CYPRESS SEMICONDUCTOR CORPORATION
Internal Correspondence

TITLE: Cypress’s WUSB-NX Solutions for HID NPI

Last Updated: 04/28/2014

Frequently Asked Questions

Contents
PRODUCT FEATURES ...........................................................................................................2
SYSTEM IMPLEMENTATION/BOM ..................................................................................3
SOLUTION CAPABILITY ....................................................................................................5
APPLICATIONS ................................................................................................................7
SOFTWARE/TOOLS/DRIVERS .......................................................................................7
HARDWARE/MODULES/KITS ............................................................................................7
COMPETITION/POSITIONING .........................................................................................8
PORTFOLIO/ROADMAP ..................................................................................................10
SUPPORT ..........................................................................................................................11
PRODUCT FEATURES

Q1: What does the acronym WUSB-NX stand for?
A: “WUSB-NX” stands for WirelessUSB™ NeXt generation. WUSB-NX is a fourth-generation Radio Frequency (RF) Transceiver that is part of Cypress’s proprietary 2.4-GHz, WirelessUSB portfolio.

Q2: What are the key features of WUSB-NX?
A: The key features of WUSB-NX are outlined below:
  • Over-the-Air Nordic Compatibility
  • Operating Voltage: 1.9 V to 3.6 V
  • Low current consumption
    o Sleep current: 900 nA
    o Idle current: 26 µA
    o Transmit current: 12 mA
    o Receive current: 15 mA
  • Programmable data rates: 2 Mbps, 250 Kbps
  • Max transmit power: +4 dBm
  • Min receive sensitivity: −93 dBm at 250 Kbps
  • RSSI: 5-bit for channel noise
    4-bit for signal strength
  • MCU interface: 4-wire SPI slave

Q3: What is RSSI and how does it enable better wireless system design?
A: RSSI or Received Signal Strength Indicator is an indicator of RF signal or noise strength. RF transceivers provide this feature to enable the system to take actions like:
  • Avoiding interference by changing the communication frequency when the noise on the current frequency is too high
  • Saving power by reducing the transmit output power level when the signal strength is higher than required

Q4: What packages is WUSB-NX available in?
A: Currently WUSB-NX is available in a 24 QFN (4 X 4 X 0.55mm) package. Known-good, bare dies for Chip-on-Board (CoB) designs can also be provided to customers on request. Please contact wusbnx@cypress.com to request for timelines and pricing for WUSB-NX bare dies.

Q5: Is this product available in any other than “C” grade?
A: No, currently, WUSB-NX is available only in the commercial temperature grade i.e. with an operating temperature range of 0°C to 70°C.
SYSTEM IMPLEMENTATION/BOM

Q6: Is an external MCU required to control WUSB-NX? If yes, what MCUs does WUSB-NX work with?
A: Yes, an external MCU is required to control WUSB-NX. WUSB-NX works with Cypress’s enCoRe MCUs and PSoc devices that can act as a Serial Peripheral Interface (SPI) master. An SPI master is required because WUSB-NX interfaces to the host microcontroller using standard four-wire SPI. For questions on interfacing WUSB-NX with third-party microcontrollers, contact wusbnx@cypress.com.

Q7: Does Cypress offer products that integrate an MCU and RF transceiver?
A: Yes. Cypress provides the PRoC-UI product family with integrated MCU, Touch Sensing and Full-Speed USB functionality with the WUSB-NL (Cypress’s 3rd Generation RF transceiver). However, Cypress does not currently provide products that integrate an MCU and the WUSB-NX RF transceiver. For more information on the PRoC-UI product family visit the PRoC-UI homepage - www.cypress.com/PRoC-UI.

Q8: What advanced features does Cypress provide for wireless HID?
A: Examples of such solutions are provided in Slide 6e (“Add Advanced Features with WUSB-NX and a Companion Cypress Product”) of the New Product Introduction presentation for WUSB-NX, shown below.

Add Advanced Features with WUSB-NX
and a Companion Cypress Product

Adding advanced features like Touch Sensing and VoRF are the trends in wireless HID design

Wireless Touch Mouse
- Radio: WUSB-NX
- Companion IC or Module: enCoRe Vi
- Touch Sensing: Windows 8-specific gestures and scrolling
- Interfaces: Optical sensor, Battery monitoring, LED and mechanical buttons

Wireless Trackpad
- Radio: WUSB-NX
- Companion IC or Module: enCoRe V LV
- Touch Sensing: Up to five-finger gestures, including Windows 8-specific gestures
- Interfaces: Battery Monitoring, LEDs and mechanical buttons

Remote Control
- Radio: WUSB-NX
- Companion IC or Module: PSoc 4
- Touch Sensing: Up to two-finger gestures, CapSense buttons/sliders
- Interfaces: Accelerometer for motion sensing, Microphone for VoRF, QWERTY keyboard matrix

Cypress provides a broad product portfolio with technical support to enable advanced features in wireless HID

Detailed solution examples for all applications shown above are available in slides 20a, 20b and 20c of the New Product Introduction presentation for WUSB-NX.
Q9: Does Cypress provide reference schematics to help customers understand application circuit design using WUSB-NX?
A: Yes, Cypress provides reference schematics for WUSB-NX along with the Bill-of-Materials (BoM) for the antenna matching network as part of the WUSB-NX datasheet. Please refer figure 11 and table 33 in the WUSB-NX datasheet available here - www.cypress.com/go/WUSB-NX-Datasheet.

Q10: Does Cypress provide hardware design guidelines to guide customers who are building PCBs with WUSB-NX?
A: Yes, Cypress provides hardware design guidelines for WUSB-NX as part of the “WUSB-NX Hardware Design Guidelines” application note, available here - www.cypress.com/go/AN89878.

Q11: What antennae can be used with WUSB-NX?
A: Virtually any type of 50 Ω, 2.4 GHz antenna can be used with WUSB-NX. A few popular types of antennae which can be used with WUSB-NX are:
- Printed Trace Antenna
- Chip Antenna
- Half-wave Dipole Antenna
Further details are provided in the application note “WUSB-NX Hardware Design Guidelines” available here - www.cypress.com/go/AN89878.

Q12: Is there a recommended schematic and layout checklist that can be used by a customer while designing a PCB with WUSB-NX?
A: Yes, the checklist is provided in the application note “WUSB-NX Hardware Design Guidelines” available at - www.cypress.com/go/AN89878.

Q13: Does Cypress provide an Arduino™ compatible WUSB-NX shield which can plug into Arduino boards?
A: Cypress provides free WUSB-NX modules which can be blue-wired to any Arduino board. However, currently Cypress does not provide an Arduino compatible shield with WUSB-NX. A WUSB-NX shield is currently under development and is expected to be available by December 2014. This shield will also work with Cypress’s CY8CKIT-042 (PSoC® Pioneer Kit) and will ship with code examples for Cypress’s PSoC 4.
To request for WUSB-NX modules please contact Cypress sales or wusbnx@cypress.com.
SOLUTION CAPABILITY

Q14: What is the power consumption and battery life of a typical HID application when using a WUSB-NX based solution?

A: Power consumption and battery life vary across wireless HID applications. The following table outlines the battery life and power consumption figures for a typical wireless mouse built using WUSB-NX, enCoRe V LV microcontroller, and a Pixart optical sensor. Below table outlines that mouse offers 156 weeks or ~3 years of battery life.

<table>
<thead>
<tr>
<th>Key Components</th>
<th>Company</th>
<th>Product Name</th>
<th>MPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microcontroller</td>
<td>Cypress</td>
<td>enCoRe V LV</td>
<td>CY7C60445-32LQXC</td>
</tr>
<tr>
<td>Radio</td>
<td>Cypress</td>
<td>WirelessUSB NX</td>
<td>CYRF9935-24LQXC</td>
</tr>
<tr>
<td>Optical Sensor</td>
<td>Pixart</td>
<td>CMOS Optical Mouse Sensor</td>
<td>PAW3204DB-TJDN</td>
</tr>
</tbody>
</table>

**Battery Life Calculation for Wireless Mouse**

<table>
<thead>
<tr>
<th>System Power State**</th>
<th>Usage Model*</th>
<th>System Current Consumption **(mA)</th>
<th>System Power Consumption (mAh/Week)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mon-Fri (Hours)</td>
<td>Sat-Sun (Hours)</td>
<td>Hours/Week</td>
</tr>
<tr>
<td>Active</td>
<td>0.65</td>
<td>0.00</td>
<td>3.25</td>
</tr>
<tr>
<td>S1</td>
<td>1.30</td>
<td>0.00</td>
<td>6.50</td>
</tr>
<tr>
<td>S2</td>
<td>1.30</td>
<td>0.00</td>
<td>6.50</td>
</tr>
<tr>
<td>S3</td>
<td>6.75</td>
<td>0.00</td>
<td>118.00</td>
</tr>
<tr>
<td>Shutdown</td>
<td>14.00</td>
<td>24.00</td>
<td></td>
</tr>
</tbody>
</table>

Total Power Consumption per week in mAH

Battery Capacity for 2 X AA batteries in mAH: 5200

Life Time in Weeks: 156

**Light Usage - 14 hours shutdown on weekday, complete shutdown on weekend**

<table>
<thead>
<tr>
<th>System Power State**</th>
<th>Usage Model*</th>
<th>System Current Consumption **(mA)</th>
<th>System Power Consumption (mAh/Week)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mon-Fri (Hours)</td>
<td>Sat-Sun (Hours)</td>
<td>Hours/Week</td>
</tr>
<tr>
<td>Active</td>
<td>1.00</td>
<td>0.00</td>
<td>5.00</td>
</tr>
<tr>
<td>S1</td>
<td>2.00</td>
<td>0.00</td>
<td>10.00</td>
</tr>
<tr>
<td>S2</td>
<td>2.00</td>
<td>0.00</td>
<td>10.00</td>
</tr>
<tr>
<td>S3</td>
<td>19.00</td>
<td>24.00</td>
<td>143.00</td>
</tr>
<tr>
<td>Shutdown</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Total Power Consumption per week in mAH

Battery Capacity for 2 X AA batteries in mAH: 5200

Life Time in Weeks: 90

* Usage model is empirically obtained by monitoring the behaviour of users when using a wireless mouse in an office environment

** System power states are explained below:
- Active mode: Mouse is active. Microcontroller and radio are intermittently in active, idle and sleep states. Optical sensor is in active state when mouse is moving and is in sleep state otherwise
- S1 (Sleep 1) mode: Mouse is inactive. Microcontroller, radio and optical sensor are in sleep state. Sensor is in sleep 1 mode with 300µA current consumption
- S2 (Sleep 2) mode: Mouse is inactive. Microcontroller, radio and optical sensor are in sleep state. Sensor is in sleep 2 mode with 60µA current consumption
- S3 (Sleep 3) mode: Mouse is inactive. Microcontroller, radio and optical sensor are in sleep state. Sensor is in power down mode with 7µA current consumption
- Shutdown: Mouse is powered off

*** System current consumption figures are obtained by measuring the current on an actual wireless mouse
Q15: What transmission range is achievable with WUSB-NX?
A: A wireless mouse using WUSB-NX has been proven to operate reliably at up to 10 m range in a typical office environment.
Note: Transmission range depends on several factors including transmit power settings, antenna gain, and free space loss.

Q16: What is the maximum over-the-air data rate achievable with WUSB-NX?
A: WUSB-NX supports a maximum over-the-air data rate of 2 Mbps.
Note: The throughput on an end application depends on the interference, protocol overhead, and application requirements.

Q17: What is the typical duty cycle of WUSB-NX for a wireless HID?
A: The duty cycle of WUSB-NX depends upon the type of wireless HID application, the report rate and the size of each data packet. WUSB-NX has a short 5% duty cycle for a typical wireless mouse with a report rate of 125 Hz and a data packet size of 32 bytes. For details refer to slide 6a (“WUSB-NX Enables a Three-Year Battery Life”) of the New Product Introduction presentation for WUSB-NX, shown below.

Q18: Can multiple HID communicate to a dongle using a WUSB-NX based solution? If yes how many HID can one WUSB-NX based dongle support?
A: Yes, WUSB-NX has 8 internal pipes which enable a dongle to support up to 8 HID.
Note: Nordic's proprietary nRF24L01+ transceiver has 6 internal pipes. This means a Cypress WUSB-NX based dongle can support 2 more HID than the Nordic based dongle.

APPLICATIONS

Q19: What are the target applications for WUSB-NX?
A: The target applications for WUSB-NX are:
- Wireless keyboards
- Wireless mice
- Wireless touch mice
- Wireless trackpads
- Wireless keyboards with integrated trackpads
- RF remote controls with trackpad and voice support

SOFTWARE/TOOLS/DRIVERS

Q20: What firmware does Cypress provide for WUSB-NX?
A: WUSB-NX is not a programmable part. It is controlled by an external MCU using the SPI interface. Cypress provides radio controller firmware that runs on the enCoRe series of MCUs and controls WUSB-NX. This firmware is implemented in the “C” language to enable easy porting across enCoRe and PSoC devices. The radio controller firmware is available on request from wusbnx@cypress.com.

HARDWARE/MODULES/KITS

Q21: Is there a kit available for WUSB-NX?
A: The WUSB-NX Demonstration Kit is available and can be requested by contacting Cypress sales or by writing to wusbnx@cypress.com. Details of the kit are provided in slide 6c (“WUSB-NX Demonstration Kit”) of the New Product Introduction presentation for WUSB-NX. This slide is also shown below.
COMPETITION/POSITIONING

Q22: How does WUSB-NX compare with Nordic nRF24L01+ RF transceiver?  
A: WUSB-NX has several advantages compared to the Nordic nRF24L01+ transceiver. These include:

<table>
<thead>
<tr>
<th>Cypress WUSB-NX Features</th>
<th>Nordic nRF24L01+ Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate 5-bit RSSI for signal strength detection and 4-bit RSSI accurate channel noise detection</td>
<td>Only provides Received Power Detector (RPD), 1-bit register that is set when the received signal power is above -64 dBm</td>
</tr>
<tr>
<td>More programmable levels and -24 dBm control range for transmitter output power</td>
<td>-18 dBm control range for transmitter output power</td>
</tr>
<tr>
<td>Companion Cypress products to support advanced features like touch sensing</td>
<td>No such companion products – customers must procure from other vendors</td>
</tr>
</tbody>
</table>

Refer to slide 7 ("Cypress’s WUSB-NX vs. Nordic’s Radio") in the New Product Introduction presentation for WUSB-NX for details. This slide is also shown below.
Q23: How is WUSB-NX compatible with Nordic’s proprietary RF devices? How does WUSB-NX’s Nordic Compatibility benefit customers?

A: WUSB-NX is over-the-air compatible with Nordic’s nRF24L and nRF31 series at 2 Mbps data rate. This means WUSB-NX can communicate with a Nordic RF device. Moreover Cypress provides radio controller firmware for WUSB-NX with the same Application Programming Interface as Nordic’s radio controller firmware. Customer can reuse existing, Nordic-based application and protocol firmware with WUSB-NX.

Refer slide 6b (“WUSB-NX Is Nordic-Compatible”) in the New Product Introduction presentation for WUSB-NX for details on WUSB-NX’s Nordic Compatibility. This slide is also shown below.
Note: WUSB-NX is not pin-to-pin or footprint compatible with Nordic’s RF devices.

Contact [Cypress sales](#) and sign a Non-Disclosure Agreement to obtain the WUSB-NX datasheet with Nordic Compatibility information.

**PORTFOLIO/ROADMAP**

Q24: What are the other products available in Cypress’s wireless portfolio?

A: Cypress has an extensive portfolio of 2.4 GHz wireless products including RF transceivers and System-on-Chips (MCU + RF). The existing portfolio comprises of Cypress proprietary RF products. WUSB-NX is the 4th generation proprietary RF transceiver launched by Cypress. Cypress is also expected to launch a Bluetooth® Low-Energy radio in the second half of 2014.

The wireless roadmap is available in slide 10 (“Cypress Wireless/RF Roadmap”) in the New Product Introduction presentation for WUSB-NX. This slide is also shown below.
Future products are shown under a Non Disclosure Agreement (NDA). Please contact Cypress sales to initiate an NDA and request for the NDA version of the roadmap.

**SUPPORT**

Q25: How can I place sample orders for WUSB-NX?
A: Customer can order samples through the Cypress WUSB-NX website (www.cypress.com/WUSB-NX) or contact Cypress sales to receive free samples.

Q26: What support can CY provide for customers who are not familiar with wireless designs?
A: Cypress provides customer support in the form of:
- Reference schematics, layout design guidelines, and reference firmware for typical wireless HID applications
- “Copy-exact” PCB antenna board layout files
- Reviewing customer schematics and layout to reduce design cycle time
- Schematics, layout, and firmware for customers to manufacture low-cost manufacturing test kits

Q27: Can WUSB-NX support any other application apart from HID?
A: WUSB-NX can support a variety of wireless applications that require a low-power wireless link of up to 2 Mbps. However the performance of such applications is
dependent upon associated communication protocol and application firmware, which needs to be developed by the customer.

**Q28: Does Cypress provide any manufacturing support for applications using WUSB-NX?**

A: Cypress provides a Manufacturing Test Kit (MTK) that enables customers to quickly test their WUSB-NX products without the need for expensive RF test equipment. The kit is designed to be integrated into the test flow and simulates a limit-of-operation condition using shielded test fixture and enclosure, preventing interference between multiple units that may be on the test floor simultaneously. Key features of the MTK and the tests offered by the MTK along with a block diagram are described below:

- **Key features**
  - One-click RF testing
  - LEDs to indicate pass/busy/fail
  - Data logging via USB for failure analysis

- **Test Coverage**
  - TX carrier frequency test - Tests deviations in carrier frequency
  - Packet Error Rate test - Tests reliability of wireless communication
  - Range test - Variable attenuator enables simulation of desired range

To request for the MTK contact Cypress sales or wusbnx@cypress.com.

For clarification on an answer or for any other questions on WUSB-NX, please email wusbnx@cypress.com.