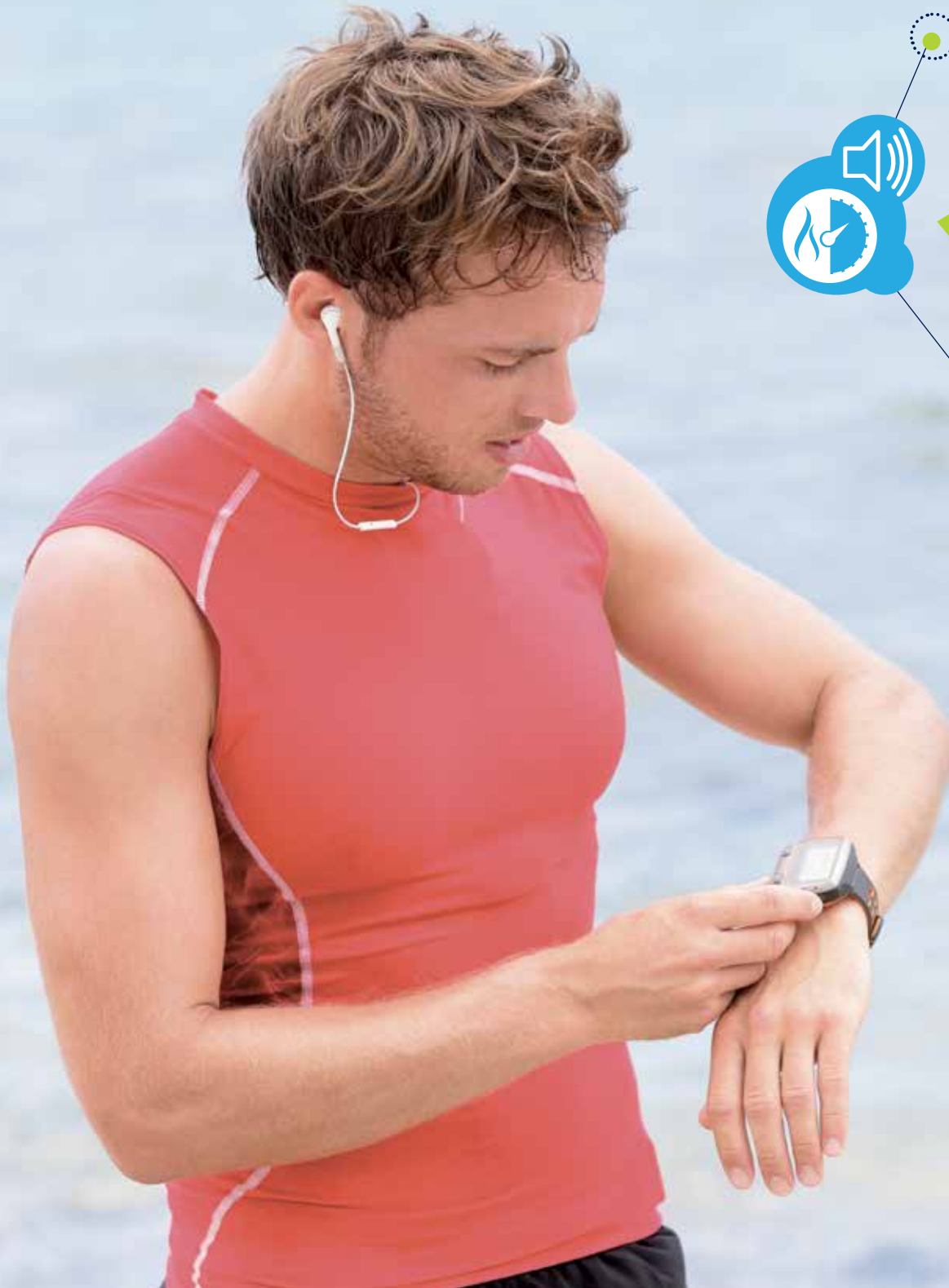




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# Analog ICs for wearable devices

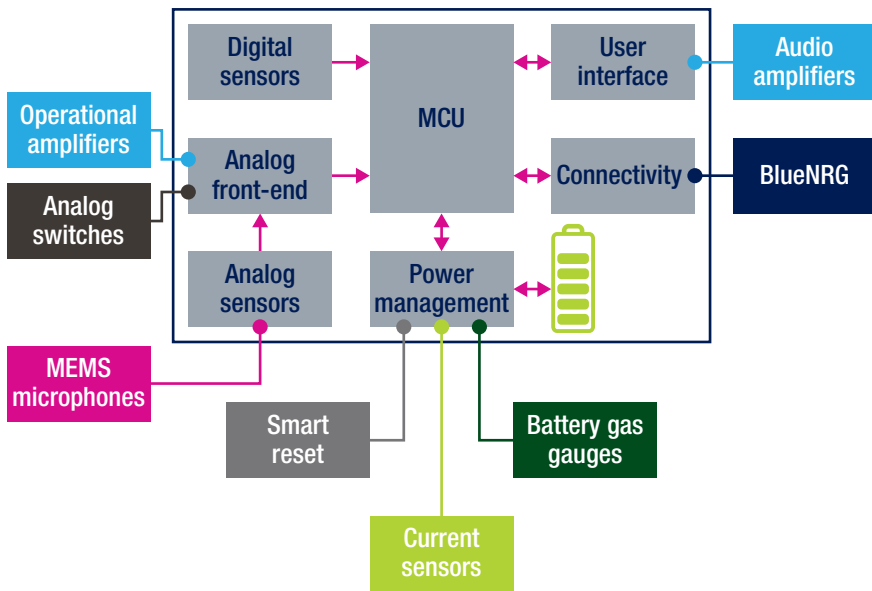


# STMICROELECTRONICS OFFERS SMART SOLUTIONS FOR WEARABLE DEVICES

Leveraging its long experience in a wide range of technologies, ST offers a selection of products specifically designed for wearable devices targeting applications such as:


- Consumer fitness and wellness
- Healthcare and medical
- Portable infotainment
- Industrial monitoring and safety

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



- Operational amplifiers
- Current sensors
- Audio amplifiers
- Smart reset
- Analog switches
- Battery gas gauges
- BlueNRG
- MEMS microphone

ST offers the most complete set of building blocks for wearable devices.

<p><b>Operational amplifiers</b></p> <p>Large portfolio of highly power-efficient op amp in tiny packages</p>	<p><b>Smart reset</b></p> <p>Customizable products providing safe and convenient reset</p>	<p><b>Analog switches</b></p> <p>Compact single and dual switches for audio and USB</p>
<p><b>Audio amplifiers</b></p> <p>High-efficiency Class D and G amplifiers for headsets and speakers</p>		<p><b>BlueNRG</b></p> <p>Bluetooth® smart solution with best-in-class power consumption</p>
<p><b>Current sensors</b></p> <p>High accuracy current measurement for contactless battery chargers</p>	<p><b>Battery gas gauges</b></p> <p>Low-power gas gauge providing very accurate battery life indicators</p>	<p><b>MEMS microphone</b></p> <p>Power-efficient microphone solution for smarter voice-controlled devices</p>

## OPERATIONAL AMPLIFIERS

Analog sensors need signal transducers to deliver the information for digital processing, ST offers a dedicated set of operational amplifiers suitable for wearable devices with excellent features in terms of:

- Very high accuracy and stability
- Low supply voltage and low power consumption for battery operation
- Rail-to-rail inputs and outputs
- High tolerance to ESD
- Extended temperature range
- Tiny packages

Part number	Number of channels	Input offset voltage (mV) @ 25 °C	Input bias current (pA) typ	Supply current x channel (µA)	Supply voltage (V)	Package (mm)	$\Delta V_{io}/\Delta T$ (µV/°C)	GBWP (kHz)
OA1NP	1	0.1	1	0.6	1.5 to 5.5	SC70-5 (2.0 x 2.1 x 0.9)	5	8
OA2NP	2	0.1	1	0.6	1.5 to 5.5	DFN8 (2.0 x 2.0 x 0.75) MiniS08 (3.0 x 4.9 x 1.1)	5	8
OA4NP	4	0.1	1	0.6	1.5 to 5.5	QFN16 (3.0 x 3.0 x 0.9)	5	8
OA1MPA	1	0.2	1	9	1.5 to 5.5	SC70-5 (2.0 x 2.1 x 0.9)	10	120
OA2MPA	2	0.2	1	9	1.5 to 5.5	DFN8 (2.0 x 2.0 x 0.75) MiniS08 (3.0 x 4.9 x 1.1)	10	120
OA4MPA	4	0.2	1	9	1.5 to 5.5	QFN16 (3.0 x 3.0 x 0.9)	10	120
OA1ZHA	1	0.1	50	28	1.5 to 5.5	SC70-5 (2.0 x 2.1 x 0.9)	0.01	400
OA2ZHA	2	0.1	50	28	1.5 to 5.5	DFN8 (2.0 x 2.0 x 0.75) MiniS08 (3.0 x 4.9 x 1.1)	0.01	400
OA4ZHA	4	0.1	50	28	1.5 to 5.5	QFN16 (3.0 x 3.0 x 0.9)	0.01	400

## CURRENT SENSORS

Battery and energy management in wearable devices is critical whether for wired or wireless battery chargers or precision current sources from sensors.

ST's current sensing ICs portfolio offers the following benefits:

- Up to 70 V line monitoring
- Independent supply and common mode voltages
- Selectable gains
- Low power

Part number	Common mode operating range (V)	Current consumption (µA)	Gain (V/V)	Temperature range (°C)	Supply voltage (V)	Package (mm)
CS30A	2.8 to 30	165	20	-40 to +125	4 to 24	SOT23-5 (2.9 x 2.8 x 1.2)
CS30B	2.8 to 30	165	50	-40 to +125	4 to 24	SOT23-5 (2.9 x 2.8 x 1.2)
CS30C	2.8 to 30	165	100	-40 to +125	4 to 24	SOT23-5 (2.9 x 2.8 x 1.2)
CS70	2.9 to 70	200	20 to 100	-40 to +125	2.7 to 5.5	TSSOP8 (6.4 x 3.0 x 1.2)

## SMART RESET

ST's smart reset ICs extend the functional capacity of existing control buttons to give users the possibility of resetting a device, should it be frozen because of any possible misuse. These devices integrate several useful features, such as:

- Choice of a single button or two simultaneous buttons to signal a reset
- Support for applications where the battery cannot be removed
- Tiny packages

Part number	Number of reset button	Number of power button	Reset setup delay typ (sec)	Reset pulse width (ms)	Supply voltage (V)	Package (mm)
SR1CAR	1	-	1.5	Push button controlled	2 to 5.5	UDFN6 (1 x 1.45)
SR1HAR	1	-	4.0	Push button controlled	2 to 5.5	UDFN6 (1 x 1.45)
SR1LAR	1	-	6.0	Push button controlled	2 to 5.5	UDFN6 (1 x 1.45)
SR1PAA	1	-	7.5	210	2 to 5.5	UDFN6 (1 x 1.45)
SR1PAR	1	-	7.5	Push button controlled	2 to 5.5	UDFN6 (1 x 1.45)
SR1PBB	1	-	7.5	360	2 to 5.5	UDFN6 (1 x 1.45)
SR1UAR	1	-	10.0	Push button controlled	2 to 5.5	UDFN6 (1 x 1.45)
SR2HAR	2	-	4	Push button controlled	1.65 to 5.5	UDFN (1.6 x 1.3)
SR2LAB	2	-	6	360	1.65 to 5.5	UDFN (1.6 x 1.3)
SR2LAR	2	-	6	Push button controlled	1.65 to 5.5	UDFN (1.6 x 1.3)
SR2PAR	2	-	7.5	Push button controlled	1.65 to 5.5	UDFN (1.6 x 1.3)
SR2UAB	2	-	10	360	1.65 to 5.5	UDFN (1.6 x 1.3)
SR2UAR	2	-	10	Push button controlled	1.65 to 5.5	UDFN (1.6 x 1.3)
SRCOCS25	1	1	Selectable via ext. capacitor	360	1.6 to 5.5	TDFN12 (2.0 x 3)
SRCOCS22	1	1	Selectable via ext. capacitor	360	1.6 to 5.5	TDFN12 (2.0 x 3)

## ANALOG SWITCHES

In portable devices, switches are used to route a great variety of signals such as audio to speakers/headphones or other signals to and from sensors. ST's analog switch line up is meant to cover all the possible signal typologies from audio to USB, to fit most of the applications.

- Ultra-low power dissipation
- Low on-resistance
- Wide operating voltage range
- USB (2.0) high-speed (480 Mbit/s) signal switching compliant
- Integrated fail safe function
- Tiny packages

Part number	Logical function	Propagation delay T <sub>phl</sub> typ (ns)	Supply voltage (V)	Supply current (µA)	Off Isolation (dB)	Package (mm)
AS21P2THB	Dual SPDT	0.13	1.65 to 4.3	0.2 (max)	-78 @ 1 MHz	QFN10L (1.8 x 1.4 x 0.5)
AS11P2TLR	Single SPDT	0.13	1.65 to 4.5	0.1 (max)	-75 @ 100 kHz	DFN6L (1.2 x 1.05 x 0.5)
AS21P2TLR	Dual SPDT	0.3	1.65 to 4.3	0.05	-66 @ 100 kHz	QFN10L (1.8 x 1.4 x 0.5)

## BATTERY GAS GAUGES

Wearable are battery operated devices. Knowing the battery status is a turn key feature to ensure a satisfactory, long user experience. ST's battery gas gauge ICs can be located in the battery pack or in the wearable device and integrate functions to monitor the battery voltage, current and temperature. Using a built-in coulomb counter, these fuel gauge ICs calculate battery charge and store the data in 16-bit resolution for retrieval by the system controller. Access is via an industry-standard I<sup>2</sup>C interface, enabling the controller to create an accurate graphical representation of the remaining battery-operating time.

ST's current sensing ICs portfolio offers the following benefits:

- Alarm output signals a low SOC (State-of-Charge) condition and low battery voltage
- Programmable alarm threshold levels

Part number	Supply current typ (mA)	Supply voltage (V)	Battery option (V)	Temperature range (°C)	Package (mm)
GG25L	0.045	2.7 to 4.5	4.35	-40 to +85	CSP12 (2.01 x 1.37 x 0.6)
GG25LA	0.045	2.7 to 4.5	4.20	-40 to +85	CSP12 (2.01 x 1.37 x 0.6)

## AUDIO AMPLIFIERS

ST's wide audio IC portfolio includes low-power headphone amplifiers specifically designed for wearable devices. These devices are characterized by:

- High efficiency
- Battery operated features
- Tiny packages
- Superior audio quality

Part number	Description	Channels	Output power (W)	Supply voltage (V)	SNR @ 1 kHz (dB)	Stby current (µA)	Package (mm)
A21SP16	3 W filter-free class D with standby	1	1 x 3	2 to 6	85	<1	Flip-chip 9x500u (1.60 x 1.60 x 0.6)
A22H165M	High-performance class-G headphone amplifier	2	2 x 0.25	2.3 to 4.8	100	0.6	Flip-chip 16x400u (1.65 x 1.65 x 0.6)
A22H165	High-performance class-G headphone amplifier with I <sup>2</sup> C volume control	2	2 x 0.25	2.3 to 4.8	100	0.6	Flip-chip 16x400u (1.65 x 1.65 x 0.6)



## BLUENRG

ST's Bluetooth Low Energy network processor has been selected by Electronic Products Magazine as one of the products of the year. The winning products were selected on the basis of innovative design, significant advancement in technology or application and substantial achievement in price and performance.

BlueNRG is a very low power Bluetooth low energy (BLE) single-mode network processor, compliant with Bluetooth specification v4.0. The entire Bluetooth low energy stack runs on the embedded Cortex-M0 core. The non-volatile Flash memory allows in-field stack upgrading.

BlueNRG allows applications to meet the tight peak current requirements imposed with the use of standard coin cell batteries. Ultra-low-power sleep modes and very short transition times between operating modes allow very low average current consumption, resulting in longer battery life. BlueNRG offers the option of interfacing with external microcontrollers using the SPI transport layer.



- Superior battery life
- Long communication range in real environment
- Excellent co-existence performance in crowded 2.4 GHz bandwidth
- Single firmware for supporting master and slave roles
- Easy firmware upgrades in the field to maintain compliance with future releases of the Bluetooth® specification

Part number	Tx current consumption @ 0dBm (mA)	RX current typ (mA)	Operating voltage (V)	Package (mm)
BlueNRG	8.2	7.3	2 to 3.6	VFQFPN32 (5 x 5 x 0.9)

## RELATED TOOLS AND SOFTWARE

Part number	Description
STEVAL-IDB002V1	Bluetooth® SMART board based on the BlueNRG low energy network processor
STSW-BNRG001	BlueNRG current consumption estimation tool
STSW-IDB002V1	STSW-IDB002V1 application software setup
STEVAL-IDB003V1	BlueNRG IC based Bluetooth® Smart USB dongle

## MEMS MICROPHONES

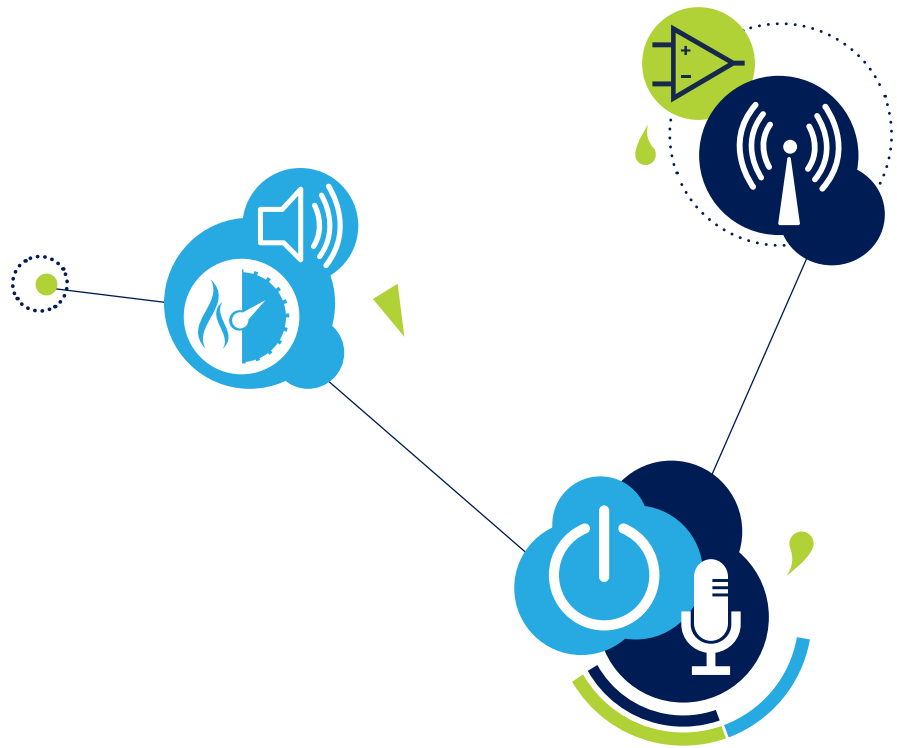
The voice control is a wide spreading trend across many portable applications, making the interaction easier, faster and smoother. It enables fashionable designs by reducing the number of button.

- Tiny packages
- Low power consumption
- High performance
- Solution to integrates more sensors in single package

Part number	Sensitivity (dBV)	SNR (dB)	AOP (dB)	Supply voltage range (V)	Supply current (µA)	Dual mode	Package (mm)
MP23AB02B	-38±3	64	125	1.6 - 3.6	150	-	RHLGA metal cap 2.5 x 3.35 x 0.98

More information: [www.st.com/mems](http://www.st.com/mems)

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