



## **Quad $\mu$ Module Analog-to-Digital Converters with Integrated Signal Conditioning Reduce Size, Power & Time-to-Market for Imaging & Base Station Designs**

MILPITAS, CA – April 24, 2012 – Linear Technology introduces the [LTM9012](#), a quad 14-bit, 125Msps  $\mu$ Module<sup>®</sup> analog-to-digital converter (ADC) with integrated fixed gain drivers, passive filtering and bypass capacitance. The integrated  $\mu$ Module converters offer dramatic reduction in board space for high channel-count applications as diverse as medical imaging systems and MIMO (multiple input multiple output) 4G base stations. This high level of integration enables smaller boards with greater density, while eliminating costly layout iterations often required to optimize the driver-to-ADC interface. This results in a significant reduction in design and debug time and faster time to market. Equivalent implementations require five devices and dozens of passive components compared to the LTM9012 in an easy-to-use 15mm x 11.25mm BGA  $\mu$ Module package.

Integrating the driver with the ADC simplifies high-speed design, whether the signal originates in an image sensor with CMOS logic outputs or an RF signal chain. CMOS image sensors are used in high-end medical instruments, such as blood cell or molecular microscope cameras, and industrial imaging equipment used for detecting voids in metal objects. Depending on the sensor, many channels of high-speed digitizers are required along with filtering and amplification to translate the sensor output to the ADC input. Filters and amplifiers often consume more than twice the circuit board area as the ADC itself and constitute the key challenge in achieving maximum camera resolution. The LTM9012 amplifiers easily accommodate the single-ended CMOS sensor outputs and translate these levels to differential for the high performance ADC to maximize dynamic range.

Ideal for digitizing high-speed digital signals for imaging applications, the LTM9012 also excels in baseband receiver applications such as cellular infrastructure. Two receiver architectures dominate base station designs: direct conversion and IF-sampling. With the

capability of supporting baseband frequencies up to about 90MHz, the LTM9012 is suitable for both types. Direct conversion demodulates the RF signal and downconverts to DC; therefore a 20MHz lowpass filter supports 40MHz signal bandwidth. Low IF-sampling below 90MHz is also possible with four channels for next generation small base station designs. With 20dB of gain, the LTM9012 achieves 68.3dB signal to noise ratio (SNR) and 78dB spurious-free dynamic range (SFDR).

Compared to previous generation devices (LTM9002), the LTM9012 offers many enhancements. It has twice the density – two channels versus four in the same package size. It requires only a third the number of digital data lines since it utilizes serial LVDS. It consumes about one fourth of the power, just 318mW per channel, operating on 1.8V for the ADC core and 3.3V for the amplifiers. The LTM9012 is packaged in a space-saving 15mm x 11.25mm BGA package, utilizing a multilayer substrate that shields sensitive analog lines from the digital traces to minimize digital feedback. Supply and reference bypass capacitance is placed inside the module, tightly coupled to the die, providing a space, cost and, more significantly, a performance advantage over traditional packaging.

The LTM9012-AB is available in production volumes today and is priced at \$149.00 each in 1,000 piece quantities. Demo boards and samples are available at [www.linear.com](http://www.linear.com) or via a local Linear Technology sales office. For more information, visit [www.linear.com/product/LTM9012](http://www.linear.com/product/LTM9012)


**Photo Caption:** Quad 14-Bit, 125Msps ADC with Integrated Drivers

### **Summary of Features: LTM9012**

- Fully Integrated 4-Channel Digitizer
- 14-bit, 125Msps Low Power ADC
- Fixed Gain, Differential ADC Drivers with Gain =10V/V or 20dB (Suitable for Single-Ended Signals)
- 68.3dB SNR
- 78dB SFDR
- Low Power: 318mW per Channel
- 15mm x 11.25mm BGA Package

## About Linear Technology

Linear Technology Corporation, a member of the S&P 500, has been designing, manufacturing and marketing a broad line of high performance analog integrated circuits for major companies worldwide for three decades. The Company's products provide an essential bridge between our analog world and the digital electronics in communications, networking, industrial, automotive, computer, medical, instrumentation, consumer, and military and aerospace systems. Linear Technology produces power management, data conversion, signal conditioning, RF and interface ICs,  $\mu$ Module<sup>®</sup> subsystems, and wireless sensor network products. For more information, visit [www.linear.com](http://www.linear.com)

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### Press Contacts:

#### North America / Worldwide

John Hamburger, Director Marketing  
Communications  
[jhamburger@linear.com](mailto:jhamburger@linear.com)  
Tel: 408-432-1900 ext 2419

Doug Dickinson, Media Relations Manager  
[ddickinson@linear.com](mailto:ddickinson@linear.com)  
Tel: 408-432-1900 ext 2233

#### UK & Nordic

Alan Timmins  
[alan@ezwire.com](mailto:alan@ezwire.com)  
Tel: +44-1-252-629937