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Programmable Mixed-Signal ICs Feature Low-Power Device With 14-Bit SAR ADC

<u>Renesas Electronics'</u> four AnalogPAK programmable mixed-signal ICs feature the SLG47011, a device that delivers a new level of performance for configurable analog integrated circuits. It contains a rich set of digital and analog features including a programable multichannel 14-bit SAR ADC with programmable gain amplifier (PGA). The SLG47011 also has flexible, user-defined power saving modes for all macrocells that enable designers to switch off some blocks in sleep mode and therefore reduce power consumption to the microamp level (Fig. 1). An automotive-qualified device (the SLG47004-A) and two cost-optimized (SLG47001/3) versions are also being introduced.

According to the vendor, AnalogPAK ICs reduce component count, BOM cost and board space for almost any application, including consumer electronics, computing, white goods, industrial, communications, and automotive. Using Go Configure Software Hub and the GreenPAK Development Kit, designers can create and program a custom circuit in minutes.

AnalogPAK devices are part of Renesas' GreenPAK family of programmable mixed-signal matrix products: costeffective, NVM programmable devices which enable innovators to integrate many system functions while minimizing component count, board space, and power consumption. GreenPAK and AnalogPAK ICs deliver functional replacement of mixed-signal standard products and standalone discrete circuits. They also provide reliable hardware supervisory functions for SoCs and microcontrollers (Fig. 2).

The SLG47011 can be used to extend the performance of, or to offload an MCU. It can also be used in conjunction with an MCU to replace a complex analog front-end (AFE). Key functions supported by the SLG47011 include measurement, data processing, logic control and data output.

Key parameters of the SLG47011 include:

- Vdd = 1.71 to 3.6 V
- SAR ADC: up to 14-bit, up to 2.35 Msps in 8-bit mode
- PGA: six amplifier configurations, rail-to-rail input/output, 1x to 64x gain
- DAC: 12 bit, 333 ksps
- Hardware math block for multiplication, addition, subtraction and division operations
- Flexible 4096 words memory table block
- Oscillators: 2/10 kHz and 20/40 MHz
- Analog temperature sensor
- Highest number of highly configurable counter/delay blocks
- I²C and SPI communication interfaces
- A tiny 16-pin QFN measuring 2.0 mm x 2.0 mm x 0.55 mm with 0.4-mm pitch package

The SLG47001 and SLG47003 enable the implementation of precise measurement systems with a low price point and a very compact package to address applications such as gas sensors, power meters, measurement equipment, servers, wearables, industrial robots, industrial and smart home sensor modules.

Key features of the SLG47001 and SLG47003 include:

- Two ultra-low offset op-amps—9 µV (max.)
- Two 10-bit digital rheostats
- Six-channel sampling comparator



- Analog switch
- Voltage reference
- 59-byte pattern generator
- 2-kHz, 10-kHz and 25-MHz oscillators
- Fully configurable blocks: LUTs, flip-flops, shift registers, timers, counters and delays

The SLG47004-A delivers the functionality of the SLG47004 devices with the addition of automotive qualification Grade 1 for applications such as infotainment, navigation, chassis and body electronics, automotive display clusters and more. The devices support a temperature range of -40°C to 125°C.

All of the AnalogPAK devices are available from Renesas and its authorized distributors, along with customized development kits. The SLG47011 comes in a 2.0- x 2.0-mm 16-pin STQFN package. The SLG47001 is packaged in a 2.0-mm x 3.0-mm 20-pin STQFN, while the SLG47003 comes in a 3.0-mm x 3.0-mm 24-pin STQFN. The SLG47004-A is available in a 4.0-mm x 4.0-mm 24-pin TQFN. For more information, see the AnalogPAK page.



Fig. 1. The SLG47011 provides a small, low-power solution for commonly used analog-to-digital conversion and mixed-signal functions. A flexible data acquisition system used in conjunction with configurable logic provides a way to implement a wide variety of functions with minimal cost. The user can create a circuit design by programming the one time programmable (OTP) non-volatile memory (NVM), to configure the interconnect logic, the macrocells, and the I/O pins. It features a SAR ADC with selectable 14-, 12-, 10-, or 8-bit resolution.





Fig. 2. The AnalogPAK subfamily of GreenPAK ICs offers analog-rich capabilities, featuring various characteristics and supporting a range of target applications. It includes embedded high-performance analog blocks, such as operational amplifiers, 10-bit rheostats, analog switches, voltage references, analog comparators, and more. These macrocells are integrated into a single IC to combine both analog and digital components for higher efficiency. This subfamily also introduces advanced data processing and analog blocks like high-resolution ADCs, programmable gain amplifiers, RAM, MathCore, and DACs. These features enable versatile data conversion solutions, both for use with MCUs and as standalone applications.