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

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

Auxiliary SMPS

High-power-density and cost-effective auxiliary power supplies can be designed using a converter (where each IC includes a power MOSFET combined with control and protection circuitry in a single package) at a higher switching frequency to avoid a considerable increase in transformer and output capacitor size. ST offers a wide portfolio of highly-integrated offline converters up to 20 W with an extremely low total standby consumption (less than 4 mW for VIPer0P devices) and high breakdown voltage of 800 V for the VIPerPLUS family and 900 V for the Altair05. To reduce BOM costs, the Altair family works as a constant-voltage primary-side regulator (PSR-CV) avoiding the need for a voltage reference and opto-coupler in the circuit. Discrete solutions consisting of an offline controller plus an external MOSFET are also supported by ST. New STRVS voltage suppressors improve system reliability against repetitive over-voltages. New FERD diodes feature a very low forward voltage and a low leakage reverse current improve the system efficiency.

<table>
<thead>
<tr>
<th>Offline converters</th>
<th>Offline controllers</th>
<th>HV power MOSFETs</th>
<th>Repetitive overvoltage protections</th>
<th>Clamping diodes</th>
<th>Volt. ref.</th>
<th>Output diodes</th>
<th>LDO</th>
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<tbody>
<tr>
<td>Buck</td>
<td>VIPer0P</td>
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<td>STH*06</td>
<td>STH*08</td>
<td>STH*10</td>
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<td>Buck-boost</td>
<td>VIPer*6</td>
<td>STCH02 L6566B</td>
<td>ST*N80K5</td>
<td>STRVS*</td>
<td>STPS*</td>
<td>FERD*45</td>
<td>LDF, LDFM, LDK220, LDK320, LDL212</td>
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<td>Non-isolated flyback</td>
<td>VIPer*1</td>
<td>VIPer*6</td>
<td>-</td>
<td>-</td>
<td>T*431</td>
<td>T*432</td>
<td>-</td>
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<tr>
<td>Isolated flyback</td>
<td>Regulation with optocoupler</td>
<td>VIPer*5</td>
<td>VIPer*10</td>
<td>STTH*06</td>
<td>STPS*</td>
<td>FERD*45</td>
<td>-</td>
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<tr>
<td></td>
<td></td>
<td>VIPer*7</td>
<td>VIPer*12</td>
<td>STH*08</td>
<td>FERD*50</td>
<td>FERD*60</td>
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<td>VIPer*8</td>
<td>VIPer*14</td>
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<td>FERD*100</td>
<td>FERD*100</td>
<td>-</td>
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<td></td>
<td></td>
<td>ALTAIR*</td>
<td>VIPer*6</td>
<td>T*431</td>
<td>STPS*</td>
<td>FERD*45</td>
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<td>VIPer*12</td>
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<td>VIPer*6</td>
<td>VIPer*14</td>
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<td>FERD*100</td>
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Typical configuration

<table>
<thead>
<tr>
<th>Repetitive OVP</th>
<th>Clamping Diode</th>
<th>Output Diode</th>
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</thead>
<tbody>
<tr>
<td>Offline Controller</td>
<td>HV Power MOSFET</td>
<td>Voltage Reference</td>
</tr>
<tr>
<td>Isolated Flyback</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Repetitive OVP</th>
<th>Diode Clamp</th>
<th>Output Diode</th>
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<td>Offline Converter</td>
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<tr>
<td>Non-Isolated Flyback</td>
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</table>

<table>
<thead>
<tr>
<th>~AC</th>
<th>DC</th>
</tr>
</thead>
</table>

Note 1: coming soon  * is used as a wildcard character for related part number

Main Evaluation Boards

STEVAL-ISA096V1
2 W, buck-boost

STEVAL-ISA192V1
7 W not-isolated flyback with smart standby using VIPer0P and touch sensing

STEVAL-ISA178V1
5 V/200 mA buck-converter based on VIPer01

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

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

<table>
<thead>
<tr>
<th>Offline converters</th>
<th>Controllers</th>
<th>Power MOSFETs</th>
<th>Repetitive overvoltage protections</th>
<th>Clamping diodes</th>
<th>Output diodes</th>
<th>CC/CV controllers or Voltage Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSR-CV/CC</td>
<td>VIPer<em>5, VIPer</em>7, VIPer<em>1V, VIPer</em>8</td>
<td>-</td>
<td>HV/LV</td>
<td>-</td>
<td>STRVS*</td>
<td>TSM10* T<em>431 T</em>432</td>
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<td>PSR-CV</td>
<td>HVLED001A</td>
<td>ST*N5M2</td>
<td>-</td>
<td>STH*06</td>
<td>FERD*45</td>
<td></td>
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<tr>
<td>PSR-CC</td>
<td>STCH02</td>
<td>ST*N5M6</td>
<td>-</td>
<td>STTH*08</td>
<td>FERD15SS0</td>
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<tr>
<td>PSC CV/CC</td>
<td>ALTAIR*</td>
<td>ST*N7M6</td>
<td>-</td>
<td>STTH*10</td>
<td>FERD20U50</td>
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<tr>
<td>Synch Rect</td>
<td>STSR30</td>
<td>STH35N65G2V-7 (SIC MOSFET)</td>
<td>-</td>
<td>-</td>
<td>STPO*100</td>
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<table>
<thead>
<tr>
<th>Battery charger ICs</th>
<th>Battery monitoring ICs</th>
<th>Li-Ion battery</th>
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</thead>
<tbody>
<tr>
<td>Application side</td>
<td>Linear</td>
<td>Switching</td>
</tr>
</tbody>
</table>

**Typical configuration**

- **Isolated Flyback with PSR CV/CC**
  - Repetitive OVP
  - Offline Controller
  - HV Power MOSFET
  - Clamping Diode
  - Output Diode
  - OR
  - LV Power MOSFET
  - SR Controller
  - Voltage Reference

- **Isolated Flyback with PSR CC**
  - Repetitive OVP
  - Offline Controller
  - HV Power MOSFET
  - Clamping Diode
  - Output Diode
  - OR
  - LV Power MOSFET
  - SR Controller
  - CC/CV Controller

- **Isolated Flyback with SSR CV/CC**
  - Repetitive OVP
  - Offline Controller
  - LV Power MOSFET
  - Clamping Diode
  - Output Diode
  - OR
  - LV Power MOSFET
  - SR Controller
Adapters

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

### Typical configuration

**Flyback with Optocoupler**
- **HV Power MOSFET**
- **Output Diode**
- **Controller**
- **PFC**
- **Repetitive VOP**
- **Clamping Diode**
- **Output Diode**
- **HV Power MOSFET**
- **CC/CV Controller**

**Flyback**
- **HV Power MOSFET**
- **Output Diode**
- **Controller**
- **PFC**

**Sync rect.**
- **HV-LLC**
  - **Flyback**
    - **HV Power MOSFET**
    - **Output Diode**
    - **Controller**
    - **PFC**
  - **Forward**
    - **HV Power MOSFET**
    - **Output Diode**
    - **Controller**

**DC-DC stage**
- **HB-LLC**
  - **HV Power MOSFET**
  - **Output Diode**
  - **Controller**

---

**MAIN EVALUATION BOARDS**

- **EVL6566A-75WES4**
  - 75 W, PFC + flyback
- **STEVAL-ISA170V1**
  - 150 W, PFC + HB-LLC + sync rect.
- **EVL-CMB1-90WADP**
  - 90 W, PFC + HB LLC

---

Note 1: MP in Q4 2017

* is used as a wildcard character for related part number
**USB Type-C™ Power delivery chargers and adapters**

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

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

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

### Typical configuration

![Diagram of USB Type-C Power Delivery Subsystem](image)

<table>
<thead>
<tr>
<th>USB Type-C PD Adapter</th>
<th>Chipset</th>
<th>Type-C Controller/Interface</th>
<th>Hard Coded Controllers</th>
<th>Authenticaion &amp; Secure MCUs</th>
<th>Protections</th>
<th>Protections</th>
<th>LDO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Part Provider</td>
<td>MCUs</td>
<td>Type-C Controller/Interface</td>
<td>ESD &amp; EOS Protections for VBUS Power Delivery</td>
<td>ESD &amp; EOS Protections for Communication Channel (CC lines)</td>
<td>STSAFE-A</td>
<td>STSAF-A</td>
<td>ST715 LDK320</td>
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<tr>
<td></td>
<td>STM32F0*</td>
<td>STUSB1600A</td>
<td>ESFA10P100-1U2M</td>
<td>ESDA8P30-1T2'</td>
<td>ESFA17P100-1U2M</td>
<td>ESDA25P35-1U1M</td>
<td>ESDA6V1W5</td>
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<td>STM32F3*</td>
<td>STUSB1602A</td>
<td>ESFA10P100-1U2M</td>
<td>ESDA8P30-1T2'</td>
<td>ESFA17P100-1U2M</td>
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<td>ESDA6V1W5</td>
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<td>STUSB4710A</td>
<td>ESFA10P100-1U2M</td>
<td>ESDA8P30-1T2'</td>
<td>ESFA17P100-1U2M</td>
<td>ESDA25P35-1U1M</td>
<td>ESDA6V1W5</td>
</tr>
<tr>
<td></td>
<td>STUSB4700</td>
<td>STUSB4710A</td>
<td>ESFA10P100-1U2M</td>
<td>ESDA8P30-1T2'</td>
<td>ESFA17P100-1U2M</td>
<td>ESDA25P35-1U1M</td>
<td>ESDA6V1W5</td>
</tr>
</tbody>
</table>

**MAIN EVALUATION BOARDS**

- **P-NUCLEO-USB002**
  - STUSB1600A USB Type-C and Power Delivery Nucleo Pack

- **STEVAL-CCC001**
  - STUSB1600A USB Type-C evaluation board

- **STEVAL-ISC004V1**
  - STUSB4710A evaluation board

- **STEVAL-USBDP45H**
  - 45 W USB PD Type-C adapter based on STCH02 and STUSB4700

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**Note**

1. under development
2. Available Q4 2017
   - * is used as a wildcard character for related part number
TV power supply units (PSU)
In addition to their outstanding image quality, new generation TVs gain attention for their slim silhouette and high energy efficiency; for which the TV’s power supply is a key factor. The power supply unit (PSU) requires a low profile to maintain the TV’s slim appearance and advanced silicon devices to ensure high efficiency. ST is able to offer both requirements: high-voltage MDmesh™ MOSFETs (K5, M2, M2-EP, M6, DM2, M5 series), low-voltage StriP Fet MOSFETs (F7 series), FERD/Schottky and Ultrafast diodes are available in low-profile SMD packages such as PowerFLAT™ 3.3x3.3 and PowerFLAT™ 5x6. Furthermore the MDmesh™ M2 series is available also in the new TO-220FP wide creepage and in the new TO-220FP ultra narrow lead package. STRVS protections against repetitive over-voltages feature small packages including flip-chip, SOD and uQFN. Dedicated smart analog controllers for PFC, HB-LLC resonant circuit, including the new combo controller (STCMB1) for both stages, and those for synchronous rectification enable energy-saving, high-power-density and lower-standby-power design solutions including protection features that are suitable for universal use in TVs of all sizes. The new generation of TV digital power supply units based on our STM32 microcontrollers or STNRG digital controllers guarantee more efficient and flexible solutions.

<table>
<thead>
<tr>
<th>Controllers</th>
<th>Gate drivers</th>
<th>Power MOSFETs</th>
<th>Repet overvolt. protect.</th>
<th>Clamping diodes</th>
<th>Output diodes</th>
<th>Volt. ref.</th>
<th>DC-DC conv.</th>
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<tbody>
<tr>
<td>Flyback</td>
<td>L6566A</td>
<td>-</td>
<td>ST*N80K5</td>
<td>STTH*06</td>
<td>T*431</td>
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<td></td>
<td>L6566B</td>
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<td>ST*N90K5</td>
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<td>PFC Boost</td>
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<tr>
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<td>L6563*</td>
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<td>L6564*</td>
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<td>T*431</td>
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<td>DC-DC stage</td>
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<td>L638*</td>
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<td>T*431</td>
<td>ST1S0*</td>
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<td>L639*</td>
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<tr>
<td>Flyback</td>
<td>STSR30</td>
<td>-</td>
<td>ST*N60M2</td>
<td>STPS*</td>
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<td>L598*</td>
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</tbody>
</table>

Typical configuration

Note 1: MP Q4 2017  
Note 2: 600 V MDmesh™ M2 series is available also in the new TO-220FP wide creepage and in the new TO-220FP ultra narrow lead
* is used as a wildcard character for related part number

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**MAIN EVALUATION BOARDS**

**EVLSTNRG-170W**

170 W, digital solution
PFC + HB-LLC

**EVL185W-LEDTV**

185 W, analog solution
PFC + HB-LLC
**Desktop PCs**

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

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

<table>
<thead>
<tr>
<th>Controllers</th>
<th>Power MOSFETs</th>
<th>Output diodes</th>
<th>DC-DC converters</th>
<th>E-fuses</th>
<th>LDO</th>
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<td><strong>PFC Boost</strong></td>
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<tr>
<td>CCM</td>
<td>L4981* L4984D</td>
<td>ST<em>N60M2</em> ST<em>N65M2 ST</em>N65M5</td>
<td>-</td>
<td>STH<em>R06 STH</em>T06</td>
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<tr>
<td>TM</td>
<td>L6562A* L6563* L6564* STCMB1</td>
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<td>STPSC’065 (SiC Diodes)</td>
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<td><strong>DC-DC stage</strong></td>
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<tr>
<td>HB-LLC</td>
<td>L6599A* L6699</td>
<td>ST<em>N50DM2 ST</em>N60DM2 ST<em>N60M2 ST</em>N60M2-EP ST*N60M6</td>
<td>-</td>
<td>STPS* FERD<em>45 FERD</em>60 FERD*100</td>
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<tr>
<td>Asym HB</td>
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<tr>
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<td><strong>Post Regulation</strong></td>
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<tr>
<td>Buck</td>
<td>L672* L673* PM6658A</td>
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<td>STD90NS3LLH7 STL60NS3LLH5</td>
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</tbody>
</table>

**Note:** 1: MP Q4 2017 2: 600 V MDmesh™ M2 series is available also in the new TO-220FP wide creepage and in the new TO-220FP ultra narrow lead package 3: samples available by Q3 2017 4: refer to dedicated page * is used as a wildcard character for related part number

Typical configuration

**MAIN EVALUATION BOARDS**

EVL400W-ADP/ATX
400 W, PFC CCM + HB-LLC + sync rect.
**Servers and telecoms: AC-DC power supply**

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

ST offers a high-performing product portfolio reducing the total cost of the solution: SiC diodes (STPSC*), high-voltage MDmesh™ MOSFETs (for PFC and DC-DC stages), low-voltage StriFET MOSFETs (for synchronous rectification stage), new STDRIVEsmart gate drivers (L639*, L649*). Smart controllers are available for the mentioned stages. For higher efficiency and power density systems, ST can offer also the breakthrough SiC MOSFET devices and the latest digital controller STNRGP01.

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

<table>
<thead>
<tr>
<th>Input Stage (Rect. &amp; inrush current limiter)</th>
<th>SCRs</th>
<th>Controllers</th>
<th>Gate drivers</th>
<th>Power MOSFETs</th>
<th>Diodes</th>
<th>DC-DC converters</th>
<th>E-fuses</th>
<th>LDO &amp; Op Amps</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Analog</td>
<td>MCU and digital</td>
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<table>
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<tr>
<th>PFC</th>
<th>Controller/ Gate Driver</th>
<th>HV Power MOSFETs</th>
<th>SCR</th>
<th>HV Diode</th>
<th>Gate Driver^4</th>
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</tbody>
</table>

**Typical configuration**

Note: 1: coming soon  2: MP Q1 2018  3: samples available by Q4 2017  4: only for Digital Controller  * is used as a wildcard character for related part number
**MAIN EVALUATION BOARDS**

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

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

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

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

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

- **EVAL-IPFC01V1**
  3 kW three-channel interleaved PFC

---

*Note 1: available in Q2 2016  2: available in Q3 2016  * is used as a wildcard character for related part number*
Servers and telecoms: 48 V direct conversion to CPUs, memories and ASICs

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

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

<table>
<thead>
<tr>
<th>Power Cell</th>
<th>Controllers</th>
<th>Drivers</th>
<th>LV Power MOSFETs</th>
<th>DC-DC Converter</th>
<th>LDO</th>
<th>eFuse</th>
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<tbody>
<tr>
<td>Full Bridge</td>
<td>-</td>
<td>STRG04</td>
<td>STL120N8F7</td>
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<td>STEF01</td>
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<tr>
<td>Synchronous Rectifier</td>
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<td>STRG02</td>
<td>STL100N12F7</td>
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<tr>
<td>Control Stage</td>
<td>Multiphase (up to 6 interleaved)</td>
<td>STRG06</td>
<td>STL260N45LF7 *</td>
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</tr>
</tbody>
</table>

Typical configurations

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

- 54 V/12 V, 42 A 500 W: 96.5% peak efficiency; size 4.3 inch²
- 54 V/3.3 V, 46 A 150 W: 95% peak efficiency; size 2.07 inch²
- 54 V/1 V, 78 A 78 W: 92.7% peak efficiency; size 1.1 inch²
- 54 V/DDR4, 120 A: 93.2% peak efficiency; size 3.87 inch²
- 54 V/CPU, VR13 165 W (TDP) and 360 W (peak power): 93.3% peak efficiency

Note 1: available in Q4 2017  * is used as a wildcard character for related part number
**INDUSTRIAL WELDING**

High efficiency and high switching frequency as well as reduced size and weight are the main requirements for welding applications. ST’s broad power portfolio offers energy and cost-saving products to meet the various welding power ranges. Both PFC and DC-DC stages, phase-shifted full-bridge (PS-FB) as well as two-transistor forward (TTF), can be managed by high-performing STM32 microcontrollers. New high-efficiency and high-power-density SiC MOSFETs (SCT*N120), VHV Power MOSFET or the suitable high-frequency series of trench-gate field-stop IGBTs driven by STUDRIVEsmart gate drivers (L639*, and L649*) offer optimum performance and reduce cooling requirements and heatsink size while the new STGAP1AS galvanically-isolated drivers guarantee high safety and reliability of the welding. Using SiC diodes (STPSC*) further improves system efficiency, taking advantage of silicon carbide’s superior physical characteristics over silicon.

### Typical configuration

![Typical configuration diagram](image)

Solution based on two-transistor forward topology

<table>
<thead>
<tr>
<th>MCUs</th>
<th>Gate drivers</th>
<th>IGBTs</th>
<th>HV power MOSFETs</th>
<th>Diodes</th>
<th>DC-DC converters</th>
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<tbody>
<tr>
<td>PFC Boost</td>
<td>STM32F0*</td>
<td>TD35*</td>
<td>STG*N65FB</td>
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<td>STM32F301</td>
<td>PM8834/41</td>
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<td>STM32F334</td>
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<td>STG*N65FB</td>
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<tr>
<td>DC-DC stage</td>
<td>STM32F334</td>
<td>L638*</td>
<td>STG*N65FB</td>
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<tr>
<td>PS-FB</td>
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<td>L638*</td>
<td>STG*N65FB</td>
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<td>L639*</td>
<td>STG*N65FB</td>
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<td>STG*N65FB</td>
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</tbody>
</table>

Note: * is used as a wildcard character for related part number
LED LIGHTING - GENERAL ILLUMINATION

Residential lighting

LED efficacy and driver IC market requirements are constantly evolving. Residential lighting applications need a high integration level, high efficiency, high power factor (PF), long lifetime, and dimming capabilities as well as a low system cost and component count. ST offers a wide portfolio of highly integrated offline converters up to 15 W (each IC includes a power MOSFET combined with control and protection circuitry on a single chip) working with a high breakdown voltage of 800 V. Among these, HVLED805, HVLED807PF and HVLED815PF LED driver converters work with a high PF and in constant-current/constant-voltage mode primary-side regulation (PSR-CC/CV) avoiding the need of secondary side regulation ICs and opto-coupler in the circuit, thus reducing costs. Thanks to its high-power-density DC-DC LED driver converters (controller + MOSFET in the same chip), ST can support MR16 LED replacement lamps for halogen light bulbs.

<table>
<thead>
<tr>
<th>Offline LED driver converters</th>
<th>Offline converters suitable for LED driving</th>
<th>CC/CV controllers</th>
<th>Repetitive overvoltage protections</th>
<th>Clamping diodes</th>
<th>Output diodes</th>
<th>DC-DC LED driver converters</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR16 halogen bulb replacement</td>
<td>-</td>
<td>-</td>
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<td>LED5000 LED6000</td>
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<tr>
<td>Buck, Buck-boost</td>
<td>VIPerOP VIPer<em>1 VIPer</em>6</td>
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<td>-</td>
<td>STPS*150 AF</td>
<td>STPS3170UF</td>
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<td>STPSxxZ/F</td>
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<td>STTHxxZ/F</td>
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<tr>
<td>HPF Buck-boost</td>
<td>HVLED805 HVLED807PF HVLED815PF</td>
<td>-</td>
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<td>STTH*</td>
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<td>HPF Flyback</td>
<td>VIPer5 VIPer<em>7 VIPer</em>8</td>
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<td>STPS200</td>
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</tbody>
</table>

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

Typical configuration

- Repetitive OVP
- Clamping Diode
- Output Diode
- Offline LED driver converter
- HPF Flyback with PSR CV/CC
- Offline LED driver
- Offline Converter
- Output Diode
- Power Management and LED driving

Phase Cut Dimmer
0-10 V/PWM Dimmer

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

<table>
<thead>
<tr>
<th>Connectivity</th>
<th>Chipset</th>
<th>Certified Module</th>
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<tbody>
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<td>BlueNRG-MS</td>
<td>BALF-SPI-01D3</td>
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<td>BALF-SPI-02D3</td>
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<td></td>
<td>BlueNRG-MS</td>
<td>BALF-SP2-01D3</td>
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<td></td>
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<td>BALF-SP2-02D3</td>
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<tr>
<td><strong>Sub 1 GHz Connectivity</strong></td>
<td>SPIRIT1</td>
<td>SPSGRF (868 and 915 MHz)</td>
</tr>
<tr>
<td></td>
<td>S2-LP</td>
<td>SPSGRFC (433, 868 and 915 MHz)</td>
</tr>
</tbody>
</table>

**Typical configuration**

- **Power Management and LED driving stage**
- **Bluetooth Low Energy Connectivity**
  - BT Low Energy SoC
  - BALUN

- **Sub 1 GHz Connectivity**
  - MCU
  - SPI
  - Sub 1 GHz RF
  - BALUN

**MAIN EVALUATION BOARDS**

- **EVLHVLED815W10A**
  - 10 W, buck-boost LED driver

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

- **EVALHVLED815W15**
  - 15 W, flyback LED driver

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

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

### Typical configuration

<table>
<thead>
<tr>
<th>Offline LED driver controller</th>
<th>Digital controllers, MCUs</th>
<th>Gate drivers</th>
<th>Power MOSFETs</th>
<th>Clamping diodes</th>
<th>Repetitive overvoltage protections</th>
<th>Output diodes</th>
<th>DC-DC LED driver converters</th>
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<td><strong>HPF Flyback</strong></td>
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<tr>
<td>Multiple strings mgmt</td>
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</tbody>
</table>

Note 1: only for digital solution  
* is used as a wildcard character for related part number
ST offers products and solutions to enrich the LED lighting applications with wireless connectivity.

### Wireless Connectivity

<table>
<thead>
<tr>
<th>Chipset</th>
<th>Connectivity IC</th>
<th>MCU</th>
<th>Balun</th>
<th>Certified Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>BlueNRG-MS</td>
<td>BlueNRG-MS</td>
<td>STM32F0*</td>
<td>BALF-SPI-01D3</td>
<td>SPBTLE-RF</td>
</tr>
<tr>
<td></td>
<td>SPIRIT1</td>
<td>STM32F0*</td>
<td>BALF-SPI-01D3</td>
<td>SPBTLE-RF0</td>
</tr>
<tr>
<td></td>
<td>S2-LP</td>
<td>STM32L0*</td>
<td>BALF-SP-01D3</td>
<td>SPSGRF (868 and 915 MHz)</td>
</tr>
<tr>
<td></td>
<td>STEVAL-ILL054V2</td>
<td>-</td>
<td>BALF-SP-02D3</td>
<td>SPSGRF (433, 868 and 915 MHz)</td>
</tr>
</tbody>
</table>

### Typical Configuration

**Bluetooth Low Energy Connectivity**

- Power Management and LED driving stage
- BT Low Energy SoC
- BALUN

**Sub 1 GHz Connectivity**

- Power Management and LED driving stage
- MCU
- SPI
- SPI
- Sub 1 GHz RF
- BALUN
- Gateway
- IoT Cloud

### MAIN EVALUATION BOARDS

- **STEVAL-ILL080V1**: 18 W Tube replacement zero ripple LED driver using HULED001A
- **STEVAL-ILL069V2**: 35 W, analog power supply (CV) for LED driving
- **STEVAL-ILL077V1**: 60 W, digital multiple-string LED driver
- **STEVAL-ILL051V2**: 18 V-3 A, buck LED driver converter
- **STEVAL-ILL054V2**: 18 V-4 A, buck LED driver converter

*Note: available in Q4 2017*
Street lighting

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

The multiple strings power supply architecture consists of a main power supply providing a constant bus voltage and a subsequent multiple strings. Usually the main power stage, consisting of a high power factor (HPF) flyback converter or a power factor correction (PFC) controller combined with an LLC resonant converter, provides the constant voltage bus. The subsequent LED strings control is implemented by multiple buck or reverse buck converters. ST offers analog and digital solutions to cover both stages (power and LED control).

<table>
<thead>
<tr>
<th>Analog controllers</th>
<th>Digital controllers, MCUs</th>
<th>Gate drivers</th>
<th>Power MOSFETs</th>
<th>Clamping diodes</th>
<th>Repetitive overvoltage protections</th>
<th>Output diodes</th>
<th>DC-DC LED driver converters</th>
<th>DC-DC Conv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPF Flyback</td>
<td>PSR-CV</td>
<td>L4981* L4984D</td>
<td>ST<em>N90K5</em></td>
<td>STH*06</td>
<td>STRVS*</td>
<td>STPS* FERD*</td>
<td>STTH* T06</td>
<td>L698*</td>
</tr>
<tr>
<td>PFC Boost</td>
<td>CCM</td>
<td>L6562A* L6563* L6564* STCM1</td>
<td>ST<em>N60M2</em></td>
<td>-</td>
<td>STTH*R06 (SiC Diodes)</td>
<td>STPS* FERD*</td>
<td>STTH15AC06*</td>
<td></td>
</tr>
<tr>
<td>DC-DC stage</td>
<td>HB-LLC</td>
<td>L6599A* L6699</td>
<td>ST<em>N50M2</em></td>
<td>-</td>
<td>STTH*06 (SiC Diodes)</td>
<td>STPS* FERD*</td>
<td>STTH15AC06*</td>
<td>L698* L7985 L7986 L7987**</td>
</tr>
<tr>
<td>Sync rect.</td>
<td>SRK2000A SRK2001</td>
<td>L6395*</td>
<td>ST<em>N60M2</em></td>
<td>-</td>
<td>STPS* FERD* (≥200 V series)</td>
<td>LED5000</td>
<td>LED6000</td>
<td></td>
</tr>
<tr>
<td>Multiple strings mgmt</td>
<td>Buck Reverse buck</td>
<td>L6395*</td>
<td>ST<em>N60M2</em></td>
<td>-</td>
<td>STPS* FERD* (≥200 V series)</td>
<td>LED5000</td>
<td>LED6000</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: MP Q4 2017  2: only for digital solution  * is used as a wildcard character for related part number

Typical configuration
In regard to analog solutions, ST’s has a wide offer. The new flyback offline LED controllers (HVLED001A) with constant-voltage primary-side regulation (PSR-CV) does not need an opto-coupler and voltage reference in the circuit (lower costs). The new STCM16 smart offline combo controller for PFC and HB-LLC resonant circuits, the new HVLED002 led driver controller for reverse buck, and the dedicated high-voltage/high-current DC-DC LED driver converters (LED5000 and LED6000) for LED strings management ensure easy and efficient analog solutions. For high-efficiency and flexible digital solutions, ST offers STLUX, a new series of dedicated digital lighting controllers, along with high-performance STM32 microcontrollers to manage both power and LED driving (reverse buck) stages. The new high-voltage MDMesh™ MOSFETs series (suggested for flyback, PFC and LLC stages), the low-voltage STripFET MOSFETs series (used in reverse buck topologies) and the SiC diodes (STPSC*) make sure that solutions are very efficient and reliable.

### Wireless Connectivity

<table>
<thead>
<tr>
<th>Connectivity IC</th>
<th>MCU</th>
<th>Balun</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPIRIT1</td>
<td>STM32F0*</td>
<td>BALF-SPI-01D3</td>
</tr>
<tr>
<td>S2-LP</td>
<td>STM32L0*</td>
<td>BALF-SPI-02D3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BALF-SP-01D3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BALF-SP-02D3</td>
</tr>
<tr>
<td>SPGRF (868 and 915 MHz)</td>
<td>SPGRFC (433, 868 and 915 MHz)</td>
<td></td>
</tr>
</tbody>
</table>

### Typical configuration

**Main Evaluation Boards**

- STEVAL-ILL066V2
  - 100 W, digital single-string PSR-CC LED driver

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

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

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

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

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

---

Note 1: MP Q4 2017  
2: only for Analog Solution  
3: available in Q4 2017  
* 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 the miscellaneous (Air conditioner, water heater) equipment are some of the major home appliance applications that ST, thanks to its wide product portfolio, is able to satisfy with suitable and dedicated power products for both power factor correction (PFC) and 3-phase inverter stages managed by high-performing STM32 microcontrollers combined with complementary new STDRIVESmart gate drivers (L639*, and L649*). Using new SiC diodes (STPSC*), high-efficiency PFC is guaranteed by the usage of new high-voltage MDmesh™ MOSFETs or suitable field-stop trench-gate IGBTs. To reduce the 3-phase inverter CTM design time and implementation efforts, 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 and features. Another approach for designing a 3-phase inverter is based on the use of six discrete IGBTs/MOSFETs and gate drivers mentioned before. High- and low-voltage DC-DC converters guarantee high power density for the post-regulation stages. High reliability against the inrush current is ensured by new SCRs in the front-end stage.

### Typical configuration

<table>
<thead>
<tr>
<th>~ AC</th>
<th>Rect. &amp; inrush current limiter</th>
<th>PFC</th>
<th>Gate driver</th>
<th>MCU</th>
</tr>
</thead>
</table>

### Power stage 1

- **Driving stage**
  - Compressors, Drum motors, Washing pumps
  - IPM

### Power stage 2

- **Fans, Drain pumps**

### DC-DC converters

<table>
<thead>
<tr>
<th>Voltage reg.</th>
<th>HV</th>
<th>LV</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRIAC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED array</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Linear voltage regulators

- **PFC**
- **Boost**
- **Bridges**
- **Compr.**
- **Fans**
- **Pumps**

### Main Evaluation Boards

- **STEVAL-IHT008V1**
  - 1 kW, digital inrush current limiter based on Triac

- **STEVAL-IPM**
  - 300 W to 3 kW Power board based on SLLIMM™

---

**Note:**
1. available in Q4 2017
2. SMD package options available in Q4 2017
3. suitable for Interleaved PFC
   - * is used as a wildcard character for related part number
Induction heating

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

<table>
<thead>
<tr>
<th>MCUs</th>
<th>Gate drivers</th>
<th>IGBTs</th>
<th>LED array drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-switch quasi-resonant (voltage resonance)</td>
<td>STM8* STM32F100</td>
<td>TD35* PM8841 PM8951</td>
<td>STG<em>IH125DF STG</em>IH135DLF2*</td>
</tr>
<tr>
<td>HB series resonant (current resonance)</td>
<td>STM32F0* STM32F100</td>
<td>L638* L639* L649*</td>
<td>STG<em>IH65DFB STG</em>IH60DLFB STG<em>IH65DF</em></td>
</tr>
<tr>
<td>User interface (front panel)</td>
<td>STM8* STM32F0* STM32F4* STM32F7*</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note 1: In development, to be release in Q1 2018
* is used as a wildcard character for related part number

Topology example

**Half-bridge series-resonant induction heating system**

**Single-switch quasi-resonant induction heating system**

**MAIN EVALUATION BOARD**

Board available on request
1.8 kW, quasi-resonant induction cooking system
RENEWABLE ENERGY & HARVESTING

Photovoltaic (centralized)

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

By integrating high-performance STM32 microcontrollers, the new high-efficiency SiC MOSFETs (SCT*N120), the new trench-gate field-stop IGBTs series, the SiC diodes (STPSC*) and the new STGAP1AS galvanically-isolated gate drivers, it’s possible to guarantee a high-efficiency central inverter implementation.

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

<table>
<thead>
<tr>
<th>Central inverter</th>
<th>MCU</th>
<th>Gate drivers</th>
<th>HV power MOSFETs</th>
<th>IGBTs</th>
<th>Diodes</th>
<th>Bypass Diodes</th>
<th>DC-DC converters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junction box</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC-DC stage</td>
<td></td>
<td>STM32F1*</td>
<td>ST*60DM2</td>
<td>ST*</td>
<td>STPS*30</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STM32F2*</td>
<td></td>
<td></td>
<td>STPS*45</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STM32F3*</td>
<td></td>
<td></td>
<td>FERD30M45</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STM32F4*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STM32F7*</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>STGAP1AS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC-AC stage</td>
<td></td>
<td>STG*H65DFB</td>
<td>ST*V60DF</td>
<td>ST*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STG*V120DF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STG*M120DF3</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STG*M65DF2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>STG*M120DF2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>STG*M65DF8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Typical configuration

Centralized approach for a solar energy solution

Note: * is used as a wildcard character for related part number
**Photovoltaic (distributed)**

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

The fully distributed approach integrates, at the PV panel level, a microinverter that includes a complete converter (DC-DC with MPPT as well as DC-AC) and manages the AC grid connection. The high-performing STM32 microcontrollers, the new high-efficiency high-voltage MDmesh™ MOSFET series, the new low-voltage STripFET MOSFET series and the SiC diodes (STPSC*) guarantee a high-efficiency converter while the new STGAP1AS galvanically-isolated gate drivers offer high safety and reliability. High- and low-voltage DC-DC converters guarantee high power density for the post-regulation stages.

### Typical configurations

**Partially distributed approach**

- **High Voltage DC bus**
- **DC-AC**
- **Central inverter**
- **HV power optimizer**

**Fully distributed approach**

- **AC grid**
- **Microinverter**
- **DC-AC**
- **DC-DC**

---

**Note:** * is used as a wildcard character for related part number
Solar – Thermo electric generator (TEG)

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

<table>
<thead>
<tr>
<th>Battery Charger with MPPT</th>
<th>Battery Charger</th>
<th>Thin-film batteries</th>
<th>Linear voltage regulators</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 mW to 3 W Boost</td>
<td>SPV1040</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PV</td>
<td></td>
<td></td>
<td>STL0015</td>
</tr>
<tr>
<td>Up to 400 mW Boost &amp; Buck-Boost</td>
<td>SPV1050</td>
<td>STBC15³</td>
<td>EFL700A39</td>
</tr>
<tr>
<td>PV and TEG</td>
<td></td>
<td></td>
<td>STL0020</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ST715</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LD39130S</td>
</tr>
</tbody>
</table>

Typical configuration

Solar panel
Thermo electric generator (TEG)

Energy Harvester, Battery charger with MPPT, Power Management

Sensing Processing (MCU) Connectivity (RF Transceiver)

Consumer portable
Climate monitoring
Industrial monitoring
Body monitoring

MAIN EVALUATION BOARDS

STEVAL-GPT001V1² Solar Rechargeable Smart Watch with SPV1050

STEVAL-IDS002V1 Autonomus wireless multisensor node powered by PV cells

STEVAL-IDS003V1³ Autonomus wireless multisensor node powered by TEG

Note 1: available in Q4 2017      2: available in Q4 2017      3: available in H2 2017      * is used as a wildcard character for related part number
UNINTERRUPTABLE POWER SUPPLIES (UPS)

Today the vast increase of sensitive loads due to the explosion in digital technology requires a high-quality supply of electrical power. In addition to its primary function of ensuring the continuity of service, an uninterruptable power supply (UPS) improves the quality of the voltage supplied to the load (computer, industrial processes, instrumentation, telecommunication, etc.). The double-conversion configuration usually is used for high-end applications in particular for medium- or high-power UPSs; offline systems are adopted for low power applications. Each stage of these configurations (PFC, charge controller, etc.) is supported by ST’s portfolio. SiC diodes (STPSC*), new high-voltage MDmesh™ MOSFETs (M2, DM2, M5 series), new low-voltage STripFET™ MOSFETs (F6, F7 series), trench-gate field-stop IGBTs, SiC MOSFETs (SCT*N120), new STGAP1AS galvanically-isolated gate drivers and high-performance STM32 microcontrollers guarantee high reliability and efficiency.

<table>
<thead>
<tr>
<th>Feature</th>
<th>MCUs and Digital Controllers</th>
<th>Gate drivers</th>
<th>IGBTs</th>
<th>Power MOSFETs</th>
<th>Diodes</th>
<th>SCRs</th>
<th>Triacs</th>
<th>Linear voltage regulators</th>
<th>DC-DC Conv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rect. &amp; inrush current limiter</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>STBR3012</td>
<td></td>
<td></td>
<td>T1635T</td>
<td>-</td>
</tr>
<tr>
<td>PFC Boost</td>
<td>STNRGPF01</td>
<td>PM8834</td>
<td>STG*H650DB</td>
<td>STBR6012</td>
<td>TN4015H-6</td>
<td>TN5015H-6</td>
<td>TM85050H-8</td>
<td>TN305050H-12Y</td>
<td>TN5050H-12Y</td>
</tr>
<tr>
<td>Charge controller</td>
<td>HB</td>
<td>L638*</td>
<td>STG*H650DB</td>
<td>STN60M2</td>
<td>STH*06</td>
<td>STH*L06</td>
<td>STH*S12</td>
<td>STPSC* (SiC Diodes)</td>
<td>-</td>
</tr>
<tr>
<td>DC-DC stage Push Pull NPC FB</td>
<td>STM32F4*</td>
<td>PM8834</td>
<td>STG*H650DB</td>
<td>STN60M2</td>
<td>STH*06</td>
<td>STH*L06</td>
<td>STH*S12</td>
<td>STPSC* (SiC Diodes)</td>
<td>-</td>
</tr>
<tr>
<td>DC-AC stage NPC FB</td>
<td></td>
<td>L638*</td>
<td>STG*H650DB</td>
<td>STT*N120</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>L698*</td>
</tr>
<tr>
<td>Bypass</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Example of high-end configuration

Normal operation
Backup operation

Double-conversion system solution

Note: * is used as a wildcard character for related part number
### e-MOBILITY

#### On-board chargers

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

<table>
<thead>
<tr>
<th>PFC</th>
<th>HV Input rectification and LF path devices</th>
<th>MCUs Gate drivers</th>
<th>HV Power MOSFETs Silicon</th>
<th>HV output diodes</th>
<th>Bypass diodes</th>
<th>Protections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interleaved boost</td>
<td>STTH16L06C-Y&lt;br&gt;STTH30L06-Y&lt;br&gt;STBR*012-Y</td>
<td>TN3050H-12Y&lt;br&gt;STGAP1AS</td>
<td>STB43N65M5&lt;br&gt;STW62N65M5&lt;br&gt;STW78N65M5</td>
<td>STPSC12065-Y&lt;br&gt;STPSC20065-Y&lt;br&gt;STPSC40065C-Y</td>
<td>-</td>
<td>STTH30L06-Y&lt;br&gt;STBR*012-Y</td>
</tr>
<tr>
<td>Semi-bridgeless</td>
<td>STBR*012-Y</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>SM4TY</td>
<td></td>
</tr>
<tr>
<td>Totem pole</td>
<td>STTH30L06-Y&lt;br&gt;STBR*012-Y</td>
<td>TN3050H-12WY&lt;br&gt;STW62N65M5&lt;br&gt;STW78N65M5</td>
<td>SPC58R&lt;br&gt;STPSC10H12-Y&lt;br&gt;STPSC15H12-Y&lt;br&gt;STPSC20H12-Y</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Vienna original (3-Phase)</td>
<td>-</td>
<td>E Line&lt;br&gt;N Line</td>
<td>A6387&lt;br&gt;STGAP1AS</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Vienna modified (3-phase)</td>
<td>STTH30L06-Y&lt;br&gt;STBR*012-Y</td>
<td>TN3050H-12WY&lt;br&gt;STW62N65M5&lt;br&gt;STW78N65M5</td>
<td>SPC57&lt;br&gt;STPSC10H12-Y&lt;br&gt;STPSC15H12-Y&lt;br&gt;STPSC20H12-Y</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

#### DC-DC stage

<table>
<thead>
<tr>
<th>DC-DC stage</th>
<th>HV Input rectification and LF path devices</th>
<th>MCUs Gate drivers</th>
<th>HV Power MOSFETs Silicon</th>
<th>HV output diodes</th>
<th>Bypass diodes</th>
<th>Protections</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB-PS</td>
<td>-</td>
<td>-</td>
<td>STW45N60DM2AG&lt;br&gt;STW58N60DM2AG&lt;br&gt;STW72N60DM2AG&lt;br&gt;STWA50N65DM2AG&lt;br&gt;STWA58N65DM2AG&lt;br&gt;STWA65N65DM2AG</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>FB-LLC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3-Level HB LLC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

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

Note 1: samples available on request  
2: SCR option to replace relay for inrush current limit  
3: available in Q1-2018  
* is used as a wildcard character for related part number
WIRELESS CHARGING

In the coming years, wireless charging applications will become more and more common for a wide range of applications starting with today’s smartphone charging. ST already offers dedicated and general-purpose wireless ICs for Transmitter (Tx) and Receiver (Rx) side able to support Qi/ PMA and AirFuel market standard and the main topologies: STWBC-WA (Tx) and STWLC04 (Rx) for wearables, STWBC (5 W Tx), STWBC-EP (15 W Tx) and STWLC03 (5 W Rx), STWLC33 (15 W Rx) for the other mobile applications. The use of new low-voltage StripFET MOSFETs guarantees high-efficiency converters. To reduce the time to market, a complete wireless kit (Tx + Rx) for wearables and a general-purpose wireless evaluation boards are available.

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>DC-AC stage</th>
<th>HB</th>
<th>STWBC</th>
<th>STWBC-WA</th>
<th>STWBC-EP</th>
<th>STM32F0*</th>
<th>Gate drivers</th>
<th>Power MOSFETs</th>
<th>Protections</th>
<th>Diodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver</td>
<td>Rectification</td>
<td>STWLC03</td>
<td>STWLC04</td>
<td>STWLC33</td>
<td>STM32F0*</td>
<td>L6747*</td>
<td>STL*NS3LLLH7</td>
<td>ST*N2VH5</td>
<td>-</td>
<td>STPSxx45/60/100 FERDxx45/60/100</td>
</tr>
<tr>
<td></td>
<td>Voltage/Current regulation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>SMM4F SMA6J*</td>
<td>BAT30F4</td>
<td>BAT46</td>
<td></td>
</tr>
</tbody>
</table>

Typical configuration

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>Power stage</th>
<th>Primary Coil</th>
<th>Communication</th>
<th>Secondary Coil</th>
<th>Rectification</th>
<th>V/I regulation</th>
<th>Battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver</td>
<td>Wireless power transmitter, MCU</td>
<td>Wireless power receiver, MCU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MAIN EVALUATION BOARDS

STEVAL-ISB027V1  Qi A11 Wireless charger transmitter based on STWBC
STEVAL-ISB036V1  Wireless charger receiver based on STWLC03
STEVAL-ISB042V1  Qi 15 W AirFuel inductive 5 W dual mode receiver and Qi based 3 W transmitter with STWLC33
STEVAL-ISB044V1  Qi 15W Wireless Charger transmitter based on STWBC-EP
STEVAL-ISB038V1  Wireless charging reference design kit for wearables based on STWBC-WA and STWLC04

Note: * available in Q4 2017  * is used as a wildcard character for related part number
eDesignSuite

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

SMART SIMULATOR AND SYSTEM DESIGN ENGINE

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

SMART SELECTOR

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

CONFIGURATORS

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

Smart simulator and system design engine view
AC-DC CONVERSION ICs

High-voltage converters

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

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

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

ViPerPLUS & ALTAIR

PWM controller + HV power MOSFET
in the same package

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

Different features for different controllers

- ViPerOP
  - Zero-Power Mode
- ViPer series 1
  - Low VCC voltage
- ViPer series 5
  - Quasi-resonant
- ViPer series 6
  - Minimal BoM
- ViPer series 7
  - Brown-out
- ViPer series 8
  - Peak power
- Altair
  - PSR CC/CV

Different MOSFET size for different output power capabilities

<table>
<thead>
<tr>
<th>Fly-back Converter 85-265 Vac</th>
<th>4 W</th>
<th>6 W</th>
<th>8 W</th>
<th>12 W</th>
<th>15 W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buck Converter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max $R_{	ext{DS(on)}}/I_{	ext{lim}}$</td>
<td>30 Ω/350 mA</td>
<td>24 Ω/400 mA</td>
<td>20 Ω/400 mA</td>
<td>14 Ω/700 mA</td>
<td>7 Ω/700 mA</td>
</tr>
<tr>
<td></td>
<td>150 mA</td>
<td>200 mA</td>
<td>200 mA</td>
<td>350 mA</td>
<td>4.5 Ω/1 A</td>
</tr>
</tbody>
</table>

$V_{	ext{SWISS}} = 800$ V, $900$ V (Altair05)

MAIN APPLICATIONS

- Consumer electronics
- Factory automation
- Home appliances
- Lighting
- Metering
- Home automation

Note 1: available in Q3 2017

* is used as a wildcard character for related part number

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

TM PFC controllers

CCM PFC controllers

![Diagram of TM and CCM PFC controllers]

**Main Applications**

Adapters and TVs
- L6562A*, L6563*, L6564*

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

Desktop PCs and Server
- L4981*, L4984D

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

www.st.com/ac-dc-converters
www.st.com/pfc-controllers
PWM and resonant controllers

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

Flyback controllers

**STCH02**
- Offline quasi-resonant controller in SO-8 package
- Constant-current primary-side regulation mode (PSR-CC) or constant-voltage regulation with optocoupler
- Advanced burst mode operation (< 10 mW consumption @ no load)
- 650 V HV start up

**L6566***
- Offline fixed-frequency or quasi-resonant controllers
- Suited for SMPS with PFC front-end (A version)
- Suited for SMPS with 3-phase mains (BH version)
- 700 V start up (A/B version), 840 V start up (BH version)

**L6565***
- Offline quasi-resonant controller
- Constant power vs mains change
- Ultra-low start-up current

HB-LLC resonant controllers

<table>
<thead>
<tr>
<th>Basic features</th>
<th>Anti-capacitive protection</th>
<th>Self-adjusting dead-time</th>
<th>Soft burst mode</th>
<th>Smooth Start-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>L6699</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L6599A***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Combo controller (PFC+LLC)

**STCMB1**
- 800 V start-up voltage
- Embedded X-cap discharge circuit
- Transition Mode (TM) PFC control method
- Self-adjusting dead-time and anticapacitive mode for LLC

Asymmetrical half-bridge controller

**L6591**
- PFC interface
- Brown out
- 700 V start-up voltage

Main Applications

- **Tablets and smartphones**
  L6565, L6566*, STCH02
- **Laptops**
  L6565, L6566*, STCH02, STCMB1
- **High-power adapters and TVs**
  L6565, L6566*, L6599A*, L6699, STCMB1
- **Desktop PCs, commercial and street lighting**
  L6599A*, L6699, STCMB1

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

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

**Synchronous rectifiers** are used to drive power MOSFETs that replace the rectification diodes in the secondary side of SMPS, thus providing high efficiency especially in low-output-voltage, high-current power supplies. The product portfolio supports the most common flyback, forward and LLC resonant topologies. The main benefits include high efficiency, space saving, cost reduction and high reliability.

**SR controllers for Flyback**
- STSR30
  - Possibility to operate in discontinuous mode
  - Automatic turn-off for D<14%

**SR controllers for Forward**
- STSR2P*
  - Possibility to operate in discontinuous mode
  - Smart turn-off anticipation timing

**SYNCHRONOUS RECTIFICATION BENEFITS**
- Improved efficiency
- Better thermal performance
- High power density
- Increased reliability

**SR controllers for LLC resonant**

<table>
<thead>
<tr>
<th>Basic features</th>
<th>Matched turnoff threshold</th>
<th>Self compensation for the inductance of MOSFET package</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRK2000A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRK2001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MAIN APPLICATIONS**
- High-power adapters and TVs
  - STSR30, STSR2P*
- Desktop PCs and Server/Telecoms
  - SRK2000A, SRK2001

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

www.st.com/ac-dc-converters
www.st.com/synchronous-rectification-controllers
**Voltage and current controllers**

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

**SEA05 internal block diagram**

![SEA05 internal block diagram](image)

**CC/CV controllers for chargers, adapters and others**

<table>
<thead>
<tr>
<th>Model</th>
<th>Features</th>
</tr>
</thead>
</table>
| SEA01  | - Advanced CC/CV controller with online digital trimming  
- 0.1% voltage reference precision up to 36 V<sub>cc</sub>  
- 200 µA low quiescent current |
| SEA05  | - Advanced CC/CV controller (SEA05)  
- Advanced CC/CV controller with efficient LED pilot lamp driver (SEA05L)  
- 0.5% voltage reference precision up to 36 V<sub>cc</sub>  
- Low quiescent current: 200 µA (SEA05), 250 µA (SEA05L)  
- Current sense threshold 50 mV (SEA05)  
- 4% current loop precision (SEA05L) |
| SEA05L | - Advanced CC/CV controller with efficient LED pilot lamp driver (SEA05L)  
- 0.5% voltage reference precision up to 36 V<sub>cc</sub>  
- Low quiescent current: 250 µA (SEA05L) |
| TSM10* | - Compact solution  
- Easy compensation  
- 0.5 and 1% voltage reference precision |

**Main Applications**

- Adapters
- Battery chargers
- Residential, commercial and street lighting

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

www.st.com/ac-dc-converters  
www.st.com/voltage-and-current-controllers
BATTERY MANAGEMENT ICs

Battery chargers and battery monitoring ICs

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

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

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

MAIN APPLICATIONS

Bluetooth accessories
STC4054

USB
L6924U, STC4054, STBCFG01

Fitness
STNS01, STBC02, sSTBC03

Smartphones
STBCFG01, STC3115, SCT3117

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

STNS01
- LDO integrated, USB compatible

STBC151
- Ultra low power for ThinFilm and Li-Ion batteries

L6924D
- Linear charger for Li-Ion and Li-Polymer battery packs
- Thermal regulation, USB power specification supported
- LDO integrated, USB compatible, Power path
- LDO integrated, USB compatible, Power path, Swire

L6924U
- Switching battery charger & voltage mode fuel gauge, 500 mA OTG

STBC03
- Switching battery charger

STBCFG01
- Linear battery charger

Note 1: available in Q4 2017
**Wireless charging ICs**

ST fully covers wireless charging applications with dedicated ICs for both transmitter and receiver. The STWBC and STWBC-EP, compatible with Qi standard, and the STWBC-WA, dedicated to wearable applications, make-up ST’s wireless power transmitters (Tx) family. The receiver family (Rx) consists of the STWLC04 dedicated to wearable application, the STWLC03, compliant with both Qi and PMA standards, which is suitable for smartphones, tablets, medical applications and the STWLC33 which is new multi-mode Qi/AirFuel inductive wireless power Rx/Tx solution.

### Wireless power transmitters

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
</table>
| STWBC | - Supports applications up to 5 W  
        - Qi A11 certified |
| STWBC-WA | - Supports applications up to 2.5 W  
             - Wireless power transmitter dedicated to wearables |
| STWBC-EP | - Supports applications up to 15 W  
              - Qi extended power certified |

Common features:
- Digital feedback with foreign object detection (FOD)
- Smart standby (best in class consumption)
- Firmware customization via API

### Wireless power receivers

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
</table>
| STWLC03 | - Supports applications up to 7.5 W  
            - Multiple Qi and PMA standard compliant |
| STWLC04 | - Supports applications up to 1 W  
             - Wireless power receiver dedicated to wearables |
| STWLC33 | - Supports up to 15 W output power in RX mode and 5 W in TX mode  
              - Multiple Qi and Airfuel inductive standard compliant  
              - Outstanding total system efficiency  
              - Precise voltage and current measurements for FOD function |

### MAIN APPLICATIONS

- **Wireless battery charger transmitters**: STWBC, STWBC-EP
- **Medical & healthcare equipment**: STWLC03
- **Tablets and smartphones**: STWLC03, STWLC33
- **Wearables**: Transmitter STWBC-WA Receiver STWLC04
Thin-film batteries

ST’s EnFilm™ thin-film batteries are a new concept of extremely thin (220 µm), rechargeable solid-state batteries with fast constant-voltage recharge and a lifetime of more than 10 years or 4000 cycles. They feature a LiCoO2 cathode, LiPON ceramic electrolyte and a lithium anode, on a 25.7 x 25.7 mm footprint and are completely safe from risks of burning or explosion.

![Charge capacity graph](image)

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

**EnFilm™ thin film rechargeable battery: the energy of things**

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

**Ultra low consumption linear charger for thin film battery**

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

**THIN FILM BATTERY MAIN BENEFITS**

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

**MAIN APPLICATIONS**

- Fitness and wearables
- NFC
- RF ID tags
- Sensors and networks
- Smart cards

Note 1: available in Q4 2017  * is used as a wildcard character for related part number
**DC-DC SWITCHING CONVERSION ICs**

**DC-DC converters**

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

**Main Features**
- Up to $61 \text{Vin}/3 \text{A}$
- Synchronization capability
- Internal compensation
- Low consumption
- Adjustable fsw
- Internal soft start
- Low quiescent current

---

**Main Applications**

- **Smartphones**: ST1S0*, ST1S1*, ST1S3*, ST1S4*, ST1S50, ST2S*, L598*, PM6641, STBB*, L6920*, STOD1812, STOD1317, ST8R00W
- **TVs**: ST1S10, L7985
- **Computing**: ST1S10, L7985
- **Solar**: ST1S0*, ST1S1*, ST1S3*, ST1S4*, ST1S50, L497*, L597*, L7987*
- **Set-top boxes**: ST1S0*, ST1S1*, ST1S3*, ST1S4*, ST1S50, ST2S*, L598*, PM6644, STBB*, L6920*, STOD1812, STOD1317, ST8R00W
- **Wearables**: ST1S15, ST1S14
- **Server/Telecom**: PM890*, ST1S1*, ST1S3*, ST1S4*, ST1S50, STBB*, L598*, L698*, L798*
- **Home appliances**: ST1S0*, ST1S1*, ST1S3*, ST1S4*, ST1S50, L497*, L597*, L598*, L698*, L798*
- **Factory automation**: ST1S0*, ST1S1*, ST1S3*, ST1S4*, ST1S50, L497*, L597*, L598*, L698*, L798*

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Note: * is used as a wildcard character for related part number.
Multi-output regulators

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

<table>
<thead>
<tr>
<th>Input Voltage</th>
<th>Number of Sw. Buck Regulators</th>
<th>LDO</th>
<th>eFuse</th>
<th>Serial Interface</th>
<th>Special Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>STPMIC01</td>
<td>2.7 V - 5.5 V</td>
<td>6</td>
<td>0.25 A</td>
<td></td>
<td>Low quiescent current (35 uA), Automatic PWM → PFM transition</td>
</tr>
<tr>
<td>STPMIC02</td>
<td>4.3 V - 5.5 V; 10.5 V - 13.2 V</td>
<td>2</td>
<td></td>
<td></td>
<td>Temperature monitor and shutdown</td>
</tr>
<tr>
<td>STPMIC03</td>
<td>5 V - 12 V</td>
<td>2</td>
<td>0.1 A</td>
<td></td>
<td>3 Amp current capability (w/ embedded Lowside MOS), interleaving synchronization</td>
</tr>
<tr>
<td>STPMIC06</td>
<td>4.5 V - 15.6 V</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L7292</td>
<td>2.7 V - 5.5 V</td>
<td>5</td>
<td></td>
<td></td>
<td>PWM and PFM modes</td>
</tr>
</tbody>
</table>

Main Applications

- Server/Telecom
- HD and SSD
DC-DC controllers

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

**Single-phase Buck controllers**

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

**Multi-phase Buck controllers**

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

**MAIN APPLICATIONS**

- Server
- Microserver
- Telecoms
- PC desktop

Note: * is used as a wildcard character for related part number
Digital Power Controllers and Microcontrollers

Digital Power Controllers

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

Digital controllers tailored for power conversion and lighting applications

STNRG* STLUX*

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

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

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

Digital controller for interleaved CCM boost PFC

STNRGPF01
- Digital controller fully configurable through GUI for fast and easy design, does not require writing any firmware
- Up to 3-channel interleaved boost PFC
- Ideal for wide power range above 1 kW
- Reduced EMI filter and inductor volume
- Reduced output capacitor RMS current
- Flexible working frequency up to 300 kHz to drive both MOSFETs and IGBTs
- Configurable phase shedding for wide load range high efficiency conversion
- Soft start-up to reduce electrical stress and to manage inrush current PFC Soft Power-On
- On-chip UART/I2C digital interfaces for convenient connectivity
- Ideal for outdoor applications with -40 to +105 °C operating range

Main Applications

Solar
STNRG*

UPS
STNRG*

HEV charging stations
STNRG*

Factory automation
STNRG*

Commercial, architectural and street lighting
STLUX*

www.st.com/stlux
www.st.com/stnr

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

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

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

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

STM32F334, the MCU tailored for digital SMPS

**STM32F334**

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

STM32 F0 series, the MCUs for cost sensitive applications

**STM32F0**

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

STM32F334 features

- 64-Kbyte Flash memory
- Up to 12-Kbyte SRAM
- 20-byte backup registers
- 4-byte CCM code-SRAM
- ARM Cortex-M4 72 MHz
- Floating point unit (FPU)
- Nested vector interrupt controller (NVIC)
- JTAG/SW debug

**STM32F334**

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

**STM32F334**, the MCU tailored for digital SMPS

**System**

- Power supply 1.8 V regulator
- POR/PDR/PVD
- Xtal oscillators 32 kHz + 4 ~ 32 MHz
- Internal RC oscillators 40 kHz + 8 MHz
- PLL
- Clock control
- RTC/I-WDG
- SysTick timer
- 2x watchdogs (independent and window)
- 24/37/51 I/Os
- Cyclic redundancy check (CRC)
- Touch-sensing controller 18 keys
- JTAG/SW debug
- AHB bus matrix
- 7-channel DMA

**Connectivity**

- 1x SPI
- 1x I²C
- 1x CAN 2.0B
- 2x USART + 1xUSART/LIN, smartcard, IrDA, modem control
- IR transmitter

**Analog**

- 3x 12-bit DAC + 2x timers
- 2x 12-bit ADC 21 channels / 5 MSPS
- 3x Comparators (22 ns)
- 1x Programmable Gain Amplifiers (PGA)
- Temperature sensor

**MAIN APPLICATIONS**

- Solar
- Welding
- Commercial, architectural and street lighting
- Server/Telecom
- Factory automation

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

www.st.com/stm32
DIODES AND RECTIFIERS

Silicon diodes

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

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

Field-effect rectifiers (FERD)

<table>
<thead>
<tr>
<th>FERD*</th>
<th>Low voltage diodes, for high efficiency and high power density applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>STPS*</td>
<td>Power Schottky diodes for low voltage general purpose applications</td>
</tr>
<tr>
<td>STTH*</td>
<td>Ultrafast high voltage diodes for general purpose application</td>
</tr>
</tbody>
</table>

Power Schottky diodes

Ultrafast rectifiers

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

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

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

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

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

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

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

Offering the best-in-class forward voltage (lowest VF) and state-of-the-art robustness, our 1200 V SiC diodes provide extra freedom to achieve high efficiency and reliability with lower current rating and therefore lower cost, while reducing operating temperature and extending application lifetime. The 1200 V SiC diode family covers current ratings from 2 to 40 A, including automotive-qualified devices, in surface-mount DPAK HV (high-voltage) and D²PAK, or through-hole TO-220AC and TO-247LL (long-lead) packages.

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

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

MAIN APPLICATIONS

Solar inverters  HEV  UPS  Server/Telecoms and PFC
STPSC*065, STPSC*12  STPSC*065  STPSC*065, STPSC*12  STPSC*065, STPSC*12

Note: * is used as a wildcard character for related part number
HOT-SWAP POWER MANAGEMENT

E-fuses

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

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

E-fuses, a smart offer for a lot of applications

E-FUSE MAIN FEATURES

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

MAIN APPLICATIONS

- Home appliances: STEF05, STEF01, STEF12
- HD and SSD: STEF033, STEF05, STEF05L, STEF4S, STEF12
- USB connections: STEF05, STEF05L
- Factory automation: STEF01, STEF12
- Set-top boxes: STEF12

www.st.com/e-fuse
Power breakers & current limiter ICs

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

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

**Power breakers**

<table>
<thead>
<tr>
<th>STPW05</th>
<th>STPW12</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Auto-retry function with programmable delay</td>
<td></td>
</tr>
<tr>
<td>• Adjustable precise power limitation from 11 to 16 W</td>
<td></td>
</tr>
<tr>
<td>• 5 V (STPW05) and 12 V (STPW12) rails</td>
<td></td>
</tr>
<tr>
<td>• Programmable power limit masking time</td>
<td></td>
</tr>
<tr>
<td>• Over-temperature protection</td>
<td></td>
</tr>
<tr>
<td>• Integrated N-channel power MOSFET</td>
<td></td>
</tr>
<tr>
<td>• Internal undervoltage lockout</td>
<td></td>
</tr>
</tbody>
</table>

**Current limiter IC**

<table>
<thead>
<tr>
<th>STFC01</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Wide Vcc range (10 - 48 V)</td>
</tr>
<tr>
<td>• Fully programmable current limitation</td>
</tr>
<tr>
<td>• P-channel MOSFET driving capability</td>
</tr>
<tr>
<td>• Remote On/Off control</td>
</tr>
<tr>
<td>• Latch, autoretry or foldback configuration</td>
</tr>
<tr>
<td>• Analog and digital current monitoring (status telemetry)</td>
</tr>
<tr>
<td>• Undervoltage lockout</td>
</tr>
</tbody>
</table>

---

**MAIN APPLICATIONS**

- **Home appliances**
  - STPW05, STPW12
- **Air conditioning**
  - STPW05, STPW12
- **Factory automation**
  - STPW05, STPW12, STFC01
- **Server/Telecoms**
  - STFC01

---

*Note 1: samples available, contact ST sales office  
* is used as a wildcard character for related part number
IGBTs

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

**S series**

**STG*S120DF3**

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

**M series**

**STG*M**

650 V family

- 6 µs of min short-circuit capability @ starting $T_J = 150$ °C
- Wide safe operating area (SOA)
- From 4 to 120 A as current capability
- Very soft and fast recovery antiparallel diode
- Suitable for any inverter system up to 20 kHz
- AEC-Q101 qualified devices

1200 V family

- 10 µs of min short-circuit capability @ starting $T_J = 150$ °C
- From 8 to 40 A as current capability
- Freewheeling diode tailored for target application
- Suitable for any inverter system up to 20 kHz

**IH series**

**STG*IH**

650 V family

- Very low $V_{CE(sat)}$: 1.4 V @ $I_{ON}$
- Very low $E_{off}$
- Low drop forward voltage diode
- Designed for soft commutation application only
- Mass production in Q1 2018

1250 V family

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

1350 V family

- Enhanced efficiency
- Very high robustness
- Mass production in Q1 2018
HB series

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

H series

STG*H*

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

1200 V family

- 5 µs of short-circuit capability @ starting $T_j = 150 \, ^\circ C$
- Low turn-off losses
- Up to 100 kHz as switching frequency

V series

STG*V60*

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

MAIN APPLICATIONS

Welding HB, V  Solar  UPS  Home appliances  Air conditioning  Motor control  Induction heating

Note: * is used as a wildcard character for related part number
Intelligent power module - SLLIMM™

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

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

**KEY BENEFITS**
- Easy to drive through microcontroller
- Higher robustness and reliability
- Plug’n Play solution

---

**MAIN APPLICATIONS**
- Fan
- Fridge
- Washing Machine
- Air conditioning
- Motor control

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

www.st.com/igbt
INTELLIGENT POWER SWITCHES

STMicroelectronics offers intelligent power switches (IPS) for low- and high-side configurations. ST’s IPS feature a supply voltage range from 6 to 60 V, overload and short-circuit protection, current limitation set for industrial applications, different diagnostic types, high-burst, surge and ESD immunity, very low power dissipation and fast demagnetization of inductive loads. Devices are designed using ST’s latest technologies, thus offering state-of-the-art solutions in any application field.

ISO8200*, the galvanic isolated IPS ideal for factory automation

Channels

<table>
<thead>
<tr>
<th>Channels</th>
<th>High side</th>
<th>Low side</th>
<th>High/Low side</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>VN808*</td>
<td>VNI8200</td>
<td>ISO8200*</td>
</tr>
<tr>
<td>4</td>
<td>VN330</td>
<td>VN340</td>
<td>VNI4140</td>
</tr>
<tr>
<td></td>
<td>L6374</td>
<td>L6376</td>
<td>IPS4260*</td>
</tr>
<tr>
<td>2</td>
<td>TDE1747</td>
<td>TDE18*</td>
<td>L6370</td>
</tr>
<tr>
<td></td>
<td>TDE32*</td>
<td>L6375</td>
<td>VN751</td>
</tr>
<tr>
<td>1</td>
<td>TDE1798</td>
<td>TDE18*</td>
<td>L6377</td>
</tr>
<tr>
<td></td>
<td>VNI4140</td>
<td>IPS160</td>
<td>IPS161</td>
</tr>
<tr>
<td></td>
<td>TDE170*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: available in Q4 2017  * is used as a wildcard character for related part number

MAIN APPLICATIONS

Factory automation  Vending machines  Renewable energy

www.st.com/ips
Offline LED converters with PSR

<table>
<thead>
<tr>
<th>Model</th>
<th>HPF</th>
<th>PSR-CC</th>
<th>PSR-CV</th>
<th>Internal power</th>
<th>MOSFET</th>
<th>Flyback</th>
<th>Buck-boost</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVLED805</td>
<td></td>
<td></td>
<td></td>
<td>8 W</td>
<td>800 V&lt;sub&gt;BR&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVLED807PF</td>
<td></td>
<td></td>
<td></td>
<td>10 W</td>
<td>800 V&lt;sub&gt;BR&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVLED815PF</td>
<td></td>
<td></td>
<td></td>
<td>15 W</td>
<td>800 V&lt;sub&gt;BR&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Offline LED controllers with PSR

<table>
<thead>
<tr>
<th>Model</th>
<th>HPF</th>
<th>PSR-CC</th>
<th>PSR-CV</th>
<th>Dimming</th>
<th>Flyback</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVLED001A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Topology example

MAIN APPLICATIONS

- Residential lighting: HVLED807PF, HVLED815PF
- Commercial and street lighting: HVLED001A

Note 1: power level @ 230 V mains
* is used as a wildcard character for related part number
**DC-DC LED drivers**

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

### DC-DC LED drivers converters

<table>
<thead>
<tr>
<th></th>
<th>Buck</th>
<th>Buck-boost</th>
<th>I_{outMax}</th>
<th>Dimming</th>
<th>V_{inMax}</th>
<th>Synchronous</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED2000</td>
<td>✔</td>
<td>✔</td>
<td>3 A</td>
<td>✔</td>
<td>18 V</td>
<td>✔</td>
</tr>
<tr>
<td>LED2001</td>
<td>✔</td>
<td>✔</td>
<td>4 A</td>
<td>✔</td>
<td>18 V</td>
<td>✔</td>
</tr>
<tr>
<td>ST1CC40</td>
<td>✔</td>
<td>✔</td>
<td>3 A</td>
<td>✔</td>
<td>18 V</td>
<td>✔</td>
</tr>
<tr>
<td>LED5000</td>
<td>✔</td>
<td>✔</td>
<td>3 A</td>
<td>✔</td>
<td>48 V</td>
<td>✔</td>
</tr>
<tr>
<td>LED6000</td>
<td>✔</td>
<td>✔</td>
<td>3 A</td>
<td>✔</td>
<td>61 V</td>
<td>✔</td>
</tr>
</tbody>
</table>

### DC-DC LED drivers controllers

<table>
<thead>
<tr>
<th></th>
<th>Reverse buck</th>
<th>Buck-boost</th>
<th>Boost &amp; Sepic</th>
<th>Dimming</th>
<th>V_{inMax}</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVLED002</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>30 V</td>
</tr>
<tr>
<td>LED6001</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>36 V</td>
</tr>
<tr>
<td>STLDC08</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>3.6 V</td>
</tr>
</tbody>
</table>

### Topology examples

- **Synchronous buck**
- **Asynchronous buck**
- **Reverse buck**

### 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](http://www.st.com/led)
LED array drivers

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

Channels

24 channel RGB (8x3) drivers
- Current gain control (LED2472G), constant current (STP24DP05)
- Error detection
- Autopower saving (LED2472G)

12/16 channel drivers
- Current gain control (LED1642GW), constant current (STP16C*/D*)
- Error detection (STP16C*/D*)
- Dot correction (LED1202)
- Autopower saving
- Local dimming (LED1642GW, LED1202), global dimming (STP16C*/D*)

4/8 channel drivers
- Constant current
- Direct I/O (LED8102S)
- Error detection (STP08)
- Global dimming

MAIN APPLICATIONS

Traffic signals
LED8102S, LED2472G, STP24DP05, STP04

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

Home appliances
LED8102S, STP16, STP08, LED1642GW, STP4CMP

Special lighting
STP04, LED1642GW, LED2472G, LED8102S

wearable/
High End consumer
LED1202

Note 1: available in Q4 2017
* is used as a wildcard character for related part number

www.st.com/led
**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

<table>
<thead>
<tr>
<th>6 rows</th>
<th>5 rows</th>
<th>4 rows</th>
<th>1 row</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED7707</td>
<td>LED7706</td>
<td>STLED25</td>
<td>STLA02*</td>
</tr>
<tr>
<td>85 mA/row</td>
<td>30 mA/row</td>
<td>25 mA/row</td>
<td>20 mA/row</td>
</tr>
</tbody>
</table>

### LED row driver controllers

<table>
<thead>
<tr>
<th>16 rows</th>
<th>LED7708</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 mA/row</td>
<td>Grouped or independent row dimming</td>
</tr>
</tbody>
</table>

### LED matrix driver

<table>
<thead>
<tr>
<th>5 x 24 matrix</th>
<th>STLED524</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mA/dot</td>
<td>Adjustable luminance for each LED (dot)</td>
</tr>
</tbody>
</table>

---

**MAIN APPLICATIONS**

- **Smartphones** STLED25, STLD40D
- **Game consoles** STLD41
- **Keyboard and accessories** STLA02*
- **Home appliances and ATMs** LED7706, LED7707, LED7708, STCS*
- **Wearables** STLED524

---

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

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

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

**STOD1317B**
- Wide output range (up to 13 V)
- Very low output ripple
- High efficiency
- 100 mV LDO output drop

**STOD13CM**
- High efficiency in overall output range
- Wide output negative range
- External feedback output sense

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

---

**MAIN APPLICATIONS**

- **Fitness and wearables**
  - STOD32W, STOD1317B

- **Low-end smartphones**
  - STOD1317B, STOD13CM

- **High-end smartphones**
  - STOD32A

---

[www.st.com/oled](http://www.st.com/oled)
**LED bypass protection**

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

### LBP01 get reliable your led application

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

### MAIN APPLICATIONS

- Display panels
- Residential, commercial, architectural and street lighting
- Emergency lighting
- Traffic signals

[www.st.com/lbp01](http://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 ultra-low dropout voltage (from 50 to 220 mV for 100 mA to 3 A load current) and low quiescent current - for the highest efficiency design – (from 0.3 to 20 μA for 50 mA to 2 A) or dynamic performance for the best transient response, power supply ripple rejection (up to 92 dB at 1 kHz) and low noise (as low as 6.3 μVrms). All this coupled with a choice of the smallest form factor packages for size-conscious applications such as a 0.47 x 0.47 mm STSTAMP™ package.

### Ultra-low dropout
- High efficiency in low-/medium-power applications
- Best cost/performance trade-off
- Large offer for Iout capability and packaging

### Low quiescent current Iq
- Extending battery life
- Suitable for space-constrained battery-powered applications

### Low noise, high PSRR
- High signal fidelity
- Reduced size of external filter components

#### MAIN APPLICATIONS

<table>
<thead>
<tr>
<th>Tablets, smartphones, and digital camera</th>
<th>Healthcare</th>
<th>Fitness and wearables</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD39115, LD39130, LD39020/30, ST1L08, LDBL20, LD59015, LDLN025, STLQ020</td>
<td>STLQ015, STLQ020, ST715, LD39130</td>
<td>LD39130, LDLN015, LDLN025, LD39115, LD39020, LD39030, LDBL20, STLQ020</td>
</tr>
</tbody>
</table>

[www.st.com/linear-regulators](http://www.st.com/linear-regulators)
LNB SUPPLIES

LNB supplies ICs

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

Main common features

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

MAIN APPLICATIONS

Set-top boxes and PC card satellite receiver

www.st.com/lnb-supplies
MOSFET AND IGBT DRIVERS

ST’s power MOSFET and IGBT drivers include integrated high-voltage half-bridge, single and multiple low-voltage gate drivers. The MOSFET/IGBT drivers provide state-of-the-art integration, reducing BOM cost and final application dimensions, while also increasing robustness and noise immunity. In particular the STDRIVEsmart families L639*, L649* and STDRIVEgap STGAP1AS offer smart functionalities to protect and simplify application implementation and usage.

Robustness and reliability, system integration and flexibility; that’s ST’s gate driver offer you

<table>
<thead>
<tr>
<th>Features</th>
<th>L6390</th>
<th>L6391</th>
<th>L6392</th>
<th>L6491</th>
<th>L6494L1</th>
<th>L6498/L1</th>
<th>L6393</th>
<th>L6394</th>
<th>L6395</th>
<th>L6396</th>
<th>L6397</th>
<th>L6398</th>
<th>L6490</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low side gate drivers</td>
<td>4 A source/sink driver high current capability (L6491)</td>
<td>Integrated bootstrap diode</td>
<td>Adjustable deadtime (L6494L)</td>
<td>Comparator, op amp integrated, smart SD, interlocking and program. DT (L6390)</td>
<td>Smart shutdown (L649*, L639*)</td>
<td>Extended temperature range (A version)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

600 V Half bridge gate drivers

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

<table>
<thead>
<tr>
<th>Features</th>
<th>TD350</th>
<th>TD351</th>
<th>TD352</th>
<th>TD354</th>
<th>TD350</th>
<th>TD351</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low side gate drivers</td>
<td>2 level turn-off (TD35*)</td>
<td>Miller clamp (TD35*)</td>
<td>Pulse transf / opto input (TD35*)</td>
<td>Dual independent low side driver (PM8834)</td>
<td>4 A source/sink driver high current capability (PM8834)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Features</th>
<th>PM8851</th>
<th>PM8841</th>
<th>PM8834</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galvanically-isolated single gate driver</td>
<td>4 kV isolation</td>
<td>High voltage rail up to 1.5 kV</td>
<td>5 A source/sink driver current capability</td>
</tr>
<tr>
<td></td>
<td>2 Level turn-off</td>
<td>Miller clamp, negative gate supply</td>
<td>Optimized for SiC MOSFET driving</td>
</tr>
</tbody>
</table>

MAIN APPLICATIONS

Factory automation, home appliances, and motor control
L638*E, TD35*, L639*, L6491, L6494L1, L6498/L1, PM8841, PM8851

Commercial, architectural and street lighting
PM8834, PM8841, PM8851

Solar inverters, HEV / EV, and factory automation
STGAP1AS, PM8841, PM8851

Note 1: available in Q4 2017 * is used as a wildcard character for related part number

www.st.com/mosfet-igbt-drivers
PHOTOVOLTAIC ICs

DC-DC converters with embedded MPPT algorithm

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

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

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

### MAIN APPLICATIONS

**Smartphones, digital cameras, and camcorders**

SPV1040

**Fitness, climate, home and factory automation monitoring**

SPV1050

---

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

www.st.com/photovoltaic-ics
www.st.com/mppt-dcdc-converters
**POWER MOSFETs**

**High-voltage power MOSFETs (silicon)**

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

**K5 series**

- ST*N*K5
  - Very low $R_{DS(on)}$
  - Small Qg and capacitance
  - Small packages available
  - Suited for hard switching topologies

**M5 series**

- ST*N*M5
  - Extremely low $R_{DS(on)}$
  - High switching speed
  - Suited for hard switching topologies

**M2/M2-EP series**

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

- ST*N*M2-EP
  - Extremely low $R_{DS(on)}$
  - High switching speed
  - Suited for hard switching topologies

**DM2 & DM6 series**

- ST*N*DM2
  - Improved trr of intrinsic diode
  - High dv/dt capability
  - Suited for ZVS/LLC topologies

- ST*N*DM6
  - Extremely low Qg
  - Optimized for light load conditions
  - Tailored for high-frequency applications (M2-EP)
  - Suited for hard switching & ZVS/LLC topologies

**DK5 Series**

- ST*N*DK5
  - Lowest trr @ Very High Voltage BVDSS
  - High dv/dt capability
  - Targeting high power 3-phases industrial equipment

**M6 series**

- ST*N*M6
  - Lower $R_{DS(on)}$ 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

### MAIN APPLICATIONS

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

- **Solar inverters, welding, HEVs, and UPS**
  - K5, M5, M2, DM2, DM6, DK5

- **Residential, commercial, architectural and street lighting**
  - K5, DK5

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

---

Note: * is used as a wildcard character for related part number
Low-voltage power MOSFETs (silicon)

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

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

### H6 series

<table>
<thead>
<tr>
<th>ST<em>N</em>H6</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Very good $R_{ds(on)}$</td>
</tr>
<tr>
<td>• Soft diode recovery</td>
</tr>
<tr>
<td>• Suited for OR-ing, square-wave HB, battery mgmt topologies</td>
</tr>
</tbody>
</table>

### H7 series

<table>
<thead>
<tr>
<th>ST<em>N</em>H7</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Extremely low $R_{ds(on)}$</td>
</tr>
<tr>
<td>• High current capability</td>
</tr>
<tr>
<td>• Monolithic Schottky</td>
</tr>
<tr>
<td>• Super logic level (P-channel)</td>
</tr>
<tr>
<td>• Suited for reverse buck, buck-boost, battery mgmt, forward and buck topologies</td>
</tr>
</tbody>
</table>

### F6 series

<table>
<thead>
<tr>
<th>ST<em>N</em>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Wide voltage range</td>
</tr>
<tr>
<td>• Soft diode recovery</td>
</tr>
<tr>
<td>• Very good $R_{ds(on)}$</td>
</tr>
<tr>
<td>• Suited for load-safety switch, buck and sync rectification</td>
</tr>
</tbody>
</table>

### F7 series

<table>
<thead>
<tr>
<th>ST<em>N</em>F7</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Extremely low $R_{ds(on)}$</td>
</tr>
<tr>
<td>• Optimized body diode (low $Q_{d}.$) and intrinsic capacitance</td>
</tr>
<tr>
<td>• Proper Crss/Ciss ratio</td>
</tr>
<tr>
<td>• Suited for flyback and sync rectification</td>
</tr>
</tbody>
</table>

### MAIN APPLICATIONS

- **Small motor control and USB battery chargers**
  - F6
- **HDD, power tools, STB, and game consoles**
  - H6, H7
- **Server/Telecoms and SMPS**
  - H7, F7
- **UPS, e-bikes, and fans**
  - F6, F7
- **Solar inverters, forklifts, and EHV**
  - F7

---

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

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

Normalized $R_{\text{DS(on)}}$ vs. temperature

![Graph showing normalized $R_{\text{DS(on)}}$ vs. temperature]

SiC MOSFETs, the real breakthrough in high voltage switching

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

MAIN BENEFITS

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

MAIN EVALUATION BOARD

4 kW
Boost inverter evaluation board
Available on request

MAIN APPLICATIONS

Motor control
HEVs / EVs
Welding
UPS
Solar inverters

Note 1: coming soon
* is used as a wildcard character for related part number

www.st.com/sicmos
POWER OVER ETHERNET ICs

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

PoE-PD devices

**PM8803**
- IEEE 802.3at PD interface
- PWM current mode controller with double gate driver
- Integrated 100 V, 0.45 W, 1 A hot-swap MOSFET
- Supports flyback, forward active clamp, and flyback with synchronous rectification topologies

**PM8801**
- Sleep mode with LED indicator and Maintain Power Signature
- IEEE 802.3at PD interface + PWM current mode ctrl with double gate driver
- Integrated 100 V, 0.45 W, 640 mA hot-swap MOSFET
- Supports flyback, forward active clamp, and flyback with synchronous rectification topologies

**PM8800A**
- IEEE 802.3af PD interface
- PWM current mode controller
- Integrated 100 V, 0.5 W, 800 mA hot-swap MOSFET
- Supports both isolated and non-isolated topologies

Main standards

<table>
<thead>
<tr>
<th>PM8800A</th>
<th>PM8803, PM8801</th>
<th>PM8803 with external booster</th>
</tr>
</thead>
<tbody>
<tr>
<td>PoE (IEEE 802.3af)</td>
<td>PoE+ (IEEE 802.3at)</td>
<td>4-pair PoE</td>
</tr>
<tr>
<td>13 W</td>
<td>25 W</td>
<td>60 W</td>
</tr>
</tbody>
</table>

Power over Ethernet power supply protection

**PEP01-5841**
- Power supply protection compliant with IEC61000-4-5 Level 2 : 1 kV
- Allow to use 100 V power MOSFET
- Stand off voltage: 58 V
- Surface mount SO-8 package

www.st.com/PoE
**PROTECTION DEVICES**

**EOS 8/20 µs surge protection**

ST’s 8/20 µs surge protection comply with IEC 61000-4-5 for power supply lines or datalines. A large choice of package is available to meet application requirements.

![Graph showing stand-off voltage and maximum peak pulse power and current](image)

* EOS protections, upgraded performance for high temperature applications

**MAIN APPLICATIONS**

- Offline and DC-DC power supplies, PFC
- Solar inverters
- Smart metering

[www.st.com/eos8-20-protection](www.st.com/eos8-20-protection)
ESD protection

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

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

Power delivery Protections

Ultimate TVS protection for USB fast-charging ports

**ESDAxxP**

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

### KEY FEATURES & BENEFITS

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

### MAIN APPLICATIONS

Tablets, smartphones, and digital cameras

Healthcare

I/O microcontrollers and signal conditioning

Factory automation

Human machine interface (HMI)

Smart metering

SIM cards, Ethernet, and HDMI/DVI ports

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

---

**Figure: Peak pulse current performances**

IPP 8/20 µs versus VRM

**Table:**

<table>
<thead>
<tr>
<th>Stand-off voltage (V_MR)</th>
<th>ESDA7P60-1U1M</th>
<th>ESDA7P120-1U1M</th>
<th>ESDA13P70-1U1M</th>
<th>ESDA15P60-1U1M</th>
<th>ESDA17P50-1U1M</th>
<th>ESDA17P100-1U2M</th>
<th>ESDA25P35-1U1M</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5 V</td>
<td>60 A</td>
<td>120 A</td>
<td>70 A</td>
<td>60 A</td>
<td>50 A</td>
<td>160 A</td>
<td>35 A</td>
</tr>
<tr>
<td>12 V</td>
<td>60 A</td>
<td></td>
<td>50 A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.2 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 V</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 V</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>22 V</td>
<td></td>
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</tr>
</tbody>
</table>

ST Competition

www.st.com/esd-protection
Repetitive voltage suppressor

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

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

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

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

**STRVS topology usage example**

-15% consumption in Stand-by mode

**MAIN APPLICATIONS**

- Adapters
- Smart metering
- Solar inverters
- Residential, commercial, architectural and street lighting

Note: * is used as a wildcard character for related part number
USB TYPE-C AND POWER DELIVERY CONTROLLERS

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

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

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

**STUSB1600A**
- Roles: Source/Sink/Dual Role Power
- Configurable start-up profiles (embedded FTP memory)
- Integrated VCONN switch
- Adjustable current limit (600 mA max)
- OVP, OCP, UVP, short protection
- Direct interface to MCU thru I²C + IRQ
- Dead battery support
- Dual power supply:
  - VBUS = (4.6 V - 22 V) - AMR = 28 V
  - VSYS = (3.0 V; 5.5 V)

**STUSB1602A**
- Roles: Source/Sink/Dual Role Power
- Configurable start-up profiles (embedded FTP memory)
- Integrated VCONN switch
- Adjustable current limit (600 mA max)
- OVP, OCP, UVP, short protection
- I²C, SPI+ IRQ MCU interface – Dual I²C address support
- Integrated Voltage monitoring
- Integrated VBUS discharge path
- Accessory & dead battery support
- Dual power supply:
  - VBUS = (4.6 V - 22 V) - AMR = 28 V
  - VSYS = (3.0 V; 5.5 V)

**STUSB47**
- Role: Source
- Support all USB PD profiles
- Configurable start-up profiles (embedded FTP memory)
- Dedicated Voltage & Current control Interface
- Integrated Voltage monitoring
- Integrated VBUS discharge path
- Auto-run support
- Nominal power supply
- VBUS = (4.6 V - 22 V)
- AMR = 28 V

STUSB1600A with PD PHY and BCM driver
STUSB1602A Type-C controller
STUSB47 Power Delivery controller

USB Type-C interface
USB Type-C controller
Power Delivery controller

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

X-CUBE-USB-PD