ST Driving Innovation in Motion Control

Yolanda Zhang
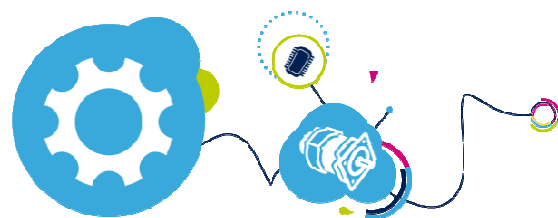
ST Technical Marketing

life.augmented

ST Motion Control Ecosystem
Easy Plug and Spin

- **Industrial Motion Control:**

  - Motion Control Products Portfolio

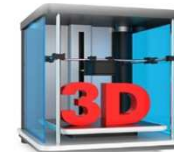 - 3-phase brushless motors

  - Stepper motors

  - Brushed DC motors

ST Motion Control Ecosystem
Easy Plug and Spin

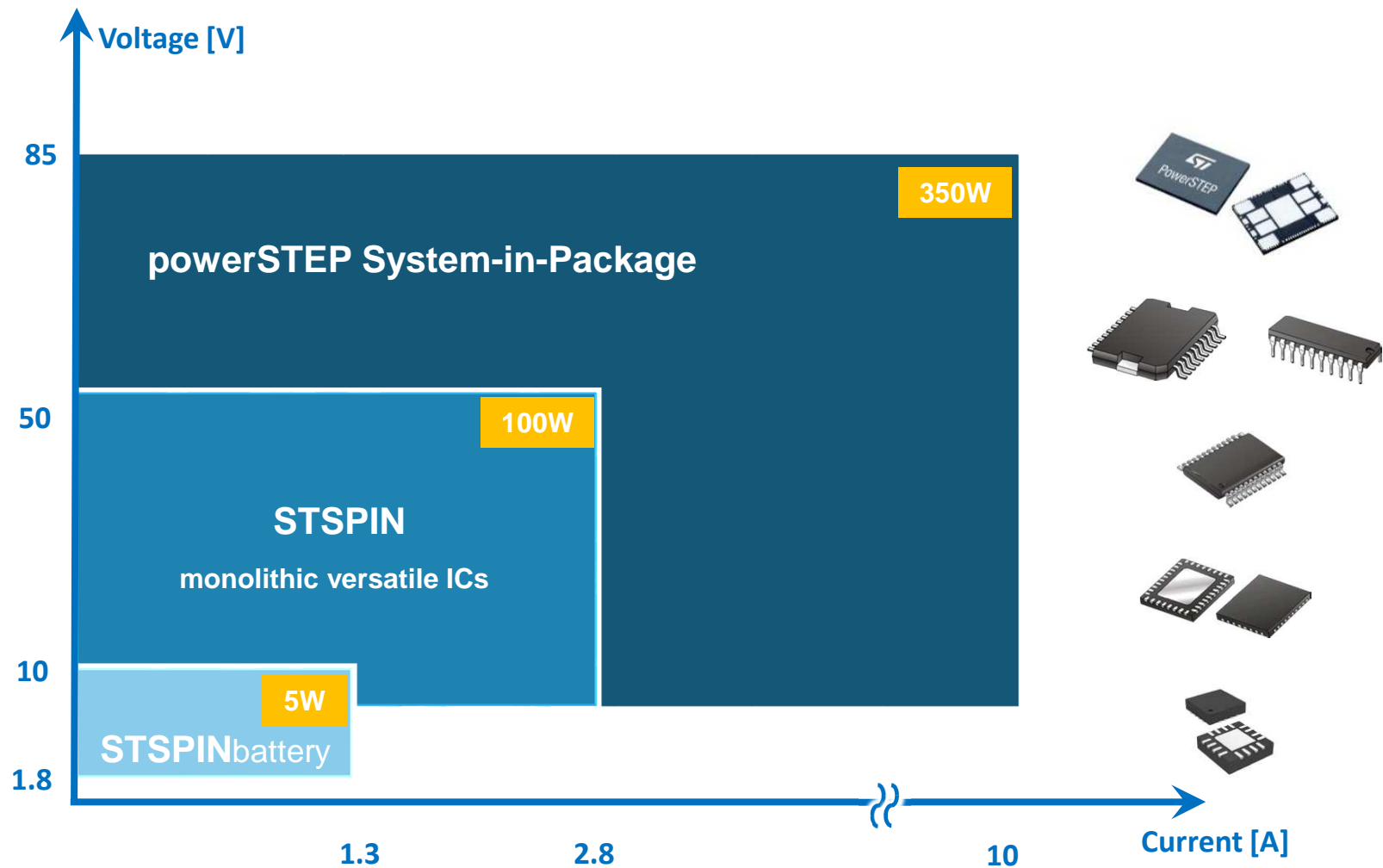| STSPIN	STDRIVE & STPOWER
Stage lighting	Washing machines
Antenna positioning	Dish washers
ATM	MWO
POS	Refrigerators
Textile and sewing machines	Induction heating (IH)
Lawn trimmer	Hand dryers
Industrial paints mixer	Air purifier
Assembly machines	Aircon FANs
Valve control	Vacuum cleaners
Liquid pumps	3ph & linear Compressors
Door lockers	Power drills
Industrial and office printers	Car refrigerator
Scanners	E-scooters & bikes
Industrial and educational robots	Automotive HEV/EV
Kitchen robots	HID for Automotive
3D printers	DC/DC for Automotive
Drones and Aero modeling	Server power
Toys and gaming	UPS
Security cameras	Projector ballast
Camera Lens	Wireless charger
Portable vacuum cleaners	Pool water pump
Massage chairs	Food processors
DNA sequencer	Exhaust host reels
Liquid agitators	Fork lift

STSPIN™ Family Positioning

Monolithic and System-in-Package Motor Drivers

Voltage [V]

85

350W

powerSTEP System-in-Package

50

100W

STSPIN

monolithic versatile ICs

10

5W

STSPINbattery

1.8

1.3   **2.8**   **10**

Current [A]

3-phase Low Voltage Motors

Application typical block diagram

Monolithic Motor Drivers
- **L6229/Q**
- **L623x**
  - L6230/Q, L6234, L6235/Q
- **STSPIN230/STSPIN233 ***
- **STSPIN830 ****

Gate Drivers
- **STSPIN32Fxx**
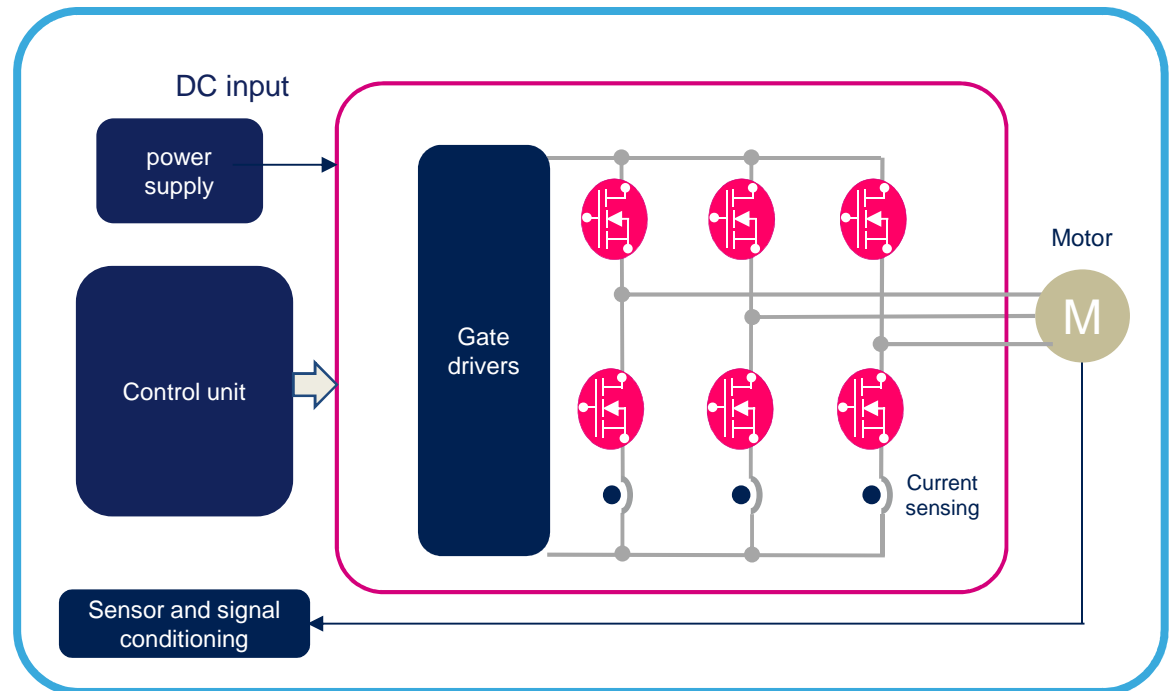- L638x, L639x, L649x, TD35x

Power Management
DCDC converter, LDO, …

Microcontrollers 8-bit / 32-bit
STM32Fx (CORTEX M0, M3,M4), STM8S

Op. Amp. and comparators

Power MOSFETs
- **STripFET VI, VII**
- **DeepGATE (20V-100V)**

DC input

power supply

Control unit

Gate drivers

Motor

M

Current sensing

Sensor and signal conditioning

  * = available in MP in Q2 2017

** = available in MP in Q3 2017

Features

L6230

- Output current: $1.4A_{DC}$ (2.8A peak); $R_{DS(on)}$ 0.7Ω
- **+ Optimized for sensorless FOC**
- **+ 3 independent current senses (6 steps or sinusoidal)**
- + Non-dissipative over-current protection
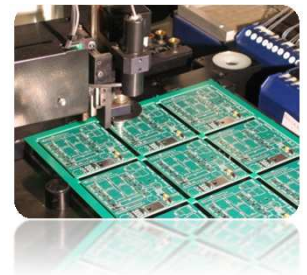- + UVLO
- + QFN package availability (L6230Q)

L6234

- 7–52V DC operating range
- Output current: $2.8A_{DC}$ (5A peak)
- Low $R_{DS(on)}$ Output: 0.3Ω Typ
- Operating freq up to 150KHz
- X-conduction protection & OT shutdown
- **Wide packages offer**

Power Architecture
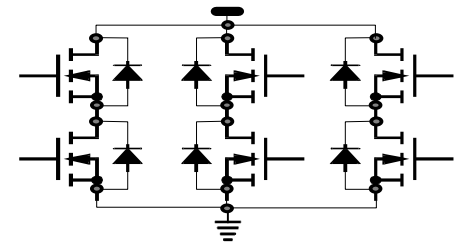
We sell in

L6229 and L6235

- 7–52V DC operating range

- Output current: 1.4A_{DC} (2.8A peak) L6229

  2.8A_{DC} (5.6A peak) L6235

- Low $R_{DS(on)}$ Output: 0.7Ω Typ L6229

  0.3Ω Typ L6235

- Operating frequency up to 100KHz

- **Integrated 6step Hall-sensor (60/120°) decoding logic.**

- **Embedded PWM current control (slow decay + OCP)**

- **Tacho output for easy speed control**

- Non-dissipative over-current protection

- Cross conduction protection

- Integrated Thermal Shutdown

- UVLO

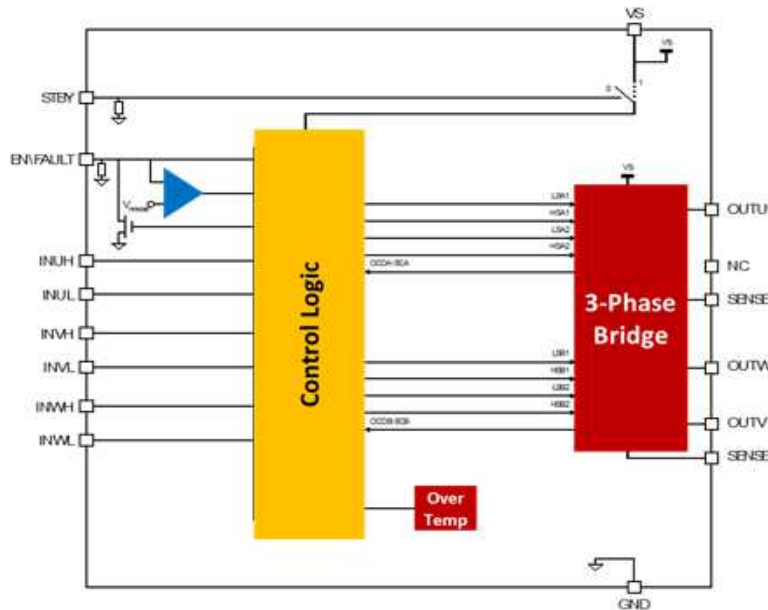- QFN packages availability (L6229Q / L6235Q)

Power Architecture
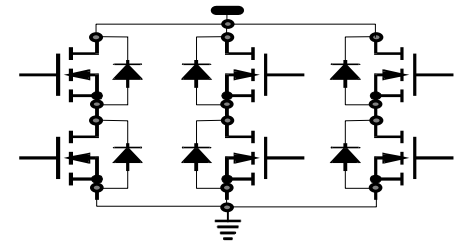
We sell in

STSPIN230

Best for sensorless **battery powered** BLDC

We designed-in

- Supply: 1.8V – 10V
- **3 Half-Bridges:**
    - **$1.3A_{rms}$ (2A peak)**
    - **$R_{DS(ON)} = 0.4\Omega$ (HS+LS)**

- Direct Inputs driving
- **I control with programmable off-time**
- **Extremely low STBY consumption (<150nA)**
- **FW support for 1 shunt FOC**

- Fully protected:
    - Non-dissipative OCP
    - Cross conduction protection
    - Thermal shutdown & UVLO
- **Ultra compact QFN package**

Qual in Q2 2017

Best for sensorless **battery powered** BLDC

- Supply: 1.8V – 10V
- **3 Half-Bridges:**
  - **1.3A$_{rms}$ (2A peak)**
  - **R$_{DS(ON)}$ = 0.4Ω (HS+LS)**

- Direct Inputs driving
- **I control with programmable off-time**
- **Extremely low STBY consumption (<150nA)**
- **FW support for 1 or 3 shunts FOC**

- Fully protected:
  - Non-dissipative OCP
  - Cross conduction protection
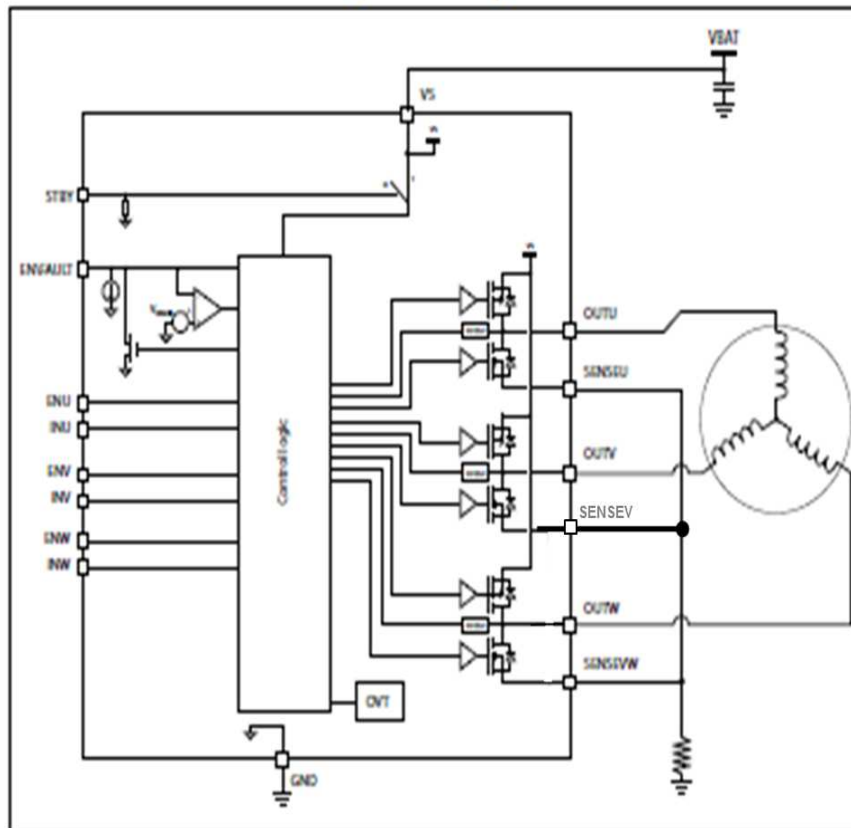 - Thermal shutdown & UVLO
- **Ultra compact QFN package**

STSPIN32F0 – SiP for 3phase BLDC

Breakthrough innovation: integration & flexibility

Main Features

- **STM32F031 MCU**
  - 32 bit ARM M0 Core
  - 48 MHz
  - 32k Flash, 4k SRAM
  - 12 bit ADC
  - I2C / UART / SPI
  - *On the Field FW update ***
- **45V 3 phase Gate Driver**
  - 600 mA
  - Integrated Boot Diodes
  - **12V LDO**
  - **3.3V DC-DC**
  - UVLO, OCP, OTP
  - 4 Op-Amp *
  - 1 Comparator
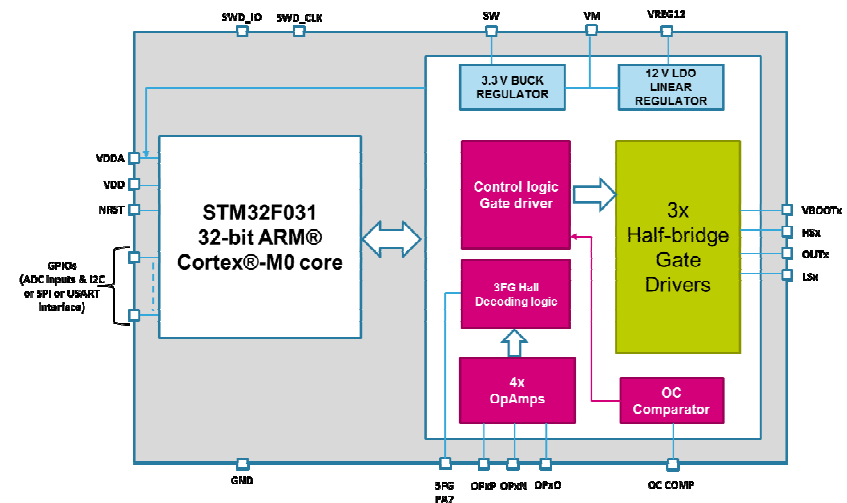- *Field Oriented Control*

* **STSPIN32F0A** in MP in Q1 2017

    3x OpAmps instead of 4

    UVLO @ 6.6V

    FW boot loader available only in STSPIN32F0A

Target Applications

- Drones
- Power Tools
- FAN, Vacuum cleaner
- Home Appliances

STM32F031x6x7 MCU characteristics

Core: ARM® 32-bit Cortex® -M0 CPU, frequency up to 48 MHz

STM32 F0
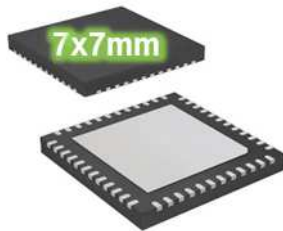
STM32 F0

Cortex-M0
32 bit
48 MHz
1.8 to 3.6V

- Memories: 4kB of SRAM, 32 kB of Flash Memory

- CRC calculation unit

- Up to 15 fast I/Os

- Up to 5 general purpose timers

- 12-bit ADC (up to 9 channels)

- Communication interfaces: I2C, USART, SPI

- Serial Wire Debug (SWD)

- Extended temperature range: -40 to 125°C

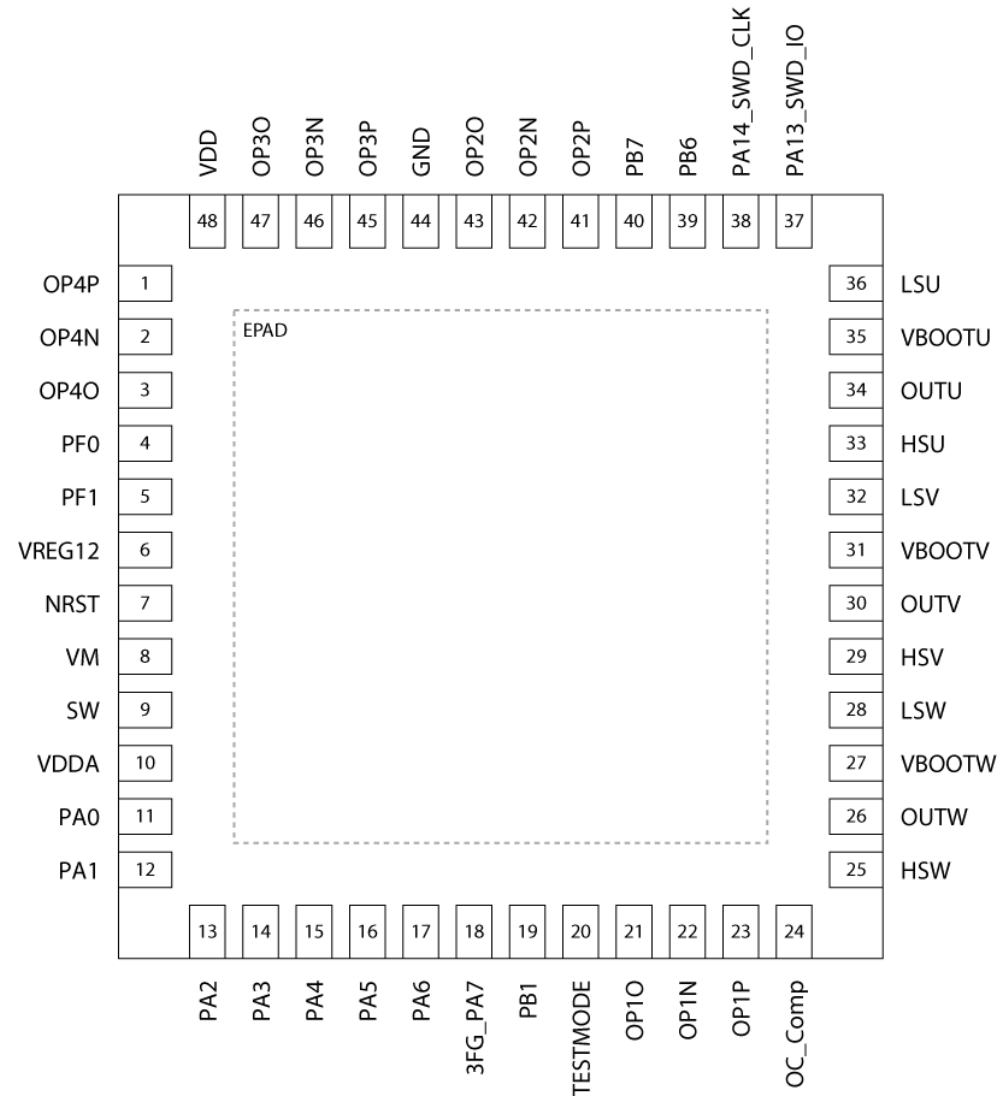**Cortex™**
Low-Power Leadership from ARM

QFN 48
7x7x1.0 48L pitch 0.5

3-phase Motor Drivers Selection Guide

3-phase Motors					
Part Number	**Description**	**Supply Voltage max (V)**	**Output Current RMS max (A)**	$R_{DS(on)}$ **(Ω)**	**Package**	**Key Advantages**
L6229	Three-phase BLDC motor driver with integrated PWM current controller, 6step Hall-sensors decoding logic and fully protected power stage	52	1.4	0.7	PDIP-24.3; PowerSO-36; SO-24; VFQFPN-32 (5x5x1)	• High positioning precision • Reduced pwr dissipation • Optimized PCB BOM • Wide packages offer
L6230	Three-phase BLDC motor driver optimized for sensorless FOC (3 independent sense pins) with integrated a fully protected power stage	52	1.4	0.7	PowerSO-36; VFQFPN-32 (5x5x1)	• Flexibility • System efficiency (optimized for advanced FOC control) • Reduced pwr dissipation • Optimized PCB BOM
L6234	Three-phase BLDC motor driver with fully protected power stage	52	2.8	0.3	PDIP-20; PowerSO-20	• Simple system architecture
L6235	Three-phase BLDC motor driver with integrated PWM current controller, 6step Hall-sensors decoding logic and fully protected power stage.	52	2.8	0.3	PDIP-24.3; PowerSO-36; SO-24; VFQFPN-48 (7x7x1)	• High positioning precision • Reduced pwr dissipation • Optimized PCB BOM • Wide packages offer
STSPIN230	Compact three-phase BLDC motor driver with integrated current controller and fully protected power stage. Suitable for 1 or 2 shunts FOC.	10	1.3	0.2	VFQFPN-16 (3x3x1)	• Very low STBY consumption • Extreme system compactness • Reduced pwr dissipation • System efficiency (optimized for advanced FOC control)
STSPIN233	Smallest three-phase BLDC motor driver with 3 shunts FOC support. Integrates current controller and fully protected power stage.	10	1.3	0.2	VFQFPN-16 (3x3x1)	• Very low STBY consumption • Extreme system compactness • Reduced pwr dissipation • System efficiency (optimized for advanced FOC control)

ST**DRIVE**^{TM} Family Portrait

HIGH VOLTAGE GATE DRIVER — HALF-BRIDGE POWER STAGE
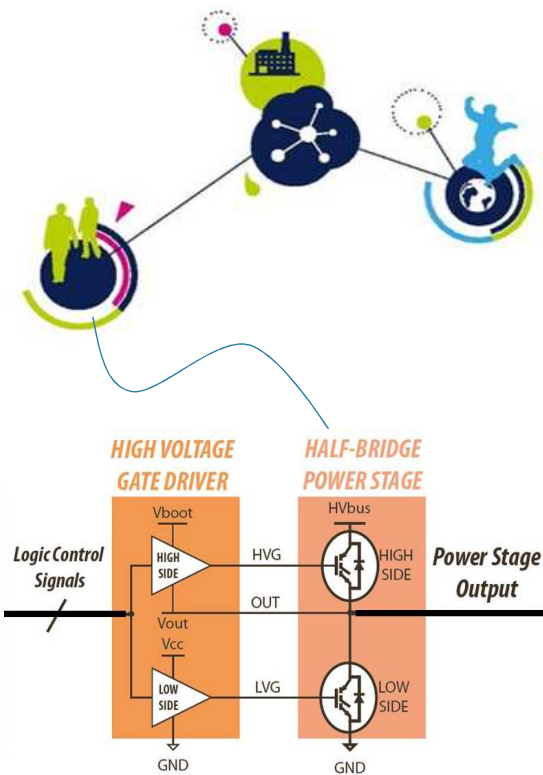
Galvanic Isolated
4kV – 6kV Gate Drivers

ST**DRIVE**$_{gap}$

Low & High Voltage
Gate Drivers

ST**DRIVE**$_{smart}$

Diversified
Products Portfolio

STDRIVE – Product Family and Positioning

Applications

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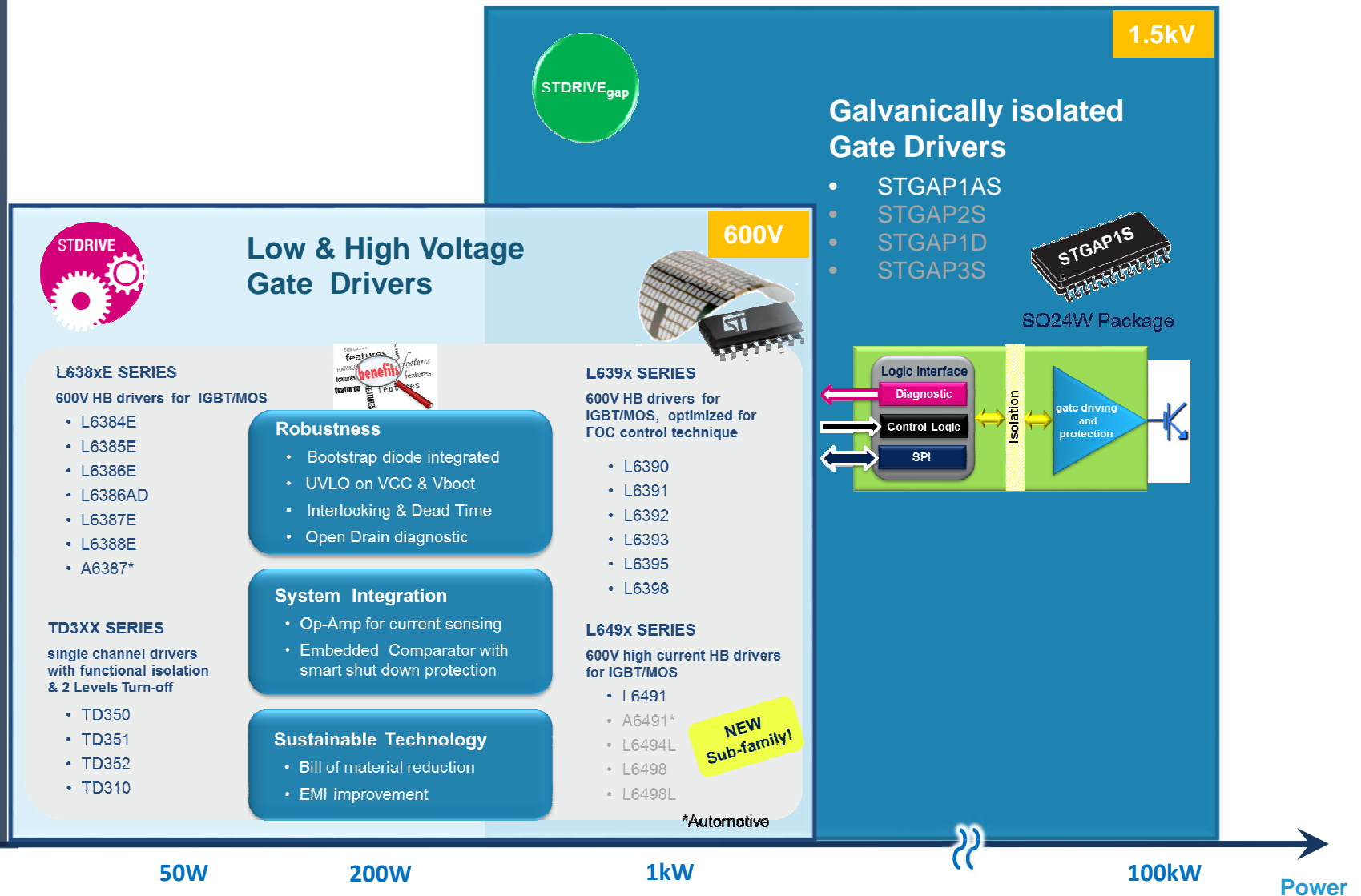- Washing machines
- Compressors
- Dish washers
- HID
- E-bikes
- Server
- UPS
- DC/DC Auto
- Solar
- Factory automation

1.5kV

STDRIVE gap

Galvanically isolated Gate Drivers

- STGAP1AS
- STGAP2S
- STGAP1D
- STGAP3S

STGAP1S

SO24W Package

600V

Low & High Voltage Gate Drivers

L638xE SERIES

600V HB drivers for IGBT/MOS

- L6384E
- L6385E
- L6386E
- L6386AD
- L6387E
- L6388E
- A6387*

TD3XX SERIES

single channel drivers with functional isolation & 2 Levels Turn-off

- TD350
- TD351
- TD352
- TD310

Robustness
- Bootstrap diode integrated
- UVLO on VCC & Vboot
- Interlocking & Dead Time
- Open Drain diagnostic

System Integration
- Op-Amp for current sensing
- Embedded Comparator with smart shut down protection

Sustainable Technology
- Bill of material reduction
- EMI improvement

L639x SERIES

600V HB drivers for IGBT/MOS, optimized for FOC control technique

- L6390
- L6391
- L6392
- L6393
- L6395
- L6398

L649x SERIES

600V high current HB drivers for IGBT/MOS

- L6491
- A6491*
- L6494L
- L6498
- L6498L

NEW Sub-family!

*Automotive

Logic interface

Diagnostic

Control Logic

SPI

Isolation

gate driving and protection

50W   200W   1kW   100kW   **Power**

Features

L6388E
- High & Low Side Inputs (3.3V compatible)
- UVLO on VCC/Vboot
- Interlocking & DT protections

L6387E / A6387
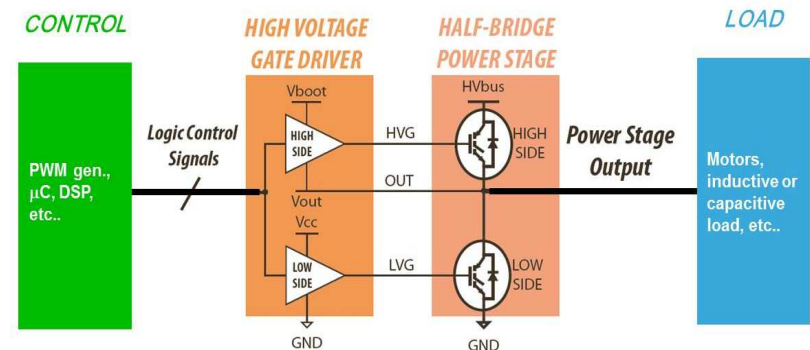- Interlocking
- **AEC-Q100 qualified**

L6386E
+ SD In & Open Drain diagnostic
+ **Embedded uncommitted Comparator**

L6385E
- High & Low Side Inputs
- UVLO on VCC/Vboot
- **Able to drive asymmetrical loads**

L6384E
- **Single In & shutdown input**
- Interlocking & programmable DT,
- UVLO on VCC

- 400mA/650mA driving capability

- Integrated Bootstrap Diode

- Extremely robust and compact

- Comparator & Shut Down features

- Versatile and flexible

- SO-8/14 and DIP packages

L6390
- **Comparator & Op Amp integrated**

L6391
- **Smart SD feature**
- **Comparator integrated**

L6392
+ **OpAmp integrated**

L6393
- **Phase, Brake & Shutdown Inputs**
- **Uncommitted Comparator**
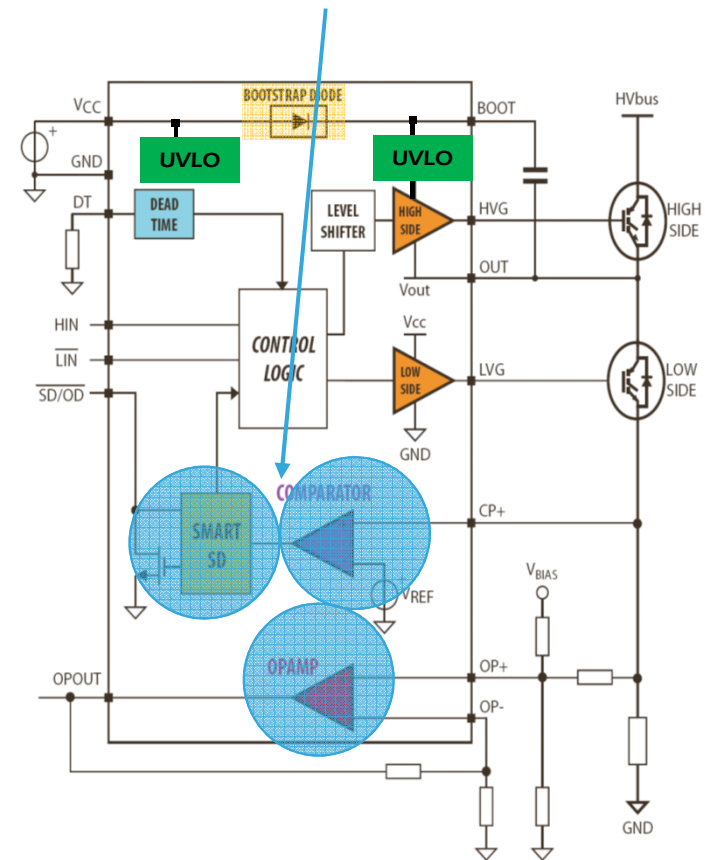- Interlocking & Programmable DT
- UVLO on Vcc / Vboot

L6395
+ Able to drive asymmetrical loads

L6398
- High & Low side Inputs
- Interlocking & DT
- UVLO on Vcc / Vboot

Features

Integrated features optimized for
Field **O**riented **C**ontrol **(F.O.C.)** technique

SmartDRIVE Plus - features

- Supply: 10-20V

- High voltage rail up to 600V

- **Outstanding robustness & below-gnd immunity**

- **Integrated bootstrap diode**

- **Embedded Comparator for fault protections with smart shutdown**

- Ton/toff is 85ns

- Switching frequency is up to 800khz

- 3.3 V, 5 V compatible inputs

- UVLO on Vcc and Vboot

- Interlocking & adjustable deadtime

- Compact and simplified layout

SmartDRIVE Plus - features

- New BCD6-OFFLINE technology and optimized design allowed reaching outstanding ruggedness and immunity to below-ground spikes

- During lab testing of first samples spikes down to 120V below-ground have been measured, with no evidence of any malfunction or failure

STDRIVE: High Current evolution

L6494L
- Half-Bridge driver
- 600V, 2.5A
- p2p replacement for IR21844, FAN7393A
- Single input and SD
- Programmable DT
- Integrated bootstrap diode
- Very High creepage
- SO-14

• **ES available;**

L6498L
- Half-Bridge driver
- 600V, 2.5A
- p2p replacement for IR21814, FAN73933
- Dual input with interlocking
- Integrated bootstrap diode
- Very High creepage
- SO-14
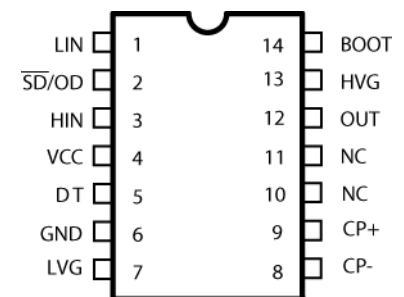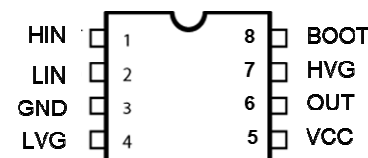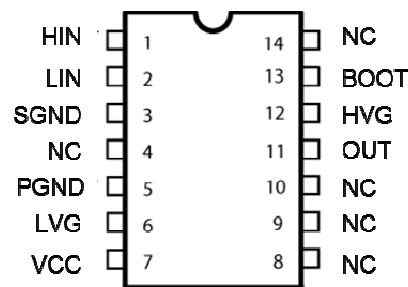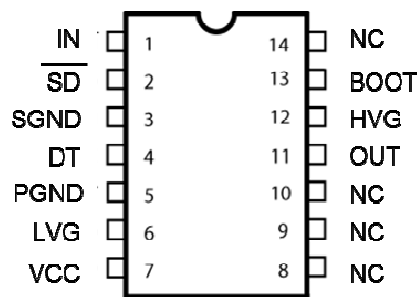
• **ES available**

L6498
- Half-Bridge driver
- 600V, 2.5A
- p2p replacement for IR2181, FAN73901
- Dual input with interlocking
- Integrated bootstrap diode
- SO-8

• **ES available**

L/A6491
- Half-Bridge driver
- AEC-Q100 Automotive
- 600V, 4A
- Dual input and SD
- interlocking
- Programmable DT
- Comparator for fast OCP with smartSD
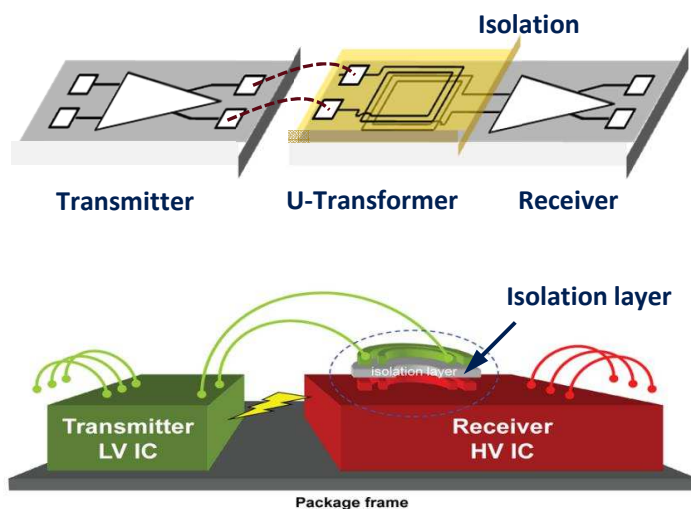- Integrated bootstrap diode
- High creepage
- SO-14

• **ES available**

L6494L pinout (SO-14):
Pin		Pin	
IN	1	14	NC
SD	2	13	BOOT
SGND	3	12	HVG
DT	4	11	OUT
PGND	5	10	NC
LVG	6	9	NC
VCC	7	8	NC

L6498L pinout (SO-14):
Pin		Pin	
HIN	1	14	NC
LIN	2	13	BOOT
SGND	3	12	HVG
NC	4	11	OUT
PGND	5	10	NC
LVG	6	9	NC
VCC	7	8	NC

L6498 pinout (SO-8):
Pin		Pin	
HIN	1	8	BOOT
LIN	2	7	HVG
GND	3	6	OUT
LVG	4	5	VCC

L/A6491 pinout (SO-14):
Pin		Pin	
LIN	1	14	BOOT
SD/OD	2	13	HVG
HIN	3	12	OUT
VCC	4	11	NC
DT	5	10	NC
GND	6	9	CP+
LVG	7	8	CP-

w/o DT: for high switching frequency applications

Isolated Gate Drivers – New STGAP1AS

Galvanic isolated gate driver for IGBT and MOSFET in high demanding applications

Isolation

Transmitter U-Transformer Receiver

Isolation layer

Transmitter LV IC   Receiver HV IC

Package frame

STGAP1S (or "gapDRIVE")

On-chip isolation layer provides galvanic separation between input and control stage

To withstand the highest voltage up to 1500 V for enhanced robustness, noise immunity and design flexibility

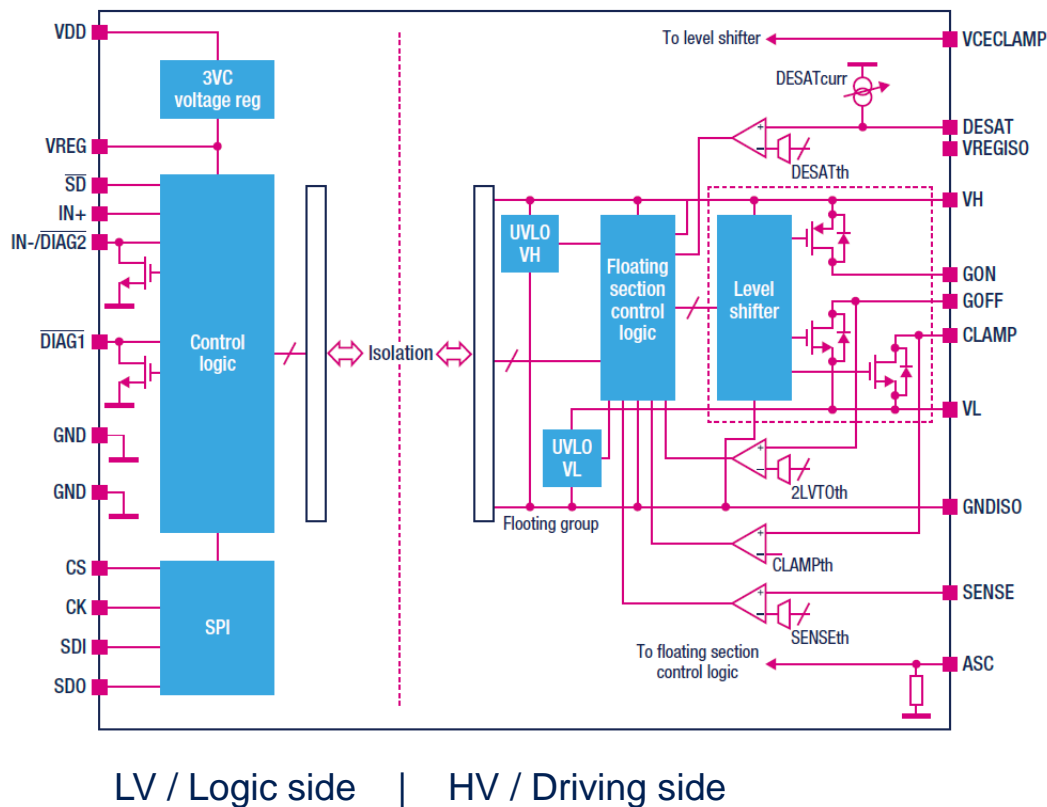Inductive coupling transfers the logic signal across the isolation with strong signal integrity and fast propagation

The SPI communication interface provides a complete and easy configurability as well as full digital diagnostics

LV / Logic side | HV / Driving side

AEC-Q100 qualification
Wide operating range (-40°C -125°C)

SPI Interface
Parameters programming and diagnostics
Daisy chaining possibility

High Voltage Rail up to 1.5KV
Positive drive voltage up to 36V
Negative Gate drive ability (-10V)

Very short propagation delay
In to Out < 150ns (full Temp range)

Fully protected – System safety
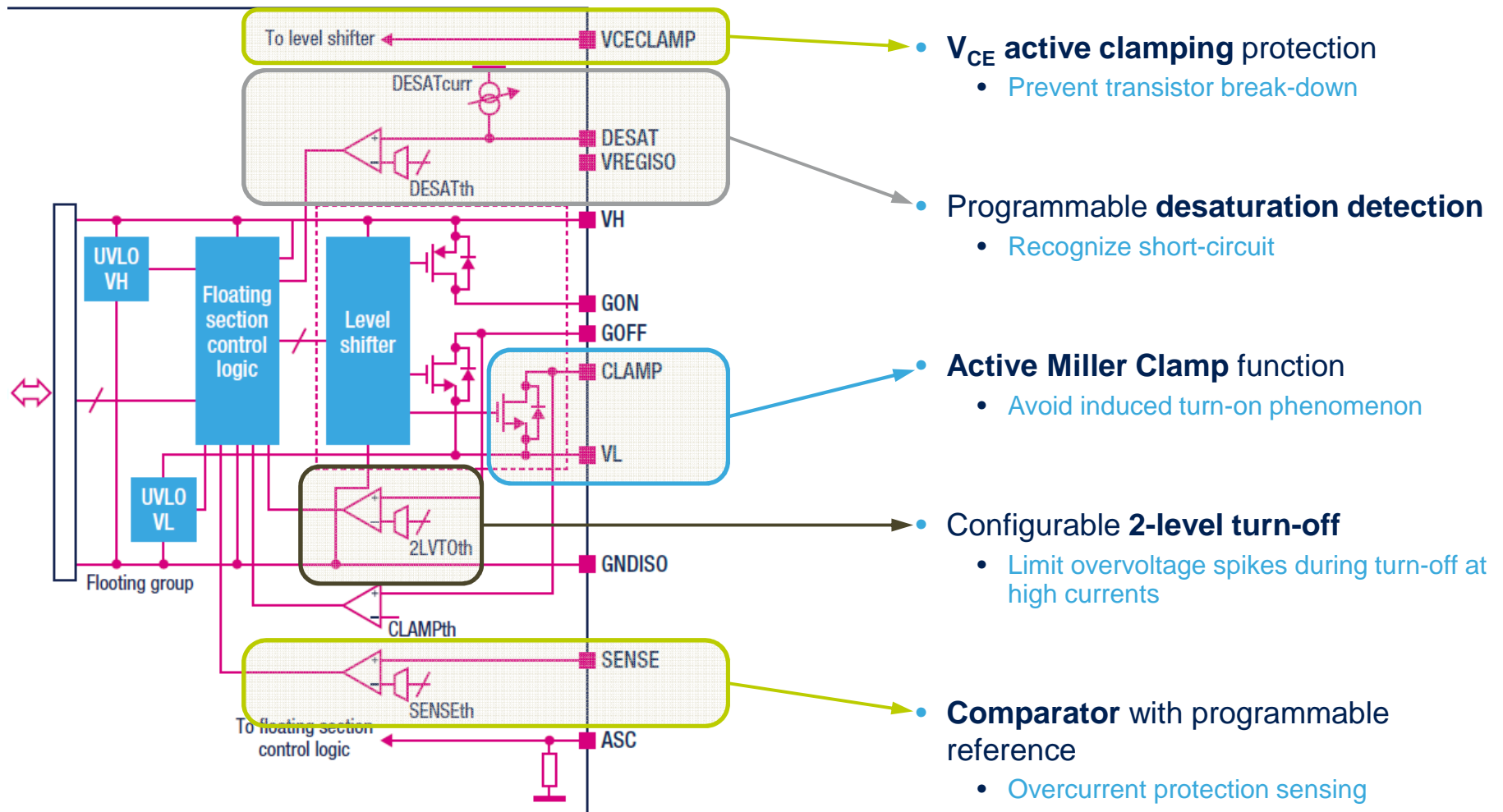UVLO, OVLO, Over-Current,
Thermal Warning and Shut-Down

Advanced protection features
Active Miller & VCE clamping
IGBT Desaturation & Output 2-level turn-off

- **V$_{CE}$ active clamping** protection
  - Prevent transistor break-down

- Programmable **desaturation detection**
  - Recognize short-circuit

- **Active Miller Clamp** function
  - Avoid induced turn-on phenomenon

- Configurable **2-level turn-off**
  - Limit overvoltage spikes during turn-off at high currents

- **Comparator** with programmable reference
  - Overcurrent protection sensing

Embedded features save external components, increasing reliability and ensuring better performances

Industrial Motion Control

Motor type

- 3-phase motors
- **Stepper motors**
- DC Brushed Motors
- Universal motor And AC Load

Applications addressed

- Home appliances (washing machines, Fridge, etc..)
- Industrial (pumps, fans, etc.) Servo drives, Robotics

- Industrial
- Security systems
- Building automation
- Medical and Appliances

- Battery powered application like Power tools and others

- Appliances like washing machines, vacuum cleaners, power tools etc.

Application typical block diagram

Monolithic Motor Drivers

- **L6208/Q, L6228/Q**
- **L6470, L6472, L6474**
- **POWERSTEP01**
- **STSPIN220**
- **STSPIN820 ****

Gate Drivers
- **Half-bridge MOS drivers**
  - L638x (0.65A, 600V)
  - L639x (0.43A, 600V)
  - L6491 (4A, 600V)
- **Dual Full-bridge MOS drivers**
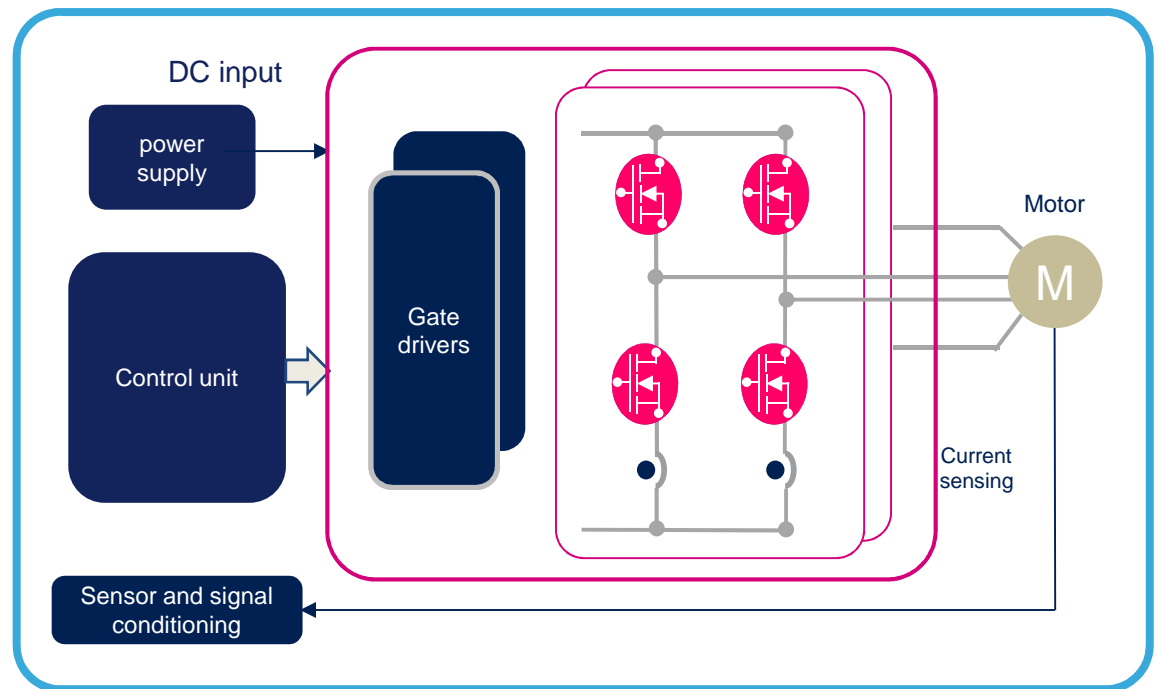 - **L6480, L6482**

**DC-DC converters
Buck regulators**

- **L597x, L798x**
- **ST1S1x**
- **L698x**

Microcontrollers
- **8-bit MCU;**
  - STM8S
- **32-bit MCU**
  - STM32F0/F1/F3

Op. Amp. and comparators

Power MOSFETs
- **STripFET H7, F6, F7**

DC input

power supply

Control unit

Gate drivers

Motor

M

Current sensing

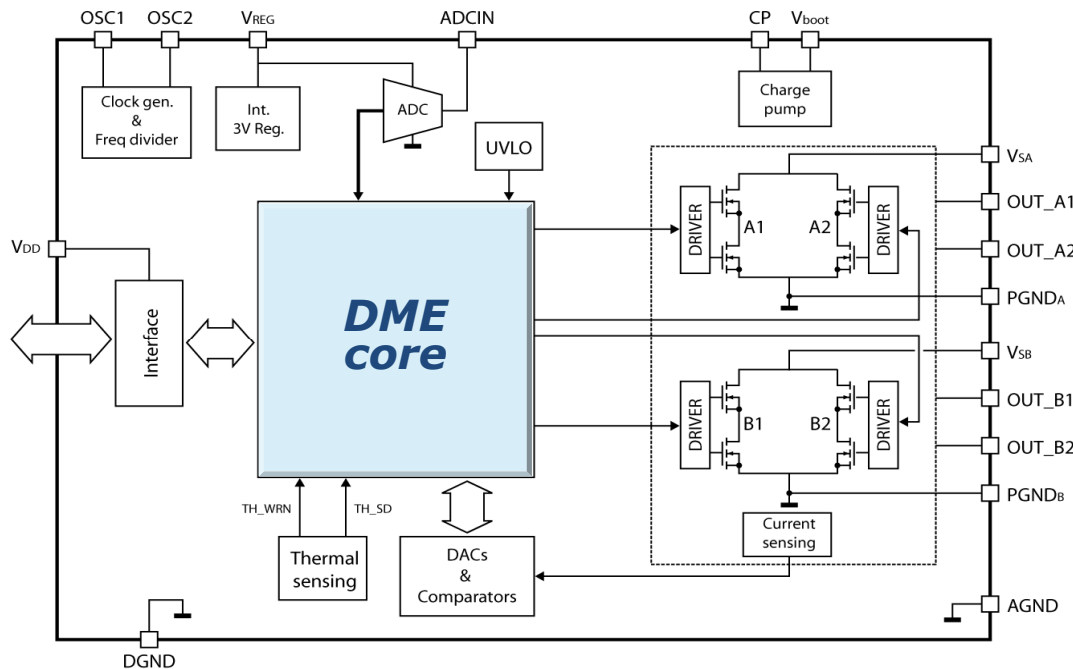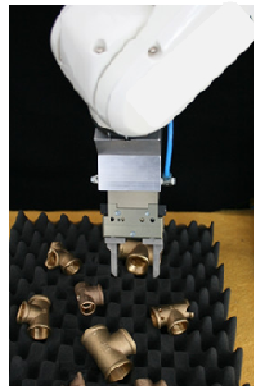Sensor and signal conditioning

** = available in MP in Q3 2017

For unprecedented smoothness and precision

We sell in

- Supply: 8V – 45V
- Power stage
  - $3A_{rms}$ (7A peak), $R_{DS(ON)} = 0.28\Omega$
- Up to 16µsteps
- **Patented Predictive I Control**
  (accurate positioning)
- **Adaptive auto-regulated decay**
  (system stability & low noise guaranteed)
- **Digital Motion Engine**
  - High-level motion commands
  - Programmable speed & positioning
- **Full real-time diagnostics (SPI)**
- Optional clock & dir driving;
- Programmable non-dissipative OCP
 *(reduced dissipation & BOM)*
- Fully protected

Stepper motor smooth & silent motion as a BLDC !

- Supply: 8V – 45V

- Power stage
  - $3A_{rms}$ (7A peak), $R_{DS(ON)} = 0.28\Omega$

- Up to 128 μsteps

- **Advanced Voltage Mode Control**
  (smooth & very silent motion)

- **SPI interface to MCU**
  (programmability & daisy chaining)

- **Digital Motion Engine**
  - High-level motion commands
  - Programmable speed & positioning

- **Full real-time diagnostics (SPI)**

- **Sensorless stall detection**

- Programmable non-dissipative OCP
  (reduced dissipation & BOM)

- Fully protected
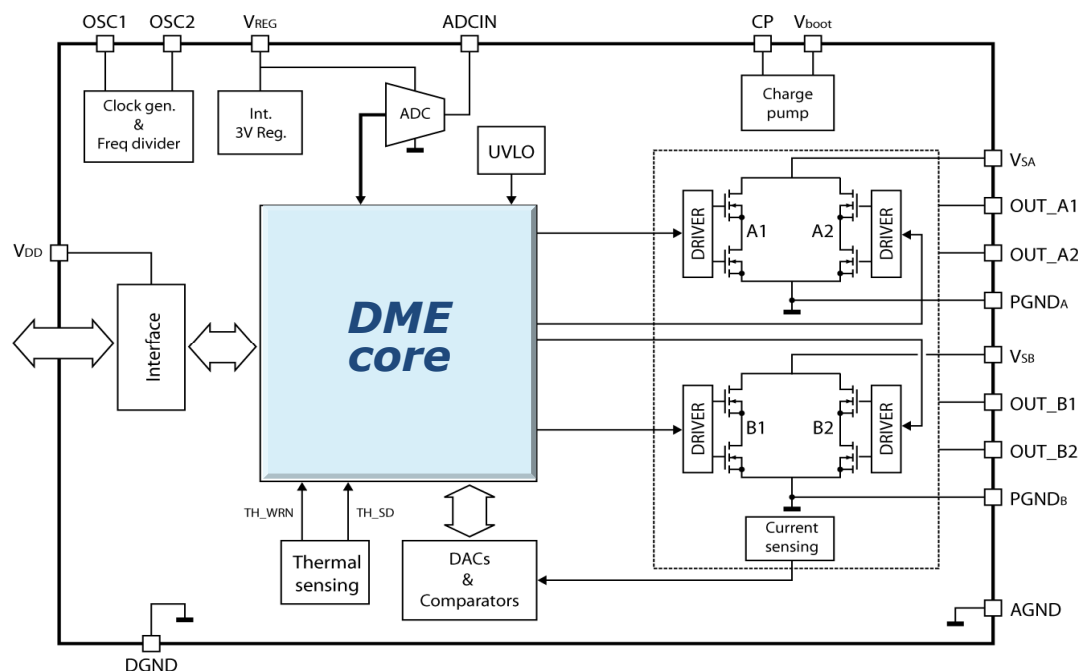
We sell in

ST**SPIN** Voltage Mode

ST patent and KEY differentiator

From current to voltage mode

- Current profile is very smooth
- No compromise on current ripple. No mixed decays
- No tuning of the decays
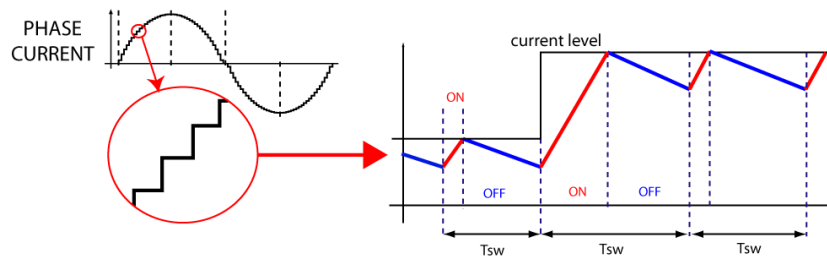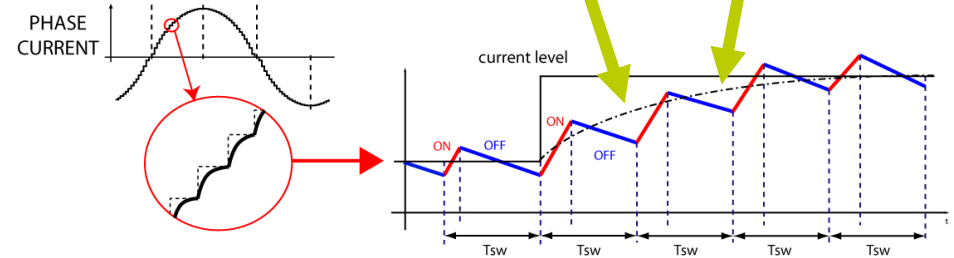- Best decay is always used with each motor

POWERSTEP01

L6472, L6482

Average current is controlled.
Accurate positioning

Smooth current transient reduces mechanical vibrations.
Motor movement is soft and silent!

CURRENT MODE

VOLTAGE MODE

Constant switching frequency
**Torque ripple and EMI are under control.**

For accurate and stable motion

- Supply Voltage: 8V-45V

- Up to 16 µsteps

- Power stage
  - $3A_{rms}$ (7A peak) , $R_{DS(ON)} = 0.28\Omega$

- Step-clock & direction driving

- **Adaptive auto-regulated decay**
  (system stability and low noise guaranteed)

- **Integrated current sensing**
  (reduced Pwr dissipation and PCB BOM)

- **Detailed digital diagnostics embedded**

- **Fully protected**
  - Over Current, Over Temperature, UVLO

- **SPI Interface to MCU**
  (programmability & daisy chaining)
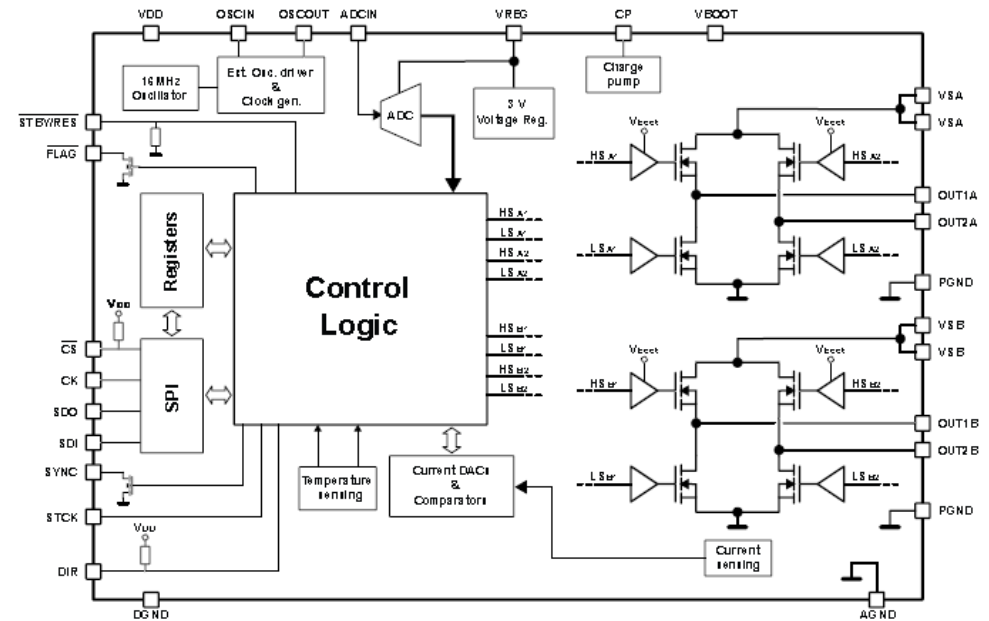
We sell in
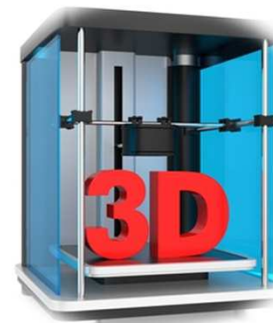
STSPIN General Purpose Stepper Drivers

L6208/Q and L6228/Q

- 7–52V DC operating range
- Output current: $2.8A_{DC}$ (5.6A peak) L6208
  $1.4A_{DC}$ (2.8A peak) L6228
- Low $R_{DS(on)}$ Output: 0.3Ω typ L6208
  0.7Ω typ L6228
- **Embedded stepping sequence generator**
- **Twin integrated PWM current control**
- Operating freq up to 100KHz
- Prog non-dissipative OCP
- Cross conduction protection
- Thermal Shutdown & UVLO
- Diagnostic Out
- **Wide packages offer**
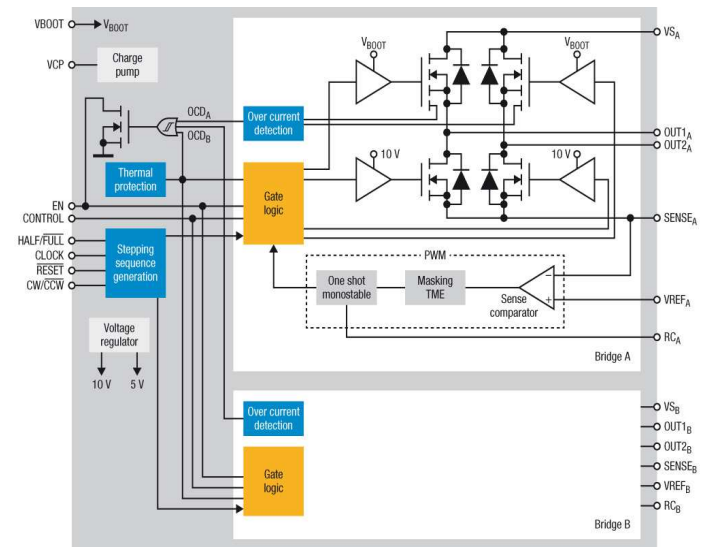
POWERSTEP01

Stands for power and accuracy
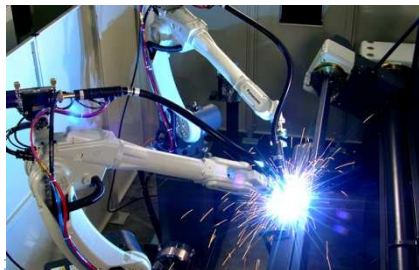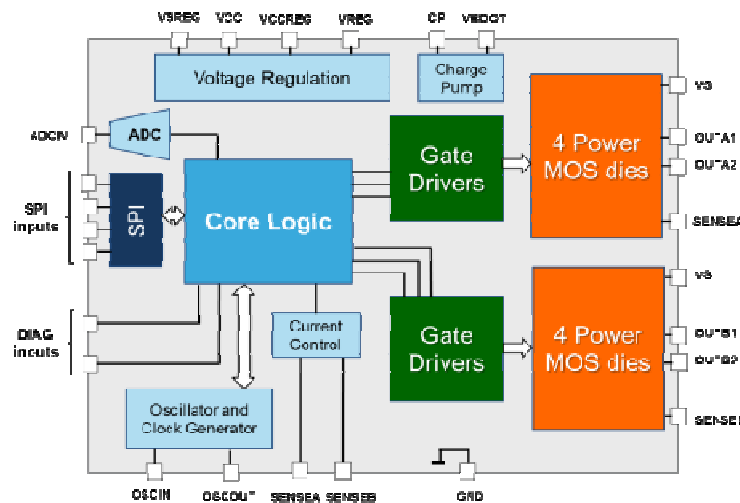
- Supply: 8V – 85V
- **Dual full-bridge (8 discrete MOSFETs):**
  - **$10A_{rms}$ & $R_{DS(ON)} = 16m\Omega$**
- Up to 128 µsteps
- **Programmable to work in:**
  - Voltage mode control
  - Predictive I control + adaptive decay
- **SPI Interface:**
  - Programmable features (OCP, etc.)
  - Full real-time diagnostics
- **Digital Motion Engine**
  - High-level motion commands
  - Programmable speed profile & positioning
- Sensorless stall detection
- **Thermally efficient QFN package**

Best for **battery powered** microstepping

We designed-in

- **Supply: 1.8V – 10V**
- **Dual Full-bridge:**
  - **1.3A$_{rms}$ (2A peak)**
  - **R$_{DS(ON)}$ = 0.4Ω (HS+LS)**

- Step-clock / direction Inputs
- **Up to 256 microsteps resolution**
- **PWM I control with programmable off-time**
- **Extremely low STBY consumption (<150nA)**

- Fully protected:
  - Non-dissipative OCP
  - Cross conduction protection
  - Thermal shutdown & UVLO
- **Ultra compact QFN package**

	Stepper Motors					
Part Number	**Description**	**Supply Voltage max (V)**	**Output Current RMS max (A)**	**$R_{DS(on)}$ (Ω)**	**Package**	***Key Advantages***
L6208	Stepper motor driver with integrated PWM current controller, stepping sequence generator and fully protected power stage	52	2.8	0.3	PDIP-24.3; PowerSO-36; SO-24; VFQFPN-48 (7x7x1)	*• Easy interface/control* *• Reduced pwr dissipation* *• BOM optimization*
L6228	Stepper motor driver with integrated PWM current controller, stepping sequence generator and fully protected power stage	52	1.4	0.7	PDIP-24.3; PowerSO-36; SO-24; VFQFPN-48 (7x7x1)	*• Easy interface/control* *• Reduced pwr dissipation* *• BOM optimization*
L6470	Fully integrated microstepping (128) motor driver with Digital Motion Engine, SPI interface, ***advanced Voltage Mode control*** and fully protected power stage	45	3	0.28	PowerSO-36; SO-28	*• End-system simplification* *• Silent and smooth motion* *• Sensor less stall detection* *• Diagnostics, daisy chaining*
L6472	Fully integrated microstepping (16) motor driver with Digital Motion Engine, SPI interface, ***advanced Predictive Current control with Adaptive Decay*** and fully protected power stage	45	3	0.28	PowerSO-36; SO-28	*• End-system simplification* *• Very accurate positioning* *• System stability* *• Diagnostics, daisy chaining*
L6474	Integrated microstepping (16) motor driver with SPI interface, digital diagnostics, ***advanced Adaptive Decay*** and fully protected power stage	45	3	0.28	PowerSO-36; SO-28	*• Easy interface/control* *• Reduced pwr dissipation* *• Optimized PCB BOM* *• Diagnostics, daisy chaining*
L6480	Fully integrated microstepping (128) controller with Digital Motion Engine, SPI interface, ***advanced Voltage Mode control***	85	---	---	SO-38	*• End-system simplification* *• Silent and smooth motion* *• Sensor less stall detection*
L6482	Fully integrated microstepping (16) controller with Digital Motion Engine, SPI interface, ***advanced Predictive Current control with Adaptive Decay***	85	---	---	SO-38	*• End-system simplification* *• Very accurate positioning* *• System stability*
POWERSTEP01	***System-in-Package*** integrating advanced microstepping (128) controller and 8 pwr MOSFTEs Features Digital Motion Engine, SPI interface, ***advanced Voltage Mode or Predictive Current control with Adaptive Decay***	85	10	0.016	VFQFPN 11x14x1	*• Very high power in QFN* *• Programmability* *• Flexibility (V & I modes control)* *• Extreme smoothness for high power motors*
STSPIN220	Compact microstepping (256) motor driver with integrated PWM current controller, step/clk dir interface and fully protected power stage	10	1.3	0.2	VFQFPN-16 (3x3x1)	*• Very low STBY consumption* *• Extreme system compactness* *• High precision (256µsteps)*

Industrial Motion Control

Motor type

3-phase motors
Stepper motors
DC Brushed Motors
Universal motor And AC Load

Applications addressed

- Home appliances (washing machines, Fridge, etc..)
- Industrial (pumps, fans, etc.) Servo drives, Robotics

- Industrial
- Security systems
- Building automation
- Medical and Appliances

- Battery powered application like Power tools and others

- Appliances like washing machines, vacuum cleaners, power tools etc.

Features

L6207/L6227:

+ Twin integrated PWM current control

L6206/L6226

+ Settable non-dissipative over-current protection

+ QFN package availability (L6206Q/L6226Q)

L6205/L6225

- 7–52V DC operating range
- Output current: $2.8A_{DC}$ ($R_{DS(on)}$ 0.3Ω) L620x
  $1.4A_{DC}$ ($R_{DS(on)}$ 0.7Ω) L622x
- Operating freq up to 100KHz
- **Parallel Outputs for higher I & lower $R_{DS(on)}$**
- X-conduction protection and OT shutdown
- Non-dissipative OCP; Diagnostic Out
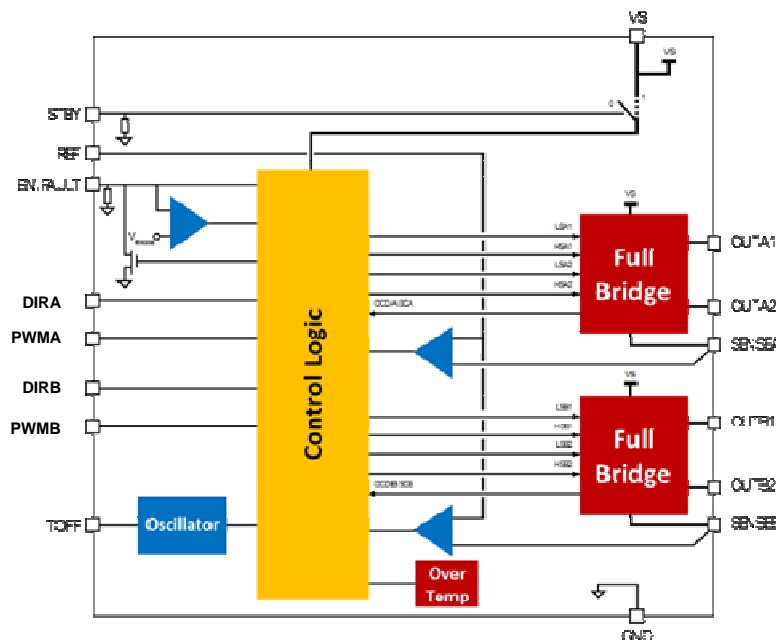- **Wide package offer**
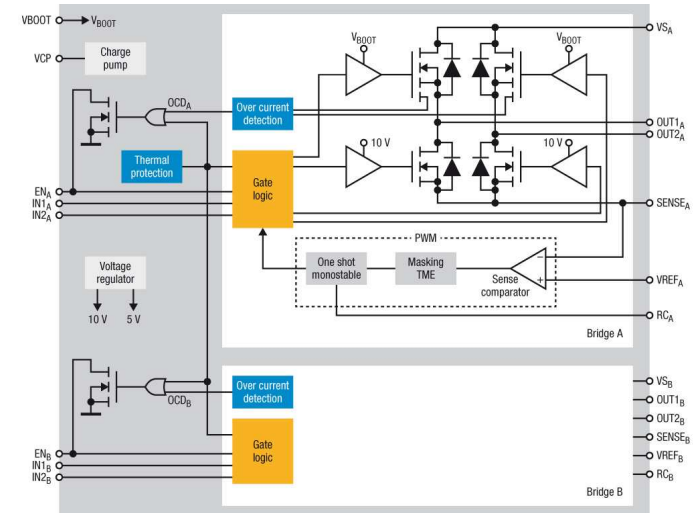
Best for **battery powered** DC Motors
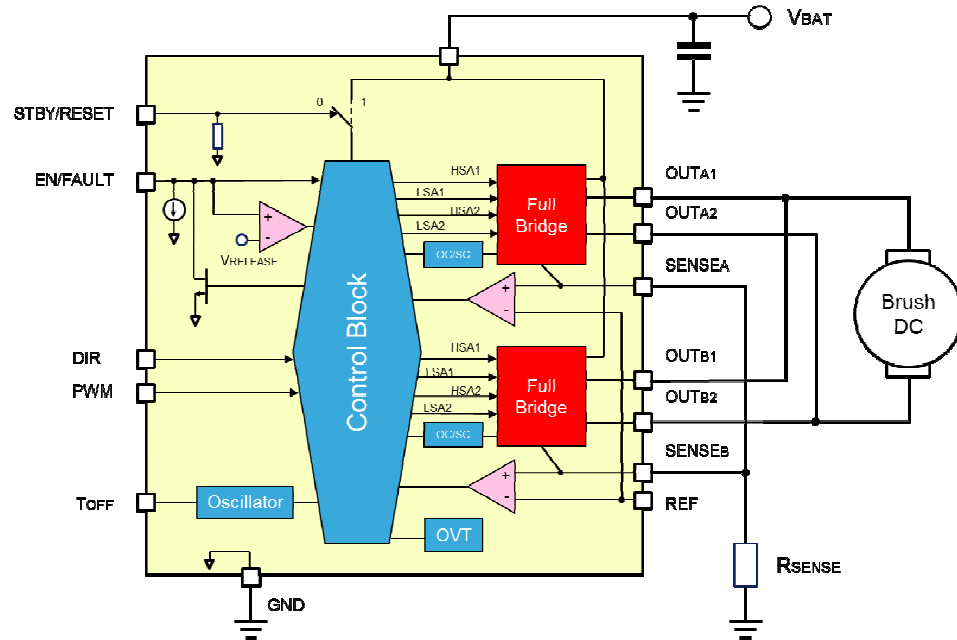

We designed-in

- **Supply: 1.8V – 10V**
- **Dual Full-bridge:**
  - **1.3A$_{rms}$ (2A peak)**
  - **R$_{DS(ON)}$ = 0.4Ω (HS+LS)**

- Direct PWM Inputs driving
- **I control with programmable off-time**
- **Extremely low STBY consumption (<150nA)**

- Fully protected:
  - Non-dissipative OCP
  - Cross conduction protection
  - Thermal shutdown & UVLO
- **Ultra compact QFN package**

STSPIN250

Best for **battery powered** DC Motors

We designed-in

- **Supply: 1.8V – 10V**
- **Single Full-bridge (more I @ lower R_{DSON}):**
  - **2.6A$_{rms}$ (4A peak)**
  - **$R_{DS(ON)}$ = 0.2Ω (HS+LS)**
- Direct PWM Inputs driving
- **I control with programmable off-time**
- **Extremely low STBY consumption (<150nA)**
- Fully protected:
  - Non-dissipative OCP
  - Cross conduction protection
  - Thermal shutdown & UVLO
- **Ultra compact QFN package**

Brush DC Motor Drivers Selection Guide

|		Brushed DC Motors				
Part Number	**Description**	**Supply Voltage max (V)**	**Output Current RMS max (A)**	**$R_{DS(on)}$ (Ω)**	**Package**	***Key Advantages***
L6205	Dual DC motor driver with non-dissipative OCP and fully protected power stage	52	2.8	0.3	PDIP-20.3; PowerSO-20; SO-20;	• *Simple system architecture* • *Reduced pwr dissipation*
L6206	Dual DC motor driver with programmable non-dissipative OCP and fully protected power stage	52	2.8	0.3	PDIP-24.3; PowerSO-36; SO-24; VFQFPN-48 (7x7x1)	• *Versatility (parallelable outputs, programmable OCP)* • *Reduced pwr dissipation*
L6207	Dual DC motor driver with integrated PWM current control, programmable non-dissipative OCP and fully protected power stage	52	2.8	0.3	PDIP-24.3; PowerSO-36; SO-24; VFQFPN-48 (7x7x1)	• *Versatility (parallelable outputs, programmable OCP)* • *Reduced pwr dissipation* • *BOM optimization*
L6225	Dual DC motor driver with non-dissipative OCP and fully protected power stage	52	1.4	0.7	PDIP-20.3; PowerSO-20; SO-20;	• *Simple system architecture* • *Reduced pwr dissipation*
L6226	Dual DC motor driver with programmable non-dissipative OCP and fully protected power stage	52	1.4	0.7	PDIP-24.3; PowerSO-36; SO-24; VFQFPN-32 (5x5x1)	• *Versatility (parallelable outputs, programmable OCP)* • *Reduced pwr dissipation*
L6227	Dual DC motor driver with integrated PWM current control, programmable non-dissipative OCP and fully protected power stage	52	1.4	0.7	PDIP-24.3; PowerSO-36; SO-24; VFQFPN-32 (5x5x1)	• *Versatility (parallelable outputs, programmable OCP)* • *Reduced pwr dissipation* • *BOM optimization*
STSPIN240	Compact dual DC motor driver with integrated PWM current controller, direct PWM driving signals and fully protected power stages	10	1.3	0.2	VFQFPN-16 (3x3x1)	• *Very low STBY consumption* • *Extreme system compactness* • *Versatility and easy interfacing*
STSPIN250	Compact single DC motor driver with integrated PWM current controller, direct PWM driving signal and fully protected power stage	10	2,6	0.1	VFQFPN-16 (3x3x1)	• *Very low STBY consumption* • *Extreme system compactness* • *Versatility and easy interfacing*

In development

STSPIN-L Platform – Preview
Same fit-form and performance for Stepper, DC and BLDC Motors

- Stepper, Brush-DC & 3-Phase Motors

- QFN 4x4 (devices with same fit-form)

- Proprietary state-of-the-art 180nm BCD process

- Main Features:

  - $V_S = 45V$, Output I = $1.5A_{RMS}$ (2.5A peak)

  - Low-power consumption and stand-by mode

  - State-of-the-art precision; up to 256 usteps Current Control with Programmable Off-Time

  - Direct driving

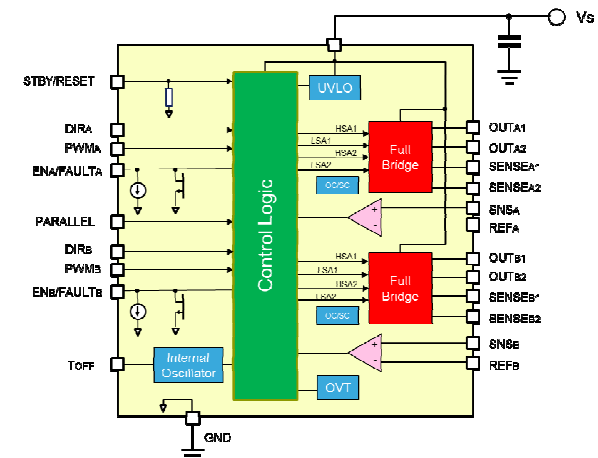 - 1 or 3 shunts FOC support
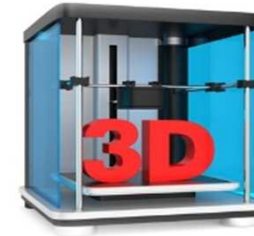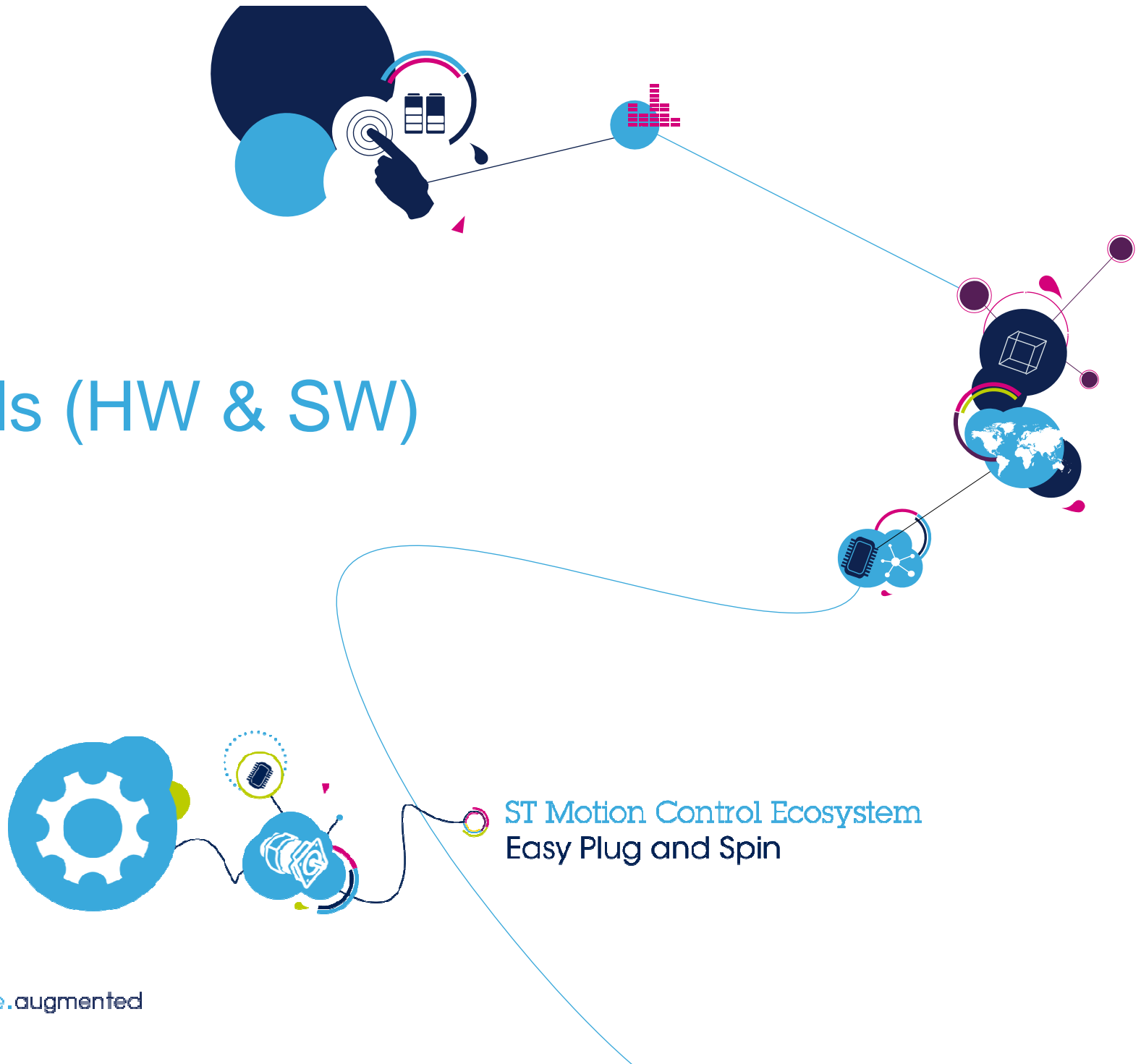
STSPIN820
Stepper

STSPIN830
3phase BLDC

STSPIN840
Dual DC

Tools (HW & SW)

ST Motion Control Ecosystem
Easy Plug and Spin

life.augmented

ST**SPIN** – Evaluation Tools

Order code	Description	Core product
X-NUCLEO-IHM01A1	Stepper motor driver expansion board for STM32 **Nucleo**	L6474H/PD
X-NUCLEO-IHM02A1	Two axes stepper motor driver expansion board based on L6470 for STM32 **Nucleo**	L6470H
X-NUCLEO-IHM03A1	POWERSTEP01 System-in-Package motor driver expansion board for STM32 **Nucleo**	POWERSTEP01
X-NUCLEO-IHM04A1	Dual full-bridge motor driver expansion board based on L6206 for STM32 **Nucleo**	L6206PD
X-NUCLEO-IHM05A1	Dual full-bridge stepper motor driver expansion board based on L6208 for STM32 **Nucleo**	L6208PD
X-NUCLEO-IHM06A1	Low voltage microstepping motor driver expansion board based on STSPIN220 in QFN 3x3 package for STM32 **Nucleo**	STSPIN220
X-NUCLEO-IHM07A1	3-phase motor driver expansion board based on L6230 for STM32 **Nucleo**	L6230PD
X-NUCLEO-IHM09M1	MC Connector adapter expansion board for STM32 **Nucleo**	
X-NUCLEO-IHM11M1	Low voltage 3-phase BLDC motor driver expansion board based on STSPIN230 in QFN 3x3 package for STM32 **Nucleo**	STSPIN230
X-NUCLEO-IHM12A1	Low voltage dual DC motor driver expansion board based on STSPIN240 in QFN 3x3 package for STM32 **Nucleo**	STSPIN240
X-NUCLEO-IHM13A1	Low voltage single DC motor driver expansion board based on STSPIN250 in QFN 3x3 package for STM32 **Nucleo**	STSPIN250
EVLPOWERSTEP01	System-in-package integrating **microstepping** controller and 10 A power MOSFETs; evaluation board	POWERSTEP01

Order code	Description	Core product
EVAL6470H	Fully integrated **microstepping** motor driver based on L6470 evaluation board	L6470H
EVAL6470H-DISC	Discovery kit: development tool to easily explore L6470 **microstepping** motor driver	L6470H
STEVAL-IKM001V1	Evaluation kit based on the L6470H	L6470H
EVAL6470PD	Fully integrated **microstepping** motor driver based on L6470 in PowerSO package; evaluation board	L6470PD
EVAL6472H	Fully integrated **microstepping** motor driver based on L6472; evaluation board	L6472H
EVAL6472H-DISC	Discovery kit: development tool to easily explore L6472 **microstepping** motor driver	L6472H
EVAL6472PD	Fully integrated **microstepping** motor driver based on L6472 in PowerSO package; evaluation board	L6472PD
EVAL6474H	**Microstepping** motor driver based on L6474 (current control and adaptive decay) ; evaluation board	L6474H
EVAL6474PD	**Microstepping** motor driver based on L6474 in PowerSO package; evaluation board	L6474PD
EVAL6480H	Fully integrated **microstepping** motor controller with Digital Motion Engine, SPI and voltage mode control; evaluation board	L6480H
EVAL6480H-DISC	Discovery kit: development tool to easily explore L6480 **microstepping controller**	L6480H
EVAL6482H	Fully integrated **microstepping controller** with Digital Motion Engine, SPI, predictive current control and adaptive decay; evaluation board	L6482H
EVAL6482H-DSIC	Discovery kit: development tool to easily explore L6482 **microstepping controller**	L6482H
EVAL6206PD	**Dual full-bridge** motor driver in high power PowerSO package (programmable overcurrent); evaluation board	L6206PD
EVAL6206Q	**Dual full-bridge** motor driver in QFN package (programmable overcurrent); evaluation board	L6206Q
EVAL6207N	**Dual full-bridge** motor driver in PowerDIP package (embedded PWM current control); evaluation board	L6207N
EVAL6207Q	**Dual full-bridge** motor driver in QFN package (embedded PWM current control); evaluation board	L6207Q
EVAL6208N	**Dual full-bridge** motor driver in PowerDIP package (embedded stepping sequence generator); evaluation board	L6208N
EVAL6208PD	**Dual full-bridge** stepper driver in high power PowerSO package (embedded stepping sequence generator); evaluation board	L6208PD
EVAL6208Q	**Dual full-bridge** stepper driver in QFN package (embedded stepping sequence generator); evaluation board	L6208Q

STSPIN – Evaluation Tools

Order code	Description	Core product
P-NUCLEO-IHM01	STM32 Nucleo Pack FOC and 6-step control for Low voltage 3-ph motors	L6230PD
EVAL6229PD	**3-Phase Brushless DC** motor driver in high power PowerSO package (6step Hall-sensors decoding logic); evaluation board	L6229PD
EVAL6229QR	**3-Phase Brushless DC** motor driver in QFN package (6step Hall-sensors decoding logic); evaluation board	L6229Q
EVAL6230QR	**3-Phase Brushless DC** motor driver in QFN package (sensorless FOC & 3 independent sense pins); evaluation board	L6230Q
EVAL6235N	**3-Phase Brushless DC** high current motor driver in DIP package (6step Hall-sensors decoding logic); evaluation board	L6235N
EVAL6235PD	**3-Phase Brushless DC** high current motor driver in PowerSO package (6step Hall-sensors decoding logic); evaluation board	L6235PD
EVAL6235Q	**3-Phase Brushless DC** high current motor driver in QFN package (6step Hall-sensors decoding logic); evaluation board	L6235Q

P-NUCLEO-IHM001

L6230 for 3-phase BLDC

X-NUCLEO-IHM03A1

POWERSTEP01 SiP

X-NUCLEO-IHM04A1

L6206PD for Brushed DC

X-NUCLEO-IHM06A1

STSPIN220 for LV microstepping

STSPIN for 3D Printers

Diversified strategy to serve fragmented and rapid evolving 3D printers market

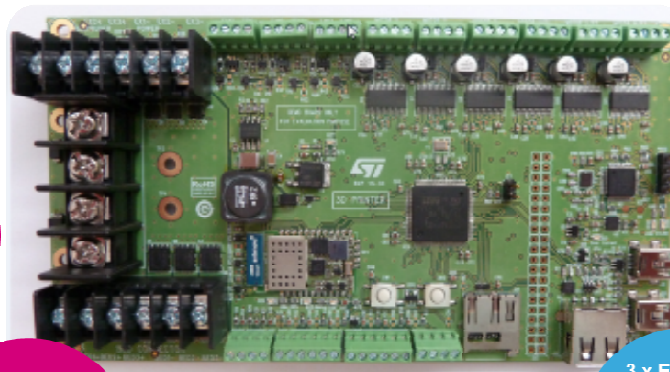STEVAL3DP001V1

Total HW+FW

Stepper drivers
STM32
Pwr management
MOSFETs
WiFi connectivity

Reference design for FFF printers

- Plug-n-play solution with 100% ST on board:

- 6-axis motion thru **L6474**

- Open source FW ported to STM32F4xx

- Multiple extruders and multi-zone heated beds

- Remote connectivity thru SPWF01SA

3 x Hot ends (+ fans)

3 x Heated beds or hot chambers

Web server
WiFi

USB connection

Head positioning (XYZ axis)

3 x Extruders (UVW axis)

- Engaging Open Source players

- Working on 2nd enhanced version to surpass PRUSA, SmoothieBoard and RAMPS.

life.augmented

Thanks!