Car Access
PEPS, RKE, AES Immobilizer

Atmel Car Access System Solutions

- Atmel® launched the first dedicated transmitter PLL U2741B for Remote Keyless Entry (RKE) applications in 1997

- Atmel is a leading car access supplier and delivered already more than 250 Mio ICs in this application

- Strong relationships to the key players in the automotive market

Car Access – Basic of RKE
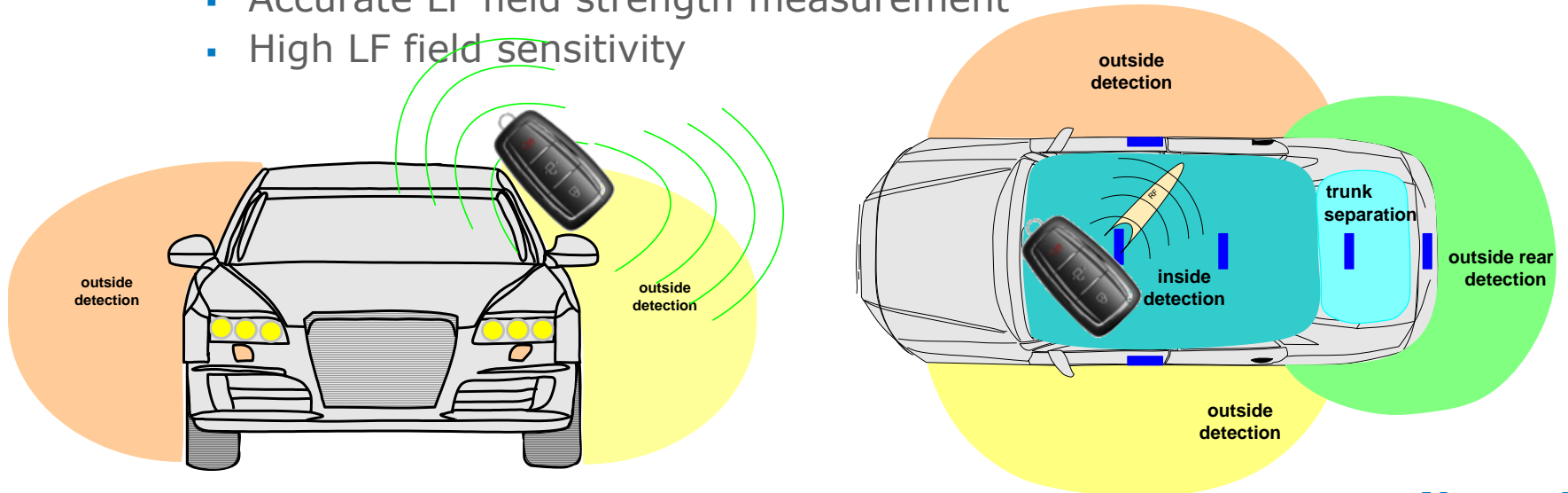
Remote **S**tart

- Like RKE but RF is typically 2-way
    - Fob sends RF to car to "start engine"
    - Car replies with RF to fob "engine running"
- Importand Design Considerations
    - Very long range, > 300m, requires high RF link budget
    - RF Link budget = f (TX power, RX sensitivity, antenna efficiencies)
    - Higher TX power by managing R   averaging)
    - Higher RX sensitivity with narrower IF bandwidth & lower data rate
        - Requires tight frequency control & compensation (temp/voltage/lot)

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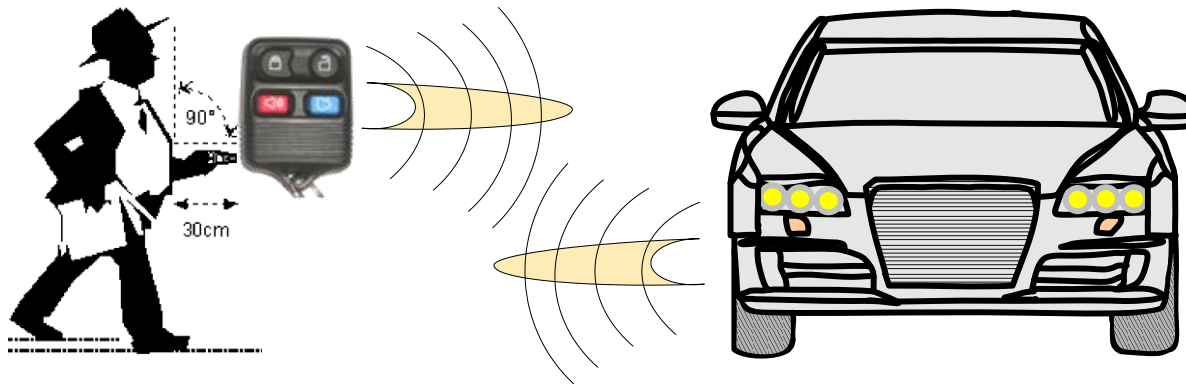
Car Access – Basic of PEPS

Passive **E**ntry / **P**assive **S**tart

- From outside the vehicle: Touch car door (PE)
- From inside the vehicle: Press "start" button on dashboard (PS)
- LF from car awakens fob (LF downlink)
- Fob measures field strength vectors & sends info to vehicle
    - Fob orientation is arbitrary - must measure x, y, & z axis (3D)
    - Fob localized: Allow "Unlock" if outside (confirm if 2-way RF)
    - Fob localized: Allow "Start" if inside (confirm if 2-way RF)
- Important system design considerations:
    - LF field strength regulation over across voltage/temp/coil variation
    - Accurate LF field strength measurement
    - High LF field sensitivity

outside
detection

outside
detection

outside
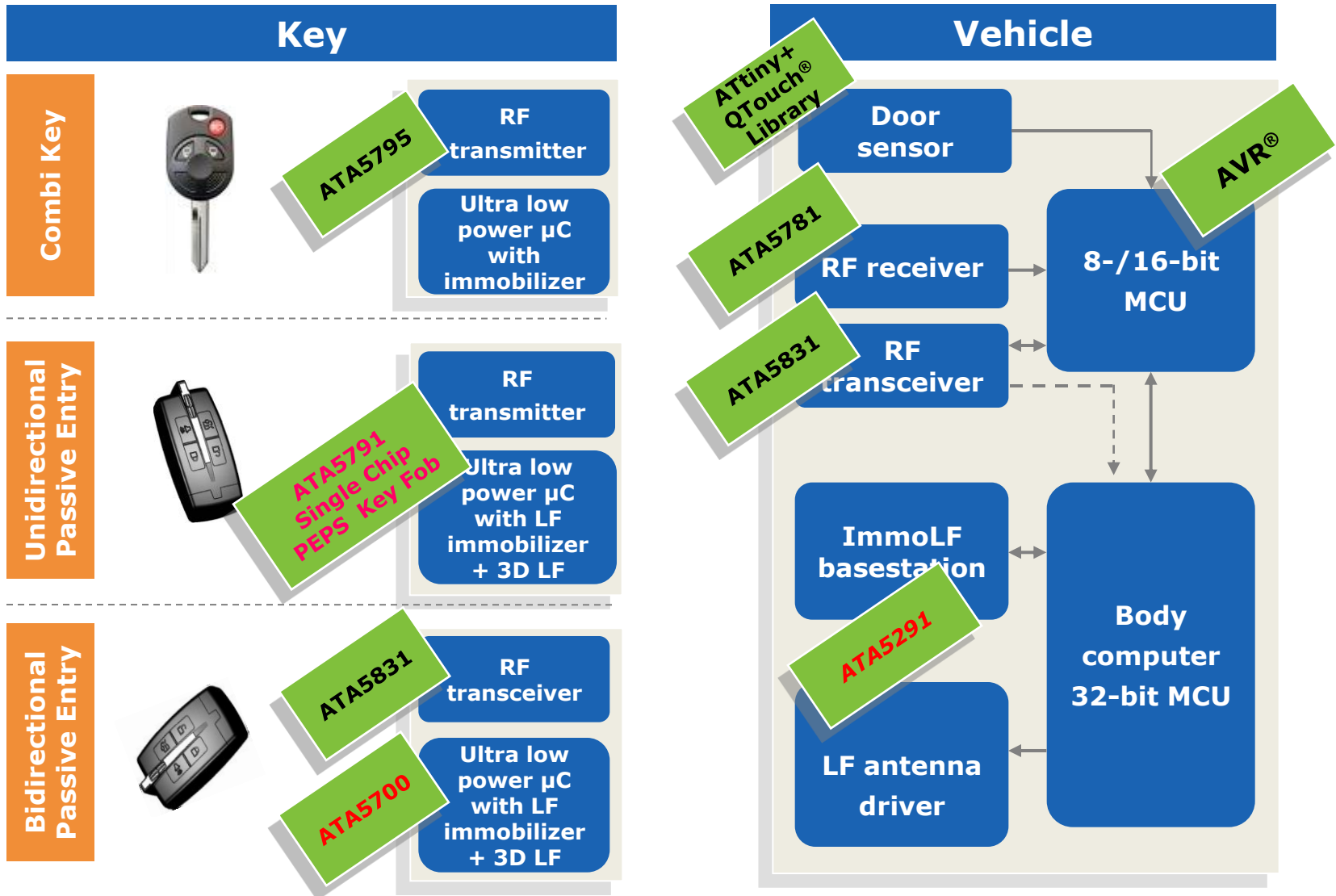detection

trunk
separation

inside
detection

outside rear
detection

outside
detection

4

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Wide Range Of Car Access Solutions

RKE	RKE + Immo	PKE + Immo	Optional
Single chip key solution, best in class performance – **ATA5774C** Best in class receiver, with minimum external component, no external IF filter, supports self polling – **ATA5724C / ATA5781**	Single chip key solution, 128 bit AES H/W encryption engine, up to 12.5dBm output power, works down to 1.9V – **ATA5795C** Best in class receiver, with minimum external component, no external IF filter, supports self polling – **ATA5724C / ATA5781** Immo transponder with built in coil, AES standard – **ATA5580**	Single chip MCU, Immo + 3D LF Wake up – **ATA5791** Single chip LF driver + Immo Basestation – **ATA5291** Immo transponder with built in coil, AES standard – **ATA5580**	RF transceiver for smart key and 2 way BCM basestation – **ATA5831** Smart RF receiver with Flash+MCU – **ATA5782** **TPMS** Receiver support **Door handle touch**

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Car Access: System Solution

Key

Combi Key	ATA5795 — RF transmitter / Ultra low power µC with immobilizer
Unidirectional Passive Entry	ATA5791 Single Chip PEPS Key Fob — RF transmitter / Ultra low power µC with LF immobilizer + 3D LF
Bidirectional Passive Entry	ATA5831 — RF transceiver / ATA5700 — Ultra low power µC with LF immobilizer + 3D LF

Vehicle

- ATtiny+ QTouch® Library
- AVR®
- Door sensor
- ATA5781 — RF receiver
- ATA5831 — RF transceiver
- 8-/16-bit MCU
- ImmoLF basestation
- ATA5291
- Body computer 32-bit MCU
- LF antenna driver

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Product Availability

Car / Fob	Function	Embedded AVR	Part Number	Availability
Both	Immobilizer protocol stack		Software	Production
Key fob	AES immobilizer transponder	✓	ATA5580	Production
Key fob	AES RKE AVR with immobilizer and RF transmitter	✓	ATA5795	Production
Key fob	AES PEG AVR with immobilizer and 3D wake-up	✓	ATA5791	Production
Key fob	Fractional-N RF transmitter		ATA5749C	Production
Both	Fractional-N RF transceiver AVR®	✓	ATA5831	Production
Car	Fractional-N RF receiver		ATA5781	Production
Car	Fixed-frequency RF receiver		ATA572x	Production
Car	6-channel LF driver		ATA5279C	Production
Car	4-channel LF driver with Immobilizer Basestation		ATA5291	Sampling

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Car Access Key Fob Controllers
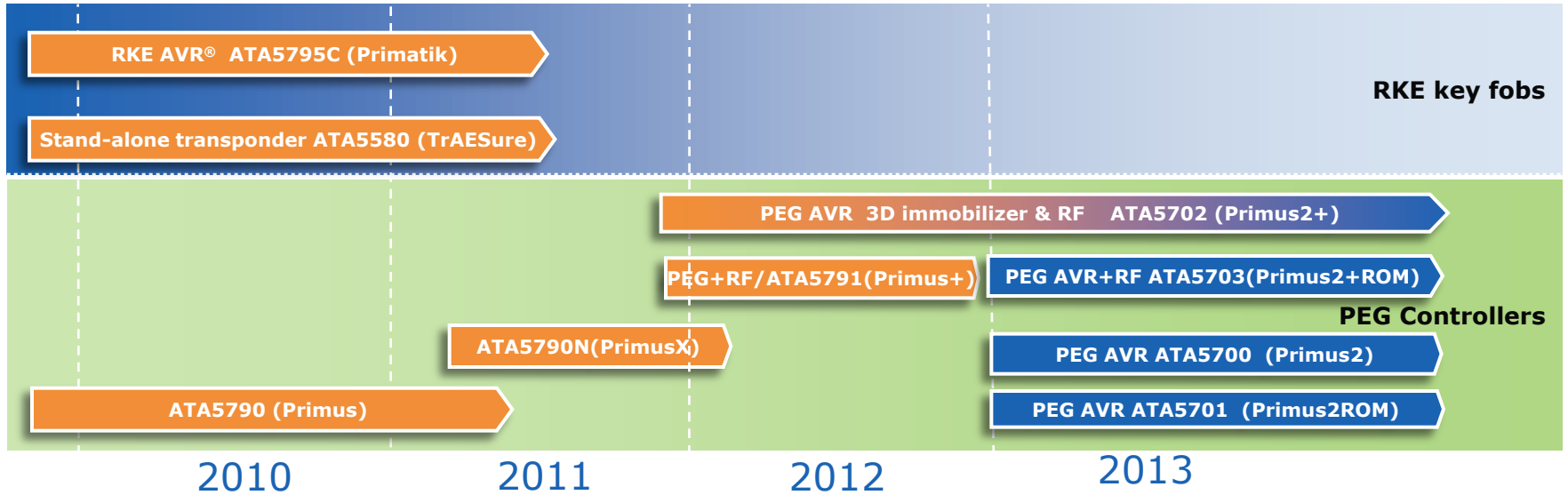
Part Number	Description
ATA5795	RKE AVR® controller with AES-128, 315/433MHz RF transmitter and immobilizer
ATA5580	Stand-alone AES-128 transponder, 8K Flash, 2K EEPROM
ATA5790	PEPS AVR controller with AES-128, 3D LF, immobilizer, 16K Flash, 2K EEPROM
ATA5790N	PEPS AVR controller with AES-128, 3D LF (enhanced), immobilizer, 16K Flash, 2K EEPROM
ATA5791	PEPS AVR controller with AES-128, 3D LF (enhanced), immobilizer, 315/433MHz RF transmitter, 16K Flash, 2K EEPROM
ATA5700	PEPS AVR controller with AES-128, 3D LF, 3D immobilizer, 16K/32K Flash, 1K/2K EEPROM
ATA5701	PEPS AVR controller with AES-128, 3D LF, 3D immobilizer, 16K/32K ROM, 1K/2K EEPROM
ATA5702	PEPS AVR controller with AES-128, 3D LF, 3D immobilizer, 315/433/868/915MHz, 16K/32K Flash, 1K/2K EEPROM
ATA5703	PEPS AVR controller with AES-128, 3D LF, 3D immobilizer, 315/433/868/915MHz, 16K/32K ROM, 1K/2K EEPROM

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Remote Keyless Entry (with Immo)

Vehicle

Keyfob

ATA577xC / ATA5795C
Ultra Low power AVR With TX for 315/433/ 868/915 MHz

Remote Control

RF Data →

ATA5724C
Smart RF Receiver → **AVR**

Transponder

ATA5580
Ultra Low power AVR With LF Immobilizer AES Crypto

Immobilizer

← **Energy / Data**

Data →

Immo
LF Basestation
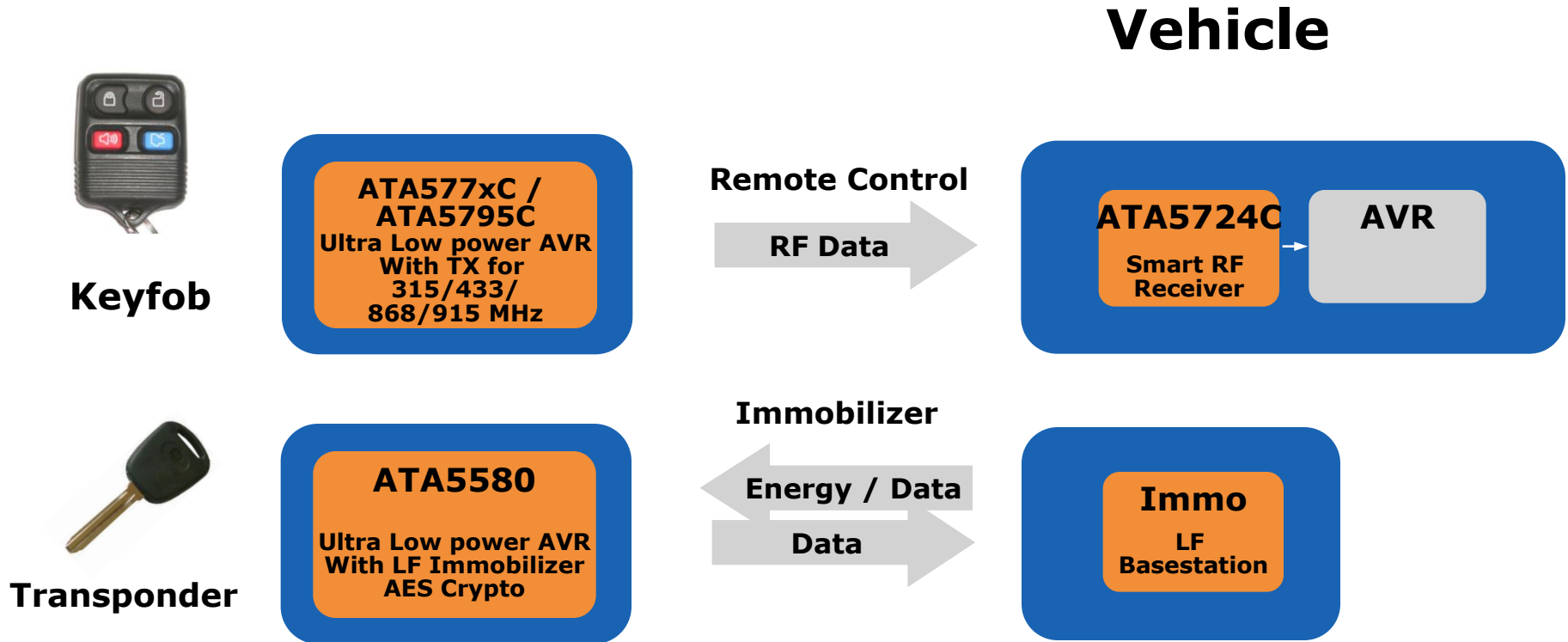
Two different ICs for Keyfob and Transponder allows a cost optimized approach on the key side

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Transmitter with AVR µC: ATA577xC

Remote Keyless Entry: key

Key characteristics

- Highly integrated micro-transmitter based on AVR® microcontroller
- Highly integrated with low external BOM
- Limited software design effort required

Key features

- 4kbytes Flash, in-system programmable
- Perfect current consumption due to optimized AVR microcontroller
- Wake-up interrupt for all I/Os
- Small package and low external component count allows small board design
- Integrated temperature sensor
- 10-bit ADC, brown-out detection
- ESD protection: 2kV HBM
- Temperature range - 40° C to +85° C

Package:	**QFN24, 5x5mm**
Samples available:	**now**
PPAP available:	**now**

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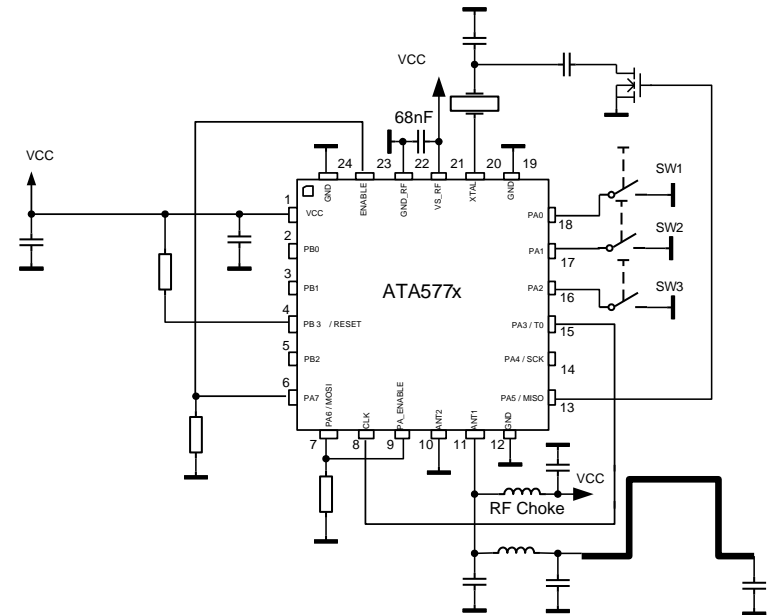
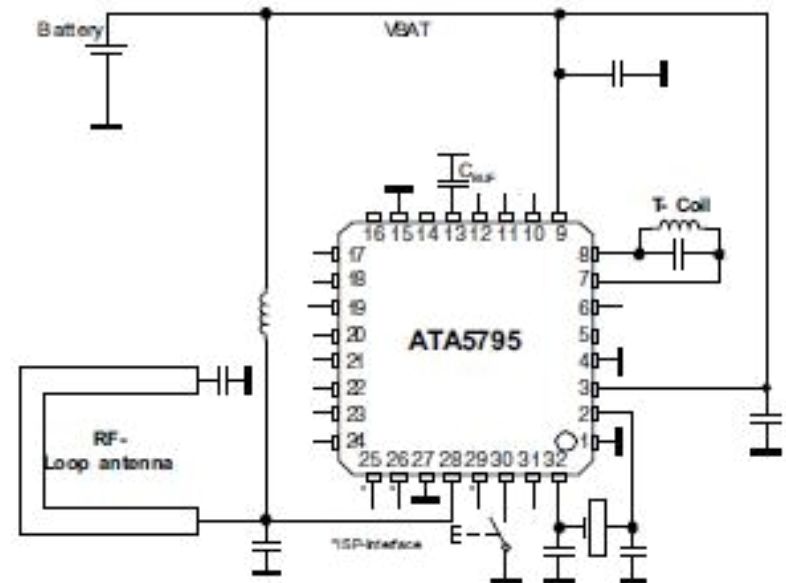# Single Chip LF + RF with µC: ATA5795C

Remote Keyless Entry: key

Key characteristics

- RKE low-power AVR® with immobilizer and RF TX
- 125kHz immobilizer interface compatible to existing base-station ICs
- 315MHz – 433MHz Fractional-N RF TX with 12.5dBm Pout
- Fast AES hardware crypto engine for both RF and LF
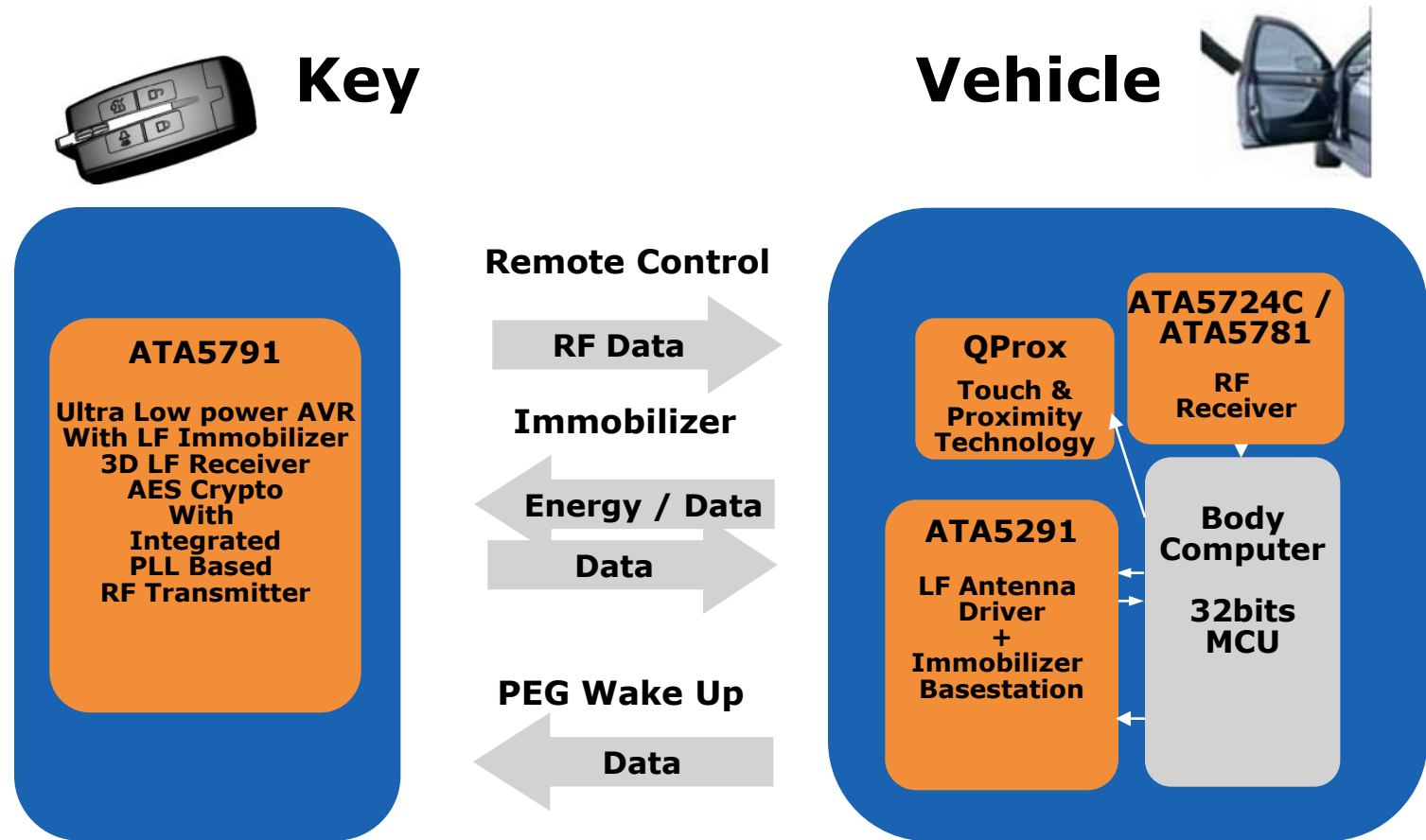- CMMI-certified immobilizer stack

Key features

- AES is basis for open-source immobilizer software library
- Highest security level for encryption (128bit)
- Special memory protection secures immobilizer software
- High power TX allows extended coverage

- Easy software design with existing AVR tool set
  - Low-power effective AVR microcontroller
  - 6kB Flash for customer software available

- Small package and low external component count allows small board design
- 1.9V to 3.6V supply voltage

Package:	**QFN32, 5x5mm**
Samples available:	**now**
PPAP available:	**now**

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Passive Entry Go - Unidirectional

Key

ATA5791

**Ultra Low power AVR
With LF Immobilizer
3D LF Receiver
AES Crypto
With
Integrated
PLL Based
RF Transmitter**

Vehicle

Remote Control

RF Data →

Immobilizer

← **Energy / Data**

Data →

PEG Wake Up

← **Data**

QProx
Touch & Proximity Technology

ATA5724C / ATA5781
RF Receiver

ATA5291
LF Antenna Driver + Immobilizer Basestation

Body Computer
32bits MCU

- Single chip PEPS Keyfob solution

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Passive Entry / Go – Bidirectional RF

Key

ATA5831

Smart RF Transceiver

↕

ATA5790N
Ultra Low power AVR
With LF Immobilizer
3D LF Receiver
AES Crypto

Vehicle

ATA5831

Smart RF Transceiver → **AVR**

↕

ATA5291

LF Antenna Driver + Immobilizer Basestation

Body Computer

32bits MCU

QProx

Touch & Proximity Technology

Remote Control
RF Data

Immobilizer
Energy / Data
Data

PEG Wake Up
Data
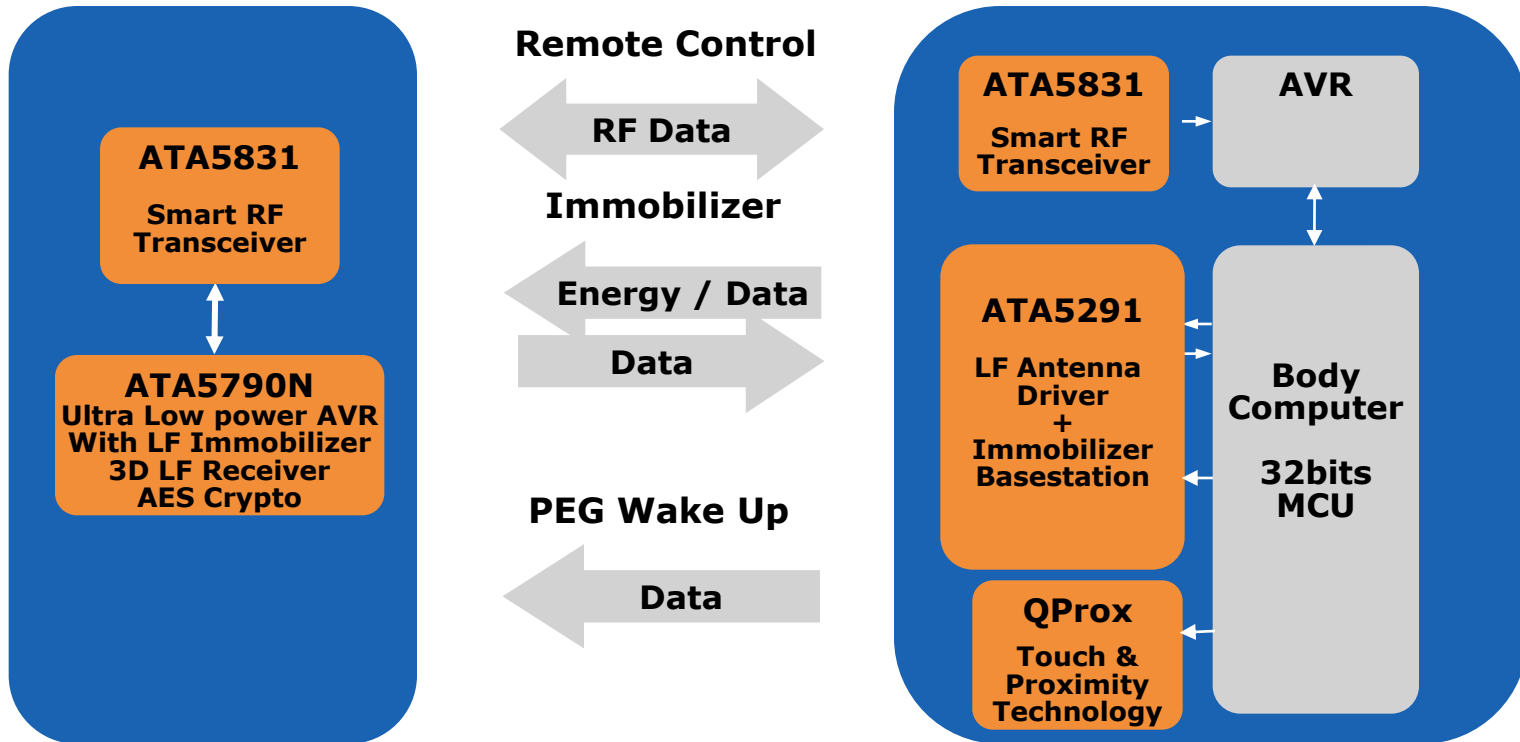
- Complete PEPS solution with Atmel chipset, including capacitive sensing

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Microcontroller with Immobilizer, 3D LF and RF Transmitter: ATA5791

Passive Entry Go: key

Key characteristics

- Low-power AVR® with immobilizer and 3D LF
- 125kHz immobilizer interface
- 3D LF receiver with RSSI: 1.5mVpp worst case
- Current consumption in listening mode ~ 4µA
- 300 to 450MHz RF Transmitter up to 12.5dBm
- Fast AES hardware crypto engine

Key features

- AES is basis for open-source immobilizer SW library and comes along with integrated fast AES encryption engine
  - 32-bit unique identification number
  - Two 128-bit secret keys, one 128-bit transponder key
- Highest security level for encryption (128bit)
- Special memory protection secures immobilizer software
- Highly sensitive 3D LF RSSI measurement allows fast wake-up
- Tolerance compensation for 3D RSSI measurement
- Easy software design with existing AVR tool set
  - Low-power, effective AVR microcontroller
  - 14kB Flash for customer software available
- Frac-N RF Transmitter (300MHz – 450MHz) up to 12.5dBm
- 1.9V to 4.2V supply voltage
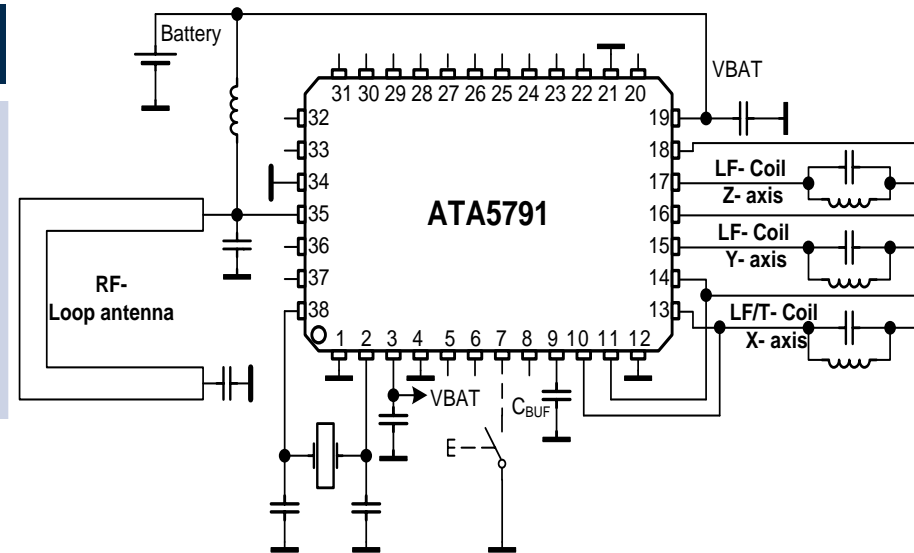
- **Package:** QFN38 5x7mm
- **Samples available:** Now
- **PPAP available:** Now

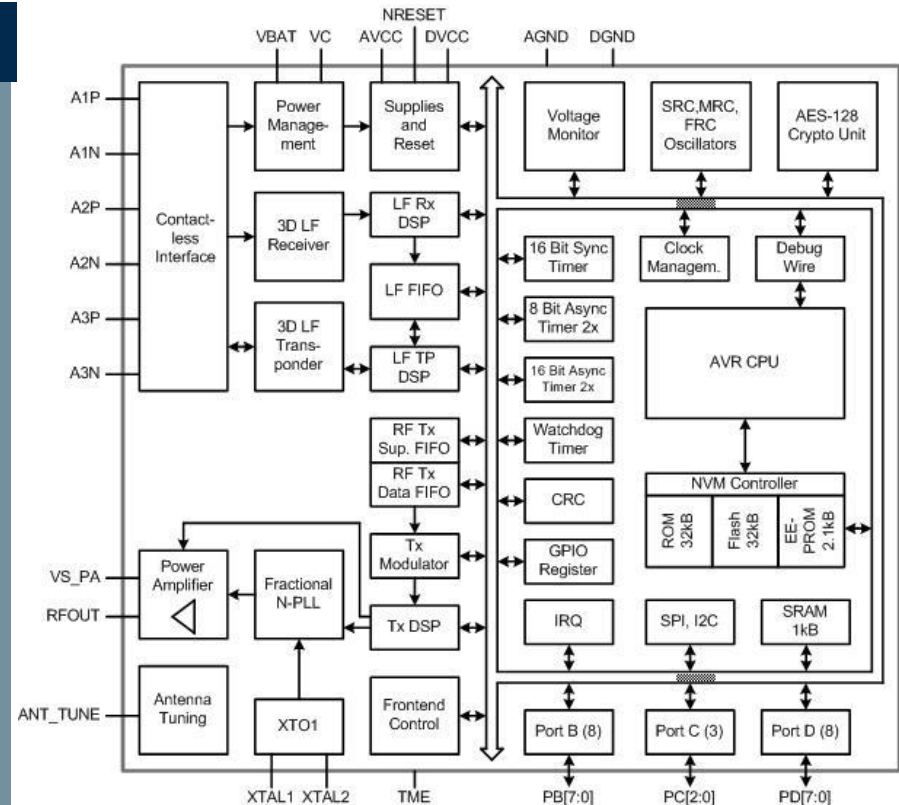Atmel

ATA5702 – 3rd Gen PEPS KeyFob with 3D Immobilizer
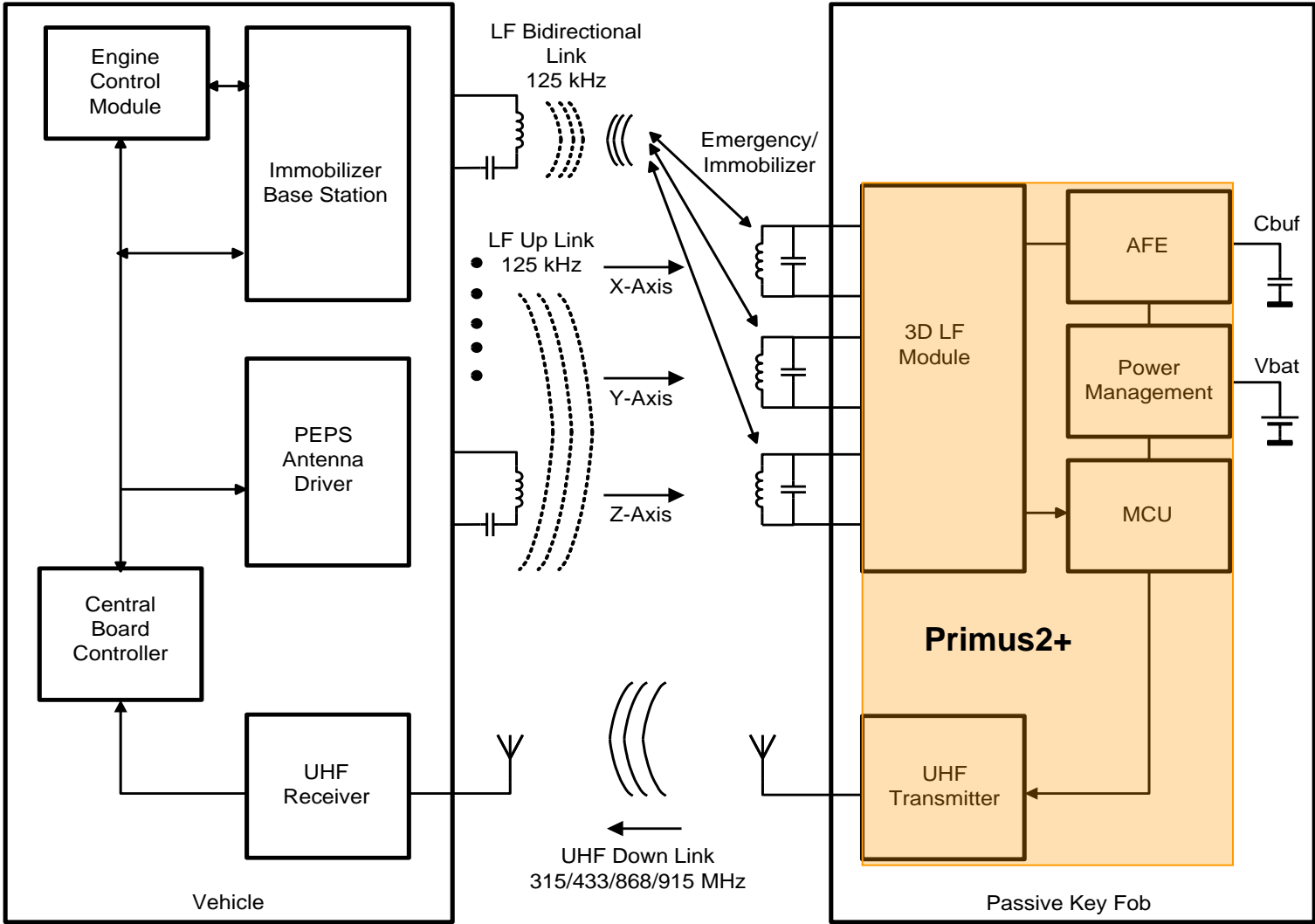
ATA5702 – One chip PEPS Keyfob

2nd Generation Key Fob uC with AES-128, 3D IMMO & RF TX

RKE + PEPS + IMMO: Key

Key Features

- Monolithic Immobilizer/PEPS solution with AES 128
- Open immobilizer Stack
- LF Interface:
  - 3D Transponder and 3D LF wake-up
  - Programmable sensitivity: $100uV_{pp}$ / $250uV_{pp}$ / $500uV_{pp}$
  - 4.7uA current consumption at $250uV_{pp}$
  - Programmable LF bitrates: 1.95k / 3.9k / 7.8kbits/s
  - Logarithmic RSSI measurement for better spatial localization
  - RSSI measurement on 3 channels simultaneously <2.4ms
  - 3D LF Battery charging capability
- AVR Core:
  - 16kB/32kB User Flash, 1/2kB EEPROM, 1kB SRAM
  - 32kB System Firmware (RF protocol handling, LF handling)
- RF Transmitter:
  - Programmable Frac-N PLL covering 310 – 318MHz, 418-477MHz, 836-956MHz in 93Hz / 185Hz steps
  - Programmable RF Output Power: -12 to 14.5dBm
  - Up to 80kBit/s Manchester coded data stream
- Controller Interfaces:
  - 19 GPIOs, SPI & I2C interfaces, Debug-wire
  - Supply voltage: 1.9V to 4.2V
  - QFN 5x7 – 38 pins

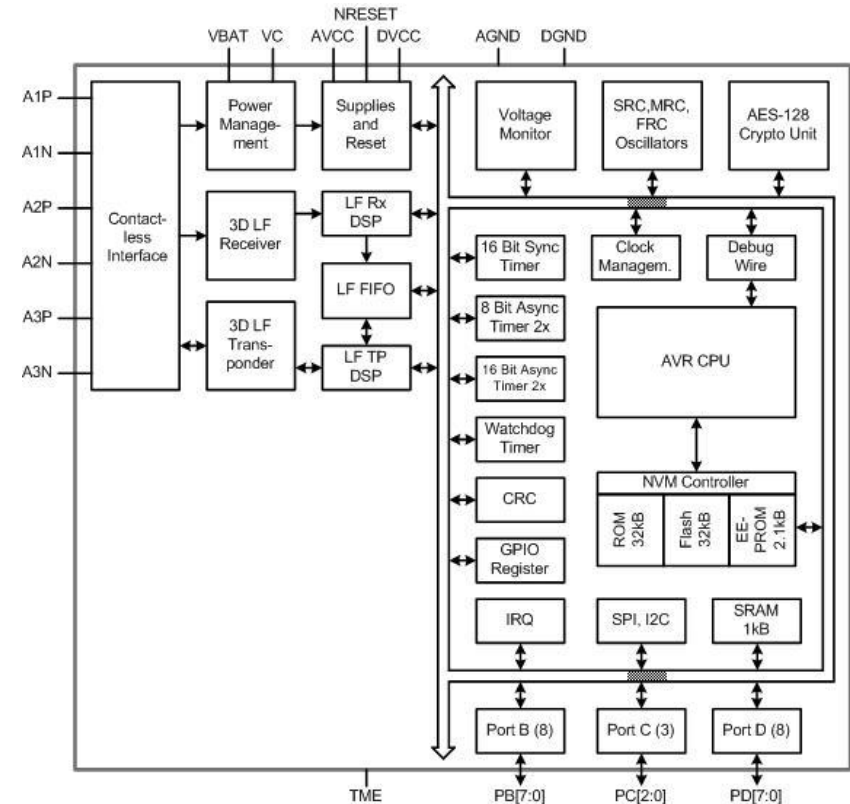| Status:	In Design
Engineering samples:	Nov 2013
Final Samples:	Jun 2014
PPAP:	Sep 2014

Atmel

ATA5700 – Primus2 (No Transmitter)

2nd Generation Key Fob uC with AES-128 & 3D IMMO

PEPS + IMMO: Key

Key Features

- Monolithic Immobilizer/PEPS solution with AES 128
- Open immobilizer Stack
- LF Interface:
  - 3D Transponder and 3D LF wake-up
  - Programmable sensitivity: $100uV_{pp}$ / $250uV_{pp}$ / $500 uV_{pp}$
  - 4.7uA current consumption at $250uV_{pp}$
  - Programmable LF bitrates: 1.95k / 3.9k / 7.8kbits/s
  - Logarithmic RSSI measurement for better spatial localization
  - RSSI measurement on 3 channels simultaneously <2.4ms
  - 3D LF Battery charging capability
- AVR Core:
  - 16kB / 32kB User Program Memory, 1/2kB EEPROM, 1kB SRAM
  - 32kB System Firmware (RF protocol handling, LF handling)
- Controller Interfaces:
- 19 GPIOs, SPI & I2C interfaces
- Debug-wire
- Supply voltage: 1.9V to 4.2V
- QFN 5x7 – 38 pins

| Status:	In Design
Engineering samples:	**Nov 2013**
Final Samples:	**Jun 2014**
PPAP:	**Sep 2014**

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Primus2plus – ATA5700

Competitive Assessment

- ✓ 3D Immobilizer , no direction base
- ✓ Best in class range detection (sensitivity - 100uVpp) vs battery lifetime (power consumption) with good out of band blocking
  - ✓ Allows approach lighting/walk away with acceptable battery lifetime
  - ✓ Possible range measurement for Convertible cars
- ✓ Fastest in/out car detection thanks to direct RSSI measurement on 3 channels simultaneously
- ✓ Best in class RF performance due to the integration of PLL based Transmitter
- ✓ Compatible with almost all Immobilizer Base-station in the market
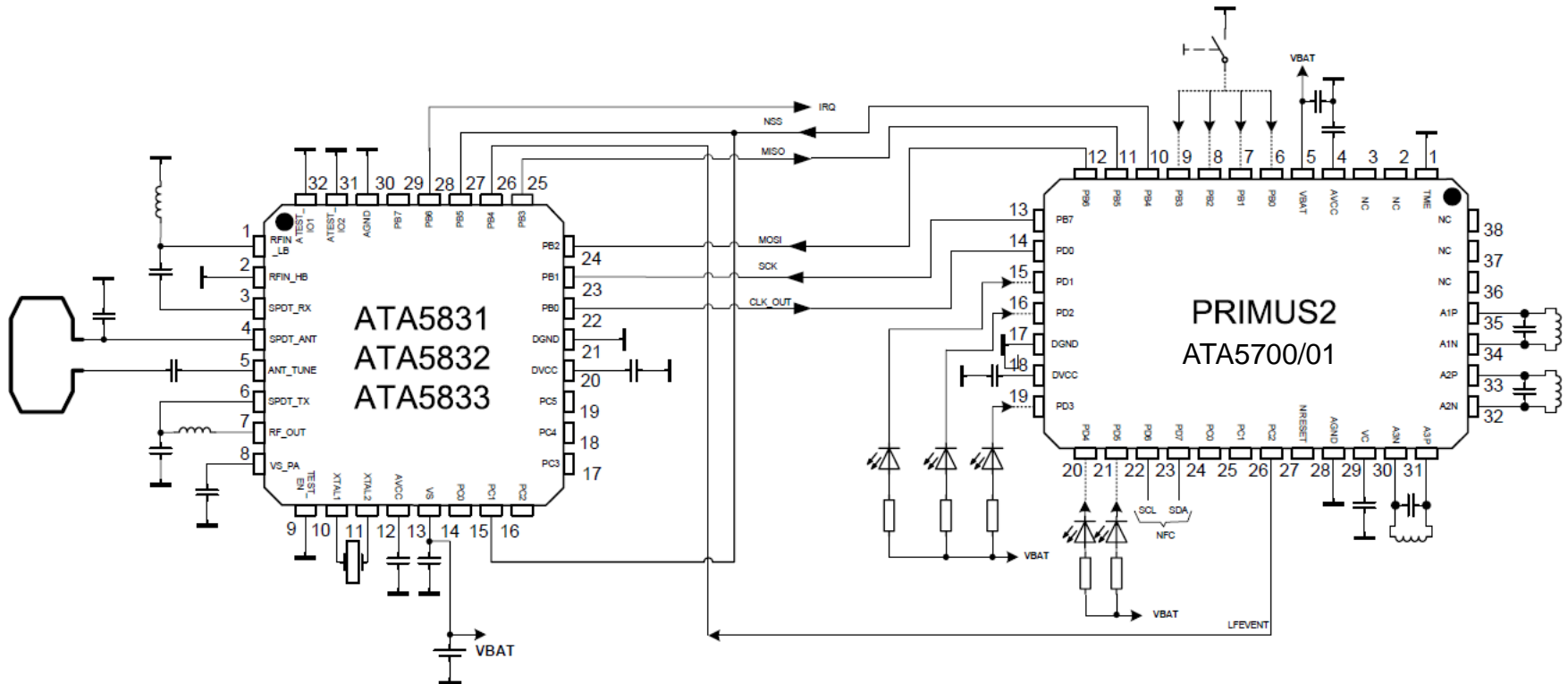- ✓ Small package to accomodate small keyfob

Atmel

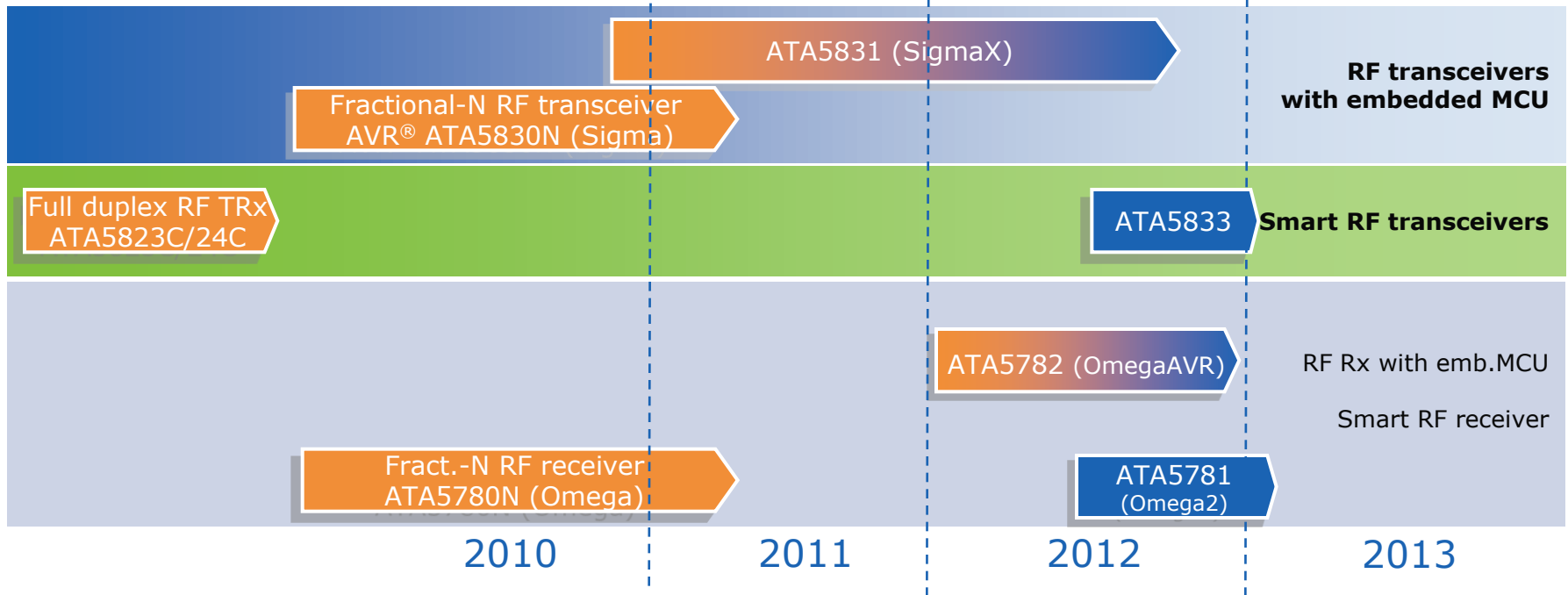## Application 3D-LF/RF-Transmitter
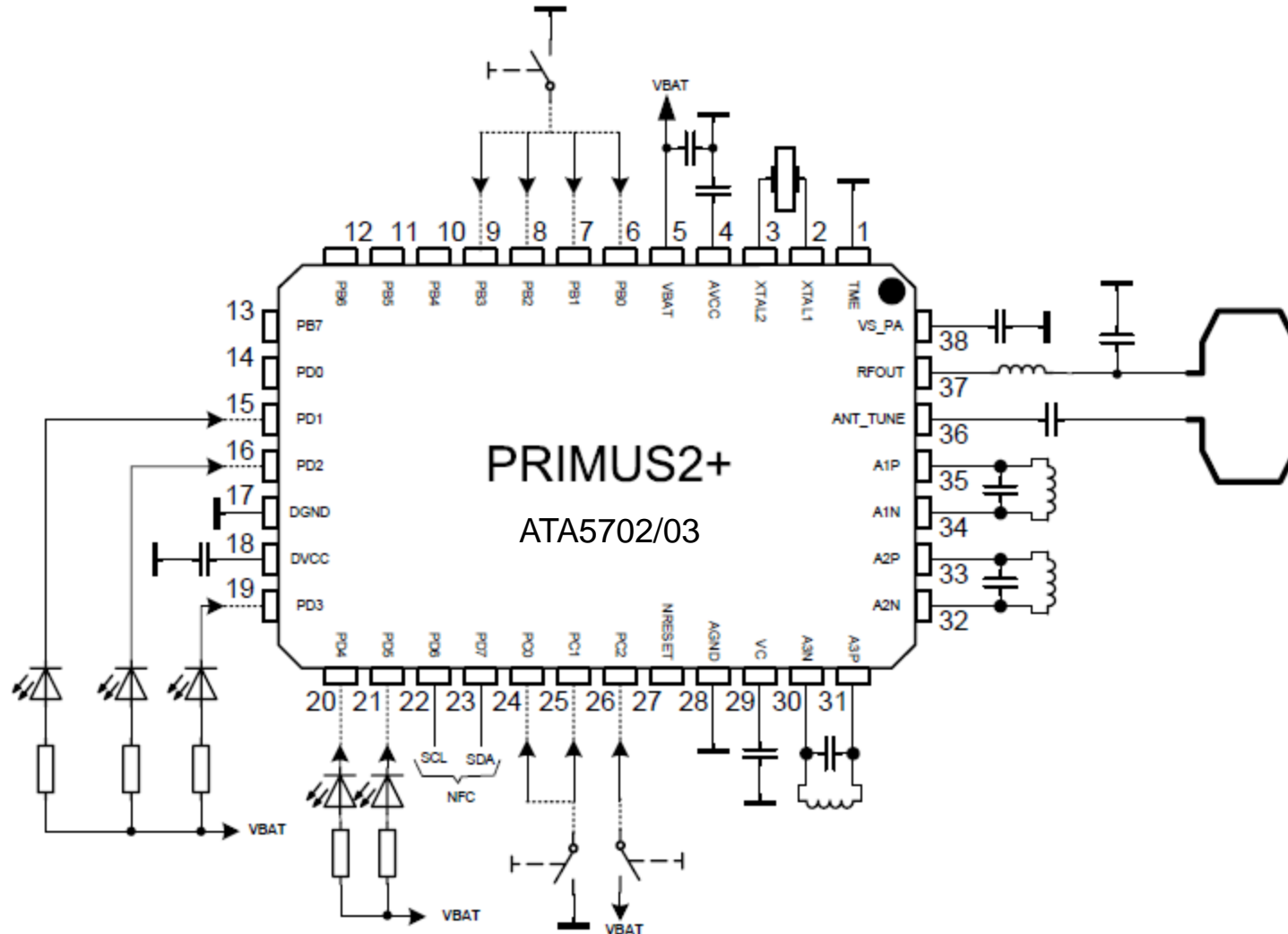
ATA5702/Primus2+

Application   3D-LF/RF-Transceiver

- LFEVENT: Trigger Signal for fast TRX wake up: < 2ms
- SPI-Builder: Library for easier SPI communication between Primus2 and TRX
- Crystal clock from TRX

RF Roadmap

Part Number	Frequencies	Description
ATA5823C	315MHz	Full duplex RF transceiver
ATA5824C	433/868MHz	Full duplex RF transceiver
ATA5830N	315/433/868–915MHz	RF transceiver AVR® microcontroller – 6KByte user Flash
ATA5831	315/433/868–950MHz	RF transceiver AVR microcontroller – 20KByte user Flash
ATA5833	315/433/868–950MHz	Fractional-N smart RF transceiver for key fobs
ATA5780N	315/433/868–915MHz	Fractional-N smart RF receiver
ATA5781	315/433/868–950MHz	2nd-generation Fractional-N smart receiver
ATA5782	315/433/868–950MHz	RF receiver AVR microcontroller – 20KByte user Flash

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Sigma (TrX) & Omega (Rx) Family Roadmap

	ATA5830N	ATA5780N	ATA5831		ATA5781	ATA5782
Flash (KB)	6	—	20		—	20
User ROM (KB)	—	—	—	20	—	—
RF Transmitter	✓	—	✓		—	—
Independent Services	3	3	5	5	5	5
Enhanced RF switch time	—	—	✓		✓	✓
Enhanced sensitivity	—	—	✓		✓	✓

Transceiver

Receiver

Common Features	Best in class Blocking RF Receiver	24kB ROM RF Library	Package & pin compatible

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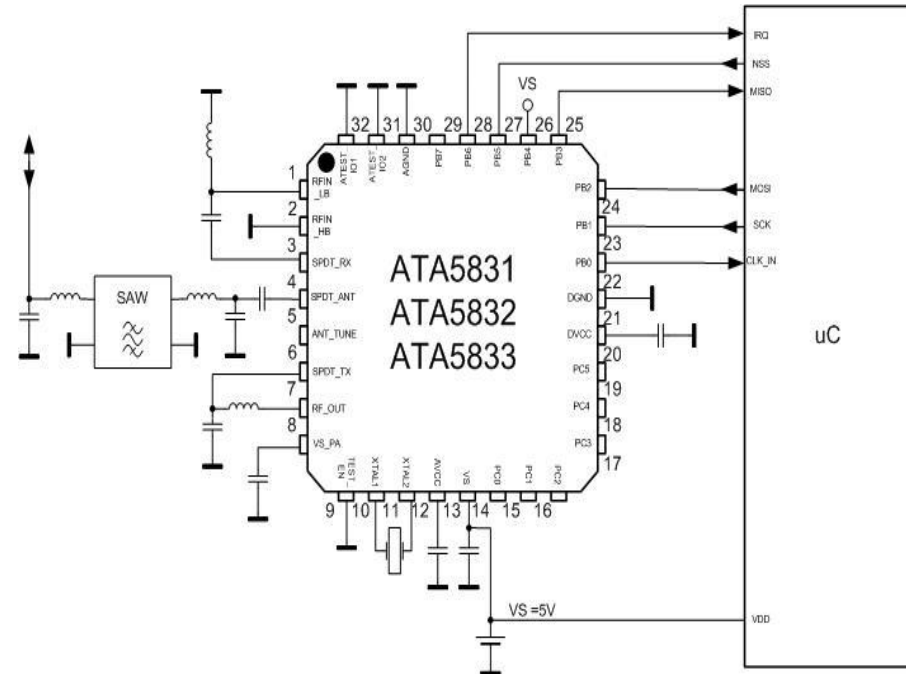
Advanced RF TRX: ATA5831

RKE / PEG & TPMS RF Transceiver

Key Characteristics

- UHF Transceiver AVR with Excellent RF Performance
- Pin, package & Software Compatible with ATA578x family (Rx)
- One Device & Crystal Covers All Frequencies
- Integrated RF Switch
- ATA5831@20 KB user Flash, ATA5832@20KB user ROM and ATA5833 @no user ROM(+24 kB ROM firmware lib. For all versions)
- Autonomous operation possible

Key Features

- **UHF transceiver with excellent RF performance**
- **ASK Sensitivity (Manchester) at 433.92MHz:**
  - -109dBm @ 20kBit/s   IFBW=366 kHz
  - -119dBm @ 1kBit/s   IFBW=366 kHz
- **FSK Sensitivity (Manchester) at 433.92MHz:**
  - -108dBm @ 20kBit/s $\Delta f=\pm20kHz$ IFBW=165 kHz
  - -114dBm @ 5kBit/s $\Delta f=\pm5kHz$ IFBW=165 kHz
  - -123dBm @ 0.75kBit/s $\Delta f=\pm0.75kHz$ IFBW=25 kHz
- **Best in Class blocking performances**
  e.g. 64 dBc@IFBW=165kHz) and 48dBc@IFBW=225kHz at Freq. Offset of 1MHz
- **High image rejection:** e.g. 55dB @ 315/433MHz; 50 dB @868.3MHz/915MHz without calibration
- **Automatic antenna tuning for loop antenna**
- **Programmable output power:** -10 to 14 dBm
- **5 independent services with 3 channels each**
- **Supply range:** 1.9V – 3.6 V; 4.5 - 5.5 V
- **Temperature range -** 40° C to +105° C

Wettable flanks package: **QFN32 5x5mm**
Samples Available: **Now**
PPAP Available: **Now**

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Advanced RF RX: ATA5781/82

RKE / PEG & TPMS RF Receiver

Key Characteristics

- UHF Receiver AVR with Excellent RF Performance
- Pin, package & Software Compatible with ATA583x family (TRX)
- One Device & Crystal Covers All Frequencies
- Integrated RF Switch
- ATA5782@20 KB user Flash, and AT5781@no user ROM(+24 kB ROM firmware lib. For all versions)
- Autonomous operation possible

Key Features

- **UHF Receiver with excellent RF performance**
- **ASK Sensitivity (Manchester) at 433.92MHz:**
  - -109dBm @ 20kBit/s   IFBW=366 kHz
  - -119dBm @ 1kBit/s   IFBW=366 kHz
- **FSK Sensitivity (Manchester) at 433.92MHz:**
  - -108dBm @ 20kBit/s $\Delta f=\pm20$kHz   IFBW=165 kHz
  - -114dBm @ 5kBit/s $\Delta f=\pm5$kHz   IFBW=165 kHz
  - -123dBm @ 0.75kBit/s $\Delta f=\pm0.75$kHz IFBW=25 kHz
- **Best in Class blocking performances**
  e.g. 64 dBc@IFBW=165kHz) and 48dBc@IFBW=225kHz at Freq. Offset= 1MHz
- **High image rejection:** e.g. 55dB @ 315/433MHz; 50 dB @868.3MHz/915MHz without calibration
- **Automatic antenna tuning for loop antenna**
- **5 independent services with 3 channels each**
- **Supply range:** 1.9V – 3.6 V; 4.5 - 5.5 V
- **Temperature range -** 40° C to +105° C
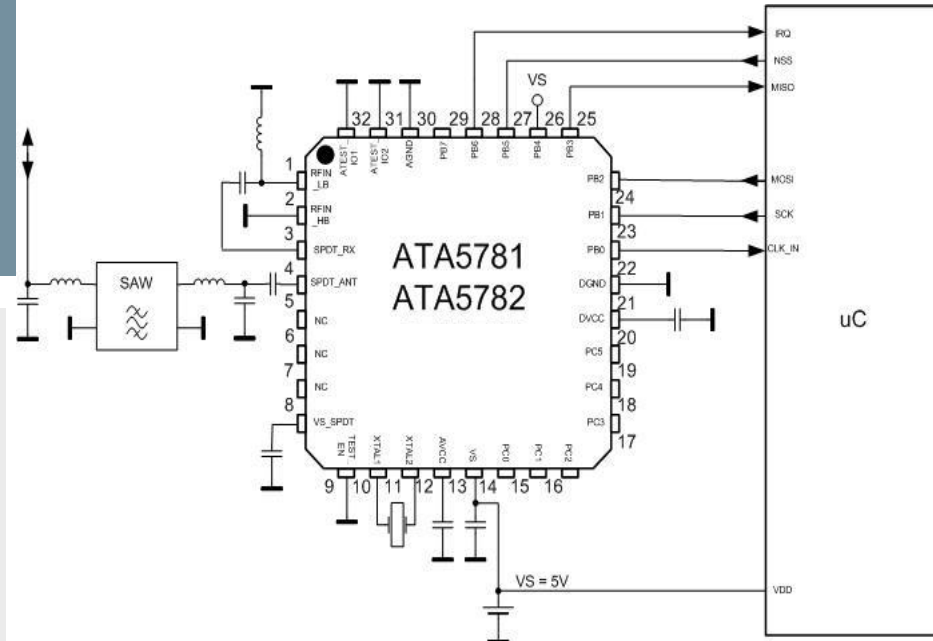
Package: Wettable flanks QFN32 5x5mm
Samples Available: Now
PPAP Available: Now

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Competitive Battery Lifetime and Blocking Behavior

Operating Mode	ATA5831	A	B	ATA5781	C
Receive 433MHz	11mA	22mA	22mA	11mA	12mA
Transmit 433MHz (10dBm)	18mA	25mA	33mA	N/A	N/A
Off (2.7V, 85C)	0.5uA	5uA	5uA	0.5uA	27uA
Multi-profile wake-up	✔	✖	✖	✔	✖

Operating Mode	ATA5831	A	B	ATA5781	C
Blocking (typical)	62dBc	40dBc	40–50dBc	62dBc	tbd
Image rejection (typical)	55dBc	45dBc ①	31dBc ②	55dBc	40dBc ③

1 ... Requires calibration

2 ... Narrower channel selcted

3 ... 10.7MHz IF filter

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LF Base-station Roadmap

Immobilizer base station

ATA5291
LF driver + immobilizer

LF drivers

ATA5279C 6-fold antenna driver for PEG (Adrima)

2010   2011   2012   2013

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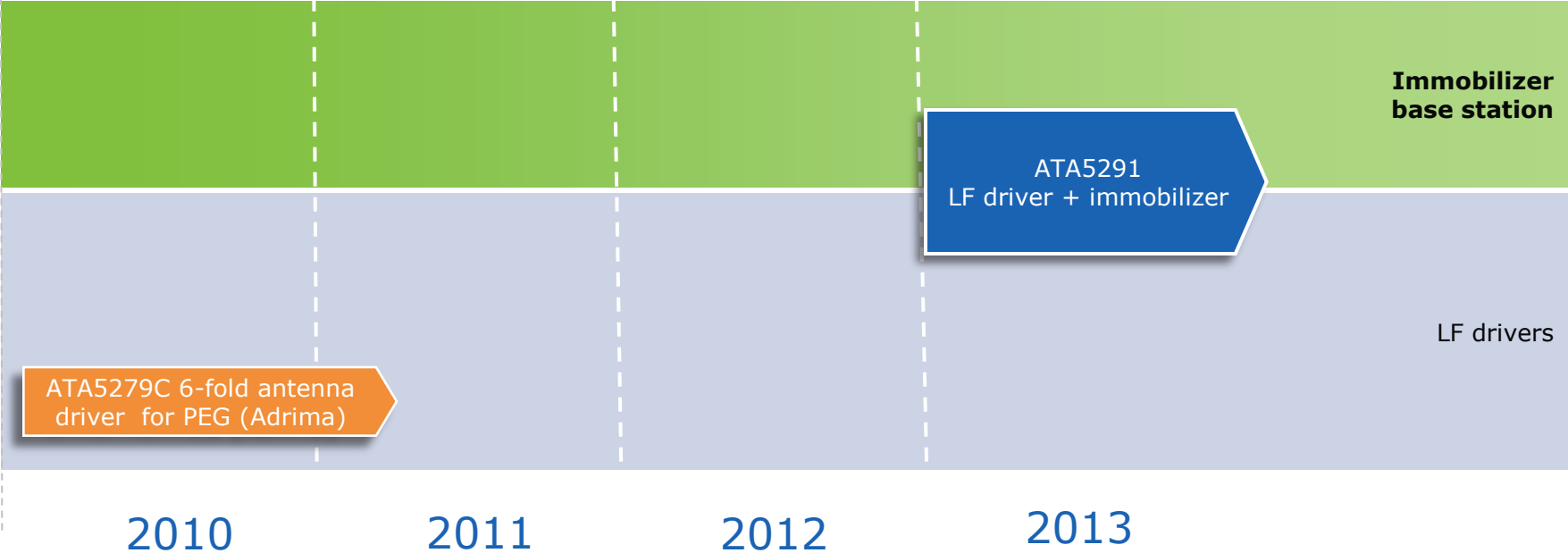
# 6-channel LF Antenna Driver: ATA5279C

Passive Entry Go: car side

Key characteristics

- 6-channel antenna driver for 125kHz LF coils
- Capability to drive high currents (up to 1A for 3 channels)
- Very low power-down current consumption
- Provides high performance with easy control
- Provides a wake-up and initialized channel to the key fob
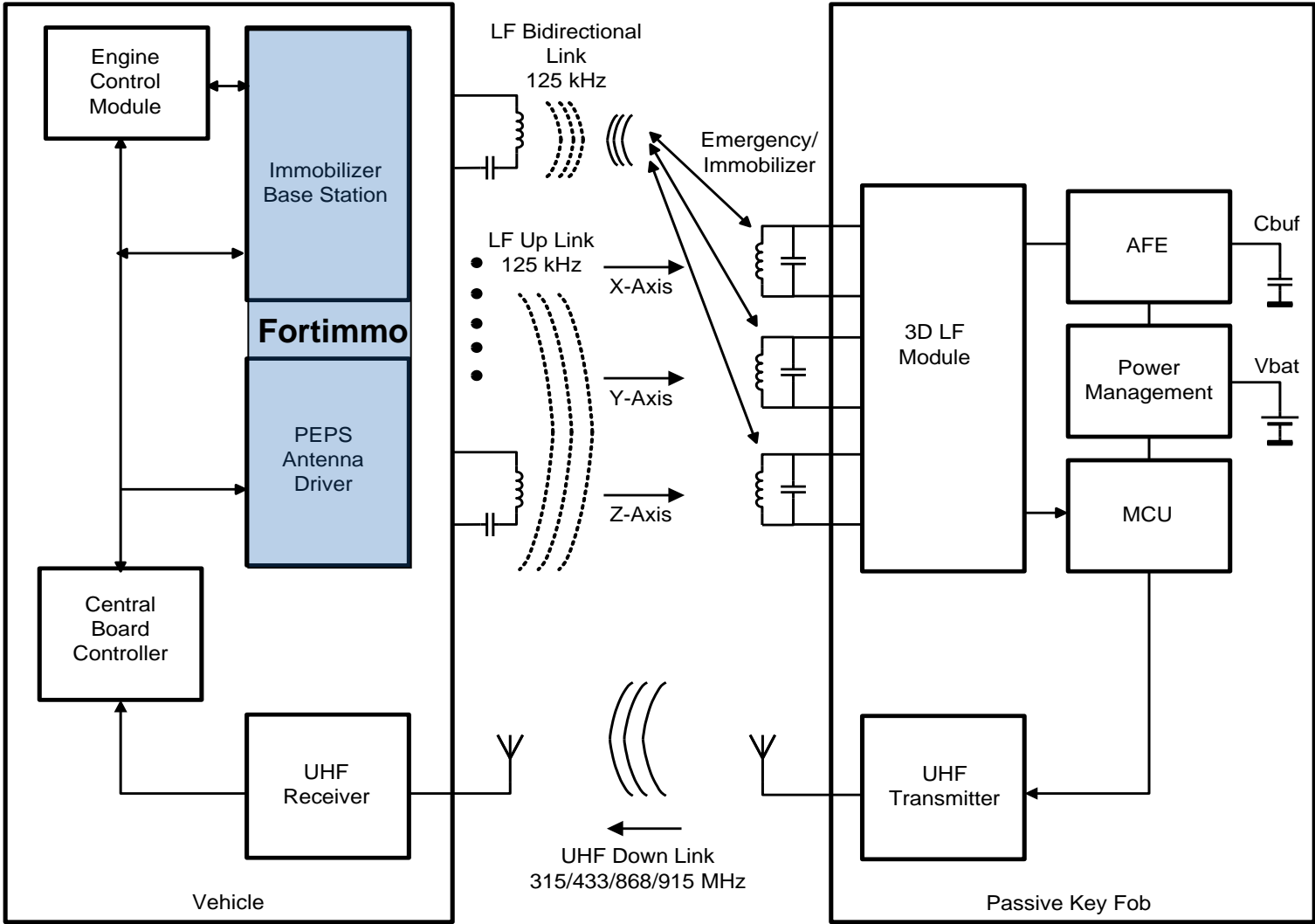- Output driver stage protected against overload and heat

Key features

- Flexible current regulation integrated (20 steps)
- Autonomous timing generation to unload microcontroller
- RSSI measurement supported
- Fault protection and reporting
- Diagnostic mode for antenna check
- Reduced effort for external HOST controller due to:
    - SPI interface for communication and programming
    - Embedded command set (LF data buffer)
    - Low level control
- Cost effective due to low external BOM
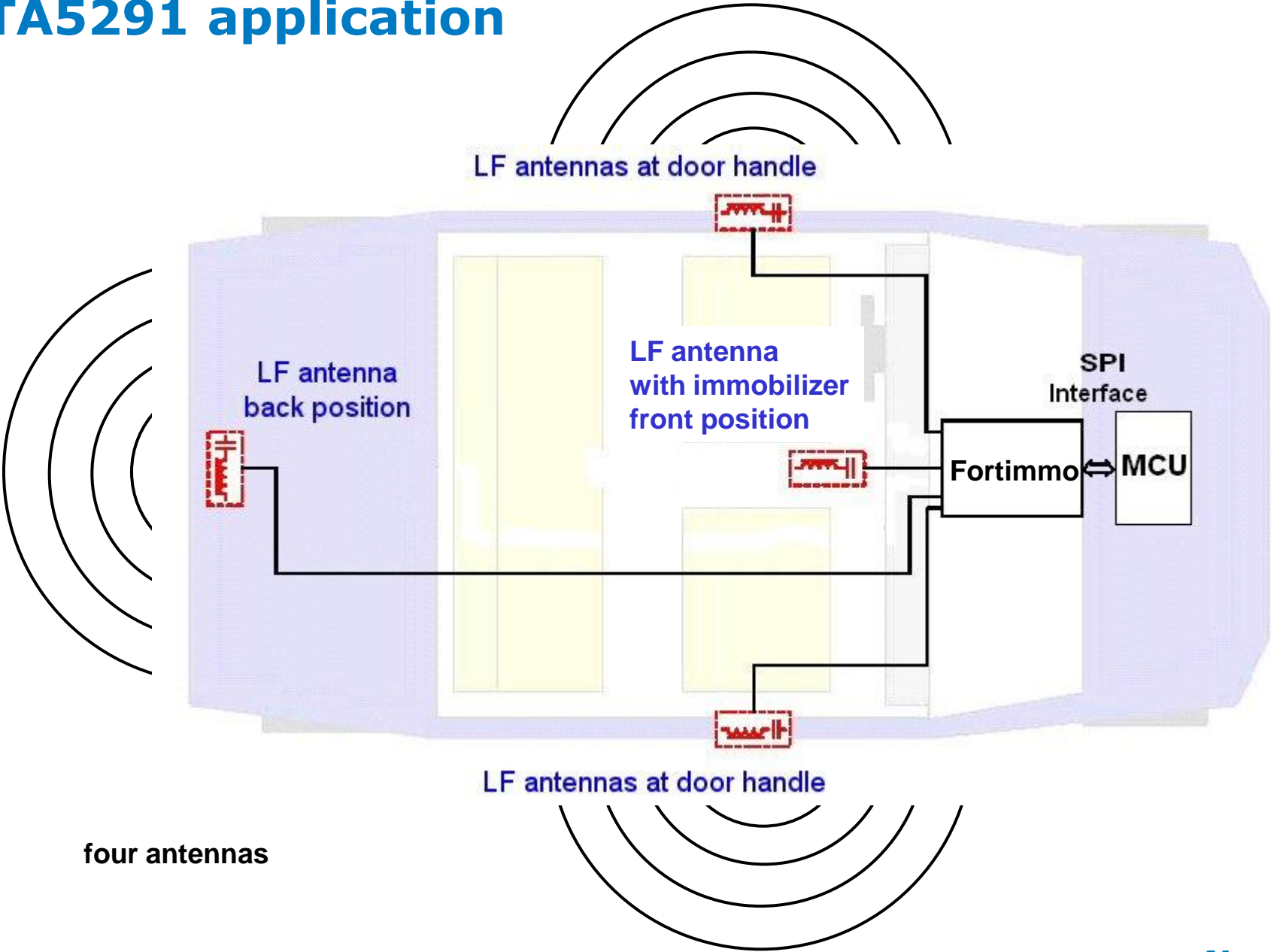- Sinusoidal output signal for improved EMV
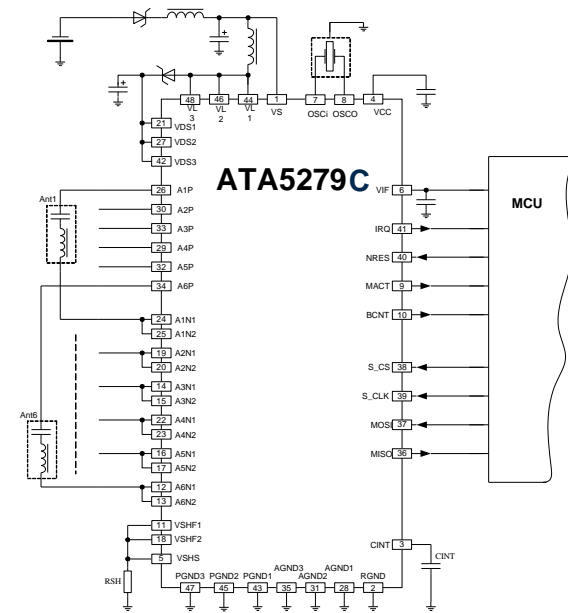
ATA5279C

- **Package:** QFN48, 7x7mm
- **Samples available:** now
- **PPAP available:** available

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ATA5291 – LF Driver with Immo Basestation

ATA5291 application

LF antennas at door handle

LF antenna back position

LF antenna with immobilizer front position

SPI Interface

Fortimmo ⇔ MCU

LF antennas at door handle

four antennas

29

Key Features of LF PEG Products

	ATA5279C	ATA5291
Transmit Channels (Expandable)	6 (9)	4 (8)
Current Shaping	Sinus	Prog. Shaping
Immo Base-Station	—	✓
Integrated Boost Converter	✓	✓
Polling	—	✓

Atmel

ATA5291 – Fortimmo

- ## PEPS Coil Driver & Immobilizer Basestation

PEPS + IMMO: Vehicle

Key Characteristics

- Derived from the market leading IC ATA5279C
- Highly integrated solution (Base-station + LF drivers)
- Regulated current for stable RSSI measurement
- 1 coil mulitplexed for Immo/wakeup function (immo coil can also be separated)
- Compatible with nearly all transponders in the market
- Full diagnostics coverage provides highest safety level

Key Features

- Internal LC Oscillator for carrier generation (+/-0.3%)
- Immobilizer sensitivity of 5mVpp at the tap point
- Wide 7-16.5V operating supply for normal operation
- Jump Start from 7V-28V & Immobilizer down to 5V
- Fast 2Mbit/s SPI interface
- 4 integrated LF drivers with programmable peak current up to 1A adjustable in 20 steps
- Integrated coil multiplexer (4 internal, 4 external) with the ability to drive any of 2 coils together
- Full diagnostic coverage for all channels: Short to GND, VCC and other coil lines. Open detection.
- Programmable carrier shaping (square wave, progressive transitions, sinus)
- Operating temperature:-40° C/125° C

| Package: | QFN48 7x7mm |
| Samples Available: | MAY 2013 |
| PPAP Available: | 2Q2014 |

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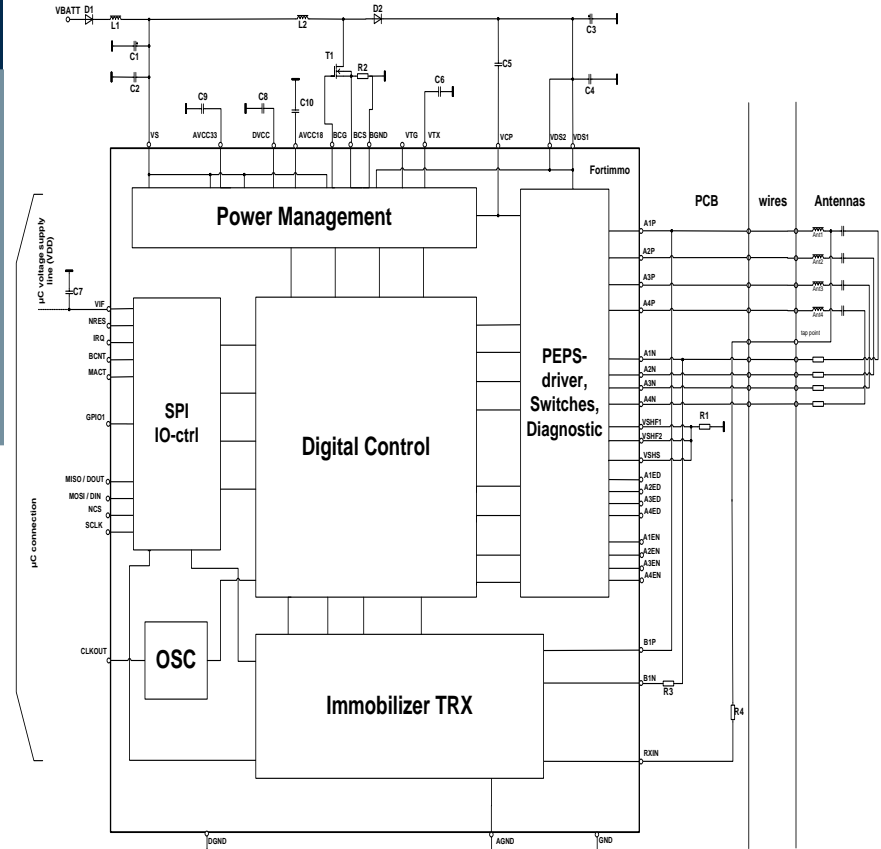
Fortimmo – General Features

- LF carrier frequency from 125 kHz

- Internal LC Oscillator for carrier generation (+/-0.5%)

- Battery power supply voltage from 7V to 16.5V for normal operation, from 7V to 28V for jump start operation and 5V is the minimum required for Immobilizer operation

- Fast SPI interface (2Mbit/s) for Data Access and Configuration, slave select input, multiplex SPI-data with transparent data-in data-out pins

- Ability to support antennas with tuning capacitor far or close to the IC while keeping all diagnostic capabilities.

- Diagnostic functions for electrical and thermal stress conditions

- Output driver stages are protected against electrical and thermal overload

- QFN 7x7-48 with wettable flanks - Operating temperature: -40° C / 125° C

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FortImmo application with four coils
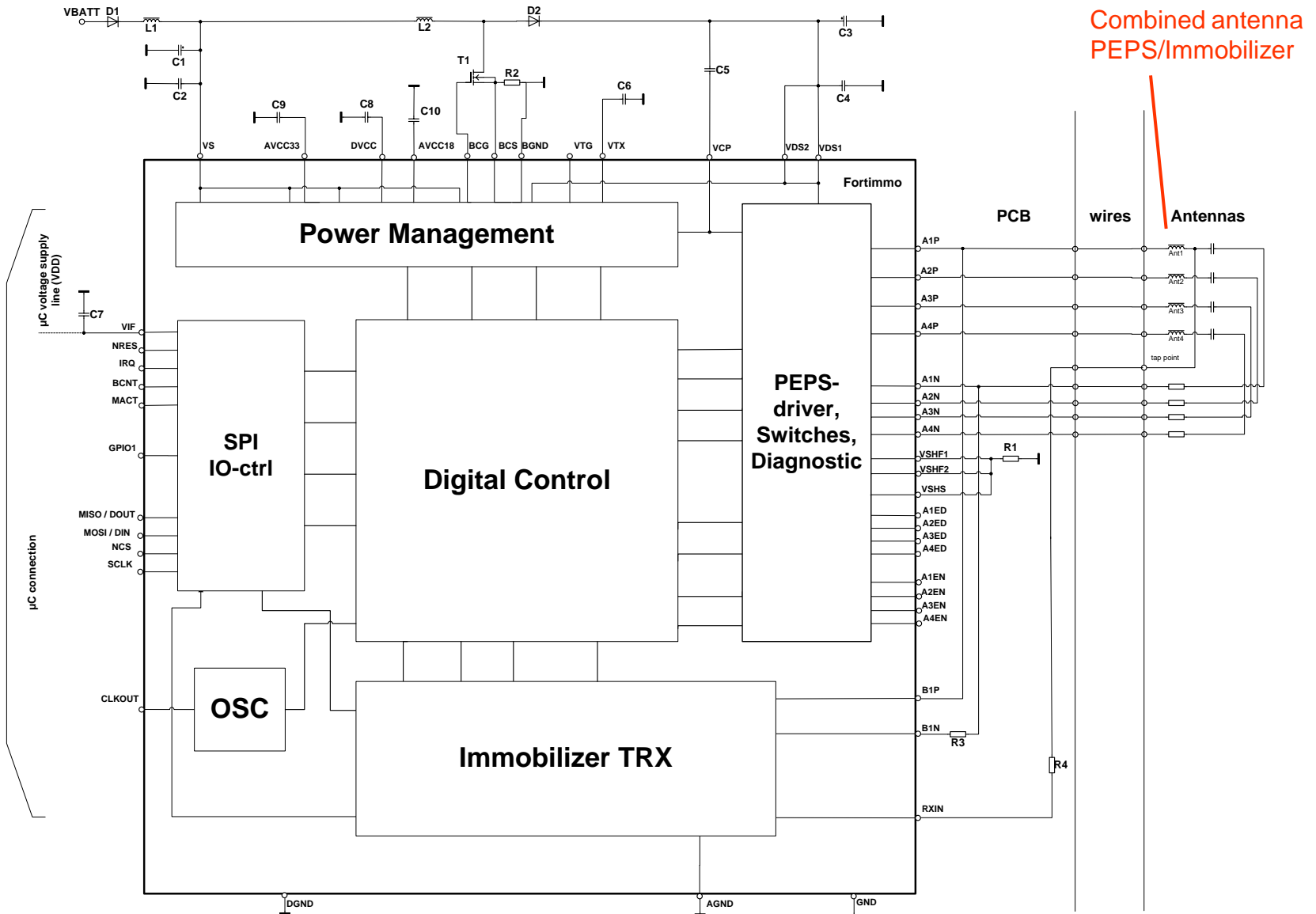
FortImmo application with eight coils
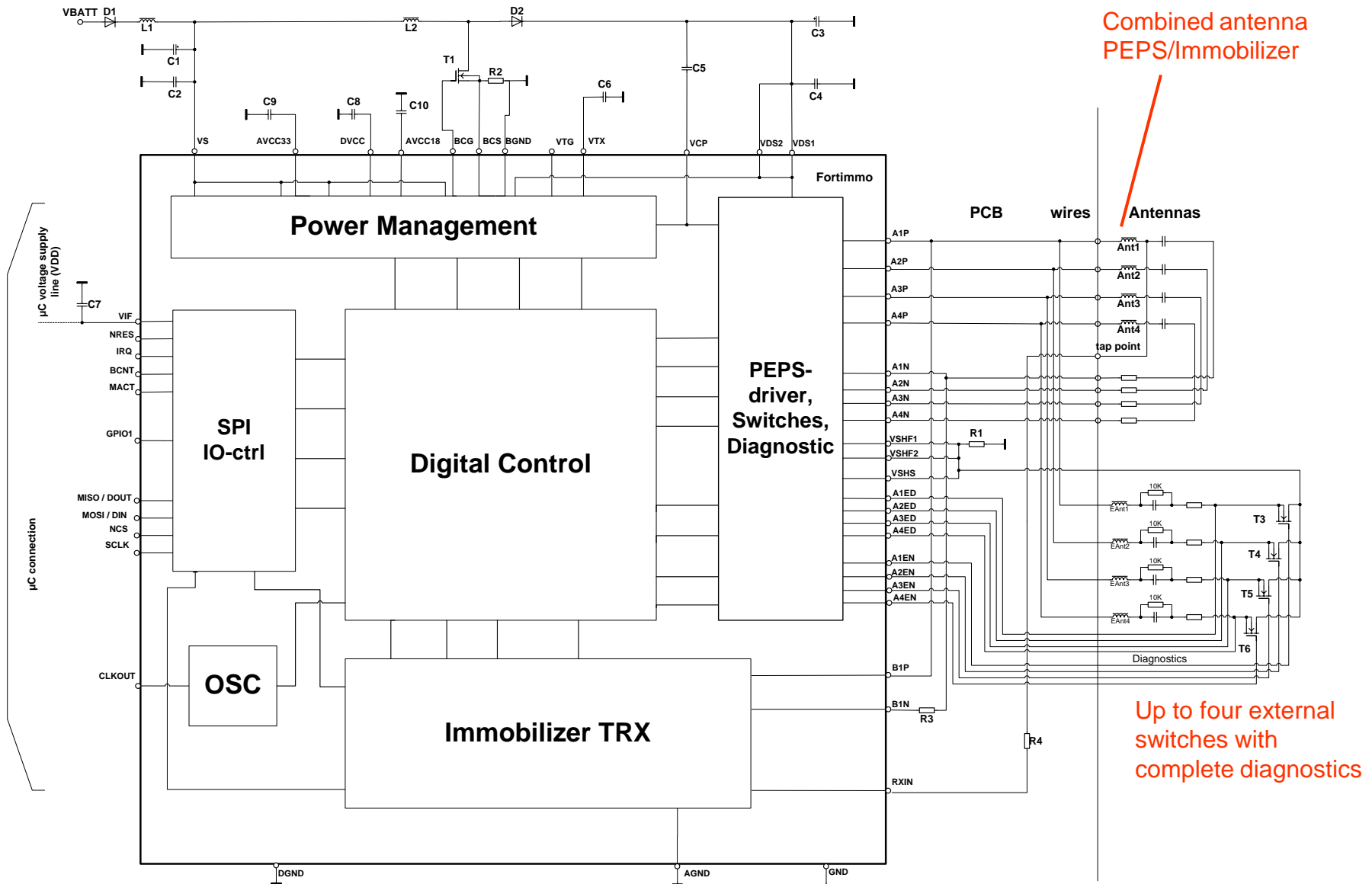
Companion Transponder Solution: ATA5580

Remote Keyless Entry: service key

Key characteristics

- Stand-alone transponder based on 128bit AES
- Embedded 125kHz antenna
- Atmel open-immobilizer protocol incorporated
- 125kHz immobilizer interface compatible to existing base-station ICs
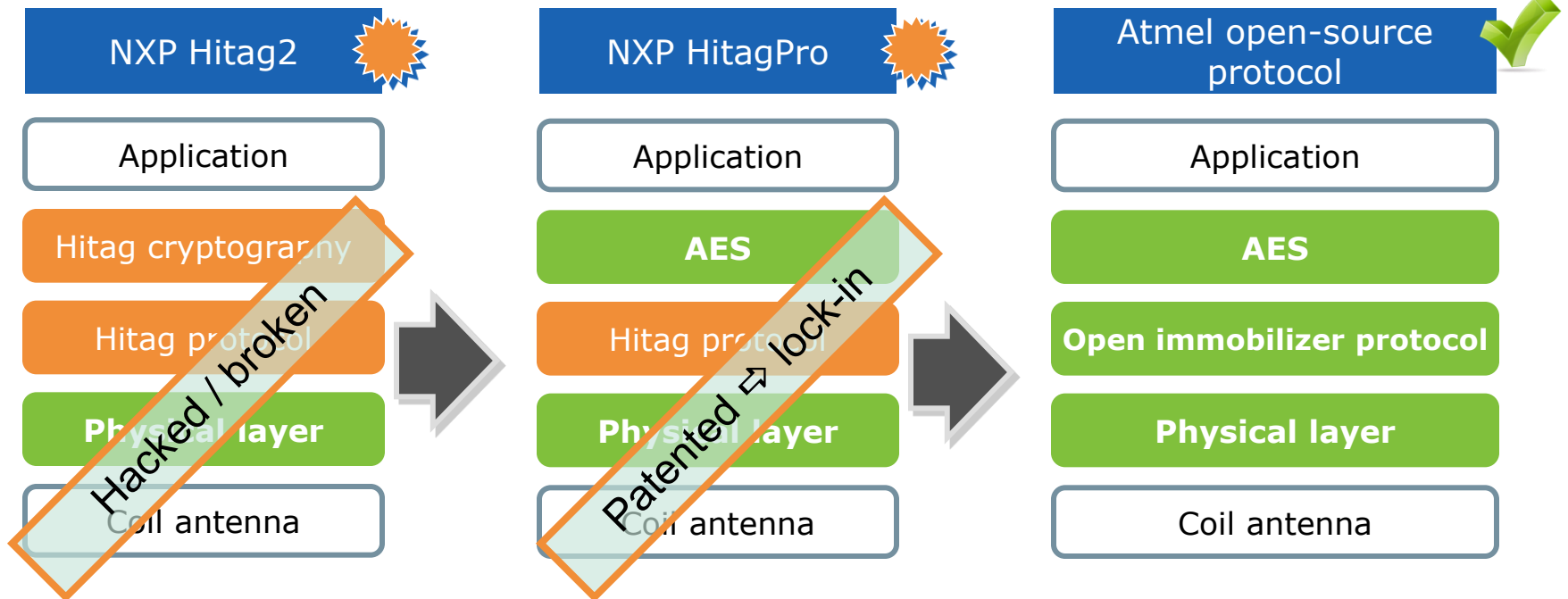- Fast AES hardware crypto engine

Key features

- Best companion solution to ATA5795 as the same microcontroller IC is equipped
- Pre-programmed during production process with Atmel's open-source immobilizer protocol
  - AES is basis for open-source immobilizer software library
  - Highest security level for encryption (128bit)
  - Special memory protection secures immobilizer software
- Coupling factor of 1.5
- Same immobilizer approach as in other Atmel ICs
  - ATR5790N (uni- and bi-directional RF)
  - ATR5795 (uni-directional RF)

TrAESure/ 6x12mm

Ferrite Antenna

ATMegaPA 3,4x3,4mm

ATmegaPA
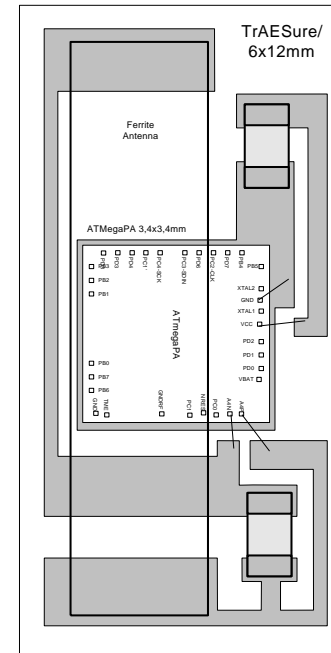
Transponder package: 3x6x12mm
Samples available: now
PPAP available: now

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AES Cipher & Open-source Immobilizer Stack

NXP Hitag2

Application

Hitag cryptography

Hitag protocol

Physical layer

Coil antenna

Hacked / broken

NXP HitagPro

Application

AES

Hitag protocol

Physical layer

Coil antenna

Patented ⇨ lock-in

Atmel open-source protocol

Application

AES

Open immobilizer protocol

Physical layer

Coil antenna

Download the open immobilizer protocol stack here:
http://www.atmel.com/dyn/products/tools_card.asp?tool_id=17197

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Benefits

- Higher security through peer reviewing of protocol design

- Allows mixing LF ICs from different suppliers

- Allows multi-sourcing of immobilizer devices

- Flexible configuration according to customer requirements

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Open Immobilizer Stack

Immobilizer / RKE / PEG: car & key

Key characteristics

- Complete open immobilizer solution
- CMMI certified
- Fast, secure and configurable
  - AES-128 crypto engine with 3 separate keys
  - Configurable uni- and bi-lateral authentification
  - Advanced retry strategy

Key features

- Software runs in all Atmel car access AVR® ICs
- With Atmel ICs a low coupling factor of <1% can be reached
- Compatible with already existing base-station solutions
- Two 128-bit keys stored in protected EEPROM
- One 128-bit transport key
- 32-bit unique identifier
- Configurable challenge/response length (32 – 128 bit)
- Optional CRC on all communication frames
- With enable CRC advanced retry strategy available
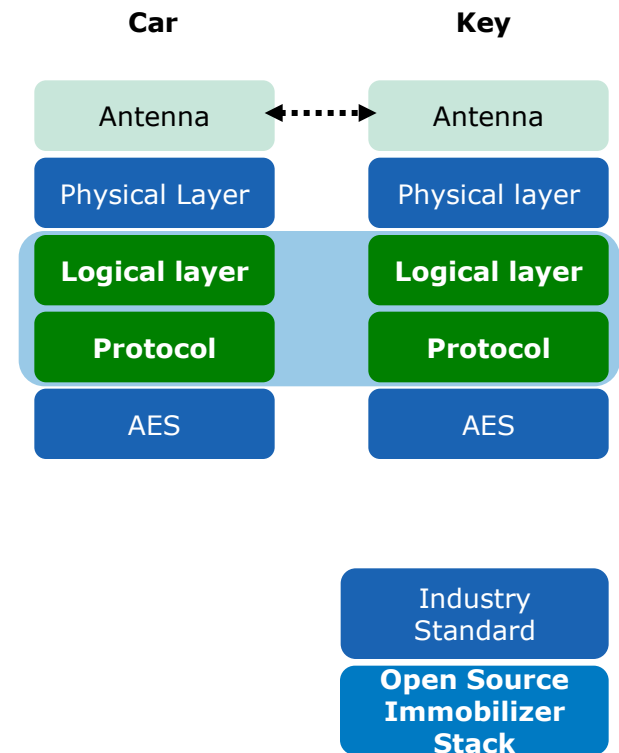- 64-byte configuration stored in EEPROM
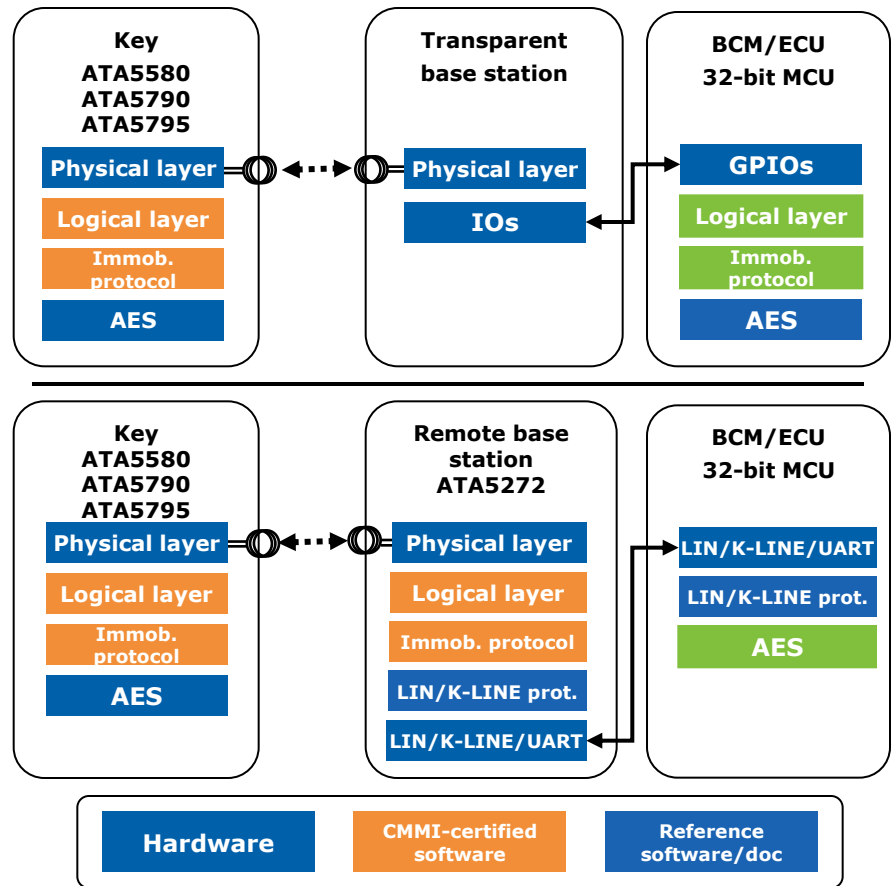
- **CMMI-certified package & doc:** now
- **LIN/K-line protocol example:** now

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Open Source Immobilizer Stack

The industry's only fully auditable, immobilizer system!

- Protocol layer definition based on third-party audit firm specializing in Automotive Security, Escrypt GmbH

- Definition reviewed and amended by Tier1 suppliers and Car Manufacturers

- Open Source license allows any party to enhance or review the protocol for the industry's benefit

- Allows interoperability of existing Immobilizer ICs (protocol is implemented in software)
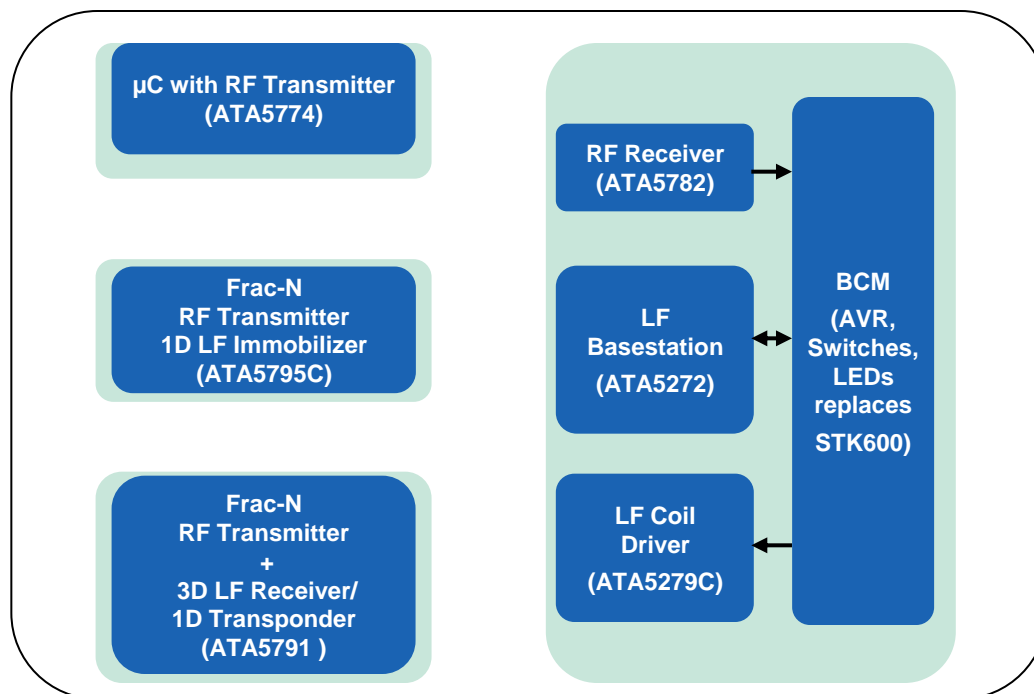
- Available upon free registration on Atmel's website

Car		Key
Antenna	◄┄┄►	Antenna
Physical Layer		Physical layer
Logical layer		**Logical layer**
Protocol		**Protocol**
AES		AES

Industry Standard
Open Source Immobilizer Stack

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Evaluation Kit: ATAK51003-V1

- Complete Car Access Reference System – IMMO+PEPS+RKE
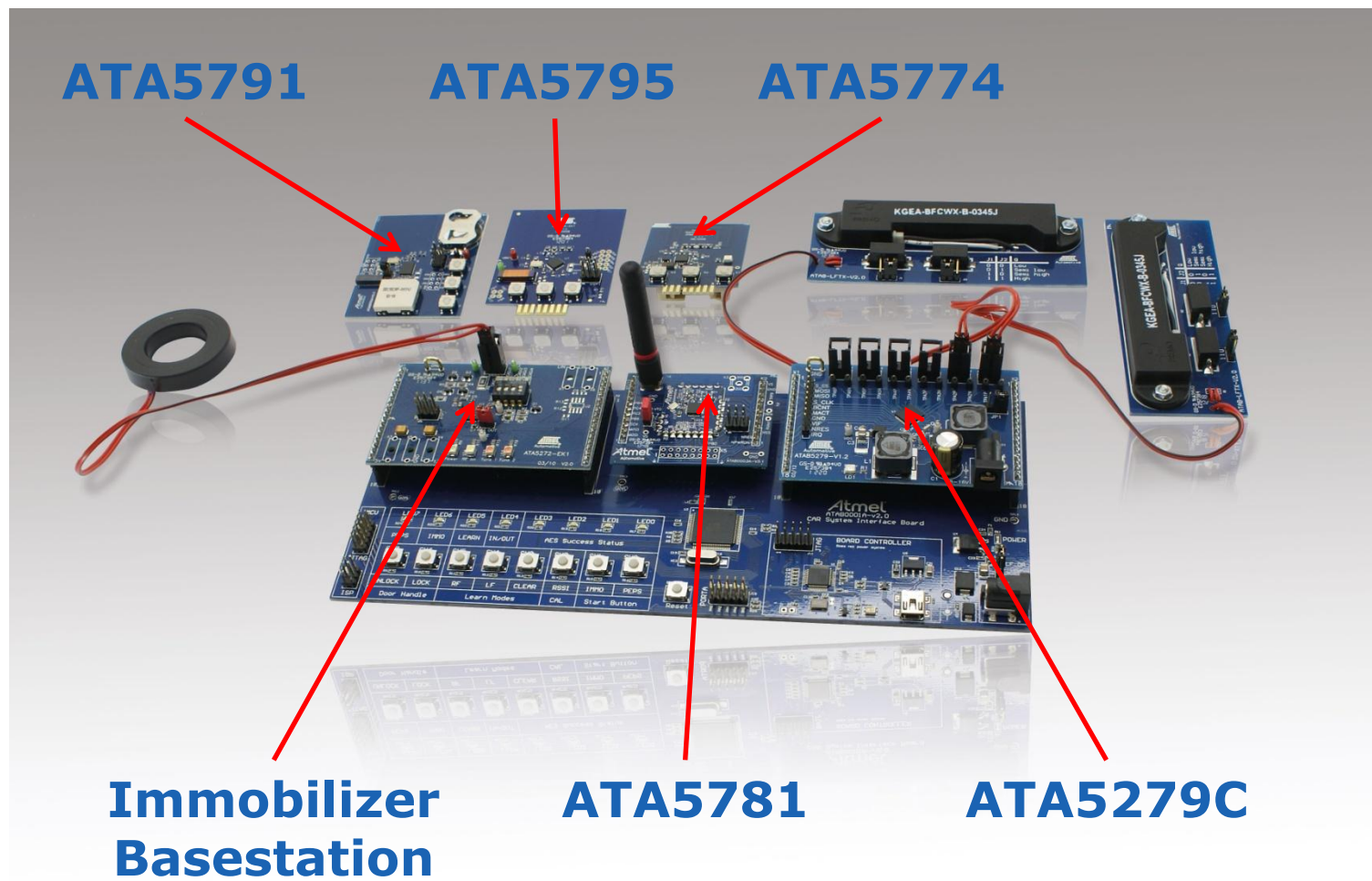
Key Characteristics
- Contains reference designs for new devices:
  - OmegaII ATA5781
  - PrimusX+ (ATA5791) – PrimusX and Atik die in same package
- Kit uses Open PEPS Protocol (RF+LF) and Open Immobilizer Protocol (LF)

Available:
Now

μC with RF Transmitter
(ATA5774)

Frac-N
RF Transmitter
1D LF Immobilizer
(ATA5795C)

Frac-N
RF Transmitter
+
3D LF Receiver/
1D Transponder
(ATA5791)

RF Receiver
(ATA5782)

LF
Basestation
(ATA5272)

LF Coil
Driver
(ATA5279C)

BCM
(AVR,
Switches,
LEDs
replaces
STK600)

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Evaluation Kit: ATAK51003-V1

- Complete Car Access Reference System – IMMO+PEPS+RKE

ATA5791   ATA5795   ATA5774
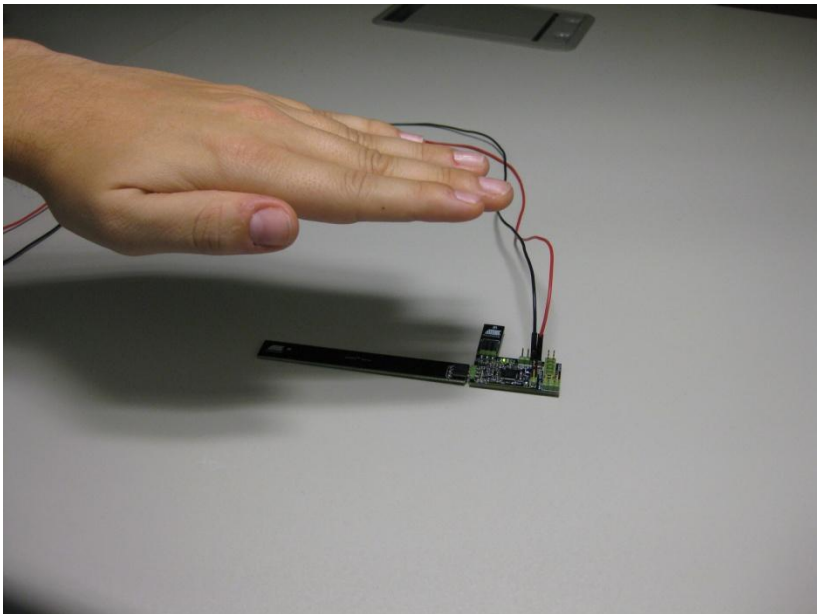
Immobilizer Basestation   ATA5781   ATA5279C

Door Handle Solution

- Using a ATA6616 (LDO, LIN interface and Tiny167 microcontroller)
- Optimized for space and connectivity

Proximity Sensor

Touch Sensor

LIN, V$_{BAT}$

QT600 Connector

Prox&Touch controller

ISP Connector
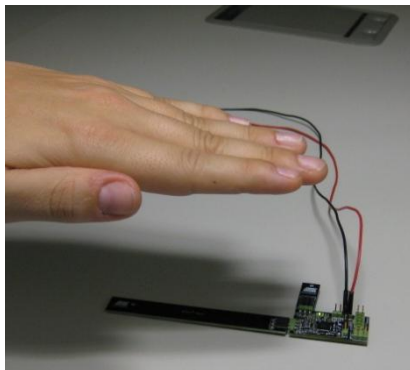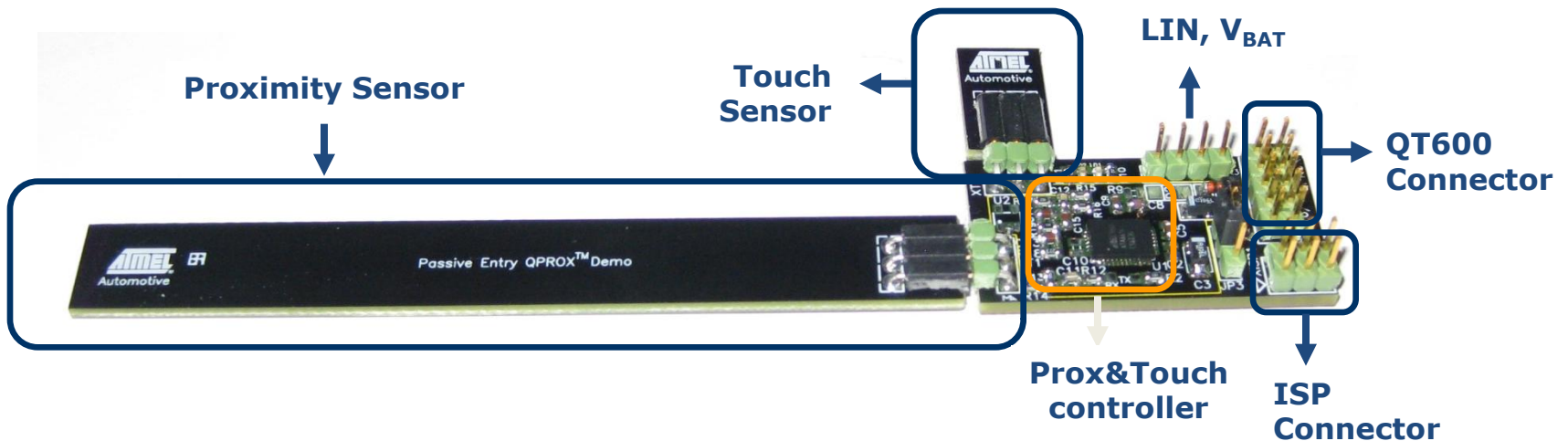
Proximity detection at 150mm distance

Real case setup – Approaching Hand

Tiny44 Demo within Door Handler

Proximity detection in 150mm distance

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Innovation Lead By Atmel

- Car manufacturers are locked-in with hacked immobilizer protocols (HiTag-2)
  - Open standard cryptography
  - Open communication protocols

- Crowded RF spectrum: passive start or RKE systems jammed by RF interferers
  - Industry leading RF blocking characteristics
  - Multi-channeling protocols

- Enabling industry longest battery lifetime on key fob while expanding functionality
  - Automatic scanning of TPMS, RKE, PEG and remote start channels without microcontroller assistance

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Atmel's Solution Benefits For OEM-Tier 1

- **Innovation**
  - TPMS & car access as sub-channels with 1 receiver → ATA5745, ATA5780N
  - Ultra low power consumption for PEPS Key fob

- **Performance**
  - Increase RKE distance (at reduced power budget) → Up to 12.5dBm outpower for Tx
  - Increase passive entry distance → ATA5790N with 1.5mV sensitivity
  - Greater robustness against noise (e.g. 3 sub-channel) → ATA5780N

- **Open Platform Immobilizer**
  - Remove proprietary protocols that does not require being tied to N** supplier, no monopoly
  - OEM- Tier 1 fully in control of Immobilizer software source code

- **Cost Down**
  - Next generation PEPS solution with better cost option
  - Single chip PEPS keyfob ATA5791
  - Complete PEPS, RKE solution, single stop shop (Door handle to PEPS ECU)

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Car Access Customer Highlights

- Customer List:
    - Continental
    - Hella
    - BOSCH
    - Lear China
    - Kostal China
    - Magneti Marelli China
    - Mitsubishi Automotive Japan
    - Mobis Korea
    - Denso Japan
    - Alps
    - Omron

- Key OEM
    - BMW
    - GM
    - Ford
    - VW Group
    - FIAT
    - Chrysler
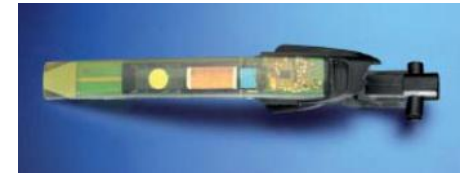
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Atmel | Enabling Unlimited Possibilities®