100 and 200 MHz Selectable-Voltage Digital Waveform Generator/Analyzers

NI PXIe-6544, NI PXIe-6545 *NEW!*

- 100/200 MHz maximum clock rate
- Data streaming at 660 MB/s input and 400 MB/s output
- 32 channels with per-channel direction control
- Selectable voltages of 1.2, 1.5, 1.8, 2.5, and 3.3 V
- x4 PXI Express interface
- Onboard DDS clock with subhertz resolution
- 1, 8, and 64 Mb/channel

Operating Systems

- Windows Vista/XP/2000
- LabVIEW Real-Time

Recommended Software

- LabVIEW
- LabWindows™/CVI
- LabVIEW SignalExpress

Driver and Editing Software

- NI-HSDIO driver
- Script Editor
- Digital Waveform Editor (included with 8 and 64 Mb/channel models)

Overview

NI PXIe-6544/45 modules are PXI Express-based 32-channel digital instruments capable of clock rates up to 200 MHz. You can programmatically select voltages of 1.2, 1.5, 1.8, 2.5, or 3.3 V. You also can configure each channel for input or output independently. Streaming rates at 660 MB/s to the PC and 400 MB/s from the PC make the NI PXIe-6544/45 modules two of the fastest streaming digital products in the industry. They feature an onboard direct digital synthesis (DDS) clock that you can use to clock your digital data from 0 to 200 MHz with subhertz resolution.

High Signal Quality

NI PXIe-6544/45 modules feature an improved architecture that offers not only higher clock rates up to 200 MHz but also superior signal integrity and impedance matching. You can use the NI PXIe-6544 and PXIe-6545 to interface to high-speed digital chips requiring small setup and hold times. At the maximum clock rates of the NI PXIe-6544/45 modules, the signal quality becomes an important feature.

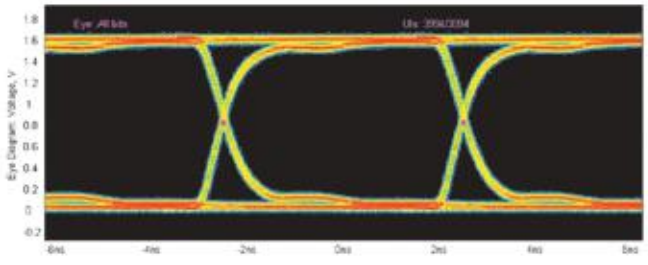

Figure 1. This eye diagram of an NI PXIe-6545 at 200 Mb/s illustrates a setup including a shielded SHC68-C68-D4 cable with an SMB-2163 terminal block. The oscilloscope being used to acquire the signal is set to 50 Ω input impedance.

High Data-Streaming Rates

With the x4 PXI Express architecture, you can stream at typical rates of 660 MB/s (input) and 400 MB/s (output) to and from a host (PC) or a high-speed storage solution such as the NI HDD-8264 3 TB (RAID) array to onboard memory. You can use these devices to stream high-definition digital video signals for generation or acquisition. You also can test LCD screens, television components, high-definition signals (up to 1080p at 60 Hz), RF baseband devices, and high-definition audio with the NI PXIe-6544/45 modules.

With this technology, you can generate terabyte waveforms of unique, high-bandwidth data for several hours. Applications that benefit from this capability include RF and baseband recording and playback for signal intelligence and communications system design, validation, and verification.

Advanced Timing Capabilities

NI PXIe-6544/45 modules also feature enhanced timing and synchronization capabilities. The onboard direct digital synthesis (DDS) clock provides subhertz resolution ranging up to 200 MHz, so you can clock data (generation or acquisition) with higher precision without having to use an external clock. Also, you can now test applications requiring arbitrary clock frequencies with these modules. You can share clocks across the PXI backplane or through an SMA connector on the front panel of the device. You also can clock your data by importing an external clock through the front panel or backplane. With these features, you can synchronize NI PXIe-6544/45 modules with other analog or digital instruments.

These modules are built on the Synchronization and Memory Core (SMC), so you can synchronize multiple SMC-based devices (analog or digital) using the NI-TCLK API. You can achieve subnanosecond resolution while synchronizing multiple devices and create highly synchronized high-channel-count systems in a PXI Express chassis.

NATIONAL INSTRUMENTS™

Advanced Features

- Adjust data position (acquisition or generation) to precise locations using the data delay capabilities, which allow you to adjust your data with respect to the edge of the clock with a resolution of better than 150 ps for all internally generated frequencies.
- Link and loop multiple waveforms without any software lag using the scripting features of NI-HSDIO. You can use this feature to write waveforms to the deep onboard memory and then control these waveforms with instructions written in the Script Editor.
- Achieve advanced linking, looping, and data streaming with the 128 Mb per channel (acquisition or generation) and scripting feature of the NI PXIe-6544/45 modules.

Supporting Software

With the NI Digital Waveform Editor, an interactive software tool for creating and editing digital waveforms, you can import test patterns from popular spreadsheet and VHDL simulation packages in ASCII or value change dump (VCD) formats. Once you have imported them, you can view the waveforms graphically and edit them interactively for new devices or new test conditions. You also can build new waveforms with built-in fill patterns such as pseudorandom bit sequences (PRBS) and count up/down patterns. When you are ready to test your device, you can seamlessly import the waveforms into LabVIEW, LabVIEW SignalExpress, and ANSI C. The Digital Waveform Editor is included with the 8 and 64 Mb per channel memory models and is a separate add-on for use with the 1 Mb per channel model.

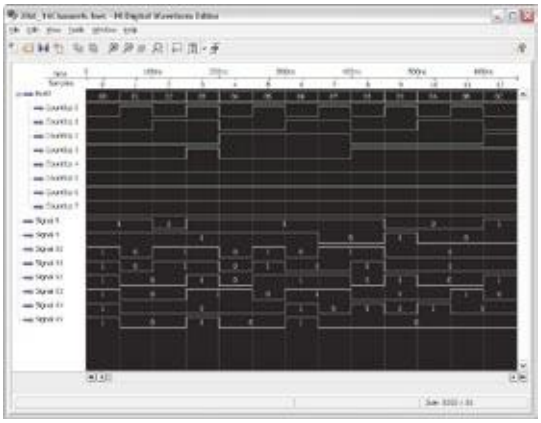

Figure 2. Create and edit digital waveforms using the NI Digital Waveform Editor.

With the NI-HSDIO driver, you can use NI PXIe-6544/45 modules with graphical programming languages such as LabVIEW or text-based languages such as LabWindows/CVI or ANSI C.

You can even use these modules in a nonprogramming environment such as LabVIEW SignalExpress. With the intuitive LabVIEW SignalExpress environment, you can generate, acquire, and perform advanced capabilities such as hardware comparisons. You also can use LabVIEW SignalExpress for digital processing functions.

Connectivity

To meet connectivity requirements for high-speed digital applications, you can use NI PXIe-6544/45 modules with a variety of accessories like the following:

- NI CB-2162 connector block
- Shielded 50 Ω flying-lead cable
- VHDCI high-density connector

Tight Synchronization Capabilities

The PXI Express backplane offers a built-in common reference clock for synchronization of multiple digital instruments in a system. You can synchronize multiple analog and digital modules on a picosecond level using the PXI platform. Figure 3 shows how you can synchronize multiple analog and digital instruments using the trigger and clock routes on the PXI backplane.

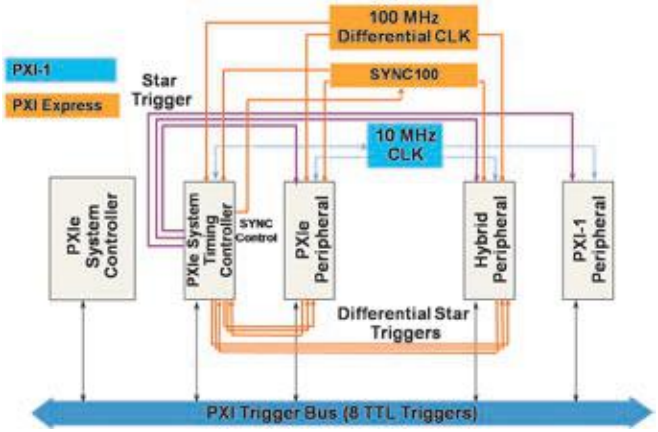

Figure 3. You can use the backplane of a PXI chassis to route triggers and clocks for channel expansion or mixed-signal synchronization.

Applications

With these features, you can perform tests on semiconductor devices such as analog-to-digital converters (ADCs), digital-to-analog converters (DACs), ASICs, and microcontrollers. For example, with a 16-bit, parallel interface, 200 MS/s dual-channel DAC, you can use the NI PXIe-6545 to generate data on 32 lines (continuously or in bursts) to test the DAC at its maximum clock rate. With the selectable voltages, you can test digital devices, which need logic levels that traditional instruments cannot provide. You can also pair the NI PXIe-6545 with other NI modular instruments such as digitizers or source measure units (SMUs) to characterize the DAC for various tests including spurious-free dynamic range (SFDR), signal-to-noise ratio (SNR), intermodulation distortion (IMD), integral

nonlinearity (INL), and differential nonlinearity (DNL) tests at higher rates. Figure 4 shows the front panel of a dynamic characteristics test implemented in LabVIEW.

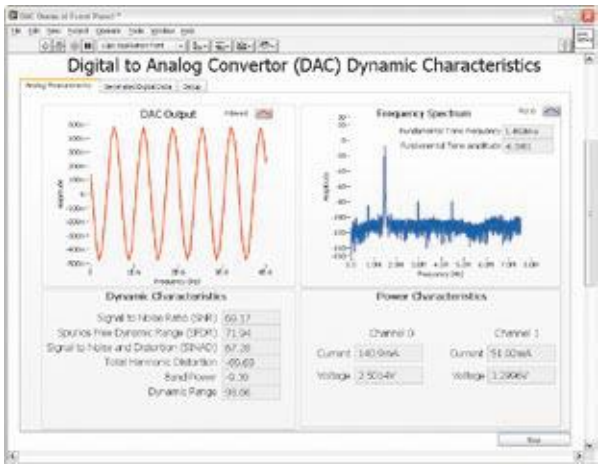

Figure 4. SFDR of a 200 MS/s DAC Using the NI PXIe-6545

Easy Integration with Other PXI-Based Instruments

Test systems typically contain many instrument types, including signal sources, measurement devices, and switches. The PXI platform has unparalleled breadth, with modules for analog and digital I/O, high-speed instrumentation, vision, motion, and numerous bus interfaces.

More than 1,500 PXI modules are available from the more than 70 members of the PXI Systems Alliance (PXISA). So you can build a comprehensive test system in a single chassis as well as synchronize modules in that chassis to picosecond-level accuracy when using NI modular instrumentation.

You can use an NI PXIe-6544/45 module with other instruments such as digitizers, power supplies, and switches to create a flexible and powerful mixed-signal test system.

Ordering Information

NI PXIe-6544 ..... 780992-0X

NI PXIe-6545 ..... 780993-0X

NI Digital Waveform Editor[1] 778724-03

Memory options are 1, 8, and 64 Mb/ch for all modules.

[1] Included with 8 and 64 Mb/ch models.

Cables

SHC68-C68-D4 shielded single-ended cable 196275-01

C68-C68-D4 (unshielded 1 m cable) 195949-01

SHC68-H1X38 (flying-lead 1.5 m cable) 192681-1R5

Terminal Blocks

CB-2162 (terminal block with pin headers) 778592-01

SMB-2163 (SMB breakout box) 778747-01

Header Jumper Kit 199101-01

Connectors

Dual-stacked VHDCI connector, 68-pin, right-angle 780390-01

VHDCI connector, 68-pin, vertical 780389-01

VHDCI connector, 68-pin, right-angle 778914-01

BUY NOW

For complete product specifications, pricing, and accessory information, call 800 813 3693 (U.S.) or go to **ni.com/hsdio**.

Specifications

» For complete specifications, see the *NI PXIe-6544/45 Specifications* manual at **ni.com/manuals**.

Channel Specifications

Number of data channels..... 32 single data rate (SDR) channels
Direction control of data channels..... Per channel, per operation
Number of programmable function interface (PFI) channels..... 4
Direction control of PFI channels..... Per channel
Number of clock terminals..... 2 input; 2 output

Generation Channels (Data, DDC CLK OUT, and PFI <0..3>)

Generation signal type..... Single-ended
Generation voltage range..... 1.2 to 3.3 V
DC generation voltage accuracy
- Characteristic..... ±35 mV
- Maximum..... ±200 mV

Generation logic families..... 1.2, 1.5, 1.8, 2.5, and 3.3 V

Note: Generation and acquisition sessions share a common voltage resource. Simultaneous operations must be set to the same logic family.

Generation Voltage Levels	Voltage Low Levels		Voltage High Levels	
	Nominal (V)	Maximum (V)	Minimum (V)	Nominal (V)
1.2 V logic family (V_{OH} = 1.2 V)	0.0	0.2	1	1.2
1.5 V logic family (V_{OH} = 1.5 V)	0.0	0.2	1.3	1.5
1.8 V logic family (V_{OH} = 1.8 V)	0.0	0.2	1.6	1.8
2.5 V logic family (V_{OH} = 2.5 V)	0.0	0.2	2.3	2.5
3.3 V logic family (V_{OH} = 3.3 V)	0.0	0.2	3.1	3.3

Output impedance..... 50 Ω
Maximum allowed DC drive strength... ±12 mA at 1.2 V
±15 mA at 1.5 V
±18 mA at 1.8 V
±25 mA at 2.5 V
±33 mA at 3.3 V
Data channel driver enable/disable control..... Per channel (software selectable)
Channel power-on state..... Drivers disabled, 50 kΩ nominal input impedance
Output protection..... The device can indefinitely sustain a short to any voltage between 0 and 5 V.

Acquisition Channels (Data, STROBE, and PFI <0..3>)

Acquisition signal type..... Single-ended
Acquisition voltage threshold range..... 0.6 to 1.65 V
Acquisition voltage threshold resolution..... 50 mV
DC acquisition voltage threshold accuracy
- Typical..... ±150 mV
- Maximum..... ±30%

Acquisition logic families..... 1.2, 1.5, 1.8, 2.5, and 3.3 V

Acquisition Voltage Thresholds	Voltage Thresholds Low		Voltage Thresholds High	
	Min	Typical	Typical	Max
1.2 V logic family (V_{IH}, V_{IL} = 0.60 V)	420 mV	450 mV	750 mV	780 mV
1.5 V logic family (V_{IH}, V_{IL} = 0.75 V)	525 mV	600 mV	900 mV	975 mV
1.8 V logic family (V_{IH}, V_{IL} = 0.90 V)	630 mV	750 mV	1.05 V	1.17 V
2.5 V logic family (V_{IH}, V_{IL} = 1.25 V)	875 mV	1.10 V	1.40 V	1.625 V
3.3 V logic family (V_{IH}, V_{IL} = 1.65 V)	1.155 V	1.50 V	1.80 V	2.145 V

Input impedance..... High-impedance (50 kΩ)
Input protection..... -1 to 5 V

Timing Specifications

Sample Clock

Sample clock sources
- Onboard clock..... Internal 800 MHz VCO with 16-bit DDS
- CLK IN..... SMA jack connector
- STROBE..... Digital Data & Control (DDC) connector acquisition only

Onboard clock frequency range
- NI 6544..... 100 Hz to 100 MHz
- NI 6545..... 100 Hz to 200 MHz

Onboard clock frequency resolution..... 0.2 Hz maximum
Onboard clock frequency accuracy..... ±150 ppm + 5 ppm per year
CLK IN frequency range
- NI 6544..... 20 kHz to 100 MHz
- NI 6545..... 20 kHz to 200 MHz

STROBE frequency range
- NI 6544..... 100 Hz to 100 MHz
- NI 6545..... 100 Hz to 200 MHz

Sample clock relative delay adjustment range
- Acquisition sessions..... 0.0 to 1.0 sample clock period
- Generation sessions..... 0.0 to 5.0 ns

Sample clock relative delay adjustment resolution	0.5 ps
Exported sample clock destinations	
DDC connector	DDC CLK OUT
SMA jack connector	CLK OUT
Exported sample clock delay range	0.0 to 1.0 sample clock periods
Exported sample clock delay resolution (δ_c)	117 to 143 ps nominal
Exported sample clock delay frequency	
Onboard clock	All frequencies
External clock	Frequencies ≥20 MHz
Exported sample clock jitter	
Period jitter	24 ps_{rms}
Cycle-to-cycle jitter	43 ps_{rms}

Safety and Compliance

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note: For UL and other safety certifications, refer to the product label or visit **ni.com/certification**, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

Note: For EMC compliance, operate this device according to product documentation.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Note: Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit **ni.com/certification**, search by model number or product line, and click the appropriate link in the Certification column.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers: At the end of their life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit **ni.com/environment/weee.htm**.