



# AU9525

## USB Smart Card Reader Controller

### Technical Reference Manual



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# 1. Introduction

## 1.1 Description

AU9525 is a highly integrated single chip, is the second generation USB Smart Card reader controller. Highly integration enables the lowest BOM cost of USB Smart Card reader. The AU9525 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. And support flexible Keyboard/LCM display interface. With our embedded enhanced 8051 MCU, user can self control Keyboard/LCM display by AP. Manufacturers can easily create a higher-security Smart Card reader by deploying Au9525. The application of AU9525 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, prepay system, loyalty system...etc.

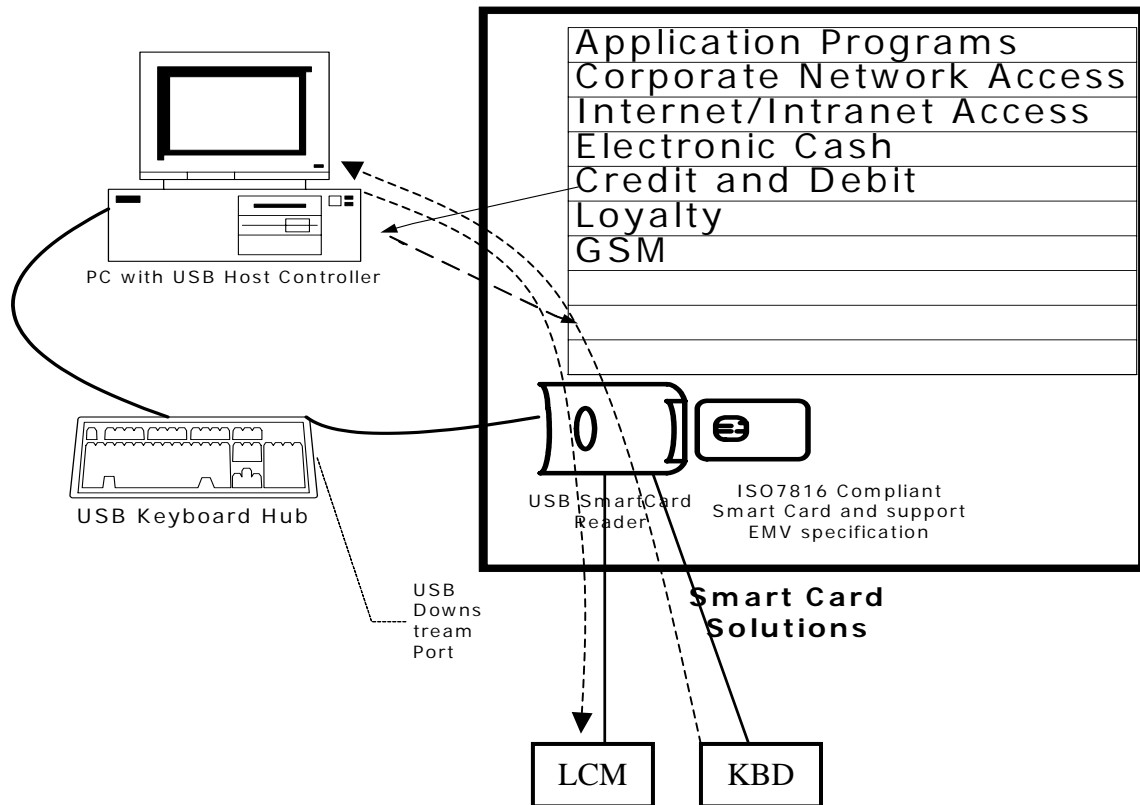
## 1.2 Features

- Support EMV specification
- Support the Universal Serial Bus Specification, 2.0 full speed.
- Based on ISO7816 implementation
- Embedded enhanced 8051 MCU
- Support Firmware upgrade mechanism(ISP, In-System Programming)
- Support PC Smart Card industry standard – PC/SC 1.0
- Support CT-API
- 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 Protocol and parameter selection
- Support card clock up to 4 MHz
- 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 64-LQFP Package
- Based on USB-CCID class, short and extended APDU level
- Compatible with Microsoft USB-CCID driver
- Support 3V/5V card
- Support 5\*6 keypad scan, keypad value can be sent to AP directly
- Support different LCM Interface(such as HD44780,KS0108,ST7920 or compatible)
- LCM is controlled by AP, User can develop their AP to support the LCM type needed

## 2. Application Block Diagram

AU9525 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 AU9525. By connecting the card reader to a ATM or E-Commerce...etc.

Figure 2.1 Block Diagram

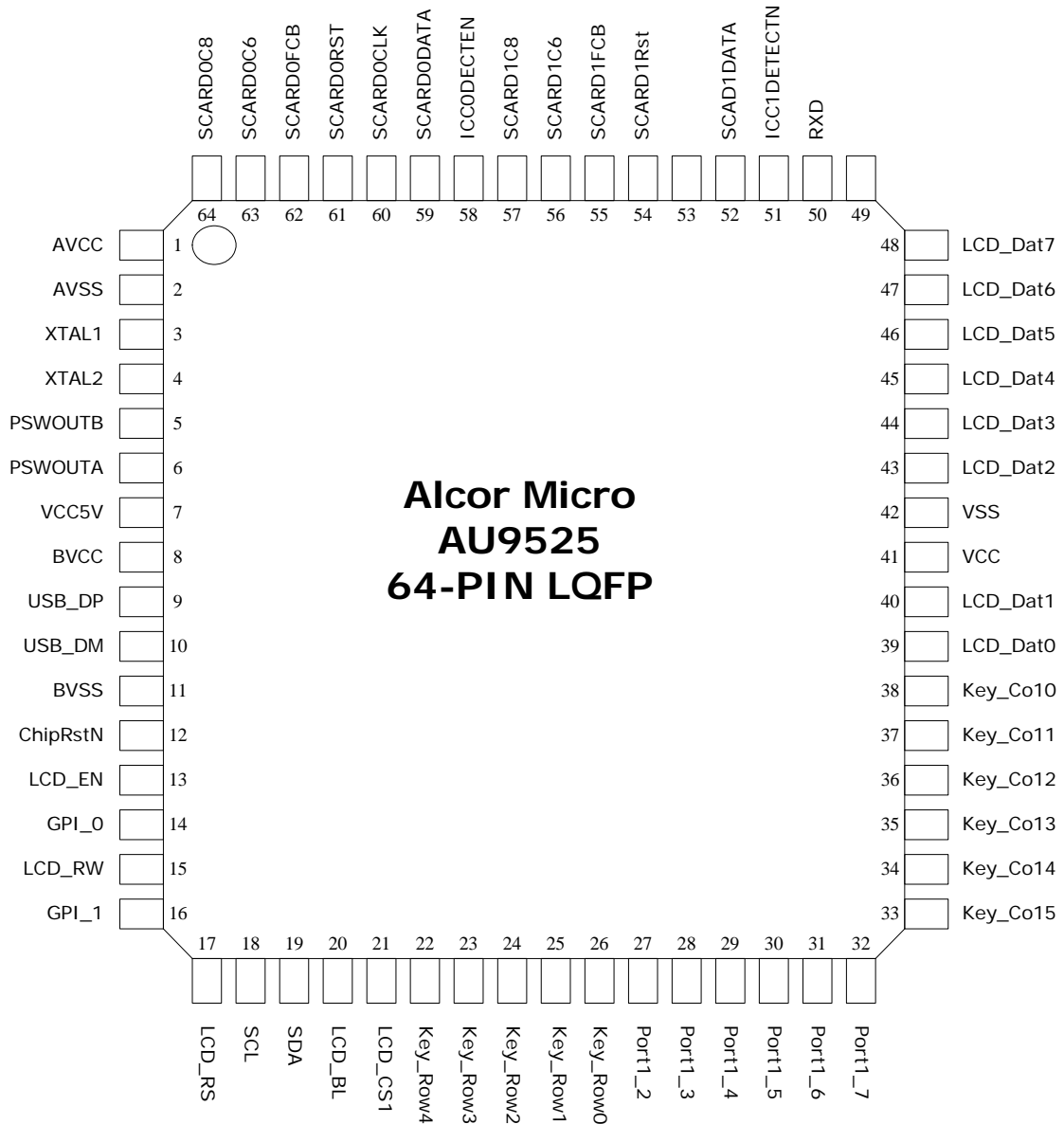




### 3. Pin Assignment

The AU9525 is delivered in 64pin LQFP form factor. Documented below is a figure shows signal names of each pin and a table in the following page describes each pin in more details.

**Figure 3.1 AU9525 Pin Assignment Diagram**



**Table 3.1 AU9525 Pin Descriptions**

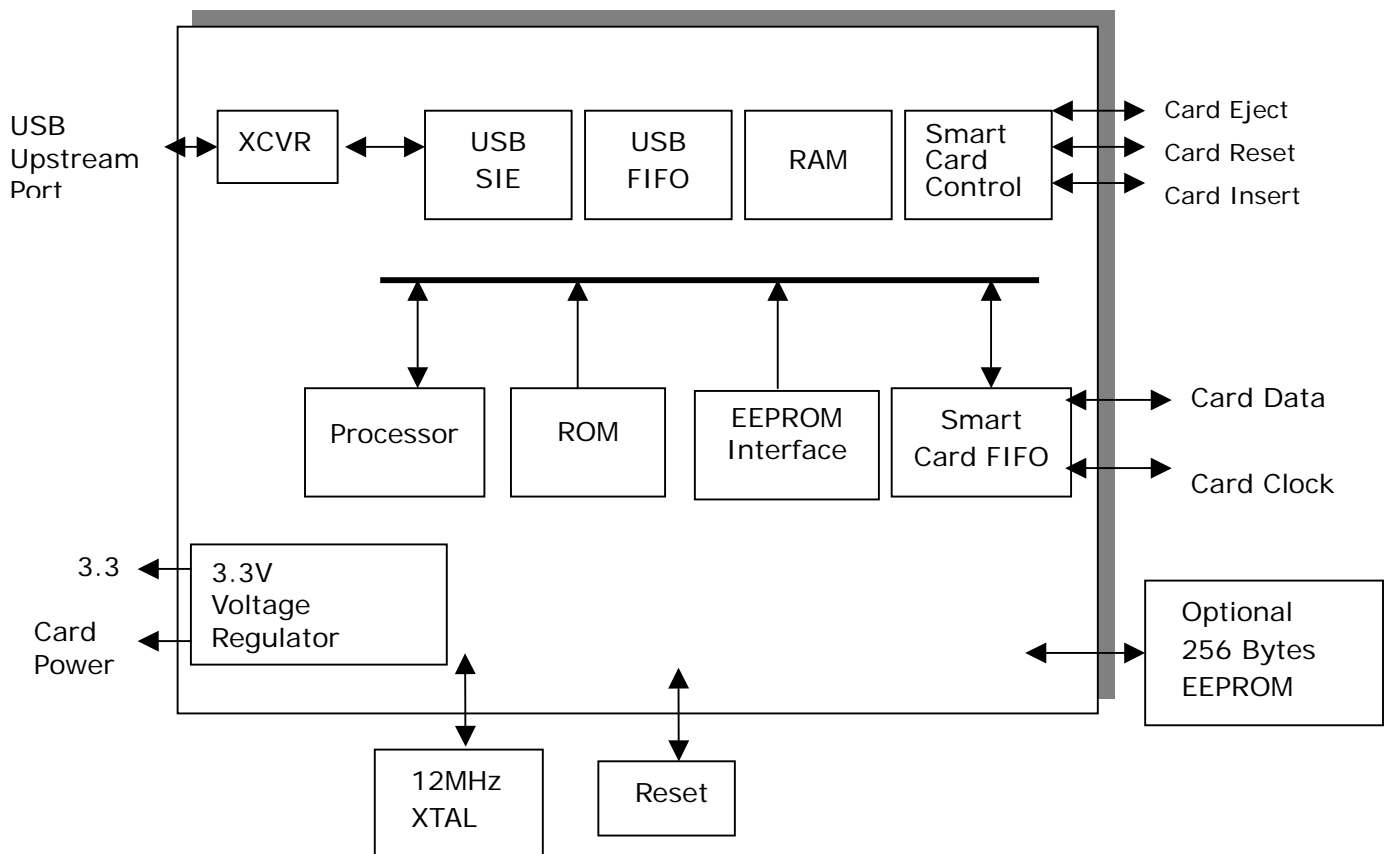
Pin #	Pin Name	I/O	Description
1	AVCC	PWR	Analog 3.3V power supply
2	AVSS	PWR	Analog ground.
3	XTAL1	I	Crystal Oscillator Input (12MHz).
4	XTAL2	O	Crystal Oscillator Output (12MHz).
5	PSWOUTB	O	Connect to Slot1 Power.
6	PSWOUTA	O	Connect to Slot0 Power.
7	VCC5V	PWR	5V power supply Input
8	BVCC	PWR	3.3V power supply output
9	USB_DP	I/O	USB D+
10	USB_DM	I/O	USB D-
11	BVSS	PWR	Chip I/O Ground.
12	ChipRstN	I	Chip Reset
13	LCD_En	O	LCD Enable ( High effective).
14	GPI_0	I	Reserved (need pull down)
15	LCD_Rw	O	LCD Read/Write.0:write;1:read.
16	GPI_1	I	Reserved (need pull down)
17	LCD_RS	O	LCD driver dedicated I/O line: LCD Register Select.
18	SCL	I/O	EEPROM Clock (need pull high)
19	SDA	I/O	EEPROM Data (need pull high)
20	LCD_BL	O	LCD Background Light control, 1:on,0:off.
21	LCD_CS1	O	LCD Display control(To select the left side or right side).
22	Key_Row4	I	Keyboard row input 4.
23	Key_Row3	I	Keyboard row input 3.
24	Key_Row2	I	Keyboard row input 2.
25	Key_Row1	I	Keyboard row input 1.
26	Key_Row0	I	Keyboard row input 0.
27	PORT1_2	O	Slot1 LED
28	PORT1_3	O	Slot2 LED
29	PORT1_4	O	Card Power LED
30	PORT1_5	I	PID/VID ("1": 9525 one slot mode, "0": 9526 two slot mode, default: "1")
31	PORT1_6	I	Reserved(need pull Low)
32	PORT1_7	I	Reserved(need pull Low)
33	Key_Col5	I	Keyboard columniation input 5.

Pin #	Pin Name	I/O	Description
34	Key_Col4	I	Keyboard columniation input 4.
35	Key_Col3	I	Keyboard columniation input 3.
36	Key_Col2	I	Keyboard columniation input 2.
37	Key_Col1	I	Keyboard columniation input 1.
38	Key_Col0	I	Keyboard columniation input 0.
39	LCD_Dat0	I/O	LCD driver dedicated I/O lines – data0.
40	LCD_Dat1	I/O	LCD driver dedicated I/O lines – data1.
41	VCC	PWR	Core power supply 3.3V
42	VSS	PWR	Core ground
43	LCD_Dat2	I/O	LCD driver dedicated I/O lines - Data pin2.
44	LCD_Dat3	I/O	LCD driver dedicated I/O lines - Data pin3.
45	LCD_Dat4	I/O	LCD driver dedicated I/O lines - Data pin4.
46	LCD_Dat5	I/O	LCD driver dedicated I/O lines - Data pin5.
47	LCD_Dat6	I/O	LCD driver dedicated I/O lines - Data pin6.
48	LCD_Dat7	I/O	LCD driver dedicated I/O lines - Data pin7.
49	TXD	O	RS232 output pin
50	RXD	I	RS232 input pin
51	ICC1DETECTN	I	Smart card 1 inserted (Low true) (pull high)
52	SCARD1DATA	I/O	Smart card 1 serial data
53	SCARD1CLK	I/O	Smart card 1 clock
54	SCARD1RST	I/O	Smart card 1 reset
55	SCARD1FCB	I/O	Smart card 1 GPIO_0
56	SCARD1C6	I/O	Smart card 1 GPIO_1
57	SCARD1C8	I/O	Smart card 1 GPIO_2
58	ICC0DECTEN	I	Smart card 0 inserted (Low true)(pull high)
59	SCARD0DATA	I/O	Smart card 0 serial data
60	SCARD0CLK	I/O	Smart card 0 clock
61	SCARD0RST	I/O	Smart card 0 reset
62	SCARD0FCB	I/O	Smart card 0 GPIO_0
63	SCARD0C6	I/O	Smart card 0 GPIO_1
64	SCARD0C8	I/O	Smart card 0 GPIO_2

# 4. System Architecture and Reference Design

## 4.1 AU9525 Block Diagram

Figure 4.1 AU9525 Block Diagram



## 5. Electrical Characteristics

### 5.1 Recommended Operating Conditions

Table 5.1 Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
V <sub>5IN</sub>	Power Supply	4.75	5.0	5.25	V
V <sub>DDHM</sub>	Power Supply	3.0	3.3	3.6	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>IN</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	Pad Limit		5		ρF
C <sub>OUT</sub>	Output capacitance	Pad Limit		5		ρF
C <sub>BID</sub>	Bi-directional buffer capacitance	Pad Limit		5		ρF

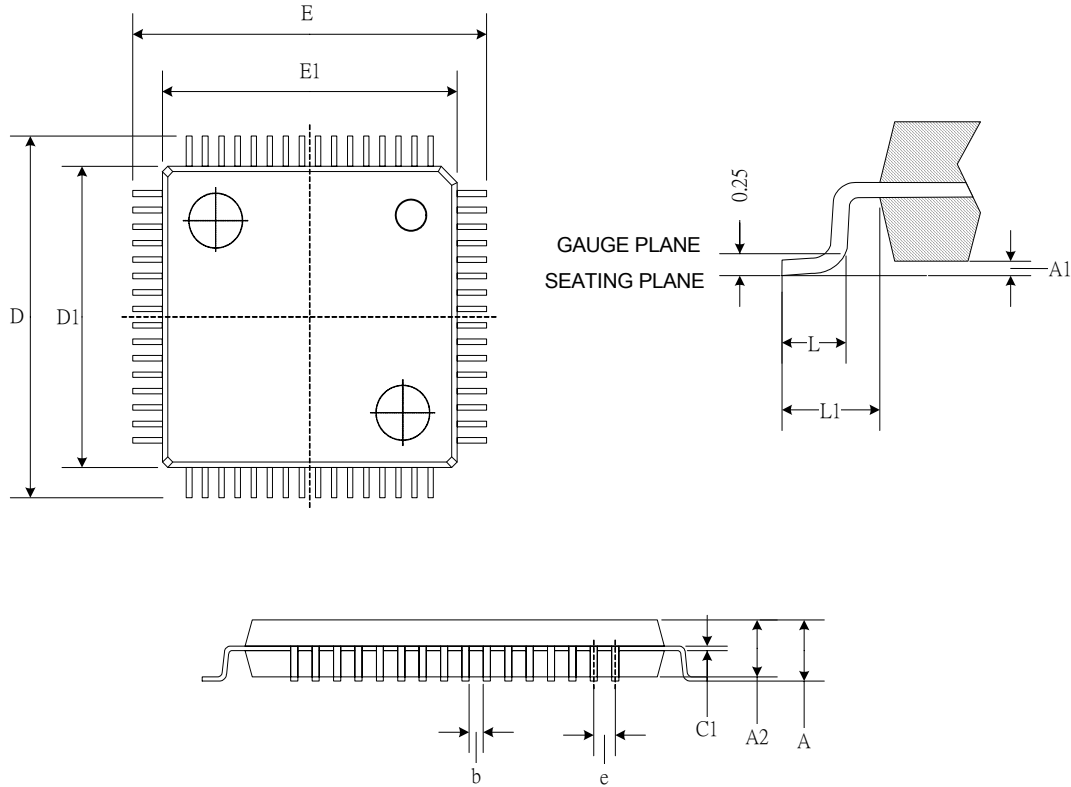
### 5.3 DC Electrical Characteristics of 3.3V I/O Cells

Table 5.3 DC Electrical Characteristics of 3.3V I/O Cells

SYMBOL	PARAMETER	CONDITIONS	Limits			UNIT
			MIN	TYP	MAX	
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>   = 2~16mA			0.4	V
V <sub>OH</sub>	Output high voltage	I <sub>OH</sub>   = 2~16mA	2.4			V
R <sub>I</sub>	Input Pull-up/down resistance	V <sub>IL</sub> =0V or V <sub>IH</sub> =VCC		10K/200K		KΩ

## 6. Mechanical Information

Figure 6.1 Mechanical Information Diagram



SYMBOLS	MIN.	MAX.
A	--	1.60
A1	0.05	0.15
A2	1.35	1.45
b	0.17	0.27
c1	0.09	0.16
D	12.00 BSC	
D1	10.00 BSC	
E	12.00 BSC	
E1	10.00 BSC	
e	0.50 BSC	
L	0.45	0.75
L1	1.00 REF	

1. JEDEC OUTLINE: MS-026 BCD
2. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25mm PER SIDE. D1 AND E1 ARE MAXIMUM PLASTIC BODY SIZE DIMENSIONS INCLUDING MOLD MISMATCH.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED THE MAXIMUM b DIMENSION BY MORE THAN 0.08mm.

## 7. Abbreviations

In this chapter some of the terms and abbreviations used throughout the technical reference manual are listed as follows.

<b>WHQL</b>	Windows Hardware Quality Labs
<b>EMV</b>	Europay MasterCard Visa
<b>ATM</b>	Automatic Teller Machine
<b>BOM</b>	Bill of Material
<b>PC/SC</b>	This is association name. ( <a href="http://www.pcscworkgroup.com/">http://www.pcscworkgroup.com/</a> )
<b>VID</b>	Vendor ID
<b>PID</b>	Product ID
<b>PLL</b>	Phase Lock Loop
<b>GSM</b>	Globe System for Mobile Communication
<b>ESD</b>	Electrostatic Sensitive Device

## 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.