NXB/NXS Autosense Translators - 1, 2, 4, 6, 8 channel voltage translator

Over the last decade semiconductor CMOS technology has advanced to produce high-performance systems with lower voltage and lower power I/O standards, especially in portable applications. There is an inherent requirement that many applications utilize a mix of I/O voltages and power supplies which has been driven by design and manufacturing of lower power systems. When older legacy peripherals are used in multi-voltage applications these higher voltage devices need to be interfaced with the lower voltages of the latest application processors that are used widely today. Nexperia's Autosense translators enable these voltage translating interfaces and can be used for both push-pull buffered and open-drain applications.

Overview
Nexperia's Voltage Level Translators offer lower voltage and excellent performance in pin-to-pin compatible packages with industry-standard footprints. These bi-directional level translators address various applications that need a transition of voltage signals through multiple domains and serves as an interface between different supply and I/O voltage levels. With auto-direction sensing, no external direction pin is required allowing these families to match up well with the latest low voltage microprocessors.

Key Features
- Complete Family – comprising of 1, 2, 4, 6 and 8-channel level translators
- Easy to Use – Dual supply translating transceiver family
- Auto-sensing bi-directional – no direction pin required
- Wide Voltage Level Translation (wide supply voltage range)
  - NXS
    - \( V_{CC(A)} \): 1.65 V to 3.6 V and \( V_{CC(B)} \): 2.3 V to 5.5 V
  - NXB
    - \( V_{CC(A)} \): 1.2 V to 3.6 V and \( V_{CC(B)} \): 1.65 V to 5.5 V
- Overvoltage tolerant inputs up to 5.5V
- Multiple pin-compatible package options
- \( I_{OFF} \) circuitry provides partial power-down mode operation
- Low power consumption
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

Applications
NXS
- Open-drain applications
- \( I^2C \), SMBus, UART, GPIO and other telecom infrastructure
- Mobile and computing
- Automotive

NXB
- Push-Pull based applications
- General Portable consumer applications
- Bluetooth headsets
- Mobile and computing
- Communications systems
- Automotive
**NXS** level shifters are switch-type translators suitable for open-drain application. They are FET based devices that use an N-channel pass-gate transistor that ties two ports together (Figure 1) and do not need an input signal to change the direction from port A to B or from Port B to A.

The combination of an N-channel pass FET, integrated with 10 kΩ pull-up resistors, and edge-rate acceleration circuits makes NXS translators ideal for interfacing devices or systems operating at disparate voltage levels, while also allowing for simple interfacing with open-drain drivers, as is required in I²C, 1-wire, and SD/MMC-card interface applications.

**NXB** level shifters (Figure 2.) are ideal for use as push-pull or CMOS-type drivers that drive long traces, capacitive, or high-impedance loads in applications that use SPI and UART interfaces.

The architecture of one I/O channel of an NXB level translator incorporates a weak buffer with one-shot circuitry to improve the transition speeds of rising and falling edges. As an example, when the A port is connected to a system driver and driven high, the one-shot will trigger when it senses the rising edge and the high-drive buffer drives the B port high. The weaker 4 kΩ will hold B high once the one-shot pulse is complete. Similarly the same is true for driving low.

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**Output edge-rate accelerator**

The addition of one-shot circuitry, provides the NXB / NXS family with output edge-rate accelerators to improve LOW-to-HIGH transition time (NXS devices) or both HIGH-to-LOW and LOW-to-HIGH (NXB devices). During a transition the output one-shot switches on the NMOS transistor (HIGH-to-LOW transitions) or the PMOS transistor (LOW-to-HIGH transitions). This lowers the output impedance increasing current drive and reducing the output transition time. The one-shot is activated once the input transition reaches half of its reference supply voltage and a low ohmic pulse is generated producing a fast transient on the output.

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**Autosense Voltage level Translator Families**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>$V_{CGA}$ (V)</th>
<th>$V_{CGB}$ (V)</th>
<th>$T_{amb}$ (°C)</th>
<th>Product type</th>
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<tbody>
<tr>
<td>NXS0101</td>
<td>Switch based, 1-bit dual supply translating transceiver with auto-direction sensing</td>
<td>1.65 - 3.6</td>
<td>2.3 - 5.5</td>
<td>-40 °C to +125 °C</td>
<td>NXS0101GW, NXS0101GW-Q100, NXS0101GM, NXS0101GS</td>
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<tr>
<td>NXS0102</td>
<td>Switch based, 2-bit dual supply translating transceiver with auto-direction sensing</td>
<td>1.2 - 3.6</td>
<td>1.65 - 5.5</td>
<td>-40 °C to +125 °C</td>
<td>NXS0102DC, NXS0102DC-Q100, NXS0102GT, NXS0102UN</td>
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<td>NXS0104</td>
<td>Switch based, 1-bit dual supply translating transceiver with auto-direction sensing</td>
<td>1.65 - 3.6</td>
<td>2.3 - 5.5</td>
<td>-40 °C to +125 °C</td>
<td>NXS0104PW, NXS0104PW-Q100, NXS0104BQ, NXS0104GU12</td>
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<tr>
<td>NXS0106</td>
<td>Switch based, 1-bit dual supply translating transceiver with auto-direction sensing</td>
<td>1.2 - 3.6</td>
<td>1.65 - 5.5</td>
<td>-40 °C to +125 °C</td>
<td>NXS0106PW, NXS0106PW-Q100, NXS0106BQ, NXS0106GU12, NXS0106GU12-Q100</td>
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**Figure 1. Open-drain based NXS Autosense Translation**

**Figure 2. Push-pull based, NXB Autosense Translation**

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**Figure 3. NXS Level Shifter**

**Figure 4. NXB Level Shifter**

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**Figure 5. NXS Level Shifter**

**Figure 6. NXB Level Shifter**

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**Figure 7. NXS Level Shifter**

**Figure 8. NXB Level Shifter**

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**Figure 9. NXS Level Shifter**

**Figure 10. NXB Level Shifter**
<table>
<thead>
<tr>
<th>SOT</th>
<th>Package Suffix</th>
<th>Package Name</th>
<th>No of terminals</th>
<th>Package dimensions L x W x H (mm)</th>
<th>Lead pitch (mm)</th>
<th>Package</th>
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<tbody>
<tr>
<td>SOT1202</td>
<td>GS</td>
<td>XSON</td>
<td>6</td>
<td>1 x 1 x 0.35</td>
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<td>SOT886</td>
<td>GM</td>
<td>XSON</td>
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<td>1.45 x 1 x 0.5</td>
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<td>SOT363-2</td>
<td>GW</td>
<td>TSSOP</td>
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<td>2.1 x 2 x 0.95</td>
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<td>SOT8023-1</td>
<td>UN</td>
<td>WLCSP</td>
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<td>1.55 x 0.75 x 0.6</td>
<td>0.4</td>
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<tr>
<td>SOT833-1</td>
<td>GT</td>
<td>XSON</td>
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<td>1.95 x 1 x 0.5</td>
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<tr>
<td>SOT765-1</td>
<td>DC</td>
<td>VSSOP</td>
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<td>2 x 3.1 x 1</td>
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<td>SOT1174-1</td>
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<td>XQFN</td>
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<td>DHVQFN</td>
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<td>0.5</td>
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<td>PW</td>
<td>TSSOP</td>
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<td>5 x 6.4 x 1.1</td>
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<td>DHVQFN</td>
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<td>3.5 x 2.5 x 1.0</td>
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<td>DHVQFN</td>
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<td>SOT360-1</td>
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<td>TSSOP</td>
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<td>6.5 x 6.4 x 1.1</td>
<td>0.65</td>
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