SIC618C

LF FDX transponder at 125 kHz field frequency with built-in 128-bit encryption (A64)
REV 1.0

Features Summary

Highlight Features

- Security transponder for the immobilization applications
- Low-frequency FDX technology at 125 kHz field frequency
- Authentication based on A64 crypto algorithm (128-bit secret key)
- Qualified AEC-Q100 Grade 3

Interface and Peripheral

- ASK downlink and uplink data transmission
- Manchester and Bi-Phase data coding with RF/32, RF/64 data rate
- Fully compatible with A64 command sets and protocol
- ID8C transponder family replacement

Memory

- 128-bit identification code
- 128-bit secret key for encrypted authentication
- 32-bit transponder configuration
- 32-bit password protection
- 100,000 erase/write cycles
- 20 years of non-volatile data retention

Operating Conditions

- Carrier frequency f_c is 125 kHz
- Operating temperature: –40°C to 85°C

Package

- Wedge Transponder

Applications

- Immobilizer Key
- Access Control
- Industrial

Revision History

Revision	Date	Description	Change/Update Comment
1.0	13 February 2026	Release	1st Release

Ordering information

Part No.	Description	Package	Marking
PAUDW103EP0SU8C33C3	SIC618C-33, Immobilizer LF FDX with T 128-bit encryption Wedge, Canister, RFID TAG	Wedge	-

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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
ASK	Amplitude shift keying
FSK	Frequency Shift Keying
CMD	Command
CRC	Cyclic redundancy check
EEPROM	Electrically Erasable Programmable Read-Only Memory
FDX	Full Duplex
Lock	Permanently disable memory programming
LSB	Least significant bit
MSB	Most significant bit
POR	Power on Reset
RF	Radio Frequency
Rx	Receiver
Tx	Transmitter
TM	Transponder memory
UM	User memory
CM	Configuration memory

1. Functional Overview

The SIC618C is a specialized, low-frequency, Full-duplex RFID tag designed for demanding security environments. It features a built-in encryption module, which enables the tag to independently process complex authentication operations required for critical applications like automotive immobilizers, industrial access control, and high-level security systems.

1.1 Details Block Diagram

The SIC618C block diagram consists of two parts:

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

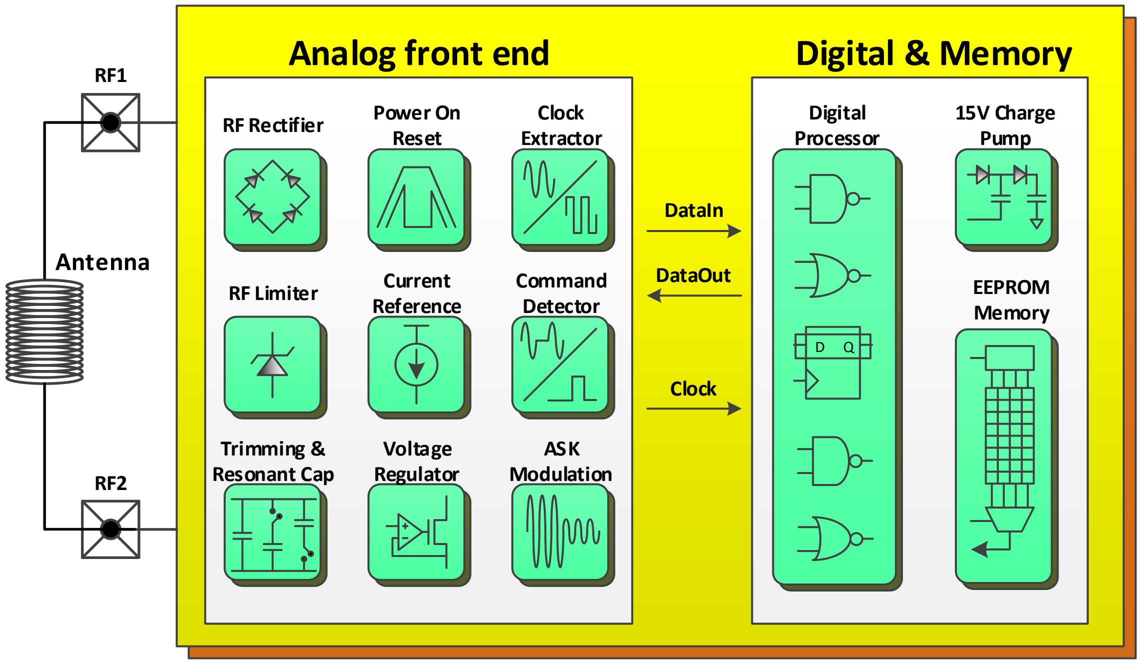

Figure 1-1: SIC618C block diagram

1.2 Block Component Description

1.2.1 Analog Front End (AFE)

The Analog Front end (AFE) has RF1 and RF2 terminals for connecting to an external antenna. It harvests energy from the induced RF signal in the antenna 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, and a clock extractor for data synchronization.

1.2.2 Digital controller and memory

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
- Process authentication using an encryption module

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 reliability. Only one absolute maximum rating can be applied at a time.

Table 2-1: Absolute Maximum Rating

Parameter	Rating
Operating temperature range	-40 ℃ to +85 ℃
Programming temperature range	-40 ℃ to +85 ℃
Storage temperature range	-40 ℃ to +125 ℃

2.2 Electrical Characteristic

Table 2-2: AFE Characteristic

Parameter	Description	Min	Typ	Max	Unit	Conditions
T_{op}	Operating Temperature	-40	+25	+85	°C	
f_{op}	RF operating frequency		125		kHz	
f_{res}	Resonance frequency	122	125	128	kHz	T_{op} = +25°C
V_H	Clamp RF voltage level		8.3		V	
$V_{RF,CMD}$	Command reception level	4.0			V	
$V_{RF,PROG}$	Programming RF level	5.0			V	

Table 2-3: EEPROM Characteristic

Parameter	Description	Min	Typ	Max	Unit	Conditions
T_{ret}	EEPROM Data Retention	20			Years	T_{op} = +50°C
N_{CY}	EEPROM write cycles	100k			Cycles	T_{op} = +25°C

Table 2-4: Environment and Data Reliability

Parameter	Min	Typ	Max	Unit	Conditions
ESD	5			kV	MIL 883 3015.7 (Test 2times)
Vibration	2.5			Hrs.	IEC 68 part 2-6 (Test 10G,10-2000 kHz, 3-axis)
Drop	100			Times	Test 1.8m free fall
Shock	4000			Times	IEC 68 part 2-29 (Test 40G, 6ms, 3-axis)

3. Memory organization

3.1 EEPROM Organization

The SIC618C Memory has a total of 320 bits and is organized into 10 pages, each of which page by 32-bit.

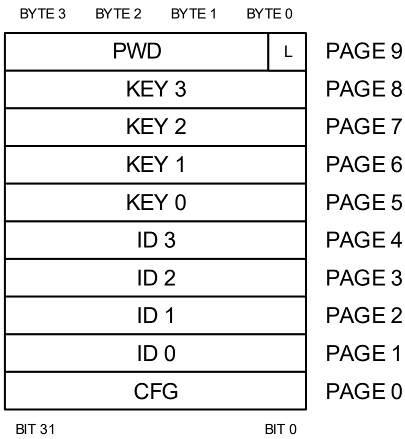

Figure 3-1: Memory Structure

4. Communication

The communication between a base station and a transponder consists of three phases:

- Initialization Phase (Base Station to Transponder)
- Downlink Mode (Base station to Transponder)
- Uplink Phase (Transponder to Base Station)
- RF damping phase

4.1 Initialization Phase (Base Station to Transponder)

This phase starts when a transponder is placed near the reader's RF field. The field burst charges up the transponder until there is enough energy level. The Power-On Reset signal is generated and asserted to reset the entire chip. During this phase, chip configuration bits in the memory are read and stored for later use by the digital controller. Then, the transponder stays idle and waits for commands from the reader.

4.2 Downlink Phase (Base Station to Transponder)

The reader sends commands to the transponder by turning the RF field OFF and ON with pre-defined intervals. The transponder converts those patterns into the command signal and then sends them to the Digital Controller to translate the operation.

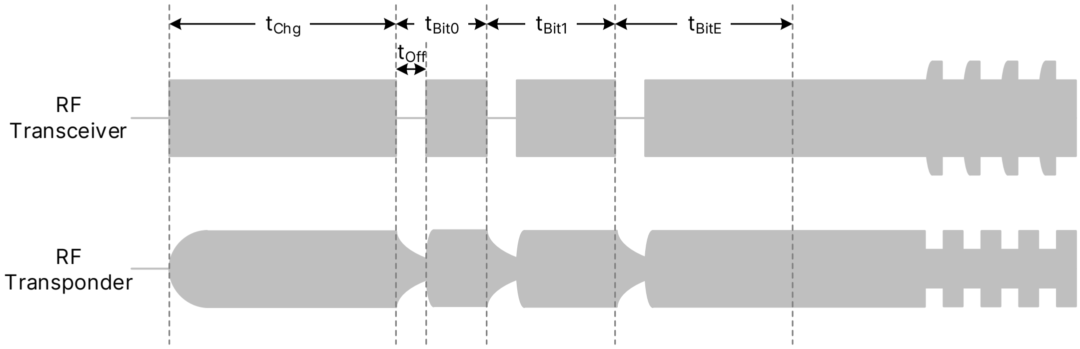

Figure 4-1: RF protocol of base station to transponder

Table 4-1: Downlink timing characteristic

Parameter	Description	Min	Typ	Max	Unit
t_{Chg}	Charge time (Charge)	5			ms
t_{Bit0}	Bit ‘0’ duration (Command)	18	20	22	Cycle
t_{Bit1}	Bit ‘1’ duration (Command)	26	28	30	Cycle
t_{BitE}	End bit duration (Command)	36			Cycle
t_{OffH}	Pulse-off bit	4	6	10	Cycle

Characteristic at operating frequency (f_{op}) 125 kHz

4.3 Uplink Phase (Transponder to Base Station)

During the uplink phase, the transponder transmits data back to the base station by using ASK modulation with the rate of RF/32 or RF/64. The response data bits ‘0’ and ‘1’ are encoded by the Manchester coding format, as illustrated in Figure 4-2

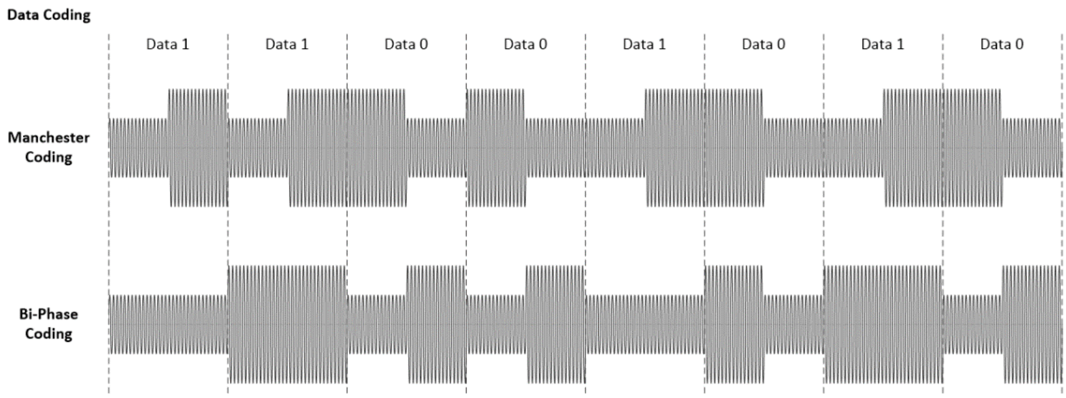

Figure 4-2: RF protocol of transponder to base station

Table 4-2: Uplink timing characteristic

Parameter	Description	Min	Typ	Max	Unit
Data 0, Data 1	Modulation data duration		32 or 64		Cycle

4.4 RF Damping Phase

At the end of the Uplink phase, any residual Radio Frequency (RF) field remaining inside the tag is extinguished. This operation is necessary to ensure that the chip is fully prepared for the subsequent Initialization phase.

5. Package information

5.1 Wedge transponder

5.1.1 Wedge dimension

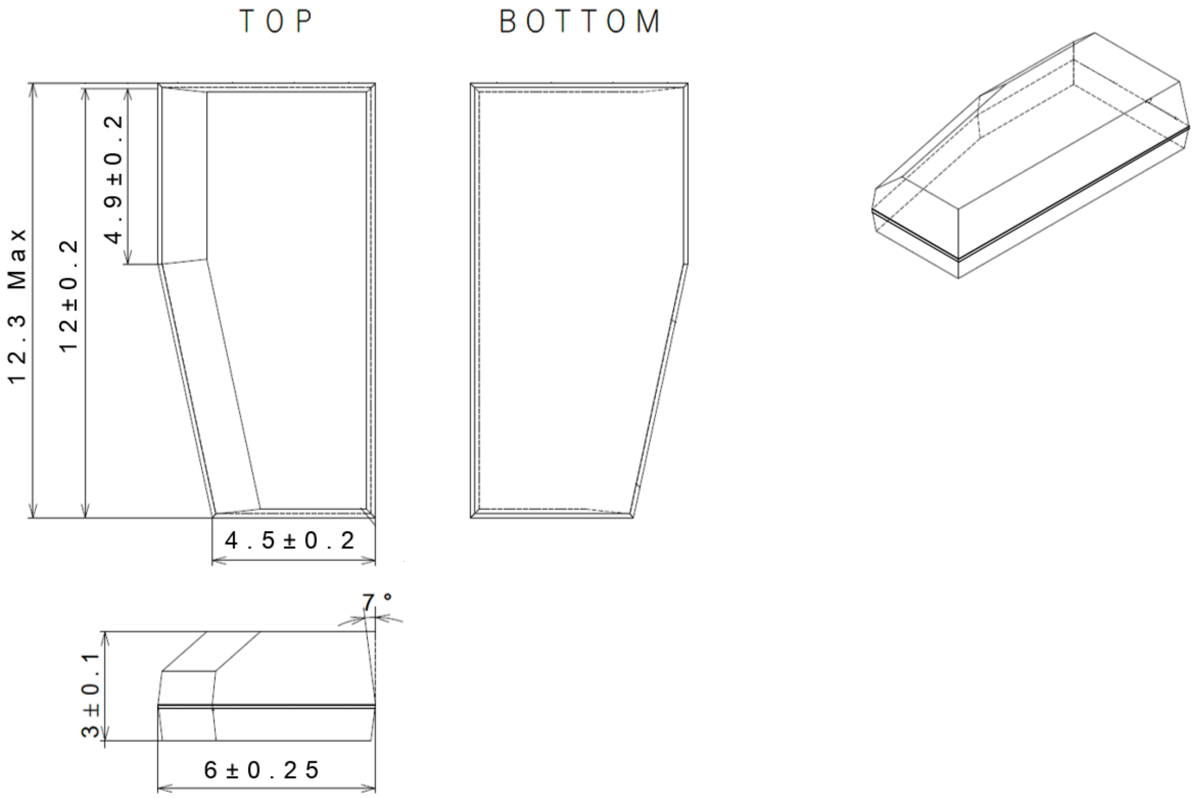

Figure 5-1: Wedge Drawing and dimension

6. Packing Specification

Internal Label

Figure 6-1: Product packing

Table 6-1: Canister information

Packing information	Value	Unit
Canister PVC dimension	ø116 x 128.5	mm
Product quantity per canister	2,000	ea.
Canister weight (Included product)	0.93	kg

Inner Box

External Label

Figure 6-2: Inner box dimension

Table 6-2: Inner box information

Packing information	Value	Unit
Inner box dimension (l x w x h)	255 x 255 x 180	mm
Canister quantity per inner box	4	ea.
Inner box weight (Included product)	3.96	kg

Outer Box

Figure 6-3: Outer box dimension

Table 6-3: Outer box standard packing information

Outer box standard	Outer box dimensions l x w x h (mm)	Total maximum weight (kg)	Inner box quantity
1	330 x 240 x 310	4.46	1
2	390 x 380 x 390	8.92	2
3	620 x 390 x 390	17.14	4

The outer box has three standard box sizes depending on the order.

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