

Computing & Storage

January 2020



INNOVATIVE COMPUTING SOLUTIONS

Dialog Semiconductor offers highly integrated mixed-signal and power solutions that enable its customers to significantly reduce the height and board area of their designs. This enables the development of product form factors that significantly differentiate our customers' individual positions within the marketplace.

Dialog's low power haptics drivers provide new interface capabilities within computing system designs and are now delivering an exciting range of new user experiences and enhanced features. In addition, our Audio CODECs, validated by ecosystem partners, provide a fast, low-risk solution for seamless integration into customer systems.

Dialog's long heritage in custom ASIC solutions and advanced mixed signal IP portfolio are now successfully utilized and configured for deployment in a broad range of our customers' platforms in applications including gaming, solid state drives and compact form-factor computing designs.

Contents

- Power management ICsPage 04
- Custom mixed-signal ICsPage 07
- Switched capacitor DC-DC convertersPage 09
- CODEC ICsPage 12
- HapticsPage 13
- GreenPAK® configurable mixed-signal ICsPage 16

Power Management ICs (PMICs)

Highly integrated, efficient and scalable power management ICs (PMICs) and sub-PMICs for powering system chipsets and DDR memory



GreenPAK

Programmable Mixed-signal ICs for size reduction and custom features



CODECs & Class D Amps

High performance, low noise CODECs and Class D amplifier standard products

Switched capacitor DC-DC converters

98% efficient power converter used as a pre-regulator for system PMICs and sub-PMICs

Haptics

Low-power, wide-bandwidth haptic driver for vibrations and clicks using ERM (eccentric rotating mass motor) and LRA (linear resonant actuator) applications

Power management ICs

Highly integrated solutions offer space saving in notebook computing solutions

Dialog's integration of multiple switching regulators and LDOs meets the diverse power management needs of platform chipsets and conserves valuable board space. Additionally, these highly integrated solutions deliver higher reliability, reduced system complexity and provide greater layout flexibility.

Flexible and configurable for multiple computing platforms

Dialog's comprehensive solutions meet the challenges of powering today's advanced computing system platforms with their increasingly diverse voltage and current needs, multiple channels, power sequencing requirements and the ability to scale designs to cope with future higher power needs.

PMIC and sub-PMIC families meet wide-ranging needs in today's applications

In addition to highly integrated PMIC solutions with integrated multiple buck regulators and LDOs, Dialog offers a family of high-power sub-PMICs that satisfy the high-current needs of the latest DDR memory banks, key to fulfil the needs for higher transfer rates in modern computing. These sub-PMICs offer multi-phase, high current (up to 20A) buck regulators in a compact footprint with advanced power management features to maximize power-performance density - vital for best-in-class computing applications.



System PMIC Product Portfolio

| Product | Package | Input Voltage (V) | Regulators | LDOs | ADC | USB charger | RTC | Interface | GPIOs | Backup charger | LED boost | Watchdog | Audio Amplifier (Class G, Class D) | Audio Codec |
|---------|---------|-------------------|------------|------|-----|-------------|-----|-----------------------|-------|----------------|-----------|----------|------------------------------------|-------------|
| DA9061 | QFN | 2.7 to 5.5 | 3 | 4 | - | - | - | I ² C | 5 | - | - | Y | - | - |
| DA9062 | QFN | 2.8 to 5.5 | 4 | 4 | - | - | Y | I ² C | 5 | Y | - | Y | - | - |
| DA9063 | BGA | 2.8 to 5.5 | 6 | 11 | Y | - | Y | I ² C, SPI | 16 | Y | - | Y | - | - |

Sub-PMIC Product Portfolio

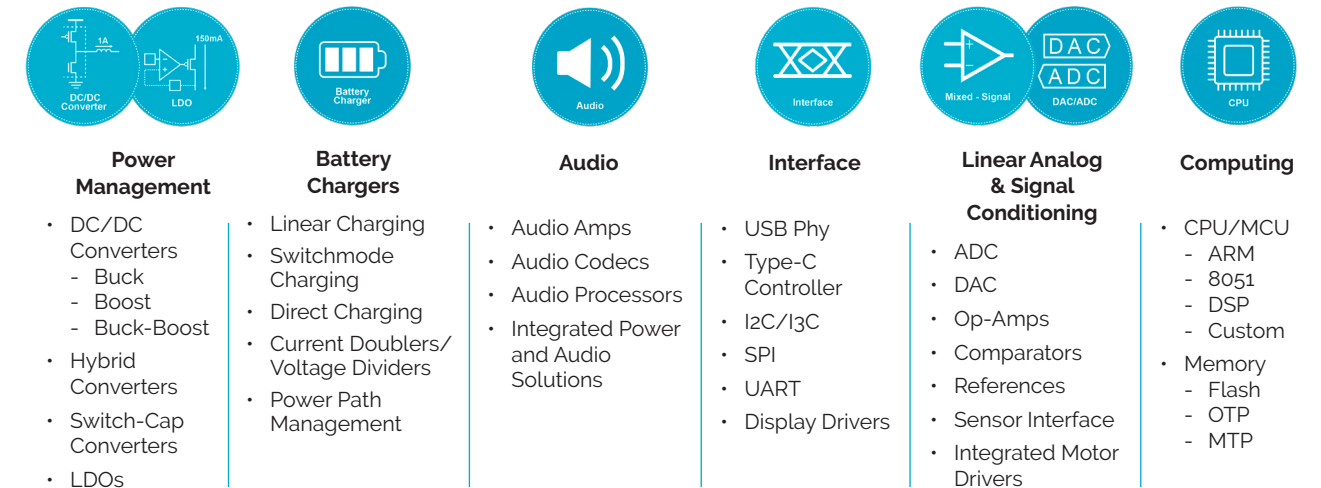
| Product | Package | Input Voltage (V) | Regulators | Interface | GPIOs |
|---------|---------|-------------------|---|-----------------------|-------|
| DA9121 | WLCSP | 2.5 to 5.5 | One dual-phase buck (10A) | I ² C | 5 |
| DA9122 | WLCSP | 2.5 to 5.5 | Two single-phase bucks (5A each) | I ² C | 5 |
| DA9211 | WLCSP | 2.8 to 5.5 | One quad-phase buck (12A) | I ² C, SPI | 5 |
| DA9212 | WLCSP | 2.8 to 5.5 | Two dual-phase bucks (6A each) | I ² C, SPI | 5 |
| DA9213 | WLCSP | 2.8 to 5.5 | One quad-phase buck (20A) | I ² C, SPI | 5 |
| DA9214 | WLCSP | 2.8 to 5.5 | Two dual-phase bucks (10A each) | I ² C, SPI | 5 |
| DA9215 | WLCSP | 2.8 to 5.5 | One triple-phase buck (15 A) and one single-phase buck (5A) | I ² C, SPI | 5 |
| DA9217 | WLCSP | 2.5 to 5.5 | One dual-phase buck (6A) | I ² C | 5 |
| DA9220 | WLCSP | 2.5 to 5.5 | Two single-phase bucks (3A each) | I ² C | 5 |

Custom Mixed-Signal ICs

Dialog Semiconductor, a market leader in custom Power Management ICs (PMICs) and Mixed-Signal ASICs, has a proven track record and long history in its close collaboration with industry leaders to deliver customized, high-performance solutions. The company's exemplary record has resulted in multi-generational partnerships which have firmly established Dialog as a trusted partner of choice.

Integrate to Differentiate

Dialog enables many of the most unique and advanced electronics products on the market today. Its broad, mixed-signal portfolio ranges from advanced power conversion topologies, battery chargers, audio solutions, digital and analog interfaces to linear analog and signal conditioning technologies. Dialog's digital capabilities include embedded computing as well as memory to empower next generation solutions. Advanced packaging technologies co-developed with the company's packaging experts and vendor partners continue to deliver leading edge solutions in the mixed-signal market.



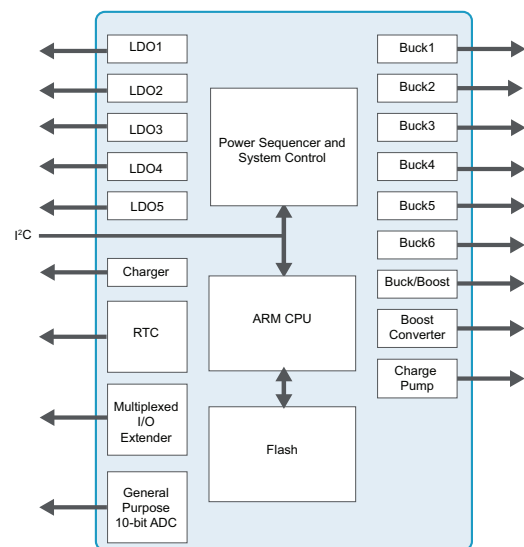
Time-to-Market

Dialog is now the leading pure play provider of advanced Power Management ICs. This level of success was achieved through absolute attention to detail. Dialog ensures that all IP is proven to perform as designed. Its accumulated library of leading-edge technologies enables Dialog to execute flawlessly and deliver "First Time Right" solutions.

Operational Excellence

Dialog's long-standing relationships with world-class manufacturing partners for wafer fabrication back-end assembly and test provide access to advanced mixed signal process nodes. Expertise in mixed-signal ASIC design and development from concept to production guarantees the highest levels of quality.

Dialog's unparalleled high-volume production ramp capability (from zero to 80 M units within a quarter) empowers its customers to rapidly deliver new products to market. The internal supply chain team at Dialog has delivered 99%+ on-time-delivery (OTD) while working closely to react to today's dynamic and volatile market conditions.



A representative example of a high-performance Custom ASIC in production

Switched capacitor DC-DC converters

High current, inductor-less power converters

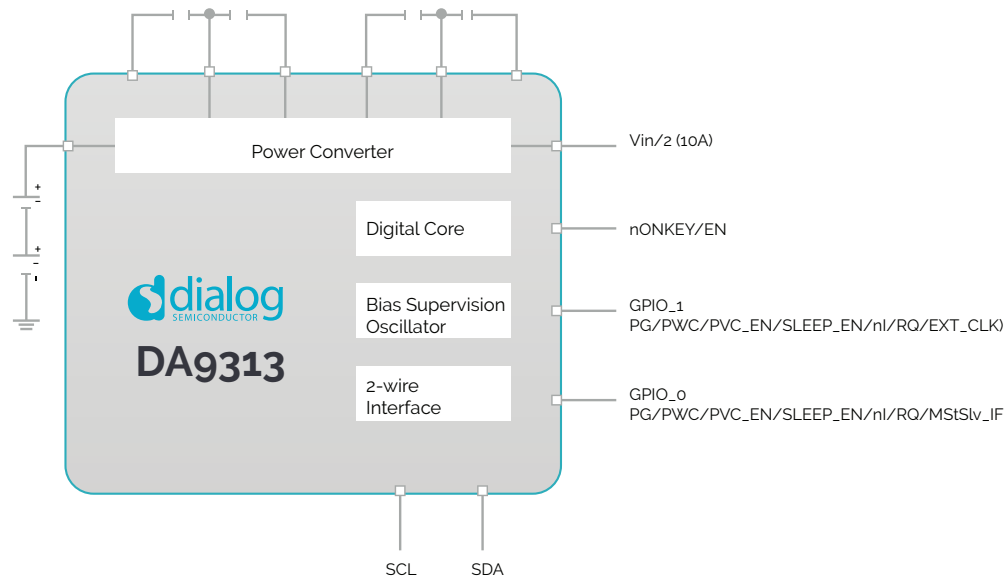
Dialog's DA9313 is an ultra-efficient buck converter that does not require the use of inductors. This differentiated technology is leading the way in optimizing next-generation storage and computing devices. This family of devices - also referred to as switched capacitor DC-DC converters - can offer up to 98% efficiency at high power levels.

This converter family allows system designers to transition from 1S to 2S systems without any changes in their power tree, making system power regulation more efficient, reducing PCB board area to less than 50% and height to less than 1mm when compared to the traditional inductor-based buck configuration.

Switched capacitor DC-DC converters can also be used for direct charging of single cell Lithium batteries, reducing routing loss by 75% and enabling the use of 3A USB cables to deliver up to 6A for charging.

DA9313 is a stand-alone converter for applications supplied by voltages from 5.0V to 10.5V and represents the industry's first inductor-less 10A power converter to deliver over 50W in a less than 10 mm² package. With its best-in-class efficiency and master/slave operational capability for up to 20A output current, the DA9313 enables applications to be powered with improved efficiencies requiring less volume compared to conventional high voltage direct conversion solutions.

These fully integrated power converters halve the input voltage without the requirement for an inductor and provide high efficiency over a very wide range of output current loads - delivering superior performance to conventional solutions using charge pump technology which suffer the disadvantage of very limited output current capability.



Features

- 🔌 **2 to 1 Power Converter stage with Integrated power switches $V_{OUT} = \frac{1}{2} V_{IN}$**
 - High and flat efficiency, above 98%
 - 10 A output current
 - Up to 20A output current in master/slave mode
 - Typical $60\mu A + 10\mu A$ quiescent current in master/slave configuration
- 🔌 **nONKEY and enable/disable function**
- 🔌 **Power good indication**
- 🔌 **Master/slave synchronization**
- 🔌 **Power Cycling input**
- 🔌 **External clock input**
- 🔌 **I2C interface including interrupt signal (optional)**

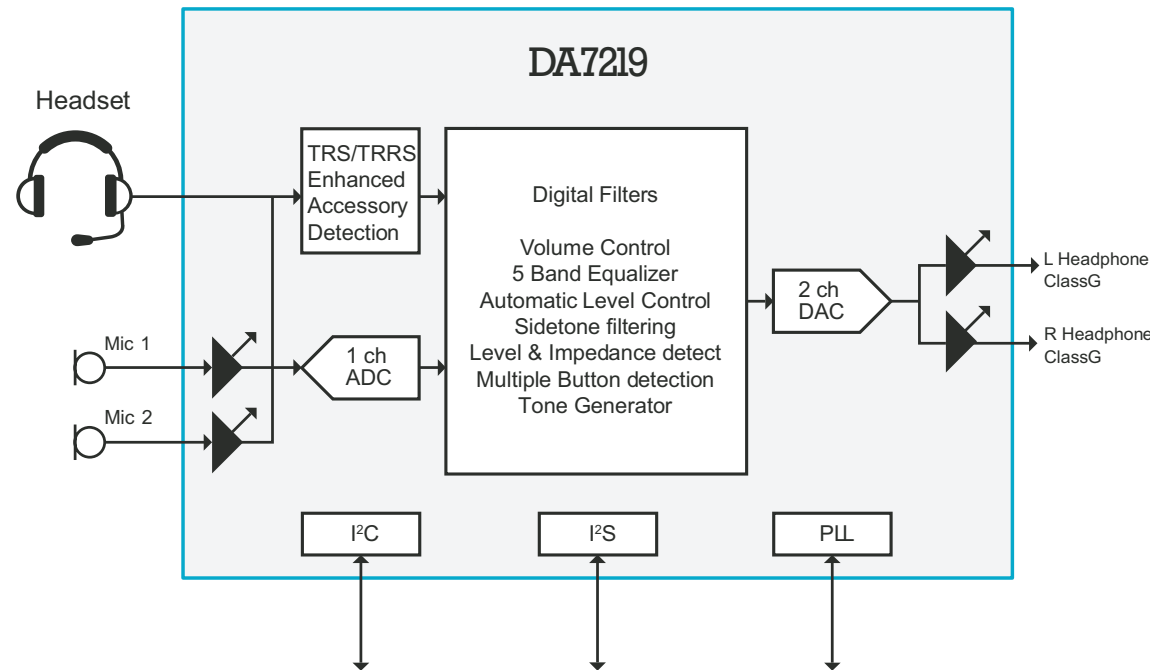
Benefits

- 🔌 **10A total output current from 5.0V to 10.5V**
- 🔌 **Master/slave configuration for up to 20A output current**
- 🔌 **Enabling low profile externals (z-height $\leq 1\text{mm}$) for high current application**
- 🔌 **Solution size reduction in comparison to inductor based solutions**
- 🔌 **Thermal hotspot reduction through ultra-high efficiency (98%)**

CODEC ICs

Dialog offers high-performance, low-power audio CODECs that are optimized for use in Chromebooks.

The DA7219 includes Advanced Accessory Detection (AAD) which supports the detection and identification of 3-pole (headphone) and 4-pole (headset) jacks, and allows the automatic pin order switching of MIC/GND on CTIA or OMTP headsets. DA7219 is on the approved vendor list for multiple Chromebook systems in addition to being used in multiple systems with 3.5 mm audio I/O jacks, and is the industry's lowest power consumption, portable audio CODEC.



| Device | Why it benefits audio applications |
|--------|---|
| DA7219 | Mono in, stereo out CODEC with advanced 3.5 mm Jack detect and button detection |

Haptics

Haptics technology recreates the sense of touch to the user by applying forces and vibrations in the form of touch feedback in displays, touch surfaces and buttons.

The DA728x - High definition, low power and flexible:

The DA728x family of High-Definition (HD) Haptic Drivers, combine custom drive sequences, on- and off resonance, at up to 1kHz. The device can drive both ERM and LRA (narrow and wideband) actuators and track resonance up to 300Hz to drive the most complex click/vibration touch effects in a wide range of applications.

Saving power when idle:

As haptic drivers spend the majority of their time in standby/idle mode, the DA728x family was designed to utilize very low idle current consumption (360nA) to maximize battery life.

The DA7282 has an additional standby mode where current consumption drops to 5nA, making it an ideal driver for systems where the highest priority is current consumption when not in use.

The DA728x family combines very low idle current consumption with low-latency trigger inputs to minimize system power consumption. Integrated trigger inputs allow haptic operation without waking the application processor, and latency times at sub-1ms give real switch behavior - 10x better than any other solution available today.

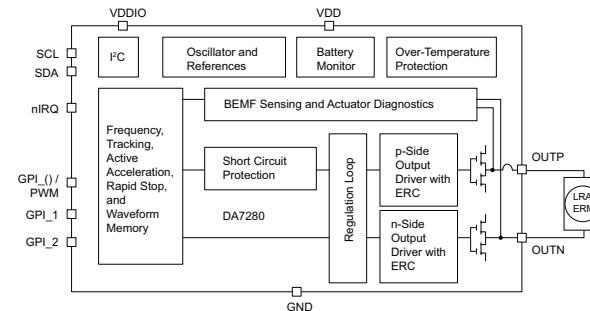
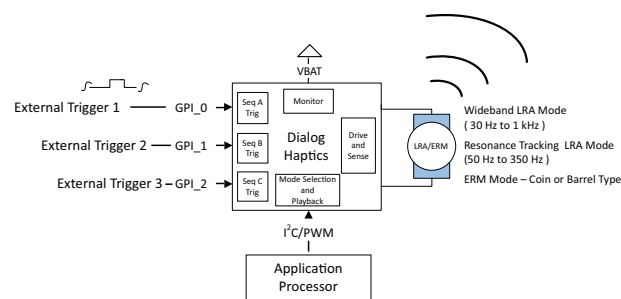
Simplifying usage in touchscreen and capacitive touch systems:

| Product | Market Focus | Control Method | # of input trigger pins | Lowest power mode | I ² C Addresses |
|---------|-------------------|----------------------------|-------------------------|-------------------|----------------------------|
| DA7280 | General Market | I ² C, PWM, GPI | 3 | 360nA Idle | 1 |
| DA7281 | Multi-LRA Systems | I ² C, PWM, GPI | 1 | 360nA Idle | 4 |
| DA7282 | Wearables | I ² C, PWM, GPI | 3 | 5nA Standby | 1 |

DA728x Family Overview

- Wideband LRA driver: 25Hz to 1kHz with resonant mode Frequency tracking support up to 300Hz**
 Drives LRAs off-resonance for custom effects, or dual resonant systems for two-dimensional vibration
- Up to 500mA output current**
 Drive large or small LRAs and ERMs for the best haptic experience
- 360nA idle power mode with full I²C control and memory retention**
 Ultra-low power consumption means longer battery life
 Only 0.75ms latency when responding from ultra-low idle power state
- On-the-fly diagnostics**
 Detect issues with the LRA/ERM Automatically and generate interrupts
- Three methods of drive for ease of use**
 I²C, PWM and General Purpose Inputs (GPIs)
- 5nA standby mode enabled in the DA7282**

The power to be...
 ...personal
 ...portable
 ...connected



GreenPAK Development Platform

Enabling Innovation At A Low Price

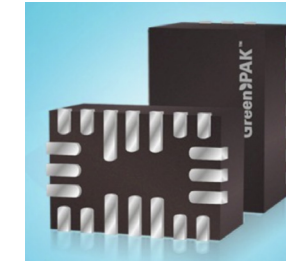
Computing and storage electronics continue to evolve as users desire more intelligent solutions that are speedy, reliable and powerful. The GreenPAK Development Platform includes an intuitive software GUI and development kit to allow designers to create custom ICs tailored to their specific smart device. Customized GreenPAK IC prototypes can be ready for use in just minutes and ready for mass production in weeks.



| | | | | | |
|--|--|--|---|---|--|
| | STEP 1 Place unprogrammed GreenPAK into socket | | STEP 2 Design your IC with GreenPAK GUI | STEP 3 Click program to freeze GreenPAK's OTV NVM <input type="button" value="Program"/> | STEP 4 Your custom IC is ready for use |
|--|--|--|---|---|--|

GreenPAK Configurable Mixed-signal IC

GreenPAK Configurable Mixed-signal IC (CMIC) allow designers to integrate previously separate functions into the same tiny silicon package, reducing supply chain issues, system cost and power consumption. The possible mixed-signal circuits that can be implemented using GreenPAK are endless.



Power Rail Sequencing

Many higher functioning ICs require precise power rail sequencing such as SOCs, μ processors and application processors. GreenPAK is especially well suited to implementing this type of function. Its internal oscillator precision is better than standard passive components that are typically used to set timing between rails. Power good functions can be implemented with analog comparators. Rails can be left on or off using custom logic based on different system operating modes (for example, a standby mode may only have a couple of power rails active).

Power Rail Sequencing

Supervisory Functions

Supercap Support

Safety Features

Custom Logic Functions

Supervisory Functions

GreenPAK can implement many supervisory functions that are typically required around a processing IC. Reset functionality is desirable to have in an external IC to guarantee the ability to re-start a system. Other typical functions that are also used include power rail monitoring for OVP, watchdogs, push button resets, temperature monitoring, GPIO expansion, logic multiplexing, and many others.

Supercap Support

Supercaps are useful devices for holding a power rail up long enough to store data when the main power supply has failed. Some of the functions typically required are cell balancing, voltage monitoring, supercap aging (by monitoring its ESR), temperature monitoring, ripple monitoring, overcharge prevention, as well as many other possible functions.

Safety Features

All complex systems that are consumer oriented require safety feature consideration. GreenPAK can implement many circuits that can help such as temperature monitoring, over current monitoring, port detection, over voltage control, battery monitoring, as well as other custom safety needs.

Custom Logic Functions

Each system is different and based on the desired implementation and final feature set. GreenPAK can fulfill many custom functions including boot and sleep state control, level shifting and voltage translation, power supply ORing controller, drive detection, hot plug detection, and many others!

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