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|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
| CLASSIFICATION                                | PRODUCT SPECIFICATION                                    | No.<br>DS-13xx-2400-102 | REV.<br>3.71 |
| SUBJECT                                       | CLASS 1 or 2 BLUETOOTH MODULE                            | PAGE                    | 1 of 60      |
| CUSTOMER'S CODE<br>PAN13XX Core Specification | PANASONIC'S CODE<br>See Chapter 28. Ordering Information | DATE                    | 20.08.2013   |

# Specification for Production

Applicant / Manufacturer      Panasonic Industrial Devices Europe GmbH  
Hardware                              Zeppelinstrasse 19  
                                                    21337 Lüneburg  
                                                    Germany

Applicant / Manufacturer      Not applicable  
Software

Software Version                      Not applicable

Contents                                  Approval for Mass Production

Customer

Bluetooth QDL ID                      Qualified Design Listing (QDL) ID: B019784  
                                                    As Controller Sub-System Listing for PAN13xx Series.

By purchase of any 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<br>Wireless Connectivity<br>Panasonic Industrial Devices Europe GmbH | APPROVED | CHECKED | DESIGNED |
|---------------------------------------------------------------------------------------------------|----------|---------|----------|

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| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Recommended Foot Pattern .....                                 | 33                                                                 |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| 18.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | recommended foot pattern PAN131x without antenna .....         | 33                                                                 |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| 18.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | recommended foot pattern PAN132x with antenna .....            | 34                                                                 |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Layout Recommendations with Antenna (PAN132x).....             | 35                                                                 |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Bluetooth LE (LOW ENERGY) PAN1316/26 .....                     | 35                                                                 |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| 20.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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| 20.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Current consumption for different LE scenarios .....           | 37                                                                 |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| 21.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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| 21.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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                                                                                                                                                           | Triple mode (BR/EDR + Bluetooth low energy + ANT) PAN1323..... | 39                                                                 |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| 23.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Tools to be needed .....                                       | 40                                                                 |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | List of Profiles .....                                         | 41                                                                 |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| 27.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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| 29                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| PANASONIC INDUSTRIAL DEVICES EUROPE GMBH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                | <a href="http://www.pideu.panasonic.de">www.pideu.panasonic.de</a> |              |    |                        |    |      |                                                |    |      |                                             |    |    |                               |    |      |                                         |    |      |                                      |    |    |                        |    |    |                              |    |    |                                |    |      |                                                        |    |      |                                                     |    |    |                                                    |    |    |                                            |    |      |                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| CLASSIFICATION                                | PRODUCT SPECIFICATION                                    | No.<br>DS-13xx-2400-102 | REV.<br>3.71 |
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## 1 SCOPE OF THIS DOCUMENT

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

For detailed family overview that includes part numbers see Chapter 28, 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 19, for information on ANT refer to Chapter 21.

### 1.1 NEW PAN1315A, PAN1325A

The PAN1315A/1325A Series is based on Texas Instruments' NEW CC2560A controller. A ROM update from Texas Instruments to the CC2560 IC has allowed Panasonic to improve PAN1315/1325 Series. The NEW PAN1315A/1325A Series Modules has increased power and system efficiency resulting from reduced initialization script size, start-up time and decreased system memory requirements.

#### Compatibility:

PAN1315, PAN1315A, PAN1316 and PAN1317 are 100% footprint compatible

PAN1325, PAN1325A, PAN1326 and PAN1327 are 100% footprint compatible

As an updated initialization script resident on the application microcontroller is required for modules based on the CC2560A, compatibility between the PAN1315/PAN1325 and PAN1315A/PAN1325A is dependant on the Bluetooth stack. Stacks are available that will operate with all PAN1315/1325 variations.

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 28 Ordering Information.

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

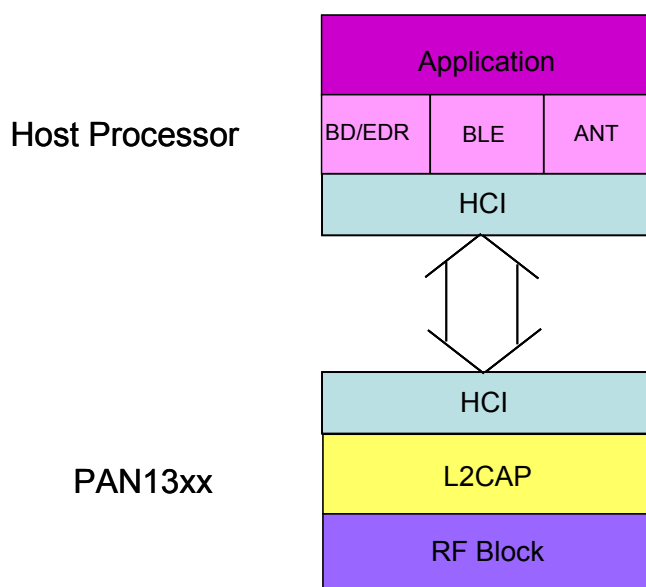
<sup>1</sup> Bluetooth is a registered trademark of the Bluetooth Special Interest Group.

|                                               |                                                          |                         |              |
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## 2 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 mm<sup>3</sup>
- Up to 10.5dBm Tx power (typical) 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  $\mu$ -law or A-law Codecs and CVSD transcoders on up to 3 SCO channels
- Full 8- to 128-bit encryption
- UART, I<sup>2</sup>C 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

### 2.1 SOFTWARE BLOCK DIAGRAM



|                                               |                                                          |                         |              |
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### 3 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

### 4 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 7.

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](http://www.ti.com/connectivity.com)

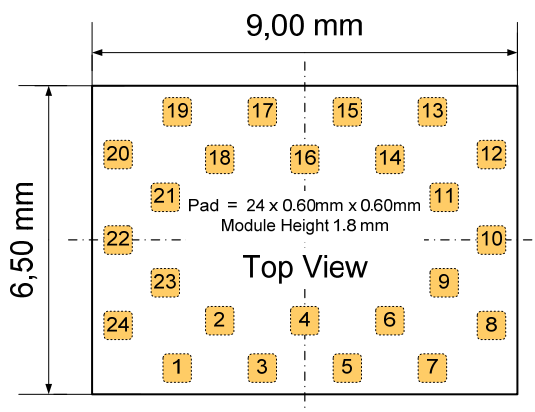
Contact your local sales office for further details on additional options and services, by visiting [www.panasonic.com/rfmodules](http://www.panasonic.com/rfmodules) or write an e-mail to [wireless@eu.panasonic.com](mailto:wireless@eu.panasonic.com).

|                                               |                                                          |                         |              |
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## 5 DETAILED DESCRIPTION

### 5.1 TERMINAL LAYOUT

#### 5.1.1 5.1.1. Terminal Layout PAN131x without antenna



| No | Pin Name     | Pull at Reset | Def. Dir. <sup>2</sup> | I/O Type <sup>3</sup> | 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 <sup>4</sup> |
| 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 <sup>2</sup> C SDA (Internal)                   |
| 22 | VDD_IO       |               | PI                     |                       | I/O power supply 1.8 V Nom                               |
| 23 | NC           |               |                        |                       | EEPROM I <sup>2</sup> C SCL (Internal)                   |
| 24 | NC           |               | IO                     |                       | Not connected                                            |

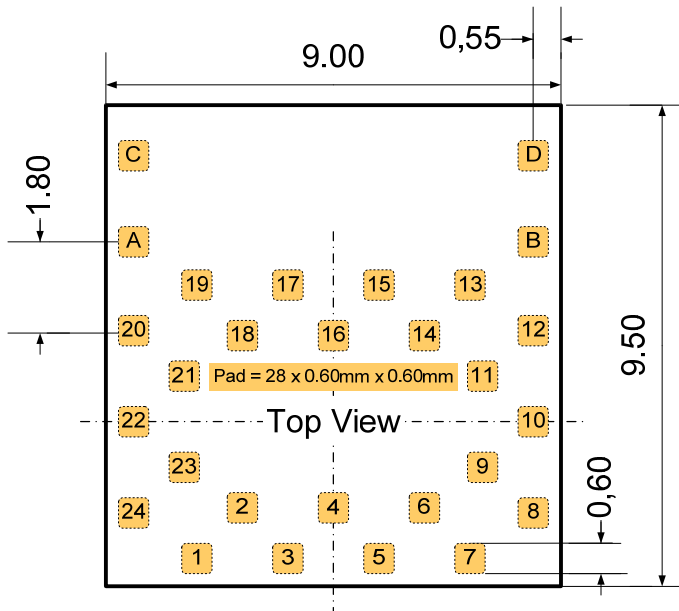
<sup>2</sup> I = input; O = output; IO = bidirectional; P = power; PU = pulled up; PD = pulled down

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

<sup>4</sup> 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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### 5.1.2 5.1.2. Terminal Layout PAN132x with antenna



| No | Pin Name | Pull at Reset | Def. Dir. <sup>5</sup> | I/O Type <sup>6</sup> | 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 5.1.1. 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.

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

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

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 5.2 PIN DESCRIPTION

| Pin Name                                                      | No | ESD <sup>7</sup><br>(V) | Pull<br>Reset | at | Def.<br>Dir. <sup>8</sup> | I/O Type <sup>9</sup> | Description of Options                                                                                 |
|---------------------------------------------------------------|----|-------------------------|---------------|----|---------------------------|-----------------------|--------------------------------------------------------------------------------------------------------|
| Bluetooth IO SIGNALS                                          |    |                         |               |    |                           |                       |                                                                                                        |
| HCI_RX                                                        | 5  | 750                     | PU            |    | I                         | 8 mA                  | HCI UART data receive                                                                                  |
| 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<br>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<br>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<br>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 <sup>2</sup> C SCL (Internal)                                                                 |
| NC                                                            | 21 | 1000                    | PU/PD         |    | IO                        | HY, 4mA               | EEPROM I <sup>2</sup> 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.

<sup>7</sup> ESD: Human Body Model (HBM). JEDEC 22-A114

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

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

|                                               |                                                          |                         |              |
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### 5.3 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:

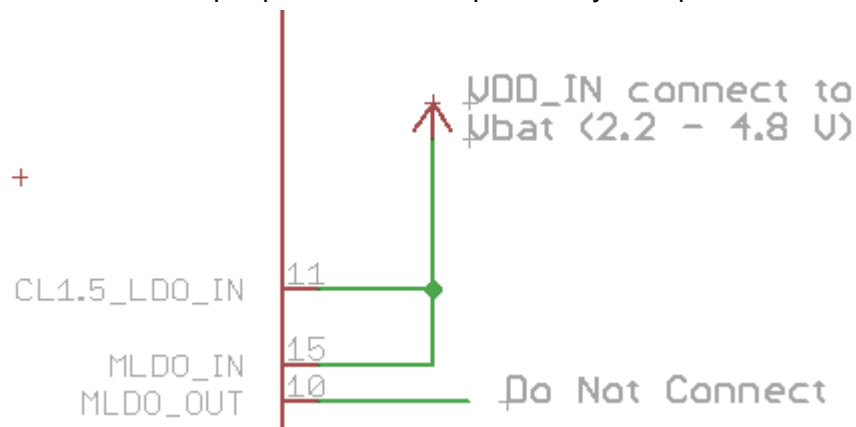
- Main power supply for the Bluetooth -  $VDD\_IN = V_{BAT}$
- Power source for the 1.8 V I/O ring -  $VDD\_IO$

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.

There are three ways to supply power:

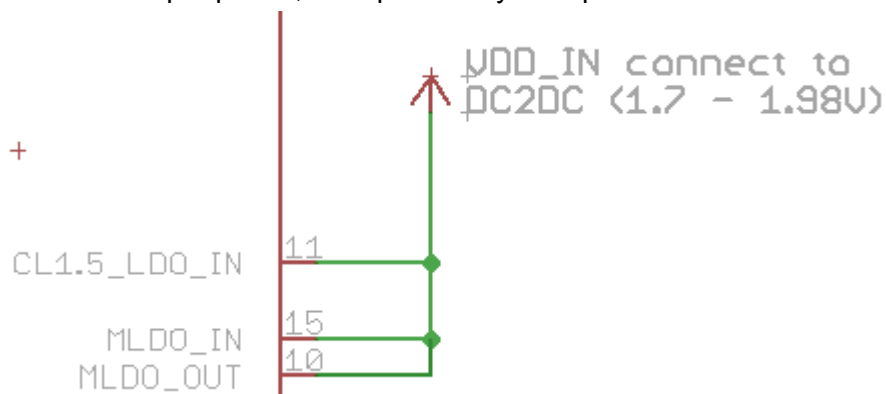
- Full- $V_{BAT}$  system:

Maximum RF output power, but not optimum system power:



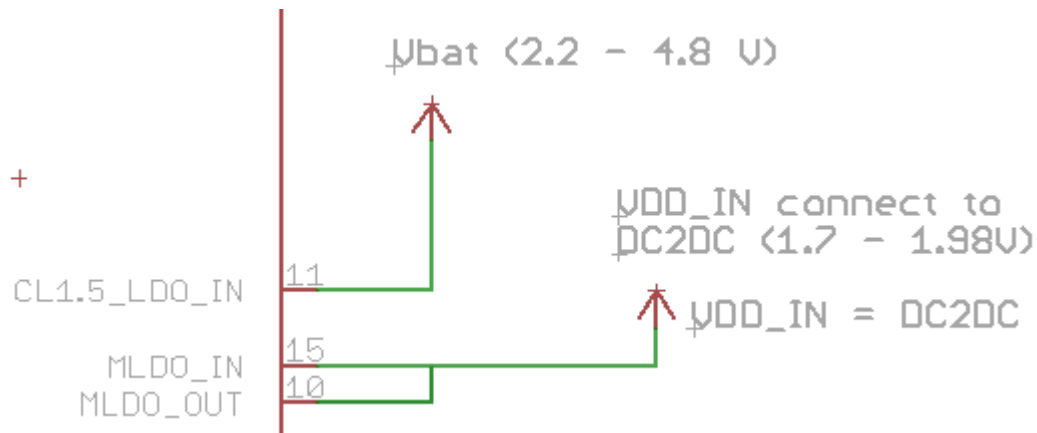
- Full-DC2DC system:

Lower RF output power, but optimum system power:



|                                               |                                                          |                         |              |
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- Mixed DC2DC- $V_{BAT}$  system:  
Maximum RF output power and optimum system power, but requires routing of  $V_{BAT}$ :



#### 5.4 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).

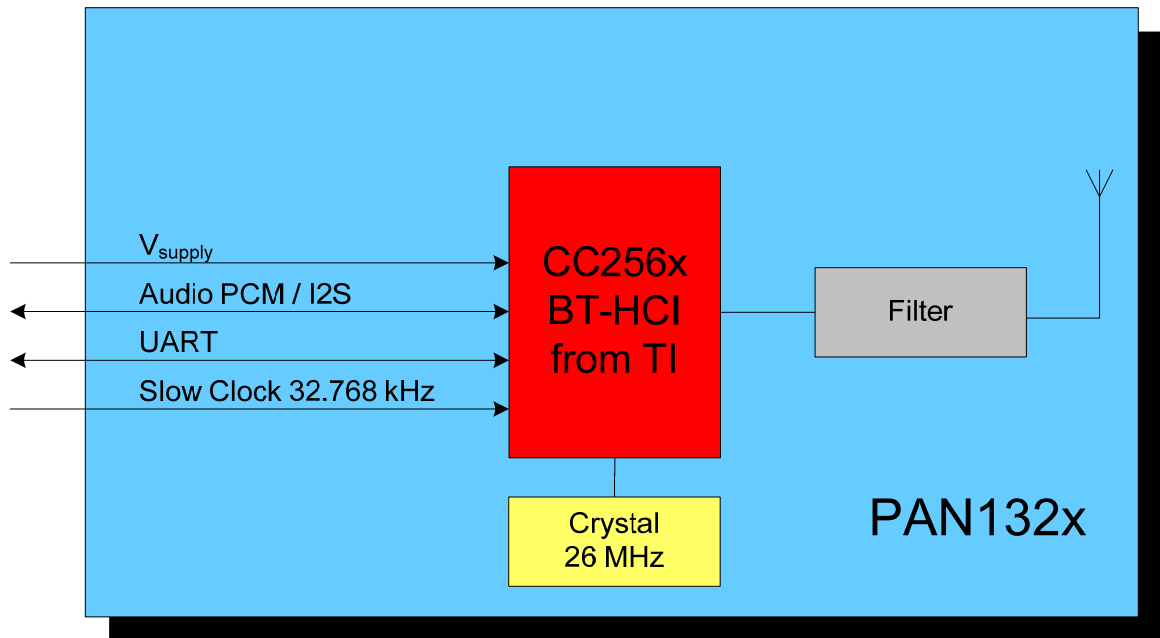
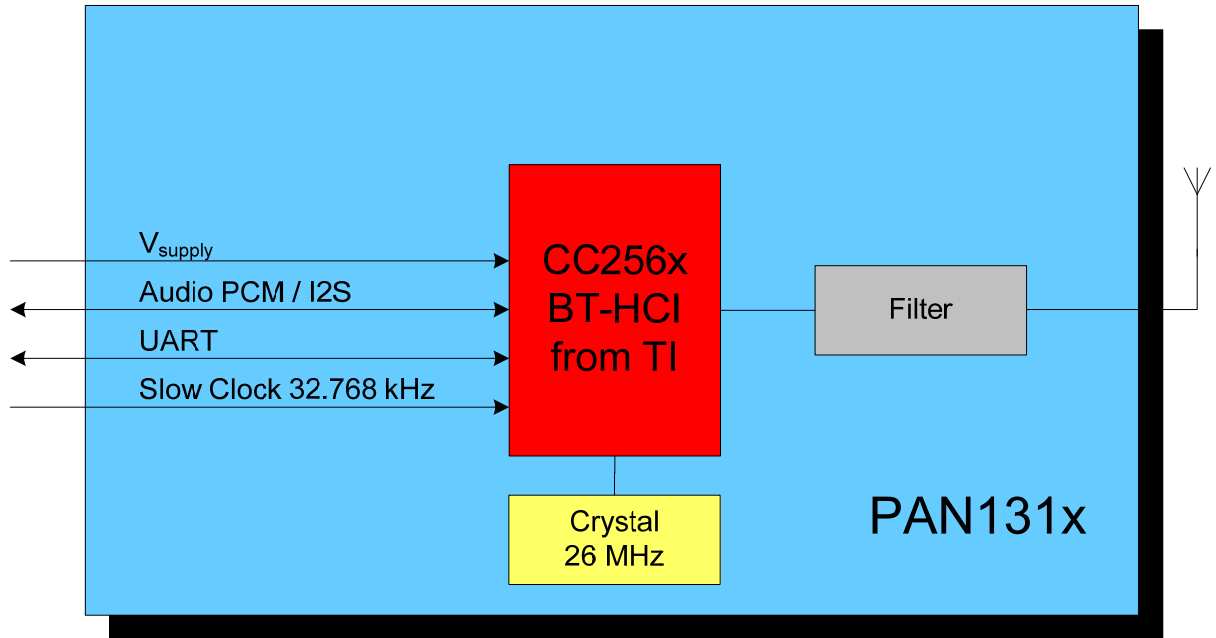
The Slow Clock 32.768 kHz is mandatory to start the internal controller, otherwise the module does not start up.

## 6 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,  $\mu$ -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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## 7 BLOCK DIAGRAM



Note: The Slow Clock 32.768 kHz is mandatory, otherwise the module does not start up, refer to Chapter 5.4 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.

|                                               |                                                          |                         |              |
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## 8 TEST CONDITIONS

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

## 9 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.

### 9.1 ABSOLUTE MAXIMUM RATINGS

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

#### Note

All parameters are measured as follows unless stated otherwise:

$$VDD\_IN^{10} = 3.3 \text{ V}, VDD\_IO = 1.8 \text{ V}.$$

| No                                                | See <sup>11</sup>                   | Value                | Unit                        |
|---------------------------------------------------|-------------------------------------|----------------------|-----------------------------|
| Ratings Over Operating Free-Air Temperature Range |                                     |                      |                             |
| 1                                                 | VDD_IN                              | Supply voltage range | -0.5 to 5.5 V <sup>12</sup> |
| 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 <sup>13</sup> °C  |
| 5                                                 | Storage temperature range           |                      | -40 to 125 °C               |

<sup>10</sup> VDD\_IN is supplied to MLDO\_IN (Pin 15) and CL1.5\_LDO\_IN (Pin 11), other options are described in Chapter 5.3.

<sup>11</sup> 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.

<sup>12</sup> 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.

<sup>13</sup> 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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| No | See <sup>11</sup>                          | Value | Unit |
|----|--------------------------------------------|-------|------|
| 6  | Bluetooth RF inputs (Pin 13)               | 10    | dBm  |
| 7  | ESD: Human Body Model (HBM). JEDEC 22-A114 | 500   | V    |

## 9.2 RECOMMENDED OPERATING CONDITIONS

| No | Rating                                                                                     | Condition      | Symbol          | Min           | Max           | Unit  |
|----|--------------------------------------------------------------------------------------------|----------------|-----------------|---------------|---------------|-------|
| 1  | Power supply voltage <sup>14</sup>                                                         |                | 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 <sub>IH</sub> | 0.65 x VDD_IO | VDD_IO        | V     |
| 4  | Low-level input voltage                                                                    | Default        | V <sub>IL</sub> | 0             | 0.35 x VDD_IO | V     |
| 5  | IO Input rise/fall times, 10% to 90% <sup>15</sup>                                         |                | 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 <sub>BAT</sub> ) (duration = 577 μs to 2.31 ms, period = 4.6 ms) |                |                 |               | 400           | mV    |
| 8  | Maximum ambient operating temperature <sup>16</sup>                                        |                |                 |               | 85            | °C    |
| 9  | Minimum ambient operating temperature <sup>17</sup>                                        |                |                 |               | -40           | □C    |

<sup>14</sup> Excluding 1.98 < VDD\_IN < 2.2 V range – not allowed.

<sup>15</sup> Asynchronous mode.

<sup>16</sup> The device can be reliably operated for 7 years at T<sub>ambient</sub> 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.

<sup>17</sup> The device can be reliably operated for 7 years at T<sub>ambient</sub> 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.

|                                               |                                                          |                         |              |
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### 9.3 CURRENT CONSUMPTION

| No | Characteristics                                         | Min<br>25°C | Typ<br>25°C | Max<br>25°C | Min<br>-40°C | Typ<br>-40°C | Max<br>-40°C | Min<br>+85°C | Typ<br>+85°C | Max<br>+85°C | Unit |
|----|---------------------------------------------------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|------|
| 1  | Current consumption in shutdown mode <sup>18</sup>      |             | 1           | 3           |              |              |              |              |              | 7            | μA   |
| 2  | Current consumption in deep sleep mode <sup>19</sup>    |             | 40          | 105         |              |              |              |              |              | 700          | μA   |
| 3  | Total IO current consumption for active mode            |             |             | 1           |              |              | 1            |              |              | 1            | mA   |
| 4  | Current consumption during transmit DH5 full throughput |             | 40          |             |              |              |              |              |              |              | mA   |

<sup>18</sup> Vbat + Vio

<sup>19</sup> Vbat + Vio + Vsd (shutdown)

|                                               |                                                          |                         |              |
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## 9.4 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                    | $\mu F$   |     |         |
| 4  | Output rise/fall times, 10% to 90% (Digital pins) | $C_L = 20 \text{ pF}$ |                      | 10                   | Ns        |     |         |
| 5  | IO currents pull                                  | TX_DBG, PCM bus       | PU                   | typ = 6.5            | 3.5       | 9.7 | $\mu A$ |
|    |                                                   |                       | PD                   | typ = 27             | 9.5       | 55  |         |
|    |                                                   | All others            | PU                   | typ = 100            | 100       | 300 | $\mu A$ |
|    |                                                   |                       | PD                   | typ = 100            | 100       | 360 |         |

## 9.5 NSHUTD REQUIREMENTS

| No | Parameter                                           | Symbol    | Min  | Max  | Unit    |
|----|-----------------------------------------------------|-----------|------|------|---------|
| 1  | Operation mode level <sup>20</sup>                  | $V_{IH}$  | 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                                     | $T_r/T_f$ |      | 20   | $\mu s$ |

## 9.6 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                       |           |                       |       | $\pm 250$             | Ppm       |
| 3  | Input transition time $T_r/T_f - 10\%$ to $90\%$   |                                 | $T_r/T_f$ |                       |       | 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         | $V_{IH}$  | $0.65 \times VDD\_IO$ |       | $VDD\_IO$             | V peak    |
|    |                                                    |                                 | $V_{IL}$  | 0                     |       | $0.35 \times VDD\_IO$ |           |
| 8  | Input impedance                                    |                                 |           | 1                     |       |                       | $M\Omega$ |
| 9  | Input capacitance                                  |                                 |           |                       |       | 5                     | $\mu F$   |

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

|                                               |                                                          |                         |              |
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## 10 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.

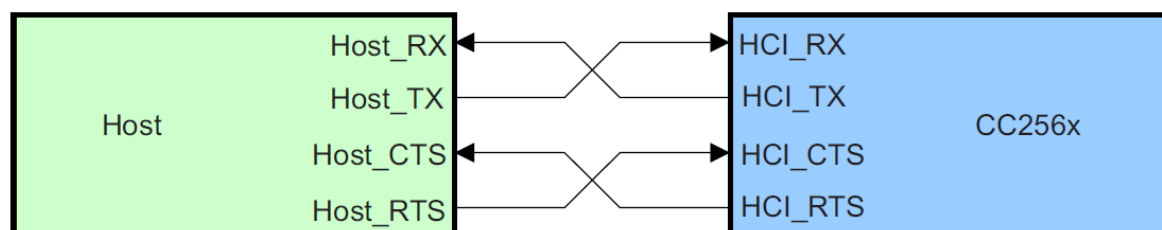
The UART module supports H4 (4-wires) protocol with maximum baud rate of 4 Mbps for all fast clock frequencies.

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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## 11 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  $\mu$ -Law) and Linear (CVSD). In addition, module also supports transparent scheme:

- Two voice channels
- Master / slave modes
- $\mu$ -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

### 11.1 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  $\mu$ Controller/DSP directly with the module's I2S interface is not recommended.

The suggested low pass filter component values are:

470pf  
120 ohms

### 11.2 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.

|                                               |                                                          |                         |              |
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- 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.
- 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 powerup, Data Out is configured as high-Z.

### 11.3 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.

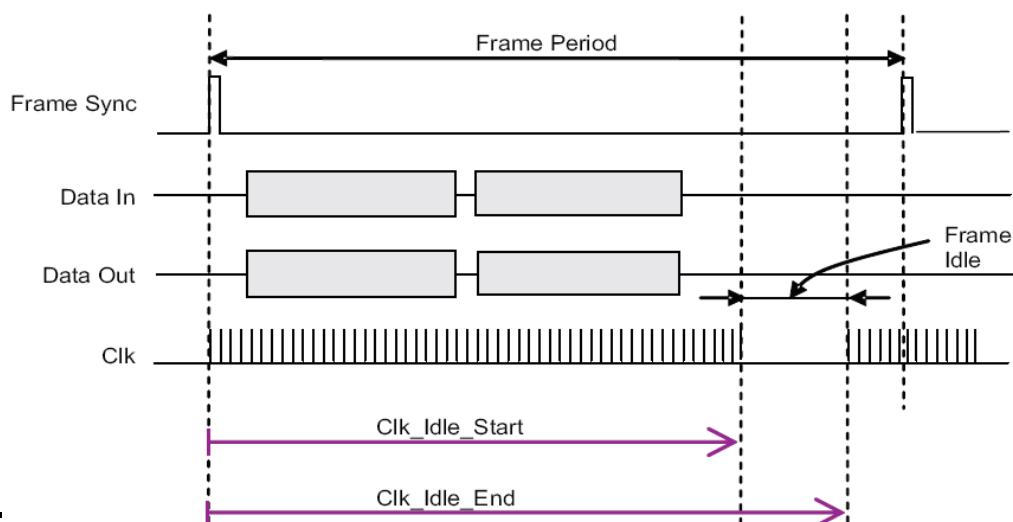
When CC256X is the master of the interface, the frame idle period is configurable. There are two configurable parameters:

- 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.

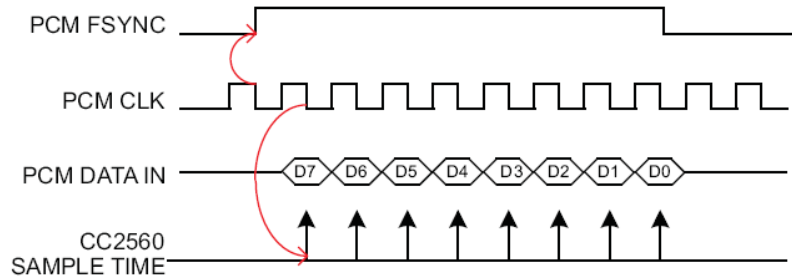


|                                               |                                                          |                         |              |
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### 11.4 CLOCK-EDGE OPERATION

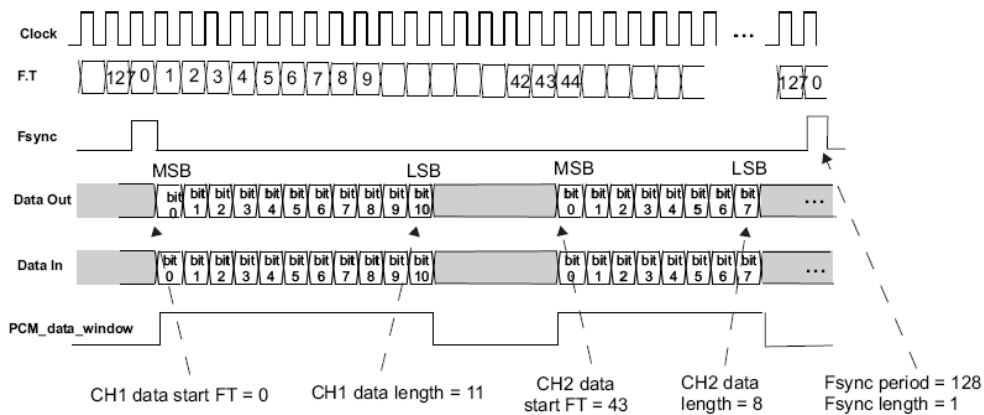
The codec interface of the CC256X can work on the rising or the falling edge of the clock. It also has the ability to sample the frame sync and the data at inversed polarity.

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.



### 11.5 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)



### 11.6 AUDIO ENCODING

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

- A-Law (8-bit)
- $\mu$ -Law (8-bit)
- Linear (8- or 16-bit)

|                                               |                                                          |                         |              |
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### 11.7 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.

### 11.8 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.

### 11.9 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 the microcontroller/DSP directly to the module's PCM interface, a simple RC low pass filter is recommended to improve noise suppression.

|                                               |                                                          |                         |              |
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## 11.10 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   |

## 12 BLUETOOTH RF PERFORMANCE

| No | Characteristics                                   | Typ  | BT Spec<br>Max<br>Class1 | BT Spec<br>Min<br>Class1 |
|----|---------------------------------------------------|------|--------------------------|--------------------------|
| 1  | Average Power Hopping DH5 [dBm] <sup>22, 23</sup> | 7.2  | 20                       | 4                        |
| 2  | Average Power: Ch0 [dBm] <sup>22, 23</sup>        | 7.5  | 20                       | 4                        |
| 3  | Peak Power: Ch0 [dBm] <sup>22, 23</sup>           | 7.7  | 23                       |                          |
| 4  | Average Power: Ch39 [dBm] <sup>22, 23</sup>       | 7.0  | 20                       | 4                        |
| 5  | Peak Power: Ch39 [dBm] <sup>22, 23</sup>          | 7.2  | 23                       |                          |
| 6  | Average Power: Ch78 [dBm] <sup>22, 23</sup>       | 6.7  | 20                       | 4                        |
| 7  | Peak Power: Ch78 [dBm] <sup>22, 23</sup>          | 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                      |

|                                               |                                                          |                         |              |
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| No | Characteristics                    | Typ   | BT Spec | BT Spec |
|----|------------------------------------|-------|---------|---------|
|    |                                    |       | Max     | Min     |
|    |                                    |       | Class1  | Class1  |
| 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     |         |
| 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    |         |

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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| No  | Characteristics                     | Typ   | BT Spec | BT Spec |
|-----|-------------------------------------|-------|---------|---------|
|     |                                     |       | Max     | Min     |
|     |                                     |       | Class1  | Class1  |
| 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     |
| 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  |
|    |                           | π/4-DQPSK, BER = 0.01% |      | -92.5 |      | -70     |      |
|    |                           | 8DPSK, BER = 0.01%     |      | -85.5 |      | -70     |      |

|                                               |                                                          |                         |              |
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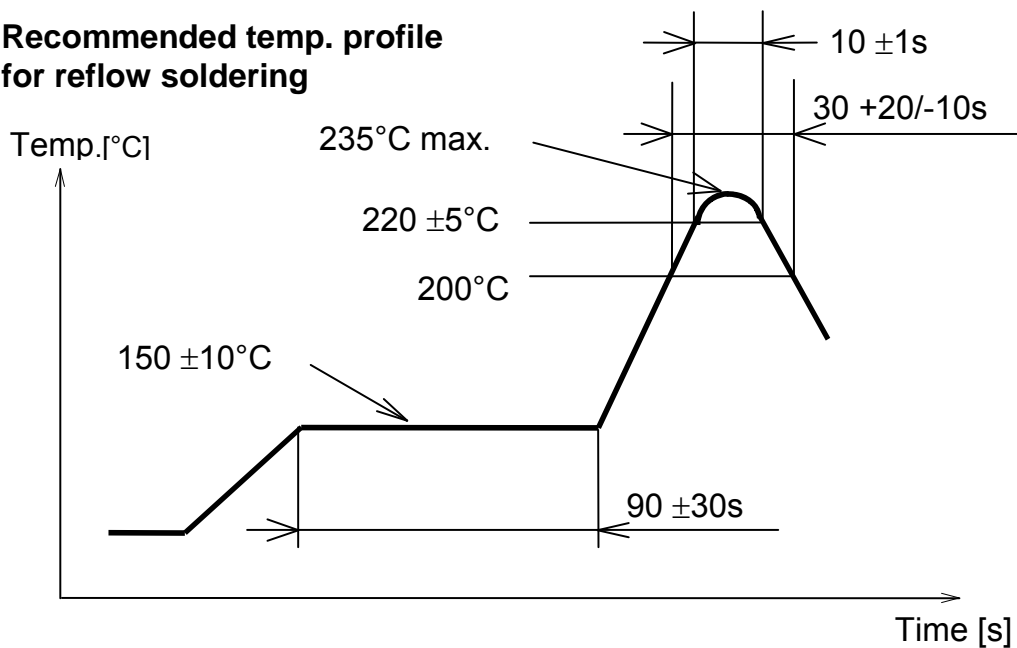
| No | Characteristics                                         | Condition                                  | Typ | Max | Unit |
|----|---------------------------------------------------------|--------------------------------------------|-----|-----|------|
| 1  | Tx and Rx out-of-band emissions<br>Output signal = 7dBm | 30 kHz to 1 GHz <sup>21, 22, 23</sup>      |     | -30 | dBm  |
|    |                                                         | 1 to 12.75 GHz <sup>21, 22, 23</sup>       |     | -30 |      |
| 2  | 2nd harmonic                                            | at 7dBm output power <sup>21, 22, 23</sup> |     | -30 | dBm  |
| 3  | 3rd harmonic                                            | at 7dBm output power <sup>21, 22, 23</sup> |     | -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.

### 13 SOLDERING TEMPERATURE-TIME PROFILE (FOR REFLOW SOLDERING)

#### 13.1 FOR LEAD SOLDER

#### Recommended temp. profile for reflow soldering



<sup>21</sup> Includes effects of frequency hopping

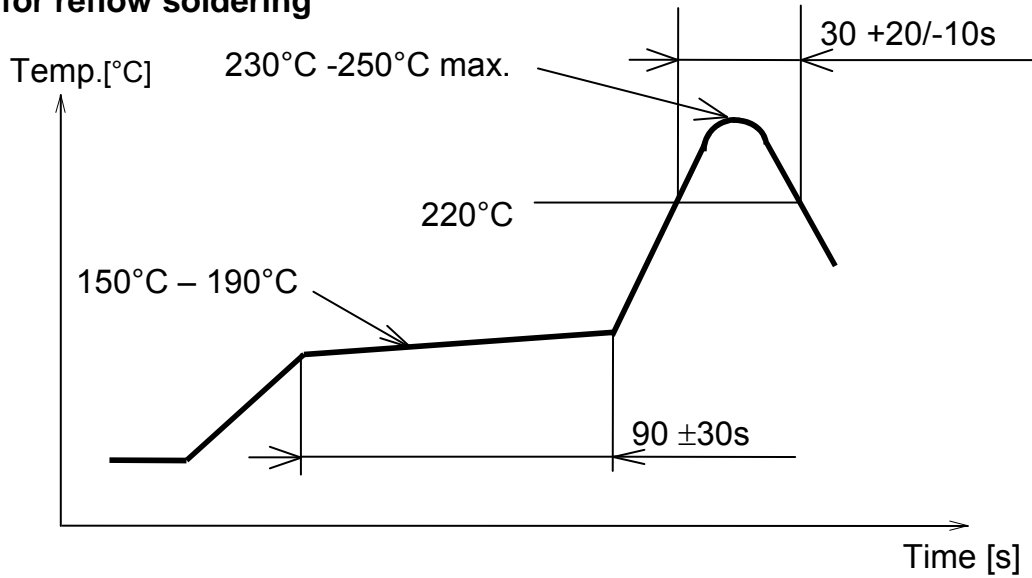
<sup>22</sup> Average according FCC, IC and ETSI requirements. Above +7dBm output power (refer also to 23) the customer has to verify the final product against national regulations.

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

|                                               |                                                          |                         |              |
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### 13.2 FOR LEADFREE SOLDER

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



Reflow permissible cycle: 2  
 Opposite side reflow is prohibited due to module weight.

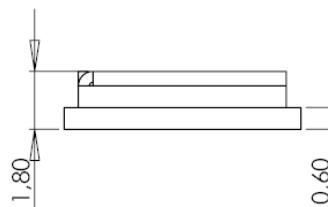
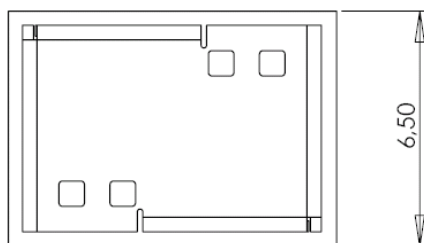
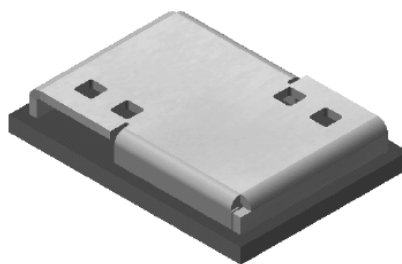
|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 14 MODULE DIMENSION

### 14.1 MODULE DIMENSIONS PAN131X WITHOUT ANTENNA

| No. | Item   | Dimension | Tolerance  | Remark    |
|-----|--------|-----------|------------|-----------|
| 1   | Width  | 6.50      | $\pm 0.20$ |           |
| 2   | Lenght | 9.00      | $\pm 0.20$ |           |
| 3   | Height | 1.80      | $\pm 0.20$ | With case |

#### PAN131X Module Drawing

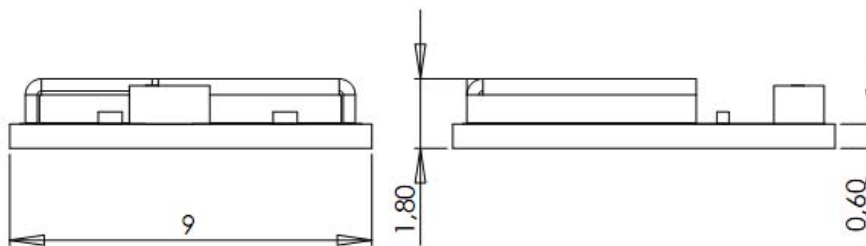
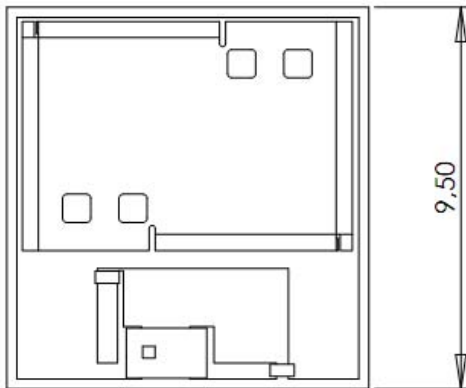


|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 14.2 MODULE DIMENSIONS PAN132X WITH ANTENNA

| No. | Item   | Dimension | Tolerance  | Remark    |
|-----|--------|-----------|------------|-----------|
| 1   | Width  | 9.50      | $\pm 0.20$ |           |
| 2   | Lenght | 9.00      | $\pm 0.20$ |           |
| 3   | Height | 1.80      | $\pm 0.20$ | With case |

PAN132X Module Drawing



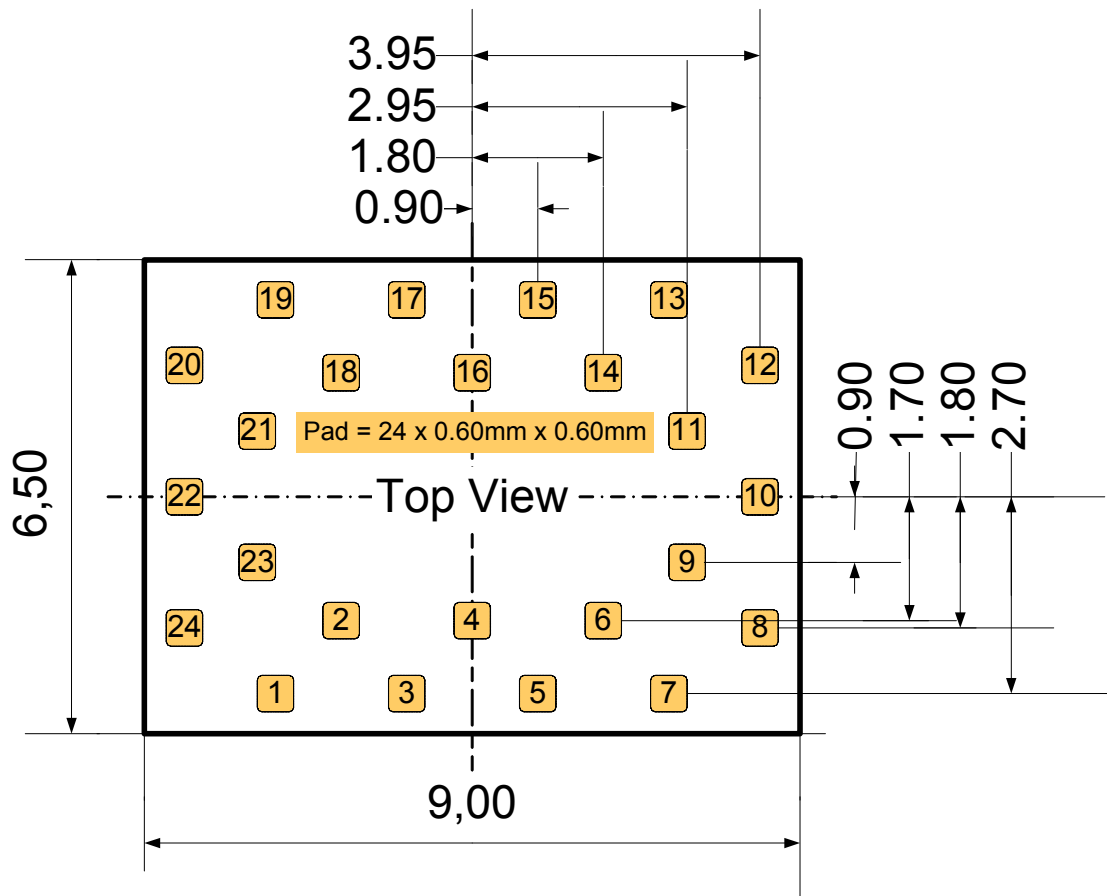
|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 15 FOOTPRINT OF THE MODULE

### 15.1 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.

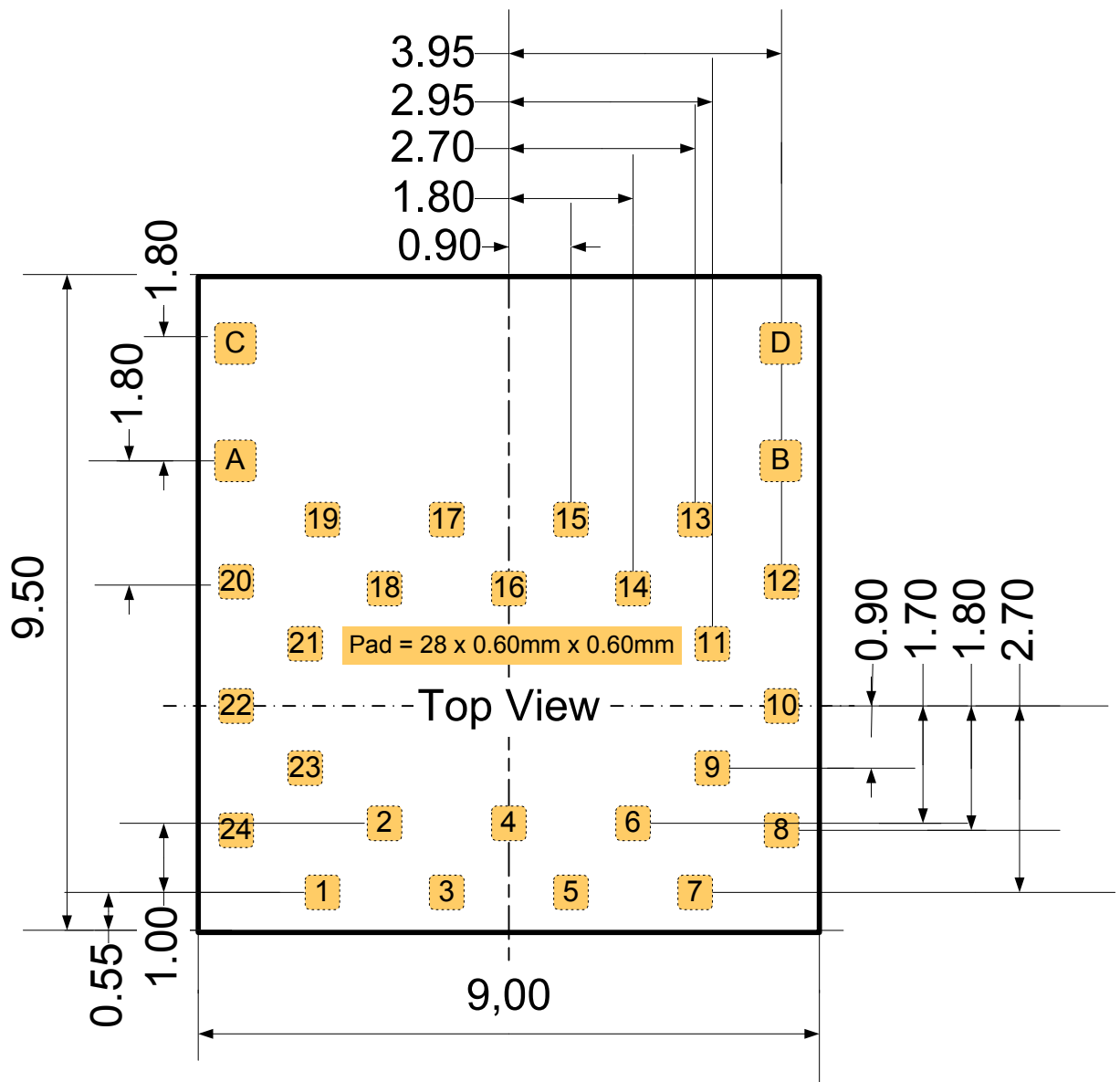


|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 15.2 FOOTPRINT PAN132X WITH ANTENNA

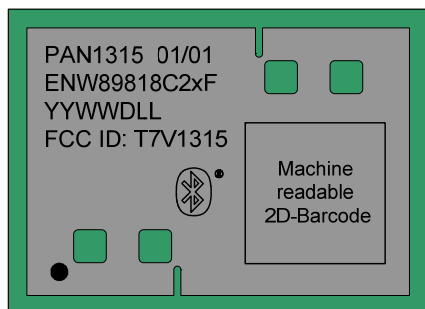
All dimensions are in millimeters.  
The outer dimensions have a tolerance of  $\pm 0.2\text{mm}$ .

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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## 16 LABELING DRAWING



The above pictures show the laser marking on the top case, this is only an example from PAN1315.

## 17 MECHANICAL REQUIREMENTS

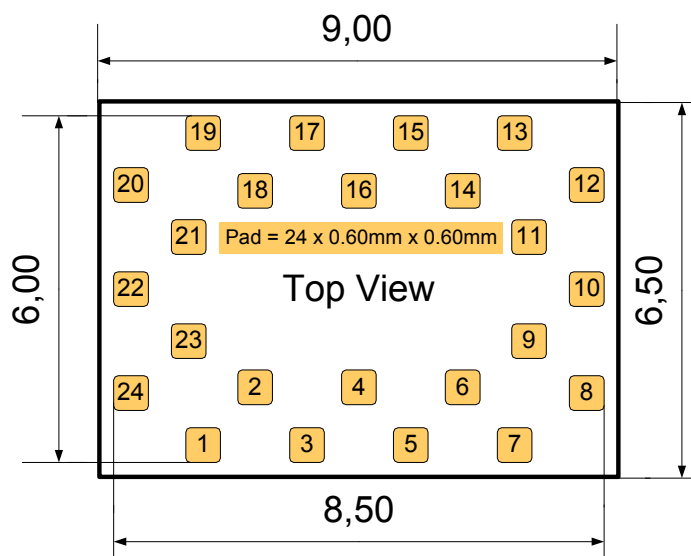
| No. | Item                         | Limit                                                                      | Condition                                               |
|-----|------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------|
| 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 13.2                                        |

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 18 RECOMMENDED FOOT PATTERN

### 18.1 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).

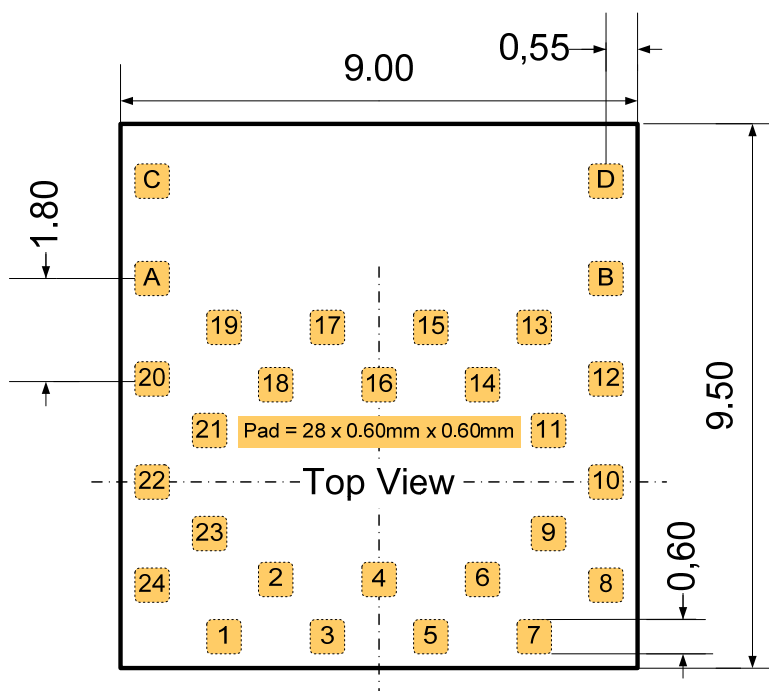
If you have any questions on these points, contact your local Panasonic representative.

Schematics and layouts may be sent to [wireless@eu.panasonic.com](mailto:wireless@eu.panasonic.com) for final review.

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 18.2 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 120 $\mu$ m to 150 $\mu$ m is recommended.

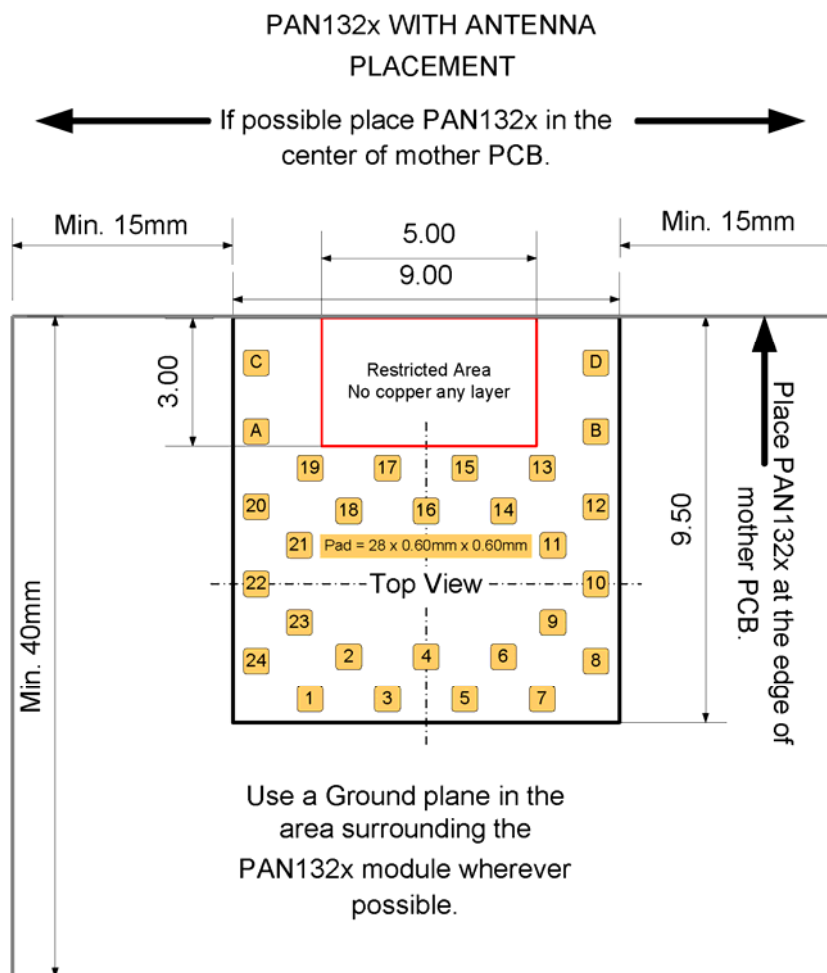
**IMPORTANT:** In cases where a track or through hole via has to be located under the module, it must be kept away from PAN132X bottom pads. The PAN132X multilayer pcb contains an inner RF shielding plane, therefore no pcb shielding plane below the module is needed.

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

Schematics and layouts may be sent to [wireless@eu.panasonic.com](mailto:wireless@eu.panasonic.com) for final review.

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 19 LAYOUT RECOMMENDATIONS WITH ANTENNA (PAN132X)



Dimensions are in mm.

## 20 BLUETOOTH LE (LOW ENERGY) PAN1316/26

### 20.1 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 uA. The benefit 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:

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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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.

This data sheet describes dual-mode Bluetooth Low Energy technology combined with Classic Bluetooth functionality on a single module. Additional information on Panasonic's single mode products can be found by visiting [www.panasonic.com/rfmodules](http://www.panasonic.com/rfmodules) or write an e-mail to [wireless@eu.panasonic.com](mailto:wireless@eu.panasonic.com).

## 20.2 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

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 20.3 CURRENT CONSUMPTION FOR DIFFERENT LE SCENARIOS

Conditions: VDD<sub>IN</sub> = 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<br>1.28msec advertising interval<br>15Bytes advertise Data      | 104             | µA   |
| Advertising, discoverable    | Advertising in all 3 channels<br>1.28msec advertising interval<br>15Bytes advertise Data      | 121             | µA   |
| Scanning                     | Listening to a single frequency per window<br>1.28msec scan interval<br>11.25msec scan window | 302             | µA   |
| Connected<br>(master role)   | 500msec connection interval<br>0msec Slave connection latency<br>Empty Tx/Rx LL packets       | 169             | µA   |

## 21 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).[

### 21.1 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 CC2567 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. CC2567 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.

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 21.2 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"> <li>- Requires 80% less board area than any dual module or device design</li> <li>- Reduces costs associated with incorporating two wireless technologies</li> </ul>                                                |
| Fully validated optimized single antenna solution                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>- Enables simultaneous operation of ANT+ and Bluetooth without the need for two devices or modules</li> <li>- Includes built-in coexistence</li> </ul>                                                          |
| Best-in-class Bluetooth and ANT RF performance: <ul style="list-style-type: none"> <li>- +10 dBm Tx power with transmit power control</li> <li>- -93 dBm sensitivity</li> </ul>                                                                  | <ul style="list-style-type: none"> <li>- Delivers twice the distance between the aggregator and ANT sensor device than competitive single-mode ANT solutions</li> <li>- Enables a robust and high-throughput connection with extended range</li> </ul> |
| Support for: <ul style="list-style-type: none"> <li>- ANT+ ultra low power (master and slave devices)</li> <li>- Bluetooth power saving modes (park, sniff, hold)</li> <li>- Bluetooth ultra low power modes (deep sleep, power down)</li> </ul> | <ul style="list-style-type: none"> <li>- Improves battery life and power efficiency of the finished product</li> </ul>                                                                                                                                 |
| Turnkey solution: <ul style="list-style-type: none"> <li>- Fully integrated module</li> <li>- Complete development kit with software and documentation</li> <li>- TI MSP430 hardware and software platform integration (optional)</li> </ul>     | <ul style="list-style-type: none"> <li>- Ease of integration into system allows quick time to market</li> <li>- Reduces costs and time associated with certification</li> </ul>                                                                        |

## 21.3 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   |

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 22 TRIPLE MODE (BR/EDR + BLUETOOTH LOW ENERGY + ANT) PAN1323

The PAN1323 has been engineered to give designers the flexibility to implement Bluetooth Classic (BR/EDR), Bluetooth Low Energy and 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, 15A, 16, 17, 25, 25A, 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.

### 22.1 TRIPLE MODE CURRENT CONSUMPTION

The current consumption of the PAN1326 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.

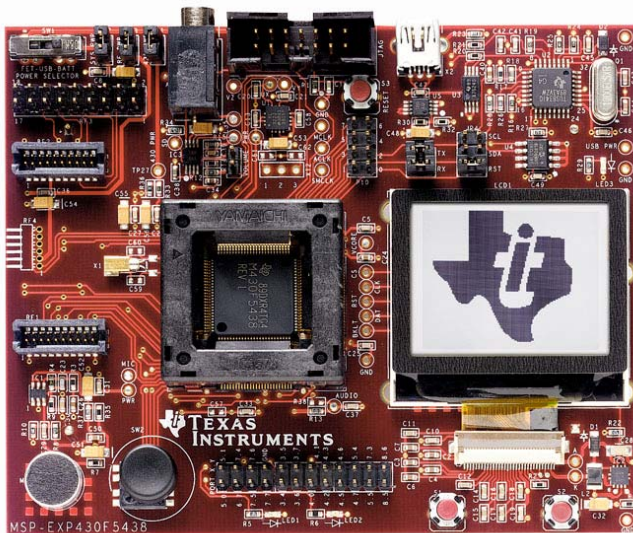
|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 23 DEVELOPMENT OF APPLICATIONS

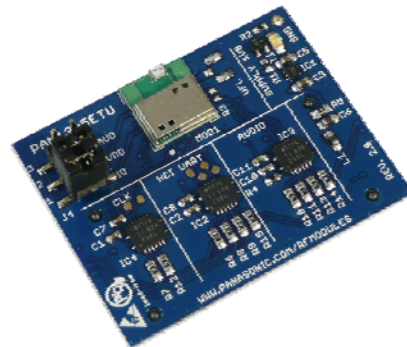
Mindtree Ltd. has developed a Bluetooth SPP freeware for TIs MSP430 and Panasonics PAN1315(A) and PAN1325(A). For other software refer to Chapter 24 or visit the following link [www.panasonic.com/rfmodules](http://www.panasonic.com/rfmodules).

### 23.1 TOOLS TO BE NEEDED

| Tool                                                    | Source                                                                    |
|---------------------------------------------------------|---------------------------------------------------------------------------|
| TI - MSP-EXP430F5438 - Experimenter Board               | <a href="http://www.ti.com/lit/zip/msp-exp430f5438">MSP-EXP430F5438</a>   |
| TI - MSP-FET430UIF430 - Debugging Interface             | <a href="http://www.ti.com/lit/zip/msp-fet430uif430">MSP-FET430UIF430</a> |
| PAN1323EMK - Bluetooth Evaluation Module Kit for MSP430 | TI <a href="http://www.ti.com/lit/zip/pan1323emk">PAN1323EMK</a>          |
|                                                         | Panasonic <a href="http://www.panasonic.com/rfmodules">PAN1323ETU</a>     |



**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_Bluetooth)

[http://processors.wiki.ti.com/index.php/IAR\\_Embedded\\_Workbench\\_for\\_TI\\_MSP430](http://processors.wiki.ti.com/index.php/IAR_Embedded_Workbench_for_TI_MSP430)

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

|                                               |                                                          |                         |              |
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## 24 LIST OF PROFILES

| Profile | Software Developer | Controller | Availability |
|---------|--------------------|------------|--------------|
|---------|--------------------|------------|--------------|

### Bluetooth

|                  |                |               |     |
|------------------|----------------|---------------|-----|
| SPP and others   | MindTree       | TI, MSP430    | Now |
| SPP              | Seeran         | STM32, MSP430 | Now |
| HDP, SPP         | Stollmann      | TI, MSP430    | Now |
| A2DP, AVRCP, SPP | StoneStreetOne | TI, Stellaris | Now |
| SPP and others   | ARS            | Multiple      | Now |

### Bluetooth LE

|     |                                             |                       |              |
|-----|---------------------------------------------|-----------------------|--------------|
| All | ARS, MindTree,<br>StoneStreetOne, Stollmann | TI, MSP430 and others | Upon request |
|-----|---------------------------------------------|-----------------------|--------------|

### ANT Protocol

|     |            |                   |     |
|-----|------------|-------------------|-----|
| ANT | Dynastream | MSP430 and others | Now |
|-----|------------|-------------------|-----|

### Triple Mode Stack

|     |                |                   |     |
|-----|----------------|-------------------|-----|
| SPP | StoneStreetOne | MSP430 and others | Now |
|-----|----------------|-------------------|-----|

For all other profiles contact your local sales representative.

## 25 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<br>a) 20min. / cycle,1hrs. each of XYZ axis<br>b) Freq.:30~100Hz, 6G<br>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.;<br>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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## 26 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.

### 26.1 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.

### 26.2 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.

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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### 26.3 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.

### 26.4 STORAGE NOTES

- (1) The module should not be stressed mechanically during storage.
- (2) Do not store these products in the following conditions or the performance characteristics of the product, such as RF performance will be adversely affected:
  - Storage in salty air or in an environment with a high concentration of corrosive gas, such as Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, or NO<sub>x</sub>
  - Storage in direct sunlight
  - Storage in an environment where the temperature may be outside the range of 5°C to 35°C 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).

|                                               |                                                          |                         |              |
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## 26.5 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.

## 26.6 OTHER CAUTIONS

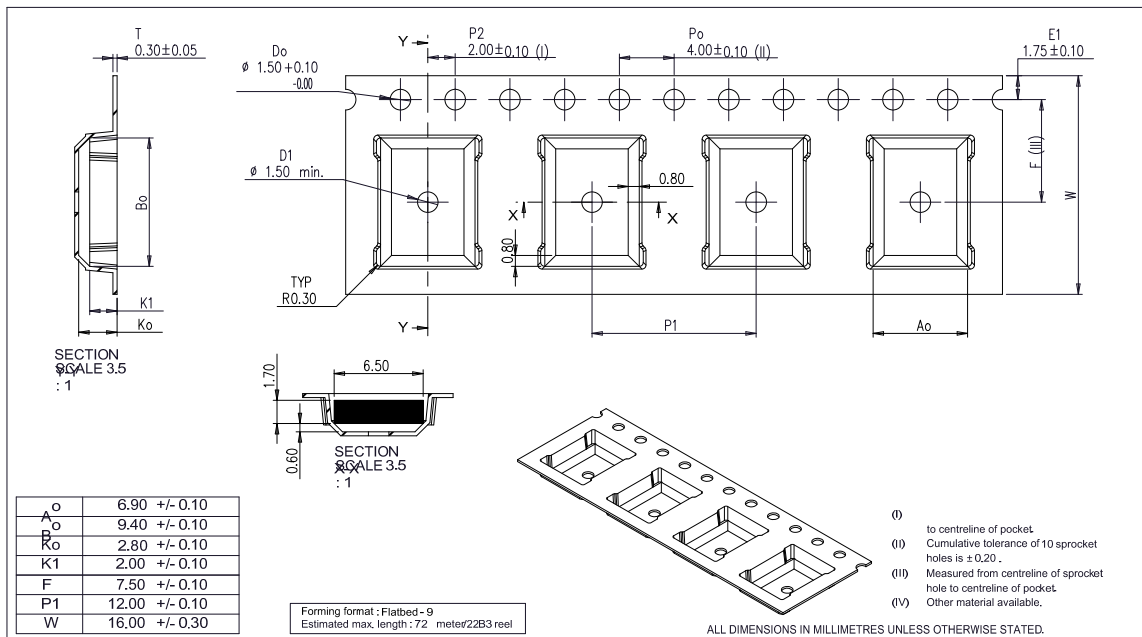
- (1) This specification sheet is copyrighted.
- (2) Do not use the products for other purposes than those listed.
- (3) Be sure to provide an appropriate fail-safe function on your product to prevent an additional damage that may be caused by the abnormal function or the failure of the product.
- (4) 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, Cl<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, and NO<sub>x</sub>)
- (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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## 27 PACKAGING

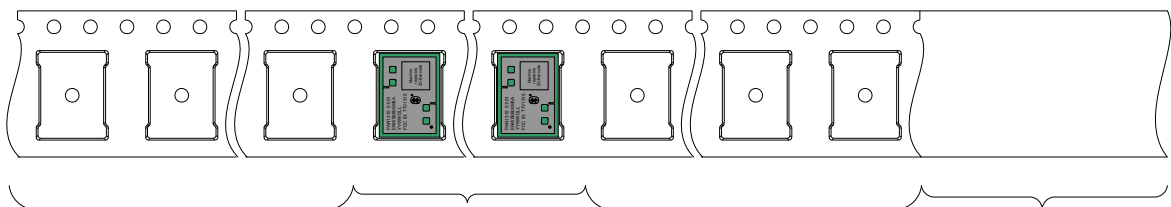
### 27.1 PACKAGING OF PAN131X WITHOUT ANTENNA

#### Tape Dimension



#### Packing in Tape

Direction of unreeling (for customer) →



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

component  
packed area  
standard  
1500pcs

leader (empty)  
minimum 10 pitch

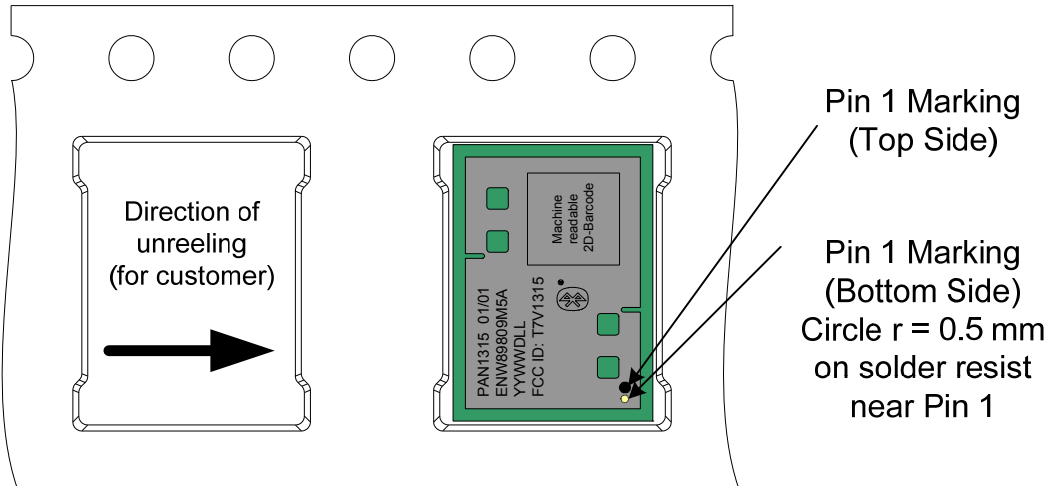
Top cover tape more  
than 1 x  
circumference plus  
100mm to avoid  
fixing of tape end on  
sealed modules.

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

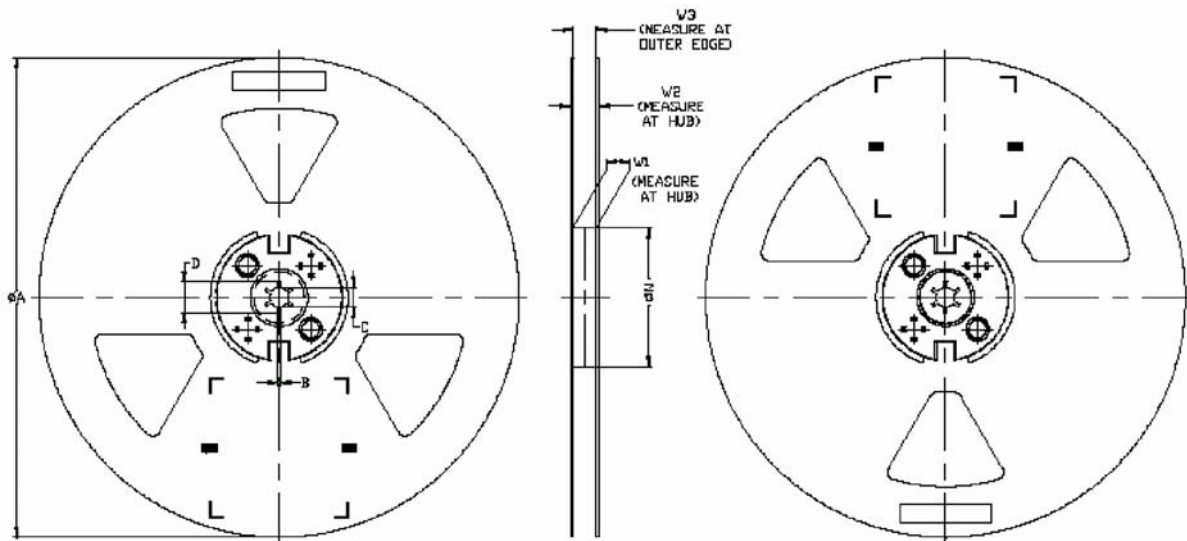
Top cover tape shall not be found on reel holes and shall not stick out from reel.

|                                               |                                                          |                         |              |
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### Component direction



### Reel dimension



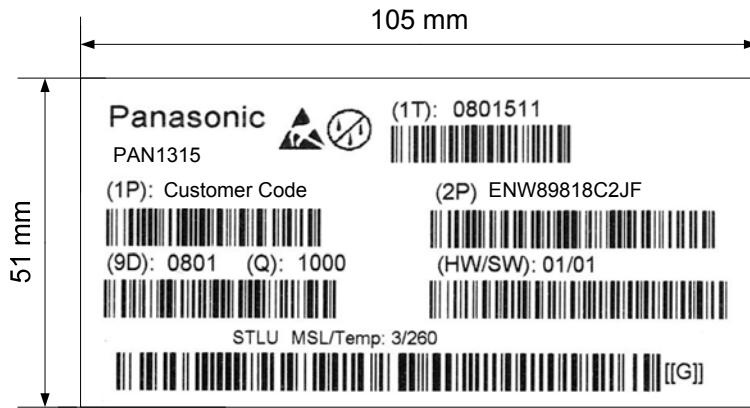
| TAPE SIZE | A<br>MAX | B<br>MIN | C                 | D<br>MIN | N<br>$\pm 1.0$ | W1                  | W2<br>MAX | W3                  | Assembly<br>Method |
|-----------|----------|----------|-------------------|----------|----------------|---------------------|-----------|---------------------|--------------------|
| 24mm      | 330.0    | 1.5      | 13 $+0.5$<br>-0.2 | 20.2     | 100.0          | 25.0 $+2.0$<br>-0.0 | 30.4      | 24.4 $+3.0$<br>-0.5 | *Latch             |

All dimensions in millimeters unless otherwise stated

\*Latch (2PC)

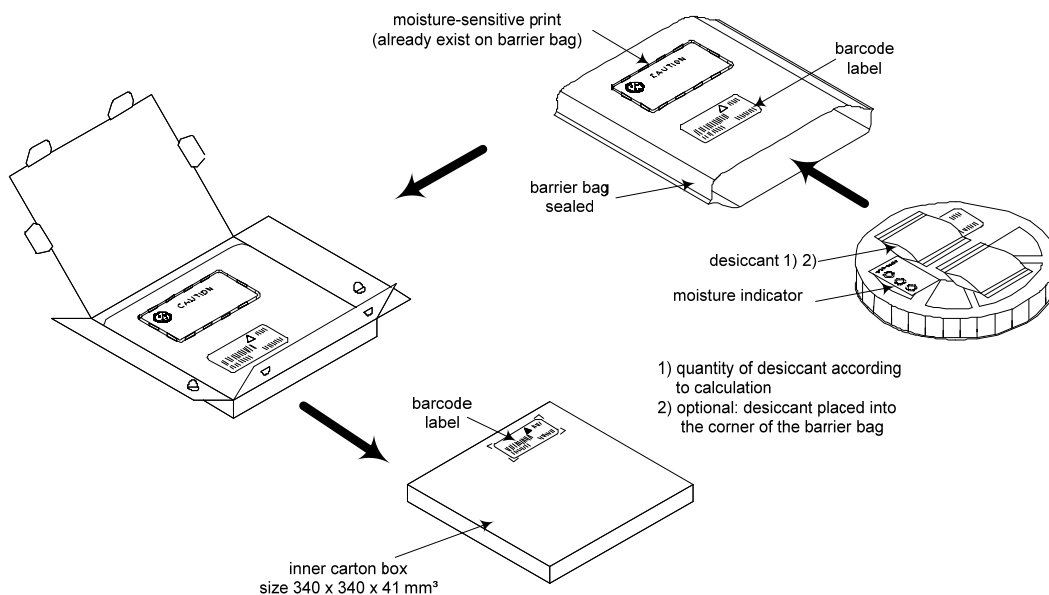
|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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### Label for Package



- |         |                                                                     |                     |
|---------|---------------------------------------------------------------------|---------------------|
| (1T)    | Lotcode [YYWDDL]                                                    | Example from above: |
|         | YY year                                                             | printed 08          |
|         | WW normal calendar week                                             | printed 01          |
|         | D day                                                               | printed 5 (Friday)  |
|         | L line identifier, if more as one                                   | printed 1           |
|         | L lot identifier per day                                            | printed 1           |
| (1P)    | Customer Order Code, if any, otherwise company name will be printed |                     |
| (2P)    | Panasonic Order Code refer to chapter 28 Ordering Information       |                     |
| (9D)    | Datecode as [YYWW]                                                  |                     |
| (Q)     | Quantity [XXXX], variable max. 1500                                 |                     |
| (HW/SW) | Hardware /Software Release                                          |                     |

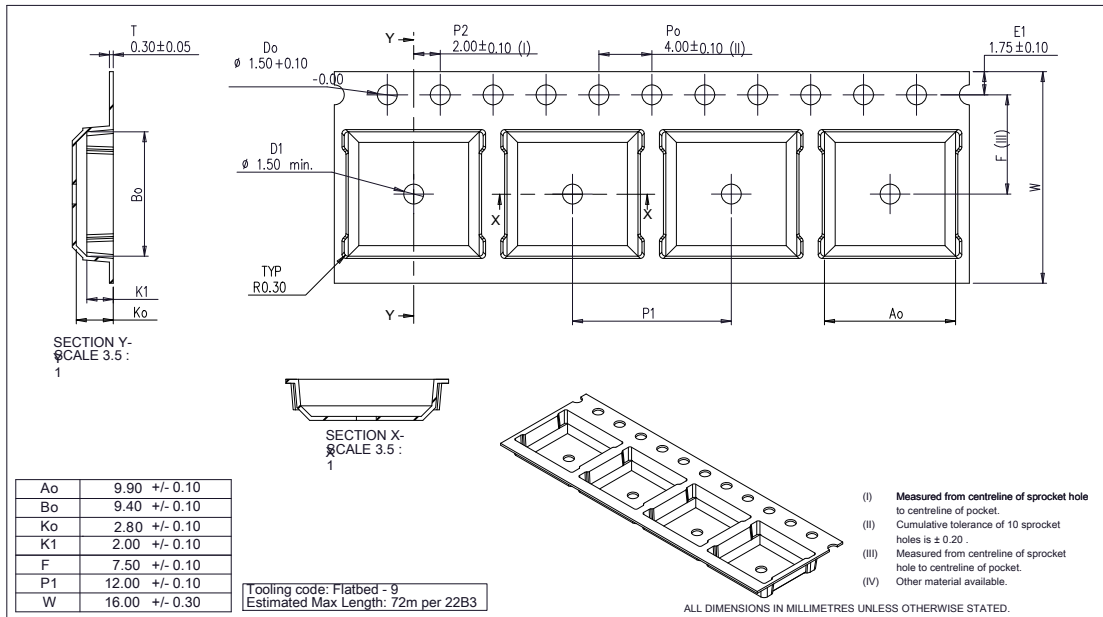
### Total Package



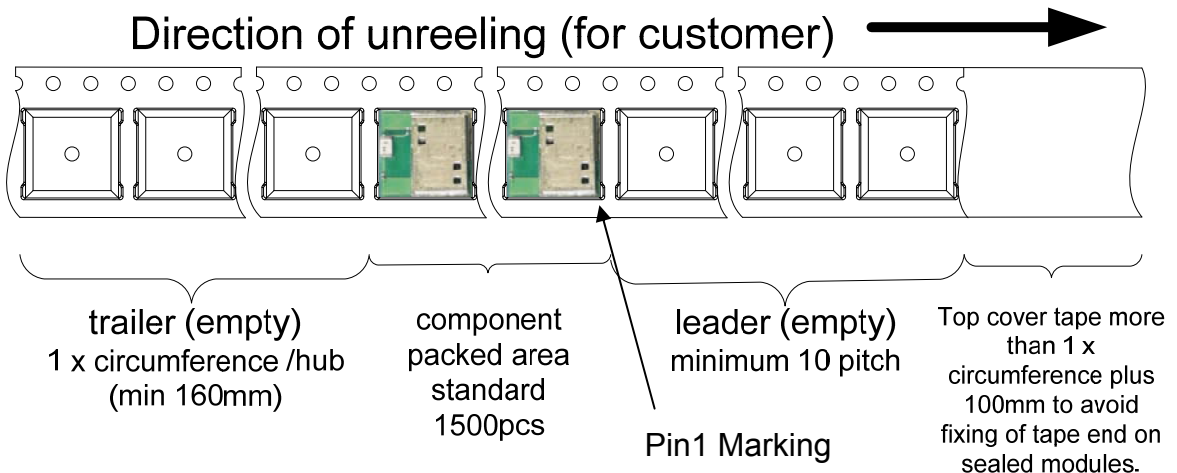
|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 27.2 PACKAGING FOR PAN132X WITH ANTENNA

### Tape Dimension



### Packing in Tape



All other packaging information is similar to Chapter 27.1

|                                               |                                                          |                         |              |
|-----------------------------------------------|----------------------------------------------------------|-------------------------|--------------|
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## 28 ORDERING INFORMATION

| Model    | Temp.          | Part Number  | TI-Device | Remark                      |
|----------|----------------|--------------|-----------|-----------------------------|
| PAN1315  | -20°C to +70°C | ENW89818C2JF | CC2560    | NR for new designs          |
| PAN1315A | -20°C to +70°C | ENW89829C2JF | CC2560A   | NR for new designs          |
| PAN1315A | -40°C to +85°C | ENW89829C2KF | CC2560A   | Recommended for new designs |
| PAN1316  | -20°C to +70°C | ENW89823C2JF | CC2564    | NR for new designs          |
| PAN1316  | -40°C to +85°C | ENW89823C2KF | CC2564    | Recommended for new designs |
| PAN1317  | -20°C to +70°C | ENW89827C2JF | CC2567    | NR for new designs          |
| PAN1317  | -40°C to +85°C | ENW89827C2KF | CC2567    | Recommended for new designs |
| PAN1323  | -20°C to +70°C | No           | CC2567    | Only ETU Module             |
| PAN1323  | -20°C to +70°C | ENW89842A2JF | CC2567    | NR for new designs          |
| PAN1323  | -40°C to +85°C | ENW89842A2KF | CC2567    | Recommended for new designs |
| PAN1325  | -20°C to +70°C | ENW89818A2JF | CC2560    | NR for new designs          |
| PAN1325A | -20°C to +70°C | ENW89829A2JF | CC2560A   | NR for new designs          |
| PAN1325A | -40°C to +85°C | ENW89829A2KF | CC2560A   | Recommended for new designs |
| PAN1326  | -20°C to +70°C | ENW89823A2JF | CC2564    | NR for new designs          |
| PAN1326  | -40°C to +85°C | ENW89823A2KF | CC2564    | Recommended for new designs |
| PAN1327  | -20°C to +70°C | ENW89827A2JF | CC2567    | NR for new designs          |
| PAN1327  | -40°C to +85°C | ENW89827A2KF | CC2567    | Recommended for new designs |

|                                               |                                                          |                         |              |
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## 29 ROHS DECLARATION

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

## 30 DATA SHEET 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.

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

Use this URL to search for the most recent version of this data sheet: [PAN13xx Latest Data Sheet!](#)

|                                               |                                                          |                         |              |
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### 31 HISTORY FOR THIS DOCUMENT

| Revision | Date         | Modification / Remarks                                                                                                                                                                                                                                    |
|----------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.90     | 18.12.2009   | 1 <sup>st</sup> preliminary version                                                                                                                                                                                                                       |
| 0.95     | 01.03.2010   | Updated Chapter 14.2 and 28.                                                                                                                                                                                                                              |
| 0.96     | Not released | Change ESD Information on foot note 7 in chapter Pin Description                                                                                                                                                                                          |
| 0.97     | 25.03.2010   | Various updates. Deleted links to TI Datasheet.                                                                                                                                                                                                           |
| 0.98     | 21.04.2010   | Updated Links Some minor changes in Chapter 8 and 9.1 and change the base for the values in Chapter 9.                                                                                                                                                    |
| 0.99     | 22.10.2010   | Adopted changes according to CC2560 Datasheet. Included Interface Description, performance values. Not released.                                                                                                                                          |
| 1.00     | 04.11.2010   | 1 <sup>st</sup> 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 34.2 "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 34.3 European R&TTE Declaration of Conformity.                                                                                                                                                                               |
| 1.05     | 28.10.2011   | Including CC2560A silicon PAN1315A HW40 at Chapter 1.1, Chapter New PAN1315A 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 Recommendations 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<br>1. NCC Statement (only valid for PAN1325)<br>2. Bluetooth SIG Statement<br>3. Chapter 11.9, Second Paragraph was updated<br>4. Link in Chapter 34.1.1. was fixed                       |
| 3.50     | 31.10.2012   | Changed the Overview in chapter Ordering Information<br>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.                                                                                                                                                                                              |

|                                               |                                                          |                         |              |
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## 32 RELATED DOCUMENTS

For an update, search in the suitable 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](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](http://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.pideu.panasonic.de/pdf/174ext.zip>
- [5] To aide in the implementation of this reference design, Eagle formatted application and layout files are available on the web at the address below.  
[www.panasonic.com/industrial/includes/pdf/PAN1323ETU\\_Eagle\\_Ver1\\_1.zip](http://www.panasonic.com/industrial/includes/pdf/PAN1323ETU_Eagle_Ver1_1.zip)
- [6] Application Note Land Grid Array: <http://www.pideu.panasonic.de/pdf/184ext.pdf>

|                                               |                                                          |                         |              |
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### 33 GENERAL INFORMATION

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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.

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### 34 REGULATORY INFORMATION

#### 34.1 FCC FOR US

##### 34.1.1 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.

|                                               |                                                          |                         |              |
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#### 34.1.2 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

#### 34.1.3 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

This FCC identifiers are valid for all PAN13xx modules, for details, see the Chapter 28. 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).

#### 34.1.4 Antenna Warning



For the related part number of PAN13xx refer to Chapter 28. 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 15.247 for emissions. The FCC identifier for this device with the antenna listed below are the same (FCC ID: T7V1315 or T7V1316).

|                                               |                                                          |                         |              |
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### 34.1.5 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       |

### 34.1.6 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       |

### 34.1.7 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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## 34.2 INDUSTRY CANADA CERTIFICATION

### 34.2.1 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](http://www.ic.gc.ca).

This device has been designed to operate with the antennas listed in Tables 34.1.5 and 34.1.6 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](http://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).

|                                               |                                                          |                         |              |
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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.

### 34.2.2 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)

This IC identifiers are valid for all PAN13xx modules, for details, see the Chapter 28. 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 28. 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).

### 34.3 EUROPEAN R&TTE DECLARATION OF CONFORMITY

Hereby, Panasonic Industrial Devices Europe GmbH, declares that the Bluetooth module PAN13xx and their versions is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. As a result of the conformity assessment procedure described in Annex III of the Directive 1999/5/EC, the end-customer equipment should be labelled as follows:



PAN13xx and their versions in the specified reference design can be used in the following countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, The Netherlands, the United Kingdom, Switzerland, and Norway.

|                                               |                                                          |                         |              |
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## Declaration of Conformity (DoC) 1999/5/EC

We, Panasonic Industrial Devices Europe GmbH  
Wireless Connectivity, Power Electronics R&D Center  
Zeppelinstrasse 19, 21337 Lueneburg, Germany

declare under our sole responsibility that the product:

Type of equipment: Bluetooth Module  
Brand name: PAN1315, PAN1315A, PAN1316, PAN1317  
PAN1323, PAN1325, PAN1325A, PAN1326, PAN1327  
Model name: ENW898xxC2yF (xx = 18, 29, 23 or 27) [y = J or K]  
ENW898xxA2yF (xx = 42, 18, 29, 23 or 27) [y = J or K]

to which this declaration relates, is in compliance with all the applicable essential requirements, and other provisions of the European Council Directive:

|           |                                                                   |
|-----------|-------------------------------------------------------------------|
| 1999/5/EC | Radio and Telecommunications Terminal Equipment Directive (R&TTE) |
|-----------|-------------------------------------------------------------------|

The conformity assessment procedure used for this declaration is Annex IV of this Directive.

Product compliance has been demonstrated on the basis of:

|                                                                             |                                                       |
|-----------------------------------------------------------------------------|-------------------------------------------------------|
| - EN 60950-1: 2006+A11:2009+A1:2010<br>+A12:2011+AC:2011<br>- EN 62311:2008 | For article 3.1 (a) : Health and Safety of the User   |
| - EN 301 489-17 V2.2.1 (2012-09)                                            | For article 3.1 (b) : Electromagnetic Compatibility   |
| - EN 300 328 V1.7.1 (2006-10)                                               | For article 3.2 : Effective use of spectrum allocated |

The technical construction file is kept available at:

Panasonic Industrial Devices Europe GmbH, Zeppelinstrasse 19, 21337 Lueneburg, Germany

Issued on: 29<sup>th</sup> of May 2013

Signed by the manufacturer:

(Company name) Panasonic Industrial Devices Europe GmbH

(Signature) 

(Printed name) Heino Kähler

(Title) Manager

|                                               |                                                          |                         |              |
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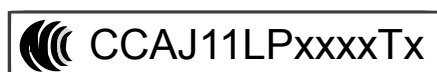
## 34.4 NCC FOR TAIWAN

### 34.4.1 Labeling Requirements

Due to the limited size on the module, the NCC ID is not visible on the module.

When the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

“Contains Transmitter Module NCC ID:” or “Contains NCC ID:”



Any similar wording that expresses the same meaning may be used.

For ENW89829A2JF the ID is CCAJ12LP2601T5.

For ENW89818A2JF the ID is CCAJ12LP2600T3.

Panasonic is able to provide the above content from the label as a vector graphic, please ask at [wireless@eu.panasonic.com](mailto:wireless@eu.panasonic.com).

### 34.4.2 NCC Statement

Due to the national rule from Taiwan we have to print the below statement in Chinese language.

根據NCC低功率電波輻射性電機管理辦法 規定:

- |          |                                                                                                                               |
|----------|-------------------------------------------------------------------------------------------------------------------------------|
| 1.1 第十二條 | 1.2 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。                                                                 |
| 1.3 第十四條 | 1.4 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。<br>前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。 |

## 34.5 BLUETOOTH SIG STATEMENT

The Design is listed as Controller Subsystem with QDID: B019784

[https://www.bluetooth.org/tpg/QLI\\_viewQDL.cfm?qid=19784](https://www.bluetooth.org/tpg/QLI_viewQDL.cfm?qid=19784)

|                                               |                                                          |                         |              |
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### 35 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.