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DATA SHEET

HITAG S

HTS IC H32/HTS IC H56/HTS IC H48

Transponder IC

Product Specification
Revision 3.1
PUBLIC INFORMATION

2006 July 18
079231

Philips
Semiconductors

PHILIPS

CONTENTS

1 FEATURES

- Integrated Circuit for Contactless Identification Transponders and Cards
- Integrated resonance capacitor of 210 pF with ± 5 % tolerance over full production
- Frequency range 100..150 kHz.

1.1 Protocol

- Modulation Read/Write Device → Transponder: 100 % ASK and Binary Pulse Length Coding
- Modulation Transponder → Read/Write Device: Strong ASK modulation with Anticollision, Manchester and Biphase Coding
- Fast Anticollision Protocol for inventory tracking: 100 Tags in 3.2 seconds
- Data integrity check (CRC)
- Optional Transponder Talks First Modes with user defined data length
- Temporary switch from Transponder Talks First into Reader Talks First Mode
- Data Rate Read/Write Device to Transponder: 5.2 kBit/s
- Data Rates Transponder to Read/Write Device: 2 kBit/s, 4 kBit/s, 8 kBit/s

1.2 Memory

- Three memory options (32 Bit UID, 256 Bit, 2048 Bit)
- More than 100000 erase/write cycles
- 10 years non - volatile data retention
- Secure Memory Lock functionality

1.3 Supported Standards

- Full compliant to ISO 11784/85 Animal ID
- Targeted to operated on hardware infrastructure of new upcoming standards
  - ISO14223
    (Animal ID with anticollision and read/write functionality)
  - ISO 18000-2
    (AIDC Techniques-RFID or Item Management)
- Supports German Waste Management Standard and Pigeon Race Standard

1.4 Security Features

- 32 Bit Unique Identification Number (UID)
- 48 Bit secret key based encrypted authentication

1.5 Delivery Types

- Sawn, gold - bumped 8” Wafer
- Contactless Chip Card Module MOA2
- I – Connect (Low Cost Flip Chip Package)

2 GENERAL DESCRIPTION

The HITAG™ product line is well known and established in the contactless identification market.

Due to the open marketing strategy of Philips Semiconductors there are various manufacturers well established for both the transponders / cards as well as the Read/Write Devices. All of them supporting HITAG 1 and HITAG 2 transponder IC's. With the new HITAG S family, this existing infrastructure is extended with the next generation of IC's being substantially smaller in mechanical size, lower in cost, offering more operation distance and speed, but still being operated with the same reader infrastructure and transponder manufacturing equipment.

One Protocol - three memory options.

The protocol and command structure for HITAG S is based on HITAG 1, including anticollision algorithm.

Three different memory sizes are offered and can be operated using exactly the same protocol.

HITAG S 32	32 Bit Unique Identifier	Read Only
HITAG S 256	256 Bit Total Memory	Read/Write
HITAG S 2048	2048 Bit Total Memory	Read/Write

2.1 Target Markets

2.1.1 Animal Identification

Basically, the animal id market can be divided into two different areas:

a) Identification of pet animals

Some countries require that the your dog/cat is being microchiped prior to immigration. But it is also of advantage in case your pet is getting lost. The microchiped pet gets easily identified with a handheld reader and thus can be distinguished from stray animals.

The ISO standard 11784/85 is well established in this markets and HITAG S 256 and HITAG S 2048 are compliant to this standard, while offering additional memory for storage of customised off line data, such as phone number/address of the pets owner.

b) Identification and Tracking of livestock like cattle, pork and sheep

Being compatible with the ISO 11784/85 reader infrastructure, HITAG S can be switched temporarily into read/write mode, thus enabling additional features, like e.g. off line data storage directly on the animals tag

This concept has already been standardised within ISO 14223/1.

2.1.2 Laundry Automation

- Identify 200 pcs of garment with one Read/Write Device
- Long operation distance with typical small shaped laundry button transponders
- Insensitive to harsh conditions like pressure, heat and water.

2.1.3 Beer Keg and Gas Cylinder Logistic

- Recognising a complete pallet of gas cylinders at one time.
- Long writing distance.
- Voluntarily change between TTF Mode with user defined data length and Read/Write Modes with out changing the configuration on the transponder.
- Authenticity check at the beer pubs- between beer bumper and supplied beer keg, provides a safe protection of the beer brand.

2.1.4 Pigeon Race Sports

According to European pigeon race standards, offering the additional shadow memory, that is required in some European companies.

2.1.5 Security Applications

Authenticity check for high level brands or for original refilling e.g. toner for fax machines.

2.1.6 Access Control, Company Cards, Amusement Parks

The included encrypted authentication feature is well suited for applications like access control and vending machines. In particular the combined application with one company card opening the barrier for the car parking, opening the access to the building and rooms with different security levels, offering drinks and coffee from the vending machines in the socialising area.

2.2 Customer Application Support and Training

Within the dedicated CAS team within the BU Identification.

Please Contact:

info.bli@philips.com

Accompanying Data Sheets and Application Notes:

http://www.semiconductors.com/markets/identification/customer/download/index.html#hitag

3 ORDERING INFORMATION

EXTENDED TYPE NUMBER	DESCRIPTION	MEMORY SIZE	ORDERING CODE	PACKAGE	TEMPERATURE RANGE (°C)
HTS IC **H32** 01EW/V4	Sawn 8" wafer on foil (FFC), 150 µm, inked and mapped, with gold bumps	**32** Bit	9352 729 70005	–	-25 °C to +85 °C
HTS IC **H56** 01EW/V4		2**56** Bit	9352 729 71005	–	
HTS IC **H48** 01EW/V4		20**48** Bit	9352 729 73005	–	
HTS MO **H32** 01EV	MOA2 Package	**32** Bit	9352 729 69118	SOT500AA1	-25 °C to +85 °C
HTS MO **H56** 01EV		2**56** Bit	9352 729 72118		
HTS MO **H48** 01EV		20**48** Bit	9352 729 74118		
HTS FC **H32** 01EV/DH	Flip Chip Package, Hot Laminated	**32** Bit	9352 729 75118	SOT732AA1	-25 °C to +85 °C
HTS FC **H56** 01EV/DH		2**56** Bit	9352 729 76118		
HTS FC **H48** 01EV/DH		20**48** Bit	9352 729 77118		

4 BLOCKDIAGRAM

The HITAG S Transponder 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 Read/Write Device (RWD). The interface also demodulates data transmitted from the RWD to the HITAG S Transponder, and modulates the magnetic field for data transmission from the HITAG S Transponder to the RWD.

Data are stored in a non-volatile memory (EEPROM). The EEPROM has a capacity up to 2048 Bit and is organised in 64 Pages consisting of 4 Bytes each (1 Page = 32 Bits).

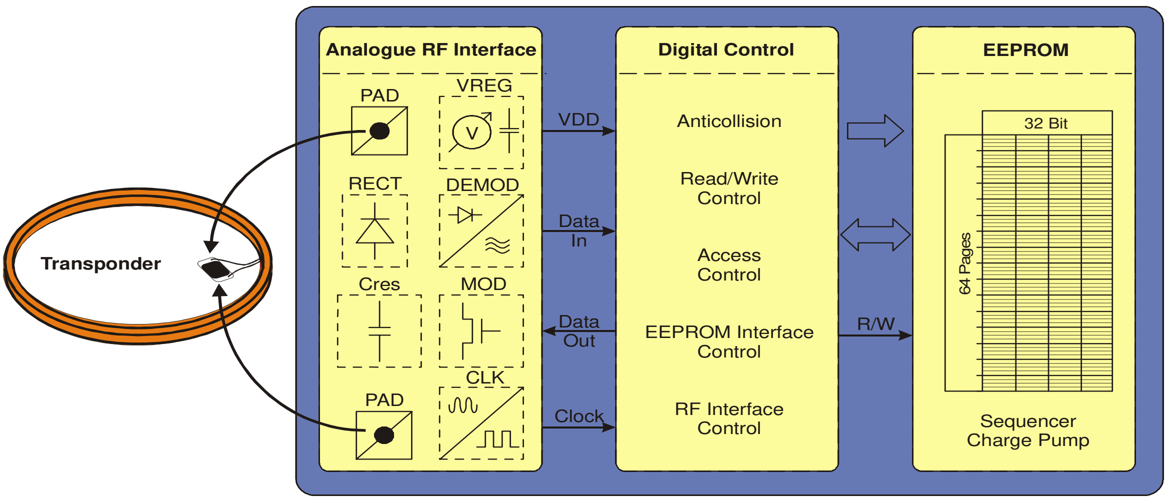

Fig.1 Block diagram.

5 REFERENCE DOCUMENTS

- General Quality Specification
- General Specification for 8” Wafer
- Bumped Wafer Specification
- Addendum Bumped Wafer Specification HTS IC H32/ HTS IC H56/ HTS IC H48 (electrical values)
- Contactless Chip Card Module Specification
- Addendum Contactless Chip Card Module Specification HTS MO H32/HTS MO H56/HTS MO H48
- Flip Chip Package Specification
- Addendum Flip Chip Package Specification HTS FC H32/HTS FC H56/HTS FC H48
- Application Note HITAG S Coil Design Guide.

6 MEMORY ORGANISATION

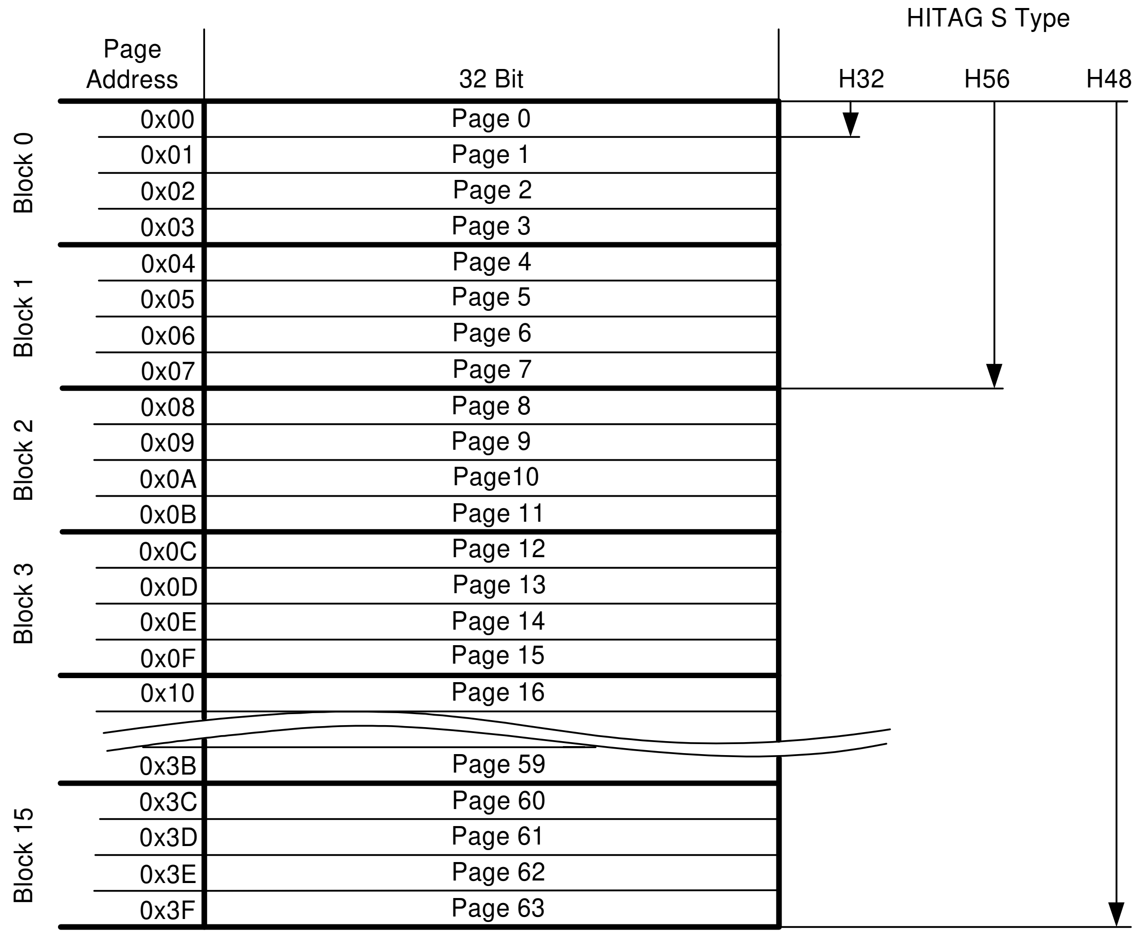

Fig.2 Memory Organisation.

The EEPROM has a capacity up to 2048 Bit and is organised in 16 Blocks, consisting of 4 Pages each, for commands with Block access. A Page consists of 4 Bytes each (1 Page = 32 Bits) and is the smallest access unit.

Addressing is done Page by Page (Page 0 up to 63) and access is gained either Page by Page or Block by Block entering the respective Page start address. In case of Block Read/Write access, the transponder is processed from the start Page address within one block to the end of the corresponding block.

Three different types of HITAG S IC's with different memory sizes as shown in the figure above are available.

6.1 Unique Identifier (UID)

Page 0 contains the 32 Bit Unique Identifier (UID) which is programmed during the manufacturing process.
Page 0 access: Read Only (RO)

	MSByte			**LSByte**
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x00	UID 3	UID 2	UID 1	UID 0

6.1.1 Product Identifier (PID)

The Product Identifier (PID) for the HITAG S Transponder IC is coded in the UID 3 Byte of the Unique Identifier (UID). This enables to distinguish between different ICs of the HITAG family.

	UID3	
	MSB	LSB
	PID 1	PID 0

Condition for HITAG S:
PID 1 = 0x7 – 0xF **and** PID 0 ≠ 0x5 – 0x6

6.2 HITAG S Plain Mode

Page 1

In Plain Mode, Page 1 contains three configuration Bytes CON 0 to CON 2 and a reserved byte.

	MSByte			**LSByte**
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x01	Reserved	CON 2	CON 1	CON 0

Page 2 - 63

In Plain Mode, Pages 2 – 63 can be used to store user data.

	MSByte			**LSByte**
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x02 – 0x3F	Data 3	Data 2	Data 1	Data 0

Memory Map for HITAG S in Plain Mode:

	MSByte			**LSByte**
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x00	UID 3	UID 2	UID 1	UID 0
0x01	Reserved	CON 2	CON 1	CON 0
0x02	Data 3	Data 2	Data 1	Data 0
0x03	Data 3	Data 2	Data 1	Data 0

6.3 HITAG S Authentication Mode

Page 1

In Authentication Mode, Page 1 contains three configuration Bytes CON 0 to CON 2 and the password high Byte PWDH 0.

	MSByte			LSByte
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x01	PWDH 0	CON 2	CON 1	CON 0

Page 2

In Authentication Mode, Page 2 contains the password low Bytes PWDL 0 and PWDL 1 and the key high Bytes KEYH 0 and KEYH 1.

	MSByte			LSByte
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x02	KEYH 1	KEYH 0	PWDL 1	PWDL 0

Page 3

In Authentication Mode, Page 3 contains the key low Bytes KEYL 0 - KEYL 3.

	MSByte			LSByte
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x03	KEYL 3	KEYL 2	KEYL 1	KEYL 0

Page 4 - 63

	MSByte			LSByte
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x04 – 0x3F	Data 3	Data 2	Data 1	Data 0

Memory Map for HITAG S in Authentication Mode:

	MSByte			LSByte
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x00	UID 3	UID 2	UID 1	UID 0
0x01	PWDH 0	CON 2	CON 1	CON 0
0x02	KEYH 1	KEYH 0	PWDL 1	PWDL 0
0x03	KEYL 3	KEYL 2	KEYL 1	KEYL 0
0x04	Data 3	Data 2	Data 1	Data 0
0x05	Data 3	Data 2	Data 1	Data 0
⋮	⋮	⋮	⋮	⋮

7 FUNCTIONAL DESCRIPTION

7.1 Basic System Configuration

The following block diagram shows in principle the HITAG system configuration

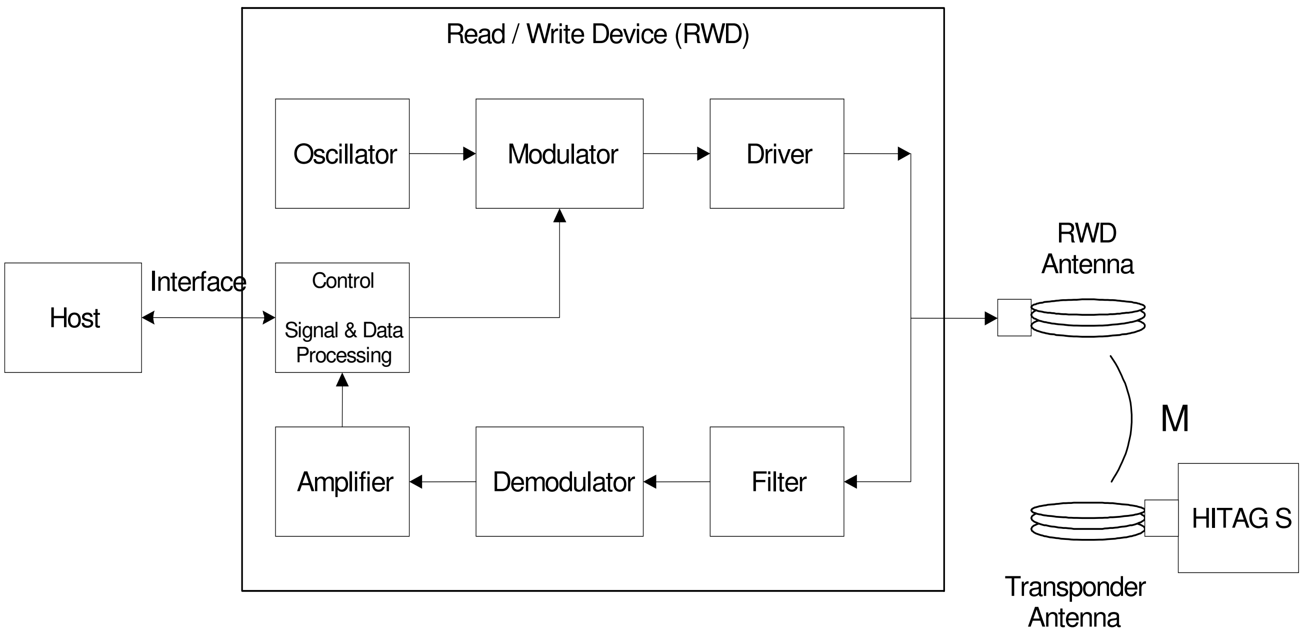

Fig.3 HITAG System configuration.

A control and data processing unit controls the modulation of the carrier signal and processes data coming back from the demodulator circuit.

7.2 Energy Transmission

Passive transponders must somehow be supplied with energy to be able to operate. In the HITAG System, this is achieved by using the principle of a loose coupled transformer:

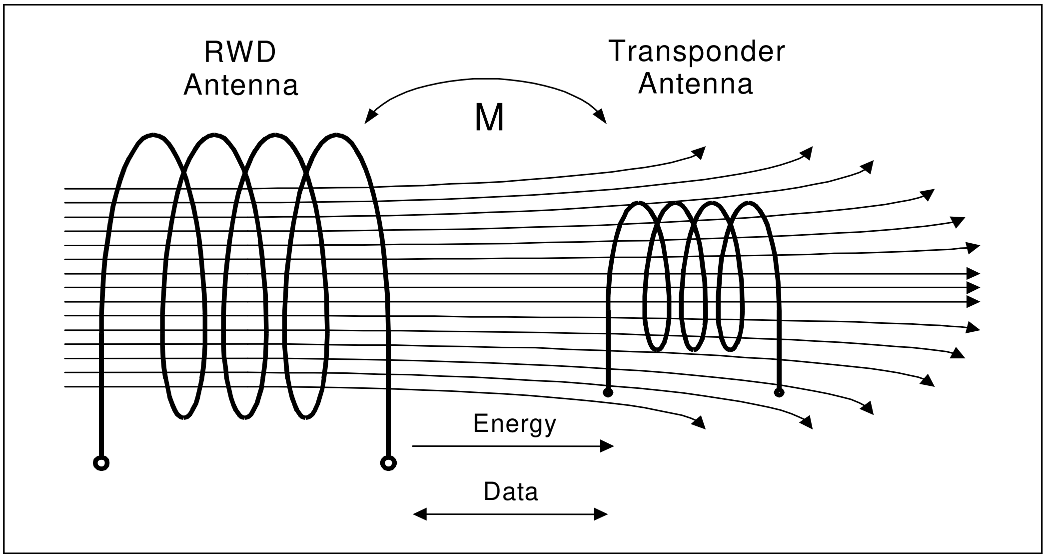

Fig.4 Loose coupled transformer.

The RWD antenna generates a magnetic field. Some of the generated magnetic flux flows through the transponder antenna and induces a voltage there. The voltage drives a current and the transponder will start operating. As this current will be very small when the transponder is far away from the antenna, the HITAG S Transponder IC is designed for low power consumption.

The principle of a loose coupled transformer enables also a bi-directional data transmission.

7.3 Data Transmission: Transponder → Read/Write Device

For data transmission from the HITAG S Transponder to the RWD, the implemented method is called 'load modulation'. Here the HITAG S Transponder continuously changes the load on the magnetic field, by in principle turning on/off a resistor, according to the information to transmit. Alteration of the magnetic field is detected by the receiver of the RWD.

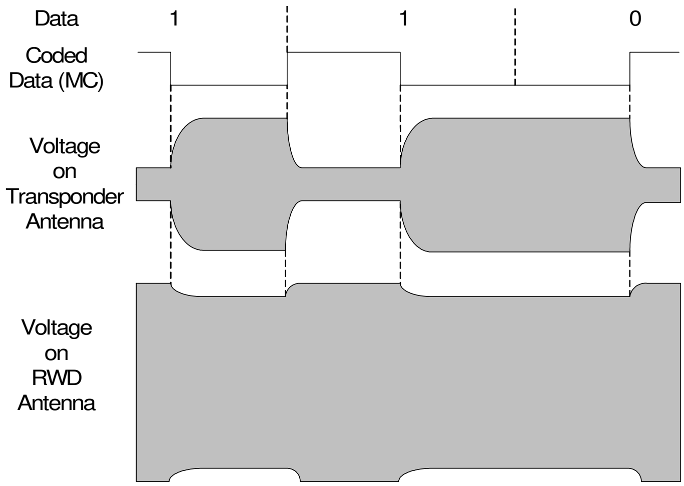

Fig.5 Data Transmission Transponder to Read/Write Device.

The modulation ratio of the RWD antenna voltage depends on the coupling factor of the antenna configuration (RWD antenna size, transponder antenna size, distance between the antennas,...).

7.3.1 CODING

Three different coding techniques for different States and Modes of the HITAG S Transponder IC are used (see also Chapters 11 “Command Set” and 12 “Transponder Talks First (TTF) Mode”:

- AC: **A**nticollision Coding in Init State
- MC: **M**anchester Coding in Selected State and in Transponder Talks First State
- BC: **B**iphase Coding in Transponder Talks First State

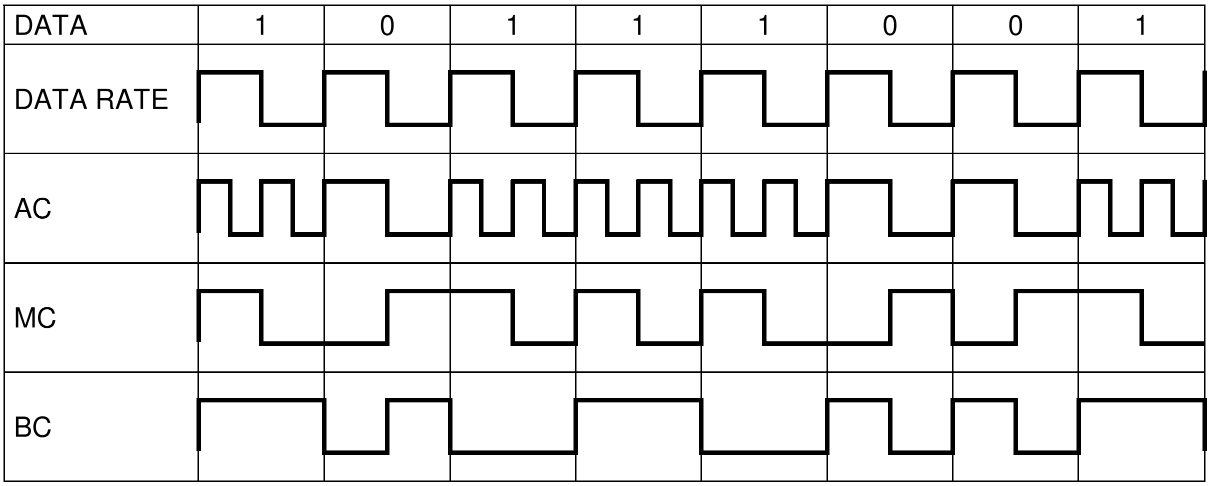

Fig.6 Coding.

A high level of the above coding signals means the physical state ‘modulator on’ (field loaded), a low level means ‘modulator off’ (field unloaded).

7.3.2 DATA RATE

The data rate for HITAG S Transponder in Reader Talks First (RTF) Mode depends on the corresponding UID REQUEST xx command.

For Transponder Talks First (TTF) Mode the data rate can be defined by configuration

Table 1

MODE	CODING	BIT RATE	BIT LENGTH
HITAG S RTF Mode	AC	2 kBit/s	64 T_0
		4 kBit/s	32 T_0
	MC	4 kBit/s	32 T_0
		8 kBit/s	16 T_0
HITAG S TTF Mode	MC	2 kBit/s	64 T_0
		4 kBit/s	32 T_0
		8 kBit/s	16 T_0
	Biphase	2 kBit/s	64 T_0
		4 kBit/s	32 T_0
		8 kBit/s	16 T_0

Note

$T_{0...}$Carrier period time ($^1/_{125\ kHz}$ = 8 µs nominal).

7.4 Data Transmission: Read/Write Device → Transponder (Physical Layer)

Data are transmitted to the transponder using Amplitude Shift Keying (ASK) modulation with a modulation index of 100 %. When the field is switched off, the physical state is named low field, otherwise high field.

7.4.1 CODING

Binary Pulse Length Coding (BPLC) is used to encode the data stream.

All coded data Bits and the end of frame (EOF) condition start with a low field of length Tg. Afterwards the field is switched on again.

- ‘0’ and ‘1’ can be distinguished by the duration of T[0] and T[1].
- The end of the data transmission is characterised by an end of frame condition.

The following figure shows the data transmission from the Read/Write Device to the transponder.

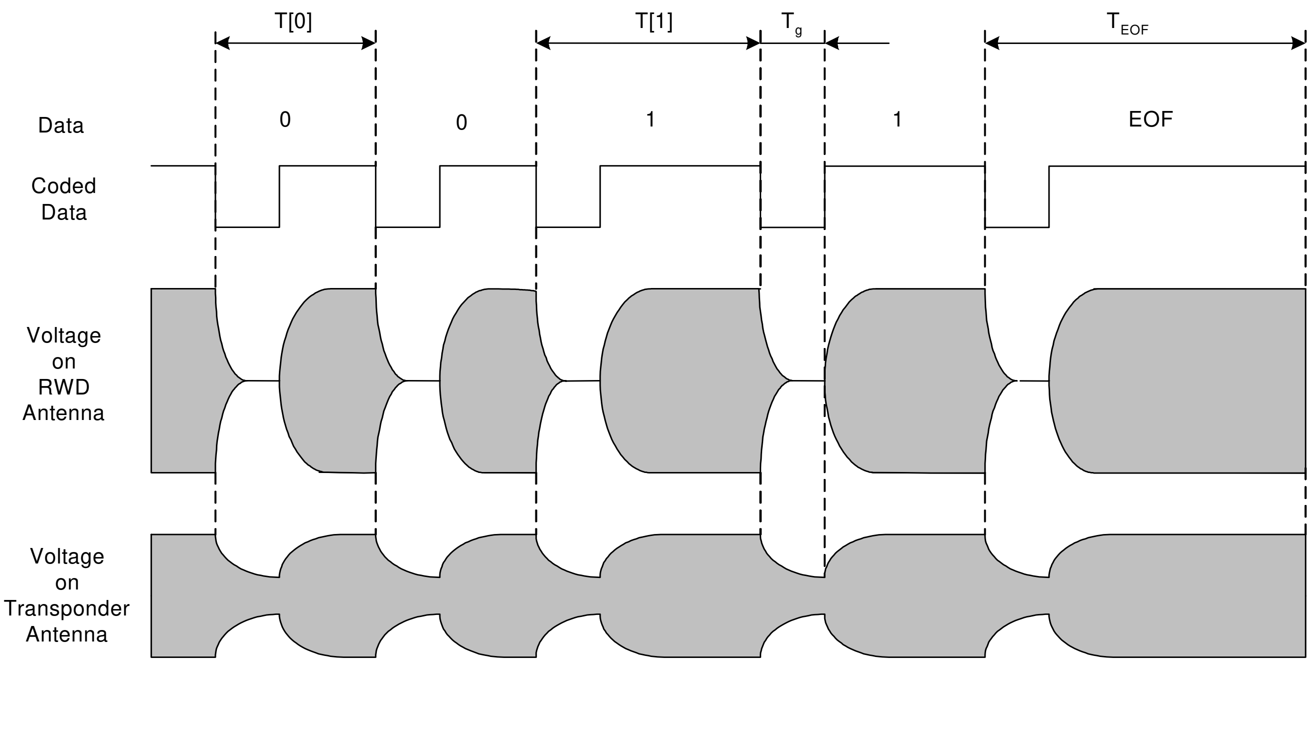

Fig.7 Data Transmission Read/Write Device to Transponder.

SYMBOL	DESCRIPTION	DURATION
T_g	Gap time	$4..10\ T_0$ (1)
T[0]	Logic 0 Bit length	$18..22\ T_0$ (1)
T[1]	Logic 1 Bit length	$26..30\ T_0$ (1)
T_{EOF}	Duration for end of frame condition	$> 36\ T_0$

Note

1. This application specific values must be within this frame, but have to be optimized for each application depending on rise and decay times of the RWD antenna voltage and the transponder antenna quality factor!

$T_{0...}$Carrier period time ($^1/_{125\ kHz}$ = 8 µs nominal).

The average Bit rate from the Read/Write Device to the HITAG S Transponder therefore is:

$$\text{Bit rate} = \frac{2}{T[0] + T[1]} = 5.2\text{kBit/s}$$

Note: The end of each data sequence from the Read/Write Device to the HITAG S Transponder has to be a EOF condition.

7.4.2 MODULATION DETAILS

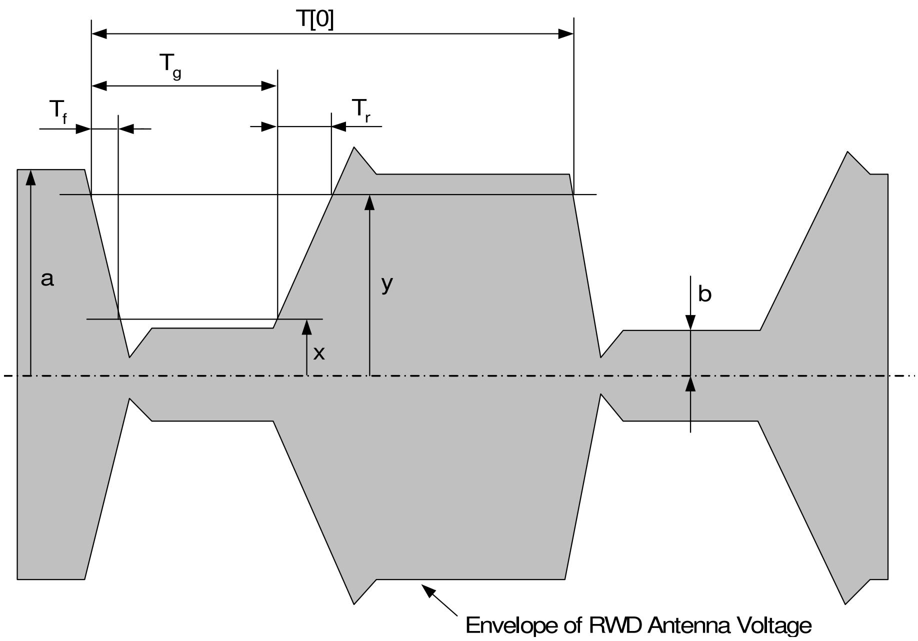

Fig.8 Modulation details.

x = 0.05 a, y = 0.95 a

m = (a - b) / (a + b).....Modulation index

SYMBOL	MIN	MAX
m	95%	100%
T_f	0	0.5 T_g
T_r (1)	0	1 (T[0] – T_g)

Note

1. This application specific value must be within this range, but has to be optimized depending on transponder coil quality factor and Read performance requirements. For high quality factor transponder coils, a lower rise time T_r should be implemented (recommended T_r = 0.5 (T[0] – T_g)) to achieve the maximum possible performance.

The following table shows two examples of modulation timing parameters for typical short- and long range applications.

SYMBOL	SHORT RANGE APPLICATION	LONG RANGE APPLICATION
T_g	6 T_0	9 T_0
T[0]	20 T_0	22 T_0
T[1]	28 T_0	28 T_0
T_f	3 T_0	4 T_0
T_r	4 T_0	5 T_0

8 CONFIGURATION

8.1 Configuration Page

Memory Page 1 contains the three configuration Bytes CON 0, CON 1 and CON 2 (see Chapter “Memory Organisation”).

Changes on the Configuration Bytes are effective after a power on reset of the HITAG S Transponder.

CON0: Memory Type Information

CON0

MSB							LSB
RES 5	RES 4	RES 3	RES 2	RES 1	RES 0	MEMT 1	MEMT 0

The following table describes the **Mem**ory Type Bits MEMT 0 and MEMT 1 of configuration byte CON 0.

Table 2 Memory Type Bits MEMT 0 and MEMT 1

MEMT 1	MEMT 0	MEMORY TYPE
0	0	32 Bit
0	1	256 Bit
1	0	2048 Bit
1	1	Reserved

Bits RES 0 to RES 5 are reserved for future use. Only Read access to configuration byte CON 0 is possible.

CON 1: Mode and Lock Bits

CON1

MSB							LSB
AUT	TTFC	TTFDR 1	TTFDR 0	TTFM 1	TTFM 0	LCON	LKP

If the **Aut**hentication Bit AUT = ‘0’ the HITAG S Transponder IC is configured in Plain Mode and can be selected directly by the SELECT (UID) command and the corresponding UID. For Bit AUT = ‘1’ the HITAG S Transponder IC is configured in Authentication Mode and can only be Selected with the SELECT (UID) command and a following secure CHALLENGE sequence (see also Chapters 10 “State Diagram” and 11 “Command Set”).

Table 3 Authentication Bit AUT

AUT	HITAG S MODE
0	Plain
1	Authentication

The **T**ransponder **T**alks **F**irst **C**oding Bit TTFC defines the used coding during transmitting data to the RWD. This effects the TTF State only.

Table 4 Transponder Talks First Coding Bit TTFC

TTFC	CODING IN TTF STATE
0	Manchester
1	Biphase

The **T**ransponder **T**alks **F**irst **D**ata **R**ate Bits TTFDR 0 and TTFDR 1 select the data rate used during transmission of data to the RWD. This effects the TTF State only.

Table 5 Transponder Talks First Data Rate Bits TTFDR 0 and TTFDR 1

TTFDR 1	TTFDR 0	DATA RATE IN TTF STATE
0	0	4 kBit
0	1	8 kBit
1	0	2 kBit
1	1	2 kBit and Pigeon Race Standard

The **T**ransponder **T**alks **F**irst **M**ode Bits TTFM 0 and TTFM 1 defines the number of Pages continuously transmitted to the RWD. This effects the TTF State only.

Table 6 Transponder Talks First Mode Bits TTFM 0 and TTFM 1

TTFM 1	TTFM 0	PAGES TRANSMITTED IN TTF STATE
0	0	TTF Mode disabled (= RTF Mode)
0	1	Page 4, Page 5
1	0	Page 4, Page 5, Page 6, Page 7
1	1	Page 4

The **L**ock **C**onfiguration Bit LCON defines the access rights on the configuration Bytes CON 1 and CON 2. This Bit is one time programmable (OTP).

Table 7 Lock Configuration Bit LCON

LCON	ACCESS RIGHT CON 1 AND CON 2
0	Read / Write
1	CON 1: Read Only. CON 2: OTP

The **L**ock **K**ey and **P**assword Bit LKP defines the access rights of the PWDH 0 Byte of Page 1, password low Bytes and key high Bytes of Page 2 and key low Bytes of Page 3 when configured in Authentication Mode. In Plain Mode this Bit can be used to lock the user data of Page 2 and Page 3.

Table 8 Lock Key and Password Bit LKP

LKP	ACCESS RIGHT KEY AND PASSWORD/PAGE 2 AND PAGE 3
0	Read / Write
1	Read Only in Plain Mode No Access in Authentication Mode

Attention: In order to prevent further access to key and password, the following procedure must take place: After setting Bit LKP to ‘1’ the Lock Configuration Bit LCON must be set to ‘1’, because the Bit LKP has no OTP functionality!

CON 2: Memory Lock Bits

CON2

MSB							LSB
LCK 7	LCK 6	LCK 5	LCK 4	LCK 3	LCK 2	LCK 1	LCK 0

Table 9 Description of Memory Lock Bits

BIT	SYMBOL	FUNCTION	ACCESS RIGHTS	COMMENT
7	LCK 7	Lock Page 4 and Page 5	0...Read / Write 1...Read Only	OTP if LCON = ‘1’ If Pigeon Race Standard is enabled (TTFDR 0 = TTFDR 1 = ‘1’) 16 Bits (Data 3 u. Data 2) of Page 5 remain still Read/Write accessible for LCK 7 = ‘1’
6	LCK 6	Lock Page 6 and Page 7	0...Read / Write 1...Read Only	OTP if LCON = ‘1’
5	LCK 5	Lock Page 8 – Page 11	0...Read / Write 1...Read Only	OTP if LCON = ‘1’
4	LCK 4	Lock Page 12 – Page 15	0...Read / Write 1...Read Only	OTP if LCON = ‘1’
3	LCK 3	Lock Page 16 – Page 23	0...Read / Write 1...Read Only	OTP if LCON = ‘1’
2	LCK 2	Lock Page 24 – Page 31	0...Read / Write 1...Read Only	OTP if LCON = ‘1’
1	LCK 1	Lock Page 32 – Page 47	0...Read / Write 1...Read Only	OTP if LCON = ‘1’
0	LCK 0	Lock Page 48 – Page 63	0...Read / Write 1...Read Only	OTP if LCON = ‘1’

8.2 Delivery Configuration

8.2.1 HITAG S32

This delivery configuration is valid for the following HITAG S 32 types:

- HTS IC **H32** 01EW/V4
- HTS MO **H32** 01EV
- HTS FC **H32** 01EV/DH

MSByte			LSByte
MSB LSB	MSB LSB	MSB LSB	MSB LSB
UID 3	UID 2	UID 1	UID 0

The 32 Bit Unique Identifier (UID) is programmed during the manufacturing process. Access rights: Read Only (RO).

On a Select (UID) command the HITAG S 32 Transponder IC sends back three Reserved Bytes and the Byte CON 0 containing the Memory Type Information.

MSByte			LSByte
MSB LSB	MSB LSB	MSB LSB	MSB LSB
X	X	X	CON0

CON 0							
MSB							LSB
X	X	X	X	X	X	0	0

The content of Bits and Bytes marked with ‘X’ are **not** defined at delivery!

8.2.2 HITAG S256

This delivery configuration is valid for the following HITAG S 256 types:

- HTS IC **H56** 01EW/V4
- HTS MO **H56** 01EV
- HTS FC **H56** 01EV/DH

	MSByte			LSByte
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x00	UID 3	UID 2	UID 1	UID 0
0x01	0xAA	0x00	0x00	CON 0
0x02	0x4E	0x4F	0x54	0x48
0x03	0x52	0x4B	0x49	0x4D
0x04	X	X	X	X
0x05	X	X	X	X
0x06	X	X	X	X
0x07	X	X	X	X

CON 0

MSB							LSB
X	X	X	X	X	X	0	1

The content of Bits and Bytes marked with 'X' are **not** defined at delivery!

- The 32 Bit Unique Identifier (UID) is programmed during the manufacturing process.
- Modes: Reader Talks First (RTF), Plain
- Access Rights:
  - UID: Read Only
  - Page 1: Read/Write with exception of byte CON 0 (Read Only)
  - Page 2 – Page 7: Read/Write

8.2.3 HITAG S2048

This delivery configuration is valid for the following HITAG S 2048 types:

- HTS IC **H48** 01EW/V4
- HTS MO **H48** 01EV
- HTS FC **H48** 01EV/DH

	MSByte			**LSByte**
Page Address	MSB LSB	MSB LSB	MSB LSB	MSB LSB
0x00	UID 3	UID 2	UID 1	UID 0
0x01	0xAA	0x00	0x00	CON 0
0x02	0x4E	0x4F	0x54	0x48
0x03	0x52	0x4B	0x49	0x4D
0x04	X	X	X	X
0x05	X	X	X	X
⋮	⋮	⋮	⋮	⋮
0x3E	X	X	X	X
0x3F	X	X	X	X

CON 0

MSB							LSB
X	X	X	X	X	X	1	0

The content of Bits and Bytes marked with ‘X’ are **not** defined at delivery!

- The 32 Bit Unique Identifier (UID) is programmed during the manufacturing process.
- Modes: Reader Talks First (RTF), Plain
- Access Rights:
  - UID: Read Only
  - Page 1: Read/Write with exception of byte CON 0 (Read Only)
  - Page 2 – Page 63: Read/Write

9 PROTOCOL TIMING

9.1 Read/Write Device waiting time before sending the first command

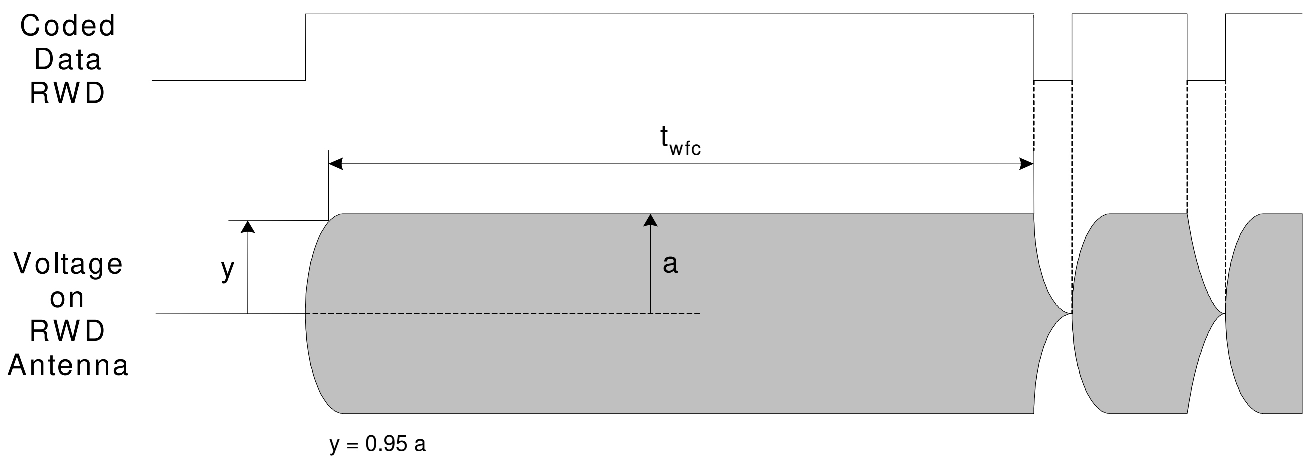

Fig.9 Read/Write Device waiting time before sending the first command.

After switching on the powering field, the Read/Write Device has to wait at least the minimum time t_{wfc} = 280 T_0 before sending the first command. The first command must not be sent later than the maximum time t_{wfc} = 5000 T_0.

Table 10

	MIN	TYP	MAX	UNIT
t_{wfc}	280		5000	T_0

9.2 Read/Write Device waiting time before sending a subsequent command

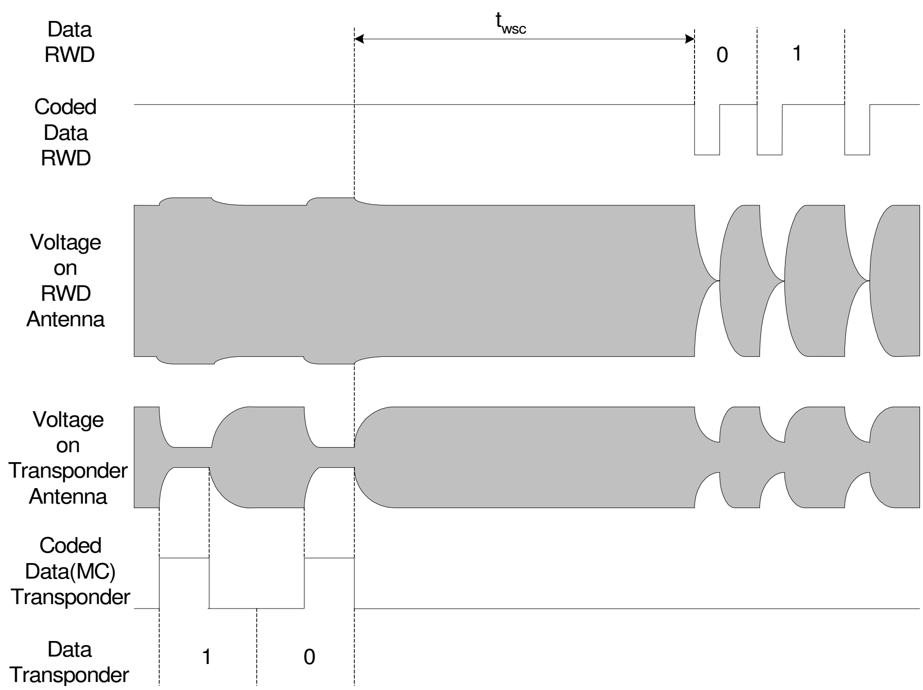

Fig.10 Read/Write Device waiting time before sending a subsequent command.

When the Read/Write Device has received the response from the HITAG S Transponder to a previous command, the RWD has to wait at least the minimum time t_{wsc} = 90 T_0 before sending a subsequent command or Write data after a Write command. The subsequent command or Write data must not be sent later than the maximum time t_{wsc} = 5000 T_0.

Table 11

	MIN	TYP	MAX	UNIT
t_{wsc}	90		5000	T_0