.

If we deliver ES samples to the customer, these samples have the status Engineering Samples. This means, the design of this product is not yet concluded. Engineering Samples may be partially or fully functional, and there may be differences to be published Product Specification. Engineering Samples are not qualified and are not to be used for reliability testing or series production.

Disclaimer:

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 Customer,
- deviation or lapse in function of Engineering Sample,
- improper use of Engineering Samples.

Panasonic disclaims any liability for consequential and incidental damages.

In case of any questions, please contact your local sales partner or the related product manager.

28. REGULATORY INFORMATION

28.1. FCC NOTICE



The devices PAN1760, for details refer to Chapter 21, including the antennas, which are listed in 28.5, 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. 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.

28.2. 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

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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

28.3. LABELING REQUIREMENTS



The Original Equipment Manufacturer (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: T7V1760**. This FCC identifier is valid for all PAN1760 modules, for details, see the Chapter 21. Ordering Information.

In any case the end product must be labelled exterior with "Contains FCC ID: T7V1670"

28.4. ANTENNA WARNING



For the related part number of PAN1760 refer to Chapter 21. Ordering Information.

These devices are tested with a standard SMA connector and with the antennas listed below. When integrated in the OEMs 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 Section 15.247 for emissions. The FCC identifier for this device with the antenna listed in item 1 is the same (FCC ID: T7V1760).

28.5. APPROVED ANTENNA LIST

Note: We are able to qualify your antenna and will add to this list as that process is completed.

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

28.6. RF EXPOSURE PAN1760

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To comply with FCC RF Exposure requirements, the Original Equipment Manufacturer (OEM) must ensure that the approved antenna in the previous table must be installed.

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 PAN1760 with mounted ceramic antenna (**FCC ID: T7V1760**) is far below the FCC radio frequency exposure limits. Nevertheless, the PAN1760 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.

29. INDUSTRY CANADA CERTIFICATION

PAN1760 is licensed to meet the regulatory requirements of Industry Canada (IC), license: IC: 216Q-1760.

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 Table 20 above, 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 cannot be displayed on the modules label due to the limited size (8.7x15.6mm).

29.1. IC NOTICE



The devices PAN1760, for details refer to Chapter 21, including the antennas, which are listed in 28.5, 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.

Le présent appareil est conforme aux CNR 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.

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PAN1760 est garanti conforme aux dispositions réglementaires d'Industry Canada (IC), licences: **IC: 216Q-1760**

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 ci-dessus, présentant un gain maximum de 0.9dBi. Des antennes autres que celles listées ici, ou présentant un gain supérieur à 0.9dBi ne doivent en aucune circonstance être utilisées en combinaison avec ce produit. L'impédance des antennes compatibles est 50Ohm. 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.

29.2. LABELING REQUIREMENTS



The Original Equipment Manufacturer (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 216Q-1760. This IC identifier is valid for all PAN1760 modules, for details, see the Chapter 21. Ordering Information.

In any case the end product must be labelled exterior with "Contains IC: 216Q-1760"

Obligations d'étiquetage

Les fabricants d'équipements (OEM) doivent s'assurer que les obligations d'étiquetage 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.

Les identifiants IC sont: **IC: 216Q-1760**

Ces identifiants sont valides pour tous les modules PAN1760 (Chapter 21. Ordering Information). Dans tous les cas les produits finaux doivent indiquer sur leur emballage externe une des mentions suivantes: "**Contient IC: 216Q-1760**"

30. BLUETOOTH CERTIFICATION

The End Product QD ID is 81039.

Declaration ID is D028290.

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31. 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:



PAN1760 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.

32. LIFE SUPPORT POLICY

This Panasonic 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 for any damages resulting.

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Product Specification

Manufacturer Panasonic Industrial Devices Europe GmbH
 Zeppelinstrasse 19
 21337 Lüneburg
 Germany

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.

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

Power Electronics R&D Center Wireless Connectivity Panasonic Industrial Devices Europe GmbH	APPROVED	CHECKED	DESIGNED
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1 ABOUT THIS DOCUMENT

1.1 PURPOSE

This product specification describes Panasonic's HCI, Class 1.5 , TI based, Bluetooth®¹ modules, series number 13xx.

For detailed family overview that includes part numbers see Chapter 29, Ordering Information.

Non-antenna versions will be referred to as PAN131x, versions with antenna will be referred to as PAN132x in this document.

For information and features on Bluetooth Low Energy 4.0 refer to Chapter 21, for information on ANT refer to Chapter 23.

1.2 REVISION HISTORY

Revision	Date	Modification / Remarks
1.00	04.11.2010	1 st internal Release.
1.01	03.12.2010	Included reference to PAN1325 Application Note. AN-1325-2420-111.pdf.
1.02	10.01.2011	Changed wording in Chapter 31.2 "Industry Canada Certification".
1.03	23.05.2011	Included DOC for PAN1315 series. Included PAN13xx ANT and BLE Addendum Rev1.x.pdf reference. Included Note for IO voltage and MLD_OUT pin.
1.04	02.07.2011	Corrected wording in Chapter 31.3 European Conformity.
1.05	28.10.2011	Including CC2560A silicon PAN1315A HW40 at Chapter 2, Chapter New PAN13x5 and Chapter 0. Deleted ES label in Chapter.
1.06	15.11.2011	Added overview for the core specification and their addendums. Updated front page. Updated Related Documents.
3.00	11.01.2012	Merging PAN13xx documents into this specification and correct some format.
3.10	16.01.2012	Minor mistakes fixed.
3.20	29.05.2012	DoC replaced with revised version.
3.30	11.06.2012	Added triple mode stack Module PAN1323, add PAN1323 to ordering and software information overview, Software Block Diagram added, Bluetooth Inter IC-Sound chapter information added Layout Recommandations with Antenna added, Application Note LGA added
3.31	27.06.2012	Added design information to use low pass filter (chapter 11.1 / 11.9) for better noise suppression when using PCM interface.
3.40	18.07.2012	Re-organize chapter Regulatory Information and added 2 chapters.
3.50	31.10.2012	Changed the Overview in chapter Ordering Information Included -40°C to 85°C Version ENW898xxA2KF. So called K-Version.
3.60	17.05.2013	Changed FCC-ID for models ENW89823xxx and ENW89827xxx.
3.70	31.05.2013	DoC replaced with revised version, updated links.
3.71	15.08.2013	Added component values for low pass filter on PCM interface.
3.80	11.11.2013	Changed CC2567 to CC2564 in chapter ordering information.
3.90	03.12.2013	Included CC2560/4B PAN1325/6B in chapter 2.

¹ Bluetooth is a registered trademark of the Bluetooth Special Interest Group.

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Revision	Date	Modification / Remarks
4.00	19.12.2013	Updated chapter European Conformity.
4.10	10.01.2014	Added chapter 20 Radiation Pattern.
4.20	28.02.2014	Changed chapter Key Features according to EN regulations.
4.3	24.09.2014	Added chapter 27.
4.4	06.11.2014	Added DoC.
4.5	29.04.2015	Removed chapter 27 and updated chapter 8 Block Diagram.
4.6	07.05.2015	Removed Taiwan Regulatory chapter.
4.61	19.05.2015	Deleted Chapter 2.1 Software Blockdiagram.
4.7	11.06.2015	Changed the wording in chapter 8 Block Diagram.
4.8	23.09.2015	Added Japanese radio law requirements for labeling.
4.9	09.03.2017	Added CC2564C in the product description. Added new partnumber.
5.0	14.06.2017	Editorial changes. Added RED declaration. Added Korean certification chapter.
5.1	08.11.2017	Removed PAN13x6C Version => moved to separate product specification

1.3 RELATED DOCUMENTS

For an update, please refer to the the respective homepage.

- [1] PAN1323ETU Design-Guide:
<http://www.panasonic.com/industrial/includes/pdf/PAN1323ETUDesignGuide.pdf>
- [2] CC2560 Product Bulletin: http://focus.ti.com/pdfs/wtbu/cc2560_slyt377.pdf
- [3] Bluetooth SW for MSP430 is supported by IAR IDE service pack 5.10.6 and later. Use full IAR version edition (not the kick-start version). You can find info on IAR at <http://www.iar.com/website1/1.0.1.0/3/1/> and www.MSP430.com . Note, that there is an option for a 30-day free version of IAR evaluation edition.
- [4] PAN13xx CAD data: <http://www.pedeu.panasonic.de/pdf/174ext.zip>
- [5] To help with the implementation of this reference design, Eagle formatted application and layout files are available on the web at the address below.
- [6] www.panasonic.com/industrial/includes/pdf/PAN1323ETU_Eagle_Ver1_1.zip
- [7] Application Note Land Grid Array: <http://www.pedeu.panasonic.de/pdf/184ext.pdf>

1.4 GENERAL INFORMATION

This document may contain errors. Panasonic reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its literature at any time. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to Panasonic's terms and conditions of sale supplied at the time of order acknowledgment.

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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.

1.5 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>

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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2 NEW PAN13X5B, PAN13X6B

The PAN13x5B and PAN13x6B Series are based on Texas Instruments CC2560B and CC2564B controller respectively. The PAN13x5B/13x6B Series Modules support assisted mode for the HFP1.6 (WBS) profile or the A2DP profile. The PAN13x6B also supports 10 LE connections (instead of 6 before).

Compatibility:

PAN1315(A/B) and PAN1316(B) are 100% footprint compatible

PAN1325(A/B) and PAN1326(B) are 100% footprint compatible

NOTE: In the following chapters PAN13x5, PAN13x6 naming also considers the A and B version.

As an updated initialization script resident on the application microcontroller is required for modules based on the CC2560A and CC2564A/B, compatibility between the basic, A and B version is dependent on the Bluetooth stack.

BT-Stack solutions provided by software development partners are available for most processors, including linux based host systems.

For detailed family overview that includes part numbers see Chapter 29 Ordering Information.

Contact your stack provider or local Panasonic sales company for currently available Bluetooth Profiles.

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3 KEY FEATURES

- Bluetooth specification v2.1 + EDR (Enhanced Data Rate)
- Surface mount type 6.5(9.5 w. Ant.) x 9.0 x 1.8 mm³
- Up to 10 dBm Tx power with transmit power control
- High sensitivity (-93 dBm typ.)
- Texas Instrument's CC256X BlueLink 7.0 inside
- Fast Connection Setup
- Extended SCO Link
- Supports convenient direct connection to battery (2.2-4.8 V), or connect to DC/DC (1.7-1.98 V) for improved power efficiency
- Internal crystal oscillator (26MHz)
- Fully shielded for immunity
- Full Bluetooth data rate up to 2,178kbps asymmetric
- Support for Bluetooth power saving modes (Sniff, Hold)
- Support for very low-power modes (deep sleep and power down)
- Optional support for ultra-low-power mode. Standby with Battery-Backup
- PCM Interface Master / Slave supporting 13 or 16 bit linear, 8 bit µ-law or A-law Codecs and CVSD encoders on up to 3 SCO channels
- Full 8- to 128-bit encryption
- UART, I²C and PCM Interface
- IO operating voltage = 1.8 V nominal
- Bluetooth profiles such as SPP, A2DP and others are available. Refer to Panasonic's RF module website for a listing of the most current releases.
- Manufactured in conformance with RoHS

4 APPLICATIONS FOR THE MODULE

All Embedded Wireless Applications

- Smart Phones
- Industrial Control
- Medical
- Scanners
- Wireless Sensors
- Low Power
- Cable Replacement
- Automotive
- Access Points
- Consumer Electronics
- Monitoring and Control
- Access Points

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5 DESCRIPTION FOR THE MODULE

The PAN1315 and PAN1315A are short-range, Class 1 or 2, HCI modules for implementing Bluetooth functionality into various electronic devices. A block diagram can be found in Chapter 8.

Communication between the module and the host controller is carried out via UART.

New designs can be completed quickly by mating the PAN13xx series modules with Texas Instruments' MSP430BT5190 that contains Mindtree's EtherMind Bluetooth Protocol Stack and serial port profile, additional computing power can be achieved by choosing TI's Stellaris ARM7 controller that includes StoneStreet One's A2DP profile. Other BT profiles are available on custom development basis.

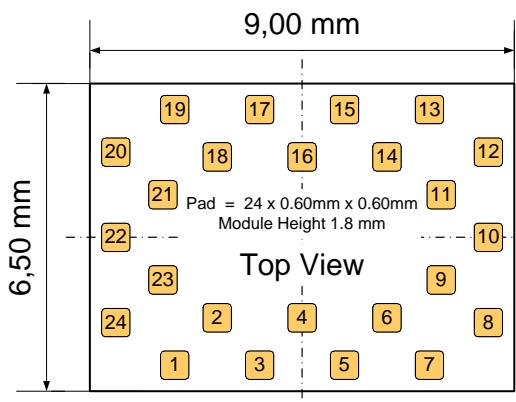
Additional controllers are also supported by the PAN13xx series by using a TI/Panasonic software development partner to port the Bluetooth stack and profiles. Mindtree's Software Development Kit (SDK) is available on TI's website -- www.ti.com/connectivity.com

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6 DETAILED DESCRIPTION

6.1 TERMINAL LAYOUT

6.1.1 Terminal Layout PAN131x without antenna



No	Pin Name	Pull at Reset	Def. Dir. ²	I/O Type ³	Description of Options (Common)
1	GND				Connect to Ground
2	TX_DBG	PU	O	2 mA	Logger output
3	HCI_CTS	PU	I	8 mA	HCI UART clear-to-send.
4	HCI_RTS	PU	O	8 mA	HCI UART request-to-send.
5	HCI_RX	PU	I	8 mA	HCI UART data receive
6	HCI_TX	PU	O	8 mA	HCI UART data transmit
7	AUD_FSYNC	PD	IO	4 mA	PCM frame synch. (NC if not used) Fail safe ⁴
8	SLOW_CLK_IN		I		32.768-kHz clock in Fail safe
9	NC		IO		Not connected
10	MLDO_OUT		O		Main LDO output (1.8 V nom.)
11	CL1.5_LDO_IN		I		PA LDO input
12	GND				Connect to Ground
13	RF		IO		Bluetooth RF IO
14	GND				Connect to Ground
15	MLDO_IN		I		Main LDO input
16	nSHUTD	PD	I		Shutdown input (active low).
17	AUD_OUT	PD	O	4 mA	PCM data output. (NC if not used) Fail safe
18	AUD_IN	PD	I	4 mA	PCM data input. (NC if not used) Fail safe
19	AUD_CLK	PD	IO	HY, 4 mA	PCM clock. (NC if not used) Fail safe
20	GND				Connect to Ground
21	NC				EEPROM I ² C SDA (Internal)
22	VDD_IO		PI		I/O power supply 1.8 V Nom
23	NC				EEPROM I ² C SCL (Internal)
24	NC		IO		Not connected

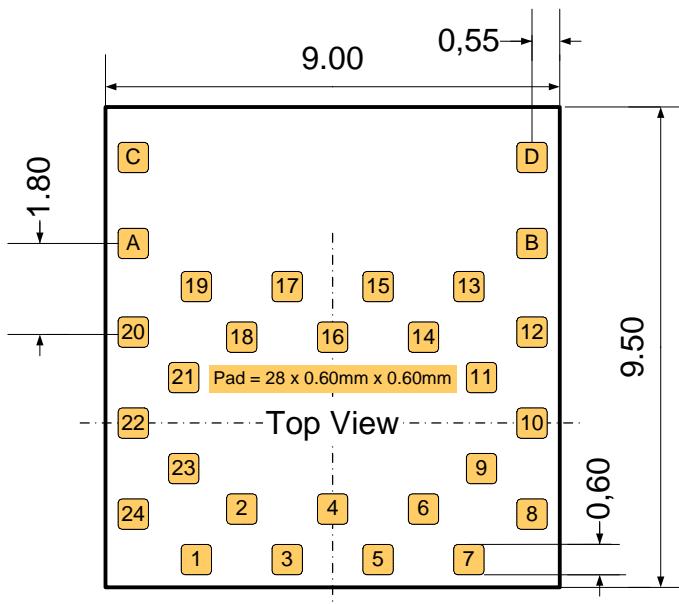
² I = input; O = output; IO = bidirectional; P = power; PU = pulled up; PD = pulled down

³ I/O Type: Digital I/O cells. HY = input hysteresis, current = typ. output current

⁴ No signals are allowed on the IO pins if no VDD_IO (Pin 22) power supplied, except pin 7, 8, 17-19.

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6.1.2 Terminal Layout PAN132x with antenna



No	Pin Name	Pull at Reset	Def. Dir. ⁵	I/O Type ⁶	Description of Options (Common)
A	GND				Connect to Ground
B	GND				Connect to Ground
C	GND				Connect to Ground
D	GND				Connect to Ground

No 1-24 see above in Chapter 6.1.1. Except PIN 13 is not connected. For RF conducted measurements, either use the PAN1323ETU or de-solder the antenna and solder an antenna connector to the hot pin.

6.2 PIN DESCRIPTION

Pin Name	No	ESD ⁷ (V)	Pull at Reset	Def. Dir. ⁸	I/O Type ⁹	Description of Options
Bluetooth IO SIGNALS						
HCI_RX	5	750	PU	I	8 mA	HCI UART data receive

⁵ I = input; O = output; IO = bidirectional; P = power; PU = pulled up; PD = pulled down

⁶ I/O Type: Digital I/O cells. HY = input hysteresis, current = typ. output current

⁷ ESD: Human Body Model (HBM). JEDEC 22-A114

⁸ I = input; O = output; IO = bidirectional; P = power; PU = pulled up; PD = pulled down

⁹ I/O Type: Digital I/O cells. HY = input hysteresis, current = typ output current

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Pin Name	No	ESD ⁷ (V)	Pull at Reset	Def. Dir. ⁸	I/O Type ⁹	Description of Options		
HCI_TX	6	750	PU	O	8 mA	HCI UART data transmit		
HCI_RTS	4	750	PU	O	8 mA	HCI UART request-to-send.		
HCI_CTS	3	750	PU	I	8 mA	HCI UART clear-to-send.		
AUD_FYSNC	7	500	PD	IO	4 mA	PCM frame synch (NC if not used)	Fail safe	
AUD_CLK	19	500	PD	IO	HY, 4 mS	PCM clock (NC if not used)	Fail safe	
AUD_IN	18	500	PD	I	4 mA	PCM data input (NC if not used)	Fail safe	
AUD_OUT	17	500	PD	O	4 mA	PCM data output (NC if not used)	Fail safe	
TX_DBG	2	1000	PU	O	2 mA	Logger output		
						OPTION: nTX_DBG – logger out (low = 1)		
CLOCK SIGNALS								
SLOW_CLK_IN	8	1000		I		32.768-kHz clock in	Fail safe	
Bluetooth ANALOG SIGNALS								
RF	13	1000		IO		Bluetooth RF IO (not connected with antenna)		
nSHUTD	16	1000	PD	I		Shutdown input (active low).		
Bluetooth POWER AND GND SIGNALS								
VDD_IO	22	1000		PI		I/O power supply 1.8 V Nom		
MLDO_IN	15	1000		I		Main LDO input Connect directly to battery or to a pre-regulated 1.8-V supply		
MLDO_OUT	10	1000		O		Main LDO output (1.8 V nom.) Can not be used as 1.8V supply due to internal connection to the RF part.		
CL1.5_LDO_IN	11	1000		I		PA LDO input Connect directly to battery or to a pre-regulated 1.8-V supply		
GND	1			P		Connect to Ground		
GND	12			P		Connect to Ground		
GND	14			P		Connect to Ground		
GND	20			P		Connect to Ground		
EEPROM IO SIGNALS (EEPROM is optional in PAN13x product line)								
NC	23	1000	PU/PD	I	HY, 4mA	EEPROM I ² C SCL (Internal)		
NC	21	1000	PU/PD	IO	HY, 4mA	EEPROM I ² C IRQ (Internal)		

Remark:

HCI_CTS is an input signal to the CC256X device:

- When HCI_CTS is low, then CC256X is allowed to send data to Host device.
- When HCI_CTS is high, then CC256X is not allowed to send data to Host device.

6.3 DEVICE POWER SUPPLY

The PAN13XX Bluetooth radio solution is intended to work in devices with a limited power budget such as cellular phones, headsets, hand-held PC's and other battery-operated devices. One of the main differentiators of the PAN13XX is its power management – its ability to draw as little current as possible.

The PAN13XX device requires two kinds of power sources:

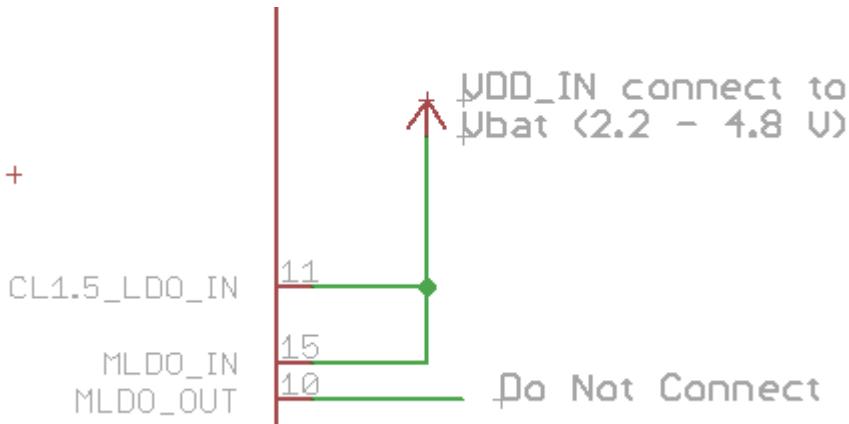
1. Main power supply for the Bluetooth - V_{DD_IN} = V_{BAT}
2. Power source for the 1.8 V I/O ring - V_{DD_IO}

The PAN13XX includes several on-chip voltage regulators for increased noise immunity. The PAN13XX can be connected either directly to the battery or to an external 1.8-V DC to DC converter.

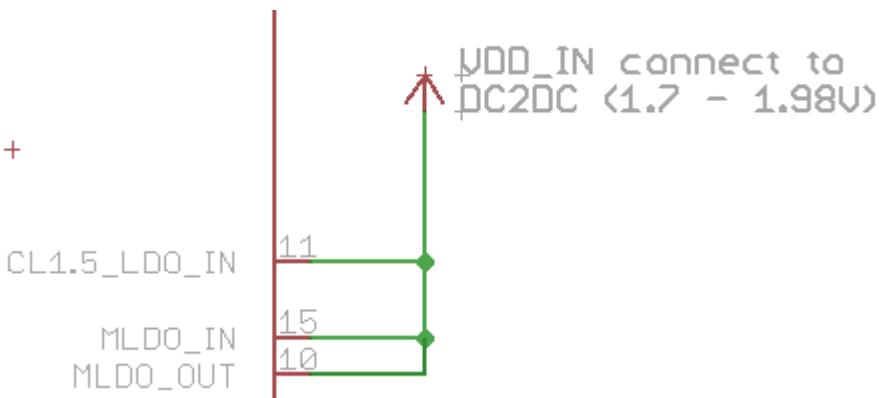
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There are three ways to supply power:

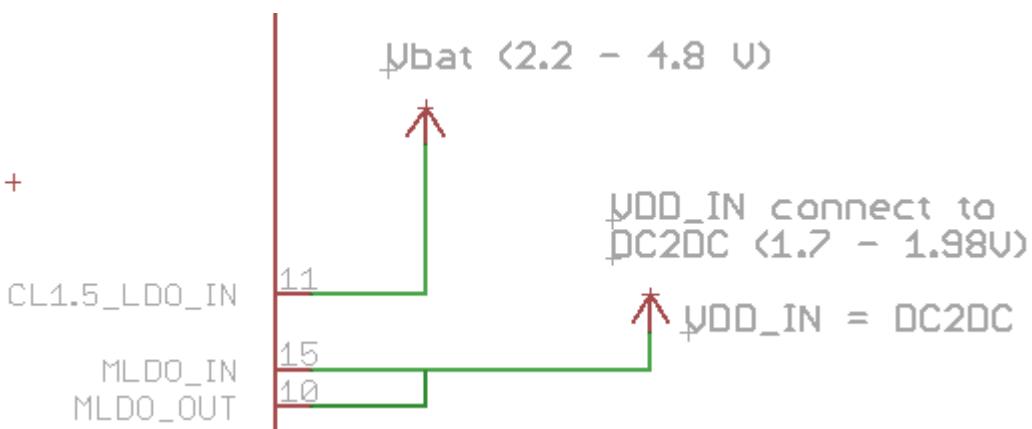
1. Full-V_{BAT} system (Maximum RF output power, but not optimum system power):



2. Full-DC2DC system (Lower RF output power, but optimum system power):



3. Mixed DC2DC-V_{BAT} system (Maximum RF output power and optimum system power, but requires routing of V_{BAT}):



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6.4 CLOCK INPUTS

The slow clock is always supplied from an external source. It is connected to the SLOW_CLK_IN pin number 8 and can be a digital signal with peak to peak of 0-1.8 V.

The slow clock's frequency accuracy must be 32.768 kHz \pm 250 ppm for Bluetooth usage (according to the Bluetooth specification).

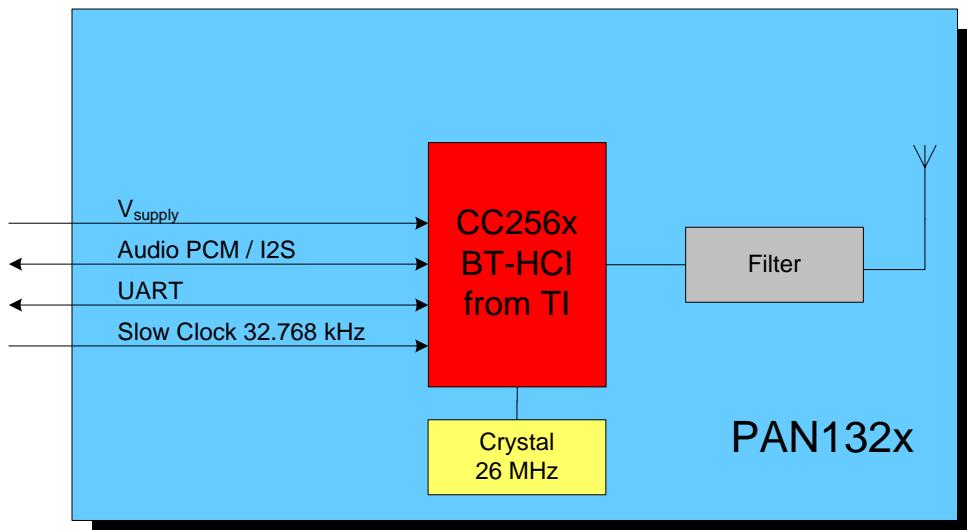
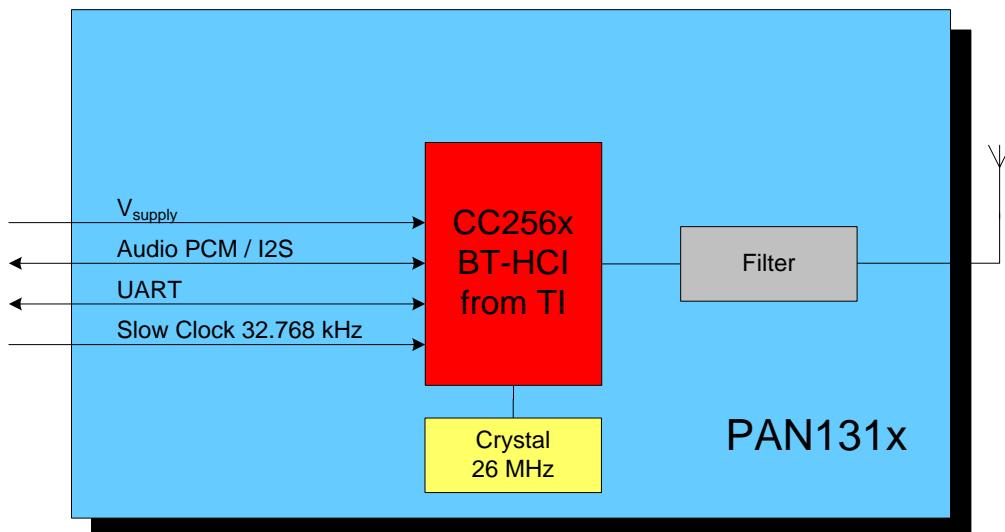
The Slow Clock 32.768 kHz is mandatory to start the internal controller, otherwise the module does not start up.

7 BLUETOOTH FEATURES

- Support of Bluetooth2.1+EDR (Lisbon Release) up to HCI level.
- Very fast AFH algorithm for both ACL and eSCO.
- Supports typically 4 dBm Class 2 TX power w/o external PA, improving Bluetooth link robustness. Adjusting the host settings, the TX power can be increased to 10 dBm. However it is important, that the national regulations and Bluetooth specification are met.
- Digital Radio Processor (DRP) single-ended 50 ohm.
- Internal temperature detection and compensation ensures minimal variation in the RF performance over temperature.
- Flexible PCM and I2S digital audio/voice interfaces: Full flexibility of data-format (Linear, a-Law, μ -Law), data-width, data order, sampling and slot positioning, master/slave modes, high clock rates up to 15 MHz for slave mode (or 4.096 MHz for Master Mode). Lost packet concealment for improved audio.
- Proprietary low-power scan method for page and inquiry scans, achieves page and inquiry scans at 1/3rd normal power.

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8 BLOCK DIAGRAM



Note: The Slow Clock 32.768 kHz is mandatory, otherwise the module does not start up, refer to Chapter 6.4 for additional information.

Note: The IO are 1.8V driven and might need external level shifter and LDO. The MLDO_OUT PIN can not be used as reference due to RF internal connection.

The total capacity will not exceed 2.8uF and the total inductance will not exceed 0nH. There are no voltage multiplying or voltage boosting circuits.

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9 TEST CONDITIONS

Measurements shall be made under room temperature and humidity unless otherwise specified.

10 GENERAL DEVICE REQUIREMENTS AND OPERATION

Temperature	25 ± 10°C
Humidity	40 to 85%RH
SW-Patch	V2.30
Supply Voltage	3.3V

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

10.1 ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range (unless otherwise noted).

Note

All parameters are measured as follows unless stated otherwise:

VDD_IN¹⁰ = 3.3 V, VDD_IO = 1.8 V.

No	See ¹¹	Value	Unit
Ratings Over Operating Free-Air Temperature Range			
1	VDD_IN	Supply voltage range	-0.5 to 5.5 V ¹²
2	VDDIO_1.8V		-0.5 to 2.145 V
3	Input voltage to RF (Pin 13)		-0.5 to 2.1 V
4	Operating ambient temperature range	-40 to 85 ¹³	°C
5	Storage temperature range	-40 to 125	°C
6	Bluetooth RF inputs (Pin 13)	10	dBm
7	ESD: Human Body Model (HBM). JEDEC 22-A114	500	V

¹⁰ VDD_IN is supplied to MLDO_IN (Pin 15) and CL1.5_LDO_IN (Pin 11), other options are described in Chapter 6.3.

¹¹ Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

¹² Maximum allowed depends on accumulated time at that voltage: VDD_IN is defined in Reference schematics. When DC2DC supply is used, maximum voltage into MLDO_OUT and LDO_IN = 2.145 V.

¹³ Older generation parts, which are not recommended for new designs, will support a temperature range -20 to 70. See chapter 28, ordering information, for details.

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10.2 RECOMMENDED OPERATING CONDITIONS

No	Rating	Condition	Symbol	Min	Max	Unit
1	Power supply voltage ¹⁴		VDD_IN	1.7	4.8	V
2	IO power supply voltage		VDD_IO	1.62	1.92	V
3	High-level input voltage	Default	V _{IH}	0.65 x VDD_IO	VDD_IO	V
4	Low-level input voltage	Default	V _{IL}	0	0.35 x VDD_IO	V
5	IO Input rise/fall times, 10% to 90% ¹⁵		Tr/Tf	1	10	ns
6	Maximum ripple on VDD_IN (Sine wave) for 1.8 V (DC2DC) mode	0 to 0.1 MHz			60	mVp-p
		0.1 to 0.5 MHz			50	
		0.5 to 2.5 MHz			30	
		2.5 to 3.0 MHz			15	
		> 3.0 MHz			5	
7	Voltage dips on VDD_IN (V _{BAT}) (duration = 577 µs to 2.31 ms, period = 4.6 ms)				400	mV
8	Maximum ambient operating temperature ¹⁶				85	°C
9	Minimum ambient operating temperature ¹⁷				-40	□C

10.3 CURRENT CONSUMPTION

No	Characteristics	Min 25°C	Typ 25°C	Max 25°C	Min -40°C	Typ -40°C	Max -40°C	Min +85°C	Typ +85°C	Max +85°C	Unit
1	Current consumption in shutdown mode ¹⁸		1	3						7	µA
2	Current consumption in deep sleep mode ¹⁹		40	105						700	µA

¹⁴ Excluding 1.98 < VDD_IN < 2.2 V range – not allowed.

¹⁵ Asynchronous mode.

¹⁶ The device can be reliably operated for 7 years at T_{ambient} of 85°C, assuming 25% active mode and 75% sleep mode (15,400 cumulative active power-on hours).

Older generation parts, which are not recommended for new designs, will support a temperature range -20 to 70. See chapter 28, ordering information, for details.

¹⁷ The device can be reliably operated for 7 years at T_{ambient} of 85°C, assuming 25% active mode and 75% sleep mode (15,400 cumulative active power-on hours).

Older generation parts, which are not recommended for new designs, will support a temperature range -20 to 70. See chapter 28, ordering information, for details.

¹⁸ V_{bat} + V_{io}

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No	Characteristics	Min 25°C	Typ 25°C	Max 25°C	Min -40°C	Typ -40°C	Max -40°C	Min +85°C	Typ +85°C	Max +85°C	Unit
3	Total IO current consumption for active mode			1			1			1	mA
4	Current consumption during transmit DH5 full throughput		40								mA

10.4 GENERAL ELECTRICAL CHARACTERISTICS

No	Rating	Condition	Min	Max	Value
1	High-level output voltage, V_{OH}	at 2/4/8 mA	$0.8 \times VDD_IO$	VDD_IO	V
		at 0.1 mA	$VDD_IO - 0.2$	VDD_IO	V
2	Low-level output voltage, V_{OL}	at 2/4/8 mA	0	$0.2 \times VDD_IO$	V
		at 0.1 mA	0	0.2	V
3	IO input impedance	Resistance	1		$M\Omega$
		Capacitance		5	pF
4	Output rise/fall times, 10% to 90% (Digital pins)	$C_L = 20 \text{ pF}$		10	Ns
5	IO pull currents	TX_DBG, PCM bus	typ = 6.5	3.5	9.7
		PD	typ = 27	9.5	55
	All others	PU	typ = 100	100	300
		PD	typ = 100	100	360

10.5 NSHUTD REQUIREMENTS

No	Parameter	Symbol	Min	Max	Unit
1	Operation mode level ²⁰	V_{IH}	1.42	1.98	V
2	Shutdown mode level	V_{IL}	0	0.4	V
3	Minimum time for nSHUT_DOWN low to reset the device		5		ms
4	Rise/fall times	Tr/Tf		20	μs

10.6 EXTERNAL DIGITAL SLOW CLOCK REQUIREMENTS

No	Characteristics	Condition	Symbol	Min	Typ	Max	Unit
1	Input slow clock frequency				32768		Hz
2	Input slow clock accuracy (Initial + temp + aging)	Bluetooth				± 250	Ppm

¹⁹ $V_{bat} + V_{io} + V_{sd}$ (shutdown)

²⁰ Internal pull down retains shut down mode when no external signal is applied to this pin.

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No	Characteristics	Condition	Symbol	Min	Typ	Max	Unit
3	Input transition time Tr/Tf – 10% to 90%		Tr/Tf			100	Ns
4	Frequency input duty cycle			15%	50%	85%	
5	Phase noise	at 1 kHz				-125	dBc/Hz
6	Jitter	Integrated over 300 to 15000 Hz				1	Hz
7	Slow clock input voltage limits	Square wave, DC coupled	V _{IH}	0.65 x VDD _{_IO}		VDD _{_IO}	V peak
			V _{IL}	0		0.35 x VDD _{_IO}	
8	Input impedance			1			MΩ
9	Input capacitance					5	pF

11 HOST CONTROLLER INTERFACE

The CC256X incorporates one UART module dedicated to the host controller interface (HCI) transport layer. The HCI interface transports commands, events, ACL, and synchronous data between the Bluetooth device and its host using HCI data packets.

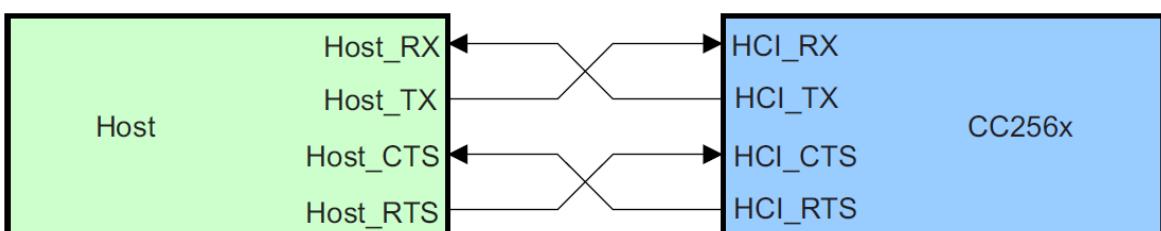
The UART module supports H4 (4-wires) protocol with maximum baud rate of 4 Mbps for all fast clock frequencies.

After power up the baud rate is set for 115.2 kbps, irrespective of fast clock frequency. The baud rate can thereafter be changed with a vendor specific command. The CC256X responds with a Command Complete Event (still at 115.2 kbps), after which the baud rate change takes place. HCI hardware includes the following features:

- Receiver detection of break, idle, framing, FIFO overflow, and parity error conditions
- Transmitter underflow detection
- CTS/RTS hardware flow control

The interface includes four signals: TXD, RXD, CTS, and RTS. Flow control between the host and the CC256X is byte-wise by hardware.

Flow control is obtained by the following:



When the UART RX buffer of the CC256X passes the “flow control” threshold, it will set the UART_RTS signal high to stop transmission from the host.

When the UART_CTS signal is set high, the CC256X will stop its transmission on the interface. In case HCI_CTS is set high in the middle of transmitting a byte, the CC256X will finish transmitting the byte and stop the transmission.

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12 AUDIO/VOICE CODEC INTERFACE

The codec interface is a fully-dedicated programmable serial port that provides the logic to interface to several kinds of PCM or I2S codec's. PAN13XX supports all voice coding schemes required by Bluetooth specification – Log PCM (A-Law or μ-Law) and Linear (CVSD). In addition, module also supports transparent scheme:

- Two voice channels
- Master / slave modes
- μ-Law, A-Law, Linear, Transparent coding schemes
- Long and short frames
- Different data sizes, order, and positions.
- High rate PCM interface for EDR
- Enlarged interface options to support a wider variety of codecs
- PCM bus sharing

12.1 PCM HARDWARE INTERFACE

The PCM interface is one implementation of the codec interface. It contains the following four lines:

- Clock – configurable direction (input or output)
- Frame Sync – configurable direction (input or output)
- Data In – Input
- Data Out – Output/3-state

The Bluetooth device can be either the master of the interface where it generates the clock and the frame-sync signals, or slave where it receives these two signals. The PCM interface is fully configured by a vendor specific command.

For slave mode, clock input frequencies of up to 16 MHz are supported. At clock rates above 12 MHz, the maximum data burst size is 32 bits. For master mode, the CC256X can generate any clock frequency between 64 kHz and 6 MHz.

When the I2S bus is used in an application, Panasonic recommends adding a low pass filter (series resistor and capacitor to GND) to the bus for better noise suppression. Connecting the host μController/DSP directly with the module's I2S interface is not recommended.

The suggested low pass filter component values are:

470pf
120 ohms

12.2 DATA FORMAT

The data format is fully configurable:

- The data length can be from 8 to 320 bits, in 1-bit increments, when working with two channels, or up to 640 bits when using 1 channel. The Data length can be set independently for each channel.
- The data position within a frame is also configurable in with 1 clock (bit) resolution and can be set independently (relative to the edge of the Frame Sync signal) for each channel.

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- The Data_In and Data_Out bit order can be configured independently. For example; Data_In can start with the MSB while Data_Out starts with LSB. Each channel is separately configurable. The inverse bit order (that is, LSB first) is supported only for sample sizes up to 24 bits.
- It is not necessary for the data in and data out size to be the same length.
- The Data_Out line is configured to 'high-Z' output between data words. Data_Out can also be set for permanent high-Z, irrespective of data out. This allows the CC256X to be a bus slave in a multi-slave PCM environment. At power up, Data Out is configured as high-Z.

12.3 FRAME IDLE PERIOD

The codec interface has the capability for frame idle periods, where the PCM clock can "take a break" and become '0' at the end of the PCM frame, after all data has been transferred.

The CC256X supports frame idle periods both as master and slave of the PCM bus.

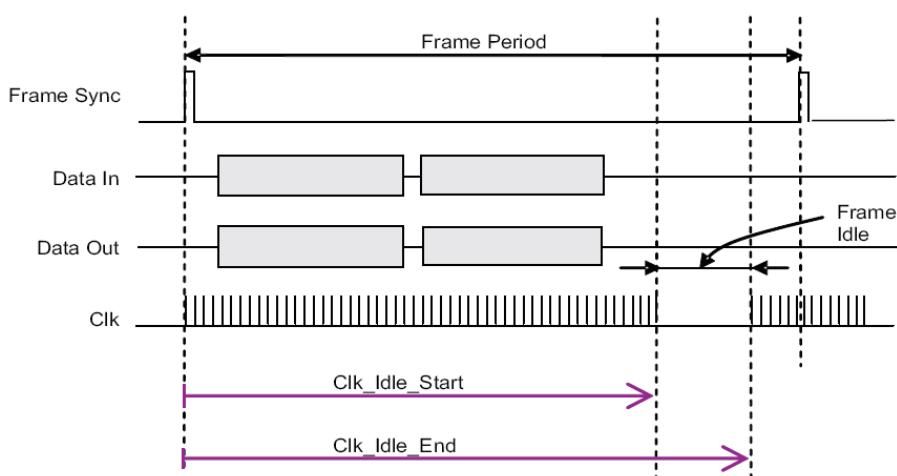
When CC256X is the master of the interface, the frame idle period is configurable. There are two configurable parameters:

- Clk_Idle_Start – Indicates the number of PCM clock cycles from the beginning of the frame until the beginning of the idle period. After Clk_Idle_Start clock cycles, the clock will become '0'.
- Clk_Idle_End – Indicates the time from the beginning of the frame till the end of the idle period. This time is given in multiples of PCM clock periods.

The delta between Clk_Idle_Start and Clk_Idle_End is the clock idle period.

For example, for PCM clock rate = 1 MHz, frame sync period = 10 kHz, Clk_Idle_Start = 60, Clk_Idle_End = 90.

Between each two frame syncs there are 70 clock cycles (instead of 100). The clock idle period starts 60 clock cycles after the beginning of the frame, and lasts 90 – 60 = 30 clock cycles. This means that the idle period ends 100 – 90 = 10 clock cycles before the end of the frame. The data transmission must end prior to the beginning of the idle period.

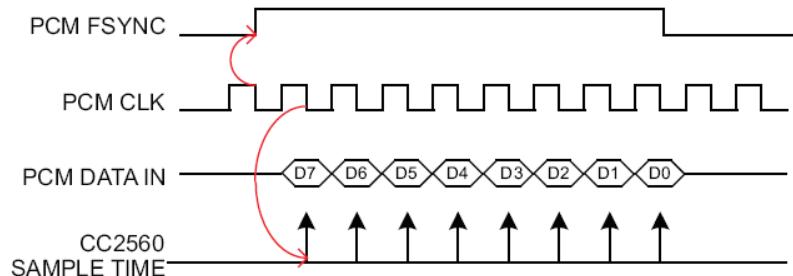


12.4 CLOCK-EDGE OPERATION

The codec interface of the CC256X can work on the rising or the falling edge of the clock. It also has the ability to sample the frame sync and the data at inverted polarity.

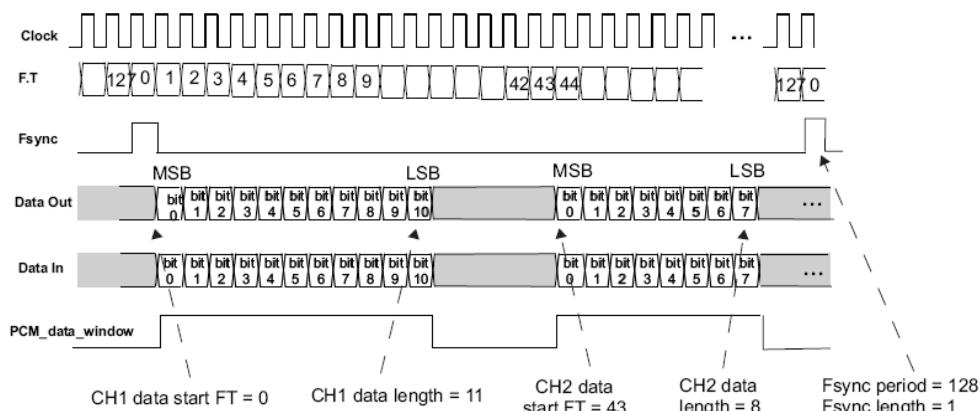
This is the operation of a falling-edge-clock type of codec. The codec is the master of the PCM bus. The frame sync signal is updated (by the codec) on the falling clock edge and therefore shall be sampled (by the CC256X) on the next rising clock. The data from the codec is sampled (by the CC256X) on the clock falling edge.

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12.5 TWO-CHANNEL PCM BUS EXAMPLE

In below figure, a 2-channel PCM bus is shown where the two channels have different word sizes and arbitrary positions in the bus frame. (FT stands for Frame Timer)



12.6 AUDIO ENCODING

The CC256X codec interface can use one of four audio-coding patterns:

- A-Law (8-bit)
- μ -Law (8-bit)
- Linear (8- or 16-bit)

12.7 IMPROVED ALGORITHM FOR LOST PACKETS

The CC256X features an improved algorithm for improving voice quality when received voice data packets are lost. There are two options:

- Repeat the last sample – possible only for sample sizes up to 24 bits. For sample sizes >24 bits, the last byte is repeated.
- Repeat a configurable sample of 8 to 24 bits (depends on the real sample size), in order to simulate silence (or anything else) in the PCM bus. The configured sample will be written in a specific register for each channel.

The choice between those two options is configurable separately for each channel.

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12.8 BLUETOOTH/PCM CLOCK MISMATCH HANDLING

In Bluetooth RX, the CC256X receives RF voice packets and writes these to the codec I/F. If the CC256X receives data faster than the codec I/F output allows, an overflow will occur. In this case, the Bluetooth has two possible behaviour modes: 'allow overflow' and 'don't allow overflow'.

- If overflow is allowed, the Bluetooth will continue receiving data and will overwrite any data not yet sent to the codec.
- If overflow is not allowed, RF voice packets received when buffer is full will be discarded.

12.9 BLUETOOTH INTER-IC SOUND (I2S)

The CC256X can be configured as an Inter-IC Sound (I2S) serial interface to an I2S codec device. In this mode, the CC256X audio codec interface is configured as a bi-directional, full-duplex interface, with two time slots per frame: Time slot 0 is used for the left channel audio data and time slot 1 for the right channel audio data. Each time slot is configurable up to 40 serial clock cycles in length and the frame is configurable up to 80 serial clock cycles in length.

Do not connect the microcontroller/DSP directly to the module's PCM interface, a simple RC low pass filter is recommended to improve noise suppression.

12.10 CURRENT CONSUMPTION FOR DIFFERENT BLUETOOTH SCENARIOS

The following table gives average current consumption for different Bluetooth scenarios.

Conditions: VDD_IN = 3.6 V, 25°C, 26-MHz fast clock, nominal unit, 4 dBm output power.

Mode Description	Master/Slave	Average Current	Unit
Idle current (ARM off)	Master/Slave	2.5	mA
SCO link HV3	Master/Slave	12	mA
eSCO link EV3 64 kbps, no retransmission	Master/Slave	11.5	mA
eSCO link 2-EV3 64 kbps, no retransmission	Master/Slave	8.3	mA
GFSK full throughput: TX = DH1, RX = DH5	Master/Slave	38.5	mA
EDR full throughput: TX = 2-DH1, RX = 2-DH5	Master/Slave	39.2	mA
EDR full throughput: TX = 3-DH1, RX = 3-DH5	Master/Slave	39.2	mA
Sniff, 1 attempt, 1.28 s	Master/Slave	76/100	µA
Page or Inquiry Scan 1.28 s, 11.25 ms	Master/Slave	300	µA
Page (1.28 s) and Inquiry (2.56 s) scans, 11.25 ms	Master/Slave	430	µA
Low power scan, 1.28-s interval, quiet environment	Master/Slave	135	µA

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13 BLUETOOTH RF PERFORMANCE

No	Characteristics	Typ	BT Spec	BT Spec
			Max	Min
1	Average Power Hopping DH5 [dBm] ^{22, 23}	7.2	20	4
2	Average Power: Ch0 [dBm] ^{22, 23}	7.5	20	4
3	Peak Power: Ch0 [dBm] ^{22, 23}	7.7	23	
4	Average Power: Ch39 [dBm] ^{22, 23}	7.0	20	4
5	Peak Power: Ch39 [dBm] ^{22, 23}	7.2	23	
6	Average Power: Ch78 [dBm] ^{22, 23}	6.7	20	4
7	Peak Power: Ch78 [dBm] ^{22, 23}	7.0	23	
8	Max. Frequency Tolerance: Ch0 [kHz]	-2.6	75	-75
9	Max. Frequency Tolerance: Ch39 [kHz]	-2.2	75	-75
10	Max. Frequency Tolerance: Ch78 [kHz]	-2.1	75	-75
11	Max. Drift: Ch0_DH1 [kHz]	3.6	25	-25
12	Max. Drift: Ch0_DH3 [kHz]	3.7	40	-40
13	Max. Drift: Ch0_DH5 [kHz]	4.0	40	-40
14	Max. Drift Rate: Ch0_DH1 [kHz]	-2.6	20	-20
15	Max. Drift Rate: Ch0_DH3 [kHz]	-3.2	20	-20
16	Max. Drift Rate: Ch0_DH5 [kHz]	-3.3	20	-20
17	Max. Drift: Ch39_DH1 [kHz]	4.0	25	-25
18	Max. Drift: Ch39_DH3 [kHz]	4.3	40	-40
19	Max. Drift: Ch39_DH5 [kHz]	4.3	40	-40
20	Max. Drift Rate: Ch39_DH1 [kHz]	-3.1	20	-20
21	Max. Drift Rate: Ch39_DH3 [kHz]	-3.6	20	-20
22	Max. Drift Rate: Ch39_DH5 [kHz]	-3.7	20	-20
23	Max. Drift: Ch78_DH1 [kHz]	4.1	25	-25
24	Max. Drift: Ch78_DH3 [kHz]	4.5	40	-40
25	Max. Drift: Ch78_DH5 [kHz]	4.4	40	-40
26	Max. Drift Rate: Ch78_DH1 [kHz]	-3.4	20	-20
27	Max. Drift Rate: Ch78_DH3 [kHz]	-3.9	20	-20
28	Max. Drift Rate: Ch78_DH5 [kHz]	-4.1	20	-20
29	Delta F1 Avg: Ch0 [kHz]	159.5	175	140
30	Delta F2 Max.: Ch0 [%]	100.0		99.9
31	Delta F2 Avg/Delta F1 Avg: Ch0	0.9		0.8
32	Delta F1 Avg: Ch39 [kHz]	159.8	175	140
33	Delta F2 Max.: Ch39 [%]	100.0		99.9
34	Delta F2 Avg/Delta F1 Avg: Ch39	0.9		0.8
35	Delta F1 Avg: Ch78 [kHz]	159.1	175	140
36	Delta F2 Max.: Ch78 [%]	100.0		99.9
37	Delta F2 Avg/Delta F1 Avg: Ch78	0.9		0.8
45	Sensitivity	-93.0		-81
46	f(H)-f(L): Ch0 [kHz]	918.4	1000	
47	f(H)-f(L): Ch39 [kHz]	918.3	1000	
48	f(H)-f(L): Ch78 [kHz]	918.2	1000	
49	ACPower -3: Ch3 [dBm]	-51.5	-40	
50	ACPower -2: Ch3 [dBm]	-50.4	-40	

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No	Characteristics	Typ	BT Spec Max	BT Spec Min
			Class1	Class1
51	ACPower -1: Ch3 [dBm]	-18.5		
52	ACPower Center: Ch3 [dBm]	8.1	20	4
53	ACPower +1: Ch3 [dBm]	-19.2		
54	ACPower +2: Ch3 [dBm]	-50.7	-40	
55	ACPower +3: Ch3 [dBm]	-53.3	-40	
56	ACPower -3: Ch39 [dBm]	-51.6	-40	
57	ACPower -2: Ch39 [dBm]	-50.7	-40	
58	ACPower -1: Ch39 [dBm]	-19.0		
59	ACPower Center: Ch39 [dBm]	7.7	20	4
60	ACPower +1: Ch39 [dBm]	-19.7		
61	ACPower +2: Ch39 [dBm]	-50.9	-40	
62	ACPower +3: Ch39 [dBm]	-53.2	-40	
63	ACPower -3: Ch75 [dBm]	-51.7	-40	
64	ACPower -2: Ch75 [dBm]	-50.7	-40	
65	ACPower -1: Ch75 [dBm]	-19.2		
66	ACPower Center: Ch75 [dBm]	7.5	20	4
67	ACPower +1: Ch75 [dBm]	-20.0		
68	ACPower +2: Ch75 [dBm]	-51.0	-40	
69	ACPower +3: Ch75 [dBm]	-53.4	-40	
70	omega i 2-DH5: Ch0 [kHz]	-4.7	75	-75
71	omega o + omega i 2-DH5: Ch0 [kHz]	-6.0	75	-75
72	omega o 2-DH5: Ch0 [kHz]	-1.5	10	-10
73	DEVM RMS 2-DH5: Ch0 [%]	0.0	0.2	
74	DEVM Peak 2-DH5: Ch0 [%]	0.1	0.35	
75	DEVM 99% 2-DH5: Ch0 [%]	100.0		99
76	omega i 3-DH5: Ch0 [kHz]	-3.7	75	-75
77	omega o + omega i 3-DH5: Ch0 [kHz]	-5.8	75	-75
78	omega o 3-DH5: Ch0 [kHz]	-2.6	10	-10
79	DEVM RMS 3-DH5: Ch0 [%]	0.0	0.13	
80	DEVM Peak 3-DH5: Ch0 [%]	0.1	0.25	
81	DEVM 99% 3-DH5: Ch0 [%]	100.0		99
82	omega i 2-DH5: Ch39 [kHz]	-4.8	75	-75
83	omega o + omega i 2-DH5: Ch39 [kHz]	-6.1	75	-75
84	omega o 2-DH5: Ch39 [kHz]	-1.4	10	-10
85	DEVM RMS 2-DH5: Ch39 [%]	0.0	0.2	
86	DEVM Peak 2-DH5: Ch39 [%]	0.1	0.35	
87	DEVM 99% 2-DH5: Ch39 [%]	100.0		99
88	omega i 3-DH5: Ch39 [kHz]	-3.8	75	-75
89	omega o + omega i 3-DH5: Ch39 [kHz]	-5.9	75	-75
90	omega o 3-DH5: Ch39 [kHz]	-2.6	10	-10
91	DEVM RMS 3-DH5: Ch39 [%]	0.0	0.13	
92	DEVM Peak 3-DH5: Ch39 [%]	0.1	0.25	
93	DEVM 99% 3-DH5: Ch39 [%]	100.0		99
94	omega i 2-DH5: Ch78 [kHz]	-4.9	75	-75
95	omega o + omega i 2-DH5: Ch78 [kHz]	-6.2	75	-75

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No	Characteristics	Typ	BT Spec Max	BT Spec Min
			Class1	Class1
96	omega o 2-DH5: Ch78 [kHz]	-1.4	10	-10
97	DEVM RMS 2-DH5: Ch78 [%]	0.0	0.2	
98	DEVM Peak 2-DH5: Ch78 [%]	0.1	0.35	
99	DEVM 99% 2-DH5: Ch78 [%]	100.0		99
100	omega i 3-DH5: Ch78 [kHz]	-3.8	75	-75
101	omega o + omega i 3-DH5: Ch78 [kHz]	-6.0	75	-75
102	omega o 3-DH5: Ch78 [kHz]	-2.7	10	-10
103	DEVM RMS 3-DH5: Ch78 [%]	0.0	0.13	
104	DEVM Peak 3-DH5: Ch78 [%]	0.1	0.25	
105	DEVM 99% 3-DH5: Ch78 [%]	100.0		99

No	Characteristics	Condition	Min	Typ	Max	BT Spec	Unit
1	Operation frequency range		2402		2480		MHz
2	Channel spacing			1			MHz
3	Input impedance			50			Ω
4	Sensitivity, Dirty Tx on	GFSK, BER = 0.1%		-93.0		-70	dBm
		Pi/4-DQPSK, BER = 0.01%		-92.5		-70	
		8DPSK, BER = 0.01%		-85.5		-70	

No	Characteristics	Condition	Typ	Max	Unit
1	Tx and Rx out-of-band emissions Output signal = 7dBm	30 kHz to 1 GHz ^{21, 22, 23}		-30	dBm
		1 to 12.75 GHz ^{21, 22, 23}		-30	
2	2 nd harmonic	at 7dBm output power ^{21, 22, 23}		-30	dBm
3	3 rd harmonic	at 7dBm output power ^{21, 22, 23}		-30	dBm

The values are measured conducted. Better suppression of the spurious emissions with an antenna can be expected as, antenna frequently have band pass filter characteristics.

²¹ Includes effects of frequency hopping

²² Average according FCC, IC and ETSI requirements. Above +7dBm output power (refer also to 23) the customer has to verify the final product against national regulations.

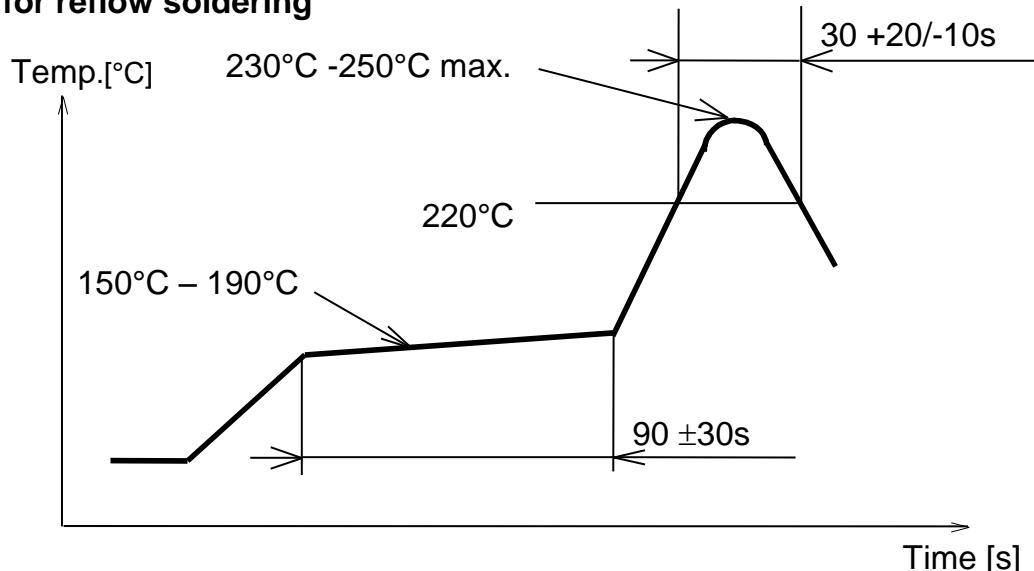
²³ +7dBm related to power register value 18, according to TI service pack 2.30

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14 SOLDERING TEMPERATURE-TIME PROFILE (FOR REFLOW SOLDERING)

14.1 FOR LEADFREE SOLDER

**Our used temp. profile
for reflow soldering**



Reflow permissible cycle: 2

Opposite side reflow is prohibited due to module weight.

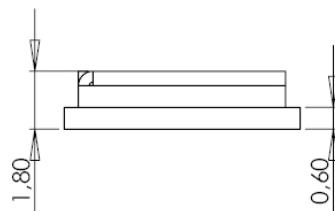
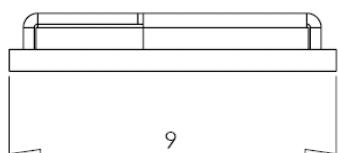
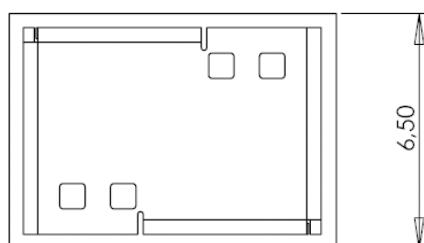
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15 MODULE DIMENSION

15.1 MODULE DIMENSIONS PAN131X WITHOUT ANTENNA

No.	Item	Dimension	Tolerance	Remark
1	Width	6.50	± 0.20	
2	Lenght	9.00	± 0.20	
3	Height	1.80	± 0.20	With case

15.1.1 PAN131X Module Drawing

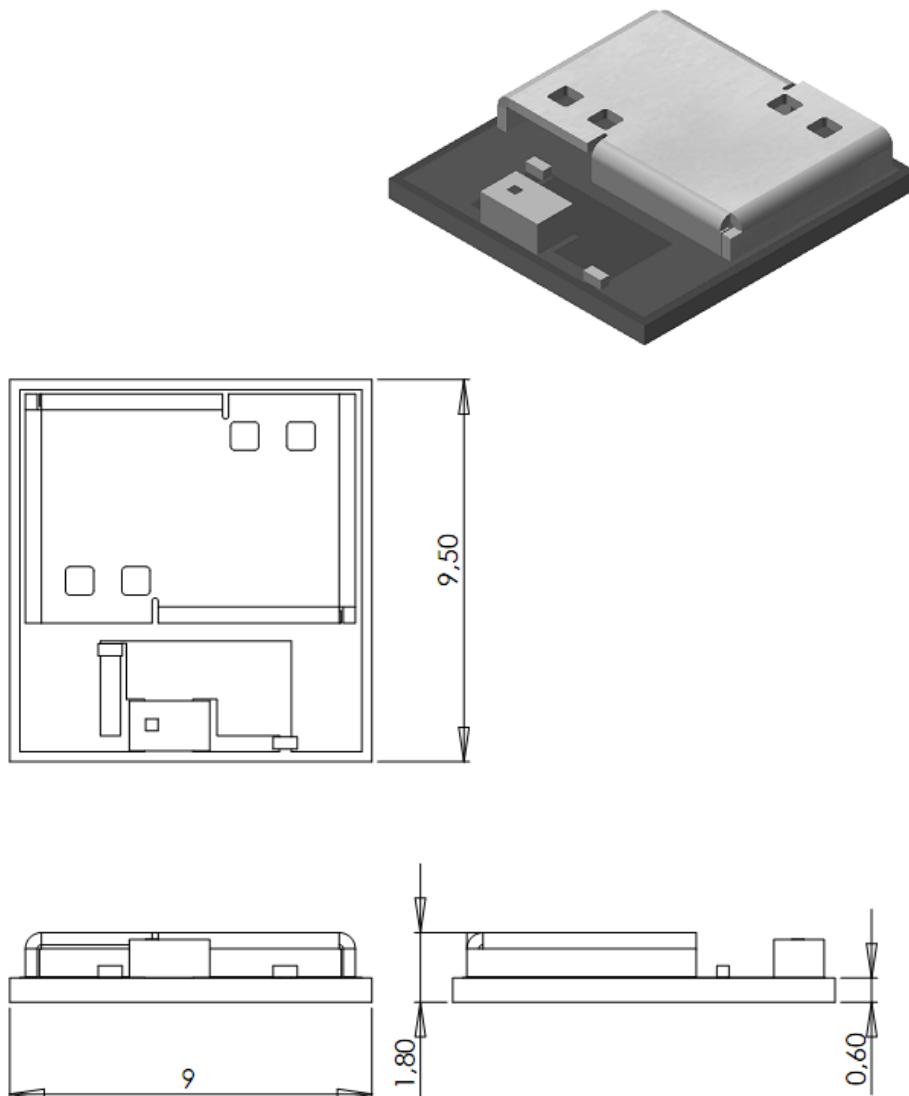


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15.2 MODULE DIMENSIONS PAN132X WITH ANTENNA

No.	Item	Dimension	Tolerance	Remark
1	Width	9.50	± 0.20	
2	Length	9.00	± 0.20	
3	Height	1.80	± 0.20	With case

15.2.1 PAN132X Module Drawing



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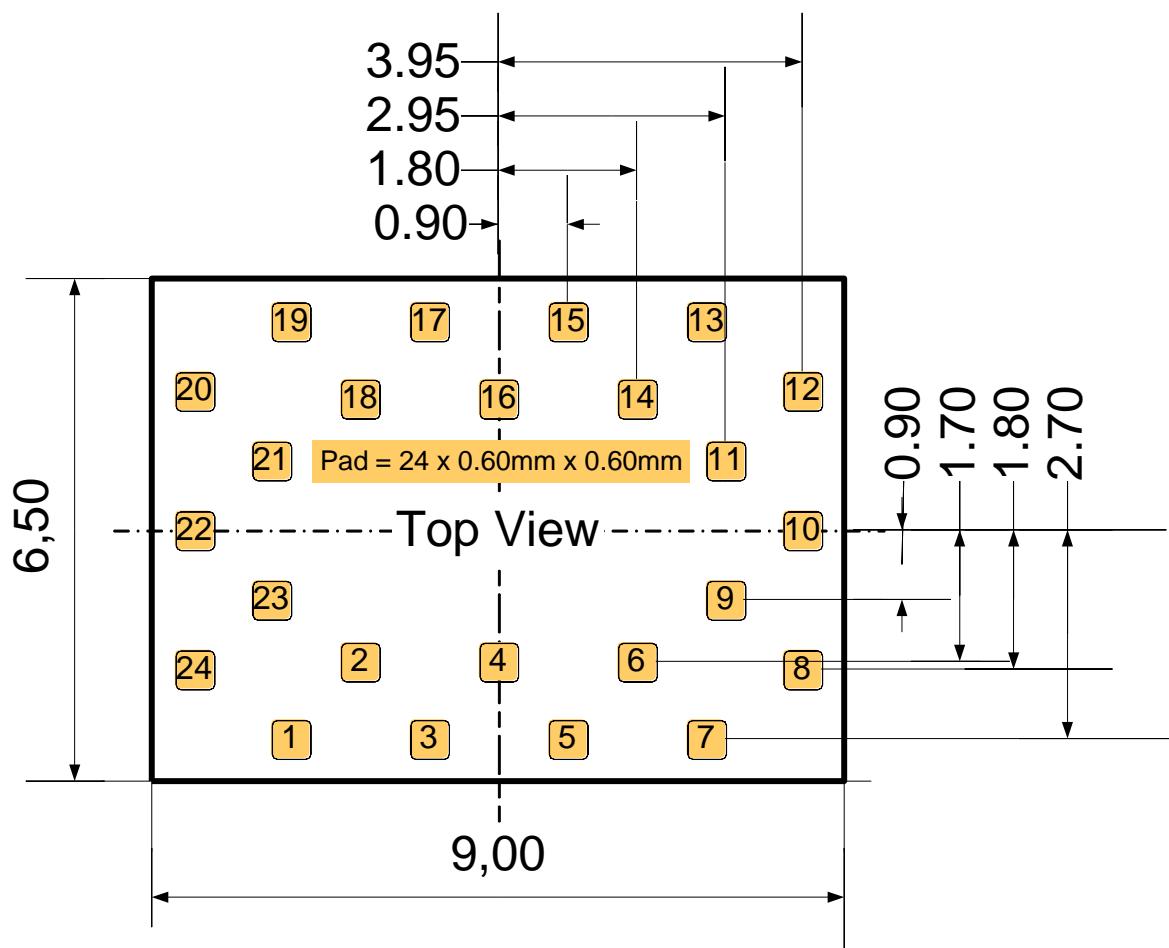
16 FOOTPRINT OF THE MODULE

16.1 FOOTPRINT PAN131X WITHOUT ANTENNA

All dimensions are in millimeters.

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

The layout is symmetric to center. The inner pins (2,4,6,9,11,14,16,18,21,23) are shifted to the center by 1mm.



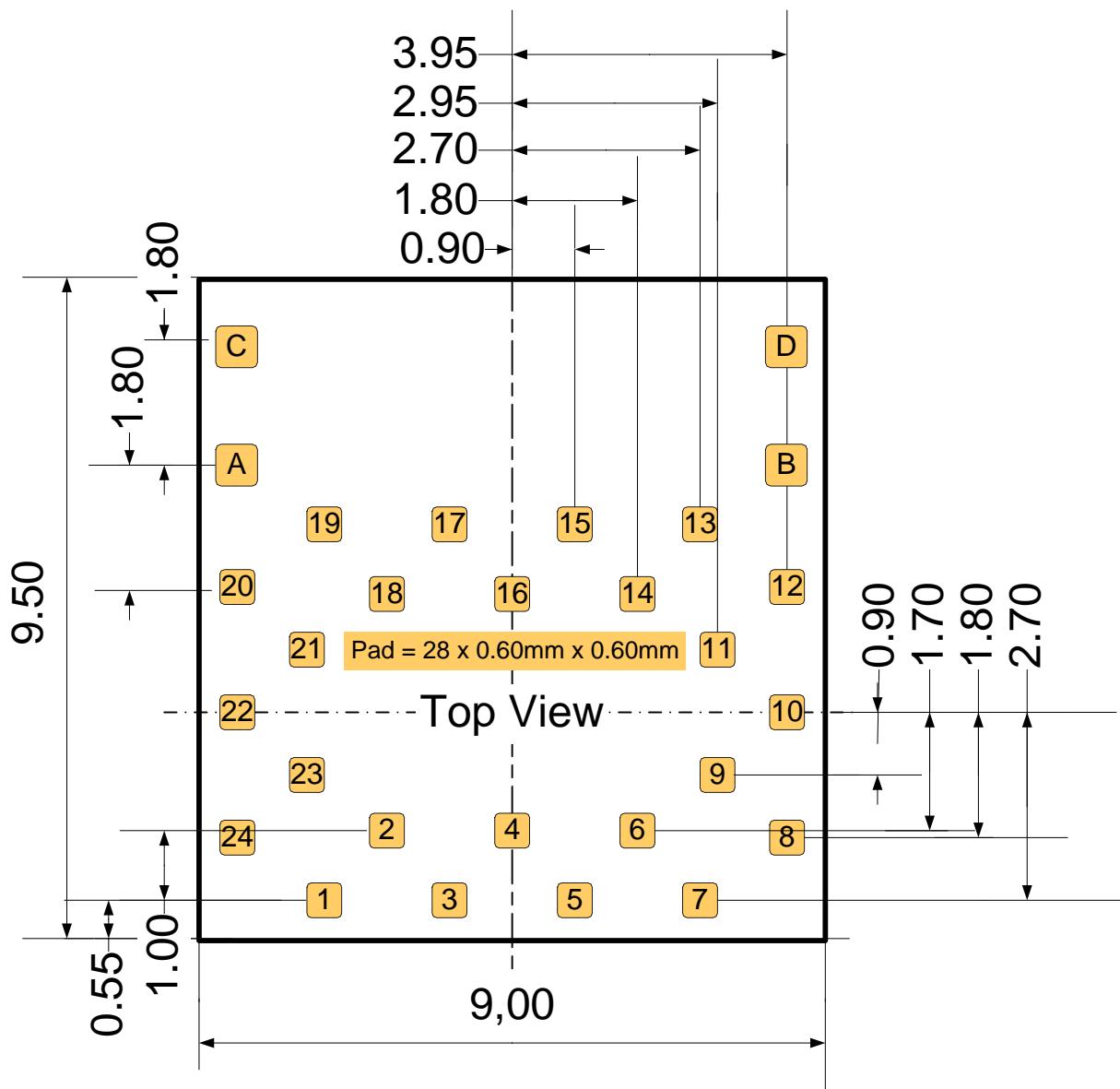
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16.2 FOOTPRINT PAN132X WITH ANTENNA

All dimensions are in millimeters.

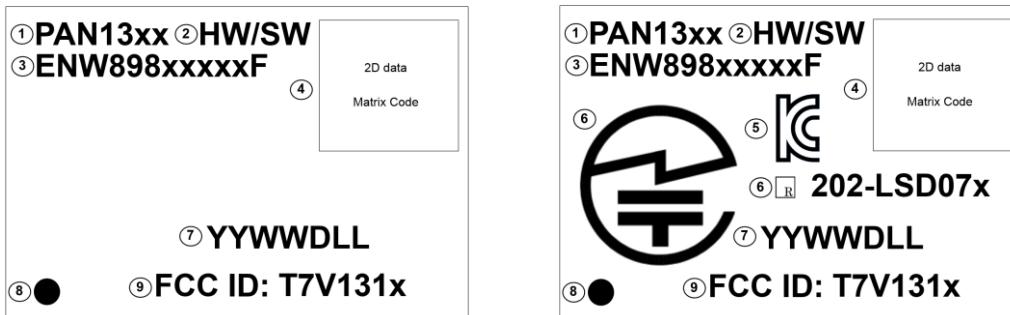
The outer dimensions have a tolerance of $\pm 0.2\text{mm}$.

The layout is symmetric to center. The inner pins (2,4,6,9,11,14,16,18,21,23) are shifted to the center by 1mm.



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17 LABELING DRAWING



The above pictures show the laser marking on the top case, this is only an example.

- 1: Brand Name
- 2: Hardware Version
- 3: Order Number
- 4: 2D Data Matrix Code
- 5: KCC Logo
- 6: MIC Logo/ID
- 7: Lot code
- 8: PIN1 Marking
- 9: FCC ID

18 MECHANICAL REQUIREMENTS

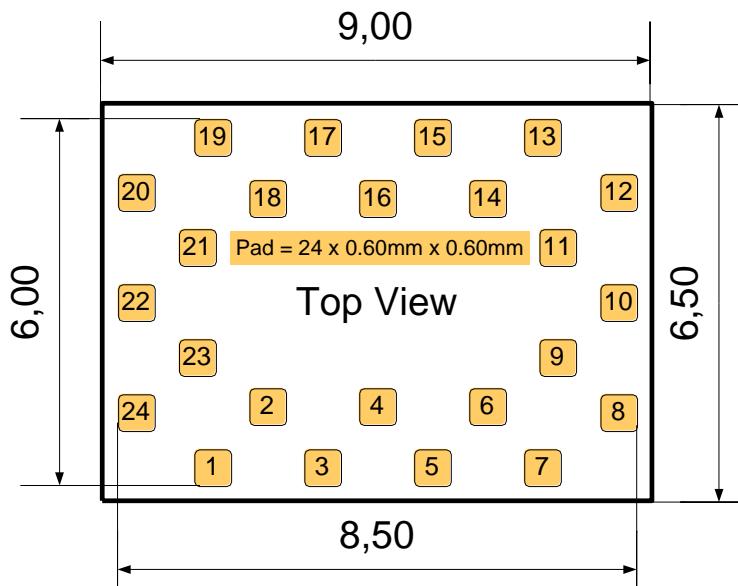
No.	Item	Limit	Condition
1	Solderability	More than 75% of the soldering area shall be coated by solder	Reflow soldering with recommendable temperature profile
2	Resistance to soldering heat	It shall be satisfied electrical requirements and not be mechanical damage	See Chapter 14.1

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19 RECOMMENDED FOOT PATTERN

19.1 RECOMMENDED FOOT PATTERN PAN131X WITHOUT ANTENNA

Dimensions in mm.



The land pattern dimensions above are meant to serve only as a guide. This information is provided without any legal liability.

For the solder paste screen, use as a first guideline the same foot print as shown in the figure above. Solder paste screen cutouts (with slightly different dimensions) might be optimum depending on your soldering process. For example, the solder paste screen thickness chosen might have an effect. The solder screen thickness depends on your production standard 120µm to 150µm is recommended.

IMPORTANT:

Although the bottom side of PAN131X is fully coated, no copper such as through hole vias, planes or tracks on the board component layer should be located below the PAN131X to avoid creating a short. In cases where a track or through hole via has to be located under the module, it must be kept away from PAN131X bottom pads. The PAN131X multilayer pcb contains an inner RF shielding plane, therefore no pcb shielding plane below the module is needed.

When using an onboard ceramic antenna, place the antenna on the edge of your carrier board (if allowable).

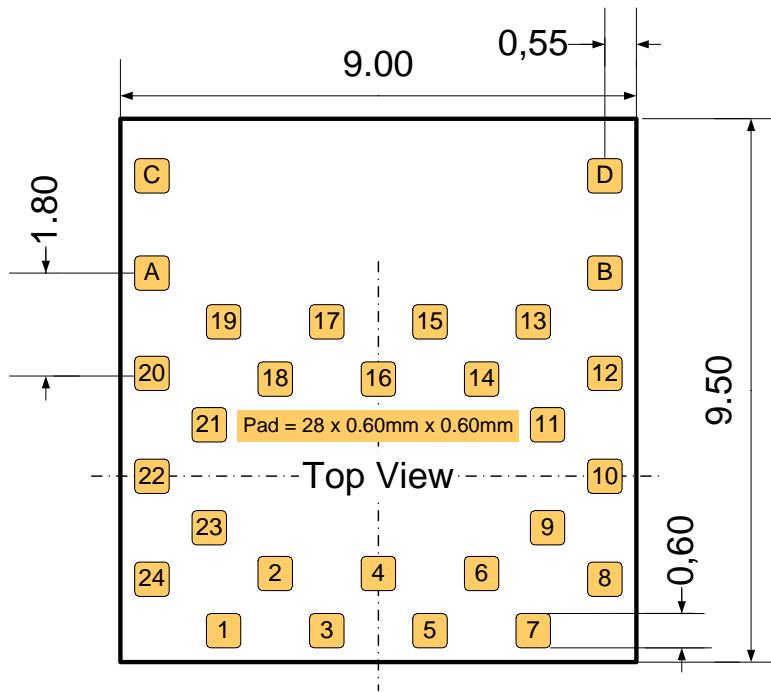
If you have any questions on these points, contact your local Panasonic representative.

Schematics and layouts may be sent to wireless@eu.panasonic.com for final review.

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19.2 RECOMMENDED FOOT PATTERN PAN132X WITH ANTENNA

Dimensions in mm.



The land pattern dimensions above are meant to serve only as a guide.

For the solder paste screen, use as a first guideline the same foot print as shown in the Figure above. Solder paste screen cutouts (with slightly different dimensions) might be optimum depending on your soldering process. For example, the solder paste screen thickness chosen might have an effect. The solder screen thickness depends on your production standard 120µm to 150µm is recommended.

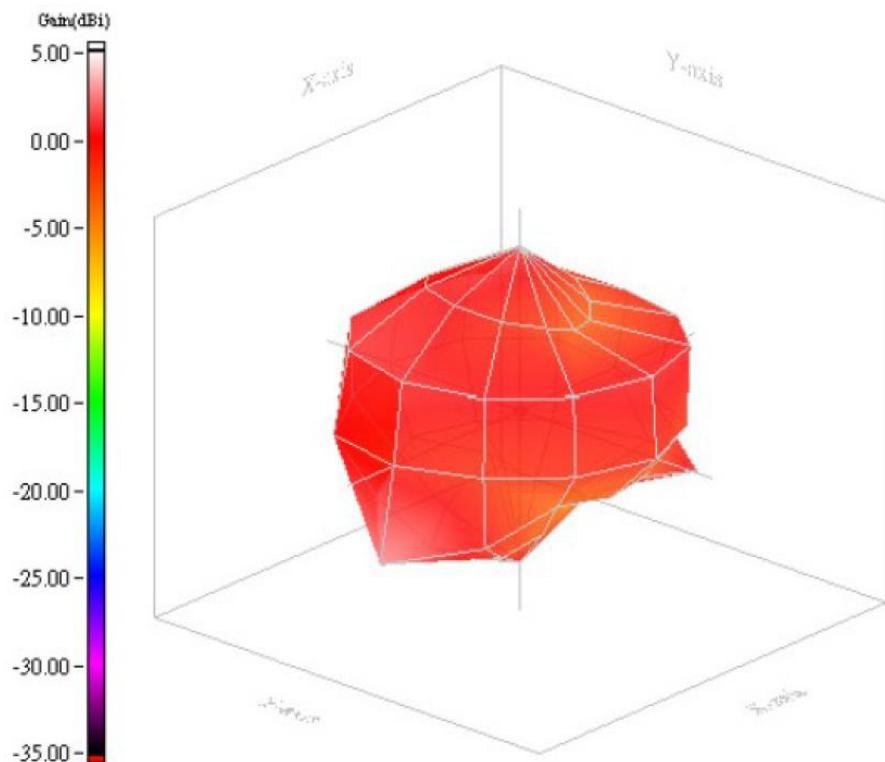
IMPORTANT: In cases where a track or through hole via has to be located under the module, it must be kept away from PAN132X bottom pads. The PAN132X multilayer pcb contains an inner RF shielding plane, therefore no pcb shielding plane below the module is needed.

If you have any questions on these points, contact your local Panasonic representative.

Schematics and layouts may be sent to wireless@eu.panasonic.com for final review.

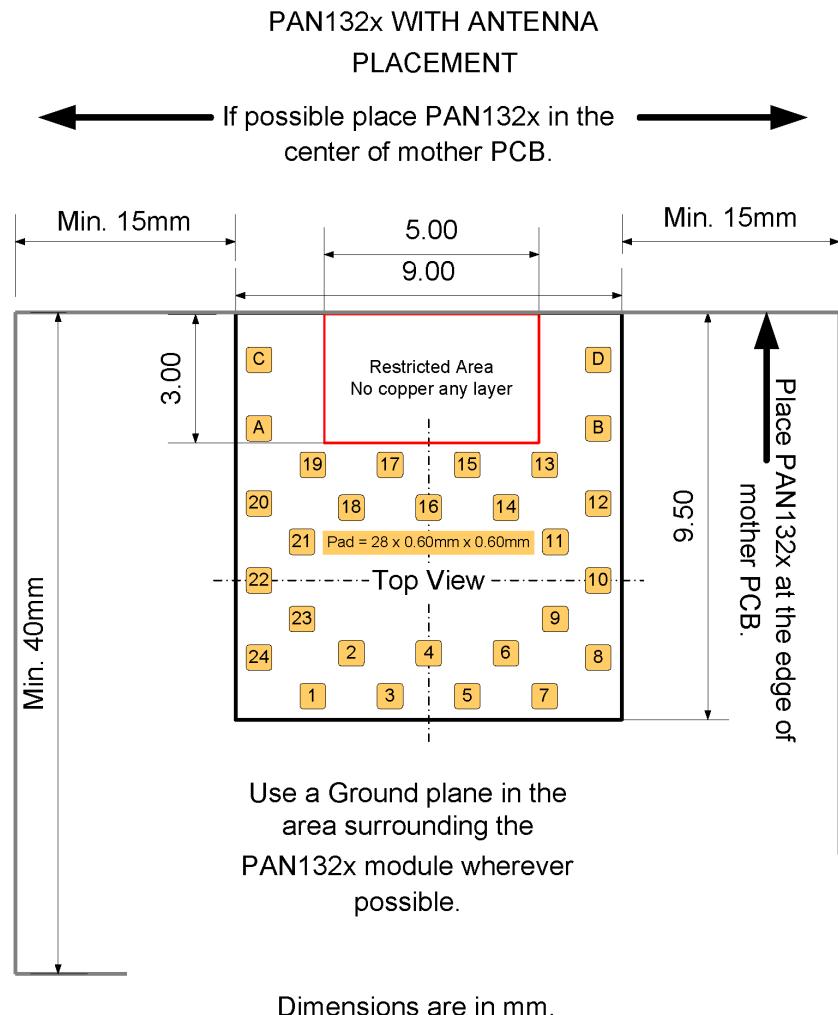
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20 RADIATION PATTERN



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21 LAYOUT RECOMMENDATIONS WITH ANTENNA (PAN132X)



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22 BLUETOOTH LE (LOW ENERGY) PAN1316/26

22.1 NETWORK TOPOLOGY

Bluetooth Low Energy is designed to reduce power consumption. It can be put into a sleep mode and is only activated for event activities such as sending files to a gateway, PC or mobile phone. Furthermore the maximum power consumption is set to less than 15 mA and the average power consumption is about 1 µA. The benefits of low energy consumption are short messages and establishing very fast connections (few ms). Using these techniques, energy consumption is reduced to a tenth of a Classic Bluetooth unit. Thus, a small coin cell – such as a CR2032 – is capable of powering a device for up to 10 years of operation.

To be backwards compatible with Classic Bluetooth and to be able to offer an affordable solution for very inexpensive devices, Panasonic Low Energy Bluetooth modules are offered in two versions:

Dual-mode: Bluetooth Low Energy technology combined with Classic Bluetooth functionality on a single module. Dual mode devices act as gateways between these two technologies.

Single Mode: Bluetooth Low Energy technology to optimize power consumption, which is particularly useful for products powered by small batteries. These modules have embedded controllers allowing the module to operate autonomously in low cost applications that lack intelligence.

22.2 MODULE FEATURES

Fully compliant with Bluetooth 4.0:

- Optimized for proximity and sports use
- Supports up to 10 simultaneous connections
- Multiple sniff instances are tightly coupled to minimize power consumption
- Independent buffering allows a large number of multiple connections without affecting BR/EDR performance
- Includes built-in coexistence and prioritization handling for BR/EDR and LE

22.3 CURRENT CONSUMPTION FOR DIFFERENT LE SCENARIOS

Conditions: VDD_IN = 3.6 V, 25°C, 26-MHz fast clock, nominal unit, 10 dBm output power

Mode	Description	Average Current	Unit
Advertising, non-connectable	Advertising in all 3 channels 1.28msec advertising interval 15Bytes advertise Data	104	µA
Advertising, discoverable	Advertising in all 3 channels 1.28msec advertising interval 15Bytes advertise Data	121	µA
Scanning	Listening to a single frequency per window 1.28msec scan interval 11.25msec scan window	302	µA
Connected (master role)	500msec connection interval 0msec Slave connection latency Empty Tx/Rx LL packets	169	µA

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23 ANT PAN1317/27

ANT+ (sometimes ANT + or ANT Plus) is an interoperability function that can be added to the base ANT protocol (a proprietary wireless sensor network technology).

23.1 NETWORK TOPOLOGY

ANT™ is a wireless sensor network protocol operating in the 2.4 GHz spectrum. Designed for ultra-low power, ease of use, efficiency and scalability, ANT supports peer-to-peer, star, tree and fixed mesh topologies. It provides reliable data communications, flexible and adaptive network operation and cross-talk immunity. The ANT protocol stack is compact, requiring minimal microcontroller resources to reduce system costs, lighten the computational burden and improve efficiency. Low-level security is implemented to allow user-defined network security.

PAN1317/1327 provides the first wireless, single-chip solution with dual-mode ANT and Bluetooth connectivity with inclusion of TI's CC2564 device. This solution wirelessly connects 13 million ANT-based devices to the more than 3 billion Bluetooth endpoint devices used by people every day, creating new market opportunities for companies building ANT products and Bluetooth products alike. CC2564 requires 80% less board area than a design with two single-mode solutions (one ANT+, one Bluetooth) and increases the wireless transmission range up to two times the distance of a single-mode ANT+ solution.

23.2 MODULE FEATURES

Fully compliant with ANT protocol:

- ANT solution optimized for fitness, health and consumers use cases
- Supports up to eight simultaneous connections, various network topologies and high-resolution proximity pairing
- Includes built-in coexistence and prioritization handling for BR/EDR and ANT

Features	Benefits
Dual-mode ANT+ and Bluetooth (Bluetooth v2.1 + EDR) on a single chip	<ul style="list-style-type: none"> - Requires 80% less board area than any dual module or device design - Reduces costs associated with incorporating two wireless technologies
Fully validated optimized single antenna solution	<ul style="list-style-type: none"> - Enables simultaneous operation of ANT+ and Bluetooth without the need for two devices or modules - Includes built-in coexistence
Best-in-class Bluetooth and ANT RF performance: - +10 dBm Tx power with transmit power control - -93 dBm sensitivity	<ul style="list-style-type: none"> - Delivers twice the distance between the aggregator and ANT sensor device than competitive single-mode ANT solutions - Enables a robust and high-throughput connection with extended range
Support for: - ANT+ ultra low power (master and slave devices) - Bluetooth power saving modes (park, sniff, hold) - Bluetooth ultra low power modes (deep sleep, power down)	<ul style="list-style-type: none"> - Improves battery life and power efficiency of the finished product
Turnkey solution:	<ul style="list-style-type: none"> - Ease of integration into system allows quick time to market

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<ul style="list-style-type: none"> - Fully integrated module - Complete development kit with software and documentation - TI MSP430 hardware and software platform integration (optional) - Reduces costs and time associated with certification 				

23.3 ANT CURRENT CONSUMPTION

Mode	Description	Average Current	Unit
Rx message mode	250msec interval	380	µA
Rx message mode	500msec interval	205	µA
Rx message mode	1000msec interval	118	µA

24 TRIPLE MODE (BR/EDR + BLUETOOTH LOW ENERGY OR ANT) PAN1323

The PAN1323 has been engineered to give designers the flexibility to implement Bluetooth Classic (BR/EDR), Bluetooth Low Energy or ANT into an application using a single module, reducing cost and footprint area. Refer to the paragraphs above for complete descriptions on each of the three protocols. The module is fully hardware compatible with the PAN1315, 16, 17, 25, 26 and 27. A highly efficient single RF block serves all three protocols. Protocols access the RF block using time division multiplexing. The application layer determines the priority and timing of the RF block. Customers interested in this unique module are encouraged to contact StoneStreetOne for a Bluetooth SIG certified stack. Note ANT and BLE can not be used simultaneously.

24.1 TRIPLE MODE CURRENT CONSUMPTION

The current consumption of the PAN1323 is a function of the protocol that the module is running at any point in time. Refer to the paragraphs above for details on current consumption for each of the three protocols or software vendor.

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25 DEVELOPMENT OF APPLICATIONS

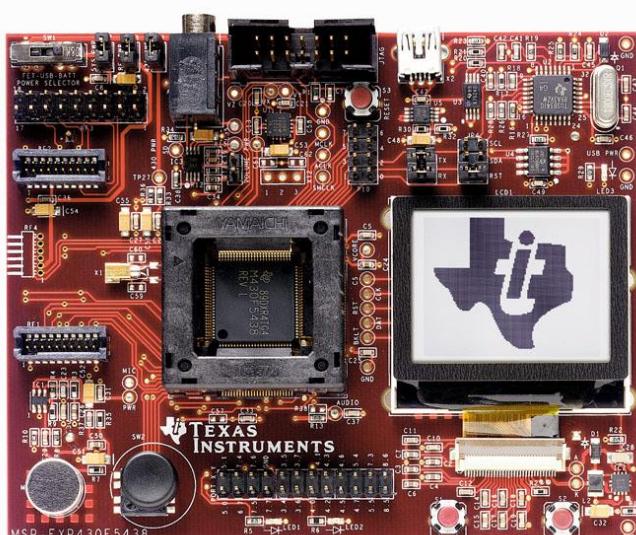
For software versions visit the following links:

www.panasonic.com/rfmodules

http://processors.wiki.ti.com/index.php/CC256x_Forum_Guidelines_and_FAQs

25.1 TOOLS TO BE NEEDED

Tool	Source
TI – MSP-EXP430F5438 – Experimenter Board	MSP-EXP430F5438
TI – MSP-FET430UIF430 – Debugging Interface	MSP-FET430UIF430
PAN1323EMK – Bluetooth Evaluation Module Kit for MSP430	TI PAN1323EMK Panasonic PAN1323ETU



MSP-EXP430F5438
MSP430F5438 Experimenter Board



PAN1323ETU

In addition you need the software development environment, e.g. IAR Embedded Workbench, refer to:

http://processors.wiki.ti.com/index.php/CC256x_Bluetooth

http://processors.wiki.ti.com/index.php/CC256x_Forum_Guidelines_and_FAQs

Evaluation kits and modules are available through Panasonic's network of authorized distributors. For any additional information, please visit www.panasonic.com/rfmodules.

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26 RELIABILITY TESTS

The measurement should be done after being exposed to room temperature and humidity for 1 hour.

No.	Item	Limit	Condition
1	Vibration test	Electrical parameter should be in specification	a) Freq.:10~50Hz,Amplitude:1.5mm a) 20min. / cycle,1hrs. each of XYZ axis b) Freq.:30~100Hz, 6G b) 20min. / cycle,1hrs. each of XYZ axis
2	Shock test	the same as above	Dropped onto hard wood from height of 50cm for 3 times
3	Heat cycle test	the same as above	-40°C for 30min. and +85°C for 30min.; each temperature 300 cycles
4	Moisture test	the same as above	+60°C, 90% RH, 300h
5	Low temp. test	the same as above	-40°C, 300h
6	High temp. test	the same as above	+85°C, 300h

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27 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.

27.1 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.
- (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.

27.2 INSTALLATION NOTES

- (1) Reflow soldering is possible twice based on the conditions in Chapter 15. 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 a board by hand soldering, 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.

27.3 USAGE CONDITIONS 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.

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- (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.

27.4 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 Cl₂, H₂S, NH₃, SO₂, or NO_x
 - Storage in direct sunlight
 - Storage in an environment where the temperature may be outside the range of 5°C to 35°C range, or where the humidity may be outside the 45 to 85% range.
 - Storage of the products for more than one year after the date of delivery Storage period: 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).

27.5 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, 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 single fault causing an unsafe status.

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27.6 OTHER CAUTIONS

- (1) This specification sheet is copyrighted.
- (2) Do not use the products for other purposes than those listed.
- (3) Be sure to provide an appropriate fail-safe 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 (e.g. salty air, HCl, Cl₂, SO₂, H₂S, NH₃, and NO_x)
- (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 Panasonic.

27.7 LIFE SUPPORT POLICY

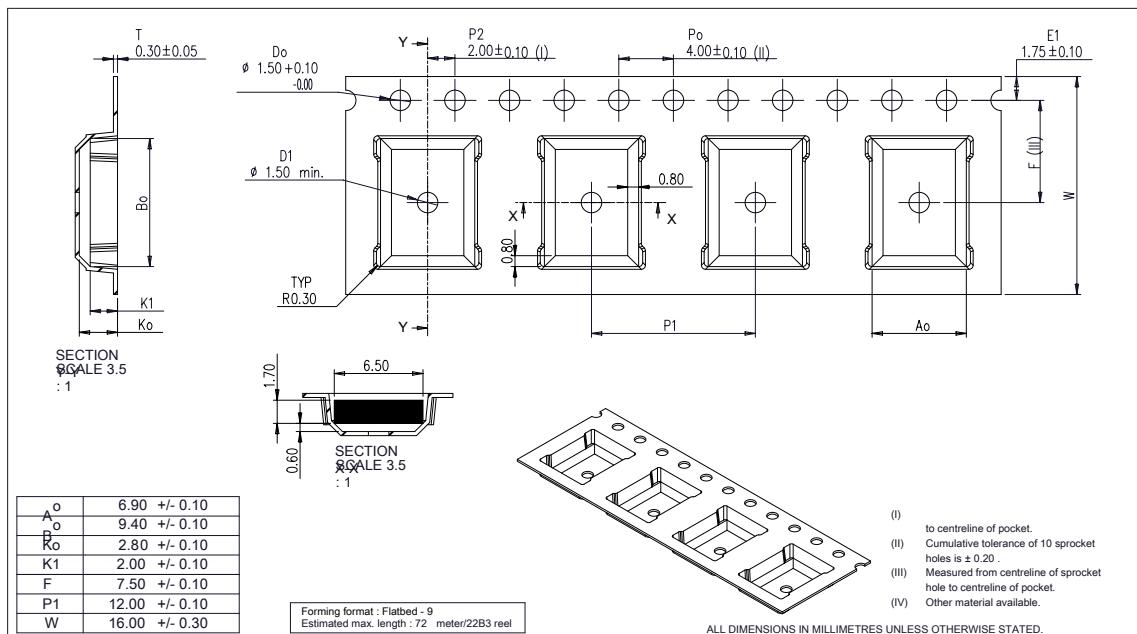
This Panasonic product is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably 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 for any damages resulting.

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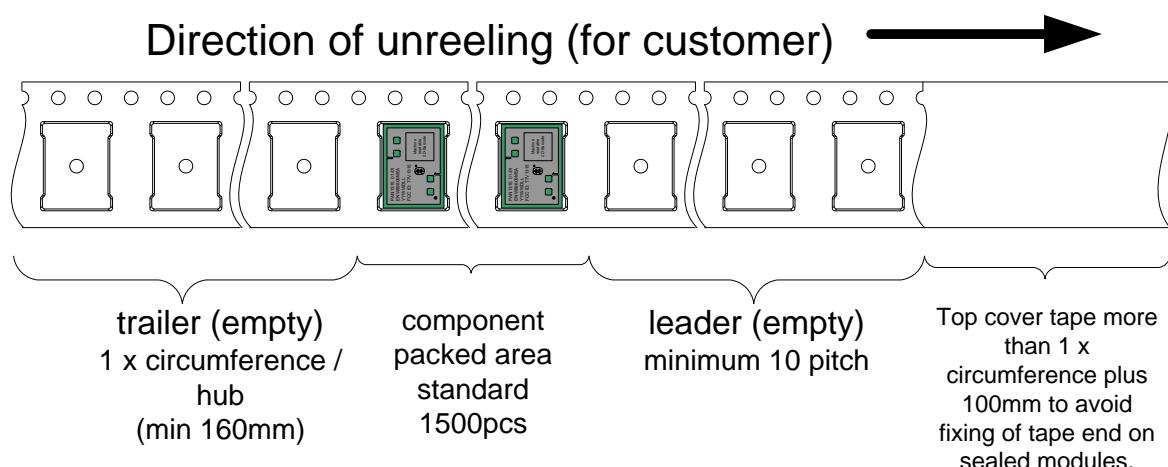
28 PACKAGING

28.1 PACKAGING OF PAN131X WITHOUT ANTENNA

28.1.1 Tape Dimension



28.1.2 Packing in Tape



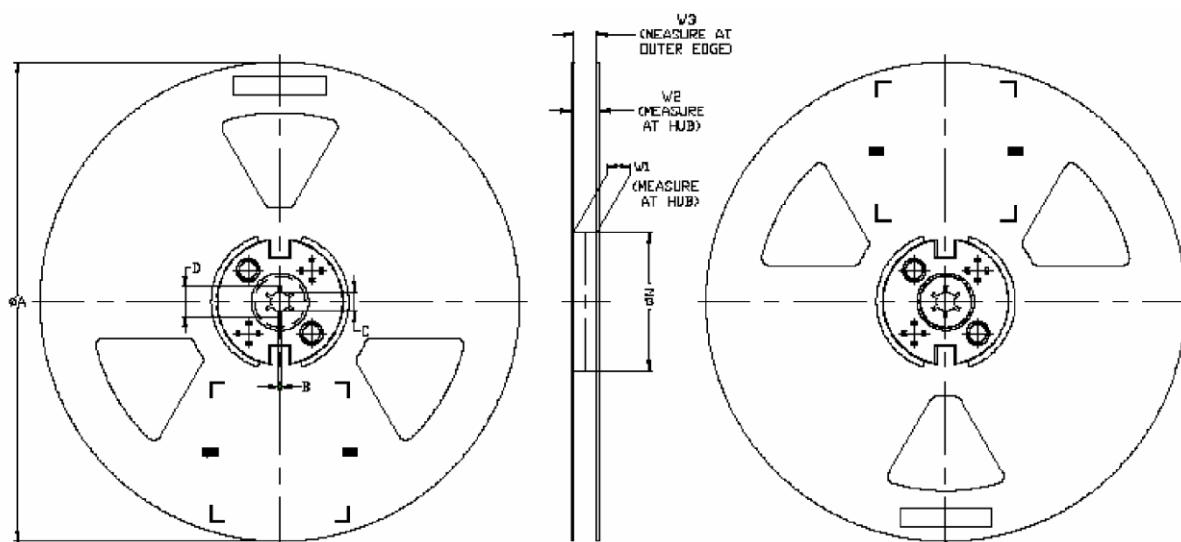
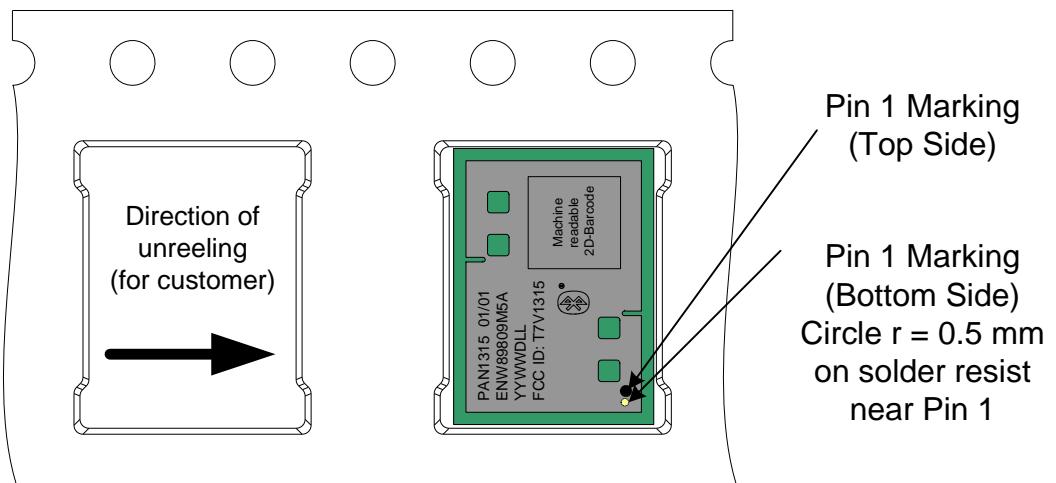
Empty spaces in component packed area shall be less than two per reel and those spaces shall not be consecutive.

Top cover tape shall not be found on reel holes and shall not stick out from reel.

Component direction

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28.1.3 Reel Dimension

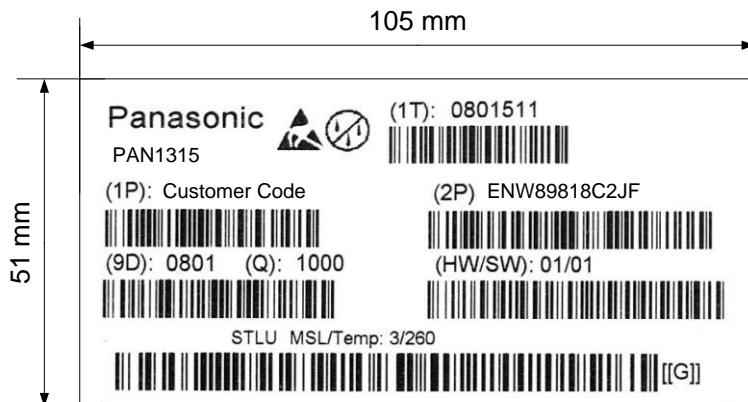


TAPE SIZE	A MAX	B MIN	C	D MIN	N ± 1.0	W1	W2 MAX	W3	Assembly Method
24mm	330.0	1.5	$13^{+0.5}_{-0.2}$	20.2	100.0	$25.0^{+2.0}_{-0.0}$	30.4	$24.4^{+3.0}_{-0.5}$	*Latch

*Latch (2PC)

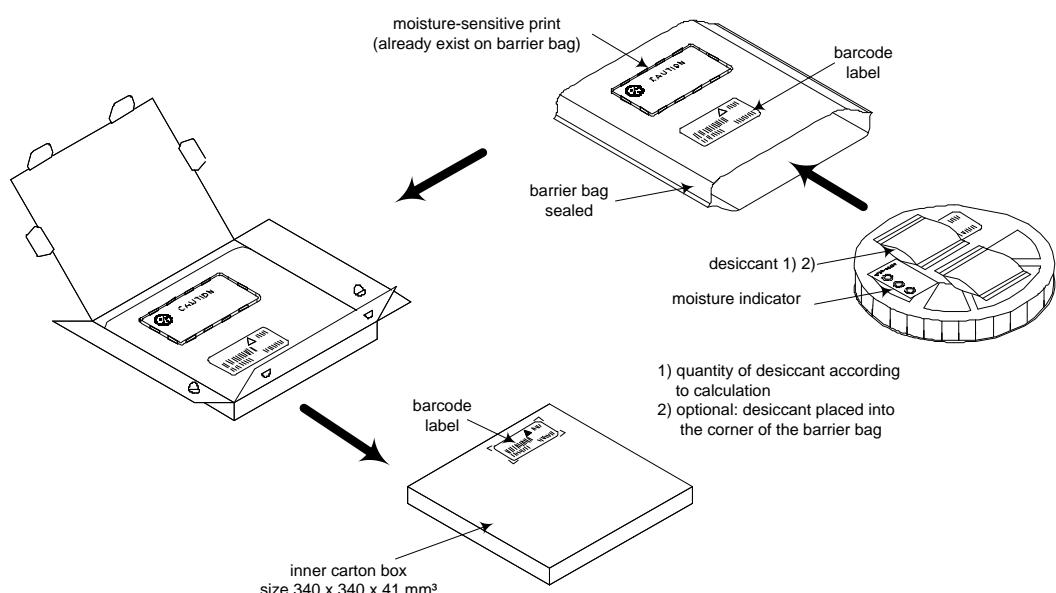
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28.1.4 Label for Package



(1T)	Lot code [YYWW DLL] YY year WW normal calendar week D day L line identifier, if more as one L lot identifier per day	Example from above: printed 08 printed 01 printed 5 (Friday) printed 1 printed 1
(1P)	Customer Order Code, if any, otherwise company name will be printed	
(2P)	Panasonic Order Code refer to chapter 29 Ordering Information	
(9D)	Date code as [YYWW]	
(Q)	Quantity [XXXX], variable max. 1500	
(HW/SW)	Hardware /Software Release	

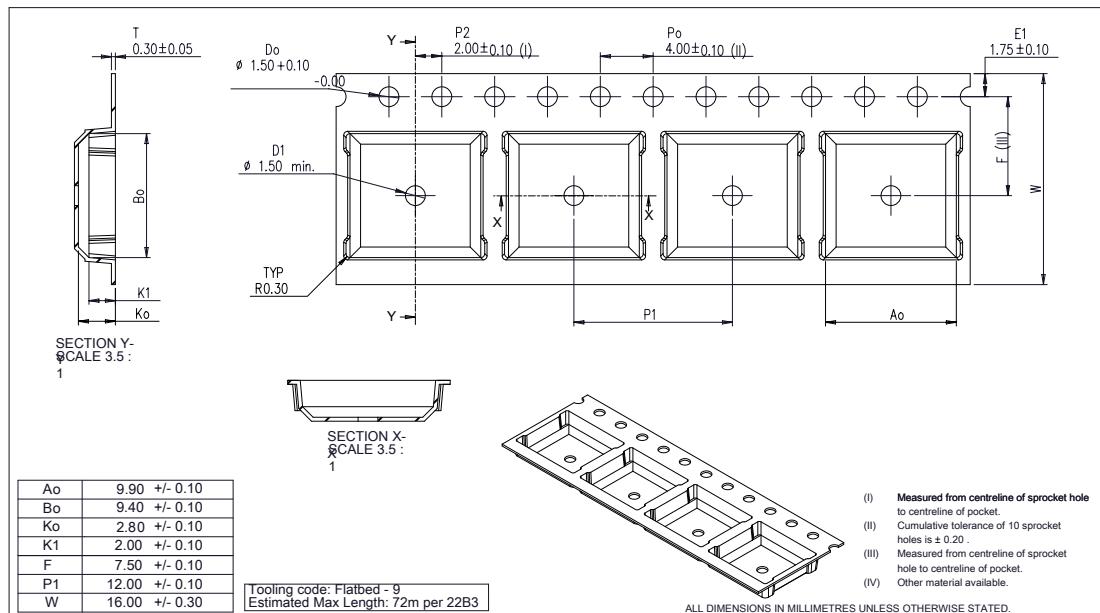
28.1.5 Total Package



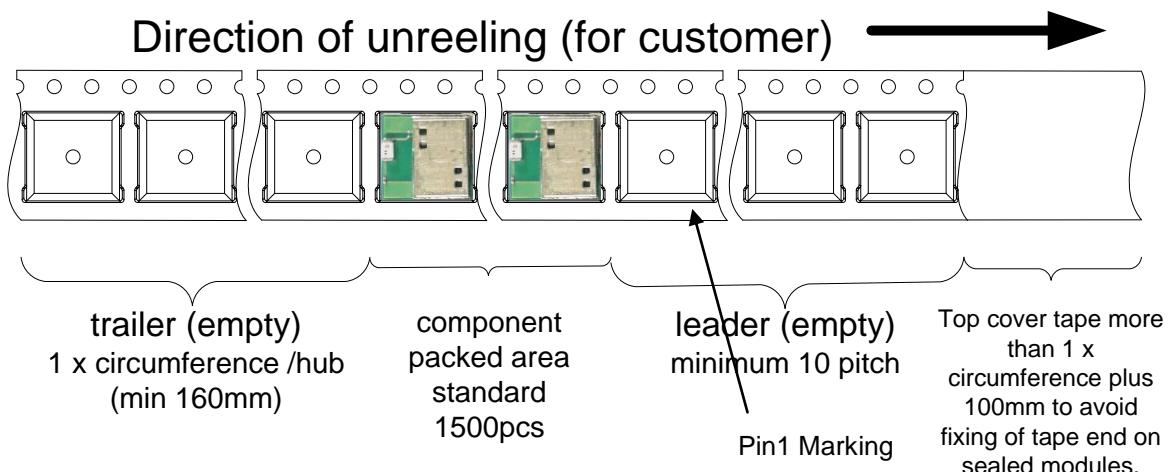
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28.2 PACKAGING FOR PAN132X WITH ANTENNA

28.2.1 Tape Dimension



28.2.2 Packing in Tape



All other packaging information is similar to Chapter 28.1

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29 ORDERING INFORMATION

Model	Temp.	Part Number	TI-Device	Remark
PAN1315A	-20°C to +70°C	ENW89829C2JF	CC2560A	NR for new designs
PAN1315A	-40°C to +85°C	ENW89829C2KF	CC2560A	NR for new designs
PAN1315B	-40°C to +85°C	ENW89829C3KF	CC2560B	Recommended for new designs
PAN1316	-20°C to +70°C	ENW89823C2JF	CC2564	NR for new designs
PAN1316	-40°C to +85°C	ENW89823C2KF	CC2564	NR for new designs
PAN1316B	-40°C to +85°C	ENW89823C3KF	CC2564B	Recommended for new designs
PAN1317	-20°C to +70°C	ENW89827C2JF	CC2564	NR for new designs
PAN1317	-40°C to +85°C	ENW89827C2KF	CC2564	NR for new designs
PAN1323	-20°C to +70°C	ENW89842A2JF	CC2564	NR for new designs
PAN1323	-40°C to +85°C	ENW89842A2KF	CC2564	NR for new designs
PAN1325A	-20°C to +70°C	ENW89829A2JF	CC2560A	NR for new designs
PAN1325A	-40°C to +85°C	ENW89829A2KF	CC2560A	NR for new designs
PAN1325B	-40°C to +85°C	ENW89829A3KF	CC2560B	Recommended for new designs
PAN1326	-20°C to +70°C	ENW89823A2JF	CC2564	NR for new designs
PAN1326	-40°C to +85°C	ENW89823A2KF	CC2564	NR for new designs
PAN1326B	-40°C to +85°C	ENW89823A3KF	CC2564B	NR for new designs
PAN1327	-20°C to +70°C	ENW89827A2JF	CC2564	NR for new designs
PAN1327	-40°C to +85°C	ENW89827A2KF	CC2564	NR for new designs

NR: Not recommended

ETU: Easy to use development board

30 ROHS 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.

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31 REGULATORY INFORMATION

31.1 FCC FOR US

31.1.1 FCC Notice



The devices PAN13xx, for details refer to Chapter 28 in this document, including the antennas, which are listed in Chapter 34.1.5 of this data sheet, 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.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.

31.1.2 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

31.1.3 Labeling Requirements



The Original Equipment Manufacturer (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 identifiers are:

FCC ID: T7V1315 for PAN1315 and PAN1325

FCC ID: T7V1316 for PAN1316, PAN1317, PAN1326 and PAN1327

These FCC identifiers are valid for all PAN13xx modules, for details, see the Chapter 29. Ordering Information. In any case the end product must be labelled exterior with "Contains FCC ID: T7V1315" (PAN1315, PAN1325) or

"Contains FCC ID: T7V1316" (PAN1316, PAN1317, PAN1326 and PAN1327).

31.1.4 Antenna Warning



For the related part number of PAN13xx refer to Chapter 29. Ordering Information.

These devices are tested with a standard SMA connector and with the antennas listed below. When integrated in the OEMs product, these fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Any antenna not in the following tables must be tested to comply with FCC Section 15.203 for unique antenna connectors and Section

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15.247 for emissions. The FCC identifier for this device with the antenna listed below are the same (FCC ID: T7V1315 or T7V1316).

31.1.5 Approved Antenna List (PAN1315, PAN1325)

Note: We are able to qualify your antenna and will add to this list as that process is completed.

Item	Part Number	Manufacturer	Frequency Band	Type	Gain (dBi)
1	2450AT43B100	Johanson Technologies	2.4GHz	Chip-Antenna	+1.3
2	LDA212G3110K	Murata	2.4GHz	Chip-Antenna	+0.9
3	4788930245	Würth Elektronik	2.4GHz	Chip-Antenna	+0.5

31.1.6 Approved Antenna List (PAN1316, PAN1317, PAN1326, PAN1327)

Note: We are able to qualify your antenna and will add to this list as that process is completed.

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

31.1.7 RF Exposure PAN13xx

To comply with FCC RF Exposure requirements, the Original Equipment Manufacturer (OEM) must ensure that the approved antenna in the previous tables must be installed.



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 PAN13xx with mounted ceramic antenna (FCC ID: T7V1315 or T7V1316) is far below the FCC radio frequency exposure limits. Nevertheless, the PAN13xx 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.

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31.2 INDUSTRY CANADA CERTIFICATION

31.2.1 IC Notice

This device complies with Industry Canada RSS-210 (Rev.8). Operation is subject to the following two conditions

- 1) this device may not cause interference, and
- 2) this device must accept any interference, including interference that may cause undesired operation of the device.

PAN131x is licensed to meet the regulatory requirements of Industry Canada (IC), license:

IC: 216Q-1315 (PAN1315, PAN1325)

IC: 216Q-1316 (PAN1316, PAN1317, PAN1326, PAN1327)

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 Tables 31.1.5 and 31.1.6 above, having a maximum gain of 1.3 dBi (PAN13x6: 0.9dBi). Antennas not included in this list or having a gain greater than 1.3 dBi (PAN13x6: 0.9dBi) 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.

Le présent appareil est conforme aux CNR 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.

PAN131x est garanti conforme aux dispositions réglementaires d'Industry Canada (IC), licences:

IC: 216Q-1315 (PAN1315, PAN1325)

IC: 216Q-1316 (PAN1316, PAN1317, PAN1326, PAN1327)

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 ci-dessus, présentant un gain maximum de 1.3dBi (PAN13x6:0.9dBi). Des antennes autres que celles listées ici, ou présentant un gain supérieur à 1.3dBi (PAN13x6: 0.9dBi) ne doivent en aucune circonstance être utilisées en combinaison avec ce produit. L'impédance des antennes compatibles est 50Ohm. 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.

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31.2.2 Labeling Requirements



The Original Equipment Manufacturer (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 identifiers are:

IC: 216Q-1315 (PAN1315, PAN1325)

IC: 216Q-1316 (PAN1316, PAN1317, PAN1326, PAN1327)

These IC identifiers are valid for all PAN13xx modules, for details, see the Chapter 29. Ordering Information. In any case the end product must be labelled exterior with "**Contains IC: 216Q-1315**" (PAN1315, PAN1325) or "**Contains IC: 216Q-1316**" (PAN1316, PAN1317, PAN1326 and PAN1327).

Obligations d'étiquetage

Les fabricants d'équipements (OEM) doivent s'assurer que les obligations d'étiquetage 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.

Les identifiants IC sont:

IC: 216Q-1315 (PAN1315, PAN1325)

IC: 216Q-1316 (PAN1316, PAN1317, PAN1326, PAN1327)

Ces identifiants sont valides pour tous les modules PAN13xx (Chapter 29. Ordering Information). Dans tous les cas les produits finaux doivent indiquer sur leur emballage externe une des mentions suivantes:

"**Contient IC: 216Q-1315**" (PAN1315, PAN1325) ou

"**Contient IC: 216Q-1316**" (PAN1316, PAN1317, PAN1326, PAN1327).

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31.3 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:



PAN13xx and its model versions 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.

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31.4 JAPANESE RADIO LAW AND JAPANESE TELECOMMUNICATIONS BUSINESS 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 following models are qualified for the Japanese market:

ENW89823A2KF MIC ID: [R]202-LSD072

ENW89823A3KF MIC ID: [R]202-LSD072

ENW89829A2KF MIC ID: [R]202-LSD073

ENW89829A3KF MIC ID: [R]202-LSD073

31.5 KOREAN CERTIFICATION

This device is granted pursuant to the Korean Law.

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

1. Indicate the following expression on the product where it can be easily seen: "This radio equipment can be crossed during operation."

"該当の無線設備は運用の中で電波混信可能性がある"という文具を同設備のちゃんと見える所に表

示すること => "該当の無線設備は運用の中で電波混信可能性がある"

2. The manufacturer and installer should fully inform the operator or users: "This radio equipment cannot provide a service relevant to the human life safety, as it can be crossed" through the User Manual etc.

製作者及び設置者は当該の無線設備が電波混信可能性があるので人命安全と係わるサービスは出

来ないことをマニュアルなどを通じて運用者及び使用者に充分に知らせること

=> "該当の無線設備が電波混信可能性がありますので人命安全と係わるサービスは出来ません"

The MSIP number is: MSIP-CRM-Pid-ENW89823A3KF

This ID is valid for:

ENW89823A3KF

31.6 BLUETOOTH SIG STATEMENT

The Design is listed as Controller Subsystem with QDID: B019784

https://www.bluetooth.org/tpg/QLI_viewQDL.cfm?qid=19784

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Specification for Production

Applicant / Manufacturer Hardware	Panasonic Electronic Devices Europe GmbH Zeppelinstrasse 19 21337 Lüneburg Germany
Applicant / Manufacturer Software	Stollmann Entwicklungs- und Vertriebs-GmbH Mendelssohnstrasse 15 D 22761 Hamburg Germany
Supported Bluetooth Profiles	BlueRS , SPP, HDP, HID, OPP, HDP/SPP
Contents	Approval for Mass Production
Customer	

By signing this document, you acknowledge that you are the legal representative for your company and that you understand and accept the validity of the contents herein .

CHECKED / APPROVED:

DATE:	NAME:	SIGNATURE:
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NOTE:

AT LEAST ONE SET OF APPROVED SPECIFICATIONS SHOULD BE RETURNED TO THE ADDRESS OF THE ISSUING PARTY.

PANASONIC ELECTRONIC DEVICES EUROPE GMBH High Frequency Products Business Group - Wireless Modules -	APPROVED genehmigt	CHECKED geprüft	DESIGNED erstellt
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1. KEY FEATURES

Schlüsseleigenschaften

- Bluetooth specification v2.0 + EDR (Enhanced Data Rate)
- CSR BlueCore6-ROM inside
- Complete Co-location and Co-existence with IEEE 802.11 (AWMA, AFH and SFH)
- Fast Connection Setup
- Extended SCO Link
- RF output power class 2 with power control
- Supply Voltage 3.0V to 3.6V
- Internal crystal oscillator (26MHz, 14.7456 MHz and 32 kHz for deep sleep)
- Surface mount type
 - PAN1455: 13.5 x 18.75 x 2.85 mm
 - PAN1555: 13.5 x 22.75 x 2.85 mm
- Built-in shielding to be compliant to FCC
- Full Bluetooth data rate up to 2178kbps asymmetric
- Support for all Bluetooth power saving modes (Park, Sniff, Hold)
- Support for very low-power modes (deep sleep and power down)
- Optional support for ultra-low-power mode. Standby with Battery-Backup
- PCM Interface Master / Slave supporting 13 or 16 bit linear, 8 bit µ-law or A-law Codecs and CVSD encoders on up to 3 SCO channels
- Full 8- to 128-bit encryption
- High sensitivity design (-86 dBm typ.)
- 3 UART, USB, I2C and SPI Interface
- 18 GPIO's for individual usage for your embedded software
- 3 Channel ADC and 1 Channel DAC
- Cortex-M3 ST32F103 core for embedded profiles or application software
- Manufactured in conformance with RoHS

2. APPLICATIONS FOR THE MODULE

Applikationen für das Modul

All Embedded Wireless Applications

- Access Points
- Printer Adapters
- Printers
- Scanners
- Wireless Sensors
- Cable Replacement
- Personal Digital Assistants (PDAs)
- Access Points
- Computers and Peripherals
- Industrial Control Applications

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3. DESCRIPTION FOR THE MODULE

Modulbeschreibung

PAN1455/1555 is a short-range class 2 module for implementing Bluetooth functionality into various electronic devices. The module consists of three major parts; a baseband controller, a EEPROM memory and a radio that operates in the license-free 2.45 GHz ISM band.

The module is listed as a Bluetooth End Product (EPL). Customers have to list their product under the BT QDID: B015522

Communication between the module and the host controller is carried out normally via UART. Optional via below interfaces. Please contact your local sales office for further details on additional options.

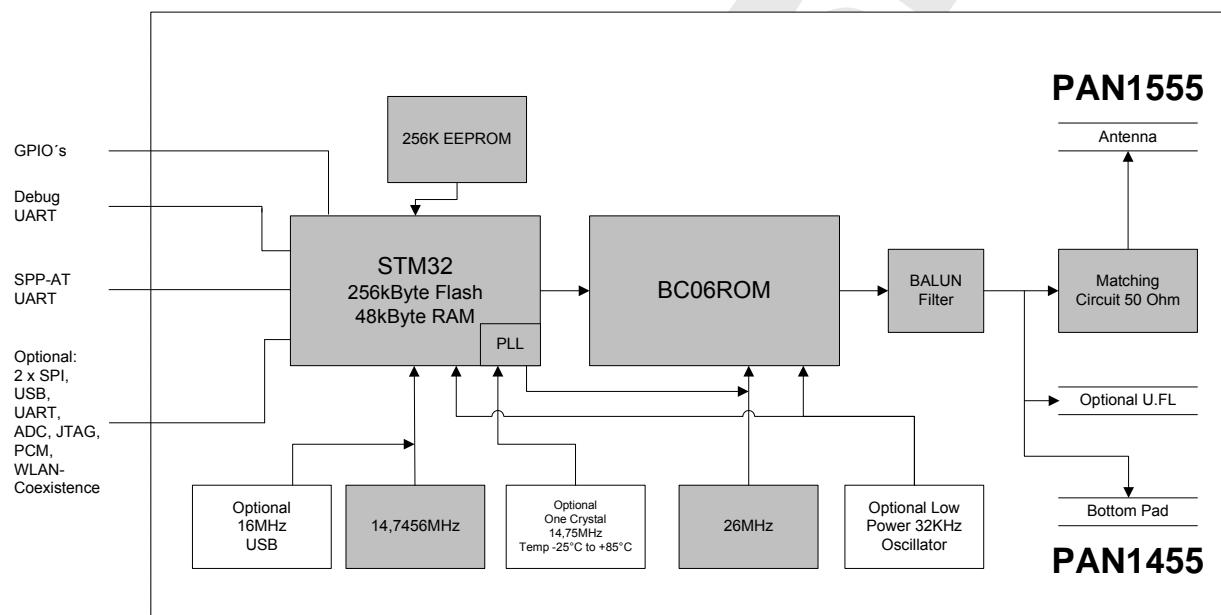


Figure 3.1 PAN1455/1555 Block-Diagram

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4. SCOPE OF THIS DOCUMENT

Umfang dieses Dokumentes

This product specification applies to the class 2 bluetooth module ENW89815CxKF/ENW89815AxKF. The different characters indicates different versions (refer to chapter 24 Ordering Information) The used bluetooth chip is the BlueCore6 from the company CSR. (www.csr.com).

Diese Produktionsunterlagen beziehen sich auf das Class 2 Bluetooth Modul ENW89815CxKF/ENW89815AxKF.

Die unterschiedlichen Zeichen bezeichnen verschiedene Versionen (Erklärung im Kapitel 24 Ordering Information)

Der verwendete Bluetooth Chip ist der BlueCore6 der Firma CSR.

5. HISTORY FOR THIS DOCUMENT

Versionsverwaltung dieses Dokumentes

Revision Version	Date Datum	Modification / Remarks Änderungen / Bemerkungen
0.90	06.03.2009	Preliminary release.
0.91	30.03.2009	Add FCC Notice
0.92	04.05.2009	Include RF-Performance and current consumption
0.93	06.05.2009	Do minor changes in formatting, content links now included.
0.94	29.05.2009	Include final tables and Interface description
0.95	28.08.2009	SW-Status updated
1.00	01.02.2011	Power update for min values, add foot note from CSR, add CSR datasheet in appendix, add HDP Partnumbers, add link to Stollmann SW support page. Include BT Listing QDID information.
1.10	27.06.2011	Updated laser label information in chapter 20 Labelling Drawing.

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6. TERMINAL LAYOUT Anschlußbelegung

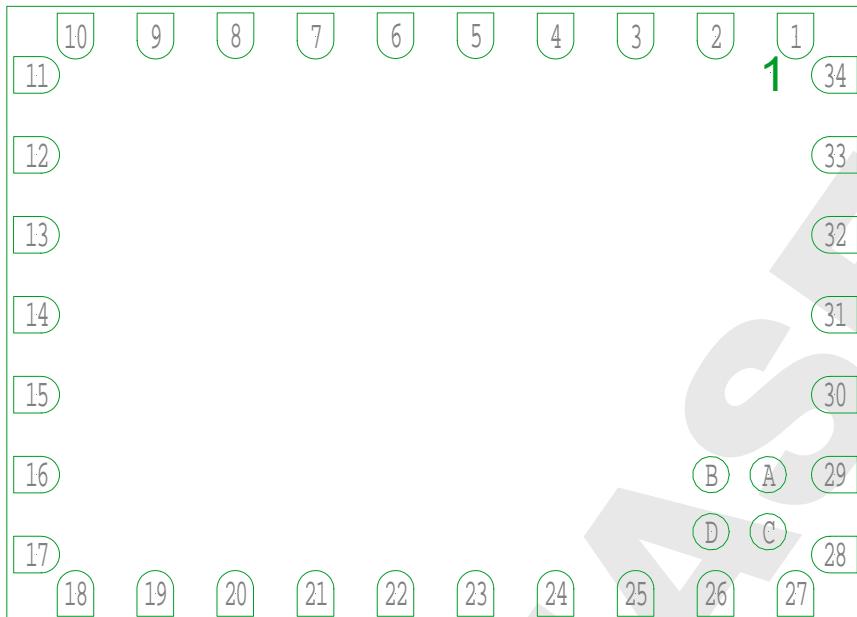


Figure 6.1 PAN1455/1555 Pin Numbering Bottom View

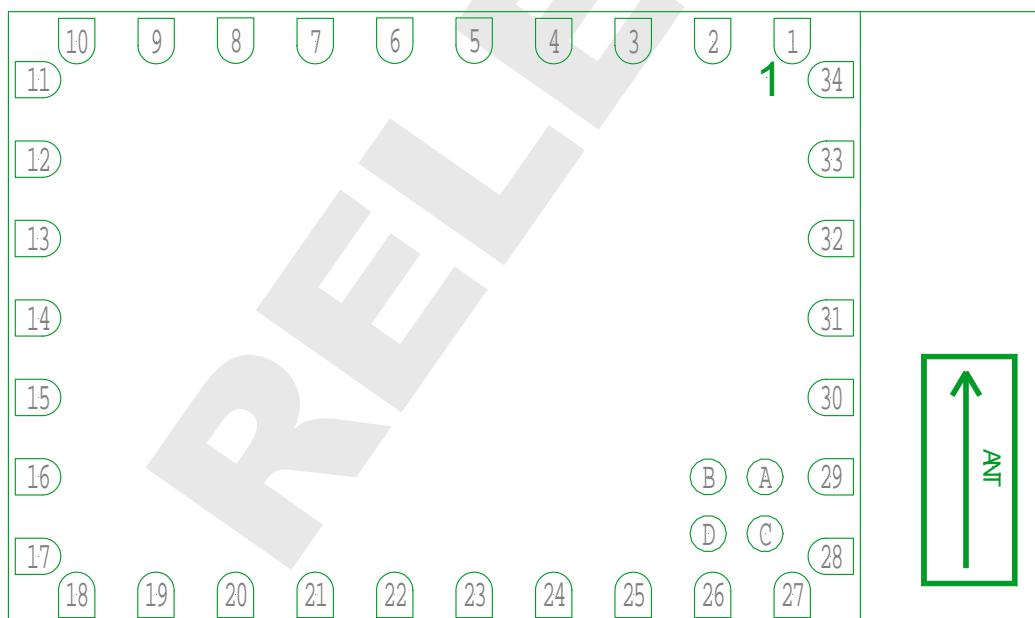


Figure 6.2 PAN1455/1555 Pin Numbering Bottom View

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6.1. GENERAL PIN ASSIGNMENT

No	Pin Name	Type	PU/PD	Active	Description
1	GND1	P	-	-	Connect to Ground
2	ANT	I/O	-	-	Antenna Connector
3	UART_RTS#	I	PD	H	UART Request To Send (active low)
4	UART_TXD	I	PD	L	UART Data Input, weak internal Pull-Down
5	UART_RXD	O	-	L	UART Data Output
6	UART_CTS#	O	-	H	UART Clear To Send, internal Pull-Up
7	GPIO[9]/PCM_CLK	I/O	PU	L	General Purpose Input/Output, weak internal Pull-Up / PCM Data Clock Output
8	GPIO[10]/PCM_O/TXD3	I/O	PU	L	General Purpose Input/Output, weak internal Pull-Up / PCM Data Output/ UART3 DATA Output
9	GPIO[7]/PCM_SYNC	I/O	PD	H	General Purpose Input/Output, weak internal Pull-Down / PCM Data Sync Output
10	GND2	P	-	-	Connect to Ground
11	ATRST/SPI2_MISO	I/O	PU	H	JTAG reset, internal Pull-Up / SPI2 Master In - Slave Out
12	GPIO[8]/PCM_I/RXD3	I/O	PU	L	General Purpose Input/Output, weak internal Pull-Up / PCM Data Input / UART3 DATA Input
13	ATDI/SPI2_CS	I/O	PU	-	JTAG test data input, weak internal Pull-Up / SPI2 Chip Select
14	ATMS	I	PU	-	JTAG mode select, weak internal Pull-Up
15	reserved	I	PD	-	for Debug-Use only, nc
16	VCC	P	-	-	VCC
17	RESET#	I	PU	L	Reset input
18	GND3	P	-	-	Connect to Ground
19	GPIO[14]	I/O	PU	L	General Purpose Input/Output, weak internal Pull-Up
20	GPIO[13]	I/O	PD	H	General Purpose Input/Output, weak internal Pull-Down
21	GPIO[15]	I/O	PU	L	General Purpose Input/Output, weak internal Pull-Up
22	GPIO[6]/ADC	I/O	PD	H	General Purpose Input/Output, weak internal Pull-Up / ADC Input
23	ATDO/SPI2_SCK	O	PU	-	JTAG test data output
24	ATCK	O	PD	-	JTAG clock, weak internal Pull-Down
25	GPIO[3]/SPI_CLK	I/O	PD	H	General Purpose Input/Output, weak internal Pull-Down / SPI Clock
26	GPIO[0]/SPI_MOSI	I/O	PD	H	General Purpose Input/Output, weak internal Pull-Down / SPI Master Out – Slave In
27	GND4	P	-	-	Connect to Ground
28	GPIO[2]/SPI_CS	I/O	PD	H	General Purpose Input/Output, weak internal Pull-Down / SPI Chip Select
29	GPIO[1]/SPI_MISO	I/O	PD	H	General Purpose Input/Output, weak internal Pull-Down / SPI Master In – Slave Out
30	GPIO[5]/TXD2	I/O	PD	H	General Purpose Input/Output, weak internal Pull-Down / UART2 DATA Output
31	GPIO[4]/RXD2	I/O	PD	H	General Purpose Input/Output, weak internal Pull-Down / UART2 DATA Input
32	USB_DM	I/O	PD	-	USB Data Minus Terminal
33	USB_DP	I/O	PD	-	USB Data Plus Terminal
34	GPIO[17]/TAMPER	I/O	PD	-	General Purpose Input/Output, weak internal Pull-Down, do not use as current source! / TAMPER In
A	GPIO[16]/SPI2_MOSI	I/O	PU	L	General Purpose Input/Output, weak internal Pull-Up / SPI2 Master Out – Slave In
B	GPIO[12]/I2C_SCL	I/O	PU	L	General Purpose Input/Output, weak internal Pull-Up / I2C Serial Clock Line
C	GPIO[11]/I2C_SDA	I/O	PU	L	General Purpose Input/Output, weak internal Pull-Up / I2C Serial Data Line
D	VBAT	P	-	-	Optional Batterie Backup

Type: PU - Pulled up; PD – pulled down; P – Power; I – Input; O – Output; I/O - bidirectional

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6.2. APPLICATION SPECIFIC PIN DESCRIPTION

6.2.1. SPP configuration DCE Mode

No	Pin Name	SPP-Function	Type	PU/PD	Active	Description
1	GND1	Power	P	-	-	Connect to Ground
2	ANT	Antenna	I/O	-	-	Antenna Connector
3	UART_RTS#	/RTS	I	PU	L	UART Request To Send
4	UART_TXD	TXD	I	PD	H	UART Data Input
5	UART_RXD	RXD	O		H	UART Data Output
6	UART_CTS#	/CTS	O		L	UART Clear To Send
7	GPIO[9]/PCM_CLK	/LED2	O		L	Bluetooth connected. Active if a Bluetooth connection exists. Inactive in idle state. Flashes during startup.
8	GPIO[10]/PCM_O/TXD3	UA2	O			User Output 2
9	GPIO[7]/PCM_SYNC	/LED1	O		L	Device Ready
10	GND2	Power	-	-	-	Connect to Ground
11	ATRST/SPI2_MISO	reserved	I/O	PU	H	leave open
12	GPIO[8]/PCM_I/RXD3	/UE1	I	PU	L	User Input 1
13	ATDI/SPI2_CS	reserved	I/O	PU	-	leave open
14	ATMS	reserved	I	PU	-	leave open
15	BOOT0	reserved	I	PD	H	for Debug-Use only, nc
16	VCC	Power	-	-	-	VCC
17	RESET#	/RESET	I	PU	L	Reset input (active low for 5 ms); Schmitt triggered
18	GND3	Power	-		-	Connect to Ground
19	GPIO[14]	/RTC-OUT	O		L	DSR in DCE mode, DTR in DTE mode
20	GPIO[13]	/RTC-IN	I	PU	L	DTR in DCE mode, DSR in DTE mode
21	GPIO[15]	/DCD or /DCD-DTE	I/O	PU	L	Data Carrier Detect , Input in DTE mode Output in DCE mode
22	GPIO[6]/ADC	/RI	I/O	PU	L	Ring Indicator, Input in DTE mode Output in DCE mode
23	ATDO/SPI2_SCK	reserved	O	PU	-	JTAG
24	ATCK	reserved	O	PD	-	JTAG
25	GPIO[3]/SPI_CLK	reserved	I/O	PD	H	leave open
26	GPIO[0]/SPI_MOSI	reserved	I/O	PD	H	leave open
27	GND4	Power	-		-	Connect to Ground
28	GPIO[2]/SPI_CS	reserved	O			leave open
29	GPIO[1]/SPI_MISO	/UE2	I	PD	H	User Input 2, Break Detect (1)
30	GPIO[5]/TXD2	reserved	O			leave open
31	GPIO[4]/RXD2	DTE-/DCE Select	I	PD	H	DTE (high) DCE (low) mode selector
32	USB_DM	reserved	I/O	PD	-	leave open
33	USB_DP	reserved	I/O	PD	-	leave open
34	GPIO[17]/TAMPER	reserved	I/O	PD	-	leave open
A	GPIO[16]/SPI2_MOSI	reserved	I/O	PU	L	leave open
B	GPIO[12]/I2C_SCL	reserved	I/O	PU	L	leave open
C	GPIO[11]/I2C_SDA	reserved	I/O	PU	L	leave open
D	VBAT	Power	-		-	Optional Batterie Backup

Type: PU - Pulled up; PD – pulled down; P – Power; I – Input; O – Output; I/O - bidirectional

All other pins do not have a dedicated functionality in SPP mode. See 6.1 General Pin Assignment for all other terminals.

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7. TERMINAL SPECIFICS

Interfacebeschreibungen

7.1. RF-INTERFACE - ANT

The PAN1455 presents a 50Ω impedance on the antenna pin. If you need antenna support please e-mail to wireless@ecom.panasonic.de or use the PAN1555 with integrated ceramic antenna.

7.2. POWER SUPPLY

PAN1455/1555 require a power supply with the following characteristics:

Typical : 3.3VDC, min.: 3.0VDC – max.: 3.6VDC, low noise ($\leq 10mV$), $>80mA$ peak

Due to the technological requirements and the pulsed radio transmission the supply needs to be fed by an ultra fast (response time $\leq 20\mu s$) linear regulator placed as close as possible to the VSUP pin (16). Functionality has been verified with the following types: TOREX:
XC6204x332xx or XC6401xx42xx

It is also recommended to place a low ESR capacitor with at least $10\mu F$ as close as possible to the VSUP pin (16).

NOTE: You must ensure that during operation the supply voltage never drops below 2.8 VDC. Otherwise the flash contents (firmware and/or configuration data) can get lost.

7.3. POWER-ON-RESET

PAN1455/1555 are equipped with circuitry for generating Power ON-/OFF Reset from the internal core voltage. A reset is generated when the core voltage falls below typically 1.88V and is released when it rises above typically 1.92V.

In case of Power-On, Power-Off, Watchdog, Low-Power or Software, RESET# acts as an Output by holding RESET# at $\leq 0.3V$ for min. 1,5ms and max. 3,5ms.

In an application with an external Reset as an Input, for example external Reset-Controller, we recommend to use Open-Drain-Output for this circuit. An external reset shall be generated at $RESET\# \leq 0.3V$ for $\geq 5ms$ after VSUP has stabilized in the recommended voltage range.

The following table shows the pin states of PAN1455/1555 on reset.

Pin Name	State: PAN1455/1555
UART_RTS#	Input Floating
UART_RXD	Input Floating
UART_RXD	Input Floating
UART_CTS#	Input Pull-Up
GPIO[0] – GPIO[13], GPIO[16], GPIO[17]	Input Floating
GPIO[14]	Input Pull-Up
GPIO[15]	Input Pull-Up
Boot0	Input Pull-Down
ATRST	Input Pull-Up
ATDI	Input Pull-Up
ATMS	Input Pull-Up
ATDO	Input Floating
ATCK	Input Pull-Down
USB_DM	Input Floating
USB_DP	Input Floating

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7.4. UART INTERFACE – TXD, RXD, CTS, RTS

The functionality of the interface corresponds to the V.24 / RS-232 standard on TTL-level.

Transmission speeds:

- 1200 bps
- 2400 bps
- 4800 bps
- 9600 bps
- 19200 bps
- 38400 bps
- 57600 bps
- 115200 bps
- 230400 bps
- 460800 bps
- 921200 bps

Character representation:

- 8 or 9 Bit, even/odd/no Parity, 1 or 2 stop bits
- 7 Bit, even/odd Parity, 1 or 2 stop bits
- 7 Bit no Parity, 2 or 3 stop bits

Hardware flow-control with UART_RTS and UART_CTS (active low)

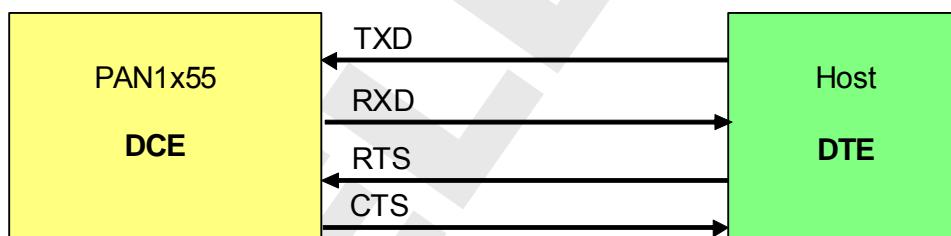


Figure 7.1 UART Signal Connections

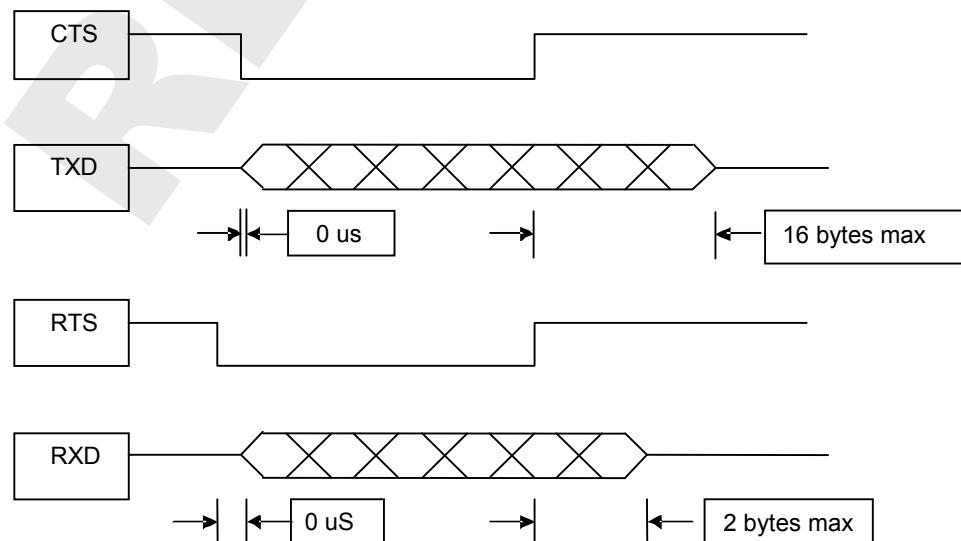


Figure 7.2 UART Timing Diagram

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7.5. 3-WIRE SERIAL INTERFACE

When using only GND and UART_Rx, UART_Tx serial lines, you may leave UART_RTS# and UART_CTS# open.

Note: Not using flow control can result in loss of data.

7.6. USB INTERFACE^{1,2}

7.6.1. USB_DP, USB_DN

PAN1455/1555 contain a full speed USB version 2.0 compliant interface capable of directly driving an USB cable. The PAN1455/1555 operates as a USB peripheral and responds to requests from a USB master host controller.

7.7. GPIO INTERFACE

It is possible to use the programmable digital I/Os GPIO[0:17]. The Current from GPIO[17] is limited to 3mA max.

For 5V tolerant GPIO's refer to chapter 6.2.1SPP configuration DCE Mode

7.8. ADC³

It is possible to use the programmable I/Os PIO[0:3,6,7,13:15] as ADC.

The 12-bit ADC is a successive approximation analogue-to-digital converter. A/D conversion can be performed in single, continuous, scan or discontinuous mode.

7.9. DAC⁴

It is possible to use the programmable I/Os PIO[2,3] as ADAC

The DAC module is a 12-bit, voltage output digital-to-analogue converter. The DAC can be configured in 8- or 12-bit mode and may be used in conjunction with the DMA controller.

7.10. PCM INTERFACE⁵

PCM or Pulse Code Modulation is a sampling technique for digitising analogue signals.

The PCM interface for voice applications is provided via the PCM_OUT, PCM_IN, PCM_CLK and PCM_SYNC pins.

The PCM interface can act as master or as slave device.

In master mode, clock frequencies of 128kHz, 256kHz or 512kHz can be generated, when using the internal 4MHz clock. In slave mode, clock frequencies up to 2048kHz are accepted.

The Frame Clock is 8kHz. Long and Short Frame Sync are supported.

PAN1455/1555 interface directly to PCM audio devices including the following:

¹ subject to firmware support, contact Stollmann for current status.

² subject to hardware support, contact Stollmann for availability of variants

³ subject to firmware support, contact Stollmann for current status

⁴ subject to firmware support, contact Stollmann for current status

⁵ subject to firmware support, contact Stollmann for current status

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- Qualcomm MSM3000 series and MSM5000 series CDMA base band devices
- OKI MSM7705 four channel A-law and μ-law codec
- WINBOND W681310 8-bit A-law and μ-law codec
- WINBOND W681360 13-bit linear codec
- STW 5093 5094 14-bit linear codec

8. KEY PARTS LIST

Liste der Schlüsselkomponenten

Part Name Teilenummer	Material Material
P.W.Board	Glass cloth epoxide resin with gold plating
BT-IC part name	BC63B239A04Q (Cambridge Silicon Radio Ltd www.csr.com) You have to register, before you can download the data sheet.
μ-Controller	ST32F103xxxx (Cortex baseed STMicroelectronics www.stm.com)

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9. TEST CONDITIONS

Meßbedingungen

Measurements shall be made under room temperature and humidity unless otherwise specified.
Messungen unter normalen Bedingungen, Abweichungen sind gesondert notiert.

Temperature	25 ± 10°C	Humidity	40 to 85%RH
Temperatur	25 ± 10°C	Luftfeuchtigkeit	40 to 85%RH

10. ABSOLUTE MAXIMUM RATINGS ⁽¹⁾

Absolute Grenzwerte

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

No.	Item Punkt	Symbol Zeichen	Absolute Maximum Ratings Absolute Grenzwerte	Unit Einheit
1	Supply voltage Versorgungsspannung	V _{cc}	-0.4 to +3.7	V
2	Voltage on any pin Spannung an jedem Pin	V _{Pin}	GND -0.3 to V _{cc} +0.40	V
3	Storage temperature range Lagertemperatur	T _{stg}	-40 to +105	°C
4	Operating temperature range Betriebstemperatur	T _{op}	-40 to +85	°C
6	Lead temperature Löttemperatur	T _{Death}	See chapter 17.2	°C
7	ESD on any pin ESD Festigkeit	V _{ESD}	max 2000 V (C _{Load} =150pF, R _{Load} =330Ω)	V

Notes:

(1) ABSOLUTE MAXIMUM RATINGS indicate limits beyond which damage to the device may occur.

11. ELECTRICAL REQUIREMENTS

V_{cc} = 3.3V, T_{amb} = 25°C if nothing else stated

No Nr.	Item Punkt	Condition Bedingung	Limit / Grenzen			Unit Einheit
			Min	Typ	Max	
1	Frequency Range Frequenzbereich		2400		2483.5	MHz
2	Load impedance Ausgangsimpedanz	Measured with network analyzer in the frequency range at antenna pin		50		Ω
3	Output return loss Ausgangsanpassung	Receive Mode to 50Ω load Transmit Mode to 50Ω load	-10 -10			dBm
4	Supply voltage Versorgungsspg.	The typical voltage is recommended V _{cc} at voltage pin	3.0	3.3	3.6	Vdc
5	Ripple on V _{cc} AC Anteil auf V _{cc}	Ripple frequency ≥200kHz Ripple frequency <200kHz			10	mVms

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12. I/O OPERATING CHARACTERISTICS

Vcc = 3.3V, T_{amb} = 25°C if nothing else stated

Symbol	Item	Condition	Limit			Unit
			Min	Typ	Max	
V _{IL}	Low-Level Input Voltage	VSUP = 3.3V	- 0.5	-	0.8	V
V _{IH}	High-Level Input Voltage		2.0	-	VSUP +0.5	V
V _{OL}	Low-Level Output Voltage	I _{OL} = mA	-	-	0.2	V
V _{OH}	High-Level Output Voltage	I _{OH} = -4mA	VSUP-0.2	-	-	V
I _{OL}	Low -Level Output Current (except GPIO[17])	V _{OL} = 0.4V	-	-	8	mA
I _{OH}	High-Level Output Current (except GPIO[17])	V _{OH} = 2.4V	-	-	8	mA
I _{OL(GPIO[17])}	Low -Level Output Current at GPIO[17]	V _{OL} = 0.4V	-	-	3	mA
I _{OH(GPIO[17])}	High-Level Output Current at GPIO[17]	V _{OH} = 2.4V	-	-	3	mA
I _{wp-u}	Input-current	Weak pull-up typ. 40kΩ	-5.0	-1.0	-0.2	µA
I _{wp-d}	Input-current	Weak pull-down typ. 40kΩ	+0,2	+1.0	+5.0	µA
I _{lc}	I/O pad leakage current	Standard I/Os	-1.0	0	+1.0	µA
I _{lc}	I/O pad leakage current	Vin = 5V	-3,0	0	+3,0	µA
C _i	Input Capacitance		-	5	-	pF

13. USB INTERFACE

Vcc = 3.3V, T_{amb} = 25°C if nothing else stated

Item			Unit
	Min	Max	
Input logic level low	-	0.3xVSUP	V
Input logic level high	0.7xVSUP	5.5	V
Output logic level low)*	0	0.2	V
Output logic level high)*	2.8	VSUP	V

)* connected to correctly terminated USB cable

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14. TYPICAL CURRENT CONSUMPTION

14.1. SPP CONFIGURATION

14.1.1. Deep Sleep State

The Bluetooth RF is completely deactivated, no paging requests from other Bluetooth devices will be recognized. Only rising control line DTR will activate the PAN1455/1555 and may initiate a Bluetooth link dependent on other parameters.

Note: In Deep Sleep state the AT command set is not active, CTS line is low.

14.1.2. Power Down State

The Bluetooth RF is activated every 1.25 seconds, paging requests from other Bluetooth devices will be recognized after that intervals and accepted if allowed. Additionally rising control line DTR will activate the PAN1455/1555 and may initiate a Bluetooth link dependent on other parameters.

Note: In Power down state the AT command set is not active, CTS line is low.

14.1.3. Idle State

No power down mode activated.

All functionality is available immediately including connection control using AT command set.

14.2. POWER CONSUMPTION

The following values are approximate power consumption values in the different states:

VSUP = 3.3V, T_{amb} = 25°C

Condition	Current Consumption		Unit
	I _{MEAN}	I _{PEAK}	
Idle, no page scan, no inquiry scan, Uart baud rate: 1200 baud	7,5	15	mA
Idle, all functions available, no Bluetooth link, page scan & inquiry scan interval 1,28s	8	56	mA
Idle, all functions available, no Bluetooth link, continuous page scans	50	60	mA
Bluetooth connected, no data traffic – close range (Slave)	10	56	mA
Bluetooth connected, data traffic 115 kbit/s – close range (Slave)	33	61	mA
ACL connected DH5 max PWR, shortest Poll Period (Slave)	43	68	mA
ACL connected DH5 min PWR, shortest Poll Period (Slave)	42	67	mA
ACL connected DH1 max PWR, shortest Poll Period (Slave)	43	69	mA
ACL connected DH1 min PWR, shortest Poll Period (Slave)	41	67	mA
Power Down	7,5	--	mA
Device in reset	1,5	--	mA

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14.3. POWER-UP TIME

The time until the PAN1455/1555 is able to accept link requests or serial data depends on the firmware version and the software parameters RSTTIM and RSTMSG. In the SPP firmware version 1.001 the module is command ready after at least 0,3s (RSTTIM=3 / RSTMSG=0) and 2,16s (RSTTIM=40 / RSTMSG=1) maximum. Bluetooth links are accepted 2,3s after reset.

15. ELECTRICAL RF-CHARACTERISTICS

Vcc = 3.0V to 3.6V, Tamb = - 40°C to +85°C

Receiver	Frequency [GHz]	Limit			BT Spec	Unit
		Min	Typ	Max		
Sensitivity at 0.1% BER DH1	2.402	-70,0	-85,3		≤-70	dBm
	2.441	-70,0	-85,4			
	2.480	-70,0	-86,0			
Sensitivity at 0.1% BER DH5	2.402	-70,0	-84,4		≤-70	dBm
	2.441	-70,0	-84,9			
	2.480	-70,0	-85,6			
Sensitivity at 0.1% BER EDR2, PI/4 DQPSK	2.402	-70,0	-88,1		≤-70	dBm
	2.441	-70,0	-88,3			
	2.480	-70,0	-88,1			
Sensitivity at 0.1% BER EDR3, 8DPSK ^{a)}	2.402	-70,0	-82,0		≤-70	dBm
	2.441	-70,0	-82,7			
	2.480	-70,0	-82,4			
Maximum received signal at 0.1% BER with DH1	-20,0	>10			≥-20	dBm
Maximum received signal at 0.1% BER with DH5	-20,0	>10			≥-20	dBm
Maximum received signal at 0.1% BER with EDR2, PI/4 DQPSK	-20,0	>0			≥-20	dBm
Maximum received signal at 0.1% BER with EDR3, 8DPSK	-20,0	>0			≥-20	dBm
C/I co-channel ^{a)}		6	11	≤ 11	dB	
Adjacent channel selectivity C/I f = f ₀ + 1MHz ^{a)}		-5	0	≤ 0	dB	
Adjacent channel selectivity C/I f = f ₀ - 1MHz ^{a)}		-5	0	≤ 0	dB	
Adjacent channel selectivity C/I f ≥ f ₀ + 2MHz ^{a)}		-38	-30	≤ -30	dB	
Adjacent channel selectivity C/I f ≤ f ₀ - 2MHz ^{a)}		-22	-20	≤ -20	dB	
Adjacent channel selectivity C/I f ≥ f ₀ + 3MHz ^{a)}		-42	-40	≤ -40	dB	
Adjacent channel selectivity C/I f ≤ f ₀ - 5MHz ^{a)}		-45	-40	≤ -40	dB	
Adjacent channel selectivity C/I f = f _{image} ^{a)}		-15	-9	≤ -9	dB	

Notes: a) For BER less then 0,1%. Applies according to BT Test Specification Ver. 1.2/2.0/2.0 + EDR only for Tamb = 20°C

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Vcc = 3.3V, Tamb = +25°C

Transmitter	Frequency [GHz]	Limit Min	Typ	Max	BT Spec	Unit
RF transmit power 50 Ω load with GFSK Modulation and default settings ^{b)}	2.402	2,0	3,9			dBm
	2.441	2,0	3,2			
	2.480	2,0	3,0			
RF transmit power 50 Ω load with EDR, PI/4 DQPSK Modulation and default settings ^{b)}	2.402 GFSK		2,7			dBm
	2.402 DPSK		1,6			
	2.441 GFSK		2,7			
	2.441 DPSK		1,6			
	2.480 GFSK		2,2			
	2.480 DPSK		1,0			
RF transmit power 50 Ω load with EDR, 8DPSK Modulation and default settings ^{b)}	2.402 GFSK		2,6			dBm
	2.402 DPSK		1,6			
	2.441 GFSK		2,7			
	2.441 DPSK		1,6			
	2.480 GFSK		2,2			
	2.480 DPSK		1,0			
RF power control range		-21	-	4,0		dB
RF power range control resolution		3,2	3,9	4,6	2 to 8	dB
20 dB bandwidth for modulated carrier		920	924	1000	≤1000	kHz
Initial carrier frequency tolerance		-75	-10	75	≤ ±75	kHz
Carrier frequency drift (packet DH1)		-25	11	25	≤ ±25	kHz
Drift Rate		-20	0	20	20	kHz/ 50μs
Δf1 _{avg} "Maximum Modulation"		140	166	175	≥140 to ≤175	kHz
Δf2 _{avg} "Minimum Modulation"		115	155	-	≥ 115	kHz

Notes: b) excluding antenna gain

16. MECHANICAL REQUIREMENTS

Mechanische Anforderungen

No.	Item Punkt	Limit Grenzwerte	Condition Bedingung
1	Solderability Lötfähigkeit	More than 75% of the soldering area shall be coated by solder Mehr als 75% der Lötfäche soll mit Lötpaste bedeckt sein.	Reflow soldering with recommendable temperature profile
2	Resistance to soldering heat	It shall be satisfied electrical requirements and not be mechanical damage	See chapter 17.2

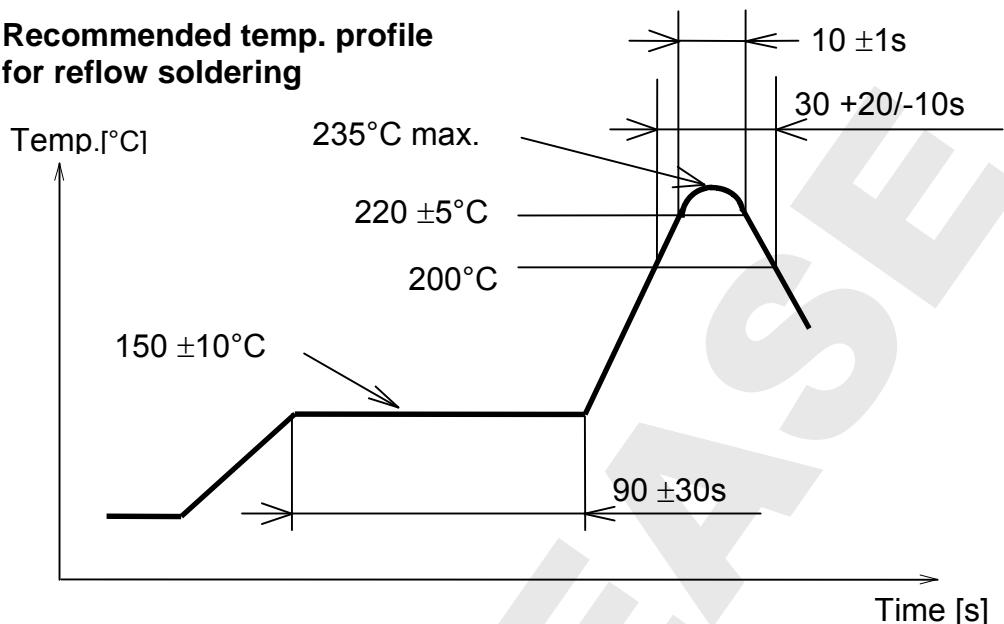
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17. SOLDERING TEMPERATURE-TIME PROFILE (FOR REFLOW SOLDERING)

Temperatur-Zeit Profil für die Reflowlötzung

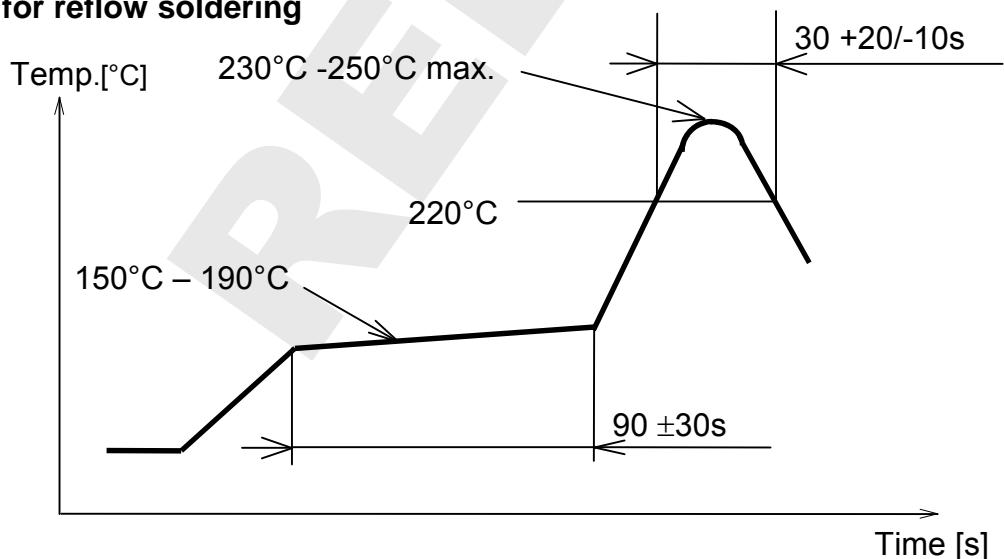
17.1. FOR LEAD SOLDER

Recommended temp. profile for reflow soldering



17.2. FOR LEADFREE SOLDER

Our used temp. profile for reflow soldering



Reflow permissible cycle: 2

Opposite side reflow is prohibited due to module weight.

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18. MODULE DIMENSION Modulabmessungen

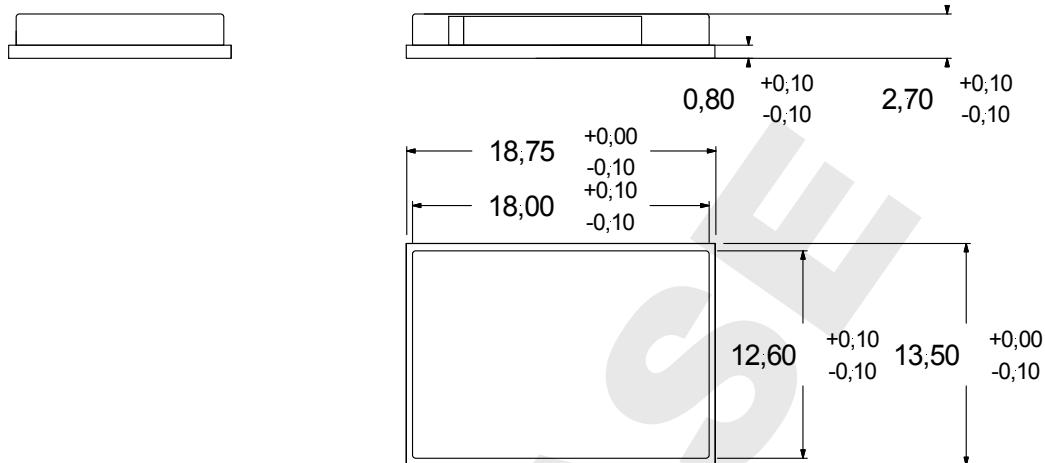


Figure 18.1 PAN1455 dimensions

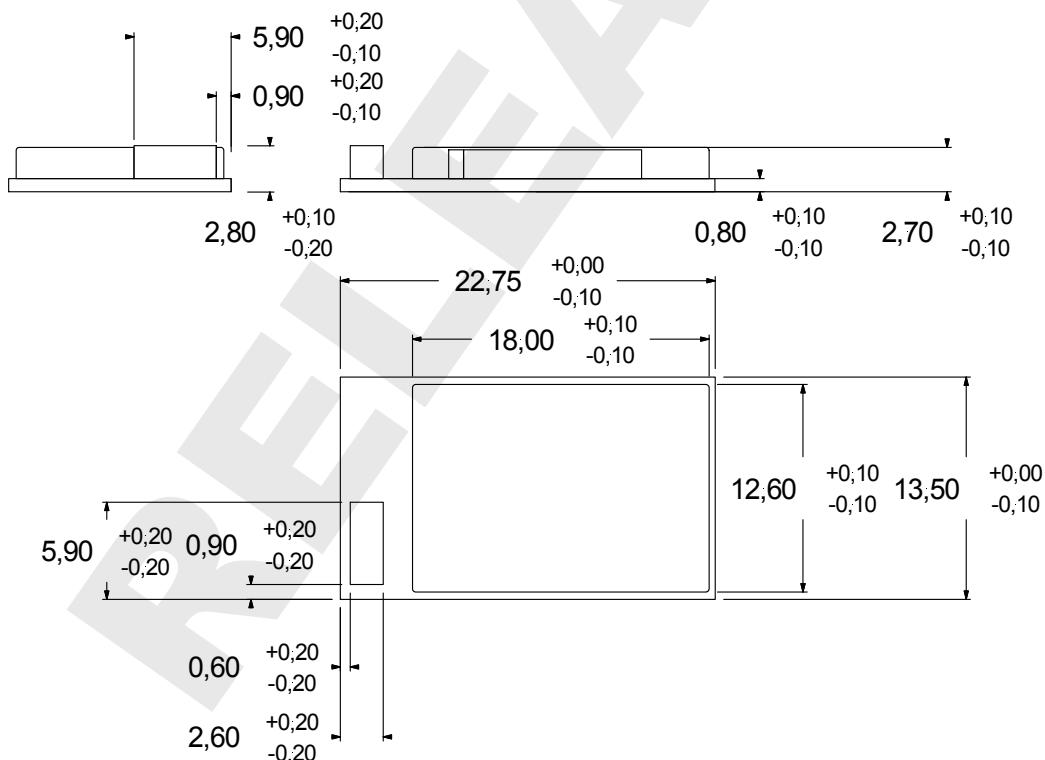


Figure 18.2 PAN1555 dimensions

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19. RECOMMENDED FOOT PATTERN

Empfohlenes Land Pattern

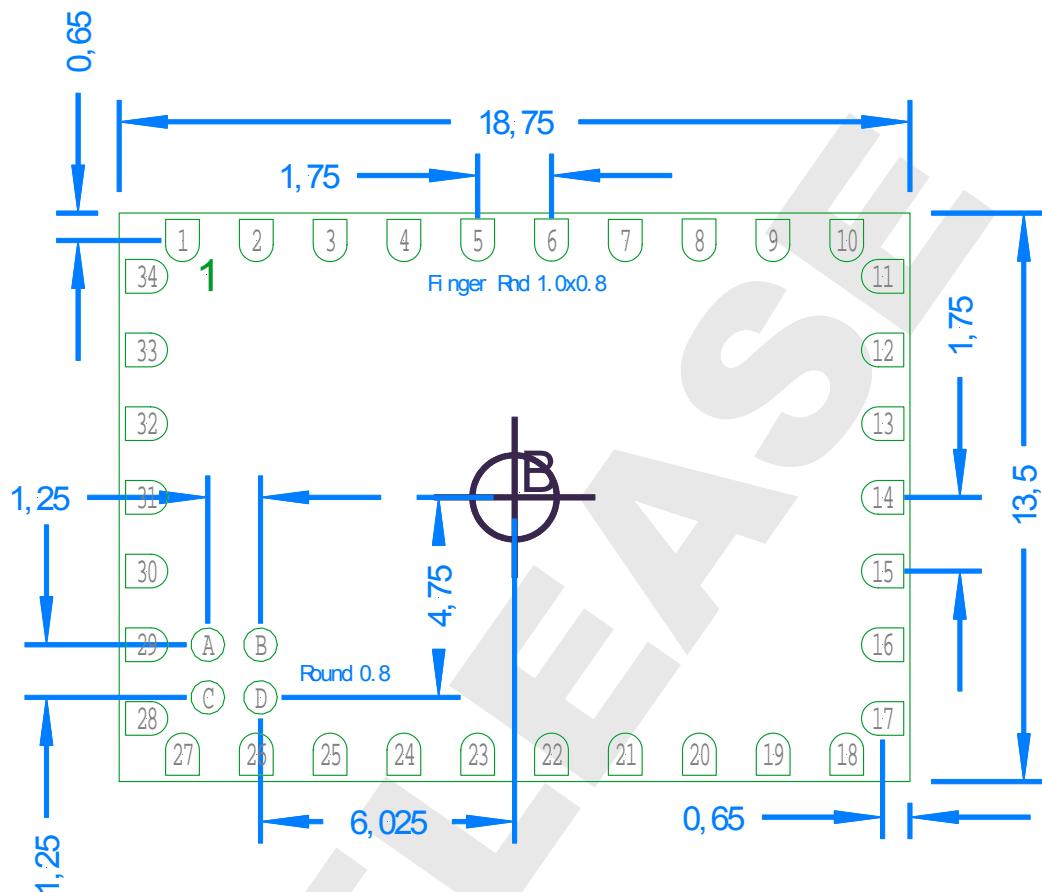
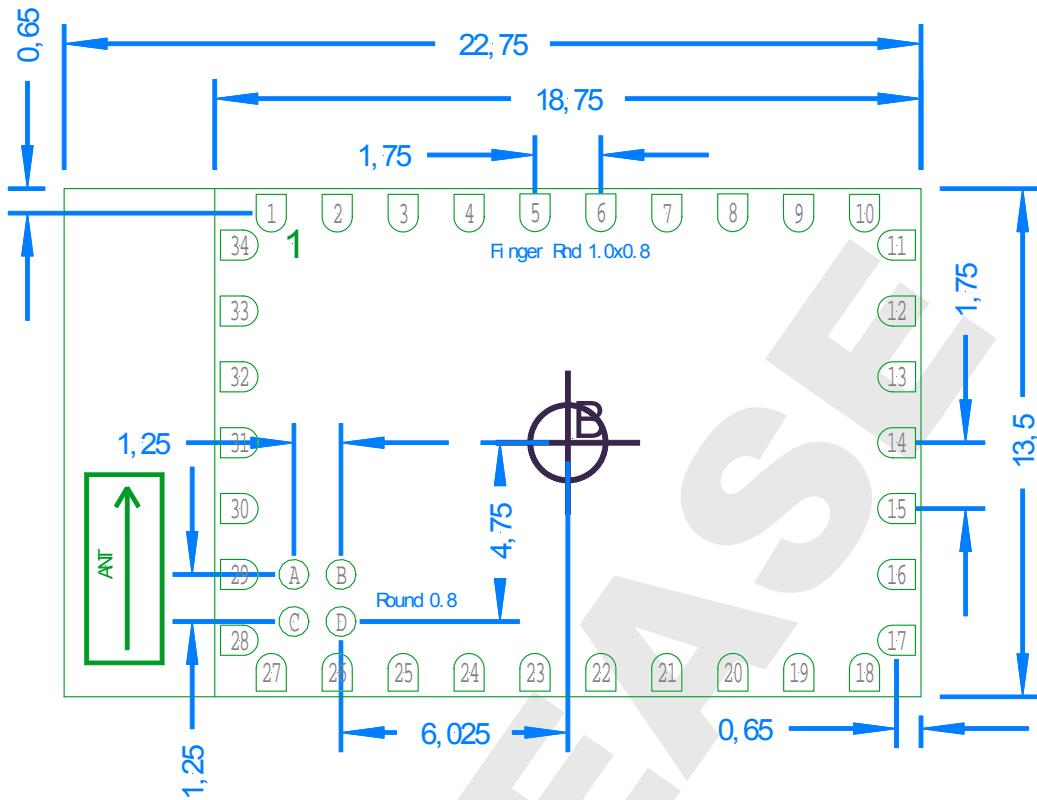


Figure 19.1 PAN1455 Recommended Land pattern
(Top-View not scaled)

Dimensions in mm.

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**Figure 19.2 PAN1555 Recommended Land pattern
(Top-View not scaled)**

Dimensions in mm.

If you have no experience about the land pattern, this figure can guide you, but this information is given without any legal responsibility.

We recommend the same dimension for the solder paste screen.

The solder screen thickness depends on your production standard, we recommend 120µm to 150µm.

IMPORTANT:

Please be careful with the area under the module to avoid short cuts.

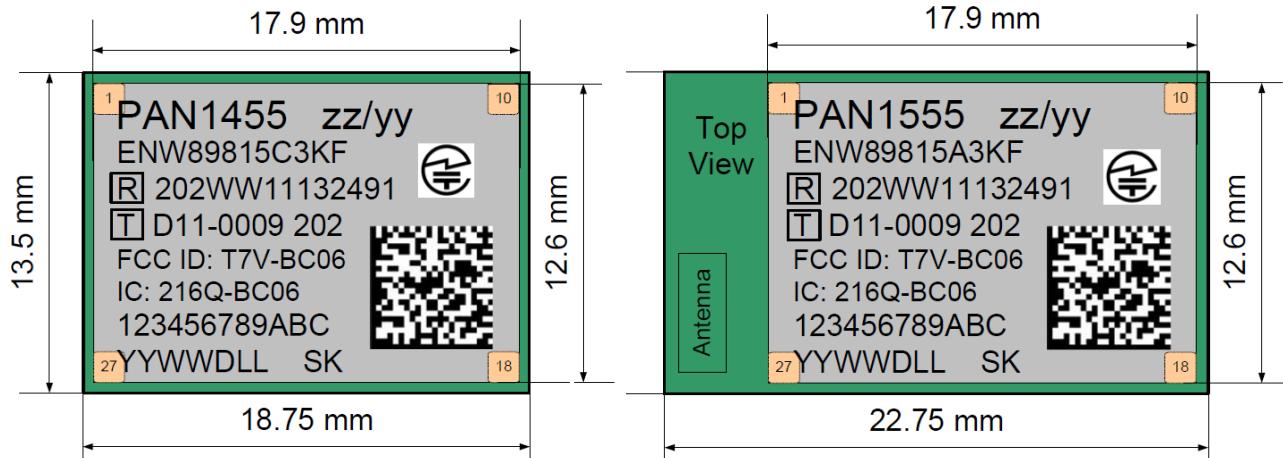
The bottom side from the PAN1455/1555 is fully coated, **also** the vias!

If you have any questions on this point, we are open to discuss your individual situation.

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20. LABELLING DRAWING

Kennzeichnung des Modules durch Label



The information on the Module are marked by laser.

Information in the 2D-Barcode are in the format

- BT-address [12 signs, here 123456789ABC].
- Ordering number [12 signs, please refer also to chapter 24];
- The identifier for the software release (2 signs, here yy);
- Datecode: Year-Week-Day-Lotnumber [7 signs, here YYWW DLL].

All items are separated by a semicolon.

As a summary:

[R] 202WW11132491	Japan Radio Marking
[T] D11-0009 202	Japan TTE Marking
FCC ID: T7V-BC06	FCC Certification Marking
zz	Identifier for the hardware version
yy	Identifier for the software version
123456789ABC	BT-Address
YYWW DLL	Datecode – Year-Week-Day-Lotnumber

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21. SOFTWARE

Software

Standard platforms of PAN1455/1555 are available with several popular Bluetooth profiles, many other profiles are available on request. Before starting production, be certain to carefully review that the software meets your requirements.

21.1. SPP SOFTWARE

Serial Port Profile

Customized variants are available on request.

Please refer to Reference [1].

21.2. HDP SOFTWARE

The Health Device Profile

Please refer to Reference [1].

21.3. HID SOFTWARE

The Human Interface Device Software

Please refer to Reference [1].

21.4. HDP/SPP SOFTWARE

The combined HDP and SPP Profile enables customers to use both versions (SPP/HDP) in parallel.

Please refer to Reference [1].

21.5. OTHER PROFILES ARE AVAILABLE ON REQUEST.

22. CAUTIONS

Warnungen

Failure to do so may result in degrading of the product's functions and damage to the product.

22.1. DESIGN NOTES

Designhinweise

- (1) Please follow the condition written in this specification, especially the control signals of this module.
- (2) The supply voltage has to be free of ac ripple voltage, as for example from a battery or a low noise regulator output. For noisy supply voltages provide a decoupling circuit as for example a ferrite in series connection and a blocking capacitor to ground of at least 47uF directly at the module.
- (3) This product should not be stressed when installed.
- (4) Heat is the major cause of shortening the life of these products. Please keep this product away from heat.
Avoid assembly and use of the target equipment in conditions where the products' temperature may exceed the maximum allowable.
- (5) The supply voltage should not be exceeding or reverse, and should not carry noise and spike.
- (6) Please keep this product away from other high frequency circuits.

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22.2. INSTALLATION NOTES

Verarbeitungshinweise

- (1) Reflow soldering is possible for twice on the condition in chapter 15. Please 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 stressed or vibrated when reflowed.
- (6) Keep the following conditions when you install this product for reparation by hand soldering.
- (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 cover is not allowed.

22.3. USAGE CONDITIONS NOTES

Benutzerhinweise

- (1) Take measure against static electricity. If pulses or other transient loads (a large load applied in a short time) are applied to the products, then before use, check and evaluate their operation when assembled on your products.
- (2) Do not use the fallen product.
- (3) Do not put on damage and dirt to the pin , and don't touch the electric components.
- (4) Be certain to follow the condition written in the ratings , about the power supply instruments 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 is not allowed.
- (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.

22.4. STORAGE NOTES

Lagerhinweise

- (1) The module may 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 Cl₂, H₂S, NH₃, SO₂, or NO_x
 - Storage in direct sunlight
 - Storage in an environment where the temperature may be outside the range of 5°C to 35°C range, or where the humidity may be outside the 45 to 85% range.

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- Storage of the products for more than one year after the date of delivery at your company if the avoidance all the above conditions (1) to (3) have been met.
- (3) Storage period: Please check the adhesive strength of the embossed tape and soldering after 6 months of storage.
- (4) Please keep this product away from water, poisonous gas and corrosive gas.
- (5) This product should not be stressed or shocked when transported.
- (6) Please follow the specification when piling up the packed crate (max. 10).

22.5. SAFETY CAUTIONS

Sicherheitshinweise

These specifications are intended to preserve the quality assurance of products as individual components.

Before use, check and evaluate their 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 at least, 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.

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22.6. OTHER CAUTIONS

Weitere Hinweise

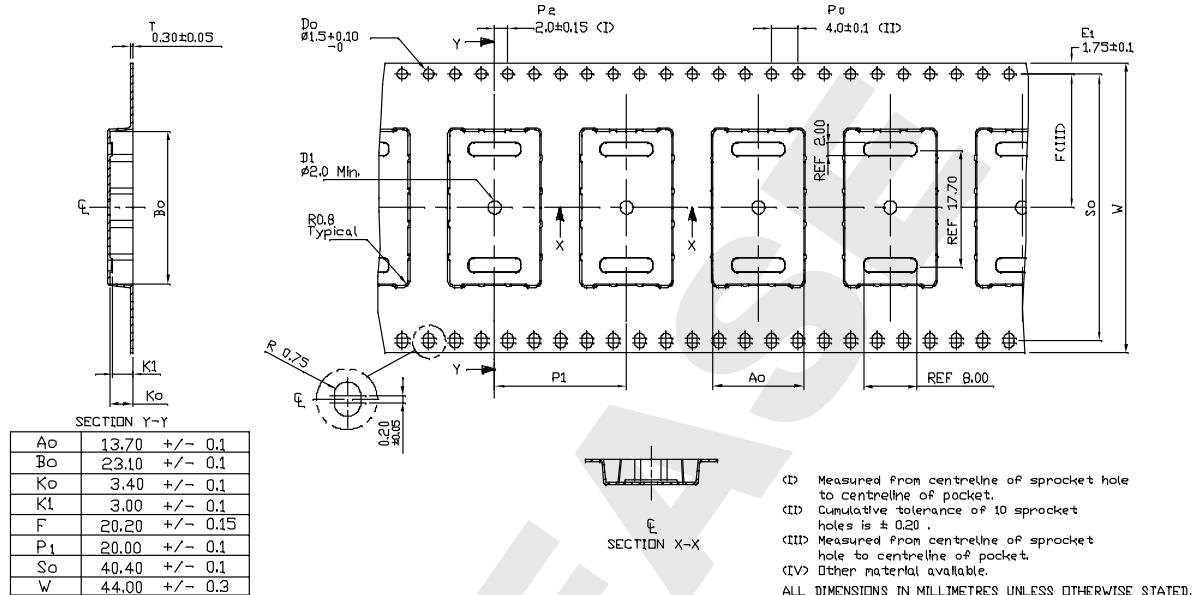
- (1) This specification sheet is copyrighted. Please do not open it to the third party.
- (2) Do not use this product of our company for another purpose.
- (3) Be sure to provide an appropriate fail-safe function on your product to prevent a second damage that may be caused by the abnormal function or the failure of our product.
- (4) This product has not been manufactured with 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 (e.g. salty air, HCl, Cl₂, SO₂, H₂S, NH₃, and NO_x)
- (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 , both of you and Panasonic sincerely cope with it.

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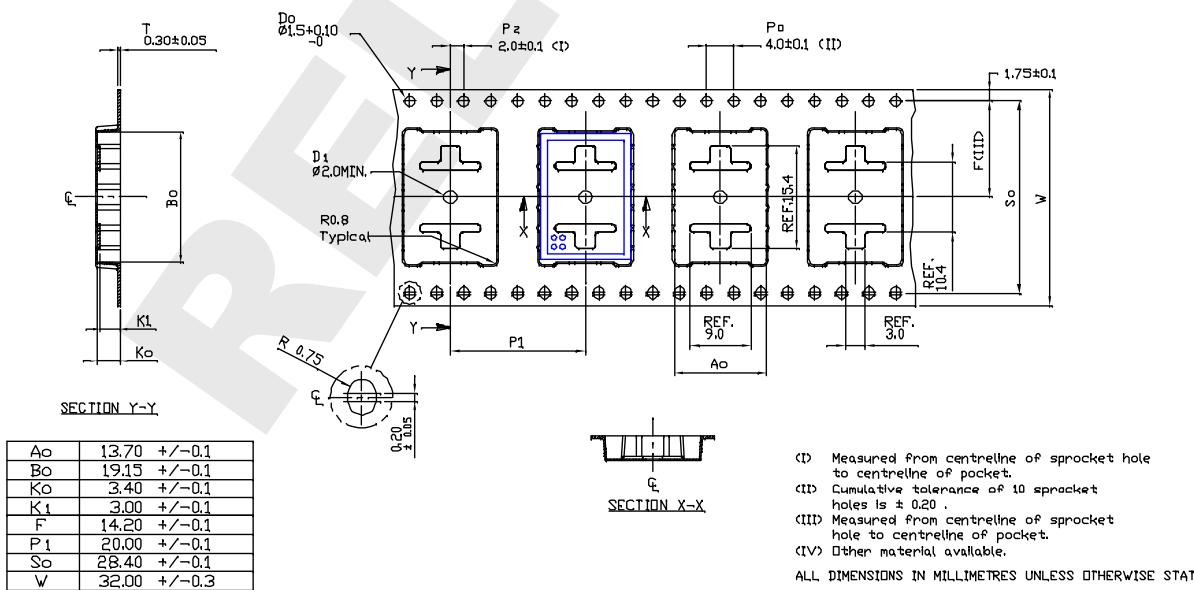
23. PACKAGING

Verpackung

23.1. EMBOSSED TAPE / BLISTERGURT



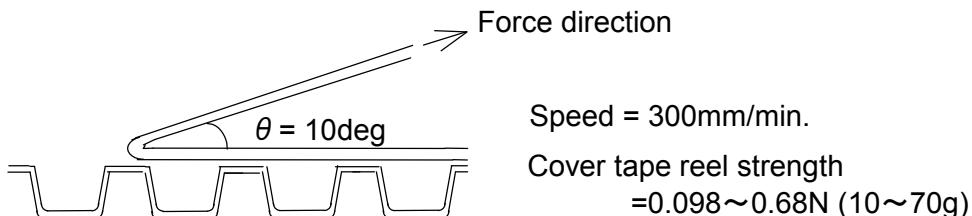
(1) Dimension of the tape PAN1555 / Abmessungen des Gurtes (EIAJ-tbd)



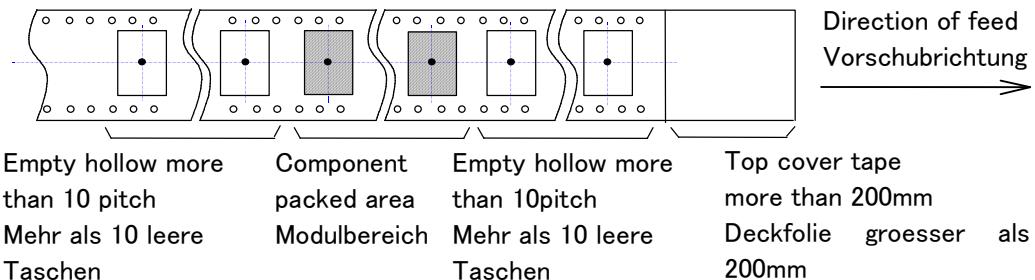
(2) Dimension of the tape PAN1455 / Abmessungen des Gurtes (EIAJ-tbd)

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(3) Cover tape reel strength / Abzugskräfte Blistergurt Deckfolie



(4) Empty hollow / leere Taschen



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

Es dürfen minimal 2 leere Taschen im Bereich der Komponenten vorhanden sein, diese dürfen aber nicht aufeinander folgen.

23.2. COMPONENT DIRECTION Komponentenanordnung

Top cover tape shall not be found on reel holes and shall not stick out from reel.
Deckfolien darf nicht durch die Löcher der Spule und nicht außerhalb der Spule geführt werden.

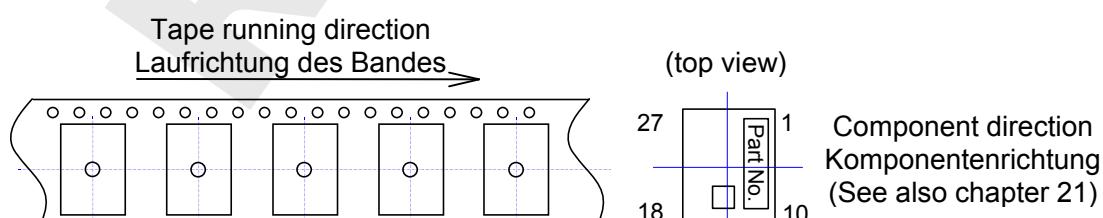


Figure 1

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23.3. REEL DIMENSION

Abmaße der Rolle

- (1) Quantity per reel : 500 pieces
Anzahl pro Rolle : 500 Stück
- (2) Marking : Customer's part No. / Quantity / Lot No. and Our part# with bar-code shall be on the reel.

Kennzeichnung : Kundennummer / Anzahl / Losnummer und unsere Komponentennummer als Barcode wird auf die Rolle gedruckt

Refer to figure 2

Bezugnehmend zur Zeichnung 2

23.4. PACKAGE

Umverpackung

- (1) Package box : 1 or 2 reel (depends on quantity)
Paketbox.: 1 oder 2 Rollen (abhängig von der Liefermenge)
- (2) Marking : Customer's part No. / Quantity / Lot No. and Our part# with bar-code shall be on the package box.

Kennzeichnung : Kundennummer / Anzahl / Losnummer und unsere Komponentennummer als Barcode wird auf die Verpackung gedruckt

Refer to figure 2 and 3

Bezugnehmend zur Zeichnung 2 und 3

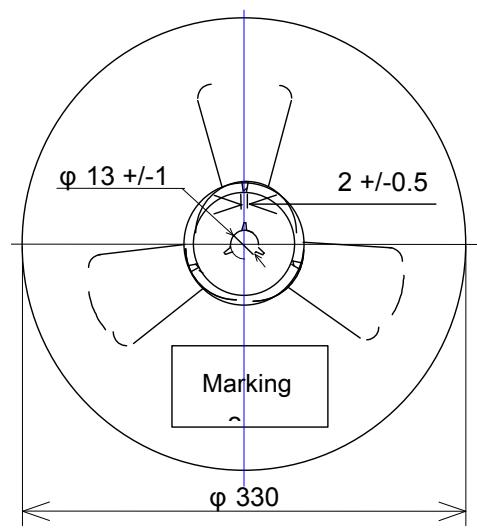


Figure 2

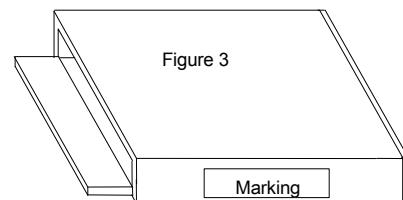
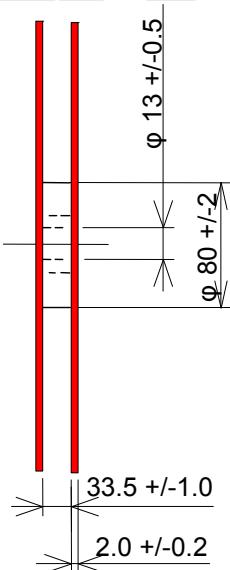


Figure 3

CLASSIFICATION Einstufung	PRODUCT SPECIFICATION Produktspezifikation	No. DS-1x55-2400-102	REV. 1.10
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24. ORDERING INFORMATION

Bestellinformationen

Ordering part number	Description
ENW89815C3KF	PAN1455 BT 3.0 256kByte Flash Memory, without Antenna Software: SPP ⁽¹⁾
ENW89815A3KF	PAN1555 BT 3.0 256kByte Flash Memory, with Antenna Software: SPP ⁽¹⁾
ENW89815A4KF	PAN1555 BT 3.0 256kByte Flash Memory, with Antenna Software: HDP ⁽¹⁾
ENW89815A5KF	PAN1555 BT 3.0 256kByte Flash Memory, with Antenna Software: SPP/HDP ⁽¹⁾
ENW89815C4KF	PAN1455 BT 3.0 256kByte Flash Memory, without Antenna Software: HDP ⁽¹⁾
ENW89815C5KF	PAN1455 BT3.0 256kByte Flash Memory, without Antenna Software: SPP/HDP ⁽¹⁾

Notes:

- (1) This software is licensed by the company Stollmann please refer to [1] .

25. ROHS DECLARATION

RoHS-Erklärung

Declaration of environmental compatibility for supplied products:

Hereby we declare to our best present knowledge based on declaration of our suppliers that this product do not contain by now the following substances which are banned by Directive 2002/95/EC (RoHS) or if contain a maximum concentration of 0,1% by weight in homogeneous materials for

- Lead and lead compounds
- Mercury and mercury compounds
- Chromium (VI)
- PBB (polybrominated biphenyl) category
- PBDE (polybrominated biphenyl ether) category

And a maximum concentration of 0,01% by weight in homogeneous materials for

- Cadmium and cadmium compounds

26. DATA SHEET STATUS

Datenblatt Status

This data sheet contains the final specification (RELEASE).

Panasonic reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

Supplementary data will be published at a later date.

Please consult the most recently issued data sheet before initiating or completing a design.

CLASSIFICATION Einstufung	PRODUCT SPECIFICATION Produktspezifikation	No. DS-1x55-2400-102	REV. 1.10
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CUSTOMER'S CODE PAN1455/1555	PANASONIC'S CODE ENW89815CxKF/ENW89815AxKF	DATE Datum	27.06.2011

27. REGULATORY INFORMATION

27.1. FCC NOTICE



The device PAN1555, including the ceramic antenna and also the SMD type PAN1455, including with the antennas, which are listed in 27.5, 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.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.

27.2. 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 Electronic 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

27.3. LABELING REQUIREMENTS



The Original Equipment Manufacturer (OEM) must ensure that FCC labeling 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 are **FCC ID: T7V-BC06**. This FCC identifier is valid for all versions, for details, please see the chapter 24. Ordering Information.

In any case end product must be labelled exterior with "Contains FCC ID: T7V-BC06"

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27.4. ANTENNA WARNING



The related part number for this device is PAN1455 with SMD pad). For details, please see the chapter 24. Ordering Information. This device are tested with a standard SMA connector and with the antennas listed below. When integrated in the OEMs product, these fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Any antenna exceeding 2dBi not in the following table must be tested to comply with FCC Section 15.203 for unique antenna connectors and Section 15.247 for emissions. The FCC identifier for this device with the antenna listed in item 1 are the same (FCC ID: T7V-BC06).

27.5. APPROVED ANTENNA LIST

Note: We are able to qualify your antenna and will add to this list as that process is completed.

Item	Part Number	Manufacturer	Frequency Band	Type	Gain (dBi)
1	WIMO17010.10	Wimo	2.4GHz	ROD	+2
2	2450AT42B100	Johanson	2.4GHz	SMD	-1.5

27.6. RF EXPOSURE PAN1455/PAN1555



To comply with FCC RF Exposure requirements, the Original Equipment Manufacturer (OEM) must ensure that the approved antenna in the previous table must be installed.

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 PAN1455 with mounted ceramic antenna (FCC ID: T7V-BC06) is far below the FCC radio frequency exposure limits. Nevertheless, the PAN1455 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.

27.7. INDUSTRY CANADA CERTIFICATION

PAN1455/PAN1555 comply with the regulatory requirements of Industry Canada (IC), license: IC: 216Q-BC06

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 antenna listed in section 27.5 above, having a maximum gain of 2.0 dBi. Antennas not included in this list or having a gain greater than 2.0 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 colocated or operating in conjunction with any other antenna or transmitter.

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28. RELATED DOCUMENTS

Mitgeltende Dokumente

[1] Stollmann Firmware updates/support:

<http://www.stollmann.de/de/support/downloads/bluetooth-adapter/bluemod-p2xg2.html>

29. GENERAL INFORMATION

Allgemeine Informationen

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This product description does not lodge the claim to be complete and free of mistakes.

Please contact the related product manager in every case.

If we deliver ES samples to the customer, these samples have the status Engineering Samples. This means, the design of this product is not yet concluded. Engineering Samples may be partially or fully functional, and there may be differences to be published Data Sheet.

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

Disclaimer:

Customer acknowledges that samples may deviate from the Data Sheet 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 an other product to be sold by Customer,
- deviation or lapse in function of Engineering Sample,
- improper use of Engineering Samples.

Panasonic disclaims any liability for consequential and incidental damages.

In case of any questions, please contact your local sales partner or the related product manager.

30. LIFE SUPPORT POLICY

Politik für Lebenserhaltungssysteme

This Panasonic 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 for any damages resulting.