

AU9410 USB Keyboard Controller Technical Reference Manual

Revision 1.6



2003 Alcor Micro Corp.
All Rights Reserved

Copyright Notice

Copyright 1998- 2003
Alcor Micro Corp.
All Rights Reserved.

Trademark Acknowledgements

The company and product names mentioned in this document may be the trademarks or registered trademarks of their manufacturers.

Disclaimer

Alcor Micro Corp. reserves the right to change this product without prior notice.
Alcor Micro Corp. makes no warranty for the use of its products and bears no responsibility for any error that appear in this document.
Specifications are subject to change without prior notice.

Contact Information:

Web site: <http://www.alcormicro.com/>

Taiwan

Alcor Micro Corp.
4F-1, No 200, Kang Chien Rd., Nei Hu,
Taipei, Taiwan, R.O.C.
Phone: 886-2-8751-1984
Fax: 886-2-2659-7723

Santa Clara Office

2901 Tasman Drive, Suite 206
Santa Clara, CA 95054
USA
Phone: (408) 845-9300
Fax: (408) 845-9086

Los Angeles Office

9400 Seventh St., Bldg. A2
Rancho Cucamonga, CA 91730
USA
Phone: (909) 989-3060
Fax: (909) 944-0464

Table of Contents

1.0	Introduction-----	1
1.1	Description-----	1
1.2	Features-----	1
2.0	Application Block Diagram-----	3
3.0	Pin Assignment-----	5
4.0	System Architecture and Reference Design-----	9
4.1	AU9410 Block Diagram-----	9
4.2	Sample Schematics-----	10
4.3	AU9410 Keyboard EEPROM Sample Value-----	11
5.0	Electrical Characteristics-----	19
5.1	Recommended Operating Conditions -----	19
5.2	General DC Characteristics -----	19
5.3	DC Electrical Characteristic for 3.3 volts operation -----	19
5.4	Crystal Oscillator Circuit Setup for Characteristics -----	20
5.5	ESD Test Results -----	21
5.6	Latch-Up Test Results -----	22
6.0	Mechanical Information-----	25
7.0	Errata-----	27

1.0 Introduction

1.1 Description

The AU9410 is a single chip integrated USB keyboard, ACPI and multimedia function controller chip. It supports the 19 x 8 keyboard matrix. Each key can be individually programmed for any USB usage page and usage code, including standard key code, ACPI and multimedia usage...etc.

Separated ACPI key is another special feature offered by AU9410. There is one pin dedicated for all-in-one ACPI function, and one additional scan line to support 8 “Desktop” page keys.

The USB descriptors and keyboard matrix can be customized via an optional external 24C08 EEPROM, or directly select the internal 4 different models from internal ROM. This feature makes customization of new projects cost-effective and efficient by only adding an external EEPROM while still using the same mass production chip.

To minimize BOM cost, the AU9410 integrated all other components typically founded in an USB keyboard, it also eliminate external crystal. This single chip integration makes the AU9410 the most cost effective USB keyboard solution available in the market.

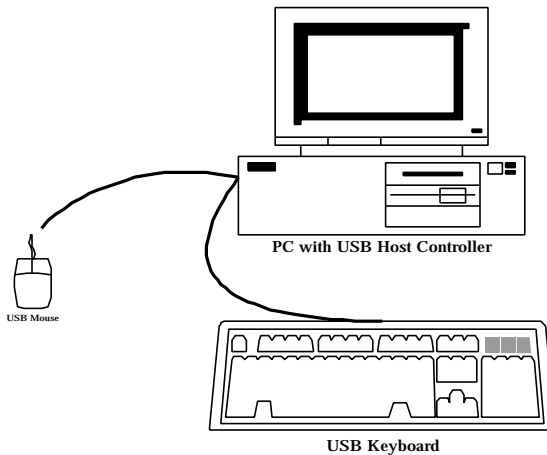
1.2 Features

- Fully compliant with the Universal Serial Bus Specification, version 1.1
- USB keyboard design is compliant with USB Device Class Definition for Human Interface Devices (HID), version 1.1
- Built-in 3.3v voltage regulator allows single +5V operating voltage drawing directly from USB bus.
- Support for 19 x 8 standard key matrix. An Fn pin to selection of alternative matrix.
- Support separate ACPI keys. One pin dedicated for all-in-one ACPI function and also editable in the 19x8 key matrix
- Each key can be individually programmed for standard key code, ACPI or multimedia usage
- Ability to configure the generic LEDs to blink on and off at a rate of 512ms.
- Additional LED1 (vendor defined)

- An additional LED2 for suspend special usage which will be turned on in suspend or can be defined by vendors
- Support ACPI compliant suspend/shutdown key
- Fn key toggles or selectable based on a configuration bit
- Extended debounce timing is added on the Caps Lock and CD eject key
- USB vendor ID, product ID, and keyboard scan code table can be customized via optional external EEPROM.
- Built-in 6 MHz crystal
- Contains 4K byte ROM to support 4 different keyboard models
- Available in 48 DIP, 48 LQFP and probed good die. COB module solution is also available

2.0 Application Block Diagram

The AU9410 is a single chip that integrates USB keyboard, ACPI and multimedia control functionalities. The multimedia function keys are designed to support a full range of hotkeys such as CD/DVD, Play/Pause, Stop, Eject, Mute and general purpose shortcut keys for one key Internet, E-mail, Help and etc.



3.0 Pin Assignment

3.1 Pin Assignment

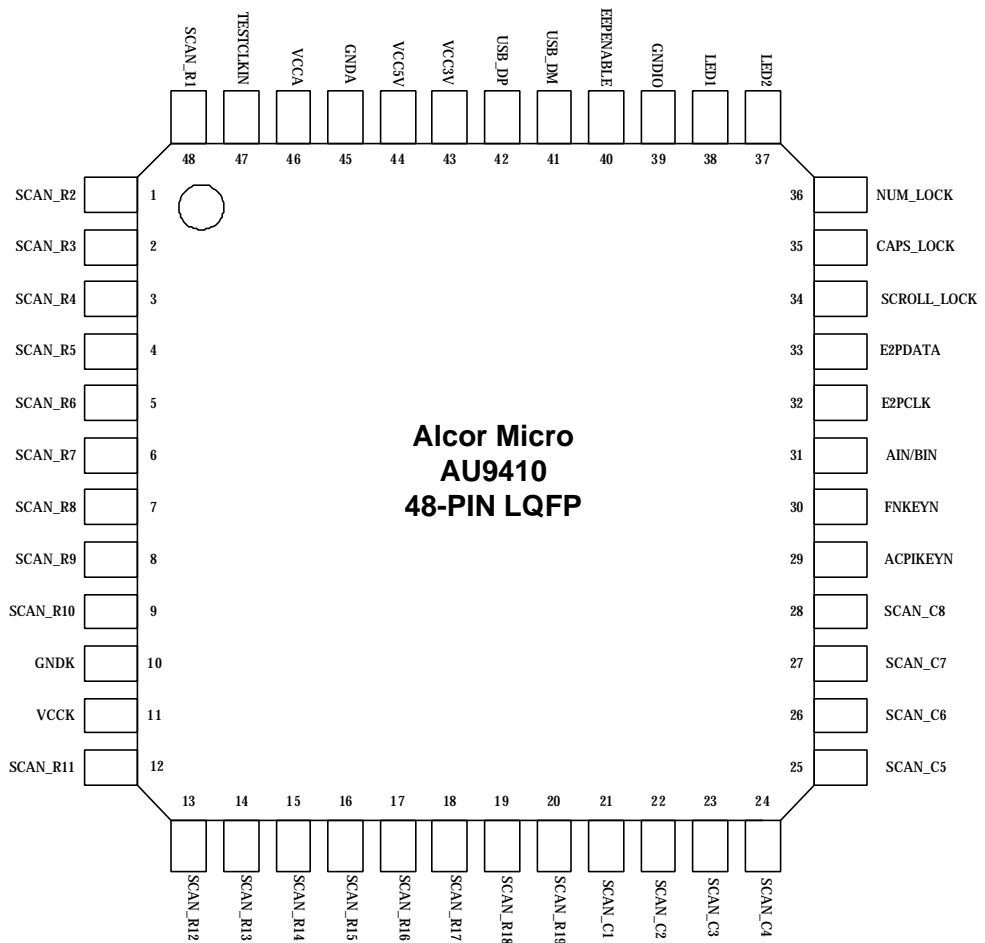


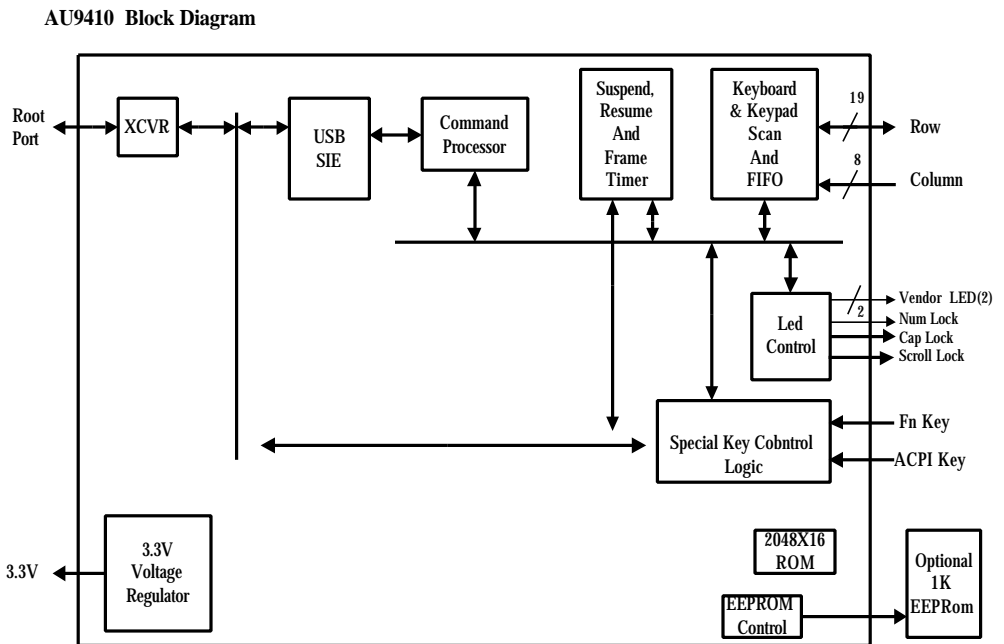
Table 3-1 Pin Description

Pin No.	Pin Name	I/O Type	Description
1	SCAN_R2	Input/Output, Pull down	Row Scan line
2	SCAN_R3	Input/Output, Pull down	Row Scan line
3	SCAN_R4	Input/Output, Pull down	Row Scan line
4	SCAN_R5	Input/Output, Pull down	Row Scan line
5	SCAN_R6	Input/Output, Pull down	Row Scan line
6	SCAN_R7	Input/Output, Pull down	Row Scan line
7	SCAN_R8	Input/Output, Pull down	Row Scan line
8	SCAN_R9	Input/Output, Pull down	Row Scan line
9	SCAN_R10	Input/Output, Pull down	Row Scan line
10	GNDK	Ground	
11	VCCK	Power	Core Power
12	SCAN_R11	Input/Output, Pull down	Row Scan line
13	SCAN_R12	Input/Output, Pull down	Row Scan line
14	SCAN_R13	Input/Output, Pull down	Row Scan line
15	SCAN_R14	Input/Output, Pull down	Row Scan line
16	SCAN_R15	Input/Output, Pull down	Row Scan line
17	SCAN_R16	Input/Output, Pull down	Row Scan line
18	SCAN_R17	Input/Output, Pull down	Row Scan line
19	SCAN_R18	Input/Output, Pull down	Row Scan line
20	SCAN_R19	Input/Output, Pull down	Row Scan line
21	SCAN_C1	Input, Pull up	Column Scan line
22	SCAN_C2	Input, Pull up	Column Scan line
23	SCAN_C3	Input, Pull up	Column Scan line
24	SCAN_C4	Input, Pull up	Column Scan line
25	SCAN_C5	Input, Pull up	Column Scan line
26	SCAN_C6	Input, Pull up	Column Scan line
27	SCAN_C7	Input, Pull up	Column Scan line

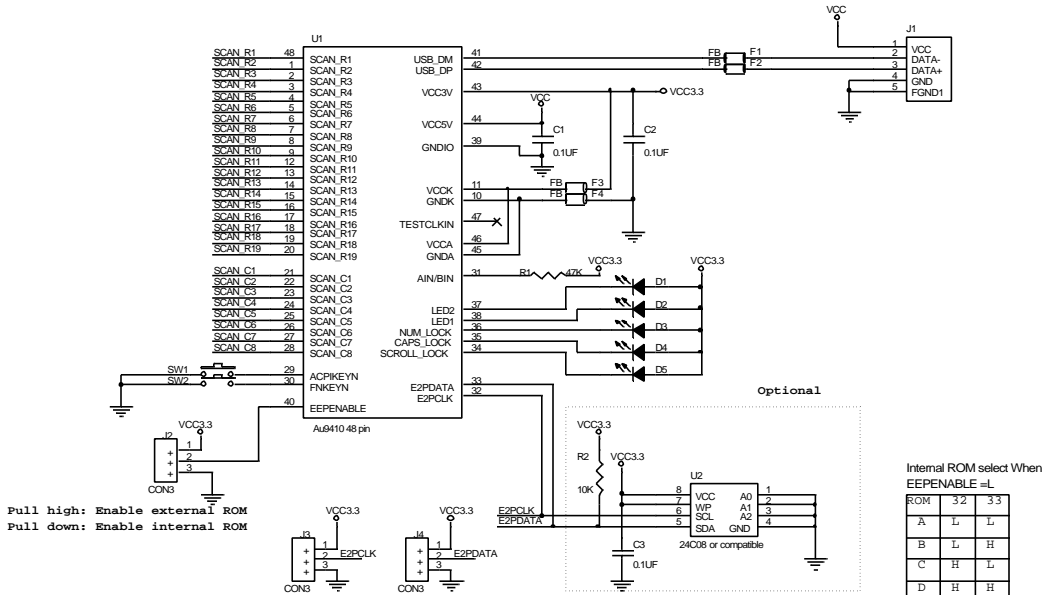
28	SCAN_C8	Input, Pull up	Column Scan line
29	ACPIKEYN	Input, Pull up	Sleep,Wake up (low active)
30	FNKEYN	Input, Pull up	Selective alternative keyboard (low active)
31	AIN/BIN		Test pin ; always pull high
32	E2PCLK	Input, Pull up	EEPROM Clock
33	E2PDATA	Input, Pull up	EEPROM Data
34	SCROLL_LOCK	Output	Scroll_lock LED output-low active-open drain
35	CAPS_LOCK	Output	Cap lock LED – low active – open drain
36	NUM_LOCK	Output	Num lock LED – low active –open drain
37	LED2	Output	Additional LED 2 – low active –open drain
38	LED1	Output	Additional LED 1 –low active –open drain
39	GNDIO	Ground	
40	EEPENABLE	Input	Enable EEPROM function =0 use internal ROM =1 use external EEPROM
41	USB_DM	Input/ Output	USB downstream Port1 D-
42	USB_DP	Input/ Output	USB downstream port1 D+
43	VCC3V	Power	3v power supply
44	VCC5V	Power	5v power supply
45	GND A	Ground	
46	VCCA	Power	Analog Power
47	TESTCLKIN		Test Pin
48	SCAN_R1	Input/Output, Pull down	Row Scan line

4.0 System Architecture and Reference Design

4.1 AU9410 Block Diagram



4.2 Sample Schematics



Disclaimer: This schematic is for reference only. Alcor Micro Corp. makes no warranty for the use of its products and bears no responsibility for any error that appear in this document. Specifications are subject to change without notice.

Size A	Document Number	Au6410 demonstration schematics	Rev	3.2
Date:		Friday, February 27, 2004	Sheet	1 of 1

4.3 AU9410 Keyboard EEPROM Sample Value

Offset	Hex Value	Description
0	00,01	Configuration Byte 0 bit 5 : 1= Individual Power Byte 0 bit 6 : 1= HUB Enable Port Error Byte 0 bit 7 : 1= HUB Select SelfPower change by HID Byte 1 bit 0 : 1=Wakeup on any key; 0=only on ACPL Byte 1 bit 1 : 1=Send 2 Zeros; 0=send 3 zeros. Byte 1 bit 2 : 1=Blink LED1; 0=No blink LED1. Byte 1 bit 3 : 1=Blink LED2; 0=no blink LED2. Byte 1 bit 4 : 1=Toggle Fn key; 0= no toggle Fn key. Byte 1 bit 5 : 1=Fn toggle state driven on LED2; 0= normal LED2 Feature Byte 1 bit 6 : 1= String Desc, Not English, Don't add zeros.
2	B1,C3	RESERVED LoByte: Pointer to Hub device descriptor 000h ROM address HiByte: Xferend address +1
4	1C,35	RESERVED LoByte : Pointer to Hub configuration descriptor 000h ROM addr HiByte : Xfer end address + 1 (config+interface+endpoint)
6	C3,CC	RESERVED LoByte : Pointer to HUB Class descriptor (0x29) 000h ROM addr HiByte : Xfer end address + 1
8	CC,DE	LoByte : Pointer to Keyboard device descriptor 000h ROM address HiByte : Xfer end address + 1
A	35,70	LoByte : Pointer to Keyboard configuration descriptor HiByte : Xfer end address + 1 000h ROM address (config+interface0+HID0+endpoint1+interface1+HID1+endpoint2)
C	47,50	LoByte : Pointer to Keyboard HID descriptor (0x21) Interface 0 HiByte : Xfer end address + 1 000h ROM address
E	70,B1	LoByte : Pointer to Keyboard Report descriptor (0x22) Interface 0 HiByte : Xfer end address + 1 000h ROM address
10	60,69	LoByte : Pointer to Keyboard HID descriptor (0x21) Interface 1 HiByte : Xfer end address + 1 000h ROM address
12	DE,48	LoByte : Pointer to Keyboard Report descriptor (0x22) Interface 1 HiByte : Xfer end address + 1 start in 000h ROM address end in 100h ROM
14	48,4C	LoByte : Pointer to string descriptor (index 0) 100h ROM address

		HiByte : Xfer end address + 1
16	4C,52	LoByte : Pointer to string descriptor (index 1) 100h ROM address HiByte : Xfer end address + 1
18	52,6A	LoByte : Pointer to string descriptor (index 2) 100h ROM address HiByte : Xfer end address + 1
1A	6A,82	LoByte : Pointer to string descriptor (index 3) 100h ROM address HiByte : Xfer end address + 1
1C	09,02,19,00,01,01,00,A0,19	RESERVED Config Desc. 1 interface, bus powered, remote wakeup, 50 mA Total bytes returned : 0x19
25	09,04,00,00,01,09,00,00,00	RESERVED Hub interface descriptor, interface 0. Class code 0x9
2E	07,05,81,03,01,00,FF	RESERVED Hub endpoint descriptor
35	09,02,3B,00,02,01,00,A0,19	Keybrd Config Desc. 2 interfaces, bus powered, remote wakeup, 50 mA Total bytes returned : 0x3B
3E	09,04,00,00,01,03,01,01,00	Keyboard interface descriptor, interface 0. Class code 0x3.Boot subclass
47	09,21,10,01,00,01,22,41,00	Keyboard HID 1.1 descriptor, Country code=00 ANSI
50	07,05,81,03,08,00,0A	Keyboard endpoint descriptor
57	09,04,01,00,01,03,00,00,00	Added Key interface descriptor, interface 1. Class code 0x3. No subclass
60	09,21,10,01,00,01,22,6A,00	Added Key HID 1.1 descriptor, Country code=00 ANSI
69	07,05,82,03,04,00,FF	Added Key endpoint descriptor
70	05,01,09,06,A1,01,05,07, 19,E0,29,E7,15,00,25,01, 75,01,95,08,81,02,95,01, 75,08,81,01,95,05,75,01, 05,08,19,01,29,05,91,02, 95,01,75,03,91,01,95,06, 75,08,15,00,26,FF,00,05, 07,19,00,2A,FF,00,81,00, C0	Keyboard report descriptor
B1	12,01,10,01,09,00,00,08, 8F,05,40,94,22,01,01,02, 00,01	RESERVED Hub device descriptor, USB version 1. 1, VID,PID Device version 1.22 12 Descriptor length 01 Device Descriptor 10 01 USB Version 1.1 09 Hub class 00 Sub-class 00 Device Protocol 08 Maximum packet size VV VV Vender ID – Alcor Hub Vender ID PP PP Product ID - Alcor Hub Product ID 22 01 Device release number 01 Index of Manufacturer string descriptor 02 Index of Product string descriptor 00 Index of serial number string descriptor – no serial number 01 Number of configuration
C3	09,29,03,04,00,16,32,02,FF	RESERVED

		Hub class descriptor. 09 Descriptor length 29 Hub Descriptor 03 Number of downstream port – one keyboard and 2 external ports 04 00 Over-current sensing, compound device, gang power switch 16 Power good wait time 16hx21 ^{ms} 32 Maximum current required (50 mA) 02 Port 1 is not removable FF Port power control mask
CC	12,01,10,01,00,00,00,08, 8F,05,40,94,22,01,01,02, 03,01	Keyboard device descriptor, USB version 1.1, VID,PID Device version 1.22 12 Descriptor length 01 Device Descriptor 10 01 USB Version 1.1 00 Class defined in interface descriptor 00 Sub-class 00 Device Protocol 08 Maximum packet size VV VV Vender ID – Keyboard Vender ID (058F) PP PP Product ID - Keyboard Product ID (9440) 22 01 Device release number 01 Index of Manufacturer string descriptor 02 Index of Product string descriptor 03 Index of serial number string descriptor – no serial number 01 Number of configuration
DE	05,01,09,80,A1,01,85,02, 75,01,95,01,15,00,25,01, 09,81,81,06,09,82,81,06, 09,83,81,06,75,05,81,01, C0,05,0C,09,01,A1,01,85, 03,95,01,75,10,19,00,2A, FF,7F,81,00,C0,06,7F,FF, 09,01,A1,01,85,04,95,01, 75,10,19,00,2A,FF,7F,81, 00,75,02,25,02,09,90,B1, 02,75,06,B1,01,75,01,25, 01,05,08,09,2A,91,02,09, 4B,91,02,75,06,95,01,91, 01,C0	Added Key report descriptor 05 01 Usage Page Generic Desktop 09 80 Usage System Control A1 01 Collection Application 85 02 Report ID 2 75 01 Report Size 1 95 01 Report Count 1 15 00 Logical Minimum 0 25 01 Logical Maximum 1 09 81 Usage System Sleep 81 06 Input (variable, Relative, Preferred State) 09 82 Usage System Sleep 81 06 Input (variable, Relative, Preferred State) 09 83 Usage System Wake Up 81 06 Input (variable, Relative, Preferred State) 75 05 Report Size 5 81 01 Input (Constant) C0 End Collection 05 0C Usage Page Consumer Device 09 01 Usage Consumer Control A1 01 Collection Application 85 03 Report ID 3 95 01 Report Count 1 75 10 Report Size 16 19 00 Usage Minimum 0 2A FF 7F Usage Maximum 32767 81 00 Input (data, variable, absolute,

		<pre> preferred State) C0 End Collection 06 00 FF Usage Page Vendor Defined Page 1 09 01 Usage Vendor Usage 1 A1 01 Collection Application 85 04 Report ID 4 95 01 Report Count 1 75 10 Report Size 16 19 00 Usage Minimum 0 2A FF 7F Usage Maximum 32767 81 00 Input (data, variable, absolute, preferred State) 75 02 Report Size 2 25 02 Logical Maximum 2 09 90 Usage Feature SelfPower B1 02 Feature (Variable, Absolute) 75 06 Report Size 6 B1 01 Feature (Constant - Padding) 75 01 Report Size 1 25 01 Logical Maximum 1 05 08 Usage Page LEDs 09 2A Usage On-Line 91 02 Output (Variable) 09 4B Usage Generic Indicator 91 02 Output (Variable) 75 06 Report Size 6 95 01 Report Count 1 91 01 Output (Constant) C0 End Collection </pre>
148	04,03,09,04	Lang ID array, (index 0), change string
14C	0C, 41,4C,43,4F, 52,	Leng,Str_desc, (index 1) Manufacturer, ALCOR
158	30, 55,53,42,20,4D,75,6C,74, 69,6D,65,64,69,61,20,4B, 65,79,62,6F,61,72,64,	Leng, Str_desc (index 2), change string Product, USB Multimedia Keyboard
16A	30, 55,53,42,20,4D,75,6C,74, 69,6D,65,64,69,61,20,4B, 65,79,62,6F,61,72,64,	Leng,Str_desc (Serial number, index 3), change string USB Multimedia Keyboard
182	00,00,00,00,00,00,00,00, 00,00,00,00,00,00,00,00, 00,00,00,00,00,00,00,00, 00,00,00,00,00,00,	Spare bytes
1A0	00,00,00,00, 00,00,00,00, 00,00,00,00, ,00,00,00,00, 00,00,00,00, 00,00,00,00,	Keyboard Matrix 8x19 Row 19 column8 NA Row 19 column7 NA Row 19 column6 NA Row 19 column5 NA Row 19 column4 NA Row 19 column3 NA

	<p>00,00,00,00, 00,00,00,00,</p> <p>44,F0,00,00, 44,F3,00,00, 43,25,02,00, 00,00,00,E3, 43,24,02,00, 00,00,00,65, 43,B6,00,00, 43,B5,00,00,</p> <p>44,F1,00,00, 00,00,00,E7, 43,E2,00,00, 44,F2,00,00, 43,B7,00,00, 43,EA,00,00, 43,2A,02,00, 43,83,01,00,</p> <p>00,00, 00,00, 00,00,00,E4, 43,B8,00,00, 44,F5,00,00, 43,E9,00,00, 44,F4,00,00, 43,27,02,00, 00,00,00,E0,</p> <p>42,81,00,00, 00,00,00,E5, 43,CD,00,00, 42,82,00,00,, 00,00,00,E1, 43,94,01,00, 43,21,02,00, 43,8A,01,00,</p> <p>00,00,00,E6, 00,00,00,00, 00,00,00,E2, 00,00,00,01, 43,92,01,00, 00,00,00,47, 00,00,00,46, 43,23,02,00,</p> <p>00,00,00,50, 00,00,00,48, 00,00,00,52, 00,00,00,58, 00,00,00,85, 00,00,00,57, 00,00,00,4D, 00,00,00,4A,</p>	<p>Row 19 column2 NA Row 19 column1 NA</p> <p>Row 18 column8 Hotkey/ID4: <User 1> Row 18 column7 Hotkey/ID4: <User 4> Row 18 column6 Hotkey/ID3: <Forward> Row 18 column5 Normal Key: <Win-L> Row 18 column4 Hotkey/ID3 <Back> Row 18 column3 Normal Key: <Apps> Row 18 column2 Hotkey/ID3: <Last Track> Row 18 column1 Hotkey/ID3: <Scan Next Track></p> <p>Row 17 column 8 Hotkey/ID4: <User 2> Row 17 column 7 Normal Key: <Win-R> Row 17 column6 Hotkey/ID3: <Mute> Row 17 column5 Hotkey/ID4: <User 3> Row 17 column4 Hotkey/ID3: <Stop> Row 17 column3 Hotkey/ID3: <Volume Down> Row 17 column2 Hotkey/ID3: <Bookmark> Row 17 column1 Hotkey/ID3: <A1 Consumer></p> <p>Row 16 column8 NA Row 16 column7 Normal Key: <Ctrl-R> Row 16 column6 Hotkey/ID3: <Eject> Row 16 column5 Hotkey/ID4: <User 6> Row 16 column4 Hotkey/ID3: <Volume Up> Row 16 column3 Hotkey/ID4: <User 5> Row 16 column2 Hotkey/ID3: <Refresh> Row 16 column1 Normal Key: <Ctrl-L></p> <p>Row 15 column8 ACPIkey/ID2: <Power> Row 15 column7 Normal Key: <Shift-R> Row 15 column6 Hotkey/ID3: <Play/Pause> Row 15 column5 ACPIkey/ID2: <Sleep> Row 15 column4 Normal Key: <Shift-L> Row 15 column3 Hotkey/ID3: <My Computer> Row 15 column2 Hotkey/ID3: <Search> Row 15 column1 Hotkey/ID3: <E-mail></p> <p>Row 14 column8 Normal Key: <Alt-R> Row 14 column7 NA Row 14 column6 Normal Key: <Alt-L> Row 14 column5 Normal Key: <000> Row 14 column4 Hotkey/ID3: <Calculator> Row 14 column3 Normal Key: <Scroll> Row 14 column2 .Normal Key: <PrtSc> Row 14 column1 Hotkey/ID3: <Internet></p> <p>Row 13 column8 Normal Key: <? > Row 13 column7 Normal Key <Pause> Row 13 column6 Normal Key: <? > Row 13 column5 Normal Key: <Enter-R> Row 13 column4 Normal Key: <K107> Row 13 column3 Normal Key: <+></p>
--	--	--

00,00,00,56, 00,00,00,55, 00,00,00,63, 00,00,00,5B, 00,00,00,5E, 00,00,00,61, 00,00,00,4E, 00,00,00,4B,	Row 13 column2 Normal Key: <End> Row 13 column1 Normal Key: <Home>
00,00,00,51, 00,00,00,53, 00,00,00,00, 00,00,00,59, 00,00,00,5C, 00,00,00,5F, 00,00,00,44, 00,00,00,4C,	Row 12 column8 Normal Key: <-> Row 12 column7 Normal Key: <*> Row 12 column6 Normal Key: <. Del> Row 12 column5 Normal Key: <3 PgDn> Row 12 column4 Normal Key: <6 ? > Row 12 column3 Normal Key: <9 Pgup> Row 12 column2 Normal key: <PageDn> Row 12 column1 Normal Key: <PageUp>
00,00,00,4F, 00,00,00,54, 00,00,00,62, 00,00,00,5A, 00,00,00,5D, 00,00,00,60, 00,00,00,45, 00,00,00,49,	Row 11 column8 Normal Key: <? > Row 11 column7 Normal Key: <Num> Row 11 column6 Normal Key: <00> Row 11 column5 Normal Key: <1 End> Row 11 column4 Normal Key: <4 ? > Row 11 column3 Normal Key: <7 Home> Row 11 column2 Normal Key: <F11> Row 11 column1 Normal Key: <Delete>
00,00,00,2C, 00,00,00,28, 00,00,00,3E, 00,00,00,31, 00,00,00,2A, 00,00,00,89, 00,00,00,43, 00,00,00,42,	Row 10 column8 Normal Key: <? > Row 10 column7 Normal Key: </> Row 10 column6 Normal Key: <0 Ins> Row 10 column5 Normal Key: <2 ? > Row 10 column4 Normal Key: <5> Row 10 column3 Normal Key: <8 ? > Row 10 column2 Normal Key: <F12> Row 10 column1 Normal Key: <Insert>
00,00,00,38, 00,00,00,32, 00,00,00,34, 00,00,00,33,	Row 9 column8 Normal Key: <Space> Row 9 column7 Normal Key: <Enter> Row 9 column6 Normal Key: <F5> Row 9 column5 Normal Key: < \ (K29)> Row 9 column4 Normal Key: <BackSps> Row 9 column3 Normal Key: <K14> Row 9 column2 Normal Key: <F10> Row 9 column1 Normal Key: <F9>
00,00,00,2F, 00,00,00,13, 00,00,00,27, 00,00,00,2D,	Row 8 column8 Normal Key: <? /> Row 8 column7 Normal Key: <K42> Row 8 column6 Normal Key: <" ' > Row 8 column5 Normal Key: <: :> Row 8 column4 Normal Key: <{ > Row 8 column3 Normal Key: <P> Row 8 column2 Normal Key: <) 0> Row 8 column1 Normal Key: <- ->
00,00,00,88, 00,00,00,37, 00,00,00,8A, 00,00,00,0F, 00,00,00,40, 00,00,00,12, 00,00,00,26, 00,00,00,41,	Row 7 column8 Normal Key: <K133> Row 7 column7 Normal Key: <.> Row 7 column6 Normal Key: <K132> Row 7 column5 Normal Key: <L> Row 7 column4 Normal Key: <F7> Row 7 column3 Normal Key: <O> Row 7 column2 Normal Key: <(9>

00,00,00,87, 00,00,00,36, 00,00,00,3F, 00,00,00,0E, 00,00,00,30, 00,00,00,0C, 00,00,00,25, 00,00,00,2E,	Row 7 column1 Normal Key: <F8> Row 6 column8 Normal Key: <K56> Row 6 column7 Normal Key: <<, > Row 6 column6 Normal Key: <F6> Row 6 column5 Normal Key: <K> Row 6 column4 Normal Key: <}]> Row 6 column3 Normal Key: <I> Row 6 column2 Normal Key: <*8> Row 6 column1 Normal Key: <
00,00,00,11, 00,00,00,10, 00,00,00,0B, 00,00,00,0D, 00,00,00,1C, 00,00,00,18, 00,00,00,24, 00,00,00,23,	Row 5 column8... Normal Key: <N> Row 5 column7 Normal Key: <M> Row 5 column6 Normal Key: <H> Row 5 column5 Normal Key: <J> Row 5 column4 Normal Key: <Y> Row 5 column3 Normal Key: <U> Row 5 column2 Normal Key: <& 7> Row 5 column1 Normal Key: <^ 6>
00,00,00,05, 00,00,00,19, 00,00,00,0A, 00,00,00,09, 00,00,00,17, 00,00,00,15, 00,00,00,21, 00,00,00,22,	Row 4 column 8 Normal Key: Row 4 column 7 Normal Key: <V> Row 4 column6 Normal Key: <G> Row 4 column5 Normal Key: <F> Row 4 column4 Normal Key: <T> Row 4 column3 Normal Key: <R> Row 4 column2 Normal Key: <\$4> Row 4 column1 Normal Key: <%5>
00,00,00,90, 00,00,00,06, 00,00,00,3D, 00,00,00,07, 00,00,00,3C, 00,00,00,08, 00,00,00,20, 00,00,00,3B,	Row 3 column8 Normal Key: <K151> Row 3 column7 Normal Key: <C> Row 3 column6 Normal Key: <F4> Row 3 column5 Normal Key: <D> Row 3 column4 Normal Key: <F3> Row 3 column3 Normal Key: <E> Row 3 column2 Normal Key: <#3> Row 3 column1 Normal Key: <F2>
00,00,00,91, 00,00,00,1B, 00,00,00,64, 00,00,00,16, 00,00,00,39, 00,00,00,1A, 00,00,00,1F, 00,00,00,3A,	Row 2 column 8 Normal Key: <K150> Row 2 column 7 Normal Key: <X> Row 2 column6 Normal Key: <K45> Row 2 column5 Normal Key: <S> Row 2 column4 Normal Key: <Caps> Row 2 column3 Normal Key: <W> Row 2 column2 Normal Key: <@2> Row 2 column1 Normal Key: <F1>
00,00,00,8B, 00,00,00,1D, 00,00,00,29, 00,00,00,04, 00,00,00,2B, 00,00,00,14, 00,00,00,1E, 00,00,00,35,	Row 1 column 8 Normal Key: <K131> Row 1 column 7 Normal Key: <Z> Row 1 column6 Normal Key: <Esc> Row 1 column5 Normal Key: <A> Row 1 column4 Normal Key: <Tab> Row 1 column3 Normal Key: <Q> Row 1 column2 Normal Key: <! 1> Row 1 column1 Normal Key: <~ `>

5.0 Electrical Characteristics

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	$^{\circ}C$
T_{STG}	Storage Temperature	-40		125	$^{\circ}C$

5.2 General DC Characteristics

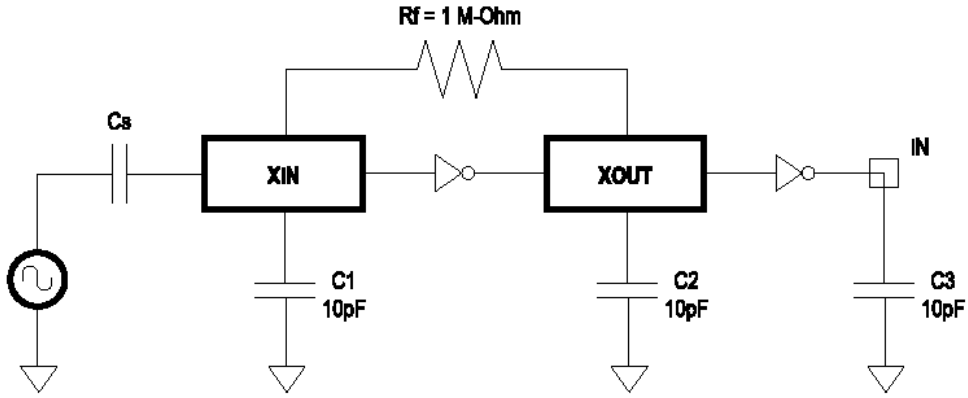
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I_{IL}	Input low current	no pull-up or pull-down	-1		1	μA
I_{IH}	Input high current	no pull-up or pull-down	-1		1	μA
I_{OZ}	Tri-state leakage current		-10		10	μA
C_{IN}	Input capacitance			5		ρF
C_{OUT}	Output capacitance			5		ρF
C_{BID}	Bi-directional buffer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

5.3 DC Electrical Characteristics for 3.3 volts operation

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IL}	Input Low Voltage	CMOS			0.9	V
V_{IH}	Input High 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	$V_{il}=0_v$ or $V_{ih}=V_{CC}$		10k/200k		$K\Omega$

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 .



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
- Criteria : I-V Curve Tracing

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

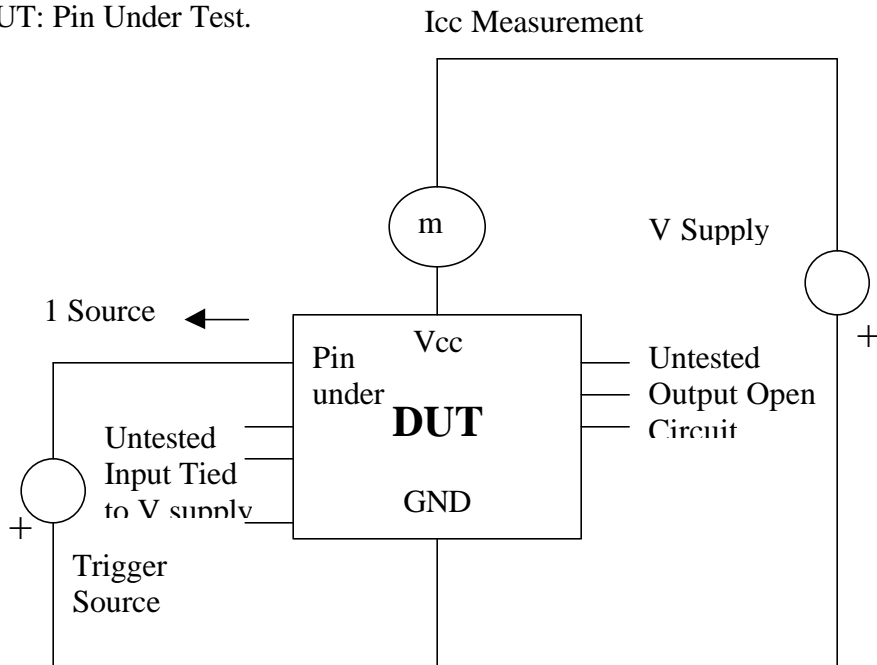
Testing was started at 5.0 V (Positive) or 0 V(Negative), and the DUT was biased for 0.5 seconds.

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.

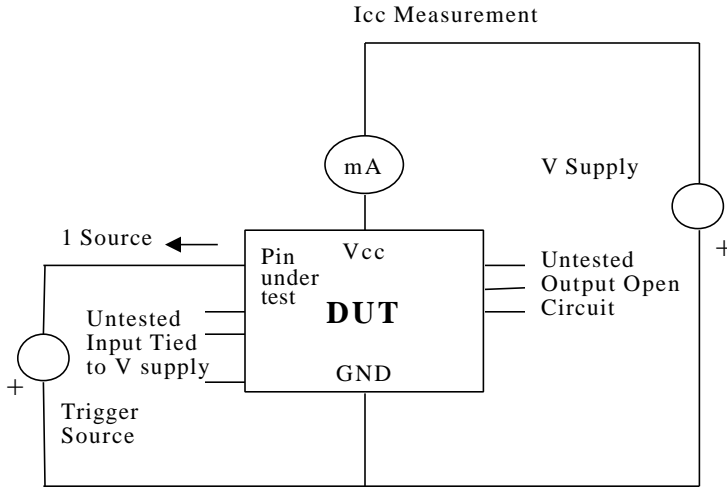
This procedure was recommended by the JEDEC JC-40.2 CMOS Logic standardization committee.

Notes:

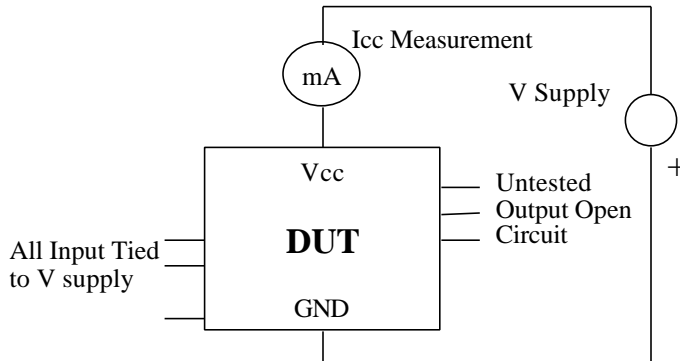
1. DUT: Device Under Test.
2. PUT: Pin Under Test.



Test Circuit : Positive Input/ output Overvoltage /Overcurrent



Test Circuit : Negative Input/ Output Overvoltage /Overcurrent



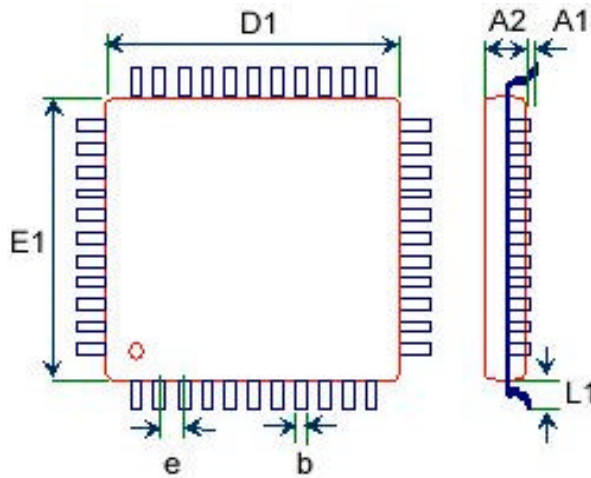
Supply Voltage test

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

6.0 Mechanical Information

Following diagrams show the dimensions of the AU9410 48-pin LQFP. Measurements are in inches.



body size		lead count	A1	A2	L1	b	c	e
D1	E1							
7	7	48	0.1	1.4	1	0.2	0.127	0.5

A1	stand-off
A2	body thickness
L1	lead length
b	lead width
c	lead thickness
e	lead pitch

7.0 Errata

Record History

- 3/10/2003 PIN 40:DP is updated to PIN 41
 PIN 41:DM is updated to PIN40
- 3/13/2003 4.1 AU9410 Block Diagram Row18 is corrected to Row 19
 4.3 AU9410 Keyboard EEPROM Sample Value Update and Check
- 6/11/2003 Notice: AU9410 is packaged in 48-pin LQFP but not SSOP. 48-pin SSOP on
 page 2 in revision 1.4 was owing to mistyping.