



Alcor Micro Corp.

# Data Book

## AU9223 USB KVM Controller Technical Reference Manual

**Product Specification**

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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.

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# 1.0 Introduction

## 1.1 Description

AU9223 is a highly integrated single chip USB KVM controller offering users the possibility of sharing keyboard, mouse and monitor between two PC. Not like traditional PS2 KVM devices, AU9223 uses USB as its upstream and downstream interface to support its driver-free and plug-n-play features, which allow users to easily install and use the KVM.

Typical application of AU9223 is under an environment, in which only one set of monitor, keyboard and mouse is available. Applying such kind of devices in a computing environment will not only result in a centralized control, but also reduce the power and space consumption.

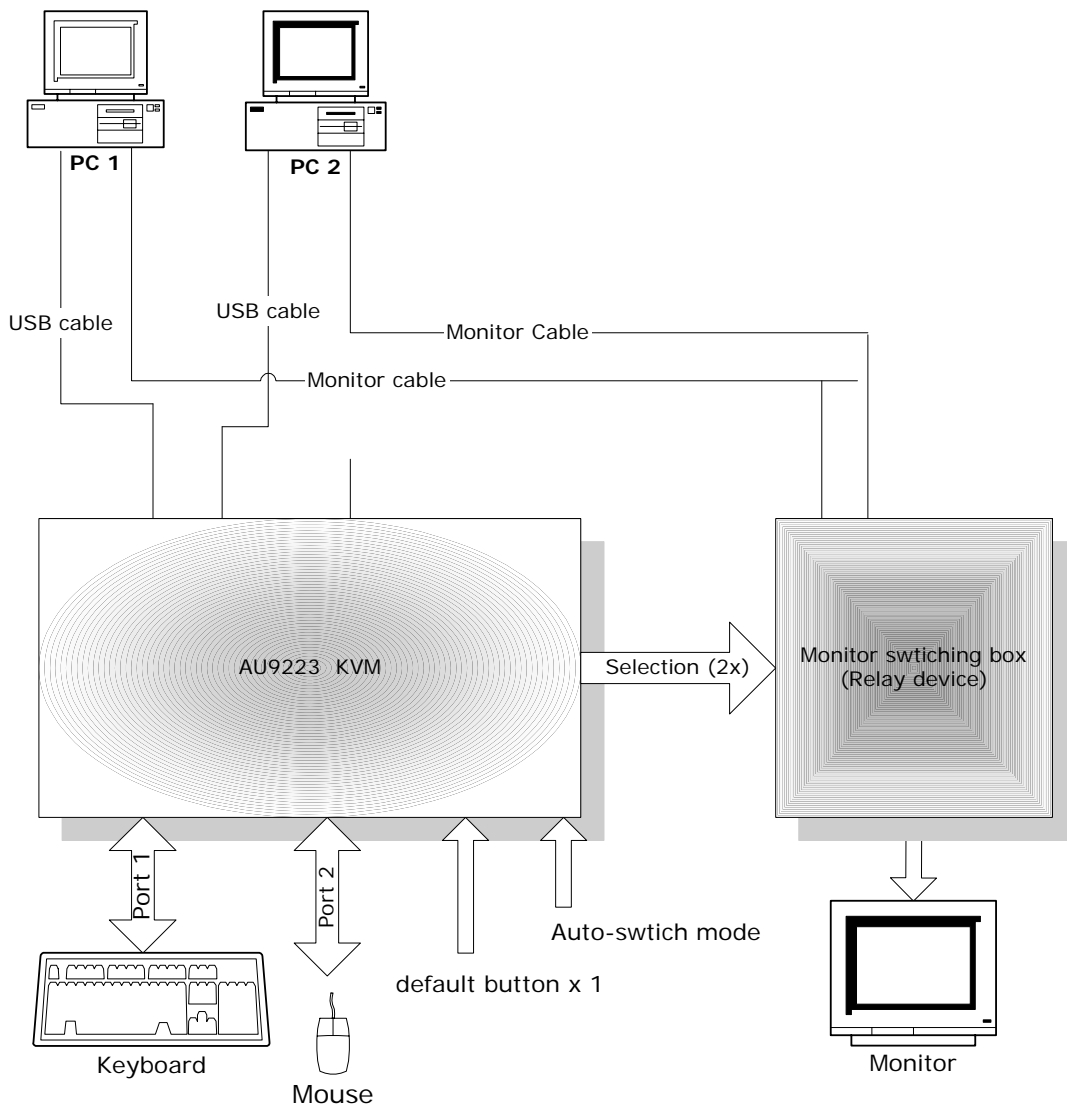
## 1.2 Features

- Support USB v1.1 specification
- Support USB bus power and device self power.
- No need to install device driver under Windows, Macintosh and Linux operating system
- Support 2 PC: 2 USB upstream ports and three downstream ports for keyboard & mouse and one spare port.
- Support PS2 Keyboard.
- Support "Push Button" on KVM device to switch between PC
- Support "Auto-Scan" mode
- Support Audio feedback when system switch.
- Support upstream port selected LED indicators for each PC respectively.
- Support Phantom keyboard features to let user does not need to configure BIOS to turn on "No halt on error".
- Support 4 different modes of key sequence to let users to switch between two PC easily using hot key defined on left side of keyboard. (Please see the key definition in the following.)
- Users could use hot key for switching to any one of hot key combinations out of 4 pre-defined hot keys.
- System does not need to redo Keyboard and mouse detection again after the first time machine switching using KVM.
- Recalls "Caps Lock", "Num Lock" and "Scroll Lock" keys' status for each PC automatically.
- AU9223 will output a monitor select signal to the external video -switching circuit.

## 2.0 Application Block Diagram

Typical application is in a computing environment where it demands a centralized control and space & energy saving is critical.

Figure 2.1 AU9223 Application Block Diagram





# 3.0 Pin Assignment

Figure 3.1 Pin Assignment Diagram

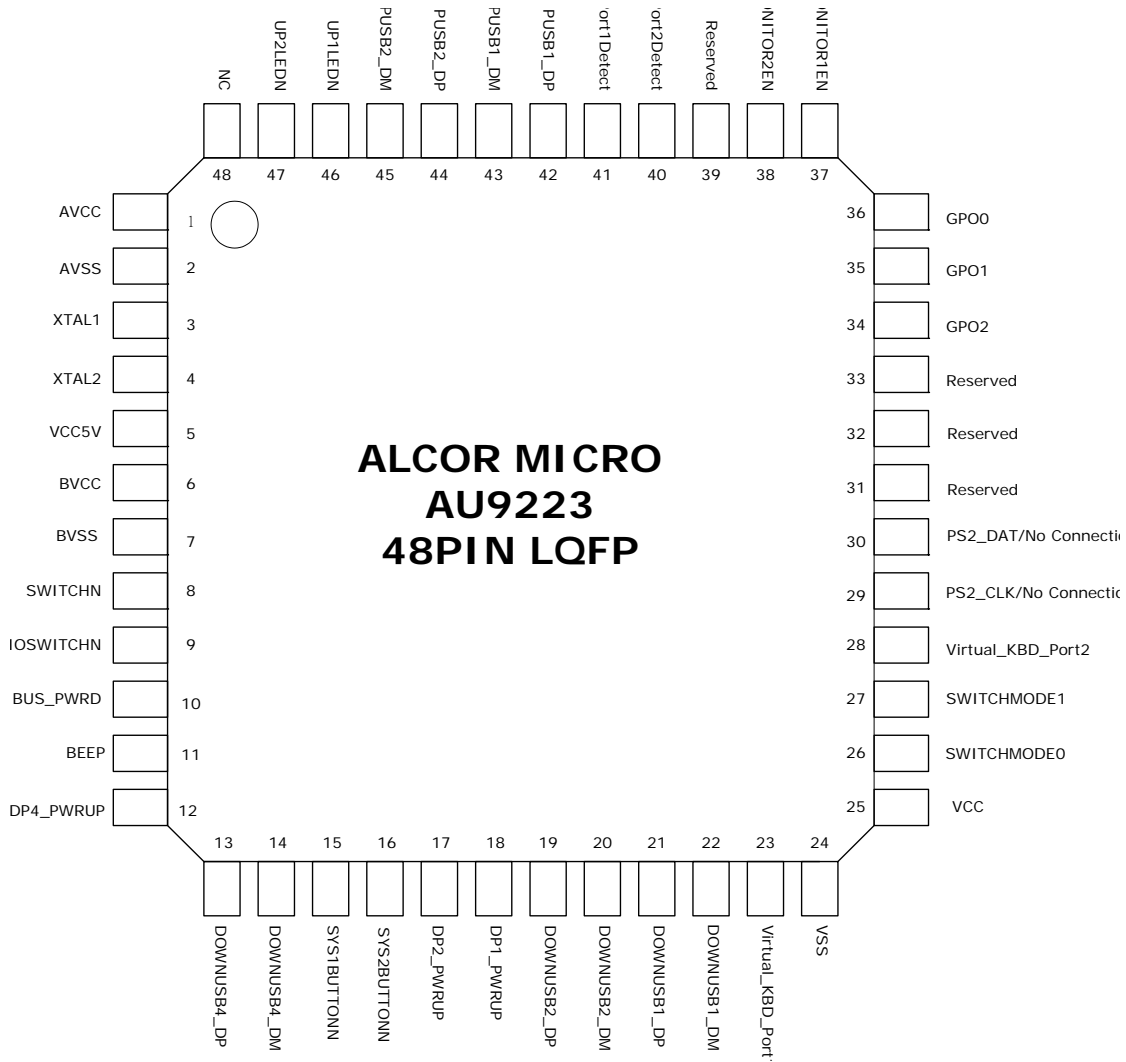






Table 3.1 Pin Descriptions

Pin No.	Pin Name	I/O Type	Description
1	AVCC	PWR	Provides 3.3V analog input power to silicon; Connects to BVCC;
2	AVSS	PWR	Ground Pin of AVCC Power Plane
3	XTAL1	I	12 MHz Crystal Input
4	XTAL2	O	12 MHz Crystal Output
5	VCC5V	PWR	5V Input Power from USB port
6	BVCC	PWR	Provides 3.3V analog output power from internal regulator
7	BVSS	PWR	Ground Pin of BVCC Power Plane
8	SWITCHN	I	Push Button for switching to next system (0: Enable; 1: Normal)
9	AUDIOSWITCHN	I	Audio On/Off Switch (1: Off; 0: On)
10	BUS_PWRD	I	Bus power selection (1: Device Self Power; 0: Bus Power)
11	BEEP	O	Audio Output (4KHz frequency) when system switches
12	DP4_PWRUP	O	Power Up For DownPort4
13	DOWNUSB4_DP	I/O	DownPort4 DP
14	DOWNUSB4_DM	I/O	DownPort4 DM
15	SYS1BUTTONN	I	System1 Enable (0: Enable ; 1: Normal)
16	SYS2BUTTONN	I	System2 Enable (0: Enable ; 1: Normal)
17	DP2_PWRUP	O	Power Up for DownPort2
18	DP1_PWRUP	O	Power Up for DownPort1
19	DOWNUSB2_DP	I/O	DownPort2 DP
20	DOWNUSB2_DM	I/O	DownPort2 DM
21	DOWNUSB1_DP	I/O	DownPort1 DP
22	DOWNUSB1_DM	I/O	DownPort1 DM
23	Virtual_KBD_Port1	I	Control Virtual Keyboard Port1 (0: Enable; 1: Disable)
24	VSS	PWR	Ground Pin for VCC Power Plane
25	VCC	PWR	3.3 V Input Power; Connects to BVCC
26	SWITCHMODE0	I	Switch Mode Selection: (SW0, SW1) (0,0): [Scroll][Scroll] Mode (0,1): [CapsLock][CapsLock] Mode (1,0): [NumLock][NumLock] Mode (1,1): [CTRL][SHIFT] Mode (Left Hand Side)
27	SWITCHMODE1	I	
28	Virtual_KBD_Port2	I	Control Virtual Keyboard Port2 (0: Enable; 1: Disable)
29	PS2_CLK/No Connection	I	PS2 Clock Output; No Connection if only support USB Keyboard
30	PS2_DAT/No Connection	I	PS2 Data Output; No Connection if only support USB Keyboard
31	Reserved		Connect to ground; Reserved for system use
32	Reserved		Connect to ground; Reserved for system use



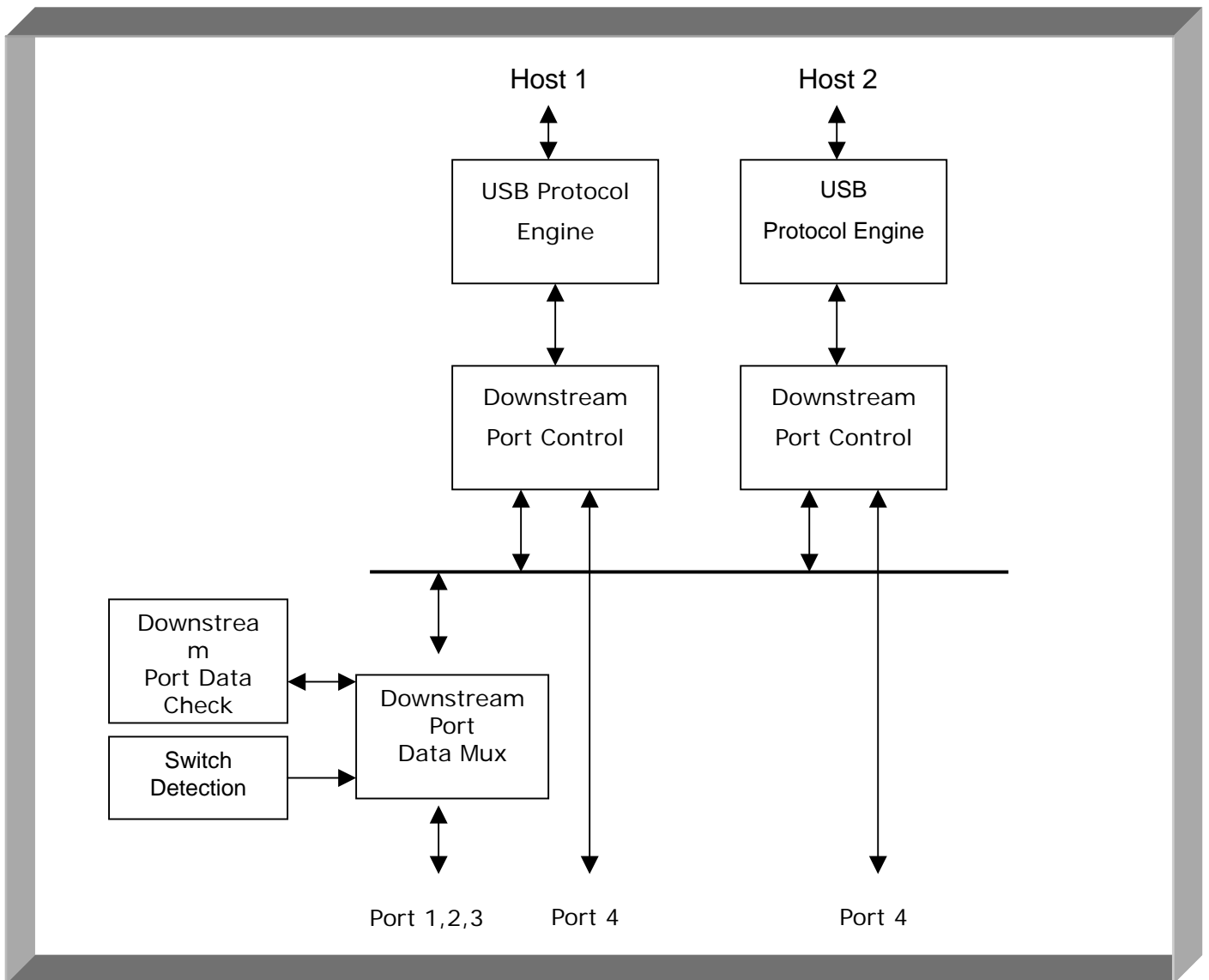
Pin No.	Pin Name	I/O Type	Description
33	Reserved		Reserved for system use. Please see reference circuit schematics for suggested connection
34	GPO2	O	General Purpose Output Pin2
35	GPO1	O	General Purpose Output Pin1
36	GPO0	O	General Purpose Output Pin0
37	MONITOR1EN	O	Monitor 1 Enable (0: Enable; 1: Disable)
38	MONITOR2EN	O	Monitor 2 Enable (0: Enable; 1: Disable)
39	Reserved		Connect to ground; Reserved for system use
40	Port2Detect	I	Connect to Upstream Port 2's VCC
41	Port1Detect	I	Connect to Upstream Port 1's VCC
42	UPUSB1_DP	I/O	Upstream Port 1 DP
43	UPUSB1_DM	I/O	Upstream Port 1 DM
44	UPUSB2_DP	I/O	Upstream Port 2 DP
45	UPUSB2_DM	I/O	Upstream Port 2 DM
46	UP1LEDN	O	System 1 LED Indicator
47	UP2LEDN	O	System 2 LED Indicator
48	NC		No Connection Required



# 4.0 System Architecture and Reference Design

## 4.1 AU9223 Block Diagram

Figure 4.1 AU9223 Block Diagram





## 5.0 Hot Key Definition

AU9223 supports 4 level of "Hot Key" mode to help users to switch PC, rapidly and easily, via hot key sequence defined using keypads on the left hand side of a keyboard.

### 5.1 [Scroll] ++ [Scroll] mode

Hot Key Definition	
[Scroll] ++ [Scroll] + 1 <b>(note1)</b>	Switch to PC1
[Scroll] ++ [Scroll] + 2	Switch to PC2
[Scroll] ++ [Scroll] + → or ↓	Switch to Next PC
[Scroll] ++ [Scroll] + ← or ↑	Switch to Previous PC
[Scroll] ++ [Scroll] + B	Beeper On/Off <b>(note2)</b>
[Scroll] ++ [Scroll] + S	Auto-scan mode every 10 second. ("ESC" switch to regular key code.)
[Scroll] ++ [Scroll] + S + n	Set Auto-scan rate <b>(note3)</b> . ("ESC" switch to regular key code)
[Scroll] ++ [Scroll] + F1 ~ F8	Customer define key <b>(note4)</b> .
[Scroll] ++ [Scroll] + [Caps]	Switch to [Caps] ++ [Caps] hot key mode
[Scroll] ++ [Scroll] + [Num]	Switch to [Num] ++ [Num] hot key mode
[Scroll] ++ [Scroll] + [Ctrl]	Switch to [Ctrl] + [Shift] hot key mode

### 5.2 [Caps] ++ [Caps] mode

Hot Key Definition	
[Caps] ++ [Caps] + 1	Switch to PC1
[Caps] ++ [Caps] + 2	Switch to PC2
[Caps] ++ [Caps] + → or ↓	Switch to Next PC
[Caps] ++ [Caps] + ← or ↑	Switch to Previous PC
[Caps] ++ [Caps] + B	Beeper On/Off <b>(note2)</b>
[Caps] ++ [Caps] + S	Auto-scan mode every 10 second.
[Caps] ++ [Caps] + S + n	Set Auto-scan rate <b>(note3)</b>
[Caps] ++ [Caps] + F1 ~ F8	Customer define key <b>(note4)</b>
[Caps] ++ [Caps] + [Scroll]	Switch to [Scroll] ++ [Scroll] hot key mode
[Caps] ++ [Caps] + [Num]	Switch to [Num] ++ [Num] hot key mode
[Caps] ++ [Caps] + [Ctrl]	Switch to [Ctrl] + [Shift] hot key mode



### 5.3 [Num] ++ [Num] Mode

Hot Key Definition	
[Num] ++ [Num] + 1	Switch to PC1
[Num] ++ [Num] + 2	Switch to PC2
[Num] ++ [Num] + → or ↓	Switch to Next PC
[Num] ++ [Num] + ← or ↑	Switch to Previous PC
[Num] ++ [Num] + B	Beeper On/Off <b>(note2)</b>
[Num] ++ [Num] + S	Auto-scan mode every 10 second. (“ESC” switch to regular key code.)
[Num] ++ [Num] + S + n	Set Auto-scan rate <b>(note3)</b> (“ESC” switch to regular key code)
[Num] ++ [Num] + F1 ~ F8	Customer define key <b>(note4)</b>
[Num] ++ [Num] + [Scroll]	Switch to [Scroll] ++ [Scroll] hot key mode
[Num] ++ [Num] + [Caps]	Switch to [Caps] ++ [Caps] hot key mode
[Num] ++ [Num] + [Ctrl]	Switch to [Ctrl] + [Shift] hot key mode

### 5.4 [Ctrl] + [Shift] mode

Hot Key Definition	
[Ctrl] ++ [Ctrl]	Switch to next live PC
[Ctrl + Shift + 1]	Switch to PC1
[Ctrl + Shift + 2]	Switch to PC2
[Ctrl + Shift + → or ↓]	Switch to Next PC
[Ctrl + Shift + ← or ↑]	Switch to Previous PC
[Ctrl + Shift + B]	Beeper On/Off <b>(note2)</b>
[Ctrl + Shift + S]	Auto-scan mode every 10 second. (“ESC” switch to regular key code.)
[Ctrl + Shift + S + n]	Set Auto-scan rate <b>(note3)</b> (“ESC” switch to regular key code)
[Ctrl + Shift + F1 ~ F8]	Customer define key <b>(note4)</b>
[Ctrl + Shift + Scroll]	Switch to [Scroll] ++ [Scroll] hot key mode
[Ctrl + Shift + Caps]	Switch to [Caps] ++ [Caps] hot key mode
[Ctrl + Shift + Num]	Switch to [Num] ++ [Num] hot key mode



**Note 1:** “++” means press key rapidly, “[Scroll]++[Scroll]+1” means press “Scroll” twice rapidly and then press “1”. If system receives “Scroll ++ Scroll” command only, system will reset the buffer when it does not receive any input comes after within a defined interval of time (say, 5 seconds).

**Note 2:** Audible feedback when beeper is ON and keep the device in silent mode when beeper is OFF.

**Note 3:** n = number from 1 to 9, each represents 5 seconds’ interval latency to 60 seconds correspondingly.

Auto-scan rate set	
【N】 number	Second
1	5
2	10
3	15
4	20
5	25
6	30
7	35
8	40
9	60



**Note 4:**

	GPO 2	GPO 1	GPO 0
Function key +F1	0	0	0
Function key +F2	0	0	1
Function key +F3	0	1	0
Function key +F4	0	1	1
Function key +F5	1	0	0
Function key +F6	1	0	1
Function key +F7	1	1	0
Function key +F8	1	1	1



## 6.0 Electrical Characteristics

### 6.1 Recommended Operating Conditions

Table 6.1 Recommended Operating Conditions

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

### 6.2 General DC Characteristics

Table 6.2 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

### 6.3 DC Electrical Characteristics for 3.3 volts operation

Table 6.3 DC Electrical Characteristics for 3.3 volts operation

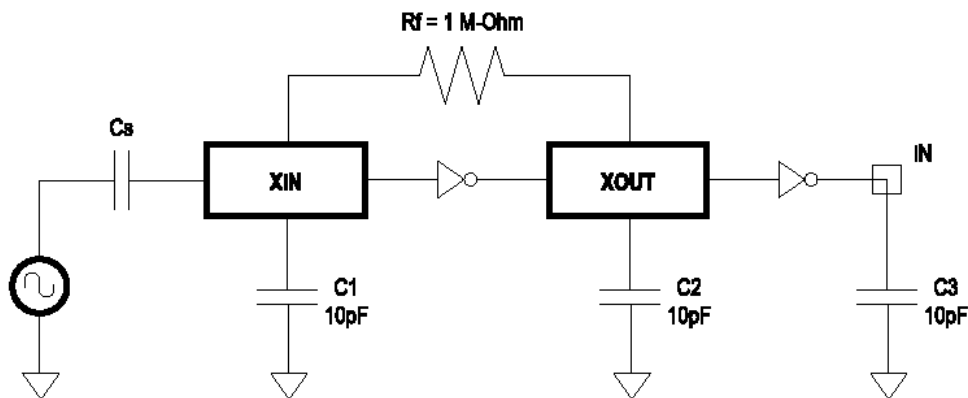
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V <sub>IL</sub>	Input Low Voltage	CMOS			0.9	V
V <sub>IH</sub>	Input High Voltage	CMOS	2.3			V
V <sub>OL</sub>	Output low voltage	I <sub>OL</sub> =4mA, 16mA			0.4	V
V <sub>OH</sub>	Output high voltage	I <sub>OH</sub> =4mA, 16mA	2.4			V
R <sub>I</sub>	Input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



## 6.4 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 6.1 Crystal Oscillator Circuit Setup for Characterization



## 6.5 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
- Criteria : I-V Curve Tracing

Table 6.4 ESD Data

Model	Model	S/S	TARGET	Results
HBM	Vdd, Vss, I/C	15	4000V	Pass
MM	Vdd, Vss, I/C	15	200V	Pass

## 6.6 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.

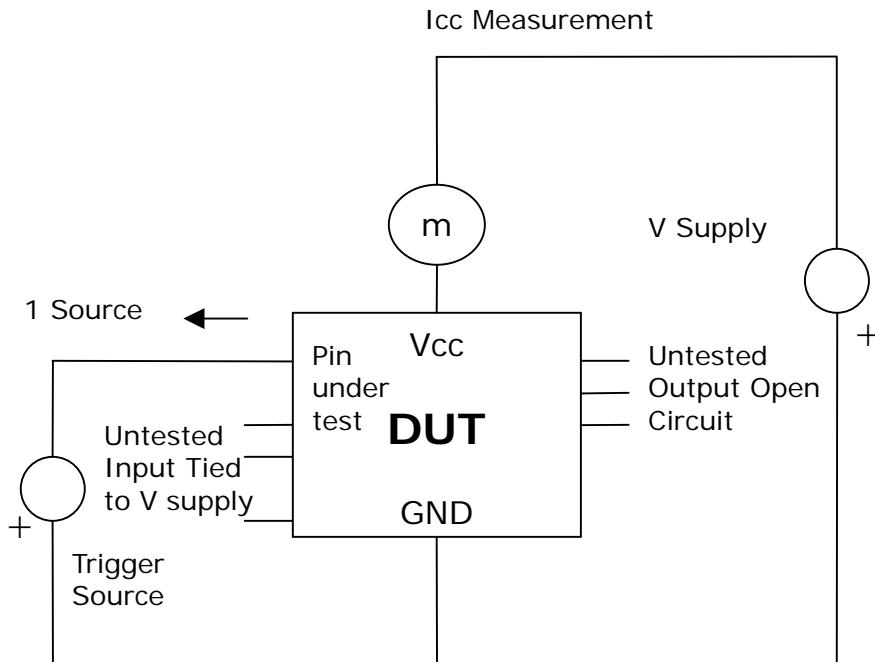
If neither the PUT current supply nor the device current supply reached the predefined limit (DUT=0 mA , Icc=100 mA), then the voltage was increased by 0.1 Volts and the pin was tested again.

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

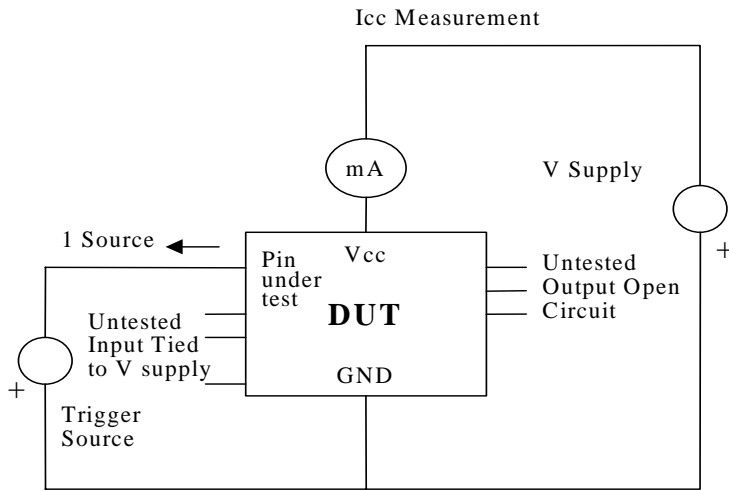
**Notes:**

1. DUT: Device Under Test.
2. PUT: Pin Under Test.

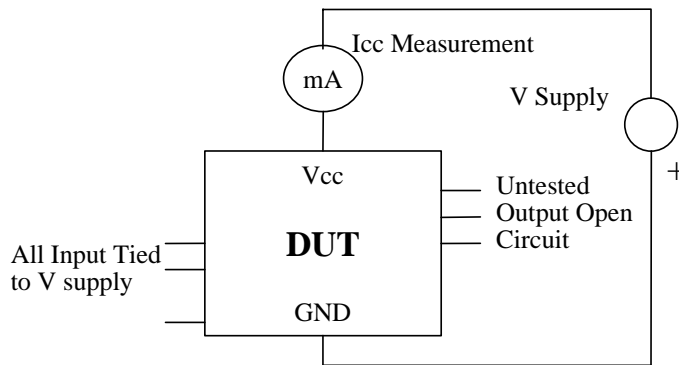
**Figure 6.2 Latch-Up Test Results**



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



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



**Supply voltage Test**

**Table 6.5 Latch-Up Data**

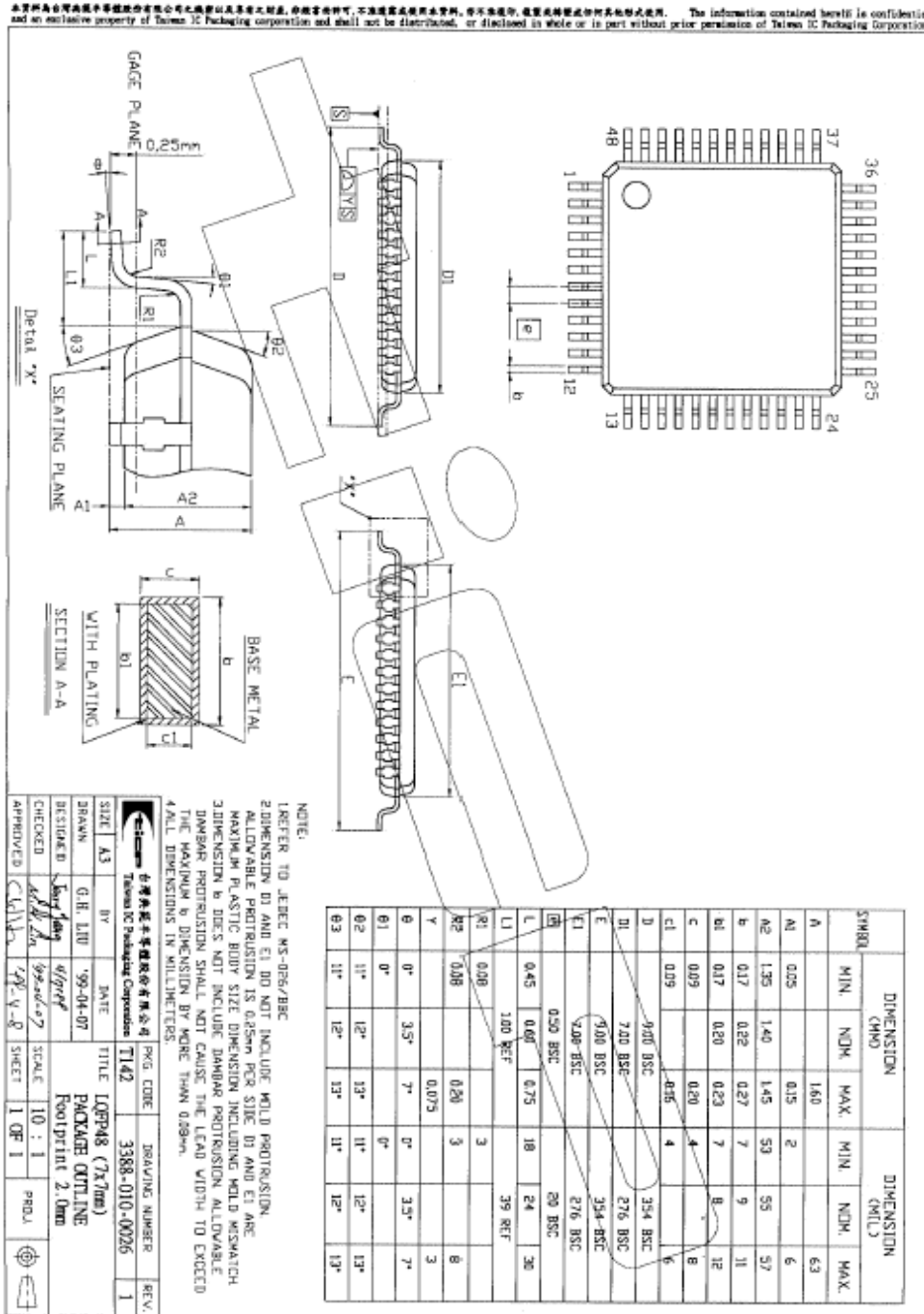
Model	Model	Voltage (v)/ Current (mA)	S/S	Results
Voltage	+	11.0	5	Pass
	-	11.0		
Current	+	200	5	
	-	200		
Vdd-Vxx		9.0	5	Pass



# 7.0 Mechanical Information

The Following diagram shows the dimensions of the AU9223 48-pin LQFP. Measurements are in inches.

Figure 7.1 Mechanical Information Diagram





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**【MEMO】**

### **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.