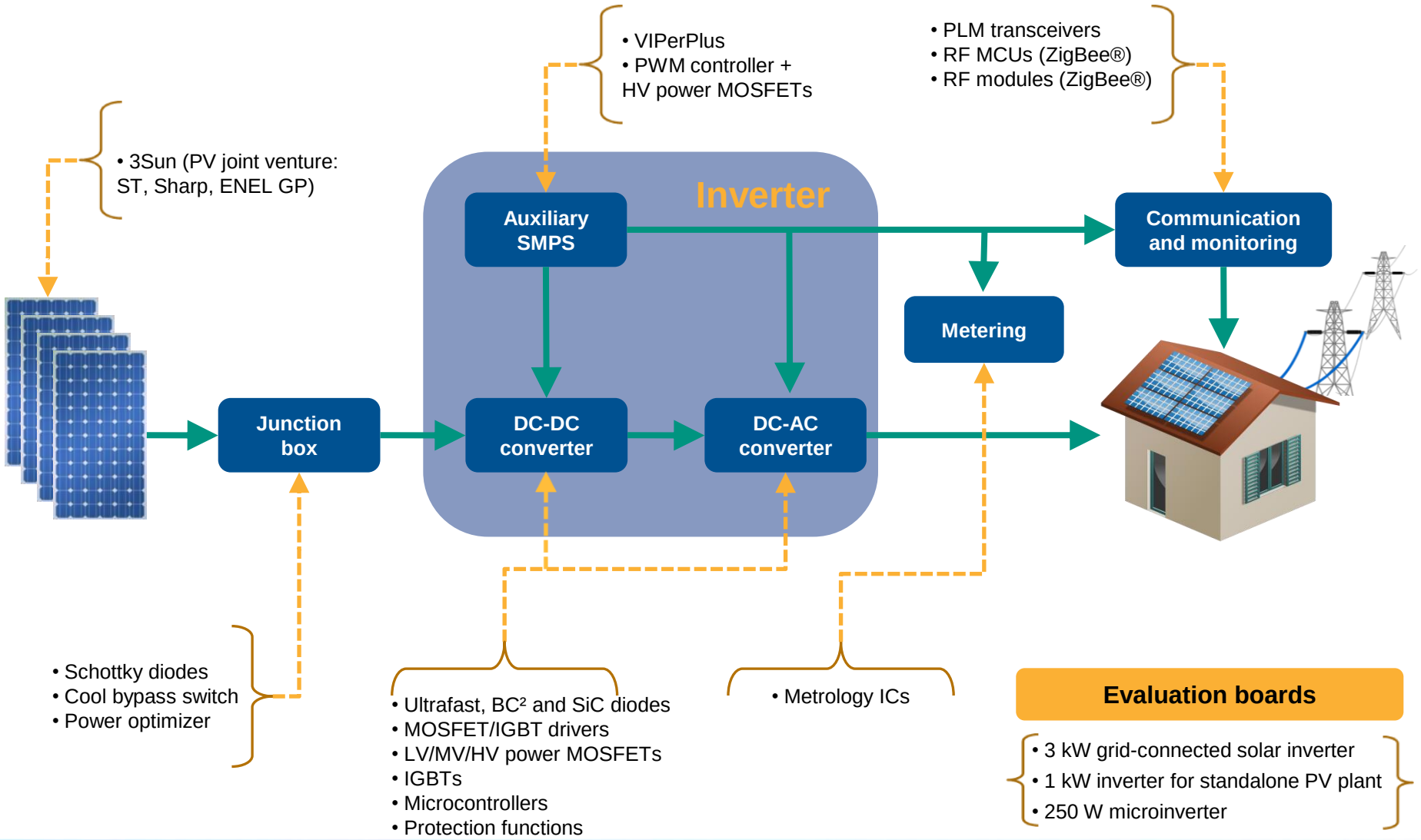
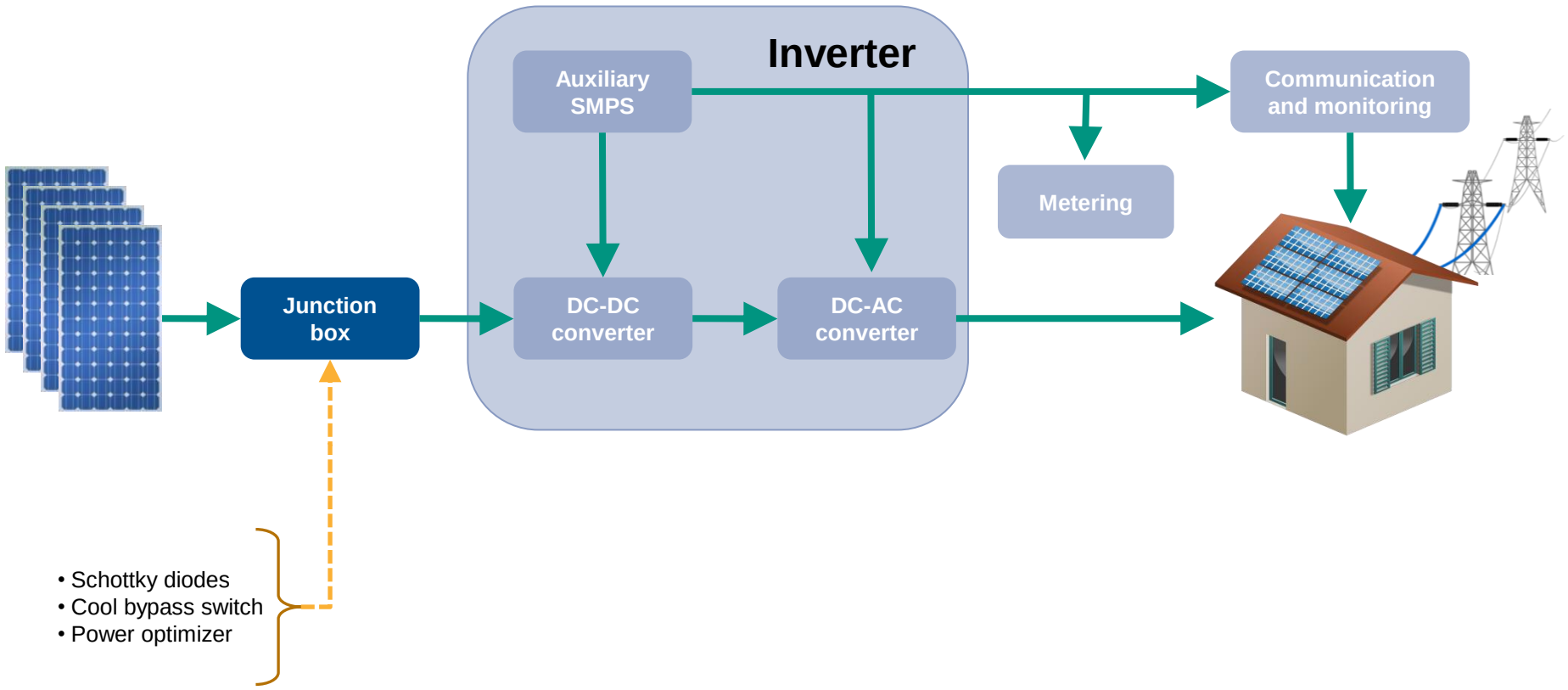
ST products and solutions for solar energy

ST's positioning in the photovoltaic world



ST products for junction boxes



Schottky diodes

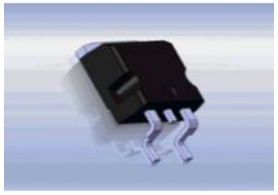
Key features

- Low reverse current
- Low forward voltage
- Low-profile packages
- Halogen-free packages

Main benefits

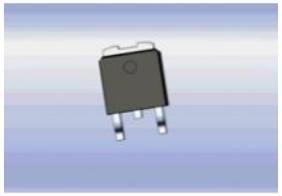
- Increased panel efficiency
- Increased power density
- Environmentally friendly

D²PAK



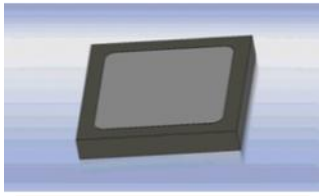
STPS1545CG
STPS2045CG
STPS2545CG
STPS3045CG

DPAK



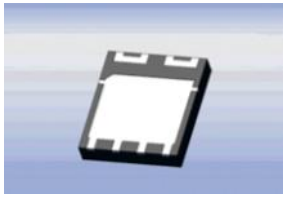
STPS1045B
STPS15L45CB

Bare die



JTPS1045-D4 (*)

PowerFLAT™ 5x6



STPS15L30CDJF
STPS3045DJF

(*) Contact ST office

Cool bypass switch – SPV100x

Key features

- System in package
- Embedded power MOSFET
- Very low forward-voltage drop
- Very low reverse leakage current

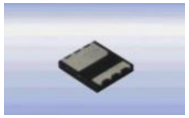
TO-220

SPV1001T40
SPV1002T40

D²PAK

SPV1001D40
SPV1002D40

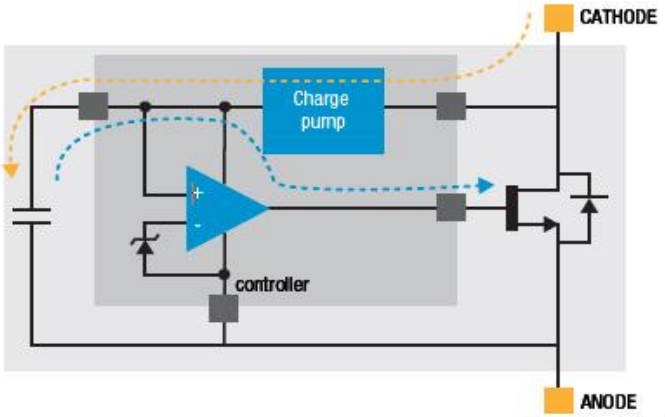
PQFN 5x6



SPV1001N40
SPV1001N30

Main benefits

- Cooler than Schottky diodes
- Low power dissipation
- Longer lifetime
- Higher reliability



Power optimizer – SPV1020

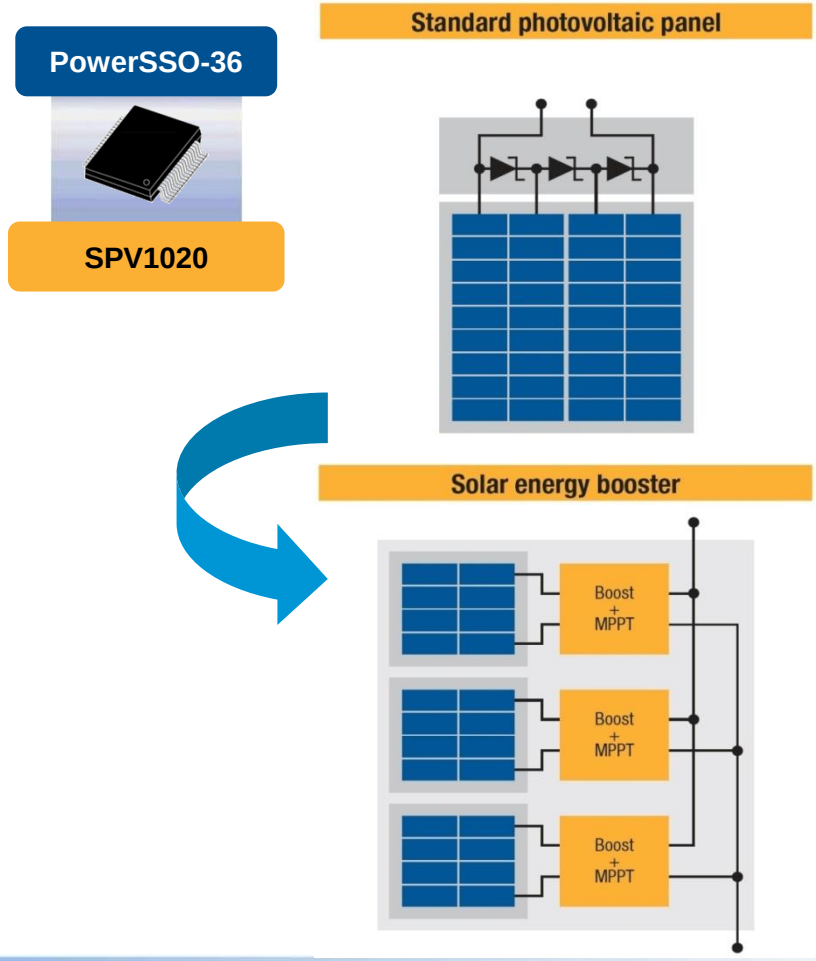
The SPV1020 distributes MPPT at panel level, boosting photovoltaic power conversion efficiency

Key features

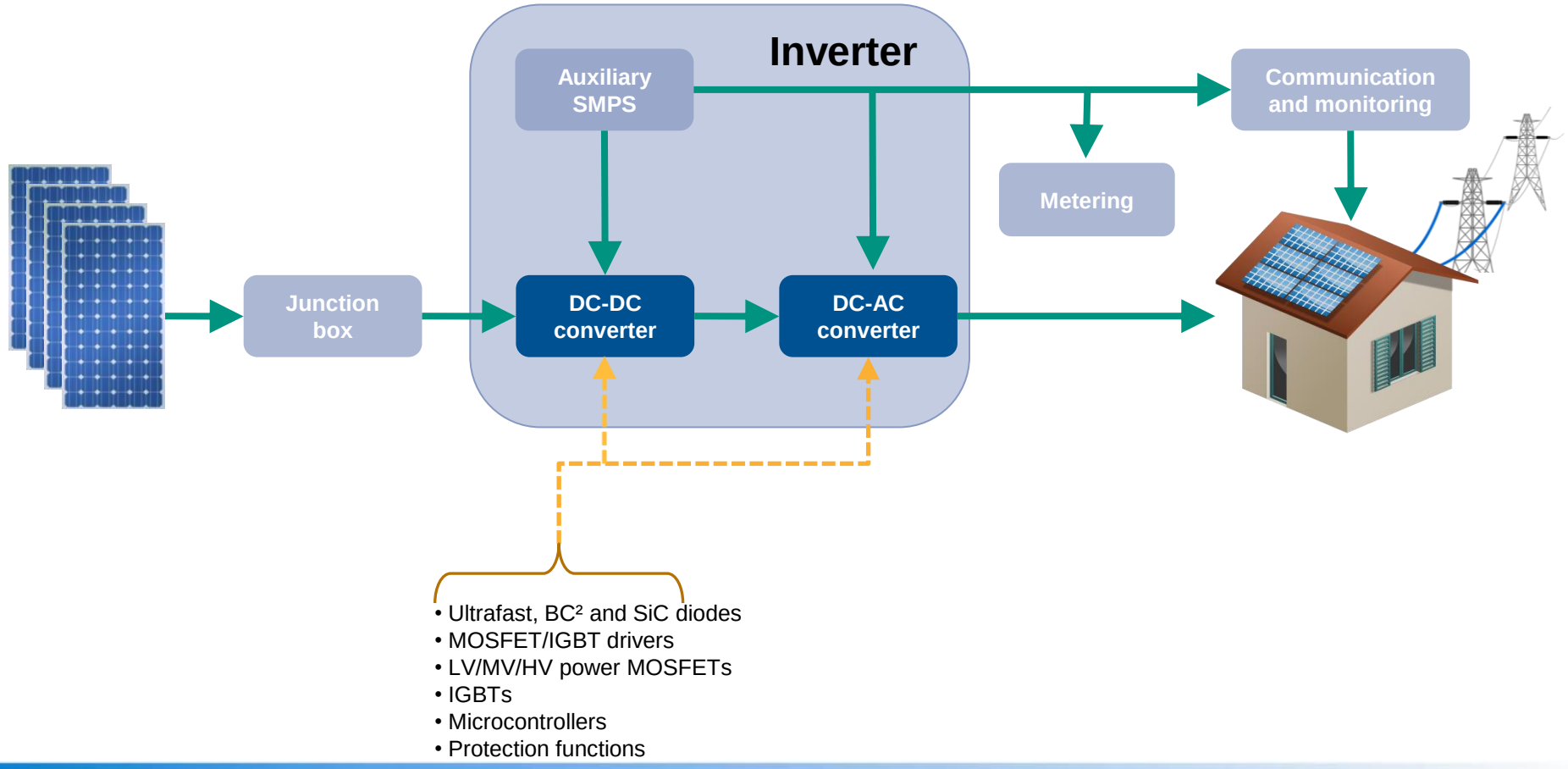
- Monolithic DC-DC converter embedded in the panel
- Interleaved boost converter
- Built-in MPPT algorithm
- BCD8 0.18 µm technology

Main benefits

- Minimized shadowing impact on power generation
- Minimized panel mismatch
- Improved inverter efficiency
- Panel diagnosis using remote monitoring and control functions



ST products for DC-DC and DC-AC converters

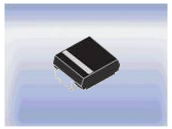
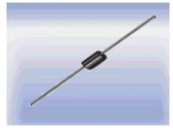
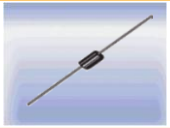


Rectifiers for BC² topology

STTHxxBCxx series: new ST solution for efficiency improvement in PV systems

Key features

- Specially designed for the dedicated BC² (back-current circuit) topology (ST patent)
- Suited for non-insulated DC-DC converters
- High-voltage rating

BC² up to 500 W	BC² up to 1 kW	BC² up to 2 kW
		
STTH10BC065CT	STTH16BC065CT	STTH8BC065DI
		STTH8BC060D
		
STTH3BCF060U	STTH5BCF060	STTH5BCF060

Main benefits

- Improved efficiency over full power range (heavy and light load)
- Reduced power-switch junction temperature
- Increased power density
- Reduced BOM cost

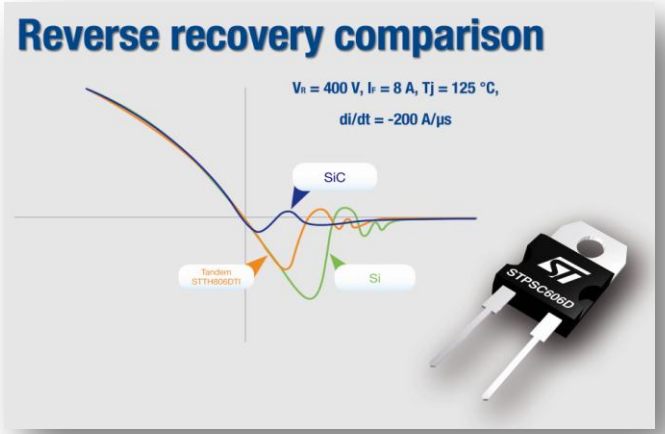
Note: use of BC² topology and design methodology is subject to an NDA with STMicroelectronics

Silicon carbide (SiC) diodes

STPSCxx06 series**: instant switching diodes**

Key features

- 600 V SiC Schottky barrier diodes
- Reliability tested under extreme conditions
- No reverse recovery charges (by construction)
- Temperature-independent switching behavior



Main benefits

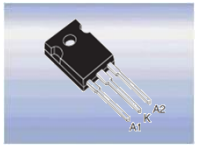
- Higher current density, frequency and efficiency
- Low forward-voltage drop (typically 100 mV lower than competition)
- Operation certified from -40 C
- Lower EMI

600 V ultrafast diodes

Key features

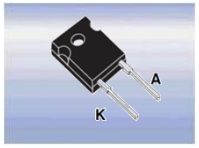
- Ultrafast switching
- Low reverse current
- Low thermal resistance
- Reduced switching and conduction losses

TO-247



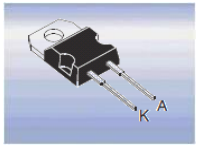
STTH60L06CW
STTH30L06CW

DO-247



STTH6006W
STTH3006W

TO-220AC



STTH15L06D

Main benefits

- High current capability
- Suitable trade-off between V_F and t_{RR} for boost converters in solar inverters

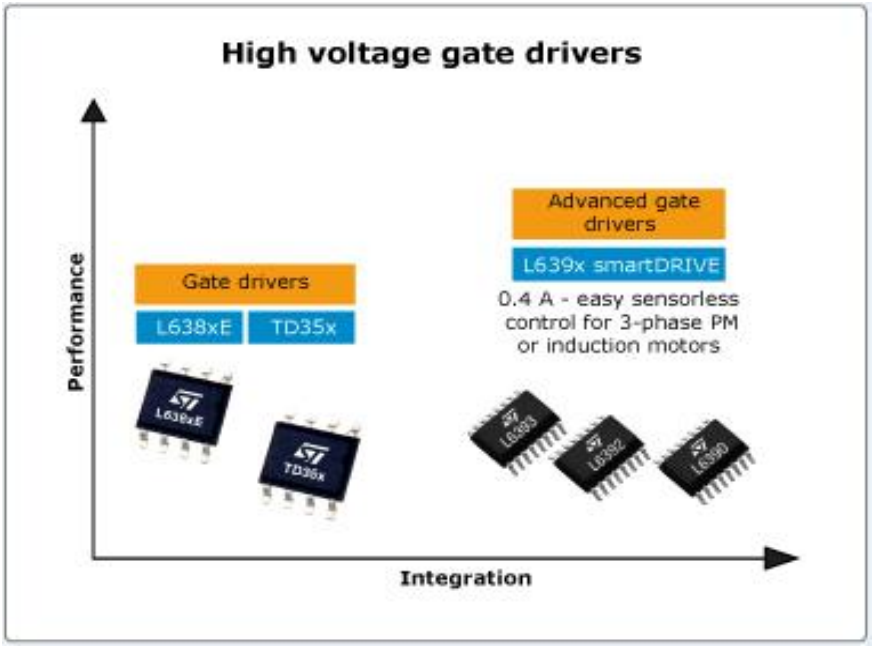
MOSFET/IGBT drivers

Key features

- Integrated high-voltage half-bridge, single and multiple low-voltage gate drivers
- High current capability (up to 4 A with PM8834)
- Embedded comparator for protection features (L6386E, L6390, L6393)

Main benefits

- Eliminates external high-voltage diode
- Fully protected design through smart shutdown (ST patented)
- Unique level of integration: reduced BOM cost



HV power MOSFETs – MDmesh™

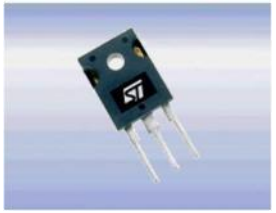
Key features

- 650 V lowest $R_{DS(on)}$ x area
- Higher breakdown voltage
- Minimal intrinsic diode reverse recovery time (FDmesh™ II)
- MDmesh™ V targeted for best efficiency PV converters: **>99% in a boost topology**
- FDmesh™ II especially suitable for bridge topologies

Main benefits

- Higher energy saving
- Increased power density
- Increased safety margin

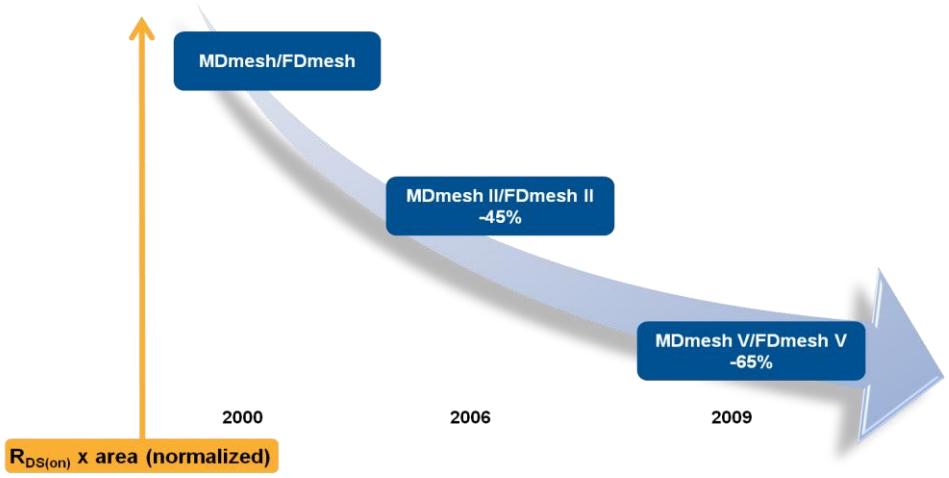
FDmesh II fast diode series



STW54NM65ND

MDmesh V

STW77N65M5



LV/HV power MOSFETs for microinverters

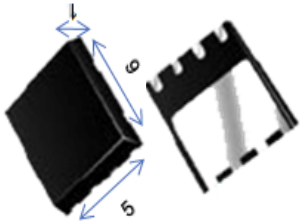
Key features

- PowerFLAT 8x8 HV:
  1 mm height and 64 mm^2 footprint
- Low parasitic inductance
- MDmesh V 650 V lowest $R_{DS(on)}$ x area
- SuperMESH 5 850V lowest $R_{DS(on)}$ x area
- STripFET VI DeepGATE series $R_{DS(on)}$ * Qg industry benchmark

Main benefits

- Higher energy saving
- Increased power density
- Higher PCB compactness with PowerFLAT package
- Multiple sources

PowerFLAT™ 5x6



STL80N75F6
STL75N8LF6

PowerFLAT™ 8x8 HV

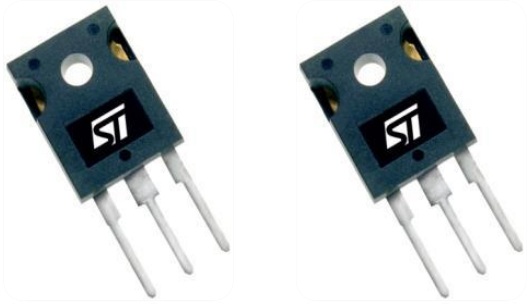
STL21N65M5
STL42N65M5
STL23NM60ND
STL23N85K5

1200/650 V IGBTs

H series: the optimum choice for solar systems

Key features

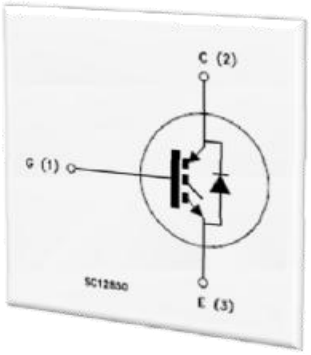
- Using novel field stop IGBT technology
- High current and voltage capability
- Low saturation voltage
- Fast switching



STGW50H65F, STGW25H120DF: trench gate field stop

Main benefits

- Superior conduction and switching performances
- Ideal for increasing total system efficiency



600 V low drop IGBTs

S (low frequency) series

STGW50HF60S

STGW50HF60SD

Key features

- Tailored to low-frequency leg of mixed-frequency PV inverter topologies
- Ideal for applications with PF > 0.8
- Co-packaged diodes

Main benefits

- Extremely low conduction losses
- Low switch-off losses
- Excellent switch-on performance guaranteed by co-packaged diode

W (ultra-fast) series

STGW35HF60WD

STGW45HF60WD

Key features

- Operating frequency over 100 kHz
- No cross-conduction susceptibility
- Ultra-fast soft recovery anti-parallel diode

Main benefits

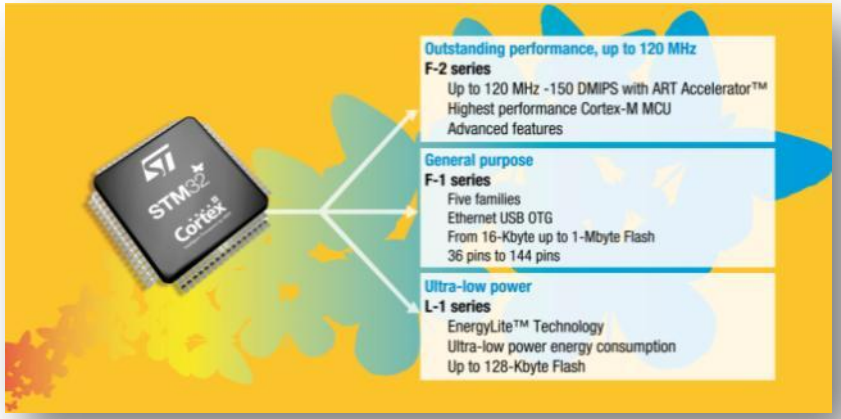
- More stable switching performance (E_{off}) versus temperature
- Extremely low power dissipation

STM32F microcontroller family

High-performance ARM Cortex-M MCUs

Key features

- More than 130 compatible devices
- 16-Kbyte to 1-Mbyte Flash
- 36 to 144 pins
- From low cost …
  … to high performance

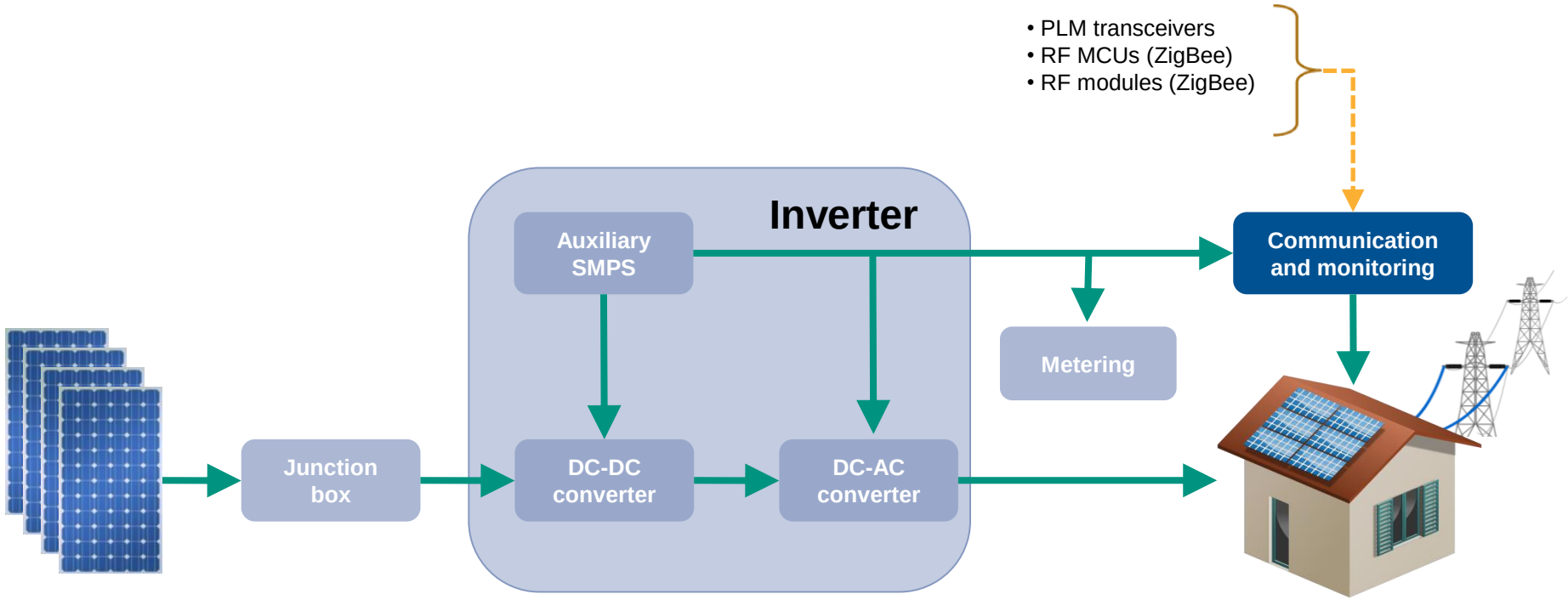


New STM32 F-2 Series

Main benefits

- Real-time performances
- Superior and innovative peripherals
- Maximum integration
- Extensive tools and software

ST products for communication and monitoring



STarGRID powerline modem SoC platform

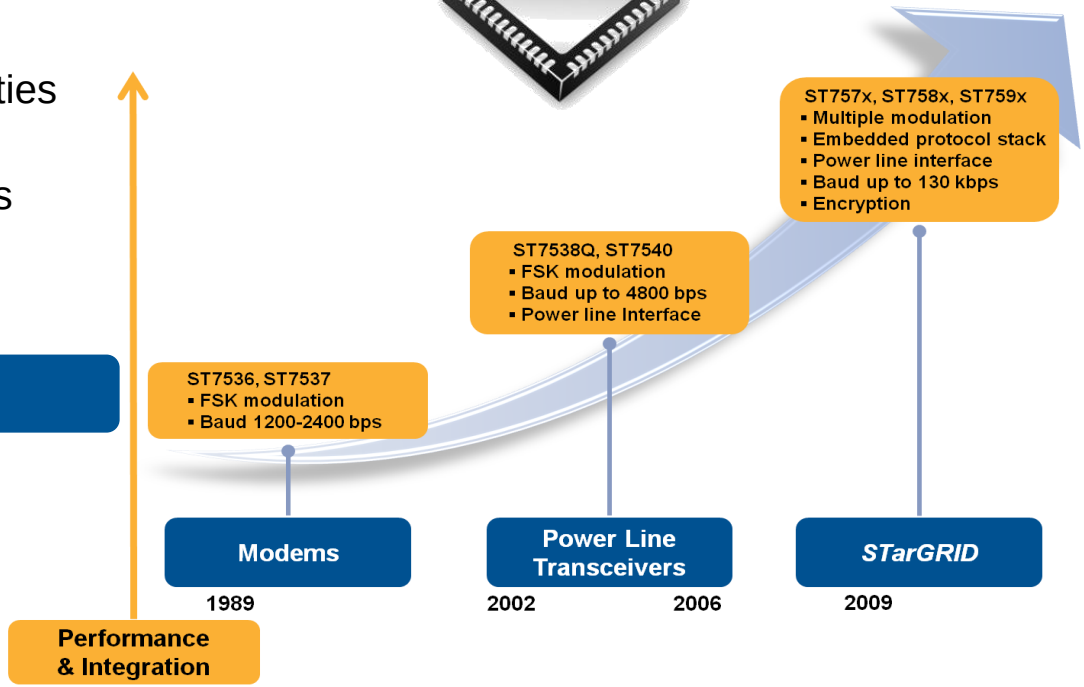
ST7540, ST7570, ST7580, ST7590: from command and control to smart grids

Key features

- Multiple modulations and protocols
- All PLC system blocks embedded in a single chip
- Embedded message encryption
- Non-proprietary modulations, no royalties
- Turnkey implementations available compliant with major protocols such as IEC 61334-5-1, PRIME and others

Main benefits

- High modularity and flexibility
- Highest integration
- High scalability
- Openness



RF MCU family – STM32W

Integrated 2.4 GHz radio MCU enables efficient and low-cost wireless network implementation

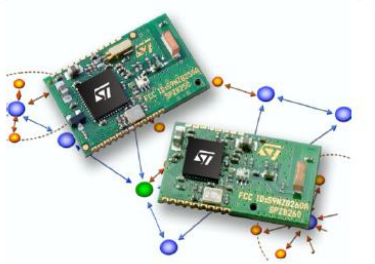
Key features

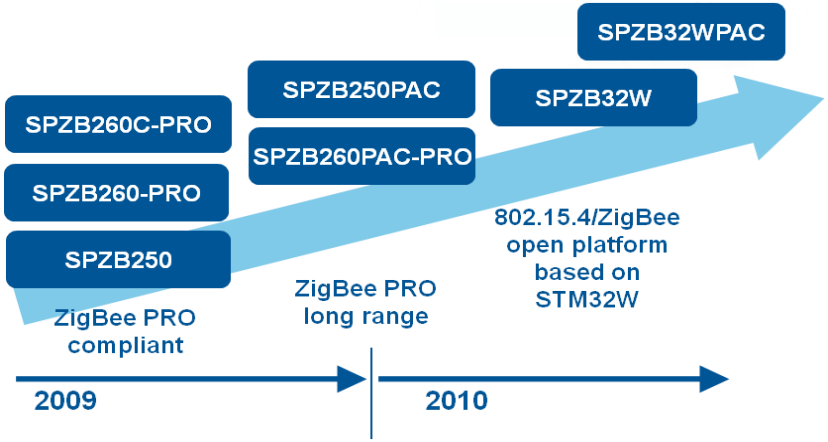
- Industry-leading RF performance
  - ZigBee certified platform (PRO Stack)
  - ZigBee RF4CE certified platform
  - IEEE 802.15.4 certified platform
- Part of largest ARM Cortex-M3 product family: STM32

Main benefits

- Highest throughput
- Lowest latency for routing
- Security computations

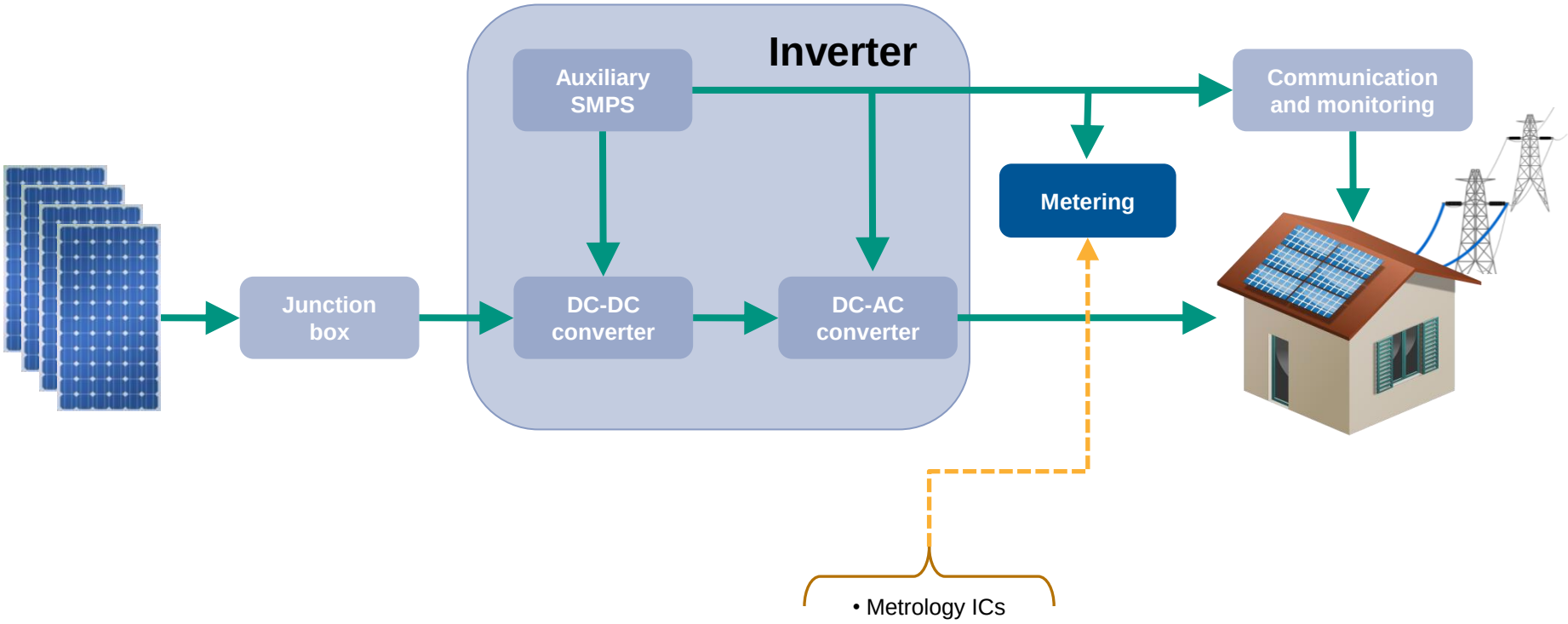
STM32W108CB
STM32W108HB





ZigBee modules

ST products for metering



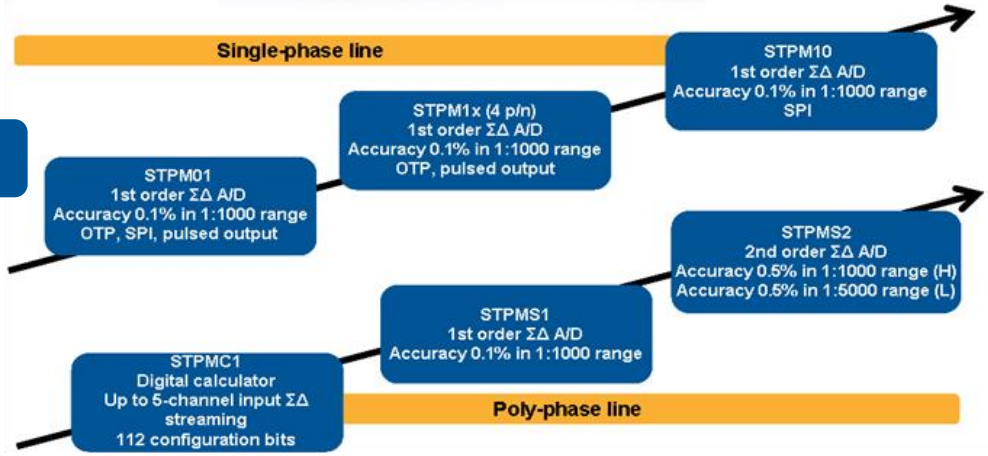
Metrology ICs – STPMxx family

Key features

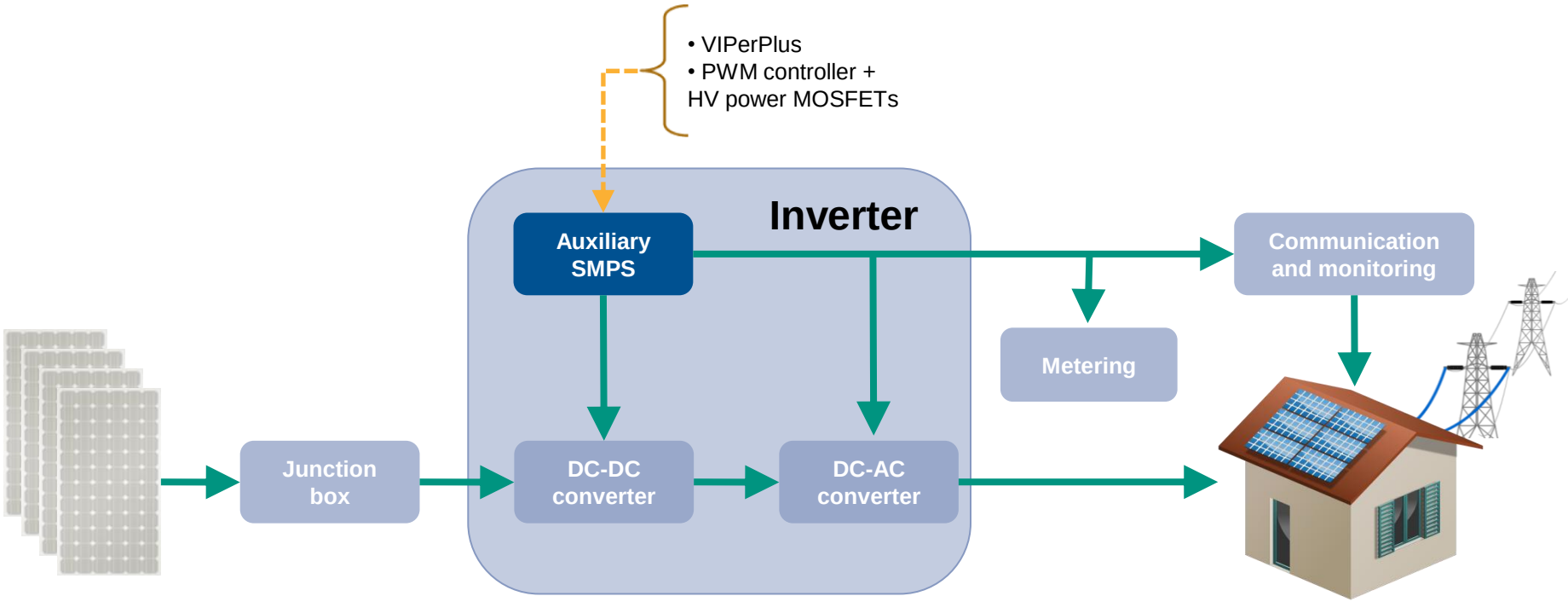
- STPMxx: multiple, cost-effective metering, IC solutions for **single-phase**
- STPMC1, STPMSx: the first modular metering chip set solution for **poly-phase**
- Multiple measurements
- Multiple sensor support

Main benefits

- High accuracy
- Fast digital calibration
- Anti tamper



ST products for auxiliary SMPS



VIPerPlus family

VIPerPlus: designed for power efficiency

Key features

- Multichip: BCD6S for control and SuperMesh™ for rugged power section
- Fixed frequency with jittering (VIPerx6/x7/x8) or quasi-resonant operation (VIPerx5)

Main benefits

- High efficiency: > 80%
- Standby power: < 30 mW
- 800 V avalanche-rugged power section
- Embedded advanced protection for high PSU reliability

VIPerPlus = VIPer plus

+ Technology	+ Robustness
+ Functions	+ Efficiency
+ Protections	+ Intelligence

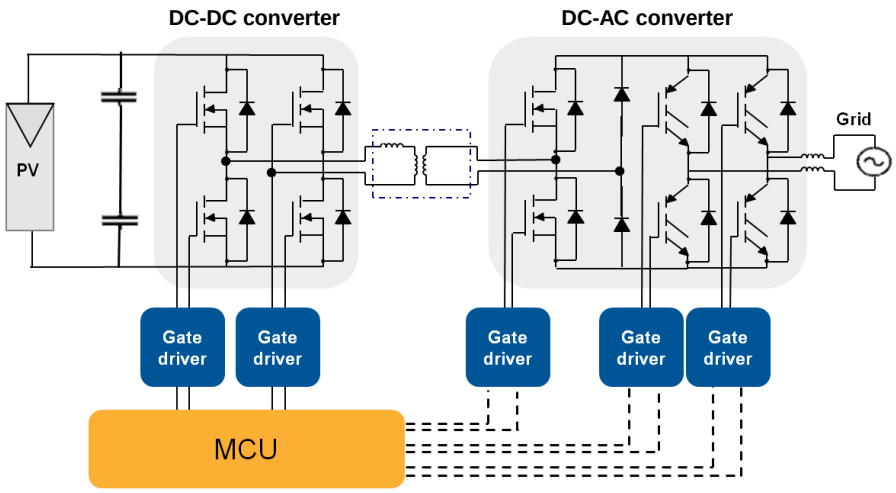
ST system solutions for solar energy

3 kW grid-connected solar inverter

Key features

- High conversion efficiency: up to 96%
- Uses phase-shift DC-DC converter with MPPT plus full-bridge DC-AC converter
- Galvanic isolation between PV array and grid
- Optimized MPPT algorithm for maximum energy yield from PV array
- Grid-connected algorithm with decoupled control of active and reactive power

System architecture



Key products

- STM32F103ZE (32-bit microcontroller)
- STW55NM60ND (power MOSFETs)
- STGW35HF60WD (IGBTs)
- L6386ED, TD350 (MOSFET/IGBT drivers)
- STTH60L06, STTH30R06, STTH16L06, STPS3150, STPS5L40 (diodes)
- ST3232EB (RS-232 interface)
- VIPer17, VIPer27 (auxiliary SMPS)

System evaluation board (STEVAL-ISV002V1)

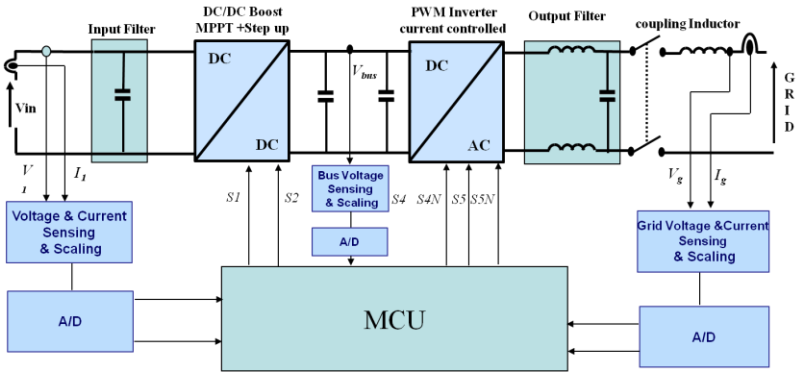
250 W microinverter for plug-in PV modules

DC-AC conversion in a compact system attached directly to each solar module to maximize energy output and for panel diagnostics and monitoring

Key features

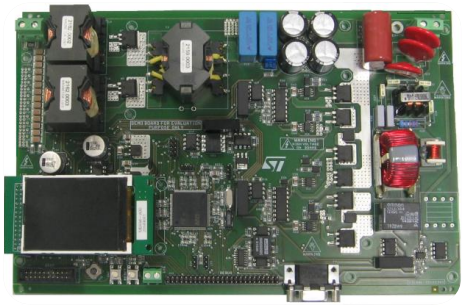
- Wide voltage range: 120/230 V_{AC}
- Conversion efficiency: > 94%
- MPPT efficiency: 99%
- Anti-islanding
- Galvanic isolation between PV panel and grid

System architecture



Key products

- STM32F103ZE (32-bit microcontroller)
- STB42N65M5, STH180N10F3-2 (power MOSFETs)
- PM8834, L6390 (MOSFET drivers)
- STPSC806, STPS3L40S, STTH108 (diodes)
- ST3232EB (RS-232 interface)



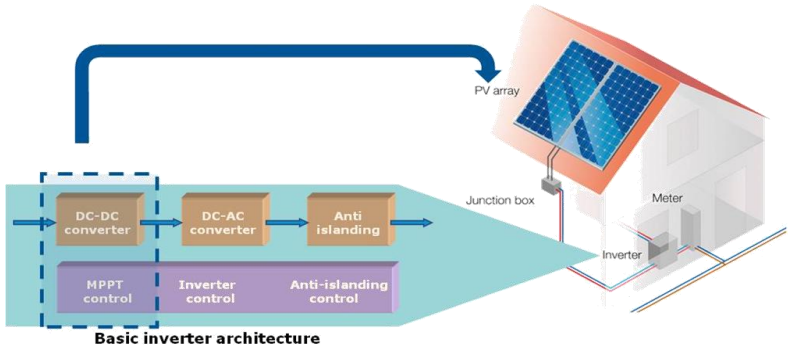
System evaluation board (STEVAL-ISV003V1(*))

(*) Available Q4 2011

300 W DC-DC optimizer for standard PV panels

Key features

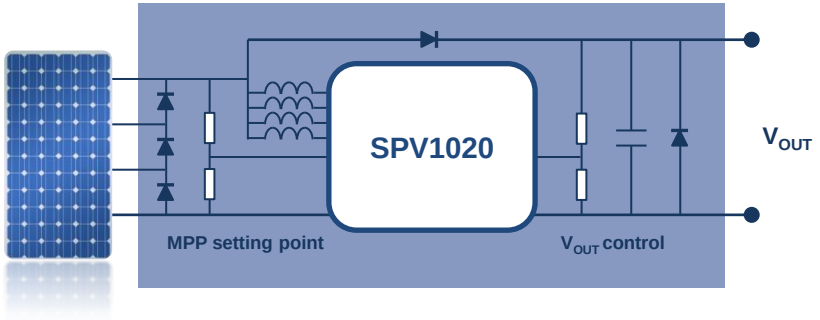
- 300 W DC-DC boost converter with MPPT
- 40 V output voltage operating range
- Built-in MPPT and soft-start
- Output overvoltage and over-temperature control
- Efficiency: > 98%
- SPI interface for remote telemetry and control



Basic inverter architecture

Key products

- SPV1020 (solar energy booster)
- SPV1001N30, SPV1001N40 (cool bypass switch)
- STPS160U (power Schottky diode)



System evaluation board
(STEVAL-ISV009V1(*))

(*) Available Q3 2011

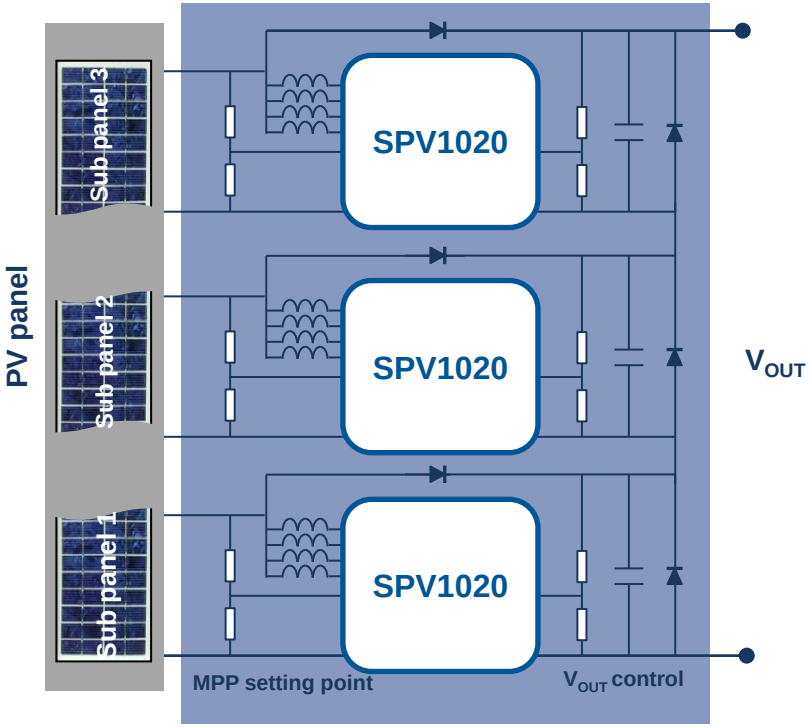
300 W DC-DC optimizer for distributed PV panels

Key features

- 300 W DC-DC boost converter with MPPT
- 120 V output voltage operating range
- Built-in MPPT and soft-start
- Output overvoltage and over-temperature control
- Efficiency: > 98%
- SPI interface for remote telemetry and control

Key products

- SPV1020 (solar energy booster)
- SPV1001N30, SPV1001N40 (cool bypass switch)
- STPS160U (power Schottky diode)



System evaluation board (STEVAL-ISV008V1)

Solar battery applications

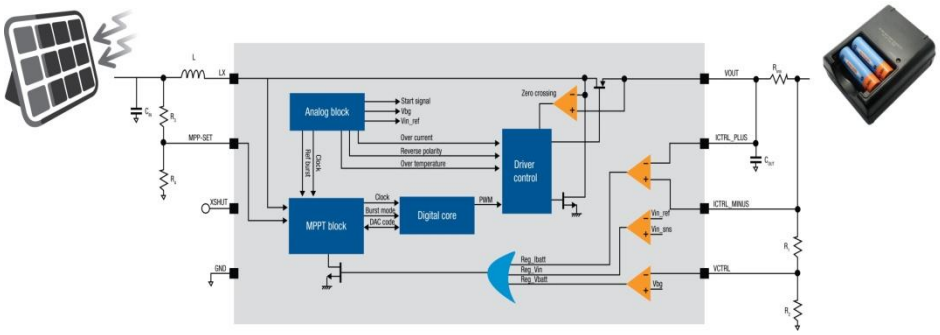
SPV1040: solar battery charger

Key features

- High-efficiency monolithic step-up DC-DC converter
- Proprietary Perturb and Observe embedded MPPT algorithm
- Very low input voltage: down to 0.3 V
- Very low $R_{DS(on)}$ integrated N-MOSFET and P-MOSFET
- Overcurrent and over-temperature protection
- Input reverse polarity protection

Main benefits

- Energy harvesting
- Up to 95% efficiency
- Optimized charging of any battery type
- Suitable for any portable application powered by a few solar cells
- Battery and system safety guaranteed



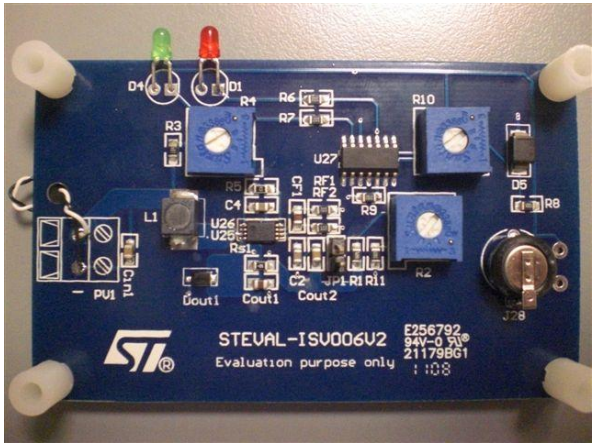
Up to 5 W solar battery charger with SPV1040

Key applications

- Home lighting
- Small appliances
- Smartphones and wireless headsets
- Portable consumer appliances and toys
- Solar lanterns
- Digital still cameras
- Portable healthcare, sensors

Key products

- SPV1040 (high-efficiency solar battery charger with embedded MPPT)
- L6924D (option for Li-ion batteries, STEVAL-ISV012V1(*))



System evaluation board (STEVAL-ISV006V2)

(*) Available Q3 2011

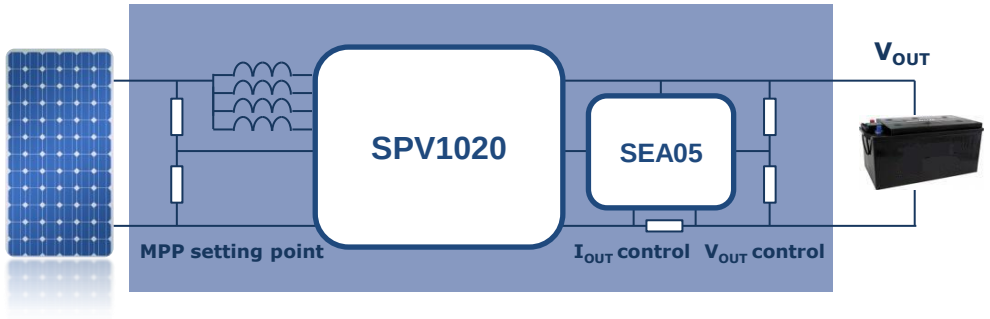
100 W PV battery charger with SPV1020

Key features

- Lead-acid battery charger from PV panel
- Built-in MPPT and soft-start
- Input and output overcurrent control
- Output overvoltage control
- Internal over-temperature control
- Efficiency: > 98%
- SPI interface

Key products

- SPV1020 (step-up DC-DC converter with embedded MPPT)
- SEA05 (CV/CC controller)



System evaluation board (STEVAL-ISV005V1(*))

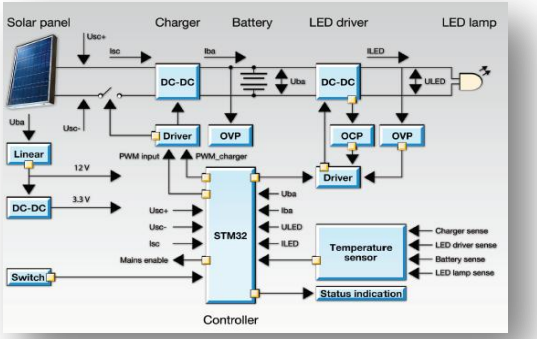
(*) Available Q4 2011

Solar LED streetlight controller

80 W solar battery charger plus 25 W LED lamp driver featuring automatic day/night detection and battery/mains switchover

Key features

- Maximum power point tracker (MPPT) for more efficient energy use
- Constant-current control for LED lamp
- Battery charge control with temperature monitoring
- Easy system monitoring via debug indicators
- Full protection function for battery, LED and solar panel



Key products

- STM32F101R6 (32-bit microcontroller)
- STP40NF10, STP75NF75 (LV power MOSFETS)
- STPS20H100C, STPS1H100, STPS2045C, STPS1L60 (power Schottky diodes)
- TSC101 (current sense IC)

System evaluation board (STEVAL-ILL022V1)