

# USAR SerialCoder™ Low-Power Keyboard Encoder interfaces RS-232

**Preliminary**

USAR KeyCoder™ family  
product specifications

## Description

The USAR SerialCoder™ UR5HC703 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 USAR SerialCoder™ provides unprecedented power consumption minimization, making it ideal for use in add-on keyboards for handheld and cellular / web phones and single-board systems designed for portable applications.

The IC provides Zero-Power™ operation, 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 1µA at room temperature and 10µA at 85°C. If a single key or groups of keys are stuck in the depressed position, the IC will enter a total shutdown after a 10-minute wait — to protect against unintended and unnecessary discharge of the batteries in the Host.

Custom versions of the USAR SerialCoder™ are available with Hardware Handshaking for the Communication channel, support for extra-low-power operations of the Host, various baud rates and Full-Duplex I/O, etc. The USAR SerialCoder™ is simple to implement. It requires few external components and utilizes a tiny, low-profile 32-pin LQFP package that measures 7mm x 7mm.

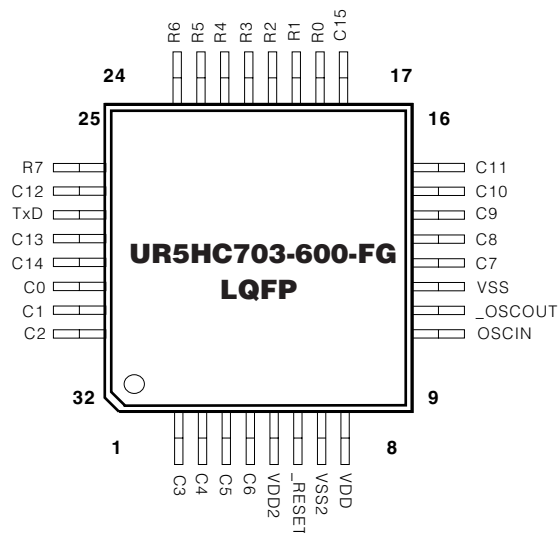
## Features

- 8 x 16 Matrix Encoding
- 9600 Baud 8N1Serial Data Format
- IC is independent of the keyboard layout
- Zero-Power™ operation, transparent to the Host
- Average current consumption of less than 1µA at room temperature; 10µA at 85°C
- Customized versions available
- TTL/CMOS Output-only Asynchronous Serial Interface to the Host (direct connection to the UART)
- Very simple serial protocol — Two-Byte Identification String on power-up; single-Byte Matrix-position for each key-press or key-release
- Robust algorithm for Ghost-key elimination

## Applications

- Built-in keyboards for HH PDAs/Organizers
- Add-on accessory keyboards for Palm and H/PC Devices
- Portable Personal Computers
- Instrumentation
- Remote Control
- Cellular Phones

## Pin Assignments



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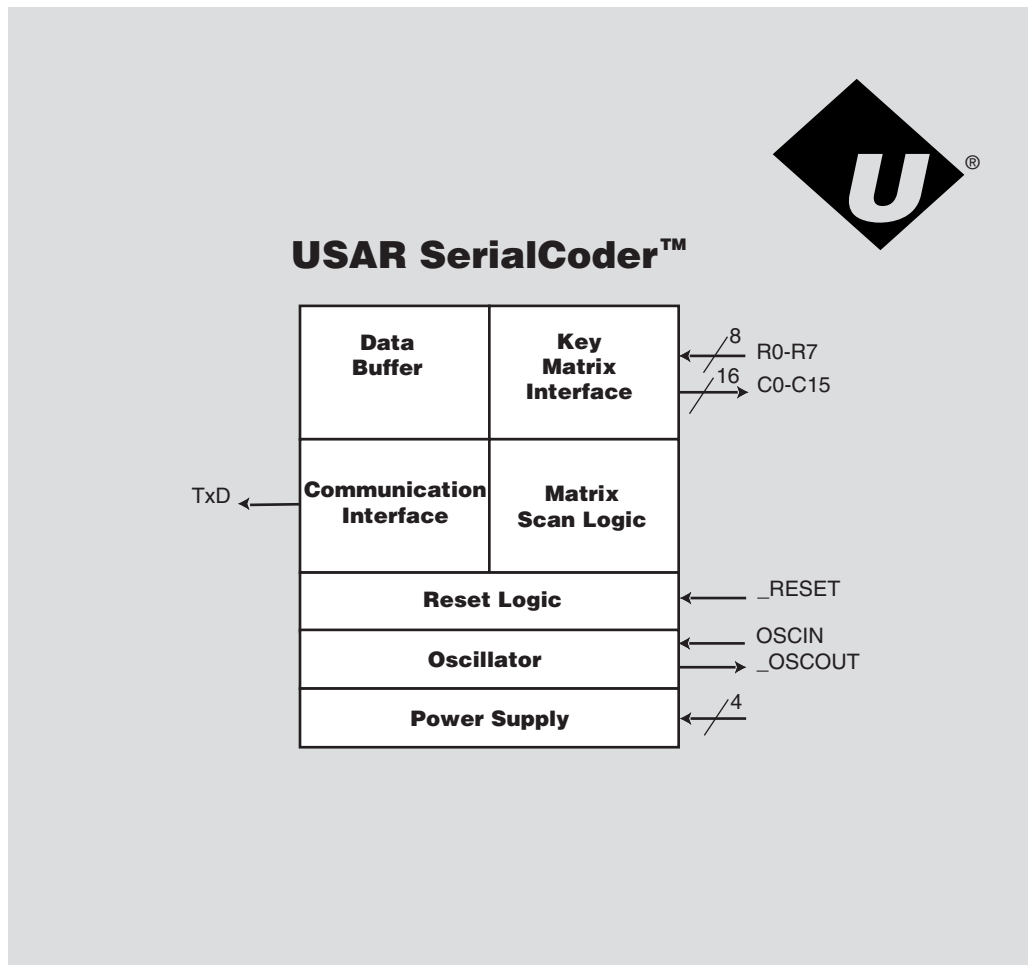
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**Ordering Code**

Package Options	Pitch in mm's	Ta=-20° C to +85° C
32-pin, Plastic LQFP	0.8	UR5HC703-600-FG

Other Materials	Type	Order number
USAR SerialCoder™ Eval Kit	Evaluation Kit	EVK5-703-600-XXX

**Functional Diagram**



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**Pin Definitions**

<b>Mnemonic</b>	<b>Pin Numbers</b>		<b>Name and Function</b>
	<b>LQFP</b>	<b>Type</b>	
<b>Power Supply</b>			
Vdd, Vdd2	8,5	PWR	<b>Positive Supply Voltage</b>
Vss, Vss2	11,7	PWR	<b>Negative Power Supply:</b> Signal Ground
<b>Reset</b>			
_RESET	6	I	<b>Hardware reset pin:</b> Reset Input for orderly start-up. Low logic level is required until power supply reaches minimum operating voltage
<b>Oscillator pins</b>			
OSCI	9	I	<b>Oscillator input:</b> Connect ceramic resonator with built-in load capacitors or CMOS clock from external oscillator 2 MHz operating frequency
_OSCO ceramic	10	O	<b>Oscillator Output:</b> Connect resonator with built-in load capacitors or keep open if external oscillator is used
<b>Host Interface</b>			
TxD	27	O	<b>Serial Data Output:</b> Idle at high voltage (logical 1), non-inverted Data (direct connection to the UART)
<b>Scanned matrix pins</b>			
ROW0-ROW7	18-25	I, pup	<b>Row matrix inputs:</b> With pulsed pull-up current sources
COL0-COL15	1-4, 12-17 26,28-32	O, nD	<b>Column matrix output</b>

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**Protocol**

Serial transmissions are at the rate of 9600 Baud, 8 data bits, no parity, least significant bit is transmitted first, Idle/Stop level is High (logical 1), Start bit level is Low (logical 0), non-inverted Data.

Within 5ms after the power-up the IC sends a two-Byte Identifications String of 0xF9, 0xFB. These two Bytes are transmitted only once after each 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 will never be 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 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 after the current key release all of the keys on the key Matrix are in the released state, the last transmission is repeated. Host's Driver looking for two Bytes with exactly the same value and key release indication (b7=1) can recognize that the keyboard is completely idle.

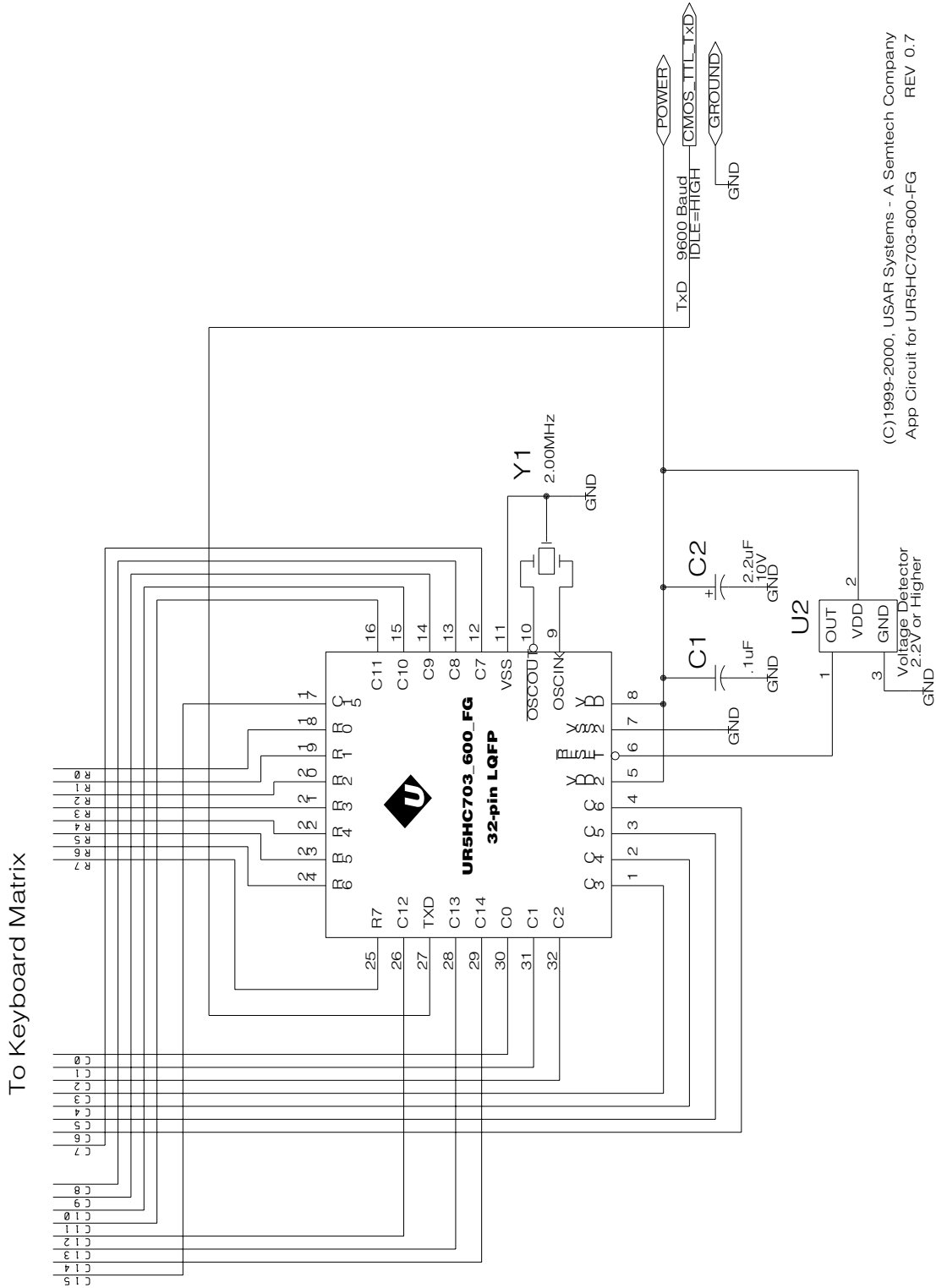
**Byte Transmission**

<b>Bit Number</b>	<b>Comment</b>
b7	0 for key press, 1 for key release
b6	Column location in the key Matrix (0-15)
b5	
b4	
b3	
b2	Row location in the key Matrix (0-7)
b1	
b0	

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**Sample Schematic for the USAR UR5HC703-600-FG**



(C)1999-2000, USAR Systems - A Semtech Company  
App Circuit for UR5HC703-600-FG  
REV 0.7

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**USAR SerialCoder™ 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) ΣIOL (Peak)	-80 80	mA
Total average for all pins	ΣIOH (Avg) ΣIOL (Avg)	-40 40	mA
Peak for each pin	IOH (Peak) IOL (Peak)	-10 10	mA
Average for each pin	IOH (Avg) IOL (Avg)	-5 5	mA
<b>Temperature range</b>			
Operating Temperature	TLOW to THIGH	-20 TO 85	°C
Storage Temperature	TSTG	-40 TO 125	°C

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Operating Voltage</b>	VDD	2.2		5.5	V
<b>Input Voltage</b>					
High	VIH	.8 VDD		VDD	V
Low	VIL	0		.3 VDD	V
	VIL (_RESET)	0		.2 VDD	V
	VIL (OSCIN)	0		.16 VDD	V
<b>Input Current High</b>					
	IiH			5.0	µA
	IiH (OSCIN)		4.0		µA
<b>Input Current Low</b>					
	IiL	-5.0			µA
	IiL (OSCIN)		-4.0		µA
<b>Output Voltage</b>					
	VOH IOH=-1.0mA	VDD-1.0		VDD	V
	VOL IOL=1.0mA			1.0	V
<b>Power Consumption</b>					
	IDD ONE OR MORE KEYS ARE DEPRESSED			600	µA
	IDD ALL KEYS ARE RELEASED TA=25°C		.1	1.0	µA
	TA=85°C			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)**

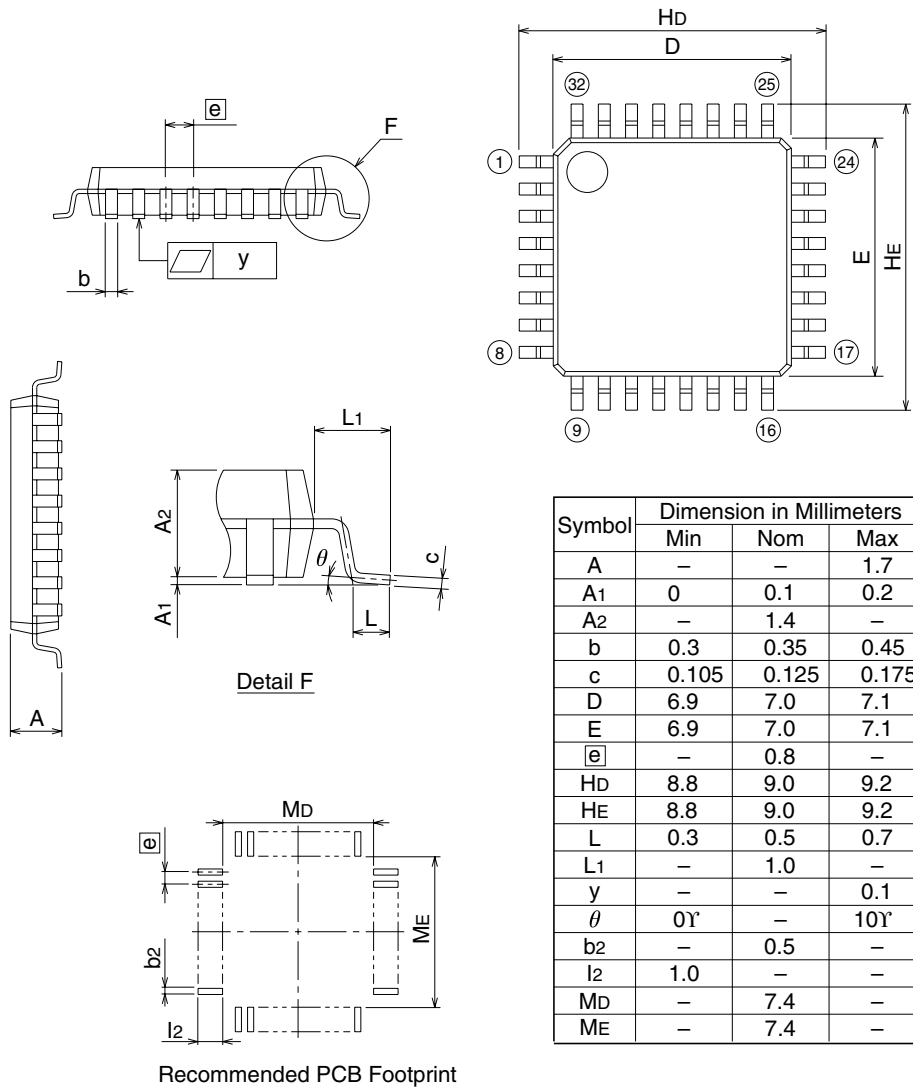
Characteristic	Symbol	Value	Unit
<b>Frequency of Operations</b>	fosc		
Ceramic Resonator with built-in load capacitors		2.0	MHz
External Oscillator		2.0	MHz

**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 USAR for further information.

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**Mechanicals for the UR5HC703-600 LQFP Package**



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