WIRELESS POWER CONSORTIUM

Ki Cordless Kitchen

- Ki Kitchen standard by WPC
- NFC for communication and aux. power
- Authenticate with STSAFE
- Power modules

Wireless Power Consortium standard
Ki Cordless Kitchen

This standard aims to replace power cords in traditional kitchen appliances with induction cooktop charging

- **Efficiency >90% of equivalent corded devices, up to 2.2 kW**
- **Advantages:** higher safety, higher flexibility, and high interoperability between transmitter and receiver
- **Communication** between transmitter and appliance **based on NFC**: power control and additional smart features

Induction cooktops can act as power supplies for kitchen applications

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Ki Kitchen power modes for different appliances

Static power transfer

The receiver in the appliance carries the information of the requested power to be transferred plus an ON/OFF message

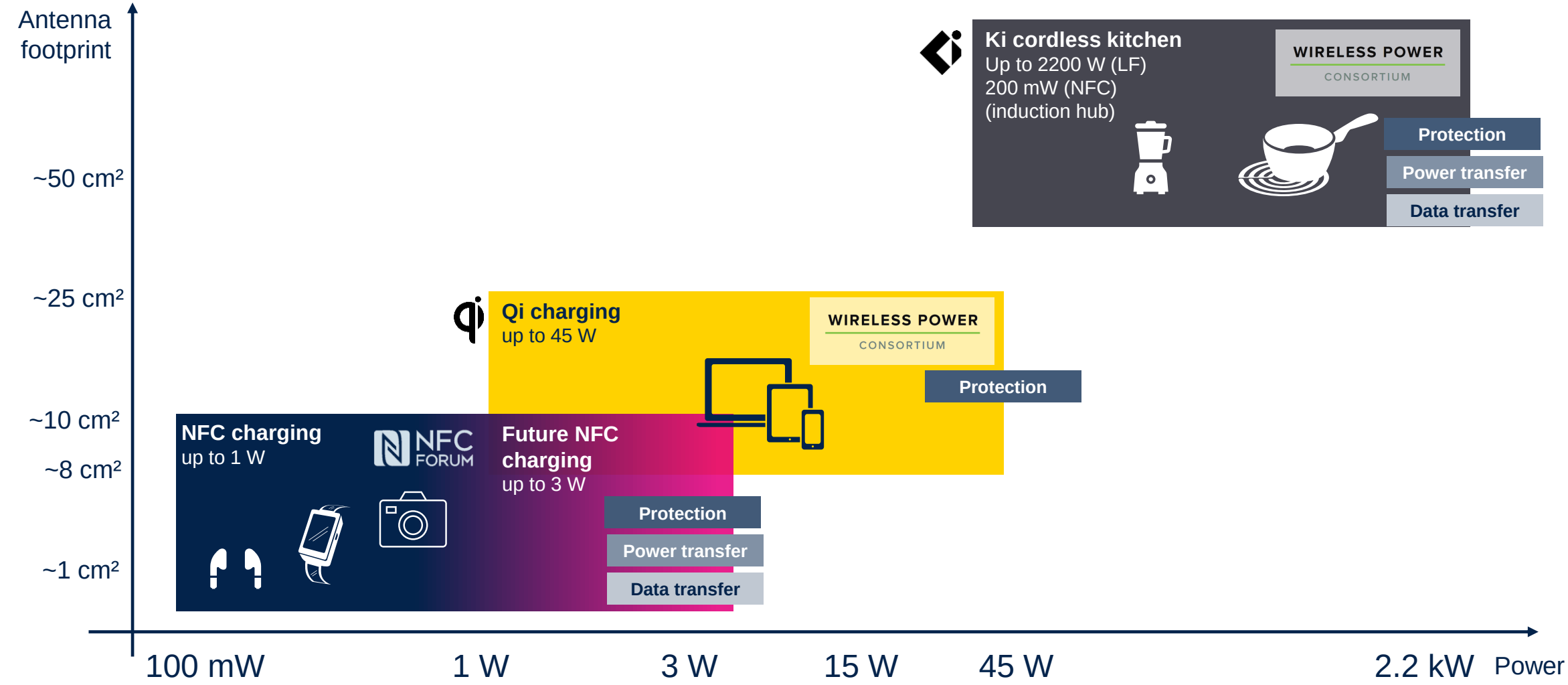
- Kettles
- Rice cookers
- Filter coffee
- Pod coffee
- Espresso machines
- Deep fat fryers
- Electric grills
- Light fryers

Dynamic power transfer

The transmitter and receiver exchange information to dynamically adjust the power transfer

- Blenders
- Freestanding cookers
- Food processor
- Mixers
- Slow cookers
- Juice extractors
- Coffee grinders
- Bread makers

NFC usage in the Ki Cordless Kitchen



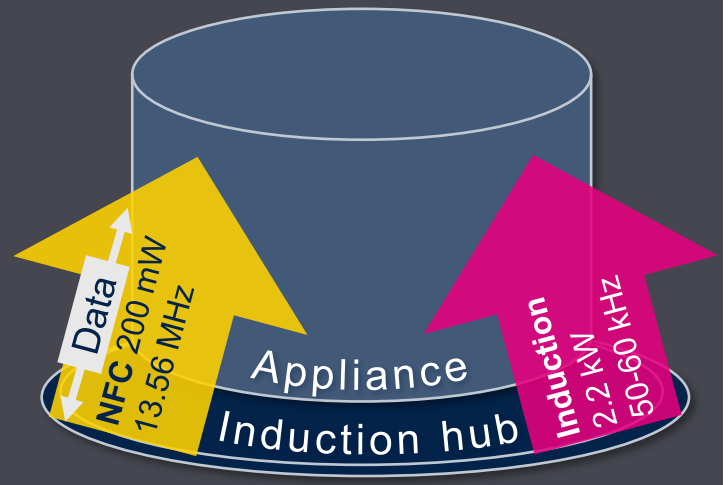
NFC usage in the Ki Cordless Kitchen

Auxiliary power transfer:
200 mW wireless power transfer via induction to operate appliance with auxiliary power

Communication:
Power negotiation, pairing, authentication, parameter setting, etc.

Power control:
Dynamic control of transferred energy

Protection:
Detection of foreign objects to avoid damaging credit cards, passport,…



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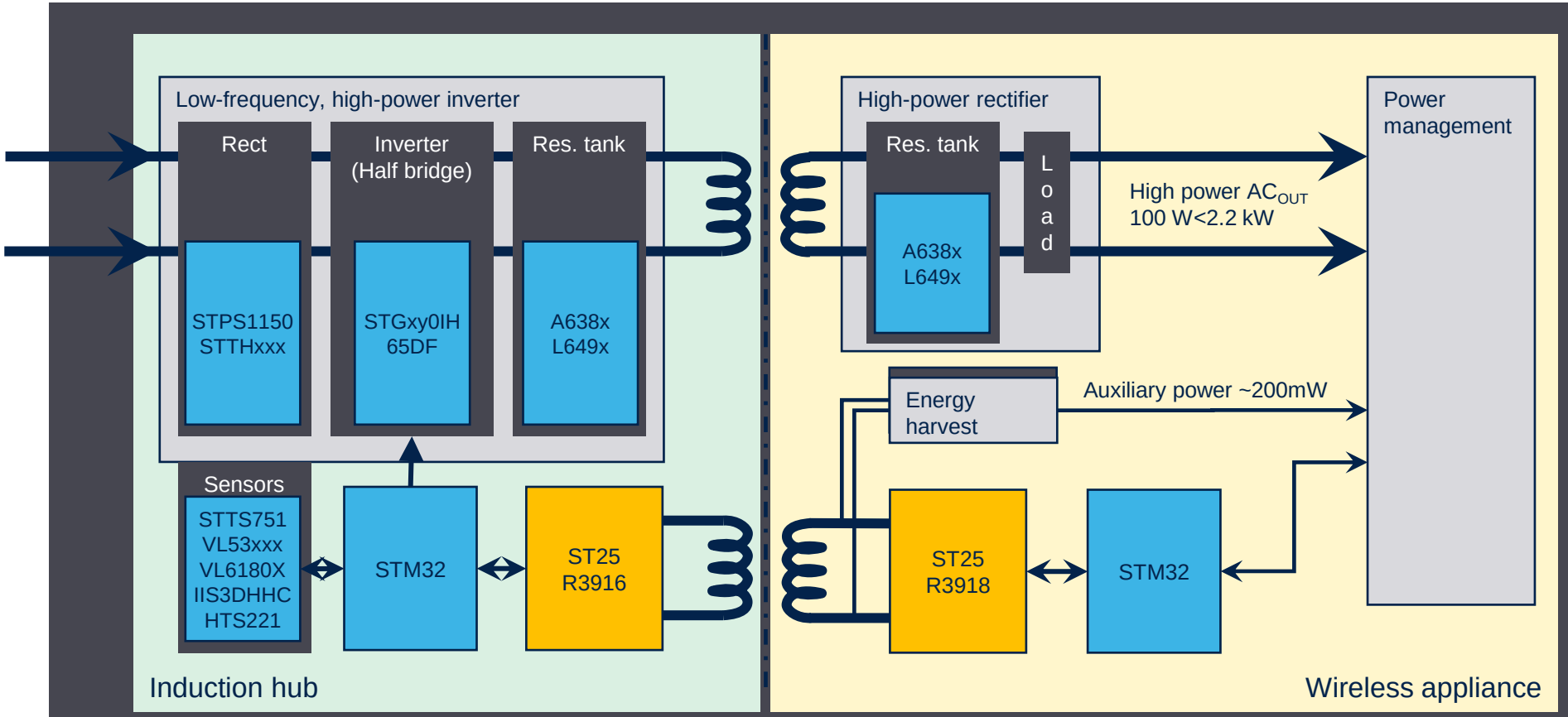
Ki system architecture



NFC

Auxiliary power transfer: wireless power transfer via induction to operate appliance with auxiliary power

Communication: power negotiation, pairing, authentication, parameter setting

Power control: dynamic control of transferred energy

Protection: detection of foreign objects to avoid damaging credit cards, passport

ST solution for KI-Poller (NFC): ST25R3916

ST25R3916

Reader writer	ISO14443 ISO15693 FeliCa	RAM BUFFER	SPI/I²C
AP2P PP2P Card emulation	NFC	512 bytes	2.4/5.5 V
1.6 W	848 KB/s		3.4 Mb/s 10 Mb/s

DPO	Dynamic power output
CIWU	Capacitive & inductive wake up
AWS	Active wave shaping
NSR	Noise suppression receiver
AAT	Automatic antenna tuning
DSO	Driver slope adjustment
EMD	Automatic EMD error handling

QFN32
Wettable flank

WLCSP

Use cases

- Ideal for **NFC WLC charging** applications
- Accessories, IoT devices, small consumer electronics

Key features

- NFC Forum universal device (with CE mode)
- **1.6 W** output power with dynamic power adjustment
- **Active wave shaping, noise suppression receiver**
- **Automatic antenna tuning**
- -40°C to **105°C** ambient temperature range (QFN)

Key benefits

- Low power operation & standby mode (capacitive wake-up)
- Works in challenging environment like noisy LCD displays

ST solution for KI-Receiver (NFC): ST25R3918

ST25R3918

Reader writer	ISO14443 ISO15693	RAM BUFFER	SPI/I²C
PP2P	NFC	512 bytes	2.4/5.5 V
CE	848 KB/s		3.4 Mb/s 10 Mb/s
0.5 W			

DPO	Dynamic power output
LPID	Low power inductive card detection
AWS	Active wave shaping
NSR	Noise suppression receiver
DSO	Driver slope adjustment
EMD	Automatic EMD error handling

QFN32
Wettable flank

Use cases

- Ideal for reader+tag
- Access control, gaming, consumer
- Apple AppClip; Android InstantApp

Key features

- 0.5 W dynamic output power
- Active wave shaping, noise suppression receiver
- Low power tag detection
- -40°C to 85°C ambient temperature range

Key benefits

- Low power operation and standby mode
- Works in challenging environments like noisy LCD displays
- Excellent performance for low-power applications
- CE mode allows easy start and interface with phone apps

ST25R39xx characteristics

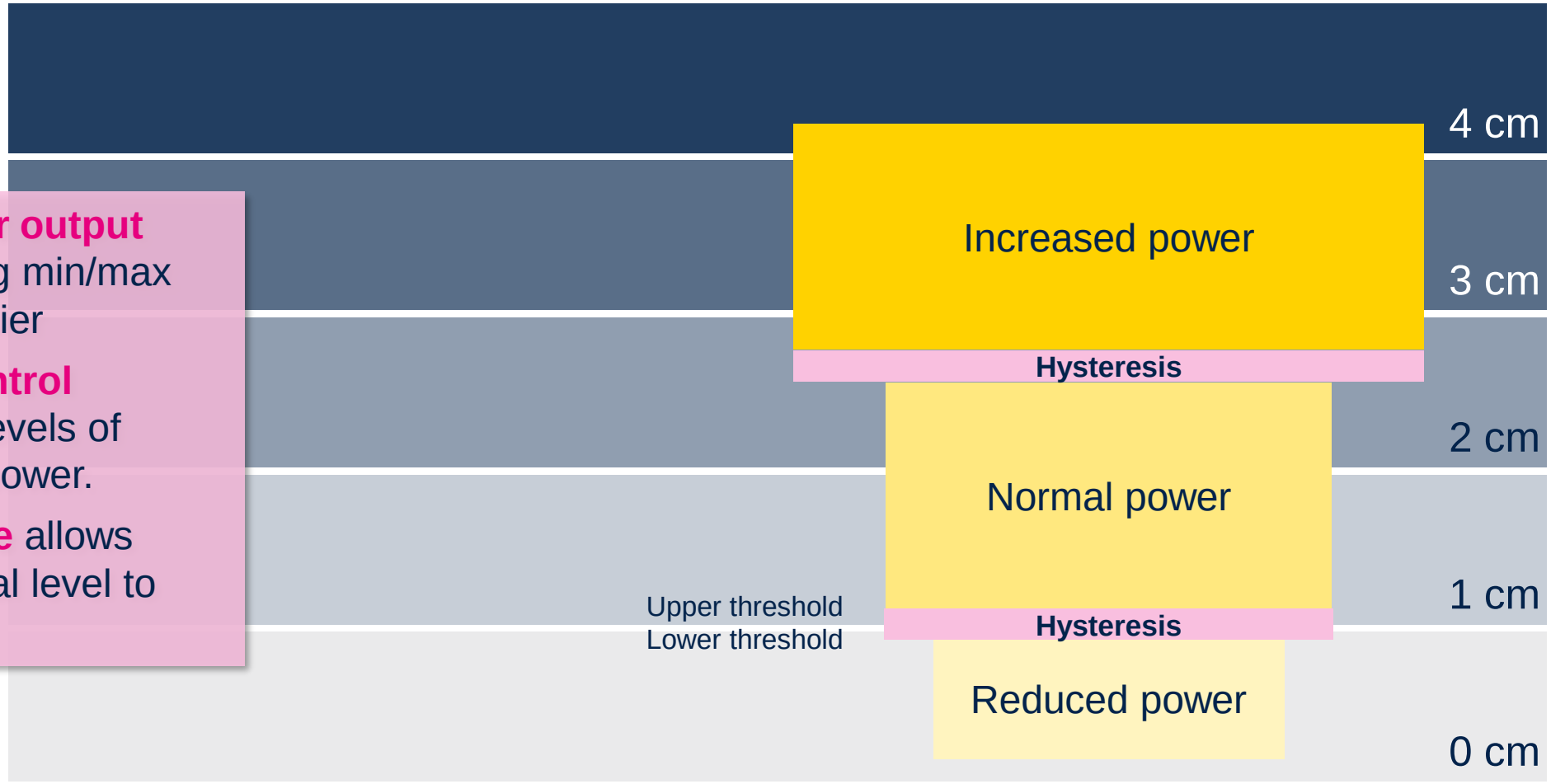
Features	ST25R3916	ST25R3917	ST25R3918
Power	1.6 W		0.5 W
ISO/IEC 14443 Type-A	Yes		
ISO/IEC 14443 Type-B	Yes		
ISO/IEC 15693	Yes		
FeliCa™	Yes		No
NFC tag read support	Yes		
ISO/IEC 18092 passive initiator mode	Yes		
ISO/IEC 18092 passive target mode	Yes	No	Yes
ISO/IEC 18092 active initiator and target mode	Yes	No	
Card emulation	Yes	No	Yes
Automatic antenna tuning (AAT)	Yes	No	
Capacitive sensor wake-up	Yes	No	
Low power tag detection	Yes		

ST25 reader dynamic power output

Dynamic power output makes achieving min/max power limits easier

Active gain control allows various levels of card response power.

Squelch feature allows scaling the signal level to improve noise



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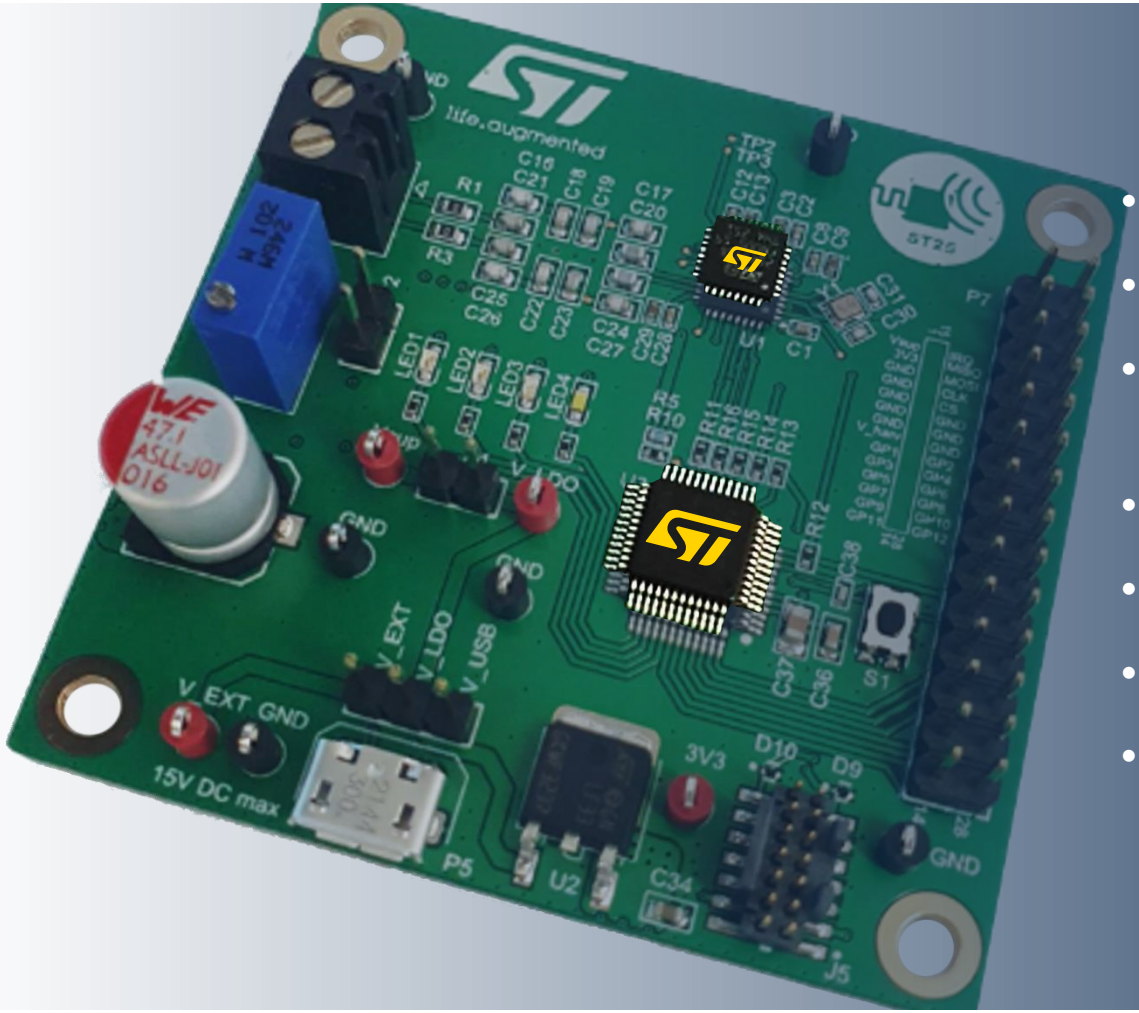
NFC receiver reference board KI Kitchen appliances



- With ST25R3918 (HF reader) and STM32G061C8T6 (MCU)
- NFC power harvesting in connected mode
- Variable load (potentiometer) helps developing the matching network for maximum power transfer to harvester
- LEDs indicate level of harvested voltage
- 3V3 supply via LDF33DT LDO
- External voltage supply connectors
- All relevant signals on 2x14 pole header for connecting external peripherals

Ki Cordless Kitchen with STSAFE for mutual authentication

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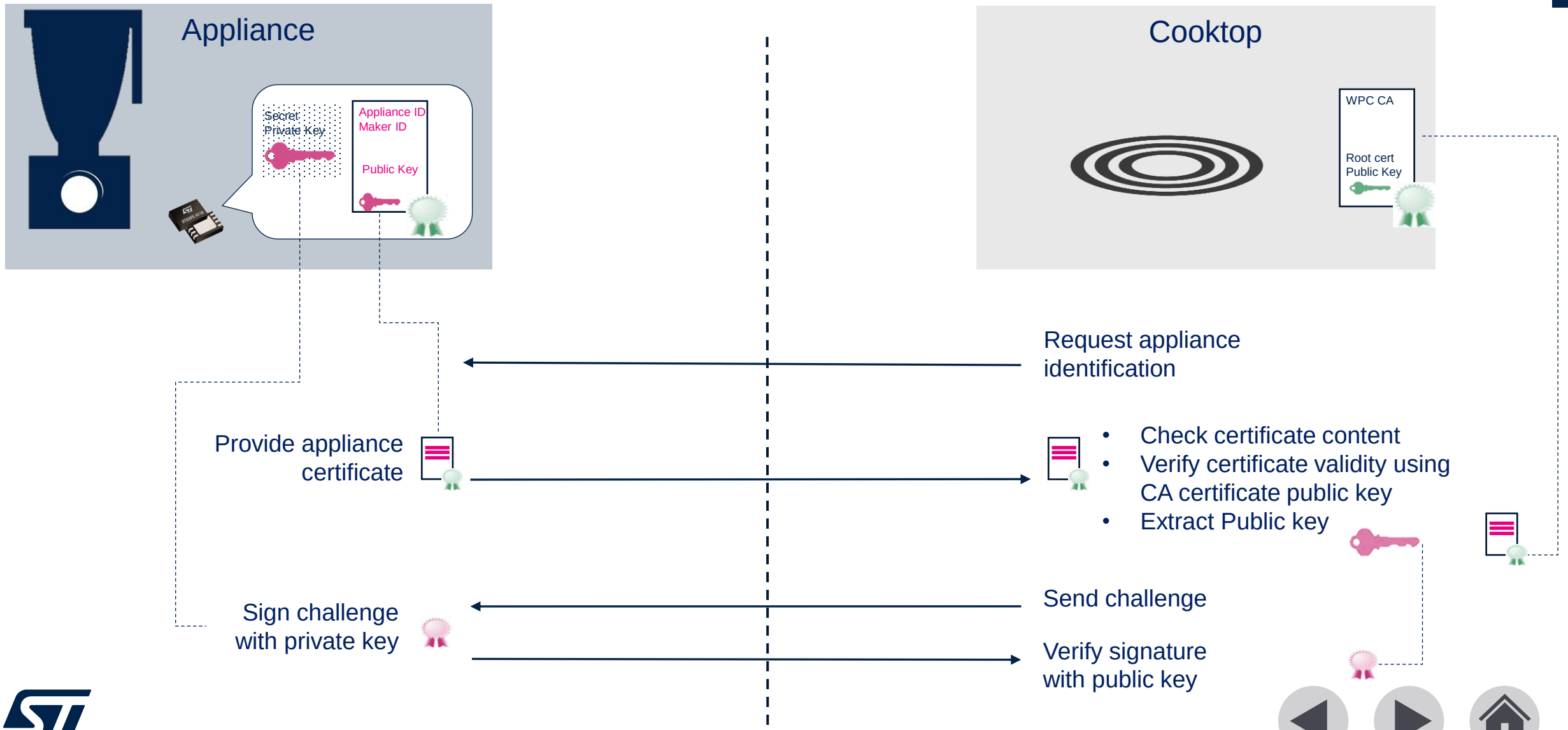
Enabling power transfer with mutual authentication

Mutual authentication ensures that the cooktop and the appliance are both operating with a certified Ki product

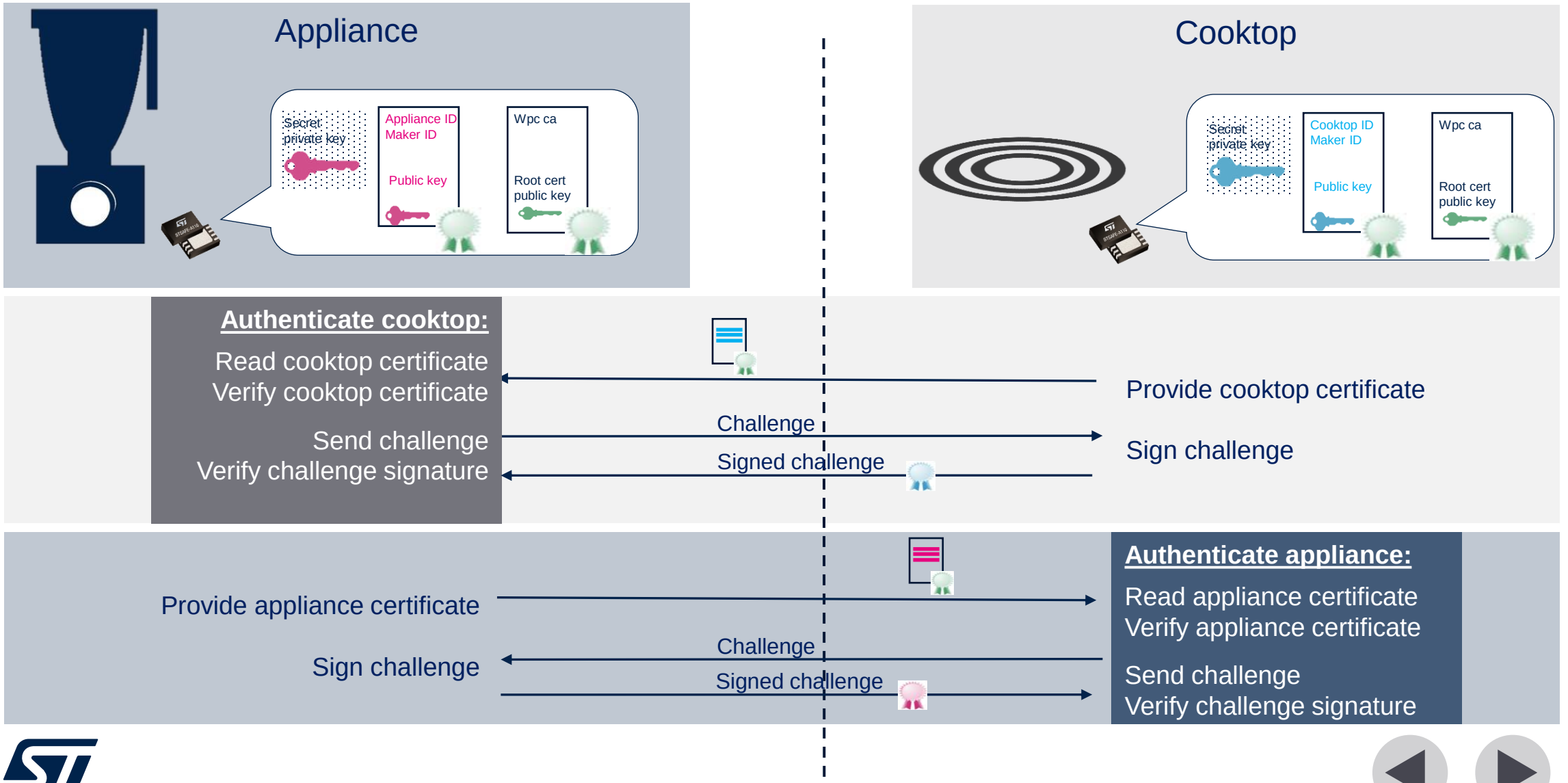
ST is completing its Ki power transmitter and power receiver reference designs with an **STSAFE-A secure element** acting as an authentication companion chip

Final authentication specification under discussion at WPC

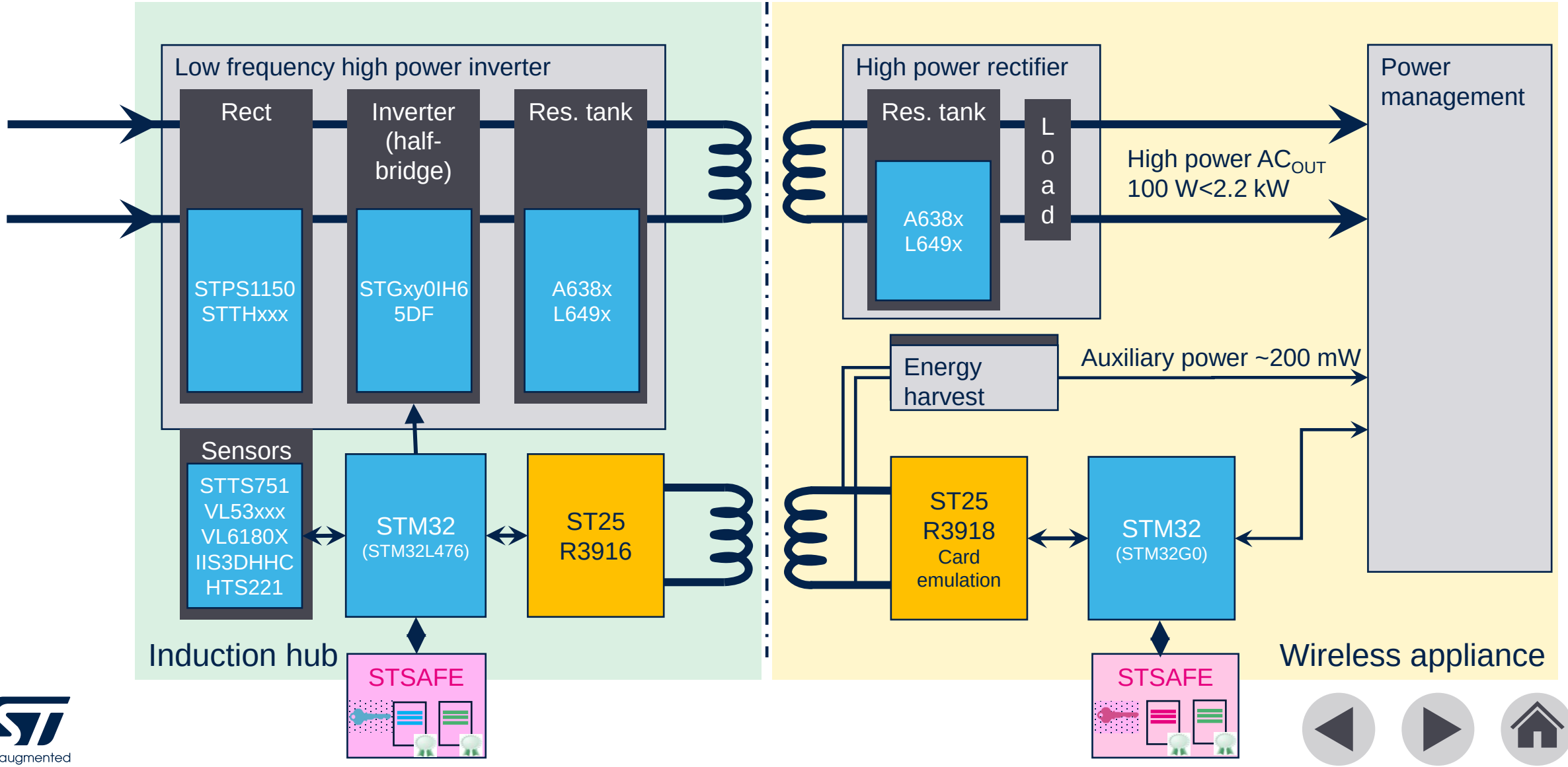
How authentication works



How WPC Ki mutual authentication works



Ki architecture with STSAFE mutual authentication



Best-in-class STSAFE-A110 embedded secure element (eSE)

Rich feature set

- Authentication with personalized certificate
- Secure connection establishment
- Secure data storage
- Signature verification

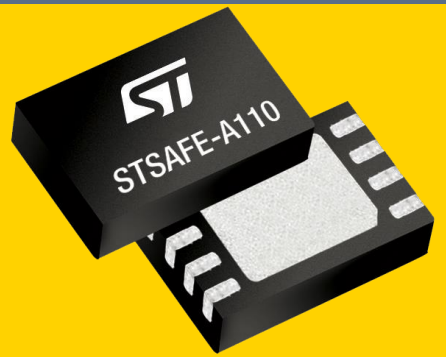
Best-in-class hardware

- Highly secure MCU, CC EAL5+ AVA_VAN5 certified
- 6kBytes EEPROM
- 30 years data retention, 500 kcycles
- Temperature range: -40°C to 105°C
- 1 µA consumption in hibernate mode

Personalization

- Customer certificate and keys loading at ST secure factory
- Compatible with Wireless Power Consortium CA
- **MOQ 5 Ku**

- Consumables and accessories anticloning
- Cordless powering (Ki)
- Smart home (Matter ready)
- Metering & industrial equipment
- Healthcare
- Wireless charging (Qi)



CC EAL5+ certified

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Secure provisioning at ST factory

Personalization @ST secure factory

Common Criteria

Hardware **security module**

Product personalization with **customer** keys and certificates

Certificates

Personalization schemes:

- **Per wafer** for large volume projects
- **Per chip** for fast project start and/or small volume projects (MOQ 5 Ku)

Chip development and packaging

Personalization

Customer

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ST is a WPC Manufacturer Certificate Service Provider

ST is accredited to issue and stamp the certificates of official WPC standard products

Thanks to its certified secure facilities and its strict certified security policy

Official **Qi Charger** reference

Official **Qi2 Charger** reference

Official **Ki Appliance** reference

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STSAFE-A110 development ecosystem

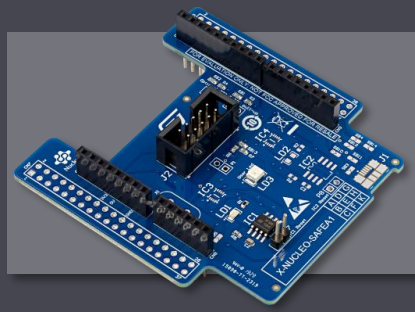
Support for Ki Cordless Powering

Personalized samples

In SO8N package

In DFN8 package

Evaluation expansion boards



- Mounted with STSAFA110S8SPL02
- Arduino connector
- STM32 Nucleo connector
- X-NUCLEO-SAFEA1A

Local host middleware

- Reusable referent open integration code source
- Straightforward service API for ki cordless powering mutual authentication:

Query	Response
GENERATE_RND	Challenge
GET_CERTIFICATE	Certificate chain
SIGN	Challenge_Auth
VERIFY	Challenge_Verify

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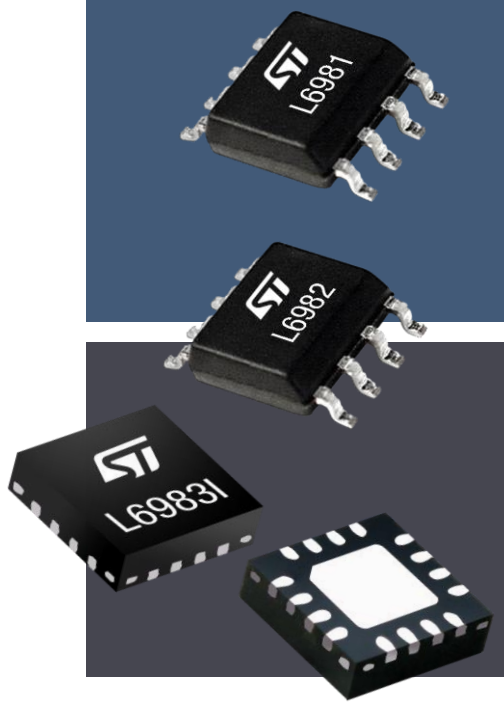
L6983/2/1: synchronous 24 V input rail series

Very simple design-in, load limit from 1.5 to 3 A



System benefits

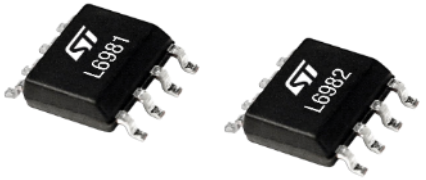
- Compact size/footprint
- Efficiency @ all load conditions
- V_{BIAS}, power-good, spread spectrum in the 3 A version

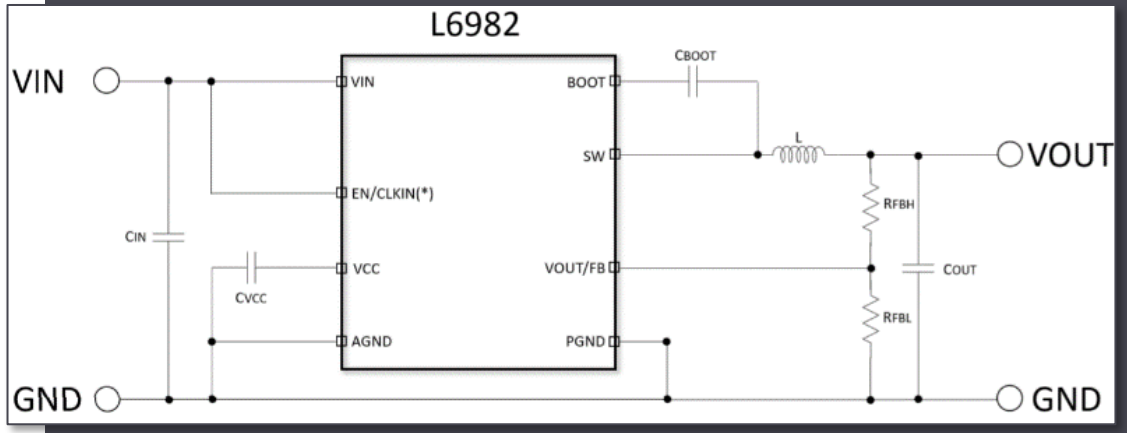
Key features

- SO8/HSO8, QFN16 3x3
- I_q 35 µA or down to 3.5 µA with V_{BIAS}=5 V
- V_{IN} = 3.5 V – 38 V, V_{OUT} fixed @ 3.3 / 5 V or Adj = 0.8 V – V_{IN}

L6982/L6981

38 V 2/1,5A high efficiency synchronous step-down converter for industrial applications





Key applications

- 24 V bus industrial power systems
- 12/24 V battery-powered equipment
- Sensors and always-on applications
- Low noise applications

High efficiency from light to full load operation

- 90% typical efficiency at full load (24-5 V)
- IQ @ 3.3 V = 35 µA in low consumption mode
- IQ @ shutdown = 2 µA

High integration to minimize board size

- Synchronous rectification embedded low and high side MOSFETs
- Internal Loop compensation
- Embedded overvoltage protection and soft-start circuit

Design flexibility

- Base frequency of 400kHz
- Can be synchronized to external 200-500 kHz clock signals (LNM version)
- SO-8 package

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Gate driver portfolio overview

Driving MOS, IGBT, SiC, or GaN

BCD low voltage

Low-side drivers MOS

- PM8851, PM8841
- PM8834

Single driver for IGBT

- TD3501, TD351, TD352

<100 V 3-dhase drivers MOS

- STDRIVE101
- STDRIVE102x dev

600 V BCD offline

600 V half-bridge drivers for IGBT, MOS

- L638x, L639x
- L6491

600 V half-bridge drivers for GaN

- STDRIVEG600
- STDRIVEG610, STDRIVEG611

600 V 3-phase drivers

- STDRIVE601

BCD galvanic isolation

Galvanic isolated drivers

- STGAP1
- STGAP2S, STGAP2D
- STGAP2HS, STGAP2HD
- STGAP2SICSN
- STGAP2SICS, STGAP2SICD
- STGAP2GS, STGAP2GSN
- STGAP2SICSAN, STGAP2SICSA
- STGAP3x dev
- STGAP4

In development

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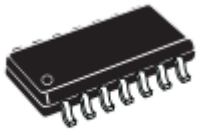
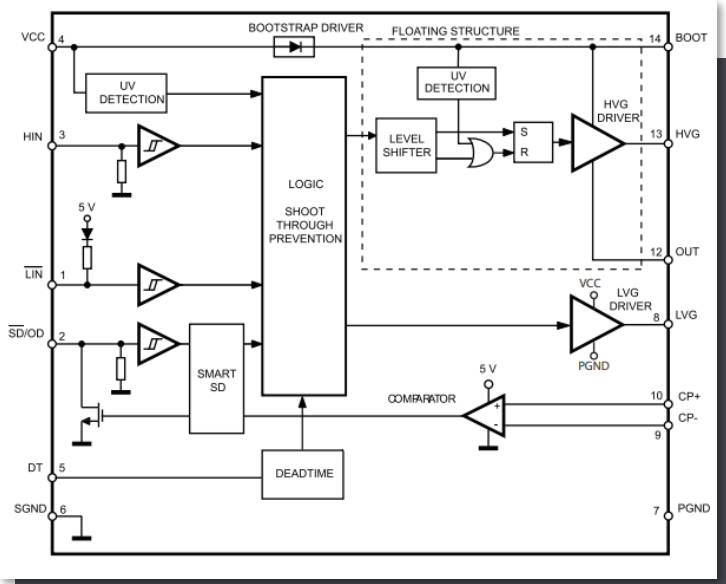
L6491D

High voltage high and low-side 4 A gate driver



SO-14



Key applications

- Home appliance
- Induction heating
- Industrial inverters
- UPS

Robustness:

- High voltage rail up to 600 V
- dV/dt immunity ± 50 V/ns in full temperature range
- Driver current capability: 4 A source/sink
- Switching times 15 ns rise/fall with 1 nF load
- 3.3 V, 5 V TTL/CMOS inputs with hysteresis

Integration:

- Integrated bootstrap diode
- Comparator for fault protections

Flexibility:

- Smart shutdown function
- Adjustable deadtime
- Interlocking function
- Compact and simplified layout

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VIPer family

P_{OUT}
R_{ON}

120 W
190 mΩ

100 W
225 mΩ

65 W
260 mΩ

50 W
450 mΩ

40 W
600 mΩ

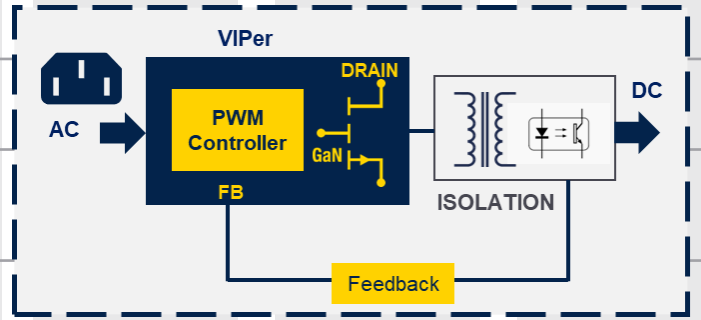
30 W
1.1 Ω

18 W
3.5 Ω

12 W
7 Ω

8 W
20 Ω

5 W
30 Ω

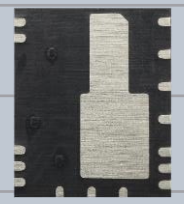


VIPERGAN120
VIPERGAN100
VIPERGAN65
VIPERGAN50

VIPERP4
VIPERP3

EVLVIPGAN50PD

18.3W/in³ Power Density



VIPER31

VIPER26/26K

VIPER35
VIPER37
VIPER38

VIPER25
VIPER27
VIPER28

VIPER222

VIPER17

VIPER0P
VIPER11
VIPER16

VIPER122

VIPER01
VIPER06

VIPER0P	VIPERx1	VIPERx6	VIPERx22	VIPERx5	VIPERx7	VIPERx8	VIPer II gen	VIPerGaN
800 V	800 V	800 / **1050 V**	730 V	800 V	800 V	800 V	800 V	650 V (850 V max)

Buck and flyback PSR/SSR

Flyback SSR

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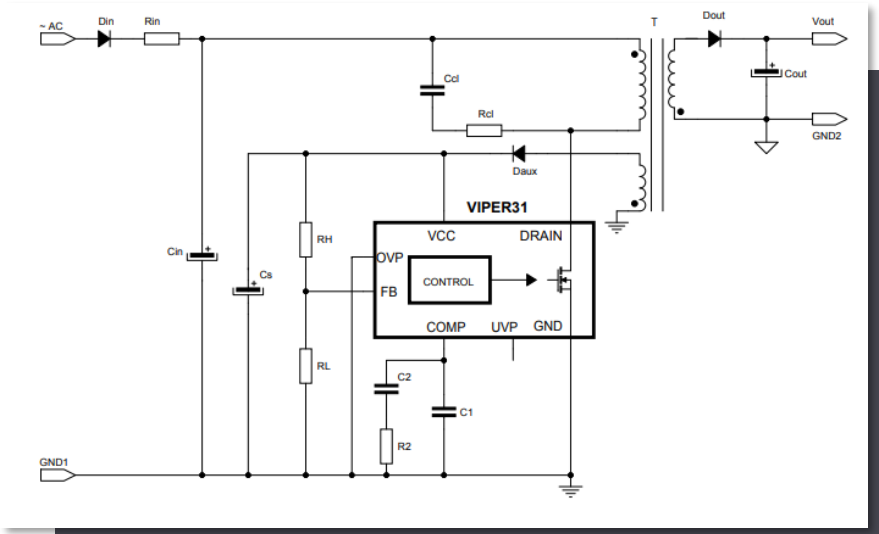
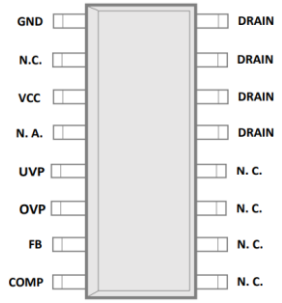
VIPER31

Energy-saving offline high-voltage converter





Low power SMPS for

- home appliances
- home automation
- industrial
- Consumers
- Lighting

- 800 V avalanche-rugged power MOSFET to cover ultrawide VAC input range
- Drain current limit protection (OCP): 710 mA (VIPER317); 850 mA (VIPER318); 990 mA (VIPER319)
- Wide supply voltage range:
  4.5 V to 30 V< 20 mW @ 230 V< 430 mW @ 230 V
- Jittered switching frequency reduces the EMI filter cost
- Embedded HV startup and sense FET
- Embedded E/A with 1.2 V reference
- Built-in soft-start for improved system reliability
- Full set of protections with/without automatic restart
- Flyback, buck, and buck-boost topologies
- eDesignSuite supported

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