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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 VIPerOP devices) and high breakdown voltage of 800 V for the VIPerPLUS family and 900 V for the Altair05. To reduce BOM costs, the Altair family works as a constant-voltage primary-side regulator (PSR-CV) avoiding the need for a voltage reference and opto-coupler in the circuit. Discrete solutions consisting of an offline controller plus an external MOSFET are also supported by ST. New STRVS voltage suppressors improve system reliability against repetitive 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>Applications</th>
<th>MAIN EVALUATION BOARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEVAL-ISA096V1</td>
<td>2 W, buck-boost</td>
</tr>
<tr>
<td>STEVAL-ISA192V1</td>
<td>7 W not-isolated flyback with smart standby using VIPerOP and touch sensing</td>
</tr>
<tr>
<td>STEVAL-ISA178V1</td>
<td>5 V/200 mA buck-converter based on VIPer01</td>
</tr>
<tr>
<td>STEVAL-ISA183V1</td>
<td>16 W quasi resonant flyback converter for air conditioning applications using VIPer3SLD</td>
</tr>
</tbody>
</table>

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

<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>
</tr>
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<tbody>
<tr>
<td>Buck</td>
<td>VIPerOP*1</td>
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<td>-</td>
<td>STH*06</td>
<td>STH*08</td>
<td>STH*10</td>
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<tr>
<td>Buck-boost</td>
<td>VIPerOP*6</td>
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<td>Non-isolated flyback</td>
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<td>VIPerOP*1</td>
<td>ST*N80K5</td>
<td>STPS*</td>
<td>T*431</td>
<td>LDF, LDFM LDK220, LDK320 LDL212</td>
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<td>VIPer*6</td>
<td>VIPer*6</td>
<td>STRVS*</td>
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<td>VIPer0P</td>
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<td>STH*08</td>
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<tr>
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<td>VIPer0P</td>
<td>VIPer*6</td>
<td>STPS*</td>
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<td>T*431</td>
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<td>VIPer*8</td>
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<td>FERD*45</td>
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<td>T*432</td>
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Typical configuration

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<thead>
<tr>
<th>~AC</th>
<th>Offline Converter</th>
<th>Output Diode</th>
<th>DC</th>
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<tr>
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<td>Isolated Flyback</td>
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<tr>
<td></td>
<td>Repetitive OVP</td>
<td>Clamping Diode</td>
<td>Output Diode</td>
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<tr>
<td></td>
<td>Offline Controller</td>
<td>HV Power MOSFET</td>
<td>Voltage Reference</td>
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<tr>
<td>~AC</td>
<td>Non-Isolated Flyback</td>
<td>FB</td>
<td>DC</td>
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<tr>
<td></td>
<td>Offline Converter</td>
<td>Diode Clamp</td>
<td>Output Diode</td>
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<tr>
<td></td>
<td>Output Diode</td>
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</tr>
<tr>
<td></td>
<td>LDO</td>
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<table>
<thead>
<tr>
<th>~AC</th>
<th>Offline Converter</th>
<th>Output Diode</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Buck, Buck-Boost converter</td>
<td></td>
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</tr>
</tbody>
</table>
Battery chargers

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

### Offline converters

<table>
<thead>
<tr>
<th>Wall side</th>
<th>Flyback</th>
<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>5 W, 5 V- 3 A output</td>
<td>SSR-CV/CC</td>
<td>VIPer*5/7/8 VIPer06/01/02</td>
<td>HVLED001A</td>
<td>ST<em>N65M2 ST</em>N65M5 ST<em>N70M6</em> STH35N65G2V-7* (SiC MOSFET)</td>
<td>-</td>
<td>-</td>
<td>STRVS*</td>
<td></td>
</tr>
<tr>
<td>5 W, 5 V- 3 A output</td>
<td>PSR-CV</td>
<td>STCH02</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 W, 5 V- 3 A output</td>
<td>PSR-CC</td>
<td>ALTAIR*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
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</tr>
<tr>
<td>5 W, 5 V- 3 A output</td>
<td>Synch Rect</td>
<td>STSR30</td>
<td>-</td>
<td>ST<em>N4F7 ST</em>N6F7 ST*N10F7</td>
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</table>

### Battery charger ICs

<table>
<thead>
<tr>
<th>Application side</th>
<th>Linear</th>
<th>Switching</th>
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<tbody>
<tr>
<td>STBC02 STBC03 L6924* STC4054 STNS01</td>
<td>STBCFG01</td>
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</tr>
<tr>
<td>STC3117 STC3115</td>
<td>EFL700A39</td>
<td></td>
</tr>
</tbody>
</table>

### Typical configuration

- **Isolated Flyback with PSR CV/CC**
  - **Offline Controller**
  - **HV Power MOSFET**
  - **SR Controller**

- **Isolated Flyback with PSR CC**
  - **Offline Controller**
  - **LV Power MOSFET**
  - **SR Controller**

- **Isolated Flyback with SSR CV/CC**
  - **Offline Controller**
  - **LV Power MOSFET**
  - **SR Controller**

Note: 1: MP Q4 2017 2: coming soon * is used as a wildcard character for related part number
Adapters

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

### Offline converters

<table>
<thead>
<tr>
<th>Flyback with optocoupler</th>
<th>Controllers</th>
<th>Power MOSFETs</th>
<th>Repet. overvoltage protect.</th>
<th>Clamping diodes</th>
<th>Output diodes</th>
<th>CC/CV contr.</th>
<th>Volt. ref.</th>
<th>DC-DC conv.</th>
<th>LDO</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSR-CV</td>
<td>STCH02</td>
<td>L6566B L6566A</td>
<td>ST<em>N80K5 ST</em>N90K5 ST*N95K5</td>
<td>-</td>
<td>STPS*</td>
<td>STTH<em>06 STTH</em>08</td>
<td>T<em>431 T</em>432</td>
<td>T<em>431 T</em>432</td>
<td>ST715 LDK320</td>
</tr>
<tr>
<td>PFC Boost</td>
<td>TM</td>
<td>L6562A L6563 L6564</td>
<td>ST<em>N50M2 ST</em>N60M2 ST<em>N55M2 ST</em>N56M5 ST*N60M6</td>
<td>-</td>
<td>-</td>
<td>STTH<em>L06 STTH</em>06</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DC-DC stage</td>
<td>HB-LLC</td>
<td>L6599A L6699</td>
<td>ST<em>N50DM2 ST</em>N60DM2 ST<em>N60M2 ST</em>N60M2-EP ST<em>N65M2-EP ST</em>N60M6</td>
<td>-</td>
<td>-</td>
<td>STPS* FERD<em>45 FERD</em>50 FERD<em>60 FERD</em>100</td>
<td>TSM10* sea0*</td>
<td>T<em>431 T</em>432</td>
<td>ST715 LDK320</td>
</tr>
</tbody>
</table>

### Sync rect.

| SBK                         | STSR2*      | SRK2000A SRK2001 | ST*110N10F7 ST*100N10F7 STL*NS3LLH7 ST*N4LF7* ST*N6F7 STL130N8F7 ST*N10F7 ST*N20D | - | - | - | - | - |

### Typical configuration

- PFC: HV Power MOSFET + Output Diode + Repetitive OVP + Clamping Diode + CC/CV Controller
- HB-LLC: LV Power MOSFET + SR Controller + Output Diode + CC/CV Controller

### MAIN EVALUATION BOARDS

- **EVL6566A-75WES4**
  - 75 W, PFC + flyback
- **STEVAL-ISA170V1**
  - 150 W, PFC + HB-LLC + sync rect.
- **EVLCMCB1-90WADP**
  - 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.

<table>
<thead>
<tr>
<th>USB Type-C PD Adapter 1 Part Provider</th>
<th>Type-C and USB-PD Controllers</th>
<th>Hard Coded Controllers</th>
<th>Authentication &amp; Secure MCUs</th>
<th>ESD &amp; EOS Protections for VBUS Power Delivery</th>
<th>ESD &amp; EOS Protections for Communication Channel (CC lines)</th>
<th>LDO</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM32F0* and STM32F3*</td>
<td>STUSB1600A STUSB1602A</td>
<td>STUSB4700 STUSB4710A</td>
<td>STSAFE-A</td>
<td>ESAD17P100-1U2M ESDA25P35-1U1M ESDA17P50-1U1M</td>
<td>ESADLP20-1BF4 ESDA5-1BF4 ESD2V5H-1BU2</td>
<td>ST715 LDK320</td>
</tr>
</tbody>
</table>

Typical configuration

USB Type-C™ Power Delivery Subsystem

<table>
<thead>
<tr>
<th>Chipset</th>
<th>Type-C Controller/Interface</th>
<th>MCUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB Type-C PD Adapter 1 Part Provider</td>
<td>STUSB1600A STUSB1602A</td>
<td>STUSB4700 STUSB4710A</td>
</tr>
</tbody>
</table>

**MAIN EVALUATION BOARDS**

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

- STEVAL-CCC001
  - STUSB1600A USB Type-C and Power Delivery Nucleo Pack

- STEVAL-ISC004V1
  - STUSB4710A evaluation board

- STEVAL-USBPD45H
  - 45 W USB PD Type-C adapter based on STCH02 and STUSB4700

**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>
</tr>
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<tbody>
<tr>
<td>Flyback</td>
<td>L6566A</td>
<td>-</td>
<td>STN90K5</td>
<td>STTH*06</td>
<td>STTH<em>06, STTH</em>10</td>
<td>T*431</td>
<td>T*432</td>
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<td>L6566B</td>
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<td>PFC Boost</td>
<td>L4981*</td>
<td>STM32F0*</td>
<td>STN60M2</td>
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<tr>
<td>TM</td>
<td>L6562A*</td>
<td>L6563*</td>
<td>STN50MD2</td>
<td>STH*06</td>
<td>STH<em>06, STH</em>10</td>
<td>T*431</td>
<td>T*432</td>
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<td></td>
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<td>L6569*</td>
<td>STN50MD2</td>
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<td>STN50MD2</td>
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<td>DC-DC stage</td>
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<td>STCMB1</td>
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<td>STH*06</td>
<td>STH<em>06, STH</em>10</td>
<td>T*431</td>
<td>T*432</td>
</tr>
<tr>
<td></td>
<td>L6699</td>
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<td>STN60M2</td>
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<tr>
<td>Sync rect.</td>
<td>SRK2000A</td>
<td>PM8834</td>
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<td>T*431</td>
<td>T*432</td>
</tr>
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<td>SRK2001</td>
<td>PM8834</td>
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<tr>
<td>Flyback</td>
<td>STSR30</td>
<td>-</td>
<td>STN60M2</td>
<td>STH*06</td>
<td>STH<em>06, STH</em>10</td>
<td>T*431</td>
<td>T*432</td>
</tr>
<tr>
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<td></td>
<td>-</td>
<td>STN60M2</td>
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</tr>
</tbody>
</table>

Typical configuration

Note: 1: M4 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. * is used as a wildcard character for related part number.

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

<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>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PFC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boost</td>
<td>CCM</td>
<td>L4981* L4984D</td>
<td>ST<em>N60M2 ST</em>N65M2 ST*N65M5</td>
<td>STTH<em>R06 STTH</em>T06 STPSC*065 (SiC Diodes)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TM</td>
<td>L6562A* L6563* L6564* STCMB1</td>
<td>ST<em>N500M2 ST</em>N600M2 ST<em>N60M2 ST</em>N60M2-EP ST*N60M6</td>
<td>STPS* FERD<em>45 FERD</em>60 FERD<em>100 ST1S3</em> ST1S4* ST1S50 L598*</td>
<td></td>
</tr>
<tr>
<td><strong>DC-DC</strong></td>
<td>stage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HB-LLC</td>
<td></td>
<td>ST<em>NS3LLH7 ST</em>N4LF7 ST<em>N10F7 ST</em>NF20D</td>
<td>ST90NS3LLH7 ST60NS3LLH5</td>
<td>STEF01 STEF05 STEF12</td>
<td>LDF LDFM LDK320 LDL212</td>
</tr>
<tr>
<td>Asym HB</td>
<td>L6591</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sync</strong></td>
<td>rect.</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>HB-LLC</td>
<td>SRK2000A</td>
<td>STL<em>NS3LLH7 ST</em>N4LF7 ST<em>N10F7 ST</em>NF20D</td>
<td>ST90NS3LLH7 ST60NS3LLH5</td>
<td>STEF01 STEF05 STEF12</td>
<td>LDF LDFM LDK320 LDL212</td>
</tr>
<tr>
<td>Asym HB</td>
<td>SRK2001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Post</strong></td>
<td>Regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buck</td>
<td>L672* L673* PM6680A</td>
<td></td>
<td>ST90NS3LLH7 ST60NS3LLH5</td>
<td>STEF01 STEF05 STEF12</td>
<td>LDF LDFM LDK320 LDL212</td>
</tr>
</tbody>
</table>

**Typical configuration**

**MAIN EVALUATION BOARDS**

EVL400W-ADP/ATX

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

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
Servers and telecoms: AC-DC power supply

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

ST offers a high-performing product portfolio reducing the total cost of the solution: SiC diodes (STPSC*), high-voltage MDmesh™ MOSFETs (for PFC and DC-DC stages), low-voltage STripFET MOSFETs (for synchronous rectification stage), new STDRIVE gate drivers (L639*, L649*). Smart controllers are available for the mentioned stages. For higher efficiency and power density systems, ST can offer also the breakthrough SiC MOSFET devices and the latest digital controller STNRGPF01.

High robusteness 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.

### Typical configuration

#### DC-DC stage

<table>
<thead>
<tr>
<th>DC-DC stage</th>
<th>SCR</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>LD0 &amp; Op Amps</th>
</tr>
</thead>
<tbody>
<tr>
<td>HB-LLC</td>
<td>L6599* L6699</td>
<td>L6591</td>
<td>L638* L639* L649*</td>
<td>ST<em>N50DM2 ST</em>N60DM2 ST<em>N60DM2 ST</em>N60DM2 ST<em>N60DM6 ST</em>N60DM6</td>
<td>-</td>
<td>STL<em>NS3LLH7 STL</em>94LF7 STL<em>N6F7 STL</em>N10F7 STL*N6D20D</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HC-PC</td>
<td>-</td>
<td>STM32F334 STNRF*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FB-PS</td>
<td>-</td>
<td>STM32F334 STNRF*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Asym HB</td>
<td>-</td>
<td>STM32F334 STNRF*</td>
<td>-</td>
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</tr>
</tbody>
</table>

#### Sync rect.

<table>
<thead>
<tr>
<th>Sync rect.</th>
<th>SCR</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>LD0 &amp; Op Amps</th>
</tr>
</thead>
<tbody>
<tr>
<td>HB-LLC</td>
<td>SRK2000A SRK2001</td>
<td>PM8834</td>
<td>-</td>
<td>-</td>
<td>STL<em>NS3LLH7 STL</em>94LF7 STL<em>N6F7 STL</em>N10F7 STL*N6D20D</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Asym HB</td>
<td>-</td>
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</tr>
</tbody>
</table>

#### Input Stage

<table>
<thead>
<tr>
<th>Input Stage (Rect. &amp; inrush current limiter)</th>
<th>SCR</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>LD0 &amp; Op Amps</th>
</tr>
</thead>
<tbody>
<tr>
<td>TN1515-600B TN2015H-6 TN4015H-6 TN5015H-6 TM8050H-8 TN3050H-12Y TN5050H-12Y</td>
<td>L4981* L4984D</td>
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<td>STBR3012 STBR6012</td>
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</tbody>
</table>

### 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
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>STRG04</td>
<td>ST120N8F7</td>
<td>ST100N12F7</td>
<td>ST1S40</td>
<td>LDK220 LDK320</td>
<td>STEF01</td>
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<tr>
<td>Synchronous Rectifier</td>
<td>STRG02</td>
<td>ST35N75LF3</td>
<td>ST260N45LF71</td>
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<tr>
<td>Control Stage</td>
<td>STRG06</td>
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</tbody>
</table>

Typical configurations

Main Evaluation Board

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

- 54 V/12 V, 42 A 500 W: 96.5% peak efficiency; size 4.3 inch²
- 54 V/3.3 V, 46 A 150 W: 95% peak efficiency; size 2.07 inch²
- 54 V/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 STDRIVE gate drivers (L639*, and L649*) offer optimum performance and reduce cooling requirements and heatsink size while the new STGAP series galvanically-isolated drivers guarantee high safety and reliability of the welding. Using SiC diodes (STPSC*) further improves system efficiency, taking advantage of silicon carbide’s superior physical characteristics over silicon.

<table>
<thead>
<tr>
<th></th>
<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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<td>Boost</td>
<td>Demagn</td>
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<td><strong>PFC Boost</strong></td>
<td>STM32F0*</td>
<td>TD35*</td>
<td>STG<em>N65FB STG</em>N60F STG*N120F2</td>
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<td>STTH<em>R06 STTH</em>T06 STTH<em>W06 STPSC</em>065 (SiC Diodes)</td>
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<td>PM8834</td>
<td>STGAP1AS STGAP1AS STGAP1AS</td>
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<td>STM32F334</td>
<td>PM8841</td>
<td>STGAP2S/2D</td>
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</tr>
<tr>
<td><strong>DC-DC stage</strong></td>
<td>STM32F334</td>
<td>L638*</td>
<td>STG<em>N65DF STG</em>N60DF STG*N120F2</td>
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<td>STTH<em>R06 STTH</em>T06 STTH<em>W06 STPSC</em>065 (SiC Diodes)</td>
<td>-</td>
</tr>
<tr>
<td><strong>TTF</strong></td>
<td>STM32F334</td>
<td>L639*</td>
<td>STG<em>N65DF STG</em>N60DF STG*N120F2</td>
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</tr>
<tr>
<td><strong>PS-FB</strong></td>
<td>STM32F334</td>
<td>L649*</td>
<td>STG<em>N65DF STG</em>N60DF STG*N120F2</td>
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</table>

Typical configuration

[Diagram of the typical configuration]

Solution based on two-transistor forward topology

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 converter</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>
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<td>-</td>
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<td>-</td>
<td>-</td>
<td>LED5000 LED6000</td>
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<tr>
<td>Buck, Buck-boost</td>
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<td>VIPer0P VIPer<em>1 VIPer</em>6</td>
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<td>-</td>
<td>-</td>
<td>STTH*</td>
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<td>HPF Buck-boost</td>
<td>HVLED805 HVLED807PF HVLED815PF</td>
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<td>-</td>
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<td>-</td>
<td></td>
</tr>
<tr>
<td>HPF Flyback</td>
<td>PSR-CC/CV</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td></td>
</tr>
<tr>
<td>Flyback</td>
<td>SSR-CC/CV</td>
<td>VIPer<em>5 VIPer</em>7 VIPer*8</td>
<td>VIPer0P VIPer<em>1 VIPer</em>6</td>
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<td>STRVS*</td>
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<tr>
<td></td>
<td>PSR-CV</td>
<td>-</td>
<td>VIPer*6</td>
<td>-</td>
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</tr>
<tr>
<td></td>
<td>PSR-CC/CV</td>
<td>ALTAIR*</td>
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</tbody>
</table>

Typical configuration

- Repetitive OVP
- Clamping Diode
- Output Diode
- Offline LED driver converter
- Output Diode
- Offline Converter
- Power Management and LED driving

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

<table>
<thead>
<tr>
<th>Wireless Connectivity</th>
<th>Chipset</th>
<th>Certified Module</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BlueNRG-MS</td>
<td>BALF-SPI-01D3</td>
</tr>
<tr>
<td></td>
<td>BlueNRG-MS</td>
<td>BALF-SPI-02D3</td>
</tr>
<tr>
<td><strong>Sub 1 GHz Connectivity</strong></td>
<td>SPIRIT1</td>
<td>BALF-SP2-01D3</td>
</tr>
<tr>
<td></td>
<td>S2-LP</td>
<td>BALF-SP2-02D3</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

Gateway IoT Cloud

**MAIN EVALUATION BOARDS**

<table>
<thead>
<tr>
<th>Board</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVLVLED815W10A</td>
<td>10 W, buck-boost LED driver</td>
</tr>
<tr>
<td>STEVAL-ILL082V1/STEVAL-ILL083V1</td>
<td>Smart home lighting based on HVLED815PF and SPSGRF (STEVAL-ILL082V1) and SPBTLE-RF (STEVAL-ILL083V1)</td>
</tr>
<tr>
<td>EVALVLED815W15</td>
<td>15 W, flyback LED driver</td>
</tr>
</tbody>
</table>

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.

<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>
</tr>
</thead>
<tbody>
<tr>
<td>HPF Flyback</td>
<td></td>
<td></td>
<td>ST*N80K5</td>
<td>STH*06</td>
<td>STRV*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ST*N90K5</td>
<td>STH*08</td>
<td></td>
<td>FERD*100</td>
<td>LED2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ST*N95K5</td>
<td>STH*10</td>
<td></td>
<td>STPS*150</td>
<td>LED5000</td>
</tr>
<tr>
<td>Sepic</td>
<td></td>
<td></td>
<td>ST*N60M2</td>
<td></td>
<td></td>
<td>STPS*170</td>
<td>LED6000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ST*N60M2</td>
<td></td>
<td></td>
<td>STPS*200</td>
<td></td>
</tr>
<tr>
<td>Multiple strings mgmt</td>
<td>STLUX*</td>
<td>L6395</td>
<td>ST*N6F7</td>
<td></td>
<td></td>
<td>FERD15S50B</td>
<td></td>
</tr>
<tr>
<td>Buck</td>
<td>STM32F334</td>
<td></td>
<td>ST*N10F7</td>
<td></td>
<td></td>
<td>STPS*170AF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STM32F301</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>STPS*4S200UF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STM32F0*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>STPSxxZF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STM32S5*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>STTHxxZF</td>
<td></td>
</tr>
<tr>
<td>Reverse buck</td>
<td>TD35*</td>
<td>PM8834</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LED2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PM8841</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LED2001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PM8851</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LED5000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LED6000</td>
</tr>
</tbody>
</table>

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

### Wireless Connectivity

<table>
<thead>
<tr>
<th></th>
<th>Chipset</th>
<th>Certified Module</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bluetooth Low Energy Connectivity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPBTLE-1S</td>
</tr>
<tr>
<td></td>
<td>BlueNRG-MS</td>
<td>SPBTLE-RF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPBTLE-RF0</td>
</tr>
<tr>
<td><strong>Sub 1 GHz Connectivity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPIRIT1</td>
<td>SPIRIT1</td>
<td>BALF-SPI-01D3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BALF-SPI-02D3</td>
</tr>
<tr>
<td></td>
<td>S2-LP</td>
<td>BALF-SP2-01D3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BALF-SP2-02D3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPSGRF (868 and 915 MHz)</td>
</tr>
<tr>
<td></td>
<td></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**
- **Gateway**
- **IoT Cloud**

### MAIN EVALUATION BOARDS

- **STEVAL-ILL080V1**
  - 18 W Tube replacement zero ripple LED driver using HVLED001A

- **STEVAL-ILL069V2**
  - 35 W, analog power supply (CV) for LED driving

- **STEVAL-ILL070V4**
  - 35 W, analog power supply (CC/CV) for single string LED driver

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

- **STEVAL-ILL051V2**
  - 18 V-3 A, buck LED driver converter

- **STEVAL-ILL054V2**
  - 18 V-4 A, buck LED driver converter

* is used as a wildcard character for related part number

**Note 1:** 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).

### Typical configuration

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

<table>
<thead>
<tr>
<th>Wireless Connectivity</th>
<th>Chipset</th>
<th>Certified Module</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Connectivity IC</td>
<td>MCU</td>
</tr>
<tr>
<td>Sub 1 GHz Connectivity</td>
<td>SPIRIT1</td>
<td>STM32F0*</td>
</tr>
<tr>
<td></td>
<td>S2-LP</td>
<td>STM32L0*</td>
</tr>
</tbody>
</table>

Typical configuration

**MAIN EVALUATION BOARDS**

- **STEVAL-ILL066V2**: 100 W, digital single-string PSR-CC LED driver
- **STEVAL-ILL053V1**: 130 W, analog power supply (CV_{CC}) for LED driving
- **STEVAL-ILL074V1/V2**: 60 W, analog power supply (CV_{CC}) for LED driving
- **STEVAL-ILL077V1**: 60 W, digital multiple-string LED driver
- **STEVAL-ILL056V1**: 48 V-3 A, buck LED driver converter
- **STEVAL-ILL078V1**: 60 V-1 A, buck LED driver converter

*Note: 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 STDRIVE gate drivers (L639*, 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

![Diagram of typical configuration]

- **Rect. & inrush current limiter**
- **PFC**
- **3-ph inverter**
- **Fan**
- **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 STDRIVE gate drivers family (L639*, L649*) improves the reliability (robustness and noise immunity) of the application. Depending on your needs, new 8/16 channels LED array drivers allow to have an user-friendly human interface. ST’s complete offer is given in the following table.

<table>
<thead>
<tr>
<th>Topology example</th>
<th>MCUs</th>
<th>Gate drivers</th>
<th>IGBTs</th>
<th>LED array drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single-switch</strong></td>
<td>STM8*</td>
<td>TD35*</td>
<td>STG*IH125DF</td>
<td>-</td>
</tr>
<tr>
<td><strong>quasi-resonant</strong> (voltage resonance)</td>
<td>STM32F100</td>
<td>PM8841</td>
<td>STG*IH135DLF2</td>
<td>-</td>
</tr>
<tr>
<td><strong>HB series resonant</strong></td>
<td>STM32F0*</td>
<td>L638*</td>
<td>STG*H65DFB</td>
<td>-</td>
</tr>
<tr>
<td><strong>(current resonance)</strong>*</td>
<td>STM32F100</td>
<td>L639*</td>
<td>STG*H60DLFB</td>
<td></td>
</tr>
<tr>
<td><strong>User interface</strong></td>
<td>STM8*</td>
<td>-</td>
<td>STG<em>IH65DF</em></td>
<td>-</td>
</tr>
<tr>
<td><strong>(front panel)</strong></td>
<td>STM32F0*</td>
<td>-</td>
<td>LED1642GW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STM32F4*9</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STM32F7*</td>
<td>-</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

**MAIN EVALUATION BOARD**

Board available on request
1.8 kW, quasi-resonant induction cooking system

Topology example

Half-bridge series-resonant induction heating system

Single-switch quasi-resonant induction heating system
RENEWABLE ENERGY & HARVESTING

Photovoltaic (centralized)

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

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

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

<table>
<thead>
<tr>
<th>Central inverter</th>
<th>DC-DC stage</th>
<th>DC-AC stage</th>
<th>3-Level HB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junction box</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MCUs</td>
<td>Gate drivers</td>
<td>MOSFETs</td>
<td>IGBTs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ST60DM2</td>
</tr>
<tr>
<td>STM32F1*</td>
<td>L638*</td>
<td>ST65DM2</td>
<td>STPS*12</td>
</tr>
<tr>
<td>STM32F2*</td>
<td>L639*</td>
<td>ST*N120</td>
<td>STTH*S12</td>
</tr>
<tr>
<td>STM32F3*</td>
<td>L649*</td>
<td>STGAP1AS</td>
<td>STPSC*065</td>
</tr>
<tr>
<td>STM32F4*</td>
<td>STGAP2S/2D</td>
<td>STGAP3AS</td>
<td>STPSC*12</td>
</tr>
<tr>
<td>STM32F7*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC-AC stage</td>
<td>FB mix freq</td>
<td>FB mix freq</td>
<td>STG*H65DFB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STG*H120DF2</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>STG*S120DF3</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>STG*M120DF3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STG*M65DFB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STG*M65DF2</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 (STPS*) guarantee a high-efficiency converter while the new STGAP series galvanically-isolated gate drivers offer high safety and reliability. High- and low-voltage DC-DC converters guarantee high power density for the post-regulation stages.

<table>
<thead>
<tr>
<th>Power optimizer</th>
<th>DC-DC stage</th>
<th>Isolated FB boost</th>
<th>MCUs</th>
<th>Gate drivers</th>
<th>Power MOSFETs</th>
<th>IGBTs</th>
<th>Diodes</th>
<th>Bypass Diode</th>
<th>DC-DC converters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>STM32F103</td>
<td>L638*</td>
<td>STH*N10F7</td>
<td>STH*N6F7</td>
<td>STTH*R06</td>
<td>STPS*30</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>STM32F3*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>STPS*45</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>STM32F4*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FERD*45</td>
<td></td>
</tr>
</tbody>
</table>

| Central inverter | DC-AC stage | 3-level HB | STM32F103 | L639* STGAP1AS STH*N120 (SiC MOSFET) | STG*H65DFB | STH*R06 STTH*06 | STPS*065 STPS*12 (SiC Diodes) | L6985F L6986 L597* L7985 L7986 L7987* |
|                 |             |           | STM32F2*  |               |              |        |        |              |                  |
|                 |             |           | STM32F3*  |               |              |        |        |              |                  |
|                 |             |           | STM32F4*  |               |              |        |        |              |                  |

| Microinverter | DC-DC Inter. Boost | STM32F103 | TD35* PM8834 PM8841 PM8851 | STH*N10F3 STH*N8F7 ST*160N75F3 | STB*N6S5M5 | STB*N6S5M5 | STB*N6S5M5 | STB*N6S5M5 | STB*N6S5M5 |
|               | DC-AC FB mix freq. | STM32F3*  | L639* STGAP1AS STGAP2S/2D | STB*N6S5M5 | STB*N6S5M5 | STB*N6S5M5 | STB*N6S5M5 | STB*N6S5M5 | STB*N6S5M5 |

**Typical configurations**

**Partially distributed approach**

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

**Fully distributed approach**

- AC grid
- DC-AC Microinverter

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 LDOS. These requirements involve not only the electronics but also reliable, good-quality Li-Ion batteries. ST also provides ultra-thin, fast recharging Li-Ion batteries with a long cycle life and low capacity loss, making them suitable for renewable energy and harvesting applications. The ST devices best suited for each of the most common topologies are listed in the following table.

<table>
<thead>
<tr>
<th>Battery Charger</th>
<th>Battery Charger with MPPT</th>
<th>Thin-film batteries</th>
<th>Linear voltage regulators</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV 400 mW to 3 W</td>
<td>SPV1040</td>
<td>-</td>
<td>STL0015</td>
</tr>
<tr>
<td>PV and TEG Up to 400 mW</td>
<td>SPV1050</td>
<td>STBC15</td>
<td>EFL700A39</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STLQ015</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STLQ020</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

![Typical configuration diagram](image)

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
Autonomous wireless multisensor node powered by PV cells

STEVAL-IDS003V1³
Autonomous 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 STGAP series galvanically-isolated gate drivers and high-performance STM32 microcontrollers guarantee high reliability and efficiency.

<table>
<thead>
<tr>
<th></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 STBR6012</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PFC Boost</td>
<td>STNRGPF01</td>
<td>PM8834</td>
<td>PM6851</td>
<td>ST*N60M2</td>
<td>-</td>
<td>-</td>
<td>T1635</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Charge controller</td>
<td>HB</td>
<td>L638*</td>
<td>-</td>
<td>STG*H65DFB</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DC-DC stage</td>
<td>Push</td>
<td>PM8834</td>
<td>PM6841</td>
<td>STGAP1AS</td>
<td>ST<em>N500DM2 ST</em>N60M2 ST*N60M2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DC-AC stage</td>
<td>Pull</td>
<td>L638*</td>
<td>L649*</td>
<td>STGAP2S/2D</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</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

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 - 450 V). In the car the on-board charger (OBC) allows charging of the battery from home AC mains plug or private/public outlets (AC charging station). Typical AC power charging levels range 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 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>Interleaved boost</th>
<th>STTH16L06C-Y</th>
<th>STTH30L06-Y</th>
<th>TN3050H-12Y</th>
<th>MCUs</th>
<th>Gate Drivers</th>
<th>HV Power MOSFETs</th>
<th>HV output diodes</th>
<th>Bypass diodes</th>
<th>Protections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Semi-bridgeless</td>
<td>STBR*012-Y</td>
<td></td>
<td></td>
<td></td>
<td>STGAP1AS</td>
<td>STB43N65M5</td>
<td>STPSC12065-Y</td>
<td></td>
<td>SM4TY</td>
</tr>
<tr>
<td></td>
<td>Totem pole</td>
<td>STTH30L06-Y</td>
<td>STBR*012-Y</td>
<td>TN5050H-12WY</td>
<td></td>
<td></td>
<td>STW62N65M5</td>
<td>STPSC20065-Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vienna original</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td>SPC58</td>
<td>STW78N65M5</td>
<td>STPSC30065C-Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vienna modified</td>
<td>STTH30L06-Y</td>
<td>STBR*012-Y</td>
<td>TN5050H-12WY</td>
<td></td>
<td>SPC57</td>
<td>A6387 STGAP1AS</td>
<td>STPSC40065C-Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC-DC stage</td>
<td>FB-PS</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>STW45N60DM2AG</td>
<td>STPSC10H12-Y</td>
<td></td>
<td>SM4TY</td>
</tr>
<tr>
<td></td>
<td>FB-LLC</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>STW58N60DM2AG</td>
<td>STPSC15H12-Y</td>
<td></td>
<td>SM6TY</td>
</tr>
<tr>
<td></td>
<td>3-Level HB LLC</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>STW72N60DM2AG</td>
<td>STPSC20H12-Y</td>
<td></td>
<td>SM30TY</td>
</tr>
</tbody>
</table>

Topography example: (3ph + N) input modular approach
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.

Typical configuration

<table>
<thead>
<tr>
<th>Wireless charging ICs, MCUs</th>
<th>Gate drivers</th>
<th>Power MOSFETs</th>
<th>Protections</th>
<th>Diodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter DC-AC stage HB</td>
<td>STWBC</td>
<td>L6747*</td>
<td>STL*NS3LLH7</td>
<td>STPSxx45/60/100 FERDxx45/60/100</td>
</tr>
<tr>
<td></td>
<td>STWBC-WA</td>
<td></td>
<td>ST*N2VH5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STWBC-EP</td>
<td></td>
<td>ST*P2UH7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STM32F0*</td>
<td></td>
<td>STL8DN10LF3</td>
<td></td>
</tr>
<tr>
<td>Receiver Rectification</td>
<td>STWLC03</td>
<td>L6747*</td>
<td>STL*N3LLH6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STWLC04</td>
<td></td>
<td>STL10N3LLH5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STWLC33</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Voltage/Current regulation</td>
<td>STM32F0*</td>
<td></td>
<td>SMM4F</td>
<td>BAT30F4</td>
</tr>
</tbody>
</table>

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

MAIN EVALUATION BOARDS

STEVAL-ISB027V1 Qi A11 Wireless charger transmitter based on STWBC
STEVAL-ISB036V1 Wireless charger receiver based on STWLC03
STEVAL-ISB042V1 Qi 15W/AirFuel inductive 5W dual mode receiver and Qi based 3W 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
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** (VIPer0P and VIPer*1, VIPer*5, VIPer*6, VIPer*7, VIPer*8 families) features an 800 V avalanche-rugged power MOSFET and leading-edge PWM controller and consumes less than 4 mW for VIPer0P, 10 mW for VIPer*1 and 30 mW in standby for the others. It also comes with the largest choice of protection schemes and supports different topologies.

The 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 VIPer0P, VIPer*1 and VIPer*6
- PSR-CV/CC and tight tolerance using ALTAIR*
- Buck & buck-boost topologies supported by VIPer0P, VIPer*1 and VIPer*6

**Different features for different controllers**

- **VIPer0P**
  - 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><strong>Buck Converter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max $R_{\text{DRAIN}}/I_{\text{LIM}}$</td>
<td>30 $\Omega$/350 mA</td>
<td>24 $\Omega$/400 mA</td>
<td>20 $\Omega$/400 mA</td>
<td>14 $\Omega$/700 mA</td>
<td>7 $\Omega$/700 mA</td>
</tr>
<tr>
<td>$V_{\text{SWSS}}$</td>
<td>800 V</td>
<td>900 V (ALTAX05)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Products**

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 \( P \leq 250 \) W) and continuous current mode (CCM, suitable for \( P > 250 \) W), and are suitable for a wide-range-mains operation. These devices embed advanced protection features, which make SMPS more robust and compact, requiring fewer external components. These features include output overvoltage, brown-out, feedback disconnection and boost inductor saturation protection. The high-voltage start-up capability, present in the L6564H and L6563H, helps improve the SMPS standby efficiency in systems that do not include an auxiliary power supply.

TM PFC controllers

![TM PFC controller diagram](image)

<table>
<thead>
<tr>
<th>L6562A*</th>
<th>Basic features</th>
<th>Advanced protections</th>
<th>Remote on/off control</th>
<th>Tracking boost function</th>
<th>Interface for cascaded converter</th>
</tr>
</thead>
<tbody>
<tr>
<td>L6564*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L6563*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CCM PFC controllers

![CCM PFC controller diagram](image)

<table>
<thead>
<tr>
<th>L4984D</th>
<th>Line-modulated, fixed-off-time (LM-FOT) control</th>
</tr>
</thead>
<tbody>
<tr>
<td>L4981A</td>
<td>Fixed frequency, average-current mode</td>
</tr>
<tr>
<td>L4981B</td>
<td>Line modulated frequency, average-current mode</td>
</tr>
</tbody>
</table>

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

Combo controller (PFC+LLC)

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

Asymmetrical half-bridge controller

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

HB-LLC resonant controllers

<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>

**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
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

**SR controllers for LLC resonant**

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

**SYNCHRONOUS RECTIFICATION BENEFITS**

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

**MAIN APPLICATIONS**

- **High-power adapters and TVs**
  - STSR30, STSR2P*

- **Desktop PCs and Server/Telecoms**
  - SRK2000A, SRK2001

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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

CC/CV controllers for chargers, adapters and others

- **SEA01**
  - Advanced CC/CV controller with online digital trimming
  - 0.1% voltage reference precision up to 36 V_{cc}
  - 200 µA low quiescent current

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

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

- **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.

Battery chargers

<table>
<thead>
<tr>
<th>Current</th>
<th>ICs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 A</td>
<td>STBCFG01</td>
</tr>
<tr>
<td>1 A</td>
<td>L6924U, L6924D</td>
</tr>
<tr>
<td>0.8 A</td>
<td>STC4054</td>
</tr>
<tr>
<td>0.65 A</td>
<td>STBC03</td>
</tr>
<tr>
<td>0.45 A</td>
<td>STBC02</td>
</tr>
<tr>
<td>0.2 A</td>
<td>STNS01</td>
</tr>
<tr>
<td>0.04 A</td>
<td>STBC151</td>
</tr>
</tbody>
</table>

STBC02/STBC03
- Embed a linear battery charger, a 150 mA LDO, 2 SPDT load switches and a protection circuit module
- STBC02 embeds a smart reset/watchdog and a single wire interface for IC control
- Use a CC/CV algorithm with programmable (only STBC02) fast charge, precharge and termination current

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

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

STC3117
- 3% accuracy of battery state of charge no need for shunt resistor
- Accurate estimation of battery state of charge at power-up
- Reliable battery swap detection
- SoH and impedance tracking with OptimGauge+ algorithm (ST IP)
- Charger enable and system reset control for accurate OCV reading
- Minimum form factor

MAIN APPLICATIONS

Bluetooth accessories
STC4054

USB
L6924U, STC4054, STBCFG01

Fitness
STNS01, STBC02, sSTBC03

Smartphones
STBCFG01, STC3115, SCT3117

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>IC</th>
<th>Features</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 application up to 15 W  
- Qi extended power certified |

Common features

- Digital feedback with foreign object detection (FOD)
- Smart standby (best in class consumption)
- Firmware customization via API
- GUI for configuration and run-time analysis

Wireless power receivers

<table>
<thead>
<tr>
<th>IC</th>
<th>Features</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.

**Main Applications**

- Fitness and wearables
- NFC
- Sensors and networks
- Smart cards

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

**EFL700A39**

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

 Ultralow consumption linear charger for thin film battery

**STBC15**

- 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

**Note 1:** available in Q4 2017

* is used as a wildcard character for related part number

www.st.com/battery-management-ics
www.st.com/enfilm
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 $V_{in}$/3 A
- Synchronization capability
- Internal compensation
- Low consumption
- Adjustable fsw
- Internal soft start
- Low quiescent current

### MAIN APPLICATIONS

- **Smartphones**
- **TVs**
- **Computing**
- **Solar**
- **UPS**
- **Lighting**
- **Set-top boxes**
- **Wearables**
- **Server/Telecom**
- **Home appliances**
- **Factory automation**

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

**DC-DC CONVERTERS MAIN FEATURES**
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>I2C</td>
<td>Low quiescent current (35 uA), Automatic PWM 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>5 V &amp; 12 V (3.5 A)</td>
<td>I2C</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>I2C &amp; SPI</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>I2C</td>
<td>PWM and PFM modes</td>
</tr>
<tr>
<td>L7292</td>
<td>- 2.7 V - 5.5 V</td>
<td>5</td>
<td></td>
<td>I2C</td>
<td></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

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

STNRGPFO1
- Digital controller fully configurable through GUI for fast and easy design, does not require writing any firmware
- Up to 3-channel interleaved boost PFC
- Ideal for wide power range above 1 kW
- Reduced EMI filter and inductor volume
- Reduced output capacitor RMS current
- Flexible working frequency up to 300 kHz to drive both MOSFETs and IGBTs
- Configurable phase shedding for wide load range high efficiency conversion
- Soft start-up to reduce electrical stress and to manage inrush current PFC Soft Power-On
- On-chip UART/I2C digital interfaces for convenient connectivity
- Ideal for outdoor applications with -40 to +105 °C operating range

MAIN APPLICATIONS

Solar STNRG*
UPS STNRG*
HEV charging stations STNRG*
Factory automation STNRG*
Commercial, architectural and street lighting STLUX*

www.st.com/stlux
www.st.com/stnrg

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

- 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

<table>
<thead>
<tr>
<th>Feature</th>
<th>STM32F0*8</th>
<th>STM32F0*2</th>
<th>STM32F0*1</th>
<th>STM32F0*0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>1.8 V regulator</td>
<td>POR/PDR/PVD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xtal oscillators</td>
<td>32 kHz + 4 ~32 MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal RC oscillators</td>
<td>40 kHz + 8 MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLL</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Clock control</td>
<td></td>
<td></td>
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<tr>
<td>RTC/I-WDG</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>SysTick timer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2x watchdogs</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>(independent and window)</td>
<td></td>
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<tr>
<td>24/37/51 I/Os</td>
<td></td>
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</tr>
<tr>
<td>Cyclic redundancy check</td>
<td></td>
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<tr>
<td>(CRC)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Touch-sensing controller</td>
<td></td>
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<tr>
<td>18 keys</td>
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</tr>
<tr>
<td>JTAG/SW debug</td>
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</tr>
<tr>
<td>ARM Cortex-M4</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>72 MHz</td>
<td></td>
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<tr>
<td>Floating point unit (FPU)</td>
<td></td>
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<tr>
<td>Nested vector interrupt</td>
<td></td>
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<tr>
<td>controller (VIC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AHB bus matrix</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7-channel DMA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### System

- **STM32F334 features**

<table>
<thead>
<tr>
<th>Connectivity</th>
<th>1x SPI</th>
<th>1x I²C</th>
<th>1x CAN 2.0B</th>
<th>2x USART + 1xUSART/LIN, smartcard, IrDA, modem control</th>
<th>IR transmitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog</td>
<td>3x 12-bit DAC + 2x timers</td>
<td>2x 12-bit ADC</td>
<td>21 channels / 5 MSPS</td>
<td>3x Comparators (22 ns)</td>
<td>1x Programmable Gain Amplifiers (PGA)</td>
</tr>
</tbody>
</table>

### MAIN APPLICATIONS

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

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

![Diagram of diode types]

**Field-effect rectifiers (FERD)**
- **FERD***: Low voltage diodes, for high efficiency and high power density applications
- **STPS***: Power Schottky diodes for low voltage general purpose applications
- **STTH***: Ultrafast high voltage diodes for general purpose application

**Power Schottky diodes**

**Ultrafast rectifiers**

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

**MAIN APPLICATIONS**

- **Adapters and TVs**
- **Battery chargers**
- **Solar inverters, welding, HEVs, and UPS**
- **Residential, commercial, architectural and street lighting**
- **PC Desktop and Server/Telecoms**
- **HEV charging stations**
- **Factory automation**
- **Home appliances**
- **Consumer electronics**

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

**SIC DIODES BENEFITS**

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

**MAIN APPLICATIONS**

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

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

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

E-fuses can be found in various 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

E-fuses can operate at different voltages:

- 3.3 V
- 3.3 V/5 V (low quiescent current)
- 5 V
- 12 V
- 8 to 48 V (fully programmable)

[www.st.com/e-fuse](http://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

STPW05\textsuperscript{1} STPW12\textsuperscript{1}

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

![Power breaker circuit](image)

Current limiter IC

STFC01

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

![Current limiter circuit](image)

**MAIN APPLICATIONS**

- **Home appliances**
  - STPW05\textsuperscript{1}, STPW12\textsuperscript{1}
- **Air conditioning**
  - STPW05\textsuperscript{1}, STPW12\textsuperscript{1}
- **Factory automation**
  - STPW05\textsuperscript{1}, STPW12\textsuperscript{1}, 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 Tj = 150 °C
- Wide safe operating area (SOA)
- Soft and fast recovery antiparallel diode
- Low drop series: very low VCE(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 Tj = 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 Tj = 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 VCE(sat) = 1.4 V @ Id
- Very low Eoff
- Low drop forward voltage diode
- Designed for soft commutation application only
- Mass production in Q1 2018

1250 V family

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

1350 V family

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

**STG**H*B

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

### H series

**STG**H*

600 V family

- 3 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
  $T_j = 150$ °C
- Low turn-off losses
- Up to 100 kHz as switching frequency

### V series

**STG**V60*F

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

---

**MAIN APPLICATIONS**

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

---

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

[www.st.com/igbt]
Intelligent power module - SLLIMM™

The SLLIMM, small low-loss intelligent molded module, is the 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**
- Washing Machine Motor control
- Air conditioning
- Fan
- Fridge
- Refrigerator
- Small Pump
- Small Industrial
- Inverter & Pump
- Package A/C
- Room A/C
- WM
- Power Tools
- Refrigerator

End Products

<table>
<thead>
<tr>
<th>Power</th>
<th>30 W</th>
<th>330 W</th>
<th>500 W</th>
<th>1 kW</th>
<th>2 kW</th>
<th>3 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>STGIPN<em>H60x, STGIPN</em>HD60x, STIPNxM50x</td>
<td>STGIB<em>CH60x, STGIB</em>M60x</td>
<td>STGIPQ<em>C60x, STIPQ</em>M60x</td>
<td>STGIF*CH60x</td>
<td></td>
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</tr>
</tbody>
</table>

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

www.st.com/igbt
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>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>8</td>
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<tr>
<td>VN808*</td>
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<tr>
<td>VNI8200</td>
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<tr>
<td>ISO8200**</td>
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<td>VN330</td>
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<tr>
<td>VN340</td>
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</tr>
<tr>
<td>VNI4140</td>
<td></td>
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</tr>
<tr>
<td>L6374</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td>L6376</td>
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<td></td>
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<tr>
<td>L6360</td>
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<td></td>
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</tr>
<tr>
<td>L6362A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDE1747</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDE18*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L6370</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>VN751</td>
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<tr>
<td>TDE1798</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TDE32*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L6375</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPS160</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDE170*</td>
<td></td>
<td></td>
<td>4</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
LED DRIVERS

Offline LED drivers

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

Offline LED converters with PSR

<table>
<thead>
<tr>
<th>Model</th>
<th>HPF</th>
<th>PSR-CC</th>
<th>PSR-CV</th>
<th>( P_{\text{outMax}} )</th>
<th>Internal power</th>
<th>MOSFET</th>
<th>Flyback</th>
<th>Buck-boost</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVLED805</td>
<td>Float</td>
<td>Float</td>
<td>Float</td>
<td>8 W</td>
<td>800 V_{BR}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVLED807PF</td>
<td>Float</td>
<td>Float</td>
<td>Float</td>
<td>10 W</td>
<td>800 V_{BR}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVLED815PF</td>
<td>Float</td>
<td>Float</td>
<td>Float</td>
<td>15 W</td>
<td>800 V_{BR}</td>
<td></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>Float</td>
<td>Float</td>
<td>Float</td>
<td>Float</td>
<td></td>
</tr>
</tbody>
</table>

Topology example

![Topology diagram](image)

**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

www.st.com/led
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.

### 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

---

### DC-DC LED drivers converters

<table>
<thead>
<tr>
<th></th>
<th>Buck</th>
<th>Buck-boost</th>
<th>(I_{\text{outMax}})</th>
<th>Dimming</th>
<th>(V_{\text{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_{\text{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**

---

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

<table>
<thead>
<tr>
<th>Channels</th>
<th>Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>LED2472G, STP24DP05</td>
</tr>
<tr>
<td>16</td>
<td>LED1642GW, STP16C*/D*</td>
</tr>
<tr>
<td>12</td>
<td>LED1202, LED8102S</td>
</tr>
<tr>
<td>8</td>
<td>STP16C*/D*</td>
</tr>
<tr>
<td>4</td>
<td>STP4CMP, STP08, STP04</td>
</tr>
</tbody>
</table>

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
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

<table>
<thead>
<tr>
<th>Smartphones</th>
<th>Game consoles</th>
<th>Keyboard and accessories</th>
<th>Home appliances and ATMs</th>
<th>Wearables</th>
</tr>
</thead>
<tbody>
<tr>
<td>STLED25, STLD40D</td>
<td>STLD41</td>
<td>STLA02*</td>
<td>LED7706, LED7707, LED7708, STCS*</td>
<td>STLED524</td>
</tr>
</tbody>
</table>

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)

1 channel driver
(for displays up to 4”)
STOD1317B

2 channel drivers
(for displays up to 5”)
STOD13CM

3 channel drivers
(for displays up to 6”)
STOD32A, STOD32W

MAIN APPLICATIONS

Fitness and wearables
STOD32W, STOD1317B

Low-end smartphones
STOD1317B, STOD13CM

High-end smartphones
STOD32A

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.

MAIN APPLICATIONS

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

LBP01 get reliable your led application

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

www.st.com/lbp01
LINEAR VOLTAGE REGULATORS

ST offers a complete portfolio of industry-standard high-performance regulators for both positive and negative outputs. Among our products, you can find the optimal combination of 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.

Main Applications

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

Healthcare
STLQ015, STLQ020, ST715, LD39130

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

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
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
STDRIVE MOSFET AND IGBT GATE DRIVERS

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

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

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

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

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

MAIN APPLICATIONS

Factory automation, home appliances, and motor control
L638*E, TD35*, L639*, L6491, L6494, L6498, PM8841, PM8851

Commercial, architectural and street lighting
PM8834, PM8841, PM8851

Solar inverters, HEV / EV, and factory automation
STGAP1AS, PM8841, PM8851
STGAP2S, STGAP2D

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

www.st.com/stdrive
**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.

<table>
<thead>
<tr>
<th>SPV1040</th>
<th>SPV1050</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outdoor solar battery charger with embedded MPPT</strong></td>
<td><strong>Indoor ultra-low-power energy harvester and battery charger with embedded MPPT and LDOs</strong></td>
</tr>
<tr>
<td>400 mW to 3 W</td>
<td>&lt; 400 mW</td>
</tr>
<tr>
<td>PV</td>
<td>PV and TEG</td>
</tr>
<tr>
<td>Any type</td>
<td>Any type (including supercap and EFL700A39)</td>
</tr>
</tbody>
</table>
| Sync Boost | Sync Boost
| Sync Buck-Boost |
| Over-current and Over-temperature protection, input reverse polarity protection | Over-voltage and under-voltage battery protection, n. 2 embedded LDOs (1.8 V and 3.3V) |

**Output Power Capability**

- SPV1040: 400 mW to 3 W
- SPV1050: < 400 mW

**Harvesting Source**

- SPV1040: PV
- SPV1050: PV and TEG

**Target Battery**

- SPV1040: Any type
- SPV1050: Any type (including supercap and EFL700A39)

**Topology**

- SPV1040: Sync Boost
- SPV1050: Sync Boost

**Other Features**

- Over-current and Over-temperature protection, input reverse polarity protection
- Over-voltage and under-voltage battery protection, n. 2 embedded LDOs (1.8 V and 3.3V)

**Solar curves**

![Solar curves graph]

**Thermo-electric generator (TEG)**

![Thermo-electric generator graph]

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

**DM2 & DM6 series**
- ST*N*DM2
  - Improved trr of intrinsic diode
  - High dv/dt capability
  - Suited for ZVS/LLC topologies
- ST*N*DM6
  - Improved trr of intrinsic diode
  - High dv/dt capability
  - Suited for ZVS/LLC topologies

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

**M6 series**
- ST*N*M6
  - Lower RDS(on) x area vs previous generation
  - Extremely low gate charge (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, DM2, DM6, DK5
- **Residential, commercial, architectural and street lighting**
  - K5, DK5
- **Server/Telecoms**
  - M5, M2, M2-EP, DM2

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

www.st.com/mosfet
Low-voltage power MOSFETs (silicon)
ST’s LV MOSFET portfolio offers a broad range of breakdown voltages from -100 V to 120 V, with low gate charge and low on-resistance, combined with state-of-the art packaging.
ST’s STripFET MOSFETs support a wide voltage range for synchronous rectification, UPS, motor control, SMPS, power-over-Ethernet (PoE), inverter, automotive and other applications in a wide range of miniature and high-power packages: DPAK, D²PAK, SOT-223, TO-220, TO-220FP, TO-247, PowerFLAT (5 x 6)/(3.3 x 3.3)/(2 x 2), SO-8 and SOT23-6L.

H6 series
- ST*N*H6
  - Very good R\(_{\text{DS(on)}}\)
  - Soft diode recovery
  - Suited for OR-ing, square-wave HB, battery mgmt topologies

H7 series
- ST*N*H7
  - Extremely low R\(_{\text{DS(on)}}\)
  - High current capability
  - Monolithic Schottky
  - Super logic level (P-channel)
  - Suited for reverse buck, buck-boost, battery mgmt, forward and buck topologies

F6 series
- ST*N*F6
  - Wide voltage range
  - Soft diode recovery
  - Very good R\(_{\text{DS(on)}}\)
  - Suited for load-safety switch, buck and sync rectification

F7 series
- ST*N*F7
  - Extremely low R\(_{\text{DS(on)}}\)
  - Optimized body diode (low Q\(_{\text{r}}\)) and intrinsic capacitance
  - Proper Crss/Ciss ratio
  - Suited for flyback and sync rectification

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

www.st.com/mosfet


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 Rds(on) vs. temperature](image)

SiC MOSFETs, the real breakthrough in high voltage switching

- **V_{BR}** = 1200 V (SCT*N120), 650 V (SCT*N65G2V)
- Low power losses at high temperature
- High operating temperature capability (200 °C)

**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-PSE (Power source equipment)

PoE-PD (Powered device)

PoE-PD devices

<table>
<thead>
<tr>
<th>PM8803</th>
<th>PM8801</th>
<th>PM8800A</th>
</tr>
</thead>
<tbody>
<tr>
<td>• IEEE 802.3at PD interface</td>
<td>• Sleep mode with LED indicator and Maintain Power Signature</td>
<td>• IEEE 802.3af PD interface</td>
</tr>
<tr>
<td>• PWM current mode controller with double gate driver</td>
<td>• IEEE 802.3at PD interface + PWM current mode ctrl with double gate driver</td>
<td>• PWM current mode controller</td>
</tr>
<tr>
<td>• Integrated 100 V, 0.45 W, 1 A hot-swap MOSFET</td>
<td>• Integrated 100 V, 0.45 W, 640 mA hot-swap MOSFET</td>
<td>• Integrated 100 V, 0.5 W, 800 mA hot-swap MOSFET</td>
</tr>
<tr>
<td>• Supports flyback, forward active clamp, and flyback with synchronous rectification topologies</td>
<td>• Supports flyback, forward active clamp, and flyback with synchronous rectification topologies</td>
<td>• Supports both isolated and non-isolated topologies</td>
</tr>
</tbody>
</table>

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.

![Diagram showing various components and their specifications]

**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]
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 this 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.

Peak pulse current performances

IPP 8/20 µs versus VRM

<table>
<thead>
<tr>
<th>Voltage (VRM)</th>
<th>Stand-off voltage (V_{rms})</th>
<th>Peak pulse current (IPP 8/20 µs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5 V</td>
<td>60 A</td>
<td>60 A</td>
</tr>
<tr>
<td>5.5 V</td>
<td>120 A</td>
<td>120 A</td>
</tr>
<tr>
<td>12 V</td>
<td>70 A</td>
<td>70 A</td>
</tr>
<tr>
<td>13.2 V</td>
<td>60 A</td>
<td>60 A</td>
</tr>
<tr>
<td>15 V</td>
<td>50 A</td>
<td>50 A</td>
</tr>
<tr>
<td>15 V</td>
<td>160 A</td>
<td>160 A</td>
</tr>
<tr>
<td>22 V</td>
<td>35 A</td>
<td>35 A</td>
</tr>
</tbody>
</table>

ST Competition

www.st.com/esd-protection

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

**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
- **USB Type-C Interface**
  - 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
- **USB Type-C controller with PD PHY and BCM driver**
  - 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
- **Power Delivery controller provider only**
  - 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

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

X-CUBE-USB-PD

STUSB1602A Type-C Controller

USB-C