



SL3S4001

UCODE I²C

Rev. 1.2 — 12 October 2011
211312

Objective short data sheet
COMPANY PUBLIC

1. General description

The UHF EPCglobal Generation 2 standard allows the commercialized provision of mass adoption of UHF RFID technology for passive smart tags and labels. Main fields of applications are supply chain management and logistics for worldwide use with special consideration of European, US and Chinese frequencies to ensure that operating distances of several meters can be realized.

The UCODE I²C is a product out of the NXP Semiconductors UCODE product family. The entire UCODE product family offers anti-collision and collision arbitration functionality. This allows a reader to simultaneously operate multiple labels/tags within its antenna field. A UCODE I²C based label/ tag requires no external power supply for contactless operation.

Its contactless interface generates the power supply via the antenna circuit by propagative energy transmission from the interrogator (reader), while the system clock is generated by an on-chip oscillator. Data transmitted from the interrogator to the label/tag is demodulated by the interface, and it also modulates the interrogator's electromagnetic field for data transmission from the label/tag to the interrogator.

A label/tag can be operated without the need for line of sight or battery, as long as it is connected to a dedicated antenna for the targeted frequency range. When the label/tag is within the interrogator's operating range, the high-speed wireless interface allows data transmission in both directions.

The UCODE I²C also features an I²C interface to read/write data from its build in memory. In this mode the UCODE I²C needs to be supplied externally. The I²C interface supports standard and fast I²C modes.

The used EEPROM is based on a field proven non-volatile memory technology. The EEPROM memory cell is also used in high quality automotive applications.

2. Features and benefits

2.1 UHF interface

- Dual UHF antenna port
- -15 dBm read operating power
- -10 dBm write operating power
- Compliant to EPCglobal Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Protocol for communications at 860 to 960 MHz version 1.2.0
- Wide RF interface temperature range: -40 °C up to +85 °C



- Memory read protection
- Interrupt output
- Digital switch
- RF - I²C bridge function

2.2 I²C interface

- Supports Standard (100 kHz) and Fast (400 kHz) mode (See [Ref. 2](#))
- RFID chip can be used as standard I²C EEPROMs

2.3 Command set

- All mandatory EPC Gen2 v1.2.0 commands
- Optional commands: Access, Block Write (32 bit)
- Custom command: ChangeConfig

2.4 Memory

- 3328 bit user memory
- 160 bit EPC memory
- 96-bit tag identifier (TID) including 48-bit unique serial number
- 32-bit KILL password to permanently disable the tag
- 32-bit ACCESS password to allow a transition into the secured transmission state
- Data retention: 20 years @ 55 °C
- Write endurance: 50 kcycles @ 85 °C

2.5 Package

- SOT-902; MO-255B footprint
- Outline 1.6 × 1.6 mm
- Thickness ≤ 0.5 mm

3. Applications

- Firmware downloads
- Return management
- Counterfeit protection and authentication
- Production information
- Theft protection and deterrence
- Production automation
- Device customization/product configuration

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
EEPROM characteristics						
t_{ret}	retention time	$T_{amb} \leq 55\text{ °C}$	10	-	-	year
$N_{endu(W)}$	write endurance	$T_{amb} \leq 85\text{ °C}$	50000	-	-	cycle
Interface characteristics						
P_{tot}	total power dissipation		-	-	30	mW
f_{oper}	operating frequency		840	-	960	MHz
$P_{i(min)}$	minimum operating power supply	read mode	-	-15	-	dBm
		write mode	-	-10	-	dBm
V_{DD}	supply voltage	I ² C, on V _{DD} input	1.5	-	3.7	V
$V_{CC(ripple)}$	ripple supply voltage	$f \leq 1\text{ MHz}$	-	-	50	mV _{pp}
I_{DD}	supply current	from VDD in I ² C read mode	-	10	-	μA
		from VDD in I ² C write mode	-	40	-	μA

5. Ordering information

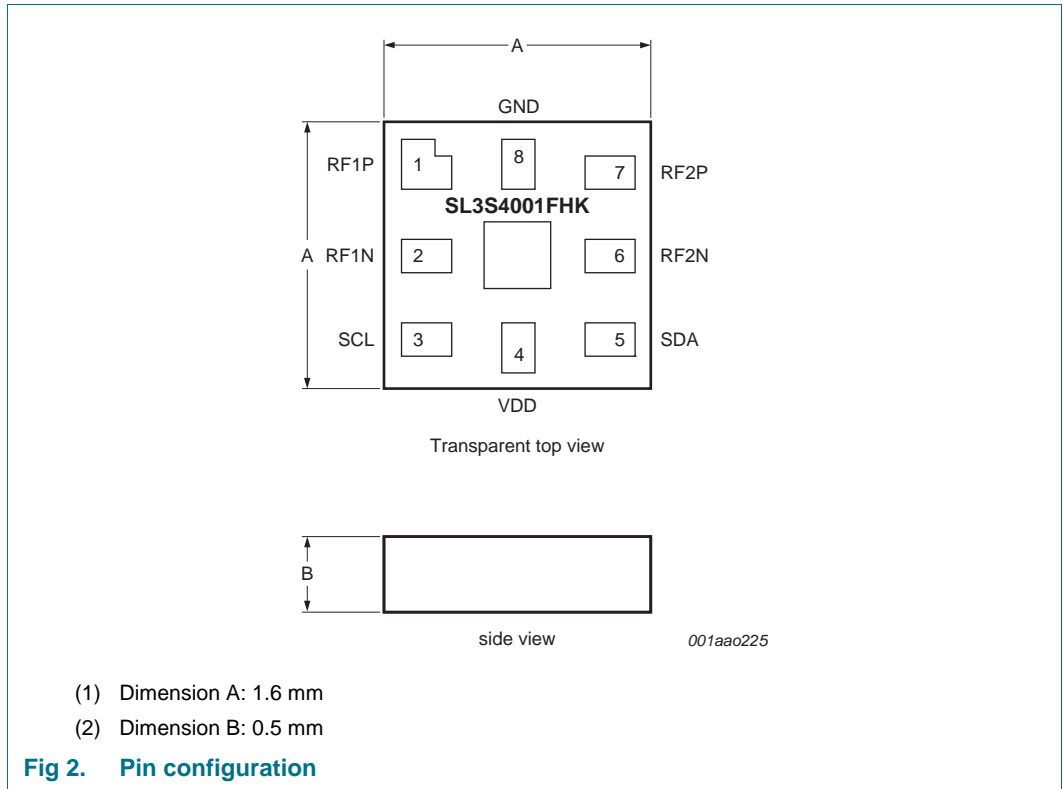
Table 2. Ordering information

Type number	Package		
	Name	Description	Version
SL3S4001FUG	Wafer	Single differential Front End [1]- Bumped UCODE I ² C die on sawn 150 μm wafer	not applicable
SL3S4001FHK	XQFN8	Single differential Front End [1]- Plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 × 1.6 × 0.5 mm	SOT902-2
SL3S4011FUG	Wafer	Dual differential Front End - Bumped UCODE I ² C die on sawn 150 μm wafer	not applicable
SL3S4011FHK	XQFN8	Dual differential Front End - Plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 × 1.6 × 0.5 mm	SOT902-2

[1] RFP1, RFN1

7. Pinning information

7.1 Pinning

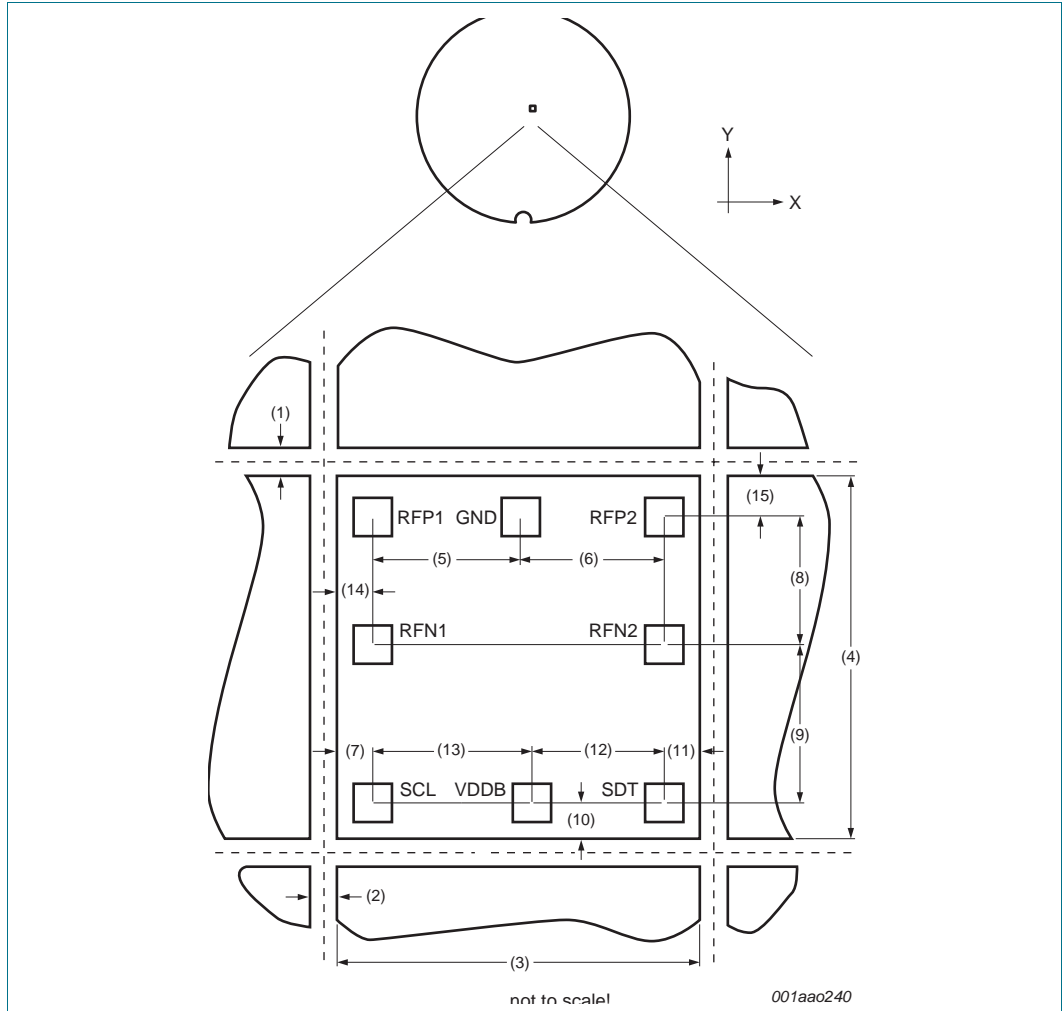


7.2 Pin description

Table 3. Pin description

Pin	Symbol	Description
1	RF1P	active antenna 1 connector
2	RF1N	antenna 1
3	SCL	I ² C clock / _INT
4	VDD	supply
5	SDA	I ² C data
6	RF2N	antenna 2
7	RF2P	active antenna 2 connector
8	GND	ground

8. Wafer layout



- (1) X-scribe line width: 50 μ m
 - (2) Y-scribe line width: 50 μ m
 - (3) Chip step, x-length: 600 μ m
 - (4) Chip step, y-length: 600 μ m
 - (5) Bump to bump distance X (RFP1 - GND): 254 μ m
 - (6) Bump to bump distance Y (GND - RFP2): 254 μ m
 - (7) Distance bump RFP2 to metal sealing X: 68 μ m (outer edge - top metal)
 - (8) Bump to bump distance Y (RFP2 - RFN2): 239 μ m
 - (9) Bump to bump distance Y (RFN2 - SDT): 266 μ m
 - (10) Distance bump SDT to metal sealing Y: 48 μ m
 - (11) Distance bump SDT to metal sealing X: 68 μ m
 - (12) Bump to bump distance X (VDDB - SDT): 222 μ m
 - (13) Bump to bump distance X (SCL - VDDB): 242 μ m
 - (14) Distance bump RFP1 to metal sealing X: 46 μ m
 - (15) Distance bump RFP2 to metal sealing Y: 47 μ m
- Bump size X \times Y: 60 μ m \times 60 μ m

Fig 3. UCODE I²C wafer layout

9. Limiting values

Table 4. Limiting values^{[1][2] [3][4]}

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND.

Symbol	Parameter	Conditions	Min	Max	Unit
Die					
V_{\max}	maximum voltage	on pin VDD, SDA, SCL, GND	-0.3	4.1	V
T_{stg}	storage temperature		-55	+125	°C
T_{amb}	ambient temperature		-40	+85	°C
V_{ESD}	electrostatic discharge voltage	Human body model; SNW-FQ-302A	-	±2	kV
		Charged device model	-	±500	V

- [1] Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any conditions other than those described in the Operating Conditions and Electrical Characteristics section of this specification is not implied.
- [2] This product includes circuitry specifically designed for the protection of its internal devices from the damaging effects of excessive static charge. Nonetheless, it is suggested that conventional precautions be taken to avoid applying greater than the rated maxima.
- [3] For ESD measurement, the die chip has been mounted into a CDIP8 package.
- [4] For ESD measurement, the die chip has been mounted into a CDIP8 package.

10. Package outline

XQFN8: plastic, extremely thin quad flat package; no leads;
8 terminals; body 1.6 x 1.6 x 0.5 mm

SOT902-2

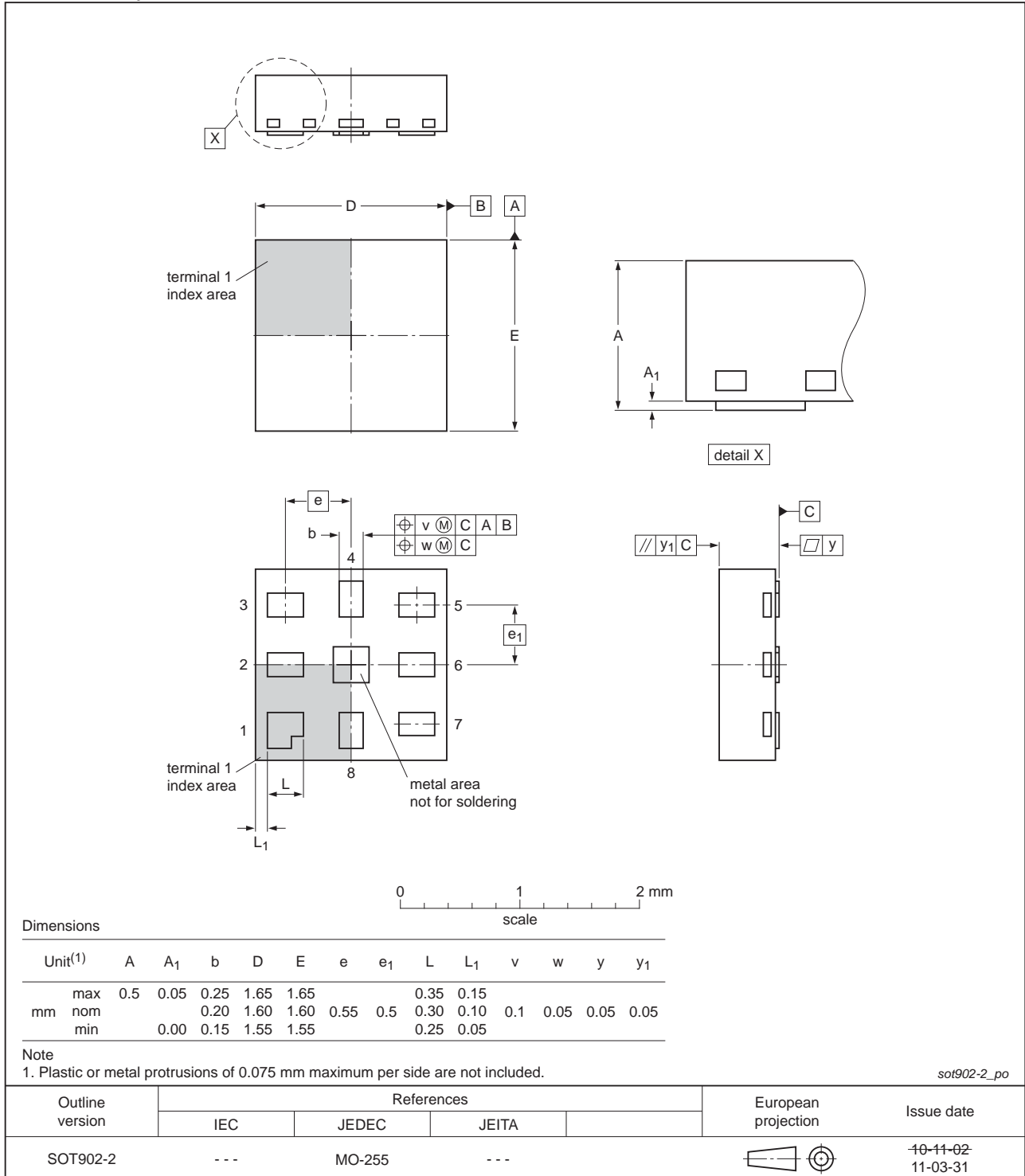


Fig 4. Package outline SOT902-2

11. Abbreviations

Table 5. Abbreviations

Acronym	Description
EEPROM	Electrically Erasable Programmable Read Only Memory
EPC	Electronic Product Code (containing Header, Domain Manager, Object Class and Serial Number)
RF	Radio Frequency
RFID	Radio Frequency IDentification
UHF	Ultra High Frequency

12. References

- [1] Data sheet - SL3S4001FHK - UCODE I²C, BU-ID document number: 2049**
- [2] I²C-bus specification and user manual (NXP standard UM10204.pdf / Rev. 03 - 19 June 2007)
- [3] EPC Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Protocol for Communications at 860 MHz - 960 MHz Version 1.2.0
- [4] EPC Conformance Standard Version 1.0.5
- [5] ESD Method SNW -FQ-302A
- [6] ISO/IEC 18000-1: Information technology - Radio frequency identification for item management - Part 1: Reference architecture and definition of parameters to be standardized
- [7] Data sheet - Delivery type description - General specification for 8" wafer on UV-tape with electronic fail die marking, BU-ID document number: 1093**¹

1. ** ... document version number

13. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
SL3S4001_SDS v.1.2	20111012	Objective short data sheet	-	SL3S4001_SDS v.1.1
Modifications:	<ul style="list-style-type: none">• Figure 3 "UCODE I²C wafer layout": values updated			
SL3S4001_SDS v.1.1	20110929	Objective short data sheet	-	SL3S4001_SDS v.1.0
Modifications:	<ul style="list-style-type: none">• Table 2 "Ordering information": updated• Section 7 "Pinning information": inserted			
SL3S4001_SDS v.1.0	20110721	Objective short data sheet	-	-

14. Legal information

14.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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