CUSTOMER SUCCESS STORY

Geophysical Technology, Inc.

Designing Autonomous Seismic Recording Technology with Maxim Analog ICs

GTI designs, manufactures, sells, and supports differentiated geophysical technology such as its NuSeis NRU-1C seismic recording unit.

Challenge

- Deliver high-fidelity seismic signal recordings from autonomous nodes
- Lower power consumption of the nodes to support operational efficiency, cost, and quality criteria

Solution

- MAX11216
- MAX6126
- MAX4736
- MAX14689
- MAX7315

Benefits

- At least 10dB improvement in instantaneous dynamic range, which supports high-fidelity capture of miniscule seismic signals
- Low-power ADC
- Low noise floor over wide operating temperatures

Based in Houston, Texas, **Geophysical Technology, Inc. (GTI)** designs, manufactures, sells, and supports geophysical technology that efficiently illuminates and monitors the earth's subsurface for resource extraction, earthquake monitoring, construction, and hydrothermal projects.

The company's flagship NuSeis™ autonomous seismic recording technology enables continuous, high-quality data acquisition. The NuSeis NRU-1C™ is a battery-powered, self-contained nodal seismic recording unit with one channel of 24-bit digitization; internal or external geophone; integrated, high-sensitivity GNSS/GPS; and high-speed data download capability. Traditional seismic recording devices are interconnected by copper wires. Worldwide, seven million seismic channels are used for oil and gas exploration, and five and a half million of them are interconnected systems, some stretching for up to 100 miles on a project. As the industry began moving toward standalone units, GTI saw an opportunity to create its NuSeis technology.

CUSTOMER SUCCESS STORY: GTI

"The power/performance and fidelity are two of the ingredients that made the MAX11216 attractive to us."

- Richard Degner, CEO and President, GTI

Challenges

Shaped like an earth probe, the NuSeis NRU-1C plants firmly in the soil and records seismic energy at a configurable rate up to 2,000 observations per second. The recordings are stored in the nonvolatile memory integrated into each node and are rapidly transferred to the central software for further processing. Health and status information from each NRU is transmitted via Bluetooth Low Energy (BLE). Field crews equipped with tablets can then pick up the BLE advertising packets and, when within WiFi range, upload the data to a command and control center. So far, the nodes are being used in environments as extreme as the Arctic, the desert, and all places in between. Company CEO and President Richard Degner would like to eventually scale the technology for uses on the sea floor and in security.

"We get a really high-quality transfer of small seismic-reflected signals from three to five miles down in the earth," said Degner. To enable this quality, the company needed an analog-to-digital converter (ADC) with a low noise floor and an instantaneous dynamic range that would support the fidelity required by the nodes. Also important for the underlying components: low power to ensure that the nodes meet cost, operating efficiency, and quality criteria.

Solution and Benefits

GTI looked to Maxim for some of its key analog requirements, drawn largely by the **MAX11216** low-power, low-noise ADC with integrated programmable gain amplifier. "The power/performance and fidelity are two of the ingredients that made the MAX11216 attractive to us," Degner said. When the company learned about the IC several years ago, its engineers began working with development boards and liked what they experienced. The MAX11216 is ideal for seismic data acquisition, achieving 140dB signal-to-noise ratio (SNR) while dissipating only 10mW. In the NuSeis NRU-1C, the MAX11216 is the primary device that digitizes analog signals in the presence of noise, yielding 10dB or more improvement in instantaneous dynamic range relative to some competitive systems. As Degner explained, this capability allows NuSeis to record very small reflected seismic signals even with a background of strong ambient noise.

Other Maxim analog ICs in GTI's nodes include:

- **MAX6126** ultra-high-precision, ultra-low-noise low-dropout voltage reference
- **MAX4736** low on-resistance, low-voltage, dual single-pole/double-throw (SPDT) analog switch
- **MAX14689** ultra-small, low on-resistance double-pole/double-throw (DPDT) analog switch with Beyond-the-Rails™ capability
- **MAX7315** 8-port I/O expander with LED intensity control, interrupt, and hot-insertion protection

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Solution and Benefits (Continued)

These additional components were chosen first as fit-for-purpose, then for quality and value, and together they complete core sensor circuitry. Combining the MAX11216 with the ultra-high-precision MAX6126 low-noise voltage reference maintains the extremely low noise floor over the wide operating temperature ranges that the NRU-1C typically sees.

With the number of channels for oil and gas earth imaging typically doubling every six years, GTI has a growing market to tap for its autonomous seismic recording technology. "We're continuing to develop the ecosystem to make our technology more efficient, and continuing to develop different packaging and form factors that give our customers better data and higher operating performance in each specific project environment," said Degner. The team behind GTI collectively has experience in doing seismic studies in about 45 different countries—knowledge that will certainly be valuable as the company pursues new opportunities.

Learn more at www.maximintegrated.com

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