Innovative
Silicon IDIC® Solutions

ATMEL®

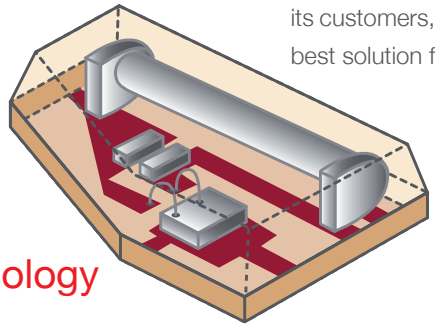
Atmel – The Expert with Long-term Know-how

Atmel®, a pioneer in the RFID area, provided the industry's first read-only RFID ICs at the end of the 80's. Since 1995, Atmel has also been offering the world's most flexible read/write ICs.

Today, Atmel is a key player for low-frequency-based125 kHz RFID ICs for access control systems. The portfolio also includes ICs addressing the HF segment at 13.56 MHz.

Through continuous improvement and innovation, Atmel is able to present a product scope that covers all semiconductors required for a complete RFID system. Our RFID ICs provide outstanding performance, they are flexible and easy-to-designin solutions.

Customers also benefit from Atmel's extensive application support. Atmel engineers with excellent know-how will support even very specific demands, including the development of ASICs. Together with its customers, Atmel defines and helps to realize the best solution for dedicated applications.

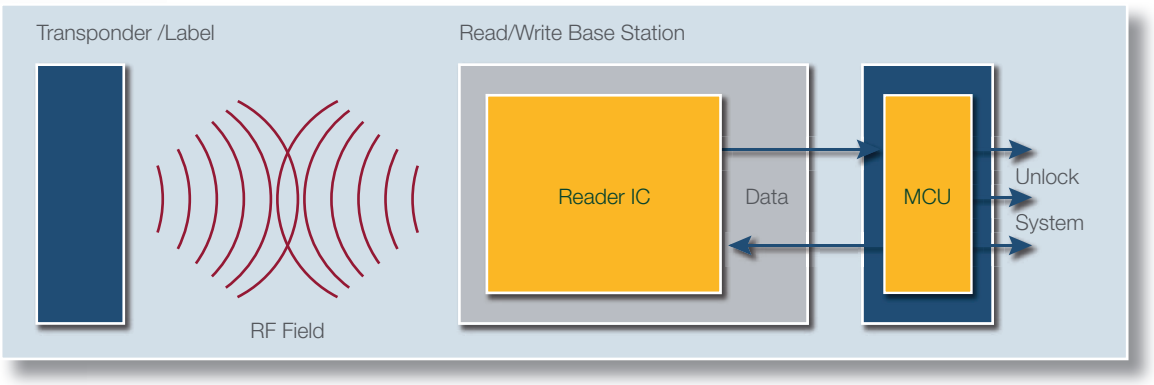


RFID – The Technology

An RFID system consists basically of two components:

- Transponder
  (fixed on an object that shall be identified)
- Reader
  (or interrogator base station)

A transponder includes the IC, and in LF systems optionally a capacitor and a coil. HF systems only need a coil, UHF systems an antenna. The reader generates an RF field which is used to transmit power and to perform bi-directional, contactless data transmission (no connection or line-of-sight necessary). As soon as a transponder or smart label gets into the field generated by the reader, the tag transmits information either immediately or on request only. The reader decodes this information, sends it to a host, or displays it.



RFID Applications

Versatile and flexible products form an Atmel product scope that offers solutions for almost all applications in the main RFID market segments. Atmel's products fulfill the market requirements that call for fast, secure and reliable identification systems.

Manufacturing and Logistics

RFID systems guarantee reliability even in dirty and harsh environments. Efficient and time-saving systems can be achieved by fast and secure identification solutions that do not need direct contact or line-of-sight. In addition, fast anticollision methods enable identification of a set quantity of products at the same time.

Atmel products address several ISO standards, which are a general demand for open-item management applications (e.g. ISO 18000). In addition, Atmel also provides proprietary solutions.

In this area, accurate manufacturing and logistic systems enable to save time and money. The environmental and velocity factors especially play an important role.

Typical Applications

- Supply Chain Management
- Asset Management
- Bulk Shipment Tracking
- Cylinder Tracking
- Garments
- Inventory/Item Management
- Laundry Automation
- Material Handling and Assembly Equipment
- Toll Collection
- Pallet Tracking
- Pharmaceutical Management
- Parcel Services
- Warehouse Management
- Waste Management

Transportation

Convenience and time efficiency are the reasons why RFID is used in the transportation segment. With increasing travel the employment of faster ID systems becomes necessary. In public transportation, RFID guarantees efficient toll and traffic management, which prevents queues.
Due to long reading distances required by transportation applications such as container tracking, Atmel also provides components for active tags. Several Atmel products address the ISO 14443 standard that is mainly used in public transportation.

Typical Applications

- Airport Baggage Tagging
- Cargo Tracking
- Electronic Toll and Traffic Management
- Fuel and Maintenance Operations
- Parking Structures
- Loading Docks
- Rail Car Tagging
- Ticketing
- Electronic Payment

Animal Identification

RF identification is significantly involved in the improvement of livestock tracking. Stock monitoring, breeding or disease control are also supported. And with the outbreak of various animal epidemics, secure animal identification is more important than ever. RFID tags can easily be injected under the animal's skin. This helps to identify not only livestock but also pets and zoo animals.

- Animal Ownership Detection
- Animal Tracking
- Fisheries
- Lifestock Tracking
- Wildlife Tracking

In animal sports, RFID systems help prevent manipulation and records the correct time of arrival (e.g. in pigeon sports). The standards ISO 11784/85, also called FDX-B are supported.

Security and Access Control

To control access to buildings or other objects by persons or items, ID systems have to ensure absolute security.
The RFID technology is utilized as access control embedded in ID cards. These cards not only prevent unauthorized access to buildings or other objects but are further used for time attendance monitoring.
In addition to identification, an RFID card may be used to store value. Whether as a transportation pass, loyalty card, prepaid utility card, an electronic purse for food purchase or parking, RFID provides convenience and security. With available memory partitioning and multiple secure keys available on one device it is possible to combine several of these functions onto one convenient card.
Another advantage of these cards is the convenient handling. As an example, simply walking through the reader field with the ID card in the briefcase identifies a person. There is no need to handle the card.
In the automotive sector, RFID-based security keys prevent unauthorized access to vehicles.

Typical Applications

- Automotive Immobilizers
- Building Access Control
- Parking Lot Security and Access
- Anti-counterfeiting/Forgery
- Electronic Purse
- Loyalty Card
- Prepaid Card

Component Authentication

Within consumer and commercial systems there are often components that need to be guaranteed authentic for the proper operation of the system or the safety of the user. RFID with security provides a convenient and secure method of identifying a removable or replaceable component.

RFID tags can be made in a variety of shapes and sizes specifically designed for the component they are attached to. With no electrical connections required a solution can be found for just about any component whether it has electronic content or not.

Utilizing the available mutual authentication protocol the system authenticates the component and the component authenticates the system before system operation begins. To further enhance system operation data may be encrypted and stored on the RFID tag for use by the system or to record historical information during operation.

Typical Applications

- Daughter Cards
- Video Cards
- Printer Cartridges
- Copier Toner Cartridges
- Pharmaceuticals
- Glucose Monitors
- Medical Devices
- Electronics

RFID Portfolio

125/134 kHz Read/Write

- Authentication Algorithm for High Security
- Anti-collision Function
- Up to 1 Kbit User Memory
- Different ISO Standards are Addressed
- Dual Interface (Hardwired and Wireless)

13.56 MHz Read/Write

- ISO 14443 Type B Compliant
- Anti-collision Function
- 1 Kbit to 64 Kbit User Memory
- Password protection
- Mutual Authentication
- Encryption

Technical Features

IPs

Modulation/Coding

Depending on the product, we provide the following modulation modes/codings: FSK, PSK, ASK, Manchester, Biphase, NRZ direct coding, etc.

Anti-collision Function

Handling of several transponders in the field at the same time is possible

Security

- UID: each transponder chip has its unique identification number (including traceability code)
- Password protection for read and write access
- Authentication: single or mutual authentication (reader and transponder authenticate each other) for copy protection
- Encryption: data transmission is encrypted, no unauthorized access possible

Memory

- 4 - 16 memory zones
- Up to 64 kbit

Technology

Down to 0.18 µm

Package Delivery Options

Atmel's RFID products are available as identification ICs or as entire transponder.

- Die on Wafer (Foil/Tape, Bumped)
- Packaged Die (Micromodule, SO, TSSOP)
- Transponder

RFID Product Overview

LF Tags (100-150 kHz)

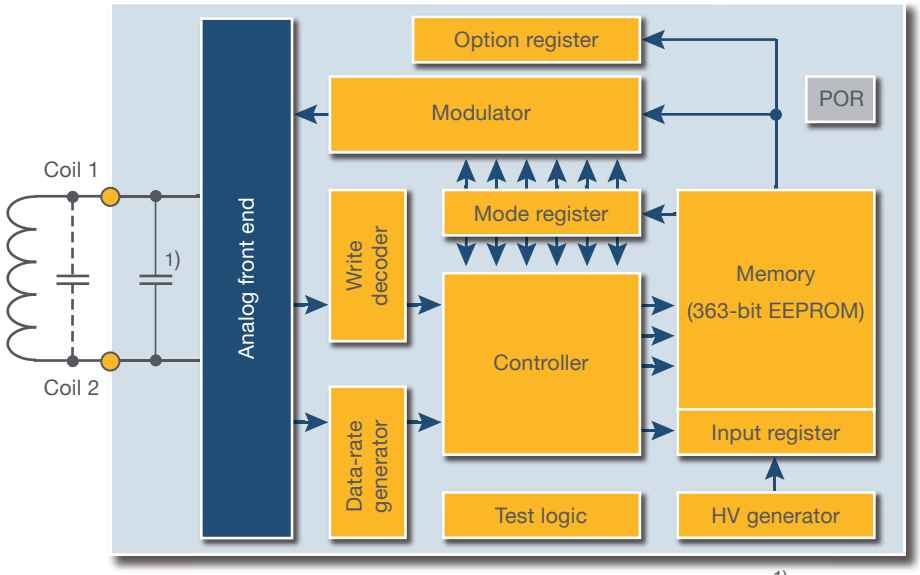
	TK5551[1]	ATA5558	e5561	ATA5570	ATA5577M1[2]	ATA5577M2[2] MEGAPADS
Memory						
Read only	–	–	–	–	–	–
Read/Write	X	X	X	X	X	X
User memory (bit)	224	1024	288	224	224	224
System memory (bit)	40	320	32	96	128	128
RF Interface						
Write protection	Blockwise	Blockwise	Blockwise	Blockwise	Blockwise	Blockwise
ISO11784/11785	FDX-B	FDX-B		FDX-B	FDX-B	FDX-B
Modulation	ASK	ASK	ASK	ASK	ASK	ASK
Encoding	FSK, PSK, Manchester, Bi-phase, Binary	Manchester, Bi-phase, NRZ	Manchester, Bi-phase	FSK, PSK, Manchester, Bi-phase, NRZ	FSK, PSK, Manchester, Bi-phase, NRZ	FSK, PSK, Manchester, Bi-phase, NRZ
Bit rate [bits/s]	RF/8 to RF/128	RF/2 to RF/64	RF/32, RF/64	RF/2 to RF/128	RF/2 to RF/128	RF/2 to RF/128
Capacitor on chip	–	80 pF and 210 pF	–	0	0[4], 75[4], 130[4], 250 or 330 pF trimmed +/- 3%	250 or 330 pF trimmed +/- 3%
Other features						
Encryption	–	–	AUT64	–	–	–
Anti-collision function	AOR (Answer on Request)	Deterministic	–	AOR (Answer on Request)	AOR (Answer on Request)	AOR (Answer on Request)
Packages	Only available as transponder	Sawn Wafer	Wafer	SO8, Sawn Wafer, waffle pack	Sawn Wafer, waffle pack, micro-module, TSSOP8[3]	Sawn Wafer, waffle pack sticky tape[4]
Main application areas	Manufacturing, logistic, security control, access-control, component authentication	Manufacturing, logistic, security control, access control, component authentication	Logistic, security control, access control, component authentication, anticounter-feiting	Manufacturing, animal identifica-tion, security control, access control, component authentication	Manufacturing, logistic, transportation, animal identifica-tion, security control, access control, component authentication	Manufacturing, logistic, transportation, animal identifica-tion, security control, access control, component authentication
Transponder part no.	TK5551	ATA555815-PP	TK5561	–	ATA5577M1-330-PP[3]	–
Sensor	–	–	–	Resistor interface 1 bit	–	–
Speciality	–	–	–	–	–	Gold Bump Mega Pads 200 x 400 micrometers

[1] Only available as transponder

[2] Successor of T5554, T5557, and ATA5567

[3] Planned

[4] On request



1) Mask option

LF RFID Front-end ICs

Part Number	Frequency	Type	User Memory [bit]	Total Memory [bit]	Bit Rate	Encoding Bi-phase	Encoding Manchester	Package	Remark
U3280M	125/134 kHz	(R/W)[1]	512	512	0 - 10 Kbit/s[2]	X	Code	SS016	Provides power supply for µC from RF field
U9280M	125/134 kHz	(R/W)[1]	512	512	0 - 10 Kbit/s[2]	X	X	SSO20	U3280M with MARC4 ATAR092[3] microcontroller

[1] Feature can be added by software control

[2] Theoretical value, actual minimum bit rate depends on the reader bandwidth

[3] 4 Kb ROM

LF Reader ICs (100-150 kHz)

Part Number	Frequency	Type	Max Bit Rate	Encoding Bi-phase	Encoding Manchester	Package	Temperature [°C]	Vcc [V]
U2270B	125/134 kHz	R/W	5 Kbit/s	X	X	S016	-40 to +105	4.5 - 16

LF Design Kits

Part Number	Description
ATA2270-EK1	This LF demonstration kit provides a completely self-contained means to begin using RFID systems. It includes an LCD and control buttons to enable interaction with the RFID system and supports the e5530/TK5530, T5551/TK5551, ATA5567(T5557), ATA5570, ATA5577, ATA5558 IDICs and U2270 from Atmel. Source code and reference designs are also included. This kit is supported by all the standard AVR development tools such as AVR Studio®, STK500, JTAGICE mkII, etc. A GUI for a PC can control the board in several modes.
ATAK2270	This LF RFID kit is available to demonstrate the key features of various RFID products. The included software supports the following products: U2270B, TK5530/e5530, TK5551, TK5552/T5552, ATA5567 (T5557) comp. mode/enhanced mode and ATA5570. ATA5577 is also supported. The kit contains samples, a CD-ROM with installation software and product documentation, as well as all accessories needed.
TMEB8704	This LF RFID kit is available to demonstrate the key features of various RFID products. The included software supports the following products: U2270B, TK5530/e5530, TK5551, TK5552/T5552, ATA5567 (T5557) comp. mode and TK5561. The kit contains samples, a CD-ROM with installation software and product documentation, as well as all accessories needed.
ATAK2270UG	Upgrade kit for the TMEB8704 to upgrade to an ATAK2270
ATAB5570	The ATA5570 is based on the ATA5567, however, it is enlarged by an additional sensor input. The board is equipped with a switchable sensor resistor. Depending on the impedence, the memory data of the tag is sent in inverse or non-inverse mode. The board design is also suitable for testing other tag versions in SO8 packages.

HF Tags (13.56 MHz)

Part Number	AT88SC0104CRF	AT88SC0204CRF	AT88SC0404CRF	AT88SC0808CRF	AT88SC1616CRF	AT88SC3216CRF	AT88SC6416CRF
Memory							
Size	128 bytes	256 bytes	512 bytes	1 Kbyte	2 Kbytes	4 Kbytes	8 Kbytes
Write endurance	100K cycles	100K cycles	100K cycles	100K cycles	100K cycles	100K cycles	100K cycles
Data retention	10 years	10 years	10 years	10 years	10 years	10 years	10 years
Organization	32 × 8 × 4	64 × 8 × 4	128 × 8 × 4	128 ×8 × 8	128 × 8 × 16	256 × 8 × 16	512 × 8 × 16
Number of zones	4	4	4	8	16	16	16
Identification area	128 bits	128 bits	128 bits	128 bits	128 bits	128 bits	128 bits
RF Interface							
ISO	14443 Type B	14443 Type B	14443 Type B	14443 Type B	14443 Type B	14443 Type B	14443 Type B
Frequency	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz	13.56 MHz
Baud rate	106 Kbps	106 Kbps	106 Kbps	106 Kbps	106 Kbps	106 Kbps	106 Kbps
Anticollision	Timeslot	Timeslot	Timeslot	Timeslot	Timeslot	Timeslot	Timeslot
Operating distance	Up to 10 cm	Up to 10 cm	Up to 10 cm	Up to 10 cm	Up to 10 cm	Up to 10 cm	Up to 10 cm
Security Options							
Read/Write password	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Encrypted password	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Symetric dynamic	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys	4 × 64 bit keys
Stream encryption	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R/W encrypted checksum	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unique serial number	32 bit user prog.	32 bit user prog.	32 bit user prog.	32 bit user prog.	32 bit user prog.	32 bit user prog.	32 bit user prog.
Write protection	Zone or byte	Zone or byte	Zone or byte	Zone or byte	Zone or byte	Zone or byte	Zone or byte
Access keys	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Encryption algorithm	64 bit key	64 bit key	64 bit key	64 bit key	64 bit key	64 bit key	64 bit key
Standard packages	Die Tag (MX1, MY1) Module (MR1)	Die Tag (MX1, MY1) Module (MR1)	Die Tag (MX1, MY1) Module (MR1)	Die Tag (MX1, MY1) Module (MR1)	Die Tag (MX1, MY1) Module (MR1)	Die Tag (MX1, MY1) Module (MR1)	Die Tag (MX1, MY1) Module (MR1)
Temperature	-45° to +85°C	-45° to +85°C	-45° to +85°C	-45° to +85°C	-45° to +85°C	-45° to +85°C	-45° to +85°C
Tools	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit	Eval./devel. kit

HF Reader IC - CryptoRF

Part Number	Frequenxy	Type	Description	Package	Temperature	Vcc
AT88RF1354	13.56 MHz	R/W	13.56 MHz, ISO 14443 type B RFID reader	PDIP, 8 ld	-40°C to 85°C	3.0-5.5

CryptoCompanion (Host Side Security IC, 2-wire Interface)

Part Number	Description	I/O	Temperature	Vcc
AT88SC016	Host side security IC for CryptoMemory and CryptoRF	TWI[1]	-40°C to 85°C	3.0-5.5

[1]TWI = I2C-compatible

HF Demo Kits

Part Number	Description
AT88SCRF-ADK1 Yuma+	AVR®-based CryptoRF DK Using Melexis® Reader IC
AT88SCRF-ADK2 Keen+	All Atmel solution on an AVR Platform with Reader, tag and development library
AT88CRF-S7DK2P	CryptoRF Demonstration Kit with SkyeTek™ Reader and Software Technology

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