
PEPS Driver and Multi-Channel Immobilizer Base Station

Introduction

The ATA5294 is a highly integrated circuit combining Low Frequency (LF) coil drivers, an immobilizer reader for Passive Entry, Passive Start (PEPS) application and a door handle interface. It is intended to be used with an external microcontroller.

The device offers 4 drivers for LF antenna coils and an integrated immobilizer base station block with a highly sensitive receiver for back scatter and charge and talk operation. The base station supports multiple antennas that can be shared with PEPS operation thus, reducing the total antenna count and the total system cost.

The immobilizer base station offers FDX operation mode based on ASK and load modulation. Optionally, a HDX mode is available and it operates with an ASK downlink and a BPSK uplink.

An SPI interface is available to connect a microcontroller. A RAM serves as buffer to transmit and receive data. The internal control logic handles buffered data transmission and reception. It supports periodic transmissions without microcontroller interaction for polling operation.

In addition, the device has interfaces for up to six door handle modules. It can supply the door handle modules with power and it offers built-in functions, to handle and buffer the door handle data signals autonomously. An interrupt request output indicates if there are any pending tasks for the connected microcontroller.

Features

General Features

- Integrated PEPS driver and transponder immobilizer base station
- Internal high precision oscillator for carrier generation ($\pm 0.5\%$)
- Internal 24 MHz XTAL oscillator to allow $\leq \pm 80$ ppm Tx carrier accuracy
- 2.25 MHz clock output based on internal oscillator or with XTAL accuracy
- IC power supply voltage from 6 V to 28 V for PEPS operation (VBATT = 7 V)
- IC power supply voltage from 4 V to 28 V for immobilizer operation (VBATT = 5 V)
- Fast SPI interface (2 Mbps) for data access and configuration
- PEPS and immobilizer Tx Mode supports data rates of 3.9 Kbps and 7.8 Kbps Manchester, BPLM, and 7.8 kSymbols/s and 15.6 kSymbols/s NRZ
- FDX/HDX immobilizer receive mode supports data rates of 3.9 Kbps and 7.8 Kbps Manchester and 7.8 kSymbols/s and 15.6 kSymbols/s NRZ
- 4 flexible GPIO pins:
 - CLKOUT
 - BCNT
 - MACT
 - IRQ
- Transparent data input and data output pins for Rx and Tx operation
- Very low current consumption of 8.5 μ A in OFF mode
- 25 μ A standby current in Sleep mode waiting for external trigger via SPI
- QFN 7x7 48 with wettable flanks
- Programmable LF carrier frequency 114 kHz ... 138 kHz

- FDX and HDX immobilizer operation possible on all coils
- Supports six door handle inputs

PEPS Driver Features

- Output driver stages are protected against electrical and thermal overload
- Diagnostic capabilities for short to battery, ground, between antenna terminals, open on all drivers and antenna detuning
- Over temperature warning flag with margin to over temperature shut down
- Low EMI sinus (-55 dBC) or switched square wave mode for driver output
- Integrated boost converter with external boost transistor and current sense resistor for high LF-drive level
- Antenna isolation between operated /non operated antennas ≥ 60 dB
- Antenna isolation between operated /non operated antennas ≥ 30 dB in shared driver applications
- 4 driver outputs delivering up to $34 V_{pp} / 2.5 A_{pp}$
- Drivers can be operated in parallel, in single ended and full bridge configurations supporting up to $5 A_{pp}$ antenna current and $68 V_{pp}$ antenna voltage
- Current measurement integrated into all drivers
- Programmable regulated current range $0.2 A_{pp}$ to $2.5 A_{pp}$ adjustable in small-sized steps
- Programmable unregulated current range $0.04 A_{pp}$ to $2.5 A_{pp}$
- $\pm 3\%$ PEPS drive current accuracy with internal current measurement using $2.5 A_{pp}$ antenna current in single driver configuration
- Sinusoidal, square wave or custom wave form LF driver output
- 2 antennas can be operated simultaneously at different antenna currents
- 3 antennas can be operated simultaneously
- Start-up time from IDLE to Tx Mode mode ≤ 1.5 ms
- Supports configurable autonomous polling
- Configurable 256 byte buffer for commands and data

Immobilizer Base Station Features

- All peps drivers can be used for immobilizer operation
 - Max driver voltage per driver = $30 V_{pp}$ at VBATT = 7 V
 - Max driver voltage per driver = $18 V_{pp}$ at VBATT = 5 V
- Narrow-band direct conversion digitized receiver for high noise immunity
- 64 byte Rx buffer
- Tx and Rx operation in buffered or in transparent mode
- Sinusoidal antenna drive
- Single ended and differential antenna operation
- FDX support on all coils with ASK/BPLM downlink and load modulation uplink
- HDX support on all coils with ASK/BPLM downlink and BPSK uplink

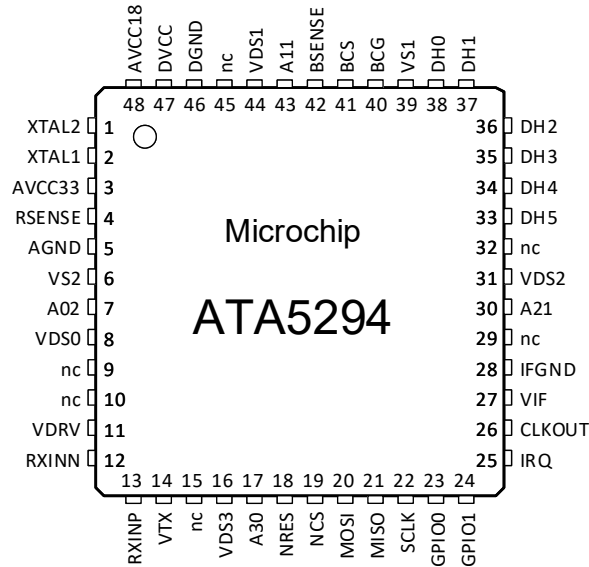
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1. Pin Description

The following figure illustrates the pin details of ATA5294 device.

Figure 1-1. ATA5294 Pin Details



The following table provides the pin description of ATA5294. Care must be taken to ensure that pin voltages are kept within the limits specified for the voltage domain to which they belong.

Table 1-1. Pin Description

Pin Number	Pin Name	Function	Remarks	Voltage Domain
Heat Slug	GND	Backside ground connection	-	GND
1	XTAL2	Optional crystal connection 2, pin must be connected to GND if not used	-	AVCC18
2	XTAL1	Optional crystal connection 1, pin must be connected to GND if not used	-	AVCC18
3	AVCC33	3.3V analog supply voltage capacitor connection	-	-
4	RSENSE	Connection for 1.3kΩ reference resistor. Used for internal current measurements	-	AVCC33
5	AGND	Dedicated ground for analog supply	-	-
6	VS2	Battery supply voltage input	-	VS
7	A02	Antenna driver output	-	VDS
8	VDS0	Supply voltage for A0x drivers	-	VDS
9	nc	can be left open or connected to GND	-	-
10	nc	can be left open or connected to GND	-	-
11	VDRV	Driver support circuitry 3.3V supply voltage	-	-
12	RXINN	Immobilizer negative polarity receiver input	-	VTX

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Pin Number	Pin Name	Function	Remarks	Voltage Domain
13	RXINP	Immobilizer positive polarity receiver input	-	VTX
14	VTX	Low noise 16V supply for immobilizer operation	-	-
15	nc	can be left open or connected to GND	-	-
16	VDS3	Supply voltage for A3x drivers	-	-
17	A30	Antenna driver output	-	VDS
18	NRES	Chip reset input pin. NRES = 0 for more than TNRES resets the chip. NRES = 1 enables the device	Digital input	VIF
19	NCS	SPI chip select input pin, active low	Digital pin	VIF
20	MOSI	Master-Out-Slave-In SPI input pin, data input in transparent mode	Digital input	VIF
21	MISO	Master-In-Slave-Out SPI output pin, data output in transparent mode, tri-state in IdleMode if NCS = 1	Digital output	VIF
22	SCLK	SPI clock input pin	Digital input	VIF
23	GPIO0	Configurable I/O pin, able to provide MACT, BCNT, CLKOUT, IRQ and other digital I/Os Default: GPIO (input)	Digital pin	VIF
24	GPIO1	Configurable I/O pin, able to provide MACT, BCNT, CLKOUT, IRQ and other digital I/Os Default: GPIO (input)	Digital pin	VIF
25	IRQ (GPIO2)	Configurable I/O pin, able to provide MACT, BCNT, CLKOUT, IRQ and other digital I/Os Default: IRQ (Interrupt request output pin)	Digital pin	VIF
26	CLKOUT (GPIO3)	Configurable I/O pin, able to provide MACT, BCNT, CLKOUT, IRQ and other digital I/Os Default: Tristate input with CLKOUT preselected on the signal multiplexor	Digital pin	VIF
27	VIF	Interface supply voltage input	-	-
28	IFGND	Reference GND interface supply voltage input	-	-
29	nc	can be left open or connected to GND	-	-
30	A21	Antenna driver output	-	VDS
31	VDS2	Supply voltage for A2x drivers	-	-

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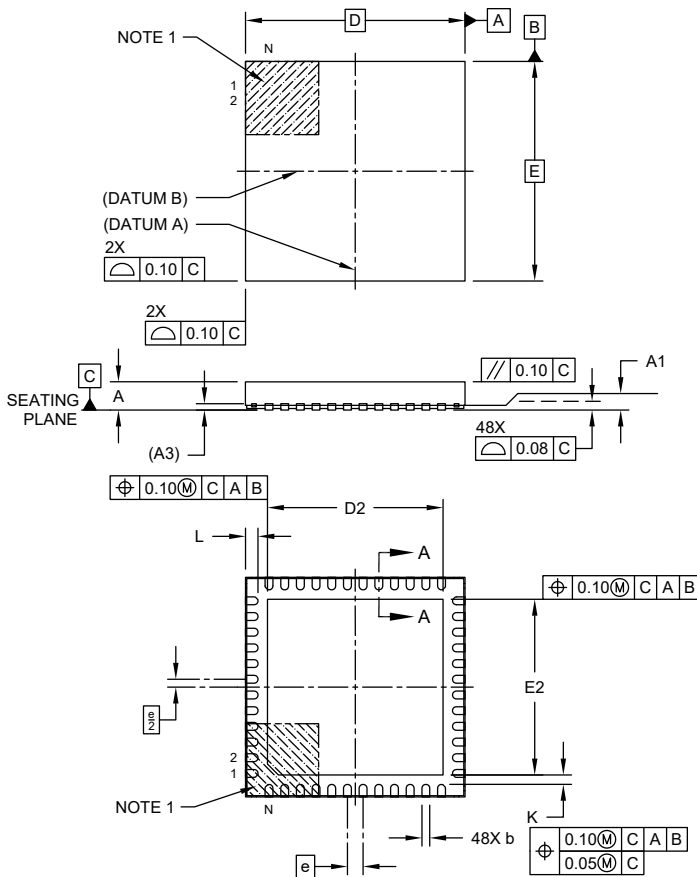
Pin Number	Pin Name	Function	Remarks	Voltage Domain
32	nc	can be left open or connected to GND	-	-
33	DH5	Door handle interface	-	VDH5
34	DH4	Door handle interface	-	VDH4
35	DH3	Door handle interface	-	VDH3
36	DH2	Door handle interface	-	VDH2
37	DH1	Door handle interface	-	VDH1
38	DH0	Door handle interface	-	VDH0
39	VS1	Battery supply voltage input	-	-
40	BCG	Boost converter gate connection to drive the gate of an external power MOSFET	-	VS
41	BCS	Boost converter source connection, current sense input connected to boost converter current sense resistor (Kelvin contact)	-	AVCC33
42	BSENSE	Boost converter sense connection, connected to boost converter current sense resistor (Kelvin contact)	-	AVCC33
43	A11	Antenna driver output	-	VDS
44	VDS1	Supply voltage for A1x drivers	-	-
45	nc	can be left open or connected to GND	-	-
46	DGND	Digital ground	-	-
47	DVCC	Digital supply voltage	-	-
48	AVCC18	1.8V analog supply voltage capacitor connection	-	-

2. Packaging Information

The following figure illustrates the packaging information of ATA5293.

Figure 2-1. QFN 48 Package

**48-Lead Very Thin Plastic Quad Flat, No Lead Package (SLB) - 7x7 mm Body [VQFN]
With 5.6x5.6 mm Exposed Pad and Stepped Wettable Flanks**



Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>

Units	MILLIMETERS		
	MIN	NOM	MAX
Number of Terminals	N	48	
Pitch	e	0.50 BSC	
Overall Height	A	0.80	0.85 0.90
Standoff	A1	0.00	0.035 0.05
Terminal Thickness	A3	0.203 REF	
Wettable Flank Step Cut Depth	A4	0.10	0.13 0.15
Overall Length	D	7.00 BSC	
Exposed Pad Length	D2	5.50	5.60 5.70
Overall Width	E	7.00 BSC	
Exposed Pad Width	E2	5.50	5.60 5.70
Wettable Flank Step Cut Width	E3	-	- 0.04
Terminal Width	b	0.20	0.25 0.30
Terminal Length	L	0.35	0.40 0.45
Terminal-to-Exposed-Pad	K	0.20	- -

Notes:

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package is saw singulated
- Dimensioning and tolerancing per ASME Y14.5M
REF: Reference Dimension, usually without tolerance, for information purposes only.
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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