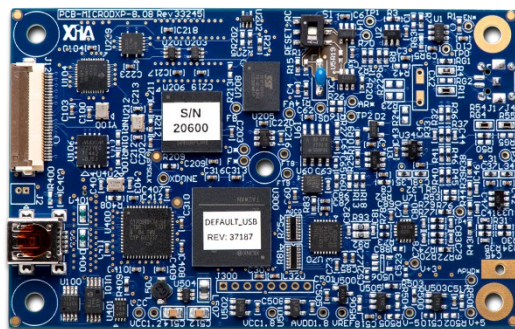# microDGF

Compact Digital Signal Processor for Gamma-ray Spectroscopy

FEATURES

- **Digitization: 14 bits at 40 MSPS or 80 MSPS**
- **Peaking Time range: 0.1 to 24 µs at 40 MSPS**
- **USB 2.0 communications**
- **Customizable user digital I/O**
- **Complete instrument control via XIA's ProSpect software and Handel drivers**

OVERVIEW

The microDGF is a complete, low power digital pulse processor the size of a credit card. This variant of the microDXP is specifically designed for use with high resolution gamma-ray detectors, such as HPGe. It replaces both the spectroscopy amplifier and MCA functions, and as intended for both portable and embedded applications. Digital filtering is implemented in a field programmable gate array (FPGA), and a digital signal processor (DSP) controls the MCA and onboard memory. All operating firmware is stored in non-volatile memory and is factory preloaded, but can also be upgraded in the field. The microDGF differs from the microDXP by providing front-end analog circuitry designed to match the low noise and high dynamic range of HPGe detectors. Most other detector types (x-ray or gamma-ray) can be operated successfully with the microDXP.

SUPPORTED DETECTORS AND PREAMPLIFIERS

Preamplifiers: RC-feedback preamplifiers with up to ± 600 mV pulse height and ± 4.5 V total input range w/o attenuation; larger signal ranges with input attenuation.

Detectors: The microDGF is designed for use with high resolution HPGe detectors. Please refer to the microDXP data sheet for applications with other detector types.

DEVELOPMENT KIT

The microDGF USB 2.0 / RS232 development kit enables rapid design of systems incorporating the microDGF. The kit includes the microCOMU interface circuit board that routes power and communication signals to the microDGF, and is designed for both development and OEM implementation.

APPLICATIONS

- **High Resolution Gamma-ray Spectroscopy:** Compact solution for HPGe portable or special configurations.

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SPECIFICATIONS

ADC

- The microDGF's speed and power consumption are set by the digitizing rate of the 14-bit ADC.
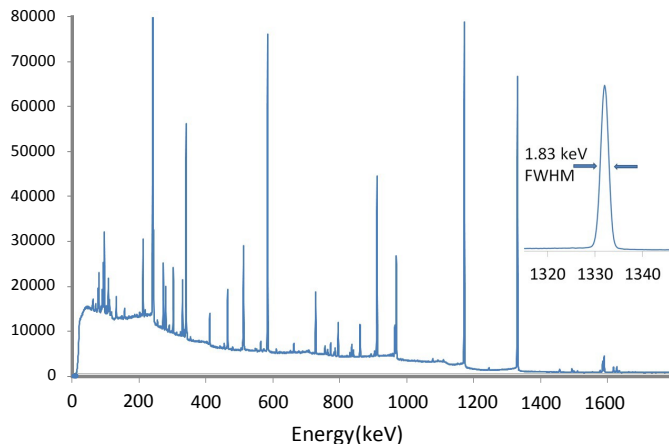- The standard digitizing rate is 40 MSPS, (80 MSPS option)

Spectroscopy Amplifier

- All settings are digitally controlled, including gain, peaking time and other filtering and pile-up inspection parameters.
- **Peaking Time Range:** 100 ns to 24 µs with standard 40 MSPS ADC: 50 ns to 12 µs with 80 MSPS ADC.
- **Gain:** Two analog gain options are available, combined with a digital fine gain adjustment of ± 6dB:
- **Variable Gain (default):** Switched variable gain with a 25.5 dB range to match the detector and preamp type.
- **Fixed Gain (optional):** Factory set using precision resistors to match specific detector and preamplifier type. (Lower power consumption and cost).

MCA

- **Spectrum size:** 8K channels, 24 bits.
- **Statistics:** Input counts detected, output counts to the spectrum, live time and real time.
- **Run Control:** Automatic run termination according to configurable user presets.

Communications

- **Primary:** USB 2.0 operates at 5 MBytes/sec. RS-232 serial port opeates at up to 921 KBaud.
- **Secondary:** Customizable serial and parpallel ports can be used to communicate with embedded hardware.
- **Auxiliary I/O:** Real-time GATE input, I²C, and four general purpose digital I/O lines.

Power

- **Power Consumption:** Depends on clock speed and installed options. Approx 750 mW with 40MSPS and variable gain.
- **Digital:** +3.3V @ 150 mA (300 mA peak).
- **Analog Option 1:** ± 5.0V @ 50 mA clean supply.
- **Analog Option 2:** >± 5.25V @ 50 mA dirty supply to feed on-board linear regulators.

Non-Volatile Memory

A distinguishing feature of the microDGF is its on-board non-volatile memory. All operating firmware is factory pre- loaded but can also be upgraded in the field. Additionally, all settings are saved in arrays that can be stored and retrieved on both a per-peaking time and per MCA- configuration basis.

SAMPLE PERFORMANCE

Mixed gamma source spectrum from HPGe detector with microDGF
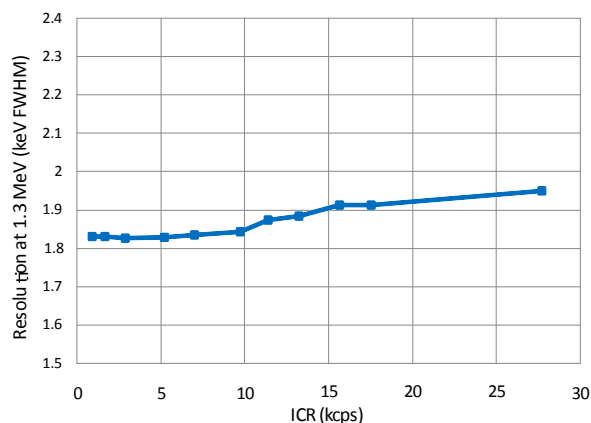
Energy resolution at 1.3 MeV vs count rate for HPGe detector with microDGF

SOFTWARE

XIA provides ProSpect, a software package that controls all microDGF settings and acquires MCA and diagnostic data, and Handel, a comprehensive set of C libraries that simplifies integration of the microDGF into the customer's embedded applications.

NRE CUSTOMIZATION

The onboard DSP can make spectral calculations in real time and control external equipment based on r esults. XIA will be pleased to quote NRE costs for developing special purpose microDGF code.

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