DT5751

2/4 Input Channel 10 bit 2/1 GS/s Digitizer

Features

- 10 bit 1 GS/s (2 GS/s in DES mode) ADC
- FPGA for real-time data processing:
  - **Pulse Shape Discrimination (DPP-PSD)**
  - **Zero Length Encoding (DPP-ZLEplus)**
- 4 input channels (2 in DES mode), single-ended
- 1 Vpp input range (default); 0.2 Vpp customization **by ordering option**
- 16-bit programmable DC offset adjustment in the full range independently on each channel
- Trigger Time stamps
- Multi-Event Memory buffer: 1.835 MS/ch (3.6 MS/ch in DES mode) or 14.4 MS/ch (28.8 MS/ch in DES mode) divisible into 1 ÷ 1024 buffers
- Programmable event size and pre-post trigger adjustment
- Programmable PLL onboard for clock synchronization with external systems or other DT5751 units
- Optical Link interface (CONET proprietary protocol) Daisy-chainable through **A5818** (PCIe Gen 3) Controller or **A4818** (USB3-to-CONET)
- USB 2.0 communication interface
- Firmware upgradeable via USB/Optical Link
- Fully supported by **CoMPASS** and **WaveDump2** software

Description

The CAEN **Mod. DT5751** is a Waveform Digitizer, in Desktop form factor, housing **4** Input Channel **10** bit **1 GS/s** Flash ADC, designed for waveform recording and supporting advanced algorithms for online digital pulse processing (DPP) making charge integration and pulse shape discrimination (PSD), and data reduction by zero-length encoding (ZLEplus). If the DES mode* (Dual Edge Sampling) is enabled, this device becomes a 2 input channel 10 bit 2 GS/s Waveform Digitizer.

The Digitizer is well suited for fast signals as the ones coming from fast organic, inorganic and liquid scintillators coupled to PMTs or Silicon Photomultipliers, Diamond detectors and others. The acquisition can be channel independent and it is possible to make coincidence/anti-coincidence logic among different channels and external veto/gating. Multiple boards can be synchronized to build up complex systems.

In the case of DPP mode, users can acquire quantitative physical parameters (Time, Integrated Charge, Pulse Shape Discrimination with very fine time resolution) as well as read out waveforms with baseline suppression on channel basis (Zero-Length Encoding) The acquisition in **DPP-PSD** mode is fully controlled by the **CoMPASS** software, which manages the algorithm parameters, builds, plots and saves the relevant energy, time, and PSD spectra. In the case of waveform recording mode, the user can take advantage of the **WaveDump** and **WaveDump2** software to access and save the waveforms. A C-based demo is provided to configure the algorithm parameters, control the data acquisition, saving, and plotting for the **DPP-ZLEPlus** mode.

Libraries and demo software in C, Phyton, and LabView are available for integration and customization of specific acquisition systems.
The communication to and from the board is provided through the **USB** and **Optical Link** interfaces.

(*) *NOTE: DES mode is not available with DPP firmware*

Technical Specifications

GENERAL

- Weight: 675 g
- Form Factor: Desktop
- Dimension: 154x50x164 mm^3 (WxHxD)

ANALOG INPUT

- Number of Inputs: 2/4, single-ended, DC coupled
- Bandwidth (-3dB): 500 MHz
- Impedance: 50 Ω
- Gain: x1, fixed
- Connector Type: MCX
- Full Scale Range: 1 Vpp default; 0.2 Vpp customization by ordering option
- 16-bit programmable DC offset adjustment in the full range independently on each channel
- Abs. Max. Voltage Rating:
  - 3 Vpp @1 Vpp (with Vrail max +3 V or –3 V for any DAC offset value)
  - 2 Vpp @0.2 Vpp (with Vrail max +2 V or –2 V for any DAC offset value)

DIGITAL CONVERSION

- Sampling Rate:
  - 1 GS/s simultaneously on each channel (default)
  - 2 GS/s in DES mode (half channels supported)
  - Down to 250 MS/s by hardware downsampling (**AN6308**)

SYSTEM PERFORMANCES

- ENOB: 9.04 (56 kS Buffer)
- SINAD: 56.19 dB
- THD: 70.2 dB
- SFDR: 79.7 dB
- SIGMA: 0.58 LSB rms (56 kS buffer, open input)

DIGITAL I/O

TRG-IN/GPO/GPI

- General-purpose digital I/Os
- Sigle-ended TTL/NIM
- LEMO 00 male connector
- Software programmable function (trigger, veto, busy, etc.)
- TRG-IN/GPI: Zin = 50 Ω (internally terminated)
- GPO requires Rt = 50 Ω

ACQUISITION MEMORY

- 1.835 MS/ch (1.9 ms @ 1GS/s), that is 3.6 MS/ch in DES mode (1.9 ms @ 2GS/s) or 14.4 MS/ch (15 ms @ 1 GS/s) that is 28.8 MS/ch in DES mode (15 ms @ 2 GS/s) Multi-event Buffer divisible into 1 ÷ 1024 buffers
- Independent read and write access
- Programmable event size and pre/post-trigger

COMMUNICATION INTERFACE

USB

- USB 2.0 compliant
- Transfer Rate: up to 30 MB/s

Optical Link

- CAEN proprietary CONET protocol
- Transfer Rate: up to 80 MB/s
- Daisy Capability: up to 8 ADC modules per single optical link by A5818 Controller or A4818 Adapter

TRIGGER AND EVENT ACQUISITION

Triggered Mode

All the channels fire simultaneously upon a global trigger generated by the Central Logic Unit receiving the trigger source signals.

Streaming Readout Mode

Each channel autonomously identifies the ROI and uses the local trigger to get events independently on the other channels; validation logics can be configured for correlated acquisition (coincidence/anticoincidence).

Trigger Sources

- Software by register writing
- External upon the leading edge of The TRG-IN signal (TTL/NIM)
- Local (self-trigger) upon the channel discriminator with programmable threshold

Trigger Timestamp – Waveform Rec. firmware

- Resolution: 16 ns
- Counter range: 31 bits (default); extendable to 48-bit by firmware
- Full-scale range: ~ 17 s @31-bit

Trigger Timestamp – DPP firmware

DPP-PSD:

- Resolution: 1 ns
- Counter Range: 48 bits
- Full-scale range: ~ 78 h
- Digital CFD: 10-bit, 1 ps fine timestamp

DPP-ZLEplus:

- Resolution: 16 ns
- Counter Range: 31-bit (default); extendable to 48-bit by firmware
- Full-scale range: ~ 17 s @31-bit

SYNCHRONIZATION

Clock Generation

By default, the Digitizer's main clocks are generated upon a 50MHz reference frequency that can optionally be internal (50MHz local Oscillator) or external (CLK-IN). Onboard programmable PLL allows locking to different external frequencies.

Clock Synchronization

Default 50MHz frequency distributed by:

- Fan-in into CLK-IN (**DT4700**)

PLL programming files for supported custom frequencies can be generated and loaded by the CAEN Toolbox software.

Run Synchronization (Acquisition Start/Stop)

Optionally, by Daisy chain or fan-in propagation through single-ended TRG-IN/GPO/GPI connectors (NIM/TTL).

CLK-IN Connector

- Reference clock differential signal
- 2.54mm 3-pin AMPMODU Mod II male connector
- AC-coupled LVDS, ECL, PECL, LVPECL, CML (Zdiff = 100 Ω)

Data Synchronization

Programmable Busy/Veto logic on single-ended NIM/TTL I/O for event building (external hardware required).

Trigger Distribution

Optionally, by Daisy chain or fan-out propagation through single-ended TRG-IN/GPO connectors, NIM/TTL (global trigger).

FPGA

- Altera Cyclone EP3C16
- One FPGA serves 2 channels

CAEN FIRMWARE

DPP Firmware (Shareware)

Pay firmware implementing a digital pulse processing algorithm:

- **DPP-PSD**: Charge Integration and Pulse Shape Discrimination
- **DPP-ZLEplus**: Zero Length Encoding

30-minute per power cycle in Trial mode; license is required for full-time work.

Waveform Recording Firmware (Freeware)

Designed for waveform recording.

Upgrades (Free)

Web available CFA files for Waveform Recording firmware upgrade through the CAEN Toolbox software, via USB or Optical Link.

SOFTWARE

Readout Software for Waveform Rec. Firmware (Freeware)

- **CAEN WaveDump**: Digitizer 1.0 series support, single-board management, user-customizable
- **WaveDump2**: Digitizer 1.0 and 2.0 series support, single and multi-board management, GUI based

Readout Software for DPP Firmware (Freeware)

- **CoMPASS**: Digitizer 1.0 and 2.0 series support, single and multi-board management, GUI based
- **DPP-ZLEplus Readout Demo**: sample code with C source files to dial with the ZLE functionalities and help in user's DAQ development

SDK and Tools (Freeware)

General-purpose libraries (C/Python, LabVIEW) with demo samples for host Windows® and Linux® PC.

ENVIRONMENTAL

- **Environment:** Indoor use
- **Operating Temperature**: 0°C to +40°C
- **Storage Temperature**: -10°C to +60 °C
- **Operating Humidity:** 10% to 90% RH non condensing
- **Storage Humidity:** 5% to 90% RH non condensing
- **Pollution Degree:** 2
- **Overvoltage Category:** II
- **EMC Environment:** Commercial and light industrial
- **IP Degree:** Enclosure (desktop models), not for wet location

REGULATORY COMPLIANCE

- EMC: CE 2014/30/EU Electromagnetic Compatibility Directive
- Safety: CE 2014/35/EU Low Voltage Directive

POWER CONSUMPTIONS

- 1.8 A @ +12 V DC (Typ.)
- AC-DC 12 V / 45 W power unit included

Ordering Options

Code	Description	
WDT5751XAAAA	DT5751 - 2/4 Ch. 10 bit 2/1 GS/s Digitizer: 3.6/1.8MS/ch, EP3C16, SE	RoHS

Accessories

A317

Cable assembly for Clock distribution 3-pin AMPMODU IV female terminations – 18 cm / 25cm

Digitizers Input Range Personalizations

Digitizers Input Range Customizations

A659

Cable assembly BNC male to MCX male – 1 m

A654

Cable assembly LEMO 00 male to MCX male – 1 m

A319B

Clock cable assembly from Digitizer Series 1.0 to Digitizer Series 2.0 - 20cm

DT4700

Clock Generator and FAN-OUT

AI2700

Optical Fiber Series

A318

Adapter for Clock signal FISCHER S101A004 male to 3-pin AMPMODU IV female – 10 cm

Related Software

WaveDump

Readout Application for CAEN Digitizer 1.0

WAVEDUMP2

Open Source Software for Digitizer 2.0 and 1.0 Series

CAEN Toolbox

Multi-Functional Software Suite for the Upgrade of Front-end Boards, Bridges and Power Supplies

COMPASS

Multiparametric DAQ Software for Physics Applications

Related Firmware

DPP-SUP

Super Licence for CAEN Digitizers

DPP-PSD

Digital Pulse Processing for Charge Integration and Pulse Shape Discrimination

D-WAVE

Digitizer Waveform Recording Firmware

DPP-ZLEPLUS

Digital Pulse Processing for the Zero Length Encoding

Related Software Libraries

CAEN FELib Library

High level library for CAEN Digitizers 2.0

CAENDigitizer Library

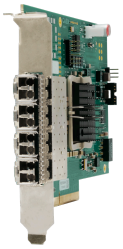
Library of functions for CAEN Digitizers high level management

CAENComm Library

Interface library for CAEN Data Acquistion Modules

Related Products

A5818



CONET2 Controller based on PCI Express Gen 3 interface

A4818

USB 3.0 to CONET2 Adapter

VX1751

4/8 Input Channel 10 bit 2/1 GS/s Digitizer

V1751

4/8 Input Channel 10 bit 2/1 GS/s Digitizer

Gallery


CAEN
Desktop Digitizer
CH0
CH1
CH2
CH3
LINK
CLK IN
GPO
TRG IN
GPI
TTL
NIM
PLL LOCK
PLL BYPS
RUN
TRG
DRDY
BUSY
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