

HID & SYSTEM MANAGEMENT PRODUCTS, SCREENCODER® FAMILY
PRELIMINARY
DESCRIPTION

The UR7HCTS2-USB Ultimate USB ScreenCoder® is the first single IC that seamlessly interfaces ANY 4-wire, 5-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 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 UR7HCTS2-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, jitter-free cursor control.

Ideal applications for the UR7HCTS2-USB include portable devices, interactive kiosks and industrial / custom displays with integrated touch screens.

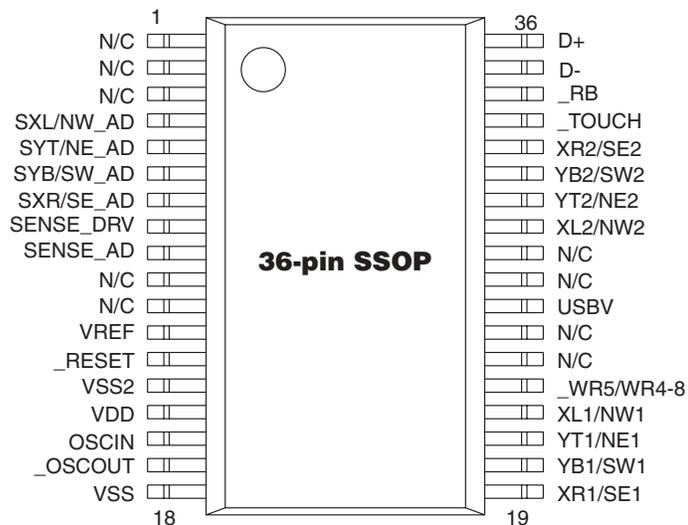
The universal features of the UR7HCTS2-USB, as implemented in both the system and the sensor interface, reduce the development effort and cost of touch input based systems. The UR7HCTS2-USB is available in a 36-pin SSOP package.

FEATURES

- Controller & digitizer in a single IC
- Interfaces the system via USB
- Works with ANY 4-, 5-, 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 absolute-mode pointing device specifications
- Free driver with calibration applet available for Windows® 98 SE, Windows® Me, Windows® 2000, and Windows® XP
- Uses 36-pin SSOP package

APPLICATIONS

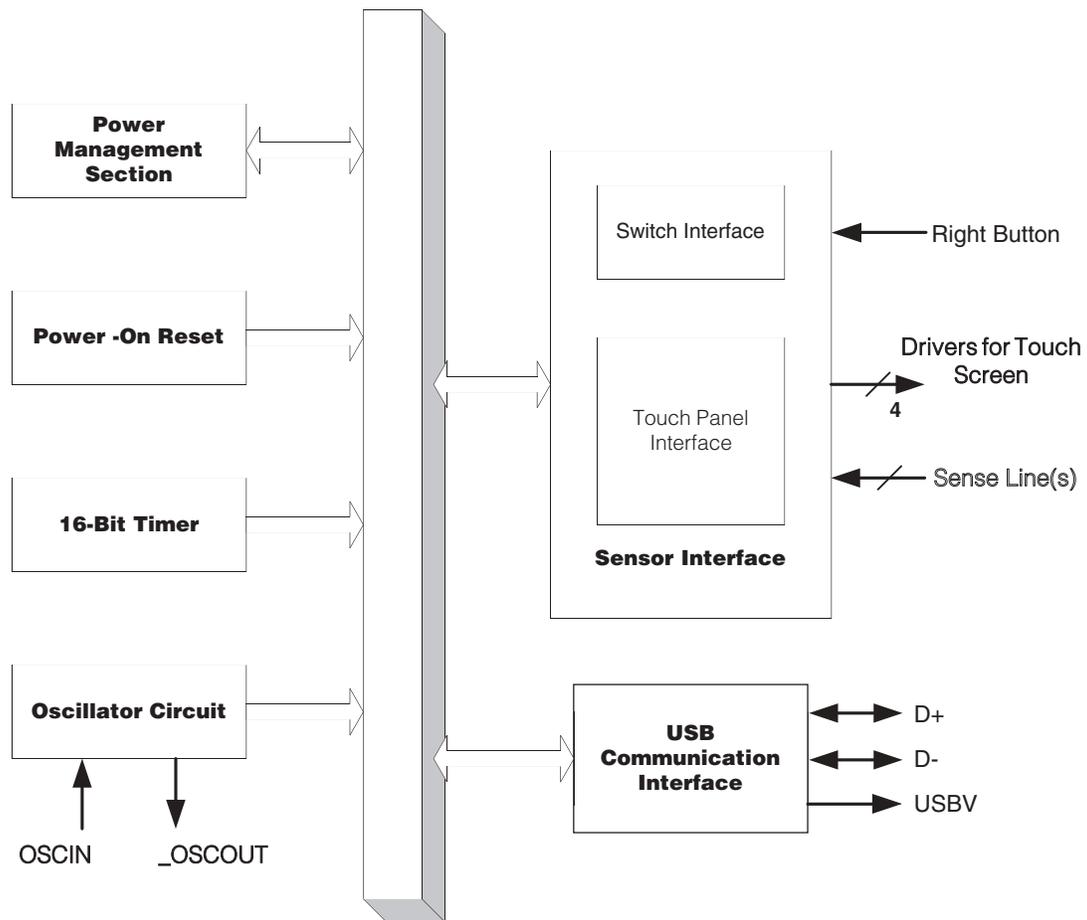
- Handheld PCs (H/PCs)
- Notebook PCs
- Portable devices
- Interactive kiosks
- Industrial/custom touch screens

PIN ASSIGNMENTS


ORDERING CODE

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

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

BLOCK DIAGRAM FOR THE UR7HCTS2-USB




FUNCTIONAL DESCRIPTION

The UR7HCTS2-USB 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 UR7HCTS2-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 UR7HCTS2-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 UR7HCTS2-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
Power			
VDD	15	P	Power supply
VSS, VSS2	18, 14	P	Ground
Reset			
_RESET	13	I	Reset: apply 0V to provide orderly start-up
Oscillator			
_OSCOUT	17	O	Oscillator output: open for external clock input or other side of the ceramic resonator with built-in load capacitors
OSCIN	16	I	Oscillator input: external clock input or one side of the ceramic resonator with built-in load capacitors
USB			
D-	35	I/O	USB D- Line
D+	36	I/O	USB D+ Line
USBV	26	O	USB reference voltage output: output pin for pulling up a D- line with a 1.5K Ohm external resistor
Touch screen			
_RB	34	I/O (nd)	Right button: active low, strobed sampling
_TOUCH	33	I/O	5-wire: Touch Detection
_WR5/WR4-8	23	I/O	4/8-wire: Leave open (has internal pull-up); 5-wire: Tie to ground
SENSE_AD	9	AI	5-wire: Sense A/D
SENSE_DRV	8	I/O	5-wire: Sense drive
SXL/NW_AD	4	AI	4/8-wire: Sense line for X Left. 5-wire: Northwest
SXR/SE_AD	7	AI	4/8-wire: Sense line for X Right. 5-wire: Southeast
SYB/SW_AD	6	AI	4/8-wire: Sense line for Y Bottom. 5-wire: Southwest
SYT/NE_AD	5	AI	4/8-wire: Sense line for Y Top. 5-wire: Northeast
VREF	12	AI	Reference voltage for built-in A/D
XL1/NW1	22	I/O	4/8-wire: Sense drive X Left. 5-wire: Northwest
XL2/NW2	29	I/O	4/8-wire: Sense drive X Left. 5-wire: Northwest
XR1/SE1	19	I/O	4/8-wire: Sense drive X Right. 5-wire: Southeast
XR2/SE2	32	I/O	4/8-wire: Sense drive X Right. 5-wire: Southeast
YB1/SW1	20	I/O	4/8-wire: Sense drive Y Bottom. 5-wire: Southwest
YB2/SW2	31	I/O	4/8-wire: Sense drive Y Bottom. 5-wire: Southwest
YT1/NE1	21	I/O	4/8-wire: Sense drive Y Top. 5-wire: Northeast
YT2/NE2	30	I/O	4/8-wire: Sense drive Y Top. 5-wire: Northeast
Reserved			
N/C	1-3, 10, 11, 24, 25, 27, 28		Reserved

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; I/O (nd) open drain

USB FUNCTIONALITY

The UR7HCTS2-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 UR7HCTS2-USB describes itself as a pointer, and provides absolute position data to the system.



TOUCH SCREEN SENSOR INTERFACE

The UR7HCTS2-USB can acquire data from any 4-wire, 5-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 (4/8-wire sensors)

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 UR7HCTS2-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 Measurement (5-wire sensors)

Position information is collected only if the touch pressure is sufficient for an accurate reading. The 5-wire touch screen has two panels. One is the resistive panel for supplying the voltage gradient. The other is the conductive panel used to get the touch voltage. To obtain position information from the resistive touch screen sensor, the UR7HCTS2-USB uses four internal drivers (three pins for each driver) and one sense line. During sampling, the drivers of the X-axis are activated by setting one X-drive high and the other X-drive low. The sense plane is 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. 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 A/D measurements.

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

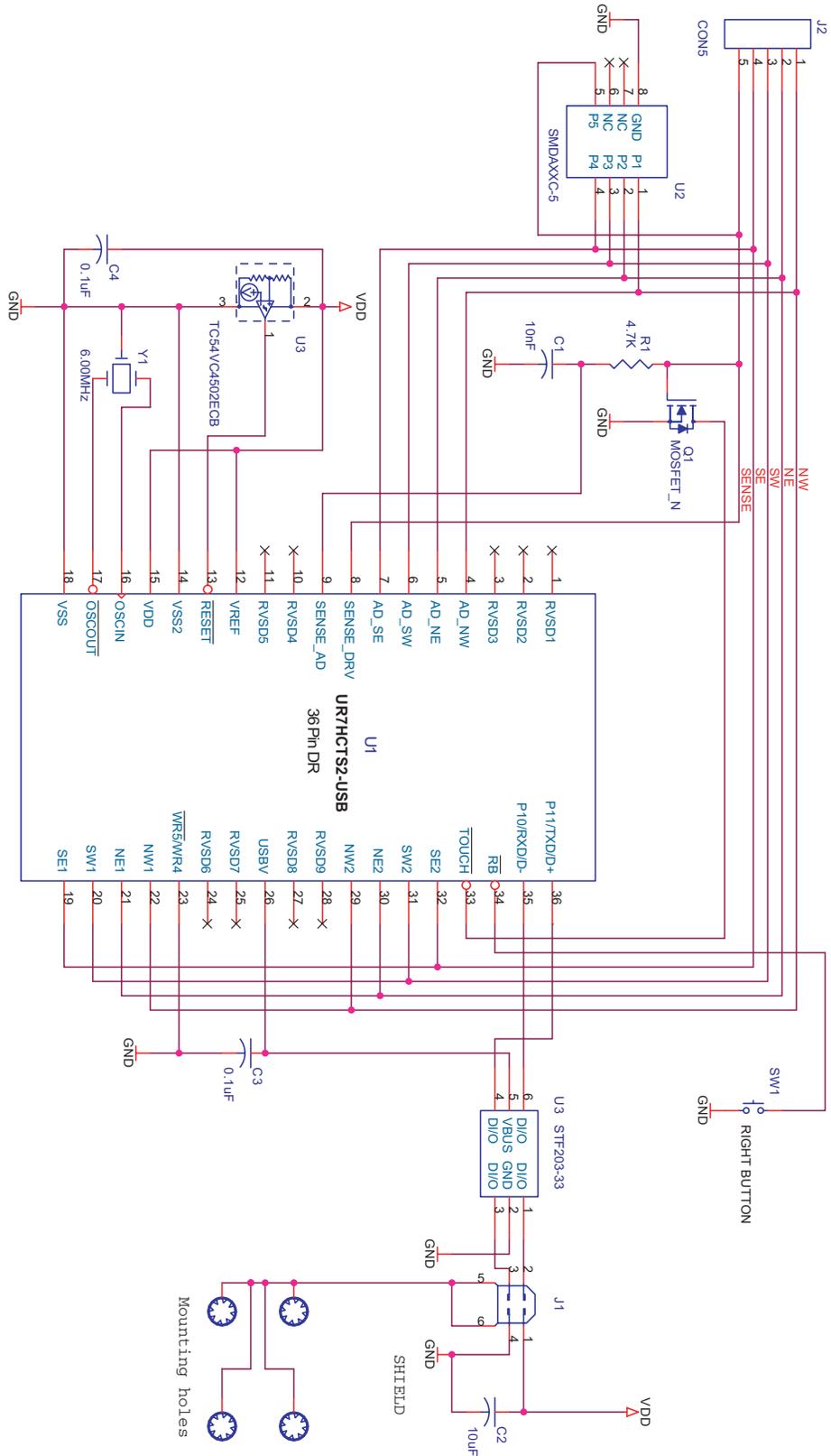
The UR7HCTS2-USB uses a built-in A/D converter to get the touch position. The maximum touch screen resolution is 1000 points per axis. Resolution varies somewhat for different touch screen sensors, due to voltage droop on connecting wires.

Touch screens 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 UR7HCTS2-USB takes these properties into account, and adjusts automatically for plate-to-plate capacitance, intrinsic plate resistances, etc.

Buttons

The UR7HCTS2-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.

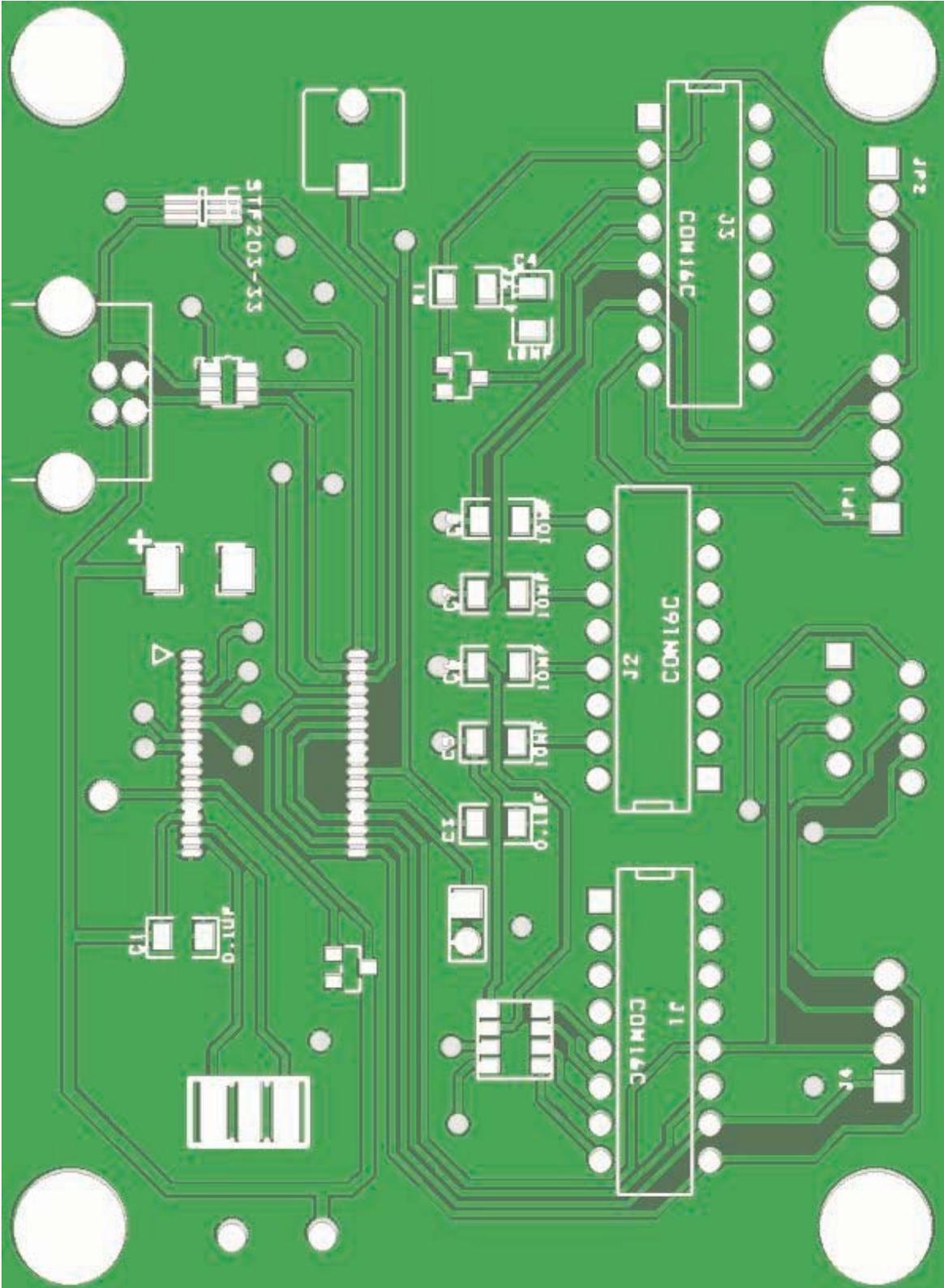
SAMPLE SCHEMATIC WITH 5-WIRE SENSOR

NOTES:

The UR7HCTS2-USB in 5-wire mode is hardware compatible with the UR7HCTS2-U560 except for pin 23. For the UR7HCTS2-USB in 5-wire mode, pin 23 must be connected to ground.

For the UR7HCTS2-U560, pin 23 is not connected.

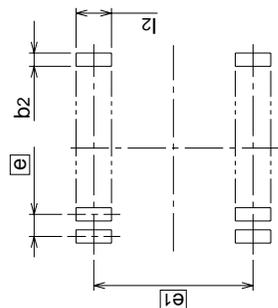
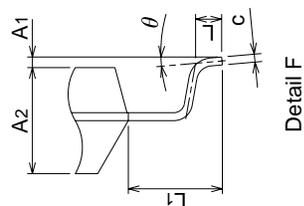
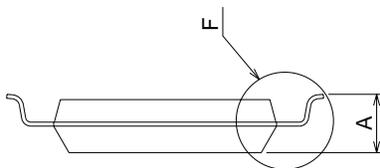
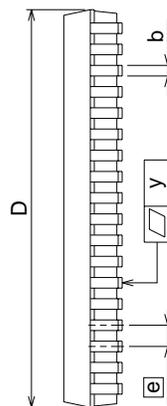
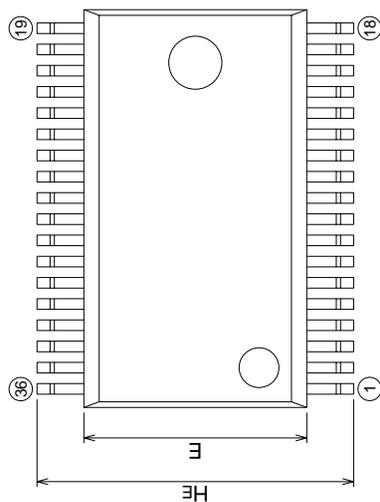
Y1 == 6.00 MHz ceramic resonator with built-in load capacitors:
AVX PBRC-6.00BR or Murata CSTC6.00MG or equivalent.

SMDAXXC-5 is optional for protection.
STP203-33 is a USB upstream port filter and protection chip.



MECHANICAL INFORMATION FOR DR (36-PIN SSOP) PACKAGE

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
θ	0°	-	10°
b2	-	0.5	-
e1	-	11.43	-
l2	1.27	-	-



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	20	mA
Operating temperature	T _A	T _{LOW} to T _{HIGH}	°C
UR7HCTS2-USB		-20 to +85	°C
Storage temperature range	T _{STG}	-40 to +125	°C
ESD rating (human body model)	V _{ESD}	TBD	kV

DC Electrical Characteristics, Temperature range = T_{LOW} to T_{HIGH} unless otherwise noted

Characteristic	Symbol	Min	Typ	Max	Unit
Supply voltage		4.4	5.0	5.5	V
Output voltage (10 μA load)	V _{OH} V _{OL}	V _{DD} -0.1		0.1	V
Input high voltage	V _{IH}	0.8 x V _{DD}		V _{DD}	V
Input low voltage	V _{IL}	V _{SS}		0.2 x V _{DD}	V
Input current	I _{IN}			+/- 10	μA
Supply current (V _{DD} =5.0 V _{DC} +/-10%, V _{SS} =0)	I _{DD}		3.0	TBD	mA

Control Timing (V_{DD}=5.0 V_{DC} +/-10%, V_{SS}=0 V_{DC}, Temperature range = T_{LOW} to T_{HIGH} unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Frequency of operation					
■ Crystal option	f _{osc}		6.0		MHz
■ External clock option	f _{osc}		6.0		MHz



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**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

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