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Data Book

AU9510F
USB Smart Card Reader Controller
Technical Reference Manual

Product Specification

Official Release

Revision 1.07W

Public   **Apr 2005**

Alcor Micro Corp.

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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
Apr 2005	1.07W	Initial release

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1.0. Introduction
1.1. Description

AU9510F is a highly integrated single chip, USB Smart Card reader controller. Highly integration enables the lowest BOM cost of USB Smart Card reader. The AU9510F supports multiple international standards including ISO7816 for IC card standard, PC/SC 1.0 for windows smart card standard, Microsoft WHQL, and USB-IF CCID standard. The application of AU9510F can be generally applied to Smart Card read/write terminal device, such as Electronic Cash, Credit and Debit, GSM, loyalty system, and access information…etc.
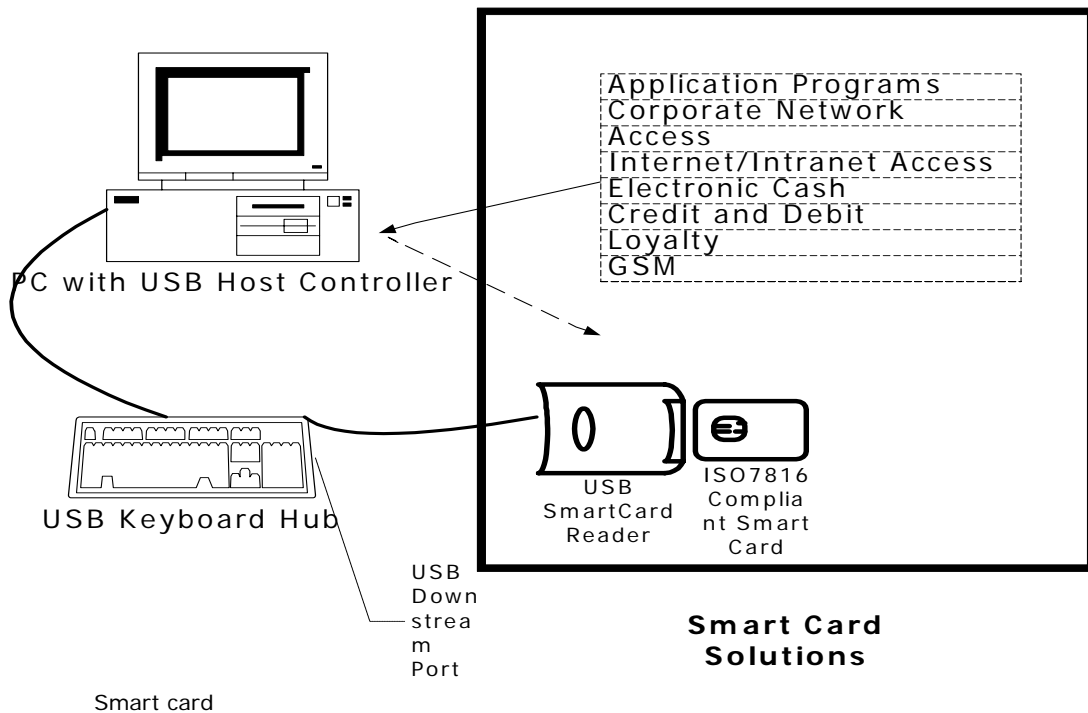
1.2.   Feature

- 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

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2.0. Application Block Diagram

AU9510F is a highly integrated single chip, which is used as an 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 AU9510F. By connecting the card reader to a GSM or Corporate network...etc.

2.1 Block Diagram

Figure 2.1   Block Diagram

Application Programs
Corporate Network Access
Internet/Intranet Access
Electronic Cash
Credit and Debit
Loyalty
GSM

PC with USB Host Controller

USB Keyboard Hub

USB Downstream Port

Smart card

USB SmartCard Reader

ISO7816 Compliant Smart Card

Smart Card Solutions

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3.0. Pin Assignment

The AU9510F 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
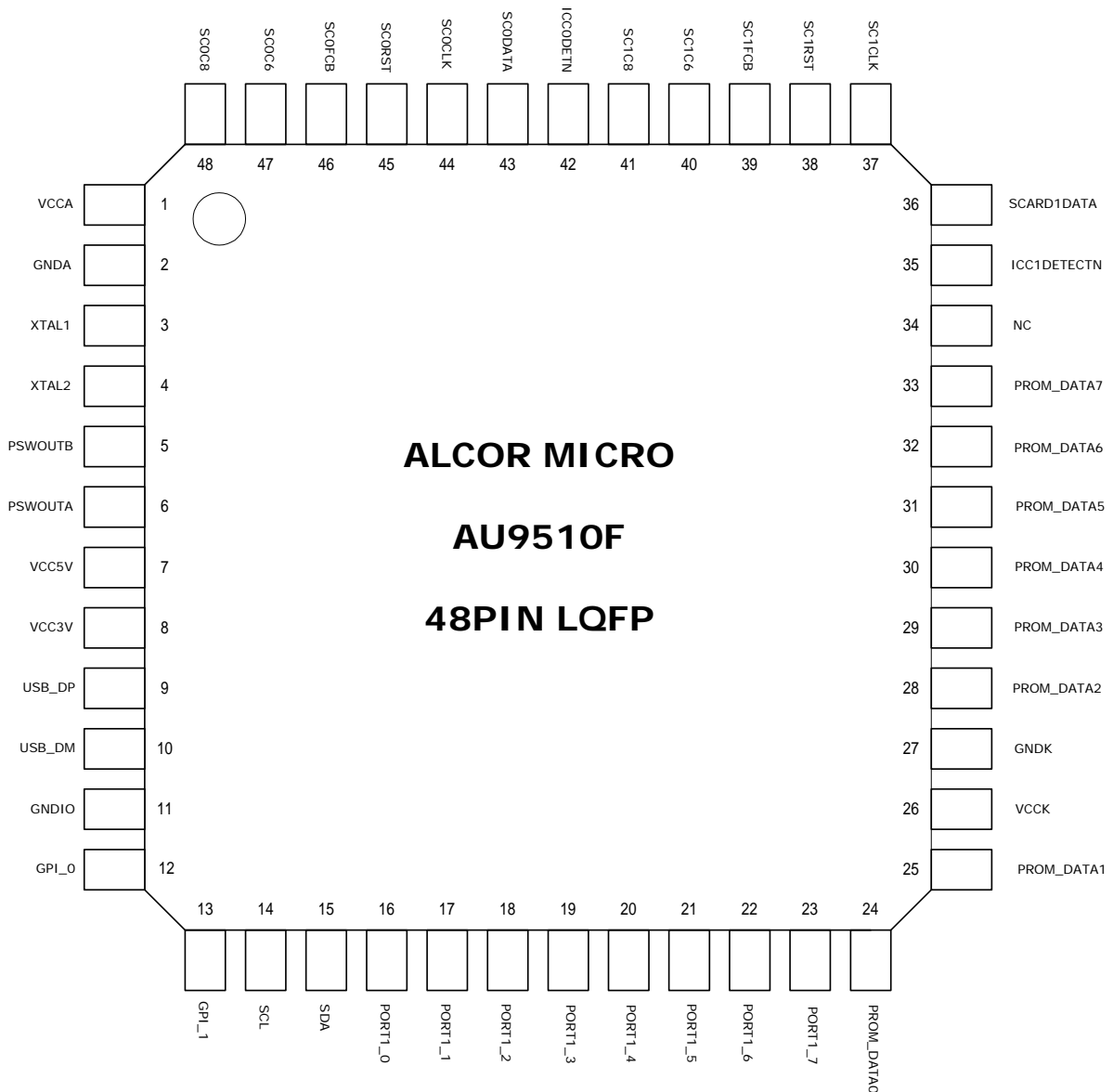
Figure 3.1 Pin Assignment Diagram

Top pins (left to right, 48–37): SC0C8, SC0C6, SC0FCB, SC0RST, SC0CLK, SC0DATA, ICC0DETN, SC1C8, SC1C6, SC1FCB, SC1RST, SC1CLK

Left pins (top to bottom, 1–12): VCCA (1), GNDA (2), XTAL1 (3), XTAL2 (4), PSWOUTB (5), PSWOUTA (6), VCC5V (7), VCC3V (8), USB_DP (9), USB_DM (10), GNDIO (11), GPI_0 (12)

Center label: ALCOR MICRO AU9510F 48PIN LQFP

Right pins (top to bottom, 36–25): SCARD1DATA (36), ICC1DETECTN (35), NC (34), PROM_DATA7 (33), PROM_DATA6 (32), PROM_DATA5 (31), PROM_DATA4 (30), PROM_DATA3 (29), PROM_DATA2 (28), GNDK (27), VCCK (26), PROM_DATA1 (25)

Bottom pins (left to right, 13–24): GPI_1 (13), SCL (14), SDA (15), PORT1_0 (16), PORT1_1 (17), PORT1_2 (18), PORT1_3 (19), PORT1_4 (20), PORT1_5 (21), PORT1_6 (22), PORT1_7 (23), PROM_DATA0 (24)

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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. - Not support in this version
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 down)
14	SCL	I/O	EEPROM Clock (need pull high)
15	SDA	I/O	EEPROM Data (need pull high)
16	NC		
17	PORT1_1	I/O	General IO 1
18	PORT1_2	O	Slot1 LED
19	PORT1_3	O	Slot2 LED - Not support in this version
20	PORT1_4	O	Device LED
21	PORT1_5	I	Reserved (need pull Low)
22	PORT1_6	I	Reserved (need pull Low)
23	PORT1_7	I	General Input 7
24	PROM_DATA0	I/O	Rom data 0
25	PROM_DATA1	I/O	Rom data 1
26	VCCK	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) - Not support in this version
36	SC1DATA	I/O	Smart card 1 serial data - Not support in this version
37	SC1CLK	I/O	Smart card 1 clock - Not support in this version
38	SC1RST	I/O	Smart card 1 reset
39	SC1FCB	I/O	Smart card 1 GPIO_0 - Not support in this version
40	SC1C6	I/O	Smart card 1 GPIO_1 - Not support in this version
41	SC1C8	I/O	Smart card 1 GPIO_2 - Not support in this version
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

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4.0. System Architecture and Reference Design

4.1. Block Diagram

Figure 4.1 AU9510F USB USB Smart Card Reader Controller

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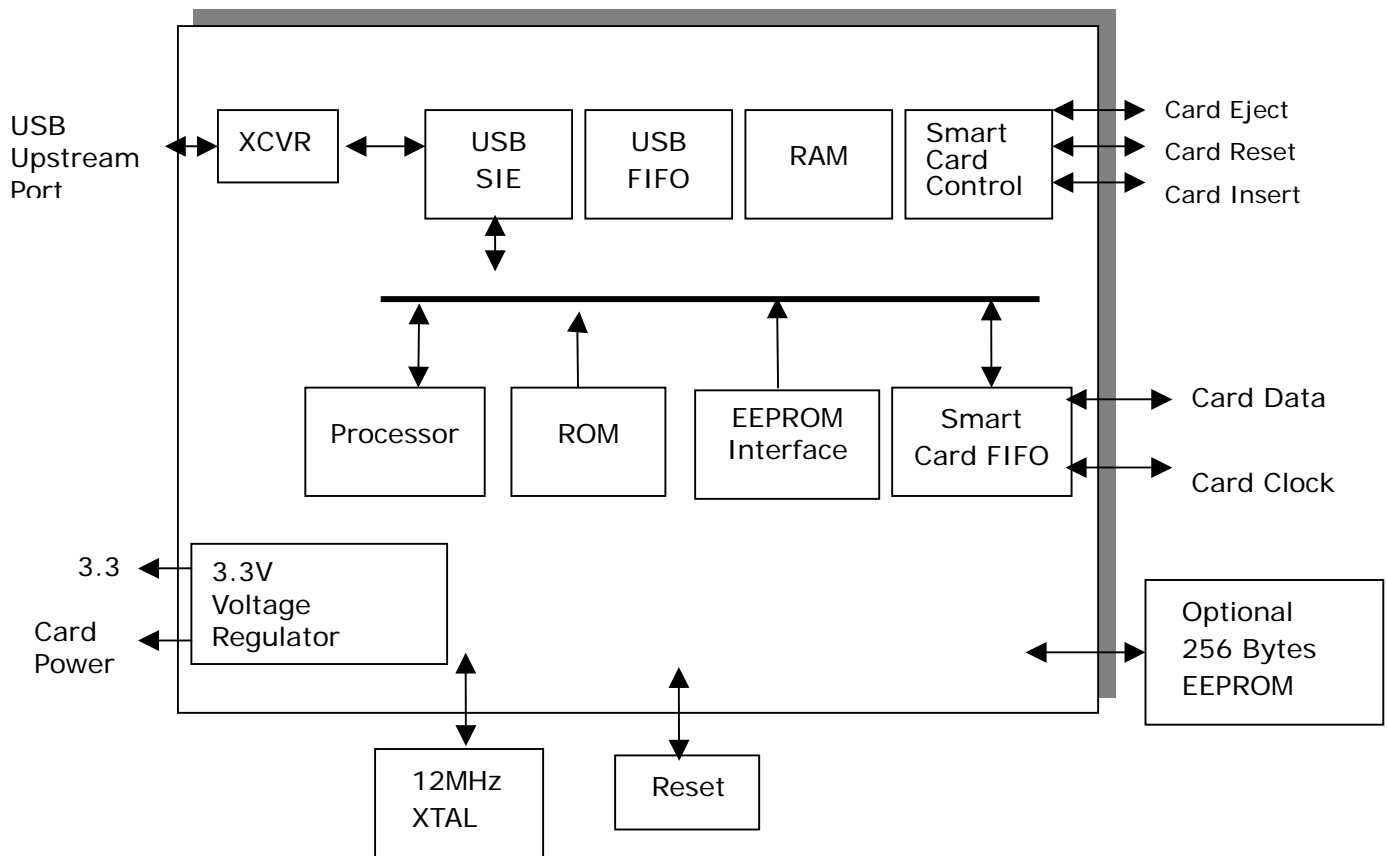
5.0. Electronic Characteristics

5.1 Recommended Operation Condition

Table 5.1 Recommended Operation Condition

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
V_{CC}	Power Supply	4.75	5	5.25	V
V_{IN}	Input Voltage	0		V_{CC}	V
T_{OPR}	Operating Temperature	0		85	^{O}C
T_{STG}	Storage Temperature	-40		125	^{O}C

5.2 General DC Characteristics

Table 5.2 General DC Characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I_{IL}	Input low current	no pull-up or pull-down	-1		1	μA
I_{IH}	Input high current	no pull-up or pull-down	-1		1	μA
I_{OZ}	Tri-state leakage current		-10		10	μA
C_{IN}	Input capacitance			5		ρF
C_{OUT}	Output capacitance			5		ρF
C_{BID}	Bi-directional buffer capacitance			5		ρF

5.3 DC Electrical Characteristics for 3.3 volts operation

Table 5.3 DC Electrical Characteristics for 3.3 volts operation

SYMBO	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IL}	Input Low Voltage	CMOS			0.9	V
V_{IH}	Input Hight Voltage	CMOS	2.3			V
V_{OL}	Output low voltage	I_{OL}=4mA, 16mA			0.4	V
V_{OH}	Output high voltage	I_{OH}=4mA,16mA	2.4			V
R_{I}	Input Pull-up/down resistance	Vil=0_{V} or Vih=V_{CC}		10K/200K		KΩ

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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, Cs, is much larger than C1 and C2.

Figure 5.1 Crystal Oscillator Circuit Setup for Characterization
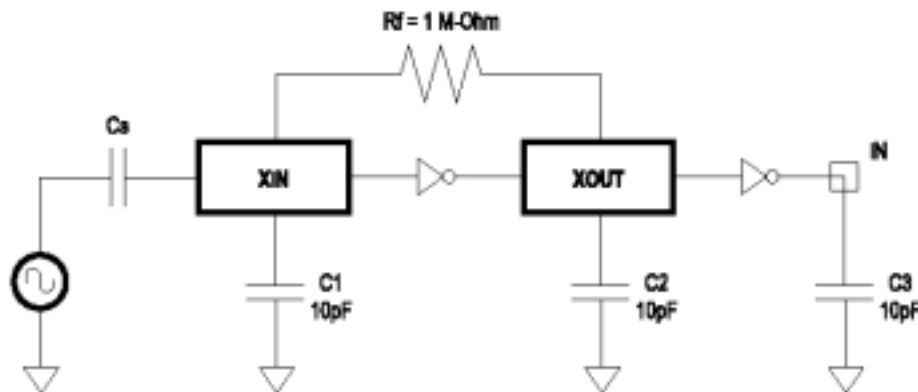
5.5 ESD Test Results

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

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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.
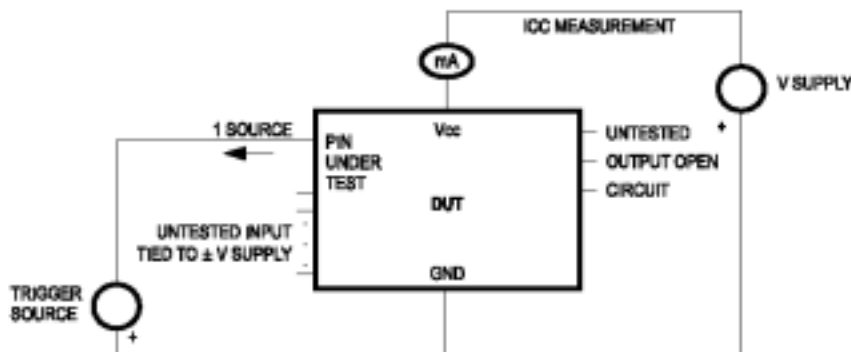
Notes:

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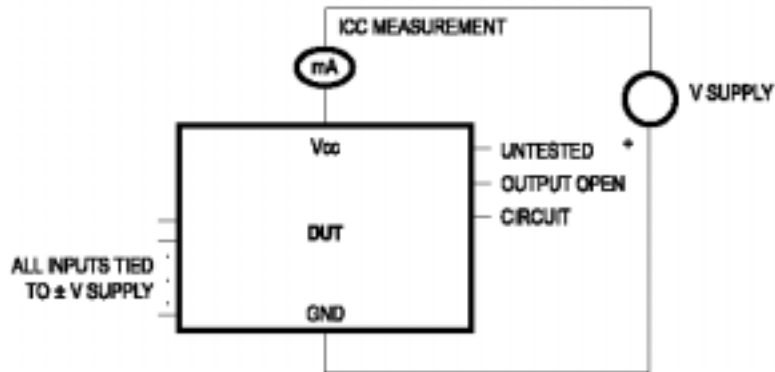2.   PUT: The pin under test.

Figure 5.2 Latch-Up Test Results Diagram
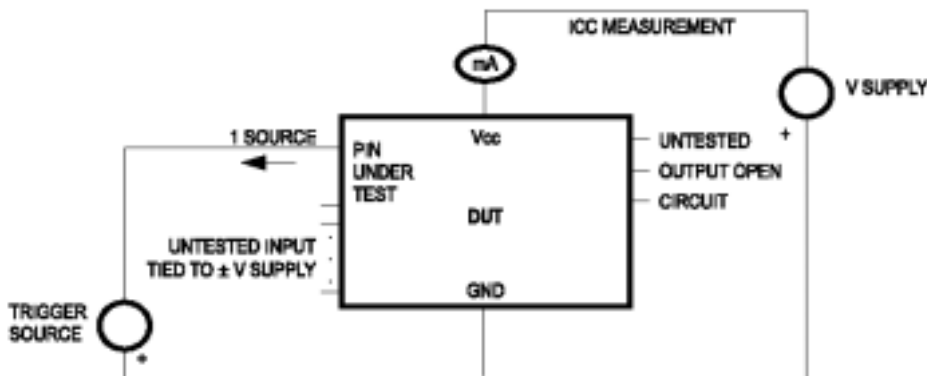
Test Circuit: Positive Input/Output Overvoltage/Overcurrent

Test Circuit: Negative Input/Output Overvoltage/Overcurrent

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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

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6.0. Mechanical Information

Figure 6.1 Mechanical Information Diagram

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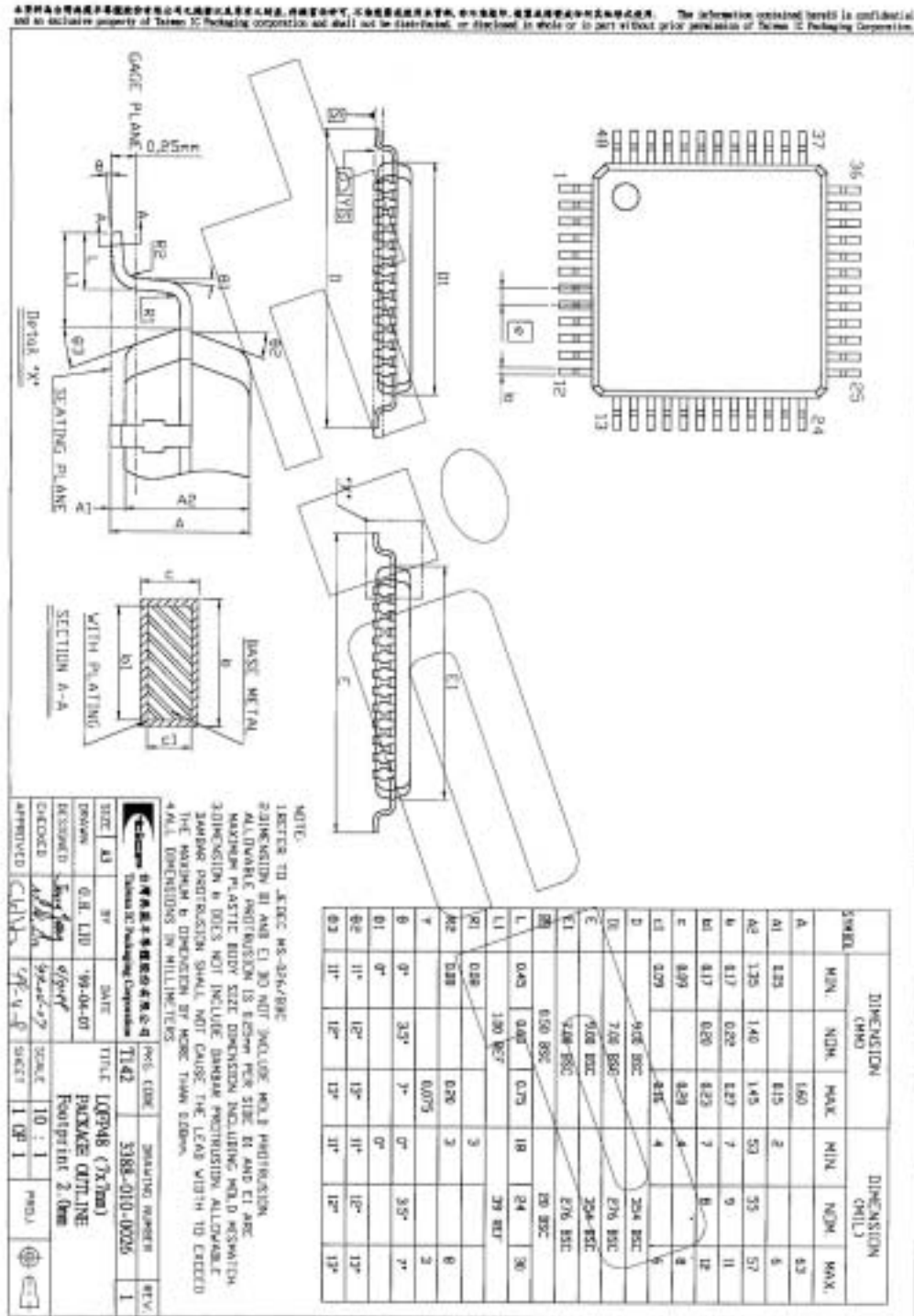
7.0. Abbreviation

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

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About Alcor Micro, Corp

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.

Alcor Micro is distinguished by its ability to provide innovative solutions for spec-driven products. Innovations like single chip solutions for traditional multiple chip products and on-board voltage regulators enable the company to provide cost-efficiency solutions for the computer peripheral device OEM customers worldwide.

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