UniDAQ4.DSP-AD

Board Revision 1.0       Document Revision 1.0       10/20

Key Features

- 8 simultaneous sampling analog input channels, 24-bit resolution
- Sampling rate programmable 0.5 to 256 kS/s
- Synchronization via dedicated SYNC signals or IEEE1588 Precision Time Protocol
- ±1.2V and ±12V Voltage Input Ranges, DC and AC (1Hz and 150Hz) coupling, single-ended and differential input configurations. Integrated 250Ω precision shunts for current measurements to acquire data from temperature and pressure sensors with a 4/20mA interface
- 4mA IEPE constant current and 24V sensor excitation supply
- Analog inputs are isolated from power supply and digital circuits
- 4 TTL inputs (trigger, tacho, position sensors and rotary encoders)
- 2 TTL outputs (trigger and PWM)
- 456 MHz TMS320C6746 DSP with 32 Mbytes DRAM
- 100-Base-T Ethernet and USB2.0 Ports
- Expansion port with GPIO, SPI, and SD/MMC/SDIO Interface, supports
  - SD-card or eMMC mass storage for data logging
  - Wireless Communication Modules via SDIO or SPI
  - Digital-I/O expansion, isolation and interface conversion
  - Industrial Network Controller
  - Micro-Controller for user interface
- 9 to 36V single-supply
  Multiple power saving modes for battery-powered portable applications
- Compact Euro-Card size
- Memory-resident utility programs for field maintenance and software updates
**Supported Sensors**

- Voltage Source, differential and single-ended
- Current Transducer
- IEPE Acceleration Sensors, Microphones and Hydrophones
- 4-20mA and 0-20mA Current Loops, 2-, 3- and 4-wire configuration

**Applications**

- General Vibration Analysis
- Machine Condition Monitoring
- Grid Monitoring for Renewable Energy Systems
- Underwater Structural Inspection
- Stand-alone Data Logger
- Mobile Vehicle Vibration and Acoustic Measurements

**Description**

UniDAQ4 is a full-featured OEM data acquisition board for high-precision dynamic analog measurements. The user only needs to provide a power supply and a customized connector front panel to complete the system.

The analog circuits are isolated from digital circuits and power supply. Combined with over-voltage protection, this facilitates system integration and guarantees excellent performance and reliability even in harsh environments.

USB and Ethernet ports provide the interface to a production environment and a link to visualization and simulation tools.

The expansion interface supports an SD-Card mass storage device for data logging, WiFi interface, a micro-controller running a human machine interface, Industrial Fieldbus connectivity, and additional Digital-I/O Ports.

The Texas Instruments TMS320C6746 floating-point processor provides a rich set of real-time signal processing capabilities for data pre-processing, filtering, and analysis.

**Input Characteristics**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Channels</td>
<td>8, voltage or current</td>
</tr>
<tr>
<td>ADC Architecture</td>
<td>24-bit Delta-Sigma, wideband brickwall or low-latency Sinc5 filter</td>
</tr>
<tr>
<td>Sampling rate</td>
<td>0.5 - 256 kS/s programmable, resolution 0.026ppb</td>
</tr>
<tr>
<td>Timebase</td>
<td>internal ±50ppm, external synchronization via dedicated SYNC signals</td>
</tr>
<tr>
<td></td>
<td>or IEEE 1588 PTP-synchronized</td>
</tr>
<tr>
<td>Sampling Mode</td>
<td>simultaneous sampling</td>
</tr>
<tr>
<td>Sampling Delay</td>
<td>34 / f_{samp} + 8µs (wideband filter), 3 / f_{samp} + 8µs (Sinc5 filter),</td>
</tr>
<tr>
<td>Input Range</td>
<td>voltage: ±1.2 V_{pk} and ±12 V_{pk}, programmable</td>
</tr>
<tr>
<td></td>
<td>current: ±4.8 mA_{pk} and ±32 mA_{pk} (limited to 32mA by 0.25W shunt</td>
</tr>
<tr>
<td></td>
<td>resistor dissipation</td>
</tr>
<tr>
<td>Input Coupling</td>
<td>DC, AC 1Hz, AC 150Hz, GND, single-ended or differential, programmable</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>1.8 MΩ</td>
</tr>
<tr>
<td>Current Shunt Resistor</td>
<td>250Ω, 0.01%, externally connect to IN+ for current measurements</td>
</tr>
<tr>
<td>Overvoltage Protection</td>
<td>±42 V_{pk}, Input current during over-voltage conditions max 500µA</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>-3dB: DC / 1Hz / 150Hz to 0.433 * sampling frequency (wideband filter)</td>
</tr>
<tr>
<td></td>
<td>-0.1dB: DC / 7Hz / 1.2kHz to 0.409 * sampling frequency (wideband filter)</td>
</tr>
</tbody>
</table>
Phase Mismatch: max. between channels: 1° at 35 kHz, 0.1° at 5 kHz with AC 1Hz coupling 1° at 7Hz, 0.1° at 70Hz

Alias Rejection: > 105dB

Common Mode Range: differential: max. ±7.5V (between IN+, IN- and GND)
: single-ended: max. ±0.5V (between IN- and GND)

CMRR: 1kHz : 67dB (12V range), 86dB (1.2V range)
10kHz: 67dB (12V range), 84dB (1.2V range)

Input Leakage: ±50nA max.

Zero Error: < ± 500 µV (0 to +50°C ambient temperature)

Gain Error: < ± 0.05% of fullscale (0 to +50°C ambient temperature)

Crosstalk: -130dB (10 kHz -1dBFS signal applied to neighbor channel, channel under test terminated with 50Ω)

IEPE supply: 4mA ±5%, 22V compliance, cable fault detection

EXC sensor supply: 24V ±5%, max. 50mA per channel, 200mA total

Dynamic Characteristics

All measurements made with wideband brickwall digital filter, ADC in median power mode except 204.8 kS/s in highspeed mode.

<table>
<thead>
<tr>
<th></th>
<th>204.8 kS/s</th>
<th>102.4 kS/s</th>
<th>51.2 kS/s</th>
<th>25.6 kS/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise Floor 12V range</td>
<td>-110 dBFS</td>
<td>-110 dBFS</td>
<td>-113 dBFS</td>
<td>-116 dBFS</td>
</tr>
<tr>
<td></td>
<td>40 µV</td>
<td>40 µV</td>
<td>27 µV</td>
<td>19 µV</td>
</tr>
<tr>
<td>Noise Floor 1.2V range</td>
<td>-109 dBFS</td>
<td>-109 dBFS</td>
<td>-112 dBFS</td>
<td>-115 dBFS</td>
</tr>
<tr>
<td></td>
<td>4.3 µV</td>
<td>4.3 µV</td>
<td>3.0 µV</td>
<td>2.1 µV</td>
</tr>
<tr>
<td>SNR 12V range</td>
<td>107 dB</td>
<td>107 dB</td>
<td>110 dB</td>
<td>113 dB</td>
</tr>
<tr>
<td>SNR 1.2V range</td>
<td>106 dB</td>
<td>106 dB</td>
<td>109 dB</td>
<td>112 dB</td>
</tr>
<tr>
<td>SNR 12V range, IEPE supply</td>
<td>106 dB</td>
<td>106 dB</td>
<td>109 dB</td>
<td>112 dB</td>
</tr>
<tr>
<td>THD 12V range, differential</td>
<td>1 kHz: -119 dB</td>
<td>1 kHz: -112 db</td>
<td>1 kHz: -115 db</td>
<td>1 kHz: -118 db</td>
</tr>
<tr>
<td></td>
<td>10 kHz: -111 db</td>
<td>10 kHz: -111 db</td>
<td>10 kHz: -110 db</td>
<td>10 kHz: -110 db</td>
</tr>
<tr>
<td>THD 12V range, single-ended</td>
<td>1 kHz: -112 dB</td>
<td>1 kHz: -112 db</td>
<td>1 kHz: -115 db</td>
<td>1 kHz: -115 db</td>
</tr>
<tr>
<td></td>
<td>10 kHz: -95 db</td>
<td>10 kHz: -95 db</td>
<td>10 kHz: -103 db</td>
<td>10 kHz: -103 db</td>
</tr>
<tr>
<td>THD 1.2V range, differential</td>
<td>1 kHz: -115 dB</td>
<td>1 kHz: -115 db</td>
<td>1 kHz: -115 db</td>
<td>1 kHz: -115 db</td>
</tr>
<tr>
<td></td>
<td>10 kHz: 102 dB</td>
<td>10 kHz: 102 db</td>
<td>10 kHz: 103 db</td>
<td>10 kHz: 103 db</td>
</tr>
<tr>
<td>THD 1.2V range, single-ended</td>
<td>1 kHz: -108 dB</td>
<td>1 kHz: -108 db</td>
<td>1 kHz: -108 db</td>
<td>1 kHz: -108 db</td>
</tr>
<tr>
<td></td>
<td>10 kHz: -98 db</td>
<td>10 kHz: -98 db</td>
<td>10 kHz: -99 db</td>
<td>10 kHz: -99 db</td>
</tr>
<tr>
<td>SFRD 12V range</td>
<td>138 dB</td>
<td>140 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFRD 1.2V range</td>
<td>137 dB</td>
<td>140 dB</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Input terminated with 50 Ω
2 Measured with 1kHz -60dBFS input signal, SNR = 20*log (RMS Fullscale Sinewave Input / RMS Noise)
3 Measured with IEPE sensor equivalent input termination (DC: 3 kΩ, AC 100Ω)
4 Input Signal = -1dBFS (21.4Vpp in 12V range, 2.14 Vpp in 1.2V range)
5 Input Signal = 1kHz sine wave, -1dBFS, measured with 65536 pt. FFT, excluding signal harmonics
Figure 1: 12V range, differential input, 1kHz -1dBFS
Figure 2: 12V range, differential input, 10kHz -1dBFS
Figure 3: 12V range, differential input, idle channel noise
Figure 4: 12V range, differential input, 1kHz -60dBFS
Figure 5: 1.2V range, differential input, 1kHz -1dBFS
Figure 6: 1.2V range, differential input, 10kHz -1dBFS
Digital I/O
Connector: D-Sub 9pin female
Inputs:
- 4, 3.3V and 5V TTL/CMOS compatible, max. input frequency 5 MHz
- Overvoltage Protection: -0.5 to +6.5V
Input Impedance: 10 kΩ
Usage:
- Pre- or post trigger event to DSP, Capture inputs (frequency, pulse width, duty cycle), Quadrature input (rotation angle and speed), GPIO
Outputs:
- 2, 3.3V LVTTL, 5V TTL/CMOS compatible
Output Impedance: 50 Ω
Usage:
- Trigger event from DSP, PWM, GPIO
Power Supply Output: +5V, max. 100mA

Communication Ports
Ethernet: 1 Port, 100 MBit/s, full-duplex, RJ45
USB2.0: 1 Port, 480 MBit/s, Device-Mode, USB-B type

Signal Processing
DSP: Texas Instruments TMS320C6746, 456 MHz
Memory:
- 32 Kbytes L1 Program RAM/Cache
- 32 Kbytes L1 Data RAM/Cache
- 256 Kbytes L2 RAM/Cache
- 32 Mbytes DDR2
- 8 Mbytes non-volatile Flash Memory

Debugging Ports
JTAG: XDS100, 200 and 560 class emulators, 20-pin CTI header
Debug UART: RS232, TxD and RxD, 3pin KK-type connector 2.54mm pitch

Expansion Port
Signals:
- SD/SDIO/MMC (1 and 4-bit mode, up to 52 MHz), alternatively 6 x GPIO
- 3 x dedicated GPIO, 1 x SPI (up to 50 Mbit/s),
- 4 Digital Inputs and 2 Digital Outputs (alternative to D-Sub Digital I/O connector)
- USB OTG port (alternative to B-type USB connector)
- Power Supply 5V max. 500mA and 3.3V max. 100mA

Power Supply
Supply Voltage: 9 to 36V ±10%, reverse-polarity protected
Power Consumption:
- 4.5W typical (IEPE and EXC supply off)
- 6.5W typical (IEPE activated on all channels, EXC supply off)
- 12.5W max. peak power

Mechanics
Size: Eurocard, 160 x 100 x 15 mm

Operating Conditions
Ambient Temperature: 0-50°C
Humidity: max. 95% rel., non condensing
Figure 7: Outline Dimensions

Ordering Information

UniDAQ4.DSP-AD  UniDAQ4 board

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