

Sun-Compatible Type 5 Keyboard Encoder KeyCoder™ UR5HCSUN

Description

The USAR UR5HCSUN keyboard encoder is a low-power HCMOS microcontroller functioning as a Type 5 Sun-compatible keyboard encoder. The UR5HCSUN fully implements the Sun Type 5 specification for keyboards and will provide a single IC solution for low-cost Sun-compatible keyboards.

The UR5HCSUN will scan, debounce and decode an 8 X 17 contact switch matrix. Scanning of the matrix allows for multi-key rollover on low-cost contact-type matrixes, without the need of decoupling diodes. The UR5HCSUN will detect "ghost" keys and will resolve conflicting situations without erroneous data transmissions. The UR5HCSUN communicates with the host system through a full duplex 9600 baud serial port. It provides direct interface for four status LEDs and for an on-board audio annunciator circuit. The UR5HCSUN will generate the 2.2 KHz required tone frequency internally without the need for additional support hardware.

The UR5HCSUN supports the complete set of commands from the system, defined in the Type 5 specification for Sun keyboards. The UR5HCSUN is offered both in a one-time-programmable version for custom layouts and small production runs and a low-cost masked ROM version for higher volumes. The UR5HCSUN contains clock monitor and watchdog circuitry for added reliability. The increased functionality makes it ideal for reduced component count implementations of reliable Sun-compatible keyboard types of devices.

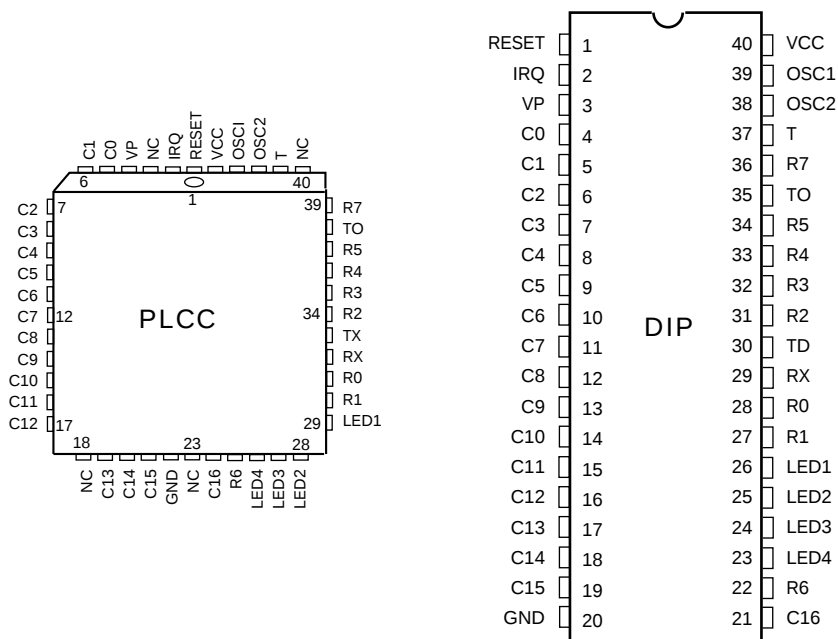
Features

- Type 5 Sun-compatible single IC keyboard/keypad encoder
- 9600 baud full duplex communication
- Low-power HCMOS technology
- Available in DIP, PLCC and Quad Flat packages
- Custom versions available in small and large quantities

Applications

- Sun-compatible keyboards
- Industrial keyboards
- RS232-compatible keyboards

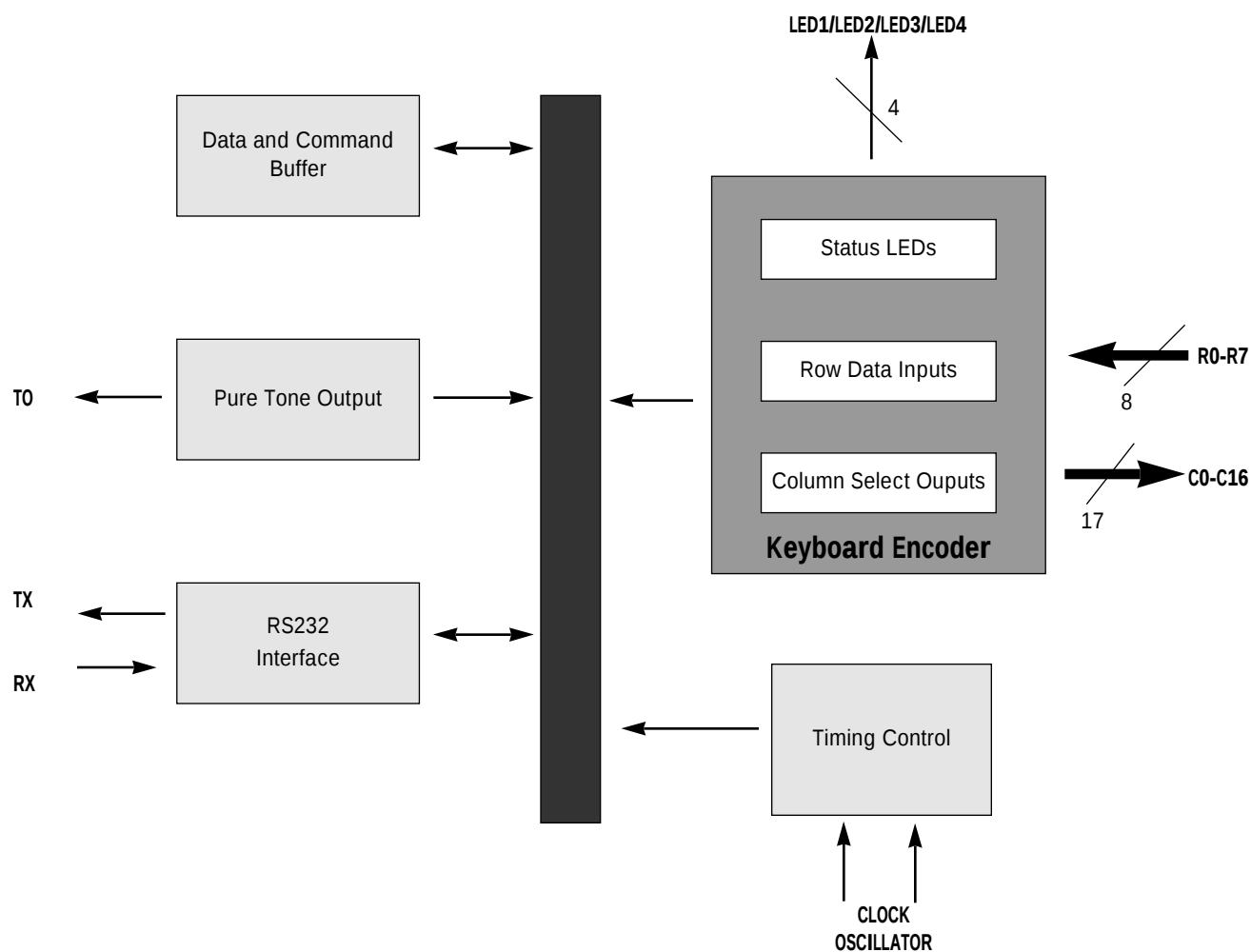
Pin Configurations



Ordering Code

PACKAGES	TA = 0°C TO +70°C	TA = -40°C TO +85°C
40 pin, Plastic DIP	UR5HCSUN-P	UR5HCSUN-CP
44 pin, Plastic PLCC	UR5HCSUN-FN	UR5HCSUN-CFN
44 pin, Plastic QFP	UR5HCSUN-FB	UR5HCSUN-CFB

Functional Diagram



Data Communication

The UR5HCSUN communicates with the host system through a full duplex, asynchronous communication port. Input and output signals are at CMOS levels and the data format is standard NRZ with one start bit, eight data bits (least significant bit first), one stop bit and no parity. Default communication speed is 9600 baud. In order to provide the Sun specification current requirements (sinking up to 30 mA) and the proper polarity of the signals, a high current inverter circuit is needed to interface between the UR5HCSUN lines and the host system. The data output format is shown on the following figure:

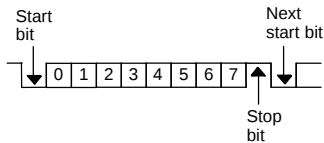


Figure1: Data Format

Commands

The UR5HCSUN implements the following commands:

Hex Code	Command
01	Reset
02	Start Beep
03	Enable Click
0A	Stop Beep
0B	Disable Click
0C-XX	Set LEDs
XX	LED number
0F	Transmit ID

Pin Description

Mnemonic	Pin Numbers		Type	Name and Function
	DIP	PLCC		
Vcc	40	44	I	Power Supply: +5 Volts.
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.
VP	3	4	I	Tie to Vcc.
TX	30	33	O	Transmit Data Output: provides RS232 logic compatible output at standard NRZ format (0 to 5 Volts)
RX	29	32	I	Receive Data Input: provides RS232 logic compatible serial input.
LED1-LED4	26-23	29-26	O	Caps Lock, Compose, Scroll Lock and Num Lock LED outputs
IRQ	2	2	I	Interrupt Line: reserved for low power applications.
R7	36	39	I	Row Data Inputs
R6	22	25	I	
R5-R2	33-29	37 34	I	
R1-R0	27-28	30-31	I	
C0-C11	4-15	5-17	O	Column Select Outputs: select 1 of 16 columns.
C12-C15	16-19	19-21	O	
C16	21	24	O	
NC		3, 18 23, 40		No Connects: these pins are unused.

Keyboard messages

The UR5HCSUN transmits to the system the following messages:

Key Operate

A unique key operate code is sent each time a key is debounced successfully.

Key Release

A release code is sent each time a key is found to be released.

Idle

The Idle Code (7F Hex) is sent when the encoder detects that all keys are released.

Error

The Error code (7E Hex) followed by 01 Hex is sent if the encoder fails its internal diagnostics. The internal diagnostics are performed at power-on, and upon a hardware or software reset.

ID Code

Upon request the encoder transmits the code FE Hex followed by the ID code for the keyboard type and country settings. The UR5HCSUN defaults to US Type 5 keyboard.

Scan Codes

Key#	Make Code	Break Code	Key#	Make Code	Break Code
1	01	81	66	42	C2
3	03	83	67	43	C3
5	05	85	68	44	C4
6	06	86	69	45	C5
7	07	87	70	46	C6
8	08	88	71	47	C7
9	09	89	72	48	C8
10	0A	8A	73	49	C9
11	0B	8B	75	4A	CA
12	0C	8C	76	4C	CC
13	0D	8D	77	4D	CD
14	0E	8E	78	4E	CE
15	0F	8F	79	4F	CF
16	10	90	80	50	D0
17	11	91	81	51	D1
18	12	92	82	52	D2
19	13	93	83	53	D3
21	15	95	84	54	D4
22	16	96	85	55	D5
23	17	97	86	56	D6
25	19	99	87	57	D7
26	1A	9A	88	58	D8
29	1D	9D	89	59	D9
30	1E	9E	90	5A	DA
31	1F	9F	91	5B	DB
32	20	A0	92	5C	DC
33	21	A1	93	5D	DD
34	22	A2	94	5E	DE
35	23	A3	95	5F	DF
36	24	A4	97	61	E1
37	25	A5	98	62	E2
38	26	A6	99	63	E3
39	27	A7	100	64	E4
40	28	A8	101	65	E5
41	29	A9	102	66	E6
42	2A	AA	103	67	E7
43	2B	AB	104	68	E8
45	2D	AD	105	69	E9
46	2E	AE	106	6A	EA
47	2F	FF	107	6B	EB
48	30	B0	108	6C	EC
49	31	B1	109	6D	ED
50	32	B2	110	6E	EE
51	33	B3	111	6F	EF
53	35	B5	112	70	F0
54	36	B6	113	71	F1
55	37	B7	114	72	F2
56	38	B8	115	73	F3
57	39	B9	116	74	F4
58	3A	BA	117	75	F5
59	3B	BB	118	76	F6
60	3C	BC	119	77	F7
61	3D	BD	120	78	F8
62	3E	BE	121	79	F9
63	3F	BF	122	7A	FA
64	40	C0	124	7C	FC
65	41	C1	125	7D	FD

Keyboard Layout

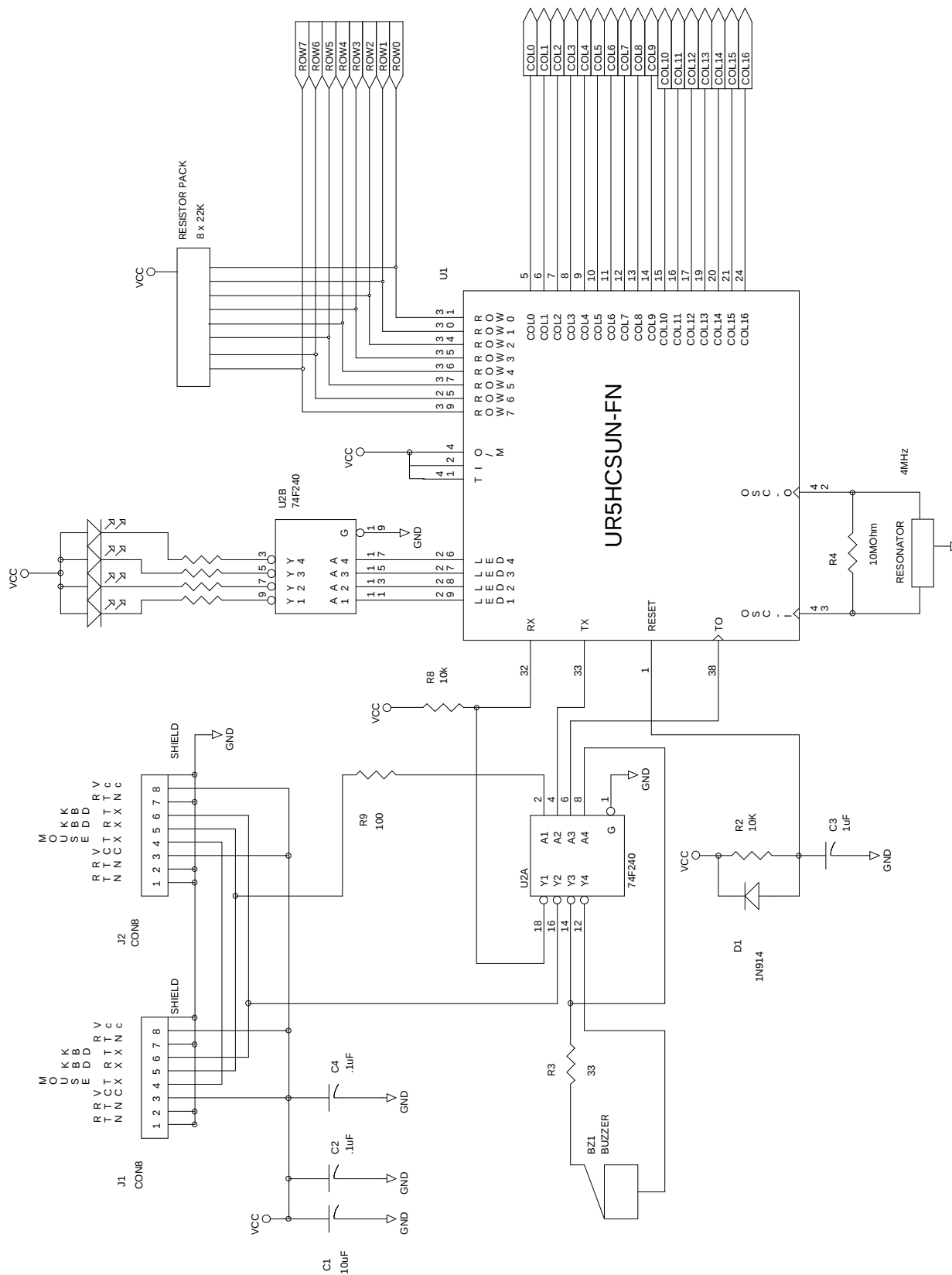


Standard Key Map

		Rows (R0-R7)							
		0	1	2	3	4	5	6	7
Columns(C0-C16)	0	Ctrl	Cmp						
	1	Esc	F1	1	F2	2	F4	F3	Q
	2	Tab	Z	Caps Lock	A	3	F5	5	W
	3	Alt	⌘>						
	4	Space	X	V	S	4	F6	6	E
	5		C	B	D	T	F7	7	R
	6	` (back-quote)		N	F	Y	F8	8	G
	7	.Insert	. (period)	M	J	U	F9	9	H
	8	Delete	/	, (comma)	K	I	F10	0	[
	9	Left Arrow		' (quote)	L	O	Num Lock	- (minus)	]
	10	Down Arrow	Up Arrow	Enter	; (column)	P	Scroll Lock	=	\
	11	Shift Left	Shift Right						
	12	Right Arrow	End	Pg Dn	Pg Up	Back Space	Print Screen	Pause	Home
	13	/ (grey)	* (grey)	1 (N)	2 (N)	3 (N)	4 (N)	5 (N)	6 (N)
	14	9 (N)	8 (N)	7 (N)	F11	F12	0 (N)	Del (N)	+ (N)
	15	Enter (N)	- (N)	Stop	Again	Props	Undo	Front	Copy
	16	Open	Paste	Find	Cut	Compose	Alt Gr	Help	

(N) Keys on the numeric keypad

Sample Schematics for the UR5HCSUN



Electrical Specifications

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	T _A	T _{LOW} to T _{HIGH} 0 to +70 -40 to +85	°C
Storage Temperature Range	T _{STG}	-65 to +150	°C

Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance	T _{JA}		°C per W
■ Plastic		60	
■ Cerdip		60	
■ PLCC		70	

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} <10uA)	V _{OL}			0.1	V
	V _{OH}	V _{DD} -0.1			
Output High Voltage (I _{LOAD} =0.8mA)	V _{OH}	V _{DD} -0.8			V
Output Low Voltage (I _{LOAD} =1.6mA)	V _{OL} :			0.4	V
Input High Voltage	V _{IH}	0.7xV _{DD}		V _{DD}	V
Input Low Voltage	V _{IL}	V _{SS}		0.2xV _{DD}	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

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	fosc			MHz
■ Crystal Option			4.0	
■ External Clock Option		dc	4.0	
Internal Operating Frequency	fop			MHz
■ Crystal (fosc/ 2)			2.0	
■ External Clock (fosc/ 2)		dc	2.0	
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	tiLH	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.