ƎSYGN

EPC C1 Gen2 UHF RFID IC
Fully-Passive Sensor Monitoring

Description

AS3213L is an EPC^{TM} Class-1 Generation-2 compliant IC for UHF RFID applications. The chip offers advanced performance in sensor acquisition mode, due to an ultra-low power internal acquisition channel. It can be powered either by a battery or by the RF energy transmitted from a reader. In a Battery Assisted Passive (BAP) configuration, the AS3213L offers an increased reading range compared to passive RFID solutions.

AS3213L embeds 512 bits of low power non-volatile memory (EEPROM) that is organized in 4 banks as described in EPC Gen 2 standard. The chip supports the EPC data structure which is compliant with the EPC Global Tag Data Standards, Version 1.10, and is delivered with a Unique Identifier (UID) to ensure full traceability.

The chip integrates an acquisition channel and biasing circuitry for an internal ambient light sensor, including an on-chip amplifier, and a 10-bit Analog to Digital Converter (ADC). In addition to this embedded ambient light sensor, AS3213L features an internal temperature sensor, allowing single-chip measurements.

The chip supports a temperature range from -40°C to +125°C.

All features are available either in passive or BAP mode. Sensor data are available on demand by standard readers using a simple read command in user memory as defined in EPC protocol. There is no need for any custom command or pre-charge sequence. It is fully compliant with standard readers.

AS3213L also provides digital interface for advanced applications such as machine to machine communication. It is made by a standard slave SPI and offers programmability and functionality setup. It also allows to trig data acquisition through the internal digital interface. Both the RF interface and the SPI bus provide the same functions.

AS3213L ICs are available either packaged in a QFN24 package or as bare dies (for wirebonding or bumped).

Features

✓ EPC Gen2 compliant

✓ Fully passive

✓ 512-bit non-volatile memory (EEPROM)

✓ 48-bit manufacturer programmed IC Serial Number

✓ 192 bits for UII/EPC encoding

✓ 96 bits for User data

✓ Forward link data rates: 26.7 to 128 kbps assuming equiprobable data

✓ Return link data rates: 40 to 640 kbps with subcarrier modulated data rates of 0.625 to 320 kbps

✓ Integrated ambient light sensor including amplifier and ADC

✓ Integrated temperature sensor for sensor data compensation

✓ Serial Peripheral Interface (SPI) Bus

✓ Battery assistance for increasing reading range

✓ 1.0V Regulated power supply available on IO

✓ Extended temperature range: -40°C to +125°C

Applications

✓ Condition monitoring (PAR light, Ambient light…)

✓ Supply chain management, tracking and tracing

✓ Smart builidings monitoring

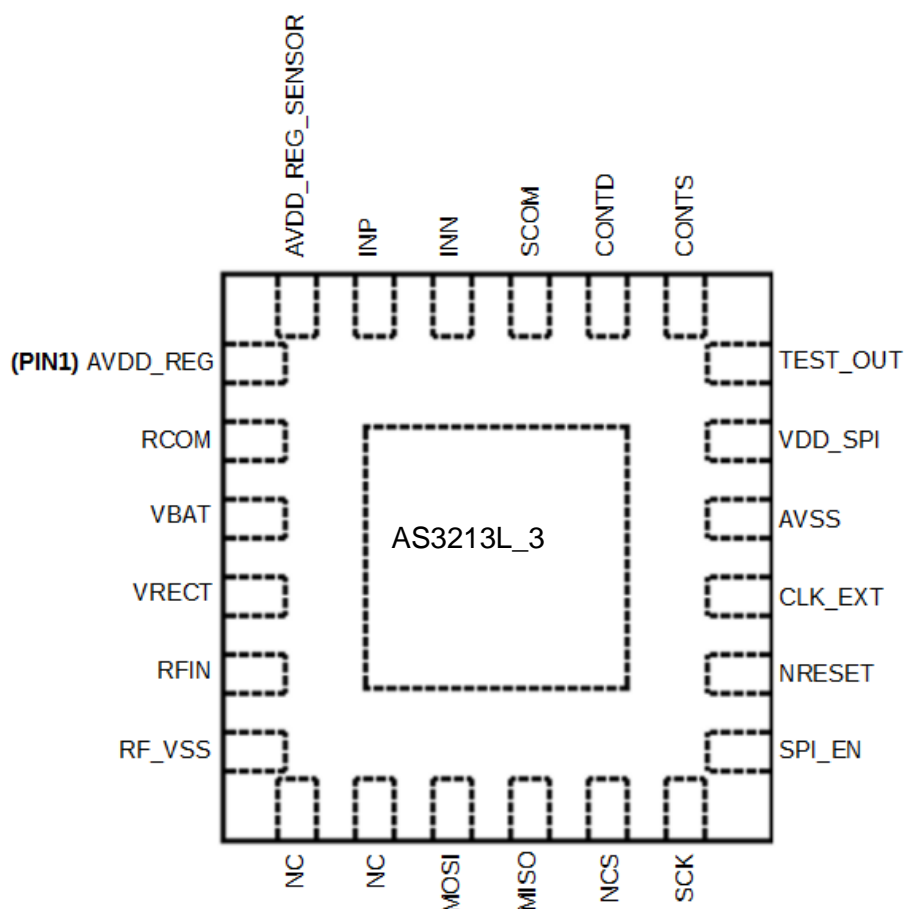## Revision History

Revision	Date	Comment
1.5	2023-02-10	First version with revision history

Table of Content

Pin Description : QFN24 4x4mm 0.5mm (Top View)

Pin	Name	Type	I/O	Description
1	AVDD_REG	A	O	1.0V Regulated Power Supply
2	RCOM	A	I	Not used
3	VBAT	A	I	External Power Supply in BAP operation [1.8V;2.5V] (*) **Need to be connected to AVSS in passive operation**
4	VRECT	A	O	Non-Regulated Power Supply from RF field [1.2V;2.0V]
5	RFIN	RF	I	Antenna input
6	RF_VSS	A	I	For antenna connection only (ground)
7	NC	NA		Not Connected
8	NC	NA		Not Connected
9	MOSI	D	I	1.8V SPI MOSI signal
10	MISO	D	O	1.8V SPI MISO signal
11	NCS	D	I	1.8V SPI Chip Select
12	SCK	D	I	1.8V SPI Clock signal
13	SPI_EN	D	I	1.8V SPI Enable signal
14	NRESET	D	I	1.8V external reset for digital part in SPI mode (SPI_EN="1")
15	CLK_EXT	D	I	External clock for digital part in SPI mode (SPI_EN="1")
16	AVSS	A	I	Ground of the IC
17	VDD_SPI	A	I	SPI 1.8V Power supply
18	TEST_OUT	A	I/O	Analog test pin for input and output
19	CONTS	A	I	Not used
20	CONTD	A	O	Not used
21	SCOM	A	I	Not used

22	INN	A	I	Not used
23	INP	A	I	Not used
24	AVDD_REG_SENSOR	A	O	Not used

A: Analog, D: Digital   (*) For write operation in the NVM, the power supply needs to be higher than 2.2V.

Pin Description : Bare Die 1680µmx1440µm (Top View)

Note:
On this view, the IO pads of the IC are on the top.
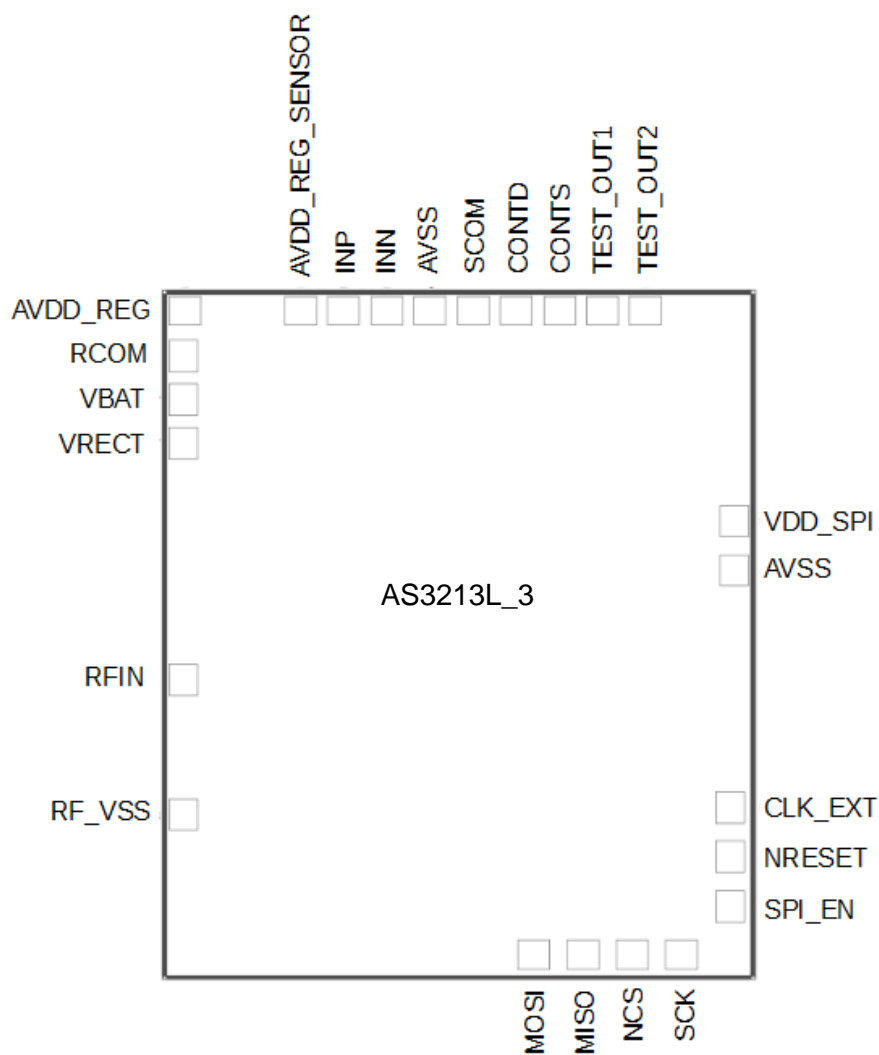
DXF files are available on request.

Typical Application

Both ambient light sensor and temperature sensor being embedded inside the IC, no connection other than antenna and grounds are needed on the tag to use this IC.

In passive mode, the needed energy is provided by the RF field. The external power supply pin VBAT needs to be connected to AVSS to avoid active mode to turn on. It is recommended (not mandatory) to connect VDD_SPI to AVSS too, to avoid any unwanted activation of the SPI mode. By the same way, it is recommended to connect SPI_EN to AVSS, but this is not mandatory because it is pulled down internally. NRESET, CLK_EXT and the SPI inputs can be left floating (internal pull down too).

More information is available on request in the form of Application Notes. Some of them can be found on the following support site: https://as321x.asygn.com/

Specification

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Tstorage	-50	150	°C
Voltage on all pads/pins except AVSS	Vpin	0	3.3	V
RF power into pad/pin RFIN	Pmax		15	dBm
Electrostatic discharge on all pads except RFIN	VESD	-1000	1000	V
Electrostatic discharge on RFIN	VESD_RF	-500	500	V

ESD are Human Body Model (HBM) values

Stresses above these listed maximum ratings may cause permanent damages to the device. Exposure beyond specified operating conditions may affect device reliability or cause malfunction.

Operating Conditions

Parameter	Symbol	Min.	Max.	Unit
Operating temperature	Toperating	-40	+125	°C
Max RF power at RFIN	Pmax_op		15	dBm
RF carrier frequency	Fcarrier	860	960	MHz

Electrical Characteristics at 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit
Battery voltage for EEPROM read operation	Vread	0.9		3.3	V
Battery voltage for EEPROM power check, erase, and write operations	Vwrite	1.8		3.3	V
Average battery current in Sleep mode (No RF applied to the antenna)	Isleep		3.8		uA

RF Characteristics @25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Impedance	Zin_passive	Die form @ Pin=-10dBm Fcarrier = 866MHz Fcarrier = 915MHz		7-j406 8.5-j383		Ω Ω
		QFN24 @ Pin=-10dBm Fcarrier = 866MHz Fcarrier = 915MHz		23-j213 30-j195		Ω Ω
Write sensitivity in passive	Pwrite_passive			-12		dBm
Read sensitivity in passive	Pread_passive			-13		dBm
Read sensitivity in passive mode with internal temperature and ambient light sensors	Pread_sensor			-13		dBm
Write sensitivity in BAP	Pwrite_bap	VBAT=2.2V		-16		dBm
Read sensitivity in BAP	Pread_bap	VBAT=2.2V		-16		dBm

Package information

TOP VIEW

SIDE VIEW

BOTTOM VIEW

0.175±0.050 TYP

4

PIN 1

4

2.4

A

A

2.4

0.635

6°

4

3.7

0.175±0.050 TYP

0.84

3.5

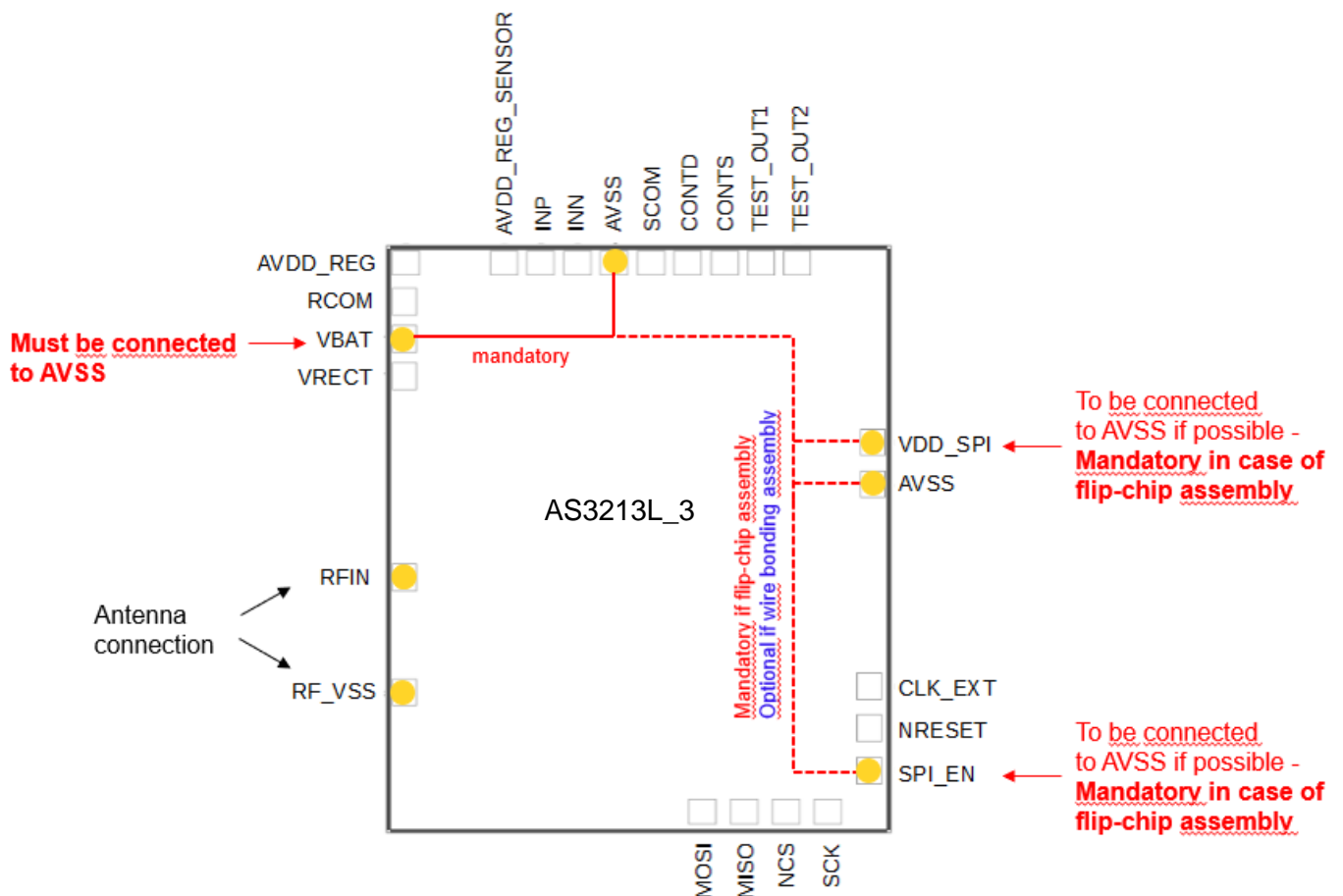SECTION A-A

0.50 TYP

0.25 TYP

PIN 1

2.4

2.5 TYP

4

0.4
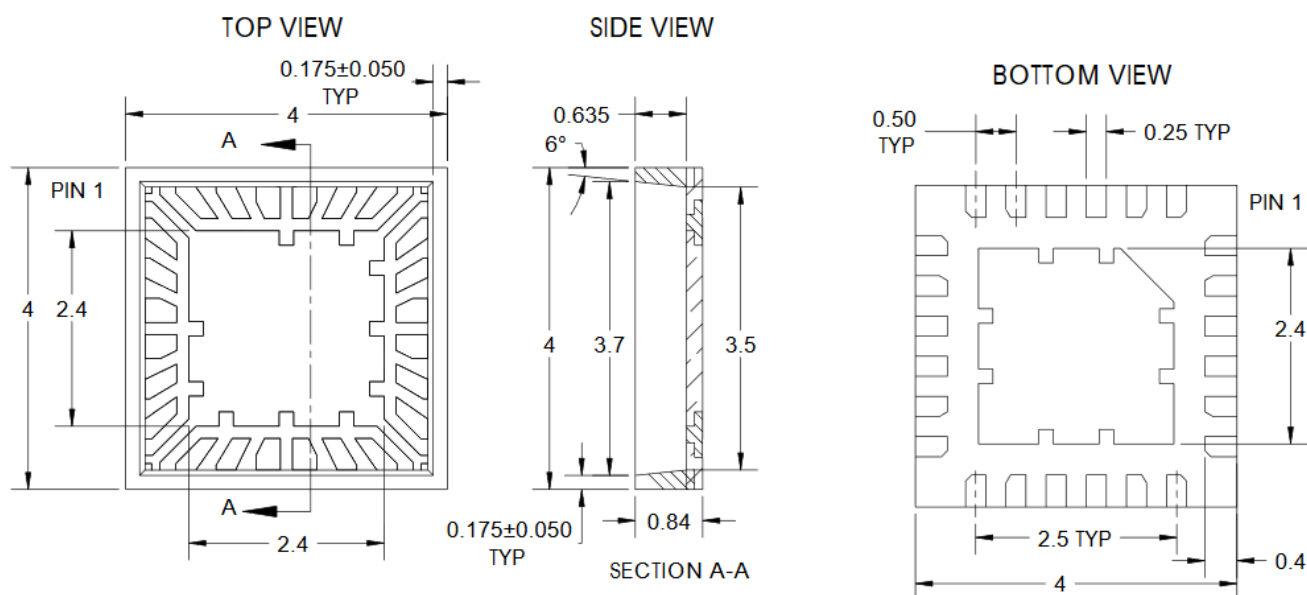
Bare Dies Information

Bumps (DXF available on demand)

Main information concerning bumps are listed below:
- Wafer Thickness : 250µm
- Pads size:70x77µm²
- Passivation opening: 70µmx77µm
- Bumps type: Accu bumps (Au)
- Bumps thickness: 45µm
- Bumps diameter: 80µm

Product Support

www.asygn.com
support@asygn.com