SerialCoder™ IR UR5HC703-IR20

Extremely Low-Power Keyboard Encoder Interfaces IrDA

HID & SYSTEM MANAGEMENT PRODUCTS, KEYCODER™ FAMILY **PRELIMINARY**

DESCRIPTION

The SerialCoder™ IR UR5HC703-IR20 is an extremely low-power, "off-the-shelf" infrared serial keyboard encoder. Robust, tiny and flexible, the IC is a good match for any application where a low-cost wireless keyboard is attractive and an IrDA host is available.

The IC provides extremely low-power operation, transparent to the host. Power consumption is reduced to just the circuit's leakage when all keys are released. The typical current consumption is less than 1µA at room temperature and 10µA at 85°C.

If a key or group of keys stays in the depressed position for ten minutes (with no other keyboard activity), the IC shuts down to save power.

The SerialCoder™ IR is simple to implement. It requires few external components and utilizes a tiny, low-profile 32-pin LQFP package that measures 7mm x 7mm.

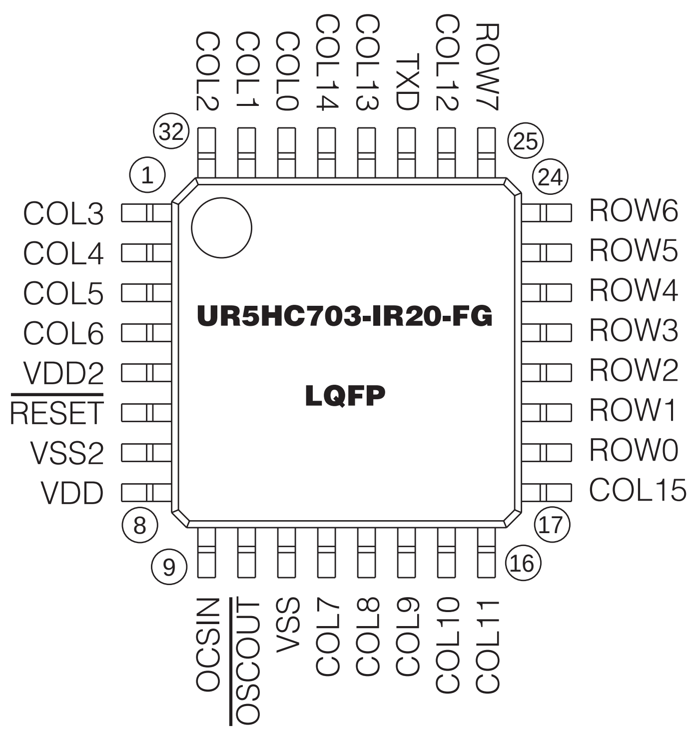
FEATURES

- 8 x 16 Matrix Encoding
- IC is independent of the keyboard layout
- Extremely low-power operation, transparent to the host
- Typical current consumption of less than 1µA at room temperature; 10µA at 85°C
- Robust algorithm for ghost-key elimination
- CMOS output-only asynchronous serial interface to the host using standard IrDA
- 9600 Baud 8N1 serial data format
- Very simple serial protocol — two-byte identification string on power-up; single-byte matrix-position for each key-press or key-release
- Low-cost wireless keyboard solution

APPLICATIONS

- Infrared wireless keyboards
- Personal digital assistant (PDA) keyboard
- Instrumentation
- Remote control
- Home entertainment or automation

PIN ASSIGNMENTS



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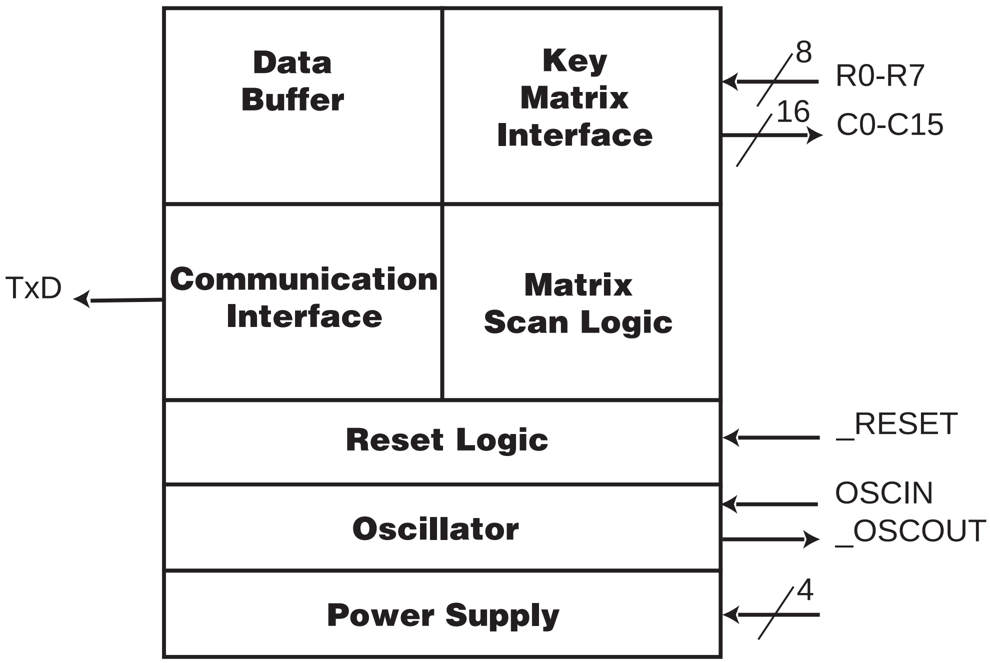
ORDERING CODE

Package Options	Pitch	Ta = -20° C to +85° C
32-pin plastic LQFP	0.8 mm	UR5HC703-IR20-FG

Other Materials	Type	Order number
UR5HC703-IR20 eval. kit	Evaluation kit	EVK5-703-IR20

SERIALCODER™ IR UR5HC703-IR20 FUNCTIONAL DIAGRAM



SEMTECH

PIN DEFINITIONS

Mnemonic	Pin #	Type	Name and Function
Power Supply			
V_{DD}, $V_{DD}2$	8,5	PWR	**Positive supply voltage**
V_{SS}, $V_{SS}2$	11,7	PWR	**Negative power Supply**: signal ground
Reset			
_RESET	6	I	**Hardware reset pin**: Reset Input for orderly start-up. Low logic level is required whenever V_{DD} is below minimum operating voltage
Oscillator pins			
OSCIN	9	I	**Oscillator input**: Connect ceramic resonator with built-in load capacitors or CMOS clock from external oscillator 2 MHz operating frequency
_OSCOUT	10	O	**Oscillator output**: Connect ceramic resonator with built-in load capacitors or keep open if external oscillator is used
Host Interface			
TxD	27	O	**Serial data output**: Idle at high voltage (logical 1), non-inverted data; 4µs pulsed output per IrDA timing specification
Scanned matrix pins			
ROW0-ROW7	18-25	I	**Row matrix inputs** with pulsed pull-up current sources
COL0-COL15	30-32, 1-4, 12-16, 26, 28, 29, 17	O	**Column matrix output**, open drain

Note: An underscore before a pin mnemonic denotes an active low signal.

"GHOST" KEYS

In any scanned contact switch matrix, whenever three keys defining a rectangle on the switch matrix are 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.

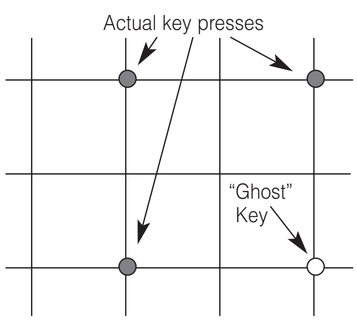


Figure 1: "Ghost" or "Phantom" Key Problem

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 should be placed in the same row or column of the matrix, whenever possible. Shift keys (Shift, Alt, Ctrl, Window) should not reside in the same row (or column) as any other keys. The SerialCoder™ IR has built-in mechanisms to detect the presence of "ghost" keys.

KEYBOARD SCANNER

The encoder scans a keyboard organized as an 8 row by 16 column matrix for a maximum of 128 keys. Smaller size matrixes can also be accommodated by simply leaving unused pins open. The SerialCoder™ IR provides internal pull-ups for the row input pins. When active, the encoder selects one of the column lines (C0-C15) every 512 μS 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) are loaded into the transmit buffer of the serial communication channel.

N-KEY ROLLOVER

N-key rollover means the code(s) corresponding to each key press are transmitted to the host system as soon as that key is debounced, independent of the release of other keys.

When a key is released, the corresponding break code is transmitted to the host system. Several keys can be held pressed at the same time. However, if two or more key closures occur within a time interval of less than 5 ms, an error flag is set, and those closures are not processed. This feature protects against the effects of accidental key presses.

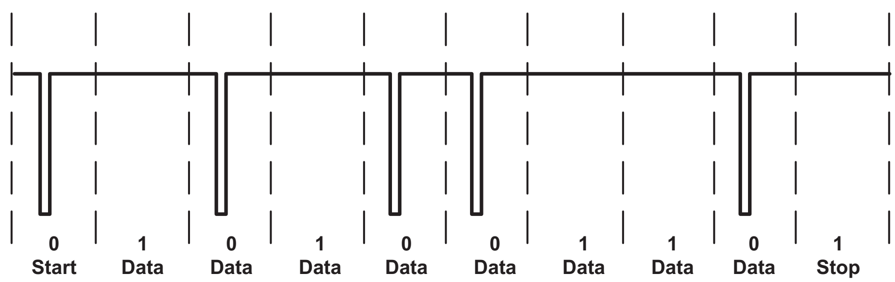
POWER MANAGEMENT

The SerialCoder™ IR achieves uniquely low system power consumption thanks to Self-Power Management™, which powers down the IC between key presses. A key press wakes up the IC immediately without losing any key data.

PROTOCOL

Serial transmission rate is 9600 Baud, with 8 data bits, no parity, least significant bits transmitted first, idle/stop level high (logical 1), start bit level low (logical 0), non-inverted data. Each bit with a zero value, including the start bit, is indicated by a four-microsecond low pulse of the TxD line toward the beginning of the time slot for the bit.

Infrared signals are based on the Infrared Data Association (IrDA) *Serial Infrared Physical Layer Specification*. The diagram below shows the electrical wave form of a single transmitted byte, 0x65. (Note that pulse width is not to scale.)



Within 5ms after power-up, the IC sends a two-byte identification string of 0xF9, 0xFB. These two bytes are transmitted only once after each power-up or reset of the IC.

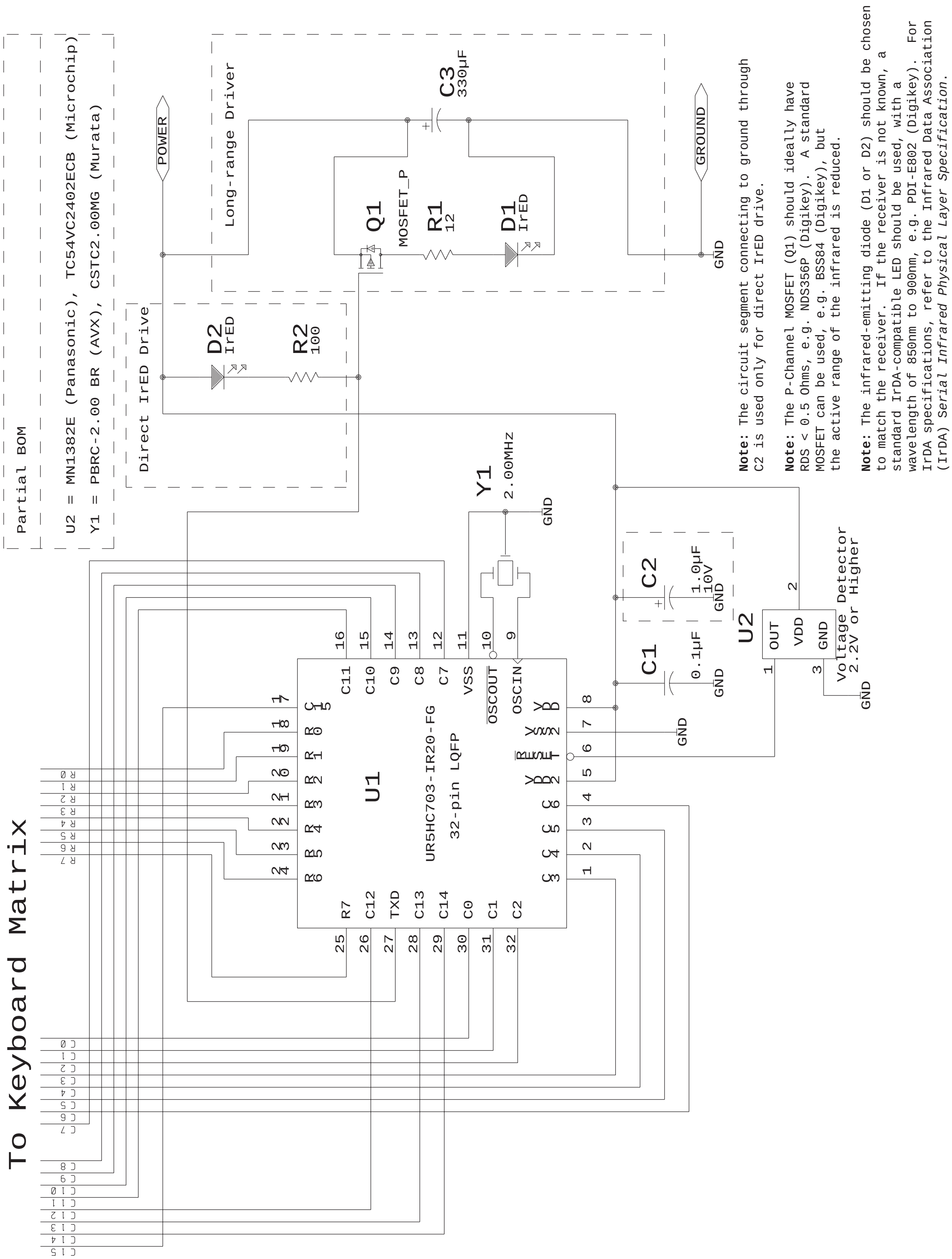
These two ID values also represent key release action in the locations [row=1, column=15] and [row=3, column=15] on the key matrix. Since the values of these bytes represent release action of the keys, extraneous characters are never generated, even if synchronization between the driver and IC is lost, or power fluctuations/erroneous resets are applied to the chip. If logistics of the host software driver do not permit "shared" use of the identification values 0xF9 and 0xFB, then the user is advised not to incorporate keys in the locations [row=1, column=15] and [row=3, column=15] for the key matrix design.

Subsequent single-byte transmissions indicate the row (0-7), column (0-15), and press/release action for each change of the state of every key. If the release of a key leaves all of the keys on the key matrix in the released state, the release report for that key is sent twice. Two release report bytes in a row for the same key are a signal to the host driver that the keyboard is completely idle and all keys are up.

Keyboard Report Byte

Bit Number	**Comment**
b7	0 for key press (make), 1 for key release (break)
b6	Column location in the key matrix 4-bit binary value (0-15)
b5	
b4	
b3	
b2	Row location in the key matrix (0-7) 3-bit binary value (0-7)
b1	
b0	

SAMPLE SCHEMATIC FOR THE SERIALCODER™ IR UR5HC703-IR20-FG



Absolute Maximum Ratings

Ratings	**Symbol**	**Value**	**Unit**
(VSS = 0V, Ambient temperature TA is in the range TLOW to THIGH)			
Supply voltage	VDD	-0.3 to +7.0	V
Input voltage:			
All input pins	VIN	-0.3 to VDD +0.3	V
Output current:			
Total peak for all pins	ΣIOH (Peak)	-80	
	ΣIOL (Peak)	80	mA
Total average for all pins	ΣIOH (Avg)	-40	
	ΣIOL (Avg)	40	mA
Peak for each pin	IOH (Peak)	-10	
	IOL (Peak)	10	mA
Average for each pin	IOH (Avg)	-5	
	IOL (Avg)	5	mA
Temperature range			
Operating temperature	TLOW to THIGH	-20 TO 85	°C
Storage temperature	TSTG	-40 TO 125	°C
ESD rating (human body model)	VESD	2.0	KV

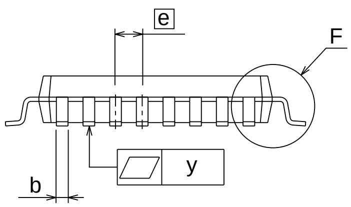
DC Electrical Characteristics, temperature range=T low to T high unless otherwise noted)

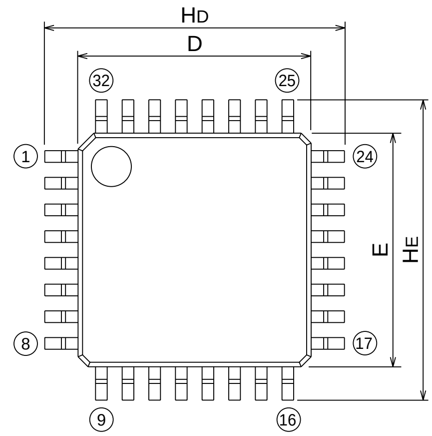
Characteristic	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Operating voltage	VDD	2.2		5.5	V
Input voltage					
High	VIH	0.8 VDD		VDD	V
Low	VIL	0		0.3 VDD	V
	VIL (_RESET)	0		0.2 VDD	V
	VIL (OSCIN)	0		0.16 VDD	V
Input current high					
	IIH			5.0	µA
	IIH (OSCIN)		4.0		µA
Input current low					
	IIL	-5.0			µA
	IIL (OSCIN)		-4.0		µA
Output voltage					
	VOH IOH=-1.0mA	VDD-1.0		VDD	V
	VOL IOL=1.0mA			1.0	V
Power consumption					
One or more keys are depressed	IDD		1.5		mA
All keys are released					
TA=25°C	IDD		0.1	1.0	µA
TA=85°C	IDD			10.0	µA

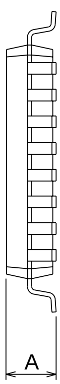
Control timing (Vdd=2.2 to 5.5 V, Vss=0 Vdc, Temperature range=T low to T high unless otherwise noted)

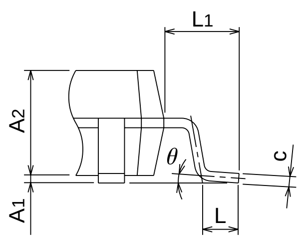
Characteristic	**Symbol**	**Value**	**Unit**
Frequency of operations			
Ceramic resonator with built-in load capacitors	fosc	2.0	MHz
Transmit pulse		4	µs

Note: Communications Baud rate and active-state power consumption are scaled linearly with operating frequency. Higher operating frequencies are possible within a reduced operating voltage range. Consult Semtech for further information.



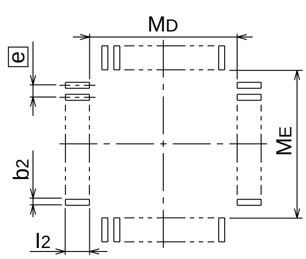






Detail F

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	–	–	1.7
A_1	0	0.1	0.2
A_2	–	1.4	–
b	0.3	0.35	0.45
c	0.105	0.125	0.175
D	6.9	7.0	7.1
E	6.9	7.0	7.1
e	–	0.8	–
H_D	8.8	9.0	9.2
H_E	8.8	9.0	9.2
L	0.3	0.5	0.7
L_1	–	1.0	–
y	–	–	0.1
θ	0ϒ	–	10ϒ
b_2	–	0.5	–
I_2	1.0	–	–
M_D	–	7.4	–
M_E	–	7.4	–



Recommended PCB Footprint

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