

**Product Group:** Vishay Foil Resistors

## Developing a Multi-channel 24-bit ADC for Down Hole Seismic Applications



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Texas Microelectronics Corporation, located in Houston, Texas, developed a complete 4-channel, 24-bit analog-to-digital converter in a single 40-pin package capable of continuous operation at 200°C

**Industry / Application Area:** High Temperature:

- Seismic data acquisition systems
- Petroleum reservoir monitoring
- High accuracy instrumentation

**Product Used:** V5X5 Bulk Metal® Foil resistor chips

### Description of Case Study

The TX424 is a complete 4-channel 24-bit analog to digital converter in a single 40-pin package capable of continuous operation at 200°C. The design would be a state-of-the-art implementation utilizing two dual 24-bit modulators and a quad FIR filter for digitization. It would also have four low noise programmable gain amplifiers and a precision voltage reference capable of digitizing millivolt signals in the presence of large common mode and noise voltages.

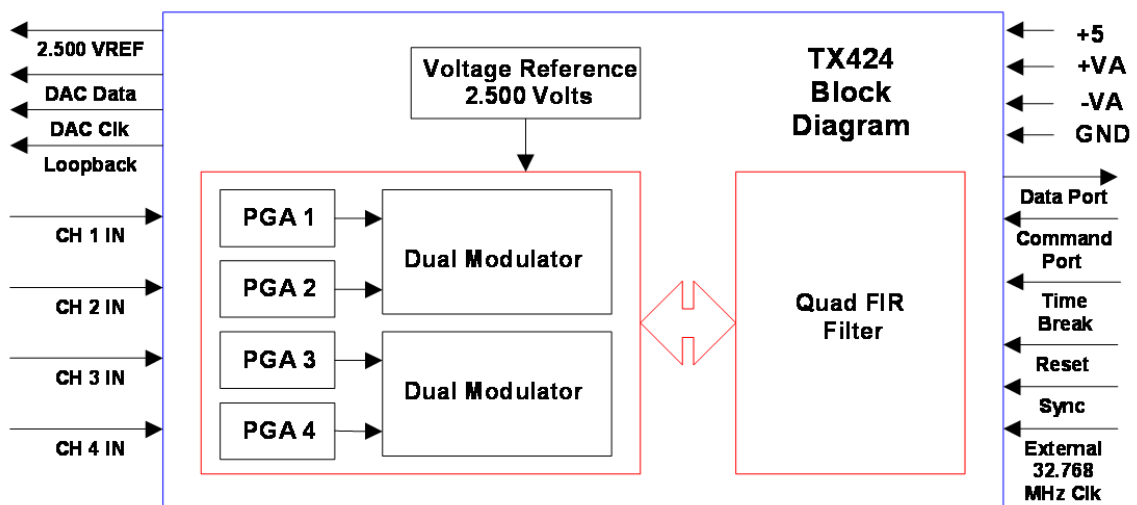


Figure 1: Block diagram of the TX424

**Product Group: Vishay Foil Resistors****The Challenge**

The typical application for down hole seismic data acquisition presents an extremely harsh environment for precision electronics. Petroleum reservoir monitoring often involves permanent installations and years of continuous service is expected. Operating temperatures up to 200°C are common. High noise and vibration are also present. The ability to operate with great stability and reliably under these conditions for long periods of time is of greatest importance.

**The Solution**

The V5X5 Bulk Metal Foil resistor chips from Vishay Foil Resistors provide the overall stability and reliability for the TX424 precision analog to digital converter.



*Figure 2: TX424 in size comparison*

**The User Explains**

While the TX424 digitizer section requires almost no resistors, the programmable gain amplifiers require many resistive components to achieve their desired functionality. The V5X5 Bulk Metal Foil resistor chips provide the best performance in many areas critical to the operation of the TX424.

These are:

- Temperature Coefficient of Resistance ( typically 2 ppm/°C )
- Thermal Stabilization (due to self-heating)
- Resistance Tolerance (can be trimmed to 0.005%)
- Load-Life Stability (< 100 ppm per 2000 hours)
- Noise (lowest noise foil design)
- Thermal EMF (low thermal EMF design)

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## Measurements

The performance of the TX424 design proved to be superb in all respects. Figure 3 shows a noise FFT of operation at 200°C. The SNR is better than -121 dB out to 125 Hz (250 samples per second). Long term tests have shown no degradation of performance beyond 2000 hours of continuous operation at 200°C.

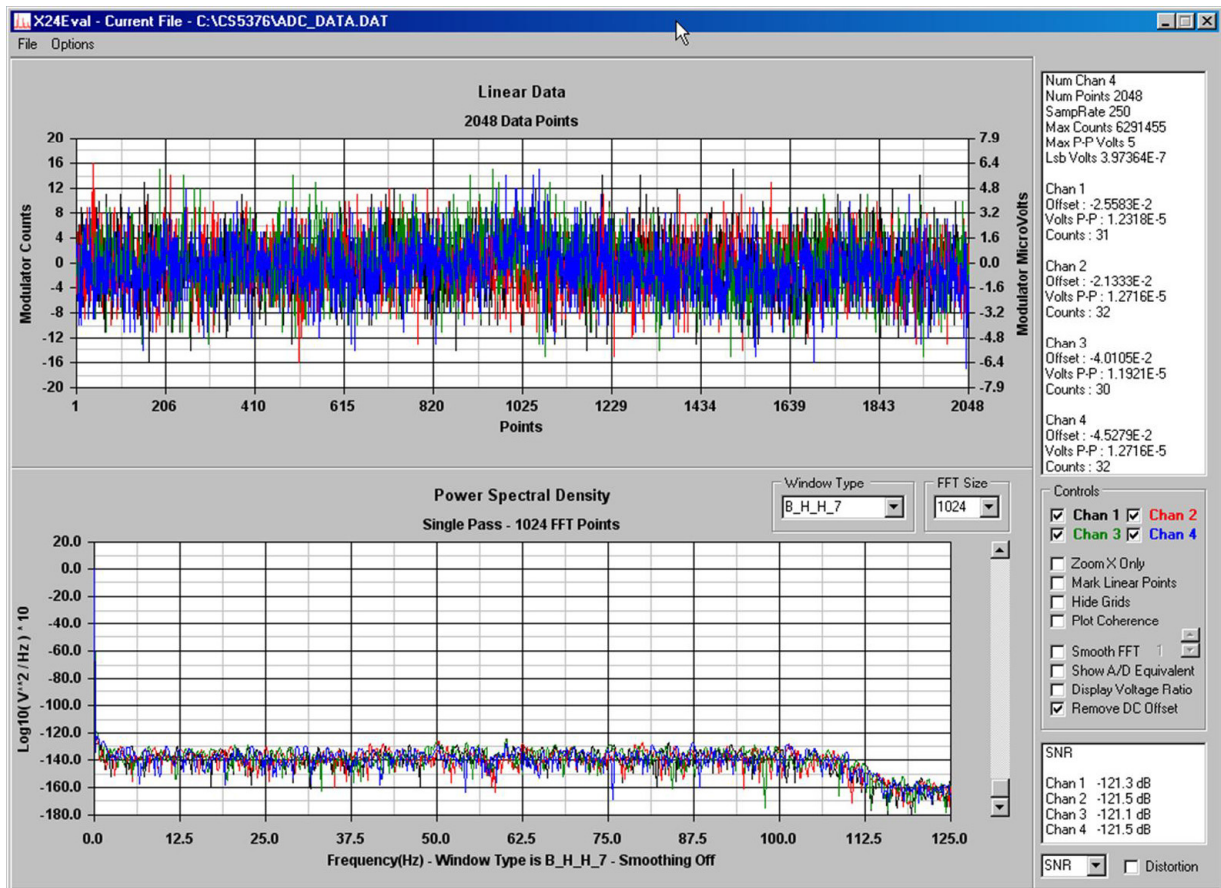


Figure 3: TX424 noise FFT of operation at 200°C

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