Motor Control Reference Guide



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ST Motor Control Ecosystem



ST's commitment to motor control reinforces the environmental revolution

In line with the environmental revolution, electric motor control is moving very quickly in the direction of higher efficiency for motors and drives. Moreover, an increased level of integration at the lowest cost is required to support market penetration of new technologies, as well as increased safety and reliability. Committed to electric motor control for more than 20 years, ST was among the first to recognize these trends.

ST continues to innovate with integrated intelligent power modules and systems-in-package, monolithic motor drivers, fast and efficient power switches, voltage-transient protected triacs, and powerful and secure microcontrollers. Whichever motor technology you use, from traditional and rugged to the most modern and efficient, ST is able to supply the right electronic devices and a complete ecosystem with a range of evaluation boards, reference designs, firmware, and development tools to simplify and accelerate design cycles.

STAY UP-TO-DATE

For more information and up-to-date material, visit the Motor Control application page on ST's website at

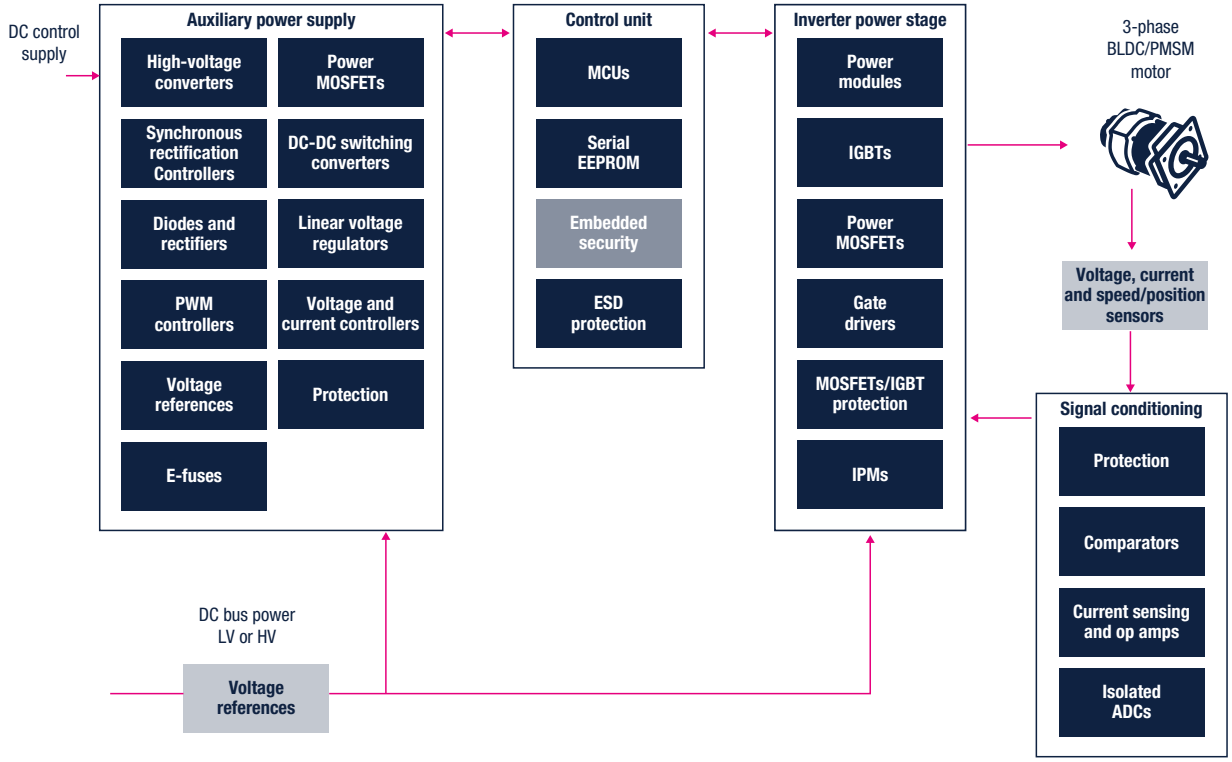
http://www.st.com/motorcontrol

PMSM & BLDC Motors

Permanent-magnet synchronous motors and Brushless DC motors are replacing DC brush motors more and more in many applications due to advantages such as higher efficiency, quieter operation and better reliability.

Despite their different structures, all three-phase permanent magnet motors (BLDC, PMSM or PMAC) are driven by a pulse-width-modulated (PWM) three-phase bridge (three half bridges) in order to supply the motor with variable frequency and amplitude of voltages and currents.

To provide the highest level of design flexibility, ST's product portfolio includes specific products for both high- and low-voltage applications like monolithic driver ICs, power MOSFETs, IGBTs, gate drivers, power modules and dedicated microcontrollers to address a broad range of applications.



Key Products

	Product family	Description with key Features	Key products
Integrated Drivers and Controllers	• STSPIN2 Series • STSPIN8 Series • STSPIN32 Series • STSPIN9P Series • L62 Series	Wide range of efficient and accurate motor drivers able to drive PMSM and BLDC motors, ranging from several watts to a few kilowatts	• STSPIN23* • STSPIN830 • STSPIN32G0 • STSPIN32G4 • STSPIN9P15 • L623*
Intelligent power Module (IPM/SiP)	• System-in-Package PWD • SLLIMM-nano (TH or SMD) • SLLIMM-nano 2nd series • SLLIMM compact • SLLIMM 2nd series • SLLIMM-HP	3-phase inverter, IGBT and MOSFET based	• PWD5T60 • STIxxyyzz • STGIxxC60S • STGIxxyyzz

	Product family		Description with key Features	Key products
Control unit	• STM32 series • STM8S series • STSPIN32 series		General-purpose product lines ranging from a basic, cost-efficient peripheral set, up to more performance and analog functions able to manage FOC motor control	• STM32C0 • STM32G0*, STM32G4* • STM32F0* • STM32F3*, STM32F4* • STM32F7* • STM32L4* • STM32H5*, STM32H7* • STM32U5* • STM8S* • STSPIN32F0, STSPIN32G4 • STSPIN32G0
MOSFET and IGBT drivers	• L649 series • L639 series • STGAP series • STDRIVE series • L638 series • TD35 series		STDRIVE MOSFET and IGBT gate drivers	• L649* • L639* • STGAP* • STDRIVE*
SiC and GaN drivers	• STGAP series • STDRIVEG series		STDRIVE SiC and GaN gate drivers	• STGAP* • STDRIVEG*
Power modules	ACEPACK		Sixpack and CIB topology, MOSFET SiC trench gate field-stop IGBT	• A1PyyMwwWz • AxPyySwwMz • AxCyySwwMz
Power switches	• F7 & F8 low voltage MOSFET • IGBT M series • IGBT H series • DM2 MOSFET • DM6 MOSFET • DM9 MOSFET		Low voltage MOSFET High voltage IGBT and MOSFET	• STxyN4F7, STxyN4F8 • STxyN6F7 • STxyN8F7, STxyN8F8 • STxyN10F7, STxyN10F8 • STGxyyM65DF2 • STGxyyM120DF3 • STGxyyH60DF • STxyN60DM6 • STxyN60DM2 • STx60NyDM9
Inrush current limiter	600 V, 800 V and 1200 V High Tj SCR		High Tj SCRs. Strong noise immunity trade-off (Up to dV/dt = 1000 V/µs at high temperature 150°C, High turn-on capability dI/dt = 100 A/µs)	• TN6050HP-12WY • TN4050HP-12WY • STTD6050H-12M2Y • TN5015H-6G • TM8050H-8W
Rotary resolver excitation	• TSB58 power op amp		4 to 36 V supply, power operational amplifier	• TSB58
Signal conditioning	• TSV TSX TSB series - operational amplifiers • TSZ series - zero drift amplifiers • TS series - comparators • TSC series - current sense amplifiers • TSB58 - power operational amplifier		High-speed operational amplifiers with a 20 MHz to 50 MHz gain-bandwidth product. High accuracy Vio < 200 µV, ideal op amps for low side current sensing. Fast response time for fault detection. Bidirectional current sense monitor for low side and high side up to 70 V	• TSV792, TSX712, TSB712 • TSB852 • TS3022 • TSC2010, 2011, 2012 • TSC210, 213
Rectification block	Bridge rectifier		Low Vf Bridge Rectifier Diodes	• STBRxxyy
PFC controllers	• L498 family • STNRG family • L656 family		Analog and digital PFC controllers	• L498x • STNRG0x • L656x
Protection	bus voltage: Protection of the integrated driver and controller	• SMAJ series • SM6F series • SM6T series • SM15T/1.5KE series	TVS (transient voltage suppressors) SMxx series and 1.5KExx series designed to clamp overvoltages and dissipate high transient power surges	• SMAJ series • SM6F series • SM6T series • SM15T/1.5KE series
	Power management: protect low voltage ICs or block	• ESDAxP-1U1M series	Protect the power line against EOS and ESD transients Low clamping voltage High 8/20 µs surge protection capability from 25 to 160 A peak pulse current	• ESDA7P 120-1U1M
	Signal conditioning: To protect signal conditioning ICs	• ESDAxxSC6 series	400 W IPP (8/20 µs) high ESD protection level up to 30 kV for sensitive equipment	• ESDA5V3-5SC6 • ESDA6V15SC6 • ESDA14V2SC6 • ESDA19SC6 • ESDA25SC6
	Connectivity/control unit: To protect data lines	• HSP061-2	Protection of high speed differential lines. Ultralarge bandwidth: 6 GHz Ultralow capacitance: 0.6 pF	• HSP061-2M6 • HSP061-2N4

Note *: one or more digits for each product of the series

Main Evaluation Boards

Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
STEVAL-STDRIVE601	Up to 600 V	Up to 1000 W	• 1xSTDRIVE601 • 6xSTGD6M65DF2	Motor drive: 3-phase motor drivers, Power board: pumps, fans, Industrial inverters, home appliances.
STEVAL-LVLP01	6-45 V_{DC}	Up to 700 W	• 6xSTL8N10F7 • STDRIVE101	Power board: home appliances
B-G473E-ZeST1S	N.A.	N.A.	• STM32G473	Control Board: to be used with STEVAL-LVLP01
STEVAL-CTM009V1	48 V_{DC}	Up to 5 kW	• 36x STH310N10F7-6 or STH315N10F7-6 • 3x L6491DTR • 1x A7986ATR • 1x TSZ121IYLT • 4x STTH102AY • 7x STPS5L60SY • 6x SM15T12CAY • 1x SM4T28AY • 1x ESDA14V2LY, ESDA6V2LY, ESDA5V2LY	Power board: forklifts, golf carts, professional power tools, e-rickshaws and more
STEVAL-CTM010V1	230 V_{AC} 50 Hz/ 60 Hz	Up to 1.5 kW	• STGIB10CH60TS-L • STGIPQ3H60T-HZ • STGWT20H65FB • STTH30AC06CPF • PM8841D • T1235T-8FP • TS391RILT • STM32F303RBT6 • VIPER26LD	Room air conditioning
STEVAL-CTM014A	230 V_{AC} 50 Hz/ 60 Hz	Up to 700 W	•STM32G431CB, VIPER122, LDK320 •STGIPQ8C60T-HZ SLIMM	Washing machine
STEVAL-IPM05F	125 – 400 V_{DC}	Up to 500 W	• 1x STGIF5CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM07F	125 – 400 V_{DC}	Up to 700 W	• 1x STGIF7CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM08B	125 – 400 V_{DC}	Up to 800 W	• 1x STGIB8CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM10B	125 – 400 V_{DC}	Up to 1200 W	• 1x STGIB10CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMM10B	125 – 400 V_{DC}	Up to 1200 W	• 1xSTIB1060DM2T-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM10F	125 – 400 V_{DC}	Up to 1000 W	• 1x STGIF10CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMM15B	125 – 400 V_{DC}	Up to 1500 W	• 1xSTIB1560DM2T-L	Power board: pumps, compressors, fans, home appliance
STEVAL-IPM15B	125 – 400 V_{DC}	Up to 1500 W	• 1x STGIB15CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM20B	125 – 400 V_{DC}	Up to 2000 W	• 1xSTGIB20M60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM30B	125 – 400 V_{DC}	Up to 2500 W	• 1xSTGIB30M60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMNM1S	125 – 400 V_{DC}	Up to 60 W	• 1x STIPNS1M50T-H	Power board: pumps, fans, small appliances
STEVAL-IPMNM2S	125 – 400 V_{DC}	Up to 100 W	• 1x STIPNS2M50T-H	Power board: pumps, fans, small appliances
STEVAL-IPMnM3Q	125 – 400 V_{DC}	Up to 300 W	• 1xSTIPQ3M60T-HZ	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMnM5Q	125 – 400 V_{DC}	Up to 450 W	• 1xSTIPQ5M60T-HZ	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMNG3S	125 – 400 V_{DC}	Up to 300 W	• 1x STGIPNS3H60T-H	Power board: pumps, compressors, fans, high-end power tools
STEVAL-IPMNM1N	125 – 400 V_{DC}	Up to 60 W	• 1x STIPN1M50T-H	Power board: pumps, fans, small appliances
STEVAL-IPMNM2N	125 – 400 V_{DC}	Up to 100 W	• 1x STIPN2M50T-H	Power board: pumps, fans, small appliances
STEVAL-IPMNG3Q	125 – 400 V_{DC}	Up to 300 W	• 1x STGIPQ3H60T-HZ	Power board: pumps, compressors, fans, high-end power tools
STEVAL-IPMNG5Q	125 – 400 V_{DC}	Up to 450 W	• 1x STGIPQ5C60T-HZ	Power board: pumps, compressors, fans, high-end power tools
STEVAL-IPMNG8Q	125 – 400 V_{DC}	Up to 600 W	• 1x STGIPQ8C60T-HZ	Power board: pumps, compressors, fans, high-end power tools
STEVAL-IHM032V1	86 to 260 V_{AC}	Up to 150 W	• 2x L6392D • 1x L6391D • 1x Viper12 • 6 x STGD3HF60HD	Power board: pumps, compressors, fans, home appliances and more
STEVAL-IHM035V2	120/230 V_{AC}	Up to 100 W	• 1x STGIPN3H60 • 1x VIPer16L	Power board: pumps, compressors, fans, home appliances and more
STEVAL-IHT008V1	230 VAC or 120 V_{AC}	Up to 800 W	• 1x T1635T-8FP • 1x ACST210-8FP • 1x ACS108-8SN • 1x Z0109MUF • 1x ViPER 26LD • 1x STM8S103K3T3C	Inrush current limiter for inverter-based home appliances
STEVAL-SCR001V1	90 - 265 V_{AC}	Up to 800 W	• 2x TN5015H-6G	Inrush current limiter for small appliances with BLDC motor
STEVAL-SCR002V1	90 - 265 V_{AC}	Up to 1000 W	• 2x TN1605H-8T	Inrush current limiter for White-Goods with BLDC motor
STEVAL-PT00L4A	12 to 28 V_{DC}	Up to 250 W	• 1x STM32G473CET6 • 6x STL220N6F7 • 1x STDRIVE101 • 1x L6981	Power and garden tools, fans, pumps, factory automation, edu/ home robots, e-bikes

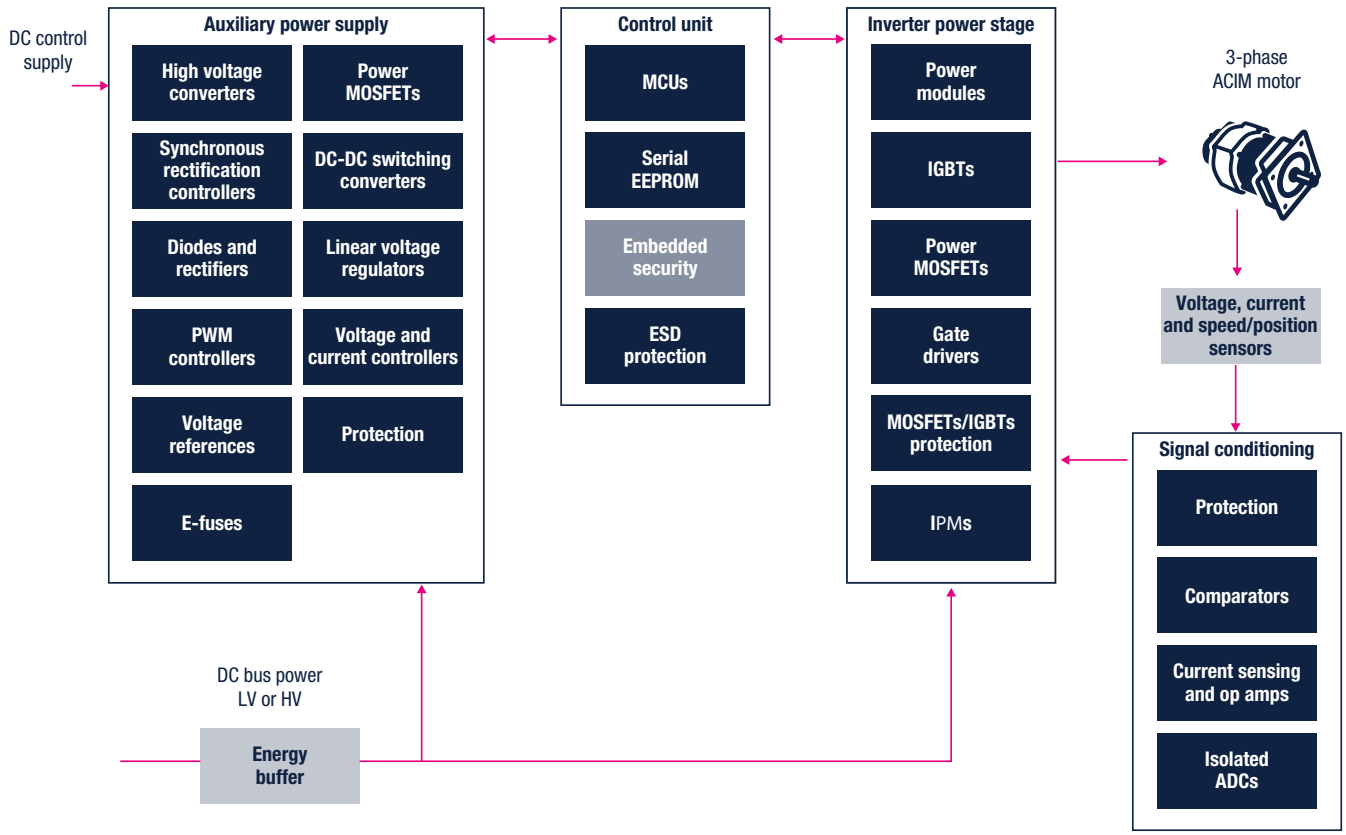
Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
STEVAL-ESC001V1	11.1 up to 22.2 V_{DC}	Up to 20 Arms	• 6x STL160N4F7 • 3x L6398DTR • STM32F303CBT7 • 3x TSV991ILT • 1x STPS1L40M, 3x STPS0560Z, 7x BAT30KFILM • 1x L7986TR	Motor drive: Electronic speed controllers for drones (E.S.C.), RC vehicles (electric cars, helicopter, trucks, etc)
STEVAL-ESC002V1	6.7 - 45 V_{DC}	Up to 20 Arms	• 1x STSPIN32F0A • 1x STL140N6F7 • 1x STPS0560Z • 1x LMV321LILT	Power tools, fans, pumps, drones ESC, air purifiers, coffee machines, edu/home robots
STEVAL-SPIN3201	8 - 45 V_{DC}	Up to 15 Arms	• 1x STSPIN32F0 • 6x STD140N6F7 • 1x STPS1L60A • 7x BAT30KFILM • 1x LD3985M33R • 1x USBLC6-2SC6	Power tools, fans, pumps, drones ESC, home appliances, factory automation, edu/home robots
EVSPIN32G4	10 V - 75 V	Up to 35 A	• 1x STSPIN32G4 • 6x STL110N10F7 • 1x STM32F103CBT6	Three-phase brushless motors: industrial and home automation. Home appliance, servo drives and e-bikes, service and automation robots, power and garden tools, pumps, fans, drones and aeromodelling
EVSPIN32G4-DUAL	10 - 75 V_{DC}	up to 10 A	• 1x STSPIN32G4 • 6x STL110N10F7 • 1x STDRIVE101	Three-phase brushless motors: industrial and home automation. Home appliance, servo drives and e-bikes, service and automation robots, power and garden tools, pumps, fans, drones and aeromodelling
STEVAL-SPIN3202	7 - 45 V_{DC}	Up to 15 Arms	• STSPIN32F0A • 6x STD140N6F7 • 1x STPS1L60A • 7x BAT30KFILM • 1x LD3985M33R • 1x USBLC6-2SC6	Power tools, fans, pumps, drones ESC, home appliances, factory automation, edu/home robots
STEVAL-SPIN3204	7 - 45 V_{DC}	Up to 15 Arms	• 1x STSPIN32F0B • 6x STD140N6F7 • 1x STPS1L60A • 7x BAT30KFILM • 1x LD3985M33R • 1x USBLC6-2SC6	Power tools, fans, pumps, drones ESC, home appliances, factory automation, edu/home robots
EVSPIN32G4NH	10 V - 75 V	Up to 25 A	• 1x STSPIN32G4 • 6x STL110N10F7 • 1x STM32F103CBT6	Three-phase brushless motors: industrial and home automation. Home appliance, servo drives and e-bikes, service and automation robots, power and garden tools, pumps, fans, drones and aeromodelling
STEVAL-GMBL02V1	6 - 8.4 V_{DC}	Up to 1.3 Arms	• 3x STSPIN233; • 1x STM32F303RE • 1x LSM6DSLTR • 1x M24C02-RMN6TP • 1x USBLC6-4SC6	Handheld applications and three-axis drone gimbals
X-NUCLEO-IHM07M1	8 - 48 V_{DC}	Up to 1.4 Arms	• 1x L6230PD • 1x TSV994IPT	Fans, pumps, factory automation, money handling machines and medical equipment
X-NUCLEO-IHM08M1	10 - 48 V_{DC}	Up to 15 Arms	• 6x STL220N6F7 • 3x L6398D • 1x TSV994IPT • 1x ST1S14PHR • 1x LMV331ILT	Power tools, fans, pumps, drones ESC, home appliances, factory automation, edu/home robots
X-NUCLEO-IHM09M2	N.A.	N.A.	• Not Silicon Part	Motor control connector adapter
X-NUCLEO-IHM16M1	7 - 45 V_{DC}	Up to 1.5 Arms	• 1x STSPIN830 • 1x TSV994IPT	Antenna control, fans, robots, factory automation, home appliances and medical equipment
X-NUCLEO-IHM17M1	1.8 - 10 V_{DC}	Up to 1.3 Arms	• 1x STSPIN233 • 1x TSV994IPT	Healthcare and medical, IoT, gimbals, edu/home robots, toys, fans, small actuators
P-NUCLEO-IHM001	8 - 48 V_{DC}	Up to 1.4 Arms	• 1x L6230 • 1x STM32F302R8	Fans, pumps, factory automation, money handling machines and medical equipment
STEVAL-IHM03	7 - 45 VDC	Up to 1.5 Arms	• 1x STSPIN830 • 1x STM32G431RB	Fans, pumps, factory automation, money handling machines and medical equipment
STEVAL-ISQ014V1	N.A.	N.A.		Low-side current sensing based on TSZ121 UM1737
STEVAL-AETKT1V2	N.A.	N.A.		High-side current-sense amplifier demonstration board based on TSC2010, 2011, 2012
STEVAL-AETKT2V1	N.A.	N.A.		High precision bidirectional current sense amplifiers based on the TSC2010/13

Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
EVLGANSPIN1-3PH	Up to 600 V	400 W	• GaNSPIN611 • STM32G473 • VIPer06 • TSV911	Full inverter for high voltage motor-control applications
EVLGANSPIN2-3PH	Up to 600 V	300 W	• GaNSPIN612 • STM32G473 • VIPer06 • TSV912	Full inverter for high voltage motor-control applications

3-phase Induction Motor (ACIM)

Overview

Three-phase induction motors are brushless motors. The stator is copper-wound and the rotor is typically an aluminum squirrel cage. The typical drive configuration is a three-phase bridge (three half-bridges) modulated to provide three sine wave voltages to the stator. Typically used in higher power applications, the driving portion can be composed of power MOSFETs or IGBTs with high-voltage gate drivers, or power modules integrating three half-bridges and related gate driving stage. Consider defining scalar control as volts-per-hertz, control algorithms are implemented in the microcontroller that controls the inverter.



Key Products

	Product family	Description with key Features	Key products
Control unit	• STM32 Series	General-purpose product lines ranging from a basic, cost-efficient peripheral set, up to more performance and analog functions able to manage FOC motor control	• STM32F7* • STM32F4* • STM32F30* • STM32F0* • STM32G0* • STM32G4 • STM32L4
Intelligent power Module (IPM)	• System-in-Package PWD • SLLIMM-nano 2nd series • SLLIMM compact • SLLIMM 2nd series • SLLIMM-HP	3-phase inverter, IGBT and MOSFET based	• PWD5T60 • STGIxxyyzz • STGIxxC60S • STIxxyyzz
MOSFET and IGBT Drivers	• L649 series • L639 series • STGAP series • STDRIVE series	STDRIVE MOSFET and IGBT gate drivers	• L649* • L639* • STGAP* • STDRIVE*
Power Module	• ACEPACK	Sixpack and CIB topology, trench gate field-stop IGBT	• AxPyySwwMz • AxCyySwwMz
Power Switch	• IGBT M series • IGBT H series • DM2 MOSFET • SiC MOSFET • DM6 MOSFET • DM9 MOSFET	IGBT and High Voltage Power MOSFET	• STGxyyM65DF2 • STGxyyM120DF3 • STGxyyH60DF • STxyN60DM2 • STxyN60DM6 • STx60NyDM9 • SCTxxxyy65G3 • SCTxxxyy75G3 • SCTxxxyy120G3 • SCTxxN170
Inrush Current Limiter	• High Temperature SCR	From 12 A to 80 A and 600 V to 1200 V SCR. Junction T_j = 150 °C Strong noise immunity trade-off (dV/dt = 500 V/us, I_{GT} = 15 mA or 1000 V/µs/50 mA)	• TN1205H-6G • TN2015H-6FP • TN3015H-6G • TN5015H-6G • TN3050H-12GY • TN4050HP-12WY • TN4050-12PI • TN6050HP-12WY
Signal conditioning	• TSV7 series • TSC2 series	High speed up to 20 MHz low voltage op amp for low side current sensing. Bi-directional current sense monitor for low side and high side up to 70 V	• TSV99x • TSV91x • TSC201x
Sigma Delta ISOSD61 and Data I/F STISO621	• TSV TSX TSB series - operational amplifiers • TSZ series - zero drift amplifiers • TS series - comparators • TSC series - current sense amplifiers	High accuracy and high gain bandwidth product for low-side current measurement. Fast response time for fault detection. High voltage capability for accurate high side current measurement	• TSV732, TSX712, TSB712 • TSZ122, TSZ182 • TS3022 • TSC2010, 2011, 2012 TSC210, 213 • TSC2011, TSC210
Rectification block	Bridge Rectifier	Low Vf Bridge Rectifier Diodes	• STBRxxyy
PFC controllers	• L498 family • STNRG family • L656 family	Analog and Digital PFC Controllers	• L498x • STNRG0x • L656x

Note *: one or more digits for each product of the series

	Product family		Description with key Features	Key products
Protection	bus voltage: Protection of the IPM	• SMAJ series • SM6F series • SM6T series • SM15T/1.5KE series	TVS (transient voltage suppressors) SMxx series and 1.5KExx series designed to clamp overvoltages and dissipate high transient power surges	• SMAJ series • SM6F series • SM6T series • SM15T/1.5KE series
	Power Management: protect low voltage ICs or block	• ESDAxP-1U1M series	Protect the power line against EOS and ESD transients Low clamping voltage High 8/20 µs surge protection capability from 25 to 160 A Peak Pulse Current	• ESDA7P 120-1U1M
	Signal conditioning: To protect signal conditioning ICs	• ESDAxxSC6 series	400 W IPP (8/20 µs) high ESD protection level up to 30 kV for sensitive equipment	• ESDA5V3-5SC6 • ESDA6V15SC6 • ESDA14V2SC6 • ESDA19SC6 • ESDA25SC6
	Connectivity/Control Unit: To protect data lines	• HSP061-2	Protection of high speed differential lines. Ultralarge bandwidth: 6 GHz Ultralow capacitance: 0.6 pF	• HSP061-2M6 • HSP061-2N4

Main Evaluation Boards

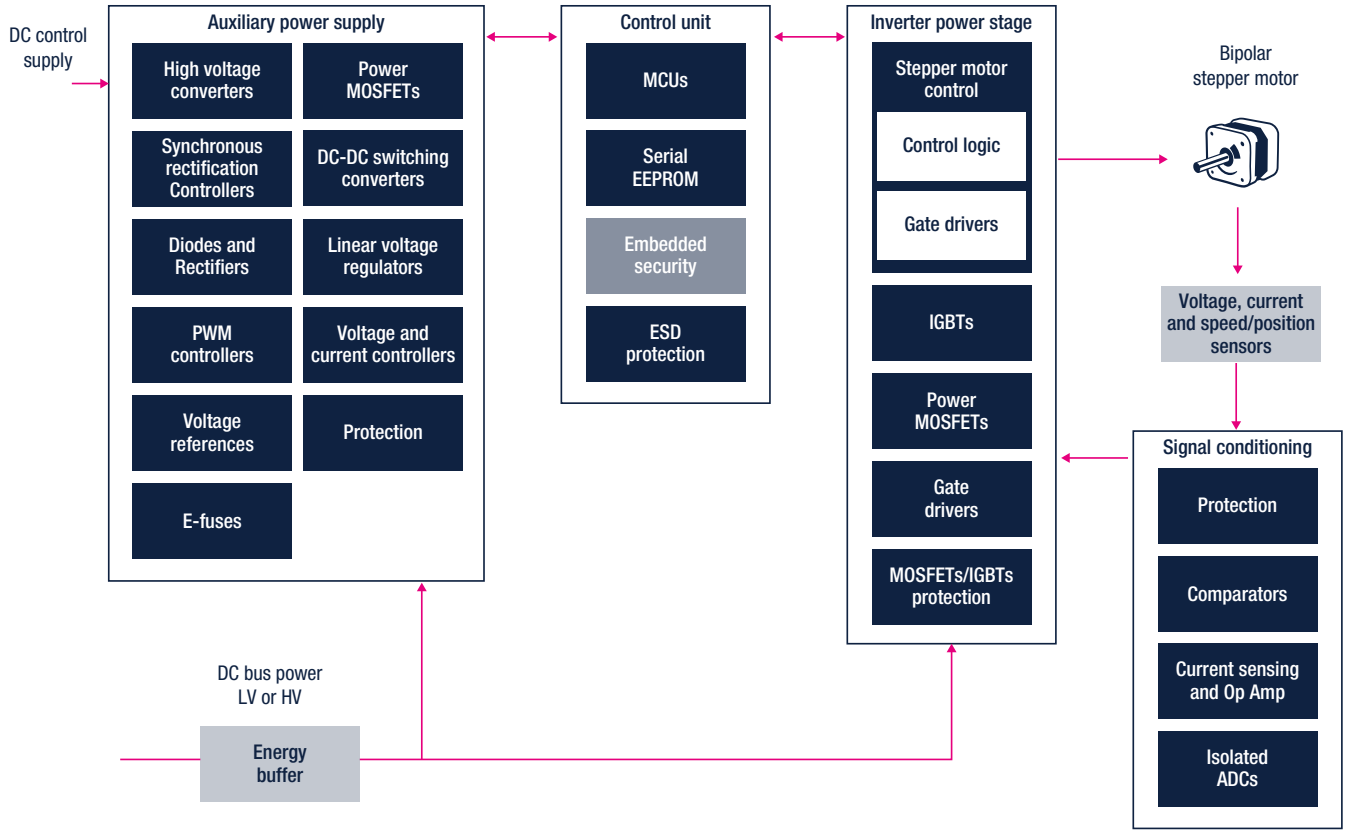
Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
STEVAL-FTD01KCB	Up to 400 V_{DC}	1.5 kW	• 1x STM32G473QB • 6x STGAP2D • 12x STGB20M65DF2 • 2x L6902D013	Modular fault-tolerant solution for a six-phase AC motor drive
STEVAL-STDRIVE601	Up to 600 V	Up to 1000 W	• 1xSTDRIVE601 • 6xSTGD6M65DF2	Motor Drive: 3-phase motor drivers, Power board: pumps, fans, Industrial inverters, home appliances
STEVAL-AP1PF50M	125 – 400 V_{DC}	Up to 10 kW	• A1P50S65M2 • STGAP2S • STGWA50M65DF2	HVAC, pumps, industrial drives
STEVAL-CTM010V1	230 V_{AC} 50 Hz/ 60 Hz	Up to 1.5 kW	• STGIB10CH60TS-L • STGIPQ3H60T-HZ • STGWT20H65FB • STTH30AC06CPF • PM8841D • T1235T-8FP • TS391RILT • STM32F303RBT6 • VIPER26LD	Room air conditioning
STEVAL-IPM05F	125 – 400 V_{DC}	Up to 500 W	• 1x STGIF5CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM07F	125 – 400 V_{DC}	Up to 700 W	• 1x STGIF7CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM08B	125 – 400 V_{DC}	Up to 800 W	• 1x STGIB8CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM10B	125 – 400 V_{DC}	Up to 1200 W	• 1x STGIB10CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMM10B	125 – 400 V_{DC}	Up to 1200 W	• 1xSTIB1060DM2T-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM10F	125 – 400 V_{DC}	Up to 1000 W	• 1x STGIF10CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMM15B	125 – 400 V_{DC}	Up to 1500 W	• 1xSTIB1560DM2T-L	Power board: pumps, compressors, fans, home appliance
STEVAL-IPM15B	125 – 400 V_{DC}	Up to 1500 W	• 1x STGIB15CH60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM20B	125 – 400 V_{DC}	Up to 2000 W	• 1xSTGIB20M60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPM30B	125 – 400 V_{DC}	Up to 2500 W	• 1xSTGIB30M60TS-L	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMNM1S	125 – 400 V_{DC}	Up to 60 W	• 1x STIPNS1M50T-H	Power board: pumps, fans, small appliances
STEVAL-IPMNM2S	125 – 400 V_{DC}	Up to 100 W	• 1x STIPNS2M50T-H	Power board: pumps, fans, small appliances
STEVAL-IPMNG3S	125 – 400 V_{DC}	Up to 300 W	• 1x STGIPNS3H60T-H	Power board: pumps, compressors, fans, high-end power tools
STEVAL-IPMNM1N	125 – 400 V_{DC}	Up to 60 W	• 1x STIPN1M50T-H	Power board: pumps, fans, small appliances
STEVAL-IPMnM3Q	125 – 400 V_{DC}	Up to 300 W	• 1xSTIPQ3M60T-HZ	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMNM2N	125 – 400 V_{DC}	Up to 100 W	• 1x STIPN2M50T-H	Power board: pumps, fans, small appliances

Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
STEVAL-IPMNG3Q	125 – 400 V_{DC}	Up to 300 W	• 1x STGIPQ3H60T-HZ	Power board: pumps, compressors, fans, high-end power tools
STEVAL-IPMnM5Q	125 – 400 V_{DC}	Up to 450 W	• 1xSTIPQ5M60T-HZ	Power board: pumps, compressors, fans, home appliances
STEVAL-IPMNG5Q	125 – 400 V_{DC}	Up to 450 W	• 1x STGIPQ5C60T-HZ	Power board: pumps, compressors, fans, high-end power tools
STEVAL-IPMNG8Q	125 – 400 V_{DC}	Up to 600 W	• 1x STGIPQ8C60T-HZ	Power board: pumps, compressors, fans, high-end power tools
STEVAL-IHM032V1	86 to 260 V_{AC}	Up to 150 W	• 2x L6392D • 1x L6391D • 1x Viper12 • 6x STGD3HF60HD	Power board: pumps, compressors, fans, home appliances and more
STEVAL-IHM034V2	230 V_{AC}	Up to 1700 W	• 1x STGIPS20C60 • 1x L6391 • 1x Viper16LD • 1x TSV914ID • 3x STTH1L06A	Motor drive with digital PFC: room air conditioning, compressor and more
STEVAL-IHM035V2	120/230 V_{A}	Up to 100 W	• 1x STGIPN3H60 • 1x VIPer16L	Power board: pumps, compressors, fans, home appliances and more
STEVAL-ISF003V1	230 V_{AC} (or 120 V_{AC})	Up to 7.4 kW	• 1x TN5050H-12WY • 1x STTH60L10WY • 1x STM8S103K3T3	Inrush current limiter board
STEVAL-IHT008V1	230 V_{AC} or 120 V_{AC}	Up to 800 W	• 1x T1635T-8FP • 1x ACST210-8FP • 1x ACS108-8SN • 1x Z0109MUF • 1x ViPER 26LD • 1x STM8S103K3T3C	Low standby loss front-end with inrush current limitation and insulated AC switch control
STEVAL-SCR001V1	90-265 V_{AC}	Up to 800 W	• 2x TN5015H-6G	Inrush current solution with bypass SCR
STEVAL-ISQ014V1	N.A.	N.A.		Low-side current sensing based on TSZ121 UM1737
STEVAL-SCR001V1	N.A.	N.A.		High-side current-sense amplifier demonstration board based on TSC2011
STEVAL-AETKT1V2	N.A.	N.A.		High-side current-sense amplifier demonstration board based on TSC2010, 2011, 2012

Stepper motors

Overview

Stepper motors are widely used for precise positioning and holding in computer peripherals, security systems, and industrial automation. Depending on the number of phases, the winding arrangement and the required level of motion smoothness, ST offers several types of bipolar stepper motor drivers to ensure the best performance for your application. In bipolar stepper motors, current can flow in both directions; a full-bridge converter is required to drive each of the two windings of a two-phase motor. During motion, the type of electronic control (full step, half step, microstepping) and the resulting phase current waveform impact the vibration level, the acoustic noise, motion smoothness and sensitivity to resonances. ST fully supports all of these configurations with monolithic motor driver ICs (embedding digital controllers, power devices and protection functions), and for higher power, with a controller + MOSFET combination approach.



Key Products

	Product family		Description with key Features	Key products
Control unit	• STM32 Series			• STM32F0 Series • STM32F1 Series • STM32F3 Series • STM32F4 Series • STM32G0 Series • STM32G4 Series • STM32L4 Series
Monolithic driver	• STSPIN2 Series • STSPIN8 Series • STSPIN9 series • L62 Series • L64 Series • L648 Series		Efficient and accurate stepper drivers able to reach high motion resolution, up to 256 microsteps and to fit in a wide range of applications, spanning from portable to high current industrial ones	• STSPIN220 • STSPIN820 • STSPIN948 • L62x8 • L647* • L6482x
SiP driver	• PowerSTEP01 • STSPIN9P2		System in package driver	• PowerSTEP01 • STSPIN9P2x
Power switch	• F7 Low Voltage • F8 Low Voltage		Low Voltage MOSFET	• STxyN4F7, STxN4F8 • STxyN6F7 • STxN8F8
Signal conditioning	• TSV TSX TSB series - operational amplifiers • TSZ series - zero drift amplifiers • TS series - comparators • TSC series - current sense amplifiers		High accuracy and high gain bandwidth product for low-side current measurement. Fast response time for fault detection. High voltage capability for accurate high side current measurement	• TSV732, TSV772, TSV782, TSV792, TSX712, TSB712 • TSZ122, TSZ182, • TS3022 • TSC2010, 2011, 2012 TSC210, 213
Protection	DCDC Protection Power Management	• ESDAxP-1U1M series	Protect the power line against EOS and ESD transients Low clamping voltage High 8/20 µs surge protection capability from 25 to 160 A Peak Pulse Current	• ESDA7P120-1U1M • ESDA13P70-1U1M • ESDA15P60-1U1M • ESDA17P100-1U1M • ESDA25P35-1U1M
	Connectivity/Control Unit: To protect data lines	• HSP061-2	Protection of high speed differential lines. Ultralarge bandwidth: 6 GHz Ultralow capacitance: 0.6 pF	• HSP061-2M6 • HSP061-2N4

Main Evaluation Boards

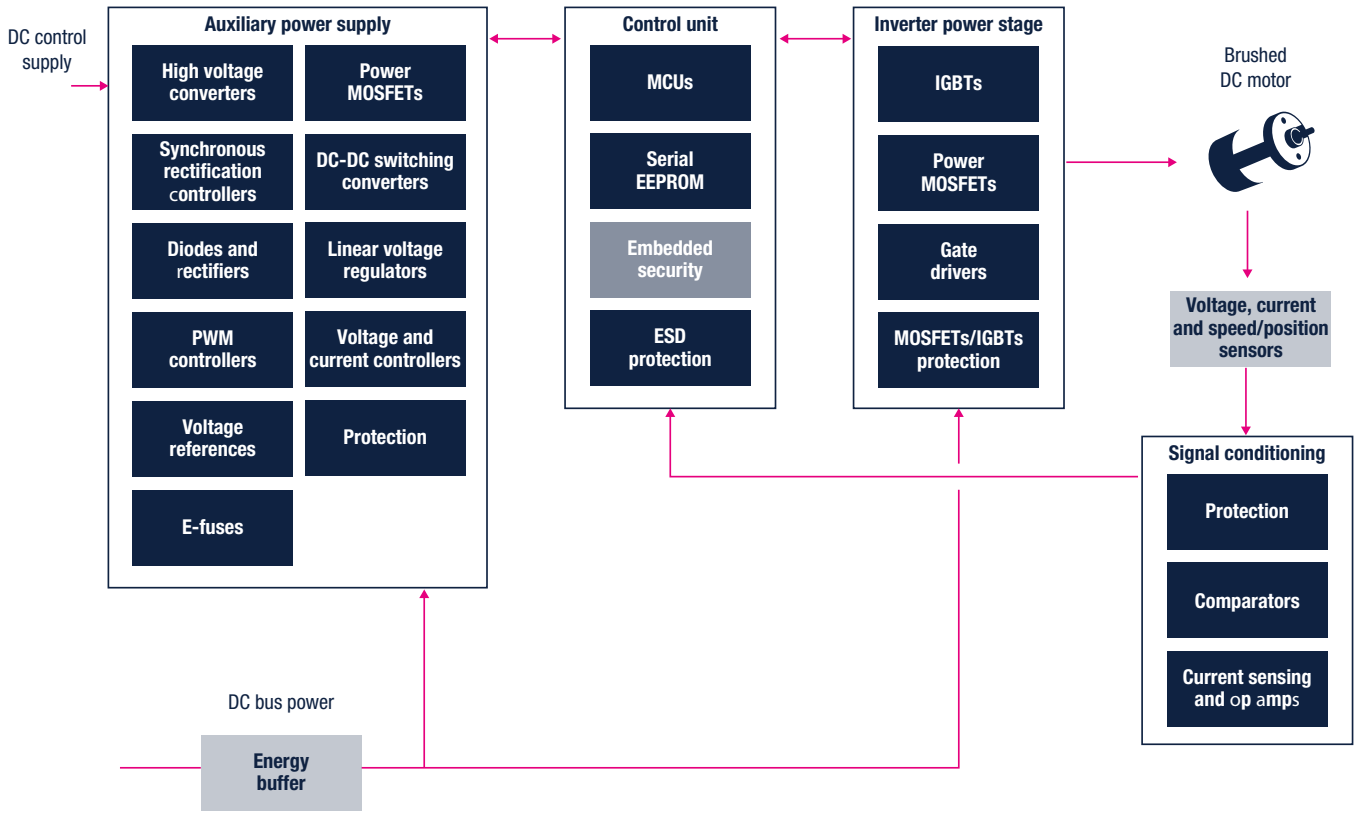
Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
X-NUCLEO-IHM14A1	7 - 45 V_{DC}	Up to 1.5 A_{rms}	• 1x STSPIN820	Label printers, surveillance and dome cameras, textile machines, 3D printers, antenna control
X-NUCLEO-IHM06A1	1.8 - 10 V_{DC}	Up to 1.3 A_{rms}	• 1x STSPIN220	POS, cash registers, toys, camera control, IoT, haptic feedback, and 3D printers
X-NUCLEO-IHM05A1	8 - 50 V_{DC}	Up to 2.8 A_{rms}	• 1x L6208PD	Money handling machines, factory automation, valves, textile machines
X-NUCLEO-IHM03A1	10.5 - 85 V_{DC}	Up to 10 A_{rms}	• 1x powerSTEP01	Textile and sewing machines, pick and place machines, factory automation, industrial printers, industrial mixers
X-NUCLEO-IHM01A1	8 - 45 V_{DC}	Up to 3 A_{rms}	• 1x L6474PD	Textile machines, factory automation, industrial and 3D printers
EVLSPIN948	5 - 58 V_{DC}	Up to 4.5 A_{rms}	• 1x STSPIN948	Home appliances, robotics, stage lighting, vending machines, textile machines, antenna control, factory automation
STEVAL-ISQ014V1	N.A.	N.A.		Low-side current sensing based on TSZ121 UM1737
STEVAL-AETKT1V1	N.A.	N.A.		High-side current-sense amplifier demonstration board based on TSC2011
STEVAL-AETKT1V2	N.A.	N.A.		High-side current-sense amplifier demonstration board based on TSC2010, 2011, 2012
EVALSP820-XS	7 - 45 V	Up to 2.5 A per phase	• STSPIN820	3D printers, medical equipment, textile, sewing machines
X-NUCLEO-IHM02A1	8 - 45 V	Up to 3 Arms	• 2 x L6470 • 1x ST1S14	Two axis stepper motor driver expansion board based on the L6470 for STM32 Nucleo

Note *: one or more digits for each product of the series

Brushed DC motors

Overview

Brushed DC motors are commonly used in industrial applications such as robots, valves and healthcare equipment. When only one direction of rotation is required, a single switch topology with PWM modulation can be used to vary the voltage applied to the motor, and thus to control its speed. When positioning is required or when both directions of rotation are needed (e.g. car windows) a full H-bridge with PWM control is used. At lower power levels, ST offers a full set of integrated motor drivers with a progressive selection of integrated features, embedded gate drivers, power transistors, protection functions, current sensing and even DC-DC converters. For higher power needs, ST's portfolio also includes discrete low voltage power MOSFETs and gate driver ICs to implement the required H-bridge. A general-purpose 8-bit microcontroller or a cost-optimized 32-bit microcontroller can be used to implement these drives.



Key Products

	Product family		Description with key Features	Key products
Control unit	• STM32 series • STM8S series			• STM32F0 Series • STM32C0 Series • STM32G0 Series
Monolithic driver	• STSPIN2 series • STSPIN8 series • STSPIN9 series • L62 series • IPS16 series • IPS1025 series • IPS2025 series		A complete set of versatile and scalable monolithic motor drivers addressing a wide range of applications, spanning from portable to high current and high voltage industrial ones	• STSPIN2* • STSPIN840 • STSPIN948 • STSPIN958 • L62* • IPS16* • IPS1025* • IPS2025*
SiP driver	• PWD series • STSPIN9P		System in package driver	• PWDF060 • STSPIN9P1x • STSPIN9P2x
MOSFET and IGBT drivers	• L649 series • L639 series • STDRIVE1x1		STDRIVE MOSFET and IGBT Gate drivers	• L649* • L639* • STDRIVE121 • STDRIVE141 • STDRIVE181
Power switches	• F6 & F7 low voltage • F8 low voltage		Low voltage MOSFET	• STxyN4F7, STxyN4F8 • STxyN6F7 • STxyN8F7, STxyN8F8 • STxyN10F7, STxyN10F8
Power Schottky	• STPSx45/60/80/100		ST's power Schottky diodes combine low voltage-drop characteristics with negligible or zero recovery. They range from 15 to 200 V and from 1 to 240 A, so covering all application needs from OR-ing and 48 V converters, to battery chargers and welding equipment. They are avalanche specified for improved ruggedness	• STPS3045 • STPS41H100
FERD diodes	• FERDx45/60/100		ST field-effect rectifier diodes (FERD) help improve designs with new versions focusing on trade-off upgrades. The design of the FERDs has allowed both a decrease in the voltage drop and a decrease in the leakage current temperature coefficient. As a result, the runaway safety margin is improved and may exceed the typical safety margin of Schottky barrier diodes	• FERD2045S • FERD20U60DJF • FERD30SM100DJF
Signal conditioning	• TSV TSX TSB series - operational amplifiers • TSZ series - zero drift amplifiers • TS series - comparators • TSC series - current sense amplifiers		High accuracy and high gain bandwidth product for low-side current measurement. Fast response time for fault detection. High voltage capability for accurate high side current measurement	• TSV772, TSX712, TSB712 • TSZ122, TSZ182 • TS3022 • TSC2010, 2011, 2012 TSC210, 213
Protection	bus voltage: Protection of the monolithic driver (full bridge topology)	• SMAJ series • SM6F series • SM6T series • SM15T/1.5KE series	TVS (transient voltage suppressors) SMxx series and 1.5KExx series designed to clamp overvoltages and dissipate high transient power surges	• SMAJ series • SM6F series • SM6T series • SM15T/1.5KE series
	Power management: protect low voltage ICs or block	• ESDAxP-1U1M series	Protect the power line against EOS and ESD transients Low clamping voltage High 8/20 µs surge protection capability from 25 to 160 A Peak Pulse current	• ESDA7P 120-1U1M
	Signal conditioning: To protect signal conditioning ICs	• ESDAxxSC6 series	400 W IPP (8/20 µs) high ESD protection level up to 30 kV for sensitive equipment	• ESDA5V3-5SC6 • ESDA6V15SC6 • ESDA14V2SC6 • ESDA19SC6 • ESDA25SC6
	Connectivity/control unit: To protect data lines	• HSP061-2	Protection of high speed differential lines. Ultralarge bandwidth: 6 GHz Ultralow capacitance: 0.6 pF	• HSP061-2M6 • HSP061-2N4

Main evaluation Boards

Reference/bundle/ PWD boards	Voltage	Power/Max Current	ST parts	Application focus
X-NUCLEO-IHM15A1	7 - 45 V_{DC}	Up to 1.3 A_{rms}	• 1x STSPIN840	Stage lighting, industrial automation, service robots, medical and health care, ATM, vending machines
X-NUCLEO-IHM13A1	1.8 - 10 V_{DC}	Up to 2.6 A_{rms}	• 1x STSPIN250	eValves, IoT, edu/home robots, healthcare, toys, eLock, actuators
X-NUCLEO-IHM12A1	1.8 - 10 V_{DC}	Up to 1.3 A_{rms}	• 1x STSPIN240	eValves, IoT, edu/home robots, healthcare, toys, eLock, actuators
X-NUCLEO-IHM04A1	8 - 50 V_{DC}	Up to 2.8 A_{rms}	• 1x L6206PD	Stage lighting, antenna control, vending machines, factory automation
EVLSPIN948	5 - 58 V_{DC}	Up to 4.5 A_{rms}	• 1x STSPIN948	Home appliances, robotics, stage lighting, vending machines, textile machines, antenna control, factory automation
EVLSPIN958	5 - 58 V_{DC}	Up to 5 A_{rms}	• 1x STSPIN958	Home appliances, robotics, antenna control, factory automation
STEVAL-ISQ014V1	N.A.	N.A.		Low-side current sensing based on TSZ121 UM1737
STEVAL-AETKT1V1	N.A.	N.A.		High-side current-sense amplifier demonstration board based on TSC2011
STEVAL-AETKT1V2	N.A.	N.A.		High-side current-sense amplifier demonstration board based on TSC2010, 2011, 2012

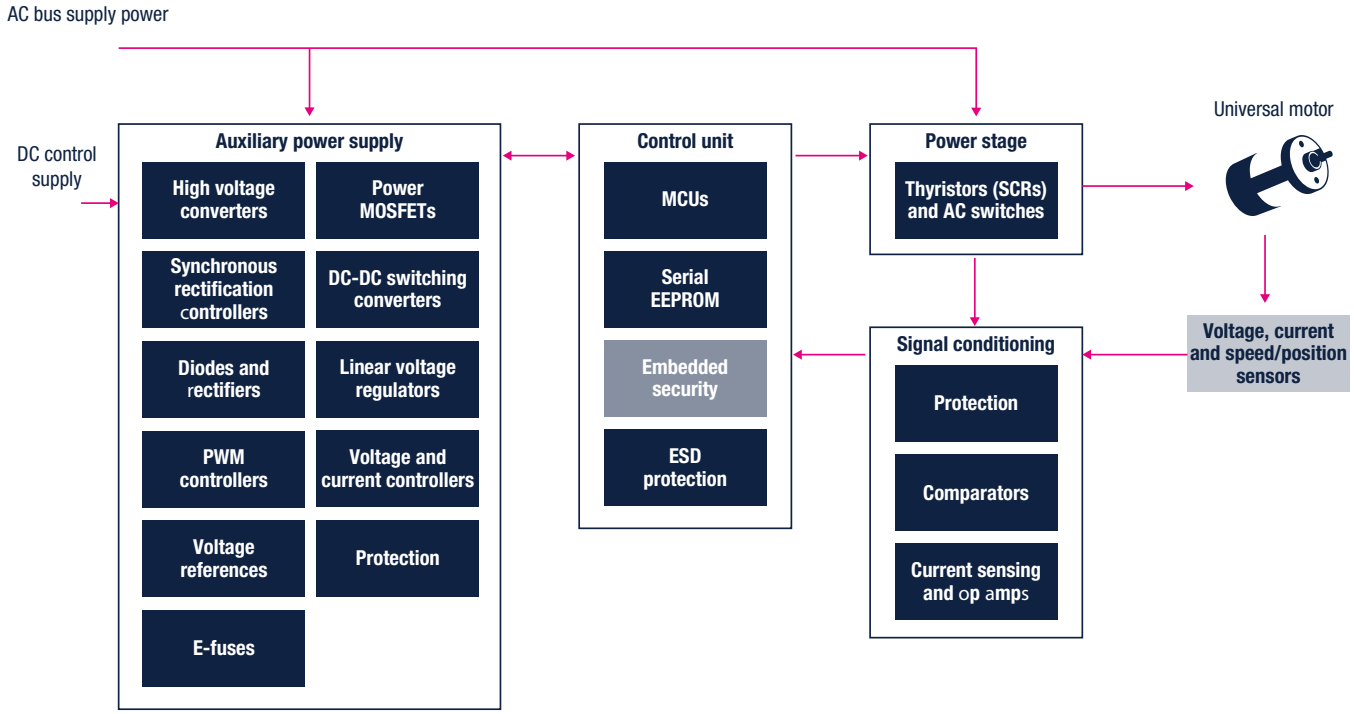
Note *: one or more digits for each product of the series

Universal motors

Universal motors can be used with AC or DC supplies and are commonly used in consumer appliances such as mixers, fans and vacuum cleaners.

Most universal motors are unidirectional. Bidirectional operation of the motor is performed by reversing the connection of the stator-inductor versus the rotor winding with an external relay. The advantages of universal motors are high starting torque, very compact design and high speed.

A simple controller with an AC supply can be implemented using a low-end microcontroller and a single triac or an AC switch.



	Product family		Description with key Features	Key products
Control unit	• STM32 Series • STM8S Series			• STM32F0 Series • STM32C0 Series • STM32G0 Series
AC switches	T-Series		High temperature triac with strong dynamic behavior (dv/dt) at full rated current	T835T-8, T1235T-8, T1635T-8, T2035T-8
	H-Series		800 V 150 °C triac with reinforced application robustness: dV/dt noise immunity; and twice rated current turn off commutation	T835H-8, T1235H-8, T1635H-8, T2035H-8, T3035H-8
	ACST-Series		Overvoltage protected AC switch, high static dv/dt, for IEC61000-4-5 voltage surge application compliance	ACST830-8, ACST1035-8FP, ACST1235-8FP, ACST1635-8FP
Signal conditioning	• TSV TSX TSB series - operational amplifiers • TSZ series - zero drift amplifiers • TS series - comparators • TSC series - current sense amplifiers		High accuracy and high gain bandwidth product for low-side current measurement. Fast response time for fault detection. High voltage capability for accurate high side current measurement	• TSV772, TSX712, TSB712 • TSZ122, TSZ182 • TS3022 • TSC2010, 2011, 2012 TSC210, 213
Protection	Protection Power Management: protect low voltage ICs or block	• ESDAxP-1U1M series	Protect the power line against EOS and ESD transients Low clamping voltage High 8/20 µs surge protection capability from 25 to 160 A peak pulse current	• ESDA7P 1201U1M

Main evaluation Boards

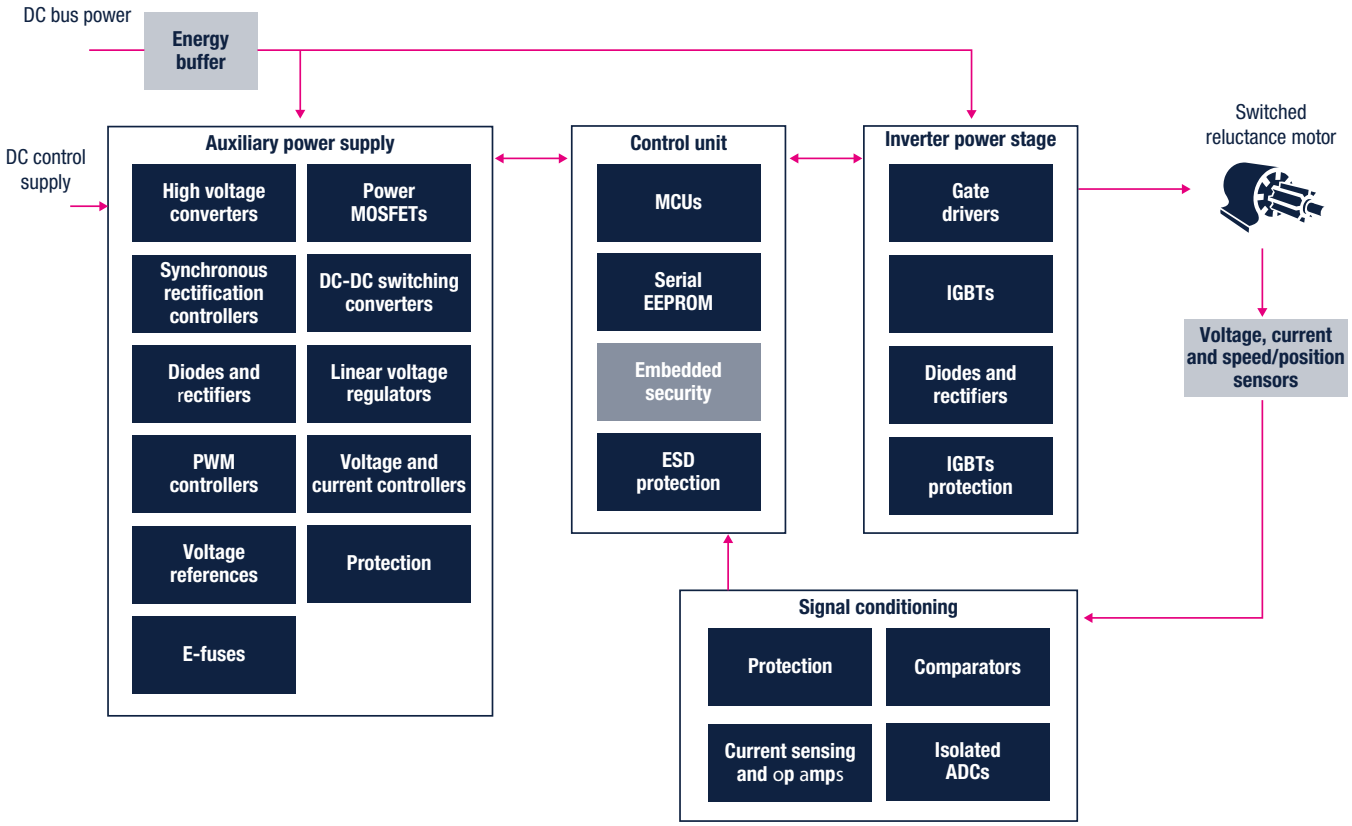
Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
STEVAL-IHT003V2	100 - 240 V_{AC} (50/60 Hz)	Up to 10 Arms	• ACST610-8T • X0202NN 5BA4	Starter for compressor
STEVAL-IHT005V2	90 - 265 V_{AC} (50/60 Hz)	Up to 2830 W	• 1x T1635H-6T • 1x ACST1635-8FP • 1x Z0109MA • 3x ACS108-8SA • 1x VIPER16L • 1x STM32F100C4T6B	AC Load drives like valves, pumps, door locks, drum motors and heating resistors
STEVAL-ISQ014V1	N.A.	N.A.		Low-side current sensing based on TSZ121 UM1737
STEVAL-AETKT1V2	N.A.	N.A.		High-side current-sense amplifier demonstration board based on TSC2010, 2011, 2012
STEVAL-AETKT2V1	N.A.	N.A.		High precision bidirectional current sense amplifiers based on the TSC2010/13

Switched reluctance motors

Overview

Switched reluctance motors are mainly used in traction, industrial pumps and home appliances (vacuum cleaners and certain washing machines). Their structure is similar to that of stepper motors, but switched reluctance motors have fewer magnetic poles. Despite their simple structure, external electronic commutation is needed.

The asymmetrical half-bridge PWM drive leverages the motor's best features. An independent current loop is implemented for each motor phase so that some phase current overlap is possible to attain higher speeds. For the drive, 2 x n power switches are required (with n being the number of motor phases).



	Product family		Description with key features	Key products
Control unit	• STM32 Series			• STM32F0 • STM32G0 • STM32F301 • STM32G4x1
Diodes & rectifiers	• STPSx45/60/80/100 • STTHxR03/04/06 • STTHxRQ06		Power Schottky Ultrafast diodes	• STPS3045, STPS41H100C • STTH30R03 • STTH8R06 • STTH15RQ06
MOSFET and IGBT drivers				• STGAP* • L6395D
Power switches	• IGBT M series • IGBT H series		High voltage IGBT	• STGxyyM65DF2 • STGxyyM120DF3 • STGxyyH60DF
Signal conditioning	• TSV TSX TSB series - operational amplifiers • TSB58 power operational amplifier • TSZ series - zero drift amplifiers • TS series - comparators • TSC series - current sense amplifiers		High accuracy and high gain bandwidth product for low-side current measurement. High output current for resolver excitation Fast response time for fault detection. High voltage capability for accurate high side current measurement	• TSV772, TSX712, TSB712 • TSB582, TSX562 • TSZ122, TSZ182 • TS3022 • TSC2010, 2011, 2012 TSC210, 213
Protection	Protection power management: protect low voltage ICs or block	• ESDAxP-1U1M series	Protect the power line against EOS and ESD transients Low clamping voltage High 8/20 µs surge protection capability from 25 to 160 A Peak Pulse Current	• ESDA7P 1201U1M

Note *: one or more digits for each product of the series

Main evaluation board

Reference / bundle	Voltage (V)	Max current (A)	Motor type / control type	ST parts	Application focus
STEVAL-CTM015V1	400	15	SRM PWM 3-shunt	• 1x STM32F303 • 6x L6395D • 6x STGB30H60DFB • 6x STTH15RQ06 • 1x Viper26L • 1x LD1117 • 3x LMV331ICT	Vacuum cleaners, blowers, fans, garden tools Industrial motor drives and more

Microcontrollers

Microcontrollers portfolio

ST's microcontroller portfolio covers the 8-bit STM8 family for robust, low-cost designs and the 32-bit STM32 family, built on Arm® Cortex®-M0, M0+, M3, M4, M7, M33 and M55 cores with a broad choice of peripherals.



	8-bit MCUs	32-bit MCUs and MPUs		
	STM8	STM32		SPC5
	Discover STM8 8-bit MCUs	Discover STM32 32-bit MPUs	Discover STM32 32-bit MCUs	Discover SPC5 32-bit MCUs
MPU		STM32MP1		
High Performance MCUs			STM32H7 STM32F7 STM32F4 STM32F2	
Mainstream MCUs	STM8S		STM32G0 STM32F0 STM32F1 STM32G4 STM32F3	
Ultra-low-power MCUs	STM8L		STM32U5 STM32L5 STM32L4+ STM32L4 STM32U3 STM32U0	
Wireless MCUs			STM32WB STM32WL	
Automotive MCUs	STM8AF STM8AL			SPC56 SPC57 SPC58

Key MCU Selection Guide for Motor control

Motor	STM8S	STM32G0 STM32F0 STM32C0	STM32G4 STM32F41x STM32F3 STM32L4	MPU STM32H7 STM32F7 STM32F4
Brushed DC motors	•	•	•	•
Single phase AC induction motors	•	•	•	
Stepper motors	•	•		
Switched reluctance motors	•	•	•	
3-phase PMSM/FOC - vector control		•	•	
3-phase BLDC/6-step	•	•	•	•
Universal motors	•	•		
PFC		•	•	•
3-phase induction motor control	•	•	•	

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

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

STM8 8-BIT MICROCONTROLLERS

The STM8 MCU is part of a platform of technologies, IPs and tools which forms the basis of ST's comprehensive family of 8-bit microcontrollers. These cover many applications where there is an electric motor, from consumer electronics, including home appliances and factory automation, to automotive segments. The platform provides outstanding levels of digital and analog performance combined with a high level of cost effectiveness.

The microcontrollers in the STM8 family are manufactured using an ST-proprietary 130 nm embedded non-volatile memory technology.

LONGEVITY 10 YEARS COMMITMENT

One series for every need

STM8 8-bit MCUs

STM8 8-bit MCUs
Core up to 24 MHz

Mainstream	Industrial, consumer and mass market	Robust and reliable Up to 125 °C	STM8**S** Data EEPROM, 3 and 5 V families, precise RC	
Ultra-low-power	Ideal combination of low-power performance and features	High-end analog IPs Active Halt < 1 µA	STM8**L** Data EEPROM, 1.65 and 3 V families, strong analog, LCD drivers, low-leakage technology	
Automotive	Long-term guarantee	AEC-Q100 Up to 150 °C	STM8**AF** Data EEPROM, 3 and 5 V families, precise RC, LIN, CAN, grade 0	ASIL Ready
Automotive	Long-term guarantee	AEC-Q100 Up to 125 °C	STM8**AL** Data EEPROM, 1.65 and 3 V families, strong analog, LCD drivers, low-leakage technology	ASIL Ready

STM8 Ecosystem

Software tools
- STM8CubeMX Configuration tool
- Integrated development environments (IDE)
- STM Studio Monitoring tool

Embedded software
- Standard Peripheral Library for STM8L (8kb)
- Standard Peripheral Library for STM8L/AL (64kb)
- Standard Peripheral Library for STM8A/S

Hardware tools
- STM8 Discovery kits, Nucleo and evaluation boards
- ST-LINK in-circuit debugger/programmer

Using STM8 peripherals for motor control

The STM8 comes with a set of peripherals that are suitable for many motor control topologies and applications.

The advanced timer available on the STM8S, STM8L and STM8A is a 16-bit timer capable of both centered or edge-aligned PWM pattern generation and, thanks to the availability of complementary outputs on 3 of its channels, is specifically designed to address 3-phase and full-bridge topologies (for 3-phase AC IM, 3-phase PMSM/ BLDC, bidirectional DC motors, stepper motor drives). The timer is also equipped with a synchronization circuit allowing the ADC to be triggered on specific events and an asynchronous emergency input.

The 12-bit ADC of the STM8L (10-bit on the STM8S and STM8A) allows motor current and voltage to be precisely sensed while its comparator could be used for hysteresis peak current control.

General-purpose 16-bit timers with their input capture capabilities are very well suited for motor speed feedback processing. In particular, the STM8L also features three input XOR gates combining the data coming from three Hall sensors to simplify speed measurement in 3-phase permanent magnet motors.

KEY FEATURES

- Advanced timer for 3-phase inverters and full-bridge converter drivers
- Fast and precise ADC can be triggered by timer events
- 5 V power supply
- Input capture on general-purpose timers for easier speed feedback processing
- Encoder operating mode only for DC motors

STM8S evaluation tools for motor control

Order code	Description	Motors covered	Documentation
STM8/128-EVAL	STM8S MCU evaluation board; any motor control power stage featuring ST's standard MC connector can be connected (see 3-phase brushless motor evaluation tools section)	Depends on power stage connected through MC connector[1]	UM0482
STEVAL-IHM029V2	Universal motor control evaluation board based on high-temperature junction Triac and STM8S microcontroller	Universal, single-phase Induction motors	UM0922
STEVAL-IHM041V1	Universal motor driver with speed control based on the STM8 microcontroller and Triac (US version)	Universal, single-phase induction motors	UM1559

Note: 1. A daughter board may be required to be plugged on STM8/128-EVAL depending on the type of the control and power stage to be connected

BRUSHLESS MOTOR CONTROL WITH STM8S IN 3 STEPS:

1. Visit www.st.com to download STM8S FW library for 3-phase motor control
2. Configure the FW library through the STM8 MC Builder PC software
3. Develop your own applications in conjunction with a third-party IDE and C compiler





STM32 32-bit microcontrollers

The STM32 family of 32-bit Flash microcontrollers based on the ARM Cortex-M processor is designed to offer new degrees of freedom to MCU users. By bringing a complete 32-bit product range that combines high-performance, real-time, low-power and low-voltage operation, while maintaining full integration and ease of development, the STM32 family helps you create new applications and design in innovations. Most STM32 product lines embed Advanced Motor Control timer and are supported by the STM32 full feature Motor Control ecosystem.



KEY FEATURES

- Advanced Motor Control timer for 3-phase inverters and full-bridge converter drivers
- Fast 12-bit and 16-bit ADCs that can be triggered by timer events
- ART Accelerator™, Control loop booster
- Safety ready: SIL, Class B
- STM32Trust: multi-level security
- Integrated analog (op amp, DAC, Comparator…)
- Connectivity (Ethernet, CAN, UART, SPI, I²C, CAN-FD, FW Com stack…)
- Temperature range from -40 °C up to 125 °C
- Precise internal oscillator (1%)

STM32F0, G0, C0, F3, G4
Mainstream

- Rich advanced analog (F3, G4)
- Control loop optimized
- Advanced PWM Motor Control and High resolution timers
- Mathematical accelerators

From cost optimized to full featured SoC solution for Motor Control

STM32H5, F4, F7, H7, MPU
High-performance

- MCU (single or dual core), MPU
- Advanced Connectivity (Ethernet…)
- Graphic Accelerator
- Large embedded SRAM

Motor Control and much more…

STM32L5, U5, L4, (U3, U0)
Ultra-low-power

- EEPROM
- LCD interface
- Graphic accelerator
- The lowest power consumption ideal for battery operated applications

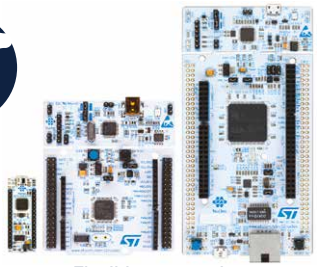
Low power performance and features

STM32 ECOSYSTEM

Hardware tools

www.st.com/stm32hardwaretools

STM32 Nucleo board



Flexible prototyping

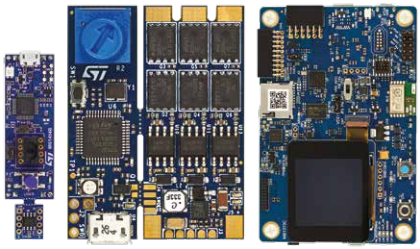
The highly affordable STM32 Nucleo boards allow anyone to try out new ideas and to quickly create prototypes with any STM32 MCU.

Sharing the same connectors, STM32 Nucleo boards can easily be extended with a large number of specialized application hardware add-ons (Nucleo-64 include Arduino Uno rev3 & ST morpho connectors, Nucleo-32 include Arduino Nano connectors).

Discovery kit

STM32 Discovery kits are an inexpensive and complete solution for the evaluation of the outstanding capabilities of STM32 MCUs. They carry the necessary infrastructure for demonstration of specific device characteristics, a HAL library and comprehensive software examples allow to fully benefit from the devices features and added values.

Extension connectors give access to most of the device's I/Os and make the connection of add-on hardware possible.



Creative demos

Evaluation board



Full-feature evaluation

The STM32 eval boards have been designed as a complete demonstration and development platform for the Arm® Cortex STM32 MCUs.

They carry external circuitry, such as transceivers, sensors, memory interfaces, displays and many more. The evaluation boards can be considered as a reference design for application development.

ZeST/HSO boards

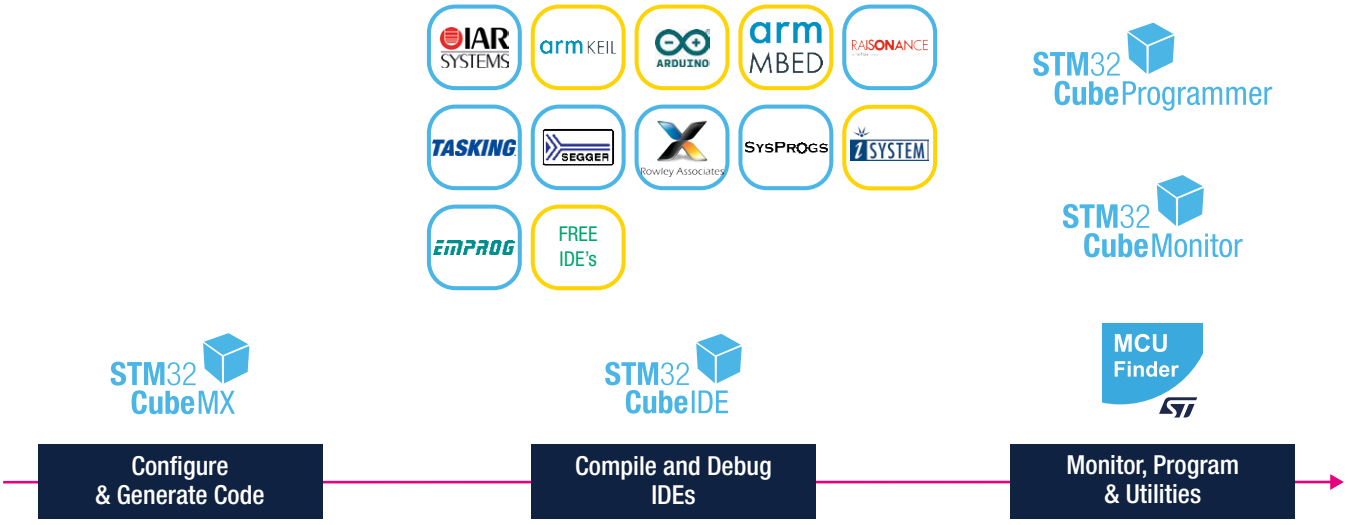
The STM32 ZeST/HSO Solution allows to exploit the capabilities of the ZeST (Zero Speed full Torque) and HSO (High sensitivity Observer) advanced algorithms. A control board based on STM32G4 is able to operate them without any additional component.



B-G473E-ZEST1S + STEVAL-LVLP01

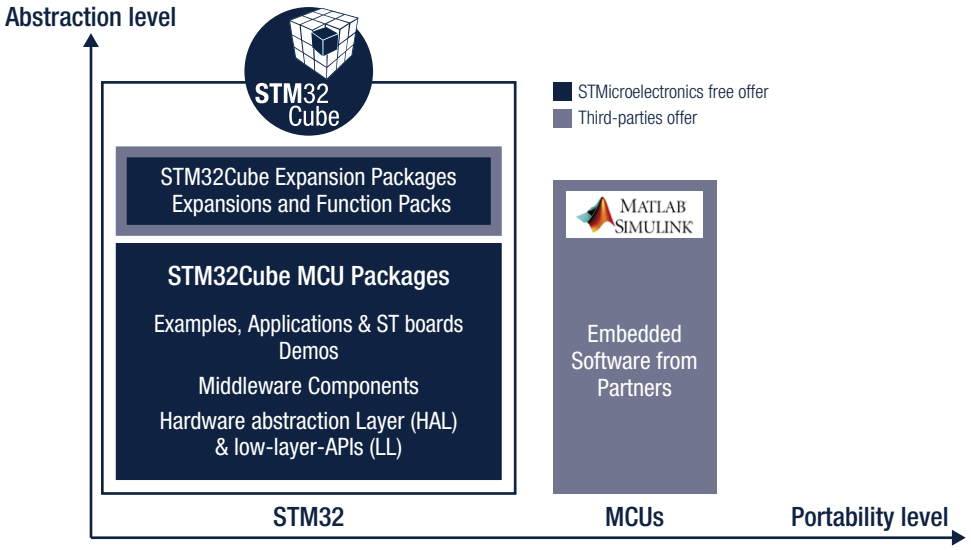
Software tools

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Embedded software

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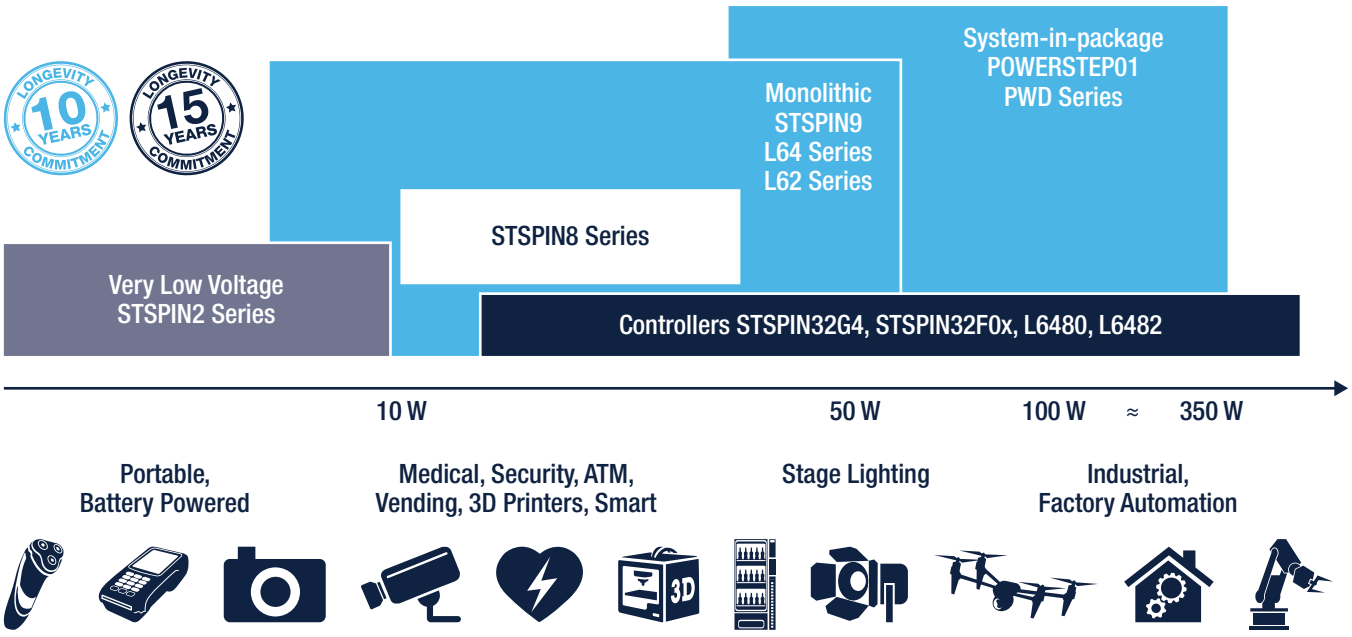
Bring your STM32 project to life with the free educational and training resources on **st.com/stm32education**

Motor Driver ICs

STSPIN motor drivers embed all the functions needed to drive motors efficiently and with the highest accuracy, and include an advanced motion profile generator to relieve the host microcontroller, while ensuring robustness and reliability thanks to a comprehensive set of protection and diagnostic features.
Particularly noteworthy are the adaptive current decay control scheme used in many of the STSPIN motor driver ICs as well as the innovative voltage mode driving used in micro-stepping motor drivers that provides enhanced torque control accuracy and thus motion smoothness.

Our line-up of STSPIN motor control ICs has been developed with the objectives of modularity, scalability and robustness to provide designers a wide choice of solutions to fit different requirements and system architectures.

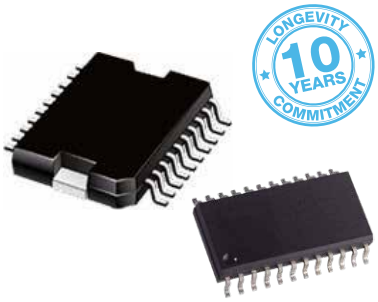
All products have comprehensive built-in protection and diagnostic schemes to help attain the level of long-term reliability and robustness requested to cope with harsh factory automation environments.
Available in a wide selection of space-saving, thermally-optimized packages, you are sure to find a device in our STSPIN line-up that addresses your motor or motion control system requirements.



L62 SERIES

The **L62** series includes a broad range of motor drivers which can drive any type of motor and fit a very wide range of applications. Designed for small and medium sized motors, they feature scalable offer of power stages. L6208 and L6228 are designed to drive stepper motors thanks to the embedded stepping sequence generator. L6205/06/07 and L6225/26/27 are general purpose brushed DC motor drivers having scalable power architecture and programmable overcurrent protection. L6229, L6230, L6234 and L6235 are ideal for both sensored and sensorless driving of 3-phase BLDC motors, also thanks to the embedded PWM current control and hall sensors decoding logic.

L62 Series offers around 30 devices allowing to select the right one from a wide range of packages and to meet all kinds of soldering and thermal needs.



L62X8
Stepper



L6229/L623X
3phase BLDC



L62X5/6/7
Dual/Single DC



Part number	Description	Vin min (V)	Vin max (V)	Rdson (Ohm)	I out max (Arms)
L6206Q	DMOS dual full bridge driver	8	52	0.3 (0.15*)	2.8 (5.6*)
L6207Q					
L6208Q	Bipolar stepper motor				
L6235	3-phase brushless DC motor driver				
L6234		7			
L6226Q	DMOS dual full bridge driver	8	52	0.7 (0.35*)	1.4 (2.8*)
L6227Q					
L6228Q	Bipolar stepper motor				
L6229	3-phase brushless DC motor driver				
L6230					

Note: * Features allowed in parallel mode driving for L62x5/6

MAIN APPLICATIONS

- Stage lighting
- Vending and textile machines
- ATM and money handling machines
- Medical equipment
- Factory automation end-points
- Small home appliances
- Antenna control

STSPIN2 SERIES

STSPIN2 series is a perfect fit for portable 2 Li-Po cells powered solutions, offering a complete set of ICs able to drive brushed DC, stepper or three-phase BLDC motors. Thanks to the extremely compact package (QFN 3x3) and the lowest standby current available on the market (max 80 nA), STSPIN2 series represents the best performance-cost trade-off.

Devices are equipped with control logic and fully protected power stage. **STSPIN220** embeds advanced microstepping circuitry able to control a stepper motor with a high resolution of up to 256 µsteps, while **STSPIN230/3** are field oriented control compliant allowing an easy implementation of one or two- or three-shunt topologies.



STSPIN220
Stepper



STSPIN230/233
3phase BLDC



STSPIN240/250
Dual DC



Part number	Description	Vin min (V)	Vin max (V)	Rdson (Ohm)	I out max (Arms)
STSPIN220	Microstepping driver up to 256 microsteps	1.8	10	0.2	1.3
STSPIN230/3	3-phase BLDC driver				
STSPIN240	Dual DC motor driver				
STSPIN250	Single DC motor driver			0.1	2.6

MAIN APPLICATIONS

- Portable health care
- e-valves, meters and e-lockers
- POS or label printers
- IoT and Gimbals
- Educational robots

STSPIN8 SERIES

STSPIN8 series represents an extension of STSPIN2 series, able to operate at a higher supply voltage. It consists of 3 fully integrated motor drivers packaged in a 4x4mm QFN package, integrating both the control logic and a fully protected low RDSon power stage making them a robust solution for the new and demanding industrial applications. **STSPIN820** allows you to control stepper motors with a high resolution of up to 256 µsteps, **STSPIN830** is field oriented control compliant and enables 3 shunt resistors implementation while **STSPIN840** can be used in parallel mode in order to drive a brushed DC motor at a higher equivalent current.



STSPIN820
Stepper



STSPIN830
3phase BLDC



STSPIN840
Dual DC



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

Note * Features allowed in parallel mode driving

MAIN APPLICATIONS

- Stage lighting and antenna control
- 3D printers
- Vending and textile machines
- ATM and money handling machines
- Factory automation end-points
- Medical and healthcare equipment
- Video surveillance and dome cameras

STSPIN9 SERIES

Available in a compact QFN packages, the **STSPIN9** high-current monolithic motor driver series integrates both the control logic and a fully protected low RDS(on) power stage to help meet the stringent requirements of demanding industrial applications. This makes **STSPIN9** Series an ideal choice for driving motors at high currents, while saving PCB space.

With a wide input options, the controller embeds two analog operational amplifiers that can be used for the signal conditioning of analog Hall-effect sensors or shunt resistor signals. Thanks to its flexibility, **STSPIN9** family can cover the needs of driving multiple different types of brushed DC and stepper motors. The adjustable slew rate ensures the best ratio between power consumption and EMI.



STSPIN948 and STSPIN 958
Brushed DC



STSPIN948
Stepper



Part number	Description	Vin min (V)	Vin max (V)	Rdson (Ohm)	I out max (Arms)
STSPIN948	Dual full bridge driver	5	58	0.4	4.5
STSPIN958	Full bridge driver	5	58	0.4	5

MAIN APPLICATIONS

- Home appliances
- Robotics
- Stage lighting
- Antenna control
- Textile machines
- Vending machines
- Factory automation

STSPIN-P SERIES



Versatile high-current half-bridge and full-bridge platform

The STSPIN-P series comprises twelve 75 V products and three 28 V products.

For STSPIN9P, the 8 half-bridge products are pin-to-pin compatible, as are the 4 full-bridge products, enabling customers to select the ideal solution based on current rating and driving method.

With integrated low-$R_{DS(ON)}$ MOSFETs, the series achieves excellent BOM area reduction. Additionally, integrated current sense amplifiers further minimize the need for external components.

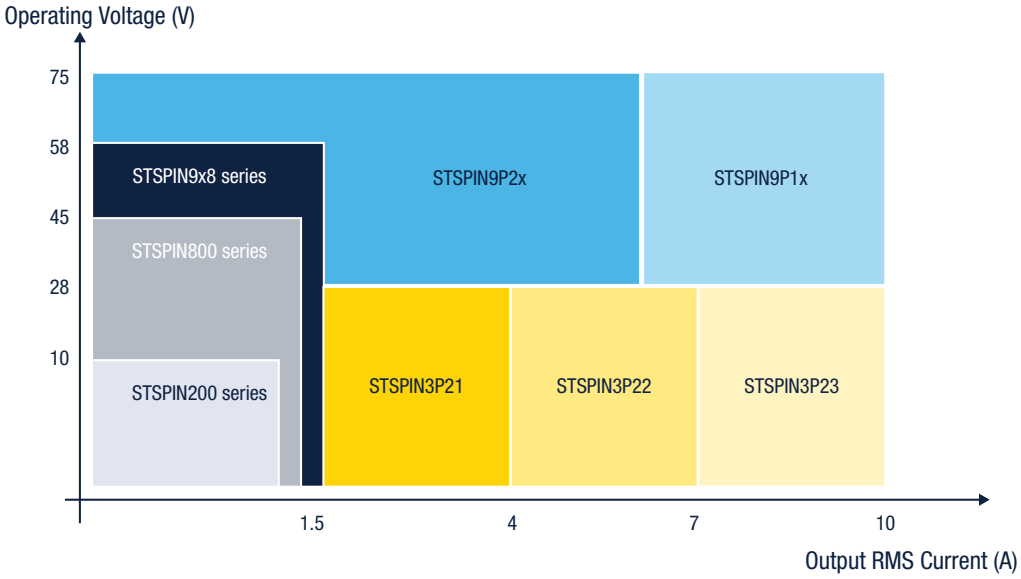
The programmable slew rate optimizes the power-to-EMI ratio, allowing precise fine-tuning for specific applications.

The devices feature comprehensive protection, including safeguards against undervoltage, overvoltage, overcurrent, and thermal issues. Open-load detection is also supported.

All products are available in compact QFN packages: 7x7 mm for half-bridge devices and 9x7 mm for full-bridge devices.

MAIN APPLICATIONS

- Home and building control
- Industrial automation
- Pumps and fans
- Textile machines
- Home appliances



Part number	Product type	R_{DSON} (mΩ)	IN Ctrl	PWM Off T	PWM trim	Comp	Package
STSPIN9P11	Half bridge	16	IN, EN	Yes	Yes	PWM	QFN7x7
STSPIN9P12				No	No	Uncomm	
STSPIN9P13			INH, INL	Yes	Yes	PWM	
STSPIN9P14				No	No	Uncomm	
STSPIN9P15		27	IN, EN	Yes	Yes	PWM	
STSPIN9P16				No	No	Uncomm	
STSPIN9P17			INH, INL	Yes	Yes	PWM	
STSPIN9P18				No	No	Uncomm	
STSPIN9P21	Full bridge	27	IN, EN	Yes	Yes	PWM	QFN9x7
STSPIN9P22				No	No	Uncomm	
STSPIN9P23			INH, INL	Yes	Yes	PWM	
STSPIN9P24				No	No	Uncomm	

The STSPIN3P series offers a scalable solution of 3 products for brushed DC motor applications with varying $R_{DS(ON)}$ values to meet different power requirements. Designed with a full-bridge configuration, these devices optimize compactness.

The power section is built on ST VIPower™ technology. STSPIN3P combines high-performance power MOSFETs with intelligent signal and protection circuitry, ensuring efficiency and reliability in demanding applications.

The multisense pin delivers real-time motor current feedback, diagnostic information, and case temperature monitoring.

The STSPIN3P series minimizes the bill of materials (BOM) by integrating low-RDS(ON) MOSFETs, charge pump and current-sense functionality, reducing the need for external components. Additionally, the standby function enables very-low-power modes.

The devices are housed in a QFN 6x6 package with three exposed islands for superior thermal dissipation. This robust design is tailored for harsh industrial environments, ensuring reliable performance and enhanced thermal management.

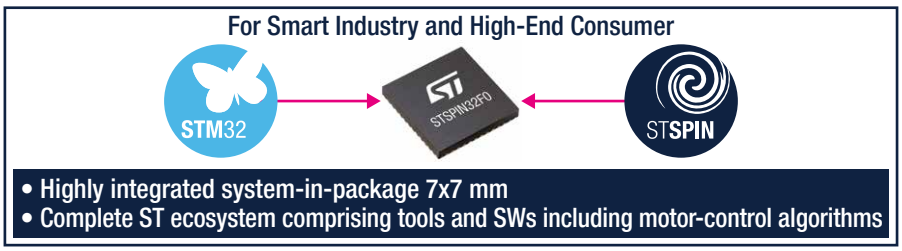
Part number	Product type	R_{DSON} (mΩ)	Peak curr (A)	RMS curr (A)	In Ctrl	Package
STSPIN3P21	Full-bridge	41	15	4	INA/INB	QFN 6x6
STSPIN3P22		22	23	7	INA/INB	
STSPIN3P23		15	35	10	INA/INB	

STSPIN32F0 LV SERIES

STSPIN32F0 series is a family of self-supplied Systems-In-Package integrating a Cortex-M0™ microcontroller and an advanced 3-phase gate driver. The embedded MCU gives the freedom to configure the device with the motion control algorithm which best fits the end application targets. Customers can choose from a set of predefined firmware algorithms, spanning from more classical 6-step to the advanced sensorless field oriented control.

Internal 3.3 V DC/DC buck converter and 12 V LDO linear regulator supply the MCU, external components and gate drivers. Operational amplifiers are available and they can be used for signal conditioning of analog Hall-effect sensors or shunt resistor signals. Programmable threshold over current protection is guaranteed by the embedded comparator.





MAIN APPLICATIONS

- Power tools
- Fans
- Vacuum cleaners, other HA
- Industrial automation and control
- Robotic arms
- Drones (gimbal and ESC control)

Part number	Description	Vin min (V)	Vin max (V)
STSPIN32F0	Advanced BLDC controller with embedded STM32 MCU	8	45
STSPIN32F0A		6.7	45
STSPIN32F0B		6.7	45

STSPIN32F0 HV SERIES

STSPIN32F0 HV family extends the flexibility and all the features of STM32-based motor controllers to high voltage applications. Four pin-to-pin compatible Systems-in-Package integrating an STM32 Cortex-M0 MCU and high-voltage 3-phase gate drivers, with embedded smartShutDown™. Advanced and fully protected 3-phase BLDC controllers are available for applications running up to 250 V and 600 V, at respectively two different gate currents of 0.35 A and 1 A. Thanks to the motor controllers' high scalability in home appliances and industrial applications, designers can easily design and reuse their current hardware and firmware in all applications fitting main voltage supplies (110 VAC & 220 VAC), without having to change PCB.

Part number	Description	Vin min (V)	Vin max (V)	Driving Current capability "Iout max (A) peak"	Vout max (V)
STSPIN32F0251/Q	250 V 3-phase driver with STM32 in TQFP and QFN package options	9	20	0.35	250
STSPIN32F0252/Q				1	
STSPIN32F0601/Q	600 V 3-phase driver with STM32	9	20	0.35	600
STSPIN32F0602/Q				1	

STSPIN32G0 SERIES OF LOW-VOLTAGE BLDC CONTROLLERS WITH EMBEDDED STM32 MCU

The **low-voltage STSPIN32G0 series** improves power computation scalability. The product is offered in **STSPIN32G0A1, STSPIN32G0A2, STSPIN32G0B1, and STSPIN32G0B2** variations. All four devices in the 7x7mm QFN package embed a triple half-bridge gate driver able to drive power MOSFETs with a current capability of 600 mA (sink and source). An integrated interlocking function ensures that the high- and low-side switches of the same half-bridge cannot be simultaneously driven high.
Depending on the option chosen, the designer can access one to three shunt resistors for current sensing and MCU backup supply voltage pin availability.

An internal DC/DC step-down converter provides the 3.3 V voltage suitable to supply both the MCU and external components. An internal LDO linear regulator provides the supply voltage for gate drivers. The integrated operational amplifiers are available for the signal conditioning of the shunt resistor signal and a comparator for over-current protection.

The integrated MCU (STM32G031C8) is based on the high-performance Cortex M0+ core, operating up to 64 MHz. This integrated MCU is the perfect fit for motion control, featuring a 12-bit ADC, internal voltage reference buffer, 16-bit PWM timer dedicated to motion control, up to 32 GPIOs, 64 KB flash, and 8 KB SRAM. This MCU allows field-oriented control, 6-Step sensorless, and other advanced driving algorithms, including the speed control loop. It has write-protection and read-protection features for embedded flash memory to protect against unwanted read or write operations by unauthorized code.

The device also features thermal shutdown and under voltage lockout protections and has a standby mode to reduce power consumption.

MAIN APPLICATIONS

- Power tools
- Battery powered home Appliances
- Industrial automation
- Fans
- Robotics

Part number	Tool type	Vin min (V)	Vin max (V)	Vbat available	Op amps	Current sensing
STSPIN32G0A1	45 V 3-phase gate driver with power management and STM32G0 embedded	6.7	45	Yes	3	Up to 3 shunts
STSPIN32G0A2				No		
STSPIN32G0B1				Yes	1	1 shunt
STSPIN32G0B2				No		

STSPIN32G0 SERIES OF HIGH-VOLTAGE BLDC CONTROLLERS WITH EMBEDDED STM32 MCU

The **high-voltage STSPIN32G0 series** from the STSPIN32 family, complements the low-voltage STSPIN32G0 series and ensures full scalability in terms of power rating and computational power. The high-voltage STSPIN32G0 series includes a full family of products targeting both battery-powered and corded applications, significantly expanding the applications of the STSPIN32 family. The STSPIN32G0 HV series specifically embeds the outstanding performance of 250/600 V gate drivers with the mainstream STM32 version (STM32G031C8).

The high-performance microcontroller and extremely robust high-voltage gate driver are combined in a QFN10x10 package in **STSPIN32G0251Q, STSPIN32G0252Q, STSPIN32G0601Q, and STSPIN32G0602Q** versions. These components ensure scalability in terms of supply voltage (250 - 600 V) and gate driving current (250/350 mA or 1/0.85 A source/sink current). The gate drivers feature a full set of protections, including a fast comparator for smart shutdown, overcurrent and overload protection, cross-conduction prevention, and undervoltage lockout.

The powerful integrated MCU (STM32G031C8) is used in the low-voltage STSPIN32G0 series and ensures the performance of various types of control algorithms, including sensored and sensorless field-oriented control (FOC) with one, two, or three shunts, as well as six-step driving. The updated STSPIN32 family targets a wide range of applications thanks to the flexibility of the external power stage.

MAIN APPLICATIONS

- Home appliances
- Compressors
- Pumps and fans
- Industrial automation
- Robotics

Part number	Tool type	Vin min (V)	Vin max (V)	Vout max (V)	I_{GATE} (A)
STSPIN32G0251Q	250 V 3-phase driver with STM32	9	20	250	0.35
STSPIN32G0252Q					1
STSPIN32G0601Q	600 V 3-phase driver with STM32			600	0.35
STSPIN32G0602Q					1

STSPIN32G4 LV SERIES



The **STSPIN32G4** is an extremely integrated and flexible motor controller for driving 3-phase brushless motors, helping designers to choose the most suitable driving mode and reduce PCB area and overall Bill Of Materials. It embeds a triple half-bridge gate driver able to drive power MOSFETs with a current capability of 1 A (sink and source). Three bootstrap diodes are embedded as well.



The high- and low-side switches of the same half-bridge cannot be simultaneously driven high thanks to an integrated interlocking function. An additional protection feature is represented by hardware VDS monitoring circuitry that constantly monitors each of the six external MOSFETs and in case an overvoltage is detected across one of them, switches off all gate driver outputs. The overvoltage threshold is set through a dedicated SCREF pin.

An internal high precision low-drop linear regulator (LDO) is used to generate the 3.3 V supply (VREG3V3) starting from the REGIN input voltage. The 3.3 V output voltage supplies both the gate driver logic and the microcontroller. It is protected against short-circuit, overload and undervoltage conditions.

The integrated MCU (STM32G431VBx3) is based on the high-performance 32-bit ARM® Cortex®-M4 core, operating at a frequency up to 170 MHz and featuring a single-precision floating-point unit (FPU), full set of DSP (Digital Signal Processing) instructions and a memory protection unit (MPU), which enhances the application's security.

Finally, with an additional external three-phase driver (such as the STDRIVE101) two independent 3-phase BLDC motors can be efficiently driven from the STSPIN32G4, offering an unprecedented BOM saving and application optimization.

MAIN APPLICATIONS

- Automation Robots
- Servo Drives
- E-Bikes
- Battery powered HA
- Industrial automation and Robotics

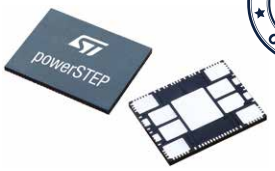
Part number	Description	Vin min (V)	Vin max (V)
STSPIN32G4	Advanced BLDC controller with embedded STM32 MCU	5.5	75

POWERSTEP01

The **POWERSTEP01** is a highly configurable high current stepper motor driver able to operate up to 85 V. It integrates an advanced microstepping controller and 8 power MOSFETs, featuring a 16 mΩ $R_{DS(ON)}$.

Thanks to proprietary and patented technologies, the device can be configured to drive the motors in voltage or in current mode. The voltage mode allows to obtain very smooth and silent motion performance, while the current driving guarantees the full control of the motor current. Many other advanced features are available such as the full customization of the motion profile (acceleration, deceleration, speed, etc.), positioning calculations, sensorless stall detection, real-time diagnostics and user-configurable failure protections.

A very rich set of protections make the POWERSTEP01 robust, as required by the most demanding motor control applications.



Part number	Description	Vin min (V)	Vin max (V)	Rdson (Ohm)	I out max (Arms)
powerSTEP01	System-in-package integrating microstepping controller and 10 A power MOSFETs	7.5	85	0.016	10

MAIN APPLICATIONS

- Textile Machines
- Sewing Machines
- Robot Welders
- Industrial label printers
- Industrial dozers and mixer

L64 SERIES

The **L64** series includes ST's most advanced microstepping motor drivers and controllers. Both **L6470** and **L6480** feature advanced voltage control mode thus obtaining very smooth and silent motion and reaching high positioning precision (up to 128 microsteps). **L6472** and **L6482** instead drive the motors through an advanced current control algorithm with self-adapting decay and guaranteeing the target current is always supplied to the motor, with no loss of steps or control.

Many other advanced features are available such as the full customization of the motion profile (acceleration, deceleration, speed, etc.), positioning calculations, sensorless stall detection, real-time diagnostics and user-configurable failure protections.

The **L648x** controllers allow higher voltage and current through external power MOSFETs.



Part number	Product	Description	Vin min (V)	Vin max (V)	Rdson (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)	8	85	not applicable	
	L6482	Predictive current control Adaptive decay (1/16 µstep)				

MAIN APPLICATIONS

- ATM and money handling machines
- Medical equipment
- Video conferencing
- Antenna control
- Pick and place machines
- Home and factory appliances

PWD SERIES–SMART POWER DRIVERS IN QFN

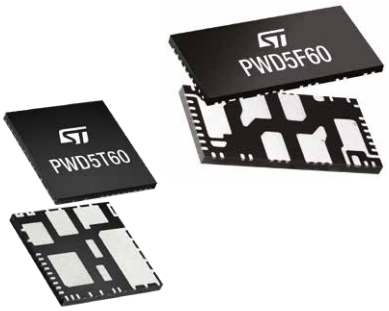
PWD series devices are advanced power systems-in-package integrating smart gate drivers and N-channel power MOSFETs.

The series includes two products embedding four N-channel power MOSFETs in dual half-bridge configuration offering a uniquely efficient alternative for brushed DC or single-phase BLDC motors. A third option is now available with six N-channel power MOSFETs for three-phase motors.

The PWD range of high-voltage products can cover a wide range of different applications for brushed and brushless DC motors.

The embedded gate drivers integrate bootstrap diodes to reduce BOM and space in tiny, thermally efficient QFN packages.

The **PWD5F60** also embeds peak-current control comparators that, combined with Hall-effect positioning sensors, offer a standalone motor driver for single-phase BLDC motors without requiring a dedicated MCU, which implies significant cost reductions to your system driving solution. The PWD5T60 is ideal for three-phase brushless DC motor drive applications such as fans, pumps and small appliances.



PWD5F60
Brushed DC



PWD5F60
1-phase BLDC



PWD5T60
3-phase BLDC



Part number	Description	Vin min (V)	Vin max (V)	$R_{DS(on)}$ (Ohm)	I out max (Arms)
PWD5F60	Full-bridge driver	10	20	1.38	3.5
PWD5T60	3-phase driver	9	20	1.38	3.5

MAIN APPLICATIONS

- Fans & pumps
- Blowers
- Home appliances
- Factory automation

GaNSPIN SERIES – GaNFET-BASED SMART HALF-BRIDGES TAILORED FOR MOTION CONTROL

The GaNSPIN series is a family of smart half-bridge products tailored for motor control. Each device integrates a smart half-bridge driver and two GaNFETs for performance and flexibility.

Together with the smart half-bridge driver, GaNSPIN611 embeds two 140 mΩ GaNFETs, while GaNSPIN612 embeds two 270 mΩ GaNFETs. They are both designed for high-voltage applications up to 600 V.

The GaNSPIN series applies the major performance advantages of GaNFETs to motion control applications, including adjustable dV/dt in the order of 10V/ns to optimize EMI and motor reliability.

Additionally, the devices embed a full set of protections for optimal motor driver performance.



Part number	Description	Supply voltage max (V)	$R_{DS(on)}$ (Ohm)	I out max (Arms)
GaNSPIN611	High-voltage half-bridge driver with GaNFETS	600	0.14	3
GaNSPIN612			0.27	2

MAIN APPLICATIONS

- Home appliances
- Servo drives and cobots
- Industrial and medical robots
- E-mobility: e-bikes, e-scooters

Stepper motor drivers

Part number	Package	General description	$R_{DS(on)}$ (Ω)	Supply voltage (V)		Output Current-Max (A) RMS	Operating temperature	
				Min.	Max.		Min. (°C)	Max. (°C)
STSPIN948	VQFPN48 7x7x1	58 V stepper motor driver 200 mΩ	0.2	5	38	4.5	-40	150
powerSTEP01	VFQFPN 11x14x1	System-in-package integrating microstepping controller and 10 A power MOSFETs	0.016	7.5	85	10	-40	150
STSPIN220	VFQFPN 16 3x3x1.0	Low Voltage Motor driver with up to 256 microsteps and embedded PWM current control	0.2	1.8	10	1.3		
L6474	HTSSOP28; PowerSO 36	Motor driver up to 16 microsteps with SPI and advanced current control	0.3	8	45	3		
L6472	HTSSOP28; PowerSO 36	Full features motor driver up to 128 microsteps with SPI, motion engine and advanced current control						
L6470								
L6208	PowerSO 36, SO24	Stepper motor driver with embedded current control			52	2.8		
L6208Q	VFQFPN 48 7x7x1.0							
STSPIN820	TFQFPN 4x4x1.05 - 24L	Compact advanced 256 microsteps motor driver with step-clock and direction interface	0.5	7	45	1.5		
L6258	PowerSO36	PWM controlled high current DMOS universal motor driver	0.6	12	40*	1.5*	-40*	
L6228	PowerSO 36, SO24	Stepper motor driver with embedded current control	0.7	8	52	1.4	-40	150
L6228Q	VFQFPN 32 5x5x1.0							
L6219	SO24	Stepper motor driver	-	4.5*	46*	0.75*	-40*	125*
L6482	HTSSOP38	Stepper controller with SPI, motion engine, gate drivers and advanced current control featuring 128 microsteps	-	7.5	85	-	-40	150
L6480			-			-		
L297	SO-20	Stepper motor controller	-	4.75	7	-		

Note * The value may vary depending on the part number

Brushed DC motor drivers

Part number	Package	General description	$R_{DS(on)}$ (Ω)	Supply voltage (V)		Output Current-Max (A) RMS	Output Current-Max (A) peak	Operating temperature	
				Min.	Max.			Min. (°C)	Max. (°C)
STSPIN948	VQFPN48 7x7x1	58 V dual DC motor driver 200 mΩ (single 100 mΩ	0.2	5	58	4.5	7	-40	150
STSPIN958	VQFPN32 5x5x1	58 V single DC motor driver 200 mΩ	0.2	5	58	5	7	-40	150
PWD5F60	VFQFPN 15x7x1 mm.	High voltage full bridge with integrated comparators	1.4	10	600	5	14	-40	125
STSPIN240	VFQFPN 16 3x3x1.0	Low voltage dual brushed DC motor driver	0.2	1.8	10	1.3	2	-40	150
STSPIN250		Low voltage brushed DC motor driver	0.1	1.8	10	2.6	4		
L6205	PowerSO-20; SO20	Versatile DMOS dual full bridge motor drivers with embedded PWM current control	0.3	8	52	2.8	7.1		
L6206	PowerSO 36; SO24								
L6206Q	VFQFPN 48 7x7x1.0								
L6207	PowerSO 36; SO24								
L6207Q	VFQFPN 48 7x7x1.0								
STSPIN840	TFQFPN 4x4x1.05 - 24L	Compact dual brushed DC motor driver with embedded PWM current control	0.5	7	45	1.5	2.5		
L6225	PowerSO-20; SO20	Versatile DMOS dual full bridge motor drivers with embedded PWM current control	0.7	8	52	1.4	3.55		
L6226	PowerSO 36; SO24								
L6226Q	VFQFPN 32 5x5x1.0								
L6227	PowerSO 36; SO24								
L6227Q	VFQFPN 32 5x5x1.0								
L6201	PowerSO-20; SO-20	DMOS full bridge motor driver	0.3	12	48	1	5		
L6203	MW 11L						10		
L2293Q	VFQFPN 32 5x5x1.0	Push-pull four channels motor driver with diodes	-	4.5	36	0.6	1.2		
L293D	SO-20								
L298	MW 15L; PowerSO-20	Dual full bridge motor driver				2	-		

3-phase brushless DC motor drivers

Part number	Package	General description	$R_{DS(on)}$ (Ω)	Supply voltage (V)		Output Current-Max (A) RMS	Output Current-Max (A) peak	Operating temperature	
				Min.	Max.			Min. (°C)	Max. (°C)
PWD5T60	VFQFPN 12x12x0.95	High voltage three-phase BLDC motor driver	1.6	9	20	5	14	-40	125
STSPIN32G0A1	QFN 48 7x7x1	45 V 3-phase gate driver with power management and STM32G0 embedded	-	6.7	45	-	0.6	-40	130
STSPIN32G0A2	QFN 48 7x7x1	45 V 3-phase gate driver with power management and STM32G0 embedded	-	6.7	45	-	0.6	-40	130
STSPIN32G0B1	QFN 48 7x7x1	45 V 3-phase gate driver with power management and STM32G0 embedded	-	6.7	45	-	0.6	-40	130
STSPIN32G0B2	QFN 48 7x7x1	45 V 3-phase gate driver with power management and STM32G0 embedded	-	6.7	45	-	0.6	-40	130
STSPIN32G0251Q	QFN 72L 10x10x1.8	250 V 3-phase gate driver with STM32G0 embedded	-	9	250	-	0.35	-40	125
STSPIN32G0252Q	QFN 72L 10x10x1.8	250 V 3-phase gate driver with STM32G0 embedded	-	9	250	-	1	-40	125
STSPIN32G0601Q	QFN 72L 10x10x1.8	600 V 3-phase gate driver with STM32G0 embedded	-	9	600	-	0.35	-40	125
STSPIN32G0602Q	QFN 72L 10x10x1.8	600 V 3-phase gate driver with STM32G0 embedded	-	9	600	-	1	-40	125
STSPIN32G4	VFQFPN 64 9x9x1	Advanced BLDC controller with embedded STM32	-	5.5	75	-	1		
STSPIN32F0	VFQFPN 48 7x7x1	Advanced BLDC controller with embedded STM32, DC-DC; optimized for FOC	-	8	45	-	0.6		

Part number	Package	General description	$R_{DS(on)}$ (Ω)	Supply voltage (V)		Output Current-Max (A) RMS	Output Current-Max (A) peak	Operating temperature	
				Min.	Max.			Min. (°C)	Max. (°C)
STSPIN32F0A	VFQFPN 48 7x7x1	Advanced BLDC controller with embedded STM32, DC-DC, extended V Range and optimized for 6-step control	-	6.7	45	-	0.6		
STSPIN32F0B	VFQFPN 48 7x7x1	Advanced BLDC with embedded STM32, DC-DC, extended V Range and extra GPIOs	-	6.7	45	-	0.35		
STSPIN32F0251	TQFP 64 10x10x1 QFN 72 10x10x1	250 V Advanced BLDC with embedded STM32	-	9	20	-	0.35		
STSPIN32F0252	TQFP 64 10x10x1 QFN 72 10x10x1	250 V Advanced BLDC with embedded STM32 and extra current capability, DCDC, extended V Range and extra GPIOs	-	9	20	-	1		
STSPIN32F0601	TQFP 64 10x10x1 QFN 72 10x10x1	600 V Advanced BLDC with embedded STM32	-	9	20	-	0.35		
STSPIN32F0602	TQFP 64 10x10x1 QFN 72 10x10x1	600 V Advanced BLDC with embedded STM32 and extra current capability	-	9	20	-	-1		
STSPIN830	TFQFPN 4x4x1 - 24L	Compact 3-phase integrated motor driver optimized for 3 shunts configuration	0.5	7	45	1.5	2.5	-40	150
STSPIN230	VFQFPN 16 3x3x1	Low voltage 3-phase integrated motor driver	0.2	1.8	10	1.3	2		
STSPIN233	VFQFPN 16 3x3x1	Low voltage 3-phase integrated motor driver optimized for 3 shunts control	0.2	1.8	10	1.3	2		
L6229	PowerSO 36; SO-24	3-phase 6-step integrated motor drivers with embedded Hall sensors decoding logic	0.7	8	52	1.4	3.55		
L6229Q	VFQFPN 32 5x5x1		0.7	8	52	1.4	3.55		
L6235	PowerSO 36; SO-24		0.3	8	52	2.8	7.1		
L6235Q	VFQFPN 48 7x7x1		0.3	8	52	2.5	7.1		
L6230	PowerSO 36; VFQFPN 32 5x5x1	Triple half-bridge integrated motor drivers	0.7	8	52	1.4	3.55		
L6234	PowerSO-20		0.3	7	52	2.8	5		

STSPIN PACKAGE OPTIONS EXAMPLES



QFN 11x14



VFQFPN 10x13



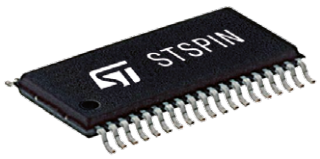
QFN 7x7 48L



QFN 3x3



POWERSO36



HTSSOP38



SO24

A COMPLETE ECOSYSTEM IS PROVIDED TO SUPPORT DESIGN-IN AND SHORTEN TIME-TO-MARKET

Designing motor control applications becomes much easier with the outstanding performance, features and full support of STSPIN motor driver ICs that make brushed DC, stepper and brushless motor control designs more efficient in a variety of applications.

A wide range of evaluation boards is provided, together with low-cost plug-and-play discovery kits: an ideal development tool for both beginners and experienced users that is autonomous and can be used with a software interface or with a custom firmware thanks to the embedded microcontroller.

Schematics, BOMs and gerber files are available to give you a headstart with your hardware design together with comprehensive technical documentation.

Software suites are also provided to enable quick and easy development of motor driving solutions.

In addition, STSPIN motor drivers can be easily evaluated in combination with an STM32 32-bit microcontroller in an open, flexible and affordable development environment to enable fast prototyping that can quickly be transformed into final designs.

The comprehensive development environment includes:

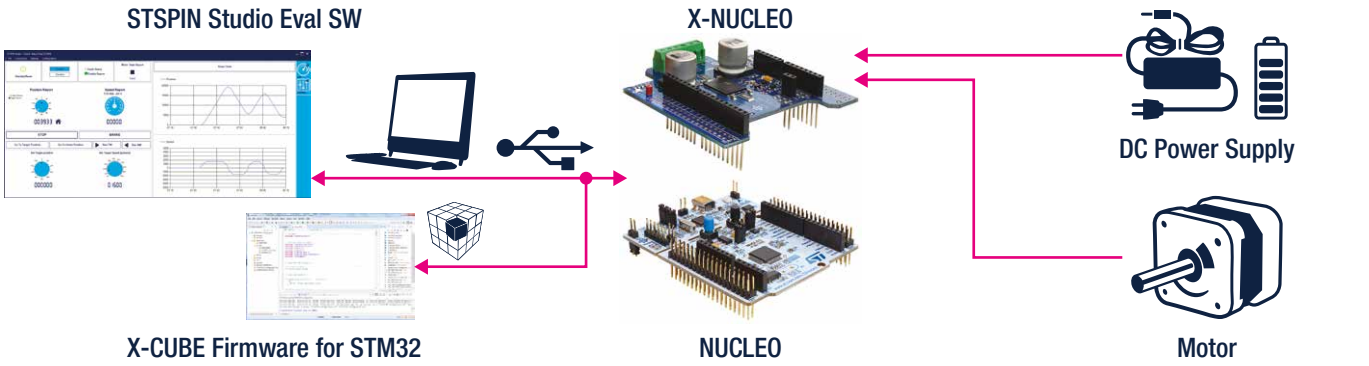
STM32 Nucleo development boards: a comprehensive range of affordable development boards for all STM32 microcontroller series.

STM32 Nucleo expansion boards: based on STSPIN motor drivers, the expansion boards can be mounted on, the STM32 Nucleo development boards. More complex functionalities can be achieved by stacking additional expansion boards.

The expansion boards are equipped with standardized interconnections such as an Arduino Uno R3 connector or a morpho connector for a higher level of connectivity.

Each expansion board is supported by STM32-based software modules.

SPEED-UP YOUR DESIGN WITH X-NUCLEO

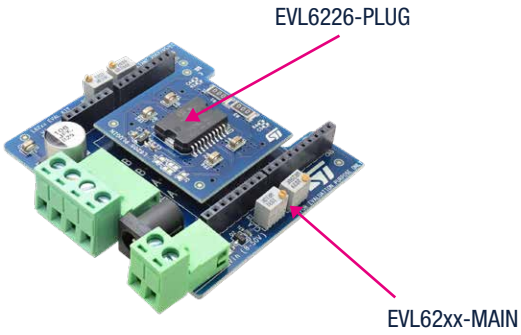


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STSPIN STUDIO SOFTWARE





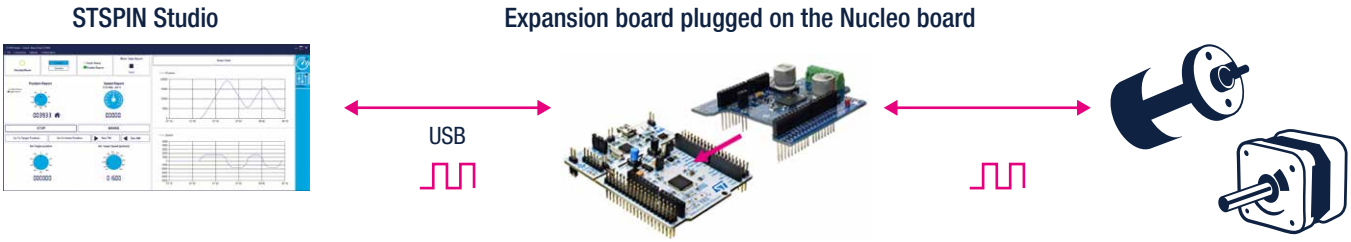
STSPIN Studio (STSW-STSPIN01) is easy-to-use software for the evaluation of brushed DC and stepper motors with the STSPIN family devices.

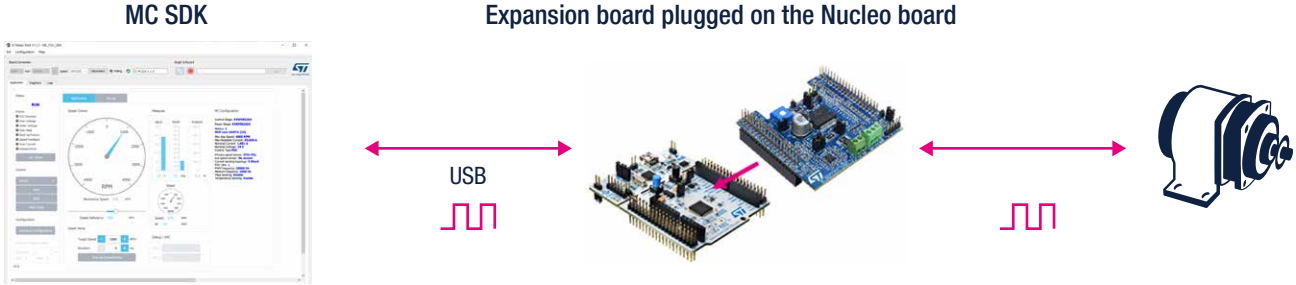
It allows the proper control of several evaluation boards of stepper and brush DC motor drivers, while three-phase brushless DC motors can be configured with the STM32 ecosystem.

STSPIN Studio covers a wide range of final applications through an intuitive GUI, where the user can control and monitor motor operation.
Its main purpose is to set parameters to apply the proper control of the motor and optimize the performance of the final application.
STSPIN Studio offers online updating, allowing the user to easily download the last version of firmware for each device.
STSPIN Studio can be used with STM32 Nucleo board development platforms to quickly evaluate and start development using expansion boards with STSPIN devices.
Additionally, a brand-new platform of interchangeable plug-in boards has been released to make evaluation even easier.
Evaluation main boards are designed to hold plug-in boards for the STSPIN2, STSPIN8, STSPIN9, L62, and L64 families creating a single hardware platform to be used in combination with STSPIN Studio.

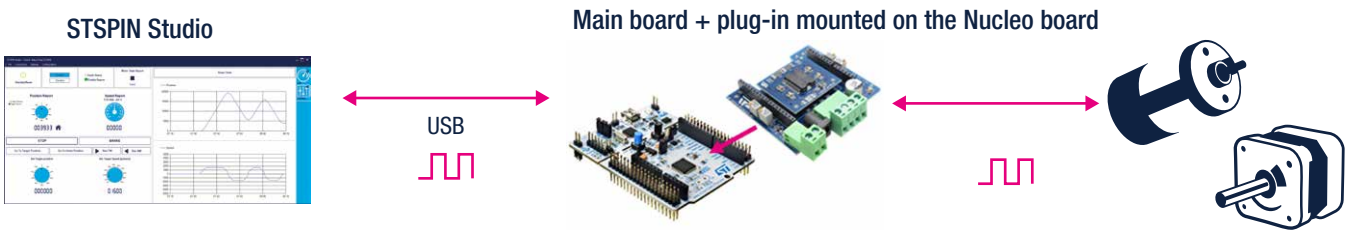
STSPIN Studio also works in combination with general-purpose evaluation boards of the same product families.

NUCLEO EXPANSION BOARD SET UP

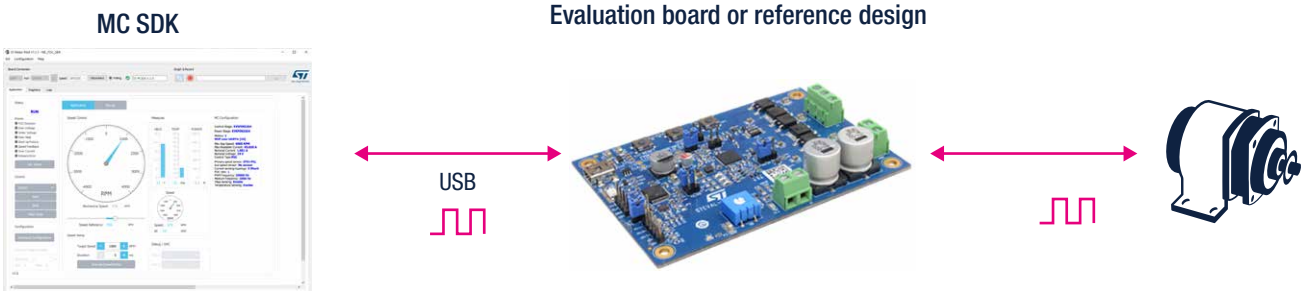




PLUG-IN BOARDS SETUP WITH NUCLEO



GENERAL PURPOSE BOARDS AND REFERENCE DESIGNS



Ecosystem for stepper motor drivers and controllers

Part number	Tool type	Core product	Evaluation software	Firmware	Companion board
X-NUCLEO-IHM14A1	Expansion board for STM32 nucleo board	STSPIN820	STSW-STSPIN01	X-CUBE-SPN14	STM32 Nucleo board F4, F0 or L0 series
X-NUCLEO-IHM06A1	Expansion board for STM32 nucleo board	STSPIN220	STSW-STSPIN01	X-CUBE-SPN6	STM32 Nucleo board F4, F0 or L0 series
EVLPOWERSTEP01	Evaluation board	POWERSTEP01	STSW-SPIN002	X-CUBE-SPN3	STEVAL-PCC009V2 interface board
X-NUCLEO-IHM03A1	Expansion board for STM32 nucleo board	POWERSTEP01	STSW-SPIN002	X-CUBE-SPN3	STM32 Nucleo board F4, F0 or L0 series
EVAL6482H-DISC	Discovery kit	L6482	STSW-SPIN002	STSW-SPIN005, STSW-SPINDISC01	-
EVAL6482H	Evaluation board	L6482	STSW-SPIN002	STSW-SPIN005	STEVAL-PCC009V2 interface board
EVAL6480H-DISC	Discovery kit	L6480	STSW-SPIN002	STSW-SPIN005, STSW-SPINDISC01	-
EVAL6480H	Evaluation board	L6480	STSW-SPIN002	STSW-SPIN005	STEVAL-PCC009V2 interface board
EVAL6474H	Evaluation board	L6474	STSW-SPIN002	X-CUBE-SPN1	STEVAL-PCC009V2 interface board
EVAL6474PD	Evaluation board	L6474	STSW-SPIN002	X-CUBE-SPN1	STEVAL-PCC009V2 interface board
X-NUCLEO-IHM01A1	Expansion board for STM32 nucleo board	L6474	STSW-SPIN002	X-CUBE-SPN1	STM32 Nucleo board F4, F0 or L0 series
EVAL6472H-DISC	Discovery kit	L6472	STSW-SPIN002	STSW-SPIN004, STSW-SPINDISC01	-
EVAL6472H	Evaluation board	L6472	STSW-SPIN002	STSW-SPIN004	STEVAL-PCC009V2 interface board
EVAL6472PD	Evaluation board	L6472	STSW-SPIN002	STSW-SPIN004	STEVAL-PCC009V2 interface board
EVAL6470H-DISC	Discovery kit	L6470	STSW-SPIN002	STSW-SPIN004, STSW-SPINDISC01	-
EVAL6470H	Evaluation board	L6470	STSW-SPIN002	STSW-SPIN004	STEVAL-PCC009V2 interface board
EVAL6470PD	Evaluation board	L6470	STSW-SPIN002	STSW-SPIN004	STEVAL-PCC009V2 interface board
X-NUCLEO-IHM02A1	Expansion board for STM32 nucleo board	L6470	-	X-CUBE-SPN2	STM32 Nucleo board F4, F0 or L0 series

Part number	Tool type	Core product	Evaluation software	Firmware	Companion board
STEVAL-IKM001V1	Evaluation kit EVAL6470H and STEVAL-PCC009V2	L6470	STSW-IKM001V1S	STSW-IKM001V1	-
X-NUCLEO-IHM05A1	Expansion board for STM32 nucleo board	L6208	STSW-SPIN002	STSW-SPIN005	STM32 Nucleo board F4, F0 or L0 series
EVAL6208Q	Evaluation board	L6208Q	STSW-SPIN003	-	STEVAL-PCC009V2 interface board
EVALSP820-XS	Evaluation board	STSPIN820	-	-	-
STSPIN220 Click Board	3rd party expansion board	STSPIN220	-	-	-
STSPIN820 Click Board	3rd party expansion board	STSPIN820	-	-	-
EVL6208-PLUG	Evaluation kit environment for L62xx family plug board	L6208PD	STSW-STSPIN01	-	EVL62XX-MAIN
EVL6228-PLUG	Evaluation kit environment for L62xx family plug board	L6228PD	STSW-STSPIN01	-	EVL62XX-MAIN
EVLSPIN948	Evaluation board for STSPIN948	STSPIN948	STSW-STSPIN01		NUCLEO-F401RE
EVL6470	Evaluation board for L6470	L6470	STSW-STSPIN01	-	NUCLEO-F401RE
EVL6472	Evaluation board for L6472	L6472	STSW-STSPIN01	-	NUCLEO-F401RE
EVL6480	Evaluation board for L6480	L6480	STSW-STSPIN01	-	NUCLEO-F401RE
EVL6482	Evaluation board for L6482	L6482	STSW-STSPIN01	-	NUCLEO-F401RE

Ecosystem for brushed DC motor drivers and controllers

Part number	Tool type	Core product	Evaluation software	Firmware	Companion board
X-NUCLEO-IHM12A1	Expansion board for STM32 nucleo board	STSPIN240	STSW-STSPIN01	X-CUBE-SPN12	STM32 Nucleo board F4, F0 or L0 series
X-NUCLEO-IHM13A1	Expansion board for STM32 nucleo board	STSPIN250	STSW-STSPIN01	X-CUBE-SPN13	STM32 Nucleo board F4, F0 or L0 series
X-NUCLEO-IHM15A1	Expansion board for STM32 nucleo board	STSPIN840	STSW-STSPIN01	X-CUBE-SPN14	STM32 Nucleo board F4, F0 or L0 series
EVLSPIN948	Evaluation board for STSPIN948	STSPIN948	STSW-STSPIN01	-	NUCLEO-F401RE
EVLSPIN958	Evaluation board for STSPIN958	STSPIN958	STSW-STSPIN01	-	NUCLEO-F401RE
EVALPWD5F60	Evaluation Board	PWD5F60	-	-	-
EVAL6207Q	Evaluation board	L6207Q	STSW-SPIN003	-	STEVAL-PCC009V2 interface board
X-NUCLEO-IHM04A1	Expansion board for STM32 nucleo board	L6206	STSW-SPIN002	X-CUBE-SPN4	STM32 Nucleo board F4, F0 or L0 series
EVAL2293Q	Evaluation Board	L2293Q	-	-	-
STSPIN250 Click Board	3rd party expansion board	STSPIN250	-	-	-
EVL6205-PLUG	Evaluation kit environment for L62xx family plug board	L6205PD	STSW-STSPIN01	-	EVL62XX-MAIN
EVL6225-PLUG	Evaluation kit environment for L62xx family plug board	L6225PD	STSW-STSPIN01	-	EVL62XX-MAIN
EVL6206-PLUG	Evaluation kit environment for L62xx family plug board	L6206PD	STSW-STSPIN01	-	EVL62XX-MAIN
EVL6226-PLUG	Evaluation kit environment for L62xx family plug board	L6226PD	STSW-STSPIN01	-	EVL62XX-MAIN
EVL6207-PLUG	Evaluation kit environment for L62xx family plug board	L6207PD	STSW-STSPIN01	-	EVL62XX-MAIN
EVL6227-PLUG	Evaluation kit environment for L62xx family plug board	L6227PD	STSW-STSPIN01	-	EVL62XX-MAIN

Ecosystem for brushless DC motor drivers and controllers

Part number	Tool type	Core product	Evaluation software	Firmware	Companion board
EVLPWD5T60	Evaluation board	PWD5T60	X-CUBE-MCSDK	-	-
EVLPWD-FAN-PUMP	Reference design for high voltage fan and pump	PWD5T60	X-CUBE-MCSDK	-	-
EVSPIN32G0A1	Evaluation board (3 shunts)	STSPIN32G0A1	X-CUBE-MCSDK	-	-
EVSPIN32G0A2	Evaluation board (3 shunts)	STSPIN32G0A2	X-CUBE-MCSDK	-	-
EVSPIN32G0B1	Evaluation board (1 shunt)	STSPIN32G0B1	X-CUBE-MCSDK	-	-
EVSPIN32G0B2	Evaluation board (1 shunt)	STSPIN32G0B2	X-CUBE-MCSDK	-	-
EVSPIN32G02Q1S1	Evaluation board (inverter, 1 shunt)	STSPIN32G0251Q	X-CUBE-MCSDK	-	-
EVSPIN32G06Q1S1	Evaluation board (inverter, 1 shunt)	STSPIN32G0601Q	X-CUBE-MCSDK	-	-
EVSPIN32G06Q1S3	Evaluation board (inverter, 3 shunts)	STSPIN32G0601Q	X-CUBE-MCSDK	-	-
EVSPIN32G06Q2S1	Evaluation board (inverter, 3 shunts)	STSPIN32G0602Q	X-CUBE-MCSDK	-	-
EVSPIN32G4	Evaluation Board	STSPIN32G4	-	-	-
EVSPIN32G4NH	Evaluation Board	STSPIN32G4	-	-	-
STEVAL-SPIN3201	Evaluation board	STSPIN32F0	-	X-CUBE MCSDK	-
X-NUCLEO-IHM11M1	Expansion board for STM32 nucleo board	STSPIN230	-	X-CUBE MCSDK	STM32 Nucleo board F4, F0 or L0 series
STEVAL-SPIN3202	Evaluation Board	STSPIN32F0A	-	X-CUBE MCSDK	NUCLEO-F030R8, NUCLEO-F103RB, NUCLEO-F302R8
X-NUCLEO-IHM16M1	Expansion board for STM32 nucleo board	STSPIN830	-	X-CUBE MCSDK	-
X-NUCLEO-IHM17M1	Expansion board for STM32 nucleo board	STSPIN233	-	X-CUBE MCSDK	NUCLEO-F030R8, NUCLEO-F103RB, NUCLEO-F302R8
STEVAL-Ptool1v1	Evaluation Board	STSPIN32F0B	-	STSW-PTOOL1V1	-
STEVAL-Ptool2v1	Evaluation Board	STSPIN32F0252	-	STSW-PTOOL2V1	-
EVALKIT-ROBOT-1	Evaluation Board	STSPIN32F0A	-	STSW-ROBOT1	-
P-NUCLEO-IHM001	Nucleo Pack with NUCLEO-F302R8 and X-NUCLEO-IHM07M1	L6230	-	X-CUBE MCSDK	-
X-NUCLEO-IHM07M1	Expansion board for STM32 nucleo board	L6230	-	X-CUBE MCSDK	STM32 Nucleo board F4, F0 or L0 series
STEVAL-IHM042V1	Evaluation board	L6230	-	X-CUBE MCSDK	-
STEVAL-IHM043V1	Evaluation board	L6234	-	X-CUBE MCSDK	-
EVAL6235Q	Evaluation board	L6235Q	STSW-SPIN003	-	STEVAL-PCC009V2
EVLSPIN32G4-ACT	Evaluation board for smart actuator	STSPIN32G4	X-CUBE-MCSDK	-	STWIN.box
EVSPIN32G4-DUAL	Evaluation board for dual motor control	STSPIN32G4	X-CUBE-MCSDK	-	-
EVLSERV01	High current reference design up to 53 Arms	STSPIN32G4	X-CUBE-MCSDK	-	-
STEVAL-CTM011V1	250W Evaluation board for compressors based on IGBTs	STSPIN32F0601Q	-	STSW-CTM011	-
STEVAL-CTM012V1	250W Evaluation board for compressors based on MOSFETs	STSPIN32F0601Q	-	STSW-CTM011	-

Ecosystem for reference design

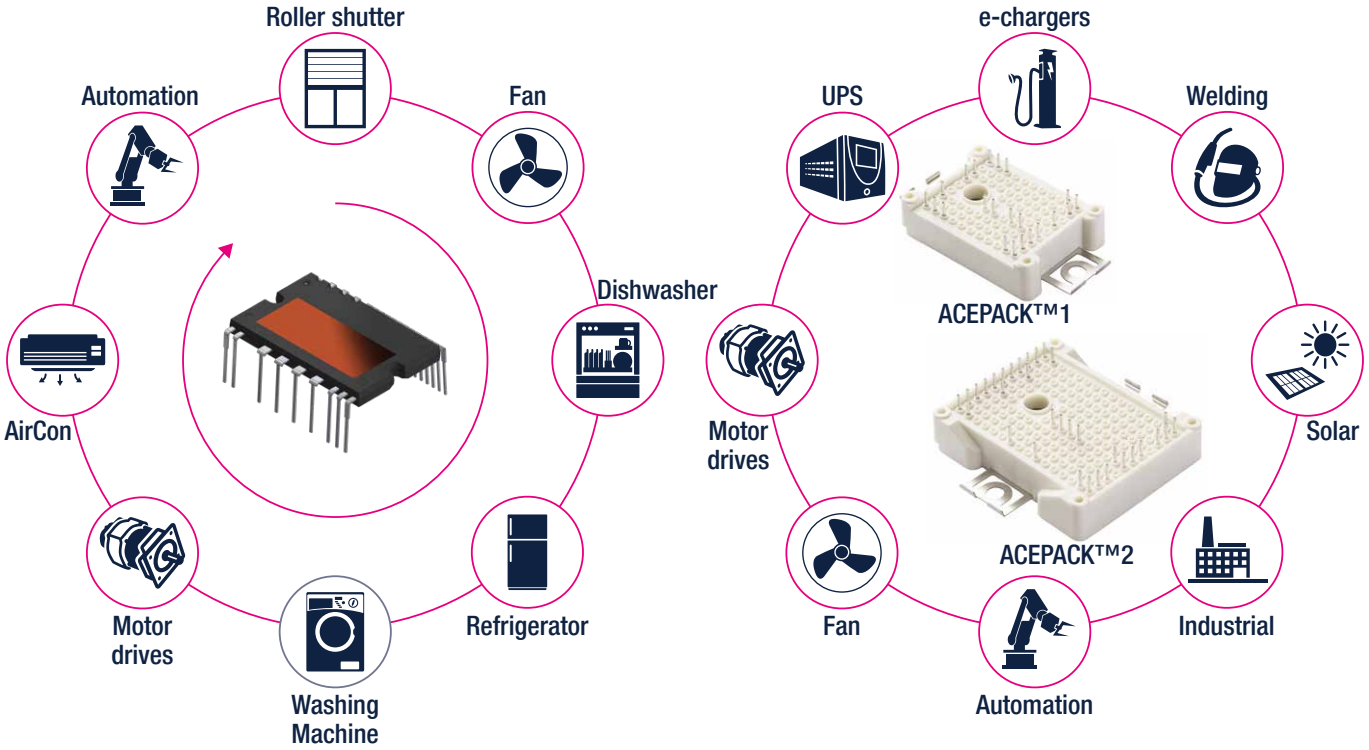
Part number	Tool type	Description	Core product	Firmware
STEVAL-ESC002V1	Evaluation kit	Electronic Speed Controller reference design based on STSPIN32F0A	STSPIN32F0A	STSW-ESC002V1
STEVAL-GMBL02V1	Evaluation kit	Reference design kit for Gimbal controller for drones and handheld applications	STSPIN233	STSW-GMBL02V1

Power Modules and IPM

Reduce your design time and efforts with ST's portfolio of highly-integrated, high-efficiency power modules for flexible and robust designs ranging from tens of watts up to 30 kW. Available in a wide selection of current capability, breakdown voltage and space-saving packages, you are sure to find a device in our Power Module product portfolio that addresses your motor or motion control system requirements.
ST's power module portfolio includes both SLLIMM™ families of Intelligent Power Modules (IPM) as well as ACEPACK™ Power Modules for all types of power switching applications.

SLLIMM
Intelligent Power Modules

ACEPACK
Power Modules



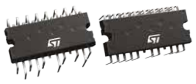
SLLIMM™ INTELLIGENT POWER MODULES

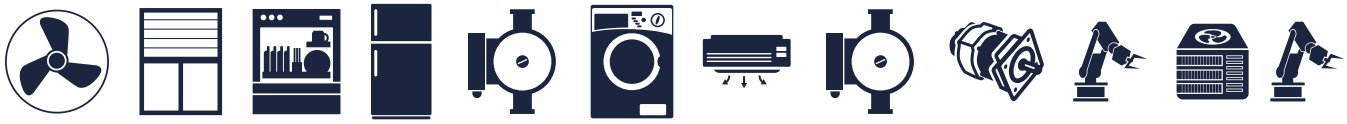
Nowadays, the market requires high performance solutions able to satisfy the increasing energy saving requirements, compactness, reliability, and system costs in home appliances and in low-/medium-power motor drive applications as well as in HVAC, servo motors and other high-power industrial drives.

To address these market needs, STMicroelectronics has developed the SLLIMM (small low-loss intelligent molded module) families of compact, high efficiency, dual-in-line Intelligent Power Modules, with optional extra features.

It provides a high integrated level that means simplified circuit design, reduced BOM, smaller weight, and high reliability.

Available in different options, both packages (fully molded and DBC) and leads (through-hole and SMD), SLLIMM series can combine six power switches (IGBT, MOSFET and SJ-MOSFET) and drivers in an inverter configuration assuring the best compromise between conduction and switching energy with an outstanding robustness and EMI behavior, making the new product ideal to enhance the efficiency of 3-phase inverters and any motor drives working up to 20 kHz in hard-switching circuitries and for an application power range from 10 W to 7 kW.

SLLIMM nano			SLLIMM 2nd series	SLLIMM Compact	SLLIMM 2nd series	SLLIMM HP
SMD	TH	2nd series TH	Full molded	DBC		
600 V IGBT 500 V MOSFET 1 up to 5 A	600 V IGBT 3 A	600 V IGBT 600 V SJ-MOSFET 3 up to 8 A	600 V IGBT 8 up to 15 A	600 V IGBT 5 up to 20 A	600 V IGBT 600 V SJ-MOSFET 12 up to 35 A	IGBT 650 V, 50 A 1200 V, 10 A
						
NSDIP-26L 12.45 x 29.15 x 3.10 mm	NDIP-26L 12.45 x 29.15 x 3.10 mm	N2DIP-26L 12.45 x 32.15 x 4.10 mm	SDIP2F-26L 24 x 38 x 3.5 mm	CDIPB-26L 18.8 x 32.8 x 3.6 mm	SDIP2B-26L 24 x 38 x 3.5 mm	SDIPHP-30L 31 x 52 x 5.6 mm
10 to 600W			300W to 3kW			3 to 7kW

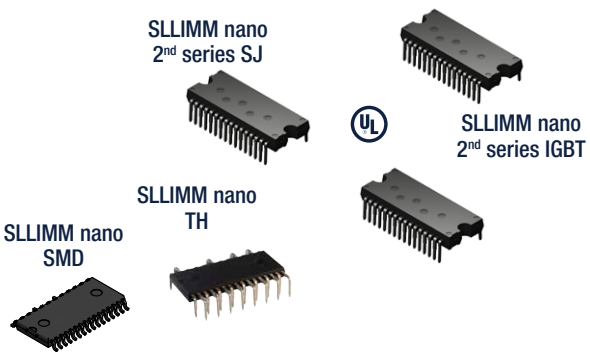


SLLIMM™ NANO SERIES

Combining six switches driven by three high-voltage gate drivers in a compact DIP package, the ST's nano IPM family has been designed to cover different motor control applications from very low to medium power range.

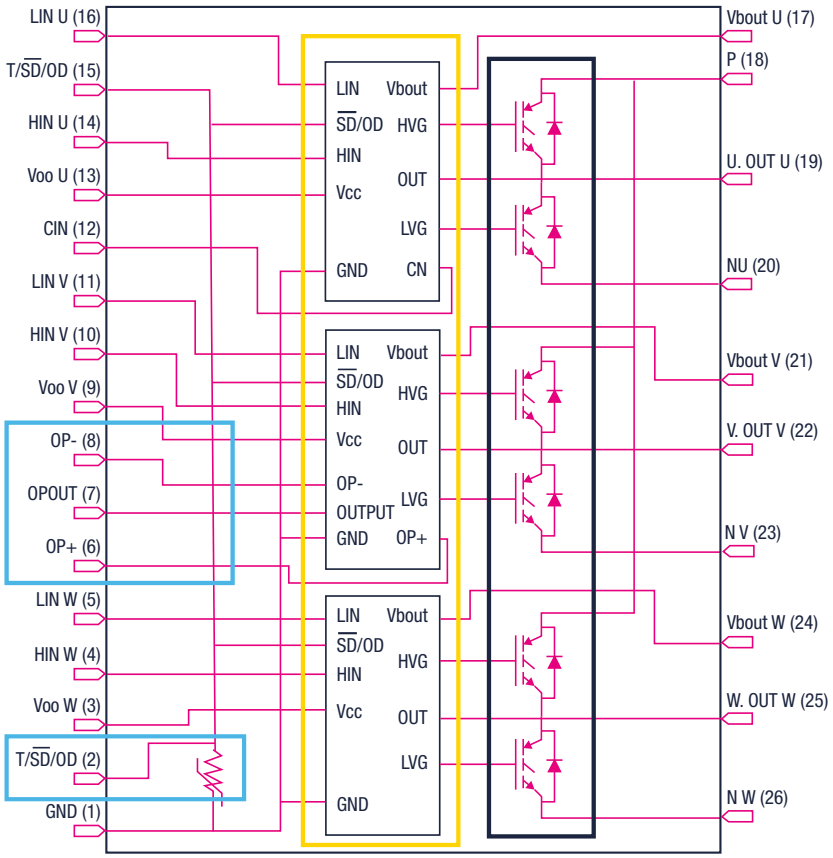
The fully isolated SLLIMM-nano package is the ideal solution to satisfy the customer request to reduce assembly PCB/system space, without sacrificing thermal performance and reliability.

ST offers three package solutions: SLLIMM-nano SMD (Surface Mounting Device), SLLIMM-nano and SLLIMM–nano 2nd series TH (Through hole).



KEY FEATURES

- Optimized voltage drop in conduction
- IGBT (planar, TFS) and MOSFET (planar, SJ) based
- 600 V and 500 V breakdown voltage
- Current availability up to 8 A at 25 °C
- Comparator for fault protection
- OpAmp for advanced current sensing
- Open emitter configuration for individual phase current sensing
- Internal bootstrap diodes
- Interlocking function and UVLO
- Mounted slots package options
- In line and zig-zag leads options (w/wo stand-off)



IGBT + FRD or high-voltage MOSFET

3 ICs for gate driving in half-bridge configuration

Additional features like NTC, Opamp and shutdown I/O

Product PN	Lead type	Switch type	BV	I_{CN}	$V_{cesat\ typ}$/Max $R_{DS(on)}$	t_{dead} min
STGIPN3H60(A)(T)-(H)	TH	IGBT	600 V	3 A	2.15 V	1.5 µs
STGIPNS3H60T-H	SMD	IGBT	600 V	3 A	2.15 V	1.5 µs
STGIPNS4C60T-H		IGBT	600 V	4 A	1.8 V	1.5 µs
STIPNS2M50T-H		MOSFET	500 V	2 A	1.7 Ω	1 µs
STIPNS1M50T-H				1 A	3.6 Ω	1 µs
STGIPQ3H60T-HZ/L(S)	TH	IGBT	600 V	3 A	2.15 V	1.5 µs
STGIPQ4C60T-HZ/L				3 A	1.6 V	1.5 µs
STGIPQ5C60T-HZ/L(S)				5 A	1.65 V	1.5 µs
STGIPQ8C60T-HZ				8 A	2.0 V	1.0 µs
STIPQ3M60T-HZ		SJ-MOSFET		3 A	1.6 Ω	1.0 µs
STIPQ5M60T-HZ				5 A	1.0 Ω	1.0 µs

SLLIMM™ 2ND SERIES

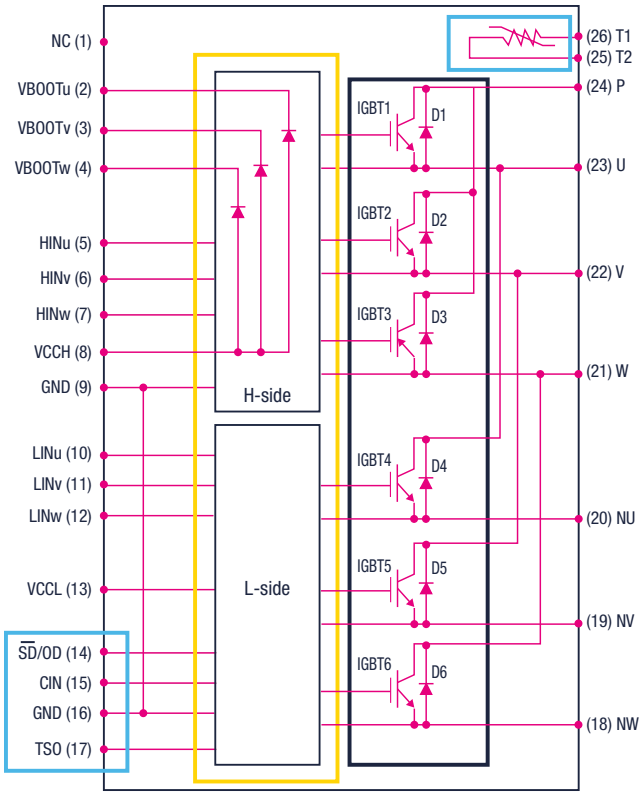
The SLLIMM 2nd series is based on a 3-phase inverter equipped with IGBTs or superjunction (SJ) MOSFETs, driven by one high-side and one low-side gate drivers. It features a current capability from 8 to 35 A and a breakdown voltage of 600 V. Thanks to the full-molded and top-side cooling direct bonded copper (DBC) package options, these IPMs address low-to-medium to high-power applications.

A built-in temperature sensor and/or an NTC (Negative temperature coefficient) option and other added features are available.

The SLLIMM 2nd series ensures high efficiency in home appliances such as washing machines, pumps, fans, and air conditioning units as well as motor drives working at up to 20 kHz in hard-switching circuitries from 300 W to 3 kW.

KEY FEATURES

- 600 V, from 8 A to 35 A DC rating at 25 °C
- Low V_{CEsat}/R_{DSon}
- Optimized driver and silicon for low EMI
- Internal bootstrap diode
- Maximum operating junction temperature
  - 175 °C for IGBT based
  - 150 °C for SJ MOSFET based
- Separate open emitter outputs
- NTC on board
- Integrated temperature sensor on Low side driver
- Comparator for fault protection
- Shutdown input/fault output
- Isolation rating of 2000 Vrms/min
- UL recognition: UL 1557

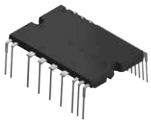


IGBT + FRD or Super Junction MOSFET

2 control ICs for gate driving

Additional features like NTC, TSO and shutdown I/O

SLLIMM 2nd series Full Molded



SLLIMM 2nd series DBC



Part Number	Switch technology	I_c @ 25 °C (@ 80 °C)	$V_{ce(sat)}$/$R_{DSon\ (typ)}$ @ I_c 25 °C (@ I_c 80 °C)	Max $R_{th(j-c)}$	t_{scw}
STGIF5CH60TS-L(E)(X)	IGBT	8 A (5 A)	1.7 V (1.5 V)	5.0 °C/W	5 µs
STGIF7CH60TS-L(E)(X)		10 A (7 A)		4.80 °C/W	
STGIF10CH60TS-L(E)		15 A (10 A)		4.60 °C/W	
STGIB8CH60TS-L(E)(XZ)		12 A (8 A)	1.7 V (1.5 V)	3.0 °C/W	5 µs
STGIB10CH60TS-L(E)(XZ)		15 A (10 A)		2.26 °C/W	
STGIB15CH60TS-L(XZ)		20 A (15 A)		1.85 °C/W	
STGIB20M60TS-L(E)(XZ)		25 A (20 A)		1.40 °C/W	8 µs
STGIB30M60TS-L(XZ)		35 A (30 A)		1.20 °C/W	
STIB1060DM2T-LZ	SJ-MOSFET	10	180 mΩ	1.59 °C/W	12 µs
STIB1560DM2T-LZ		15	150 mΩ	1.10 °C/W	12 µs

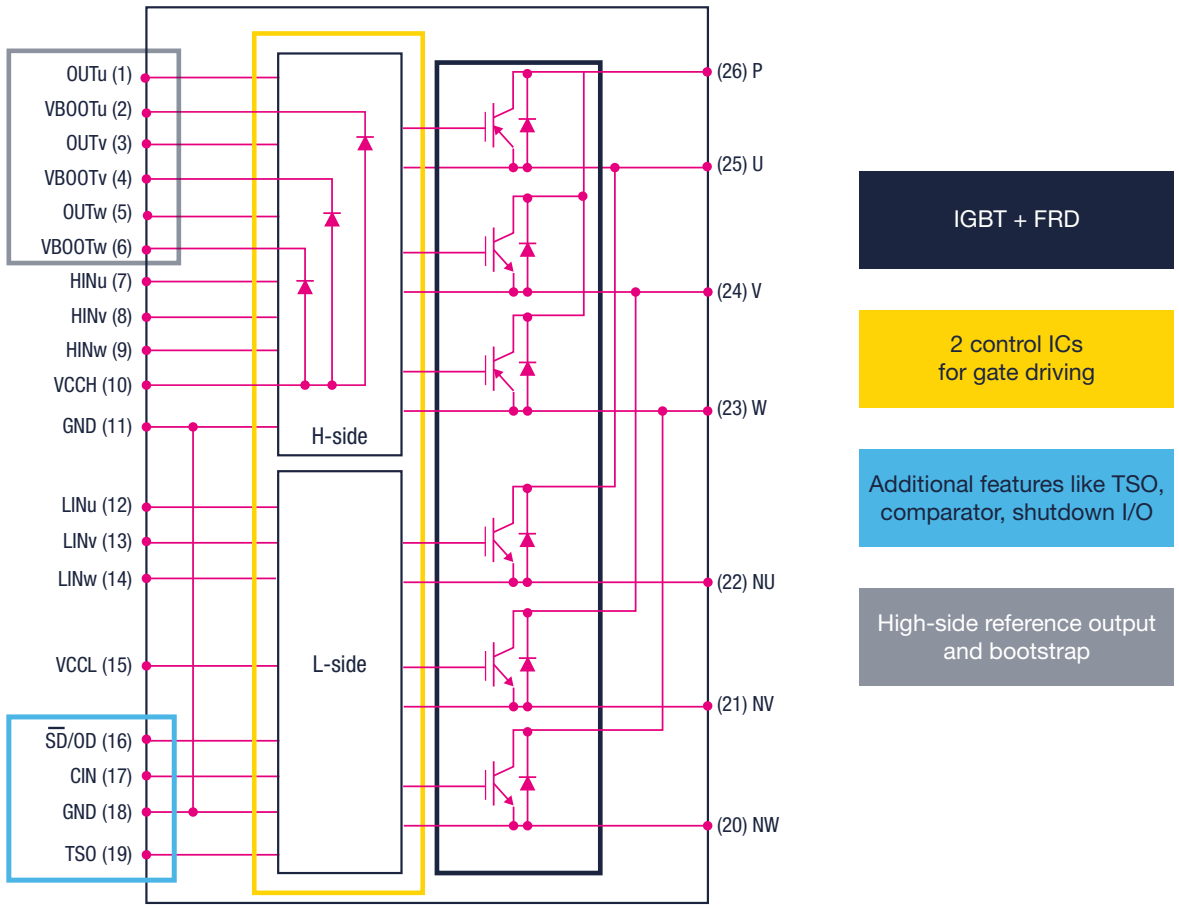
Note F = Full Molded package B = DBC package T = NTC on board S = Temperature sensing E = Short leads and emitter forward L = Long leads X = Medium leads

SLLIMM™ COMPACT

The SLLIMM compact series are intelligent power modules (IPMs) integrating a complete 3-phase inverter stage in a slim dual-in-line package measuring 32.8 × 18.8 × 3.6 mm. Each module combines 600 V short-circuit-rugged IGBTs with freewheeling diodes and dedicated high-side and low-side gate drivers, targeting low-to-medium power motor drive applications operating at up to 20 kHz in hard-switching circuitries.

Each module includes a complete set of protection and control features: internal bootstrap diode, undervoltage lockout (UVLO), shutdown input with fault output, and a temperature sensor output for thermal monitoring. A dedicated comparator provides additional fault protection.

The top-side cooling direct bonded copper (DBC) substrate enables efficient thermal dissipation, while high-side reference outputs and zig-zag signal-side leads simplify bootstrap circuit layout and PCB routing, reducing the effort required for board design.



Product PN	Switch technology	I_c @ 25°C	$V_{co(tat)}$ / $R_{DSon\ (typ)}$ @ I_c 25°C	Max $R_{th(j-c)}$	Package
STGI15C60S	IGBT	20 A	1.65 V	2.4 °C/W	CIDBP-26L

SLLIMM™ HIGH POWER

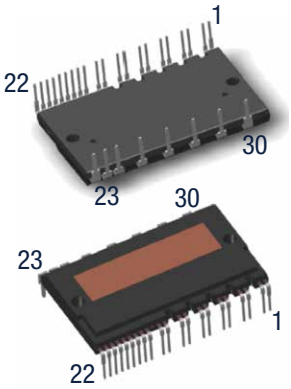
The SLLIMM High Power (HP) series is designed using a new configuration of the internal drivers, featuring three high-side and one low-side drivers, and trench gate field-stop IGBTs plus a freewheeling diode power stage.

SLLIMM HP series expands the existing SLLIMM series in terms of breakdown voltage, current capability and power range in addition to the features/functions and package options offered.

The SLLIMM HP product consists of a 650 V/50 A and 1200 V/10 A tailored for industrial applications such as HVAC (heating ventilation air conditioning), servo motors as well as GPI (general purpose inverter) and industrial washing machine applications operating at a frequency range up to 20 kHz and for power range up to 7 kW.

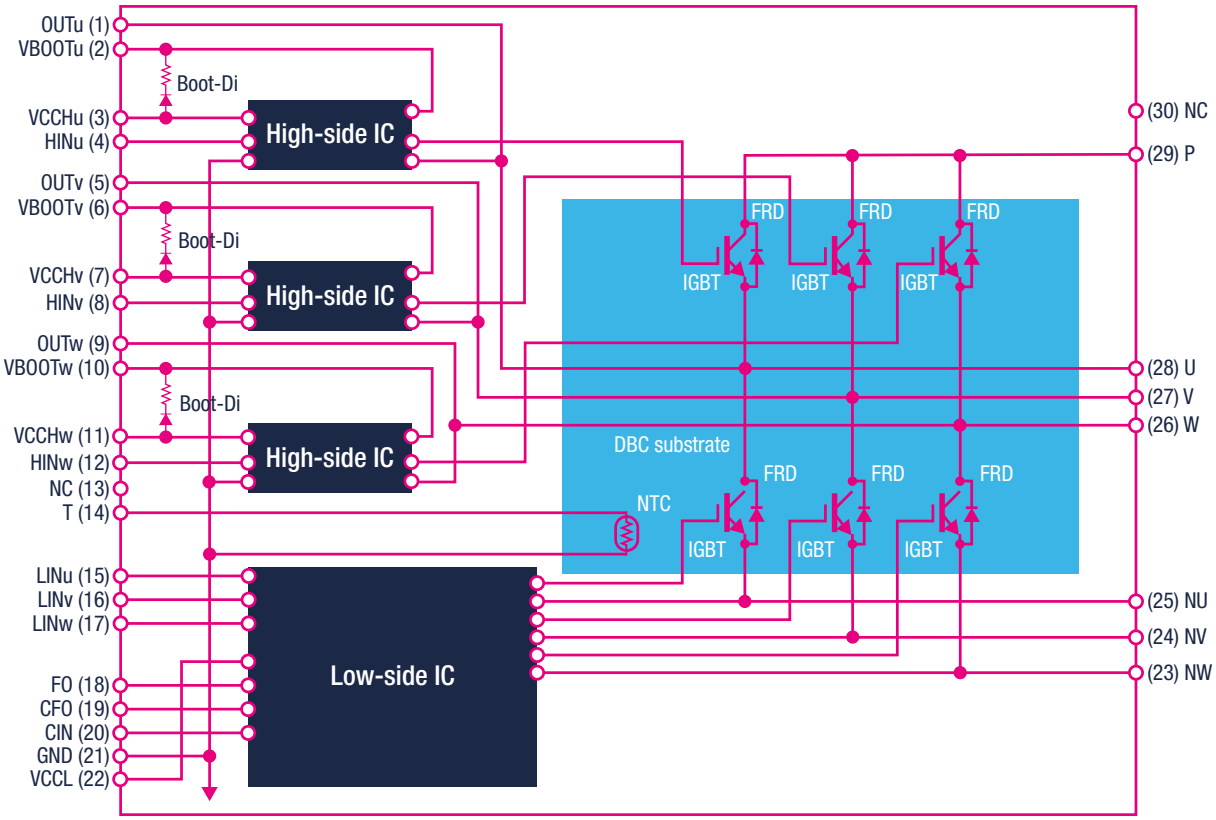
KEY FEATURES

- TFS IGBT tech 650 V,50 A and 1200 V, 10 A
- Low voltage drop conduction
- Optimized design for low EMI
- Lowest Rth value in DBC
- Embedded bootstrap diode
- 175 °C max. op. $T_{junction}$
- Distinct open emitter outputs
- On-board NTC thermistor
- Fault protection comparator
- Shutdown input/fault output
- Isolation rank: 2500 V_{RMS}/min
- UL recognition: UL 1557



SDIPHP-30L

Product PN	Switch type	BV	I_{CN}	$V_{CEsat\ typ}$	Max $R_{th(j-c)}$	Package
STGIK50CH65T2	IGBT	650 V	50 A	1.7 V	1°C/W	SDIPHP-30L
STGIK10M120T	IGBT	1200 V	10 A	1.6 V	1°C/W	SDIPHP-30L



ACEPACK™

The latest ST power module family offers new ACEPACK 1 and ACEPACK 2 Power Modules on Sixpack and Converter Inverter Brake (CIB) topologies.

With an embedded NTC thermistor, these highly reliable power modules offer the best compromise between conduction and switching loss, maximizing the efficiency of any converter system up to 20 kHz in hard-switching circuitries for an application range from 3 to 30 kW.

Offering PressFIT and solder pin options for flexible and stable mounting, these robust power modules, which are part of ST's M series Trench Gate Field- Stop IGBTs, ensure a compact design and cost-effective system.

The flexibility and characteristics of ACEPACK packages bring additional power and design features to ensure the best possible solution for your applications.

KEY FEATURES

- 15 to 75 A current rating at 25 °C
- 650 to 1200 V Breakdown voltage
- Integrated 5 kΩ NTC temperature monitoring
- Soft and fast recovery diode
- PressFIT and solder contact pin options
- Reliable and easy mounting system
- Low stray inductance module design

KEY BENEFITS

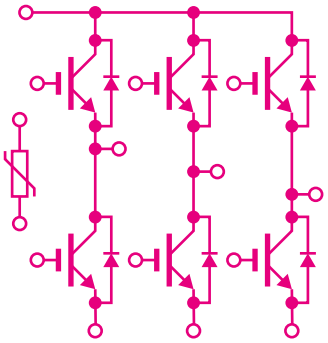
- High power density
- High reliability and quality
- 175 °C maximum junction temperature for increased robustness



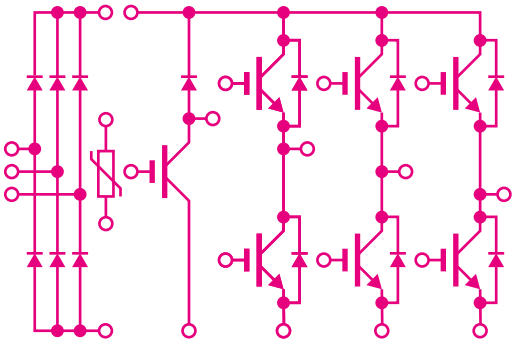
ACEPACK™1



ACEPACK™2



Six-Pack + NTC



CIB + NTC

Product PN	Package	Topology	BV_{CES}	I_C rating	Max isolation voltage
A1P25S12M3/-F	A1	Six-Pack	1200 V	25 A	2500 Vrms/min
A1P35S12M3/-F				35 A	
A1C15S12M3/-F		CIB	1200 V	15 A	
A1P50S65M2/-F		Six-Pack	650 V	50 A	
A1P18M65W2-1		Six-Pack	1200 V	$R_{DS(on)}$ = 18 mOhm	
A1P25M12W2-1		Six-Pack	650 V	$R_{DS(on)}$ = 25 mOhm	
A2C25S12M3/-F	A2	CIB	1200 V	25 A	
A2C35S12M3/-F				35 A	
A2P75S12M3/-F		Six-Pack	1200 V	75 A	
A2C50S65M2/-F		CIB	650 V	50 A	

Note Blank = Solder pin F = Press Fit

Evaluation Tools

Reference/bundle	Voltage	Power	Motor type/ control type *	ST parts	Application focus
STEVAL-HKI001V1	50 - 650 V_{DC}	Up to 35 A_{RMS} to the motor	PMSM FOC 3-shunt	• 1x A2C35S12M3-F • 7x STGAP1AS • 1x STM32F303RBT7	Power board: pumps, Motion/Servo Control, Industrial motor drives and more
STEVAL-AP1PF50M[1]	125 - 400 V_{DC}	Up to 10 kW		• A1P50S65M2 • STGAP2S • STGWA50M65DF2	HVAC, pumps, industrial drives

Note: 1. Available in Q3/26

STPOWER STUDIO, PART OF EDESIGNSUITE: DYNAMIC ELECTROTHERMAL SIMULATION SOFTWARE FOR STPOWER DEVICES

The STPOWER Studio is an online electro-thermal simulation software integrated in the eDesignSuite tool.

The software provides comprehensive power and thermal analyses and predicts the performance of ST devices to shorten the design cycle and save time and resources.

The tool also helps users select the best devices for specific application mission profiles.

STPOWER Studio (STSW POWERSTUDIO) is based on a very precise built-in electrical and thermal model for each device, considering self-heating effects. It provides highly accurate estimation of power losses, as well as junction and case temperatures.

The software can simulate a very long mission profile, consisting of many simulation steps, up to a thermal steady state.

Several thermal setup input conditions can be simulated, such as:

- devices without heatsink, estimating the case and the junction temperature
- fixed case temperature (with heatsink), estimating the junction temperature and the heatsink Rth
- fixed heatsink thermal resistance (Rth), estimating the case (or heatsink) and junction temperature
- fixed heatsink thermal impedance (Foster's model of the Zth), estimating the case and junction temperatures based on the thermal inertia of the system.

Simulation results are displayed on tables and dedicated scope views as a function of time, current load, and switching frequency. The simulation setup can be saved to a local PC or a dedicated user area of the server (only for registered users) as project files. The simulation results can also be exported as data tables to a local PC. An output report is generated providing a summary of all information and results for easier legibility and archiving.

STPOWER Studio supports a large selection of power devices (SLLIMM, SLLIMM 2nd series, SLLIMM nano, SLLIMM nano 2nd series, SLLIMM high power, and ACEPACK) and facilitates access to relevant documentation and resources on st.com.

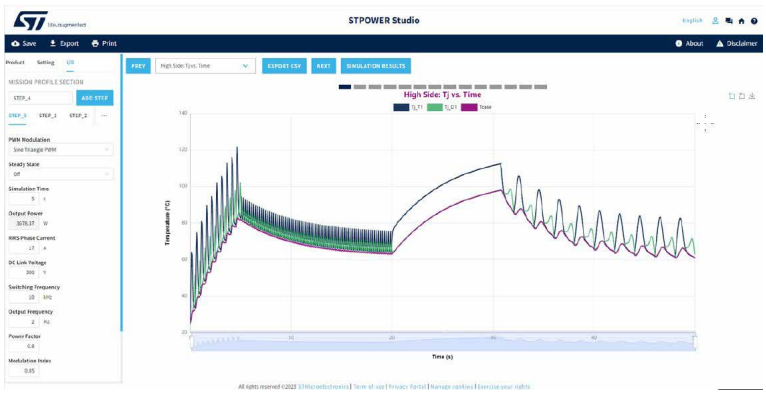
KEY FEATURES

- Comprehensive power and thermal analysis
- Intuitive and user-friendly interface
- Very fast computational calculation
- Very long mission profile duration
- Several thermal set-up input conditions
- Self-heating algorithm for temperature estimation
- Exportable report and data table files
- Projects storage in user area
- Web connectivity to product resources
- Multilanguage (English, Chinese, Japanese)
- Mini site for user manual (English)

KEY BENEFITS

- Selection of proper device fitting the application mission profile
- Easier, faster and cheaper solution design
- Deep analysis of power loss and device temperatures
- Exploration of non-testable parameters
- Very accurate temperature-dependent output results
- Complex and long mission profile simulation
- Heatsink size estimation

USER INTERFACE



FIND OUT MORE

www.st.com

Power MOSFETs

ST's power MOSFET portfolio offers a broad range of breakdown voltages from -100 V to 1700 V, with low gate charge and low on-resistance, combined with state-of-the art packaging. ST's process technology for both high-voltage power MOSFETs (MDmesh™) and low-voltage power MOSFETs (STripFET) has enhanced power handling capability, resulting in high-efficiency solutions.

LOW VOLTAGE MOSFETs- STripFET F7 & F8 MOSFETs

ST's new STripFET F8 MOSFETs deliver among the best on-resistance performance currently available in 40 V, 80 V, and 100 V devices, helping to minimize conduction losses, combined with low capacitances and gate charge. STripFET F8 also features optimized intrinsic capacitance ratios (Crss/Ciss) to minimize EMI effects, high current capability, and extremely low thermal resistance to improve power dissipation.

These devices help simplify final designs and reduce equipment size and cost by enabling system power and efficiency targets to be achieved with fewer devices in small package sizes. Together with new package solutions, they enable high power-density and high-thermal applications.

VDSS	Part number	Marketing status	Package	$R_{DS(on)}$ (@VGS = 10 V) max (Ω)	Qg typ (nC)
100	STX310N10F7	Active	TO-220/H²PAK-2/H²PAK-6	0.0023	180
	STX150N10F7	Active	TO-220/TO-220FP/H²PAK-2/I²PAK	0.0039	117
	STL110N10F7	Active	PowerFLAT 5x6	0.006	72
	STX100N10F7	Active	TO220/D²PAK/DPAK/TO-220FP	0.008	61
	STL90N10F7	Active	PowerFLAT 5x6	0.008	45
	STX80N10F7	Active	DPAK/TO-220FP	0.0095	45
	STL8N10F7	Active	PowerFLAT 3.3x3.3	0.02	25
	STH280N10F8-2/-6	Active	H2PAK-2/-6	0.0019	177
	STL160N10F8	Active	PowerFLAT 5x6	0.0032	90
	STL120N10F8	Active	PowerFLAT 5x6	0.0046	56
80	STX270N8F7	Active	TO-220/H²PAK-2/H²PAK-6	0.0021	193
	STX170N8F7	Active	TO-220/H²PAK-2	0.0037	120
	STX140N8F7	Active	TO-220/TO-220FP/H²PAK-2	0.004	96
	STL130N8F7	Active	PowerFLAT™ 5x6	0.0036	96
	STL190N8F8	Active	PowerFLAT 5x6	0.0016	85
	STL180N8F8	Active	PowerFLAT 5x6	0.0023	85
	STL110N8F8	Active	PowerFLAT 5x6	0.0045	47
60	STL220N6F7	Active	PowerFLAT™ 5x6	0.0014	100
	STP220N6F7	Active	TO-220	0.0023	100
	STL140N6F7	Active	PowerFLAT™ 5x6	0.0028	55
	STX140N6F7	Active	TO-220/H²PAK	0.0032	55
	STL130N6F7	Active	PowerFLAT™ 5x6	0.0035	42
	STX130N6F7	Active	TO-220/D²PAK/DPAK	0.005	42
	STO450N6F7	Active	TO-LL	0.00085	300

40	STL320N4LF8	Active	PowerFLAT 5x6	0.0008	96
	STL320N4F8	Active	PowerFLAT 5x6	0.00085	80
	STL300N4LF8	Active	PowerFLAT 5x6	0.001	70
	STL300N4F8	Active	PowerFLAT 5x6	0.0011	66
	STL220N4F8	Active	PowerFLAT 5x6	0.0017	42.5
	STL170N4LF8	Active	PowerFLAT 5x6	0.0022	34.5
	STL130N4LF8	Active	PowerFLAT 3.3x3.3	0.0023	28
	STL140N4LF8	Active	PowerFLAT 5x6	0.0026	28
	STL160N4F8	Active	PowerFLAT 5x6	0.0028	28
	STL100N4LF8	Active	PowerFLAT 3.3x3.3	0.0027	28

VDSS	Part number	Marketing status	Package	$R_{DS(on)}$ max @ 10 V	Qg (nC) 4.5 V
-60 V	STx10P6F6	Active	TO-220/DPAK	0.16	6.4*
40	STL260N4LF7	Active	PowerFLAT 5x6	0.0011	53
	STL260N4F7	Active	PowerFLAT 5x6	0.0011	67*
	STH320N4F6-6	Active	H²PAK	0.0013	240*
	STP260N4F7	Active	TO-220	0.0022	67*
	STL160N4F7	Active	PowerFLAT 5x6	0.0025	29*

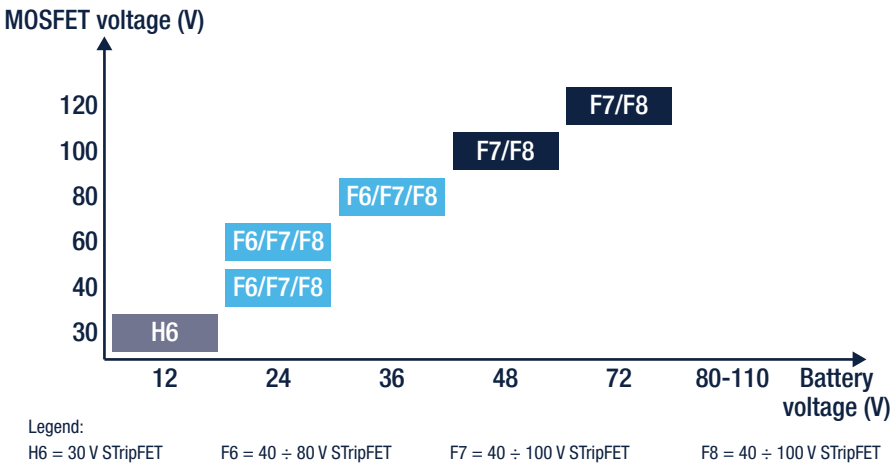
Note * value @ 10 V

LV MOTOR DRIVER ICs

The ST product portfolio offers a wide range of motor control ICs, well-suited for the most demanding industrial environments, covering the requirements of brushed DC motors, stepper motors and brushless DC motors, over an extensive range of voltage and current ratings. Efficiency and accuracy of the motor drivers are guaranteed by a unique combination of low-loss power MOSFET output stages and advanced VIPower control circuitry. Robustness and reliability are provided by the integration of a comprehensive set of protection and diagnostic features. The availability of products with different control interfaces, including PWM (Pulse Width Modulation) and serial interfaces, gives users the opportunity to find the right solution, both in centralized and distributed control applications.

Part number	Max Id output (A)	Max Voltage (V)	Typ Rdson per Leg (mohm)	Package	Configuration
VFB712S	12	38	100	SO-16N	Full bridge
VFB715S	15	38	70	SO-16N	Full bridge
VFB720Y	20	38	70	PowerSSO-36 TP	Full bridge
VFB735Y	35	38	40	PowerSSO-36 TP	Full bridge
VFB530W	30	41	10	MultiPowerSO-30	Full bridge
VHD738Y	38	38	12	PowerSSO-36	High side + Low side gate driver
VHD751Y	51	38	8	PowerSSO-36	

STripFET POSITIONING VS VOLTAGE BATTERY IN MC



Legend:
H6 = 30 V STripFET
F6 = 40 ÷ 80 V STripFET
F7 = 40 ÷ 100 V STripFET
F8 = 40 ÷ 100 V STripFET

TECHNOLOGY FEATURES

- Best-in-class, very low on-resistance
- High current capability
- Extremely low thermal resistance
- High quality & reliability
- Wide packaging options

BENEFITS

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

High Voltage MOSFETs

BV_{DSS} (V)	Max R_{DS} (Ω)	Max I_D (A)	Qg (nC)	Trr (typ) (ns)	Sales Type	Main application	Packages	Eng. Samples	Production
600	1.55	3.5	9	70	STx5N60DM2	Motor Control	D1 dice sales/DPAK	Available	Production
	1.1	5	9	73	STx6N60DM2	Motor Control	DPAK/TO-220/IPAK	Available	Production
	0.9	6	10	75	STx7N60DM2	Motor Control	DPAK/TO-220/IPAK	Available	Production
	0.600	8	13.5	80	STx8N60DM2	SMPS, HID, Motor Control	TO-220FP/DPAK	Available	Production
	0.338/0.372	12/8.5	15.3	85	STx15N60DM6	SMPS, Motor Control	DPAK/ PowerFLAT 5x6 HV	Available	Production

SiC MOSFETs

BV_{DSS} (V)	Max R_{DS} (Ω)	Max I_D (A)	Qg (nC)	Trr (typ) (ns)	Sales Type	Main application	Packages	Eng. Samples	Production
650	0.018	119	157	17	SCT018W65G3AG	Automotive, Industrial	HiP247	Available	Production
	0.018	119	157	17	SCT018W65G3AG	Automotive, Industrial	HiP247-LL	Available	Production
	0.018	119	157	17	SCT018W65G3-4AG	Automotive, Industrial	HiP247-4LL	Available	Production
	0.027	60	51	16	SCT027W65G3-4AG	Automotive, Industrial	Hip247-4	Available	Production
	0.055	119	157	17	SCT018H65G3-7	Automotive, Industrial	H2PAK-7L	Available	Production
	0.055	45	73	18	SCT055W65G3-4AG	Automotive, Industrial	HiP247	Available	Production
	0.055	45	73	18	SCT055W65G3-4AG	Automotive, Industrial	HiP247-LL	Available	Production
	0.055	45	73	18	SCT055W65G3-4AG	Automotive, Industrial	HiP247-4LL	Available	Production
	0.055	45	73	18	SCT055H65G3-7	Automotive, Industrial	H2PAK-7L	Available	Production
	0.04	30	39.5	18	SCT040H65G3AG	Automotive, Industrial	H2PAK-7L	Available	Production
750	0.011	110	144	25	SCT011H75G3AG	Automotive, Industrial	H2PAK-7	Available	Production
1200	0.035	60	94	17	SCT040W120G3	Automotive, Industrial	HiP247	Available	Production
	0.035	60	94	17	SCT040W120G3-4	Automotive, Industrial	HiP247-LL	Available	Production
	0.035	60	94	17	SCT040H120G3-7	Automotive, Industrial	HiP247-4LL	Available	Production
	0.027	55	73	18	SCT025W120G3-4AG	Automotive, Industrial	HiP247-4	Available	Production
1700	1	6	13.3	22	SCT1000N170	Motor Drive	HiP247	Available	Production
	1	6	13.3	22	SCTWA1000N170	Motor Drive	HiP247-LL	Available	Production
	0.064	25	101	13	SCT20N170	Motor Drive	HiP247	Available	Production
	0.064	25	101	13	SCTWA20N170	Motor Drive	HiP247-LL	Available	Production

STPOWER SIC MOSFET

Positioning vs. product family & Focus application

Breakdown Voltage	650 V		725 V / 900 V	1200 V
Series	G2	G3	G3	G1
On-state resistance	18 mΩ to 55 mΩ	14 mΩ to 55 mΩ	11 mΩ	52 mΩ to 520 mΩ
Focus Applications	OBC & DC-DC Renewable energy Power Supply Industrial drives	Traction OBC & DC-DC High density Power Supply	Traction inverter OBC & DC-DC High density Power Supply	Photovoltaic Power supply

Breakdown Voltage	1200 V		1700 V	2200 V
Series	G2	G3	G1	G2
On-state resistance	25 mΩ to 75 mΩ	70 mΩ and 15 mΩ	1 Ω and 65 mΩ	31 mΩ
Focus Applications	OBC & DC-DC Inverter Charging stations Industrial drives	Traction inverter OBC & DC-DC HF Power Supply	DC-DC Power Supply Renewable energy	DC-DC Power Supply Renewable energy

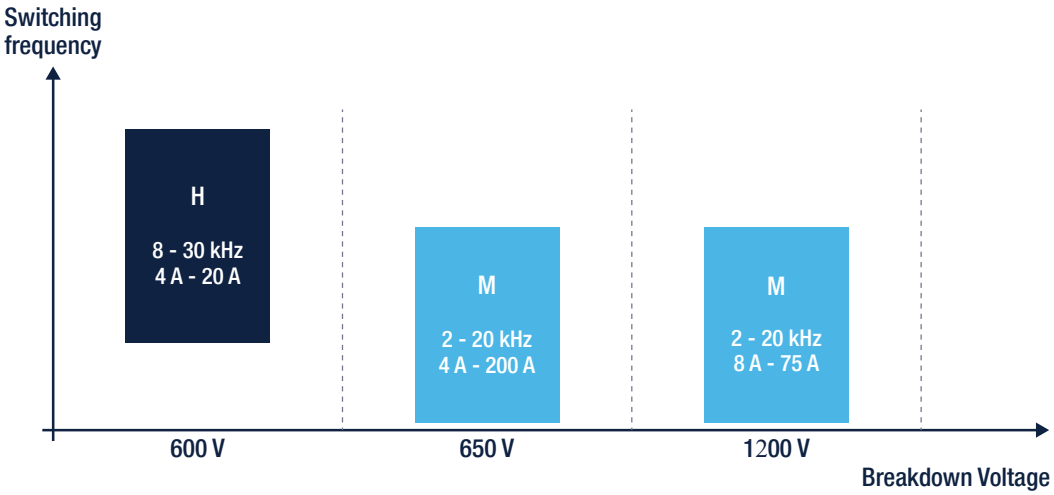
IGBT series

ST offers a very wide portfolio of IGBTs, tailored to motor control applications, developed using an advanced proprietary trench-gate field stop structure, with voltage classes of 600 V, 650 V, and 1200 V available both in bare die and discrete packages as well as IPMs and power modules.

Some of the highlights of our IGBT portfolio are as follows:

- Low $V_{CE(SAT)}$ for reduced conduction power losses
- Improved switch-off energy spread versus increasing temperature resulting in enhanced efficiency
- Tight parameter distribution for design simplification and easy paralleling
- Co-packaged anti-parallel diode specifically designed for improved EMC compatibility

Reported below the IGBTs series to motor control, which are: “H” and “M” series.
These series combine a very low saturation voltage with a maximum operating junction temperature of 175 °C and the short circuit capability.





D²PAK



TO-220



TO-220FP



TO-247



DPAK



MAX247



ACEPACK SMIT

600 V H SERIES

The 600 V “H” series, with current capability going from 5 A up to 20 A and short-circuit rated, represents an optimum compromise between conduction and switching power losses to maximize the efficiency of medium to high switching frequency inverters.

						Packages				
IGBT P/N	BV_{CES} (V)	I_{CN} [1] (A)	$V_{CE(sat)}$ [2] (V)	t_{sc} [3] (µs)	Switching frequency range	DPAK	D²PAK	TO-220	TO-220FP	TO-247
STG*4H60DF	600	4	1.5 (3 A)	4	8 - 30 kHz	D				
STG*5H60DF		5	1.5	3		D		P	F	
STG*7H60DF		7	1.5					P	F	
STG*10H60DF		10	1.5				B	P	F	
STG*15H60DF		15	1.6				B	P	F	
STG*20H60DF		20	1.6					P	F	W

Note 1) I_{CN}: IGBT nominal collector current @ T_C = 100 °C
2) $V_{CE(sat)}$: typical conduction losses @ I_{CN}, T_C = 25 °C
3) t_{sc}: min short circuit withstanding time @ V_{CC} ≤360 V, V_{GE} = 15 V, T_{jstart} =150 °C

650 V M SERIES

The 650 V “M” series, with current capability from 4 A to 120 A in standard package and now even up to 200 A in ACEPACK SMIT, optimized in EMI thanks to soft waveforms and thanks to an outstanding short-circuit withstand time of 6 µs, it is an optimum compromise in performance to maximize the efficiency of three phase industrial drive systems where low-loss and short-circuit capability are mandatory.

						Packages						
IGBT P/N	BV_{CES} (V)	I_{CN} [1] (A)	$V_{CE(sat)}$ [2] (V)	t_{sc} [3] (µs)	Switching frequency range	DPAK	D²PAK	TO-220	TO-220FP	TO-247	TO-247 long leads	Max247 long leads
STGx4M65DF2	650	4	1.6	6	Up to 20 kHz	D	B	P				
STGx6M65DF2		6	1.55			D	B	P				
STGx10M65DF2		10	1.55				B	P	F			
STGx15M65DF2		15	1.55				B		F			
STGx20M65DF2		20	1.55				B	P	F			
STGx30M65DF2		30	1.55				B	P	F		WA	
STGx50M65DF2		50	1.65								WA	
STGx75M65DF2		75	1.65							W	WA	
STGx120M65DF2		120	1.65									YA

Note 1) I_{CN}: IGBT nominal collector current @ T_C = 100 °C
2) $V_{CE(sat)}$: typical conduction losses @ I_{CN}, T_C = 25 °C
3) t_{sc}: min short circuit withstanding time @ V_{CC} ≤400 V, V_{GE} = 15 V, T_{jstart} = 150 °C

1200 V M SERIES

1200 V “M” series, with current capability from 8 A to 50 A (available in die form also in 35 A and 75 A dice), optimized in EMI and showing a minimum short-circuit withstand time of 10 µs at 150 °C, address the Motor and compressor drives offering the best trade-off performances according to the working operating frequency up to 20 kHz. Moreover, a new 1200V -50A half-bridge device is available in ACEPACK SMIT.

						Packages				
IGBT P/N	BV_{CES} (V)	I_{CN} [1] (A)	$V_{CE(sat)}$ [2] (V)	t_{sc} [3] (µs)	Switching frequency range	TO-247	TO-247 long leads	TO-220	MAX247 LL	ACEPACK SMIT
STGx8M120DF3	1200	8	1.85	10	Up to 20 kHz	W	WA	P		
STGx15M120DF3		15				W	WA			
STGx25M120DF3		25				W	WA			
STGx40M120DF3		40				W	WA			
STGYA50M120DF3		50	1.7						YA	
STGSH50M120D		50	1.8							SH

Note 1) I_{CN}: : Nominal collector current @ T_J = 100 °C
2) $V_{CE(sat)}$: Typical conduction losses @ I_{CN}, T_J = 25 °C
3) t_{sc}: min short circuit withstand time @ $T_{J\text{-start}}$ ≤150 °C, V_{CC} = 600 V, V_{GE} = 15 V

Diode & Rectifier

ST's ultrafast diodes range from 300 V to 1200 V with various Vf/Trr and Qrr/S factor trade-offs so as to achieve the best performance for any application. The «R» trade-off stands for «Rapid», and are the ones shown in the table below.These «R» diodes have been developed to have reduced switching time and associated reverse recovery charges, making them ideal for use in the PFC circuit of the motor control board.

The new «RQ» series, that stands for «Rapid & Quiet», achieve low reverse recovery time, combined with a soft behaviour. This will be particularly appreciated in higher power applications, where switching currents are higher. In that environment, a reduction of the noise generated by the commutation of the diode helps improve the system EMI performances.

All ST products are rated up to 175 °C operating junction temperature, as a result of the reduced leakage currents.

KEY FEATURES

- Wide voltage range from 300 V to 1200 V
- Up to 200 A current range
- Low-profile PowerFLAT™ packages
- Different V_F/T_{rr} trade-offs available in different packages
- 175 °C operating junction temperature

	Part number	I_{FAV} (A)	V_F max (V)/25 °C	Qrr typ (nC)/125 °C	Sfactor Typical	Package
300 V ultrafast rectifiers	STTH8R03	8	1.8	60	0.4	TO-220AC
	STTH8R03DJF	8	1	120	0.3	PowerFLAT™ 5 x 6
	STTH30R03	30	1.4	63	0.4	D²PAK, TO-247
400 V ultrafast rectifiers	STTH8R04	8	1.5	148	0.4	D²PAK, TO-220AC, TO-220AC Ins
	STTH20R04	20	1.7	225	0.3	D²PAK, TO-220AC, DO-247, TO-220FPAC
	STTH30R04	30	1.45	525	0.4	D²PAK, TO-220AC, DO-247, DOP3 Ins
600 V ultrafast rectifiers	STTH1R06	1	1.9	120		DO-41, SMA, SMB
	STTH5R06	5	2.9	110	0.35	D²PAK, TO-220AC, DPAK, TO-220FPAC
	STTH5R06DJF	5	1.2	180	0.5	PowerFLAT™ 5 x 6
	STTH8R06	8	2.9	150	0.3	D²PAK, TO-220AC, TO-220AC Ins, I²PAK, TO-220FPAC
	STTH12R06	12	2.9	180	0.2	D²PAK, TO-220AC
	STTH15RQ06	15	2.95	250	1	TO-220AC, D²PAK, DO-247, DO-247LL
	STTH25M06	25	1.6	250	0.5	TO220FPAC, DPAK
	STTH30RQ06	30	2.95	485	1	TO-220AC, D²PAK, DO-247, DO-247LL
	STTH30RQ06C	2 x 30	1.45	485	0.9	TO-247 LL
	STTH60RQ06	60	2.95	660	1	DO-247
800 V/1000 V/1200 V Ultrafast rectifiers	STTH108A	1	1.65			SMA
	STTH208A	2	1.65			SMA
	STTH110A	1	1.7			SMA
	STTH310S	3	1.7			SMC
	STTH810G	8	2	1100	2	D²PAK
	STTH212	2	1.75	680		SMB, SMC
	STTH1512G	15	2.1	2600	1.5	D²PAK
	STTH15S12W	15	3.1 typ	1300	2	DO-247
	STTH6012W	60	2.05	6400	1	DO-247, D²PAK
800 V Bridge	STBR1508-Y	15	1.1	-	-	DPAK HV
	STBR3008-Y	30	1.1	-	-	DO-247
	STB6008-Y	60	1.1	-	-	DO-247
1200 V Bridge	STBR3012	30	1.3	-	-	DO-247, D²PAK HV
	STBR6012	60	1.3	-	-	DO-247

Thyristors, Triacs and AC Switches

ST offers a complete range of SCR and AC switches with voltage ratings up to 1200 V, current ratings up to 130 A and a set of packages from miniature surface-mounted packages to high power dissipation isolated and non-isolated packages, and now with ACEPACK SMIT top-side cooled package module with SCRs.

To address control motor applications, T-Series Triacs are offering a complete range of current ratings, up to 25 Ampere. The T-Series Snubberless Triac is able to drive high inductive load thanks to its strong turn-off capabilities (dI/dt)c. The H-Series family is featuring a strong thermal performance, fully rated at 150°C at 800 V, suitable for high power loads and devices in hot environments. ACST™ and ACS™ AC Switches are overvoltage self-protected devices, improving application safety and reliability.

High-voltage triacs are dedicated to AC induction motor controller. The 1200 V of repetitive voltage capability allows single and three phase AC induction motor control applications, as Solid-State Relay or soft-starter or into an hybrid relay.

High temperature 150 °C SCRs are perfectly fitting requirements to build a solid-state relay for motor soft starter or for inrush current limitation in AC/DC stage.

TRIACS

ST's portfolio of Triacs includes devices with voltage ratings up to 800 V and RMS on-currents up to 30 A in general-purpose standard configurations, a high commutation T series in Snubberless™ technology, and 3-quadrant high-temperature Triacs (6H and 8H series) for use in harsh environments. They are the reference for universal and induction motor drivers in appliance applications where, due to their ability to manage the stringent inrush conditions when driving inductive loads, they can switch off three times their rating current.



KEY FEATURES

- Robustness and reliability
- Wide voltage and current ranges
- Extended portfolio:
  - T-Series Snubberless™ Triacs with enhanced switch-off capability, suitable for inductive loads
  - High-temperature 6H and 8H series for high power loads and hot environments

	Part number	Packages	Current rating (A_{RMS})	Non repetitive surge peak on-state current (A)	Repetitive off-state voltage (V)	Operating Tj max (°C)	I_{GT} (mA)
T series Triacs	T835T-8	TO-220AB D^2PAK	8	60	800	150	35
	T1235T-8		12	90	800	150	
	T1635T-8		16	120	800	150	
	T2035T-8	D^2PAK	20	160	800	150	
	Part number	**Packages**	**Current rating (A_{RMS})**	**Non repetitive surge peak on-state current (A)**	**V_{DRM} - V_{RRM} (V)**	**Operating Tj max (°C)**	**I_{GT} (mA)**
High-temperature Triacs	T835H-8	TO220, TO-220I, D^2PAK	8	80	800	150	35
	T1235H-8		12	120			
	T1635H-8		16	160			
	T2035H-8		20	200			
	T2535T-8		25	200			
	T3035H-8		30	270			

ASD APPLICATION-SPECIFIC DEVICE

Using innovative ASD application-specific device technology, ST's ACS™ and ACST devices are specific switches developed for home appliances and industrial control applications.

With integrated overvoltage protection against transients, no external MOV protection is needed, providing system safety with transient and surge voltage immunity as defined in the IEC 61000-4-4 and -4-5 standards, respectively. The ACST series now extends from 2 A to 16 A, housed in TO-220AB, TO-220FP, and SMD D2PAK packages.

KEY FEATURES

- Internally protected, no need of external circuitry to meet IEC 61000-4-4 and -4-5 standards
- High switch off capability
- Low gate current for direct connection to MCU

Part number	Current rating (A_{RMS})	Non repetitive surge peak on-state current (A)	Repetitive off-state voltage (V)	Operating Tj max (°C)	I_{GATE} (mA)	Packages
ACST8	8	80	800	125	30	D^2PAK, TO-220AB, TO-220FPAB
ACST1035-8FP	10	90	800	150	35	TO-220FPAB
ACST1235-8FP	12	100	800	150	35	TO-220FPAB
ACST1635-8FP	16	140	800	150	35	TO-220FPAB

HIGH VOLTAGE TRIAC

High-voltage triac, with 1200 V of repetitive voltage capability, are suitable for single and three phase AC induction motor control applications.

High-voltage triacs are suitable in hybrid relay to manage high inrush current at start-up and with soft turn-off of the controller to improve application lifetime.

Housed in high power packages in through-hole TO-220AB or TOP3 – with or without built-in insulation, and SMD D2PAK, the product line offers high scalability assembly options to designers for high power density motor controller.

Triac Part Number	Package	$I_{T(RMS)}$ A Max	V_{DRM}, V_{RRM}, V Max	I_{TSM} A Max	I_{GT} mA Max	dV/dt V/µs Min	$(dI/dt)_c$ A/ms Min	TJ °C Max
T2550-12T	TO-220AB	25	1200	240	50	2500	20	125
T2550-12I	TO-220AB Ins.							
T2550-12G	D^2PAK							
TPDV1225	TOP-3 Ins.			230	150	2000	88	
TPDV1240	TOP-3 Ins.	40		350	200	500	142	

HIGH TEMPERATURE SCR

High-temperature silicon-controlled rectifiers (SCRs), are designed to improve the reliability of applications such as overvoltage crowbar protection and motor control circuits in power tools and kitchen aids, inrush current-limiters and voltage regulators. Perfectly suited for automotive stationary battery chargers, motorbike voltage regulators and motor drive applications, they help reduce costs by using smaller heatsinks. Their voltage robustness up to 1200 V, high noise immunity and power dissipation performance at 150°C junction temperature (Tj) are key features for functions such as AC switches, AC phasing inverters, and AC-DC controlled rectifier bridges.

Available in SMD as well as through-hole-isolated and non-isolated packages, ST's high-Tj SCRs feature:

- A very low gate-triggering current (600 V SCRs only)
- A peak off-state voltage (blocking voltage) from 600 V up to 1200 V
- A maximum on-state current from 12 A to 80 A
- A maximum junction temperature of 150°C

Part number	I_{TRMS} (A)	I_{GT} (mA)	dV/dt @ 150°C (V/µs)	tq (µs)	I_{TSM} (A)	DPAK	TOP3-I	TO-220AB	TO-220FPAB	D^2PAK	TO-220AB ins	TO-247	D^3PAK
Industrial High Temperature 600 V SCR													
TN1205H-6	12	2 to 5	100	65 typ	120			•		•			
TN1605H-6	16	6	200	70 typ	140			•	•	•	•		
TN1610H-6	16	10	1000	70 typ	140			•	•		•		
TN2010H-6	20	10	400	70 typ	180			•	•	•	•		
TN2015H-6	20	15	750	70 typ	180			•	•				
TN3015H-6	30	15	1000	80 typ	270			•		•	•		
TN4015H-6	40	15	500	35 typ	360			•		•	•		
TN5015H-6	50	15	500	50 typ	450			•		•	•		
Industrial High temperature 800 V SCR													
TN1605H-8	16	8	500	85 typ	160	•		•		•	•		
TM8050H-8	80	8	1000	150 max	600							•	•
Automotive and Industrial High Temperature and High Voltage SCR													
TN3050H-12	30	50	1000	150 typ	300					•		•	
TN4050HP-12	40	50	1000	150 max	400					•		•	
TN6050HP-12WY	50/80	50	1000	150 typ	580							•	
TN5050H-12PI	50	50	1500	150 typ	450		•						
TN8050H-12PI	80	50	1500	150 typ	680		•						

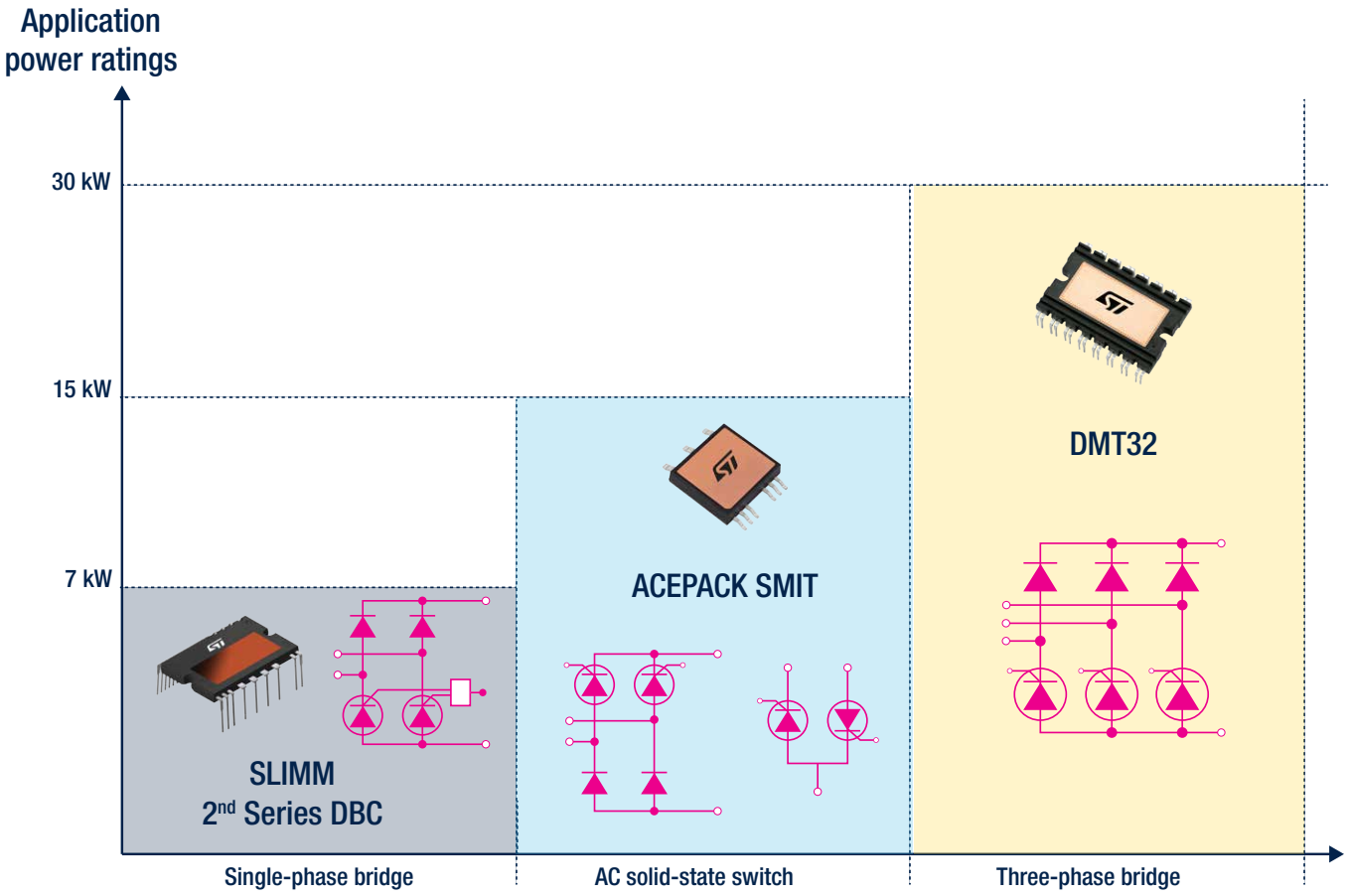
• Available

Type	Triac				SCR		Bridge
Series	T-Series	H-Series	ACST overvoltage Protected	TPDV	TN-8	TN-12	STTD-Series
Blocking voltage	800 V			1200 V	800 V	1200 V	1200 V
RMS Current	6 A - 25 A	6 A - 30 A	2 A - 16 A	25 A - 40 A	12 A - 50 A	30 A - 130 A	60 A
Motor type	AC induction motor	Universal motor	Universal motor - AC induction motor	3-Phase induction motor	1-Phase induction motor - BLDC - PMSM	3-Phase induction motor	BLDC

Thyristor modules enable power device integration in compact, high-power solutions up to 30 kW.

Suitable for motor soft-starter with two 60 A and 1200 V SCRs in back-to-back configuration, the STTN6050H-12M1Y simplifies the implementation of solid-state relays to manage load and torque at AC induction motor startup. Thanks to its SMD ACEPACK SMIT package with top-side cooling capability, this module is perfectly suitable for compact designs in industrial automation.

The single-phase and three-phase controlled bridges are suitable for inrush current management of a BLDC motor at startup. The STTD6050H-12M2Y is a 1200V single-phase-controlled bridge with 60 Arms output capability with top-side cooling. The highly efficient top-side cooled SLLIMM DBC and DMT32 packages complement the ST offering with integrated SCR gate control.

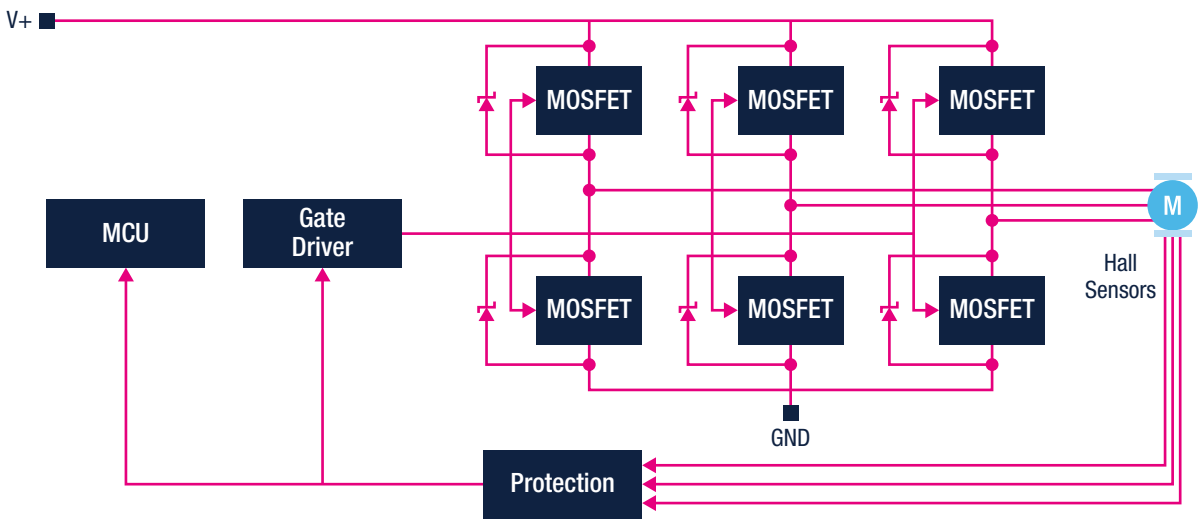


Note: SLLIMM: small low loss intelligent molded module
ACEPACK SMIT: surface mount isolated top-side cooling

Protection & Filters devices

Transient voltage suppressor (TVS) devices provide protection for many different types of surge events. For example, overcurrent protection mechanisms can play a role in creating voltage transients that must be clamped properly. Indeed, this event can cause significant voltage transients due to high di/dt. This can be due to the switching of load inductances or even because of parasitic inductance in the cable harness. TVS devices address this issue by clamping the drain to source (or collector to emitter) voltage to a level less than the rated maximum switch voltage.

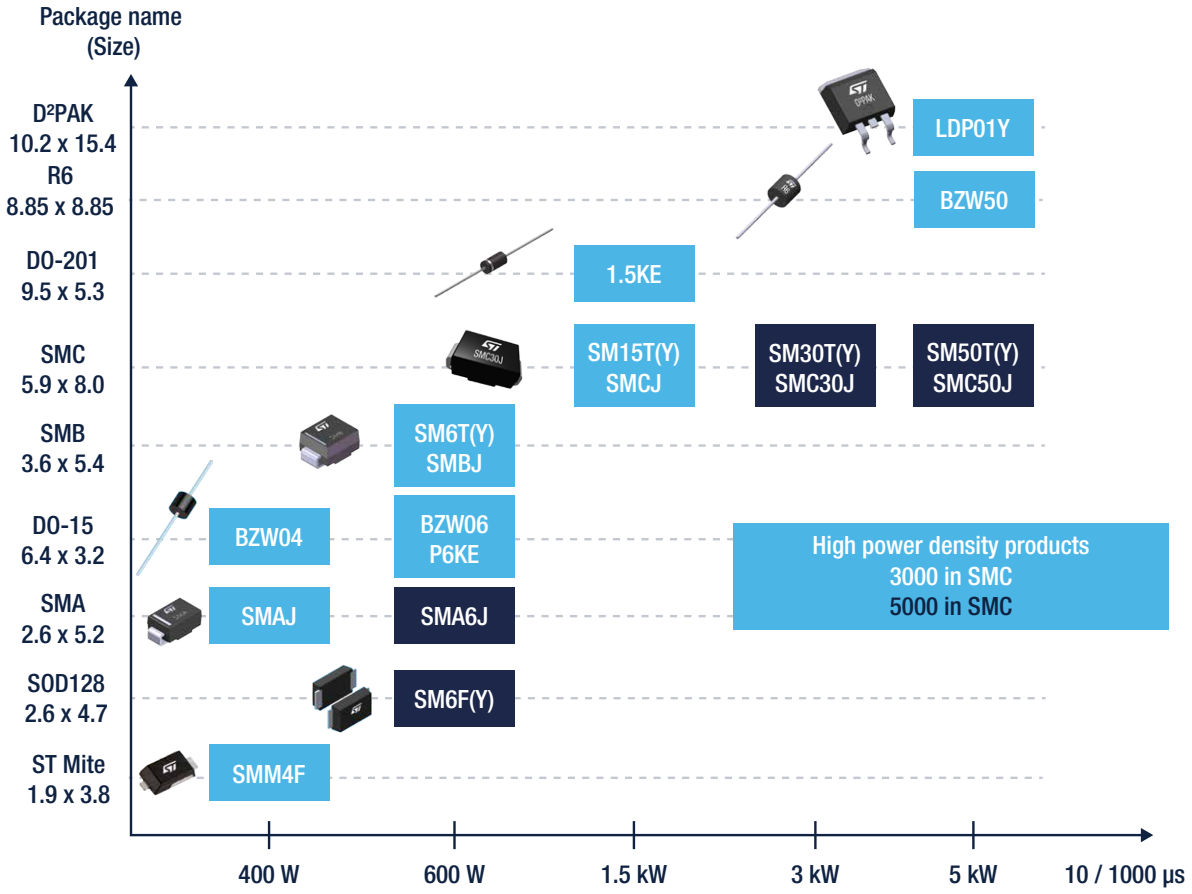
Applying a TVS between the Gate and Source prevents an overvoltage condition on the gate. If the switch is controlled by a positive voltage, then a unidirectional TVS is recommended. If a positive and negative voltage controls the switch, then a bidirectional TVS is required.

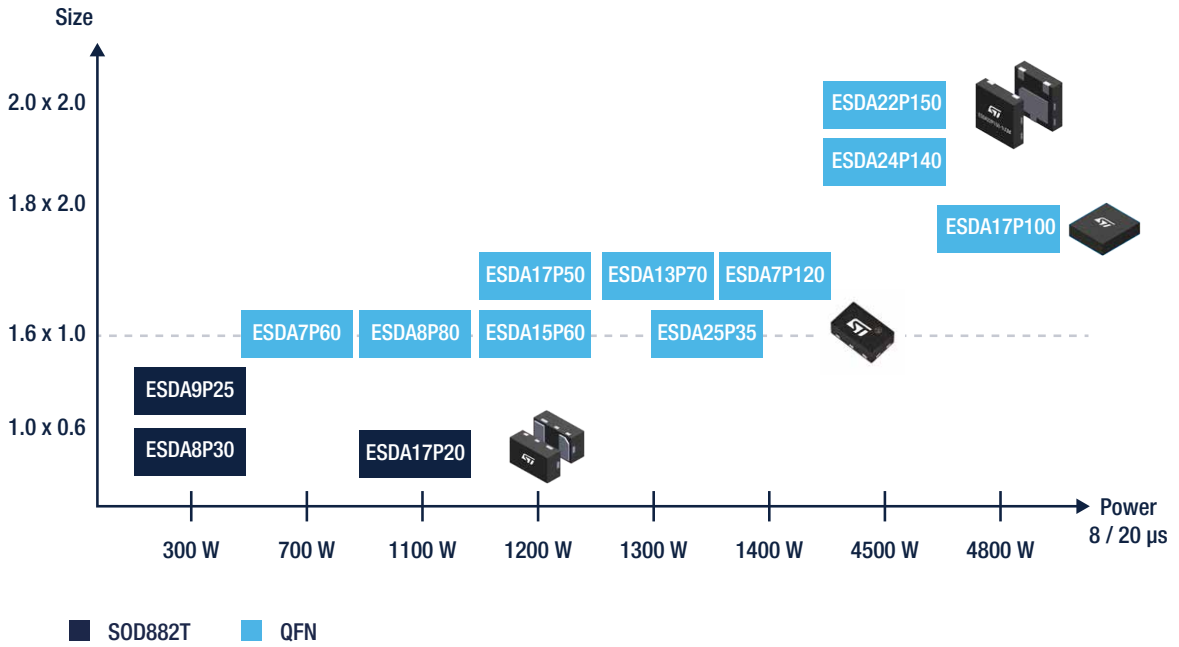


Motor	TVSEOS SMAJ/SM6F/SM6T SM15T 1.5KExx	ESD and EOS ESDAxxP-xx1U1M	ESD ESDAxxSC6	ESD and Signal HSP061-2xx
PMSM & BLDC motors	•	•	•	•
Stepper motors	•	•		•
Brushed DC motors	•	•	•	•
Universal motors		•		
Switch reluctance motors		•		

TVS

The **TVS transient voltage suppressor** is an avalanche diode specially designed to clamp overvoltages and dissipate high transient energy. TVS are power devices to protect applications against electrical overstress (EOS), specifically against surge events as defined by IEC 61000-4-5.A large choice of package is available to meet application requirements.





MOSFET and IGBT Gate Drivers

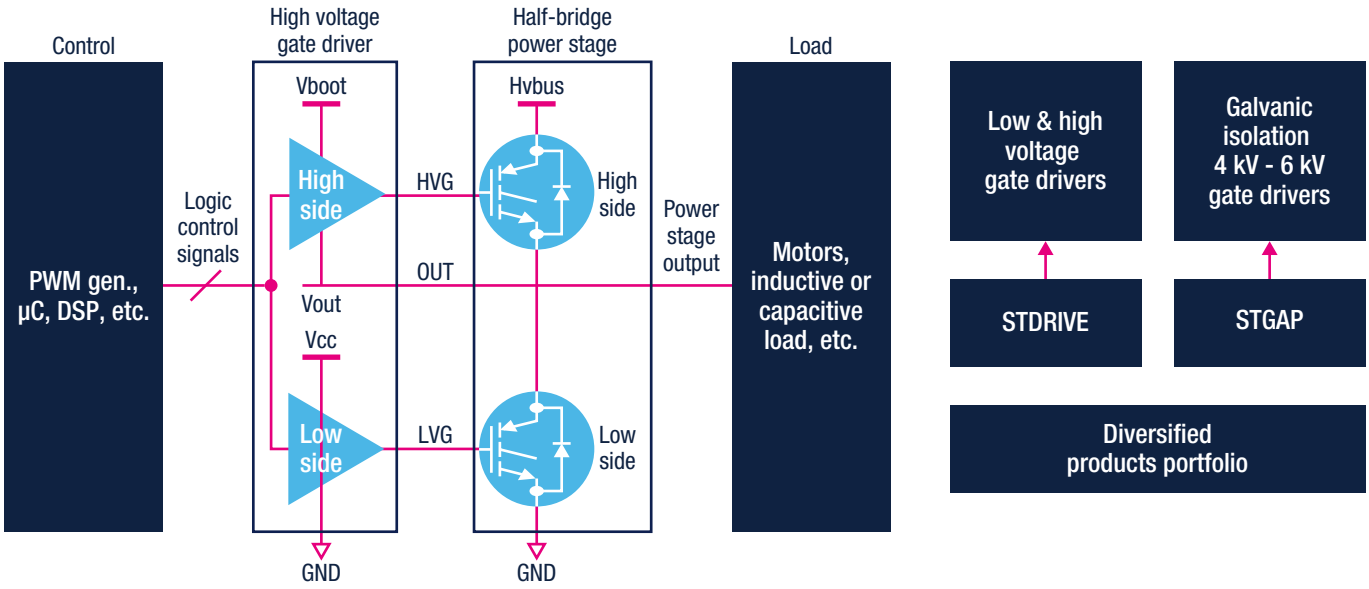
A necessary companion for discrete power MOSFETs and IGBTs as well as digital – microcontrollers, DSPs and FPGAs – or analog controllers in any switched-mode power converter, STDRIVE gate drivers generate the necessary voltage and current level required to accurately and efficiently activate the power stage in industrial, consumer, computer and automotive applications.

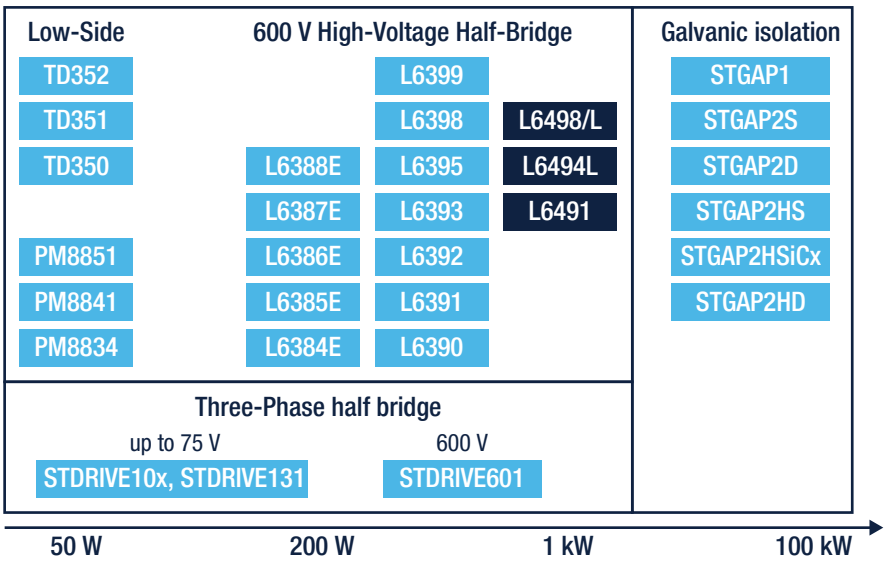
With a range spanning from single- to half-bridge and multiple-channel drivers rated for either low- or high-voltage (up to 1700 V) applications, ST also offers galvanically isolated gate driver ICs for safety and functional requirements, System-in-Package (SiP) solutions integrating high- and low-side gate drivers and MOSFET-based power stages, responding to the industrial market trend towards higher levels of integration and lower development costs.

In many cases, there is an STDRIVE perfectly designed to fit your switched-mode power converter or motor driver design.

STDRIVE comes with extensive evaluation hardware and software as well as a technical documentation toolbox to help minimize time-to-market.

The benefit of our 15 years longevity program is available for our STDRIVE MOSFET and IGBT drivers.





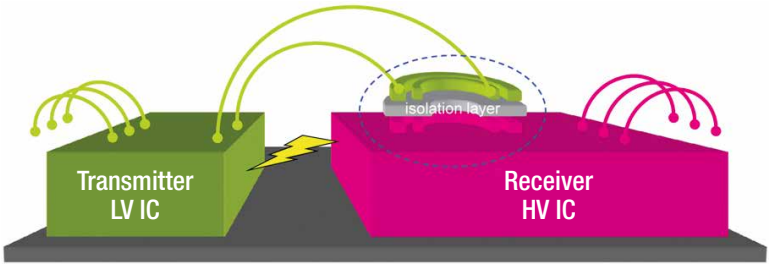
KEY FEATURES

- Half-bridge, single-channel and multichannel gate drivers
- State-of-the-art integration thanks to:
  - HV bootstrap diode
  - Op amp
  - Comparator
  - Smart shutdown
  - Undervoltage lock out (UVLO)
  - Interlocking
  - Programmable deadtime

STGAP

STGAP1 is an IGBT/MOSFET driver with 4 kV galvanic isolation which provides robustness and noise immunity. A thick oxide isolation layer is grown on-chip to build a miniature transformer which is used to transfer signals between input and output.

Protection features are embedded, and high configurability level is possible through the SPI interface.



Package frame

General description	Supply voltage (VDD) min (V) max (V)	Input configuration	Output current-Max nom (A)	Undervoltage lockout (V) (VH ON) & (VH OFF) nom (V)	Supply voltage (VH) min, max (V)	Negative gate drive ability	Miller Clamp, DESAT detection, SENSE comparator	Pin Count nom ()
STGAP1	3 V, 5.5 V	SD, IN+, IN-	5	programmable	4.5, 36 V	yes	yes	24

STGAP2S and STGAP2D are drivers which offer a functional galvanic isolation with isolation voltage up to 1.7 kV.

STGAP2HS is a driver that includes a 6 kV galvanic isolation between the gate driving channel and the low voltage control and interface circuitry.

Their 4 A current output capability and rail-to-rail outputs make the devices also suitable for high power inverter applications such as motor drives in industrial applications.

Part Number	Channel #	Configuration	Voltage max (V)	Output current max (A)	Common-mode transient immunity (V/ns)	Supply voltage c (V) max	TTL/CMOS logic inputs (V)	Propagation delay (ns)	Additional features	Package
STGAP2SCM	1	Miller Clamp	1700	4	±100	26	3.3, 5	80	UVLO and thermal shutdown Adjustable deadtime and HW interlocking function	SO-8
STGAP2SM		Separated Outputs								
STGAP2D	2									SO-16
STGAP2HSCM*	1	Miller Clamp	1200	4	±100	26	3.3, 5	80	6 kV galvanic isolation UVLO and thermal shutdown	SO-8W
STGAP2HSM*		Separated Outputs								

Note * Available soon

STDRIVE – FULL PLATFORM OF GATE DRIVERS

ST's STDRIVE are designed to integrate in a single component all the required gate drivers for multiple motor types and applications. That responds to the industrial market trend towards higher levels of integration and lower development costs.

The STDRIVE Series of products covers low voltage and high voltage applications with a scalable approach in terms of features and ratings.

Part Number	Topology	Vin max (V)	I_{GATE} (A)	VDS monitoring	VGS monitoring	Charge pump	SPI
STDRIVE121	Full-bridge	28	0.12 (programmable)	Yes	No	Yes	Yes
STDRIVE141	Dual Full-bridge	28					
STDRIVE181	Quad Full-bridge	28					
STDRIVE101	Three-phase	75	0.6			No	No
STDRIVE102		50	2 (programmable)			Yes	Yes (Optional)
STDRIVE131		52	2.2		Yes	Yes (Dual)	Yes
STDRIVE601		600	0.3	No	No	No	No

STDRIVE HIGH VOLTAGE HALF-BRIDGE GATE DRIVERS

ST's high-voltage drivers are designed to optimize Field Oriented Control motor drive systems and feature excellent performance at high switching frequency. The smart shutdown function helps to effectively protect the final application.

STDRIVE MOSFET and IGBT gate drivers can integrate a comparator for protection, an operational amplifier for current sensing and an integrated bootstrap diode, thus reducing the number of external components required at system level.

ST's new STDRIVE family of half-bridge MOSFET and IGBT gate drivers is designed to operate in harsh industrial environments withstanding high voltages up to 600 V, while maintaining good noise immunity and low switching losses.

L6491, **L6494**, and **L6498** high-voltage half-bridge gate drivers are particularly suited for medium- and high-capacity power switches thanks to their sink/source current capability up to 4 A.

Part Number	Supply Voltage (V) max	Protection Option Type	Key features	Output Current-Max (A)	Input configuration	Grade	Undervoltage lockout (V)				Operating Temperature (°C)		EVALBoard	Board description
							(On VCC ON) nom	(On VCC OFF) nom	(On VBOOT ON) nom	(On VBOOT OFF) nom	min	max		
L6390	20	Undervoltage lockout, Interlocking function, Comparator, Smart shutdown	Adjustable deadtime, Bootstrap diode, Operational amplifier	0.43	HIN, LIN, SD	Industrial	12	10.5	11.5	10	-40	125		
L6391	20	Undervoltage lockout, Interlocking function, Comparator, Smart shutdown	Adjustable deadtime, Bootstrap diode	0.43	HIN, LIN, SD	Industrial	12	10.5	11.5	10	-40	125		
L6392	20	Interlocking function	Adjustable deadtime, Bootstrap diode, Operational amplifier	0.43	HIN, LIN, SD	Industrial	12	10.5	11.5	10	-40	125		
L6393	20	Comparator	Adjustable deadtime, Bootstrap diode	0.43	SD	Industrial	9.5	8	9	8	-40	125	EVAL6393FB	Low voltage full bridge reference design board featuring L6393 advanced high-voltage gate driver
L6395	20	-	Bootstrap diode	0.43	HIN, LIN	Industrial	9.5	8.8	8.6	8	-40	125	EVALSTDRV600HB8	Demonstration board kit for L638xE and L639x high-voltage gate drivers
L6398	20	Interlocking function	Bootstrap diode	0.43	HIN, LIN	Industrial	9.5	8.8	9	8	-40	125	EVALSTDRV600HB8	Demonstration board kit for L638xE and L639x high-voltage gate drivers
L6399	20	Interlocking function	Bootstrap diode	0.43	HIN, LIN	Industrial	9.5	8	9	9	-40	125	EVALSTDRV600HB8	Demonstration board kit for L638xE and L639x high-voltage gate drivers
L6491	20	Interlocking function, Comparator, Smart shutdown	Adjustable deadtime, Bootstrap diode	4	HIN, LIN, SD	Industrial	9.3	8.7	8.6	8	-40	125	EVAL6491HB	Demonstration board for L6491 gate driver with smart shut down feature

Part Number	Supply Voltage (V) max	Protection Option Type	Key features	Output Current-Max (A)	Input configuration	Grade	Undervoltage lockout (V)				Operating Temperature (°C)		EVALBoard	Board description
							(On VCC ON) nom	(On VCC OFF) nom	(On VBOOT ON) nom	(On VBOOT OFF) nom	min	max		
L6494	20	Undervoltage lockout,	Adjustable deadtime, Bootstrap diode	2	HIN, LIN, SD	Industrial	9.3	8.7	8.6	8	-40	125	EVAL6494L	Demonstration board for L6494L gate driver
L6498	20	Undervoltage lockout, Interlocking function	Bootstrap diode	2	HIN, LIN, SD	Industrial	9.3	8.7	8.6	8	-40	125	EVAL6498L	Evaluation board for the L6498L gate driver
STGAP2D	26	Shutdown protection	Thermal Shutdown	4	IN+, IN-, SD, BRAKE	Industrial	9.1	8.4	-	-	-40	125	EVALSTGAP2DM	Demonstration board for STGAP2DM isolated half-bridge gate driver
STGAP1	36	Active Miller clamp, Desaturation detection, Overcurrent detection, 2-level turn-off, VCE overvoltage protection, Temperature warning, shutdown protection, Undervoltage lockout, Overvoltage lockout	Adjustable deadtime, Thermal Shutdown	5	IN+, SD	Automotive	4.1	3.8	-	-	-40	125	EVALSTGAP1AS	STGAP1AS evaluation board
STGAP2SM	26	Active Miller clamp, Shutdown protection, Undervoltage lockout	Thermal Shutdown	4	IN+, IN-	Industrial	9.1	8.4	-	-	-40	125	EVALSTGAP2SM	Demonstration board for STGAP2SM isolated 4 A single gate driver
STGAP2SCM	26	Separated Outputs, Shutdown protection	Thermal Shutdown	4	IN+, IN-	Industrial	9.1	8.4	-	-	-40	125	EVALSTGAP2SCM	Demonstration board for STGAP2SCM isolated 4 A single gate driver
STDRIVE601	21	Undervoltage lockout, Interlocking function, Smart shutdown, Comparator	Bootstrap diodes	0.35	HIN, LIN, SD	Industrial	8.5	8	8	7.5	-40	125	EVALSTDRIVE601	Demonstration board for STDRIVE601 triple gate driver

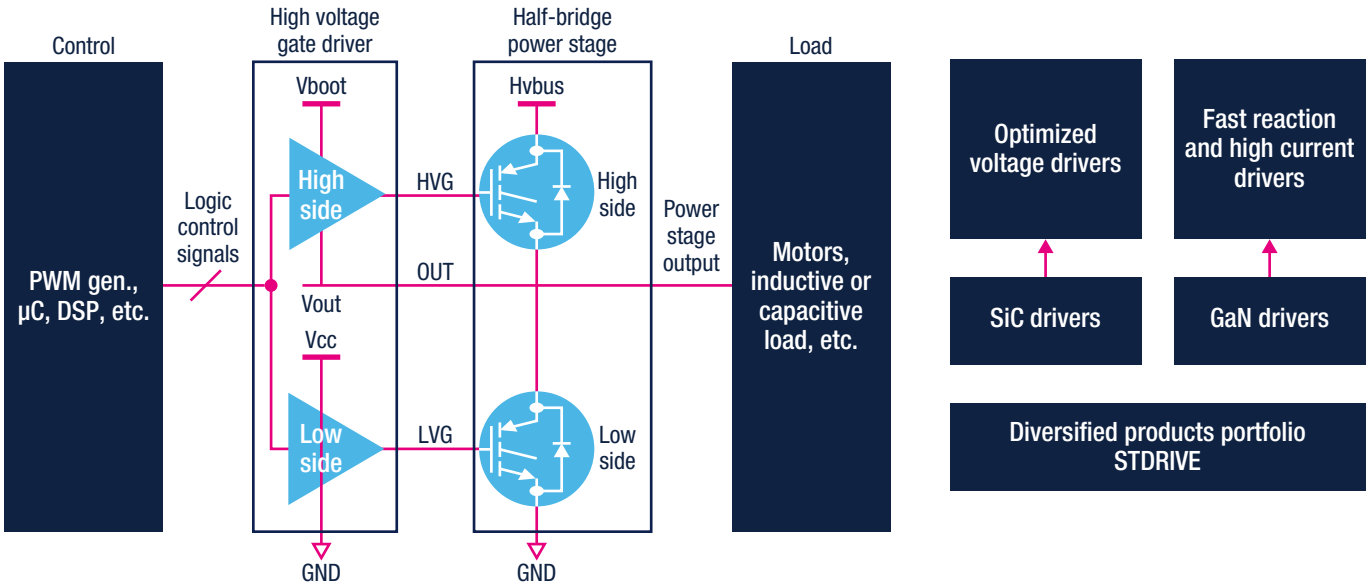
Part Number	Supply Voltage (V) max	Protection Option Type	Key features	Output Current-Max (A)	Input configuration	Grade	Undervoltage lockout (V)				Operating Temperature (°C)		EVALBoard	Board description
							(On VCC ON) nom	(On VCC OFF) nom	(On VBOOT ON) nom	(On VBOOT OFF) nom	min	max		
STGAP2HSM	26	Active Miller clamp, Shutdown protection, Undervoltage lockout	Thermal Shutdown	4	IN+, IN-	Industrial	9.1	8.4	-	-	-40	125	EVALSTGAP2SM	Demonstration board for STGAP2SM isolated 4 A single gate driver
STGAP2HSCM	26	Separated Outputs, Shutdown protection	Thermal Shutdown	4	IN+, IN-	Industrial	9.1	8.4	-	-	-40	125	EVALSTGAP2SCM	Demonstration board for STGAP2SCM isolated 4 A single gate driver

Silicon Carbide and Gallium Nitride Gate Drivers

Silicon carbide (SiC) MOSFETs combine excellent switching performance and allow more efficient and compact systems. Gallium Nitride (GaN) FETs are very fast switching elements and careful system design enables their performance advantages to be fully used.

ST's companion for discrete power SiC and GaN FETs as well as digital – microcontrollers, DSPs and FPGAs – or analog controllers in any switched-mode power converter or motor drive, STDRIVE gate drivers generate the necessary voltage and current level required to accurately and efficiently activate the power stage in industrial, consumer, computer and automotive applications.

STDRIVE perfectly fits your switched-mode power converter or motor design based on SiC or GaN FETs.



GALVANIC ISOLATION

STGAP2S and **STGAP2D** are SiC drivers with 6 kV galvanic isolation which provides robustness and noise immunity. A thick oxide isolation layer is grown on-chip to build a miniature transformer which is used to transfer signals between input and output.

Their 4 A current output capability and rail-to-rail outputs make the devices a perfect fit for SiC and GaN inverter industrial applications.

HIGH VOLTAGE GAN DRIVER

STDRIVEG600 driver is designed in order to optimize speed and output current for GaN FETs. Some useful features are embedded in the product for reducing the number of external components required at system level.

Part Number	Voltage max (V)	Output current max (A)	Common-mode transient immunity (V/ns)	Supply voltage c (V) max	UVLO thresholds		Propagation delay (ns)	Additional features	Package
					OFFth	ONth			
STGAP2S	1700	4	±100	26	8.4 V	9.1 V	75	UVLO and thermal shutdown Miller Clamp	SO-8
STGAP2HS	1200							UVLO and thermal shutdown 6 kV galvanic isolation Miller Clamp	SO-8W
STGAP2SiCSCM	1200			28	-	-	100	6 kV galvanic isolation Miller Clamp	
STGAP2SiCSM								6 kV galvanic isolation Separated outputs	
STDRIVEG600	800	Up to 5.5	±200	21	4.2 V	4.5 V	45	UVLO and thermal shutdown and HW interlocking function	SO-16

Current, Speed & Positioning Sensing

Operational amplifier

ST has a wide range of op amps, including both industry-standard and high-performance op amps. Our strengths include:

- Growing portfolio of Zero-drift amplifiers
- Reliable high-volume supplier of both standard and high-performance op amps
- Space-saving packages, such as DFN, QFN, SOT-23 and SC-70

Our JFET, bipolar, CMOS and BiCMOS technologies allow our products to support:

- A wide supply range, from 1.5 V to 36 V
- High ratios of performance-to-power consumption

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.

	Nano Power	Micro Power	Low Power	Zero Drift	Precision	Energy Effective	Fast
5 V	TSU	TSV6 ●	TSV8 ●	TSZ ●	TSV7 ●	TSV5 ●	TSV9 ●
16 V		TSX6 ●			TSX7 ●	TSX5 ●	TSX9 ●
36 V		TSB6 ●			TSB7 ●	TSB5 ●	TSB9* ●

● AECQ-100 * In development

HIGHLIGHT: TSV792

- Dual operational amplifier
- High-bandwidth: 50 MHz
- High accuracy : Vio < 200 µV
- Rail-to-rail input-output
- Unity gain stable
- Perfectly suited for low-side shunt-based current measurement

Applications	Features	Products
Low-side current sensing	Precision, low Vio as good as 5 µV	TSZ121, TSZ181, TSV7721, TSV791
Temperature sensing	Low power consumption as low as 580 nA	TSU101, TS941, TSV631, TSU111
Vibration sensing	High bandwidth up to 50 Mhz	TSX9291, TSH22, TSV991, TSV772, TSV792
Angle measurement DC brushless motor	High output current, > 100 mA	TSX561, TS982, TS507, TSB582
Low-side current sensing	High Common-mode Voltage up to 70 V	TSC101, TSC102, TSC103, TSC2011, TSC213, TSC2010, TSC2012, TSC210
Data acquisition and instrumentation, Test and measurement equipment, motor control, industrial process control, strain gauge	36 V signal conditioning	TSB572, TSB611, TSB712, TSB7192, TSB571, TSB711, TSB7191

HIGH-SIDE CURRENT SENSING (TSC SERIES)

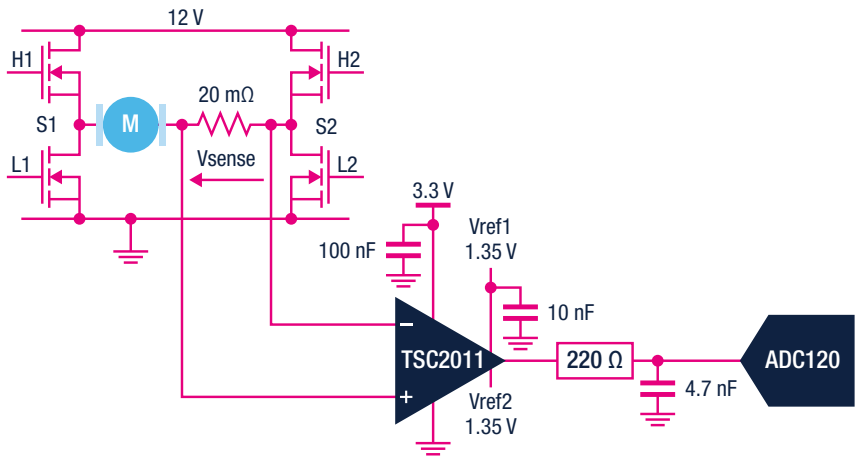
Accurate sensing of currents is central to enhancing application safety. Controlling the current within set boundaries avoids overheating and short circuits. Current measurement is also an essential part of energy metering.

The main features of our growing high-side current-sense amplifier portfolio are:

- Up to 70 V line monitoring
- Integrated solutions (for example, inclusion of EMI filtering on output) for faster design times and a reduced BOM
- Robust devices that do not require external protection
- Automotive-grade qualified current-sense amplifiers

HIGHLIGHT: TSC2011

- Wide common mode voltage: -20 to 70 V
- Offset voltage: ±200 µV max.
- 2.7 to 5.5 V supply voltage
- 60 V/V gain
- Gain error: 0.3% max.
- Offset drift: 5 µV/°C max.
- Quiescent current: 20 µA in shutdown mode
- SO8 and MiniSO8 package



Order code	Description	Reference
STEVAL-ISQ007V1	High-side current-sense amplifier demonstration board based on TSC101	AN2727
STEVAL-ISQ010V1	High-side current-sense amplifier demonstration board based on TSC102	DB0982
STEVAL-ISQ013V1	Low-side current sensing based on TS507	AN3222
STEVAL-ISQ014V1	Low-side current sensing based on TSZ121	UM1737
STEVAL-AETKT1V1	High-side current-sense amplifier demonstration board based on TSC2011	
STEVAL-AKI001V1	8 multiplexed channels conversion 50 ksps to 1 Msps based on ADC120	UM2691
STEVAL-AETKT1V2	High-side current-sense amplifier demonstration board based on TSC2010, 2011, 2012	DB4277
STEVAL-AETKT2V1	High precision bidirectional current sense amplifiers based on the TSC2010/13	DB4471

ANALOG-TO-DIGITAL CONVERTER

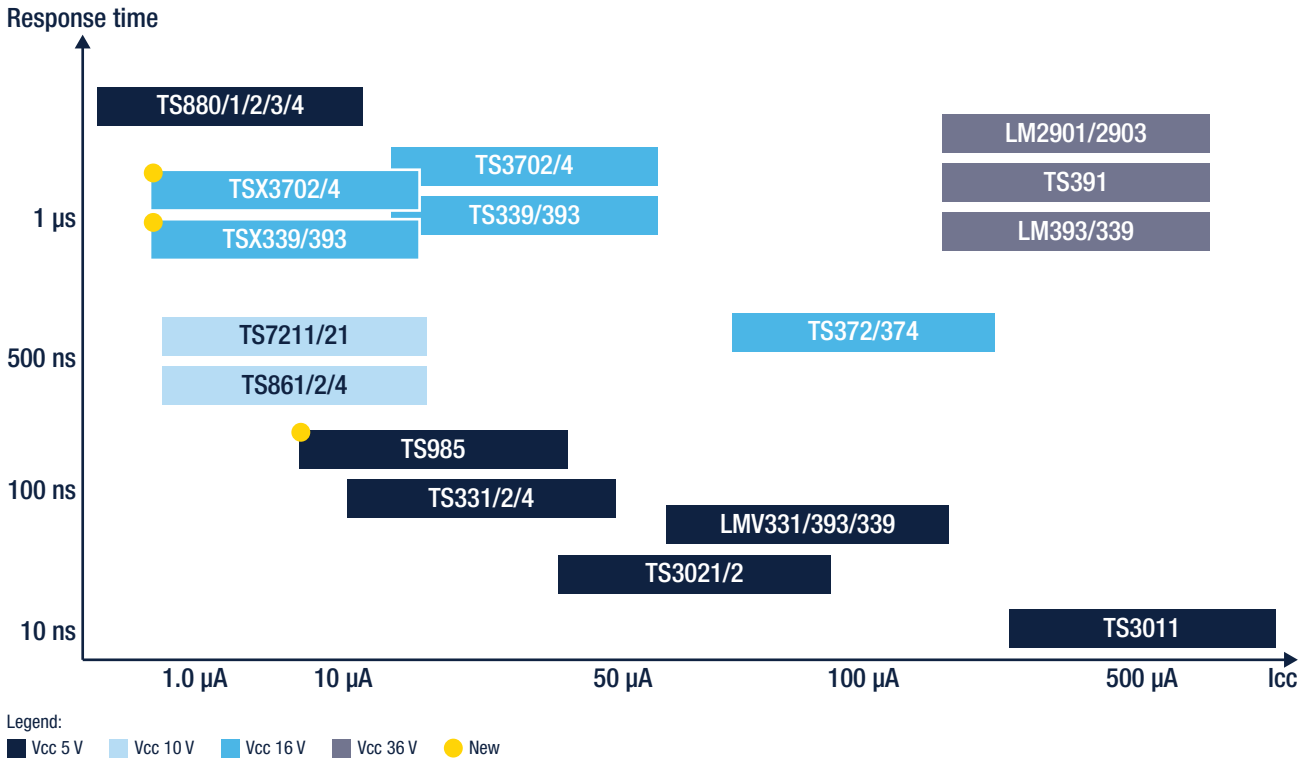
ST proposes the ADC120, a robust and flexible 8-channel, 12-bit, 50 ksps to 1 Msps ADC, for industrial environments, guaranteed up to 125 °C. The ADC120 offers the best linear performances over the largest sampling frequency range. It is interfaced through a 4-wire SPI bus.

COMPARATORS

ST is a leading supplier of comparators, and our portfolio offers:

- High-speed comparators, with response times as fast as 8 ns
- Micropower comparators with operating currents as low as 210 nA
- High-temperature (150 °C) qualified devices
- Guaranteed specified min/max electrical performances

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.



GALVANIC ISOLATED SIGMA-DELTA MODULATORS

Galvanic isolated analog to digital converters play a fundamental role in the industrial market where power and digital worlds must live together.

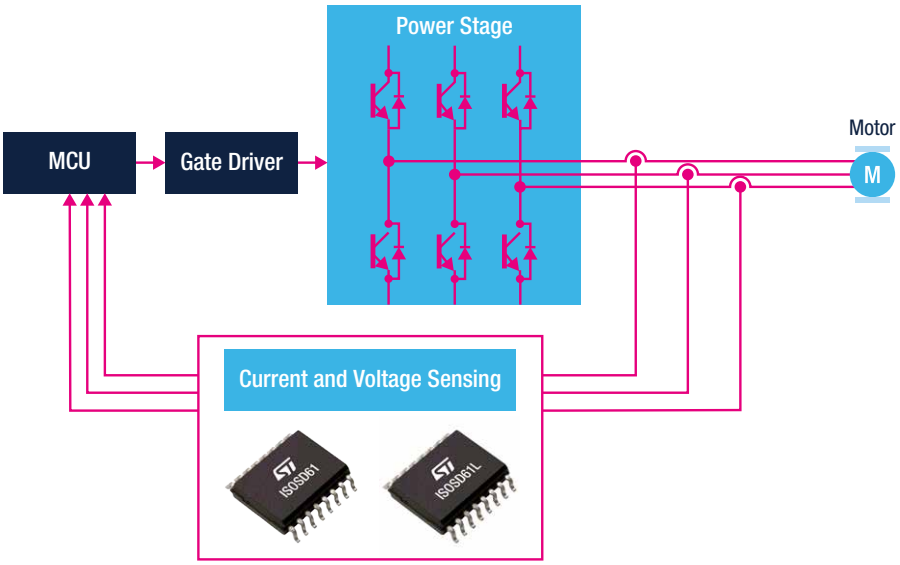
In servo drive applications, a stand-alone analog-to-digital modulator is typically used to sense and convert in digital 1-bit streaming the phase currents, the phase-to-phase voltages and the DC Bus voltage of the motor processable by the host controller.

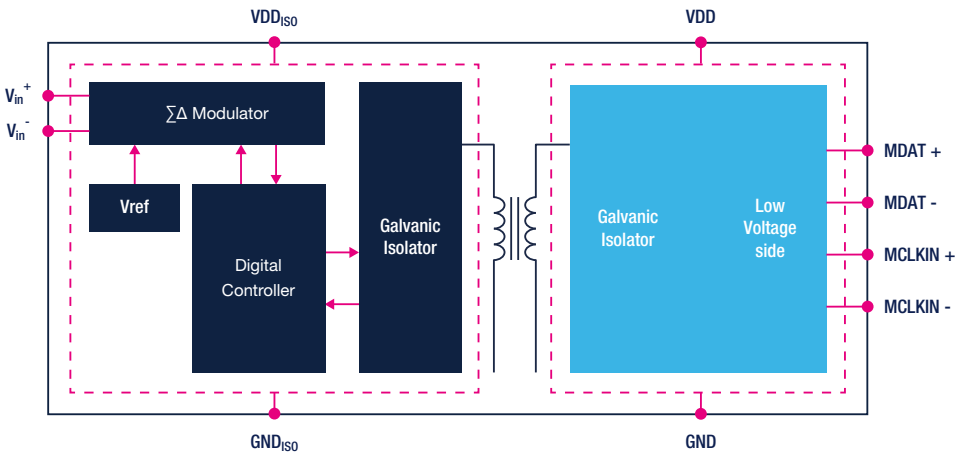
Hence ∑Δ AD converters must be very accurate, immune to noise and ensure reliability in harsh environment, with the goal of prolonging as much as possible system lifetime.

Combining the afore-mentioned functionalities with thick oxide silicon-based isolation it is possible to guarantee the needed application safety against human shocks, prevent ground potential difference or ground loop (by eliminating stray currents flowing between power system and digital system that cause data communication errors), and keep high rejection against fast noise transients.

Thanks to the very accurate and robust galvanically isolated ∑Δ modulators such as the ISOSD61, the host controller can drive the motor in real time and in a very precise way in terms of position, speed and torque.

At application level typical combination of ∑Δ 1-bit modulator and shunt are the perfect choice to achieve the best compromise for high precision, low cost, and low form factor solution in place of Hall Effect sensors.





KEY PRODUCT FEATURES

- 16-bit Resolution
- ±320mV Input Range
- ±250mV Input Linear Range
- Up to 25 MHz external clock
- 50kHz Bandwidth
- 86 dB typical SNR
- - 83 dB typical THD
- 30 kV/µs typical CMTI
- 6kV PEAK Isolation (VIOTM)
- 1.2kV PEAK Working Voltage (VIORM)
- LVDS and TTL options
- SO16 wide package

DEVELOPMENT TOOLS

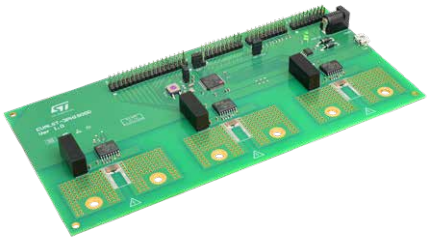
A variety of evaluation boards and reference designs are available to help you develop applications based on ST's portfolio of galvanically isolated modulators.

Part Number	Version	Linear input range	Max. clock frequency	Resolution	SNR	Isolation	CMTI	Package & Packaging
ISOSD61	TTL/CMOS	±250 mV	25 MHz	16-bit	86 dB	6 kV	30 kV/us	SO16W Tray
ISOSD61TR	TTL/CMOS							SO16W Tape & Reel
ISOSD61L	LVDS							SO16W Tray
ISOSD61LTR	LVDS							SO16W Tape & Reel

Based on the ISOSD61 galvanically isolated sigma-delta modulator with low-voltage differential signaling (LVDS) and single-ended (TTL/CMOS) options, the EVALST-ISOSD61T board comes with all the necessary documentation and resources to reduce evaluation and design phases.

The EVALST-3PHISOSD evaluation board implements a complete 3-phase current sensing platform based on low-cost shunt sensors. The input analog signal is oversampled by ISOSD61 and converted into an output bitstreams, thanks to the embedded firmware which exploits the DFSDM filters of the STM32F413 micro to convert the three bitstreams into 24-bit current data at a selectable sampling rate.
The firmware also implements a virtual COM port communication to easily access the internal parameters to read data and to calibrate the board.

A complete library of technical documentation including datasheets, application notes, user manuals, gerber files, and schematics is available for developers.



EVALST-3PHISOSD



EVALST-ISOSD61T

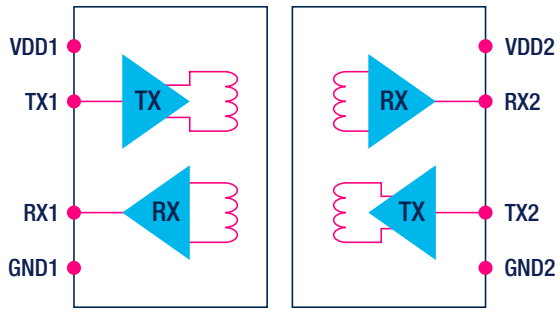
Digital Isolators

Galvanic isolation is a fundamental function in motor control applications. ST offers galvanic isolation integrated in key products targeting motor control applications, such as drivers and current sensors, nevertheless, depending on selected application architectures or for specific sections in the system, standard digital isolators transferring digital signal between two different voltage domains, which must be isolated galvanically for functional or safety reasons, could be selected by application designers.

Leveraging on ST's 6kV thick-oxide galvanic-isolation technology, STISO62x are dual-channel digital isolators which are equipped with Schmitt trigger input, providing robustness to noise and very high speed (100 Mbps) input/output switching time with an exceptional low pulse distortion (<3ns).

STISO620 has 2 both channels with the same directionality, while STISO621 and STISO621W have isolated digital channels in the opposite directionality.

STISO620 and STISO621 are offered in SO8 narrow body package option with 4mm creepage and clearance values, 4 kV peak impulse withstand voltage (VIOTM) and 2830Vrms isolation voltage (VISO). STISO621W features SO8 wide package with 8mm creepage and clearance and up to 6 kV peak impulse withstand voltage (VIOTM) and 3536Vrms isolation voltage (VISO). The part numbers support a high rate of maximum working isolation voltage (VIOWM=849Vrms). Isolation key parameters have been tested in accordance with VDE0884-10 and UL 1577 standards and the products have been certified by UL.



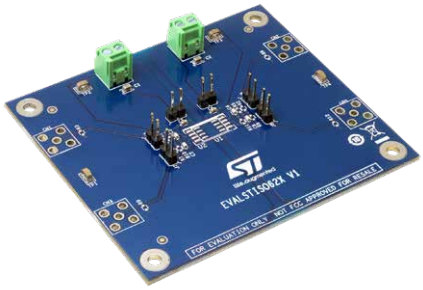
STISO621/STISO621W/STISO620 KEY FEATURES

- Dual channel, digital isolators with 1 – 1 and 2 - 0 channel direction
- Up to 6 kV peak isolation (VIOTM)
- 1.2 kV peak working voltage (VIORM)
- High common-mode transient immunity: >50 kV/µs
- Data rate up to 100 Mbps
- Pulse width distortion: < 3ns
- 3 to 5.5 V supplies
- 3.3 V and 5V level translation
- –40 to +125°C extended industrial temperature range
- SO8 narrow-body and wide package options (STISO621W)
- UL1577 Certified (File Number: E362869)

Part Number	Viotm	Viso	Creepage/Clearance	Data Rate	CMTI min	Package & packing
STISO620	4k Vpk	2828 Vrms	4 mm	100 Mbps	50 kV/us	S08 Narrow Tube
STISO620TR						S08 Narrow Tape and real
STISO621						S08 Narrow Tube
STISO621TR						S08 Narrow Tape and real
STISO621W	6k Vpk	3536 Vrms	8 mm			S08 Wide Tube
STISO621WTR						S08 Wide Tape and real

DEVELOPMENT TOOLS

The ST dual-channel digital platform can be evaluated by EVALSTISO62XV1 product evaluation board.



STM32 MC SDK: the Motor Control Software Development Kit

STM32 microcontrollers offer the performance of the industry-standard Arm® Cortex®-M cores running Field Oriented Control (FOC) modes, widely used in high-performance drives for air conditioning, home appliances, drones, building and industrial automation, medical and e-bike applications.

STM32 MC SDK (motor control software development kit) firmware (X-CUBE-MCSDK) includes the permanent-magnet synchronous motor (PMSM) firmware library and the STM32 Motor Control Workbench to configure the firmware library parameters through its graphical user interface.

STM32 Motor Control Workbench is PC software that reduces the design effort and time needed for the firmware configuration: the user generates a project file through the GUI, and initializes the library according to the application needs. Some of the variables of the algorithm being used can be monitored and changed in real time.

STM32

STM32 Open Development Environment

KEY FIRMWARE FEATURES

- Single/Dual simultaneous field-oriented control (FOC)
- Motor profiler for a fast startup of unknown motors
- Simplified firmware architecture based on the STM32Cube HAL/LL libraries
- Current reading topologies supported:
  - 1 shunt resistor
  - 3 shunt resistors
  - 2 ICS (Isolated Current Sensor)
- Speed/position sensors (Encoder and Hall) as well as sensor-less operation (state observer) supported
- On-the-fly startup for fans and eBikes
- Speed and torque control, position control
- Motor control algorithms implemented for specific applications, among them MTPA (maximum torque per ampere), Flux weakening, Feed forward and Start-on-the-fly
- Full customization and real time communication through STM32 Motor Control Workbench PC software
  - New project creation starting from the board
  - Workflow supporting the STM32CubeMX GUI configurator
  - Wide range of STM32 microcontrollers supported
- Position Control for configurations using a Quadrature Encoder as speed and position feedback
- FreeRTOS support
- Six-step support for STM32G0, STM32F0, STM32C0, STM32G4

STM32 Motor Control ecosystem web page:
https://www.st.com/content/st_com/en/stm32-motor-control-ecosystem.html

MOTOR CONTROL ECOSYSTEM

SOFTWARE

X-CUBE-MCSDK

- **Motor control software development kit (PMSM FOC)**
- **BLDC/ 6-step**

STM32 motor profiler
Identify the characteristics of PMSM and BLDC motors

STM32 motor pilot
Monitoring tool for STM32 motor control applications

STM32 motor control workbench
Configure the FOC firmware library parameters, thanks to its GUI

Motor control firmware library
based on STM32Cube HAL and LL

State-of-the-art algorithms

HSO STM32 ZeST *Contact ST sales office*

STM32Cube

HARDWARE BOARD DESCRIPTION .JSON files

HARDWARE



B-G473E-ZEST1S
Ready to embed the ZeST and HSO algorithms. Host the motor control connector V2.



STEVAL-LVLP01
Power board.
Hosts the motor-control connector.



NUCLEO-G431RB



P-NUCLEO-IHM03



X-NUCLEO-IHM16M1



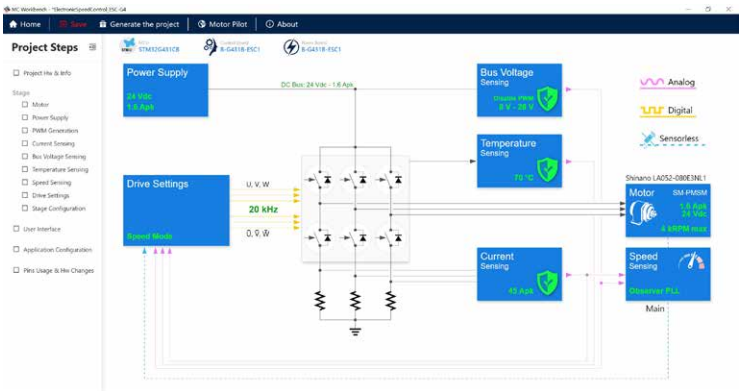
B-MOTOR-PMSMA1

ST power portfolio (STSPIN, SiC/GaN, MOSFET, IGBT, rectifiers …)

MC WORKBENCH

Motor Control Workbench (available in the X-CUBE-MCSDK) is linked with STM32CubeMX. Developers can open STM32CubeMX through Motor Control Workbench during their Motor Control development to change STM32 configuration.

1. MC app Configuration	2. MC Configuration	3. Development	4. Programming	5. MC Tune & Monitoring
MC Workbench	STM32 CubeMX	STM32 CubeIDE IAR EWARM Keil MDK-ARM	STM32 CubeProgrammer	STM32 MC Pilot



Full Integration/configuration in MC Workbench tools

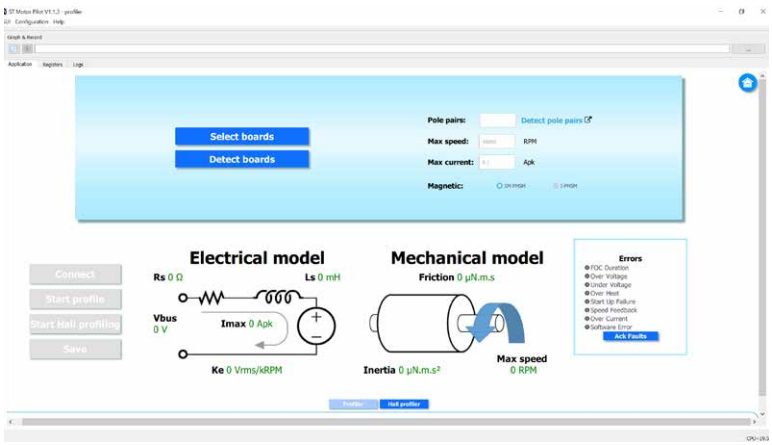
STM32 series		F0	F3	F4	F7	L4	G0	G4	C0	H5	H7	U5	STSpin32F0	STSPIN32G4
Current Sensing and over current protection OCP	Current 1-shunt or 3-shunt	•	•	•	•	•	•	•	•	•	•	•	•	•
	Insulated Current Sensing		•	•	•			•	•	•	•	•		
	Embedded Comparators OCP, OPAMPs		•					•	•	•	•	•		
Speed/Position sensing	Sensor (Hall, Encoder sensors)/ Sensor-less	•	•	•	•	•	•	•	•	•	•	•	•	•
Bus Voltage sensing/ protection UVP/OVP	Vbus reading, Over and Under voltage protection	•	•	•	•	•	•	•	•	•	•	•	•	•
Temperature sensing/ protection OTP	Temperature measurement, Over temperature protection	•	•	•	•	•	•	•	•	•	•	•	•	•
FOC	Single	•	•	•	•	•	•	•	•	•	•	•	•	•
	Dual (Couple ADCs per motor)		•	•				•	•	•	•	•		
	Dual (Sharing ADC resources for both motors)		•	•					•	•	•	•		
Control Mode	Torque/Speed/Position control	•	•	•	•	•	•	•	•	•	•	•	•	•
Other features	MTPA, Flux weakening, Feed Forward	•	•	•	•	•	•	•	•	•	•	•	•	•

Firmware examples/Full support in MC Workbench tools

STM32 series		F0	F1	F3	F4	F7	L4	G0	G4	H7 CM4	STSpin32F0
6 Step	Fully supported through dedicated UI in MC Workbench tools				•				•		•
Dual Core	FW Examples									•	
PFC	FW Examples			•							
Legacy FOC	FW Examples								•		
HSO (High Sensitivity Observer)	FW Examples								•	•	

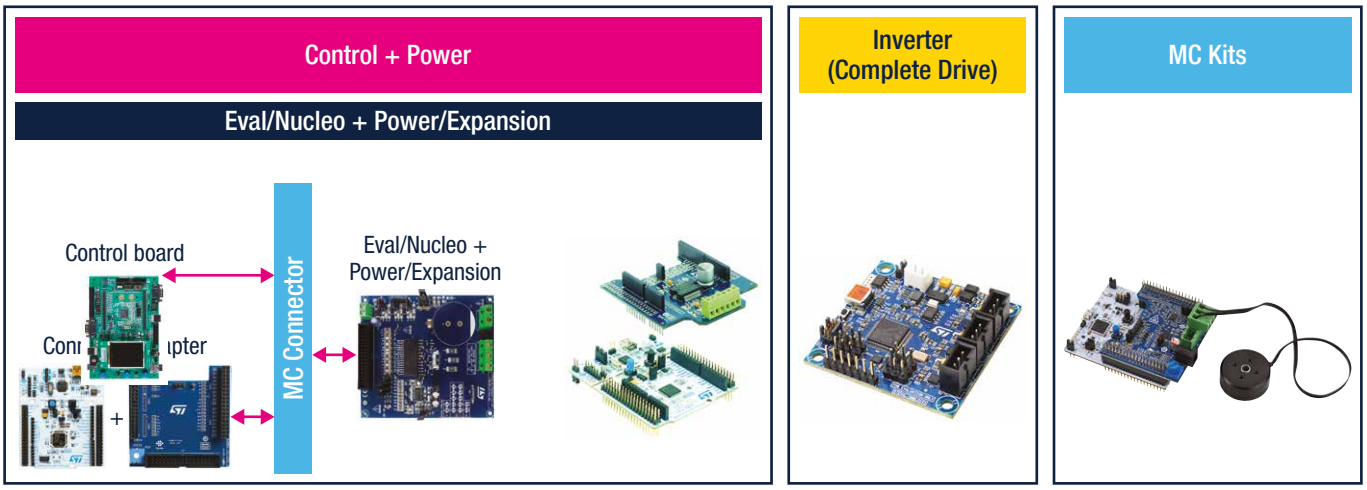
STM32 MOTOR PILOT

- Automatic detection of key parameters of a PMSM
- Zero equipment required
- Spin the motor in less than one minute
- Best accuracy when Rs ≥ 1 Ω and Ls ≥ 1 mH



STM32 EVALUATION BOARDS FOR MOTOR CONTROL

ST proposes a wide range of evaluation boards for comprehensive evaluation of ST's products and solutions while reducing your development time. In particular, all of ST's microcontroller evaluation boards have ST's standard MC connector on-board allowing the use of the board in conjunction with any of the power stage evaluation boards.



READY TO USE MOTOR CONTROL EVALUATION KITS:

- STM32 Nucleo Pack for motor control
- Complete evaluation kit -FOC, 6-step FW example based- for evaluation, fast prototyping, makers and education
  - Based on STM32 G4: P-NUCLEO-IHM03

STM32 MC SDK Control Boards

Family	MCU	Board	Description
G0	G081B	STM32G081B-EVAL	G0 Evaluation Board
F0	F030R8	NUCLEO-F030R8	F0 Nucleo Board
F0	F072RB	NUCLEO-F072RB	F0 Nucleo Board
F0	F072VB	STM32072B-EVAL	F0 Evaluation Board
F1	F103RB	NUCLEO-F103RB	F1 Nucleo Board (MD)
F1	F103ZET6	STM3210E-EVAL	F1 Evaluation Board
F3	F302R8	NUCLEO-F302R8	F3 Nucleo Board
F3	F303RE	NUCLEO-F303RE	F3 Nucleo Board
F3	F303VE	STM32303E-EVAL	F3 Evaluation Board
F4	F446RE	NUCLEO-F446RE	F4 Nucleo Board
F4	F407IG	STM3240G-EVAL	F4 Evaluation Board
F4	F417IG	STM3241G-EVAL	F4 Evaluation Board
F4	F446ZET	STM32446E-EVAL	F4 Evaluation Board
F4	F415ZGT8	STEVAL-IHM039V1	F4 Evaluation Board
F4	F401RE	NUCLEO-F401RE	F4 Nucleo Board
F7	F746ZG	NUCLEO-F746ZG	F7 Nucleo Board
F7	F769I	STM32F769I-EVAL	F7 Evaluation Board
L4	L452RE	NUCLEO-L452RE	L4 Nucleo Board
L4	L476G	STM32L476G-EVAL	L4 Evaluation Board
G4	G474Q	STM32G474E-EVAL1	G4 Evaluation Board
G4	G431R	NUCLEO-G431RB	G4 Nucleo board
G4	G473	B-G473E-ZEST1S	G4 Evaluation Board
H5	H503RB	NUCLEO-H503RB	H5 Nucleo board
H5	H533RE	NUCLEO-H533RE	H5 Nucleo board
H5	H563ZI	NUCLEO-H563ZI	H5 Nucleo board
H7	H755ZI	NUCLEO-H755ZI-Q	H7 Nucleo board
C0	C031C6	NUCLEO-C031C6	C0 Nucleo board
C0	C051C8	NUCLEO-C051C8	C0 Nucleo board
C0	C071RB	NUCLEO-C071RB	C0 Nucleo board
C0	C092RC	NUCLEO-C092RC	C0 Nucleo board
U5	U575ZI-Q	NUCLEO-U575ZI-Q	U5 Nucleo board

STM32 MC SDK Power Boards

Board	Description
STEVAL-IHM045V1	3-phase high voltage inverter power board for FOC based on the STGIPN3H60A (SLLIMM-nano)
X-NUCLEO-IHM07M1	Three-phase brushless DC motor driver expansion board based on L6230 for STM32 Nucleo
X-NUCLEO-IHM08M1	Low-Voltage BLDC motor driver expansion board based on STL220N6F7 for STM32 Nucleo
X-NUCLEO-IHM11M1	Low voltage three-phase brushless DC motor driver expansion board based on STSPIN230 for STM32 Nucleo
X-NUCLEO-IHM16M1	Three-phase brushless DC motor driver expansion board based on STSPIN830 for STM32 Nucleo
X-NUCLEO-IHM17M1	Low voltage three-phase brushless DC motor driver expansion board based on STSPIN233 for STM32 Nucleo
STEVAL-IPM05F	500 W motor control power board based on STGIF5CH60TS-L SLLIMM 2nd series IPM
STEVAL-IPM07F	700 W motor control power board based on STGIF7CH60TS-L SLLIMM 2nd series IPM
STEVAL-IPM10B	1200 W motor control power board based on STGIB10CH60TS-L SLLIMM 2nd series IPM
STEVAL-IPM08B	800 W motor control power board based on STGIB8CH60TS-L SLLIMM 2nd series IPM
STEVAL-IPM10F	1000 W motor control power board based on STGIF10CH60TS-L SLLIMM 2nd series IPM
STEVAL-IPM15B	1500 W motor control power board based on STGIB15CH60TS-L SLLIMM 2nd series IPM
STEVAL-IPMNG3Q	300 W motor control power board based on STGIPQ3H60T-H SLLIMM-nano IPM
STEVAL-IPMNG5Q	450 W motor control power board based on STGIPQ5C60T-HZ SLLIMM-nano IPM
STEVAL-IPMNG8Q	600 W motor control power board based on STGIPQ8C60T-HZ SLLIMM-nano IPM
STEVAL-IPMNM1N	60 W motor control power board based on STIPNS1M50T-H SLLIMM-nano SMD IPM MOSFET
STEVAL-IPMNM2N	100 W motor control power board based on STIPN2M50T-H SLLIMM-nano IPM MOSFET
STEVAL-CTM010V1	1500 W motor control power board based on STGIPQ5C60T-HZ SLLIMM-nano IPM
STEVAL-CTM009V1	5000 W motor control power board based on STGIPQ8C60T-HZ SLLIMM-nano IPM
STEVAL-IPMnM1S	60 W motor control power board based on STIPNS1M50T-H SLLIMM-nano SMD IPM MOSFET
STEVAL-IPMnG3S	100 W motor control power board based on STIPN2M50T-H SLLIMM-nano IPM MOSFET
STEVAL-LVLP01	700 W motor control power board based on STDRIVE101 and STL8N10F7 MOSFET

STM32 MC SDK inverters

Family	MCU	Board	Description
F0	F031	STEVAL-SPIN3201	STSPIN32F0 3-shunt
F0	F031	STEVAL-SPIN3202	STSPIN32F0A 1-shunt
F1	F103	STEVAL-IHM034V2	MC and digital PFC
F3	F303	X-Nucleo-IHM16 + Nucleo-F303RE	Bundle
F3	F303	STEVAL-ESC001V1	Electronic speed controller
F3	F303	STEVAL-IHM042V2	Dual Drive only
G4	G431	B-G431B-ESC1	G4 ESC board
G4	G473	STEVAL-PTOOL4A	G4 Power tool board
G4	G431	STEVAL-CTM014	G4 Washing machine board
STSPIN32	F031	EVSPIN32F0251S1	STSPIN32F0251 1-shunt
STSPIN32	F031	EVSPIN32F0601S1	STSPIN32F0601 1-shunt
STSPIN32	F031	EVSPIN32F0601S3	STSPIN32F0601 3-shunt
STSPIN32	F031	EVSPIN32F0602S1	STSPIN32F0602 3-shunt
STSPIN32	F031	STEVAL-SPIN3204	STSPIN32F0B 1-shunt
STSPIN32	G431	EVSPIN32G4	STSPIN32G4 3-shunt with heatsink
STSPIN32	G431	EVSPIN32G4NH	STSPIN32G4 3-shunt without heatsink

MORE RESOURCES AND SUPPORT

STM32 and STM8 Motor Control Ecosystem web page available at: **https://www.st.com/content/st_com/en/stm32-motor-control-ecosystem.html**

STM32 Motor Control Forum available at: **https://community.st.com/s/topic/0TO0X000000BoYJWA0/stm32-motor-control**

MCSDK 2025 UPDATES SUMMARY



STM32 MC SDK compatibility		STM32 MC SDK 6.4 (2025 release)
STM32 series supported		12 series (STM32F0, GO, CO, L4, F3 G4, F4, F7, H5, H7, U5) + STSPIN32
Hardware boards supported		ST Boards (control & power, board manager) User boards (JSON text format description) Board designer tool
Algorithms	BLDC 6-steps	Legacy support + full support of STM32F0, F3, F4, G0, C0, G4 series Enhanced Rotor Speed and position feedback (sensor and sensor-less mode) On the Fly and Initial position detection
	BLDC FOC	Legacy and STM32U5 support STM32C0 single shunt support New High Sensivity Observer (HSO) support STM32 ZeST support (for selected customers only)
	Observer	ST Observer (STO PLL) High-Sensivity Observer (HSO)
	STM32 ZeST	STM32 ZeST: Max Torque at Zero Speed (available for selected customers only)
Variable monitoring		Motor pilot tool (advanced variable monitoring, control and new trigger functionality)
Motor parameters measurements		Motor profiler tool

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