USAR Systems

Microcontroller products

UR5HC418

PRELIMINARY

KeyCoder™ PC/XT/AT/PS2 Compatible Versatile Keyboard Encoder

Product Specification

DESCRIPTION

The USAR UR5HC418 KeyCoder Keyboard Controller is an HCMOS microcontroller which provides a versatile Desktop computer keyboard encoder and two bidirectional communication channels for communicating with a BIOS compatible system and a keyboard compatible device such as an 101/102 standard IBM-type of keyboard or a PS2 mouse. It is designed for use in PC/AT/PS2 Desktop designs.

The keyboard encoder handles the scanning, debounce and encoding of 101 keys organized on an 8 X 16 matrix. Each key press generates one of the scan codes listed in the IBM Technical Reference Manual. The encoder supports embedded numeric keypad function as well as alternate scan codes for specific keys in order to implement the functionality of an 101/102 keyboard. The encoder can buffer up to 34 keycodes. Control inputs and outputs are provided for interfacing with a contact switch matrix. Three output pins are provided for LED status indicators.

The UR5HC418 fully supports the IBM-standard keyboard communication protocol.

In addition to the system's keyboard communication port, UR5HC418 provides a fully functional keyboard input port that can be used by a standard 83/101/102 keyboard or other compatible devices such as a PS2 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 is coming from a single source.

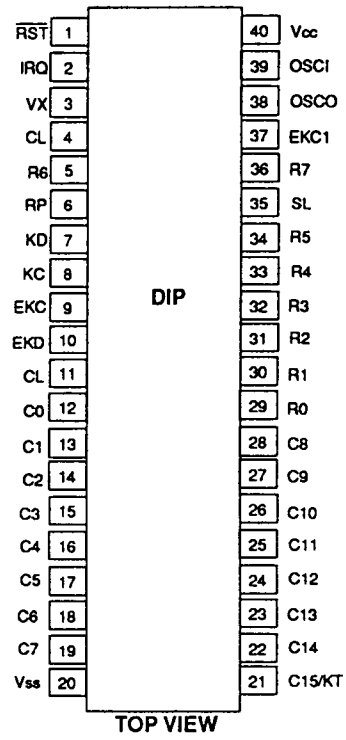
FEATURES

- **Single IC Standard 101/102 Key Keyboard Encoder**
- **PC/XT or AT/PS2 Bios compatible**
- **Provides interface for PS2 mouse, external keyboard/keypad or other 8042 compatible devices**
- **Implements All functions of an 101/102 keyboard**
- **Low Power HCMOS microcontroller, suitable for low power operated systems**
- **Custom keys available, including macros**
- **Available in DIP, PLCC and Quad Flat Packages**
- **Custom version available in small or large quantities**

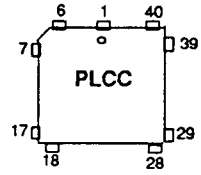
APPLICATIONS

- **Desktop computers**
- **Point of sales terminals**
- **Public information kiosks**
- **Instrumentation**
- **Industrial keyboards**

PIN CONFIGURATIONS



TOP VIEW



Pin	Function	Pin	Function
1	RST	23	NC
2	IRQ	24	C15/KT
3	NC	25	C14
4	VX	26	C13
5	NL	27	C12
6	R6	28	C11
7	RP	29	C10
8	KD	30	C9
9	KC	31	C8
10	EKC	32	R0
11	EKD	33	R1
12	CL	34	R2
13	C0	35	R3
14	C1	36	R4
15	C2	37	R5
16	C3	38	NC
17	C4	39	R7
18	NC	40	NC
19	C5	41	EKC1
20	C6	42	OSCO
21	C7	43	OSCI
22	Vss	44	Vcc

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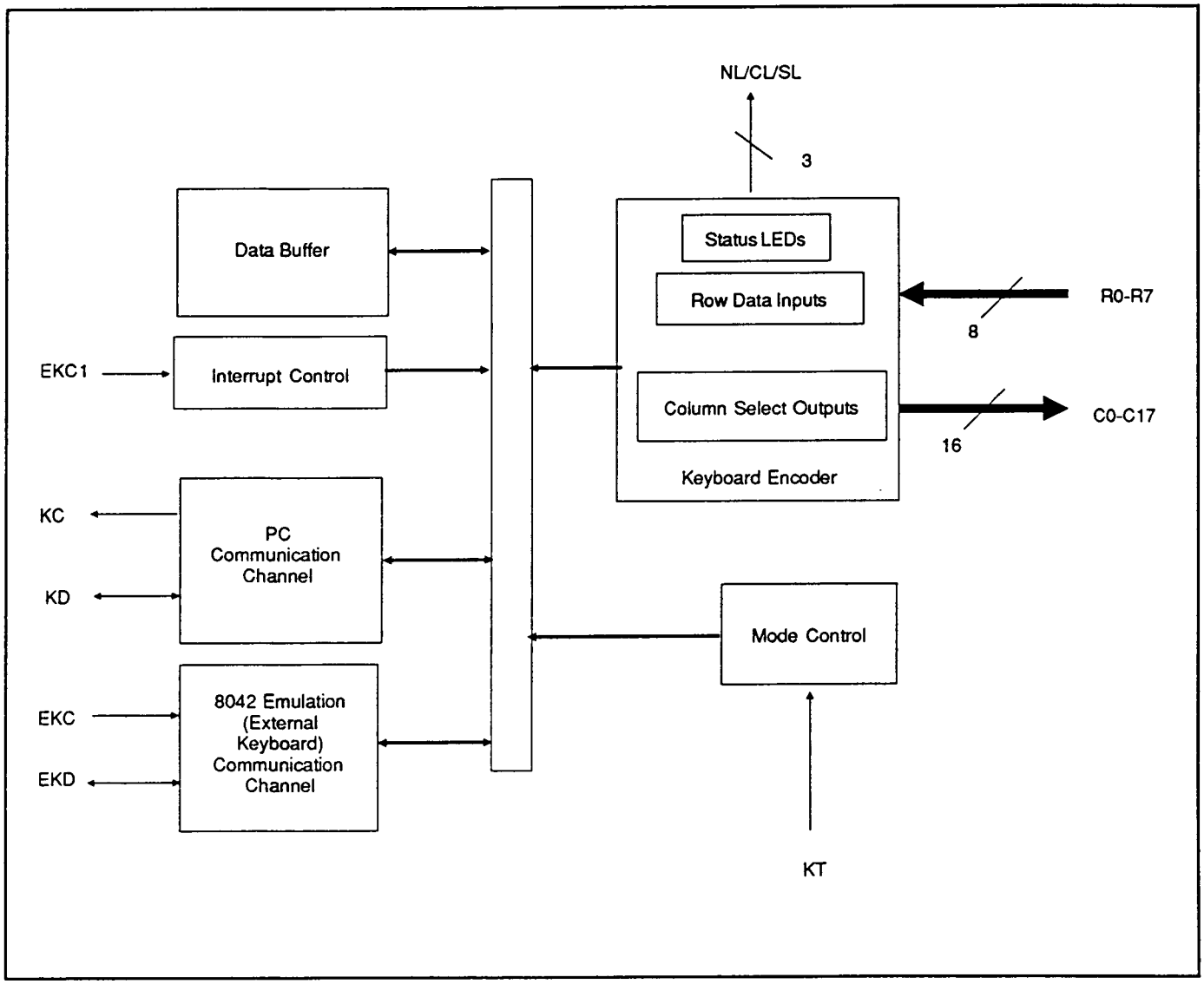
ORDERING CODE

PACKAGES	TA = 0 °C to + 70 °C	TA = -40 °C to + 85 °C
40 pin, Plastic DIP	UR5HC418-P	UR5HC418-CP
44 pin, Plastic PLCC	UR5HC418-FN	UR5HC418-CFN
44 pin, Plastic QFP	UR5HC418-FB	UR5HC418-CFB

FUNCTIONAL DIAGRAM



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PIN DESCRIPTION

MN	PIN NO. DIP	PLCC	TYPE	NAME AND FUNCTION
Vcc	40	44	I	**PowerSupply:** +5V.
Vss	20	22	I	**Ground**
OSCI	39	43	I	**OscilatorInput**
OSCO	38	42	O	**OscilatorOutput**
$\overline{RST}$	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 it is used to generate an interrupt for every clock line transition.
VX	3	4	I	For OTP parts, tie to Vcc. For ROM parts, no connect.
RP	6	7	I	**Reserved:** Tie 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	29-34	32-37	I	**Row data inputs.**
R6	5	6	I	
R7	36	39, 40	I	
C0-C7	12-19	13-17 19-21	O	**Column Select Outputs**: Select one of 16 columns.
C8-C14	28-22	31-25		
C15/KT	21	24	I/O	**Column Select 15/Keyboard type selection:** This pin is used both as a column select output and as input for keyboard type selection. When the pin is set low, selects PC/XT protocol. When it is set high, selects AT/PS2 protocol.
CL	11	12	O	**Num Lock LED**
NL	4	5	O	**Caps Lock LED**
SL	35	38	O	**Scroll lock LED**
		3, 18, 23, 40	-	**No connects:** These pins are unused.

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FUNCTIONAL DESCRIPTION

The UR5HC418 consists functionally of five major sections (see block diagram). These are the Keyboard encoder, the PC communication channel, the 8042 emulation channel, the interrupt and the mode control unit. These sections communicate with each other and operate concurrently.

KEYBOARD ENCODER

The controller is scanning continuously a keyboard organized as an 8 row by 16 column matrix, for a maximum of 128 keys. Smaller size keyboards can be connected provided that all unused row lines are connected to Vcc. The microcontroller selects one 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 zero 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) is 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 combination of keys of the IBM-standard 101/102 keyboard.

Scan Code Table Sets

UR5HC418 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 Manual. Custom scan code tables, including macros, are also available.

Status LED indicators

The controller provides interface 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 commands issued by the system in the AT/PS2 protocol.

MODE CONTROL

Protocol	KT
PC/XT	L
AT/PS2	H

Table 1. Communication Protocol Selection

Operating modes are defined by the logic level of the relevant mode pins in the mode control unit.

Protocol Selection

Pin KT selects the protocol of communicating with the host system and the standard keyboard, according to Table 1.

N-Key Rollover Mode

In this mode the code(s) corresponding to each key press is transmitted to the host system as soon as that key is debounced, independent of the release of other keys.
If the key is defined to be typematic, the corresponding code(s) is being transmitted for as long as that key is pressed. When a key is released then the corresponding break code(s) is 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. Nevertheless, two or more key closures occuring within a time interval less than 5ms will set an error flag and they will not be processed. This procedure protects from 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 appears as being pressed (See Fig. 1). This is known as the "ghost" or "phantom" key problem.

Although the problem cannot be totally eliminated in contact matrixes, there are methods that can eliminate 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

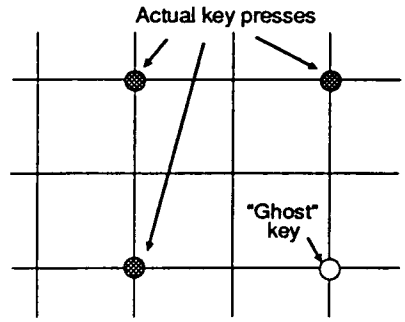

Figure 1: "Ghost key problem

row or column of the matrix, whenever possible. Shift keys (Shift, Alt, Ctrl) should not co-reside in the same row (or column) with any other key.

UR5HC418 has two mechanisms to detect a "ghost" key. Whenever a key appears in a location of the matrix for which there is no scan code assignment (empty location), it is rejected as a "ghost" key. In addition, when two or more keys are found to be pressed simultaneously, then processing for these keys is suspended until the situation is resolved.

PC COMMUNICATION

UR5HC418 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 UR5HC418 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 value 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
Resend		FE
Reset		FF

Table 3: 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. Mode 1 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 4: 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 keyboard will not affect the normal operation of UR5HC418.

EXTERNALKEYBOARD COMMUNICATION

UR5HC418 fully emulates a system's keyboard port, available to a standard 83/101/102 external keyboard or other 8042 compatible device. Communication with an external keyboard is accomplished via EKC and EKD, clock and data lines respectively. A third pin, EKC1 that connects to the clock line, interrupts the controller whenever the external keyboard initiates a communication session. When power is first applied, the controller proceeds with the standard reset sequence with the external keyboard. Data and commands coming from the external keyboard are buffered in the controller's FIFO along with data from the scanned matrix and they are presented to the system as if they are coming from a single source. Commands and data from the system after they are acknowledged are transmitted to the external keyboard.

Special Handling

External keyboard connection

UR5HC418 checks every 2 seconds for the presence of an external keyboard. If an external keyboard was not connected during power-on and it is connected at a later time the controller will proceed with the normal reset routine in order to initialize the external keyboard properly. After communication has been established, the controller still keeps checking for the external keyboard's presence. If the external keyboard gets disconnected at a later time, the controller will be aware of it, so if a new connection takes place, it will re-initiate a reset sequence. This feature allows the user to connect and disconnect an external keyboard at any time, without having to reset the entire system.

Shift Status LEDs

Shift Status LEDs (Num Lock, Caps Lock and Scroll Lock) indicate the status of the system and they 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 set properly after every new connection of an external keyboard.

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Table 5: Standard Key Map

ROW (R0-R7)								COLUMN (C0-C15)
0	1	2	3	4	5	6	7	
Ctrl (Left)	Ctrl (Right)							0
Esc	F1	! 1	F2	@ 2	F4	F3	Q	1
Tab	Z	Caps Lock	A	# 3	F5	% 5	W	2
Alt (Left)	Alt (Right)							3
Space	X	V	S	$ 4	F6	^ 6	E	4
	C	B	D	T	F7	& 7	R	5
~ `		N	F	Y	F8	* 8	G	6
Insert	> .	M	J	U	F9	(9	H	7
Delete	? /	< ,	K	I	F10	) 0	{ [	8
Left Arrow		" '	L	O	Num Lock	_ -	}]	9
Dn Arrow	Up Arrow	Enter	: ;	P	Scroll Lock	+ =	| \	10
Shift (Left)	Shift (Right)							11
Right Arrow	End	Pg Dn	PgUp	Backspace	Print Screen	Pause Break	Home	12
/	*	1 End	2 Dn Arrow	3 Pg Dn	4 Left Arrow	5	6 Right Arrow	13
9 Pg Up	8 Up Arrow	7 Home	F11	F12	0 Ins	. Del	+	14
Enter (Keypad)	-							15

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 numbers refer to the standard IBM keyboard layout (See IBM technical manual for details). Scan Code Set 1 is the only scan code set supported when UR5HC418 is set in XT mode. Scan Code Set 2 is the default when UR5HC418 is set in AT/PS2 mode.

Scan Code Set 1

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

Table 5-1. KeyCoder Scan Codes, Set 1 (Part 1 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	Base Case, or Shift+ NmLk		Shift Case		Num Lock on	
No.	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 code.

Table 5-2. Keyboard Scan Codes, Set 1 (part 2 of 5)

Key	Scan Code		Shift Case	
No.	Make	Break	Make	Break
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 code.

Table 5-3. Keyboard Scan Codes, Set 1 (Part 3 of 5)

Key	Scan Code		Ctrl Case, Shift Case		Alt Case	
No.	Make	Break	Make	Break	Make	Break
124	E0 2AE0 37	E0 B7 E0 AA	E0 37	E0 B7	54	D4

Tabel 5-4. Keyboard Scan Codes, Set 1 (Part 4 of 5)

Key No.	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.

Table 5-5. Keyboard Scan Codes, Set 1 (Part 5 of 5)

Scan Code Set 2

The following keys send the codes shown regardless of any shift states in the keyboard or in 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

Table 6-1. Keyboard Scan Codes, Set 2 (Part 1 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 #	Base Case, or Shift+ NmLk		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	EO 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 code.

Table 6-2. Keyboard Scan Codes, Set 2 (Part 2 of 5)

Key	Scan Code		Shift Case	
No.	Make	Break	Make	Break*.
95	E0 4A	E0 F0 4A	E0 F0 12 4A	E0 12 F0 4A

*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 code are sent with the other scan code.

Table 6-3. Keyboard Scan Codes, Set 2 (Part 3 of 5)

Key #	Scan Code		Ctrl Case, Shift Case		Alt Case	
	Make	Break	Make	Break	Make	Break
124	E0 12 E0 7C	E0 F0 7C E0 F0 12	E0 7C	E0 F0 7C	84 F0 84	

Table 6-4. Keyboard Scan Codes, Set 2 (Part 4 of 5)

Key No.	Make Code	Ctrl Key pressed
126*	E1 14 77 E1 F0 14 F0 77	E0 7E E0 F0 7E

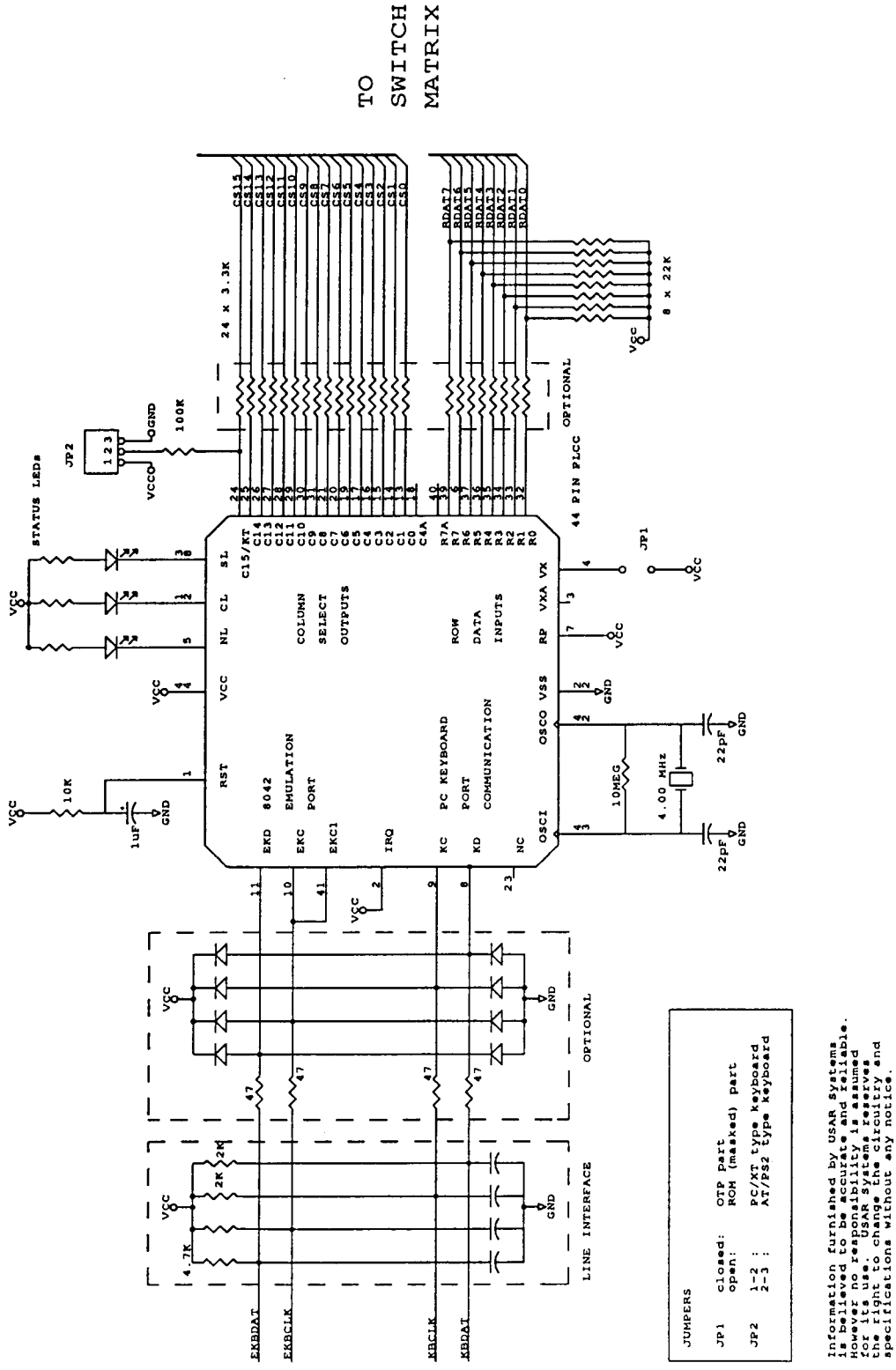
*This key is not Typematic. All associated scan codes occur on the make of the key.

Table 6-5. Keyboard Scan Codes, Set 2 (Part 5 of 5)

Key No.	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
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

Table 7-1. Keyboard Scan Codes, Set 3

Suggested Interfacing for UR5HC418



ELECTRICALSPECIFICATIONS

1.1 Absolute Maximum Ratings

Ratings	Symbol	Value	Unit
Supply Voltage	V_{DD}	-0.3 to +7.0	V
Input Voltage	V_{IN}	V_{SS} -0.3 to V_{DD} +0.3	V
Current Drain per Pin (not including V_{SS} or V_{DD})	I	25	mA
Operating Temperature UR5HC418-xx UR5HC418-Cxx	T_A	T_{LOW} to T_{HIGH} 0 to +70 -40 to +85	Deg. Celsius
Storage Temperature Range	T_{STG}	-65 to +150	Deg. Celsius

1.2 Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance	T_{JA}		Deg. C per W
Plastic		60	
Cerdip		60	
PLCC		70	

1.3 DC Electrical Characteristics

(V_{DD} = 5.0 Vdc +/- 10%, V_{SS} = 0 Vdc, Temperature range = T_{LOW} to T_{HIGH} unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage, I_{LOAD} < 10 uA	V_{OL} V_{OH}	- V_{DD} - 0.1	- -	0.1 -	V
Output High Voltage (I_{LOAD} = 0.8 mA)	V_{OH}	V_{DD} - 0.8	-	-	V
Output Low Voltage (I_{LOAD} = 1.6 mA)	V_{OL}	-	-	0.4	V
Input High Voltage	V_{IH}	0.7 x V_{DD}	-	V_{DD}	V
Input Low Voltage	V_{IL}	V_{SS}	-	0.2 x V_{SS}	V
User Mode Current	I_{PP}	-	5	10	mA
Data Retention Mode (0 to 70 C)	V_{RM}	2.0	-	-	V
Supply Current Run	I_{DD}	 -	 4.7	 7.0	 mA
I/O Ports Hi-Z leakage Current	I_{IL}	-	-	+/- 10	uA
Input Current	I_{IN}	-	-	+/- 1	uA
I/O Port Capacitance	C_{IO}	-	8	12	pF

1.4 Control Timing

(V_{DD} = 5.0 Vdc +/- 10%, V_{SS} = 0 Vdc, Temperature range = T_{LOW} to T_{HIGH} unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
Frequency of Operation	f_{osc}			MHz
Crystal Option		-	4.0	
External Clock Option		dc	4.0	
Internal Operating Frequency	f_{op}			MHz
Crystal (f_{osc} / 2)		-	2.0	
External Clock (f_{osc} / 2)		dc	2.0	
Cycle Time	t_{cyc}	500	-	ns
Crystal Oscillator Startup Time	t_{OXOV}	-	100	ms
Stop Recovery Startup Time	t_{ILCH}	-	100	ms
RESET Pulse Width	t_{RL}	8	-	t_{cyc}
Interrupt Pulse Width Low	t_{ILIH}	125	-	ns
Interrupt Pulse Period	t_{ILIL}	*	-	t_{cyc}
OSC1 Pulse Width	t_{OH}, t_{OL}	90	-	ns

* The minimum period t_{ILIL} should not be less than the number of cycle times it takes to execute the interrupt service routine plus 21 t_{CYC}.

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