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# ST portfolio for smartphone platforms



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# Introduction

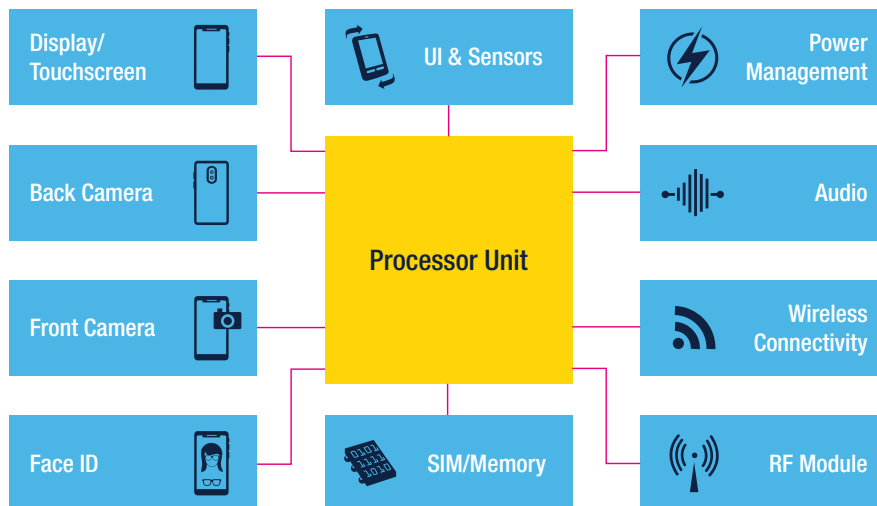
Smartphones are the most commonly used computing devices. They exhibit powerful hardware capabilities and complex operating systems, allowing advanced features and AI applications, internet and cloud access, image and video acquisition, gaming, and core phone functions such as voice calls and SMS. To perform such a variety of applications, smartphones must include many devices, including a large set of sensors (MEMS and Imaging) and devices to support several wireless communications protocols like Bluetooth, Wi-Fi, UWB, NFC, 4G/5G.

STMicroelectronics is a leading semiconductor supplier in the mobile industry which provides solutions for both mobile platform suppliers and mobile device manufacturers (OEM/ODM), with focus on specific high-volume applications.

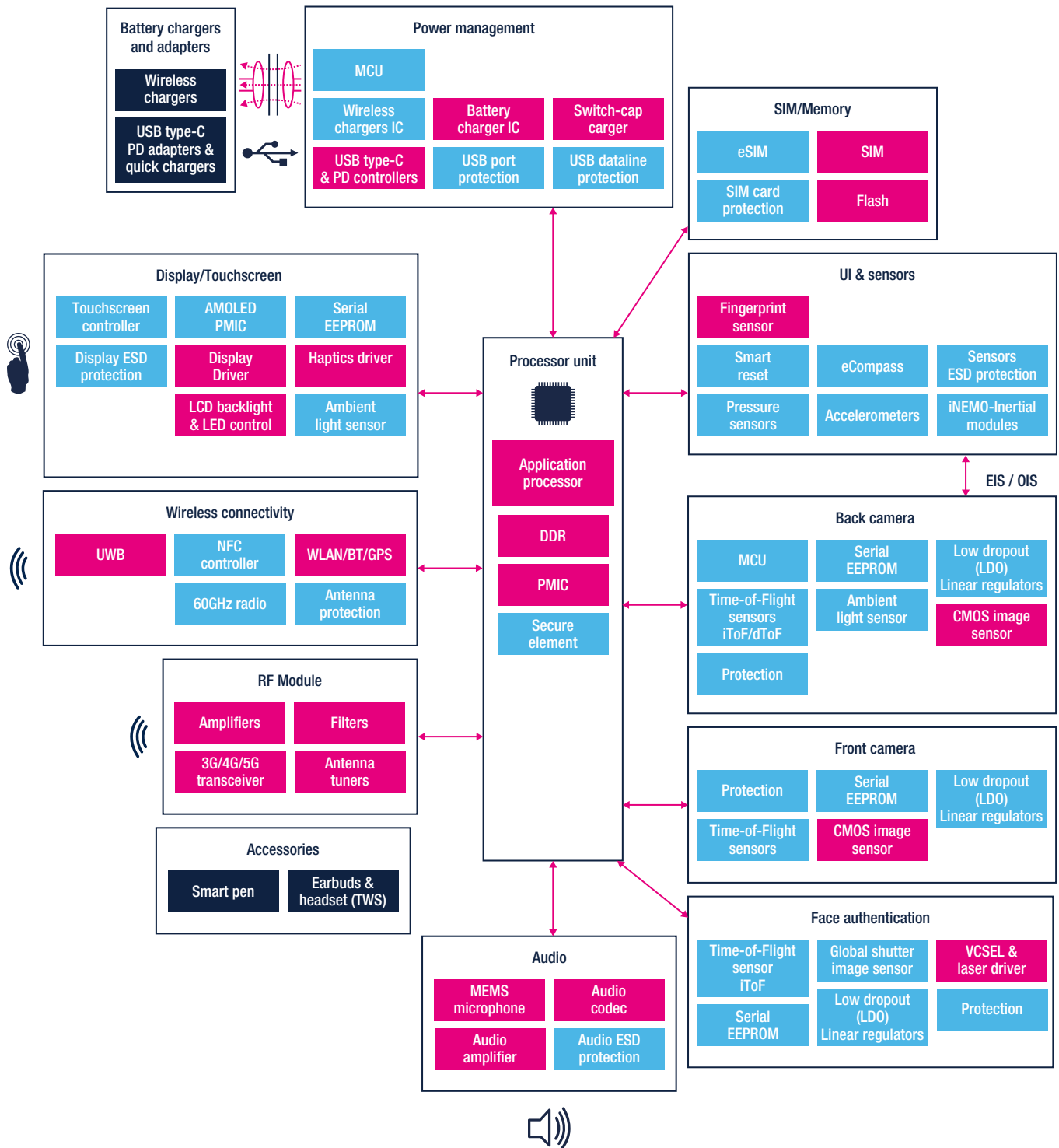
## SMARTPHONE PLATFORM

The technologies in all modern smartphones enable many applications and can be quite complex in terms of system design. The heart of this platform is the application processor (AP) which ST does not supply but offers many devices to cover most of the remaining system.

To better represent the smartphone platform, we can divide it into subsystems (main functional domains, as illustrated below), so we can analyze each subsystem separately. Besides the AP, a modern smartphone can be represented by the following set of functional blocks domains: Display domain, UI domain, Power domain, Audio domain, Connectivity domain, RF domain, Memory domain, and cameras domain.



The following block diagram expands on the previous illustration by showing the ST products for each subsystem, which are detailed separately in the following sections.



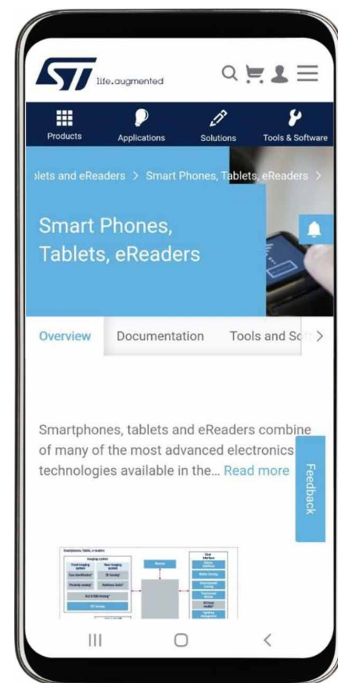
Note:

- pink box: not covered by ST products
- light blue: covered by ST products
- dark blue: external functions/devices

# Snapshot of ST Mobile Portfolio



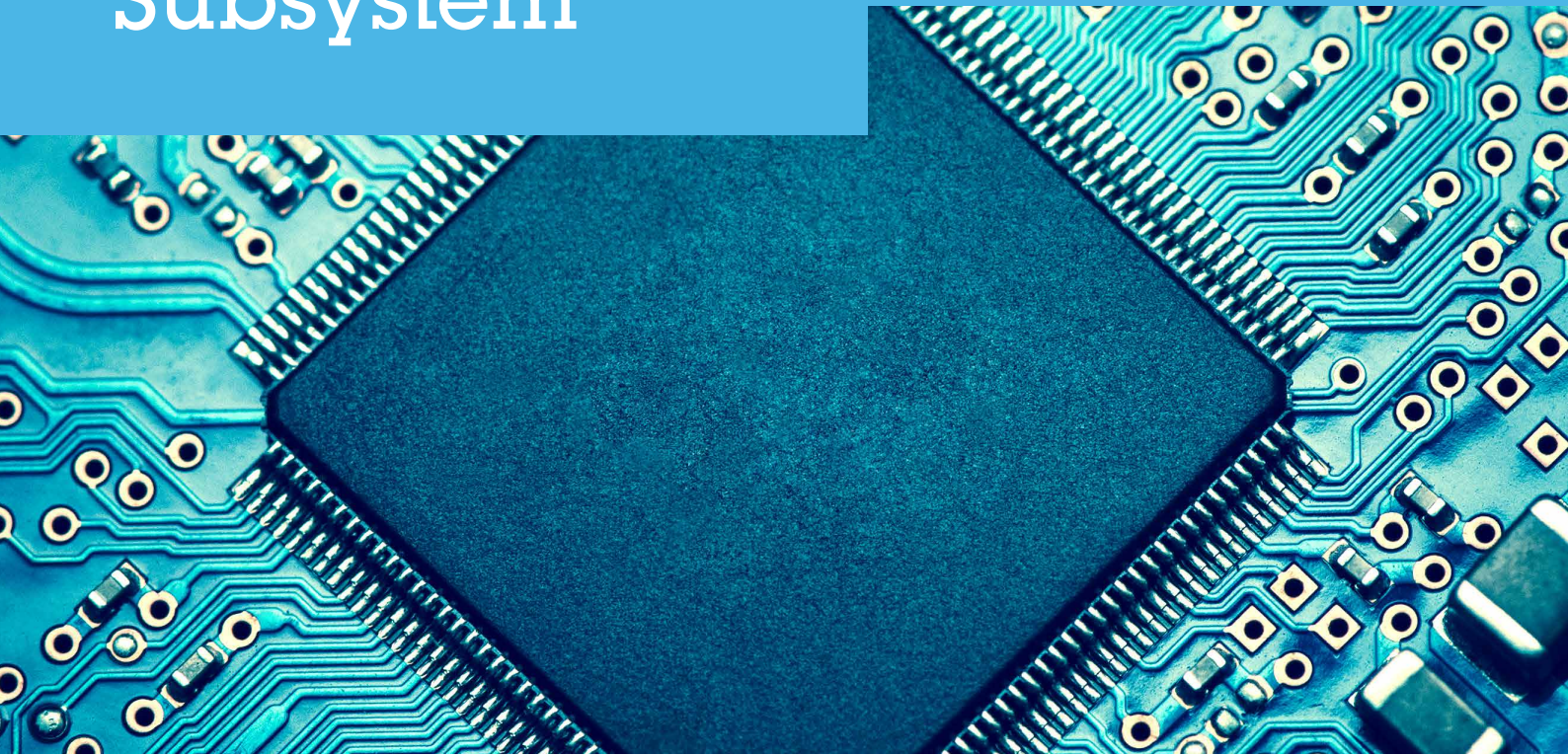
ST provides a range of products to help on the design of leading-edge mobile devices. We enhance the user experience with products such as motion and environmental sensors, imaging-related products, and MCUs for specific low-power tasks. We provide secure elements and secure near field communication (NFC) solutions, and touch-sensor controllers with multi-touch capabilities. We protect devices with integrated passive device technologies, ESD protection and EMI filtering products, and a range of analog products. We also power devices with high-efficiency power and energy management products optimized for battery-powered designs, including touchscreen power management, and wireless charging solutions. We also improve connectivity with our RF product range, which includes smart antenna tuning and RFSOI FEM solutions.



<b>Accelerometer</b>  H3LIS331DL LIS2DW12	<b>6-axis IMUs</b>  LSM6DS0 LSM6DSOX LSM6DSV16X LSM6DS016IS	<b>Magnetometer</b>  LIS2MDL	<b>Pressure sensors</b>  LPS22HH LPS22DF LPS28DFW	<b>iToF &amp; dToF</b>  VL53 family VD55H1	<b>Spectrometers</b>  VD6283	<b>GS sensor</b>  VD56G3 VD55G0
<b>NFC controller</b>  ST21NFC	<b>eSIM</b>  ST33	<b>NFC/eSE/eSIM</b>  ST54	<b>60 GHz transceiver</b>  ST60	<b>MCU</b>  STM8 & STM32 family	<b>Wireless charging</b>  STWLC38/98 (RX) STWBC2-HP (TX)	<b>Memory</b>  M24 family of EEPROM
<b>OLED controller</b>  STMP30	<b>Touch controller</b>  FingerTip	<b>Force sensors</b>  FSR1AD04	<b>Secure element</b>  STSAFE-S320	<b>Smart reset</b>  STM65XX STM66XX	<b>LDOs</b>  LDLN025 LD56010 / 57100 / 59030	<b>Protections</b>  TCPP02-M18 ESDARF02



# Processor Unit Subsystem



ST is member of the Android Ready SE Alliance and offers StrongBox on a complete range of tamper-resistant secure elements:

- for smartphone devices having an ST54 NFC/eSE solution to support NFC secure services, StrongBox is fully embedded into the ST54 Secure Element functionalities
- for smartphone devices targeting both eSIM and StrongBox functionalities, a combined ST33 eSIM + StrongBox solution is available
- for smartphone devices with no secure element, STSAFE-S320 offers a discrete and very cost-effective solution to support StrongBox.



Android Ready SE



STSAFE-S320, discrete secure element supporting StrongBox

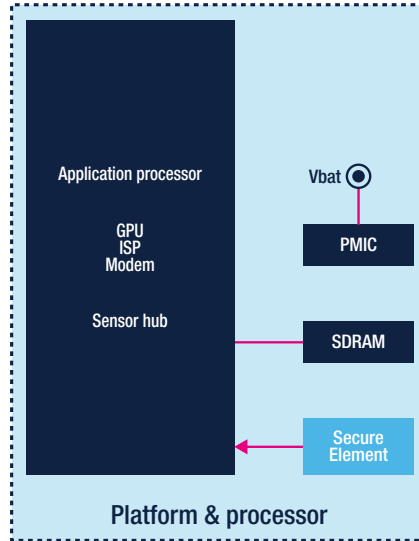
Embedded JavaCard OS / Global platform 2.3  
KeyMint, Weaver and secure storage applets

Highly secure and common criteria EAL5+ certified  
JavaCard open protection profile

Discrete hardware, small WLCSF footprint < 5mm<sup>2</sup>



## PROCESSOR UNIT SUBSYSTEM



## PROCESSOR UNIT SUBSYSTEM BILL OF MATERIAL

Secure element
<u>STSAFE-S320</u>

# Power Management Subsystem

ST offers high integration combined with a broad IP portfolio, complete system competency, and state-of-the-art technology for power management in mobile applications. We offer a wide range of products from simple power management ICs to highly-integrated devices that mix power management blocks with advanced analog and digital functionality.

The STCHARGE family offers Power Tx and Power Rx products for wireless charging solutions able to support the latest Qi BPP, EPP, and up to 100W with proprietary protocols. In order to enable fast system solution deployment, ST developed a proprietary high-power wireless charging proprietary protocol: STSuperCharge (STSC).



## WBC transmitters (PTx)

- Industry-first monolithic transmitter with integrated full bridge inverter and low BOM
- Limitless wireless power architecture for wide range of applications
- Future proof - ready for standard and proprietary protocol evolution



## WLC receivers (PRx)

- WPC Qi 1.3 BPP or EPP compatible
- Device-to-device charging with reverse power transfer
- High power with proprietary STSuperCharge (STSC) protocol



≤ 5 W

Wearables, TWS  
E-cigarettes,  
Trackers

≤ 15 W

Smartphones,  
Tablets  
Power tools,  
industrial

LIMITLESS W

Laptops, tablets  
Power tools,  
industrial

≤ 15 W

Wearables, TWS  
Portables,  
E-cigarettes

15W – 70 W

Laptops, tablets  
Power tools,  
industrial

≤ 100 W

Laptops, tablets  
Power tools,  
industrial

### STWBC86

- Qi 1.2.4 BPP compatible
- Monolithic Tx

### STWBC2-HP

- Qi 1.3 EPP compatible reference design

### STWBC2-HP

- Qi 1.3 EPP
- Proprietary STSC support

### STWLC38JR

- Qi 1.3 EPP
- 2.5W and 5W ref. designs

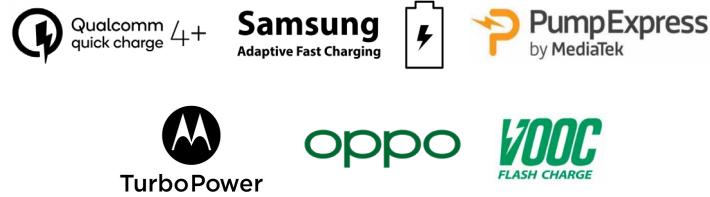
### STWLC98JR

- Qi 1.3 EPP
- Dual-mode up to 12 W transmitter

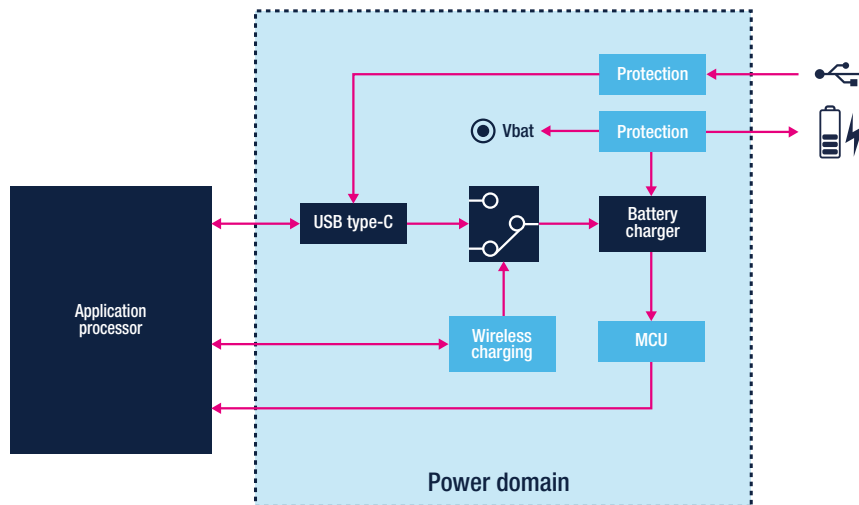
### STWLC99JR

- Qi 1.3 EPP
- Dual-mode up to 15 W transmitter

Almost all OEMs have their own fast charging protocol (see figure below). ST can support this requirement with dedicated MCUs (8-bit or 32-bit) for the implementation of each protocol. Furthermore, the new Switched Capacitor Charger family enables fast charging with the state-of-the-art efficiency performance supporting both wired and wireless battery charging functions.



## POWER MANAGEMENT SUBSYSTEM BLOCK DIAGRAM



## POWER MANAGEMENT SUBSYSTEM BILL OF MATERIAL

Wireless charging	MCU	Protection	Switch capacitor charger
<u>STWBC2-HP (TX)</u> <u>STWBC86 (TX)</u> <u>STWLC38 (RX)</u> <u>STWLC98 (RX)</u> <u>STWLC99* (RX)</u>	<u>STM8s</u>	<u>ESDA25P35-1U1M</u> <u>ICPP01-M12</u>	<u>STSWC58*</u> <u>STSWC68*</u>

Note \*: Product not released yet. Please contact the the local sales representative

## TURNKEY SOLUTIONS

- STEVAL-ISB68WA (wearable 2.5W receiver reference design using STWLC68)
- STEVAL-ISB68RX (5W receiver evaluation board using STWLC68)
- STEVAL-WLC38RX\* (Qi 1.3 compatible 5W receiver evaluation board using STWLC38)
- STEVAL-WBC86TX\* (Qi 1.2.4 compatible 5W transmitter evaluation board using STWBC86)

Note \*: Product not released yet. Please contact the local sales representative

STEVAL-WLC38RX (Q4 2022 – tentative target date)

STEVAL-WBC86TX (Q4 2022 – tentative target date)

## SW BASKET

- STSW-ISB68GUI (PC GUI for prototyping with STWLC68)
- STSW-WPSTUDIO\* (ST Wireless Power Studio PC GUI for fast prototyping and mass production for all products except STWBC2-xx family)
- STSW-WLC38FWBPP\* (5W BPP compatible receiver FW)
- STSW-WBC86FWBPP\* (5W BPP compatible transmitter FW)

# Connectivity Subsystem



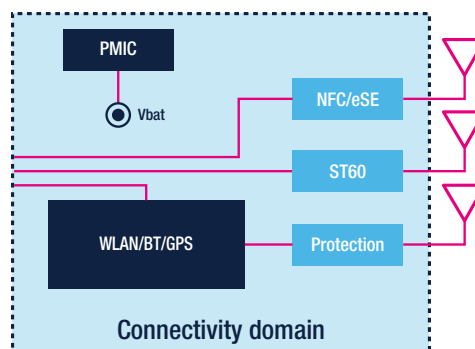
The connectivity domain includes all the connectivity options offered in smartphones.

The mobile market predominately uses integrated system-on-chip (SoC) solutions combining at least Wi-Fi, Bluetooth®, and GPS. ST is more focused on the other connectivity options that can deliver competitive advantages to mobile makers, such as NFC. ST can offer a wide range of products enabling NFC data exchange or advanced mobile payment solutions, based on embedded secure elements.

ST provides a full range of NFC and eSE / eSIM products and solutions to address secure mobile transaction applications from the state-of-the-art ST21NFC NFC controller to the ST54 integrating the widely deployed ST33 secure element. ST54 now allows a new level of integration by merging NFC, eSE, and eSIM in the single-die ST54J solution in a compact WLCSP package.

Another connectivity solution offered by ST is the ST60 RF transceiver for the 60 GHz band. It provides a very power-efficient wireless link with a high data rate, eliminating the need for physical cables and connectors for short range (a few centimeters) point-to-point communications.

## SMARTPHONE RF SUBSYSTEM BLOCK DIAGRAM





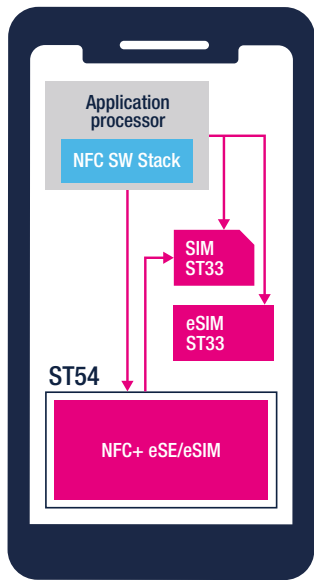
## ST21NFC FOR NFC CONTROLLER

ST21NFCDJ is the 4th generation ST NFC controller integrating a high-performance RF booster to provide the best user experience and ensure a high level of interoperability to ease integration and certification efforts for OEMs.

## ST54 FOR INTEGRATED SOLUTIONS

In order to manage secure mobile transactions, ST provides a large range of ST54 integrated solutions merging our ST21NFC NFC controller and the proven ST33 secure element. The first generation is a system-in-package (ST54H) housed in a BGA package, while the new ST54J/K system-on-chip (SoC) optimized for convergence is available as a single die in a thin WLCSP package.

The ST54J/K delivers performance-boosting integration for mobile and IoT devices with the added benefit of the ST software-partner ecosystem for smoother user experiences in mobile payments and e-ticketing transactions, as well as more convenient remote mobile provisioning to support multiple operator subscriptions.



### ST33 eSIM: #1 source at Tier 1 OEMs

- Few hundred millions shipped to date
- GSMA SAS-UP certified since 2019

### ST54 NFC+SE: reference in Android ecosystem

- Recognized RF performances
- Single die WLCSP form factor (ST54J, ST54K)
- eSIM convergence support (flagships)
- Support of UWB secure transactions

### ST21 NFC controller: validated by most tier 1 OEMs

## HIGH-SPEED 60GHZ RF TRANSCEIVER

ST60 is a 60 GHz V-Band transceiver for contactless connectivity up to 480 Mbps. It offers best-in-class wireless performance with transfer speeds up to 6.25 Gbps, along with very low power consumption.

The ST60A3G1 has a miniature form factor, optimized bill of materials and low-power operation. The ST60A3G1 is a high-speed RF transceiver compliant with eUSB2, UART and I<sup>2</sup>C protocols.

The ST60A3G1 meets the requirements of mobile applications by virtue of its compactness, low-power operation, ease of use, and its innovative architecture design for optimized system bill of materials.



### TYPICAL APPLICATIONS

- Contactless test factory automation and after sales services
- Life proof hole-less personal devices
- Contactless accessories
- Contactless personal equipment docking hub and data transfer

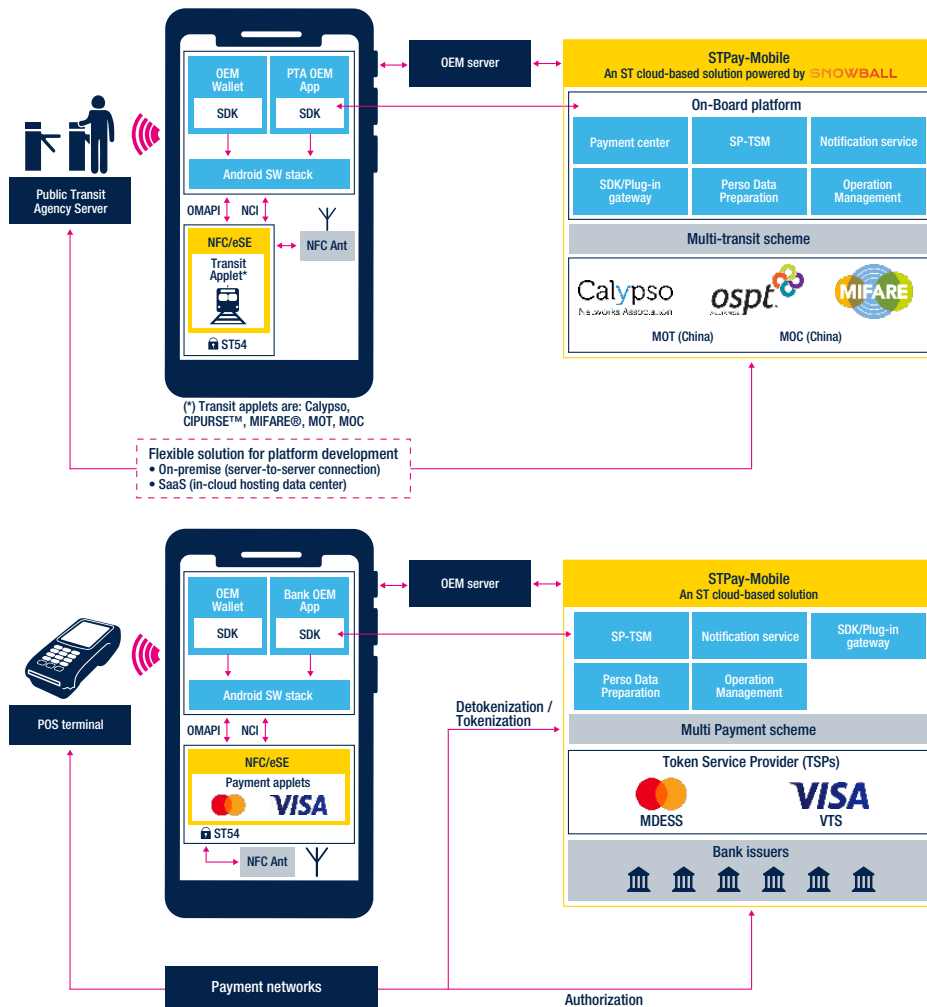
# STPAY-MOBILE

The increasing need for trusted payment transactions has been driving the banking card market towards EMV chipand-pin solutions. The STPay family offers a comprehensive range of Java OS-based banking solutions, covering a wide range of payment applications.

An end-to-end solution for smartphone OEMs, STPay-Mobile simplifies the deployment of digital wallets around the world. Based on the ST54 single-chip solution, the all-in-one STPay-Mobile platform enables more convenient and more secure services. It allows end consumers to use their smartphones as a card to pay, travel, unlock their car, and access restricted areas.

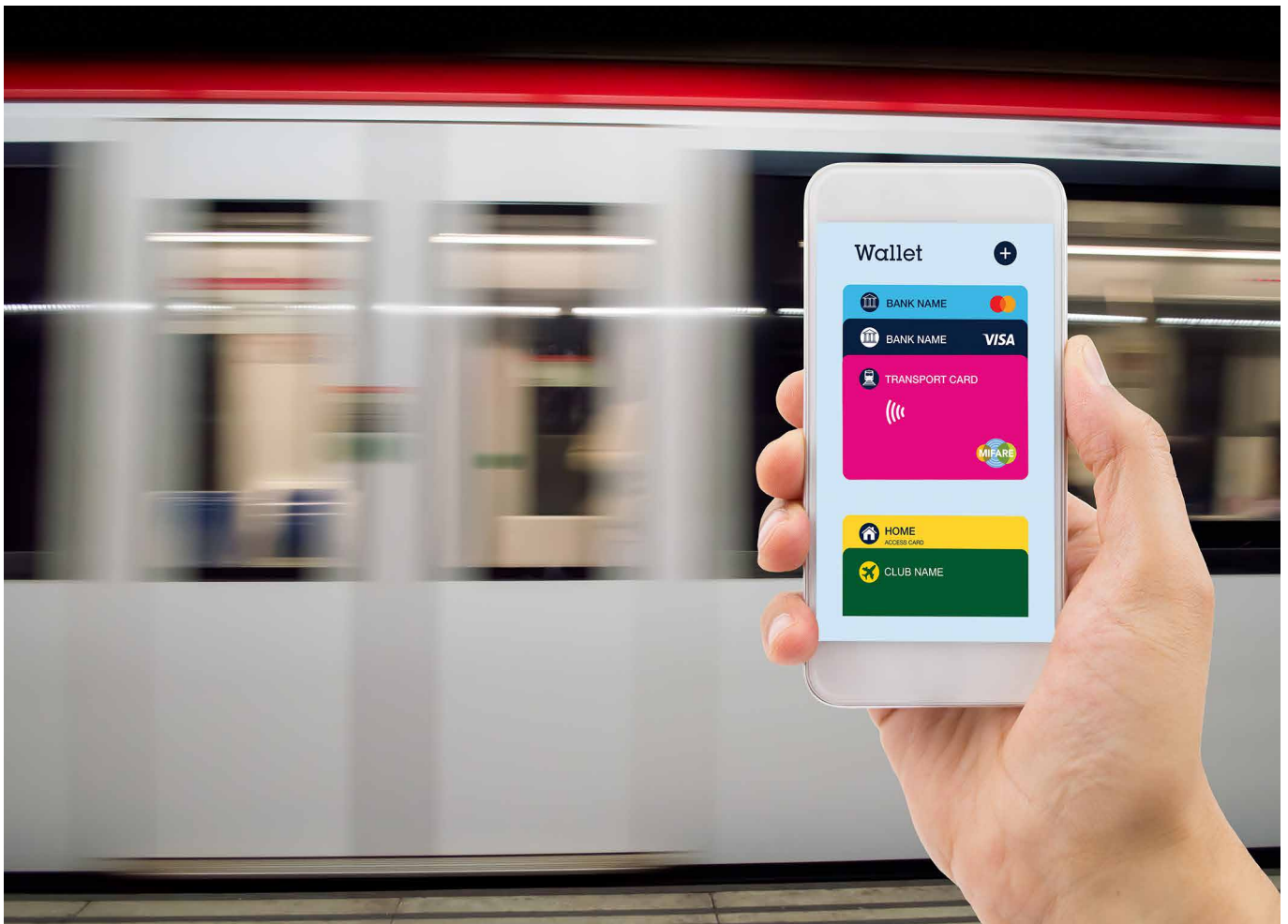
STPay-Mobile brings the most advanced value proposition to smartphone OEMs and public transit agencies (PTAs) and is compatible with over 50 PTAs worldwide. The solution is based on NFC technology powered by Snowball Technology, the market leader in mobile ticketing platforms. It offers a one-stop-shop solution for fast and stable mobile transactions. STPay-Mobile eliminates the need for updates on PTA readers and back-end sites, and streamlines service delivery. It allows OEMs to deploy mobile wallets across several platforms and devices, while ensuring long-term viability.

STPay-Mobile provides OEMs with easy access to many token service provider (TSP) schemes, such as MasterCard and Visa. This plug & play solution brings users an enhanced online, in-app, and in-store payment experience.



## CONNECTIVITY DOMAIN BILL OF MATERIAL

<b>NFC/eSE</b>	<b>60GHz</b>	<b>Protection</b>
<u>ST21NFC</u> ST54	<u>ST60A2</u>	<u>USBULC6-2M6</u>

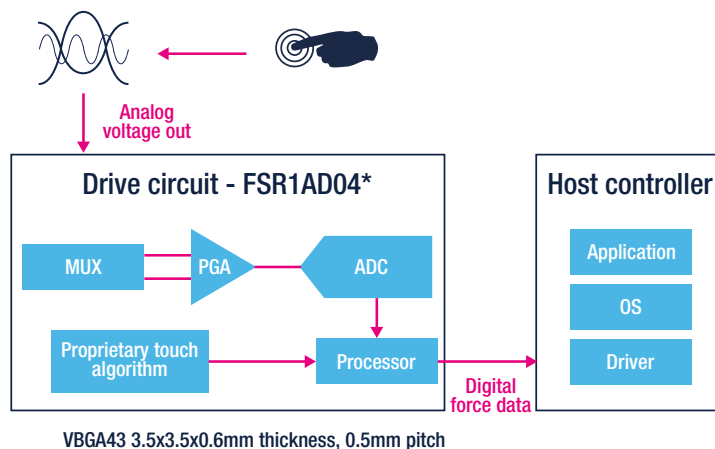


# UI Subsystem



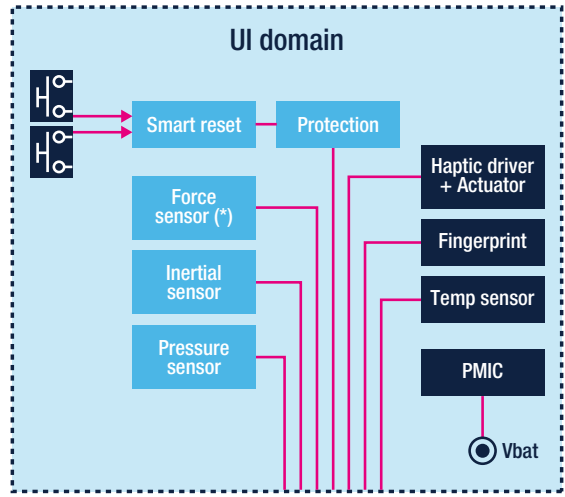
The unique STMicroelectronics portfolio of MEMS sensors supports OEM and ODM in enabling all the most advanced user interaction functionalities. Starting from accurate calculation of acceleration (linear or angular), velocity, and object position, MEMS sensors help recognize player actions as well detect special conditions and movements like nearing phones to ears for call answering. ST has the broadest offer of motion sensors, including accelerometers and 6-axis inertial measurement units (IMU).

Manufactured with our innovative MEMS silicon technologies, they all feature ultralow power consumption and high accuracy and stability over time and temperature variations. The latest applications also pressure sensors to add advanced capabilities to mobile phones and their linked accessories, such as Wireless E911 location. To complete the offering on UI, ST includes smart reset devices able to extend the functionality of existing phone buttons by enabling hidden features (hard reset, factory reset, etc). Together with partners, ST is able to offer a force sensor solution (ST offers a dedicated 8-channel standalone strain gauge controller) to emulate physical sensors and enable full waterproof designs.








Note \*: Product not released on st.com. Please contact the marketing owner

## UI SUBSYSTEM BLOCK DIAGRAM



## MEMS SENSORS FUNCTIONALITIES

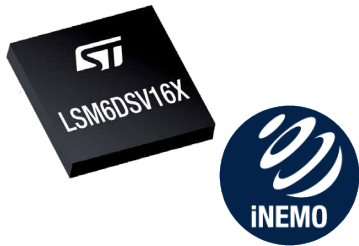
ST propose a wide range of MEMS sensors for the mobile and mobile accessories markets.

User interface	Optical image stabilization	 Low-power IMUs with Machine Learning Core LSM6DSOX, LSM6DSV16X, LSMDSO16IS
Altimeter	Activity recognition	 Low power accelerometer LIS2DW12
Gesture recognition (display wakeup)	Shock detection	 High-performance magnetometer LIS2MDL
		 High-performance barometer LPS22HH
		 Waterproof pressure sensors LPS27HHW, LPS28DFW

## IMU

Inertial measurement units (IMU) combine an accelerometer and a gyroscope in a compact 6-axis system. The integration of multiple sensor outputs bring motion sensing systems to the level of accuracy required for the most demanding applications, such as enhanced gesture recognition, gaming, augmented reality, indoor navigation, and localization-based services. In its latest generation of IMUs particularly suited to mobile applications, ST is embedding machine learning cores (MLC) for context awareness. This enables accurate low-power edge processing that, together with the finite state machine (FSM), allows the precise analysis and reconstruction of user activities and gestures.





- Advanced Processing in the Edge**  
FSM and MLC 2.0; ASC(1) with ST libraries!
- Low noise Accelerometer and Gyro**  
60 $\mu$ g  $\sqrt{\text{Hz}}$  (All FS), 2.8mpds  $\sqrt{\text{Hz}}$
- High Accuracy ODR**  
Work at higher precision, when it is needed
- Embedded Sensor Fusion**  
Low power, low latency – high performance
- Qvar™ with FSM & MLC processing**  
User interface (touch, long press, swipe)

Note 1: Adaptive System Configuration

## PRESSURE SENSORS

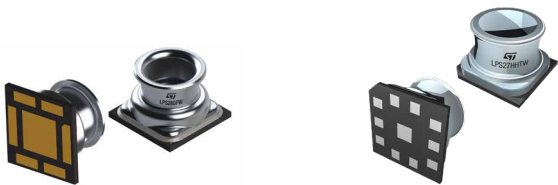
The pressure sensors in mobile phones and accessories can be used in various use cases, such as to improve the activity recognition tasks, ambient pressure monitoring, emergency E911 enablement, and automatic airplane mode.

Activity recognition	Vertical detection	Airplane mode detection
<p>Vertical context detection Stair count / Man fall down Pose &amp; fitness monitoring</p>	<p>Altitude monitoring Indoor V position for E911 Ambient pressure monitor</p>	<p>Recognize take-off and landing to set the radio/GPS signal</p>

The ST absolute digital output barometer integrates the consolidated pressure sensor in the new fully molded package to further improve robustness, reliability, and moisture resistance, while reducing package thickness.

Waterproof pressure sensors are also available in the ST pressure sensor portfolio. They are resistant to chemicals like chlorine, bromine, and salt water, as well as soaps and detergents. The LPS28DFW is an ultracompact piezoresistive waterproof pressure sensor, which functions as a digital output barometer. Thanks to the dual fullscale (FS) mode, the device provides wide coverage of both altimeter and water depth (up to 30 meters).

Another winning feature of the LPS28DFW is its lower power consumption and lower RMS noise. The LPS28DFW is the right pressure sensor for delivering the high level of functionality users want and expect in personal electronics and consumer applications.



**LPS27HHW**  
Smallest 10 Bar WP Pressure sensor  
(2.7 x 2.7 x 1.7 mm CLGA)

**LPS28DFW**  
Dual Full Scale WP Pressure Sensor  
(2.8 x 2.8 x 1.95 mm CLGA)

- Water proofing package up to 10 bar**
- Wider full scale up to 4 bar**
- Ultra low power consumption**
- Package robust to mechanical stress**

## UI SUBSYSTEM BILL OF MATERIAL

eCompass	Pressure	IMU	Accelerometer
LIS2MDL	LPS22HH LPS22DF LPS27HHW LPS28DFW	LSM6DSO/X LSM6DST/X LSM6DSR/X LSM6DSV16X LSM6DSO16IS	LIS2DW12 H3LIS331DL

Smart Reset	Protection	Force Sensors
STM6519 STM6520 STM6524 STM6600 STM6620	ESDZV5-1BF4 ESDZV5-1BV2	FSR1AD04*

Note \*: Please contact the local sales representative

## TURNKEY SOLUTIONS FOR MEMS SENSORS

- **STEVAL-MKI109V3** (motherboard; professional MEMS tool)
- **STEVAL-MKI181V1** (LIS2MDL)
- **STEVAL-MKI192V1** (LPS22HH)
- **STEVAL-MKI224V1** (LPS22DF)
- **STEVAL-MKI213V1** (LPS27HHW)
- **STEVAL-MKI225A** (LPS28DFW)
- **STEVAL-MKI196V1** (LSM6DSO)
- **STEVAL-MKI197V1** (LSM6DSOX)
- **STEVAL-MKI194V1** (LSM6DSR)
- **STEVAL-MKI195V1** (LSM6DSRX)

All adapter boards for standard DIL24 socket can be used with the following boards:

- SensorTile.box **STEVAL-MKSBOX1V1**
- STM32 Nucleo expansion **X-NUCLEO-IKS01A3**

## FW BASKET

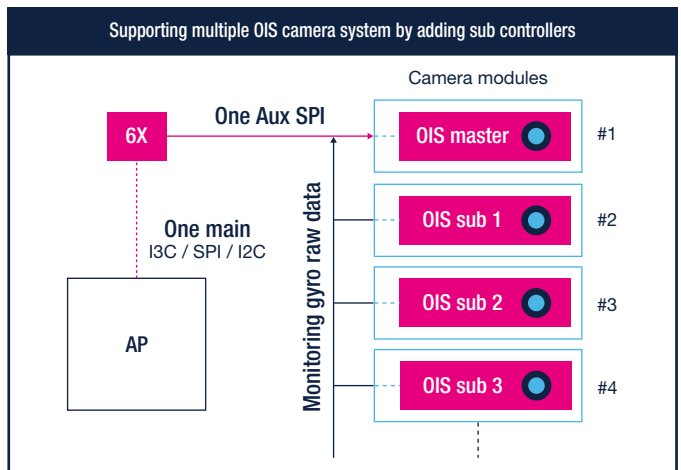
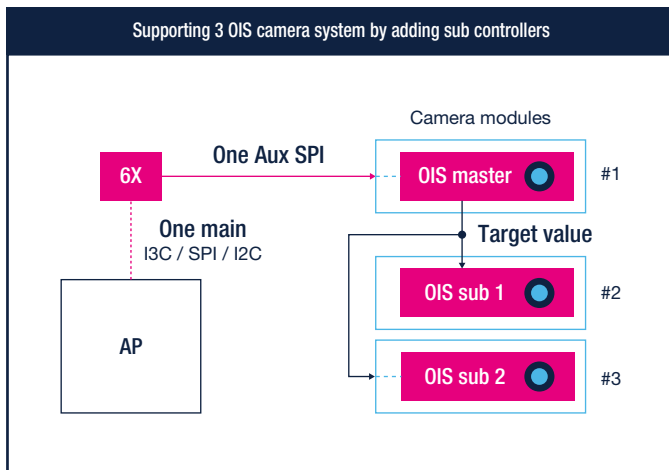
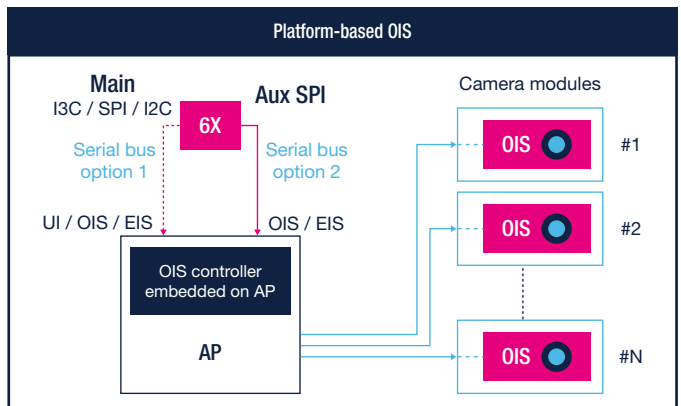
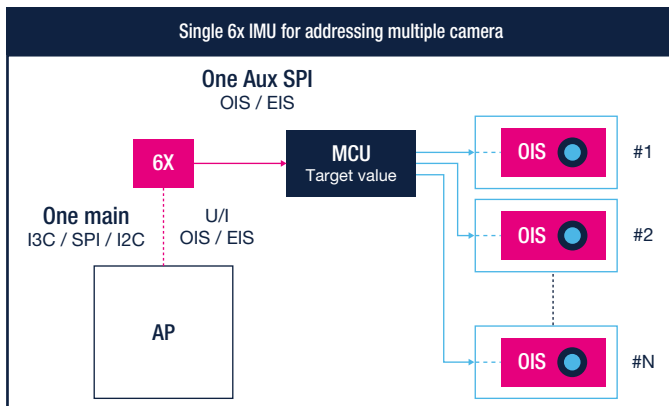
- **AlgoBuilderSuite**



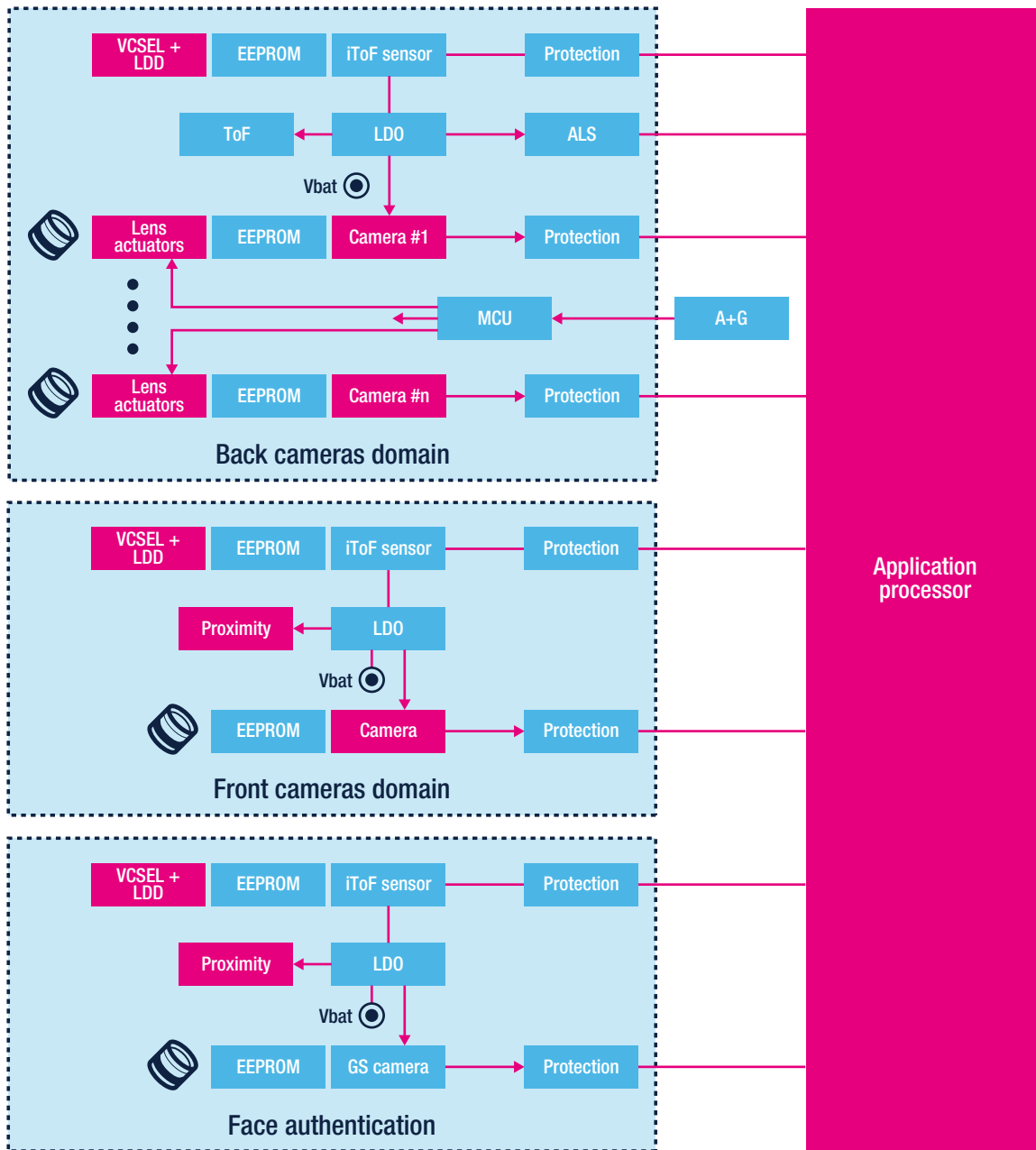
# Camera Subsystem

Smartphones are able to take high quality photos thanks to high-performance, multi-megapixel sensors, as well as devices that help compensate for shaking, adapt to ambient light levels, and optimize camera focus.

The latest smartphones integrate several cameras, many of which require optical stabilization. ST offers MEMS IMUs, widely used for the OIS (optical image stabilization). Many system topologies can be adopted to enable OIS in smartphones, including those based on STM32 MCUs.



## SMARTPHONE CAMERA SUBSYSTEM BLOCK DIAGRAM



## ALS AND TOF

Ambient light sensors (ALS) can be used with front and rear cameras to help to evaluate the light source, optimize the white balance, and compensate for light source flicker.

STMicroelectronics offers a family of high-accuracy and target-reflectance-independent Time-of-Flight (ToF) ranging sensors as well as a new high-resolution 3D Time-of-Flight camera. ST pioneered high-volume production of fully integrated miniature direct ToF products. The products feature a vertical cavity surface emission laser (VCSEL) logic implementing a ranging algorithm, an array of single photon avalanche diode (SPAD) detectors, and an ultralow power ranging architecture that is perfectly suited to the assisting camera focus algorithm.

In addition to laser autofocus assist, FlightSense sensors can address other use cases, including touch-to-focus and scene understanding enhancement.

The introduction of the high-resolution indirect ToF sensors enable exciting new use cases, including support for photographic Bokeh effect as well as high-performance face identification to enable secure phone unlock and support secure payments.

Key benefits of ToF			Key benefits of GS sensors			Key benefits of ALS		
Laser autofocus	Scene understanding	Gesture	Power efficient, high resolution, high sensitivity 3D Sensor			Power efficient, high resolution, high sensitivity 3D Sensor		
Single-point AF assist Touch-to-focus Multiple camera selection		User interaction	Secure face unlock for secure payment	Bokeh assistance	3D scanning	Secure face unlock for secure payment	Bokeh assistance	3D scanning

## EEPROM

STMicroelectronics has been the number one serial EEPROM supplier for over 10 years thanks to a complete range of densities and packages, which brings flexibility in design and enable reliable parameter management. The latest serial EEPROMs designed with advanced technology offer the required features for storing image sensor parameters.

## 2D NEAR INFRARED CAMERA

2D near infrared camera for under-OLED face authentication and other user interactions.

STMicroelectronics has been the number supplier in camera sensors with global shutter pixels for 5 years.

The sensors are optimized for sharp and sensitive light sensing for wavelengths up to 940nm, enabling high performance under-OLED sensing.

ST has the most compact global shutter sensors available, even while offering larger resolutions. The 644x604 version allows tiny modules enabling excellent horizontal and vertical fields-of-view. The very low power management of ST sensors is key for mobile usage.

The pixel size enables very thin camera modules and high near-IR sensitivity.

Through one of its partners, ST offers a turnkey solution for face authentication that is compatible with under-OLED constraints.

Global shutter sensor	<b>VD55G0 (0,4 Mpixels)</b> <ul style="list-style-type: none"> <li>• 644x604 pixels</li> <li>• Only 2.6x2.5mm<sup>2</sup> sensor</li> <li>• 2.6 μm BSI GS pixel, low noise</li> <li>• Auto-expo &amp; defect correction</li> <li>• 4 immediate contexts</li> <li>• 4 multi purpose IO strobe, PWM, Synch, GPIO, ...</li> </ul>	<b>VD56G3 (1.5 Mpixels)</b> <ul style="list-style-type: none"> <li>• 1364x1124 pixels</li> <li>• Only 3.6x4.3mm<sup>2</sup> sensor</li> <li>• 2.6μm BSI GS pixel, low noise</li> <li>• Auto-expo &amp; defect correction</li> <li>• 4 immediate contexts</li> <li>• 8 multi purpose IO strobe, PWM, Synch, GPIO, ...</li> <li>• Full Hardware Optical Flow</li> </ul>
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## LDO FOR SENSORS

Wide input voltage range from 1.1V to 5.5V, low dropout, low output noise, high PSRR, excellent stability, and very low consumption make our LDOs ideal for mobiles, sensors, and wireless modules. The tiny chip-scale package (CSP) 0.65 x 0.65 mm outline ensures a compact circuit footprint with low impact on PCB size.



## CAMERA SUBSYSTEM BILL OF MATERIAL

<b>ALS</b>	<b>TOF</b>	<b>MCU</b>	<b>Protection</b>
<u>VD6283</u> <u>VD6282</u>	<u>VL53L1CA</u> <u>VL53L3CA</u> <u>VL53L4CA</u> <u>VL53L5CA</u> <u>VL53L8CA</u> <u>VD55H1</u>	<u>STM32G0</u>	<u>ESDARF02-1BU2CK</u> <u>ECMF2-40A100N6</u> <u>ECMF4-2450A60N10</u>
<b>Memory</b>	<b>LDO</b>	<b>GS Camera</b>	
<u>M24C64X-FCU</u> <u>M24128X-FCU</u> <u>M24256X-F</u> <u>M24512X-FCU*</u>	<u>LDLN025</u> <u>LD59030</u> <u>LD57100</u> <u>LD56100</u> <u>LD39130S</u> <u>LD56050</u>	<u>VD56G3</u> <u>VD55G0</u>	

Note \*: Product not released yet. Please contact the the local sales representative

## TURNKEY SOLUTIONS

- **X-NUCLEO-6283A1** (6-channel ambient light sensor, with flicker extraction expansion board based on VD6283 for STM32 Nucleo)
- **P-NUCLEO-53L4A2** (L53L4CX STM32 Nucleo pack with X-NUCLEO-53L4A2 expansion board and NUCLEO-F401RE development board)
- **P-NUCLEO-53L3A2** (ranging sensor Nucleo pack based on VL53L3CX for STM32 Nucleo)
- **P-NUCLEO-53L5A1** (expansion pack for VL53L5CX)
- **X-NUCLEO-53L3A2** (ranging sensor expansion board based on VL53L3CX for STM32 Nucleo)
- **X-NUCLEO-53L5A1** (expansion board for VL53L5CX)
- **X-NUCLEO-53L4A2** (Time-of-Flight sensor with extended range measurement expansion board based on the VL53L4CX for STM32 Nucleo)
- **VL53L3CX-SATEL** (breakout board with VL53L3CX detection ToF ranging sensor for easy integration in customer devices)
- **VL53L5CX-SATEL** (breakout boards for VL53L5CX)

## FW BASKET

- **X-CUBE-ALS + STSW-IMG301** (ambient light sensor software for STM32Cube and GUI)

Note: Contact your sales representative to access to our latest solutions optimized for wireless applications

# Display Subsystem

The main STMicroelectronics devices in the display domain are AMOLED PMIC and touch controllers.

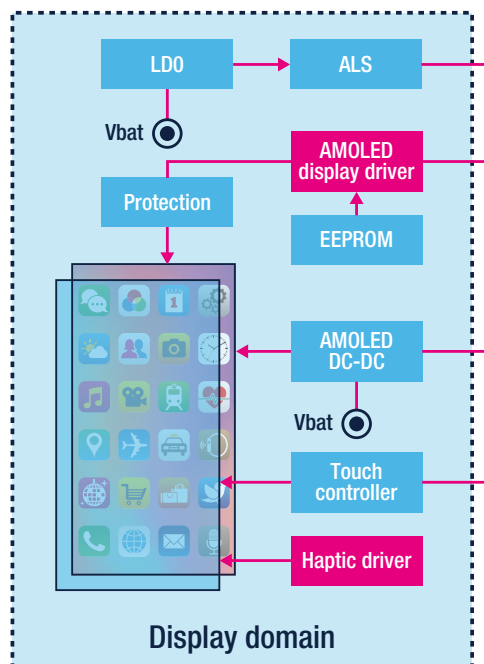
The fully integrated power-management ICs (PMICs) for AMOLED displays combine a low quiescent current and enhanced flexibility to extend the battery runtime of portable devices.

The trademark FingerTip touch controllers for both small and large screens provide an optimal mix of ultralow power, small size, and low external part count.

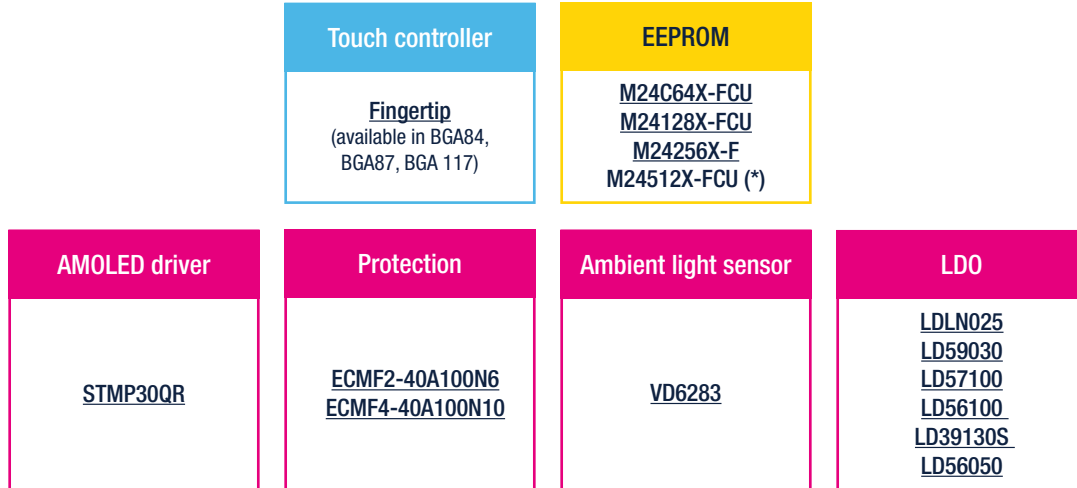
The proprietary ST low-noise capacitive analog front-end ensures very low intrinsic noise, ensuring the high sensitivity required in new AMOLED displays. The innovative node compensation hardware provides consistent touch performance across the display panel, including curved and trench areas.

## AMBIENT LIGHT SENSOR BLOCK DIAGRAM

ALS are used to dim the display backlight (photopic lux level), but also to adapt the display tone based on correlated color temperature (CCT) measurement. Light flicker detection is also available for the smartphone corner camera.



## DISPLAY SUBSYSTEM BILL OF MATERIAL



Note \*: Product not released yet. Please contact the the local sales representative

## AMOLED PMIC

With a 2.9V to 4.8V input-voltage range, the STMP30 PMIC contains three integrated DC-DC converters to provide all the power rails needed for AMOLED displays in smartphones and other portable devices. The voltage can be set between 4.6V and 5.0V to optimize the display brightness for lowest power consumption and best visibility under any conditions. The 5.0V maximum setting allows high-brightness mode (HBM) for best viewing in bright outdoor lighting.

The remaining two programmable voltages (-0.8V to -6.6V, and 5.5V to 7.9V) are programmed using single-wire (S-Wire) protocol through external pins. The PMIC also receives S-Wire messages to operate the AMOLED in always-on display (AOD) mode, which improves user convenience by showing information on-screen continuously at very low power.

The PMIC has a true shutdown mode that helps maximize power savings, as well as safety features such as thermal protection, input undervoltage lockout, and soft-start with inrush current limiting. In addition, the high- voltage outputs feature fast-discharge circuitry and short-circuit protection.

Parameter	STMP30QR*
<b>Vin range</b>	2.9V – 4.8V
<b>Vout1 range</b>	4.6V – 5V
<b>Vout2 range</b>	-6.6V to -0.8V
<b>Current capability Vout1-Vout2</b>	550mA
<b>Vout3 range</b>	5.5V to 7.9V
<b>Current capability Vout3</b>	150mA
<b>Accuracy including temp condition</b>	Vout1: +/-0.8% Vout2: +/- 60mV Vout3: +/- 1%
<b>Package</b>	WCSP25 2.1 x 2.1mm



Note \*: Product not released on st.com. Please contact the marketing owner

## TOUCH CONTROLLER

The industry-proven ST FingerTip touchscreen controller technology enables advanced multitouch user interfaces in a single-chip solution with high and uniform sensitivity on all panels, including curved screen areas and new AMOLED displays, making it perfectly suited for the latest designs.

FingerTip supports advanced features thanks to multimode sensing technology. The water rejection algorithm can detect water on the top of the screen and the device can still track one finger moving in the water without false touching or line breaking. The device supports multifinger glove operation and small passive stylus.

The device also supports all types of HSYNC and VSYNC modes, which enables touch sampling to be synchronized with the display SYNC signal. This ensures it can even work with quad high-definition displays.

The controller embeds a powerful 32-bit ARM M3 core with flash that is capable of providing a high level of overall touch performance in terms of noise rejection, response time, and power consumption.

<p><b>Thin bezel and foldable smartphone</b></p> <p>Flexible for foldable phones</p>	<p><b>High display rate / resolution</b></p> <p>Low latency touch. 240 / 288 Hz report rate</p>	<p><b>Hovering and gesture recognition</b></p> <p>Rotate, scale, pan, swipe, and more...</p>	<p><b>KEY FEATURE</b></p> <ul style="list-style-type: none"> <li>• True 10-finger multi touch</li> <li>• High SNR, high noise immunity</li> <li>• Low latency, high report rate</li> <li>• Support water and glove mode</li> <li>• Wake up gesture</li> <li>• Mutual, self &amp; proximity scanning</li> <li>• Support active pen</li> <li>• Ultra-low power</li> <li>• I2C SPI I<sup>2</sup>C communication</li> </ul>
<p><b>Proximity sensing</b></p> <p>IR-Less proximity detection</p>	<p><b>Work with glove and water</b></p> <p>Support water rejection &amp; glove sensing</p>	<p><b>Active stylus</b></p> <p>Support both USI &amp; WGP active pen protocol</p>	



# Memory/SIM Subsystem

ST provides a full range of NFC-, eSE- and GSMA-certified eSIM products and solutions to address secure mobile transactions applications. Previously offered separately, they are now available as fully integrated solutions combining an NFC controller, eSE, and eSIM, thereby enabling new design opportunities.

- ST33 SIM, eSIM, and eSE

ST33 for eSIM and eSE applications  
ST33 secure microcontrollers meet the advanced security and performance requirements for secure applications, including embedded SIM and embedded NFC secure elements with a large user flash memory capability.



An eSIM is a surface-mounted device soldered directly on the PCB, which enables OEMs to design smaller and thinner mobile devices and end-users to subscribe to the mobile network operator of their choice. Remote provisioning of the SIM application inside the eSIM device is ensured by subscription management systems compliant with the GSMA Remote SIM Provisioning specification.

### KEY FEATURES ST33

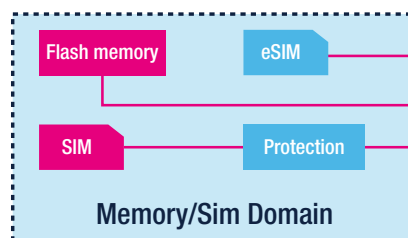
- Up to 2 Mbytes Flash
- Delivered in multiple packages (WLCSP, MFF2, DFN8)
- GSMA SAS-UP certified flow
- EMVCo, CC EAL5+, MTPS certified

## MEMORY/SIM SUBSYSTEM BILL OF MATERIAL

eSIM	SIM Protection
ST33	USBULC6-2M6* ESDAVLC5-4BX4

Note \*: Full production 2023

## MEMORY/SIM SUBSYSTEM BLOCK DIAGRAM

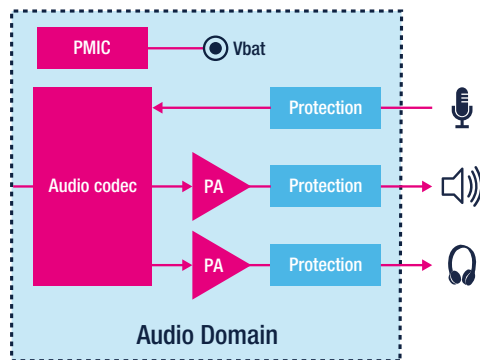


# Audio Subsystem

Audio functions are predominately integrated into main host processor. The ST offering is devoted to protection devices for connecting external cabled earphones and microphones.



## AUDIO SUBSYSTEM BLOCK DIAGRAM



## MEMORY/SIM BILL OF MATERIAL

Protection
<u>ESDZV5-1BF4</u> <u>ESDZV5-1BV2</u>



# LDO and protections in Smartphones

In smartphone applications, LDO and protection devices are widely used in several subsystems.

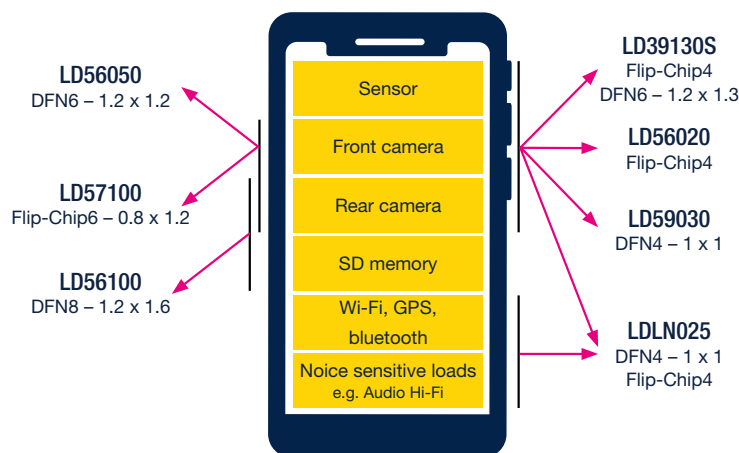
ST offers a complete portfolio of high-performance low-dropout regulators with state-of-the-art figures on the key merit parameters, all fitting into the smallest packages available. The ultrasmall, high-performance LDOs are particularly suitable for the latest generation of portable devices, such as smartphones.



Portable devices are small integrated devices using ESD-sensitive ICs with thin lithography technologies, in close contact with electrostatic charges that can develop on a human in low relative humidity. The risk of ESD damage is therefore very high.

The complete ST protection and filtering range with integrated or standalone solutions offers design flexibility while allowing space saving and high system immunity.

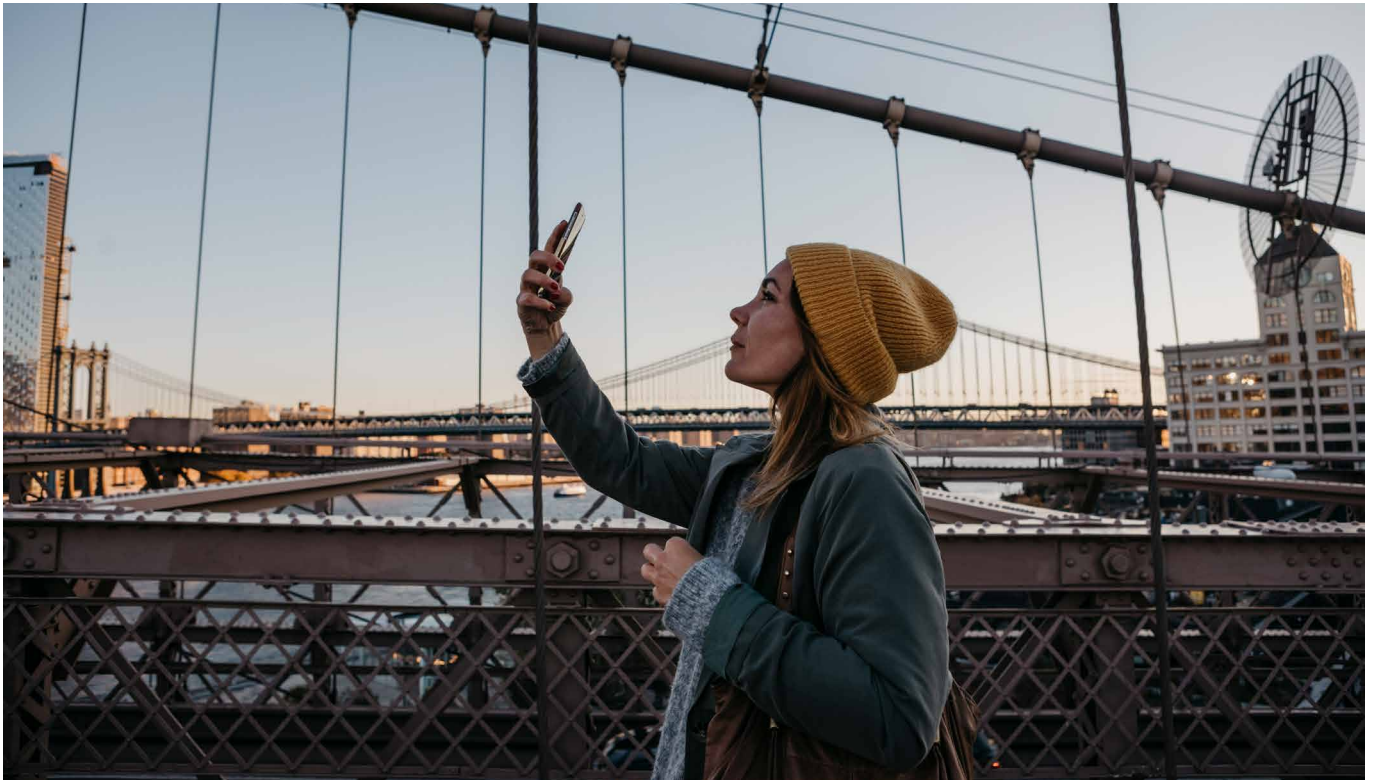
## The one-stop-shop LDO's supplier addressing high mega pixels cameras



LDO	Benefits
LDLN025	<ul style="list-style-type: none"> <li>• Ultra Low Noise</li> <li>• Very High PSRR LDOs for camera AVDD and RF</li> </ul>
LD59030	<ul style="list-style-type: none"> <li>• 300mA LDO ultra low VDROD</li> <li>• Good cost-performance trade-off</li> </ul>
LD57100	<ul style="list-style-type: none"> <li>• 1A Ultra low dropout LDO with Bias for camera DVDD</li> </ul>
LD56100	<ul style="list-style-type: none"> <li>• 1 A very low dropout fast transient ultra-low noise regulator</li> </ul>
LD39130S	<ul style="list-style-type: none"> <li>• 300 mA with very low quiescent</li> <li>• Auto green mode function allows ultra low consumption at light load</li> </ul>
LD56050	<ul style="list-style-type: none"> <li>• 500 mA ultra low VDROD with bias supply input</li> </ul>
LD56020	<ul style="list-style-type: none"> <li>• 200mA, low input voltage, low Iq, High PSRRR</li> </ul>



# PROTECTION AND FILTERING DEVICES IN SMARTPHONE



# life.augmented



Order code: BR2301SPPLATFORM

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