ST’s solutions for mobile devices
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STMicroelectronics is a leading semiconductor supplier in the mobile industry and provides solutions to both mobile platform suppliers and mobile device manufacturers (OEM/ODM). ST has proven products for the cellular handset and mobile device markets and ships billions of products to the mobile industry every year.

These products include the world’s most deployed MEMS accelerometers, gyroscopes, magnetometers, pressure sensors, compasses and inertial modules, state-of-the-art analog and digital MEMS microphones, high-quality audio headphone and speaker amplifiers, touch-sensor controllers with multi-touch capabilities, Near Field Communication Secure MCUs for SIM, M2M SIM and Secure Elements, a wide RF product offer based on Integrated passive device technology, ESD protection and EMI filtering products (IPAD™), interface devices, level translators, I/O expanders, antenna tuner, analog switches, supervisors and smart resets, imaging solutions with photonic sensors like proximity and gesture sensors, ranging sensors, ambient light sensors, high-efficiency power management devices and innovative lighting management solutions. ST is an active player in all major standardization initiatives.

- High-volume manufacturing capacity
- Multiple production sites
- Integrated HW and SW solutions
- High-quality products, already tested in different application fields
- Strong commitment to Sustainable Technology
MEMS and Sensors

Enhanced user interfaces, gaming, OIS and much more

ST has shipped 10 billion micro-electromechanical sensors and has one of the industry’s most extensive MEMS portfolio including accelerometers, gyroscopes, digital compasses, inertial modules, MEMS microphones, and environmental sensors including pressure, temperature, and humidity sensors.

Digital compasses: accurate compass heading in any conditions

ST’s digital compasses include combo solutions, with an accelerometer and magnetic sensor integrated in a single LGA package, to give the possibility of designing a solution locating the magnetic sensor in the suitable position of printed circuit board (PCB). Accurately detecting the direction and magnitude of external magnetic fields and using accelerometer measurements for tilt compensation, ST’s digital compasses ensure very accurate compass heading even when the portable device is inclined.

ST’s low-noise e-compasses offer better than 3 mgauss resolution and a wide range of full scales, all selectable by the user: up to ±16g full scale acceleration and up to ±16 gauss magnetic field full scale. The compass family includes embedded self-test and smart power functionalities to minimize current consumption. The LSM303C is board- and software-compatible with the latest generation of accelerometers, thus offering maximum design flexibility.

**KEY BENEFITS**
- Superior sensing precision combined with low power consumption
- Extended magnetic-scale range
- Minimized measurement noise
- Very small package to address footprint reduction
- Temperature detection for advanced thermal drift compensation
- New possibilities for advanced navigation and location-based services in increasingly-portable consumer devices
Digital gyroscopes

**ST’s new digital gyroscopes are the perfect synthesis of accuracy and design flexibility**

ST’s latest gyroscopes feature excellent accuracy as a result of their unique and patented mechanical structure based on a single driving mass.

ST developed specific gyroscopes for addressing user interface (L3GD20H) or Optical Image Stabilization (L2G2I5S) applications boasting superior output stability over time and temperature, removing the need for any further calibration on customer side.

They offer user-selectable full scales, ranging from ±100 to ±2000 dps, to cater for gaming, navigation, and OIS applications.

**L3GD20H FEATURES**

- Full scale ±245/±500/±2000 dps for UI, ±100/±200 dps for OIS
- I2C/SPI digital interface
- 16-bit data output
- 8-bit (UI) and 12-bit (OIS) temperature data output
- Wide supply voltage: up to 3.6 V
- Low-voltage compatible I/Os (1.8 V)
- Embedded power-down and sleep modes
- Embedded temperature sensor
- Fast turn-on and wake-up
- User-enabled integrated filters

**KEY BENEFITS**

- High performance in terms of accuracy, and stability
- Design flexibility
- Extremely low power consumption lengthens battery life
- Temperature detection for advanced thermal drift compensation
- Enables faster system wake up

---

**THE 6-AXIS ACCELEROMETER AND GYROSCOPE FAMILY**

offers best-in-class accuracy, stability and resolution ensuring ultra-low-power, always-on activity for advanced tracking and smart motion capture.
L2G2IS FEATURES

- ±100/±200 dps full-scale range
- 3- and 4-wire SPI digital interface
- Embedded temperature sensor
- Integrated low- and high-pass filters with user-selectable bandwidth
- Wide supply voltage range: 1.71 to 3.6 V
- Embedded self-test
- Power-down and sleep modes for smart power saving
- ECOPACK®, RoHS and «Green» compliant

L3GD20H features

- Typ. angular rate range (FS) (dps) ±245/±500/±2000
- Driving frequency (kHz) 20
- Angular rate noise density (°/s/√Hz) 0.011
- ODR (Hz) up to 800
- Programmable interrupts 2
- Embedded FIFO 32 levels of 16-bit data output
- Typ. current consumption (mA) 5
- Supply voltage range (V) 2.2 to 3.6
- Operating temperature range (°C) -40 to +85
- Applications Gaming, pointing devices, navigation and motion control
- Digital interfaces I²C/SPI
- Size (mm) 3 x 3 x 1

L2G2IS features

- ±100/±200 dps full-scale range
- 3- and 4-wire SPI digital interface
- Embedded temperature sensor
- Integrated low- and high-pass filters with user-selectable bandwidth
- Wide supply voltage range: 1.71 to 3.6 V
- Embedded self-test
- Power-down and sleep modes for smart power saving
- ECOPACK®, RoHS and «Green» compliant

L2G2IS FEATURES

- ±100/±200 dps full-scale range
- 3- and 4-wire SPI digital interface
- Embedded temperature sensor
- Integrated low- and high-pass filters with user-selectable bandwidth
- Wide supply voltage range: 1.71 to 3.6 V
- Embedded self-test
- Power-down and sleep modes for smart power saving
- ECOPACK®, RoHS and «Green» compliant

KEY BENEFITS

- Low noise and low latency device
- High stability in temperature reducing OIS algorithm complexity
- Embedded temperature sensor data can be accessed through SPI digital interface by application
- Robustness for ultrasonic cleaning process

DEVICE SUMMARY

<table>
<thead>
<tr>
<th>Features</th>
<th>L3GD20H</th>
<th>L2G2IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typ. angular rate range (FS) (dps)</td>
<td>±245/±500/±2000</td>
<td>±100/±200</td>
</tr>
<tr>
<td>Driving frequency (kHz)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Angular rate noise density (°/s/√Hz)</td>
<td>0.011</td>
<td>0.006</td>
</tr>
<tr>
<td>ODR (Hz)</td>
<td>up to 800</td>
<td>9090</td>
</tr>
<tr>
<td>Programmable interrupts</td>
<td>2</td>
<td>N/A</td>
</tr>
<tr>
<td>Embedded FIFO</td>
<td>32 levels of 16-bit data output</td>
<td>N/A</td>
</tr>
<tr>
<td>Typ. current consumption (mA)</td>
<td>5</td>
<td>3.8</td>
</tr>
<tr>
<td>Supply voltage range (V)</td>
<td>2.2 to 3.6</td>
<td>1.71 to 3.6</td>
</tr>
<tr>
<td>Operating temperature range (°C)</td>
<td>-40 to +85</td>
<td>-40 to +85</td>
</tr>
<tr>
<td>Applications</td>
<td>Gaming, pointing devices, navigation and motion control</td>
<td>Optical image stabilization (OIS)</td>
</tr>
<tr>
<td>Digital interfaces</td>
<td>I²C/SPI</td>
<td>SPI (3/4 W)</td>
</tr>
<tr>
<td>Size (mm)</td>
<td>3 x 3 x 1</td>
<td>2.3 x 2.3 x 0.7</td>
</tr>
</tbody>
</table>
3-axis digital accelerometers

**ST’S ULTRA-LOW-POWER ACCELEROMETERS FOR ADVANCED MOTION RECOGNITION AND POWER MANAGEMENT FEATURES**

Housed in ultra-small packages and featuring excellent stability over time and temperature, ST’s accelerometers are the ideal choice for all the most demanding consumer and industrial applications. The LIS3DSH, LIS3DH, LIS2HH12, LIS2DH12, LIS2DE12, and LIS2DS12 accelerometers are able to operate in ultra-low-power modes, thus lowering the overall system power consumption and extending the device’s battery life. They also offer smart motion features, such as sleep-to-wakeup and return-to-sleep functions, to easily design the most intuitive and precise user interfaces.

### Key Features
- Selectable full-scale up to ±16g
- High resolution
- Power-down, sleep and ultra-low-power operating modes for advanced power saving
- Smart embedded functions such as 4D/6D orientation detection auto wakeup and return-to-sleep
- Programmable interrupts and embedded FIFO
- Embedded digital functions (pedometer, step detector, step counter, and SMD)
- Embedded state machines for custom motion recognition (LIS3DSH)
- Digital interfaces: I²C/SPI
- Output data rates from 1 Hz to 6.4 kHz
- Embedded temperature sensor

### Key Benefits
- Extremely accurate motion-sensing capabilities in ever smaller and sleeker consumer gadgets
- Design flexibility
- Extremely low power consumption maximizes battery life
- Embedded FIFO for smart data storage and power saving
- State machines enable custom motion recognition inside the sensor, further reducing system complexity
- Temperature detection for advanced thermal drift compensation

### Device Summary

<table>
<thead>
<tr>
<th>Features</th>
<th>LIS2DS12</th>
<th>LIS3DSH</th>
<th>LIS3DH</th>
<th>LIS2HH12</th>
<th>LIS2DH12</th>
<th>LIS2DE12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full scale</td>
<td>±2g/4g/8g/16g</td>
<td>±2g/4g/8g/16g</td>
<td>±2g/4g/8g/16g</td>
<td>±2g/4g/8g/16g</td>
<td>±2g/4g/8g/16g</td>
<td>±2g/4g/8g/16g</td>
</tr>
<tr>
<td>Output resolution</td>
<td>14 bit</td>
<td>14 bit</td>
<td>12 bit</td>
<td>14 bit</td>
<td>12 bit</td>
<td>8 bit</td>
</tr>
<tr>
<td>Noise density (µg/√Hz)</td>
<td>120</td>
<td>150</td>
<td>220</td>
<td>130</td>
<td>220</td>
<td>350/√Hz</td>
</tr>
<tr>
<td>Output data rate (Hz)</td>
<td>1, 12, 25, 50, 100, 200, 400, 800, 1600, 3200, 6400</td>
<td>3.125, 6.25, 12.5, 25, 50, 100, 200, 400, 800, 1600</td>
<td>1.10, 25, 50, 100, 200, 400, 800, 10, 50,100, 200,400,800</td>
<td>1.10, 25, 50, 100, 200, 400, 1620, 5376</td>
<td>1.10, 25, 50, 100, 200, 400, 1620, 5376</td>
<td></td>
</tr>
<tr>
<td>Programmable interrupts</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Embedded FIFO</td>
<td>256 level</td>
<td>32 level</td>
<td>32 level</td>
<td>32 level</td>
<td>32 level</td>
<td>32 level</td>
</tr>
<tr>
<td>Supply voltage (V)</td>
<td>1.62 to 1.98</td>
<td>1.7 to 3.6</td>
<td>1.7 to 3.6</td>
<td>1.7 to 3.6</td>
<td>1.7 to 3.6</td>
<td>1.7 to 3.6</td>
</tr>
<tr>
<td>Temperature range (°C)</td>
<td>-40 to +85</td>
<td>-40 to +85</td>
<td>-40 to +85</td>
<td>-40 to +85</td>
<td>-40 to +85</td>
<td>-40 to +85</td>
</tr>
<tr>
<td>Digital interfaces</td>
<td>I²C/SPI</td>
<td>I²C/SPI</td>
<td>I²C/SPI</td>
<td>I²C/SPI</td>
<td>I²C/SPI</td>
<td>I²C/SPI</td>
</tr>
<tr>
<td>Size (mm)</td>
<td>2 x 2 x 0.86</td>
<td>3 x 3 x 1</td>
<td>3 x 3 x 1</td>
<td>2 x 2 x 1</td>
<td>2 x 2 x 1</td>
<td>2 x 2 x 1</td>
</tr>
<tr>
<td>Advanced digital functions</td>
<td>Basic function and pedometer, step detector and step counters, tilt function, sensor hub, and always-on experience</td>
<td>Basic function and programmable motion detection by FSM</td>
<td>Basic function: 6D/4D orientation detection, free-fall detection, motion detection, click - double click, and wake up</td>
<td>Basic function and anti-aliasing filter: 6-axis detection, 6D/4D orientation detection</td>
<td>Basic function: 6D/4D orientation detection, free-fall detection, motion detection, click - double click, and wake up</td>
<td>Basic function: 6D/4D orientation detection, free-fall detection, motion detection, click - double click, and wake up</td>
</tr>
</tbody>
</table>
MEMS pressure sensors

MEMS PRESSURE SENSOR: 260-1260 HPA ABSOLUTE DIGITAL OUTPUT BAROMETER
STMicroelectronics LPS25HB and LPS22HB pressure sensors integrate ST’s consolidated technology with the new fully molded package to further improve robustness, reliability, and moisture resistance while reducing package thickness.
With their ultra-low height of 0.76 mm, LPS25HB and LPS22HB sensors offer high design flexibility and easy implementation into multi-functional applications: from smartphones, tablets, and wearable technology such as sports watches, smart watches, fitness bands, and Internet-of-Things (IoT) products.

APPLICATIONS
• Weather forecast
• Barometric altitude
• Ascent/descent detection
• Vertical speed indication
• Indoor navigation (floor detection)
• Enhanced GPS navigation

KEY FEATURES
• 260 to 1260 hPa digital output barometer
• Current consumption: 4 μA
• Selectable ODR from 1 to 25 Hz
• SPI and I²C
• Embedded FIFO
• Supply voltage: 1.7 to 3.6 V
• Package: 2.5 x 2.5 x 0.76 (typ.) or 2 x 2 x 0.8 (max.) mm
ULTRA-LOW POWER CAPACITIVE MULTI-TOUCH SCREEN CONTROLLER FOR 2” TO 13” SCREENS

FingerTip capacitive touchscreen controller
FingerTip provides an optimal mix of low power, small size, low external part count and versatile features with unmatched true multi-touch performance in a single-chip touchscreen controller.

The touchscreen controller can detect, classify, and track 10 finger touches with fast a report rate and response times.
The touch acquisition analog front-end has a wide dynamic range capable of coping with touchscreens of different sizes and configurations.

This offers the flexibility to use FingerTip with multiple touchscreens using different ITO designs and overlay materials. One- or two-layer ITO sensors are supported using glass or PET substrates. FingerTip provides support for curved displays through proprietary node compensation hardware.

FingerTip’s low-noise capacitive analog front-end provides enhanced noise suppression capabilities for various noise sources such as display, 3-phase noise and severe common mode noise introduced by battery chargers.
The device utilizes ST proprietary hardware and firmware techniques to significantly reduce power in low-power active and low-power idle modes, and incorporates multiple TX driving methods that can further boost the SNR and report rate.

**Advanced features**
- Multi-mode sensing technology: Detects water on the top of the screen without false touch or line breaking
- Multi-finger glove operation
- Small passive stylus

**KEY FEATURES**
- Touch screen size with round or square form factor
- Support all types of Touch ITO
- I²C interface
- Ultra-low power modes for longer battery life
- Small and thin QFN (4 x 4 x 0.4 mm)
- Scan rate > 150 Hz
- High SNR
- Noise immunity to all sources
- GPIO for button support
- Support for multi-finger, thick glove, wet fingers and 1mm passive pen touches

The main processor implements a powerful 32-bit ARM Cortex-M3 core with Flash memory that is capable of providing a high level of overall touch performance in terms of noise rejection, response time, and power consumption.
The device supports an I²C serial interface, I²C master interface, HID over I²C interface, and SPI interface for greater flexibility.
Temperature sensors

**DIGITAL TEMPERATURE SENSOR**

**STTS751**

ST’s digital temperature sensors are high-precision CMOS ICs with a delta-sigma analog-to-digital converter (ADC) and I²C compatible serial digital interface. The on-board delta-sigma ADC converts the measured temperature to a digital value that is calibrated in degrees Celsius. These temperature sensors feature low power consumption, up to 12-bit resolution and can operate over a temperature range as wide as -40 to +125 °C.

**KEY FEATURES**

- Accuracy: ±1.0 °C (typ.), ±1.5 °C (max.) from 0 to +85 °C
- Operating voltage: 2.25 to 3.6 V
- Operating temperature: -40 to +125 °C
- Dual alarm
- Programmable resolution
- Tiny packages UDFN-6L (2 x 2 mm), SOT23-6L (1.69 x 2.9 mm)
- 9- to 12-bit resolution
- Low operating current: 50 μA (typ.)
- Low standby current: 3 μA (typ.)
- One-shot mode for power saving
- Supports 400 kHz serial clock

**ANALOG TEMPERATURE SENSOR**

**STLM20 ultra-low-power precision temperature sensor**

The analog temperature sensors feature ultra-low power consumption and provide superior linearity at much lower currents than a high accuracy thermistor and can operate over a temperature range as wide as -55 to +130 °C. They are ideal for regulating the gain of the power amp of any RF device including eReader, GPS devices, and medical instrumentation, where low power, small size, accuracy, and linearity over the full temperature range are fundamental.

**KEY FEATURES**

- Precision analog voltage output temperature sensor
- ±1.5 °C temperature accuracy at 25 °C
- Ultra-low quiescent supply current: 4.8 μA (typ.), 8.0 μA (max.)
- Operating voltage range: 2.4 to 5.5 V
- Operating temperature range: -55 to 130 °C
- Packages: ultra-small UDFN-4L (1 x 1.3 mm), SOT323-5L (2 x 1.25 mm)
VL6180X combines an IR light source, a proximity sensor and an ambient light sensor in a single integrated module

STMicroelectronics offers a family of high-accuracy and target-independent ranging sensors, leveraging ST’s own patented technology called FlightSense™ using the Time-of-Flight (ToF) principle. ST’s family of products featuring high performance, small footprint and low power consumption is ideally suited for wireless applications and handheld devices. First to enable high-volume production of fully integrated and small-sized Time-of-Flight products, ST’s Imaging solutions are opening for more innovative use-cases and for user-experience enhancements for a wide variety of devices and application markets. ST’s internal manufacturing and supply chain guarantees supply as required by high-volume applications such as mobile phones or tablets.

**Key Benefits**
- Fully integrated module: IR laser emitter, ranging sensor and ALS. No need for external LEDs
- Only SPAD (single photon avalanche diode) array-based product on market
- Absolute distance measurement (in millimeters, register output)
- Independent of target reflectance: works with dark colours, gloves
- Can work with coverglass (offset and crosstalk compensation)
- Accurate and low power

**Key Applications**
- Mobile devices
  - Proximity detection
  - Ambient light sensing
  - Simple but robust gesture control
- Home appliances
  - Power on/off, volume +/-
  - Collision avoidance for cleaning robots (wall and cliff)
- User detection
- Automatic faucet control
- Industrial
  - Object detection and ranging
  - Human-machine interface

**Key Features**
- 3-in-1 Time-Of-Flight module: proximity sensor, ALS (ambient light sensing) and basic gesture control
- Development tools and technical support
- Driver and API available
- Full set of documentation on www.st.com/VL6180X
- Proximity sensor NUCLEO expansion board compatible with STM32 NUCLEO family
SYSTEM ARCHITECTURE
The VL6180X contains an array of SPAD (Single Photon Avalanche Diode) detectors. The SPAD array forms part of an advanced system architecture that can detect the arrival of individual photons and hence calculate the time taken for the photon to leave the module, hit the target and then return back to the module. Actual distance measurement combined with signal amplitude allows simple, but robust, gesture recognition to enable multiple use cases.
Furthermore, the VL6180X’s ultra-low-power system architecture is perfectly suited to the demanding requirements of wireless and consumer products.

MODULE DESIGN
All components needed to support the proximity sensor and ambient light sensor are embedded in the simple optical module. No mechanical gaskets or additional lens systems are required to complete the industrial design.
The module can be mounted on the host PCB using a standard reflow profile or flex attached.
Its unique time-of-flight properties allow the module to be hidden behind a wide variety of cover-glass materials. This enables very innovative product design with the possibility of removing the hole that normally forms part of the industrial design.

SYSTEM BLOCK DIAGRAM

VL6180X MODULE

VL6180X NUCLEO EXPANSION BOARD

TIME-OF-FLIGHT PRINCIPLE

\[
\text{Distance} = \frac{\text{Photon travel time} \times \text{Speed of light}}{2}
\]
## Sensors and Human Interface Products

### Accelerometers

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIS2DS12</td>
<td>Ultra-low, high-performance 3-axis digital output accelerometer, embedded smart digital features, 2x2 LGA package, 12 bit</td>
</tr>
<tr>
<td>LIS3DSH</td>
<td>Ultra-low-power high-performance 3-axis nano accelerometer, embedding 2 finite-state machines</td>
</tr>
<tr>
<td>LIS3DH</td>
<td>Ultra-low-power, high-performance 3-axis digital output accelerometer, 3x3 LGA package, 12 bit</td>
</tr>
<tr>
<td>LIS2HH12</td>
<td>High-performance 3-axis digital output accelerometer, 2x2 LGA package, 14 bit</td>
</tr>
<tr>
<td>LISDH12</td>
<td>Ultra-low-power, high-performance 3-axis digital output accelerometer, 2x2 LGA package, 12 bit</td>
</tr>
<tr>
<td>LISDE12</td>
<td>Ultra-low-power, high-performance 3-axis digital output accelerometer, 2x2 LGA package, 8 bit</td>
</tr>
</tbody>
</table>

### Digital Gyroscopes

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L3GD20H</td>
<td>3-axis digital output gyroscope for User Interface</td>
</tr>
<tr>
<td>L2G2S</td>
<td>2-axis digital output gyroscope for OIS</td>
</tr>
</tbody>
</table>

### iNEMO Inertial Modules

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSM6DS3H</td>
<td>3D accelerometer and 3D gyroscope, 2.5x3 LGA package, supporting multimode connections, high performance for OIS</td>
</tr>
<tr>
<td>LSM6DS3</td>
<td>3D accelerometer and 3D gyroscope, 2.5x3 LGA package, supporting multimode connections</td>
</tr>
<tr>
<td>LSM6DS33</td>
<td>3D accelerometer and 3D gyroscope, 3x3 LGA package</td>
</tr>
</tbody>
</table>

### Digital Compasses

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSM303C</td>
<td>Ultra-compact, high-performance e-compass 3D accelerometer and 3D magnetometer module</td>
</tr>
</tbody>
</table>

### Pressure Sensors

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPS25HB, LPS22HB</td>
<td>260 to 1260 mbar absolute digital output barometer</td>
</tr>
</tbody>
</table>

### iNEMO Engine Sensor Fusion Libraries

<table>
<thead>
<tr>
<th>Library</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>iNEMOEngine_li3</td>
<td>A free software library for motion-detection system evaluation</td>
</tr>
<tr>
<td>iNEMOEngine_Pi3P</td>
<td>A compiled software library with data-fusion algorithms for multiple sensor output processing</td>
</tr>
</tbody>
</table>

### Proximity Sensors

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL6180X</td>
<td>Proximity sensor, gesture and ambient light sensing (ALS) module</td>
</tr>
<tr>
<td>HTS221</td>
<td>Capacitive digital sensor for relative humidity and temperature</td>
</tr>
</tbody>
</table>

### Humidity and Temperature Sensors

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STTS751</td>
<td>2.25 V low-voltage local digital temperature sensor</td>
</tr>
<tr>
<td>STLM20</td>
<td>Ultra-low-current 2.4 V precision analog temperature sensor</td>
</tr>
</tbody>
</table>

### Touchscreen Controllers

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FingerTip</td>
<td>Ultra-low power capacitive multi-touch screen controller for 2” to 13” screens</td>
</tr>
</tbody>
</table>

### Display Driver

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STLED524</td>
<td>5 x 24 dot intelligent matrix LED display driver</td>
</tr>
</tbody>
</table>
MEMS microphones and audio subsystems

High-quality audio is the differentiating factor for multimedia-rich mobile platforms. ST manufactures state-of-the-art analog and digital microphones with MEMS technology enabling crystal-clear sound and conversations. Our audio amplifier portfolio ranges from class G headphone drivers to class D speaker drivers that deliver high-quality sound extremely efficiently. Customers can also tune the complete audio system with ST’s APWorkbench™ software.

MEMS MICROPHONES
MEMS microphones target all audio applications where small size, high sound quality, reliability, and affordability are key. Our microphones meet price points set by the traditional electret condenser microphones (ECM), while featuring superior reliability and robustness. ST’s MEMS microphones perfectly pair with our latest generation of Sound Terminal® audio processing devices, that feature a dedicated built-in interface for direct connection of a MEMS microphone, saving part count and cost.

HEADPHONE AMPLIFIERS
Very high audio quality and low power consumption with capacitor-less class G architectures in tiny flip-chip packages.

SPEAKER AMPLIFIERS
Wide range of filterless class D audio amplifiers for mono and stereo applications with gain control, 3D sound effects, and anti-clipping.

KEY FEATURES
- Microphones: Excellent SNR (>63 dB) with full frequency response (20 Hz to 20 kHz) in small package (3 x 4 x 1 mm)
- Headphone and speaker amplifiers: High audio quality (PSRR, SNR, THD+N) for headsets in high-efficiency class G topologies; high power in low battery voltages with Class D technology
- Audio system design: ST’s APWorkbench™ software to browse through ST’s audio portfolio, and select, control and tune the complete audio system easily and accurately
FEATURED PRODUCTS

HIGH-PERFORMANCE, LOW-POWER DIGITAL MEMS MICROPHONE WITH 63 DB SNR

MP34DT01/ MP34DT01-M
The MP34DT01 and MP34DT01-M are ultra-compact, low-power, omnidirectional, digital MEMS microphones built with a capacitive sensing element and an IC interface. The sensing element that detects the acoustic waves is manufactured using a special silicon micromachining process dedicated to producing audio sensors. The IC interface is manufactured using a CMOS process so that a dedicated circuit may be designed to provide a digital signal externally in PDM format. The MP34DT01 and MP34DT01-M have an acoustic overload point of 120 dB SPL with a 63 dB signal-to-noise ratio and -26 dBFS sensitivity. The MP34DT01-M is assembled in metal cap package.

KEY FEATURES
- Single supply voltage
- Low power consumption
- 120 dB SPL acoustic overload point
- 63 dB signal-to-noise ratio
- Omnidirectional sensitivity:
  - -26 dBFS sensitivity
- PDM output
- HCLGA package
- Top port design
- SMD compliant
- EMI shielded

TOP PORT MEMS AUDIO MICROPHONE WITH ANALOG OUTPUT IN 3.35 X 2.5 X 0.98 METAL PACKAGE

MP23AB02B
The MP23AB02B is a compact, low-power microphone built with a low-profile sensing element. The sensing element, capable of detecting acoustic waves, is manufactured using a specialized silicon micromachining process to produce audio sensors. The MP23AB02B has an acoustic overload point of 125 dB SPL with a 64 dB signal-to-noise ratio. The MP23AB02B is available in a package compliant with reflow soldering and is guaranteed to operate over an extended temperature range from -40 to +85 °C.

KEY FEATURES
- SNR: 64 dB
- Sensitivity: -38 dBFS
- Acoustic overload point: 125 dB SPL
- Supply voltage: 1.6 to 3.6 V
- Current consumption: 150 μA
- Flat frequency response
- Size: 3.35 x 2.5 x 0.98 mm
NFC and secure element

Near field communication (NFC) technology is at the heart of an expanding spectrum of easy-to-use, intuitive, contactless applications. These target a broad range of electronics devices such as handsets, wearables, and other consumer electronics devices. STMicroelectronics provides a global offer of products and solutions for NFC enablement. This includes state-of-the-art NFC controllers and a set of secure 32-bit Flash-based microcontrollers to address SWP-SIM, embedded secure elements (SE), M2M SIM, and eUICC. Secure solutions are delivered as discrete ICs, or system-in-package for optimized solutions.

**NFC CONTROLLER**
The ST21NFC product family is based on a microcontroller architecture with embedded EEPROM and multiple connectivity channels. The devices comply with all relevant standards, that address all possible NFC use cases:
- ISO/IEC 14443 A, B, F
- ISO/IEC 15693 and ISO/IEC 18092 compliant
- Active load modulation is already included in the above standards
- Extremely low power consumption
- Up to 3 SWP for UICC, eUICC and SE
- Card, reader/writer and peer-to-peer modes
- Power by RF field capability

**SECURE ELEMENT, SWP-SIM, eUICC**
The ST33 family has been designed to meet the advanced EAL5+/EMVCo security and performance requirements, combining the latest Flash technologies with the highest security levels on the secure ARM® Cortex™ SC300 core.
- 32-bit ARM® SecureCore® SC300™ core
- From 512 Kbytes to 1.2 Mbytes of Flash memory
- 1.8 V, 3 V and 5 V VCC range
- High-performance cryptographic engine
- SWP, ISO and SPI interfaces
- EMVCo and CC-EAL5+ certifications
- Optional MIFARE® and M4M® support
- Wafer, micro-module, DFN8, and WLCSP packages

**KEY BENEFITS**
- No compromise on security
- Multiple application support
- Design flexibility
- One stop shop
**SECURE ELEMENT**
Lowering the complexity of secured OS management, the ST33 secure element is an ST33 with a pre-loaded state-of-the-art Global Platform GP2.2 OS. A wide range of configurations are available to meet market demand.

- Java JC 3.0.1
- Global Platform GP2.2 Amendment A, C, D, E
- Up to 600 Kbytes of user Flash memory
- EMVCo and CC EAL5+
- Multiple TSM support
- Optional MIFARE® Classic, DESFire® and Mifare4Mobile®

**NFC CONTROLLER SECURE ELEMENT COMBO**
As part of global NFC offer and to minimize the PCB footprint impact of NFC, the ST54 product family is a system in package made by stack an ST21NFC NFC controller and an ST33 secure element.

- Turnkey stack solution
- All NFC use cases supported
- BGA 4.0 x 4.0 x 0.9 mm
- Pin compatibility with ST21NFC

**NFC COMPONENTS AND ARCHITECTURES (*)**

(* ST also offers NFC tags, please refer to section NFC tags)

**NFC AND SECURE ELEMENT PRODUCTS**

<table>
<thead>
<tr>
<th>Accelerometers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST21NFCB</td>
</tr>
<tr>
<td>ST21NFCC</td>
</tr>
<tr>
<td>ST33G1M2</td>
</tr>
<tr>
<td>ST33H768</td>
</tr>
<tr>
<td>ST54D</td>
</tr>
<tr>
<td>ST54E</td>
</tr>
</tbody>
</table>
NFC/RFID tags with ISO/IEC 14443 Type A RF interface, NDEF memory and 128-bit password protection

ST’s ST25TA ICs provide the NFC Forum Type 4 Tag RF interface and built-in NDEF (NFC Data Exchange Format) message support. The embedded EEPROM memory density spans from 512 bits to 64 Kbits, covering a wide spectrum of applications including content-rich virtual business cards and smart signs. The ST25TA series delivers state-of-the-art RF performance and features a user-programmable digital CMOS General Purpose Output (GPO) that eliminates the need for an external component to trigger the host wake-up.

**KEY BENEFITS**
- Wide memory density options from 2 K to 64 K bits
- High-reliability EEPROM
- Built-in NDEF format support
- Strong password protection scheme
- Read or Write operations counter
- Flexible user-programmable GPO

**KEY APPLICATIONS**
- Smart posters
- NFC business cards
- Consumer electronics
- Wireless handover
- Gaming
- Industrial
- Traceability
- Wearable electronics

**KEY FEATURES**
- ISO/IEC 14443 Type A
- NFC Forum Type 4 Tag
- 13.56 MHz carrier frequency
- 512-bit, 2-Kbit, 16-Kbit and 64-Kbit densities
- 56-bit unique identifier
- 128-bit password protection
- Optional 20-bit counter
- Optional RF status digital output
- 5- and 8-lead UFDFPN packages
- Bumped wafer die form packages
- 25 or 50pF tuning capacitance
- 200 years data retention
- 1 million write erase cycles
## DEVICE SUMMARY

<table>
<thead>
<tr>
<th>Part number</th>
<th>RF interface</th>
<th>Memory size</th>
<th>Data protection (128 bit password)</th>
<th>20 bit Counter</th>
<th>Package</th>
<th>RF status output</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST25TA512</td>
<td>ISO 14443A Type A</td>
<td>512 bits</td>
<td>Yes</td>
<td>Yes</td>
<td>SBN12 *</td>
<td>No</td>
</tr>
<tr>
<td>ST25TA02K</td>
<td>ISO 14443A Type A</td>
<td>2 Kbits</td>
<td>Yes</td>
<td>Yes</td>
<td>SBN12 *</td>
<td>No</td>
</tr>
<tr>
<td>ST25TA02K-P</td>
<td>ISO 14443A Type A</td>
<td>2 Kbits</td>
<td>Yes</td>
<td>Yes</td>
<td>UFDFPN5 and 8, SBN12 *</td>
<td>Yes</td>
</tr>
<tr>
<td>ST25TA16K</td>
<td>ISO 14443A Type A</td>
<td>16 Kbits</td>
<td>Yes</td>
<td>No</td>
<td>SBN12 *</td>
<td>No</td>
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<tr>
<td>ST25TA64K</td>
<td>ISO 14443A Type A</td>
<td>64 Kbits</td>
<td>Yes</td>
<td>No</td>
<td>SBN12 *</td>
<td>No</td>
</tr>
</tbody>
</table>

* SBN12: Sawn and Bumped wafer (die form), 120µm thickness
ST’s EEPROMs perfectly meet the major market requirement of flexibility, with a complete portfolio of densities from 2 Kbits up to 2 Mbits. I2C and SPI buses are offered in standard and miniature packages, accommodating power supplies from 1.6 to 5.5 V. ST guarantees its portfolio at 4 million E/W cycles per byte, 100 million cycles per device, and 200 years data retention.

Standard EEPROM in WLCSP are recommended each time non-volatile memory is required and available board space is less than 1 mm²:
- Communication modules
- Display drive modules
- Camera modules

UFDFPN5 package (1.4 x 1.7 mm) with reduced footprint is also available.

This makes ST’s EEPROMs the first choice for parameter and data management in Mobile applications.
KEY BENEFITS

- Optimized footprint
- Thinnest profile
- Protect the whole/defined blocks of the EEPROM by software, against undesirable write instructions even if device has no hardware write protect pin (4-ball design)
- Mount several EEPROMs on the same I²C bus, even if device has no chip enable pin (4-ball design)

<table>
<thead>
<tr>
<th>WLCSP series</th>
<th>Part number</th>
<th>Memory density</th>
<th>Software write protect</th>
<th>Dimension</th>
<th>Profile</th>
<th>Ball size typ.</th>
<th>Pinout compatibility</th>
<th>Min pitch (mm)</th>
<th>Back side coating</th>
<th>Device select code</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWP 4-ball design</td>
<td>M24C32S-FCU6T/T</td>
<td>32-Kbit</td>
<td>Yes</td>
<td>0.853</td>
<td>0.300</td>
<td>0.185</td>
<td>M24C64S</td>
<td>0.4 x 0.5</td>
<td>No</td>
<td>1010001x</td>
</tr>
<tr>
<td></td>
<td>M24C32S-FCU6T/TF</td>
<td>32-Kbit</td>
<td>Yes</td>
<td>0.853</td>
<td>0.330</td>
<td>0.185</td>
<td>M24C64S</td>
<td>0.4 x 0.5</td>
<td>Yes</td>
<td>1010001x</td>
</tr>
<tr>
<td></td>
<td>M24C64S-FCU6T/T</td>
<td>64-Kbit</td>
<td>Yes</td>
<td>0.853</td>
<td>0.300</td>
<td>0.185</td>
<td>M24128S</td>
<td>0.4 x 0.5</td>
<td>No</td>
<td>1010001x</td>
</tr>
<tr>
<td></td>
<td>M24C64S-FCU6T/TF</td>
<td>64-Kbit</td>
<td>Yes</td>
<td>0.853</td>
<td>0.330</td>
<td>0.185</td>
<td>M24128S</td>
<td>0.4 x 0.5</td>
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<td>1010001x</td>
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<td>M24128S-FCU6T/T</td>
<td>128-Kbit</td>
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<td>0.300</td>
<td>0.185</td>
<td>M24C64S</td>
<td>0.4 x 0.5</td>
<td>No</td>
<td>1010001x</td>
</tr>
<tr>
<td></td>
<td>M24128S-FCU6T/TF</td>
<td>128-Kbit</td>
<td>Yes</td>
<td>0.853</td>
<td>0.330</td>
<td>0.185</td>
<td>M24C64S</td>
<td>0.4 x 0.5</td>
<td>Yes</td>
<td>1010001x</td>
</tr>
<tr>
<td></td>
<td>M24C32T-FCU6TP/T</td>
<td>32-Kbit</td>
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<td>0.853</td>
<td>0.300</td>
<td>0.185</td>
<td>M24C64T</td>
<td>0.4 x 0.5</td>
<td>Yes</td>
<td>1010000x</td>
</tr>
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<td></td>
<td>M24C32T-FCU6T/TF</td>
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<td>0.330</td>
<td>0.185</td>
<td>M24C64T</td>
<td>0.4 x 0.5</td>
<td>Yes</td>
<td>1010000x</td>
</tr>
<tr>
<td></td>
<td>M24C64T-FCU6TP/TF</td>
<td>64-Kbit</td>
<td>Yes</td>
<td>0.853</td>
<td>0.300</td>
<td>0.185</td>
<td>M24128T</td>
<td>0.4 x 0.5</td>
<td>Yes</td>
<td>1010000x</td>
</tr>
<tr>
<td></td>
<td>M24C64T-FCU6T/TF</td>
<td>64-Kbit</td>
<td>Yes</td>
<td>0.853</td>
<td>0.330</td>
<td>0.185</td>
<td>M24C64T</td>
<td>0.4 x 0.5</td>
<td>Yes</td>
<td>1010000x</td>
</tr>
<tr>
<td>Compatible 4-ball design</td>
<td>M24C08-FCT6TP/T</td>
<td>8-Kbit</td>
<td>No</td>
<td>0.715</td>
<td>0.330</td>
<td>0.185</td>
<td>M24C16</td>
<td>0.4 x 0.4</td>
<td>No</td>
<td>101002xx</td>
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<tr>
<td></td>
<td>M24C16-DFCU6TP/K</td>
<td>16-Kbit</td>
<td>No</td>
<td>0.745</td>
<td>0.300</td>
<td>0.185</td>
<td>M24C08</td>
<td>0.4 x 0.4</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>M24C32-FCU6TP/TF</td>
<td>32-Kbit</td>
<td>No</td>
<td>0.815</td>
<td>0.345</td>
<td>0.160</td>
<td>M24C64-FCU</td>
<td>0.4 x 0.4</td>
<td>Yes</td>
<td>1010000x</td>
</tr>
<tr>
<td></td>
<td>M24C32-FCU6T/TF</td>
<td>32-Kbit</td>
<td>No</td>
<td>0.815</td>
<td>0.345</td>
<td>0.160</td>
<td>M24C64M-FCU</td>
<td>0.4 x 0.4</td>
<td>Yes</td>
<td>1010100x</td>
</tr>
<tr>
<td></td>
<td>M24C64-FCU6TP/TF</td>
<td>64-Kbit</td>
<td>No</td>
<td>0.815</td>
<td>0.345</td>
<td>0.160</td>
<td>M24C32-FCU</td>
<td>0.4 x 0.4</td>
<td>Yes</td>
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</tr>
<tr>
<td></td>
<td>M24C64M-FCU6TP/TF</td>
<td>64-Kbit</td>
<td>No</td>
<td>0.815</td>
<td>0.345</td>
<td>0.160</td>
<td>M24C32M-FCU</td>
<td>0.4 x 0.4</td>
<td>Yes</td>
<td>1010100x</td>
</tr>
</tbody>
</table>

KEY FEATURES

- Reduced dimension at 0.72 mm² for 128-Kbit EEPROM
- Thickness less than 0.3 mm
- Software write protect feature
- Device select code option
Operational amplifiers and comparators for handheld devices

STMicroelectronics is a leading supplier of power-saving and space-saving op amps and comparators offering a wide portfolio of products. ST’s op amps and comparators enhance the signal chain by being the perfect companion chips for ST’s microcontrollers and analog sensors. In addition to providing industry-standard solutions supported with a large production capability, ST offers upgraded versions of op amps and comparators that include better accuracy, standby functions and tiny packages. On top of upgraded versions, ST also offers high-performance zero-drift and nanopower op amps and comparators.

- Heart-rate monitoring by light reflection
- Gesture recognition by electromyography
- Infrared emitter-receiver for remote control
- Ultra-violet light measurement
- Air quality sensor signal conditioning
- Wireless battery charging

### DEVICE SUMMARY

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
<th>Supply current (µA)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSU101, TSU102, TSU104</td>
<td>Nanopower 5 V CMOS op amp</td>
<td>0.56</td>
<td>SC70-5, DFN8 2 x 2, QFN16 3 x 3</td>
</tr>
<tr>
<td>TSZ121, TSZ122, TSZ124</td>
<td>Very high accuracy (5 µV) zero drift micropower 5 V op amp</td>
<td>31</td>
<td>SC70-5, DFN8 2 x 2, QFN16 3 x 3</td>
</tr>
<tr>
<td>TSV711, TSV712, TSV714</td>
<td>High accuracy (Vio &lt; 200 µV) micropower CMOS op amp</td>
<td>10</td>
<td>SC70-5, DFN8 2 x 2, QFN16 3 x 3</td>
</tr>
<tr>
<td>TSV731, TSV732, TSV734</td>
<td>High accuracy (Vio &lt; 200 µV) micropower CMOS op amp</td>
<td>60</td>
<td>SC70-5, DFN8 2 x 2, QFN16 3 x 3</td>
</tr>
<tr>
<td>TSV991A</td>
<td>Rail to rail input/output high merit factor op amp</td>
<td>820</td>
<td>DFN6 1.3 x 1.6</td>
</tr>
<tr>
<td>TS881, TS882, TS884</td>
<td>Rail-to-rail 0.9 V nanopower comparator</td>
<td>0.21</td>
<td>SC70-5, DFN8 2 x 2, QFN16 3 x 3</td>
</tr>
</tbody>
</table>
By choosing one of ST’s microcontrollers for mobile application, you gain from our leading expertise in MCU architecture, technology, multi-source manufacturing and support. ST’s product portfolio contains a comprehensive range of microcontrollers, from robust, low-cost 8-bit MCUs, 32-bit ARM®-based Cortex®-M0 and M0+, Cortex®-M3, Cortex®-M4 and up to Cortex®-M7 Flash microcontrollers with a great choice of peripherals. Leveraging its wide and market-proven portfolio, ST offers a selection of STM32 microcontrollers perfectly fitting wearable devices targeting applications such as:

- Healthcare and consumer fitness and wellness
- Medical
- Portable infotainment
- Monitoring and safety in industrial applications

In these applications, high precision, low power consumption, compact form factor, and outstanding performance are a must and ST’s products take into account the needs of the most recent and innovative wearable devices.

**STM32 SMART AND WIDE CHOICE OF SOLUTIONS FOR WEARABLE DEVICES**

**STM32 8-bit MCUs**

- Ultra-low-power

**STM32 32-bit MCUs**

- Mainstream
- High-performance

**ST MCU Finder: All ST MCUs in your hand**

The ST MCU Finder app for mobile devices is the best way to explore the STM32 and STM8 portfolio of more than 700 references of microcontrollers and development boards.

Define the part that best fits your application with the powerful search engine: choose and save your search criteria, compare and sort the results. Instantly access technical documentation, key features, functional block diagrams, and prices for our MCUs and development tools.

Share your results with colleagues and directly buy online at our distributors.

Download the complete documentation library and stay synced with the latest releases from ST.

Stay connected and keep up to date with the STM32 and STM8 world through our social media, community and news feeds.

Supported languages: English, Chinese (simplified and traditional), and Japanese.
STM32 – THE REFERENCE IN SENSOR HUBS

A complete microcontroller offer including ultra-low-power STM32L as well as high-performance and power-efficient STM32F401/411 to address sensor hub applications in smartphones, tablets, and wearable devices. STM32 sensor hub microcontrollers enable low power, low latency sensor fusion and implement an innovative batch acquisition mode (BAM) allowing ultra-low-power sensor data acquisition. The application range is wide and covers from simple activity trackers (suggestion) implementing a single accelerometer up to smartphones with 9-axis accelerometer, gyroscope & magnetometer combined with environmental sensor and audio with MEMS microphones.

STM32 sensor hub microcontrollers are available with 3rd party motion processing libraries including Always-on sensor fusion, gesture recognition, activity & sleep monitoring, context awareness, and indoor navigation with map matching on both Android™ and Windows® platforms.

Key features:
- Cortex®-M0+, M3 and M4 devices
- Up to 100 MHz with FPU
- Up to 125 DMIPS, 339 CoreMark
- Up to 1 Mbyte of Flash memory and 128 Kbytes of RAM
- Batch Acquisition Mode (BAM)
- Current down to 87 µA/MHz in Run mode
- Current down to 300 nA in Stop mode
- I²C, SPI/FS, USB, USART, and SDIO
- ADC and DFSDM (PDM to PCM)
- From WLCSP25 down to 2 x 2.2 mm

STM32 Dynamic Efficiency™
Less dynamic power
More performance

STM32L
Ultra-low-power MCUs
STM32 – THE REFERENCE IN ADVANCED GRAPHIC USER INTERFACES

Enhanced user experience with the Chrom-ART Accelerator™

STM32 high-performance products take full advantage of ST’s proprietary Chrom-ART Accelerator™ to offer advanced graphic capabilities with minimum processing overhead. Through the combination of processing acceleration, rich connectivity and optimized architecture, STM32 high-performance MCUs can handle both the demanding real-time processing and enhanced GUI that would otherwise require even more powerful – and more power-hungry – processors.

Support for the most advanced display technology

ST introduced the world’s first MIPI-Display Serial Interface (DSI) -enabled microcontroller, opening the door to the most advanced displays from the mobile phone industry with higher pixel density and lower power consumption. Efficiently combining the Chrom-ART Accelerator™ and the new MIPI-DSI interface, ST’s latest STM32 high-performance microcontrollers enable high resolution and enhanced user experience in the smallest product form factors.

Rich graphic ecosystem

The STM32 ecosystem offers a large choice of advanced graphic libraries taking the full advantage of the Chrom-ART Accelerator™ and simplifying your GUI design.

KEY FEATURES

- Chrom-ART Accelerator™ enabling efficient 2D copy, transparency effects and pixel format conversion independently from the main CPU
- MIPI-DSI controller supporting up to 720 p / 30 Hz resolution
- TFT-LCD controller supporting up to XGA resolution
- LCD parallel interface supporting 8080/6800 modes
- Power efficiency
- Maximum integration
STM32 – THE REFERENCE IN AUDIO AND VOICE

Low-power audio DSP replacement

STM32L4 ultra-low-power and STM32F4 Dynamic Efficiency™ product lines combine advanced processing capabilities, outstanding low power consumption, and maximum integration to offer the ideal low-power audio and voice solutions for wearable applications.

Leveraging ST’s proprietary ART Accelerator™, the two product lines achieve zero wait state execution from internal Flash memory and deliver the full processing capabilities of the Cortex-M4 core running at up to 80 and 100 MHz. The Cortex-M4 DSP instruction set and the embedded floating point unit boost the performance capabilities, enabling advanced audio processing.

STM32L4 ultra-low-power and STM32F4 Dynamic Efficiency™ access lines achieve an outstanding 100 µA/MHz power consumption in Run mode and offer a Batch Acquisition Mode (BAM) enabling extended battery life by exchanging batches of data through communication peripherals while maintaining the rest of the system, including the CPU, in power-saving modes.

Wide range of processing performance, connectivity features and optimized software

ST’s scalable STM32 microcontroller portfolio offers a wide range of processing performance and embedded SRAM sizes to meet a large number of audio application requirements. In addition, STM32 microcontrollers embed numerous audio interfaces with I2S, TDM and PDM support as well as audio dedicated PLLs to achieve audio accuracy.

STM32 microcontrollers also offer rich connectivity features with USB, SDMMC, camera, and display interfaces to meet the requirements for the most advanced applications.

Equally important, the STM32 software ecosystem facilitates the development of audio and voice applications by providing optimized internal and third-party audio software as well as hardware kits for prototyping. The software offer includes internal voice and audio codecs with MP3, AAC, WMA, Speex, ADPCM, G711, and G726 support. It also includes synchronization software, as well as audio post-processing solutions with SRC, equalization, bass management, smart volume control, and visualization. The STM32 ecosystem also gives access to a wide range of optimized third-party software including voice command solutions.
STM32 AND STM8 – THE REFERENCES IN TOUCH SENSING AND WIRELESS

STM32 and STM8L families: Integrated touch-sensing functions

Certain STM32 microcontrollers feature a full hardware touch-sensing acquisition module based on self-capacitance technology. These devices include several I/Os (up to 24 channels) for integrating multiple touch keys and providing developers with a single-device solution.

- Microcontroller-based I/Os internally coupled to touch sensing controller with up to 24 channels
- Touch sensing acquisition < 5% CPU load. Based on charge transfer acquisition
- Free-of-charge software libraries (C source code, firmware examples)
- Adapted development tools: STM-STUDIO and STM32CubeMX

Self-capacitance

STM8 - STM32 families: Wireless charging system

From basic waveform generation for low-end devices up to complex waveform generation, our MCU mainstream series ensures extreme flexibility for the digital control of the coil.

- Timers with flexible PWM generation, dead-time management, or complemented output.

STM32 F3
- ARM Cortex-M4 + FPU at 72 MHz – 90 DMIPS
- From 16 to 512 kbytes of Flash memory
- Mixed-signals: CCM-SRAM, 16-bit ΣΔ ADC, hi-res timer

STM32 F0x
- ARM Cortex-M0 at 48 MHz – 38 DMIPS
- From 16 to 256 kbytes of Flash memory
- Entry-level, cost-sensitive: 32-bit MCU at 32 cents, USB, CAN…

STM8 S
- STM8 core at 24 MHz
- From 4 to 128 Kbytes of Flash memory, plus E²Data
- Robust and reliable for basic functions
STM32 AND STM8 – THE REFERENCES IN POWER MANAGEMENT

STM8L family: 8-bit ultra-low-power MCU family

The STM8L, based on the 8-bit STM8 core, benefits from our proprietary ultra-low-leakage process, shared with the STM32L family, and features an ultra-low power consumption of 0.30 µA with the lowest power mode.

STM32L family: the 32-bit ultra-low power MCU family

ST’s ultra-low-power MCU platform is based on a proprietary ultra-low-leakage technology. STM32L0 (ARM® Cortex®-M0+), STM32L1 (Cortex-M3), STM32L4 (Cortex-M4) and the STM8L (8-bit proprietary core) represent a large range of devices addressing devices supplied from batteries or through energy harvesting and grant an optimized cost/performance ratio in all kinds of low-power applications.

This ultra-low-power platform with the industry’s lowest current variation between 25 and 125 °C ensures outstandingly low current consumption at elevated temperatures. The MCUs reach the industry’s lowest power consumption of 350 nA in Stop mode (with SRAM retention), while maintaining the wakeup time as low as 3.5 µs.

The new STM32L4 is the convergence of the ultra-low-power and high performance providing 100 DMIPS with DSP instructions and floating point unit, more memory (up to 1 Mbyte of Flash memory) and innovative features.

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<table>
<thead>
<tr>
<th>DMIPS Performance</th>
<th>MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>75</td>
<td>64</td>
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<tr>
<td>50</td>
<td>32</td>
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<tr>
<td>25</td>
<td>16</td>
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</tbody>
</table>

- **STM8L**
  - 8-bit STM8 core at 16 MHz
  - From 2 to 192 Kbytes of Flash memory
  - Lowest power mode + RAM + RTC: 0.8 µA

- **STM32L0**
  - 32-bit ARM Cortex-M0+ at 32 MHz
  - From 8 to 192 Kbytes of Flash memory
  - Lowest power mode + RAM + RTC: 0.8 µA

- **STM32L1**
  - 32-bit ARM Cortex-M3 at 32 MHz
  - From 32 to 512 Kbytes of Flash memory
  - Lowest power mode + RAM + RTC: 1.2 µA

- **STM32L4**
  - 32-bit ARM Cortex-M4 core with floating point unit (FPU)
  - From 256 Kbytes to 1 Mbyte of Flash memory
  - Lowest power mode + RAM + RTC: 0.6 µA
STM32 - BRIDGING BETWEEN VOLTAGE DOMAINS

The STM32F0x8 and STM32F3x8 are specific low-voltage lines, helping overcome the challenges when adding a companion chip to a low-voltage host processor. The microcontrollers with Cortex M0 or Cortex M4 cores connect to the same digital power domain as the host, such as a 1.8 V power supply, while allowing on-chip peripherals to operate from higher voltages such as 3.3 V.

This combination of 1.8 V digital supply voltage and independent analog domain is particularly strong where a wide analog dynamic range is required, or for connecting directly to USB devices. It leads to an immediate cost advantage in mobile system architectures.

KEY FEATURES

- Multiple voltage domains in one chip
- No level shifter required
- Cortex-M0 or Cortex-M4
- Up to 90 DMIPS
- Small footprint (WCSP package down to 2.6 x 2.7 mm)

STM32 FOR ANTENNA TUNING

Thanks to their low pin count and ultra-small footprint, STM32F0 and LO MCUs are ready to be used for simple auxiliary functions like flexible switches or control elements for antenna tuning. A rich peripheral set, wide operating range, and low power consumption values allow easy integration into mobile architectures, while 38 DMIPS give enough headroom for execution of control algorithms.

KEY FEATURES

- Low pin count QFN or WLCSP down to 4.4 mm²
- ARM Cortex-M0/M0+
- Up to 38 DMIPS
- Ultra-low current consumption
STM32CUBEMX POWER CONSUMPTION CALCULATOR WIZARD
With the STM32CubeMX configuration and initialization C code generator, select your chip and configure its peripherals and power supply. Then use its Power Consumption Calculator wizard to define a sequence of steps representing your application and analyze its power consumption and battery life results.
Integrated passive devices for RF front-end antenna tuners

STMicroelectronics provides a wide RF product offer based on its integrated passive device (IPD) technology. IPD solutions based on glass substrate can offer a low parasitic and high-Q solution suitable for RF applications.

**BALUNS**
Baluns use ST’s process to integrate high-quality RF passive components on a single glass substrate. As well as balanced/unbalanced conversion, they can also integrate a matching network in a footprint smaller than 1 mm² for the complete function.

**COUPLERS**
Wideband couplers use ST’s process to integrate high-quality RF passive components on a single glass substrate. They are intended for cellular applications (GSM, WCDMA, LTE). The range includes high-directivity, frequency selector and various coupling factor devices.

**DIPLEXERS**
Cost- and size-efficient way to combine different complementary radio access paths into a single antenna, combine dual antenna feeds into single feeds or vice versa.

**BAND-PASS FILTERS**
Improves RF system performance through cost-efficient frequency filtering for cellular and ISM bands. RF IPDs provide high-performance RF solutions with low sensitivity to top shielding.

**KEY BENEFITS**
- Size: up to 80% board saving
- Cost: up to 40% cost saving
- Performance: improved RF immunity
- Low component height compared to low-temperature co-fired ceramic technologies
- Fewer board placement variation effects than discrete due to monolithic implementation
- High predictability from simulation enabling fast production response time
FEATURED PRODUCTS

SMALLEST HIGH-DIRECTIVITY WIDEBAND COUPLERS WITH INTEGRATED ATTENUATORS

CPL and DCPL series
The CPL and DCPL are single- and dual-path antenna couplers used to closely monitor the forward and reverse power between the RF power amplifier and the antenna. By also integrating attenuators on coupled and isolated ports, the antenna couplers simplify circuit design while saving cost and PCB space. This additional integration is achieved using ST’s proprietary integrated passive device (IPD) technology. Other types of couplers need separate attenuators.

In addition, insulated glass-substrate fabrication and wafer-level packaging reduce total device height and footprint compared to alternative low-temperature co-fired ceramic (LTCC) technology. ST now offers a range of couplers with various coupling levels and an integrated flattener.

LOW-LOSS FREQUENCY DIPLEXER

DIP1524-01D3
The DIP1524-01D3 is a diplexer to separate GPS/Glonass signals and WLAN, Bluetooth or LTE band VII signals received on the same antenna. The 20 dB of attenuation between bands guarantees a good separation between GPS and the other RF signals. This diplexer uses ST’s proprietary integrated passive device (IPD) technology developed to address the needs of passive integration in RF applications.

The DIP1524-01D3 is available in a flip-chip package with a pitch of 0.4 mm and does not require any extra PCB land around the component such as for LTCC packages. ST’s solution is extremely small and saves over 50% more PCB space than conventional solutions.

KEY FEATURES

- 50-ohm nominal input/output impedance
- Operating frequency range: 700 to 2700 MHz
- Less than 0.2 dB insertion loss
- 20 to 40 dB typical coupling factor
- 25 dB typical directivity
- Component and PCB area:
  - 1.3 mm² for single path (incl. integrated attenuators)
  - 2.4 mm² for dual path (incl. integrated attenuators)

DEVICE SUMMARY

<table>
<thead>
<tr>
<th>Balun companion chip</th>
<th>50 Ohm / Conjugate match balun to SPIRIT1 at 868/915 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>BALF-SP-I-01D3</td>
<td>50 Ohm / Conjugate match balun to SPIRIT1 at 433 MHz</td>
</tr>
<tr>
<td>BALF-CC1101-01D3</td>
<td>50 Ohm / Conjugate match balun to CC1101 at 868/915 MHz</td>
</tr>
<tr>
<td>BALF-NRF01D3 + 0.8 pF</td>
<td>50 Ohm / Conjugate match balun to nRF51422-QFAACA/C0, nRF51822-QFAACA/C0, nRF51822-QFABAA/A0</td>
</tr>
<tr>
<td>BALF-NRF01D3</td>
<td>50 Ohm / Conjugate match balun to nRF24LE1, nRF24AP2-1CH, nRF24AP2-8CH</td>
</tr>
<tr>
<td>BALF-NRF02D3</td>
<td>50 Ohm / Conjugate match balun to nRF51822-CEAA, nRF51422-CEAA, nRF51822-CFAC, nRF51422-CEA, nRF51822-CFAC</td>
</tr>
<tr>
<td>BALF-NRF01D3</td>
<td>50 Ohm / Conjugate match balun to nRF51422-QFAADA/E00, nRF51422-QFABAO0, nRF51822-QFABAO0/0/G0, nRF51822-QFABB00, nRF51822-QFABB00/0/G0, nRF51822-QFABB00/0/G0, nRF51822-QFABB00/0/G0, nRF51822-QFABB00/0/G0</td>
</tr>
<tr>
<td>BALF-2690-02D3</td>
<td>50 Ohm / Conjugate match balun to STLC2690</td>
</tr>
<tr>
<td>BALF-NRG-01D3</td>
<td>50 Ohm / Conjugate match balun to BlueNRG</td>
</tr>
<tr>
<td>DLPF-GP-01D3</td>
<td>Dual low-pass filter matched to GreenPeak GP540/560 RF IC</td>
</tr>
<tr>
<td>BAL-C25-01D3</td>
<td>50 Ohm / Conjugate match balun to CC2540/44, CC2530/31/33, CC2520/21/30/31</td>
</tr>
<tr>
<td>BAL-CC25-02D3</td>
<td>50 Ohm / Conjugate match balun to CC2541</td>
</tr>
</tbody>
</table>
RF front-end antenna tuners

ST’s smart antenna tuners offer high quality and high reliability RF tunable capacitors based on a ferroelectric material composed of baryum strontium and titanate (BST). This new tunable material allows the implementation of dynamic impedance matching for wireless handsets, which improves power amplifier efficiency and battery life while simultaneously reducing the likelihood of dropped or missed calls.

TUNABLE CAPACITORS

The STPTIC series of integrated tunable capacitors offers excellent RF performance, low power consumption, and high linearity required in adaptive RF tuning applications. Standard capacitor values ranging from 1.5 to 8.2 pF with a tuning ratio of 3.5:1 or 5:1. They are available in miniature chip-scale packages.

BST CONTROLLERS

The STHVDAC series are dedicated devices able to control tunable capacitors. They provide a high-voltage digital-to-analog converter (DAC), specifically designed to control and meet the wide tuning bias voltage requirement of BST tunable capacitors. Devices include SPI and MIPI RFFE serial interfaces.

KEY FEATURES

• High tuning range (5:1)
• Excellent RF linearity (IP3 > 65 dB)
• High Q factor (Q > 60 @ 1 GHz)
• Miniature CSP package with single footprint all PTIC values
• Battery-powered operation with low-power mode to reduce power consumption
• Compliant with MIPI RFFE interface for easy integration in mobile phone RF front-ends
• Dynamic control to optimize capacitor transition time thanks to turbo and glide modes
FEATURED PRODUCTS

SMALLEST HIGH QUALITY FACTOR RF TUNABLE CAPACITOR

STPTIC G2 series

The STPTIC G2 series of integrated tunable capacitors offers excellent RF performance, low power consumption, and high linearity required in adaptive RF tuning applications. These tunable capacitors are controlled through an extended bias voltage ranging from 1 to 24 V to provide a 5:1 tuning ratio. Capacitor values are range from 1.5 to 8.2 pF and are packaged in a 4-ball chip-scale package to allow designers to use a single footprint for all PTIC values. The G2 series features 70dBc 3rd harmonic rejection. When higher harmonic rejection is required, the L2 series is also available. The implementation of STPTIC G2 series of tunable capacitors in mobile phones enables significant improvement in term of radiated performance, making the performance almost insensitive to the external environment.

KEY FEATURES

• Miniature CSP package with single footprint all PTIC values
• Capacitor can be connected in a shunt or series configuration
• Capacitor bias is low frequency, low noise ANALOG control
• Number of capacitors in the stack is increased for higher linearity: 24 (standard) for G series (x24) and 48 (high) for L series
• High tuning range (5:1)
• Excellent RF linearity (IP3 > 65 dB)
• High Q factor Q > 60 @ 1 GHz

NEW ANTENNA-TUNING CIRCUIT BOOSTS LTE SMARTPHONE PERFORMANCE

STHVDAC series

ST’s STHVDAC-253M integrates three high-voltage DACs, allowing it to simultaneously optimize antenna performance in three different frequency bands. It supports all MIPI RFFE features such as extended mode, triggers, 26 MHz clock operation, and brings stronger signal/more bars, fewer dropped calls, faster downloads, and longer battery life. Housed in a flip-chip 0.4 mm pitch package, the STHVDAC-253M embodies the best-in-class antenna performance in a compact and cost-effective solution.

KEY FEATURES

• 16-bump chip-scale package (1.7 x 1.7 mm) with 0.4 mm pitch
• Battery-powered operation with low power mode to reduce power consumption
• Integrated boost converter with 3 programmable outputs (from 0 to 24 V)
• Compliant with MIPI RFFE interface for easy integration in mobile phone RF front-end
• Dynamic control to optimize capacitor transition time thanks to turbo and glide mode
## Device Summary

<table>
<thead>
<tr>
<th>Tunable Capacitors F1 Series</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>STPTIC-xxF1M6</td>
<td>Tunable capacitor, 3.5:1 tuning ratio QFN 1.2x1.6 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tunable Capacitors G1 Series</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>STPTIC-xxG1H5</td>
<td>Tunable capacitor, 3.5:1 tuning ratio CSP 0.5 mm pitch</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Tunable Capacitors L1 Series</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>STPTIC-27L1M6</td>
<td>2.7 pF Tunable capacitor, 3.5:1 tuning ratio QFN 1.2x1.6 mm, high linearity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tunable Capacitors G2 Series</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>STPTIC-15G2C5</td>
<td>1.5 pF Tunable capacitor, 5:1 tuning ratio CSP 0.4 mm pitch</td>
</tr>
<tr>
<td>STPTIC-27G2C5</td>
<td>2.7 pF Tunable capacitor, 5:1 tuning ratio CSP 0.4 mm pitch</td>
</tr>
<tr>
<td>STPTIC-33G2C5</td>
<td>3.3 pF Tunable capacitor, 5:1 tuning ratio CSP 0.4 mm pitch</td>
</tr>
<tr>
<td>STPTIC-39G2C5</td>
<td>3.9 pF Tunable capacitor, 5:1 tuning ratio CSP 0.4 mm pitch</td>
</tr>
<tr>
<td>STPTIC-47G2C5</td>
<td>4.7 pF Tunable capacitor, 5:1 tuning ratio CSP 0.4 mm pitch</td>
</tr>
<tr>
<td>STPTIC-56G2C5</td>
<td>5.6 pF Tunable capacitor, 5:1 tuning ratio CSP 0.4 mm pitch</td>
</tr>
<tr>
<td>STPTIC-68G2C5</td>
<td>6.8 pF Tunable capacitor, 5:1 tuning ratio CSP 0.4 mm pitch</td>
</tr>
<tr>
<td>STPTIC-82G2C5</td>
<td>8.2 pF Tunable capacitor, 5:1 tuning ratio CSP 0.4 mm pitch</td>
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<table>
<thead>
<tr>
<th>Tunable Capacitors L2 Series</th>
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<tbody>
<tr>
<td>STPTIC-27L2C5</td>
<td>2.7 pF Tunable capacitor, 5:1 tuning ratio CSP 0.4 mm, high linearity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BST Controllers</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>STHVDA-303F6</td>
<td>3 outputs, 30 V, 0.5 mm pitch CSP package, SPI interface</td>
</tr>
<tr>
<td>STHVDA-253MF3</td>
<td>3 outputs, 25 V, 0.4 mm pitch CSP package, MIPI RFFE interface</td>
</tr>
<tr>
<td>STHVDA-253MTGF3</td>
<td>3 outputs, 25 V, 0.4 mm pitch CSP package, MIPI RFFE interface, turbo and glide modes</td>
</tr>
<tr>
<td>STHVDA-256MTGF3</td>
<td>6 outputs, 25 V, 0.4 mm pitch CSP package, MIPI RFFE interface, turbo and glide modes</td>
</tr>
</tbody>
</table>
Interface secure digital (SD) cards with ST level translators.
Increase the number of I/O ports and enhance the control capability of existing platforms with ST’s Xpander™ technology.
Direct audio and data signals on mobile devices with audio and high-speed switches.
Improve design and user experience with ST’s smart reset devices that remove the need for dedicated reset buttons or having to remove the battery when a device freezes.
Prevent over-discharging and system start-up with low battery with supervisor devices.

LEVEL TRANSLATORS
ST’s dual-supply level translators are the ideal solution for bidirectional level translation with mixed voltage systems of 1.8 V, 3.3 V and 5 V.

I/O EXPANDERS
I/O expanders with advanced features: keypad scanning, PWM and rotator general I/O expanders with 8-16 I/Os.

CAMERA INTERFACES
Deserializer for SMIA CCP1 and CCP2. Dual mode deserializer for SMIA/CCP2 and MIPI/CSI-2.

KEY BENEFITS
- Flexibility in system design versus monolithic implementation
- Easier verification of subsystems
- Faster development time by using discrete components
- Deserializer enables use of parallel interface baseband with serial cameras
Analog switches

**ANALOG SWITCHES**
When multiplexing audio lines, ST’s special negative power supply rail reduces the audible click/pop noise when switching between multiple sources.

**HIGH-SPEED SWITCHES**
For high-frequency lines such as USB and CCP (compact camera port), ST’s offers a choice of switches compliant with USB 2.0 (HS) specifications and bandwidths up to 950 MHz.

Real-time clock

ST’s M41T62LC6F real-time clock is the perfect match for wearable devices when size, weight, and power-efficiency matters. It offers a very low frequency error at 25 °C which equates to about 5 seconds per month, an ultra-low power consumption of 350 nA in standby, and comes in an ultra-small 1.5 x 3.2 mm package with an embedded crystal oscillator.

Supervisors and smart resets

**SMART RESETS**
ST’s family of Smart Reset™ ICs provides dual-assert manual-reset (push-button) inputs called smart reset inputs that make it possible to reliably resolve system hang or freeze conditions. Dual-assert manual-reset inputs require the user to assert two inputs simultaneously to initiate the system reset function. STM6519 and STM6524 are single- and dual- push-button smart reset ICs that add flexibility and user convenience at reduced size.

**SUPERVISORS**
Smart voltage supervisors with on/off controls; prevents over-charging and starting system with low battery.
FEATURED PRODUCTS
HIGH-PERFORMANCE SD CARD LEVEL TRANSLATOR

ST6G3244

The ST6G3244 is a dual-supply, low-voltage 6-bit bidirectional CMOS level translator for SD, miniSD and microSD cards. Designed for use as an interface between baseband and memory cards, it achieves high-speed operation while maintaining CMOS low power dissipation. This device is intended for two-way asynchronous communication between data buses. All inputs are equipped with protection circuits against electrostatic discharge, giving them ESD and transient excess voltage immunity.

KEY FEATURES
- Supports 60 MHz clock rate
- Supports DDR mode for SD Card™
- Compliant with
  - SD Specification Part 1 Physical Layer Specification 3.00 (SDR12, SDR25, DDR50)
  - SD Specification Part 1 Physical Layer Specification 2.00
- Bidirectional with direction control pin
- EMI filtering and signal conditioning

DEVICE SUMMARY

<table>
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<tr>
<th>Level translators</th>
<th>I/O expanders</th>
<th>Analog switches</th>
<th>Smart resets</th>
<th>Supervisors</th>
<th>Real-time clock</th>
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</thead>
<tbody>
<tr>
<td>ST2378E</td>
<td>STMPE160000</td>
<td>STG5123</td>
<td>STM6519</td>
<td>STBP110</td>
<td>M41T62</td>
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<tr>
<td>ST6G3244</td>
<td>STMPE1801</td>
<td>STG3692</td>
<td>STM6524</td>
<td>STBP120</td>
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<td>STG3696</td>
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<td>STG4158</td>
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<td>STG4160</td>
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<td></td>
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<td>STG3220</td>
<td></td>
<td></td>
<td>Ultra-low-power serial real-time clock, LCC8 package (3.2 x 1.5 mm), supply current 350 nA, supply voltage 1.3 to 4.4 V</td>
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<tr>
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<td>STG5678</td>
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</table>

ESD 15 kV and EMI

Low drop-out voltage regulator LDO

ESD 2 kV
Protection devices

IPAD™ products integrate the various functions required by wireless applications, such as ESD protection diodes, EMI low-pass or common-mode filters, line terminations, and pull-up or pull-down resistors. ST’s complete protection and filtering range with integrated or standalone solutions offers design flexibility while bringing space saving and high system immunity.

**ESD PROTECTION**

Our solutions are not only specified against the highest level of IEC 61000-4-2 for robustness, but also target the lowest clamping voltages, and lowest residual currents for the highest protection efficiency. Protective devices for clamping arrays, rail-to-rail topologies, USB ports and high-speed ports are driven by requirements for robustness, efficiency, and transparency.

**EOS PROTECTION**

ST proposes data line and powerline high power-density protection, rated against IEC 61000-4-5. These EOS 8/20 µs protection devices are available in a large choice of packages, from 0402 to SMC, bringing flexibility to designers and reliability to the application.

**KEY FEATURES**

- Robust ESD protection at system level including high-speed serial interfaces
EMI and common mode filtering

**Audio, video**

ST has developed a complete range of EMI filter and CMF (ECMF™) components dedicated to audio and video interfaces such as microphones, headsets, speakers, earphones, and analog TV out or HDMI. These devices provide efficient filtering of wireless frequencies above 800 MHz as well as superior ESD protection with extremely low clamping voltages.

**Display, camera, keypad**

ST’s ECMF™ series offers silicon common-mode filters combined with high-efficiency ESD protection. Now available in micro-QFN and CSP packages, this series offers ultra-compact form factors and covers high-speed serial interface standards including MIPI. The ECMF devices are designed to avoid RF antenna desense and to protect ICs against destructive electrostatic discharges (ESD). They are particularly well suited for applications frequently subjected to RF link-loss, due to the high-speed differential links – USB or MIPI – combined with antenna RF, Bluetooth, or Wi-Fi connectivity.

**Memory, SIM card**

A complete range of IPAD™ components dedicated to memory-card interfaces such as used for microSD, T-Flash or SIM cards. These devices provide efficient filtering of wireless frequencies above 800 MHz as well as superior ESD protection with extremely low clamping voltage. Available in CSP or micro-QFN packages, these filters cover new standards such as SDA3.0 (SDR 104).

**Standard multiline bus**

A complete range of IPAD™ components designed for bottom connectors and general-purpose uses for mobile phones. These devices provide efficient filtering of wireless frequencies above 800 MHz as well as superior ESD protection with extremely low clamping voltages. Available in CSP or micro-QFN packages, RC or LC topologies, low- or high-line capacitance, these multiline filters immunize both digital and analog lines.

**USB**

These devices combine EMI low-pass or common-mode filters, ESD protection, and pull-up or pull-down resistors to support USB 2.0 and USB 3.1 specifications.

**KEY FEATURES**

- Single chip interface integrating resistors, capacitors, inductors, and ESD components
- PCB space saving up to 80% of board area compared to equivalent discrete solutions
FEATURED PRODUCTS
USB FLOW-THRU ESD PROTECTION

HSP051-4N10
ST’s new HSP051-4N10 alleviates the increasing sensitivity to ESD events from the user through the external connector of high-speed differential-line transceivers such as USB 3.1 (10 Gbit/s) or HDMI 2.0 4K (5.94 Gbit/s) interfaces. This ESD array is compatible with USB Type C connectors and protects ICs from contact discharges up to 8 kV as defined by IEC 61000-4-2 Level 4, with very low dynamic resistance (0.48 Ω). Its 1.9 mm² and 4-channel flow-through µQFN-10L package is only 0.32 mm thick with a 0.4 mm pitch, and minimizes impedance mismatch. With only 0.35 pF line capacitance, signal integrity is preserved, providing a 10 GHz bandwidth.

Key Features
- Flow-through routing to keep signal integrity
- Ultralarge bandwidth: 10 GHz
- Ultralow capacitance:
  - 0.2 pF (I/O to I/O)
  - 0.35 pF (I/O to GND)
- Very low dynamic resistance: 0.48 Ω
- Low leakage current: 100 nA at 25 °C

COMMON-MODE FILTERS WITH INTEGRATED ESD PROTECTION
ECMF04-4HSWM10
Smartphones are exposed to antenna input power sensitivity decrease due to common-mode noise radiating in Rx bands coming from USB data transmissions. This may lead to RF link loss and consequently to user frustration. The latest common-mode filter in ST’s ECMF™ series – the ECMF04-4HSWM10 – features deep attenuation of common-mode noise at GSM, W-CDMA, LTE, GPS, BT and Wi-Fi (2.4 GHz and 5 GHz) frequencies, combined with a robust +8 kV contact discharge ESD protection. Housed in a tiny µQFN package, it is compatible with the new USB Type C connector, and saves up to 30% of the PCB area compared to an equivalent discrete solution.

Key Features
- Ultra wide differential bandwidth: up to 7 GHz
- High common-mode attenuation (Scc21): from 800 MHz to 5 GHz
- Compliance with IEC 61000-4-2 discharge with low clamping voltage
- Low DC resistance
- 60% PCB space saving versus discrete solution
## DEVICE SUMMARY

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<td><strong>ECMF06-6HSM16</strong></td>
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<td><strong>EMIF0x-15O2Mx</strong></td>
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<td><strong>ESDAXLC6-1BU2</strong></td>
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<td>4-line ultra-large bandwidth ESD protection in 1.9 x 1.0 mm flow-thru package</td>
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<td><strong>ESDARF02-18U2CK</strong></td>
<td>Single-line extra-low-capacitance (20 GHz bandwidth) bidirectional ESD protection in 0201 package</td>
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<td>5-line 1 x 1 mm ESD protection in micro-QFN</td>
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<td><strong>ESDALC6V1M3</strong></td>
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<td><strong>SMMAF24A</strong></td>
<td>20 V / 60 A (8/20 μs) EOS and ESD protection</td>
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<td><strong>SMMAF13A</strong></td>
<td>13 V / 85 A (8/20 μs) EOS and ESD protection</td>
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<td><strong>ESDA7P60-1U1M</strong></td>
<td>5 V / 60 A (8/20 μs) EOS and ESD protection</td>
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<td><strong>ESDA13P70-1U1M(2)</strong></td>
<td>9 V / 70 A (8/20 μs) EOS and ESD protection</td>
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Note: 1. Under development - target datasheet and samples available upon request.
ST’s power management ICs especially designed for use in mobile devices provide high efficiency and low standby power consumption with high power density for a wide range of functions including solutions for battery charging and monitoring, LED drivers for backlights and camera flashes, power supplies for OLEDs as well as switching and linear voltage regulators and are available in a choice of miniature packages for reduced footprint and height.

**LDO regulators**

Our range of LDOs features an optimal combination of low dropout voltage, low quiescent current, fast transient response, low noise and high power supply rejection even with no external capacitor. With output voltages ranging from 0.8 to 5 V and current from 50 to 300 mA, they are available in miniature packages making them ideal for use in mobile devices.

**KEY FEATURES**
- Large selection of output voltages and currents
- Miniature DFN, SOT and chip-scale packages
- Very low quiescent current
- Ultra-low noise and high PSRR for RF circuit power supplies
- Requires no bypass capacitor

**FEATURED PRODUCTS**

**LDBL20**

200 mA - low quiescent LDO in ultra-miniature bump-less CSP

Small is good in mobile devices. Smallest is best: LDBL20 is world’s smallest 200 mA LDO with its amazing 0.47x0.47 mm bump-less chip-scale package (CSP). In addition to its low quiescent current, shutdown feature, a large selection of output voltages and tiny size makes it a great help for designers.

**KEY FEATURES**
- 200 mV typical dropout at 200 mA
- Low quiescent current
  - 20 µA @ no load
  - 100 µA @ 200 mA
  - 0.03 µA in OFF mode
- Output voltage range from 0.8 to 5 V in 50 mV steps
- Bump-less CSP (0.49 x 0.49 mm)
DC-DC Converters

In mobile, battery-operated applications high efficiency and small size are paramount and that’s what drove us in the development of our dedicated DC-DC converters. Available in step-down, step-up and buck-boost topologies, they feature high switching frequencies and low quiescent current and are hosted in miniature DFN or chip-scale packages.

**FEATURED PRODUCTS**

**ST1S15, 500 mA step-down converter**

The ST1S15 is a high-efficiency miniaturized step-down converter with 500 mA output current from an input voltage ranging from 2.3 to 5.5 V. Thanks to its capability to run at a 6 MHz switching frequency, the ST1S15 can use the smallest nominal values for the inductor (470 nH) and for the output capacitor (4.7 µF) still providing very good load and line transients. Hosted in a small 6-bump chip-scale package, it provides invaluable help in reducing size and efficiency.

**Battery management**

ST’s range of battery management solutions includes linear and single- or dual-input switching chargers, a chipset for wireless charging for implementations compliant with industry standards, standalone gas-gauge for accurate battery state-of-charge reporting and PMIC with charger, gas gauge and LDOs. Many solutions for a single problem: keeping your battery in great shape for a prolonged, useful life.

**FEATURED PRODUCTS**

**STWBC and STWLC03, RX and TX chipset for wireless chargers**

The STWBC and STWLC03 form a complete transmitter and receiver chip-set for wireless chargers. With their optimized set of analog peripherals – such as ADCs and timers for PWM generation - their efficient CPU and the on-chip of non-volatile memory, they require just a handful of external components to implement a complete wireless chargers that can be easily made to comply with PMA and Qi industry standards.
**STBCFG01, battery charger with OTG boost and voltage mode fuel gauge for single-cell Li+ batteries**

The STBCFG01 is a highly integrated power management IC with all the necessary functions to charge single cell Li-Ion batteries, monitor the battery charge and generate 5 V to supply USB OTG bus powered devices. High switching frequency and low quiescent current ensure high efficiency in the charger section while the voltage mode fuel gauge provides accurate estimation of the state of requiring no external sensing resistor to keep external part count low and size small also thanks to a small 2.3 x 2.2 mm CSP.

**Key Features**

- High efficiency switching battery charger
- 1.2 A max. charging current and 20 V max tolerant input with OVP
- 500 mA supply for USB OTG
- High accuracy voltage mode fuel gauge
- Small-footprint flip-chip package, 25 bumps (2.3 x 2.2 mm)

**Battery monitoring**

**Gas gauge IC for handheld applications**

The STC3115 and STC3117 include the hardware functions required to implement a low-cost gas gauge for battery monitoring. The devices use current sensing, Coulomb counting and accurate measurements of the battery voltage to estimate the state-of-charge (SOC) of the battery. An internal temperature sensor simplifies implementation of temperature compensation.

An alarm output signals a low SOC condition and can also indicate low battery voltage. The alarm threshold levels are programmable.

The STC3115 and STC3117 offer advanced features to ensure high-performance gas gauge functions in all application conditions.

The devices are available in a 10-bump CSP package (1.4 x 2.0 mm) and in a 9-bump CSP package (1.5 x 1.6 mm) perfect for ultra-mobile, small form-factor applications, and the STC3115 also comes in a 10-lead DFN package (2.0 x 3.0 mm) that is easier to solder and has greater PCB bending tolerance.

**LED drivers and display supplies**

The many LEDs used in modern mobile terminals require driving solutions that are optimized for the different uses of the light source. ST offers a large portfolio of energy-efficient display supplies and drivers designed for boost topologies used by high-brightness LED solutions with multiple dimming controls for backlight LEDs as well as for high-efficiency, synchronous buck-boost topologies designed for driving a single or multiple strings of white LED for electronic flash units. We offer also highly-integrated optimized low-noise DC-DC converters for passive (PMOLED) and active (AMOLED) OLEDs with negative voltage capability.

**Key Features**

- Extensive integration for reduced external component count and size
- Very low quiescent current
- High efficiency, low noise
- Miniature QFN, DFN and chip-scale packages
FEATURED PRODUCTS

STOD32W, triple DC-DC converter for AMOLED display supplies.

Integrating a main step-up converter, an inverting DC-DC converter, and an auxiliary step-up converter – with programmable output voltage - the STOD32W provides an optimized solution for AMOLED display panel supplies as well as an optimized TDMA noise filter to minimize flickering. The STOD32W comes in an optimized flip-chip package to help reduce the size of the final application.

KEY FEATURES

- 100 mA/4.6 V main step-up converter
- Negative step-up with up to -4.6 V programmable output voltage
- 55 mA auxiliary step-up with up to 7.6 V programmable output voltage
- High efficiency, low noise
- Miniature flip-chip package (1.6 x 1.7 mm)

DEVELOPMENT SUMMARY

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<tr>
<td>LD39130S</td>
<td>300 mA, ultra-low-quiet current with automatic green-mode</td>
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<tr>
<td>LD39115J</td>
<td>150 mA, ultra-low-drop, low IQ, low noise</td>
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<tr>
<td>LD39050</td>
<td>500 mA, ultra-low-drop and power good</td>
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<td>LD39030SJ</td>
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<td>LD39020</td>
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<td>LDCL015</td>
<td>150 mA, capacitor less, ultra low drop</td>
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<td>LDLN015</td>
<td>150 mA, ultra-low-noise, high PSRR</td>
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<td>LDK130</td>
<td>300 mA low-quiet current and low noise</td>
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<tr>
<td>STLQ050</td>
<td>50 mA, ultra-low IQ, very low drop</td>
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<tr>
<td>STLQ015</td>
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<td>STBCG03(3)</td>
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<td>L6924D</td>
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<tr>
<td>L6924U</td>
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<td>STNS01</td>
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<td>STP4CMP</td>
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Note: 1. Under Development