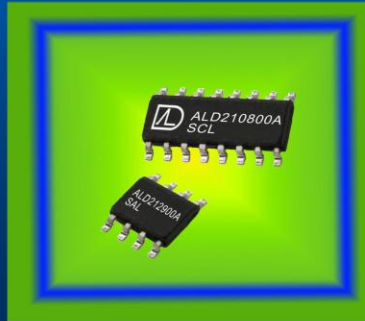




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ALD EPAD® MOSFET Arrays Introduce Revolutionary Control of Independent Devices



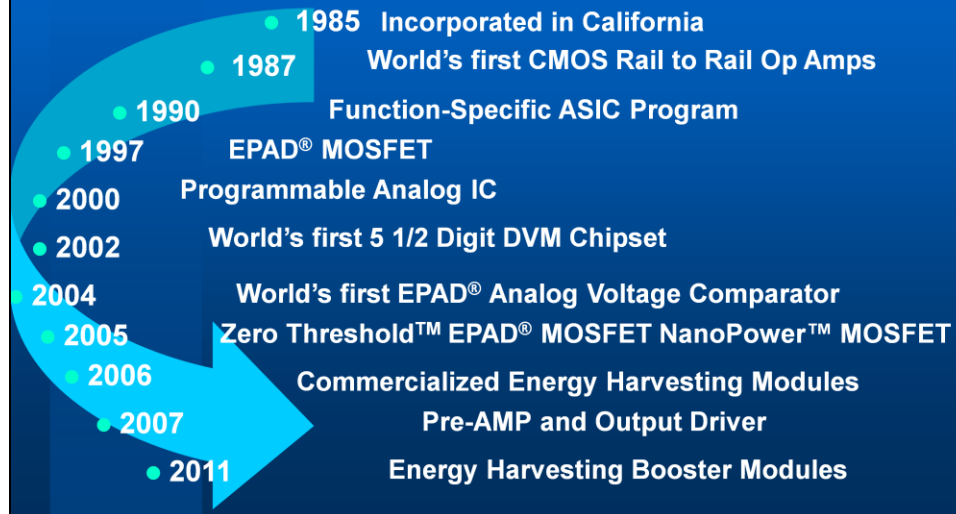
Today we are announcing our high precision N-channel Precision MOSFET. The part has a new infrastructure operation.



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ALD Milestones



ALD has invented and released many industry firsts in analog semiconductors.



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ALD210800A/ALD210800

Precision N-Channel EPAD[®] MOSFET Array

- **Industry's First Quad Zero-Threshold[™] MOSFET Array**
- **Enables Independent Control of Individual Devices**
- **Unprecedented Flexibility for Developing Energy Harvesting systems and Low-Power Mobile Devices**
 - *Zero Threshold[™] $V_{GS(th)} = 0.00\text{ V} \pm 0.01\text{ V}$*
 - *VOS ($V_{GS(th)}$ match) to 2mV / 10mV max.*
 - *Sub-threshold voltage (nano-power) operation*

This is the industry's first quad device with 4 fully independent individual device each with separate S, D, G terminals and controls. This provides unprecedented flexibility.



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ALD210800A/ALD210800

Enabling Revolutionary Analog Circuit Design

- <100 mV Min. operating voltage
- <1nA Min. operating current
- <1nW Min. operating power

Each MOSFET characterized by independent inputs and outputs

- Increases output current by greater than an order of magnitude
- Reduces size and weight of systems by shrinking MOSFET circuits up to 50 percent
- Decreases board real estate, circuit board complexity, cost and time to market
- Single chip full cascode current source and current mirror implementation

This new device is a technology enabler that enables a new level of precision and control, which is now possible. Many new types of products can now be developed. A few key features point towards greatly expanded ranges inside the circuit.



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Applications

Typical Zero Threshold Applications

- Reduce Number of Batteries Required for Mobile Devices
- Improving Energy Efficiency and Battery Life in Medical Devices
- Boosting Audio Sound Quality in High-End Headphones and Consumer Devices
- Redundant Power Systems
- Extending Operating Range for Energy Harvesting
- Enhancing Sensitivity in Sensor Arrays

Key points for this device are reduced operating voltages, reduced power consumption, and increased precision for all of the above.



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Circuit Building Blocks

Ideally Suited For:

- Current Mirrors
- Matching Circuits
- Current Sources
- Integrators
- Differential Amplifier Input Stages
- Transmission Gates
- Multiplexers
- Very Low Level Voltage Clamps
- Normally-On Nanopower Circuits

Many of these circuits have been built before, but not with the low voltage, low current ranges, and the precision this new MOSFET brings.

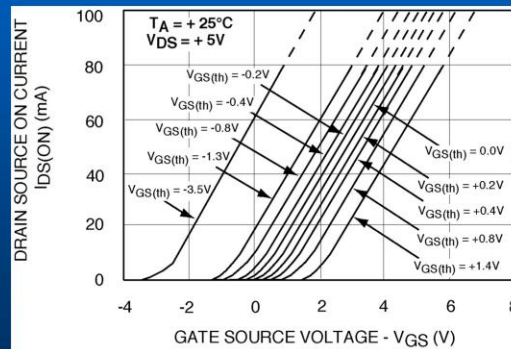


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Typical Performance Char.

Forward Transfer Characteristics



Here is a typical I_{DS} (output) vs V_{GS} (input) curve for this MOSFET product family. The vertical scale current range on this graph goes from 0 to 100 mA and gate voltage range goes from -4V to +8V (horizontal scale).

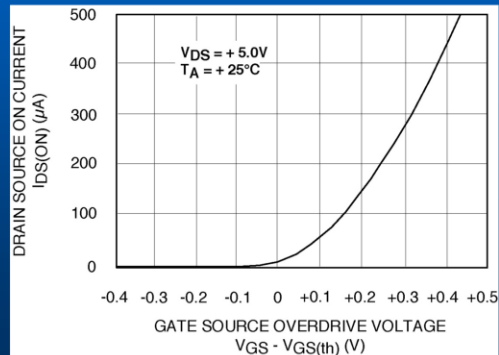


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Forward Transfer Characteristics Low Voltage



The same I_{DS} vs. V_{GS} curve at a low drain current range and low gate voltage range. Vertical scale is 0 to 500 μA , horizontal scale is -0.4V to +0.5V.

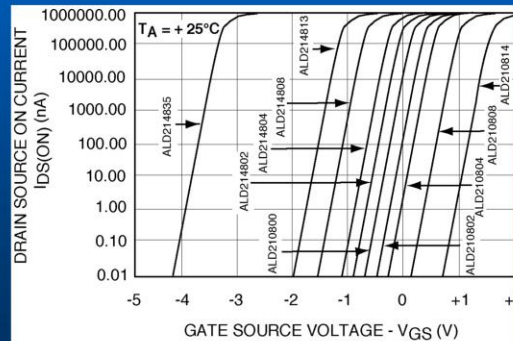


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Typical Performance Char.

Forward Transfer Characteristics Expanded (Sub-threshold)



Looking closer at the I_{DS} vs. V_{GS} curve but with a log drain current vertical axis and linear horizontal gate source voltages, the vertical axis is now from 0.01nA or 10pA, to 1,000,000 nA which translates into 1.0mA which is a tiny part of the first curve. This current range spans over eight orders of magnitude.

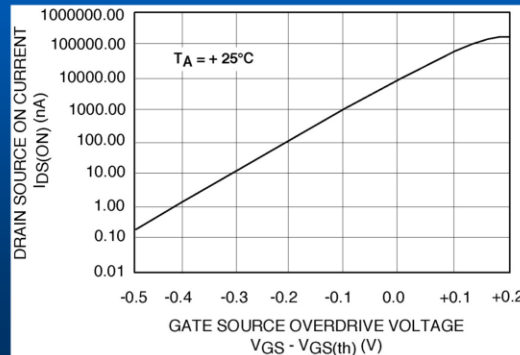


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Typical Performance Char.

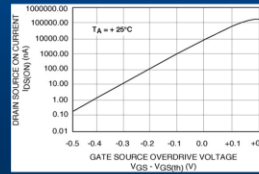
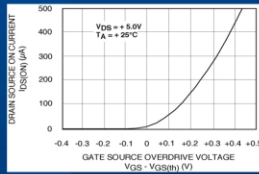
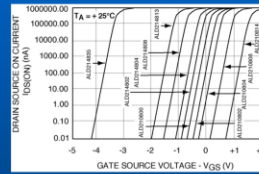
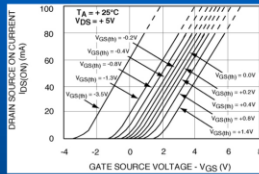
Forward Transfer Characteristics Further Expanded (Sub-threshold)



This graph describes exactly the same device and the same I_{DS} current vs. V_{GS} gate voltage relationship, except on a different horizontal unit scale. This gives yet another curve that looks different from the previous graphs.



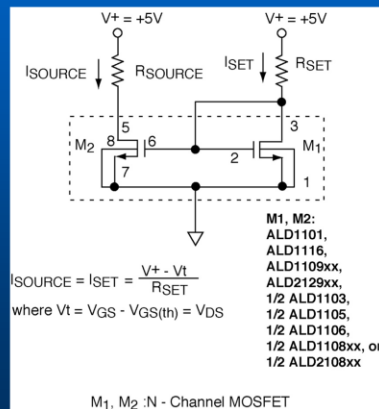
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This slide shows the four previous curves together and that the ALD210800 product has a truly huge dynamic current range, as well as the fine further expanded (sub-threshold) transfer characteristics.



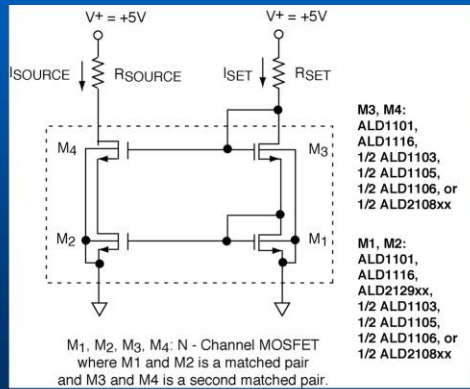
N-Channel Current Source



This is a simple circuit, with a basic current source and actual useful current and voltage range varies according to the device used. The new devices enable new specs. It offers absolute low currents involved at the voltage and precision.



Cascode Current Source



A full cascode current source can also be built with further expanded specs.
The entire circuit can be operated in deep sub-threshold mode.



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Summary

Thank You