

# 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.

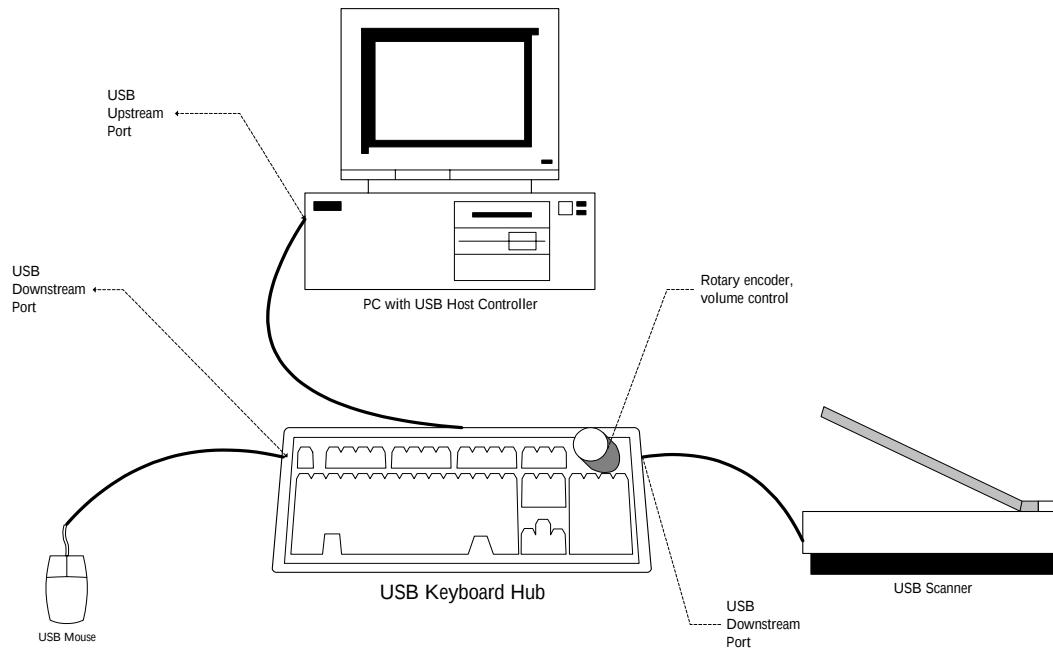
## 1.2 Features

- 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
- Integrated 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

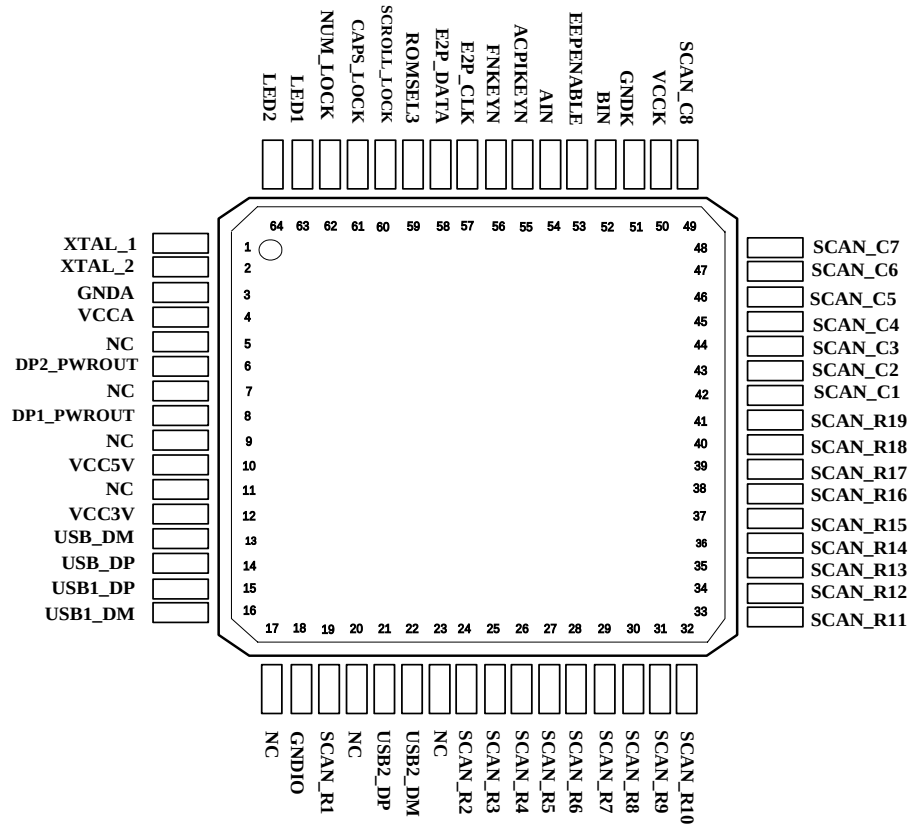


Table 3-1. Pin Description

| Pin | Pin Name   | IO Type                  | Description                                     |
|-----|------------|--------------------------|-------------------------------------------------|
| 1   | XTAL_1     | Input                    | 12MHz Crystal input                             |
| 2   | XTAL_2     | Output                   | 12MHz Crystal output                            |
| 3   | GNDA       | 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                                   |

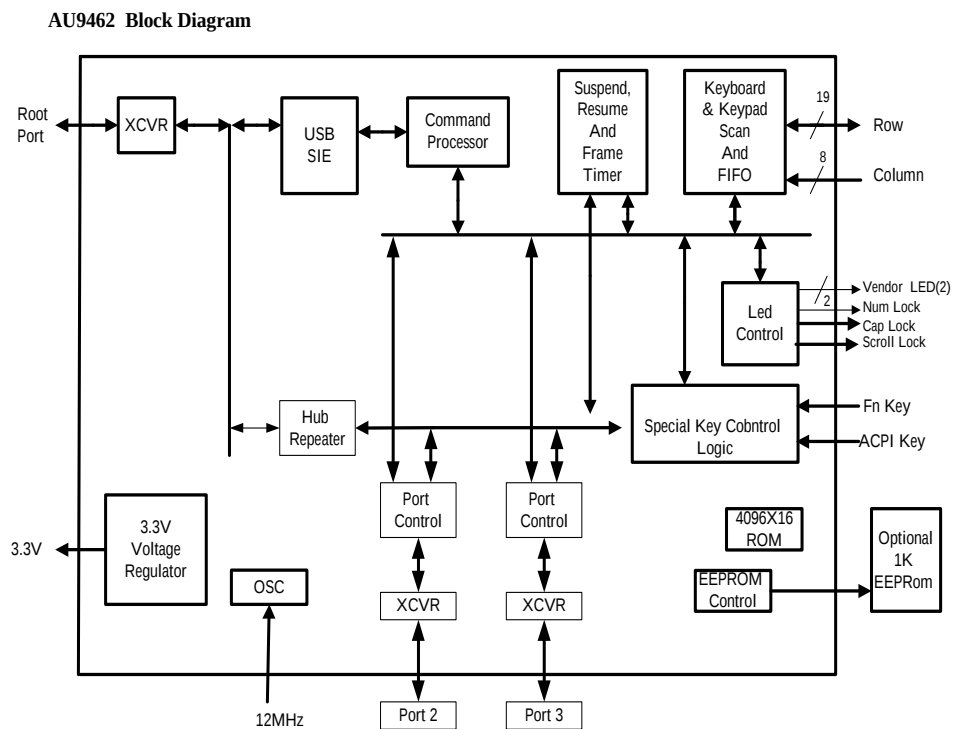
|    |             |                          |                                                                          |
|----|-------------|--------------------------|--------------------------------------------------------------------------|
| 34 | SCAN_R12    | Input/ Output, Pull down | Row Scan 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 | VCKK        | Power                    | Core power                                                               |
| 51 | GNDK        | Ground                   |                                                                          |
| 52 | BIN         | Input                    | Rotary encoder input 'B'                                                 |
| 53 | EEPENABLE   | Input                    | Enable EEPROM function,<br>=0 use internal ROM<br>=1 use external EEPROM |
| 54 | AIN         | Input                    | Rotary encoder input 'A'                                                 |
| 55 | ACPIKEYN    | Input/ Pull up           | Sleep, Shutdown, Wake up<br>-(low active)                                |
| 56 | FNKEYN      | Input/ Pull up           | Selective alternative keyboard<br>-(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 7

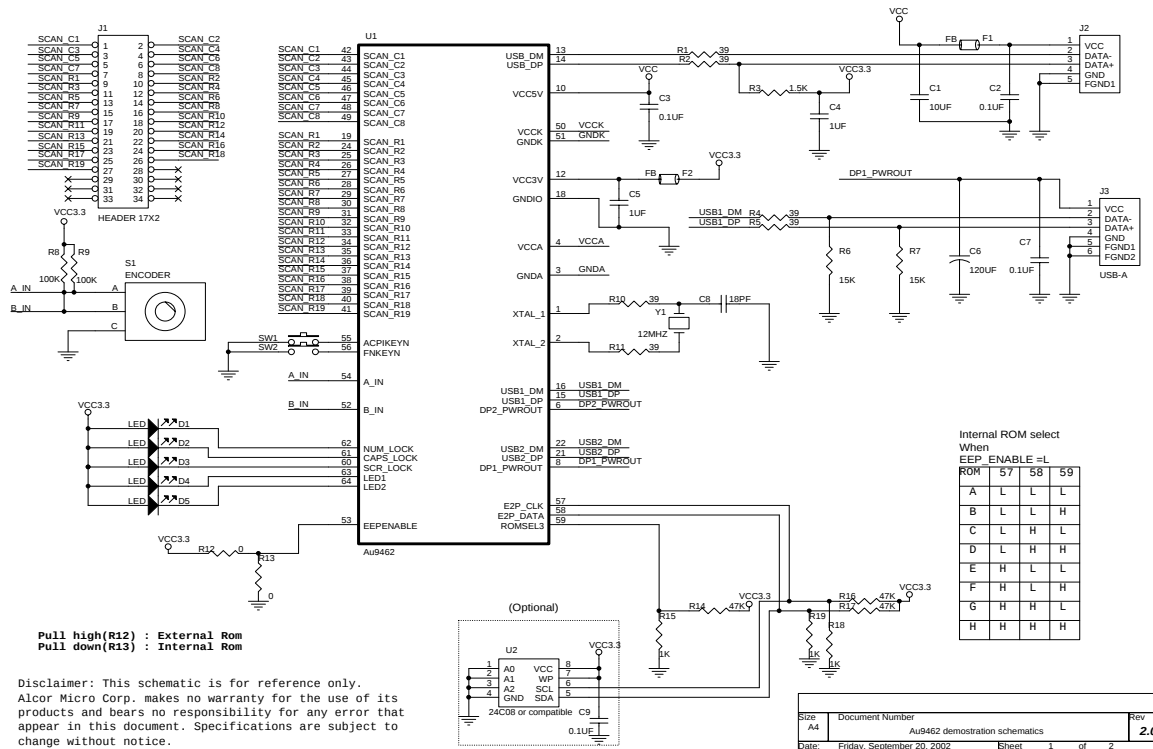
PIN ASSIGNMENT 8

# 4.0 System Architecture and Reference Design

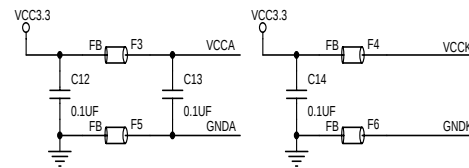
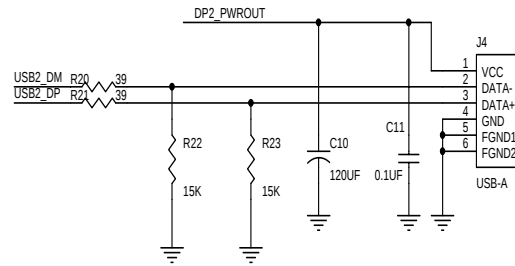
## 4.1 AU9462 Block Diagram



## 4.2 Sample Schematics



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|       |                                 |              |
|-------|---------------------------------|--------------|
| Size  | Document Number                 | Rev          |
| A     | Au9462 demonstration schematics | 2.0          |
| Date: | Friday, September 20, 2002      | Sheet 2 of 2 |

### 4.3. AU9462 Keyboard EEPROM Sample Value

| Offset | Hex Value | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | 00,01     | Configuration<br>Byte 0 bit 5 : 1= Individual Power<br>Byte 0 bit 6 : 1= HUB Enable Port Error<br>Byte 0 bit 7 : 1= HUB Select SelfPower change by HID<br>Byte 1 bit 0 : 1=Wakeup on any key; 0=only on ACPI.<br>Byte 1 bit 1 : 1=Send 2 Zeros; 0=send 3 zeros.<br>Byte 1 bit 2 : 1=Blink LED1; 0=No blink LED1.<br>Byte 1 bit 3 : 1=Blink LED2; 0=no blink LED2.<br>Byte 1 bit 4 : 1=Toggle Fn key; 0= no toggle Fn key.<br>Byte 1 bit 5 : 1=Fn toggle state driven on LED2; 0= normal LED2<br>Feature<br>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<br>HiByte : Xfer end address + 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 4      | 1C,35     | LoByte : Pointer to Hub configuration descriptor 000h ROM addr<br>HiByte : Xfer end address + 1 (config+interface+endpoint)                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 6      | C3,CC     | LoByte : Pointer to HUB Class descriptor (0x29) 000h ROM addr<br>HiByte : Xfer end address + 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 8      | CC,DE     | LoByte : Pointer to Keyboard device descriptor 000h ROM address<br>HiByte : Xfer end address + 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| A      | 35,70     | LoByte : Pointer to Keyboard configuration descriptor<br>HiByte : Xfer end address + 1 000h ROM address<br>(config+interface0+HID0+endpoint1+interface1+HID1+endpoint2)                                                                                                                                                                                                                                                                                                                                                                                                |
| C      | 47,50     | LoByte : Pointer to Keyboard HID descriptor (0x21) Interface 0<br>HiByte : Xfer end address + 1 000h ROM address                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| E      | 70,B1     | LoByte : Pointer to Keyboard Report descriptor (0x22) Interface 0<br>HiByte : Xfer end address + 1 000h ROM address                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 10     | 60,69     | LoByte : Pointer to Keyboard HID descriptor (0x21) Interface 1<br>HiByte : Xfer end address + 1 000h ROM address                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 12     | DE,48     | LoByte : Pointer to Keyboard Report descriptor (0x22) Interface 1<br>HiByte : Xfer end address + 1<br>start in 000h ROM address<br>end in 100h ROM address                                                                                                                                                                                                                                                                                                                                                                                                             |
| 14     | 66,6A     | LoByte : Pointer to string descriptor (index 0) 100h ROM address<br>HiByte : Xfer end address + 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 16     | 6A,70     | LoByte : Pointer to string descriptor (index 1) 100h ROM address<br>HiByte : Xfer end address + 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 18     | 70,88     | LoByte : Pointer to string descriptor (index 2) 100h ROM address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|    |                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                                                                                                                                                                    | address<br>HiByte : Xfer end address + 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 1A | 88,A0                                                                                                                                                                                                                              | LoByte : Pointer to string descriptor (index 3) 100h ROM address<br>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<br>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<br>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,<br>19,E0,29,E7,15,00,25,01,<br>75,01,95,08,81,02,95,01,<br>75,08,81,01,95,05,75,01,<br>05,08,19,01,29,05,91,02,<br>95,01,75,03,91,01,95,06,<br>75,08,15,00,26,FF,00,05,<br>07,19,00,2A,FF,00,81,00,<br>C0 | Keyboard report descriptor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| B1 | 12,01,10,01,09,00,00,08,<br>8F,05,40,94,22,01,01,02,<br>00,01                                                                                                                                                                      | Hub device descriptor, USB version 1. 1, VID,PID<br>Device version 1.22<br>12 Descriptor length<br>01 Device Descriptor<br>10 01 USB Version 1.1<br>09 Hub class<br>00 Sub-class<br>00 Device Protocol<br>08 Maximum packet size<br>VV VV Vender ID – Alcor Hub Vender ID<br>PP PP Product ID - Alcor Hub Product ID<br>22 01 Device release number<br>01 Index of Manufacturer string descriptor<br>02 Index of Product string descriptor<br>00 Index of serial number string descriptor – no serial number<br>01 Number of configuration |
| C3 | 09,29,03,04,00,16,32,02,FF                                                                                                                                                                                                         | Hub class descriptor.<br>09 Descriptor length<br>29 Hub Descriptor<br>03 Number of downstream port – one keyboard and 2 external ports<br>04 00 Over-current sensing, compound device, gang power switch<br>16 Power good wait time 16hx21`` mS<br>32 Maximum current required (50 mA)<br>02 Port 1 is not removable                                                                                                                                                                                                                       |

|    |                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                                                                                                                                                                                                                                                                                                                   | FF Port power control mask                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| CC | 12,01,10,01,00,00,00,08,<br>8F,05,40,94,22,01,01,02,<br>03,01                                                                                                                                                                                                                                                                                                                     | Keyboard device descriptor, USB version 1.1, VID,PID<br>Device version 1.22<br>12 Descriptor length<br>01 Device Descriptor<br>10 01 USB Version 1.1<br>00 Class defined in interface descriptor<br>00 Sub-class<br>00 Device Protocol<br>08 Maximum packet size<br>VV VV Vender ID – Keyboard Vender ID (058F)<br>PP PP Product ID - Keyboard Product ID (9442)<br>22 01 Device release number<br>01 Index of Manufacturer string descriptor<br>02 Index of Product string descriptor<br>03 Index of serial number string descriptor – no serial number<br>01 Number of configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| DE | 05,01,09,80,A1,01,85,02,<br>75,01,95,01,15,00,25,01,<br>09,81,81,06,09,82,81,06,<br>09,83,81,06,75,05,81,01,<br>C0,05,0C,09,01,A1,01,85,<br>03,95,01,75,10,19,00,2A,<br>FF,7F,81,00,C0,06,7F,FF,<br>09,01,A1,01,85,04,95,01,<br>75,10,19,00,2A,FF,7F,81,<br>00,75,02,25,02,09,90,B1,<br>02,75,06,B1,01,75,01,25,<br>01,05,08,09,2A,91,02,09,<br>4B,91,02,75,06,95,01,91,<br>01,C0 | Added Key report descriptor<br>05 01 Usage Page Generic Desktop<br>09 80 Usage System Control<br>A1 01 Collection Application<br>85 02 Report ID 2<br>75 01 Report Size 1<br>95 01 Report Count 1<br>15 00 Logical Minimum 0<br>25 01 Logical Maximum 1<br>09 81 Usage System Sleep<br>81 06 Input (variable, Relative, Preferred State)<br>09 82 Usage System Sleep<br>81 06 Input (variable, Relative, Preferred State)<br>09 83 Usage System Wake Up<br>81 06 Input (variable, Relative, Preferred State)<br>75 05 Report Size 5<br>81 01 Input (Constant)<br>C0 End Collection<br><br>05 0C Usage Page Consumer Device<br>09 01 Usage Consumer Control<br>A1 01 Collection Application<br>85 03 Report ID 3<br>95 01 Report Count 1<br>75 10 Report Size 16<br>19 00 Usage Minimum 0<br>2A FF 7F Usage Maximum 32767<br>81 00 Input (data, variable, absolute, preferred State)<br>C0 End Collection<br><br>06 00 FF Usage Page Vendor Defined Page 1<br>09 01 Usage Vendor Usage 1<br>A1 01 Collection Application<br>85 04 Report ID 4<br>95 01 Report Count 1 |



|                                                                                                                               |                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 43,24,02,00,<br>00,00,00,65,<br>43,B6,00,00,<br>43,B5,00,00,                                                                  | Row 18 column4 Hotkey/ID3 <Back><br>Row 18 column3 Normal Key: <Apps><br>Row 18 column2 Hotkey/ID3: <Last Track><br>Row 18 column1 Hotkey/ID3: <Scan Next Track>                                                                                                                                                                |
| 44,F1,00,00,<br>00,00,00,E7,<br>43,E2,00,00,<br>44,F2,00,00,<br>43,B7,00,00,<br>43,EA,00,00,<br>43,2A,02,00,<br>43,83,01,00,  | Row 17 column 8 Hotkey/ID4: <User 2><br>Row 17 column 7 Normal Key: <Win-R><br>Row 17 column6 Hotkey/ID3: <Mute><br>Row 17 column5 Hotkey/ID4: <User 3><br>Row 17 column4 Hotkey/ID3: <Stop><br>Row 17 column3 Hotkey/ID3: <Volume Down><br>Row 17 column2 Hotkey/ID3: <Bookmark><br>Row 17 column1 Hotkey/ID3: <A1 Consumer>   |
| 00,00, 00,00,<br>00,00,00,E4,<br>43,B8,00,00,<br>44,F5,00,00,<br>43,E9,00,00,<br>44,F4,00,00,<br>43,27,02,00,<br>00,00,00,E0, | Row 16 column8 NA<br>Row 16 column7 Normal Key: <Ctrl-R><br>Row 16 column6 Hotkey/ID3: <Eject><br>Row 16 column5 Hotkey/ID4: <User 6><br>Row 16 column4 Hotkey/ID3: <Volume Up><br>Row 16 column3 Hotkey/ID4: <User 5><br>Row 16 column2 Hotkey/ID3: <Refresh><br>Row 16 column1 Normal Key: <Ctrl-L>                           |
| 42,81,00,00,<br>00,00,00,E5,<br>43,CD,00,00,<br>42,82,00,00,,<br>00,00,00,E1,<br>43,94,01,00,<br>43,21,02,00,<br>43,8A,01,00, | Row 15 column8 ACPIkey/ID2: <Power><br>Row 15 column7 Normal Key: <Shift-R><br>Row 15 column6 Hotkey/ID3: <Play/Pause><br>Row 15 column5 ACPIkey/ID2: <Sleep><br>Row 15 column4 Normal Key: <Shift-L><br>Row 15 column3 Hotkey/ID3: <My Computer><br>Row 15 column2 Hotkey/ID3: <Search><br>Row 15 column1 Hotkey/ID3: <E-mail> |
| 00,00,00,E6,<br>00,00,00,00,<br>00,00,00,E2,<br>00,00,00,01,<br>43,92,01,00,<br>00,00,00,47,<br>00,00,00,46,<br>43,23,02,00,  | Row 14 column8 Normal Key: <Alt-R><br>Row 14 column7 NA<br>Row 14 column6 Normal Key: <Alt-L><br>Row 14 column5 Normal Key: <000><br>Row 14 column4 Hotkey/ID3: <Calculator><br>Row 14 column3 Normal Key: <Scroll><br>Row 14 column2 Normal Key: <PrtSc><br>Row 14 column1 Hotkey/ID3: <Internet>                              |
| 00,00,00,50,<br>00,00,00,48,<br>00,00,00,52,<br>00,00,00,58,<br>00,00,00,85,<br>00,00,00,57,<br>00,00,00,4D,<br>00,00,00,4A,  | Row 13 column8 Normal Key: <←><br>Row 13 column7 Normal Key <Pause><br>Row 13 column6 Normal Key: <↑><br>Row 13 column5 Normal Key: <Enter-R><br>Row 13 column4 Normal Key: <K107><br>Row 13 column3 Normal Key: <+><br>Row 13 column2 Normal Key: <End><br>Row 13 column1 Normal Key: <Home>                                   |
| 00,00,00,56,<br>00,00,00,55,<br>00,00,00,63,<br>00,00,00,5B,<br>00,00,00,5E,<br>00,00,00,61,                                  | Row 12 column8 Normal Key: <-><br>Row 12 column7 Normal Key: <*><br>Row 12 column6 Normal Key: <, Del><br>Row 12 column5 Normal Key: <3 PgDn><br>Row 12 column4 Normal Key: <6 →>                                                                                                                                               |

|  |                                                                                                                              |                                                                                                                                                                                                                                                                                                   |
|--|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | 00,00,00,4E,<br>00,00,00,4B,                                                                                                 | Row 12 column3 Normal Key: <9 Pgup><br>Row 12 column2 Normal key: <PageDn><br>Row 12 column1 Normal Key: <PageUp>                                                                                                                                                                                 |
|  | 00,00,00,51,<br>00,00,00,53,<br>00,00,00,00,<br>00,00,00,59,<br>00,00,00,5C,<br>00,00,00,5F,<br>00,00,00,44,<br>00,00,00,4C, | Row 11 column8 Normal Key: <↓><br>Row 11 column7 Normal Key: <Num><br>Row 11 column6 Normal Key: <00><br>Row 11 column5 Normal Key: <1 End><br>Row 11 column4 Normal Key: <4 ←><br>Row 11 column3 Normal Key: <7 Home><br>Row 11 column2 Normal Key: <F11><br>Row 11 column1 Normal Key: <Delete> |
|  | 00,00,00,4F,<br>00,00,00,54,<br>00,00,00,62,<br>00,00,00,5A,<br>00,00,00,5D,<br>00,00,00,60,<br>00,00,00,45,<br>00,00,00,49, | Row 10 column8 Normal Key: <→><br>Row 10 column7 Normal Key: </><br>Row 10 column6 Normal Key: <0 Ins><br>Row 10 column5 Normal Key: <2 ↓><br>Row 10 column4 Normal Key: <5><br>Row 10 column3 Normal Key: <8 ↑><br>Row 10 column2 Normal Key: <F12><br>Row 10 column1 Normal Key: <Insert>       |
|  | 00,00,00,2C,<br>00,00,00,28,<br>00,00,00,3E,<br>00,00,00,31,<br>00,00,00,2A,<br>00,00,00,89,<br>00,00,00,43,<br>00,00,00,42, | Row 9 column8 Normal Key: <Space><br>Row 9 column7 Normal Key: <Enter><br>Row 9 column6 Normal Key: <F5><br>Row 9 column5 Normal Key: < \ (K29)><br>Row 9 column4 Normal Key: <BackSps><br>Row 9 column3 Normal Key: <K14><br>Row 9 column2 Normal Key: <F10><br>Row 9 column1 Normal Key: <F9>   |
|  | 00,00,00,38,<br>00,00,00,32,<br>00,00,00,34,<br>00,00,00,33,<br>00,00,00,2F,<br>00,00,00,13,<br>00,00,00,27,<br>00,00,00,2D, | Row 8 column8 Normal Key: <? /><br>Row 8 column7 Normal Key: <K42><br>Row 8 column6 Normal Key: <" '><br>Row 8 column5 Normal Key: <: ;><br>Row 8 column4 Normal Key: <{[><br>Row 8 column3 Normal Key: <P><br>Row 8 column2 Normal Key: <) 0><br>Row 8 column1 Normal Key: <- _>                 |
|  | 00,00,00,88,<br>00,00,00,37,<br>00,00,00,8A,<br>00,00,00,0F,<br>00,00,00,40,<br>00,00,00,12,<br>00,00,00,26,<br>00,00,00,41, | Row 7 column8 Normal Key: <K133><br>Row 7 column7 Normal Key: <>.><br>Row 7 column6 Normal Key: <K132><br>Row 7 column5 Normal Key: <L><br>Row 7 column4 Normal Key: <F7><br>Row 7 column3 Normal Key: <O><br>Row 7 column2 Normal Key: <(9><br>Row 7 column1 Normal Key: <F8>                    |
|  | 00,00,00,87,<br>00,00,00,36,<br>00,00,00,3F,<br>00,00,00,0E,<br>00,00,00,30,                                                 | Row 6 column8 Normal Key: <K56><br>Row 6 column7 Normal Key: <<, ><br>Row 6 column6 Normal Key: <F6><br>Row 6 column5 Normal Key: <K><br>Row 6 column4 Normal Key: <}]>                                                                                                                           |

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

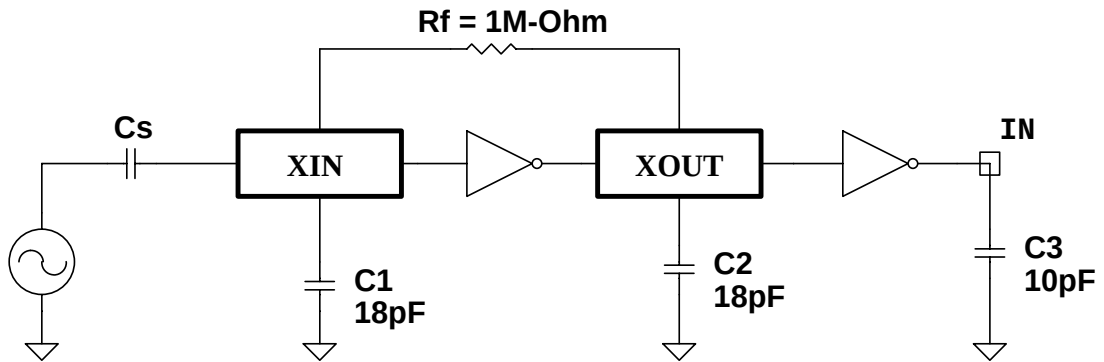
| SYMBOL           | PARAMETER                         | CONDITIONS              | MIN | TYP | MAX | UNITS |
|------------------|-----------------------------------|-------------------------|-----|-----|-----|-------|
| I <sub>IL</sub>  | Input low current                 | no pull-up or pull-down | -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.

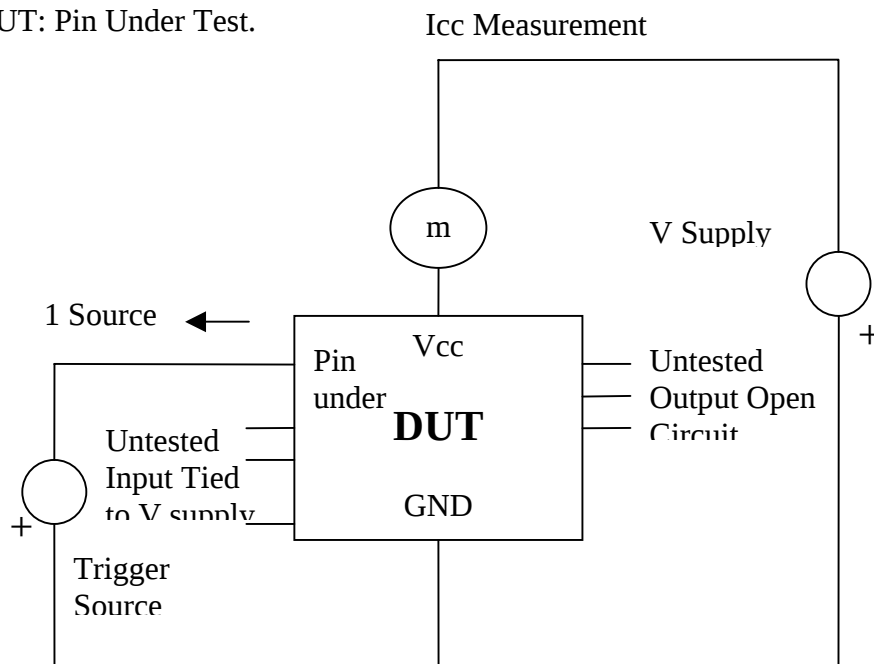
Testing was started at 5.0 V (Positive) or 0 V(Negative), and the DUT was biased for 0.5 seconds.

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.

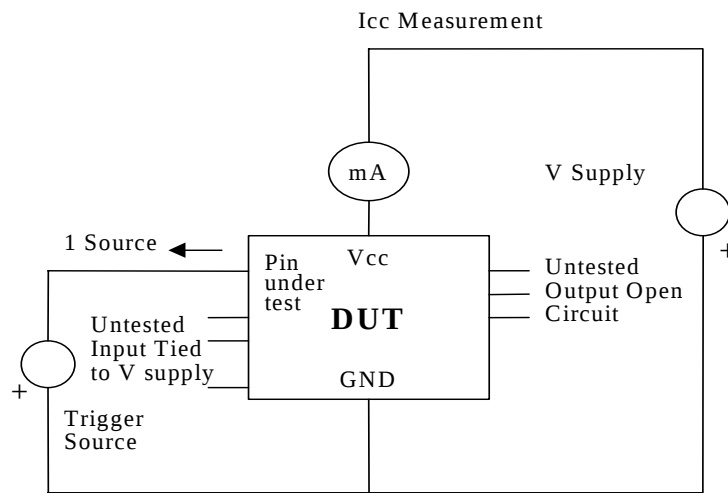
This procedure was recommended by the JEDEC JC-40.2 CMOS Logic standardization committee.

### Notes:

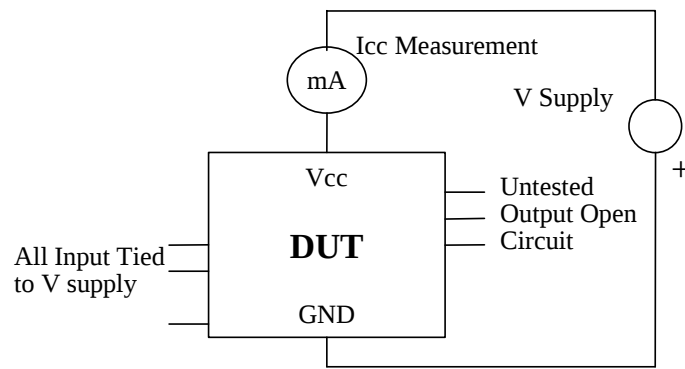
1. DUT: Device Under Test.
2. PUT: Pin Under Test.



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



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



**Supply Voltage test**

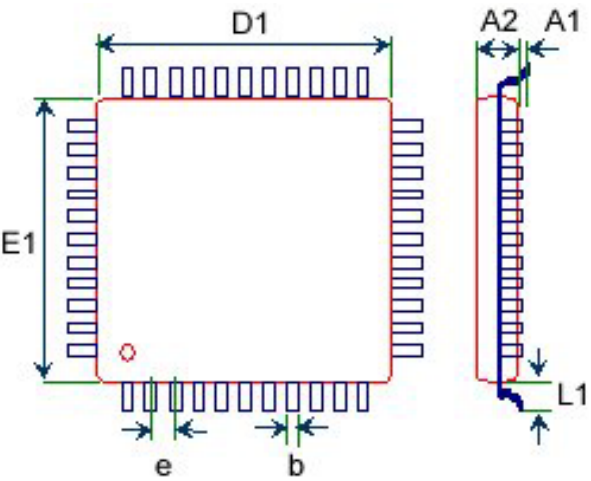
### Latch-Up Data

| 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