Power management guide

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Introduction

More than 30 years of technology innovation in power management directly resulting in value creation for our customers, from products to system solutions

OUR STRONG COMMITMENT TO INNOVATION

When designing a power management system or sub-system, regardless of whether it is an energy generation or distribution system, a power supply for server and telecom applications, an industrial SMPS or an electric vehicle power application, it must provide high efficiency and low standby power, as well as high power density, reliability, and safety, while respecting specific cost constraints.

The key enablers for any such system are discrete and integrated power semiconductors, which play a crucial role in every step along the energy supply chain and, when applied in conjunction with advanced control technologies, can drive continuous improvement in energy savings for homeowners and communities, and ultimately for the entire planet.

The technological innovation, which persists at the core of ST strategy for more than 30 years, is the reason why ST today can offer an extensive range of cutting-edge products for power and energy management. ST portfolio includes higher-efficiency power technologies such as:

- Silicon carbide power discretes
- PowerGaN transistors
- GaN power ICs
- HV and LV power MOSFET and IGBTs
- Customized power modules
- Diodes and thyristors
- Protection devices and filters
- AC-DC converters and controllers
- DC-DC converters
- Linear voltage regulators
- Analog ICs
- Battery management ICs
- STM32 microcontrollers
- MOSFET and IGBT gate drivers

ST provides a selection of new PowerGaN, devices which represent a major step forward in power electronics by providing high-frequency operation with increased efficiency and higher power density than traditional solutions.

Moreover, as design complexity continues to rise, especially in digital power applications, our strong commitment to innovation is driving the development of highly reliable, energy-efficient solutions and unmatched control algorithms.

Additionally, we provide a comprehensive range of reference designs, hardware, software evaluation, and development tools, including the eDesignSuite tool that helps engineers design and optimize their high-efficiency power solutions.

Applications

ENERGY GENERATION AND DISTRIBUTION

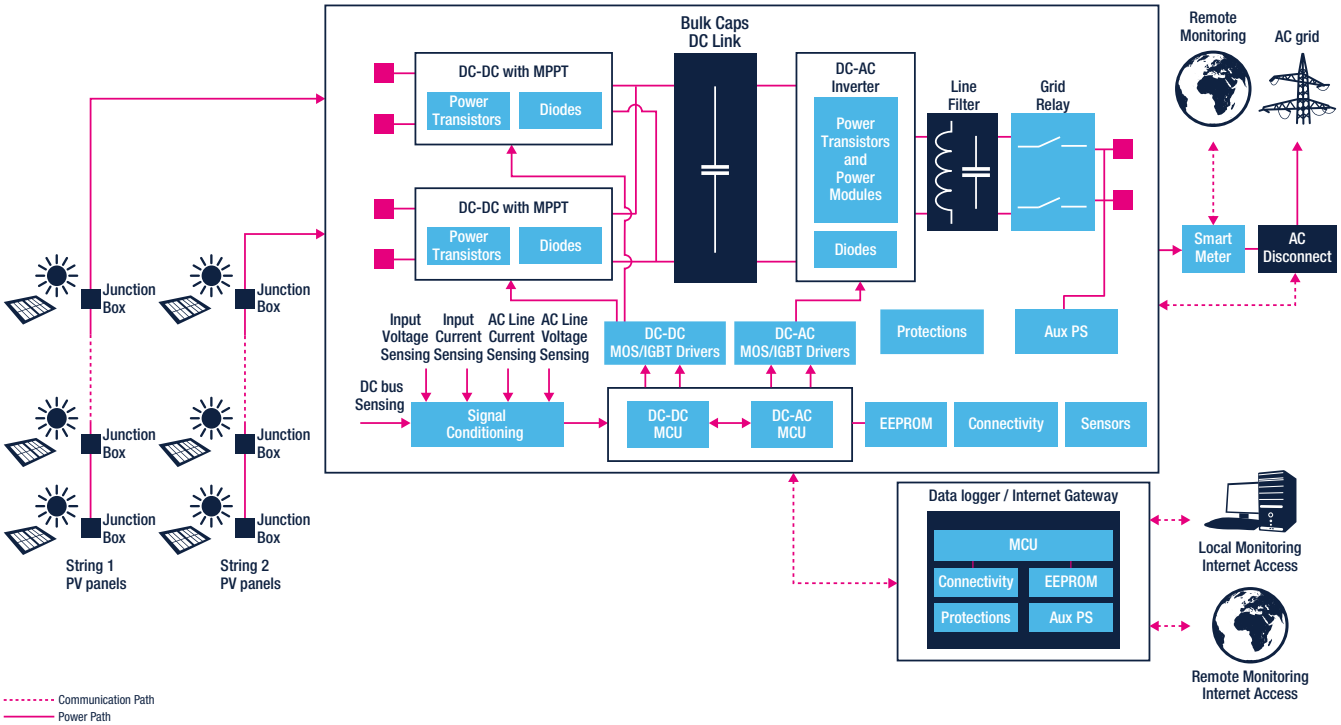
Solar centralized generation - solar inverters (string and central)

String and central inverters are the most common power conversion systems used for grid-connected solar applications. They comprise a DC-DC conversion stage to adapt voltage levels and implement the maximum power point tracking (MPPT) function to maximize energy transfer from the panel, and a DC-AC conversion stage to correctly shape current and voltage waveforms transferred to the AC grid. The inverter has an anti-islanding function that guarantees safety in case of AC disconnection, along with the arc fault circuit interruption (AFCI) function to prevent fire hazards. With power ranging from a few kilowatts for string and multi-string inverters to tens or hundreds of kilowatts for central inverter solutions, the trend is to use topologies with very high input voltages (up to 1500 V).

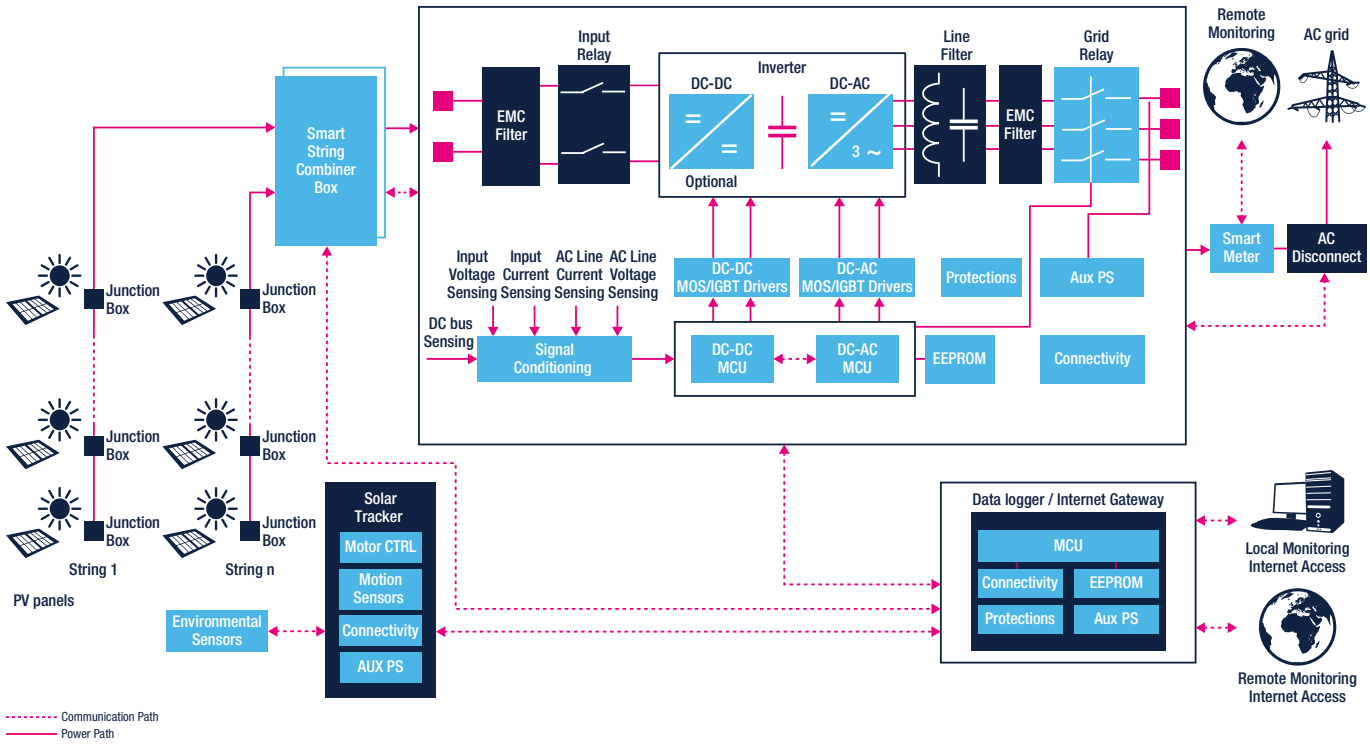
To further enhance safety and system integrity, converters should incorporate the arc fault circuit interruption (AFCI) function, which detects and mitigates dangerous electrical arcs that could lead to fire hazards.

We offer a broad range of silicon-carbide (SiC) power MOSFETs - with the industry's highest operating junction temperature of 200 °C - and trench-gate field-stop IGBTs, which are also integrated in our high-efficiency ACEPACK power modules. Together with galvanically-isolated gate drivers and high-performance STM32 microcontrollers, our solutions enable engineers to design high-efficiency string and central inverters. In addition, we have a range of wireless and wired connectivity solutions.

Typical block diagram for string inverter



Typical block diagram for central inverter



ST product offering for string and central solar inverter

	Power MOSFFETs	IGBTs	Power modules	Diodes and discretes
Inverter power stage DC-DC and DC-AC	600 V-650 V MDmesh DM9 ST*60N*DM9, ST*65N*DM9 600 V-650 V MDmesh DM6 ST*60DM6, ST*65DM6 600 V-650 V MDmesh DM2 ST*60DM2, ST*65DM2 600 V-650 V MDmesh M9, ST*60N*M9, ST*65N*M9 650 V MDmesh M5 ST*65M5 1200 V MDmesh K5 ST*N120K5 650 V-750 V-900 V-1200 V-1700 V SiC MOSFETs SCT*170G1(AG) SCT*65/75/90/120G3(AG)	600 V V series STG*V60DF 650 V HB series STG*H65DFB 650 V HB2 series STG*H65DFB2 1200 V H series STG*H120DF2 1200 V M series STG*M120DF3	ACEPACK Power modules A2U8M12W3-FC A2F20M65W3-FC A2TBH45M65W3-FC **Thyristors SCRs** Thyristors SCRs for grid relay TN5050H-12PI, TN8050H-12PI, TM8050H-8W	600 V Ultrafast STTH*06 STTH*R06 1200 V Ultrafast STTH*12 100 V power Schottky STPS*100 SiC diodes STPSC*065 STPSC*12 TVS for power MOSFET and IGBT protection SMAJ, SM6T, SM15T series

	MCUs	MOSFET and IGBT gate drivers	Protections	Connectivity
Inverter driving and control stage	STM32H7 STM32G4 STM32F334 STM32F3 STM32F4 STM32F7	HV HB gate drivers L649* Isolated gate drivers STGAP* Multiple LS gate drivers PM8834 **LDO** L78xx, LD1117, LD39200, ST730/2 **DC-DC converters** L6983, L6982, L6981	TVS for power rail surge protection SMAJ, SM6T, SM15T, SMC30J, SMC50J series ESD and HSP series for Ethernet and USB protection	Zigbee, Thread STM32WB LoRaWAN, Sub-1GHz wireless MCU STM32WL NBIoT module ST87M01 Bluetooth Low Energy BlueNRG, STM32WB, STM32WBA5 KNX STKNX Power Line transceivers ST8500, ST7580 RS-422 and RS-485 ST3485*, STR485*, ST4E1240* Isolated interfaces for wired connectivity STISO62*
	MCUs	**EEPROM**	**Protections**	
Data logger/internet Gateway	STM32F0 STM32G0 STM32F1 STM32F3	Standard serial EEPROM	ESD and HSP series for Ethernet and USB protection	

	Motor CTRL	Motion sensors	Environmental sensors	Connectivity
Solar tracker	3-phase field oriented control (FOC)	Accelerometer IIS3DHHC, IIS2DH, IIS2ICLX Magnetometer-IIS2MDC eCompass-ISM303DAC 6 axis IMU-ISM330DLC, ISM330DHCX	Pressure - LPS22HH Temperature - STTS22H	Bluetooth Low Energy BlueNRG, STM32WB, STM32WBA5

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

Solar distributed generation - microinverter

In residential photovoltaic systems, microinverters are often used as an alternative to string inverters to perform DC to AC power conversion at the panel level, helping maximize energy yield and mitigate problems related to partial shading, dirt, or single panel failures. A microinverter consists of a DC-DC converter implementing maximum power point tracking MPPT, and a DC-AC inverter to shape current and voltage for injection into the AC grid. Data (including voltage, current, and power generated) from all the microinverters in the installation are collected by a concentrator and dispatched to a local or remote monitoring and control access point.

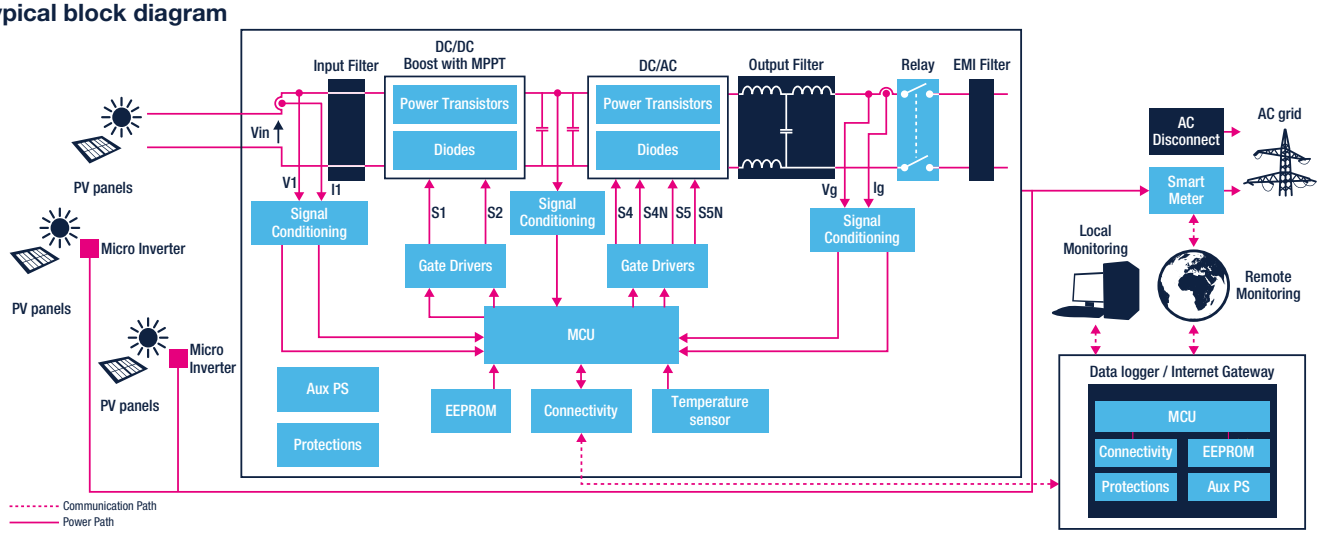
Our solution includes MDmesh and STripFET power MOSFETs, high-voltage, galvanically isolated gate drivers, high-voltage silicon carbide (SiC) diodes, together with high-performance STM32 microcontrollers featuring dedicated peripherals to help implement complex power conversion control algorithms. A range of wireless and wired connectivity solutions including multi-standard power line modems complete the solution.

ST product offering for microinverter

<table>
<tr><th></th><th colspan="2">Power MOSFFETs and GaN transistors</th><th colspan="2">Signal conditioning</th></tr>
<tr><td rowspan="2">Microinverter power stage</td><td colspan="2">60 V-100 V STripFET F7/F8
ST*N6F7, ST*N8F7/F8, ST*N10F7/F8
100 V-700 V PowerGaN SGT*10*, SGT*70*
600 V-650 V MDmesh DM9 ST*60N*DM9, ST*65N*DM9
600 V-650 V MDmesh DM6
ST*60DM6, ST*65DM6
600 V-650 V MDmesh DM2
ST*60DM2, ST*65DM2
600 V- 650 V MDmesh M9
ST*60N*M9, ST*65N*M9
600 V MDmesh M6
ST*60M6
650 V MDmesh M5
ST*65M5
800 V MDmesh K6 ST*80*K6
800 V-900 V MDmesh K5
ST*80K5, ST*90K5
650 V-750 V-900 V-1200 V-1700 (V) SiC MOSFETs
SCT*170G1(AG)
SCT*65/75/90/120G3(AG)</td><td>Precision Op Amps (<50 MHz)
TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV*
Current sensing TSC*v
Diodes
600 V Ultrafast STTH*R06
11200 V Ultrafast STTH*S12
100 V power Schottky STPS*100
SiC diodes, STPSC*065, STPSC*12
100 V Trench Schottky STPST*100
Protections
TVS for power MOSFET and
power rail surge protection
SMAJ, SM6T, SM15T series
Thyristors SCRs and triacs
Thyristors SCRs and triacs for grid relay
TN815-800B, TN1515-600B, T1635H-8G, T2550-12G, TN1605H-8B</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">Microinverter Driving and control stage</td><td>MCUs</td><td>GaN, MOSFET and IGBT gate drivers</td><td>Sensors</td><td>EEPROM</td></tr>
<tr><td>STM32H7
STM32G4
STM32F334
STM32F3
STM32F4
STM32F7</td><td>HV HB gate drivers for GaN
STDRIVEG6*
HV HB gate drivers
L638*, L639*, L649*
Isolated gate drivers
STGAP*
LV HB gate drivers for GaN
STDRIVEG2*
Multiple LS gate drivers PM8834
Single LS gate drivers PM88*1</td><td>Pressure - LPS22HH
temperature - STTS22H
Protections
TVS for power rail surge protection SMAJ, SM6T, SM15T, SMC30J, SMC50J series</td><td>Standard serial EEPROM
Connectivity
Zigbee, Thread
STM32WB[1]
Bluetooth Low Energy
BlueNRG, STM32WB, STM32WBA5
KNX STKNX
Power Line transceivers
ST8500, ST7580
RS-422, RS-485 and RS-232
ST3485*, STR485*, ST4E1240*, ST3232*
Isolated interfaces for wired connectivity
STISO62*</td></tr>
<tr><td>MCUs</td><td>EEPROM</td><td>Protections</td></tr>
<tr><td>Data Logger/ Internet Gateway</td><td>STM32F0
STM32G0</td><td>Standard serial EEPROM</td><td>ESD and HSP series for Dataline ESD and EOS protection</td></tr>
</table>

Note: * is used as a wildcard character for related part number 1: for data Logger/Internet Gateway only

Typical block diagram



Solar distributed generation - power optimizer

In architectures based on the use of power optimizers, the maximum power point tracking (MPPT) function is performed at the level of photovoltaic panels, individually operating each one at its optimal I-V point which ensures maximum power generation. This results in an improved energy yield of the overall solar system compared to traditional string or central inverter based architectures.

Power optimizers can help minimize system design constraints as well as improve reliability and safety by helping ensure compliance with the latest NEC 2017 regulations that require rapid shut-down in the event of grid disconnection, while reducing maintenance costs.

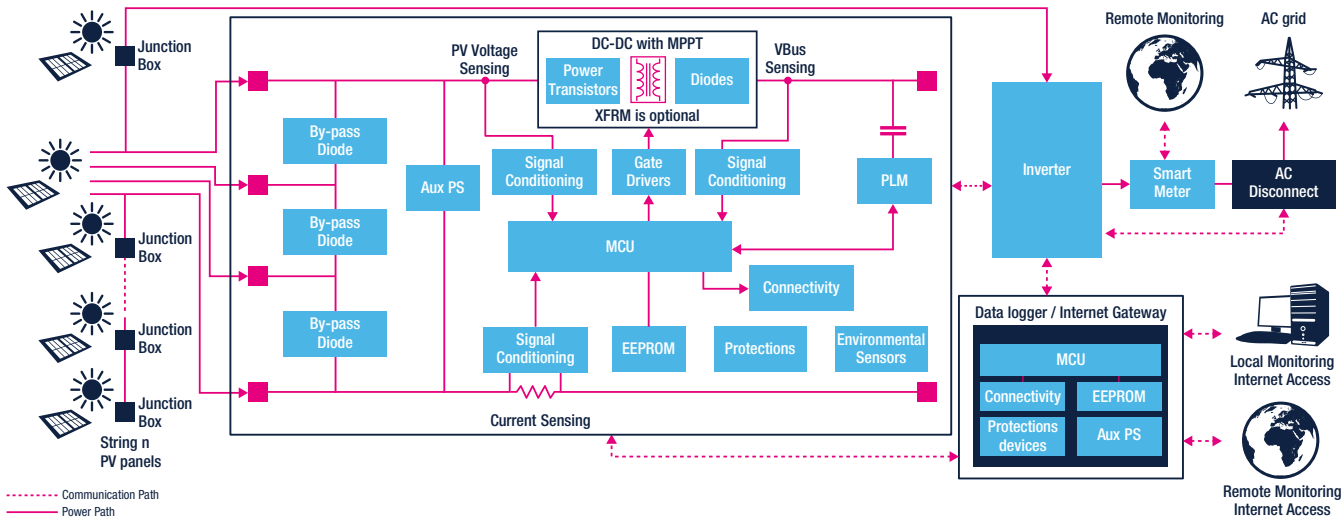
We provide high-performance STM32 microcontrollers and high-efficiency STripFET F7 and STripFET F8 LV MOSFETs diodes, SiC MOSFETs and trench gate field-stop IGBTs, galvanically-isolated gate drivers, and power line communication solutions to help achieve superior efficiency and reliability for power optimizer based architectures.

ST product offering for power optimizer

	MCUs	Power MOSFETs	Gate drivers	By pass diodes	Diodes	Protections	Signal conditioning
Power optimizer	STM32F334 STM32F0 STM32G0 STM32F3 STM32G4	60 V to 100 V STripFET F7/F8 ST*N6F7 ST*N8F7/F8 ST*N10F7/F8 100 V PowerGaN SGT*10*	HV HB gate drivers L649* Isolated gate drivers STGAP* Multiple LS gate drivers PM8834 Single LS gate drivers PM88*1	30 V to 45 V Power Schottky STPS*30 STPS*45 45 V FERD FERD*45	100 V to 200 V Power Schottky STPS*100 STPS*200 100 V FERD FERD*100 100 V Trench Schottky STPST*100	TVS for power MOSFET and IGBT protection SMAJ, SM6T, SM15T, SMC30J, SMC50J series TVS for power rail surge protection SMAJ, SM6T, SM15T, SMC30J, SMC50J series ESD protection for I/O interfaces	Precision Op Amps (<50 MHz) TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV* Current sensing TSC*
							Connectivity
	MCUs	**Power MOSFETs**		**IGBTs**	**Diodes**		Zigbee, Thread STM32WB[1] LoRaWAN, Sub-1GHz wireless MCU STM32WL Bluetooth Low Energy, BlueNRG STM32WB, STM32WBA5 NBIoT module ST87M01 Power Line transceivers ST8500, ST7580 Isolated interfaces for wired connectivity STISO62*
Inverter	STM32H7 STM32G4 STM32F334 STM32F3 STM32F4 STM32F7	650 V-750 V-900 V 1200 V-1700 (V) SiC MOSFETs SCT*170G1(AG) SCT*65/75/90/120G3(AG)		600 V V series STG*V60DF 650 V HB series STG*H65DFB 650 V HB2 series STG*H65DFB2 1200 V H series STG*H120DF2 1200 V M series STG*M120DF3	600 V Ultrafast STTH*06 STTH*R06 SiC diodes STPSC*065 STPSC*H12		
	MCUs	**EEPROM**				**Protections**	
Data Logger/ Internet Gateway	STM32F0 STM32G0	Standard serial EEPROM				EESD and HSP series for Dataline ESD and EOS protection	

Note: * is used as a wildcard character for related part number 1: for data Logger/Internet Gateway only

Typical block diagram



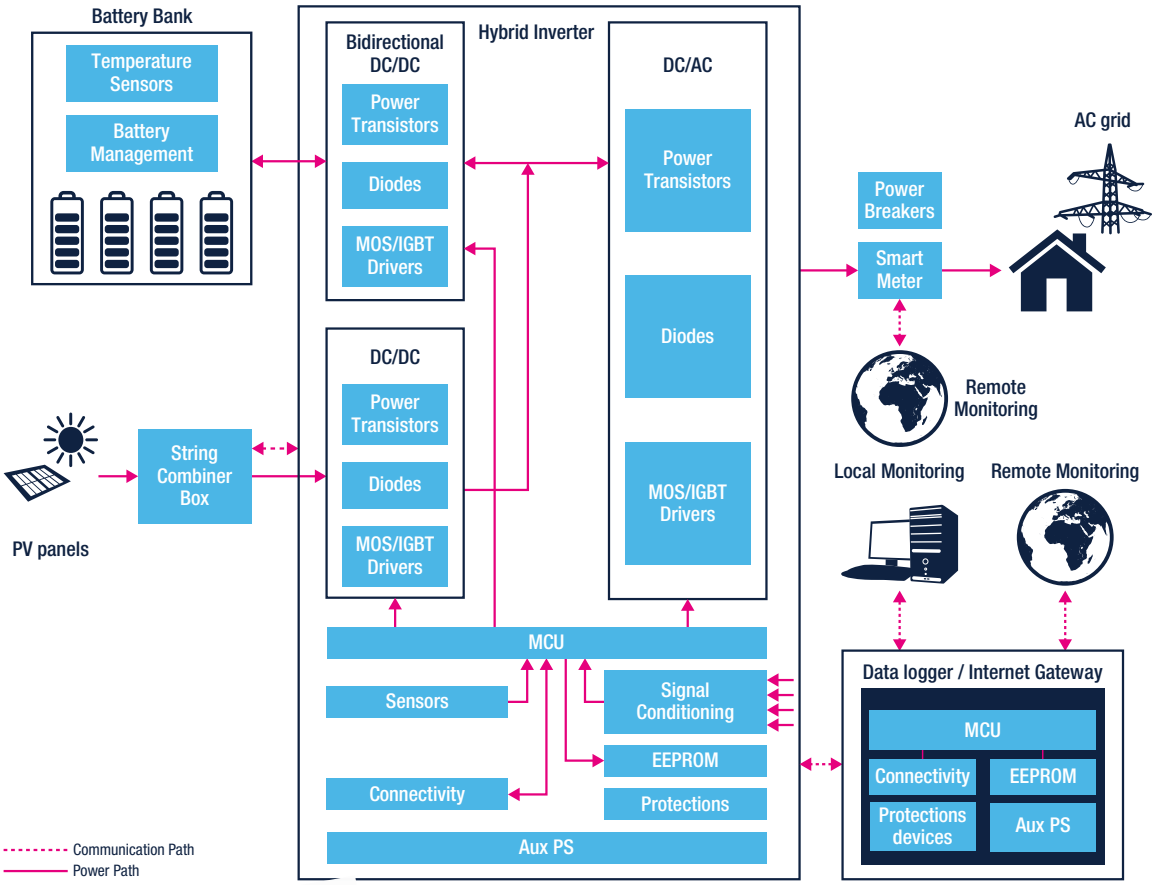
Energy distribution - home and commercial battery storage systems

The adoption of energy storage devices, whose reserve capacity can be used for balancing purposes, peak-load shaving, or to shift loads, is increasingly widespread in energy distribution networks.

Two use cases are particularly important: in residential or commercial buildings to help reduce consumer electricity bills by reducing energy consumption from the grid during peak hours, and to help avoid problems with stability and voltage drop associated with the fast-charging requirements of an increasing number of electric vehicles (EV).

By interacting with the grid, batteries, and potentially solar panels, power converters at the heart of these systems must operate with high-efficiency and superior reliability over time.
To further enhance safety and system integrity, converters should incorporate the arc fault circuit interruption (AFCI) function, which detects and mitigates dangerous electrical arcs that could lead to fire hazards. We provide a range of power discretes, including silicon carbide (SiC) and silicon power transistors, ACEPACK power modules, silicon carbide and silicon diodes, isolated gate drivers and high-performance STM32 microcontrollers, as well as energy metering ICs for high-efficiency commercial battery storage systems.

Typical block diagram - home battery storage system

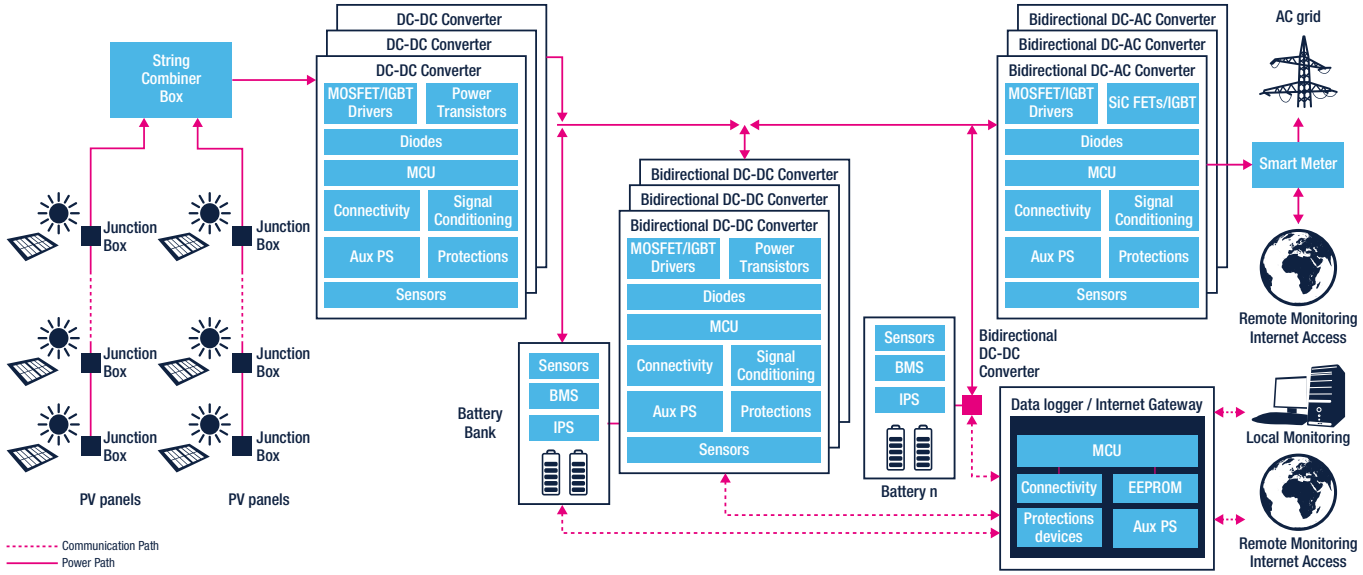


STVEVAL-7BIDIRCB
7 kW bidirectional AC-DC converter based on totem pole PFC and CLLC

STEVAL-11BID1KCB
11 kW bidirectional battery charger based on three phase two level PFC and DAB converter

STDES-DABBIDIR
25 kW dual active Bridge (DAB) bidirectional power converter for BESS and EV charging

Typical block diagram - commercial battery storage system



ST product offering for home and commercial battery storage systems

	Power MOSFETs	IGBTs	Power modules	MOSFET and IGBT gate drivers	Diodes and discretes
DC-DC converter and bidirectional DC-DC converter **Power stage**	40 V-100 V STripFET F7/F8 ST*N4F7, ST*N4F8, ST*N6F7, ST*N8F7/F8, ST*N10F7/F8 600 V-650 V MDmesh DM9 ST*60N*DM9, ST*65N*DM9 600 V-650 V MDmesh DM6 ST*60DM6, ST*65DM6 600 V-650 V MDmesh DM2 ST*60DM2, ST*65DM2 600 V-650 V MDmesh M9 ST*60N*M9, ST*65N*M9 600 V-650 V MDmesh M6 ST*60M6, ST*65M6 600 V-650 V MDmesh M2 ST*60M2, ST*65M2 800 V MDmesh K6 ST*80*K6 800 V to 1200 V MDmesh K5 ST*80K5, ST*9*K5 ST*105K5, ST*120K5 650 V-750 V-900 V-1200 V 1700 V SiC MOSFETs SCT*/170G1(AG) SCT*65/75/90/120G3(AG)	600 V V series STG*V60DF 650 V HB series STG*H65DFB 650 V HB2 series STG*H65DFB2 650 V M series STG*M65DF2 1200 V H series STG*H120DF2 1200 V M series STG*M120DF3	ACEPACK Power modules A2U8M12W3-FC A2F20M65W3-FC A2TBH45M65W3-FC **Thyristors SCRs** Thyristors SCRs for power breakers TS110-8 X0115	HV HB gate drivers L649* Isolated gate drivers STGAP* Multiple LS gate drivers PM8834 Single LS gate drivers PM88*1 **LDO** LD1117*, ST730/2, L78* **DC-DC converters** L6983, L6982, L6981	600 V Ultrafast STTH*06 STTH*R06 800 V to 1200 V Ultrafast STTH*08 STTH*10 STTH*12 SiC diodes STPSC*065 STPSC*12 TVS for power MOSFET and IGBT protection and for power rail surge protection SMAJ, SM6T, SM15T series
DC-AC converter **Power stage**					

	MCUs	Signal conditioning	EEPROM	Sensors	Connectivity
System control stage	STM32H7 STM32G4 STM32F334 STM32F3 STM32F4 STM32F7	Precision Op Amps (<50 MHz) TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV* Current sensing TSC*	Standard serial EEPROM **Protection** TVS for power rail surge protection SMAJ, SM6T, SM15T, and ESD series	Pressure - LPS22HH Temperature - STTS22H **BMS** L99BM2C, L99BM218, L99BM114, L99BM1T, L99BM2T* **IPS** IPS2050H, IPS2050H-32, IPS1025H, IPS1025H-32, IPS4260LM	KNX STKNX Power Line transceivers ST8500, ST7580 RS-485 and RS-232 STR485*, ST4E1240*, ST3232* Isolated interfaces for wired connectivity STISO62*

	MCUs	Protections	EEPROM	Connectivity
Data Logger/ Internet Gateway	STM32H7 STM32G4 STM32F334	ESD and HSP series for Dataline ESD and EOS protection	Standard serial EEPROM	Power Line transceivers ST8500, ST7580 Bluetooth Low Energy BlueNRG STM32WB, STM32WBA5 RS-485 and RS-232 STR485*, ST3232* Sub-1GHz RF transceivers[2] S2-LP, SPIRIT1 Sub-1GHz wireless MCU STM32WL3 LoRaWAN STM32WL5 NBIoT ST87M01 2,4GHz, Thread, ZigBee STM32WB Isolated interfaces for wired connectivity STISO62*

Note: * is used as a wildcard character for related part number 1: only for bidirectional dc-dc converter 2: only for commercial battery storage systems

INDUSTRIAL POWER AND TOOLS

Uninterruptable power supplies (UPS)

Uninterruptable power supplies (UPS) ensure continuity of supply by converting the DC voltage from a battery or battery bank to an AC voltage with the requested amplitude and frequency in case of power outages.

Depending on application requirements, an UPS can be built with a simple off-line configuration or with a double conversion online method for high-end, medium, or high-power UPSs. This also improves the quality of the power supplied to sensitive loads, including computers, servers, smart industry machines, instrumentation, and telecommunication equipment. We offer high-performance discrete devices, including high- and low-voltage power MOSFETs, IGBTs, thyristors, and silicon carbide (SiC) diodes and power MOSFET as well as galvanically-isolated and high-voltage gate drivers, PFC controllers, and high-performance STM32 microcontrollers to enable high-efficiency, high-reliability UPS designs.

ST product offering for uninterruptable power supplies (UPS)

<table>
<tr><td></td><td colspan="2">SCRs and TRIACs</td><td colspan="3">Diodes</td><td></td><td>SCRs and TRIACs</td></tr>
<tr><td>Rect. and inrush current limiter</td><td colspan="2">High Temp. SCR
TN*015H-6, TN*050H-8, TN*050H-12W,
TN1605H-8x
High Temp. triacs
T1635T</td><td colspan="3">Bridge rectifier diodes
STBR*08, STBR*12</td><td>Bypass</td><td>Standard SCR
TYN6*, TYN8*, TYN10*, TYN12*
High Temp. SCR
TN5050H-12PI, TN8050H-12PI
Standard and Snubberless Triacs
T2550-12, TPDV</td></tr>
<tr><td></td><td>MCUs and digital controllers</td><td>Power modules</td><td>Power MOSFETs & GaN transistors</td><td>IGBTs</td><td>Diodes</td><td>Op-Amp V/I sensing</td><td>Protections</td></tr>
<tr><td>PFC</td><td>MCUs
STM32F0, STM32G0,
STM32F301,
STM32F334,
STM32G4
Digital controllers
STNRG388A</td><td rowspan="4">ACEPACK
Power modules

A2U8M12W3-FC
A2F20M65W3-FC
A2TBH45M65W3-FC

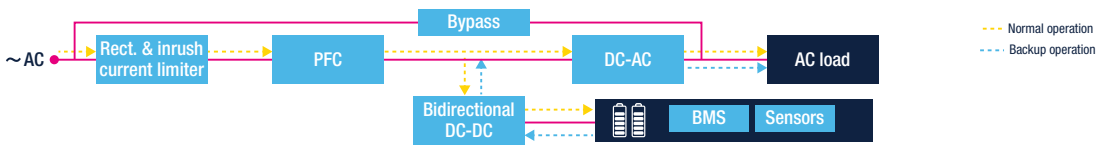
M1P45M12W2-1LA
M2P45M12W2-1LA
M1F45M12W2-1LA
M1TP80M12W2-2LA
M2TP80M12W2-2LA</td><td>600 V- 650 V MDmesh M9
ST*60N*M9, ST*65N*M9
600 V MDmesh M6 ST*60M6
600 V-650 V MDmesh M2
ST*60M2, ST*65M2
650 V MDmesh M5 ST*65M5
650 V-750 V-900 V-1200 V
1700 V SiC MOSFETs
SCT*170G1(AG)
SCT*65/75/90/120G3(AG)
700 V PowerGaN SGT*70*</td><td>600 V V series
STG*V60F
650 V HB series
STG*HP65FB
650 V HB2 series
STG*HP65FB2
1200 V H series
STG*H120F2</td><td>600 V Ultrafast for CCM
STTH*R06
1200 V Ultrafast
STTH*12
SiC diodes
STPSC*065
STPSC*12</td><td>Precision op amps (<50 MHz)
TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV*
Current sensing TSC*

GaN, MOSFETs and IGBT gate drivers</td><td rowspan="2">TVS for power MOSFET protection
SMAJ, SM6T, SM15T series</td></tr>
<tr><td></td><td>MCUs</td><td>Power MOSFETs & GaN transistors</td><td>Diodes</td><td>Post regulation</td><td rowspan="3">HV HB gate drivers
L649*
Isolated gate drivers
STGAP*
HV HB gate drivers for GaNs
STDRIVEG6*
LS gate drivers
PM8834</td></tr>
<tr><td>Bidirectional DC-DC</td><td rowspan="2">STM32H7
STM32G4
STM32F334
STM32F7
STM32F4</td><td rowspan="2">60 V-100 V STripFET F7/F8
ST*N6F7, ST*N8F7/F8, ST*N10F7/F8
600 V-650 V MDmesh DM9
ST*60N*DM9, ST*65N*DM9
600 V-650 V MDmesh DM6
ST*60DM6, ST*65DM6
600 V-650 V MDmesh DM2
ST*60DM2, ST*65DM2
600 V- 650 V MDmesh M9
ST*60N*M9, ST*65N*M9
600 V MDmesh M6 ST*60M6
600 V-650 V MDmesh M2
ST*60M2, ST*65M2
650 V-750 V-900 V-1200 V
1700 V SiC MOSFETs
SCT*170G1(AG)
SCT*65/75/90/120G3(AG)
700 V PowerGaN SGT*70*</td><td>600 V Ultrafast
STTH*06
STTH*R06
800 V to 1200 V
Ultrafast
STTH*08
STTH*10
STTH*12
SiC diodes
STPSC*065
STPSC*12</td><td rowspan="2">DC-DC converters
L698*, L7983,
L7985, L7986,
L7987*

LDO
LDF, LDFM,
LDK*20*
LDK715, LDL212,
LDQ40</td><td rowspan="2">BMS
L99BM2C, L99BM218,
L99BM114, L99BM1T,
L99BM2T*

Sensors
Temperature - STTS22H</td></tr>
<tr><td></td><td>IGBTs</td></tr>
<tr><td>DC-AC stage</td><td></td><td>600 V V series
STG*V60DF
650 V HB series
STG*H65DFB
650 V HB2 series
STG*H65DFB2
650 V M series
STG*M65DF2
1200 V H series
STG*H120DF2
1200 V M series
STG*M120DF</td><td></td><td></td></tr>
</table>

Typical block diagram for online UPS with double conversion stage



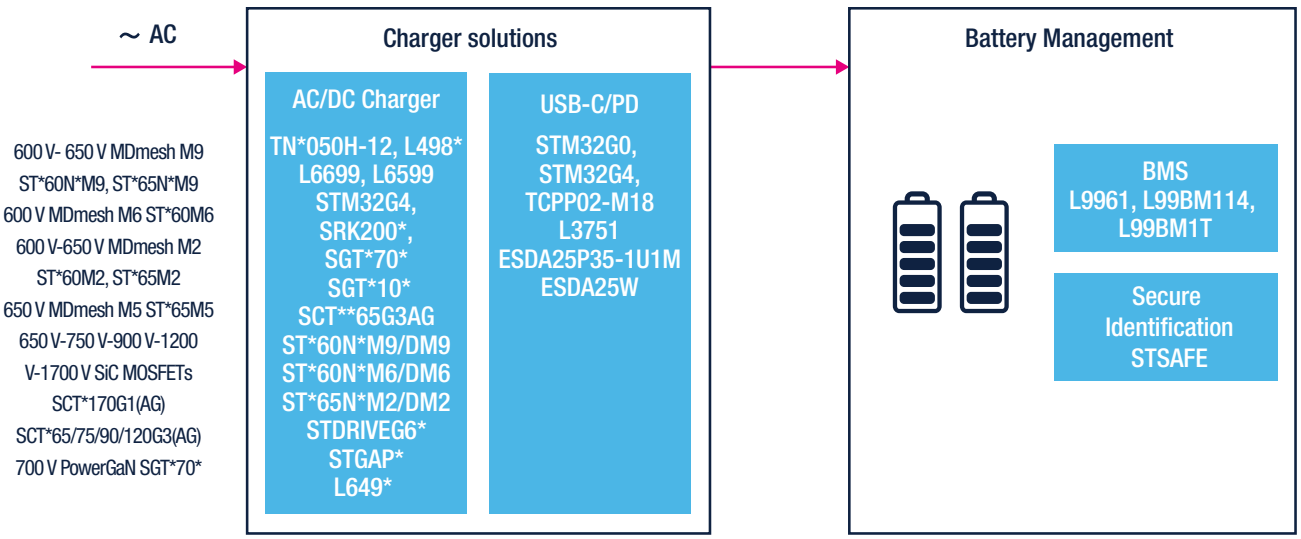
Industrial battery chargers

Industrial battery charger solutions target at highly efficient charging operation, enhanced battery lifetime and protection of Li-ion batteries used in different applications such as cordless power tools, garden tools, AGV and service robots, light electric vehicle (LEV) including e-bike, e-scooter, e-rickshaw, e-microcars, e-golf-cart, and e-forklift.

Specifically for cordless power tools, bidirectional power converters are more and more required to replace with one single power supply the two converters, one typically used to generate the AC voltage and one to recharge the battery pack. The use of a single converter will reduce the space required for the power electronics and will make this space available to increase the number of cells in the battery pack. In this way the UPS operating time will be extended.

ST takes into account the different needs of this wide range of use cases, which can features sophisticated or cost-optimized BOM, for hobby or professional use, by offering scalable solutions thanks to its wide portfolio of power discrete and modules, digital and analog controllers, combined with gate drivers and analog.

Typical block diagram



* For more detailed information, please refer to the application section

Main application boards and reference designs

STEVAL-205GANCB
24 V - 250 W power adapter based on GaN and digital control

STDES-2KW5CH48V
2.5 kW - 48 V battery charger reference design for industrial light electric vehicles (LEVs)

STEVAL-DPSTPFC1
3.6 kW PFC Totem-Pole with digital inrush current limiter

STEVAL-DPSLLCK1
3 kW Full Bridge LLC resonant digital power supply

Industrial welding

Arc welding is an assembling process that joins metal parts by causing their fusion through high-current flowing through the electrode and the base material. The current, either DC or AC, is generated by a specifically designed high-frequency inverter switched mode power supply (SMPS), usually based on half-bridge, full-bridge, and two-transistor forward topologies.

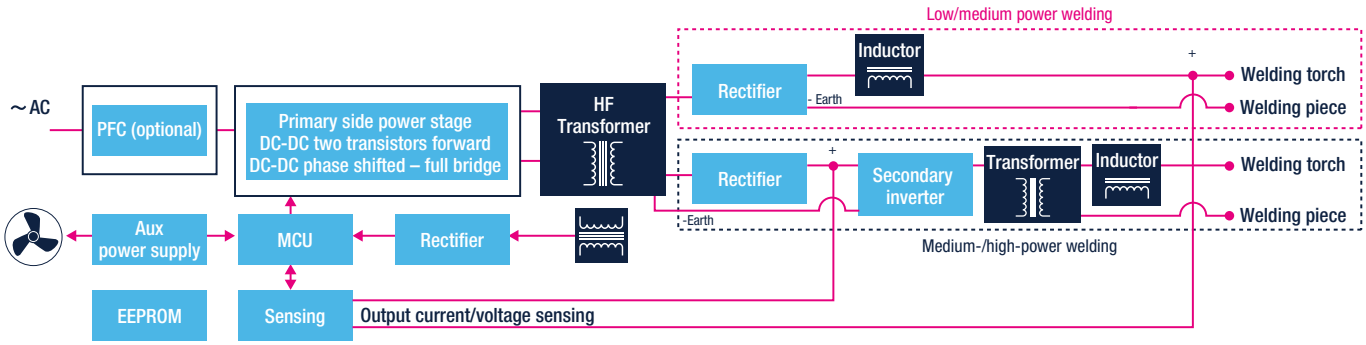
The main requirements in an SMPS for welding are high efficiency and reliability, as well as power density to enable lighter and more compact designs.

We have a range of power MOSFETs and diodes – both Si and SiC based for higher efficiency – and IGBTs as well as galvanically isolated gate drivers and high-performance 32-bit STM32 microcontrollers to enable compact designs with higher efficiency.

ST product offering for industrial welding

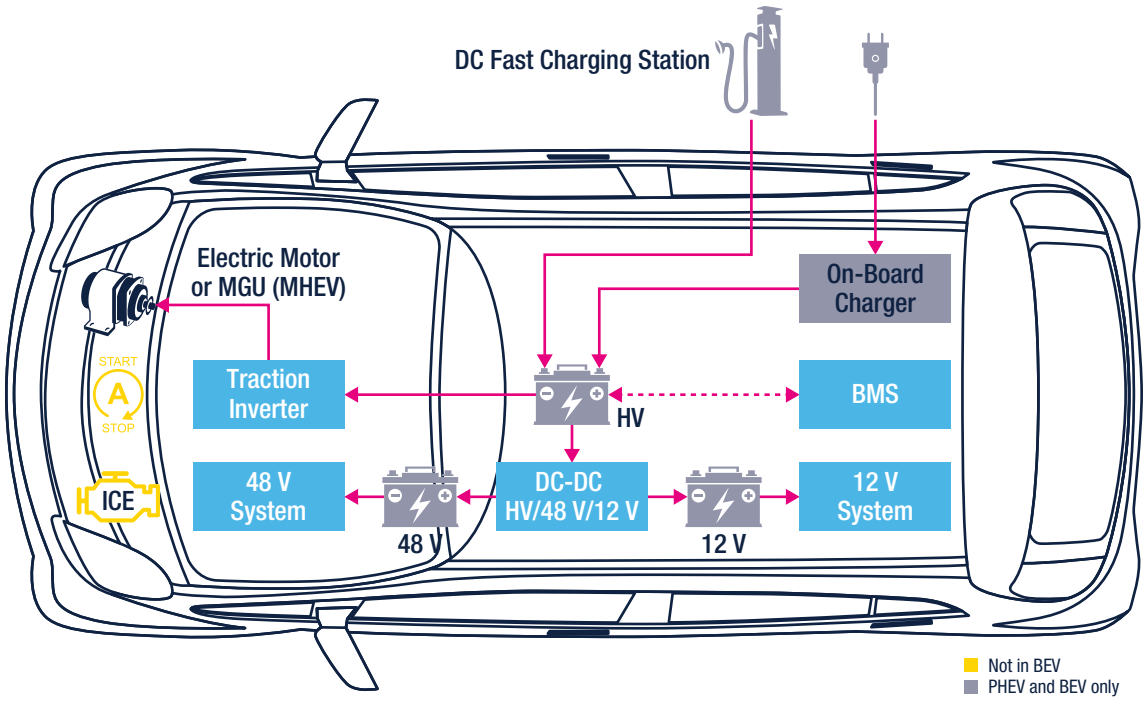
	MCUs and digital controllers	MOSFET/IGBT gate drivers	IGBTs and power modules	Power MOSFETs and GaN transistors	Diodes and protections
PFC	MCUs STM32F0 STM32G0 STM32F301 STM32F334 STM32G4 Digital controllers STNRG388A	Single LS gate drivers PM88*1, TD35* Multiple LS gate drivers PM8834 Isolated gate drivers STGAP* HV HB gate drivers L649* HV HB gate drivers for GaNs STDRIVEG600 STDRIVEG611	600 V V series STG*V60F 650 V HB series STG*HP65FB 650 V HB2 series STG*HP65FB2 1200 V H series STG*H120F2	600 V- 650 V MDmesh M9 ST*60N*M9, ST*65N*M9 600 V MDmesh M6 ST*60M6 650 V MDmesh M5 ST*65M5 650 V-750 V-900 V-1200 V-1700 V SiC MOSFETs SCT*170G1(AG) SCT*65/75/90/120G3(AG) 700 V PowerGaN SGT*70*	600 V Ultrafast STTH*W06, STTH*R06, STTH*T06 1200 V Ultrafast STTH*S12 SiC diodes STPSC*065, STPSC*12 TVS for power rail surge protection SM*T, SMC30J, SMC50J series
DC-DC TTF (low/medium power)	STM32F334 STM32G4 STM32F301 STM32F1 STM32F3	Isolated gate drivers STGAP* HV HB gate drivers L649* HV HB gate drivers for GaNs STDRIVEG600 STDRIVEG611	600 V V series STG*V60DF 650 V HB series STG*H65DFB 650 V HB2 series STG*H65DFB2 1200 V H series STG*H120DF2 ACEPACK Power modules customized modules	600V-650V MDmesh M9 ST*60N*M9, ST*65N*M9 600 V MDmesh M6 ST*60M6 800 V to 1200 V MDmesh K5 ST*80K5, ST*9*K5, ST*105K5, ST*120K5 600 V-650 V MDmesh DM9 ST*60N*DM9, ST*65N*DM9 600 V-650 V MDmesh DM6 ST*60DM6, ST*65DM6 950 V to 1050 V MDmesh DK5 ST*95DK5, ST*105DK5 650 V-750 V-900 V-1200 V-1700 V SiC MOSFETs SCT*170G1(AG) SCT*65/75/90/120G3(AG) 700 V PowerGaN SGT*70*	600 V Ultrafast STTH*R06, STTH*06 1000-1200 V Ultrafast STTH*10, STTH*12
DC-DC PS-FB (medium/high power)					TVS for power rail surge protection SM*T, SMC30J, SMC50J series
Secondary inverter			600 V V series STG*V60DF 650 V HB series STG*H65DFB 650 V HB2 series STG*H65DFB2	600 V-650 V MDmesh M6 ST*60M6, ST*65M6 600 V-650 V MDmesh M2 ST*60M2, ST*65M2, ST*60M2-EP 600 V MDmesh DM6 ST*60DM6 600 V-650 V MDmesh DM2 ST*60DM2, ST*65DM2	200 V to 400 V Ultrafast STTH*W02, STTH*W03, STTH*W04 Power Schottky high temperature STTH*10, STTH*12 TVS for power rail surge protection SM*T, SMC30J, SMC50J series

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



ELECTRO-MOBILITY

Key applications



Solutions

ST key products and solutions for electro-mobility applications include:

SiC MOSFETs and diodes	Transceivers	Signal conditioning	Power Management	32-bit automotive microcontrollers
Power MOSFETs and IGBTs	Power diodes and thyristors	EOS and ESD protection	BCD integrated and isolated drivers	

HW and SF development tools – Sample kits, evaluation kits, product selectors

Smart driving

FIND OUT MORE

www.st.com/electro-mobility

Battery management system (BMS)
Charging station
DC-DC converter
Small electric vehicles
Electric traction (Main inverter)
Mild hybrid 48 V systems
On board charger (OBC)
Acoustic vehicle alerting system (AVAS)
HV battery disconnect and fire-off system
Vehicle control unit (VCU)

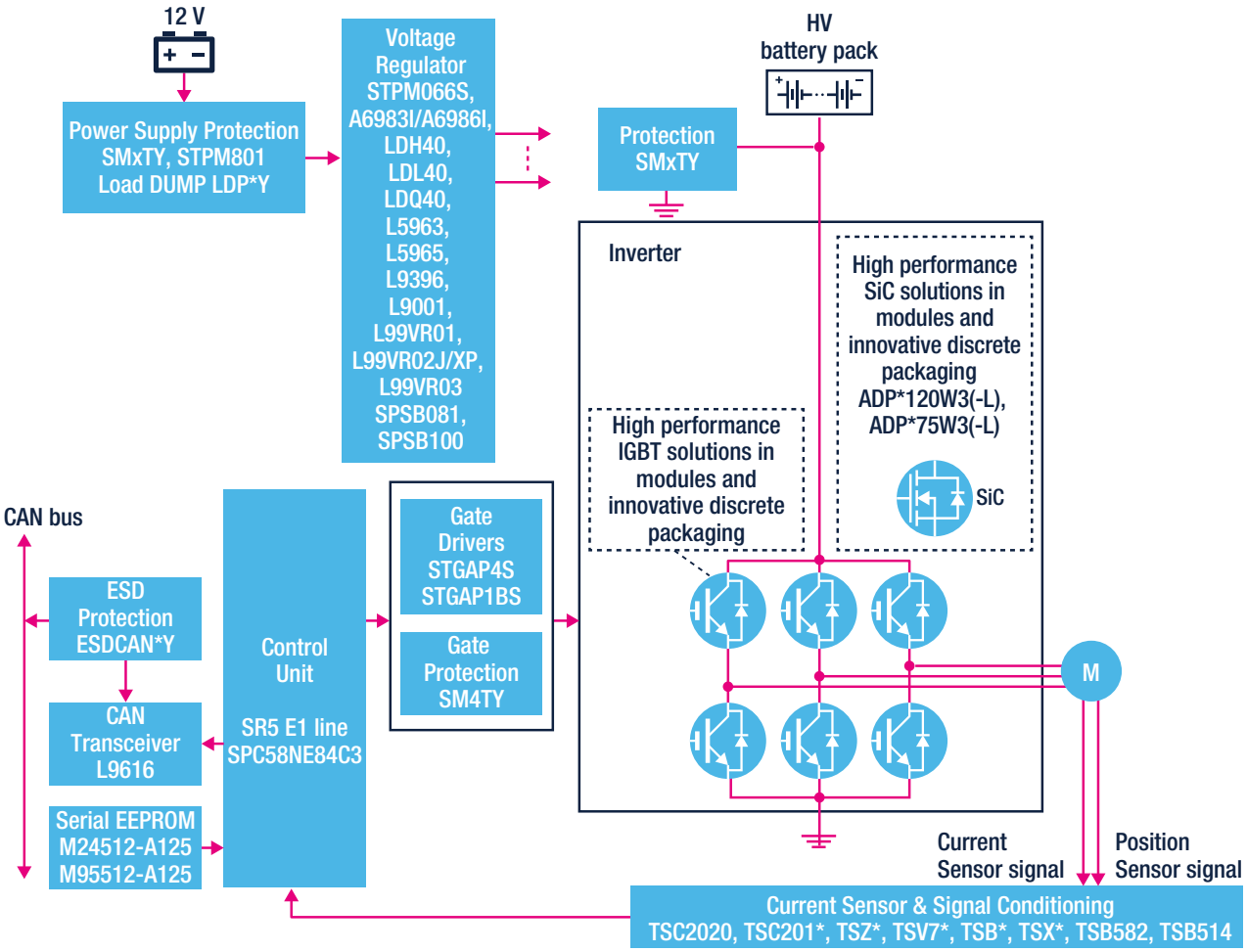
Main traction inverter

The traction inverter converts energy from the vehicle battery to drive the electrical engine. This key component has a direct impact on vehicle road performance, driving range, and reliability, which also depends on inverter weight and size.

Subject to all the possible stress found in a road vehicle from heat and vibrations, these converters must be able to handle high power and current along with the associated electro magnetic compatibility (EMC) challenges, as well as provide fail-safe operation to ensure reliability and safety for the driver and passengers.

To help developers increase inverter power efficiency and reduce size and weight, ST has a wide portfolio of discrete semiconductors, including AEC-Q101 qualified silicon and silicon carbide (SiC) MOSFETs and diodes, as well as IGBTs. These are complemented by AEC-Q100 qualified galvanically isolated IGBT and MOSFET gate drivers and SPC5 32-bit automotive microcontrollers for implementing scalable, cost-effective, and energy-efficient solutions. Furthermore, ST offers a compact and high-power-density solutions with the 750 V and 1200 V ACEPACK DRIVE power modules based on SiC Gen3 technology.

Typical block diagram - main inverter



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

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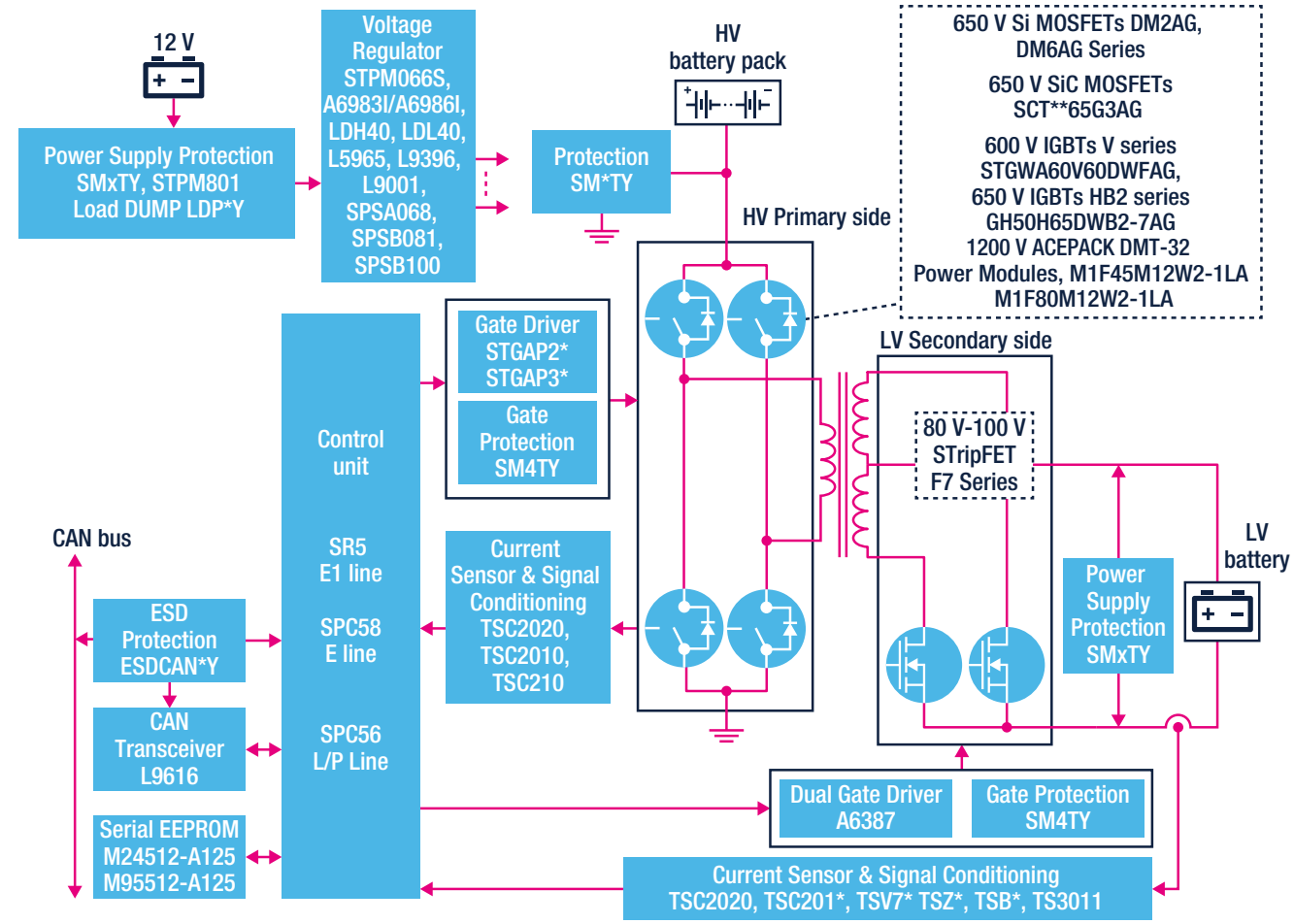
www.st.com/main-inverter-electric-traction

Bidirectional DC-DC converter

Electric vehicles (EV) use two different power systems, a high-voltage battery (200 to 800 V_{DC}) for traction and a low-voltage (12/48 V) one for supplying all the electric appliances in the vehicle. Traditionally, the low-voltage battery was charged from the alternator, but in today's vehicles, it gets its power from the high-voltage battery pack. However, in specific electric car architectures, this low-voltage battery should be ready to help recharge the high-voltage battery pack in order to provide energy for cranking the car. This means that the DC-DC converter must be bidirectional, and very efficient and highly reliable.

ST has a wide offer of discrete semiconductors including AEC-Q101 qualified silicon and silicon carbide (SiC) MOSFETs and diodes, as well as IGBTs. These are complemented by AEC-Q100 qualified galvanically isolated IGBT, and MOSFET gate drivers and SPC5 32-bit automotive microcontrollers to enable scalable, cost-effective, and energy-efficient solutions. ST product portfolio has been enlarged with power module family AQG-324 compliant, by including ACEPACK DMT-32, ACEPACK 1 and ACEPACK 2 with SiC power switches.

Typical block diagram - bidirectional DC-DC converter



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

FIND OUT MORE

www.st.com/bidirectional-dc/dc-converter

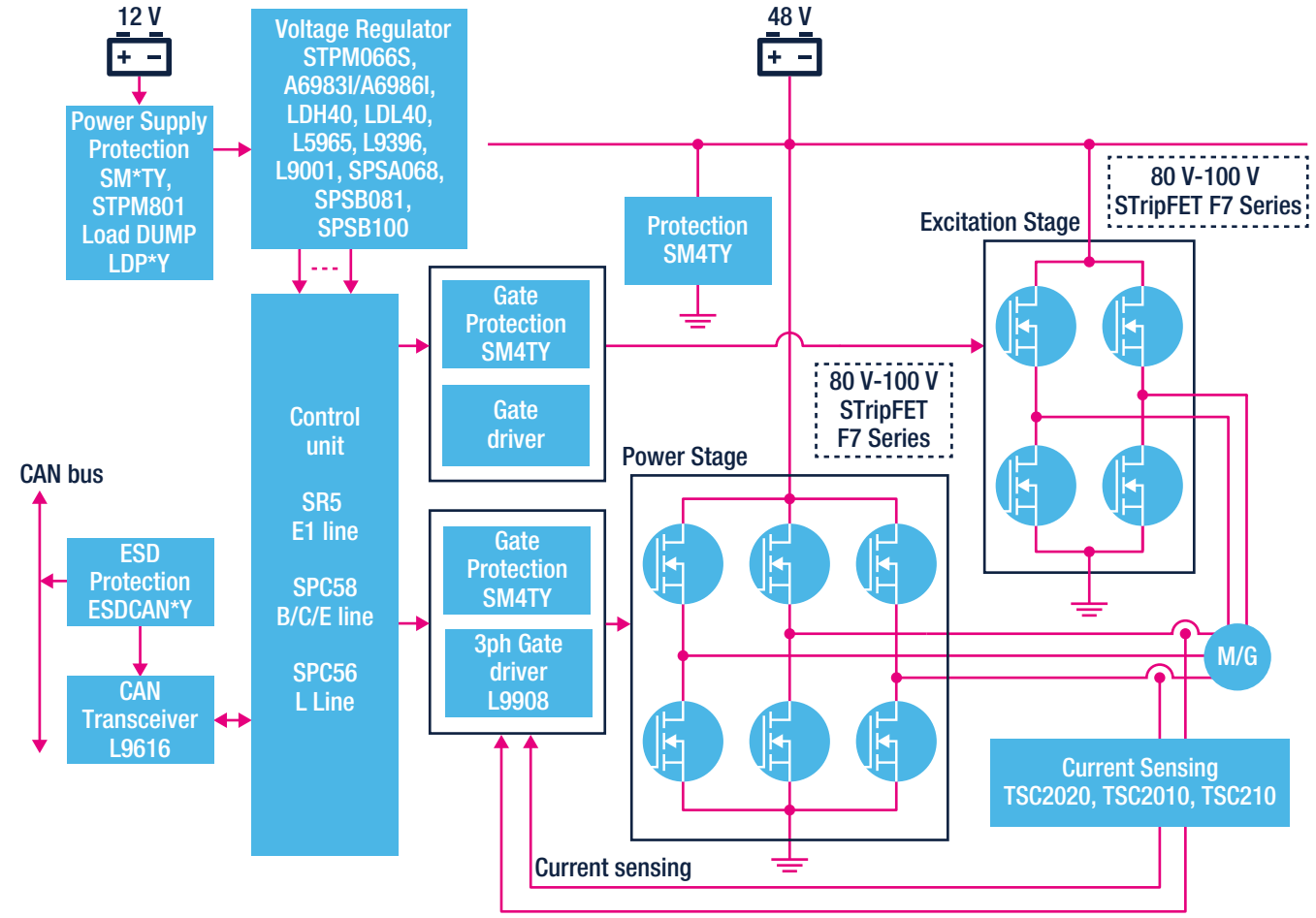
48 V start-stop system

A start-stop system aims at reducing the amount of engine idle time by shutting down and restarting the internal combustion engine automatically when the vehicle stops. It therefore contributes to improving fuel economy and reducing CO2 emissions. This is especially useful in urban environments where vehicles can spend significant amounts of time in traffic.

Start-stop operations require power electronics that can handle high current during cranking and ensure reliability during start-stop cycles, operating on/off at high temperatures.

ST solutions include silicon power MOSFETs, protections, gate drivers, and microcontrollers in accordance with AEC-Q100 and AEC-Q101 standards.

Typical block diagram - start-stop system



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

FIND OUT MORE

www.st.com/48v-start-stop-system

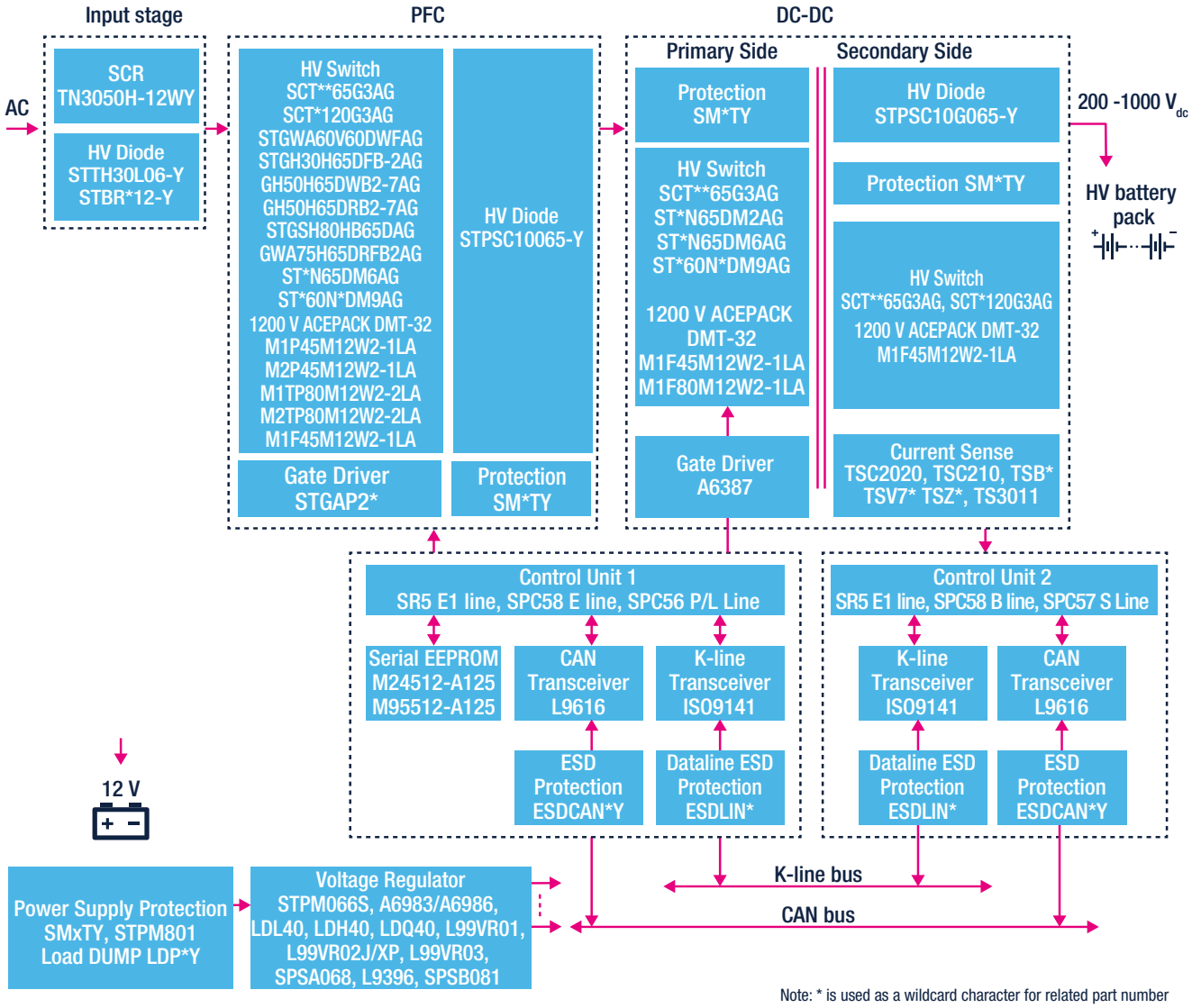
On-Board charger (OBC)

At the heart of any electric (EV) or plug-in hybrid (HEV) vehicle lies the high-voltage (200 to 800 Vdc) battery and its associated charging system. The on-board charger (OBC) provides the means to recharge the battery from the AC mains either at home or from outlets of private or public charging stations.

From a 3.6 kW single-phase to a 22 kW three-phase high-power converter, today's OBCs must have the highest possible efficiency and reliability to ensure rapid charging times, as well as meet the limited space and weight requirements.

ST has a wide offer of discrete semiconductors, including AEC-Q101 qualified silicon and silicon-carbide (SiC) MOSFETs and diodes, as well as IGBTs. These are complemented by AEC-Q100 qualified galvanically isolated IGBT and MOSFET gate drivers, and SPC5 and Stellar 32-bit automotive microcontrollers for implementing these challenging converters. The AQG-324 compliant ACEPACK DMT-32 power modules embedding SiC power switches enlarge the ST product portfolio.

Typical block diagram - OBC



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

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www.st.com/on-board-charger

Battery management

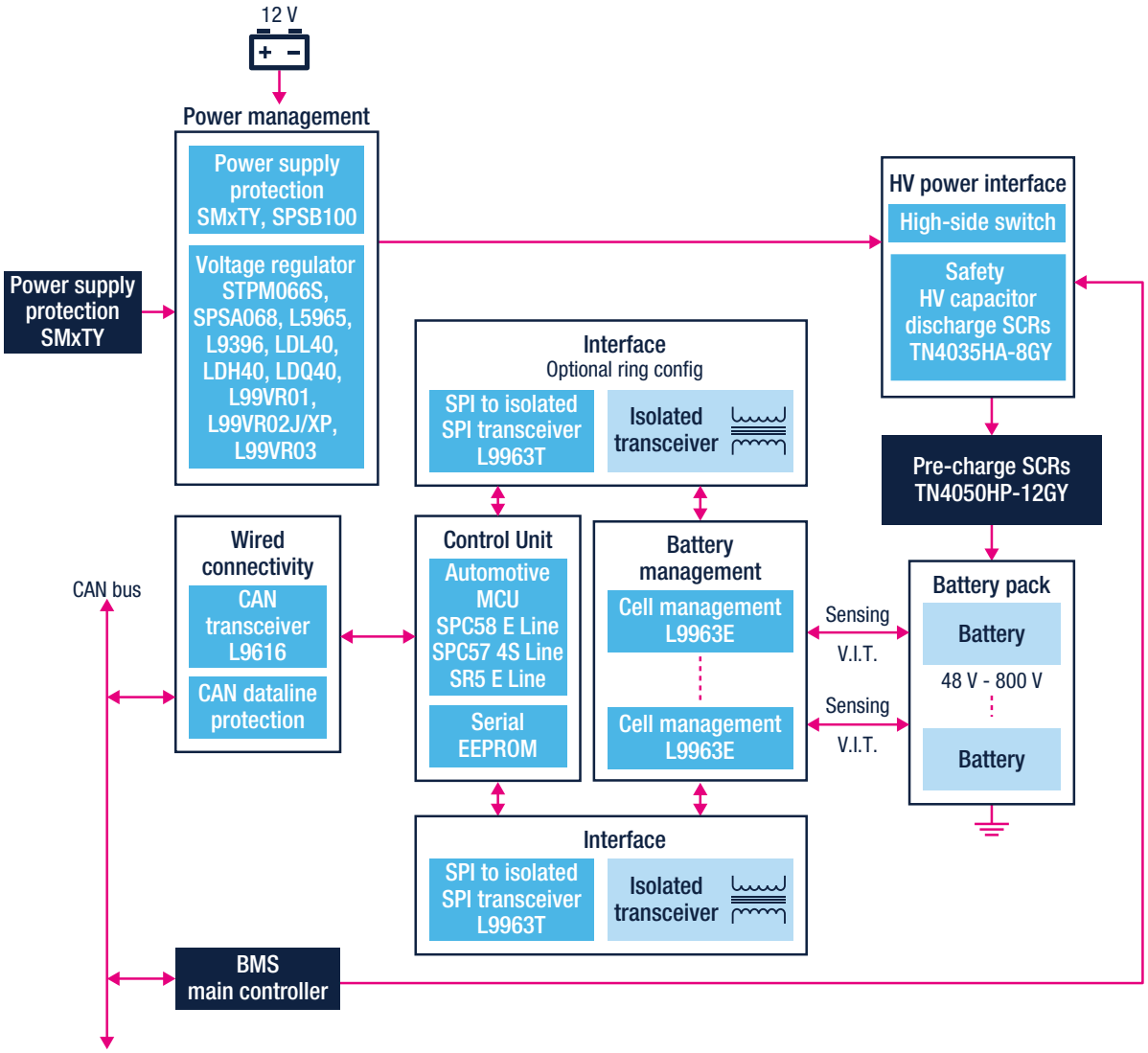
Automotive battery management system (BMS) must be able to meet critical features such as voltage, temperature and current monitoring, battery state of charge (SoC), and cell balancing of lithium-ion (Li-ion) batteries.

Indeed, the main functions of a battery management system for electric vehicles are:

- **Battery protection** in order to prevent operations outside its safe operating area
- **Battery monitoring** by estimating the battery pack state of charge (SoC) and state of health (SoH) during charging and discharging
- **Battery optimization** thanks to cell balancing that improves the battery life and capacity, thus optimizing the driving range for hybrid (HEV), plug-in (PHEV) and full electric vehicles (BEV)
- **Battery thermal management** to drive resistive loads to maintain optimal temperature of battery pack in any environmental condition and so optimize efficiency and lifetime

A discharge circuit is present using an HV power MOSFET (MDmesh K5 AG) working in linear mode to discharge the battery in case of malfunctioning or accident. Battery thermal management is improved by using IGBT 1200 V MS series and 650 V M series. ST25R NFC Reader and ST25D NFC dynamic tags will help fulfill government requirements in certain countries to track batteries for light electric vehicles (like EV motorbikes) and exchange data between the battery and the vehicle.

Typical block diagram - automotive battery management system (BMS)



Main application boards

AEK-POW-BMS63EN
Battery management system module

AEK-COM-ISOSPI1
SPI to isolated SPI dongle for BMS

AEK-POW-BMSWTX
BMS module based on the L9963E and L9963T

AEK-POW-BMSLV
BMS module for low-voltage applications

AEK-POW-BMSHOLD
Battery holder and BMS node

AEK-POW-BMSNOTX
Non-isolated Battery Management node

STDES-DIS001V1
Active discharge of high-voltage 400 V bus

STDES-OVP001
+/- 6 kV Lightning Surge Protection

STDES-PRE001V1
Pre-charge reference design for 800 V battery

AEK-POW-BMSCC
Battery management system module based on L9963E

AEK-POW-BMSCCTX
Battery management system module based on L9963E

STEVAL-SPSA068
PMIC evaluation board based on SPSA068

EVAL-STPM066
PMIC evaluation board based on SPSA068

FIND OUT MORE

https://www.st.com/en/applications/electro-mobility/automotive-battery-management-system-bms.html

DC Fast charging Station

The number of full electric vehicles (EVs) is rapidly growing and, as a result, the charging infrastructure is also expanding, including DC fast charging stations, which have the attractive capability of providing the vehicle with a 100 km driving range in just 10-12 minutes.

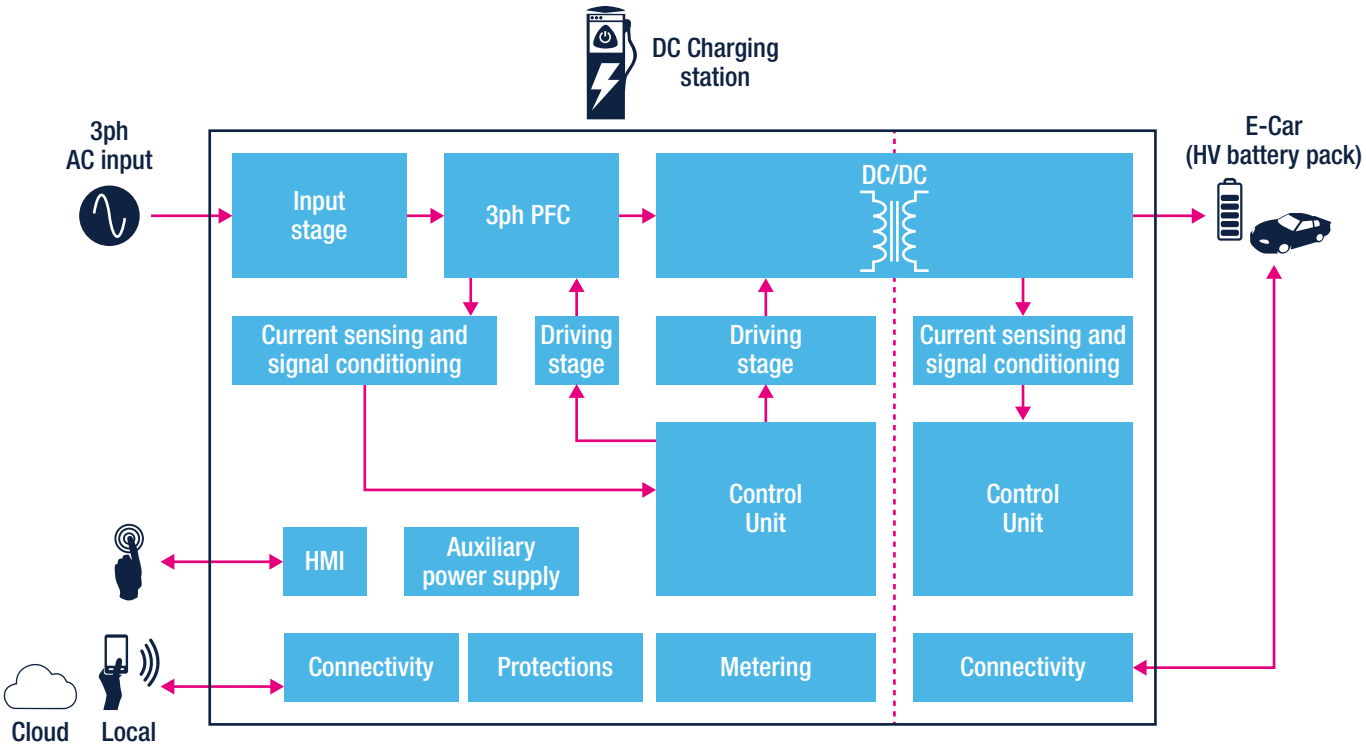
While architectures based on renewable sources and battery storage technologies to take charging stations off-grid are emerging, mainstream solutions are fed from the grid, and a converter, in the range of 150 kW or more, has a 3-phase input power factor correction (PFC) stage and an isolated DC-DC converter for different configurations: all-in-one, DC distributed, central unit with distributed dispenser. DC charging stations also provide secure connectivity and authentication with the vehicle.

We can provide a range of power discretes including silicon carbide (SiC) and silicon power MOSFETs and diodes, isolated gate drivers, as well as high-performance STM32 microcontrollers to help develop high-efficiency, high-power density DC charging stations.

ST25R NFC readers will help compliance with rules in certain countries to accept credit cards following the EMVCo standard or accept closed-loop payment and even track charging in private environments.

We also provide eDesignSuite - Digital power workbench SW design tool.

Typical block diagram - DC fast charging station



Main application boards and reference designs

STDES-PFCBIDIR

15 kW, three-phase, three-level active front-end (AFE) bidirectional converter

STDES-DABBIDIR

25 kW dual active Bridge (DAB) bidirectional power converter for EV charging and BESS

STDES-VRECTFD

15 kW, three-level, three-phase Vienna rectifier with digital control for power factor correction

STDES-30KWVRECT

30 kW Vienna PFC rectifier reference design with digital control

ST product offering for DC Fast charging Station

			Input stage	3ph PFC	DC-DC		Control units		Driving stage	Current sensing and signal conditioning	Aux SMPS	HMI	Metering	Connectivity	
					1^ side	2^ side	1^ side	2^ side						1^ side	2^ side
Rectifiers	SiC series - 650 V			•		•									
	SiC series - 1200 V			•		•									
	Ultrafast RQ series - 600 V			•	•	•									
	Ultrafast R series - 600 V			•	•						•				
	STBR series - 800 V/1200 V		•	•											
	Schottky series - 40/45/60/100 V										•				
Thyristors	TN series - 1200 V		•												
	TYN series - 1200 V		•												
	TM8050H series - 800 V		•												
	TN3050H, TN*050HP series -1200 V		•												
TVS protections	SM4TY, SM6TY, SM15TY, SM30TY, SM50TY			•	•	•					•				
HMI ESD protections	ESDAxxY series, EMIF06-1005M12											•			
Power MOSFETs	SiC series - 650 V/1200 V			•	•										
	M5 series - 650 V			•											
	M6 series - 600 V			•	•										
	DM6 series - 600 V/650 V				•										
	DM2 series - 600 V/650 V				•										
	K5 series - 1200 V			•							•				
	M9 series - 600 V/650 V			•	•										
	DM9 series - 600 V/650 V				•										
IGBTs	H series - 1200 V			•											
	HB series - 650 V			•	•										
	HB2 series - 650 V			•	•										
	V series - 600 V			•	•										
ACEPACK power modules	A2U8M12W3-FC			•	•										
MCUs (32bit)	STM32F334, STM32G4, STM32F3			•	•		•								
	STM32F0, STM32F1, STM32G0					•		•							
Gate drivers	L6491								•						
	STGAP2*, STGAP3*								•						
Iso Sigma-Delta ADC	ISOSD61, ISOSD61L									•					
Current sense amplifiers	TSC2020, TSC201*, TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV*			•						•					
HV converters	VIPer*7, VIPer*6, VIPer26K										•				
Offline controllers	L6566BH, STCH03										•				
Voltage regulators	STPM066S, L5965, L9396, A6986I, A798*, A698*, SPSA068, SPSB081, SPSB100										•				
	L798*, L698*, LDK130, LD39100, LD49100										•				
CAN transceivers	L9616														•
CAN ESD protections	ESDCAN*Y series								•				•		•
Power line transceivers	ST2100													•	•
	ST7540, ST7580, ST8500													•	
Bluetooth Low energy Transceiver	SoC and wireless MCUs	BlueNRG-* STM32WB5* STM32WBA5												•	
	STM32 wireless module	STM32WB5MMG STM32WB1MM												•	
	Modules	BlueNRG-M0, BlueNRG-M2												•	
NFC/RFID	Dynamic tags	M24SR, ST25DV04KC, ST25DV16KC, ST25DV64KC												•	•
	Readers	ST25R												•	•
Metering ICs	STPM32, STPM33*, STPM34*, STPMS2, STISO621												•		
LED array drivers	LED1642GW, STP08*, STP16*, LED77*, LED8102S, LED1202, STLED316S											•			

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

POWER SUPPLIES

Auxiliary SMPS

Appliances and equipment often require a switch-mode power supply (SMPS) that works separately from the main power supply to support auxiliary functions like standby operation. Power ratings can vary from a few watts to tens of watts for these auxiliary supplies, which can be either isolated or non-isolated. To ensure good performance, engineers must choose the power topology including fixed frequency or quasi-resonant flyback, that best meets the efficiency, size, safety, and cost requirements.
ST offers a wide portfolio of highly-integrated high-voltage converters for applications up to 100 W, with an extremely low total standby consumption (down to less than 4 mW) and breakdown voltages as high as 1050 V. In addition to PWM switching controllers, power MOSFETs, and diodes, we offer an extensive set of evaluation tools, as well as eDesignSuite SW design tool to help engineers develop high-efficiency and compact auxiliary power supply solutions.

Isolated auxiliary SMPS

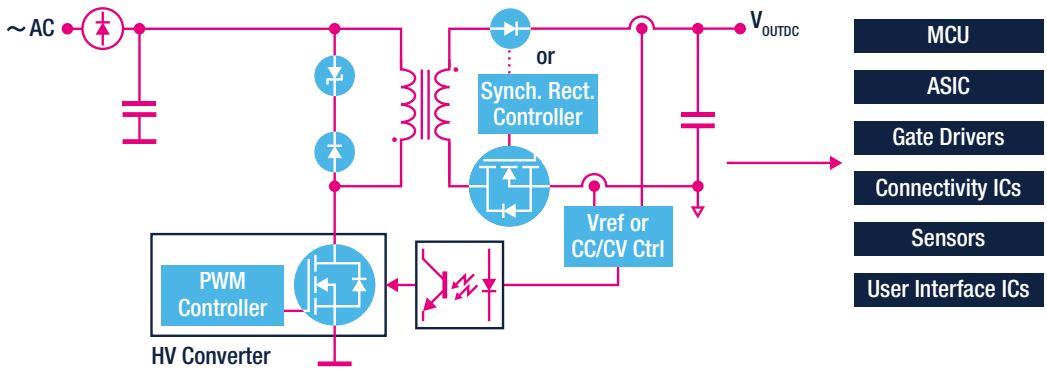
ST helps the designers of high-power-density and cost-effective isolated auxiliary power supplies with higher switching frequency solutions to minimize transformer and output capacitor size.
In the 20 to 100 W power range, the need to meet increasingly tight efficiency and standby requirements for auxiliary power supplies has pushed the use of quasi-resonant topologies in place of more mainstream fixed-frequency-based designs.
The power stage is managed by a high-voltage converter.

ST recommended products for isolated auxiliary SMPS

		HV converters		Offline controllers	HV Power MOSFETs and GaN transistors	MOSFET protection	Voltage Ref CC/CV Ctrl	Output diodes	Synch Rect	LDO
Isolated flyback	PSR-CV		VIPer0P VIPer*1 VIPer*6 VIPer122 VIPer222 ALTAIR*	HVLED101, HVLED001*	800 V MDmesh K6 ST*80*K6 800 V to 1700 V MDmesh K5 ST*80K5, ST*9*K5, ST*105K5, ST*120K5, ST*150K5, ST*12N170K5 650 V SiC MOSFETs SCT*65G3AG 700 V PowerGaN SGT*70*	Power MOSFET protection SMAJ, SM6T, SM15T series Reverse blocking diodes 600 V Ultrafast STTH*06 800 V to 1200 V Ultrafast STTH*08 STTH*10 STTH*12		Schottky, FERD STPS* FERD*45 FERD*50 FERD*60 FER*100 100 V Trench Schottky STPST*100	SR controllers SRK1004 LV Power MOSFETs 40 V-100 V STripFET F7/F8 ST*N4F7, ST*N4F8, ST*N6F7, ST*N8F7/F8 ST*N10F7/F8	Low dropout (LDO) linear regulators LDF LDFM LDH40 LDK220 LDK320 LDL212 ST730 ST732
	Regulation with optocoupler	VIPer*5 VIPer*7 VIPer*8 VIPerGaN50W VIPerGaN65W VIPerGaN100W VIPerGaN100WB VIPerGaN65D		STCH03 L6566B L6566BH L6565			Voltage reference T*431 T*432 Voltage and current Ctrl TSM*, SEA05*			

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

Typical configuration for isolated auxiliary power supply up to 100 W



Main application boards and reference designs

STEVAL-VP26K01F
Three outputs, isolated SSR flyback converter with extended input voltage range for Smart meter and power Line communication

STEVAL-VP318L1F
15 V/1.2 A isolated SSR flyback converter

EVAL-STCH03-45W
45 W/12 V QR flyback with adaptive synchronous rectification

EVLVIPGAN50WF
15 V - 50 W QR SSR flyback with HV GaN converter and synchronous rectification

Non-Isolated auxiliary SMPS

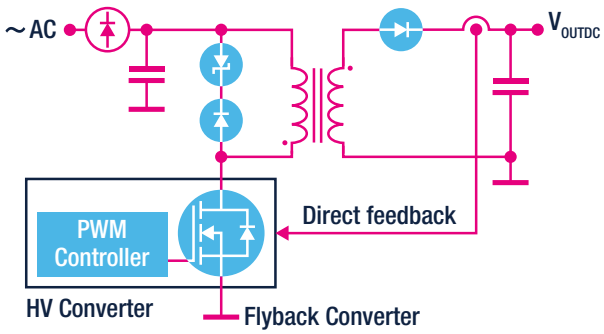
In a number of applications, the reference of the secondary circuit is connected to the same reference as the primary; that is, the AC mains. In such cases, an off-line non-isolated auxiliary power supply can be used to provide a regulated DC voltage using an inductor or low-cost transformer, with simplified isolation, as an energy transfer element by modulating the power supply's duty-cycle.
A buck (step-down) topology can be used to generate a positive output with respect to the common terminal and a buck-boost when the output voltage needs to be negative. A non-isolated flyback converter is the alternative when a higher output power is required.

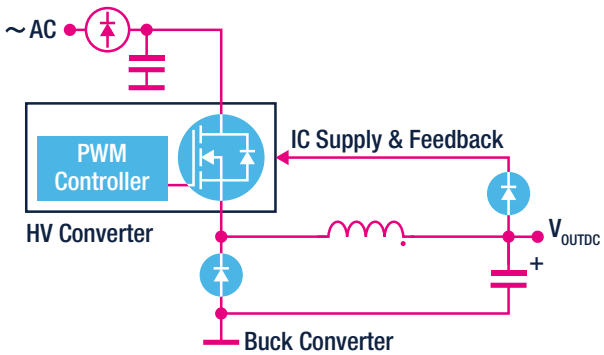
ST recommended products for Non-Isolated auxiliary SMPS

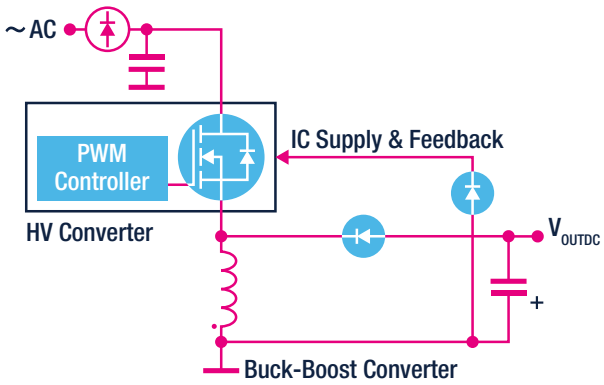
	HV converters	VIPer protection	Reverse blocking diodes	Output diodes	LDO
Buck	VIPer0P VIPer*1 VIPer*6 VIPer122 VIPer222			600 V Ultrafast STTH*06 800 V to 1200 V Ultrafast STTH*08 STTH*10	Low dropout (LDO) linear regulators LDF, LDFM, LDK220, LDK320, LDL212, ST730, ST732, LDH40
Buck-boost					
Non-isolated flyback		SMAJ, SM6T, SM15T series	600 V Ultrafast STTH*06 800 V to 1200 V Ultrafast STTH*08 STTH*10 STTH*12	Schottky, FERD STPS* FERD*45, FERD*50, FERD*60, FER*100 100 V Trench Schottky STPST*100	

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

Typical configurations for Non-Isolated auxiliary power supply







Main application boards

STEVAL-VP12201B
15 V/200 mA buck converter

STEVAL-VP319X1B
5 V/600 mA buck converter

STEVAL-VP22201B
5 V/0.36 A buck converter

STEVAL-ISA196V1
5 V/1.2 A non-isolated flyback converter

Smart chargers and adapters

USB Type-C® PD adapters and quick chargers

The new slim and reversible USB Type-C connector with USB power delivery (PD) feature provides up to 240 W (48 V, 5 A) enabling a faster and more efficient charging solution.

Designers of USB Type-C and power delivery compliant adapters and wall chargers can benefit from the ST-ONE digital controller, the MasterGaN series, from STM32 MCUs as well as a dedicated range of protection devices. Customers can also choose from the VIPerGaN series, which can provide up to 100 W power.

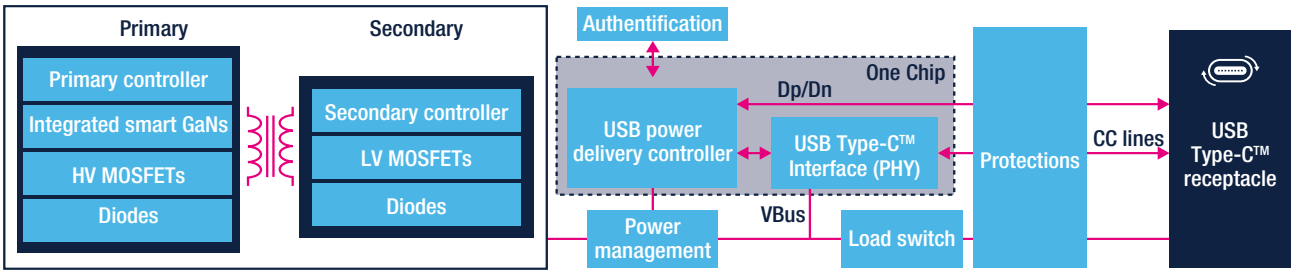
ST recommended products for USB Type-C power delivery smart chargers and adapters

Power stage primary side				Fully integrated controller	Power stage secondary side		
Primary Controller	Integrated Smart GaNs	HV power MOSFETs and GaN transistors	Diodes		Secondary Controller	LV MOSFETs and GaN transistors	Diodes
PFC L656* Isolation stage VIPerGaN50W VIPerGaN65W VIPerGaN100W VIPerGaN100WB VIPerGaN65D STCH03 L6599*, L6699, STACF01	MASTERGAN1 MASTERGAN2 MASTERGAN3 MASTERGAN4 MASTERGAN5 MasterGaN1L MasterGaN4L	700 V PowerGaN SGT*70* 600 V-650 V MDmesh M9 ST*60N*M9, ST*65N*M9 600 V MDmesh M6 ST*60M6 600- 650 V MDmesh M2 ST*N60M2, ST*N65M2 650 V MDmesh M5 ST*65M5	600 V Ultrafast for TM STTH*L06, STTH*06	ST-ONE ST-ONEHP ST-ONEMP	SR analog controllers SRK1004 for flyback SRK2000A, SRK2001, SRK2001A for LLC	100 V STripFET F7/F8 ST*N10F7 ST*N10F8 100 V PowerGaN SGT*10*	Output diodes for flyback Schottky STPS*, FERD FERD*45, FERD*50, FERD*60, FERD*100 Output diodes for LLC Schottky STPS*, FERD FERD*45, FERD*50, FERD*60, FERD*100

Type-C and USB-PD controllers				Protections				LDO/ DC-DC converters
Programmable solutions			Standalone solutions	Type C Port protection Over voltage protection for USB-C and PD 3.0 controllers	Vrm	High surge current compact protection (V_{BUS})	Single and multi lines protection for MCUs communication channel (CC) and side band use (SBU)	
Fully integrated controller	MCUs	Type-C Controller/ interface						
ST-ONE ST-ONEHP ST-ONEMP	STM32 with UCPD STM32G0, STM32G4, STM32L5		STUSB4500L STUSB4500 STUSB4531		5 V	ESDA7P120-1U1M	ESDA6V1L	STPD01 L6983/2/1 LDK320 ST730/2 LDQ40
					9 V	ESDA13P70-1U1M	ESDA25W	
			No need	TCPP01-M12 TCPP02-M18 TCPP03-M20	15 V	ESDA15P50-1U1M	ESDA25W	Load switch
	All STM32 and STM (5 V only)		No need	TCPP01-M12 for sink TCPP02-M18 for source	20 V	ESDA25P35-1U1M	ESDA25W	
					20 V	ESDA25P35-1U1M	No need as already integrated in TCPP product	STELPD01

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

Typical configuration



Main application boards and reference designs

EVLSTACF01-65WU

65 W active clamp flyback (ACF) converter USB Power Delivery, with integrated GaN

EVLVIPGAN65DF/WF

24 V - 65 W QR SSR flyback with HV GaN converter and synchronous rectification

EVLVIPGAN50WP/65WP/100WP

45 W/ 65 W/100 W USB PD 3.0 adapter with GaN HV converter

EVLONE65W

65 W USB Type-C power delivery reference design with integrated GaN

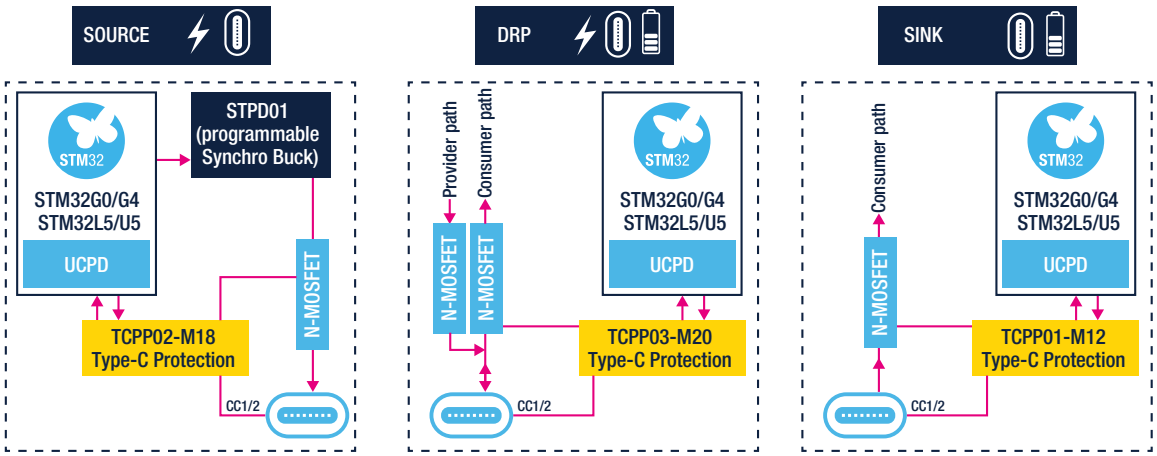
EVLONE140W

140 W USB-PD 3.1 EPR certified reference design with integrated controller and GaN

EVLONEMP

Very high density board- 65 W multi-port (USB Type-C and USB Type-A) power delivery with integrated GaN

Block diagrams with certified source, Sink, and DRP with STM32 having UCPD controller



Main application boards and reference designs

EVAL-SCS007V1
USB PD sink reference design

STEVAL-2STPD01
USB Type-C power delivery dual port adapter

EVAL-SCS006/1/2V1
SINK USB-PD reference design
(EVAL-SCS006V1: migration from DC barrel)
(EVAL-SCS001V1: migration from DC barrel)
(EVAL-SCS002V1: migration from USB micro-B)

X-NUCLEO-SRC1M1
USB Type-C power delivery source expansion board based on TCPP02-M18

X-NUCLEO-SNK1M1
USB Type-C power delivery SINK expansion board based on TCPP01-M12

X-NUCLEO-DRP1M1
USB Type-C power delivery dual role power expansion board based on TCPP03-M20

Adapters for tablets, notebook, and all-in-one (AIO) computers

Power AC-DC adapters for notebooks, tablets, and AIO need to be small, thin, lightweight, and provide excellent EMI performance, as well as ultra-low, highly efficient standby power, regardless of the load conditions.

A typical high-efficiency design includes a flyback or an active clamp flyback stage with synchronous rectification, and for higher power, a power factor corrector (PFC) working in transition mode (TM) followed by a flyback, forward, or half-bridge LLC resonant stage with synchronous rectification.

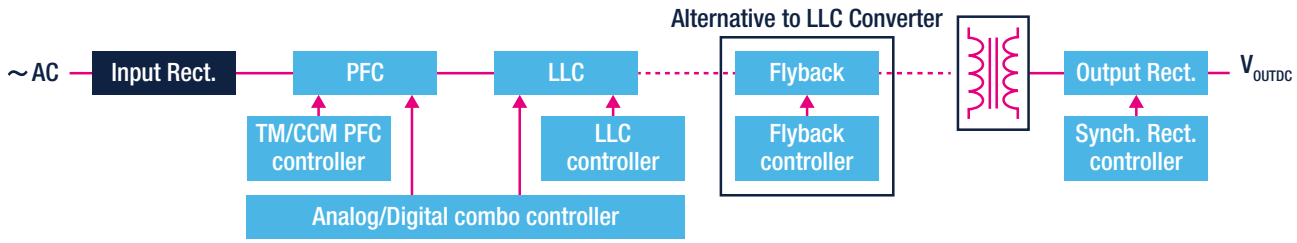
ST has recently introduced GaN power ICs and offers a broad range of high-voltage MDmesh and low-voltage STripFET power MOSFETs, as well as standard and field-effect rectifiers (FERD). Our offering also includes a range of PFC, PWM primary controllers, synchronous rectification controllers, and single-chip analog and digital combo controllers.

ST recommended products for tablets, notebook and AIO adapters

	Controllers	Power MOSFETs and GaN transistors	Diodes	
PFC Block	TM analog controllers L6562A*, L6563*, L6564* CCM analog controllers L4985, L4986, L4981*, L4984D	700 V PowerGaN SGT*70* 600 V-650 V MDmesh M9 ST*60N*M9, ST*65N*M9 600 V MDmesh M6 ST*60M6 600 V-650 V MDmesh M2 ST*60M2, ST*65M2 650 V MDmesh M5 ST*65M5	600 V Ultrafast for TM STTH*L06, STTH*06, STTH15AC06* 600 V Ultrafast for CCM STTH*R06, STTH*M06	
	Converters and controllers	**GaN power ICs**	**Diodes and protections**	**Voltage reference, CC/CV Ctrl**
Isolation stage	Fully integrated Controller for active clamp flyback (ACF) STACF01, ST-ONE, ST-ONEHP HV converters for flyback SSR: VIPer*5, VIPer*7, VIPer*8 PSR: VIPer0P, VIPer*1, VIPer122, VIPer222, VIPer*6, ALTAIR* Flyback controllers STCH03, L6566A, L6566B, L6565 PFC and LLC combo controllers STNRG011, STNRG011A LLC analog controllers L6599*, L6699 SR analog controllers SRK1004 for flyback SRK2000A, SRK2001, SRK2001A for LLC	High voltage GaN converters VIPerGaN50W, VIPerGaN65W, VIPerGaN100W, VIPerGaN100VB, VIPerGaN65D Integrated Smart GaNs 600 V MASTERGAN* **Power MOSFETs and GaN transistors** 700 V PowerGaN SGT*70* 600 V-650 V MDmesh DM9 ST*60N*DM9, ST*65N*DM9 600 V MDmesh DM6 ST*60DM6 600 V-650 V MDmesh DM2 ST*60DM2, ST*65DM2 600 V MDmesh M6 ST*60M6, 600 V-650 V MDmesh M2 ST*60M2, ST*65M2 800 V MDmesh K6 ST*80*K6 800 V to 950 V MDmesh K5 ST*80K5, ST*9*K5 40 V-100 V STripFET F7/F8 ST*N4F7, ST*N4F8, ST*N6F7, ST*N8F7, ST*N8F8, ST*N10F7, ST*N10F8 100 V PowerGaN SGT*10*	100 V Trench Schottky STPST*100 Output diodes for flyback Schottky, FERD, STPS*, FERD*45, FERD*50, FERD*60, FERD*100 Clamping diodes for flyback 600 V to 1000 V Ultrafast STTH*06, STTH*08, STTH*10 Output diodes for LLC Schottky, FERD STPS* FERD*45, FERD*50, FERD*60, FERD*100 MOSFET protection for flyback SM6T, SM15T series	Voltage reference T*431, T*432 Voltage and current Ctrl TSM*, SEA05* **Post regulation** DC-DC converters L6983/2/1, ST1PS03/2/1, ST1S40 Low dropout (LDO) linear regulators ST715 LDK320 ST715 ST730 ST732 LDQ40 LDL40

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

Typical block diagram with PFC front-end



Main application boards and reference designs

STEVAL-205GANCB

24 V - 250 W power adapter based on GaN and digital control

EVLSTACF01-65WU

USB-PD board with STACF01 controller

EVL011A150ADP

12 V - 150 W power supply based on TM PFC and HB LLC digital combo controller

EVL400W-80PL

12 V - 400 W adapter based on CCM PFC and HB LLC analog controller

Wireless charging

In a wireless battery-charging system, power is transferred by electromagnetic induction (inductive power transfer) between a transmitting pad (TX) and a battery-powered device (RX), such as a smartphone, smartwatch, or sports gear. The power transmitter unit controls the current in the transmitting coil to transfer the correct amount of power required by the receiver unit. The receiver unit continuously provides this information to the transmitter by modulating the transmitter carrier frequency through controlled resistive or capacitive load insertion. Generating the correct amount of power ensures the highest level of end-to-end energy efficiency and helps limit the device's operating temperature.

ST offers a wide range of wireless charger IC solutions, including transmitters and receivers that provide accurate foreign object detection (FOD) and reverse-charging features.

In order to prevent unwanted damage to any NFC cards that might be close to the wireless charging

source during operation, it is recommended to add an NFC Reader. The NFC Reader is able to detect the presence of the NFC card or tag (ST Reader ICs can detect Type A, B, F, or V NFC cards), and therefore instruct the operating system to stop transmitting power.

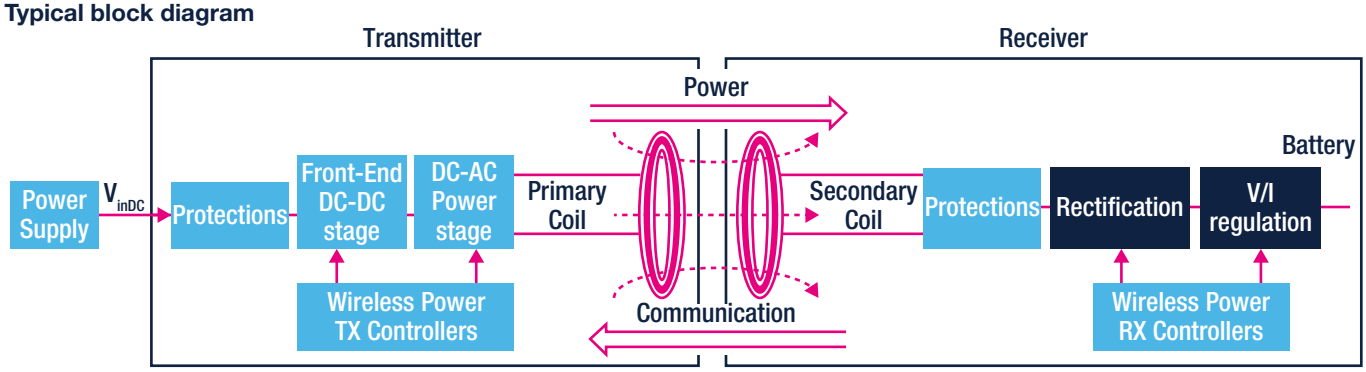
ST also offers evaluation and development tools and reference designs upon customer request to help develop high-efficiency and compact wireless chargers. Moreover, easy-to-use evaluation tools enable customization with the ST Super Charge protocol for personal electronics, industrial, and medical applications.

ST recommended products for wireless charging

	Wireless charging ICs	Battery charger ICs	MCUs	Power MOSFETs	Protections	Diodes	NFC reader
Transmitter	STWBC86 STWBC2-HP		STM32G0 STM32F334 STM32G4	60 V STripFET F7 STL20N6F7	TVS SMAJ, SM6T, SM15T series USB Port Protection TCPP01-M12	STPS*L30 STPS*45/60/100 FERD*45/60/100	ST25R3911B ST25R3912
Receiver	STWLC38 STWLC98	STBC02			ESDALC14V2-1U2	BAT30F4, BAR46	ST25R3916B ST25R3917B

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

Typical block diagram



Desktop PC power supply

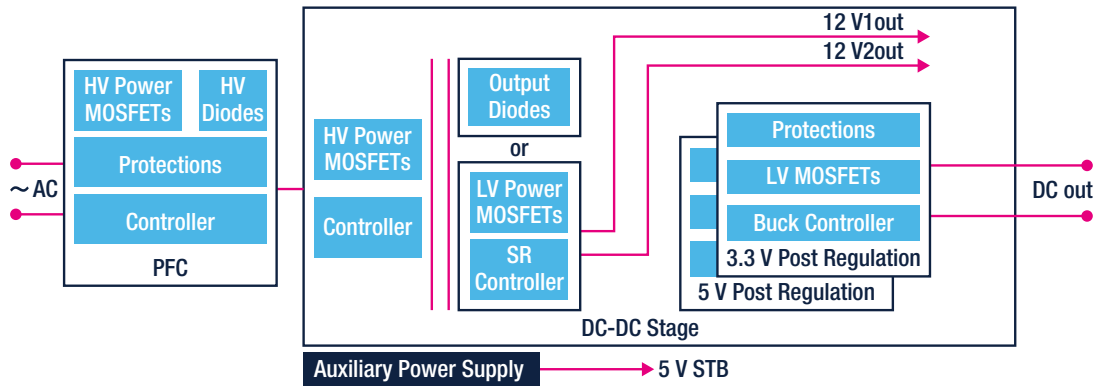
The requirements for the standard ATX PC power market are small form factor with better performance.
An intelligent control scheme that enables adaption to load variation to minimize power consumption, together with optimized power semiconductors, are key to meeting market demands. Smart analog and digital controllers such as the STNRG011, GaN power ICs such as the MASTERGAN series and the GaN drivers, high-voltage MDmesh power MOSFETs, low-voltage STripFET power MOSFETs, and SiC diodes (STPSC*) help designers develop the best PC power supply solutions to improve efficiency. ST DC-DC converters guarantee high power density for the post-regulation.

ST recommended products for desktop PC's power supply

	Controllers	Power MOSFETs	Diodes and discretes	Op amp V/I sensing
PFC Block	TM analog controllers L6562A*, L6563*, L6564* CCM analog controllers L4985, L4986, L4981*, L4984D MCUs and digital controllers STM32F0, STM32G0, STM32F301, STM32F334, STM32G4, STNRG388A	600 V- 650 V MDmesh M9 ST*60N*M9, ST*65N*M9 600 V MDmesh M6 ST*60M6, 600 V-650 V MDmesh M2 ST*60M2, ST*65M2 650 V MDmesh M5 ST*65M5	600 V Ultrafast for TM STTH*L06, STTH*06, STTH15AC06* 600 V Ultrafast for CCM STTH*R06, STTH*M06 SiC diodes STPSC*065 TVS for power rail surge protection SMAJ40CA-TR	Precision op amps (<50 MHz) TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV* **MOSFET and IGBT gate drivers** Multiple LS gate drivers PM8834 Single LS gate drivers PM88*1
	Controllers	**Power MOSFETs and GaN transistors**	**Diodes**	**eFuses**
Isolation DC-DC stage	PFC and LLC Combo controllers STNRG011, STNRG011A LLC analog controllers L6599*, L6699 Asymmetrical HB controllers L6591 MCUs and digital controllers STM32F0, STM32G0, STM32F301, STM32F334, STM32G4, STNRG388A SR analog controllers SRK2000A, SRK2001, SRK2001A for LLC	700 V PowerGaN SGT*70* 600 V-650 V MDmesh DM9 ST*60N*DM9, ST*65N*DM9 600 V-650 V MDmesh DM6 ST*60DM6, ST*65DM6 600 V-650 V MDmesh DM2 ST*60DM2, ST*65DM2 600 V- 650 V MDmesh M9 ST*60N*M9, ST*65N*M9 600 V MDmesh M6 ST*60M6 600 V-650 V MDmesh M2 ST*60M2, ST*65M2 40 V-100 V STripFET F7/F8 ST*N4F7, ST*N4F8, ST*N6F7, ST*N8F7/F8, ST*N10F7/F8	Output diodes Schottky, FERD STPS*, FERD*45, FERD*50, FERD*60, FERD*100 **Protections** TVS for power MOSFET and power rail surge protection SMAJ, SM6T, SM15T series **LDO** Low dropout (LDO) linear regulators LDF, LDFM, LDK320, LDL212, LD39200, LD1117, LD56100	STEF01 STEF05-STEF05S STEF12-STEF12S STEF12H60M **GaN Power ICs** Integrated smart GaNs 600 V MasterGaN* **MOSFET and IGBT gate drivers** HV HB gate drivers for GaNs STDRIVEG6* HV HB gate drivers L649* Isolated gate drivers STGAP* LV HB gate drivers for GaNs STDRIVEG2* SR multiple LS gate drivers PM8834
	Controllers	**Power MOSFETs**	**Voltage reference**	
Post regulation	L6726A, PM6680	STL90N3LLH6	T*431, T*432, TS33*	

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

Typical configuration



Main application boards and reference designs

STEVAL-205GANCB
24 V - 250 W power adapter based on GaN and digital control

EVL011A150ADP
12 V - 150 W power supply based on TM PFC and HB LLC digital combo controller

EVL4986-350W / EVL4985-350W
Low-THD 350 W CCM-PFC pre-regulator

EVL400W-80PL
12 V - 400 W adapter based on CCM PFC and HB LLC analog controller

AI server power

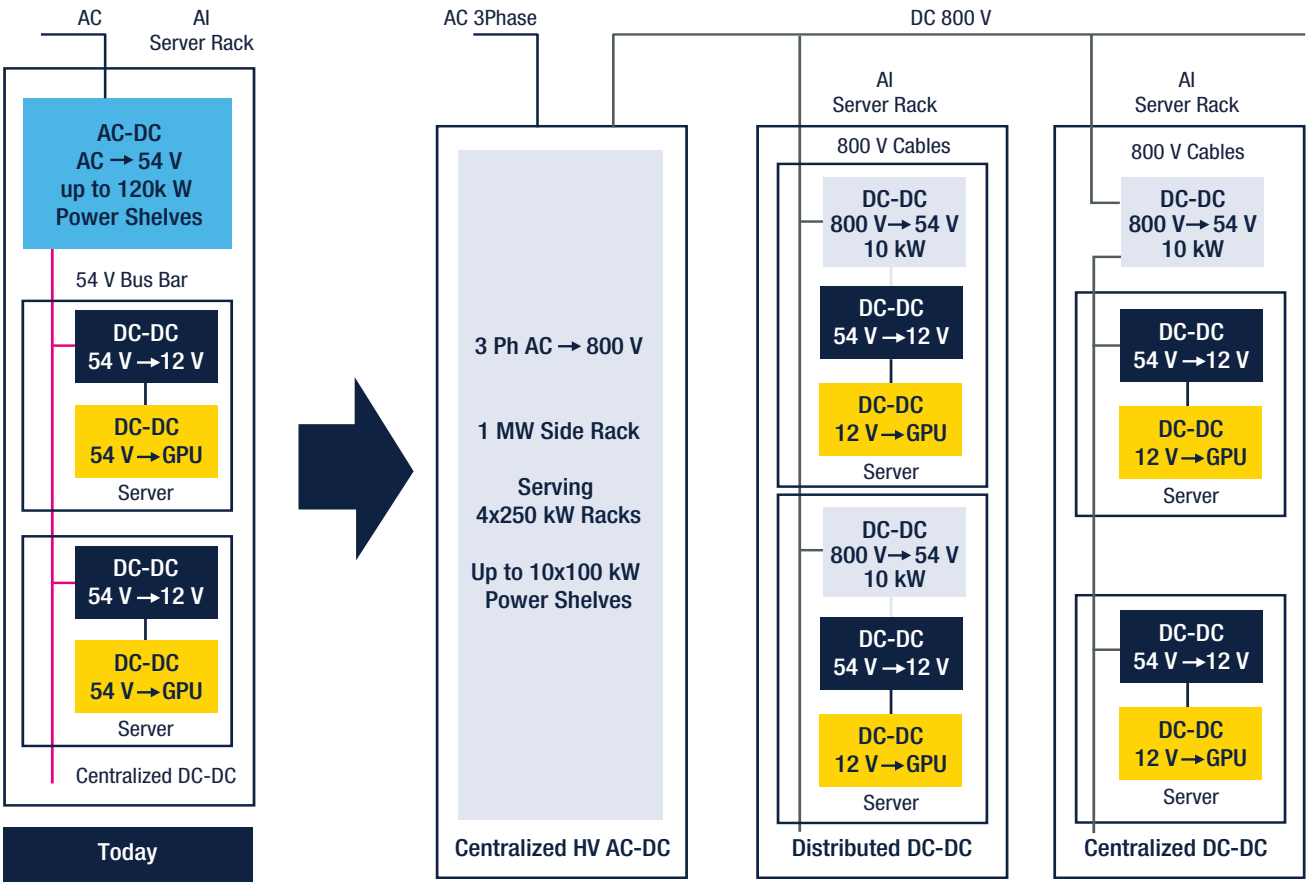
AC-DC PSU and DC-DC power distribution

Data centers house thousands of servers usually built in very dense network farms. With the advent of AI and the boom in GPU-powered applications, system architects now face the challenge of designing racks with power requirements ranging from 600 kW to 1 MW, which requires a transition to 800 Vdc or ±400 Vdc systems to improve resource utilization and significantly reduce in cabling and busbars.

Thanks to the latest advancements in SiC and GaN power technologies, STGAP silicon-embedded galvanic isolation IP, and advanced analog and digital processing capabilities, ST is able to address efficient and reliable solutions for converting AC input voltage to 800 Vdc or ±400 Vdc, followed by PDB conversion to an intermediate bus, which then generates the GPU core voltage, all in a compact form factor suitable for a server rack and achieving unprecedented power densities over 1.1 kW/inch^3.

For back-end DC-DC power distribution, ST offers advanced solutions for point-of-load conversion and an innovative DC-DC conversion from a 48 V DC supply.

Typical block diagram for AI server power



Main application boards and reference designs

STEVAL-TTPPFC01
2 kW ZVS Interleaved totem pole PFC with digital control

STDES-3KWTLCP
3 kW telecom rectifier reference design with Totem-Pole PFC and LLC converter

STEVAL-ISA172V2
2 kW fully digital AC-DC power supply (D-SMPS)

STEVAL-DPSLLCK1
3 kW Full Bridge LLC resonant digital power supply

ST product offering for server PSU

<table>
<tr><td rowspan="5">AC-DC
AC → 54 Vdc</td><td rowspan="2">MCUs and digital controllers
STM32G4
STM32F334
STNRG388A

SR analog controllers
SRK2000A, SRK2001,
SRK2001A</td><td>High Temp. SCR
TN*015H-6, TM8050H-8,
TN*050H-12, TN*015H-8</td><td>Integrated smart GaNs
600 V MASTERGAN*</td><td rowspan="2">Bridge rectifier diodes
STBR*08, STBR*12
600 V Ultrafast for CCM
STTH*R06, STTH*M06
SiC diodes
STPSC*065
Output diodes for LLC
Schottky, FERD
STPS*
FERD*45, FERD*50, FERD*60
TVS for power MOSFET and power rail surge protection
SMAJ, SM6T, SM15T, series</td></tr>
<tr><td>Power MOSFTES and GaN Transistors</td><td>GaN, MOSFET and IGBT gate drivers</td></tr>
<tr><td>700 V PowerGaN SGT*70*
650 V SiC MOSFETs SCT**65G3AG
600 V- 650 V MDmesh M9,
ST*60N*M9, ST*65N*M9
600 V- 650 V MDmesh DM9,
ST*60N*DM9, ST*65N*DM9
600 V MDmesh M6 ST*60M6
600 V- 650 V MDmesh DM6,
ST*60N*DM6, ST*65N*DM6
600 V-650 V MDmesh M2
ST*60M2, ST*65M2
600 V- 650 V MDmesh DM2,
ST*60N*DM2, ST*65N*DM2
650 V MDmesh M5 ST*65M5
SR 60 V-100 V STripFET F7/F8
ST*N6F7, ST*N8F7, ST*N8F8, ST*N10F7,
ST*N10F8</td><td>HV HB gate drivers for GaN
STDRIVEG6*
Isolated gate drivers
STGAP*
HV HB gate drivers
L649*
LV HB gate drivers for GaN
STDRIVEG2*
Multiple LS gate drivers
PM8834
Single LS gate drivers
PM88*1</td><td>LDO

Low dropout linear regulators
LDF, LDFM, LD39050, LD39100,
LD39200, LDL112, LDL212,
LD49100, LD59100, LD57100,
LDQ40</td></tr>
<tr><td>HV converters</td><td>DC-DC converters</td><td>V/I sensing</td><td>eFuses</td></tr>
<tr><td>VIPerGaN*</td><td>L3751, L698*, L6983I, L6986I</td><td>Isolated Sigma-Delta ADC
ISOSD61, ISOSD61L
Precision op amps (<50 MHz)
TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV*
Currrent/Voltage/Power Monitors
TSC1641</td><td>STEF01, STEF05-STEF05S
STEF12-STEF12S
STEF12H60M</td></tr>
<tr><td rowspan="4">3Ph AC →
800 Vdc</td><td>Controllers</td><td>SiC MOSFTES and GaN Transistors</td><td>GaN, MOSFET and IGBT gate drivers</td><td>Diodes and protections</td></tr>
<tr><td rowspan="2">MCUs and digital controllers
STM32G4
STM32F334
STNRG388A</td><td>700 V PowerGaN SGT*70*
650 V-750 V-900 V-1200 V-1700 V SiC MOSFETs
SCT*65/75/90/120G3(AG)</td><td>HV HB gate drivers for GaN
STDRIVEG6*
Isolated gate drivers STGAP*
HV HB gate drivers L649*</td><td>SiC diodes
STPSC*065, STPSC*12
1200 V Ultrafast STTH*12
TVS for power MOSFET and power rail surge protection
SMAJ, SM6T, SM15T, series</td></tr>
<tr><td>DC-DC converters</td><td>V/I sensing</td><td>LDO</td></tr>
<tr><td>L3751, L698*, L6983I, L6986I</td><td>Isolated Sigma-Delta ADC
ISOSD61, ISOSD61L
Precision op amps (<50 MHz)
TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV*
Currrent/Voltage/Power Monitors
TSC1641</td><td>Low dropout linear regulators
LDF, LDFM, LD39050, LD39100,
LD39200, LDL112, LDL212,
LD49100, LD59100, LD57100,
LDQ40</td></tr>
<tr><td rowspan="4">800 V → 54 V</td><td>Controllers</td><td>Power MOSFTES and GaN Transistors</td><td>GaN Drivers</td><td>LDO</td></tr>
<tr><td>MCUs and digital controllers
STM32G4</td><td rowspan="3">700 V PowerGaN SGT*70*
100 V PowerGaN SGT*10*
1050 V to 1700 V MDmesh K5
ST*105K5, ST*120K5,
ST*150K5, ST*12N170K5</td><td rowspan="3">Isolated gate drivers for GaN
STGAP2GS
LV FB gate drivers for GaN
STPRDC02</td><td>LDQ40PU33R
LDQ40PUR</td></tr>
<tr><td>PWM controllers</td><td>DC-DC converters</td></tr>
<tr><td>L6565</td><td>STP1S50</td></tr>
</table>

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

STEVAL-DPSG474
Digital power control board

STEVAL-ISA147V3
500 W fully digital AC-DC power supply (D-SMPS)

STEVAL-DPSTPFC1
3.6 kW PFC Totem-Pole with digital inrush current limiter

EVL4986A-1KWBL
Low THD-High efficiency, 1 KW bridgeless CCM-PFC

Power distribution for modern data center

To support the evolution and expansion of cloud services, the internet of things, mobile apps, and new generation of telecommunication infrastructure, the demand for data centers performance is growing exponentially with more powerful CPUs, and this segment is expanding in artificial intelligence and machine learning.

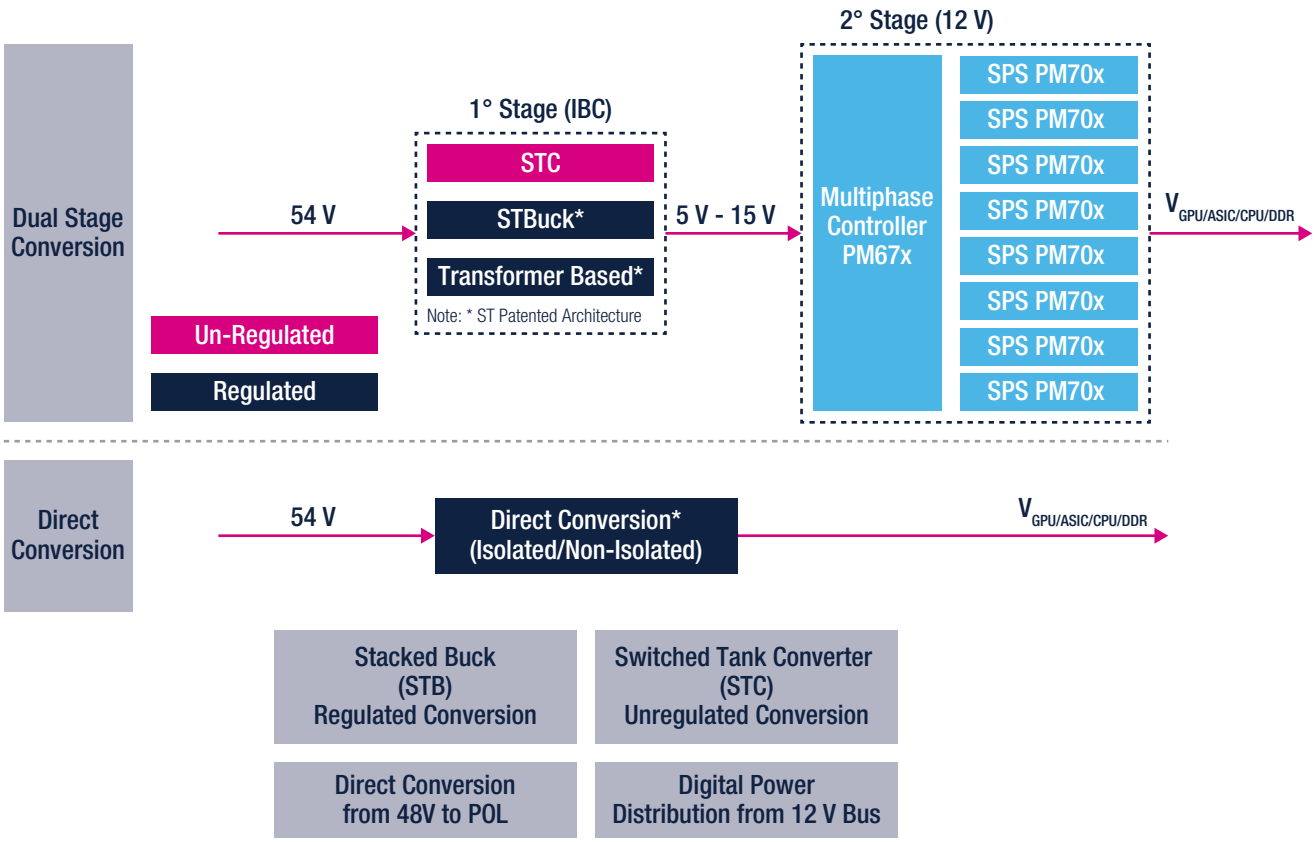
In the newest architecture, a 48 V DC rail is generated from the AC-DC power supply unit, which is then converted to provide the number of DC rails needed to supply the various loads and circuits in the server. This conversion must meet stringent efficiency targets requiring innovative architectures like those developed by ST.

We offer a wide range of high-efficiency regulated and unregulated DC-DC conversion solutions, including STB, STC, HSTC for 48 to 12 V intermediate bus conversion.

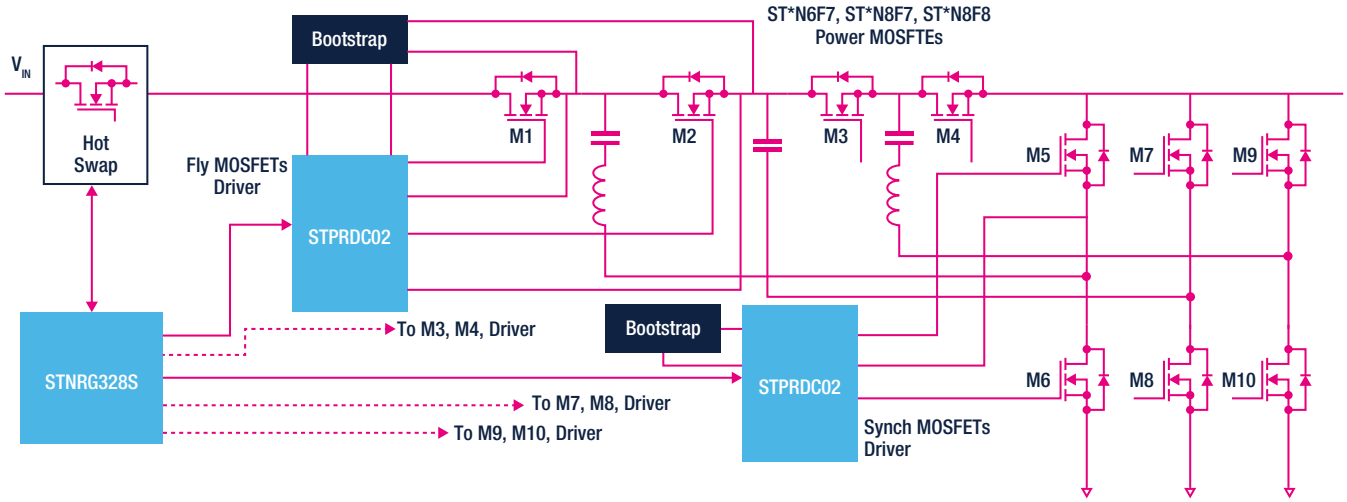
Moreover, we offer 12 V to point of load conversion, including multi-phase digital controller and smart power stages (SPS) to support the most recent INTEL and AMD CPU specifications.

Finally, ST offers direct conversion solutions, from 48 V to point-of-load.

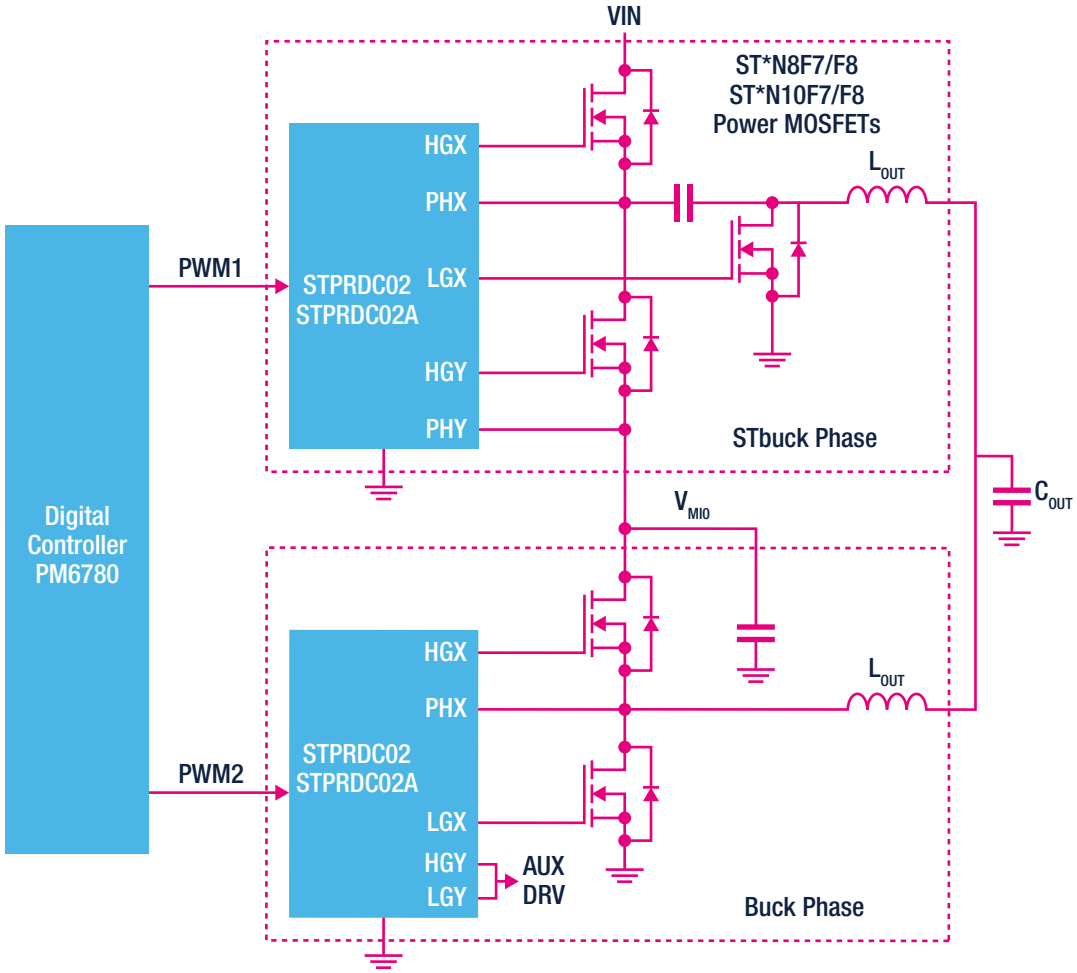
Power delivery for modern data center



Typical configuration for switched-tank converter (STC) system - 48 V to 12 V non isolated unregulated IBC



Typical configuration for STBUCK - 48 V / 54 V to 12 V non isolated regulated IBC



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

SSD power management

Solid state drives (SSD) serve the same function as hard disk drives, but they have a different set of internal components; they have no moving parts and data is stored in flash memory. SSDs can access data faster than HDDs and have several other advantages such as better performance and robustness and lower power consumption. SSDs are widely used in desktop and notebook computers, as well as for storage in data centers.

ST offers state-of-the-art products for SSD system architecture, including power management ICs featuring protections and communication bus. Our portfolio of high-quality components allows the design of solutions that meet the most demanding requirements of both consumer SSD and enterprise-grade SSDs.

The ST device family is ideal for designing advanced power management solutions for microcontroller, DDR, flash memory, on SSD server and consumer applications.

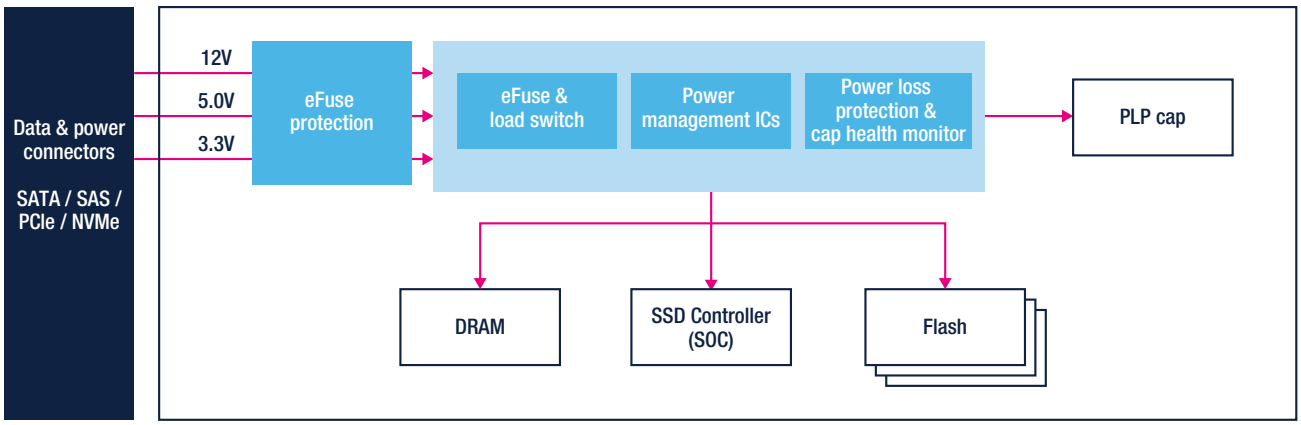
The IC series features multiple Buck and LDOs with programmable outputs and supports conversions from a wide range of input voltage buses like 12 V, 5 V, and 3.3 V.

Electronic fuses (eFuses) for 3.3, 5 and 12 V located at the power connector minimize system down-time by protecting the SSD and the host from failures.

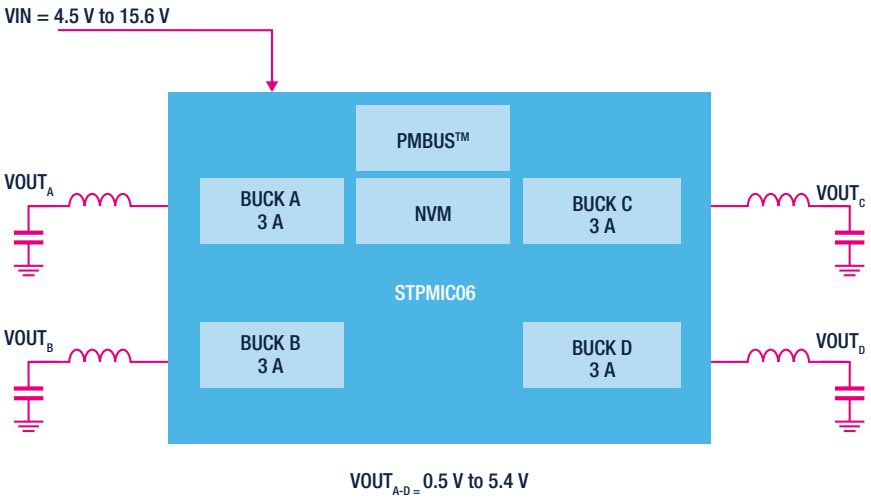
High switching frequency eases the design of compact applications, while specific control techniques ensure best-in-class efficiency at heavy and light load operation.

Full programmability via high speed serial interfaces like I²C and PMBus® allows configurability for different application requirements.

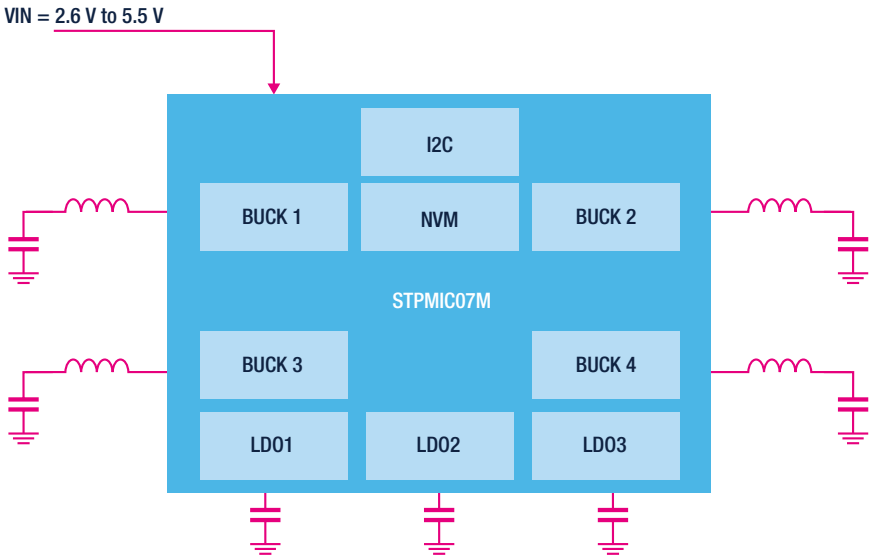
Typical block diagram for SSD power management



STPMIC06



STPMIC07M

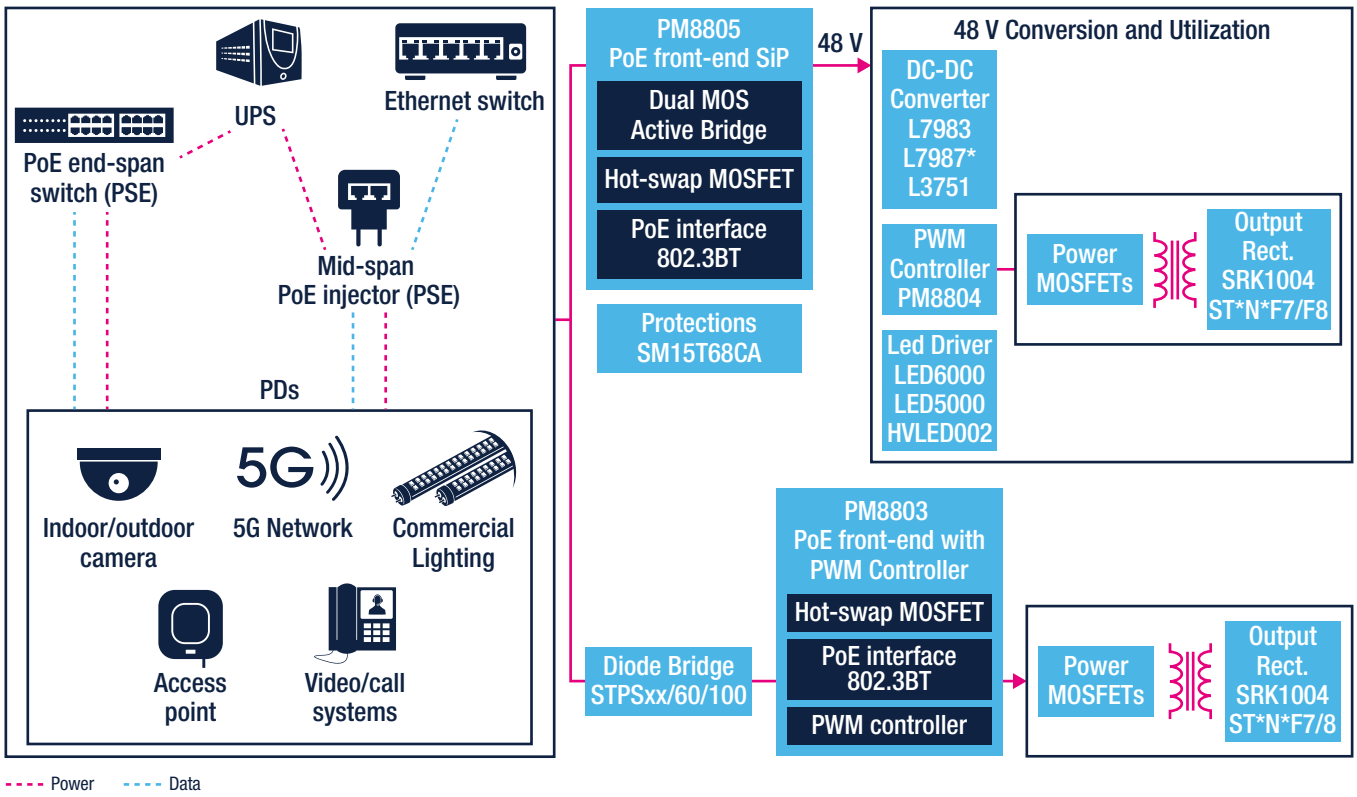


Power over Ethernet (PoE)

Power over Ethernet (PoE) is a widely adopted technology used to transfer power and supply the powered device (PD), including wireless access points, VoIP phones over an RJ-45 cable also carrying data as described in the IEEE 802.3 standard, and its evolutions including IEEE 802.3bt, IEEE 802.3at, and IEEE 802.3af.

We offer a range of products for complete interface with all the functions required by the communication standard, including detection and classification, as well as protection features such as under-voltage lockout (UVLO) and in-rush current limitation. In addition, these products can control hot-swap power MOSFETs that can greatly simplify the development of IEEE 802.3 compliant solutions for powered devices (PD).

Typical block diagram for PoE power management



Main application boards and reference designs

STEVAL-POE001V1

Power over Ethernet (PoE) - IEEE 802.3bt compliant interface

STEVAL-POE002V1

5 V/8 A, synchronous flyback converter, power over Ethernet (PoE) IEEE 802.3bt compliant reference design

STEVAL-POE003V1

5 V/20 A, active clamp forward converter, power over Ethernet (PoE) - IEEE 802.3bt compliant reference design

STEVAL-POE005V1

12 V/8 A, active clamp forward converter, power over Ethernet (PoE) IEEE 802.3bt compliant reference design

STEVAL-POE006V1

3.3 V/20 A, active clamp forward converter, power over Ethernet (PoE) IEEE 802.3bt compliant reference design

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

LED TV power supply

Beyond their outstanding image quality, new-generation televisions have a very thin design, are highly power-efficient and feature a stand-by power mode. Power supply units (PSUs) play a key role in ensuring TVs meet market requirements and have an elegant form factor.

To achieve these stringent requirements, PSUs typically have a power factor corrector (PFC) stage and use advanced topologies like half-bridge LLC resonant converter.

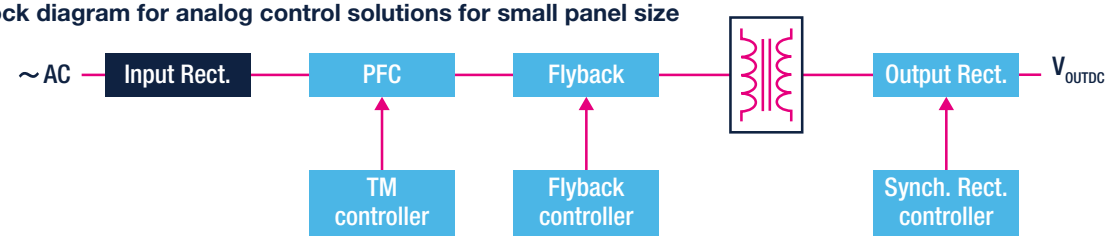
ST offers a broad portfolio of high-voltage MDmesh and low-voltage STripFET power MOSFETs, field-effect rectifier diodes (FERD), Schottky and Ultrafast diodes, a full range of protection ICs, as well as dedicated analog and digital switching controllers, which negate the necessity of auxiliary power by consuming very low power at no load. In addition, STM32 microcontrollers enable developers to exploit the full potential of digital PSU implementations.

ST recommended products for LED TV power supply

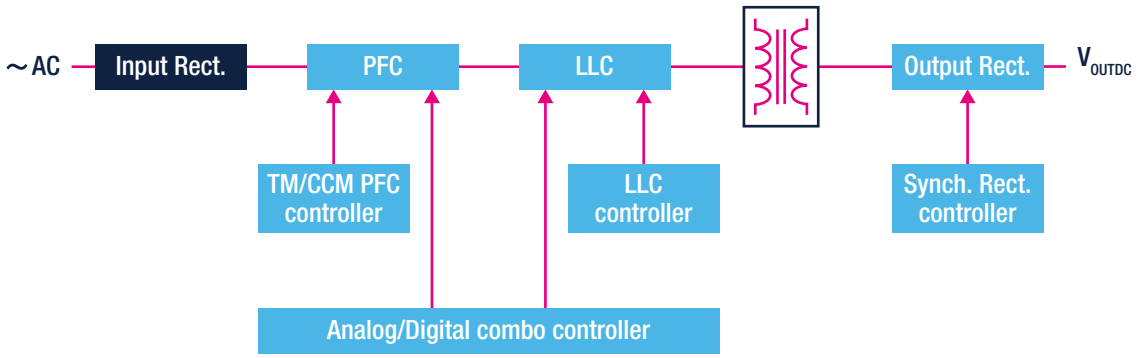
<table>
<tr><td></td><td colspan="4">SCR</td></tr>
<tr><td>Input rectifier</td><td colspan="4">High Temp. SCR
TN*015H-6, TM8050H-8, TN*050H-12, TN*015H-8</td></tr>
<tr><td></td><td>Controllers</td><td>Power MOSFETs and GaN</td><td>Diodes</td><td>Op-amp V/I sensing</td></tr>
<tr><td>PFC Block</td><td>TM analog controllers
L6562A*, L6563*, L6564*
CCM analog controllers
L4985, L4986, L4981*, L4984D
MCUs and digital controllers
STM32F0, STM32G0, STM32F301, STM32F334, STM32G4, STNRG388A</td><td>700 V PowerGaN SGT*70*
600 V-650V MDmesh M9
ST*60N*M9, ST*65N*M9
600 V MDmesh M6 ST*60M6
600 V-650 V MDmesh M2
ST*60M2, ST*65M2
650 V MDmesh M5 ST*65M5</td><td>600 V Ultrafast for TM
STTH*L06
STTH*06
STTH15AC06*
600 V Ultrafast for CCM
STTH*R06
STTH*M06
SiC diodes
STPSC*065</td><td>Precision op amps (<50 MHz)
TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV*
MOSFET and IGBT gate drivers
Multiple LS gate drivers
PM8834
Single LS gate drivers
PM88*1</td></tr>
<tr><td></td><td>Controllers</td><td>GaN power ICs</td><td>Diodes and protections</td><td>MOSFET and IGBT gate drivers</td></tr>
<tr><td>Isolation stage</td><td>Flyback controllers
L6566A, L6566B, L6565, L6668, STCH03
ACF (Active Clamp Flyback controllers)
STACF01
PFC and LLC Combo controllers
STNRG011, STNRG011A
LLC analog controllers
L6599*, L6699
Asymmetrical HB controllers
L6591
MCUs and digital controllers
STM32F0, STM32G0, STM32F301, STM32F334, STM32G4, STNRG388A
SR analog controllers
SRK1004 for flyback SRK2000A, SRK2001, SRK2001A for LLC</td><td>Integrated Smart GaNs
600 V MASTERGAN
HV HB gate drivers for GaNs
STDRIVEG6*
LV HB gate drivers for GaNs
STDRIVEG2*
Power MOSFETs and GaN transistors
700 V PowerGaN SGT*70*
600 V-650 V MDmesh DM9
ST*60N*DM9, ST*65N*DM9
600 V-650 V MDmesh DM6
ST*60DM6, ST*65DM6
600 V-650 V MDmesh DM2
ST*60DM2, ST*65DM2
650 V MDmesh M9
ST*65N*M9
600 V MDmesh M6 ST*60M6
600 V-650 V MDmesh M2
ST*60M2, ST*65M2
800 V MDmesh K5 ST*N80K5
800 V MDmesh K6 ST*80N*K6
60 V-100 V STripFET F7/F8
ST*N6F7, ST*N8F7/8, ST*N10F7/8</td><td>Output diodes for flyback
Schottky, FERD, Ultrafast
STPS*, FERD*, STTH*
Clamping diodes for flyback
600 V to 1000 V Ultrafast
STTH*06, STTH*08, STTH*10
Output diodes for LLC
Schottky, FERD
STPS*
FERD*45, FERD*50, FERD*60, FERD*100
100 V Trench Schottky STPST*100
MOSFET protection for flyback
SMAJ, SM6T, SM15T series
Voltage reference
T*431, T*432</td><td>HV HB gate drivers
L649*
Isolated gate drivers
STGAP*
SR multiple LS gate drivers
PM8834
SR HV HB gate drivers
L649*
Isolated interfaces for wired connectivity
STISO62*
Post regulation
DC-DC converters
L698*, L7983, ST1S40
Low dropout (LDO) linear regulators
LD1117*, ST730/2, LD39100, LD49100, LDQ40</td></tr>
</table>

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

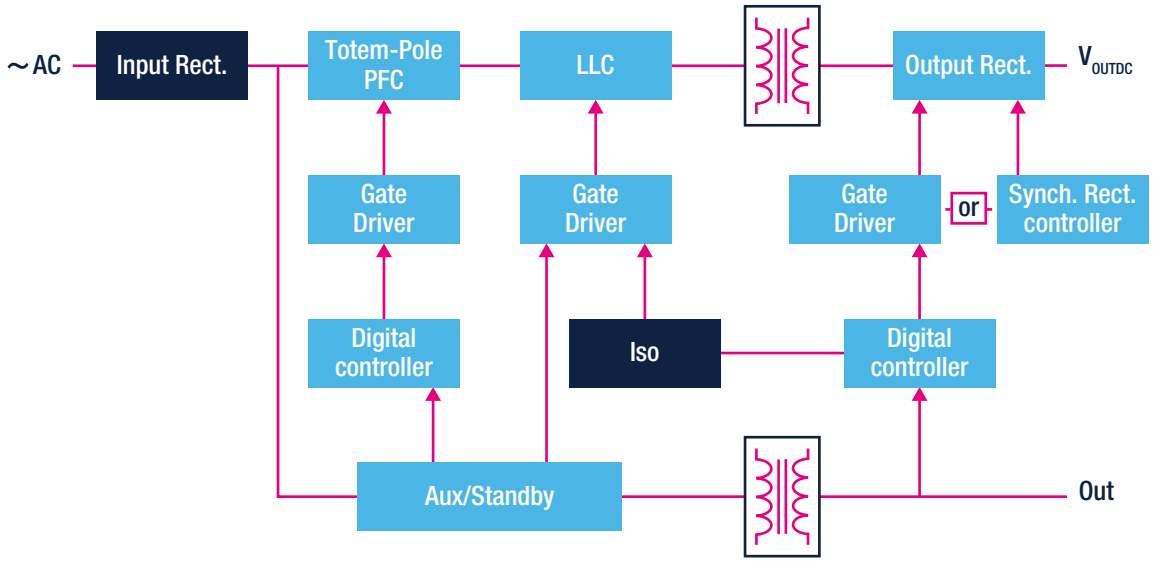
Typical block diagram for analog control solutions for small panel size



Typical block diagram: Analog control solutions with no Aux supply, for small/medium panel size



Typical block diagram for digital control solutions for medium/large panel size



Main application boards and reference designs

STEVAL-250GANCB

24 V - 250 W power adapter based on GaN and digital control

STEVAL-NRG011TV

200 W power supply based on STNRG011 digital combo for LED TV

STEVAL-TTPPFC01

2 kW ZVS Interleaved totem pole PFC with digital control

STEVAL-SCR002V1

Inrush current limiter for 1 kW AC-DC

EVL400W-80PL

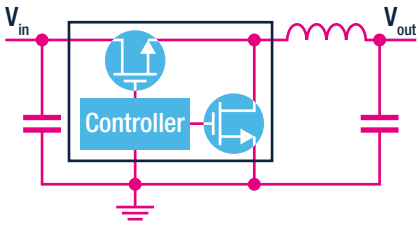
12 V - 400 W adapter based on CCM PFC and HB LLC analog controller

DC-DC conversion

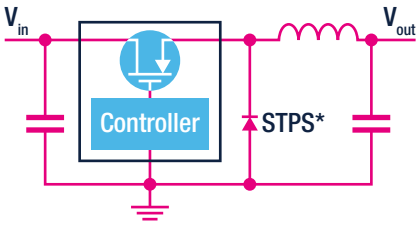
A DC-DC switching converter is used to locally supply any component or part of a system with the desired DC voltage and current. Depending on the application's relationship between the input and output voltage, engineers have to choose the best power topology: buck, boost, buck-boost or inverting, with or without synchronous rectification. In addition, they can decide to use an implementation based on monolithic ICs, or with discrete power switches and controllers, or even an advanced digital implementation. Whatever the choice, the right semiconductor products are key to meeting the specific efficiency and size design targets.

ST broad product portfolio includes highly-integrated DC-DC converters and PWM controllers, power MOSFETs and rectifiers, protection ICs, and linear voltage regulators to address a wide range of topologies and power requirements. We also provide a comprehensive range of hardware and software evaluation and development tools, including eDesignSuite, which that helps engineers design high-efficiency DC-DC converters.

Typical buck configuration: up to 61 Vin/3 A Iout

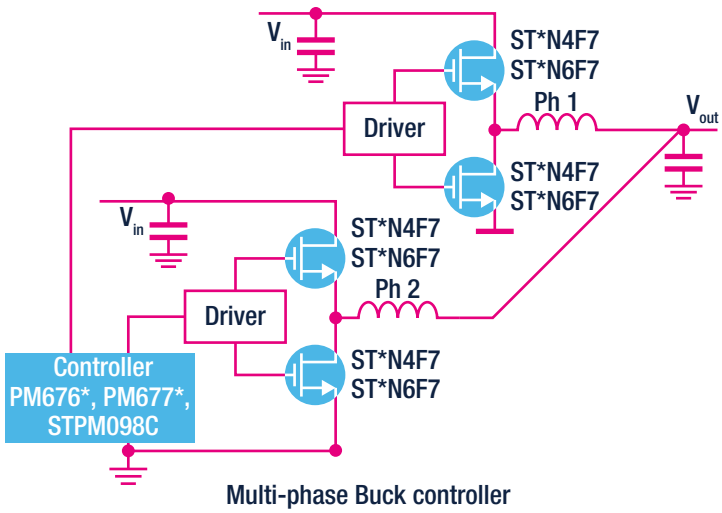


Synchronous buck converter



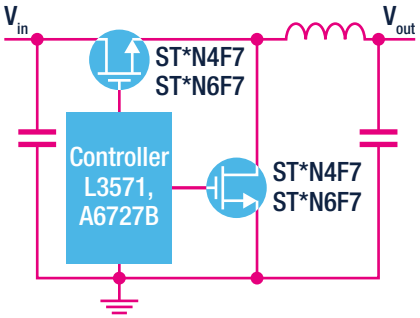
Asynchronous buck converter

Typical multi-phase configuration: up to 12 Vin, very high output current



Multi-phase Buck controller

Typical single phase discrete configuration: up to 18 Vin, high output current



Single-phase buck controller

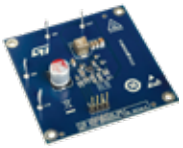
Main application boards and reference designs

STEVAL-3601CV1

Synch. step-down converter evaluation board based on DCP3601

STEVAL-A6986IV3

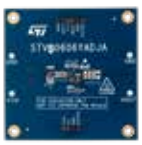
Automotive-grade 5 W isobuck-boost up to 28 Vin, selectable output voltage pairs: 18 V / -5v or 15 V / -8V



STEVAL-A6983CV1/NV1

Automotive-grade synch. buck up to 38 Vin

5 Vout - 3 A Iout



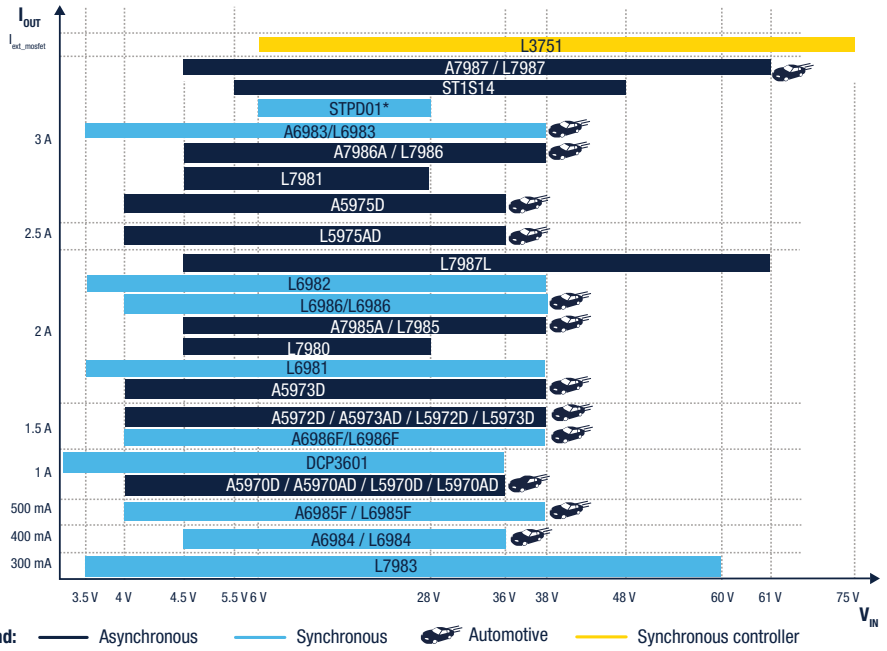
STEVAL-0606YADJ

Automotive step-down converter based on the DCP0606Y

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

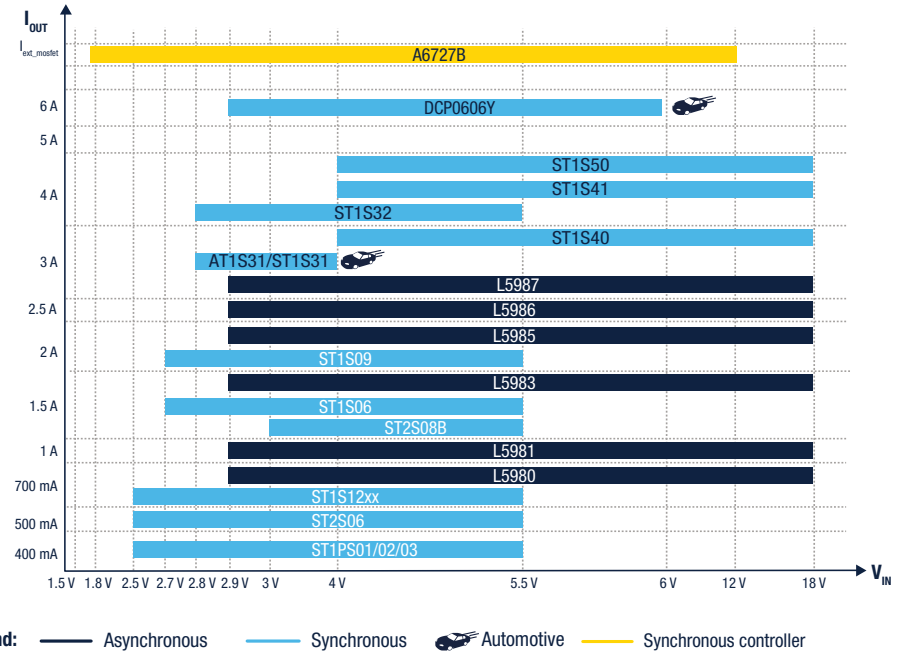
ST product offering for switching converters (DC-DC)

Buck for pre-regulation (<24 V)

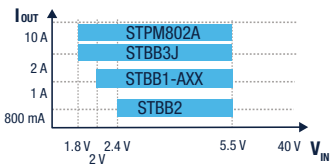


Note: *for USB PD, up to 60 W output power (20 V, 3 A)

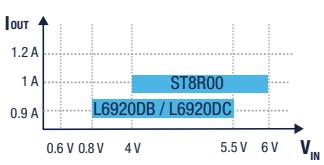
Buck for post-regulation (<24 V)



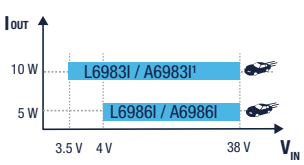
Buck-Boost



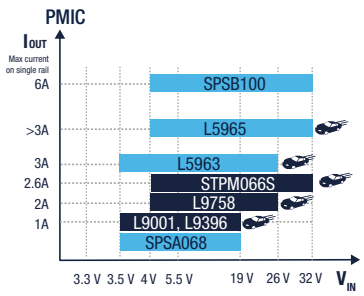
Boost



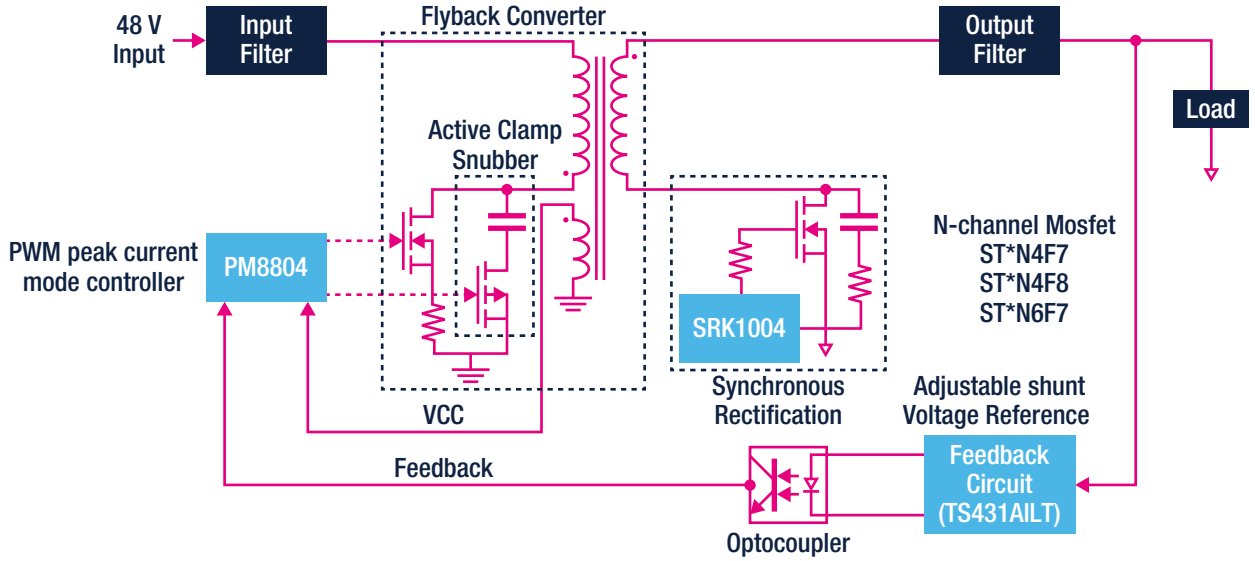
IsoBuck



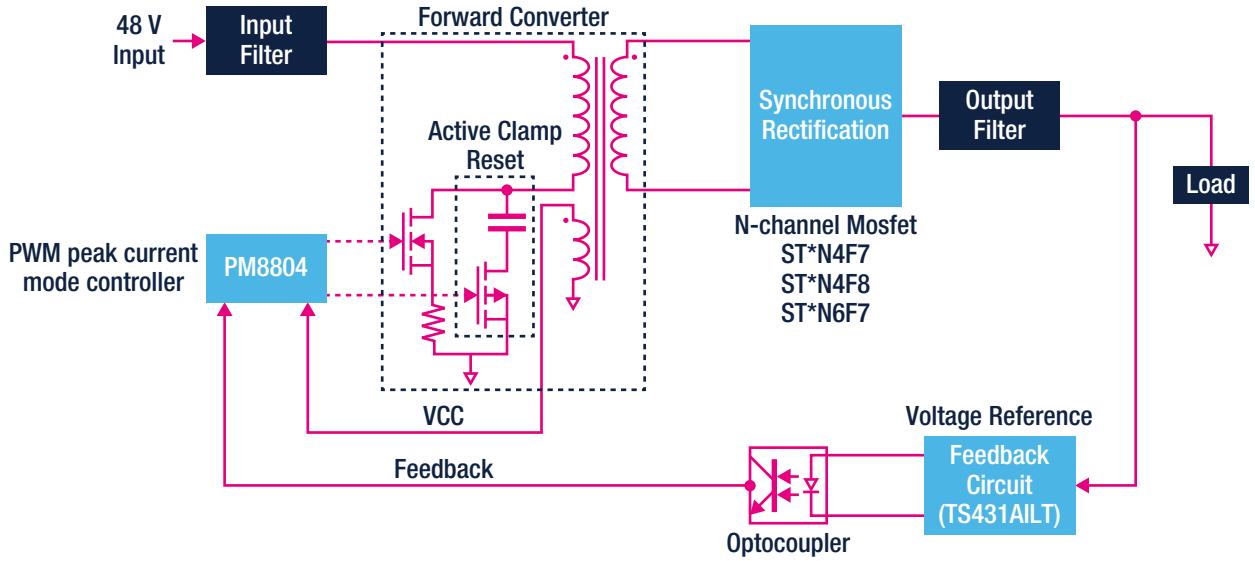
PMIC



Typical 48 Vin, up to 65 W Pout, synchronous flyback configuration



Typical 48 Vin, > 65 W Pout, active clamp forward configuration



Main evaluation boards

STEVAL-ISA203V1

- Input voltage range: 42 - 56 V DC
- Switching frequency - 250 kHz
- Output:
- Power - 60 W
- Voltage - 12 V DC
- Current - 5 A
- Peak efficiency > 94%

STEVAL-ISA204V1

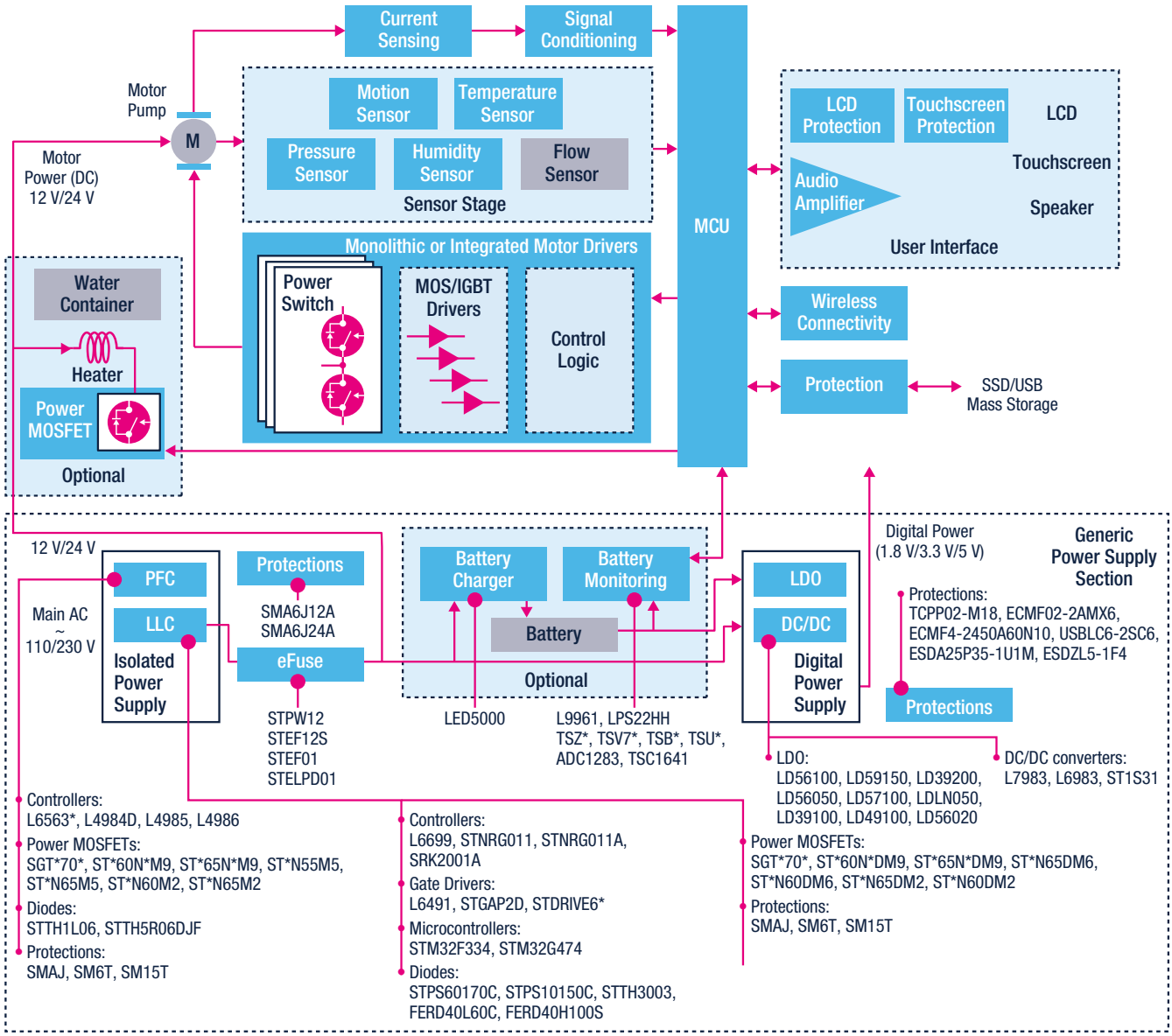
- Input voltage range: 42 - 56 V DC
- Switching frequency - 250 kHz
- Output:
- Power - 100 W
- Voltage - 5 V DC
- Current - up to 20 A
- Peak efficiency > 94%

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

Medical power supply

The mission critical nature of medical devices demands high quality, reliable, and safe products. Our goal is to consistently deliver products that meet this criteria and help our customers meet this goal. Medical power supplies are a crucial part of the equipment, usually you with open frame, enclosed, fanless, and configurable models, as well as wall-mount adapters and DC-DC modules. Often, the backup battery is part of the power supply to guarantee continuity of operation when the main supply is interrupted.

Typical block diagram of a medical power supply for artificial ventilators



Main application boards and reference designs

EVL6564-100W
100 W transition-mode PFC pre-regulator

EVLSTNRG011-150
EVL011A150ADP
12 V - 150 W power supply based on TM PFC and HB LLC digital combo controller

STEVAL-L7983ADJ
12 V/0.3 A step down DC-DC converter (VIN = 12 to 60 V)

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

LED LIGHTING AND CONTROLS

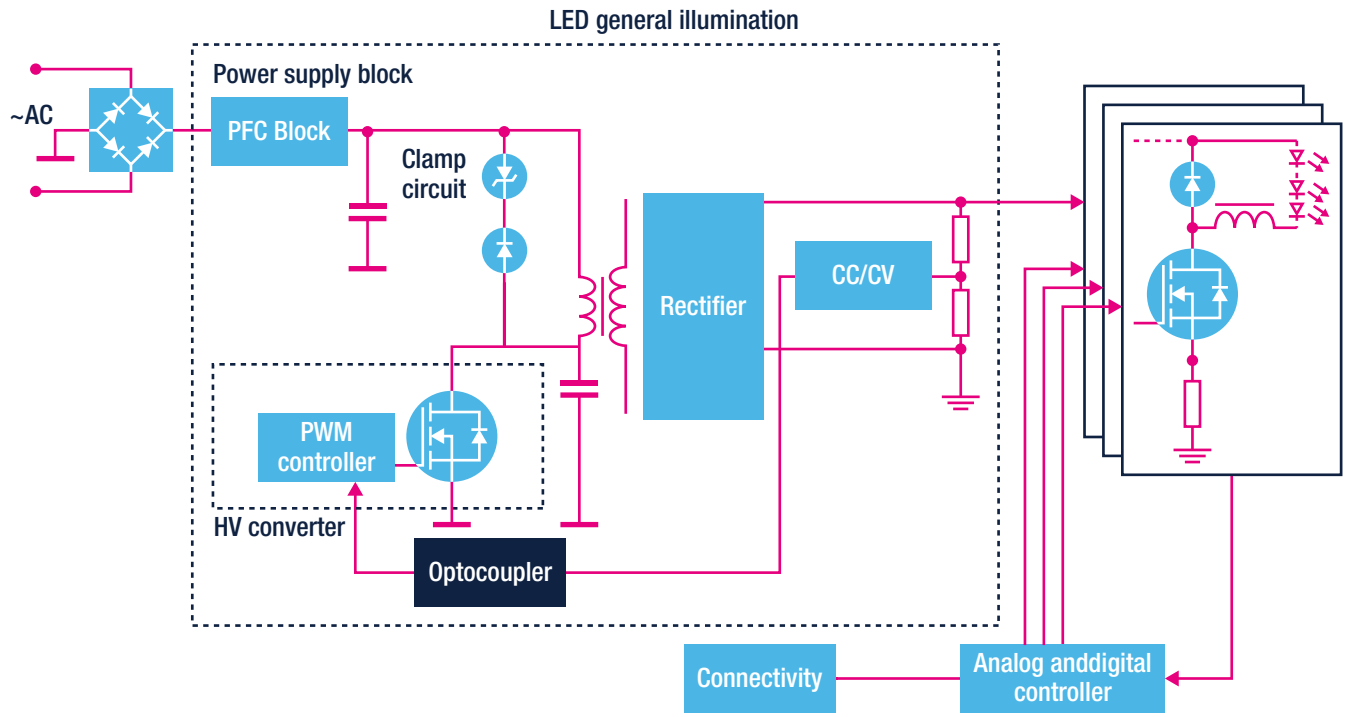
LED general illumination

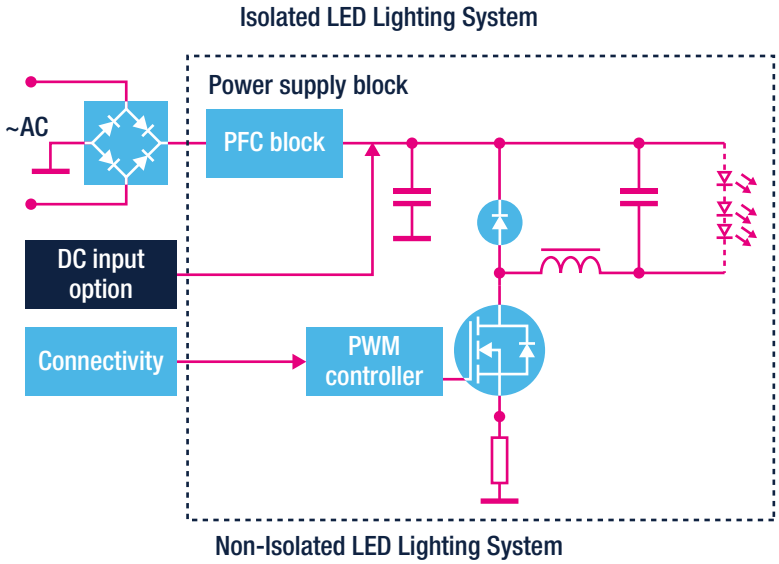
LED lamps and bulbs can have a number of different form-factors, depending on the specific use, size, and dimensions of the application, including retrofit bulbs, high-bay lights, low-bay lights and emergency lights. Driving a string of LEDs involves AC-DC and DC-DC conversion designed using non-isolated, isolated, single stage or multi-stage topologies, which must ensure high efficiency and reliability at a competitive cost point.

Modern applications include a range of connectivity features to implement remote monitoring and control, making LED lighting a pillar of smart home, smart building and smart city environments. ST portfolio includes a variety of RF transceivers, wireless MCUs, network processor ICs and fully certified modules for key wireless connectivity technologies. Our embedded software for BLE Mesh enables mesh networking of connected smart lighting end products.

For the LED driving stage, we have a range of pulse-width modulation (PWM) and power factor correction (PFC) controllers, power MOSFETs and diodes, as well as a comprehensive set of hardware evaluation and development tools, including eDesignSuite SW design tool to help developers design high-efficiency LED lighting solutions.

Typical block diagram





ST product offering for LED general illumination

	Controllers	Power MOSFETs and GaN	Diodes	MOSFET and IGBT gate drivers
PFC Block	TM analog controllers L6562*, L6563*, L6564* CCM analog controllers L4985, L4986, L4981*, L4984D MCUs and digital controllers STM32F0, STM32G0, STM32F301, STM32F334, STM32G4, STLUX, STNRG388A	600 V MDmesh M6 ST*60M6 600 V-650 V MDmesh M2 ST*60M2, ST*65M2 800 V MDmesh K6 ST*80*K6 800 V to 1200 V MDmesh K5 ST*80K5, ST*9*K5, ST*105K5, ST*120K5 650 V SiC MOSFETs SCT**65G3AG 700 V PowerGaN SGT*70*	600 V Ultrafast for TM STTH*L06, STTH*06, STTH15AC06* 600 V Ultrafast for CCM STTH*R06, STTH*M06 SiC diodes STPSC*065	Single LS gate drivers PM88*1 Multiple LS gate drivers PM8834

	Controllers and converters	Power MOSFETs and GaN	Diodes and discretes	Voltage reference, CC/CV Ctrl
Isolation stage	Offline LED drivers HVLED101, HVLED001A/B, HVLED007, HVLED8* HV converters VIPer0P, VIPer*1, VIPer*6, VIPer122, VIPer222, VIPer*5, VIPer*7, VIPer*8 LLC analog controllers L6599*, L6699 PFC and LLC/LCC Combo controllers STNRG011, STNRG011A, STNRG012 MCUs and digital controllers STM32G0, STM32G4, STM32F334, STM8S, STLUX, STNRG388A SR analog controllers SRK1004 for flyback SRK2000A, SRK2001, SRK2001A for LLC	600 V MDmesh DM6 ST*60DM6 600 V-650 V MDmesh DM2 ST*60DM2, ST*65DM2 950 V MDmesh DK5 ST*95DK5 600 V MDmesh M6 ST*60M6, 600 V-650 V MDmesh M2 ST*60M2, ST*65M2 700 V PowerGaN SGT*70* 800 V MDmesh K6 ST*80*K6 800 V to 950 V MDmesh K5 ST*80K5, ST*9*K5 60 V-100 V STripFET F7/F8 ST*N6F7, ST*N8F7, ST*N8F8, ST*N10F7, ST*N10F8 **Integrated Smart GaNs** 600 V MASTERGAN*	Clamping diodes for flyback 600 V to 1000 V Ultrafast STTH*06, STTH*08, STTH*10 100 V Trench Schottky STPST*100 Output diodes for flyback Schottky, FERD, Ultrafast STPS*, FERD*, STTH* Output diodes for LLC/LCC Schottky, FERD STPS* FERD*45, FERD*50, FERD*60, FERD*100 MOSFET protection for flyback SMAJ, SM6T, SM15T series SCR protection switch TNx015H-6”	Voltage reference T*431, T*432 Voltage and current Ctrl TSM*, SEA05* **Signal conditioning** TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV* **MOSFET and IGBT gate drivers** HV HB gate drivers for GaN STDRIVEG6* HV HB gate drivers L649* Isolated gate drivers STGAP* Multiple LS gate drivers PM8834
Multiple strings management	Offline LED drivers HVLED002 MCUs and digital controllers STM32F0, STM32G0, STM32F334, STM32G4, STM8S, STLUX, STNRG388A	700 V PowerGaN SGT*70* STripFET F7/F8 ST*N4F7, ST*N6F7, ST*N10F7 ST*N10F8	Schottky diodes STPS* FERD diodes FERD* ≥ 200 V Ultrafast diodes STTH* **DC-DC LED drivers** LED5000, LED6000, ST1CC40, LED2000, LED2001	LV HB gate drivers for GaN STDRIVEG2* HV HB gate drivers L649*, L6395 Single LS gate drivers PM88*1 Multiple LS gate drivers PM8834

	Bluetooth Low Energy (BLE, BLE MESH)		2.4 GHz Multi Standard (ZigBee, Thread, 802.15.4)		Sub-1 GHz	Cellular
Wireless connectivity	Bluetooth LE 5.3 BlueNRG-1, BlueNRG-2 BlueNRG-LP, BlueNRG-LPS BLE network processor BlueNRG-2N Baluns BALF-NRG-0*D3 Dual core MCUs BLE 5.4 STM32WB10/15 STM32WB05 STM32WB06/7/9 IPD (Integrated passive device) MLPF-WB55-01E3, MLPF-WB55-02E3, MLPF-WB-01E3, MLPF-WB-01D3, MLPF-WB-02D3	BlueNRG modules BlueNRG-M0 BlueNRG-M2 STM32 wireless module STM32WB5MMG, STM32WB1MM	2.4 GHz application processors: Dual core: STM32WB Single core: STM32WBA5	STM32 wireless module STM32WB5MMG, STM32WB1MM	Sub-1GHz wireless MCU STM32WL33/54/55/E4/E5 Sub-1GHz wireless module STM32WL5M Sub-1GHz transceivers S2-LP, SPIRIT1 Baluns BALF-SPI-0*D3, BALF-SPI2-0*D3, BALFHB-WL-0xD3, BALFLB-WL-0xD3	NB-IoT & GNSS ST87M01 Secure MCU STSAFE-A110, STSAFE-A120 eSIM ST4SIM

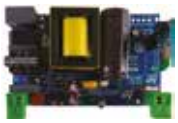
Main application boards

EVLHV101PSR50W
EVLHV101SSR50W
50 W converter based on quasi resonant HPF flyback controller with primary side/secondary side regulation

EVLHVLED007W35F
35 W LED driver with very low THD, based on transition mode flyback converter (CVout)

EVAL-PSR01B-35W
EVAL-SSR01B-35W
35 W LED driver with very high efficiency based on QR flyback converter with PSR (CVout) /SSR (CC/CV)

EVAL-IBD002-35W
35 W inverse buck with LED current control and with Analog/PWM dimming



STEVAL-LLL012V1
Smart LED driver with high power factor using BLE Mesh network for indoor lighting

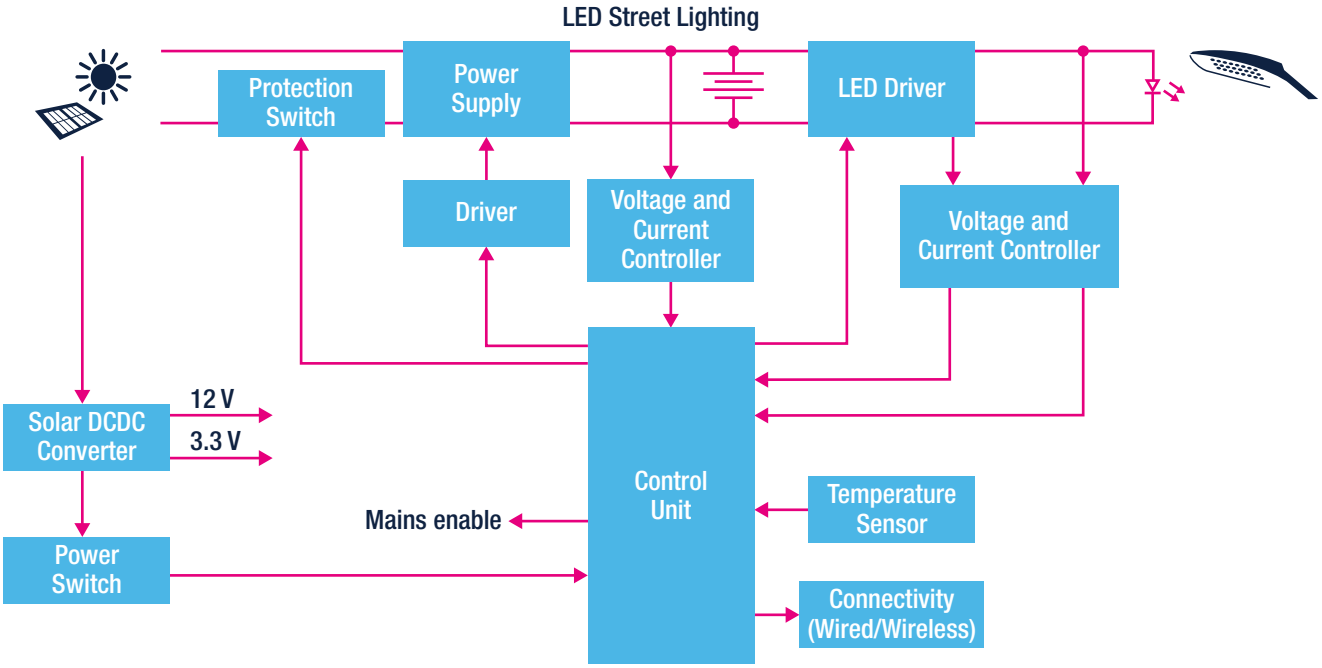
STEVAL-ILL078V1
1A, up to 60 V Vin, buck LED driver with digital dimming

LED street lighting

Street lighting installations have evolved from basic energy-hungry illumination spots to central devices enabling a set of services, such as presence and traffic-level monitoring and incident-detection surveillance, while optimizing illumination levels to specific road and weather conditions to support administrations in transforming cities in smart cities.

We have a broad range of wired and wireless connectivity, power management, and LED driving solutions. A range of high-performance and low-power STM32 microcontrollers, together with presence, proximity, camera, and environmental sensors, as well as MEMS microphones, enable design of advanced street lighting systems.

Typical block diagram



Main application boards

EVLMG4L-IBCKFL

High power inverse buck for dimmable LED application with MASTERGAN4L

STEVAL-LLL004V1

75 W AC-DC digitally controlled non isolated constant current LED driver

EVL80WLED-STCH03

80 W -1 A primary side current loop control LED driver based on QR flyback converter

EVL150W-HVSL

150 V - 1 A LED driver featuring TM PFC and LCC resonant converter with analog combo controller

EVL6699-HVSL

150 V - 1 A LED driver featuring TM PFC and LCC resonant converter with L6699

STEVAL-LLL009V1

300 W very high AC input voltage LED driver with digital power control

ST product offering for LED street lighting

	Controllers	Power MOSFETs and GaN	Diodes and protections	MOSFET and IGBT gate drivers
Power supply	TM PFC analog controllers L6562*, L6563*, L6564* CCM PFC analog controllers L4985, L4986, L4981*, L4984D Offline LED drivers HVLED101, HVLED001B, HVLED001A, HVLED007 PFC and LLC/LCC Combo controllers STNRG011, STNRG011A, STNRG012 LLC/LCC controllers L6599A*, L6699 MCUs and digital controllers STM32F0, STM32G0, STM32F301, STM32F334, STM32G4, STLUX, STNRG388A SR analog controllers SRK1004 for flyback SRK2000A, SRK2001, SRK2001A for LLC	600 V MDmesh DM6 ST*60DM6 600 V-650 V MDmesh DM2 ST*60DM2, ST*65DM2 600 V MDmesh M6 ST*60M6 600 V-650 V MDmesh M2 ST*60M2, ST*65M2 800 V MDmesh K6 ST*80*K6 950 V MDmesh DK5 ST*95DK5 800 V to 1050 V MDmesh K5 ST*80K5, ST*9*K5, ST*105K5 650 V SiC MOSFETs SCT*65G3AG 700 V PowerGaN SGT*70* 60 V-100 V STripFET F7/F8 ST*N6F7, ST*N8F7, ST*N10F7, ST*N10F8 **GaN power ICs** Integrated Smart GaNs 600 V MASTERGAN*	600 V Ultrafast for TM PFC STTH*L06, STTH*06, STTH15AC06* 600 V Ultrafast for CCM PFC STTH*R06, STTH*M06 SiC diodes STPSC*065 Output diodes for flyback Schottky, FERD, Ultrafast STPS*, FERD*, STTH* Clamping diodes for flyback 600 V to 1000 V Ultrafast STTH*06, STTH*08, STTH*10 Output diodes for LLC/LCC Schottky, FERD STPS*, FERD*45, FERD*50, FERD*60, FERD*100 MOSFET protection for flyback SMAJ, SM6T, SM15T series SCR protection switch TNx015H-6	HV HB gate drivers for GaN STDRIVEG6* Single LS gate drivers PM88*1 Multiple LS gate drivers PM8834 HV HB gate drivers L649* Isolated gate drivers STGAP* LV HB gate drivers for GaN STDRIVEG2* **Voltage reference, CC/CV Ctrl** Voltage reference T*431, T*432 Voltage and current Ctrl TSM*, SEA05* **Signal conditioning** TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV*

	Controllers	DC-DC Buck LED drivers	DC-DC boost LED drivers	LED array drivers
LED driver	Offline LED drivers HVLED002	LED5000, LED6000, ST1CC40, LED2000, LED2001	LED6001, LED7707, LED7708	STP08*/16*/24* STCS*, LED8102S

	Temperature sensors	Control unit	Protection switch	Diodes and discretes
Sensing, processing, control, LED bypass	STLM20 STTS751 LM135Z	MCUs STM32F0, STM32G0	60 V-100 V STripFET F7 ST*N6F7, ST*N8F7, ST*N10F7	LBP01

	Wired - power Line communication	Wireless - Sub-1 GHz	Wireless - Sigfox	Wireless - LoRa	Cellular
Connectivity	Power Line transceivers ST7580, ST8500	Sub-1GHz wireless MCU STM32WL33/54/55/E4/E5 Sub-1GHz wireless module STM32WL5M Sub-1GHz transceivers S2-LP, SPIRIT1 Balun BALF-SPI-0*D3, BALF-SPI2-0*D3, BALFHB-WL-0xD3, BALFLB-WL-0xD3	Sub-1GHz wireless MCU STM32WL Sub-1GHz transceivers S2-LP Baluns BALF-SPI2-01D3 BALFHB-WL-0xD3 BALFLB-WL-0xD3 Secure MCUs STSAFE-A110 STSAFE-A120	LoRa wireless MCU STM32WL LoRa wireless module STM32WL5M Embedded software I-CUBE-LRWAN Secure MCUs STSAFE-A100	NB-IoT & GNSS ST87M01 Secure MCU STSAFE-A110 STSAFE-A120 eSIM ST4SIM

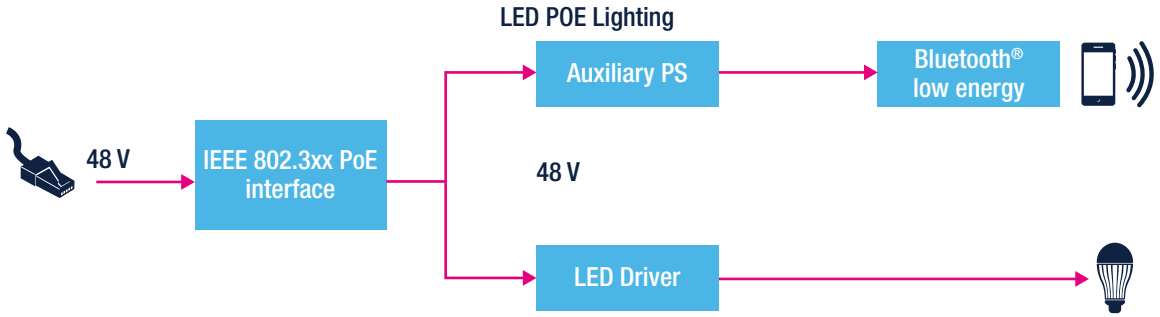
Note: * is used as a wildcard character for related part number

LED POE lighting

Power over Ethernet (PoE) is a widely adopted technology used to supply a powered device (PD) over an RJ-45 cable while carrying data. Described in the IEEE 802.3 standard and its enhancements including IEEE 802.3bt, IEEE 802.3at and IEEE 802.3af, this technology is becoming attractive for LED lighting.

We have a range of products providing a complete interface with all the functions required by the communication standard, including detection and classification, protection features such as under-voltage lockout (UVLO) and in-rush current limitation, as well as the control of hot-swap power MOSFETs that can greatly simplify the development of IEEE 802.3 compliant solutions for powered devices (PD). We also have high-efficiency and optimized DC-DC conversion solutions for supplying LEDs.

Typical block diagram



ST product offering for LED PoE lighting

PoE interface	Protections	Auxiliary power supply	LED driver		Bluetooth LE
IEEE 802.3bt PM8805 IEEE 802.3at PM8803	TVS for power rail surge protection SMAJ, SM15T	Buck Converter L7983 L7987L	Buck LED6000, LED5000 Inverse Buck HVLED002	60 V-100 V STripFET F7/F8 ST*N6F7, ST*N8F7, ST*N8F8, ST*N10F7, ST*N10F8 Schottky diodes STPS*	Bluetooth Low Energy SoC, wireless MCUs, modules BlueNRG-*, STM32WB*

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

Main application boards

STEVAL-POEL45W1
45 W PoE powered LED lighting with BLE control

STEVAL-ILL078V1
1 A, up to 60 V Vin, buck LED driver board based on the LED6000

STEVAL-ILL056V1
3 A Buck LED driver board based on the LED5000

Lighting controls

Lighting controls have evolved from simple triac dimmers to more sophisticated architectures, including light sensors, digital and PWM dimmers, DALI network-based systems, and wireless programming solutions.

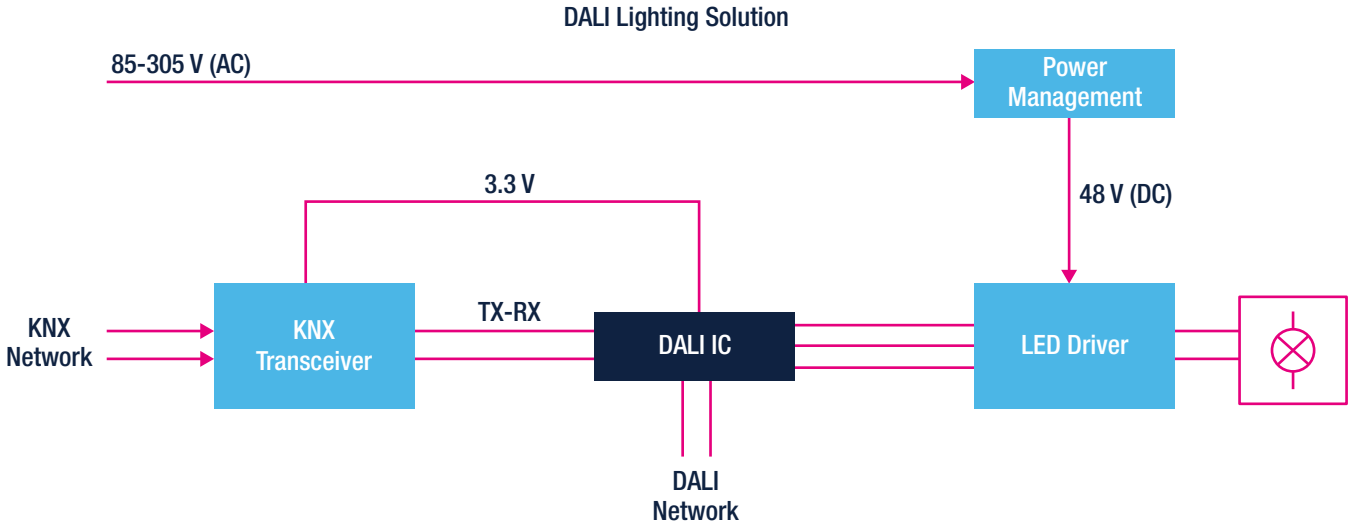
ST long-term partnerships with major lighting suppliers combined with our leadership in discrete and integrated power devices enable us to offer high efficiency and cost-optimized solutions for all types of lighting applications and their control, both wired (e.g. powerline) or wireless (RF), for industrial, residential, commercial, and architectural lighting applications.

DALI lighting solution

Digital addressable lighting interface (DALI) is a trademark for a network-based technology used to effectively control lighting in building automation. Originally defined in IEC 60929 standards, it has been updated for IEC 62386, which includes LED device types.

We provide a range of analog and digital controllers, including the STLUX family and the STM32 microcontrollers to implement the AC-DC and DC-DC power converter and run the DALI protocol.

Typical block diagram for DALI lighting system



ST product offering for lighting controls

LED driver		Power management	KNX transceiver
Digital controllers STLUX	MCUs STM32F1, STM32L1, STM8	Refer to LED General illumination section	TVS protection on KNX bus SMAJ40CA-TR
Development tools STSW-STLUXLIB02, STSW-STLUXSMED02	Embedded software STSW-DALI002, STSW-DALI001, STSW-STM8025		STKNX

Main application boards

STEVAL-ILL066V2

100 W LED street lighting evaluation board with DALI2.0 communication interface using the STLUX385A digital controller

STEVAL-ILM001V1

Plug-in hardware module for the STM8S-DISCOVERY interface for DALI communication

EVALKITSTKNX

Miniature transceiver STKNX evaluation and development kit

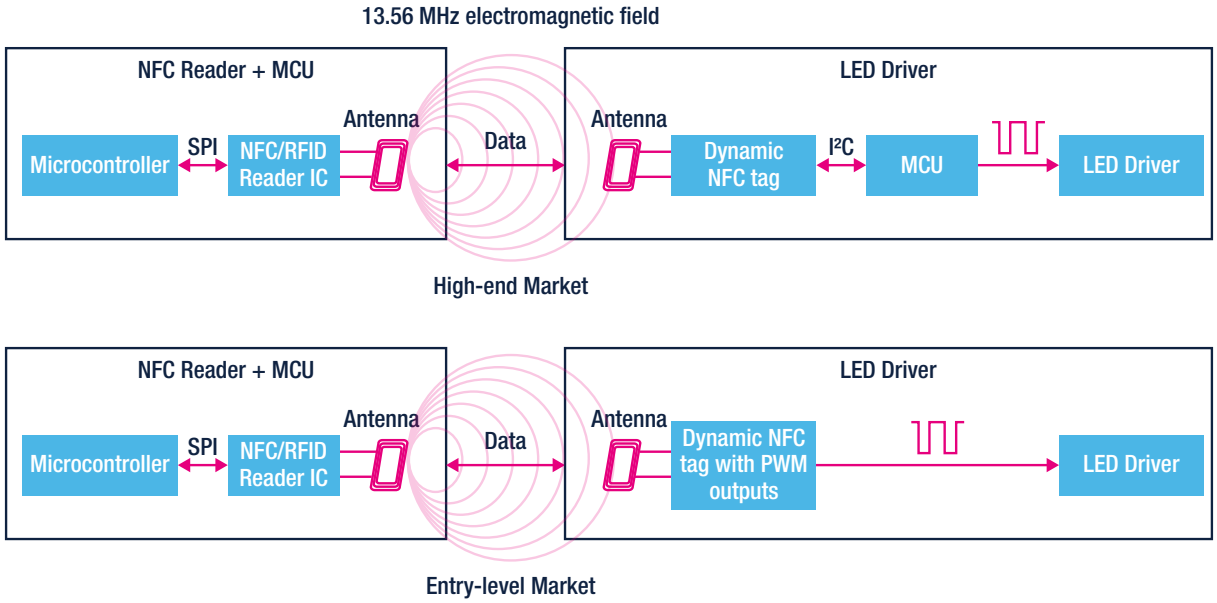
LED wireless programming

Today's smart LED bulbs let users control features including brightness and color. These properties are controlled through the driver and can be programmed and modified at any time during manufacturing, distribution, installation, or maintenance.

The use of NFC technology enables wireless programming using a smartphone, tablet, or portable RFID/NFC reader, without having to power up the LED driver and brings enhanced flexibility and energy savings in addition to reducing development time and cost.

STMicroelectronics offers optimized and complete LED driver programming solutions with its comprehensive NFC portfolio, fully addressing the lighting market and featuring all the functions needed for wireless LED programming.

Typical block diagram of LED wireless programming



ST product offering for LED wireless programming

	NFC/RFID reader IC	Protections	Microcontrollers	
NFC reader + MCU	ST25R	Antenna protection Reader: ESDZX168B-1BF4 Tag: USBULC6-2M6	STM8S STM32F0. STM32G0	
	Dynamic NFC Tag		**MCUs and digital controllers**	**LED driver**
LED driver for high-end market	ST25DV04KC ST25DV16KC ST25DV64KC		STM8S STM32F0, STM32G0 STM32F3, STM32F334, STM32G4 STLUX	HVLED101, HVLED001*, HVLED002 LED600*, LED5000, LED2000 STP08*/16*/24*
	Dynamic NFC Tag with PWM output			**LED driver**
LED driver for entry-level market	ST25DV02KC-W1 ST25DV02KC-W2			HVLED101, HVLED001*, HVLED002 LED600*, LED5000, LED2000 STP08*/16*/24*, LED12/16/24*, LED8102S

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

Main application boards

STEVAL-25R300KA

Discovery kit for the ST25R300 high-performance NFC universal device

ST25DV-PWM-eSET

Discovery kit for the ST25DV-PWM NFC/RFID tag IC

ST25DV64KC-DISCO

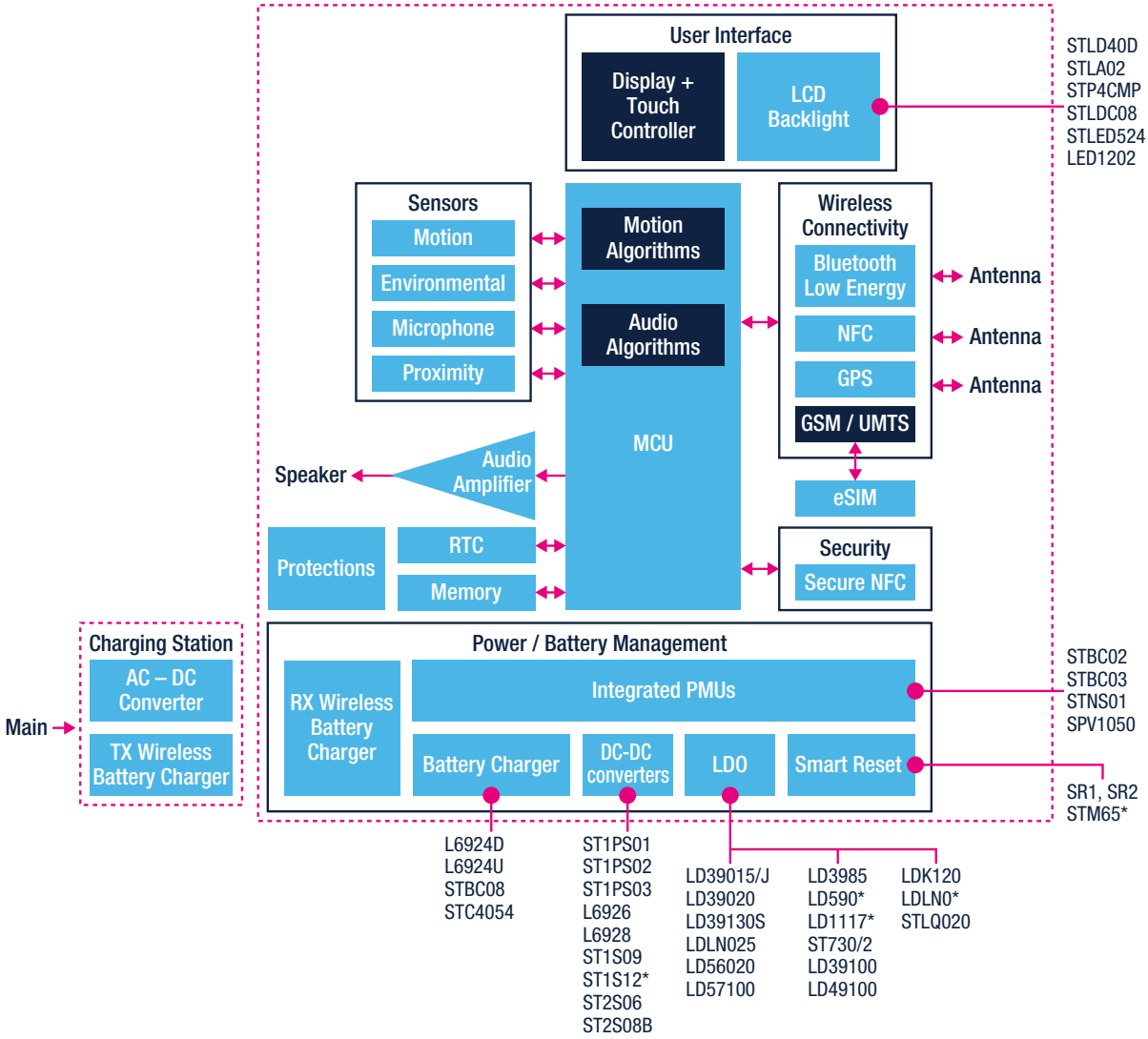
Discovery kit for the ST25DV64KC dynamic NFC/RFID tag

WEARABLE DEVICES - POWER MANAGEMENT

Wearable devices, by their very nature, must be compact and comfortable for the user. They need to deliver precise information about user states and conditions, have low power consumption, and the right level of performance to make them convenient and easy to use. ST products for wearable devices are designed to meet the needs of the most demanding systems with a portfolio covering smart watches, fitness trackers, heart-rate monitors, sports equipment, and a variety of other wearable devices. Our portfolio includes digital processing, sensors, connectivity, security, and power management solutions that can make the difference in a challenging and competitive market.

Specifically for power management, ST provides a range of solutions to allow very small form factor with outstanding efficiency performance and longer battery life.

Typical block diagram of a smart watch



Main application boards and reference designs

STEVAL-1PS01AJR/DJR/EJR

Evaluation board based on the ST1PS01 400 mA nano-quiescent synchronous step-down converter with digital voltage selection

STEVAL-1PS02B

Evaluation board based on the ST1PS2 400 mA nano-quiescent synchronous step-down converter with digital voltage selection and AUX switch

STEVAL-1PS03A

Evaluation board based on ST1PS03AQTR 400 mA nano-quiescent synchronous step-down converter with load switch

STEVAL-QUADV01

Evaluation board based on the stepdown regulators L6981, L7983, ST1PS03, and the ST730 LDO

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

MAJOR HOME APPLIANCES

Refrigeration, washing, drying, and miscellaneous equipment

The white goods market requires low-cost and high-energy-efficiency solutions. The refrigeration, washing, drying, and miscellaneous (air conditioner, water heater) equipment are some of the major home appliance applications that ST is able to satisfy with various power products and high-performance STM32 microcontrollers, along with complementary gate drivers (L638* and L649*). High-efficiency PFC is guaranteed using our SiC diodes (STPSC*), new high-voltage MDmesh MOSFETs, or field stop trench-gate IGBTs. To reduce the 3-phase inverter design effort, ST offers the SLLIMM family (small low-loss intelligent molded module) of highly-integrated, high-efficiency intelligent power modules (IPM) integrating the power stage (both on IGBT and MOSFET discretes), driving network, and protections. Another approach for designing a 3-phase inverter is based on the use of six discrete IGBTs/MOSFETs with the STDRIVE601 3-phase gate drivers. High robustness against inrush current is ensured by new SCRs in the front-end stage. The STPW programmable electronic power breaker family provides a convenient and integrated solution for quickly and safely disconnecting a faulty load from a 12 V bus.

ST product offering for refrigeration, washing, drying, and miscellaneous equipment

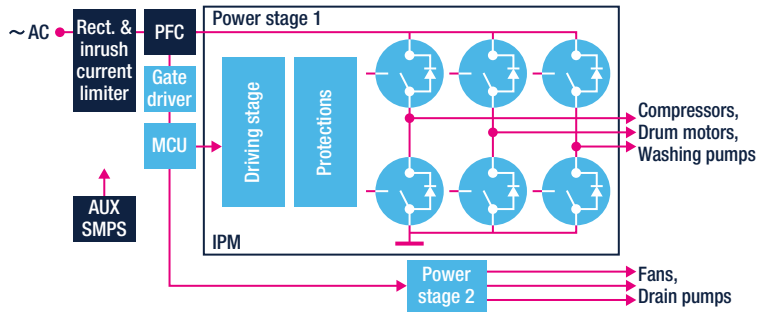
	SCRs and TRIACs	Diodes		LED drivers		HV converters
Rect. and inrush current limiter	High Temp. SCR TN*015H-6, TN*015H-8, TN*050H-12W, TN1605H-8x High temperature T-Series and 8H-Triacs Txx35T-8 and Txx35H-8	Bridge rectifier diodes STBR*08, STBR*12	**User Interface**	LED array drivers STP08*/16*/24* LED12/16/24* STLED316S STLED524 STCS*, LED8102S	**AUX SMPS**	VIPerPlus

	MCUs and digital controllers	IGBTs	Diodes	Op-amp V/I sensing	Power MOSFETs and GaN transistors	Power breakers
PFC	MCUs STM32F0, STM32G0, STM32F103, STM32F301, STM32F334, STM32G4, STM32F4 Digital controllers STNRG388A	600 V V series STG*V60 650 V HB series STG*H(P)65(D)FB 650 V HB2 series STG*H(P)65(D)FB2	STTH*AC06 STTH*R06 STPSC*065 DLF	Precision op amps (<50 MHz) TSZ*, TSV7*, TSB*, TSX*, TSU*, TSV* **GaN, MOSFET and IGBT gate drivers** HV HB gate drivers for GaN STDRIVEG6* Multiple LS gate drivers PM8834 Single LS gate drivers PM88*1 HV HB gate drivers L649* Isolated gate drivers STGAP*	600 V-650 V MDmesh M9 ST*60N*M9, ST*65N*M9 600 V-650 V MDmesh M6 ST*60M6, ST*65M6 600 V-650 V MDmesh M2 ST*60M2, ST*65M2 650 V MDmesh M5 ST*65M5 700 V PowerGaN SGT*70* 650 V SiC MOSFETs SCT**65G3AG	STPW12 **Protections** TVS for power rail SMAJ, SM6T, SM15T, SMC30J, SMC50J series

	MCUs	IGBTs	IPM	MOSFET and IGBT gate drivers	Power MOSFETs	Post regulation
3Ph Inverter Compressor, Drum motor, Fan, Pumps	STM32F0, STM32G0, STM32F103, STM32F301, STM32F334, STM32G4, STM32F4	600 V H series STG*H60DF 650 V M series STG*M65DF2 **AC switches and triacs** ACST*	IPM for compressor and drum motor STGIPQ*60T-H STIPQ*M60T-H STGIB*CH60(T)S-L(E,X) STGIB*M60(T)S-L(E, X) STIB*60DM2T-L IPM for fan and pumps STIPNS*M50T-H STGIPNSC/H60T-H STIPQ*M60 STGIPQ*60T-H	3-Phase HV gate driver STDRIVE601 HV HB gate drivers L638*, L649* Isolated gate drivers STGAP* **Protections** TVS for power rail surge protection SMAJ, SM6T, SM15T, SMC30J, SMC50J series	600 V-650 V MDmesh DM9 ST*60N*DM9, ST*65N*DM9 600 V-650 V MDmesh DM6 ST*60DM6, ST*65DM6 600 V-650 V MDmesh DM2 ST*60DM2, ST*65DM2 650 V SiC MOSFETs SCT**65G3AG	DC-DC converters L698*, L7985, L7986, ST1S4*, ST1S50 Low dropout (LDO) linear regulators LDF, LDFM, LDK220, LDK320, LDK715, LDL212

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

Typical configuration



Main application boards

STEVAL-IHT008V1

1 kW, digital inrush current limiter based on Triac

STEVAL-IPM*

300 W to 3 kW power board based on SLLIMM™

Induction cooking

Induction cooking ranges must be efficient, safe, and provide friendly user interfaces. Resonant-switching topologies are typically used for the power converter in these appliances as they also help achieve lower levels of electro-magnetic interferences (EMI).

We have specifically developed trench gate field-stop IGBTs and diodes that, together with a selection of high-voltage gate drivers and high-performance STM32 microcontrollers, are ideal for high-efficiency converters. ST also offers environmental sensors and LED and LCD display drivers, touchscreen controllers, and proximity and sensors required for touch or touch-less user interfaces. The ST25R NFC reader portfolio will allow induction hubs to communicate with cookware to negotiate power transfer, making kitchen appliance, cordless.

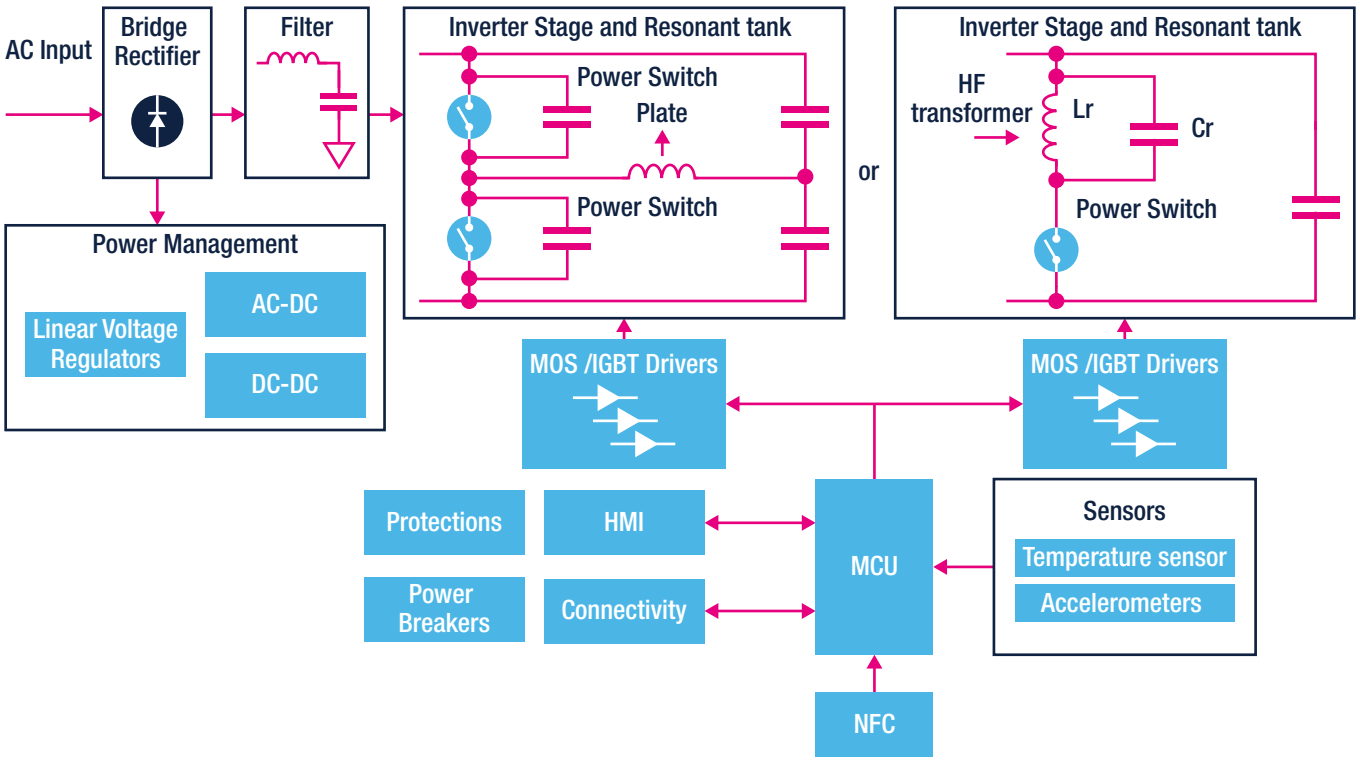
ST product offering for induction cooking

	MCUs	IGBTs	Gate drivers	Sensors	NFC
Single-switch quasi-resonant (voltage resonance)	STM32G0 STM32G4	1250 V IH series STG*IH125DF 1350 V IH2 series STG*IH135DF2	Multiple LS gate drivers PM8834 Single LS gate drivers PM88*1	Environmental sensors temperature - STTS22H Motion sensors accelerometer - IIS2ICLX Proximity sensors ToF - VL53L*	ST25R200, ST25R3916B, ST25R300
	MCUs	**IGBTs**	**Gate drivers**		**Connectivity**
HB series resonant (current resonance)	STM32F0, STM32G0, STM32F303, STM32G4	600 V HB series STG*H60DLFB 650 V IH series STG*IH65DF	HV HB gate drivers L649* Isolated gate drivers STGAP*		Bluetooth Low Energy SoC, wireless MCUs, modules BlueNRG-*, STM32WB*, STM32WBA5

	MCUs	LED drivers		AC-DC converters	DC-DC converters	LDO	Power breakers
User interface (front panel)	STM32G0	LED array drivers STLED316S, STLED524, STP08*/16*/24*, LED1642GW, LED8102S*, LED12*/16*/2472G	**Power management**	VIPerPlus	L698*, L7983, L7985, L7986*, L7987*	LDF, LDFM, LDK220, LDK320, LDK715, LDL212, ST730, ST732, LDH40	STPW12

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

Topology example



Software tools

Progress from power converter design to real prototyping with a powerful online tool

eDesignSuite - power management design center

eDesignSuite is a comprehensive and flexible suite of design aid utilities and engineering tools that streamlines development of winning solutions with a wide range of ST products meeting user application requirements. Explore the advanced features of our power management design center, an on-line design tool that smartly helps designers of power management systems and subsystems accelerating the engineering development process (select, evaluate, refine, and prototype) for a large and growing number of ICs and discrete devices in our broad portfolio. The software tool supports a variety of switching power converters in power supply, digital power, LED lighting, and battery charger applications, simplifying the design path from user specification to circuit analysis and customization. The main features of the tool are automatic proposal for complete solution or fully customizable design, fully annotated and interactive schematics, complete and interactive bill of materials, main current and voltage simulations, efficiency curves, Bode stability and power-loss data, and fully interactive transformer design.

POWER SUPPLY DESIGN TOOL

- SMPS design, by topology, by type, and by product
- PFC design with analog control
- Supports various PCB configurations

LED LIGHTING DESIGN TOOL

- Handles AC-DC and DC-DC design in common topologies
- Displays interactive and annotated schematic
- Provides current/voltage graphs, Bode plots, efficiency curves and power-loss data

DIGITAL POWER WORKBENCH

- Addresses both single-phase and three-phase PFC and DC-DC converters
- Provides a step-by-step optimized design for the power section and control loop
- Generates the STM32Cube embedded software package for custom applications and generates firmware project compatible with multiple STM32 IDEs

POWER TREE DESIGNER

- Characterize each node in the tree
- Check for consistency
- Design each individual node

eDSim

eDSim is a fast and powerful electrical simulation tool for SMPS and analog ICs integrated in the eDesignSuite tool. It features enhanced accuracy and higher convergence speed for SMPS, enabling a simulation time 10-50x faster than the classic analog SPICE simulators. Design your analog circuit using the eDesignSuite engine, display a preview with full annotated schematic and BOM, and then run the electrical simulation through eDSim to get fast and accurate simulations and reliable design validation, thus reducing the effort and risks related to hardware prototyping. With the eDSim tool, you can also create your schematic from scratch using ST models or simulate your SMPS and analog ICs from a list of predefined ST application schematics-test benches, that you can partially modify according to your needs.

Products

GALLIUM NITRIDE (GaN) POWER ICs and DISCRETE

Integrated smart GaNs - MASTERGAN

Gallium nitride (GaN) is revolutionizing the power engineering world by enabling higher speed, efficiency, and power density than ever before possible with silicon MOSFETs. Integrating GaN transistors and gate drivers, our advanced MASTERGAN system-in-package offer high efficiency due to their optimized gate drive layout, high power density, and increased switching frequency due to minimal parasitic effects, translating in a number of benefits for fast chargers, USB PD adapters, LED lighting drivers, TV power supplies, and server/telecom power designs.

KEY FEATURES AND BENEFITS

- QFN 9 x 9 x 1 mm package
- Embedded gate driver easily supplied by the integrated bootstrap diode
- Overtemperature protection
- Extended 3.3 to 15 V input range with hysteresis and pull-down
- Accurate internal timing match
- Interlocking function
- -40 to 125 °C operating temperature range
- High switching frequency >1 MHz
- No investment to learn GaN required
- Fast time-to-market

Part number	General description	Output current max (A) @25 °C	High side $R_{DS(on)}$ (mΩ)	Low side $R_{DS(on)}$ (mΩ)	Supported topologies
MASTERGAN1	High power density 600 V half-bridge high voltage driver with two 650 V enhancement mode GaN HEMT	10	150	150	Resonant, ACF, inverse buck
MASTERGAN2		6.5	225	150	ACF
MASTERGAN3		4	450	225	ACF
MASTERGAN4		6.5	225	225	Resonant, ACF, inverse buck
MASTERGAN5		4	450	450	Resonant, ACF
MASTERGAN6		10	140	140	Resonant, ACF totem pole PFC
MASTERGAN1L		10	150	150	Resonant, ACF, inverse buck
MASTERGAN4L		6.5	225	225	Resonant, ACF, inverse buck

STGAP2GS and STDRIVEG6* GaN drivers

The GaN driver devices are galvanic isolated 1200 V single channel (STGA2GS) and 600 V - 220 V half-bridge (STDRIVEG6*, STDRIVEG21*) gate drivers for e-mode GaN FETs. These gate drivers allow designers to implement GaN performance advantages, enhance system robustness and reliability, and simplify design and bill-of-material requirements at the same time.

KEY FEATURES AND BENEFITS

- Highest robustness, efficiency, and integration
- Galvanic isolation 6 kVpk (STGAP2GS)
- Up to 20 V gate driver
- Voltage rail to 1200 V (STGAP2GS) 600 V (STDRIVEG6*) 220 V (STDRIVEG21*)
- 5.5 A / 6 A source/sink currents (STDRIVEG6*)
- 1 A/ 2.4 A source / sink (STDRIVEG61*/21*)
- 2 A / 3 A source/sink currents (STGAP2GS)
- 45 ns short propagation delay
- Separate ON-OFF outputs for easier tuning
- 3.3 V / 5 V logic inputs
- UVLO on Vcc and VBOOT
- Thermal shutdown
- Interlocking function
- Shut-down pin
- Stand-by function (STGAP2GS , STDRIVEG61*, STDRIVEG21*)

Part number	General description	Package
STGAP2GS	Galvanic isolated 3 A single channel driver for Enhancement mode GaN FETs	SO-8W
STGAP2GSN		SO-8N
STDRIVEG600/TR	High voltage and high-speed half-bridge gate driver for GaN transistors	SO-16N
STDRIVEG600W		Wafer
STDRIVEG610		QFN 4x5
STDRIVEG611		QFN 4x5

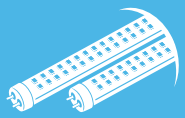
MAIN APPLICATIONS


SMPS


USB PD Adapter


UPS


Solar


LED lighting

High-voltage GaN converters – VIPerGaN series

The high-voltage power converters series is enriched by the introduction of GaN HEMT (high-electron-mobility transistor) technology, assembled in a QFN 5x6 and SO16-14L package. The VIPerGaN series offers excellent design opportunities for compact and light fast chargers, adapters, and power supplies up to 100 W with a wide input range.

Part number	Package	R_{ON} @ 25C	Max GaN HEMT transient voltage	Max P_{OUT} @ 85-265 V_{AC}	Max P_{OUT} @ 185-265 V_{AC}
VIPERGAN50WTR	QFN 5x6 with exposed pad	0.47 Ω	800 V	50 W	75 W
VIPERGAN65WTR		0.29 Ω	800 V	65 W	85 W
VIPERGAN100WTR/ 100WBTR		0.27 Ω	800 V	75 W*	100 W
VIPERGAN65DTR	SO16-14L	0.27 Ω	800 V	65 W	85 W

*100 W with a PFC in the front-end

KEY FEATURES AND BENEFITS

- Quasi-resonant (QR) flyback controller
- 700 V E-mode power GaN transistor (800 V transient voltage)
- Minimal standby power consumptions
- Embedded sense FET
- Dynamic blanking time and adjustable valley synchronization delay
- Output OVP protection
- Input voltage feedforward compensation for mains independent OPP variation
- Brown-in and brown-out
- Input OVP protection
- Embedded thermal shutdown
- Frequency jitter for EMI suppression

MAIN APPLICATIONS

USB PD adapter

Air conditioning

TV power supply

Home appliances

PowerGaN

ST is expanding its STPOWER power transistor family with the PowerGaN G-HEMT (intrinsically normally-off devices). **Gallium nitride (GaN)** is a wide-bandgap semiconductor material capable of supporting higher voltages than traditional silicon without compromising on-resistance and thus reducing conduction losses. Products developed in gallium nitride technology can be switched much more efficiently, resulting in significant switching loss reduction. These devices feature higher frequency operation with improved power density to allow the reduction of the size of passive components in power conversion applications.

Part number	VDS	RDS(on) max [mΩ]	IDmax [A]	Series
SGT070R70HTO	700 V	70	26	G-HEMT
SGT08R70ILB	700 V	80	29	G-HEMT
SGT105R70ILB	700 V	105	21.7	G-HEMT
SGT140R70ILB	700 V	140	17	G-HEMT
SGT190R70ILB	700 V	190	11.5	G-HEMT
SGT240R70ILB	700 V	240	10	G-HEMT
SGT350R70GTK	700 V	350	6	G-HEMT

KEY FEATURES AND BENEFITS

- Better figure-of-merit (RDS xQG) vs silicon technology
- Low capacitances
- Unbeatable recovery charge Qrr
- Vey low parasitic inductance package technology
- Reduced conduction losses
- Excellent efficiency in hard switching-high frequency topologies
- Reduced power losses and passive device size

MAIN APPLICATIONS

Smart chargers and adapters

Server and telecom power

OBC

Energy generation and distribution

Led lighting

AC-DC CONVERSION ICs

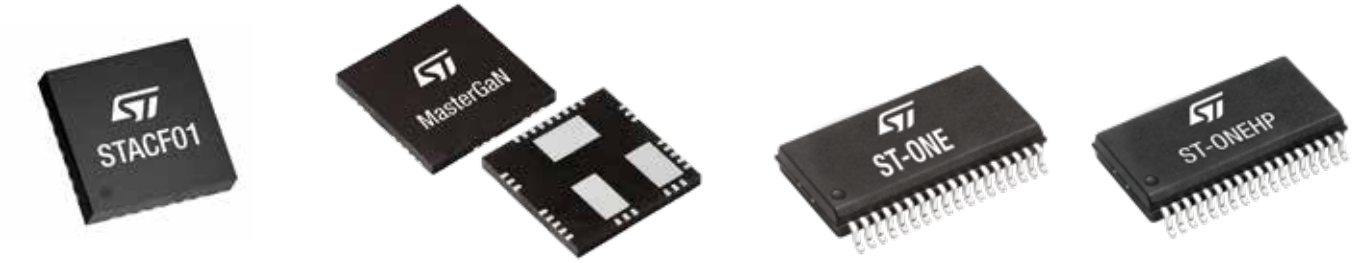
ST-ONE all-in-one digital controller for USB-PD adapters and STACF01

The **ST-ONE** family of digital controllers is a world-first for embedding everything you need to design a USB PD adapter in a single package.

It includes an ARM Cortex M0+ core, an offline programmable controller with synchronous rectification, and USB PD PHY. This system is specifically designed to control ZVS noncomplementary active clamp flyback converters to create high-power-density chargers and adapters with the USB PD interface. The primary side includes an active clamp flyback controller and corresponding HV startup, while the secondary side has a microcontroller and all the peripherals required to control conversion and USB PD communication. The two sides are connected through an embedded galvanically isolated dual communication channel. By using a novel noncomplementary control technique and specific power modes, the devices enable high efficiency and low no load power consumption.

The devices are delivered with preloaded firmware to handle the power conversion and the communication protocols for USB PD, including optional PPS and electronically marked cable management.

The **STACF01A** and **STACF01B** ICs drive and control Active Clamp Flyback (ACF) converters with non-complementary driving of the active clamp (high-side, HS) switch. It is specifically intended for high performance AC-DC adapters for USB-PD with GaN HEMTS rated up to 100 W and beyond, which are aimed at high efficiency as well as high power density. The ICs are provided with an embedded high-voltage startup circuit that also implements the line voltage monitoring system. STACF01A also discharges the X capacitors when the converter gets disconnected from the AC power line. STACF01B is intended for use with DC input, for example in lighting applications or applications supplied by a DC bus. The ICs must be paired with a high-voltage half-bridge driver ICs or with a SiP such the MasterGaN families.



KEY FEATURES AND BENEFITS

- All-in-one digital controller for USB PD chargers up to 140 W
- ZVS active clamp flyback + synchronous rectification
- USB PD 3.1 PPS/EPR interface and integrated 24 V USB PD PHY

Part number	Description
ST-ONE	100 W single port USB-PD 3.1
ST-ONEMP	100 W dual / multi port USB-PD 3.1
ST-ONEHP	140 W single port USB-PD 3.1 EPR

MAIN APPLICATIONS

Tablet AC chargers

Smartphone AC chargers

Power adapter for laptops and desktops

Wall plug USB-C chargers

www.st.com/ac-dc-converters
www.st.com/pfc-controllers

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

High-voltage converters

ST **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 from a few watts to a few tens of watts.

The **VIPerPlus series** (VIPer0P, VIPer122, VIPer222, 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 VIPer0P, 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 VIPer26K belongs to VIPer*6 family and integrates a 1050 V avalanche-rugged power MOSFET, suitable for cost effective 1-phase/3-phases smart meters, industrial systems, and lighting power supplies.

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 offers opto-less implementation, thus significantly reducing component count.

VIPerPlus

1050 V	10 W	VIPer26K	Very High Voltage SMPS Embedded E/A for direct output regulation/fly-back or buck converter
900 V	7 W	Altair04	Accurate Primary Side Regulation Constant current/constant volatage
800 V	Up to 18 W	VIPer01-11-31	Logic Level MOSFET - 5 V supply voltage Embedded E/A, Very low standby consumption, 18 V DC start-up voltage
	6 W	VIPer0P	Zero Power Mode Smart standby management through buttons or MCU
	Up to 15 W	VIPer06-16-26	Embedded E/A Direct output regulation/settable current limit/fly-back or buck converter
		VIPer17-27-37	Brown-out Output OVP, current limit, fly-back with optocoupler
		VIPer28-38	Peak Power Output OVP, current limit, fly-back with optocoupler
		VIPer25-35	Quasi Resonant Output OVP, current limit, fly-back with optocoupler
730 V	Up to 8 W	VIPer122-222	Embedded E/A, 730 V BV Optimized for low power

Flyback
Primary side regulation

VIPer01-11-31	VIPer122-222
VIPer26K	VIPer06-16-26
Altair04-05	VIPer0P

Flyback
Secondary side regulation

VIPer01-11-31	VIPer122-222	VIPer28-38
VIPer26K	VIPer06-16-26	VIPer25-35
VIPer27-37	VIPer0P	VIPer122-222

Buck Converter
Up to 600 mA Output Current

VIPer01-11-31	VIPer122-222
VIPer26K	VIPer06-16-26
	VIPer0P

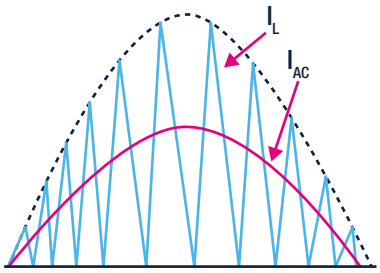
MAIN APPLICATIONS

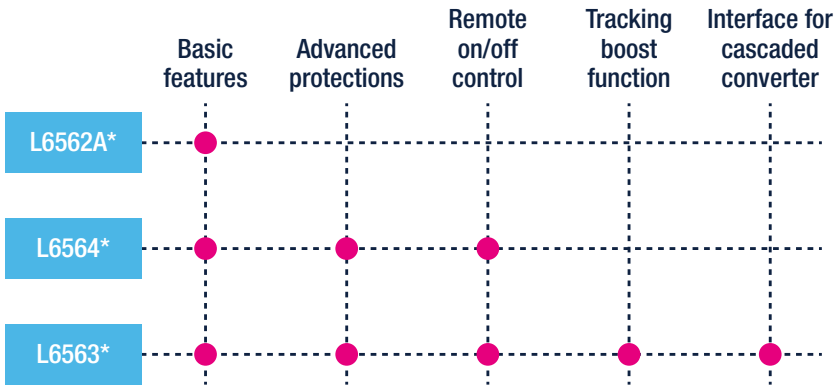
PFC controllers

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

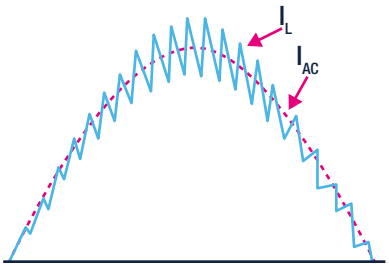
These devices embed advanced protection features, which make the SMPS more robust and compact, requiring fewer external components. These features include output overvoltage, brown-out, feedback disconnection, and boost inductor saturation protection. The high-voltage start-up capability present in the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

TM PFC controllers





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
L4985A/B	Quasi-fixed frequency, peak-current mode
L4986A/B	Quasi-fixed frequency, peak-current mode, adjustable PGOOD

MAIN APPLICATIONS

Adapters and TVs
L6562A*, L6563*, L6564,
L4985, L4986

Commercial and street lighting
L6562A*, L6563*, L6564*,
L4985, L4986, L4981*, L4984D

Desktop PCs and Server
L4985, L4986,
L4981*, L4984D

www.st.com/ac-dc-converters
www.st.com/pfc-controllers

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

Primary Controllers

The ST portfolio of advanced controllers includes a variety of primary controllers for high-performance applications. Very high efficiency is achieved with single-ended topologies at fixed frequency, quasi-resonant, or active clamp flyback non-complementary operation. The new quasi-resonant STCH03 offline constant-current controller (PSR-CC) ensures very low power consumption at the no load condition, and the new active clamp flyback STACF01 is designed for high performance AC-DC and high-power density adapters for USB-PD, with Gan HEMTS rated up to 100 W and above.

Flyback controllers

STCH03

- 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)
- UVP, autorestart/latched OVP and internal OTP
- 650 V HV start up

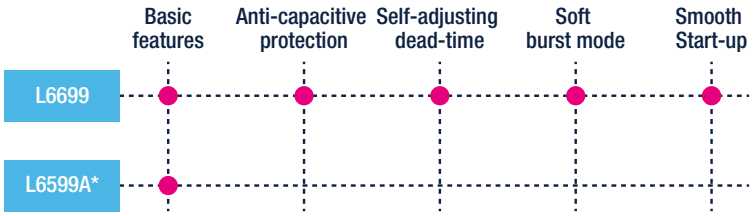
L6566*

- 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)
- Brownout protection

L6565

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

HB-LLC resonant controllers



Non-complementary ACF controller

STACF01

- Active clamp flyback with non-complementary control
- 800 V HV startup with optional X-Cap discharge
- Buck Boost DC-DC for VCC regulation over wide Vout range
- Up to 500 kHz switching frequency
- Programmable frequency reduction at light load
- Interface with PFC for power sequencing
- Optimized for MasterGaN®, compatible with discrete GaN

Asymmetrical half-bridge controller

L6591

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

MAIN APPLICATIONS

Tablets and smartphones
L6565, L6566*, STCH03

Laptops
L6565, L6566*, STCH03

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

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

www.st.com/ac-dc-converters
www.st.com/pwm-controllers
www.st.com/resonant-controllers

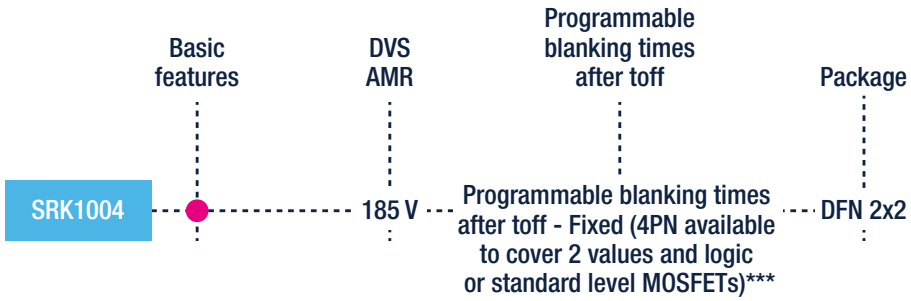
Note: * is used as a wildcard character for related part number

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 and LLC resonant topologies. The main benefits include high efficiency, space saving, cost reduction, and high reliability.

SR controllers for flyback

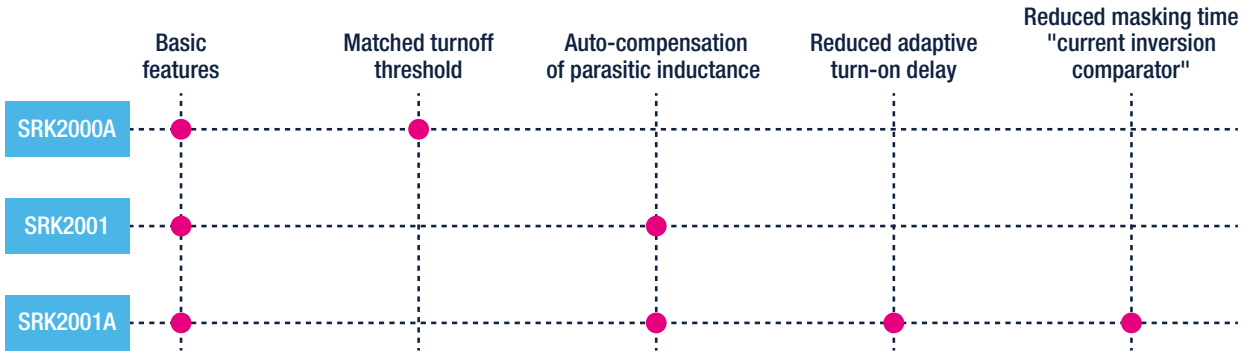


*** A and B for logic level MOSFETs or GANs, C and D for standard level MOSFETs
A and C with turn off delay of 25ms, B and D with turn off delay of 150 ms
E and F versions optimized for QR flyback controllers

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
SRK1004

Desktop PCs and Server/Telecoms
SRK2000A, SRK2001, SRK2001A

www.st.com/ac-dc-converters
www.st.com/synchronous-rectification-controllers

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

Signal conditioning

Signal conditioning devices include **operational amplifiers, current sense amplifiers, and digital power monitors.** These devices enable accurate and fast current measurement in power supplies. **Comparators** are also very powerful allies of the power supply designer to implement protection features such as overtemperature, overcurrent, and over/undervoltage.

Operational amplifiers

TSZ121/51/81, TSZ901

- 5 V zero-drift amplifier
- Vcc min. 1.8 V to 2.2 V
- Input offset voltage 5 µV to 25 µV
- Gain bandwidth 400 kHz 1.6 MHz 3 MHz, 10 MHz

Current sense amplifiers

TSC200/201/202

- Operating voltage -16 to 80 V
- Amplification gain x20 x50 x100
- Comparator +Vref embedded

TSC21*

- Bi-directional
- Operating voltage -0.3 to 26 V
- Amplification gain x50 x75 x100 x200 x500 x1000
- Offset voltage ±35 µV max
- Gain error 1% max

Comparators

TS3021, TS3022

- Propagation delay 38 ns
- Low current consumption: 73 µA
- Rail-to-rail inputs
- Push-pull outputs
- Supply operation from 1.8 to 5 V

A/D-D/A converters

ADC1283

- 12-bit 8 multiplexed channels ADC
- 50 ksps to 200 ksps
- 2.7 V to 5.5 V
- 11.8 effective bits (ENOB)
- 3 mW power consumption at 5 V power supply

TSB182

- Operating voltage 4 to 36 V
- 36 V zero-drift amplifier
- Input offset voltage: 20 µV max.
- Gain bandwidth product: 3 MHz
- Rail-to-rail output

TSC2010/1/2

- Bi-directional
- Operating voltage - 20 to 70 V
- Amplification gain x20 x60 x100
- Offset voltage ± 200 µV max
- 2.7 to 5.5 V supply voltage
- Gain error 0.3% max

TSC1801

- Bidirectional low-side
- Supply voltage range: 2.0 V to 5.5 V fixed gain: 20 V/V
- Total output error < 0.5%
- Gain error: 0.1% max
- Bandwidth: 2.1 MHz

TS3121

- Propagation delay 60 ns
- Low current consumption 70 µA
- Rail-to-rail inputs with fail-safe
- Open-drain outputs
- Supply operation from 1.7 to 5 V

Current/Voltage/Power Monitors

TSC1641

- Up to 60 V load voltage
- High-side current sensing, bi-directional
- Dual 16-bit ADC
- I²C up to 1 MHz, I³C up to 12 MHz

TSV771, TSV781, TSV791

- 5 V high bandwidth amplifiers
- Vcc min. 2.0 to 5.5 V
- Rail-to-rail input and output
- Vio max. 200 µV
- Gain bandwidth 20/30/50 MHz

TSC20/21/22

- Bi-directional
- Operating voltage - 4 to 100 V
- Amplification gain x20, x50, x100, Gain error 0.3%
- Offset voltage ± 150 µV max.
- High common-mode rejection CMR: 100 dB min.
- 2.7 to 5.5 V supply voltage

TSC240

- Bidirectional
- Enhanced PWM rejection
- Operating voltage:-4 to 100 V
- Amplification gain x20, gain error 0.2%
- Offset voltage ±25 µV max
- 2.7 to 5.5 V supply voltage

TS3011

- Propagation delay 8 ns
- Low current consumption 470 µA
- Rail-to-rail inputs
- Push-pull outputs
- Supply operation from 2.2 to 5 V

MAIN APPLICATIONS

Wireless battery charger transmitters | Server/Telecom | Solar | UPS | Lighting | Factory automation

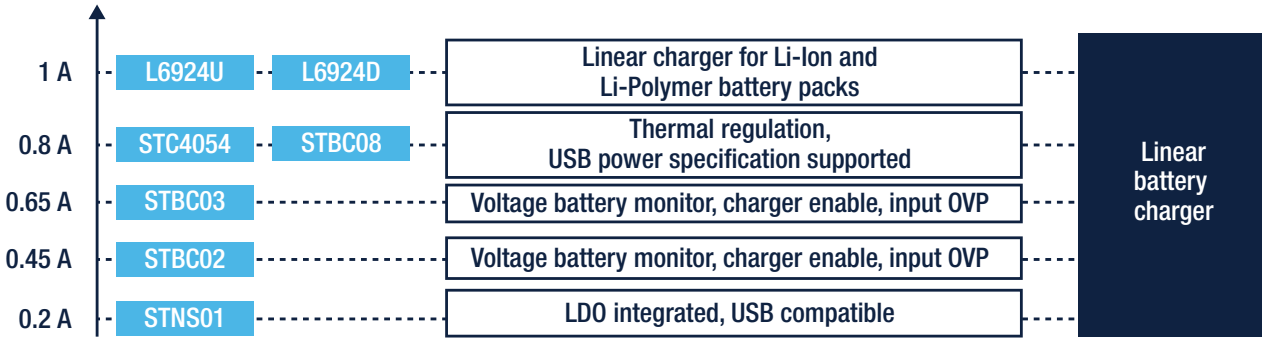
www.st.com/opamps
www.st.com/current-sense-amplifiers
www.st.com/comparators

BATTERY MANAGEMENT ICs

Battery chargers and battery monitoring ICs

ST **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 10 mA up to 1.0 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 **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

- OptimGauge algorithm for STC3115
- OptimGauge+ algorithm for SCT3117

STC3117

- Coulomb counter and voltage gas gauge operations
- Programmable low battery alarm
- Internal temperature sensor

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

MAIN APPLICATIONS

Bluetooth accessories
STC4054

USB
L6924U, STC4054, STBCFG01

Fitness
STNS01, STBC02, STBC03

Smartphones
STC3115, SCT3117

Wireless charging ICs

ST leverages over a decade of expertise in wireless power transfer technology to deliver highly integrated charging ICs for consumer, industrial, and medical markets. The portfolio addresses the requirements of major standards, with a strong emphasis on 5 W and 15 W power applications, while also supporting proprietary protocols for power needs of up to 30 W.

The STWBC2-HP and the STWBC86 are wireless power transmitter devices, while the STWLC38 and the STWLC89 are wireless charging receivers.

ST's wireless charging ICs are embedded in smartphones, wearables, POS terminals, industrial applications, and medical devices, delivering reliable performance across diverse environments.

Wireless charger transmitter ICs

STWBC2-HP | STWBC86

STWBC2-HP

- TX controller with external full bridge inverter
- Up to 15 W with external full bridge
- Up to 30 W in pair with STWLC89

STWBC86

- Up to 5 W power transfer
- Monolithic solution with integrated
- full-bridge inverter
- Popular applications are not only Tx for public spaces like restaurants, offices, and airports, but also chargers for wearable and hearable devices

Wireless charger receiver ICs

STWLC89 | STWLC38

STWLC89

- Up to 15 W with magnetically aligned coils
- Supports up to 9 W in Tx mode
- Up to 30 W in pair with STWBC2-HP
- ARM 32-bit Cortex™-M0+ core up to 64 MHz
- Optimized device size

STWLC38

- Up to 15 W
- Optimized for wearables and compact low-power applications
- ARM 32-bit Cortex™-M0+ core up to 64 MHz
- Monolithic solution with integrated full-bridge rectifier
- Optimized device size and BOM for a small PCB footprint

Common features

- Excellent efficiency performance with integrated power management capabilities optimizes energy usage, reduces heat generation, and enhances overall system reliability
- Accurate foreign object detection (FOD)
- Embedded protection features include on-chip thermal management, overvoltage protection, and overcurrent protection to prevent overheating and ensure user and system safety
- GUI for run-time analysis, tuning and basic customization
- Built-in communication interfaces, including I²C, UART, and GPIO, enable easy and flexible configuration of parameters.

MAIN APPLICATIONS

Wireless battery charger transmitters

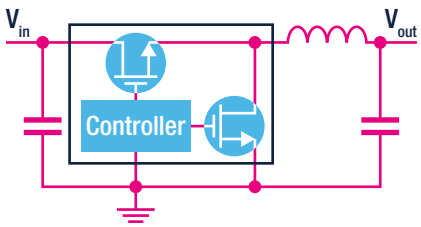
Tablets and smartphones
STWLC38

Wearables & hearables
STWBC86 , STWLC38

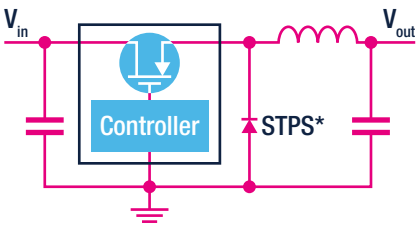
DC-DC SWITCHING CONVERSION ICs

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 consists 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, and storage, etc.) and server/telecom applications.



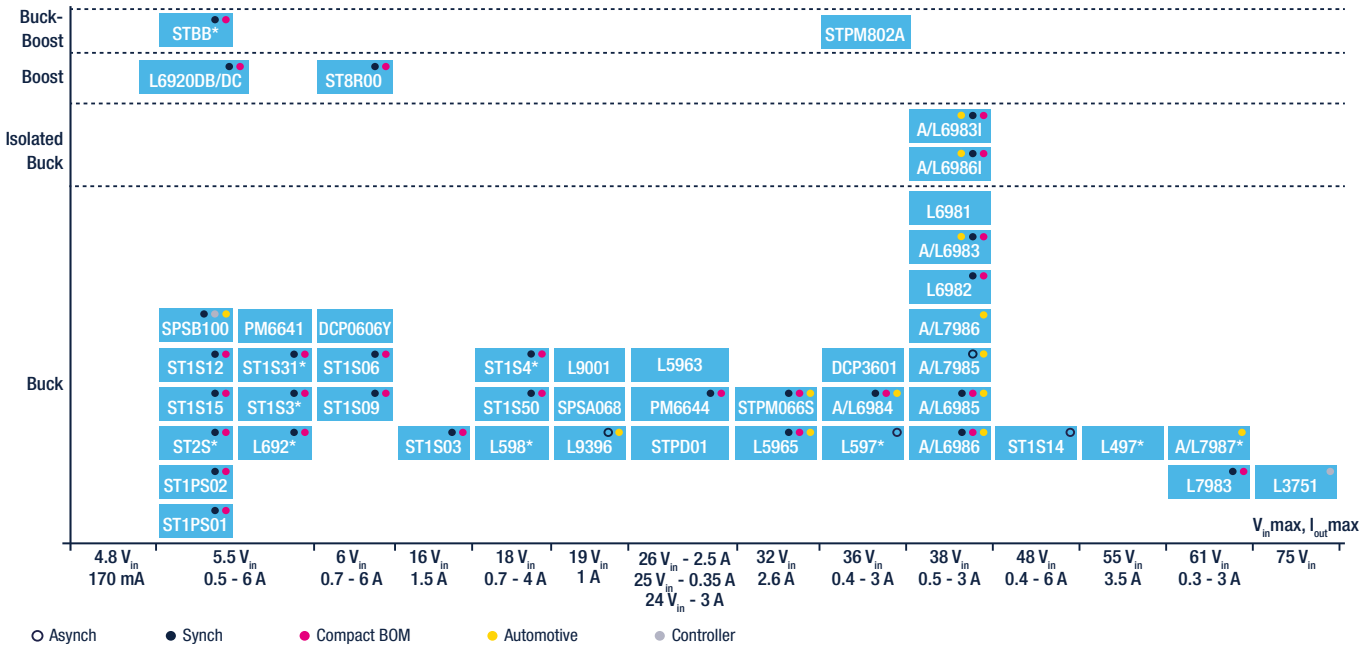
Synchronous buck converter



Asynchronous buck converter

DC-DC CONVERTERS MAIN FEATURES

- Up to 61 VIN/3 A
- Synchronization capability
- Internal compensation
- Low consumption
- Adjustable fsw
- Internal soft start
- Low quiescent current
- Isolated buck version available



MAIN APPLICATIONS


Smartphones


TVs


Automotive


Solar


UPS


Lighting


Set-top boxes


Wearables


Computing


Server/Telecom


Home appliances


Factory automation

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

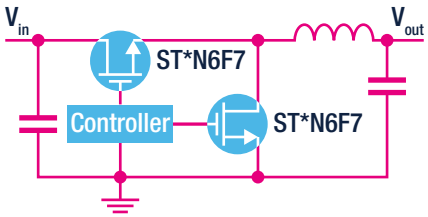
www.st.com/dc-dc-switching-converters

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 and DDR memory power supplies. The newest L3751 controller ensures high reliability in industrial applications with high Vdrop and robotics with potential high voltage spikes due to inductive loads

Single-phase Buck controllers

A6727B	Single-phase cost effective PWM controller for automotive applications
PM6680	Dual-output PWM controller up to 36 Vin
L3751	Wide 6 to 75 V input voltage synchronous buck controller



Single-phase buck controller

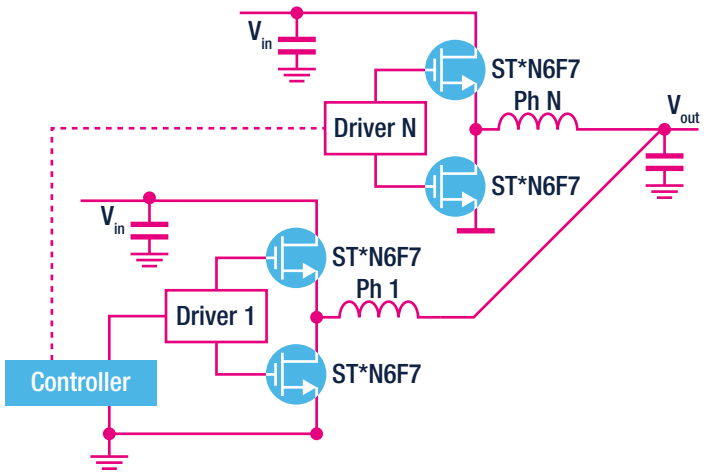
Multi-phase Buck controllers

STPM098	Fully digital buck controller for automotive applications (CPU/MCU)
PM6779*	Fully digital buck controller with PMBus for advanced CPU/DDR

Single-phase buck-boost controller

STPM802*	Single-phase synchronous buck-boost controller

* under develepoment



Multi-phase Buck controller

MAIN APPLICATIONS

Server · Smart mobility · Microserver · Automotive · Telecoms · PC desktop

www.st.com/dc-dc-switching-converters
www.st.com/single-phase-controllers
www.st.com/multi-phase-controllers

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

Highly integrated power management IC for micro-processor units

STPMIC1, a high performance fully integrated power management IC, is the ideal companion chip of the **STM32MP1 microprocessor** series, being also optimized for power applications requiring low power and high efficiency. The STPMIC1 integrates buck and boost converters, linear regulators with sink/source capability, power switches specifically designed to supply all required power rails for the STM32MP1 and for other components on the board such as DDR, flash memory, Wi-Fi, and Bluetooth connectivity ICs, providing a total system solution.
STPMIC1L is a cost-effective variant of the STPMIC1 for a more affordable power management solution. Currently under development, the STPMIC1L maintains compatibility with the STM32MP1 microprocessor.

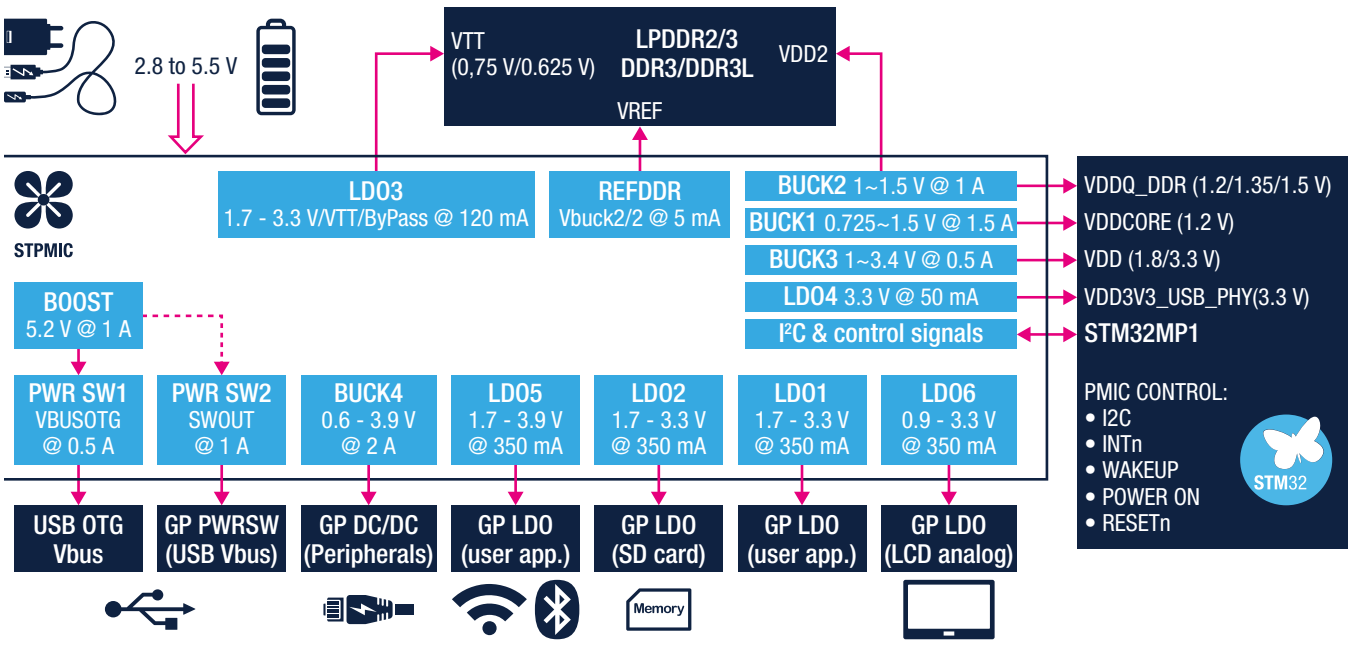
STPMIC

STPMIC1 versions

	5 V power supply application		Battery power supply application		Custom application, no output turned ON		5 V power supply application		Battery power supply application	
	STPMIC1A		STPMIC1B		STPMIC1C		STPMIC1D		STPMIC1E	
	Default output voltage (V)	Rank	Default output voltage (V)	Rank	Default output voltage (V)	Rank	Default output voltage (V)	Rank	Default output voltage (V)	Rank
LDO1	1.8	0	1.8	0	1.8	0	1.8	0	1.8	0
LDO2	1.8	0	2.9	2	1.8	0	1.8	0	1.8	0
LDO3	1.8	0	1.8	0	1.8	0	1.8	0	1.8	0
LDO4	3.3	3	3.3	3	3.3	0	3.3	3	3.3	3
LDO5	2.9	2	2.9	2	1.8	0	3.3	2	2.9	2
LDO6	1.0	0	1.0	0	1.0	0	1.0	0	1.0	0
REFDDR	0.55	0	0.55	0	0.55	0	0.55	0	0.55	0
BOOST	5.2	N/A	5.2	N/A	5.2	N/A	5.2	N/A	5.2	N/A
BUCK1	1.2	2	1.2	2	1.1	0	1.2	3	1.2	3
BUCK2	1.1	0	1.1	0	1.1	0	1.1	0	1.1	0
BUCK3	**3.3**	1	**1.8**	1	1.2	0	**3.3**	1	**1.8**	1
BUCK4	3.3	2	3.3	2	1.15	0	1.2	2	1.2	2

Rank = 0: rail not autom. turned ON
Rank = 1: rail autom. turned ON after 7 ms
Rank = 2: rail autom. turned ON after further 3 ms
Rank = 3: rail autom. turned ON after further 3 ms

STPMIC1 and STM32MP1



MAIN APPLICATIONS

Home automation
Industrial control
POS terminals
Networking
Medical monitoring

Microprocessors companion PMIC with high-level integration powering complete advanced MPU applications

STPMIC25, a high performance fully integrated power management IC, is the ideal companion chip of the **STM32MP2 microprocessor** series, being also optimized for power applications requiring low power and high eff. The STPMIC25 integrates buck and linear regulators with sink/source capability to supply all required power rails for the STM32MP2 and for other components on the board such as DDR, flash memory, Wi-Fi, and Bluetooth connectivity ICs, providing a total system solution.
STPMIC2L is a cost-effective variant of the STPMIC25, for a more affordable power management solution. Currently under development, the STPMIC2L maintains compatibility with the STM32MP2 microprocessor

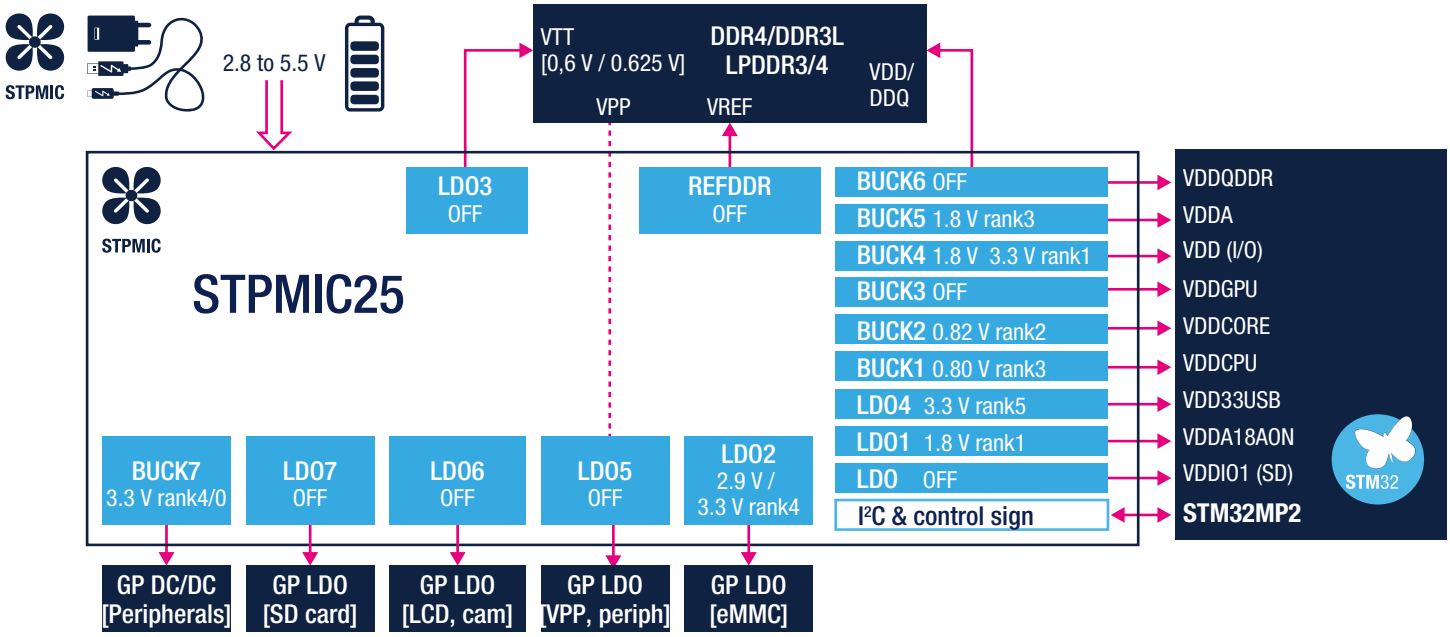
STPMIC

STPMIC25 versions

	Default configuration table					
	STPMIC25A			STPMIC25B		
	Default output voltage	Default output current	Rank	Default output voltage	Default output current	Rank
LDO1	1.8 V	20 mA OCP level1	1	1.80 V	20 mA OCP level1	1
LDO2	3.3 V	0.4 A OCP level0	4	2.90 V	0.4 A OCP level0	4
LDO3	-	-	0	-	-	0
LDO4	3.3 V	40 mA OCP level0	5	3.30 V	40 mA OCP level0	5
LDO5	-	-	0	-	-	0
LDO6	-	-	0	-	-	0
LDO7	-	-	0	-	-	0
LDO8	-	-	0	-	-	0
VREFDDR	-	-	0	-	-	0
BUCK1	0.80 V	1.0 A OCP level1	3	0.80 V	1.0 A OCP level1	3
BUCK2	0.82 V	2.0 A OCP level1	2	0.82 V	2.0 A OCP level1	2
BUCK3	-	-	0	-	-	0
BUCK4	3.3 V	0.5 A OCP level1	1	1.80 V	0.5 A OCP level1	1
BUCK5	1.8 V	0.5 A OCP level1	3	1.80 V	0.5 A OCP level1	3
BUCK6	-	-	0	-	-	0
BUCK7	3.3 V	2.5 A OCP level0	4	-	-	0

Rank = 0: rail not autom. turned ON
Rank = 1: rail autom. turned ON after 7 ms
Rank = 2: rail autom. turned ON after 7 ms
Rank = 3: rail autom. turned ON after further 1.5 ms
Rank = 4: rail autom. turned ON after further 1.5 ms
Rank = 5: rail autom. turned ON after 1.5 ms

STPMIC25 and STM32MP2



MAIN APPLICATIONS

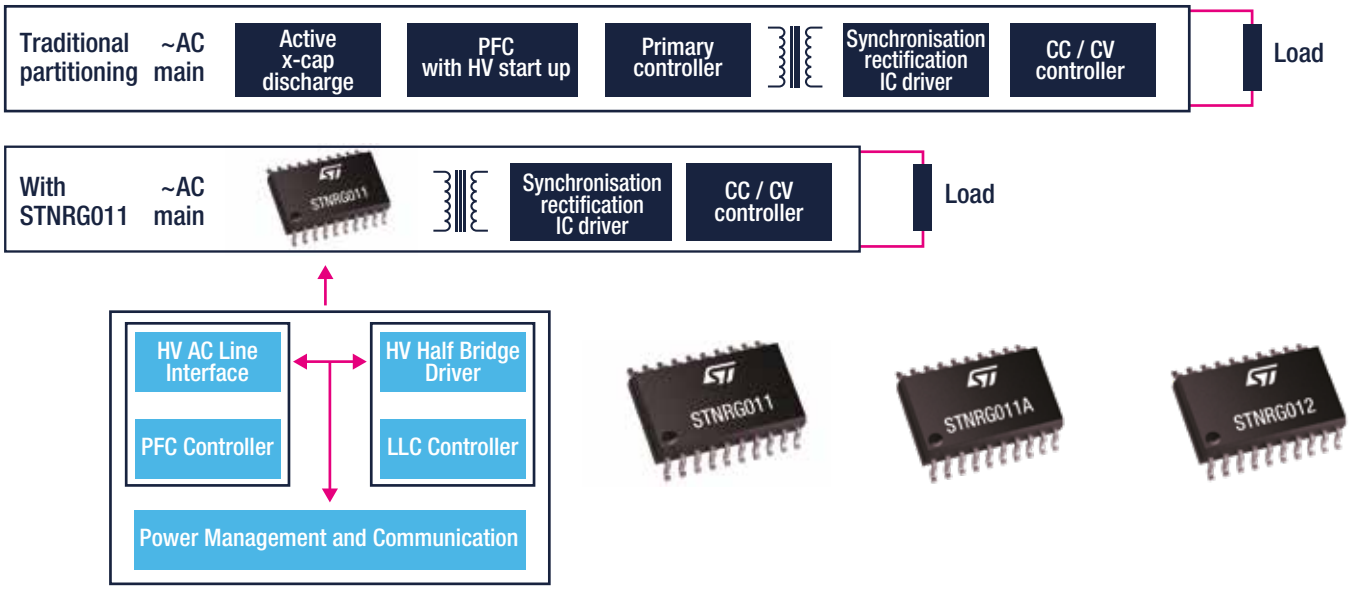
Home automation
Industrial control
POS terminals
Networking
Medical monitoring

DIGITAL POWER CONTROLLERS AND MICROCONTROLLERS

STNRG digital power controllers

The high level of integration of today's latest features and functions make **STNRG011**, **STNRG11A,** and **STNRG012** ideal for SMPS and lighting applications required to comply with the most stringent energy-saving regulations and guarantees high reliability, safety, and BOM optimization. Configurable through an intuitive GUI, ST STNRG digital controllers provide high-end performance and flexibility and do not require any firmware implementation. All the key application parameters of the device are stored in an internal NVM, allowing wide configurability and calibration.

Simplified 2-stage digital SMPS design with high performance and low component count



Multi-mode digital combo controller (PFC+LLC/LCC)

STNRG011 | STNRG011A | STNRG012

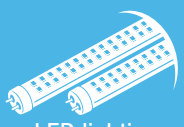
- Onboard 800 V startup circuit, line sense and X-cap discharge compliant with IEC 62368-1, for reduced standby power (STNRG011 only)
- DC source management with no X-cap discharge (STNRG012 only)
- THD optimizer for LED lighting applications (STNRG012 only)
- Enhanced fixed on time multi-mode TM PFC controller
- Time-shift control of resonant half-bridge
- ROM memory for SW digital algorithms
- NVM memory for programmable key application parameters
- Advanced OLP - over load management (STNRG011A only)

STNRG

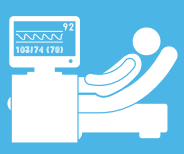
MAIN APPLICATIONS

TV power supply and All-in-One STNRG011, STNRG011A

High power adapters STNRG011, STNRG011A



LED lighting STNRG012



Industrial and medical equipment STNRG012

Emergency lighting STNRG012

Microcontrollers for digital power

The **32-bit microcontrollers** most suitable for power management applications are the STM32F334 and the STM32G474 MCU from the mixed-signal **STM32F3 series** and **STM32G4 series**, the STM32H743 MCU from the high performance **STM32H7 series,** and those of the entry-level **STM32G0 series.**

The STM32G0 series has a 32-bit ARM® Cortex®-M0+ core (with MPU) running at 64 MHz, and is well suited for cost-sensitive applications. STM32G0 MCUs combine real-time performance, low-power operation, and the advanced architecture and peripherals of the STM32 platform.

The STM32F3 series MCU combines a 32-bit ARM® Cortex®-M4 core (with FPU and DSP instructions) running at 72 MHz with a high-resolution timer and complex waveform builder plus event handler.

The STM32G4 series with 32-bit ARM® Cortex®-M4 core running at 170 MHz continues the STM32F3 series, keeping leadership in analog, leading to cost reduction at the application level and a simplification of the application design.

Finally, the STM32H7 series has a 32-bit ARM® dual core Cortex®-M7 + Cortex®-M4 (480 MHz + 240 MHz) or single-core Cortex®-M7 (480 MHz) with precision FPU, DSP, and advanced MPU.

STM32 F3, G4, and H7 series contain a flexible high-resolution timer to generate highly accurate pulse-width modulated (PWM) signals for stable control of switched-mode power circuits.

These MCUs specifically address digital power conversion applications, such as digital switched-mode power supplies, lighting, welding, solar, wireless charging, motor control, and much more.

STM32G0

- Cortex®-M0 core
- Very low power consumption
- Timer frequency up to 128 Mhz resolution (8 ns)
- High-speed ADCs for precise and accurate control
- More RAM for flash: up to 36 KB SRAM for 128 KB and 64 KB flash memory

STM32F334

- Cortex®-M4 core
- High resolution timer V1 (217 ps resolution) with waveform builder and event handler
- 12-bit ADCs up 2.5 Msps conversion time
- Built-in analog peripherals for signal conditioning and protection (25 ns from fault input to PWM stop)

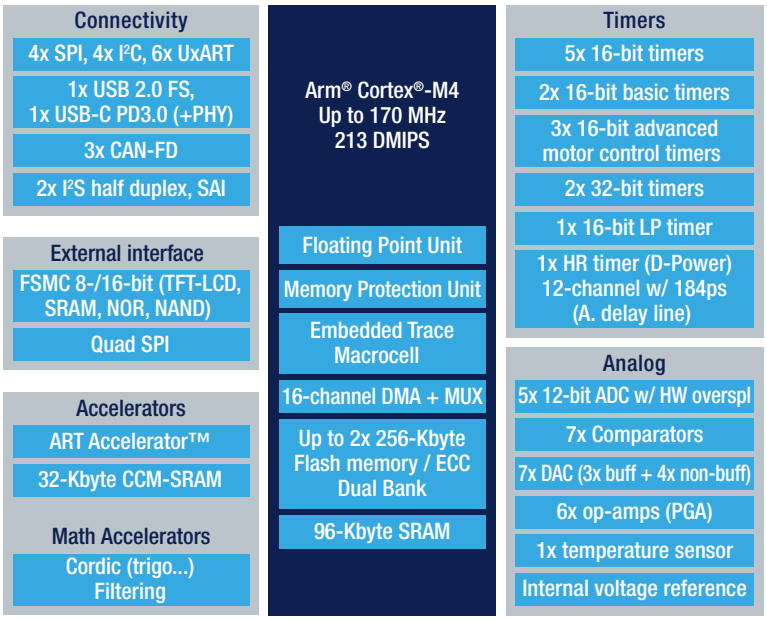
STM32G474

- Cortex®-M4 core
- High resolution timer V2 (184 ps resolution) with waveform builder and event handler
- Mathematical accelerator, digital SMPS power factor correction
- High-speed ADCs for precise and accurate control (4 Msps)
- Dual bank flash for live upgrade
- Digital power supply and PFC design workshop with STM32 MCUs in collaboration with the company partner Biricha

STM32H743

- Cortex®-M7 core
- High performance up to 480 MHz
- High resolution timer V1 (2.1 ns resolution) for real time control
- High-speed ADCs for precise and accurate control (3.6 Msps)

STM32G474 block diagram



MAIN APPLICATIONS

www.st.com/stm32 STM32 digital power ecosystem

Automotive microcontrollers for in-car digital power

SPC5 automotive microcontrollers are suited for in-car digital power applications, such as traction inverters, on-board chargers, bidirectional DC-DC, and battery management systems.

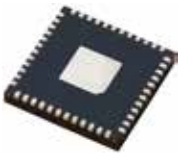
SPC58 E-line combines real-time behavior with ISO26262 ASIL-D safety.
The embedded hardware security module (HSM) ensures protection against cyber security attacks.
The generic time module (GTM) completes the peripheral set by delivering a high-performance timer, synchronization units, embedded hardware DPLL, and micro-cores.

SPC58 chorus family provides a connected, secure, and scalable platform delivering a wide range of communication interfaces and low-power capabilities to complete the in-car connectivity needs.

SPC5	SPC58 E Line
Core	Triple 3x e200z4d @ 180 MHz
eFlash Code	4 MB to 6 MB
Timers	GTM3
Safety	ASIL-D
Advanced networking	8x CAN-FD FlexRay 2x Ethernet
Security	HSM medium
ADC	5x 12 bit (SAR) 3x 10 bit (SAR) 6x 16 bit (SigmaDelta)
High temperature support (165 Tj)	Qualified

Package options

eTQFP 64-176
(exposed pad)



QFN 48
(exposed pad)

Networking

ETHERNET

LIN LOCAL INTERCONNECT NETWORK

CAN FD

OPEN ALLIANCE

FlexRay™

Scalability

Up to:
3 cores, 200 HMz, 10 MB flash

ASIL D

Secure and Safety

Evita Medium/Full

HIS

ISO 26262

MAIN APPLICATIONS

- Vehicle security
- Software over-the-air
- Parking services
- Remote assistance
- Maintenance free
- Safety
- HEV

AutoDevKit automotive Development Kit enables faster ECU prototyping

AutoDevKit is a fast-growing toolset for automotive and transportation application development. It allows design engineers to quickly and easily prototype with hardware, firmware, and software, and includes extensive community support.

Our ecosystem offers a wide selection of automotive MCUs and devices covering several automotive applications:

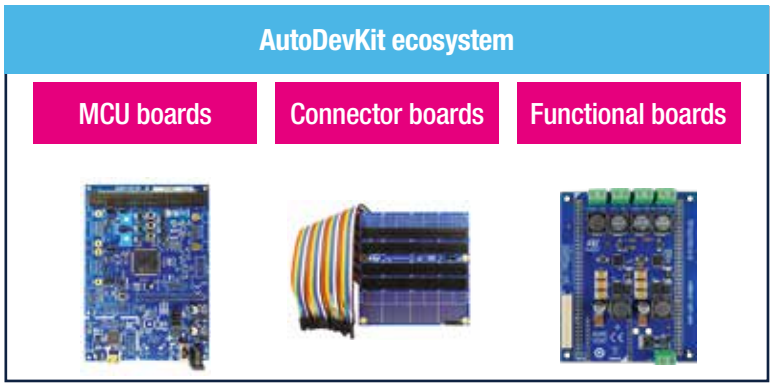
- BMS
- Delivery/logistic robots
- AI on standard MCUs
- Internal and external lighting
- Power distribution
- Audio generation and AVAS
- Motor control: door control, side mirror, tailgate, seat adjustment
- HVAC, ventilation, air quality
- USB Type-C power delivery

Once the MCU platform and the functions needed for the application have been selected, the developer can customize existing demo codes using high-level programming, without needing to deal with complex technical details.

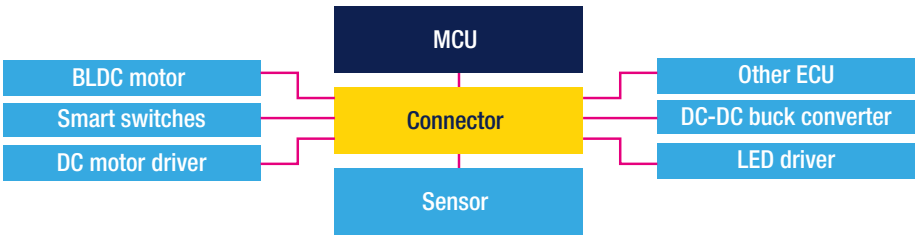
Automatic pin configuration and a visual procedure enable easy board assembly with the correct wiring, and the embedded debug allows quick prototyping.

The AutoDevKit ecosystem includes:

- MCU discovery and functional boards
- System solution and demonstrators
- STSW software



Solution/demonstrator KIT



MCU + connector + functional boards

Community

Video introduction

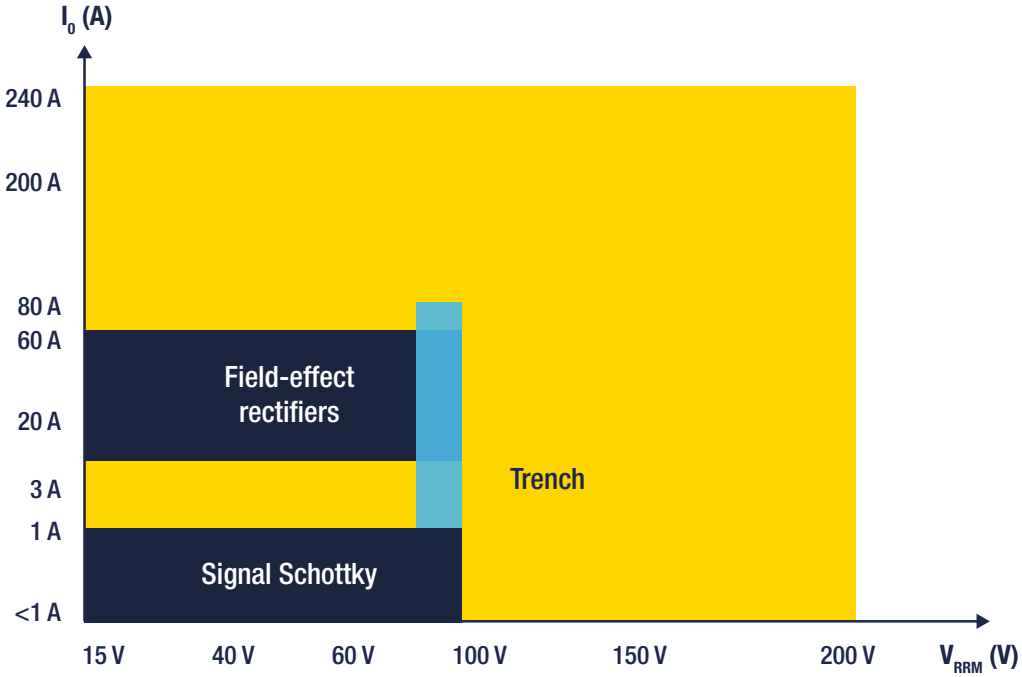
Brochure

Find out more at **www.st.com/autodevkit**

Software download **www.st.com/autodevkitsw**

DIODES AND RECTIFIERS

ST **Schottky** and **Ultrafast** diode portfolio includes 650 to 1200 V SiC and 45 to 100 V field-effect rectifier diodes (**FERD**), ensuring that designers can take advantage of the very latest technologies to develop cost-efficient, high-efficiency converter/inverter solutions. Depending on the targeted application and its voltage, developers can choose from a wide range of devices to ensure the best compromise in terms of forward voltage drop (VF) and leakage current (IR) as well as other characteristics.



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
STPST*	Power Schottky trench rectifier for high frequency for miniature switched mode power supplies

Ultrafast rectifiers

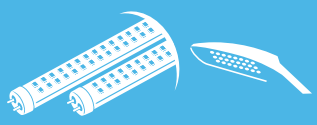
STTH*	Ultrafast high voltage diodes for general purpose application

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

www.st.com/schottky
www.st.com/ultrafast-rectifiers
www.st.com/field-effect-rectifier-diodes

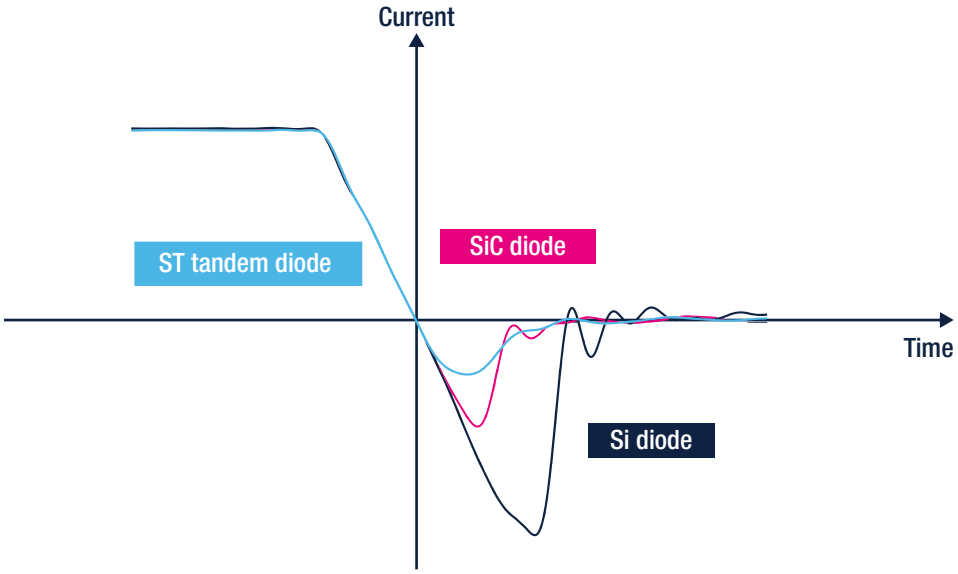
Note: * is used as a wildcard character for related part number

SiC diodes

In addition to ensuring compliance with today's most stringent energy efficiency regulations (energy Star, 80Plus, and European efficiency), ST **silicon carbide** diodes feature four times better dynamic characteristics with 15% less forward voltage (VF) than standard silicon diodes. Silicon carbide diodes belong to the STPOWER family.

The efficiency and robustness of solar inverters, motor drives, uninterruptible power supplies, and circuits in electrical vehicles are therefore greatly improved by the use of silicon carbide (SiC) diodes.

ST proposes a 650 to 1200 V range with single and dual diodes in packages ranging from DPAK to TO-247, including the ceramic insulated TO-220 and the slim and compact PowerFLAT 8x8 featuring excellent thermal performance and representing, the new standard for high-voltage (HV) surface-mount (SMD) packages and available for 650 V SiC diodes from 4 to 10 A.



SiC diodes provide zero recovery time with negligible switching losses

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*12

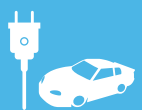
- 650 V (STPSCx065)
- 1200 V (STPSC*12)
- 2 available trade-offs, low VF and high surge

STPST Trench diodes

The trench diode design perpetuates the ST move towards ever increasing compactness in power systems. It covers applications from tiny appliance adaptors (STPST8H100SF takes a mere 30 mm² footprint) to automotive power actuators (-SFY suffix for this 8 Amps). Together with the D2PAK and PSMC surface mount power housing, the slimmer 1 mm SOD123Flat, SOF128Flat, and SMB Flat packages give access to the newer, leaner circuit modules.

MAIN APPLICATIONS

Solar inverters
STPSC*065, STPSC*12



HEV
STPSC*065

UPS
STPSC*065, STPSC*12

Charging Station
STPSC*065, STPSC*12

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

www.st.com/sic-diodes

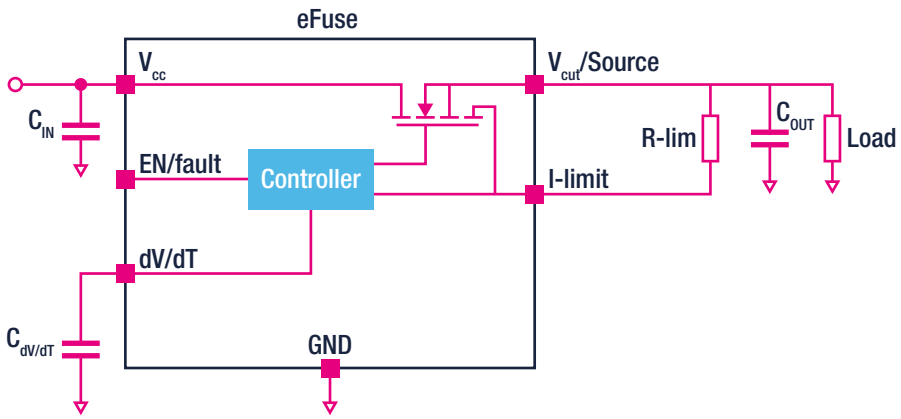
Note: * is used as a wildcard character for related part number

eFuses AND HOT-SWAP ICs

eFuses

eFuses are electronic fuses that can replace larger conventional fuses or other protections, 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 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. UL2367 and IEC62368 certifications are available on many part numbers.

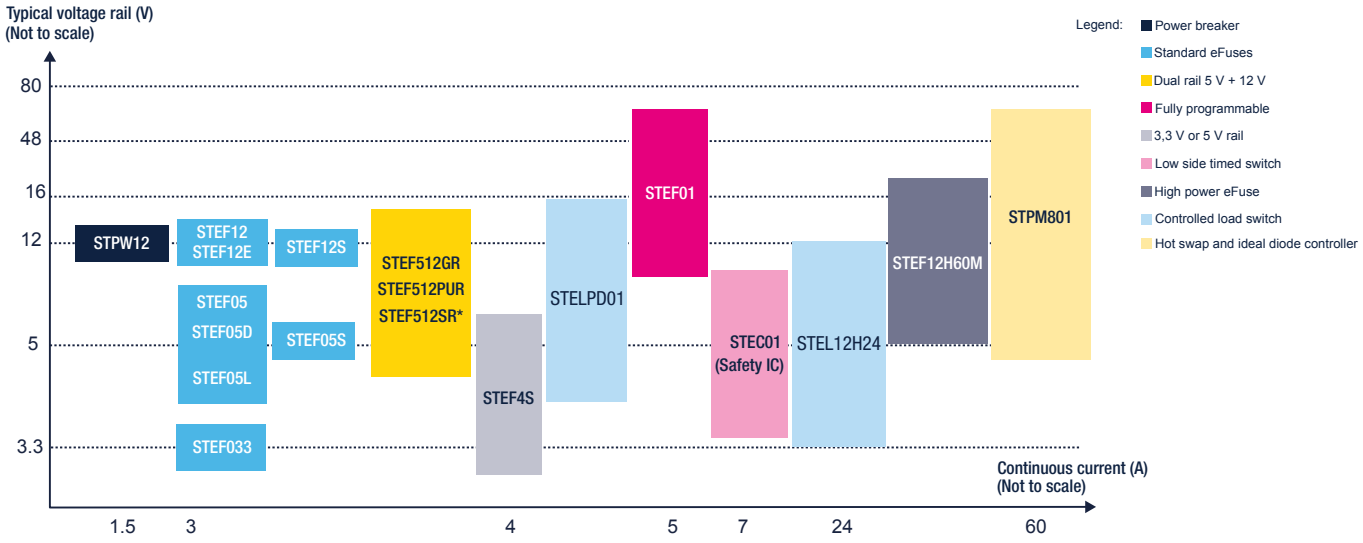


eFuse MAIN FEATURES

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

www.st.com/efuse

eFuses, a smart offer for a lot of applications



MAIN APPLICATIONS

Home appliances
STEF05, STEF01, STEF12, STEF12S

Server and data storage
STEF033, STEF05, STEF05L, STEF4S, STEF12, STEF05S, STEF12S, STEF512, STEF512SR*, STEL12H24

USB connections
STEF05, STEF05L, STEF05S, STELPD01

Factory automation
STEF01, STEF12, STEF12S, STELPD01

Set-top boxes
STEF12, STEF12S

Power breakers

Connected in series to the power rail, ST **power breakers** are able to disconnect the electronic circuitry when 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.

The STPW programmable electronic power breaker family provides a convenient and integrated solution for quickly and safely disconnecting a faulty load from a 12 V bus.

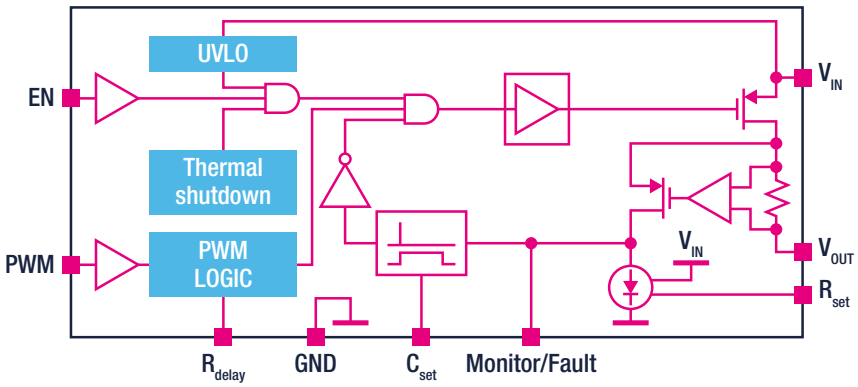
Inserted between the power rail and the load, STPW power breakers contain a low-resistance (50 mΩ) power switch and precision circuitry for sensing the load power. If the user-programmed limit is exceeded, the switch turns off and a signal on the dedicated monitor/fault pin informs the host system. In normal operation, this output presents an analog voltage proportional to the load power to permit continuous monitoring.

Also featuring built-in auto-restart after a user-adjustable delay and programmable PWM masking time to prevent protection triggering by inrush current, the STPW family simplifies design for safety and eases certification for standards such as the UL 60730 specifications for abnormal operation. This integrated solution effectively replaces discrete circuitry or a combination of ICs such as a current-sense amplifier or a hot-swap controller plus MOSFET switches, by offering improved accuracy and saving board space and bill of materials for each load protected.

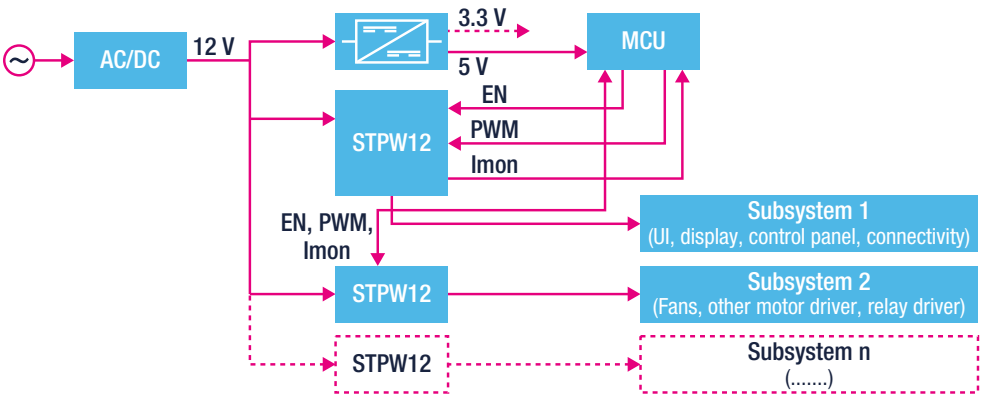
Power breakers

STPW12

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



Typical home appliance block diagram for STPW12



MAIN APPLICATIONS

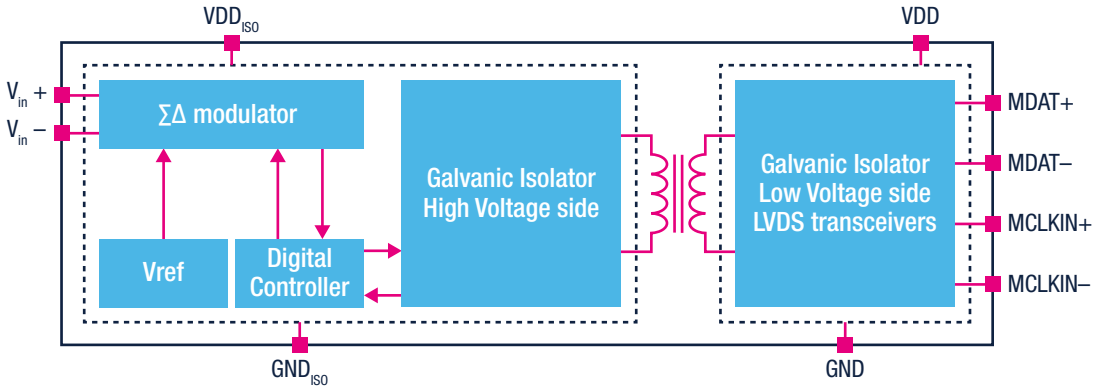
Home appliances
STPW12

Air conditioning
STPW12

Factory automation
STPW12

GALVANIC ISOLATED SIGMA-DELTA ADC

The galvanically isolated **ISOSD61/ISOSD61L** second order Sigma-Delta modulator, based on the highly successful ST transformer coupling technology, is available in the single-ended (**ISOSD61**) and differential (**ISOSD61L**) signaling versions. It converts analog input signals into high-speed single-bit digital data streams, from which analog information can be recovered by a low-pass filter and further processed by a host controller. The modulator protects the output peripheral interface with a galvanic isolation barrier that separates low and high voltage domains and blocks stray currents between different grounds. The silicon-based isolation technology offers a number of advantages over traditional opto-coupling, including significantly lower power consumption, higher data transfer rates, and greater reliability for longer device lifetime, and over hall-effect sensors in terms of accuracy, noise rejection, latency, form factor, and cost.



KEY FEATURES

- 2nd order 16-bit Sigma-Delta modulator
- ±320 mV full scale differential input signal Range
- Up to 25 MHz external clock input for easier synchronization
- Up to 50 kHz bandwidth
- 86 dB typical SNR
- - 83 dB typical THD
- 30 kV/µs typical common-mode transient immunity
- 6 kV VPEAK highest allowable over-voltage (V_{IOTM})
- 6 kV VPEAK maximum surge insulation voltage (V_{IOSM})
- 1.2 kV V_{PEAK} maximum working insulation voltage (V_{IORM})
- Flexible interface options: Low voltage differential signaling (LVDS) and single ended (TTL/CMOS) options
- –40 °C to +125 °C extended industrial temperature range
- SO-16 wide package

Product table

Part number	Version	Input Range	Max. clock frequency	Resolution	SNR	Isolation	CMTI	Package and packing
ISOSD61	TTL/CMOS	±320 mV	25 MHz	16-bit	86 dB	1.2 kV Viorm	30 kV/us	SO16W tray
ISOSD61TR	TTL/CMOS							SO16W tape and reel
ISOSD61L	LVDS							SO16W tray
ISOSD61LTR	LVDS							SO16W tape and reel

MAIN APPLICATIONS

Servo drive

Factory automation

EV charging station

Server and telecom power

IGBTs

ST offers a comprehensive portfolio of **IGBTs (insulated gate bipolar transistors)** ranging from 600 to 1700 V in trench gate field-stop (TGFS) technologies.
Featuring an optimal trade-off between switching performance and on-state behavior (variant), ST IGBTs are suitable for industrial and automotive segments in applications such as general-purpose inverters, motor control, home appliances, HVAC, UPS/SMPS, welding equipment, induction heating, solar inverters, traction inverters, on-board chargers, and fast chargers.

Industrial

Breakdown Voltage	600 V		650 V				1200 V			1250 V	1350 V	1700 V
Current	4 to 20 A	20 to 80 A	4 to 200 A	20 to 80 A	15 to 100 A	20 to 50 A	40 A	8 to 75 A	15 to 75 A	20,30 A	25 A, 35 A	50 A (bare die)
Switching frequency	8 to 30 kHz	50 to 100 kHz	2 to 20 kHz	16 to 60 kHz			2 to 20 KHz		20 to 100 kHz	16 to 60 kHz		2 to 20 KHz
IGBT Series	H	V	M	HB	HB2	IH	MS	M	H	IH	IH2	M
Focus Applications	Home appliances	Welding, PFC, solar, UPS, charger	Industrial motor control, automotive traction inverter, GPI, Air-Con	PFC, solar, UPS, charger, welding and soft switching		Induction heating and soft switching	Motor control, aux, load, PTC heaters battery thermal mgmt	Industrial motor control, GPI, Air-Con	Welding, PFC, solar, UPS, charger	Induction heating, microwave and soft switching		Industrial motor control, GPI, Windmill

Automotive

Breakdown Voltage	600 V	650 V			750 V	1200 V	
Nominal Current	20 to 80 A	30 to 200 A	20 to 80 A	15 to 100 A	200 to 500 A	15 to 40 A	160 A
Switching frequency	50 to 100 kHz	2 to 20 kHz	16 to 60 kHz		2 to 20 KHz	2 to 20 KHz	
IGBT Series	V	M	HB	HB2	MH	MS	GK
Focus Applications	OBC	Traction inverter, Motor Control, Aux loads, PTC heaters	OBC, Air-Con		EV, HEV Traction inverter	Motor Control, Aux loads, PTC heaters, Battery thermal management	Traction inverter

Development

H series

STG*H*

H* - 600 V family

- 3 µs of short-circuit capability
- Low saturation voltage
- Minimal collector turn-off
- Series optimized for home appliance applications

H - 1200 V family

- 5 µs of short-circuit capability @ starting T_J = 150 °C
- Low turn-off losses
- Up to 100 kHz as switching frequency

V series

STG*V60*F

- Optimized for high switching frequencies
- Negligible current tail at turn-off
- Very low turn-off switching losses
- Soft and very fast recovery antiparallel diode
- Up to 100 kHz in hard switching topologies
- AEC-Q101 qualified device

M series

STG*M*

650 V family

- 6 µs of min short-circuit capability @ starting T_J = 150 °C
- Wide safe operating area (SOA)
- 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 °C
- Freewheeling diode tailored for target application
- Suitable for any inverter system up to 20 kHz

HB series

STG*H*B

- Low saturation voltage
- Minimal tail current turn-off
- Different diode option
- Optimum trade-off between conduction and switching losses
- Low thermal resistance
- 4 leads package available
- Very high robustness in final application
- Automotive eligible

HB2 series

STG*H*FB2

- Very low saturation voltage
- Reduced gate charge
- Different diode option
- Optimum trade-off between conduction and switching losses
- Low thermal resistance
- 4 leads package available
- High efficiency in final application
- Automotive eligible

IH/IH2 series

STG*IH*

650 V IH family

- Very low $V_{CE(sat)}$: 1.5 V @ ICN
- Very low Eoff
- Low drop forward voltage diode
- Designed for soft commutation application only

1250 V IH family - 1350 V IH2 family

- Minimized tail current
- Very low drop freewheeling diode
- Tailored for single-switch topology

MH series

STG*MH*

- Increased BV robustness and current density
- Low $V_{CE(sat)}$ = 1.3 V (typ.) @ IC = 300A
- Integrated Kelvin and current sensing option
- Enhanced switching performances
- Dice top and back metallization suitable for high performance linking
- High current and temperature fully tested
- Rebuilt wafers for customized modules

MS series

STG*MS*

- Designed for automotive application
- 8 µs of short-circuit withstanding time @ V_{CC}=800 V, V_{GE}=15 V,T_J-start=150 °C
- Maximum continuous operating junction temperature: T_J=175 °C
- Low $V_{CE(sat)}$ = 1.95 V (typ.) @ IC = 40A

GK series

STG*GK*

- 5 µs of short-circuit withstand time
- $V_{CE(sat)}$ = 1.9 V (typ.)
- Tight parameter distribution
- Positive $V_{CE(sat)}$ temperature coeff.

MAIN APPLICATIONS

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

www.st.com/igbt

INTELLIGENT POWER MODULE - SLLIMM

The **SLLIMM**, small low-loss intelligent molded module, is the ST family of compact, high efficiency, dual-in-line **intelligent power modules (IPM)** with extra optional features. This family includes different solutions in terms of package (SMD, through hole, full molded, and DBC) and silicon technology (IGBT, MOSFET, and superjunction MOSFET). Optimally balancing conduction and switching energy with an outstanding robustness and EMI behavior makes the new products ideal to enhance the efficiency of compressors, pumps, fans, and any motor drives working up to 20 kHz in hard switching circuitries and for an application power range from 10 W to 7 KW.

KEY FEATURES

- Low $V_{CE(sat)}$, Low $R_{DS(on)}$
- Optimize driver and silicon for low EMI
- Lowest Rth value on the market for the DBC package versions
- Internal bootstrap diode
- Maximum junction temperature: 175 °C for IGBT and 150 °C for SJ-MOSFET
- Separate open emitter outputs
- NTC on board
- Integrated temperature sensor
- Comparator for fault protection
- Shutdown input/fault output

KEY BENEFITS

- Integrated and efficient solution
- Easy to drive through microcontroller
- Higher robustness and reliability
- Plug'n play solution

SLLIMM nano series

600 V IGBT
600 V SJ-MOSFET
500 V MOSFET
3 up to 8 A

Power rating: 10 to 600 W

SLLIMM 2nd series

600 V IGBT
600 V SJ-MOSFET
8 up to 35 A

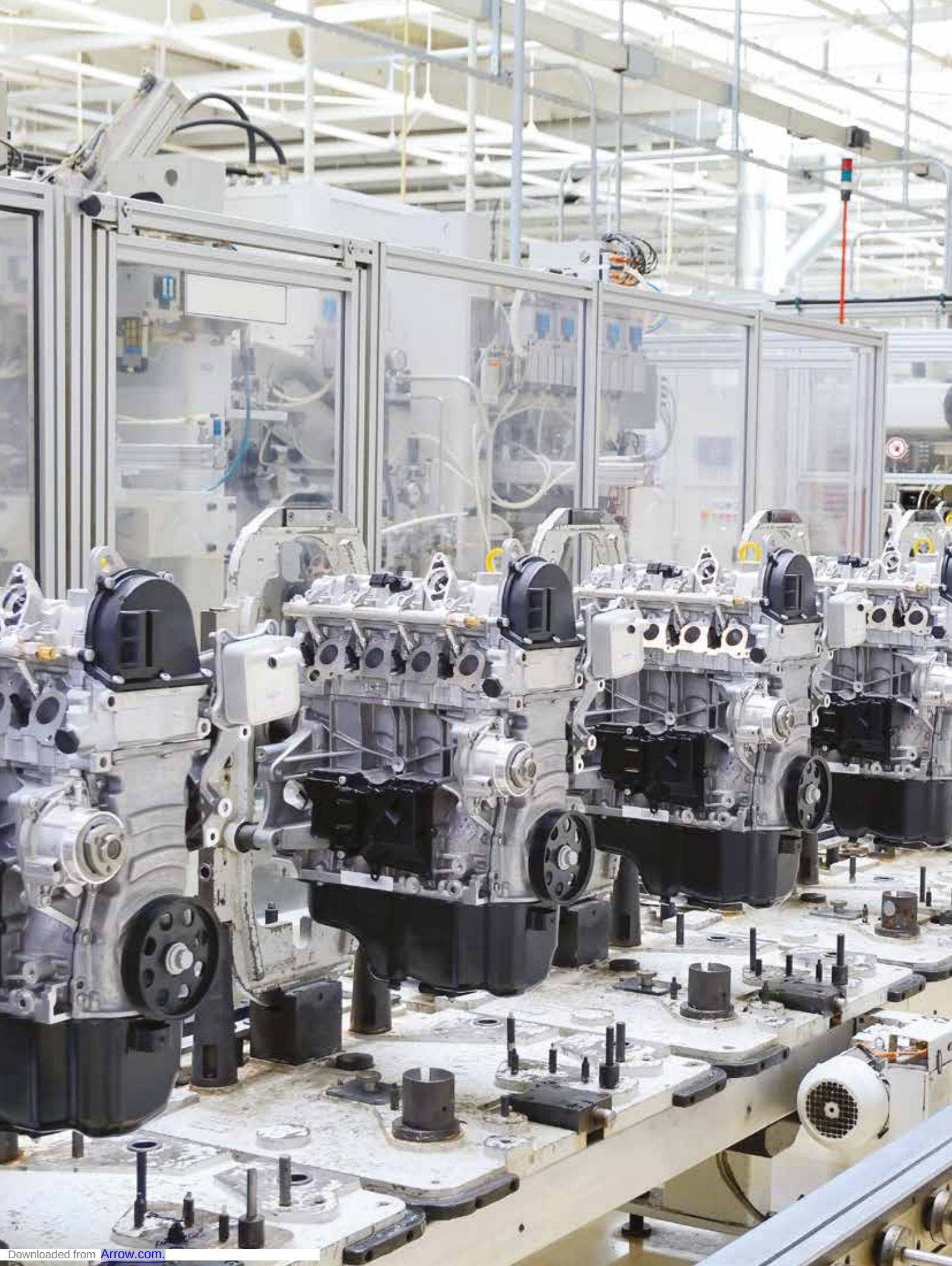
Power rating:
300 W to 3 kW

SLLIMM high power series

IGBT
650 V, 50 A
1200 V, 10 A

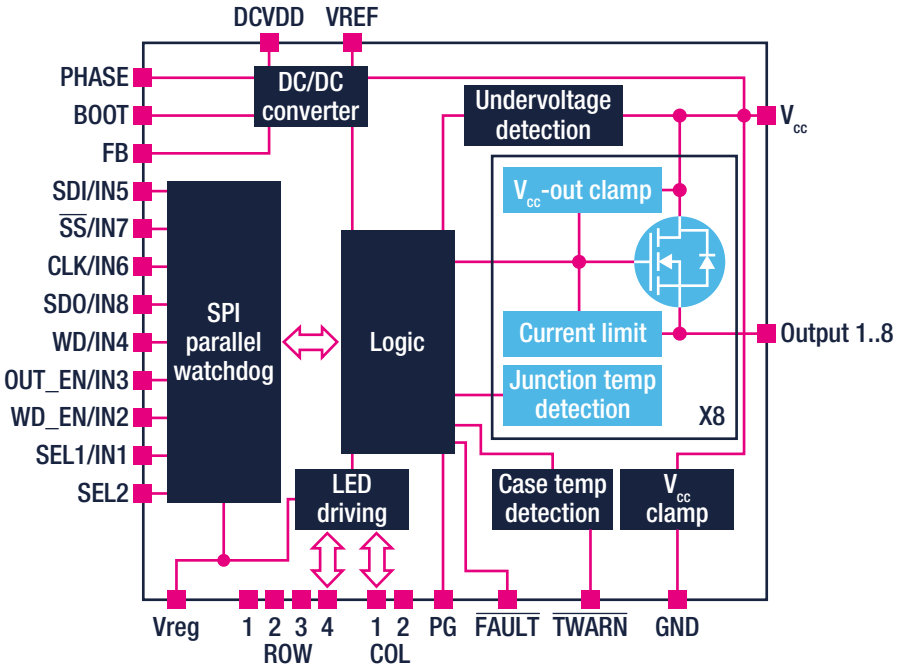
Power rating:
3 to 7 kW

www.st.com/igbt



INTELLIGENT POWER SWITCHES

STMicroelectronics offers **intelligent power switches (IPS)** for low- and high-side configurations. ST 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.
The devices are designed using ST latest technologies for state-of-the-art solutions in any application field.

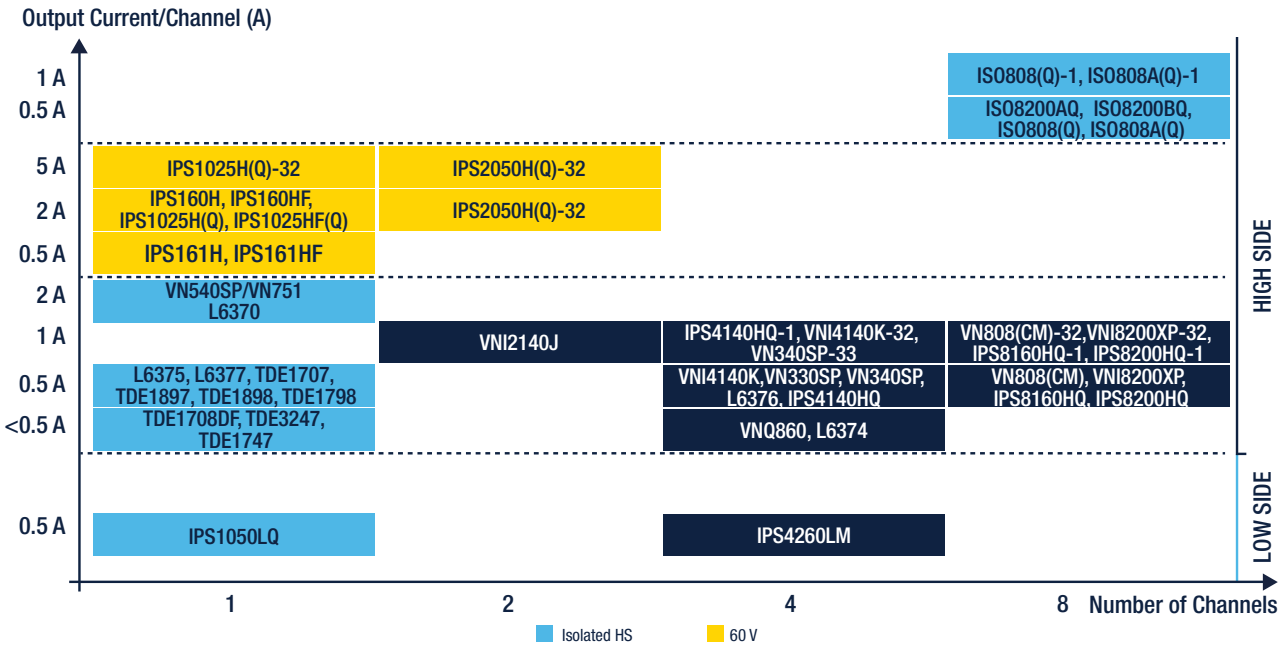


IPS MAIN FEATURES

- Logic
- Driving
- Protections
- Diagnostic
- Power stage
- Isolation

...all in a single chip

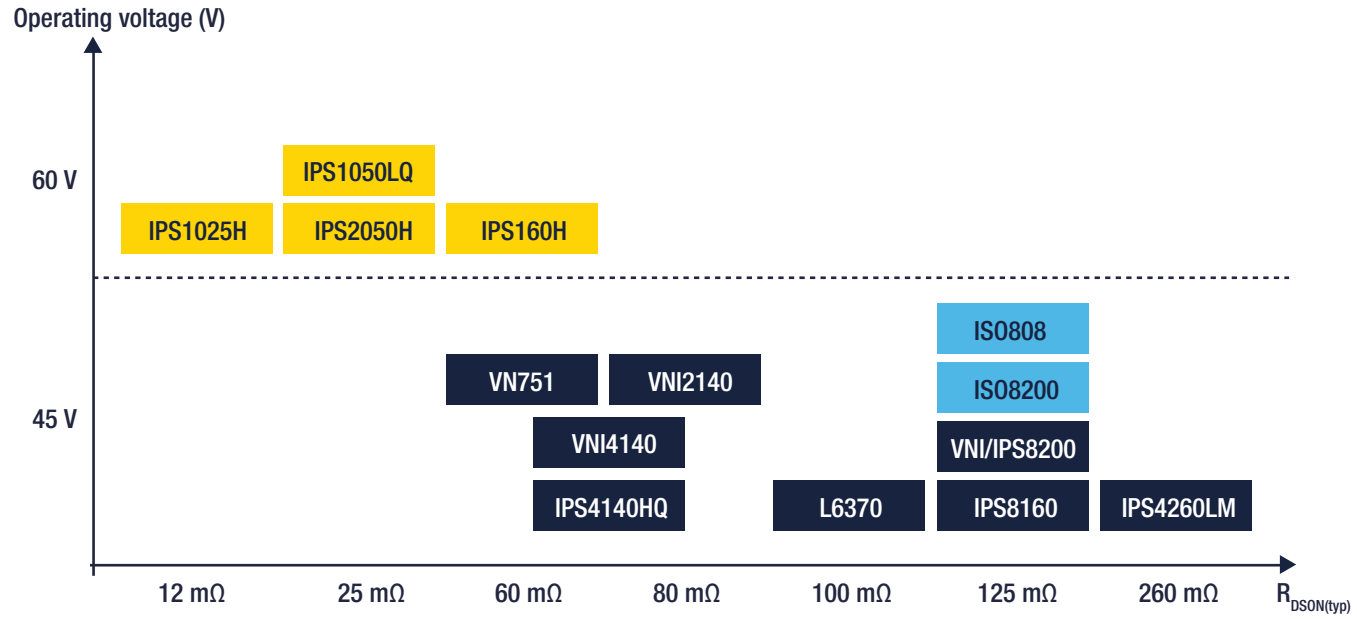
www.st.com/ips



MAIN APPLICATIONS

- Factory automation
- Vending machines
- Renewable energy
- Lighting for building automation

Industrial power switches–high-side and low-side
Positioning by operating voltage and on-resistance

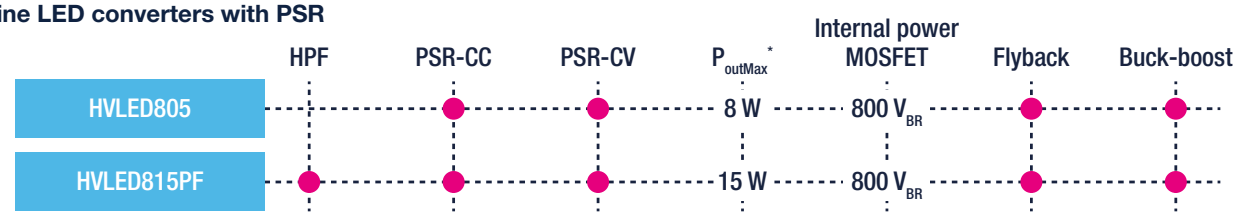


LED DRIVERS

Offline LED drivers

Dedicated **LED drivers** operating from the AC mains ensure highly accurate LED control to provide a high level of light quality and avoid flickering. By combining state-of-the-art low-voltage technology for the controller and 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, HVLED001B, and HVLED101 controllers are 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.

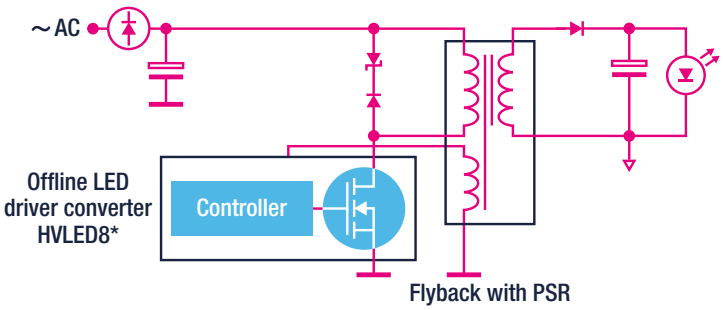
Offline LED converters with PSR



Offline LED controllers with PSR

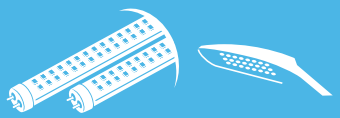
Offline LED controllers

Topology example



MAIN APPLICATIONS

Residential lighting
HVLED815PF



Commercial and street lighting
HVLED001A, HVLED001B, HVLED007, HVLED101

www.st.com/led

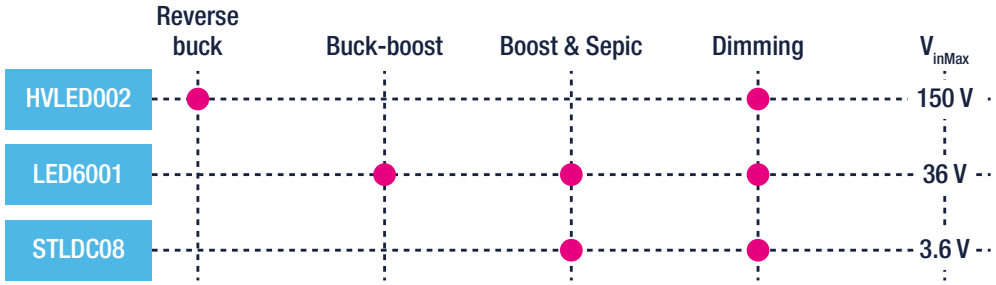
Note: * output power for European input voltage 230 Vac

DC-DC LED drivers

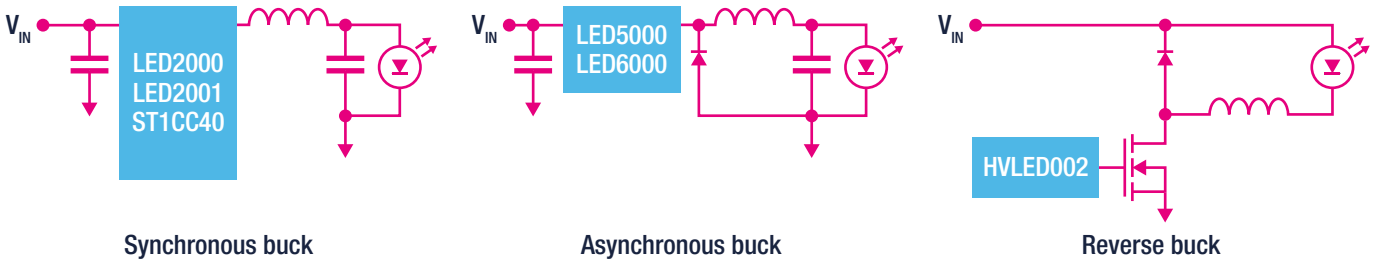
ST monolithic buck switching regulators offer input voltage capability up to 61 V and deliver output currents up to 4 A with high switching frequency. They enable simple, efficient, and cost-effective solutions for driving high-brightness LEDs. They also feature dedicated circuitry for dimming. Boost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

DC-DC LED drivers converters

DC-DC LED drivers controllers



Topology examples



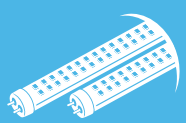
MAIN APPLICATIONS

Halogen bulbs replacements and home appliances
LED5000, LED6000

Traffic signals
LED2000, LED2001, ST1CC40, LED5000, LED6000

Street lighting
LED5000, LED6000, HVLED002

Emergency lighting
LED6001, ST1CC40

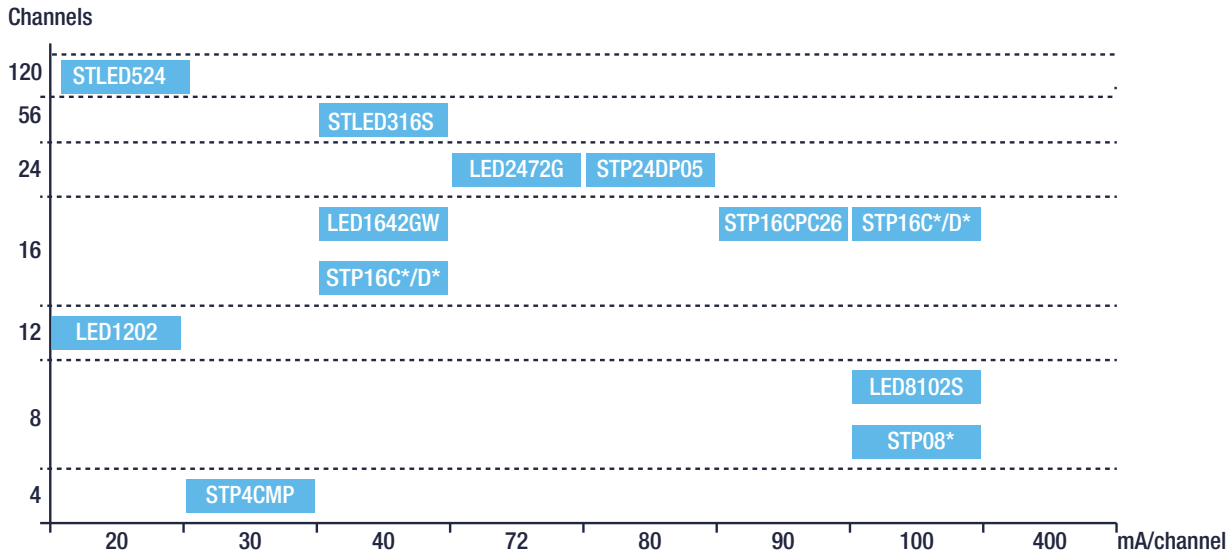


Commercial and architectural lighting
LED5000, LED6000, LED6001, HVLED002

www.st.com/led

LED array drivers

ST **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.



24 channel RGB (8x3) drivers

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

5x24 matrix drivers

- 20 mA/dot
- Adjustable luminance for each LED (dot)

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

16 digit, 56 LED matrix

- 40 mA current capability
- 16 key-scanning (8 x 2 matrix)
- 3-wire serial bus interface

MAIN APPLICATIONS

Traffic signals
LED8102S, LED2472G, STP24DP05

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

Home appliances
LED8102S, STP16, STP08, LED1642GW, STP4CMP, STLED524

Special lighting
LED1642GW, LED2472G, LED8102S

Smartphones / wearable
STLED524, LED1202

www.st.com/led

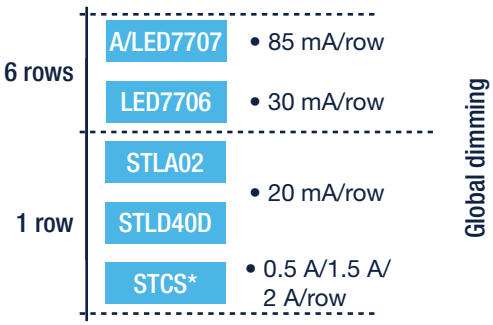
Note: * is used as a wildcard character for related part number

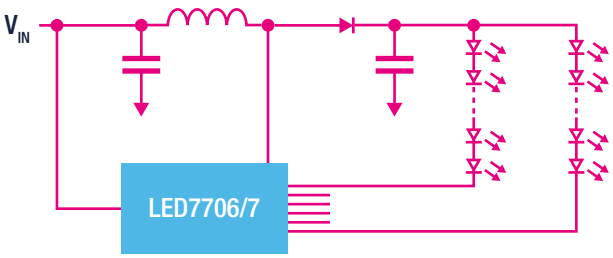
LED row drivers

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

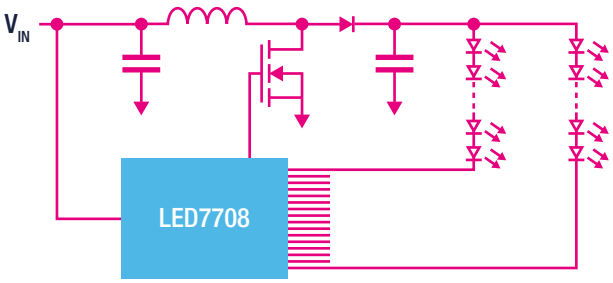




LED row driver controllers

16 rows **LED7708**
- 85 mA/row
- Grouped or independent row dimming

4 rows **ALED7709**
- 200 mA/channel
- A version for bus driven mode (BDM) or B version for standalone mode (SAM)



LED drivers for automotive exterior lighting systems

L99LD21
- Voltage boost controller
- Dual channel step-down converter for high-current LED string regulation up to 1.5 A
- SPI serial interface
- Full diagnostics and functional safety support for automotive head light systems
- Full LED/OLED lighting features

L99LDLH32
- High-side 32 channels up to 15 mA
- Focused on new automotive vOLED rear lighting systems
- Full diagnostics and functional safety support
- CAN FD light interface with integrated transceiver
- Full LED/OLED lighting features
- Power dissipation optimization algorithm

LDLL16EN
- Low-side 16 channels up to 100 mA
- Focused on automotive rear lighting and front grill lamps systems
- Full diagnostics and functional safety support
- CAN FD light interface
- Full LED lighting features

MAIN APPLICATIONS

Smartphones
STLA02, STLD40D

Keyboard and accessories
STLA02*

Automotive exterior lighting
L99LD21, L99LDLH32 e LDLL16EN

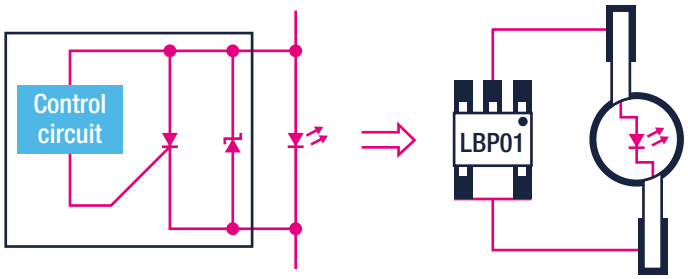
Home appliances and ATMs
LED7706, LED7707, LED7708, STCS*

www.st.com/led

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

LED bypass protection

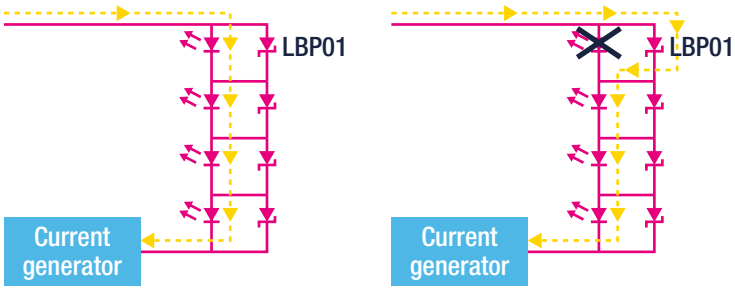
The **LBP01 series** of LED bypass protection devices are bypass switches that can be connected in parallel with 1 or 2 LEDs. In the event of an LED failure, this device shunts the current through other LEDs. It also provides overvoltage protection against surges as defined in IEC 61000-4-2 and IEC 61000-4-5



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 street lighting

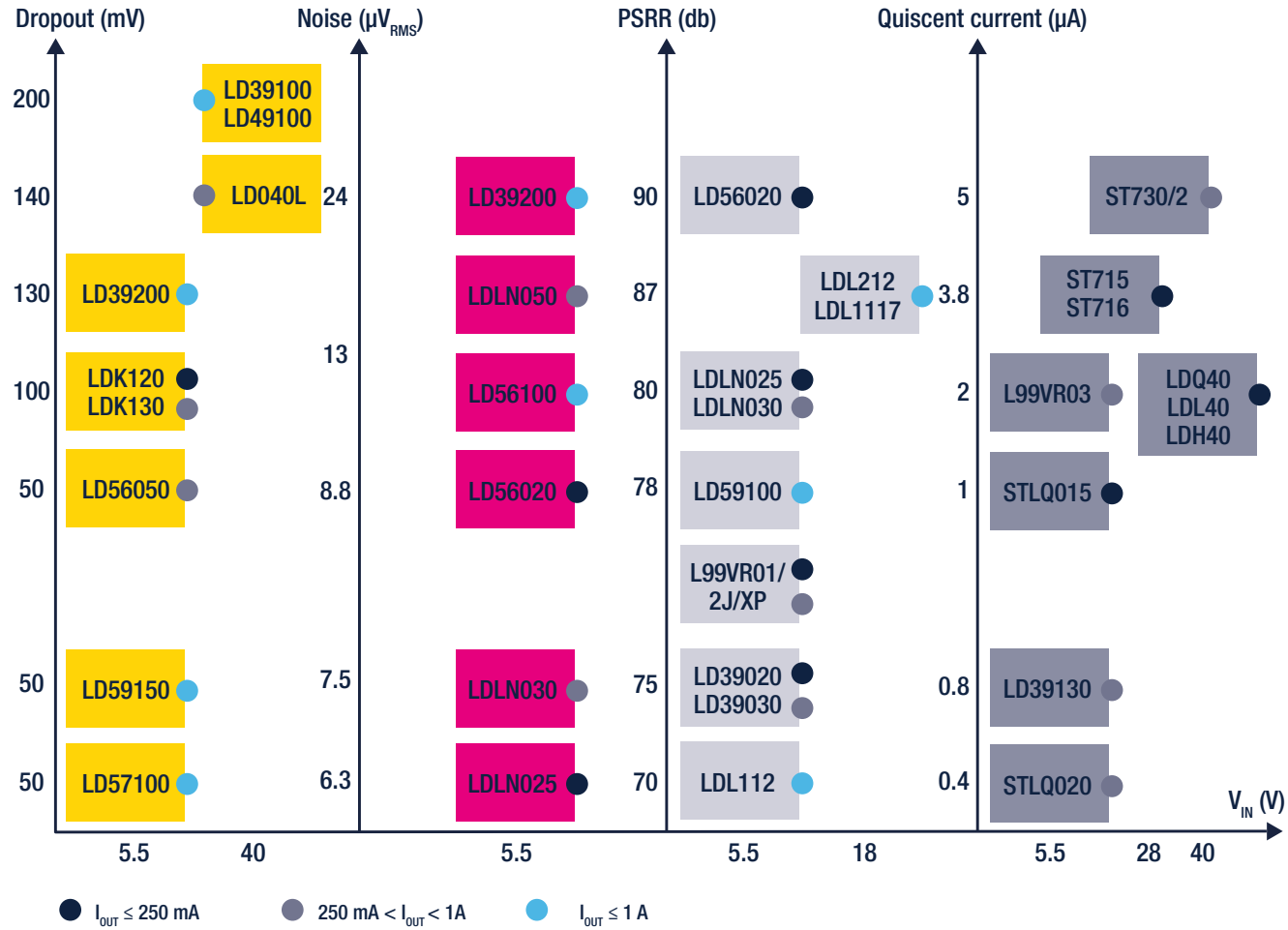
Emergency lighting

Traffic signals

www.st.com/lbp01

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 ultralow 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). This is coupled with a range of the smallest form factor packages for size-conscious applications, such as a 0.47 x 0.47 mm STSTAMP package.



MAIN APPLICATIONS

Tablets, smartphones, and wearables
LD39115, LD39130, LD39020/30, ST1L08, LD59015, LDLN025/30 /50, STLQ020, LD56030, LD56050, LD56100, LD57100, LD56020

Healthcare
STLQ015, STLQ020, ST715, LD39130, LD56020

Home appliances
LDK220/320, LDF, LDFM, LDL212, ST730/2

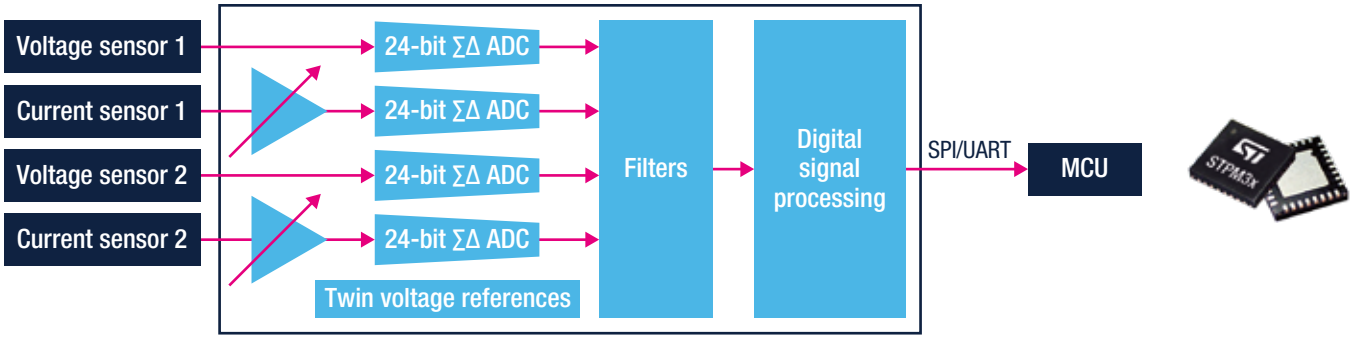
Automotive ADAS, ECU
LDK130, LD39100, LD59150, LD040L, L5050, L5150, L99VR01, L99VR02J, L4995, L5300, LD49100 , L99VR02XP, LDQ40, LDL40, LDH40, L99VR03

www.st.com/linear-regulators

METERING ICs

STPM32, **STPM33**, **and STPM34** are high accuracy AFE (analog front-end) for DC and AC energy measurement, offering high accuracy down to extremely low current typical of home appliances in standby. A full set of on-board features provides high system integration and enables on-chip power quality monitoring, reducing smart-meter cost of ownership, and contributing to a fast and easy design to dramatically reduce manufacturing time and cost.

STPM34: 4 independent channels block diagram



KEY FEATURES

- Up to 4 independent 24 bits 2nd order ∑Δ ADC with PGA integrated DSP for "turn-key energy parameters calculations
- Built-in twin independently temperature compensated voltage references
- Double LED output programmable for active and reactive energy pulses generation
- Applicable to class 0.2 meters
- < 0.1% active power accuracy over a dynamic range of 5000:1
- 3.6 kHz bandwidth
- Very fast single point calibration
- AC and DC measurement
- Multiple sensors support: Shunt, current transformer, Rogowsky coils
- Multiple host interfaces 5 and 3 wires SPI, UART
- I, V bit stream available to host controller for customer own processing
- Case removal and neutral Anti-tamper detection
- Exceeds 50-60 Hz EN 50470-x, IEC 62053-2x, ANSI12.2x

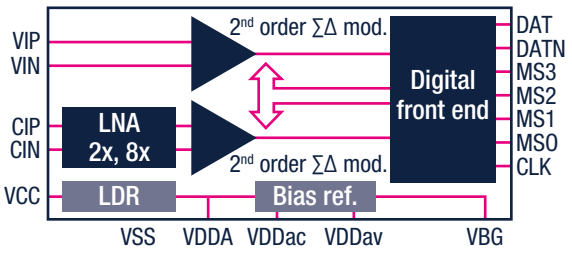
STPMS2

The STPMS2, also called smart-sensor, is a dual SD modulator with embedded PGA. In combination with a microcontroller that embeds DFSDM filters, it allows you to position the A/D conversion (STPMS2) very close to the current transducers, therefore minimizing noise capture from the analog tracks. Once converted, the SD streaming of voltage and current are multiplexed and transferred through a single-wire data line to the MCU.

KEY FEATURES

- Two 2nd order SD modulators
- 0.1% active energy max. error over 1:2500 dynamic range
- Standards supported: EN 50470-1, EN 50470-3, IEC 62053-21, IEC 62053-22, IEC 62053-23, ANSI C12.1-2001, ANSI C12.10-1997, ANSI C12.20-2002
- Fast digital calibration
- Allows the use of multiple shunts

STPMS2



MAIN APPLICATIONS

Energy metering · EV charging · Lighting · Smart plug · Servers power monitor · Solar charging

PHOTOVOLTAIC ICs

DC-DC converters with embedded MPPT algorithm

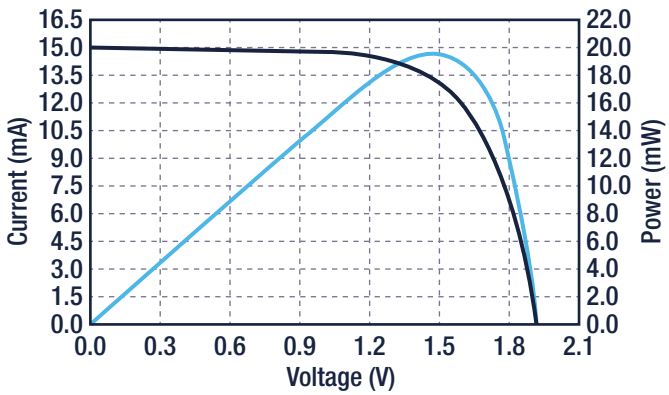
The maximum power point tracking (MPPT) algorithm maximizes the power output by photovoltaic panels according to temperature and solar irradiation conditions.

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.

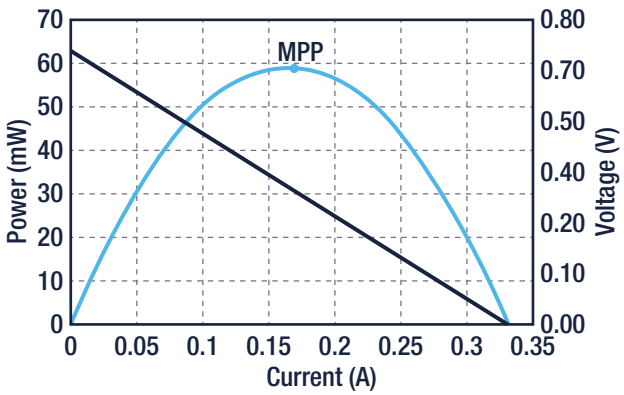
The SPV1050 is an ultra-low-power battery charger and energy harvester (from photovoltaic cells or thermo-electric generators) that guarantees a very fast charge of supercapacitors and any type of battery, including thin-film solid-state batteries. It is specifically designed to work in indoor environments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

		Input 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)	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

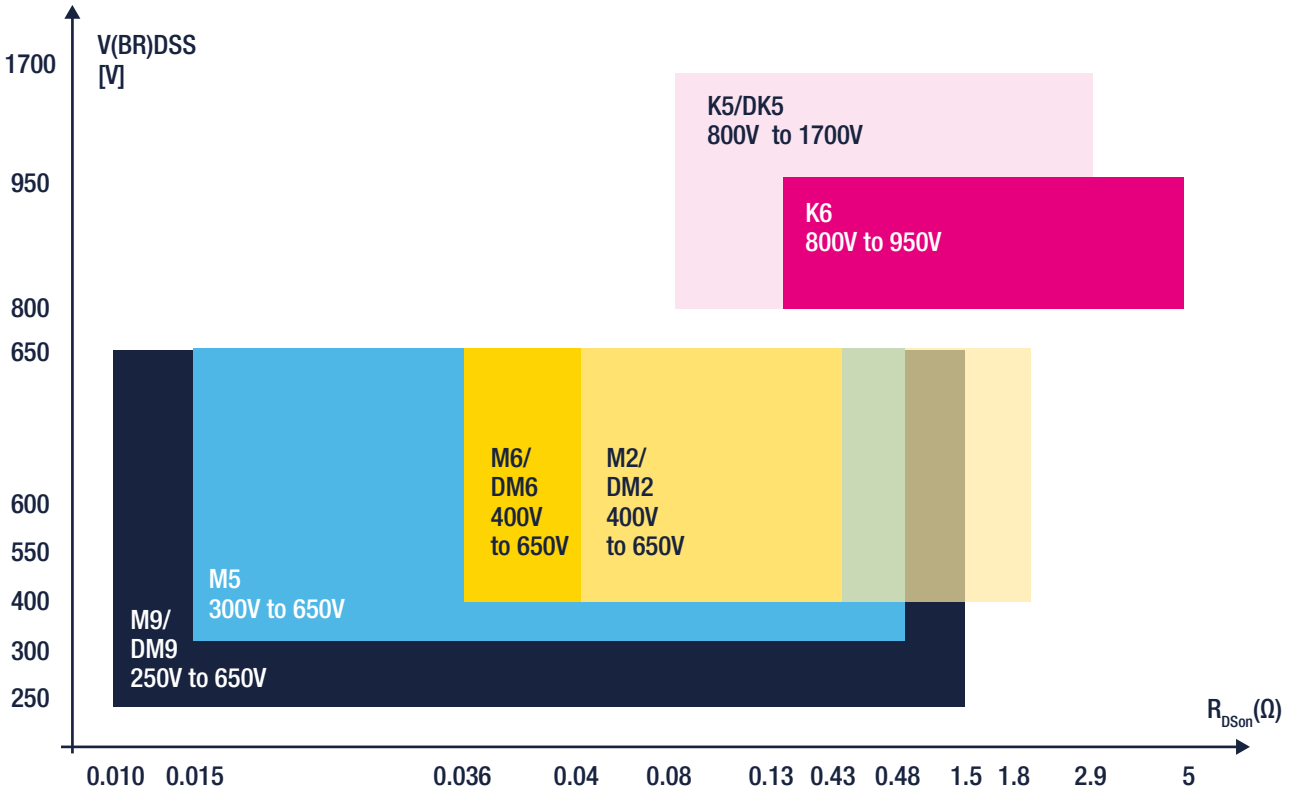
www.st.com/photovoltaic-ics
www.st.com/mppt-dcdc-converters

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

POWER MOSFETs

High-voltage power MOSFETs

The ST **HV power MOSFETs** portfolio offers a broad range of breakdown voltages from 250 to 1700 V with low gate charge and low on-resistance, combined with state-of-the-art packaging. The **MDmesh** high-voltage MOSFET 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 power MOSFET for your design.



M9 series

ST*N*M9

- Best figure of Merit ($R_{DS(on)}$ x Qg) on the market
- Industry's best $R_{DS(on)}$ for 650 V voltage range
- Lowest Qg
- Higher reverse diode dv/dt and MOSFET dv/dt ruggedness

M5 series

ST*N*M5

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

M6 series

ST*N*M6

- Lower $R_{DS(on)}$ x area vs previous generation
- Extremely low gate charge (Qg)
- Optimized capacitances profile for better efficiency @ light load
- Optimized threshold voltage (VTH) and gate resistance (RG) values for soft switching

M2/M2-EP series

ST*N*M2 **ST*N*M2-EP**

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

DM9 series

ST*N*DM9

- Best figure of Merit ($R_{DS(on)}$ x Qg) on the market
- Improved intrinsic diode reverse recovery time (trr)
- Higher dv/dt and di/dt capability
- Optimized body diode recovery phase and softness

DM6/DM2 series

ST*N*DM6 **ST*N*DM2**

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

K5 and K6 series

ST*N*K5/6

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

DK5 series

ST*N*DK5

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

MAIN APPLICATIONS

Adapters
K5, K6, M5, M2, M2-EP, M6, M9

Solar inverters, EV charging stations, energy storage systems and UPS
K5, K6, M5, M9, DM2, DM6, DM9, DK5

Welding, residential, commercial, and street lighting
K6, K5, DK5

Server/Telecoms
M9, M5, M6, M2, DM9, DM6, DM2

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

www.st.com/mosfet

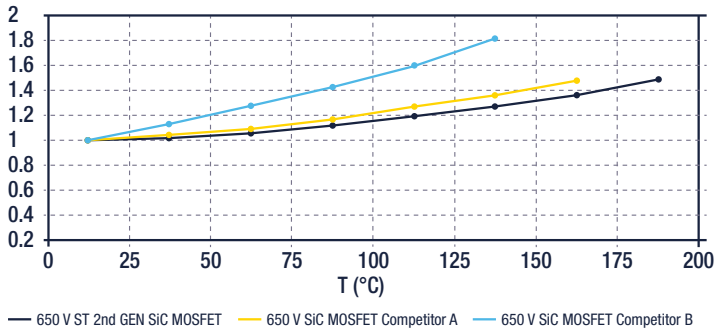
SiC MOSFETs

Based on the advanced and innovative properties of wide-bandgap materials, ST **silicon carbide (SiC) MOSFETs** feature very low $R_{DS(on)}$ per area for the 650 V/1200 V Gen3 product families, combined with excellent switching performance, translating into more efficient and compact designs.

ST is among the first companies to produce high-voltage SiC MOSFETs. These new families feature 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 and minimal variation with the temperature. These features render the device perfectly suitable for high-efficiency and high-power-density applications.

ST's SiC Mosfet 650 V - Normalized $R_{DS(on)}$ vs Temperature



Sic MOSFETS, the real breakthrough in high voltage switching

SCT*N120G3AG | **SCT*N170** | **SCT**65G3AG**

- VBR = 1700 V (SCT*N170), 1200 V (SCT*N1203AG), 650 V (SCT**65G3AG)
- 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

STPOWER

SIC MOSFETS MAIN BENEFITS

- Smaller form factor and higher power density
- Reduced size/cost of passive components
- Higher system efficiency
- Reduced cooling requirements and heatsink size

THROUGH-HOLE EXTENDED PACKAGE RANGE


HiP247 LL™


HiP247- 4L

SURFACE MOUNT EXTENDED PACKAGE RANGE


ACEPACK™ SMIT


POWER FLAT 8x8


TO-LL


HU3PAK

H2PAK-7


STPAK

MAIN APPLICATIONS

- Motor drive and factory automation
- HEVs / EVs (Traction inverter, OBC, DC-DC)
- Charging station
- UPS and data center power supply
- Solar inverters

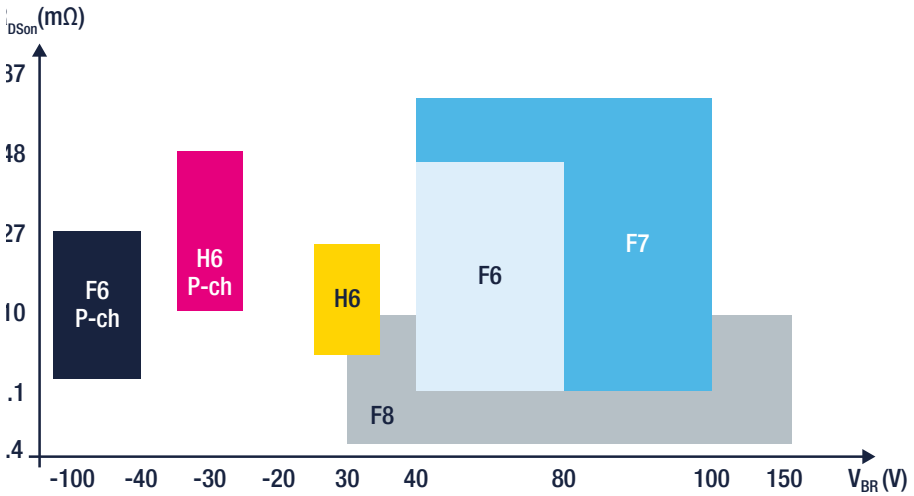
www.st.com/sicmos

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

Low-voltage power MOSFETs

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

ST **STripFET** low-voltage 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 management

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 Qrr) and intrinsic capacitance for an excellent switching performance
- Proper Crss/Ciss ratio for best-in-class EMI performance
- Outstanding performance for motor control and synchronous rectification

F8 series

ST*N*F8

- Extremely low RDS(on)
- Optimized FOM
- Increased power density
- Reduced conduction losses

STPOWER

MAIN APPLICATIONS

Small motor control and USB battery chargers
F6

HDD, power tools, STB, and game consoles
H6

Server/Telecoms and SMPS
F7, F8

UPS, e-bikes, and fans
F6, F7, F8

Solar inverters, forklifts, and EHVs
F7, F8

www.st.com/mosfet

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

POWER MODULE – ACEPACK PACKAGES OPTIONS

ST ACEPACK power modules come with several topologies that address industrial applications such as motor drives, solar inverters, charging stations, UPS, welding tools, and power converter solutions, while they are also suitable for electric vehicle power applications like on-board chargers (OBC), electric traction drives, and power converter solutions.

These highly reliable and compact power modules feature an embedded NTC thermistor and offer the best compromise between conduction and switching losses, maximizing the efficiency of any converter system in hard-switching circuitries for an application range from few kW to hundreds of kW. For flexible and stable mounting, PressFIT and additional soldered pin options are provided. These power modules implement power semiconductor switches based on ST state-of-the-art SiC MOSFET and IGBT technologies.

ACEPACK 1

Up to 15 kW

ACEPACK 2

Up to 30 kW

KEY FEATURES

- Very low stray inductance
- 2.5 KVrms electrical isolation
- Pin out flexibility
- Custom configurations
- Optimized thermal behavior
- Different DBC options (Al2O3–AlN)
- Press-fit and solder pin options

CONFIGURATIONS

- CIB
- Six-pack
- Three level t-type
- Four Pack
- Half brige
- Boost
- Customized configurations

ACEPACK DRIVE

120 kW to 300 kW

KEY FEATURES

- AMB substrate for enhanced thermal dissipation
- 3 different bus bar configuration options
- Extremely low energies dissipation
- Direct cooled Cu base plate with pin fins

CONFIGURATIONS

- Six-pack

ACEPACK DMT-32

up to 22 kW

KEY FEATURES

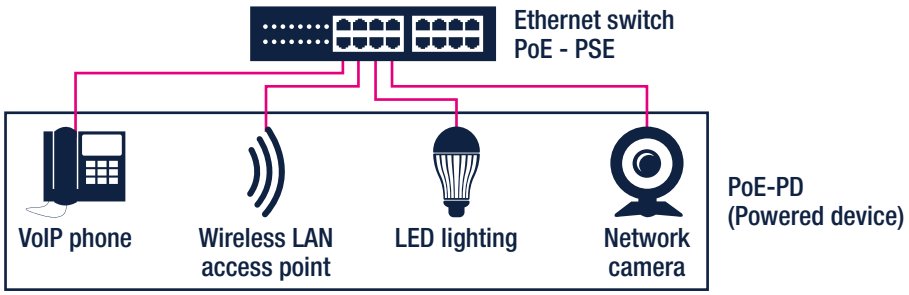
- Designed for automotive applications
- AlN DBC for improved thermal performances
- 3.0 kV insulation voltage
- SiC MOSFET, rectifiers
- Integrated NTC temperature sensor

CONFIGURATIONS

- Six-pack
- Four Pack
- Customized configurations
- In-Line and ZigZag pin options
- 3-phase, four-wire PFC

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 **PoE-PD ICs** are compliant with the more recent IEEE 802.3bt specification.



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

PM8805

- IEEE 802.3bt PoE-PD interface
- System in Package
- Dual active bridges
- HotSwap MOSFET
- Compact package (10 times smaller than discrete BOM) with high thermal performances
- 100 W capability

PM8804

- PWM current mode controller
- Double gate driver
- Support isolated active Forward converter
- Input voltage up to 75 VDC
- Embedded start-up (20 mA)
- Slope compensation
- Programmable fixed frequency (up to 1 MHz)

Main standards

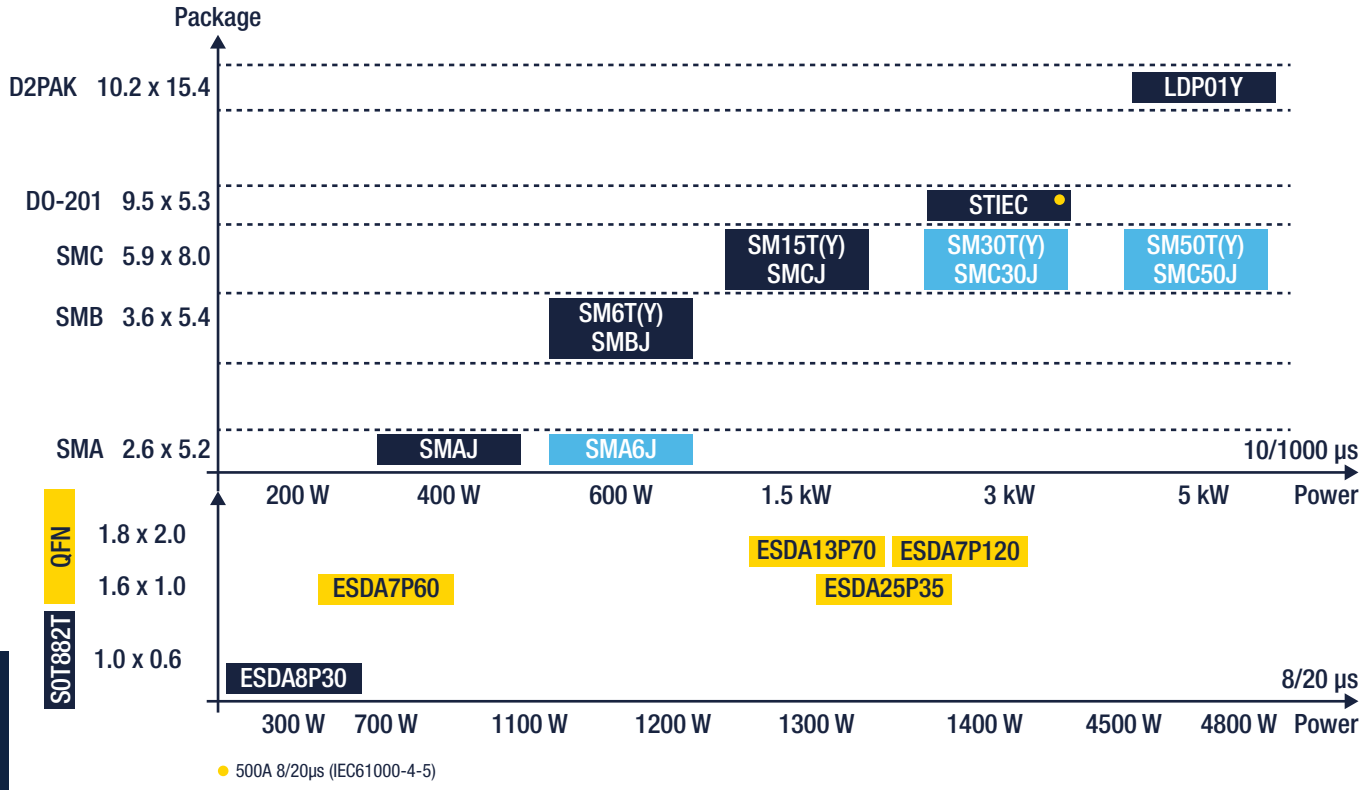
www.st.com/PoE

PROTECTION DEVICES

TVS

The **TVS transient voltage suppressor** is an avalanche diode designed to clamp over-voltages and dissipate high transient energy. TVS are power devices to protect applications against electrical over-stress (EOS), specifically against surge events as defined by IEC 61000-4-5.

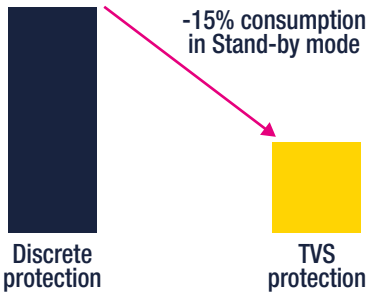
A large choice of package is available to meet application requirements.



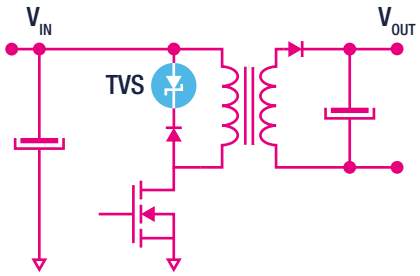
TVS Transil series against repetitive overvoltage in high temperature conditions

TVS

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



MOSFET protection with TVS



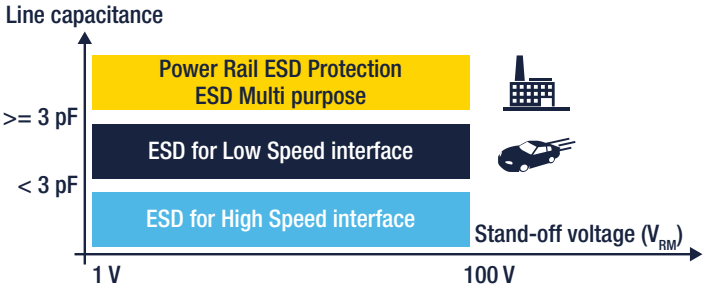
MAIN APPLICATIONS

www.st.com/eos8-20-protection

ESD protection

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

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



Power delivery protections

Ultimate TVS protection for USB fast-charging ports

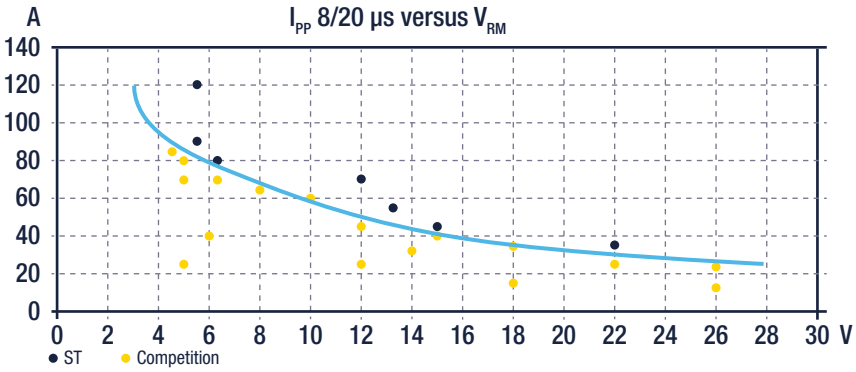
ESDAxxP

Strong and thin protection, the ESDAxxP series helps to stop damages due to the surge events

KEY FEATURES AND BENEFITS

- Complete voltage range: 5 to 22 V
- High 8/20 µs surge protection capability from 25 to 160 A peak pulse current
- Small, thin packages:
  - ST1610x (1.6 x 1.0 mm)
  - SOD882T (1.0 x 0.6 mm)
- High-power, miniature protection
- Saves PCB real-estate
- Highest peak pulse current in the market

Peak pulse current performance



Type	STM32	Pins	5 V - 15 W	9 - 27 W	15 - 45 W	20 V - 100 W
All	With or without STM32	D+/D-	ECMF2-40A100N16	ECMF2-40A100N16	ECMF2-40A100N16	ECMF2-40A100N16
		SSRx/SSTx	ECMF4-40A100N10, HSP053-4M5	ECMF4-40A100N10, HSP053-4M5	ECMF4-40A100N10, HSP053-4M5	ECMF4-40A100N10, HSP053-4M5
		CC1/CC2 SBU1/SBU2	ESDZV5-1BF4 ESDA6V1L	ESDA14V2L	ESDZX168B-1BF4 ESDA25L	ESDA25L
		Vbus	ESDA7P60-1U1M ESDA7P120-1U1M ESDA8P30-1T2 SMAJ6.0A	ESDA13P70-1U1M SMAJ10A	ESDA17P50-1U1M SMAJ18A	ESDA25P35-1U1M SMAJ22A
Sink	Yes	TCPP01-M12				
Source		TCPP02-M18				
DRP		TCPP03-M20				

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

www.st.com/esd-protection

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

STDRIVE AND STGAP GATE DRIVERS

ST **power MOSFETs and IGBTs gate drivers** include integrated high-voltage half-bridge, single and multiple low-voltage gate drivers. Robustness and reliability, system integration and flexibility. The STGAP series of isolated gate drivers provides galvanic isolation between the input section, which connects to the control part of the system and the MOSFET or IGBT being driven.

STGAP2HS - 6 kV isolation

Features

L6389E
L6388E
A/L6387E
L6386E/AD
L6385E
L6384E

L6390
L6392
L6391
L6393
L6395
L6398
L6399

STDRIVE601 (3-Phase HV)
L6491
L6494
L6498
STDRIVEG6*
STDRIVEG21*

Features

TD350E
TD352
TD351
PM8851
PM8841
PM8834

Features

STGAP3SXS/I
STGAP3S6S/I
STGAP2HS
STGAP2S/D
STGAP2SiCS/N
STGAP2HD
STGAP2SiCD
STGAP2GS/N

STGAP4S
STGAP1BS
STGAP2SA
STGAP2HSA
STGAP2SiCSAN
STGAPSiCSA

600 V gate drivers

Half bridge

- 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)
- Extended temperature range (A version)

3-Phase

- Best In Class for propagation delay 85 ns
- 200 mA/350 mA sink / source driver current capability
- Integrated bootstrap diode

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 drivers

- Up to 10 kV reinforced isolation
- High voltage rail up to 1.7 kV
- Up to 10 A source/sink driver current capability
- Protections and monitoring (STGAP1BS, STGAP3S, STGAP3*)
- Miller clamp, negative gate supply
- Optimized for SiC MOSFETs (STGAP2SiCS) and for GaN HEMT (STGAP2GSN, STGAP2GS) driving

STDRIVEG6* - high voltage half-bridge gate driver for GaN transistors

- dV/dt immunity ±200 V/ns
- Driver current capability:
  - 1.3/2.4 A source/sink typ @ 25 °C, 6 V
  - 5.5/6 A source/sink typ @ 25 °C, 15 V
- Separated turn on and turn off gate driver pins
- 45 ns propagation delay with tight matching
- Fast startup option and smart shutdown comparator option
- Interlocking function
- UVLO on low-side and high-side sections

MAIN APPLICATIONS

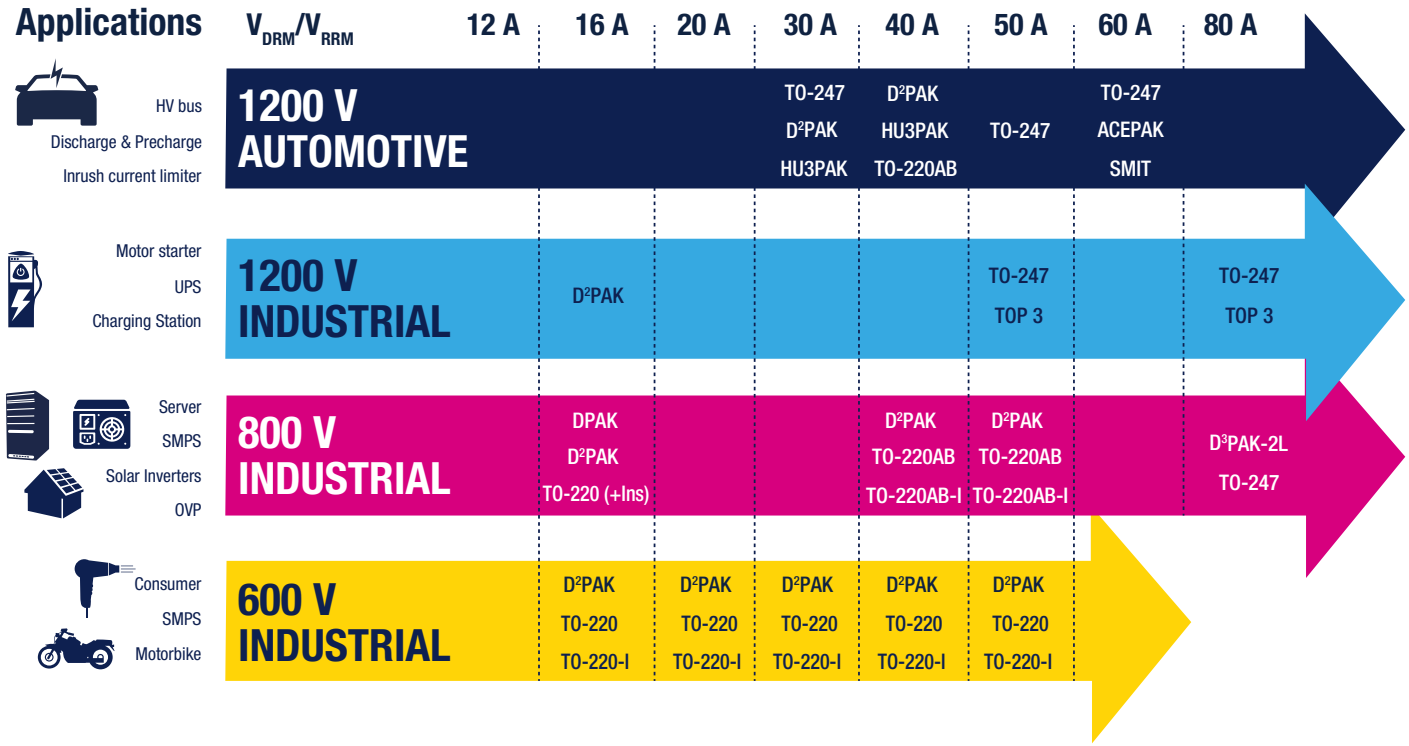
Factory automation | Home appliances | Motor control | Lighting | Solar inverters | HEV / EV

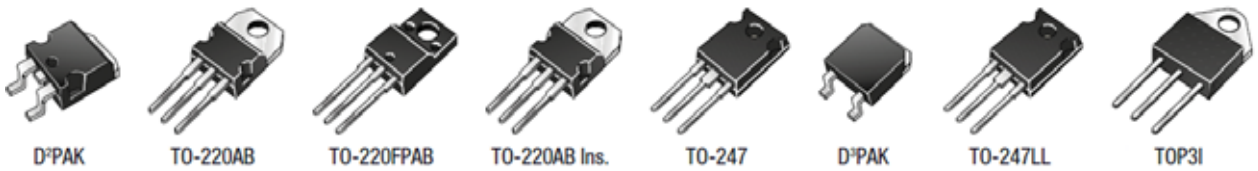
www.st.com/stdrive

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

THYRISTORS

Available in through-hole and surface-mount packages, ST **high-temperature silicon controlled rectifiers SCR** provide designers with more headroom for heatsink reduction or more compactness. In addition, the voltage surge immunity is fully specified at 150 °C, ensuring designs are precise and secure. These 12 - 80 A SCRs are ideal for use in charging stations, solid-state relays, inrush current limiters, motor starters, SMPS, UPS, and renewable-energy junction boxes. The 1200 V automotive-grade thyristor makes AC-DC converters safe by limiting the inrush current and providing insulation against AC line over-voltages.





MAIN APPLICATIONS


AC-DC conversion SMPS and PSU


UPS


EV on-board charger

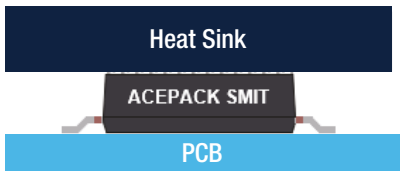

Motor control

1200 V high temperature SCRs are now available in Surface Mount packages with top-cooled capability. In discrete package with HU3PAK or in module integration with ACEPACK SMIT package, these products are suitable in all bridge or bridgeless AC-DC converter topologies, where compactness and thermal performances are optimized. Thanks to 150 °C maximum junction temperature, the **1200 V high temperature SCRs** are suitable for industrial and automotive applications in harsh environments.

TN4050HP-12xY
HU3PAK

STTN6050H-12M1Y
ACEPACK SMIT

STTD6050H-12M2Y
ACEPACK SMIT



Optimized for industrial, building and residential appliances and based on ST new high temperature technology, our 800 V **8H Triacs** can work at 150 °C without compromise. Enabling designers to maximize current density or reduce the heatsink size by up to 50%, these triacs are the right choice to run in very hot, confined environments and improve the reliability of systems such as light control, compact heaters, starters, or solid-state relays.

Part number	Package				I_T (RMS) A max	T_j °C max	V_{DRM}/V_{RRM} V max	I_{GT} mA max	I_{TSM} A max	dV/dt V/µs @ 150 °C min	(dI/dt)c A/ms @ 10 V/µs, @ 150 °C min
	TO-220AB	TO-220AB Ins.	D²PAK	TOP3 Ins							
T835H-8	T	I	G		8	150	800	35	80	2000	8
T1235H-8	T	I	G		12				120		12
T1635H-8	T	I	G		16				160		16
T2035H-8	T		G		20				200		20
T3035H-8	T	I	G		30				270		25
T5035H-8				PI	50				500		40

MAIN APPLICATIONS

Home appliances

Air conditioning

Lighting

Heating

USB TYPE-C® AND POWER DELIVERY CONTROLLERS

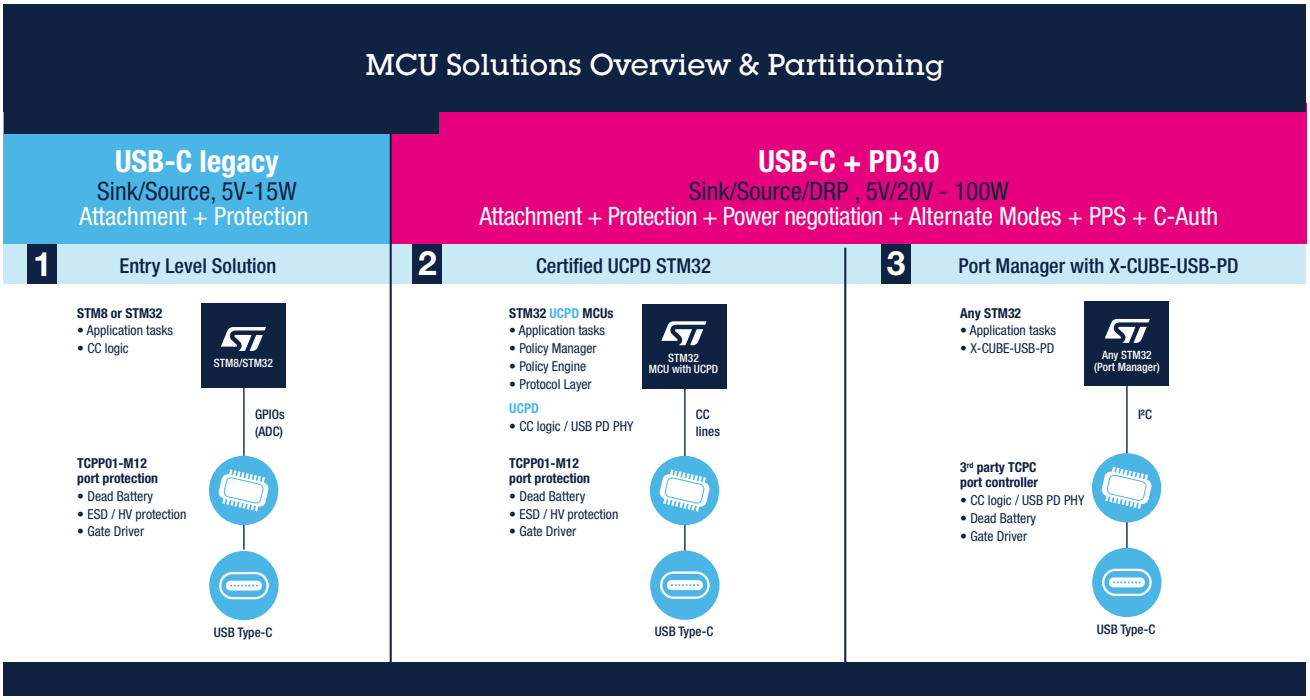
With an extensive technology and IPs portfolio, ST provide a range of **USB-IF certified solutions for USB Type-C and power delivery** to support implementations in a variety of sink, source, and dual role devices. From USB Type-C interfaces and PD controllers to authentication, ST complements the portfolio with power management ICs, full range of **protection** for data, and power line protection. ST solutions range from **Type-C port interface ICs** to **USB PD controllers** and offer wide flexibility with hard wired and MCUs to fit different use cases and all power ratings.

MCU-based solutions

Our STM32 solutions help you manage the complexity of implementing USB Type-C® and power delivery technology to ensure that your embedded application supports the latest use cases. The ST ecosystem for USB Type-C reduces the acquisition cost of a technology that requires multiple areas of expertise, such as connectivity, power management, data communication, and authentication.

Combining middleware, configuration, and debugging tools, as well as hardware development platforms, our MCU-based solutions are specifically designed to address this challenge and offer high flexibility to implement USB Type-C and power delivery (PD).

A companion Type-C Port Protection device **TCPP01-M12** is proposed for advanced protection of the USB-C connector line in sink applications, such as CC and Vbus line. For source applications like power adapters, **TCPP02-M18** is recommended (mass-production Q4-2020). For dual role Port applications (DRP), **TCPP03-M20** is recommended.

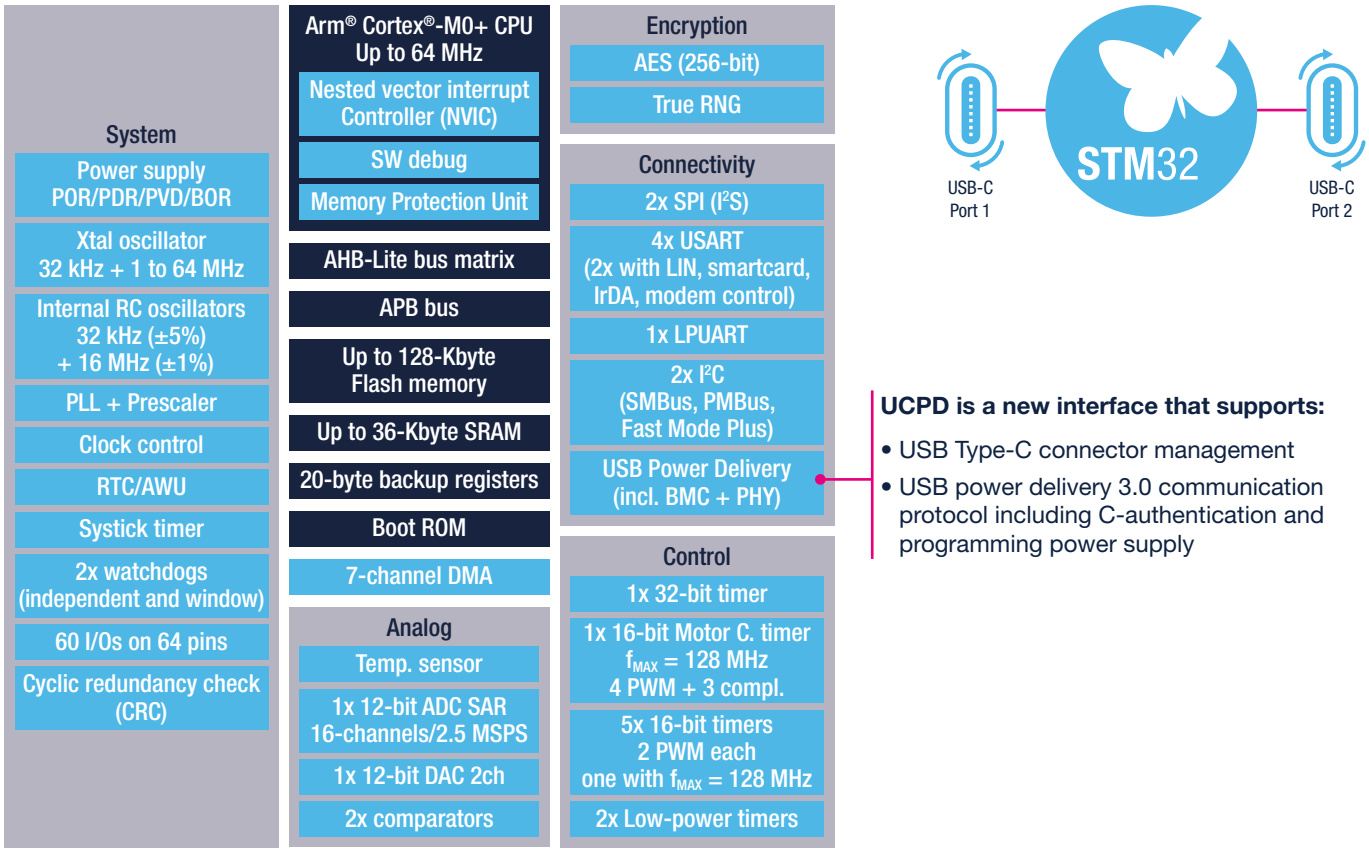


STM32 USB PD3.0 controllers

Introduced in December 2017, **STM32G0** is the world's 1st standard USB PD 3.0 microcontroller with a UCPD interface (UCPD stands for USB Type-C and power delivery).
This new IP, available in **STM32G0/G4/L5 series**, allows development of USB-C sink, source, and dual role devices in a wide range of embedded applications.
UCPD-enabled STM32G0/G4/L5 provides a high flexibility to migrate embedded applications to USB-C and power delivery technology, while managing other application environments thanks to the versatile feature set and peripherals available in a traditional MCU. UCPD is certified PD3.0 and supports all new features such as C-Authentication and programming power supply (PPS).

https://www.st.com/content/st_com/en/stm32-usb-c.html

STM32G081 block diagram



STM32G0 USB-C ecosystem: for short time-to-market

Our STM32G071B-DISCO kit enables discovery and display of USB-C power and feature capabilities of any USB-C complaint host. Associated with our professional-grade STM32CubeMonitor-UCPD software GUI, the kit acts as a USB PD analyzer and allows customers to debug, configure, and inject USB PD3.0 packets in a single click while monitoring Vbus voltage and Ibus current between two USB-C devices.
Our well-known STM32 configurator STM32CubeMx supports easy setting of UCPD.
An STM32G081B-eval evaluation board is proposed with two USB-C ports offering 45 W of power with different profiles.

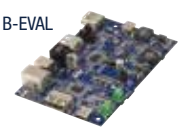
Discover and lean

STM32G071B-DISCO

Develop

NUCLEO-G071RB

STM32G081B-EVAL



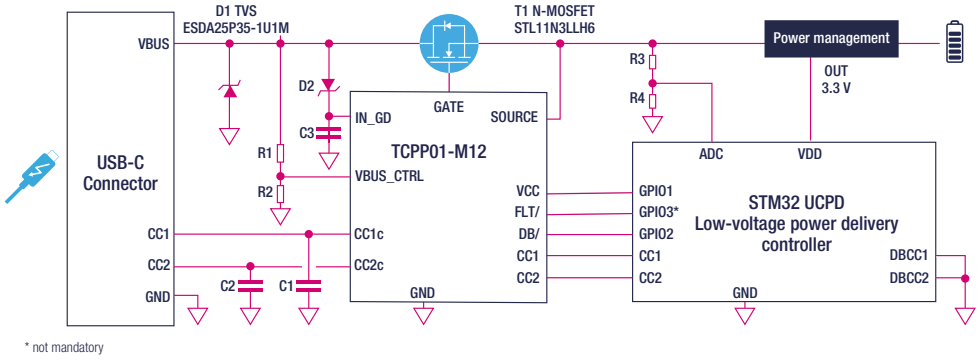
Configure and Debug

STM32 CubeMX

STM32 CubeMonitor-UCPD

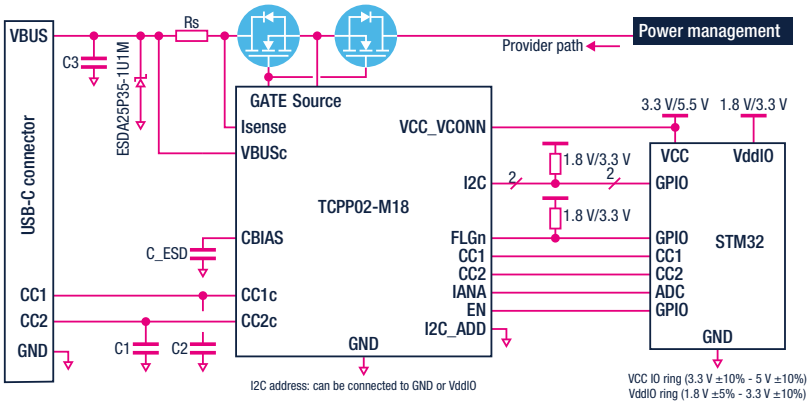
STM32 USB power delivery controller-based solutions

SINK

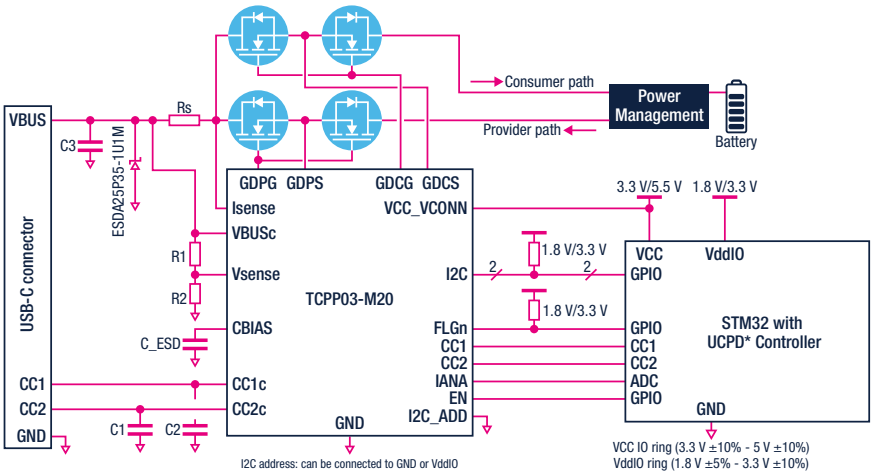


* not mandatory

SOURCE



DUAL ROLE



Note: * UCPD stands for USB Type-C and Power Delivery

KEY FEATURES

- USB-C power delivery standard 3.1, standard power range (SPR) up to 100 W
- USB-IF certified on X-NUCLEO boards
- Embedded gate drivers for N-MOSFET on consumer and provider paths
- 24 V tolerant on VBUS and CC pins
- Integrated discharge on VBUS and VCONN
- Overvoltage protection on CC lines against short-to-VBUS
- VBUS current sense analog output through amplifier
- 100 mW OCP and 6 V OVP on VCONN
- Integrated “dead battery” management
- Over temperature protection (150 °C typ.)
- I2C communication with two I2C addresses available
- IEC 61000-4-2 level 4 on CC1 and CC2 pins:
  - ±8 kV contact discharge
  - ±15 kV air discharge

  ECOPACK2, and RoHS compliant UL94, V0 molding compound
- Cost-effective solutions for driving USB-C PD when the application uses a microcontroller.

ST PROTECT

LONGEVITY 10 YEARS COMMITMENT

STUSB family of standalone (auto-run) USB-C and power delivery controllers

Being designed with ST 20 V process technology, the **STUSB family** is natively compliant with USB PD electrical requirements. STUSB controller ICs are certified and integrate the mandatory protection and application features for autonomous port management, without the need for external circuitry. STUSB controllers are optimized for power path applications ranging from 15 to 100 W, on both SINK and SOURCE sides. Being hardwired, STUSB controllers are fast and predictive to guarantee safety and interoperability, while increasing port robustness and minimizing power consumption. Implementation is fast and easy and requires no deep knowledge of the USB PD standard or advanced software skills. Standalone controllers are powered from VBUS to minimize BOM cost and can fully operate without external MCU support. For more flexibility, an MCU can optionally change main power parameters or read port status with a light software layer.

STUSB4531

- Standalone USB PD sink controller with dead battery support
- Up to 5 programmable sink PDOs (fixed, variable, PPS)
- AUTORUN mode: no MCU needed for power negotiation
- Hybrid mode: advanced features with light MCU support
- Active VBUS monitoring and integrated discharge path
- Compact QFN-16 and CSP-16 packages

STUSB4500

- USB PD SINK
- Dead battery support
- VBUS powered (ZERO power on VBAT)
- Input over voltage protection
- QFN and CSP package available
- SOURCE power profile reporting
- STSW-STUSB002: GUI
- STSW-STUSB003: optional open source software drivers for dynamic power management
- Mini-dongle: EVAL-SCS001V1

STUSB4500L

- USB-C 5 V SINK
- Dead battery support
- VBUS powered (ZERO power on VBAT)
- Input over voltage protection
- SOURCE power budget reporting
- QFN and CSP package available
- Mini-dongle: EVAL-SCS002V1

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