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**Discover ST's portfolio for
signal conditioning,
interface, and power
management in wearables**

Wearable devices attributes



Devices worn for an extended time with significantly enhanced user experience

Always on

Low power

Compact

Environment aware

Intelligent

Connected

Market and applications



Fitness and wellness

Monitor activity and emotions

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

Healthcare and medical

Monitor vital signs

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



Infotainment

Entertain and enhance lifestyle

- Headsets
- Smart glasses, smart watches

Industrial

Hand-worn terminals, heads-up displays, smart clothing, wearable detection devices.



ST signal conditioning and interface portfolio for wearable devices



Operational amplifiers

Large portfolio of highly power efficient op amp in tiny packages

Smart reset

Customizable products providing safe and convenient reset

Battery gas gauges

Low-power gas gauge providing very accurate battery life indicator

Current sensors

High accuracy current measurement for contactless battery chargers

Audio amplifiers

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

DC-DC Buck regulators

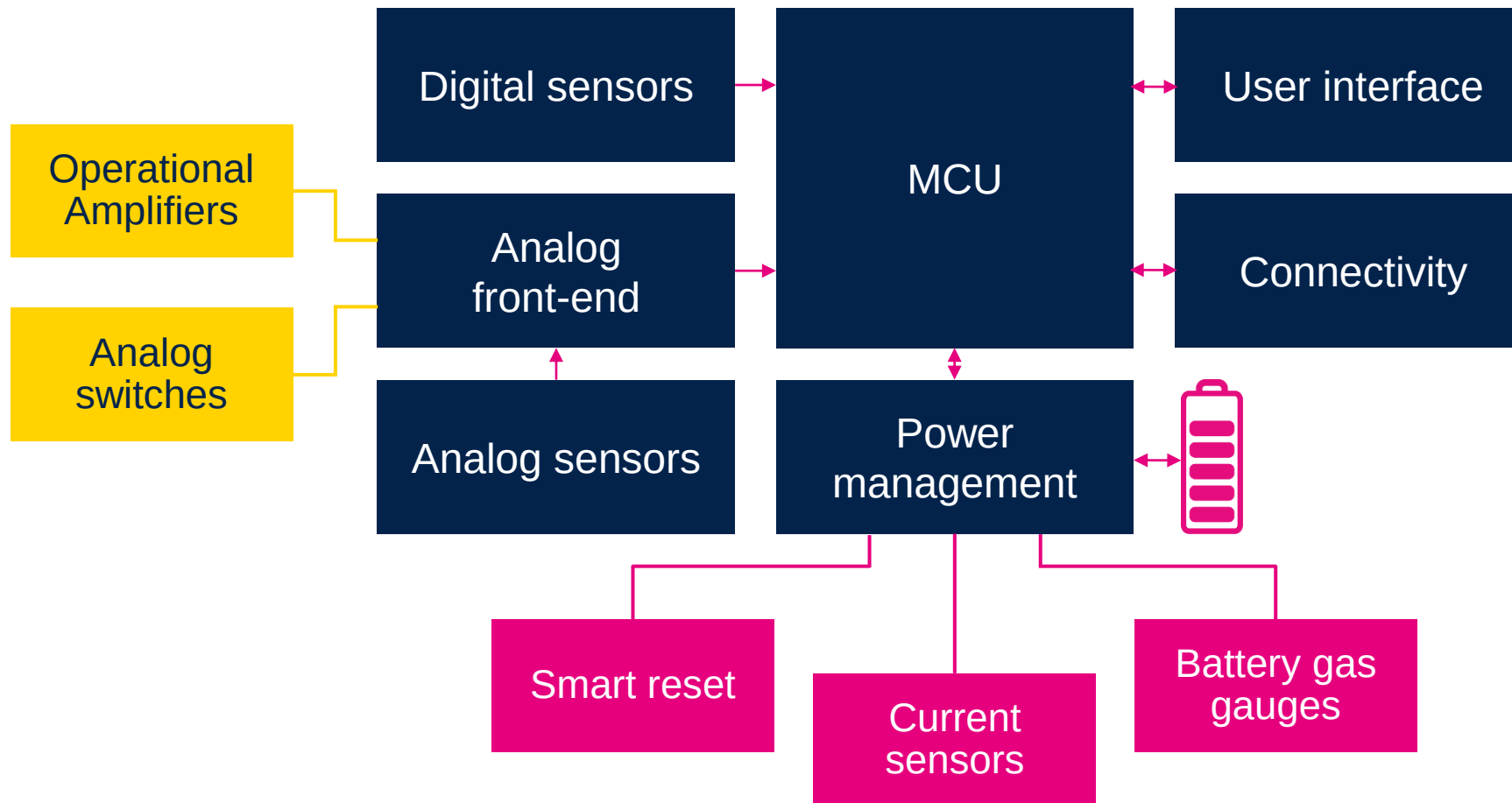
Very high efficiency in any output load conditions, high integration, flexibility

New ST LDOs for smartphones

The one-stop-shop supplier

Wearable devices

Analog and mixed signal products partitioning



Solutions for analog front-end

Analog transducers, getting the best from your sensor

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

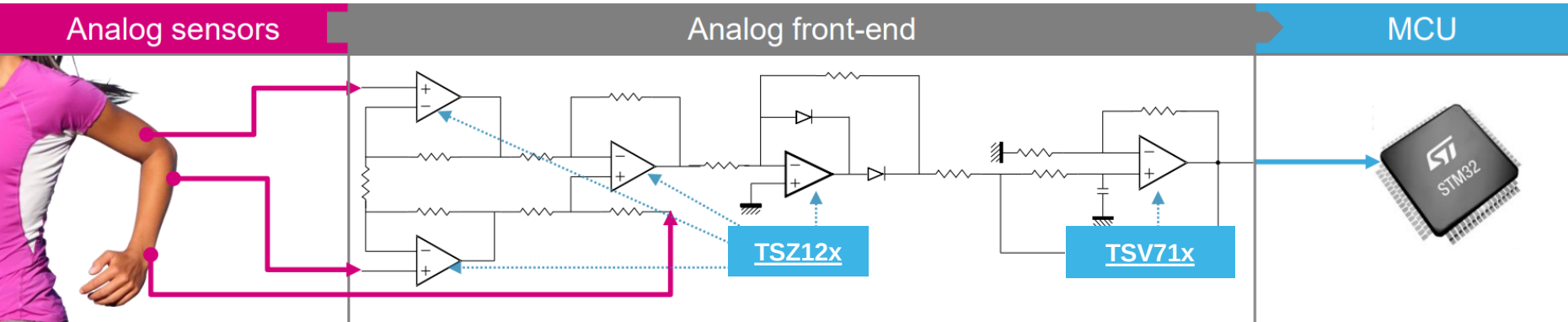
- Accurate and stable to guarantee the maximum precision of the information
- Low power to guarantee a longer user experience
- Small to be integrated in the most stylish and thin designs

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

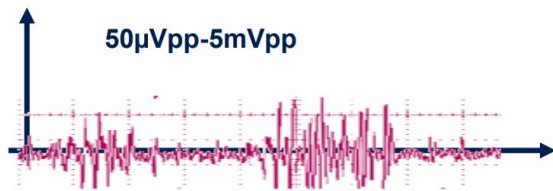
	Input offset voltage [μV]	Input offset voltage drift [μV]	Supply current [μA]	GBP [kHz]	Supply voltage [V]
TSU10x Very low power	100	5	0.6	8	1.5 - 5.5
TSV71x Low power precision	50	10	9	120	1.5 - 5.5
TSZ12x High precision zero drift	1	0.01	28	400	1.8 - 5.5

Analog Front-End

Signal transducers application: electromyography



Raw input signal



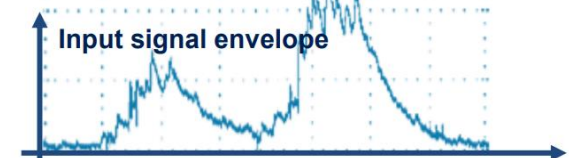
A low input offset voltage with zero drift amplifier is mandatory. Otherwise, the electrodes information would be less accurate or lost. **TSZ12x** family is the perfect match offering:

- $V_{IO} = 1\mu V$
- $\Delta V_{IO}/\Delta T = 0.010\mu V$

Once the signal dynamic has been restored **precision** and **micro power consumption** amplifiers are needed before the signal is fed to the MCU **TSV71x** is the perfect match offering:

- $V_{IO} = 50\mu V$
- $I_{CC} = 9\mu A$

Conditioned output signal



User Interface Audio amplifiers

ST offers highly-efficient devices that can deliver high-quality audio into small, low power solutions

CLASS G HEADPHONE AMPLIFIER [TS4621ML](#) | [TS4621E](#) (μ-less)

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

3W CLASS D MONO SPEAKER AMPLIFIER [TS4962M](#)

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

Low power

High quality

Small size

Solutions for power management

Smart reset

KEY APPLICATIONS

- Smartphones
- Tablets
- Handheld devices
- Wearable
- IoT
- Non-removable battery powered devices

KEY FEATURES

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



SMART RESET ICs

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

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



STUSB4500L

USB-C charging - SINK

Auto-run / plug & play / optional MCU support
SOURCE power budget identification
Automatic error recovery and **restart** on fault
Dead battery support

Collateral

STSW-STUSB002 - GUI
STSW-STUSB007 - Software library

Package



QFN-24 EP
4x4 mm²

CSP-25
2.6x2.6 mm²

Evaluation boards & ref designs



open source ALTIUM library
EVAL-SCS002V1

STUSB4500L – USB micro-B replacement – 15 W

Wearable, portable consumer, gaming, healthcare, POS



Current sensing

	Offset voltage (mV)	Common mode operating range [V]	Supply voltage range [V]	Supply current [μ A]	Gain [V/V]	Bidirection feature	Package
TSC101	1.5	2.8 - 30.0	4.0 - 24.0	165	20, 50, 100 fixed internally	no	SOT23-5L
TSC103	0.5	2.9 - 70.0 -2.1 - 65.0	2.7 - 5.5	200	20, 50, 100 pin selectable	no	TSSOP-8L, SO-8
TSC21x	0.035	-0.3 - +26	2.7 - 26	100	200 500 1000 50 100 75	yes	SC70-6, QFN-10L

Power management in wearable devices:



Wired or wireless battery chargers



Precision current sources from sensors



Photovoltaic systems

ST current sensing ICs portfolio cover most application needs:

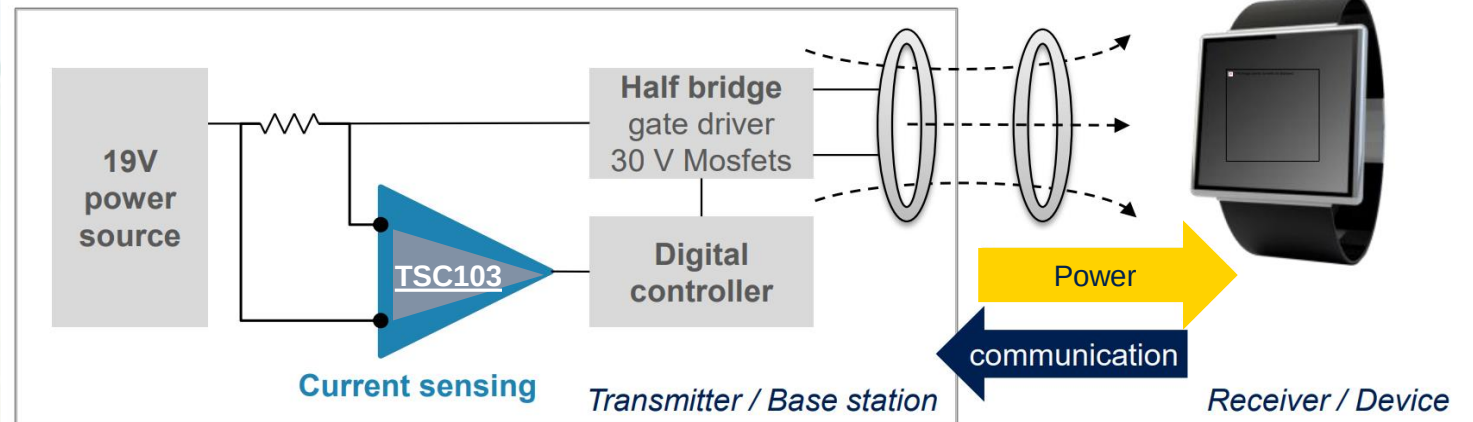
- Independent supply and common mode voltages
- Wide supply voltage range
- Selectable gains
- Low power solutions



Current sensing application: wireless battery charging

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

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



Intelligent battery monitoring

Battery gas gauges

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

STC3115 - Gas gauge IC with alarm output for wearable devices

Accuracy	• Coulomb counter mode, voltage mode and mixed mode operations • 0.25 % accuracy battery voltage monitoring
Robustness	• Analog and temperature compensation • Internal temperature sensor
Flexibility	• Low battery level alarm output with programmable thresholds • Custom battery OCV curve
Low power	2 μ A in standby, 45 μ A in operating
Small size	Flip chip, 2.01 x 1.37 x 0.6 mm, 10 bumps, 0.4 mm pitch





New ST LDOs for smartphones

One-stop shop supplier



DFN5 -
1.2x1.2

LD56050

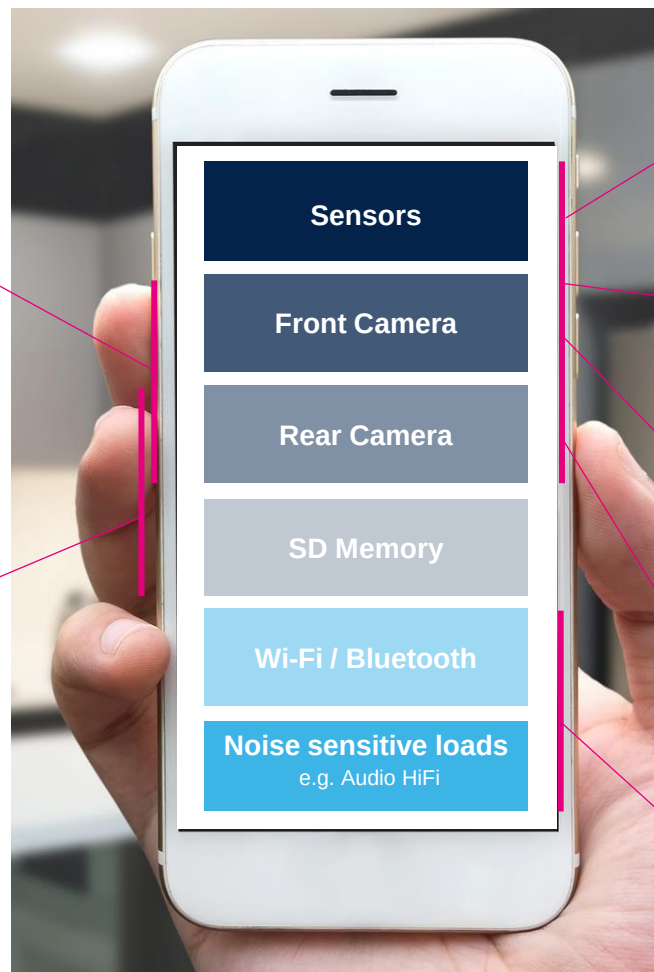
500 mA Ultra Low Dropout
Separate Bias Rail
Low output voltages



DFN8 -
1.2x1.6

LD56100

1 A Ultra Low Dropout
Fast transient
Ultra Low Noise



LD56020

200 mA, low input voltage
High PSRR, Low noise

LD39130S

300 mA Ultra Low I_Q
Green Mode

LD57100

1 A Ultra, Low I_Q
Low Dropout with bias

LD59030

300 mA Ultra Low Dropout

LDLN025

250 mA Ultra Low Noise
Very High PSRR



Flip-Chip4



Flip Chip6 (0.8x1.2 mm)



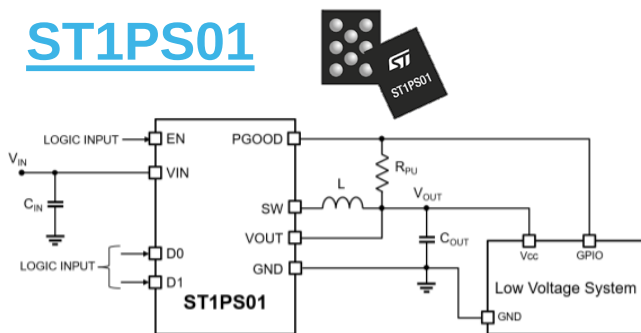
DFN4-1x1



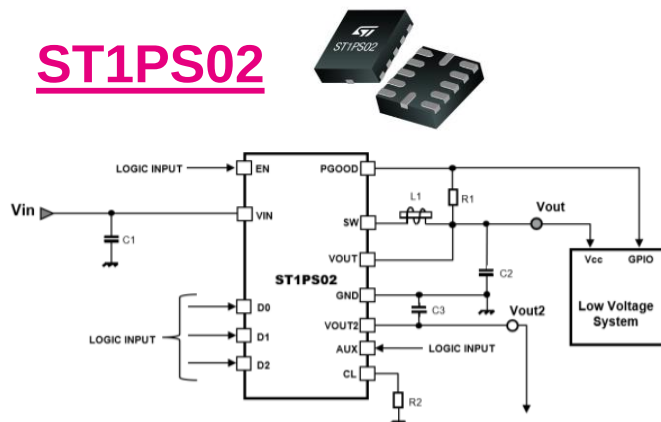
DFN4-1x1

Flip-Chip4

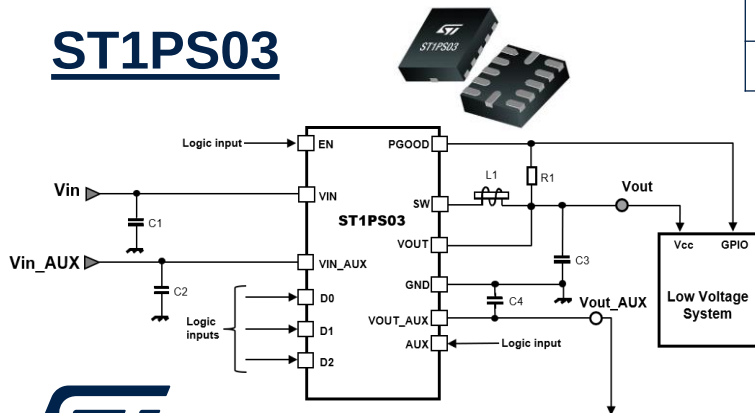
ST1PS01



ST1PS02



ST1PS03



Part Numbers	Output Voltages	Package
ST1PS01AJR	From 1.9V to 2.8V	FlipChip
ST1PS01BJR	From 1.1V to 1.7V	
ST1PS01CJR	From 1V to 1.5V	
ST1PS01DJR	From 1.8V to 2.8V	
ST1PS01EJR	From 1.8V to 3.3V	
ST1PS01FJR	From 1.05V to 1.55V	
ST1PS01GJR	From 0.73V to 1V	
ST1PS01HJR	From 0.625V to 1.05V	

Part Numbers	Output Voltages	Output Discharge	Package
ST1PS02AQTR	From 1.4V to 1.75V, 50mV step	Yes	TQFN12L
ST1PS02A1QTR		No	
ST1PS02BQTR	From 1.8V to 2.5V, 100mV step	Yes	
ST1PS02B1QTR		No	
ST1PS02CQTR	From 2.6V to 3.3V, 100mV step	Yes	
ST1PS02C1QTR		No	
ST1PS02DQTR	From 1V to 1.35V, 50mV step	Yes	
ST1PS02D1QTR		No	

Part Numbers	Output Voltages	Output Discharge	Package
ST1PS03AQTR	From 1.6V to 3.3V	Yes	TQFN12L
ST1PS03A1QTR		No	



[Read more about buck regulators](#)

DC-DC buck regulators

Very high efficiency in any output load conditions

- ✓ 95% typical efficiency at 1mA load
- ✓ 92% typical efficiency at 400mA load

High integration for the minimum board size and number of external components

- ✓ Synchronous rectification
- ✓ Internal Loop Compensation
- ✓ Tiny external components
- ✓ Embedded Soft start Circuit

Flexibility

- ✓ Extended input voltage range, minimum $V_{in}=1.8V$
- ✓ Dynamic output voltage selection



KEY APPLICATIONS

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



Our technology starts with You



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