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Atmel Innovative Silicon RFID IDIC® Solutions

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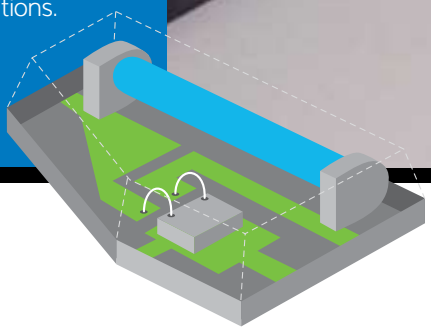
Atmel: The Expert with Long-Term Know-How

Atmel, a pioneer in the RFID area, provided the industry's first read-only RFID ICs at the end of the '80s. Since 1995, Atmel has also been offering the world's most flexible read/write ICs. Today, Atmel is a key player for low-frequency-based 100 -150kHz RFID ICs for access control and animal ID tags.

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

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





The Technology

Passive RFID

A passive RFID system consists basically of two components:

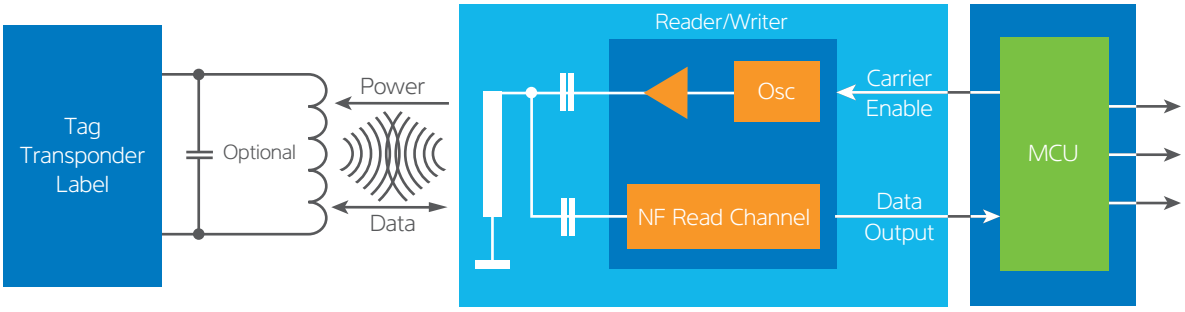
- Tag, transponder or label
- Reader, interrogator or base station

A tag includes the IC, a coil and, optionally, a capacitor. 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 tag 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.



Passive RFID System



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Active RFID

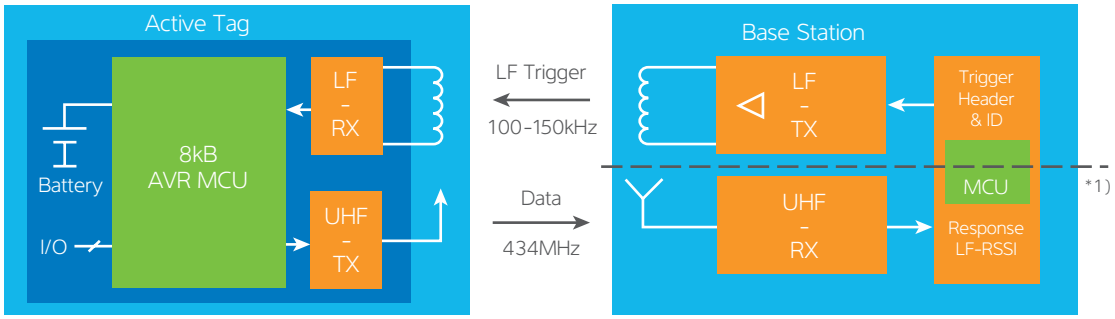
The following two components form an active RFID system:

- Battery-driven tag, transponder or label
- Reader or trigger and receive station

An active RFID system is very similar to passive RFID. The main difference is that the tag or transponder is battery driven. Also, the reader consists of two main parts:

1. LF trigger and TX channel: sends the trigger or wake-up signal (not the power for the tag), transmits data to the tag.
2. UHF RX channel: receives the return message sent by the tag in the UHF frequency band.

Active RFID System



*1) Graph shows one combined base station. Option is to split that as RX distance is much higher. So multiple trigger stations and one or few RX stations.

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. Most applications use passive RFID technology. In those cases, however, where increased distance, higher tag memory or sensor inputs are required, active RFID is the right choice.

Security and Access Control

To control access to buildings or other objects such as hotel rooms or lockers 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 or loyalty/prepaid utility card, RFID provides convenience and security.

In the automotive sector, RFID-based security keys prevent unauthorized access to vehicles.

Typical Applications

- Building access control
- Hotel room access
- Locker locks
- Automotive immobilizers
- Parking lot security and access
- Anti-counterfeiting/forgery prevention
- Company badges
- Loyalty card
- Prepaid card



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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 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. 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

- Printer cartridges
- Copier toner cartridges
- Pharmaceuticals
- Medical devices
- Electronics
- Electronic labels
- Consumables



Animal Identification

RF identification is significantly involved in the improvement of livestock and wildlife tracking as well as pet identification. 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 as glass transponders under the animal's skin (pets, equine, wildlife, fish) or attached to the animal's ear (livestock). This also helps to identify zoo animals.

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

Typical Applications

- Livestock tracking
- Wildlife tracking
- Pigeon tracking
- Poultry tagging
- Fisheries
- Pet ownership detection
- Lab animal tracking





Manufacturing and Logistics

RFID systems guarantee reliability even in dirty and harsh environments. LF RFID is well suited for applications in difficult conditions where HF, UHF or Microwave RFID systems are not able to operate, such as under water or surrounded by metal.

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 this area, accurate manufacturing and logistic systems enable cost and time savings. The environmental and velocity factors especially play an important role.

Active RFID technology is well suited for such applications due to its extended communication range that allows for easy location of assets or items.

Typical Applications

- Asset management
- Cylinder tracking
- Container and cargo tagging
- Material handling
- Assembly control
- Pallet tracking
- Pharmaceutical management
- Parcel services
- Waste management

RFID Portfolio

Passive 100-150kHz Read/Write

- Up to 288 bits of user memory
- ISO standards 11784 and 11785
- AOR answer-on-request feature
- Security:
  - Password protection
  - Every chip has a unique number on-chip: UID
- Modulation scheme: ASK
- Coding schemes: Manchester, Biphase, FSK, PSK, NRZ

Active 100–150kHz and 434MHz Read/Write

- LF trigger channel
- UHF receive channel at 434MHz
- Active trigger mode with ultra low current consumption
- 8-bit AVR® microcontroller core
- 8kByte user Flash memory
- Freely available user ports
- 7-bit RSSI measurement

Package Delivery Options

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

- Die on wafer (foil, blister or sticky tape, die in waffle pack)
- Optional gold bumps
- Packaged die:
  - NOA3 micromodule
  - Ultra small and ultra thin XDFN package
- Transponder



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RFID Product Overview

LF Tags (100–150kHz)

	ATA5551[1]	ATA5577M1[2]	ATA5577M2[2] MEGAPADS	ATA5577M3[3] MEGAPADS	ATA5575M1 MEGAPADS	ATA5575M2 MEGAPADS
Memory						
Usage	General	General	General	General (Q5)	Unique format	Animal ID (Q5 basic)
Read/Write	X	X	X	X	X[4]	X[4]
User memory (bit)	224	224	224	224	64, 128	96, 128
System memory (bit)	40	128	128	128	8	8
RF Interface						
Write protection	Blockwise	Blockwise	Blockwise	Blockwise	Memory complete	Memory complete
ISO11784/11785	FDX-B	FDX-A, FDX-B	FDX-A, FDX-B	FDX-A, FDX-B	–	FDX-A, FDX-B
Modulation	ASK	ASK	ASK	ASK	ASK	ASK
Encoding	Manchester, FSK, PSK, Biphase, NRZ	Manchester, FSK, PSK, Biphase, NRZ	Manchester, FSK, PSK, Biphase, NRZ	Manchester, FSK, PSK, Biphase, NRZ	Manchester	Biphase, FSK
Bit rate [bits/s]	RF/8 to RF/128	RF/2 to RF/128	RF/2 to RF/128	RF/2 to RF/128	RF/64	RF/32, RF/50
Capacitor on chip	-	0[6], 75[6], 130[6], 250 or 330pF, trimmed, +/- 3%	250 or 330pF, trimmed, +/- 3%	250 or 330pF[5]	250 or 330pF, trimmed, +/-3%	250 or 330pF, trimmed, +/-3%
Other Features						
Anti-collision function	AOR (answer on request)	AOR (answer on request)	AOR (answer on request)	AOR (answer on request)	–	–
Packages	Only available as transponder	Sawn wafer, XDFN-2-pin package, NOA3-micromodule, transponder	Sawn wafer, blister tape	Sawn wafer, blister tape	Sawn wafer, blister tape[6]	Sawn wafer, blister tape[6]
Main application areas	Manufacturing, logistic, security control, access control, component authentication	Manufacturing, logistic, transportation, animal identification, security control, access control, component authentication	Manufacturing, logistic, transportation, animal identification, security control, access control, component authentication	Manufacturing, logistic, transportation, animal identification, security control, access control, component authentication	Access control, manufacturing, logistic, security control	Animal identification, manufacturing, logistic, waste management
Transponder part no.	ATA5551M-PPMY	ATA5577M1330C-PPMY	–	–	–	–
Speciality	–	AFE setting	AFE setting, Mega pads, 200 x 400 micrometers, with gold bumps	AFE setting, Mega pads, 200 x 400 micrometers, with gold bumps	Mega pads, 200 x 400 micrometers, with or without gold bumps	Mega pads, 200 x 400 micrometers, with or without gold bumps

[1] Only available as transponder
[2] Successor of T5554, T5557, and ATA5567
[3] Successor of T5555
[4] Limited write distance
[5] +/-12% over production, +/-3% on wafer
[6] On request



LF Design Kits

Part Number	Description
ATA2270-EK3	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, ATA5551/T5551/TK5551, ATA5567 (T5557), ATA5575, ATA5577 and ATA5558 IDICs from Atmel. Source code and reference designs are also included. This kit is supported by all the standard AVR development tools such as Atmel Studio, STK®600, JTAGICE3, etc. A GUI for a PC can control the board in several modes.
ATARFID-EK1	This 125kHz reader kit is based on a reader unit supplied by http://www.gis-net.de/. The kit supports Atmel's ATA5575, ATA5577 and ATA5577M3 (Q5), and includes several tag samples. For full control the GUI can be downloaded from GiS' website. This is the first kit in the portfolio supporting both ASK and FSK.
ATARFID-EK2	This 134.2kHz reader kit is based on a reader unit supplied by http://www.gis-net.de/. The kit supports Atmel's ATA5575 and ATA5577 animal ID devices according to ISO 11784/85 at 134.2kHz. Both the FDX-B (Biphase) and the FDX-A standard (FSK) are supported. Several tag samples are included. For full control the GUI can be downloaded from GiS' website.

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Active RFID ICs (100-150kHz and 434MHz)

Part Number	MCU	LF RX	UHF TX Frequency (MHz)	TX Power (dBm)	V_{CC}[V]	Temperature [°C]	Package
ATA6286	8kByte	100-150kHz	432-448	6 (max.)	2 – 3.6	-40 to 85	QFN32 5 x 5mm

Active RFID Trigger ICs (100-150kHz)

Part Number	f_0 (kHz)	Channels	Max Current (A)	Data Rate Kbit/s	EMC	Output Power	Package
ATA5279	125	6	1	5.7 (max.)	Sinusoidal output	Scalable in 20 steps	QFN48 7 x 7mm

Active RFID UHF Rx ICs (434MHz)

Part Number	f_0 (MHz)	Sensitivity (dBm)	Modulation	Data Rate Kbit/s	V_{CC}[V]	Temperature [°C]	Package
ATA8202	433-435	-113 (2.4kBit/s)	ASK, FSK	10 ASK 20 FSK	2.7 – 3.3 or 4.5 – 5.5	-40 to 85	QFN24 5 x 5mm

Active RFID Demo Kits

Part Number	Description
ATA6286-EK3	This kit consists of two main boards and a battery-powered tag. First main board is the control board for the LF (125kHz) trigger circuit based on ATA5279. Second one is the UHF receiver unit to receive the message from the battery-powered tag. This board operates at 434MHz using the ATA8202 receiver IC. The tag incorporates the ATA6286 and operates at 125kHz as well as at 434MHz.







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