

### Features

- Designed for Windows 95/98/NT
- Supports 3 Windows 95 Keys
- Supports Power, Sleep and Wake-up Windows 98 ACPI functions
- Supports Japanese, Korean and Portuguese
- Supports Japanese DOS/V 106-key keyboard
- Supports code set 1, for PS/2 model 30 keyboard
- Supports code set 2, for PC/AT, PS/2 model 50,60 keyboards
- Supports code set 3, for PS/2 model 80 keyboard
- RC oscillator
- Phantom key detection
- Minimal external components
- Pin-compatible with Holtek HT6547E-2
- 40-pin DIP/DICE form

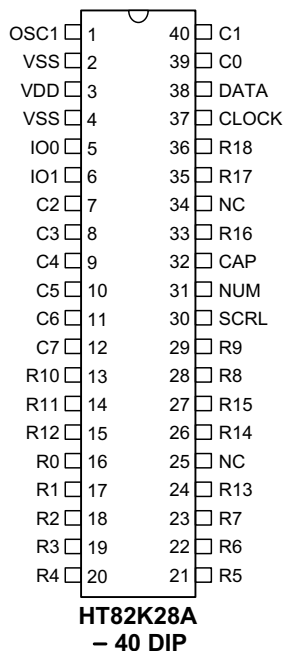
### General Description

The HT82K28A is a keyboard encoder especially designed for IBM PC/AT, IBM PS/2 and all compatible machines.

The HT82K28A accepts keyboard inputs and contains a 16-character first-in-first-out buffer

in which data is stored. An inexpensive RC oscillator can be used for the system clock. The device offers the advantage of simple implementation in high performance and low cost keyboard applications.

### Pin Assignment



**Pin Description**

Pin No.	Pin Name	I/O	Description
1	OSC1	I	System clock input
2, 4	VSS	—	Negative power supply, ground
3	VDD	—	Positive power supply
5, 6	IO0~IO1	O	Customer defined optional output lines
39, 40, 7~12	C0~C7	I	Keyboard matrix scanning input pins
16~23, 28, 29, 13~15 24, 26, 27 33, 35	R0~R18	O	Keyboard matrix scanning output pins
25, 34	NC	—	No connection
30	SCRL	O	LED pin
31	NUM	O	LED pin
32	CAP	O	LED pin
37	CLOCK	I/O	Synchronous clock signal. Used to clock the transmission data
38	DATA	I/O	Bidirectional data transmission line

**Absolute Maximum Ratings**

Supply Voltage.....4.75V to 5.25V      Input Voltage..... $V_{SS}-0.3V$  to  $V_{DD}+0.3V$   
Storage Temperature..... $-55^{\circ}C$  to  $125^{\circ}C$       Operating Temperature ..... $0^{\circ}C$  to  $70^{\circ}C$

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

**Electrical Characteristics**
 $T_a=25^{\circ}\text{C}$ 

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{DD}$	Operating Voltage	—	4.75	5	5.25	V
$I_{DD}$	Operating Current	—	—	2	5	mA
$V_{IL}$	Input Low Voltage (C0~C7)	—	0	—	0.6	V
	Input Low Voltage (DATA, CLOCK)	—	0	—	0.6	V
$V_{IH}$	Input High Voltage	—	3.5	—	$V_{DD}$	V
$V_{OL}$	Output Low Voltage (R0~R18)	$I_{OL}=10\text{mA}$	—	—	0.5	V
	Output Low Voltage (DATA, CLOCK)	$I_{OL}=15\text{mA}$	—	—	0.5	V
$R_{ph}$	Internal Pull-high Resistance (C0~C7)	—	5	10	20	$k\Omega$
	Internal Pull-high Resistance (CLOCK, DATA)	—	2	5	15	$k\Omega$
$f_{SYS}$	System Clock	—	—	4	—	MHz

## Functional Description

The HT82K28A basic function is to detect key press and release activity and to transmit the corresponding scan code, as well as make 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 is 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

Three working modes are supported by the HT82K28A. These are setup by the alternate scan code command F0. The various modes are described as follows.

#### Mode 1

- Supports code set 1 for PS/2 model 30 keyboards.
- Enters mode1 after an F0 Command is issued followed by a 1".
- Contains an 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.
- Enters mode 2 after power on.  
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.
- Contains an 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.
- Enters mode 3 when an F0 command is issued followed by a 3".
- Contains an 11 bit data stream, including one start bit (always zero) eight data bits, one parity bit (odd parity) and one stop bit (always one).

#### Buffers

The buffers support the following functions:

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

#### Basic assurance test – BAT

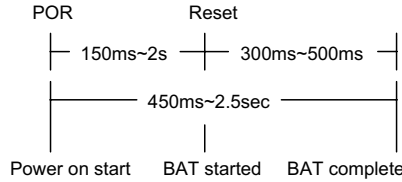
The following functions are offered by the Basic Assurance Test:

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

Note: During the BAT, activity on the "clock" and "data" line are ignored. The LED's are turned on at the beginning and turned off at the end of the BAT. The BAT takes a minimum of 450ms after POR and a maximum of 2.5s. The response to a satisfactory BAT completion is "AA" 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 presence of an H/W signal POR (Power-On-Reset) that resets the keyboard processor. The second activity is the running of the self test BAT (Basic Assurance Test) routine.



**PC-type/mode/code set**

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

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

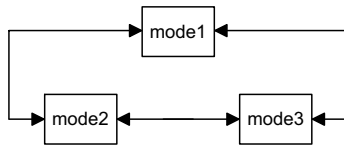
The mode can be changed between mode 2 & 3.

**Keys**

- For code set 1, 2

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 to 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

Note: "make1" send out only one make code.

"Make2" continue sending out make codes until key is released.

"X" nothing sent out.

- For code set 3
  - Typematic
  - Make/break
  - Make
  - Typematic/make/break
 Can be configured by command

**Time interval between phantoms**

The time interval between two continuous error codes 00/FF sent while phantom detected= 1000ms ± 20%

**System command table**

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

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

**Command description**

- Default disable – F5
  - ♦ Send an acknowledge FA to the system
  - ♦ Clear its output buffer, FIFO
  - ♦ Set the default key types
  - ♦ Set typematic rate/delay as default value
  - ♦ Clear the last typematic key
  - ♦ Stop scanning and wait for 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 the system
  - ♦ No further activities
  - Note: No ACK
- Read ID – F2
  - ♦ Send an ACK to the 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 500 $\mu$ s: acceptance of ACK
  - ♦ The system can issue any command to the KB within the 500 $\mu$ s period mentioned above to override FF
  - ♦ If no override, the system performs its BAT and enters mode 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 value 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 the 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)  $\times$  250ms  
 Typematic rate= 1/period  
 ...where period= (8+A)  $\times$  (2<sup>B</sup>)  $\times$  0.00417  
 ...where A= binary value of bit 2, 1 and 0  
 ...where B= binary value of bit 4 and 3

<b>b4~b0</b>	<b>Typematic rate</b>	<b>b4~b0</b>	<b>Typematic rate</b>
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 the 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 the system.  
If the command is FE, then send the last key code to system.  
If there is an interrupt while sending FA, the KB discards the FA and accepts the command from the system and processes it.
- 00/FF: Key overrun  
If the keyboard detects an overrun error, the KB sends an overrun error code to the system.  
mode 1: FF  
mode 2,3: 00

- FE: Resend  
The KB issues an FE when there is a parity error in transmission.

#### Data communications

- Data output
  - 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.
  - The 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
  - 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
  - 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**

<b>Mode 1,2,3</b>	
B1:	start bit always 0
B2:	data bit 0
b3:	data bit 1
b4:	data bit 2
b5:	data bit 3
B6:	data bit 4
b7:	data bit 5
b8:	data bit 6
b9:	data bit 7
b10:	parity bit (odd par)
b11:	stop bit always 1

Note: 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	50	30 / B0
2	02 / 82	51	31 / B1
3	03 / 83	52	32 / B2
4	04 / 84	53	33 / B3
5	05 / 85	54	34 / B4
6	06 / 86	55	35 / B5
7	07 / 87	56	73 / F3
8	08 / 88	57	36 / B6
9	09 / 89	58	1D / 9D
10	0A / 8A	60	38 / B8
11	0B / 8B	61	39 / B9
12	0C / 8C	62	E0 38 / E0 B8
13	0D / 8D	64	E0 1D / E0 9D
14	7D / FD	90	45 / C5
15	0E / 8E	91	47 / C7
16	0F / 8F	92	4B / CB
17	10 / 90	93	4F / CF
18	11 / 91	96	48 / C8
19	12 / 92	97	4C / CC
20	13 / 93	98	50 / D0
21	14 / 94	99	52 / D2
22	15 / 95	100	37 / B7
23	16 / 96	101	49 / C9
24	17 / 97	102	4D / CD
25	18 / 98	103	51 / D1
26	19 / 99	104	53 / D3
27	1A / 9A	105	4A / CA
28	1B / 9B	106	4E / CE
29	2B / AB	107	7E / FE
30	3A / BA	108	E0 1C / E0 9C
31	1E / 9E	110	01 / 81
32	1F / 9F	112	3B / BB
33	20 / A0	113	3C / BC
34	21 / A1	114	3D / BD
35	22 / A2	115	3E / BE
36	23 / A3	116	3F / BF
37	24 / A4	117	40 / C0
38	25 / A5	118	41 / C1
39	26 / A6	119	42 / C2
40	27 / A7	120	43 / C3
41	28 / A8	121	44 / C4
42	2B / AB	122	57 / D7
43	1C / 9C	123	58 / D8
44	2A / AA	125	46 / C6
45	56 / D6	131	7B / FB
46	2C / AC	132	79 / F9
47	2D / AD	133	70 / F0
48	2E / AE		
49	2F / AF		

**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
	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
R Win	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	

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.		

ACPI Key	Make	Break	Windows Virtual Key
Power	E0 5E	E0 DE	N/A
Sleep	E0 5F	E0 DF	N/A
Wake	E0 63	E0 E3	N/A

**Key code set 2**

Key Number	Make/Break Code	Key Number	Make/Break Code
1	0E / F0 0E	50	32 / F0 32
2	16 / F0 16	51	31 / F0 31
3	1E / F0 1E	52	3A / F0 3A
4	26 / F0 26	53	41 / F0 41
5	25 / F0 25	54	49 / F0 49
6	2E / F0 2E	55	4A / F0 4A
7	36 / F0 36	56	51 / F0 51
8	3D / F0 3D	57	59 / F0 59
9	3E / F0 3E	58	14 / F0 14
10	46 / F0 46	60	11 / F0 11
11	45 / F0 45	61	29 / F0 29
12	4E / F0 4E	62	E0 11 / E0 F0 11
13	55 / F0 55	64	E0 14 / E0 F0 14
14	6A / F0 6A	90	77 / F0 77
15	66 / F0 66	91	6C / F0 6C
16	0D / F0 0D	92	6B / F0 6B
17	15 / F0 15	93	69 / F0 69
18	1D / F0 1D	96	75 / F0 75
19	24 / F0 24	97	73 / F0 73
20	2D / F0 2D	98	72 / F0 72
21	2C / F0 2C	99	70 / F0 70
22	35 / F0 35	100	7C / F0 7C
23	3C / F0 3C	101	7D / F0 7D
24	43 / F0 43	102	74 / F0 74
25	44 / F0 44	103	7A / F0 7A
26	4D / F0 4D	104	71 / F0 71
27	54 / F0 54	105	7B / F0 7B
28	5B / F0 5B	106	79 / F0 79
29	5D / F0 5D	107	6D / F0 6D
30	58 / F0 58	108	E0 5A / E0 F0 5A
31	1C / F0 1C	110	76 / F0 76
32	1B / F0 1B	112	05 / F0 05
33	23 / F0 23	113	06 / F0 06
34	2B / F0 2B	114	04 / F0 04
35	34 / F0 34	115	0C / F0 0C
36	33 / F0 33	116	03 / F0 03
37	3B / F0 3B	117	0B / F0 0B
38	42 / F0 42	118	83 / F0 83
39	4B / F0 4B	119	0A / F0 0A
40	4C / F0 4C	120	01 / F0 01
41	52 / F0 52	121	09 / F0 09
42	5D / F0 5D	122	78 / F0 78
43	5A / F0 5A	123	07 / F0 07
44	12 / F0 12	125	7E / F0 7E
45	61 / F0 61	131	67 / F0 67
46	1A / F0 1A	132	64 / F0 64
47	22 / F0 22	133	13 / F0 13
48	21 / F0 21		
49	2A / F0 2A		

**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
APP	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.		

ACPI key	Make	Break	Windows Virtual Key
Power	E0 37	E0 F0 37	N/A
Sleep	E0 3F	E0 F0 3F	N/A
Wake	E0 5E	E0 F0 5E	N/A

**Key code set 3**

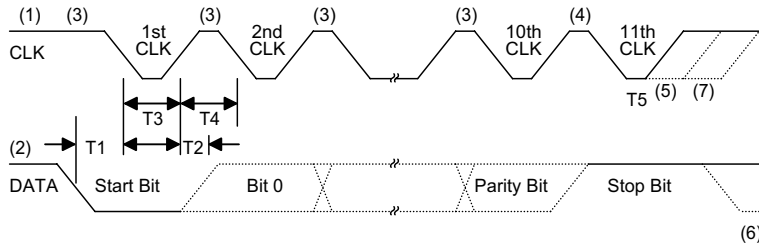
Key #	Make/ Break Code	Note	Default Key State	Key #	Make/ Break Code	Note	Default Key State
1	0E / F0 0E		Typematic	57	59 / F0 59		Make/Break
2	16 / F0 16		Typematic	58	11 / F0 11	*	Make/Break
3	1E / F0 1E		Typematic	60	19 / F0 19	*	Make/Break
4	26 / F0 26		Typematic	61	29 / F0 29		Typematic
5	25 / F0 25		Typematic	62	39 / F0 39	*	Make Only
6	2E / F0 2E		Typematic	64	58 / E0 58	*	Make Only
7	36 / F0 36		Typematic	75	67 / F0 67	*	Make Only
8	3D / F0 3D		Typematic	76	64 / F0 64	*	Typematic
9	3E / F0 3E		Typematic	79	61 / F0 61	*	Typematic
10	46 / F0 46		Typematic	80	6E / F0 6E	*	Make Only
11	45 / F0 45		Typematic	81	65 / F0 65	*	Make Only
12	4E / F0 4E		Typematic	83	63 / F0 63	*	Typematic
13	55 / F0 55		Typematic	84	60 / F0 60	*	Typematic
14	5D / F0 5D	*	Typematic	85	6F / F0 60	*	Make Only
15	66 / F0 66		Typematic	86	6D / F0 6D	*	Make Only
16	0D / F0 0D		Typematic	89	6A / F0 6A	*	Typematic
17	15 / F0 15		Typematic	90	76 / F0 76	*	Make Only
18	1D / F0 1D		Typematic	91	6C / F0 6C		Make Only
19	24 / F0 24		Typematic	92	6B / F0 6B		Make Only
20	2D / F0 2D		Typematic	93	69 / F0 69		Make Only
21	2C / F0 2C		Typematic	95	77 / F0 77	*	Make Only
22	35 / F0 35		Typematic	96	75 / F0 75		Make Only
23	3C / F0 3C		Typematic	97	73 / F0 73		Make Only
24	43 / F0 43		Typematic	98	72 / F0 72		Make Only
25	44 / F0 44		Typematic	99	70 / F0 70		Make Only
26	4D / F0 4D		Typematic	100	7E / F0 7E		Make Only
27	54 / F0 54		Typematic	101	7D / F0 7D		Make Only
28	5B / F0 5B		Typematic	102	74 / F0 74		Make Only
29	5C / F0 5C		Typematic	103	7A / F0 7A		Make Only
30	14 / F0 14		Make/Break	104	71 / F0 71		Make Only

Key #	Make/ Break Code	Note	Default Key State	Key #	Make/ Break Code	Note	Default Key State
31	1C / F0 1C		Typematic	105	84 / F0 84	*	Make Only
32	1B / F0 1B		Typematic	106	7C / F0 7C	*	Typematic
33	23 / F0 23		Typematic	107	7B / F0 7B	*	Make Only
34	2B / F0 2B		Typematic	108	79 / F0 79	*	Make Only
35	34 / F0 34		Typematic	110	08 / F0 08	*	Make Only
36	33 / F0 33		Typematic	112	07 / F0 07	*	Make Only
37	3B / F0 3B		Typematic	113	0F / F0 0F	*	Make Only
38	42 / F0 42		Typematic	114	17 / F0 17	*	Make Only
39	4B / F0 4B		Typematic	115	1F / F0 1F	*	Make Only
40	4C / F0 4C		Typematic	116	27 / F0 27	*	Make Only
41	52 / F0 52		Typematic	117	2F / F0 2F	*	Make Only
42	5D / F0 5D	*	Typematic	118	37 / F0 /37	*	Make Only
43	5A / F0 5A		Typematic	119	3F / F0 3F	*	Make Only
44	12 / F0 12		Make/Break	120	47 / F0 47	*	Make Only
45	13 / F0 13	*	Typematic	121	4F / F0 4F	*	Make Only
46	1A / F0 1A		Typematic	122	56 / F0 56	*	Make Only
47	22 / F0 22		Typematic	123	5E / F0 5E	*	Make Only
48	21 / F0 21		Typematic	124	57 / F0 57	*	Make Only
49	2A / F0 2A		Typematic	125	5F / F0 5F	*	Make Only
50	32 / F0 32		Typematic	126	62 / F0 62	*	Make Only
51	31 / F0 31		Typematic	131	85 / F0 85	*	Make Only
52	3A / F0 3A		Typematic	132	86 / F0 86	*	Make Only
53	41 / F0 41		Typematic	133	87 / F0 87	*	Make Only
54	49 / F0 49		Typematic	L Win	8B / F0 8B	*	Make/Break
55	4A / F0 4A		Typematic	R Win	8C / F0 8C	*	Make/Break
56	51 / F0 51		Typematic	APP	8D / F0 8D	*	Make/Break

\* Different from code set 2

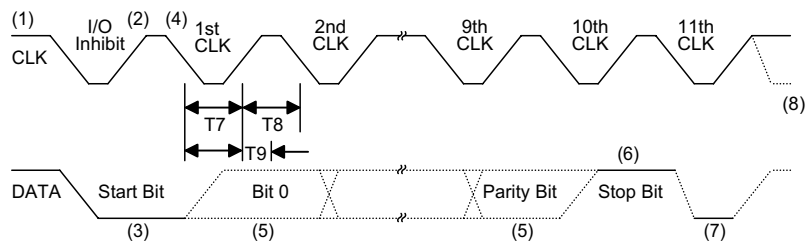
## Timing Diagrams

### Data output



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

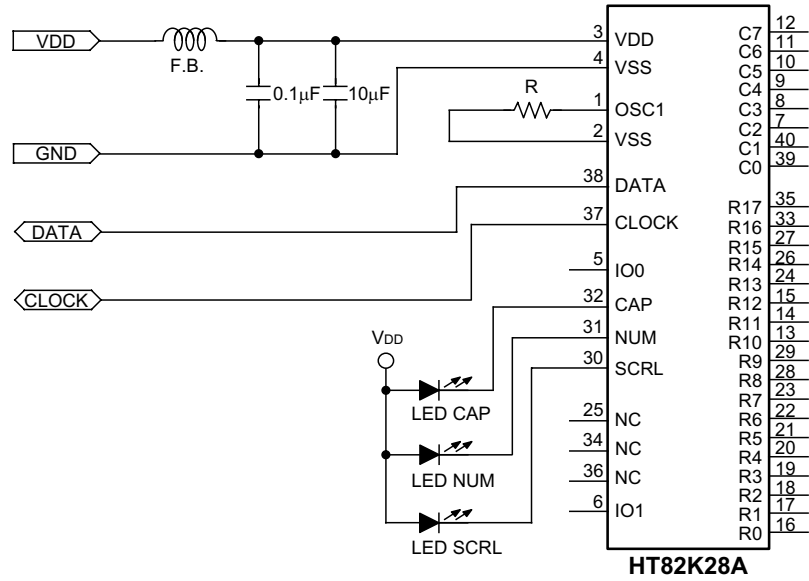
### Keyboard data input



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



Application Circuits



**Standard Holtek Win98 keyboard**

	<b>C7</b>	<b>C6</b>	<b>C5</b>	<b>C4</b>	<b>C3</b>	<b>C2</b>	<b>C1</b>	<b>C0</b>
<b>R0</b>	F5	L-CTRL	WAKE-UP	R-CTRL	SLEEP		POWER	PAUSE
<b>R1</b>	! 1	~	K131	Z	ESC	A	TAB	Q
<b>R2</b>	@ 2	F1	K132	X	K45	S	CAP LOCK	W
<b>R3</b>	# 3	F2	K133	C	F4	D	F3	E
<b>R4</b>	\$ 4	% 5	B	V	G	F	T	R
<b>R5</b>	& 7	^ 6	N	M	H	J	Y	U
<b>R6</b>	* 8	+ =	K56	< ,	F6	K	} ]	I
<b>R7</b>	( 9	F8	APP	> .		L	F7	O
<b>R8</b>	) 0	- _	? /	K42	" ,	: ;	{ [	P
<b>R9</b>	PRINT		R-ALT		L-ALT			SCR LOCK
<b>R10</b>	F10	F9	F12	ENTER	F11	 \	BS	K14
<b>R11</b>	POWER	DEL	DOWN Arrow	NUM LOCK	SPACE	NUM 1	NUM 4	NUM 7
<b>R12</b>	SLEEP	INSERT	RIGHT Arrow	NUM /	NUM 0	NUM 2	NUM 5	NUM 8
<b>R13</b>	PG DN	PG UP	NUM -	NUM *	NUM .	NUM 3	NUM 6	NUM 9
<b>R14</b>	END	HOME	LEFT Arrow		UP Arrow	NUM ENTER	K107	NUM +
<b>R15</b>			K94			R-SHF	L-SHF	WAKE UP
<b>R16</b>	K129						L-WIN	K130
<b>R17</b>		K109				R-WIN		

The above key code is according to the Microsoft specification except for the following keys.

<b>Key No</b>	<b>Code Set 1 Make/Break</b>		<b>Code Set 2 Make/Break</b>		<b>Code Set 3 Make/Break</b>	
14	7D	FD	6A	F0 6A	5D	F0 5D
94	7C	FC	68	F0 68	68	F0 68
109	78	F8	63	F0 63	78	F0 78
129	F1		F1		F1	
130	F0		F2		F2	

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