Volume MEMS and Analog Division (VMA)

Health and Wellness
Mobility
Cloud computing

June 2015
Where VMA products can bring **added value** for **HEALTH AND WELLNESS**?

- **Gesture recognition by electromyography**
  - Op Amp
  - TSZ124IQ4T
  - [ppt](#) - [www](#)

- **Heart rate monitoring by light reflection**
  - Op Amp
  - TSV711ICT
  - [ppt](#) - [www](#)

- **Battery monitoring**
  - Gas Gauge
  - STC3115AIJT
  - [ppt](#) - [www](#)

STMicroelectronics - Anthony Boimond
Gesture recognition by electromyography

The measurement of muscles electrical activity appears as a fascinating new way to interface with machines. Simple analog processing allows gesture recognition by wearable devices.

**CONTEXT**

The measurement of muscles electrical activity appears as a fascinating new way to interface with machines. Simple analog processing allows gesture recognition by wearable devices.

**HOW DOES IT WORK?**

Surface EMG signals are amplified by op amp in instrumentation configuration, then rectified and filtered to provide feedback to digital system.

**ST OFFER**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input offset voltage (V_{io} &lt; 5 \mu V \text{ @}25^\circ C) (V_{io} &lt; 8 \mu V \text{ -40 to 125}^\circ C)</td>
<td>Excellent measurement without trimming</td>
</tr>
<tr>
<td>Input offset voltage drift (\Delta V_{io}/\Delta T \text{ 30nV}/^\circ C \text{ max})</td>
<td>Stability of measurement versus temperature change</td>
</tr>
<tr>
<td>Input bias current (\text{lib &lt; 200 pA})</td>
<td>Compatible with high impedance sensor</td>
</tr>
</tbody>
</table>

Op Amp – Zero Drift

TSZ124IQ4T
Heart rate monitor by light reflection

The heart rate monitoring is one of the first physiological parameter for health monitoring devices first application of the quantified self movement.

HOW DOES IT WORK?

The LED emits light into the skin of the user. The reflected light - synchronized with heart pulses - is measured by op amp in trans impedance configuration.

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<th>Feature</th>
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<tr>
<td>Input bias current</td>
<td>Maintains excellent accuracy by not affecting diode current</td>
</tr>
<tr>
<td>( \text{I}_{\text{ib}} &lt; 10 \text{ pA} @ 25^\circ\text{C} )</td>
<td>( \text{I}_{\text{ib}} &lt; 300\text{pA} @ 125^\circ\text{C} )</td>
</tr>
<tr>
<td>Supply voltage range</td>
<td>Compatible with wide choice of supplies</td>
</tr>
<tr>
<td>1.5 to 5.5V</td>
<td>SC70-5 2mm x 2mm</td>
</tr>
<tr>
<td>Op Amp – Micro Power</td>
<td>Micro package with leads for optimized form factor and soldering on flex PCB</td>
</tr>
</tbody>
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TSV711ICT

STMicroelectronics - Anthony Boimond
Battery monitoring

Lithium-ion and Lithium-polymer are the leading technologies for portable energy storage, and they require dedicated monitoring circuit to operate safely and to provide accurate estimation of remaining use time.

HOW DOES IT WORK?

The OptimGauge™ algorithm combines battery physical measurements to provide an accurate State of Charge indication.

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- **Feature**: Voltage mode only configuration
  - **Benefit**: 3% accuracy of battery state of charge, no need for shunt resistor
- **Feature**: Initial open circuit voltage (OCV) measurement
  - **Benefit**: Accurate estimation of battery state of charge at power up
- **Feature**: 1.4 x 2.0 mm 10-bump Flip Chip
  - **Benefit**: Minimum form factor

Gas Gauge

STC3115AIJT

STMicroelectronics - Anthony Boimond
Where VMA products can bring added value for **MOBILITY**?

- Infrared emitter receiver for remote control
  - Op Amp TSV991AIQ2T
  - [ppt - www](#)

- Battery monitoring Gas Gauge
  - STC3115AIQT
  - [ppt - www](#)

- Active Noise Cancellation MEMS Microphone
  - MP34DT01
  - [ppt - www](#)

- Screen of death recovery Smart Reset
  - STM6519
  - [ppt - www](#)
Infrared emitter receiver

Smartphone is the electronic counterpart of the Swiss Army Knife: why not to use it as Infrared Remote Controls at home for TV sets or air conditioning? Op amps enable easy implementation of this feature.

**HOW DOES IT WORK?**

The photodiode generates a reverse current proportional to the amount of light. This current is converted into voltage and amplified by op amp.

**CONTEXT**

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</tr>
<tr>
<td>$I_{ib} &lt; 100\text{pA} @ 125\degree C$</td>
<td></td>
</tr>
<tr>
<td>Slew rate $10 \text{ V/µs}$</td>
<td>Compatible transmission frequency</td>
</tr>
<tr>
<td>DFN8 2mm*2mm (0.6mm thickness)</td>
<td>Shrinks device form factor</td>
</tr>
</tbody>
</table>

**Op Amp**

TSV991AIQ2T

AN4451

**STMicroelectronics - Anthony Boimond**
Active Noise Cancellation

Silicon membrane microphones enable the multiplication of sound sensors and new applications as stereo recording, ambient noise reduction and active noise cancellation.

An array of microphones are working together to provide omnidirectional sound recording.

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Feature
AOP: 120dB SPL
SNR: 63dB
Sensitivity: -26 dBFS

Benefit
Outstanding audio performances

Stability of performances after soldering and drop test
Easy manufacturing and customer satisfaction during product lifetime

SMD package
3.0 x 4.0 x 1.0 mm
Enables application minimum form factor

MEMS Microphone
MP34DT01

HOW DOES IT WORK?

An array of microphones are working together to provide omnidirectional sound recording.

AN4041 AN4426

CODEC

Vdd 1.8V
100nF 1µF

1 Vdd
3 CLK
4 DOUT
5 GND

1 Vdd
3 CLK
4 DOUT
5 GND

Vdd
Lithium-ion and Lithium-polymer are the leading technologies for portable energy storage, and they require dedicated monitoring circuit to operate safely and to provide accurate estimation of remaining use time.

The OptimGauge™ algorithm combines battery physical measurements to provide an accurate State of Charge indication.

**Feature**
- Coulomb counter and voltage-mode gas gauge
- Initial open circuit voltage (OCV) measurement

**Benefit**
- 1% accuracy of battery state of charge
- Accurate estimation of battery state of charge at power up

**ST OFFER**
- DFN10
  - 2.0 x 3.0 x 0.55 mm
- Minimum form factor
- STC3115AIQT

**CONTEXT**
- Lithium-ion and Lithium-polymer are the leading technologies for portable energy storage, and they require dedicated monitoring circuit to operate safely and to provide accurate estimation of remaining use time.
Single push-button Smart Reset

The recovery of devices freeze by long push on hardware key or combination of several keys is now fully integrated into users’ culture.

**HOW DOES IT WORK?**

- **STM6519**
  - VCC
  - RST
  - SR
  - VSS

**MCU**
- VCC
- RESET
- INT/NMI
- VSS

**ST OFFER**

<table>
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<tr>
<th>Feature</th>
<th>Benefit</th>
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<tr>
<td>Extended Smart Reset input delay time</td>
<td>No system reset by inadvertent short reset push-button closures</td>
</tr>
<tr>
<td>Low supply current 1 μA</td>
<td>Zero impact on application lifetime</td>
</tr>
<tr>
<td>DFN6 1.00 mm x 1.45 mm</td>
<td>Minimum form factor</td>
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**Feature**

- **Feature**: Extended Smart Reset input delay time
- **Benefit**: No system reset by inadvertent short reset push-button closures
- **Feature**: Low supply current 1 μA
- **Benefit**: Zero impact on application lifetime
- **Feature**: DFN6 1.00 mm x 1.45 mm
- **Benefit**: Minimum form factor

**STM6519**

- VCC
- RST
- SR
- VSS

**Smart reset**

STMicroelectronics - Anthony Boimond
Where VMA products can bring added value for CLOUD COMPUTING?

Server Power: output current measurement
Op Amp TSX711ILT
ppt · www

Server Power: PFC current measurement
Op Amp TSX921ILT
ppt · www

Mother board voltage regulator
Op Amp TSX561AICT
ppt · www

Hard disk drive protection
Op Amp TSV631AICT
ppt · www
Power Factor Correction is required by government regulation for server power supplies. Additionally, the trend in power electronics is to implement digital controllers, which are efficiently seconded by op amps.

The current of the power Mosfet is measured by a shunt resistor. The resulting voltage drop is amplified and filtered by the op amp and feedback to the controller.

**Feature** | **Benefit**
--- | ---
Supply voltage range 4 to 16V | Same power supply as PWM controller
Gain Bandwidth Product 10 MHz | Real-time current measurement
SOT23-5 package | Small form factor and optimal solderability

Op Amp – 16V CMOS TSX921ILT
Server Power: output current measurement

The electrical power required by servers is exponential. It implies fast protections against abnormal currents, accurate balance between redundant power supplies and feedback of current value to digital.

**HOW DOES IT WORK?**

The output current of the power supply is measured on low-side by a shunt resistor. The resulting voltage drop is amplified by op amp.

**Feature**

- **Supply voltage range**: 2.7 to 16V
- **Input offset voltage**
  - $V_{io} < 200 \, \mu V @ 25^\circ C$
  - $V_{io} < 460 \, \mu V \, -40 \, \text{to} \, 85^\circ C$
- **SOT23-5 package**

**Benefit**

- Direct supply by 12V output line
- Minimizes shunt resistor cost
- Small form factor and optimal solderability

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- Op Amp – 16V CMOS
- TSX711ILT

*UM1737*
State of the art hard disk drives are rotating at tremendous velocity, with reading heads as close as possible to the disk platter in order to optimize the reading speed. Every shock needs to be detected to protect platter.

The shock is detected by a piezo sensor, creating an electrical charge at its electrodes. The charge is converted into voltage and amplified by op amp.

### HOW DOES IT WORK?

1. **Piezo Sensor**: A piezo sensor detects the shock and generates an electrical charge.
2. **Capacitor (C1)**: The charge is stored in the capacitor, allowing it to be measured later.
3. **Resistor (R1)**: The resistor limits the current flow, ensuring safety.
4. **Op Amp**: The voltage is converted into a usable signal and amplified for processing.

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- **Op Amp – Micropower**
  - **TSV631AILT**

### Feature

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<tr>
<th>Feature</th>
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</thead>
<tbody>
<tr>
<td>Input bias current</td>
<td>Accurate measurement of small electric charges</td>
</tr>
<tr>
<td>( I_{ib} &lt; 10 \text{ pA} ) @25°C</td>
<td></td>
</tr>
<tr>
<td>( I_{ib} &lt; 100 \text{ pA} ) -40 to 125°C</td>
<td></td>
</tr>
<tr>
<td>Input offset voltage</td>
<td>Detection accuracy</td>
</tr>
<tr>
<td>( V_{io} &lt; 500 \mu \text{V} ) @25°C</td>
<td></td>
</tr>
<tr>
<td>( V_{io} &lt; 2 \text{ mV} ) -40 to 125°C</td>
<td></td>
</tr>
<tr>
<td>SOT23-5 package</td>
<td>Small form factor and optimal solderability</td>
</tr>
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</table>
Mother board voltage regulator

Mother boards include different levels of supply voltages with many conversion stages. Accuracy and stability are key performances.

**How Does It Work?**

The op amp is driving the gate of a power Mosfet used as a linear regulator.

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<table>
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<tr>
<th>Feature</th>
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</thead>
<tbody>
<tr>
<td>Supply voltage range 3 to 16V</td>
<td>Direct supply by 12V output line</td>
</tr>
<tr>
<td>Input offset voltage Vio &lt; 600 µV @25°C</td>
<td>Ensures regulation accuracy</td>
</tr>
<tr>
<td>SOT23-5 package</td>
<td>Small form factor and optimal solderability</td>
</tr>
</tbody>
</table>

Op Amp – 16V CMOS
TSX561AICT
Thank you for your attention!
Check out our product selector on tablets and smartphones:

Click [here](#) or [here](#)

**New version!**
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