

FEATURE

- Compatible with ISO/IEC 15693 Standard
- No External power supply required
- 13.56MHz operating frequency
- Embedded **Total 2048 bit OTP** memory
- ASK demodulator
- Support both single and dual sub-carrier operations
- Internal clock recovery circuit
- Support 26.69kbps high data rate, and 6.62kbps low data rate
- Manchester encoding TX data output
- Self-destruct function

OTP Memory

- 224 bytes of data memory organized in 56 four-byte blocks
- Each block is organized in 4 bytes for one time programming
- Data retention up to 10 years
- Lock bits for each block, AFI, DSFID

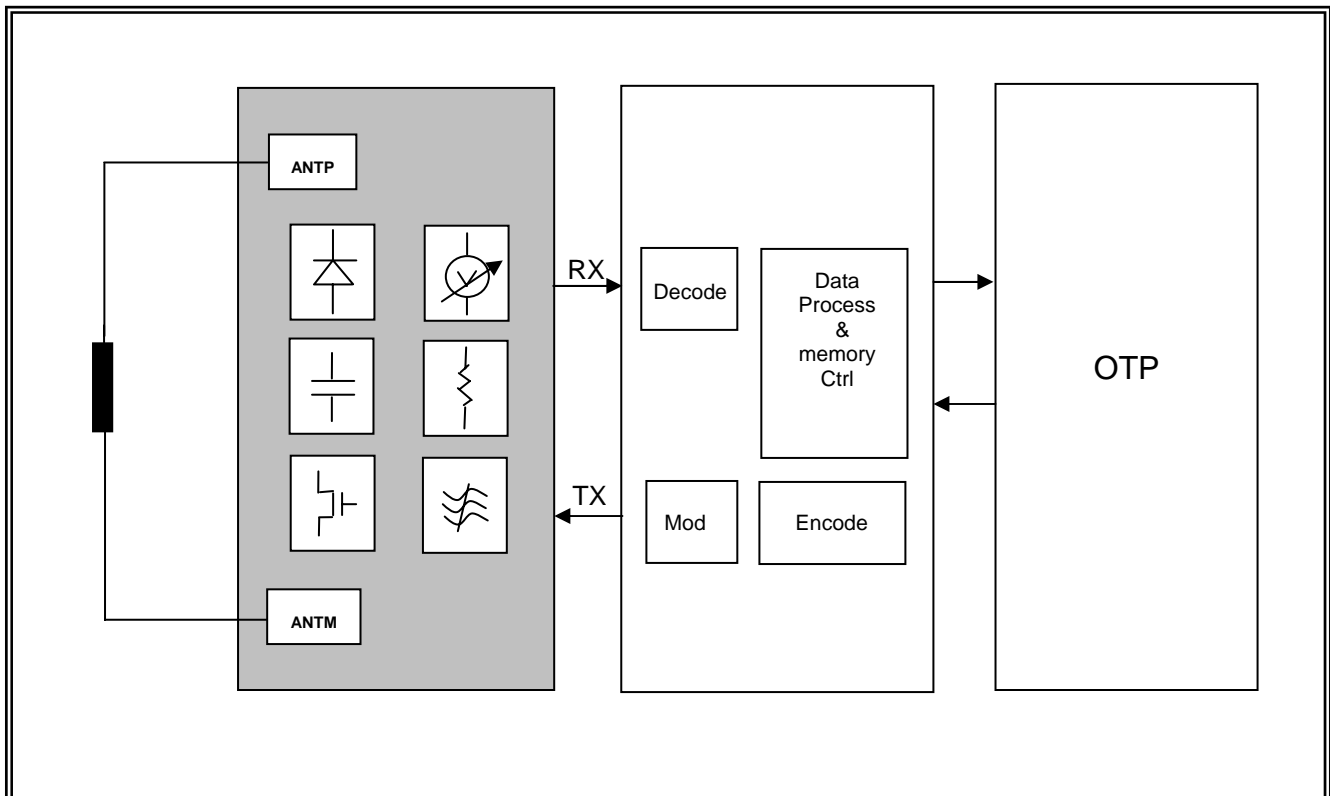


Figure 1: A9210-B Block System Diagram

Ver 1.1 Short Form

Pin Descriptions

Symbol	Type	Description
ANTP	-	Antenna pad A
ANTM	-	Antenna pad B
TIO1	-	Reserved
TIO2	-	Reserved
TIO3	-	Reserved

Table 1

Floor Plan

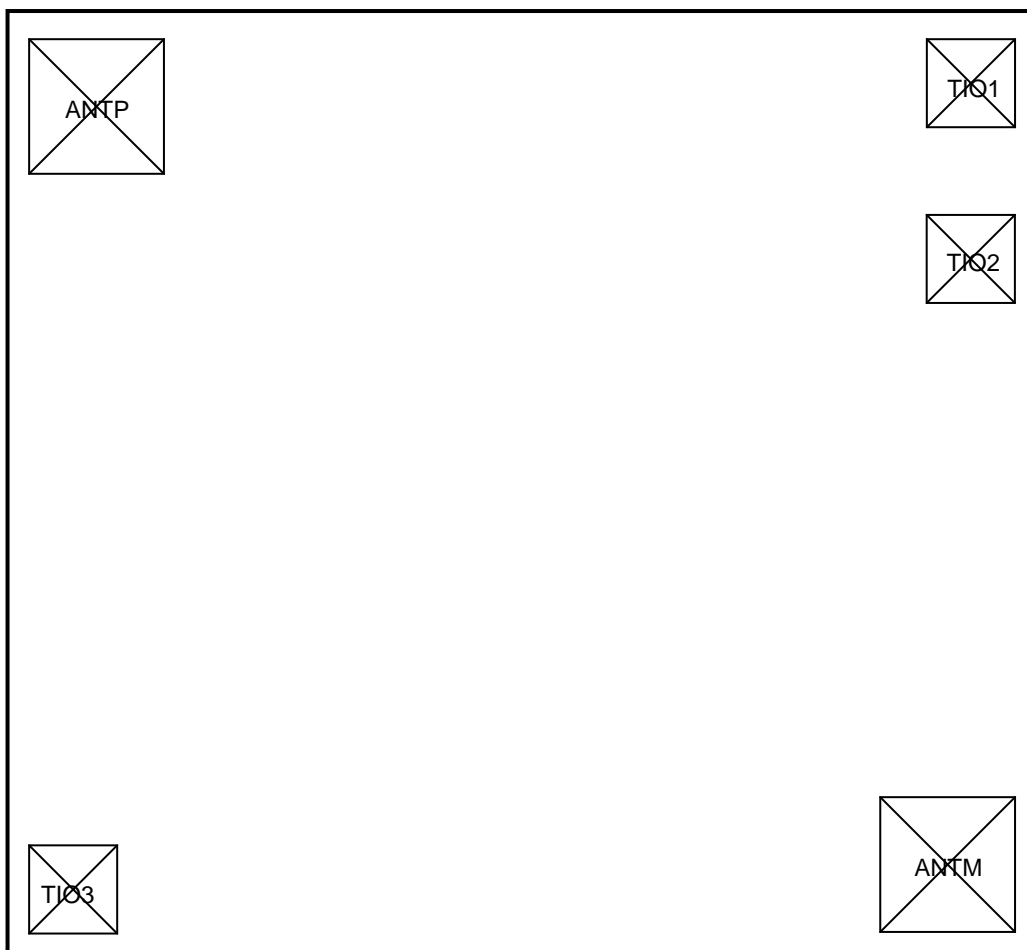


Figure 2: A9210-B Pin-out Diagram



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General OTP Memory Mapping

OTP Address	Byte 0	Byte 1	Byte 2	Byte 3
0x00 ~ 0x03	Reserved	Reserved	Reserved	Reserved
0x04 ~ 0x07	Reserved	Reserved	Reserved	Reserved
0x08 ~ 0x0B	Block 0 ~ Block 7 Lock Status	Block 8 ~ Block 15 Lock Status	Block 16 ~ Block 23 Lock Status	Block 24 ~ Block 31 Lock Status
0x0C ~ 0x0F	Block 32 ~ Block 39 Lock Status	Block 40 ~ Block 47 Lock Status	Block 48 ~ Block 54 Lock Status	Reserved
0x10 ~ 0x13	UID 0	UID 1	UID 2	UID 3
0x14 ~ 0x17	UID 4	UID 5	UID 6	UID 7
0x18 ~ 0x1B				
0x1C ~ 0x1F				
0x20 ~ 0x23	Block 0			
0x24 ~ 0x27	Block 1			
0x28 ~ 0x2B	Block 2			
0x2C ~ 0x2F	Block 3			
0x30 ~ 0x33	Block 4			
0x34 ~ 0x37	Block 5			
0x38 ~ 0x3B	Block 6			
0x3C ~ 0x3F	Block 7			
//	//			
0xDC ~ 0xDF	Block 54			
0xE0 ~ 0xFF	Device dependent. Please see respective part number for details			

Table2: OTP Memory Mapping Table



Ver 1.1 Short Form

Unique Identifier (UID)

MSB			LSB				
64	57	56	49	48	41	40	1
'E0'		IC Mfg Code (0x33)		Tag Type		IC Manufacturer Serial Number	

The UID, in ISO/IEC 15693-3 format, is programmed by IC manufacturer during production process and cannot be changed afterwards.

Bit64 ~ Bit57: Shall be 'E0' according to ISO/IEC 15693-3.

Bit56 ~ Bit49: AMIC IC manufacturer code

Bit48 ~ Bit41: Tag type for AMIC Tag IC A9210-B

Bit40 ~ Bit 1: 40-bit unique serial number.

General Command List

	Command	Command Code	Description
1	Inventory	0x01	Anti-collision sequence. Used for multiple RFID detection
2	Stay Quiet	0x02	Command tag to enter Quiet state (no response)
3	Read Single Block	0x20	Read data from requested block
4	Write Single Block	0x21	Write data to requested block
5	Lock Block	0x22	Lock the requested block, and the memory block will be locked permanently.
6	Read Multiple Block	0x23	Read the requested blocks
7	Select	0x25	Command tag to enter Selected state
8	Reset To Ready	0x26	Return tag to Ready state
9	Write AFI	0x27	Write AFI value into tag memory
10	Lock AFI	0x28	Lock AFI value and the contents of AFI will be locked permanently
11	Write DSFID	0x29	Write DSFID value into tag memory
12	Lock DSFID	0x2A	Lock DSFID value and the contents of DSFID will be locked permanently
13	Get System Information	0x2B	Retrieve tag system information from memory
14	Get Multiple Block Security Status	0x2C	Receive tag memory block security status

Table3: A9210-B General Commands

Note: For any standard command not described in this data sheet, please see ISO/IEC 15693-3 document for details.

Custom and Proprietary Command List

	Command	Command Code	Description
Custom & Proprietary Commands			
1	Inventory Read	0xA0	Read specific memory content while performing anti-collision algorithm
2	Fast Inventory Read	0xA1	Same as Inventory Read but using high data rate
3	Write Kill Code	0xA8	Program self-destruct password
4	Lock Kill Code	0xA9	Lock self-destruct password
5	Self-destruct	0xAA	Enable IC self destruction feature. Once enabled, IC will be inoperable permanently.

Table4: A9210-B Custom and Proprietary Commands

RFID Tag IC Command and Response

All commands listed above are described in details in ISO/IEC15693-3 documents. Some of the frequent used commands are discussed here for quick reference.

Protocol concept

A9210-B RFID tag IC follows ISO-15693 standard's simplex communication protocol scheme. Reader needs to issue appropriate command before A9210-B RFID tag IC will respond with the corresponding data packet. A9210-B RFID tag IC is designed base upon the one command one action structure.

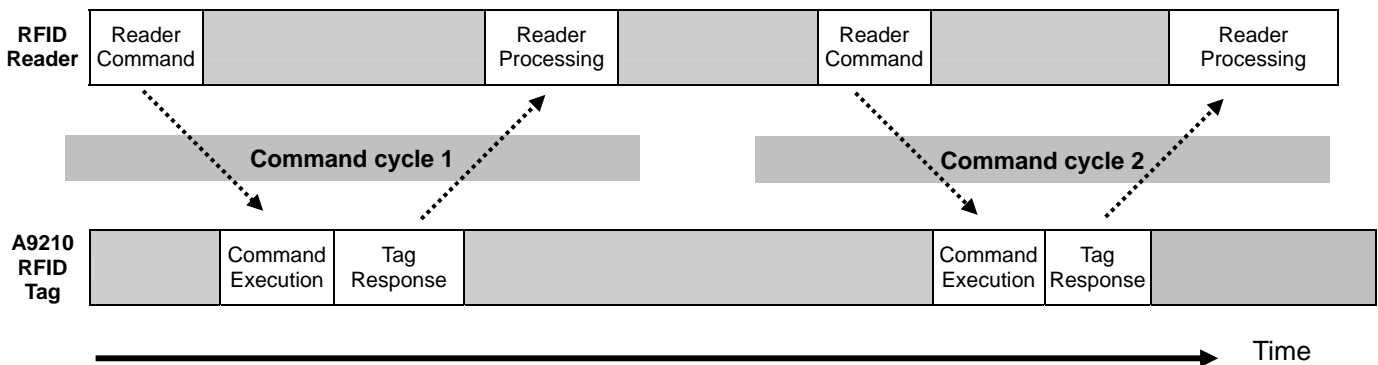


Figure3: A9210-B Command Cycle Diagram

Each reader command and each tag response packet are contained in a frame. The frame is delimited by frame delimiters SOF (Start of Frame) and EOF (End of Frame). Each reader command consists of the following fields:

- Flags
- Command code
- Mandatory and optional parameter fields (command dependent)
- Application data field
- CRC

Reader command as seen by A9210-B RFID tag IC should have the following format

SOF	Flags	Command Code	Parameters	Data	CRC	EOF
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A9210-B RFID Tag IC's response packet consists of the following fields:

- Flags
- one or more parameter fields
- Data
- CRC

SOF	Flags	Parameters	Data	CRC	EOF
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Absolute Maximum Rating

Parameter	Symbol	Min	Type	Max	Unit
Storage Temperature	T_{sto}	-55		140	°C
Junction Temperature	T_j	-55		140	°C
Electrostatic Discharge Voltage	V_{ESD}			2K ₍₁₎	V
Maximum input peak current	$I_{Max P-M}$			50	mA
Operating junction temperature	T_{jop}		TBD		°C
Input current	I_{P-M}			30	mA

(1) Applicable for ANTP and ANTM pads

DC Electrical Characteristics

Parameter	Symbol	Condition	Min	Typical	Max	Unit
Operating Frequency	f_{OP}			13.560		MHz
Input Capacitance	C_{in}	V_{P-M}	23	26.0	29	pf
OTP Data Retention	t_{ret}	T	-	10	-	Years
OTP Write Endurance	n_{wr}			1		Cycles

Mechanical Specification

- Wafer diameter: 8"
- Wafer thickness: Raw wafer ($725\mu\text{m} \pm 15 \mu\text{m}$)
- Backside material: Si
- Backside treatment: Etched; to achieve 30~50% brightness relative to surface
- Backside roughness: Not specified
- Chip size: $1010.4\mu\text{m} \times 1036.52\mu\text{m}$
- Scribe line: 100 μm (with 20 μm seal ring per side)
- Passivation type: PSG and SIN
- Passivation material: PSG and SIN
- Passivation Thickness: PSG 2.5K Å and SIN 3K Å

Gold Bump Specification

- Bump material: >99.9% pure Au
- Bump hardness: 35 – 80 HV 0.005
- Bump shear strength: >70MPa
- Bump height: $15 \pm 3\mu\text{m}$
- Bump height uniformly:
 - Within a die $\pm 2\ \mu\text{m}$
 - Within a wafer $\pm 3\ \mu\text{m}$
 - Wafer to wafer $\pm 4\ \mu\text{m}$
- Bump flatness: $\pm 1.5\ \mu\text{m}$
- Bump size:
 - ANTP, ANTM, TIO1, TIO2, TIO3: ANTP, ANTM: 114 μm x 114 μm ;
TIO1, TIO2, TIO3: 60 μm x 60 μm
 - Variation: $\pm 5\ \mu\text{m}$
- Under bump metallization: Sputtered TiW



Order Information

<i>Part Number</i>	<i>Form Factor</i>	<i>Packaging</i>
A9210-B-W0	Bare dice	Sawn wafer (wafer on blue tape)
A9210-B-W1	Dice with Au Bump	Sawn wafer (wafer on blue tape)
A9210-B-M2	MOA2 / IOA2 module	Reel

Copyright Information

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Ver 1.1 Short Form

Revision History

<i>Revision</i>	<i>Date</i>	<i>Description</i>	<i>by</i>
0.0	03/2008	Initial creation	G.W.
0.1	09/2008	A9210-B revision	Q.S.
0.2	01/2009	Add self-destruct function	R.L.
1.0	03/2009	Pad location update	R.L.
1.1	07/2009	Command description update	R.L.