

WCT-15W1CFFPD

Leading the Wireless Power Level to 22W MP-A11 Based Fixed Frequency Transmitter Reference Design

Full Market Launch: 28th June 2019



PUBLIC



SECURE CONNECTIONS
FOR A SMARTER WORLD

NXP's Solution Organization

- Crosses Business Line organizations within NXP
- Applications of specific expertise and focus
- Works at system level, bringing together cross-NXP hardware and software to develop and support complete solutions
- For wireless power, the transmitters and receivers are Qi certified, and contain NXP application software, libraries, controllers, NFC readers, and power devices

NXP WIRELESS POWER SOLUTIONS LEADING THE WAY TO A WIRELESS FUTURE

Hardware

- Full Qi certified reference design
- Optimized BOM

Software

- Professional grade Qi certified library
- Customizable application / clean API

Support

- Application Expertise
- On-site support up to production

Certification

- Qi Certification support
- Qi 1.2.4 certified solution

- Most comprehensive portfolio of Qi certified transmitter and receiver solutions in industry
- Most flexible solutions for wide range of end applications
- Fastest time to market

- Chair/co-chair of Working Groups in WPC
- Board member of Qi Wireless Power Consortium (WPC)
- NXP Qi Solutions are golden units in WPC specification
- NXP Qi Solutions are part of certification interoperability test bed



NXP's Solution Organization

1. Product summary
2. Applications
3. Market challenges & NXP solution advantages
4. Competitive analysis
5. NXP deliverables & ecosystem

1-PRODUCT SUMMARY

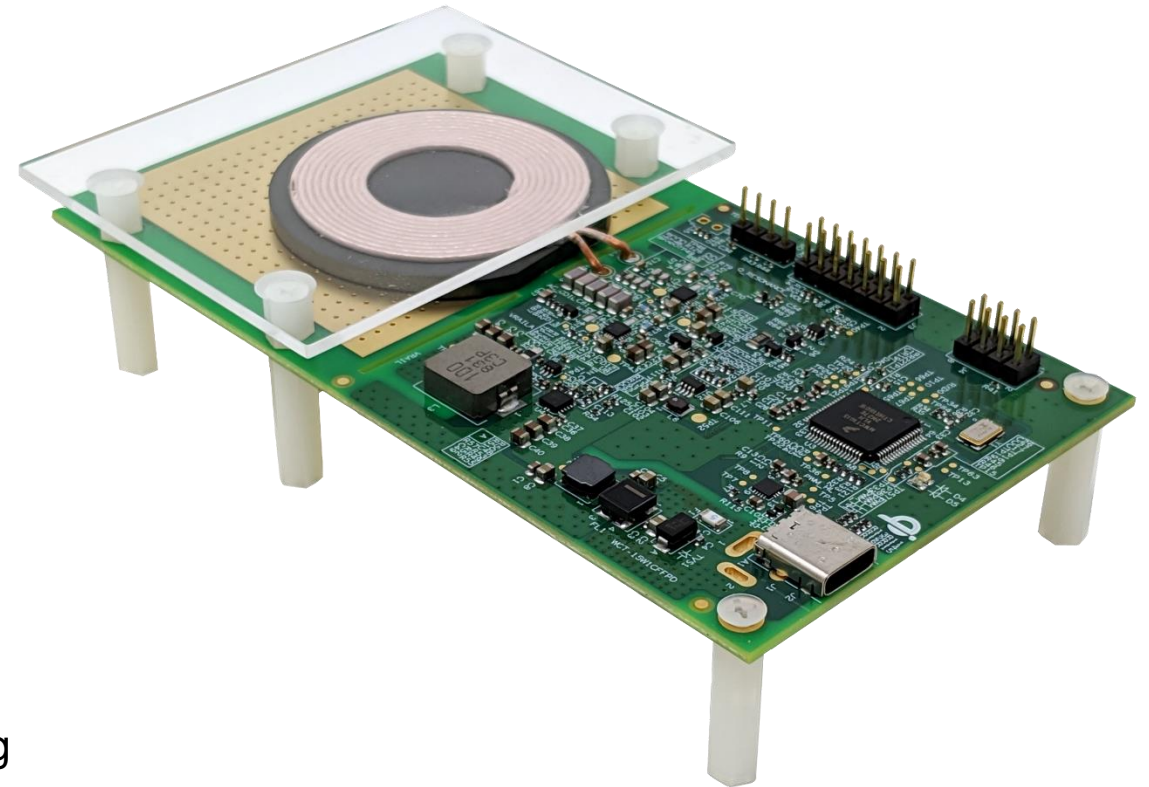
New 22W SINGLE COIL TRANSMITTER WCT-15W1CFFPD

- **Target Applications:**

- Qi mobile phone for phones and tablets charging
- Home appliance
- Medical Devices

- **Features and Enablement:**

- MP-A11 Qi EPP certification
- Compliant with the Qi v1.2.4 EPP specification
- Fixed Frequency solution
- Integrated digital demodulation in chip
- Supports FOD based on quality factor (Q factor) change
- Supports FOD based on calibrated power loss accounting
- Supports Qi certified RX with up to 22W output power capability
- Supports multiple types of RX modulation signals (AC capacitor, AC resistor, and DC resistor)
- High performance core, up to 100MHz DSC



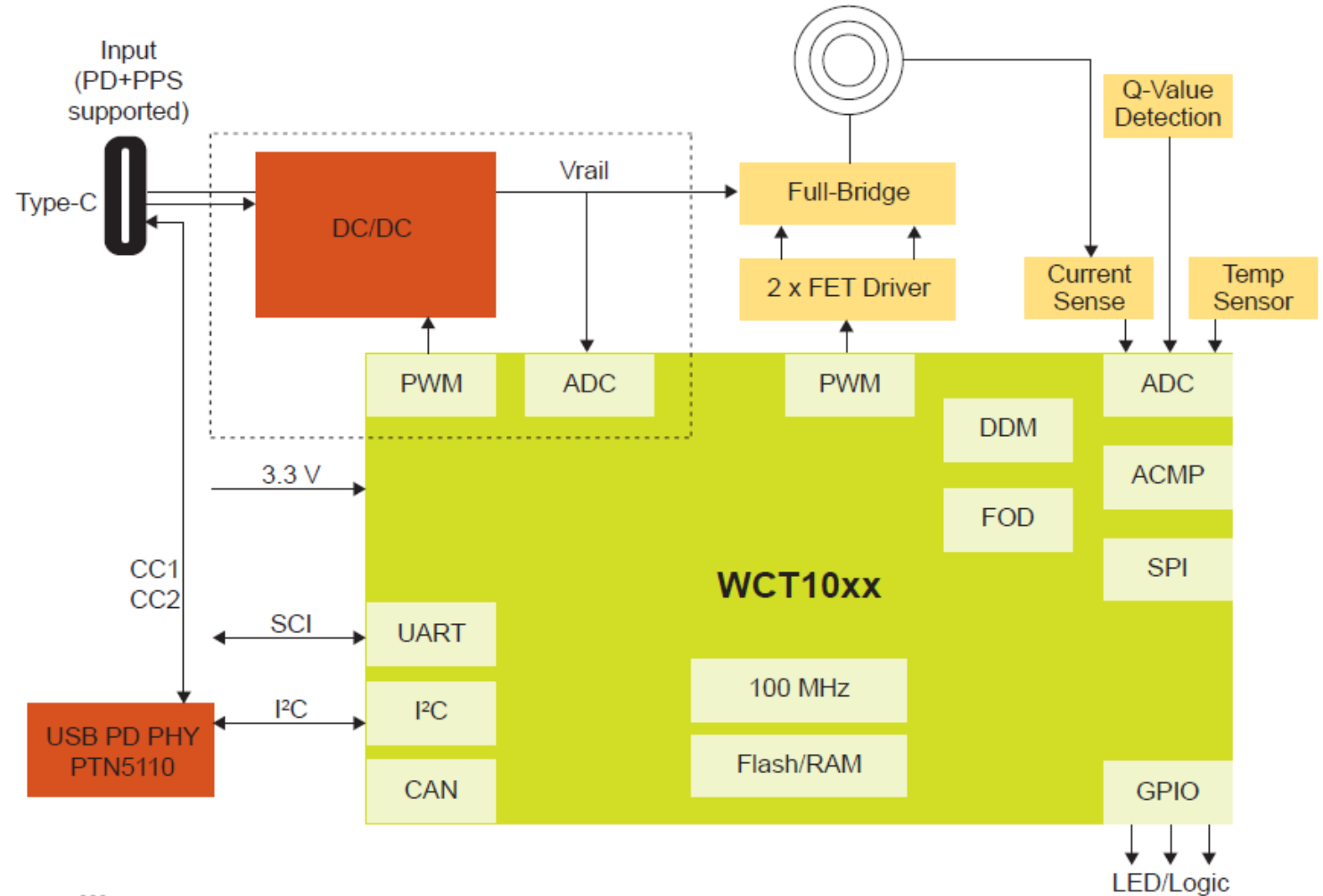
- **Availability & Certification:**

- Available for demo and evaluation now!

Block Diagram - WCT-15W1CFFPD

*Single chip for DDM
And Q-factor detection*

*Input supports:
QC2.0/QC3.0/PD3.0+PPS
Voltage supports up-to 22V
Output supports: up-to 22W*



Proprietary Technology Optional

Main Controller - MWCT1013

Exceptional Precision:

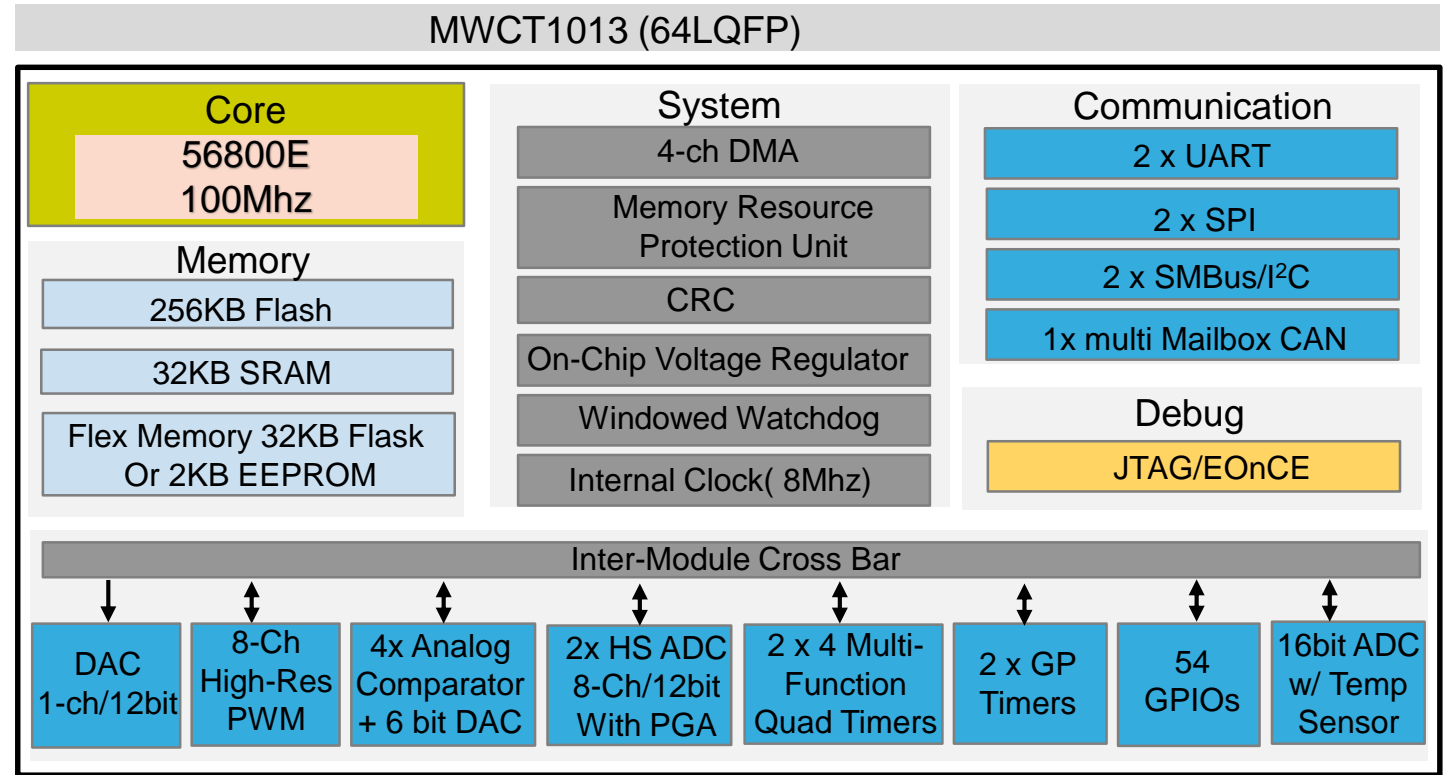
- High Res PWM with 312 pico-second resolution for accurate adjustment of the control loops
- 2x12-bit High Speed ADCs with 3.3 Msp resolution reducing jitter on current and voltage reads
- 16ch 16b SAR ADC that enables external sensors inputs
- 4 Analog Comparators with integrated 6-bit DACs that can enable emergency shut down of the PWMs
- Integrated PGAs to increase the accuracy of ADCs conversions on small voltages and currents

Performance:

- 100MHz/100 MIPS 32-bit core for fast control loop execution via single-cycle math computations and parallel moves
- 256KB Flash and 32KB RAM
- Fractional arithmetic supported for greater accuracy
- DMA Controller for reduced core intervention when shifting data from peripherals

Easy Implementation:

- 5 volt tolerant I/O for cost effective board design
- Memory resource protection unit to ease safety certification
- Freescale FlexMemory for simplified data storage
- Market-focused software components, reference designs, and development tools for fast knowledge ramp up



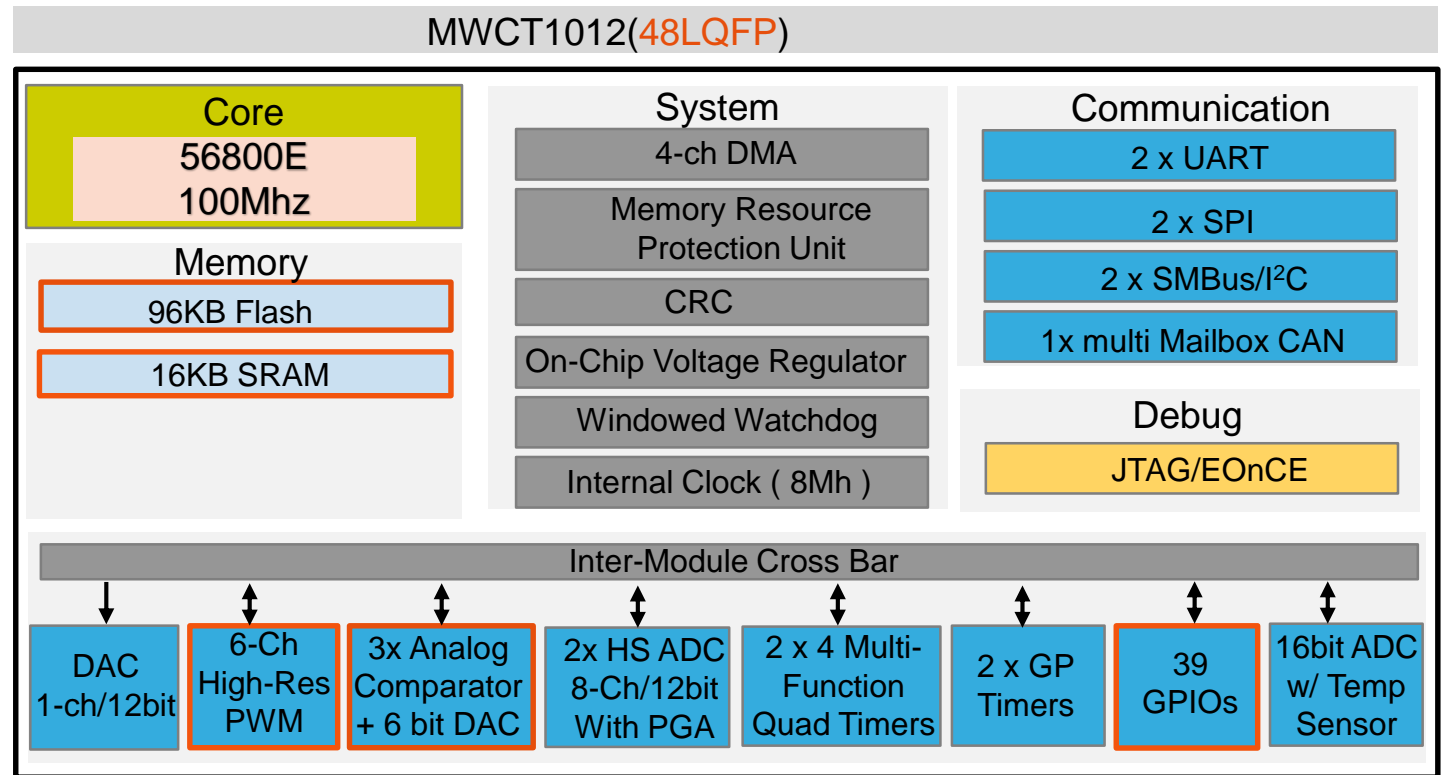
Main Controller - MWCT1012

Exceptional Precision:

- High Res PWM with 312 pico-second resolution for accurate adjustment of the control loops
- 2x12-bit High Speed ADCs with 3.3 Msp/s resolution reducing jitter on current and voltage reads
- 16ch 16b SAR ADC that enables external sensors inputs
- 4 Analog Comparators with integrated 6-bit DACs that can enable emergency shut down of the PWMs
- Integrated PGAs to increase the accuracy of ADC conversions on small voltages and currents

Performance:

- 100MHz/100 MIPS 32-bit core for fast control loop execution via single-cycle math computations and parallel moves
- 96KB Flash and 16KB RAM
- Fractional arithmetic supported for greater accuracy
- DMA Controller for reduced core intervention when shifting data from peripherals



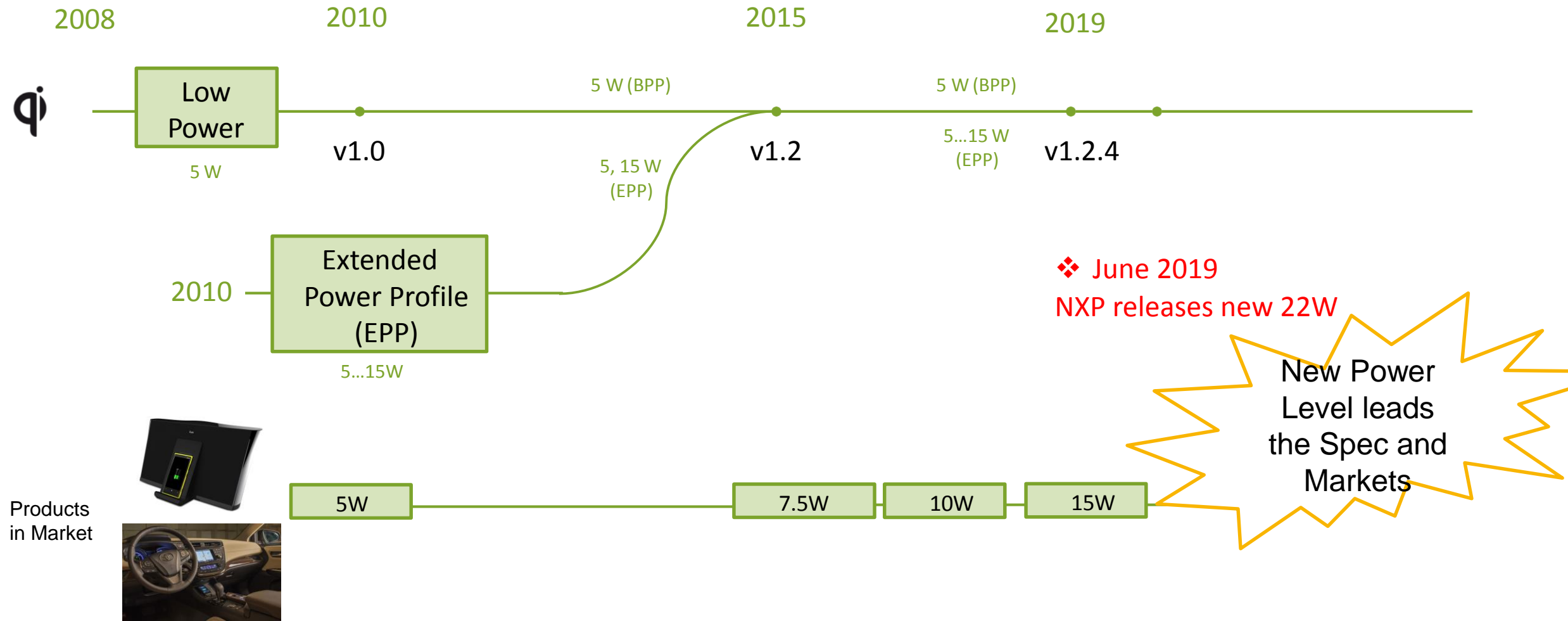
Easy Implementation:

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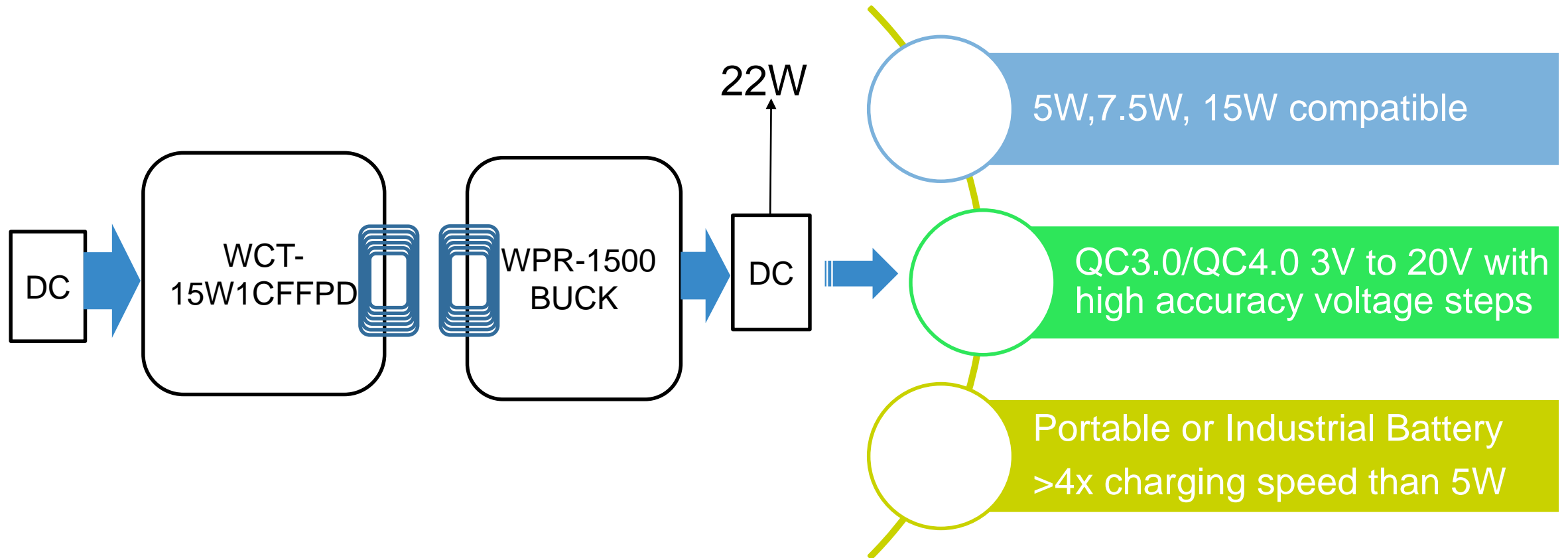
2-TARGET APPLICATIONS





History of Wireless Power



What the 22W Power Can Be Used For



WPC Qi Everywhere

Mobiles	Industrial	Consumer
<p data-bbox="112 305 537 458">iPhone, Samsung, Google, LG, Sony, Microsoft, Nokia, etc.</p>  <p data-bbox="124 554 565 892">An iPhone and a Samsung smartphone are shown on a black charging pad. Below them, two rugged mobile phones are displayed on a white background.</p>	<p data-bbox="606 305 1047 401">Tools, robot cleaner, home appliances, etc.</p>  <p data-bbox="639 554 1116 806">A black circular robot vacuum cleaner is shown on a light-colored floor. Below it, a collection of various green and black power tools, including a drill, a saw, and a sander, are arranged on a white background.</p>	<p data-bbox="1166 305 2397 344">Ikea, Philips, iHome, Softbank, AirCharge, PowerSquare, etc.</p>  <p data-bbox="1268 544 2458 1178">A collage of consumer products: a red smartphone on a charging pad in a cafe setting; a black smartphone dock; a white digital clock with a charging pad; a hand holding a smartphone over a white charging pad with the IKEA logo; and a black Philips electric shaver on its charging base.</p>

**3-MARKET
CHALLENGES & NXP
SOLUTION
ADVANTAGES**



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



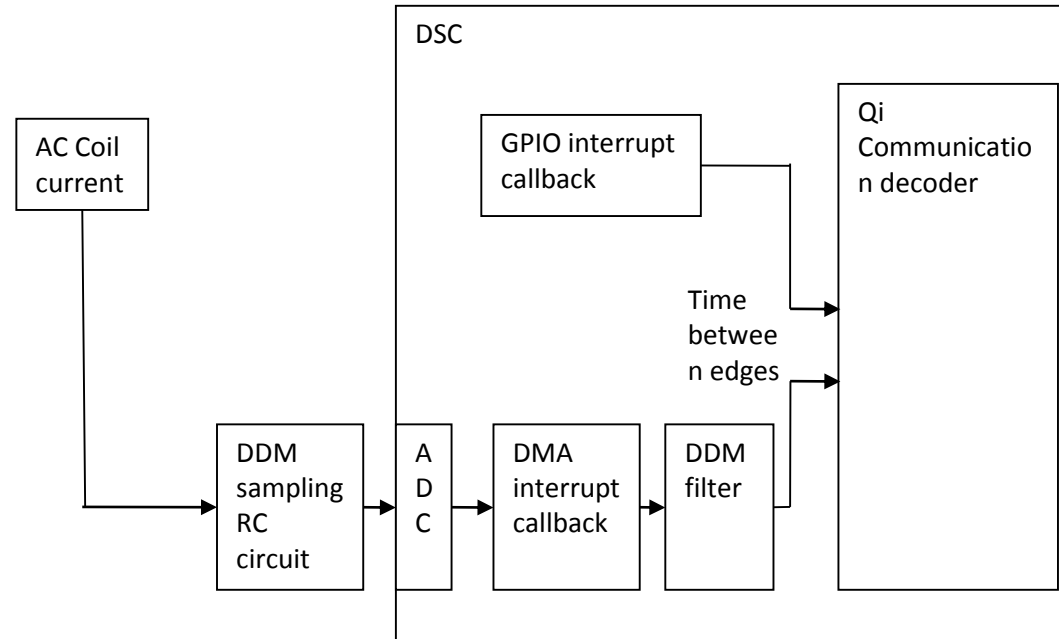
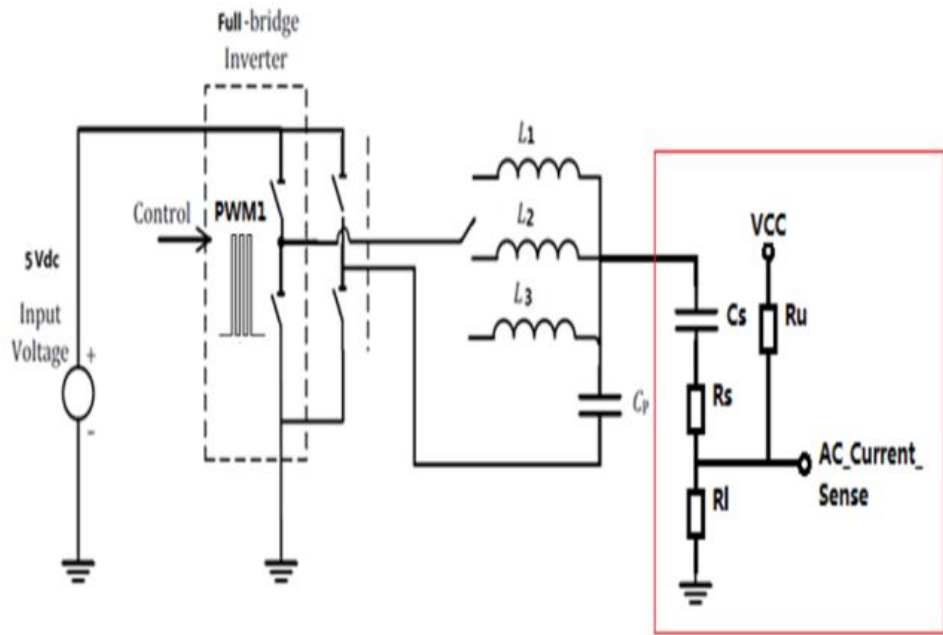
Application Flexibility

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



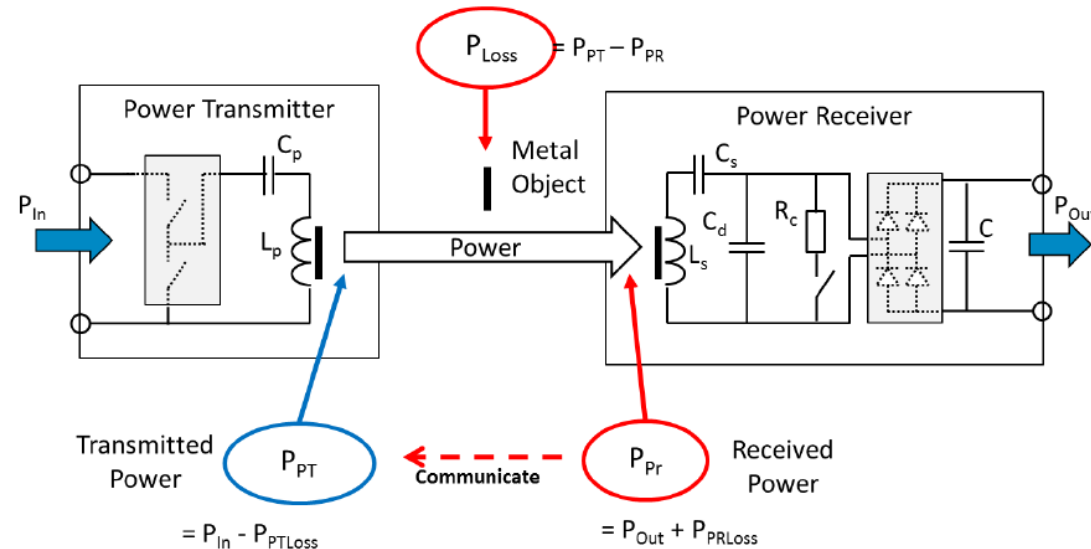
NXP Digital Demodulation Module



- The high performance processor allows the new DDM design to demodulate packets from RX
- Much lower cost hardware circuits (RC divider) vs. ADM
- Better power detection between TX&RX
- Better FOD performance

Optimized Foreign Object Detection (FOD)

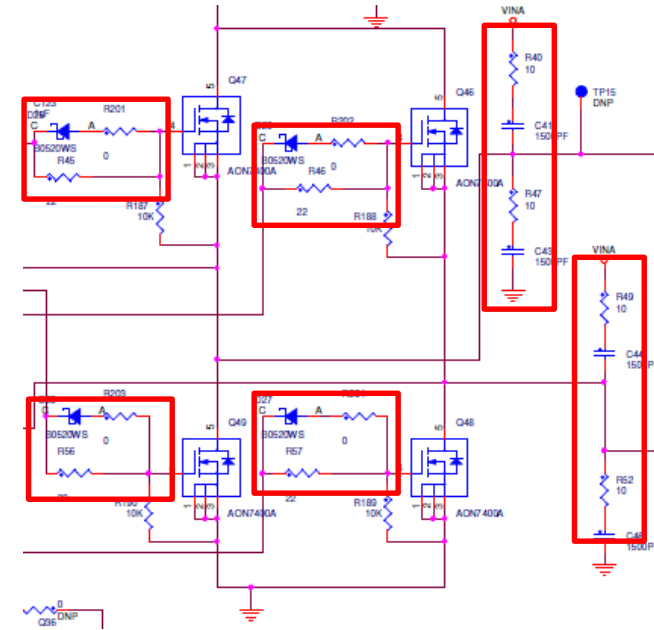
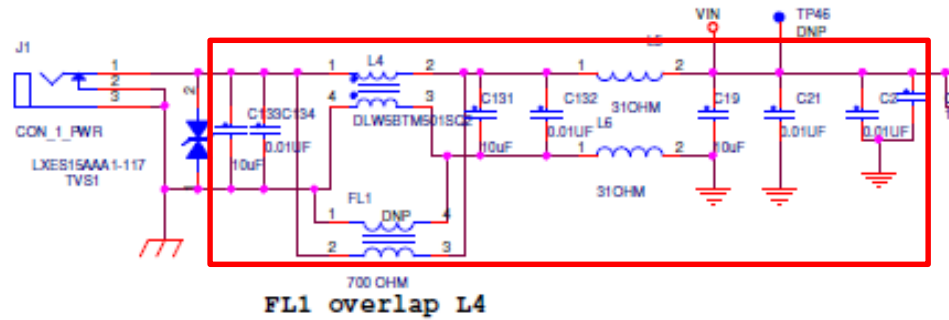
- FOD based on calibrated power loss accounting
 - During- power-Xfer, **Decrease the PLOSS bias when there is no FO**



- Calibration before power xfer: A systematic bias in power loss inside TX and RX estimate results in difference between the Transmitted Power and Received Power, even if there is no FO
- This bias will decrease the effectiveness of power loss method, and TX can remove it by calibration

PCB Layout Considerations and EMC Design

--NXP Solution



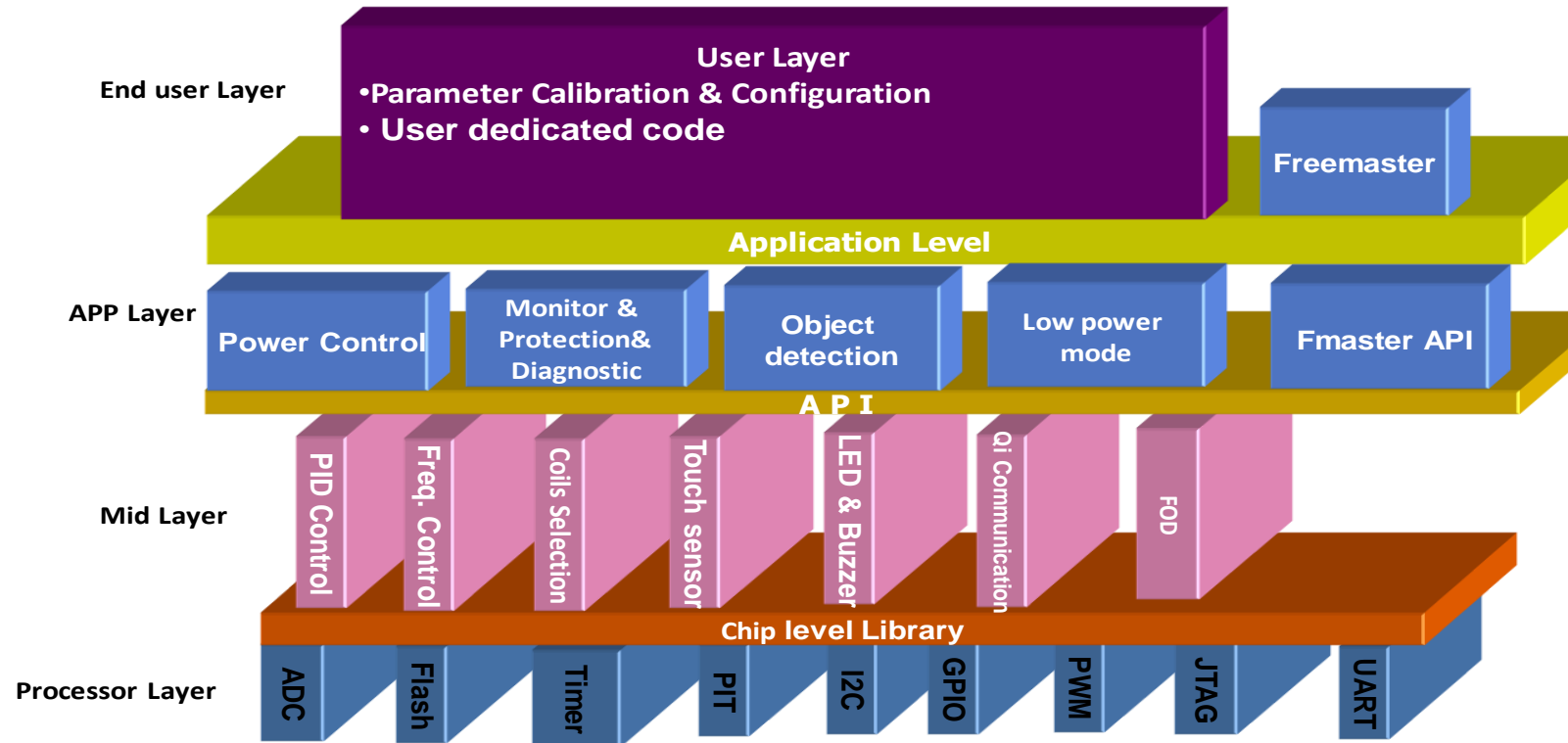
The MP TX system can pass the EMI test with the qualified adaptor without additional filter, and below design items should be considerate:

1. Input filter circuits are added
2. The full bridge Mosfet driver resistor can be adjusted
3. Mosfet Snubber circuit should be added to decrease the spike on the mosfet when switching. This circuit is shown on the example schematic.
4. Shielding for the power boards and the coil (just cover the low frequency radiation)

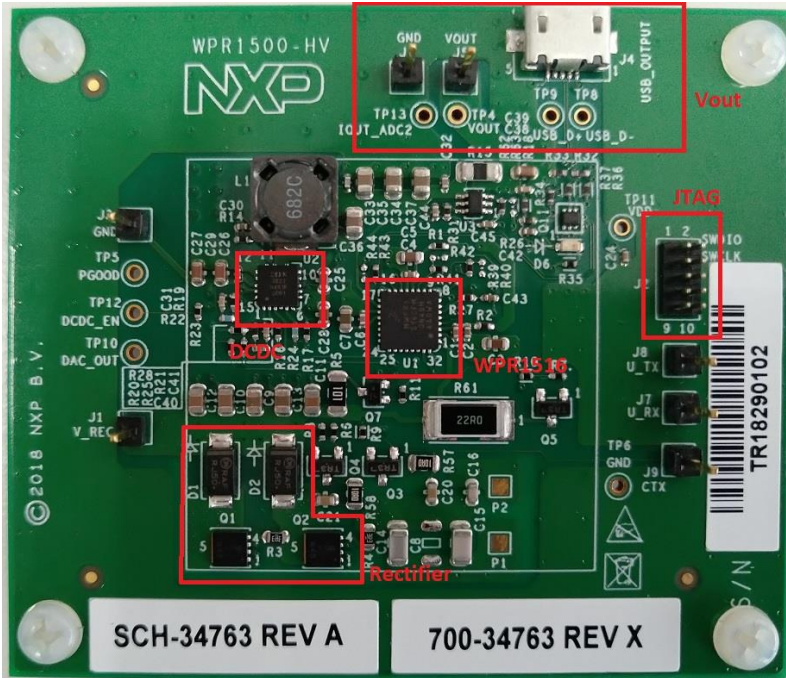
Quick Remove Detection

- Qi defines that TX can detect RX is removed after it couldn't get valid packet for 1.5s, which takes at least 1.5s for TX to stop power signal; if putting RX down during this period, RX could be damaged.
- Quick remove detection allows TX detect RX removal in several hundreds ms, like 200-300ms:
 - Test: Use one RX and measure the interval between removing RX and TX stops power signal

Software Architecture



Total Solution of TX+RX

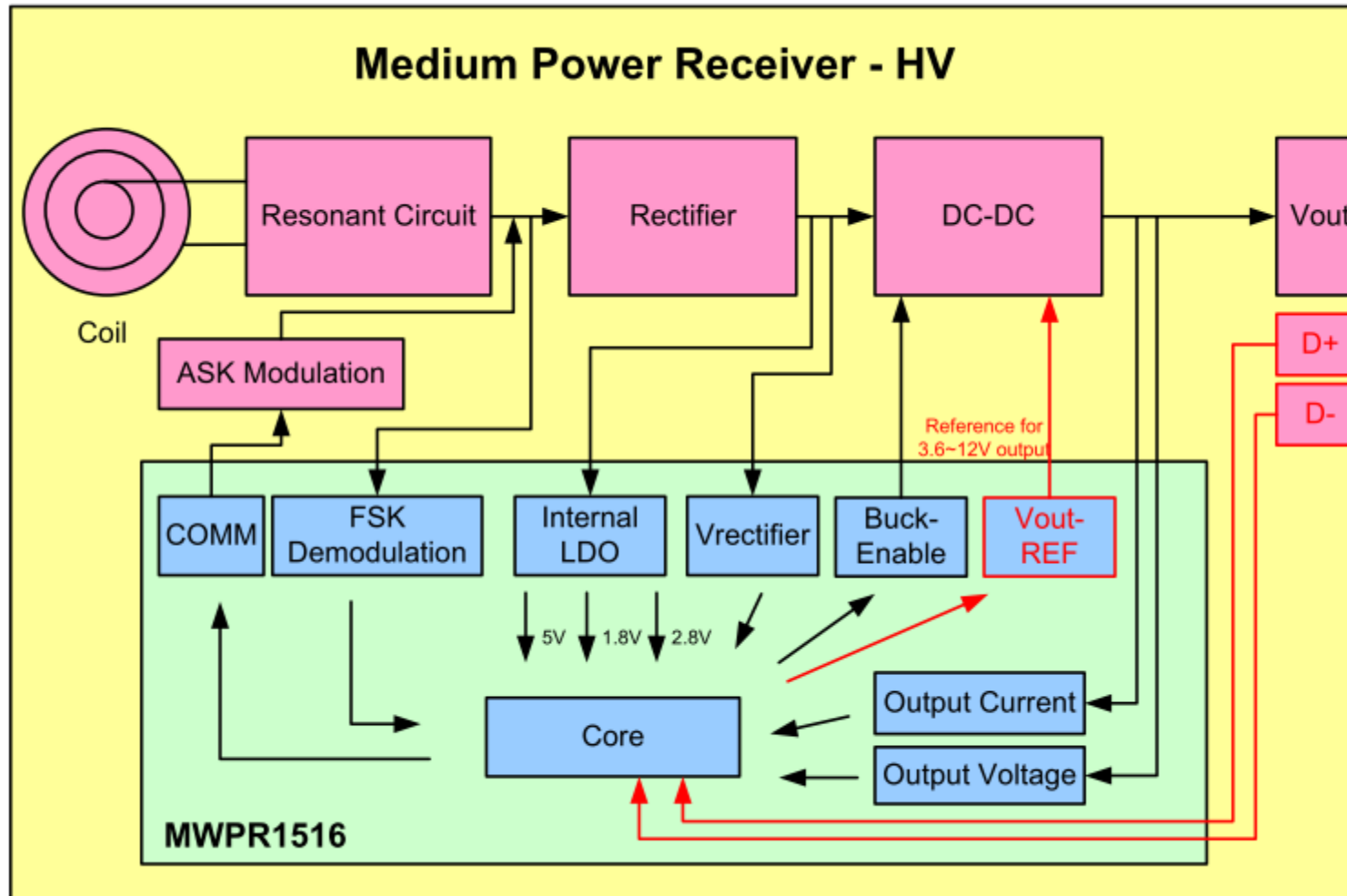


- Compliance with the medium power WPC Qi V1.2 specification;
- Input power (3.5V~20Vac peak) from the transmitter via receiver coil;
- Support of FSK communication signals from the medium power transmitter;
- Hardware protection of rectifier voltage, output voltage and output current;
- Support debugging with IAR/Keil and FreeMASTER tools

High voltage receiver - WPR1500-HV board

- Output power of 22W and adjustable output voltage range from 3.6V to 15V
- Support Quick Charge 2.0 & 3.0 (Class A), MTK Pump Express Plus and more

WPR1500-HV Board Block Diagram



4-COMPETITIVE ANALYSIS

Advantages of WCT-15W1CFFPD in New Markets

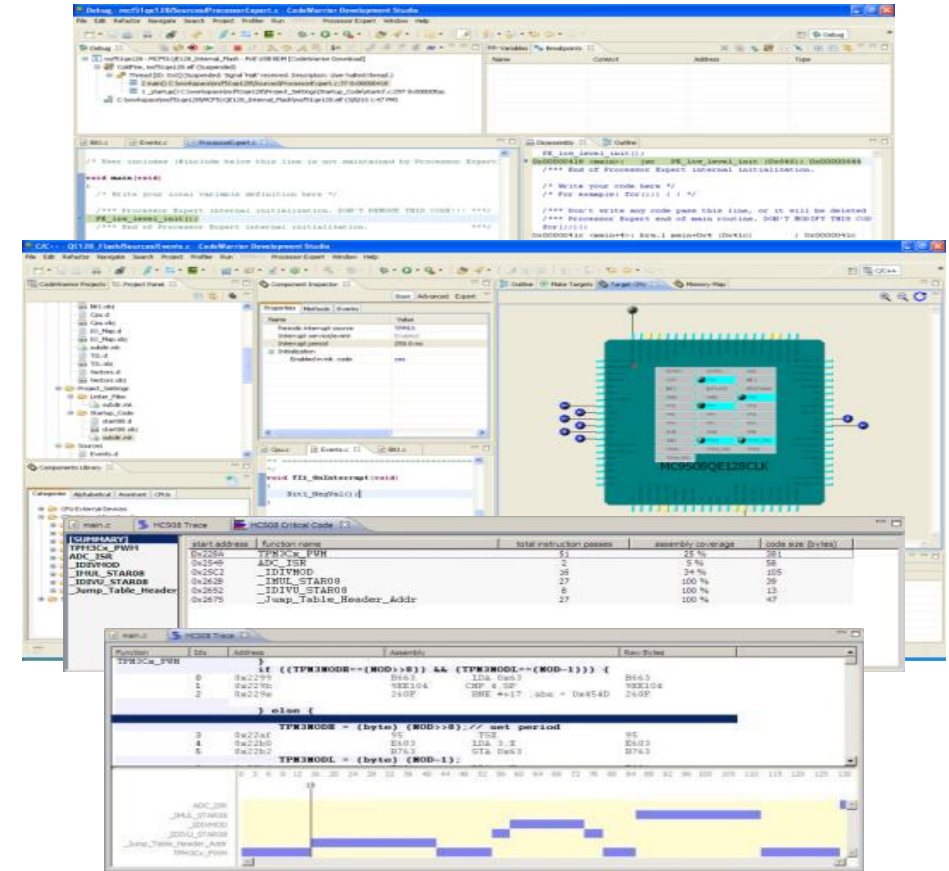
Features	WCT-15W1CFFPD (22W)	WCT-15W1CFFPD (15W)	IDT_TX_P92xx (15W)	Low end SOC (10W)
Core	100MHz DSC	100MHz DSC	32-bit M0	8-bit / 32-bit M0
LEDs controller / Buzzer	Up to 5	Up to 5	2 / 1	2 / 2
Input voltage	5V-24V	5V-24V	4.25V - 21V	5V-20V
Integrated half-bridge drivers	External (2*MP86901)	External (SP1M15 integrates driver + MOS)	2	yes
FOD Method	Digital	Digital	Analog	Analog / Thermal control
Over-current and over-temperature protection	Yes	Yes	Yes	Optional
I2C / SPI / SCI / CAN	All supported	All supported	I2C	I2C
Operation Mode	Fix frequency (support iPhone fast charge)	Fix frequency (support iPhone fast charge)	Variable / Fix frequency	Variable / Fix frequency
Chip package	64LQFP / 48LQFP	64LQFP / 48LQFP	48-VFQFN	32QFN / 48LQFP / 48QFN
Firmware upgrade	Flexible (NFC/...)	Flexible (NFC/...)	Fix	Fix
Demodulation Method	DDM	DDM	Analog	Analog

5-NXP DELIVERABLES & ECOSYSTEM



Software Development Tool – CodeWarrior v10.x

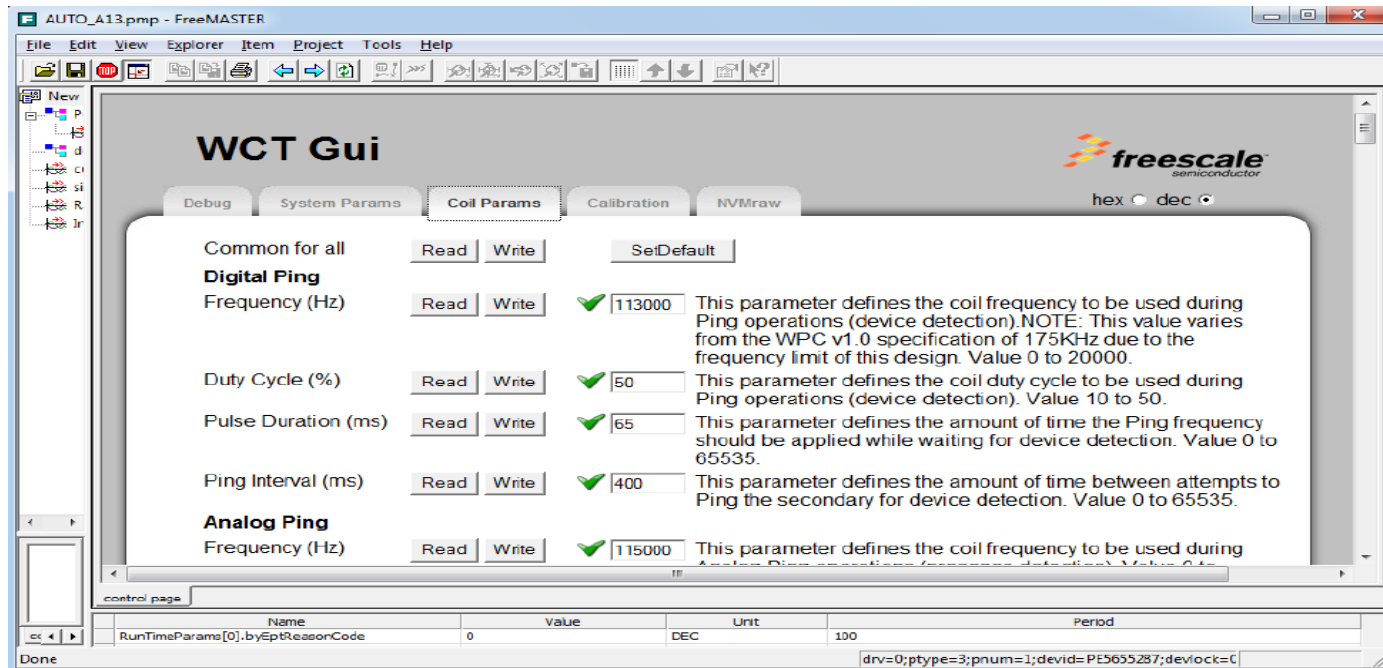
- Eclipse IDE 3.6.1
- Can create a new project in as few as 6 clicks with New Project Wizard
- Retargets a project to a new processor in as few as 6 clicks with MCU Change Wizard
- Builds optimized C/C++ code with CodeWarrior HCS08, RS08, DSC, ColdFire, ColdFire+ and Kinetis compilers
- Troubleshoots and repairs embedded applications with CodeWarrior extensions to Eclipse C/C++ Development Tools (CDT)
- Generates initialization and low-level driver code with Processor Expert's easy-to-use, application design tools and expert knowledge system
- Uses trace and profile tools to get emulator-like debug capability with NO additional trace capture hardware for HCS08, V1 ColdFire and Kinetis processors



Accelerate the development of the most complex embedded applications

Software Development Tool – GUI

- NXP wireless charging GUI tool is based on FreeMASTER, and provides:
 - Configuration: System parameters, coil parameters and FOD parameters
 - Calibration: Analog signal sensing coefficients, FOD algorithm coefficients
 - Debugging: System real-time status and variables



Supporting Documentation & Downloads

NXP Designs: Reference Design Library
Technical content and expertise to help jump start your design and get you to production faster.

Filter by Keyword Filter by Application **Wireless Charging** Filter by Product

NXP Designs (8 of 69)

- 15 W Consumer Fixed Frequency Single-Coil Transmitter**
Documentation
Software
- Multi-Coil Wireless Charging Transmitter**
Buy
Documentation
Schematics
- 5 W Multi-Coil Automotive Transmitter**
Buy
Documentation
Schematics
- 15 W Single-Coil Wireless Charging Transmitter**
Buy
Documentation
Schematics
- 15 W Wireless Charging Receiver based on Buck Architecture**
Buy
Documentation
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NXP Wireless Power Solutions Support & for Promotions

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WIRELESS POWER
Safe and secure Qi-compatible wireless power solutions

The NXP wireless power portfolio enables completely cordless experiences for consumer, industrial, and automotive markets without compromising high performance and reliability. Our cost-effective 5 and 15 W transmitter and receiver controller ICs support the Qi industry standard for wireless charging and come to you with a superior enablement environment of software, evaluation boards, and reference designs.

PRODUCTS	SOLUTIONS
In-Vehicle Wireless Charging Solutions For single- and multi-coil support in the harshest automotive environments. 5 W Multi-Coil Automotive Transmitter Solution 15 W Multi-Coil Automotive Transmitter Solution	Consumer and Industrial Wireless Charging Solutions Receivers and transmitters for single- and multi-coil configurations, consumer applications and lowest bill of materials. 15 W Single-Coil Fixed Frequency Wireless Charging Transmitter 15 W Single-Coil Variable Frequency Wireless Charging Transmitter 5 W Multi-Coil Wireless Charging Transmitter 15 W Wireless Charging Receiver, LDO 15 W Wireless Charging Receiver, Buck

Suggested Stocking

Evaluation Kit	MOQ	Suggested Stocking	Status	Resale price
WCT-15W1CFFPD	1	3	Available	\$ 119.00

Silicon	Flash	GPIO	Package	MOQ	Suggested Stocking	Status	Resale price (@10k)
MWCT1013VLH	256KB	39	64 LQFP	160 pcs	320 pcs	Available	\$4.39
MWCT1012VLF	96KB	54	48LQFP	250 pcs	500 pcs	Available	\$1.90



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