



Design Examples of Module-to-Module Dual Supply Voltage Logic Translators

Prepared by: Jim Lepkowski
ON Semiconductor

Introduction

Dual supply voltage logic translators connect modules or PCBs together that operate at different supply voltages. Figure 1 lists some popular applications that use uni-directional, autosense and conventional bi-directional with control pin translators. Design examples that often require logic translation include:

- SIM Cards
- SDIO Cards
- Display Modules
- HDMI
- 1-Wire™ Sensor Bus

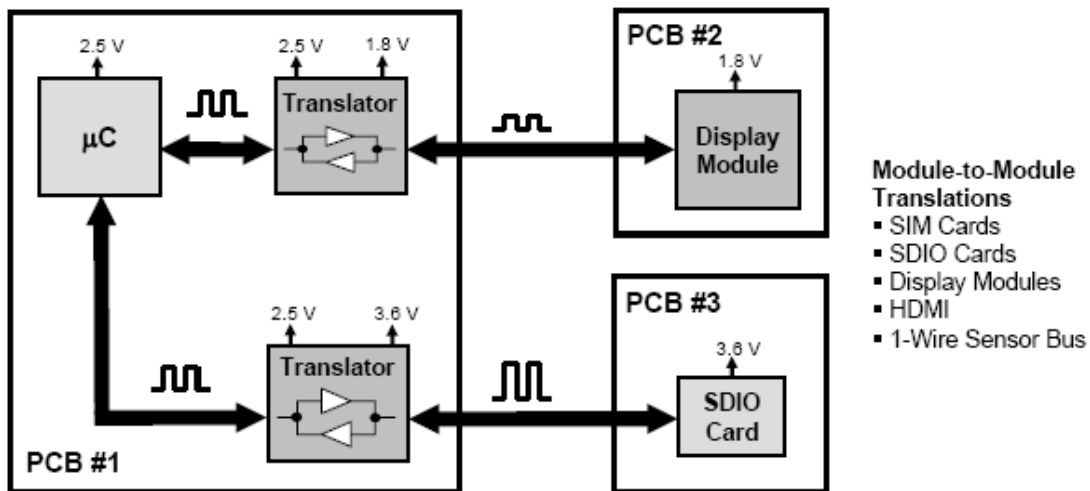


Figure 1. Dual Power Supply Translators can be used to Interface ICs Located on Different Modules or PCBs

SIM Cards

Subscriber Identity Module (SIM) cards are a popular application that often use voltage translators, as shown in Figure 2. SIM cards are popular in cell phones and other portable devices that store subscriber information. Voltage

translators are typically used to interface a baseband processor that operates at a fixed voltage to multiple generations of SIM cards that use a different supply voltage.

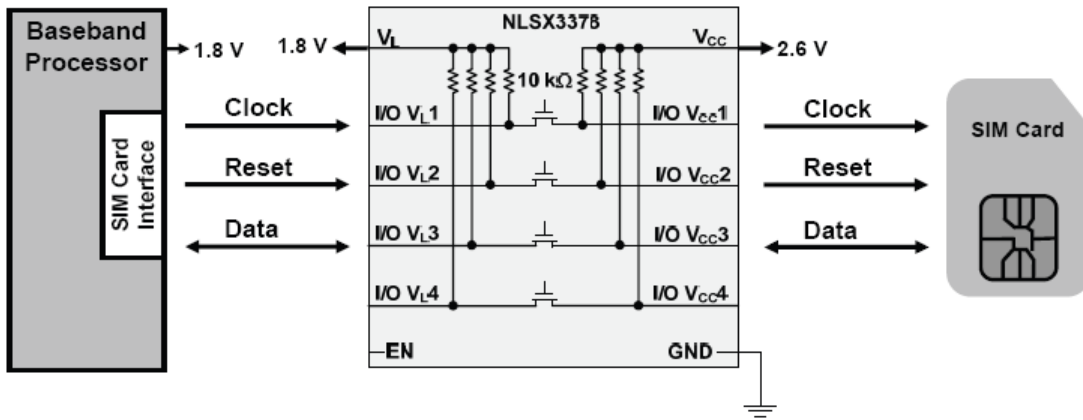


Figure 2. Open-drain autosense translators can be used to connect a SIM card to a processor.

SDIO Cards

Secure Data Input / Output (SDIO) cards are incorporated in many portable products such as cell phones. The memory cards are accessed in ‘blocks’ and the data is streamed to a buffer in the μ C. The supply voltages of μ Cs are dropping in order to incorporate more features. However, the supply voltage of memory cards is typically fixed at a higher

voltage. Data translators are needed because memory card specifications require the system to be ‘backward’ compatible with older cards that often use a higher operating voltage. Figure 3 provides a translation circuit for SDIO cards.

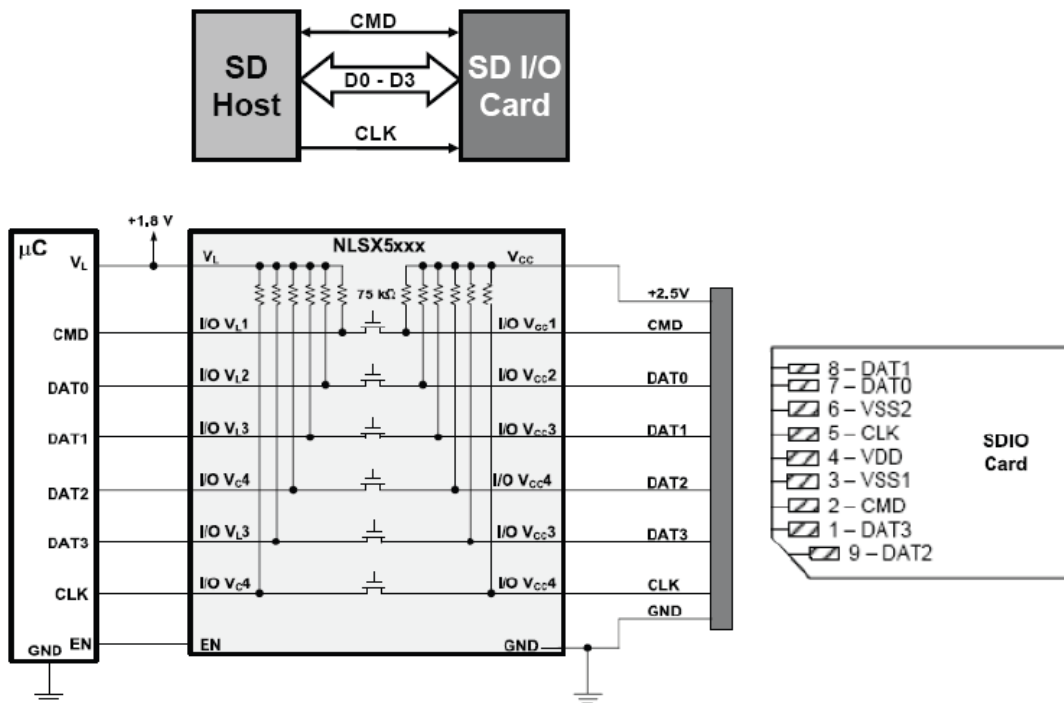


Figure 3. Open-drain auto sensing translators minimize the required μ C I/O pins in SDIO cards, which is a major advantage in pin-limited portable applications

Display Modules

Open-drain translators can be used to interface two modules with different operating voltages. In addition, translators can be used to lower the emissions in EMI sensitive applications such as LCD panels. RF emissions are

proportional to the amplitude of the signals, and translators can lower the amplitude of the transmitted signals. Figure 4 provides an example of a display module that incorporates translators to lower the voltage level of the signals transmitted across the cable.

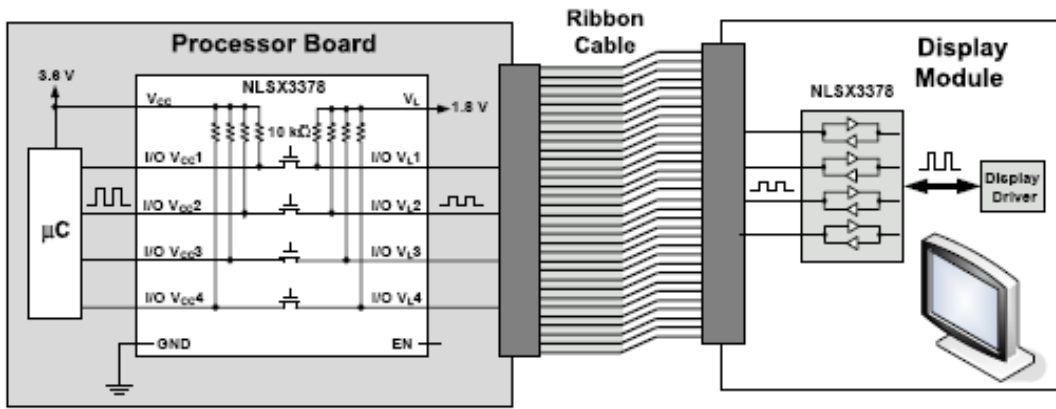


Figure 4. Open-drain autosense translators with integrated pull-up resistors translators set the I/O pins at logic '1' if the cable becomes disconnected

HDMI

The High-Definition Multimedia Interface (HDMI) is a popular communication protocol used to transmit digital audio and video signals in set top boxes, HD televisions, home theaters, audio systems and display monitors. Logic

translators can be used to shift the voltages of the four signal line Display Data Channel (DDC), as shown in Figure 5. In addition, several display interfaces exist that are similar to HDMI, including the Digital Visual Interface (DVI), Unified Display Interface (UDI) and DisplayPort protocols.

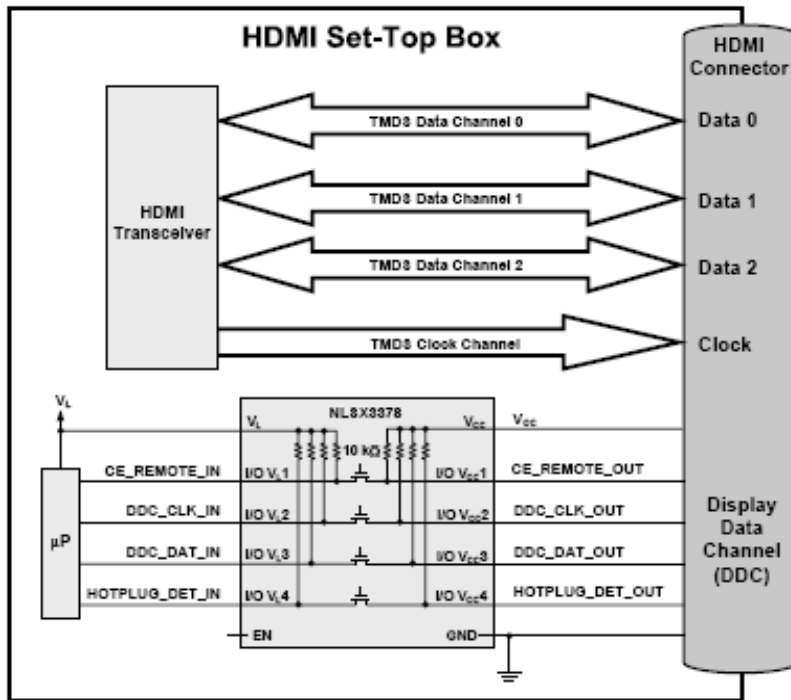


Figure 5. The DDC channel uses the I²C™ protocol to communicate information such as the graphics modes that a monitor can support

1-Wire Sensor Bus

The 1-Wire sensor bus [1] provides asynchronous communication between a master and one or more slave devices by using timed pulse widths to represent either logic 1 or 0. A feature of the 1-Wire bus is that a single wire can be used to provide both data and power. The 1-Wire bus is an emerging communication standard that is popular with sensors and battery monitors.

Figure 6 provides a design example of the 1-Wire bus. The microcontroller and sensor 1 are powered by supply voltage VL, while sensor 2 is powered to VCC. Sensor 2 receives its power by charging a capacitor on the DATA_C line to a value of VCC during the idle time between data transfers.

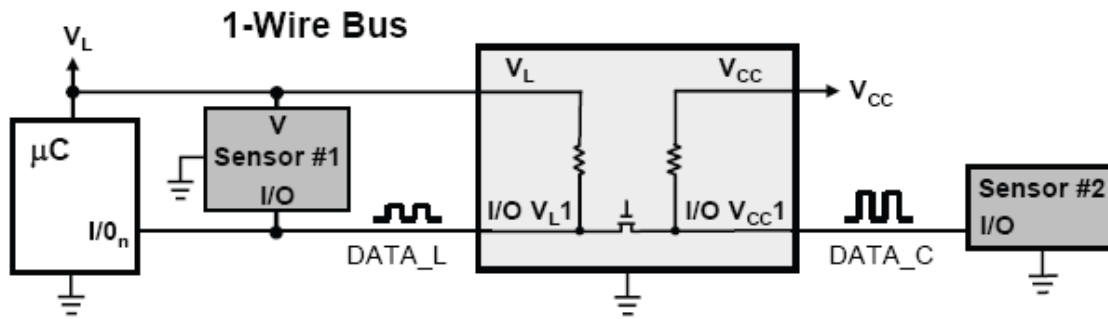


Figure 6. An open-drain translator can be used to connect sensors with two different operating voltages to a microcontroller via the 1-Wire bus

Bibliography

1. “Application Note 1796: Overview of 1-Wire Technology and Its Use”, Maxim Semiconductor, 2003.

Appendix I: ON Dual Power Supply Autosense Voltage Translator

	Autosense Bi-Directional Translators (Push-Pull Output)	Autosense Bi-Directional Translators (Open-Drain Output)
Block Diagram		
Attributes	High Data Rate Low Power Consumption Flexible PCB Design	High Output Drive Low Power Consumption Flexible PCB Design
Trade-Offs	Modest Output Current	Modest Bandwidth
Applications	SPI UARTs USB Ports GPIO	I ² C, SMBus, PMBus SIM / SDIO Cards Display Modules HDMI 1-Wire Bus GPIO
ON Products (I/O Channels / Package)	NLSX3012 (2-bit, UDFN-8) NLSX3014 (4-bit, UQFN-12) NLSX3013 (8-bit, CSP-20) NLSX3018 (8-bit, UDFN-20) NLSX4014 (4-bit, UQFN-12)	NLSX3373 (2-bit, UDFN-8) NLSX3378 (4-bit, CSP-12)

AND8335/D

Appendix II: ON Dual Power Supply Uni-Directional and Bi-Directional with Directional Pin Voltage Translators

	Uni-Directional Translators	Bi-Directional with Directional Pin Translators
Block Diagram		
Attributes	High Data Rate Low Power Consumption	High Data Rate High Output Drive
Trade-Offs	Fixed Input & Output Pins	All I/O Lines Configured for Either A-to-B or B-to-A Single Direction Translation Control Pin Limits Usability in Pin Sensitive Portable Applications
Applications	SPI USB Ports GPIO	Memory Mapped I/O GPIO
ON Products (I/O Channels / Package)	NLSV1T34 (1-bit, ULLGA-6) NLSV1T240 / 244 (1-bit, UDFN-6) NLSV2T240 / 244 (2-bit, UDFN-8) NLSV4T240 / 244 (4-bit, UQFN-12) NLSV4T3234 (4-bit, CSP-11) NLSV8T240 / 244 (8-bit, UDFN-20)	MC74LVXC4245 (8-bit, SOIC-24, TSSOP-24) MC74LVXC3245 (8-bit, SOIC-24, TSSOP-24)

The I²C bus is a registered trademark of NXP / Philips Semiconductor.

The 1-Wire bus is a registered trademark of Maxim / Dallas Semiconductor.

ON Semiconductor and **ON** are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5773-3850

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative