SIC73WR

LF HDX transponder with 80-bit programable ID

REV 1.3

Features Summary

Highlight Features

- Transponder in a wedge and glass tag shape package for industrial application
- Low-frequency HDX technology at 134.2 kHz field frequency
- Best-in-class read and write sensitivity

Memory

- 80-bit programable ID memory
- 720-bit extended user memory
- Memory erase/write cycle up to 100,000 cycles
- Memory retention up to 20 years

Supported Protocol

- ASK downlink data transmission
- FSK uplink at 134.2kHz/123.2kHz with RF/16 data rate

Package

- Wedge
- Glass Tag
- IC

Application

- Access Control
- Asset Management
- Vehicle Identification
- Container Tracking
- Waste Management

Revision History

Revision	Date	Change/Update Comment
1.0	02 Oct 2023	1st Initial product factsheet
1.1	20 Feb 2024	Update IC package information
1.2	26 Apr 2024	- Update Ordering information - Update Electrical Characteristic
1.3	28 May 2024	- Update features summary - Update Ordering information

Ordering information

Part No.	Description	Package	Marking
PADAW303EP0SUWRWKC3	SIC73WR-WK LF HDX with 80-bit programmable ID Wedge 134.2kHz, Canister, RFID TAG	Wedge	-
PADAGU53G10SUWR3PT1	SIC73WR-3P LF HDX with 80-bit programmable ID Glass tag 134.2kHz, TnR, RFID TAG	Glass tag 23mm	-
PADAGU54G10SUWR2BT1	SIC73WR-2B LF HDX with 80-bit programmable ID Glass tag 134k.2Hz, TnR, RFID TAG	Glass tag 32mm	-
PADAVDG2T10UTWRVDT3	SIC73WR-VD LF HDX with 80-bit programmable ID 134k.2Hz, TnR, IC	IC	TBD

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0. Notation

0.1 Styles and Fonts for key words

This part defines styles and fonts used for the key words throughout this document. The key words are names of signal, register, pin, state of operation and command. The styles, fonts, and their indications are shown in Table 0-1.

Table 0-1: Style and Fonts key word

Symbol	Indication
Signal	Signal name
Register	Register name or Bit name
pin RX	Pin name
"State of Operation"	State of operation
Command	Command name for RF interface
"Flag"	Flag name in response state

- To refer to a register address and a value in a register, a hexadecimal number proceeding with letter "0x" is used, for example 0x0A.
- To refer to a bit located in a register address, a symbol "." following by a number reflecting the bit location starting from 0 to 7 is used. For example, 0x0A.0 refers to bit 0, least significant bit, in the register 0x0A.
- To refer to a set of consecutive bits located in a register address, a format ".[msb:lsb]" is used after a register value. For example, a value of 0x0A.[3:0] refers to bit 3 ,2, 1, and 0 in the register 0x0A.
- To refer to a binary value in some registers, the letter "b" is placed at the end of the binary number, for example "1010b".
- To refer to logic level, the number in single quote '1' and '0' are used to refer to binary logic level.

0.2 Abbreviation

Table 0-2: Abbreviation

Abbreviation	Term
AFE	Analog-Front-End
CRC	Cyclic redundancy check
EEPROM	Electrically Erasable Programmable Read-Only Memory
EOB	End of burst
fc	Carrier frequency
FSK	Frequency Shift Keying
HDX	Half duplex
HV	High-voltage supply
ID	Identification
LF	Low frequency
POR	Power-on-reset
RFID	Radio frequency identification
SIC	Silicon Craft Technology
USR	User memory

1. Functional Overview

SIC73WR is a low-frequency half-duplex RFID tag with 80-bit programable code suitable for industrial applications.

1.1 Block Diagram

Figure 1-1 depicts a conceptual block diagram of SIC73WR, which mainly consists of two parts as listed below:

- RF Analog Front End (RF-AFE)
- Digital Controller and Memory

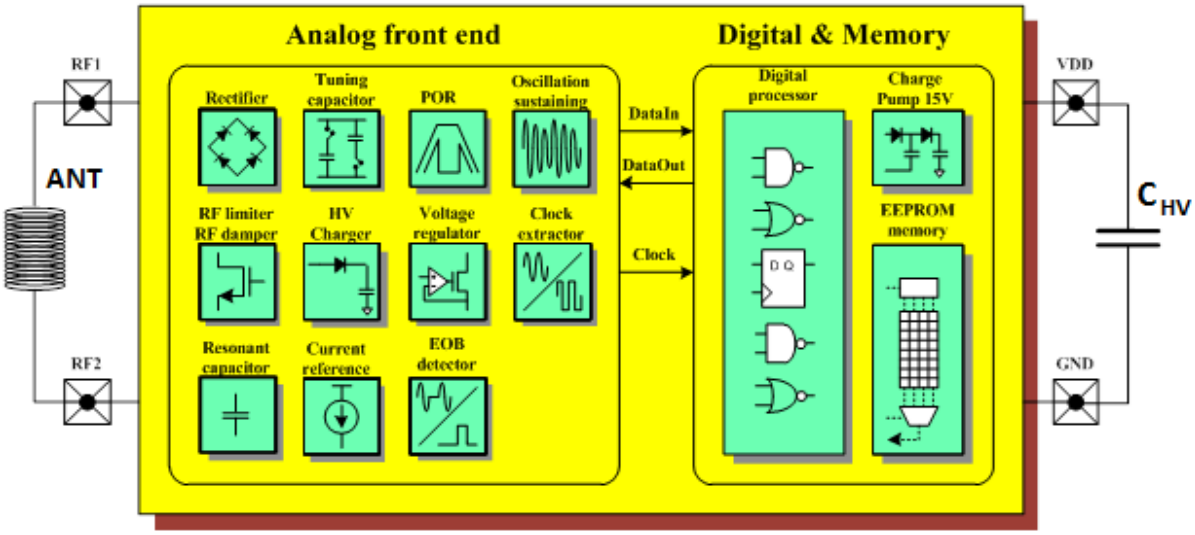

Figure 1-1: Functional Block Diagram

1.1.1 Analog Front End (AFE)

The RF Analog-Front-End (AFE) has ***RF1*** and ***RF2*** terminals for connecting to an external antenna VDD and GND terminals for connecting to the external storage capacitor (CHV). It harvests energy from the induced RF signal in the antenna and stores the energy in CHV to supply the internal circuit. The AFE also provides facilities for RF communication, such as a modulator for uplink data communication, a demodulator for downlink data communication, a power-on-reset module (***POR***), and a clock extractor for data synchronization.

1.1.2 Digital Controller

The digital controller controls data transactions between the AFE and the EEPROM. The digital controller handles the following operations:

- Decoding incoming RF downlink commands and encoding RF uplink data/response
- Reading and programming data from/to the EEPROM

2. Specification

2.1 Absolute Maximum Rating

Conditions above the listed maximum ratings may cause permanent damage to the device. Exposure to the absolute maximum rating conditions for an extended period may affect the device's reliability. Only one absolute maximum rating can be applied at a time.

Table 2-1: Absolute Maximum Rating

PARAMETER	SYMBOL	MIN	NOM	MAX	UNIT
Operating temperature	T_A	-40		+85	°C
Storage temperature	T_S	-40		+125	°C

Environment and Data Reliability

Table 2-2: Environment and Data Reliability

PARAMETER	CONDITION	MIN	NOM	MAX	UNIT
Programming cycle	@25°C	100k			Cycles
Data retention time	@50°C storage temp.	20			Years
ESD immunity	IEC 801-2	2			kV
Vibration	IEC 68-2-6 Test 10g, 10-2000Hz, 2axis	2.5			Hr
Drop	Test 1.8m free fall	100			Time
Shock	IEC 68-2-29 Test 40g, 18ms	2000			Time

Table 2-3: Electrical Characteristic

PARAMETER	SYMBOL	MIN	NOM	MAX	UNIT
Resonance capacitor	C_{Res}		380		pF
Operating coil's inductance	L_{coil}		3.4		mH
Operating coil's quality factor	Q_{coil}		45		
Operating resonant frequency	f_{RES}		134.2		kHz
Low bit response frequency	f_L	131.2	134.2	137.2	kHz
High bit response frequency	f_H	120.2	123.2	126.2	kHz
Operating RF level	$V_{H,Cmd}$	4			V
Operating RF level for memory programming	$V_{H,Prog}$	5			V

2.2 Timing Characteristic

Timing parameters listed in the table specify the RF protocol pattern in Table 2-4.

Table 2-4: Timing Characteristic

PARAMETER	SYMBOL	MIN	NOM	MAX	UNIT
Charging time	t_{Chg}		25		ms
Reset time	t_{Reset}	15			ms
Pulse Width Modulation					
Pulse-off low bit (PWM)	t_{OffL}		40		cycle
Pulse-on low bit (PWM)	t_{OnL}		228		cycle
Bit duration low bit (PWM)	t_{BitL}		268	360	cycle
Pulse-off high bit (PWM)	t_{OffH}		134		cycle
Pulse-on high bit (PWM)	t_{OnH}		134		cycle
Bit duration high bit (PWM)	t_{BitH}		268	360	cycle
Execution (t_{EXE})					
Programming time (40 bits)	t_{PROG40}		15		ms
Programming time (80 bits)	t_{PROG80}		15		ms
Locking time	t_{LOCK}		15		ms
Response (t_{resp})					
Prebit time	t_{PreBit}		255		cycle
Response time (96 bits)	t_{Resp}		12		ms
Response time (Read-Only)	$t_{Resp,RO}$		16		ms
Read time	t_{Read}		20		ms

Note:
* This timing is measured at 134.7 kHz. The value may be changed from various factors, such as detuning and coupling factor with reader antenna.
** 1 clk = 1 period of RF cycle

3. Memory organization

3.1 EEPROM Organization

SIC73WR contains 80-bit programable ID memory and 720-bit extended user memory of non-volatile EEPROM memory.

Table 3-1: EEPROM Memory Organization

Page	Data (Hex)					Access
	Byte4 [7:0]	Byte3 [7:0]	Byte2 [7:0]	Byte1 [7:0]	Byte0 [7:0]	
0	USER 0					Read / Write
1	USER 1					Read / Write
2	USER 2					Read / Write
3	USER 3					Read / Write
4	USER 4					Read / Write
5	USER 5					Read / Write
6	USER 6					Read / Write
7	USER 7					Read / Write
8	USER 8					Read / Write
9	USER 9					Read / Write
10	USER 10					Read / Write
11	USER 11					Read / Write
12	USER 12					Read / Write
13	USER 13					Read / Write
14	ID80L / USER 14					Read / Write
15	ID80M / USER 15					Read / Write
16	USER 16					Read / Write
17	USER 17					Read / Write
18	USER 18					Read / Write
19	USER 19					Read / Write

4. Package Information

4.1 Wedge

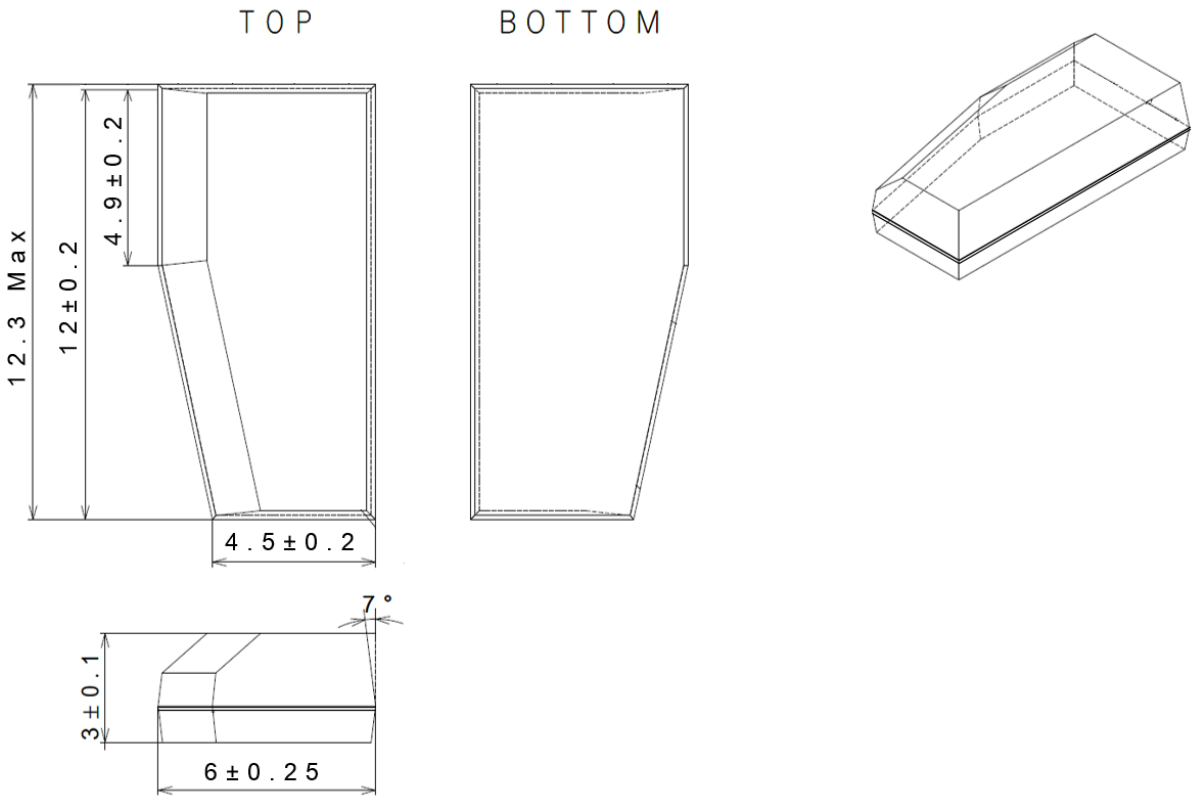

Figure 4-1: Wedge Transponder Drawing

Table 4-1: Wedge Physical Characteristic

Parameter	Symbol	Min	Typ	Max	Unit
Width	W	5.75	6	6.25	mm
Length	L	11.9	12	12.3	mm
Height	H	2.9	3	3.1	mm

4.2 Glass Tag 23mm

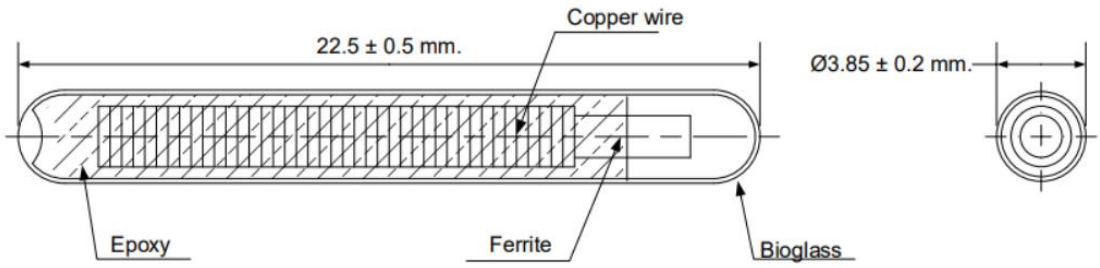

Figure 4-2: Glass Tag 23mm Transponder Drawing

Table 4-2: Glass Tag 23mm Physical Characteristic

Parameter	Symbol	Min	Typ	Max	Unit
Outside Diameter	ø OD	3.65	3.85	4.05	mm
Length	L	22.0	22.5	23.0	mm

4.3 Glass Tag 32mm

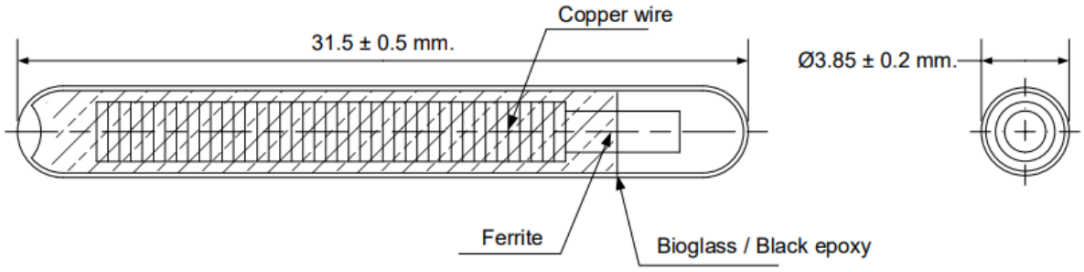

Figure 4-3: Glass Tag 32mm Transponder Drawing

Table 4-3: Glass Tag 32mm Physical Characteristic

Parameter	Symbol	Min	Typ	Max	Unit
Outside Diameter	ø OD	3.65	3.85	4.05	mm
Length	L	31.0	31.5	32.0	mm

4.4 IC Package

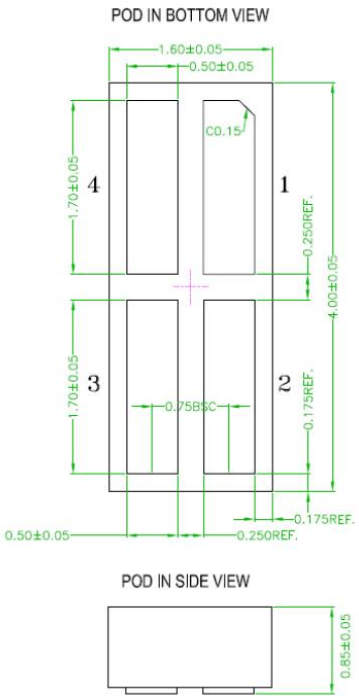

Figure 4-4: IC Package Drawing

Table 4-4: IC Physical Characteristic

Parameter	Symbol	Min	Typ	Max	Unit
Width	W	1.55	1.60	1.65	mm
Length	L	3.95	4.00	4.05	mm
Height	H	0.80	0.85	0.90	mm

Table 4-5: Pin Descriptions

Pin	Symbol	Descriptions
1	GND	Ground
2	RF1	Radio Frequency 1
3	RF2	Radio Frequency 2
4	HV	High Voltage