CAEN
Tools for Discovery

DT5743

8 Input Channel 12bit 3.2 GS/s Switched Capacitor Digitizer

Features

- 12-bit @ 3.2 GS/s ADC
- Switched Capacitor technology based on the SAMLONG chip (CEA/IRFU & CNRS/IN2P3/LAL Orsay)
  - 1024 capacitor cells per channel (acquisition window of ~ 320 ns @ 3.2 GS/s)
- 3.2 GS/s , 1.6 GS/s, 800 MS/s, 400 MS/s software selectable sampling frequencies
- 8 input channels, single-ended
- Max. AD conversion dead-time: 125 µs @1024 samples
- 2.5 Vpp input range
- 16-bit programmable DC offset adjustment in the full range independently on each channel
- Trigger Time stamps
- Memory buffer (max.): 7 events/ch @1024 S/event
- Pre-post trigger adjustment
- Max. AD conversion dead-time: 125 µs @1024 samples
- Real time hit counting independent of acquisition rate on each channel
- On-board charge calculation for fast histogramming (user-defined integration window)
- One embedded pulser per channel for test and reflectometry applications
- Programmable PLL onboard for clock synchronization with external systems or other DT5743 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 controlled by the **WaveCatcher** readout software

Description

The CAEN **Mod. DT5743** is a Waveform Digitizer, in Desktop form factor, housing **8** Channel **12** bit **3.2 GS/s** ADC stage based on Switched Capacitor Digitizer arrays. This technology makes it suited for typical applications like precise characterization of high speed detectors (PMTs, SiPMs, APDs,...) and High Resolution Photon timing with MCP-PMTs.

The Switched Capacitor Array is **SAMLONG chip** (designed by LAL Orsay & CEA/IRFU in collaboration with CNRS/IN2P3), implementing a series of **1024** capacitors (analog memory) in which the analog input signal is **continuously sampled** in a circular way. The default sampling frequency is 3.2 GHz, while 1.6 GHz, 800 MHz, and 400 MHz can be software selected.

The input signal is continuously sampled at high frequency in the SAMLONG array of capacitive cells (holding phase) until the trigger arrival. The trigger stops the sampling, the analog memory buffer is frozen, and the cell content is sent to the 12-bit ADC to be digitized at lower frequency. The non-simultaneity between the Sample & Hold phase and the digital conversion generates a dead-time (up to 125 µs @1024 samples).

The acquisition takes place upon different global trigger sources, which can be the external TRG-IN, software , or the logic combination of local channel under-/over-thresholds generated from individual discriminator with programmable threshold.

The DT5743 features an embedded **Charge Mode**, where the pulse integration window is defined by the user (high rates ~3.5 kEvents/s). This feature allows to perform on-line processing on detector signal directly digitized.

The events are stored into the channel digital memory (up to 7 events/ch @1024 samples) to be read out through the **USB** or **Optical Link** interfaces. Multiple boards can be synchronized to build up complex systems.

This Digitizer is fully supported by **WaveCatcher** software, while libraries and demo software in C, Phyton, and LabView are available for integration and customization of specific acquisition systems.

Technical Specifications

GENERAL

- Weight: 680 g
- Form Factor: Desktop
- Dimension: 166 x 69 x 171 mm^3 (WxHxD)

ANALOG INPUT

- Number of Inputs: 8, single-ended, DC coupled
- Bandwidth (-3dB): 500 MHz
- Impedance: 50 Ω
- Connector Type: MCX
- Full Scale Range: 2.5 Vpp
- 16-bit programmable DC offset adjustment in the full range independently on each channel
- Abs. Max. Voltage Rating: 3.5 Vpp (with Vrail max +3.5V or -3.5V) for any DAC offset in single ended configuration

DIGITAL CONVERSION

- Resolution: 12 bits
- Sampling Rate:
  - 3.2 GS/s default
  - 1.6 GS/s, 0.8 GS/s, 0.4 GS/s software selectable
- Switched Capacitor Array: SAMLONG chip, 8 channels with 1024 storage cells each
- Dead-time: max. 125 µs @1204 samples (decreasing with programmable lower record lengths)

TEST FUNCTION

- One pulse generator per channel
- 16-bit programmable pulse pattern
- Fixed amplitude: ~0.7 V with floating input
- Pattern period: 3.5 µs

SYSTEM PERFORMANCES

Sampling Time Precision	Noise Level
• < 20 ps @ 3.2 GS/s (before calibration) • < 5 ps @ 3.2 GS/s (after calibration) Note: obtained with factory calibration and dual-pulse timing measurement with pulse generator. **Test conditions** • Periodic input pulses with 1-V Amplitude • 1-kHz Frequency Rise time of 0.8 / 1.6 / 2.5 ns. The resolution does not change significantly when varying the delay Δt between the two pulses.	0.75 mV RMS

DIGITAL I/O

TRG-IN/GPO/GPI

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

ACQUISITION MEMORY

- 7 full event/ch Multi-event buffer (1024 S/event, that is 320 ns/event @ 3.2 GS/s)
- 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.

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: 5 ns
- Counter range:40 bits
- Full-scale range: ~ 83 min

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
- 1 FPGA serves 4 channels

CAEN FIRMWARE

Waveform Recording Firmware (Freeware)

- Default mode: waveform recording
- Charge mode: charge integration, software selectable

Upgrades (Free)

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

SOFTWARE

Readout Software for Waveform Rec. Firmware (Freeware)

CAEN WaveCatcher: GUI-based application for the 743 Digitizer series, developed in LabWindows/CVI by CNRS/IN2P3/LAL, and capable to fully control single-board and multi-board syncronized systems.

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

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

Ordering Options

Code	Description	
WDT5743XAAAA	DT5743 - 8 Ch. 12 bit 3.2GS/s Switched-Capacitor Digitizer: 7 events/ch (1kS/event), EP3C16, SE	RoHS

Accessories

A659

Cable assembly BNC male to MCX male – 1 m

A654

Cable assembly LEMO 00 male to MCX male – 1 m

A317

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

AI2700

Optical Fiber Series

A318

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

A319B

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

DT4700

Clock Generator and FAN-OUT

Related Software

CAEN Toolbox

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

Related Firmware

D-WAVE

Digitizer Waveform Recording Firmware

Related Software Libraries

CAENDigitizer Library

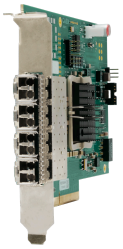
Library of functions for CAEN Digitizers high level management

CAENComm Library

Interface library for CAEN Data Acquistion Modules

Related Products

A5818

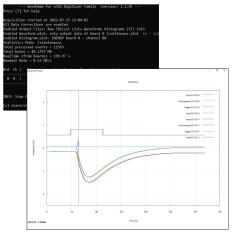


CONET2 Controller based on PCI Express Gen 3 interface

V1743

16 Input Channel 12bit 3.2 GS/s Switched Capacitor Digitizer

WaveDemo x743



CAEN x743 Digitizer Readout Application

VX1743

16 Input Channel 12bit 3.2 GS/s Switched Capacitor Digitizer

WAVECATCHER

Oscilloscope Tool for 743 digitizer family

A4818

USB 3.0 to CONET2 Adapter

Gallery


CAEN
Desktop Digitizer
CH0
CH1
CH2
CH3
CH4
CH5
CH6
CH7
LINK
CLK IN
GPO
TRG IN
GPI
TTL
NIM
PLL LOCK
PLL BYPS
RUN
TRG
DRDY
BUSY
USB

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