

**HID & SYSTEM MANAGEMENT PRODUCTS, SCREENCODER® FAMILY**
**PRELIMINARY**
**DESCRIPTION**

The UR7HCTS2-U860 ScreenCoder® USB is the first single IC that seamlessly interfaces ANY 4-wire or 8-wire resistive touch screen to a USB-equipped system. It is also the first touch screen controller IC on the market designed to accommodate a very wide range of size, capacitance and resistance of 4-wire or 8-wire touch screens, providing a universal performance solution among different OEM products and touch screen vendors. This unique feature of the IC provides OEMs with a wide variety of interchangeable touch screen options.

Unlike implementations with separate digitizers, the ScreenCoder® USB integrates a digitizer with a controller that performs all touch detection, noise filtering, error elimination and provides the host with processed and stable positioning data over USB. Semtech's unique motion algorithms provide high resistance to RF and other noise sources resulting in precise, non-jittery cursor control.

Ideal applications for the ScreenCoder® USB include portable devices, interactive kiosks and industrial / custom displays with integrated touch screens.

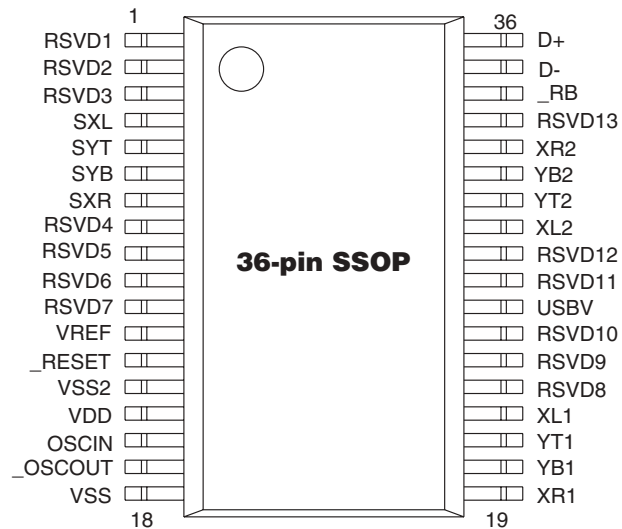
The universal features of the ScreenCoder® USB, as implemented in both the system and the sensor interface, reduce the development effort and cost of touch input based systems. The ScreenCoder® USB is available in a slim, 36-pin SSOP package.

**FEATURES**

- Controller & digitizer in a single IC
- Interfaces the system via USB
- Works with ANY 4-wire or 8-wire resistive touch screen regardless of size, material or vendor
- Provides high resolution: 1000 points per axis, enabling IC to make precise drawing and signature captures
- Accurate, quick touch response due to Semtech's advanced sampling technology and algorithms
- Highly resistant to RF and other noise
- No digitizer or external A/D necessary
- Fully compliant with USB HID specifications; works with native USB drivers under Windows® 98 SE, Windows® Me, Windows® 2000, and Windows® XP
- Convenient calibration applet offered free of charge
- Uses slim 36-pin, SSOP package

**APPLICATIONS**

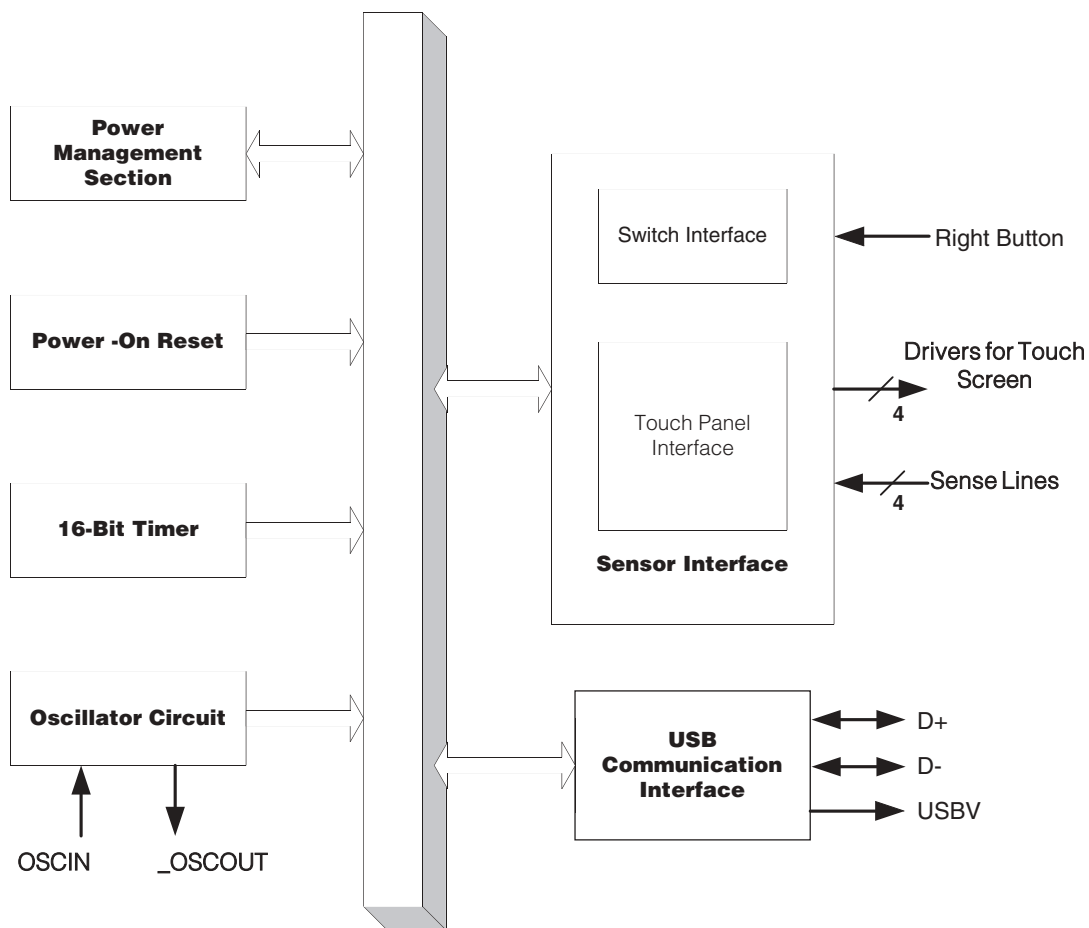
- Handheld PCs (H/PCs)
- Notebook PCs
- Portable devices
- Interactive kiosks
- Industrial/custom touch screens

**PIN ASSIGNMENTS**


**ORDERING CODE**

Package Options	Pitch	TA = -20° C to +85° C
36-pin plastic SSOP	0.8 mm	UR7HCTS2-U860-DR

Other Materials	Type	Order number
ScreenCoder® USB eval. kit	Evaluation kit	EVK7-TS2-U860

**BLOCK DIAGRAM FOR THE UR7HCTS2-U860**




## FUNCTIONAL DESCRIPTION

The UR7HCTS2-U860 consists functionally of five major sections (see the Functional Diagram on Page 2). These are the Sensor Interface, the Power Management Section, the 16-Bit Timer, the Oscillator Circuit and the USB Interface.

## OSCILLATOR

This IC has a built-in oscillator circuit capable of operations with an external 6.00 MHz clock source, such as a ceramic resonator with built-in load capacitors.

## POWER MANAGEMENT

According to the USB specification, if there is no activity of the USB port for 3 ms, the system is considered to be in a suspended state. The ScreenCoder® USB, on detecting that the system is in suspend, checks the state of the touch screen and the right button. If there is no touch pressure detected and no button pressed, the ScreenCoder® USB enters the suspended state. In suspend, the IC fully complies with the USB specification for power consumption, dissipating current only in the USB-mandated pull-up for device identification.

The IC supports remote wake-up to conserve power. If the system relies on the device to perform wake-up, the IC sends a resume message to the system when there is activity on the touch screen or button.

If the system does not allow remote wake-up, the ScreenCoder® USB does not send resume messages to the system when it is awakened by activity on the touch screen or button.

## PIN DEFINITIONS

Mnemonic	Pin #	Type	Name and Function
<b>Power</b>			
V <sub>DD</sub>	15	P	<b>Power supply</b>
V <sub>SS</sub> , V <sub>SS2</sub>	18, 14	P	<b>Ground</b>
<b>Reset</b>			
<u>RESET</u>	13	I	<b>Reset</b>
<b>Oscillators</b>			
OSCIN	16	I	<b>Oscillator input</b>
<u>OSCOUT</u>	17	O	<b>Oscillator output</b>
<b>USB:</b>			
D-	35	I/O	<b>USB D- line</b>
D+	36	I/O	<b>USB D+ line</b>
USBV	26	O	<b>USB reference voltage out</b>
<b>Touch Screen</b>			
XR1, XR2	19, 32	I/O	<b>Touch screen right drive pins</b>
YB1, YB2	20, 31	I/O	<b>Touch screen bottom drive pins</b>
YT1, YT2	21, 30	I/O	<b>Touch screen top drive pins</b>
XL1, XL2	22, 29	I/O	<b>Touch screen left drive pins</b>
SXL	4	AI	<b>Touch screen sense pin:</b> for X left
SYT	5	AI	<b>Touch screen sense pin:</b> for Y top
SYB	6	AI	<b>Touch screen sense pin:</b> for Y bottom
SXR	7	AI	<b>Touch screen sense pin:</b> for X right
VREF	12	AI	<b>Voltage reference for A/D converter</b>
<u>RB</u>	34	I	<b>Mouse right button</b>
<b>Reserved</b>			
RSVD1-13	1-3, 8-11, 23-25, 27, 28, 33		<b>Reserved for future use</b>

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

**Pin Types Legend:** I=Input; O=Output; I/O=Input or Output; P=Power; AI= Analog Input

## USB FUNCTIONALITY

The ScreenCoder® USB is a low-speed USB device with remote wake-up capability. The IC asks the system to send report requests every 10ms according to the USB specification for a low speed device.

The ScreenCoder® USB describes itself as a pointer, and provides absolute position data to the system.



## TOUCH SCREEN SENSOR INTERFACE

The ScreenCoder® USB can acquire data from any 4-wire or 8-wire resistive touch screen sensors. The sensor interface has the following features:

### *Touch detection*

The IC periodically checks touch pressure applied to the panel. If there is no touch, the IC does not perform measurements and does not send data to system. When touch pressure is detected, the IC further qualifies and determines the amount of pressure. Semtech's proprietary, patent-pending touch detection algorithm performs this test very quickly, accommodating sensors with various plate-to-plate capacitances.

### *Touch Measurement*

Position information is only collected if it has been determined that the touch pressure is sufficient for an accurate reading. To obtain position information from the resistive touch screen sensor, the ScreenCoder® USB uses four internal drivers (two pins for each driver) and four sense lines. During sampling, the drivers of the X-axis are activated by setting one X-drive high and the other X-drive low. The drivers for Y-axis are set floating. This action produces a voltage gradient across the touch screen's surface in the X direction. The internal A/D measures both the voltage across the activated X-plane and the voltage potential between the planes. Next, the drivers for the Y-axis are activated while the drivers for X-axis are set floating. Again, the internal A/D measures both voltage across the activated plane and potential between the planes. The X and Y absolute position is obtained from these four A/D measurements. The IC keeps measuring the touch pressure even while the positioning data is acquired. If insufficient touch pressure is detected during sampling of the position, the current data set is rejected.

### *Touch algorithm*

Due to vibration and electrical noise, the raw data can not be used directly. Internal data processing delivers consistent position accuracy and quick touch response.

### *Resolution*

The ScreenCoder® USB uses a built-in A/D converter to get the touch position. The maximum touch screen resolution is 1000 points per axis. Resolution varies somewhat for different touch screen sensors, due to voltage droop on connecting wires.

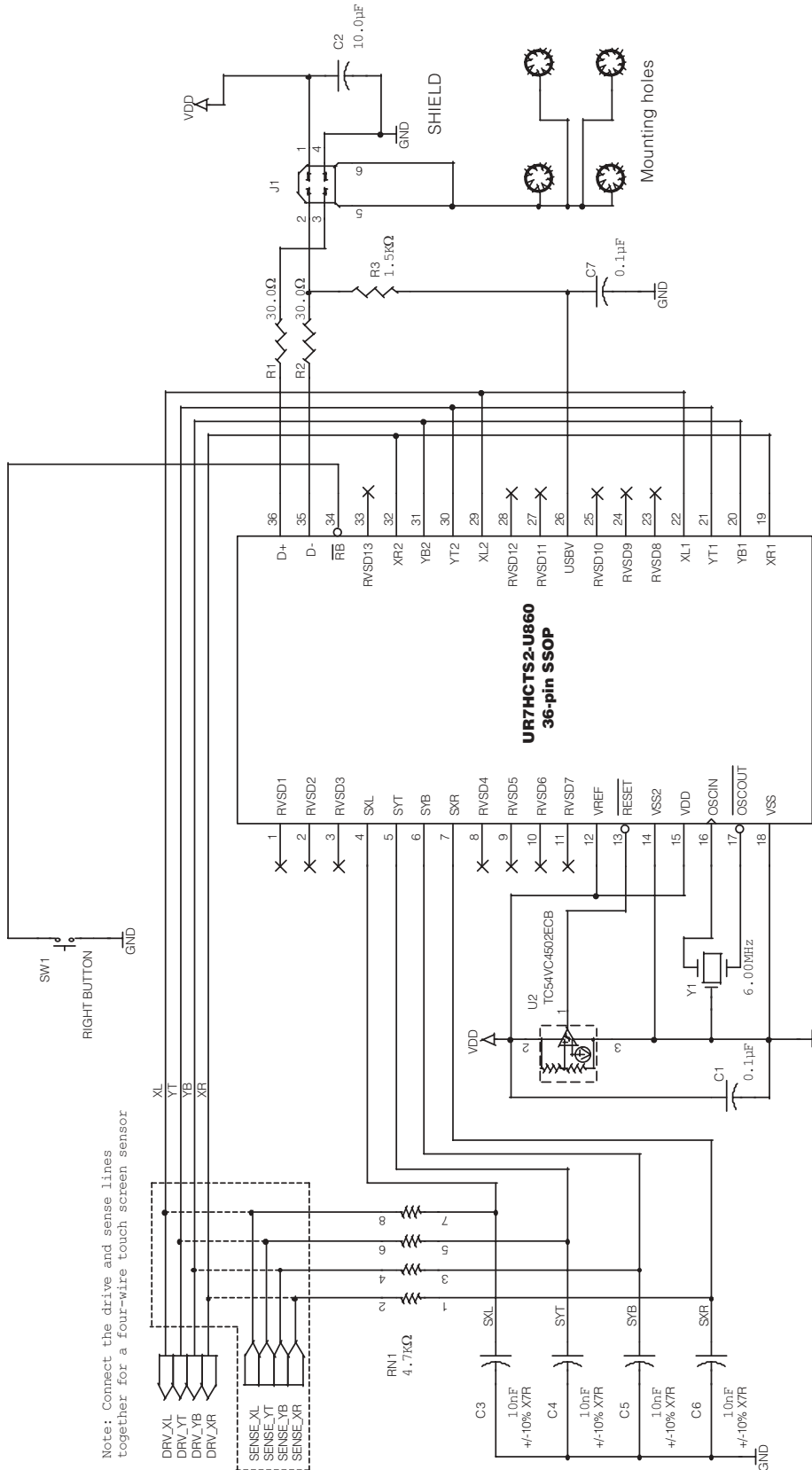
### *Touch screen from different makers*

Operating parameters for the touch screens from different manufacturers vary depending on the size of the sensor, material it is made from, and mechanical construction. The ScreenCoder® USB takes these properties into account, and adjusts automatically for plate-to-plate capacitance, intrinsic plate resistances, etc.

### *Buttons*

The ScreenCoder® USB implements the equivalent of left and right mouse buttons. Left button press is reported when there is touch pressure on the panel, and then released when the pressure stops. The right button is implemented as a switch using pin 34.

SUGGESTED INTERFACING FOR THE SCREENCODER® USB UR7HCTS2-U860-DR



Note: Connect the drive and sense lines together for a four-wire touch screen sensor

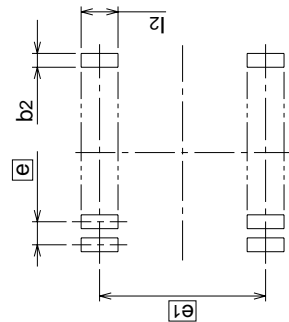
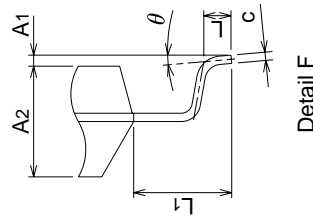
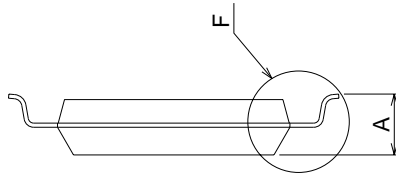
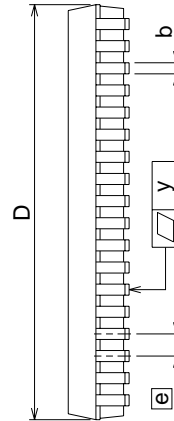
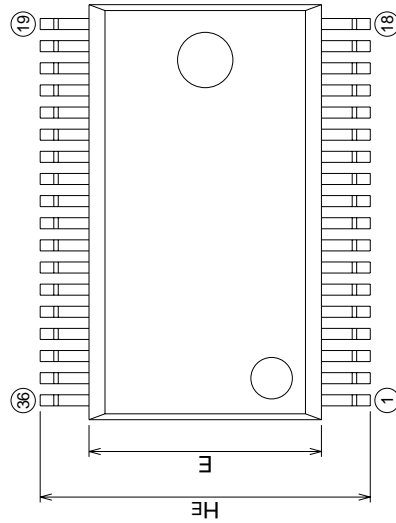
Note: U2 = reset IC; TC54VC4502ECB (Microchip) or equivalent  
 Note: Y1 = 6.00 MHz ceramic resonator with built-in load capacitors; AVX PBRC-6.00BR or Murata CSTC6.00MG or equivalent



SCREENCODER® USB UR7HCTS2-U860 BILL OF MATERIALS

**UR7HCTS2-U860-DR BOM**

Description	Quantity	Manufacturer	Part#	Description
<b>Capacitors</b>				
C1, C7	2	Generic	Any	0.1µF capacitor
C2	1	Generic	Any	10.0µF capacitor
C3, C4, C5 C6	4	Generic	Any	0.01µF capacitor, 10% X7R or better
<b>Connectors</b>				
J1	1	Generic	Any	USB connector
<b>ICs</b>				
U1	1	Semtech	UR7HCTS2-U860	ScreenCoder® encoder
U2	1	Microchip	TC54VC2702ECB	Low-power reset voltage detector
<b>Resistors</b>				
R1, R2	2	Generic	Any	30.0Ω resistor
R3	1	Generic	Any	1.5KΩ resistor
RN1	1	Generic	Any	4 x 4.7KΩ resistor network
<b>Resonator</b>				
Y1	1	AVX or Murata	PBRC-6.00BR CSTC6.00MG	6.00 MHz ceramic resonator with built-in load capacitors
<b>Button</b>				
SW1	1	Generic	Any	Push button

**36-pin SSOP Plastic**

**Recommended Mount Pad**

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	-	-	2.4
A1	0.05	-	-
A2	-	2.0	-
b	0.35	0.4	0.5
c	0.13	0.15	0.2
D	14.8	15.0	15.2
E	8.2	8.4	8.6
e	-	0.8	-
HE	11.63	11.93	12.23
L	0.3	0.5	0.7
L1	-	1.765	-
y	-	-	0.15
$\theta$	0°	-	10°
b2	-	0.5	-
e1	-	11.43	-
l2	1.27	-	-



## ELECTRICAL SPECIFICATIONS

### Absolute Maximum Ratings

Ratings	Symbol	Value	Unit
Supply voltage	V <sub>DD</sub>	-0.3 to 7.0	V
Input voltage	V <sub>IN</sub>	V <sub>SS</sub> -0.3 to V <sub>DD</sub> +0.3	V
Current drain per pin (not including V <sub>SS</sub> or V <sub>DD</sub> )	I	20	mA
Operating temperature	T <sub>A</sub>	T <sub>LOW</sub> to T <sub>HIGH</sub>	°C
UR7HCTS2-U860		-20 to +85	°C
Storage temperature range	T <sub>STG</sub>	-40 to +125	°C
ESD rating (human body model)	V <sub>ESD</sub>	TBD	kV

### DC Electrical Characteristics, Temperature range = T<sub>LOW</sub> to T<sub>HIGH</sub> unless otherwise noted

Characteristic	Symbol	Min	Typ	Max	Unit
Supply voltage		3.0	5.0	5.5	V
Output voltage (10 μA load)	V <sub>OH</sub> V <sub>OL</sub>	V <sub>DD</sub> -0.1		0.1	V
Input high voltage	V <sub>IH</sub>	0.8 x V <sub>DD</sub>		V <sub>DD</sub>	V
Input low voltage	V <sub>IL</sub>	V <sub>SS</sub>		0.2 x V <sub>DD</sub>	V
Input current	I <sub>IN</sub>			+/- 10	μA
Supply current (V <sub>DD</sub> =5.0 V <sub>DC</sub> +/-10%, V <sub>SS</sub> =0)	I <sub>DD</sub>		3.0	TBD	mA

### Control Timing (V<sub>DD</sub>=5.0 V<sub>DC</sub> +/-10%, V<sub>SS</sub>=0 V<sub>DC</sub>, Temperature range = T<sub>LOW</sub> to T<sub>HIGH</sub> unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Frequency of operation					
■ Crystal option	f <sub>osc</sub>		6.0		MHz
■ External clock option	f <sub>osc</sub>		6.0		MHz





Page Left Blank Intentionally



**For sales information  
and product literature,  
contact:**

Semtech Corporation  
Human Interface Device (HID)  
and System Management Division  
200 Flynn Road  
Camarillo, CA 93012-8790  
**sales@semtech.com**  
**<http://www.semtech.com/>**  
(805)498-2111 Telephone  
(805)498-3804 Fax

Copyright ©2000-2002 Semtech Corporation. All rights reserved.  
Semtech and ScreenCoder are registered trademarks of Semtech  
Corporation. All other trademarks belong to their respective  
owners.

**INTELLECTUAL PROPERTY DISCLAIMER**

This specification is provided "as is" with no warranties whatsoever including any warranty of merchantability, fitness for any particular purpose, or any warranty otherwise arising out of any proposal, specification or sample. A license is hereby granted to reproduce and distribute this specification for internal use only. No other license, expressed or implied to any other intellectual property rights is granted or intended hereby. Authors of this specification disclaim any liability, including liability for infringement of proprietary rights, relating to the implementation of information in this specification. Authors of this specification also do not warrant or represent that such implementation(s) will not infringe such rights.