Low voltage motor control

Power & Analog

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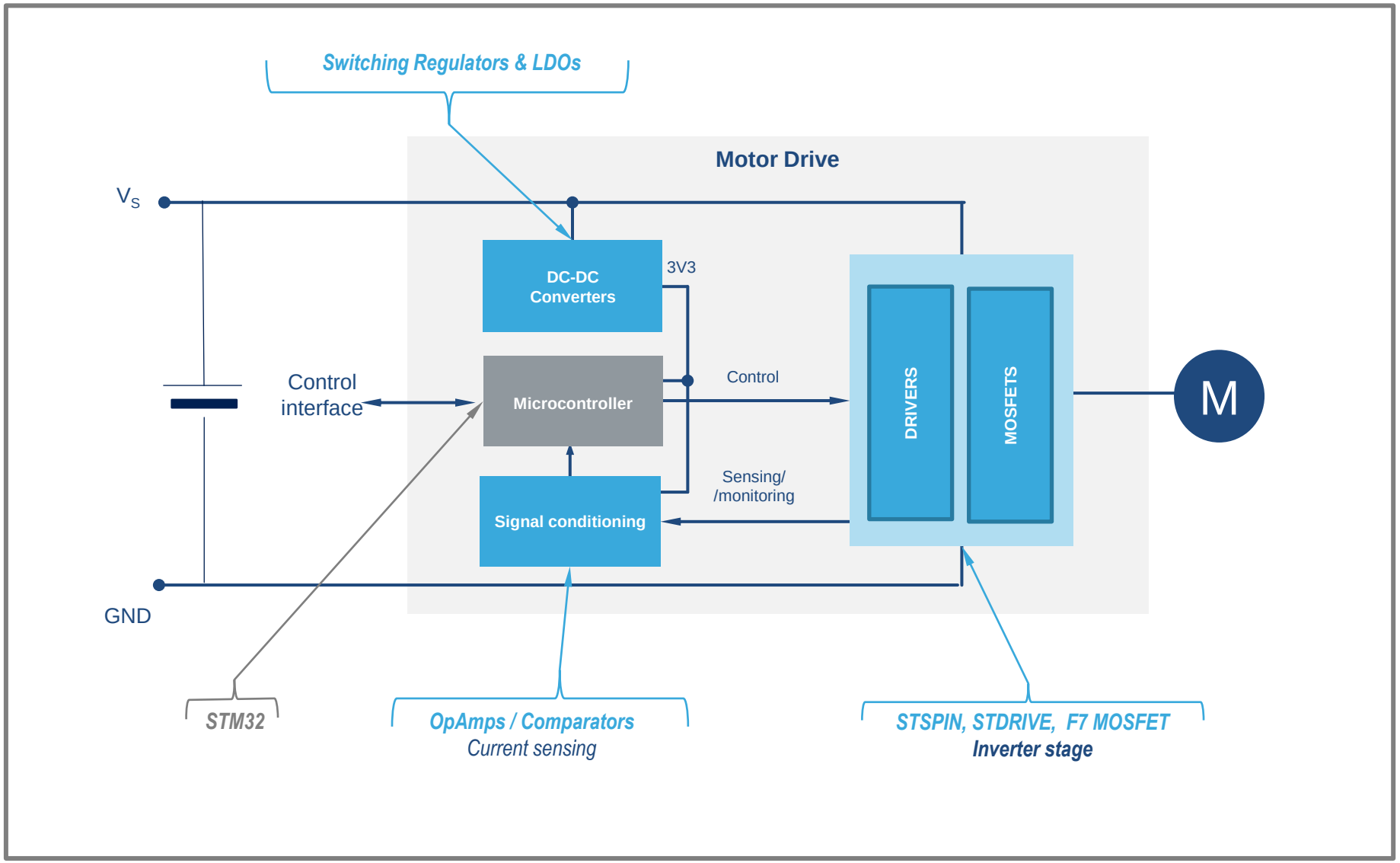
What is all about?



ST Longevity Program & Motor Control ICs

STSPIN2xx, STSPIN8xx, L647x, L648x, POWERSTEP01

& others product lines

L62xx:

L6205, L6206, L6207, L6208, L6225, L6226, L6227, L6228, L6229, L6230, L6234, L6235

STSPIN32F0x , Op Amp (TSV, TSZ), selected LDO's & Sw Reg

others product lines

http://www.st.com/content/st_com/en/support/resources/product-longevity.html

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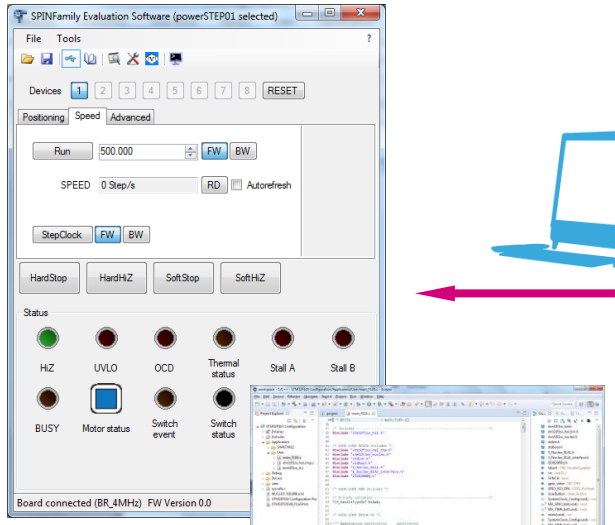
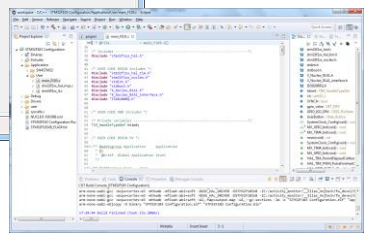
Evaluation Ecosystem

Speed-up your design with X-NUCLEO!

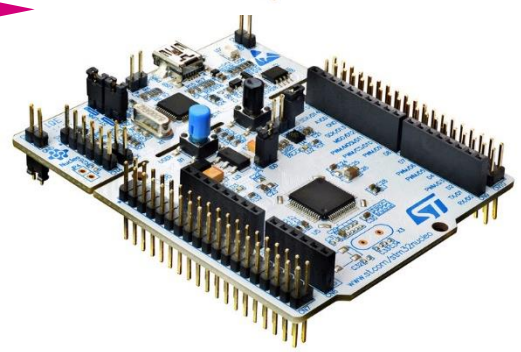
SPIN Family Evaluation Software





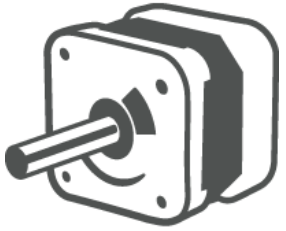
X-CUBE Firmware for STM32

X-NUCLEO



NUCLEO

DC Power Supply



Motor

Find your X-Nucleo now on st.com/x-nucleo

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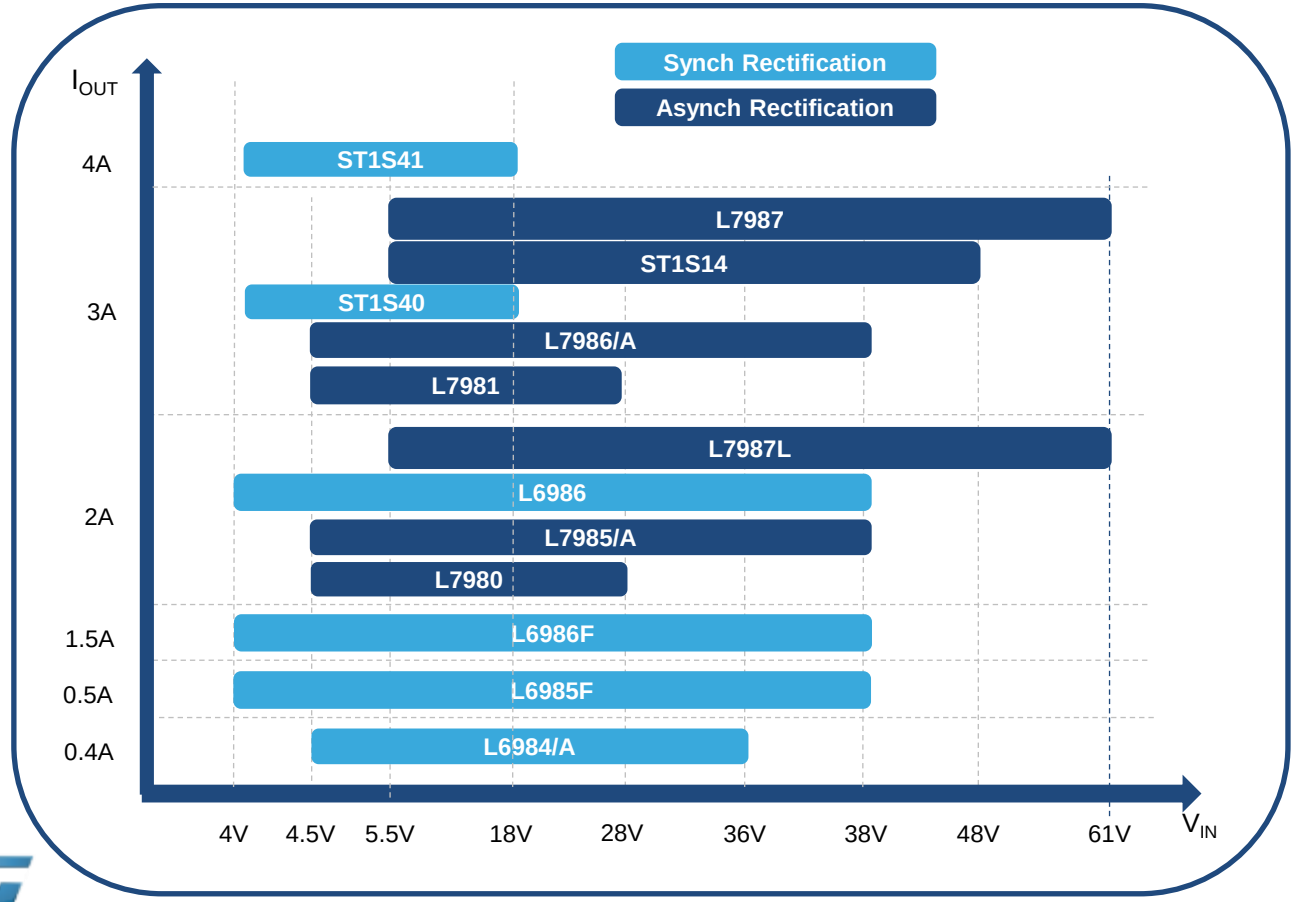
Switching Regulators in Motor Control Application



KEY BENEFITS & FEATURES

Wide range of operating voltage and current

- From 4V to 61 V ranging up to 4A.

Premium efficiency with L698x

- Synchronous rectification , quiescent current <100µA & low consumption mode at light load

Best solution for high V_{IN} bus with L798x

- Asynchronous rectification to optimize small duty cycle conversion

Simplest solution with minimal BOM with ST1S

- Internal compensation

A solution for any soldering & thermal constrain

- Wide package variety: from QFN 3x3 up to HTSSOP16 going through SO and HSOP8

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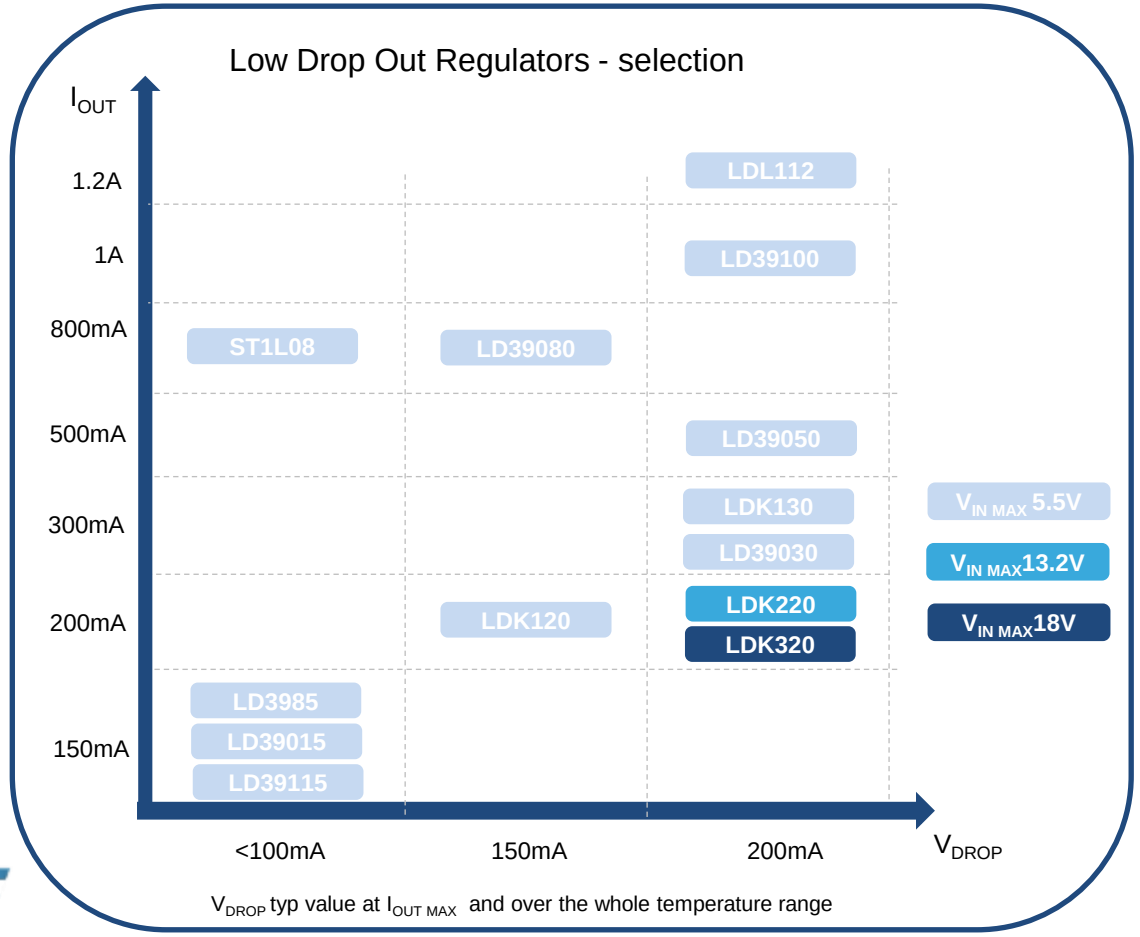
Linear Regulators in Motor Control Application



KEY BENEFITS & FEATURES

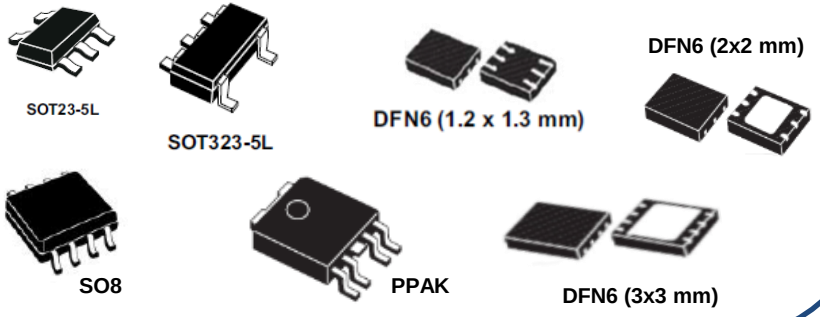
Ultra Low Drop Out: LD39xxx

- When system efficiency and minimum power dissipation are key .

LDL112: when reverse current protection is needed.

LDK & LDL: simple and cost effective solutions:

- Several package options are available for easy plug in



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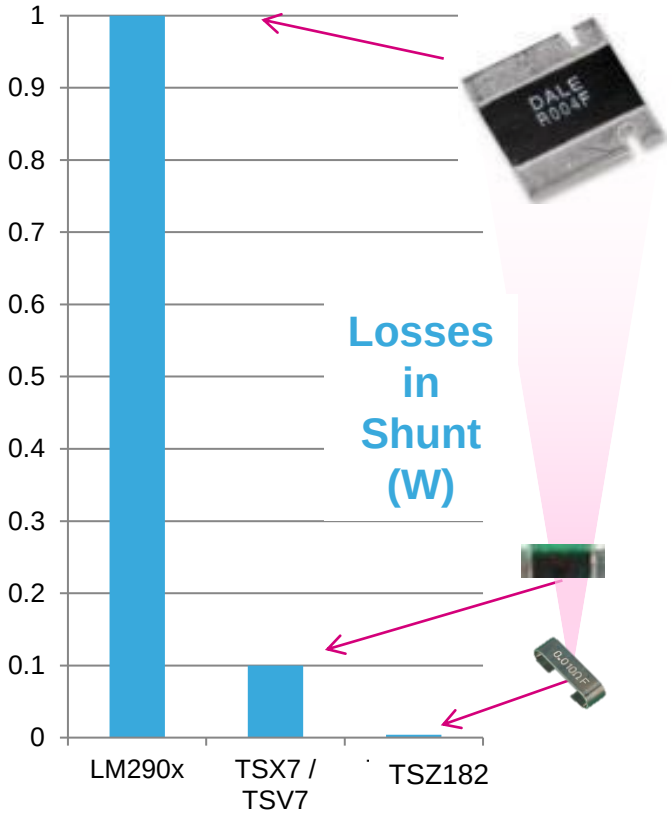
Signal Conditioning

Current Sensing in Motor Control Application



High Precision Op-Amp Smaller shunt → minimize losses

- **TSZ12x** (5uV, 400kHz)
- **TSZ18x** (25uV, 3MHz)

High slew rate → track PWM

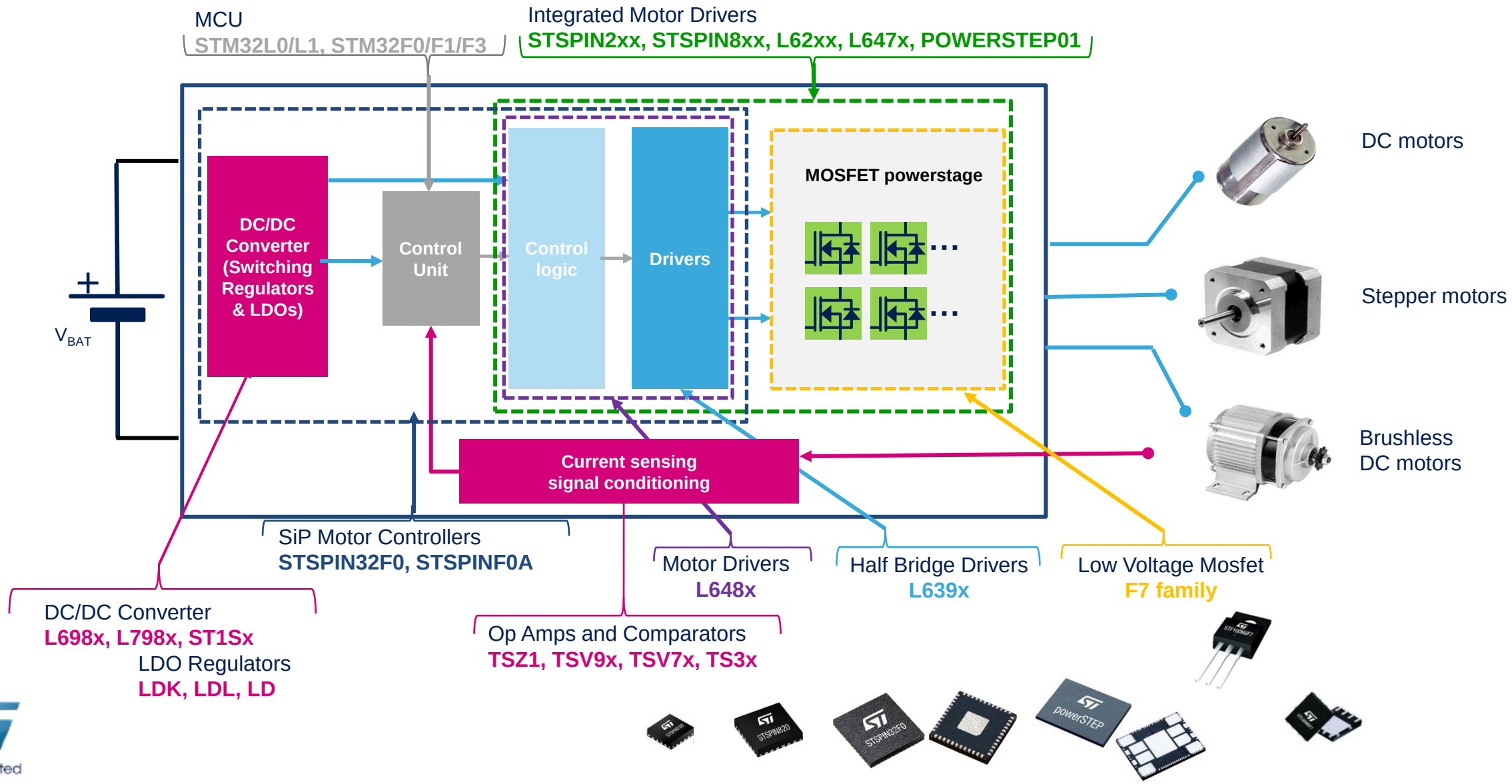
- **TSV99x** (1.5mV 20MHz)

Overcurrent protection

- **TS3xx** (comparator)

Part	Op-amp	Vio max (mV)	Shunt (mΩ)	Losses (W)
LM290x	Standard	2	40	1
TSV7xx TSX7xx	High-Precision 5V / 16V CMOS	0.2	4	0.1
TSZ18x	Ultra-Precision 5V Zero-Drift	0.025	0.5	0.0125

Low Voltage Motor Control in ST



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Discrete solution

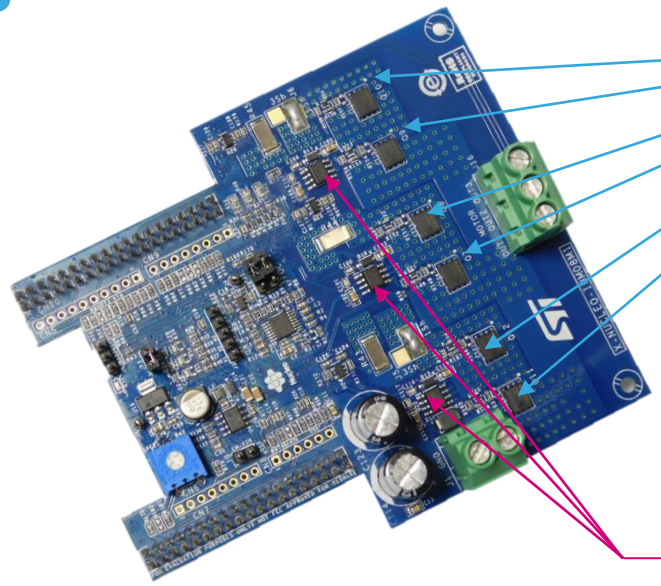
Basic Power Solution Fitting any motor (DC, BLDC, Stepper)

Our Excellence

Power Transistors

Half Bridge Drivers

Microcontrollers

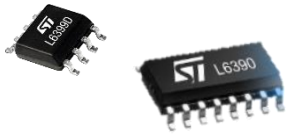


X-NUCLEO-IHM08M1

Low Voltage (40V- 100V) mosfet
- F7 series

STDRIVE - Half Bridge Drivers (up to 600V):

- L639x series – scalability first:
  - standard solutions for easy plug in
  - full feature device to support FOC solution



- L649x series
  - Up to 4A driving for higher power application

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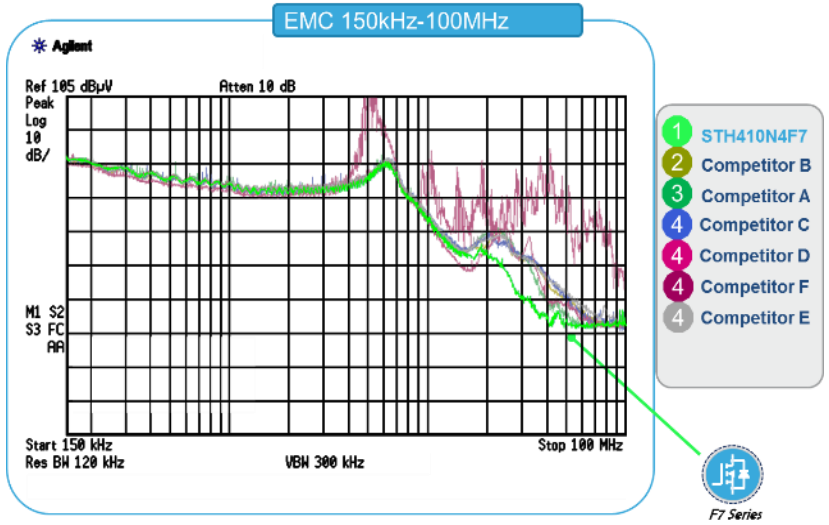
40V-100V MOSFETs

STripFET™ F7 series

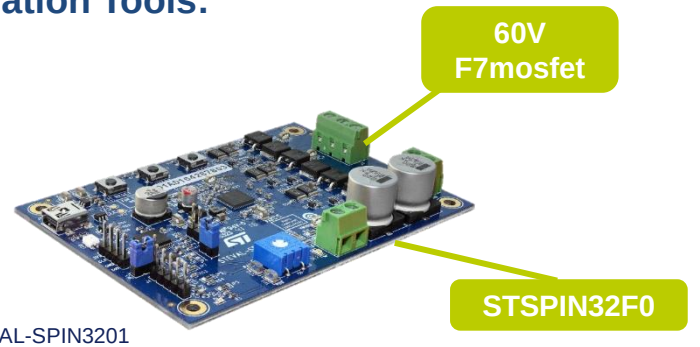
- Wide Portfolio
  40V, 60V, 80V, 100V

- Excellent for Motor Driving
  Superior EMI/EMC behavior
  Outstanding intrinsic body diode

CISPR25 conducted emissions – voltage method



Evaluation Tools:



STEVAL-SPIN3201

Target Applications:

- Battery Power Tools,
- Forklift,
- Pump

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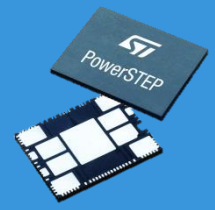
STSPIN Family Portrait

Leading integration, performance, efficiency

System-in-package
POWERSTEP01



Monolithic
L6470, L6472, L6474
L620x, L622x

Monolithic New
STSPIN800 Series

Monolithic Low Voltage
STSPIN200 Series

Controllers STSPIN32F0/A & L648x + F7 mosfet

10 W — 50 W — 100 W — 350 W

Portable, Battery Powered

Medical, Security, ATM, Vending Machine, 3D Printers, Domotic

Stage Lighting

Industrial, Factory Automation

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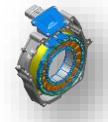
STSPIN by product family

	battery powered application motor drivers	NEW! compact & energy conscious motor drivers	versatile & scalable motor drivers
 DC	STSPIN240 STSPIN250	STSPIN840	L6225 & L6205 L6226 & L6206 L6227 & L6207
 3phase BLDC	STSPIN230 STSPIN233	STSPIN830	L6229 & L6935 L6230 & L6234
 Stepper	STSPIN220	STSPIN820	L6228 & L6208

STSPIN32F0 / STSPIN32F0A NEW!

SiP

Embedding Control (STM32 Cortex M0)

600mA 3 phase Drivers

Micro stepping motor drivers

L6470 L6472, L6474

Micro stepping controllers:
L6480 L6482

SiP → POWERSTEP01
w 10A & 16mΩ R_{DSON} mosfet

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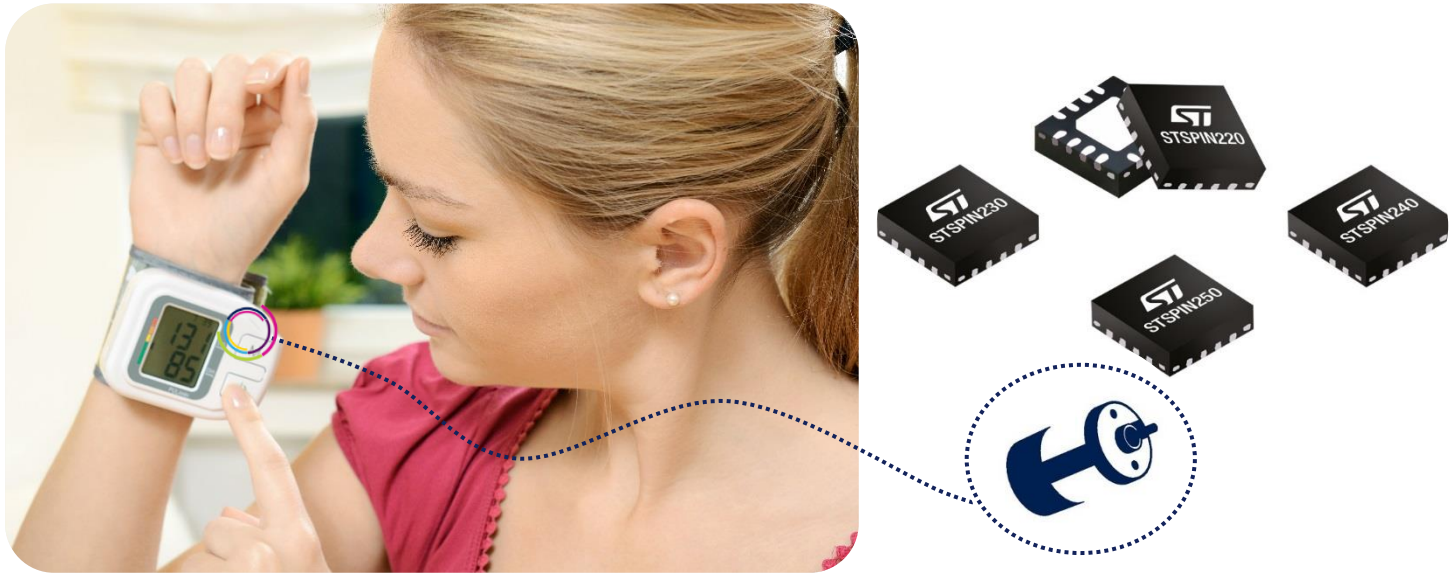
STSPIN200 Series Motor Drivers

Ideal for battery-powered applications



Product	Desription	V_{IN} min (V)	V_{IN} max (V)	R_{DSON} (Ohm)	I_{OUT} max (Arms)
STSPIN220	Microstepping driver up to 256 microsteps	**1.8**	**10**	**0.2**	**1.3**
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	Description	V_{IN} min (V)	V_{IN} max (V)	R_{DSON} (Ohm)	I_{OUT} max (Arms)
STSPIN820	Microstepping driver up to 256 microsteps	**7**	**45**	**0.5**	**1.5**
STSPIN830	3-phase 3shunts BLDC motor driver				
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} @ $R_{DS(ON)}$ = 500mΩ

High efficiency

- Standby mode to minimize power consumption in idle state (<50µA)

Smooth and silent motion

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

Reliable thanks to full set of protections

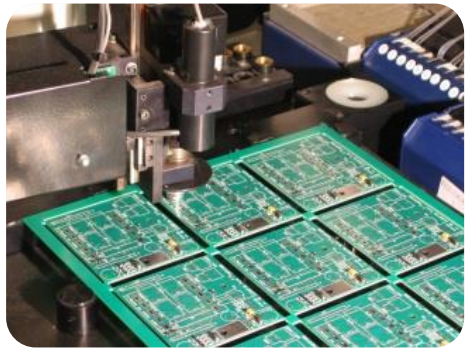
- UVLO, non-dissipative over-current and thermal protection

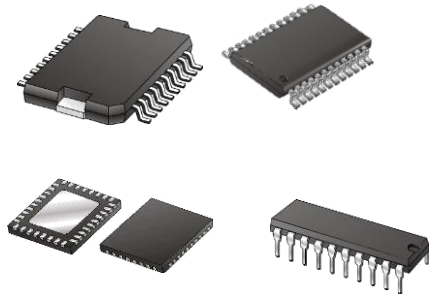
Minimum footprint and lightweight

- Compact 4 x 4 mm QFN package

L62xx Series Motor Drivers

Market leading family: versatile, scalable and reliable





KEY BENEFITS & FEATURES

Scalable in feature set and motor type:

- From basic power stage (L62x5) to full feature BLCD or Stepper Drivers (L6235 and L6208)

Powering small-medium sized motors

- Output current from 1.4 A_{RMS} up to 5.6 A_{RMS}

- Wide choices of packages to accomodate any soldering and thermal needs
  - PowerSO36, SO20 & SO24, DIP20 & DIP24, QFN 5x5 & QFN 7x7

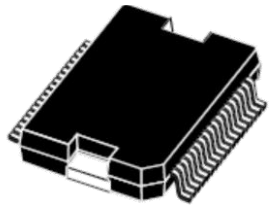
Topology	Product	Description
Dual DC Power Stage	L6205x (*) L6225x (*)	DC or Stepper; Fixed OCP
	L6206x (*) L6226x (*)	DC or Steppers Programmable OCP & Diagnostic output
	L6207x L6227x	DC or Steppers Programmable OCP & Twin PWM current control
Stepper Motor Driver	L6208x L6228x	Stepping seq generator Twin PWM current control
BLDC Power Stage	L6234 L6230	Opt for sensorless FOC Programmable OCP & Diagnostic output
BLDC Drivers	L6235 L6229	PWM current control Hall sensor decoding logic & Speed control output

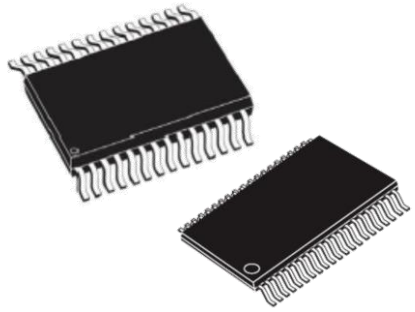
Product	V_{IN} min (V)	V_{IN} max (V)	R_{DSON} (Ohm)	I_{OUT} max (Arms)
L620x (*)	7	52	0.3 (0.15 *)	2.8 (5.6 *)
L6234				
L6235				
L622x (*)			0.7 (0.35*)	1.4 (2.8 *)
L6230				

(*) in parallel mode driving: feature allowed in L6205 & L6225 and :L6206 & L6226

Stepper Motor Solutions: L647x & L648x

Highly autonomous solutions using high-level motion commands from system host





Topology	Product	Description	V_{IN} min (V)	V_{IN} max (V)	R_{DSON} (Ohm)	I_{OUT} max (Arms)
Motor Drivers	L6470	Voltage mode driving algorithm (1/128 µstep)	8	45	0.3	3
	L6472	Predictive current control Adaptive decay (1/16 µstep)				
	L6474	Adaptive decay(1/16 µstep)				
Controllers	L6480	Voltage mode driving algorithm (1/128 µstep)	7.5	85	not applicable	
	L6482	Predictive current control Adaptive decay (1/16 µstep)				

KEY BENEFITS & FEATURES

Easy programmability thanks to SPI bus with daisy- chain

- Programmable parameters & on-the-fly diagnostics
- Multiple drivers can be driven by 1 MCU (STM32)

System stability and low noise:

- adaptive auto regulated decay (slow /fast /mixed decay) (*)

Accurate positioning and control

- Predictive current control (*)

Smooth & very silent motion

- Voltage mode control (*) ensure driving performances similar to BLDC ones

Power Scalability

- Using L648x controller with ST power mosfet (F7 family)

(*) ST patented features

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STSPIN Systems-in-Package

More Power Density…. and More Intelligence

Our Excellence

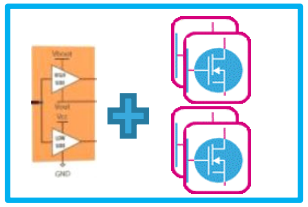
Power Transistors

Motor Drivers

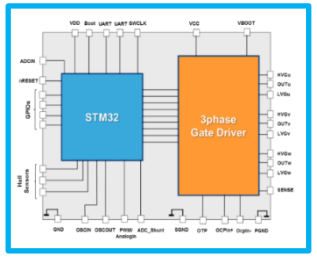
Microcontrollers

SiP evolution

Driver + Power stage



Driver + STM32



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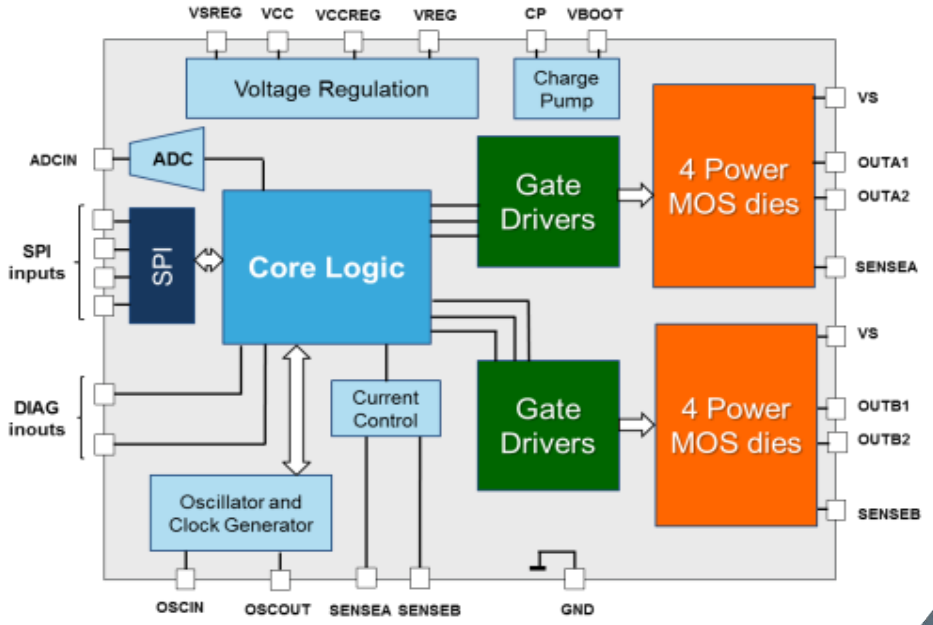
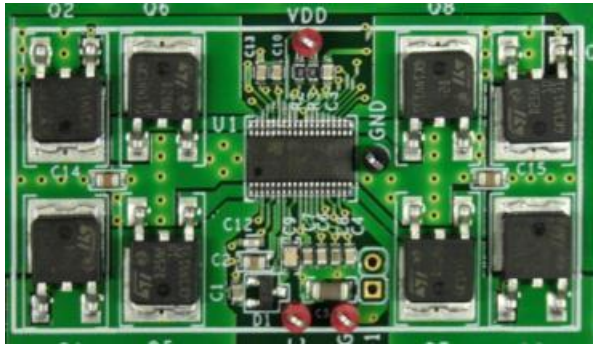
POWERSTEP01

Programmable motor controller + 8 Pwr MOSFETs @ 16 mΩ ($10A_{RMS}$ - 85V)

Power Transistors

Motor Control

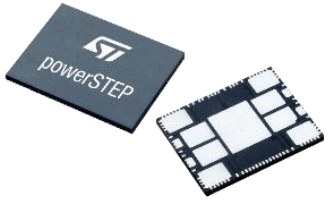




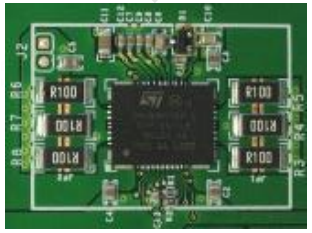
Improved performance

BOM Cost saving

67% PCB Area Saving



QFN 11mm x14mm



STSPIN32 Family

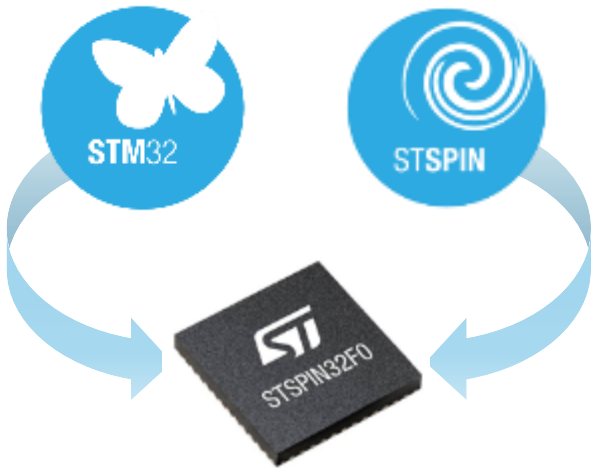
From analog to digital motor control

Power Transistors

Motor Control

Microcontroller

For
Smart Industry and **High-End Consumer**



- 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

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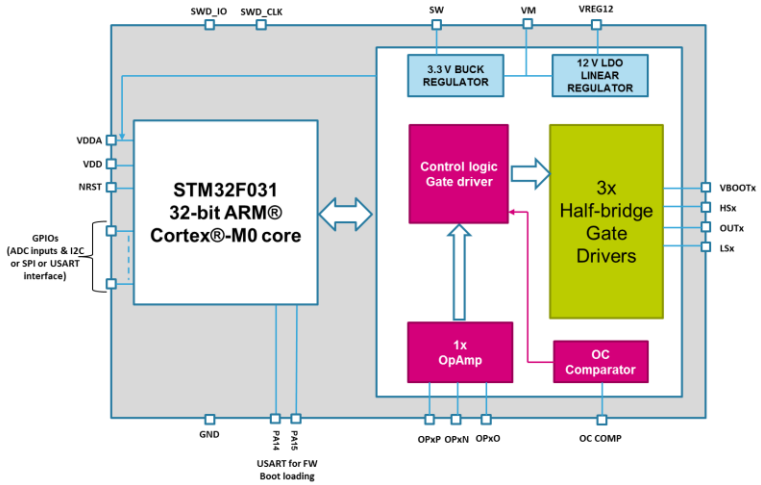
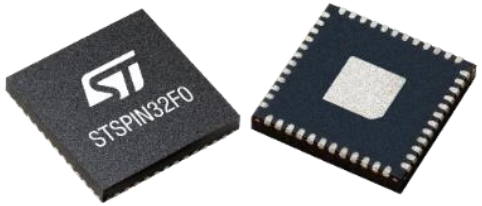
STSPIN32F0 / STSPIN32F0A

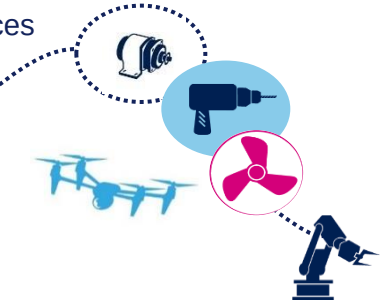
Advanced 3-phase BLDC driver + STM32 – from 2 Li-Po Cells to 45V





KEY APPLICATIONS:

- Battery powered Home Appliances
- Power tools
- Fans
- Industrial automation
- Robotics
- Drones and aeromodelling



KEY BENEFITS & FEATURES

STM32 Cortex M0 + 3-phase Gate Driver

Fully compatible with STM32 ecosystem

12V LDO & 3.3V DCDC regulators integrated

6 step & FOC sensorless / sensored algorithms

- VS = 6.6V–45V (A version), I = 600mA driving capability
- 48 MHz, 32k Flash & 4k SRAM
- 12 bit ADC , I2C / UART / SPI
- **FW boot loader support** (A version)
- Fully protected (UVLO, Short-circuit, OCP, OTP)
- 3 Op-Amps & 1 Comparator (A version)
- **Compact design** with 7x7 mm QFN
- Extended temp range: -40 to 125°C

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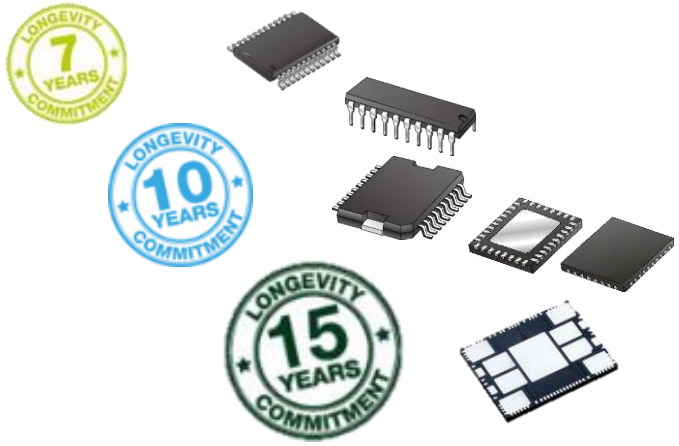
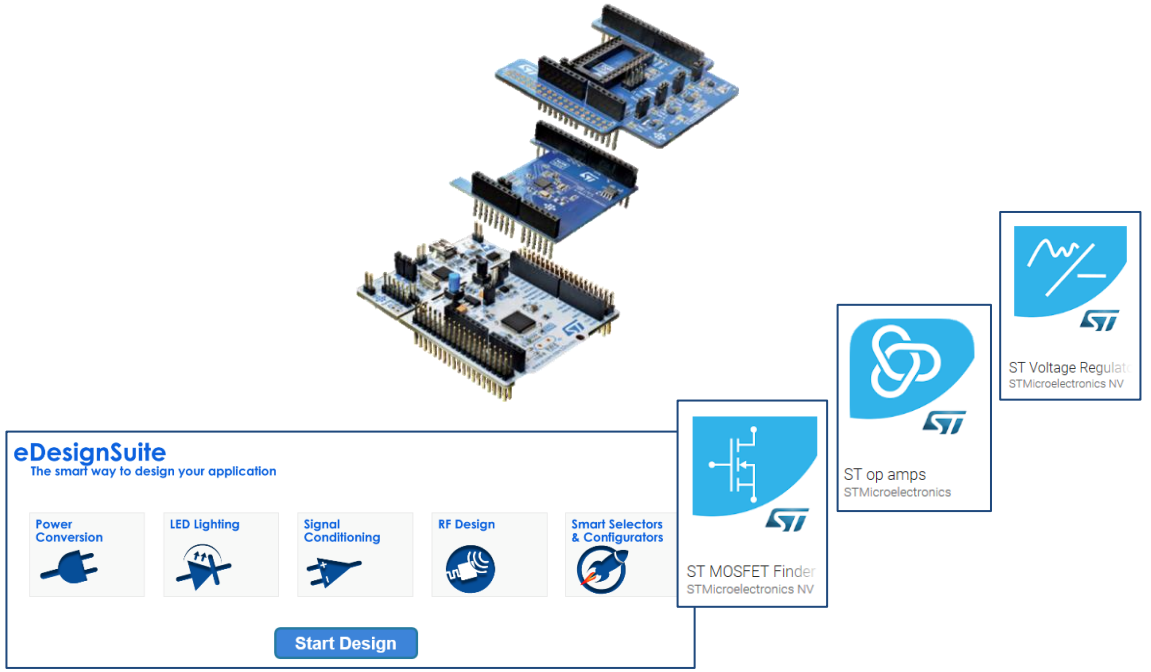
Takeaway: Why Choose ST ?

- Power & Analog silicon solutions to fit each and every motor control application need:
  - Application Specific Products: from basic power stage to latest system in package solutions
  - Power Management, Signal Conditioning, Discrete Mosfets
    - plus ST microcontrollers and sensors for full application coverage
  - ST longevity program across product families





- Enablers Ecosystem:
  - Motor Control X-Nucleo boards (with libraries & GUI)

    http://www.st.com/content/st_com/en/support/learning/stm32-education/stm32-for-motor-control-/hw-board-list.html
  - E-Design studio & product selectors

    http://www.st.com/content/st_com/en/support/resources/edesign.html

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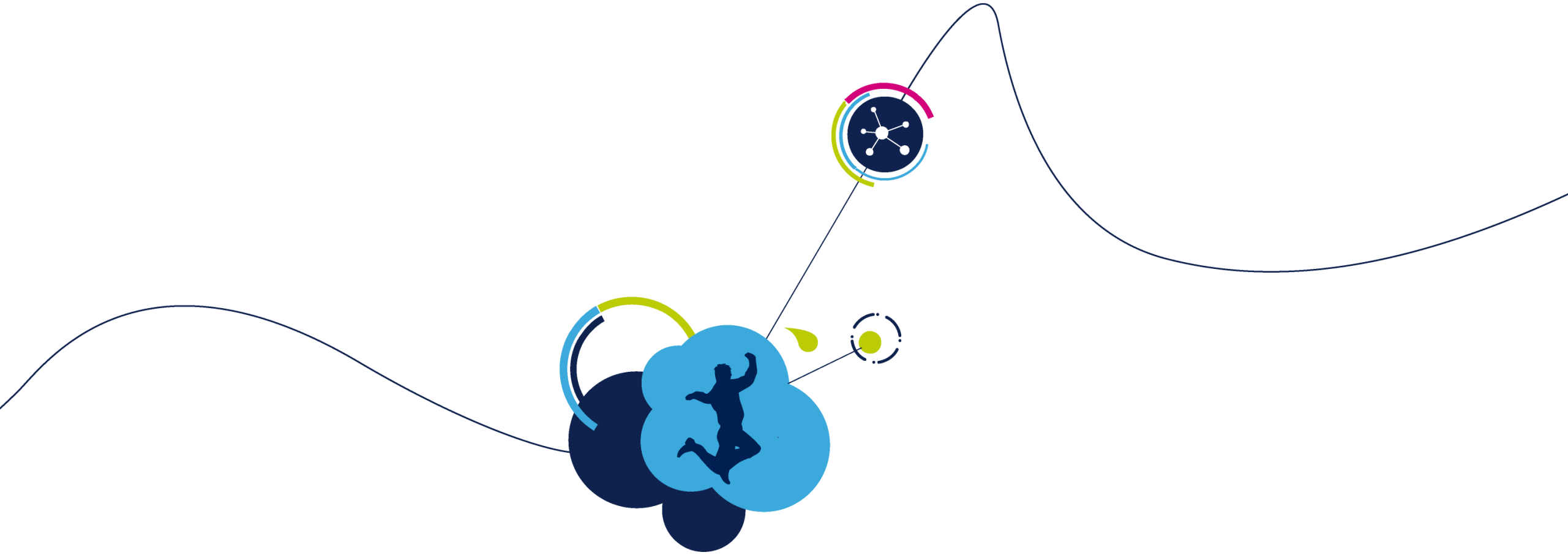

Thank you!

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