

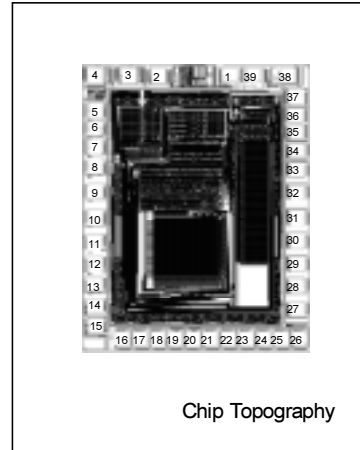
KEYBOARD ENCODER

DESCRIPTION

The SC83053 is dedicated to a keyboard encoder, specially designed for IBM PC AT and all compatible machines. The SC83053 control all scan codes, three LEDs status, scan timing and communications between the keyboard and PC. It is easy to implement a high performance, low cost keyboard with the minimal external components.

FEATURES

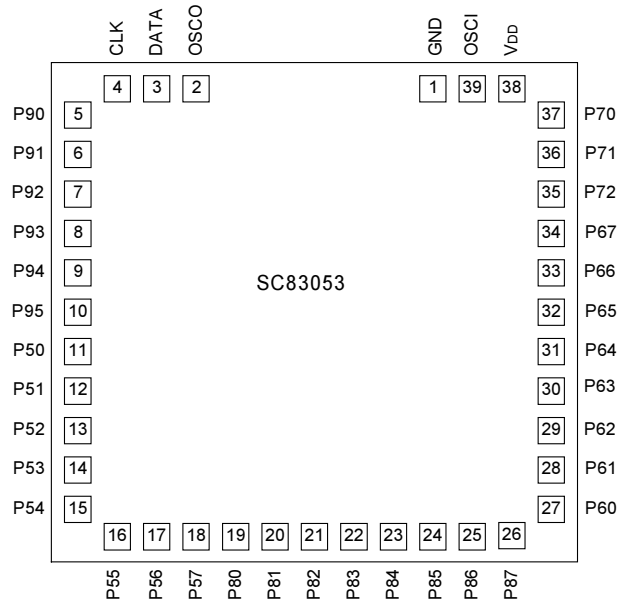
- Low cost - eliminate need external components.
- Phantom key detects.
- RC oscillator (1.8432MHz).
- Support scan code set 1, 2 and 3.
- Support PC AT and PS/2 keyboard.
- Low power CMOS device technology.
- Internal pull-up resistor.
- Tri-state outputs for easy board application.
- Built-in 4K ROM.
- Support WINDOWS™ 95, 98, 2000 keys.
- 104/107 keys with multi-media or other special application keyboard encoder.
- WINDOWS is registered trademarks of Microsoft corporation.



APPLICATION

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

PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| Characteristic | Symbol | Value | Unit |
|------------------------|--------|---------|------|
| Supply Voltage | VCC | -0.5~+7 | V |
| Input Voltage | VIN | -0.3~+6 | V |
| Output Voltage | VOUT | -0.3~+6 | V |
| Temperature under Bias | TB | 0~70 | °C |
| Storage Temperature | TS | -65~150 | °C |

DC ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Test condition | Min. | Typ. | Max. | Unit |
|---|--------|----------------|------|------|------|------|
| Operating Voltage | VCC | | 4.5 | 5 | 5.5 | V |
| Operating Supply Current | ICC1 | FOSC=1.8432MHz | | | 3 | mA |
| Input Leakage | IIN | VIN=VCC, VSS | | | ±1 | μA |
| Input High Voltage | VIH | | 2.0 | | | V |
| Input Low Voltage | VIL | | | | 0.8 | V |
| Output Low Voltage | VOL1 | IOL1=3.0mA | | | 0.4 | V |
| Output Low Voltage for LEDS | VOL2 | IOL2=10mA | | | 3.2 | V |
| Internal Pull-high Resistance (port 6,9) | RPH1 | VPH1=0V | 12 | | 23 | KΩ |
| Internal Pull-high Resistance for DATA, CLK | RPH2 | VPH2=0V | 1.5 | 2.2 | 3 | KΩ |
| Output Low Voltage for DATA CLK | VOL3 | IOL3=5mA | | | 0.4 | V |

AC ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | 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 to 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 | | 1.8432 | | MHz |

PIN DESCRIPTION

| Pin no. | Symbol | I/O | Function |
|---------|--------|-----|--|
| 11 | P50 | O | Column 3 low output scan line, 3-state |
| 12 | P51 | O | Column 4 low output scan line, 3-state |

(To be continued)

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(Continued)

| Pin no. | Symbol | I/O | Function |
|---------|---------|-----|---|
| 7-10 | P92-P95 | O | Low output scan line, 3-state |
| 13 | P52 | O | Column 5 low output scan line, 3-state |
| 14 | P53 | O | Column 6 low output scan line, 3-state |
| 15 | P54 | O | Column 7 low output scan line, 3-state |
| 16 | P55 | O | Column 14 low output scan line, 3-state |
| 17 | P56 | O | Column 13 low output scan line, 3-state |
| 18 | P57 | O | Column 12 low output scan line, 3-state |
| 19 | P80 | O | Column 11 low output scan line, 3-state |
| 20 | P81 | O | Column 15 low output scan line, 3-state |
| 21 | P82 | O | Column 10 low output scan line, 3-state |
| 22 | P83 | O | Column 8 low output scan line, 3-state |
| 23 | P84 | O | Column 9 low output scan line, 3-state |
| 24 | P85 | O | Column 0 low output scan line, 3-state |
| 25 | P86 | O | Column 16 low output scan line, 3-state |
| 26 | P87 | O | Column 17 low output scan line, 3-state |
| 5 | P90 | O | Column 1 low output scan line, 3-state |
| 6 | P91 | O | Column 2 low output scan line, 3-state |
| 1 | GND | I | Ground |
| 35 | SCROLL | O | Scroll lock indicator |
| 36 | NUM | O | NUM lock indicator |
| 37 | CAPS | O | Caps lock indicator |
| 27 | P60 | I | Row 0 input scan line, internal pull high (17K Ω) |
| 28 | P61 | I | Row 1 input scan line, internal pull high (17K Ω) |
| 29 | P62 | I | Row 2 input scan line, internal pull high (17K Ω) |
| 30 | P63 | I | Row 3 input scan line, internal pull high (17K Ω) |
| 31 | P64 | I | Row 4 input scan line, internal pull high (17K Ω) |
| 32 | P65 | I | Row 5 input scan line, internal pull high (17K Ω) |
| 33 | P66 | I | Row 6 input scan line, internal pull high (17K Ω) |
| 34 | P67 | I | Row 7 input scan line, internal pull high (17K Ω) |
| 4 | CLK | I/O | CLOCK line for IBM communication, internal pull high (2.2K Ω) |
| 3 | DATA | I/O | DATA line for IBM communication, internal pull high (2.2K Ω) |
| 38 | VDD | I | +5V power supply |
| 2 | OSCO | O | CLOCK output |
| 39 | R_OSCI | I | Connect 51K Ω resistor for 1.8432MHz oscillation. |
| 40 | NC | | |

FUNCTION DESCRIPTION

Keyboard buffer

The keyboard will buffer 16 bytes in a first-in-first-out order when the system is able to receive scan codes from the keyboard. The response codes and repeated 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-overflow condition occurs.

Power-on Reset and self test

The duration of the keyboard Power-on-Reset(POR) should be within 150 milliseconds and 2 seconds after the 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 milliseconds and a maximum 500 milliseconds. 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 is sent, the keyboard is disabled and waits for a command from the system. The completion codes are sent between 450 milliseconds and 2.5 seconds after POR, and between 300 and 500 milliseconds after a RESET command is acknowledged.

Keyboard data output

When the keyboard is ready to send data to the system, it first checks 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, keyboard starts clocking data out. Data will be valid before the trailing edge and after the leading edge of the clock pulse. During the 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, then buffer the data and return clock and data lines to high state.

Keyboard data input

When the system is ready to send data to the keyboard, it first checks clock line to see if keyboard is sending data. If 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 low for more than 60 microseconds and prepares to send data. The keyboard checks 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 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 data line goes high, then pulls it low and issues a RESEND to the system.

Command from the system

The system can send commands to the keyboard at any time. The keyboard needs to respond within 20 milliseconds, unless the system prevents keyboard output, when doing self test or executing a RESET.

The following are the keyboard input commands and the actions that keyboard needs to take.

Set /Reset Status indicators (Hex ED)

- Responds ACK.
- Receives option byte.
- Responds ACK.
- Updates status indicators.
- Returns to previous scanning state.

Echo (Hex EEH)

- Responds with EE hex.
- Returns to previous scanning state.

Invalid commands (Hex EF and F1)

- Returns a RESEND command.
- Returns to previous scanning state.

Select Alternate Scan Codes (Hex F0)

- Responds ACK.
- Clears output buffer.
- Sets the default typematic rate/delay.
- Clears last typematic key.
- Receives option byte.
- Responds ACK.
- Option byte =
01 : selects scan code set 1
02 : selects scan code set 2

03 : selects scan code set 3

- Returns to previous scanning rate.

Read ID (F2)

- Responds with ACK.
- Discontinues scanning.
- Sends two ID bytes. The second byte 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 (* Note 1)
- Returns to previous scanning state.

* Note 1

1. Repeat period = $(8+A) \times (2B) \times 0.00417$ 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.

| bit4~bit0 | Typematic rate $\pm 20\%$ | Bit 4~bit0 | Typematic rate $\pm 20\%$ |
|-----------|---------------------------|------------|---------------------------|
| 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 |

3. Default rate = 10.9 chars/sec + 20%

Default delay = 500 ms \pm 20%

Enable (Hex F4)

- Responds with ACK.
- Clears output buffer.
- Clears last typematic key.
- Start scanning.

Default Disable (Hex F5)

- Responds with ACK.
- Resets all conditions to power-on state.
- Clears output buffer.
- Sets the default key type (scan code set 3 only).
- Set the default typematic rate/delay.

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- Clears last typematic key.
- Stops scanning,

Set Default (Hex F6)

- Responds with ACK.
- Resets all conditions to power-on state.
- Clears output buffer.
- Sets the default key type (scan code set 3 only).
- Set the default typematic rate/delay.
- Clears last typematic key.
- 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 operation).

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 operation).

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.
- Checks clock and data lines - Reset in the high state for at least 500 microseconds or receives another command.
- Default to scan code set 2.

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.

BAT Completion Code (Hex AA)

This command is issued 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)

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 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.

Keyboard Scan Code Table

The keyboard contains 3 scan code sets. 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 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 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.

The following table shows three scan code sets 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 |
| BACK SPACE | 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 |

(To be continued)

(Continued)

| Key | Make code | Break code | Key | Make code | Break code |
|----------|-----------|------------|---------|-----------|------------|
| U | 16 | 96 | (2) | 50 | D0 |
| I | 17 | 67 | (0) | 52 | D2 |
| O | 18 | 98 | (*) | 37 | B7 |
| P | 19 | 99 | (9) | 49 | C9 |
| [() | 1A | 9A | (6) | 4D | CD |
|] () | 1B | 9B | (3) | 51 | D1 |
| \ () @5 | 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 |

(To be continued)

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(Continued)

| Key | Base case, or shift+num lock make/break | Shift case @3 make/break | Num lock make/break |
|-----------|---|-----------------------------|-----------------------------|
| 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 | 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 |

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.

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Scan code set 2

| Key | Make code | Break code | Key | Make code | Break code |
|------------|-----------|------------|---------|-----------|------------|
| `(~) | 0E | F0 0E | 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 |
| BACK SPACE | 66 | F0 66 | ALT_R | E0 11 | F0 E0 11 |
| TAB | 0D | F0 0D | CTRL_R | E0 14 | F0 E0 14 |
| 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 | (0) | 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 |
| \ () @5 | 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 | F0 E0 5A |
| D | 23 | F0 23 | ESC | 76 | F0 76 |
| F | 2B | F0 2B | F1 | 05 | F0 05 |

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| Key | Make code | Break code | Key | Make code | Break code |
|---------|-----------|------------|--------|-----------|------------|
| 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 @6 | 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 @6 | 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 @7 make/break | Num lock make/break |
|-----------|--|-----------------------------------|--------------------------------------|
| INS | E0 70/E0 F0 70 | E0 F0 12 E0 70 /E0 F0 70 E0 12 | E0 F0 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 F0 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 F0 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 F0 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 F0 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 F0 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 F0 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 F0 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 F0 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 F0 12 E0 74 /E0 F0 74 E0 F0 12 |

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| 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 @8 | E1 14 77 E1 F0 14 F0 77 | E0 7E E0 F0 7E |

Note .

@5 : 101-key keyboard only.

@6 : 102-key keyboard only.

@7 : 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.

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

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 |
| BACK SPACE | 66 | F0 66 | Typematic |

(To be continued)

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(Continued)

| Key | Make code | Break code | Default key state |
|----------|-----------|------------|-------------------|
| 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 |
| \ () @9 | 5D | F0 5D | 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 |
| L | 4B | F0 4B | Typematic |
| ;(: | 4C | F0 4C | Typematic |
| ' (" | 52 | F0 52 | Typematic |
| K42 @10 | 53 | F0 53 | Typematic |
| ENTER | 5A | F0 5A | Typematic |
| SHIFT_L | 12 | F0 12 | Make/break |
| K45 @10 | 13 | F0 13 | Typematic |
| Z | 1A | F0 1A | Typematic |
| X | 22 | F0 22 | Typematic |
| C | 21 | F0 21 | Typematic |

(To be continued)

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(Continued)

| Key | Make code | Break code | Default key state |
|-----------|-----------|------------|-------------------|
| 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 |
| (/) | 77 | F0 77 | Make only |
| (8) | 75 | F0 75 | Make only |
| (5) | 73 | F0 73 | Make only |
| (2) | 72 | F0 72 | Make only |
| (0) | 70 | F0 70 | Make only |
| (*) | 7E | F0 7E | Make only |

(To be continued)

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(Continued)

| Key | Make code | Break code | Default key state |
|---------|-----------|------------|-------------------|
| (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 1 F | 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: @ 9 : 101-key keyboard only

@10 : 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 |

(To be continued)

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(Continued)

| New key | Make | | Break | |
|----------------|-------------|----|--------------|----|
| CHG (132) | 79 | | F9 | |
| ROMA (133) | 70 | | F0 | |
| K14 | 7D | | FD | |
| K56 | 73 | | F3 | |
| K107 | 7E | | FE | |
| KL | F1 | | X | |
| KR | F0 | | X | |
| 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 | | X | | |
| KR | F2 | | X | | |
| 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 | | |
|------------|------|-------|----|------------|
| 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 | | X | |
| KR | F2 | | X | |
| POWER | X | | X | |
| SLEEP | X | | X | |
| WAKE UP | X | | X | |

Windows 2000 multi-media key code:

| | SET1 | | SET2 | |
|---------------------|-------------|-------|-------------|--------|
| | MAKE | BREAK | MAKE | BREAK |
| K130: WWW Back | E06A | E0EA | E038 | E0F038 |
| K131: WWW Forward | E069 | E0E9 | E030 | E0F030 |
| K132: WWW stop | E068 | E0E8 | E028 | E0F028 |
| K133: WWW Refresh | E067 | E0E7 | E020 | E0F020 |
| K134: WWW Search | E065 | E0E5 | E010 | E0F010 |
| K135: WWW Favorites | E066 | E0E6 | E018 | E0F018 |
| K136: WWW Web/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: Pre Track | E010 | E090 | E015 | E0F015 |
| K144: Next track | E019 | E099 | E04D | E0F04D |
| K145: Media Select | E06D | E0ED | E050 | E0F050 |
| K146: My Computer | E06B | E0EB | E040 | E0F040 |
| K147: Calculator | E021 | E0A1 | E02B | E0F02B |

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Turbo Function:

| | | | | |
|-----|----|--------|-----|----------|
| Fn+ | F1 | 2.1Hz | F6 | 30Hz |
| | F2 | 4.2Hz | F7 | 46Hz |
| | F3 | 7.2Hz | F11 | Key Loak |
| | F4 | 16.3Hz | | |
| | F5 | 21Hz | | |

Internal-Multikey Function:

| | Multi-Media Function | Internal 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 Pre Track | Pad_- Favorites | |
| | Pad_5 Media | Pad_ Search | |
| | Pad_6 Next Track | Right Arrow Forward | E Eur Key |
| | Pad_7 Mute | Left Arrow Back | |
| | Pad_8 Volume+ | Down Arrow Stop | |
| | Pad_9 Stop | Up Arrow Refresh | |

Fig1. The Windows 2000 keyboard layout

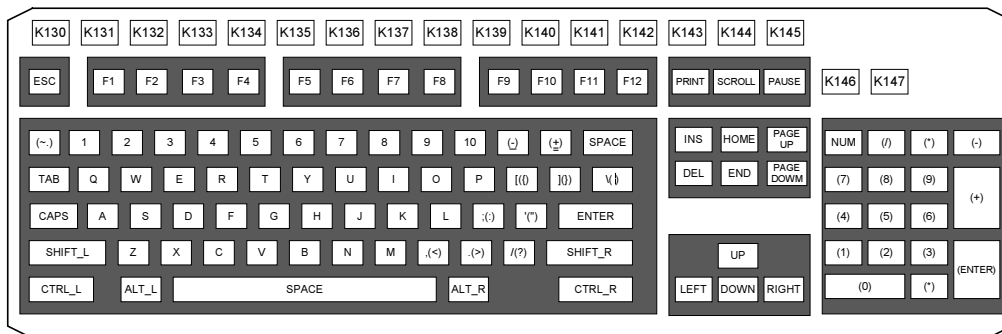


Fig2. The 107-key keyboard layout

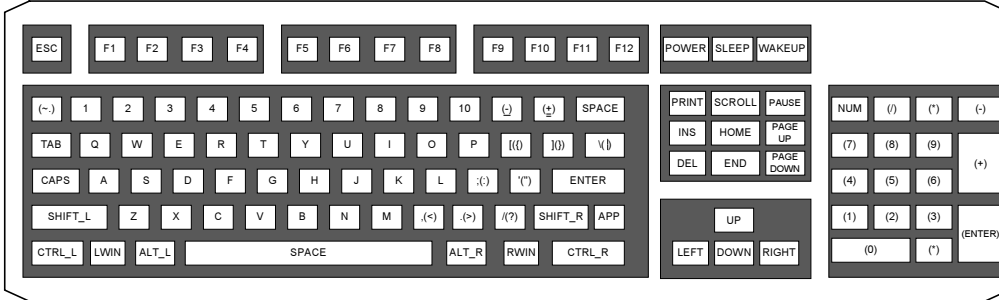
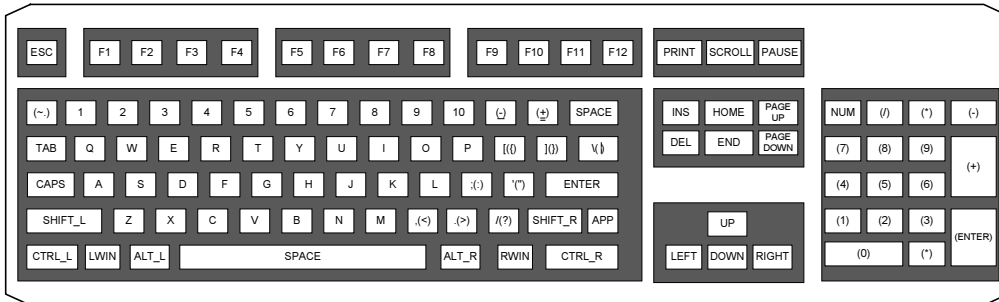


Fig3. The 104-key keyboard layout



TIMING DIAGRAMS

Fig4. Keyboard output data timings

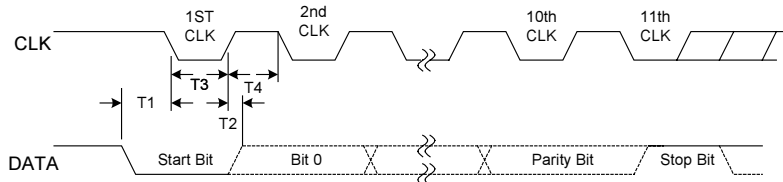
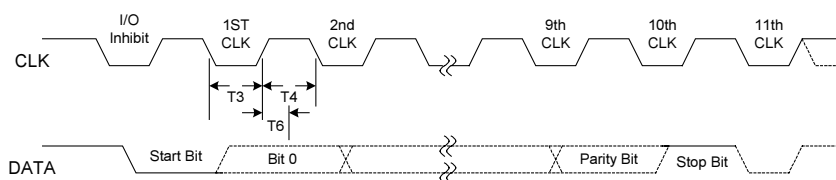
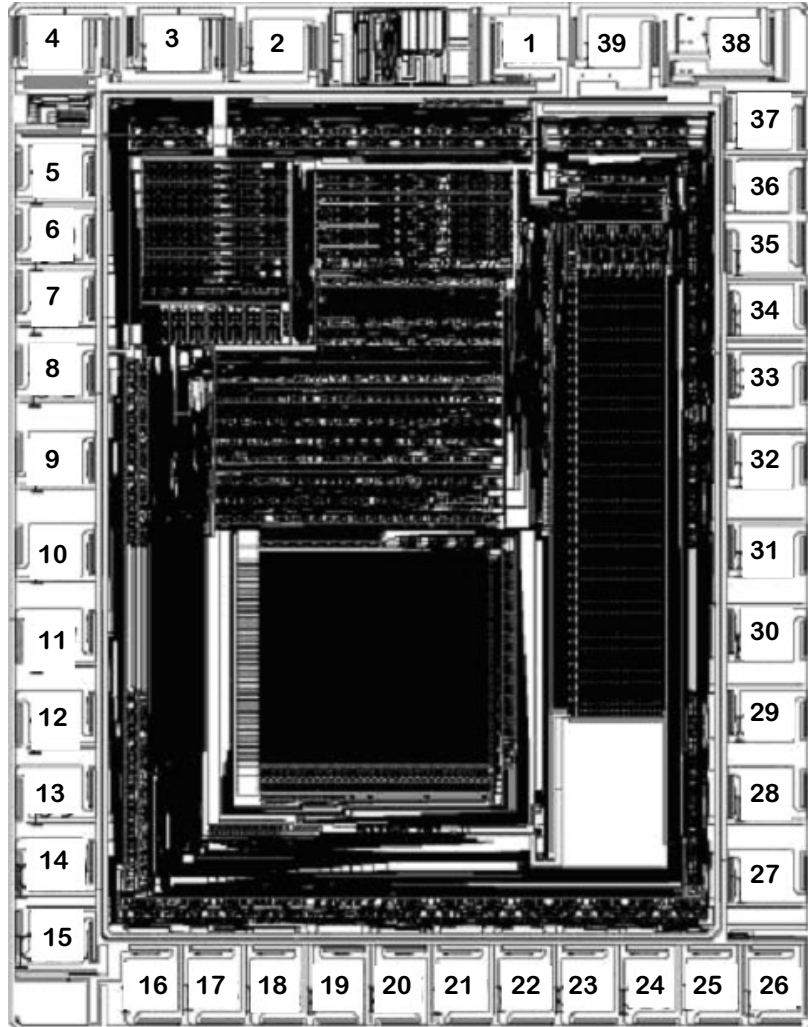


Fig5. Keyboard input data timings



| | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 |
|-----|----------------|----------------|----------------|--------------|---------------|-------------------|----------------|---------------------|
| C0 | PAUSE 126 | POWER | € | SLEEP | CRTL-R 064 | WAKE UP | CTRL-L 058 | F5 116 |
| C1 | Q 017 | TAB 016 | A 031 | ESA 110 | Z 046 | N-CHG 131 | `(~) 001 | 1(!) 002 |
| C2 | W 018 | CAP 030 | S 032 | K45 045 | X 047 | CHG 132 | F1 112 | 2(@) 003 |
| C3 | E 019 | F3 114 | D 033 | F4 115 | C 048 | ROMA 133 | F2 113 | 3(#) 004 |
| C4 | R 020 | T 021 | F 034 | G 035 | V 049 | B 050 | 5(%) 006 | 4(\$) 005 |
| C5 | U 023 | Y 022 | J 037 | H 036 | M 052 | N 051 | 6(^) 007 | 7(&) 008 |
| C6 | I 024 |]({) 028 | K 038 | F6 117 | ,(<) 053 | K56 056 | + (=) 013 | 8(* 009 |
| C7 | O 025 | F7 118 | L 039 | | .(>) 054 | APP APP 119 | F8 119 | 9(') 010 |
| C8 | P 026 | [({) 027 | ;(:) 040 | '(") 041 | K42 042 | / (?) 055 | _ (-) 012 | 0(') 011 |
| C9 | SCROLL 125 | | FN | ALT-L 060 | M/Mode | ALT-R 062 | | PRINT 124 |
| C10 | K14 014 | BACK 015 | \() 029 | F11 122 | ENTER 043 | F12 123 | F9 120 | F10 121 |
| C11 | 7 (K) 091 | 4 (K) 092 | 1 (K) 093 | SPACE 061 | NUM 090 | ↓ 084 | DEL 076 | POWER 121 |
| C12 | 8 (K) 096 | 5 (K) 097 | 2 (K) 098 | 0 (K) 099 | / (K) 095 | → 089 | INS 075 | SLEEP |
| C13 | 9 (K) 101 | 6 (K) 102 | 3 (K) 103 | ¥ (K) 104 | * (K) 100 | - 105 | PAGE UP 085 | PAGE DOWN 086 |
| C14 | + (K) 106 | | ENTER 108 | ↑ 083 | Play/Pause | ← 079 | HOME 080 | END 081 |
| C15 | Wake up | SHIFT-L 044 | SHIFT-R 057 | Volume- | Volume+ | Next track | Prev track | Media |
| C16 | Mail | WIN-L | WWWforward | WWWstop | WWWback | WWWrefresh | mute | WWWsearch |
| C17 | K150 (KC-L) | WWWfavorite | WIN-R | MyComputer | stop | calculator | Web/home | K151 (KC-R) |

CHIP TOPOGRAPHY



Chip Size: $1.72 \times 2.17(\text{mm}^2)$

The substrate should be connected to the GND level.

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Rev: 1.0 2001.11.8.

PAD COORDINATES (Unit: μm)

| Pad No. | Symbol | X | Y | Pad No. | Symbol | X | Y |
|---------|--------|---------|---------|---------|--------|--------|---------|
| 1 | GND | 234.40 | 937.20 | 21 | P82 | 98.80 | -933.75 |
| 2 | OSCO | -270.90 | 928.25 | 22 | P83 | 221.80 | -933.75 |
| 3 | DATA | -482.25 | 938.55 | 23 | P84 | 345.00 | -933.75 |
| 4 | CLK | -708.20 | 938.40 | 24 | P85 | 468.20 | -933.75 |
| 5 | P90 | -707.95 | 679.15 | 25 | P86 | 591.40 | -933.75 |
| 6 | P91 | -707.95 | 555.95 | 26 | P87 | 714.60 | -933.75 |
| 7 | P92 | -707.95 | 432.75 | 27 | P60 | 699.55 | -716.85 |
| 8 | P93 | -707.95 | 284.20 | 28 | P61 | 699.55 | -553.00 |
| 9 | P94 | -707.95 | 111.65 | 29 | P62 | 699.55 | -400.45 |
| 10 | P95 | -707.95 | -70.75 | 30 | P63 | 699.55 | -239.85 |
| 11 | P50 | -707.95 | -239.30 | 31 | P64 | 699.55 | -72.80 |
| 12 | P51 | -707.95 | -401.25 | 32 | P65 | 699.55 | 106.10 |
| 13 | P52 | -707.95 | -550.70 | 33 | P66 | 699.55 | 265.20 |
| 14 | P53 | -707.95 | -695.40 | 34 | P67 | 699.55 | 404.25 |
| 15 | P54 | -707.95 | -840.50 | 35 | P72 | 694.35 | 527.45 |
| 16 | P55 | -517.20 | -933.75 | 36 | P71 | 694.35 | 650.65 |
| 17 | P56 | -394.00 | -933.75 | 37 | P70 | 694.35 | 773.85 |
| 18 | P57 | -270.80 | -933.75 | 38 | VDD | 633.95 | 929.90 |
| 19 | P80 | -147.60 | -933.75 | 39 | OSCI | 397.05 | 937.25 |
| 20 | P81 | -24.40 | -933.75 | | | | |

Note: The original point of the coordinate is the die center.