



# **Data Book**

## **AU9410 USB Keyboard Controller Technical Reference Manual**

**Product Specification**

**Official Release**

**Revision 3.00**

**Public**

**Sep 2006**



## Data book status

Objective specification	This data book contains target specifications for product development.
Preliminary specification	This data book contains preliminary data; supplementary data may be published later.
Product specification	This data book contains final product specifications.

## Revision History

Date	Revision	Description
Sep 2006	3.00W	Official release



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# 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.

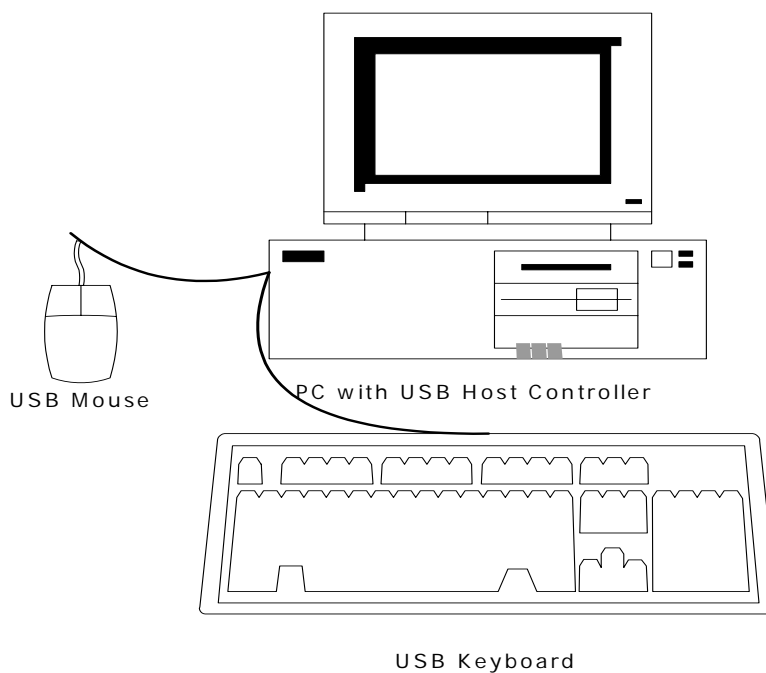
## 1.2 Features

- 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 LQFP, 64 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.

**Figure 2.1 Au9410 Application Block Diagram**

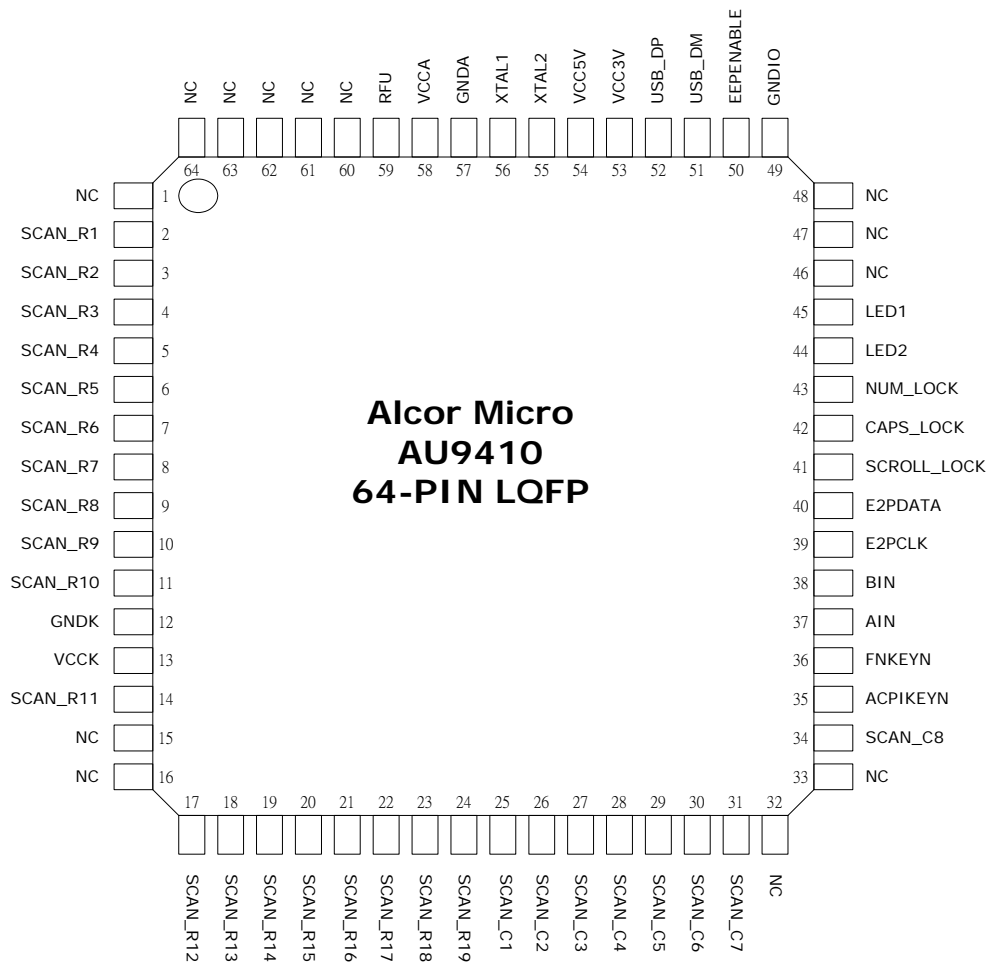




# 3.0 Pin Assignment

## 3.1 Pin Assignment Diagram

Figure 3.1 Pin Assignment Diagram







### 3.2 Pin Descriptions

Table 3.2 64Pin Descriptions

Pin No.	Pin Name	I/O Type	Description
1	NC		
2	SCAN_R1	I/O	Row Scan Line 1
3	SCAN_R2	I/O	Row Scan Line 2
4	SCAN_R3	I/O	Row Scan Line 3
5	SCAN_R4	I/O	Row Scan Line 4
6	SCAN_R5	I/O	Row Scan Line 5
7	SCAN_R6	I/O	Row Scan Line 6
8	SCAN_R7	I/O	Row Scan Line 7
9	SCAN_R8	I/O	Row Scan Line 8
10	SCAN_R9	I/O	Row Scan Line 9
11	SCAN_R10	I/O	Row Scan Line 10
12	GNDK	Power	Core GND
13	VCKK	Power	VCC 3.3V for Core power
14	SCAN_R11	I/O	Row Scan Line 11
15	NC		
16	NC		
17	SCAN_R12	I/O	Row Scan Line 12
18	SCAN_R13	I/O	Row Scan Line 13
19	SCAN_R14	I/O	Row Scan Line 14
20	SCAN_R15	I/O	Row Scan Line 15
21	SCAN_R16	I/O	Row Scan Line 16
22	SCAN_R17	I/O	Row Scan Line 17
23	SCAN_R18	I/O	Row Scan Line 18
24	SCAN_R19	I/O	Row Scan Line 19
25	SCAN_C1	I	Column Scan Line 1
26	SCAN_C2	I	Column Scan Line 2
27	SCAN_C3	I	Column Scan Line 3
28	SCAN_C4	I	Column Scan Line 4
29	SCAN_C5	I	Column Scan Line 5
30	SCAN_C6	I	Column Scan Line 6
31	SCAN_C7	I	Column Scan Line 7
32	NC		
33	NC		
34	SCAN_C8	I	Column Scan Line 8
35	ACPIKEYN	I	ACPI Control ("0": Sleep; "1": Wakeup; Default:"1")
36	FNKEYN	I	Alternative keyboard Selection ("0": Seleted; "1": Normal; Default:"1")
37	AIN	I	Rotary encoder input 'A'

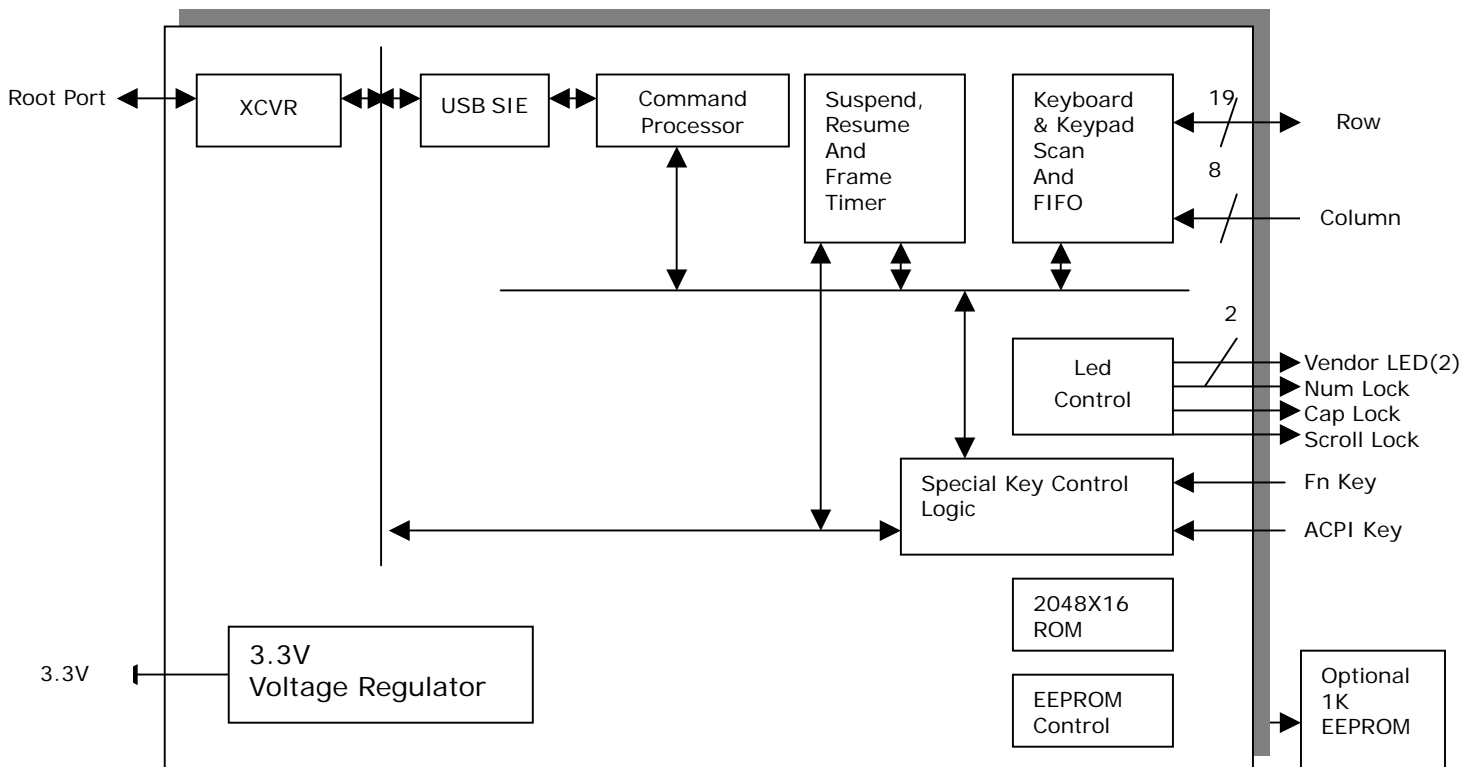


38	BIN	I	Rotary encoder input 'B'
39	E2PCLK	I	EEPROM Clock
40	E2PDATA	I	EEPROM Data
41	SCROLL_LOCK	O	Scroll Lock LED
42	CAPS_LOCK	O	CAPS Lock LED
43	NUM_LOCK	O	Num Lock LED
44	LED2	O	Additional LED2
45	LED1	O	Additional LED1
46	NC		
47	NC		
48	NC		
49	GNDIO	PWR	I/O GND
50	EEPENABLE	I	EEPROM Enable ("0": Internal ROM; "1": External ROM)
51	USB_DM	I/O	USB DM
52	USB_DP	I/O	USB DP
53	VCC3V	PWR	VCC 3V Output
54	VCC5V	PWR	VCC 5V Input
55	XTAL2	O	6MHz Crystal Onput
56	XTAL1	I	6MHz Crystal Iutput
57	GND A	PWR	Analog GND
58	VCCA	PWR	Analog Power 3.3V
59	RFU		Reserved
60	NC		
61	NC		
62	NC		
63	NC		
64	NC		

# 4.0 System Architecture and Reference Design

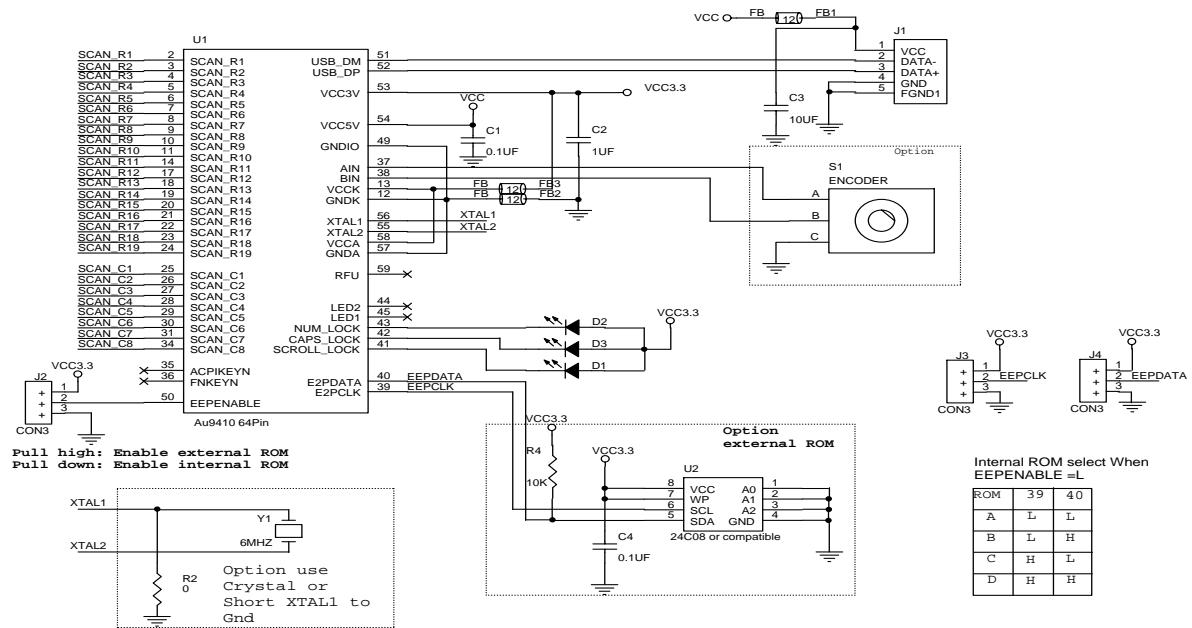
## 4.1 Block Diagram

Figure 4.1 Block Diagram



## 4.2 Sample Schematics

Figure 4.2 64Pin 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.

Title			<Title>
Size	Document Number	Rev	
A	Au9410 64Pin demonstration schematic	1.00	
Date:	Wednesday, April 06, 2005	Sheet	1 of 1



### 4.3 Keyboard EEPROM Sample Value

Table 4.1 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 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	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 address
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,	Added Key report descriptor



	<p>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</p>	<p>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</p> <p>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</p> <p>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</p>
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,	Leng,Str_desc (Serial number, index 3), change string USB Multimedia Keyboard



	65,79,62,6F,61,72,64,	
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	<p>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,</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,</p>	<p>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</p> <p>Row 18 column8 Hotkey/ID4: &lt;User 1&gt; Row 18 column7 Hotkey/ID4: &lt;User 4&gt; Row 18 column6 Hotkey/ID3: &lt;Forward&gt; Row 18 column5 Normal Key: &lt;Win-L&gt; Row 18 column4 Hotkey/ID3 &lt;Back&gt; Row 18 column3 Normal Key: &lt;Apps&gt; Row 18 column2 Hotkey/ID3: &lt;Last Track&gt; Row 18 column1 Hotkey/ID3: &lt;Scan Next Track&gt;</p> <p>Row 17 column 8 Hotkey/ID4: &lt;User 2&gt; Row 17 column 7 Normal Key: &lt;Win-R&gt; Row 17 column6 Hotkey/ID3: &lt;Mute&gt; Row 17 column5 Hotkey/ID4: &lt;User 3&gt; Row 17 column4 Hotkey/ID3: &lt;Stop&gt; Row 17 column3 Hotkey/ID3: &lt;Volume Down&gt; Row 17 column2 Hotkey/ID3: &lt;Bookmark&gt; Row 17 column1 Hotkey/ID3: &lt;A1 Consumer&gt;</p> <p>Row 16 column8 NA Row 16 column7 Normal Key: &lt;Ctrl-R&gt; Row 16 column6 Hotkey/ID3: &lt;Eject&gt; Row 16 column5 Hotkey/ID4: &lt;User 6&gt; Row 16 column4 Hotkey/ID3: &lt;Volume Up&gt; Row 16 column3 Hotkey/ID4: &lt;User 5&gt; Row 16 column2 Hotkey/ID3: &lt;Refresh&gt; Row 16 column1 Normal Key: &lt;Ctrl-L&gt;</p> <p>Row 15 column8 ACPIkey/ID2: &lt;Power&gt; Row 15 column7 Normal Key: &lt;Shift-R&gt; Row 15 column6 Hotkey/ID3: &lt;Play/Pause&gt; Row 15 column5 ACPIkey/ID2: &lt;Sleep&gt; Row 15 column4 Normal Key: &lt;Shift-L&gt; Row 15 column3 Hotkey/ID3: &lt;My Computer&gt; Row 15 column2 Hotkey/ID3: &lt;Search&gt; Row 15 column1 Hotkey/ID3: &lt;E-mail&gt;</p> <p>Row 14 column8 Normal Key: &lt;Alt-R&gt; Row 14 column7 NA Row 14 column6 Normal Key: &lt;Alt-L&gt; Row 14 column5 Normal Key: &lt;000&gt; Row 14 column4 Hotkey/ID3: &lt;Calculator&gt; Row 14 column3 Normal Key: &lt;Scroll&gt; Row 14 column2 Normal Key: &lt;PrtSc&gt; Row 14 column1 Hotkey/ID3: &lt;Internet&gt;</p> <p>Row 13 column8 Normal Key: &lt;←&gt; Row 13 column7 Normal Key &lt;Pause&gt; Row 13 column6 Normal Key: &lt;↑&gt;</p>





00,00,00,57,	Row 13 column5	Normal Key: <Enter-R>
00,00,00,4D,	Row 13 column4	Normal Key: <K107>
00,00,00,4A,	Row 13 column3	Normal Key: <+>
	Row 13 column2	Normal Key: <End>
00,00,00,56,	Row 13 column1	Normal Key: <Home>
00,00,00,55,		
00,00,00,63,	Row 12 column8	Normal Key: <->
00,00,00,5B,	Row 12 column7	Normal Key: <*>
00,00,00,5E,	Row 12 column6	Normal Key: <. Del>
00,00,00,61,	Row 12 column5	Normal Key: <3 PgDn>
00,00,00,4E,	Row 12 column4	Normal Key: <6 →>
00,00,00,4B,	Row 12 column3	Normal Key: <9 Pgup>
	Row 12 column2	Normal key: <PageDn>
00,00,00,51,	Row 12 column1	Normal Key: <PageUp>
00,00,00,53,		
00,00,00,00,	Row 11 column8	Normal Key: <↓>
00,00,00,59,	Row 11 column7	Normal Key: <Num>
00,00,00,5C,	Row 11 column6	Normal Key: <00>
00,00,00,5F,	Row 11 column5	Normal Key: <1 End>
00,00,00,44,	Row 11 column4	Normal Key: <4 ↔>
00,00,00,4C,	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,	Row 10 column8	Normal Key: <→>
00,00,00,62,	Row 10 column7	Normal Key: </>
00,00,00,5A,	Row 10 column6	Normal Key: <0 Ins>
00,00,00,5D,	Row 10 column5	Normal Key: <2 ↓>
00,00,00,60,	Row 10 column4	Normal Key: <5>
00,00,00,45,	Row 10 column3	Normal Key: <8 ↑>
00,00,00,49,	Row 10 column2	Normal Key: <F12>
	Row 10 column1	Normal Key: <Insert>
00,00,00,2C,		
00,00,00,28,	Row 9 column8	Normal Key: <Space>
00,00,00,3E,	Row 9 column7	Normal Key: <Enter>
00,00,00,31,	Row 9 column6	Normal Key: <F5>
00,00,00,2A,	Row 9 column5	Normal Key: <  \ (K29)>
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00,00,00,43,	Row 9 column3	Normal Key: <K14>
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	Row 1 column1	Normal Key: <~ `>



## 5.0 Electrical Characteristics

### 5.1 Recommended Operating Conditions

Table 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		V <sub>CC</sub>	V
T <sub>OPR</sub>	Operating Temperature	0		85	°C
T <sub>STG</sub>	Storage Temperature	-40		125	°C

### 5.2 General DC Characteristics

Table 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		ρF
C <sub>OUT</sub>	Output capacitance			5		ρF
C <sub>BID</sub>	Bi-directional buffer capacitance			5		ρF

### 5.3 DC Electrical Characteristics for 3.3 volts operation

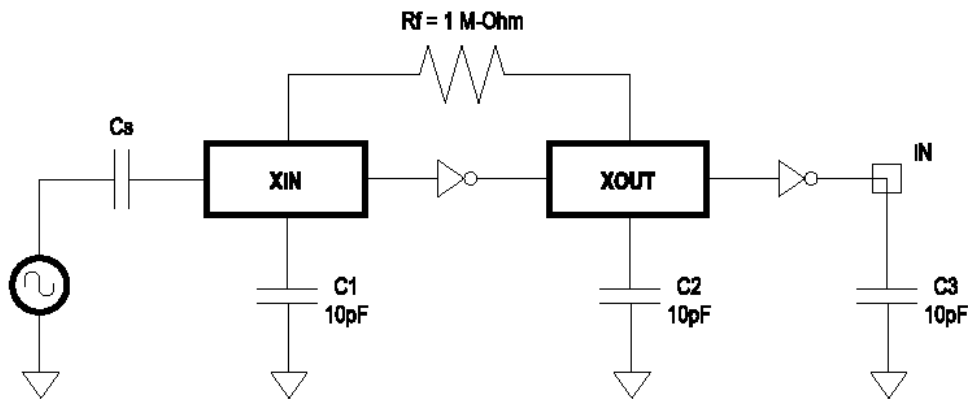
Table 5.3 DC Electrical Characteristics for 3.3 volts operation

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

## 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  $C_2$ .

Figure 5.1 Crystal Oscillator Circuit Setup for Characterization



## 5.5 ESD Test Results

**Test Description :** ESD Testing was performed on a Zapmaster system using the Human-Body –Model (HBM) and Machine-Model (MM), according to MIL\_STD 883 and EIAJ IC\_121 respectively.

- Human-Body-Model stress devices by sudden application of a high voltage supplied by a 100 PF capacitor through 1.5 Kohm resistance.
- Machine-Model stresses devices by sudden application of a high voltage supplied by a 200 PF capacitor through very low (0 ohm) resistance

### Test circuit & condition

- Zap Interval : 1 second
- Number of Zaps : 3 positive and 3 negative at room temperature
- Criteria : I-V Curve Tracing

Table 5.4 ESD Data

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

## 5.6 Latch-Up Test Results

**Test Description:** Latch-Up testing was performed at room ambient using an IMCS-4600 system which applies a stepped voltage to one pin per device with all other pins open except Vdd and Vss which were biased to 5 Volts and ground respectively.

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

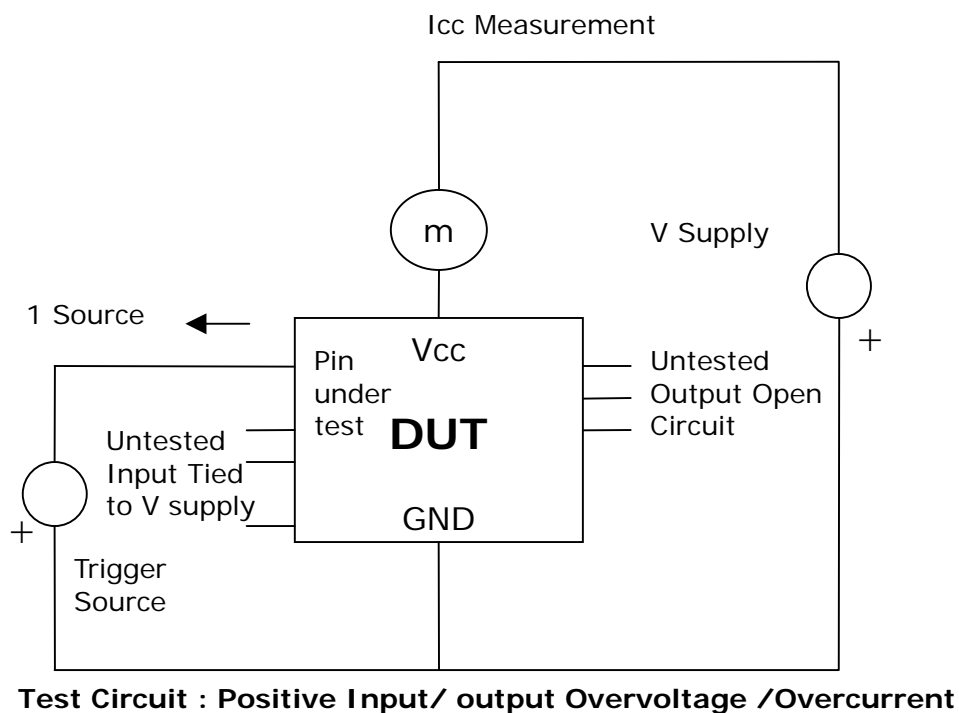
If neither the PUT current supply nor the device current supply reached the predefined limit (DUT=0 mA , Icc=100 mA), then the voltage was increased by 0.1 Volts and the pin was tested again.

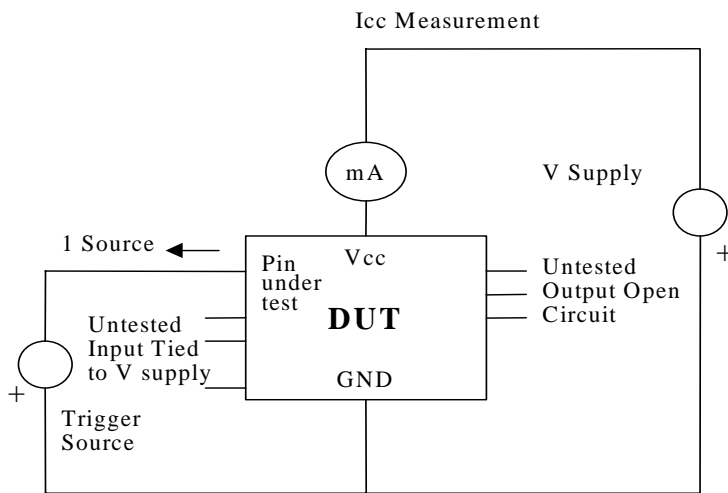
This procedure was recommended by the JEDEC JC-40.2 CMOS Logic standardization committee.

**Notes:**

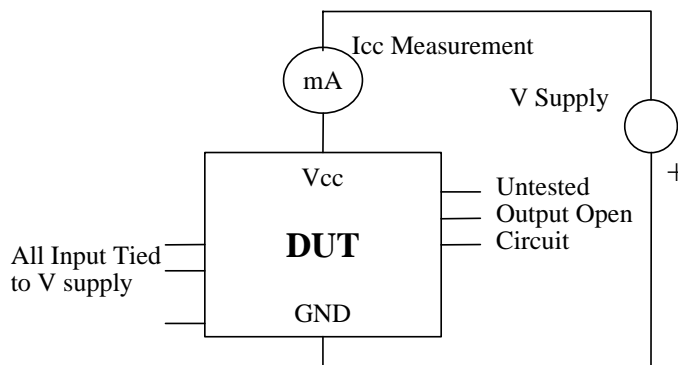
1. DUT: Device Under Test.
2. PUT: Pin Under Test.

**Figure 5.2 Latch-Up Test Results**





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



**Supply voltage Test**

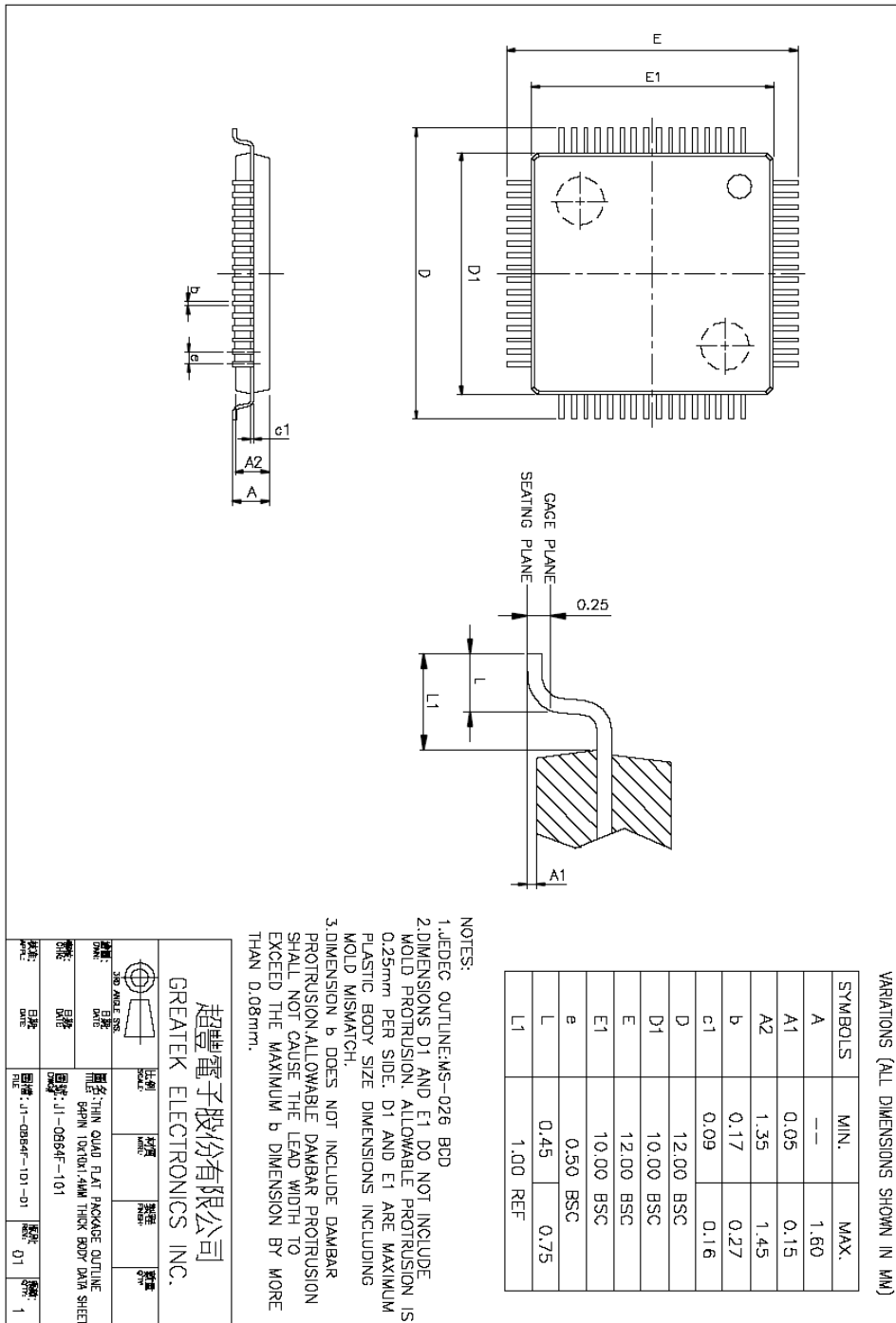
**Table 5.5 Latch-Up Data**

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

# 6.0 Mechanical Information

## 6.1 Mechanical Information Diagram

Figure 6.1 Pin Mechanical Information Diagram





**【MEMO】**

### **About Alcor Micro, Corp**

Alcor Micro, Corp. designs, develops and markets highly integrated and advanced peripheral semiconductor, and software driver solutions for the personal computer and consumer electronics markets worldwide. We specialize in USB solutions and focus on emerging technology such as USB and IEEE 1394. The company offers a range of semiconductors including controllers for USB hub, integrated keyboard/USB hub and USB Flash memory card reader...etc. Alcor Micro, Corp. is based in Taipei, Taiwan, with sales offices in Taipei, Japan, Korea and California.

Alcor Micro is distinguished by its ability to provide innovative solutions for spec-driven products. Innovations like single chip solutions for traditional multiple chip products and on-board voltage regulators enable the company to provide cost-efficiency solutions for the computer peripheral device OEM customers worldwide.