HOLTEK

HT6547C
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
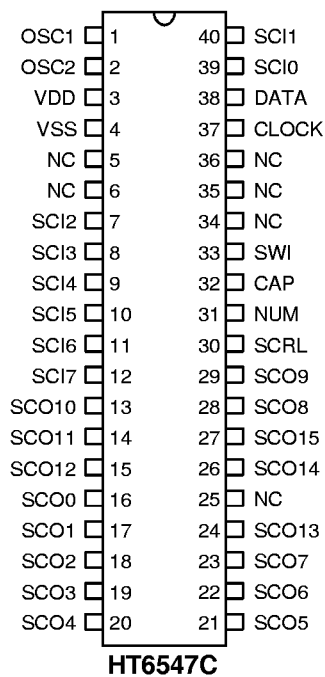- 101-key or 102-key application
- 40 Pin dual-in-line package

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

OSC1	1	40	SCI1
OSC2	2	39	SCI0
VDD	3	38	DATA
VSS	4	37	CLOCK
NC	5	36	NC
NC	6	35	NC
SCI2	7	34	NC
SCI3	8	33	SWI
SCI4	9	32	CAP
SCI5	10	31	NUM
SCI6	11	30	SCRL
SCI7	12	29	SCO9
SCO10	13	28	SCO8
SCO11	14	27	SCO15
SCO12	15	26	SCO14
SCO0	16	25	NC
SCO1	17	24	SCO13
SCO2	18	23	SCO7
SCO3	19	22	SCO6
SCO4	20	21	SCO5

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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

Input Voltage .... V_{SS}–0.3V to V_{DD}+0.3V

Operating Temperature .... 0°C to 70°C

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

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Functional Description

The basic function of the HT6547C is to detect when a keyboaord 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 keystoke scan codes.
- Additional keystokes will be ignored.
- Response codes, i.e FA/FE... do not occupy buffer positions.

Basic Assurance Test - BAT

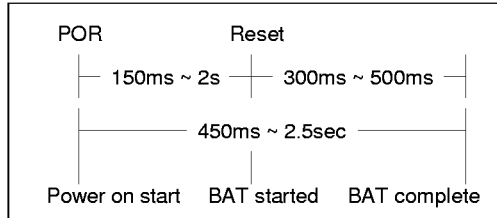The following functions are offered by the Basic Assurance Test:

- 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.

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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.

```
POR              Reset
  ├── 150ms ~ 2s ──┼── 300ms ~ 500ms ──┤
  ├────────── 450ms ~ 2.5sec ──────────┤
  │               │
Power on start  BAT started   BAT complete
```
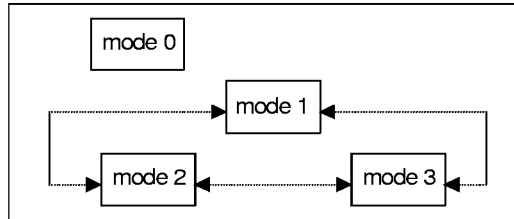
PC-type/Mode/Code Set

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 suported 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 sequesting 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:
aceptance 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 com-
mand

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, clear
s its output buffer;and prepares to receive
key identification

• Key identification is accomplished by the sys-
tem 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/overrun (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 it's 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 allways 1	b1:	start bit allways 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 allways 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.

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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 D2	E0 AA E0 52 /E0 D2 E0 2A	E0 B6 E0 52 /E0 D2 E0 36	E0 2A E0 52 /E0 D2 E0 AA
76	E0 53 /E0 D3	E0 AA E0 53 /E0 D3 E0 2A	E0 B6 E0 53 /E0 D3 E0 36	E0 2A E0 53 /E0 D3 E0 AA
79	E0 4B /E0 CB	E0 AA E0 4B /E0 CB E0 2A	E0 B6 E0 4B /E0 CB E0 36	E0 2A E0 4B /E0 CB E0 AA
80	E0 47 /E0 C7	E0 AA E0 47 /E0 C7 E0 2A	E0 B6 E0 47 /E0 C7 E0 36	E0 2A E0 47 /E0 C7 E0 AA
81	E0 4F /E0 CF	E0 AA E0 4F /E0 CF E0 2A	E0 B6 E0 4F /E0 CF E0 36	E0 2A E0 4F E0 CF E0 AA
83	E0 48 /E0 C8	E0 AA E0 48 /E0 C8 E0 2A	E0 B6 E0 48 /E0 C8 E0 36	E0 2A E0 48 E0 C8 E0 AA
84	E0 50 /E0 D0	E0 AA E0 50 /E0 D0 E0 2A	E0 B6 E0 50 /E0 D0 E0 36	E0 2A E0 50 /E0 D0 E0 AA
85	E0 49 /E0 C9	E0 AA E0 49 /E0 C9 E0 2A	E0 B6 E0 49 /E0 C9 E0 36	E0 2A E0 49 /E0 C9 E0 AA
86	E0 51 /E0 D1	E0 AA E0 51 /E0 D1 E0 2A	E0 B6 E0 51 /E0 D1 E0 36	E0 2A E0 51 E0 D1 E0 AA
89	E0 4D /E0 CD	E0 AA E0 4D /E0 CD E0 2A	E0 B6 E0 4D /E0 CD E0 36	E0 2A E0 4D E0 CD E0 AA
L Win	E0 5B /E0 DB	E0 AA E0 5B /E0 DB E0 2A	E0 B6 E0 5B /E0 DB E0 36	E0 2A E0 5B /E0 DB E0 AA
R Win	E0 5C /E0 DC	E0 AA E0 5C /E0 DC E0 2A	E0 B6 E0 5C /E0 DC E0 36	E0 2A E0 5C /E0 DC E0 AA
APP	E0 5D /E0 DD	E0 AA E0 5D /E0 DD E0 2A	E0 B6 E0 5D /E0 DD E0 36	E0 2A E0 5D /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			

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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 12 E0 70	E0 F0 59 E0 70	E0 12 E0 70
	/E0 F0 72	/E0 F0 70 E0 12	/E0 F0 70 E0 59	/E0 F0 70 E0 F0 12
76	E0 71	E0 F0 12 E0 70	E0 F0 59 E0 71	E0 12 E0 71
	/E0 F0 71	/E0 F0 71 E0 12	/E0 F0 71 E0 59	/E0 F0 71 E0 F0 12
79	E0 6B	E0 F0 12 E0 70	E0 F0 59 E0 6B	E0 12 E0 6B
	/E0 F0 6B	/E0 F0 6B E0 12	/E0 F0 6B E0 59	/E0 F0 6B E0 F0 12
80	E0 6C	E0 F0 12 E0 70	E0 F0 59 E0 6C	E0 12 E0 6C
	/E0 F0 6C	/E0 F0 6C E0 12	/E0 F0 6C E0 59	/E0 F0 6C E0 F0 12
81	E0 69	E0 F0 12 E0 70	E0 F0 59 E0 69	E0 12 E0 69
	/E0 F0 69	/E0 F0 69 E0 12	/E0 F0 69 E0 59	/E0 F0 69 E0 F0 12
83	E0 75	E0 F0 12 E0 70	E0 F0 59 E0 75	E0 12 E0 75
	/E0 F0 75	/E0 F0 75 E0 12	/E0 F0 75 E0 59	/E0 F0 75 E0 F0 12
84	E0 72	E0 F0 12 E0 70	E0 F0 59 E0 72	E0 12 E0 72
	/E0 F0 72	/E0 F0 72 E0 12	/E0 F0 72 E0 59	/E0 F0 72 E0 F0 12
85	E0 7D	E0 F0 12 E0 70	E0 F0 59 E0 7D	E0 12 E0 7D
	/E0 F0 7D	/E0 F0 7D E0 12	/E0 F0 7D E0 59	/E0 F0 7D E0 F0 12
86	E0 7A	E0 F0 12 E0 70	E0 F0 59 E0 7A	E0 12 E0 7A
	/E0 F0 7A	/E0 F0 7A E0 12	/E0 F0 7A E0 59	/E0 F0 7A E0 F0 12
89	E0 74	E0 F0 12 E0 70	E0 F0 59 E0 74	E0 12 E0 74
	/E0 F0 74	/E0 F0 74 E0 12	/E0 F0 74 E0 59	/E0 F0 74 E0 F0 12
L Win	E0 1F	E0 F0 12 1F	E0 F0 59 E0 1F	E0 12 E0 1F
	/E0 F0 1F	/E0 F0 1F E0 12	/E0 F0 1F E0 59	/E0 F0 1F E0 F0 12
R Win	E0 27	E0 F0 12 27	E0 F0 59 E0 27	E0 59 E0 27
	/E0 F0 27	/E0 F0 27 E0 12	/E0 F0 27 E0 59	/E0 F0 27 E0 F0 12
APP	E0 2F	E0 F0 12 2F	E0 F0 59 E0 2F	E0 59 E0 2F
	/E0 F0 2F	/E0 F0 2F E0 12	/E0 F0 2F E0 59	/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

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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.		

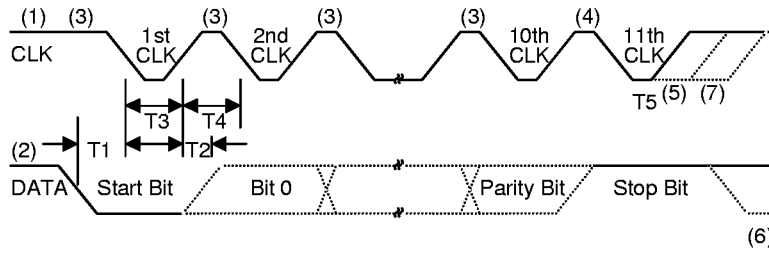3rd Mar 97'

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
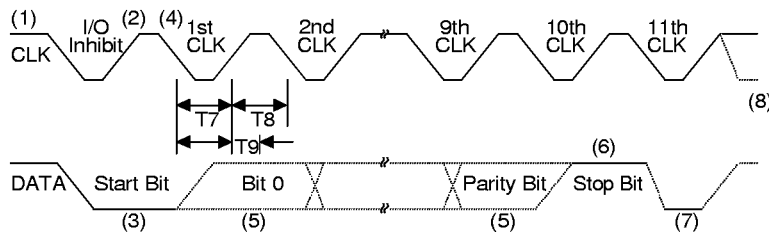*** different from code set 2

Timing Charts

Data output

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

Keyboard data input

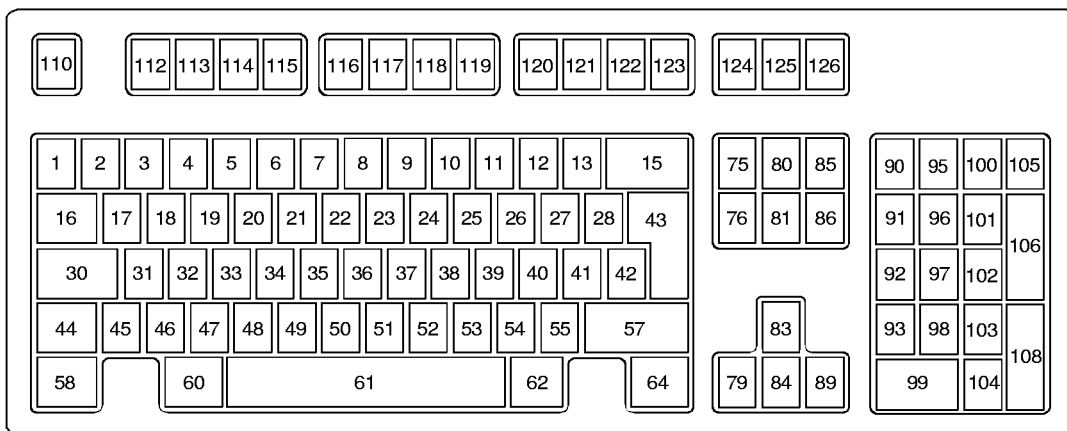|	Timing Parameter	Min/Max
T7	Duration of CLK inactive	30/50μsec
T8	Duration of CLK active	30/50μsec
T9	Time from inactive to active CLK transition, used to time when the auxiliary device samples DATA	5/25 μsec

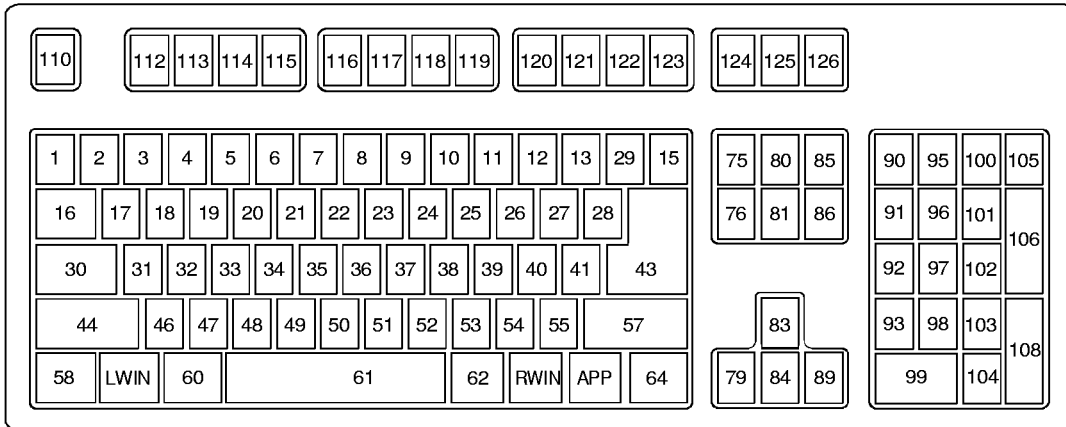3rd Mar 97'

The Keyboard Layout
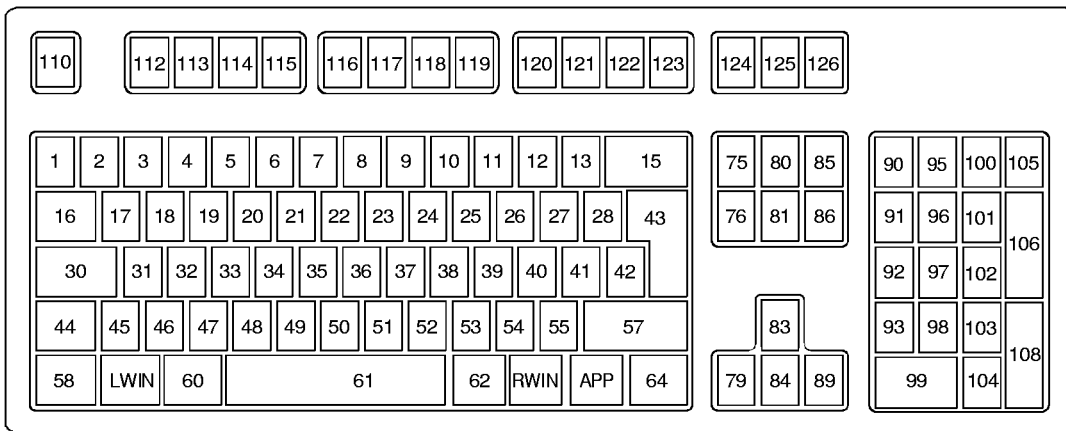
1. The 101 key keyboard

| 110 | | 112 | 113 | 114 | 115 | | 116 | 117 | 118 | 119 | | 120 | 121 | 122 | 123 | | 124 | 125 | 126 |

1	2	3	4	5	6	7	8	9	10	11	12	13	29	15		75	80	85		90	95	100	105
16	17	18	19	20	21	22	23	24	25	26	27	28			76	81	86		91	96	101	106
30	31	32	33	34	35	36	37	38	39	40	41	43						92	97	102
44	46	47	48	49	50	51	52	53	54	55	57		83		93	98	103	108
58	60	61	62	64		79	84	89		99	104

2. The 102 key keyboard

| 110 | | 112 | 113 | 114 | 115 | | 116 | 117 | 118 | 119 | | 120 | 121 | 122 | 123 | | 124 | 125 | 126 |

1	2	3	4	5	6	7	8	9	10	11	12	13	15		75	80	85		90	95	100	105
16	17	18	19	20	21	22	23	24	25	26	27	28	43		76	81	86		91	96	101	106
30	31	32	33	34	35	36	37	38	39	40	41	42						92	97	102
44	45	46	47	48	49	50	51	52	53	54	55	57		83		93	98	103	108
58	60	61	62	64		79	84	89		99	104

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Application Circuit

1. The 104 key keyboard

2. The 105 key keyboard

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Application Circuit

Application Circuit (AT Only)