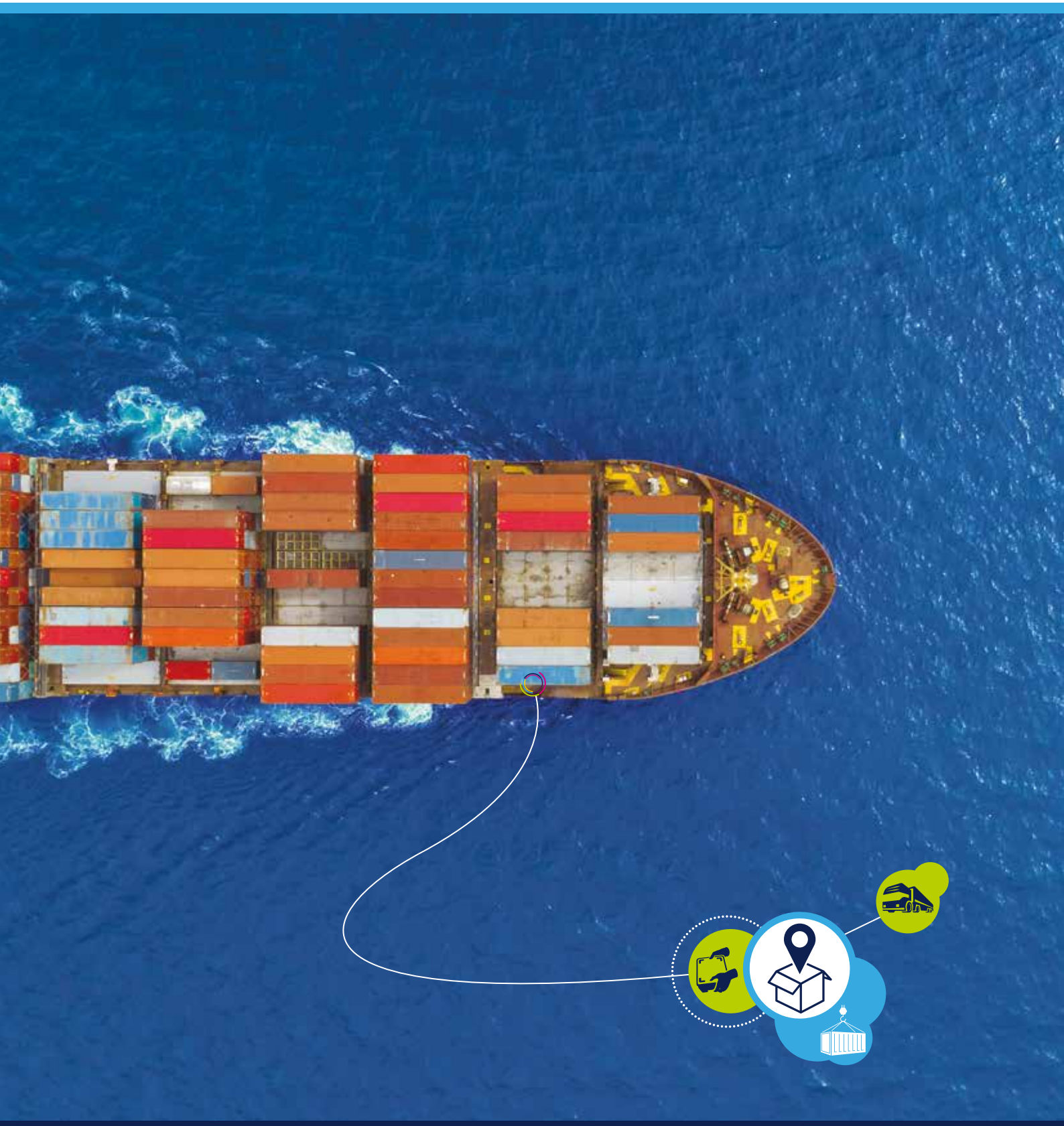
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Asset Tracking
a Complete Solution from ST



Introduction

In global manufacturing and commerce, raw materials, components and final goods travel long distances before arriving at the final destination. More than often, the value – direct or indirect – of any particular item warrants the cost associated with monitoring its condition – like detecting shocks or recording temperatures in a cold-chain for food storage and transportation – and track it all along the logistics chain.
Tracking relies mostly GNSS location technologies or wireless communications triangulation positioning, while the continuous monitoring of storage conditions is based on an array of sensors depending on the physical variables involved.

APPLICATIONS AND SEGMENTATION

Outdoor Real-Time Monitoring		Containers	Livestock monitoring	e-bike	Fleet management	Pet tracking
Industrial Logistic		Pallets	Racks	Luggage	Smart parcels	
Good Guarantee		Cold chain	Food	Medical		
Disposable		Letters	Packages	Parcels		

ST 360° PORTFOLIO DELIVERS 100% FLEXIBILITY

Sensing & Actuating

Accelerometers
Vibration
Orientation
Free Fall detection

Temperature & Humidity
Shipping Environment
Goods Status

Pressure
Take off and
landing detection

Ranging sensor
Objects
presence detection
and counting

Signal Conditioning & Protection

Analog
Including Signal
Conditioning,
Protections, ...

Processing

STM32
Computation
by STM32 Family

Connectivity

BLE
Bluetooth Low Energy
Connectivity
to gateway/tablet

Sub-1GHz
Long Range Connectivity
to base stations/gateway
Sigfox/LoRa

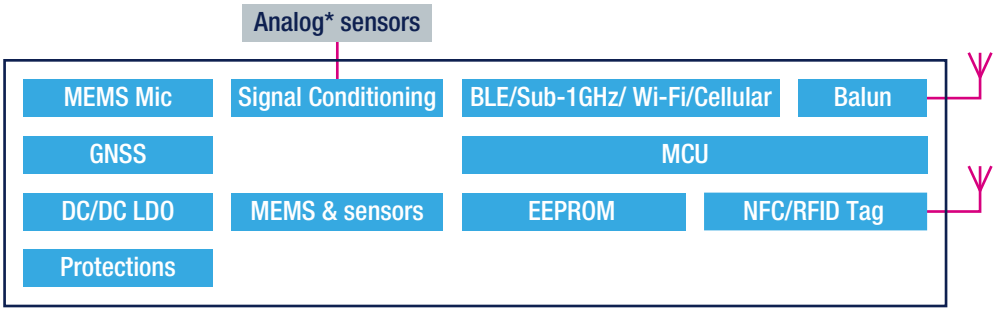
NFC
Short Connectivity
to handheld devices

Positioning
Localization

Power & Energy Management

Power Management
DC/DC, LDO

TYPICAL ASSET TRACKING APPLICATION DIAGRAM



ST offering a wide extensive range of environmental sensors(temperature, humidity and pressure), inertial sensors (accelerometers, gyroscopes and magnetometers), proximity sensors. Besides ST provides a huge product portfolio for low-power wireless connectivity such as Bluetooth Low Energy and NFC as short range solution, UHF Reader, and for Low Power Wide Area Network (LPWAN) as LoRa and Sigfox, and easy to use solution for GNSS positioning receiver, that in addition to a wide range of motion, environmental and proximity sensors, low-power microcontrollers, EEPROM memories and high efficiency power management ICs, allow easily to build ultra low-power tracking solutions for pallets and containers.

PALLETS AND CONTAINER TRACKING END-NODE - APPLICATION EXAMPLES

Tracking Bluetooth Low energy and SigFox

Signal Conditioning
TSU112
TSU101
TS882

BLE SoC
BlueNRG-2

Sub-1GHz
S2-LP
STM32WL (SoC)

MEMS & sensors
LIS2DW12
HTS221
STTS22H

Balun
BALF-NRG-02D3

Protection
EMIF06-MSD02N16
ESDA7P120-1U1M

DC/DC, LDO
ST1PS01, STLQ020
LDLN030, LD59030

sigfox
Bluetooth



Tracking LTE

Signal Conditioning
TSU112, TSU101
TS882

GNSS
Teseo-LIV3F

Wi-Fi/LTE

MEMS & sensors
LIS2DW12
HTS221
STTS22H

MCU
STM32L496

BLE SoC
BlueNRG-2

Balun
BALF-NRG-02D3

DC/DC, LDO
ST1PS01, STLQ020
LDLN030, LD59030

Protection
EMIF06-MSD02N16
ESDA7P120-1U1M

GNSS
3GPP



Signal Conditioning
TSU112
TSU101
TS882

Balun

BLE SoC
STM32WB

Sub-1GHz
S2-LP
STM32WL (SoC)

MEMS & sensors
LIS2DW12
HTS221
STTS22H

Protection
EMIF06-MSD02N16
ESDA7P120-1U1M

MLPF-WB55-0xE3
Matched harmonic filter

DC/DC, LDO
ST1PS01
STLQ020
LDLN030
LD59030

Signal Conditioning
TSU112, TSU101
TS882

GNSS
Teseo-LIV3F

Wi-Fi/LTE

MEMS & sensors
LIS2DW12
HTS221
STTS22H

MCU
STM32L496

Balun

BLE SoC
STM32WB

DC/DC, LDO
ST1PS01, STLQ020
LDLN030, LD59030

Protection
EMIF06-MSD02N16
ESDA7P120-1U1M

MLPF-WB55-0xE3
Matched harmonic filter

Note: * Also parts not available in ST portfolio
BLE = Bluetooth Low Energy

Key Products

SENSORS

To support the design of ultra-low-power tracking and monitoring solutions, ST offers an extensive range of temperature, humidity and pressure sensors, inertial measurement units (accelerometers, gyroscopes and magnetometers), proximity sensors.

Accelerometers

H3LIS331DL	High-g shock accelerometer
IIS3DHHC **IIS2ICLX**	Inclinometer
IIS2DH*	Vibration
LIS2DW12	Ultra-low power
LIS2DTW12	With embedded temperature sensor

iNEMO® Inertial Module

LSM6DSx	6x IMU

Pressure Sensors

LPS22HH	Precision pressure sensor
LPS27HHW	Waterproof pressure sensor

Temperature & Humidity Sensors

HTS221	Humidity & temperature sensor
STTS751 **STTS22H**	Digital temperature sensor
LM235 **STLM20**	Analog temperature sensor

MEMS Microphones

MP34DT05-A	Digital microphone

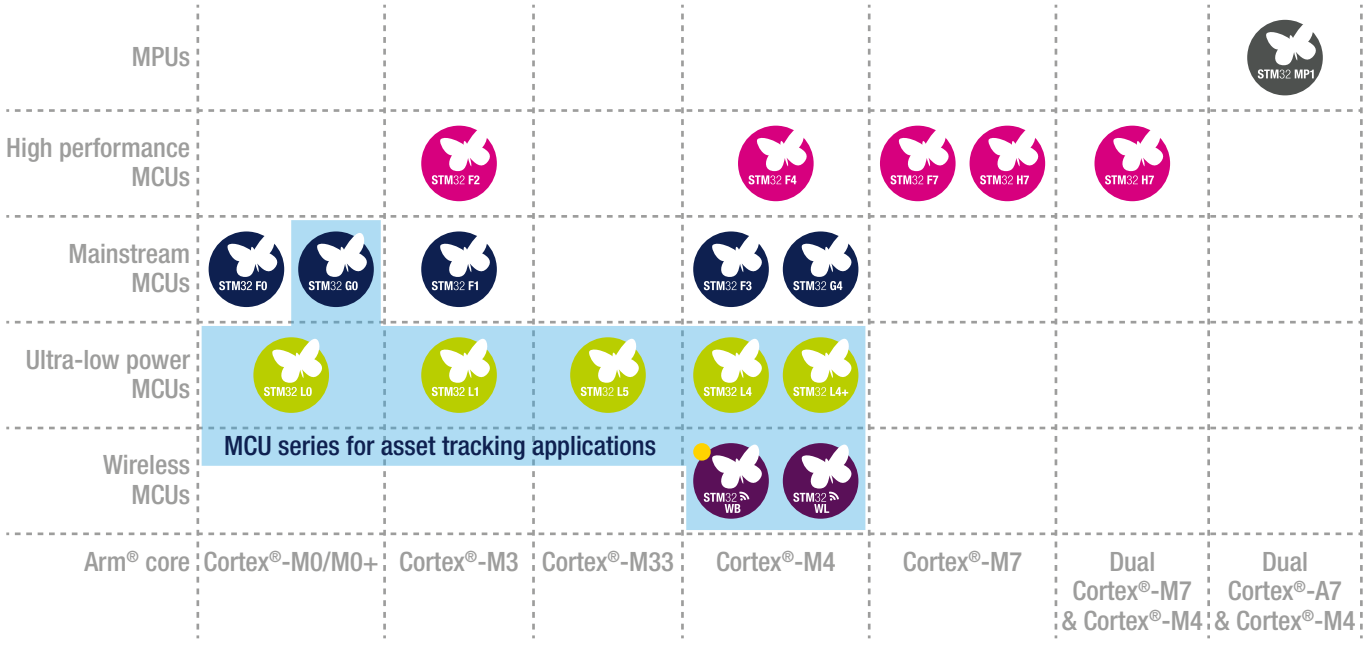
FlightSense™ Ranging sensor

VL6180X	Proximity sensor and ALS
VL53L0X	Ranging sensor
VL53L1X	Long distance ranging sensor

Note: * Coming soon

MICROCONTROLLERS & MICROPROCESSORS

The STM32 family of 32-bit microcontrollers based on the Arm® Cortex®-M processor is designed to offer new degrees of freedom to MCU users. It offers products combining very high performance, real-time capabilities, digital signal processing, low-power and low-voltage operation, as well as wireless connectivity, while maintaining full integration and ease of development.
The wide range of STM32 microcontrollers are based on an industry-standard core and come with a large choice of tools and software, making this product family ideal for both small projects or entire system platforms.



● With Cortex®-M0+ radio co-processor

WIRELESS CONNECTIVITY SOLUTIONS

ST's portfolio includes a variety of transceivers, network processors ICs and fully certified modules that support major technologies currently available for wireless connectivity including sub-1GHz long-range networks (6LowPan, WMBUS, SigFox and LoRaWAN), Bluetooth-Smart®, 802.15.4 ZigBee and OpenThread.

NFC & RFID

ST25TV	NFC/RFID tags
ST25DV	Dynamic NFC/RFID tags
ST25R	NFC Readers
ST25RU3993	NFC Readers for UHF

Sub-1 GHz

S2-LP	Sub-1 GHz Transceiver Sigfox compatibility
BALF-SPI2-01D3 **BALF-SPI2-02D3**	Balun for S2-LP
STM32WL	STM32 Sub-GHz SoC

sigfox LoRa

Positioning

TESEO-LIV3	GNSS Module

GNSS

Bluetooth Low Energy

BlueNRG-2	Highly energy-efficient Bluetooth 5.0 Wireless SoC
BALF-NRG-02D3	Balun & Filter for BlueNRG
BlueNRG-M2	Bluetooth 5.0 Modules
STM32WB	Multi-protocol (BLE 5.0/802.15.4) Wireless SoC
MLPF-WB55-0xE3	STM32WB Filter

WPAN

STM32WB	Multi-protocol (BLE 5.0 / 802.15.4) Wireless SOC (balun integrated)
BAL-UWB-x	Balun for UWB

6LoWPAN THREAD

Cellular

Cellular connectivty
In collaboration with several partners

NB-IoT LTE-M



Complementary Products

POWER MANAGEMENT

ST is a leading supplier in power management and mixed-signal ICs for mobile applications, offering a wide range of products from simple power management ICs up to highly-integrated devices that mix power management blocks with advanced analog and digital functionalities.

DC/DC converters	
ST1PS01/02	Synchronous converter, Output voltage flexibility, 400 mA output current, Nano-quiescent current (500 nA) for extended sensors battery life

Voltage regulators	
STLQ020	200 mA ultra-low quiescent current LDO
LDLN030	Low Iq, ultra low noise 300 mA LDO with power good
LDLN025	Low Iq, ultra low noise 250 mA LDO
LD59030	Low Iq, ultra low drop 300 mA LDO

SIGNAL CONDITIONING

STMicroelectronics offers a wide analog portfolio including high-performance amplifiers and comparators dedicated to the challenging industrial, automotive and consumer markets. The main features of our growing portfolio are low power, high precision and tiny packages. The range of products allows easy and fast integration of analog products. For more information visit www.st.com/opamps

ST Op Amps

TSZ12 Series Zero Drift CMOS Amplifier	• Very low offset 5 µV max • Very low drift in Temperature 30 nV/°C
TSZ18 Series Zero Drift & Speed Amplifier	• Very low offset 25 µV max • Very low drift in Temperature 0.1 µV/°C • Excellent Speed/power ratio 3 MHz/1 mA
TSU11 Series Nano-power Amplifiers Zero Drift	• 900 nA current Consumption • Only 150 µV max input offset Voltage • Operating from 1.5 V
TSU10 Series Nano-power Amplifiers	• 580 nA current consumption • Operating from 1.5 V
TS88 Series Nano-power Comparator	• 200 nA current Consumption • Operating from 0.9 V • Push Pull & Open Drain

PROTECTION

ST's large portfolio of protection devices and ICs have passed all certifications, meeting or exceeding international protection standards for electrical hazards on electronics boards found in the demanding, industrial market. Standard and advanced innovative packages (flow-through µDFN, WLCSP and PowerQFN) keep board space to a minimum, helping improve layout options. For more info refer to https://www.st.com/en/protection-devices.html

Protection	
EMIF06-MSD02N16	SD card protection
ECMF02-4CMX8	USB DATALINE
ESDA7P120-1U1M	DC-DC protection
DSILC6-4P6	ESD protection for NFC Tag
EMIF03-SIM02M8	SIM card ESD protection and filter

Design support

ST provides different hardware and software solutions to help designers in their job. Starting from the Product Evaluation Boards, that can be used to perform a comprehensive evaluation of ST's products, arriving to the **Solution Evaluation Boards** tailored to exploit one or more features of the application. Between these two families of evaluation boards, ST offers a fast and modular prototyping system, namely **STM32 Open Development Environment (ODE)**, which permits to combine STM32 microcontroller with a broad range of expandable boards to reproduce the desired set of functions for sensing, connectivity, power, audio, motor control and more.

The ST Software Development Tools complement the ST hardware ecosystem adding programming tools, firmware libraries, middleware and stacks to reduce the design complexity.

KEY PLATFORMS

NFC & RFID



Smart and flexible NFC Tracker

Solution Board
STEVAL-SMARTAG1

Firmware Packs
FP-SNS-SMARTAG1
ST NFC Sensor mobile app

STM32 ODE Approach
NUCLEO-L053R8
X-NUCLEO-NFC04A1
X-NUCLEO-IKS01A2

Target Applications

Bluetooth Low Energy



BlueNRG-Tile - Bluetooth LE enabled sensor node

Solution Board
STEVAL-BCN002V1B

Firmware Packs
STSW-BLUETILE-DK
STBLESensor

Target Applications

Bluetooth Low Energy



SensorTile.box wireless multi sensor ready-to-go IoT Node

Solution Board
STEVAL-MKSBOX1V1

Firmware Packs
FP-SNS-STBOX1

Target Applications

Sub-1 GHz

sigfox



Sigfox™ Tracker

Firmware Packs

FR-ATR-SIGFOX1

STM32 ODE Approach

NUCLEO-L053R8/L476RG
X-NUCLEO-S2868A2/915A1
X-NUCLEO-IKS01A2/3

Target Applications

Sub-1 GHz

LoRa



IoT LoRa® Tracker

Solution Board

STEVAL-STRKT01

Firmware Packs

FP-ATR-LORA1

STM32 ODE Approach

B-L072Z-LRWAN1
X-NUCLEO-GNSS1A1
X-NUCLEO-IKS01A2

Target Applications

Cellular & GNSS

TOMTOM



TOMTOM™ Tracker

Firmware Packs

FP-ATR-TOMTOM

STM32 ODE Approach

NUCLEO-F401RE
P-L496G-CELL01 2G/3G
P-L496G-CELL02 LTE

Target Applications

MIX
Paper from responsible sources
FSC® C003379

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