A 0.47-1.6MW 5BIT 0.5-1GS/S TIME-INTERLEAVED SAR ADC FOR LOW-POWER RADIOS

This ADC is a 16-channel time-interleaved 5-bit ADC for UWB radios. Each slice is asynchronous Successive Approximation Register (SAR) core. Two relevant modes are supported: 1GS/s at 1V supply and 0.5GS/s at 0.75V supply. The ADC consumes 1.6mW and 0.47mW at the two modes, yielding 36 and 57 fJ/conversion-step FoM (Figure-of-Merit) respectively.

This ADC is an 16-channel time-interleaved 5-bit asynchronous SAR ADC for UWB radios. It proposes 400aF unit capacitors, offset calibration, a self-resetting comparator and a distributed clock divider to optimize the performance. Only a simple calibration of the channel-offset is needed while the other error sources (Gain mismatch error, time-skew error, etc.) are minimized by intrinsic design. The offset calibration settings are loaded via the on-chip SPI registers. And the outputs of the 16 channels (16×5bits) are multiplexed on-chip into 4 channels outputs (4×5bits) to save pad numbers. The offset calibration of the ADC is controlled by a digital SPI interface. There are 16 registers numbered 0 to 15. Register <n> is the ADC offset calibration for channel <n>. Each register can tune the channel offset from -7½ LSB to +7½ LSB.

KEY FEATURES:

- Outstanding Performance:
  - High throughput: 0.5GS/s and 1GS/s
  - INL/DNL below 0.1LSB
  - Small active area: 0.11mm²
  - Low supply: from 1V down to 0.75V
- Ultra Low Power:
  - 1.6mW for 1GS/s mode
  - 0.47mW for 0.5GS/s mode
  - Leakage below 1uW
  - Dynamic power consumption from DC to 1GS/s
- Highly Integrated:
  - 16 channel time-interleaved
  - Low time skew signal/clock distribution circuits
- Simple calibration:
  - Gain/Time skew mismatch immune
  - Offset calibration method simple

APPLICATIONS:

- Ultra-wideband radio communication
- Ultra-wideband radio localization
- Wireless sensor networks

MORE INFORMATION:

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After calibration, the measured INL/DNL are well below 0.1LSB.

**EVALUATION BOARDS**

Imec provides evaluation boards (EB) on request to prospective customers and partners interested in licensing imec’s radio designs and IP.

- **LUPUS EB**: allows complete evaluation of the ADC with the assistance of external FPGA board.

**IP AVAILABLE FOR LICENSING**

This technology is available for licensing. A Technology License Agreement (TLA) includes the following:

- ‘White box’ license on imec technology
- Technology transfer: designs, evaluation boards, and documentation
- Support during the transfer phase & the production phase

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**SPECIFICATIONS**

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<thead>
<tr>
<th>RESOLUTION (BITS)</th>
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<tbody>
<tr>
<td>SUPPLY (V)</td>
<td>0.75</td>
<td>1.0</td>
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<tr>
<td>POWER CONSUMPTION (µW)</td>
<td>0.47</td>
<td>1.6</td>
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<tr>
<td>SAMPLE FREQUENCY (GS/s)</td>
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<tr>
<td>ERBW (GHz)</td>
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<tr>
<td>FOM (fJ/CONVERSION.STEP)</td>
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<td>57</td>
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<tr>
<td>SIGNAL RANGE (Vpp, DIFF)</td>
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<tr>
<td>SAMPLING CAPACITANCE</td>
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<tr>
<td>AREA (MM²)</td>
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<tr>
<td>CALIBRATION</td>
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<td>PACKAGE</td>
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