

# AU9462

## USB Keyboard Hub Controller

### Technical Reference Manual

Revision 1.1



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# 1.0 Introduction

## 1.1 Description

The AU9462 is an integrated low cost single chip USB keyboard controller with 2-port hub. It supports the 19 x 8 keyboard matrix. Each key can be individually programmed for standard key code, ACPI or multimedia usage. It also supports combinational key definitions in the standard 19 x 8 key matrix.

Separated ACPI key is a special feature offered by AU9462. There is one pin dedicated for all-in-one ACPI function. Fn key function is designed to enable selection of alternative matrix for small size keyboard application.

The USB descriptors and keyboard matrix can be customized via an optional external 24C08 EEPROM, or directly select the internal ROMs for 8 different model keyboards. This feature makes customization of new projects cost-effective and efficient by adding an optional external EEPROM while still using the same chip for mass production. Alcor also provides utility program to simplify EEPROM contents programming.

The USB downstream ports can be used to connect various USB peripheral devices, such as USB printer, modem, scanner, camera, mouse and joystick to the system without adding external glue logic. Multimedia and shortcut keys can support volume control, CD/DVD Play/Pause, Stop, Eject, Mute and general purpose shortcut keys such as Internet, e-mail and help.

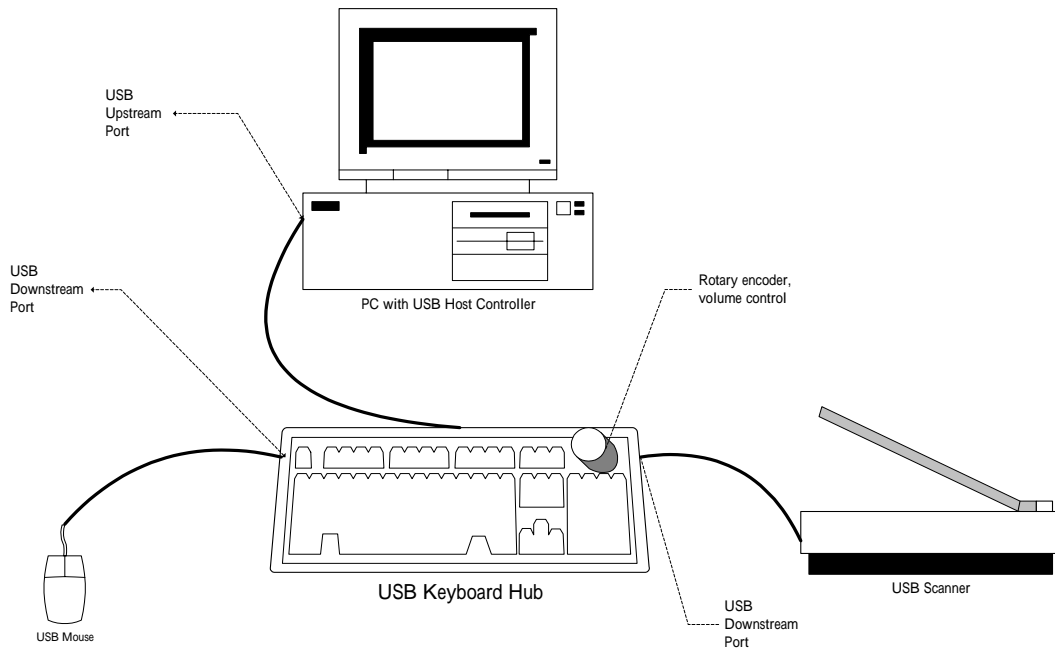
## 1.2 Features

- 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
- Intergrated USB full speed transceiver
- Support for 19 x 8 standard key matrix. An Fn pin to select alternative matrix. Each matrix location is flexible to be used as standard or any report ID & usage page code.
- Support separate ACPI keys. One pin dedicated for all-in-one ACPI function
- 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 and LED2.

- An additional LED2 for suspend special usage which will be turned on in suspend or can be defined by vendors
- Fn key toggles or selectable based on a configuration bit
- Extended delay key debounce timing option for any keys defined.
- USB vendor ID, product ID, and keyboard scan code table can be customized via optional external EEPROM.
- Contains 8K byte ROM to support 8 different keyboard models
- Runs at 12 Mhz frequency
- Integrated dual port power switch to eliminate the requirement of external power switch.
- Available in 64 pin LQFP package chips or probed for dies COB module

## 2.0 Application Block Diagram

The AU9462 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.



APPLICATION BLOCK DIAGRAM 4



# 3.0 Pin Assignment

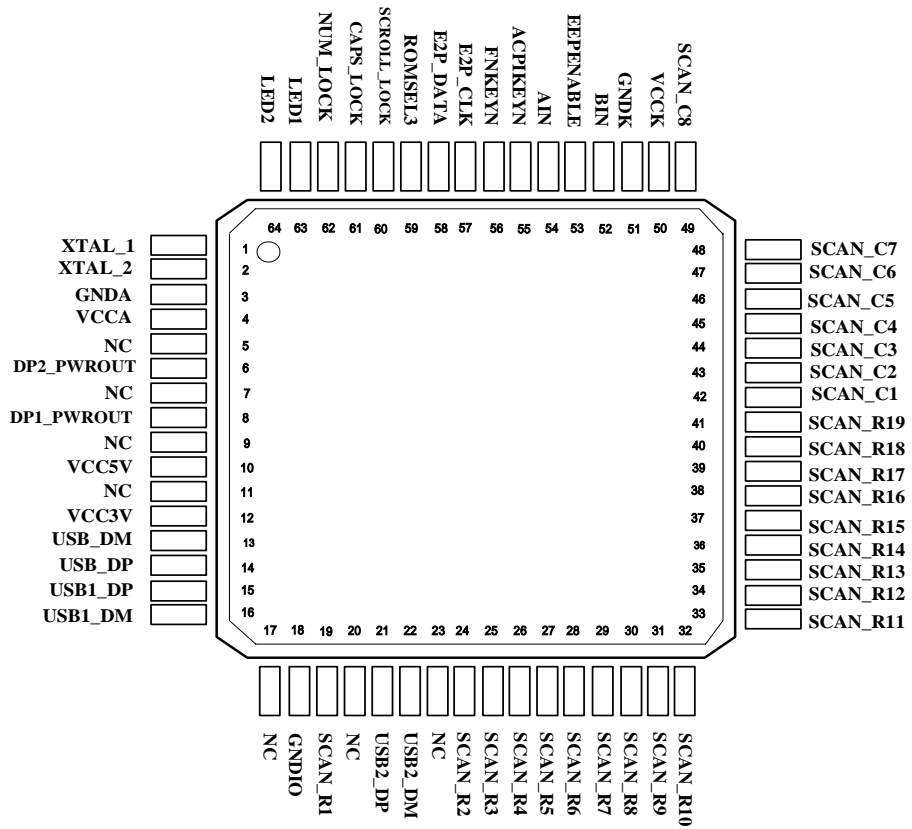


Table 3-1. Pin Description

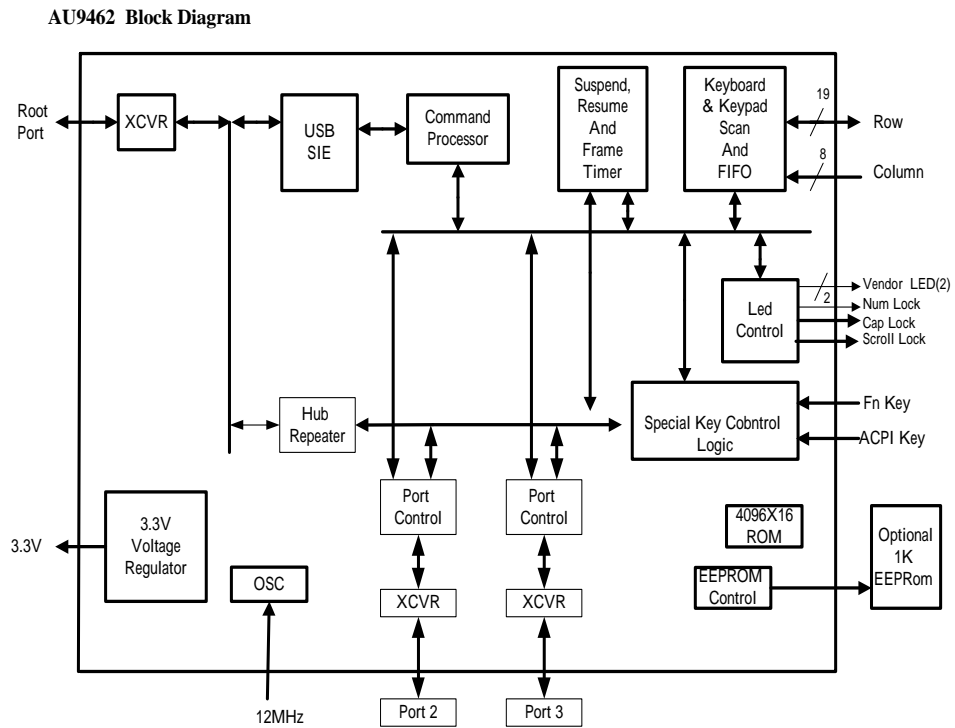
Pin	Pin Name	IO Type	Description
1	XTAL_1	Input	12MHz Crystal input
2	XTAL_2	Output	12MHz Crystal output
3	GND_A	Ground	
4	VCCA	Power	Analog power
5	NC		
6	DP2_PWROUT	Power	Port 2 power supply and over-current detection.
7	NC		
8	DP1_PWROUT	Power	Port 1 power supply and over-current detection.
9	NC		
10	VCC5V	Power	5v power supply
11	NC		
12	VCC3V	Power	3v power supply
13	USB_DM	Input/ Output	USB upstream D-
14	USB_DP	Input/ Output	USB upstream D+
15	USB1_DP	Input/ Output	USB downstream Port1 D+
16	USB1_DM	Input/ Output	USB downstream port1 D-
17	NC		
18	GNDIO	GROUND	
19	SCAN_R1	Input/ Output, Pull down	Row Scan line
20	NC		
21	USB2_DP	Input/ Output	USB downstream Port2 D+
22	USB2_DM	Input/ Output	USB downstream Port2 D-
23	NC		
24	SCAN_R2	Input/ Output, Pull down	Row Scan line
25	SCAN_R3	Input/ Output, Pull down	Row Scan line
26	SCAN_R4	Input/ Output, Pull down	Row Scan line
27	SCAN_R5	Input/ Output, Pull down	Row Scan line
28	SCAN_R6	Input/ Output, Pull down	Row Scan line
29	SCAN_R7	Input/ Output, Pull down	Row Scan line
30	SCAN_R8	Input/ Output, Pull down	Row Scan line
31	SCAN_R9	Input/ Output, Pull down	Row Scan line
32	SCAN_R10	Input/ Output, Pull down	Row Scan line
33	SCAN_R11	Input/ Output, Pull down	Row Scan line

34	SCAN_R12	Input/ Output, Pull down	Row Scan line
35	SCAN_R13	Input/ Output, Pull down	Row Scan line
36	SCAN_R14	Input/ Output, Pull down	Row Scan line
37	SCAN_R15	Input/ Output, Pull down	Row Scan line
38	SCAN_R16	Input/ Output, Pull down	Row Scan line
39	SCAN_R17	Input/ Output, Pull down	Row Scan line
40	SCAN_R18	Input/ Output, Pull down	Row Scan line
41	SCAN_R19	Input/ Output, Pull down	Row Scan line
42	SCAN_C1	INPUT,PULL UP	Column Scan line
43	SCAN_C2	Input, Pull up	Column Scan line
44	SCAN_C3	Input, Pull up	Column Scan line
45	SCAN_C4	Input, Pull up	Column Scan line
46	SCAN_C5	Input, Pull up	Column Scan line
47	SCAN_C6	Input, Pull up	Column Scan line
48	SCAN_C7	Input, Pull up	Column Scan line
49	SCAN_C8	Input, Pull up	Column Scan line
50	VCCK	Power	Core power
51	GNDK	Ground	
52	BIN	Input	Rotary encoder input 'B'
53	EEPENABLE	Input	Enable EEPROM function, =0 use internal ROM =1 use external EEPROM
54	AIN	Input	Rotary encoder input 'A'
55	ACPIKEYN	Input/ Pull up	Sleep, Shutdown, Wake up -(low active)
56	FNKEYN	Input/ Pull up	Selective alternative keyboard -(low active)
57	E2P_CLK	Input	EEPROM CLK/SEL2
58	E2P_DATA	Input	EEPROM data/SEL/
59	ROMSEL3	Input	ROMSEL3
60	SCROLL_LOCK	Output	Scroll_lock LED output-low active-open drain
61	CAPS_LOCK	Output	Cap lock LED – low active
62	NUM_LOCK	Output	Num lock LED – low active
63	LED1	Output	Additional LED 1 –low active
64	LED2	Output	Additional LED 2 – low active

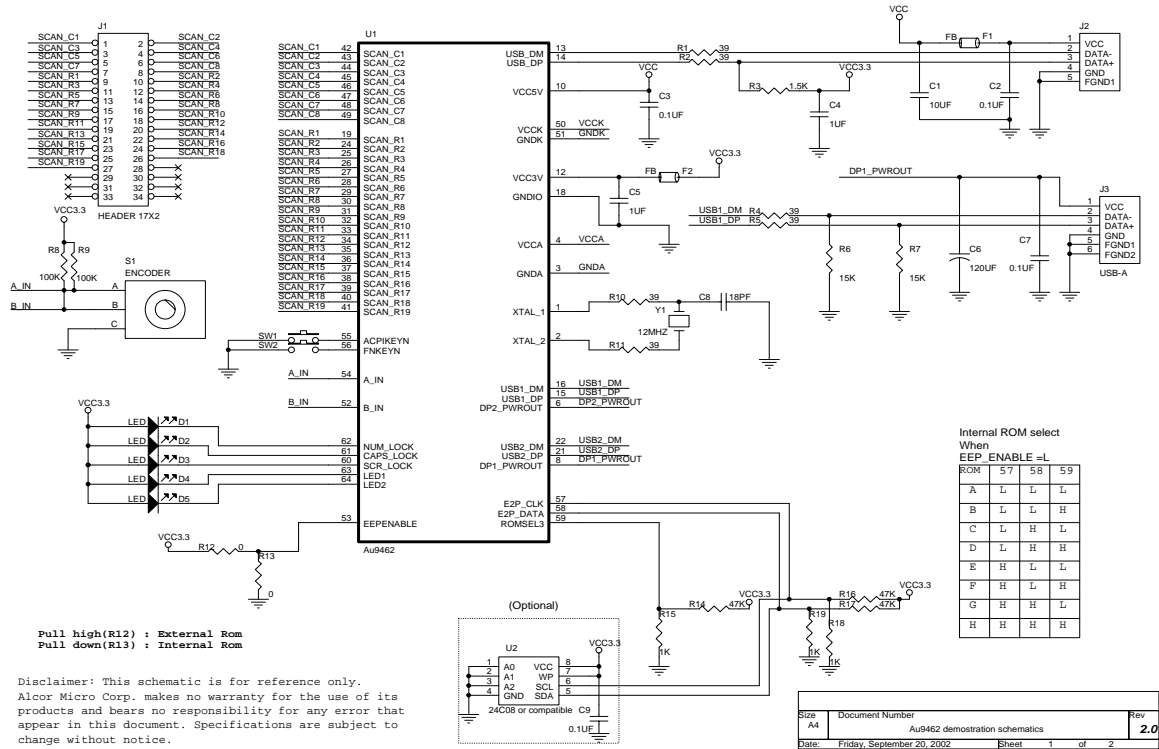
PIN ASSIGNMENT 8

# 4.0 System Architecture and Reference Design

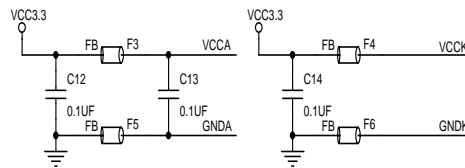
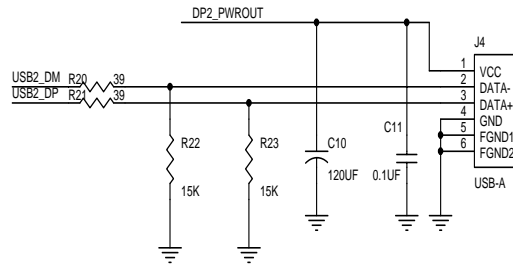
## 4.1 AU9462 Block Diagram



## 4.2 Sample Schematics



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Size A	Document Number Au9462 demonstration schematics	Rev <b>2.0</b>
Date: Friday, September 20, 2002	Sheet 2 of 2	

### 4.3. AU9462 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 ACPI. 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	LoByte : Pointer to Hub device descriptor 000h ROM address HiByte : Xfer end address + 1
4	1C,35	LoByte : Pointer to Hub configuration descriptor 000h ROM addr HiByte : Xfer end address + 1 (config+interface+endpoint)
6	C3,CC	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 address
14	66,6A	LoByte : Pointer to string descriptor (index 0) 100h ROM address HiByte : Xfer end address + 1
16	6A,70	LoByte : Pointer to string descriptor (index 1) 100h ROM address HiByte : Xfer end address + 1
18	70,88	LoByte : Pointer to string descriptor (index 2) 100h ROM address HiByte : Xfer end address + 1



		address HiByte : Xfer end address + 1
1A	88,A0	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	Config Desc. 1 interface, bus powered, remote wakeup, 50 mA Total bytes returned : 0x19
25	09,04,00,00,01,09,00,00,00	Hub interface descriptor, interface 0. Class code 0x9
2E	07,05,81,03,01,00,FF	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	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	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 (9442) 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, 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
148	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
166	04,03,09,04	Lang ID array, (index 0), change string
16A	0C, 41,4C,43,4F, 52,	Leng_Str_desc, (index 1) Manufacturer, ALCOR
170	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
188	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
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, 00,00,00,00, 00,00,00,00, 00,00,00,00,  44,F0,00,00, 44,F3,00,00, 43,25,02,00, 00,00,00,E3,	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 Row 19 column2 NA Row 19 column1 NA  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>

43,24,02,00, 00,00,00,65, 43,B6,00,00, 43,B5,00,00,	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>
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,	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>
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,	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>
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,	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>
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,	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>
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,	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: <+> Row 13 column2 Normal Key: <End> Row 13 column1 Normal Key: <Home>
00,00,00,56, 00,00,00,55, 00,00,00,63, 00,00,00,5B, 00,00,00,5E, 00,00,00,61,	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 >

00,00,00,4E, 00,00,00,4B,	Row 12 column3 Normal Key: <9 Pgup> Row 12 column2 Normal key: <PageDn> Row 12 column1 Normal Key: <PageUp>
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 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>
00,00,00,4F, 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 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>
00,00,00,2C, 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 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>
00,00,00,38, 00,00,00,32, 00,00,00,34, 00,00,00,33, 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> Row 7 column1 Normal Key: <F8>
00,00,00,87, 00,00,00,36, 00,00,00,3F, 00,00,00,0E, 00,00,00,30,	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: <}]>

00,00,00,0C, 00,00,00,25, 00,00,00,2E,	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: <I> 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: <B> 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 <sub>CC</sub>	Power Supply	4.75	5	5.25	V
V <sub>IN</sub>	Input Voltage	0		3.3V	V
T <sub>OPR</sub>	Operating Temperature	0		85	°C
T <sub>STG</sub>	Storage Temperature	-40		125	°C

## 5.2 General DC Characteristics

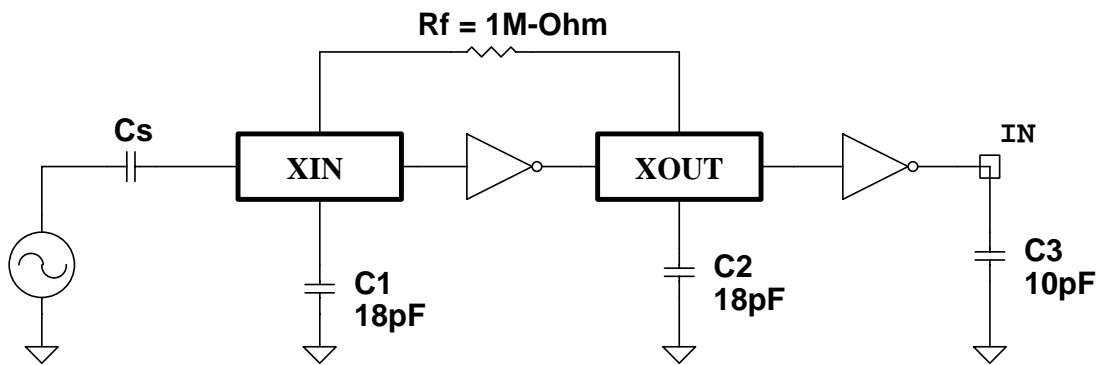
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
I <sub>IL</sub>	Input low current	no pull-up or pull-down	-1		1	μA
I <sub>IH</sub>	Input high current	no pull-up or pull-down	-1		1	μA
I <sub>OZ</sub>	Tri-state leakage current		-10		10	μA
C <sub>IN</sub>	Input capacitance			5		pF
C <sub>OUT</sub>	Output capacitance			5		pF
C <sub>BID</sub>	Bi-directional buffer capacitance			5		pF

## 5.3 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

## 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.

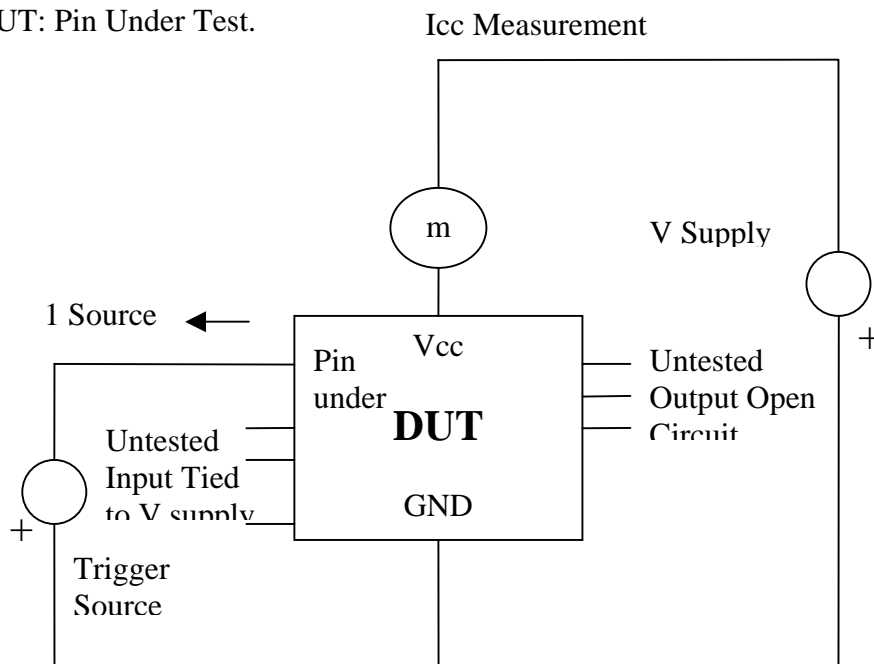
Testing was started at 5.0 V (Positive) or 0 V(Negative), and the DUT was biased for 0.5 seconds.

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.

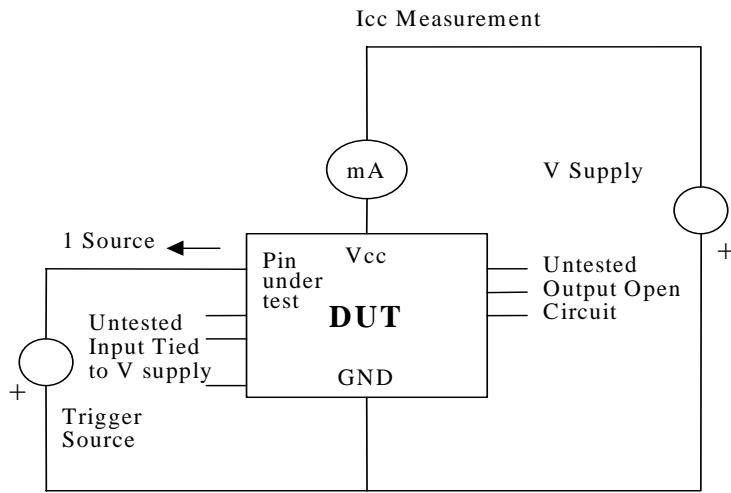
This procedure was recommended by the JEDEC JC-40.2 CMOS Logic standardization committee.

### Notes:

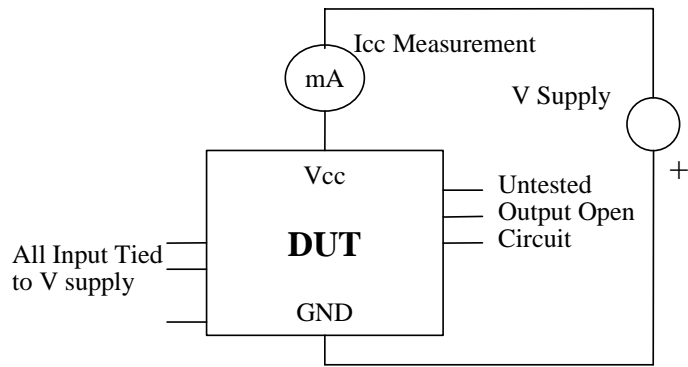
1. DUT: Device Under Test.
2. PUT: Pin Under Test.



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



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



**Supply Voltage test**

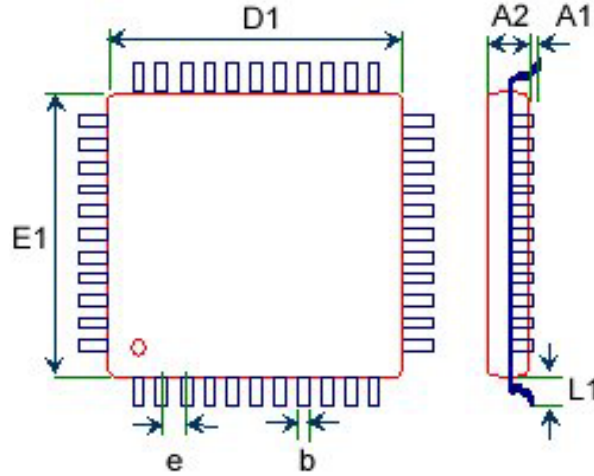
**Latch-Up Data**

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 AU9462 64-pin LQFP. Measurements are in inches.



body size		lead	A1	A2	L1	b	c	e
D1	E1	count						
10	10	64	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

3/13/2003      Mechanical Format Revision