



# **Data Book**

## **AU9520**

### **USB Smart Card Reader Controller**

### **Technical Reference Manual**

**Product Specification**

**Official Release**

**Revision 1.18W**

**Public**

**May 2005**



## Data Sheet Status

|                           |                                                                                       |
|---------------------------|---------------------------------------------------------------------------------------|
| Objective specification   | This data sheet contains target or goal specifications for product development.       |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification     | This data sheet contains final product specifications.                                |

## Revision History

| Date     | Revision   | Description                                                         |
|----------|------------|---------------------------------------------------------------------|
| May 2005 | V1.18W/D22 | Removed the schematics.<br>Please contact our sales if you need it. |
|          |            |                                                                     |
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## 1.0. Introduction

### 1.1. Description

AU9520 is a highly integrated single chip, USB Smart Card reader controller. Highly integration enables the lowest BOM cost of USB Smart Card reader. The AU9520 supports multiple international standards including **ISO7816 for IC card standard, PC/SC 1.0 for windows smart card standard, Microsoft WHQL, EMV for Europay MasterCard Visa standard and USB-IF CCID standard.** Manufacturers can easily create a high-security Smart Card reader by deploying Au9520. The application of AU9520 can be generally applied to Smart Card read/write terminal device, such as ATM, POS terminal, Public telephone, E-Commerce, personal consumption on Internet, personal certification, prepaid system, loyalty system...etc.

### 1.2. Feature

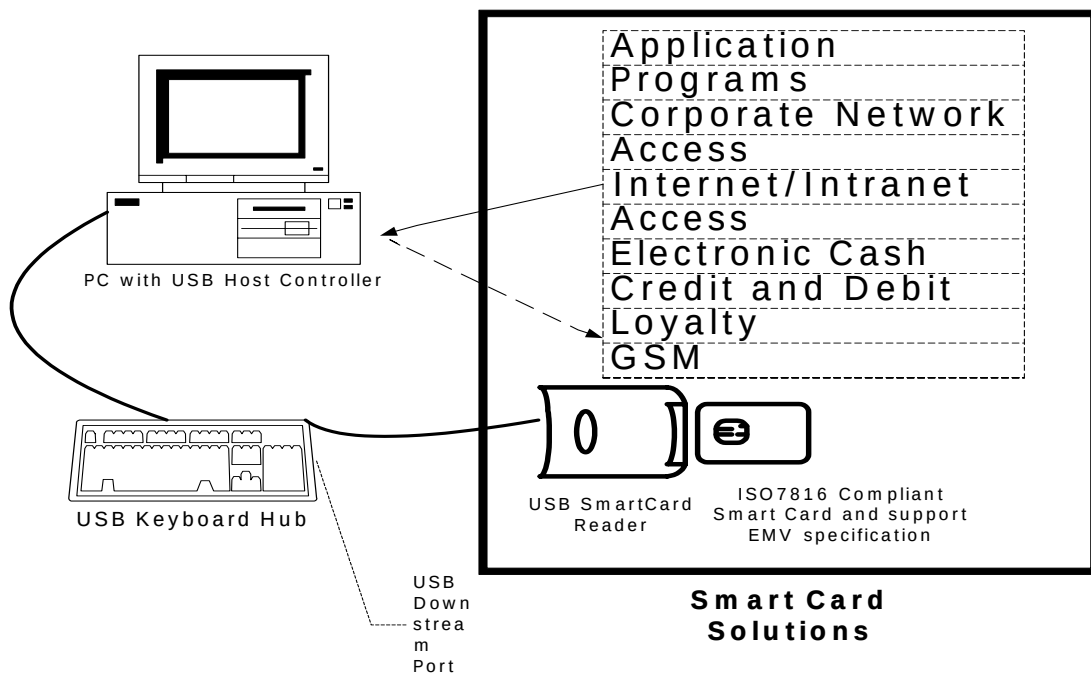
- Support EMV specification.
- Support the Universal Serial Bus Specification, version 1.1.
- Based on ISO7816 implementation
- Support PC Smart Card industry standard – PC/SC 1.0
- Support Microsoft Smart Card for Windows
- Meet Microsoft WHQL USB Smart Card Reader requirements
- Include WDM driver to work on Windows 98 and Windows 2000
- Support dual slots for higher security application
- Support T0, T1 protocol, I2C memory card, SLE4418, SLE4428, SLE4432, SLE4442, AT88SC1608 and AT45D041 card.
- Dedicated hardware block implementation for IC and memory card protocols for highest performance
- Implemented as an USB full speed device with bulk transfer endpoint
- Built-in 3.3V regulator for single 5V operation
- Built-in PLL for USB and Smart Card clocks requirement
- Support EEPROM for USB descriptors customization, including VID/PID
- Available in 48-LQFP Package
- Based on USB-CCID class, short APDU level
- Compatible with Microsoft USB-CCID driver
- Support 3V/5V card

## 2.0. Application Block Diagram

AU9520 is a highly integrated single chip, which is used as USB Smart Card reader or in an embedded USB device in the downstream port of an USB hub. Following is the application diagram of a typical card reader product with AU9520. By connecting the card reader to a ATM or E-Commerce...etc.

### 2.1 Block Diagram

Figure 2.1 Block Diagram





## 3.0. Pin Assignment

The AU9520 is packed in 48-LQFP-form factor. The following figure shows signal name for each pin and the table in the following page describes each pin in detail

**Figure 3.1 Pin Assignment Diagram**

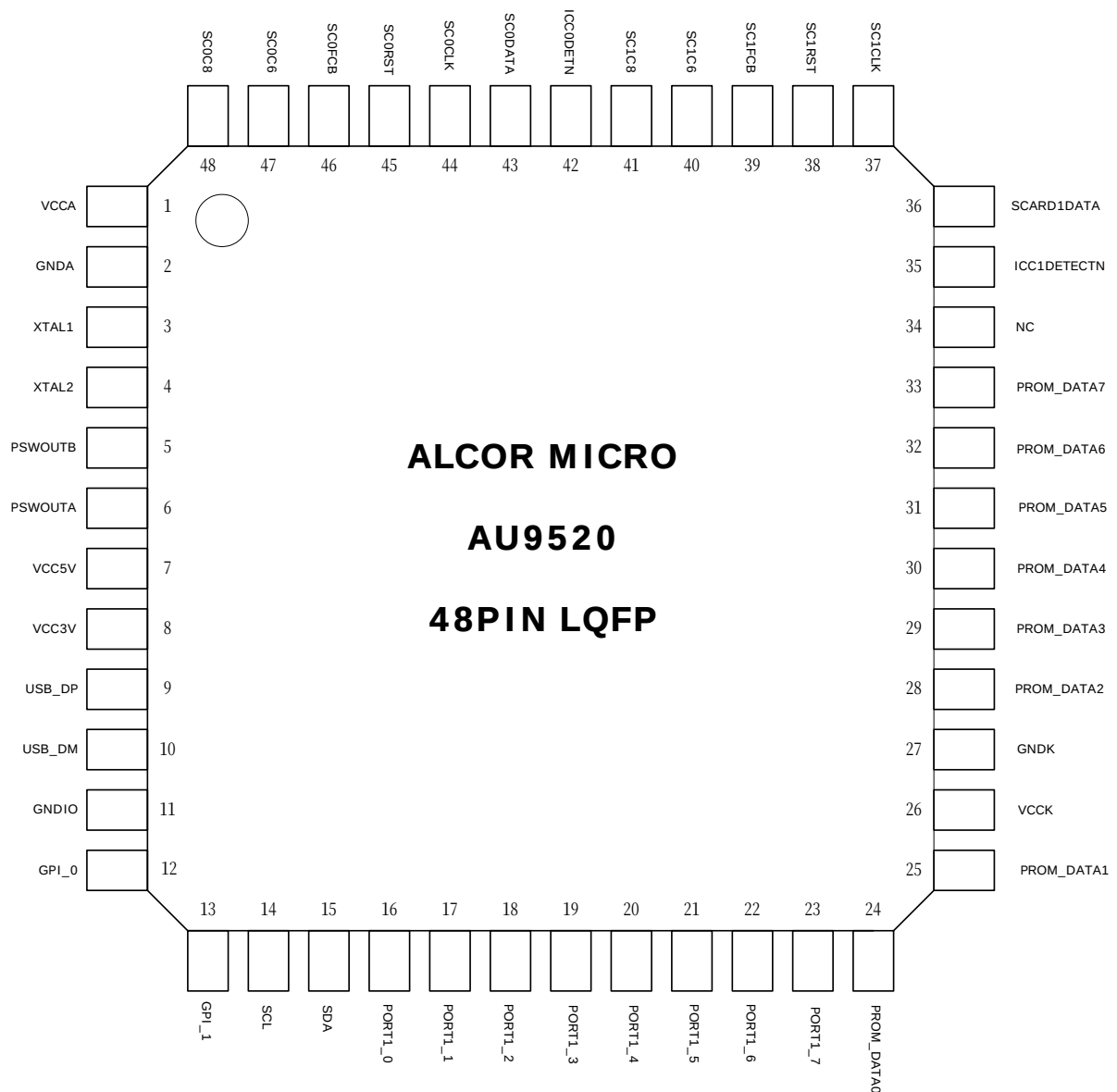




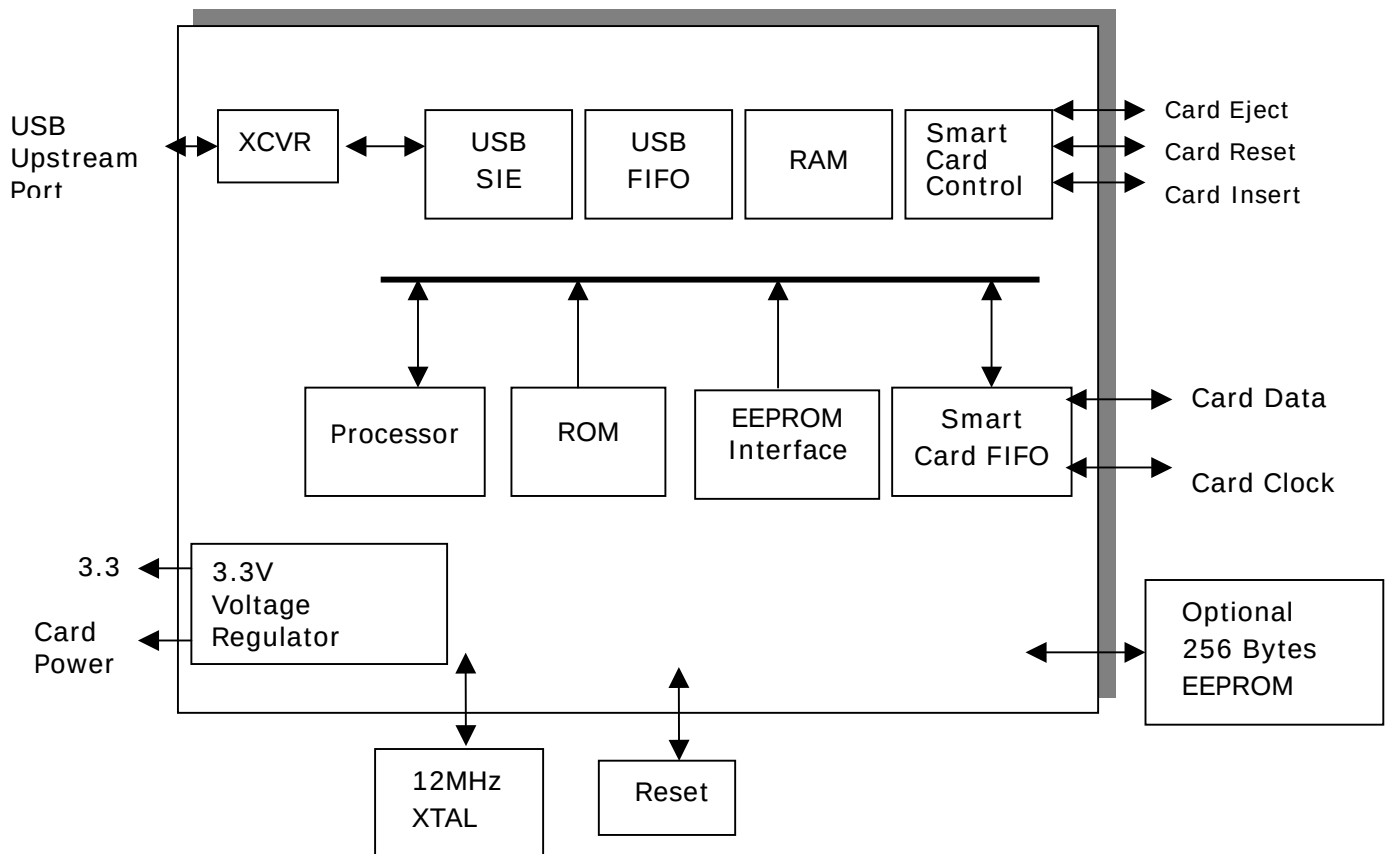
**Table 3.1 Pin Descriptions**

| Pin | Pin Name   | I/O | Description                                                              |
|-----|------------|-----|--------------------------------------------------------------------------|
| 1   | VCCA       | PWR | Analog 3.3V power supply                                                 |
| 2   | GNDA       | PWR | Analog ground.                                                           |
| 3   | XTAL1      | I   | Crystal Oscillator Input (12MHz).                                        |
| 4   | XTAL2      | O   | Crystal Oscillator Output (12MHz).                                       |
| 5   | PSWOUTB    | O   | Connect to Slot1 Power.                                                  |
| 6   | PSWOUTA    | O   | Connect to Slot0 Power.                                                  |
| 7   | VCC5V      | PWR | 5V power supply Input                                                    |
| 8   | VCC3V      | PWR | 3.3V power supply output                                                 |
| 9   | USB_DP     | I/O | USB D+                                                                   |
| 10  | USB_DM     | I/O | USB D-                                                                   |
| 11  | GNDIO      | PWR | Chip I/O Ground.                                                         |
| 12  | GPI_0      | I   | Reserved (need pull Low)                                                 |
| 13  | GPI_1      | I   | Reserved (need pull Low)                                                 |
| 14  | SCL        | I/O | EEPROM Clock (need pull High)                                            |
| 15  | SDA        | I/O | EEPROM Data (need pull High)                                             |
| 16  | PORT1_0    | I   | Reserved (need pull Low)                                                 |
| 17  | PORT1_1    | I/O | General IO 1                                                             |
| 18  | PORT1_2    | O   | Slot1 LED                                                                |
| 19  | PORT1_3    | O   | Slot2 LED                                                                |
| 20  | PORT1_4    | O   | Device LED                                                               |
| 21  | PORT1_5    | I   | PID/VID ("1": 9520 one slot mode, "0": 9522 two slot mode, default: "1") |
| 22  | PORT1_6    | I   | Reserved (need pull Low)                                                 |
| 23  | PORT1_7    | I   | Reserved (need pull low)                                                 |
| 24  | PROM_DATA0 | I/O | Rom data 0                                                               |
| 25  | PROM_DATA1 | I/O | Rom data 1                                                               |
| 26  | VCKK       | PWR | Core power supply 3.3V                                                   |
| 27  | GNDK       | PWR | Core ground                                                              |
| 28  | PROM_DATA2 | I/O | Rom data 2                                                               |
| 29  | PROM_DATA3 | I/O | Rom data 3                                                               |
| 30  | PROM_DATA4 | I/O | Rom data 4                                                               |
| 31  | PROM_DATA5 | I/O | Rom data 5                                                               |
| 32  | PROM_DATA6 | I/O | Rom data 6                                                               |
| 33  | PROM_DATA7 | I/O | Rom data 7                                                               |
| 34  | NC         |     |                                                                          |
| 35  | ICC1DETN   | I   | Smart card 1 inserted (Low true) (pull high)                             |
| 36  | SC1DATA    | I/O | Smart card 1 serial data                                                 |
| 37  | SC1CLK     | I/O | Smart card 1 clock                                                       |
| 38  | SC1RST     | I/O | Smart card 1 reset                                                       |
| 39  | SC1FCB     | I/O | Smart card 1 GPIO_0                                                      |
| 40  | SC1C6      | I/O | Smart card 1 GPIO_1                                                      |
| 41  | SC1C8      | I/O | Smart card 1 GPIO_2                                                      |
| 42  | ICC0DETN   | I   | Smart card 0 inserted (Low true)(pull high)                              |
| 43  | SC0DATA    | I/O | Smart card 0 serial data                                                 |
| 44  | SC0CLK     | I/O | Smart card 0 clock                                                       |
| 45  | SC0RST     | I/O | Smart card 0 reset                                                       |
| 46  | SC0FCB     | I/O | Smart card 0 GPIO_0                                                      |
| 47  | SC0C6      | I/O | Smart card 0 GPIO_1                                                      |
| 48  | SC0C8      | I/O | Smart card 0 GPIO_2                                                      |

## 4.0. System Architecture and Reference Design

### 4.1. Block Diagram

Figure 4.1 AU9520 USB Dual-Slot USB Smart Card Reader Controller





## 5.0. Electronic Characteristics

### 5.1 Recommended Operation Condition

Table 5.1 Recommended Operation Condition

| SYMBOL           | PARAMETER             | MIN  | TYP | MAX             | UNITS |
|------------------|-----------------------|------|-----|-----------------|-------|
| V <sub>CC</sub>  | Power Supply          | 4.75 | 5   | 5.25            | V     |
| V <sub>IN</sub>  | Input Voltage         | 0    |     | V <sub>CC</sub> | V     |
| T <sub>OPR</sub> | Operating Temperature | 0    |     | 85              | °C    |
| T <sub>STG</sub> | Storage Temperature   | -40  |     | 125             | °C    |

### 5.2 General DC Characteristics

Table 5.2 General DC Characteristics

| SYMBOL           | PARAMETER                         | CONDITIONS              | MIN | TYP | MAX | UNITS |
|------------------|-----------------------------------|-------------------------|-----|-----|-----|-------|
| I <sub>IL</sub>  | Input low current                 | no pull-up or pull-down | -1  |     | 1   | μA    |
| I <sub>IH</sub>  | Input high current                | no pull-up or pull-down | -1  |     | 1   | μA    |
| I <sub>OZ</sub>  | Tri-state leakage current         |                         | -10 |     | 10  | μA    |
| C <sub>IN</sub>  | Input capacitance                 |                         |     | 5   |     | pF    |
| C <sub>OUT</sub> | Output capacitance                |                         |     | 5   |     | pF    |
| C <sub>BID</sub> | Bi-directional buffer capacitance |                         |     | 5   |     | pF    |

### 5.3 DC Electrical Characteristics for 3.3 volts operation

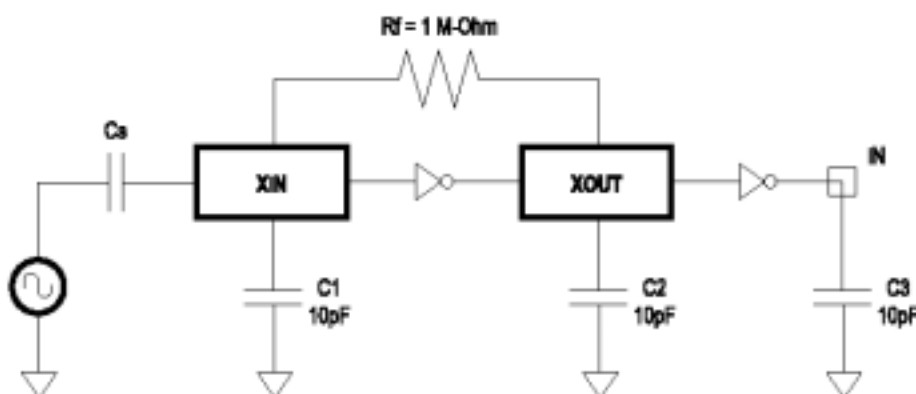
Table 5.3 DC Electrical Characteristics for 3.3 volts operation

| SYMBOL          | PARAMETER                     | CONDITIONS                                                | MIN | TYP      | MAX | UNITS |
|-----------------|-------------------------------|-----------------------------------------------------------|-----|----------|-----|-------|
| V <sub>IL</sub> | Input Low Voltage             | CMOS                                                      |     |          | 0.9 | V     |
| V <sub>IH</sub> | Input High Voltage            | CMOS                                                      | 2.3 |          |     | V     |
| V <sub>OL</sub> | Output low voltage            | I <sub>OL</sub> = 4mA, 16mA                               |     |          | 0.4 | V     |
| V <sub>OH</sub> | Output high voltage           | I <sub>OH</sub> = 4mA, 16mA                               | 2.4 |          |     | V     |
| R <sub>I</sub>  | Input Pull-up/down resistance | V <sub>IL</sub> = 0V or V <sub>IH</sub> = V <sub>CC</sub> |     | 10K/200K |     | KΩ    |

## 5.4 Crystal Oscillator Circuit Setup for Characterization

The following setup was used to measure the open loop voltage gain for crystal oscillator circuits. The feedback resistor serves to bias the circuit at its quiescent operating point and the AC coupling capacitor,  $C_s$ , is much larger than  $C_1$  and  $C_2$ .

**Figure 5.1 Crystal Oscillator Circuit Setup for Characterization**



## 5.5 ESD Test Results

**Test Description:** ESD Testing was performed on a Zapmaster system using the Human-Body-Model (HBM) and Machine-Model (MM), according to MIL-STD 883 and EIAJ IC-121 respectively.

- Human-Body-Model stresses devices by sudden application of a high voltage supplied by a 100pF capacitor through 1.5k-ohm resistance.
- Machine-Model stresses devices by sudden application of a high voltage supplied by a 200pF capacitor through very low (0 ohm) resistance.

### Test Circuit & Condition

- Zap Interval: 1 second
- Number of Zaps: 3 positive and 3 negative at room temperature
- Criteria: I-V Curve Tracing

**Table 5.4 ESD Data**

| Model | Mode          | S / S | Target | Results |
|-------|---------------|-------|--------|---------|
| HBM   | Vdd, Vss, I/C | 15    | 6000V  | PASS    |
| MM    | Vdd, Vss, I/C | 15    | 200V   | PASS    |

## 5.6 Latch-Up Test Results

**Test Description:** Latch-Up testing was performed at room ambient using an IMCS-4600 system which applies a stepped voltage to one pin per device with all other pins open except Vdd and Vss which were biased to 5Volts and ground respectively.

Testing was started at 5.0V (Positive) or 0V (Negative), and the DUT was biased for 0.5 seconds.

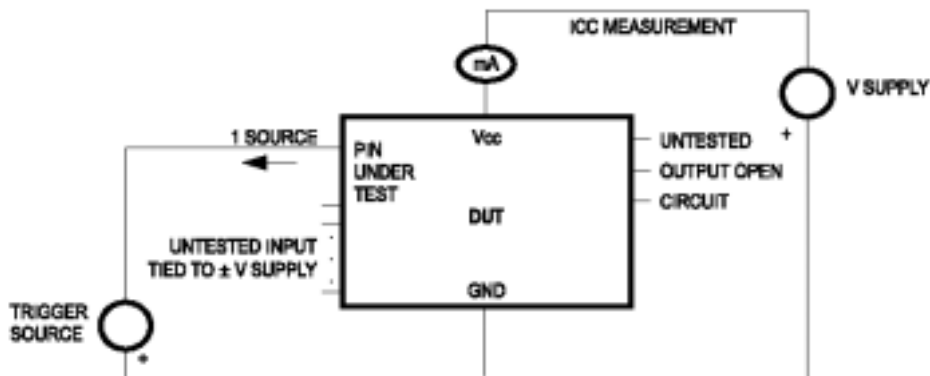
If neither the PUT current supply nor the device current supply reached the predefined limit (DUT=00mA, Icc=100mA), then the voltage was increased by 0.1Volts and the pin was tested again.

This procedure was recommended by the JEDEC JC-40.2 CMOS Logic standardization committee.

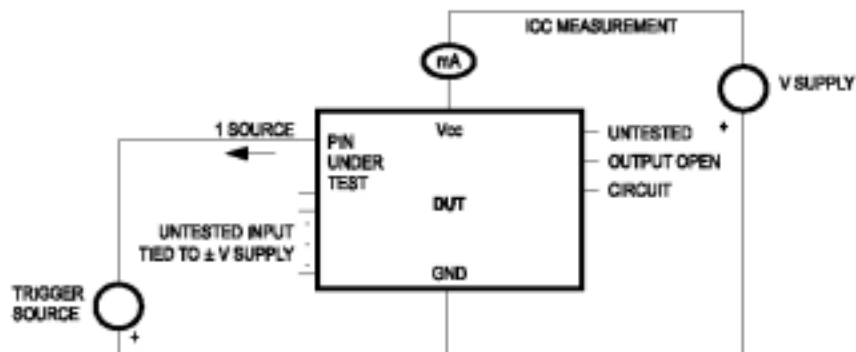
### Notes:

1. DUT: The device under test.
2. PUT: The pin under test.

**Figure 5.2 Latch-Up Test Results Diagram**

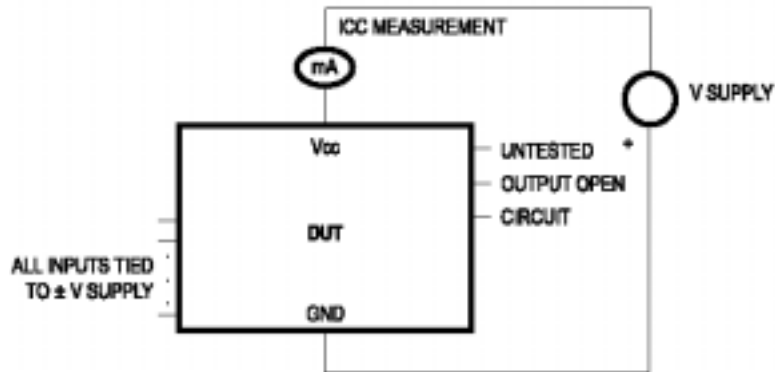


**Test Circuit: Positive Input/Output Overvoltage/Overcurrent**



**Test Circuit: Negative Input/Output Overvoltage/Overcurrent**

Figure 5.2 Latch-Up Test Results Diagram (continue)



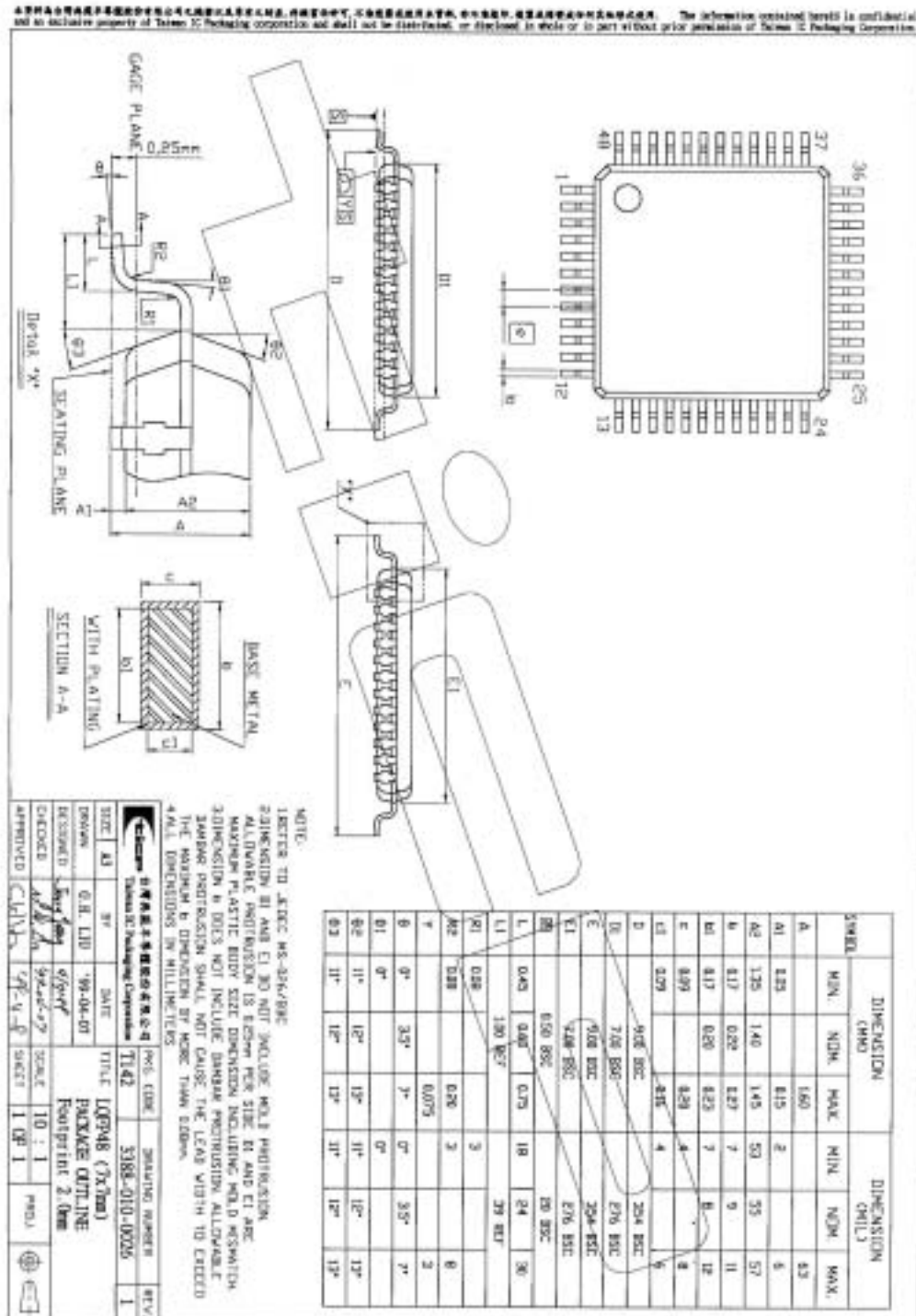
### Supply Overvoltage Test

Table 5.5 Latch-Up Data Table

| Mode      |   | Voltage (V) / Current (mA) | S / S | Results |
|-----------|---|----------------------------|-------|---------|
| Voltage   | + | 11.0                       | 5     | Pass    |
|           | - | 11.0                       | 5     | Pass    |
| Current   | + | 200                        | 5     | Pass    |
|           | - | 200                        | 5     | Pass    |
| Vdd - Vxx |   | 9.0                        | 5     | Pass    |

## 6.0. Mechanical Information

### Figure 7.1 Mechanical Information Diagram





## 7.0. Abbreviation

This chapter lists and defines terms and abbreviations used throughout this specification.

**WHQL** Windows Hardware Quality Labs

**EMV** Europay MasterCard Visa

**ATM** Automatic Teller Machine

**BOM** Bill of Material

**PC/SC** This is association name.( <http://www.pcscworkgroup.com/>)

**VID** Vendor ID

**PID** Product ID

**PLL** Phase Lock Loop

**GSM** ..Globe System for Mobile Communication

**ESD** Electrostatic Sensitive Device



**【MEMO】**

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Alcor Micro, Corp. designs, develops and markets highly integrated and advanced peripheral semiconductor, and software driver solutions for the personal computer and consumer electronics markets worldwide. We specialize in USB solutions and focus on emerging technology such as USB and IEEE 1394. The company offers a range of semiconductors including controllers for USB hub, integrated keyboard/USB hub and USB Flash memory card reader...etc. Alcor Micro, Corp. is based in Taipei, Taiwan, with sales offices in Taipei, Japan, Korea and California.

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