USB332x

Industry’s Smallest Hi-Speed USB Transceiver with 1.8V ULPI Interface

PRODUCT FEATURES

- Integrated ESD protection circuits
  - Up to ±15kV IEC Air Discharge without external devices
- Over-Voltage Protection circuit (OVP) protects the VBUS pin from continuous DC voltages up to 30V
- Integrated USB Switch
  - No degradation of Hi-Speed electrical characteristics
  - Allows single USB port of connection by providing switching function for:
    - Battery charging
    - Stereo and mono/mic audio
    - USB Full-Speed/Low-Speed data
- flexPWR® Technology
  - Low current design ideal for battery powered applications
  - “Sleep” mode tri-states all ULPI pins and places the part in a low current state
  - 1.8V IO Voltage (±10%)
- Integrated battery to 3.3V LDO regulator
  - 2.2uF bypass capacitor
  - 100mV dropout voltage
- “Wrapper-less” design for optimal timing performance and design ease
  - Low Latency Hi-Speed Receiver (43 Hi-Speed clocks Max) allows use of legacy UTMI Links with a ULPI bridge
- External Reference Clock operation
  - ULPI Input Clock Mode (60MHz sourced by Link)
  - 0 to 3.6V input drive tolerant
  - Able to accept “noisy” clock sources as reference to internal, low-jitter PLL
  - Frequencies: 12, 13, 19.2, 26, or 27MHz
- Smart detection circuits allow identification of USB charger, headset, or data cable insertion
- Includes full support for the optional On-The-Go (OTG) protocol detailed in the On-The-Go Supplement Revision 2.0 specification
- Supports the OTG Host Negotiation Protocol (HNP) and Session Request Protocol (SRP)
- UART mode for non-USB serial data transfers
- Internal 5V cable short-circuit protection of ID, DP and DM lines to VBUS or ground
- Industrial Operating Temperature -40°C to +85°C
- 25 ball WLCSP lead-free RoHS compliant package; (2.0 x 2.0 x 0.53mm height)

Applications

The USB332x is targeted for any application where a Hi-Speed USB connection is desired and when board space, power, and interface pins must be minimized.

The USB332x is well suited for:

- Cell Phones
- PDAs
- MP3 Players
- GPS Personal Navigation Devices
- Datacards
- Scanners
- External Hard Drives
- Digital Still and Video Cameras
- Portable Media Players
- Entertainment Devices
- Printers
- HDTVs
- Set Top Boxes/DVR/PVR
- Video Record/Playback Systems
- IP and Video Phones
- Gaming Consoles
- POS Terminals

Applications
Note 1 All versions support ULPI Clock In Mode (60MHz input at REFCLK).

This product meets the halogen maximum concentration values per IEC61249-2-21

For RoHS compliance and environmental information, please visit www.smsc.com/rohs

<table>
<thead>
<tr>
<th>ORDER NUMBER</th>
<th>REFCLK FREQUENCY (Note 1)</th>
<th>PACKAGE TYPE</th>
<th>REEL SIZE</th>
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<tbody>
<tr>
<td>USB3321C-GL-TR</td>
<td>26MHz</td>
<td>25 Ball, WL CSP Lead-Free RoHS Compliant Package (tape and reel)</td>
<td>3000 pieces</td>
</tr>
<tr>
<td>USB3322C-GL-TR</td>
<td>12MHz</td>
<td></td>
<td></td>
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<tr>
<td>USB3326C-GL-TR</td>
<td>19.2MHz</td>
<td></td>
<td></td>
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<tr>
<td>USB3327C-GL-TR</td>
<td>27MHz</td>
<td></td>
<td></td>
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<td>USB3329C-GL-TR</td>
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General Description

SMSC’s USB332x is a family of Hi-Speed USB 2.0 Transceivers that provides a physical layer (PHY) solution well-suited for portable electronic devices. Both commercial and industrial temperature applications are supported.

Each model in the USB332x family may use a 60MHz reference clock, or the model-number specific reference clock shown in Order Numbers on page 2.

Several advanced features make the USB332x the transceiver of choice by reducing both electrical bill of material (eBOM) part count and printed circuit board (PCB) area. Outstanding ESD robustness eliminates the need for external ESD protection devices in typical applications. The internal Over-Voltage Protection circuit (OVP) protects the USB332x from voltages up to 30V. By using a reference clock from the Link, the USB332x removes the cost of a dedicated crystal reference from the design. And the integrated USB switch enables unique product features with a single USB port of connection.

The USB332x meets all of the electrical requirements to be used as a Hi-Speed USB Host, Device, or an On-the-Go (OTG) transceiver. In addition to the supporting USB signaling, the USB332x also provides USB UART mode and USB Audio mode.

USB332x uses the industry standard UTMI+ Low Pin Interface (ULPI) to connect the USB PHY to the Link. ULPI uses a method of in-band signaling and status byte transfers between the Link and PHY to facilitate a USB session with only 12 pins.

The USB332x uses SMSC’s “wrapper-less” technology to implement the ULPI interface. This “wrapper-less” technology allows the PHY to achieve a low latency transmit and receive time. SMSC’s low latency transceiver allows an existing UTMI Link to be reused by adding a UTMI to ULPI bridge. By adding a bridge to the ASIC the existing and proven UTMI Link IP can be reused.

Figure 1 USB332x Block Diagram
The USB332x includes an integrated 3.3V Low Drop Out (LDO) linear voltage regulator that may optionally be used to generate 3.3V from power applied at the VBAT pin. The voltage on the VBAT pin can range from 3.1 to 5.5V. The regulator dropout voltage is less than 100mV which allows the PHY to continue USB signaling when the voltage on VBAT drops to 3.1V. The USB transceiver will continue to operate at lower voltages, although some parameters may be outside the limits of the USB specifications. If the user would like to provide a 3.3V supply to the USB332x, the VBAT and VDD33 pins should be connected together.

The USB332x also includes integrated pull-up resistors that can be used for detecting the attachment of a USB Charger. By sensing the attachment to a USB Charger, a product using the USB332x can charge its battery at more than the 500mA allowed when charging from a USB Host.

In USB UART mode, the USB332x DP and DM pins are redefined to enable pass-through of asynchronous serial data. The USB332x can only enter UART mode when the user programs the part into this mode.

In USB audio mode, a switch connects the DP pin to the SPK_R pin, and another switch connects the DM pin to the SPK_L pin. The USB332x can be configured to enter USB audio mode. In addition, these switches are on when the RESETB pin of the USB332x is asserted. The USB audio mode enables audio signalling from a single USB port of connection, and the switches may also be used to connect Full Speed USB from another PHY onto the USB cable.
**Package Outline**

**COMMON DIMENSIONS**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>MIN</th>
<th>NOM</th>
<th>MAX</th>
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<th>REMARK</th>
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<td>A</td>
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<td>-</td>
<td>0.62</td>
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<td>OVERALL PACKAGE HEIGHT</td>
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<tr>
<td>A1</td>
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<tr>
<td>A2</td>
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<td>0.38</td>
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<td>D1/E1</td>
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<td>-</td>
<td>X/Y END BALLS DISTANCE</td>
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<tr>
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<td>0.30</td>
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<td>BALL DIAMETER</td>
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<td>0.40 BSC</td>
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<td>BALL PITCH</td>
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<tr>
<td>SD/SE</td>
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<td>-</td>
<td>CENTER BALL POSITION (OUTER ROW)</td>
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<tr>
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<td>0.05</td>
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<td>COPLANARITY</td>
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**NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER, PARALLEL TO PRIMARY DATUM "C".
3. THE BALL "A1" CORNER MUST BE IDENTIFIED IN THE INDICATED AREA OF THE TOP PACKAGE SURFACE.
4. PRIMARY DATUM "C" AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE CONTACT SOLDER BALLS.
5. DIMENSION "a" DOES NOT INCLUDE ATTACHED EXTERNAL FEATURES, SUCH AS HEAT SINK OR CHIP CAPACITORS. DIMENSION "a(max)" IS GIVEN FOR THE EXTREMELY THIN VARIATION OF THE PACKAGE PROFILE HEIGHT.
6. DIMENSION "A2" INCLUDES A DIE COATING THICKNESS.

**Figure 2**
25WL CSP, 2.0x2.0mm Body, 0.4mm Pitch