SerialCoder™ 700 UR5HC703-700

Extremely Low-Power Keyboard Encoder Interfaces RS-232

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

DESCRIPTION

The SerialCoder™ 700 UR5HC703-700 is an extremely low-power, “off-the-shelf” serial keyboard encoder. Robust, tiny and flexible, the IC is a good match for any application where the use of complicated keyboard protocols are not required and where asynchronous serial interface hardware is available.

The SerialCoder™ 700 provides Self-Power Management™ and draws its power entirely from the host device. It is ideal for use in add-on keyboards for handheld and cellular / web phones and other portable applications.

Self-Power Management™ is transparent to the host. Power consumption is reduced to just the circuit’s leakage when all keys are released. The average current consumption is less than 1 µA at room temperature and 10 µA 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™ 700 is simple to implement. It requires few external components and utilizes a tiny, low-profile 32-pin LQFP package that measures 7mm x 7mm.

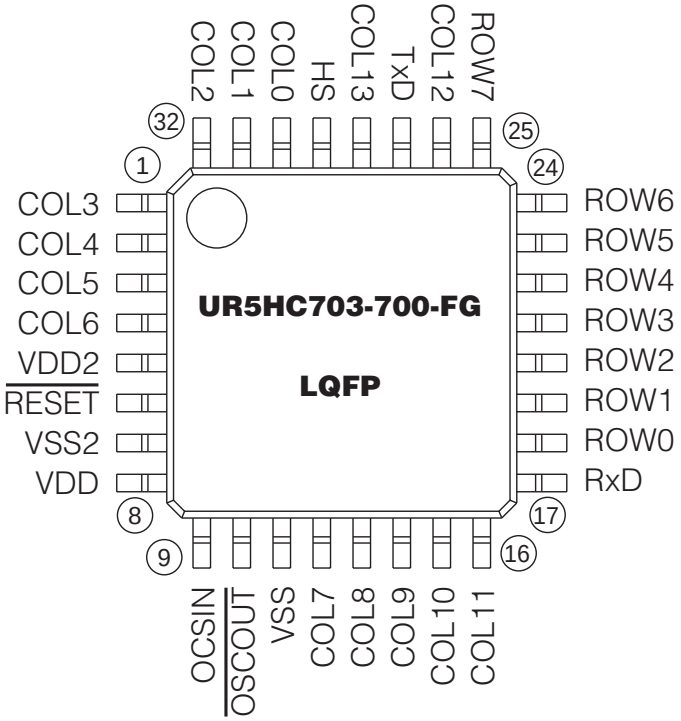
FEATURES

- 8 x 14 keyboard matrix encoding
- IC is independent of the keyboard layout
- Extremely low-power operation, transparent to the host
- Typical current consumption of less than 1 µA at room temperature; 10 µA at 85°C
- 9600 Baud 8N1 serial data format
- Direct connection to RS-232 signals from the host UART
- Simple, proprietary serial protocol
- Robust algorithm for ghost-key elimination
- Self-Power Management™, sleeps between keystrokes

APPLICATIONS

- Built-in keyboards for personal digital assistant (PDA) and hand-held PC (H/PC) devices
- Add-on accessory keyboards for PDA and H/PC devices
- Portable personal computers
- Instrumentation
- Remote control
- Cellular phones

PIN ASSIGNMENTS



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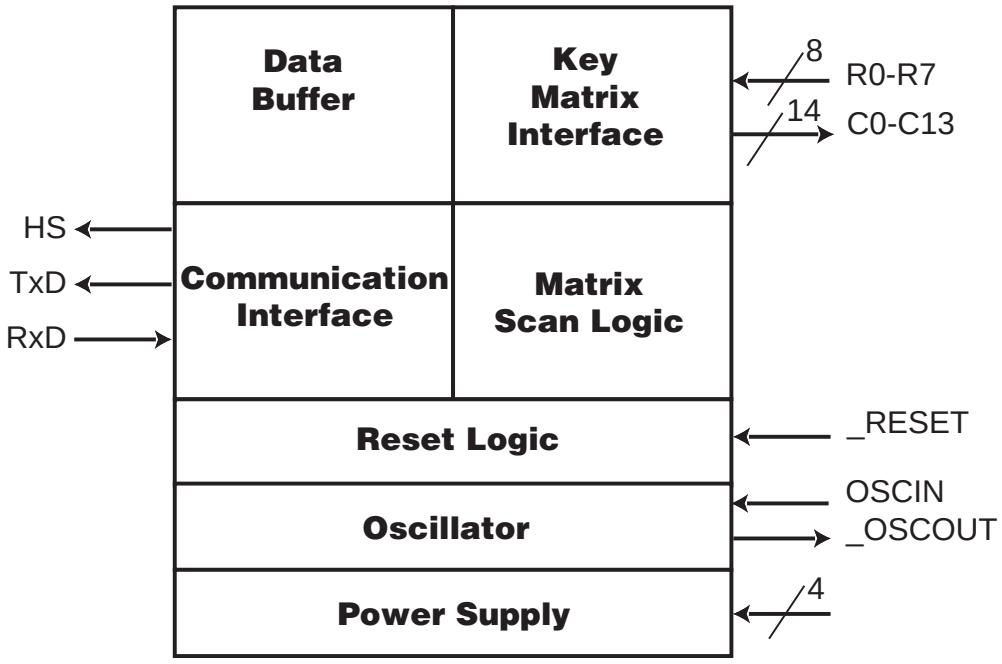
ORDERING CODE

Package Options	Pitch	Ta = -20° C to +85° C
32-pin, Plastic LQFP	0.8 mm	UR5HC703-700-FG

Other Materials	Type	Order number
SerialCoder™ 700 eval. kit	Evaluation kit	EVK5-703-700

SERIALCODER™ 700 FUNCTIONAL DIAGRAM

UR5HC703-700



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PROTOCOL

The SerialCoder™ 700 uses a proprietary serial protocol (patent pending) for two-way communication with the host device. The specification for this protocol is available, subject to a non-disclosure agreement (NDA), to customers and driver developers. This protocol allows the host device to save significant power, by indicating to the host device when it can lower its power consumption to a minimum. This flexible protocol can also accommodate additional types of data if desired; for example, position data from a pointing stick embedded in the keyboard.

PIN DEFINITIONS

Mnemonic	Pin #	Type	Name and Function
Power Supply			
VDD, VDD2	8, 5	PWR	**Positive supply voltage**
VSS, VSS2	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 VDD is below minimum operating voltage
Oscillator pins			
OSCIN	9	I	**Oscillator input**: connect ceramic resonator with built-in load capacitors; 2 MHz operating frequency
_OSCOUT	10	O	**Oscillator output**: connect ceramic resonator with built-in load capacitors
Host Interface			
TxD	27	O	**Serial data output**: idle at 0V, non-inverted data (direct connection to RS232 port)
RxD	17	I	**Serial data input**
HS	29	O	"**Hot" synchronization signal**
Scanned matrix pins			
ROW0-ROW7	18-25	I	**Row matrix inputs** with pulsed pull-up current sources
COL0-COL13	30-32, 1-4, 12-16, 26, 28	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.

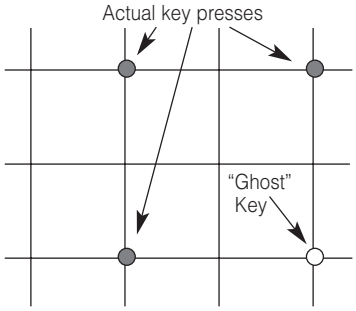

Figure 1: "Ghost" or "Phantom" Key Problem

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™ has built-in mechanisms to detect the presence of "ghost" keys.

KEYBOARD SCANNER

The encoder scans a keyboard organized as an 8 row by 14 column matrix for a maximum of 112 keys. Smaller size matrixes can also be accommodated by simply leaving unused pins open. The SerialCoder™ provides internal pull-ups for the row input pins. When active, the encoder selects one of the column lines (C0-C13) 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™ 700 achieves uniquely low system power consumption, due partly to Self-Power Management™, and partly to the proprietary protocol the IC uses to communicate with the the host system driver. Self-Power Management™ powers down the IC between key presses; a key press wakes up the IC immediately without losing any key data. The protocol allows the host system to power down the power-wasting charge pumps (for the communications interface) after a short period of inactivity.

Alerting the host on connection

When a keyboard assembly (including the SerialCoder™ 700 and the recommended components) is plugged into a host system, the SerialCoder™ 700 sends an identification code to the host, and forces the host into a state where the host can acknowledge the code. After the host receives and acknowledges this code, the host is aware that the keyboard assembly is connected, and the host can then choose what to do next. For example,

(1) The host can choose to enter a fully awakened state, and turn on the screen, etc.

(2) If no keys have been pressed, the host can choose to return to a sleep state.

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EVALUATION BOARD NOTE

Note: Jumper Setting

When using the SerialCoder™ 700 evaluation board, and powering the IC from the PDA interface, jumper 3 (J3) must be open; when powering from the RS232 port, jumper 3 must be closed.

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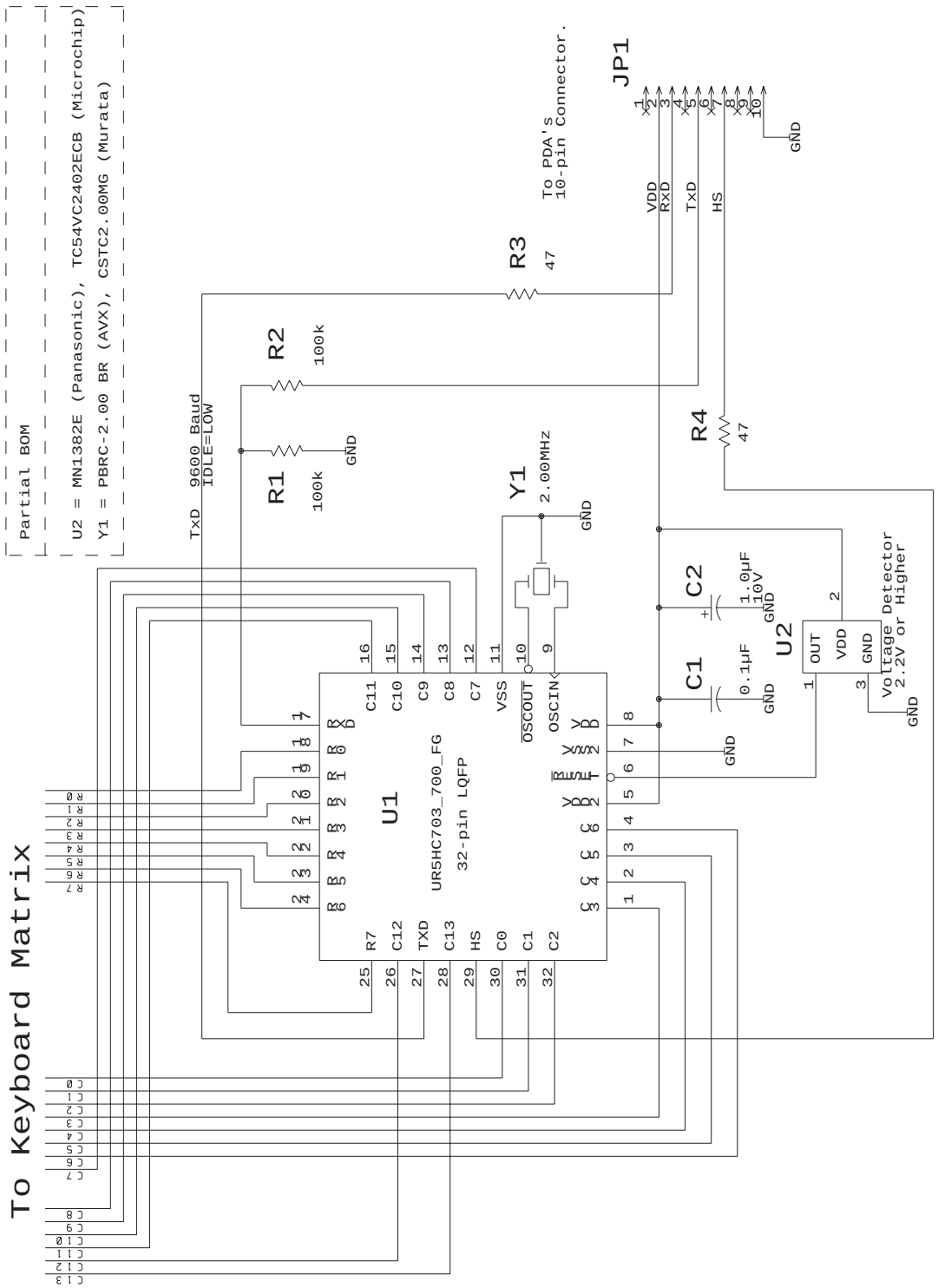
SAMPLE SCHEMATIC FOR THE SERIALCODER™ 700 UR5HC703-700-FG



SERIALCODER™ 700 ELECTRICAL CHARACTERISTICS

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)

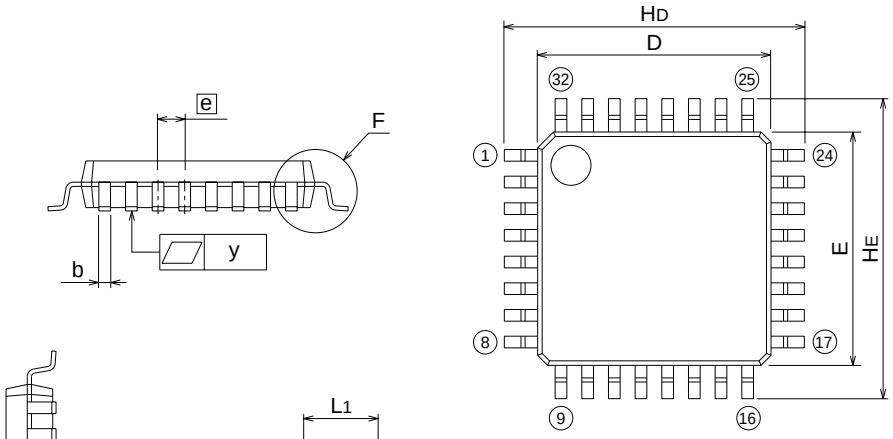
Characteristic	Symbol	Min	Typ	Max	Unit
Operating voltage	VDD	2.2		5.5	V
Input voltage					
High	VIH	0.8 VDD		VDD	V
LOW	VIL	0		0.3 VDD	V
	VIL (_RESET)	0		0.2 VDD	V
	VIL (OSCIN)	0		0.16 VDD	V
Input current high					
	IIH			5.0	µA
	IIH (OSCIN)		4.0		µA
Input current low					
	IIL	-5.0			µA
	IIL (OSCIN)		-4.0		µA
Output voltage					
IOH=-1.0mA	VOH	VDD-1.0		VDD	V
IOL=1.0mA	VOL	0		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)

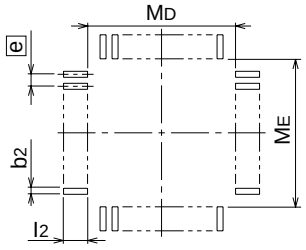
Characteristic	Symbol	Value	Unit
Frequency of operation			
Ceramic resonator with built-in load capacitors	fosc	2.0	MHz

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.

MECHANICALS FOR THE SERIALCODER™ 700 UR5HC703-700-FG LQFP PACKAGE



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	0°	–	10°
b_2	–	0.5	–
l_2	1.0	–	–
M_D	–	7.4	–
M_E	–	7.4	–



Recommended PCB Footprint

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