ULTRALOW POWER VOLTAGE REGULATOR, SUPERVISORY, AND PMIC

For Wireless Sensor Nodes, Wearable (Health Monitoring Access), and Cloud Connected Gateways
Emerging “Internet of Things” Drives ULP Need

Internet of Things Powered by Energy Harvesting

- **Energy harvesting**
  - **ADP5090**: ULP boost charger with MPPT
- **Voltage regulation**
  - **ADP530x**: <0.2 μA I/Q buck regulator with supervisory
  - **ADP165**: <0.7 μA I/Q linear regulator

Internet of Things Powered by Battery

- **Voltage regulation**
  - **ADP530x**: <0.2 μA I/Q buck regulator with supervisory
  - **ADP165**: <0.7 μA I/Q linear regulator
- **Microcontroller reset**
  - **ADM8615**: <0.1 μA I/Q voltage supervisor and watchdog timer
- **Sensor output detection**
  - **ADCMP380**: <0.1 μA I/Q voltage comparator
Wearable Devices Supported by Ultralow Power System

- **Voltage regulation**
  - ADP5301: 180 nA I/Q buck regulator with supervisory in 1.6 mm × 1.8 mm
  - ADP165: 600 nA I/Q linear regulator

- **Li-Ion battery charger**
  - ADP5061: 220 nA I/Q USB compliance with power path in 2 mm × 2.5 mm

- **Energy harvesting**
  - ADP5090: 260 nA I/Q nanopower boost charger

- **Ultralow power supervisory**
  - ADM8641/ADM8642: 92 nA I/Q voltage detector
  - ACMP380: 92 nA I/Q voltage comparator

![Diagram of wearable devices and related components]
Microenergy Harvesting for Photovoltaic and Thermoelectric

Ultralow Power Regulator for Microenergy Harvesting

Analog Devices introduces ultralow power boost regulators for photovoltaic and thermoelectric energy harvesting systems. The ADP5090 optimizes efficient conversion of the harvested limited power down to the 15 µW to 1 mW range with best-in-class sub-µW operation losses. Programmable maximum power point tracking with harvester open circuit voltage sensing ensures that the most energy is extracted from the harvester. The 260 nA quiescent current used in deep sleep mode prolongs operation time with minimal loss in the absence of ambient energy. Integrated charge pump circuitry enables a cold start at 380 mV input voltage with no energy on the system node.

In addition to efficient ultralow power conversion, ADP5090 provides the best system design flexibility with support of charging different energy storage through external resistor programmability. An optional backup cell battery can be connected to the ADP5090 that intelligently manages and prioritizes power paths with fully integrated power switches. ADP5090 is capable of stopping a switcher within 10 µs delay to proceed transmitting data via an RF transceiver without interference by switching noise.

Photovoltaic Cell/ Solar Panel
- GaAs thin film: Alta Devices
- A-Silicon: Sanyo
- Dye sensitized solar cell: GCell, ElectricFilm

Thermoelectric Generator
- Thin film TEG—LairdTech eTEG HV56
- Buck TEG—Marlow eTEG HV56
ADP5090 Key Features

Ultralow Power Boost Regulator
- Hysteresis controller optimizes sub-1 mW efficiency
- Cold start from 16 μW at $V_{IN} = 380$ mV
- Ultralow quiescent current
  - $I/Q$ (sys) = 320 nA when $V_{IN} (OCV) > MINIOP$
  - $I/Q$ (sys) = 260 nA when $V_{IN} (OCV) < MINIOP$
- OCV (open circuit voltage) sensing maximum power point tracking
- Programmable MPPT ratio for PV or TEG
- Programmable switcher shutdown point (MINIOP)

Energy Storage Management
- Programmable charging termination voltage and shutdown voltage level to prevent over charging and over discharging
- Supports optional backup battery power path (primary cell battery)

RF Transmission Friendly
- Ability to shut down switcher temporarily via MCU communication

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Topology</th>
<th>Quiescent Current (Standby Current)</th>
<th>$V_{IN}$ Cold Startup Operating Range</th>
<th>Max Input Current (mA)</th>
<th>$V_\text{TERM}$</th>
<th>Shutdown Discharging Voltage</th>
<th>Accuracy Over Temperature (%)</th>
<th>Cell Type</th>
<th>Package</th>
<th>Price @ 1k (U.S.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADP5090</td>
<td>Switching/boost 320 nA (CBP &gt; MINIOP), 260 nA (CBP &lt; MINIOP)</td>
<td>80 mV to 3.3 V</td>
<td>380</td>
<td>100</td>
<td>2.2 to 5.2</td>
<td>2.0 V to $V_\text{TERM}$</td>
<td>3</td>
<td>SuperCap Li-Ion</td>
<td>3.0 mm × 3.0 mm, 16-lead LFCS</td>
<td>1.99</td>
</tr>
</tbody>
</table>

ADP5090 Evaluation Boards

ADP5090-1-EVALZ
- Flexibility to connect to any harvester, any battery, any backup energy storage, and any load with simple 2-lead connectors
- Test points for detailed product performance evaluation

ADP5090-2-EVALZ
- Plug and play with PV panel
- Easy connection to other harvesters
- Large pads allow different energy storage options
- Jumpers allow for different load voltage
- Backup CR2032 coin cell battery on back of board
Microenergy Harvesting for Piezoelectric

Diagram of Piezoelectric Energy Harvesting System

ADP5304 as Piezo Harvester PMU

Programmable VINPK Monitor Threshold as a Piezoelectric Harvester MPPT Point

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>VINOK monitor threshold = 2.05 V</td>
</tr>
<tr>
<td>1</td>
<td>VINOK monitor threshold = 2.10 V</td>
</tr>
<tr>
<td>2</td>
<td>VINOK monitor threshold = 2.15 V</td>
</tr>
<tr>
<td>3</td>
<td>VINOK monitor threshold = 2.20 V</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>VINOK monitor threshold = 3.00 V (default)</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>VINOK monitor threshold = 5.10 V</td>
</tr>
<tr>
<td>63</td>
<td>VINOK monitor threshold = 5.15 V</td>
</tr>
</tbody>
</table>

Typical Power and Voltage vs. Time

Tuned to 180 Hz, 0 Gram Tip Mass

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Topology</th>
<th>Configuration</th>
<th>Quiescent Current with No Load</th>
<th>$V_{IN}$ Operating Range (V)</th>
<th>$V_{OUT}$ Programmable Range</th>
<th>Max Output Current (mA)</th>
<th>VOUTOK (Power Good)</th>
<th>VINOK (Low Battery Warning)</th>
<th>Special Features</th>
<th>Package</th>
<th>Price @ 1k (U.S.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADP5304</td>
<td>Switching</td>
<td>1 x buck</td>
<td>180 nA ($V_{IN} = 4.2$ V)</td>
<td>2.05 to 6.5</td>
<td>Adjustable via single resistor with 32 level</td>
<td>500</td>
<td>N/A</td>
<td>N/A</td>
<td>Input power impedance match to support piezoharvesting power conversion</td>
<td>10-lead LFCS</td>
<td>0.95</td>
</tr>
</tbody>
</table>
Ultralow Power Switching Regulator

ADP5300/ADP5301/ADP5302/ADP5303: Ultralow Power Buck

Hysteretic/PWM mode controls for always alive rail and ultralow power microconverter/RF/sensor with voltage supervisory.

**Features**

- Ultralow power step-down regulator
  - 180 nA quiescent current in regulation with zero load
  - Excellent efficiency in sub-1 mW operation range
  - Adjustable/fixed output options via factory fuse
- Low output noise with fixed switching frequency
  - Selectable operation mode (FPWM or hysteretic)
  - Output current up to 500 mA under FPWM mode
  - 600 kHz or 1.2 MHz switching frequency and optional synchronization input from 400 kHz to 1.4 MHz
  - ±1.5% output voltage regulation accuracy
  - 100% duty cycle operation mode
- Flexible voltage supervisory
  - Monitor V\text{OUT} as PGOOD flag: ADP5300/ADP5301
  - Monitor V\text{IN} as LOW\_BAT indicator: ADP5302/ADP5303
  - Stop switching pin: ADP5300/ADP5302

**Input Voltage**

- Min: 2.05 V
- Max: 6.50 V

**Efficiency @ V\text{IN} = 4.2 V**

- 82% at 10 μA @ 1.8 V
- 90% at 15 mA @ 1.8 V
- 90% at 400 mA @ 1.8 V

**Programmability**

- Resistor adjustable or factory trimming

**Package Options**

- 10-lead LFCSP (3 mm × 3 mm)
- 9-lead WLCSP (1.65 mm × 1.87 mm)

**Applications**

- Always alive power rail in portable devices
- Batteries/energy harvester powered devices

**Flexible Voltage Monitoring Features**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Topology</th>
<th>Configuration</th>
<th>Quiescent Current with No Load</th>
<th>V\text{IN} Operating Range (V)</th>
<th>V\text{OUT} Programmable Range</th>
<th>Max Output Current (mA)</th>
<th>VOUTOK (Power Good)</th>
<th>VINOK (Low Battery Warning)</th>
<th>Special Features</th>
<th>Package</th>
<th>Price @ 1k (U.S.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADP5300</td>
<td>Switching</td>
<td>1 × buck</td>
<td>180 nA (V\text{IN} = 4.2 V)</td>
<td>2.05 to 6.5</td>
<td>Adjustable via single resistor with 32 level</td>
<td>500</td>
<td>Yes</td>
<td>N/A</td>
<td>Selectable hysteretic or FPWM mode, optional sync clocking, quick output discharge option</td>
<td>10-lea LFCS</td>
<td>0.95</td>
</tr>
<tr>
<td>ADP5301</td>
<td>Switching</td>
<td>1 × buck</td>
<td>180 nA (V\text{IN} = 4.2 V)</td>
<td>2.05 to 6.5</td>
<td>Adjustable via single resistor with 32 level</td>
<td>500</td>
<td>Yes</td>
<td>N/A</td>
<td>Selectable hysteretic or FPWM mode, optional sync clocking, quick output discharge option</td>
<td>9-ball WLCSP</td>
<td>0.95</td>
</tr>
<tr>
<td>ADP5302</td>
<td>Switching</td>
<td>1 × buck</td>
<td>280 nA (V\text{IN} = 4.2 V)</td>
<td>2.05 to 6.5</td>
<td>Adjustable via single resistor with 32 level</td>
<td>500</td>
<td>N/A</td>
<td>Yes</td>
<td>Selectable hysteretic or FPWM mode, optional sync clocking, quick output discharge option</td>
<td>10-lea LFCS</td>
<td>0.95</td>
</tr>
<tr>
<td>ADP5303</td>
<td>Switching</td>
<td>1 × buck</td>
<td>280 nA (V\text{IN} = 4.2 V)</td>
<td>2.05 to 6.5</td>
<td>Adjustable via single resistor with 32 level</td>
<td>500</td>
<td>N/A</td>
<td>Yes</td>
<td>Selectable hysteretic or FPWM mode, optional sync clocking, quick output discharge option</td>
<td>9-ball WLCSP</td>
<td>0.95</td>
</tr>
</tbody>
</table>
# Ultralow Power Linear Regulator

## ADP165/ADP166 Very Low Quiescent Current 150 mA LDO with Pass Through Mode

### Features
- **Very low quiescent current**
  - $I/Q = 560 \text{ nA}$ with $0 \mu\text{A}$ load
  - $I/Q = 860 \text{ nA}$ with $1 \mu\text{A}$ load
- **Maintains very low quiescent current in dropout (pass through mode):**
  - $I/Q_{\text{DROP}} = 780 \text{ nA}$ with $0 \mu\text{A}$ load
  - $I/Q_{\text{DROP}} = 1200 \text{ nA}$ with $1 \mu\text{A}$ load
- **Stable with $1 \mu\text{F} \pm 30\%$ ceramic input and output capacitors**
- **Maximum load current ($I_{\text{LOAD\_MAX}}$):** 150 mA
- **Input voltage range:** 2.2 V to 5.5 V
- **Low shutdown current:** 50 nA typical
- **Low dropout voltage:** 120 mV at 150 mA load

### Applications—Always On Power for RTC and Sequencers
- Portable and battery operated equipment
- Wireless system network
- **Initial output voltage accuracy:** $\pm1\%$
- **Accuracy over line, load, and temperature:** $\pm3.5\%$
- **Seven fixed output voltage options:** 1.2 V to 3.3 V
- **Adjustable output option can be set from 1.2 V to 4.2 V**
- **PSRR performance of 72 dB at 100 Hz, $V_{\text{OUT}} = 1.2$ V**
- **Current-limit and thermal overload protection**
- **Logic control enable**
- **Integrated output discharge resistor—ADP165 only**

### Part Number Table

<table>
<thead>
<tr>
<th>Part Number</th>
<th>$V_{\text{IN}}$ Range (V)</th>
<th>$V_{\text{OUT}}$ Options or Adj Range (V)</th>
<th>$I_{\text{OUT}}$ (mA)</th>
<th>Supply Current No Load Typical (μA)</th>
<th>Supply Current Full Load Typical (μA)</th>
<th>Quick Output Discharge</th>
<th>Pass-Through Mode</th>
<th>RMS Noise @ 10 Hz to 100 kHz (μV rms)</th>
<th>PSRR @ 1 MHz (dB)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADP160</td>
<td>2.2 to 5.5</td>
<td>Fixed: 1.2 to 4.2</td>
<td>150</td>
<td>0.56</td>
<td>42</td>
<td>Yes</td>
<td>No</td>
<td>80</td>
<td>25</td>
<td>5-lead TSOT, 1 mm x 1 mm, 4-ball WLCSP</td>
</tr>
<tr>
<td>ADP161</td>
<td>2.2 to 5.5</td>
<td>Adjustable: 1.2 to 4.2</td>
<td>150</td>
<td>0.56</td>
<td>42</td>
<td>Yes</td>
<td>No</td>
<td>80</td>
<td>25</td>
<td>5-lead TSOT</td>
</tr>
<tr>
<td>ADP162</td>
<td>2.2 to 5.5</td>
<td>Fixed: 1.2 to 4.2</td>
<td>150</td>
<td>0.56</td>
<td>42</td>
<td>No</td>
<td>No</td>
<td>80</td>
<td>25</td>
<td>5-lead TSOT</td>
</tr>
<tr>
<td>ADP163</td>
<td>2.2 to 5.5</td>
<td>Adjustable: 1.2 to 4.2</td>
<td>150</td>
<td>0.56</td>
<td>42</td>
<td>No</td>
<td>No</td>
<td>80</td>
<td>25</td>
<td>5-lead TSOT</td>
</tr>
<tr>
<td>ADP165 <em>New</em></td>
<td>2.2 to 5.5</td>
<td>Fixed: 1.2 to 4.2, adjustable: 1.0 to 4.2</td>
<td>150</td>
<td>0.59</td>
<td>42</td>
<td>Yes</td>
<td>Yes</td>
<td>80</td>
<td>25</td>
<td>5-lead TSOT, 2 mm x 2 mm, 6-ball WLCSP</td>
</tr>
<tr>
<td>ADP166 <em>New</em></td>
<td>2.2 to 5.5</td>
<td>Fixed: 1.2 to 4.2, adjustable: 1.0 to 4.2</td>
<td>150</td>
<td>0.59</td>
<td>42</td>
<td>No</td>
<td>Yes</td>
<td>80</td>
<td>25</td>
<td>5-lead TSOT, 2 mm x 2 mm, 6-ball WLCSP</td>
</tr>
</tbody>
</table>
Analog Devices introduces a new ultralow power regulator, the ADPS310, which consumes extremely little current during voltage regulation. It generates superior efficiency, particularly in ultralight load condition such as sub-1 mW compared with other dc-to-dc switches. For battery-powered applications where systems need to be always on but consuming current as low as ten microamps. Unlike traditional PSM (power saving mode), which still consumes tens of microamp quiescent current, ADPS310 has only 600 nA I/Q, which enables the efficient conversion of up to a tens of microamps load.

Moreover, the ADPS310 is equipped with a selectable forced PWM mode that allows for low noise output voltage when powering an analog sensitive load. ADPS310 benefits battery-powered systems with an extended battery life and offers high efficiency in standby mode and active mode. The ADPS310 also mitigates noise interference with analog loads.

### Output Current vs. Part Number

![Graph showing output current vs. Part Number](image-url)

### Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Topology</th>
<th>Configuration</th>
<th>Quiescent Current (CH2 in regulation; CH1 = CH3 = Off)</th>
<th>$V_{IN}$ Operating Range</th>
<th>$V_{OUT}$ Programmable Range</th>
<th>Max Output Current</th>
<th>Special Features</th>
<th>Package</th>
<th>Price @ 1k (S/J)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADPS310</td>
<td>Switching</td>
<td>2 × buck 1 × load switch</td>
<td>620 nA ($V_{IN} = 6.0$ V)</td>
<td>2.7 V to 15.0 V</td>
<td>CH1: 1.2 V, 1.5 V, 1.8 V, 2.5 V, 2.85 V, 3.3 V, 5 V or adjustable</td>
<td>CH2: 1.2 V to 5.0 V (50 mV per step) or adjustable</td>
<td>Selectable hysteretic or FPWM mode, optional sync clocking, quick output discharge option</td>
<td>16-lead TSSOP-EP</td>
<td>1.99</td>
</tr>
</tbody>
</table>

ULP micro-PMU for smart metering RF module.

ULP micro-PMU for low power DSP companion.
Ultralow Power Supervisory: Reset and Watchdog Timer

Ultralow Power Supervisory

- Lowest power consumption in the industry
- <125 nA power consumption over temperature
- Precision monitoring
- ±1.5% threshold accuracy
- Supervisor, comparator, and reference
- Based on switched capacitor architecture for the reference and divider
- Real-time response (not a sampled architecture)

Ultralow Power Monitoring Portfolio

ADM861x Selection Table

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Low Voltage Monitoring</th>
<th>Manual Reset</th>
<th>Watchdog Timer</th>
<th>Watchdog Disable Input</th>
<th>Watchdog Timeout Selection Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADM8611</td>
<td>—</td>
<td>Yes</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>ADM8612</td>
<td>Yes</td>
<td>Yes</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>ADM8613</td>
<td>—</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ADM8614</td>
<td>—</td>
<td>—</td>
<td>Yes</td>
<td>Yes</td>
<td>—</td>
</tr>
<tr>
<td>ADM8615</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>—</td>
<td>Yes</td>
</tr>
</tbody>
</table>

125 nA Max Supply Current

Reset Thresholds from 1.8 V to 4.63 V

Watchdog Timers

WLCSP Packaging
ADM8611/ADM8612 Ultralow Power Microprocessor Supervisory with Manual Reset

**Features**

- Ultralow power consumption ICC = 92 nA (typ)
- Continuous monitoring with no blank time
- Precision, low voltage monitoring down to 0.5 V
- Pretrimmed monitoring threshold options
  - 10 options from 2 V to 4.63 V for ADM8611
  - 20 options from 0.5 V to 1.9 V for ADM8612
- ±1.3% threshold accuracy over full temperature range
- Manual reset input
- 200 ms (typical) reset timeout
- Low voltage input monitoring down to 0.5 V (ADM8612)
- Active low, open-drain reset output
- Power supply glitch immunity
- Available in 1.46 mm × 0.96 mm WLCSP
- Operational temperature range: −40°C to +85°C

### Part Number | Reset Threshold (V) | Min Reset Timeout (ms) | Reset Output Stage | Manual Reset Capability | Supply Current Typ (μA) | Typ Watchdog Timeout (ms) | Package | Price @ 1k (U.S.)
--- | --- | --- | --- | --- | --- | --- | --- | ---
ADM8611 | 2 to 4.63 | 140 | Open-drain | Yes | 0.092 | — | 1.5 mm × 1 mm, 6-ball WLCSP | 0.39
ADM8612 | 0.6 to 1.9 | 140 | Open-drain | Yes | 0.092 | — | 1.5 mm × 1 mm, 6-ball WLCSP | 0.42

ADM8613/ADM8614/ADM8615 Ultralow Power Microprocessor Supervisory with Watchdog Timer

**Features**

- Ultralow power consumption with ICC = 92 nA (typ)
- Continuous monitoring with no blank time
- Precision, low voltage monitoring down to 0.5 V
- Pretrimmed monitoring threshold options
  - 20 options from 0.5 V to 1.9 V for ADM8615
  - 5 options from 2.32 V to 4.63 V for ADM8613/ADM8614
- ±1.3% threshold accuracy over full temperature range
- Manual reset input
- 200 ms (typical) reset timeout
- Low voltage input monitoring down to 0.5 V
- Available in 1.46 mm × 0.96 mm WLCSP
- Operational temperature range: −40°C to +85°C
- Watchdog timer
- Watchdog function disable input
- Watchdog timeout extension input
- Active low, open-drain RESET output
- Power supply glitch immunity

### Part Number | Reset Threshold (V) | Min Reset Timeout (ms) | Reset Output Stage | Supply Current Typ (μA) | Typ Watchdog Timeout (ms) | Package | Price @ 1k (U.S.)
--- | --- | --- | --- | --- | --- | --- | ---
ADM8613 | 2.32 to 4.63 | 140 | Open-drain | 0.092 | 1600/25,600 | 1.5 mm × 1 mm, 6-ball WLCSP | 0.59
ADM8614 | 2.32 to 4.63 | 140 | Open-drain | 0.092 | 1600/100,000 | 1.5 mm × 1 mm, 6-ball WLCSP | 0.59
ADM8615 | 0.5 to 1.9 | 140 | Open-drain | 0.092 | 1600/25,600 | 1.5 mm × 1 mm, 6-ball WLCSP | 0.59
Ultralow Power Supervisory: Voltage Detector and Comparator

**ADM8641/ADM8642 Ultralow Power Voltage Detector**

**Features**
- Ultralow power consumption with ICC = 92 nA (typical)
- Precision low voltage monitoring
- Pretrimmed monitoring threshold options
- 10 options from 2 V to 4.63 V for the ADM8641
  - 20 options from 0.5 V to 1.9 V for the ADM8642
- ±1.2% threshold accuracy over full temperature range
- Output disable input
- 23 μs to 26 μs typical propagation delay
- Open-drain type output
- Power supply glitch immunity
- Available in a 1.46 mm × 0.96 mm WLCSP
- Operational temperature range: −40°C to +85°C

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Reset Threshold (V)</th>
<th>Min Reset Timeout (ms)</th>
<th>Reset Output Stage</th>
<th>Manual Reset Capability</th>
<th>Supply Current Typ (μA)</th>
<th>Package</th>
<th>Price @ 1k ($U.S.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADM8641</td>
<td>2 to 4.63</td>
<td>0</td>
<td>Open-drain</td>
<td>Yes</td>
<td>0.092</td>
<td>1.5 mm × 1 mm, 16-lead WLCSP</td>
<td>0.25</td>
</tr>
<tr>
<td>ADM8642</td>
<td>0.6 to 1.9</td>
<td>0</td>
<td>Open-drain</td>
<td>Yes</td>
<td>0.092</td>
<td>1.5 mm × 1 mm, 16-lead WLCSP</td>
<td>0.25</td>
</tr>
</tbody>
</table>

**ADCMP380 Ultralow Power Voltage Comparator with Reference**

**Features**
- Comparator with on-chip reference
- Ultralow power consumption with ICC = 92 nA (typical)
- Precision low voltage monitoring to 0.5 V
- Accurate internal reference level over full temperature range
  - ±1.6% at 1 V
  - ±2.2% at 0.5 V
- Enable input
- 23 μs typical propagation delay
- Open-drain type output
- Input glitch immunity
- Available in a 1.46 mm × 0.96 mm WLCSP
- Operational temperature range: −40°C to +85°C

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Internal Reference</th>
<th>Reference Accuracy (%)</th>
<th>Supply Voltage (V)</th>
<th>Supply Current Typ (μA)</th>
<th>Input Range (V)</th>
<th>Propagation Delay Typ (μs)</th>
<th>Hysteresis</th>
<th>Logic I/O</th>
<th>Package</th>
<th>Price @ 1k ($U.S.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADCMP380</td>
<td>Yes</td>
<td>1.60</td>
<td>2.0 to 5.5</td>
<td>0.092</td>
<td>0 to 5.5</td>
<td>23</td>
<td>Internal</td>
<td>Open-drain</td>
<td>1.46 mm × 0.96 mm, 16-lead WLCSP</td>
<td>0.39</td>
</tr>
</tbody>
</table>