



# 250 W Grid Connected Microinverter

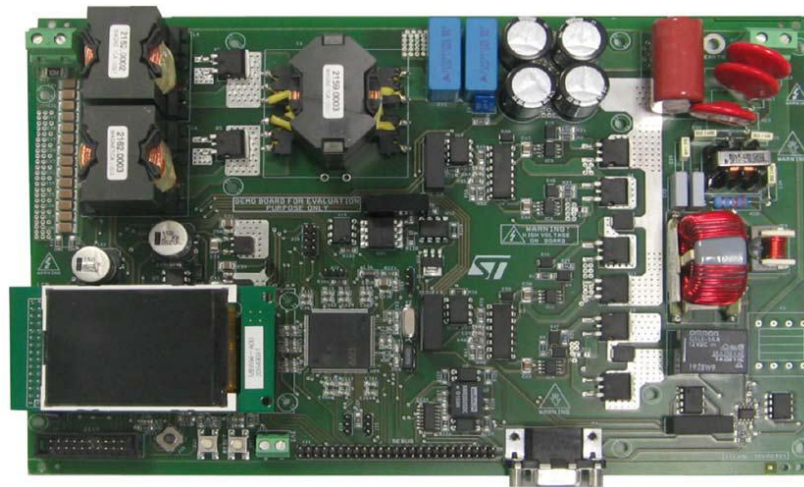
Enabling new generation of PV systems



# 250 W microinverter for PV applications

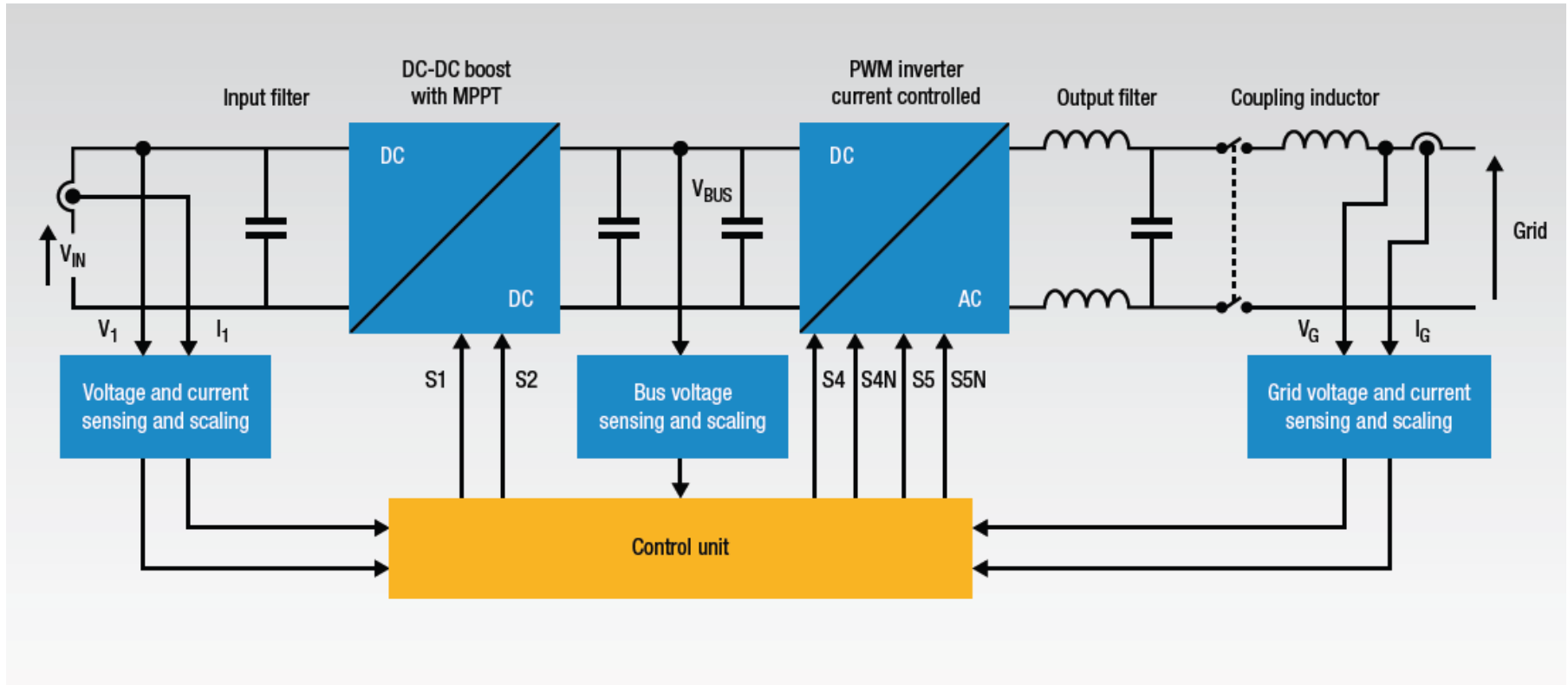
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- Key features:
  - 250 W power capability
  - Output voltage  $V_{out} = 230V_{ac} 50Hz - 240V_{ac} 60Hz$
  - High conversion efficiency ( $>94\%$ , 93.5% CEC)
  - MPPT efficiency (99%)
  - Decoupled control of active and reactive power
  - Overcurrent 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(\*)**

# 250 W microinverter: block diagram

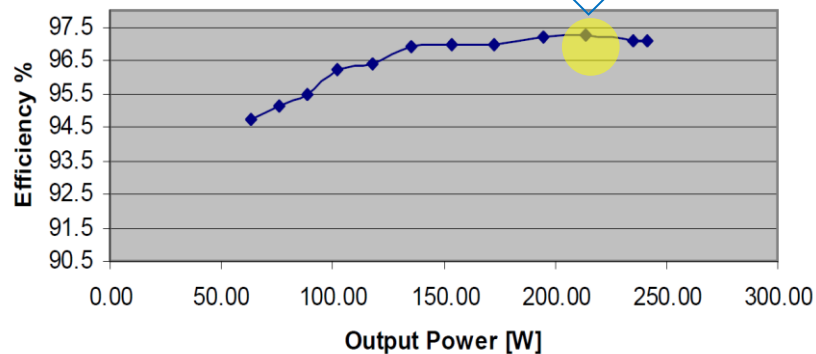


# 250 W microinverter: DC-DC section

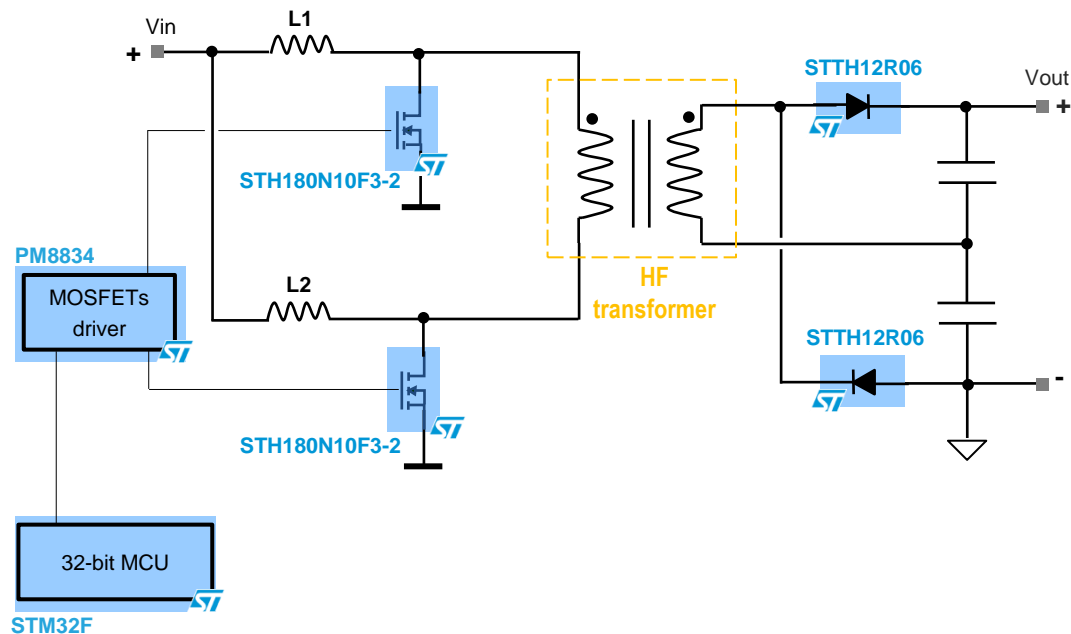
## Electrical Specs

- $V_{in}$  = 18V to 55V
- $V_{mppt}$  = 20V to 40V
- $I_{in}$  = 7,6A (nominal)
- $V_{out}$  = 370Vdc to 430Vdc
- $I_{out}$  = 0.65A (nominal)
- $P_{out}$  = 250W
- $f_{sw}$  = 35kHz

Max Efficiency  
DC-DC converter 97.4%



## The topology



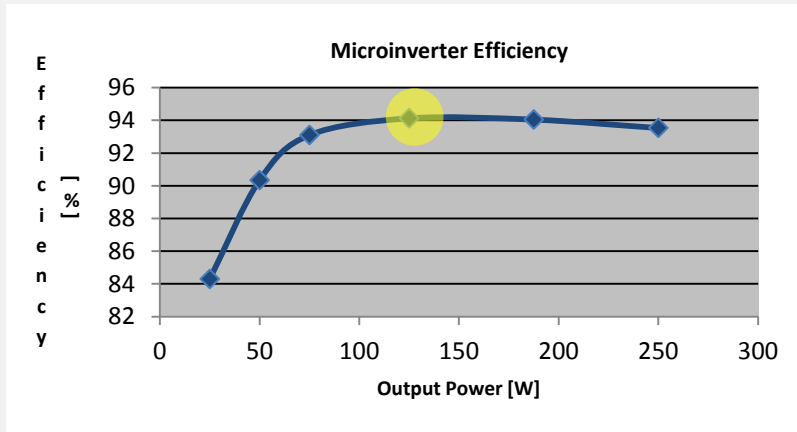
## ISOLATED INTERLEAVED BOOST CONVERTER

# 250 W microinverter: DC-AC section

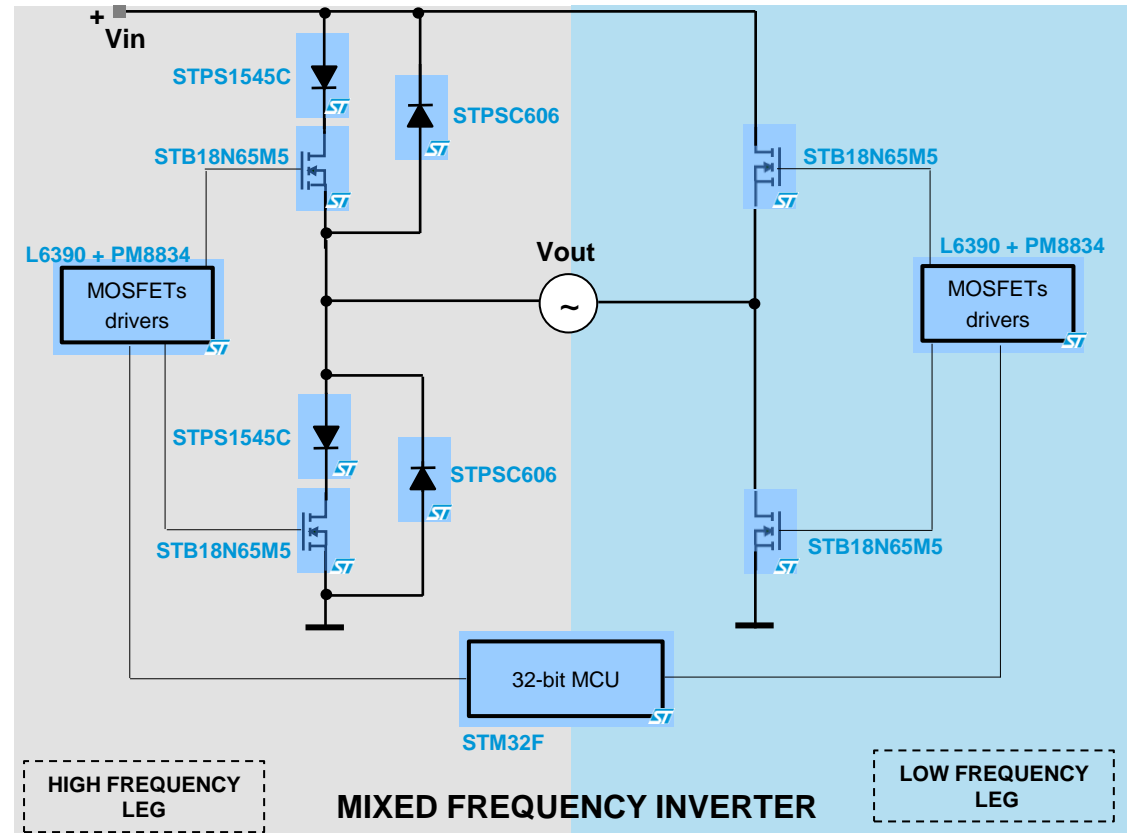
## Electrical Specs

- $V_{in}$  = 370Vdc to 430Vdc
- $f_{sw1}$  = 17kHz (high frequency leg)
- $V_{in}$  (nominal) = 380 V
- $f_{sw2}$  = 50Hz (low frequency leg)
- $V_{out}$  = 230Vac / 240Vac
- $f_{out}$  = 50Hz / 60Hz
- $I_{out}$  = 1.1 A / 1.06A

**Max conversion efficiency**  
**94.1%**

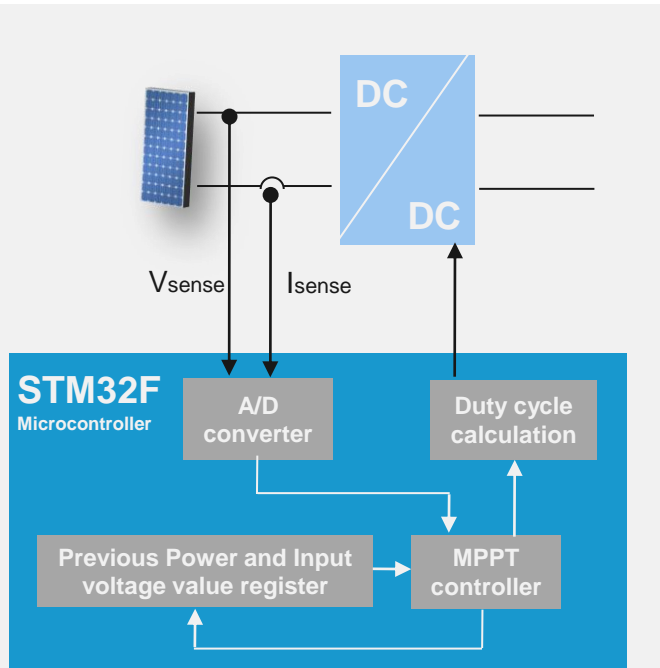


## The topology

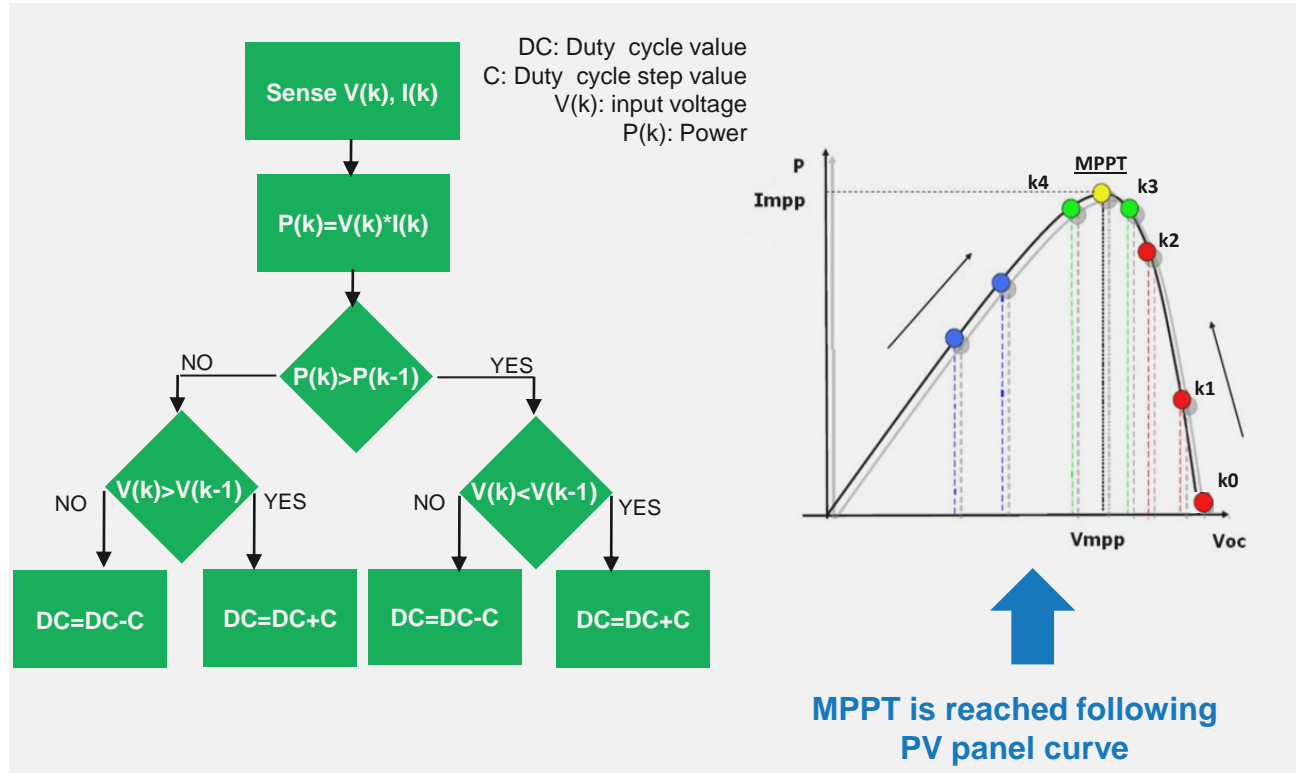


# 250 W microinverter: MPPT algorithm

## STM32F and MPPT



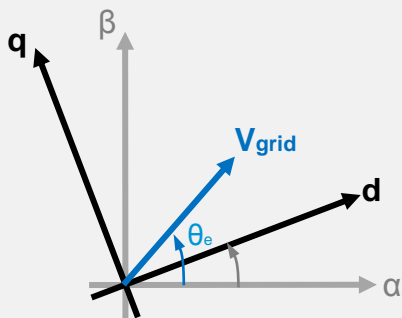
## The MPPT "Perturb and Observe" algorithm



MPPT is reached following PV panel curve

# 250 W microinverter: grid connection

## The PARK transformation



FROM

$V_\alpha$  and  $V_\beta$

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

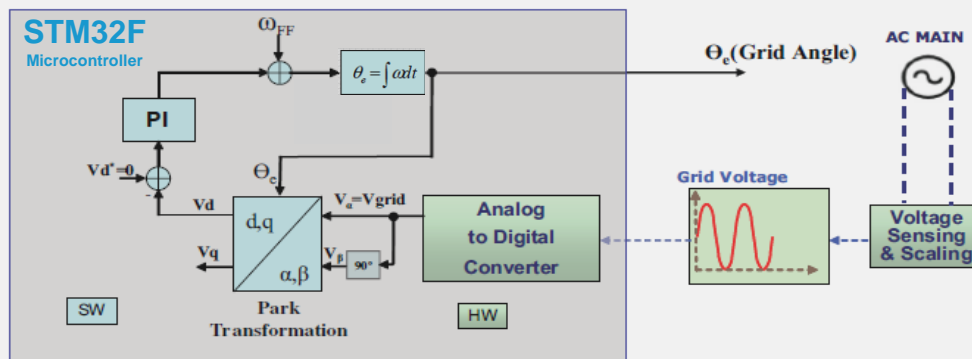
TO

$V_d$  and  $V_q$

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

## The DQ-Phase Locked Loop (PLL) structure

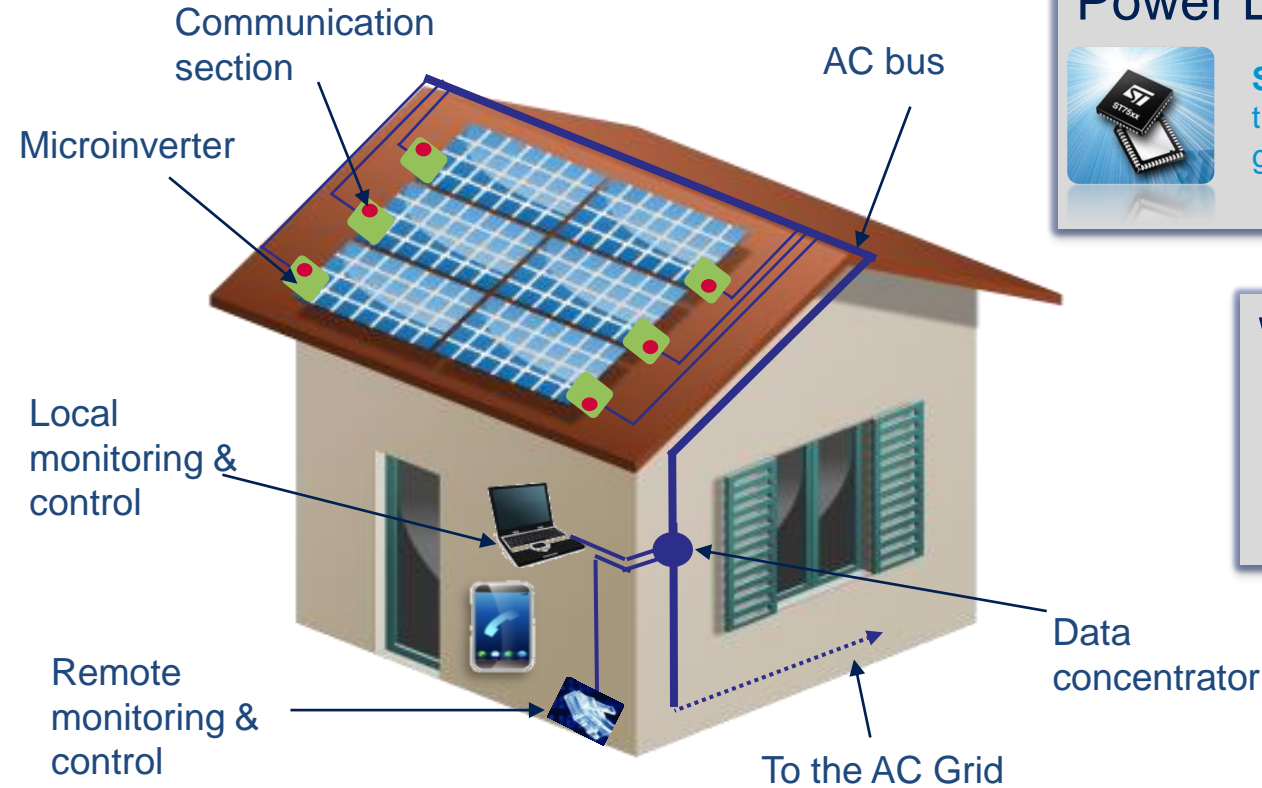
$V_d$  is controlled to zero with a PI regulator → **GRID ANGLE  $\theta_e$  KNOWN**



## ADVANTAGES of DQ-PLL

- $V_d$ ,  $V_q$ ,  $I_d$ ,  $I_q$  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

# 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