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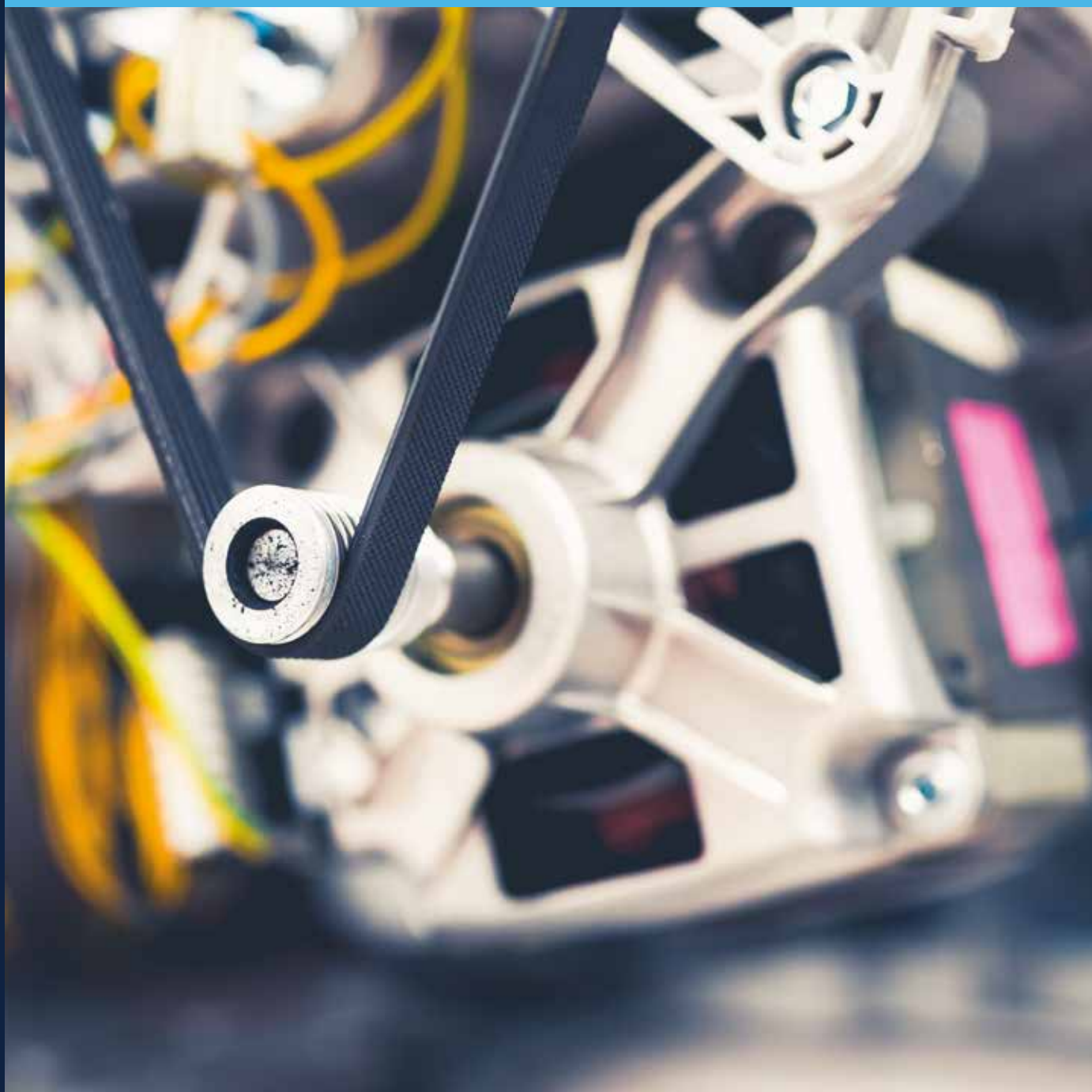
Motor control Reference Guide



Contents

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 is riding the winds of change with innovations in integrated intelligent power modules and systems-in-package, monolithic motor drivers, fast and efficient power switches, voltage-transient protected Triacs, 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

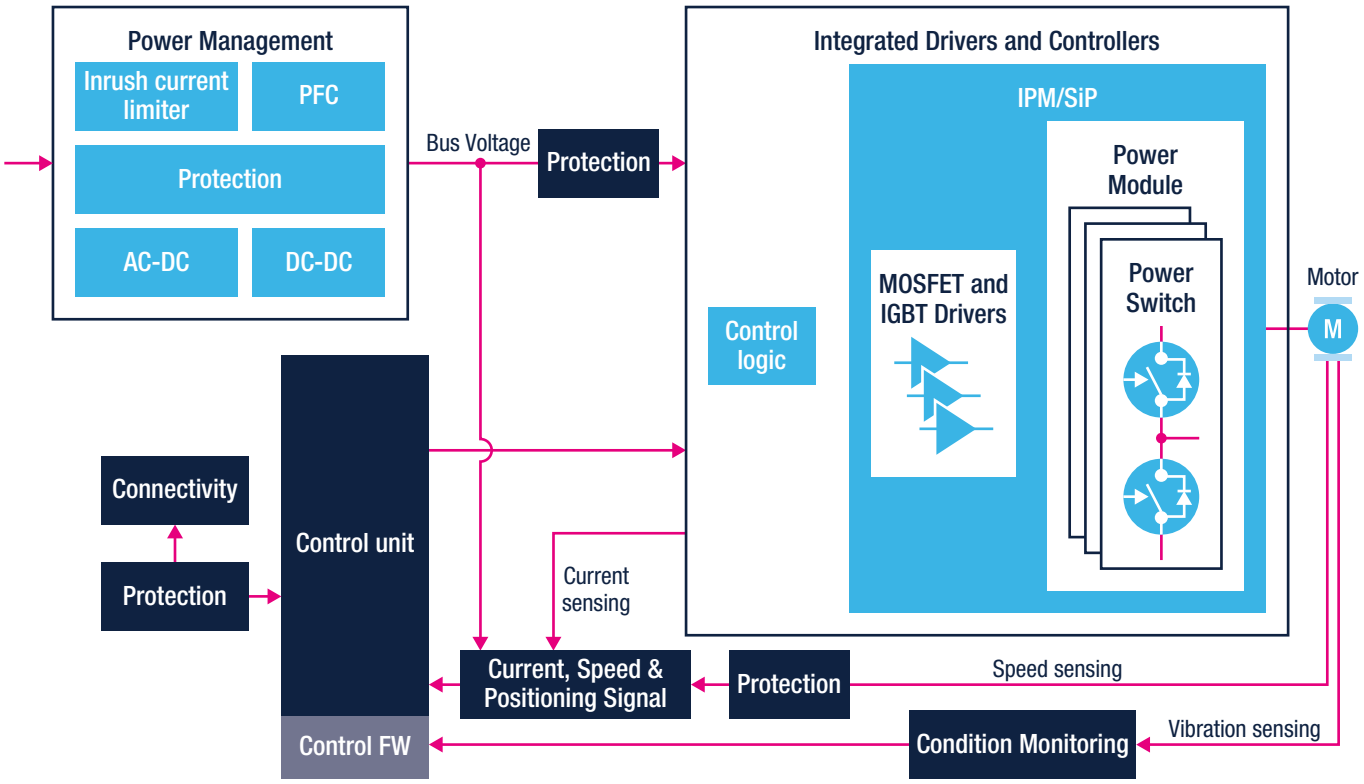
For more information and up-to- date material, visit motor control application page on ST's website at **http://www.st.com/motorcontrol**

PMSM & BLDC Motors

Permanent Magnet synchronous motor 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 drivers 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 • L62 Series	Wide range of efficient and accurate motor drivers able to drive PMSM and BLDC motors, ranging from several watts to few kilowatts	• STSPIN23* • STSPIN830 • STSPIN32F0* • STSPIN32G4 • L623*
Intelligent power Module (IPM/SiP)	• SLLIMM 2nd series • SLLIMM-nano • SLLIMM-nano 2nd series • SLLIMM-nano SMD • System-in-Package PWD	3-phase inverter, IGBT and MOSFET based	• STGI* • STI* • PWD5T60

	Product family		Description with key Features	Key products
Control unit	• STM32 Series • STM8S 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	• STM32G0* • STM32G4* • STM32F0* • STM32F103* • STM32F30* • STM32F4* • STM32F7* • STM32L4* • STM8S*
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 Module	ACEPACK		Six pack and CIB topology, MOSFET SiC trench gate field-stop IGBT	• A1PyyMwwWz • AxPyySwwMz • AxCyySwwMz
Power Switch	• F6 & F7 Low Voltage MOSFET • IGBT M series • IGBT S series • IGBT H series • DM2 MOSFET • DM6 MOSFET		Low Voltage MOSFET High voltage IGBT and MOSFET	• STxyN4F7 • STxyN6F7 • STxyN8F7 • STxyN10F7 • STGxyyM65DF2 • STGxyyM120DF3 • STGxyyS120DF3 • STGxyyH60DF • STxyN60DM6 • STxyN60DM2
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/us at high temperature 150 °C, High turn-on capability dI/dt = 100 A/us)	• TN6050HP-12WY • TN4050HP-12WY • STTD6050H-12M2Y • TN5015H-6G • TM8050H-8W
Signal conditioning	• TSV9 series • TSC2 series		High speed up to 20 MHz Gain Bandwidth Product 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
Protection	bus voltage: Protection of the integrated Driver and controler	• SMA4F series • SMA6F series • SMB6F series • SMB15F 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	• SMA4F series • SMA6F series • SMB6F series • SMB15F 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 conditionning ICs	• ESDAxxSC6 series	400 W IPP (8/20 µs) high ESD protection level up to 30 kV for sensitive équipements	• 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

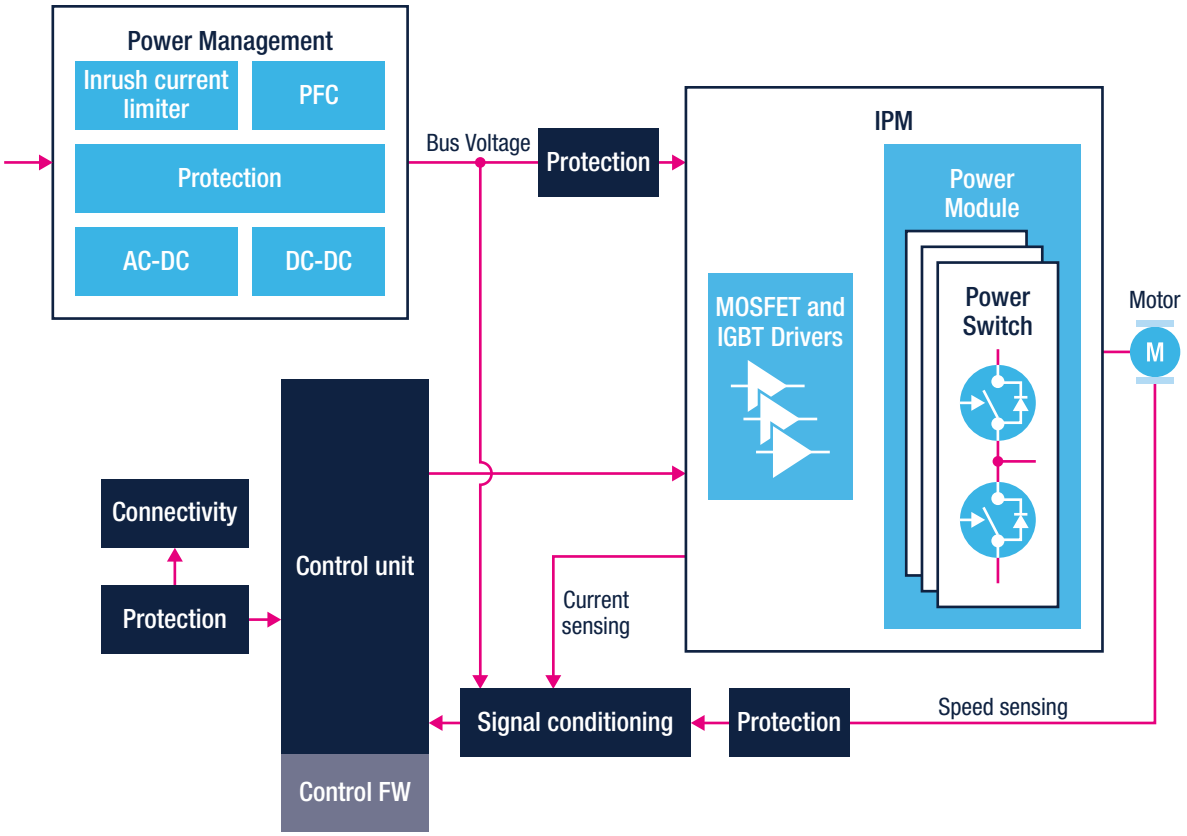
Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
STEVAL-HKI001V2	50 – 650 V_{DC}	Up to 35 A_{RMS} to the motor	• 1x A2C35S12M3-F • 7x STGAP1AS • 1x STM32F303RBT7	Motor drive: pumps, Motion/Servo Control, Industrial motor drives and more
STEVAL-STDRIVE601	Up to 600 V	Up to 1000 kW	• 1xSTDRIVE601 • 6xSTGD6M65DF2	Motor Drive: 3-phase motor drivers, Power board: pumps, fans, Industrial inverters, home appliances
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 2 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-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-IHM023V3	90 – 285 V_{AC} 125 – 400 V_{DC}	Up to 1 kW	• 3x L6390 • 1x Viper16 • 7x STGP10H60DF	Power board: pumps, compressors, washing machines and more
STEVAL-IHM028V2	90 – 285 V_{AC} 125 – 400 V_{DC}	Up to 2 kW	• 1x STGIPS20C60 • 1x VIPer26LD • 1x STGW35NB60SD	Power board: pumps, compressors, air conditioning and more
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-IHM034V2	230 V_{AC}	Up to 1700 W	• 1x STGIPS20C60 • 1xSTM32F103RC • 1x L6391 • 1x Viper16LD • 1x TSV914ID • 3x STTH1L06A	Motor drive with digital PFC: room air conditioning, compressor 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-ISF003V1	230 V_{AC} (or 120 V_{AC})	Up to 7.4 kW	• 1x TN5050H-12WY • 1x STTH60L10WY • 1x STM8S103K3T3	Inrush current limiter in front-end bridge for motor power board

Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
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-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: Electronics 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 automations Home appliance, servo drives and e-bikes, service and automation robots, powet 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 automations Home appliance, servo drives and e-bikes, service and automation robots, powet 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 drone 3 axis 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-IHM09M1	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 STM32F3	Fans, pumps, factory automation, money handling machines and medical equipment
P-NUCLEO-IHM003	7 - 45 V_{DC}	Up to 1.5 Arms	• 1x STSPIN830 • 1x STM32G4	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-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

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 (3 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. Field oriented-control or scalar (volts/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* • STM32L4
Intelligent power Module (IPM)	• SLLIMM 2nd series • SLLIMM-nano • SLLIMM-nano 2nd series • System-in-Package PWD		3-phase inverter, IGBT and MOSFET based	• STGIxxyyzz • STIxxyyzz • PWD5T60
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 S series • IGBT H series • DM2 MOSFET • SiC MOSFET		IGBT and High Voltage Power MOSFET	• STGxyyM65DF2 • STGxyyM120DF3 • STGxyyS120DF3 • STGxyyH60DF • STxyN60DM2 • SCTWA90N65G2V-4 • SCTWA60N120G2-4 • SCT20N170
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	• TSV9 series • TSC2 series		High speed up to 20 MHz low voltage opamp 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
Protection	bus voltage: Protection of the IPM	• SMA4F series • SMA6F series • SMB6F series • SMB15F 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	• SMA4F series • SMA6F series • SMB6F series • SMB15F 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 conditionning ICs	• ESDAxxSC6 series	400 W IPP (8/20 µs) high ESD protection level up to 30 kV for sensitive équipements	• 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

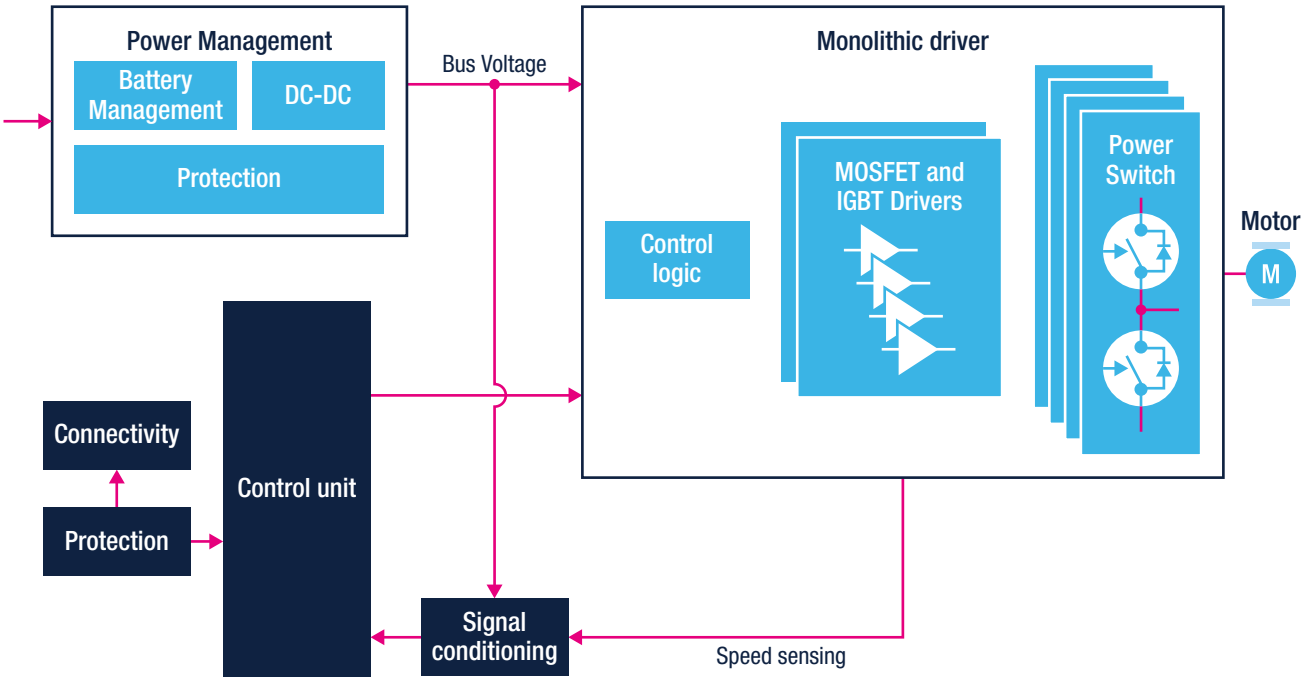
Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
STEVAL-HKI001V2	50 – 650 V_{DC}	Up to 35 A_{RMS}	• 1x A2C35S12M3-F • 7x STGAP1AS • 1x STM32F303RBT7	Motor drive: pumps, Motion/Servo Control, Industrial motor drives and more
STEVAL-STDRIVE601	Up to 600 V	Up to 1000 W	• 1xSTDRIVE601 • 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 2 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-IHM023V3	90 – 285 V_{AC} 125 – 400 V_{DC}	Up to 1 kW	• 3x L6390 • 1x Viper16 • 7x STGP10H60DF	Power board: pumps, compressors, washing machines and more
STEVAL-IHM028V2	90 – 285 V_{AC} 125 – 400 V_{DC}	Up to 2 kW	• 1x STGIPS20C60 • 1x VIPer26LD • 1x STGW35NB60SD	Power board: pumps, compressors, air conditioning and more
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 in holding and positioning applications in the computer, security, industrial automation sectors. 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 • STM32G0 Series • STM32G4 Series
Monolithic driver	• STSPIN2 Series • STSPIN8 Series • PowerSTEP01 • L62 Series • L64 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 • PowerSTEP01 • L62x8 • L64*
Power switch	• F7 Low Voltage		Low Voltage MOSFET	• STxyN4F7 • STxyN6F7
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, TSX712, TSB712 • TSZ122, TSZ182, • TS3022 • TSC2010, 2011, 2012 TSC210, 213 • TSC2011, TSC210
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

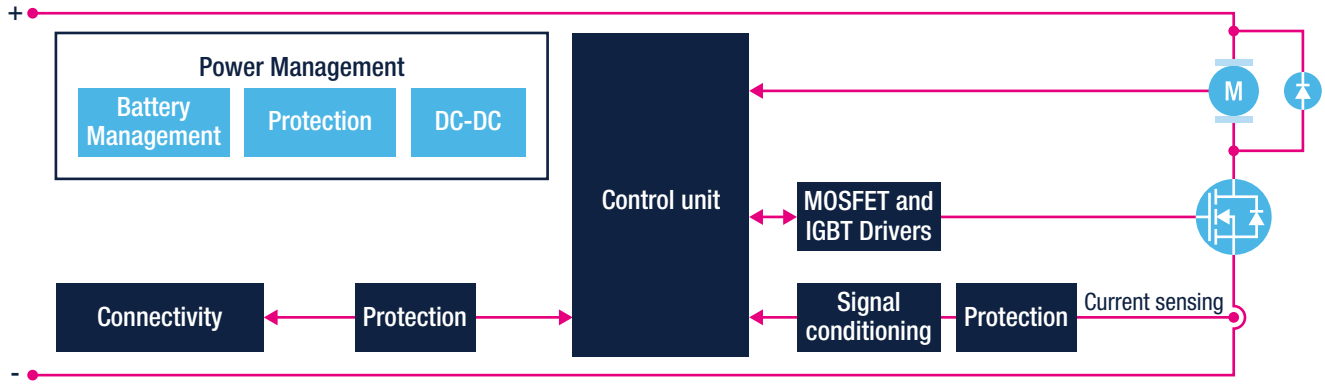
Main Evaluation Boards

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 and haptic feedbacks 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
STEVAL-3DP001V1	8 - 45 V_{DC}	Up to 3 A_{rms}	• 6x L6474H • 1x STM32F401VET6 • 1x ST1S40IPHR • 3x STL8N10F7 • 3x STT6N3LLH6	Fused Filament Fabrication 3D printers
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

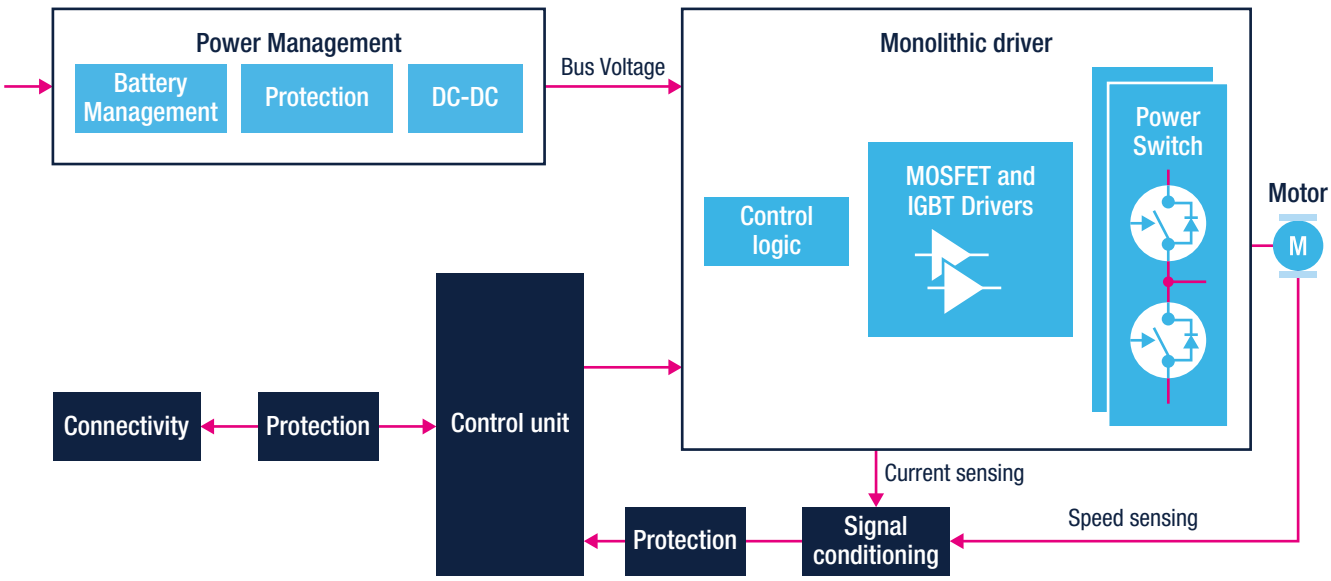
Brushed DC motors

Overview

Brushed DC motor 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.



Single switch topology



Full Bridge topology

Key Products

	Product family		Description with key Features	Key products
Control unit	• STM32 Series • STM8S Series			• STM32F0 Series • STM32F1 Series • STM32G0 Series
Monolithic driver	• STSPIN2 Series • STSPIN8 Series • PWD Series • L62 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 • PWD*F60 • L62*
MOSFET and IGBT Drivers	• L649 series • L639 series • STDRIVE101 • STDRIVE601		STDRIVE Mosfet and IGBT Gate drivers	• L649* • L639* • STDRIVE*
Power Switch	• F6 & F7 Low Voltage		Low voltage MOSFET	• STxyN4F7 • STxyN6F7 • STxyN8F7 • STxyN10F7
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 maybe beyond 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	• TSV732, TSX712, TSB712 • TSZ122, TSZ182 • TS3022 • TSC2010, 2011, 2012 TSC210, 213 • TSC2011, TSC210
Protection	bus voltage: Protection of the monolothic driver (full bridge topology)	• SMA4F series • SMA6F series • SMB6F series • SMB15F 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	• SMA4F series • SMA6F series • SMB6F series • SMB15F 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 conditionning ICs	• ESDAxxSC6 series	400 W IPP (8/20 µs) high ESD protection level up to 30 kV for sensitive équipements	• 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

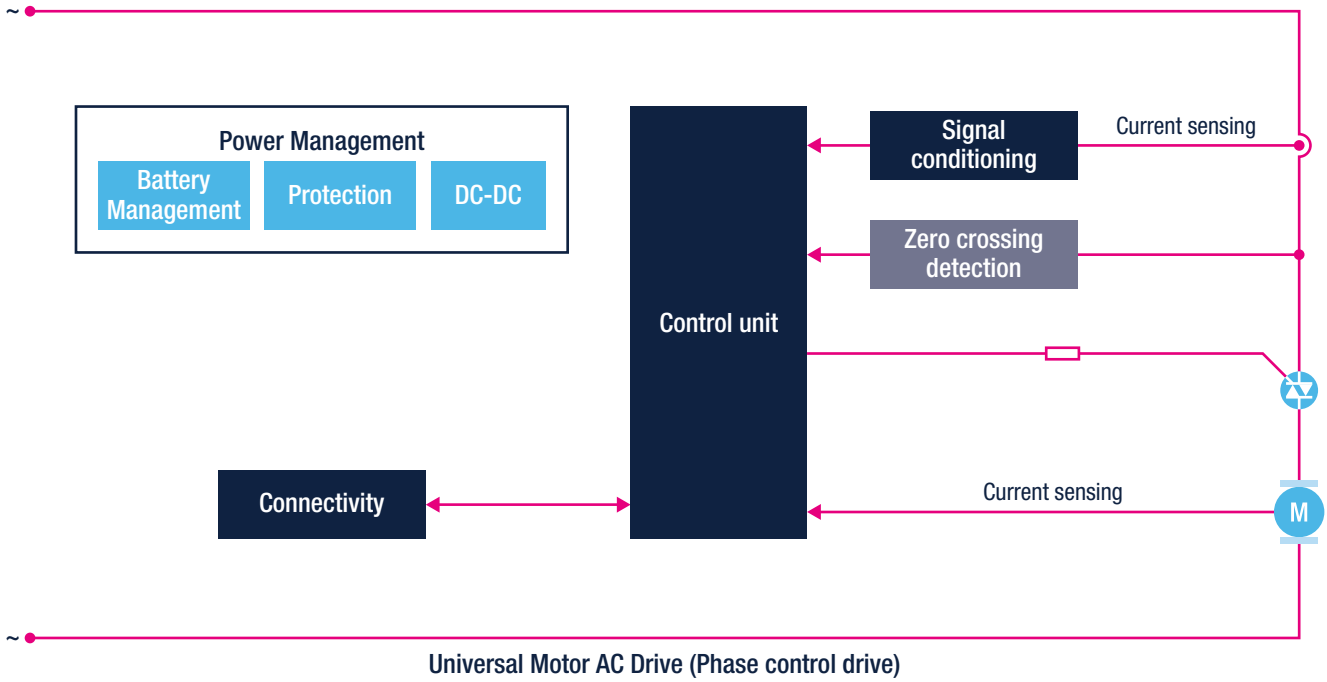
Reference/bundle/ PWD boards	Voltage	Power/Max Current	ST parts	Application focus
X-NUCLEO-IHM15A1	7 - 45 V_{DC}	Up to 1.3 A_{rms}	• 1x STSPIN840	Stage lighting, Industrial automation, service robots, medical and health care, ATM, Vending machines
X-NUCLEO-IHM13A1	1.8 - 10 V_{DC}	Up to 2.6 A_{rms}	• 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
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

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.



Universal Motor AC Drive (Phase control drive)

	Product family		Description with key Features	Key products
Control unit	• STM32 Series • STM8S Series			• STM32F0 Series • STM32F1 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, 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	• TSV732, TSX712, TSB712 • TSZ122, TSZ182 • TS3022 • TSC2010, 2011, 2012 TSC210, 213 • TSC2011, TSC210
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

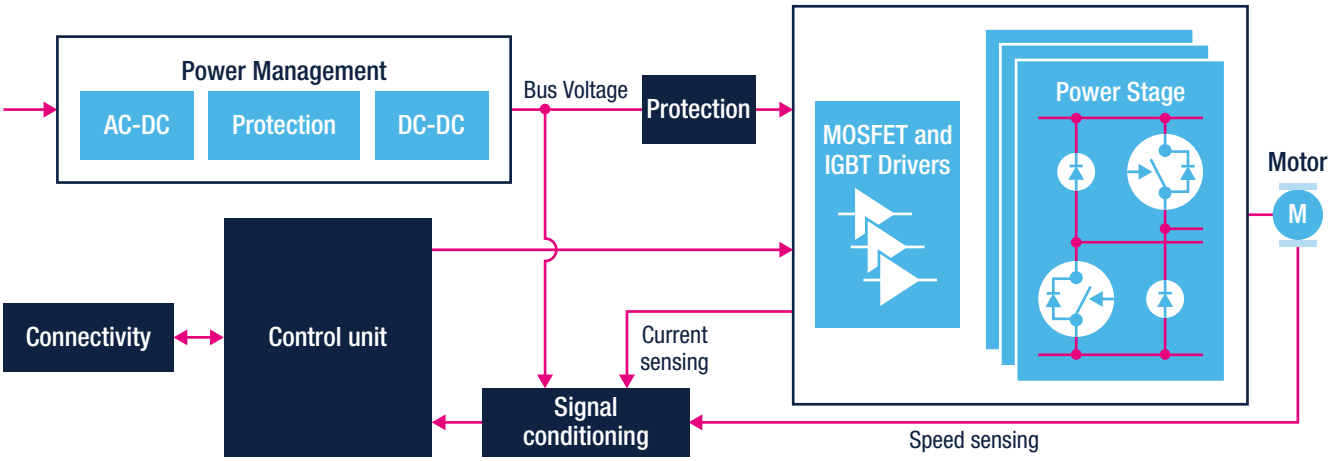
Reference/bundle	Voltage	Power/Max Current	ST parts	Application focus
STEVAL-GLA001V1	90 - 265 V_{AC} (50/60 Hz)	Up to 1 kW	• 1x T1635T-8FP • 1x ACST310-8B • 1x ACS108-8TN • 1x Viper16HD • 1x TSV631ILT	AC Load drives: up to 3 loads like lamp; Defrost resistor; door locks
STEVAL-IHT001V2	100 - 240 V_{AC} (50/60 Hz)	Up to 1.5 Arms	• 1x ACST610-8FP • 1x ACS110-7SN • 1x ACS102-6TA • 1x STM8S003F3P6 • 1x USBUF02W6	Compressor; Lamps; Defrost resistor; Fans
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-IHM029V2	90 - 265 V_{AC} (50/60 Hz)	Up to 900 W	• T1635T-8FP • VIPER16 • STTH1R06 • STM8S103	Vacuum cleaners; food processors and power tools
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

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
Diode & Rectifier	• STPSx45/60/80/100 • STTHxR03/04/06 • STTHxRQ06		Power Schottky Ultrafast diodes	• STPS3045, STPS41H100C • STTH30R03 • STTH8R06 • STTH15RQ06
MOSFET and IGBT Drivers				• STGAP*
Power Switch	• IGBT M series • IGBT S series • IGBT H series		High voltage IGBT	• STGxyyM65DF2 • STGxyyM120DF3 • STGxyyS120DF3 • STGxyyH60DF
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, TSX712, TSB712 • TSZ122, TSZ182 • TS3022 • TSC2010, 2011, 2012 TSC210, 213 • TSC2011, TSC210
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

Microcontrollers

Microcontrollers portfolio

ST's product portfolio contains a comprehensive range of microcontrollers, from robust, low-cost 8-bit MCUs, the STM8 family, up to 32-bit Arm®-based Cortex®-M0/M0+, Cortex®-M3, Cortex®-M33; Cortex®-M4, Cortex®-M7 Flash microcontrollers with a rich choice of peripherals, the STM32 family.

	8-bit MCUs	32-bit MCUs and MPUs		
	STM8 8-bit	Discover STM32 32-bit MCUs	Discover STM32 32-bit MCUs	SPC5
MPU		STM32**MP1**		
High Performance MCUs			**MPU** STM32**H7** STM32**F7** STM32**F4** STM32**F2**	
Mainstream MCUs	STM8**S**		STM32**G4** STM32**F3** STM32**G0** STM32**F0** STM32**F1**	
Ultra-low-power MCUs	STM8**L**		STM32**L0** STM32**L1** STM32**L4** STM32**L4+** STM32**L5**	
Wireless MCUs			STM32**WB** STM32**WL**	
Automotive MCUs	STM8**AF** STM8**AL**			SPC**56** SPC**57** SPC**58**

Key MCU Selection Guide for Motor control

Motor	STM8S	STM32G0 STM32F0 STM32F1	STM32G4 STM32F41x STM32F3 STM32L4	MPU STM32H7 STM32F7 STM32F4
Brushed DC Motors	x	x	x	x
Single Phase AC Induction Motors	x	x	x	
Stepper Motors	x	x		
Switched Reluctance Motors	x	x	x	
3-phase PMSM/FOC - vector control	x	x	x	
3-phase BLDC/6-step	x	x	x	x
Universal Motors	x	x		
PFC		x	x	x
3-phase Induction motor control	x	x	x	

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, among others, 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.

Implemented around a high-performance 8-bit core and a state-of-the-art set of peripherals and IPs, the microcontrollers in the STM8 family are manufactured using an ST-proprietary 130 nm embedded non-volatile memory technology.

One series for every need

Mainstream	Automotive		Ultra-low-power
STM8	STM8	ASIL Ready	STM8
	STM8AF	STM8AL	
Data EEPROM, 3 and 5 V families, precise RC	Data EEPROM, 3 and 5 V families, precise RC, LIN, CAN, grade 0	Data EEPROM, 1.65 and 3.6 V families, precise RC, LIN, grade 1	Data EEPROM, 1.65 and 3 V families, strong analog, LCD drivers, low-leakage technology
Industrial, consumer and mass market	Long-term guarantee	Long-term guarantee	Ideal combination of low-power performance and features
Robust and reliable Up to 125 °C	AEC-Q100 Up to 150 °C	AEC-Q100 Up to 125 °C	High-end analog IPs Active Halt < 1 A
www.st.com/stm8s	www.st.com/stm8af	www.st.com/stm8al	www.st.com/stm8l

Using STM8's 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 complimentary output 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
- Encorder 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
STEVAL-IHT001V2	Cold digital thermostat kit	Single-phase induction motors	UM1542

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 the innovations you have long been dreaming about.

Most of the STM32 products 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 -ADC- 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, F1, 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

STM32F2, 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, L4, (L1, L0)
Ultra-low-power

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

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.

Software tools

www.st.com/stm32softwaretools

STM32 CubeMX — Configure & Generate Code

STM32 CubeIDE — Compile and Debug IDEs

STM32 CubeProgrammer

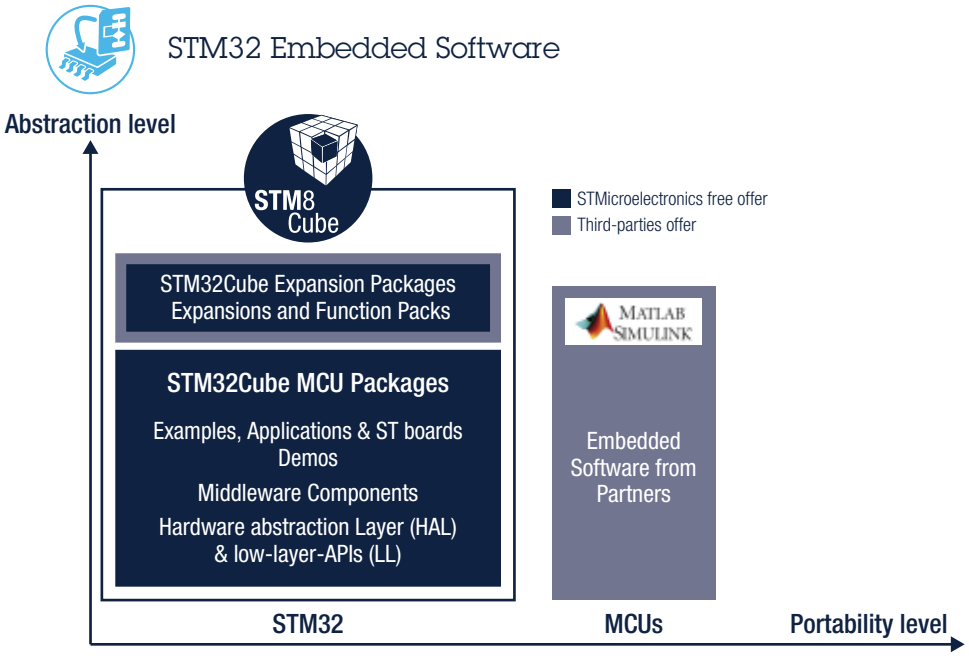
STM32 CubeMonitor

MCU Finder

Monitor, Program & Utilities

Embedded software

www.st.com/stm32embeddedsoftware



ST COMMUNITY

Ask, learn, share, discuss, become famous and engage with the community of STM32 enthusiasts on **community.st.com/stm32**

STM32 EDUCATION

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

ST-MC-SUITE

The STM32/STM8 Motor Control Suite is the entry point for easy access to all resources for motor-control application development with STM32 and STM8 microcontrollers. The tool lets users gather tutorials, documentation and videos, store project setups including appropriate software and a choice of applicable evaluation boards (control and power), motor-control kits, and inverters that can be purchased online.

Thereby, users can select all the resources required and include it in a bundle. At the end of the process, they can download their bundle as a zip file that will centralize everything they requested.

ST-MC-SUITE will thus become the birthplace of many projects by offering knowledge, training, documentation, and a structure that can help engineers focus on what they want to do rather than lose time hunting for software, components, and information.

KEY FEATURES

- Browse St's MCU to find the one which fit the best with your motor control application
- Select motor control materials needed and download all of them as a .zip file
- Save your setups for future reference
- Focus on PMSM (Permanent Magnet Synchronous Motors) controlled in FOC
- (Field Oriented Control) mode and BLDC (Brushless DC) motors controlled in 6-Step
- Extra motor types and control techniques will be added soon

STM32

STM8

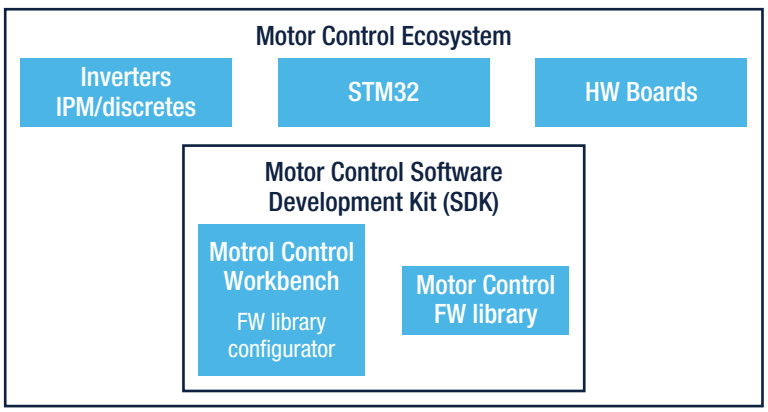
STM32 Motor Control Ecosystem

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 Open Development Environment



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

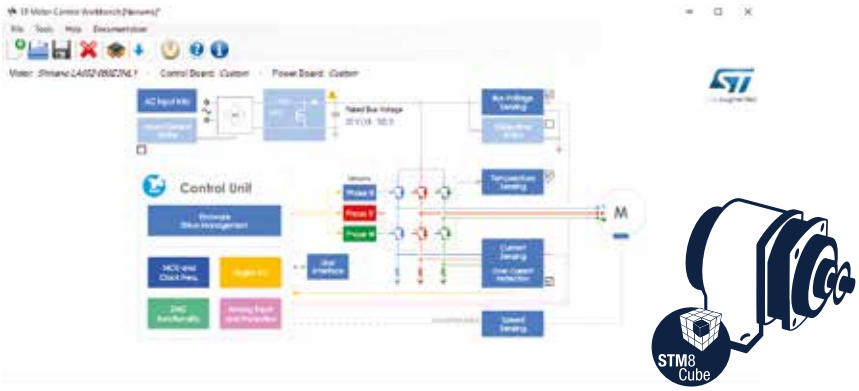
KEY FIRMWARE FEATURES

- 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
- AzureRTOS support
- Six- step examples available for STM32G4, STM32F4 and STSPINF0
- PFC FW example on STM32F1 and F3

MC WORKBENCH

Motor Control Workbench (available in the X-CUBE-MCSDK) is linked with STM32CubeMX. Developers can open STM32CubeMX thru 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 CubeMonitor MC Monitor



Full Integration/configuration in MC Workbench tools

STM32 series		F0	F1	F3	F4	F7	L4	G0	G4	STSpin32F0
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	•	•	•	•	•	•	•	•	•
	PFC - FW support		•	•						

FW Examples/No configuration possible in MC Workbench tools

STM32 series		F0	F1	F3	F4	F7	L4	G0	G4	H7 CM4	STSpin32F0
6 Step	FW Examples (No configuration possible in MC Workbench tools)				•				•		•
Dual Core	FW Examples									•	
PFC	FW Examples			•							

STM32 MOTOR PROFILER

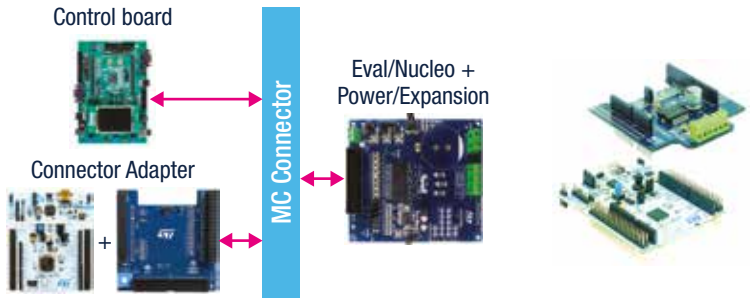
- Automatic detection of key parameters of a PMSM
- Zero equipment required
- Spin motor within less than 1 min
- Best accuracy when Rs ≥ 1 Ω and Ls ≥ 1 mH

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.

Control + Power

Eval/Nucleo + Power/Expansion



Inverter (Complete Drive)

MC Kits

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
  - Based on STM32 F3: P-NUCLEO-IHM001 and P-NUCLEO-IHM002
- Complete evaluation kit -FOC, 6-step FW example based- for evaluation, fast prototyping, makers and education

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	STM32F103ZET6	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
H7	H745ZI	NUCLEO-H745ZI	H7 Nucleo board

STM32 MC SDK Power Boards

Board	Description
STEVAL-IHM023V3	1 kW 3-phase motor control evaluation board featuring L6390 drivers and STGP10H60DF IGBT
STEVAL-IHM028V2	2 kW 3-phase motor control evaluation board featuring the STGIPS20C60 IGBT intelligent power module
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
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	450 W motor control power board based on STGIPQ5C60T-HZ SLLIMM™-nano IPM
STEVAL-CTM009V1	600 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

STM32 MC SDK inverters

Family	MCU	Board	Description
F0	F031	STEVAL_SPIN3201	STSPIN32F0 3-shunt
F0	F031	STEVAL_SPIN3202	STSPIN32F0A 1-shunt
F1	F103RC	STEVAL_IHM034V2	MC and digital PFC
F3	F303RE	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
F0	F0251	EVSPIN32F0251S1	STSPIN32F0251 1-shunt
F0	F0601	EVSPIN32F0601S1	STSPIN32F0601 1-shunt
F0	F0601	EVSPIN32F0601S3	STSPIN32F0601 3-shunt
F0	F0602	EVSPIN32F0602S1	STSPIN32F0602 3-shunt
F3	F303	STEVAL-HKI001V2	STGAP1AS

AND MORE TO STAY TUNED

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 Wiki available at: https://wiki.st.com/stm32mcu/wiki/Motor_control_overview

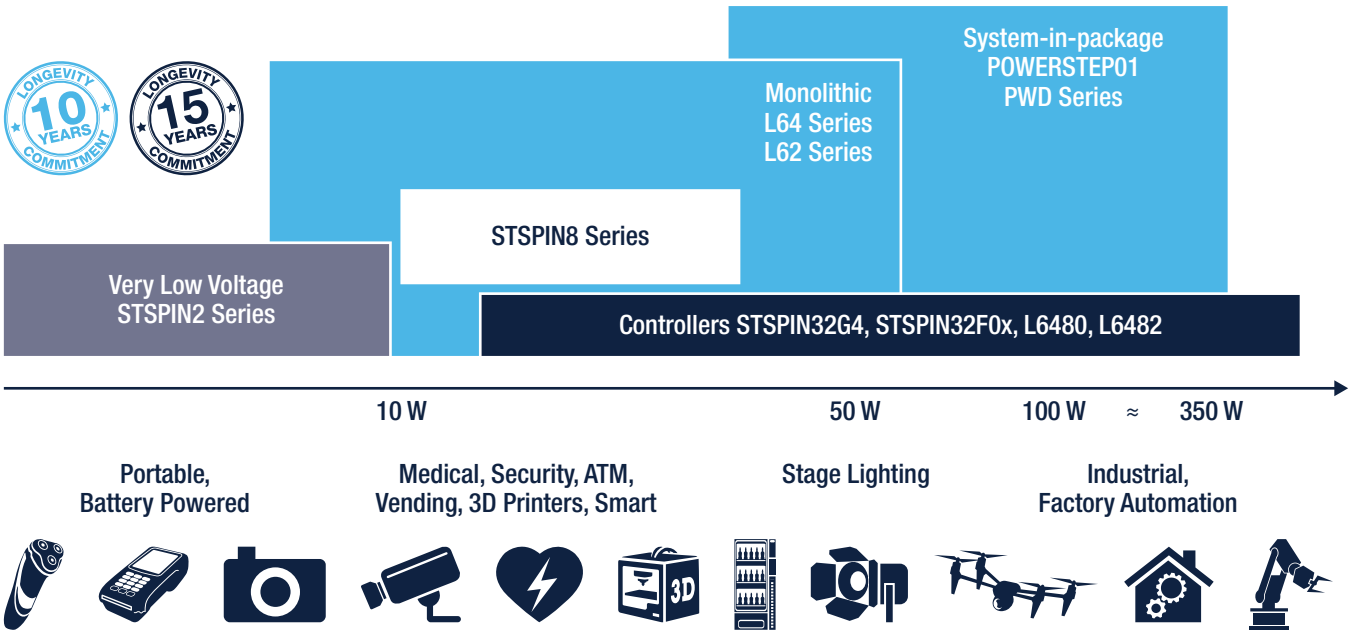
STM32 Motor Control Forum available at: **https://community.st.com/s/topic/0TO0X000000BoYJWA0/stm32-motor-control**

Motor Driver ICs

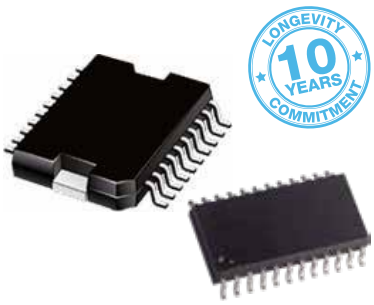
STSPIN motor drivers embed all the functions needed to drive motors efficiently and with the highest accuracy, and include an advanced motion profile generator to relieve the host microcontroller, while ensuring robustness and reliability thanks to a comprehensive set of protection and diagnostic features.
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	Desription	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 1 or 2or 3 shunts topologies.

STSPIN220
Stepper

STSPIN230/233
3phase BLDC

STSPIN240/250
Dual DC

Part number	Desription	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 bullet proof solution for the new wave of 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	Desription	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

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. ST offers a set of the customers can choose among a set of pre-defined FW 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.

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

MAIN APPLICATIONS

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

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 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	

STSPIN32G 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.

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

MAIN APPLICATIONS

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

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 bullet proof, as required by the most demanding motor control applications.

Part number	Desription	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 128usteps). **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	Desription	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

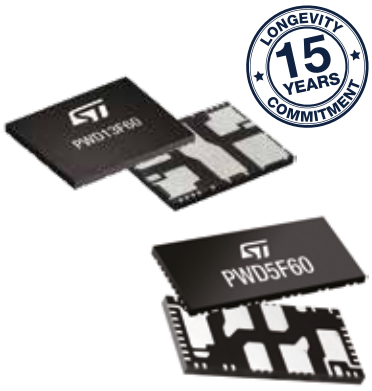
- ATM and money handling machines
- Medical equipment
- Video conferencing
- Antenna control
- Pick and place machines
- Home and factory appliances

PWD SERIES - INTELLIGENT POWER MODULE IN QFN

PWD Series are advanced power systems-in-package integrating smart gate drivers and four N-channel power MOSFETs in dual half-bridge configuration. These full-bridge power drivers represent a uniquely efficient alternative for brushed DC or single-phase BLDC motors.

The actual offer is related to two 600V rated devices, capable of delivering 3.5 A and 8 A of continuous current per MOSFET, respectively. Embedded gate drivers integrate bootstrap diodes allowing BOM space and cost saving. Both devices are offered in highly thermally efficient tiny QFN packages.

PWD5F60 embeds also the peak-current control comparators that, in conjunction with positioning Hall-effect sensors, allow to achieve a stand-alone motor driver for single-phase BLDC motors (no need of a dedicated MCU), and thus significantly reducing the cost of such a driving system.



Part number	Desription	Vin min (V)	Vin max (V)	Rdson (Ohm)	I out max (Arms)
PWD13F60	High-density power driver - high voltage full bridge with integrated gate driver	6.5	17	0.32	8
PWD5F60		10	20	1.38	3.5

MAIN APPLICATIONS

- Industrial/Home appliances
- Factory automation
- Fans and pumps
- HID, ballasts
- Power supply units
- DC-DC and DC-AC converters
- Cooking hoods and gas heaters
- Blowers
- Power supply units

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)
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	
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	PDIP 20; 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)
PWD5F60	VFQFPN 15x7x1 mm.	High voltage full bridge with integrated comparators	1.4	10	600	5	14	-40	125
PWD13F60	VFQFPN 10x13x1.0	High voltage full bridge with integrated smart driver	0.3	6.5	600	8	32		
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	PDIP20; 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	PDIP20; 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		
L6202	PDIP 18						10		
L6203	MW 11L								
L2293Q	VFQFPN 32 5x5x1.0	Push-pull four channels motor driver with diodes	-	4.5	36	0.6	1.2		
L293D	PDIP 16; SO-20								
L293B	PDIP 16					1	2		
L293E	PDIP 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)
STSPIN32G4	VFQFPN 64 9x9x1	Advanced BLDC controller with embedded STM32	-	5.5	75	-	1	-40	125
STSPIN32F0	VFQFPN 48 7x7x1	Advanced BLDC controller with embedded STM32, DC-DC; optimized for FOC	-	8	45	-	0.6		
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	PDIP 20; 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:

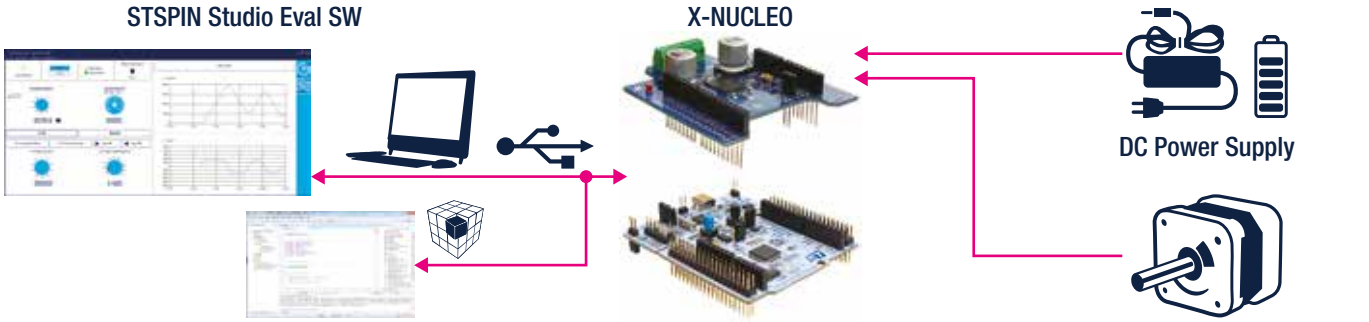
STM32 Nucleo development boards: a comprehensive range of affordable development boards for all STM32 microcontroller series.

STM32 Nucleo expansion boards: based on STSPIN motor drivers, the expansion boards can be plugged on top of 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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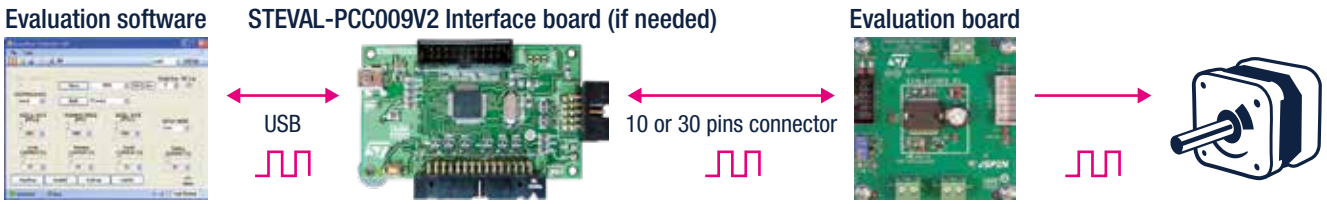
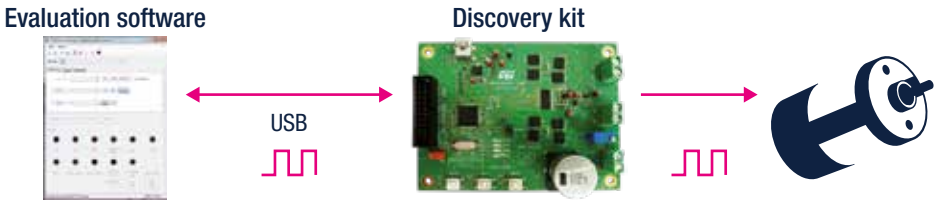
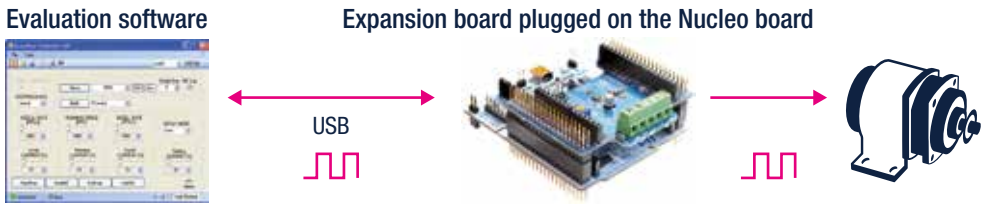
EVALUATION BOARD SETUP



DISCOVERY KIT SETUP



NUCLEO BOARD SETUP



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	-	X-CUBE-SPN14	STM32 Nucleo board F4, F0 or L0 series
X-NUCLEO-IHM06A1	Expansion board for STM32 nucleo board	STSPIN220	STSW-SPIN002	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
STEVAL-3DP001V1	Reference design	L6474	STSW-3DP001	-	-
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
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
EVAL6228QR	Evaluation board	L6228Q	-	-	-
EVALSP820-XS	Evaluation board	STSPIN820	-	-	-
STSPIN220 Click Board	3rd party expansion board	STSPIN220	-	-	-
STSPIN820 Click Board	3rd party expansion board	STSPIN820	-	-	-

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-SPIN002	X-CUBE-SPN12	STM32 Nucleo board F4, F0 or L0 series
X-NUCLEO-IHM13A1	Expansion board for STM32 nucleo board	STSPIN250	STSW-SPIN002	X-CUBE-SPN13	STM32 Nucleo board F4, F0 or L0 series
X-NUCLEO-IHM15A1	Expansion board for STM32 nucleo board	STSPIN840	-	X-CUBE-SPN14	STM32 Nucleo board F4, F0 or L0 series
EVSPIN32G4	Evaluation Board	STSPIN32G4	-	-	-
EVSPIN32G4NH	Evaluation Board	STSPIN32G4	-	-	-
EVALPWD5F60	Evaluation Board	PWD5F60	-	-	-
EVALPWD13F60	Evaluation board	PWD13F60	-	-	-
EVAL6227QR	Evaluation board	L6227Q	-	-	-
EVAL6227PD	Evaluation board	L6227	-	-	-
EVAL6225PD	Evaluation board	L6225	-	-	-
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
EVAL6206Q	Evaluation board	L6206Q	STSW-SPIN003	-	STEVAL-PCC009V2 interface board
EVAL6205N	Evaluation board	L6205	-	-	-
EVAL2293Q	Evaluation Board	L2293Q	-	-	-
STSPIN250 Click Board	3rd party expansion board	STSPIN250	-	-	-

Ecosystem for brushless DC motor drivers and controllers

Part number	Tool type	Core product	Evaluation software	Firmware	Companion board
STEVAL-SPIN3201	Evaluation board	STSPIN32F0	-	STSW-SPIN3201	-
X-NUCLEO-IHM11M1	Expansion board for STM32 nucleo board	STSPIN230	-	X-CUBE-SPN11	STM32 Nucleo board F4, F0 or L0 series
STEVAL-SPIN3202	Evaluation Board	STSPIN32F0A	STSW-SPIN3202	-	NUCLEO-F030R8, NUCLEO-F103RB, NUCLEO-F302R8
X-NUCLEO-IHM16M1	Expansion board for STM32 nucleo board	STSPIN830	-	X-CUBE-SPIN16	-
X-NUCLEO-IHM17M1	Expansion board for STM32 nucleo board	STSPIN233	-	X-CUBE-SPIN17	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	-	-	-
P-NUCLEO-IHM001	Nucleo Pack with NUCLEO-F302R8 and X-NUCLEO-IHM07M1	L6230	-	X-CUBE-SPN7, STSW-STM32100	-
X-NUCLEO-IHM07M1	Expansion board for STM32 nucleo board	L6230	-	X-CUBE-SPN7, STSW-STM32100	STM32 Nucleo board F4, F0 or L0 series
STEVAL-IHM042V1	Evaluation board	L6230	-	STSW-STM32100	-
STEVAL-IHM043V1	Evaluation board	L6234	-	STSW-STM32100	-
EVAL6230QR	Evaluation board	L6230	-	-	-
EVAL6235Q	Evaluation board	L6235Q	STSW-SPIN003	-	STEVAL-PCC009V2
EVAL6229PD	Evaluation board	L6229	-	-	-

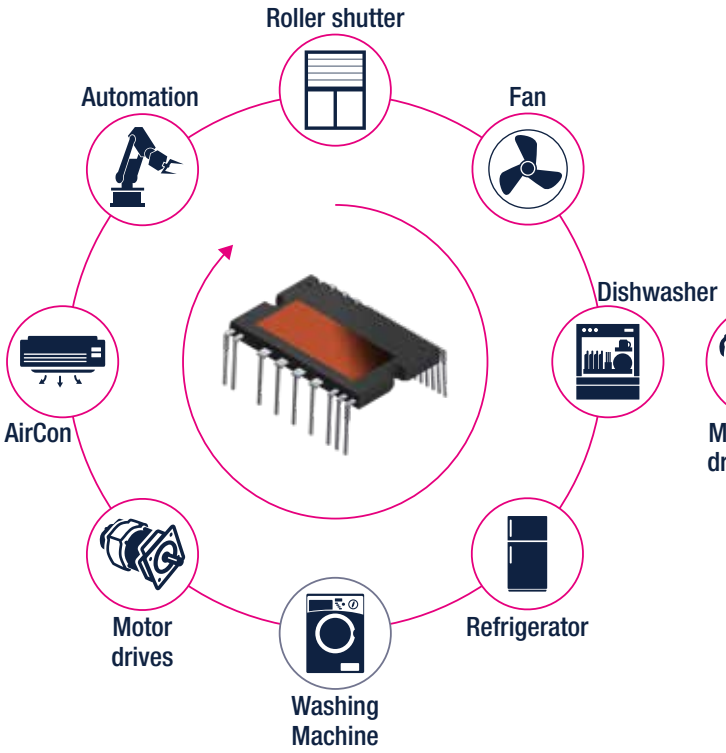
Ecosystem for reference design

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

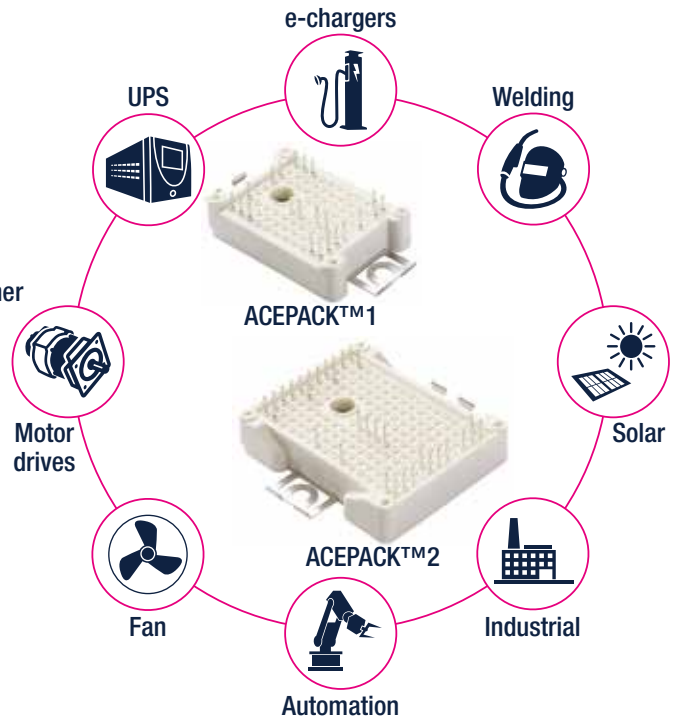
Power Modules

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, break down 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.

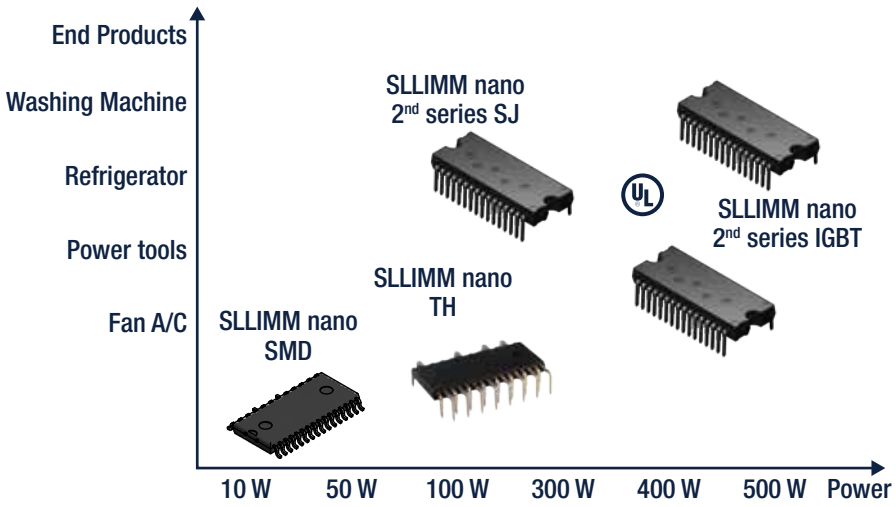
Available in different options, both packages (fully molded and DBC) and leads (through-hole and SMD), SLLIMM series can combine six power switches (IGBT, MOSFET and SJ-MOSFET) and drivers in an inverter configuration assuring the best compromise between conduction and switching energy with an outstanding robustness and EMI behavior, making the new product ideal to enhance the efficiency of 3 phases inverter and any motor drives working up to 20 kHz in hard-switching circuitries and for an application power range from 10 W to 5 KW.

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)

Product PN	Lead type	Switch type	BV	I_{CN}	$V_{cesat\ typ}$/Max $R_{DS(on)}$	t_{dead} min
STGIPQ4C60T-HZ/HL	TH	IGBT	600 V	6 A	1.79 V	1.5 µs
STGIPN3H60(A)(T)-(H)				3 A	2.15 V	1.5 µs
STGIPN3HD60-H				3 A	2.15 V	1 µs
STIPN2M50T-H/L		MOSFET	500 V	2 A	1.7 Ω	1 µs
STIPN1M50T-H				1 A	3.6 Ω	1 µs
STGIPNS3H60T-H	SMD	IGBT	600 V	3 A	2.15 V	1.5 µs
STGIPNS3HD60-H				3 A	2.15 V	1 µs
STIPNS2M50(T)-H		MOSFET	500 V	2 A	1.7 Ω	1 µs
STIPNS1M50T-H				1 A	3.6 Ω	1 µs
STIPNS1M50SDT-H						
STGIPQ3H60T-HZ/L(S)	TH	IGBT	600 V	3 A	2.15 V	1.5 µs
STGIPQ3HD60-HZ/L				3 A	2.15 V	1.0 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/L		SJ-MOSFET		3 A	1.6 Ω	1.0 µs
STIPQ5M60T-HZ/L				5 A	1.0 Ω	1.0 µs

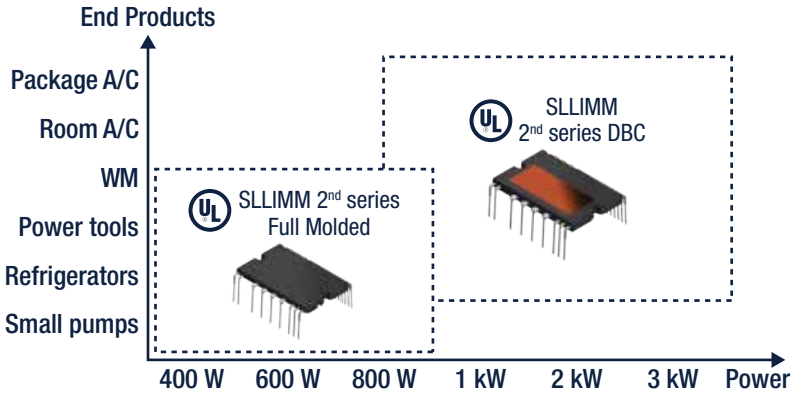
SLLIMM™ 2ND SERIES

The SLLIMM 2nd series is the last ST's family of compact, high efficiency, dual-in-line intelligent power modules, with optional extra features.

This family has been designed using a new internal configuration with two drivers, one high-side driver and one low-side driver, and with the improved trench gate field-stop IGBT or SJ-MOSFETs.

The best compromise between conduction and switching energy with an outstanding robustness and EMI behavior make the new product ideal to enhance the efficiency of compressor, pumps, fans and any motor drives working up to 20 kHz in hard-switching circuitries and for an application power range from 300 W to 3 KW.

This series will complement and overcome the already available SLLIMM series in term of power and features, package types and flexibility and it takes over the main functions of previous one, adding some more features and enlarging the package option to SDIP2F and SDIP2B.



KEY FEATURES

- 600 V, from 8 A to 35 A DC rating at 25 °C
- Low V_{CEsat}/R_{DSon}
- Optimize driver and silicon for low EMI
- Lowest Rth value on the market for the DBC package versions
- 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 1600 Vrms/min

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-LZ(E)		12 A (8 A)	1.7 V (1.5 V)	3.0 °C/W	5 µs
STGIB10CH60TS-LZ(E)(X)		15 A (10 A)		2.26 °C/W	
STGIB15CH60TS-LZ(E)(X)		20 A (15 A)		1.85 °C/W	
STGIB20M60TS-LZ(E)		25 A (20 A)		1.40 °C/W	8 µs
STGIB30M60TS-LZ(E)		35 A (30 A)		1.20 °C/W	
STIB1060DM2T-L	SJ-MOSFET	10	180 mΩ	1.59 °C/W	12 µs
STIB1560DM2T-L		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™ HIGH POWER

The SLLIMM High Power (HP) series is the new family of compact, powerful, dual-in-line intelligent power modules (IPMs) belonging to the STPOWER family. 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 first SLLIMM HP product consists of a 650 V/50 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 5 kW.

Product PN	Switch type	BV	I_{CN}	$V_{CEsat\ typ}$	Max $R_{th(j-c)}$	Package
STGIK50CH65T	IGBT	650 V	50 A	1.8 V	1 °C/W	SDIPHP-30L

KEY FEATURES

- TFS IGBT tech: 650 V, 50 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

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

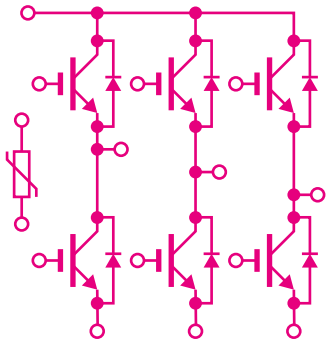
- 15 to 75 A current rating at 25 °C
- 650 to 1200 V Breakdown voltage
- Integrated 5 kΩ NTC temperature monitoring
- Soft and fast recovery diode
- PressFIT and solder contact pin options
- Reliable and easy mounting system
- Low stray inductance module design

KEY BENEFITS

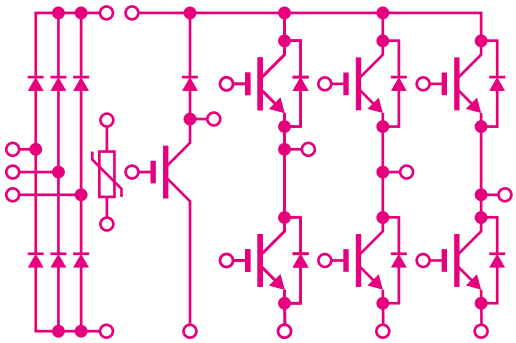
- High power density
- High reliability and quality
- 175 °C maximum junction temperature for increased robustness

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 * Samples available in Q4 2020

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

ST PowerStudio - THE DYNAMIC ELECTRO-THERMAL SIMULATION SOFTWARE FOR POWER DEVICES

ST PowerStudio is a powerful and flexible simulation software for SLLIMM™ intelligent power modules and ACEPACK™ power modules.

The tool features a one-click power and thermal analysis, avoiding long, complex and expensive application testing.

It provides a very accurate estimation of power loss, junction and case temperatures, and even explores non-testable parameters and helps in sizing a suitable heatsink.

Finally, the software helps developers select the proper device fitting the application mission profile, saving design time and resources.

ST PowerStudio (STSW-POWERSTUDIO) is based on a very precise built-in electrical and thermal model for each device and thanks to an iterative calculation taking into account the self-heating effects, it provides a very accurate estimation of the power loss as well as junction and case temperatures.

The software simulates mission profiles with a static load (single set of input conditions) or a dynamic load, changing the input conditions over time

and performing very long simulation profiles.

Several thermal set-up input conditions can be simulated, such as:

- devices without heatsink, estimating the case and the junction temperatures;
- fixed case temperature (with heatsink), estimating the junction temperature and the heatsink;
- fixed heatsink thermal resistance, estimating the case and junction temperatures;
- fixed heatsink thermal impedance, estimating the case and junction temperatures and considering the thermal inertia of the system.

Simulation results are shown on tables and on dedicated scope views, in function of time, load current and switching frequency.

An output report is provided with the summary of all the information and results for an easy comparison or archiving.

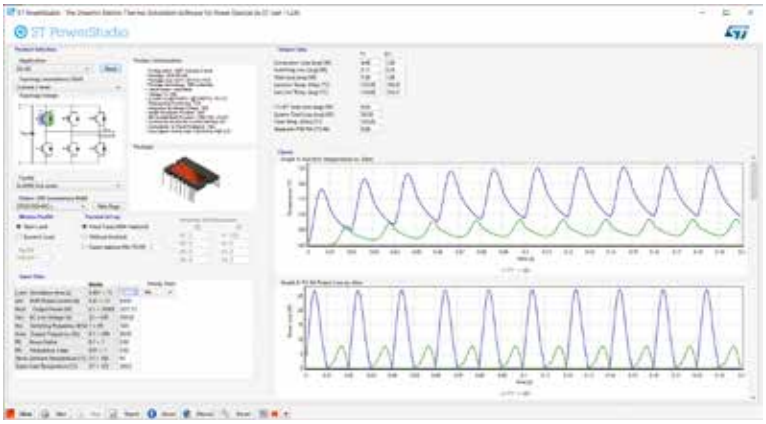
KEY FEATURES

- Power and thermal analysis
- User-friendly interface
- Static and dynamic mission profile
- Multi thermal set-up
- Simulation with or without heatsink
- Internal self-heating model
- Output data, tables and charts, for each power device
- Quick link to the device documentation
- Output PDF report
- Online forum
- Portable software
- Multi-language (English, Chinese and Japanese)

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
- Internet connection not required for simulation

USER INTERFACE



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 MOSFETs

ST's new STripFET F7 MOSFETs deliver among the best on resistance currently available at 40 V, 60 V, 80 V and 100 V devices to minimize conduction losses, coupled with minimal capacitances and gate charge. STripFET F7 shows furthermore Optimized intrinsic capacitances ratio (Crss/Ciss) to minimize EMI effects, high current capability and extremely low thermal resistance to improve power dissipation

The resulting devices help to simplify final designs and reduce equipment size and cost by allowing system power and efficiency targets to be met using fewer devices in small package sizes.

The F7 product offer is complemented with the cost effective H/F6 series, available in both, N and P-Channel polarity.

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
80	STX270N8F7	Active	TO-220/H²PAK-2/H²PAK-6	0.021	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
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

LV MOTOR DRIVER ICs

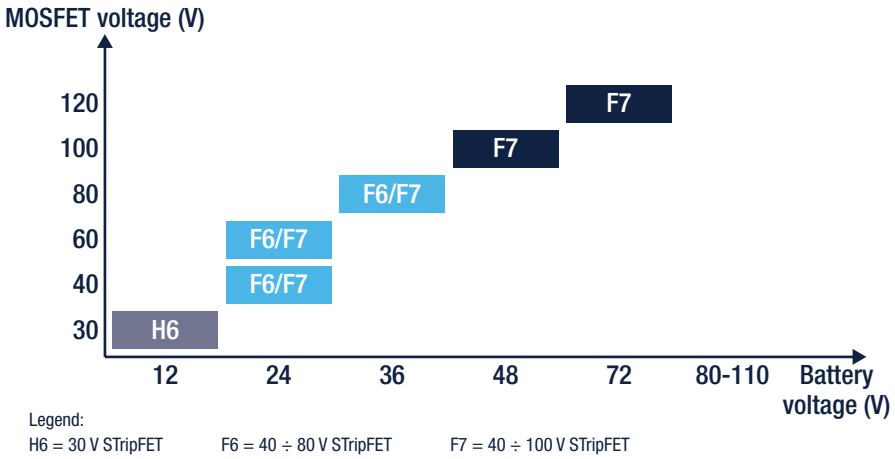
The ST product portfolio offers a wide range of motor control ICs, well-suited for the most demanding industrial environments, covering the requirements of brushed DC motors, stepper motors and brushless DC motors, over an extensive range of voltage and current ratings. Efficiency and accuracy of the motor drivers are guaranteed by a unique combination of low-loss Power Mos output stages and advanced VIPower control circuitry. Robustness and reliability are provided by the integration of a comprehensive set of protection and diagnostic features. New products for industrial motor drive application will be available by Q4/2021. 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	

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	H^2PAK	0.0013	240*
	STP260N4F7	Active	TO-220	0.0022	67*
	STL160N4F7	Active	PowerFLAT 5x6	0.0025	29*

Note * value @ 10 V

STripFET POSITIONING VS VOLTAGE BATTERY IN MC



Legend:
H6 = 30 V STripFET F6 = 40 ÷ 80 V STripFET F7 = 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	SCTW90N65G2V	Automotive, Industrial	HiP247	Available	Production
	0.018	119	157	17	SCTWA90N65G2V	Automotive, Industrial	HiP247-LL	Available	Production
	0.018	119	157	17	SCTWA90N65G2V-4	Automotive, Industrial	HiP247-4LL	Available	Production
	0.55	119	157	17	SCTH90N65G2V-7	Automotive, Industrial	H2PAK-7L	Available	Production
	0.55	45	73	18	SCTW35N65G2V	Automotive, Industrial	HiP247	Available	Production
	0.55	45	73	18	SCTWA35N65G2V	Automotive, Industrial	HiP247-LL	Available	Production
	0.55	45	73	18	SCTWA35N65G2V-4	Automotive, Industrial	HiP247-4LL	Available	Production
	0.55	45	73	18	SCTH35N65G2V-7	Automotive, Industrial	H2PAK-7L	Available	Production
1200	0.035	60	94	17	SCTW60N120G2	Automotive, Industrial	HiP247	Available	Production
	0.035	60	94	17	SCTWA60N120G2-4	Automotive, Industrial	HiP247-LL	Available	Production
	0.035	60	94	17	SCTH60N120G2-7	Automotive, Industrial	HiP247-4LL	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	1200 V		1700 V
Series	G2	G1	G1	G1
On-state resistance	18 mΩ to 55 mΩ	52 mΩ to 520 mΩ	25 mΩ to 75 mΩ	1 Ω and 65 mΩ
Focus Applications	OBC & DC-DC Renewable energy Power Supply Industrial drives	Photovoltaic Power supply	OBC & DC-DC Inverter Charging stations Industrial drives	DC-DC Power Supply Renewable energy

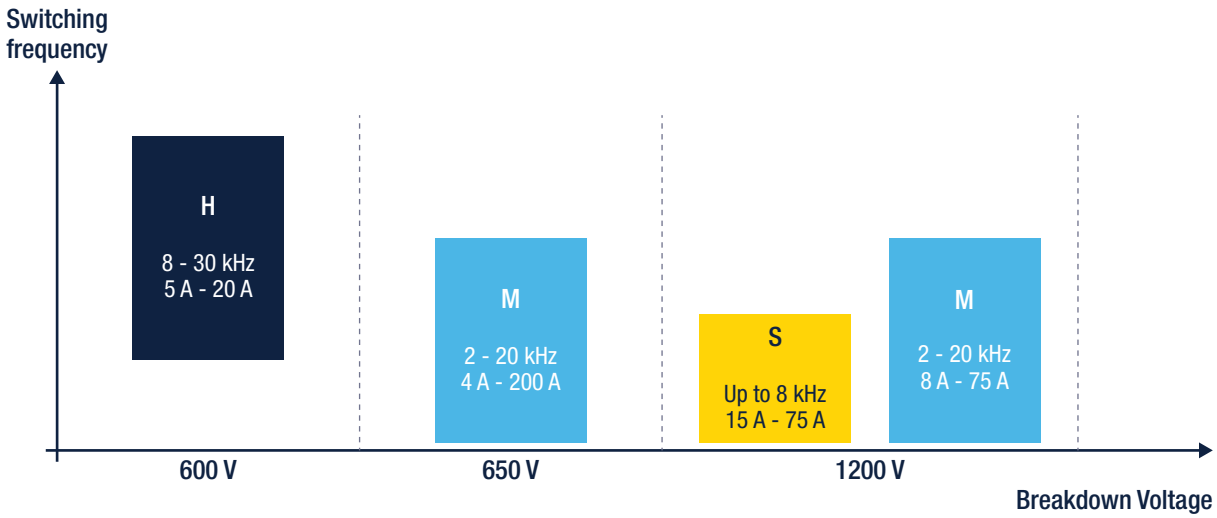
IGBT

The ST offers a very wide portfolio of IGBTs, tailored to motor control application, 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”, “M” and “S” series.
These series combine a very low saturation voltage with a maximum operating junction temperature of 175 °C and the short circuit capability.



600-650 V IGBT series

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.

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

IGBT P/N	BV_{CES} (V)	I_{CN} [1] (A)	$V_{CE(sat)}$ [2] (V)	t_{sc} [3] (µs)	Switching frequency range	Packages							
						DPAK	D²PAK	TO-220	TO-220FP	TO-247	TO-247 long leads	Max247 long leads	ACEPACK SMIT
STGx4M65DF2	650	4	1.6	6	Up to 20 kHz	D	B	P	F				
STGx6M65DF2		6	1.55			D	B	P	F				
STGx10M65DF2		10	1.55				B	P	F	W			
STGx15M65DF2		15	1.55				B	P	F				
STGx20M65DF2		20	1.55				B	P	F		WA		
STGx30M65DF2		30	1.55				B	P	F	W	WA		
STGx50M65DF2		50	1.65								WA		
STGx75M65DF2		75	1.65							W	WA		
STGx120M65DF2		120	1.65									YA	
STGSB200M65DF2AG		200	1.65										SB

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 IGBT series

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.

						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
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

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 whitstand time @ $T_{J\text{-start}}$ ≤150 °C, V_{CC} = 600 V, V_{GE} = 15 V

1200 V S SERIES

The 1200 V “S” series, with current capability from 15 A up to 40 A (available in die form up to 75 A) and short-cicuit withstand time of 10 µs, is tailored to get the best trade-off between conduction and switching-off energy losses to improve significantly the overall performance of three phase industrial drive systems at low switching frequency (<8 kHz).

						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
STGx15S120DF3	1200	15	1.55	10	Up to 8 kHz	W	WA	
STGx25S120DF3		25	1.60			W	WA	
STGx40S120DF3		40	1.65			W	WA	

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 whitstand 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 proposed in the below metric.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 current are more important. In that environment, a reduction of the noise generated by the commutation of the diode enable to 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	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 (SCRs and Triacs) and AC Switches

ST offers a complete range of Thyristors and AC switches with voltage ratings up to 1200 V, current ratings up to 100 A and a set of packages from miniature surface-mounted packages to high power dissipation isolated and non-isolated packages.

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 performances, fully rated at 150 °C, suitable for high power loads and devices (600 V and new 800 V) in hot environments. ACST™ and ACS AC Switches are overvoltage self-protected devices, improving the application safety and reliability.

High temperature 150 °C SCRs are perfectly fitting requirements to build a solid-state relay for motor 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 40 A in general-purpose standard configurations, a new 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	T405T-6FP	T0220FPAB	4	30	600	125	5
	T435T-600FP		4	30	600	125	35
	T635T-8	T0220FPAB TO-220AB D^2PAK	6	45	800	150	
	T835T-8		8	60	800	150	
	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	T410H	TO-220	4	40	600	150	10
	T610H	TO-220	6	60			10
	T835H-6	TO-220, D^2PAK, TO-220I	8	80			35
	T1035H-6		10	100			
	T1235H-6		12	120			
	T1635H-6		16	160			
	T2035H-6		20	200			
	T3035H-6	TO-220, TO-220I	30	270			
	T835H-8	T0220, TO-220I, D^2PAK	8	80	800		
	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.

While maintaining very high switch-off capability, logic-level devices allow direct drive by a microcontroller. With integrated overvoltage protection against random transients, no external MOV protection is needed, providing system safety and transient and surge voltage immunity as defined in the IEC 61000-4-4 and -4-5 standards. The ACST series now extends from 2 A to 16 A, housed in TO-220AB and TO-220FP packages, and the ACS series is also extended to 800 V with a lower gate triggering sensitivity of 5 mA.

KEY FEATURES

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

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
ACS108	0.8	13.7	800	125	10	SOT223, TO92
ACS120	2	20	700	125	10	DPAK, TO-220AB, TO-220FPAB
ACST2	2	8	800	125	10	DPAK, TO-220FPAB
ACST3	3	20			10	TO-220FPAB, DPAK
ACST4	4	30			10, 35	DPAK, TO-220FPAB
ACST8	8	80			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 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

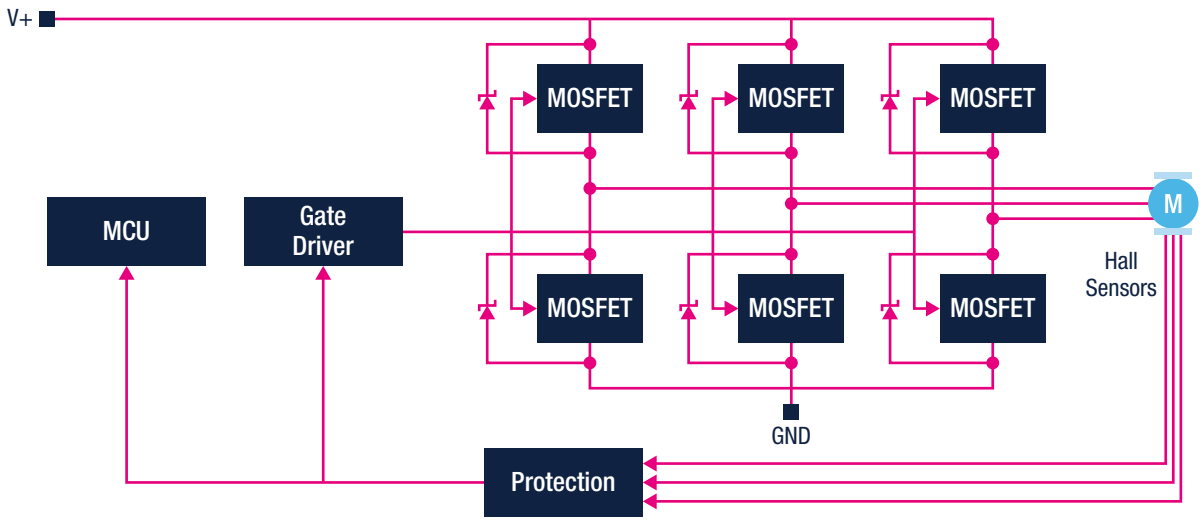
Part number	I_{TRMS} (A)	I_{GT} (mA)	dV/dt @ 150 °C (V/µs)	tq (µs)	I_{TSM} (A)	TO-220AB	TO-220FPAB	D^2PAK	TO-220AB ins	TO-247	D^3PAK
Industrial High Temperature 600 V SCR											
TN1205H-6	12	2 to 5	100	65 typ	120	•		•			
TN1605H-6	16	6	200	70 typ	140	•	•	•	•		
TN1610H-6	16	10	1000	70 typ	140	•	•		•		
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-8	40	15	500	35 typ	360	•		•	•		
TN5015H-8	50	15	500	50 typ	450	•		•	•		
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					•	
TM8050H-8	80	50	1000	150 max	600					•	•

• Available

Protection & Filters devices

Transient Voltage Suppressor (TVS) devices allow a protection for many different types of surge events. For example, over current 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.

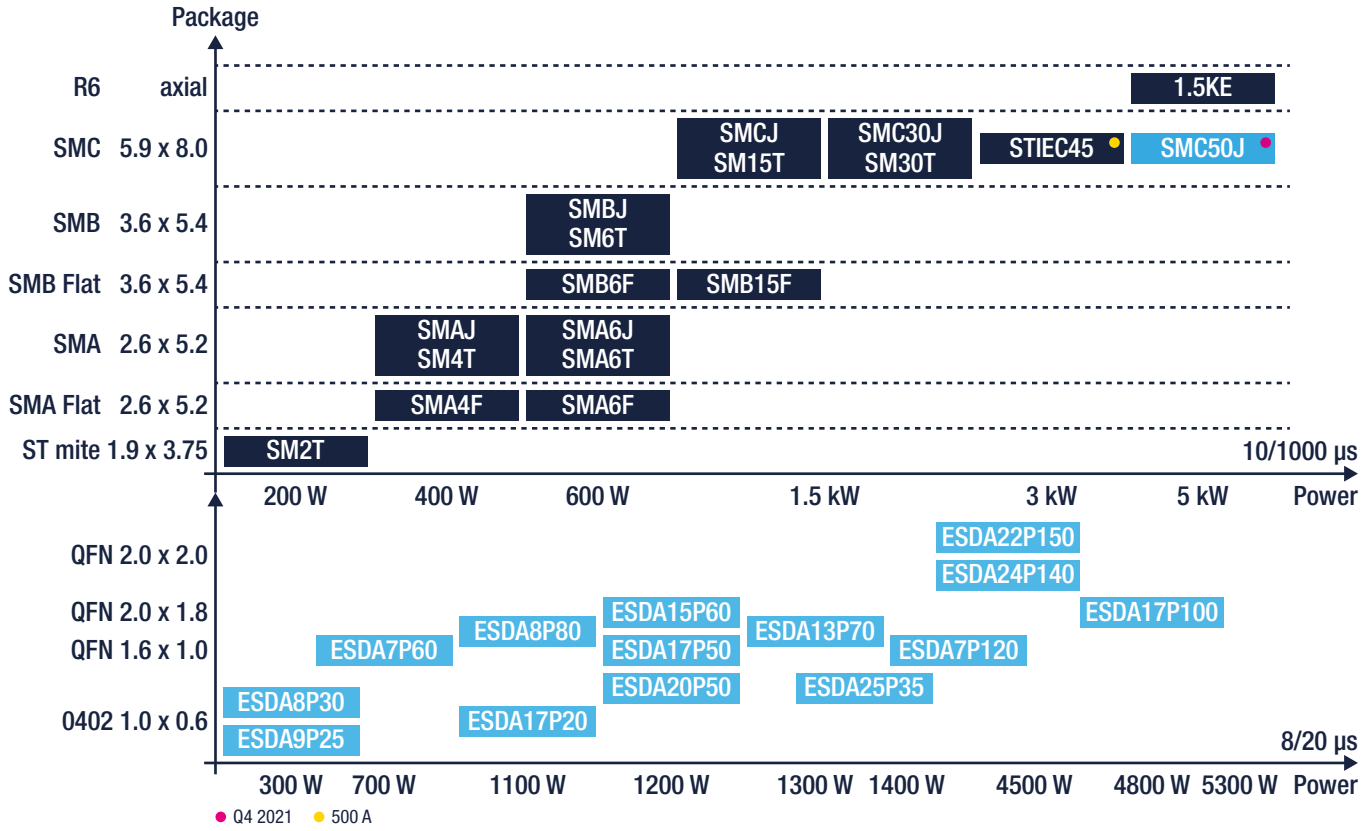
Applying a TVS between the Gate and Source prevents an overvoltage condition on the gate. If the switch is controlled by a positive voltage, then a unidirectional TVS is recommended. If a positive and negative voltage controls the switch, then a bidirectional TVS is required.



Motor	TVSEOS SMAxF/SMBxF SM15T 1.5KExx	ESD and EOS ESDAxxP-xx1U1M	ESD ESDAxxSC6	ESD and Signal HSP061-2xx
PMSM & BLDC motors	x	x	x	x
Stepper motors	x	x		x
Brushed DC motors	x	x	x	x
Universal motors		x		
Switch reluctance motors		x		

TVS

The **TVS Transient Voltage Suppressor** is an avalanche diode specially designed to clamp over voltages and dissipate hightransient energy. TVS are power devices to protect applications against Electrical Over-Stress (EOS), specifically against surgeevents as defined by IEC 61000-4-5.A large choice of package is available to meet application requirements.



MOSFET and IGBT Gate Drivers

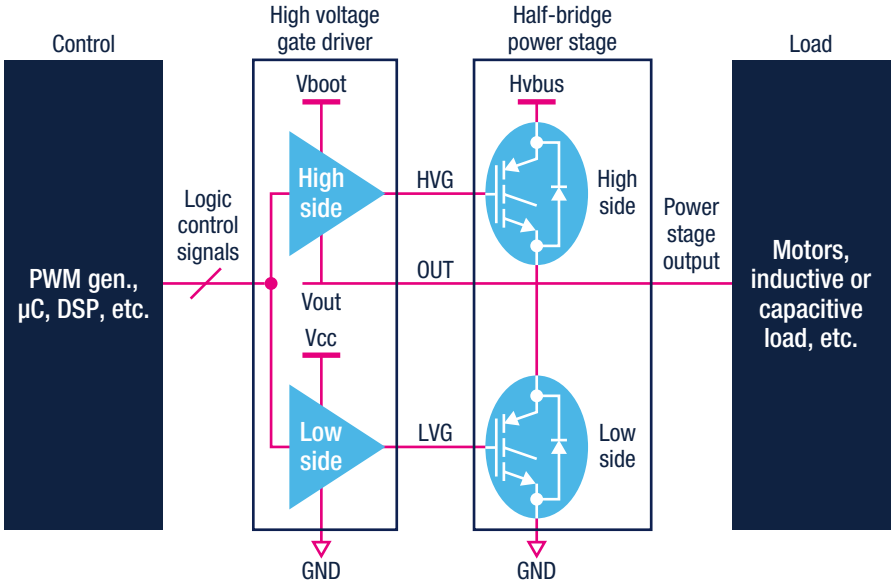
A necessary companion for discrete power MOSFETs and IGBTs as well as digital – microcontrollers, DSPs and FPGAs – or analog controllers in any switched-mode power converter, STDRIVE gate drivers generate the necessary voltage and current level required to accurately and efficiently activate the power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

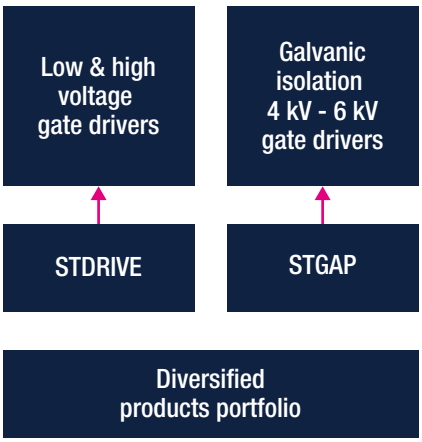
With a range spanning from single- to half-bridge and multiple-channel drivers rated for either low- or high-voltage (up to 1700 V) applications, ST also offers galvanically-isolated gate driver ICs for safety and functional requirements, System-in-Package (SiP) solutions integrating high- and low-side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

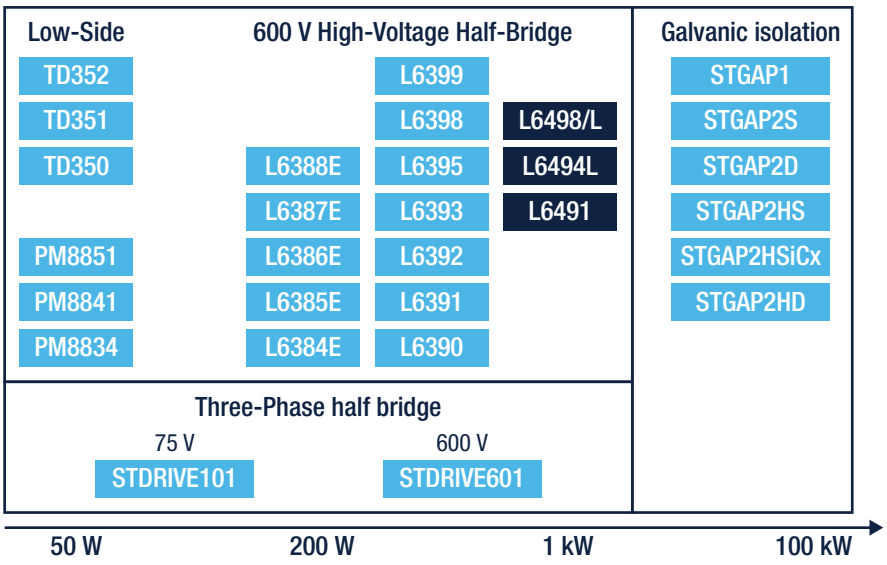
In many cases, there is an STDRIVE perfectly designed to fit your switched-mode power converter or motor driver design.

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.







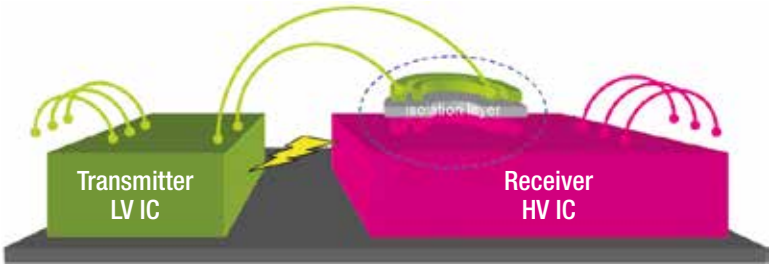
KEY FEATURES

- 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 driver which include 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 * Short to come

STDRIVE THREE-PHASE BRIDGE GATE DRIVERS

ST's three-phase STDRIVE are designed to integrate in a single component all the required gate drivers for three-phase motor applications. That responds to the industrial market trend towards higher levels of integration and lower development costs. High level of integration, moreover, can offer a better matching of critical parameter in power applications, as propagation delays.

Part Number	Channel #	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
STDRIVE101*	6	75	0.6	±50	20	3.3, 5	120	Two input strategies: HIN, LIN or EN, PWM driving, VDS monitoring	QFN4x4 24 Leads
STDRIVE601		600	0.35	±100	20	3.3, 5	80	UVLO and thermal shutdown and HW interlocking function	SO-28

Note * Short to come

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.

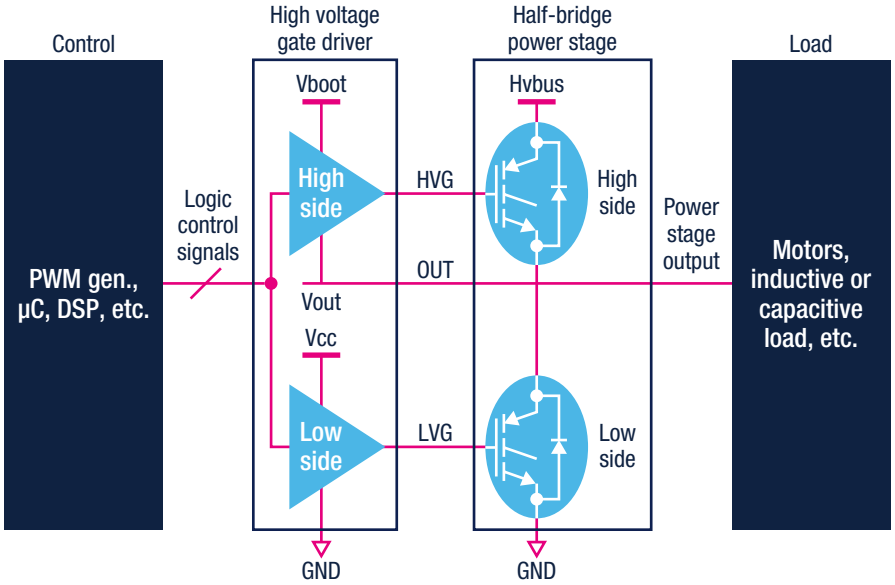
Part Number	Supply Voltage (V) max	Protection Option Type	Key features	Output Current-Max (A)	Input configuration	Grade	Undervoltage lockout (V)				Operating Temperature (°C)		EVALBoard	Board description
							(On VCC ON) nom	(On VCC OFF) nom	(On VBOOT ON) nom	(On VBOOT OFF) nom	min	max		
L6390	20	Undervoltage 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
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	Shudown 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
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

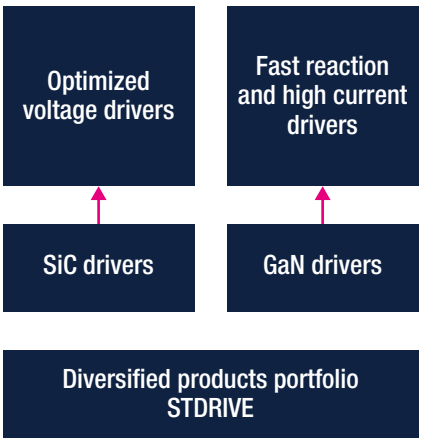
Silicon Carbide and Gallium Nitride Gate Drivers

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 an accurate design allows to drive them taking all the advantages brought by these switches.

ST's companion for discrete power SiC and GaN FETs as well as digital – microcontrollers, DSPs and FPGs – 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 applications in industrial.

HIGH VOLTAGE GAN DRIVER

STDRIVEG600 driver is designed in order to optimize speed and output current for GaN FET. 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

SiC MOSFET GEN2 1200 V

The best RdsOn vs Gate charge trade off, suitable for industrial motor driver application.

Part Number	V_{DS} (V)	$R_{DS(on)}$ typ @25 °C (Ω)	Id (A)	Package			
				HiP247	HiP247-LL	HiP247-4LL	H²PAK-7L
				Tj max = 200 °C			
1200 Gen2 (Vgs = 18 V) series							
SCTW70N120G2V	1200	0.025	80	x			
SCTWA70N120G2V-4						x	
SCTH70N120G2V-7							x
SCTW40N120G2V		0.070	45	x			
SCTWA40N120G2					x		
SCTWA40N120G2V-4						x	
SCTH40N120G2V-7							x

Current, Speed & Positioning Sensing

Operational amplifier

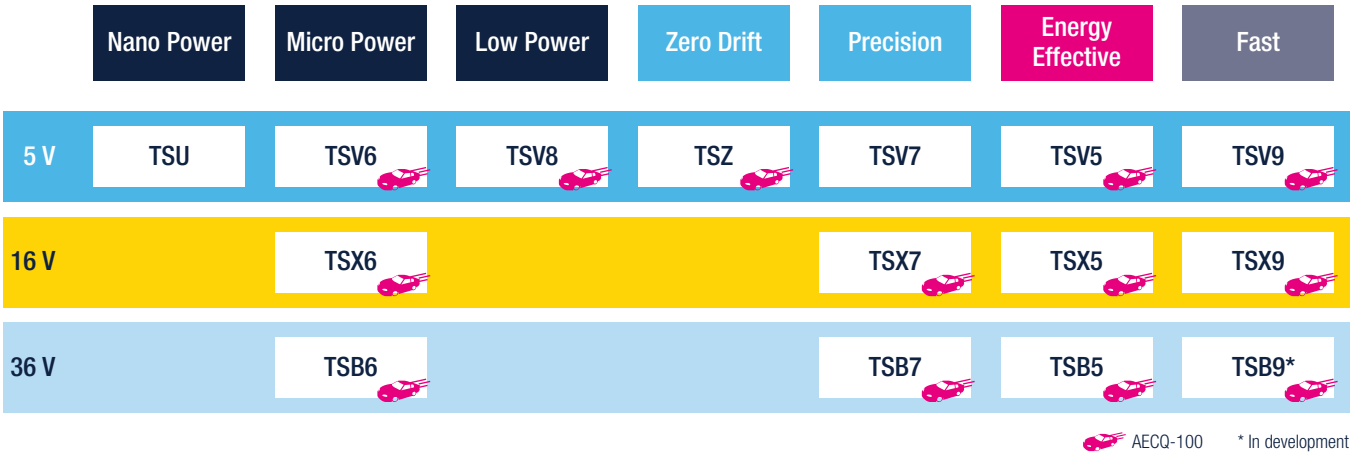
ST has a wide range of Op-Amps, including both industry-standard and high-performance Op-Amps. Our strengths include:

- 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.



HIGHLIGHT: TSB712

- Dual amplifier
- Rail-to-rail input and output
- 6 MHz bandwidth
- 2.7 V to 36 V supply voltage
- Excellent precision
- Guaranteed input offset voltage of 300 µV max at 25 °C
- Perfectly suited for a wide variety of applications such as: active filters, motor control, actuator driving, hall effect sensors and resistive transducers

Applications	Features	Products
Low side current sensing	Precision, low Vio as good as 5 µV	TSZ121, TSZ181, TSV731, TSX711
Temperature sensing	Low power consumption as low as 580 nA	TSU101, TS941, TSV631, TSU111
Vibration sensing	High Bandwidth up to 20 Mhz	TSX9291, TSH22, TSV991
Angle measurement DC brushless motor	High output Current, > 100 mA	TSX561, TS982, TS507
High 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 equipments, Motor control, Industrial process control, Strain gauge	36 V Signal conditioning	TSB572, TSB611, TSB712, TSB7192, TSB571, TSB711, TSB7191

HIGH-SIDE CURRENT SENSING (TSC SERIES)

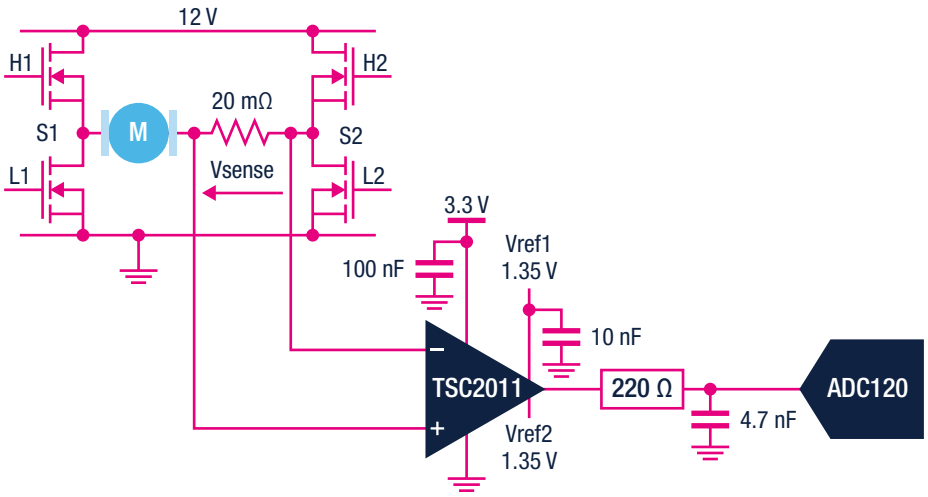
Accurate sensing of currents is central to enhancing application safety. Controlling the current within set boundaries avoids overheating and short circuits. Current measurement is also an essential part of energy metering.

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	

ANALOG-TO-DIGITAL CONVERTER

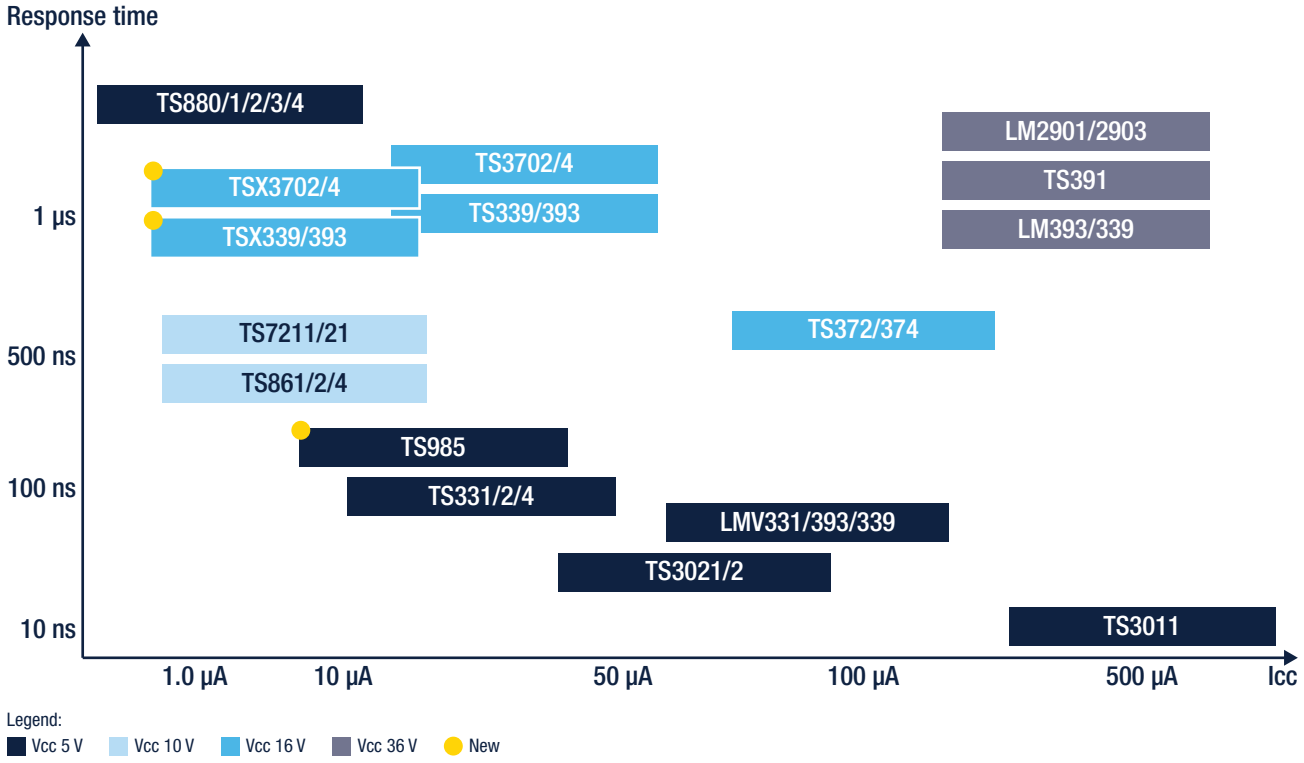
ST proposes the ADC120, a robust and flexible 8-channel,12-bit, 50 ksps to 1Msps ADC, for industrial environments, guaranteed up to 125 °C. The ADC120 offers the best linear performances over the largest sampling frequency range. It is interfaced through a 4-wire SPI bus.

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.



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