
eKK8011S

**USB and PS/2
Keyboard Encoder**

**Product
Specification**

DOC. VERSION 1.0

ELAN MICROELECTRONICS CORP.

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ELAN MICROELECTRONICS CORPORATION

Headquarters:

No. 12, Innovation 1st Road
Hsinchu Science Park
Hsinchu, TAIWAN 30076
Tel: +886 3 563-9977
Fax: +886 3 563-9966
webmaster@emc.com.tw
<http://www.emc.com.tw>

Hong Kong:

Elan (HK) Microelectronics Corporation, Ltd.
Flat A, 19F., World Tech Centre 95
How Ming Street, Kwun Tong
Kowloon, HONG KONG
Tel: +852 2723-3376
Fax: +852 2723-7780

USA:

Elan Information Technology Group (U.S.A.)
PO Box 601
Cupertino, CA 95015
U.S.A.
Tel: +1 408 366-8225
Fax: +1 408 366-8225

Korea:**Elan Korea Electronics Company, Ltd.**

301 Dong-A Building
632 Kojan-Dong, Namdong-ku
Incheon City, KOREA
Tel: +82 32 814-7730
Fax: +82 32 813-7730

Shenzhen:**Elan Microelectronics Shenzhen, Ltd.**

8A Floor, Microprofit Building
Gaoxin South Road 6
Shenzhen Hi-tech Industrial Park (South Area), Shenzhen
CHINA 518057
Tel: +86 755 2601-0565
Fax: +86 755 2601-0500
elan-sz@elanic.com.cn

Shanghai:**ELAN Microelectronics Shanghai, Ltd.**

Rm101, #3 Lane 289, Bisheng Rd.,
Zhangjiang Hi-Tech Park
Pudong New Area, Shanghai,
CHINA 201204
Tel: +86 21 5080-3866
Fax: +86 21 5080-0273
elan-sh@elanic.com.cn

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Specification Revision History

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1.0	Initial Release Version	2013/01/31



1 General Description

The eKK8011S is a high performance CMOS microcontroller specially designed for keyboard encoder applications and functions both in USB and PS/2 interface environment. For USB interface, it supports the USB standard request Version 2.0 as well as HID class request Version 1.11. For PS/2 interface, it supports IBM PC AT and all compatible machines as well as provides a 16-character first-in-first-out buffer in which data is stored.

The eKK8011S controls all scan codes, three LED status, scan timing, and communications between the keyboard and the PC. It brings together enhanced features to ensure the easy implementation of high performance, low cost keyboard with Internal RC Oscillator (IRC).

2 Features

- Complies with USB specifications:
 - Universal Serial Bus Specification Version 2.0
 - USB Device Class Definition for Human Interface Device (HID), Firmware Specification Version 1.11
- Embedded Internal RC Oscillator (IRC)
- Low cost: No external components required
- Operating frequency: 6 MHz
- Phantom key detection
- Supports Scan Code Sets 1, 2, and 3 for PS/2
- Supports HID Usage ID for USB
- Supports PC PS/2 and USB keyboard
- Supports USB Sleep Mode
- Low power CMOS device technology
- Internal pull-up resistor
- Supports Windows™ 95, 98, 2000, ME, XP, Vista, Windows 7, and Windows 8
- Supports multi-media or other special application keyboard encoder
- Supports 3 LEDS (Caps/Num/Scroll) change state to synchronize with PC status when plugged into a PS2 port

3 Application

- Both USB and PS/2 compatible keyboards

4 Pin Assignment

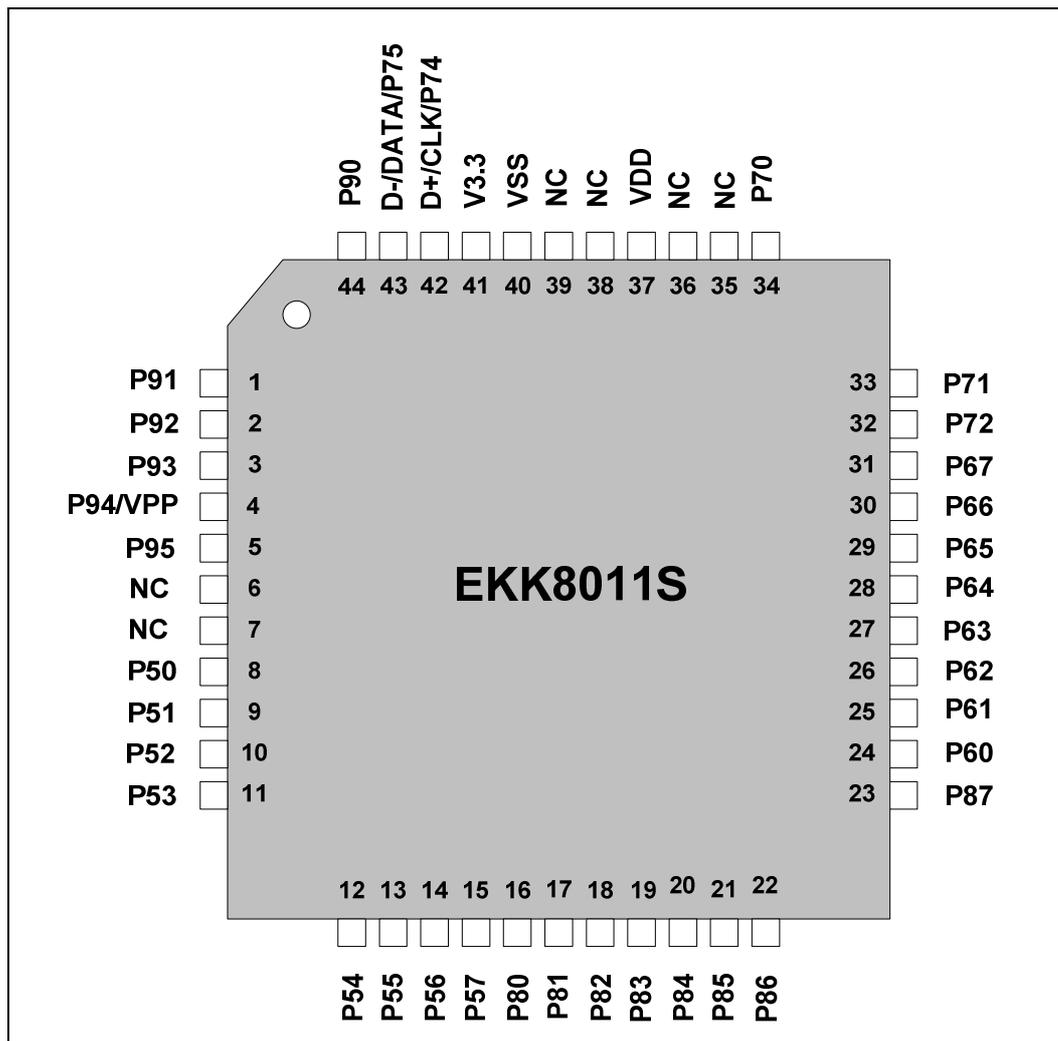


Figure 4-1 44-Pin QFP eKK8011S Pin Assignments

5 Pin Description

Symbol	I/O	Function
P50	O	Column 3 Low output scan line
P51	O	Column 4 Low output scan line
P52	O	Column 5 Low output scan line
P53	O	Column 6 Low output scan line
P54	O	Column 7 Low output scan line
P55	O	Column 14 Low output scan line
P56	O	Column 13 Low output scan line
P57	O	Column 12 Low output scan line
P80	O	Column 11 Low output scan line
P81	O	Column 15 Low output scan line
P82	O	Column 10 Low output scan line
P83	O	Column 8 Low output scan line
P84	O	Column 9 Low output scan line
P85	O	Column 0 Low output scan line
P86	O	Column 16 Low output scan line
P87	O	Column 17 Low output scan line
P90	O	Column 1 Low output scan line
P91	O	Column 2 Low output scan line
P92	I	Internal Multi-Function 1 selection
P93	I	Internal Multi-Function 2 selection
P95	O	Mode LED
VSS	PWR	Ground
SCROLL	O	Scroll Lock Indicator
NUM	O	NUM Lock Indicator
CAPS	O	Caps Lock Indicator
P60	I	Row 0 Input scan line, internal pull-high (25K Ω)
P61	I	Row 1 Input scan line, internal pull-high (25K Ω)
P62	I	Row 2 Input scan line, internal pull-high (25K Ω)
P63	I	Row 3 Input scan line, internal pull-high (25K Ω)
P64	I	Row 4 Input scan line, internal pull-high (25K Ω)
P65	I	Row 5 Input scan line, internal pull-high (25K Ω)
P66	I	Row 6 Input scan line, internal pull-high (25K Ω)
P67	I	Row 7 Input scan line, internal pull-high (25K Ω)
CLK/D+	I/O	Clock line for IBM communication, internal pull-high (2.2K Ω) or D+ line for USB communication, internal weak pull-high (2M Ω)
DATA/D-	I/O	Data line for IBM communication, internal pull-high (2.2K Ω) or D- line for USB communication, internal pull-high (1.4 K Ω)
VDD	PWR	+5V Power Supply
V3.3	PWR	3.3V output

6 Functional Description

This section is divided into two subsections for your convenience and easy distinction. Detailed PS/2 keyboard functions are described in Section 6.1, while that of USB keyboard functions are discussed in Section 6.2.

6.1 PS/2 Keyboard Functional Description

The following describes the keyboard buffer, power-on reset and self test, input, output, commands, and scan codes.

6.1.1 Keyboard Buffer

The keyboard buffer holds 16 bytes in a first-in-first-out order when the system receives scan codes from the keyboard. The response codes and repeated codes are not buffered. If the keystrokes generate a multiple-byte sequence, the entire sequence must fit into the buffer, otherwise the keystroke is discarded and a buffer-overflow condition occurs.

6.1.2 Power-on Reset and Self Test

The duration of keyboard Power-on-Reset (POR) is within 150 milliseconds to 2 seconds after the power is applied.

After executing POR, the keyboard executes a self test. The LEDs are light-on at the beginning and tight-off at the end of the self test. The self test takes a minimum of 300 milliseconds and a maximum of 500 milliseconds. If the self test is successful, a complete Code AA hex is sent to the system and the keyboard starts scanning. If the self test fails, an error code is sent, then; the keyboard is disabled and waits for a command from the system. The complete codes are sent within 450ms to 2.5s after POR, and between 300ms to 500ms after a reset command is acknowledged.

6.1.3 Keyboard Data Output

When the keyboard is ready to send data to the system, it first checks the clock and data lines. If either one is in the low state, data is stored in the keyboard buffer. If both are in the high state, the keyboard starts clocking data out. Data is valid before the trailing edge and after the leading edge of the clock pulse. During transmission, the keyboard checks the clock line at least every 60 microseconds. If the system lowers the clock lines before the leading edge of the 10th clock, the keyboard should stop sending data, then buffers the data and returns the clock and data lines to a high state.

6.1.4 Keyboard Data Input

When the system is ready to send data to the keyboard, it first checks the clock line to see if the keyboard is sending data. If the keyboard is not sending data or it is sending data but has not reached the 10th clock, the system can inhibit the interface by forcing the clock line to low for more than 60 microseconds and prepares to send data.

The keyboard checks the clock line status at least every 5 milliseconds. If a system Request to Send (RTS) is detected, the keyboard clocks 11 bits in. After the 10th bit, the keyboard checks for a high state in the data line then pulls it low and clocks one more bit to signal the system that data has been received. If data is low after the 10th bit, it indicates a frame error. The keyboard should continue to count until the data line goes high, then pulls it low and issues a Resend to the system.

6.1.5 Command from the System

The system can send commands to the keyboard any time of which the keyboard needs to respond within 20 milliseconds, unless the system stops the keyboard from outputting data during self test or reset execution. The following are the input commands that the keyboard receives and actions that it needs to respond:

- **Set/Reset Status indicators (Hex ED)**
 - Respond with ACK
 - Receive option byte
 - Respond with ACK
 - Update status indicators
 - Return to previous scanning state
- **Echo (Hex EEH)**
 - Respond with EE hex
 - Return to previous scanning state
- **Invalid commands (Hex EF and F1)**
 - Return a RESEND command
 - Return to previous scanning state
- **Select Alternate Scan Codes (Hex F0)**
 - Respond with ACK
 - Clear output buffer
 - Set the default Typematic rate/delay
 - Clear last Typematic key
 - Receive option byte
 - Respond with ACK
 - Option byte: **01**: Select Scan Code Set 1
02: Select Scan Code Set 2
03: Select Scan Code Set 3
 - Return to previous scanning rate



- **Read ID (F2)**
 - Respond with ACK
 - Discontinue scanning
 - Send two ID bytes. The second byte is sent within 500µs after the first byte.
 - Resume scanning

- **Set Typematic Rate/Delay (Hex F3)**
 - Respond with ACK
 - Receive rate/delay value byte
 - Respond with ACK
 - Set rate/delay (see Note 1 below)
 - Return to previous scanning state

NOTE

1. Repeat period = $(8+A) \times (2^B) \times 0.00417$ seconds
A: Binary value of Bits 2, 1, and 0.
B: Binary value of Bits 4 and 3.

2. Delay = $(C + 1) \times 250$ milliseconds
C: Binary value of Bits 6 and 5. Bit 7 is always 0.

3. Default rate = 10.9 chars/sec + 20%
 Default delay = 500ms ± 20%

Bit 4~ Bit 0	Typematic Rate ± 20%	Bit 4~ Bit 0	Typematic Rate ± 20%
00000	30.0	10000	7.5
00001	26.7	10001	6.7
00010	24.0	10010	6.0
00011	21.8	10011	5.5
00100	20.0	10100	5.0
00101	18.5	10101	4.6
00110	17.1	10110	4.3
00111	16.0	10111	4.0
01000	15.0	11000	3.7
01001	13.3	11001	3.3
01010	12.0	11010	3.0
01011	10.9	11011	2.7
01100	10.0	11100	2.5
01101	9.2	11101	2.3
01110	8.6	11110	2.1
01111	8.0	11111	2.0

- **Enable (Hex F4)**
 - Respond with ACK
 - Clear output buffer
 - Clear last typematic key
 - Start scanning
- **Default Disable (Hex F5)**
 - Respond with ACK
 - Reset all conditions to power-on state
 - Clear output buffer
 - Set the default key type (Scan Code Set 3 only)
 - Set the default typematic rate/delay
 - Clear the last typematic key
 - Stop scanning
- **Set Default (Hex F6)**
 - Respond with ACK
 - Reset all conditions to power-on state
 - Clear output buffer
 - Set the default key type (Scan Code Set 3 only)
 - Set the default typematic rate/delay
 - Clear last typematic key
 - Continue scanning
- **Set All Keys (Hex F7, F8, F9, FA)**
 - Respond with ACK
 - Clear output buffer
 - Set all key type (affects Scan Code Set 3 operation only)
 - F7: Typematic
 - F8: Make/Break
 - F9: Make
 - FA: Typematic/Make/Break
 - Return to previous scanning rate
- **Set Key Type (Hex FB, FC, FD)**
 - Respond with ACK
 - Clear output buffer
 - Receive key ID byte
 - Respond ACK
 - Set key ID type (affects Scan Code Set 3 operation only)



- **FB: Typematic**
FC: Make/Break
FD: Make
 - Return to previous scanning rate
- **Resend (Hex FE)**
 - Send the previous output again. If the previous byte is RESEND, the last byte before RESEND will be sent.
- **Reset (Hex FF)**
 - Respond with ACK
 - Check clock and data lines. Reset in the high state for at least 500µs or receive another command.
 - Default to Scan Code Set 2.

6.1.6 System Commands

The following are the keyboard output commands:

- **Acknowledge (Hex FA)**

The keyboard sends an acknowledge in response to any valid command from the system, except for RESEND and ECHO.

- **BAT Completion Code (Hex AA)**

This command is issued after a successful completion of the keyboard self test.

- **Echo (Hex EE)**

The keyboard sends this code in response to an ECHO command.

- **Keyboards ID (Hex 83AB)**

The 2-byte ID is issued to respond to READ ID command. The low byte is sent first, followed by the high byte.

- **Keyboard Buffer Overrun (Hex 00 or FF)**

If the keyboard buffer overflows, the overrun code will replace the last byte in the buffer. If the keyboard is using Scan Code Set 1, the code is Hex FF. For Sets 2 and 3, the code is Hex 00.

- **Resend (Hex FE)**

When the keyboard receives an invalid input or any input with incorrect parity, the RESEND command is sent.

6.1.7 Keyboard Scan Code Table

The keyboard contains three sets of scan code. The system defaults to Scan Code Set 2, but can be switched to Set 1 or Set 3. The following tables show the key numbers and the three scan code sets in hexadecimal values. All the keys are typematics except for the pause key. When a key is pressed down, the Make Scan Code is sent to the system. When the key is released, its Break Code is sent. If two or more keys are held down, only the last pressed key repeats at the typematic rate. Typematic operation stops when the last pressed key is released, even if the other keys are being released or some other keys are still held down.

The following table shows three sets of scan code used in the keyboard.

■ Scan Code Set 1

Key	Make Code	Break Code	Key	Make Code	Break Code
~(`)	29	A9	X	2D	AD
1	02	82	C	2E	AE
2	03	83	V	2F	AF
3	04	84	B	30	B0
4	05	85	N	31	B1
5	06	86	M	32	B2
6	07	87	,(<)	33	B3
7	08	88	.(>)	34	B4
8	09	89	/(&?)	35	B5
9	0A	8A	SHIFT_R	36	B6
0	0B	8B	CTRL_L	1D	9D
-(-)	0C	8C	ALT_L	38	B8
=(+)	0D	8D	SPACE	39	B9
Backspace	0E	8E	ALT_R	E0 38	E0 B8
TAB	0F	8F	CTRL_R	E0 1D	E0 9D
Q	10	90	NUM	45	C5
W	11	91	(7)	47	C7
E	12	92	(4)	4B	CB
R	13	93	(1)	4F	CF
T	14	94	(8)	48	C8
Y	15	95	(5)	4C	CC
U	16	96	(2)	50	D0
I	17	97	()	52	D2
O	18	98	(*)	37	B7
P	19	99	(9)	49	C9



(Continuation)

Key	Make Code	Break Code	Key	Make Code	Break Code
[{}	1A	9A	(6)	4D	CD
]}	1B	9B	(3)	51	D1
\()@1	2B	AB	(Del)	53	D3
CAPS	3A	BA	(-)	4A	CA
A	1E	9E	(+)	4E	CE
S	1F	9F	(Enter)	E0 1C	E0 9C
D	20	A0	ESC	01	81
F	21	A1	F1	3B	BB
G	22	A2	F2	3C	BC
H	23	A3	F3	3D	BD
J	24	A4	F4	3E	BE
K	25	A5	F5	3F	BF
L	26	A6	F6	40	C0
;(:	27	A7	F7	41	C1
'(")	28	A8	F8	42	C2
K42 @2	2B	AB	F9	43	C3
Enter	1C	9C	F10	44	C4
Shift_L	2A	AA	F11	57	D7
K45 @2	56	D6	F12	58	D8
Z	2C	AC	SCROLL	46	C6

Key	Base Case, or Shift + Num Lock Make/Break	Shift Case @3 Make/Break	Num Lock Make/Break
Ins	E0 52 / E0 D2	E0 AA E0 52 / E0 D2 E0 2A	E0 2A E0 52 / E0 D2 E0 AA
Del	E0 53 / E0 D3	E0 AA E0 53 / E0 D3 E0 2A	E0 2A E0 53 / E0 D3 E0 AA
Left	E0 4B / E0 CB	E0 AA E0 4B / E0 CB E0 2A	E0 2A E0 4B / E0 CB E0 AA
Home	E0 47 / E0 C7	E0 AA E0 47 / E0 C7 E0 2A	E0 2A E0 47 / E0 C7 E0 AA
End	E0 4F / E0 CF	E0 AA E0 4F / E0 CF E0 2A	E0 2A E0 4F / E0 CF E0 AA
Up	E0 48 / E0 C8	E0 AA E0 48 / E0 C8 E0 2A	E0 2A E0 48 / E0 C8 E0 AA
Down	E0 50 / E0 D0	E0 AA E0 50 / E0 D0 E0 2A	E0 2A E0 50 / E0 D0 E0 AA
Page Up	E0 49 / E0 C9	E0 AA E0 49 / E0 C9 E0 2A	E0 2A E0 49 / E0 C9 E0 AA
Page Down	E0 51 / E0 D1	E0 AA E0 51 / E0 D1 E0 2A	E0 2A E0 51 / E0 D1 E0 AA
Right	E0 4D / ED CD	E0 AA E0 4D / E0 CD E0 2A	E0 2A E0 4D / E0 CD E0 AA

Key	Scan Code Make/Break	Shift Case Make/Break @3
/()	E0 35 / E0 B5	E0 AA E0 35 / E0 B5 E0 2A

Key	Scan Code Make/Break	Ctrl Case, Shift Case Make/ Break	Alt Case Make/Break
PRINT	E0 2A E0 37 / E0 B7 E0 AA	E0 37 / E0 B7	54 / D4

Key	Make Code	Ctrl Key Pressed
PAUSE @4	E1 1D 45 E1 9D C5	E0 46 E0 C6

Key	Base Case Make Code	Num Lock Off Case Make Code
€ @5	E1 1D 45 E1 9D C5	E0 46 E0 C6

NOTE

@1 : 101-key keyboard only.

@2 : 102-key keyboard only.

@3 : If the left Shift key is held down, the AA/2A shift "make and break" is sent with the other scan codes. If the right Shift key is held down, B6/36 is sent. If both Shift keys are down, both sets of codes are sent with the other scan code.

@4 : This key is not typematic. All associated scan codes occur on the "make" of the key.

@5 : This Key is Make only. When the Num Lock is OFF, the encoder will send the code which is the same as de-pressing Alt+0+1+2+8. When the Num Lock is ON, the encoder will send the code which is the same as de-pressing Num+Alt+0+1+2+8+Num, and you will see the Num Lock LED flash once.

■ **Scan Code Set 2**

Key	Make Code	Break Code	Key	Make Code	Break Code
`(~)	OE	F0 OE	X	22	F0 22
1	16	F0 16	C	21	F0 21
2	1E	F0 1E	V	2A	F0 2A
3	26	F0 26	B	32	F0 32
4	25	F0 25	N	31	F0 31
5	2E	F0 2E	M	3A	F0 3A
6	36	F0 36	,(<)	41	F0 41
7	3D	F0 3D	,(>)	49	F0 49
8	3E	F0 3E	/(&?)	4A	F0 4A
9	46	F0 46	SHIFT_R	59	F0 59
0	45	F0 45	CTRL_L	14	F0 14
-(-)	4E	F0 4E	ALT_L	11	F0 11
=(+)	55	F0 55	SPACE	29	F0 29
Backspace	66	F0 66	ALT_R	E0 11	E0 F0 11
Tab	0D	F0 0D	CTRL_R	E0 14	E0 F0 14



(Continuation)

Key	Make Code	Break Code	Key	Make Code	Break Code
Q	15	F0 15	NUM	77	F0 77
W	1D	F0 1D	(7)	6C	F0 6C
E	24	F0 24	(4)	6B	F0 6B
R	2D	F0 2D	(1)	69	F0 69
T	2C	F0 2C	(8)	75	F0 75
Y	35	F0 35	(5)	73	F0 73
U	3C	F0 3C	(2)	72	F0 72
I	43	F0 43	~)	70	F0 70
O	44	F0 44	(*)	7C	F0 7C
P	4D	F0 4D	(9)	7D	F0 7D
[{}	54	F0 54	(6)	74	F0 74
]}	5B	F0 5B	(3)	7A	F0 7A
\()@6	5D	F0 5D	(Del)	71	F0 71
CAPS	58	F0 58	(-)	7B	F0 7B
A	1C	F0 1C	(+)	79	F0 79
S	1B	F0 1B	(Enter)	E0 5A	E0 F0 5A
D	23	F0 23	ESC	76	F0 76
F	2B	F0 2B	F1	05	F0 05
G	34	F0 34	F2	06	F0 06
H	33	F0 33	F3	04	F0 04
J	3B	F0 3B	F4	0C	F0 0C
K	42	F0 42	F5	03	F0 03
L	4B	F0 4B	F6	0B	F0 0B
;()	4C	F0 4C	F7	83	F0 83
'(")	52	F0 52	F8	0A	F0 0A
K42 @7	5D	F0 5D	F9	01	F0 01
Enter	5A	F0 5A	F10	09	F0 09
Shift_L	12	F0 12	F11	78	F0 78
K45 @7	61	F0 61	F12	07	F0 07
Z	1A	F0 1A	SCROLL	7E	F0 7E



Key	Base Case, or Shift + Num Lock Make/Break	Shift Case @ 8 Make/Break	Num Lock Make/Break
Ins	E0 70/E0 F0 70	E0 F0 12 E0 70/E0 F0 70 E0 12	E0 12 E0 70/E0 F0 70 E0 F0 12
Del	E0 71/E0 F0 71	E0 F0 12 E0 71/E0 F0 71 E0 12	E0 12 E0 71/E0 F0 71 E0 F0 12
Left	E0 6B/E0 F0 6B	E0 F0 12 E0 6B/E0 F0 6B E0 12	E0 12 E0 6B/E0 F0 6B E0 F0 12
Home	E0 6C/E0 F0 6C	E0 F0 12 E0 6C/E0 F0 6C E0 12	E0 12 E0 6C/E0 F0 6C E0 F0 12
End	E0 69/E0 F0 69	E0 F0 12 E0 69/E0 F0 69 E0 12	E0 12 E0 69/E0 F0 69 E0 F0 12
Up	E0 75/E0 F0 75	E0 F0 12 E0 75/E0 F0 75 E0 12	E0 12 E0 75/E0 F0 75 E0 F0 12
Down	E0 72/E0 F0 72	E0 F0 12 E0 72/E0 F0 72 E0 12	E0 12 E0 72/E0 F0 72 E0 F0 12
Page Up	E0 7D/E0 F0 7D	E0 F0 12 E0 7D/E0 F0 7D E0 12	E0 12 E0 7D/E0 F0 7D E0 F0 12
Page Down	E0 7A/E0 F0 7A	E0 F0 12 E0 7A/E0 F0 7A E0 12	E0 12 E0 7A/E0 F0 7A E0 F0 12
Right	E0 74/E0 F0 74	E0 F0 12 E0 74/E0 F0 74 E0 12	E0 12 E0 74/E0 F0 74 E0 F0 12

Key	Scan Code Make/Break	Shift Case Make/Break @ 3
(/)	E0 4A / E0 F0 4A	E0 F0 12 E0 4A/E0 F0 4A E0 12

Key	Scan Code Make/Break	Ctrl Case, Shift Case Make/ Break	Alt Case Make/Break
Print	E0 12 E0 7C / E0 F0 7C E0 F0 12	E0 7C /E0 F0 7C	84/ F0 84

Key	Make Code	Ctrl Key Pressed
Pause @9	E1 14 77 E1 F0 14 F0 77	E0 7E E0 F0 7E

Key	Base Case Make Code	Num Lock Off Case Make Code
€ @10	11 70 F0 70 69 F0 69 72 F0 72 75 F0 75 F0 11	77 F0 77 11 70 F0 70 69 F0 69 72 F0 72 75 F0 75 F0 11 77 F0 77

NOTE

@6 : 101-key keyboard only.

@7 : 102-key keyboard only.

@8 : If the left Shift key is held down, the F0 12/12 shift "make and break" is sent with the other scan codes. If the right Shift key is held down, F0 59/59 is sent. If both Shift keys are down, both sets of codes are sent with the other scan code.

@9 : This key is not typematic. All associated scan codes occur on the "make" of the key.

@10 : This Key is Make only. When the Num Lock is off, the encoder will send the code which is the same as de-pressing Alt+0+1+2+8. When the Num Lock is on, the encoder will send the code which is the same as de-pressing Num+Alt+0+1+2+8+Num, and you will see the Num Lock LED flash once.

■ Scan Code Set 3

Key	Make Code	Break Code	Default Key State
`(~)	0E	F0 0E	Typematic
1	16	F0 16	Typematic
2	1E	F0 1E	Typematic
3	26	F0 26	Typematic
4	25	F0 25	Typematic
5	2E	F0 2E	Typematic
6	36	F0 36	Typematic
7	3D	F0 3D	Typematic
8	3E	F0 3E	Typematic
9	46	F0 46	Typematic
0	45	F0 45	Typematic
-(_)	4E	F0 4E	Typematic
=(+)	55	F0 55	Typematic
Backspace	66	F0 66	Typematic
TAB	0D	F0 0D	Typematic
Q	15	F0 15	Typematic
W	1D	F0 1D	Typematic
E	24	F0 24	Typematic
R	2D	F0 2D	Typematic
T	2C	F0 2C	Typematic
Y	35	F0 35	Typematic
U	3C	F0 3C	Typematic
I	43	F0 43	Typematic
O	44	F0 44	Typematic
P	4D	F0 4D	Typematic
[({)	54	F0 54	Typematic
]})	5B	F0 5B	Typematic
\()@11	5C	F0 5C	Typematic
CAPS	14	F0 14	Make/Break
A	1C	F0 1C	Typematic
S	1B	F0 1B	Typematic
D	23	F0 23	Typematic
F	2B	F0 2B	Typematic
G	34	F0 34	Typematic
H	33	F0 33	Typematic
J	3B	F0 3B	Typematic
K	42	F0 42	Typematic



(Continuation)

Key	Make Code	Break Code	Default Key State
L	4B	F0 4B	Typematic
;(:)	4C	F0 4C	Typematic
'(")	52	F0 52	Typematic
K42 @12	53	F0 53	Typematic
Enter	5A	F0 5A	Typematic
Shift_L	12	F0 12	Make/Break
K45 @12	13	F0 13	Typematic
Z	1A	F0 1A	Typematic
X	22	F0 22	Typematic
C	21	F0 21	Typematic
V	2A	F0 2A	Typematic
B	32	F0 32	Typematic
N	31	F0 31	Typematic
M	3A	F0 3A	Typematic
,(<)	41	F0 41	Typematic
.(>)	49	F0 49	Typematic
/(&?)	4A	F0 4A	Typematic
Shift_R	59	F0 59	Make/Break
Ctrl_L	11	F0 11	Make/Break
Alt_L	19	F0 19	Make/Break
Space	29	F0 29	Typematic
Alt_R	39	F0 39	Make only
Ctrl_R	58	F0 58	Make only
Ins	67	F0 67	Make only
Del	64	F0 64	Typematic
Left	61	F0 61	Typematic
Home	6E	F0 6E	Make only
End	65	F0 65	Make only
Up	63	F0 63	Typematic
Down	60	F0 60	Typematic
Page Up	6F	F0 6F	Make only
Page Down	6D	F0 6D	Make only
Right	6A	F0 6A	Typematic
Num	76	F0 76	Make only
(7)	6C	F0 6C	Make only
(4)	6B	F0 6B	Make only
(1)	69	F0 69	Make only

(Continuation)

Key	Make Code	Break Code	Default Key State
(/)	77	F0 77	Make only
(8)	75	F0 75	Make only
(5)	73	F0 73	Make only
(2)	72	F0 72	Make only
~()	70	F0 70	Make only
(*)	7E	F0 7E	Make only
(9)	7D	F0 7D	Make only
(6)	74	F0 74	Make only
(3)	7A	F0 7A	Make only
(Del)	71	F0 71	Make only
(-)	84	F0 84	Make only
(+)	7C	F0 7C	Typematic
(Enter)	79	F0 79	Make only
ESC	08	F0 08	Make only
F1	07	F0 07	Make only
F2	0F	F0 0F	Make only
F3	17	F0 17	Make only
F4	1F	F0 1F	Make only
F5	27	F0 27	Make only
F6	2F	F0 2F	Make only
F7	37	F0 37	Make only
F8	3F	F0 3F	Make only
F9	47	F0 47	Make only
F10	4F	F0 4F	Make only
F11	56	F0 56	Make only
F12	5E	F0 5E	Make only
Print	57	F0 57	Make only
Scroll	5F	F0 5F	Make only
Pause	62	F0 62	Make only
€	×	×	×

NOTE

@11 : 101-key keyboard only.

@12 : 102-key keyboard only.



■ **New Key Codes for Scan Set 1**

New Key	Make	Break
LWIN	E0 5B	E0 DB
RWIN	E0 5C	E0 DC
APP	E0 5D	E0 DD
N-CHG (131)	7B	FB
CHG (132)	79	F9
ROMA (133)	70	F0
K14	7D	FD
K56	73	F3
K107	7E	FE
KL	F1	×
KR	F0	×
Power	E0 5E	E0 DE
Sleep	E0 5F	E0 DF
Wake up	E0 63	E0 E3

■ **New Key Codes for Scan Set 2**

New Key	Make	Break
LWIN	E0 1F	E0 F0 1F
RWIN	E0 27	E0 F0 27
APP	E0 2F	E0 F0 2F
N-CHG (131)	67	F0 67
CHG (132)	64	F0 64
ROMA (133)	13	F0 13
K14	6A	F0 6A
K56	51	F0 51
K107	6D	F0 6D
KL	F1	×
KR	F2	×
Power	E0 37	E0 F0 37
Sleep	E0 3F	E0 F0 3F
Wake up	E0 5E	E0 F0 5E

■ **New Key Codes for Scan Set 3**

New Key	Make	Break	Default Key State
LWIN	8B	F0 8B	Make/break
RWIN	8C	F0 8C	Make/break
APP	8D	F0 8D	Make/break
N-CHG (131)	85	F0 85	Make
CHG (132)	86	F0 86	Make
ROMA (133)	87	F0 87	Make
K14	5D	F0 5D	Typematic
K56	51	F0 51	Typematic
K107	7B	F0 7B	Typematic
KL	F1	×	–
KR	F2	×	–
Power	×	×	–
Sleep	×	×	–
Wake up	×	×	–

■ **Windows 2000 Multi-Media Key Codes**

Key	SET 1		SET 2	
	Make	Break	Make	Break
K130 : WWW Back	E06A	E0EA	E038	E0F038
K131 : WWWForward	E069	E0E9	E030	E0F030
K132 : WWWstop	E068	E0E8	E028	E0F028
K133 : WWWRefresh	E067	E0E7	E020	E0F020
K134 : WWWSearch	E065	E0E5	E010	E0F010
K135 : WWWFavorites	E066	E0E6	E018	E0F018
K136 : WWWWeb/Home	E032	E0B2	E03A	E0F03A
K137 : Mail	E06C	E0EC	E048	E0F048
K138 : Mute	E020	E0A0	E023	E0F023
K139 : Volume-	E02E	E0AE	E021	E0F021
K140 : Volume+	E030	E0B0	E032	E0F032
K141 : Play/Pause	E022	E0A2	E034	E0F034
K142 : Stop	E024	E0A4	E03B	E0F03B
K143 : PreTrack	E010	E090	E015	E0F015
K144 : Nexttrack	E019	E099	E04D	E0F04D
K145 : Media Select	E06D	E0ED	E050	E0F050
K146 : My Computer	E06B	E0EB	E040	E0F040
K147 : Calculator	E021	E0A1	E02B	E0F02B

6.2 USB Keyboard Function Description

The following describes the USB keyboard function and data transfer.

6.2.1 USB Keyboard Description

- **Device Descriptor:**
 - Descriptor size: 0x12
 - Descriptor type: 0x01
 - USB Specification release number: 0X0110
 - Device class: 0x00
 - Device subclass: 0x00
 - Device Protocol: 0x00
 - Max package for Endpoint 0 0x08
 - Vendor ID: 0x04F3
 - Product ID: 0x0103
 - Device Release number: 0x0107
 - Index of string descriptor describing manufacturer: 0x00
 - Index of string descriptor describing product: 0x00
 - Index of string descriptor describing the device's serial number: 0X00
 - Number of possible configurations: 0x01
- **Configuration Descriptor:**
 - Descriptor size: 0x09
 - Descriptor type: 0x02
 - Total length of data return for this configuration: 0x003B
 - Number of interfaces: 0x02
 - Value used to address this configuration: 0x01
 - Index of string descriptor describing this configuration: 0x00
 - Configuration characteristic: 0xA0
 - Maximum power consumption: 0x32
- **Interface Descriptor (Interface 0)**
 - Descriptor size: 0x09
 - Descriptor type: 0x04
 - Number of this interface: 0x00
 - Alternate setting: 0x00
 - Number of endpoints used by this interface: 0X01
 - Class code: 0x03
 - Subclass code: 0x01
 - Protocol code: 0x01
 - Index of string descriptor describing this interface: 0x00

- **HID (Human Interface Device) Descriptor**
 - Descriptor size: 0x09
 - Descriptor type: 0x21
 - HID Specification release number: 0x0110
 - Country code: 0x00
 - Number of class descriptors: 0x01
 - Type of class descriptor: 0x22
 - Length of report descriptor: 0x0036

- **Endpoint Descriptor**
 - Descriptor size: 0x07
 - Descriptor type: 0x05
 - Endpoint's status: 0x81
 - Endpoint's attributes: 0x03
 - Maximum package size of this endpoint: 0x08
 - Interval for polling endpoint for data transfers: 0x000A

- **Report Descriptor (Endpoint 1)**
 - Using page (generic desktop): 0x05 0x01
 - Using (keyboard): 0x09 0x06
 - Collection (application): 0xa1 0x01
 - Using page (Page# for LEDs): 0x05 0x08
 - Using minimum (1): 0x19 0x01
 - Using maximum (3): 0x29 0x03
 - Logical minimum (0): 0x15 0x00
 - Logical maximum (1): 0x25 0x01
 - Report size (1): 0x75 0x01
 - Report count (3): 0x95 0x03
 - Output (data, variable, absolute): 0x91 0x02
 - Report count (5): 0x95 0x05
 - Output (constant): 0x91 0x01
 - Using page (key codes): 0x05 0x07
 - Using minimum (224): 0x19 0xe0
 - Using maximum (231): 0x29 0xe7
 - Report count (8): 0x95 0x08
 - Input (data, variable, absolute): 0x81 0x02
 - Report size (8): 0x75 0x08
 - Report count (1): 0x95 0x01
 - Input (constant): 0x81 0x01
 - Using minimum (0): 0x19 0x00
 - Using maximum (91): 0x29 0x91

- Logical maximum (ff): 0x26 0xff 0x00
- Report count (6): 0x95 0x06
- Input (data, array): 0x81 0x00
- End collection: 0xc0
- **Interface Descriptor (Interface 1)**
 - Descriptor size: 0x09
 - Descriptor type: 0x04
 - Number of this interface: 0x01
 - Alternate setting: 0x00
 - Number of endpoints used by this interface: 0x01
 - Class code: 0x03
 - Subclass code: 0x00
 - Protocol code: 0x00
 - Index of string descriptor describing this interface: 0x00
- **HID (Human Interface Device) Descriptor**
 - Descriptor size: 0x09
 - Descriptor type: 0x21
 - HID Specification release number: 0x0110
 - Country code: 0x00
 - Number of class descriptors: 0x01
 - Type of class descriptor: 0x22
 - Length of report descriptor: 0x0034
- **Endpoint Descriptor**
 - Descriptor size: 0x07
 - Descriptor type: 0x05
 - Endpoint's status: 0x82
 - Endpoint's attributes: 0x03
 - Maximum package size of this endpoint: 0x03
 - Interval for polling endpoint for data transfer: 0x000A
- **Report Descriptor (Endpoint 2)**
 - Using page (consumer): 0x05 0x0c
 - Using (consumer): 0x09 0x01
 - Collection (application): 0xa1 0x01
 - Report id (01): 0x85 0x01
 - Using minimum (00): 0x19 0x00
 - Using maximum (023c): 0x2a 0x3c 0x02
 - Logical minimum (0): 0x15 0x00
 - Logical maximum (023c): 0x26 0x3c 0x02



- Report count (1): 0x95 0x01
- Report size (10): 0x75 0x10
- Input (data, array, absolute): 0x81 0x00
- End collection: 0xc0
- Using page (generic desktop): 0x05 0x01
- Using (system control): 0x09 0x80
- Collection (application): 0xa1 0x01
- Report id (2): 0x85 0x02
- Using minimum (81): 0x19 0x81
- Using maximum (83): 0x29 0x83
- Logical minimum (0): 0x15 0x00
- Logic maximum (1): 0x25 0x01
- Report size (1): 0x75 0x01
- Report count (3): 0x95 0x03
- Input (data, variable, absolute): 0x81 0x02
- Report count (5): 0x95 0x05
- Input (constant): 0x81 0x01
- End collection: 0xc0

6.2.2 LED Report for USB Keyboard

When one of the LED buttons (Num, Caps, Scroll) is pressed, the host issues a Setup package (with a Set_Report request to Endpoint 0) and an Out package with 1 byte data, which indicates the LED status. The format of the 1-byte data is –

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Constant	Constant	Constant	Constant	Constant	Scroll Lock	Caps Lock	Num Lock

6.2.3 USB Keyboard Scan Code

When the keys of HID Usage Page 07 are pressed, the scan codes are sent using Endpoint 1. If the keys of HID Usage Page 01 and 0C are pressed, the scan codes are sent using Endpoint 2.

When the host issues an IN packet to Endpoint 1 to receive data from the device and the keys of HID Usage Page 07 are pressed, the device returns an 8 bytes to the host. The 8 bytes are as follows:

Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
Key 6	Key 5	Key 4	Key 3	Key 2	Key 1	Reserved	Modifier

The modifier bytes are as follows:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Right GUI	Right Alt	Right Shift	Right Ctrl	Left GUI	Left Alt	Left Shift	Left Ctrl

When the host issues an IN packet to Endpoint 2 to receive data from the device and the keys of HID Usage Page 0C (or 01) are pressed, the device returns a 3 (or 2) bytes to the host. The 3 (or 2) bytes are as follows:

■ **HID Usage Page 0C:**

Byte 2	Byte 1	Byte 0
Using ID 2nd Byte	Using ID 1st Byte	Report ID 0x01

■ **HID Usage Page 01:**

Byte 1	Byte 0
Using ID	Report ID 0x02

■ **HID Usage ID:**

Key	HID Usage Page	HID Usage ID	Key	HID Usage Page	HID Usage ID
`(~)	07	35	×	07	1B
1	07	1E	C	07	06
2	07	1F	V	07	19
3	07	20	B	07	05
4	07	21	N	07	11
5	07	22	M	07	10
6	07	23	,(<)	07	36
7	07	24	.(>)	07	37
8	07	25	/(?)	07	38
9	07	26	Shift_R	07	E5
0	07	27	Ctrl_L	07	E0
-(-)	07	2D	Alt_L	07	E2
=(+)	07	2E	Space	07	2C
Backspace	07	2A	Alt_R	07	E6
Tab	07	2B	Ctrl_R	07	E4
Q	07	14	Num	07	53
W	07	1A	(7)	07	5F
E	07	08	(4)	07	5C
R	07	15	(1)	07	59
T	07	17	(8)	07	60
Y	07	1C	(5)	07	5D
U	07	18	(2)	07	5A
I	07	0C	(0)	07	62
O	07	12	(*)	07	55
P	07	13	(9)	07	61
[({)	07	2F	(6)	07	5E
]})	07	30	(3)	07	5B
\()@1	07	31	(DEL)	07	63

(Continuation)

Key	HID Usage Page	HID Usage ID	Key	HID Usage Page	HID Usage ID
CAPS	07	39	(-)	07	56
A	07	04	(+)	07	57
S	07	16	(Enter)	07	58
D	07	07	ESC	07	29
F	07	09	F1	07	3A
G	07	0A	F2	07	3B
H	07	0B	F3	07	3C
J	07	0D	F4	07	3D
K	07	0E	F5	07	3E
L	07	0F	F6	07	3F
;(,)	07	33	F7	07	40
'(")	07	34	F8	07	41
K42	07	32	F9	07	42
Enter	07	28	F10	07	43
Shift_L	07	E1	F11	07	44
K45	07	64	F12	07	45
Z	07	1D	Scroll	07	47
Ins	07	49	(/)	07	54
Del	07	4C	Print	07	46
Left	07	50	Pause	07	48
Home	07	4A	Break (Pause+Ctrl)	07	48
End	07	4D			
Up	07	52	www Back	0C	0224
Down	07	51	www Forward	0C	0225
Page Up	07	4B	www Stop	0C	0226
Page Down	07	4E	www Refresh	0C	0227
Right	07	4F	www Search	0C	0221
WIN_L	07	E3	www Favorite	0C	022A
WIN_R	07	E7	www Home	0C	0223
APP	07	65	Mail	0C	018A
N-CHG (131)	07	8B	Mute	0C	00E2
CHG (132)	07	8A	Volume +	0C	00E9
ROMA (133)	07	88	Volume -	0C	00EA
K14	07	89	Play/Pause	0C	00CD
K56	07	87	Stop	0C	00B7
K107	07	85	PreTrack	0C	00B6
KL	07	91	Nexttrack	0C	00B5
KR	07	90	Media Select	0C	0183
Power	01	81	My Computer	0C	0194
Sleep	01	82	Calculator	0C	0192
Wake up	01	83	-	-	-

6.3 Internal-Multi Function

Pin 92 and Pin 93 are the Internal-Multi Function select pins (see Figure 11.1a in Section 11). You can enable either the Internal-Multi Function 1 or Internal-Multi Function 2 by connecting JP1 or JP2 to ground.

NOTE
Do not connect JP1 and JP2 to ground at the same time.

■ **Internal-Multi Function 1:**

Key	Multi-Media Function	Internet Function	O.S. Function
Fn+ (M/Mode)	Pad_2 Volume-	Pad_Enter Web/Home	Pad_0 My Computer
	Pad_3 Play/Pause	Pad_+ Mail	Pad_1 Calculator
	Pad_4 PreTrack	Pad_- Favorites	- -
	Pad_5 Media	Pad_. Search	- -
	Pad_6 NextTrack	Right Forward	E Eur Key
	Pad_7 Mute	Left Back	- -
	Pad_8 Volume+	Down Stop	- -
	Pad_9 Stop	Up Refresh	- -

■ **Internal-Multi Function 2:**

Key	Multi-Media Function	Internet Function	O.S. Function
Fn+ (M/Mode)	Pad_Enter Volume-	F1 Web/Home	F10 My Computer
	Down Play/Pause	F8 Mail	F11 Calculator
	Left PreTrack	F2 Favorites	- -
	F9 Media	F3 Search	- -
	Right NextTrack	F6 Forward	E Eur Key
	F12 Mute	F7 Back	- -
	Pad_+ Volume+	F5 Stop	- -
	Up Stop	F4 Refresh	- -

7 Absolute Maximum Ratings

Parameter	Sym.	Ratings		
Supply Voltage	VCC	-0.5V	to	+6V
Input Voltage	VIN	-0.3V	to	+6V
Output Voltage	VOOUT	-0.3V	to	+6V
Temperature under bias	TB	0	to	70°C
Storage Temperature	TS	-60°C	to	150°C

8 DC Electrical Characteristics

Parameter	Sym.	Condition	Min.	Typ.	Max.	Unit
Operating voltage	VCC	–	4.0	5	5.5	V
Operating supply current	ICCI	Freq. = 6 MHz	–	–	10	mA
Input leakage	IIN	V IN =V CC, V SS	–	–	1	μA
Input high voltage	VIH	–	2.0	–	–	V
Input low voltage	VIL	–	–	–	0.8	V
Output low voltage	VOL1	I OL1 = 10 mA	–	0.4	–	V
Output low voltage for LEDs	VOL2	IOL2 = 10 mA	–	3.0	–	V
Output low voltage for Mode LED	VOL3	IOL3 = 10 mA	–	1	–	V
Internal Pull-high resistance (Ports 6, 9)	RPH1	VPH1 = 0V	–	25	–	KΩ
Internal Pull-high resistance for Data, CLK	RPH2	VPH2 = 0V	–	2.2	–	KΩ
Internal Pull-high resistance for D-	RPH3	VPH3 = 0V	–	1.4	–	KΩ
Output low voltage for Data CLK	VOL3	IOL3 = 5 mA	–	0.4	–	V

9 AC Electrical Characteristics

Parameter	Sym.	Min.	Typ.	Max.	Unit
Time from Data transition to falling edge of CLK	T1	5	–	25	μs
Time from rising edge of CLK to Data transition	T2	5	–	T4 - 5	μs
Duration of CLK inactive	T3	30	40	50	μs
Duration of CLK active	T4	30	40	50	μs
Time for auxiliary device inhibit after Clock 11 to ensure the auxiliary device does not start another transmission	T5	–	–	50	μs
Time from inactive to active CLK transition, used to time when auxiliary device samples Data	T6	5	–	25	μs
System clock	FCLK	–	6	–	MHz

10 PS/2 Timing Diagram

10.1 Output Data Timing

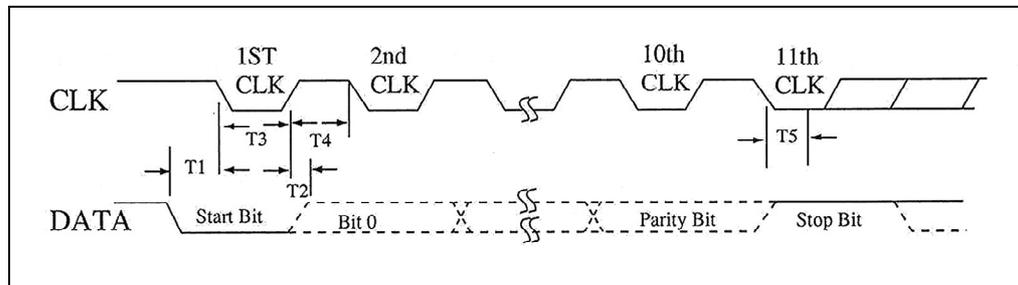


Figure 10-1a PS/2 Keyboard Output Data Timing Diagram

10.2 Input Data Timing

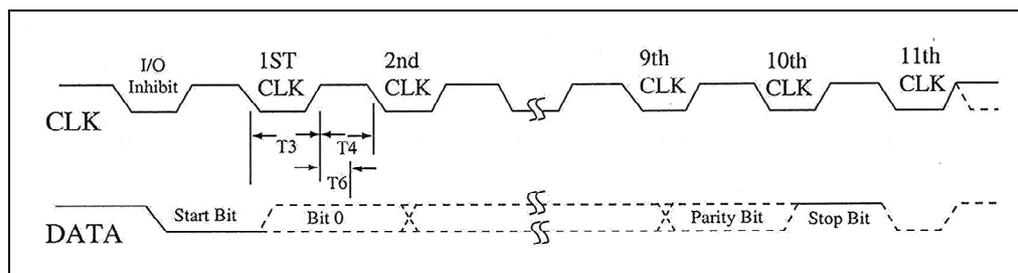


Figure 10-1b PS/2 Keyboard input Data Timing Diagram

11 Application Circuits

11.1 eKK8011S QFP (or Chip Form) Application Circuit

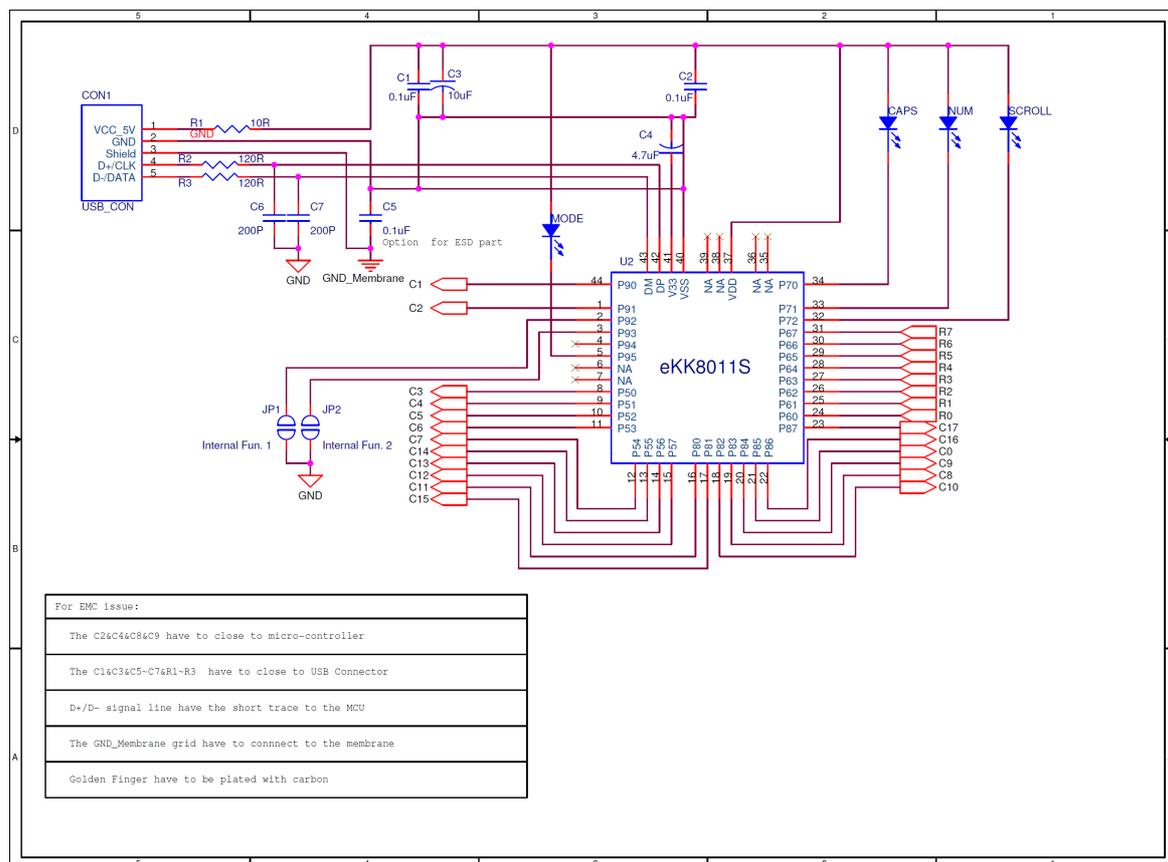


Figure 11-1 eKK8011S QFP (or Chip Form) Application Circuit Diagram

12 Application Matrix

	R0, P60, 24	R1, P61, 25	R2, P62, 26	R3, P63, 27	R4, P 64, 28	R5, P65, 29	R6, P66, 30	R7, P67, 31
C0 P85, 21	Pause	Power	€	Sleep	Ctrl-R	Wake-up	Ctrl-L	F5
C1 P90, 44	Q	Tab	A	ESC	Z	N-CHG	` (~)	1 (!)
C2 P91, 1	W	CAP	S	K45	X	CHG	F1	2 (@)
C3 P50, 8	E	F3	D	F4	C	ROMA	F2	3 (#)
C4 P51, 9	R	T	F	G	V	B	5 (%)	4 (\$)
C5 P52, 10	U	Y	J	H	M	N	6 (^)	7 (&)
C6 P53, 11	I] (})	K	F6	, (<)	K56	= (+)	8 (*)
C7 P54, 12	O	F7	L	¥	. (>)	APP	F8	9 ('')
C8 P83, 19	P	[({)	; (:)	' (")	K42	/ (?)	_ (-)	0 ('')
C9 P84, 20	SCROLL		Fn	ALT-L	M/Mode	ALT-R		PRINT
C10 P82, 18	K14	BACK	\ ()	F11	Enter	F12	F9	F10
C11 P80, 16	7 (K)	4 (K)	1 (K)	Space	Num	↓	DEL	Power
C12 P57, 15	8 (K)	5 (K)	2 (K)	0 (K)	/ (K)	→	INS	Sleep
C13 P56, 14	9 (K)	6 (K)	3 (K)	. (K)	* (K)	- (K)	Page Up	Page Down
C14 P55, 13	+ (K)	K107	Enter (K)	↑	Play/Pause	←	Home	End
C15 P81, 17	Wake Up	Shift-L	SHIFT-R	Volume-	Volume+	NextTrack	PrevTrack	Media
C16 P86, 22	Mail	WIN-L	WWW Forward	WWWStop	WWWBack	WWW Refresh	Mute	WWW Search
C17 P87, 23	K150 (KC-L)	WWW Favorites	WIN-R	My Computer	Stop	Calculator	Web/Home	K151 (KC-R)

13 Pad Diagram

13.1 eKK8011S 44-Pin Pad Diagram

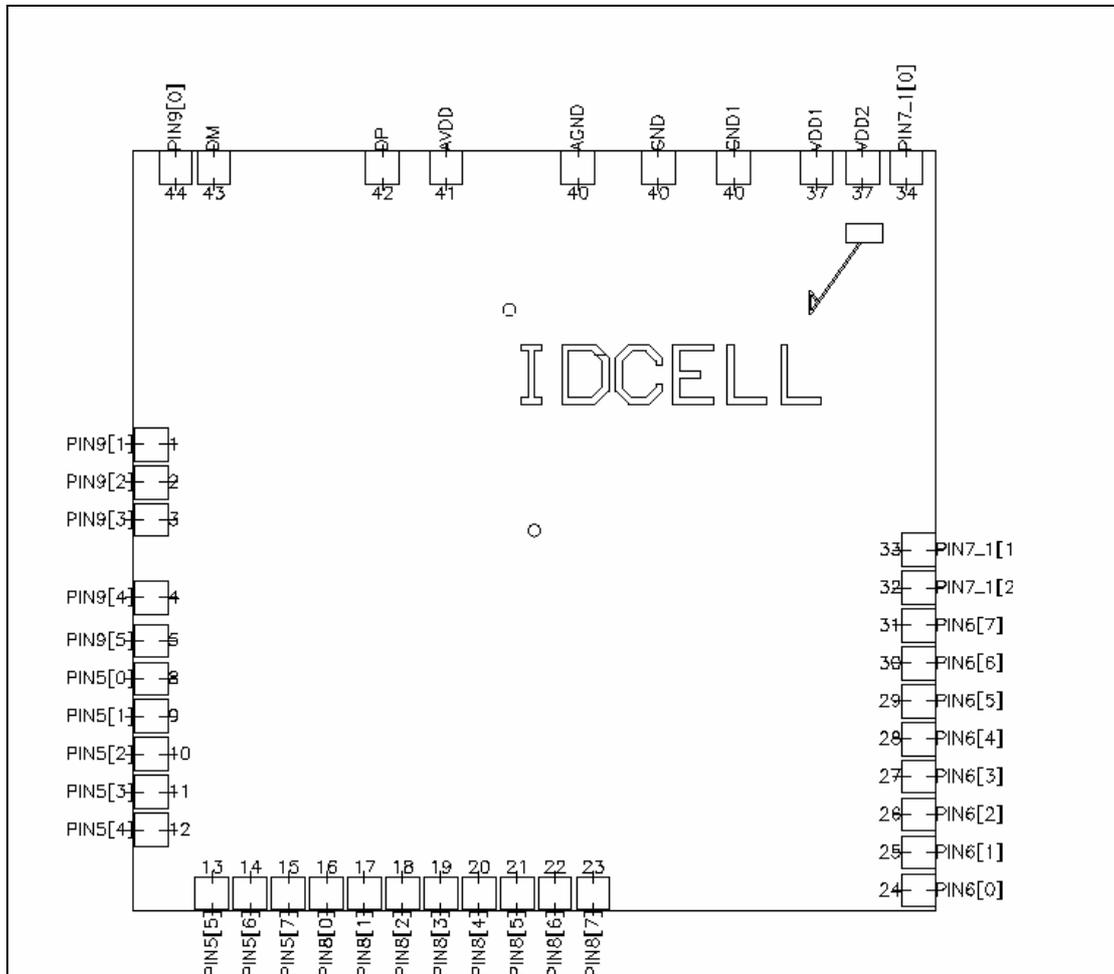


Figure 13-1 eKK8011S 44-pin Pad Diagram

13.2 44-pin Pad Name and Pad Coordinates Table

■ Pads Bonded Together (VDD2 VDD1) (GND1 GND AGND)

Pin No	Pad Name	Coordinate_X	Coordinate_Y
1	PIN9[1]	-860.129	194.85
2	PIN9[2]	-860.129	109.35
3	PIN9[3]	-860.129	23.85
4	PIN9[4]	-860.129	-151.38
5	PIN9[5]	-860.129	-249.03
6	-	-	-
7	-	-	-
8	PIN5[0]	-860.129	-334.53
9	PIN5[1]	-860.129	-420.03
10	PIN5[2]	-860.129	-505.53
11	PIN5[3]	-860.129	-591.03
12	PIN5[4]	-860.129	-676.53
13	PIN5[5]	-723.779	-819.63
14	PIN5[6]	-638.279	-819.63
15	PIN5[7]	-552.779	-819.63
16	PIN8[0]	-467.279	-819.63
17	PIN8[1]	-381.779	-819.63
18	PIN8[2]	-296.279	-819.63
19	PIN8[3]	-210.779	-819.63
20	PIN8[4]	-125.279	-819.63
21	PIN8[5]	-39.779	-819.63
22	PIN8[6]	45.721	-819.63
23	PIN8[7]	131.221	-819.63
24	PIN6[0]	860.131	-813.015
25	PIN6[1]	860.131	-727.515
26	PIN6[2]	860.131	-642.015
27	PIN6[3]	860.131	-556.515
28	PIN6[4]	860.131	-471.015
29	PIN6[5]	860.131	-385.515
30	PIN6[6]	860.131	-300.015
31	PIN6[7]	860.131	-214.515

(Continuation)

Pin No	Pad Name	Coordinate_X	Coordinate_Y
32	PIN7_1[2]	860.13	-129.015
33	PIN7_1[1]	860.13	-43.515
34	PIN7_1[0]	832.861	819.63
35	-	-	-
36	-	-	-
37	VDD2	734.94	819.63
37	VDD1	631.53	819.63
38	PIN7_2	536.355	819.63
39	-	-	-
40	GND1	446.22	819.63
40	GND	276.705	819.63
40	AGND	96.435	819.63
41	AVDD	-198.675	819.63
42	DP	-341.37	819.63
43	DM	-719.955	819.63
44	PIN9[0]	-805.455	819.63