Technologies & Products Press Conference

Key Components for Wireless Power Transmission

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Wireless power transmission goes mobile

Long established for applications in the **home**

Recent expansion to meet the need for interoperability of **mobile devices**

WIRELESS POWER CONSORTIUM

80 kHz to 250 kHz

Alliance for Wireless Power

6.78 MHz

CEA

IWCS

13.56 MHz

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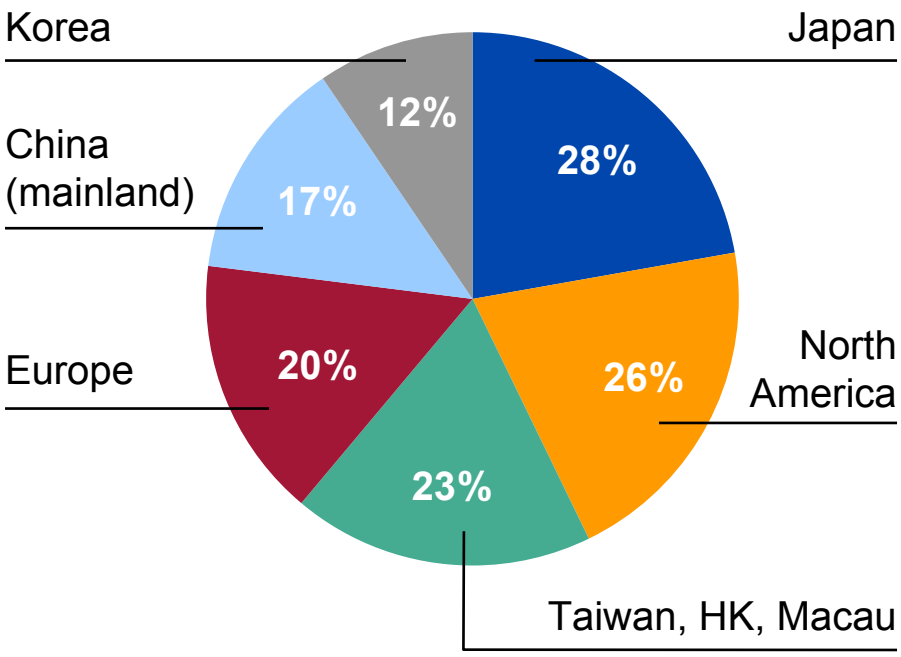
Wireless Power Consortium's Qi standard

126 members worldwide
(September 2012)



Source: Wireless Power Consortium

Qi specification ver 1.1.1
(released July 2012)

- For up to 5 W
- Covers a broad range of primary (Tx) and secondary (Rx) coils, including
  - **19 types** of Tx coils
  - Custom-designed Rx coils

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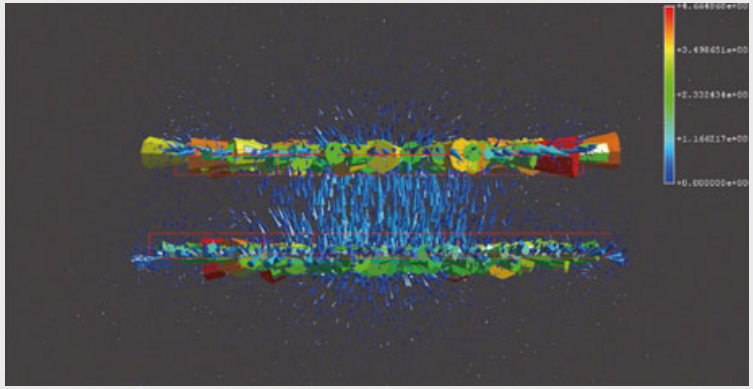
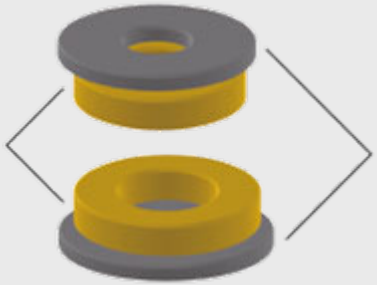
Principle of inductive charging

Magnetic flux between Tx and Rx coils

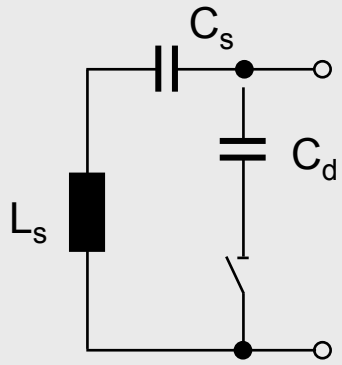




Rx and Tx coils

Magnetic sheets

Rx circuit for efficient resonant coupling



$$f_s = \frac{1}{2\pi \cdot \sqrt{L_s' \cdot C_s}} = 100^{+x}_{-y}\ \text{kHz},$$

$$f_d = \frac{1}{2\pi \cdot \sqrt{L_s \cdot \left(\frac{1}{C_s} + \frac{1}{C_d}\right)^{-1}}} = 1000^{\pm 10\%}\ \text{kHz}.$$

The dual resonant circuit ensures optimal efficiency no matter which Tx coil is used

Source: WPC Spec. ver1.1

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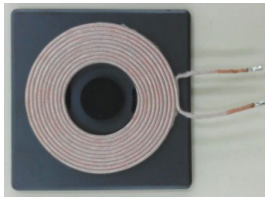
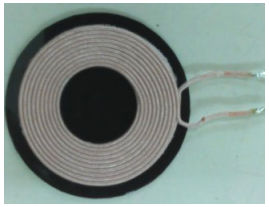
Different types of Tx coils

Single and multiple coils

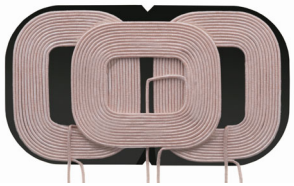
Coil with magnet



Coil without magnet

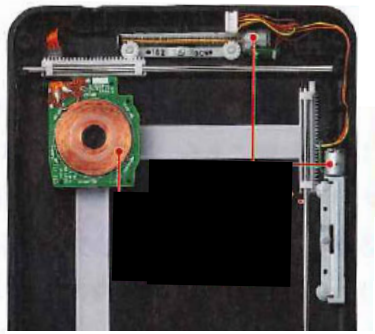


Dual coils

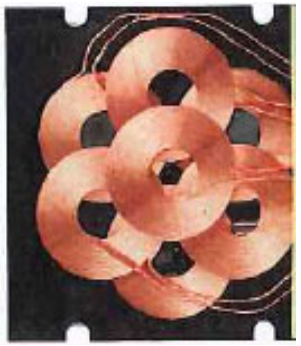


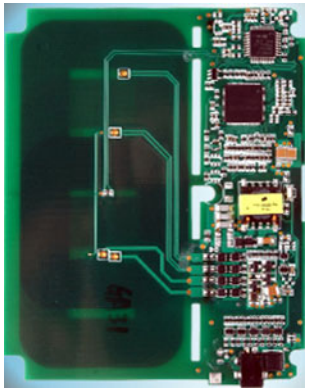
Three coils

Moving coils



Coil arrays





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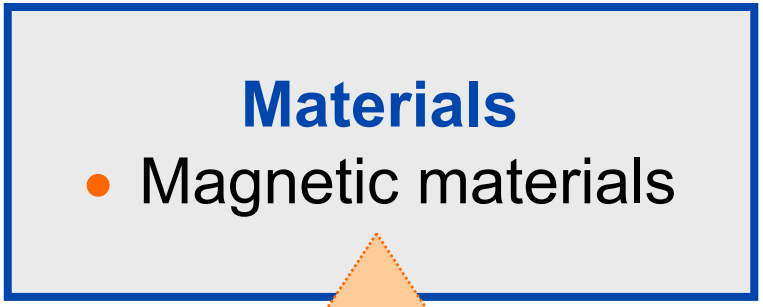
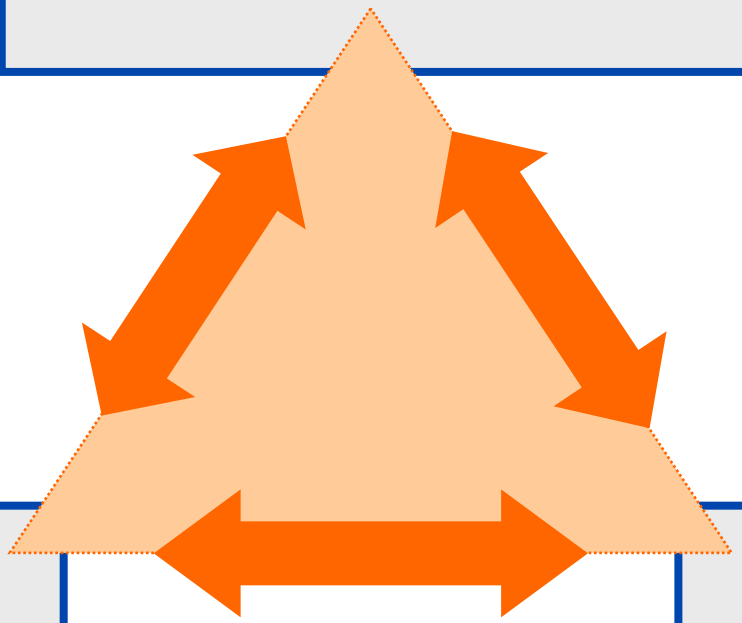
TDK competence for wireless power transmission solutions





Electronic components
- Ferrite cores
- Inductors

Devices
- Transformers
- Anechoic chambers
- Production equipment

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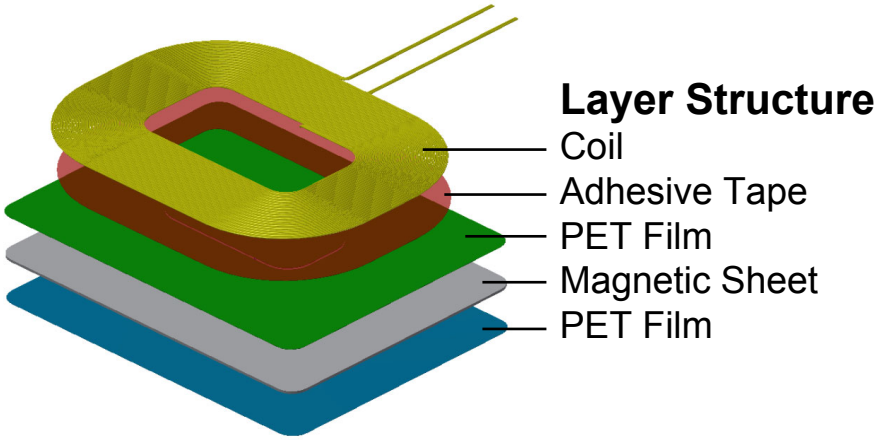
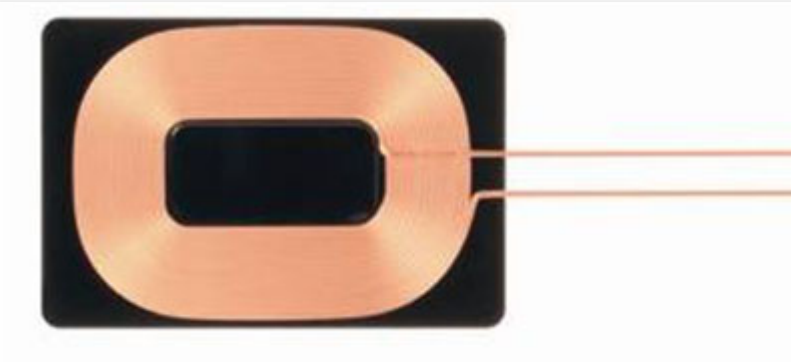
Ultra-thin Rx coil (0.57 mm type) for the most demanding Qi specifications





Efficiency	
WPC A1* Tx coil (magnet)	60 to 65 %
WPC A11* Tx coil (no magnet)	65 to 70 %

* According to Qi specifications

Thermal properties	
Output current	**Coil temperature** (after 60 min.)
0.5 A	34 ° C
0.6 A	36 ° C
0.7 A	40 ° C

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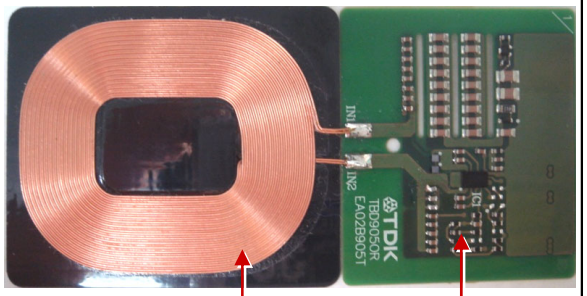
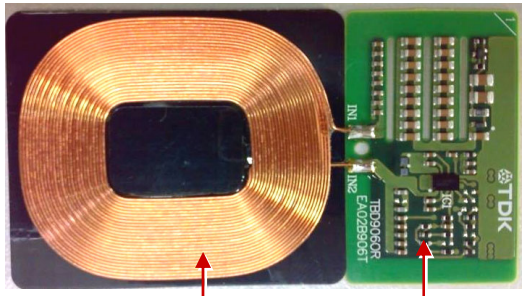
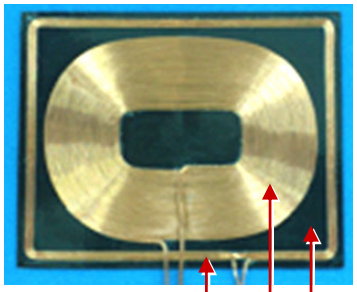
Key data for Rx modules and combo products

5 V Rx coil module	7 V Rx coil module	NFC combo
		
Output power: 5 W	**Output power:** 5 W	**Output power:** Up to 5 W
Area: 38 mm x 32 mm (coil) 66 mm x 32 (coil + module)	**Area:** 38 mm x 32 mm (coil) 58 mm x 32 (coil + module)	**Frequency WLC coil:** 80 to 250 kHz
Max. thickness: 1 mm (coil) 0.94 mm (module)	**Max. thickness:** 1 mm (coil) 0.94 mm (module)	**Frequency NFC antenna:** 13.56 MHz

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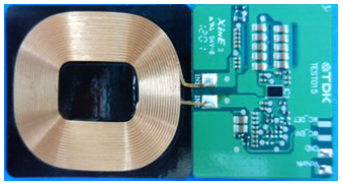
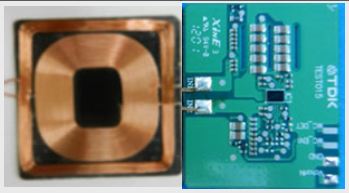
Roadmap for Rx coil units and modules

Combo Rx coil units

Larger	e.g. 55 mm x 51 mm
Thinner	0.50 mm max.
More integration	Combo with NFC antenna or another WPT coil

Rx modules



Higher power	10 W Smartphones	20 W Tablet PCs	**30 W** Ultra mobile PCs
More integration	Combo module wireless charger + NFC		

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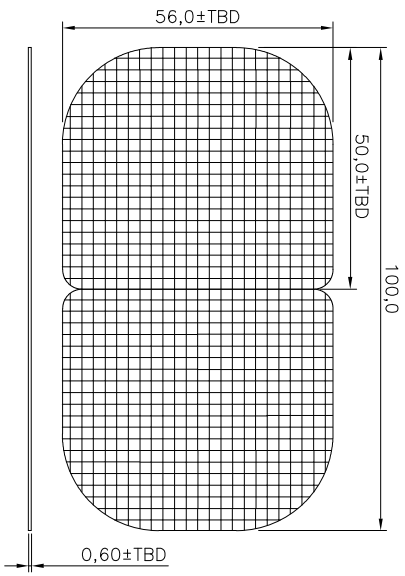
Tx three coil unit

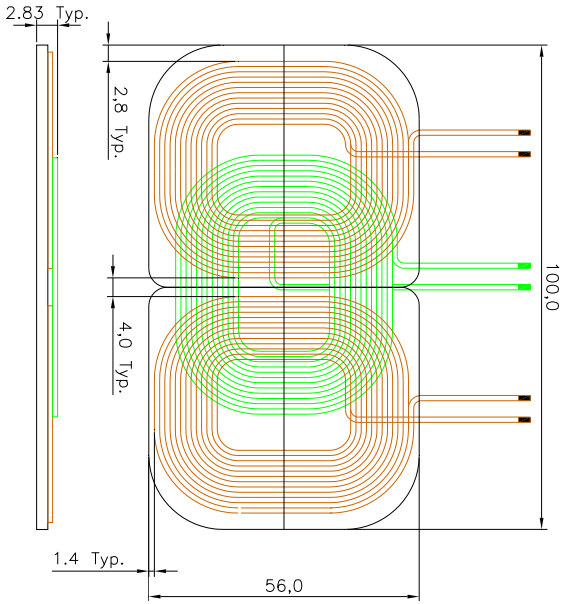
Flexible ferrite plate

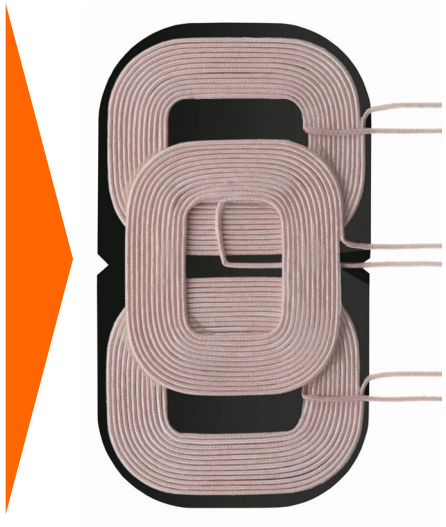


0.5 to 1.0 mm

+

Thin and lightweight design





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Roadmap for Tx coil units and modules

Magnetic sheets
- Various kinds of ferrite
- Thinner (0.5 mm to 1.0 mm) and lighter
- More flexible (pre-cracked for higher durability)

Automotive applications
- Higher reliability from -40 °C to +85 °C (+105 °C)

NFC combo
- For automotive applications (hands-free talking)
- For Bluetooth ID

Tx modules
- Higher power (5 W and up to 30 W)
- Multiple coils and arrays
- Positioning flexibility

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