PS/2-Compatible Laptop/Notebook Keyboard Encoder LapCoder™ UR5HCFJ8

Description

The UR5HCFJ8 LapCoder™ is an HCMOS microcontroller functioning as a versatile, low-power laptop/notebook keyboard encoder while providing two bidirectional channels for communication with a BIOS-compatible system as well as any optional keyboard-compatible devices, such as a 101/102 desktop keyboard or a PS/2 mouse.

The UR5HCFJ8 Lapcoder™ fully supports the IBM standard keyboard communication protocol; each key press generates one of the scan codes designated in the IBM Technical Reference Manuals. The keyboard encoder handles the scanning, debounce, and encoding of 82/84 keys organized on an 8x16 matrix and supports embedded numeric keypad functions as well as alternate scan codes for specific keys, so that a keyboard with only 82 keys is able to emulate the functionality of a 101/102 keyboard.

In addition to the system's keyboard communication port, the UR5HCFJ8 provides a fully functional keyboard input port that can be used by a standard 84/101/102 keyboard or another 8042-compatible device, such as a PS/2 mouse, an external numeric keypad, an OCR, or a bar-code reader. Input from both the matrix and the external device is multiplexed and presented to the system as if it were coming from a single source.

The features of UR5HCFJ8 make it ideal for use in PC/AT/PS2 laptop/notebook designs that utilize the Fujitsu FKB7211 low-profile, full-travel membrane keyboard.

Features

- *Interfaces the Fujitsu FKB7211 or other similar laptop/notebook keyboards to a BIOS-compatible system*
- *Single IC laptop/notebook keyboard encoder*
- *PC/XT or AT/PS2-compatible*
- *Interfaces a PS/2 mouse, an external keyboard/keypad or other 8042-compatible devices*
- *Implements all functions of an 101/102 keyboard with only 82 keys*
- *Low-power HCMOS microcontroller, suitable for 3V battery-operated systems*
- *Available in DIP, PLCC and Quad Flat packages*
- *Custom versions available in small or large quantities*

Applications

- *Laptop/notebook computers*
- *Instrumentation*
- *Industrial keyboards*
- *Point of sales terminals*
- *Public information kiosks*

Pin Configurations
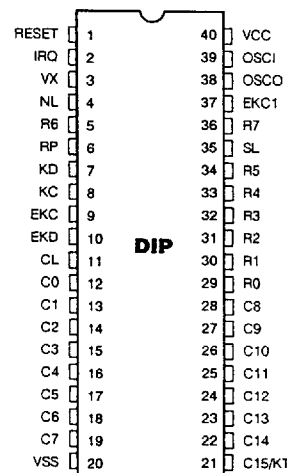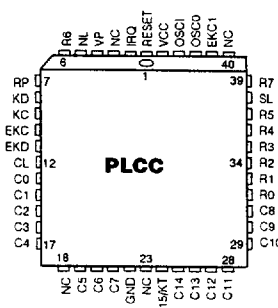
Ordering Code

PACKAGES	TA = 0°C TO +70°C	TA = -40°C TO +85°C
40 pin, Plastic DIP	UR5HCFJ8-P	UR5HCFJ8-CP
44 pin, Plastic PLCC	UR5HCFJ8-FN	UR5HCFJ8-CFN
44 pin, Plastic QFP	UR5HCFJ8-FB	UR5HCFJ8-CFB

Functional Diagram
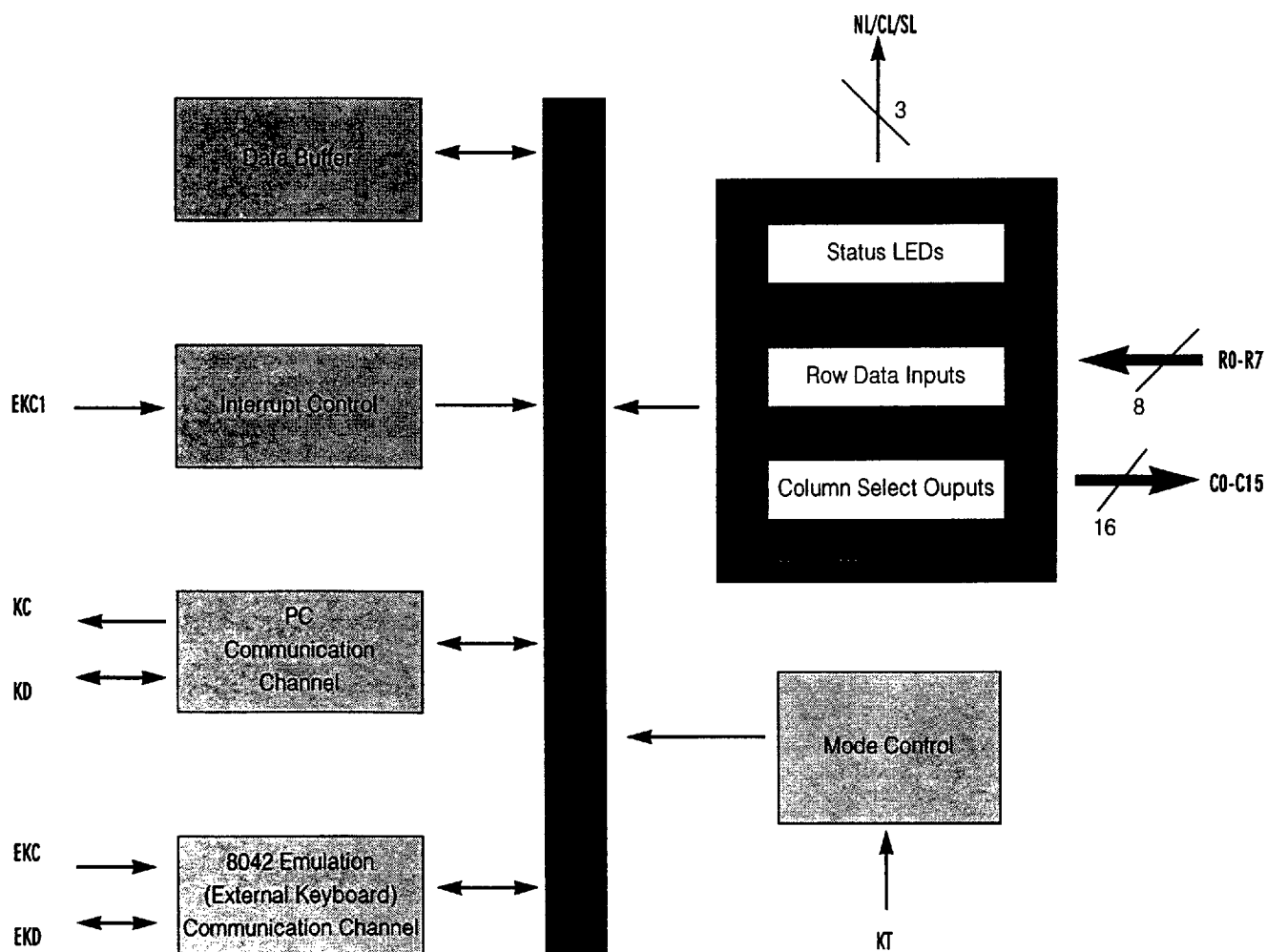
Functional Description

The UR5HCFJ8 consists functionally of four major sections (see Functional Diagram, previous page). These are the Keyboard Encoder, the Mode Control Unit, the PC Communication Channel, and the 8042 Emulation Channel. All sections communicate with each other and operate concurrently.

Keyboard Encoder

The controller continuously scans a keyboard organized as an 8 row by 16 column matrix for a maximum of 128 keys. Smaller-size keyboards are supported provided that all unused row lines are pulled to Vcc.
The microcontroller selects 1 of the 16 column lines (C0-C15) every 512 us and then reads the row data lines (R0-R7).
A key closure is detected as a 0 in the corresponding position of the matrix.
A complete scan cycle for the entire keyboard takes approximately 9.2 mS. Each key found pressed is debounced for a period of 20 mS. Once the key is verified, the corresponding key code(s) are loaded into the transmit buffer of the PC Keyboard Communication Channel.

Switch Matrix Encoding

Each matrix location is programmed to represent either a single key or a key combination of the IBM 101/102 standard keyboard.

Scan Code Table Sets

The UR5HCFJ8 supports all three scan code table sets. Scan Code Sets 1 and 2 are the default sets for PC/XT and AT/PS2 systems respectively. Scan Code Table Set 3 allows the user to program individual key attributes such as Make/Break and Typematic or Single-Touch Action. For more information, refer to the IBM Technical Reference Manuals. Custom scan code tables, including macros, are also available.

Pin Description

Mnemonic	Number of pins DIP	PLCC	TYPE	NAME AND FUNCTION
VCC	40	44	I	**Power Supply:** +5V.
VSS	20	22	I	**Ground**
OSCI	39	43	I	**Oscillator Input**
OSCO	38	42	O	**Oscillator Output**
RESET	1	1	I	**Reset:** apply 0 V to provide orderly start up.
EKC1	37	41	I	**External Keyboard Clock 1:** connects to external keyboard Clock Line and is used to generate an interrupt for every Clock Line transition.
VX	3	4	I	Tie to Vcc.
RP	6	7	I	**Reserved:** ties to VCC.
KC	8	9	I/O	**Keyboard Clock:** this pin connects to PC keyboard port Clock Line.
KD	7	8	I/O	**Keyboard Data:** connects to PC keyboard port Data Line.
EKD	10	11	I/O	**External Keyboard Data:** connects to external keyboard Data Line.
EKC	9	10	I/O	**External Keyboard Clock:** connects to external keyboard Clock Line.
IRQ	2	2	I	**Interrupt Line:** reserved for low-power applications.
R0-R5 R6 R7	29-34 5 36	32-37 6 39, 40	I I	**Row Data Inputs**
C0-C7 C8-C14	12-19 28-22	13-17 19-21 31-25	O	**Column Select Outputs:** selects 1 of 16 columns.
C15/KT	21	24	I/O	**Column Select 15/Keyboard Type Selection:** this pin is used both as column select output and as input for keyboard-type selection. When the pin is set high, PC/XT protocol is selected. When it is set low, AT/PS2 protocol is chosen.
CL	11	12	O	**Caps Lock LED**
NL	4	5	O	**Num Lock LED**
SL	35	38	O	**Scroll Lock LED**
NC		3, 18 23, 40		**No Connects:** these pins are unused.

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Mode Control

Embedded Numeric Keypad

The UR5HCFJ8 implements an embedded numeric keypad. The Numeric Keypad Function is invoked by pressing the Num Lock Key.

FN Key

A special FN Key has been implemented to perform the following functions while it is held pressed:

- Function Key F1 becomes F11
- Function Key F2 becomes F12
- Control Left Key becomes Ctrl Right
- Alt Left Key becomes Alt Right

If Num Lock is set:

- Embedded numeric keypad keys become regular keys.

If Num Lock is not set:

- Embedded numeric keypad keys provide the same codes as a numeric keypad when the Num Lock is not set (Arrow Keys, PgUp, PgDn, etc.)

Status LED indicators

The controller provides interfacing for three LED shift status indicators. All three pins are active low to indicate the status of the host system (Num Lock, Caps Lock and Scroll Lock). They are set by either the controller (PC/XT protocol) or by the system (AT/PS2 protocol).

Operating modes are defined by the logic level of the mode pin in the Mode Control Unit.

Protocol Selection

Pin KT selects the communication protocol with the host system and the standard keyboard, as shown in Table 1.

Protocol	KT
PC/XT	H
AT/PS2	L

Table 1: **Communication Protocol Selection**

N-Key Rollover

In this mode, the code(s) corresponding to each key press are transmitted to the host system as soon as that key is debounced, independently of the release of other keys.

If a key is defined to be Typematic, the corresponding code(s) will be transmitted while that key is held pressed. When the key is released, the corresponding break code(s) are then transmitted to the host system. If the released key happens to be the most recently pressed, then Typematic Action is terminated. There is no limitation in the number of keys that can be held pressed at the same time. However, two or more key closures, occurring within a time interval less than 5ms, will set an error flag and will not be processed. This procedure protects against the effects of accidental key presses.

"Ghost" Keys

In any scanned contact switch matrix, whenever three keys defining a rectangle on the switch matrix are held pressed at the same time, a fourth key positioned on the fourth corner of the rectangle is sensed as being pressed. This is known as the "ghost" or "phantom" key problem.
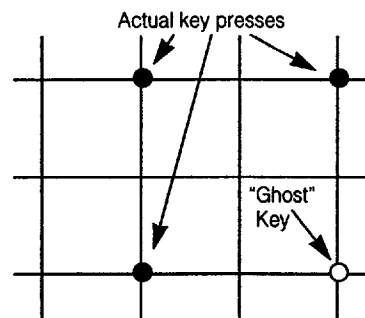
Figure 1: **"Ghost" or "Phantom" Key Problem**

Although the problem cannot be totally eliminated without using external hardware, there are methods to neutralize its negative effects for most practical applications. Keys that are intended to be used in combinations or are likely to be pressed at the same time by a fast typist (i.e., keys located in adjacent positions on the keyboard) should be placed in the same row or column of the matrix whenever possible. Shift keys (Shift, Alt, Ctrl) should not reside in the same row (or column) with any other keys.

The UR5HCFJ8 has built-in mechanisms to detect the presence of a "ghost" key, thus eliminating the necessity of external hardware.

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PC Communication

The UR5HCFJ8 implements all the standard functions of communication with a BIOS-compatible PC/XT or AT/PS2 host system. Two lines, KC and KD, provide bidirectional clock and data signals according to the protocol (PC or AT) selected. In addition, the UR5HCFJ8 supports all commands from and to the system, as described in the IBM Technical Reference Manuals. The following table shows the commands that the system may send and their values in hex.

Command	Hex Value
Set/Reset Status Indicators	ED
Echo	EE
Invalid Command	EF
Select Alternate Scan Codes	F0
Invalid Command	F1
Read ID	F2
Set Typematic Rate/Delay	F3
Enable	F4
Default Disable	F5
Set Default	F6
Set All Keys	
■ Typematic	F7
■ Make/Break	F8
■ Make	F9
■ Typematic/Make/Break	FA
Set Key Type	
■ Typematic	FB
■ Make/Break	FC
■ Make	FD
Reset	FF
Resend	FE

Table 2: **Keyboard Commands from the System (AT/PS2 protocol)**

These commands are supported in the AT/PS2 protocol and can be sent to the keyboard at any time. PC/XT mode accepts only the 'reset' command.

The following table shows the commands that the keyboard may send to the system.

Command	Hex Value
Key Detection Error/Overrun	00*
Keyboard ID	83AB
BAT Completion Code	AA
BAT Failure Code	FC
Echo	EE
Acknowledge (Ack)	FA
Resend	FE
Key Detection Error/Overrun	FF**

*Code Sets 2 and 3
**Code Set 1

Table 3: **Keyboard Commands to the System (AT/PS2 protocol)**

When an external keyboard is connected, commands from the system will also be directed to the external keyboard. Presence or absence of an external device will not affect the normal operation of the UR5HCFJ8.

8042 Emulation Channel

The UR5HCFJ8 fully emulates a system's keyboard port, available to a standard 83/101/102 external keyboard or other 8042-compatible device. Communication with a keyboard-compatible device is accomplished by clock and data lines via EKC and EKD pins, respectively. A third pin, EKC1, connects to the Clock Line and interrupts the controller whenever the external device initiates a communication session. When power is first applied, the controller proceeds with the standard reset sequence with the external device. Data and commands initiated from the external device are buffered in the controller's FIFO along with data from the scanned matrix, and then are presented to the system as if they were coming from a single source. After they are acknowledged, commands and data from the system are transmitted to the external device.

Special Handling

External Keyboard Connection

The UR5HCFJ8 checks periodically for the presence of an external device. If an external keyboard or other device was not connected during power-on and is connected at a later time, the controller will proceed with the normal reset routine in order to properly initialize the external keyboard. After communication has been established, the controller will continue to check for the presence of the external keyboard. If this keyboard is disconnected at a later time, the controller will be aware of it. If a subsequent connection takes place, the controller will re-initiate a reset sequence. This unique feature allows the user to connect or disconnect an external device at any time, without having to reset the system.

Shift Status LEDs

Shift Status LEDs (Num Lock, Caps Lock and Scroll Lock) indicate the status of the system and are controlled by commands sent from the system. Set/Reset Status Indicator commands from the system will be executed both by the external keyboard and the scanned matrix. For example, if the user presses the Caps Lock Key on either keyboard, the Caps Lock LED will be affected in both keyboards. The LED status indicators are properly set after every new connection of an external keyboard.

Key Map for FKB7211

	Columns (C0–C13)													
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
0	Ctrl (Left)	Esc	Tab	Fn	Alt (Left)	Space		'	Insert	Delete	Left Arrow	Down Arrow	Shift (Left)	Right Arrow
1		F11 F1	Z			X	C		> . .	? / /		Up Arrow	Shift (Right)	End
2		! 1	Caps Lock			V	B	N	M 0	< , ,	` ,	Enter		Page Down
3		F12 F2	A			S	D	F	J 1	K 2	L 3	: ; +		Page Up
4		@ 2	# 3			$ 4	T	y	u 4	i 5	o 6	p -		Back-space
5		F4	F5			F6	F7	F8	F9	F10	Number Lock	Scroll Lock		Print Screen
6		F3	% 5			^ 6	& 7 7	* 8 8	(9 9	) 0 *	— -	+ +		Pause Break
7		Q	W			E	R	G	H	{ [	}]	| \		Home

Rows (R0–R7)

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Keyboard Layouts (US English)

Depending on the status of the Num Lock and the FN Key, the UR5HCFJ8 implements one of four keyboard layouts.
(Key numbering of a standard 101/102 keyboard is shown.)

Layout A (Default layout)

110 Esc	112 F1	113 F2	114 F3	115 F4	116 F5	117 F6	118 F7	119 F8	120 F9	121 F10	90 NmLk	125 ScLk	124 PrSc	126 Brk

Row: 2/1, 3/2, 4/3, 5/4, 6/5, 7/6, 8/7, 9/8, 10/9, 11/0, 12 -, 13 =, 15 BkSp, 80 Home

Row: 16 Tab, 17 Q, 18 W, 19 E, 20 R, 21 T, 22 Y, 23 U, 24 I, 25 O, 26 P, 27 [, 28], 29 \, 85 PgUp

Row: 30 CpsLck, 31 A, 32 S, 33 D, 34 F, 35 G, 36 H, 37 J, 38 K, 39 L, 40 ;, 41 ', 43 Enter, 86 PgDn

Row: 44 Shift, 46 Z, 47 X, 48 C, 49 V, 50 B, 51 N, 52 M, 53 ,, 54 ., 55 /, 57 Shift, 83 ↑, 81 End

Row: 58 Ctrl, FN, 60 Alt, SPACE 61, 1 ,, 75 Ins, 76 Del, 79 ←, 84 ↓, 89 →

Layout B (Num Lock is set)

110 Esc	112 F1	113 F2	114 F3	115 F4	116 F5	117 F6	118 F7	119 F8	120 F9	121 F10	90 NmLk	125 ScLk	124 PrSc	126 Brk

Row: 2/1, 3/2, 4/3, 5/4, 6/5, 7/6, 91/7, 96/8, 101/9, 100 *, 12 -, 13 =, 15 BkSp, 80 Home

Row: 16 Tab, 17 Q, 18 W, 19 E, 20 R, 21 T, 22 Y, 92/4, 97/5, 102/6, 105 -, 27 [, 28], 29 \, 85 PgUp

Row: 30 CpsLck, 31 A, 32 S, 33 D, 34 F, 35 G, 36 H, 93/1, 98/2, 103/3, 106 +, 41 ', 43 Enter, 86 PgDn

Row: 44 Shift, 46 Z, 47 X, 48 C, 49 V, 50 B, 51 N, 99/0, 53 ,, 104 ., 95 /, 57 Shift, 83 ↑, 81 End

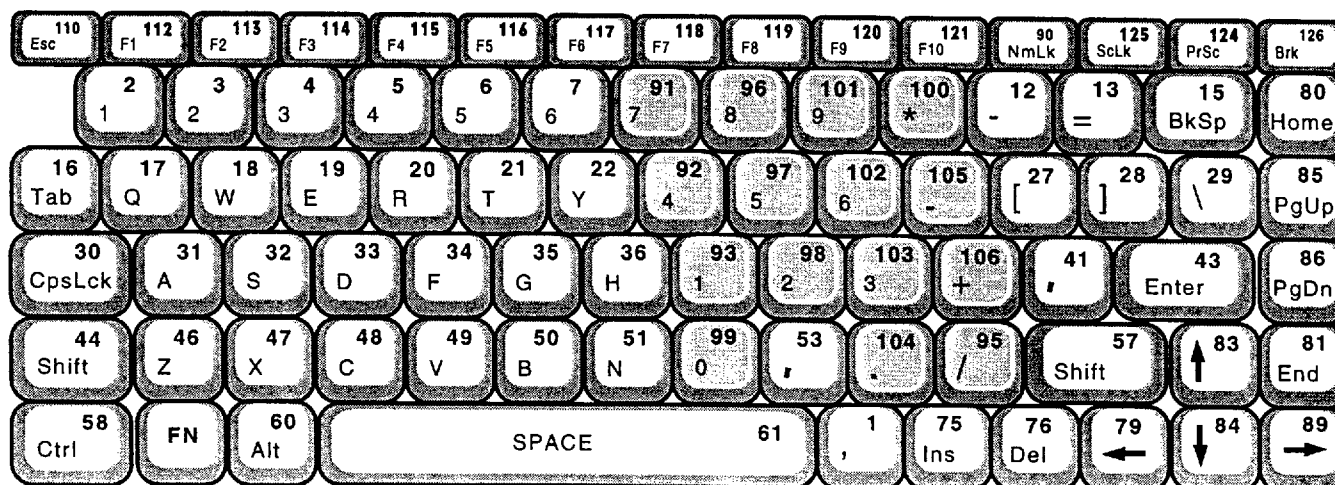Row: 58 Ctrl, FN, 60 Alt, SPACE 61, 1 ,, 75 Ins, 76 Del, 79 ←, 84 ↓, 89 →

Keyboard Layouts (US English)

Depending on the status of the Num Lock and the FN Key, the UR5HCFJ8 implements one of four keyboard layouts.
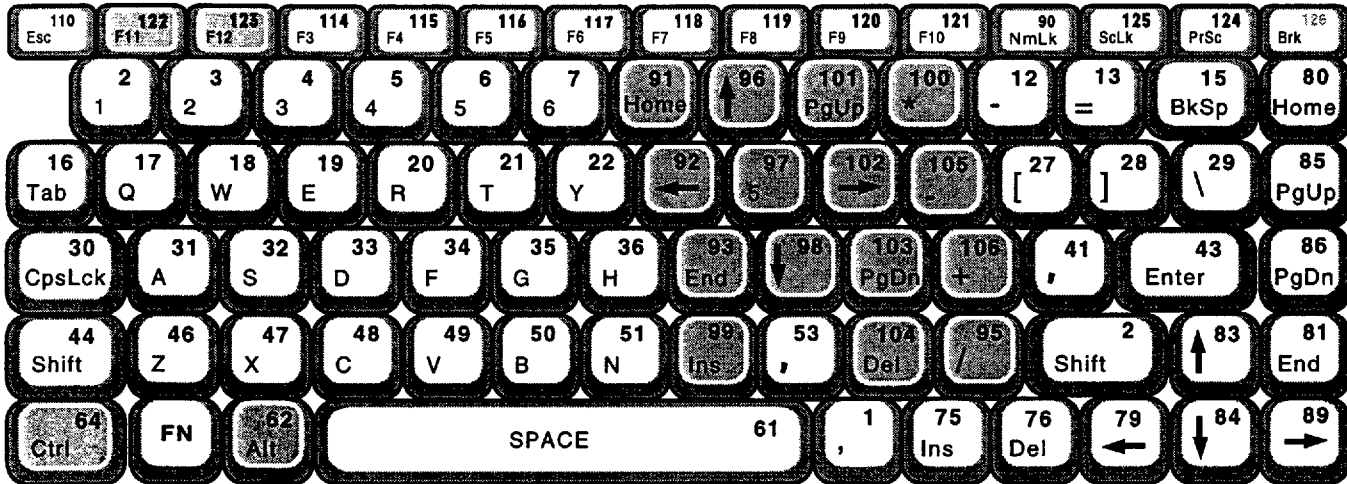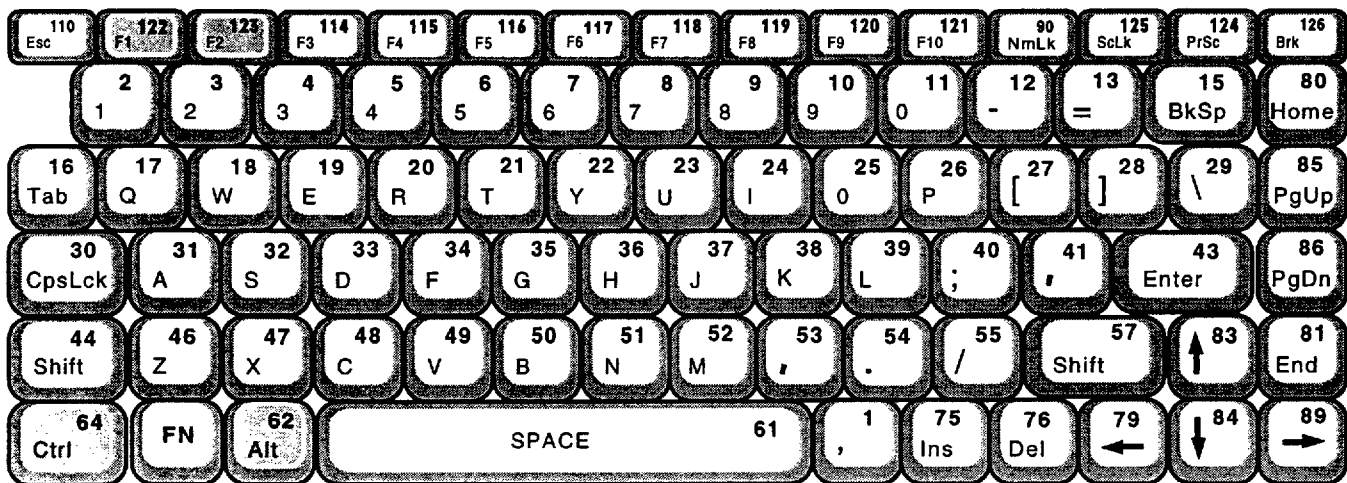(Key numbering of a standard 101/102 keyboard is shown.)

Layout C (FN key pressed)

Layout D (Num Lock set and FN key pressed)

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Scan Codes

The following tables list the scan codes associated with each key for each scan code set. To determine the character that corresponds to each key number, refer to the Keyboard Layouts A–D on the two previous pages. Scan Code Set 1 is the only scan code supported when the UR5HCFJ8 is set in XT mode. Scan Code Set 2 is the default when the UR5HCFJ8 is set in AT/PS2 mode.

Scan Code Set 1 (Part 1 of 5)

The following keys send the assigned scan codes independently of the state of any Shift Keys (Ctrl, Alt and Shift) or the Num Lock state (On or Off).

Key#	Make Code	Break Code	Key#	Make Code	Break Code	Key#	Make Code	Break Code
1	29	A9	31	1E	9E	90	45	C5
2	02	82	32	1F	9F	91	47	C7
3	03	83	33	20	A0	92	4B	CB
4	04	84	34	21	A1	93	4F	CF
5	05	85	35	22	A2	96	48	C8
6	06	86	36	23	A3	97	4C	CC
7	07	87	37	24	A4	98	50	D0
8	08	88	38	25	A5	99	52	D2
9	09	89	39	26	A6	100	37	B7
10	0A	8A	40	27	A7	101	49	C9
11	0B	8B	41	28	A8	102	4D	CD
12	0C	8C	43	1C	9C	103	51	D1
13	0D	8D	44	2A	AA	104	53	D3
15	0E	8E	46	2C	AC	105	4A	CA
16	0F	8F	47	2D	AD	106	4E	CE
17	10	90	48	2E	AE	110	01	81
18	11	91	49	2F	AF	112	3B	BB
19	12	92	50	30	B0	113	3C	BC
20	13	93	51	31	B1	114	3D	BD
21	14	94	52	32	B2	115	3E	BE
22	15	95	53	33	B3	116	3F	BF
23	16	96	54	34	B4	117	40	C0
24	17	97	55	35	B5	118	41	C1
25	18	98	57	36	B6	119	42	C2
26	19	99	58	1D	9D	120	43	C3
27	1A	9A	60	38	B8	121	44	C4
28	1B	9B	61	39	B9	122	57	D7
29	2B	AB	62	E038	E0B8	123	58	D8
30	3A	BA	64	E01D	E09D	125	46	C6

Scan Code Set 1 (Part 2 of 5)

The following keys send a series of codes dependent on the state of the Shift Keys and the state of the Num Lock.

Key Number	Base Case, or Shift+Num Lk		Shift Case*		Num Lock on	
	Make	Break	Make	Break	Make	Break
75	E0 52	E0 D2	E0 AA E0 52	E0 D2 E0 2A	E0 2A E0 52	E0 D2 E0 AA
76	E0 53	E0 D3	E0 AA E0 53	E0 D3 E0 2A	E0 2A E0 53	E0 D3 E0 AA
79	E0 4B	E0 CB	E0 AA E0 4B	E0 CB E0 2A	E0 2A E0 4B	E0 CB E0 AA
80	E0 47	E0 C7	E0 AA E0 47	E0 C7 E0 2A	E0 2A E0 47	E0 C7 E0 AA
81	E0 4F	E0 CF	E0 AA E0 4F	E0 CF E0 2A	E0 2A E0 4F	E0 CF E0 AA
83	E0 48	E0 C8	E0 AA E0 48	E0 C8 E0 2A	E0 2A E0 48	E0 C8 E0 AA
84	E0 50	E0 D0	E0 AA E0 50	E0 D0 E0 2A	E0 2A E0 50	E0 D0 E0 AA
85	E0 49	E0 C9	E0 AA E0 49	E0 C9 E0 2A	E0 2A E0 49	E0 C9 E0 AA
86	E0 51	E0 D1	E0 AA E0 51	E0 D1 E0 2A	E0 2A E0 51	E0 D1 E0 AA
89	E0 4D	E0 CD	E0 AA E0 4D	E0 CD E0 2A	E0 2A E0 4D	E0 CD E0 AA

* 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 codes.

Scan Code Set 1 (Part 3 of 5)

Key Number	Scan Code		Shift Case	
	Make	Brake	Make	Brake
95	E0 35	E0 B5	E0 AA E0 35	E0 B5 E0 2A

*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 codes

Scan Code Set 1 (Part 4 of 5)

Key Number	Scan Code		Ctrl Case, Shift Case		Alt Case	
	Make	Brake	Make	Brake	Make	Brake
124	E0 2AE0 37	E0 B7 E0 AA	E0 37	E0 B7	54	D4

Scan Code Set 1 (Part 5 of 5)

Key Number	Make Code	Ctrl Key Pressed
126*	E1 1D 45 E1 9D C5	E0 46 E0 C6

*This key is not Typematic. All associated scan codes occur on the make of the key.

Scan Code Set 2 (Part 1 of 5)

The following keys send the codes shown regardless of any Shift states in the keyboard or the system.

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

Scan Code Set 2 (Part 2 of 5)

The following keys send a series of codes dependent on the state of the Shift Keys and the state of the Num Lock.

Key Number	Base Case, or Shift+Num Lk		Shift Case*		Num Lock on	
	Make	Break	Make	Break	Make	Break
75	E0 70	E0 F0 70	E0 F0 70 E0 12	E0 F0 12 E0 70	E0 12 E0 70	E0 F0 70 E0 F0 12
76	E0 71	E0 F0 71	E0 F0 12 E0 71	E0 F0 71 E0 12	E0 12 E0 71	E0 F0 71 E0 F0 12
79	E0 6B	E0 F0 6B	E0 F0 12 E0 6B	E0 F0 6B E0 12	E0 12 E0 6B	E0 F0 6B E0 F0 12
80	E0 6C	E0 F0 6C	E0 F0 12 E0 6C	E0 F0 6C E0 12	E0 12 E0 6C	E0 F0 6C E0 F0 12
81	E0 69	E0 F0 69	E0 F0 12 E0 69	E0 F0 69 E0 12	E0 12 E0 69	E0 F0 69 E0 F0 12
83	E0 75	E0 F0 75	E0 F0 12 E0 75	E0 F0 75 E0 12	E0 12 E0 75	E0 F0 75 E0 F0 12
84	E0 72	E0 F0 72	E0 F0 12 E0 72	E0 F0 72 E0 12	E0 12 E0 72	E0 F0 72 E0 F0 12
85	E0 7D	E0 F0 7D	E0 F0 12 E0 7D	E0 F0 7D E0 12	E0 12 E0 7D	E0 F0 7D E0 F0 12
86	E0 7A	E0 F0 7A	E0 F0 12 E0 7A	E0 F0 7A E0 12	E0 12 E0 7A	E0 F0 7A E0 F0 12
89	E0 74	E0 F0 74	E0 F0 12 E0 74	E0 F0 74 E0 12	E0 12 E0 74	E0 F0 74 E0 F0 12

* 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 codes.

Scan Code Set 2 (Part 3 of 5)

Key Number	Scan Code		Shift Case *	
	Make	Brake	Make	Brake
95	E0 4A	E0 F0 4A	E0 F0 12 4A	E0 12 F0 4A

*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 codes.

Scan Code Set 2 (Part 4 of 5)

Key Number	Scan Code		Ctrl Case, Shift Case		Alt Case	
	Make	Brake	Make	Brake	Make	Brake
124	E0 12 E0 7C	E0 F0 7C E0 F012	E0 7C	E0 F0 7C	84	F0 84

Scan Code Set 2 (Part 5 of 5)

Key Number	Make Code	Ctrl Key Pressed
126*	E1 14 77 E1 F0 14 F0 77	E0 7E E0 F0 7E

*This key is not Typematic. All associated scan codes occur on the make of the key.

■ 9228217 0000298 529 ■

Scan Code Set 3.1

Key Number	Make Code	Break Code	Default Key State
1	0E	F0 0E	Typematic
2	16	F0 16	Typematic
3	1E	F0 1E	Typematic
4	26	F0 26	Typematic
5	25	F0 25	Typematic
6	2E	F0 2E	Typematic
7	36	F0 36	Typematic
8	3D	F0 3D	Typematic
9	3E	F0 3E	Typematic
10	46	F0 46	Typematic
11	45	F0 45	Typematic
12	4E	F0 4E	Typematic
13	55	F0 55	Typematic
15	66	F0 66	Typematic
16	0D	F0 0D	Typematic
17	15	F0 15	Typematic
18	1D	F0 1D	Typematic
19	24	F0 24	Typematic
20	2D	F0 2D	Typematic
21	2C	F0 2C	Typematic
22	35	F0 35	Typematic
23	3C	F0 3C	Typematic
24	43	F0 43	Typematic
25	44	F0 44	Typematic
26	4D	F0 4D	Typematic
27	54	F0 54	Typematic
28	5B	F0 5B	Typematic
29	5C	F0 5C	Typematic
30	14	F0 14	Make/Break
31	1C	F0 1C	Typematic
32	1B	F0 1B	Typematic
33	23	F0 23	Typematic
34	2B	F0 2B	Typematic
35	34	F0 34	Typematic
36	33	F0 33	Typematic
37	3B	F0 3B	Typematic
38	42	F0 42	Typematic
39	4B	F0 4B	Typematic
40	4C	F0 4C	Typematic
41	52	F0 52	Typematic
43	5A	F0 5A	Typematic
44	12	F0 12	Make/Break
46	1A	F0 1A	Typematic
47	22	F0 22	Typematic
48	21	F0 21	Typematic
49	2A	F0 2A	Typematic
50	32	F0 32	Typematic
51	31	F0 31	Typematic
52	3A	F0 3A	Typematic
53	41	F0 41	Typematic

Key Number	Make Code	Break Code	Default Key State
54	49	F0 49	Typematic
55	4A	F0 4A	Typematic
57	59	F059	Make/Break
58	11	F0 11	Make/Break
60	19	F0 19	Make/Break
61	29	F0 29	Typematic
62	39	F0 39	Make only
64	58	F0 58	Make only
75	67	F0 67	Make only
76	64	F0 64	Typematic
79	61	F0 61	Typematic
80	6E	F0 6E	Make only
81	65	F0 65	Make only
83	63	F0 63	Typematic
84	60	F0 60	Typematic
85	6F	F0 6F	Make only
86	6D	F0 6D	Make only
89	6A	F0 6A	Typematic
90	76	F0 76	Make only
91	6C	F0 6C	Make only
92	6B	F0 6B	Make only
93	69	F0 69	Make only
95	77	F0 77	Make only
96	75	F0 75	Make only
97	73	F0 73	Make only
98	72	F0 72	Make only
99	70	F0 70	Make only
100	7E	F0 7E	Make only
101	7D	F0 7D	Make only
102	74	F0 74	Make only
103	7A	F0 7A	Make only
104	71	F0 71	Make only
105	84	F0 84	Make only
106	7C	F0 7C	Typematic
110	08	F0 08	Make only
112	07	F0 07	Make only
113	0F	F0 0F	Make only
114	17	F0 17	Make only
115	1F	F0 1F	Make only
116	27	F0 27	Make only
117	2F	F0 2F	Make only
118	37	F0 37	Make only
119	3F	F0 3F	Make only
120	47	F0 47	Make only
121	4F	F0 4F	Make only
122	56	F0 56	Make only
123	5E	F0 5E	Make only
124	57	F0 57	Make only
125	5F	F0 5F	Make only
126	62	F0 62	Make only

Suggested Interfacing for UR5HCFJ8
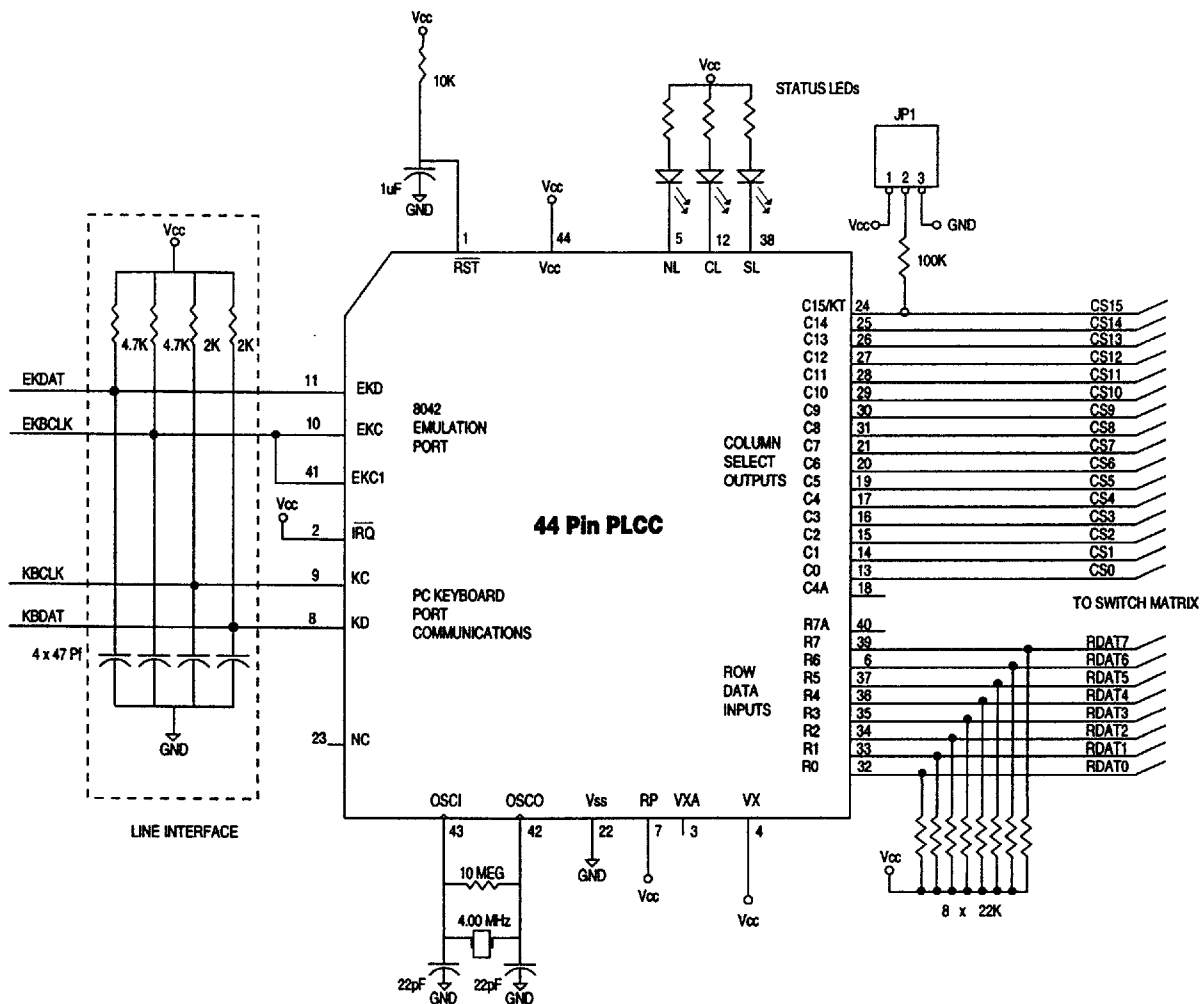
Jumpers

JP1	1-2:	PC/XT type keyboard
	2-3:	AT/PS2 type keyboard

9228217 0000300 T07

Electrical Specifications

Absolute Maximum Ratings

Ratings	Symbol	Value	Unit
Supply Voltage	VDD	-0.3 TO +7.0	V
Input Voltage	VIN	Vss -0.3 to VDD +0.3	V
Current Drain per Pin (not including Vss or VDD)	I	25	mA
Operating Temperature UR5HCFJ8-xx UR5HCFJ8-Cxx	TA	T LOW to T HIGH 0 to +70 -40 to +85	°C
Storage Temperature Range	TSTG	-65 to +150	°C

Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance ■ Plastic ■ Cerdip ■ PLCC	TJA	60 60 70	°C per W

DC Electrical Characteristics (Vdd=5.0 Vdc +/-10%, Vss=0 Vdc, Temperature range=T low to T high unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (I LOAD<10uA)	VOL VOH	VDD–0.1		0.1	V
Output High Voltage (I LOAD=.0.8mA)	VOH	VDD–0.8			V
Output Low Voltage (I LOAD=1.6mA)	VOL:			0.4	V
Input High Voltage	VIH	0.7xVDD		VDD	V
Input Low Voltage	VIL	Vss		0.2xVDD	V
User Mode Current	IPP		5	10	mA
Data Retention Mode (0 to 70°C)	VRM	2.0			V
Supply Current (Run)	IDD		4.7	7.0	mA
I/O Ports Hi-Z Leakage Current	IIL			+/-10	uA
Input Current	IIN			+/- 1	uA
I/O Port Capacitance	CIO		8	12	pF

Control Timing (Vdd=5.0 Vdc +/-10%, Vss=0 Vdc, Temperature range=T low to T high unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
Frequency of Operation ■ Crystal Option ■ External Clock Option	fosc	dc	4.0 4.0	MHz
Internal Operating Frequency ■ Crystal (fosc/ 2) ■ External Clock (fosc/ 2)	fOP	dc	2.0 2.0	MHz
Cycle Time	tcyc	500		ns
Crystal Oscillator Startup Time	toxov		100	MS
Stop Recovery Startup Time	tILCH		100	ms
RESET Pulse Width	tRL	8		tcyc
Interrupt Pulse Width Low	tLIH	125		ns
Interrupt Pulse Period	tILIL	*		tcyc
OSC1 Pulse Width	toH, toL	90		ns

*The minimum period tILIL should not be less than the number of cycle times it takes to execute the interrupt service routine plus 21 tcyc.