

What Goes Around The ST Microcontroller

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Technology Tour 2019

Dallas-Richardson, TX | March 7











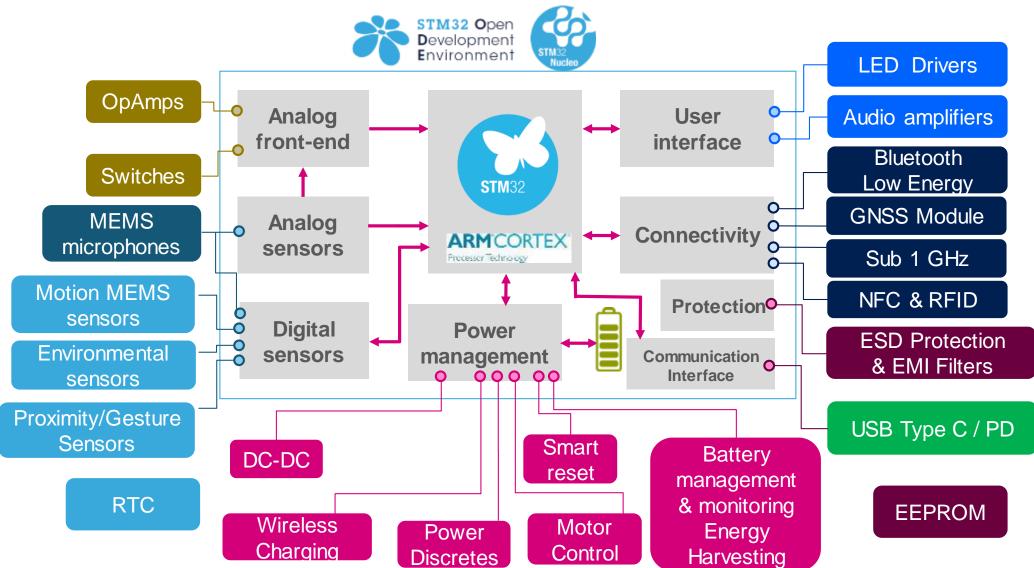


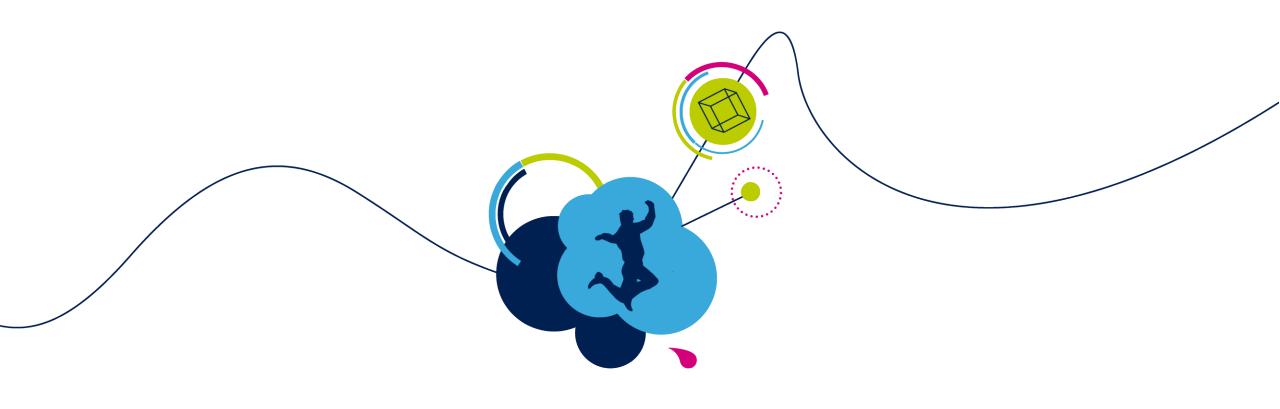






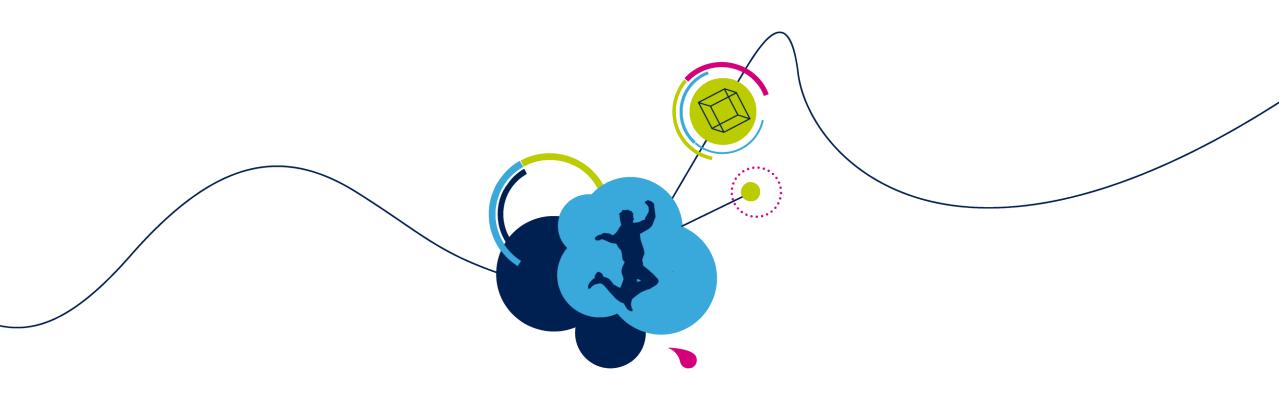
What Goes Around the Micro





What Goes Around a Micro? (Let's look at the best micro's first)





STM32





STM32 Key Messages

STMicroelectronics is leading the market

The broadest 32-bit MCU offering

LEVERAGE



Leadership

- #1 choice by engineers
- 750+ parts, 10yrs w/STM32



Ecosystem

- Rapid Development
- Low-cost Prototype

STM32 Open Davelopment Environment

Vertical Solutions

Audio, MC, Graphics, Connectivity, Security...



Product Life Support

10 Yrs. Commitment



Invitation Promotion/Seminars

- Technology Tours
- Hands-On Seminars

OPPORTUNITIES

- Uncertainty at other MCU companies
- Legacy MCUs
- Time Saving Development
- Low \$ entry to 32-bit MCU
- Alignment with Disty/Partners
- Emerging Customers
- Legacy MCU Customers
- Product consolidation by competition
- Customer Exposure
- Customer Engagement



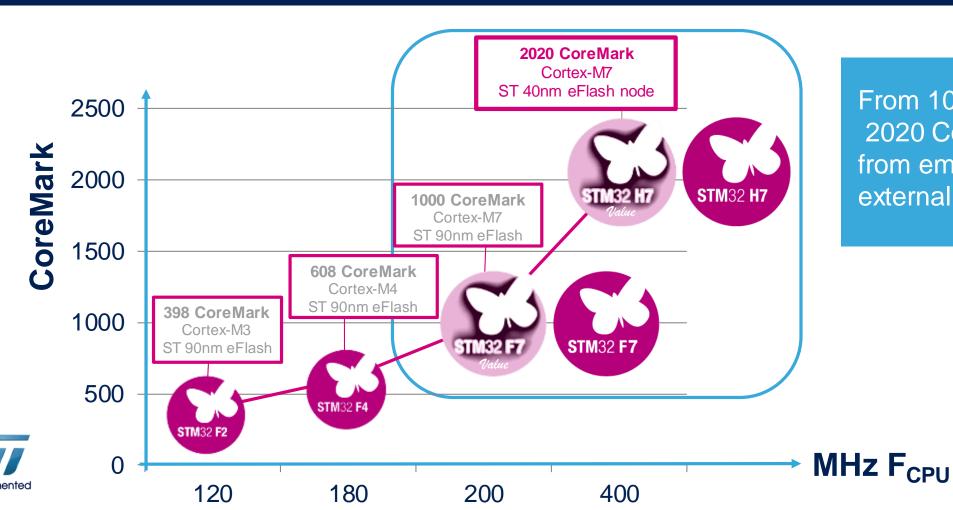
STM32 High Performance MCUs (STM32F7 / STM32H7)

- The latest additions to the STM32 family, the STM32F7x0 and H7x0 Value Line microcontrollers (MCU) from STMicroelectronics, give extra flexibility to create affordable performance-oriented systems including real-time IoT devices, without compromising features or cyber protection.
- These new lines trim embedded Flash to the essential, still allowing secure boot, sensitive code and real-time routines to run safely on-chip, leveraging access times over 25 times faster than for external Flash (for cache miss). If needed, applications can scale-up either by adding off-chip serial or parallel (up to 32-bit) memories and leveraging the MCUs' broad external interfaces and eXecute in Place (XiP) capability, or by porting to other pin-to-pin compatible STM32F7 or STM32H7 MCU lines, with up to 2Mbyte Flash and up to 1Mbyte RAM, supported by the same ecosystem with the same easy-to-use tools.
- The MCUs are also energy efficient, with flexible power modes, gated power domains, and on-chip power management that simplify design and reduce BOM cost. With execution performance up to 2020 CoreMark® at the heart of a secure and power-efficient architecture, the new Value Line devices are the entry point to IoT innovation in medical, industrial, and consumer applications. With up to 125°C as the maximum junction temperature, developers can leverage the full core and peripherals performance even when ambient temperature increases.



STM32 High Performance MCUs (STM32F7 / STM32H7) Product Portfolio

High performance STM32F7 / STM32H7



From 1000 CoreMark to 2020 CoreMark executing from embedded and external memories

STM32 Mainstream MCUs

- Devices in ST's ARM® Cortex®-M0+-based STM32 G0 series is a new generation of microcontrollers delivering an upgrade in 32-bit performance and integration while featuring the essentials of the STM32 family and are particularly suited for cost-sensitive applications. STM32 G0 MCUs combine real-time performance, very low-power operation, and the advanced architecture and peripherals of the STM32 platform.
- ST pushes the all-in-one concept at its most with the STM32 G0 Series: simple, robust, efficient in all directions.
- STM32G0x1 devices answer the need for higher performance in analog, low-power operations or more control on secure transactions, such as the loT applications, home-entertainment products, appliances and industrial equipment. It supports a higher temperature range up to 125°C and a wide set of package types such as WLCSP, UFBGA, TSSOP, QFP and QFN packages. The STM32G0x0 Value Line comes with a very accurate internal clock making external oscillator useless, a full set of performing peripherals such as faster 12-bit ADC, advanced and flexible timers, calendar RTC and communication peripherals such as the I²C, USART and SPI.



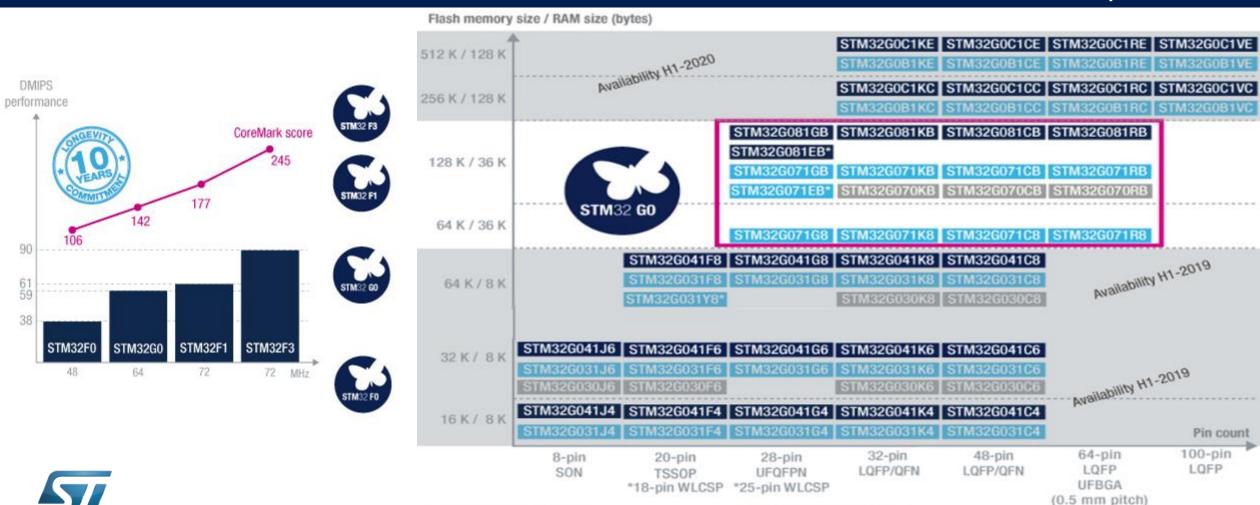
STM32 Mainstream MCUs Product Portfolio

STM32G0x1 Access line

Without 128-/256-bit AES Hardware Encryption

STM32G0x0 Value line

STM32 Mainstream MCUs: STM32G0 Series: efficient, robust and simple.



STM32G0x1 Access line

With 128-/256-bit AES Hardware Encryption

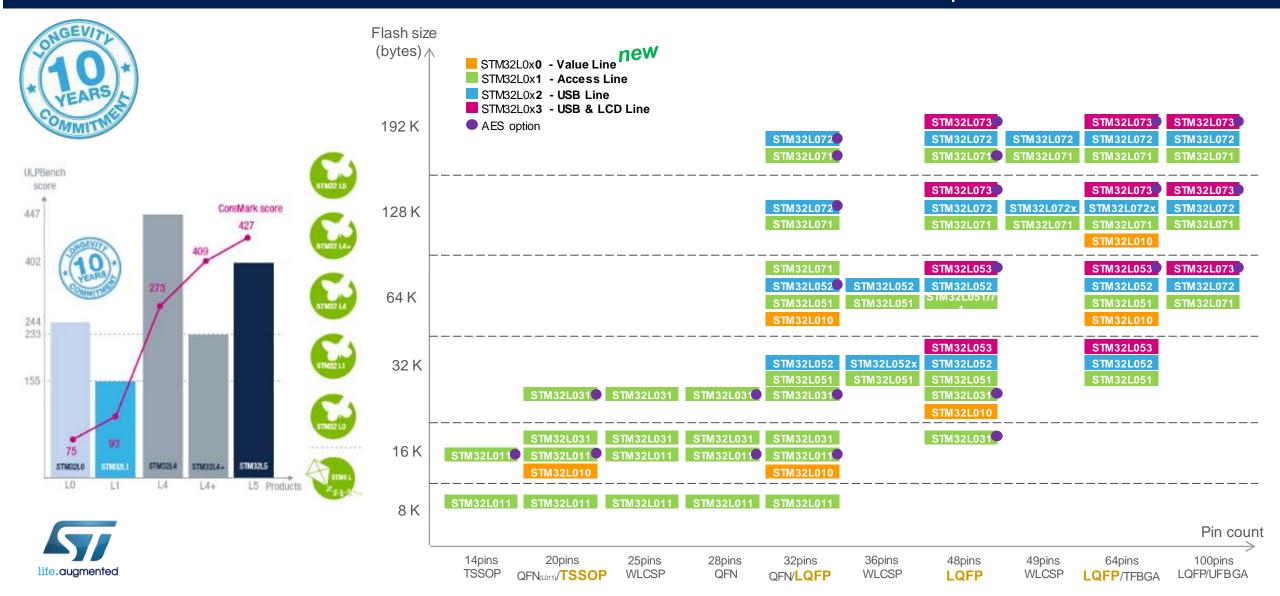
STM32 Ultra Low Power MCUs

- New STM32L0x0 Value Line microcontrollers (MCUs) from STMicroelectronics present an additional, low-cost entry point to the STM32L0* series, delivering ultra-low-power technology and efficient 32-bit performance with the Arm® Cortex®-M0+ core for designers facing tight cost, size, or power constraints.
- With up to 128Kbyte Flash memory, 20KByte SRAM, and 512Byte true embedded EEPROM on-chip
 the STM32L0x0 MCUs save external components to cut down on board space and BOM cost. In
 addition to price-sensitive and space-constrained consumer devices such as fitness trackers, computer
 or gaming accessories, and remotes, the new STM32L0x0 Value Line MCUs are ideal for personal
 medical devices, industrial sensors, and IoT devices such as building controls, weather stations, smart
 locks, smoke detectors, or fire alarms.
- The STM32L0x0 Value Line comprises six new parts, giving a choice of 16-Kbyte, 64-Kbyte, or 128-Kbyte of Flash memory, 128-Byte, 256-Byte or 512-Byte EEPROM, and various package options. In addition, pin-compatibility with the full STM32 family of more than 800 part numbers offering a wide variety of core performance and integrated features, allows design flexibility and future scalability, with the freedom to leverage existing investment in code, documentation, and tools.



STM32 Ultra Low Power MCUs Product Portfolio

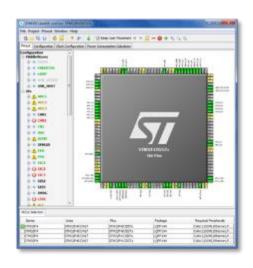
STM32 Ultra Low Power MCUs: STM32L0 value lines Series: Ultra-Low power and low cost.

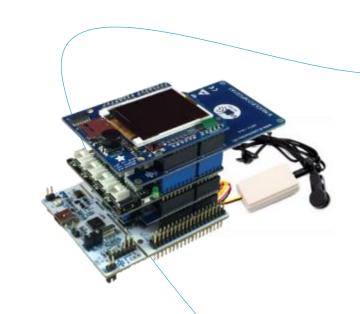






STM32 Ecosystem

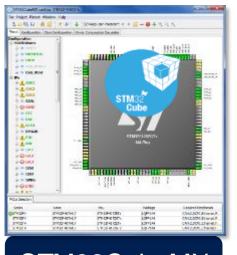






STM32 Ecosystem: Software tool-chains

Comprehensive choice of IDEs



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Standard

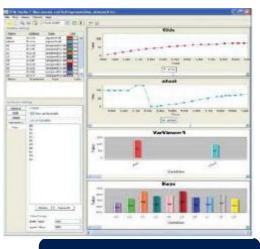
Standard

Standard

Standard

Standard

Standard



STM32CubeMX

Partners IDEs

STMStudio

Generate Code

Compile & Debug

Monitor











Free IDE



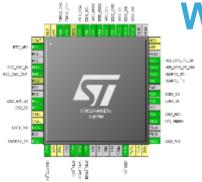








What is the STM32CubeMX?



Pinout Wizard

Configuration tool on PC



Basic Parameters				
Baud Rate	115200 Bits/s			
Word Length	8 Bits (including Parity)			
Parity	None			
Stop Bits	1			
□ Advanced Parameters				
Data Direction	Receive and Transmit			
Over Sampling	16 Samples			

BaudRate must be between 110 Bits/s and 10.5 MBits/s.



Sequence Chart

Peripherals & Middleware Wizard





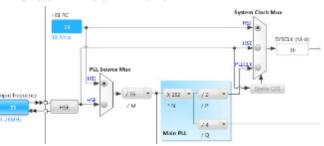




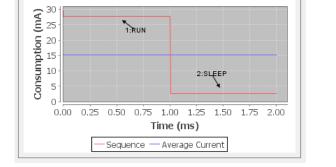


Power Consumption Wizard

Clock Tree wizard



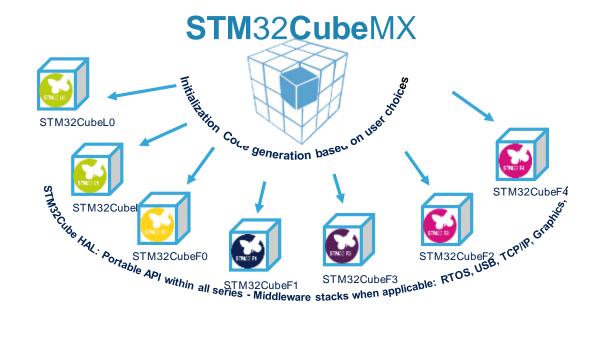
C code generation for initialization, according to user choices





STM32CubeTM Introduction

- STM32CubeTM includes:
 - STM32CubeMX, a configuration tool for generating user driven initialization
 - Firmware collateral, delivered for every STM32 device series (i.e. STM32CubeF4) with:
 - An STM32 Abstraction Layer embedded software: STM32Cube HAL
 - A consistent set of Middleware: RTOS, USB, TCP/IP, Graphics, ...





ST MCU Finder App

- Finding the perfect MCU cannot be any easier with the ST MCI Finder App. Quickly browse STM32 & STM8 families wide portfolio and select the product that best fit the design needs
- Access to key product information
 - Features & Description
 - Technical documentation

(Datasheet, Databrief, Errata Sheet, AN)

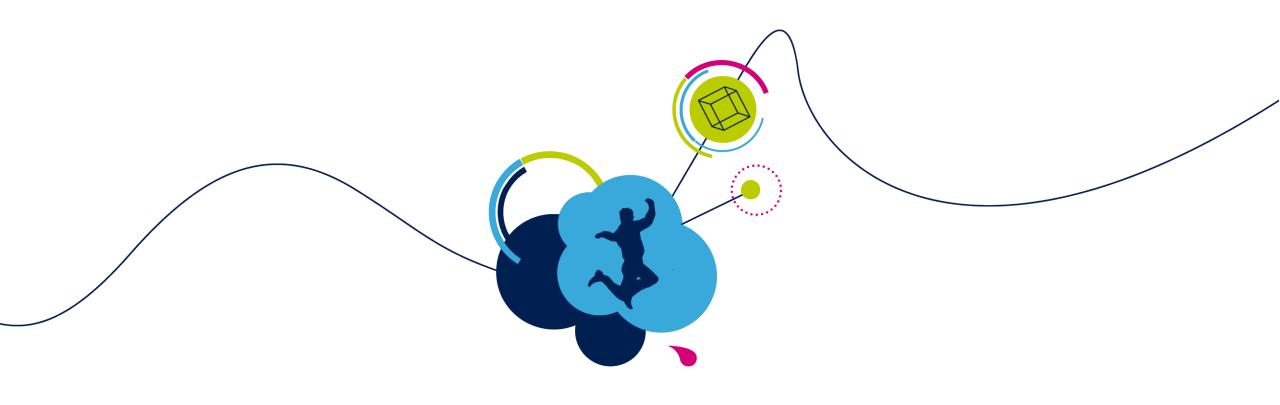
- Block Diagrams
- st.com product page
- Latest News/Announcements
- Connectivity
 - Offline product browsing
 - Downloaded PDF documentation and access offline

Automatic data refresh when online



Now available for Desktop PC



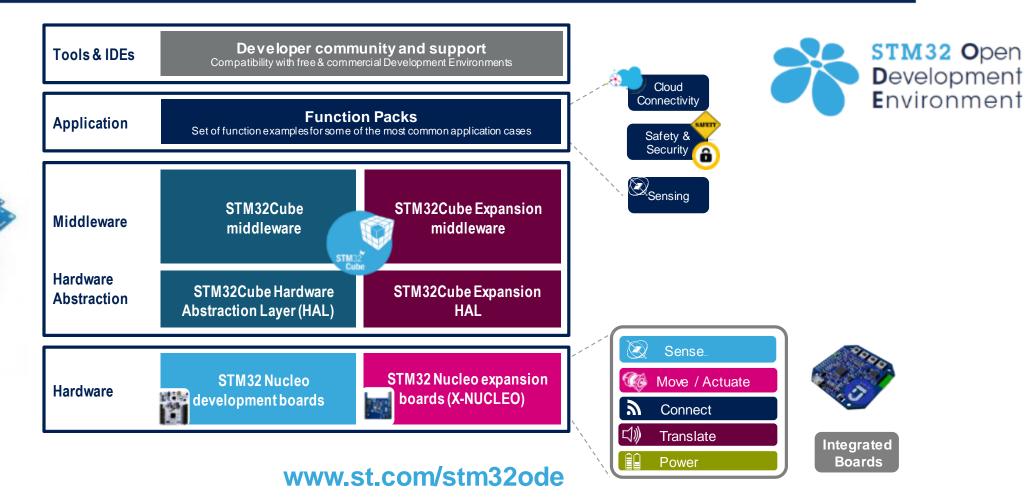


STM32 Open Development Environment



STM32 Open Development Environment

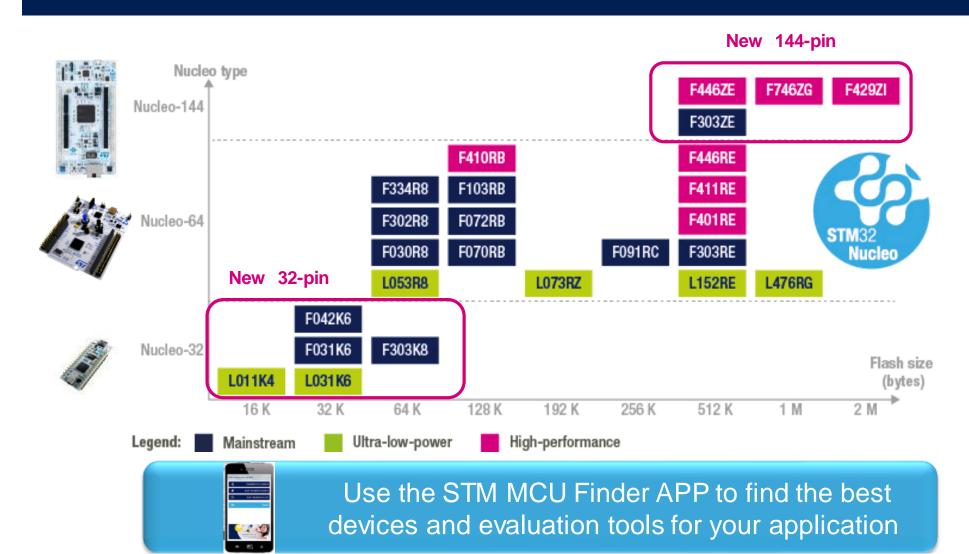
Fast, affordable prototyping & development





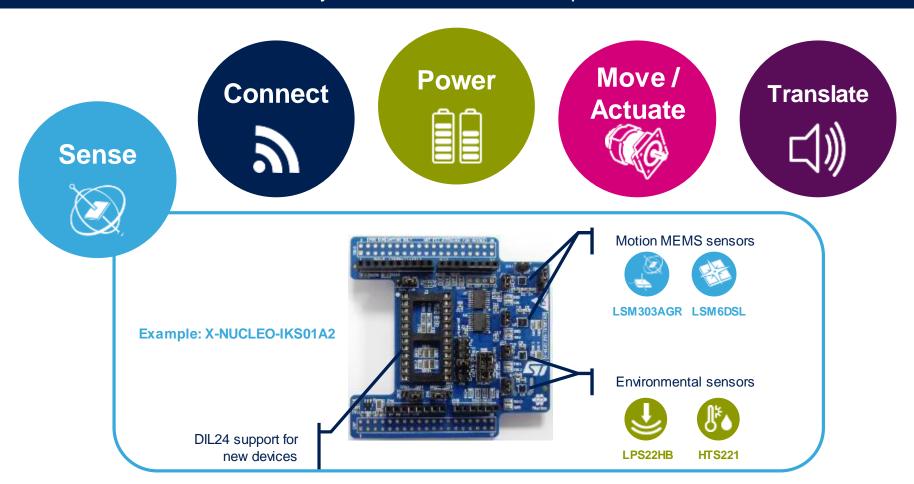
STM32 Nucleo portfolio

A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer



STM32 Nucleo Expansion Boards

Boards with additional functionality that can be plugged on top of the STM32 Nucleo development board directly or stacked on another expansion board.





X-Nucleo family overview

29 expansion boards covering all the key functions



Motion & environmental sensors

Proximity sensor

Microphone



BLE

Wi-Fi

Sub-GHz

NFC



Power management

LED boost



Motor drive
Actuator



Audio amplifier

OpAmp













































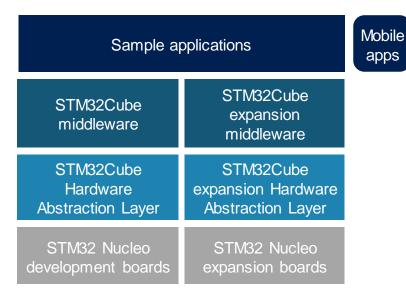




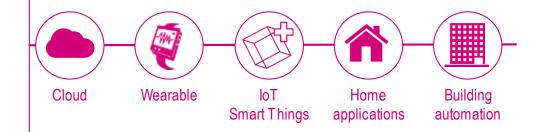


Function Packs

Pre-Integrated Package of Functions



A set of key building blocks used in most popular application domains





Pre-packaged offer integrating functionality from several expansion boards



Function Pack - Example

Required Hardware



Motion and environmental sensor expansion board

MEMS 3D accelerometer, gyroscope and magnetometer MEMS pressure and humidity sensors



X-Nucleo-IKS01A1



Bluetooth Low Energy expansion board

BlueNRG Bluetooth Low Energy network processor



X-NUCLEO-IDB05A1



STM32 Nucleo-64 development board

STM32F4 MCU



NUCLEO-F401RE

Software (free of charge)

FP-SNS-MOTENV1 SW package



Sample applications (streaming sensor data to Smartphone App)

Bluetooth Low Energy and Sensor software expansions for STM32Cube X-CUBE-BLE1 X-CUBE-MEMS1

STM32Cube

"ST BlueMS" mobile application







SDK available on Github (BlueSTSDK)



Open Software eXpansion

Open.MEMS is a free and easy-to-use software program for the development of best-in-class MEMS and sensor applications.

Open.MEMS libraries combine data from several sensors achieving the high level of accuracy required by portable and wearable devices and other emerging applications, such as the IoT

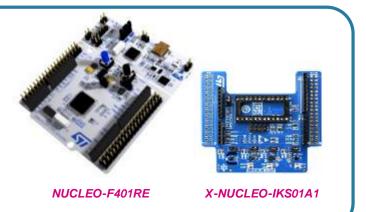
Development set-up:

HW platform composed by:

STM32 NUCLEO-F401RE board; X-NUCLEO-IKS01A1 Expansion board; STEVAL-MKI160V1 Evaluation board.

SW package composed by:

X-CUBE-MEMS1 software package for STM32Cube; Specific core engine algorithm.



Available software packages:

Library	Notes
FX V1.5.0	Sensor Fusion Algorithm
AR V1.3.0	Activity Recognition
CP V1.2.0	Carry Position Recognition
GR V1.1.0	Gesture Recognition



Sensor Fusion



Activity Recognition



Carry Position



Gesture Recognition



What do WE expect now?

















What do WE expect now?





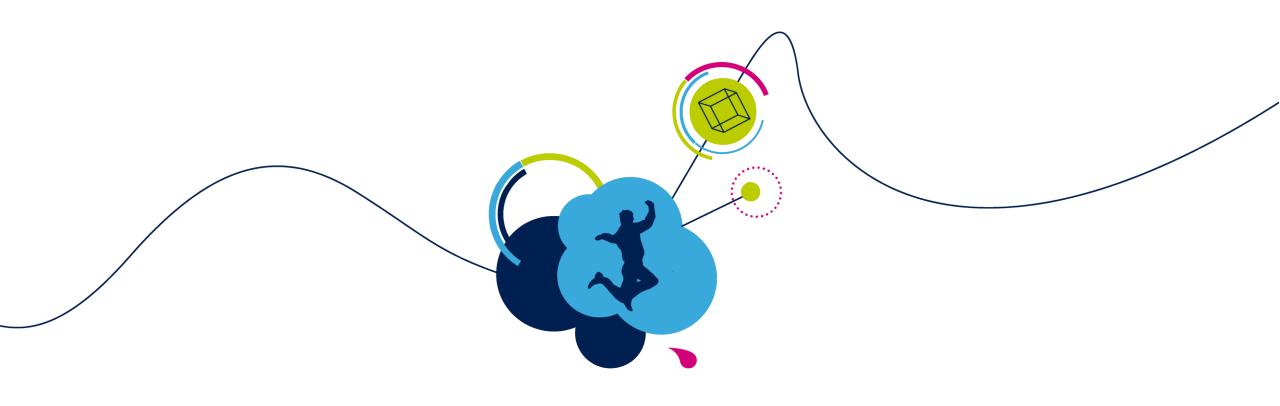












Smart Reset



Watchdog and Smart Reset





STWD100

Watchdog



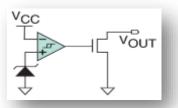
STM6524

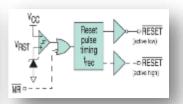
Smart Reset

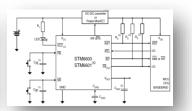


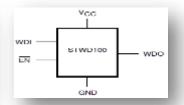
www.st.com/reset

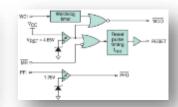
Voltage Reset & Supervisors











Voltage Protection

Resets

Smart Reset™ Standalone Watch Dog

3V micro Supervisors

Voltage detectors

Multi-voltage resets

On/Off controllers

5V micro Supervisors

- Manage system wake-up and initialization at power-up
- Monitoring of Software and Power failures
- System re-boot in case of failing or frozen application

Security Supervisors

STBP112 STM1061 STM809 STM1001 STM6779 STM6519 STM6524 STM6600

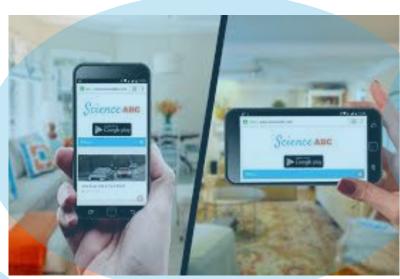
STWD100

STM706 STM695 STM805



What do WE expect now?







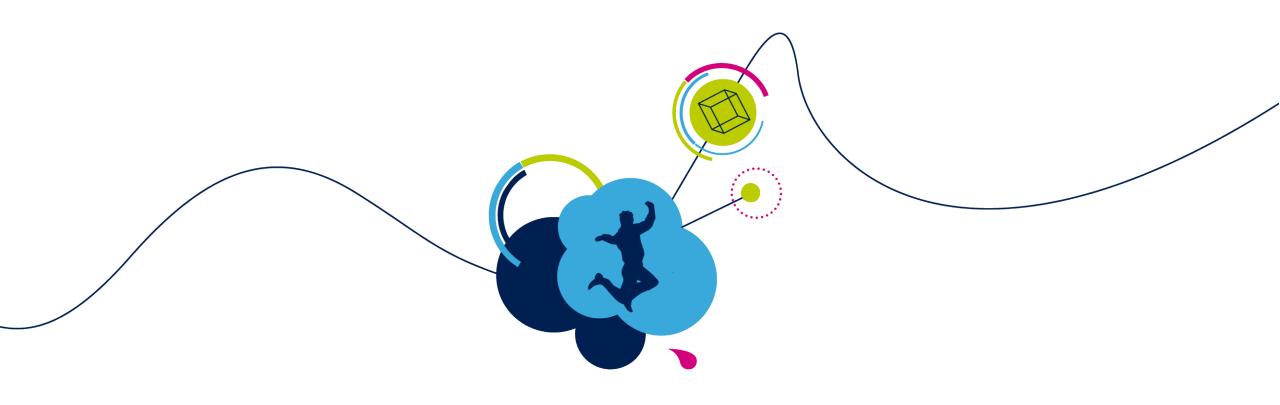












Motion MEMS



Why ST as MEMS & Sensor supplier?







Our Strengths









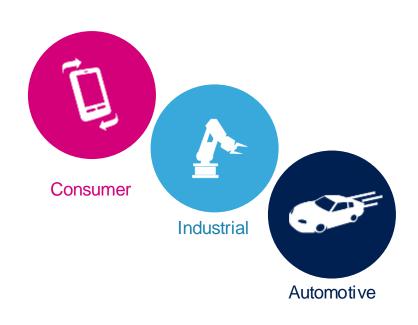
Paving the Future with Unique Assets in Process Technology, Pkg Innovations, Sensor Leadership



Sensor Accuracy

a Key Challenge for Consumer, Automotive & Industrial Sensing







New Applications Driven by Accuracy 34

















Accelerometers 6

Ultra thin packaging 0.5mm for low

compatible

Compact size, LGA-12, pin to pin

Features & Benefits

General Purpose



LIS2DH12

Mainstream accelerometer with 2/4/8/16g sensing range, 8/10/12 bits resolution, and up to 5.3KHz output data rate

32-level FIFO, Interrupts, High Pass filter, power saving feature, SPI/I2C



LGA-12 (2.0x2.0x1 mm)

2/4/8/16g to 24/100/200/400g

Ultra Low Power



LIS2DW12

Highly 5 flexible power saving modes,, including 0.38uA in active sensing mode, 3uA at 50Hz/12bits operating mode 1.6Hz to 1.6KHz output data rate

32 -level FIFO. Interrupt. Activity/Inactivity stationary/motion detection, single/double tap detection, 6D/4D orientation, SPI/I2C



LGA-12 (2 x 2 x 0.8 mm)





LGA-12 (2.0x2.0x0.86 mm)

16 bits data output with step detection, step counting, and significant motion detection HW embedded feature, perfect for standalone pedometer application, up to 6.4KHz output data rate

High temperature stability

power

256-level FIFO, Interrupt, Activity/Inactivity stationary/motion detection, single/double tap detection, 6D/4D orientation, SPI/I2C

Advanced Features

LIS2DS12

SW Selectable Full Scales:



Accelerometers

Applications	Package size (mm)					-		
	2 x 2	2 x< 1 mm	2 x 2 x 1 mm	2 x 1 mm 3 x 3 x 1 mm		≥ 4 x 4 x 1.5 mm	Features	
				12-bit	H3LIS331DL			
				8-bit	H3LIS200DL H3LIS100DL		High-g	
				12-bit	LIS331HH LIS331DLH		7 5 7 7 7 7 7 7	
Consumer & Industrial	16-bit		LIS2HH12		LIS3DSH			
	14-bit	LIS2DW12 LIS2DS12					Low-g	
	12-bit		LIS2DH12 LIS2DH	LIS3DH LIS3DE			Low-g	
	8-bit		LIS2DE LIS2DE12					
						LIS344ALH	Analog	
Long-life applications	II IIS	S2DH 2DLPC	***************************************			IIS3DHHC (IIS328DQ)	10-years commitment	
Automotive Non-safety						AIS328DQ AIS3624DQ	AEC-Q100 qualified	
Automotive Safety (Central & Peripherals Airbags)						AIS1120SX AIS2120SX AIS1200PS		
Medical	М	IS2DH					For Implantable devices	



6-Axis IMUs

Features & Benefits

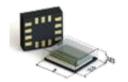
Consumer Grade



LSM6DSL/M

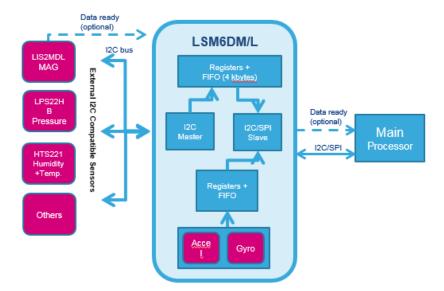
±2/±4/±8/±16 g full scale ±125/±245/±500/±1000/±2000 dps full scale Analog supply voltage: 1.71 V to 3.6 V Independent IOs supply (1.62 V) Compact footprint, 2.5 mm x 3 mm x 0.83 Smart FIFO up to 4 kbyte 0.4 mA in normal 6-axis mode and 0.65 mA in high-performance 6-axis mode

Smart FIFO up to 4 kbyte



Compliant with Android K, L, and M

Sensor Hub Capability



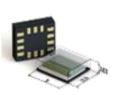
Industrial Grade

ISM330DLC

Industry 4.0 applications, digital output, low power 10Year Longevity

Delivering high accuracy and stability with ultra-low power consumption

Smart FIFO up to 4 kbyte







Magnetometer and eCompass

Features & Benefits

eCompass (AXL+ Mag)



LSM303AH



2.0x2.0x1 mm

Dynamic Range: ± 50Ga

Mag Noise RMS [HP] = 3mGa

 $Idd_{XL} = 150\mu A [HP] / 22 \mu A [LP]$

An = 120 μ g/ \sqrt{Hz}

High Performance eCompass
Based on LIS2DS12, up to ± 16g FS

Pedo1.x: WeChat compliant

SMD, Step counter

Standalone Mag.



LIS2MDL



2.0x2.0x0.7 mm

I_{MAG} = 200μA @ 20 Hz Dynamic Range: ± 50Ga Noise RMS [HP] = 3mGa

High Performance AMR
Board compatible with LSM303AH

Magnetic offset cancellation

Embedded Temperature Compensation



High Full scale and Low noise

LGA-12: 2 x 2 x 1 mm³ compatible with ST accelerometers

LSM303AH compatible with LIS2DS12 AXL

ST Algorithms support

Calibration Algorithms



Magnetometer Calibration



Motion Tracking

Sensor Fusion



eCompass



X-NUCLEO-IKS01A2

Motion MEMS and environmental sensor expansion board for STM32 Nucleo

- The X-NUCLEO-IKS01A2 is NEW motion MEMS and environmental sensor evaluation board system
- It is compatible with the Arduino UNO R3 connector layout, and is designed around ST's latest sensors.

Key products on board

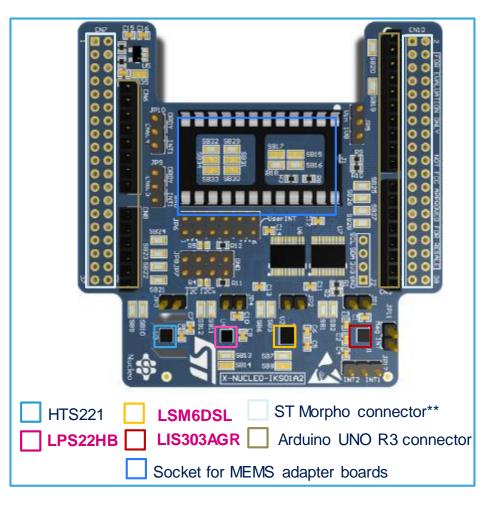
LSM6DSL: MEMS 3D accelerometer $(\pm 2/\pm 4/\pm 8/\pm 16 \text{ g}) + 3D$ gyroscope $(\pm 245/\pm 500/\pm 2000 \text{ dps})$

LSM303AGR: MEMS 3D magnetometer (±50 gauss) + 3D accelerometer (±2/±4/±8 g /±16 g)

LPS22HB: MEMS pressure sensor, 260-1260 hPa absolute digital output barometer

HTS221: Capacitive digital relative humidity and temperature

DIL 24-pin: Socket available for additional MEMS adapters and other sensors

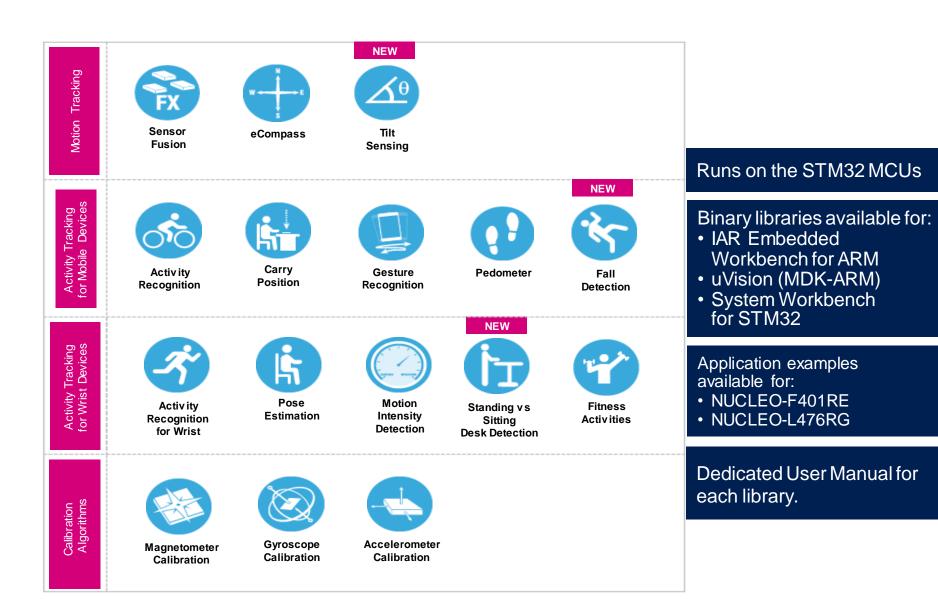




Latest info available at X-NUCLEO-IKS01A2

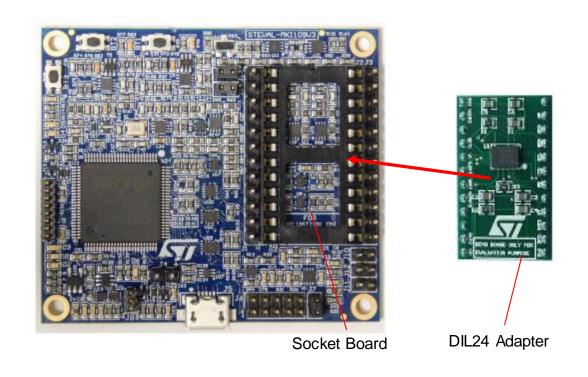
Order code: X-NUCLEO-IKS01A2

X-CUBE-MEMS1 – Algorithms Summary





Professional MEMS Tools - DIL24 Adapter





All ST MEMS sensors are available with DIL24 adapter support
The DIL24 Adapter can be placed on socket board

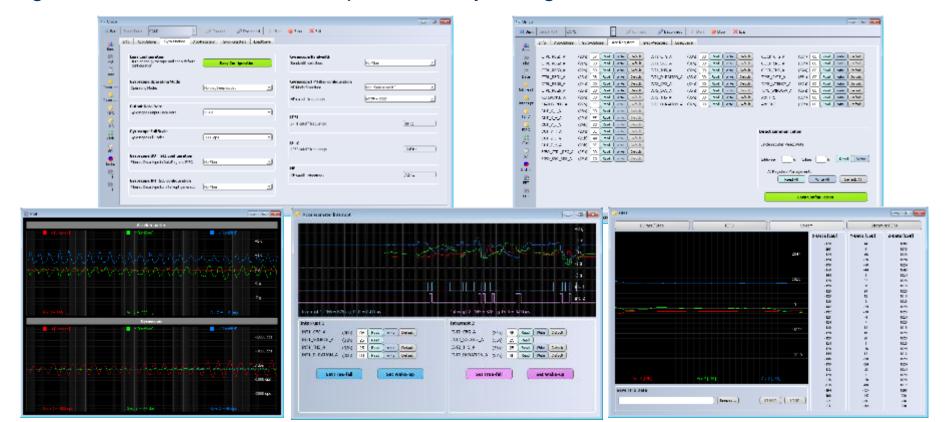


Professional MEMS Tool – UNICO GUI SW

Profi MEMS Tool connected with UNICO SW:

The STM32F401VE uses the STM32 microcontroller as a bridge between the sensor under test mounted on socket and the PC by USB cable.

It is possible to use the UNICO graphical user interface (GUI) or dedicated software routines for customized applications (Virtual Com Command Line Interface) to read/write all sensor registers, plot the data, manage FIFO, set and show interrupts, set easy configuration, etc.





DIL24 Adapter Boards

5	0 15 10
Part Number	General Description
STEVAL-MKI109V2	eMotion: Mainboard based on STM32F103, for all ST MEMS adapter
STEVAL-MKI109V3	Professional MEMS tool: based on STM32F401VET6 for 2v adapters
STEVAL-MKI110V1	AIS328DQ adapter board for standard DIL24 socket
STEVAL-MET001V1	LPS22HB adapter board for a standard DIL 24 socket
STEVAL-MKI125V1	A3G4250D adapter board for standard DIL 24 socket
STEVAL-MKI136V1	L3GD20H adapter board for standard DIL 24 socket
STEVAL-MKI141V2	HTS221 humidity sensor adapter board for standard DIL24
STEVAL-MKI151V1	LIS2DH12 3-axis accelerometer adapter board for standard DIL 24
STEVAL-MKI153V1	H3LIS331DL 3-axis digital accelerometer adapter board
STEVAL-MKI158V1	AIS3624DQ adapter board for a standard DIL24 socket
STEVAL-MKI159V1	LSM9DS1 adapter board for standard DIL24 socket
STEVAL-MKI160V1	LSM6DS3 adapter board for standard DIL24 socket
STEVAL-MKI163V1	LSM303C adapter board for standard DIL24 socket
STEVAL-MKI164V1	LIS2HH12 adapter board for a standard DIL24 socket
STEVAL-MKI165V1	LPS25HB adapter board for a standard DIL 24 socket
STEVAL-MKI166V1	H3LIS100DL adapter board for a standard DIL 24 socket
STEVAL-MKI167V1	H3LIS200DL adapter board for a standard DIL 24 socket
STEVAL-MKI168V1	IIS2DH adapter board for a standard DIL 24 socket
STEVAL-MKI169V1	I3G4250D adapter board for a standard DIL 24 socket
STEVAL-MKI170V1	IIS328DQ adapter board for a standard DIL 24 socket
STEVAL-MKI172V1	*LSM303AGR adapter board for a standard DIL 24 socket
STEVAL-MKI173V1	LSM303AH adapter board for standard DIL24 socket
STEVAL-MKI174V1	LIS2DS12 adapter board for standard DIL24 socket
STEVAL-MKI175V1	LIS2DE12 adapter board for standard DIL24 socket
STEVAL-MKI176V1	LSM6DS3H adapter board for standard DIL24 socket
STEVAL-MKI177V1	LPS35HW adapter board for a standard DIL24 socket
STEVAL-MKI178V1	LSM6DSL adapter board for standard DIL24 socket
STEVAL-MKI179V1	LIS2DW12 adapter board for a standard DIL 24 socket
STEVAL-MKI180V1	LIS3DHH adapter board for a standard DIL 24 socket
STEVAL-MKI181V1	LIS2MDL adapter board for a standard DIL24 socket
STEVAL-MKI182V1	ISM330DLC adapter board for a standard DIL24 socket
X-NUCLEO-CCA02M1	Digital MEMS microphones expansion board with MP34DT01-M



LIS2DW12 STEVAL-MKI179V1



LSM6DS3 STEVAL-MKI160V1



LSM6DSL STEVAL-MKI178V1



LSM303AH STEVAL-MKI173V1



LPS22HB STEVAL-MET001V1



LPS35HW STEVAL-MKI177V1

Latest info available at

DIL24 adapter boards

Open.MEMS Firmware Libraries

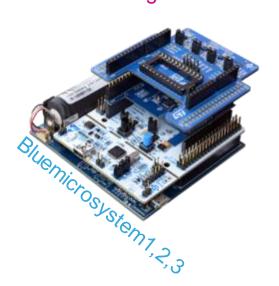
HW Reference Designs

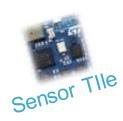


FW/SW Libraries and Toolkits



Enablement Partnerships





Motion Libraries MotionAC(Accelerometer Calibration)

MotionAR(Activity Recognition)

MotionAW (Activity Recognition for Wrist)

MotionCP(Carry Position)

MotionEC(eCompass) [NEW]

MotionFA(Fitness Activity) [NEW]

MotionFX(Sensor Fusion)

MotionGC(Gyroscope Calibration)

MotionGR(Gesture Recognition)

MotionID(Intensity Detection)

MotionMC(Magnetometer Calibration)

MotionPE(Pose Estimation)

MotionPM(Pedometer)

Many more in development. Customer feedback is valuable for

prioritization of of new libraries development.















Libraries are available now on www.st.com!

Development Platforms Systems Solutions

ST offers state-of-the-art platforms for application development

SmartTag

based on NFC Dynamic Tag and MEMS Sensor

Bluecoin

Augmented hearing plus range, environmental and motion sensing



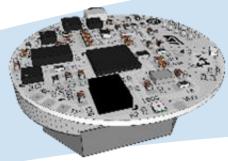




BlueNRG-2 Tile:

Connectivity, Motion Sensors, Proximity, Microphone







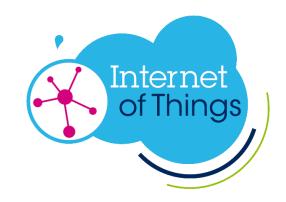
Professional MEMS Tool



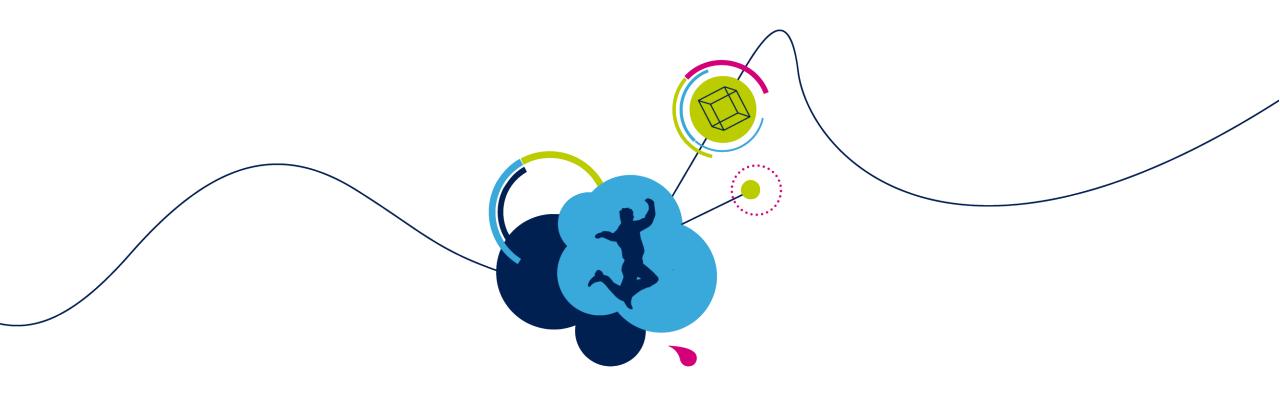
SensorTile

IoT module with powerful processing capabilities, Bluetooth low energy, with a wide spectrum of motion and environmental MEMS sensors, and microphone.









SensorTile



SensorTile Kit

SensorTile Core System STLCS01V1



STEVAL-STLKT01V1

Connectable sensor node

SensorTile kit

SENSORTILE

SensorTile Cradle Board STLCR01V1



PROGRAMMING CABLE

CRADLE EXPANSION BOARD

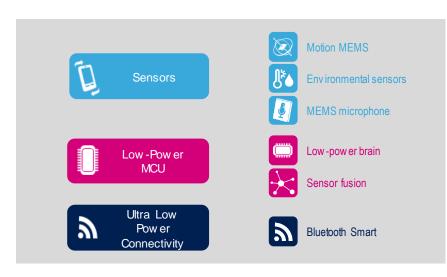
PLASTIC CASE

WWW.st.com/sensortile

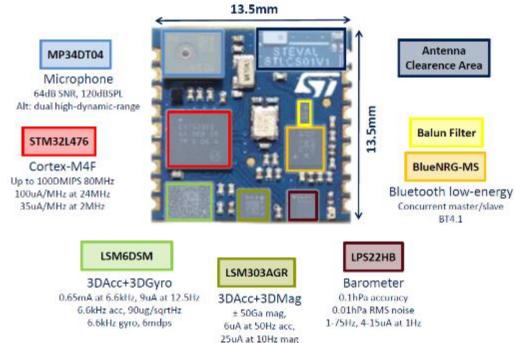
SensorTile
Cradle eXpansion
STLCX01V1



SensorTile Core System



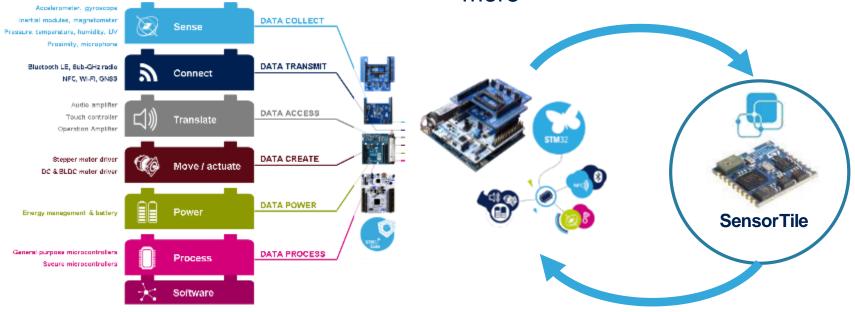
Miniaturized Tile that can be soldered or plugged onto a host board





Nucleo / X-Nucleo And SensorTile

- Modular development system
- Rich set of firmware packages
- Form-factor development system
- Same set of firmware packages & more









Main Window

COM Port selection

(only COM ports with manufacturer set to ST Nucleo boards with appropriate firmware)

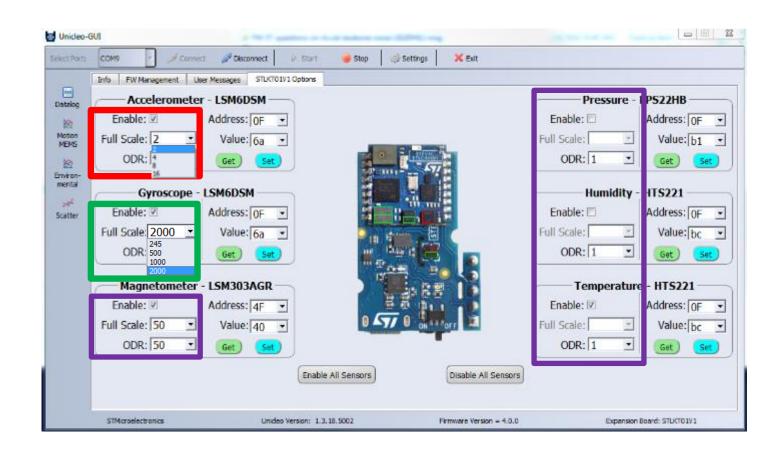




^{*} Functions are added to the vertical toolbar based on firmware functionality

Changing Full Scale

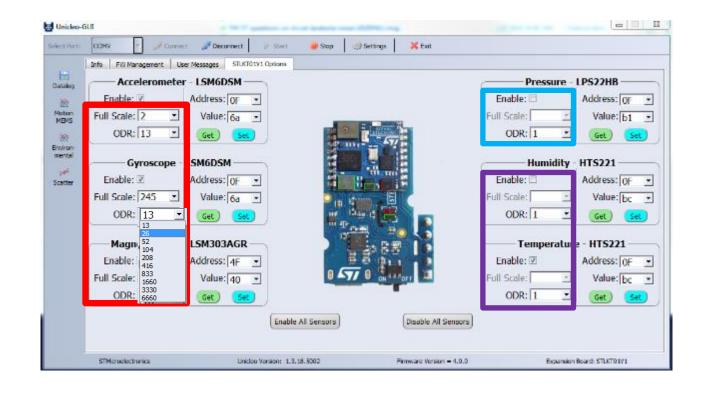
- •No Selection of FS x Mag. Pressure, Hum & Temp
- Select Accelerometer FS:
 - ±2g
 - ±4g
 - ±8g
 - ±16g
- Select Gyro FS
 - ±245dps
 - ±500dps
 - ±1000dps
 - ±2000dps





Changing Output Data Ready

- •Select Hum & Temp ODR [Hz]:
 - 1, 7, 12.5
- •Select Accel & Gyro ODR [Hz]:
 - 13, 26, 52,104, 208, 416, 833
 - 1660, 3330, 6660
- •Select Pressure ODR [Hz]:
 - 1, 10, 25, 50, 75
- •Select Mag ODR [Hz]:
 - 10, 20, 50

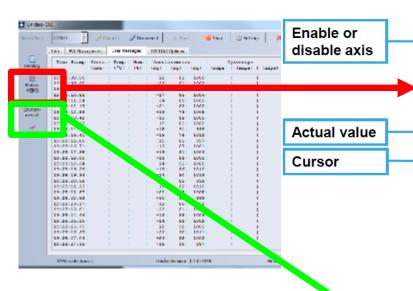




Plot Sensor

Auto scale

or fix scale

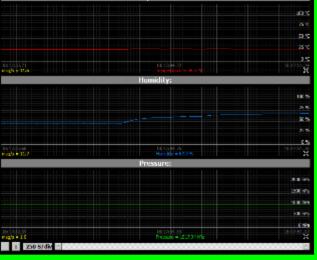


- Accelerometer X, Y, Z axes in mg
- •Gyroscope X, Y, Z axes in dps
- •Magnetometer X, Y, Z axes in mGauss



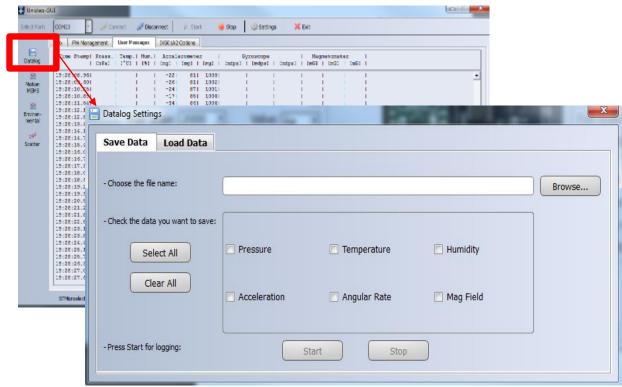
- Temperature data [°C]
- •Humidity data [%]
- Pressure data [hPascal]





Datalog

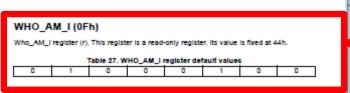
- •CSV (comma separated values) or TSV (tab separate values) format
- Possible to select which data should be saved
- •File name is automatically generated
- Dedicated directory for datalogs



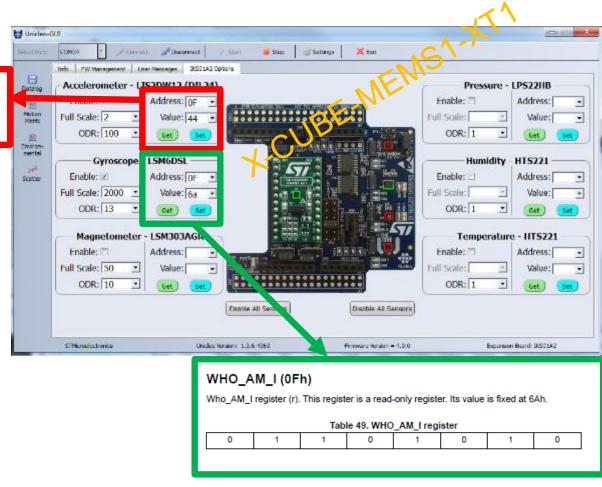
June 29. 2	017														
Sensor Datalog with Extended Functionality															
Time	Time	Pressure	Temperat	Humidity	Accelerati	on(XYZ)		Angular R	ate(XYZ)		Mag Field	(XYZ)		NewData	
[h:m]	[s]	[hPa]	[?C]	[%]	[mg]	[mg]	[mg]	[mdps]	[mdps]	[mdps]	[mGauss]	[mGauss]	[mGauss]	MSBfirst:-	-THPMGA
19:29	29.05				-21	76	1002							0x01	
19:29	29.69				-16	79	1004							0x01	
19:29	30.34				-27	83	1007							0x01	
19:29	30.99				-12	85	1000							0x01	
19:29	31.63				-26	85	1011							0x01	
19:29	32.28				-28	86	1001							0x01	
19:29	32.92				-23	86	1010							0x01	



Read/Write Registers on Nucelo+Adapter



- •Read data (GET) & Write data (SET)
- •accelerometer ID (0Fh) =44h
- •Gyroscope ID (0Fh) =6ah





What do WE expect now?







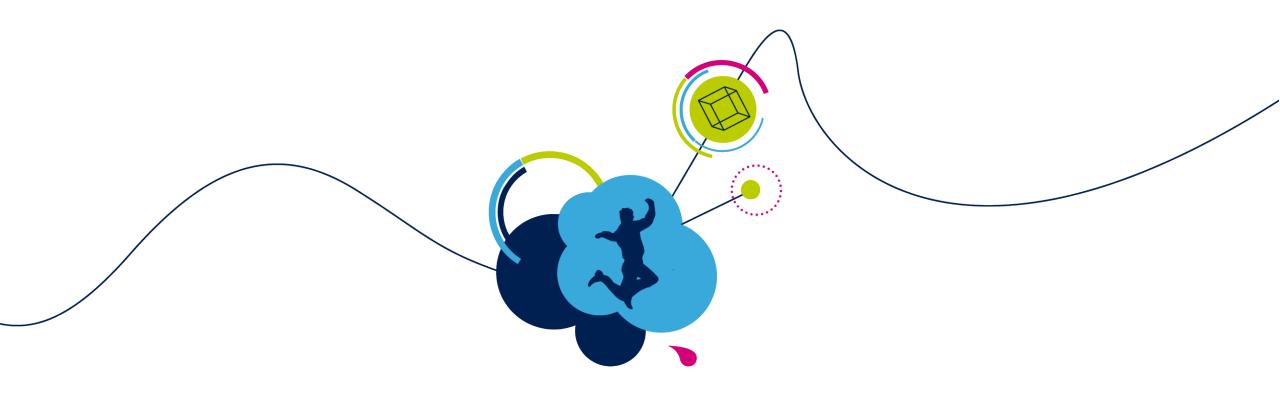












MEMS Microphones



MEMS Microphones

- Digital or analog output, top or bottom acoustic port available
- Best-in-class acoustic overload point (AOP) (up to 135 dB SPL)
- Best-in-class signal-to-noise ratio (SNR) (up to 65 dB)
- Package size down to 2.65x3.5 mm
- Software and acoustic gasket simulation support is offered by ST to ensure rapid development of the best solution for all audio application needs



MEMS Microphones

Features & Benefits

Digital TOP Port Low Cost



MP34DT01-M

120 dBSPL acoustic overload point 61 dB signal-to-noise ratio **Omnidirectional sensitivity** - 26 dBFS sensitivity **PDM** output

Top-port design, SMD-compliant, EMIshielded



Ultra-compact, low-power, omnidirectional

Low-distortion with a 64 dB SNR

EMI-shielded package operating from -40 °C to +85 °C

Acoustic SW Libraries Available

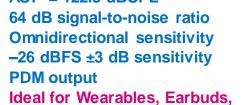
Digital TOP Port HP

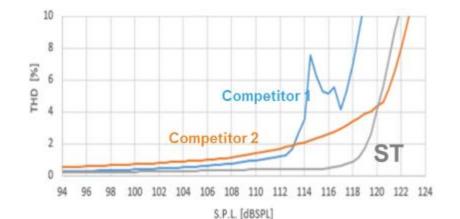


MP34DT05-A



AOP = 122.5 dBSPL64 dB signal-to-noise ratio **Omnidirectional sensitivity** -26 dBFS ±3 dB sensitivity **PDM** output **Speakers and Industrial**







MEMS Microphone Tools

- Coupon boards for MEMs microphones
 - MP23AB01DH: STEVAL-MKI139V5
- Nucleo Board Shield
 - X-NUCLEO-CCA02M1







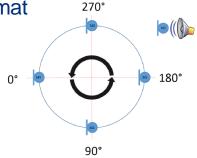


Open.Audio X-Nucleo

X-NUCLEO-CCA02M1

MEMS Microphone expansion board based on MP34DT01 for STM32 Nucleo

- PDM Library (part of X-CUBE-MEMS1)
 - Converts digital MEMS microphone PDM signal to the PCM format
- SOUND SOURCE LOCALIZATION
 - using a MEMS microphone array, it can estimate the angle of arrival of the audio signal



- BEAMFORMING
 - using a MEMS microphone (omnidirectional) array, the library enables to create a virtual directional microphone
- AEC
 - Acoustic Echo Cancelation (Speex based)

1000 - 100 -



- BlueVoice1 (Vertical application)
 - Speech audio data transfer over BLE RF link

Entry Level to Advanced Audio in 3 steps





Integrated
Development
Platforms



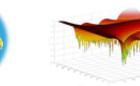




Advanced Free-Licensed Premium libraries



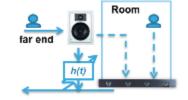
Audio Over BLE



Beamforming



Source Localization



Acoustic Echo-Cancellation

MEMS microphones on Function Packs

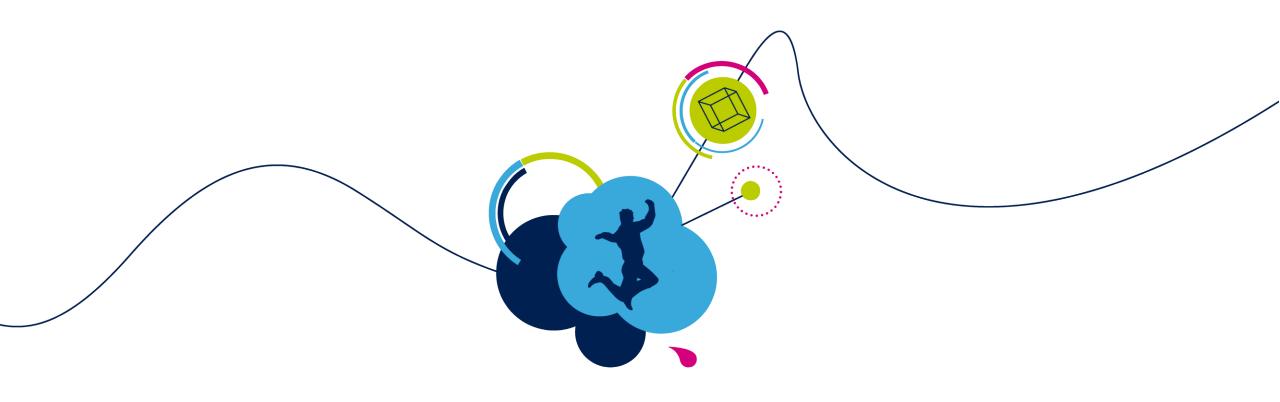










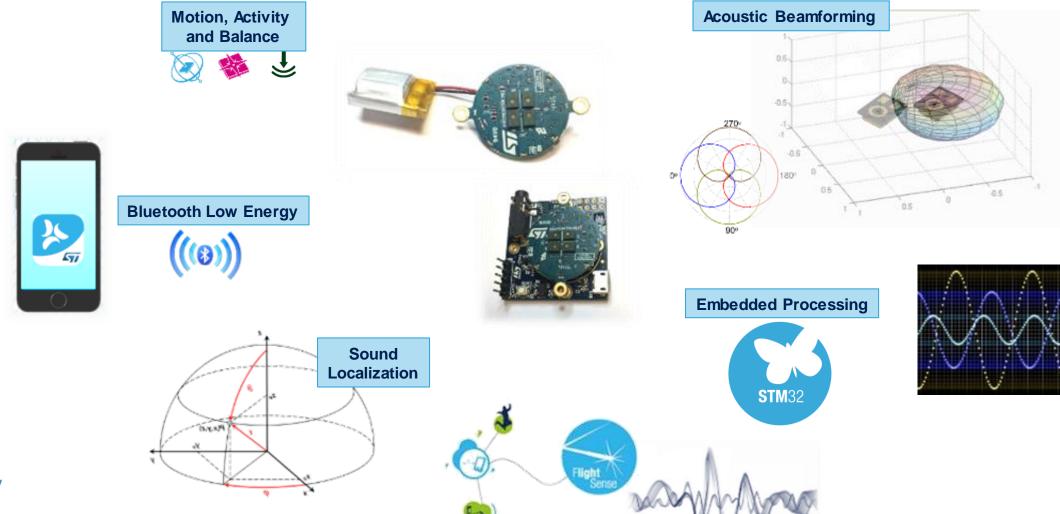


BlueCoin



BlueCoin: the Robotic Ear

Augmented hearing, ToF and motion sensing





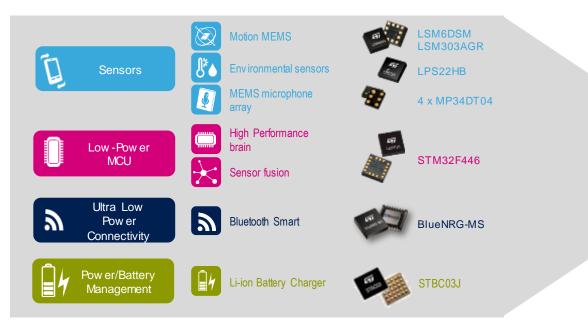


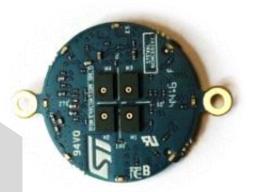
STEVAL-BCNCS01V1 - BlueCoin





ST BlueMS STMICROELECTRONICS INC

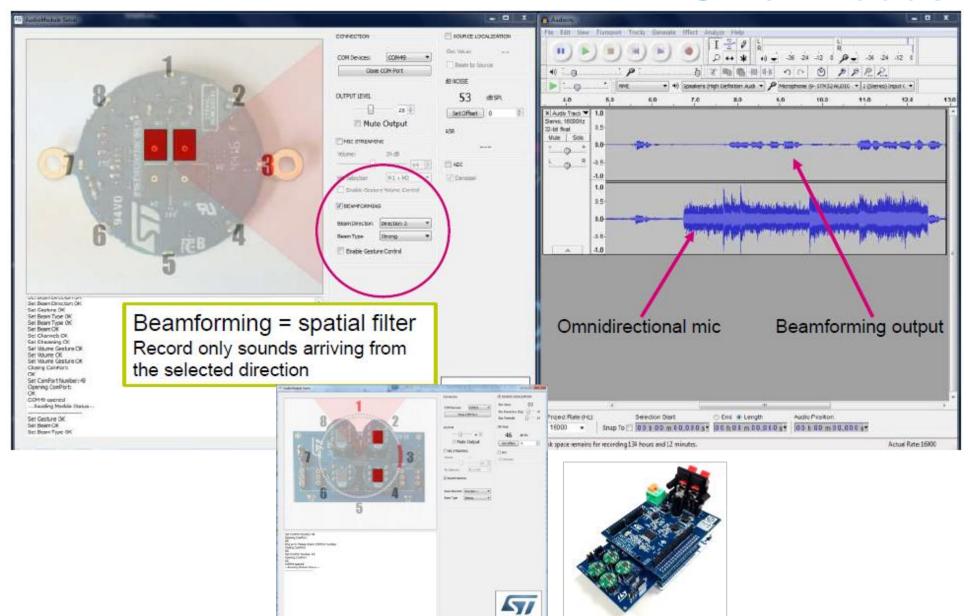








SmartAcoustic1





What do WE expect now?







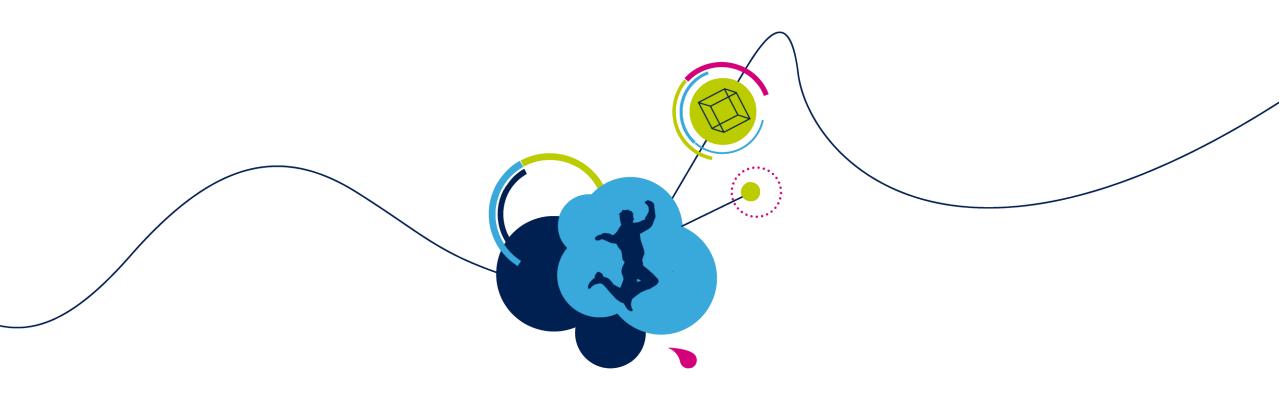












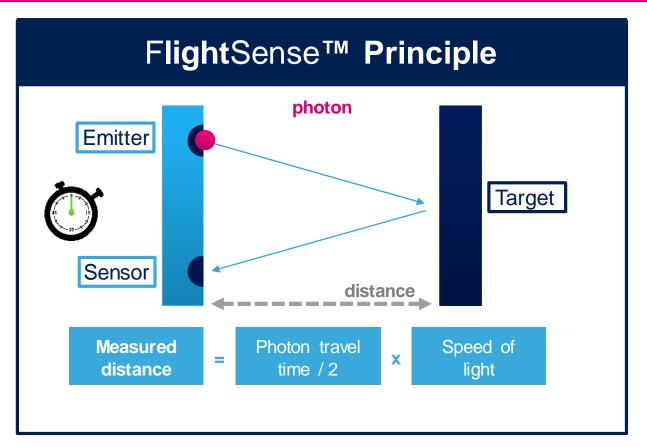
Proximity Sensors

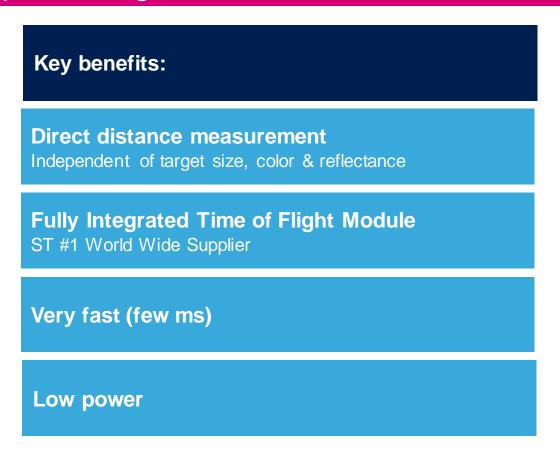




Flightsense™ Breakthrough Technology

Measurement at the speed of light!







Flightsense TM

Optical Time-of-Flight Product Family

ST is Worldwide #1 ToF supplier



Proven track record in manufacturing

>500Mu products shipped

300% AAGR

Single Photon Avalanche Diode

Ultra fast time resolution enabling Direct ToF processed in ST CMOS SPAD process



ST Proprietary Time-of-Flight IP

Best compromise of cost, complexity & power vs performance



Compact integrated system

Sensor, filters, optics, VCSEL and driver integrated Fully calibrated system



Optimized and reliable supply chain High volume & low cost





FlightSense™ Gesture Recognition

Basic Movement Detection

4 Gestures from a single ToF sensor

Directional swipe detection when using 2x ToF sensors

Single Tap

Double Tap

Single Swipe

Double Swipe

	Name	Description
√ ↓↑	Single Tap	Press a virtual 'button' on top of the sensor, once
√	Double Tap	Press a virtual 'button' on top of the sensor, twice
\longrightarrow or \longleftarrow	Single Swipe	Slide hand left to right or from right to left over the sensor
or S	Double Swipe	Slide hand from left to right and back to left or from right to left and back to right over the sensor





• Discriminate right to left, from left to right gesture when using 2x sensors

FlightSense™ Mass-Market Products

VL6180X

VL53L0X







- 1st Generation ST ToF Sensor
- 2nd Generation ST ToF Sensor
- 3rd Generation ST ToF Sensor, with lens

- Proximity/ALS sensor up to 60cm
- Ranging sensor up to 2m

Ranging sensor up to 4m, with programmable FoV

Main use-cases: proximity, distance measurement, user / object detection, robotics, lighting control, basic gesture...



VL53L1X: Product Highlights

New Generation ToF Sensor with Lens, for Long-distance Ranging and ROI Selection

Enhanced performance:

- Full FoV ranging: 400cm+ (white target, no IR)
- SPAD array zone selection (2x2; 4x4; full screen) for FoV reduction

Cutting-edge module and silicon:

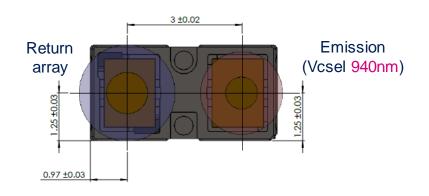
- Longest ranging distance miniature ToF product in the market
- Integrated lens for longer range and better immunity to ambient light
- Programmable settings to best fit customer's application:
 - Low power with interrupts for user / object detection
 - Long distance ranging
 - High accuracy for small movement detection



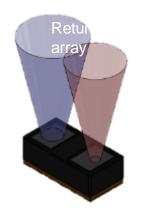


VL53L1X System FoV (Field of View)

Compatible Footprint with VL53L0X: Easy Migration



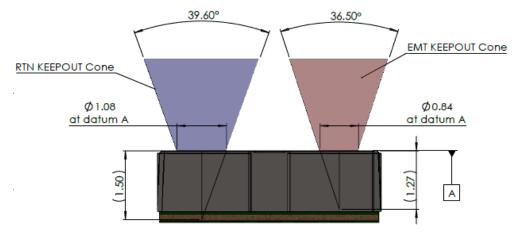
- OLGA12 Package
- LxW = $4.9 \times 2.5 \text{ mm}$
- Height: 1.56mm
- Reflowable (IPC/JEDEC JSTD-020-C)
- A 30° lens is added on return aperture
 (SPAD array) to increase the signal strength back from the target (8x more signal than VL53L0X)
 It increases ranging performance and accuracy
- The VCSEL is not equipped with an emitter lens
 Emitted optical power is identical to VL53L0X
 Retain full laser class1 registration



Typical System
Field of View: 27°

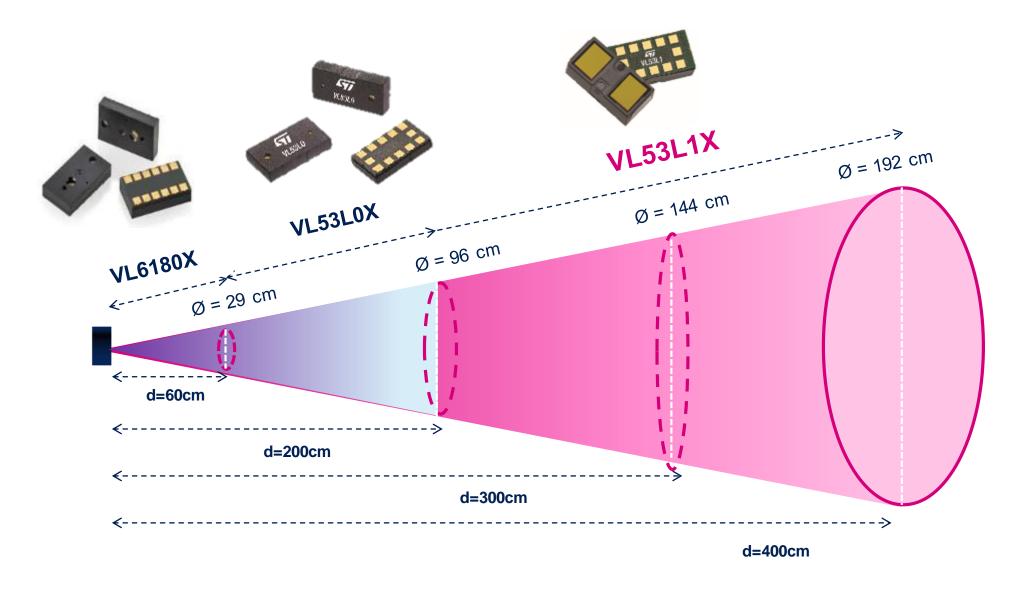
Emission (Vcsel 940nm)

Exclusion cones for mechanical integration





Detection Cone





"Getting Started" Video for VL53L1X

Nucleo Expansion Board

Videos available on:

- st.com
- Imaging YouTube





https://www.st.com/en/imaging-and-photonics-solutions/vl53l1x.html



What do WE expect now?







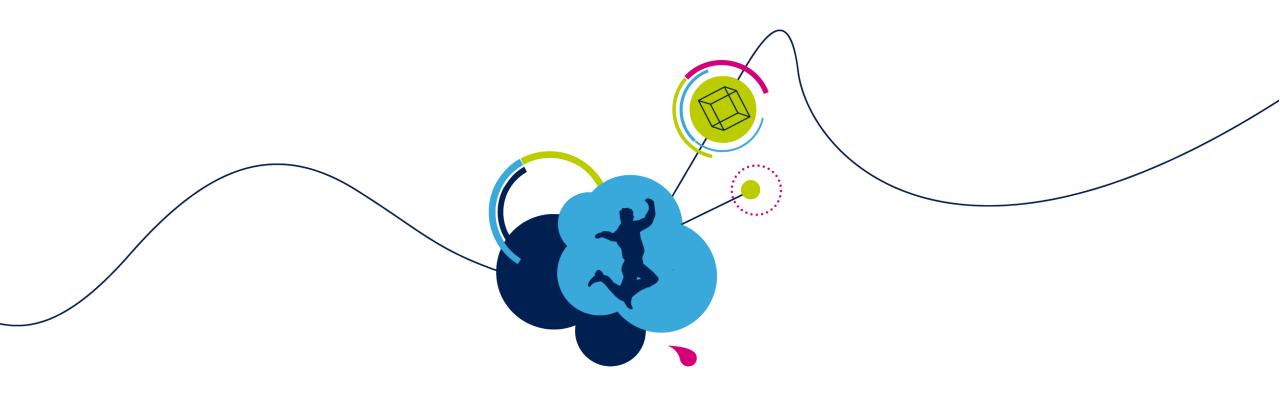












NFC / RFID



ST25 NFC / RFID Tags

Innovation for industrial applications – ST25T

- With the ST25 product family, ST offers a complete portfolio of NFC and RFID tag and reader ICs for a wide variety of NFC-enabled solutions. NFC technology is a convenient, always-on low power short-range wireless link that is driving the growth for convenient pairing, diagnostic readout, data tracking, and parameter setting use cases in Consumer, Industrial, Automotive and Medical applications. The benefit of our 10 years longevity program is available for Industrial-grade and Medical NFC / RFID applications.
- The ST25T product family offers a wide range of NFC / RFID tags with memory sizes from 512-bit to 64-Kbit. Both short-range (ISO14443-A or B) and long-range (ISO15693) standards are supported.
- The ST25TV series of NFC/RFID tags offers a 13.56 MHz long-range interface compatible with NFC phones and readers. ST25TV Type 5 NFC Tag ICs are the first solution to combine the convenience of the longer read range of the ISO/IEC15693 vicinity standard with a tamper detect capability. When compared to other NFC types, ST25TV tags are easier to tap and read by consumers, therefore improving the user experience designed by each brand. Brands and manufacturers now have access to smaller NFC tag labels and stickers. This unique solution can be used from the point of manufacture up to consumer engagement at the point of sales and beyond. It gives a digital life to everyday consumer goods.



ST25 NFC / RFID Tags Product Portfolio

ST25	NFC / RFID Tags	
ST25TA	ST25TB	ST25TV
ISO14443-A 106kb/s NFC type 4	IS014443-B 106kb/s	ISO15693 up to 53kb/s NFC type 5
EEPROM 512bit to 64Kbit 200-year, 1Mcycles	EEPROM 512bit to 4Kbit 40-year, 1Mcycles	EEPROM 2Kbit & 64Kbit 40-year, 1Mcycles
128bit password 20bit counter UID, Field detect	32bit counters Lock, OTP, UID	32bit password UID
Wireless pairing Traceability Brand recognition	Mass transit Event ticketing	Logistic Asset tracking Gaming

Tags				
ST25TA	ST25TB	ST25TV		
ISO14443-A 106kb/s NFC type 4	ISO14443-B 106kb/s	ISO15693 up to 53kb/s NFC type 5		
EEPROM 512b-64Kbit 200-year 1Mcycles	EEPROM 512b-4Kbit 40-year 1Mcycles	EEPROM 512b-64Kbit 60-year 100kcycles		
TruST25 128bit password 20bit counter UID Field Detect	32bit counters Lock OTP bits UID	TruST25 64bit password 16-bit counter UID Tamper detect		

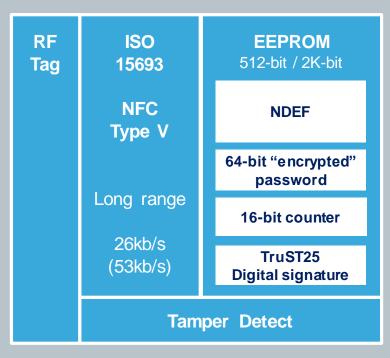




ST25TV Low Density NFC Tags



ST25TV512 / 02K





Use cases

- Consumer engagement, asset tracking, NFC tags, gaming
- Tamper proof application



Key Features

- ISO15693 and NFC Type V
- Long range operations, up to 53kb/s speed
- Tamper Detect pin for open / short detection
- TruST25 digital signature
- Counter 16-bit with anti-tearing

Key Benefits

- Specific Feature (EAS) for Library Application
- Cloning Protection with <u>Digital Signature</u> in association with Cloud management
- RF tuning capacitor (23.5pF/99pF)





ST25TV Evaluation Board

ST25TV-eSeal Board

- ST25TV02K NFC/RFID tag IC
- UDFPN5 package
- 48x39 mm 9-turn antenna
- Custom Fast read access up to 53 Kbit/s
- Featuring Tamper detect loop



ST25TV-eSeal

ST25-TAG-BAG-U

- ST25-TAG-BAG-U ready-to-use tag set
- Different tag form factors based on NFC Forum Type 5 Tag ICs (ST25TV512 and ST25TV02K) and NFC Forum Type 4 Tag ICs (ST25TA02KB and ST25TA64K).



ST25-TAG-BAG-U



ST25 Dynamic NFC Tags (ST25DV-PWM & ST25DV-I2C Series)

- With the ST25 product family, ST offers a complete portfolio of NFC and RFID tag and reader ICs for a
 wide variety of NFC-enabled solutions. NFC technology is a convenient, always-on low power shortrange wireless link that is driving the growth for convenient pairing, diagnostic readout, data tracking,
 and parameter setting use cases in Consumer, Industrial, Automotive and Medical applications. The
 benefit of our 10 years longevity program is available for Industrial-grade and Medical NFC / RFID
 applications
- ST's dynamic NFC / RFID tags feature up to 64-Kbit of EEPROM memory which can be accessed either through an RF contactless interface operating at 13.56 MHz or a low-power I²C interface except for ST25DV-W series (PWM outputs). Both short-range (ISO14443-A) and long-range (ISO15693) standards are supported
- The ST25DV-PWM & ST25DV-I2C series of dynamic NFC/RFID tags offer a 13.56 MHz long-range interface compatible with NFC phones and readers.
 - ST25DV-PWM: The ST25DV02K-W1/W2 device is an NFC/RFID tag IC with PWM outputs. The PWM output can be programmed independently and securely, allowing a large field of application. The IC provides live update of PWM parameters by contactless interface, extending the user experience
 - ST25DV-I2C: They also include an I²C interface that lets them connect to a host (MCU, MPU, etc.). These tags feature an innovative fast transfer mode between an embedded host and an NFC phone or reader thanks to their half-duplex 256-byte buffer. ST25DV dynamic NFC/RFID tags can be used in a wide variety of applications including consumer electronics, industrial, metering, electronic shelf labels, IoT objects and more.

ST25 Dynamic NFC Tags Product Portfolio

5	Dynamic	NFC Tags	
ST25DV-FC	ST25DV-PWM	M24LR	M24SR
IS015693 up to 53kb/s NFC type 5	ISO15693 26kb/s NFC type 5	ISO15693 up to 53kb/s	ISO14443-A 106kb/s NFC type 4
256Bytes buffer EEPROM 4-Kbit to 64-Kbit 40-year, 1Mcycles	EEPROM 2-Kbit 40-year, 100k cycles	EEPROM 4-Kbit to 64-Kbit 40-year, 1Mcycles	EEPROM 2-Kbit to 64-Kbit 200-year, 1 Mcycles
Fast Transfer Mode 64-bit password E-harvesting Field detect	64-bit password Up to 15-bit PWM resolution	32-bit password E-harvesting Field detect	128-bit password RF disable Field detect
PC 1.8V - 5.5V 1MHz	Up to 2 PWM outputs 1.8V - 5.5V 488Hz to 31.25kHz	PC 1.8V - 5.5V 400kHz	PC 2.4V - 5.5V 1MHz
Metering, Lightning Healthcare Home automation	Industrial	Metering Lightning Healthcare	Consumer Home appliance Wearable

Dynamic tags				
M24SR	M24LR	ST25DV-I2C	ST25DV-PWM	
ISO14443-A 106kb/s NFC type 4	ISO15693 up to 53kb/s	ISO15693 up to 53kb/s NFC type 5	ISO15693 up to 53kb/s NFC type 5	
EEPROM 2Kbit to 64Kbit 200-year 1Mcycles	EEPROM 4Kbit to 64Kbit 40-year 1Mcycles	256Bytes buffer EEPROM 4Kbit to 64Kbit 40-year 1Mcycles	EEPROM 2Kbit 40-year 100kcycles	
128bit password RF disable Field Detect UID	32bit password E-harvesting Field Detect UID	Fast Transfer Mode 64bit password E-harvesting Field Detect UID	TruST25 64bit password UID	
I2C 1MHz 2.7V - 5.5V	I2C 400kHz 1.8V - 5.5V	I2C 1MHz 1.8V - 5.5V	2x PWM 488 – 31250Hz 1.8V - 5.5V	



ST25DV-PWM

Dynamic NFC tag with PWM output

Innovation for industrial applications



- ✓ NFC Forum Type 5 for smartphone interface
- ✓ RFID ISO15693 for factory programming and track & trace
- ✓ 2 x PWM outputs
- ✓ TruST25 digital signature
- ✓ Large operating voltage 1.8-5.5V
- ✓ Industrial temperature range -40°C / +105°C
- ✓ Coming soon: NFC certification & 10-y longevity program
- √ 4 patents pending to protect ST & customers
- ✓ Turn-key evolutive discovery kit













- Lighting
- ✓ Motor control
- ✓ Other industrial









ST25DV-PWM Dynamic NFC Tag



Use cases

Industrial applications like Lighting LED driver, Motor control

Key Features

- ISO15693 and NFC Type V
- 2K-bit memory
- Up to 2 PWM signal (push pull)
- Up to 15 bits resolution (62.5ns resolution step)
- Power Supply 1.8V 5.5V
- -40°C to +105°C (PWM) temperature range
- TruST25 digital signature

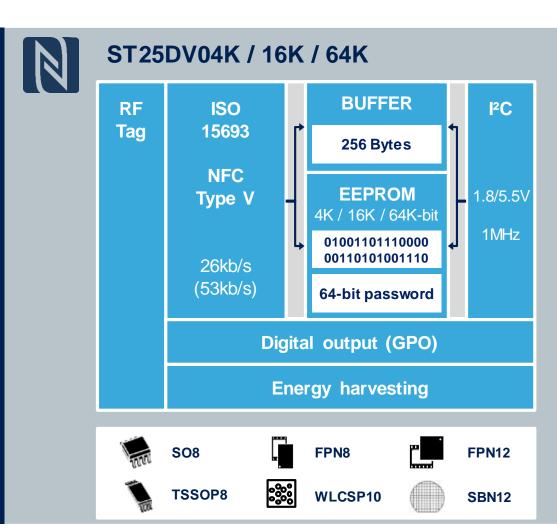
Key Benefits

- 2 in 1 chip, putting NFC connectivity with PWM functionality
- Cost optimized solution to address low end Lighting market
 - Significant BOM reduction as no MCU is required to drive the system





ST25DV-I2C Dynamic NFC Tag



Use cases

- Fast data exchange with NFC phones / HF readers. Long range
 - Fast data transfer for MCU FW upgrade, Fast data exchange
 - Parameters settings and update, with in the box programming
 - Datalog download
- Battery less applications

Key Features

- ISO15693 and NFC Type V
- Fast data transfer thanks to 256 Bytes buffer
- Low Power mode, < 1µA power consumption in Standby
- -40 to +125°C (I2C) industrial Grade 8 temperature range
- Energy harvesting function through RF

Key Benefits

- Smart applications using a flexible interrupt GPO
- Enhanced protection with multiple 64-bit passwords
- Same 28.5pF internal RF tuning capacitor, as in M24LR



ST25 Eco-system DNA

Easy-to-use and customer-oriented



ST25 NFC / RFID Readers

- With the ST25 product family, ST offers a complete portfolio of NFC and RFID tag and reader ICs for a wide variety of NFC-enabled solutions.NFC technology is a convenient, always-on low power short-range wireless link that is driving the growth for convenient pairing, diagnostic readout, data tracking, and parameter setting use cases in Consumer, Industrial, Automotive and Medical applications. The benefit of our 10 years longevity program is available for Industrial-grade and Medical NFC / RFID application.
- The ST25R HF reader series provides multiprotocol support for 13.56 MHz NFC / RFID communications as ISO14443 Type A or B, ISO15693, ISO18092, FeliCa and NFC Forum protocols. They integrate an SPI interface for interface to a host microcontroller
- ST25R39xx devices provide a complete solution for payment and point of sale terminals (POS) with the ST25R3911B/12/13 boasting EMVCo & PBOC certifications while the ST25R3914/15 are full AEC-Q100 grade 1 automotive grade making them ideal for keyless entry and immobilizer applications. They are also ideal applications like access control, door locks and gaming



ST25 NFC / RFID Readers Product Portfolio

-(()						
ST25			HF Readers			UHF Readers
CF	95HF 95HF	ST25R3910	ST25R3911B	ST25R3912 ST25R3913	ST25R3914 ST25R3915	ST25RU3993 ST25RU3980
IS0	443-A/B 15693 elica	IS014443-A/B IS015693 Felica	IS014443-A/B IS015693 / IS018092 Felica	IS014443-A/B IS015693 / IS018092 Felica	IS014443-A/B IS015693 / IS018092 Felica	IS018000 6c & b Gen2 Protocol Engine
	r / Writer mulation	Reader / Writer Limited P2P	Reader / Writer P2P EMVco & PBOC	Reader / Writer P2P EMVco & PBOC	Reader / Writer P2P AECQ100	Reader / Writer -90dBm sensitivity Internal VCO
		AAT	VHBR AAT Multi Antenna Dynamic power output	AAT Multi Antenna Dynamic power output	AAT Multi Antenna Dynamic power output	Dense Reader Mode Linear RSSI Automatic PSRR Auto ACK
2.7V	SPI & UART - 5.5V 0mW	6Mbit/s SPI 2.4V - 3.6V 700mW	6Mbit/s SPI 2.4V - 5.5V 1.4W	6Mbit/s SPI 2.4V - 5.5V 1W	6Mbit/s SPI 2.4V - 5.5V 1W	5Mbit/s SPI 2.7V - 3.6V 0/20dBm output power
	configuration tering	Access control Metering Gaming	Point of Sales Access control NFC infrastructure	Point of Sales Access control NFC infrastructure	Automotive	Logistics Asset tracking Cold chain management

nr Readers			
ST25R95	ST25R3911B ST25R3912 ST25R3913	ST25R3914 - ST25R3915	
ISO14443-A/B ISO15693	ISO14443-A/B FeliCa ISO15693 ISO18092	ISO14443-A/B FeliCa ISO15693 ISO18092	
Reader / Writer Card Emulation	Reader / Writer P2P EMVCo & PBOC	Reader / Writer P2P AEC-Q100 grade 1	
-	VHBR AAT Multi Antenna Dynamic output power	AAT Multi Antenna Dynamic output power	
SPI & UART 2Mbit/s 2.7V - 5.5V 230mW	SPI 6Mbit/s 2.4V - 5.5V 1 - 1.4W max	SPI 6Mbit/s 2.4V - 5.5V 1 - 1.4W max	

HF Readers

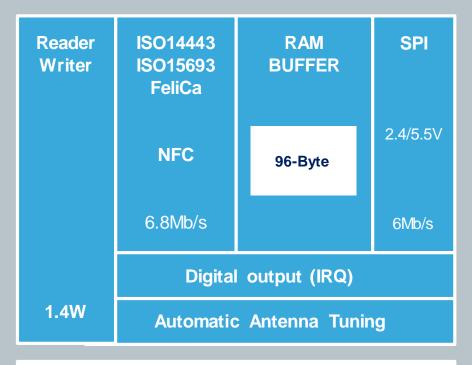


ST25R3911B

High performing reader IC fitting most applications including high temperature and automotive



ST25R3911B



QFN32 Wafer

Use cases

- Ideal for Payment applications
- Access Control, Gaming, eGovernment passport

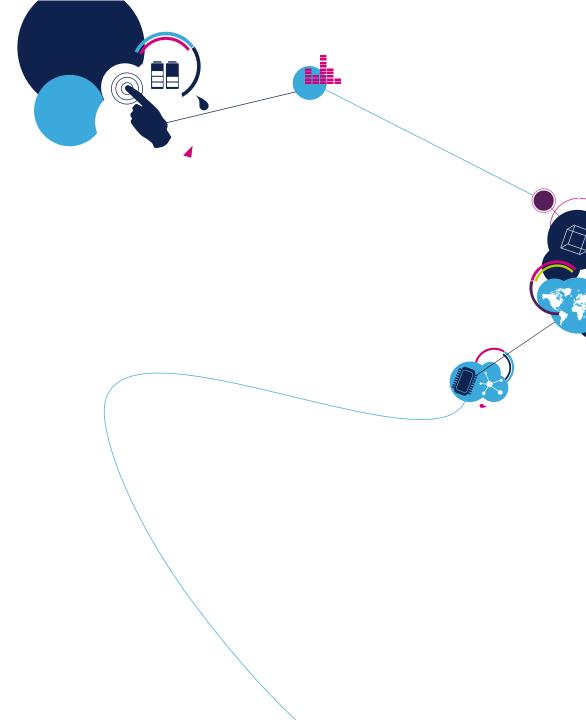
Key Features

- All NFC modes supported (ISO14443, ISO15693, FeliCa) with P2P
- 1.4W output power at 5V
- EMVCo & PBOC certification without external power amplifier
- Automatic Antenna Tuning
- VHBR support up to 6.8Mb/s
- -40°C to 125°C temperature range

Key Benefits

- Low power operation & Stand-by mode (capacitive wake-up)
- 2 antennas operation at the same time
- Enhanced fast transfer rate for Passport application

SmarTag





NFC- SmarTag



Multiple applications: Asset Tracking, Cold Chain, Medical, smart sensing, smart home, smart city and home building automation

Multiple ST technologies: NFC dynamic tag connectivity and energy harvesting, Low Power MCU, environmental and motion sensors

Complete evaluation solution available from ST in small form factor 4x4cm





STEVAL-SMARTAG1





- ST25DV64K
- ☐ HTS221
- STM32L031
- LPS22HB
- STLQ015
- LIS2DW12

SmarTag Solution

STEVAL-SMARTAG1

- Hardware:
 - STM32L031, MCU ARM Cortex M0+
 - ST25DV64K, NFC Dynamic Tag
 - MEMS SENSORS:
 - Acc. and Magn. : LIS2DW12
 - Press. and Temp.: LPS22HBTR
 - Hum. and Temp. : HTS221
 - SWD connector for programming and debug
 - Power Management
 - STLQ015: Low Drop Linear Regulator
 - CR2032 Battery powered
- Small form factor: 4x4cm
- FP-SNS-SMARTAG1: Small form factor Firmware
 ODE Function Pack Firmware
- ST SmarTag: Mobile App (Android / iOS) available
- FCC verified



Dual Operation



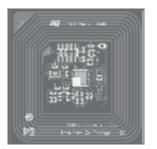
Operation in Full Passive mode

- NFC Tags get the required energy from the field generated by the reader.
- The energy harvested by the NFC Tag is used to power sensors and the low power MCU.
- The lifetime of the tag is theoretically unlimited, and it requires no wired connections.
- Battery-less sensor measurements that utilize energy harvesting from the RF field can be implemented in applications ranging from smart packaging, smart clothing, smart home, smart building, smart environment, medical, health and fitness, and industrial where instantaneous measurements are required and a battery is not feasible or desired.

Operation in Semi-Passive mode

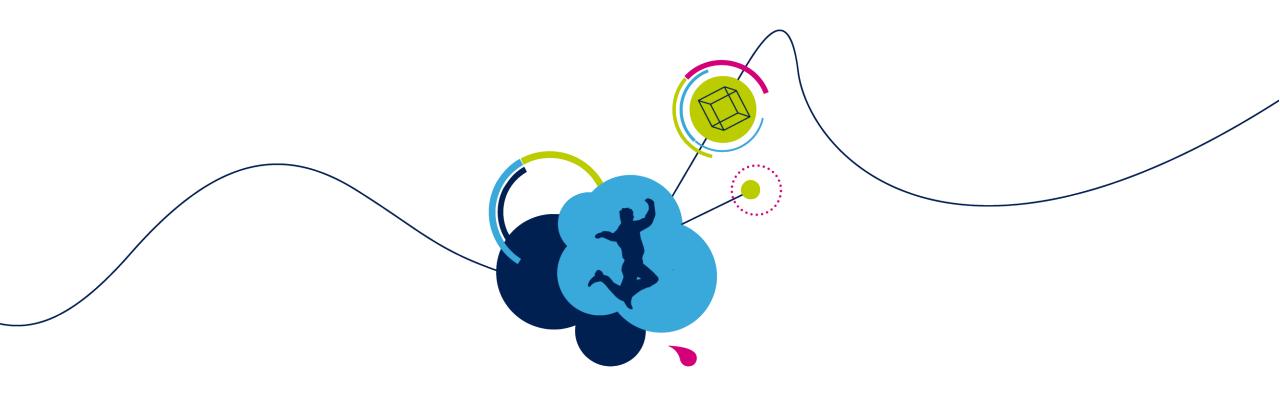
- Semi-passive mode it includes an on-board power source to support tag and sensor operation.
- User-controlled semi-passive sensory tags spend most of their time in a quiescent state, in which the current drawn from the battery is negligible. Data transmission operates in the same way as in a normal passive tag, using backscattered power emitted by a reader.
- Sensors can record conditions including temperature, humidity, pressure, vibration and motion and transmit the data when triggered by an NFC reader.











BlueNRG-Tile



BlueNRG-Tile Sensor TAG Eval board



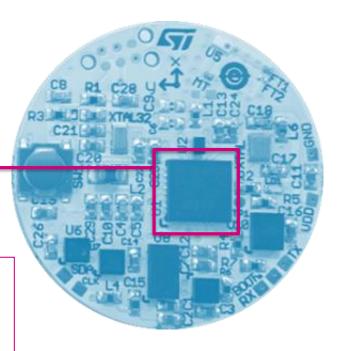


BlueNRG SoC

Sensing, processing and streaming

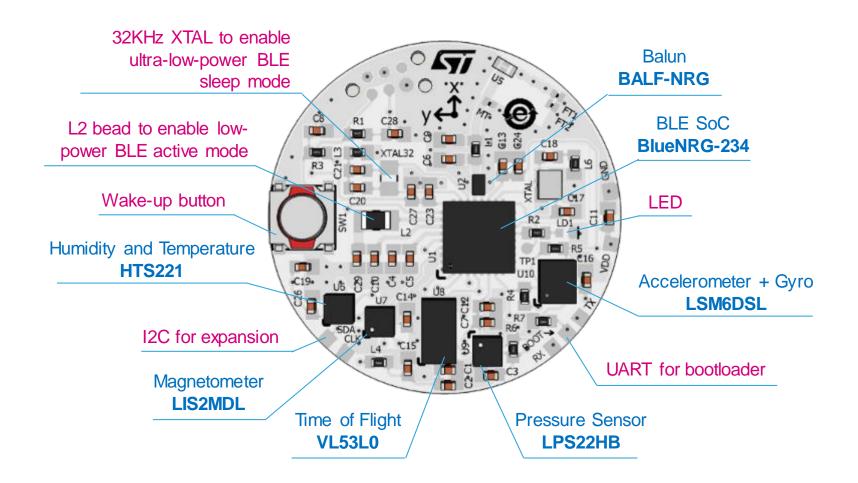
Ultra-low-power software libraries for **Motion MEMS processing**:

- 6/9 axis fusion
- Gesture recognition
- Activity recognition





BlueNRG-Tile Sensor TAG evalboard





Target Application

- Door/Windows Open Sensor device
- Asset tracking
- Proximity Sensor Smart Home
- BLE Mesh Network (friendship)
- Bluetooth Area Network up to 8 nodes (wearable, smart clothes, smart accessories)
- Virtual Reality remote and headset controller (low latency for motion sickness)
- Air filter monitoring for HVAC
- Urinals and faucet (proximity + mesh)
- People counting (building automation)

BlueNRG-Tile Applications

Target:

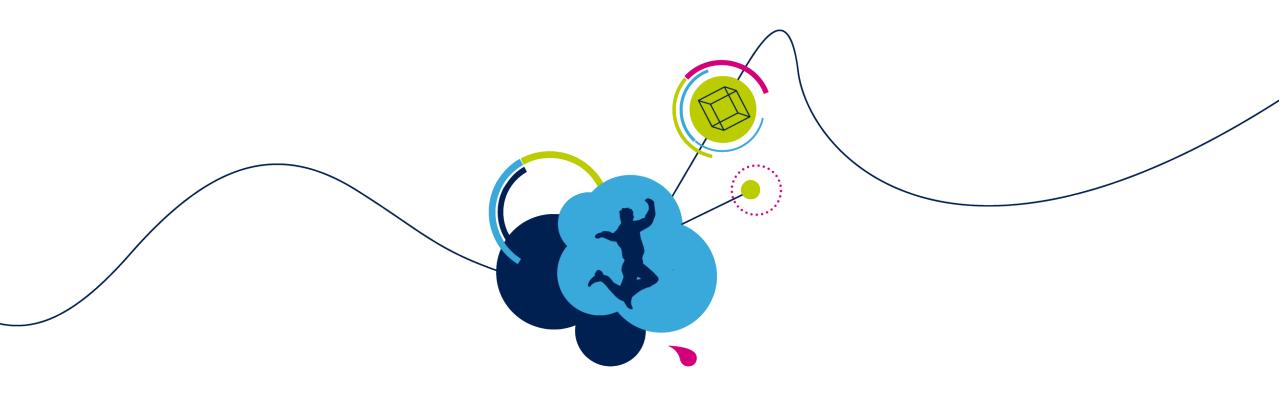
2 year with CR2032 battery





ST BlueMS
STMICROELECTRONICS INC

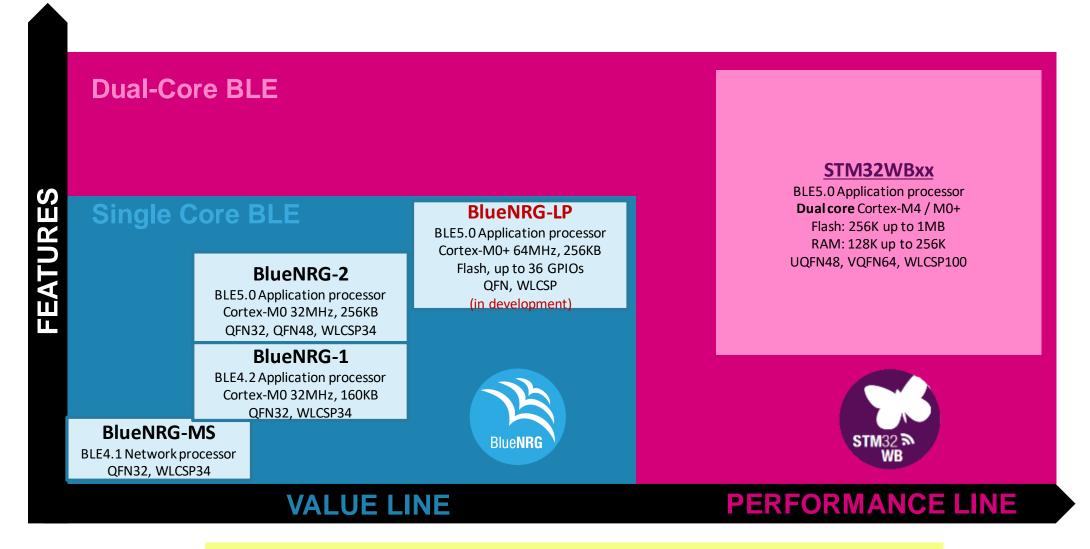




Bluetooth Low Energy



ST BLE Portfolio Roadmap





The most complete BLE portfolio in the market!

BlueNRG-1 / -2 scalable solution

Bluetooth LE Wireless Application Processor

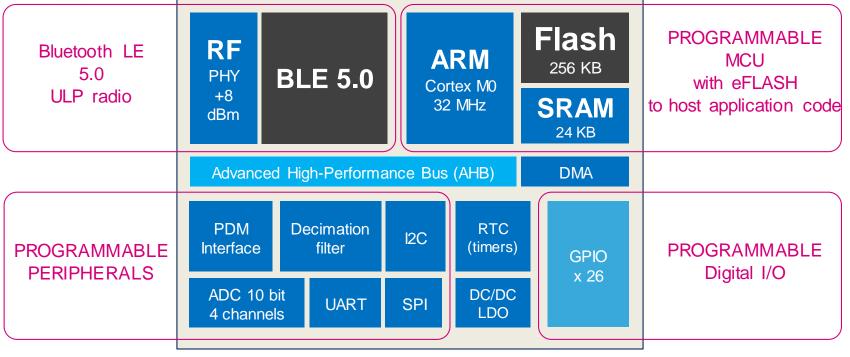


BlueNRG-1 and BlueNRG-2 are respectively Bluetooth 4.2 and Bluetooth 5.0 certified, which ensures interoperability with the latest generation of smartphones, and supports enhanced features such as state-of-the-art security, privacy, and extended packet length for faster data transfer.



BlueNRG-2 Wireless SOC











BlueNRG-1 / -2 overview

SoC featured IPs

ARM Cortex-M0

- 25 μA/MHz up to 32 MHz core speed
- Ultra-low leakage retention state
- SWD debug port

Ultra-low-power

- +8dBm max Tx output power
- TX 8.3mA @ 0dBm / RX 7.7mA
- Ultra-low-power sleep @ 0.9µA

160kB / 256kB Flash

BLE radio

- o Provide storage for BLE 5.0 certified and upgradable stack
- o Up to 100KB / 190KB available for application code (depending on BLE stack features)

24kB RAM

Ultra Low Leakage

- One 12kB block always in retention
- One 12kB block switchable

10 bit ADC

- Single Ended or Differential mode
- o Continuous or single acquisition
- Support for PDM stream decimation

I/O Peripherals

- SPI: Master and Slave support
- o I2C: Up to 400 kb/s
- UART and PDM for Digital MEMS Mic

GPIO

- o 14 (WLCSP), 15 (QFN32) and 26 GPIOs (QFN48)
- Fast wake up function from GPIO

Crypto Engine

- Hardware AES-128 and RNG
- Public Key Accelerator for computation of ECC cryptographic public key primitives

TIMERS

- MFTX: Two multi function timers
- o Programmable PWM output
- Sleep timers and Watch Dog

DMA

- o Up to 8 configurable channels
- Programmable IRQ priorities



BlueNRG-MESH 105

Bluetooth® Low Energy (BLE) System-on-Chip accelerates the spread of connected objects



Easily connecting appliances to iOS/Android, out-of-the-box



















Extending Bluetooth Capabilities

PAIRING

one-to-one



DATA TRANSFER

- Sports & fitness devices
- Health and wellness devices
- Peripherals and accessories

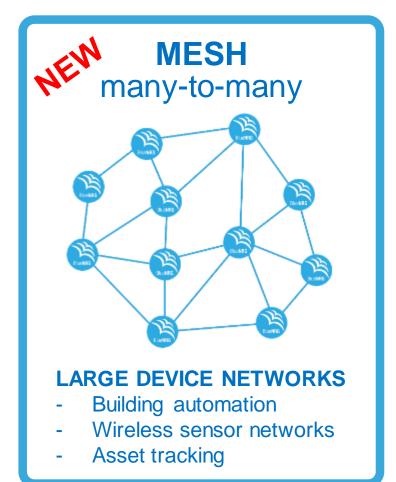
BROADCASTING

one-to-many



LOCALIZED INFORMATION

- Point of interest beacons
- Item finding beacons
- Way finding beacons





BlueNRG-Mesh in Numbers

Power consumption 7 mA average

Hop latency 30 ms

Provisioning procedure
15 seconds average

Memory footprint
32 KB Flash
10 KB RAM



Compatible with both BLE 4.X or 5.0

BLE Mesh 1.0 certification
End of June 2018

Application Payload8 bytes unsegmented64 bytes segmented

Network size

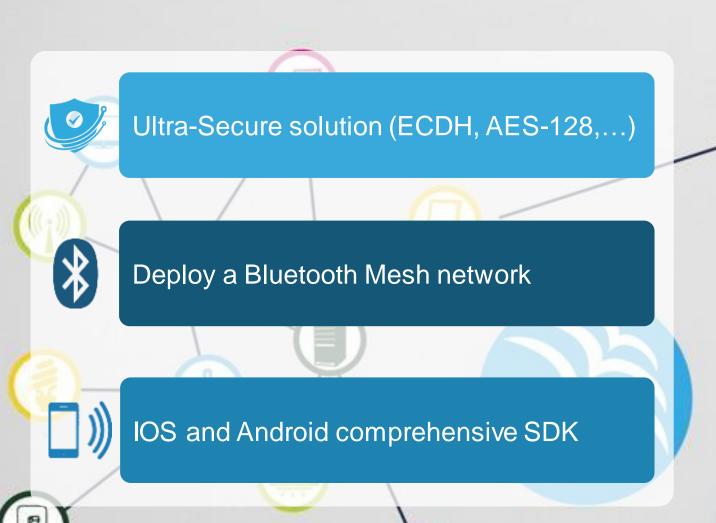
Max 32767 devices for single network

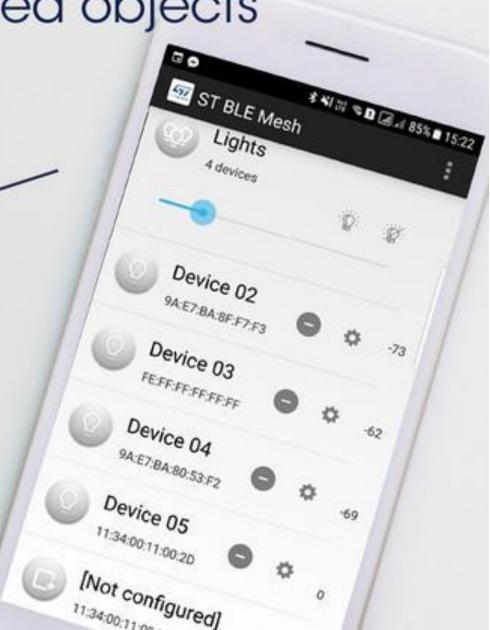
Max network diameter of 126 hops



Bluetooth® Mesh Networking Software kit

accelerates arrival of Connected objects





Setup & demo examples

Hardware prerequisites

Smartphone



App for Demo



BlueNRG-Mesh App for Android and iOS

BLE Hardware



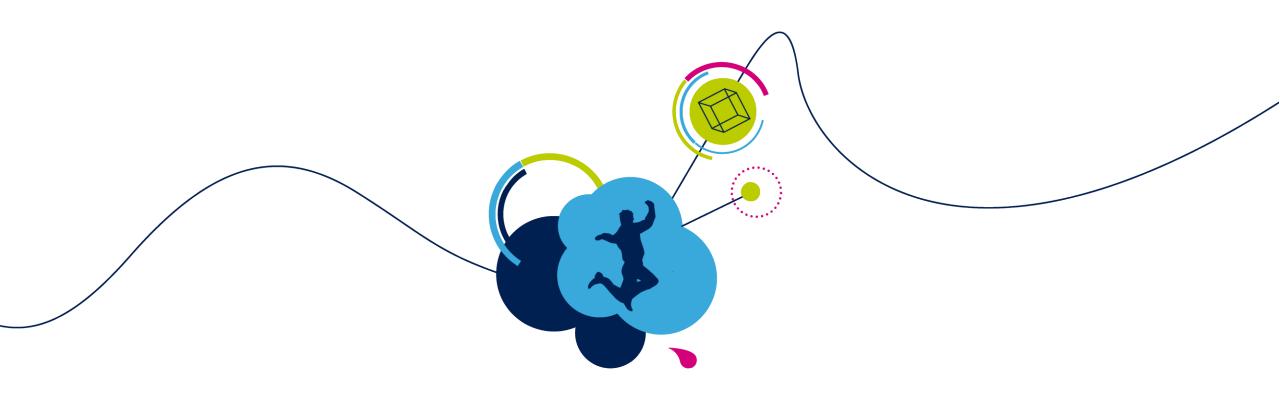
STEVAL-IDB007V1: evaluation platform based on the BlueNRG-1

STEVAL-IDB008V1: evaluation platform based on the BlueNRG-2



X-NUCLEO-IDB05A1 + NUCLEO-L152RE





Sub 1GHz



S2-LPCB

Sub-1GHz proprietary RF transceiver

Main features

- Ultra-low-power
 - 600nA in Sleep mode
 - 7 mA RX
 - 10 mA TX @ +10 dBm
 - Sniff mode
- Frequency bands:
 - 470-512 MHz
- Modulation schemes:
 - 2(G)FSK, 4(G)FSK, OOK and ASK
- RF link budget higher than 140dB
- Up to +16 dBm maximum output power
- 6LowPAN supported
- Available in QFN24 package

- Sensors to Cloud
- Smart Metering
- Smart Home and building automation
- Power Fault Indicator
- Wireless Alarm Systems





Low-Power RF Module Catalog

Low-power RF connectivity made easy

SPBTLE-1S certified BLE module





Sub-GHz

Sub-1GHz proprietary radio

For the Remote monitoring and control



RX:9.2mA / TX: 19.5mA @ +11dBm

Sleep/Stby: 850 / 600nA

Max.Out / Sensitivity: +16dBm / -120dBm

Mod: 2(G)FSK, OOK

QFN20 4x4



430-470 MHz 860-940 MHz

SI

S2-LP

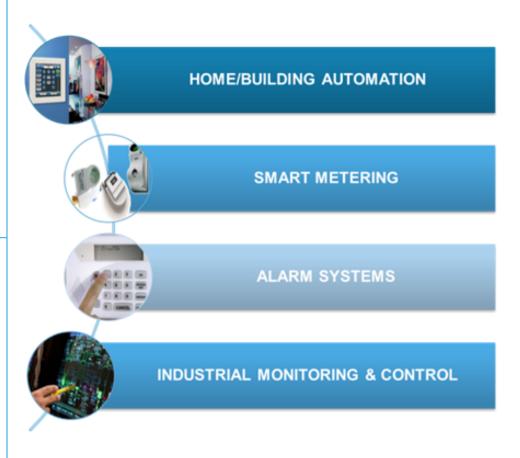
RX:6.7 mA

TX: 10mA @ +10dBm Sleep/Stby: 600 / 300nA Max.Out: +16dBm Sensitivity: -124dBm

Mod: 2(G)FSK, 4(G)FSK, OOK/ASK

QFN24 4x4

802.15.4g for Home Energy Management **SIGFOX** for Long Range Networking





Sub-GHz

S2-LP Overview

RF Features Overview

- Frequency bands: 430-470 MHz, 860-940MHz
- Modulation schemes: (2G) FSK, (4G) FSK, OOK and ASK
- Air data rate from 0.3 to 500 kbps
- Programmable output power: -30dBm to +16dBm
- RX sensitivity: -124dBm @1.2kbps / -130dBm @ 300bps
- SigFox modulation compliancy
- Built-in SMPS block for optimum current consumption

MAC Features

- Embedded packet handler, LDC/Sniff mode, CSMA/CA...
- Advanced packet handler flexibility :
 - Bit granularity for preamble (up to 256Bytes) and sync (up to 64bytes)
 - Configurable pattern recognition down to bit granularity
 - Manchester encoding/decoding
- IEEE 802.15.4g MAC for Home Energy Management System

Protocol Support

6LowPAN, Wireless M-BUS, SIGFOX and 802.15.4g



RX Power (peak) 6.7 mA

Tx Power **10** mA @ +10dBm

Sleep/Shutdown 300 nA /2.5nA











SPIRIT1 vs. S2LP

	Spirit1	S2-LP
Sensitivity[dBm] @ 1.2kbps BER 1%	-117	-124
Max Power level [dBm]	+16 (boost mode)	+16 (boost mode)
RX Current consumption [mA]	9.2	6.7
TX Current consumption [mA]	49.3 @ 16 dBm 19.5 @ 11 dBm	30 @ 16dBm 10 @ 10dBm
Shutdown Current consumption [nA]	2.5	2.5
Stand-by Current consumption [nA]	600	300
Sleep Current consumption [nA]	850	600
Max Data Rate [kbps]	500	500 (4-GFSK)
Sub-GHz Freq. Range	150-174 MHz 300-348 MHz 387-470 MHz 779-956 MHz	430-470 MHz 860-940 MHz
Mod scheme	2(G)FSK OOK	2(G)FSK 4(G)FSK OOK/ASK
Adj. Channel Selectivity[dB]	49	60
Blocking @ 2MHz[dB]	60	66
IIP3[dBm]	-31	-20
802.15.4g hardware packet support	No	Yes
Sigfox support	No	Yes
Package	QFN20 4x4	QFN24 4x4



Two chip solution, BLE and Sub-GHz...



Smartphone connectivity

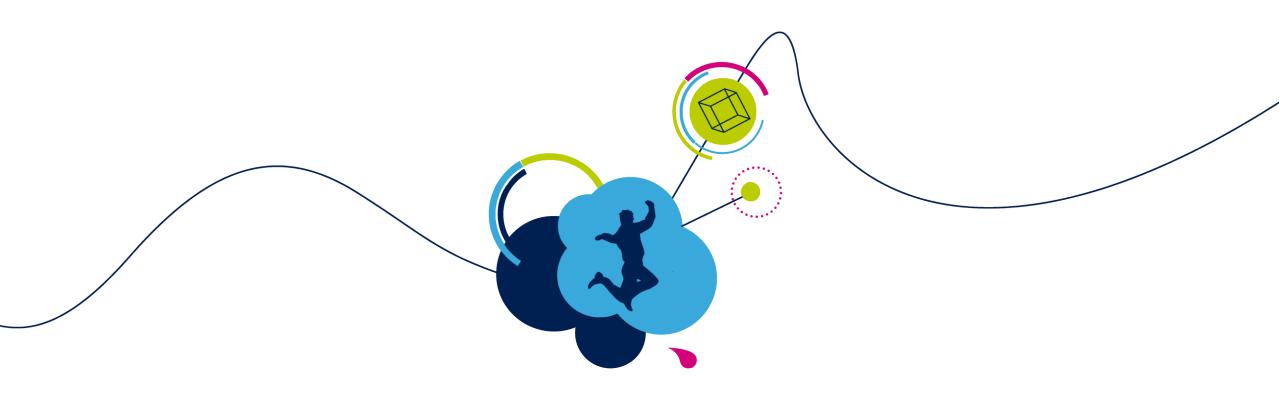
Cloud connectivity

Application scenarios:

- Wireless Sensor Nodes
- Remote diagnostic
- Smart Parking
- Smart Objects







GNSS Module



ST GNSS Module - Teseo-LIV3F

Leading integration, performance, efficiency

 ST offers its best in class Teseo III GNSS receiver in a new form-factor to open the ST Teseo III GNSS technology to a new position awareness IoT and Industrial applications.

 Teseo-LIV3F is the first product of ST GNSS module family. Its high precision and minimum foot-print are the key factor to address IoT and Industrial applications.

Teseo-LIV3F supports up to 3 simultaneous GNSS constellations, programmed and configured by ST, dual ports ready (UART and I2C).

GNSS Modules Product Portfolio

GNSS Modules: High Accuracy Tiny Standalone Global Navigation And Positioning (GNSS) Module





Teseo-LIV3F Tiny GNSS Module

Fleet Management / Insurance / Transportation

People / Pet / Package Tracking

Road Tolling / Anti Theft

Drones / Emergency Call





























Teseo-LIV3F

ST GNSS Module



KEY APPLICATIONS

Position awareness applications as:

- Sport tracker
- Fleet management
- Logistincs
- Leisure



KEY BENEFITS & FEATURES

Tailored for portable:

- GPS/Glonass/BeiDou/QZSS supported
- Galileo supported (Teseo-LIV3F only)
- Protocol: NMEA
- UART/I2C interface
- Geofencing/Odometer
- Datalogging (Teseo-LIV3F only)
- Firmware Update supported (Teseo-LIV3F only)
- 2.1 to 4.3V supply voltage range
- STM32 driver ready

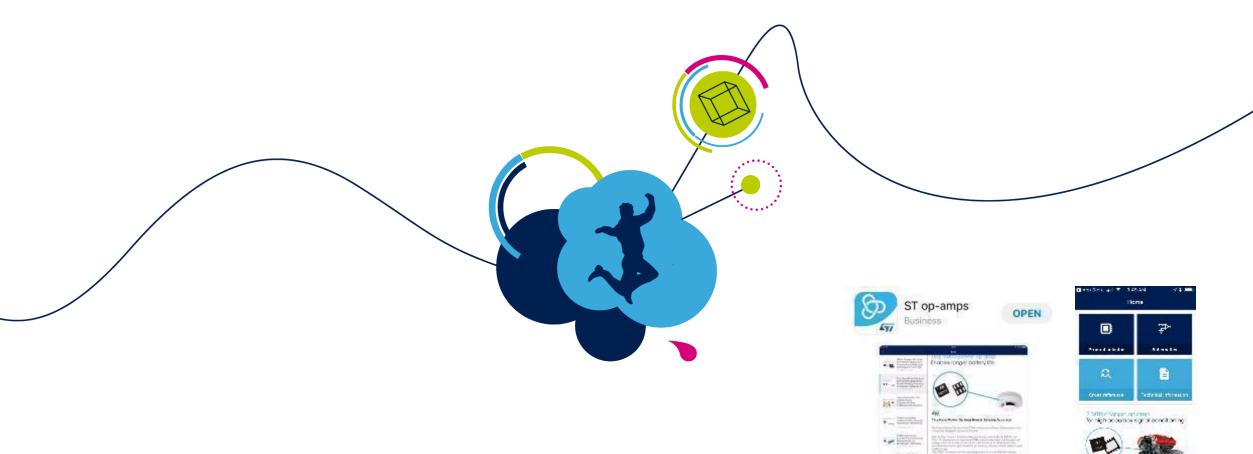
Extended battery life

less than 15uA stand-by current

Minimum footprint and lightweight

Tiny LLC18 pins (9.7 x 10.1 mm)





Operational Amplifiers





Operational Amplifiers (Op Amps)

ST's op amp portfolio provides a unique choice of high performance, low power, precision op amps and tiny packages.

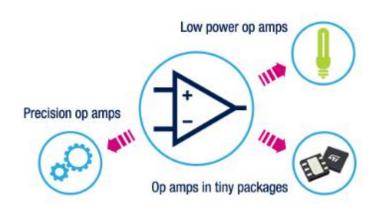
- Largest micropower op amp portfolio on the market, with consumption as low as 2 μA
- Reliable high volume supplier of both standard and high-performance op amps
- Space-saving packages, such as DFN, QFN, SOT-23 and SC-70

ST's precision op amp solutions include zero drift amplifiers and amplifiers with a low offset drift over temperature. Thus the precision op amps from ST are a perfect fit for use with any sensor, including gas, temperature, pressure, and position sensors.

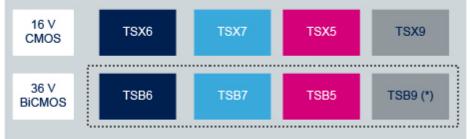
ST's low-power operational amplifier solutions include widely used devices, but also provide design engineers with upgrade options such as better accuracy, a standby feature and small packages. Our automotive-grade products are AEC-Q100 qualified and tested with certified high-reliability flow, to meet the very specific, rigorous demands of the automotive market.



Operational Amplifiers (Op Amps) Product Portfolio







16 V CMOS	TSX6	TSX7	TSX5	TSX9
36 V BiCMOS	TSB6	TSB7	TSB5	TSB9 (*)
L.				

(*) Under development

Series	Main features	Ideal for
TSB5 TSB6 TSB7	- Low power, 36V BiCMOS - High ESD performance - Stable performance over a wide temperature range	- Industrial and automotive sensors signal conditioning
TSX7 TSX92 - TSX929 TSX5 - TSX6	 Micropower 16 V CMOS High precision Excellent power/bandwidth ratio Space saving solution 	- Power applications (12 V, 15 V, +/- 5 V) - AFE for high voltage sensors
TSV7 - TSZ	- High precision - Micropower 5 V CMOS	- Sensor signal conditioning - Medical instrumentation
TSV5 - TSV6 TSV8 - TSV9 TSU1	- Micropower 5 V CMOS - Low voltage - Precision option	- Sensor signal conditioning - Battery operated devices
LMV3 - LMV8 LMX3	- General purpose 5 V CMOS - Low cost	- Computer - Tablets



New family



TSB7192A

Precision (300µV) rail-to-rail and 22MHz 36V Amplifier

Main features

- Fast amplifier: 22MHz GBP and 12V/µs slew rate.
- Wide supply voltage: 2.7V up to 36V
- Rail-to-rail input and output
- Low offset voltage Vio: 300 µV max at 25 °C
- Precision stability over input voltage range: CMRR > 110 dB
- Low noise : 12 nV / √ Hz
- 4kV HBM ESD tolerance.
- Automotive grade qualified.



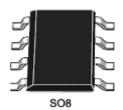
Benefits

- Fast device over large supply voltage range.
- High accuracy.
- Able to work up to 125oC.

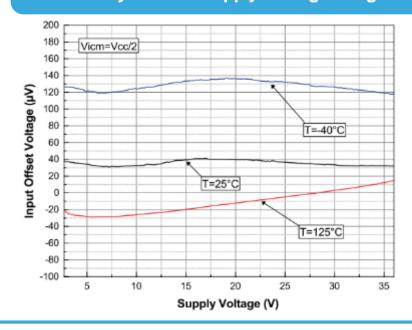








Accuracy across supply voltage range



- Test and measurement equipment.
- High side and low side current sensing.
- Hall effect sensors.
- Industrial process control.





Wide Bandwidth 20MHz, rail-to-rail 5V CMOS Amplifier

Main features

- Low input offset voltage: 1.5 mV max (A grade)
- Rail-to-rail input and output
- Wide bandwidth 20 MHz
- Stable for gain ≥ 4 or ≤ -3
- Low power consumption: 820 μA typ
- High output current: 35 mA
- Operating from 2.5 V to 5.5 V
- Low input bias current, 1 pA typ
- ESD internal protection ≥ 5 kV
- Tiny Packages: SOT23-5, DFN8 2X2 & DFN6

Benefits

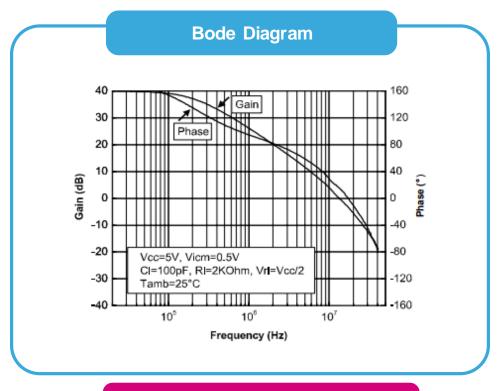
- Excellent speed/power consumption Ratio.
- Ideal for Sensor interfaces
- Able to work up to 125°C.







DFN6 1.2x1.3



- Signal conditioning & active Filtering.
- Portable devices
- · Industrial process control.
- Medical Instrumentation





TSB712A

Precision (300µV) rail-to-rail and 6MHz 36V Amplifier

Main features

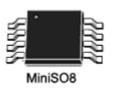
- Fast amplifier: 6MHz GBP and 3V/µs slew rate.
- Wide supply voltage: 2.7V up to 36V
- Rail-to-rail input and output
- Low offset voltage Vio: 300 µV max at 25 °C
- Precision stability over input voltage range : CMRR > 110 dB
- Low noise : 12 nV / √ Hz
- 4kV HBM ESD tolerance.
- Automotive grade qualified.

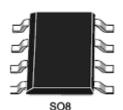
Benefits

- Fast device over large supply voltage range.
- High accuracy.
- Able to work up to 125oC.

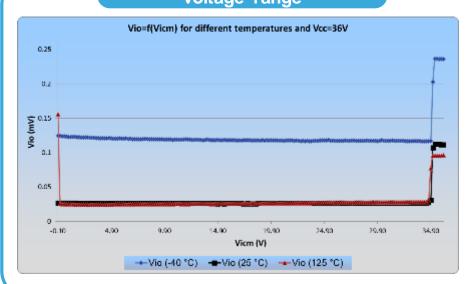








Accuracy stability vs input voltage range



- Test and measurement equipment.
- High side and low side current sensing.
- Hall effect sensors.
- Industrial process control.



TSB7192A

Precision (300µV) rail-to-rail and 6MHz 36V Amplifier

Main features

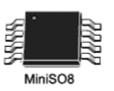
- Fast amplifier: 22MHz GBP and 12V/µs slew rate.
- Wide supply voltage: 2.7V up to 36V
- Rail-to-rail input and output
- Low offset voltage Vio: 300 µV max at 25 °C
- Precision stability over input voltage range : CMRR > 110 dB
- Low noise : 12 nV / √ Hz
- 4kV HBM ESD tolerance.
- Automotive grade qualified.

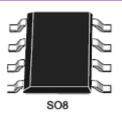
Benefits

- Fast device over large supply voltage range.
- High accuracy.
- Able to work up to 125oC.

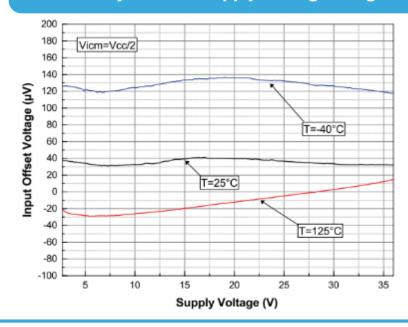








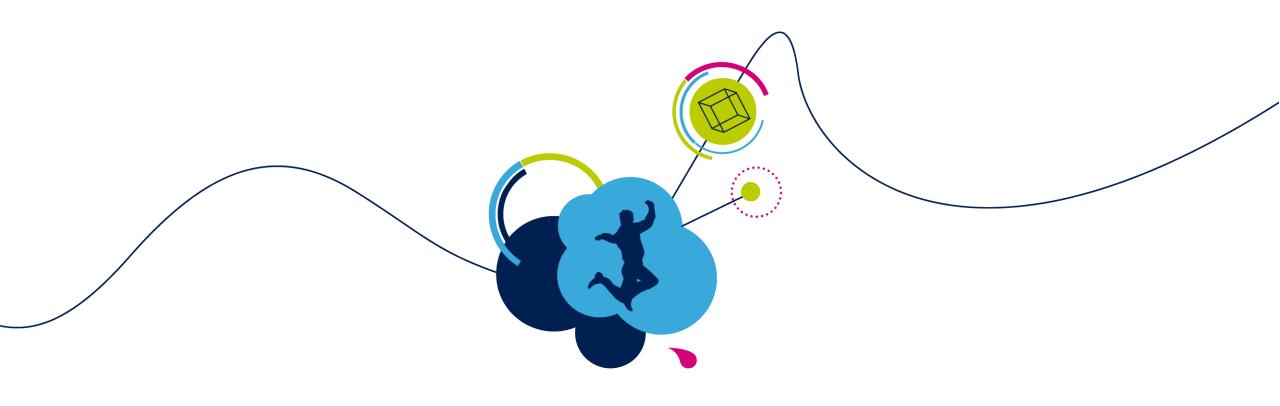
Accuracy across supply voltage range



- Test and measurement equipment.
- High side and low side current sensing.
- · Hall effect sensors.
- Industrial process control.

eDesign Suite for OpAmps 128





Environmental Sensors



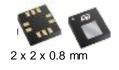
Environmental MEMS

Features & Benefits

Pressure Sensors



LPS22HBTR LPS22HD



ST patented construction
Water and dust resistant
0.075mbar noise ~6cm resolution
Embedded Temperature Compensation
FIFO, IIR, Interrupts, SPI/I2C

LPS33HWTR

Up to 10 ATM water resistant

CCLGA 3.3x3.3x3.9mm

ISO 22810 Horology Certified (water resistant watches standard)

FIFO, IIR Filter, Interrupt, Temp Compensated, SPI/I2C

All sensors are Factory Calibrated

Programmable Thresholds (Interrupts)

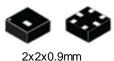
One shot or programmable ODR

ST World Class supply chain

Humidity+Temp Combo



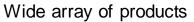
HTS221TR



Relative Humidity and Temperature
Low power consumption 2uA @ 1Hz--40C to +120C operation
SPI/I2C host interface

Ideal for comfort zone control, IOT sensor node, and battery powered devices.

Temp Sensors



Host interface: Digital, Analog, I2C, SMBus

For applications such as consumer, portable, industrial IOT, home appliances, and automotive aftermarket applications.

STTS2004, STTS751 STTS75 LM135 LM235/LM335 STLM20









TDFN-8

UDFN-4L

808

LPS35HW – Water Resistant

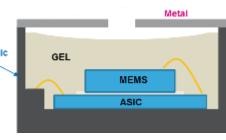


ST Water Resistant Pressure Sensor solution - 5 ATM & 10 ATM(*)

LPS35HW

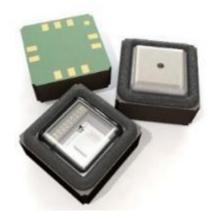
In Mass production





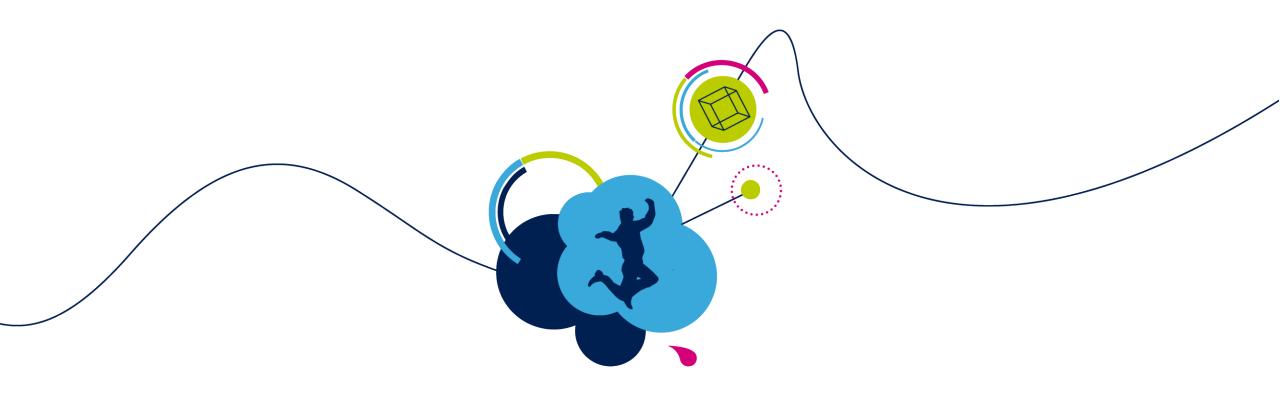
FEATURES:

- Low Power consumption: 3uA
- 260 to 1260hPa absolute pressure
- Absolute Accuracy (after OPC) Typ. 1hPa
- Verified & Certified with 5ATM condition.
 - ISO22810 Horology Certified
 - IEC60529 (IP Code): IPx7, IPx8 certified



CCLGA-10L, 3.5 x 3.5 x 1.85mm

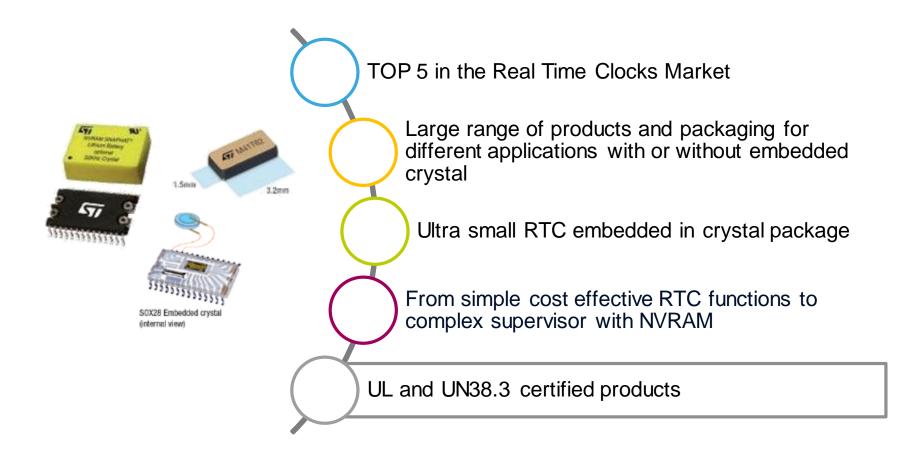




Real Time Clock



Real Time Clocks and Timekeepers





RTC products highlights

M41T00S

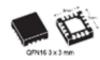
- Industry Standard
- Cost effective



M41T62

- Low stand-by power
- Best in class size with embedded crystal (M41T62LC6F)





M41T83

- High accuracy
- For battery backed applications
- Embedded crystal option







Standalone RTC vs MCU RTC

Feature	User benefit
Stand-by current consumption	Improve battery or capacitor timekeeping duration
Timer Accuracy	Real time fast analog calibration allows clock calibration in production
Minimum timekeeping voltage	Allows reducing backup capacitor size
Maximum supply voltage	5.5V allows direct connection to the battery
Crystal parallel capacitance	MCU needs high driver capability to drive 12.5pF crystals. This increases the current consumption to more than 1uA STANDALONE: M41T83 can drive 12.5pF with 365nA of current
Oscillator capacitors	MCU: needs external high quality low drift ceramic capacitors STANDALONE: always integrated capacitors

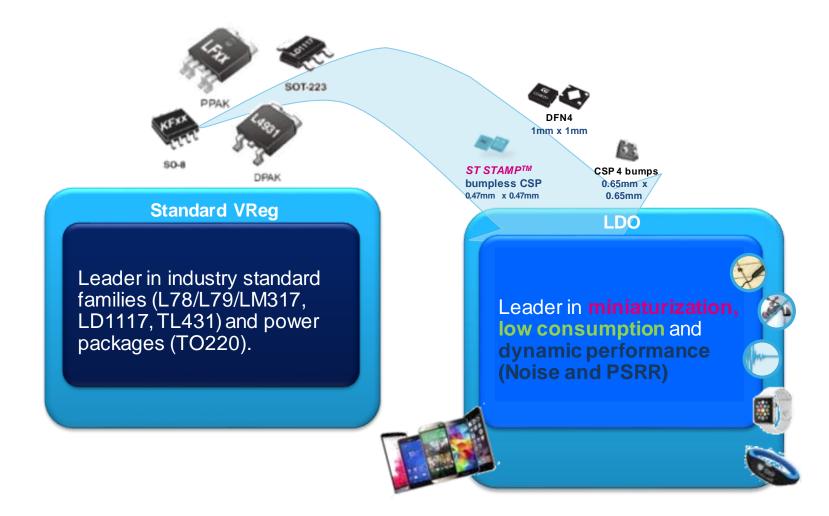




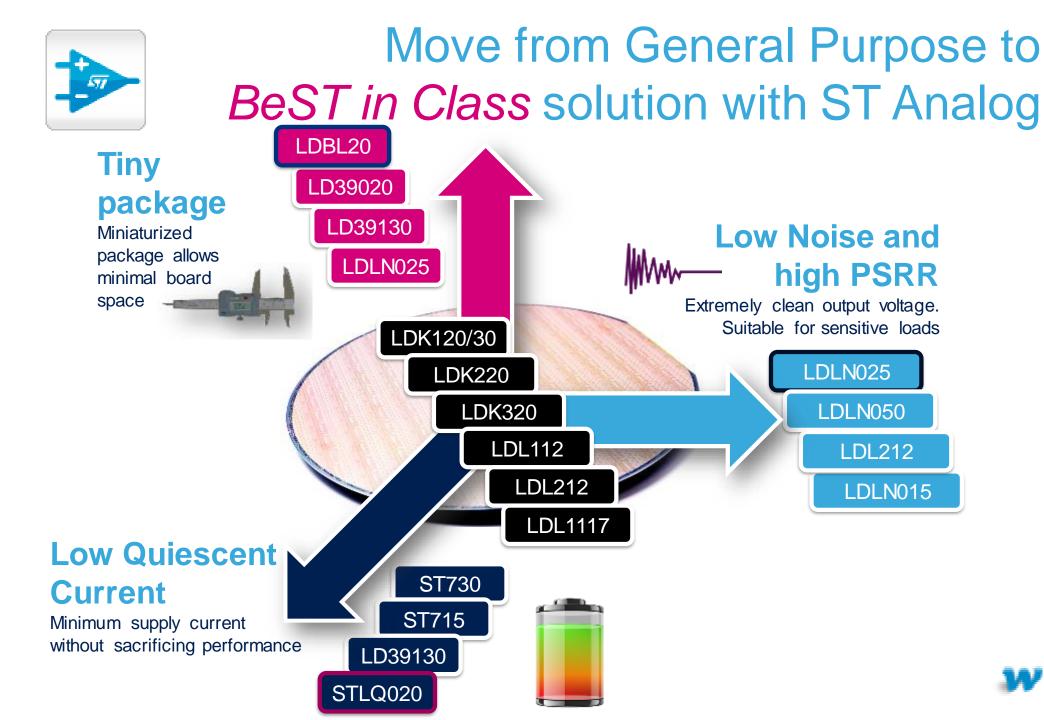
Power Conversion – DC:DC Download the App



Linear Voltage Regulatorsfrom standard functions to high-end







STLQ020

200mA LDO with Low Quiescent Current

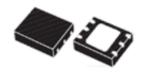
Main features

- Input voltage: 2V to 5.5 V
- Output current: up to 200 mA
- Low dropout: 200mV typ at 200 mA
- Ultra-low operating current: 300nA typ. at 0 load
- 1uA max Iq over temperature
- Controlled Iq in dropout conditions
- Output discharge feature (optional)
- DFN6-2x2, SOT323-5L, CSP4 0.8x0.8

Benefit:

Ultra low operating current to extend battery life of wearable/portable applications

- Wearable
- Smartphones and Tablets
- Portable Healthcare
- Metering and sensors





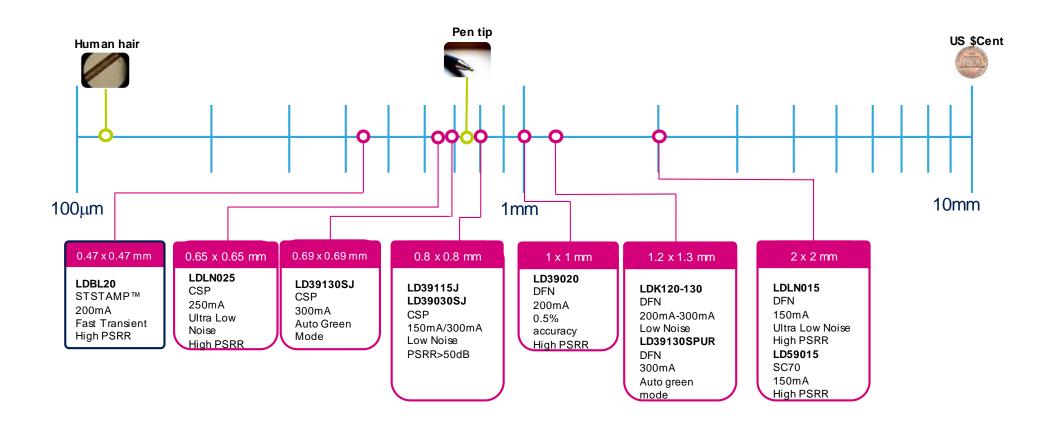




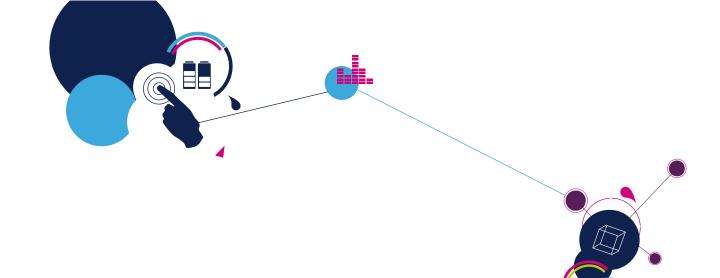


Tiny Package LDOs

"Think Small" with ST







DC/DC Converters



What is it?

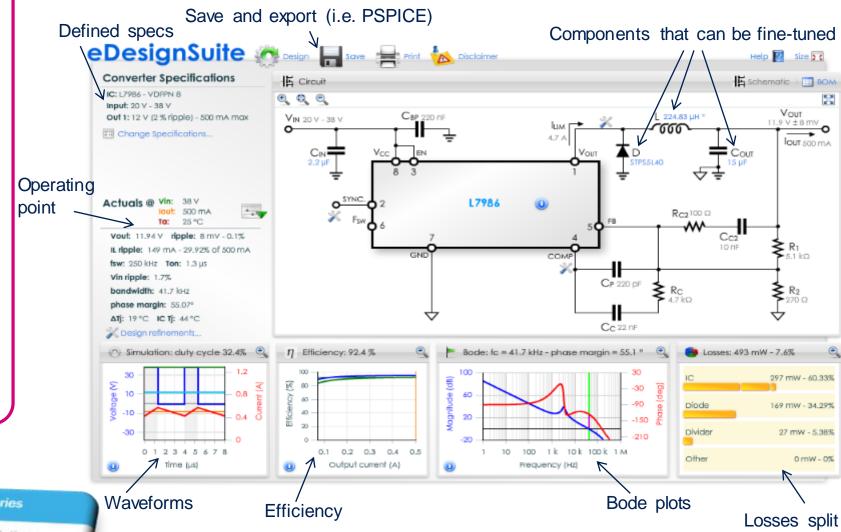
eDesignSuite is a SW platform that helps to select the right product for power conversion and speeds-up the design-in

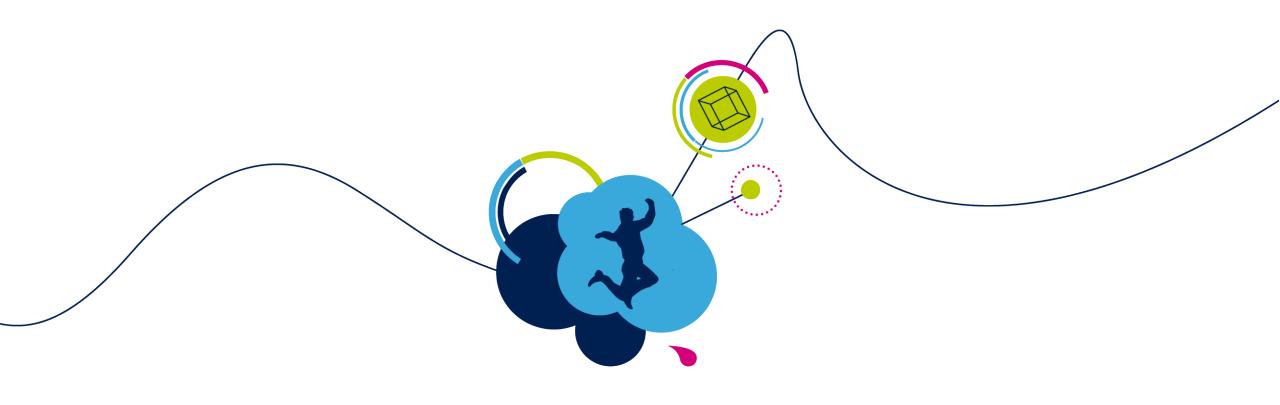
- Go to <u>www.st.com/edesignsuite</u>
- Register the first time and log in
- Insert your design specifications
- Get the suitable products
- Choose one, simulate and get
 - Circuit BOM
 - Electrical Waveforms
 - Additional information (stability, efficiency, etc.)
 - Export a PSPICE Model

<u>NEW!</u> You can now export a PSPICE model also directly from st.com product page



eDesignSuite





Wireless Charging



Wireless Charger ICs

- ST offers wireless battery charger ICs with a complete portfolio of both transmitter and receiver chip-sets optimized for different implementation requirements and ready to comply with the major wireless charging standards including Qi by Wireless Power Consortium (WPC).
- The STWBC family of transmitter ICs performs all the functions for transmitter control, ensuring compliancy with the leading standards in the market and providing customers with a turnkey Qi-certified solution, for a fast go-to-market strategy, or with an environment to build personalized solutions. Efficient power transfer is enhanced by a smart standby state while waiting for a receiver, which guarantees a power consumption as low as 3 mW while maintaining the foreign object detection (FOD) function active for maximum safety.
- To support customers in building their applications and minimize the time-to-market, a complete development ecosystem is available including certified reference design boards, API libraries and documentation to customize software, and graphical user interfaces to access to real-time data and configurable parameters.



Wireless Charger ICs Product Portfolio

Wireless battery charger transmitters portfolio

Wearable

Optimized for 1 – 2.5 W

STWBC-WA

2.5 W Single Coil



STEVAL-ISB045V1

Consumer

Optimized for 5 – 15 W

STWBC

A11 5 W Single Coil

STWBC-MC

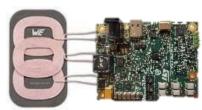
5 – 15 W Multi Coil

STWBC-EP

MP-A10 15 W Single Coil







STEVAL-ISB047V1



STEVAL-ISB044V1











STWBC-MC

15 W wireless battery charger transmitter designed to control multi-coils, for a larger charging area/ freedom of positioning, and a better user experience



15 W wireless battery charging systems, for smartphones, tablets and accessories

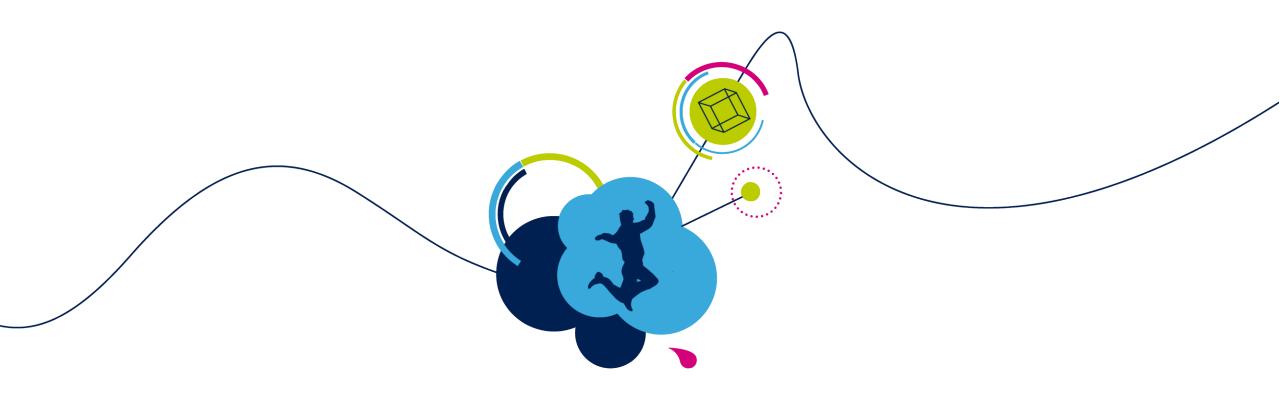
KEY BENEFITS & FEATURES

- Fully compatible with new Qi® 1.2.4 standard and with proprietary wireless fast charge extensions from world leading smartphone manufacturers
- Maximum efficiency and safety: detects the presence of the rx and exits
 the standby mode, selects the most efficient coil and supports extended
 Foreign Object Detection (FOD) through bi-directional communication with
 the RX
- Coexistence with most advanced smartphones features: thanks to the embedded digital DC-DC controller, the STWBC-MC is capable of controlling the delivered power while keeping a fixed-frequency operation



- Low standby power consumption
- Coil current and voltage monitoring for accurate power control
- UART open protocol interface to monitor the system via GUI or host CPU
 - 32-lead QFN (5 x 5 mm) package for a compact design

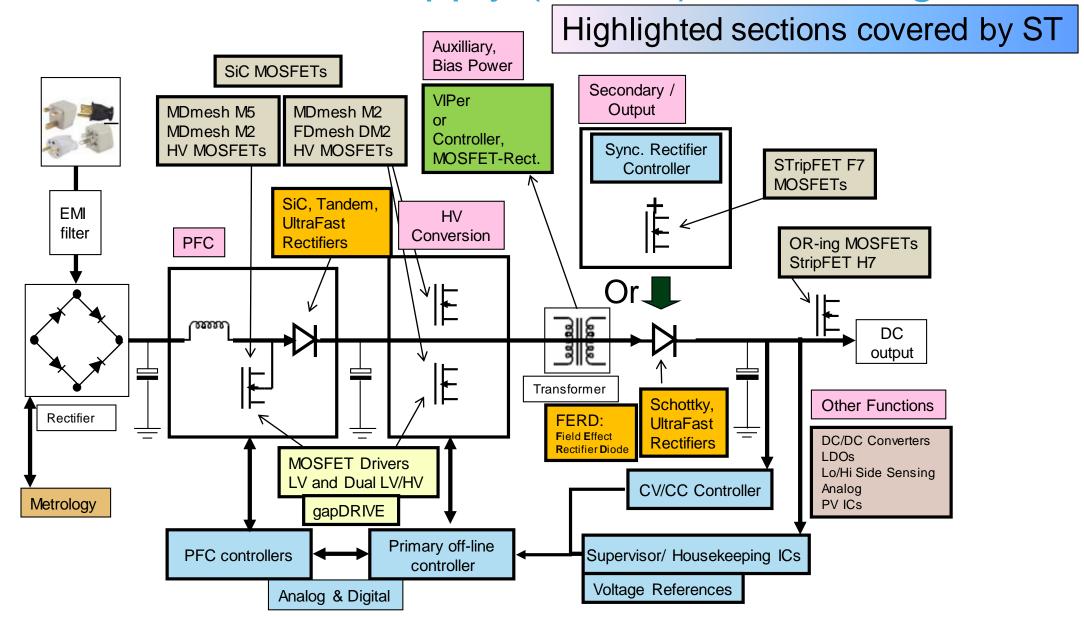




Power Discretes

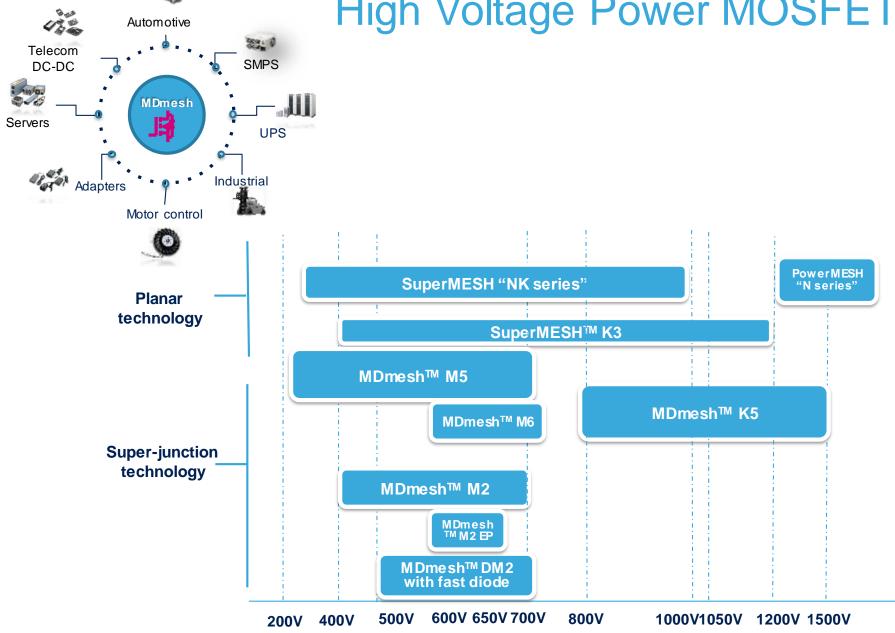


Switch Mode Power Supply (SMPS) Block Diagram





High Voltage Power MOSFET





SuperJunction MDmesh™ M5, M2, M2 EP, M6, DM2/DM6 & K5 Technologies

Products & Applications

M5: the leading technology for high power hard switch

Key Features

- Industry's one of the lower R_{DS}(on) in the Market
- High switching speed
- 650V BVdss rated

Benefit

- highest efficiency in the application
- Smaller form factor of final system
- Especially targeted for High Power hard switching (PFC, Boost, TTF, Flyback)



M6: improving performance technology for LLC & high-medium power hard switch Key Features

- R_{DS}(on) reduction vs M2/M2 EP tech.
- Extremely low Qg vs previous series
- 400 700V Bvdss rated
- Vth, Rg optimized
- Back-to-Back G-S zener protected

Benefit

- Better efficiency in high-medium power hard switch application
- Reduced switching losses through optimized (Qg, Vth, Rg) (Ciss, Coss)
- Especially
 targeted for LLC
 and high-medium
 power hard
 switching (PFC,
 Boost, TTF,
 Flyback

M2 / M2 EP: good for LLC

Key Features

- Up to 30% lower Qg (equivalent die size)
- 400 700V Bvdss rated
- Vth, Rg optimized for M2 EP smaller dice
- Back-to-Back G-S zener protected

Benefit

- Reduced switching losses through optimized (Qg) (Ciss, Coss)
- Especially targeted for HB LLC, TTF, Flyback..)
- M2 EP Tailored for Very High Frequency Converters (f > 150 kHz)
- Enhanced immunity vs ESD & Vgs spikes in the application

DM2 / DM6 Fast Diode: best F/B ZVS

Key Features

- Integrated fast body diode
- Softer commutation behavior
- Back-to-Back G-S zener protected

Benefit

- Reduced switching losses through optimized (Qg) (Ciss, Coss)
- High peak diode dV/dt capabilities
- Best use in Full Bridge ZVS

K5: best in class Very High Volt.

Key Features

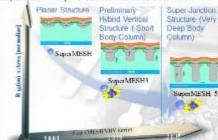
Extremely good RDS(on) at very high BVDSS
High switching speed
From 800 till 1500V BVDSS rated
950 V and 1050 V integrated fast body diode

Benefit

High efficiency with lower design complexity

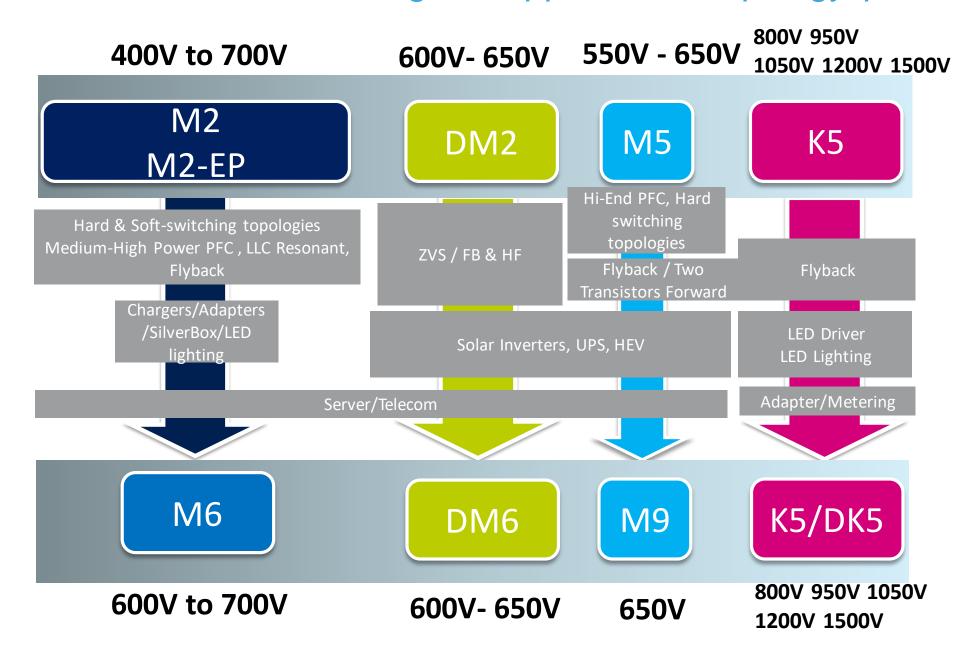
Especially targeted for flyback LED topologies and high voltage range in the application

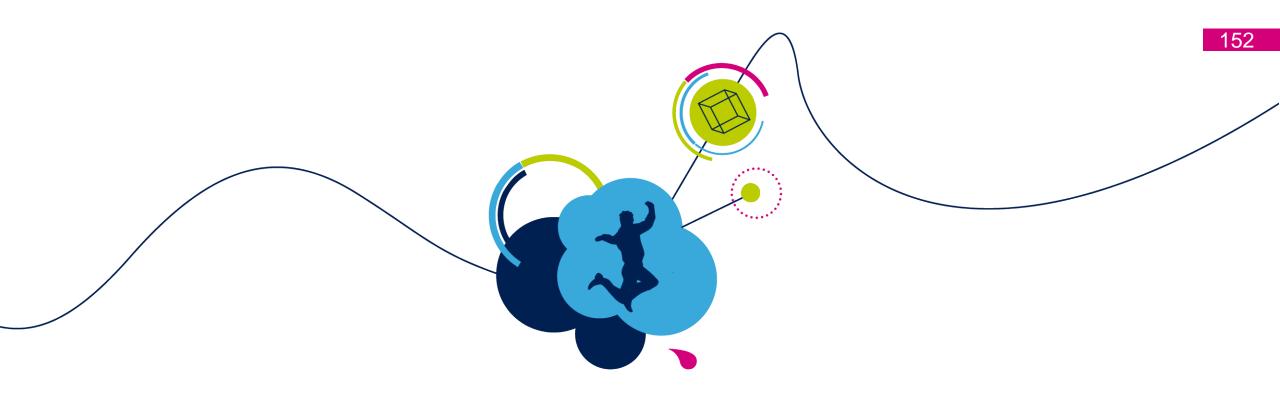






Current & Next SJ technologies: Application / topology positioning





IGBTs



IGBTs (Insulated Gate Bipolar Transistors)

Why IGBT?

- Used for white goods, high current applications that are not very fast switching.
- Best of both worlds when it comes to a MOSFET turn ON/OFF capabilities and the TRANSISTOR current carrying capability.
- Conduction losses per unit area benefit with lower overall cost compared to a MOSFET.
- Voltage above 250VDC and higher, higher than 10A current, 3 phase motor control.

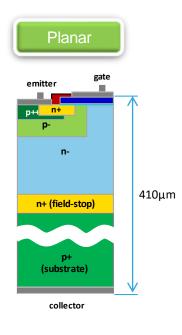
Why ST IGBT?

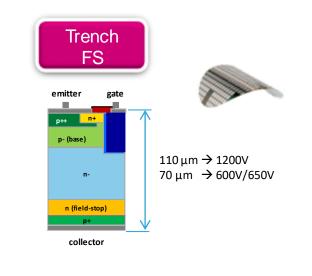
- Low VCE(SAT) for reduced conduction losses
- Improved switch-off energy spread versus increasing temperature resulting in reduced switching losses
- Tight parameter distribution for design simplification and easy paralleling
- Co-packaged tailored anti-parallel diode option for improved power dissipation and best thermal management





IGBTs Trench Gate Field Stop Technology Milestone and Features





TFS Technology Milestones

- ▶ Implanted Back Emitter
- ▶ Implanted Field Stop
- Optimized P-N-P BJT
- Trench Gate
- Thin wafer thickness

TFS Technology Benefits

- Lower E_{OFF} due to improved minority carrier recombination
- High switching robusteness (Large RBSOA)
- ▶ Lower V_{CE(sat)}
- ▶ Lower R_{TH}



Robustness and Reliability

The Increasing up to 175°C of the max Junction Temperature Tj(max), Ensures an higher lifetime

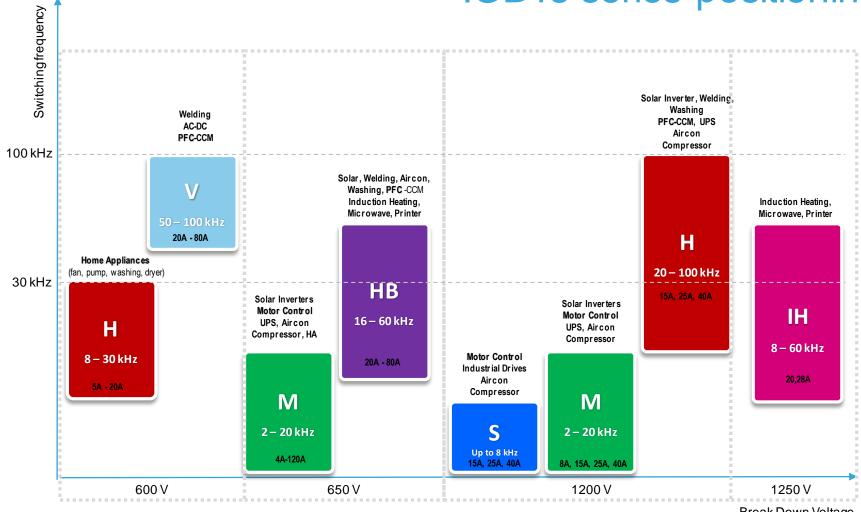


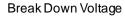
Energy Saving

<u>Extremely low switching-off</u> combined with a low conduction losses.



IGBTs series positioning

















← 577 Parametric Search

FW Diode

V_{CE8} (V)

V_{CE(sat)} (V)

lo 100°C (A).

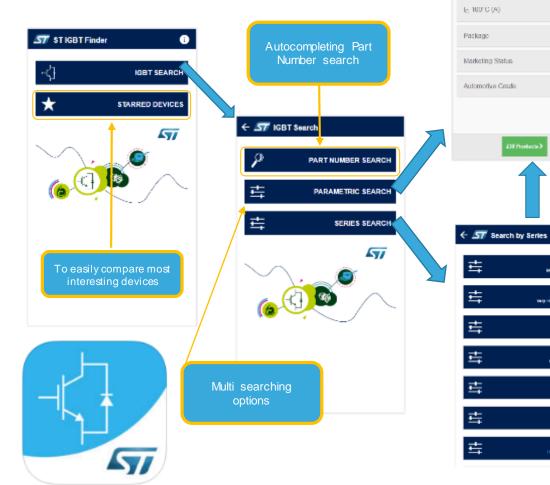
Package

丰

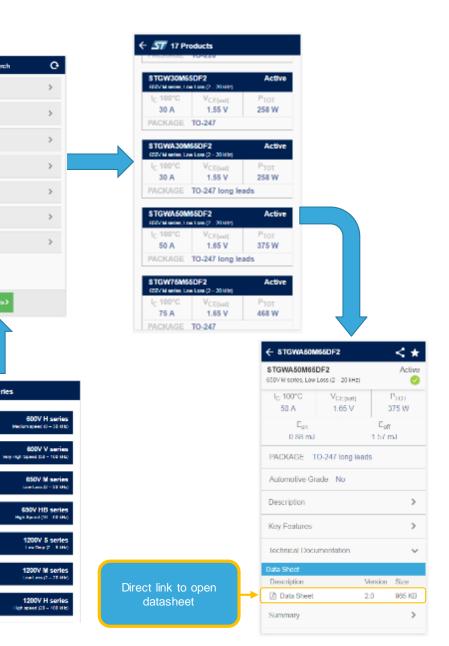
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Marketing Status

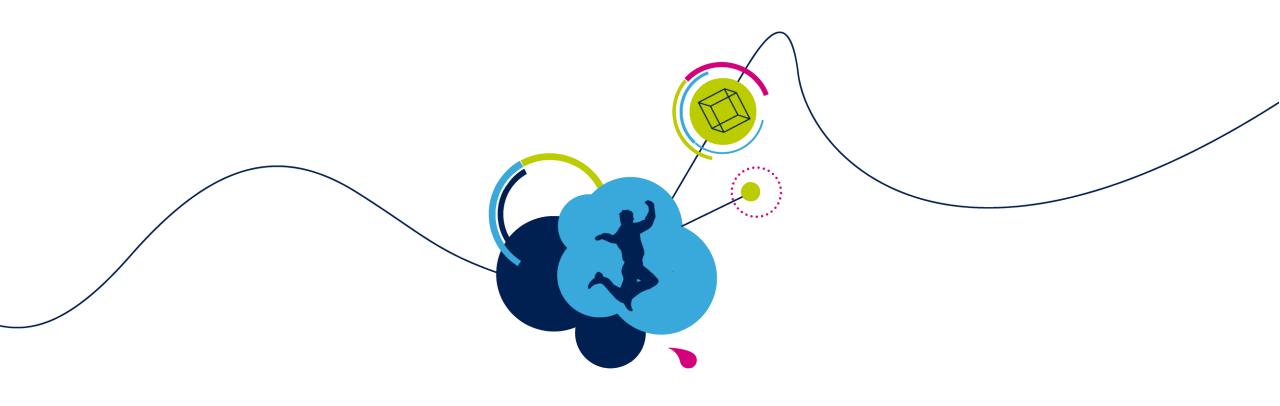
Automotive Crade



ST IGBT Finder







Motor Control





STSPIN Family Portrait

Leading integration, performance, efficiency

Monolithic L6470, L6472, L6474 L620x, L622x

STSPIN800 Series

System-in-package POWERSTEP01



Monolithic Low Voltage STSPIN200 Series

Controllers STSPIN32F0/A, L6480, L6482

10 W

50 W

100 W

350 W

Portable, Battery Powered

Medical, Security, ATM, Vending, 3D Printers, Domotics

Stage Lighting

Industrial, Factory Automation























STSPIN200 Series Motor Drivers

Ideal for battery-powered applications



Product	Desription	Vin min (V)	Vin max (V)	Rdson (Ohm)	l out max (Arms)		
STSPIN220	Microstepping driver up to 256 microsteps						
STSPIN230 STSPIN233	3-phase 1 and 3 shunts BLDC drivers						
STSPIN240	Dual brushed DC motor driver						
STSPIN250	Single brushed DC motor driver			0.1	2.6		

KEY BENEFITS & FEATURES

Tailored for portable applications:

Low operating V (1.8–10V), ideal for battery-operated motors

Powering small and medium-size motors

High output I, up to 2.6 A_{RMS} for each full-bridge

Accurate and smooth motion

 Extreme positioning accuracy and motion smoothness, up to 256 usteps (STSPIN220)

Extended battery life

 Energy saving and long battery life, best-in-class standby consumption < 80 nA

Reliable

Fully protected with UVLO, OCP and thermal protections

Minimum footprint and lightweight

Ultra-miniaturized 3 x 3 mm QFN package



STSPIN800 Series Motor Drivers

Compact, energy conscious and cost-competitive motor drivers











Product	Desription	Vin min (V)	Vin max (V)	Rdson (Ohm)	l out max (Arms)	
STSPIN820	Microstepping driver up to 256 microsteps	7	45	0.5	1.5	
STSPIN830	3-phase 3shunts BLDC motor driver	,	45	0.5	1.5	
STSPIN840	Dual brushed DC motor driver	7	45	0.5 (0.25 *)	1.5 (3 *)	

(*) Features allowed in parallel mode driving

KEY BENEFITS & FEATURES

Wide operating Voltage range

From 7 to 45 V

Powering small-medium sized motors

• Output current up to 1.5 A_{RMS} and 2.5 A_{peak} @ $R_{DS(ON)} = 500 m\Omega$

High efficiency

Standby mode to minimize power consumption in idle state

Smooth and silent motion

- Smooth and silent motion thanks to I control and 256 usteps
- FOC & 6-step FW support

Reliable thanks to full set of protections

• UVLO, non-dissipative over-current and thermal protection

Minimum footprint and lightweight

Compact 4 x 4 mm QFN package



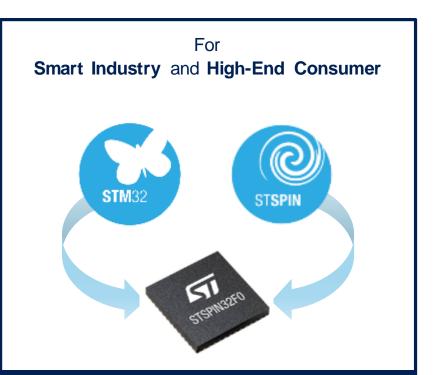
STSPIN32 Family

From analog to digital motor control









- Highly integrated system-in-package 7x 7mm
- Complete ST ecosystem comprising tools and SWs including motor-control algorithms

High integration

embedded 32-bit STM32F0 ARM Cortex-M0 High performance 3-phase gate driver

600 mA and 45 V

Versatile Control

cost-effective sensorless or accurate Hall sensors

Maximum efficiency

on-chip supplies for MCU, driver and external circuitry





STSPIN32F0A

3-phase BLDC motor driver with embedded STM32 MCU ideal for battery-operated systems



from 6.7 to 45 V, such as

- Portable home appliances
 - Vacuum cleaners
 - Air purifiers
 - Fans
 - Small fridges
- Drones and aeromodelling
 - Electronic speed control (ESC)
 - Gimbal
- Power tools
- Industrial and educational robots
- Server cooling fans

KEY BENEFITS & FEATURES

- Wide range of use cases
 - 600 mA current capability to drive a wide range of MOSFETs or IGBTs
 - 6.7- 45 V applications, including battery-operated systems powered by a minimum of 2 LiPo cells
- High integration with embedded 32-bit STM32F0 MCU with ARM® Cortex®-M0
 - 48 MHz, 4-Kbyte SRAM and 32-Kbyte Flash memory,12-bit ADC
 - 1 to 3 shunt FOC supported
 - Communication interfaces: I2C, UART, and SPI
 - Complete & widely deployed development ecosystem available

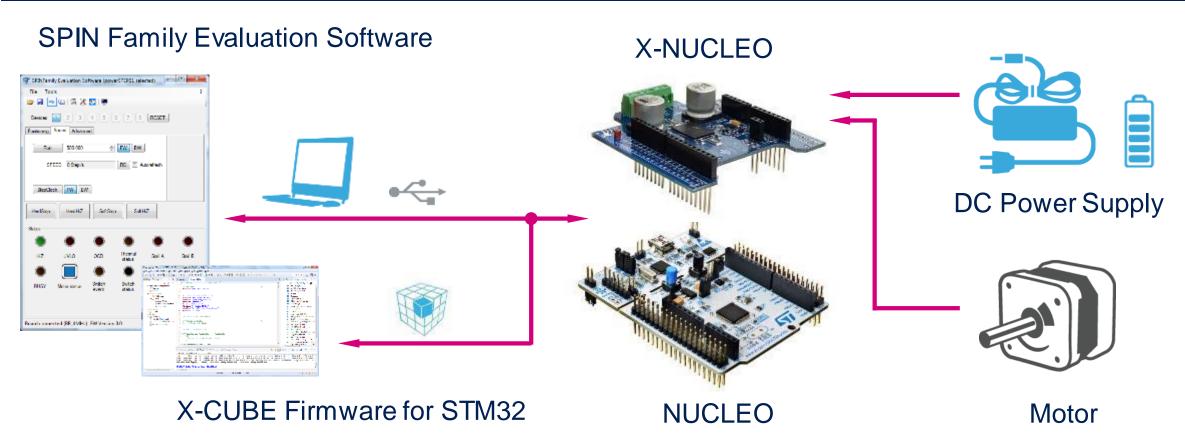
Design flexibility

- Operational amplifiers/ comparator for cost-effective sensorless systems or accurate control with Hall-effect sensor feedback
- Access to the STM32 boot loader via SPI, to customize the firmware over the air
- Maximum efficiency with on-chip generated supplies for MCU, driver and external circuitry
- Robust and BoM saving with integrated real-time programmable over-current, cross-conduction, under-voltage, temperature protection and bootstrap diodes
- Compact design with a 7x7 mm QFN package



STSPIN Evaluation Ecosystem

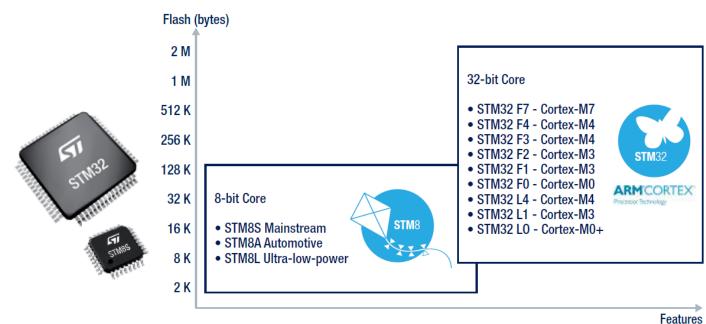
Speed-up your design with X-NUCLEO!







MICROCONTROLLER STM8 & STM32



KEY MCU SELECTION GUIDE FOR MOTOR CONTROL

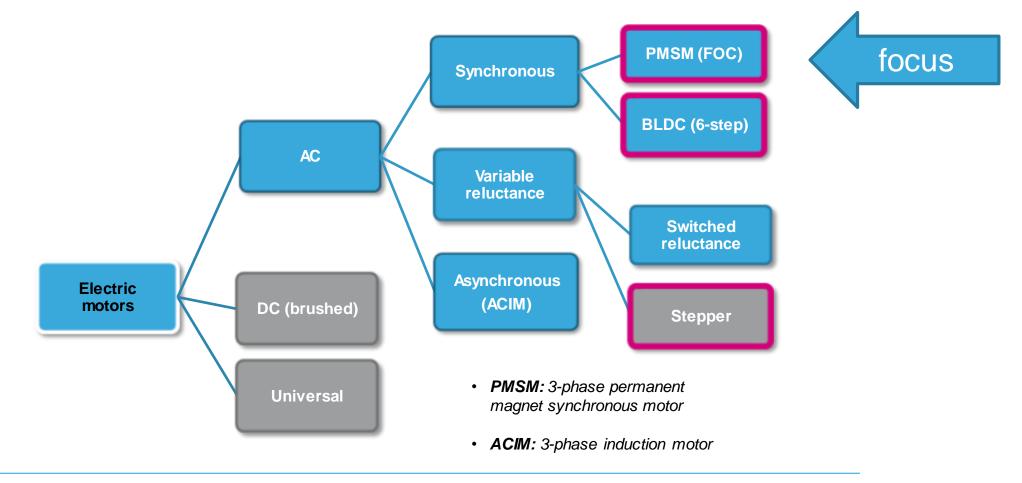
Motor	STM8S	STM32F0 STM32F1	STM32F3 STM32F1	STM32F4 STM32F7
Brushed DC motors	х	х		
Single-phase AC induction motors	х	Х		
Stepper motors	х	х		
Switched reluctance motors	х	х	х	
3-phase brushless motors	x	х	х	х
Universal motors	х	х		
PFC		Х	Х	х

STM8S:
Brushed DC motors
Single-phase AC induction motors
Universal Motors

STM8S, STM32: Stepper motors Switched reluctance motors 3-phase brushless motors



Electric Motor: Classification

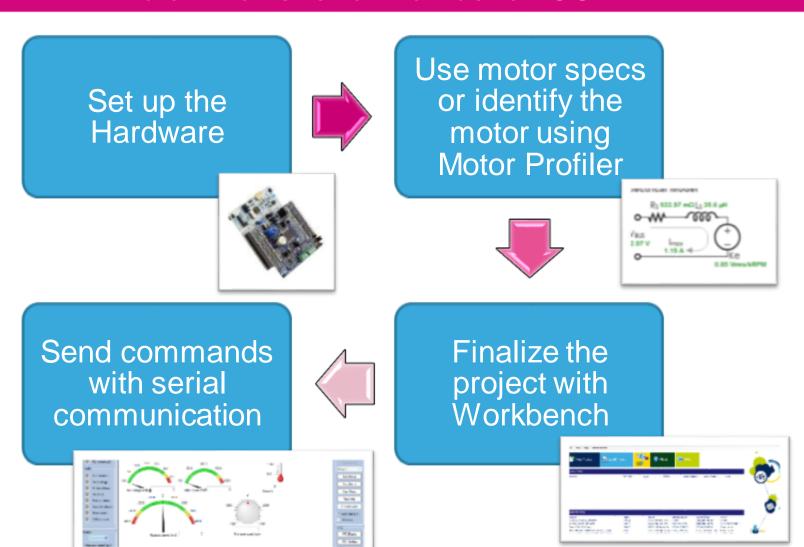




STM32/STM8 ecosystem offer Limited computation need, Driving method well-known, Basic ADC/PWM requirmts, Light ecosystem Complex driving,
Computation intensive,
Requires 3-phase timer + sync'd ADC,
Complete ecosystem

Motor Control Workflow

Motor Profiler and Workbench GUI





P-NUCLEO-IHM002 Motor Control Kit 168

Contents

- NUCLEO-F302R8
 - Control board based on the STM32F302
- X-NUCLEO-IHM07M1
 - · Power board based on the L6230
- 3 Phase Motor
 - BullRunning BR2904-1700KV
- AC/DC Converter
 - 12VDC @ 2A







Gate Drivers- Portfolio Overview

A future-proof portfolio for a wide range of applications

Electric/ Hybrid vehicles

1200 V inverters

Server, UPS

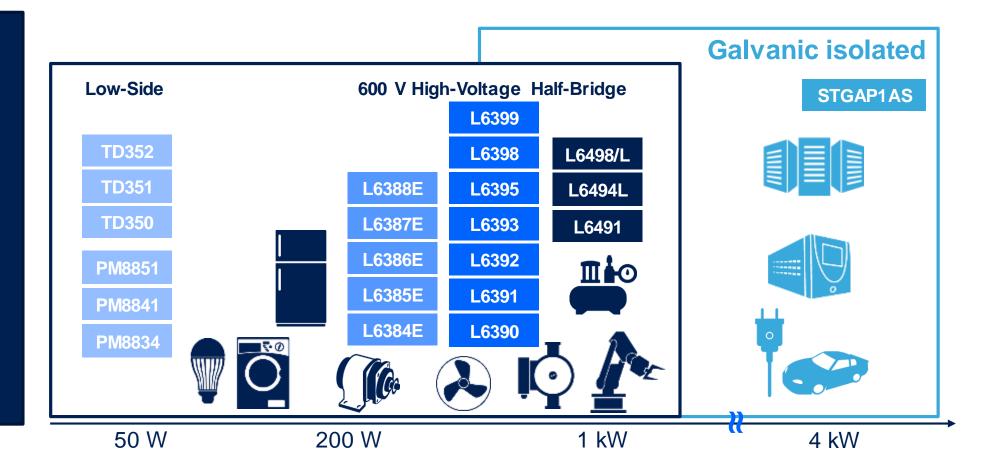
Compressors

Factory automation

White goods

Solar

E-bikes







PWD13F60

System-in-Package integrating 2x 600V gate drivers & 4 high voltage pwr MOSFETs



KEY APPLICATIONS

General purpose inductive, resistive or capacitive loads with up to 600 V and 8 A capability, typically a brushed DC motor, in:

- Industrial and home appliances fans and pumps
- Factory automation
- HID, ballasts
- Power supply units, DC-DC and DC-AC converters

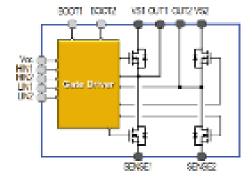
KEY BENEFITS & FEATURES

BOM space and cost saving both during the design and system assembling

- 600 V full-bridge system in package
- Bootstrap diodes embedded inside gate drivers

Suitable for a wide range of industrial applications

 8 A and 320 mΩ embedded power MOSFETs



Easy interfacing with microcontrollers, DSP units or Hall effect sensors

• 3.3 and 15 V compatible inputs

Maxiumum protection

 Integrated cross-conduction and undervoltage lock out protections



STDRIVE - Evaluation Tools

Order code	Description	Core product
EVAL6393FB	600V full-bridge reference design featuring L6393; suitable for FANs and DC motors control	L6393D
EVAL6491HB	Evaluation board for L6491 gate driver	L6491D
EVALSTGAP1AS	Evaluation board for STGAP1S galvanically isolated 1.5KV gate driver	STGAP1AS
STEVAL-IHM021V2	100W 3-phase inverter reference design for FOC controlled PMSM; based on L6390 advanced half-bridge gate driver and MOSFET	L6390D
STEVAL-IHM023V3	1KW 3-phase reference design for single shunt FOC controlled PMSM; based on L6390 advanced half-bridge gate driver and IGBT	L6390D
STEVAL-IHM032V1	150W 3-phase inverter reference design for FOC and trapezoidal control; based on L6391 & L6392 advanced half-bridge gate drivers and IGBT	L6391D, L6392D





L6393 + MOSFETs

EVALSTGAP1S



STGAP1S + IGBT

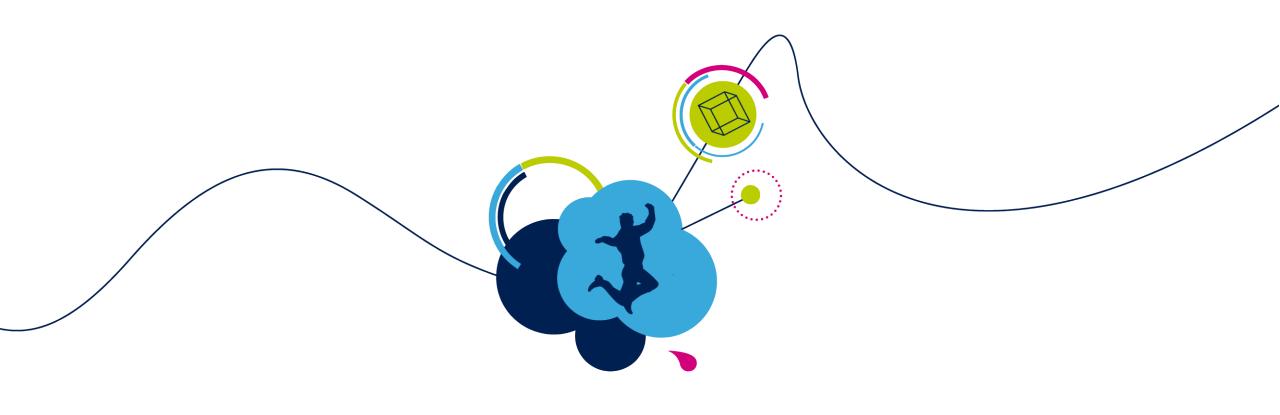


L6390 + IGBTs



L6491 + IGBT/Power MOSFETs





Battery management & monitoring Energy Harvesting

Battery Management Solutions



Battery Monitoring

Fuel Gauge

- Best SOC stability & accuracy
- · Voltage and current mode
- Fuel gauging based on Patented algorithm
- 45uA lq (2 µA (max) in standby mode)
- CSP 1.5x1.6 mm
- STC3115/7



Wired Battery Chargers

Linear or Switching solutions

- 10mA to 1.2A fast charge
- · Li-lon, Li-Po, ThinFilm support
- L6924, STBC08, STC4054, STBCFG01





Charger + LDO + protections

- Up to 650mA Battery current
- · Power path, Battery protection, watchdog
- S-wire
- Switch matrix
- Flipchip package or DFN
- · Li-lon, Li-Po, ThinFilm support
- STNS01, STBC02, STBC03

Wireless Battery Chargers



Wireless charging

- TX & Rx complete solution
- Qi and PMA compatible
- 1W solution optimized for Wearable
- STWBC & STWLC

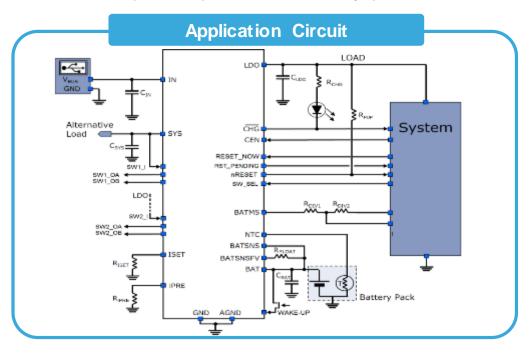


STBC02

450mA Ultra Low Quiescent Current Li-Ion Battery Charger with LDO, power path and battery protections

Main features

- Input voltage range from 4.55V to 5.4V
- Up to 450mA Charging current
- Programmable Vfloat up to 4.45V±0.5%
- Battery Aging Correction [200mV, 50mV steps via S-wire]
- Built-in Battery Protection allows the usage of batteries without Protection Circuit Module [PCM]
- Current consumption in Battery Mode: 4.5uA typ.
- S-wire control interface
- Smart Charge/Fault status output
- Adjustable IPRE and IFAST Current
- Automatic Power path [Battery or USB source]
- Always ON LDO @150mA [3,3.3.1.3V]
- Very Low leakage current<50nA [Shipping Mode]
- Wake-up input allows exiting from shipping mode state
- Two independent 50mA SPDT switches [e.g. AUX load]
- Reset/Watchdog triggered by USB detection
- ±4KV ESD Protection HBM
- Auto-Recharge
- NTC input for Battery Temperature Monitoring
- Available in a CSP30 bumps, 2.15x2.65 mm 400um pitch



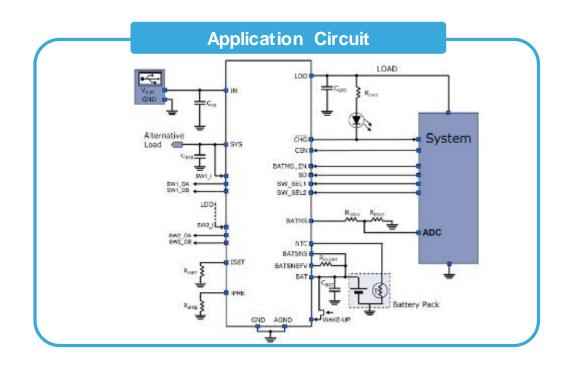


STBC03

650mA Ultra Low Quiescent Current Li-Ion Battery Charger with LDO, power path and battery protections

Main features

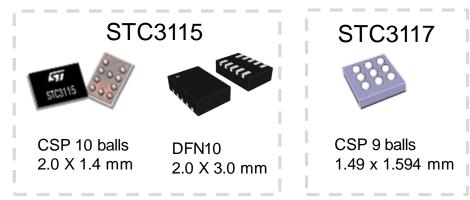
- Input voltage range from 4.55V to 5.4V
- Up to 650mA charging current
- Programmable Vfloat up to 4.45V±0.5%
- Integrated LDO regulator (3V)
- Automatic power path management
- Built-in Battery Protection allows the usage of batteries without
- Charging timeout
- Current consumption in Battery Mode: 4.5uA typ.
- Very Low leakage current<50nA [Shipping Mode]
- Charge/Fault status output
- Battery voltage measurement enable input
- Two 4Ω SPDT load switches with control pins
- Available in a Flipchip30bumps 400um pitch Package
- ±4KV ESD Protection, HBM on IN,SYS,WAKE-UP, LDO, BAT, BATSNS, BATSNSFV, AGND, PGND pins, ±2KV for all the others

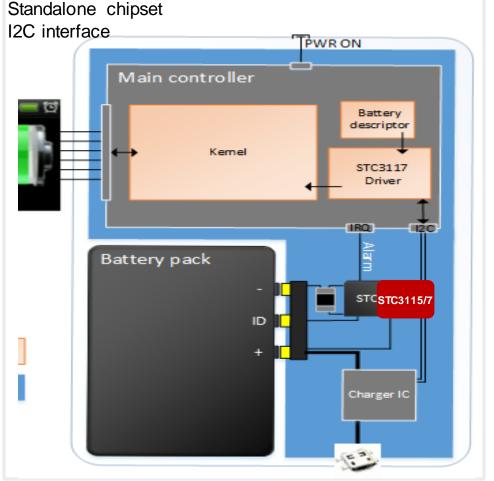




STC3115/7 Battery monitoring OptimGauge™ solution

- Direct SOC reading
- Robust initial open-circuit-voltage (OCV) measurement at power up
- Programmable low battery alarm
- Missing/swapped battery detection
- Average current internal calculation
- End-of-charge detection
- Temperature and aging compensations
- Battery swap detection with protection against false battery insertion





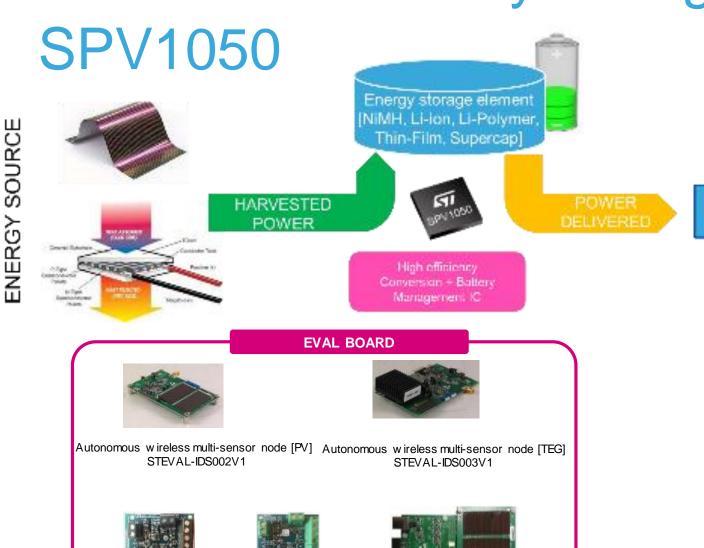


OCV: open Cell voltage SOC:State of Charge

Energy Harvester and Battery Charger IC

Main features

- Photovoltaic [PV] Cells and Thermo-electric Generator [TEG] energy harvester
- Charges any type of batteries [Li-ion, Lipolymer, Super-cap, NiMH, Lithium thin-film solid state]
- Supports Boost and Buck-Boost topologies
- Start-Up Voltage:
 - 0.5V [Boost mode]
 - 2.6V [Buck-boost]
- Up to 70 mA maximum battery charging current
- Embedded Maximum Power Point Tracker [MPPT] algorithm maximizes system efficiency
- 1% battery charging voltage accuracy
- Programmable Overcharge and Overdischarge protection thresholds
- Battery disconnect function
- Shipping mode supported [1nA]
- 2 independent LDOs [1.8V/3.3V @ 100mA]
- VFQFPN 3 x 3 x 1 mm 20L or DIE form



Buck Boost configuration

STEVAL-ISV020V1

Boost

STEVAL-ISV019V1

Complete energy harvesting module

STEVAL-ISV021V1

SYSTEM





EEPROM



Complete EEPROM offer



Standard

-40 to +85°C Industrial -40 to +105°C Industrial-Plus Up to 2 Mbits, also in Ultrathin WLCSP





Automotive

-40 to +125°C AEC-Q100 grade 1 -40 to +145°C AEC-Q100 grade 0 Up to 2 Mbits, PPAP level 3, SO8N, TSSOP8 and DFN8



SPD

DRAM Module supporting DDR2, DDR3 and DDR4

One stop shop EEPROM supplier







		1Kb	2Kb	4Kb	8Kb	16Kb	32Kb	64Kb	128K	256K	512K	1Mb	2Mb
	SO8N	•	•	•	•	•	•	•	•	•	•	•	•
	TSSOP8	•	•	•	•	•	•	•	•	•	•	•	•
120	DFN8		•	•	•	•	•	•	•	•	•		
I2C	DFN5					•	•	•	•				
	WLCSP				•	•	•	•	•	•	•	•	•
	Wafer form / Dle					•	•	•	•	•	•	•	
	SO8N	•	•	•	•	•	•	•	•	•	•	•	•
	TSSOP8	•	•	•	•	•	•	•	•	•	•	•	•
SPI	DFN8		•	•	•	•	•	•	•	•	•		
	WLCSP					•		•	•	•	•		
	Wafer form / Die						•			•	•	•	
	M93C - SO8N	•	•	•	•	•							

Note:

MW

M93C - TSSOP8

M93C - DFN8

M93S* - SO8N

*M93S series feature a programmable write protect PDIP package under PTN - PC 1Kb to 16Kb, MICROWIRE 1Kb

-40°C to +85°C
4 Million E/W
cycles
200 Years retention

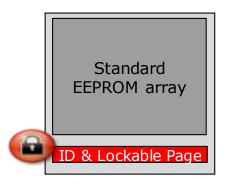




Industrial Plus series Extended range 105°C

		1Kb	2Kb	4Kb	8Kb	16Kb	32Kb	64Kb	128Kb	256Kb	512Kb	1Mb	2Mb
I2C	105°C	-	-	SO8N TSSOP8									
SPI	105°C	-	SO8N TSSOP8										





Flexible, fast and robust

- 1.7V to 5.5V
- -40°C and +105°C
- SPI 2.5V 10MHz, 1.8V 5MHz
- 12C 1MHz
- Write time 4ms

4 Million E/W cycles 200 Years retention





USB Type-C / Power Delivery

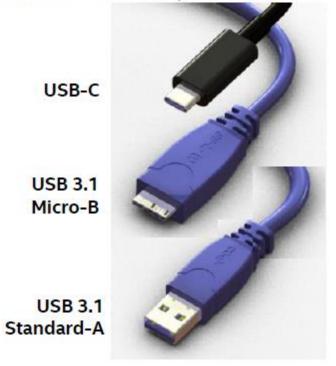


USB-Type-C/PD

- Symmetric and Flip-able/Reversible
- Power delivery up to 100W of power 20V at 5A

Supports Alternate Modes – DisplayPort*, Thunderbolt™, Audio etc.







USB 3.1, USB Type-C, USB-PD

- USB 3.1 is a standard for high-speed data transmission that increases the bandwidth of the USB 3.0, from 5Gbps to 10Gbps; (USB 2.0 is 480Mbps max)
- Type-C is a cable and connector specification, defined by the USB standard as an extension of the USB 3.1 specification, that can support USB 3.1 and USB Power Delivery;
- USB Power Delivery (USB-PD) 3.0 is a HW and SW specification defined to allow devices to send or receive up to 100 watts of power along with data over a Type-C cable.



If a product features USB Type-C, it does not necessarily support USB-PD and/or USB 3.1. The terms USB Type-C, USB-PD and USB 3.1 are not interchangeable.



USB in relation to Power

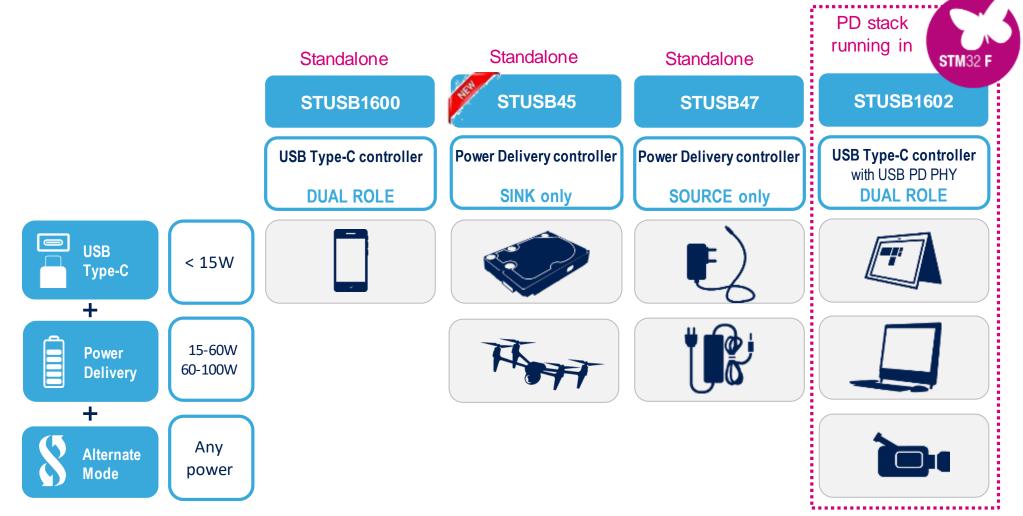
Standard		Nominal Maximum Voltage Current		Max Power	Precendence
USB PD		Configurable up to 20 V	5.0 A	100 W	Highest
USB Type-C current @ 3A		5 V	3.0 A	15 W	
USB Type-C current @ 1.5A		5 V	1.5 A	7.5W	
USB BC 1.2		5 V	1.5 A	7.5 W	
Default USB	USB 3.1	5 V	900 mA	4.5 W	
Power	USB 2.0	5 V	500 mA	2.5 W	Lowest





New Family of interfaces Hard Coded Type-C™ and USB PD Controllers

Covering all use cases from Type-C to full feature Power Delivery



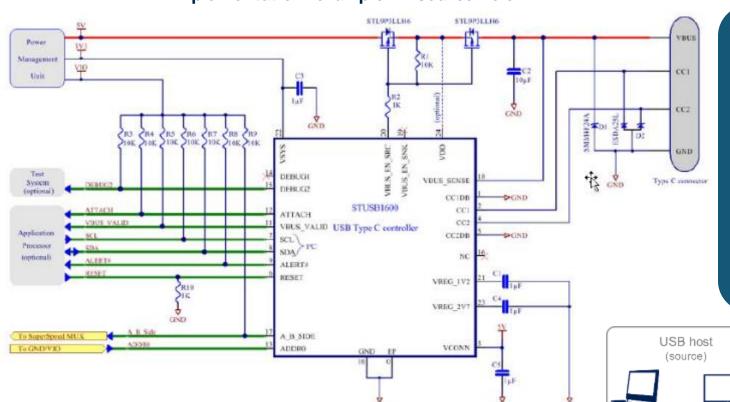




STUSB1600

Standalone USB Type-C Controller

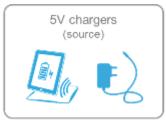
Implementation example in source role



- Type-C applications (<15W)
- Source/Sink/Dual Role Power
- Optional uC connection
- Dead Battery Mode in Sink Mode
- 600mA VCONN power switch
- 22V on CC pins, 28V on VBUS
- Dual power supply Vsys, VDD













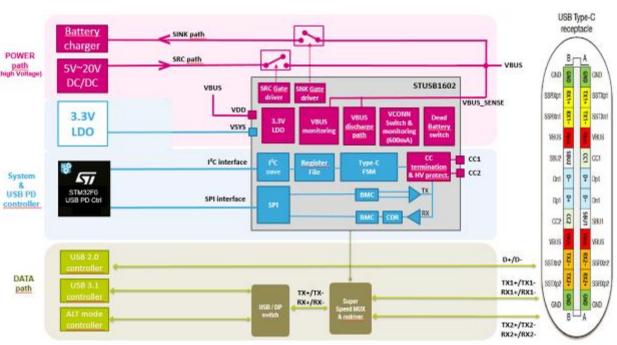




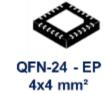


STUSB1602

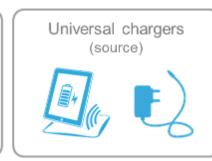
USB Type-C controller with PD PHY

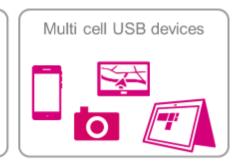


- USB PD PHY + BMC transceiver
- Sink/Source/Dual Role Power
- STM32 companion chip
- Certified USB PD r2.0 and compatible with USB PDr3.0 "core" specs







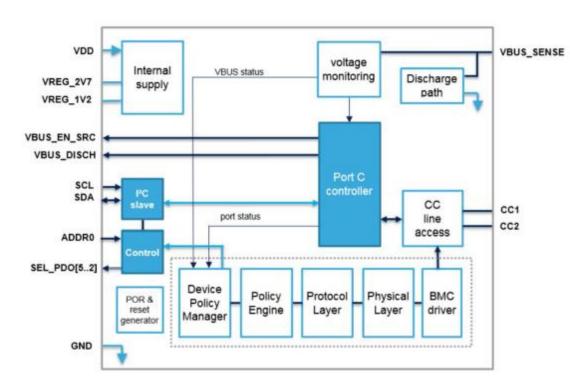






STUSB4710

Standalone USB PD Controller



- Single role: SOURCE
- Full HW solution no uC, no SW needed
- All USB PD profiles supported up to 100W
- 5 customizable PDOs
- Short-to-VBUS protections on CC pins (22 V) and VBUS pins (28 V)
- Suitable for AC/DC and DC/DC applications

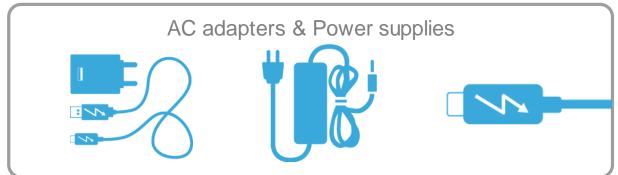






QFN-24 - EP 4x4 mm²









USB Power Delivery evaluation boards





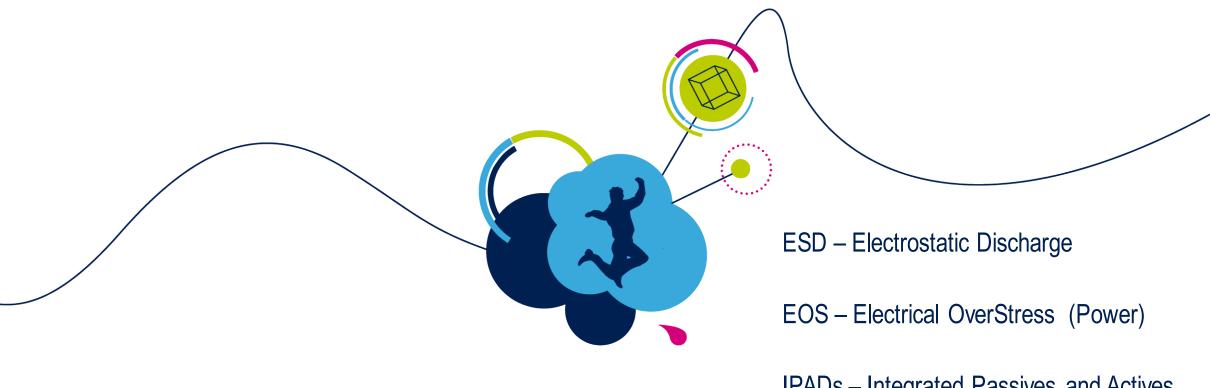


P-NUCLEO-USB002

STEVAL-ISC003

STEVAL-CCC002



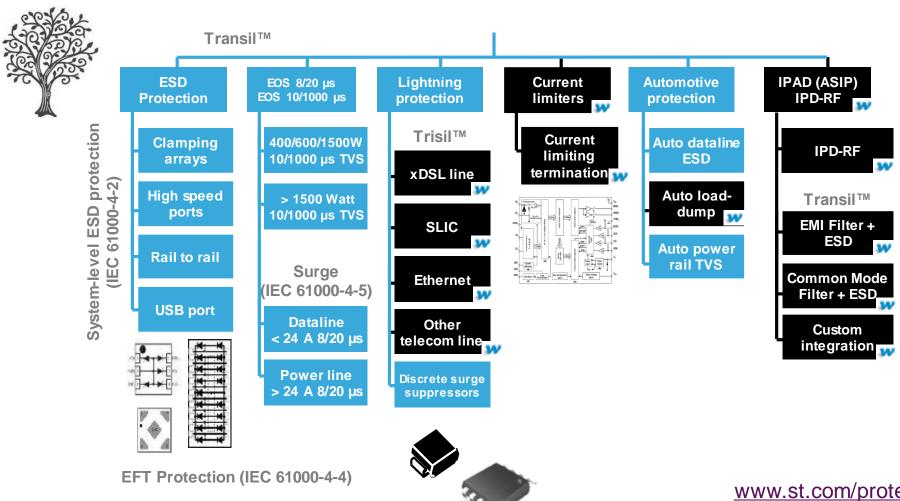


IPADs – Integrated Passives and Actives Discretes (Baluns, Filters, etc.)

ESD Protection & EMI Filters



Protection & IPADTM Product Tree



www.st.com/protection



Protection for All MCU Interfaces



Recommended ST Protection & EMI Filtering per MCU interface

Interface	Recommended Protection				
USB FS	USBLC6-2SC6 (+ ESDA7P120-1U1M for 5V VBUS det) OTG: ESDALC6V1-1U2 for ID				
USB HS	ECMF02-2AMX6 (+ESDA7P120-1U1M for 5V VBUS det) WOTG: ESDALC6V1-1U2 for ID				
USB-PD (VBUS)	5V: ESDA7P120-1U1M 20V: ESDA25P35-1U1M				
USB-PD (CC & SBU)	5V: ESDA6V1L 20V: ESDA25L				
SD CARD	SPI: USBLC6-4SC6 SD 2.0 with integrated pull-ups: EMIF06-MSD02N16 W SD 3.0 with integrated pull-ups: EMIF06-HSD03F3 W				
ETHERNET	Gbit: HSP051-4M10 10/100M: USBLC6-4SC6				
CAN	Industrial (6V): ESDA6V1L Automotive (24V): ESDCAN03-2BWY				
I2C	USBLC6-2SC6				
ADC	Positive voltage only: ESDALC6V1-1U2 Positive and negative voltage: ESDALC6V1-1BU2				
AUDIO	SPK and MIC : ESDA6V1BC6				
DIGITAL MICROPHONE	ESDALC6V1W5				
SWD & JTAG	ESDALC6V1W5				
DISPLAY & CAMERA	Parallel: EMIF08-LCD04M16 WMMIPI D-PHY (DSI/CSI): ECMF04-4HSWM10 WMMMIPI D-PHY (DSI/CSI): ECMF04-4HSWM10 WMMMMIPI D-PHY (DSI/CSI): ECMF04-4HSWM10 WMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM				
SMART CARD	EMIF03-SIM02M8 >>>				
HDMI 2.0	ESD only: HSP051-4M10 (x2) + ESDALC6V1-5M6 ESD + EMI filtering: ECMF04-4HSWM10 (x2) + ESDALC6V1-5M6(M6)				
POWER SUPPLY	3.3V: SMLVT3V3 5V: ESDA7P120-1U1M 9~12V: ESDA15P60-1U1M				
USER PUSH BUTTON JOYSTICK	ESDALC6V1-1U2 (1 line, pitch 350μm) ESDA5V3L (2 lines) ESDA6V1-5SC6 (5 lines)				
NFC	Tag: DSILC6-4P6 Reader: ESDAXLC18-1BF4				





Power Surge Portfolio

HIGH SPEED LINES

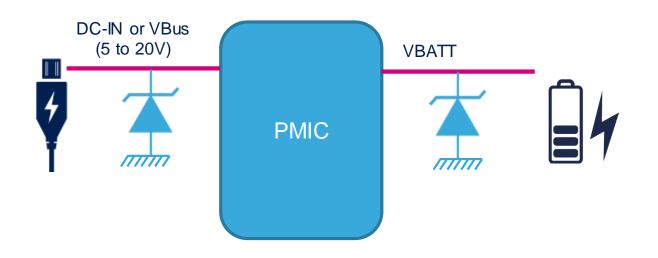
STANDARD, MULTI-PURPOSE

2 nodes have to be protected against 8/20µs surges:

DC-IN or USB Vbus to prevent surge from external DC-DC or ESD

VBATT (the battery node, to prevent PMIC failure or external ESD protection)

20 V USB PD profile2 & 3 QCM quick-charge 3.0	ESDA22P150-1U3M V _{CL} 8/20μs = 32V @100A ESDA25P35-1U1M V _{CL} 8/20μs = 40V @35A			
15 V	ESDA17P100-1U2M V _{CL} 8/20μs = 30V @160A ESDA17P50-1U1M V _{CL} 8/20μs = 27V @50A			
12 V USB PD profile2 QCM quick-charge 2.0	ESDA15P60-1U1M V _{CL} 8/20μs = 22V @60A			
9 V QCM quick-charge 2.0	ESDA13P70-1U1M V _{CL} 8/20μs = 20V @60A			
5 V USB PD profile1 QCM quick-charge 1.0	ESDA7P120-1U1M V _{CL} 8/20μs = 10V @80A Ipp = 120A, Ppp = 1100W			







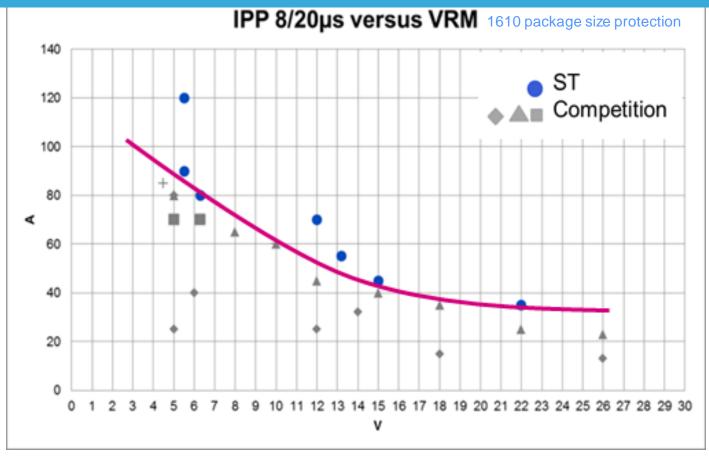
Market Leader for 1610 Package

POWER SURGE

HIGH SPEED LINES

STANDARD, MULTI-PURPOSE

ESDAXP: THE HIGHEST IPP FOR EACH VOLTAGE CATEGORY





IPP = Maximum Peak Pulse Current surge capability for an 8/20µs surge waveform as defined in IEC61000-4-5

High Speed Protection & ESD+CMF

POWER SURGE

HIGH SPEED LINES

STANDARD, MULTI-PURPOSE

Data rate (Gbit/s)

System-level ESD protection (IEC 61000-4-2 Level 4)

+ Common-mode filter (ECMF)



10



ESDAXLC6-1BU2

1-line ESD ST0201 0.6 x 0.3 x 0.3 mm



4-line ESD QFN 1.85 x 0.95 x 0.32 mm



2xESD + 2xCMF QFN 1.70 x 1.50 x 0.5 mm



4xESD + 2xCMF QFN 2.60 x 1.35 x 0.5mm





USBULC6-2N4

2-line ESD QFN 1.0 x 0.8 x 0.5 mm



USBLC6-4SC6 4-line ESD + VBUS 6V

4-line ESD QFN 2.50 x 1.00 x 0.47 mm



ECMF02-3HSM6

3xESD + 2xCMF QFN 1.60 x 1.35 x 0.5 mm



ECMF04-4HSM10

4xESD + 2xCMF QFN 2.60 x 1.35 x 0.5mm



0.48



USBLC6-2P6

2-line ESD + VBUS 6V SOT-666 1.6 x 1.6 x 0.53 mm



ECMF02-2AMX6

3xESD + 2xCMF QFN 1.70 x 1.50 x 0.5 mm



HIGHEST USB 2.0
INTEGRATION WITH VBUS





ECMF2-0730V12M12 (V_{RM}=13.5V)

0.012



USBLC6-2SC6

2-line ESD + VBUS 6V SOT23 2.92 x 1.62 x 1.17 mm



SOT23 2.92 x 1.62 x 1.17 mm

EMIF02-USB03F2

7xESD + Serial and Pull-up Resistor

CSP 1.44 x 1.94 x 0.65 mm





1 or 2 lines

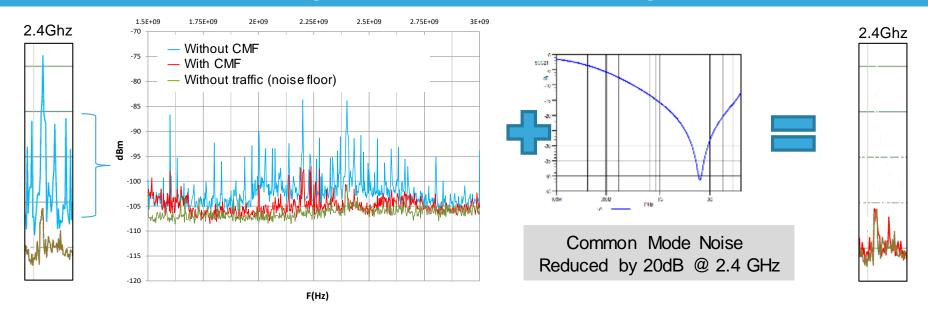
4 lines

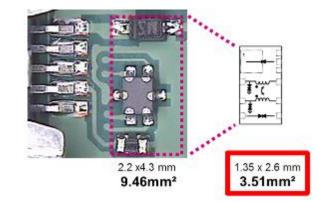
2 lines

4 lines

ECMF Benefits

By adding ST ECMF (ESD+CMF) ON HIGH SPEED DIFFERENTIAL LINKS (USB, HDMI, MIPI DSI or CSI)





ECMF products enable Smart Things (IoT) RF Circuits to Reach Further or Last Longer, and to be Smaller.





POWER SURGE

HIGH SPEED LINES

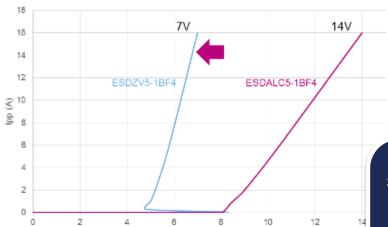
STANDARD, MULTI-PURPOSE

STATE-OF-THE-ART STANDARD ESD PROTECTION

Reference	Features	Package		
ESDALC5-1BF4	Low capacitance (10pF) Bi-directional	0201		
ESDA5-1BF4 ESDA5-1F4	High 8/20us IPP of 10A Uni & Bi-directional	0201		
ESDZV5-1BU2 ESDZV5H-1BU2	NEW Very low clamping (5pF, 8V@30ns), Bi- directional	0201		
ESDA8P30-1T2	NEW small TVS (30A) in 0.6mm² package size	0402		
HSP051-4M5	NEW 4-lines flow-through routing extra low capacitance (0.35 pF)	μQFN-5L 1.3 mm x 0.5 mm 500 μm pitch		



Wide Clamping Voltage Portfolio



VCL (V)

ST is #1 in clamping voltage for better protection, achieves this by "snap-back" technology

ST's **Snap-Back** Technology Protects at ½ of the V_{CL} of the Low Clamping Family ST0201 Standard Clamping

> ESDALC6V1-1U2 12 pF

ESDALC14V2-1U2 6 pF

ESDAVLC8-1BU2

ESDAULC6-1U2

Capacitance (CLINE)

Line

ESDAXLC6-1BU2

ST0201 Low Clamping

ESDALC8-1BF4 30 pF, 21V @ 30ns

ESDALC14-1BF4 22 pF, 18V @ 30ns

ESDALC20-1BF4 10pF. 37V @ 30ns

opi , 57 V @ 5013

ESDALC5-1BF4 10 pF, 14V @30ns

ESDV5-1BF4 5pF, 16V @ 30ns

ESDAULC5-1BF4 1.5pF, 13.5V @ 30ns

ESDAXLC18-1BF4 0.45pF, 29V @ 30ns,

ESDAR F02-1BU2C K 0.2pF, 19V @ 30ns, ST0201
Ultra-Low Clamping

ESDA5-1F4 110pF, +9V @ 30ns

ESDA5-1BF445 pF, 11V @ 30ns

ESDZL5-1F4 8pF, +9V @ 30ns

ESDZV5-1BF4 5pF, +8V @ 30ns

ESDZV5H-1BF4 4pF, +8V @ 30ns

ESDAXLC5-1U2 0.5pF. +10V @ 30ns

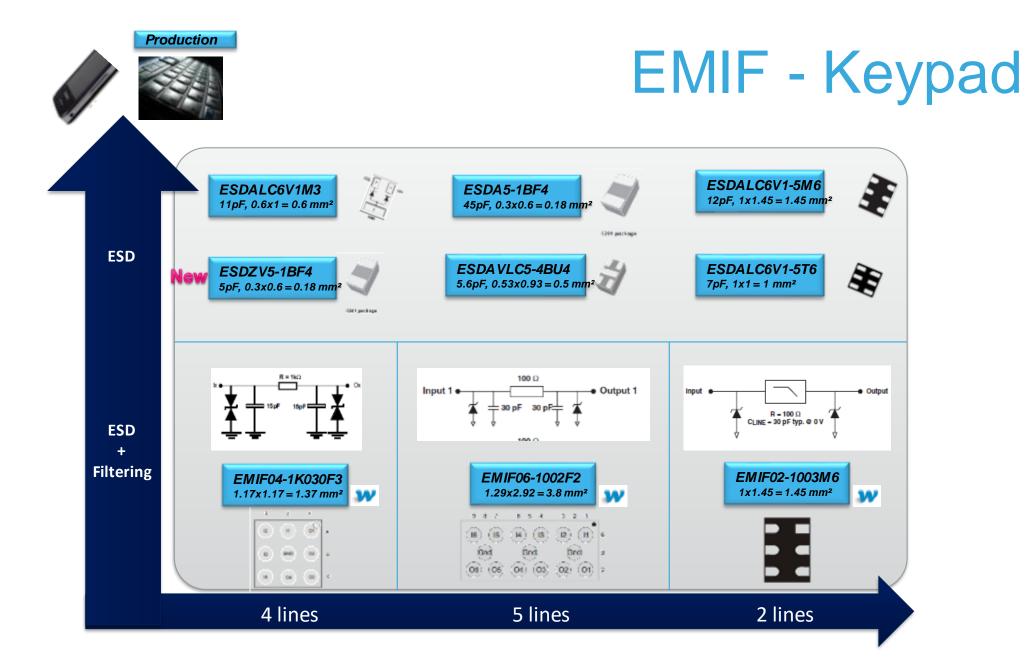
New

New

New

New







EMIF – SIM Card **Production** ESDALC6-4N4 ESDALC6-4N4 ESDALC6-4N4 10pF, $1x0.8 = 0.8 mm^2$ 10pF, $1x0.8 = 0.8 mm^2$ 10pF, $1x0.8 = 0.8 mm^2$ ESDA VLC5-4BX4 ESDA VLC5-4BX4 10pF, 0.8x0.8 = 0.64 mm² 10pF, $0.8x0.8 = 0.64 mm^2$ **ESD** ESDAULC5-1BF4 1.5pF, 0.3x0.6 = 0.18 mm ESDALC6V1M3 ESDZV5-1BF4 GDET peckage 5pF, $0.3x0.6 = 0.18 \text{ mm}^2$ 11pF, $0.6x1 = 0.6 mm^2$ GREE package **USB IC** EMIF03-SIM04F3 Cline (max) -□ CLK **ESD** + **Filtering** EMIF03-SIM06F3 EMIF03-SIM05F3 EMIF03-SIM03F3 12pF, 1.22x1.22 = 1.5 mm² 10pF, $1.14x1.14 = 1.3 mm^2$ 10pF, $1.14x1.54 = 1.36 mm^2$ 000 (II) (III) (III) RST RST 0 0 CLK Gnd CLK ⊕ ⊕ ⊜ ⋴)) NFC)) Data Vcc Data ⊕ ⊕ ⊜ ∘ 000 ISO7816 ISO7816 + USB IC ISO7816 + SWP





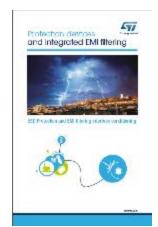
DesignTools

Download and the ST Protection Finder, and follow-up with new IPAD & RF-IPD & Smart

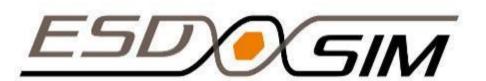
Antenna Tuning Selection Guide; ST Protection
Finder does not include IPAD & RF-IPD

products.





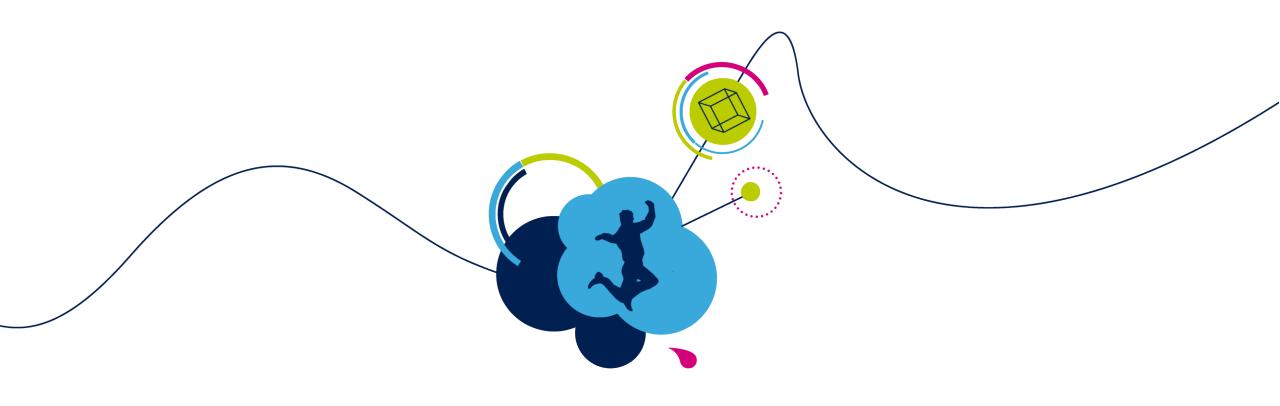






START DESIGN





Audio Amplifiers



Sound Terminal® digital class D amplifiers

STA350BW

50W x 2, 5V – 26V, 2.1 channels FFX binary / ternary modulation PSSO36 package (slug down)

STA369BWS

20W x 2, 4.5V – 21.5V, 2.1 channels FFX binary / ternary modulation PSSO36 package (slug down)

STA350B

<u>50W x 2</u>, 5V – 26V, 2.1 channels FFX binary / ternary modulation PSSO36 package (slug down)

STA369BW

30W x 2, 5V – 26V, 2.1 channels FFX binary / ternary modulation PSSO36 package (slug down)

- ST SpeakerSafe
- Multiband DRC / anti-clip
- Pre- & post-EQ mix
- Parametric equalization
- 3 filter coefficient banks
- Digital volume & mute
- Bass & treble controls
- 2.0 / 2.1

STA559BWS

10W x 2, 4.5V – 16V, 2.1 channels FFX ternary / binary modulation PSSO36 package (slug down)

STA339BWS

20W x 2, 4.5V – 21.5V, 2.1 channels FFX binary / ternary modulation PSSO36 package (slug down)

STA339BW

20W x 2, 5V – 26V, 2.1 channels FFX binary / ternary modulation PSSO36 package (slug down)

- Multiband DRC / anti-clip
- Pre- & post-EQ mix
- Parametric equalization
- 3 filter coefficient banks
- Digital volume & mute
- Bass & treble controls

STA559BW

10W x 2, 4.5V – 16V, 2.0 channels FFX ternary / binary modulation PSSO36 package (slug down)

STA333BW

20W x 2, 4.5V – 21.5V, 2.1 channels DDX binary / ternary modulation PSSO36 package (slug down)

STA326

80W x 2, 10V – 36V, 2.1 channels FFX binary / ternary modulation PSO36 package (slug up)

- DRC/anti-clip
- Pre- & post-EQ mix
- Parametric equalization
- Digital volume & mute
- Bass & treble controls
- 2.0 / 2.1

STA333IS

10W x 2, 4.5V – 20V, 2.0 channels FFX ternary modulation CSP (2.57 x 3.54 x 0.65mm)

STA333W

20W x 2, 4.5V – 20V, 2.0 channels DDX ternary modulation PSSO36 package (slug down)

STA333ML

20W x 2, 4.5V – 20V, 2.0 channels DDX ternary modulation PSSO36 package (slug down)



- Digital volume & mute
- Postscale
- 2.0 channels
- Micro-less operation
- 2.0 channels



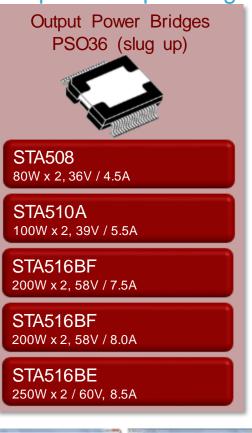
STMicroelectronics

Digital audio processors and power output bridges













Digital audio amplifier eval boards



STA350BW 50W + 50W digital class D eval board STEVAL-CCA030V1



STA335ML 20W + 20W digital class D eval board STEVAL-CCA049V1



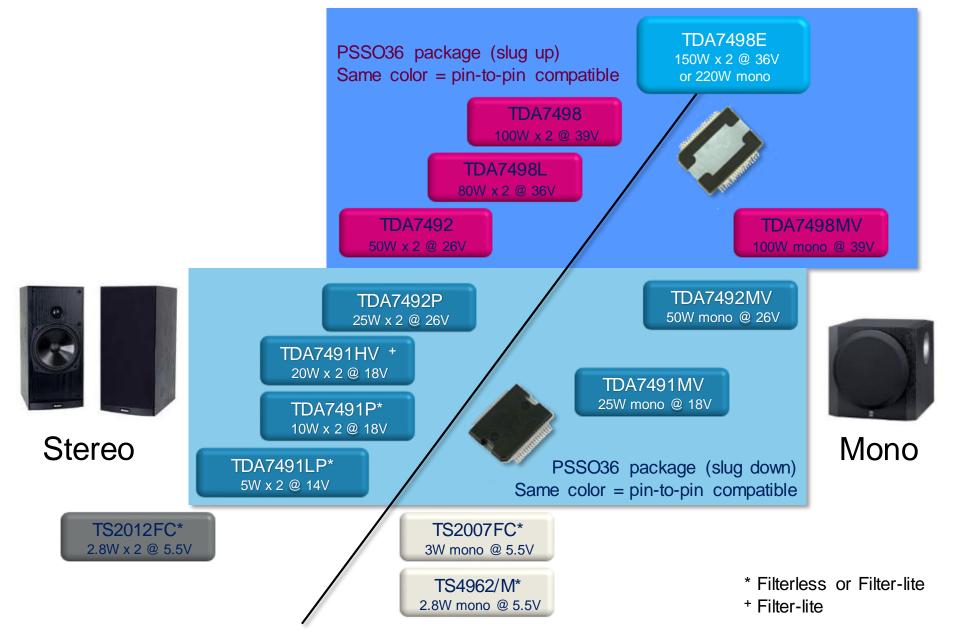
STA333IS 10W + 10W digital class D eval board STEVAL-CCA053V1

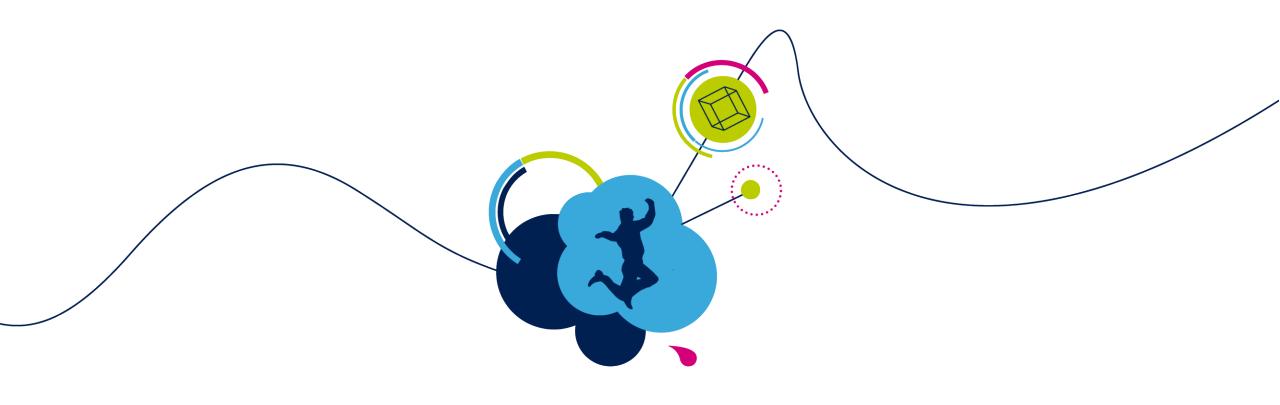


STA120 (APWLink) USB Interface for APWorkbench S/W STEVAL-CCA035V1



TDA749x Analog class D amplifiers





Class AB Amplifiers



Surface mount class AB amplifiers

Amplifier	Output Power	Inputs	Outputs	Standby	Mute	Package(s)
TS482	100mW x 2	SE	SE	No	No	MiniSO8, SO8
TS488	120mW x 2	SE	SE	Active low	No	DFN8
TS419	360mW mono	SE	BTL	Active low	No	MiniSO8
TS421	360mW mono	SE	BTL	Active low	No	DFN8
TDA2822D	380mW x 2	SE	SE	No	No	SO8
TS4890	1W mono	SE	BTL	Active low	No	MiniSO8
TS4871	1W mono	SE	BTL	Active high	No	DFN8, MiniSO8, SO8
TS4994	1W mono	Differential	BTL	Configurable	No	DFN10, MiniSO8
TS4994FC	1.2W mono	Differential	BTL	Configurable	No	Flip Chip
TS4984	1W x 2	SE	BTL	Active low	No	QFN16
TS4990	1.2W mono	SE	BTL	Active low	No	Flip Chip, DFN8, MiniSO8
TS4995	1.2W mono	Differential	BTL	Configurable	No	Flip Chip
TDA7233	1.9W mono	SE	SE	No	Active low	SO8
TDA7266P	3W x 2	SE	BTL	Active low	Active low	PSSO24
TDA7266D	5W x 2	SE	BTL	Active low	Active low	PSO36
			1	» 0	0	















High power class AB amplifiers

Amplifier	Output Power	Inputs	Outputs	Standby	Mute	Package
TDA7496	5W x 2	SE	SE	Active high	Active high	Multiwatt15
TDA7266M	7W mono	SE	BTL	Active low	Active low	Multiwatt15
TDA7266	7W x 2	SE	BTL	Active low	Active low	Multiwatt15
TDA2009A	10W x 2	SE	SE	No	No	Multiwatt11
TDA7269A	14W x 2	SE	SE	Combination standby/mute		Multiwatt11
TDA7297	15W x 2	SE	BTL	Active low	Active low	Multiwatt15
TDA7264	25W x 2	SE	SE	Combination standby/mute		Multiwatt8
TDA7265	25W x 2	SE	BTL	Combination standby/mute		Multiwatt11
TDA7265B	30W x 2	SE	SE	Combination standby/mute		Multiwatt11
STA540	26W x 2 or 13W x 4	SE	SE/BTL	Active low	External	Multiwatt15
TDA7292	40W x 2	SE	SE	Combination standby/mute		Multiwatt11
TDA7296	60W mono	Differential	SE	Active low	Active low	Multiwatt15
TDA7295	80W mono	Differential	SE	Active low	Active low	Multiwatt15
TDA7294V	100W mono	Differential	SE	Active low	Active low	Multiwatt15
TDA7293V	100W mono	Differential	SE	Active low	Active low	Multiwatt15



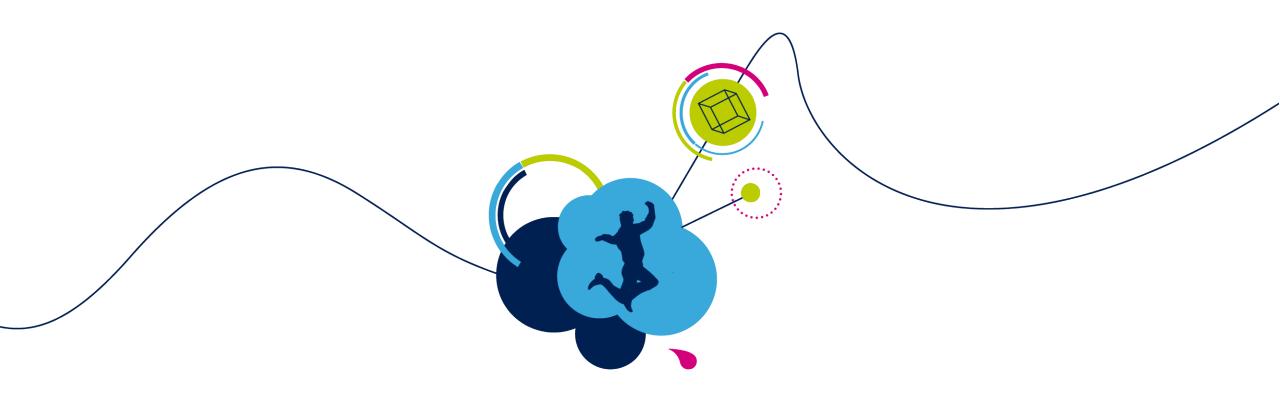










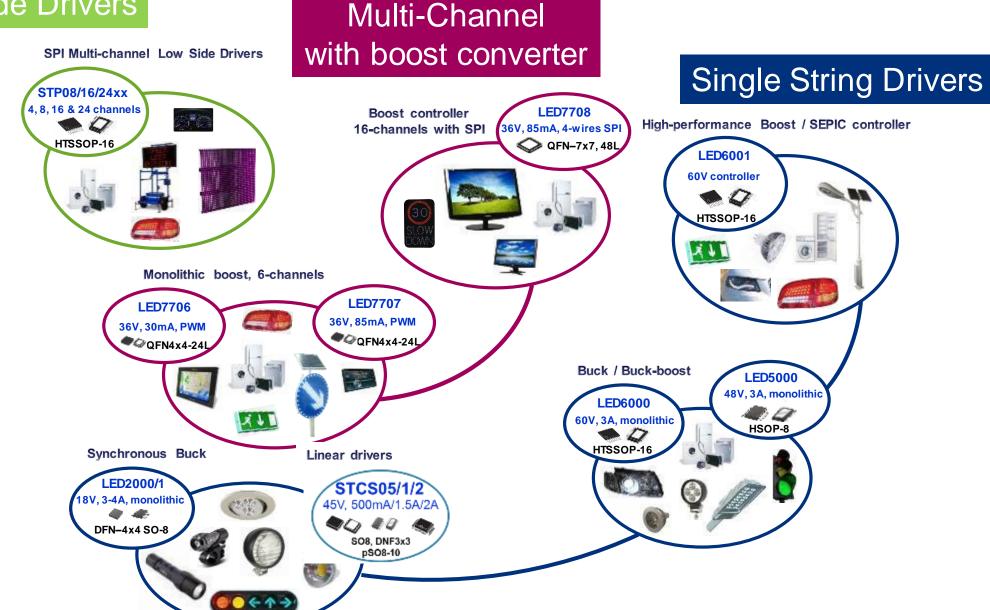


LED Drivers

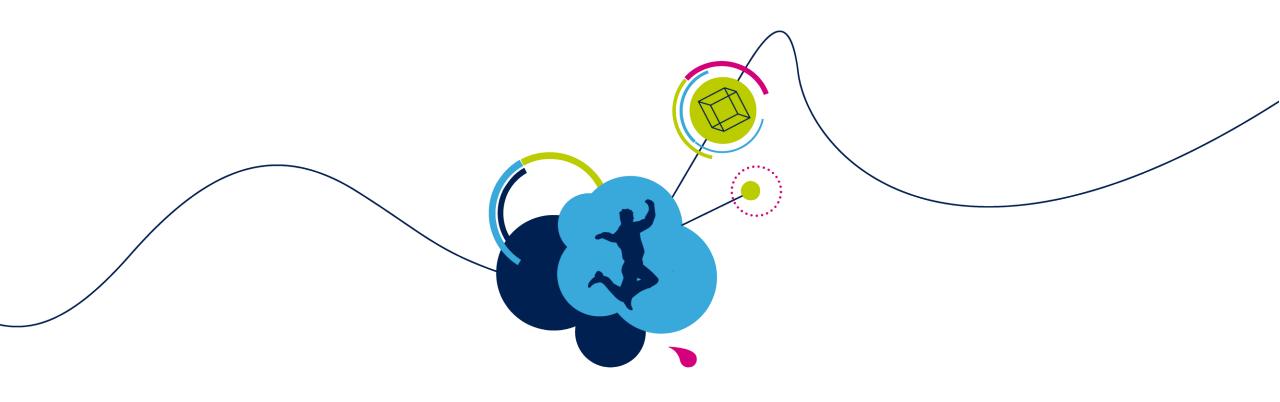


Multi-channel Low Side Drivers

DC input, hi-brightness LED Drivers







Thank You!

