WIRELESS POWER SOLUTIONS

EUF-INS-T2288

VACLAV HALBICH
MICHAL SUSEN

PUBLIC

SECURE CONNECTIONS
FOR A SMARTER WORLD

SOLUTIONS APPROACH

Addressing our customers' challenges from THEIR perspective

Key characteristics of a solution:

- Robust
- Fast to market
- Easy to deploy
- Complete software
- Hardware reference design
- Certifications (where applicable)
- Tested and validated
- Innovative

WIRELESS POWER

Convenient

No cables to deal with

Charge Anywhere

Car, Airport, Café, Hotel

Water/Dust Proof

Enables completely sealed designs

Durable

No damaged connectors or cables

Universal

One standard to rule them all (soon)

WIRELESS POWER STANDARDS

	Standard	Technology	Characteristics
Compatible HW base	Qi (WPC)	- Inductive coupling - 80 – 200kHz - 2 – 2000W	- Dominant market share low power – up to 15W high power – up to 200W kitchen – up to 2000W resonant – free positioning
	Apple	- Inductive coupling - 100 – 200kHz - 2W	- Apple Watch - Qi subset frequency range
	PMA	- Inductive coupling - 105 – 400kHz - 2 – 15W	- Qi subset frequency range
		- Inductive resonant	- No released products (May

*

*Merged to the AirFuel Alliance (Wireless compatible technology lines (kHz vs. MHz band)

WPC QI EVERYWHERE

Mobiles	Cars	Consumer
Samsung, Google, LG, Sony, HTC, Motorola, Microsoft, Nokia, …	Toyota, Ford, Audi, VW, Skoda, Honda, Hyundai, BMW, Mercedes-Benz, …	Dell, Ikea, Philips, Panasonic, McDonalds, AirCharge, PowerSquare, …

Qi is leading standard, all available Tx and Rx products support Qi

NXP® IS KEY CONTRIBUTOR IN WPC

Founding member of Qi Wireless Power Consortium (WPC)

Chair/co-chair of Working Groups in WPC

NXP Qi Solutions are golden units in WPC specification

NXP Qi Solutions are part of certification interoperability test bed

WIRELESS POWER DESIGN CHALLENGES

NXP Wireless Power Solutions platform is the answer to all these challenges!

WIRELESS POWER SOLUTIONS PLATFORM

HW
- Reference design
- Optimized ultra-low BOM

SW
- Professional Grade Qi certified library
- Customizable application / clean API

Support
- Application Expertise
- On-site support up to production

Certification
- WPC consortium SWG chair
- Compliant with latest WPC spec

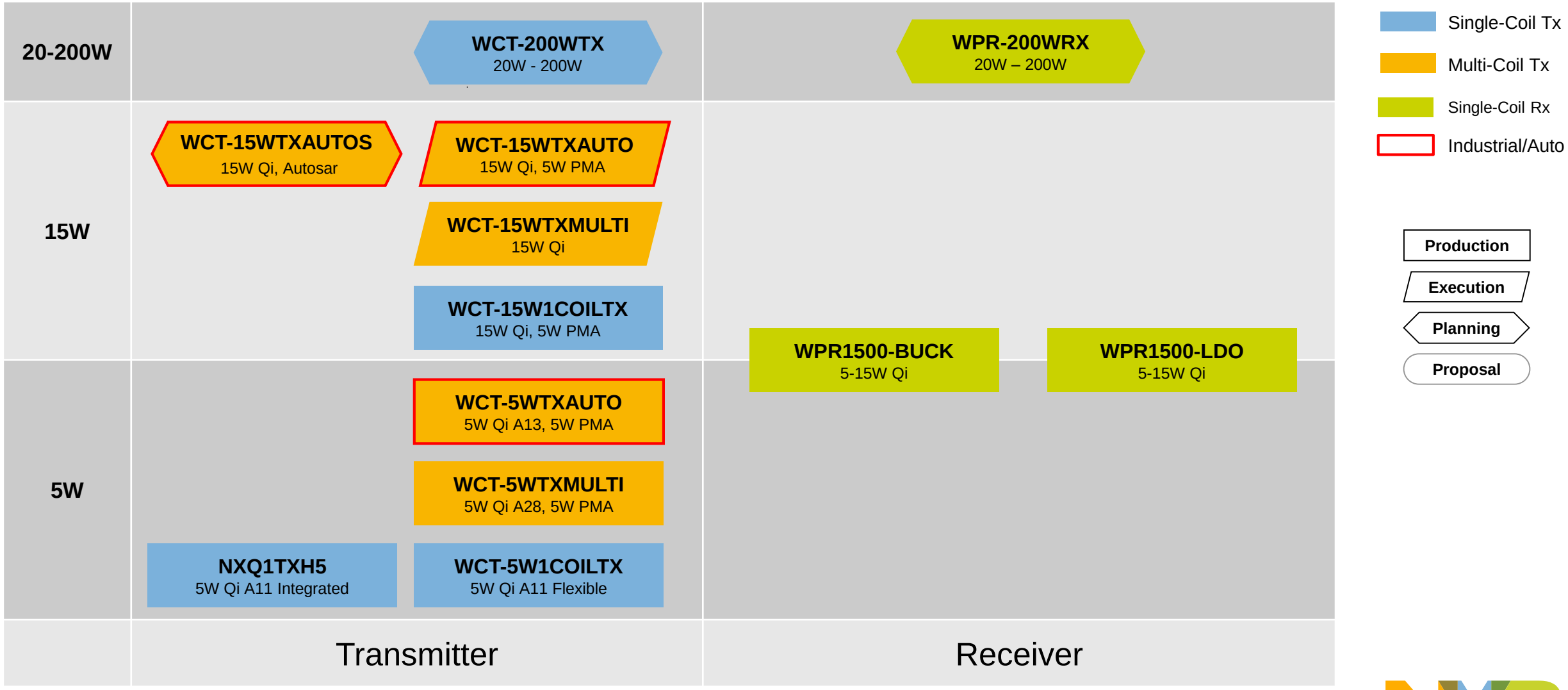
NXP Automotive
Wireless Charging Tx
Solutions Platform

Customers Benefits:

- Reduced Time to Market
- Reduced Risk
- Reduced Development Cost

NXP
WIRELESS POWER
PORTFOLIO

NXP® WIRELESS POWER SOLUTIONS PORTFOLIO



5W CONSUMER TRANSMITTERS

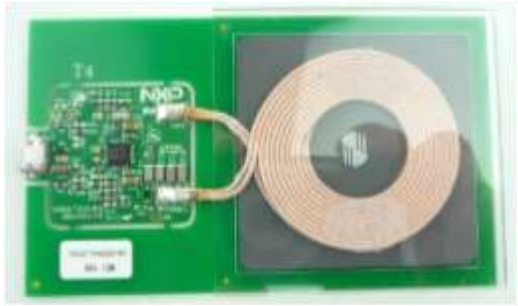
WCT-5WTXMULTI
5W Qi A28, 5W PMA

NXQ1TXH5
5W Qi A11 Integrated

WCT-5W1COILTX
5W Qi A11 Flexible

- Compliant with WPC low power specifications
- On chip digital demodulation
- Resonance Shift and Power Loss FOD methods
- Dynamic input power limit
- Power transfer efficiency exceeds 75%
- Low-BOM

WCT-5W1COILTX A11
- Flexible application
- Available now



NXQ1TXH5 A11
- Integrated passive components
- Available now

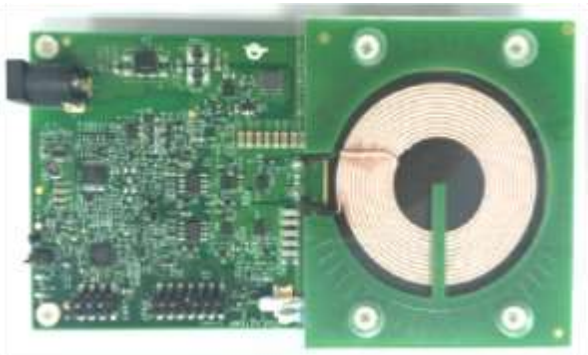
WCT-5WTXMULTI A28
- Flexible application
- Multi coil – free positioning
- PMA support
- Available now

15W CONSUMER TRANSMITTERS

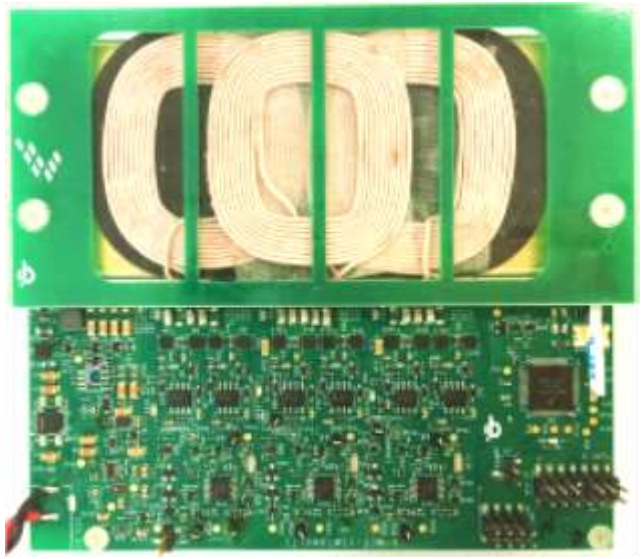
WCT-15WTXMULTI
15W Qi

WCT-15W1COILTX
15W Qi, 5W PMA

- WPC medium power specifications complaint
- On-chip digital demodulation
- Back compliant with WPC low power specifications
- More than 75% transfer efficiency
- Q-Factor and Power Loss FOD methods
- Fast charging



WCT-15W1COILTX MP-A4
- Flexible application
- Available now



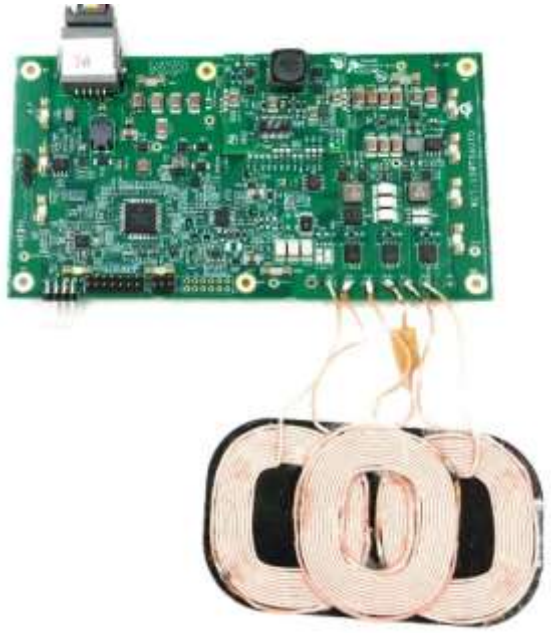
WCT-5WTXMULTI
- Flexible application
- Free positioning (multi coil)
- Available Q4

5W AND 15W AUTO TRANSMITTERS

WCT-15WTXAUTOS
15W Qi, Autosar

WCT-15WTXAUTO
15W Qi, 5W PMA

WCT-5WTXAUTO
5W Qi A13, 5W PMA



- Free positioning (multi coil)
- On chip digital demodulation
- Fixed frequency Rail Voltage control (better EMC)
- Resonance Shift and Power Loss FOD methods
- Key FOB and AM band interference avoidance
- AEC-Q100 grade 2 certification
- CAN, NFC interfaces
- PMA support

WCT-15WTXAUTO
- 125kHz operating frequency
- Fast charging
- Available now

WCT-15WTXAUTOS
- AUTOSAR
- No need for host controller
- Under development
- Available H2 2017

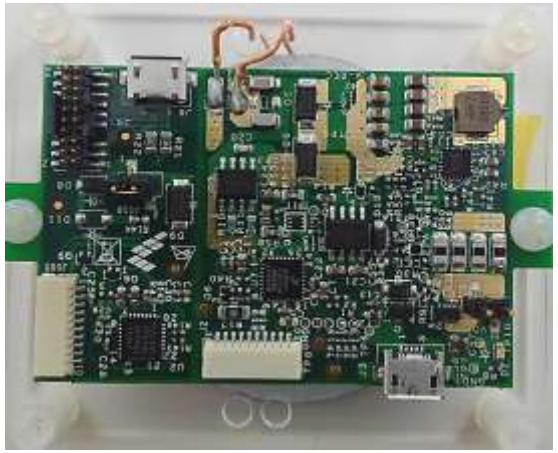
WCT-5WTXAUTO A13
- 110kHz operating frequency
- Available now

5W TO 15W CONSUMER RECEIVERS

WPR1500-BUCK
5-15W Qi

WPR1500-LDO
5-15W Qi

- Input voltage 3.5V ~ 20V AC peak on the receiver coil
- Two-way communication: Tx to Rx – FSK, Rx to Tx – ASK
- Rectifier voltage, output voltage and output current HW protection
- Power transfer efficiency exceeds 74%
- PCB size 40 mm × 40 mm
- WPC golden MP receiver



WPR1500-BUCK
- Flexible output voltage
- 5-18V output voltage

WPR1500-LDO
- Extra-low BOM
- 5V output voltage

WCT-200WTX
20W - 200W

WPR-200WRX
20W – 200W

20-200W WIRELESS POWER SOLUTION

WIRELESS HIGHER POWER SOLUTION

Customizable power level – 20W to 200W

Complete system – Tx + Rx

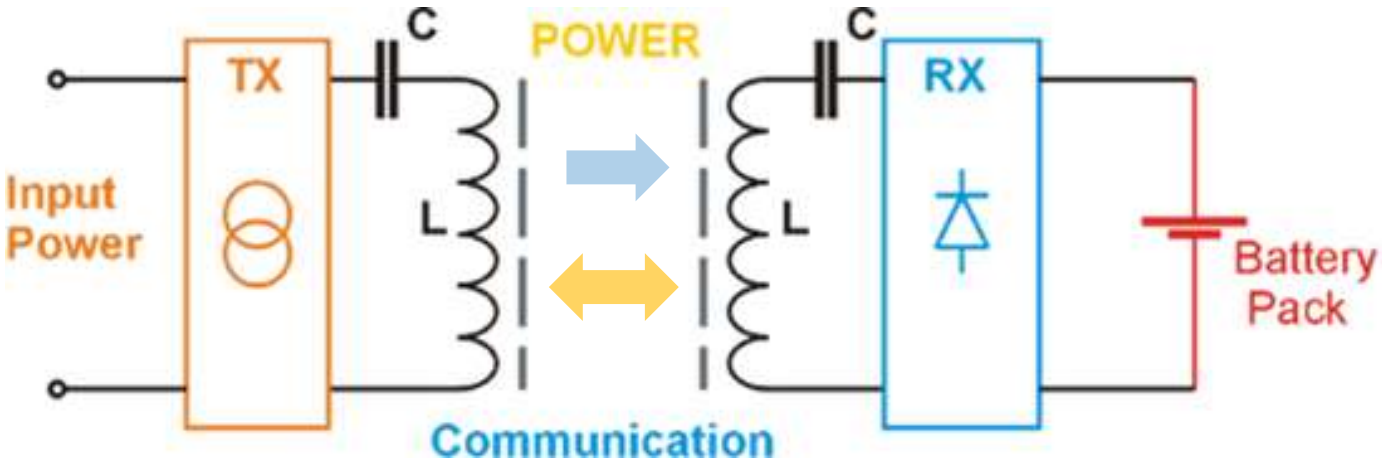
In-house NXP technology

Prepared to be Qi compatible – co-chair of WPC 60W work group

Target applications – laptops, power tools, medical devices, vacuum cleaners, …

HIGHER POWER SOLUTION TECHNICAL DETAILS

Power:	20 – 200W
Working frequency:	100 – 145kHz
Rx – Tx gap (z):	6 – 14mm
Free positioning (x/y):	30% of coil diameter in each direction
Principle:	Resonant
High efficiency:	80 – 90+% (depends on displacement)
Communication:	Bidirecitonal



20-200W TX TECHNICAL DETAILS

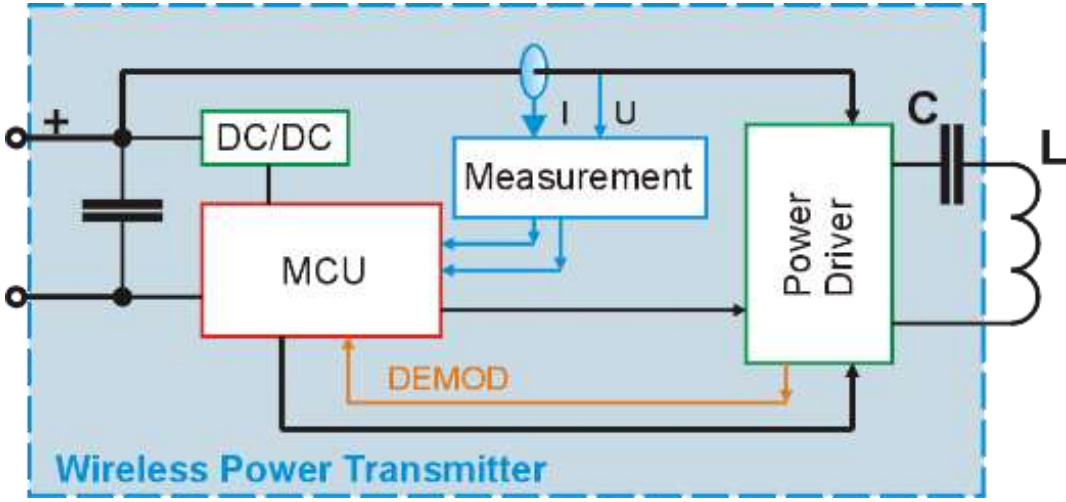
Tx supply voltage: 12 – 28V DC (nominal 24V)

WCTxxxx device

High resolution PWM – power MOSFET drivers control

12-bit ADC – current and voltage measurements

CAN/LIN/IIC/UART/SPI interfaces



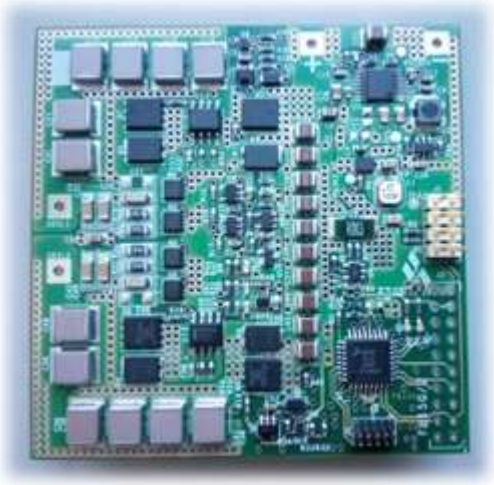
Best efficiency and EMC maintenance

Advanced control loops

NFC and in-band communication

SUBJECT TO CHANGE

20-200W RX TECHNICAL DETAILS

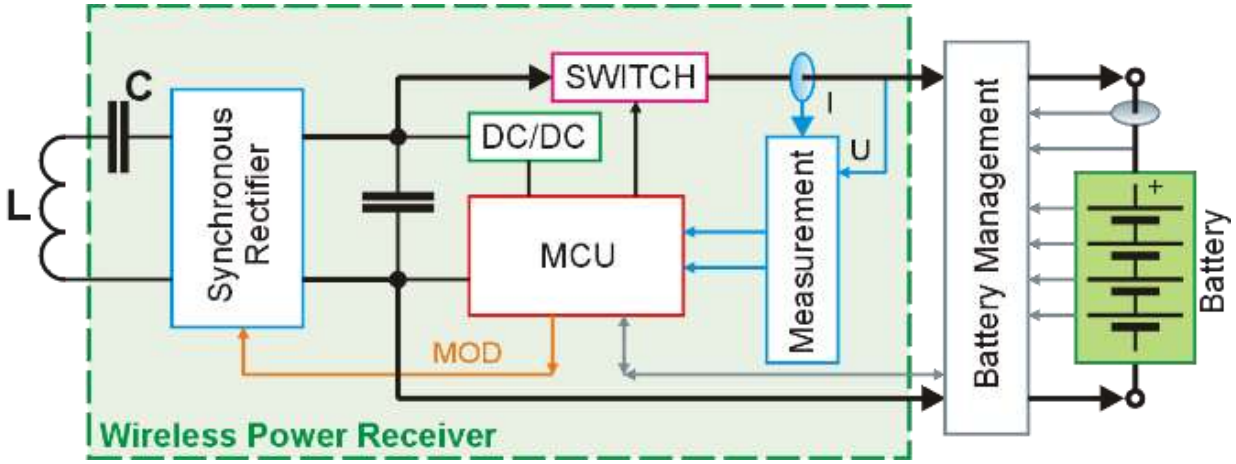


Rx output voltage: 8 – 25V DC (2 – 6 cells in series up to 10Ah)

WPRxxxx device

12-bit ADC – current and voltage measurements

SPI/UART/IIC interfaces



High efficiency synchronous rectifier

All types of Lithium batteries

NFC and in-band communication

SUBJECT TO CHANGE

SOFTWARE AND TOOLS

WIRELESS POWER SW

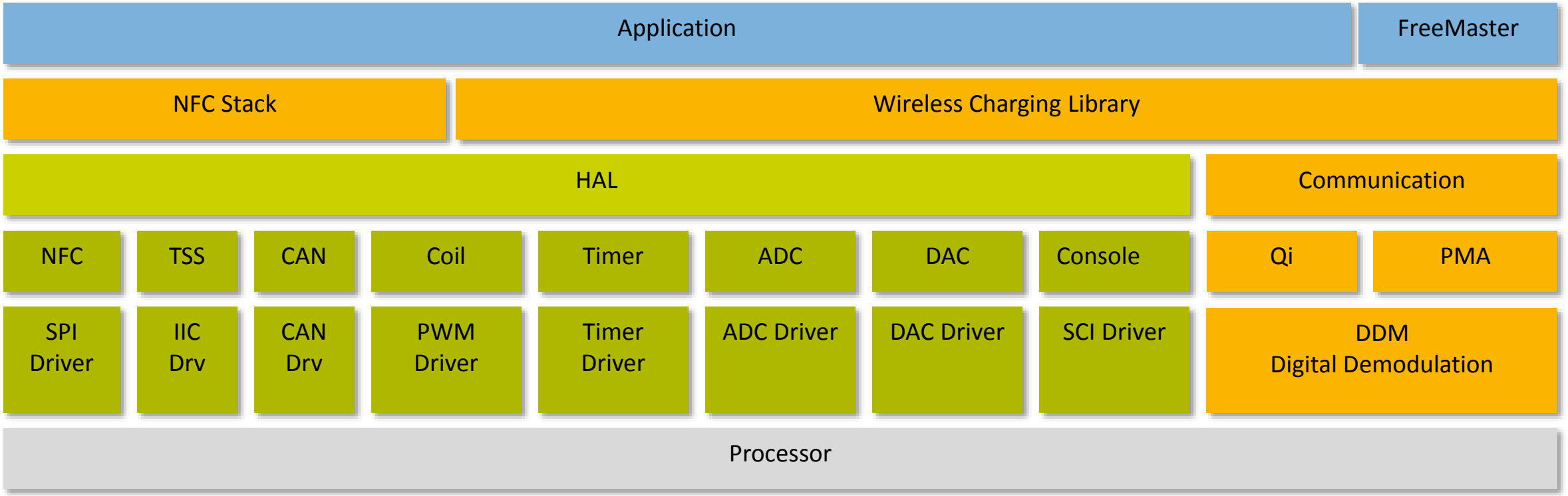
Qi certified library

- Advanced algorithms (NXP IP)
- Qi state machine

Fully customizable application

HAL layer

NFC Stack



APPLICATION FLEXIBILITY

User can fully control all aspects of library from application, develop proprietary features, easily adapt to new situations and react immediately to potential needs

- Open architecture
- Custom FOD
- Additional application
- Full control of library parameters
- System/user interfaces definition
- Proprietary monitoring/protections
- Proprietary messages between Tx and Rx

BUILT IN SAFETY

Foreign Object Detection (FOD)

- Q-Factor – comparison of expected and measured resonance curve (conductive materials shifts resonance frequency)
- Power loss method – monitoring of unexpected losses in the system
- Surface temperature measurement

Over voltage/current/temperature protection with peripherals

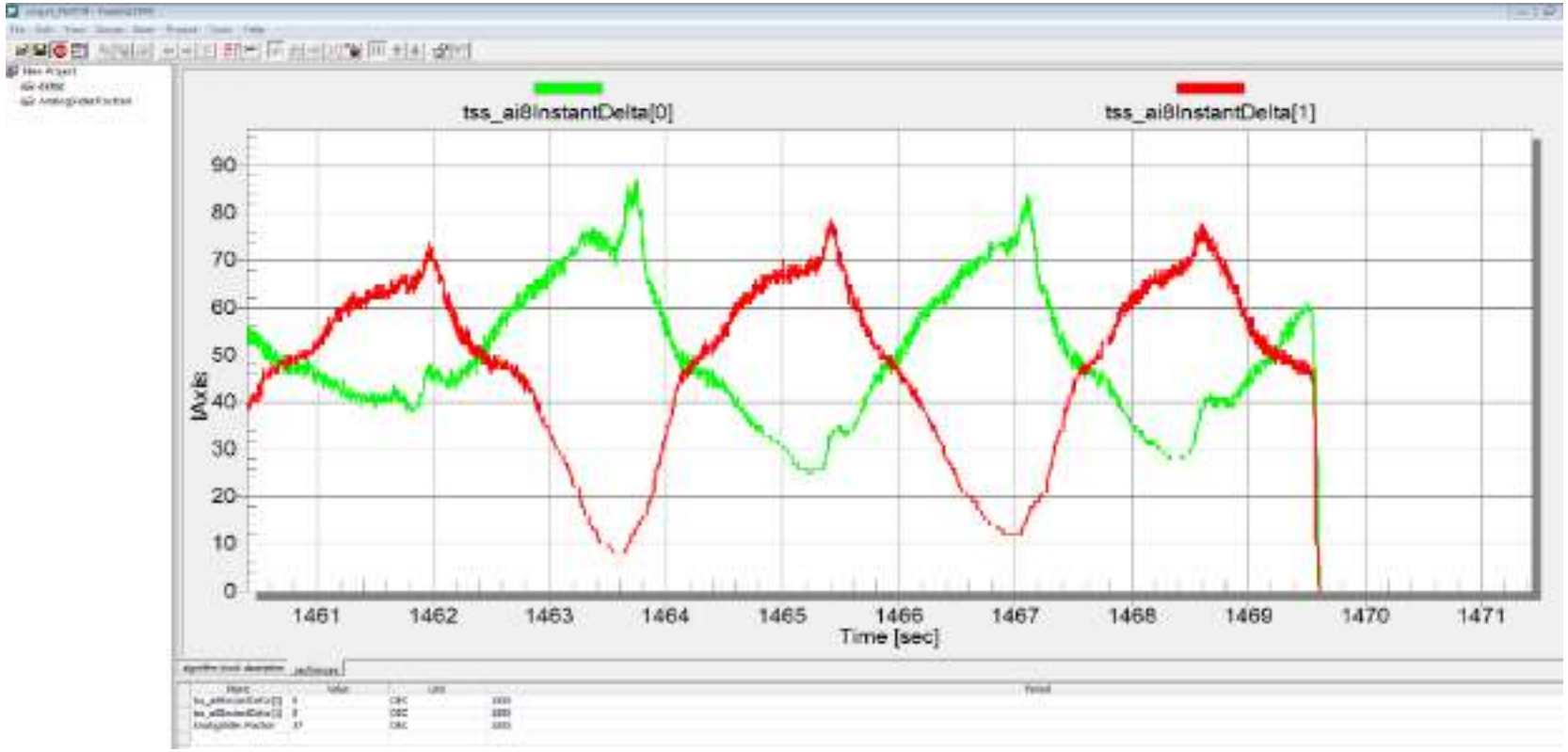
- Comparators connected directly to PWM module
- 100% safe even when the core is busy

COMPLETE DEVELOPMENT TOOL SUITE

Eclipse based IDE

FreeMaster

- Monitoring
- Tuning
- Calibration
- Debugging



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