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凌越科技
**Topro Technology Inc.**

# TP8511HB-N01

## PS/2 Keyboard controller

# DataSheet

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http://www.topro.com.tw

# TP8511HB-N01

## PS/2 Keyboard controller

## General Specification

### 1. General Description

The TP8511KB is an 8-bits micro-controller that can operate in wide range of power supply. The TP8511KB contains four 8-bit bi-directional parallel ports, two 16-bit timer/counters, and three direct LED drivers. These peripherals are supported by a two-source, two-level interrupt capability. The internal memory includes 128 bytes of RAM for data memory and 4K bytes of ROM for program memory.

### 2. Feature

- 8-bit CMOS micro-controller
- Fully static design
- Wide supply voltage range: from 4.5V to 5.5V
- Wide operating frequency range: from DC to 6 MHz
- 128 bytes of on-chip RAM
- 4K bytes of on-chip ROM
- Build in clock source(need a resistor only)
- Four 8-bit bi-directional ports
- Two 16-bit timer
- Boolean processor
- Two-source, two-level interrupt capability
    - Three direct LED drive outputs
    - Power down mode with port wake up function
    - 40 pin DIP plastic package

### 3. Applications

- IBM PC AT or compatible machine keyboard.
- IBM PS/2 model 30,50,60,80 or compatible machine keyboard.
- Japanese keyboard.
- Korean keyboard.

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## Pin Configurations and Package Type

| | | TP8511KB | | |
|---|---|---|---|---|
| VSS | 1 | | 40 | OSCO |
| P3.5 | 2 | | 39 | RC/OSCI |
| DATA/P3.7 | 3 | | 38 | VCC |
| CLOCK/P3.6 | 4 | | 37 | CAPS/LED2 |
| P3.0 | 5 | | 36 | NUM/LED1 |
| P3.1 | 6 | | 35 | SCROL/LED0 |
| P3.2 | 7 | | 34 | P2.7 |
| P3.3 | 8 | | 33 | P2.6 |
| P3.4 | 9 | | 32 | P2.5 |
| RST | 10 | | 31 | P2.4 |
| P0.0 | 11 | | 30 | P2.3 |
| P0.1 | 12 | | 29 | P2.2 |
| P0.2 | 13 | | 28 | P2.1 |
| P0.3 | 14 | | 27 | P2.0 |
| P0.4 | 15 | | 26 | P1.7 |
| P0.5 | 16 | | 25 | P1.6 |
| P0.6 | 17 | | 24 | P1.5 |
| P0.7 | 18 | | 23 | P1.4 |
| P1.0 | 19 | | 22 | P1.3 |
| P1.1 | 20 | | 21 | P1.2 |

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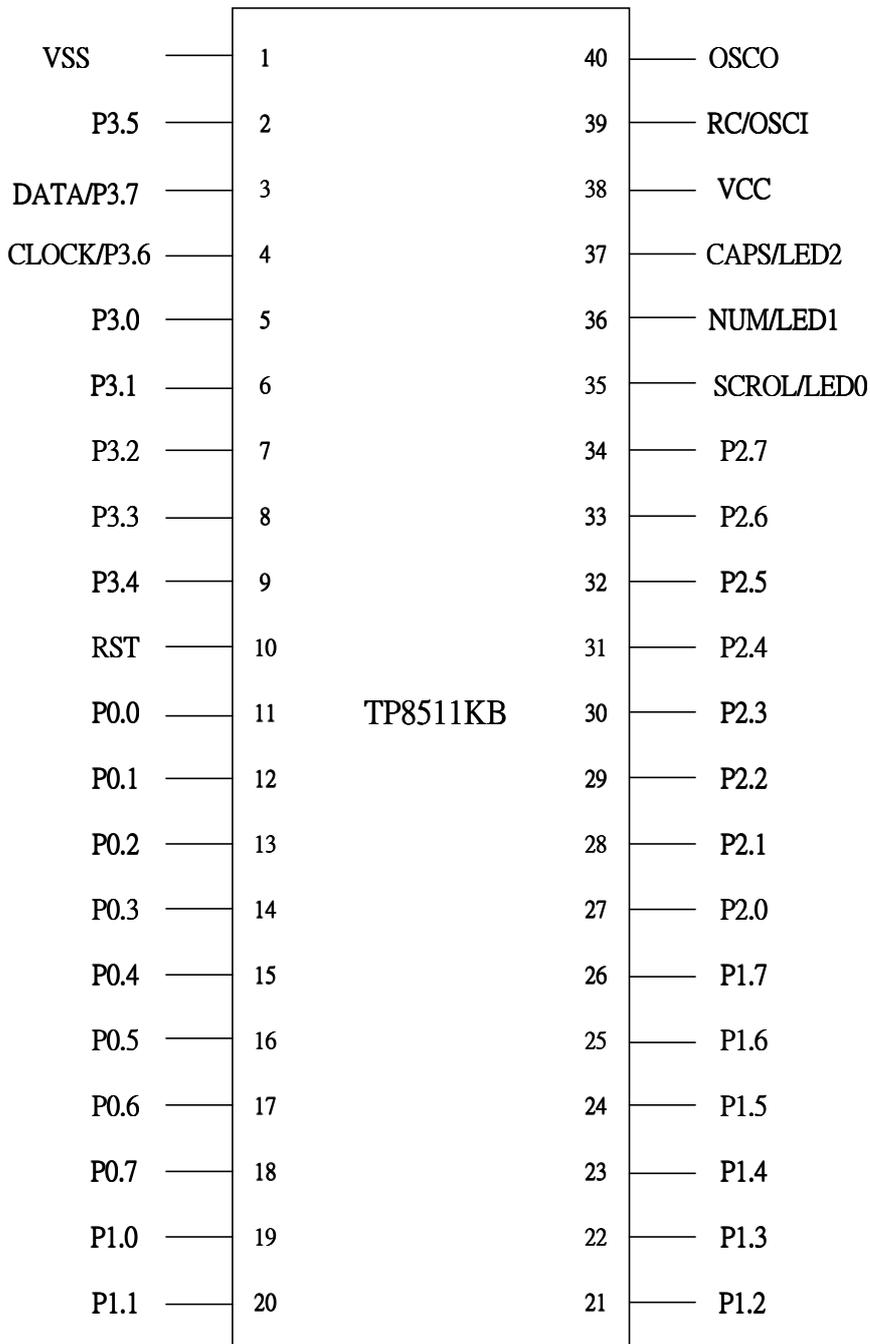
*PS/2 Keyboard controller*

## Pin Descriptions

| SYMBOL | MODE | FUNCTION DESCRIPTION |
|---|---|---|
| $V_{SS}$ | I | Circuit GND Potential. |
| $V_{CC}$ | I | Main Power Supply(+4.5V~+5.5V) |
| RST_ | I | A low level input resets the CPU. A small internal pullup resistor permits power-on reset using only a capacitor connected to GND. |
| PORT0 $(P_{0.0}-P_{0.7})$ | I/O | Port0 is an 8-bit bi-directional I/O port with internal pull-ups. Port 0 can sink/source 8 LS TTL loads. |
| PORT1 $(P_{1.0}-P_{1.7})$ | I/O | Port1 is an 8-bit quasi-bidirection I/O port with internal pull-ups. Port1 can sink/source 4 LS TTL loads. |
| PORT2 $(P_{2.0}-P_{2.7})$ | I/O | Port2 is an 8-bit quasi-bidirection I/O port with internal pull-ups. Port2 can sink/source 4 LS TTL loads. |
| PORT3 (P3.0-P3.7) | I/O | Port3 is an 8-bit quasi-bidirection I/O with internal pull-ups. *P3.6-P3.7: Connecting with a 2.2K ohm pull-up to VCC* |
| LED0 | O | Direct LED drive output |
| LED1 | O | Direct LED drive output |
| LED2 | O | Direct LED drive output |
| XTAL1 | I | Input to inverting oscillator amplifier or tie a resistor to VCC to control the frequency of internal clock source. |
| XTAL2 | O | Provide a VDD reference voltage for built in clock source. |

Note: "I" means INPUT function; "O" means OUTPUT function.

# Functional Block Diagram
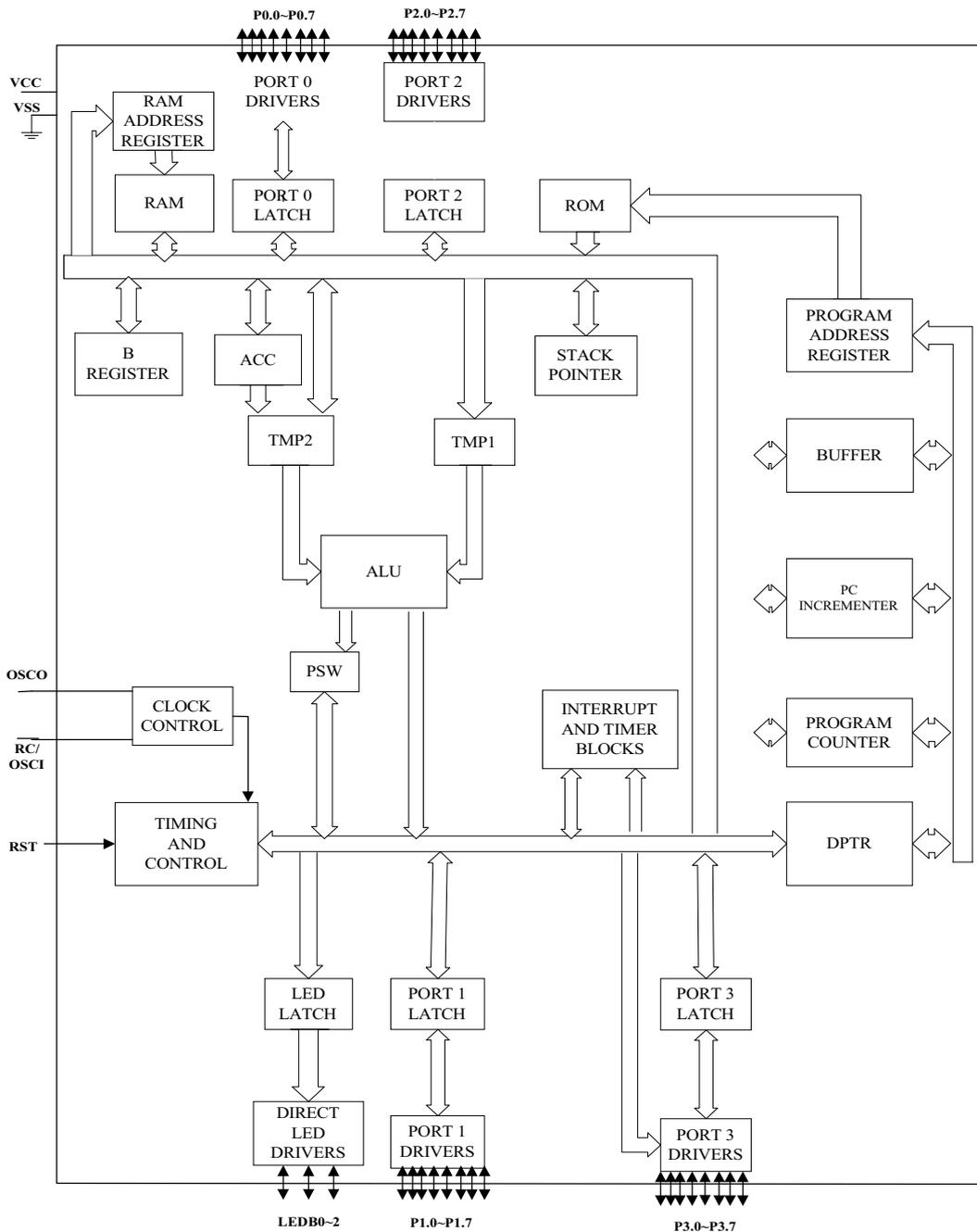
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## PS/2 Keyboard controller

# Function Descriptions

The TP8511KB architecture consists of a core controller and some special function registers. The special function registers contain two 16-bits timers/counters, four general purpose I/O ports, and two-sources, two-levels interrupt processor, and three direct LED drive output ports.

### I/O ports

There are four general purpose I/O ports in the TP8511KB, and each port has 1 8-bits register to store its output value. These registers call P0, P1, P2, and P3, respectively. The addresses of the registers and the usage of the ports are the same as the industry standard 80C51 microcontroller.

### PS2 keyboard function descriptions

**16 bytes Keyboard buffer**

The keyboard will buffer 16 bytes in a FIFO order when the system is able to receive scan codes from the keyboard. The response codes will not be buffered. If keystrokes generate a multiple-byte sequence, the entire sequence must fit into the buffer or the keystroke is discarded and a buffer-overrun. The overrun code is '00' hex for set2 or set3, 'FF' hex for set1.

**Power-on Reset and self test**

The duration of the keyboard Power-on-Reset(POR) should be timed to occur a minimum of 150ms and 2s from the time power is applied to the keyboard. After executing POR , the keyboard executes a self test. The LEDs are turned on at the beginning and off at the end of the self test. The self test takes a minimum 300 ms and a maximum 500 ms. If the self test is successful, a completion code 'AA' hex is sent to the system and the keyboard starts scanning. If the self test fails, an error code 'FC' hex is sent. Then the keyboard is disabled and waits for a command from the system.

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**Command from the system**

The system may send commands to the keyboard at any time. The keyboard will respond within 20 ms except when performing the BAT following POR or a 'Reset' command. The following are the keyboard input commands and the actions that keyboard needs to take.

Set /Reset Status indicators ( Hex ED )

- Responds ACK(Hex FA).

- Receives option byte.

- Responds ACK.

- Updates status indicators.

- Returns to previous scanning state.

Option byte format:

MSB                    LSB

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|

→ Scroll lock indicator

→ Num lock indicator

→ Caps lock indicator
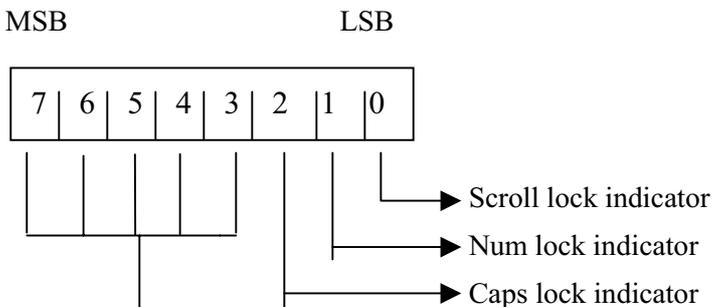
Reserved bits must be '0'

Echo ( Hex EEH )

- Responds with EE hex.

- Returns to previous scanning state.

Invalid commands ( Hex EF and F1 )

- Returns a RESEND command (Hex FE).

- Returns to previous scanning state.

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Select Alternate Scan Codes ( Hex F0 )

- Responds ACK.

- Clears output buffer.

- Sets the default typematic rate/delay.

- Clears last typematic key.

- Receives option byte.

- If option byte is '00', responds the current keyboard set (Hex 01, 02 or 03), Otherwise responds ACK.

- Option byte =

   01 : set keyboard be scan code set 1

   02 : set keyboard be scan code set 2

   03 : set keyboard be scan code set 3

- Returns to previous scanning rate.


Read ID (F2)

- Responds with ACK.

- Discontinues scanning.

- Sends two ID bytes '83AB'. The low byte 'AB' first then the second byte '83' will be sent within 500 uS after first byte.

- Resumes scanning.


Set Typematic Rate/Delay ( Hex F3 )

- Responds ACK.

- Receives rate/delay value byte

- Responds ACK.

- Set rate/delay time.

- Returns to previous scanning state.


1. Repeat period = ( 8+A ) x ( 2B) x 0.00417 s

   A = binary value of bits 2, 1, and 0(LSB).

   B = binary value of bits 4 and 3.

2. Delay = ( C +1 ) x 250 ms

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C = binary value of bits 6 and 5 and bit 7 is always 0.

3. Default rate = 10.9 cps(chars per second) + 20%

   Default delay = 500 ms ± 20%

| Bits 43210 | Rate (CPS) | Bits 43210 | Rate (CPS) | Bits 43210 | Rate (CPS) | Bits 43210 | Rate (CPS) |
|---|---|---|---|---|---|---|---|
| 00000 | 30.0 | 01000 | 15.0 | 10000 | 7.5 | 11000 | 3.7 |
| 00001 | 26.6 | 01001 | 13.3 | 10001 | 6.7 | 11001 | 3.3 |
| 00010 | 24.0 | 01010 | 12.0 | 10010 | 6.0 | 11010 | 3.0 |
| 00011 | 21.8 | 01011 | 10.9 | 10011 | 5.5 | 11011 | 2.7 |
| 00100 | 20.0 | 01100 | 10.0 | 10100 | 5.0 | 11100 | 2.5 |
| 00101 | 18.4 | 01101 | 9.2 | 10101 | 4.6 | 11101 | 2.3 |
| 00110 | 17.1 | 01110 | 8.6 | 10110 | 4.3 | 11110 | 2.1 |
| 00111 | 16.0 | 01111 | 8.0 | 10111 | 4.0 | 11111 | 2.0 |

Enable ( Hex F4 )

- Responds with ACK.

- Clears the output buffer.

- Clears the last typematic key.

- Start scanning.

Default Disable (Hex F5)

- Responds with ACK.

- Resets all conditions to power-on reset state.

- Clears the output buffer.

- Clears last typematic key.

- Sets the default key type ( for scan code set 3 only ).

- Sets the default typematic rate/delay.

- Stops scanning,

Set Default (Hex F6 )

- Responds with ACK.

- Resets all conditions to power-on reset state.

- Clears output buffer.

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- Clears last typematic key.

- Sets the default key type ( for scan code set 3 only ).

- Sets the default typematic rate/delay.

- Continues scanning,


Set All Keys ( Hex F7,F8,F9,FA )

- Responds ACK.

- Clears output buffer.

- Sets all key type (affect only scan code set 3).

F7 : Typematic

F8 : Make/Break

F9 : Make

FA : Typematic/Make/Break

- Returns to previous scanning rate.


Set Key Type ( Hex FB,FC,FD )

- Responds ACK.

- Clears output buffer.

- Receives key ID byte.

- Responds ACK.

- Sets key ID type (affect only scan code set 3).

FB : Typematic

FC : Make/Break

FD : Make

- Returns to previous scanning rate.


Resend ( Hex FE )

- Sends the previous output again. If the previous byte is RESEND, the last byte before RESEND shall be sent.


Reset ( Hex FF )

- Responds ACK.

- Default to scan code set 2.

- Checks clock and data lines in the high state for at least 500 ms or receives another command.

- Responds BAT completion code (Hex AA).

**Command to the system**

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 command.

- BAT Completion Code ( Hex AA )

This command is sent after successful completion of keyboard self test.

- Echo ( Hex EE )

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

- Keyboards ID ( Hex 83AB )

These two bytes ID is sent 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. The code is hex FF for scan code set 1 and hex 00 for others.

- Resend ( He FE )

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

**Keyboard Scan Code Table**

The keyboard contains three scan code sets. The system defaults to scan code set 2, but can be switched to set 1 or set 3 by 'F0' command. The following tables show the key numbers and three scan code sets in hexadecimal values. For scan code set 1 and 2 ,all the keys are typematics except for the pause key which is make only. When a key is depressed, the keyboard will transmit the make code for that key at the typematic rate as long as the key is held down.    When the key is released, its break code is sent. If two or more keys are held down, only the last key pressed repeats at the typematic rate. Typematic operation

stops when the last pressed key is released, even if other keys are being released or some other keys are still held down.

For scan code set 3, all keys are individually programmable by system command to allow keyboard modification to system/user requirements. At power on, Reset or Default command, the keyboard is configured to a default keytypes.

There are all four key types for scan code set 3.

- Make only keys

Keyboard data will be sent only on the depression of these keys.

- Make/Break keys

The depression of a Make/Break key cause its scan code to be output. The release of a Make/Break key causes its scan code to be output preceded by a special break code prefix(Hex 'F0').

- Typematic keys

A typematic key will output on depression and will begin to repeat after the 'typematic delay time' when held down.

- Typematic Make/Break keys

A typematic Make/Break key will output on depression and repeat when held down similar to a typematic key. The release of a typematic Make/Break key causes its scan code to be output preceded by the break code just like Make/Break key.

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

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**Scan Code:**

| Key | Set1 | | Set2 | | Set3 | | |
|---|---|---|---|---|---|---|---|
| | Make code | Break code | Make code | Break code | Make code | Break code | Default key type |
| `(~) | 29 | A9 | 0E | F0 0E | 0E | F0 0E | Typematic |
| 1 | 02 | 82 | 16 | F0 16 | 16 | F0 16 | Typematic |
| 2 | 03 | 83 | 1E | F0 1E | 1E | F0 1E | Typematic |
| 3 | 04 | 84 | 26 | F0 26 | 26 | F0 26 | Typematic |
| 4 | 05 | 85 | 25 | F0 25 | 25 | F0 25 | Typematic |
| 5 | 06 | 86 | 2E | F0 2E | 2E | F0 2E | Typematic |
| 6 | 07 | 87 | 36 | F0 36 | 36 | F0 36 | Typematic |
| 7 | 08 | 88 | 3D | F0 3D | 3D | F0 3D | Typematic |
| 8 | 09 | 89 | 3E | F0 3E | 3E | F0 3E | Typematic |
| 9 | 0A | 8A | 46 | F0 46 | 46 | F0 46 | Typematic |
| 0 | 0B | 8B | 45 | F0 45 | 45 | F0 45 | Typematic |
| -(_ ) | 0C | 8C | 4E | F0 4E | 4E | F0 4E | Typematic |
| =(+) | 0D | 8D | 55 | F0 55 | 55 | F0 55 | Typematic |
| Back space | 0E | 8E | 66 | F0 66 | 66 | F0 66 | Typematic |
| Tab | 0F | 8F | 0D | F0 0D | 0D | F0 0D | Typematic |
| Q | 10 | 90 | 15 | F0 15 | 15 | F0 15 | Typematic |
| W | 11 | 91 | 1D | F0 1D | 1D | F0 1D | Typematic |
| E | 12 | 92 | 24 | F0 24 | 24 | F0 24 | Typematic |
| R | 13 | 93 | 2D | F0 2D | 2D | F0 2D | Typematic |
| T | 14 | 94 | 2C | F0 2C | 2C | F0 2C | Typematic |
| Y | 15 | 95 | 35 | F0 35 | 35 | F0 35 | Typematic |
| U | 16 | 96 | 3C | F0 3C | 3C | F0 3C | Typematic |
| I | 17 | 97 | 43 | F0 43 | 43 | F0 43 | Typematic |
| O | 18 | 98 | 44 | F0 44 | 44 | F0 44 | Typematic |
| P | 19 | 99 | 4D | F0 4D | 4D | F0 4D | Typematic |
| [({} | 1A | 9A | 54 | F0 54 | 54 | F0 54 | Typematic |
| ](}) | 1B | 9B | 5B | F0 5B | 5B | F0 5B | Typematic |
| \(|)@1 | 2B | AB | 5D | F0 5D | 5C | F0 5C | Typematic |
| Caps | 3A | BA | 58 | F0 58 | 14 | F0 14 | Make/Break |
| A | 1E | 9E | 1C | F0 1C | 1C | F0 1C | Typematic |
| S | 1F | 9F | 1B | F0 1B | 1B | F0 1B | Typematic |
| D | 20 | A0 | 23 | F0 23 | 23 | F0 23 | Typematic |
| F | 21 | A1 | 2B | F0 2B | 2B | F0 2B | Typematic |
| G | 22 | A2 | 34 | F0 34 | 34 | F0 34 | Typematic |
| H | 23 | A3 | 33 | F0 33 | 33 | F0 33 | Typematic |

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| J | 24 | A4 | 3B | F0 3B | 3B | F0 3B | Typematic |
|---|---|---|---|---|---|---|---|
| K | 25 | A5 | 42 | F0 42 | 42 | F0 42 | Typematic |
| L | 26 | A6 | 4B | F0 4B | 4B | F0 4B | Typematic |
| ;(:) | 27 | A7 | 4C | F0 4C | 4C | F0 4C | Typematic |
| '(") | 28 | A8 | 52 | F0 52 | 52 | F0 52 | Typematic |
| K42 @2 | 2B | AB | 5D | F0 5D | 53 | F0 53 | Typematic |
| ENTER | 1C | 9C | 5A | F0 5A | 5A | F0 5A | Typematic |
| SHIFT_L | 2A | AA | 12 | F0 12 | 12 | F0 12 | Make/Break |
| K45 @2 | 56 | D6 | 61 | F0 61 | 13 | F0 13 | Typematic |
| Z | 2C | AC | 1A | F0 1A | 1A | F0 1A | Typematic |
| X | 2D | AD | 22 | F0 22 | 22 | F0 22 | Typematic |
| C | 2E | AE | 21 | F0 21 | 21 | F0 21 | Typematic |
| V | 2F | AF | 2A | F0 2A | 2A | F0 2A | Typematic |
| B | 30 | B0 | 32 | F0 32 | 32 | F0 32 | Typematic |
| N | 31 | B1 | 31 | F0 31 | 31 | F0 31 | Typematic |
| M | 32 | B2 | 3A | F0 3A | 3A | F0 3A | Typematic |
| ,(<) | 33 | B3 | 41 | F0 41 | 41 | F0 41 | Typematic |
| .(>) | 34 | B4 | 49 | F0 49 | 49 | F0 49 | Typematic |
| /(?) | 35 | B5 | 4A | F0 4A | 4A | F0 4A | Typematic |
| SHIFT_R | 36 | B6 | 59 | F0 59 | 59 | F0 59 | Make/Break |
| CTRL_L | 1D | 9D | 14 | F0 14 | 11 | F0 11 | Make/Break |
| ALT_L | 38 | B8 | 11 | F0 11 | 19 | F0 19 | Make/Break |
| SPACE | 39 | B9 | 29 | F0 29 | 29 | F0 29 | Typematic |
| ALT_R | E0 38 | E0 B8 | E0 11 | E0 F0 11 | 39 | F0 39 | Make only |
| CTRL_R | E0 1D | E0 9D | E0 14 | E0 F0 14 | 58 | F0 58 | Make only |
| NUM | 45 | C5 | 77 | F0 77 | 76 | F0 76 | Make only |
| (7) | 47 | C7 | 6C | F0 6C | 6C | F0 6C | Make only |
| (4) | 4B | CB | 6B | F0 6B | 6B | F0 6B | Make only |
| (1) | 4F | CF | 69 | F0 69 | 69 | F0 69 | Make only |
| (8) | 48 | C8 | 75 | F0 75 | 75 | F0 75 | Make only |
| (5) | 4C | CC | 73 | F0 73 | 73 | F0 73 | Make only |
| (2) | 50 | D0 | 72 | F0 72 | 72 | F0 72 | Make only |
| (0) | 52 | D2 | 70 | F0 70 | 70 | F0 70 | Make only |
| (*) | 37 | B7 | 7C | F0 7C | 7E | F0 7E | Make only |
| (9) | 49 | C9 | 7D | F0 7D | 7D | F0 7D | Make only |
| (6) | 4D | CD | 74 | F0 74 | 74 | F0 74 | Make only |
| (3) | 51 | D1 | 7A | F0 7A | 7A | F0 7A | Make only |
| (DEL) | 53 | D3 | 71 | F0 71 | 71 | F0 71 | Make only |
| (-) | 4A | CA | 7B | F0 7B | 84 | F0 84 | Make only |
| (+) | 4E | CE | 79 | F0 79 | 7C | F0 7C | Typematic |

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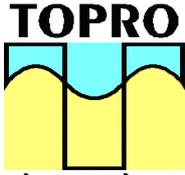
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## PS/2 Keyboard controller

| | E0 1C | E0 9C | E0 5A | E0 F0 5A | 79 | F0 79 | Make only |
|---|---|---|---|---|---|---|---|
| (ENTER) | E0 1C | E0 9C | E0 5A | E0 F0 5A | 79 | F0 79 | Make only |
| ESC | 01 | 81 | 76 | F0 76 | 08 | F0 08 | Make only |
| F1 | 3B | BB | 05 | F0 V5 | 07 | F0 07 | Make only |
| F2 | 3C | BC | 06 | F0 06 | 0F | F0 0F | Make only |
| F3 | 3D | BD | 04 | F0 04 | 17 | F0 17 | Make only |
| F4 | 3E | BE | 0C | F0 0C | 1F | F0 1F | Make only |
| F5 | 3F | BF | 03 | F0 03 | 27 | F0 27 | Make only |
| F6 | 40 | C0 | 0B | F0 0B | 2F | F0 2F | Make only |
| F7 | 41 | C1 | 83 | F0 83 | 37 | F0 37 | Make only |
| F8 | 42 | C2 | 0A | F0 0A | 3F | F0 3F | Make only |
| F9 | 43 | C3 | 01 | F0 01 | 47 | F0 47 | Make only |
| F10 | 44 | C4 | 09 | F0 09 | 4F | F0 4F | Make only |
| F11 | 57 | D7 | 78 | F0 78 | 56 | F0 56 | Make only |
| F12 | 58 | D8 | 07 | F0 07 | 5E | F0 5E | Make only |
| SCROLL | 46 | C6 | 7E | F0 7E | 5F | F0 5F | 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 | See Scan Table 1 | | See Scan Table 2 | | 60 | F0 60 | Typematic |
| PAGE UP | | | | | 6F | F0 6F | Make only |
| PAGE DOWN | | | | | 6D | F0 6D | Make only |
| RIGHT | | | | | 6A | F0 6A | Typematic |
| (/) | | | | | 77 | F0 77 | Make only |
| PRINT | | | | | 57 | F0 57 | Make only |
| PAUSE | | | | | 62 | F0 62 | Make only |

Scan Table 1:

| 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 |

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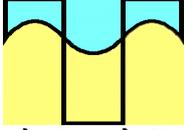
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| HOME | E0 47/E0 C7 | E0 AA E0 47 /E0 C7 E0 2A | E0 2A E0 47 /E0 C7 E0 AA |
|---|---|---|---|
| END | E0 4F/E0 CF | E0 AA E0 4F /E0 CF E0 2A | E0 2A E0 4F /E0 CF E0 AA |
| UP | E0 48/E0 C8 | E0 AA E0 48 /E0 C8 E0 2A | E0 2A E0 48 /E0 C8 E0 AA |
| 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/E0 CD | E0 AA E0 4D /E0 CD E0 2A | E0 2A E0 4D /E0 CD E0 AA |
| Key | Base case Make/Break | Shift case Make/Break @3 | |
| (/) | E0 35/E0 B5 | E0 AA E0 35/E0 B5 E0 2A | |
| Key | Base case 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 | Base case Make/Break | Ctrl case Make/Break | |
| PAUSE @4 | E1 1D 45 E1 9D C5 | E0 46 E0 C6 | |

Scan Table 2:

| Key | Base case, or Shift+Num lock Make/Break | Shift case @5 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 12 E0 72 |

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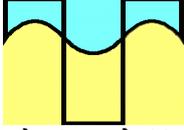
| | | /E0 F0 72 E0 12 | |
| --- | --- | --- | --- |
| PAGE UP | E0 7D/E0 F0 7D | E0 F0 12 E0 7D /E0 F0 7D E0 12 | E0 12 E0 7D /E0 F0 7D E0 F0 12 |
| PAGE DOWN | E0 7A/E0 F0 7A | E0 F0 12 E0 7A /E0 F0 7A E0 12 | E0 12 E0 7A /E0 F0 7A E0 F0 12 |
| RIGHT | E0 74/E0 F0 74 | E0 F0 12 E0 74 /E0 F0 74 E0 12 | E0 12 E0 74 /E0 F0 74 E0 F0 12 |
| Key | Base case Make/Break | | Shift case Make/Break @5 |
| (/) | E0 4A/E0 F0 4A | | E0 F0 12 E0 4A/E0 F0 4A E0 12 |
| Key | Base case 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 | Base case Make/Break | | Ctrl case Make/Break |
| PAUSE @4 | E1 14 77 E1 F0 14 F0 77 | | E0 7E E0 F0 7E |

New key codes:

| Key | Set1 | | Set2 | | Set3 | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | Make code | Break code | Make code | Break code | Make code | Break code | Default key type |
| LWIN | E0 5B | E0 DB | E0 1F | E0 F0 1F | 8B | F0 8B | Typematic |
| RWIN | E0 5C | E0 DC | E0 27 | E0 F0 27 | 8C | F0 8C | Typematic |
| APP | E0 5D | E0 DD | E0 2F | E0 F0 2F | 8D | F0 8D | Typematic |
| NCHG(131) | 7B | FB | 67 | F0 67 | 85 | F0 85 | Make only |
| CHG(132) | 79 | F9 | 64 | F0 64 | 86 | F0 86 | Make only |
| ROMA(133) | 70 | F0 | 13 | F0 13 | 87 | F0 87 | Make only |
| K14 | 7D | FD | 6A | F0 6A | 5D | F0 5D | Typematic |
| K56 | 73 | F3 | 51 | F0 51 | 51 | F0 51 | Typematic |
| K107 | 7E | FE | 6D | F0 6D | 7B | F0 7B | Typematic |
| KL | F1 | X | F1 | X | F1 | X | Make only |
| KR | F0 | X | F2 | X | F2 | X | Make only |
| POWER | E0 5E | E0 DE | E0 37 | E0 F0 37 | X | X | X |
| SLEEP | E0 5F | E0 DF | E0 3F | E0 F0 3F | X | X | X |
| WAKE UP | E0 63 | E0 E3 | E0 5E | E0 F0 5E | X | X | X |
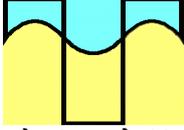
Windows 2000 Multi-Media key code:

| Key | Set1 | | Set2 | |
|---|---|---|---|---|
| | Make code | Break code | Make code | Break code |
| WWW Back | E0 6A | E0 EA | E0 38 | E0 F0 38 |
| WWW Forward | E0 69 | E0 E9 | E0 30 | E0 F0 30 |
| WWW Stop | E0 68 | E0 E8 | E0 28 | E0 F0 28 |
| WWW Refresh | E0 67 | E0 E7 | E0 20 | E0 F0 20 |
| WWW Search | E0 65 | E0 E5 | E0 10 | E0 F0 10 |
| WWW Favorites | E0 66 | E0 E6 | E0 18 | E0 F0 18 |
| WWW Web/Home | E0 32 | E0 B2 | E0 3A | E0 F0 3A |
| Mail | E0 6C | E0 EC | E0 48 | E0 F0 48 |
| Mute | E0 20 | E0 A0 | E0 23 | E0 F0 23 |
| Volume- | E0 2E | E0 AE | E0 21 | E0 F0 21 |
| Volume+ | E0 30 | E0 B0 | E0 32 | E0 F0 32 |
| Play/Pause | E0 22 | E0 A2 | E0 34 | E0 F0 34 |
| Stop | E0 24 | E0 A4 | E0 3B | E0 F0 3B |
| Previous Track | E0 10 | E0 90 | E0 15 | E0 F0 15 |
| Next Track | E0 19 | E0 99 | E0 4D | E0 F0 4D |
| Media Select | E0 6D | E0 ED | E0 50 | E0 F0 50 |
| My Computer | E0 6B | E0 EB | E0 40 | E0 F0 40 |
| Calculator | E0 21 | E0 A1 | E0 2B | E0 F0 2B |

Note:

1. 101-key keyboard only

2. 102-key keyboard only

3. If the left shift key is pressed, the AA/2A shift make and break code is sent with the other scan codes. If the right shift kehy is pressed, B6/36 is sent. If both shift keys are pressed, both sets of codes are sent.

4. This key is not typematic.

5.If the left shift key is pressed, the F0 12/12 shift make and break code is sent with the other scan codes. If the right shift kehy is pressed, F0 59/59 is sent. If both shift keys are pressed, both sets of codes are sent.

# TP8511HB-N01

## PS/2 Keyboard controller

## Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---|---|---|
| Operating Temperature | 0－+70 | ℃ |
| Storage Temperature | -65－+150 | ℃ |
| Voltage on Any Pin | -0.5－+7 | V |
| Power Dissipation | 0.2 | W |

Note: Stresses above those listed may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## DC Electrical Characteristic

$(TA=0^0C-70^0C, V_{CC}=5\pm 10\%, V_{SS}=0V)$

| Parameter | Symbol | Limit | | | Unit | Test condition |
|---|---|---|---|---|---|---|
| | | min | typ | max | | |
| Input Low Voltage | $V_{IL}$ | -0.5 | | $0.2V_{CC}-0.1$ | V | |
| Input High Voltage(Except XTAL1,RST,P3.0~P3.2) | $V_{IH}$ | $0.2V_{CC}+0.9$ | | $V_{CC}+0.5$ | V | |
| Input High Voltage(XTAL1,RST) | $V_{IH1}$ | $0.9V_{CC}$ | | $V_{CC}+0.5$ | V | |
| Input High Voltage(P3.0~P3.2) | $VIH2$ | $0.2 V_{CC}+2.5$ | | $V_{CC}+0.5$ | V | |
| Output Low Voltage (Except P3.0~P3.2,LED0~2) | $V_{OL}$ | | | 0.45 | V | $I_{OL}=1.6mA$ |
| Output Low Voltage (P3.0~P3.2,LED0~2) | $V_{OL1}$ | | | 0.7 | V | $I_{OL}=1.6mA$ |
| Output High Voltage | $V_{OH}$ | 2.4 | | | V | $I_{OH}=-60\mu A$ |
| Input Leakage Current (Except P3.6,P3.7) | $I_{IL}$ | | | -50 | $\mu A$ | Vin=0.45V |
| Input Leakage Current(Port0) | $I_{IL1}$ | | | 10 | $\mu A$ | Vin= $V_{CC}$ |
| Input Leakage Current (P3.6,P3.7) | $I_{IL2}$ | | | -350 | $\mu A$ | Vin=0.45V |

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| Power Supply Current | $I_{CC}$ | | 15 | 30 | mA | $F_{OP}$=20MHz |
|---|---|---|---|---|---|---|
| Idle Mode Supply Current | $I_{ID}$ | | 1.7 | 5 | mA | |
| Power Down Mode Supply Current | $I_{PD}$ | | 5 | 50 | $\mu$A | |
| Capacitance of I/O Buffer | $C_{IO}$ | | | 10 | pF | $F_{OP}$=1MHz |
| Internal Reset Pull-Up Resistor | $R_{RST}$ | 50 | | 150 | K$\Omega$ | |
| Build-in clock source frequency | Fosc | 4.18 | | 5.12 | MHz | Rosc=47K$\Omega$ |

Notes: (1) All DC electrical characteristics are measured at 25℃.

(2) It is suggested that conventional precautions should be taken to avoid applying voltages greater than the absolute maximum ratings.

## AC Electrical Characteristic

$T_A$=0℃ to +70℃,or $T_A$=-40℃ to +85℃/+125℃,$V_{CC}$=5V± 10%,$V_{SS}$=0V[1]

| External Clock | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_{CHCX}$ | 5 | High time[2] | 20 | | 20 | $^tCLCL$-$^tLOW$ | ns |
| $T_{CLCX}$ | 5 | Low time[2] | 20 | | 20 | $^tCLCL$-$^tHIGH$ | ns |
| $T_{CLCH}$ | 5 | Rise time[2] | | 20 | | 10 | ns |
| $T_{CHCL}$ | 5 | Fall time[2] | | 20 | | 10 | ns |

Notes:1. Parameters are valid over operating temperature range unless otherwise specified.

2. These values are characterized but not 100% production tested.

EXPLANATION OF THE AC SYMBOLS

Each timing symbol has five characters. The first character is always "t"(=time). The other characters, depending on their positions, indicate the name of a signal or the logical status of that signal. The designations are:

C - Clock

H - Logic level high

L - Logic level low

t - Time

X - No longer a valid logic level



Figure 3. External Clock Drive

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Topro Technology Inc.
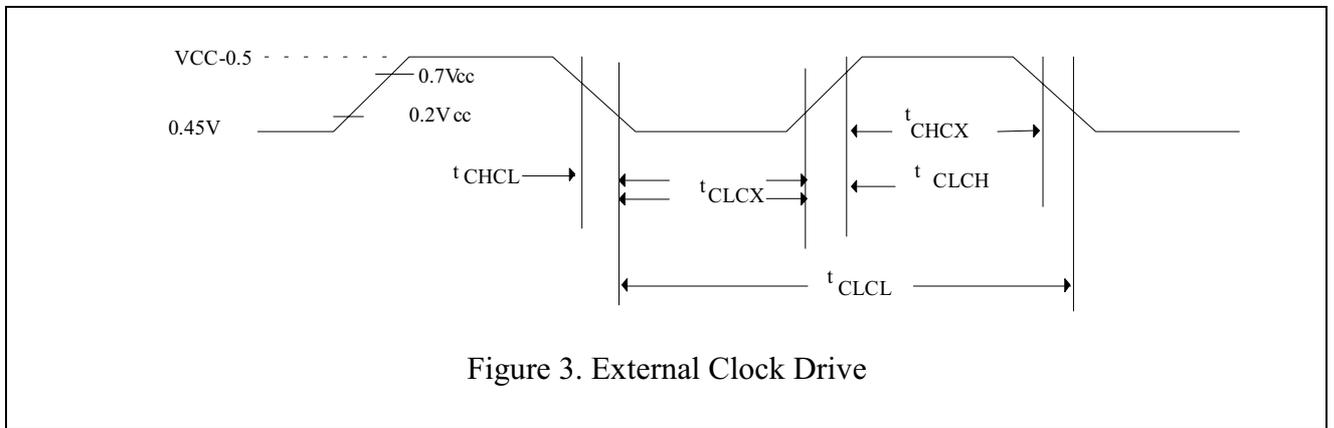
## Application Diagrams

(1)Application circuit
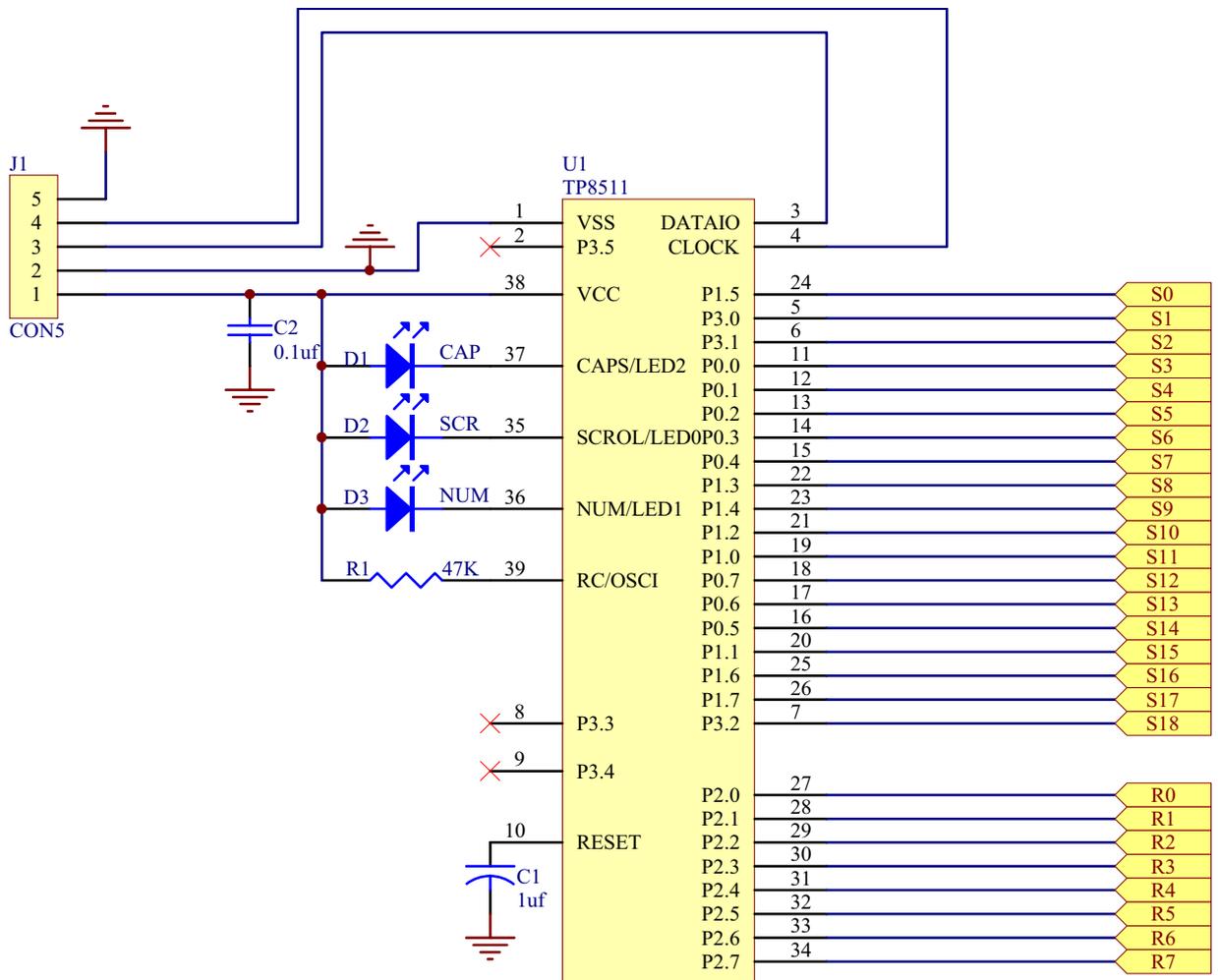
(2)Key matrix definition for windows 2000 standard code

| S0 | Pause | Power | | Sleep | R-Ctrl | Wake up | L-Ctrl | F5 |
|---|---|---|---|---|---|---|---|---|
| S1 | Q | Tab | A | Esc | Z | K131 | `(~) | ! 1 |
| S2 | W | Caps lock | S | K45 | X | K132 | F1 | @ 2 |
| S3 | E | F3 | D | F4 | C | K133 | F2 | # 3 |
| S4 | R | T | F | G | V | B | % 5 | $ 4 |
| S5 | U | Y | J | H | M | N | ^ 6 | & 7 |
| S6 | I | } ] | K | F6 | < , | K56 | + = | * 8 |
| S7 | O | F7 | L | | > . | App | F8 | ( 9 |
| S8 | P | { [ | : ; | " ' | K42 | ? / | _ - | ) 0 |
| S9 | Scroll Lock | | | L-Alt | | R-Alt | | Print Screen |
| S10 | K14 | Back Space | \| \ | F11 | Enter | F12 | F9 | F10 |
| S11 | 7(Num) | 4(Num) | 1(Num) | Space | Num Lock | | Delete | Power |
| S12 | 8(Num) | 5(Num) | 2(Num) | 0(Num) | /(Num) | | Insert | Sleep |
| S13 | 9(Num) | 6(Num) | 3(Num) | .(Num) | *(Num) | | Page Up | Page Down |
| S14 | +(Num) | K107 | Enter(Num) | | Media Next | | Home | End |
| S15 | Wake Up | L-Shift | R-Shift | Media Previous | Media Stop | Media Play | Media Mute | Volume + |
| S16 | Volume- | L-Win | WWW Mail | WWW Search | WWW Home | | | WWW Back |
| S17 | Kor-L | WWW Forward | R-Win | WWW Stop | WWW Refresh | WWW Bookmark | | Kor-R |

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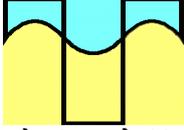
| S18 | Media Select | Calculator | My Computer | | | | | |
|-----|------|------|------|------|------|------|------|------|
| | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 |

(3) Bonding Diagram

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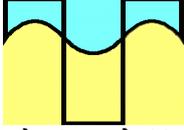
# TP8511HB-N01

*PS/2 Keyboard controller*

(1) TP NO:   TP8511         Date: Fri Mar 30 12:25:05 2001

      TR NO:   TS1E011A      First Pin: GND

      Chip Size:   1450.000*1432.000     Logo location show as '*'

(2) Pad Configuration                      Package type: 40 COB



Pin assignments:

Top row (left to right): 5 P3_PAD0, 4 P3_PAD6, 3 P3_PAD7, 2 P3_PAD5, 1 GND, 40 XTAL2, 39 XTAL1, 38 VDD, 37 LED2

Right side (top to bottom): 36 LED1, 35 LED0, 34 P2_PAD7, 33 P2_PAD6, 32 P2_PAD5, 31 P2_PAD4, 30 P2_PAD3, 29 P2_PAD2, 28 P2_PAD1, 27 P2_PAD0

Bottom row (left to right): 16 P0_PAD5, 17 P0_PAD6, 18 P0_PAD7, 19 P1_PAD0, 20 P1_PAD1, 21 P1_PAD2, 22 P1_PAD3, 23 P1_PAD4, 24 P1_PAD5, 25 P1_PAD6, 26 P1_PAD7

Left side (top to bottom): 6 P3_PAD1, 7 P3_PAD2, 8 P3_PAD3, 9 P3_PAD4, 10 RSTB, 11 P0_PAD0, 12 P0_PAD1, 13 P0_PAD2, 14 P0_PAD3, 15 P0_PAD4

(0.000,0.000)

# TP8511HB-N01

## PS/2 Keyboard controller

| Pin NO. | X , Y | Pin NO. | X , Y |
|---|---|---|---|
| Pin1: GND | -55.000, 645.000 | Pin21: P1_PAD2 | 53.550, -645.000 |
| Pin2: P3_PAD5 | -164.950, 645.000 | Pin22: P1_PAD3 | 163.550, -645.000 |
| Pin3: P3_PAD7 | -274.950, 645.000 | Pin23: P1_PAD4 | 273.550, -645.000 |
| Pin4: P3_PAD6 | -384.950, 645.000 | Pin24: P1_PAD5 | 383.550, -645.000 |
| Pin5: P3_PAD0 | -494.950, 645.000 | Pin25: P1_PAD6 | 493.550, -645.000 |
| Pin6: P3_PAD1 | -653.700, 457.300 | Pin26: P1_PAD7 | 603.550, -645.000 |
| Pin7: P3_PAD2 | -653.700, 347.300 | Pin27: P2_PAD0 | 653.700, -422.700 |
| Pin8: P3_PAD3 | -653.700, 237.300 | Pin28: P2_PAD1 | 653.700, -312.700 |
| Pin9: P3_PAD4 | -653.700, 127.300 | Pin29: P2_PAD2 | 653.700, -202.700 |
| Pin10: RESET | -653.700, 17.250 | Pin30: P2_PAD3 | 653.700, -92.700 |
| Pin11: P0_PAD0 | -653.700, -92.700 | Pin31: P2_PAD4 | 653.700, 17.300 |
| Pin12: P0_PAD1 | -653.700, -202.700 | Pin32: P2_PAD5 | 653.700, 127.300 |
| Pin13: P0_PAD2 | -653.700, -312.700 | Pin33: P2_PAD6 | 653.700, 237.300 |
| Pin14: P0_PAD3 | -653.700, -422.700 | Pin34: P2_PAD7 | 653.700, 347.300 |
| Pin15: P0_PAD4 | -653.700, -532.700 | Pin35: LED0 | 653.700, 457.300 |
| Pin16: P0_PAD5 | -496.450, -645.000 | Pin36: LED1 | 653.700, 567.200 |
| Pin17: P0_PAD6 | -386.450, -645.000 | Pin37: LED2 | 385.050, 645.000 |
| Pin18: P0_PAD7 | -276.450, -645.000 | Pin38: VDD | 275.000, 645.000 |
| Pin19: P1_PAD0 | -166.450, -645.000 | Pin39: XTAL1 | 165.000, 645.000 |
| Pin20: P1_PAD1 | -56.450, -645.000 | Pin40: XTAL2 | 55.000, 645.000 |

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