

HT2x

HITAG 2 transponder IC

Rev. 3.0 — 16 September 2011
210430

Product short data sheet
COMPANY PUBLIC

1. General description

HITAG 2 based transponders are highly integrated and do not need any additional components beside the HITAG 2 transponder IC and the external coil. Data are transmitted bidirectionally, in half duplex mode, between Read Write Device (RWD) and HITAG transponder IC. To achieve a main stream security, data may be transmitted enciphered. HITAG 2 transponder IC offer a memory of 256 bit.

Custom specific configuration of the transponder IC is possible by using the configuration page. The configuration page allows the selection of different modes and access possibilities and also the configuration of the memory. The pages of the memory can be protected against read or write access by setting corresponding memory flags.

The HITAG 2 transponder IC provides - besides password and crypto mode - the following three standard read only modes, that can be configured using the configuration byte:

- public-mode A
- public-mode B (animal identification, according to ISO 11784 and ISO 11785)
- public-mode C (PIT compatible mode PCF793x)

2. Features and benefits

- Identification transponder for use in contactless applications
- Operating frequency 125 kHz
- Data transmission and energy supply via RF link, no internal battery
- Reading distance same as writing distance
- Non-volatile memory of 256 bits (128-bit user data and 128-bit control data/secret memory) organized in 8 pages, 4 bytes each
- 10 years non-volatile data retention
- 100000 erase/write cycles
- Selective read/write protection of memory content
- Two coding schemes for read operation: Biphase and Manchester coding
- Effective communication protocol with outstanding data integrity check
- Mutual authentication function
- Read/write mode allows:
 - ◆ Plain data transmission (password mode)
 - ◆ Encrypted data transmission (crypto mode)
- In read/write mode multi-tag operation possible because of special HALT-function
- Emulation of standard industrial read-only transponders:



- ◆ public-mode A (MIRO and transponders from μ EM (H400x))
- ◆ public-mode B (according to ISO 11784 and ISO 11785 for animal identification)
- ◆ public-mode C (PIT compatible mode)

3. Applications

- Logistics
- Livestock tracking
- Asset tracking
- Gas cylinder ID
- Casino - gambling
- Industrial automation

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Wafer EEPROM characteristics						
t_{ret}	retention time	$T_{amb} \leq 55\text{ }^{\circ}\text{C}$	10	-	-	year
$N_{endu(W)}$	write endurance		100000	-	-	cycle
Interface characteristics						
C_i	input capacitance	between LA and LB HT2ICS2002W/V6F	189	210	231	pF

5. Ordering information

Table 2. Ordering information

Type number	Package		Version
	Name	Description	
HT2ICS2002W/V6F	Wafer	sawn wafer on FFC, 150 μ m, 8 inch, UV, inkless	-
HT2MOA2S20/E/3	PLLMC	plastic leadless module carrier package; 35 mm wide tape	SOT500-2 ^[1]
HT2DC20S20/F	PLLMC	plastic leadless module carrier package	SOT385-1

[1] This package is also known as MOA2.

6. Block diagram

The HITAG 2 transponder IC requires no external power supply. The contactless interface generates the power supply and the system clock via the resonant circuitry by inductive coupling to the RWD. The interface also demodulates data transmitted from the RWD to the HITAG 2 transponder IC, and modulates the magnetic field for data transmission from the HITAG 2 transponder IC to the RWD.

Data are stored in a non-volatile memory (EEPROM). The memory has a capacity of 256 bit and is organized in pages.

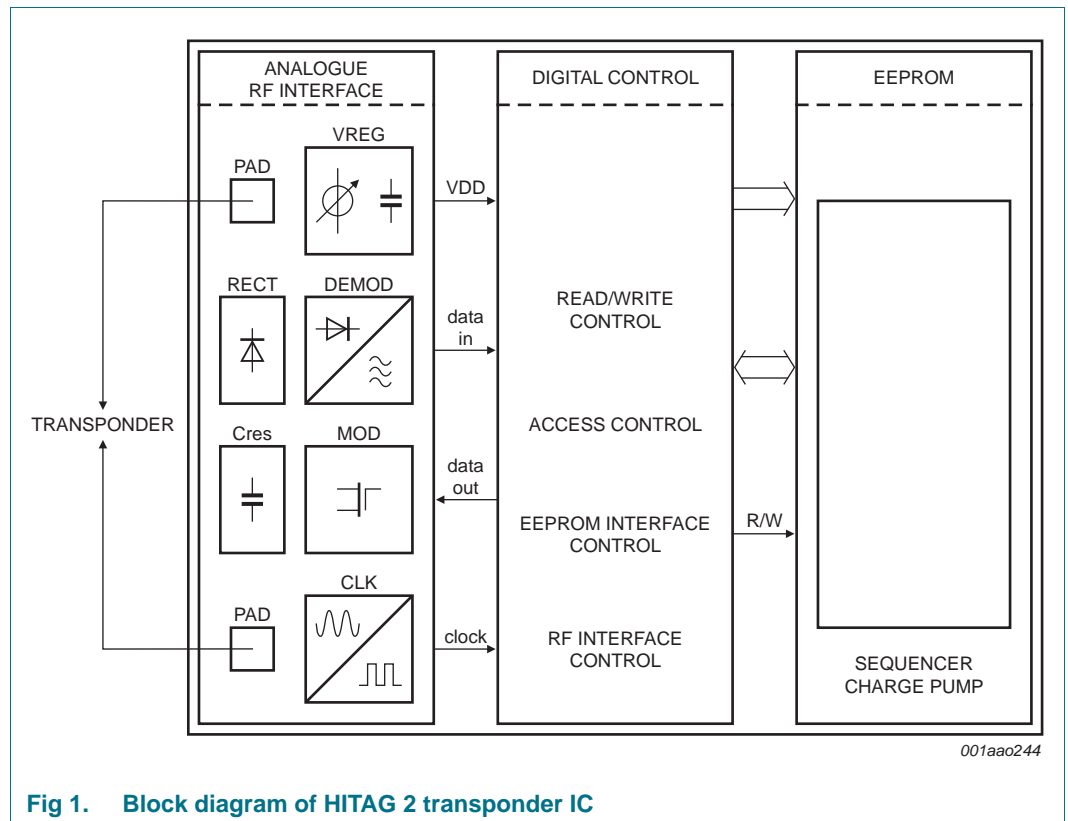


Fig 1. Block diagram of HITAG 2 transponder IC

7. Functional description

7.1 Overview of transponder

Table 3. Overview of transponders

Parameter	Description	Unit
carrier frequency	125	kHz
coding read	Manchester/Biphase	-
coding write	Pulse duration	-
modulation	ASK (amplitude shift keying)	-
total memory size	256	bit
user memory read/write	128	bit
read only serial number	32	bit
data retention	10	year
data security	encryption, authentication, passwords	-
data integrity	half-duplex handshake, reverse data transmission	-

7.2 Memory map

The 256 bit memory area of the HITAG 2 transponder IC is divided into 8 pages. Each page has a size of 32 bits.

Depending on the operation mode (crypto mode/password mode) the memory is organized as described in the following:

Table 4. Memory map in Crypto Mode

Page	Content	Access
0	serial number	ro
1	secret key low (32 bit)	r/w or 0
2	secret key high (16 bit) reserved bit (14 bit)	r/w or ro
3	configuration (8 bit) password tag (24 bit)	r/w or ro
4	usable memory page	r/w or ro
5	usable memory page	r/w or ro
6	usable memory page	r/w or ro
7	usable memory page	r/w or ro

Table 5. Memory map in Password Mode

Page	Content	Access
0	serial number	ro
1	password RWD	r/w or 0
2	reserved for future use	r/w or 0
3	configuration (8 bit) password tag (24 bit)	r/w or ro
4	usable memory page	r/w or ro
5	usable memory page	r/w or ro
6	usable memory page	r/w or ro
7	usable memory page	r/w or ro

8. Limiting values

Table 6. Limiting values - HT2ICS2002W/V6F^[1]

Symbol	Parameter	Conditions	Min	Max	Unit
V _{DD}	supply voltage		-0.5	+6.5	V
V _{ESD}	electrostatic discharge voltage	MIL-STD 883D, Method 3015.7, Human Body	2	-	kV
I _{lu}	latch-up current	MIL-STD 883D, Method 3023	100	-	mA
I _{i(max)}	maximum input current	IN1-IN2	-	30	mA
T _j	junction temperature		-55	+140	°C

[1] Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any conditions other than those described in the Operating Conditions and Electrical Characteristics section of this specification is not implied.

Table 7. Limiting values - HT2DC20S20/F (SOT385-1)/ HT2MOA2S20/E/3 (SOT500-2)^[1]

Symbol	Parameter	Conditions	Min	Max	Unit
T _{stg}	storage temperature		-55	+125	°C

[1] Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any conditions other than those described in the Operating Conditions and Electrical Characteristics section of this specification is not implied.

9. Abbreviations

Table 8. Abbreviations

Acronym	Description
EEPROM	Electrically Erasable Programmable Read-Only Memory
IC	Integrated Circuit
RF	Radio Frequency
RWD	Read Write Device

10. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
HT2X_SDS v.3.0	20110916	Product short data sheet	-	-

11. Legal information

11.1 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

11.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

11.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or

malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from national authorities.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Non-automotive qualified products — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

12. Contact information

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

11.4 Licenses

ICs with HITAG functionality

NXP Semiconductors owns a worldwide perpetual license for the patents US 5214409, US 5499017, US 5235326 and for any foreign counterparts or equivalents of these patents. The license is granted for the Field-of-Use covering: (a) all non-animal applications, and (b) any application for animals raised for human consumption (including but not limited to dairy animals), including without limitation livestock and fish.

Please note that the license does not include rights outside the specified Field-of-Use, and that NXP Semiconductors does not provide indemnity for the foregoing patents outside the Field-of-Use.

11.5 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

HITAG — is a trademark of NXP B.V.

13. Contents

1	General description	1
2	Features and benefits	1
3	Applications	2
4	Quick reference data	2
5	Ordering information	2
6	Block diagram	3
7	Functional description	4
7.1	Overview of transponder	4
7.2	Memory map	4
8	Limiting values	5
9	Abbreviations	5
10	Revision history	6
11	Legal information	7
11.1	Data sheet status	7
11.2	Definitions	7
11.3	Disclaimers	7
11.4	Licenses	8
11.5	Trademarks	8
12	Contact information	8
13	Contents	9

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP B.V. 2011.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 16 September 2011
210430