

## Features

- Full TPCA V1.1b Compatibility
- Single Chip Turnkey Solution
- Hardware Asymmetric Crypto Engine
- 2048 RSA Sign in 500 ms Using CRT
- AVR 8-bit RISC Microprocessor
- Internal EEPROM Storage for 10+ RSA Keys
- 33 MHz LPC (Low Pin Count) Bus for Easy PC Interface
- Tamper Detectors for Physical or Environmental Attacks
- Secure Hardware and Firmware Design and Chip Layout
- True Random Number Generator (RNG)
- Secure Real-time Clock Option
- 3.3V  $\pm 10\%$  Supply Voltage
- 28-lead TSSOP Package
- 0–70°C Temperature Range

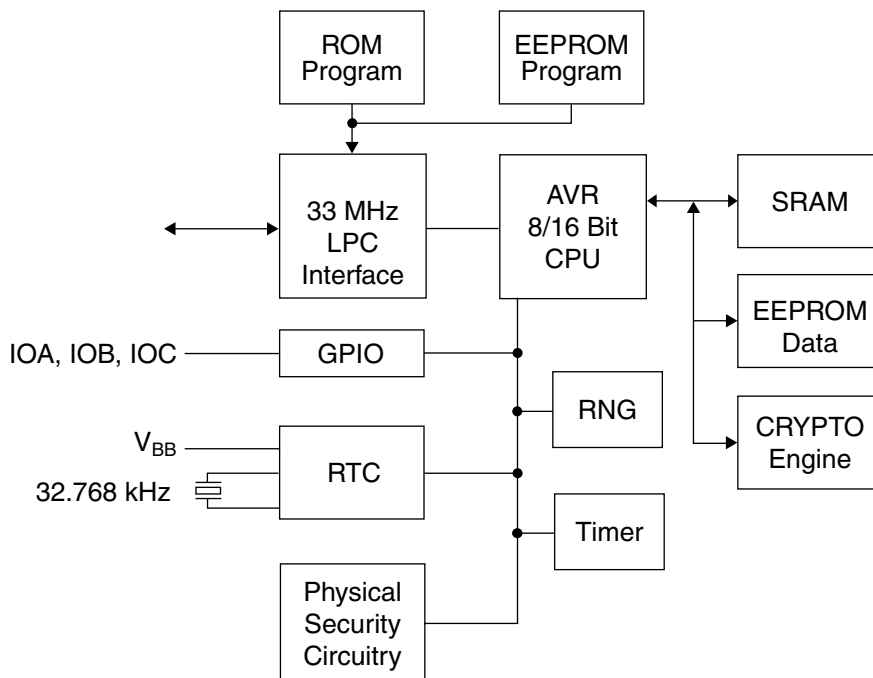
## Description

The AT97SC3201 is a fully integrated security module designed to be integrated into personal computers and other embedded systems. It implements version 1.1b of the Trusted Computing Platform Alliance (TCPA) specification for Trusted Platform Modules (TPM).

The TPM includes a crypto accelerator capable of computing a 2048-bit RSA signature in 500 ms, and a 1024-bit RSA signature in 100 ms, both using CRT.

The chip communicates with the PC through the LPC interface, which runs at 33 MHz. In addition, it supports SIRQ (for interrupts) and CLKRUN (to permit clock stopping).

**Figure 1.** AT97SC3201 Block Diagram



The chip includes a full hardware random number generator that is used for the TPCA protocol and is also available to the system for any random numbers it may need during normal operation.



## Trusted Platform Module

## AT97SC3201

## Summary



Note: This is a summary document. A complete document is available under NDA. For more information, please contact your local Atmel sales office.

Rev. 2015AS–TCPA–07/02



A real-time clock function is available using an external battery and crystal. The chip provides tamper detection if the battery or crystal is removed or tampered with, and the current time value can be signed by the appropriate internal keys to verify its accuracy. (Contact Atmel for current status of this option.)

The battery detector can be used without the crystal for lower cost. In this mode, the TPM can indicate to the system if it has been removed from the PC in any way and also take actions internally.

The chip uses a dynamic internal memory management scheme to store from 10 to 20 keys. Other than the standard TCGA commands (TPM\_Evictkey, TPM\_Loadkey), no system intervention is required to manage this internal key cache.

The TPM is offered to OEM manufacturers as a turnkey solution, including the firmware integrated on the chip. In addition, Atmel provides the necessary driver software for integration into certain operating systems, along with BIOS drivers. (Contact Atmel for a complete list of operating systems supported.)

Full documentation for TCGA primitives can be found on the TCGA web site, [www.trustedcomputing.org](http://www.trustedcomputing.org). This specification includes only mechanical, electrical and LPC protocol information.

## Absolute Maximum Ratings

Operating Temperature.....0°C to +70°C  
 Storage Temperature (without Bias).....0°C to + 70°C  
 Voltage on I/O Pins.....-0.1 to  $V_{CC} + 0.3V$   
 Voltage on VCC with Respect to Ground.....6.0V  
 Maximum ESD Voltage.....2000V

Note: Stresses beyond 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 other conditions beyond those indicated in the operational sections of this specification may cause temporary or permanent failure. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**Table 1.** DC Parameters

$V_{CC} = 3.0$  to  $3.6V$ ; Temperature = 0 to 70°C

Symbol	Parameter	Min	Nom	Max	Units	Notes
$V_{CC}$	Supply Voltage	3.0	3.3	3.6	V	
$I_{CC}$	Operating Current at fclk = 33 MHz		25	50	mA	Note 1
$I_{SB}$	Standby Current, Chip Idle			100	$\mu A$	Note 1
$I_{BB}$	Battery Current		2	4	$\mu A$	Note 1. $V_{CC} = 0V$ . fxtal = 0.
$I_{LIO}$	Input Leakage		0.1	3	$\mu A$	$V_{in} = V_{CC}$ or GND
$V_{IH}$	Input High Threshold	$0.5 \times V_{CC}$		$V_{CC} + 0.5$	V	
$V_{IL}$	Input Low Threshold	-0.5		$0.3 \times V_{CC}$	V	
$V_{OH}$	Output High Voltage	$0.9 \times V_{CC}$			V	At $I_{OUT} = -500 \mu A$
$V_{OL}$	Output Low Voltage			$0.1 \times V_{CC}$	V	At $I_{OUT} = 1.5 mA$
$I_{OH}$		-24			mA	$V_{OUT} = .3 V_{CC}$
$I_{OH}$		-0.5			mA	$V_{OUT} = .9 V_{CC}$
$I_{OH}$				116	mA	$V_{OUT} = .7 V_{CC}$
$I_{OL}$		30			mA	$V_{OUT} = .6 V_{CC}$
$I_{OL}$		1.9			mA	$V_{OUT} = .1 V_{CC}$
$I_{OL}$				113	mA	$V_{OUT} = .18 V_{CC}$
$I_{OLCR}$	Output Low Current, CLKRUN#	7			mA	At $V_{OUT} = .615 \times V_{CC}$
$C_I$	Input Pin Capacitance		6		pF	Note 2

Notes: 1. Values listed are advance information and are likely to change as production silicon is characterized.  
 2. These parameters guaranteed but not tested.

**Table 2. AC Parameters**

CI = 10 pf. V<sub>CC</sub> = 3.0 to 3.7V; Temperature = 0 to 70°C

Symbol	Parameter	Min	Nom	Max	Units	Notes
T <sub>VAL</sub>	CLK to Signal Valid Delay – LAD0-3	2		11	ns	Measured at V <sub>trise</sub> = 0.285 * V <sub>CC</sub> and V <sub>tfal</sub> = 0.615 * V <sub>CC</sub> . Measured from clk at V <sub>test</sub> = 0.4 * V <sub>CC</sub> .
T <sub>ON</sub>	Float to Active Delay	2			ns	
T <sub>OFF</sub>	Active to Float Delay			28	ns	
T <sub>SU</sub>	Input Setup Time to CLK	7			ns	
T <sub>H</sub>	Input Hold Time from CLK	0			ns	
T <sub>RST</sub>	Reset Active Time After Power Stable	1			ms	Note 2
T <sub>RST-CLK</sub>	Reset Active After CLK Stable	100			m	Note 2
T <sub>RST-OFF</sub>	Reset Active to Output Float Delay			40	ns	Note 2
T <sub>RHFF</sub>	RST# High to First FRAME# Assertion			500	clocks	
T <sub>CLKIN</sub>	CLK Period	29.5	30	31	ns	Note 3
T <sub>CLKLO</sub>	CLK Low Duration	13.4		18	ns	Note 1, Note 3
T <sub>CLKHI</sub>	CLK High Duration	13.4		18	ns	Note 1, Note 3

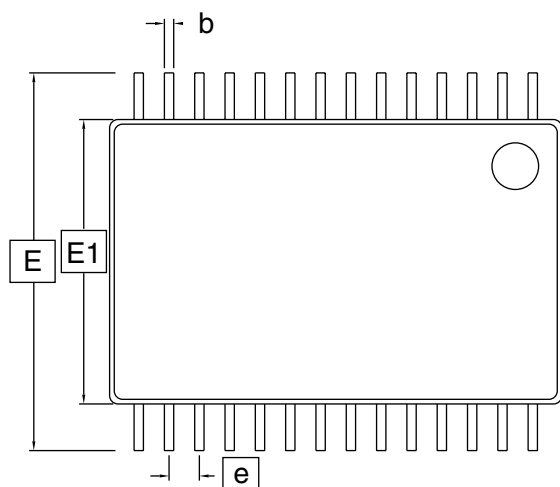
- Note:
1. All parameters measured with respect to signal crossing V<sub>test</sub> = 0.4 \* V<sub>CC</sub> unless otherwise noted.
  2. These parameters guaranteed but not tested.
  3. The minimum parameter must never be violated under any circumstances unless I<sub>reset#</sub> is asserted. If proper CLKRUN# signaling is observed, the maximum specification can be violated.

**Table 3. Ordering Information**

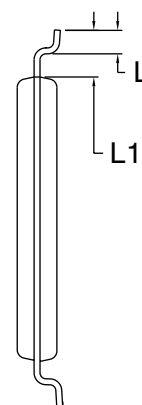
Ordering Code	Package	Operation Range
AT97SC3201-01AC	28A	Commercial (0° to 70° C)

## Package Drawing

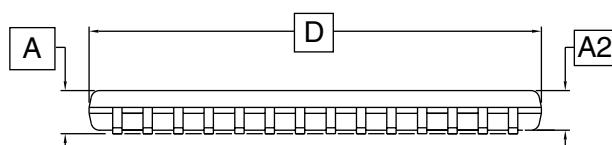
Figure 2. 28A3 – TSSOP



Top View



End View



Side View

**COMMON DIMENSIONS**  
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
D	9.60	9.70	9.80	2, 5
E	8.10 BSC			
E1	6.00	6.10	6.20	3, 5
A	—	—	1.20	
A2	0.80	1.00	1.05	
b	0.19	—	0.30	4
e	0.65 BSC			
L	0.45	0.60	0.75	
L1	1.00 REF			

- Notes:
1. This drawing is for general information only. Please refer to JEDEC Drawing MO-153, Variation DB for additional information.
  2. Dimension D does not include mold Flash, protrusions or gate burrs. Mold Flash, protrusions and gate burrs shall not exceed 0.15 mm (0.006 in) per side.
  3. Dimension E1 does not include inter-lead Flash or protrusions. Inter-lead Flash and protrusions shall not exceed 0.25 mm (0.010 in) per side.
  4. Dimension b does not include Dambar protrusion. Allowable Dambar protrusion shall be 0.08 mm total in excess of the b dimension at maximum material condition. Dambar cannot be located on the lower radius of the foot. Minimum space between protrusion and adjacent lead is 0.07 mm.
  5. Dimension D and E1 to be determined at Datum Plane H.

1/8/02



2325 Orchard Parkway  
San Jose, CA 95131

### TITLE

**28A3**, 28-lead, 6.1 x 9.7 mm Body, 0.65 pitch,  
Thin Shrink Small Outline Package (TSSOP)

### DRAWING NO.

28A3

### REV.

A



## **Atmel Headquarters**

### ***Corporate Headquarters***

2325 Orchard Parkway  
San Jose, CA 95131  
TEL 1(408) 441-0311  
FAX 1(408) 487-2600

### ***Europe***

Atmel Sarl  
Route des Arsenaux 41  
Case Postale 80  
CH-1705 Fribourg  
Switzerland  
TEL (41) 26-426-5555  
FAX (41) 26-426-5500

### ***Asia***

Room 1219  
Chinachem Golden Plaza  
77 Mody Road Tsimhatsui  
East Kowloon  
Hong Kong  
TEL (852) 2721-9778  
FAX (852) 2722-1369

### ***Japan***

9F, Tonetsu Shinkawa Bldg.  
1-24-8 Shinkawa  
Chuo-ku, Tokyo 104-0033  
Japan  
TEL (81) 3-3523-3551  
FAX (81) 3-3523-7581

## **Atmel Operations**

### ***Memory***

2325 Orchard Parkway  
San Jose, CA 95131  
TEL 1(408) 441-0311  
FAX 1(408) 436-4314

### ***Microcontrollers***

2325 Orchard Parkway  
San Jose, CA 95131  
TEL 1(408) 441-0311  
FAX 1(408) 436-4314

La Chantrerie  
BP 70602  
44306 Nantes Cedex 3, France  
TEL (33) 2-40-18-18-18  
FAX (33) 2-40-18-19-60

### ***ASIC/ASSP/Smart Cards***

Zone Industrielle  
13106 Rousset Cedex, France  
TEL (33) 4-42-53-60-00  
FAX (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.  
Colorado Springs, CO 80906  
TEL 1(719) 576-3300  
FAX 1(719) 540-1759

Scottish Enterprise Technology Park  
Maxwell Building  
East Kilbride G75 0QR, Scotland  
TEL (44) 1355-803-000  
FAX (44) 1355-242-743

### ***RF/Automotive***

Theresienstrasse 2  
Postfach 3535  
74025 Heilbronn, Germany  
TEL (49) 71-31-67-0  
FAX (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.  
Colorado Springs, CO 80906  
TEL 1(719) 576-3300  
FAX 1(719) 540-1759

### ***Biometrics/Imaging/Hi-Rel MPU/ High Speed Converters/RF Datacom***

Avenue de Rochepleine  
BP 123  
38521 Saint-Egreve Cedex, France  
TEL (33) 4-76-58-30-00  
FAX (33) 4-76-58-34-80

---

### ***e-mail***

literature@atmel.com

### ***Web Site***

<http://www.atmel.com>

## **© Atmel Corporation 2002.**

Atmel Corporation makes no warranty for the use of its products, other than those expressly contained in the Company's standard warranty which is detailed in Atmel's Terms and Conditions located on the Company's web site. The Company assumes no responsibility for any errors which may appear in this document, reserves the right to change devices or specifications detailed herein at any time without notice, and does not make any commitment to update the information contained herein. No licenses to patents or other intellectual property of Atmel are granted by the Company in connection with the sale of Atmel products, expressly or by implication. Atmel's products are not authorized for use as critical components in life support devices or systems.

ATMEL® is the registered trademark of Atmel Corporation.

Other terms and product names may be the trademark of others.



Printed on recycled paper.