Alcor Micro Corp.

Data Book

AU9386
USB Flash Disk Controller

Technical Reference Manual

Product Specification

Official Release

Revision 1.01W

Public

Apr 2005

Alcor Micro Corp.

Http://www.alcormicro.com/

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	1.01W/A21	Removed the schematics. Please contact our sales if you need it.

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1.0 Introduction

1.1 Description

The AU9386 is a highly integrated single chip USB flash disk controller. It provides the most cost effective bridge between USB enabled PC and NAND type flash memory. AU9386 can be used as a removable storage disk in enormous data exchange applications between PC, Macintosh, laptop and workstation. It can also be configured as a bootable disk for system repairing.

AU9386 gives USB storage device a new life. It will automatically execute your program & play content including Video MPEG, Audio MP3, Advertisements and Applications. AU9386 is an outstanding USB storage device controller; it enables auto run features in Windows 98, XP, 2000 and ME. These unique features give hardware device maker and software vendor tremendous opportunity to develop user-friendly appliance and application.

AU9386 works with NAND type flash memory chip with the combination of popular flash memory types such as 8M, 16M, 32M, 64M, 128M and 256M. Additional features include write protection switch, activity LED and password-protected security.

1.2 Features

- Support with USB v1.1 specification and USB Device Class Definition for Mass Storage, Bulk-Transport v1.0
- Work with default driver from Windows ME, Windows 2000, Windows XP, Mac OS 9.1, and Mac OS X. Windows 98se is supported by vendor driver from Alcor.
- Multiple FIFO implementation for concurrent bus operation
- Can be configured as "removable" or "HDD" type disk by utility software as customers' requirement
- LED for bus activity monitoring
- Runs at 12MHz, built-in 48 MHz PLL
- Built-in 3.3V regulator
- Built-in power on reset circuit
- Packed in 28-pin SSOP form
- Supports 2 pieces NAND type Flash memory chips.
- Support AutoRun feature in removable type disk.
  - AutoRun feature can be supported on Windows ME, Windows 2000, Windows XP and Windows 98.

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2.0 Application Block Diagram

Following is the application diagram of a typical flash disk product with AU9386. By connecting the flash disk to a desktop or notebook PC through USB bus, AU9386 is implemented as a bus-powered, full speed USB disk, which can be used as a bridge for data transfer between Desktop PC and Notebook PC.

Figure 2.1 AU9386 Application Block Diagram

PC with USB Host Controller

PC with USB Host Controller

Notebook with USB Host Controller

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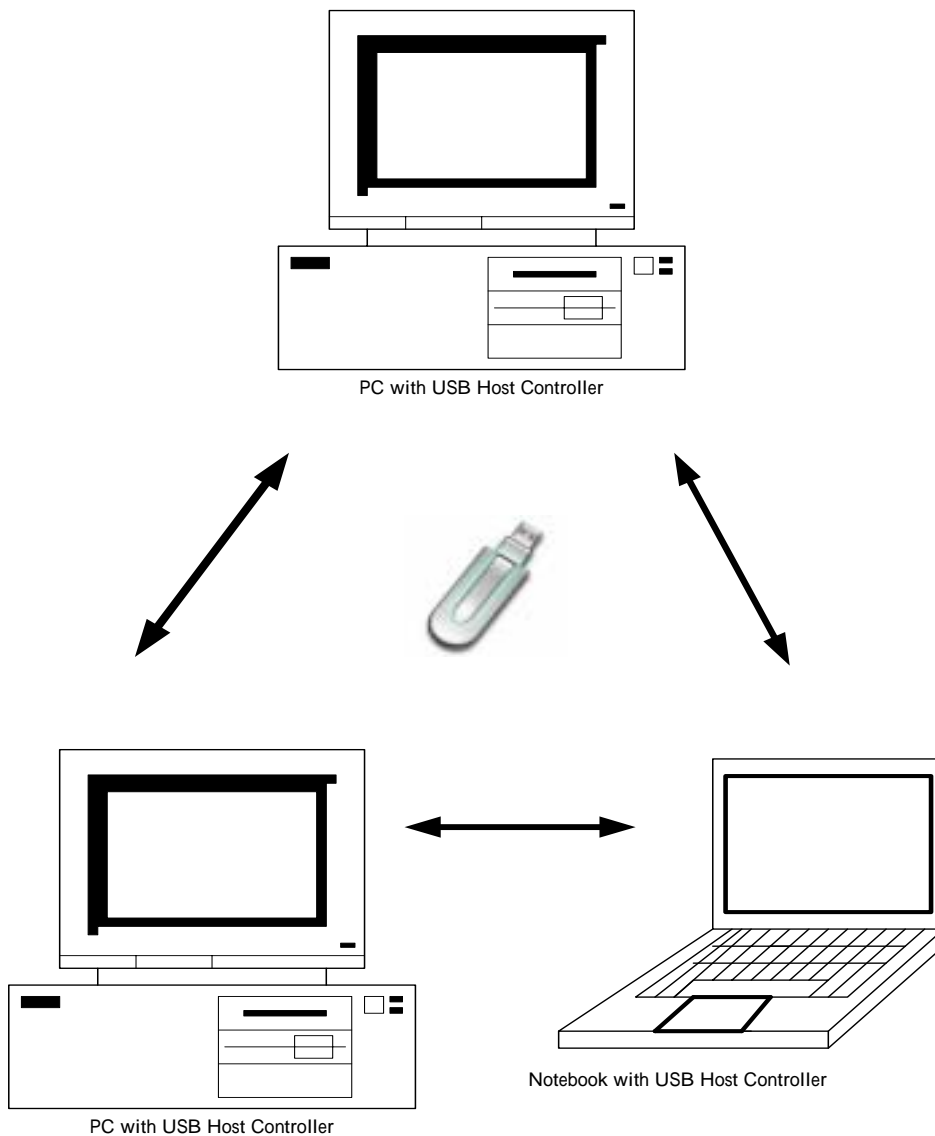
3.0 Pin Assignment

The AU9386 is packed in 28-pin SSOP form factor.   The figure on the following page shows the signal names for each of the pins on the chip. Accompanying the figure is the table that describes each of the pin signals

Figure 3.1 Pin Assignment Diagram

Pin	Signal		Pin	Signal
1	GPON7		28	FMDATA3
2	FMWPN		27	FMDATA2
3	VCC2CARD		26	FMDATA1
4	VCC5V		25	FMDATA0
5	VCCIO		24	FMDATA7
6	USB_DM		23	FMDATA6
7	USB_DP		22	FMDATA5
8	GNDIO		21	FMDATA4
9	FMWRN		20	FMRBN
10	FMALE		19	FMRDN
11	XTAL1		18	FMCE2N
12	XTAL2		17	FMCE1N
13	VCCA		16	FMCLE
14	GND		15	VCCK

Alcor Micro AU9386 28-pin SSOP

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Table 3.1 Pin Descriptions

Pin No.	Pin Name	Pin Type	Description
1	GPON7	O	General Purpose Out, used as activity LED
2	FMWPN	I	Connect to Flash Memory Write Protect
3	VCC2CARD	O	Connect to Flash Memory Vcc
4	VCC5V	PWR	5V power supply
5	VCCIO	PWR	Regular 3.3V output/ IO 3.3V input
6	USB_DM	I/O	USB D-
7	USB_DP	I/O	USB D+
8	GNDIO	PWR	Ground
9	FMWRN	O	Connect to Flash Memory Write Enable
10	FMALE	O	Connect to Flash Memory Address Latch Enable
11	XTAL1	I	Crystal Oscillator Input (12MHz)
12	XTAL2	O	Crystal Oscillator Output (12MHz)
13	VCCA	PWR	Analog 3.3V input
14	GNDA	PWR	Ground
15	VCCK	PWR	Core 3.3V Input
16	FMCLE	O	Connect to Flash Memory Command Latch Enable
17	FMCE1N	O	Connect to Flash Memory Chip1 Enable
18	FMCE2N	O	Connect to Flash Memory Chip2 Enable
19	FMRDN	O	Connect to Flash Memory Read Enable
20	FMRBN	I	Connect to Flash Memory Ready/Busy
21	FMDATA4	I/O	Connect to Flash Memory Data4
22	FMDATA5	I/O	Connect to Flash Memory Data5
23	FMDATA6	I/O	Connect to Flash Memory Data6
24	FMDATA7	I/O	Connect to Flash Memory Data7
25	FMDATA0	I/O	Connect to Flash Memory Data0
26	FMDATA1	I/O	Connect to Flash Memory Data1
27	FMDATA2	I/O	Connect to Flash Memory Data2
28	FMDATA3	I/O	Connect to Flash Memory Data3

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4.0 System Architecture and Reference Design

4.1 AU9386 Block Diagram

Figure 4.1 AU9386 Block Diagram

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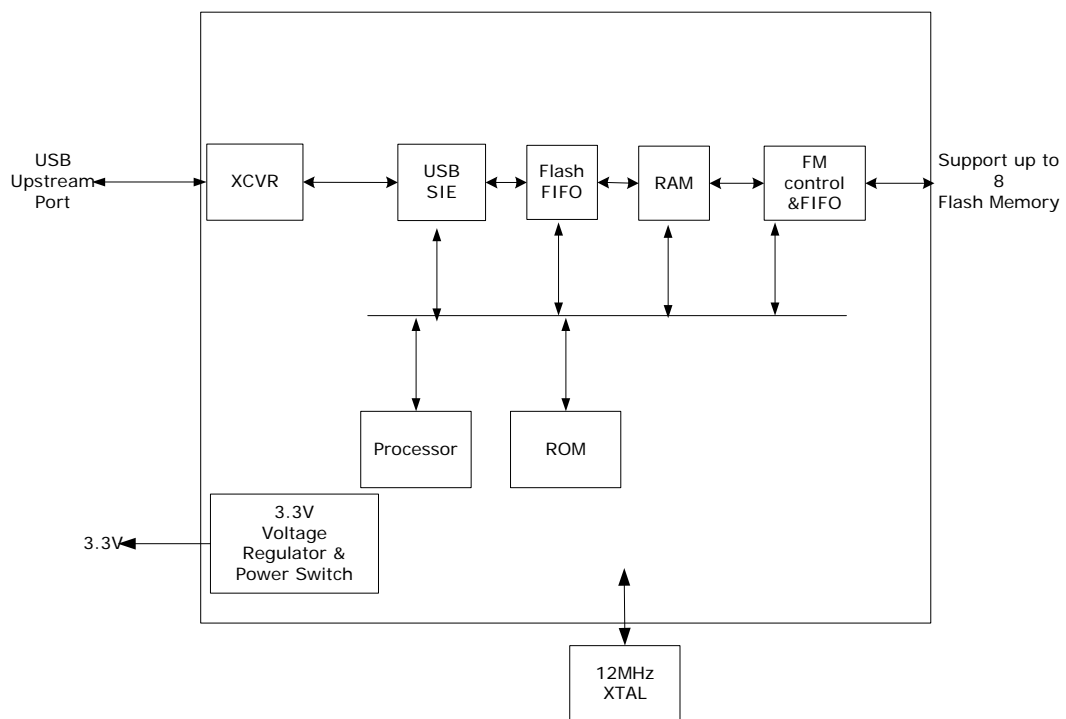
5.0   Electrical Characteristics

5.1 Recommended Operating Conditions

Table 5.1 Recommended Operating Conditions

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

SYMBOL	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
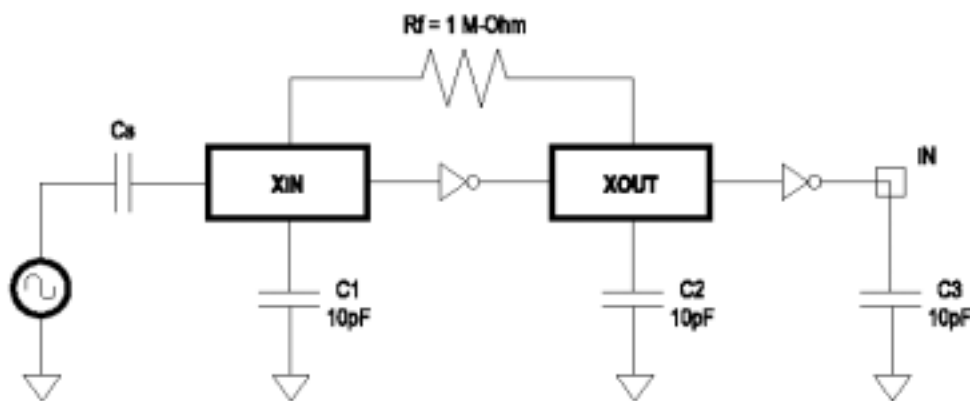
5.5 ESD Test Results

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 stress devices by sudden application of a high voltage supplied by a 100 PF capacitor through 1.5 Kohm resistance.
- Machine-Model stresses devices by sudden application of a high voltage supplied by a 200 PF 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
- Critera : I-V Curve Tracing

Table 5.4 ESD Data

Model	Model	S/S	TARGET	Results
HBM	Vdd, Vss, I/C	15	4000V	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 5 Volts and ground respectively.

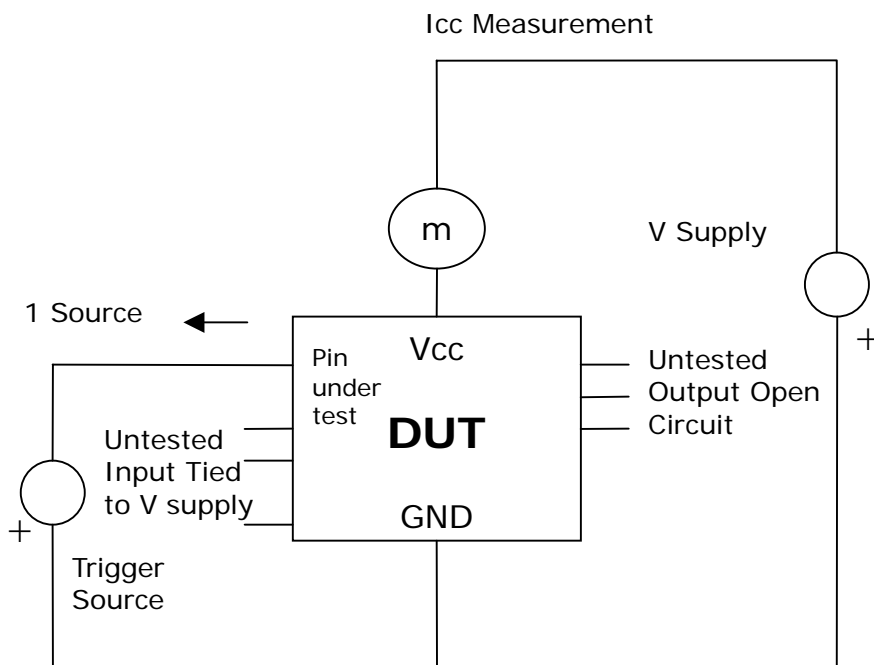Testing was started at 5.0 V (Positive) or 0 V(Negative), and the DUT was biased for 0.5 seconds.

If neither the PUT current supply nor the device current supply reached the predefined limit (DUT=0 mA , Icc=100 mA), then the voltage was increased by 0.1 Volts and the pin was tested again.

This procedure was recommended by the JEDEC JC-40.2 CMOS Logic standardization committee.
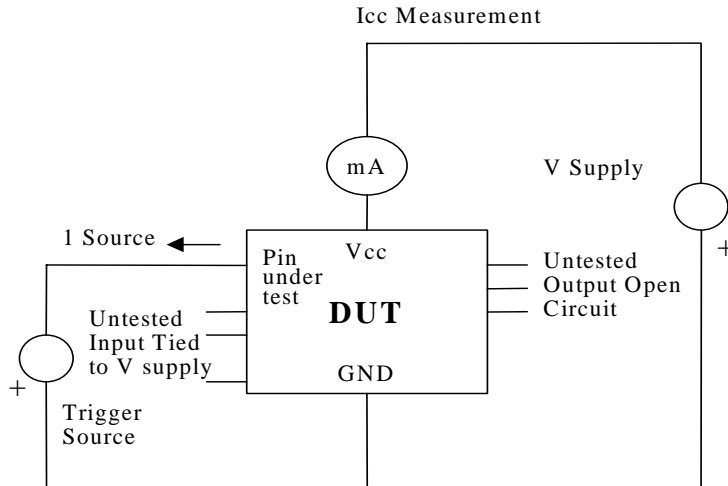
Notes:
1. DUT: Device Under Test.
2. PUT: Pin Under Test.

Figure 5.2 Latch-Up Test Results

Icc Measurement

m   V Supply

1 Source   ←

Pin under test   Vcc   Untested Output Open Circuit

DUT

Untested Input Tied to V supply   +

GND

+

Trigger Source

Test Circuit : Positive Input/ output Overvoltage /Overcurrent

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Icc Measurement

mA

V Supply

1 Source ←

Pin under test

Vcc

DUT

Untested
Output Open
Circuit

+

Untested
Input Tied
to V supply

GND

+

Trigger
Source

Test Circuit: Negative Input/Output Overvoltage/Overcurrent

Icc Measurement

mA

V Supply

Vcc

DUT

Untested
Output Open
Circuit

+

All Input Tied
to V supply

GND
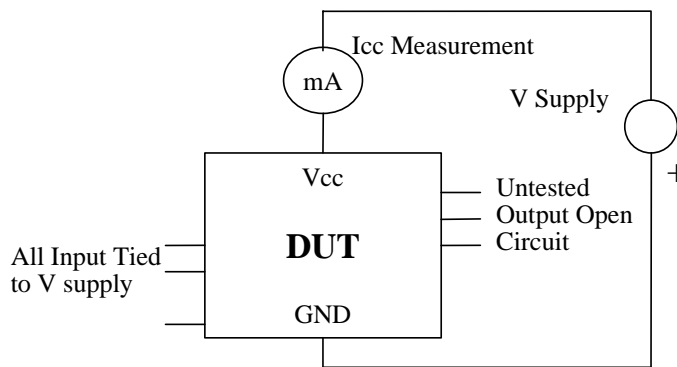
Supply voltage Test

Table 5.5 Latch–Up Data

Model	Model	Voltage (v)/ Current (mA)	S/S	Results
Voltage	+	11.0	5	Pass
	-	11.0		
Current	+	200	5	
	-	200		
Vdd-Vxx		9.0	5	Pass

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6.0 Mechanical Information

Following diagram shows the dimensions of the AU9386 28-pin SSOP.

Figure 6.1 Mechanical Information Diagram

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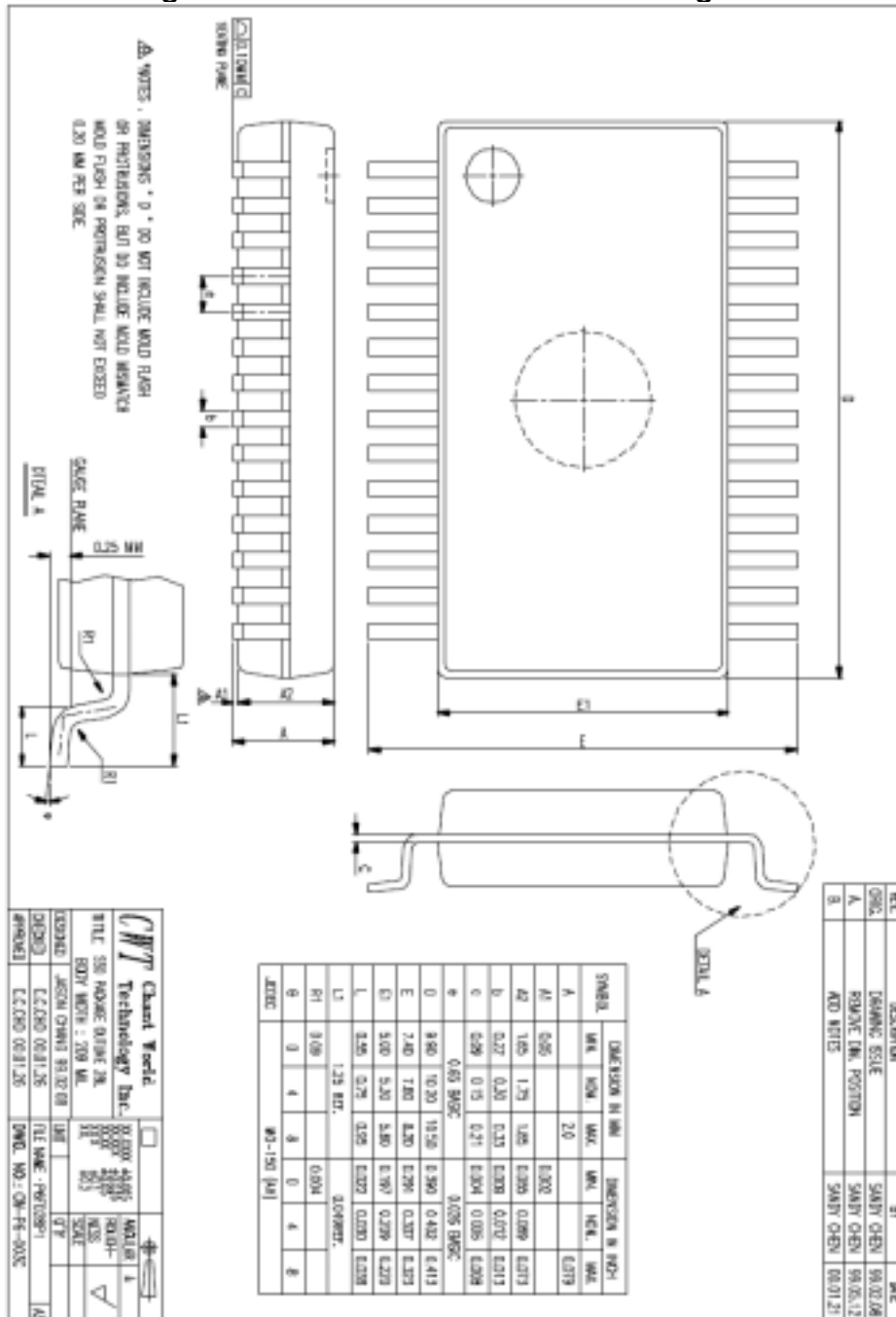
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About Alcor Micro, Corp

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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