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
  - 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

ADP5061
Tiny Linear USB Battery Charger with 0.22 μA I/Q and Power Path Management

ADP5301
ULP Buck (Step-Down) Regulator with 0.18 μA I/Q and Dual-Mode Operation

ADP5090
ULP Boost for Low VIN/Micro Energy Harvesting

ADP165
ULP Linear Regulator with 0.6 μA I/Q and Pass-Through Mode

ADuCM350
Sensor Hub (Always On)

ADXL362
ULP Accelerometer (<1 μA Standby)

Bluetooth® Low Energy RF Transceiver

Photovoltaic (Light) Harvester

Thermoelectric (Heat) Harvester

<100 mAh Li-Ion Rechargeable Battery

Cable or Wall Charger
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 (MINOP)

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 (mV)</th>
<th>Max Input Current (mA)</th>
<th>Termination Charging Voltage (V)</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</td>
<td>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>2.0 V to $V_{TERM}$</td>
<td>3</td>
<td>SuperCap Li-Ion</td>
<td>3.0 mm × 3.0 mm, 16-lead LF CSP</td>
<td>1.99</td>
</tr>
</tbody>
</table>

ADP5090 Evaluation Boards

- 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**

- Handles high output impedance from piezoelectric harvester—ADP5304 programmable VINOK with hysteretic window as MPPT scheme to enable/disable DIS_SW
- Optimizes pass through mode \( V_{IN} = V_{OUT} \)—ADP5304 to support 100% duty cycle

**Programmable VINPK Monitor Threshold as a Piezoelectric Harvester MPPT Point**

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

**Part Number** | **Topology** | **Configuration** | **Quiescent Current with No Load** | **V_{IN} Operating Range (V)** | **V_{OUT} Programmable Range** | **Max Output Current (mA)** | **VOUTOK (Power Good)** | **VINOK (Low Battery Warning)** | **Special Features** | **Package** | **Price @ 1k (U.S.)** |
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ADP5304</td>
<td>Switching</td>
<td>1 × 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 \( V_{\text{O}} \) 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 @ \( V_{\text{IN}} = 4.2 \text{ V} \)

- 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 device 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>
</tr>
</thead>
<tbody>
<tr>
<td>ADP5300</td>
<td>Switching</td>
<td>1 × buck</td>
<td>180 nA (( V_{\text{IN}} = 4.2 \text{ 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-lead LFCSP</td>
</tr>
<tr>
<td>ADP5301</td>
<td>Switching</td>
<td>1 × buck</td>
<td>180 nA (( V_{\text{IN}} = 4.2 \text{ 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>
</tr>
<tr>
<td>ADP5302</td>
<td>Switching</td>
<td>1 × buck</td>
<td>280 nA (( V_{\text{IN}} = 4.2 \text{ 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-lead LFCSP</td>
</tr>
<tr>
<td>ADP5303</td>
<td>Switching</td>
<td>1 × buck</td>
<td>280 nA (( V_{\text{IN}} = 4.2 \text{ 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>
</tr>
</tbody>
</table>

Efficiency graph:

- ADP5300 superior efficiency in ultralight load with a step-down range of 4.2 V to 1.8 V.
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 nA with 0 µA load
  - I/Q = 860 nA with 1 µA load
- Maintains very low quiescent current in dropout (pass through mode):
  - I/Q_DROP = 780 nA with 0 µA load
  - I/Q_DROP = 1200 nA with 1 µA load
- Stable with 1 µF ± 30% ceramic input and output capacitors
- Maximum load current (ILOAD_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
- Metering
- Weigh scales

### Table: ADP165/ADP166 Part Numbers and Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>VIN Range (V)</th>
<th>VOUT Options or Adj Range (V)</th>
<th>IOUT (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)</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, 1 mm x 1 mm, 4-ball WLCSP</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</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 LFCSP, 1 mm x 1 mm, 4-ball WLCSP</td>
</tr>
<tr>
<td>ADP166</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 LFCSP, 1 mm x 1 mm, 4-ball WLCSP</td>
</tr>
</tbody>
</table>
Ultralow Power PMIC

Analog Devices introduces a new ultralow power regulator, the ADP5310, 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, ADP5310 has only 600 nA I/Q, which enables the efficient conversion of up to a tens of microamps load.

Moreover, the ADP5310 is equipped with a selectable forced PWM mode that allows for low noise output voltage when powering an analog sensitive load. ADP5310 benefits battery-powered systems with an extended battery life and offers high efficiency in standby mode and active mode. The ADP5310 also mitigates noise interference with analog loads.

ULP micro-PMU for smart metering RF module.

ULP micro-PMU for low power DSP companion.

### Part Number Topology Configuration Quiescent Current (CH2 in regulation; CH1 = CH3 = Off) V\(_{\text{IN}}\) Operating Range V\(_{\text{OUT}}\) Programmable Range Max Output Current Special Features Package Price @ 1k (U.S.)

<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(_{\text{IN}}) Operating Range</th>
<th>V(_{\text{OUT}}) Programmable Range</th>
<th>Max Output Current</th>
<th>Special Features</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADP5310</td>
<td>Switching (buck)</td>
<td>2 × buck 1 × load switch</td>
<td>620 nA (V(_{\text{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 CH2: 1.2 V to 5.0 V (50 mV per step) or adjustable</td>
<td>CH1: 800 mA CH2: 300 mA</td>
<td>Selectable hysteretic or FPWM mode, optional sync clocking, quick output discharge option</td>
<td>16-lead TSSOP-EP</td>
</tr>
</tbody>
</table>
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>—</td>
</tr>
<tr>
<td>ADM8614</td>
<td>—</td>
<td>—</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ADM8615</td>
<td>Yes</td>
<td>Yes</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
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

<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>Typ Watchdog Timeout (ms)</th>
<th>Package</th>
<th>Price @ 1k (U.S.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADM8611</td>
<td>2 to 4.63</td>
<td>140</td>
<td>Open-drain</td>
<td>Yes</td>
<td>0.092</td>
<td>—</td>
<td>1.5 mm × 1 mm, 6-ball WLCSP</td>
<td>0.39</td>
</tr>
<tr>
<td>ADM8612</td>
<td>0.6 to 1.9</td>
<td>140</td>
<td>Open-drain</td>
<td>Yes</td>
<td>0.092</td>
<td>—</td>
<td>1.5 mm × 1 mm, 6-ball WLCSP</td>
<td>0.42</td>
</tr>
</tbody>
</table>

ADM8663/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

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

ADM8641/ADM8642 Ultralow Power Voltage Detector

**Features**

- Ultralow power consumption with
  
  \[ \text{ICC} = 92 \text{ nA (typical)} \]
- 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
  
  \[ ±1.6\% \text{ at } 1 \text{ V} \]
  
  \[ ±2.2\% \text{ at } 0.5 \text{ V} \]
- 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>

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BR13099.2-9/15

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