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PRH601

Multi-frequency integrated reader solution

Rev. 3.3 — 10 March 2016
219233

Product data sheet
COMPANY PUBLIC

1. Introduction

The PRH601 is an integrated RF Identification reader module for contactless communication at 13.56 MHz and 125 kHz. It implements an additional 32-bit ARM CortexM0 microcontroller core.

The package contains three dies:

1. LPC1227FBD48/301
2. HTRC11001T/02EE
3. CLRC66301HN1

Not all pins of the LPC1227 specified in the data sheet are available at the reader module. Please refer to [Section 9 “Pinning information”](#).

The device does not implement any interconnection inside the package. This enables access to all signals during system development. The device can be replaced by a integrated reader module PRH601 if no 125 kHz functionality is required. A re-design of the PCB is not required in this case.

2. General description

2.1 HTRC110

The HITAG Reader Chip HTRC110 is intended for use with transponders, which are based on the HITAG silicon (HT11CS3002x or HT21CS2002x). In addition the IC supports other 125 kHz transponder types using amplitude modulation for the write operation and AM/PM for the read operation. The receiver parameters (gain factors, filter cutoff frequencies) can be optimized to system and transponder requirements.

The HTRC110 is designed for easy integration into RF-identification readers. State-of-the-art technology allows almost complete integration of the necessary building blocks. A powerful antenna driver/modulator together with a low-noise adaptive sampling time demodulator, programmable filters/amplifier and digitizer build the complete transceiver unit, required to design high-performance readers. A three-pin microcontroller interface is employed for programming the HTRC110 as well as for the bidirectional communication with the transponders. The three-wire interface can be changed into a two-wire interface by connecting the data input and the data output. Tolerance dependent zero amplitude modulation caused severe problems in envelope detector systems, resulting in the need of very low tolerance reader antennas. These problems are solved by the new Adaptive Sampling Time technique (AST).



2.2 CLRC663

The CLRC663 is a highly integrated transceiver IC for contactless communication at 13.56 MHz. This transceiver IC utilizes an outstanding modulation and demodulation concept completely integrated for different kinds of contactless communication methods and protocols at 13.56 MHz.

The CLRC663 transceiver ICs support following different operating modes:

- Reader/Writer mode supporting ISO/IEC 14443A/MIFARE
- Reader/Writer mode supporting ISO/IEC 14443B
- Reader/Writer mode supporting FeliCa scheme
- Reader/Writer mode supporting ISO/IEC 15693
- Reader/Writer mode supporting ICODE EPC UID/ EPC OTP
- Reader/Writer mode supporting ISO/IEC 18000-3 Mode 3
- NFC P2P Initiator

The CLRC663 internal transmitter is able to drive a reader/writer antenna designed to communicate with ISO/IEC 14443A/MIFARE cards and transponders without additional active circuitry. The receiver module provides a robust and efficient implementation for demodulation and decoding signals from ISO 14443A/MIFARE compatible cards and transponders. The digital module manages the complete ISO 14443A framing and error detection (parity and CRC) functionality. The CLRC663 supports MIFARE 1K, MIFARE 4K, MIFARE Ultralight, MIFARE, Ultralight C, MIFARE PLUS and MIFARE DESFire products. The CLRC663 supports contactless communication and uses MIFARE higher transfer speeds up to 848 kBd in both directions.

The CLRC663 supports all layers of the ISO/IEC 14443B reader/writer communication scheme, given correct implementation of additional components, like oscillator, power supply, coil etc. and provided that standardized protocols, e.g. like ISO/IEC 14443-4 and/or ISO/IEC 14443B anticollision are correctly implemented.

Enabled in Reader/Writer mode for FeliCa, the CLRC663 transceiver IC supports the FeliCa communication scheme. The receiver part provides a robust and efficient implementation of the demodulation and decoding circuitry for FeliCa coded signals. The digital part handles the FeliCa framing and error detection like CRC. The CLRC663 supports contactless communication using FeliCa Higher transfer speeds up to 424 kbit/s in both directions. The CLRC663 supports vicinity protocol according to ISO/IEC 15693, EPC UID and ISO/IEC 18000-3 mode 3. The complete vicinity product family of NXP is supported and enable a readability for mid-ranger reader applications.

The following host interfaces are provided:

- Serial Peripheral Interface (SPI)
- Serial UART (similar to RS232 with voltage levels dependent on pin voltage supply)
- I²C-bus interface (two versions are implemented: I2C and I2CL)

2.3 LPC1227

The LPC1227 are ARM Cortex-M0 based microcontrollers for embedded applications featuring a high level of integration and low power consumption. The ARM Cortex-M0 is a next generation core that offers system enhancements such as enhanced debug features and a higher level of support block integration. In addition to the ARM Cortex-M0, the LPC1X features an event handler API to limit the interrupt load of the ARM Cortex-M0 CPU and to allow for additional power-savings by off-loading event handling from the main CPU.

The LPC1227 operates at CPU frequencies of up to 33 MHz and include up to 128 kB of flash memory and 8 kB of data memory.

Not all connections of the LPC1227 product are implemented by the PRH600.

3. Features and benefits

- The PRH601 is integrating multiple functions in a single small formfactor package.
- Reduced PCB size for development of systems with small physical dimensions
- Multi frequency reader support available in single package
- Integrated microcontroller allows implementation of customer firmware

4. Applications

- Small formfactor access systems
- Industrial devices with high RF performance requirements
- Multi frequency applications with 125 kHz and 13.56 MHz support

5. Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|------------------------|------------|-----|-----|-----|------|
| VDDL(PC1227) | supply voltage LPC1227 | | 3.0 | 3.3 | 3.6 | V |
| VDD(CLRC663) | supply voltage CLRC663 | | 3.0 | 5.0 | 5.5 | V |
| VDD(HTCRC110) | supply voltage HRTC110 | | 4.5 | 5.0 | 5.5 | V |
| T _{amb} | ambient temperature | | -25 | +25 | +70 | °C |

[1] Refer to the specification of integrated products for quick reference data details

6. Ordering information

Table 2. Ordering information

| Type number | Package | | |
|-------------|---------|---|----------|
| | Name | Description | Version |
| PRH601HL/C1 | LQFP100 | plastic low profile quad flat package; 100 leads; body 14 x 14 x 1.4 mm | SOT407-1 |

7. Marking

Table 3. Marking codes

| Type number | Marking code |
|---------------------|----------------------------------|
| PR601HL/C1 | |
| 1st line | product type |
| 2nd line | 1st die diffusion number |
| 3rd line | weekcode |
| 4th line | 2nd and 3rd die diffusion number |
| 5th line (optional) | additional information |

8. Block diagram

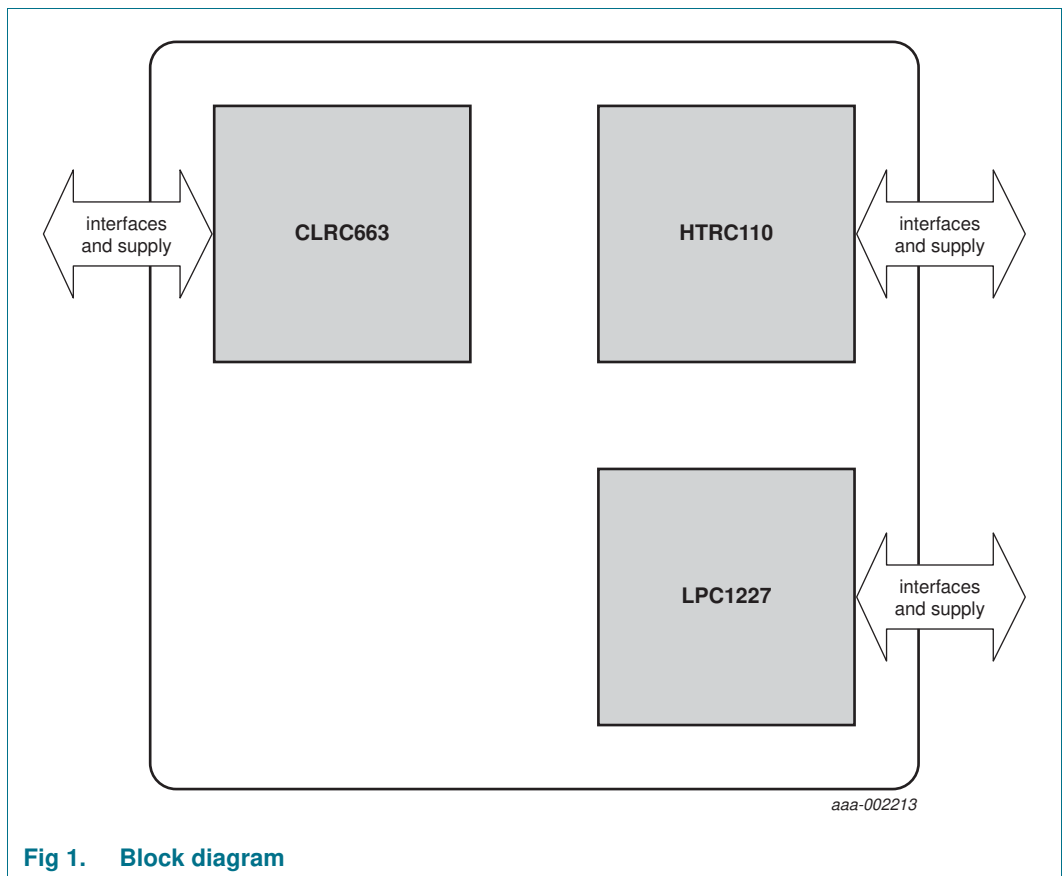


Fig 1. Block diagram

9. Pinning information

9.1 Pinning

Table 4. Pin allocation table

| Pin | Symbol | Connection |
|-----|----------------|------------|
| 1 | PIO0_10 | LPC1227 |
| 2 | PIO0_11 | LPC1227 |
| 3 | PIO0_12 | LPC1227 |
| 4 | nRESET/PIO0_13 | LPC1227 |
| 5 | PIO0_14 | LPC1227 |
| 6 | PIO0_15 | LPC1227 |
| 7 | PIO0_16 | LPC1227 |
| 8 | PIO0_17 | LPC1227 |
| 9 | PIO0_18 | LPC1227 |
| 10 | PIO0_30 | LPC1227 |
| 11 | PIO0_31 | LPC1227 |
| 12 | PIO1_0 | LPC1227 |
| 13 | PIO1_1 | LPC1227 |
| 14 | GND | all |
| 15 | PIO1_2 | LPC1227 |
| 16 | PIO1_3/WAKEUP | LPC1227 |
| 17 | PIO1_4 | LPC1227 |
| 18 | PIO1_5 | LPC1227 |
| 19 | PIO1_6 | LPC1227 |
| 20 | VSS | LPC1227 |
| 21 | VDD(3V3) | LPC1227 |
| 22 | RTCXOUT | LPC1227 |
| 23 | RTCXIN | LPC1227 |
| 24 | VDDIO | LPC1227 |
| 25 | VSSIO | LPC1227 |
| 26 | CEXT | HTRC110 |
| 27 | DGND | HTRC110 |
| 28 | RX | HTRC110 |
| 29 | VSS | HTRC110 |
| 30 | TX2 | HTRC110 |
| 31 | VDD | HTRC110 |
| 32 | TX1 | HTRC110 |
| 33 | MODE | HTRC110 |
| 34 | AVDD | CLRC663 |
| 35 | AUX1 | CLRC663 |
| 36 | AUX2 | CLRC663 |
| 37 | RXP | CLRC663 |

Table 4. Pin allocation table ...continued

| Pin | Symbol | Connection |
|-----|-----------|------------|
| 38 | RXN | CLRC663 |
| 39 | VMID | CLRC663 |
| 40 | TX2 | CLRC663 |
| 41 | TVSS | CLRC663 |
| 42 | GND | CLRC663 |
| 43 | TX1 | CLRC663 |
| 44 | TVDD | CLRC663 |
| 45 | XTAL1 | CLRC663 |
| 46 | n.c. | - |
| 47 | XTAL2 | CLRC663 |
| 48 | n.c. | - |
| 49 | PD | CLRC663 |
| 50 | n.c. | - |
| 51 | CLKOUT | CLRC663 |
| 52 | SCL | CLRC663 |
| 53 | SDA | CLRC663 |
| 54 | PVDD | CLRC663 |
| 55 | IFSEL0 | CLRC663 |
| 56 | IFSEL1 | CLRC663 |
| 57 | IF0 | CLRC663 |
| 58 | IF1 | CLRC663 |
| 59 | IF2 | CLRC663 |
| 60 | IF3 | CLRC663 |
| 61 | IRQ | CLRC663 |
| 62 | GND | CLRC663 |
| 63 | TDO | CLRC663 |
| 64 | TDI | CLRC663 |
| 65 | TMS | CLRC663 |
| 66 | TCK | CLRC663 |
| 67 | SIGIN | CLRC663 |
| 68 | SIGOUT | CLRC663 |
| 69 | DVDD | CLRC663 |
| 70 | VDDS | CLRC663 |
| 71 | XTAL1 | HTRC110 |
| 72 | XTAL2 | HTRC110 |
| 73 | SCLK | HTRC110 |
| 74 | DIN | HTRC110 |
| 75 | DOUT | HTRC110 |
| 76 | XTALIN | LPC1227 |
| 77 | XTALOUT | LPC1227 |
| 78 | VREF_COMP | LPC1227 |

Table 4. Pin allocation table ...continued

| Pin | Symbol | Connection |
|-----|---------|------------|
| 79 | PIO0_19 | LPC1227 |
| 80 | PIO0_20 | LPC1227 |
| 81 | PIO0_21 | LPC1227 |
| 82 | PIO0_22 | LPC1227 |
| 83 | PIO0_23 | LPC1227 |
| 84 | PIO0_24 | LPC1227 |
| 85 | PIO0_25 | LPC1227 |
| 86 | PIO0_26 | LPC1227 |
| 87 | PIO0_27 | LPC1227 |
| 88 | GND | all |
| 89 | PIO0_28 | LPC1227 |
| 90 | PIO0_29 | LPC1227 |
| 91 | PIO0_0 | LPC1227 |
| 92 | PIO0_1 | LPC1227 |
| 93 | PIO0_2 | LPC1227 |
| 94 | PIO0_3 | LPC1227 |
| 95 | PIO0_4 | LPC1227 |
| 96 | PIO0_5 | LPC1227 |
| 97 | PIO0_6 | LPC1227 |
| 98 | PIO0_7 | LPC1227 |
| 99 | PIO0_8 | LPC1227 |
| 100 | PIO0_9 | LPC1227 |

9.2 Pin description

For a description of the detailed pin functionality refer to the relevant product data sheet.

VSS and GND refer to the same signal and need all be connected.

10. Functional description

The functionality of this device is defined by the functionality of the three chips CLRC663, HTRC110 and LPC1227. No internal connection of the devices had been implemented except for the GND signal. All external available GND signals need to be connected. A design making use of this device shall consider a sufficient low thermal resistance between package and environment. All pins are recommended to be connected to defined signal levels. A PCB design using the PRH600 shall make use of state of the art design practices to ensure a sufficient heat dissipation. For a detailed functionality refer to the latest product specifications of the CLRC663, HTRC110 and LPC1227.

11. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|------------------|---------------------------------|-------------------------------|------|-----|------|
| P_{tot} | total power dissipation | ambient temperature 25 °C | - | 2.0 | W |
| VESD | electrostatic discharge voltage | human body model; all pins | 1500 | - | V |

12. Characteristics

Table 6. Characteristics [\[1\]](#)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|-------------------------------|---|-----|-----|-----|------|
| $V_{\text{DD(LPC)}}$ | supply voltage of LPC1227die | | 3.0 | 3.3 | 3.6 | V |
| $V_{\text{DD(CLRC)}}$ | supply voltage of CLRC663 die | | 3.0 | 5.0 | 5.5 | V |
| T_{amb} | ambient temperature | | -25 | +25 | +70 | °C |
| $I_{\text{DD(TVDD)}}$ | TVDD supply current | CLRC663 die transmitter supply current | - | 100 | 200 | mA |

[1] For a detailed information of the characteristics refer to the data sheets of the packaged products

13. Package outline

LQFP100: plastic low profile quad flat package; 100 leads; body 14 x 14 x 1.4 mm

SOT407-1

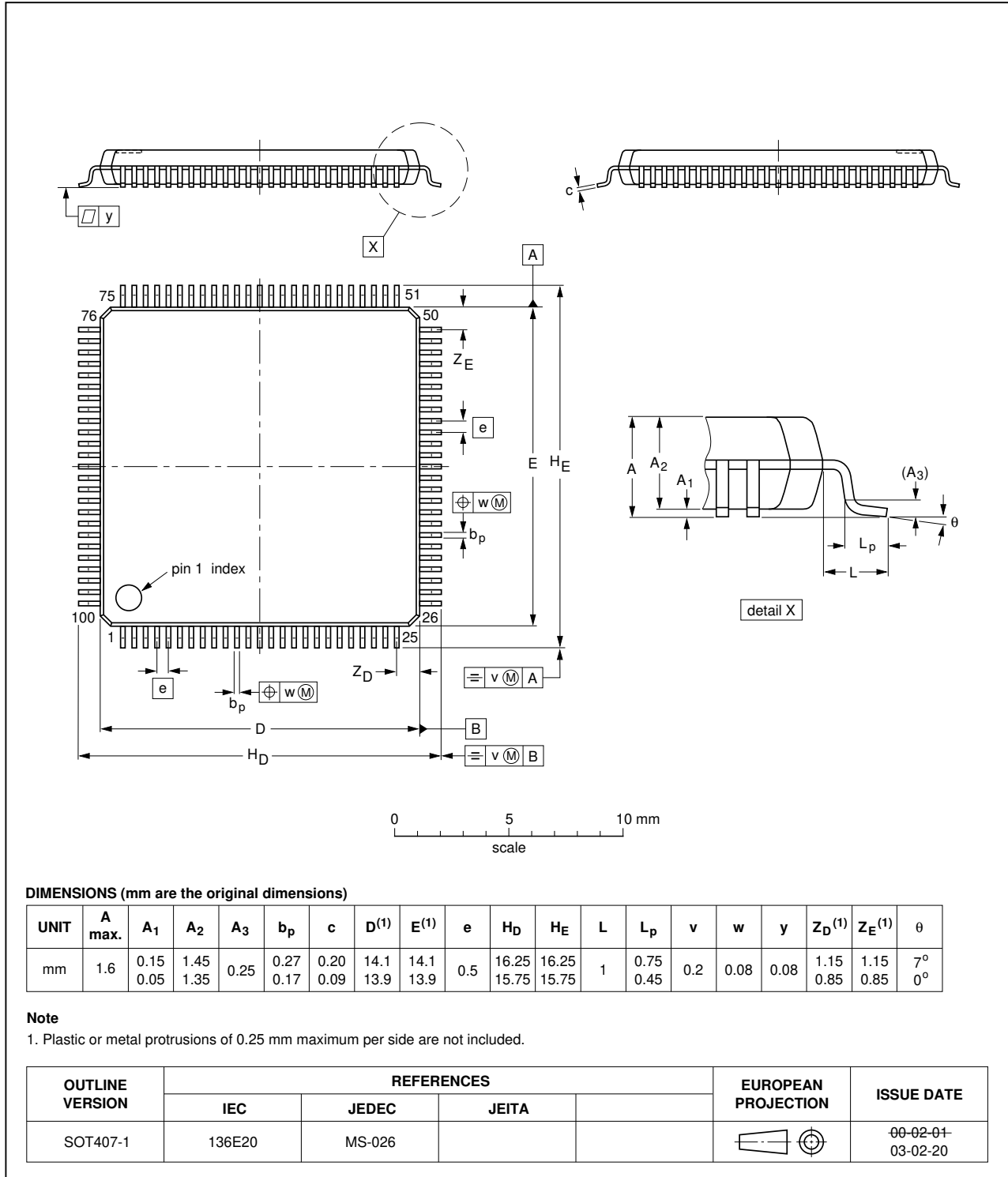


Fig 2. Package outline LQFP100 (SOT407-1)

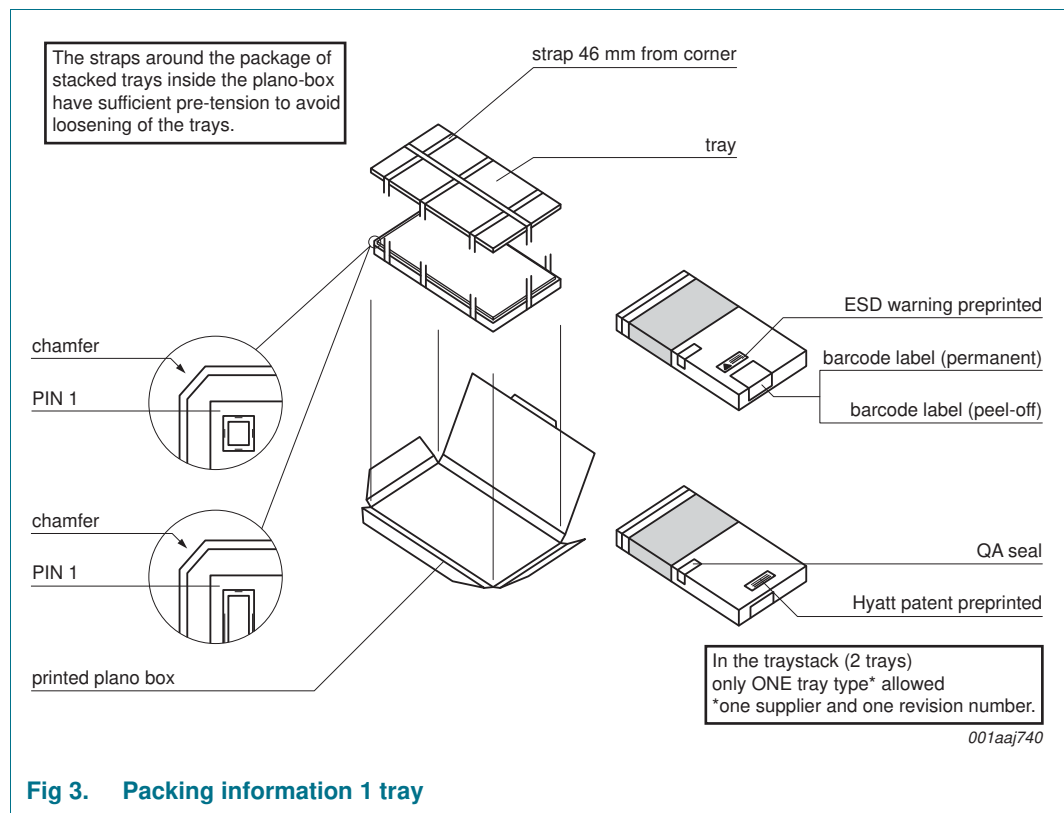
14. Handling information

Moisture Sensitivity Level (MSL) evaluation has been performed according to *SNW-FQ-225B rev.04/07/07 (JEDEC J-STD-020C)*. MSL for this package is level 2 which means 260 °C convection reflow temperature.

Dry pack is required.

1 year out-of-pack floor life at maximum ambient temperature 30 °C/ 85 % RH.

15. Packing information



16. Abbreviations

Table 7. Abbreviations

| Acronym | Description |
|---------|----------------------------------|
| AST | Adaptive Sampling Time technique |
| EPC | Electronic Product Code |
| OTP | One Time Programmable |
| SPI | Serial Peripheral Interface |
| UID | Unique IDentification |

17. Glossary

Die — unpackaged chip of a product

18. References

- [1] **Data sheet** — *CLRC663, Contactless reader IC*, BU-ID Document number 1711**1
- [2] **Data sheet** — *HTRC110, HITAG reader chip*, BU-ID Document number 0370**
- [3] **Data sheet** — *LPC122x, 32-bit ARM Cortex-M0 microcontroller; up to 128 kB flash and 8 kB SRAM*

1. ** .. document version number

19. Revision history

Table 8. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|----------------------|---------------|---------------|
| PRH601 v. 3.3 | 20160310 | Product data sheet | - | PRH601 v. 3.2 |
| Modifications: | <ul style="list-style-type: none"> Table 6 “Characteristics [1]”: TVDD supply current values added | | | |
| PRH601 v. 3.2 | 20160111 | Product data sheet | - | PRH601 v. 3.1 |
| Modifications: | <ul style="list-style-type: none"> Section 2.2 “CLRC663”: License statement updated | | | |
| PRH601 v. 3.1 | 20151006 | Product data sheet | - | PRH601 v. 3.0 |
| Modifications: | <ul style="list-style-type: none"> Descriptive title changed Pin names 13 and 15 corrected Section 20.4 “Licenses”. updated | | | |
| PRH601 v. 3.0 | 20121112 | Product data sheet | - | PRH601 v. 1.1 |
| Modifications: | <ul style="list-style-type: none"> Figure 1 “Block diagram”: corrected from LPC1127 into LPC1227 Data sheet status changed to “Product data sheet” | | | |
| PRH601 v.1.1 | 20121024 | Objective data sheet | - | PRH601 v.1.0 |
| Modifications: | <ul style="list-style-type: none"> General update | | | |
| PRH601 v.1.0 | 20120315 | Objective data sheet | - | - |

20. Legal information

20.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
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| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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Date of release: 10 March 2016
219233