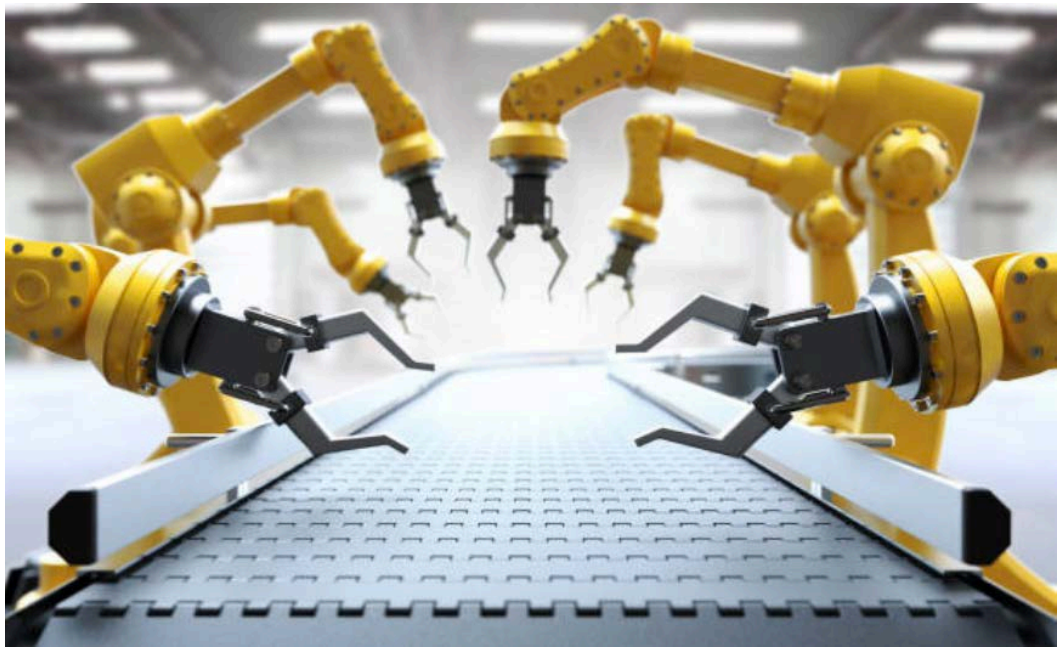
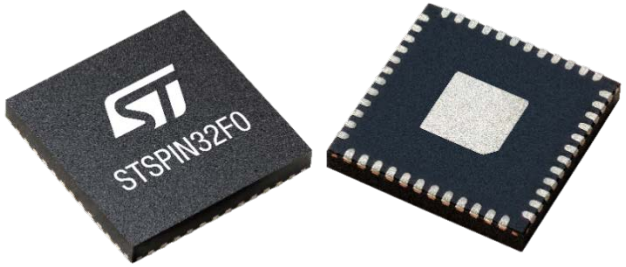
BLDC Position Control

Motor Driver IC and a 32-bit MCU in a 7 x 7 mm Footprint





- STSPIN32F0 Key Features and Benefits
- Position Control Demo
- MCU for Motor Control
- ANALOG and POWER for Motor Control
- Design Support Tools

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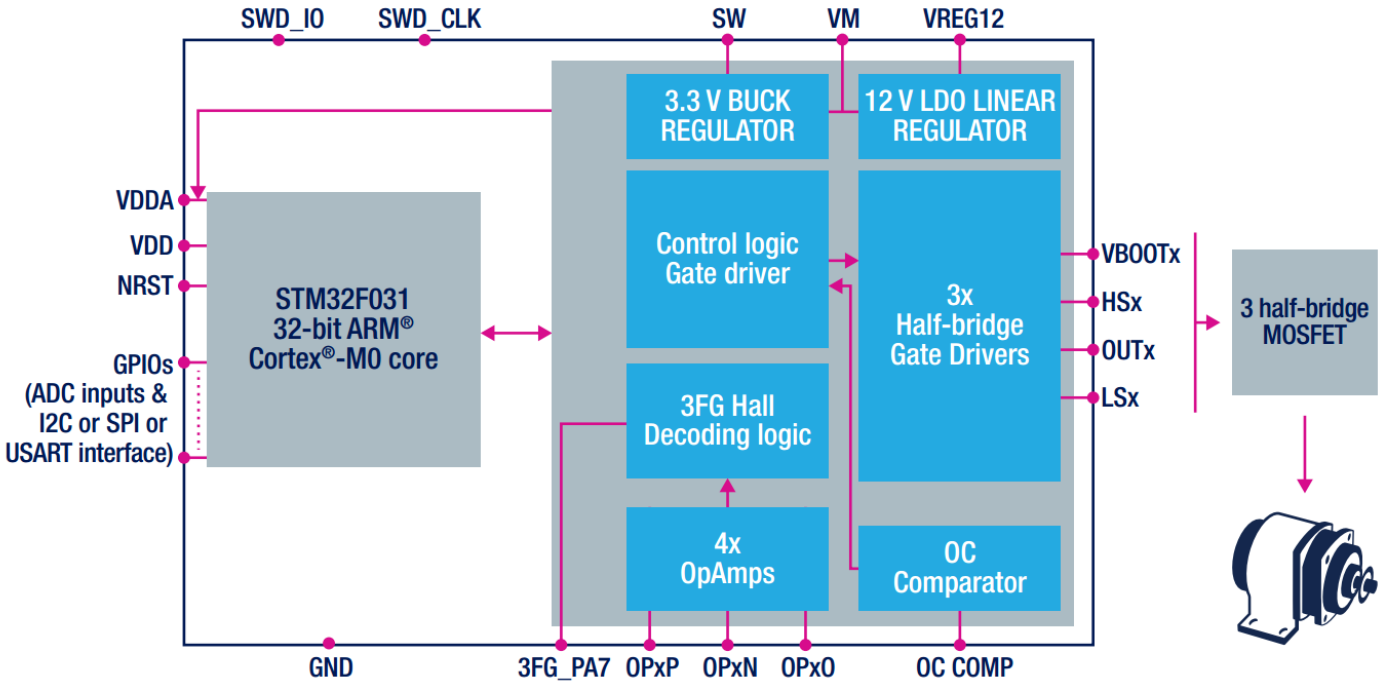
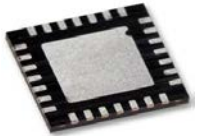
STSPIN32F0 Technical Details

- **Operating voltage from 8V to 45V**
- **3-phase gate driver for high performances**
  - 600mA current capability
  - Real-time programmable over current
  - Integrated bootstrap diodes
  - Cross conduction, under-voltage and temperature protections
- **32-bit STM32F0 MCU with ARM ® Cortex® M0 Core**
  - STM32F031x6x7 48MHz, 4-Kbyte SRAM and 32-Kbyte Flash memories
  - 12-bit ADC
  - 1 to 3 shunts FOC supported
  - Communication interfaces I2C, UART and SPI
  - Complete Development Ecosystem available
- **4x Operational Amplifiers and a Comparator**
  - Sensor-less or Hall-effect sensors supported for accurate control of 3-phase motors
  - Wide Bandwidth 20MHz
  - Adjustable Comparator's threshold
- **On-chip generated supplies for MCU driver and external circuitry**
  - 3.3V DC/DC buck regulator – Input voltage up to 45V
  - 12V LDO linear regulator
  - UVLO protection on all power supply voltages
- **Embedded Over-Temperature Protection**





- Package : VFQFPN 7 x 7 x 1.0 - 48L

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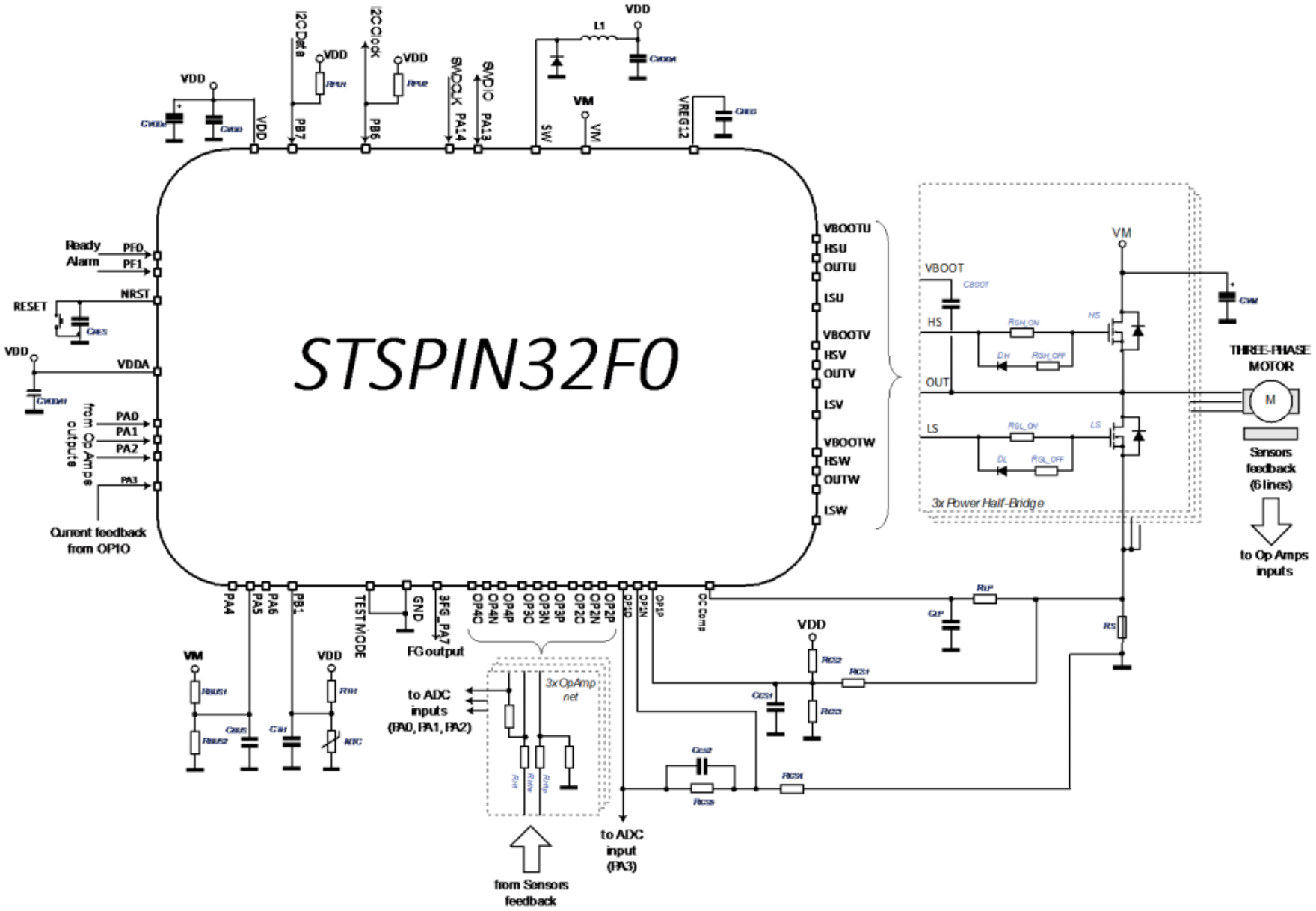
STSPIN32F0 Application Example



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Hardware Platform

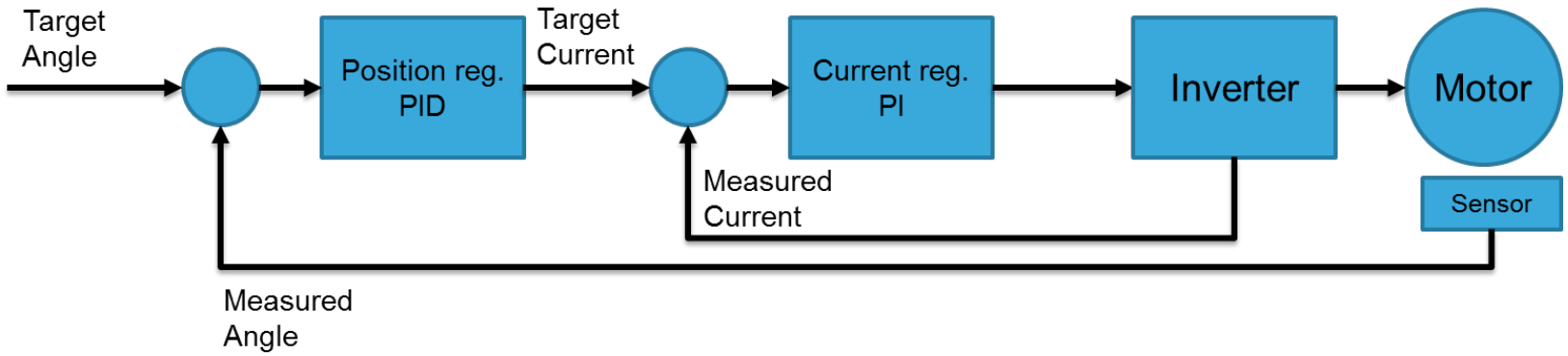
STEVAL-SPIN3201

- Input voltage from 8 V to 45 V
- Output current up to 15 Arms
- Power stage based on STD140N6F7 MOSFETs
- 3-shunt current sensing
- Digital Hall sensors and encoder input
- Overcurrent comparator
- Bus voltage sensing
- Fully supporting STM32 PMSM FOC Software Development Kit
- Embedded ST-LINK/V2-1

STSPIN32F0

- Three-phase gate drivers
  - 600 mA sink/source
  - Integrated bootstrap diodes
  - Cross-conduction prevention
- 32-bit ARM® Cortex®-M0 core:
  - Up to 48 MHz clock frequency
  - 4-kByte SRAM
  - 32-kByte Flash memory
- 16 GPIO
- 5 general-purpose timers
- 12-bit ADC converter (up to 9 channels)
- I2C, USART and SPI interfaces
- 4 rail-to-rail operation amplifiers
- Extended temperature range: -40 to +125 °C

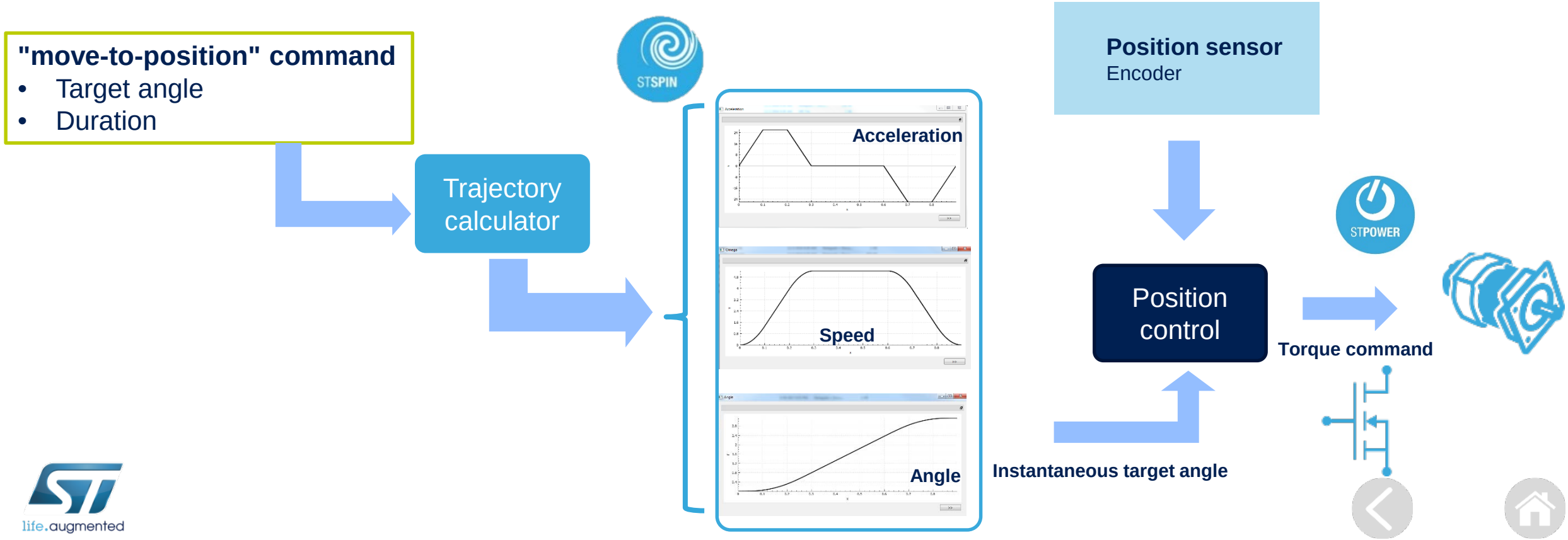
The Demo



- Two small motors are precisely synchronized allowing the intersection of two disks, performing accurate **position control** and thus avoiding collision, playing at different speeds and accelerations.
- With **STSPIN32F0** as main core, the demo show the capabilities of a **servo drive.**

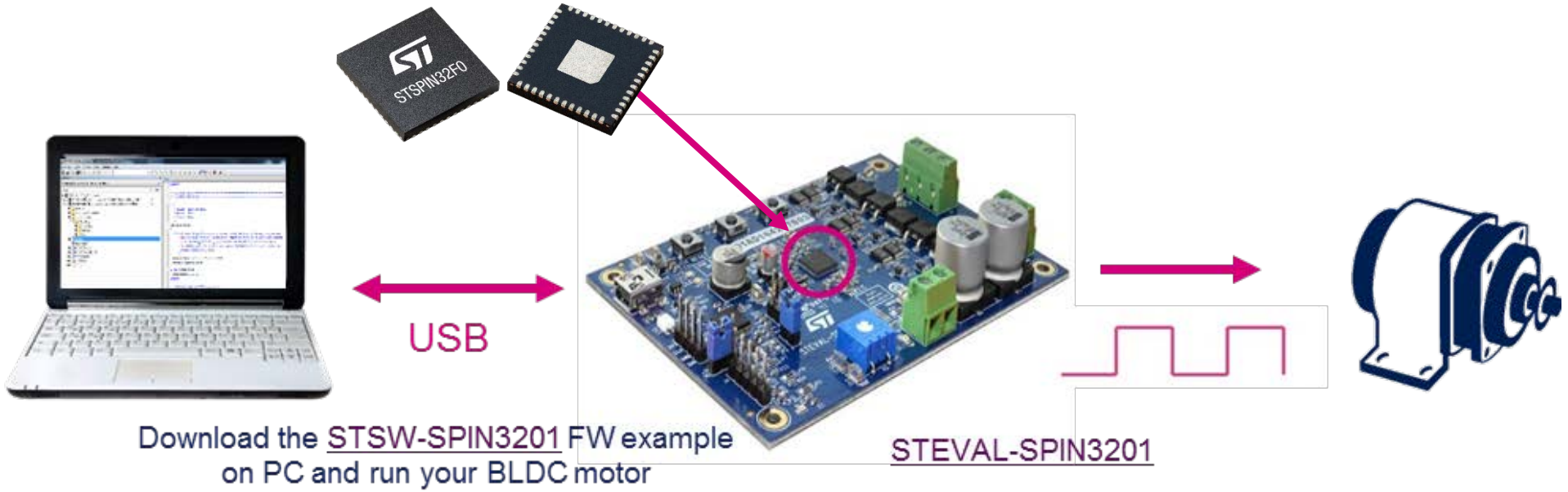
Full Featured Position Control

- A dedicated **trajectory** (as a sequence of target positions) is calculated starting from a
- "move-to-position" command.
- The trajectory is computed applying a constant angular **Jerk** approach.
- The Jerk is the rate of change of acceleration; that is, the time derivative of acceleration.



Design Support Tools

A complete environment for the development of an FOC solution



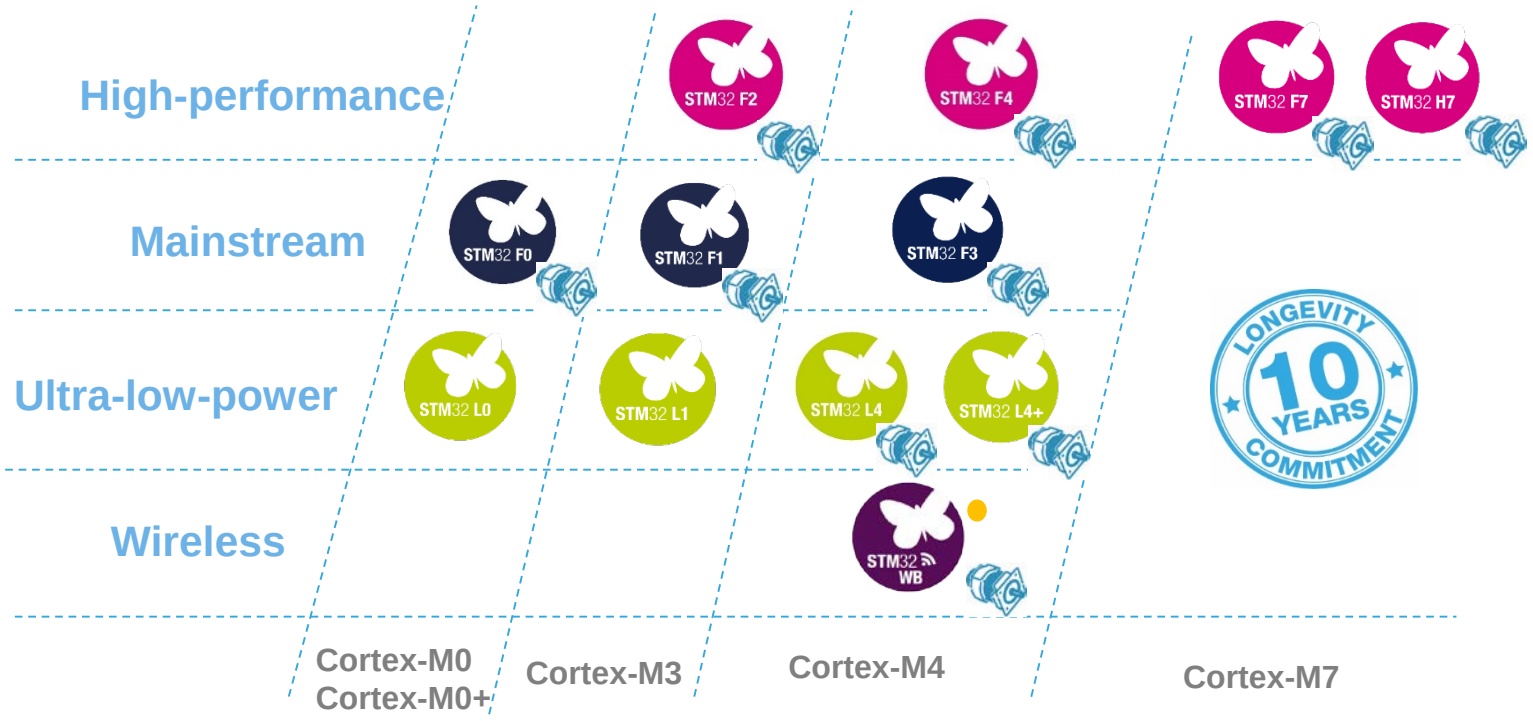
Making Your Designs Easier

To support STSPIN32F0, a comprehensive set of design tools is available, including:

Reference Code	Description
STEVAL-SPIN3201	STSPIN32F0 evaluation board Three-phase brushless DC motor driver evaluation board • Input voltage from 8 to 45 V • Output current up to 15 Arms • Power stage based on STD140N6F7 MOSFETs • Sensored or sensorless field-oriented control algorithm with 3-shunt sensing
UM2154	User manual for STEVAL-SPIN3201: advanced BLDC controller with embedded STM32 MCU evaluation board
STSW-SPIN3201	Firmware example for field oriented motor control (FOC)
UM2152	User manual for Getting started with the STSPIN32F0 FOC firmware example STSW-SPIN3201
STSW-STM32100	Library: STM32 PMSM FOC Software Development Kit

STM32 Portfolio

12 Product Series / More than 50 Product Lines



More than
40,000 customers

Legend: Cortex-M0+ Radio Co-processor

Advanced motor control timer included

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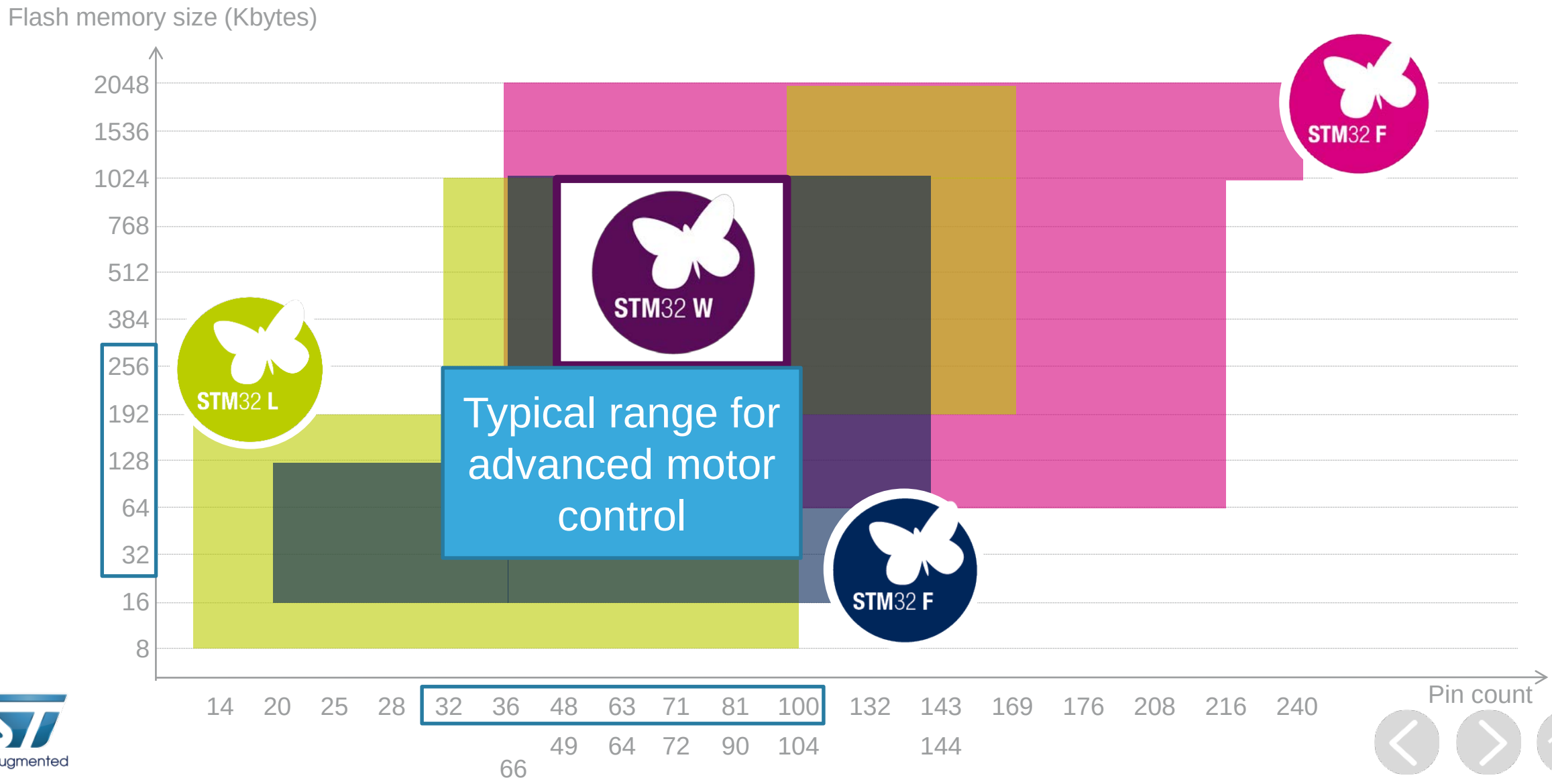
STM32 today – platform effect

Select the Best Fitting Product from a Wide & Compatible Portfolio



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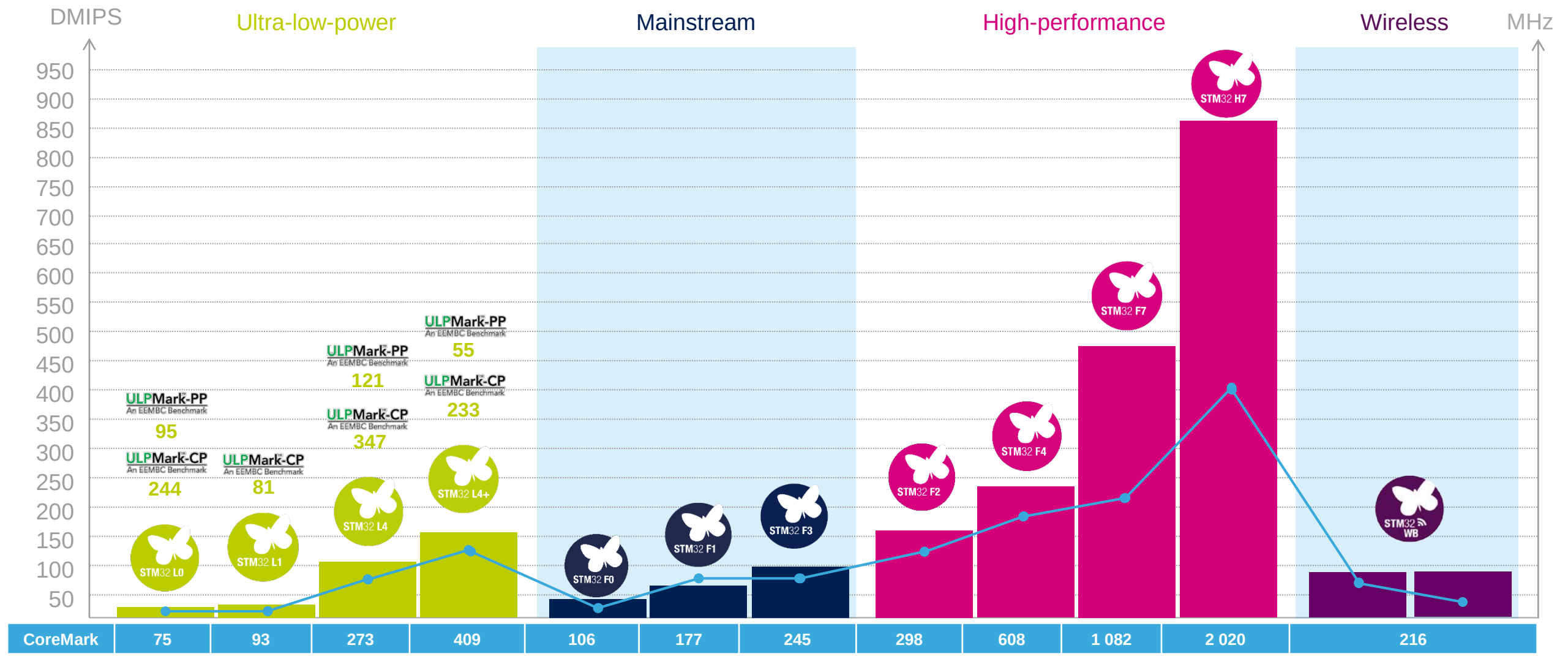
Broadest 32-bit MCU product portfolio



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STDRIVE – Product Family and Positioning

IGBT and MOSFET Drivers

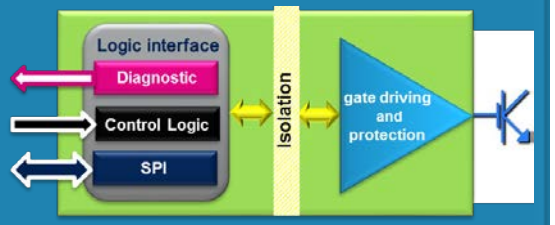
Applications

- Auto HEV/EV
- 1200V inverters
- Industrial Drives
- Washing machines
- Compressors
- Dish washers
- HID
- E-bikes
- Server
- UPS
- DC/DC Auto
- Solar
- Factory automation

1.5kV

Galvanically isolated Gate Drivers

- **STGAP1AS**



600V

Low & High Voltage Gate Drivers

L638xE SERIES
600V HB drivers for IGBT/MOS

L639x SERIES
600V HB drivers for IGBT/MOS optimized for FOC

L649x SERIES
600V high current HB drivers for IGBT/MOS

TD3xxE
Single channel drivers with functional isolation & 2-level turn-off

50W 200W 1kW 100kW

Power

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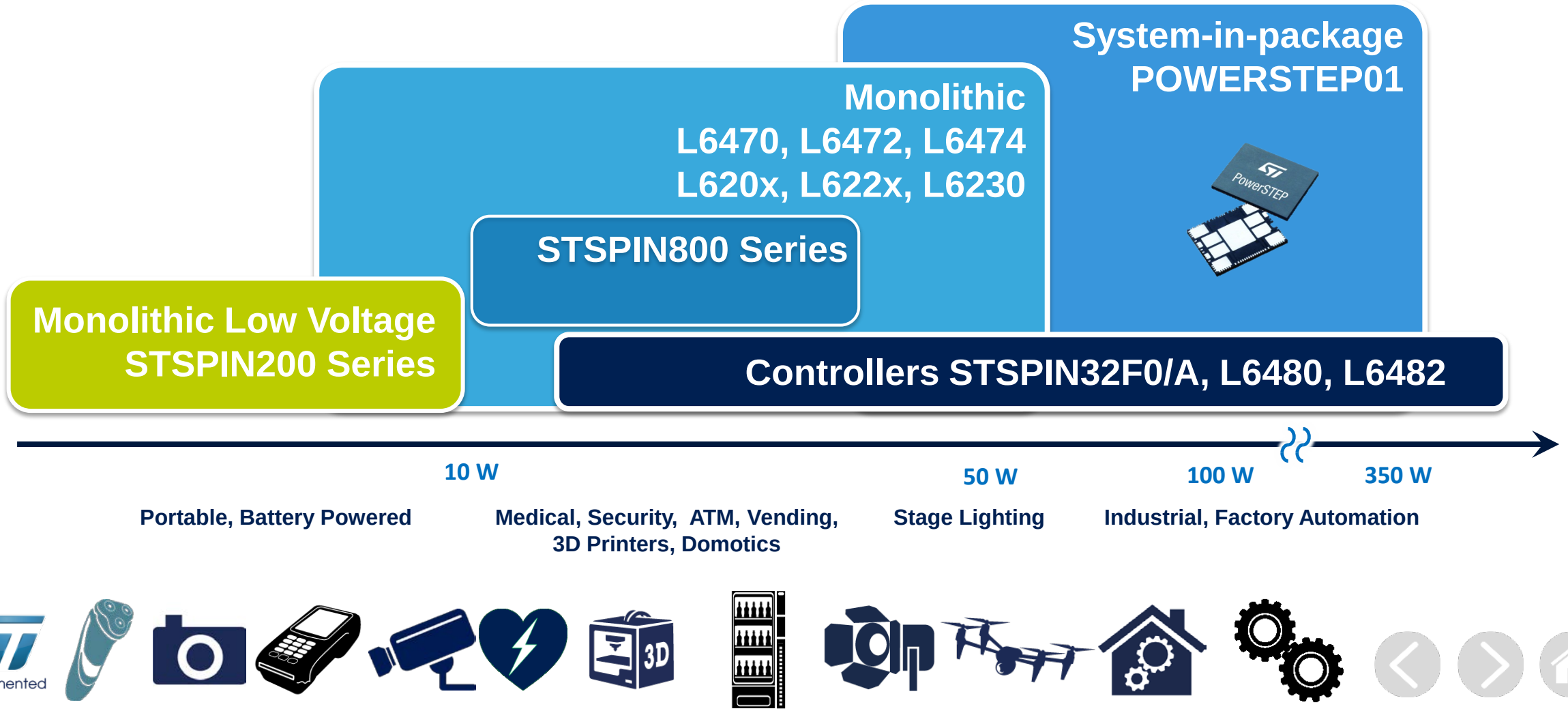
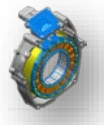
STSPIN Family Portrait

Leading Integration, Performance, Efficiency



STSPIN Family Positioning

	Monolithic motor drivers (52V / 45V / 7V)	LV motor drivers (10V / 1.8V)	Microstepping motor drivers (45V / 8V)	High Power microstepping (85V / 7V)
STEPPER 	**Dual full-bridges** L6208 L6208Q L6228 L6228Q STSPIN820	**Dual full-bridge** STSPIN220	**Dual full-bridges** L6470 (VM) L6472 (PCAD) L6474	**Controllers & SiP** L6480 (VM) L6482 (PCAD) POWERSTEP01
BRUSHED DC 	**Dual full-bridges** L6205 L6206/Q L6207/Q L6225 L6226/Q L6227/Q STSPIN840	**Dual full-bridge** STSPIN240 STSPIN250		
3-PHASE BLDC 	**Triple half-bridges** L6235/Q L6234 L6229/Q L6230/Q STSPIN830	**Triple half-bridge** STSPIN230 STSPIN233		

VM = Voltage mode

PCAD = Predictive Current control with Adaptive Decay

DME = Digital Motion Engine generates motion profiles thru commands sent over SPI

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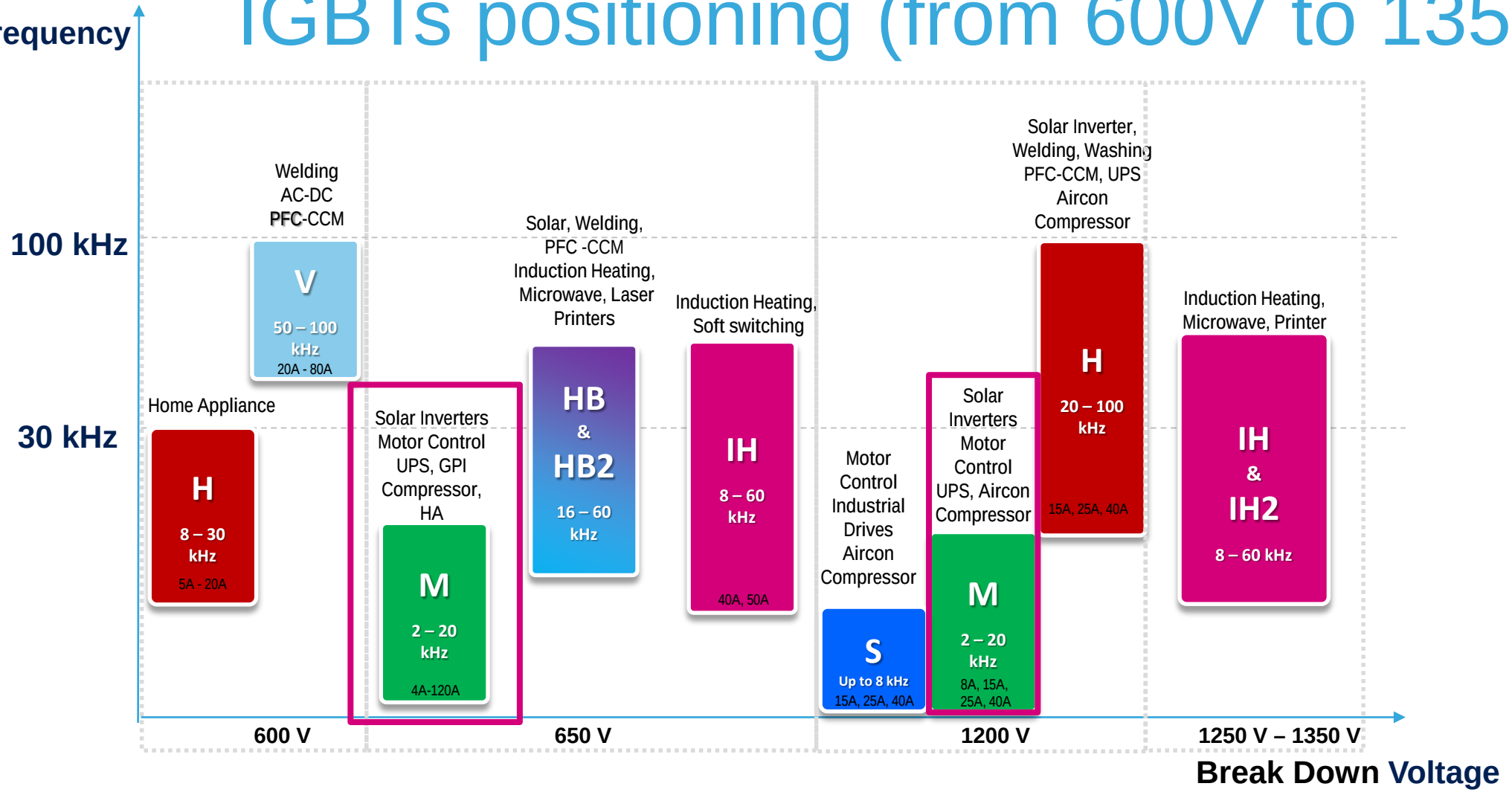
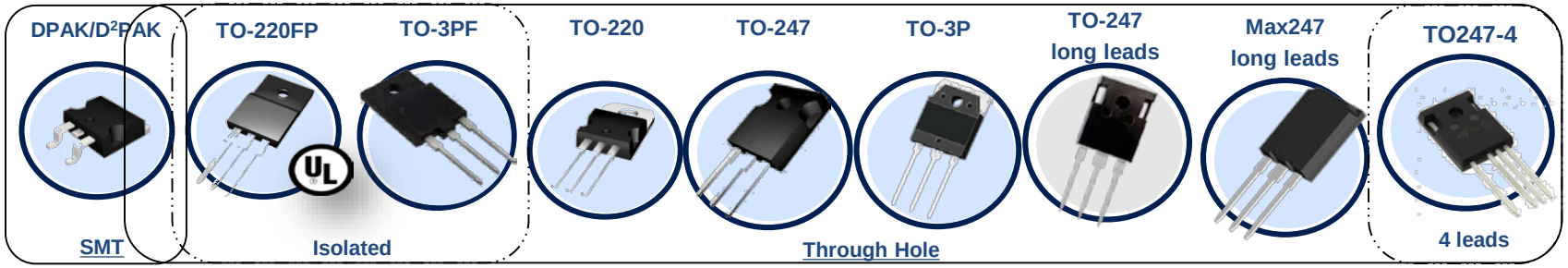
IGBTs positioning (from 600V to 1350V)





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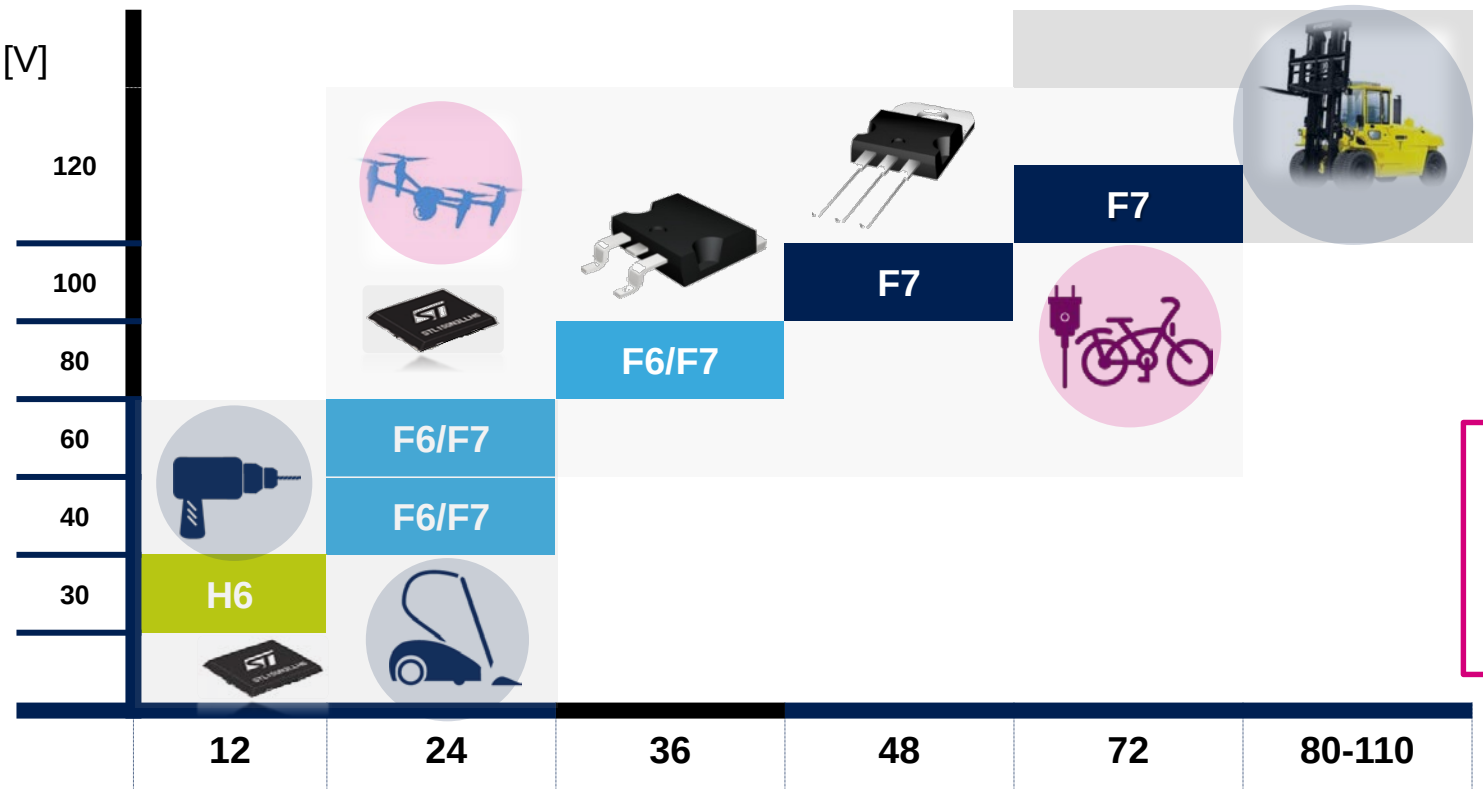
Low Voltage STripFET™ Positioning vs Battery Voltage



LEGEND:

H6 = 30V STripFET H6

F6 = 40 ÷ 80V STripFET F6

F7 = 40 ÷ 120V STripFET F7

Technology Features

- Best in class On-resistance
- High current capability
- High quality & reliability
- Wide packaging options

Benefits

- Higher efficiency and system miniaturization
- Lower battery consumption
- Reliable system operation

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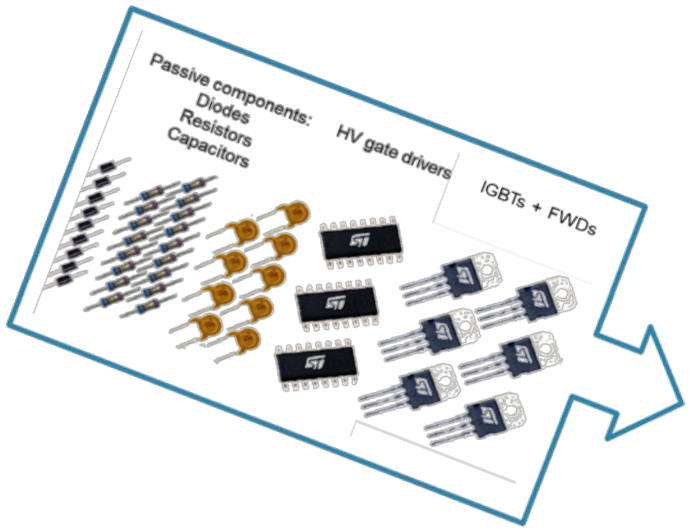
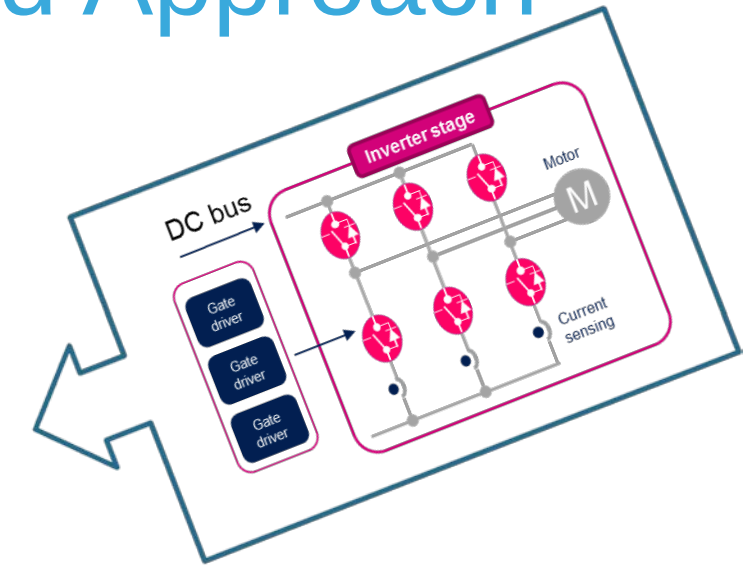
Discrete vs Integrated Approach





Advantages of integrated Power Modules (IPM)

High power dissipation due to a very low thermal resistance

Lower losses and EMI noise thanks to simultaneous optimization of power chips and driving circuits

«Plug ‘n Play» solution

Improved manufacturability and PCB routing, only one component to handle

Reduced design time and improved reliability thanks to embedded protection

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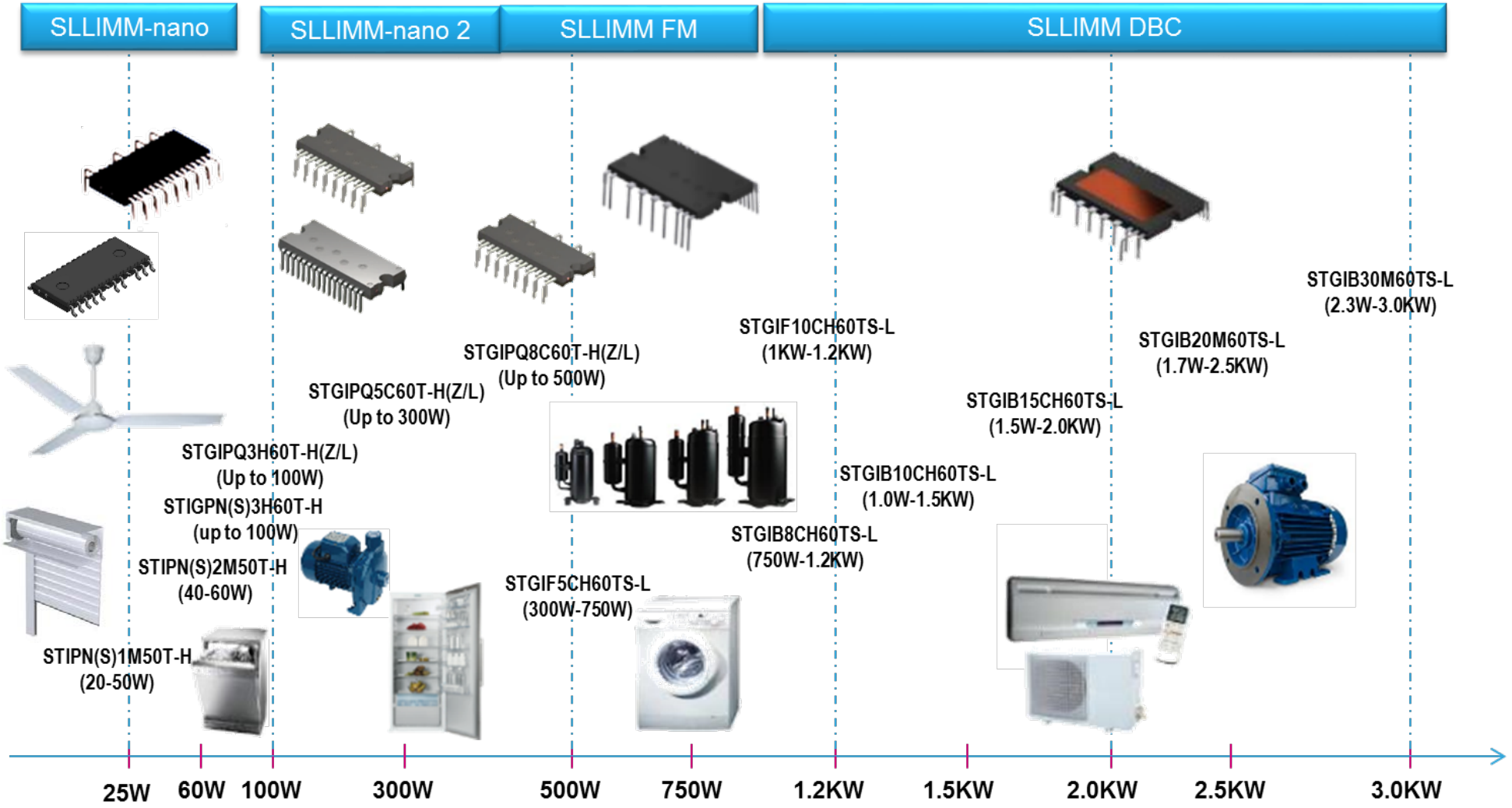
SLLIMM™ Intelligent Power Modules

Target applications

- Motor control
- Washing Machine
- Air Conditioning
- Pumps
- Compressor
- Industrial drives



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ACEPACK™

Main Features and ST capability in “Power Switch”

ACEPACK™ 2

ACEPACK™ 1

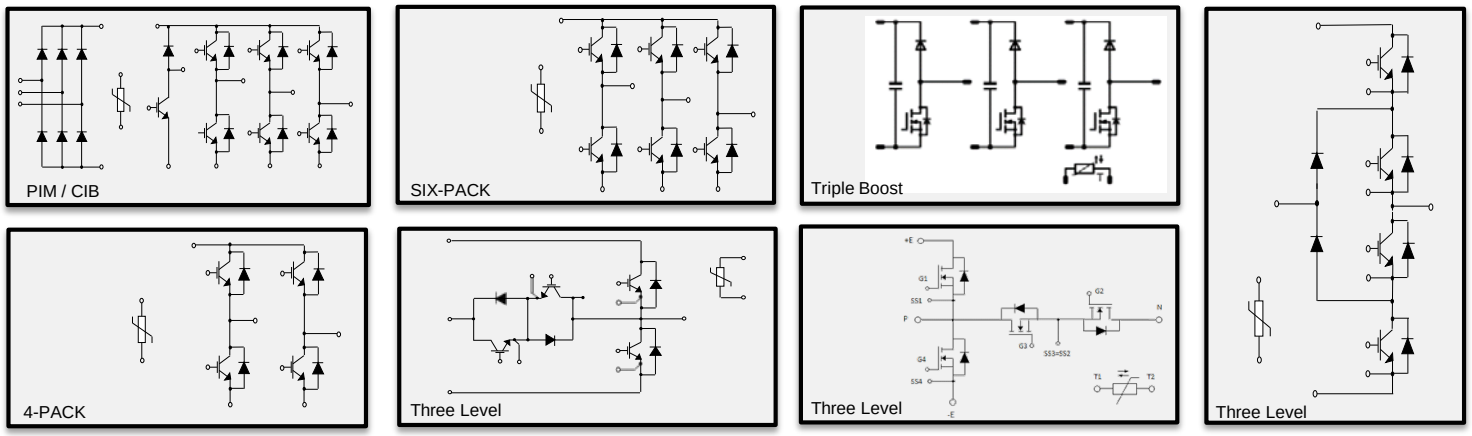
Main Features

- Compact module concept
- Configuration flexibility
- Press FIT and solder pins options
- High power density
- Reliable and easy mounting system
- Integrated temperature sensor available
- Low stray inductance module design
- PCB layout design
- High reliability and quality
- RoHS-compliant modules

ST Power Switch capability

- IGBTs
- HV MOSFETs
- Diodes
- Brigde Rectifier Diodes
- Silicon Carbide MOSFETs
- Silicon Carbide Diodes
- SCR

Main Topologies can be addressed in ACEPACK



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