Agenda

• Why NFC is key for Qi transmitter design

• Integration design of NFC and wireless charger

• NXP solution implementation on EPP Txs
Use of NFC Technology in Wireless Charging

NFC in Qi transmitter

- Contactless card protection
- Standardized communication channel for device authentication

>1W

NFC as direct charger

- NFC RF field charges a battery
- Power supply during NFC transaction

<1W
Reasons to Add NFC onto Qi Charger

**Parallel charging and card protection**
Most big wireless charging players include caveat emptor for contactless cards with NFC for card protection the risk of damaged card is eliminated. Our design is integrated in a way that parallel charging and card protection is possible by innovative antenna design and sophisticated card detection mechanism tested with all major smart card technologies.

**No breach of warranty**
Authentication of the charger against the receiver over NFC ensuring the safety of the receiver detection SW.

**NFC applications coming for free**
- Firmware update over NFC
- Data streaming (e.g. Audio) over NFC
- Storage of data such as WIFI pairing information
- Charging for NFC direct charging wearable
- Access reader for other applications
NFC for Qi EPP Charger

• Market moving from BPP to EPP technology to improve user experience (3x fast charging time, more reliable FO detection)

• The Qi communication ping may destroy already a contactless card

• As leading provider of contactless technology, NXP needs to ensure the safety of contactless cards/tickets.

• In automotive installations card protection is a de-facto-standard in any Qi-charging station
Wireless Charging + NFC

- **Why NFC on top of wireless charging:**
  - Convenience: NFC on top of wireless charging enables seamless secure connectivity on top of the convenient charging
  - Safety: NFC needs to detect presence of power sensitive objects (e.g. contactless smart cards) to prevent their destruction

- **Key differentiators of reference design:**
  - Optimized bill-off-materials
  - Pre-programmed wireless charging application
  - Integrated NFC stack
  - Antenna design ensuring interoperability with all NFC phones (no communication blind spots within pad)

- **NXP is a one stop shop for key building blocks:**
  - Inventor and market leader in NFC
  - Leading platforms for wireless charging
Object Detection – Qi vs. NFC

Object detection

- Qi charger typically uses the PING and FOD to detect object on charger
- Works perfectly for metallic objects
- System power consumption is comparatively large
- No detection of contactless cards, cards will be destroyed easily

RFID HF tag/NFC card detection

- The LPCD is based on a change of the impedance of antenna-matching and a low power wake up technology
- After LPCD wakeup the NFC transmitter polls for any RFID/NFC technology. On any response it determines if further steps of charging are blocked
- Specific polling scenarios are implemented to distinguish between physical and emulated RFID/NFC card
Use NFC LPCD for Object Detection

All RFID technologies such as ISO/IEC 15693, ISO/IEC 18000-3, FeliCa and ISO/IEC 14443 tags/cards are detected. Proprietary technologies may be added.

Distinguish between physical and emulated RFID/NFC card

START OPERATION

LPCD

Polling

Contactless Card detected

STOP

No NFC technology

Card Emulation in phone detected

START CHARGING

Ultra low system standby power

Analog PING can be removed
Co-existence of Wireless Charging and NFC

Co-existence for parallel charging and NFC communication

Unique noise performance on the wireless charging side

Unique antenna and filtering on the NFC side
Wireless charging and NFC didn’t work simultaneously.

<table>
<thead>
<tr>
<th>Case</th>
<th>Mode</th>
<th>Description</th>
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<tbody>
<tr>
<td>#1</td>
<td>Reader Mode</td>
<td>• Reading our NDEF Message of NFC Card</td>
</tr>
<tr>
<td>#2</td>
<td>Writer Mode</td>
<td>• Writing NDEF Message on NFC Card</td>
</tr>
<tr>
<td>#3a</td>
<td>P2P Mode</td>
<td>• Sending NDEF Message to Smartphone</td>
</tr>
<tr>
<td>#3b</td>
<td>P2P Mode</td>
<td>• Receiving NDEF Message from Smartphone</td>
</tr>
<tr>
<td>#4</td>
<td>Tag Emulation Mode</td>
<td>• Emulating NFC Tag</td>
</tr>
<tr>
<td>#5</td>
<td>Tag Protection Mode</td>
<td>• Check present NFC tags before start charging</td>
</tr>
</tbody>
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How to Integrate Wireless Charging and NFC

1. Standard **Compliancy**
   - Qi
   - NFC

2. Comprehensive **Software & sophisticated State Machine**
   - Supporting all NFC modes with all tag types
   - Distinguishing between tag and phone

3. Optimized **Hardware**
   - Combining complex WCh HW with NFC
   - No blind spots on whole PCB
   - RF filter for simultaneous operation

**NXP** as the perfect partner who supports all requirements for a successful WCH & NFC combination
NXP MP-A9 Solution Block Diagram

- WCT101xA controller for both WCh and NFC
- Simple communication interface between WCh controller and car system (SPI, UART, proprietary, …)
NXP MP-A4 Solution Block Diagram

- **Input Voltage**: Vin 3.3V

- **Aux. Power**: (Connected to Vin 3.3V)

- **MOS Pre-Driver**: (Connected to Aux. Power 3.3V)

- **Full Bridge**: (Connected to MOS Pre-Driver)

- **WCT1011/1111 for WCh and system management**

- **NFC firmware inside PN7360**

- **Simple communication interface between WCh controller and NFC controller**
NXP EPP Txs Solution Implementation

- NFC integration into existing EPP transmitter for reliable NFC/RFID tag and card detection
- The NFC antenna is placed above the Qi transmitter antenna
- NFC antenna placed outside Qi antenna for sufficient card detection area and decoupling
- Polling for NFC/RFID tags/cards and how to distinguish between physical tag and card/tag emulation in a mobile phone

On NXP solution, we integrate the NFC feature on the wireless charging platform
Example of NXP MP-A4 + NFC Solution

- There are several LEDs, which will show you if a RFID/NFC technology is detected and also when the charging is enabled.
Software Structure Strategy

Qi certified library
- Advanced algorithms
- Qi state machine

Fully customizable application
HAL layer
NFC Stack
Software Development Visualization – GUI

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