

Ultra-Low Power QMLV Solutions for Satellite Telemetry and Control Systems

Introduction

Satellite telemetry and control systems need high-precision analog-to-digital and digital-to-analog converters and amplifiers. Applications where these telemetry and control systems are found in satellites are the Attitude and Orbit Control Systems (AOCS) where the system is composed of the necessary sensors, actuators, electronics, and software to provide adequate knowledge of spacecraft attitude during all phases of the mission and also, to generate on-board error signals to accurately maintain spacecraft attitude, and provide necessary orbital control to satisfy the mission requirements.

In these applications, speed of electronics is not the highest priority, but rather precise measurements are needed for accurate reaction and monitoring. In addition, it is important that these systems do not consume much power since as they are not always in use and lowering the overall power consumption along with bringing down the satellite launch cost is an important objective for every satellite mission. Other considerations with satellites are where these products will be used in power supply monitoring, battery monitoring and power management.

The three new products that National has to offer in this area are the:

- LMP2012 – Dual, high-precision ultra stable rail-to-rail op amp
- ADC128S102 – 12-bit, 8-channel 50 kSPS to 1 MSPS low-power ADC
- DAC121S101 – 12-bit, micropower rail-to-rail output DAC

LMP2012QML

Dual High-Precision, Rail-to-Rail Output Operational Amplifier

The LMP2012 is the first member of National's QMLV qualified LMP precision amplifier family. The LMP2012



offers unprecedented accuracy and stability over temperature, with a TCV_{OS} of $0.015 \mu V/^{\circ}C$. This device utilizes patented techniques to measure and continually correct the input offset error voltage. The result is an amplifier which is ultra stable over time and temperature. It has excellent CMRR and PSRR ratings, and does not exhibit the familiar $1/f$ voltage and current noise increase that plagues traditional amplifiers. The combination of the LMP2012 characteristics makes it a good choice for transducer amplifiers, high-gain configurations, ADC buffer amplifiers, DAC I-V conversion, and any other 2.7V to 5V application requiring precision and long-term stability. Other useful benefits of the LMP2012 are rail-to-rail output, low supply current of $920 \mu A$, and wide gain-bandwidth product of 3 MHz. These extremely versatile features found in the LMP2012 provide high performance and ease-of-use. The QMLV qualified version of the LMP2012 has been rated to tolerate a total dose level of 50 Krad(Si) radiation by test method 1019 of MIL-STD-883.

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ADC128S102QML

12-bit, 8-Channel 50 kSPS to 1 MSPS, Analog-to-Digital Converter

The ADC128S102 is a QMLV qualified low-power, 8-channel CMOS 12-bit analog-to-digital converter specified for conversion throughput rates of 50 KSPS to 1 MSPS. The converter is based on a successive-approximation register architecture with an internal track-and-hold circuit. The output serial data is straight binary and is compatible with several standards, such as SPI™, QSPI™, MICROWIRE™, and many common DSP serial interfaces. The ADC128S102 may be operated with independent analog and digital supplies. The analog supply (VA) can range from 2.7V to 5.25V, and the digital supply (VD) can range from 2.7V to VA. Normal power consumption using a 3V or 5V supply is 2.7 mW and 11 mW, respectively. The power-down feature reduces the power consumption to 0.33 μW using a 3V supply and 0.6 μW using a 5V supply. The ADC128S102 operates over the extended temperature range of -55°C to +125°C and has been rated to tolerate a total dose level of 100 Krad(Si) radiation by test method 1019 of MIL-STD-883.

DAC121S101QML

12-bit Micropower Digital-to-Analog Converter with Rail-to-Rail Output

The DAC121S101 is a QMLV qualified full-featured, general purpose 12-bit voltage-output digital-to-analog converter (DAC) that can operate from a single 2.7 V to 5.5 V supply and consumes just 0.52 mW of power. The on-chip output amplifier allows rail-to-rail output swing and the three-wire serial interface operates at clock rates up to 20 MHz over the specified supply voltage range and is compatible with standard SPI™, QSPI™, MICROWIRE™ and other DSP interfaces. The supply voltage for the DAC121S101 serves as its voltage reference, providing the widest possible output dynamic range. A power-on reset circuit ensures that the DAC output powers up to zero volts and remains there until there is a valid write to the device. A power-down feature reduces power consumption to less than a μW. The DAC121S101 operates over the extended temperature range of -55°C to +125°C and has been rated to tolerate a total dose level of 100 krad(Si) radiation by test method 1019 of MIL-STD-883.

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Part Number	SMD Number	Description	Package	Lead Count
ADC128S102WGRQV	5962R0722701VZA	PowerWise® 8 channel, 12-bit, 50 KSPS to 1 MSPS, ADC converter	Ceramic SOIC	16
DAC121S101WGRQV	5962R0722601VZA	PowerWise® 12-bit micropower DAC with rail-to-rail output	Ceramic SOIC	10
LMP2012WGLQMLV	5962L0620601VZA	Dual, high-precision, rail-to-rail output operational amplifier	Ceramic SOIC	10

