ST Signal Conditioning, Interface and Power Management portfolio for wearable devices

May 2023
Wearable devices attributes

- Always on
- Low power
- Compact
- Environment aware
- Intelligent
- Connected

Devices being worn for an extended period of time with significantly enhanced user experience results
Market and Applications

**Fitness and Wellness**
Monitor activity and emotions

- Activity monitors, foot pods and pedometers, entertain sleep sensors, heart rate monitors
- Emotional measurement
- Smart clothing, smart watches, heads-up displays

**Healthcare and Medical**
Monitor vital signs

- Blood pressure monitors, ECG monitors, continuous glucose monitoring
- Insulin pumps, drug delivery products

**Infotainment**
Entertain and enhance lifestyle

- Headsets
- Smart glasses, smart watches

**Industrial**
Hand-worn terminals, heads-up displays, smart clothing, wearable detection devices.
ST Signal conditioning and Interface portfolio for wearable devices

**Operational amplifiers**
Large portfolio of highly power efficient op amp in tiny packages

**Smart reset**
Customizable products providing safe and convenient reset

**Battery gas gauges**
Low-power gas gauge providing very accurate battery life indicator

**Current sensors**
High accuracy current measurement for contactless battery chargers

**Audio amplifiers**
High-efficiency Class D and G amplifiers for headsets and speakers

**DC-DC Buck regulators**
Very high efficiency in any output load conditions, high integration, flexibility

**New ST LDOs for smartphones**
The one-stop-shop supplier
Wearable devices
Analog and mixed signal products partitioning

- Digital sensors
- Analog front-end
- Analog sensors
- Power management
- MCU
- User interface
- Connectivity
- Operational Amplifiers
- Analog switches
- Smart reset
- Current sensors
- Battery gas gauges
Solutions for Analog front-end
Analog transducers, getting the best from your sensor

Analog sensors need signal transducers to deliver the information to the MCU

- Accurate and stable to guarantee the maximum precision of the information
- Low power to guarantee a longer user experience
- Small to be integrated in the most stylish and thin designs

<table>
<thead>
<tr>
<th></th>
<th>Input offset voltage [µV]</th>
<th>Input offset voltage drift [µV]</th>
<th>Supply current [µA]</th>
<th>GBP [kHz]</th>
<th>Supply voltage [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TSU10x</strong></td>
<td>100</td>
<td>5</td>
<td>0.6</td>
<td>8</td>
<td>1.5 - 5.5</td>
</tr>
<tr>
<td>Very low power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TSV71x</strong></td>
<td>50</td>
<td>10</td>
<td>9</td>
<td>120</td>
<td>1.5 - 5.5</td>
</tr>
<tr>
<td>Low power precision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TSZ12x</strong></td>
<td>1</td>
<td>0.01</td>
<td>28</td>
<td>400</td>
<td>1.8 - 5.5</td>
</tr>
<tr>
<td>High precision zero drift</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ST offers a dedicated set of op amps to deliver the best match of current consumption and precision, for a wide range of applications.
Signal transducers application: electromyography

A low input offset voltage with zero drift amplifier is mandatory. Otherwise, the electrodes information would be less accurate or lost. **TSZ12x** family is the perfect match offering:
- $V_{IO} = 1\mu V$
- $\Delta V_{IO}/\Delta T = 0.010\mu V$

Once the signal dynamic has been restored precision and micro power consumption amplifiers are needed before the signal is fed to the MCU. **TSV71x** is the perfect match offering:
- $V_{IO} = 50\mu V$
- $I_{CC} = 9\mu A$
ST offers highly-efficient devices capable of delivering high quality audio into small, low power solutions.

**CLASS G HEADPHONE AMPLIFIER**

**TS4621ML | TS4621E (μ-less)**

- Power supply range 2.3 V - 4.8 V
- Low stand by current 0.6 μA
- \( V_{out} = 0.8 \text{ Vrms} \) into 16 Ω, at 1% \( \text{THD+N} \), \( V_{CC} = 3.6 \text{ V} \)
- \( \text{SNR} = 100 \text{ dB} @ 1 \text{ kHz} \)
- Reduced external BOM
- Flip-chip package

**3W CLASS D MONO SPEAKER AMPLIFIER**

**TS4962M**

- Power supply range 2.4 V - 5.5 V
- Low stand by current <1 μA
- \( P_{out} = 0.8 \text{ W} \) into 8 Ω, at 10% \( \text{THD+N} \), \( V_{CC} = 3 \text{ V} \)
- \( \text{SNR} = 85 \text{ dB} @ 1 \text{ kHz} \)
- Reduced external BOM
- Small flip-chip package

Low power

High quality

Small size
Solutions for Power Management
## KEY APPLICATIONS
- Smartphones
- Tablets
- Handheld devices
- Wearable
- IoT
- Non-removable battery powered devices

## KEY FEATURES
- 1 or 2 push buttons
- Customizable Reset set-up delay
- Device ship mode
- Tiny package

### SMART RESET ICs
Extend the functionality of existing buttons by enabling 'hidden' features (hard reset, factory reset etc…) that can be activated by users with long press of 1 or 2 buttons simultaneously

<table>
<thead>
<tr>
<th>Model</th>
<th># of reset buttons</th>
<th>Reset set-up delay</th>
<th>Reset pulse duration</th>
<th>extra feature</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM6519</td>
<td>1</td>
<td>1.5s to 10s</td>
<td>Fixed or push button controlled</td>
<td>Customer test mode</td>
<td>DFN-6</td>
</tr>
<tr>
<td>STM6520</td>
<td>2</td>
<td>7.5s to 12.5s</td>
<td>Fixed or push button controlled</td>
<td>1 push-pull output</td>
<td>DFN-8</td>
</tr>
<tr>
<td>STM6524</td>
<td>2</td>
<td>4s to 10s</td>
<td>Fixed or push button controlled</td>
<td>Customer test mode</td>
<td>DFN-6</td>
</tr>
<tr>
<td>STM6600</td>
<td>1</td>
<td>Selectable via ext. capacitor</td>
<td>360ms</td>
<td>1 power button</td>
<td>DFN-12</td>
</tr>
<tr>
<td>STM6620</td>
<td>2</td>
<td>10s</td>
<td>push button controlled</td>
<td>Ship mode</td>
<td>QFN-10</td>
</tr>
</tbody>
</table>
### STUSB4500L
USB-C charging - SINK

**Key Features**
- Auto-run / Plug & Play / optional MCU support
- SOURCE power budget identification
- Automatic error recovery and **restart** on fault
- Dead Battery Support

### Package

<table>
<thead>
<tr>
<th>Package Type</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>QFN-24 EP</td>
<td>4x4 mm²</td>
</tr>
<tr>
<td>CSP-25</td>
<td>2.6x2.6 mm²</td>
</tr>
</tbody>
</table>

### Evaluation boards & ref designs

- **STSW-STUSB002** - GUI
- **STSW-STUSB007** - Software library

### Collateral

- Open source ALTIUM library: **EVAL-SCS002V1**

### STUSB4500L – USB micro-B replacement - 15W

Wearable, Portable consumer, Gaming, Healthcare, POS

**Applications**

- Wearable, Portable consumer
- Gaming
- Healthcare
- POS
### Current Sensing

#### ST current sensing ICs portfolio cover most application needs:
- Independent supply and common mode voltages
- Wide supply voltage range
- Selectable gains
- Low power solutions

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TSC101</td>
<td>1.5</td>
<td>2.8 - 30.0</td>
<td>4.0 - 24.0</td>
<td>165</td>
<td>20, 50, 100 fixed internally</td>
<td>no</td>
<td>SOT23-5L</td>
</tr>
<tr>
<td>TSC103</td>
<td>0.5</td>
<td>2.9 - 70.0</td>
<td>2.7 - 5.5</td>
<td>200</td>
<td>20, 50, 100 pin selectable</td>
<td>no</td>
<td>TSSOP-8L, SO-8</td>
</tr>
<tr>
<td>TSC21x</td>
<td>0.035</td>
<td>-0.3 - +26</td>
<td>2.7 - 26</td>
<td>100</td>
<td>200 500 1000 50 100 75</td>
<td>yes</td>
<td>SC70-6, QFN-10L</td>
</tr>
</tbody>
</table>

**Power management in wearable devices:**

- Wired or wireless battery chargers
- Precision current sources from sensors
- Photovoltaic systems

More info Current Sensing - online
Current sensing application: wireless battery charging

- When swimming water pressure can reach up to 5 atm
- Wearable technology needs to be sealed. All the electrical connections with the external have to be removed.
- Wireless battery charging is mandatory

High side current sensing through the transmitter coil to dynamically regulate the charger power output

Application example:

- Power
- TSC103
Intelligent battery monitoring

ST offers an integrated solution combining current integration and voltage variation over the time thus providing the most accurate battery status measurement.

<table>
<thead>
<tr>
<th>STC3115 - Gas gauge IC with alarm output for wearable devices</th>
</tr>
</thead>
</table>
| **Accuracy** | • Coulomb counter mode, voltage mode and mixed mode operations  
• 0.25 % accuracy battery voltage monitoring |
| **Robustness** | • Analog and temperature compensation  
• Internal temperature sensor |
| **Flexibility** | • Low battery level alarm output with programmable thresholds  
• Custom battery OCV curve |
| **Low power** | 2 µA in standby, 45 µA in operating |
| **Small size** | Flip chip, 2.01 x 1.37 x 0.6 mm, 10 bumps, 0.4 mm pitch |

More info Battery Fuel Gauge - online
New ST LDOs for smartphones

The one-stop-shop supplier

- **LD56050**
  - 500 mA Ultra Low Dropout
  - Separate Bias Rail
  - Low output voltages
  - DFN5 - 1.2x1.2

- **LD56100**
  - 1 A Ultra Low Dropout
  - Fast transient
  - Ultra Low Noise
  - DFN8 - 1.2x1.6

- **LD56020**
  - 200 mA, low input voltage
  - High PSRR, Low noise

- **LD39130S**
  - 300 mA Ultra Low IO
  - Green Mode

- **LD57100**
  - 1 A Ultra, Low IO
  - Low Dropout with bias

- **LD59030**
  - 300 mA Ultra Low Dropout

- **LDLN025**
  - 250 mA Ultra Low Noise
  - Very High PSRR

Noise sensitive loads e.g. Audio HiFi
### DC-DC Buck Regulators

#### KEY APPLICATIONS

- **Wearable application**
- **Personal Tracking monitors**
- **Industrial sensors**
- **Bluetooth Low Energy**

#### Very high efficiency in any output load conditions
- ✔️ 95% typical efficiency at 1mA load
- ✔️ 92% typical efficiency at 400mA load

#### High integration for the minimum board size and number of external components
- ✔️ Synchronous rectification
- ✔️ Internal Loop Compensation
- ✔️ Tiny external components
- ✔️ Embedded Soft start Circuit

#### Flexibility
- ✔️ Extended input voltage range, minimum Vin=1.8V
- ✔️ Dynamic output voltage selection

### ST1PS01

<table>
<thead>
<tr>
<th>Part Numbers</th>
<th>Output Voltages</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST1PS01AJR</td>
<td>From 1.9V to 2.8V</td>
<td>FlipChip</td>
</tr>
<tr>
<td>ST1PS01BJR</td>
<td>From 1.1V to 1.7V</td>
<td></td>
</tr>
<tr>
<td>ST1PS01CJR</td>
<td>From 1V to 1.5V</td>
<td></td>
</tr>
<tr>
<td>ST1PS01DJR</td>
<td>From 1.6V to 2.8V</td>
<td></td>
</tr>
<tr>
<td>ST1PS01EJR</td>
<td>From 1.6V to 3.3V</td>
<td></td>
</tr>
<tr>
<td>ST1PS01FJR</td>
<td>From 1.05V to 1.55V</td>
<td></td>
</tr>
<tr>
<td>ST1PS01GJR</td>
<td>From 0.73V to 1V</td>
<td></td>
</tr>
<tr>
<td>ST1PS01HJR</td>
<td>From 0.625V to 1.05V</td>
<td></td>
</tr>
</tbody>
</table>

### ST1PS02

<table>
<thead>
<tr>
<th>Part Numbers</th>
<th>Output Voltages, Output Discharge</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST1PS02AQTR</td>
<td>From 1.4V to 1.75V, 50mV step, Yes</td>
<td>TQFN12L</td>
</tr>
<tr>
<td>ST1PS02A1QTR</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>ST1PS02BQTR</td>
<td>From 1.8V to 2.5V, 100mV step, Yes</td>
<td></td>
</tr>
<tr>
<td>ST1PS02B1QTR</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>ST1PS02CQTR</td>
<td>From 2.6V to 3.3V, 100mV step, Yes</td>
<td></td>
</tr>
<tr>
<td>ST1PS02C1QTR</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>ST1PS02DQTR</td>
<td>From 1V to 1.35V, 50mV step, Yes</td>
<td></td>
</tr>
<tr>
<td>ST1PS02D1QTR</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

### ST1PS03

<table>
<thead>
<tr>
<th>Part Numbers</th>
<th>Output Voltages, Output Discharge</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST1PS03AQTR</td>
<td>From 1.6V to 3.3V, Yes</td>
<td>TQFN12L</td>
</tr>
<tr>
<td>ST1PS03A1QTR</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

More info Buck Regulators - online
Our Technology starts with you

Find out more at www.st.com/automotive