250 W Grid Connected Microinverter

Enabling new generation of PV systems

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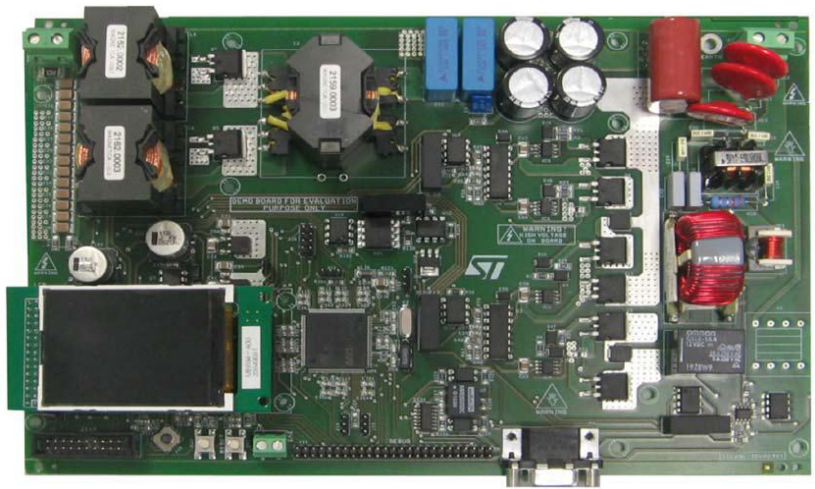
250 W microinverter for PV applications

- Key features:
  - 250 W power capability
  - Output voltage Vout= 230Vac 50Hz -240Vac 60Hz
  - High conversion efficiency (>94%, 93.5% CEC)
  - MPPT efficiency (99%)
  - Decoupled control of active and reactive power
  - Overcurrent and anti-islanding protection
  - Galvanic isolation between the panel and the grid
- Key products:
  - STM32F103ZE (32-bit microcontroller)
  - STB18N65M5, STH180N10F3-2 (power MOSFETs)
  - PM8834, L6390 (MOSFET drivers)
  - STPSC606, STPS1545C, STTH12R06 (diodes)
  - SMBJ (EOS surge protection)
  - ST3232EB (RS-232 interface)



System evaluation board order code:
STEVAL-ISV003V1(*)

(*) Available at the end of Q1 2012

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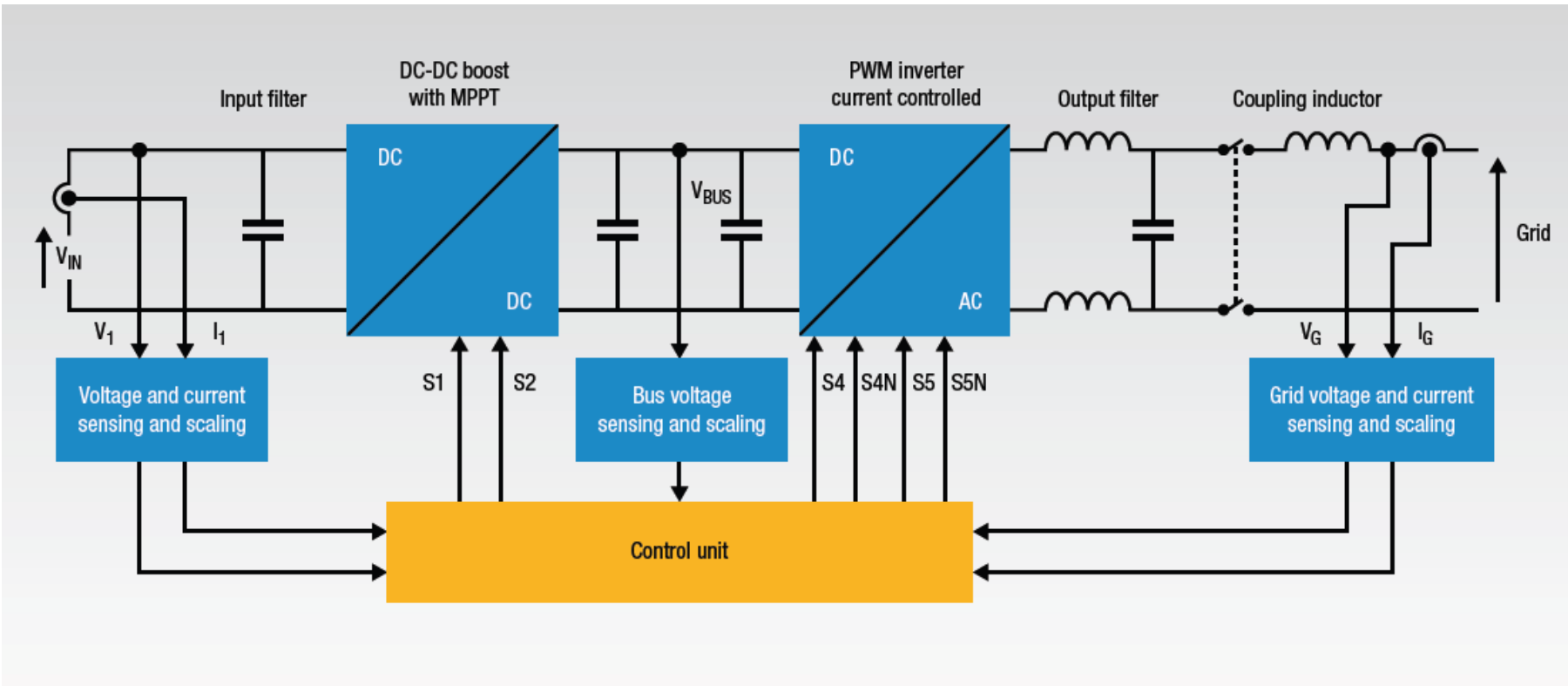
250 W microinverter: block diagram

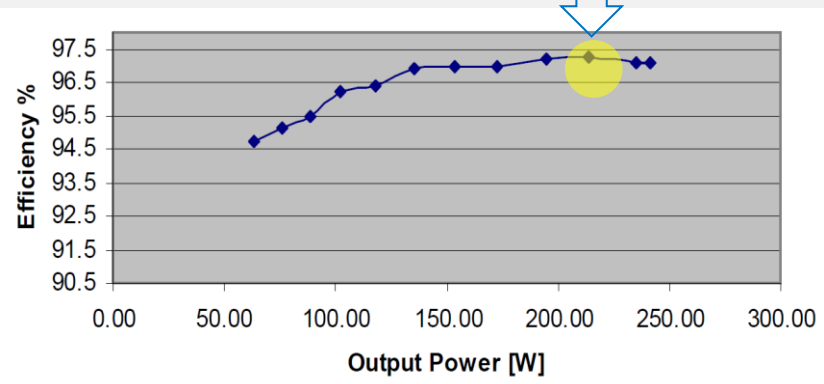


250 W microinverter: DC-DC section

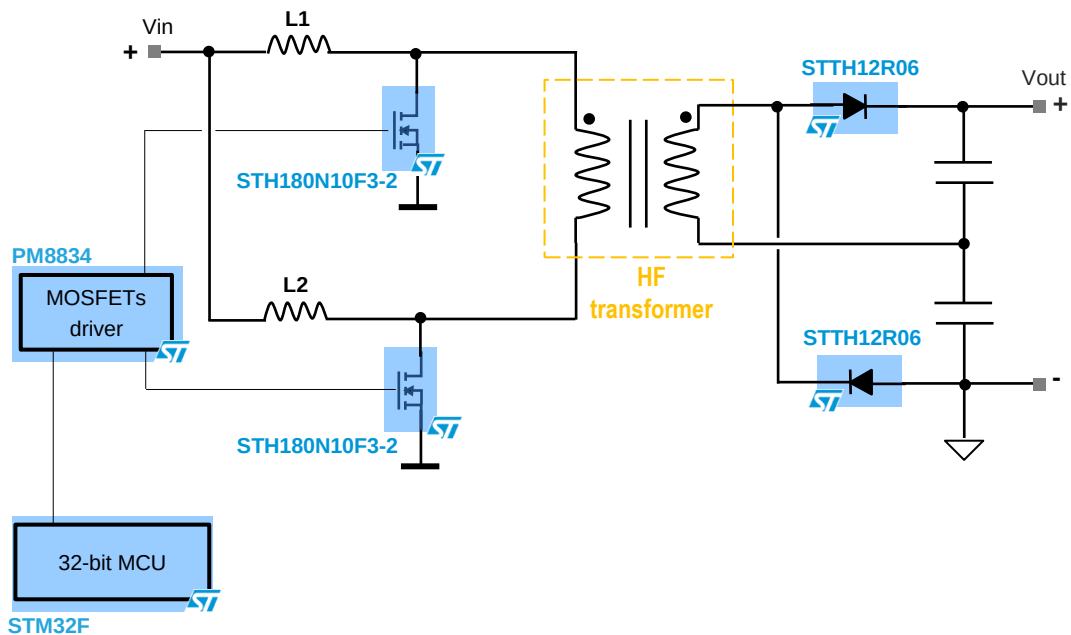
Electrical Specs

- Vin= 18V to 55V
- Vmppt= 20V to 40V
- Iin=7,6A (nominal)
- Vout= 370Vdc to 430Vdc
- Iout= 0.65A (nominal)
- Pout= 250W
- fsw = 35kHz

Max Efficiency
DC-DC converter 97.4%



The topology



ISOLATED INTERLEAVED BOOST CONVERTER

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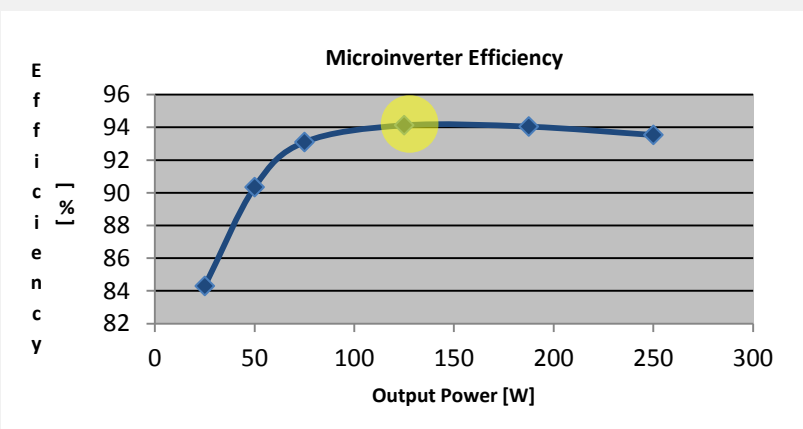
250 W microinverter: DC-AC section

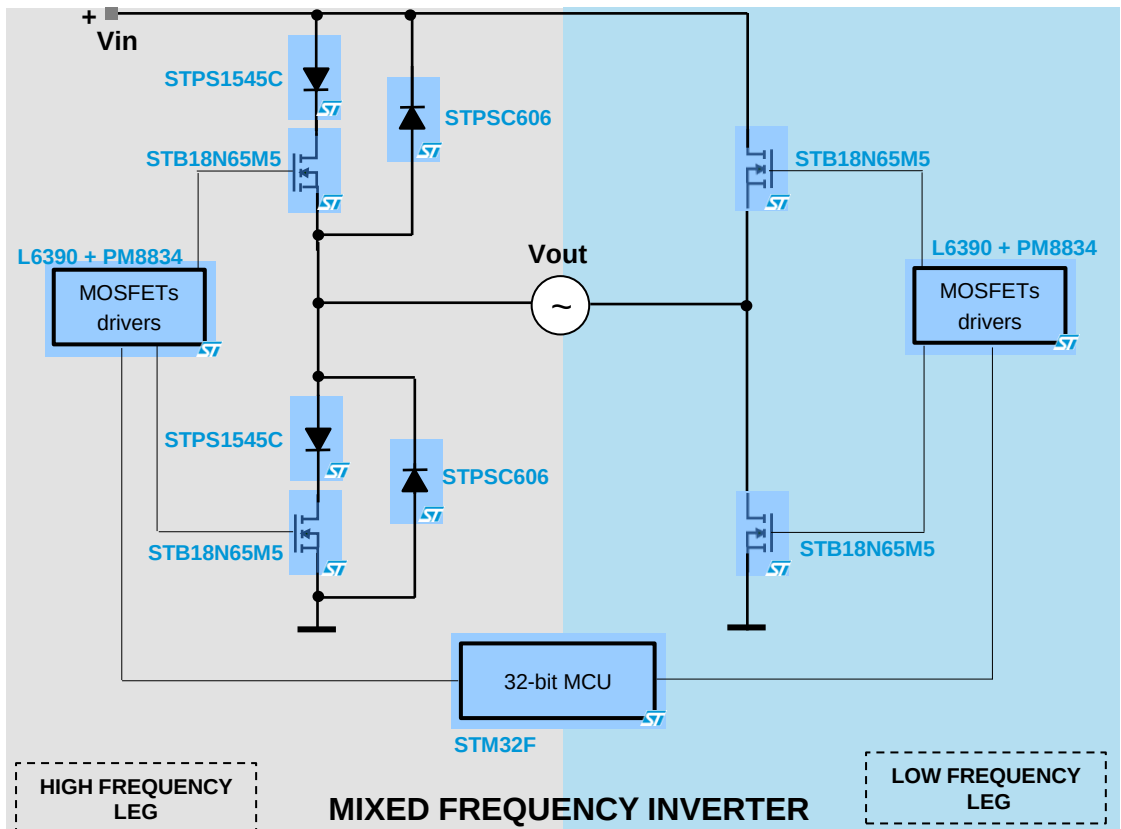
Electrical Specs

- Vin= 370Vdc to 430Vdc
- Vin (nominal) = 380 V
- Vout= 230Vac / 240Vac
- fout= 50Hz / 60Hz
- Iout = 1.1 A/ 1.06A
- fsw1= 17kHz (high frequency leg)
- fsw2= 50Hz (low frequency leg)

Max conversion efficiency 94.1%



The topology



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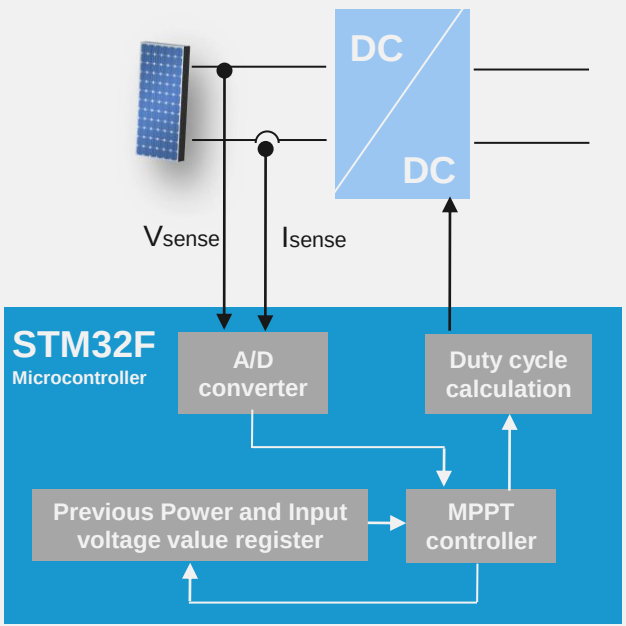
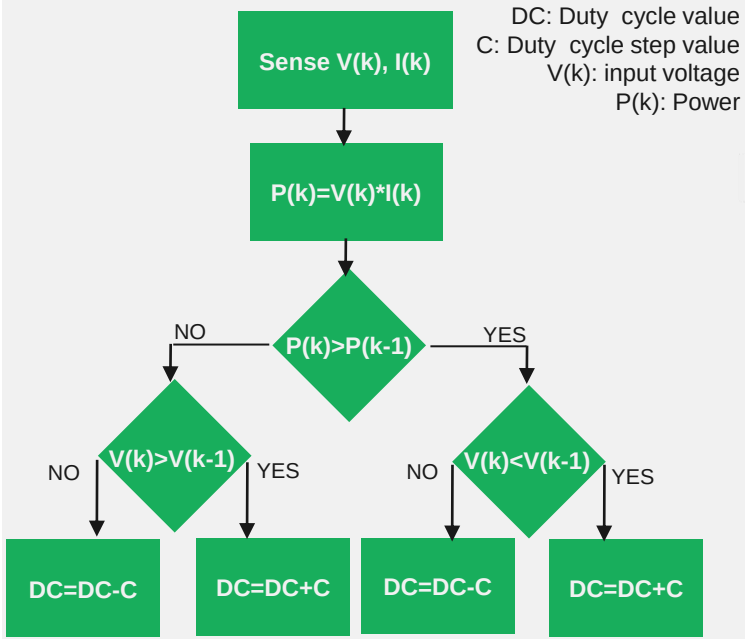
250 W microinverter: MPPT algorithm

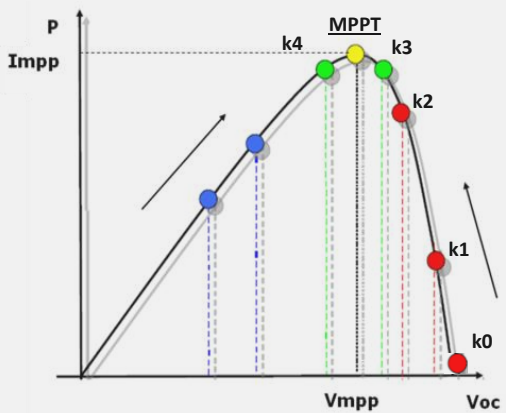
STM32F and MPPT



The MPPT "Perturb and Observe" algorithm



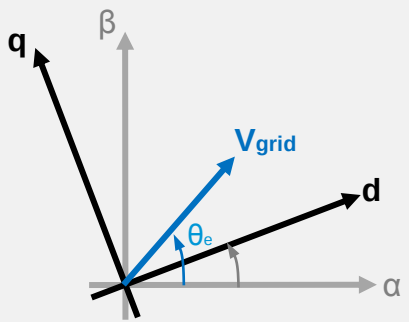
DC: Duty cycle value
C: Duty cycle step value
V(k): input voltage
P(k): Power



MPPT is reached following PV panel curve

250 W microinverter: grid connection

The PARK transformation



FROM

Vα and **Vβ**

(grid voltage and 90°phase shifted voltage on *stationary* frame)

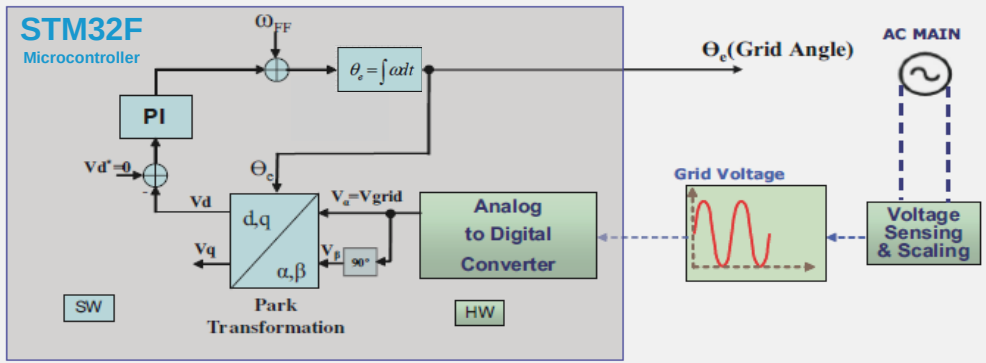
TO

Vd and **Vq**

(two voltage components on *rotating* DQ reference frame)

The DQ-Phase Locked Loop (PLL) structure

Vd is controlled to zero with a PI regulator→ **GRID ANGLE θe KNOWN**



ADVANTAGES of DQ-PLL

- Vd, Vq, Id, Iq are constants in DQ reference frame:
  standard PI regulators for their control ensure zero steady state error
- Decoupled control of active P and reactive Q power

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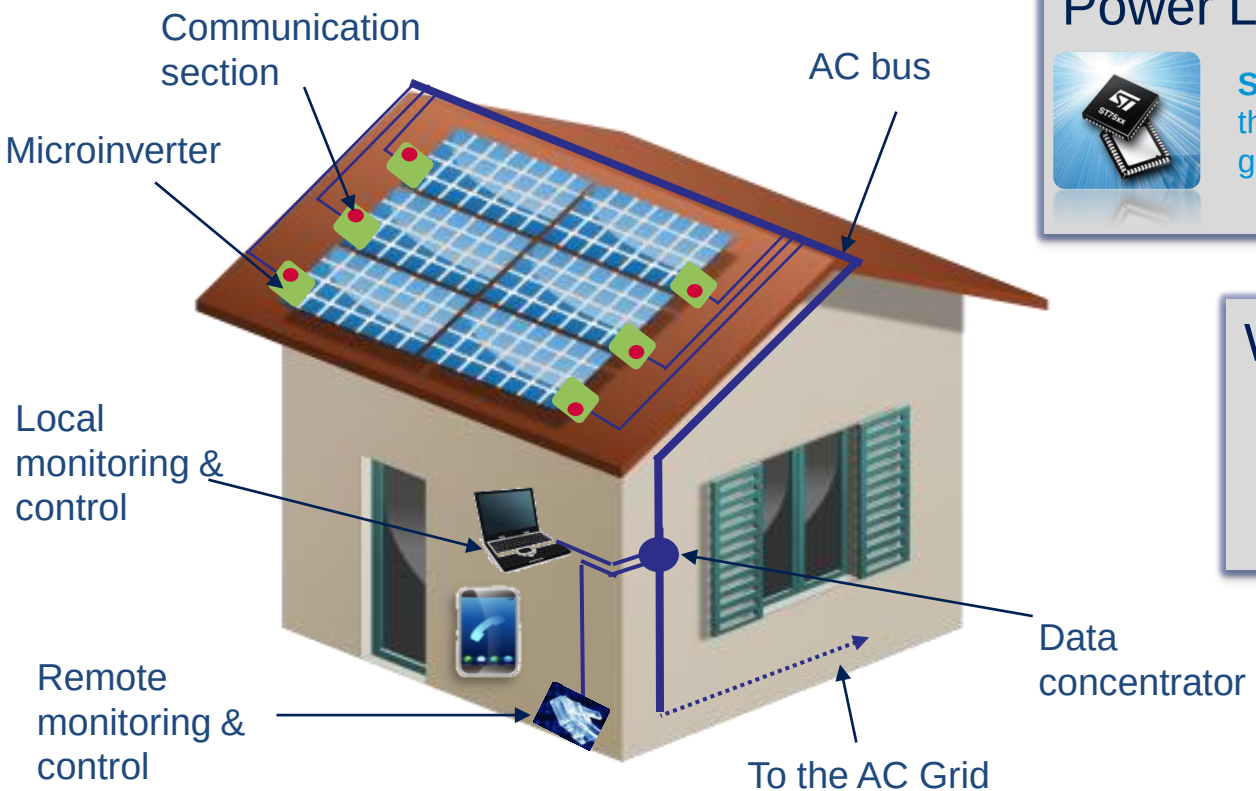
250 W microinverter: smart communication



Power Line Communication

ST75xx: STarGRID power line networking SoC
the most integrated and flexible solution for smart grid applications and smart metering

Wireless Communication

- **STM32W RF MCUs (ZigBee®)**
- **SPZB32W ZigBee® modules**
- **Bluetooth® modules**

Enabling onsite or remote monitoring of PV system

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