

Keyboard Encoder For Windows 95

Features

- Supports 3 Windows Keys
- Supports code set 1, for PC/XT keyboard
- Supports code set 1, for PS/2 model 30 keyboard
- Support code set 2, for PC/AT, PS/2 model 50,60 keyboards
- Supports code set 3, for PS/2 model 80 keyboard
- LC or crystal oscillator
- Minimal external components
- Phantom key detection
- 101-key or 102-key application
- 40 Pin dual-in-line package

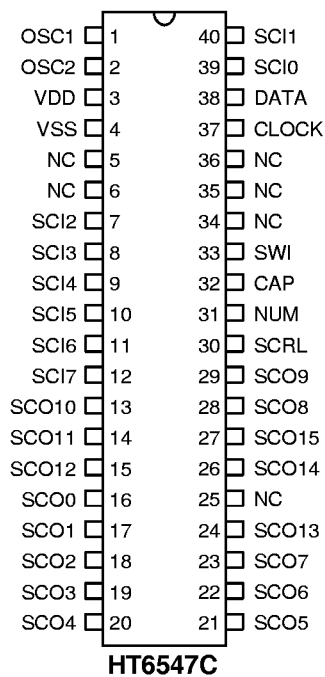
General Description

The HT6547C is a keyboard encoder specially designed for IBM PC/XT, IBM PC/AT, IBM PS/2 and all compatible machines.

The HT6547C accepts keyboard inputs and provides a 16-character first-in-first-out buffer

where data is stored. An inexpensive LC oscillator can be used for the system clock. It is easy to implement in high performance and low cost keyboards.

Pin Assignment



Pin Description

| Pin No. | Pin Name | I/O | Function |
|--|---|-----|--|
| 1,2 | OSC1,OSC2 | I | System clock input |
| 3 | VDD | — | Positive power supply. |
| 4 | VSS | — | Negative power supply (GND). |
| 39,40 7~12 | SI0,SI1 SI2~SI7 | I | Keyboard matrix scanning input pins. |
| 16~23 28,29 13~15 24 26,27 | SCO0~SCO7 SCO8,SCO9 SCO10~SCO12 SCO13 SCO14,SCO15 | O | Keyboard matrix scanning output pins. |
| 33 | SW1 | I | XT/AT mode |
| 37 | CLOCK | I/O | Synchronous clock signal. Used to clock the transmission data. |
| 38 | DATA | I/O | Bidirection data transmission line. |

Absolute Maximum Ratings

Supply Voltage 4.75V to 5.25V Operating Temperature..... 0°C to 70°C
 Input Voltage..... VSS-0.3V to VDD+0.3V Storage Temperature..... -55°C to 125°C

Electrical Characteristics

(Ta=25°C)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|------------------|---|-----------------------|------|------|-----------------|------|
| V _{DD} | Operating Voltage | — | 4.75 | 5.0 | 5.25 | V |
| I _{DD} | Operation Current | — | — | 1.0 | 2.2 | mA |
| V _{IL} | Input Low Voltage (SI0~SI7) | — | 0 | — | 1.5 | V |
| | Input Low Voltage (DATA, CLOCK, SWI) | — | 0 | — | 1.2 | V |
| V _{IH} | Input High Voltage | — | 4 | — | V _{DD} | V |
| V _{OH} | Output High Voltage SWI | I _{OH} =24mA | 4.5 | — | — | V |
| V _{OL} | Output Low Voltage (SCO0~SCO15, SWI) | I _{OL} =10mA | — | — | 0.5 | V |
| | Output Low Voltage (DATA,CLOCK) | I _{OL} =15mA | — | — | 0.5 | V |
| R _{ph} | Internal Pull High Resistance (SI0~SI7) | — | 7 | 10 | 20 | KΩ |
| | Internal Pull High Resistance (CLOCK, DATA) | — | 6 | 8 | 15 | KΩ |
| F _{sys} | System Clock | — | — | 2.0 | — | MHz |

Functional Description

The basic function of the HT6547C is to detect when a keyboard key has been pressed and released and to transmit the according scan code, including make code and break codes, to the system.

The device also accepts commands from the system and responds to the system if necessary. All communication between the keyboard and the system are managed through the CLOCK and DATA pins.

The keyboard begins to scan for pressed or released keys and commands from the system after the BAT (Basic Assurance Test) has been run.

Working Modes

Four working modes are supported by the HT6547C. These are setup by either a DIP switch or by the alternate scan code command F0. The various modes are described as follows.

Mode 0

- Supports code set 1 for PC/XT keyboards.
- Only one way to enter mode 0, that is to set the DIP switch to XT before power on.
- 9 bit data stream, including one start bit (always one) and eight data bits.
- All keys are typematic/make/break.

Note:

The keyboard will stay in mode 1 with the power connected, there is no way to change to other working modes.

Mode 1

- Supports code set 1 for PS/2 model 30 keyboards.
- Set DIP switch to AT/PS2 before power on, supply power, then issue an F0 command followed by a "1".
- 11 bit data stream, including one start bit (always zero) eight data bits, one parity bit (odd parity) and one stop bit (always one).
- All keys are typematic/make/break as default.
- The working mode can be changed again in

this mode, by issuing an F0 command followed by an option. See the F0 command for more detail.

Mode 2

- Supports code set 2 for PC/AT, PS/2 model 50,60 keyboards.
- Set the DIP switch to AT/PS2 before power on for the keyboard to power up in mode 2. The working mode can be changed by an F0 command followed by an option byte 1, 2 or 3 see the F0 command for more details.
- 11 bit data stream, including one start bit (always zero) eight data bits, one parity bit (odd parity) and one stop bit (always one)
- All keys are typematic/make/break as default.

Mode 3

- Supports code set 3, for PS/2 model 80 keyboards.
- Set the DIP switch to AT/PS2 before power on, supply power, then issue an F0 command followed by a "3".
- 11 bit data stream, including one start bit (always zero) eight data bits, one parity bit (odd parity) and one stop bit (always one).

All keys are make as default.

Buffers

The buffers support the following functions:

- 16-byte FIFO buffer: stores 16 keystroke scan codes.
- Additional keystrokes will be ignored.
- Response codes, i.e FA/FE... do not occupy buffer positions.

Basic Assurance Test - BAT

The following functions are offered by the Basic Assurance Test:

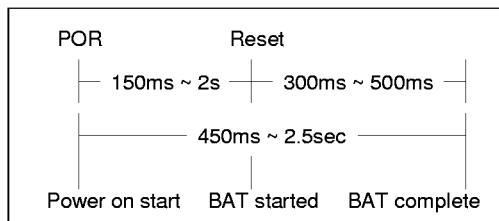
- Turns on LED status indicators.
- Keyboard processor test.
- RAM test.
- Turn off LED status indicators, i.e. the LEDs.
- Reports the BAT result to the system.

Notes

During the BAT, activity on the “clock” and “data” line is ignored. The LEDs are turned on at the beginning and off at the end of the BAT. The BAT takes a minimum of 300ms and a maximum of 500ms. The response to a satisfactory BAT completion is AA-completion and response to BAT failure is an FC-error. The reset keyboard command FF, will also cause the keyboard to execute the BAT. Completion codes are sent between 300 and 500ms after a reset command is acknowledged. After the BAT, the keyboard sets the keys to typematic and make/break, and sets the default typematic rate and delay.

Power-on

Two important activities take place when power is first applied to the keyboard. The first is the H/W signal POR (Power-On-Reset) resets the keyboard processor. The second is that the software BAT (Basic Assurance Test) runs a self test routine.



PC-type/Mode/Code Set

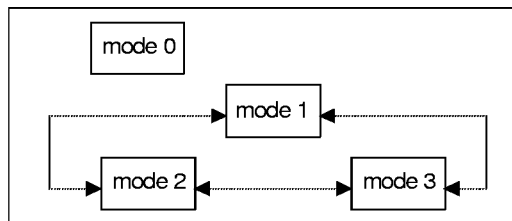
The following table describes the relationship between different computers types, the working mode and the code sets.

| | | |
|---------|--------|------------|
| PC-XT | mode 0 | code set 1 |
| PS/2 30 | mode 1 | code set 1 |
| PC-AT | mode 2 | code set 2 |
| PS/2 50 | mode 2 | code set 2 |
| PS/2 60 | mode 2 | code set 2 |
| PS/2 80 | mode 3 | code set 3 |

The mode can be changed between mode 2 and 3 but not to/from mode 0.

Keys

All keys except the PAUSE key have a make and break code. The PAUSE key has a make code only.



The defaults except for PAUSE are make/break/typematic. In mode 1,2 and 3 the key type may be changed to be one of the following:

- Typematic
- Make/break
- Make
- Typematic/make/break

All keys except PAUSE are typematic. Typematic means that the KB keeps sending make codes if the key is held down.

The data report is according the typematic rate/delay:

Default values are: delay 500ms ± 20%
10.9 char/sec ± 20%

The typematic rate and delay can be modified with the F3 command.

- If two or more keys are held down, only the last key pressed repeats at the typematic rate.

Typematic operation stops when the last key pressed is released even if other keys are still held down.

If a key is pressed and held down while keyboard transmission is inhibited, only the first make code is stored in the buffer overflow as a result of typematic action.

Four key types are supported as shown:

| Key Type | Press | Hold | Release |
|----------------------|-------|-------|---------|
| Typematic | make1 | make2 | X |
| Make/break | make1 | X | break |
| Make | make1 | X | X |
| Typematic/make/break | make1 | make2 | break |

Table of Commands from system

| Note | Command | mode 0 | mode 1 | mode 2 | mode 3 |
|------|--|--------|--------|--------|--------|
| | FF – reset | x | y | y | y |
| | FE – resend | x | y | y | y |
| *** | FD – set key type make | x | y | y | y |
| *** | FC – set key type make/break | x | y | y | y |
| *** | FB – set key type typematic | x | y | y | y |
| | FA – set all keys typematic/make/break | x | y | y | y |
| | F9 – set all keys make | x | y | y | y |
| | F8 – set all keys make/break | x | y | y | y |
| | F7 – set all keys typematic | x | y | y | y |
| | F6 – set default | x | y | y | y |
| | F5 – default disabled | x | y | y | y |
| | F4 – enable | x | y | y | y |
| | F3 – set typematic rate/delay | x | y | y | y |
| ** | F2 – Read ID | x | y | y | y |
| ** | F1 – | x | x | x | x |
| | F0 – select alternate scan codes | x | y | y | y |
| ** | EF – | x | x | x | x |
| | EE – Echo | x | y | y | y |
| | ED – set/reset status indicators | x | y | y | y |

Note:

- make1: send out only one make code.
- make2: continue sending out make codes until key is released.
- x: nothing sent out.

Note:

- ** F1 in the PC/AT standard is a NOP command, but it is an invalid command in the PS/2 standard. This is treated as an invalid command in every working mode
- *** F2 in the PC/AT standard is a NOP command, but it is a Read ID command in the PS/2 standard. The HT6547C treats this command as a read ID command except in mode 0.

The keyboard should respond within 20ms, except when performing the BAT or executing a reset command.

In mode 0 the HT6547C won't accept commands from the system. There are only two actions defined between the system and the HT6547C

- Clock low: indicates the system is requesting

the HT6547C to execute a reset.

- Data low: keyboard disabled.

Command Description
Default disable - F5

- send an acknowledge FA, to the system.
- clear it's output buffer, FIFO.
- sets the default key types.
- set typematic rate/delay as default value.
- clear the last typematic key.
- stop scanning and wait further instruction.

Echo - EE

- send an EE to the system
- continue scanning if the keyboard is enabled

Note: this command does not need to feed back the ACK

Enable - F4

- send an ACK to the system
- clear output buffer
- clear the last typematic key
- start scanning

Invalid command

- send an FE to system
- no further activities.

Note: no ACK

Read ID - F2

- send an ACK to system
- discontinue scanning
- 2 byte ID-AB, 83
the 2nd byte must follow the completion of the first byte within 500ms
- resume scanning

Resend - FE

- * send the last code to the system

Note: * no FA response.

Reset - FF

- disable keyboard
- send an ACK to the system, the keyboard acknowledges the command with an ACK and ensures the system accepts the ACK before executing the command
- the system sets CLK=DATA=high for 500ms: acceptance of ACK
- the system can issue any command to KB within the 500ms period mentioned above to override FF
- if no override, the system performs it's BAT and set to code 2 (even if it is set to be mode 3)

Select Alternate Scan Code - F0

- send an ACK to the system
- clears both output buffer and the typematic key
- accept option byte

Set all keys - F7, F8, F9, FA

- FA: set all keys to typematic/make/break
- F9: set all keys to make
- F8: set all keys to make/break
- F7: set all keys to typematic
- send an ACK to the system
- clear output buffer
- set all keys to the type indicated by the command

Set default - F6

- send an ACK to the system
- clear the output buffer
- set to default key states: default key type typematic rate/delay

Set Key Type-FB,FC,FD

- FB: Set Key Type-Typematic
- FC: Set Key Type-Make/Break
- FD: Set Key Type-Make
- The Keyboard responds with ACK, clears its output buffer;and prepares to receive key identification
- Key identification is accomplished by the system identifying each key by its scan code vales as defined in scan code set3.
- Only scan code set3 values are valid for key identification
- The type of each identified key is set to the value indicated by command
- These commands can be sent using any scan code set,but affect only the operation of scan code set3

Set LED - ED

- send ACK to the system
- discontinue scanning
- wait for the option from the system
- respond with ACK to the system
- set indicator
- if command comes from the system in place of option, discard the set LED function and then process the new command
- LED default after power on - all off
- set default disable - do not change the LEDs

Set typematic rate/delay-F3

- send an ACK to the system
- stop scanning
- wait for the system typematic rate and delay
- send an ACK to the system
- set rate/delay
- bit 6,5 – delay
- bit 4,3,2,1,0 typematic rate
- bit 7=0 (always)

Delay= (1+bit6,bit5) x 250ms

Typematic rate= 1/period

...where period= (8+A) x (2^B) x 0.00417

...where A= binary value of bit 2, 1 and 0

...where B= binary value of bit 4 and 3

| b4~b0 | typematic rate | b4~b0 | typematic rate |
|-------|----------------|-------|----------------|
| 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 |

Default:

- delay: 500ms ± 20%
- typematic rate= 10.9 characters/sec ± 20%

Commands to the system

00: keyboard detect a error/overflow (set 2, set 3)

AB,83: keyboard ID

AA: BAT completion

FC: BAT failure

EE: Echo

FA: Acknowledge

FE: resend

FF: Keyboard detects a overrun (set 1)

- FA: acknowledge

If KB (Keyboard) receives any valid input except EE (echo) and resend (FE) then send an FA to the system first.

If the command is EE, then send an EE back to system.

If the command is FE, then send the last key code to system.

If there is an interrupt while sending FA, KB dircards the FA and accepts the command from the system and processes it.

- 00/FF: Key overrun

If the keyboard detects an overrun error, KB sends a overrun error code to system.

mode 0,1 : FF

mode 2,3 : 00

- FE: resend

KB issues an FE when there is a parity error in transmission.

Data Communications

Data output - AT/PS2 mode only

- If CLK=0, no transmission (keyboard inhibited).
- If CLK=1, DATA=0, no transmission (system request to send).
- If CLK=1, DATA=1, transmission permitted.
- Data will be valid before the trailing edge and beyond the leading edge of the clock.

- KB checks the clock line for an active level at least every 60ms.
- If line contention occurs (system brings the clock low before the tenth clock), set clock=data=high.

Data input - AT/PS2 only

- The system overrides the clock line for at least 60ms
- The keyboard checks the state of the “clock” line at intervals of no more than 10ms
- If a system Request-To-Send is detected, the keyboard counts 11 data bits.
- Data will be valid before the rising edge and beyond the falling edge Note it is not the same as data input.
- After the 10th bit, the keyboard checks for an active level on the “data” line. If the line is active it is forced to be inactive, and counts one more bit.

Note:

This action signals the system that the keyboard has received its data. Upon reception of this signal, the system returns to the ready state, in which it can accept keyboard outputs or goes to the inhibit state until it is ready.

- If the keyboard “data” line is found to be at an inactive level following the 10th bit, a frame error has occurred, and the keyboard continues to count until the “data” line becomes active. The keyboard then makes the “data” line inactive and sends a Resend.

Data stream

| Mode 0 | | Mode 1,2,3 | |
|---------------|-----------------------|-------------------|-------------------------|
| b1: | start bit always 1 | b1: | start bit always 0 |
| b2: | data bit 0 | b2: | data bit 0 |
| b3: | data bit 1 | b3: | data bit 1 |
| b4: | data bit 2 | b4: | data bit 2 |
| b5: | data bit 3 | b5: | data bit 3 |
| b6: | data bit 4 | b6: | data bit 4 |
| b7: | data bit 5 | b7: | data bit 5 |
| b8: | data bit 6 | b8: | data bit 6 |
| b9: | data bit 7 | b9: | data bit 7 |
| | | b10: | parity bit (odd par) |
| | | b11: | stop bit always 1 |

Notes:

Mode 0 is a 9-bit data stream that does not have a parity bit or stop bit and whose start bit is always 1.

The parity bit is either 1 or 0, and the 8 data bits, plus the parity bit, always have an odd number of 1's.

Key Code Set 1

| Key number | make/break code | Key number | make/break code |
|------------|-----------------|------------|-----------------|
| 1 | 29 / A9 | 47 | 2D / AD |
| 2 | 02 / 82 | 48 | 2E / AE |
| 3 | 03 / 83 | 49 | 2F / AF |
| 4 | 04 / 84 | 50 | 30 / B0 |
| 5 | 05 / 85 | 51 | 31 / B1 |
| 6 | 06 / 86 | 52 | 32 / B2 |
| 7 | 07 / 87 | 53 | 33 / B3 |
| 8 | 08 / 88 | 54 | 34 / B4 |
| 9 | 09 / 89 | 55 | 35 / B5 |
| 10 | 0A / 8A | 57 | 36 / B6 |
| 11 | 0B / 8B | 58 | 1D / 9D |
| 12 | 0C / 8C | 60 | 38 / B8 |
| 13 | 0D / 8D | 61 | 39 / B9 |
| 15 | 0E / 8E | 62 | E0 38 / E0 B8 |
| 16 | 0F / 8F | 64 | E0 1D / E0 9D |
| 17 | 10 / 90 | 90 | 45 / C5 |
| 18 | 11 / 91 | 91 | 47 / C7 |
| 19 | 12 / 92 | 92 | 4B / CB |
| 20 | 13 / 93 | 93 | 4F / CF |
| 21 | 14 / 94 | 96 | 48 / C8 |
| 22 | 15 / 95 | 97 | 4C / CC |
| 23 | 16 / 96 | 98 | 50 / D0 |
| 24 | 17 / 97 | 99 | 52 / D2 |
| 25 | 18 / 98 | 100 | 37 / B7 |
| 26 | 19 / 99 | 101 | 49 / C9 |
| 27 | 1A / 9A | 102 | 4D / CD |
| 28 | 1B / 9B | 103 | 51 / D1 |
| * 29 | 2B / AB | 104 | 53 / D3 |
| 30 | 3A / BA | 105 | 4A / CA |
| 31 | 1E / 9E | 106 | 4E / CE |
| 32 | 1F / 9F | 108 | E0 1C / E0 9C |
| 33 | 20 / A0 | 110 | 01 / 81 |
| 34 | 21 / A1 | 112 | 3B / BB |
| 35 | 22 / A2 | 113 | 3C / BC |
| 36 | 23 / A3 | 114 | 3D / BD |
| 37 | 24 / A4 | 115 | 3E / BE |
| 38 | 25 / A5 | 116 | 3F / BF |
| 39 | 26 / A6 | 117 | 40 / C0 |
| 40 | 27 / A7 | 118 | 41 / C1 |
| 41 | 28 / A8 | 119 | 42 / C2 |
| ** 42 | 2B / AB | 120 | 43 / C3 |
| 43 | 1C / 9C | 121 | 44 / C4 |
| 44 | 2A / AA | 122 | 57 / D7 |
| ** 45 | 56 / D6 | 123 | 58 / D8 |
| 46 | 2C / AC | 125 | 46 / C6 |

* 101-Key Keyboard Only
 ** 102-key Keyboard Only

Key Code Set 1

| Key number | base case Shift+Num | Left-Shift | Right-Shift | Num Lock |
|--|--------------------------------|---|--------------------|-----------------|
| 75 | E0 52 | E0 AA E0 52 | E0 B6 E0 52 | E0 2A E0 52 |
| | /E0 D2 | /E0 D2 E0 2A | /E0 D2 E0 36 | /E0 D2 E0 AA |
| 76 | E0 53 | E0 AA E0 53 | E0 B6 E0 53 | E0 2A E0 53 |
| | /E0 D3 | /E0 D3 E0 2A | /E0 D3 E0 36 | /E0 D3 E0 AA |
| 79 | E0 4B | E0 AA E0 4B | E0 B6 E0 4B | E0 2A E0 4B |
| | /E0 CB | /E0 CB E0 2A | /E0 CB E0 36 | /E0 CB E0 AA |
| 80 | E0 47 | E0 AA E0 47 | E0 B6 E0 47 | E0 2A E0 47 |
| | /E0 C7 | /E0 C7 E0 2A | /E0 C7 E0 36 | /E0 C7 E0 AA |
| 81 | E0 4F | E0 AA E0 4F | E0 B6 E0 4F | E0 2A E0 4F |
| | /E0 CF | /E0 CF E0 2A | /E0 CF E0 36 | E0 CF E0 AA |
| 83 | E0 48 | E0 AA E0 48 | E0 B6 E0 48 | E0 2A E0 48 |
| | /E0 C8 | /E0 C8 E0 2A | /E0 C8 E0 36 | E0 C8 E0 AA |
| 84 | E0 50 | E0 AA E0 50 | E0 B6 E0 50 | E0 2A E0 50 |
| | /E0 D0 | /E0 D0 E0 2A | /E0 D0 E0 36 | /E0 D0 E0 AA |
| 85 | E0 49 | E0 AA E0 49 | E0 B6 E0 49 | E0 2A E0 49 |
| | /E0 C9 | /E0 C9 E0 2A | /E0 C9 E0 36 | /E0 C9 E0 AA |
| 86 | E0 51 | E0 AA E0 51 | E0 B6 E0 51 | E0 2A E0 51 |
| | /E0 D1 | /E0 D1 E0 2A | /E0 D1 E0 36 | E0 D1 E0 AA |
| 89 | E0 4D | E0 AA E0 4D | E0 B6 E0 4D | E0 2A E0 4D |
| | /E0 CD | /E0 CD E0 2A | /E0 CD E0 36 | E0 CD E0 AA |
| L Win | E0 5B | E0 AA E0 5B | E0 B6 E0 5B | E0 2A E0 5B |
| | /E0 DB | /E0 DB E0 2A | /E0 DB E0 36 | /E0 DB E0 AA |
| R Win | E0 5C | E0 AA E0 5C | E0 B6 E0 5C | E0 2A E0 5C |
| | /E0 DC | /E0 DC E0 2A | /E0 DC E0 36 | /E0 DC E0 AA |
| APP | E0 5D | E0 AA E0 5D | E0 B6 E0 5D | E0 2A E0 5D |
| | /E0 DD | /E0 DD E0 2A | /E0 DD E0 36 | /E0 DD E0 AA |
| When both shift keys are held down: key number 75 | | Both Shift E0 AA E0 B6 E0 52 / E0 D2 E0 2A E0 36 | | |

| key number | base | +left-shift | +right-shift |
|---|-----------------|---|-----------------------------|
| 95 | E0 35 /E0 B5 | E0 AA E0 35 /E0 B5 E0 2A | E0 B6 E0 35 /E0 B5 E0 36 |
| when both shift keys are held down: key number 95 | | Both Shift E0 AA E0 B6 E0 35 / E0 B5 E0 2A E0 36 | |

| key number | base | +left-shift | +right-shift |
|------------|-----------------------------|-----------------|--------------|
| 124 | E0 2A E0 37 /E0 B7 E0 AA | E0 37 /E0 B7 | 54/D4 |

| key number | base | +Ctrl |
|--|-------------------|-------------|
| 126 | E1 1D 45 E1 9D C5 | E0 46 E0 C6 |
| This key is not typematic, all associated scan codes occur on the make code. | | |

Key Code Set 2

| Key number | make/break code | Key number | make/break code |
|------------|-----------------|------------|------------------|
| 1 | 0E / F0 0E | 47 | 22 / F0 22 |
| 2 | 16 / F0 16 | 48 | 21 / F0 21 |
| 3 | 1E / F0 1E | 49 | 2A / F0 2A |
| 4 | 26 / F0 26 | 50 | 32 / F0 32 |
| 5 | 25 / F0 25 | 51 | 31 / F0 31 |
| 6 | 2E / F0 2E | 52 | 3A / F0 3A |
| 7 | 36 / F0 36 | 53 | 41 / F0 41 |
| 8 | 3D / F0 3D | 54 | 49 / F0 49 |
| 9 | 3E / F0 3E | 55 | 4A / F0 4A |
| 10 | 46 / F0 46 | 57 | 59 / F0 59 |
| 11 | 45 / F0 45 | 58 | 14 / F0 14 |
| 12 | 4E / F0 4E | 60 | 11 / F0 11 |
| 13 | 55 / F0 55 | 61 | 29 / F0 29 |
| 15 | 66 / F0 66 | 62 | E0 11 / E0 F0 11 |
| 16 | 0D / F0 0D | 64 | E0 14 / E0 F0 14 |
| 17 | 15 / F0 15 | 90 | 77 / F0 77 |
| 18 | 1D / F0 1D | 91 | 6C / F0 6C |
| 19 | 24 / F0 24 | 92 | 6B / F0 6B |
| 20 | 2D / F0 2D | 93 | 69 / F0 69 |
| 21 | 2C / F0 2C | 96 | 75 / F0 75 |
| 22 | 35 / F0 35 | 97 | 73 / F0 73 |
| 23 | 3C / F0 3C | 98 | 72 / F0 72 |
| 24 | 43 / F0 43 | 99 | 70 / F0 70 |
| 25 | 44 / F0 44 | 100 | 7C / F0 7C |
| 26 | 4D / F0 4D | 101 | 7D / F0 7D |
| 27 | 54 / F0 54 | 102 | 74 / F0 74 |
| 28 | 5B / F0 5B | 103 | 7A / F0 7A |
| * 29 | 5D / F0 5D | 104 | 71 / F0 71 |
| 30 | 58 / F0 58 | 105 | 7B / F0 7B |
| 31 | 1C / F0 1C | 106 | 79 / F0 79 |
| 32 | 1B / F0 1B | 108 | E0 5A / E0 F0 5A |
| 33 | 23 / F0 23 | 110 | 76 / F0 76 |
| 34 | 2B / F0 2B | 112 | 05 / F0 05 |
| 35 | 34 / F0 34 | 113 | 06 / F0 06 |
| 36 | 33 / F0 33 | 114 | 04 / F0 04 |
| 37 | 3B / F0 3B | 115 | 0C / F0 0C |
| 38 | 42 / F0 42 | 116 | 03 / F0 03 |
| 39 | 4B / F0 4B | 117 | 0B / F0 0B |
| 40 | 4C / F0 4C | 118 | 83 / F0 83 |
| 41 | 52 / F0 52 | 119 | 0A / F0 0A |
| ** 42 | 5D / F0 5D | 120 | 01 / F0 01 |
| 43 | 5A / F0 5A | 121 | 09 / F0 09 |
| 44 | 12 / F0 12 | 122 | 78 / F0 78 |
| ** 45 | 61 / F0 61 | 123 | 07 / F0 07 |
| 46 | 1A / F0 1A | 125 | 7E / F0 7E |

* 101–Key Keyboard Only
 ** 102–key Keyboard Only

Key Code Set 2

| Key number | base case Shift+Num | Left-Shift | Right-Shift | Num Lock |
|---|---------------------|-----------------------------------|--|-----------------------------------|
| 75 | E0 70 /E0 F0 72 | E0 F0 12 E0 70 /E0 F0 70 E0 12 | E0 F0 59 E0 70 /E0 F0 70 E0 59 | E0 12 E0 70 /E0 F0 70 E0 F0 12 |
| 76 | E0 71 /E0 F0 71 | E0 F0 12 E0 70 /E0 F0 71 E0 12 | E0 F0 59 E0 71 /E0 F0 71 E0 59 | E0 12 E0 71 /E0 F0 71 E0 F0 12 |
| 79 | E0 6B /E0 F0 6B | E0 F0 12 E0 70 /E0 F0 6B E0 12 | E0 F0 59 E0 6B /E0 F0 6B E0 59 | E0 12 E0 6B /E0 F0 6B E0 F0 12 |
| 80 | E0 6C /E0 F0 6C | E0 F0 12 E0 70 /E0 F0 6C E0 12 | E0 F0 59 E0 6C /E0 F0 6C E0 59 | E0 12 E0 6C /E0 F0 6C E0 F0 12 |
| 81 | E0 69 /E0 F0 69 | E0 F0 12 E0 70 /E0 F0 69 E0 12 | E0 F0 59 E0 69 /E0 F0 69 E0 59 | E0 12 E0 69 /E0 F0 69 E0 F0 12 |
| 83 | E0 75 /E0 F0 75 | E0 F0 12 E0 70 /E0 F0 75 E0 12 | E0 F0 59 E0 75 /E0 F0 75 E0 59 | E0 12 E0 75 /E0 F0 75 E0 F0 12 |
| 84 | E0 72 /E0 F0 72 | E0 F0 12 E0 70 /E0 F0 72 E0 12 | E0 F0 59 E0 72 /E0 F0 72 E0 59 | E0 12 E0 72 /E0 F0 72 E0 F0 12 |
| 85 | E0 7D /E0 F0 7D | E0 F0 12 E0 70 /E0 F0 7D E0 12 | E0 F0 59 E0 7D /E0 F0 7D E0 59 | E0 12 E0 7D /E0 F0 7D E0 F0 12 |
| 86 | E0 7A /E0 F0 7A | E0 F0 12 E0 70 /E0 F0 7A E0 12 | E0 F0 59 E0 7A /E0 F0 7A E0 59 | E0 12 E0 7A /E0 F0 7A E0 F0 12 |
| 89 | E0 74 /E0 F0 74 | E0 F0 12 E0 70 /E0 F0 74 E0 12 | E0 F0 59 E0 74 /E0 F0 74 E0 59 | E0 12 E0 74 /E0 F0 74 E0 F0 12 |
| L Win | E0 1F /E0 F0 1F | E0 F0 12 1F /E0 F0 1F E0 12 | E0 F0 59 E0 1F /E0 F0 1F E0 59 | E0 12 E0 1F /E0 F0 1F E0 F0 12 |
| | E0 27 /E0 F0 27 | E0 F0 12 27 /E0 F0 27 E0 12 | E0 F0 59 E0 27 /E0 F0 27 E0 59 | E0 59 E0 27 /E0 F0 27 E0 F0 12 |
| R Win | E0 27 /E0 F0 27 | E0 F0 12 27 /E0 F0 27 E0 12 | E0 F0 59 E0 27 /E0 F0 27 E0 59 | E0 59 E0 27 /E0 F0 27 E0 F0 12 |
| | E0 2F /E0 F0 2F | E0 F0 12 2F /E0 F0 2F E0 12 | E0 F0 59 E0 2F /E0 F0 2F E0 59 | E0 59 E0 2F /E0 F0 2F E0 F0 59 |
| when both shift keys are held down: key number 75 | | | Both Shift E0 F0 12 E0 F0 59 E0 70 /E0 F0 70 E0 12 E0 59 | |

| key number | base | +left-shift | +right-shift |
|---|--------------------|--|-----------------------------------|
| 95 | E0 4A /E0 F0 4A | E0 F0 12 E0 4A /E0 F0 4A E0 12 | E0 F0 59 E0 4A /E0 F0 4A E0 59 |
| when both shift keys are held down: key number 95 | | Both Shift E0 F0 12 E0 F0 59 E0 4A / E0 F0 4A E0 12 E0 59 | |

| key number | base | +Shift / +Ctrl | +Alt |
|------------|--------------------------------|--------------------|------------|
| 124 | E0 12 E0 7C /E0 F0 7C E0 12 | E0 7C /E0 F0 7C | 84 / F0 84 |

| key number | base | +Ctrl |
|--|-------------------------|----------------|
| 126 | E1 14 77 E1 F0 14 F0 77 | E0 7E E0 F0 7E |
| Note: this key is not typematic, all associated scan codes occur on the make of the key. | | |

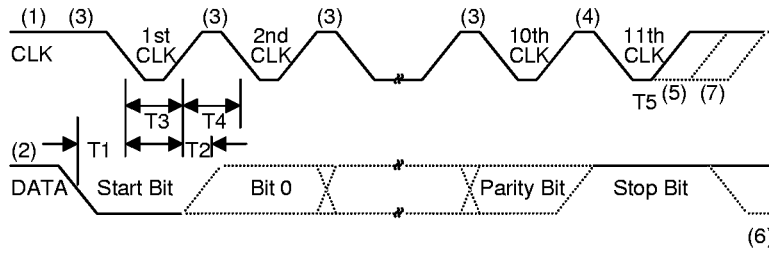
Key Code Set 3

| Key # | make/break code | Note | Default Key State | Key # | make/break code | Note | Default Key State |
|-------|-----------------|------|-------------------|-------|-----------------|------|-------------------|
| 1 | 0E / F0 0E | | Typematic | 53 | 41 / F0 41 | | Typematic |
| 2 | 16 / F0 16 | | Typematic | 54 | 49 / F0 49 | | Typematic |
| 3 | 1E / F0 1E | | Typematic | 55 | 4A / F0 4A | | Typematic |
| 4 | 26 / F0 26 | | Typematic | 57 | 59 / F0 59 | | Make/Break |
| 5 | 25 / F0 25 | | Typematic | 58 | 11 / F0 11 | *** | Make/Break |
| 6 | 2E / F0 2E | | Typematic | 60 | 19 / F0 19 | *** | Make/Break |
| 7 | 36 / F0 36 | | Typematic | 61 | 29 / F0 29 | | Typematic |
| 8 | 3D / F0 3D | | Typematic | 62 | 39 / F0 39 | *** | Make Only |
| 9 | 3E / F0 3E | | Typematic | 64 | 58 / E0 58 | *** | Make Only |
| 10 | 46 / F0 46 | | Typematic | 75 | 67 / F0 67 | *** | Make Only |
| 11 | 45 / F0 45 | | Typematic | 76 | 64 / F0 64 | *** | Typematic |
| 12 | 4E / F0 4E | | Typematic | 79 | 61 / F0 61 | *** | Typematic |
| 13 | 55 / F0 55 | | Typematic | 80 | 6E / F0 6E | *** | Make Only |
| 15 | 66 / F0 66 | | Typematic | 81 | 65 / F0 65 | *** | Make Only |
| 16 | 0D / F0 0D | | Typematic | 83 | 63 / F0 63 | *** | Typematic |
| 17 | 15 / F0 15 | | Typematic | 84 | 60 / F0 60 | *** | Typematic |
| 18 | 1D / F0 1D | | Typematic | 85 | 6F / F0 60 | *** | Make Only |
| 19 | 24 / F0 24 | | Typematic | 86 | 6D / F0 6D | *** | Make Only |
| 20 | 2D / F0 2D | | Typematic | 89 | 6A / F0 6A | *** | Typematic |
| 21 | 2C / F0 2C | | Typematic | 90 | 76 / F0 76 | *** | Make Only |
| 22 | 35 / F0 35 | | Typematic | 91 | 6C / F0 6C | | Make Only |
| 23 | 3C / F0 3C | | Typematic | 92 | 6B / F0 6B | | Make Only |
| 24 | 43 / F0 43 | | Typematic | 93 | 69 / F0 69 | | Make Only |
| 25 | 44 / F0 44 | | Typematic | 95 | 77 / F0 77 | *** | Make Only |
| 26 | 4D / F0 4D | | Typematic | 96 | 75 / F0 75 | | Make Only |
| 27 | 54 / F0 54 | | Typematic | 97 | 73 / F0 73 | | Make Only |
| 28 | 5B / F0 5B | | Typematic | 98 | 72 / F0 72 | | Make Only |
| * 29 | 5C / F0 5C | ** | Typematic | 99 | 70 / F0 70 | | Make Only |
| 30 | 14 / F0 14 | ** | Make/Break | 100 | 7E / F0 7E | | Make Only |
| 31 | 1C / F0 1C | | Typematic | 101 | 7D / F0 7D | | Make Only |
| 32 | 1B / F0 1B | | Typematic | 102 | 74 / F0 74 | | Make Only |
| 33 | 23 / F0 23 | | Typematic | 103 | 7A / F0 7A | | Make Only |
| 34 | 2B / F0 2B | | Typematic | 104 | 71 / F0 71 | | Make Only |
| 35 | 34 / F0 34 | | Typematic | 105 | 84 / F0 84 | *** | Make Only |
| 36 | 33 / F0 33 | | Typematic | 106 | 7C / F0 7C | *** | Typematic |
| 37 | 3B / F0 3B | | Typematic | 108 | 79 / F0 79 | *** | Make Only |
| 38 | 42 / F0 42 | | Typematic | 110 | 08 / F0 08 | *** | Make Only |
| 39 | 4B / F0 4B | | Typematic | 112 | 07 / F0 07 | *** | Make Only |
| 40 | 4C / F0 4C | | Typematic | 113 | 0F / F0 0F | *** | Make Only |
| 41 | 52 / F0 52 | | Typematic | 114 | 17 / F0 17 | *** | Make Only |
| ** 42 | 5D / F0 5D | *** | Typematic | 115 | 1F / F0 1F | *** | Make Only |
| 43 | 5A / F0 5A | | Typematic | 116 | 27 / F0 27 | *** | Make Only |
| 44 | 12 / F0 12 | | Make/Break | 117 | 2F / F0 2F | *** | Make Only |
| ** 45 | 13 / F0 13 | *** | Typematic | 118 | 37 / F0 /37 | *** | Make Only |
| 46 | 1A / F0 1A | | Typematic | 119 | 3F / F0 3F | *** | Make Only |
| 47 | 22 / F0 22 | | Typematic | 120 | 47 / F0 47 | *** | Make Only |
| 48 | 21 / F0 21 | | Typematic | 121 | 4F / F0 4F | *** | Make Only |
| 49 | 2A / F0 2A | | Typematic | 122 | 56 / F0 56 | *** | Make Only |
| 50 | 32 / F0 32 | | Typematic | 123 | 5E / F0 5E | *** | Make Only |
| 51 | 31 / F0 31 | | Typematic | 124 | 57 / F0 57 | *** | Make Only |
| 52 | 3A / F0 3A | | Typematic | 125 | 5F / F0 5F | *** | Make Only |
| L Win | 8B/F0 8B | | Make/Break | 126 | 62 / F0 62 | *** | Make Only |
| R Win | 8C/F0 8C | | Make/Break | APP | 8D/F0 8D | *** | Make/Break |

* 101–Key Keyboard Only
 ** 102–key Keyboard Only
 *** different from code set 2

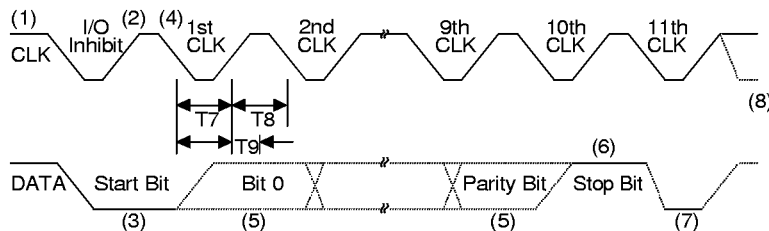
Timing Charts

Data output



| Timing Parameter | Min/Max |
|---|------------------|
| T1 DATA transition to the falling edge of CLK | 5/25 μ sec |
| T2 Rising edge of CLK to DATA transition | 5/T4-5 μ sec |
| T3 Duration of CLK inactive | 30/50 μ sec |
| T4 Duration of CLK active | 30/50 μ sec |
| T5 Time to auxiliary device inhibit after clock 11 to ensure the auxiliary device does not start another transmission | >0/50 μ sec |

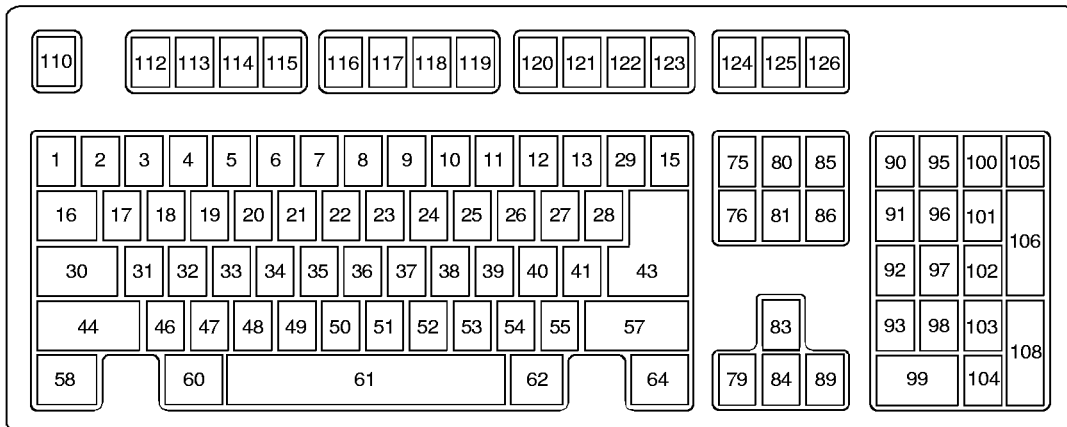
Keyboard data input



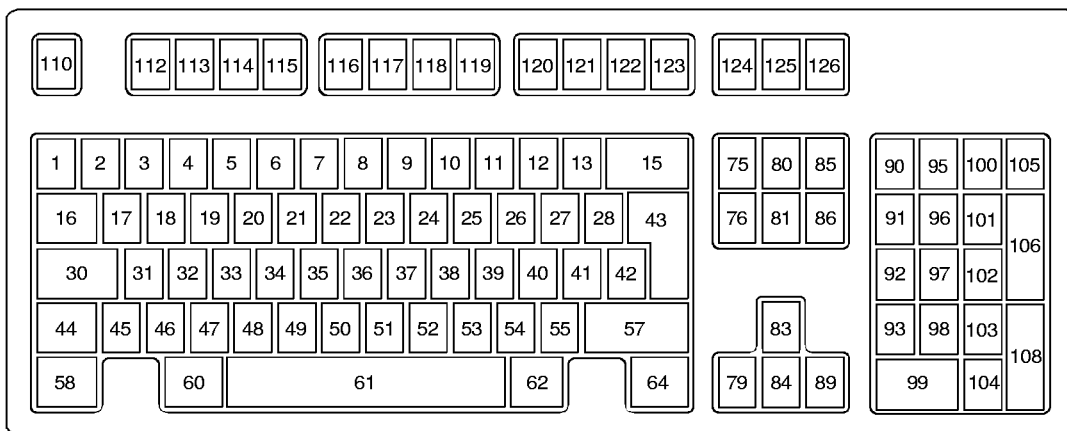
| Timing Parameter | Min/Max |
|---|-----------------|
| T7 Duration of CLK inactive | 30/50 μ sec |
| T8 Duration of CLK active | 30/50 μ sec |
| T9 Time from inactive to active CLK transition, used to time when the auxiliary device samples DATA | 5/25 μ sec |

The Keyboard Layout

1. The 101 key keyboard

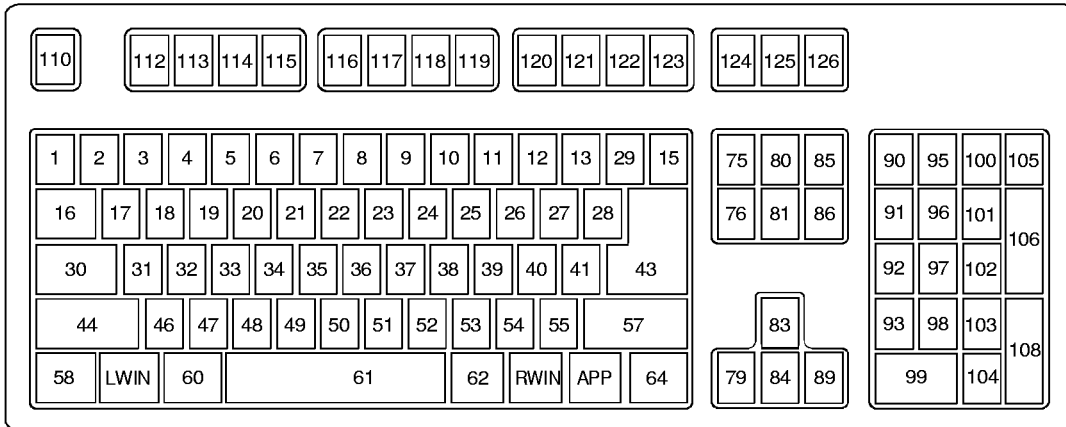


2. The 102 key keyboard

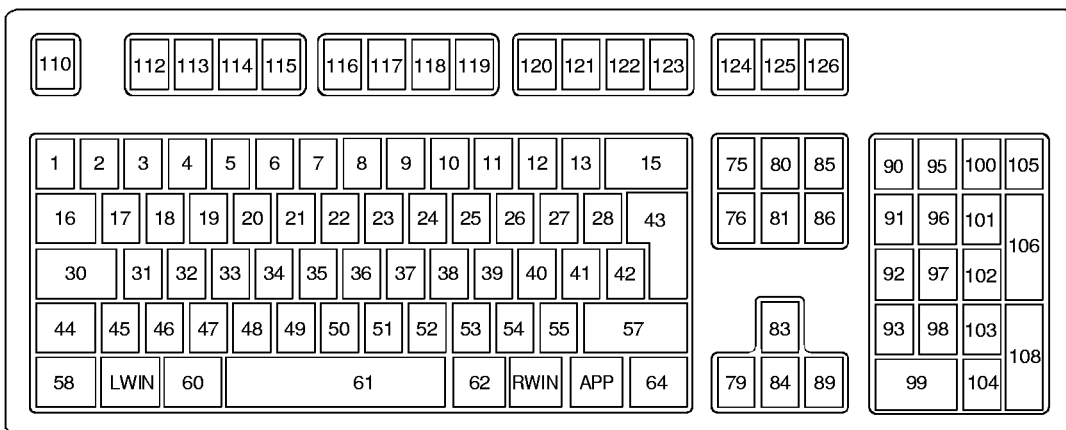


Application Circuit

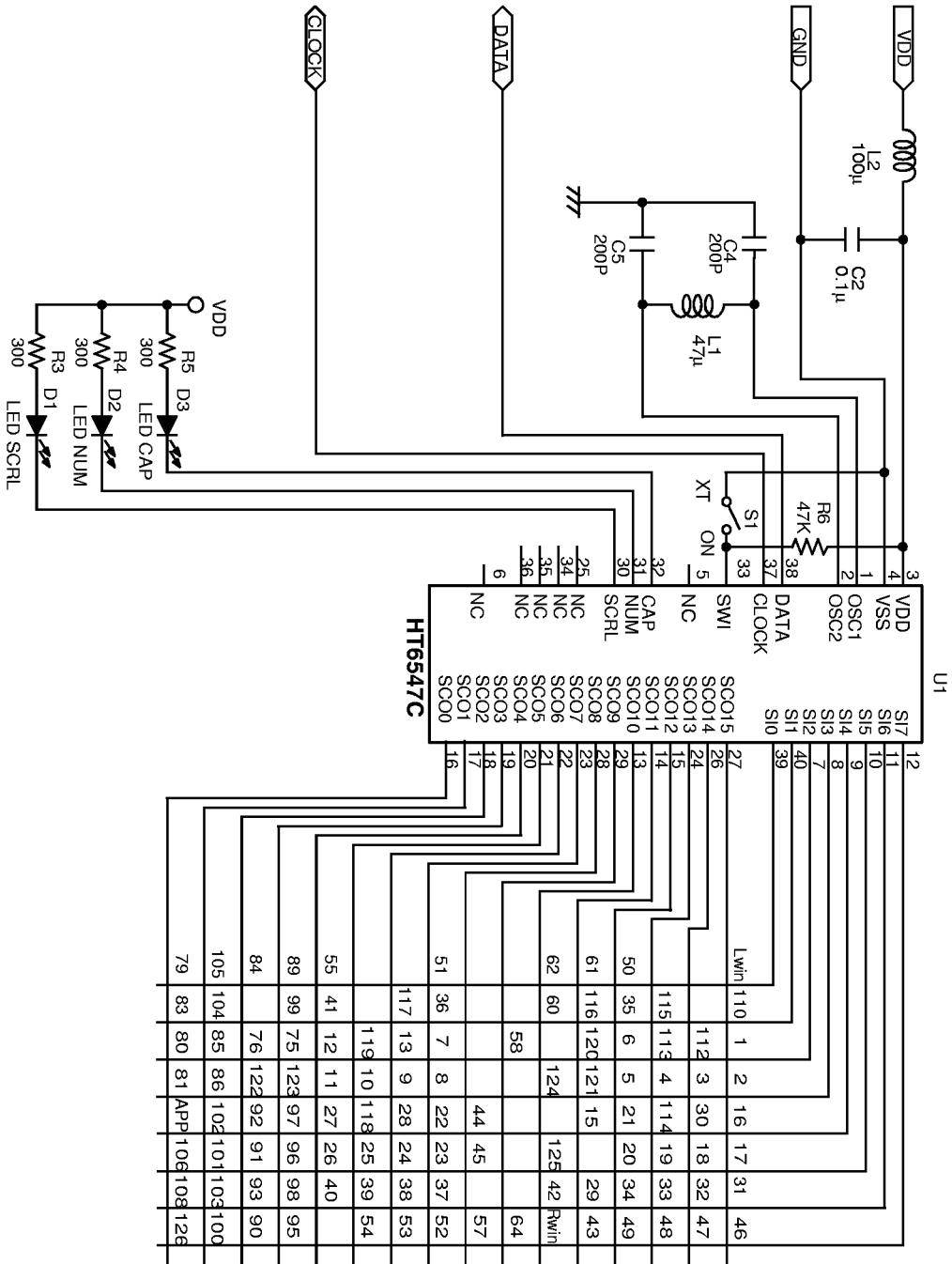
1. The 104 key keyboard



2. The 105 key keyboard



Application Circuit



Application Circuit (AT Only)

