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 (HT1ICS3002x or HT2ICS2002x). 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/IEC15693, 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)
- I^2C-bus interface (two versions are implemented: I2C and I2CL)

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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 frequence 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

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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

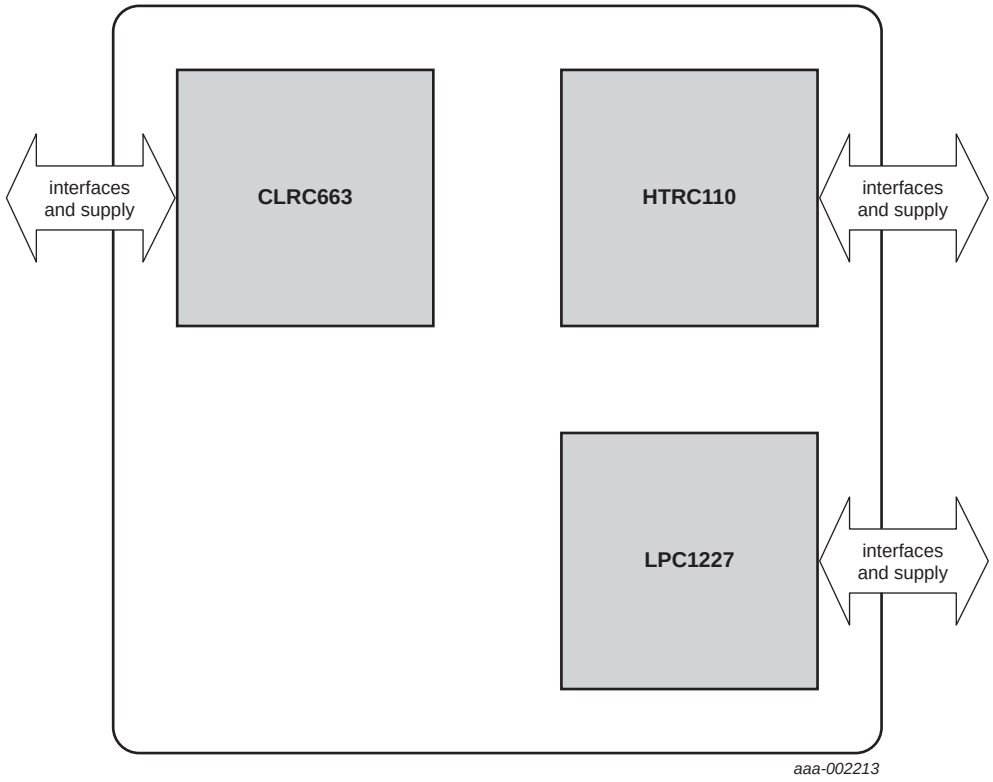


Fig 1. Block diagram

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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

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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

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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.

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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
$V_{DD(LPC)}$	supply voltage of LPC1227die		3.0	3.3	3.6	V
$V_{DD(CLRC)}$	supply voltage of CLRC663 die		3.0	5.0	5.5	V
T_{amb}	ambient temperature		−25	+25	+70	°C
$I_{DD(TVDD)}$	TVDD supply current	CLRC663 die transmitter supply current	-	100	200	mA

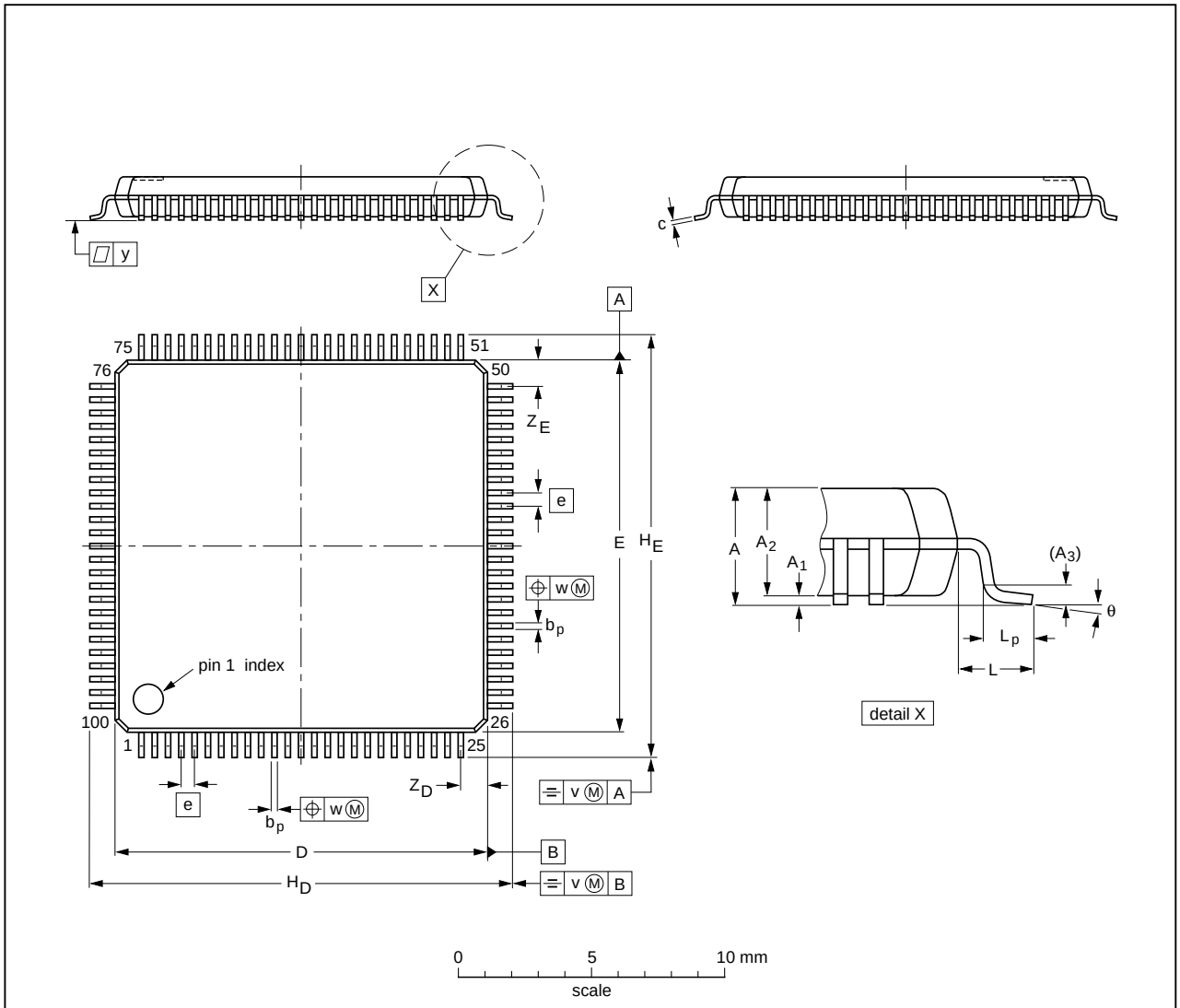
[1] For a detailed information of the characteristics refer to the data sheets of the packaged products

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13. Package outline

LQFP100: plastic low profile quad flat package; 100 leads; body 14 x 14 x 1.4 mm **SOT407-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_D	H_E	L	L_p	v	w	y	$Z_D^{(1)}$	$Z_E^{(1)}$	θ
mm	1.6	0.15 0.05	1.45 1.35	0.25	0.27 0.17	0.20 0.09	14.1 13.9	14.1 13.9	0.5	16.25 15.75	16.25 15.75	1	0.75 0.45	0.2	0.08	0.08	1.15 0.85	1.15 0.85	7^o 0^o

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT407-1	136E20	MS-026				~~00-02-01~~ 03-02-20

Fig 2. Package outline LQFP100 (SOT407-1)

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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

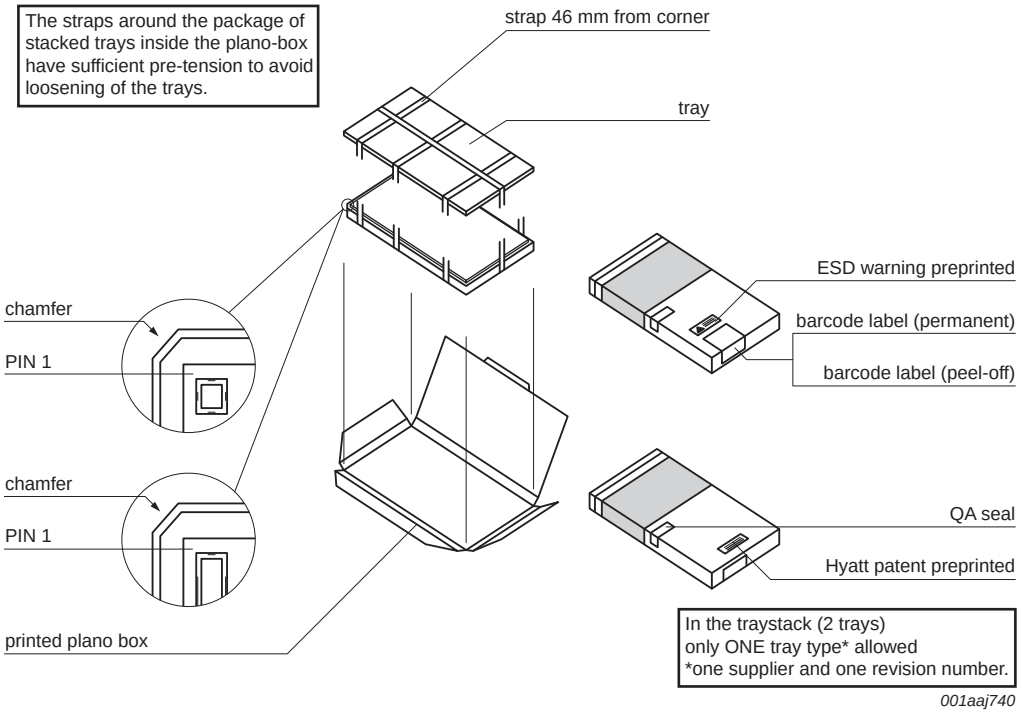


Fig 3. Packing information 1 tray

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

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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

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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:	• Table 6 “Characteristics [1]”: TVDD supply current values added			
PRH601 v. 3.2	20160111	Product data sheet	-	PRH601 v. 3.1
Modifications:	• Section 2.2 “CLRC663”: License statement updated			
PRH601 v. 3.1	20151006	Product data sheet	-	PRH601 v. 3.0
Modifications:	• 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:	• 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:	• General update			
PRH601 v.1.0	20120315	Objective data sheet	-	-

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20.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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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