

Power management Guide 2018

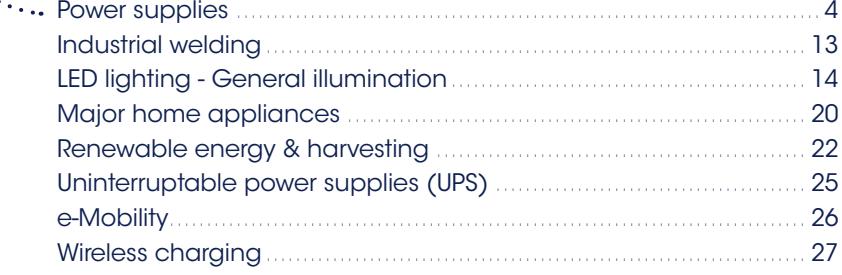




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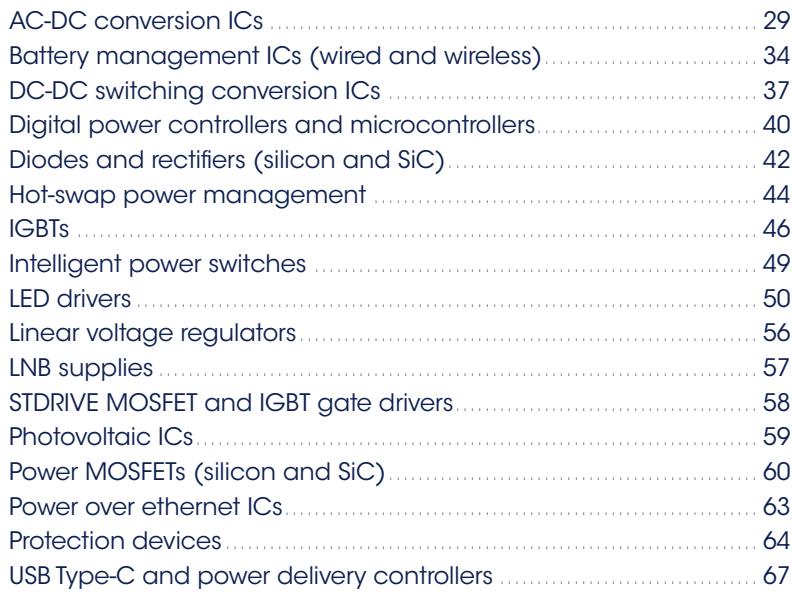


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Introduction

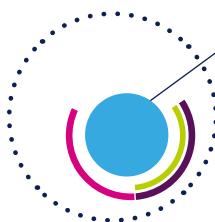


As one of the world's leading suppliers of both integrated and discrete power conversion semiconductor devices, ST's power management devices enable design of energy-saving, high-power-density and superior performance solutions. Moreover they are able to support the migration from analog to digital designs to achieve increased flexibility, smaller form factors and higher efficiency. ST's product portfolio includes highly-integrated AC-DC converters and controllers, switching DC-DC converters, silicon and SiC power MOSFETs, IGBTs, silicon and SiC rectifiers, protections, linear voltage regulators, battery management ICs (including wireless battery charger ICs), LED drivers, digital controllers, microcontrollers and more in a wide range of packages.



Today, optimizing complete solutions in terms of energy efficiency according to market requirements and energy regulations is practically mandatory. The key element in developing a successful power system is the best semiconductor device selection. To help you find the best device for the most common applications (power supplies, LED lighting, renewable energy & harvesting, wireless charging, home appliances, welding, UPS and on-board chargers for electric vehicles), this guide provides a complete mapping of ST's devices and includes information about dedicated system evaluation boards to better test the devices directly in your application and reduce the time to market. Using our eDesignSuite software tool, you can readily simulate power management circuits and choose the best-suited devices quickly.





Applications

POWER SUPPLIES

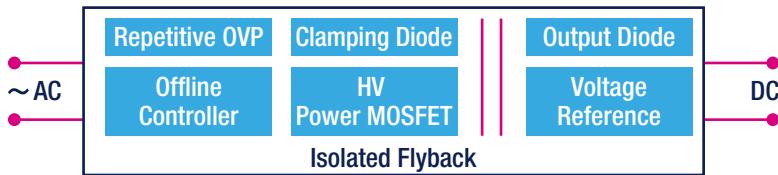
Auxiliary SMPS

High-power-density and cost-effective auxiliary power supplies can be designed using a converter (where each IC includes a power MOSFET combined with control and protection circuitry in a single package) at a higher switching frequency to avoid a considerable increase in transformer and output capacitor size. ST offers a wide portfolio of highly-integrated offline converters up to 20 W with an extremely low total standby consumption (less than 4 mW for VIPerOP devices) and high breakdown voltage of 800 V for the VIPerPLUS family and 900 V for the Altair05. To reduce BOM costs, the Altair family works as a constant-voltage primary-side regulator (PSR-CV) avoiding the need for a voltage reference and opto-coupler in the circuit. Discrete solutions consisting of an offline controller plus an external MOSFET are also supported by ST. New STRVS voltage suppressors improve system reliability against repetitive overvoltages. New FERD diodes feature a very low forward voltage and a low leakage reverse current improve the system efficiency.

		Offline converters	Offline controllers	HV power MOSFETs	Repetitive overvoltage protections	Clamping diodes	Volt. ref.	Output diodes	LD0	
Buck		VIPerOP			-	-	-	STTH*06 STTH*08 STTH*10		
Buck-boost		VIPer*1 VIPer*6					-			
Non-isolated flyback							-			
Isolated flyback	Regulation with optocoupler	VIPer*5 VIPer*7 VIPer*8	VIPerOP VIPer*1 VIPer*6 ALTAIR*	STCH02 L6566B	ST*N80K5 ST*N90K5 ST*N95K5 ST*N105K5 ST*N120K5 STW12N150K5 STW21N150K5 ST*3N170 SCT1000N170 ¹ (SiC MOSFET)	STRVS*	STTH*06 STTH*08 STTH*10 STTH*12	T*431 T*432	STPS* FERD*45 FERD*50 FERD*60 FERD*100	LDF, LDFM LDK220, LDK320 LDL212

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Typical configuration



MAIN EVALUATION BOARDS



STEVAL-ISA096V1
2 W, buck-boost



STEVAL-ISA192V1
7 W not-isolated flyback with smart standby using VIPerOP and touch sensing



STEVAL-ISA178V1
5 V/200 mA buck-converter based on VIPer0



STEVAL-ISA183V1
16 W quasi resonant flyback converter for air conditioning applications using VIPer35LD

Battery chargers

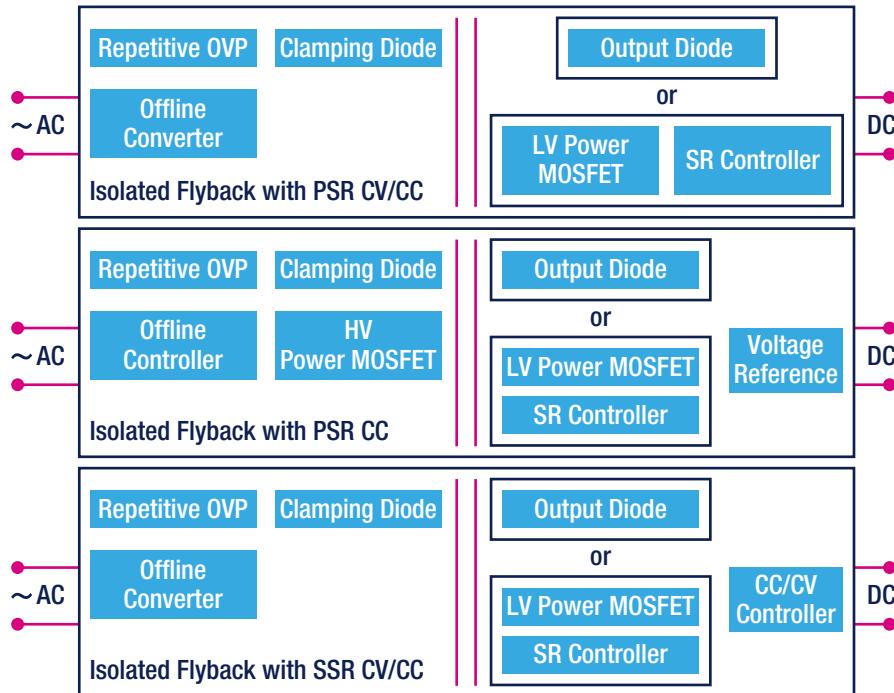
Designing lighter, smaller wall chargers for portable devices is one of the most critical challenges for developers. Excellent standby power consumption, high efficiency in all load conditions, primary-side regulation (PSR) control methods and a set of integrated protections (to minimize the component count on the circuit) are the main market requirements. High performing offline converters (Altair*) (i.e. controllers and MOSFET in the same package) and a new offline controller (STCH02) combined with an external MOSFET can be used for a reliable, efficient and safe battery charger working in PSR (i.e. without using opto-coupler and post current/voltage regulation). New STRVS protections improve the system reliability against repetitive over-voltages. For the application side (portable applications), ST offers a various set of linear and switching battery charger and monitoring ICs integrating functions able to minimize power consumption and save space on PCBs. ST also offers the EnFilm™ thin-film battery, a new concept of extremely thin (220 µm), rechargeable solid-state batteries with fast constant-voltage charging.



			Offline converters		Controllers	Power MOSFETs		Repetitive overvoltage protections	Clamping diodes	Output diodes	CC/CV controllers or Voltage Reference
Wall side	Flyback	SSR-CV/CC	VIPer*5 VIPer*7 VIPer*8	VIPerOP VIPer01V	-	HV	LV	STRVS*	STTH*06 STTH*08 STTH*10	FERD*45 FERD15S50 FERD20U50 FERD20U60 FERD*100 STPS*	TSM10* SEA0*
		PSR-CV	-	VIPer*6	HVLED001A	ST*N65M2 ST*N65M6 ST*N70M6 ¹	-				
		PSR-CC	-	STCH02	SCTH35N65G2V-7 ² (SiC MOSFET)	-	-				T*431 T*432
		PSC CV/CC	ALTAIR*	-	-	-	-				-
		Synch Rect	-	STSR30	-	ST*N4F7 ST*N6F7 ST*N10F7	-				-

	Battery charger ICs			Battery monitoring ICs	Li-Ion battery
	Linear		Switching		
Application side	STBC02 STBC03 L6924* STC4054 STNS01	STBCFG01	STC3117 STC3115	EFL700A39	

Typical configuration

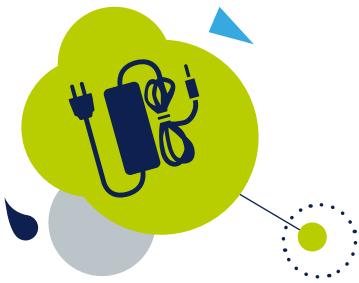


MAIN EVALUATION BOARDS

	STEVAL-ISA193V1 15 W, 5 V - 3 A output CC primary sensing USB adapter based on STCH02
	STEVAL-ISA176V1 5 W, optoless battery charger
	STEVAL-ISB033V1 5 W, switching battery charger for Li-ion batteries based on STBCFG01
	STEVAL-ISB041V1 Li-Ion/Li-Po linear battery charger evaluation board based on STBC02

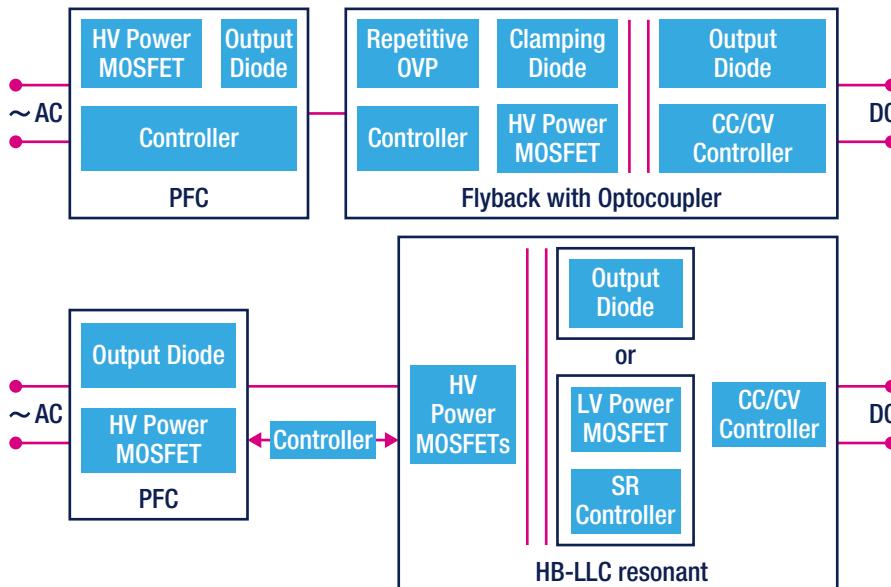
Adapters

The adapter trend goes towards a significantly higher efficiency level, especially in partial load conditions, as well as towards their miniaturization (slimmer and lighter). Adapters require ICs enabling high efficiency with good EMI performance and low standby power, high performance MOSFETs in small packages and protections for high reliability and safety. For this purpose, ST offers a wide portfolio of dedicated ICs including PFC controllers working in Transition Mode (TM), smart analog controllers for HB-LLC resonant circuits as well as for synchronous rectification (dedicated to flyback/forward or HB-LLC circuits). The new combo controller (STCMB1) is able to manage both PFC and DC-DC stages. In addition to the high-voltage MDmesh™ MOSFETs series and the low-voltage STripFET MOSFETs, new FERD diodes, new STRVS protections against repetitive over-voltages and voltage reference complete our silicon offer for adapter needs. ST's DC-DC converters guarantee high power density for post-regulation.



		Offline converters		Controllers		Power MOSFETs		Repet. overvolt. protect.	Clamping diodes	Output diodes	CC/CV contr.	Volt. ref.	DC-DC conv.	LDO
				HV	LV									
Flyback	Regulation with optocoupler	VIPer*5 VIPer*7 VIPer*8	VIPerOP VIPer*1 VIPer*6	L6566B L6566A	STCH02	ST*N80K5 ST*N90K5 ST*N95K5	-	STRVS*	STTH*06 STTH*08 STTH*10	STPS* FERD*45 FERD*50 FERD*60 FERD*100	TSM10* SEA0*	T*431 T*432	-	ST715 LDK320
	PSR-CV	-	ALTAIR*			-								
PFC Boost	TM	-	L6562A* L6563* L6564*	STCMB1	ST*N50M2 ST*N60M2 ST*N65M2 ST*N55M5 ST*N65M5 ST*N60M6	-	-	STTH*L06 STTH*06	-	-	-	-	-	
					ST*N50DM2 ST*N60DM2 ST*N60M2 ST*N60M2-EP ST*N65M2-EP ST*N60M6	-	-							
DC-DC stage	HB-LLC	-	L6599A* L6699											
Sync rect.	Flyback Forward	-	STSR30 STSR2*	SRK2000A SRK2001	ST*110N10F7 ST*100N10F7 STL*NS3LLH7 ST*N4LF7 ST*N6F7 STL130N8F7 ST*N10F7 ST*NF20D			STPS* FERD*45 FERD*50 FERD*60 FERD*100	TSM10* SEA0*	T*431 T*432	ST1S3*	ST715 LDK320		
	HB-LLC													

Typical configuration



MAIN EVALUATION BOARDS

	EVL6566A-75WES4 75 W, PFC + flyback
	STEVAL-ISA170V1 150 W, PFC + HB-LLC + sync rect.
	EVLCMB1-90WADP 90 W, PFC + HB LLC

USB Type-C™ Power delivery chargers and adapters

Modern wall chargers and adapters for consumer and industrial applications take benefit of the USB Type-C™, the new slimmer connector featuring reversible plug and cable orientation, allowing designers to develop smaller, thinner and lighter products. Additionally the USB power delivery, which expands USB to deliver up to 100 W (20 V, 5 A) of power, enables more efficient and fast charging over USB.

ST's portfolio for USB Type C and Power Delivery is designed to cope with various hardware/software partitioning solutions in order to best match your specific application requirements and design architecture: controllers ranging from STM32 general purpose MCU to hard-coded solution to fit different use cases and power ratings can be combined with a large product portfolio of protection and filtering covering all the application needs and with highly secure solution using STSAFE secure element family for strong authentication needs.

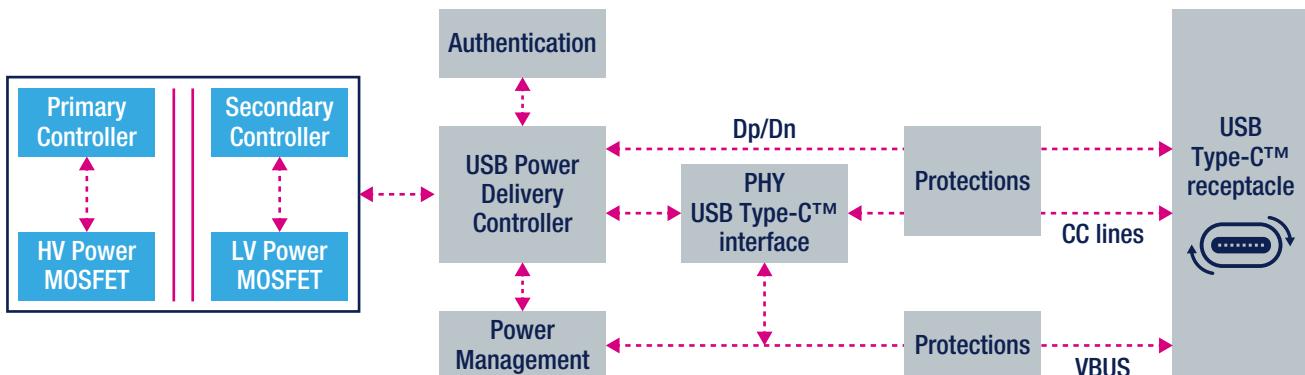
Certified Middleware Stack (X-CUBE-USBPD) enabling flexibility to various topologies and adaptability to USB specification evolution is also available.



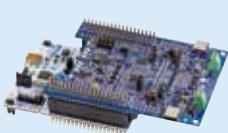
USB Type-C Power Delivery Subsystem									
	Type-C and USB-PD Controllers			Authencitication & Secure MCUs	Protections		LDO		
	Chipset		Hard Coded Controllers		ESD & EOS Protections for VBUS Power Delivery	ESD & EOS Protections for Communication Channel (CC lines)			
	MCUs	Type-C Controller/Interface							
USB Type-C PD Adapter 1 Port Provider	STM32F0* STM32F3*	STUSB1600A STUSB1602A	STUSB4700 STUSB4710A	STSAFE-A	ESDA17P100-1U2M ESDA25P35-1U1M ESDA17P50-1U1M ESDA15P60-1U1M ESDA13P70-1U1M ESDA7P120-1U1M	ESDALC20-1BF4 ESDA5-1BF4 ESDZV5H-1BU2 ESDA8P30-1T2 ¹ ESDA25W5 ESDA6V1W5	ST715 LDK320		

Typical configuration

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MAIN EVALUATION BOARDS



P-NUCLEO-USB002
STUSB1602A USB Type-C and Power Delivery Nucleo Pack



STEVAL-CCC001
STUSB1600A USB Type-C evaluation board



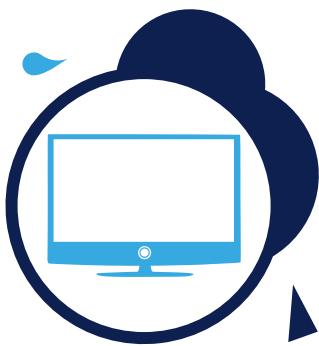
STEVAL-ISCO04V1
STUSB4710A evaluation board



STEVAL-USBPD45H²
45 W USB PD Type-C adapter based on STCH02 and STUSB4700

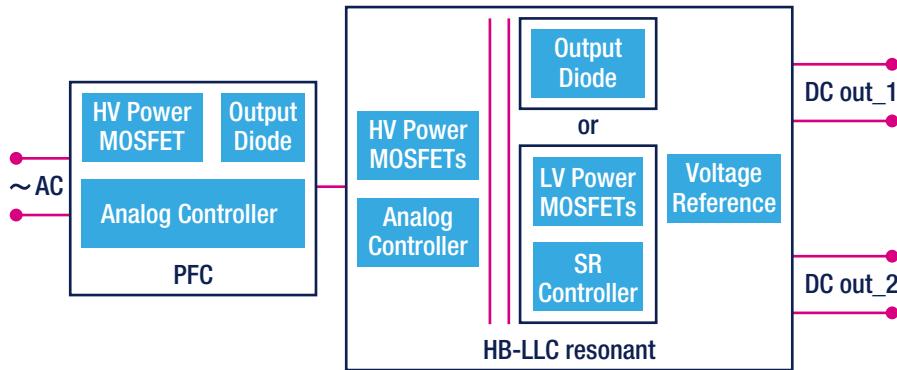
TV power supply units (PSU)

In addition to their outstanding image quality, new generation TVs gain attention for their slim silhouette and high energy efficiency; for which the TV's power supply is a key factor. The power supply unit (PSU) requires a low profile to maintain the TV's slim appearance and advanced silicon devices to ensure high efficiency. ST is able to offer both requirements: high-voltage MDmesh™ MOSFETs (K5, M2, M2-EP, M6, DM2, M5 series), low-voltage STRipFET MOSFETs (F7 series), FERD/Schottky and Ultrafast diodes are available in low-profile SMD packages such as PowerFLAT™ 3.3x3.3 and PowerFLAT™ 5x6. Furthermore the MDmesh™ M2 series is available also in the new TO-220FP wide creepage and in the new TO-220FP ultra narrow lead package. STRVS protections against repetitive over-voltages feature small packages including flip-chip, SOD and uQFN. Dedicated smart analog controllers for PFC, HB-LLC resonant circuit, including the new combo controller (STCMB1) for both stages, and those for synchronous rectification enable energy-saving, high-power-density and lower-standby-power design solutions including protection features that are suitable for universal use in TVs of all sizes. The new generation of TV digital power supply units based on our STM32 microcontrollers or STNRG digital controllers guarantee more efficient and flexible solutions.



		Controllers		Gate drivers	Power MOSFETs		Repet overvolt. protect.	Clamping diodes	Output diodes	Volt. ref.	DC-DC conv.
		Analog	MCU and digital		HV	LV					
Flyback		L6566A L6566B		-	ST*N80K5 STxN90K5 ST*N95K5	-	STRVS*	STTH*06 STTH*08 STTH*10	STPS* FERD*45 FERD*60 FERD*100 STPS*LCD170CB	T*431 T*432	-
PFC Boost	CCM	L4981* L4984D	STM32F0* STM32F1* STM32F334 STNRG*	TD35* PM8841 PM8851	ST*N60M2 ² ST*N65M2 ST*N65M5 ST*N60M6	-	-	-	STTH*R06 STTH*T06 STPSC*065 (SiC Diodes)	-	-
	TM	L6562A* L6563* L6564*			STTH*L06 STTH*06						
DC-DC stage	HB-LLC	L6599A* L6699	STCMB1	L638* L639* L649*	ST*N50DM2 ST*N60DM2 ST*N50M2 ST*N60M2 ST*N60M2-EP ST*N60M6	-	-	-	STPS*	T*431 T*432	ST1S0* ST1S12 ST1S3* ST1S4* ST1S50 L598*
Sync rect.	HB-LLC	SRK2000A SRK2001			PM8834	STL*NS3LLH7 ST*N4LF7 ¹ ST*N6F7 ST*N10F7 ST*NF20D	-	-	-	-	-
	Flyback	STSR30				ST*110N10F7 ST*100N10F7					

Typical configuration



Note 1: MP Q4 2017 2: 600 V MDmesh™ M2 series is available also in the new TO-220FP wide creepage and in the new TO-220FP ultra narrow lead

* is used as a wildcard character for related part number

Desktop PCs

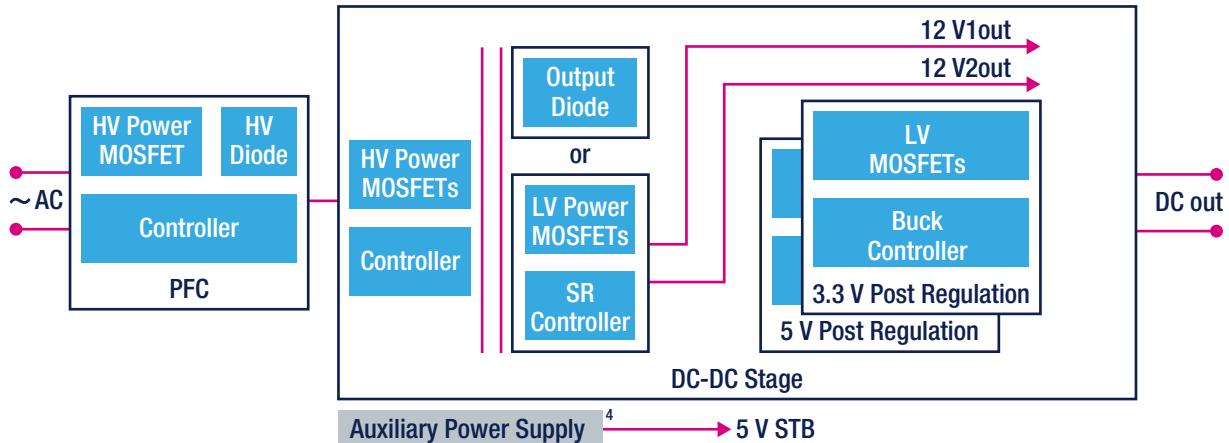
The requirements for the standard ATX PC power market are a small form factor with better performance.

An intelligent control scheme that enables the adaption of load variation to minimize power consumption, together with optimized power semiconductors, is the key in meeting market demands. The smart L4984D PFC controller operating with ST's proprietary CCM technique, high-voltage MDmesh™ MOSFETs used for the PFC and DC-DC stages, low-voltage STripFET MOSFETs for synchronous rectification, and SiC diodes (STPSC*) help designers develop the best possible PC power supply solutions to improve efficiency. Dedicated smart analog controllers allow a tailored solution for the main topologies used in the DC-DC stage with the STCMB1 combo controller (driving PFC + HB-LLC resonant circuits) and in the synchronous rectification stage with other ICs. ST's DC-DC converters guarantee high power density for the post-regulation.



		Controllers	Power MOSFETs		Output diodes	DC-DC converters	E-fuses	LDO
			HV	LV				
PFC Boost	CCM	L4981* L4984D	ST*N60M2 ² ST*N65M2 ST*N65M5		STTH*R06 STTH*T06		STEF01 STEF05 STEF12	
	TM				STPSC*065 (SiC Diodes)			
	HB-LLC	L6562A* L6563* L6564*			STTH*L06 STTH*06			
DC-DC stage	HB-LLC	L6599A* L6699	STCMB1	ST*N50DM2 ST*N60DM2 ST*N60M2 ST*N60M2-EP ST*N60M6	STPS* FERD*45 FERD*60 FERD*100	ST1S3* ST1S4* ST1S50 L598*	LDF LDFM LDK320 LDL212	
	Asym HB	L6591						
Sync rect.	HB-LLC	SRK2000A SRK2001		STL*NS3LLH7 ST*N4LF7 ¹ ST*N6F7 ST*N10F7 ST*NF20D				
	Asym HB							
Post Regulation	Buck	L672* L673* PM6680A		-	STD90NS3LLH7 STL60N3LLH5			

Typical configuration



MAIN EVALUATION BOARDS



EVL400W-ADP/ATX

400 W, PFC CCM + HB-LLC + sync rect.

Servers and telecoms: AC-DC power supply

Stringent international standards require for Server/Telecoms power supply greater efficiency, increased power density, faster and more reliable protection functions, increased flexibility and monitoring that are achievable using a proper mix of analog or dedicated digital controllers with advanced power discrete and analog ICs.

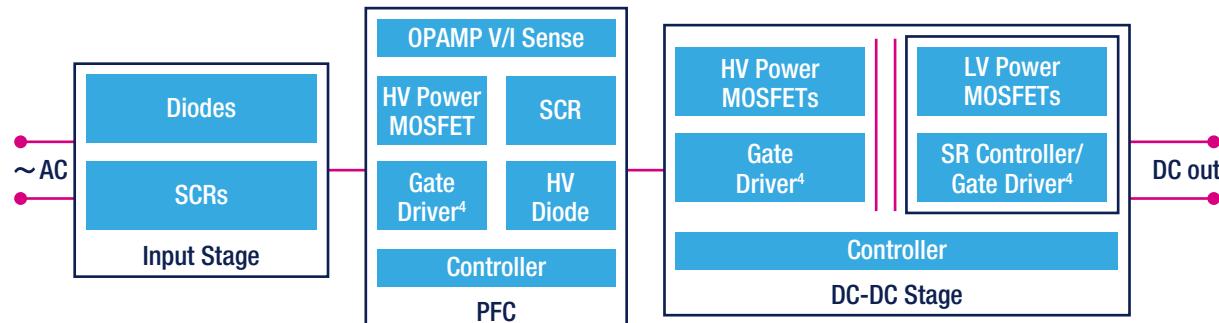
ST offers a high-performing product portfolio reducing the total cost of the solution: SiC diodes (STPSC*), high-voltage MDmesh™ MOSFETs (for PFC and DC-DC stages), low-voltage STripFET MOSFETs (for synchronous rectification stage), new STDRIVE gate drivers (L639*, L649*). Smart controllers are available for the mentioned stages. For higher efficiency and power density systems, ST can offer also the breakthrough SiC MOSFET devices and the latest digital controller STNRGPFO1.

High robustness against the inrush current is ensured by new SCRs in the front end stage. For the post-regulation, from 48 V to point-of-load (CPUs, memories and ASICs), ST's multi-IC direct power conversion enables a more efficient approach.



		SCRs	Controllers		Gate drivers	Power MOSFETs		Diodes	DC-DC converters		E-fuses	LDO & Op Amps
			Analog	MCU and digital		HV	LV		HV	LV		
Input Stage (Rect. & inrush current limiter)		TN1515-600B TN2015H-6 TN4015H-6 TN5015H-6 TM8050H-8 TN3050H-12Y TN5050H-12Y	-	-	-	-	-	STBR3012 STBR6012	-	-	-	-
PFC	Boost	L4981* L4984D	STM32F0* STM32F301 STM32F334 STNRG* STNRGPFO1	TD35* PM8841 PM8851 PM8834	ST*N60M2 ST*N65M2 ST*N65M5 ST*N60M6 SCT*35N65G2V ¹ SCT*90N65G2V ¹ (SiC MOSFETs)	-	-	STTH*R06 STTH*T06 STPSC*065 (SiC Diodes)	-	-	-	TN3050H-12WY TN5050H-12WY
	Interl. Boost											
	Bridgeless											
	Totem Pole	TN3050H-12WY TN5050H-12WY							STTH30L06* STBR*012*			
DC-DC stage	HB-LLC	L6599A* L6699	L638* L639* L649*	STM32F334 STNRG*	ST*N50DM2 ST*N60DM2 ST*N60M2 ST*N65DM2 ST*N60DM6 ST*N65DM6 ³	-	-	STPS* FERD*45 FERD*50 FERD*60 FERD*100 STTH*	L698* ST1S14 L7985 L7986 L7987* L598*	ST1S3* ST1S4* ST1S50	STEF01 STEF05 STEF12	LDF LDFM LD39050 LD39100 LD39200 LDL112 LDL212 LD59100
	HB-LC											
	FB-PS											
	Asym HB											
Sync rect.	HB-LLC	SRK2000A SRK2001	PM8834		STL*NS3LLH7 ST*N4LF7 ² ST*N6F7 ST*N10F7 ST*NF20D	-	-	-	-	-	-	-
	Asym HB											

Typical configuration



MAIN EVALUATION BOARDS



EVL400W-ADP/ATX
400 W, PFC (CCM)
+ HB-LLC + sync rect.



STEVAL-ISA147V3
500 W, bridgeless PFC
+ HB-LLC conv. + sync rect.



EVLSTNRG-1kW
1 kW, multi-phase interl.
HB-LC conv.



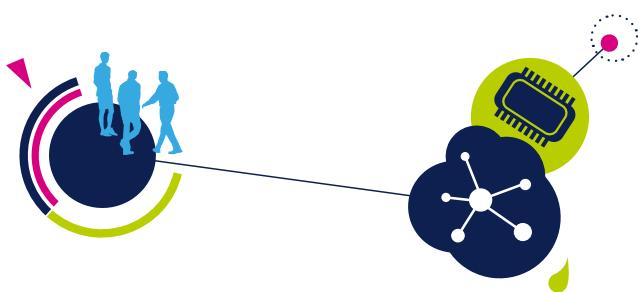
STEVAL-ISA172V2
2 kW, multi-phase interl.
Boost PFC + FB-PS conv.



STEVAL-ISF003V1
Up to 7.4 kW, digital
inrush current limiter
based on SCRs



EVAL-IPFC01V1
3 kW three-channel
interleaved PFC

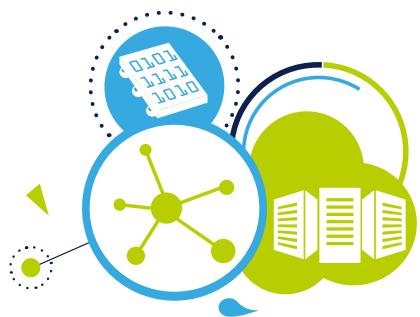


Servers and telecoms: 48 V direct conversion to CPUs, memories and ASICs

Cloud applications including Internet of Things, smartphone apps, and online services are executed in large datacenters comprising thousands of individual servers.

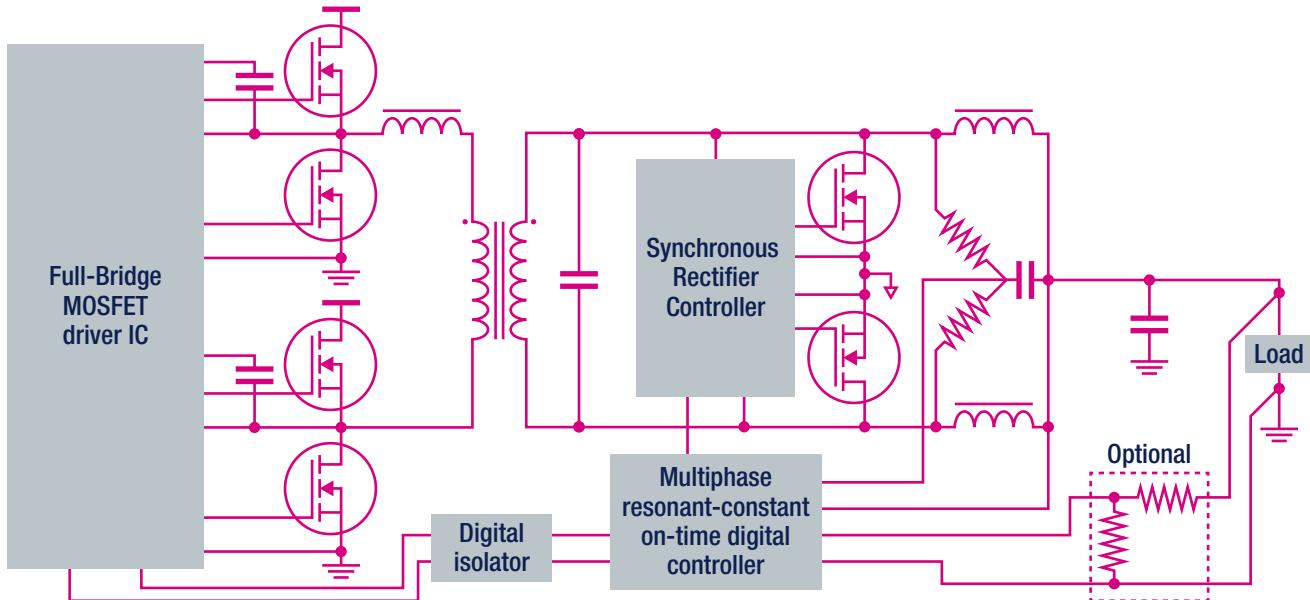
ST has developed a multi-IC solution called Isolated Resonant Direct Conversion technology, enabling a very effective distributed approach, reducing intermediate conversion steps and resulting in a more efficient and reliable system. The multi-IC solution is based on the STRG02 synchronous rectifier capable of zero-voltage and zero-current operation, the STRG04 high-voltage full-bridge MOSFET driver IC able to drive a wide range of external MOSFETs or GaN-based switches with programmable dead time and the STRG06 multiphase resonant-constant on-time digital controller with PMBus™, supporting up to 6 interleaved converters, able to deliver output voltage from 0.5 to 12 V and to support output power levels from 50 to more than 300 W. ST's turnkey solution generates flat efficiency curves ensuring the highest level of conversion both for light loads and high current demand.

All primary and secondary power MOSFETs always work at zero current and zero voltage. Power and heat come only from conduction losses, heatsinks, and not from the switching activity. Each power MOSFET produces a minimum amount of heat removing the need of expensive and complex heatsinks.



		Controllers	Drivers	LV Power MOSFETs	DC-DC Converter	LDO	eFuse
Power Cell	Full Bridge	-	STRG04	STL120N8F7 STL35N75LF3	ST1S40	LDK220 LDK320	STEF01
	Synchronous Rectifier	-	STRG02	STL100N12F7 STL260N45LF7 ¹		-	
Control Stage	Multiphase (up to 6 interleaved) Resonant Converter	STRG06	-	-	-	-	-

Typical configurations



MAIN EVALUATION BOARD



ST has developed software tools, a GUI and several reference designs available on request and including:

- 54 V/12 V, 42 A 500 W: 96.5% peak efficiency; size 4.3 inch²
- 54 V/3.3 V, 46 A 150 W: 95% peak efficiency; size 2.07 inch²
- 54 V/CPU, VR13 165 W (TDP) and 360 W (peak power): 93.3% peak efficiency
- 54 V/DDR4, 120 A: 93.2% peak efficiency; size 3.87 inch²

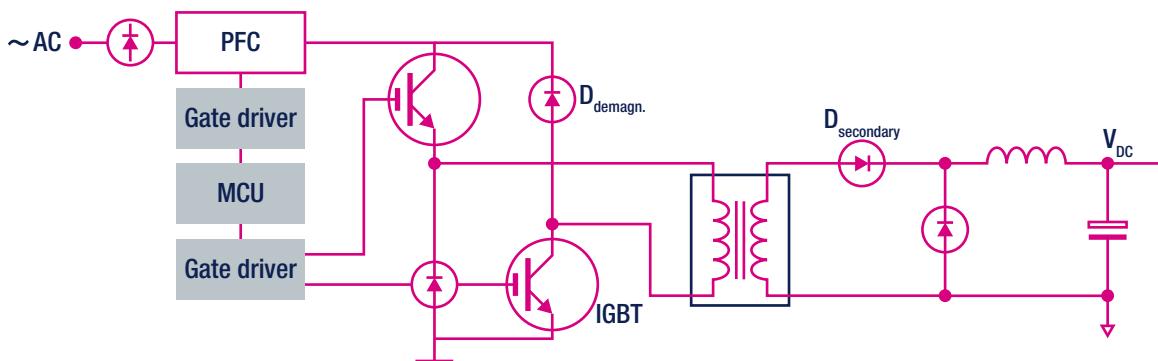
INDUSTRIAL WELDING

High efficiency and high switching frequency as well as reduced size and weight are the main requirements for welding applications. ST's broad power portfolio offers energy and cost-saving products to meet the various welding power ranges. Both PFC and DC-DC stages, phase-shifted full-bridge (PS-FB) as well as two-transistor forward (TTF), can be managed by high-performing STM32 microcontrollers. New high-efficiency and high-power-density SiC MOSFETs (SCT*N120), VHV Power MOSFET or the suitable high-frequency series of trench-gate field-stop IGBTs driven by STDRIVE gate drivers (L639*, and L649*) offer optimum performance and reduce cooling requirements and heatsink size while the new STGAP series galvanically-isolated drivers guarantee high safety and reliability of the welding. Using SiC diodes (STPSC*) further improves system efficiency, taking advantage of silicon carbide's superior physical characteristics over silicon.



		MCUs	Gate drivers	IGBTs	HV power MOSFETs	Diodes			DC-DC converters	
PFC Boost						Boost	Demagn.	Secondary side	HV	LV
DC-DC stage		STM32F0*	TD35* PM8834 PM8841 PM8851 STGAP1AS	STG*H65FB STG*V60F STG*H120F2	SCT*N120 ST*N90K5 ST*N95DK5	STTH*R06 STTH*T06 STTH*W06	-	-	-	-
						STPSC*065 (SiC Diodes)	-	-	-	-
TTF	STM32F334					STTH*R06 STTH*06 STTH*10 STTH*12	STTH*W02 STTH*W03 STTH*W04	L698* L597* L7985 L7986 STPS200170TV1	ST1S0* ST1S12 ST1S3* ST1S40 ST1S50 L598*	
PS-FB	STG*H65DFB STG*V60DF STG*H120DF2	-		-		L7987*				

Typical configuration



LED LIGHTING - GENERAL ILLUMINATION

Residential lighting

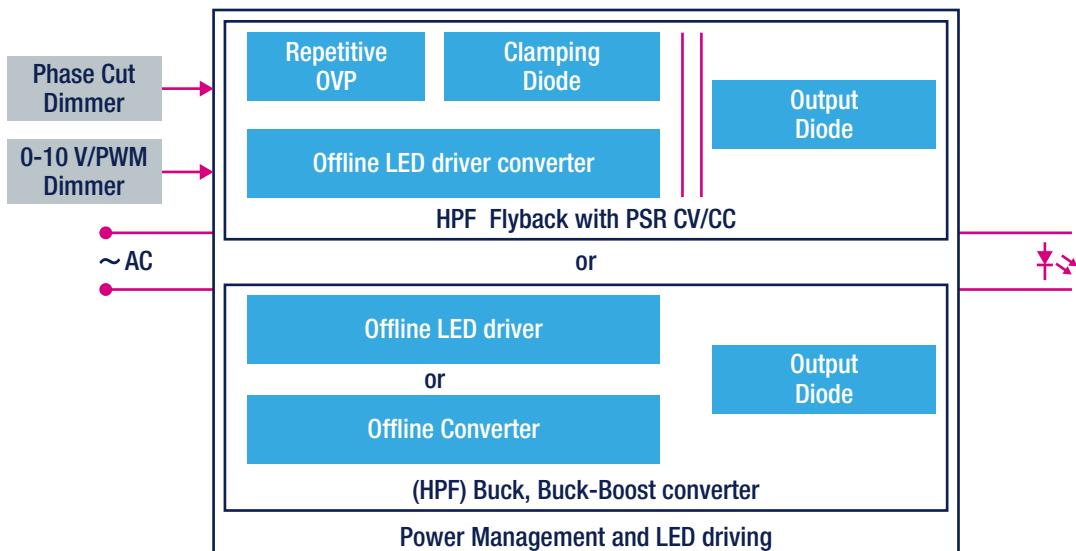
LED efficacy and driver IC market requirements are constantly evolving. Residential lighting applications need a high integration level, high efficiency, high power factor (PF), long lifetime, and dimming capabilities as well as a low system cost and component count.

ST offers a wide portfolio of highly integrated offline converters up to 15 W (each IC includes a power MOSFET combined with control and protection circuitry on a single chip) working with a high breakdown voltage of 800 V. Among these, HVLED805, HVLED807PF and HVLED815PF LED driver converters work with a high PF and in constant-current/constant-voltage mode primary-side regulation (PSR-CC/CV) avoiding the need of secondary side regulation ICs and opto-coupler in the circuit, thus reducing costs. Thanks to its high-power-density DC-DC LED driver converters (controller + MOSFET in the same chip), ST can support MR16 LED replacement lamps for halogen light bulbs.



		Offline LED driver converters	Offline converters suitable for LED driving	CC/CV controllers	Repetitive overvoltage protections	Clamping diodes	Output diodes	DC-DC LED driver converters
MR16 halogen bulb replacement		-	-	-	-	-	STPS*170AF STPS170UF STPS4S200UF STPSxxZF STTHxxZF	LED5000 LED6000
Buck, Buck-boost		-	VIPerOP VIPer*1 VIPer*6	-	-	-	STTH*	-
HPF Buck-boost		HVLED805 HVLED807PF HVLED815PF	-	-	-	-		
HPF Flyback	PSR-CC/CV	-	VIPer*5 VIPer*7 VIPer*8	VIPerOP VIPer*1 VIPer*6	TSM10* SEA0*	STRVS*	FERD*100 STPS*150 STPS*170 STPS*200	-
Flyback	SSR-CC/CV		-	-	-			
	PSR-CV		-	-	-			
	PSR-CC/CV		ALTAIR*		-			

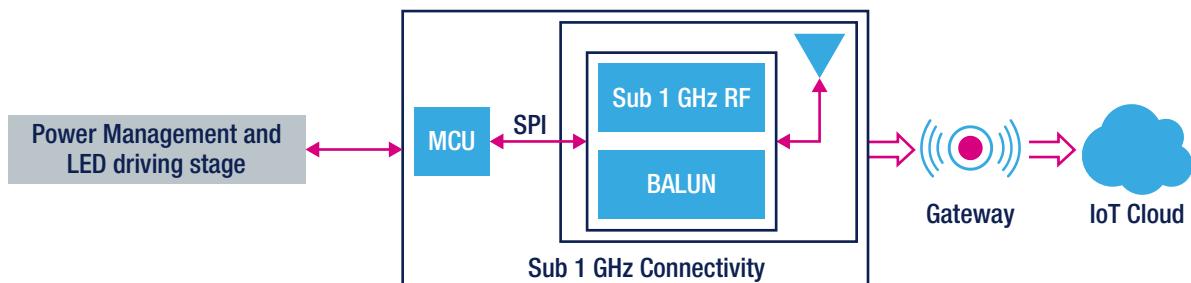
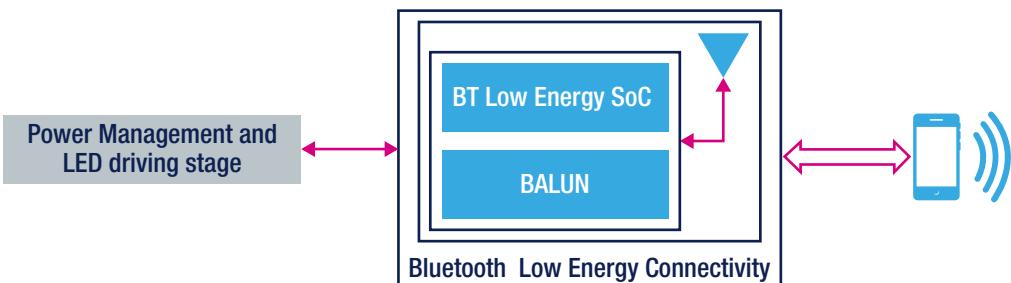
Typical configuration



ST offers products and solutions to enrich the LED lighting applications with wireless connectivity.

Wireless Connectivity				
	Chipset			Certified Module
	Connectivity IC	MCU	Balun	
Bluetooth Low Energy Connectivity	BlueNRG-1	-	BALF-NRG-02D3	SPBTLE-1S
	BlueNRG-MS	STM32F0* STM32L0*		SPBTLE-RF SPBTLE-RFO
Sub 1 GHz Connectivity	SPIRIT1 S2-LP	STM32F0* STM32L0*	BALF-SPI-01D3 BALF-SPI-02D3 BALF-SP2-01D3 BALF-SP2-02D3	SPSGRF (868 and 915 MHz) SPSGRFC (433, 868 and 915 MHz)

Typical configuration



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MAIN EVALUATION BOARDS



EVLHLED815W10A
10 W, buck-boost LED driver



STEVAL-ILL082V1/
STEVAL-ILL083V1
Smart home lighting based on
HVLED815PF and SPSGRF
(STEVAL-ILL082V1) and
SPBTLE-RF (STEVAL-ILL083V1)

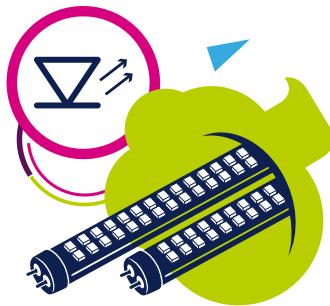


EVALHLED815W15
15 W, flyback LED driver



Commercial lighting

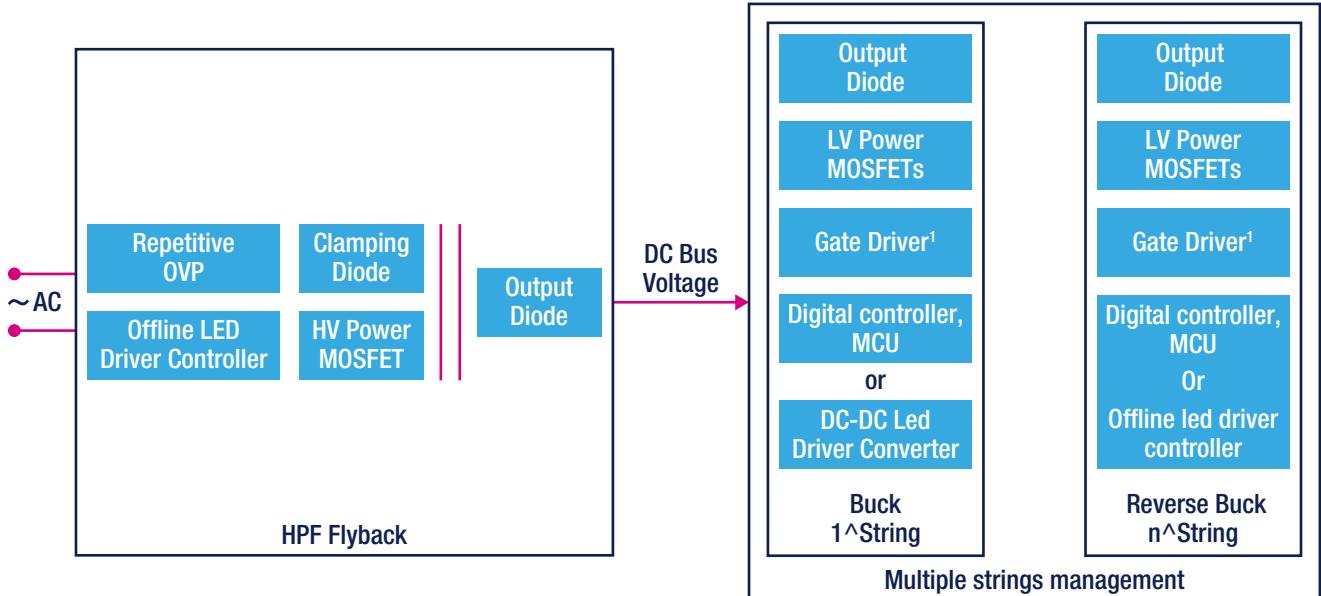
Commercial lighting applications usually require more than 20 W, a high power factor, high level of efficiency, cost-saving solution and the possibility of using more than one LED string with remote monitoring. The multiple strings power supply architecture consists of a main power supply (usually a flyback) providing a constant bus voltage and subsequent multiple strings. ST's offline LED controller HVLED001A (for flyback) with constant-voltage primary-side regulation (PSR-CV) is available for the main SMPS. Multiple strings can be managed using analog or digital means. High power-density DC-DC LED driver buck converters (LED2000, LED2001, LED5000 and LED6000) or the new HVLED002 controller for reverse buck, are used for an analog implementation. To digitally manage multiple strings stage (reverse buck), ST offers STLUX, a new series of dedicated digital lighting controllers as well as STM32 high-performance microcontrollers. ST's high-voltage MDmesh™ K5 MOSFETs series (suggested for flyback) and the low-voltage STripFET MOSFET series (used for reverse buck topologies) ensure all solutions are very efficient and reliable.



		Offline LED driver controller	Digital controllers, MCUs	Gate drivers	Power MOSFETs		Clamping diodes	Repetitive overvoltage protections	Output diodes	DC-DC LED driver converters
					HV	LV				
HPF Flyback		HVLED001A	-	-	ST*N80K5 ST*N90K5 ST*N95K5	-	STTH*06 STTH*08 STTH*10	STRVS*	FERD*100 STPS*150 STPS*170 STPS*200	-
Sepic			-	-	ST*N60M2 ST*N60DM2	-	-	-	LED2000 LED2001 LED5000 LED6000	-
Multiple strings mgmt	Buck	HVLED002	STLUX* STM32F334 STM32F301 STM32F0* STM8S*	L6395	-	ST*N6F7 ST*N10F7	-	-	FERD15S50B STPS*170AF STPS*4S200UF STPSxxZF STTHxxZF	LED2000 LED2001 LED5000 LED6000
	Reverse buck		TD35* PM8834 PM8841 PM8851	-	-		-			

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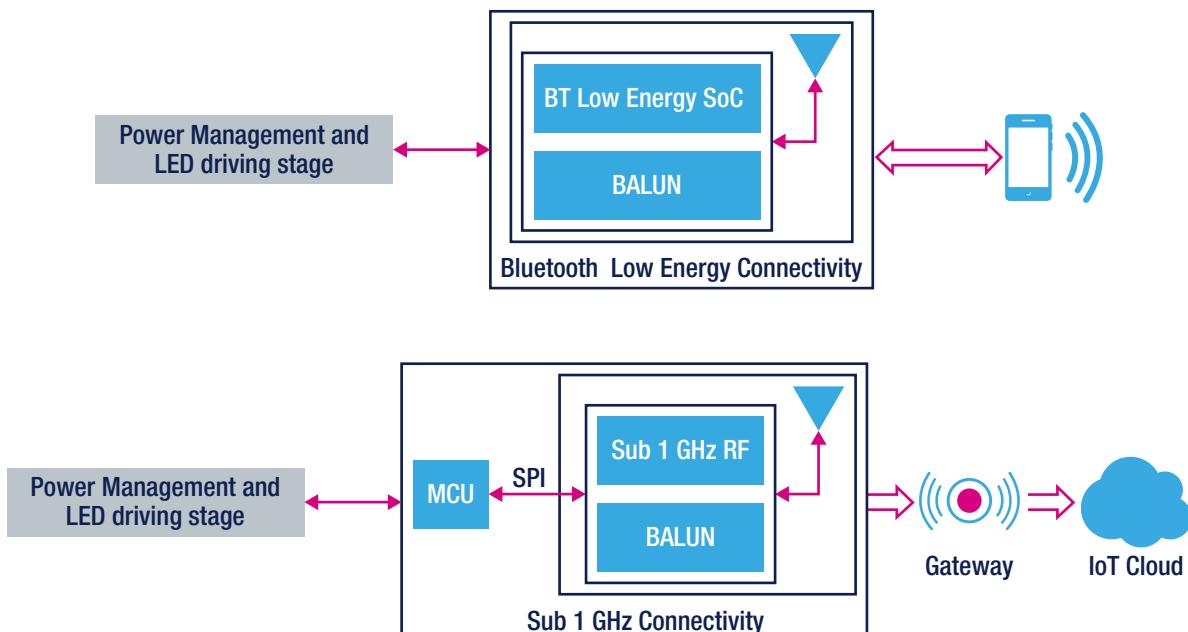
Typical configuration



ST offers products and solutions to enrich the LED lighting applications with wireless connectivity.

Wireless Connectivity				
	Chipset			Certified Module
	Connectivity IC	MCU	Balun	
Bluetooth Low Energy Connectivity	BlueNRG-1	-	BALF-NRG-02D3	SPBTLE-1S
	BlueNRG-MS	STM32F0* STM32L0*		SPBTLE-RF SPBTLE-RFO
Sub 1 GHz Connectivity	SPIRIT1 S2-LP	STM32F0* STM32L0*	BALF-SPI-01D3 BALF-SPI-02D3 BALF-SP2-01D3 BALF-SP2-02D3	SPSGRF (868 and 915 MHz) SPSGRFC (433, 868 and 915 MHz)

Typical configuration



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MAIN EVALUATION BOARDS



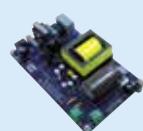
STEVAL-ILL080V1

18 W Tube replacement zero ripple LED driver using HVLED001A



STEVAL-ILL069V2

35 W, analog power supply (CV_{out}) for LED driving



STEVAL-ILL070V4¹

35 W, analog power supply (CC/CV) for single string led driver



STEVAL-ILL077V1

60 W, digital multiple-string LED driver



STEVAL-ILL051V2

18 V-3 A, buck LED driver converter



STEVAL-ILL054V2

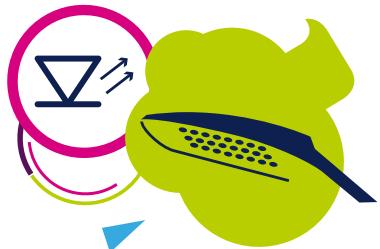
18 V-4 A, buck LED driver converter

Street lighting

Energy efficiency, long lifetime, remote control, small form factor and extended temperature range (-40 °C) are the main requirements for the LED street lighting market. For single string, it is possible to implement the primary side regulation (PSR-CC) control technique using a digital approach with a PFC regulator followed by a HB-LC resonant stage.

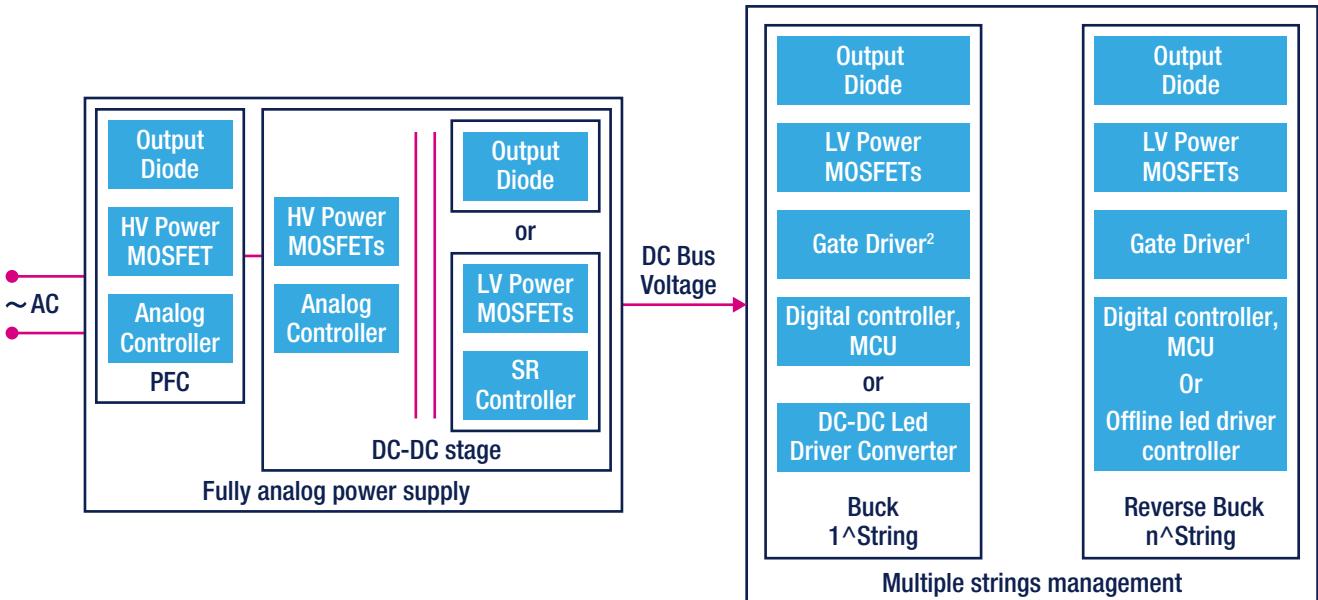
The multiple strings power supply architecture consists of a main power supply providing a constant bus voltage and a subsequent multiple strings. Usually the main power stage, consisting of a high power factor (HPF) flyback converter or a power factor correction (PFC) controller combined with an LLC resonant converter, provides the constant voltage bus.

The subsequent LED strings control is implemented by multiple buck or reverse buck converters. ST offers analog and digital solutions to cover both stages (power and LED control).



		Analog controllers	Digital controllers, MCUs	Gate drivers	Power MOSFETs		Clamping diodes	Repetitive overvoltage protections	Output diodes	DC-DC LED driver converters	DC-DC Conv.					
HPF Flyback	PSR-CV	HVLED001A	-	-	HV	LV										
HPF Flyback	PSR-CV	HVLED001A	-	-	ST*N80K5 ST*N90K5 ST*N95K5	-	STTH*06 STTH*08 STTH*10	STRVS*	STPS* FERD* STTH*	-	-					
PFC Boost	CCM	L4981* L4984D		TD35* PM8841 PM8851 STLUX* STM32F0* STM32F301 STM32F334	ST*N60M2 ST*N65M2 ST*N60M2-EP L638* L639* L649* PM8834	-	-	-	STTH*R06 STTH*T06 STPSC*065 (SiC Diodes)	-	-					
		L6562A* L6563* L6564*							STTH*L06 STTH*06 STTH15AC06*							
	HB-LLC	L6599A* L6699	STM32F0* STM32F301 STM32F334						STPS* FERD30M45D FERD40U50CPP	L698* ST1S14 L7985 L7986 L7987*	-					
	HB-LC	-							-							
Sync rect.		SRK2000A SRK2001		L6395 TD35* PM8834 PM8841 PM8851	ST*N50DM2 ST*N60DM2 ST*N60M2 ST*N65DM2 STL*NS3LLH7 ST*N4LF7' ST*N6F7 ST*N10F7 ST*NF20D	-	-	-	LED5000 LED6000 STPS* FERD* STTH* (≥200 V series)	L698* ST1S14 L7985 L7986 L7987*	-					
Multiple strings mgmt	Buck	-														
	Reverse buck	HVLED002														

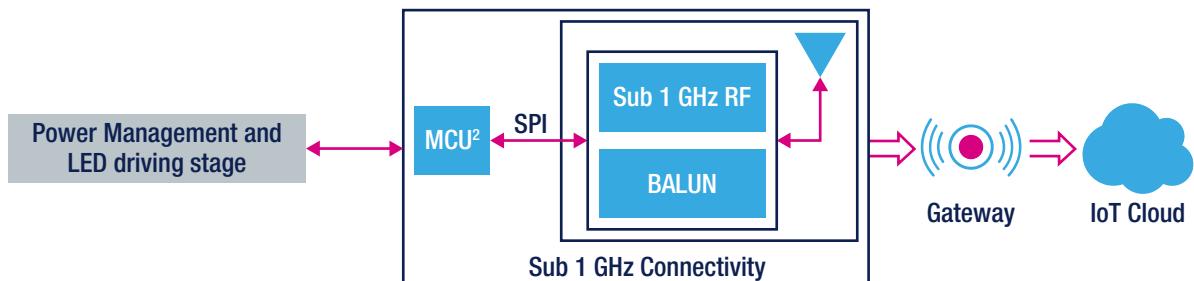
Typical configuration



In regard to analog solutions, ST's has a wide offer. The new flyback offline LED controllers (HVLED001A) with constant-voltage primary-side regulation (PSR-CV) does not need an opto-coupler and voltage reference in the circuit (lower costs).The new STCMB1 smart offline combo controller for PFC and HB-LLC resonant circuits, the new HVLED002 led driver controller for reverse buck, and the dedicated high-voltage/high-current DC-DC LED driver converters (LED5000 and LED6000) for LED strings management ensure easy and efficient analog solutions. For high-efficiency and flexible digital solutions, ST offers STLUX, a new series of dedicated digital lighting controllers, along with high-performance STM32 microcontrollers to manage both power and LED driving (reverse buck) stages. The new high-voltage MDmesh™ MOSFETs series (suggested for flyback, PFC and LLC stages), the low-voltage STripFET MOSFETs series (used in reverse buck topologies) and the SiC diodes (STPSC*) make sure that solutions are very efficient and reliable.

Wireless Connectivity				
	Chipset			Certified Module
	Connectivity IC	MCU	Balun	
Sub 1 GHz Connectivity	SPIRIT1 S2-LP	STM32F0* STM32L0*	BALF-SPI-01D3 BALF-SPI-02D3 BALF-SP2-01D3 BALF-SP2-02D3	SPSGRF (868 and 915 MHz) SPSGRFC (433, 868 and 915 MHz)

Typical configuration



MAIN EVALUATION BOARDS



STEVAL-ILL066V2³
100 W, digital single-string PSR-CC LED driver



STEVAL-ILL053V1
130 W, analog power supply (CV_{out}) for LED driving



STEVAL-ILL074V1/V2
60 W, analog power supply (CV_{out}) for LED driving



STEVAL-ILL077V1
60 W, digital multiple-string LED driver



STEVAL-ILL056V1
48 V-3 A, buck LED driver converter



STEVAL-ILL078V1
60 V-1 A, buck LED driver converter



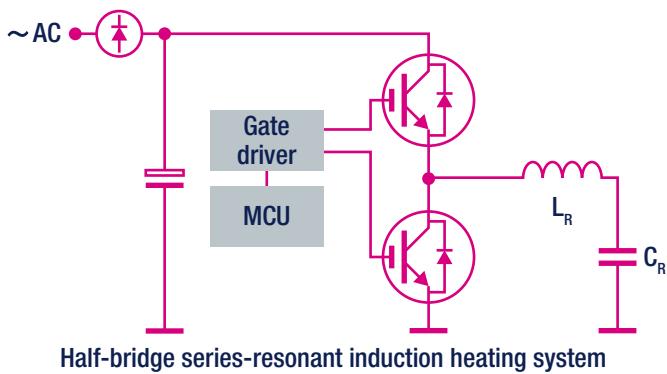
Induction heating

The induction heating market demands cost-effective, energy-efficient and reliable solutions. Resonant-switching topologies, based on voltage or current resonance, are the most adopted and can be managed using high-performing STM32 microcontrollers. To best meet these requirements and fit the selected topologies, ST has developed the dedicated IH (1250 V) and HB (650 V) series of trench-gate field-stop IGBTs and we are about to introduce a new 650 V IH series and a 1350 V series. Complementary new STDRIVE gate drivers family (L639*, L649*) improves the reliability (robustness and noise immunity) of the application. Depending on your needs, new 8/16 channels LED array drivers allow to have an user-friendly human interface. ST's complete offer is given in the following table.

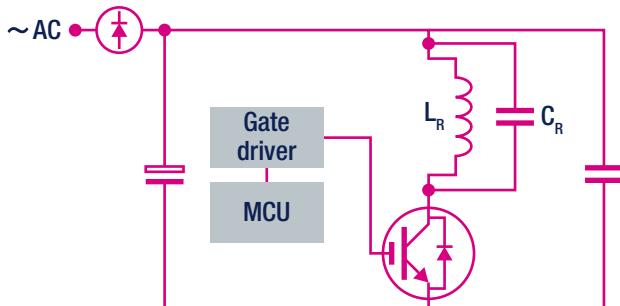


	MCUs	Gate drivers	IGBTs	LED array drivers
Single-switch quasi-resonant (voltage resonance)	STM8* STM32F100	TD35* PM8841 PM8851	STG*IH125DF STG*IH135DLF2 ¹	-
HB series resonant (current resonance)	STM32F0* STM32F100	L638* L639* L649* STGAP2S/2D	STG*H65DFB STG*H60DLFB STG*IH65DF ¹	-
User interface (front panel)	STM8* STM32F0* STM32F4*9 STM32F7*	-	-	STP08 STP16* LED1642GW

Topology example



Half-bridge series-resonant induction heating system



Single-switch quasi-resonant induction heating system

RENEWABLE ENERGY & HARVESTING

Photovoltaic (centralized)

Centralized photovoltaic (PV) energy solutions use a central inverter architecture characterized by a single central inverter (where the entire DC output of a PV array is transformed and connected to the AC grid) and, at the panel level, by a junction box that provides only the bypass function and helps prevent localized hotspots. For the junction box, ST offers the new FERD diodes with a very low forward voltage and a low leakage reverse current.

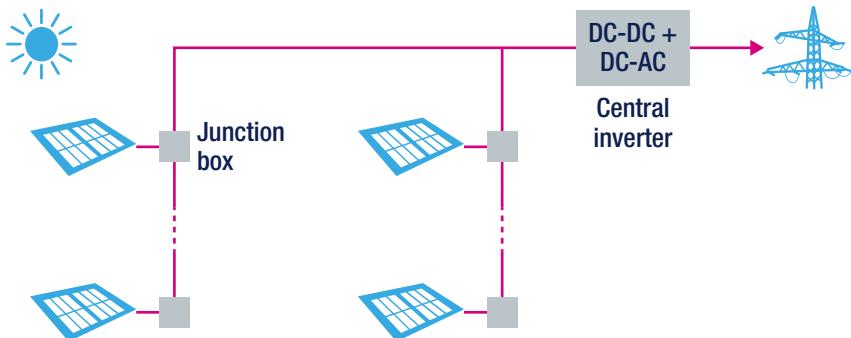
By integrating high-performance STM32 microcontrollers, the new high-efficiency SiC MOSFETs (SCT*N120), the new trench-gate field-stop IGBTs series, the SiC diodes (STPSC*) and the new STGAP series galvanically-isolated gate drivers, it's possible to guarantee a high-efficiency central inverter implementation.

High- and low-voltage DC-DC converters guarantee high power density for the post-regulation stages. Due to their low per watt costs and the simplicity of design, central inverters are the power conversion systems of choice for large PV power plants.



			MCUs	Gate drivers	HV power MOSFETs	IGBTs	Diodes	Bypass Diodes	DC-DC converters	
									HV	LV
Junction box			-	-	-	-	-	STPS*30 STPS*45 FERD30M45D	-	-
Central inverter	DC-DC stage	FB-PS	STM32F1* STM32F2* STM32F3* STM32F4* STM32F7*	L638* L639* L649* STGAP1AS STGAP2S/2D	ST*60DM2 ST*65DM2 SCT*N120	STTH*06 STTH*12 STPSC*065 STPSC*12 (SiC Diodes)	STTH*R06	L6985F L6986 L597* L7985 L7986 L7987*	ST1S4* ST1S50 L598*	
	DC-AC stage	FB mix freq								
		3-Level HB								

Typical configuration



Centralized approach for a solar energy solution

Photovoltaic (distributed)

A distributed photovoltaic (PV) energy architecture converts power using an embedded maximum power point tracking (MPPT) mechanism at the PV panel level. A partially distributed approach integrates a power optimizer (a DC-DC converter with MPPT and communication capabilities) and a central inverter for the DC-AC conversion and grid connection. In regards to the power optimizer, the bypass function is covered by ST with the new FERD diodes featuring a very low forward voltage and low leakage reverse current. The new high-efficiency SiC MOSFETs (SCT*N120) and the new trench-gate field-stop IGBTs series, guarantee a high-efficiency DC-AC central inverter.

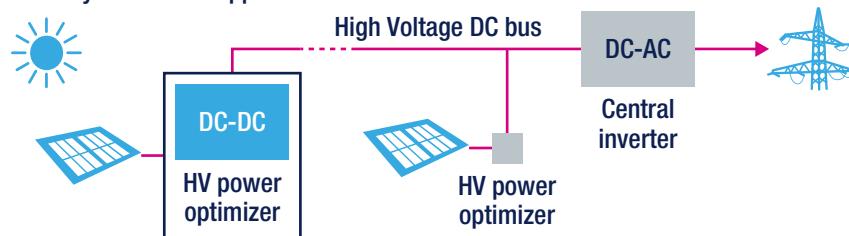
The fully distributed approach integrates, at the PV panel level, a microinverter that includes a complete converter (DC-DC with MPPT as well as DC-AC) and manages the AC grid connection. The high-performing STM32 microcontrollers, the new high-efficiency high-voltage MDmesh™ MOSFET series, the new low-voltage STripFET MOSFET series and the SiC diodes (STPSC*) guarantee a high-efficiency converter while the new STGAP series galvanically-isolated gate drivers offer high safety and reliability. High- and low-voltage DC-DC converters guarantee high power density for the post-regulation stages.



			MCUs	Gate drivers	Power MOSFETs		IGBTs	Diodes	Bypass Diode	DC-DC converters	
Power optimizer	DC-DC stage	Isolated FB boost			HV	LV				HV	LV
Power optimizer	DC-DC stage	Isolated FB boost	STM32F103 STM32F3* STM32F4*	L638* L639* L649*	-	STH*N10F7 STH*N6F7	-	STTH*R06 STTH80S06W	STPS*30 STPS*45 FERD*45	-	-
Central inverter	DC-AC stage	FB mix freq	STM32F103 STM32F2* STM32F3* STM32F4* STM32F7*	SCT*N120 (SiC MOSFET) STGAP1AS STGAP2S/2D	-	-	STG*H65DFB	STTH*R06 STTH*06	-	L6985F L6986 L597* L7985 L7986 L7987*	ST1S4* ST1S50 L598*
		3-level HB	STM32F103 STM32F3* STM32F4* STM32F7*				STG*H120DF2				
Micro inverter	DC-DC Interl. Boost		TD35* PM8834 PM8841 PM8851		-	STH*N10F3 STH*N8F7 ST*160N75F3	-	STPSC*065 STPSC*12 (SiC Diodes)	-	ST1S4* ST1S50 L598*	-
	DC-AC FB mix freq.		STM32F103 STM32F3* STM32F4*	L638* L639* L649* STGAP1AS STGAP2S/2D	STB*N65M5	-					

Typical configurations

Partially distributed approach



Fully distributed approach



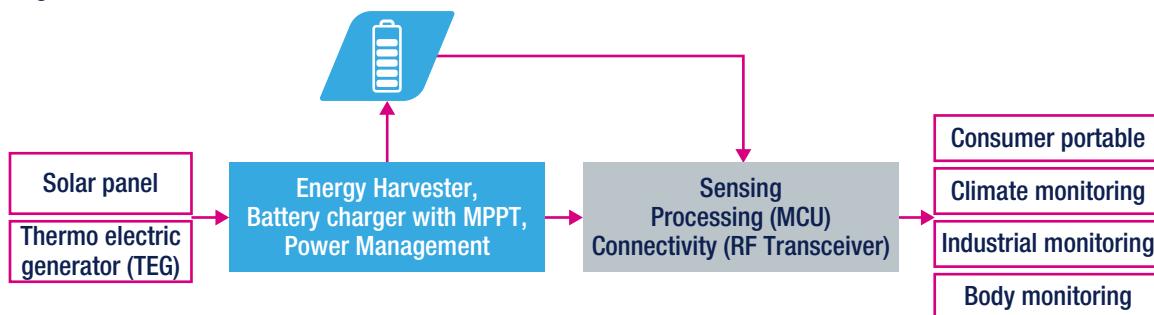
Solar – Thermo electric generator (TEG)

Today's Internet of Things (IoT) is based on the exchange of data among remote sensing units and nodes, often in a large number and located in very inaccessible places, necessitating energy-wise and fully autonomous devices to guarantee service continuity and very low maintenance cost. Also consumer portable applications (smartphone, camera, fitness, etc) need more and more continuous autonomous energy sources. This means using a battery charger powered by a harvested or renewable energy source with high conversion efficiency and its proper battery charging management. To meet this demand, ST offers dedicated products like the SPV1040 high-efficiency low-power solar constant-voltage (CV) battery charger with MPPT for outdoor, and the SPV1050 ultra low power solar and TEG energy-harvesting charger for any battery type and supercapacitor in indoor environments with embedded MPPT and LDOs. These requirements involve not only the electronics but also reliable, good-quality Li-Ion batteries. ST also provides ultra-thin, fast recharging Li-Ion batteries with a long cycle life and low capacity loss, making them suitable for renewable energy and harvesting applications. The ST devices best suited for each of the most common topologies are listed in the following table.



			Battery Charger with MPPT	Battery Charger	Thin-film batteries	Linear voltage regulators
PV	400 mW to 3 W	Boost	SPV1040	-	-	STLQ015 STLQ020 ST715 LD39130S
PV and TEG	Up to 400 mW	Boost & Buck-Boost	SPV1050	STBC15 ¹	EFL700A39	

Typical configuration



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MAIN EVALUATION BOARDS



STEVAL-GPT001V1²
Solar Rechargeable Smart Watch with SPV1050



STEVAL-IDS002V1
Autonomous wireless multisensor node powered by PV cells



STEVAL-IDS003V1³
Autonomous wireless multisensor node powered by TEG

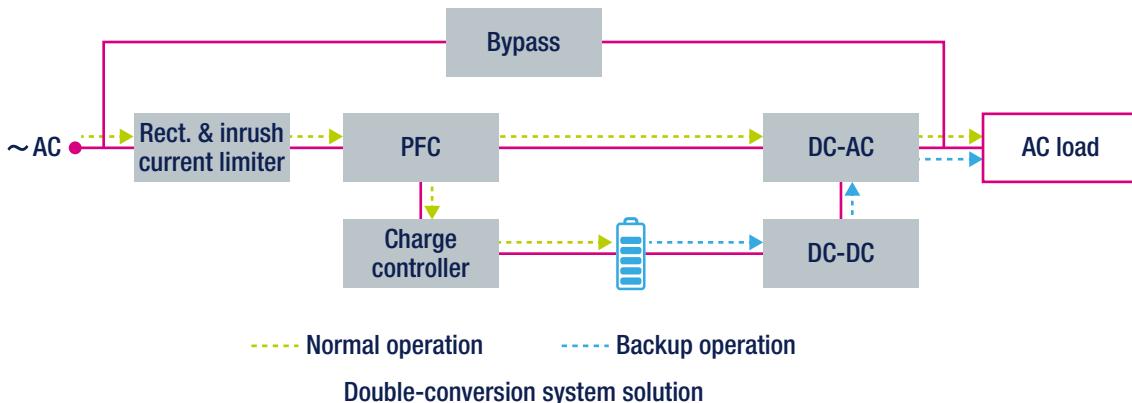
UNINTERRUPTABLE POWER SUPPLIES (UPS)

Today the vast increase of sensitive loads due to the explosion in digital technology requires a high-quality supply of electrical power. In addition to its primary function of ensuring the continuity of service, an uninterruptable power supply (UPS) improves the quality of the voltage supplied to the load (computer, industrial processes, instrumentation, telecommunication, etc.). The double-conversion configuration usually is used for high-end applications in particular for medium- or high-power UPSs; offline systems are adopted for low power applications. Each stage of these configurations (PFC, charge controller, etc.) is supported by ST's portfolio. SiC diodes (STPSC*), new high-voltage MDmesh™ MOSFETs (M2, DM2, M5 series), new low-voltage STripFET™ MOSFETs (F6, F7 series), trench-gate field-stop IGBTs, SiC MOSFETs (SCT*N120), new STGAP series galvanically-isolated gate drivers and high-performance STM32 microcontrollers guarantee high reliability and efficiency.



		MCUs and Digital Controllers	Gate drivers	IGBTs	Power MOSFETs		Diodes	SCRs	Triacs	Linear voltage regulators	DC-DC Conv.		
					HV	LV							
Rect. & inrush current limiter							STBR3012 STBR6012	TN4015H-6 TN5015H-6 TM8050H-8 TN3050H-12Y TN5050H-12Y		-			
								T1635T					
PFC Boost		STNRGP01 STM32F4* STM32F7*	PM8834 PM8841 PM8851		ST*N60M2 ST*N65M2 ST*N65M5		STTH*T06 STTH*R06 STTH*S12 STPSC* (SiC Diodes)						
Charge controller	HB												
DC-DC stage	Push Pull	STM32F4* STM32F7*	PM8834 PM8841 PM8851 STGAP1AS STGAP2S/2D	L638* L639* L649* STG*H65DFB STG*V60DF	ST*N50DM2 ST*N60DM2 ST*N60M2		STTH*06 STTH*12 STPSC* (SiC Diodes)			LDF LDFM LDK220 LDK320 LDK715 LDL212	L698* ST1S14 L7985 L7986 L7987*		
DC-AC stage	NPC												
	FB					SCT*N120 STG*H65DFB STG*H120DF2	ST*N6F7 ST*N8F7 ST*N10F7 STP*N3LL			LDF LDFM LDK220 LDK320 LDK715 LDL212	L698* ST1S14 L7985 L7986 L7987*		
Bypass							T2550-12 TPDV* TN5050H-12WY TYN6* TYN8* TYN10* TYN12*						

Example of high-end configuration

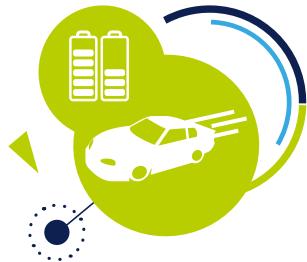


Note: * is used as a wildcard character for related part number

e-MOBILITY

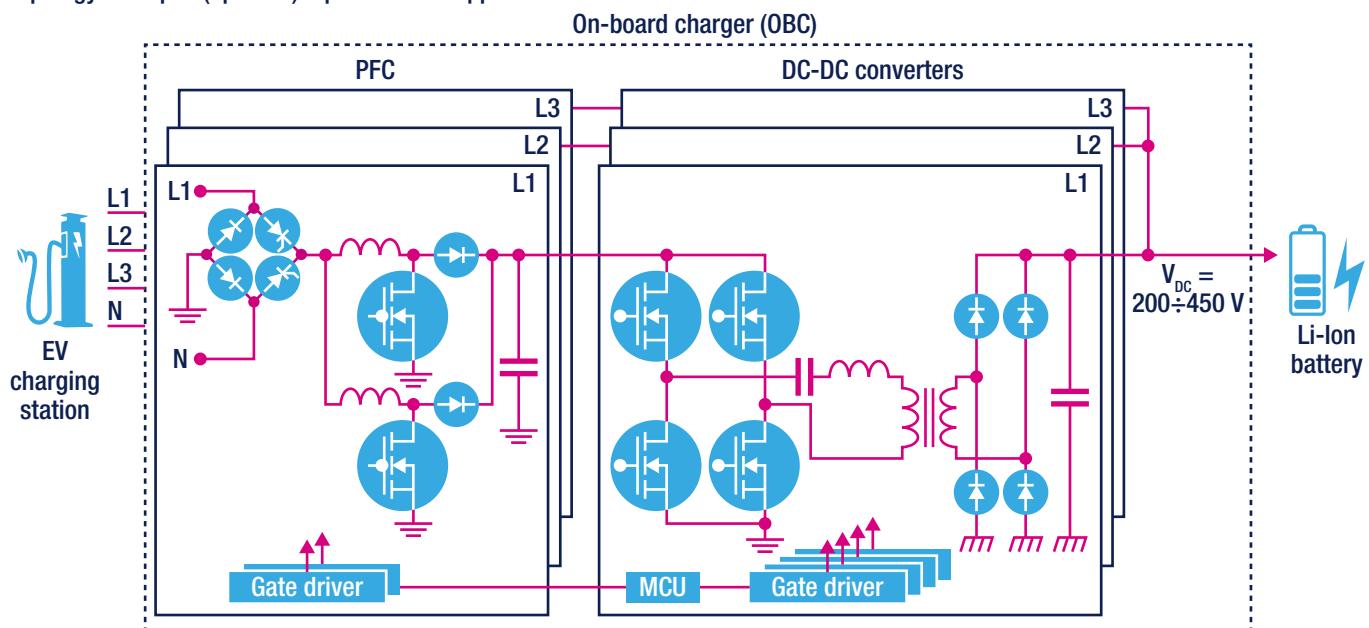
On-board chargers

One of the key element of electric (EV) or plug-in hybrid (HEV) vehicles is the traction high voltage battery (200 V_{DC} - 450 V_{DC}). In the car the on-board charger (OBC) allows the charging of the battery from home AC mains plug or private/public outlets (AC charging station). Typical AC power charging level goes from 3.6 kW (single phase) to 22 kW (three phase). In case of 3ph+N input, a modular approach based on 3 modules PFC+DC-DC (one for each phase) with the common output, can be implemented. With this approach every module can be managed like a single phase module allowing an easy system implementation, a more system reliability and an higher system efficiency. ST is able to offer a complete product portfolio including silicon and SiC power MOSFETs, silicon and SiC diodes, protections, gate drivers, and microcontrollers, in accordance to AEC-Q100 and AEC-Q101 standards.



		HV Input rectification and LF path devices		MCUs	Gate Drivers	HV Power MOSFETs		HV output diodes	Bypass diodes	Protections
		Diodes	SCRs ²			Silicon	SiC			
PFC	Interleaved boost	STTH16L06C-Y STTH30L06-Y STBR*012-Y	TN3050H-12Y	SPC58 E Line N Line ³	STGAP1AS	STB43N65M5 STW62N65M5 STW78N65M5	SCTH35N65G2V-7AG ¹	STPSC12065-Y STPSC20065-Y STPSC40065C-Y STPSC12065-Y STPSC20065-Y STPSC20H065C-Y STPSC40065C-Y	STTH30L06-Y STBR*012-Y	SM4TY
	Semi-bridgeless	STBR*012-Y	-			-				
	Totem pole	STTH30L06-Y STBR*012-Y	TN3050H-12WY TN5050H-12WY		SPC57 K Line	-				
	Vienna original (3-Phase)	-	-			STW62N65M5 STW78N65M5		STPSC10H12-Y STPSC15H12-Y STPSC20H12-Y		
	Vienna modified (3-phase)	STTH30L06-Y STBR*012-Y	TN3050H-12WY TN5050H-12WY			STW45N60DM2AG STW58N60DM2AG STW72N60DM2AG STWA50N65DM2AG ¹ STWA58N65DM2AG ¹ STWA65N65DM2AG ¹		STPSC12065-Y STPSC20065-Y STPSC20H065C-Y STPSC40065C-Y STTH30ST06-Y		
DC-DC stage	FB-PS	-	-	A6387 STGAP1AS	STW45N60DM2AG STW58N60DM2AG STW72N60DM2AG STWA50N65DM2AG ¹ STWA58N65DM2AG ¹ STWA65N65DM2AG ¹	-	STPSC10H12-Y STPSC15H12-Y STPSC20H12-Y STTH15RQ06-Y STTH30RQ06-Y STPSC12065-Y STPSC12H065-Y STPSC20065WY STPSC20H065CWY	SM4TY SM6TY SM30TY	SM4TY SM6TY SM30TY	
	FB-LCC	-	-							
	3-Level HB LLC	-	-							

Topology example: (3ph + N) input modular approach



Note 1: samples available on request

2: SCR option to replace relay for inrush current limit

3: available in Q1-2018

* is used as a wildcard character for related part number

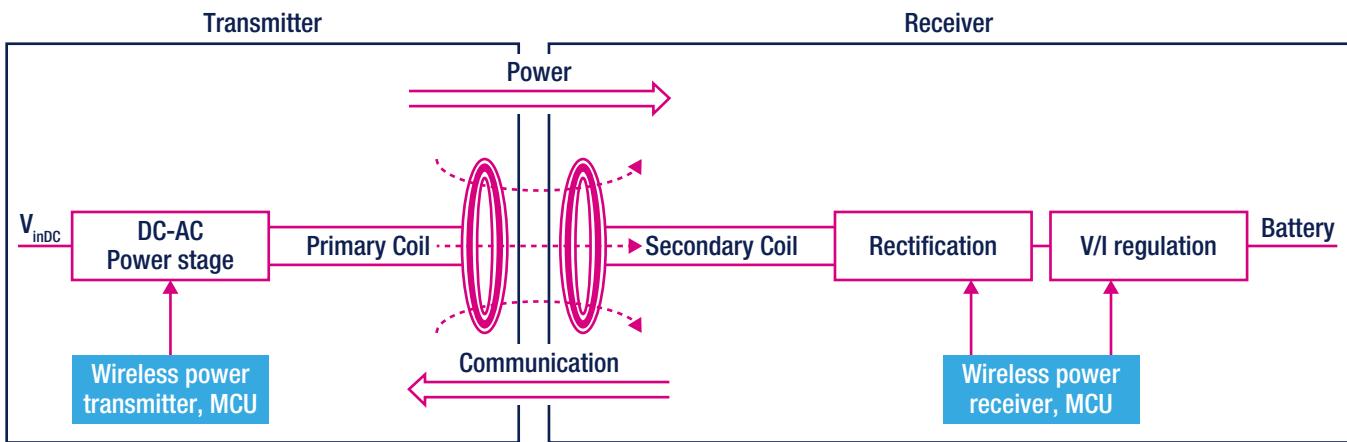
WIRELESS CHARGING

In the coming years, wireless charging applications will become more and more common for a wide range of applications starting with today's smartphone charging. ST already offers dedicated and general-purpose wireless ICs for Transmitter (Tx) and Receiver (Rx) side able to support Qi/PMA and AirFuel market standard and the main topologies: STWBC-WA (Tx) and STWLCO4 (Rx) for wearables, STWBC (5 W Tx), STWBC-EP (15 W Tx) and STWLCO3 (5 W Rx), STWLCO3 (15 W Rx) for the other mobile applications. The use of new low-voltage STripFET MOSFETs guarantees high-efficiency converters. To reduce the time to market, a complete wireless kit (Tx + Rx) for wearables and a general-purpose wireless evaluation boards are available.



			Wireless charging ICs, MCUs	Gate drivers	Power MOSFETs	Protections	Diodes
Transmitter	DC-AC stage	HB	STWBC STWBC-WA STWBC-EP STM32F0*	L6747*	STL*NS3LLH7 ST*N2VH5 ST*P2UH7 STL8DN10LF3 STL6N3LLH6 STL10N3LLH5	-	STPSxx45/60/100 FERDxx45/60/100
		FB					
Receiver	Rectification		STWLCO3 STWLCO4 STWLCO3 STM32F0*	-	-	SMM4F SMA6J*	BAT30F4 BAR46
	Voltage/Current regulation						

Typical configuration

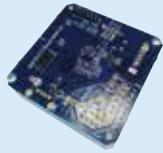


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MAIN EVALUATION BOARDS



STEVAL-ISB027V1
Qi A11 Wireless charger transmitter based on STWBC



STEVAL-ISB036V1
Wireless charger receiver based on STWLCO3



STEVAL-ISB042V1¹
Wireless Charger TRX:
Qi 15 W/Airfuel inductive 5 W dual mode receiver and Qi based 3 W transmitter with STWLCO3



STEVAL-ISB044V1
Qi 15W Wireless Charger transmitter based on STWBC-EP



STEVAL-ISB038V1
Wireless charging reference design kit for wearables based on STWBC-WA and STWLCO4





Software tools

eDesignSuite

eDesignSuite is an easy-to-use, comprehensive software suite ready to help customers define their needs by transforming their application requirements into satisfactory solutions based on the wide range of ST products. The suite includes a smart simulator and system design engine able to suggest products and topologies for various types of applications (power supply, photovoltaic, battery charger, LED lighting, signal conditioning and RF design); smart selectors to help select the types of products (e.g. diodes) best suited to your application; and configurators to reduce implementation time and efforts for setting product parameters for the specific application (e.g. STILUX & STNRG SMEDs for lighting and power, Workbench for motor control). To discover and test all the features of eDesignSuite, you can visit (after the online registration) [https://my.st.com/analogsimulator/](https://my.st.com/anologsimulator/)

eDesignSuite The smart way to design your application



SMART SIMULATOR AND SYSTEM DESIGN ENGINE

Power conversion and LED lighting

- Automatic proposal for complete solution or fully customizable design
- Fully annotated and interactive schematics
- Complete and interactive bill of materials
- Set of analysis diagrams (main current and voltage simulations, efficiency curves, Bode stability and power-loss data)
- Fully interactive transformer design
- New iPFC design based on STNRGPF01 digital controller, including C code generation

SMART SELECTOR

Diodes

- Part numbers proposed based on application electrical specifications
- I-V curves comparison among several part numbers
- Power losses calculated based on voltage/current target application waveforms

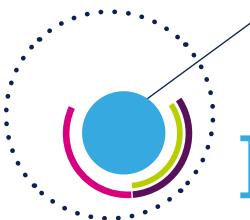


Smart simulator and system design engine view

CONFIGURATORS

STILUX & STNRG SMEDs configurator

- SMED configurator schemes
- Input configuration
- Clock, comparators and ADC settings
- FSM (finite state machine) configuration
- C code generation
- Load register setting on board in a click



Products

AC-DC CONVERSION ICs

High-voltage converters

ST's **high-voltage AC-DC converters** combine an advanced pulse width modulation (PWM) controller with a high-voltage power MOSFET in a single package. This makes them ideally suited for offline switch mode power supplies (SMPS) with output power spanning from a few to a few tens of watts.

The **VIPerPlus series** (VIPerOP and VIPer*1, VIPer*5, VIPer*6, VIPer*7, VIPer*8 families) features an 800 V avalanche-rugged power MOSFET and leading-edge PWM controller and consumes less than 4 mW for VIPerOP, 10 mW for VIPer*1 and 30 mW in standby for the others. It also comes with the largest choice of protection schemes and supports different topologies.

The Altair series has a built-in 800/900 V avalanche-rugged power MOSFET and a PWM controller specifically designed to work in constant-current/constant-voltage primary-side regulation (PSR-CC/CV). It means opto-less implementation, thus significantly reducing component count.



VIPerPLUS & ALTAIR
PWM controller +
HV power MOSFET
in the same package

- Increased robustness using 800 V AR MOSFET
- Extremely low consumption
- Better integration and minimal BoM
- Flexible and easy to use
- Flyback topology supported
- Regulation with optocoupler using all ICs
- PSR-CV using VIPerOP, VIPer*1 and VIPer*6
- PSR-CV/CC and tight tolerance using ALTAIR*
- Buck & buck-boost topologies supported by VIPerOP, VIPer*1 and VIPer*6

Different features for different controllers	VIPerOP Zero-Power Mode	VIPerOP
	VIPer series 1 Low VCC voltage	VIPer01
	VIPer series 5 Quasi-resonant	VIPer11 ¹
	VIPer series 6 Minimal BoM	VIPer25
	VIPer series 7 Brown-out	VIPer35
	VIPer series 8 Peak power	VIPer26
	Altair PSR CC/CV	VIPer27
		VIPer37
		VIPer28
		VIPer38
Altair04		Altair05

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Different MOSFET size for different output power capabilities

Fly-back Converter 85-265 Vac	4 W	6 W	8 W	12 W	15 W
Buck Converter	150 mA	200 mA	200 mA	350 mA	
Max R _{DSON} / I _{DLIM}	30 Ω/350 mA	24 Ω/400 mA	20 Ω/400 mA	14 Ω/700 mA	7 Ω/700 mA

V_{BVDSS} = 800 V, 900 V (ALTAIR05)

MAIN APPLICATIONS



Consumer
electronics



Factory
automation



Home
appliances



Lighting



Metering



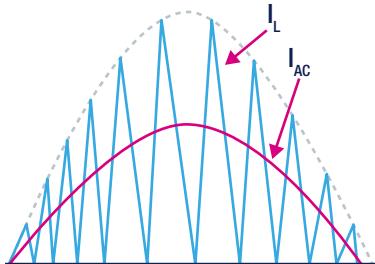
Home
automation

PFC controllers

ST power factor correction (PFC) controllers operate in transition mode (TM, suitable for $P \leq 250$ W) and continuous current mode (CCM, suitable for $P > 250$ W), and are suitable for a wide-range-mains operation.

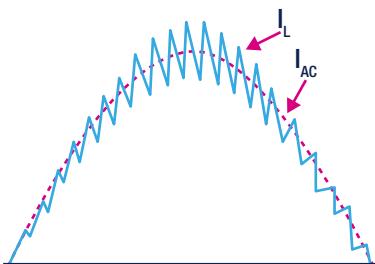
These devices embed advanced protection features, which make SMPS more robust and compact, requiring fewer external components. These features include output overvoltage, brown-out, feedback disconnection and boost inductor saturation protection. The high-voltage start-up capability, present in the L6564H and L6563H, helps improve the SMPS standby efficiency in systems that do not include an auxiliary power supply.

TM PFC controllers



	Basic features	Advanced protections	Remote on/off control	Tracking boost function	Interface for cascaded converter
L6562A*	●				
L6564*	●	●	●		
L6563*	●	●	●	●	●

CCM PFC controllers



L4984D	Line-modulated, fixed-off-time (LM-FOT) control
L4981A	Fixed frequency, average-current mode
L4981B	Line modulated frequency, average-current mode

MAIN APPLICATIONS



Adapters and TVs
L6562A*, L6563*, L6564*



Commercial and street lighting
L6562A*, L6563*, L6564*, L4981*, L4984D



Desktop PCs and Server
L4981*, L4984D



PWM and resonant controllers

ST's portfolio of advanced controllers includes a variety of primary controllers intended to fit high-performance applications. Very high efficiency is achieved with single-ended topologies at a fixed switching frequency or with quasi-resonant operation; the new STCH02 offline constant-current primary-side regulation controller (PSR-CC) guarantees very low power consumption at no load condition. For high-power, high-current applications, ST offers controllers for half-bridge resonant and asymmetrical half-bridge topologies. The new STCMB1 combo controller including high-voltage start-up, Xcap discharge circuit, PFC and LLC resonant driving stages, guarantees high performance and high integration with a smaller pinout.

Flyback controllers

STCH02

- Offline quasi-resonant controller in SO-8 package
- Constant-current primary-side regulation mode (PSR-CC) or constant-voltage regulation with optocoupler
- Advanced burst mode operation (< 10 mW consumption @ no load)
- 650 V HV start up

L6566*

- Offline fixed-frequency or quasi-resonant controllers
- Suited for SMPS with PFC front-end (A version)
- Suited for SMPS with 3-phase mains (BH version)
- 700 V start up (A/B version), 840 V start up (BH version)

L6565

- Offline quasi-resonant controller
- Constant power vs mains change
- Ultra-low start-up current

Combo controller (PFC+LLC)

STCMB1

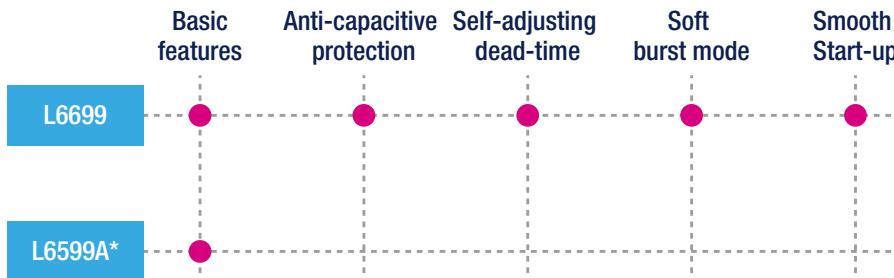
- 800 V start-up voltage
- Embedded X-cap discharge circuit
- Transition Mode (TM) PFC control method
- Self-adjusting dead-time and anticapacitive mode for LLC

Asymmetrical half-bridge controller

L6591

- PFC interface
- Brown out
- 700 V start-up voltage

HB-LLC resonant controllers



MAIN APPLICATIONS



Tablets and smartphones
L6565, L6566*, STCH02



Laptops
L6565, L6566*, STCH02,
STCMB1



High-power adapters and TVs
L6565, L6566*, L6599A*,
L6699, STCMB1



Desktop PCs, commercial
and street lighting
L6599A*, L6699, STCMB1

Synchronous rectification controllers

Synchronous rectifiers are used to drive power MOSFETs that replace the rectification diodes in the secondary side of SMPS, thus providing high efficiency especially in low-output-voltage, high-current power supplies.

The product portfolio supports the most common flyback, forward and LLC resonant topologies. The main benefits include high efficiency, space saving, cost reduction and high reliability.

SR controllers for Flyback

STSR30

- Possibility to operate in discontinuous mode
- Automatic turn-off for D<14%

SR controllers for Forward

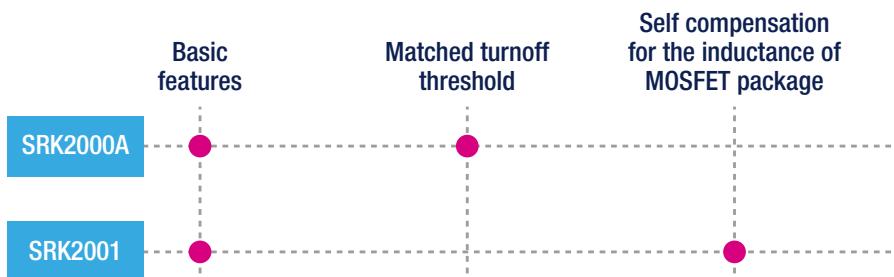
STSR2P*

- Possibility to operate in discontinuous mode
- Smart turn-off anticipation timing

SYNCHRONOUS RECTIFICATION BENEFITS

- Improved efficiency
- Better thermal performance
- High power density
- Increased reliability

SR controllers for LLC resonant



MAIN APPLICATIONS



High-power adapters and TVs
STSR30, STSR2P*

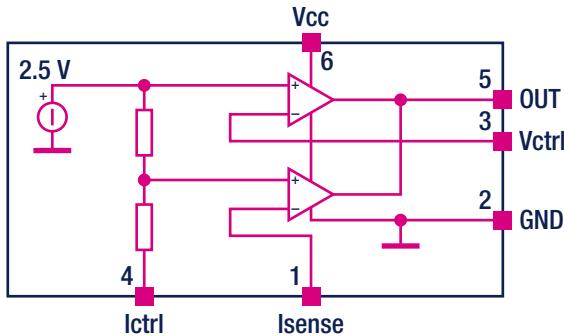


Desktop PCs and Server/Telecoms
SRK2000A, SRK2001

Voltage and current controllers

ST offers a wide range of highly-integrated voltage controllers for constant-voltage (CV), constant-current (CC) SMPS applications, such as adapters, battery chargers and LED pilot lamps. They enable a more robust design, safer SMPS, very low power dissipation and low stress for secondary-side components.

SEA05 internal block diagram



CC/CV controllers for chargers, adapters and others

SEA01

- Advanced CC/CV controller with online digital trimming
- 0.1% voltage reference precision up to 36 V_{cc}
- 200 µA low quiescent current

SEA05

- Advanced CC/CV controller (SEA05)
- Advanced CC/CV controller with efficient LED pilot lamp driver (SEA05L)
- 0.5% voltage reference precision up to 36 V_{cc}
- Low quiescent current: 200 µA (SEA05), 250 µA (SEA05L)
- Current sense threshold 50 mV (SEA05)
- 4% current loop precision (SEA05L)

SEA05L

TSM10*

- Compact solution
- Easy compensation
- 0.5 and 1% voltage reference precision

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MAIN APPLICATIONS



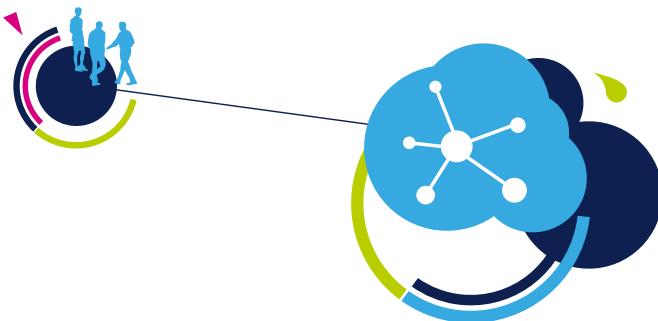
Adapters



Battery chargers



Residential, commercial
and street lighting

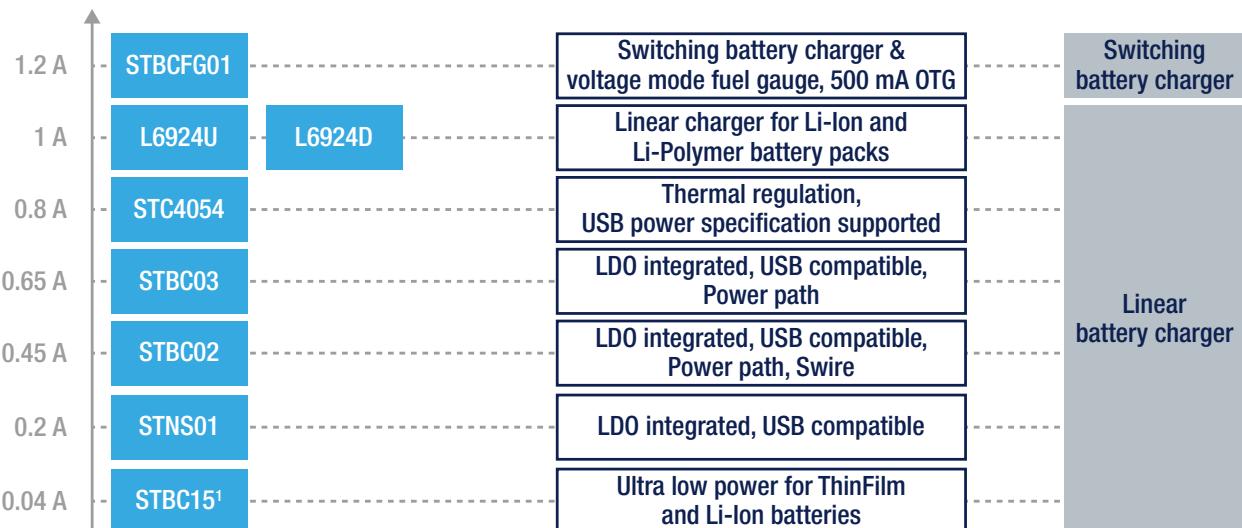


BATTERY MANAGEMENT ICs

Battery chargers and battery monitoring ICs

ST's **battery chargers** are specifically designed for the portable and mobile markets, and add value to new designs by minimizing power consumption and reducing the space on the PCB. These products offer charge currents from as little as 40 mA up to 1.2 A and can be used for any rechargeable lithium-ion and Li-Polymer battery. Using very simple topologies, some of these devices also feature a power-path function offering instant-on operation and thermal regulation according to the JEITA international standard.

Battery chargers



STBC02/ STBC03

- Embed a linear battery charger, a 150 mA LDO, 2 SPDT load switches and a protection circuit module
- STBC02 embeds a smart reset/watchdog and a single wire interface for IC control
- Use a CC/CV algorithm with programmable (only STBC02) fast charge, precharge and termination current

ST's **battery fuel gauge ICs** can be located in the battery pack or in the handheld device and integrate functions to monitor the battery voltage, current and temperature. Using a built-in Coulomb counter, these fuel gauge ICs calculate battery charge and store the data in 16-bit register resolution for retrieval by the system controller. Access is via an industry-standard I²C interface, enabling the controller to create an accurate graphical representation of the remaining battery-operating time.

STC3115

- OptimGaugeTM algorithm for STC3115
- OptimGauge+TM algorithm for SCT3117
- Coulomb counter and voltage gas gauge operations
- Programmable low battery alarm
- Internal temperature sensor

STC3117

FUEL GAUGE ICs MAIN BENEFITS

- 3 % accuracy of battery state of charge no need for shunt resistor
- Accurate estimation of battery state of charge at power-up
- Reliable battery swap detection
- SoH and impedance tracking with OptimGauge+ algorithm (ST IP)
- Charger enable and system reset control for accurate OCV reading
- Minimum form factor

MAIN APPLICATIONS



Bluetooth accessories
STC4054



USB
L6924U, STC4054, STBCFG01



Fitness
STNS01, STBC02, sSTBC03



Smartphones
STBCFG01, STC3115, SCT3117

Wireless charging ICs

ST fully covers wireless charging applications with dedicated ICs for both transmitter and receiver. The STWBC and STWBC-EP, compatible with Qi standard, and the STWBC-WA, dedicated to wearable applications, make-up ST's wireless power transmitters (Tx) family. The receiver family (Rx) consists of the STWLCO4 dedicated to wearable application, the STWLCO3, compliant with both Qi and PMA standards, which is suitable for smartphones, tablets, medical applications and the STWLCO33 which is new multi-mode Qi/AirFuel inductive wireless power Rx/Tx solution.

Wireless power transmitters

STWBC	STWBC-WA	STWBC-EP
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STWBC

- Supports applications up to 5 W
- Qi A11 certified

STWBC-WA

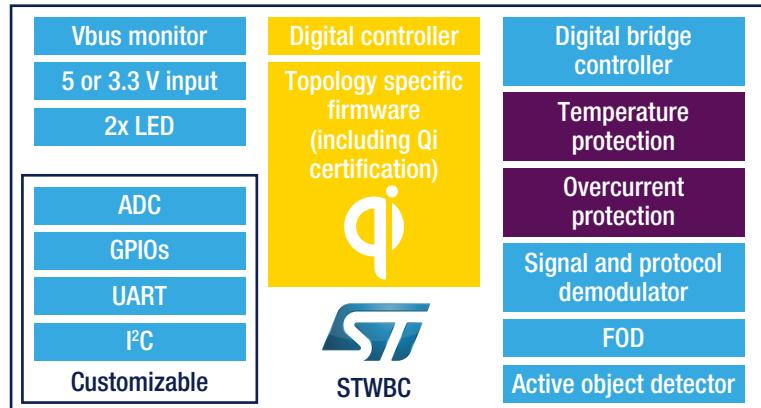
- Supports applications up to 2.5 W
- Wireless power transmitter dedicated to wearables

STWBC-EP

- Supports application up to 15 W
- Qi extended power certified

Common features

- Digital feedback with foreign object detection (FOD)



- Smart standby (best in class consumption)
- Firmware customization via API
- GUI for configuration and run-time analysis

Wireless power receivers

STWLCO3	STWLCO4	STWLCO33
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STWLCO3

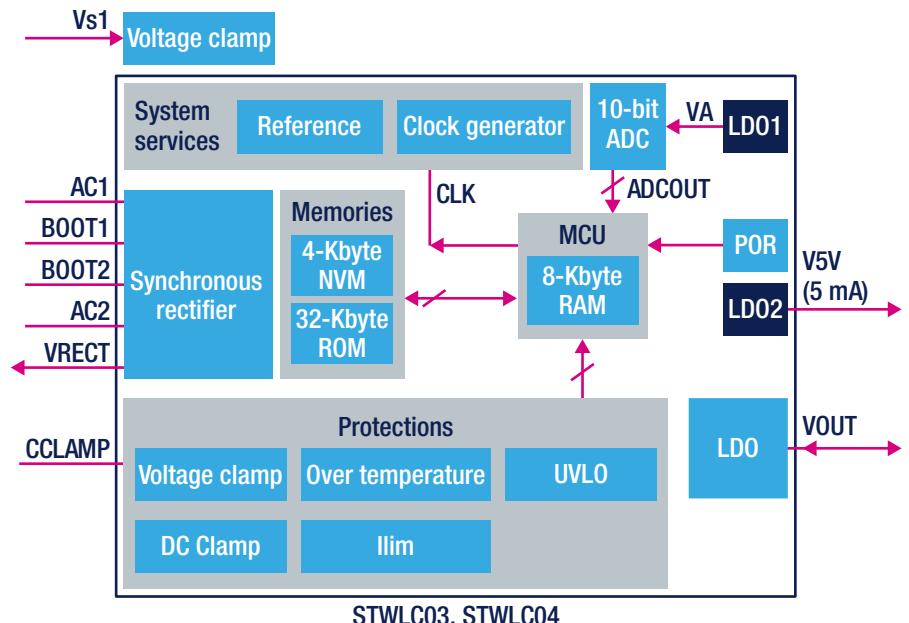
- Supports applications up to 7.5 W
- Multiple Qi and PMA standard compliant

STWLCO4

- Supports applications up to 1 W
- Wireless power receiver dedicated to wearables

STWLCO33

- Supports up to 15 W output power in RX mode and 5 W in TX mode
- Multiple Qi and Airfuel inductive standard compliant
- Outstanding total system efficiency
- Precise voltage and current measurements for FOD function



MAIN APPLICATIONS



Wireless battery
charger transmitters
STWBC, STWBC-EP



Medical & healthcare equipment
STWLCO3



Tablets and smartphones
STWLCO3, STWLCO33

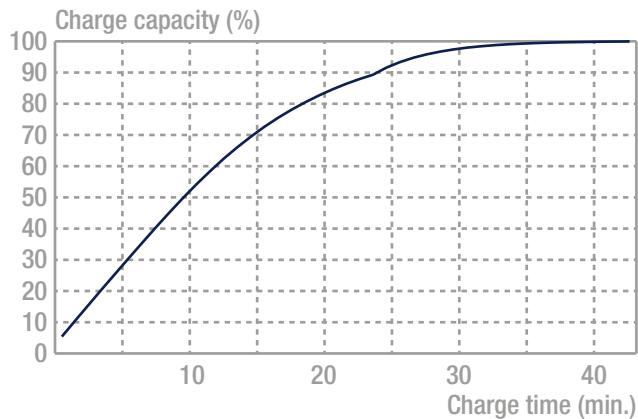


Wearables
Transmitter STWBC-WA
Receiver STWLCO4

Thin-film batteries

ST's EnFilm™ thin-film batteries are a new concept of extremely thin (220 µm), rechargeable solid-state batteries with fast constant-voltage recharge and a lifetime of more than 10 years or 4000 cycles.

They feature a LiCoO₂ cathode, LiPON ceramic electrolyte and a lithium anode, on a 25.7 x 25.7 mm footprint and are completely safe from risks of burning or explosion.



Charge done at constant voltage of 4.2 V at 30 °C

THIN FILM BATTERY MAIN BENEFITS

- 10 years life time
- Up to 4000 charges/discharge cycle
- Extremely thin
- Fast Recharge: 30 min
- Pulse current up to 10 mA

EnFilm™ thin film rechargeable battery: the energy of things

EFL700A39

- Capacity: 700 µAh
- Nominal voltage: 3.9 V
- Cycling voltage: 4.2 - 3.0 V
- Dimension: 25.7 x 25.7 mm
- Thickness: 220 µm
- UN Manual Test Criteria, Part III, subsection 38.3
- UL compliant
- IEC 62133
- Flexibility: ISO 7816



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Ultra low consumption linear charger for thin film battery

STBC151

- Microbatteries charging and monitoring circuit
- Charging current up to 40 mA (set by dedicated pin)
- 150 nA quiescent current
- Reverse current protection from battery to supply input
- Programmable floating voltage with 0.5 % accuracy
- Battery overcurrent protection
- Battery over discharge protection switch totally disconnects battery for cell durability
- Shelf-mode supported, no battery mechanical switch needed

MAIN APPLICATIONS



Fitness and wearables



RF ID tags



Sensors and networks

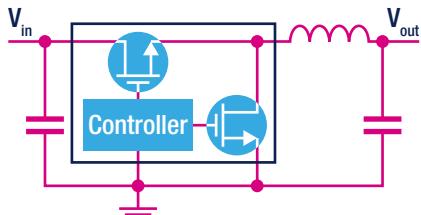


Smart cards

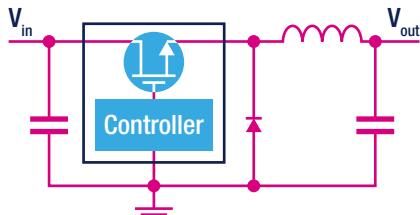
DC-DC SWITCHING CONVERSION ICs

DC-DC converters

ST offers a wide portfolio of monolithic **DC-DC switching converters** (i.e. controller and MOSFET in the same package). This broad portfolio of ICs is composed of highly-specialized products to meet every market requirement. High reliability and robustness for industrial (factory automation, UPS, solar, home appliances, lighting, etc.) and other high-voltage applications. High efficiency at any load and a high level of performance for consumer (smartphones, digital cameras, portable fitness devices, LED TVs, set top boxes, Blue-ray players, computer & storage, etc) and server/telecom applications.



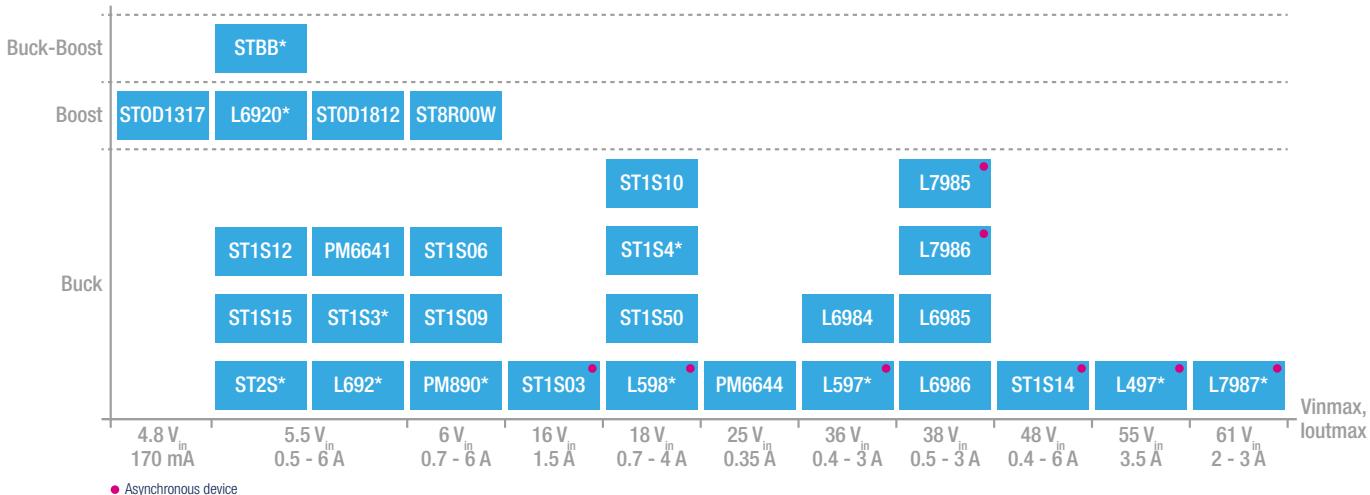
Synchronous buck converter



Asynchronous buck converter

DC-DC CONVERTERS MAIN FEATURES

- Up to 61 V_{in}/3 A
- Synchronization capability
- Internal compensation
- Low consumption
- Adjustable fsw
- Internal soft start
- Low quiescent current



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MAIN APPLICATIONS



Smartphones



TVs



Computing



Solar

UPS

Lighting



Set-top boxes



Wearables

ST1S0*, ST1S1*, ST1S3*, ST1S4*, ST1S50,
ST2S*, L598*, PM664*, STBB*, L6920*,
STOD1812, STOD1317, ST8R00W



Server/Telecom
PM890*, ST1S1*, ST1S3*,
ST1S4*, ST1S50, STBB*,
L598*, L698*, L798*



Home appliances

ST1S0*, ST1S1*, ST1S3*,
ST1S4*, ST1S50, L497*, L597*,
L598*, L698*, L798*



Factory automation

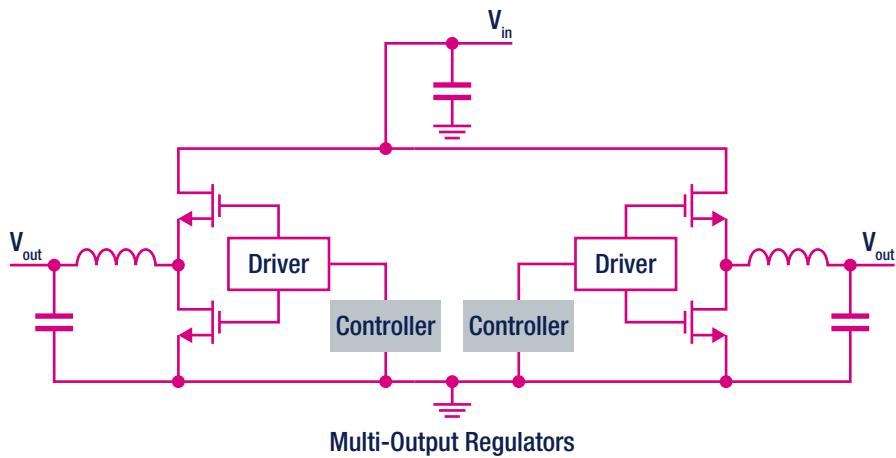
Note: * is used as a wildcard character for related part number

Multi-output regulators

This family of DC-DC regulators is designed to provide advanced power management solutions with specific control techniques to achieve best-in-class efficiency at low load and with a variety of technical solutions to fit all application needs: different number of switching regulators, embedded LDO solutions, different voltage ratings to fit specific applications from 2.7 V up to 15.6 V.

	Input Voltage	Number of Sw. Buck Regulators	LDO	eFuse	Serial Interface	Special Functions
STPMIC01	2.7 V - 5.5 V	6	0.25 A		I ² C	Low quiescent current (35 μ A), Automatic PWM \leftrightarrow PFM transition
STPMIC02	4.3 V - 5.5 V; 10.5 V - 13.2 V	2		5 V & 12 V (3.5 A)	I ² C	Temperature monitor and shutdown
STPMIC03	5 V - 12 V	2	0.1 A		I ² C & SPI	
STPMIC06	4.5 V - 15.6 V	4			I ² C	3 Amp current capability (w/ embedded Lowside MOS), interleaving synchronization
L7292	2.7 V - 5.5 V	5			I ² C	PWM and PFM modes

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MAIN APPLICATIONS



Server/Telecom



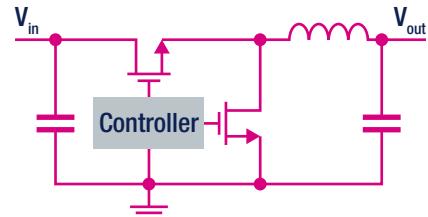
HD and SSD

DC-DC controllers

ST offers a wide portfolio of DC-DC switching controllers for server and telecom applications according to market requirements: single-phase controllers with embedded drivers, advanced single-phase controllers with embedded non-volatile memory (NVM), and our newest controllers with or without SPS (Smart Power Stage) compatibility as well as multiphase digital controllers for CPU & DDR memory power supplies.

Single-phase Buck controllers

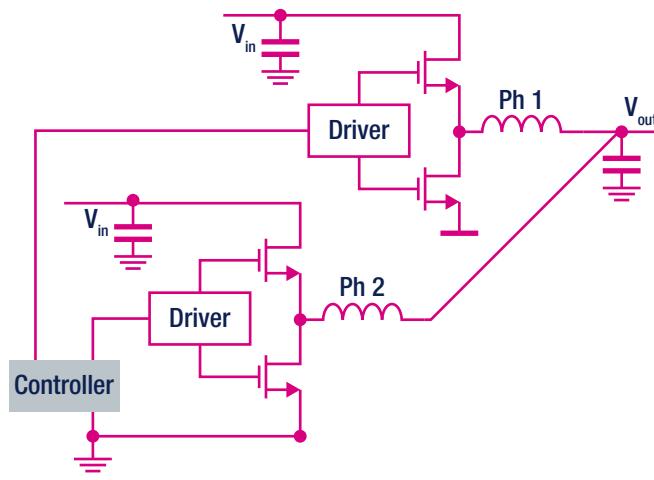
L672*	Single- phase cost effective PWM controller
L673*	Single-phase PWM controller with embedded driver and light load efficiency optimization
L6997	Single- phase PWM controller up to 35Vin
PM7701	Advanced single-phase controller with NVM (non-volatile memory) and telemetry
PM6697	Analog single-phase controller with SVID with embedded gate driver
PM6680	Dual-output PWM controller up to 36Vin



Single-phase buck controller

Multi-phase Buck controllers

PM676*	Fully digital buck controller with PMBus for CPU/DDR
PM677*	Fully digital buck controller with PMBus for advanced CPU/DDR



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MAIN APPLICATIONS



Server



Microserver



Telecoms



PC desktop

DIGITAL POWER CONTROLLERS AND MICROCONTROLLERS

Digital power controllers

ST's offers a number of advanced digital controllers, featuring innovative solutions to optimize converter efficiency in a wide range of load conditions (especially at light loads) and to have more flexibility. ST offers two main digital controller families tailored for specific applications: **STLUX** for lighting and **STNRG** for power conversion. In STLUX and STNRG families, the innovative SMED (state machine, event-driven) digital technology and the integrated microcontroller make STLUX and STNRG easily programmable and versatile. SMED is a hardware state machine triggered by internal or external events.

Digital controllers tailored for power conversion and lighting applications

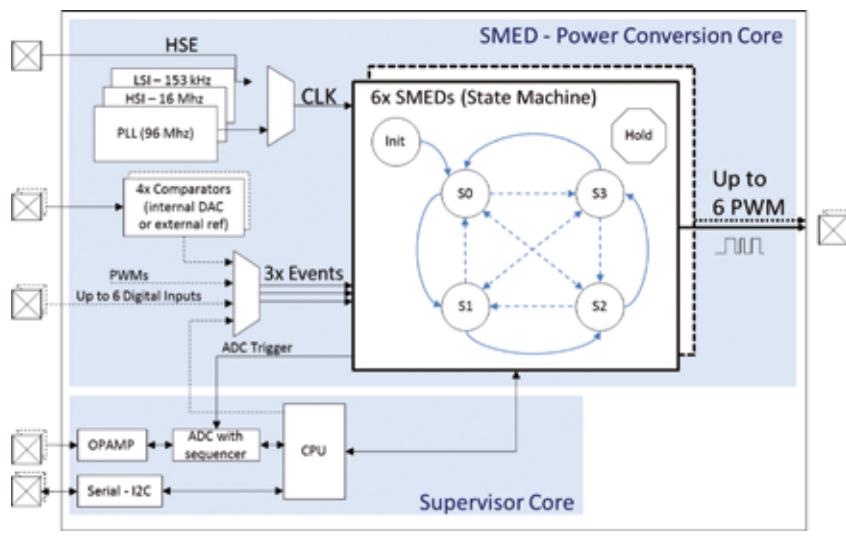


Common features

- Innovative digital control technique based on 6 programmable SMEDs with max PWM resolution of 1.3 ns
- Customizable algorithm for higher conversion efficiency
- Internal 96 MHz PLL
- Operating temperature -40 to 105°C
- Serial, I²C and GPIO interfaces

STNRG*

- Digital controller tailored for power conversion
- Up to 4 comparators with external reference



STNRG* internal block diagram

STLUX*

- Digital controller tailored for lighting applications
- Suitable for primary-side regulation and multi-strings lighting applications
- DALI 2.0 for remote control and connectivity

Digital controller for interleaved CCM boost PFC

STNRGPFO1

- Digital controller fully configurable through GUI for fast and easy design, does not require writing any firmware
- Up to 3-channel interleaved boost PFC
- Ideal for wide power range above 1 kW
- Reduced EMI filter and inductor volume
- Reduced output capacitor RMS current
- Flexible working frequency up to 300 kHz to drive both MOSFETs and IGBTs
- Configurable phase shedding for wide load range high efficiency conversion
- Soft start-up to reduce electrical stress and to manage inrush current PFC Soft Power-On
- On-chip UART/I²C digital interfaces for convenient connectivity
- Ideal for outdoor applications with -40 to +105 °C operating range

MAIN APPLICATIONS



Solar
STNRG*



UPS
STNRG*



HEV charging stations
STNRG*



Factory automation
STNRG*



Commercial, architectural and street lighting
STLUX*

Microcontrollers for digital power

The **32-bit microcontrollers** most suitable for power management applications are those of the entry-level **STM32F0 series** and the STM32F334 MCU from the mixed-signal **STM32F3 series**.

The STM32F0 series has a 32-bit ARM® Cortex®-M0 core and is particularly well suited for cost-sensitive applications. STM32F0 MCUs combine real-time performance, low-power operation, and the advanced architecture and peripherals of the STM32 platform.

The STM32F334 MCU combines a 32-bit ARM® Cortex®-M4 core (with FPU and DSP instructions) running at 72 MHz with a high-resolution timer (217 ps) and complex waveform builder plus event handler. This MCU specifically addresses digital power conversion applications such as digital switched-mode power supplies, lighting, welding, solar and wireless charging high number of integrated analog peripherals leading to cost reduction at the application level and a simplification of the application design.

STM32F334, the MCU tailored for digital SMPS

STM32F334

- Cortex®-M4 core
- High resolution timer with waveform builder and event handler
- High-speed ADCs for precise and accurate control
- Built-in analog peripherals for signal conditioning and protection (25ns from fault input to PWM stop)

STM32 F0 series, the MCUs for cost sensitive applications

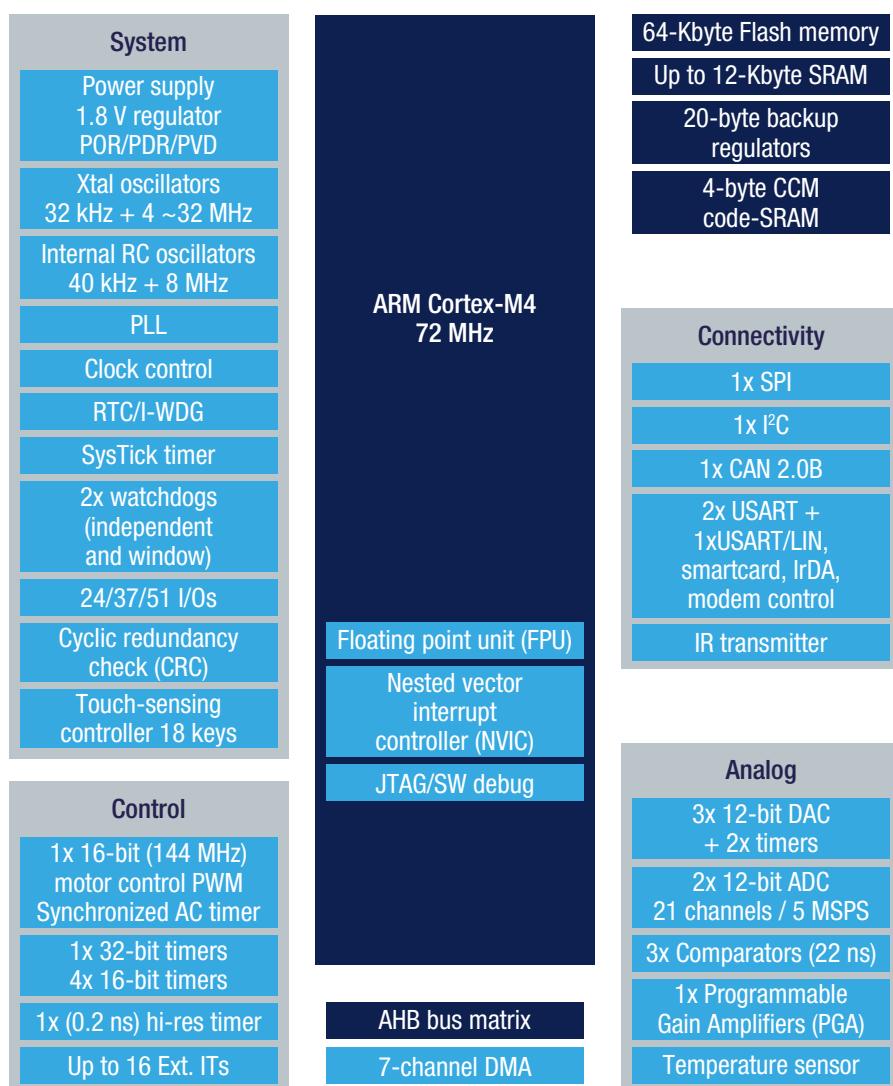
STM32F0*8

STM32F0*2

STM32F0*1

STM32F0*0

- Cortex®-M0 core
- Entry level, from 16 to 256 Kbytes
- USB crystal-less TSSOP20
6 Kbytes, 32-bit
- 8-/16-bit solutions and ecosystem



STM32F334 features

MAIN APPLICATIONS



Solar



Welding



Commercial, architectural and street lighting



Server/Telecom



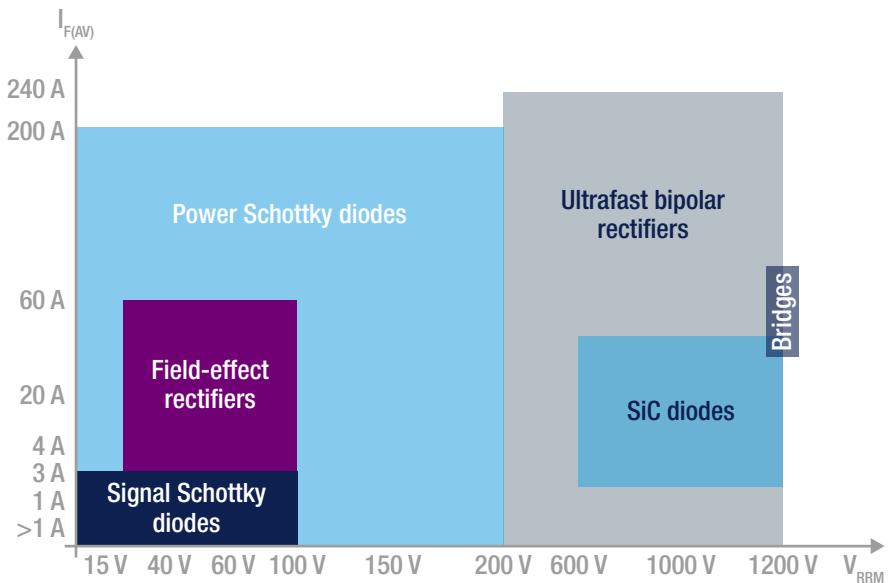
Factory automation

DIODES AND RECTIFIERS

Silicon diodes

ST offers **Schottky** and **ultrafast silicon rectifier solutions** for all market requirements. ST's latest developments include M series, based on Schottky technology, with improved avalanche rating and the integration of higher currents in low-profile PowerFLAT™ packages. Our range of small-signal Schottky diodes with flip-chip and SOD-923 devices helps meet the most stringent space-saving requirements, especially for portable communication equipment.

For high-efficiency rectification or freewheeling functions, our new field-effect rectifier diodes, **the FERD family**, improve the power density capability of the converters.



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Field-effect rectifiers (FERD)

FERD*

Low voltage diodes, for high efficiency and high power density applications

Power Schottky diodes

STPS*

Power Schottky diodes for low voltage general purpose applications

Ultrafast rectifiers

STTH*

Ultrafast high voltage diodes for general purpose application

MAIN APPLICATIONS



Adapters and TVs



Battery chargers



Solar inverters, welding, HEVs, and UPS



Residential, commercial, architectural and street lighting



PC Desktop and Server/Telecoms



HEV charging stations



Factory automation



Home appliances



Consumer electronics

SiC diodes

ST's silicon carbide diodes range from 600 to 1200 V – as single and dual diodes – and feature unbeatable reverse recovery characteristics and improved VF. Available in a wide variety of packages, from D²PAK to TO-247 and the insulated TO-220AB/AC, they offer great flexibility to designers looking for efficiency, robustness and fast time-to-market.

ST's SiC Schottky diodes show a significant power-loss reduction and are commonly used in hard-switching applications such as high-end-server and telecom power supplies, while also intended for solar inverters, motor drives and uninterruptible power supplies (UPS). ST's automotive-grade 650 and 1200 V SiC diodes – AEC-Q101-qualified and PPAP capable – feature the lowest forward voltage drop (VF) on the market, for optimal efficiency in electric vehicle (EV) applications.

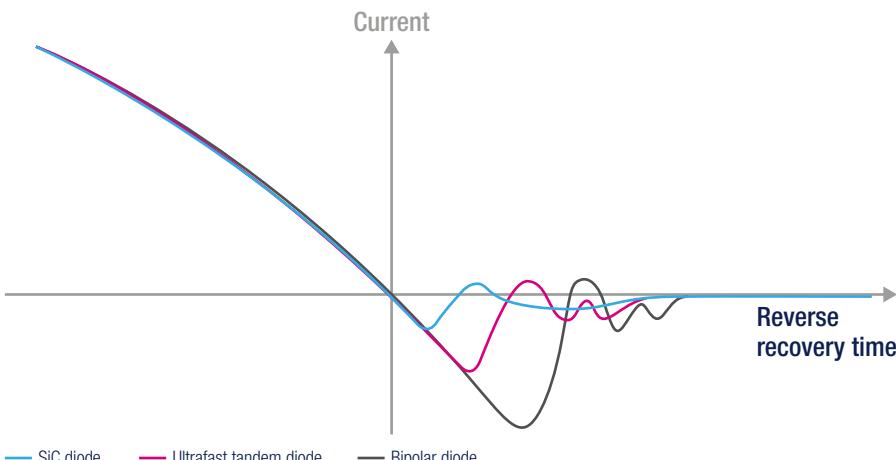
Main characteristics:

- High efficiency of the power converter (thanks to low forward conduction and switching losses)
- High power integration with dual diodes for reduced PCB form factor
- Significant reduction of power converter size and cost
- Low EMC impact, for simplified certification and reduced time-to-market
- Natural high robustness ensuring very high reliability

Our range of 1200 V silicon-carbide (SiC) JBS (Junction Barrier Schottky) diodes meet designers' needs for superior efficiency, low weight, small size, and improved thermal characteristics for performance-oriented applications.

Offering the best-in-class forward voltage (lowest VF) and state-of-the-art robustness, our 1200 V SiC diodes provide extra freedom to achieve high efficiency and reliability with lower current rating and therefore lower cost, while reducing operating temperature and extending application lifetime.

The 1200 V SiC diode family covers current ratings from 2 to 40 A, including automotive-qualified devices, in surface-mount DPAK HV (high-voltage) and D²PAK, or through-hole TO-220AC and TO-247LL (long-lead) packages.



SIC DIODES BENEFITS

- High efficiency adding value to the power converter
- Reduced size and cost of the power converter
- Low EMC impact, simplifying certification and speeding time to market
- High robustness ensuring high reliability of the power converter
- Gain on PCB and mounting cost with the dual diodes

650 V SiC diodes in insulated TO-220 packages: the solution to speed production

STPSC*065 STPSC*13

- 650 V (STPSC*065)
- 2 x 650 V (STPSC*13) dual in series diodes
- Best trade-off between efficiency and robustness thanks to the high Ifsm
- Ideal for applications with high current surge

MAIN APPLICATIONS



Solar inverters
STPSC*065, STPSC*12



HEV
STPSC*065



UPS
STPSC*065, STPSC*12



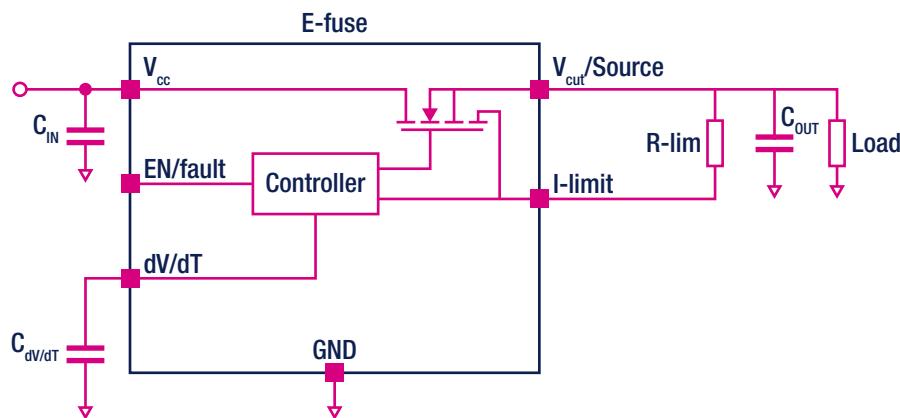
Server/Telecoms and PFC
STPSC*065, STPSC*12

HOT-SWAP POWER MANAGEMENT

E-fuses

E-fuses are electronic fuses that can replace larger conventional fuses or other protection, reducing ownership costs in production and in the field.

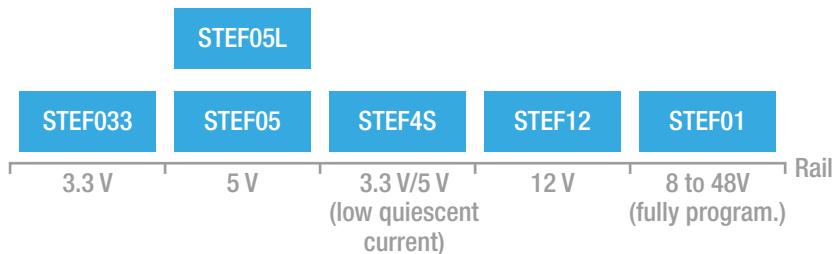
Unlike fuses, they offer complete and flexible management of the fault (overcurrent/overvoltage), without requiring replacement after actuation. They thus help to improve equipment uptime and availability and also reduce maintenance costs and false returns. Compared to traditional protection devices, these new electronic fuses enable versatile and simple programming of protection parameters, such as overcurrent threshold and start-up time.



E-FUSE MAIN FEATURES

- Do not degrade or require replacement after a trip event
- Programmable over-current protection and turn-on time
- Latched or autoretry function
- Overvoltage clamp
- Over-temperature protection
- Integrated power device
- Internal undervoltage lockout

E-fuses, a smart offer for a lots applications



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MAIN APPLICATIONS



Home appliances
STEF05, STEF01, STEF12



HD and SSD
STEF033, STEF05,
STEF05L, STEF4S, STEF12



USB connections
STEF05, STEF05L



Factory automation
STEF01, STEF12



Set-top boxes
STEF12



Power breakers & current limiter ICs

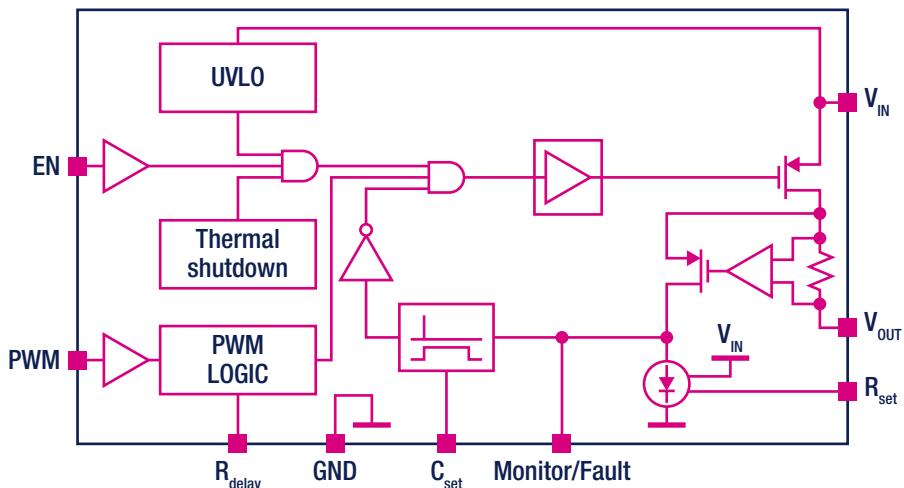
Connected in series to the power rail, ST's power breakers are able to disconnect the electronic circuitry if power consumption exceeds the programmed limit. When this happens, the device automatically opens the integrated power switch, disconnecting the load, and notifies the remote monitoring feature.

Current limiter ICs are designed to work with an external MOSFET to protect power supplies from anomalous external current demands.

Power breakers

STPW05¹ **STPW12¹**

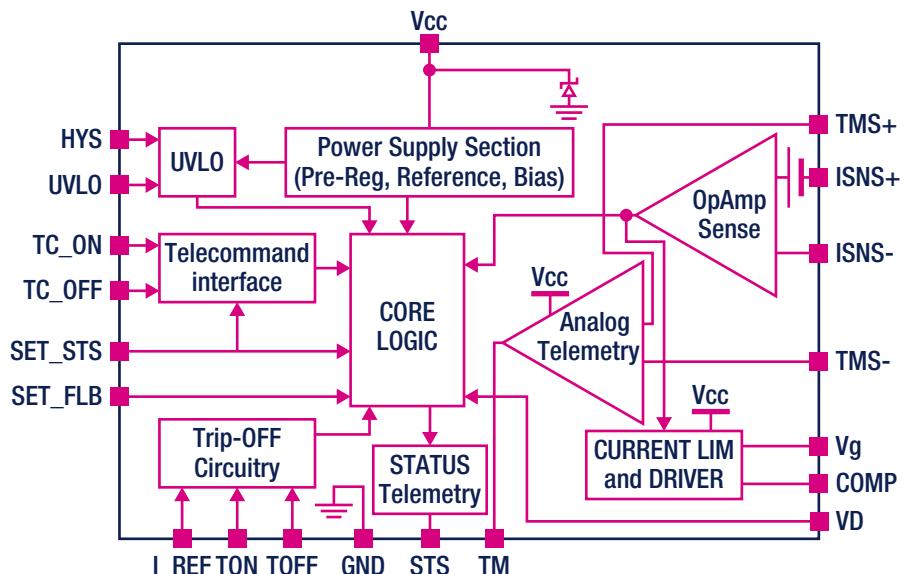
- Auto-retry function with programmable delay
- Adjustable precise power limitation from 11 to 16 W
- 5 V (STPW05) and 12 V (STPW12) rails
- Programmable power limit masking time
- Over-temperature protection
- Integrated N-channel power MOSFET
- Internal undervoltage lockout



Current limiter IC

STFC01

- Wide Vcc range (10 - 48 V)
- Fully programmable current limitation
- P-channel MOSFET driving capability
- Remote On/Off control
- Latch, autoretry or foldback configuration
- Analog and digital current monitoring (status telemetry)
- Undervoltage lockout



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MAIN APPLICATIONS



Home appliances
STPW05¹, STPW12¹



Air conditioning
STPW05¹, STPW12¹



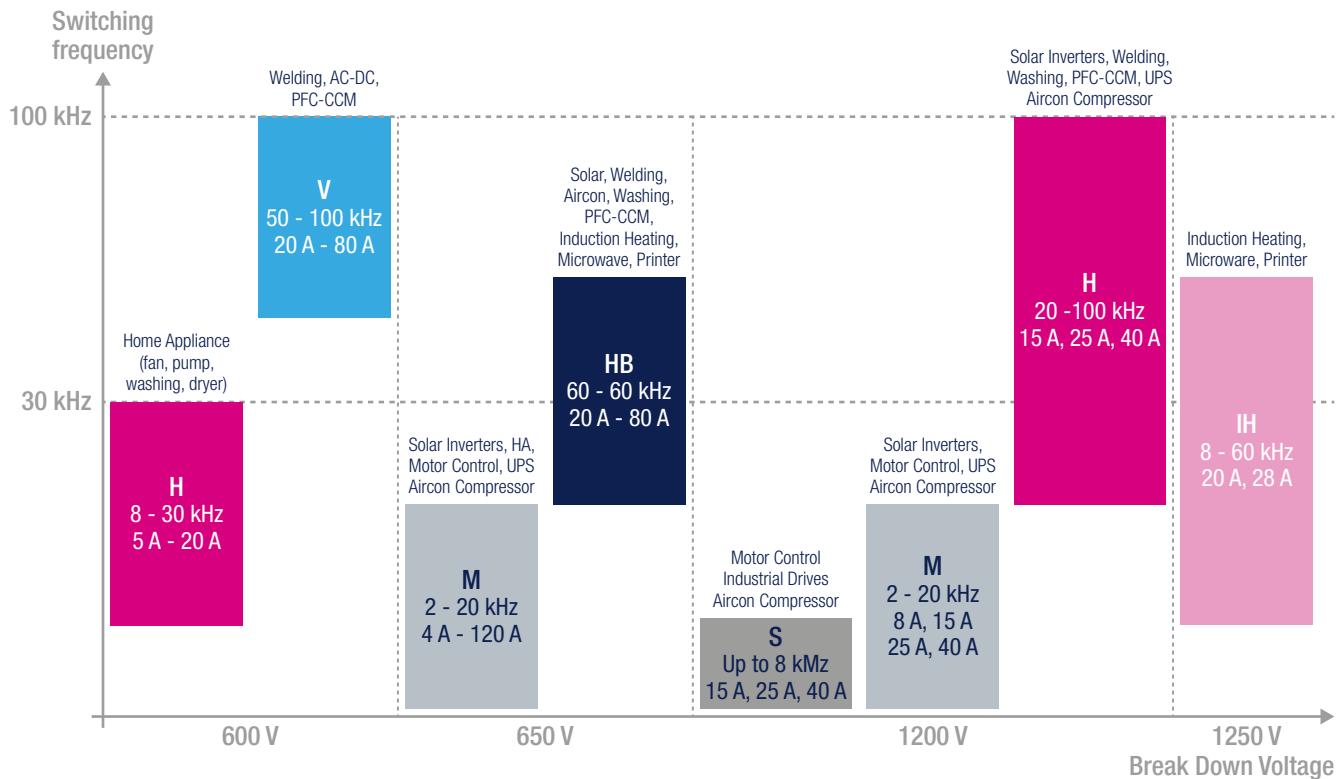
Factory automation
STPW05¹, STPW12¹, STFC01



Server/Telecoms
STFC01

IGBTs

ST provides a large portfolio of **IGBTs** with breakdown voltages between 600 and 1350 V with state-of-the-art trench-gate field-stop technology. ST's IGBTs feature the optimal trade-off between switching performance and on-state behavior due to their proprietary technology and to the 175 °C max operation junction temperature, delivering greater all round energy efficient system designs in applications such as motor control, photovoltaic, UPS, automotive, induction heating, welding, lighting and others.



S series

STG*S120DF3

- 10 µs of short-circuit capability @ starting $T_j = 150^\circ\text{C}$
- Wide safe operating area (SOA)
- Soft and fast recovery antiparallel diode
- Low drop series: very low $V_{CE(sat)}$
- Suitable for very low frequency application, up to 8 kHz

M series

STG*M*

- 650 V family
- 6 µs of min short-circuit capability @ starting $T_j = 150^\circ\text{C}$
 - Wide safe operating area (SOA)
 - From 4 to 120 A as current capability
 - Very soft and fast recovery antiparallel diode
 - Suitable for any inverter system up to 20 kHz
 - AEC-Q101 qualified devices
- 1200 V family
- 10 µs of min short-circuit capability @ starting $T_j = 150^\circ\text{C}$
 - From 8 to 40 A as current capability
 - Freewheeling diode tailored for target application
 - Suitable for any inverter system up to 20 kHz

IH series

STG*IH*

- 650 V family
- Very low $V_{CE(sat)}$: 1.4 V @ I_{CN}
 - Very low E_{off}
 - Low drop forward voltage diode
 - Designed for soft commutation application only
 - Mass production in Q1 2018
- 1250 V family
- Minimized tail current
 - Very low drop freewheeling diode
 - Tailored for single-switch topology
- 1350 V family
- Enhanced efficiency
 - Very high robustness
 - Mass production in Q1 2018

HB series

STG*H*B

- Very low saturation voltage
- Minimal tail current turn-off
- Optimum trade-off between conduction and switching losses
- Very low thermal resistance
- 4 leads package available
- Very high robustness in final application

H series

STG*H*

- 600 V family
- 3 μ s of short-circuit capability
 - Low saturation voltage
 - Minimal collector turn-off
 - Series optimized for home appliance applications

1200 V family

- 5 μ s of short-circuit capability @ starting $T_j = 150^\circ\text{C}$
- Low turn-off losses
- Up to 100 kHz as switching frequency

V series

STG*V60*F

- High f_{sw} series
- Tail less switching off
- Very low turn-off switching losses
- Soft and very fast recovery antiparallel diode
- Up to 100 kHz in hard switching topologies

MAIN APPLICATIONS



Welding
HB, V



Solar



UPS



Home appliances



Air conditioning



Motor control



Induction heating



Intelligent power module - SLLIMM™

The SLLIMM, small low-loss intelligent molded module, is the new ST's family of compact, high efficiency, dual-in-line intelligent power modules (IPM), with optional extra features. This family includes both nano and big package solutions IGBT, MOSFET and Super Junction Mosfet based. The best compromise between conduction and switching energy with an outstanding robustness and EMI behavior making the new products ideal to enhance the efficiency of compressor, pumps, fans and any motor drives working up to 20 kHz in hardswitching circuitries and for an application power range from 25 W to 3 KW.

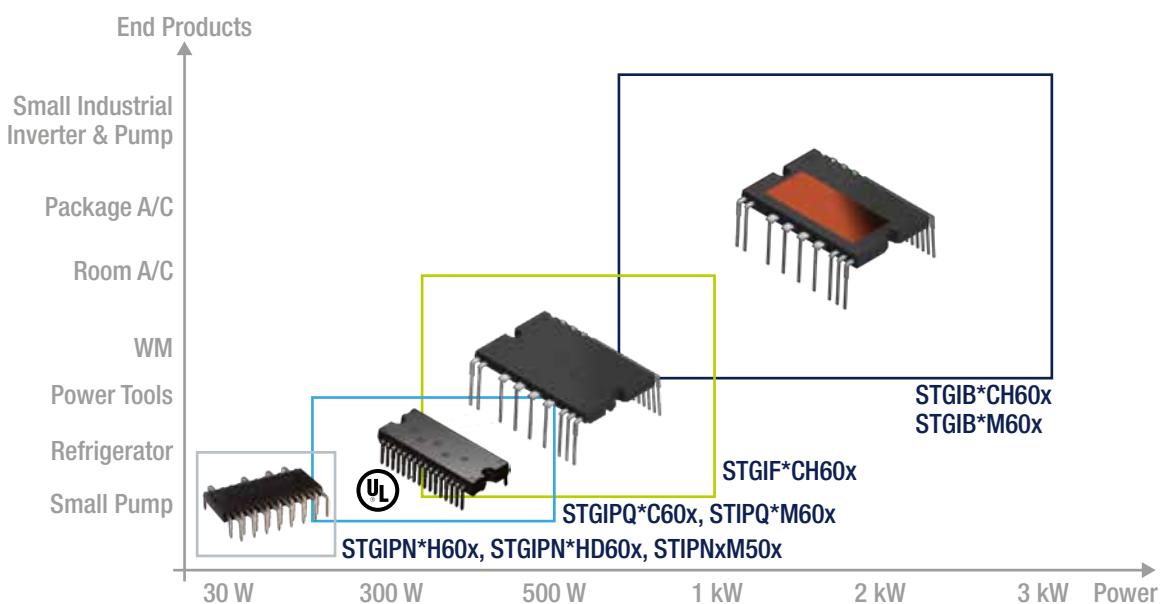
KEY FEATURES

- 600 V, IGBT based from 3 A to 35 A DC rating at 25 °C
- 600 V, Super Junction MOSFET based from 3 A to 5 A DC rating at 25 °C
- 500 V, MOSFET based from 0.5 A to 2 A DC rating at 25 °C
- Low VCE(sat), Low Rds(on)
- Optimize driver and silicon for low EMI
- Lowest R_{th} value on the market for the DBC package versions
- Internal bootstrap diode
- 175 °C of maximum operating junction temperature
- Separate open emitter outputs
- NTC on board
- Integrated temperature sensor
- Comparator for fault protection
- Shutdown input/fault output
- Isolation rating of 1500 Vrms/min

KEY BENEFITS

- Easy to drive through microcontroller
- Higher robustness and reliability
- Plug'n Play solution

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MAIN APPLICATIONS



Fan



Fridge



Washing Machine



Air conditioning

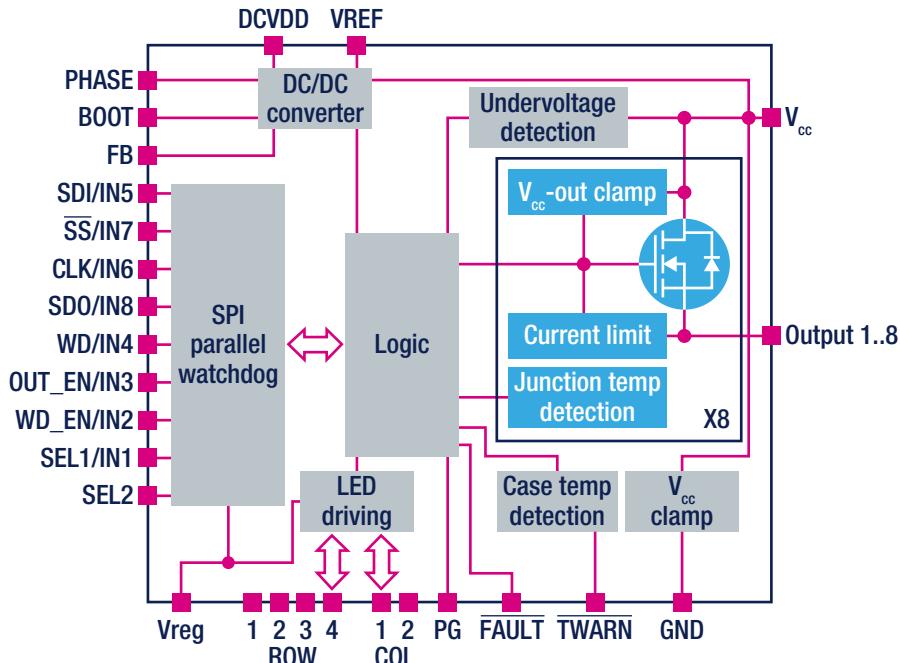


Motor control

INTELLIGENT POWER SWITCHES

STMicroelectronics offers **intelligent power switches** (IPS) for low- and high-side configurations. ST's IPS feature a supply voltage range from 6 to 60 V, overload and short-circuit protection, current limitation set for industrial applications, different diagnostic types, high-burst, surge and ESD immunity, very low power dissipation and fast demagnetization of inductive loads.

Devices are designed using ST's latest technologies, thus offering state-of-the-art solutions in any application field.

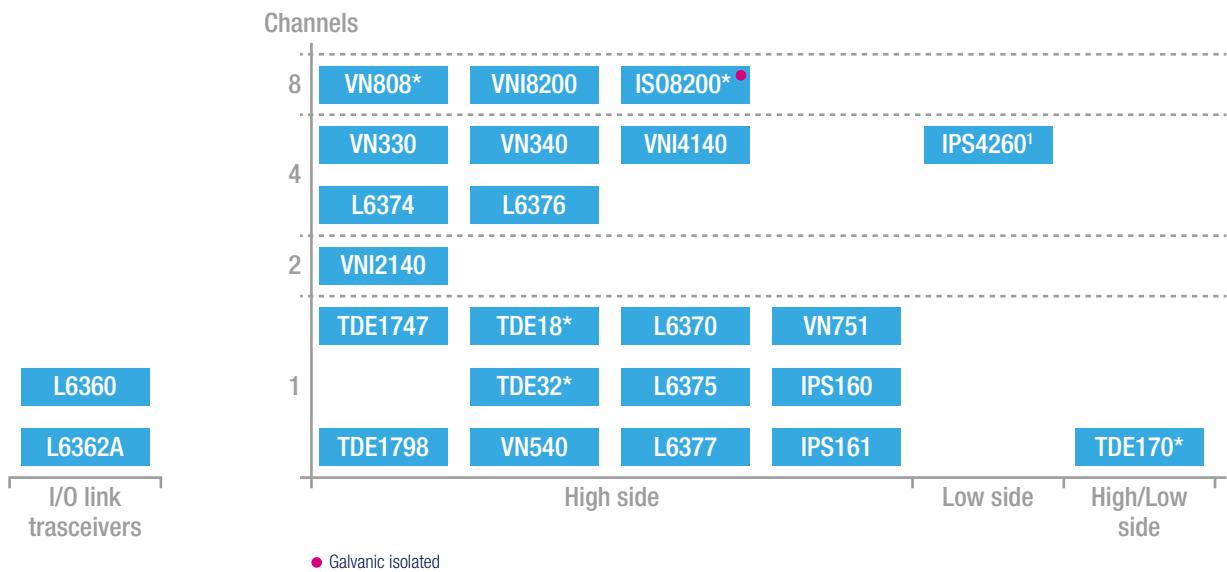


IPS MAIN FEATURES

- Logic
 - Driving
 - Protections
 - Diagnostic
 - Power stage
- ...all on a single chip

ISO8200*, the galvanic isolated IPS ideal for factory automation

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MAIN APPLICATIONS



Factory automation



Vending machines



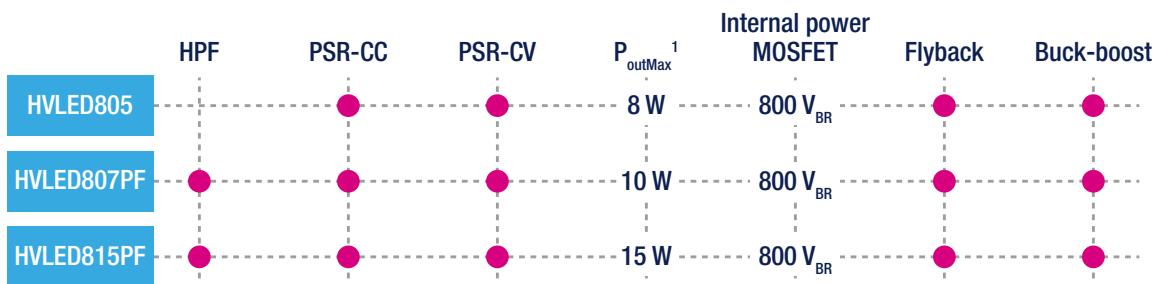
Renewable energy

LED DRIVERS

Offline LED drivers

Dedicated **LED drivers** operating from the AC mains ensure highly-accurate LEDs managing to provide a high level of light quality and avoid flickering. By combining a state-of-the-art low-voltage technology for the controller and an extremely robust 800 V technology for the power MOSFET in the same package, HVLED8* converters (i.e controller + MOSFET in the same package) feature an efficient, compact and cost-effective solution to drive LEDs directly from the rectified mains. This family of converters works in constant-current / constant-voltage primary-side regulation (PSR-CC/CV). HVLED001A controller is also available for high power needs working in constant-voltage (PSR-CV) primary-side regulation; a dimming function is also available. For both families (HVLED converters and controllers), the primary-side regulation cuts bill-of-material costs, while also simplifying design and reducing the space occupied by LED control circuitry.

Offline LED converters with PSR

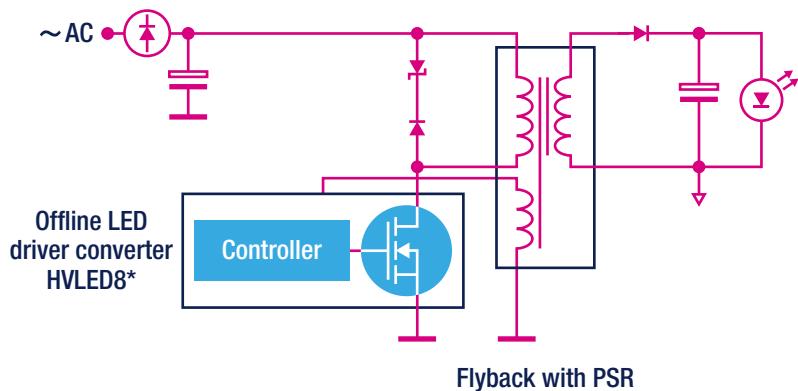


Offline LED controllers with PSR



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Topology example



MAIN APPLICATIONS



Residential lighting
HVLED807PF, HVLED815PF



Commercial and street lighting
HVLED001A

DC-DC LED drivers

ST's monolithic buck switching regulators offer input voltage capability up to 61 V and deliver output currents up to 4 A with high switching frequency. They enable simple, efficient and cost-effective solutions for driving high-brightness LEDs. They also feature dedicated circuitry for dimming. Boost regulators provide the necessary high voltages to drive multiple LEDs in series, guaranteeing accurate LED current matching.

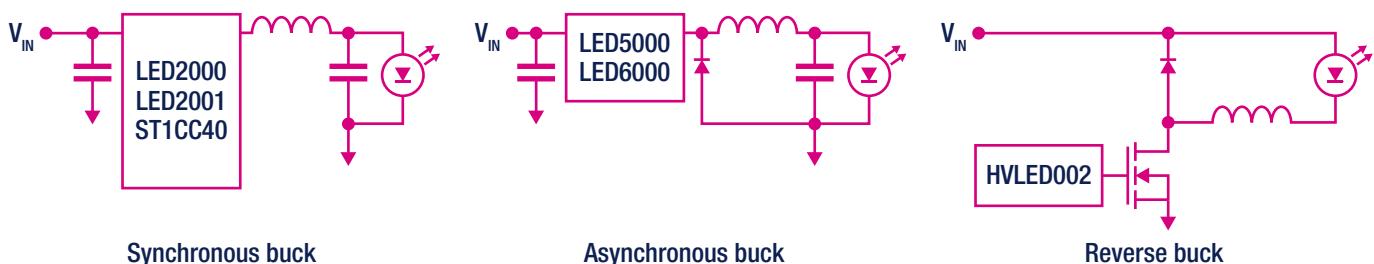
DC-DC LED drivers converters

	Buck	Buck-boost	I_{outMax}	Dimming	V_{inMax}	Synchronous
LED2000	●		3 A	●	18 V	●
LED2001	●		4 A	●	18 V	●
ST1CC40	●		3 A		18 V	●
LED5000	●	●	3 A	●	48 V	
LED6000	●	●	3 A	●	61 V	

DC-DC LED drivers controllers

	Reverse buck	Buck-boost	Boost & Sepic	Dimming	V_{inMax}
HVLED002	●			●	30 V
LED6001		●	●	●	36 V
STLDC08			●	●	3.6 V

Topology examples



MAIN APPLICATIONS



Halogen bulbs
replacements and home
appliances
LED5000, LED6000



Traffic signals
LED2000, LED2001,
ST1CC40,
LED5000, LED6000



Street lighting
LED5000,
LED6000,
HVLED002



Emergency lighting
LED6001,
ST1CC40

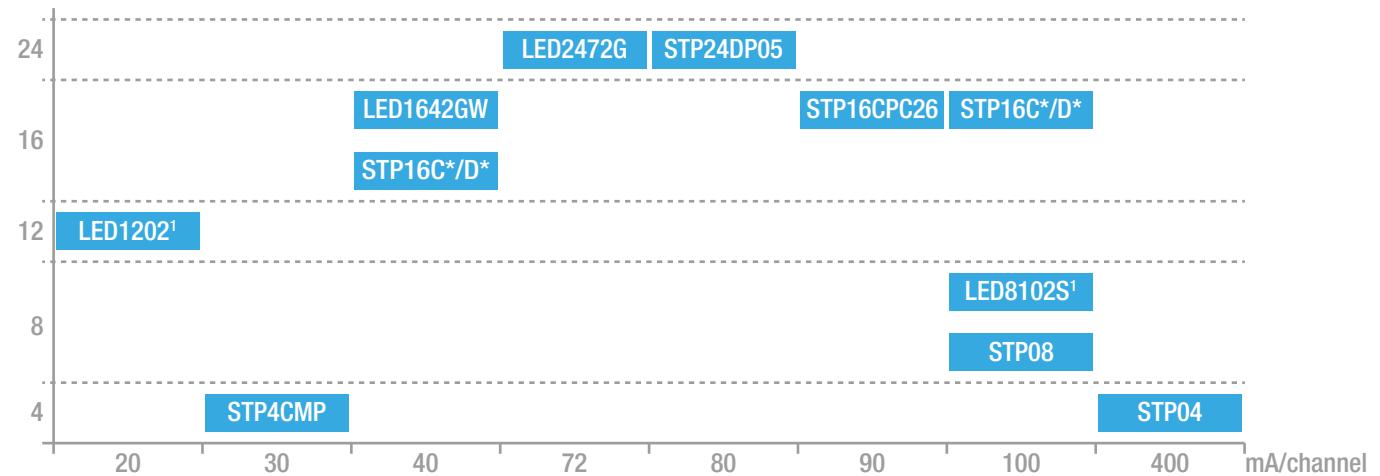


Commercial and
architectural lighting
LED5000, LED6000,
LED6001, HVLED002

LED array drivers

ST's **LED array drivers** fully integrate all functions required to drive high-brightness LEDs. These devices allow constant-current control in a single-chip solution. The external parts are reduced to only one resistor that sets the preferred maximum current for all outputs. Devices also come with additional features such as high current, high precision, local and global LED brightness adjustment, thermal shutdown, error detection and auto power-saving functionalities.

Channels



24 channel RGB (8x3) drivers

- Current gain control (LED2472G), constant current (STP24DP05)
- Error detection
- Autopower saving (LED2472G)

12/16 channel drivers

- Current gain control (LED1642GW), constant current (STP16C*D*)
- Error detection (STP16C*D*)
- Dot correction (LED1202)
- Autopower saving
- Local dimming (LED1642GW, LED1202), global dimming (STP16C*D*)

4/8 channel drivers

- Constant current
- Direct I/O (LED8102S)
- Error detection (STP08)
- Global dimming

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MAIN APPLICATIONS



Traffic signals
LED8102S, LED2472G,
STP24DP05, STP04



Large panel signs
LED1642GW, LED2472G,
STP24DP05, STP16,
STP08



Home appliances
LED8102S, STP16,
STP08, LED1642GW,
STP4CMP



Special lighting
STP04, LED1642GW,
LED2472G, LED8102S



wearable/
High End consumer
LED1202

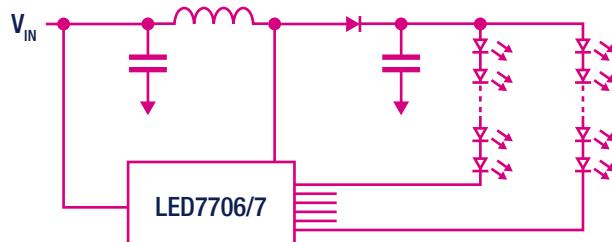
LED row drivers

LED row drivers are essentially boost regulators that provide the necessary high voltages to drive multiple LEDs in series, guaranteeing accurate LED current matching.

ST offers both single- and multi-channel high-efficiency boost LED drivers featuring a wide dimming range, low noise and small footprint. They also embed protection functions such as overvoltage and overcurrent protection, thermal shutdown and LED-array protection.

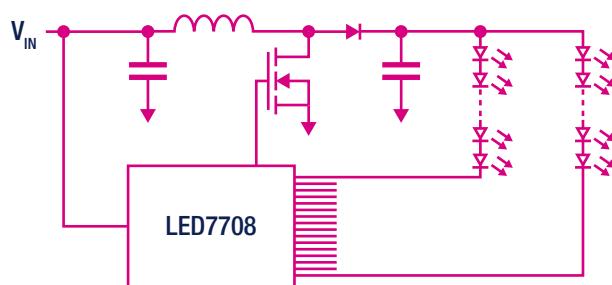
LED row driver converters

6 rows	LED7707	• 85 mA/row
5 rows	LED7706	• 30 mA/row
4 rows	STLED25	• 25 mA/row
4 rows	STLD41	• 30 mA/row
1 row	STLA02*	• 20 mA/row
1 row	STLD40D	
	STCS*	• 0.5 A/1.5 A/ 2 A/row



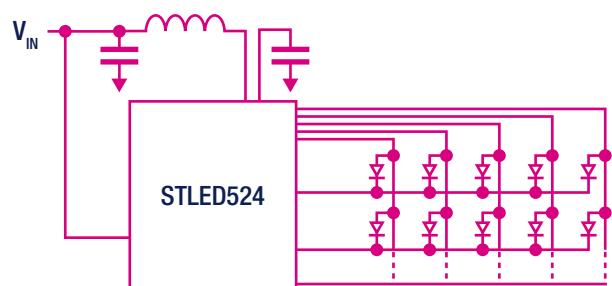
LED row driver controllers

16 rows	LED7708	• 85 mA/row • Grouped or independent row dimming
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LED matrix driver

5 x 24 matrix	STLED524	• 20 mA/dot • Adjustable luminance for each LED (dot)
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MAIN APPLICATIONS



Smartphones
STLED25, STLD40D



Game consoles
STLD41



Keyboard and accessories
STLA02*



Home appliances and ATMs
LED7706, LED7707, LED7708, STCS*

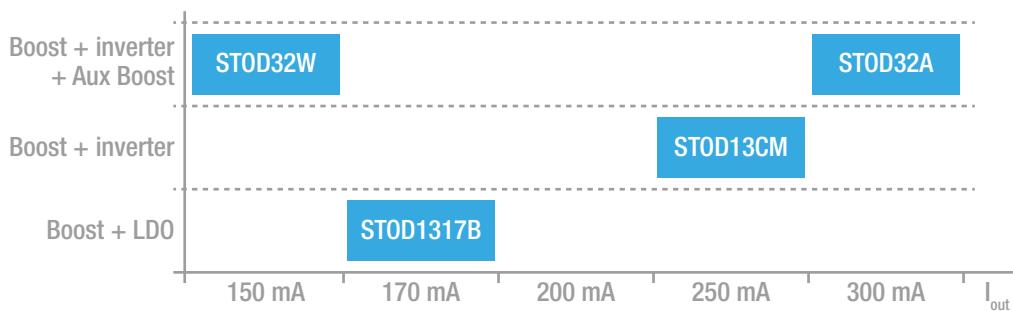


Wearables
STLED524

OLED drivers

ST supplies over 70% of the world's ICs to power AMOLED displays that enable today's advanced handheld devices to deliver high quality web and video experiences on the move.

ST's dedicated **AMOLED power ICs** add value to new designs by simplifying power supply in the circuitry ensuring outstanding energy efficiency and results in longer battery life. In addition, high immunity to mobile communication noise keeps display consistent and flicker free.



1 channel driver (for displays up to 4")

STOD1317B

- Wide output range (up to 13 V)
- Very low output ripple
- High efficiency
- 100 mV LDO output drop

2 channel drivers (for displays up to 5")

STOD13CM

- High efficiency in overall output range
- Wide output negative range
- External feedback output sense

3 channel drivers (for displays up to 6")

STOD32A, STOD32W

- Programmable auxiliary boost for driver ICs
- 100 mA output load in flipchip (STOD32W)
- Wide output negative range (STOD32A)

MAIN APPLICATIONS

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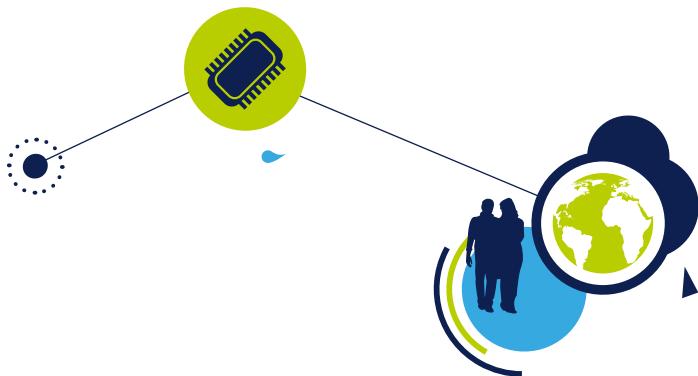
Fitness and wearables
STOD32W, STOD1317B



Low-end smartphones
STOD1317B, STOD13CM

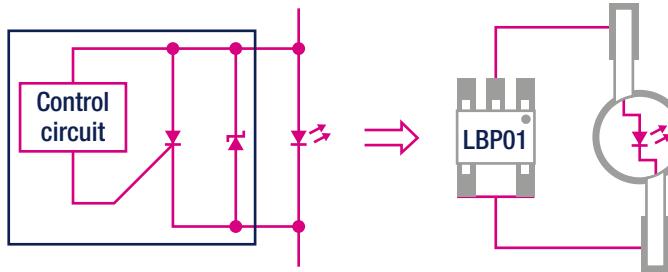


High-end smartphones
STOD32A



LED bypass protection

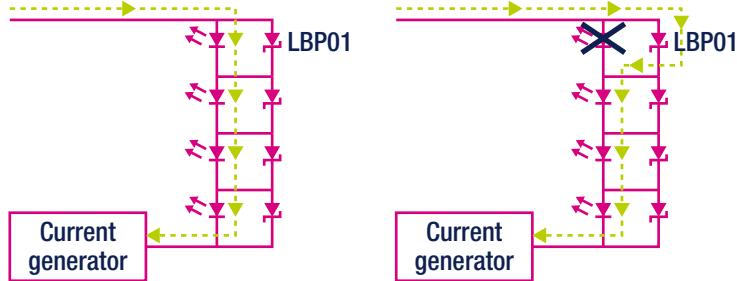
The LBP01 series of LED bypass protection devices are bypass switches that can be connected in parallel with 1 or 2 LEDs. In the event of a LED failure, this device shunts the current through other LEDs. It also provides overvoltage protection against surges as defined in IEC 61000-4-2 and IEC 61000-4-5



LBP01 get reliable your led application

LBP01

- Keep LED strings on in case of LED open mode failure
- Reduced maintenance cost
- Increase lifetime of the lighting system



MAIN APPLICATIONS



Display panels



Residential, commercial, architectural and street lighting



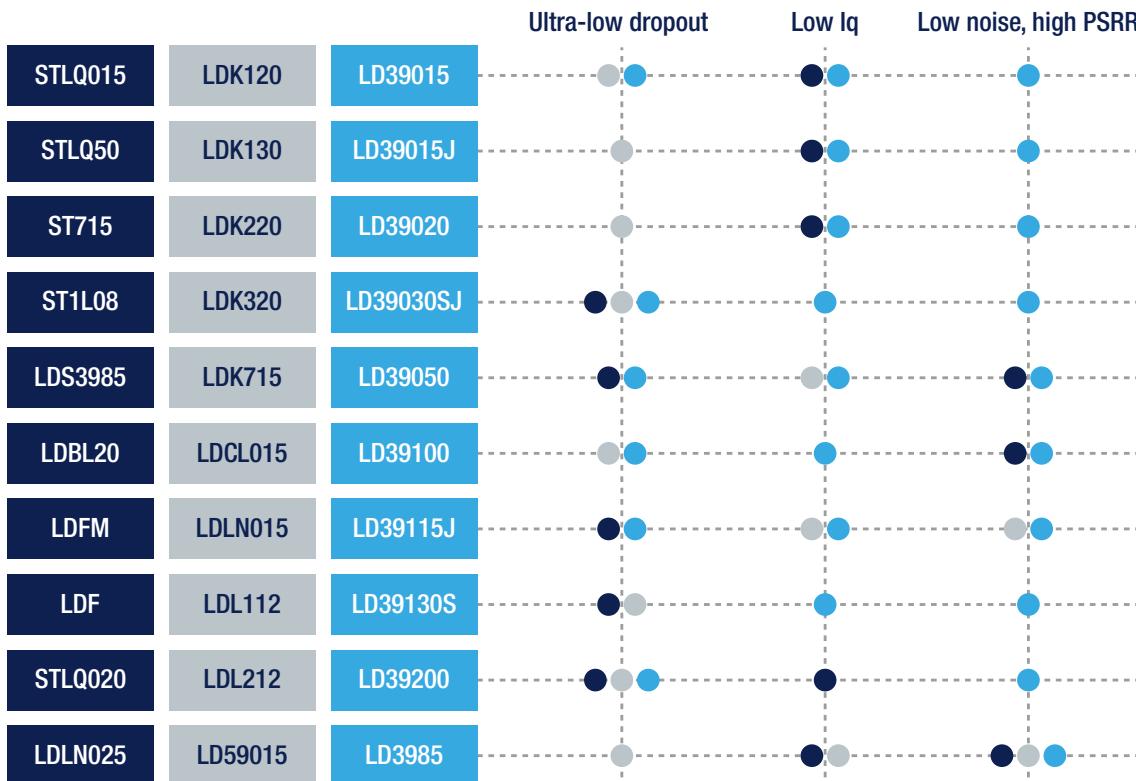
Emergency lighting



Traffic signals

LINEAR VOLTAGE REGULATORS

ST offers a complete portfolio of industry-standard high-performance regulators for both positive and negative outputs. Among our products, you can find the optimal combination of ultra-low dropout voltage (from 50 to 220 mV for 100 mA to 3 A load current) and low quiescent current - for the highest efficiency design – (from 0.3 to 20 µA for 50 mA to 2 A) or dynamic performance for the best transient response, power supply ripple rejection (up to 92 dB at 1 kHz) and low noise (as low as 6.3 µVrms). All this coupled with a choice of the smallest form factor packages for size-conscious applications such as a 0.47 x 0.47 mm STSTAMP™ package.



Ultra-low dropout

- High efficiency in low-/medium-power applications
- Best cost/performance trade-off
- Large offer for I_{out} capability and packaging

Low quiescent current I_Q

- Extending battery life
- Suitable for space-constrained battery-powered applications

Low noise, high PSRR

- High signal fidelity
- Reduced size of external filter components

MAIN APPLICATIONS



Tablets, smartphones, and digital camera
LD39115, LD39130, LD39020/30,
ST1L08, LDBL20, LD59015, LDLN025,
STLQ020



Healthcare
STLQ015, STLQ020,
ST715, LD39130



Fitness and wearables
LD39130, LDLN015,
LDLN025, LD39115,
LD39020, LD39030,
LDBL20, STLQ020

LNB SUPPLIES

LNB supplies ICs

ST's **LNB (low-noise block) supply ICs** are intended for analog and digital satellite receivers, satellite TVs, satellite PC cards. These devices are monolithic voltage regulator and interface ICs specifically designed to provide the 13/18 V power supply and the 22 kHz tone signaling to the LNB downconverter in antenna dishes or to the multi-switch box.



Single tuner ICs

LNBH25S

LNBH29

LNBH30

Dual-tuner IC

LNBH26S

Main common features

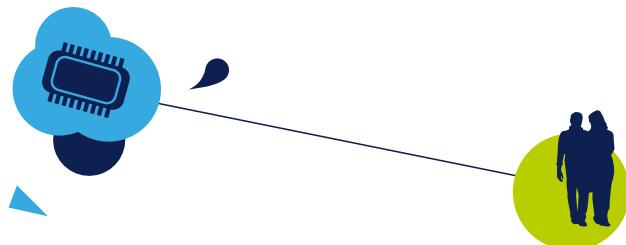
- Complete interface between LNB and I²C bus
- 15 output voltage levels
- Output surge robustness up to 40 V
- P2P compatibility between single- and dual-tuner versions
- Stable with ceramic and electrolytic capacitors
- Built-in high-efficiency 12 V DC-DC converter
- Selectable output current limit by external resistor
- Compliant with main satellite-receiver output-voltage specifications
- Accurate built-in 22 kHz tone generator suits widely accepted standards
- Internal overload and over-temperature protection

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MAIN APPLICATIONS

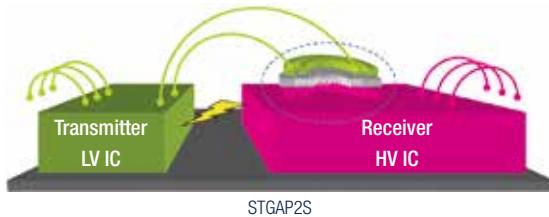


Set-top boxes and PC card satellite receiver

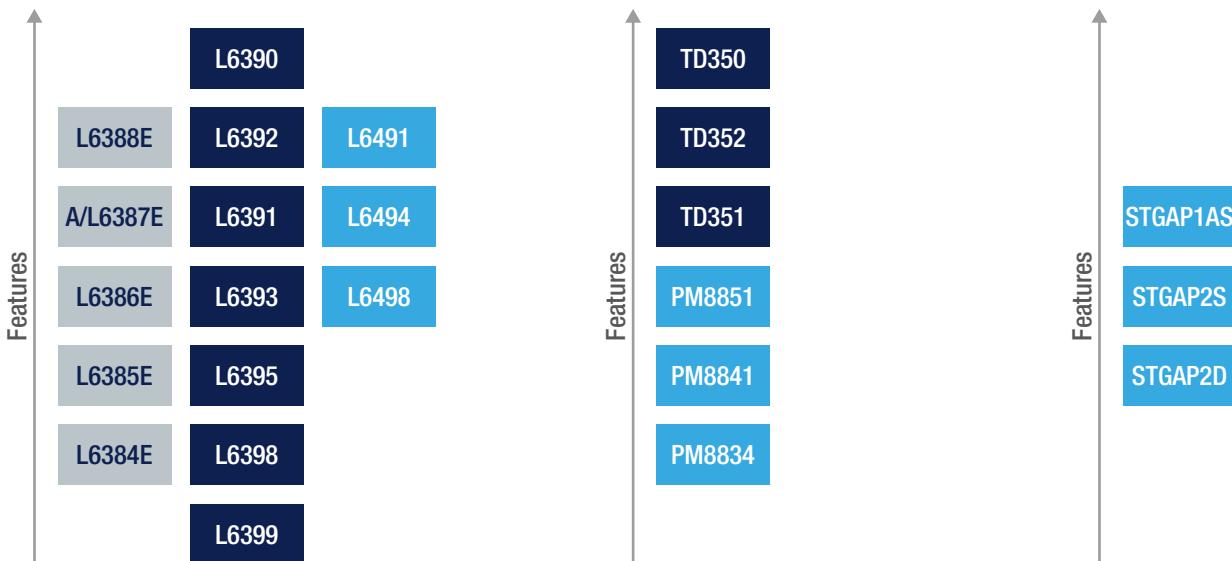


STDRIVE MOSFET AND IGBT GATE DRIVERS

ST's **power MOSFET and IGBT gate drivers** include integrated high-voltage half-bridge, single and multiple low-voltage gate drivers. The MOSFET/IGBT drivers provide state-of-the-art integration, reducing BOM cost and final application dimensions, while also increasing robustness and noise immunity. In particular the STDRIVE families L639*, L649* and STGAP series offer smart functionalities to protect and simplify application implementation and usage.



Robustness and reliability, system integration and flexibility: that's ST's gate driver offer you



600 V Half bridge gate drivers

- 4 A source/sink driver high current capability (L6491)
- Integrated bootstrap diode
- Adjustable deadtime (L6494L)
- Comparator, op amp integrated, smart SD, interlocking and program. DT (L6390)
- Smart shutdown (L649*, L639*)
- Extended temperature range (A version)

Low side gate drivers

- 2 level turn-off (TD35*)
- Miller clamp (TD35*)
- Pulse transf / opto input (TD35*)
- Dual independent low side driver (PM8834)
- 4 A source/sink driver high current capability (PM8834)

Galvanically-isolated single and dual gate driver

- Up 4 kV isolation
- High voltage rail up to 1.7 kV
- Up to 5 A source/sink driver current capability
- 2 Level turn-off (STGAP1AS)
- Miller clamp, negative gate supply
- Optimized for SiC MOSFET driving

MAIN APPLICATIONS



Factory automation, home appliances, and motor control

L638*E, TD35*, L639*, L6491, L6494, L6498, PM8841, PM8851



Commercial, architectural and street lighting

PM8834, PM8841, PM8851



Solar inverters, HEV / EV, and factory automation

STGAP1AS, PM8841, PM8851
STGAP2S, STGAP2D

PHOTOVOLTAIC ICS

DC-DC converters with embedded MPPT algorithm

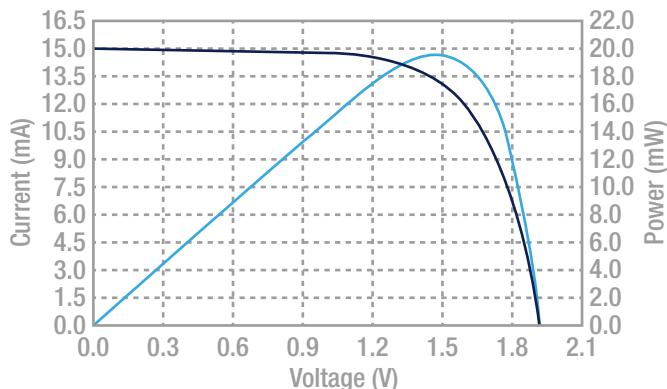
The maximum power point tracking (MPPT) algorithm maximizes the power output by photovoltaic panels according to temperature and solar irradiation conditions.

The SPV1040 is a monolithic DC-DC synchronous boost converter able to harvest the energy generated by even a single solar cell characterized by a very low output voltage. It is especially designed to work in outdoor environments with loads up to about 3 W.

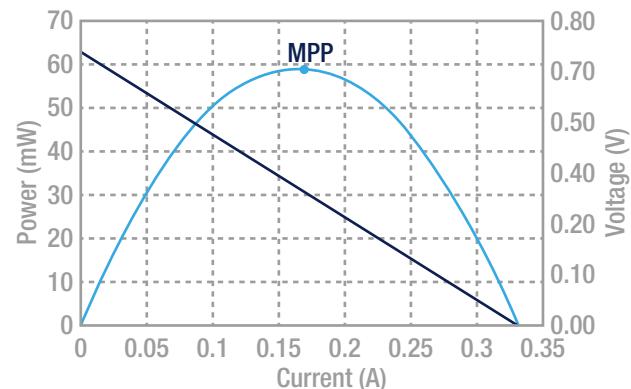
The SPV1050 is an ultra-low-power battery charger and energy harvester (from photovoltaic cells or a thermo-electric generators) that guarantees a very fast charge of supercapacitors and any type of battery including thin-film solid-state batteries. It is specifically designed to work in indoor environments or with very small thermal gradients with loads up to about 350 mW.

	Output Power Capability	Harvesting Source	Target Battery	Topology	Other Features
SPV1040 Outdoor solar battery charger with embedded MPPT	400 mW to 3 W	PV	Any type*	Sync Boost	Over-current and Over-temperature protection, input reverse polarity protection
SPV1050 Indoor ultra-low-power energy harvester and battery charger with embedded MPPT and LDOs	< 400 mW	PV and TEG	Any type (including supercap and EFL700A39)	Sync Boost Sync Buck-Boost	Over-voltage and under-voltage battery protection, n. 2 embedded LDOs (1.8 V and 3.3V)

Solar curves



Thermo-electric generator (TEG)



MAIN APPLICATIONS



Smartphones, digital cameras, and camcorders
SPV1040



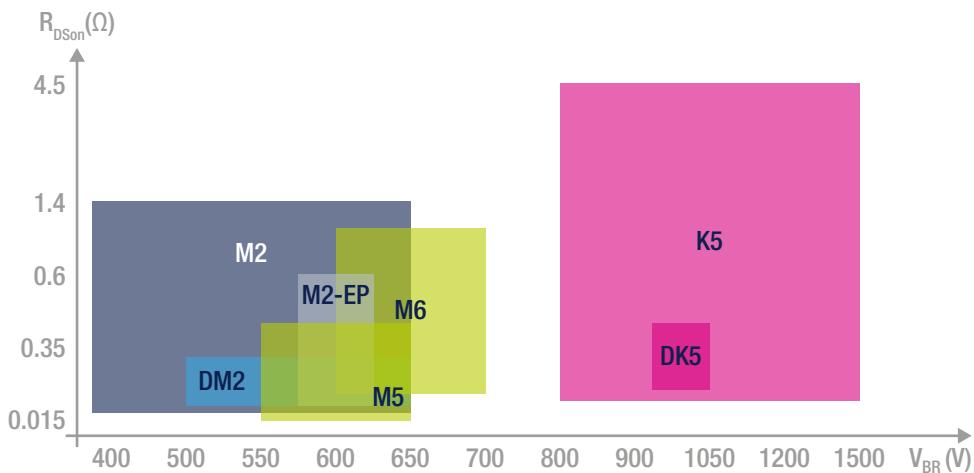
Fitness, climate, home and factory automation monitoring
SPV1050

Note: * A CC-CV battery charger is needed to apply lithium batteries charging profile

POWER MOSFETs

High-voltage power MOSFETs (silicon)

ST's HV **MOSFET** portfolio offers a broad range of breakdown voltages from 400 to 1500 V, with low gate charge and low on-resistance, combined with state-of-the-art packaging. ST's MDmesh™ high-voltage MOSFETs technology has enhanced power-handling capability, resulting in high-efficiency solutions. Supporting applications for a wide voltage range such as switch mode power supplies, lighting, DC-DC converters, motor control and automotive applications, ST has the right MOSFET for your design.



K5 series

ST*N*K5

- Very low R_{DS(on)}
- Small Q_g and capacitance
- Small packages available
- Suited for hard switching topologies

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M5 series

ST*N*M5

- Extremely low R_{DS(on)}
- High switching speed
- Suited for hard switching topologies

M2/M2-EP series

ST*N*M2

ST*N*M2-EP

- Extremely low Q_g
- Optimized for light load conditions
- Tailored for high-frequency applications (M2-EP)
- Suited for hard switching & ZVS/LLC topologies

DM2 & DM6 series

ST*N*DM2

ST*N*DM6

- Improved trr of intrinsic diode
- High dV/dt capability
- Suited for ZVS/LLC topologies

DK5 Series

ST*N*DK5

- Lowest trr @ Very High Voltage BVDSS
- High dV/dt capability
- Targeting high power 3-phases industrial equipment

M6 series

ST*N*M6

- Lower RDS(on) x area vs previous generation
- Extremely low gate charge (Q_g)
- Optimized capacitances profile for better efficiency @ light load
- Optimized threshold voltage (V_{TH}) and gate resistance (R_G) values for soft switching

MAIN APPLICATIONS



Adapters
K5, M5, M2, M2-EP,
M6



Solar inverters, welding, HEVs, and UPS
K5, M5, DM2, DM6, DK5



Residential, commercial,
architectural and street lighting
K5, DK5

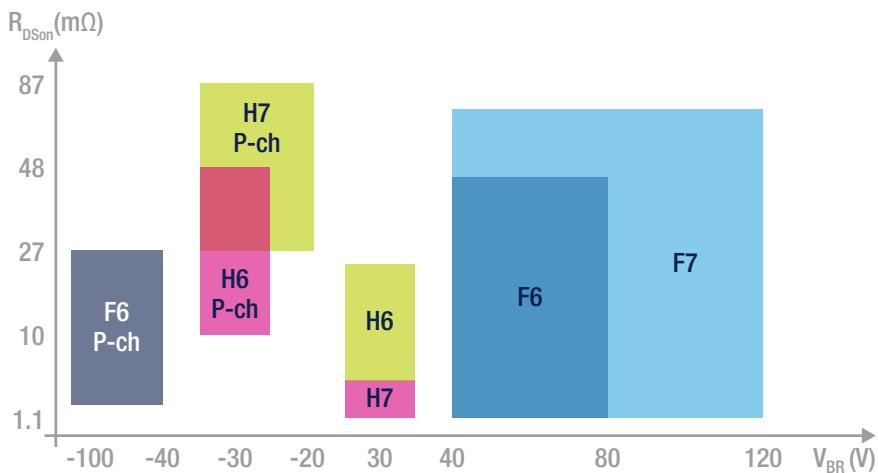


Server/Telecoms
M5, M2, M2-EP, DM2

Low-voltage power MOSFETs (silicon)

ST's LV **MOSFET** portfolio offers a broad range of breakdown voltages from -100 V to 120 V, with low gate charge and low on-resistance, combined with state-of-the art packaging.

ST's STripFET MOSFETs support a wide voltage range for synchronous rectification, UPS, motor control, SMPS, power-over-Ethernet (PoE), inverter, automotive and other applications in a wide range of miniature and high-power packages: DPAK, D²PAK, SOT-223, TO-220, TO-220FP, TO-247, PowerFLAT (5 x 6)/(3.3 x 3.3)/(2 x 2), SO-8 and SOT23-6L.



H6 series

ST*N*H6

- Very good R_{DS(on)}
- Soft diode recovery
- Suited for OR-ing, square-wave HB, battery mgmt topologies

H7 series

ST*N*H7

- Extremely low R_{DS(on)}
- High current capability
- Monolithic Schottky
- Super logic level (P-channel)
- Suited for reverse buck, buck-boost, battery mgmt, forward and buck topologies

F6 series

ST*N*F6

- Wide voltage range
- Soft diode recovery
- Very good R_{DS(on)}
- Suited for load-safety switch, buck and sync rectification

F7 series

ST*N*F7

- Extremely low R_{DS(on)}
- Optimized body diode (low Q_{rr}) and intrinsic capacitance
- Proper Crss/Ciss ratio
- Suited for flyback and sync rectification

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MAIN APPLICATIONS



Small motor control and
USB battery chargers

F6



HDD, power tools, STB,
and game consoles

H6, H7



Server/Telecoms
and SMPS

H7, F7



UPS, e-bikes,
and fans

F6, F7



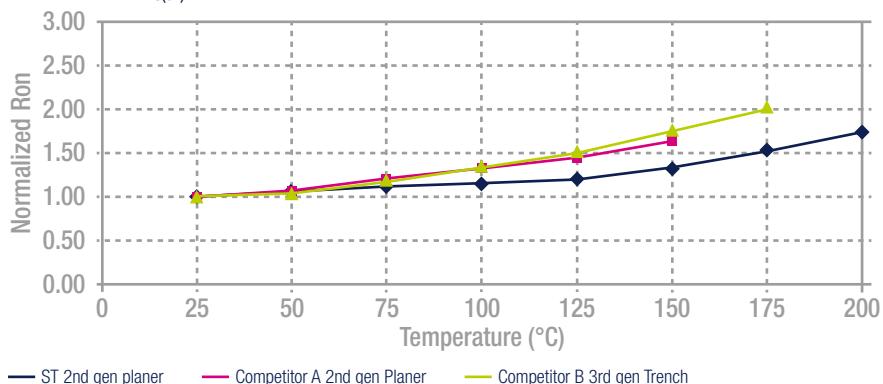
Solar inverters,
forklifts, and EHVs

F7

SiC MOSFETs

Based on the advanced and innovative properties of wide bandgap materials, ST's silicon carbide (SiC) MOSFETs feature very low RDS(on) per area for the 650 V/1200 V rating combined with excellent switching performance, translating into more efficient and compact designs. ST is among the first companies to produce high-voltage **SiC MOSFETs**. This new family features the industry's highest temperature rating of 200 °C for improved thermal design of power electronics systems. Compared to silicon MOSFETs, SiC MOSFETs also feature significantly reduced switching losses with minimal variation versus the temperature. These features render the device perfectly suitable for high-efficiency and high power density applications.

Normalized R_{DS(on)} vs. temperature



SiC MOSFETs MAIN BENEFITS

- Smaller form factor and lighter systems
- Reduced size/cost of passive components
- Higher system efficiency
- Reduced cooling requirements and heatsink size

SiC MOSFETs, the real breakthrough in high voltage switching

SCT*N120 SCT*N65G2V¹

- V_{BR} = 1200 V (SCT*N120), 650 V (SCT*N65G2V)
- Low power losses at high temperature
- High operating temperature capability (200 °C)
- Body diode with no recovery losses
- Low power losses at high temperatures
- Easy to drive
- Low gate charge (SCT*N65G2V¹)

MAIN EVALUATION BOARD



4 kW
Boost inverter evaluation board
Available on request

MAIN APPLICATIONS



Motor control



HEVs / EVs



Welding



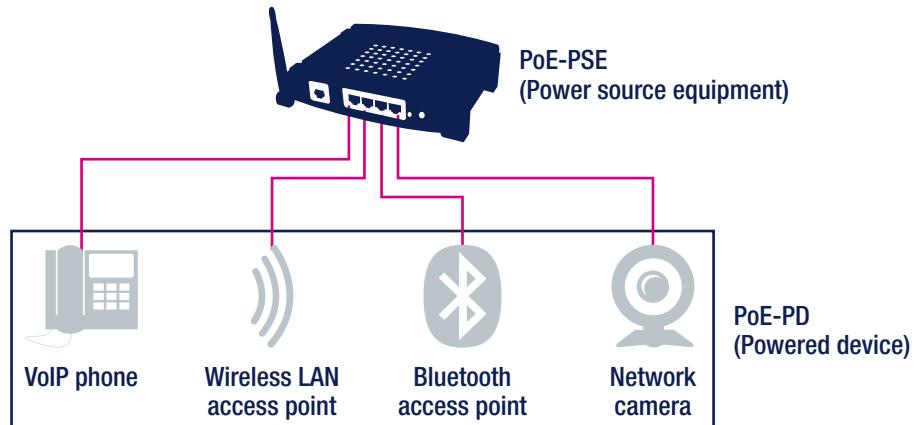
UPS



Solar inverters

POWER OVER ETHERNET ICs

Power over Ethernet (PoE) is a widely adopted technology used to transfer both data and electrical power over an RJ-45 cable. ST offers solutions for PoE applications on the powered devices (PD) side that integrate a standard power over Ethernet (PoE) interface and a current mode PWM controller to simplify the design of the power supply sections of all powered devices. ST's PoE-PD ICs are compliant with both the more recent IEEE 802.3at specification, commonly known as PoE+, and the former IEEE 802.3af (PoE).



PoE-PD devices

PM8803

- IEEE 802.3at PD interface
- PWM current mode controller with double gate driver
- Integrated 100 V, 0.45 W, 1 A hot-swap MOSFET
- Supports flyback, forward active clamp, and flyback with synchronous rectification topologies

PM8801

- Sleep mode with LED indicator and Maintain Power Signature
- IEEE 802.3at PD interface + PWM current mode ctrl with double gate driver
- Integrated 100 V, 0.45 W, 640 mA hot-swap MOSFET
- Supports flyback, forward active clamp, and flyback with synchronous rectification topologies

PM8800A

- IEEE 802.3af PD interface
- PWM current mode controller
- Integrated 100 V, 0.5 W, 800 mA hot-swap MOSFET
- Supports both isolated and non-isolated topologies

Main standards

PM8800A

PoE
(IEEE 802.3af)

13 W

PM8803, PM8801

PoE+
(IEEE 802.3at)

25 W

PM8803 with external booster

4-pair PoE

60 W

Power at
PoE-PD input

Power over Ethernet power supply protection

PEP01-5841

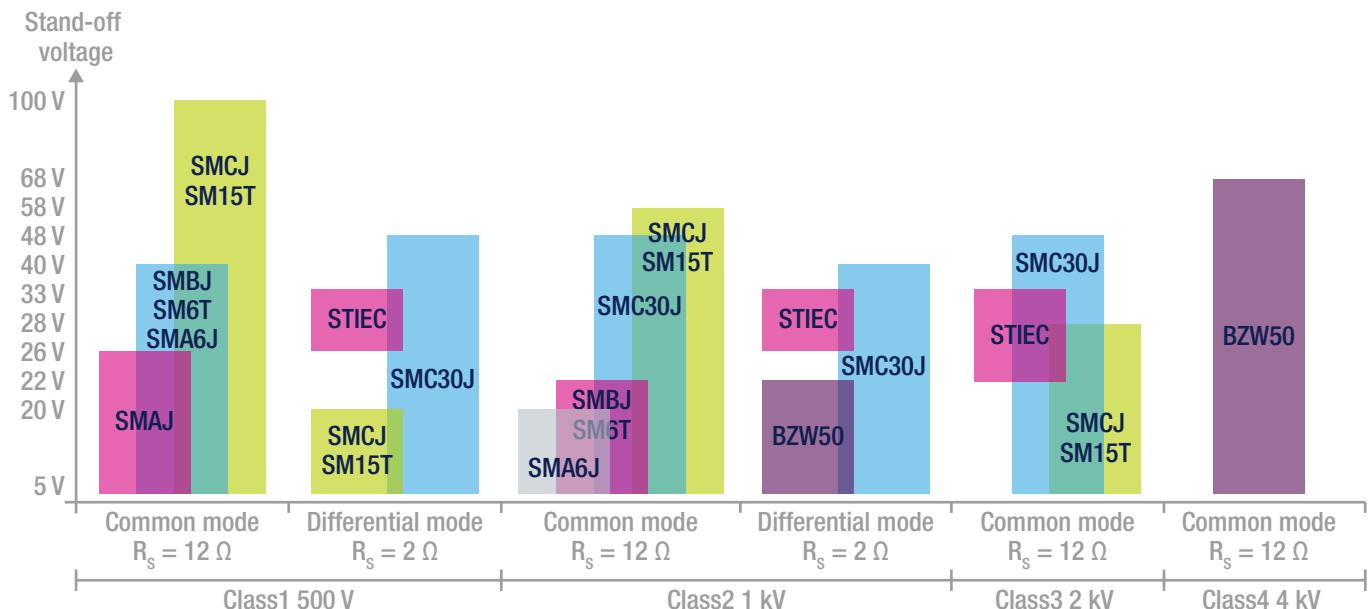
- Power supply protection compliant with IEC61000-4-5 Level 2 : 1 kV
- Allow to use 100 V power MOSFET
- Stand off voltage: 58 V
- Surface mount SO-8 package

PROTECTION DEVICES

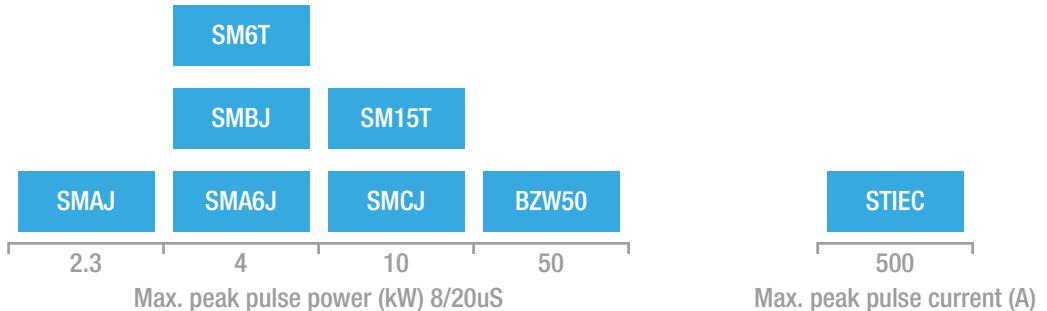
EOS 8/20 μ s surge protection

ST's 8/20 μ s surge protection comply with IEC 61000-4-5 for power supply lines or datalines.

A large choice of package is available to meet application requirements



EOS protections, upgraded performance for high temperature applications



MAIN APPLICATIONS



Offline and DC-DC power supplies, PFC



Solar inverters

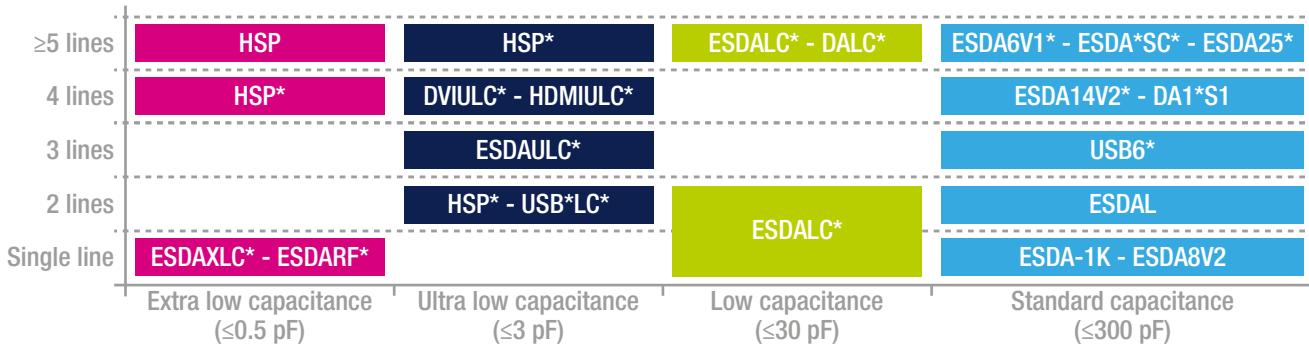


Smart metering

ESD protection

Driven by market needs, ST's ESD protection devices are available as single line devices for flexibility and multi-line arrays for integration in compact application. All these devices are rated according to IEC 61000-4-2 and specific requirements, such as low capacitance, bandwidth for high speed lines.

A large choice of package is available to meet application requirements.



Power delivery Protections

Ultimate TVS protection for USB fast-charging ports

ESDAxxP

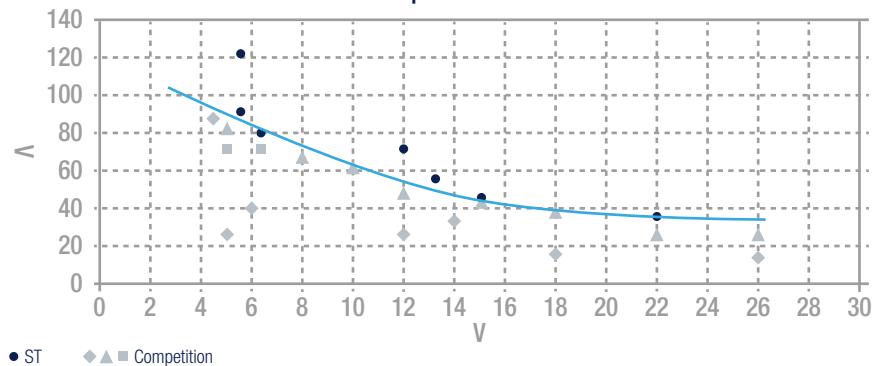
Strong and thin protection, the ESDAxP-1U1M series helps to stop damages due to the surge events

KEY FEATURES & BENEFITS

- Complete voltage range 5 V, 9 V, 12 V, 15 V and 20 V.
- A unique small and thin package for all the voltages (1.0 mm x 1.6 mm x 0.55 mm) minimizing the PCB area consumption.
- Highest housed 8/20 μs IPP in the market, from 35 A to 120 A.

Peak pulse current performances

IPP 8/20 μs versus VRM



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	ESDA7P60-1U1M	ESDA7P120-1U1M	ESDA13P70-1U1M	ESDA15P60-1U1M	ESDA17P50-1U1M	ESDA17P100-1U2M	ESDA25P35-1U1M
Stand-off voltage (V_{RM})	5.5 V	5.5 V	12 V	13.2 V	15 V	15 V	22 V
Peak pulse current (IPP 8/20 μs)	60 A	120 A	70 A	60 A	50 A	160 A	35 A

MAIN APPLICATIONS



Tablets, smartphones, and digital cameras



Healthcare



I/O microcontrollers and signal conditioning



Factory automation
Human machine interface (HMI)



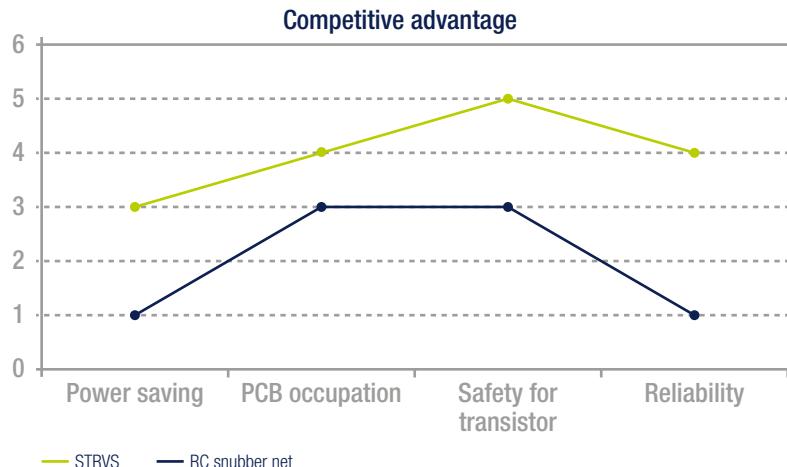
Smart metering



SIM cards, Ethernet,
and HDMI/DVI ports

Repetitive voltage suppressor

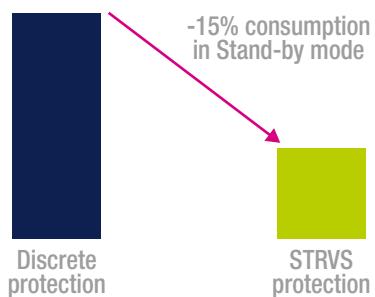
In applications, overvoltage constraints may not always come from lightning, electrical overstress or electrostatic discharge, but from the circuit itself. In such cases, standards do not apply. Repetitive surges may raise protection device temperature. The **ST's STRVS family** is the first TVS series to be specified against repetitive overvoltages in high temperature conditions. Protection devices must be selected according to their power capability at high junction temperatures and their clamping voltage specified at high temperature.



STRVS, the Transil series dedicated against repetitive overvoltage in high temperature conditions

STRVS*

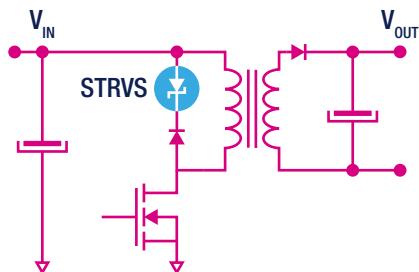
- Clamping voltage characteristics defined at 25 °C, 85 °C and 125 °C
- Stand-off voltage range: from 85 V to 188 V
- Low leakage current: 0.2 µA at 25 °C
- Maximum operating junction temperatures:
 - SMB and SMC: 150 °C
 - DO-15 and DO-201: 175°C



STRVS MAIN BENEFITS

- Better Transil™ selection for cost optimization (oversizing avoided)
- Fixed and reliable clamping voltage
- Reduced power consumption vs discrete protection (RC snubber)
- Customer design effort reduced

STRVS topology usage example



MAIN APPLICATIONS



Adapters



Smart metering



Solar inverters



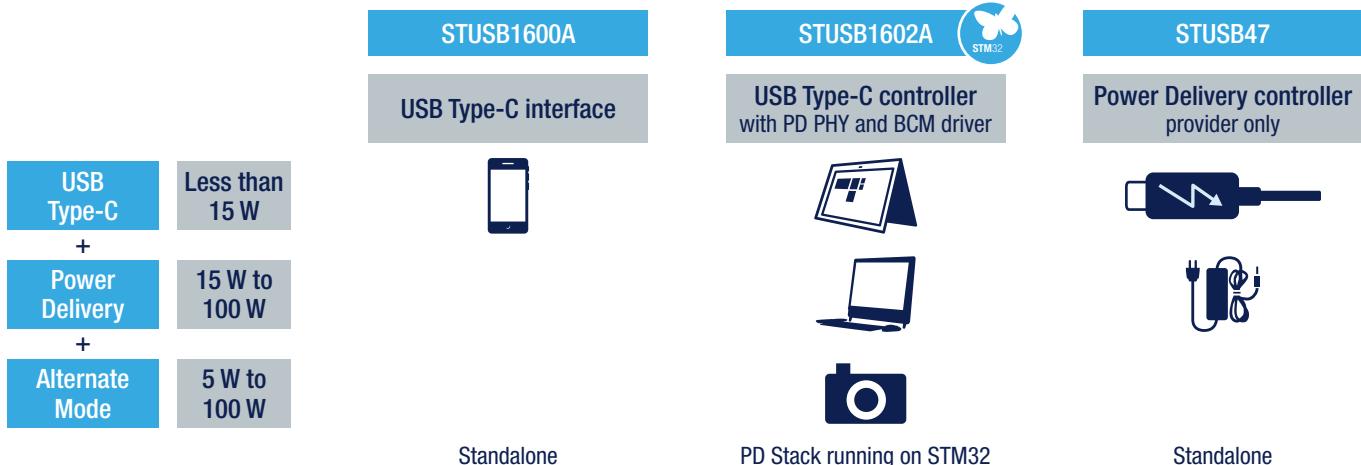
Residential, commercial, architectural and street lighting

USB TYPE-C AND POWER DELIVERY CONTROLLERS

With an extensive technology and IPs portfolio, ST can provide a range of solutions for USB type-C and Power Delivery to support implementations in a variety of devices.

Manufactured using ST's 20 V process technology, the certified STUSB Family controller IC integrates short-circuit, over-voltage, over-current protection to eliminate the need for external circuitry. Additionally, it offers plug power support (V_{CONN}) with up to 600 mA programmable current capability and, per the USB Power Delivery specification, it integrates Bi-Phase Mark Coded (BMC) Physical Layer (PHY) coding and decoding logic. Integration of such features in a single-chip Type-C™ controller enables fast migration to USB Type-C™, while minimizing MCU-resource requirements compared to alternate solutions.

STUSB Family cover all the applications with optimized partitioning from USB Type-C™ Interface for 15 W device to Power delivery PHY and BMC Driver ICs companion chip of STM32 based solution to standalone Full Hardware USB PD Controller optimized for AC adapters.



USB Type-C™ Interface

STUSB1600A

- Roles: Source/Sink/Dual Role Power
- Configurable start-up profiles (embedded FTFP memory)
- Integrated VCONN switch
- Adjustable current limit (600 mA max)
- OVP, OCP, UVP, short protection
- Direct interface to MCU thru I²C + IRQ
- Dead battery support
- Dual power supply:
 - VBUS = (4.6 V - 22 V) - AMR = 28 V
 - VSYS = (3.0 V; 5.5 V)

Power delivery PHY and BMC Driver IC companion chip of STM32 based solution

STUSB1602A

- Roles: Source/Sink/Dual Role Power
- Configurable start-up profiles (embedded FTFP memory)
- Integrated VCONN switch
- Adjustable current limit (600 mA max)
- OVP, OCP, UVP, short protection
- I²C, SPI+ IRQ MCU interface – Dual I²C address support
- Integrated Voltage monitoring
- Integrated VBUS discharge path
- Accessory & dead battery support
- Dual power supply:
 - VBUS = (4.6 V - 22 V) - AMR = 28 V
 - VSYS = (3.0 V; 5.5 V)

Full hardware USB PD controller optimized for AC adapters

STUSB47

- Role: Source
- Support all USB PD profiles
- Configurable start-up profiles (embedded FTFP memory)
- Dedicated Voltage & Current control Interface
- Integrated Voltage monitoring
- Integrated VBUS discharge path
- Auto-run support
- Nominal power supply
- VBUS = (4.6 V - 22 V)
- AMR = 28 V

STM32 as system/device policy manager running USB Power Delivery stack and application specific layers

X-CUBE-USB-PD



STUSB1602A Type-C Controller



USB-C

STUSB1602A Type-C Controller



USB-C

life.augmented



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