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HID & SYSTEM MANAGEMENT PRODUCTS, MOUSECODER™ FAMILY

DESCRIPTION

The ScreenCoder™ USB IC is the first single IC that seamlessly interfaces ANY 4- 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- 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 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 application 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- 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 including Windows® 98, Me and 2000
- Convenient calibration applet offered free of charge
- Uses slim 36-pin, SSOP package
- Customized versions available

APPLICATIONS

- Handhelds/Notebooks
- Portable Devices
- Interactive Kiosks
- Industrial/Custom Touch Screens

PIN ASSIGNMENTS

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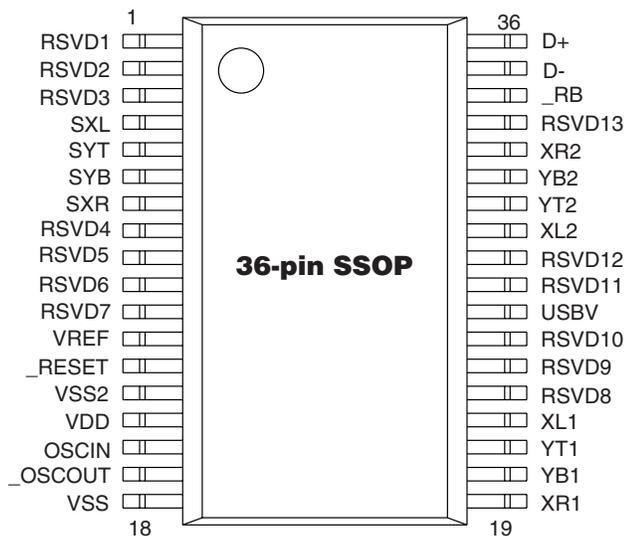
Package Options	Pitch in mm's	TA=-20° C to +85° C
36-pin, Plastic SSOP	0.8mm	UR7HCTS2-U860-DR

Other Materials	Type	Order number
ScreenCoder™ USB Eval Kit	Evaluation Kit	EVK7-TS2-U860-XXX

BLOCK DIAGRAM FOR THE UR7HCTS2-U860

Right Button

Power Management Section

Switch Interface

Power -On Reset

Drivers for Touch Screen

4

Touch Panel Interface

16-Bit Timer

Sense Lines

4

Sensor Interface

Oscillator Circuit

USB Communication Interface

D+

D-

OSCIN   _OSCOUT

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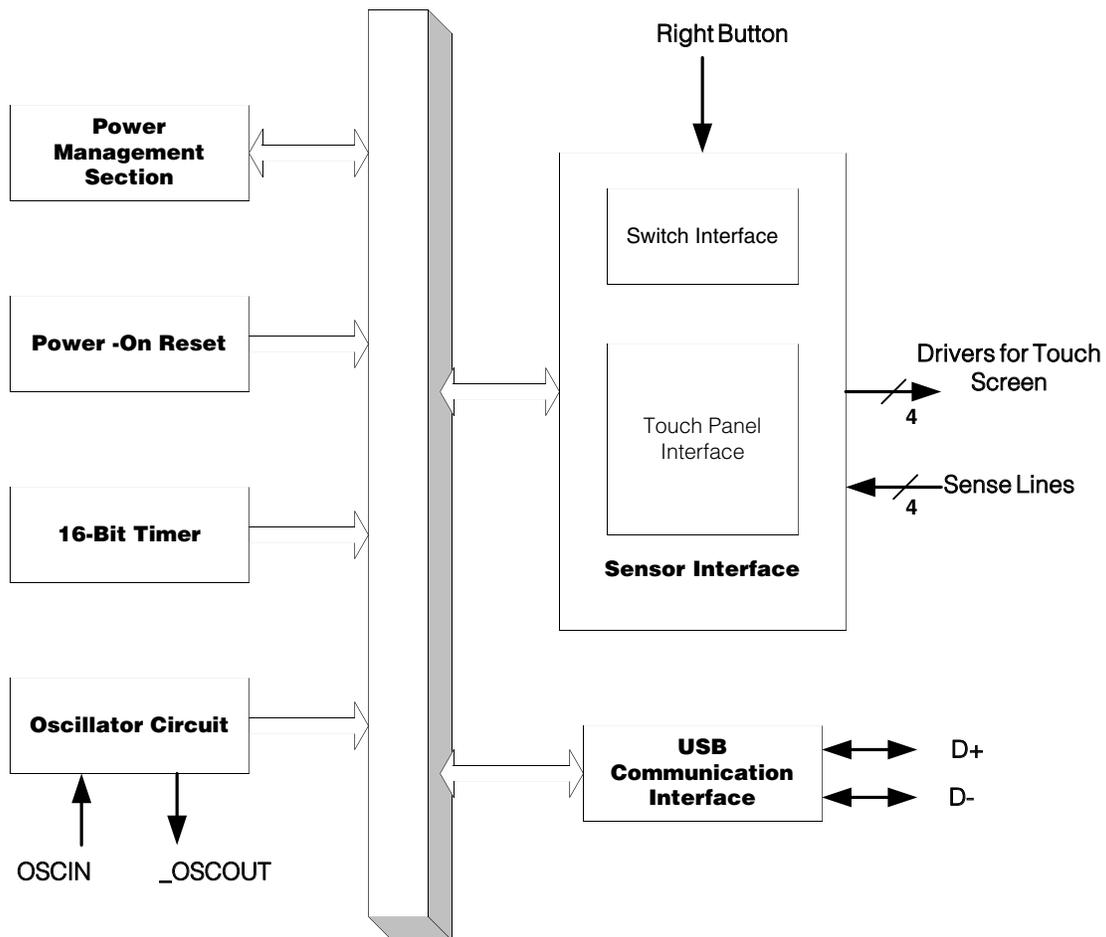
FUNCTIONAL DESCRIPTION

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, or a Ceramic Resonator (preferably with built-in Load Capacitors) or a Crystal with external 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 IC, on detecting that the system is in suspend, will check the state of the touch screen and the right button. If there is no touch pressure detected or no button pressed, the ScreenCoder™ USB enters into the suspended state. In suspend the IC fully complies with the USB specification for the power consumption, dissipating current only in the USB-mandated pull-up for the device identification.

Another technique the IC uses to conserve power is called remote wake-up. If the system relies on the device to perform wake-up, the IC will send a resume message to the system when there is activity on the touch screen or button.

PIN DEFINITIONS

Mnemonic	Pin #	Type	Name and Function
Power:			
VDD	15	P	**Power Supply**
VSS	14,18	P	**Ground**
3.3V	22	P	**USB Reference Voltage Out**
_Reset	13	I	**Reset**
Oscillators:			
OSCI	16	I	**Oscillator Input**
OSCO	17	O	**Oscillator Output**
USB:			
D-	35	I/O	**USB D- Line**
D+	36	I/O	**USB D+ Line**
Touch Screen:			
XR1, XR2	19,32	I/O	**Touch Screen Right Drive Pins**
YB1, YB2	31,20	I/O	**Touch Screen Bottom Drive Pins**
YT1, YT2	21,30	I/O	**Touch Screen Top Drive Pins**
XL1, XL2	22,29	I/O	**Touch Screen Left Drive Pins**
SXR	7	AI	**Touch Screen Sense Pin:** for X Right
SYB	6	AI	**Touch Screen Sense Pin:** for Y Bottom
SYT	5	AI	**Touch Screen Sense Pin:** for Y Top
SXL	4	AI	**Touch Screen Sense Pin:** for X Left
VREF	12	AI	**Voltage Reference for A/D Converter**
SOUT	23	O	**Output control data to A/D Converter**
_RB	34	I	**Mouse Right Button**
RDVD1-13	1-3,8-11 23-25, 27-28 33	I/O	**Reserved for future use**

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

POWER MANAGEMENT (CON'T)

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

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The ScreenCoder™ USB can acquire data from any 4- 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 will not perform measurements and will 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 will be 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 direction. 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 both left and right buttons, however, there is no physical left button. Left button press is reported when there is touch pressure on the panel. The left button is released when there is no pressure on the panel. The right button is a physical button, and can be used individually.

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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 USB specification for low speed device.

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

USB DESCRIPTORS

Offset	Part	Size	Value	Description
Device Descriptor				
0	bLength	1	0x12	Numeric expression specifying the size of device descriptor
1	bDescriptonType	1	0x01	Device descriptor type
2	bcdUSB	2	0x0100	USB HID spec release number 01.00
3	bDeviceClass	1	0x00	Class code
4	bDeviceSubClass	1	0x00	Sub class code
5	bDeviceProtocol	1	0x00	Protocol code
6	bMaxPacketSize0	1	0x08	Maximum packet size for EP0
8	idVendor	2	0x047A	USAR's vendor ID
10	idProduct	2	0x0004	USAR ScreenCoder™ USB Product ID
12	bcdDevice	2	0x0061	Device release number
14	iManufacture	1	0x04	Index of string descriptor describing manufacturer
15	iProduct	1	0x0E	Index of string descriptor describing product
16	iSerialNumber	1	0x00	Index of String descriptor describing serial number
17	bNum-	1	0x01	Number of possible configurations
Configuration Descriptor				
0	bLength	1	0x09	Size of configuration descriptor in bytes
1	bDescriptorType	1	0x02	Configuration (assigned by USB)
2	wTotalLength	2	0x0022	Total length of data returned for this
4	bNumInterface	1	0x01	Number of interfaces supported by this configuration
5	bConfigurationValue	1	0x01	Current configuration value
6	iConfiguration	1	0x00	Configuration string descriptor index
7	bmAttribute	1	0xA0	Configuration characteristics - bus powered, with remote wakeup
8	MaxPower	1	0x32	Maximum power consumption of USB device 100 mA
Interface Descriptor				
0	bLength	1	0x09	Size of Interface descriptor in bytes
1	bDescriptorType	1	0x04	Interface descriptor type
2	bInterfaceNumber	1	0x00	Number of interface
3	bAlternateSetting	1	0x00	Number of alternate setting
4	bNumEndpoints	1	0x01	Number of endpoint
5	bInterfaceClass	1	0x03	Class code (HID)
6	bInterfaceSubClass	1	0x00	Subclass code (nor boot interface subclass)
7	bInterfaceProtocol	1	0x02	Protocol code = mouse
8	iInterface	1	0x00	Index of string descriptor describing this interface
HID Descriptor				
0	bLength	1	0x09	Size of HID descriptor in byte
1	bDescriptorType	1	0x21	HID descriptor type
2	bcdHID	2	0x0100	HID Spec release number
4	bCountryCode	1	0x00	Hardware target country
5	bNumDescriptor	1	0x01	Number of HID class descriptor follow
6	bDescriptorType	1	0x22	Report descriptor type
7	wDescriptorLength	2	0x0038	Total length of report descriptor

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USB DESCRIPTORS, (CON'T)

Offset	Part	Size	Value	Description
Endpoint Descriptor				
0	bLength	1	0x07	Size of endpoint descriptor in bytes
1	bDescriptorType	1	0x05	Endpoint descriptor type
2	bEndpointAddress	1	0x81	Endpoint address (IN, Endpoint 1)
3	bmAttribute	1	0x03	Endpoint's attribute (interrupt)
4	WMaxPacketSize	2	0x0005	Maximum packet size
6	BInterval	1	0x0A	Interval for polling (poll every 10 ms)
String Descriptor				
1	bLength	1	0x04	Length of string description in bytes
2	bDescriptorType	1	0x03	Descriptor type = String
3	bString	2	0x0904	LangID code = English
5	bLength	1	0x0A	Length of string descriptor
6	bDescriptorType	1	0x03	Descriptor Type = String
7	bString	8	'U',0,'S', 0,'A',0, 'R',0	Manufacturer
15	bLength	1	0x3A	Length of string descriptor
16	bDescriptorType	1	0x03	Descriptor type = String
17	bString	20	'S',0,'c' 0,'r',0, 'e',0,etc.	"ScreenCoderTM UR7HCTS2-U860"

Offset	Data	Mnemonic	Value
Report Descriptor			
0	05 01	Usage Page	Generic Desktop
2	09 01	Usage	Pointer
4	A1 01	Collection	Application
6	09 01	Usage	Pointer
8	A1 00	Collection	Physical
10	05 09	Usage page	Buttons
12	19 01	Usage Minimum	1
14	29 03	Usage Maximum	3
16	15 00	Logical Minimum	0
18	25 01	Logical Maximum	1
20	95 03	Report Count	3
22	75 01	Report Size	1
24	81 02	Input	Variable
26	95 01	Report Count	1
28	75 05	Report Size	5
30	81 01	Input	Constant
32	05 01	Usage Page	Generic Desktop
34	09 30	Usage	X
36	09, 31	Usage	Y
38	15, 00	Logical Maximum	0
40	26, FF 7F	Usage Maximum	15 bits 7FFF
43	35, 00	Physical Minimum	0
45	46, FF 7F	Physical Maximum	15 bits 7FFF
48	75, 10	Report Size	16 bits
50	95, 02	Report Count	2
52	81, 02	Input	Variable
54	C0	End Collection	
55	C0	End Collection	
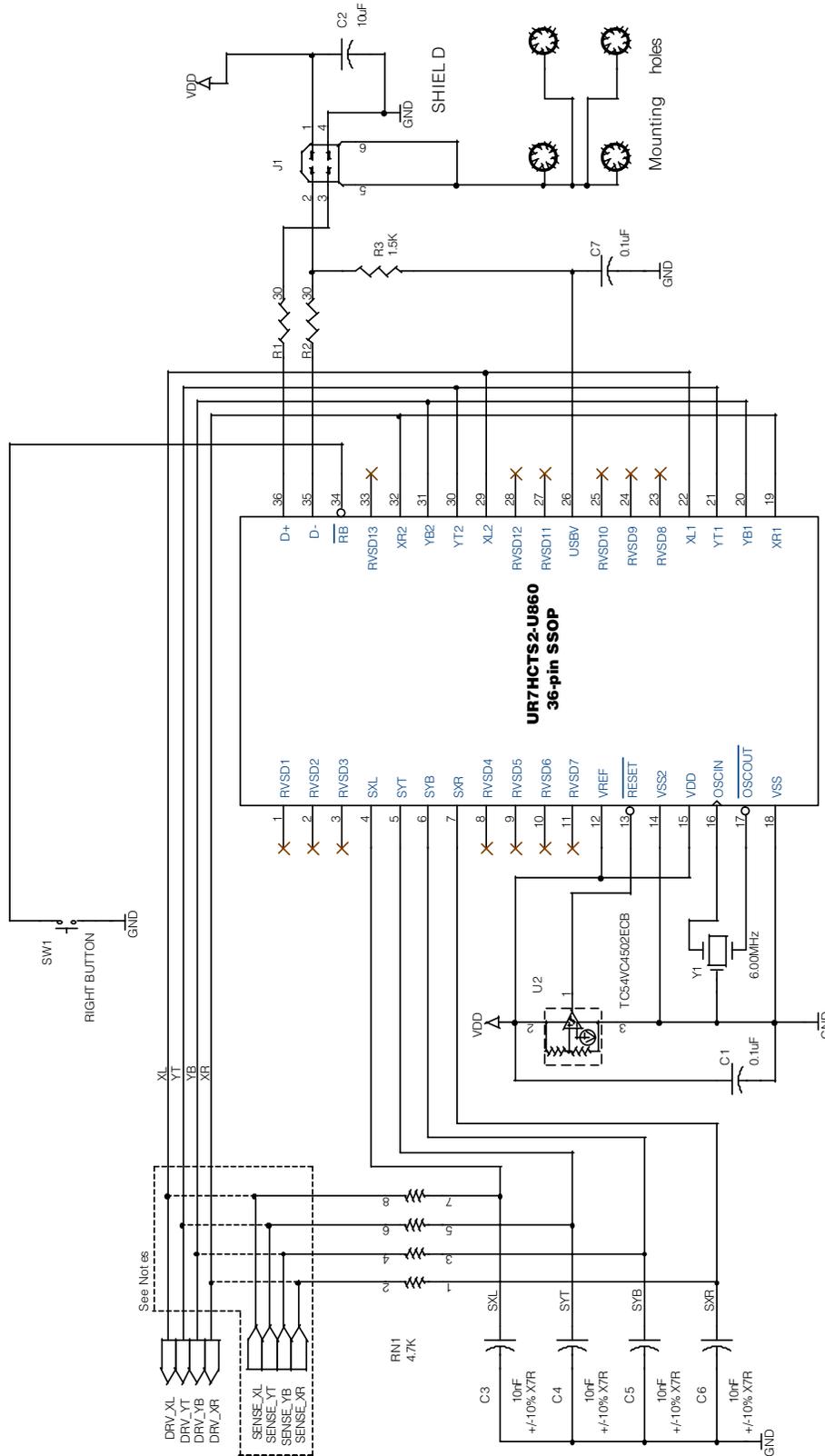
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ScreenCoder(TM) USB UR7HCTS2-U860

NOTES :

U860 == USB Out, 6.00 MHz, 8/4-wire, Mode10
Connect Drive and Sense lines together for the 4-wire sensor
Y1 == 6.00 MHz Ceramic Resonator with Load Capacitors.
Crystals can NOT be used.
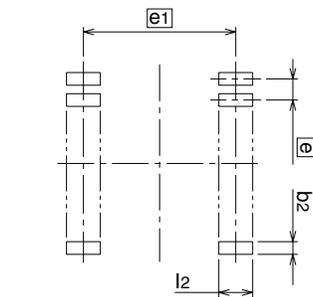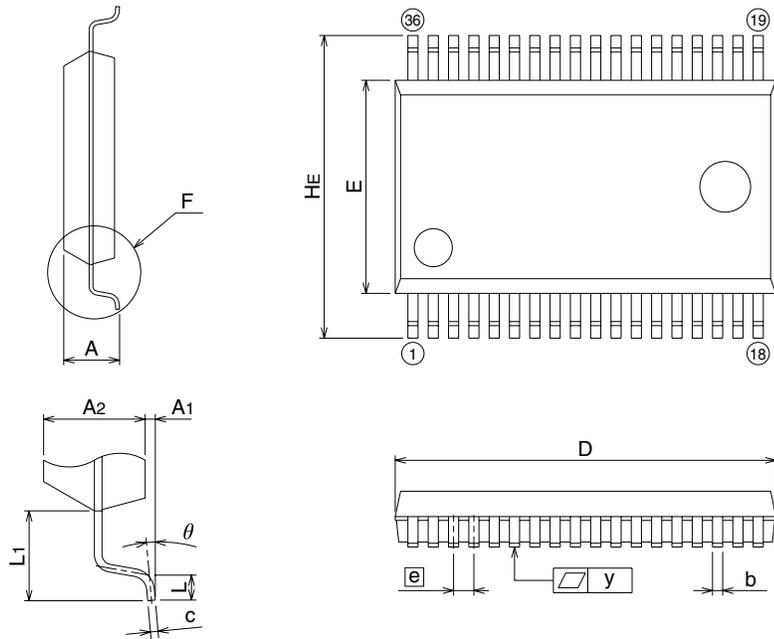
Recommended Mounting Pad

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	–	–

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ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings

Ratings	Symbol	Value	Unit
Supply Voltage	Vdd	-0.3 to 7.0	V
Input Voltage	Vin	Vss -0.3 to Vdd +0.3	V
Current Drain per Pin (not including Vss or Vdd)	I	20	mA
Operating Temperature UR7HCTS2-U860	Ta	T low to T high -20 to +85	° C ° C
Storage Temperature Range	Tstg	-40 to +125	° C

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

Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage		3.0	5.0	5.5	V
Output Voltage (10 µA load)	Voh	Vdd–0.1			V
	Vol			0.1	
Input High Voltage	Vih	0.8 x Vdd		Vdd	V
Input Low Voltage	Vil	Vss		0.2xVdd	V
Input Current	Iin			+/- 10	µA
Supply Current (Vdd=5.0 Vdc+/-10%, Vss=0)	Idd		3.0	TBD	mA

Control Timing (Vdd=5.0 Vdc +/-10%, Vss=0 Vdc, Temperature range=T low to T high unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Frequency of Operation	fosc				MHz
■ Crystal Option			6.0		
■ External Clock Option			6.0		

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UR7HCTS2-U860-DR BOM

Description	Quantity	Manufacturer	Part#	Description
Capacitors:				
C1, C7	2	Generic	Any	.1uF Capacitor
C2	1	Generic	Any	10uF Capacitor
C3, C4, C5, C6	4	Generic	Any	0.01uF Capacitor, 10% X7R or better
Connectors:				
J1	1	Generic	Any	USB Connector
ICs:				
U1	1	USAR	UR7HCTS2-860	ScreenCoder™ Controller
U2	1	TelCom	TC54VC2702ECB	Low-power Reset Voltage Detector
Resistors:				
R1, R2	2	Generic	Any	30 Ohms Resistor
R3	1	Generic	Any	1.5k Resistor
RN1	1	Generic	Any	4x, 4.7k Resistor Network
Resonator:				
Y1	1	Panasonic	EFO-S6004E5	6.00MHz Ceramic Resonator, w/ built-in Load Caps
Button:				
SW1	1	Generic	Any	Push Button

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