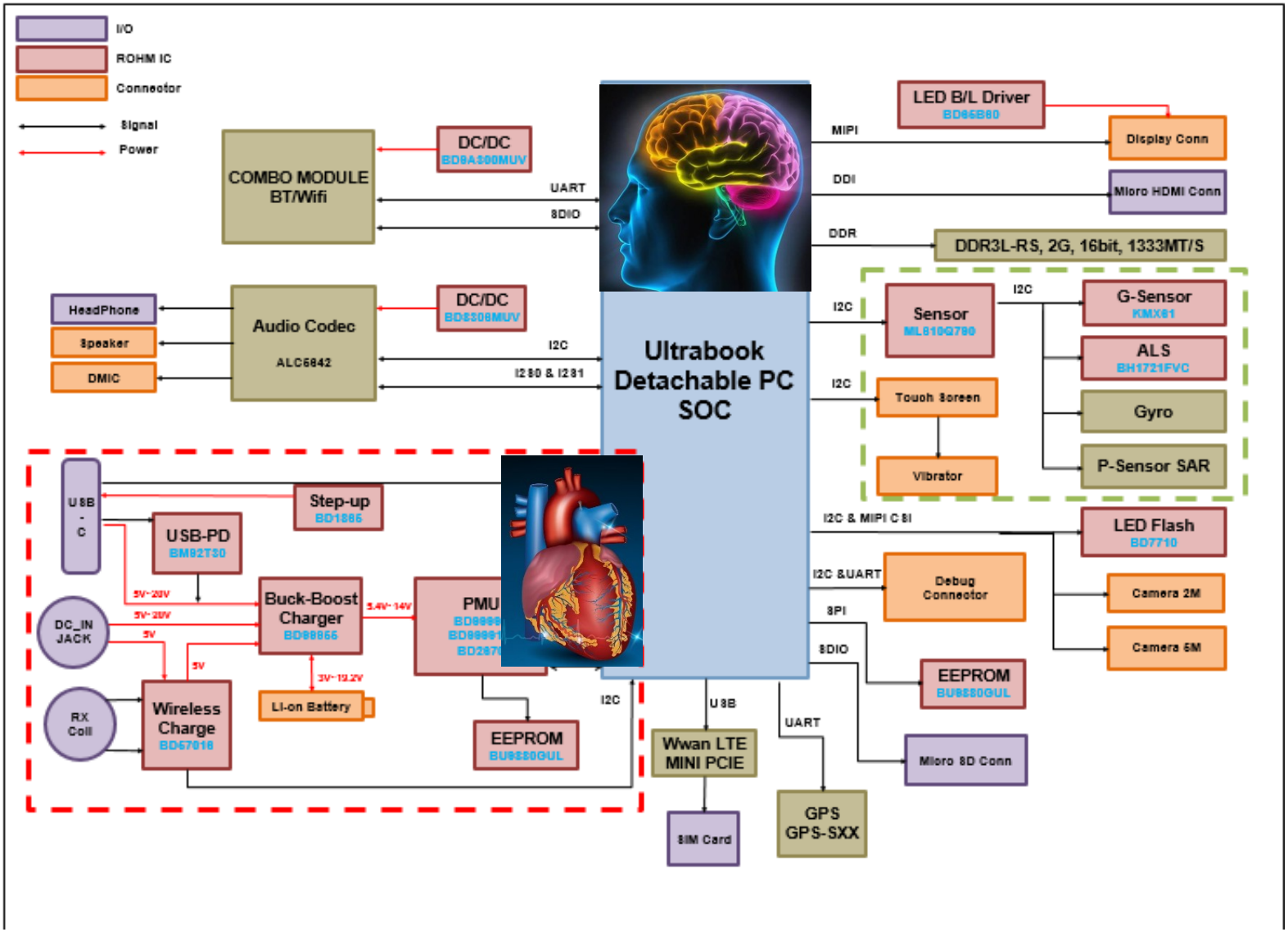
ROHM Smart Power Solution

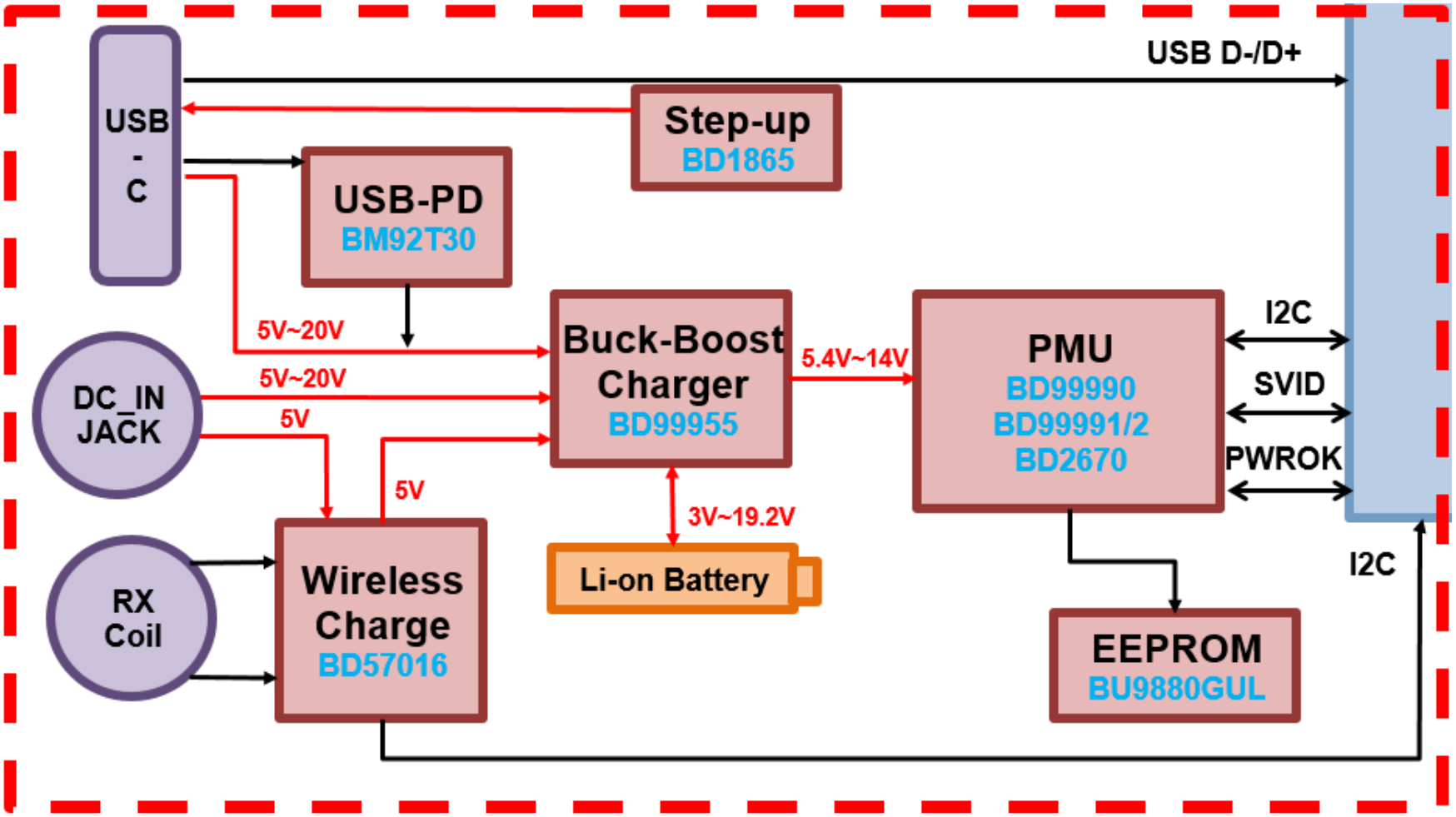
Battery Rapid Charge
Wireless Charge
USB-PD

2017.10
ROHM Semiconductor
Shanghai Design Center

Block Diagram of 3C Products (Ultrabook/Notebook)



Block Diagram of Power Part



USB PD and Charger solution used for USB-C I/F

Type-A

Type-C

5V/3A

USB-PD Charger
BM92T10
BD71621

Type-A

Type-C

5V/3A

5V/3A or 12V/3A

USB-PD Charger
BM92T30
BD71621/31

Type-C

5V/3A or 12V/3A

Type-C

20V/3A

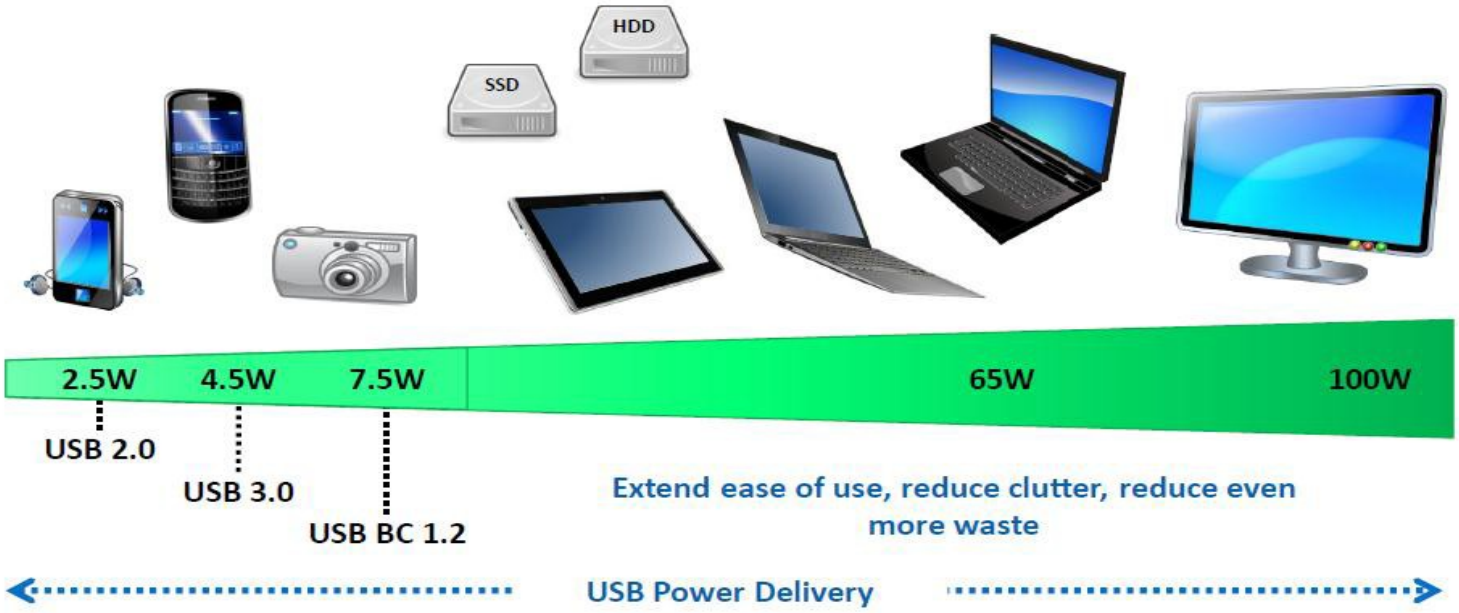
USB-PD Buck-Boost Charger
BM92T30
BD99955

USB Power Delivery

USB Power Delivery (USB PD) is a protocol that allows power control signaling:

- Enables both lower and higher power transfer than previous USB protocols
- USB PD over Type-A communicates over VBUS
- USB PD over Type-C communicates over dedicated wiring

Provider is capable of delivering up to 100 W over one USB Type-A or Type-



Power Protocol

USB Type-C can be used to deliver power via a number of different protocols:

Upon connection, power negotiation starts from the highest precedence, and works its way down the table until a protocol which both ports can support is found.

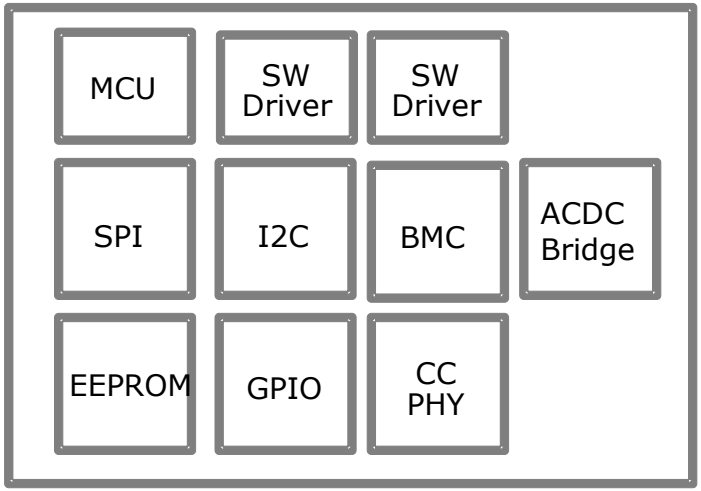
Precedence	Mode of Operation	Nominal Voltage	Maximum Current
Highest	USB PD	Up to 20 V	Up to 5 A
	USB Type-C current @ 3A	5 V	3 A
	USB Type-C current @ 1.5A	5 V	1.5 A
	USB BC1.2	5 V	Up to 1.5 A
	USB 3.1	5 V	900 mA
Lowest	USB 2.0	5 V	500 mA

BM92Tx0MWV Features (For Single port)

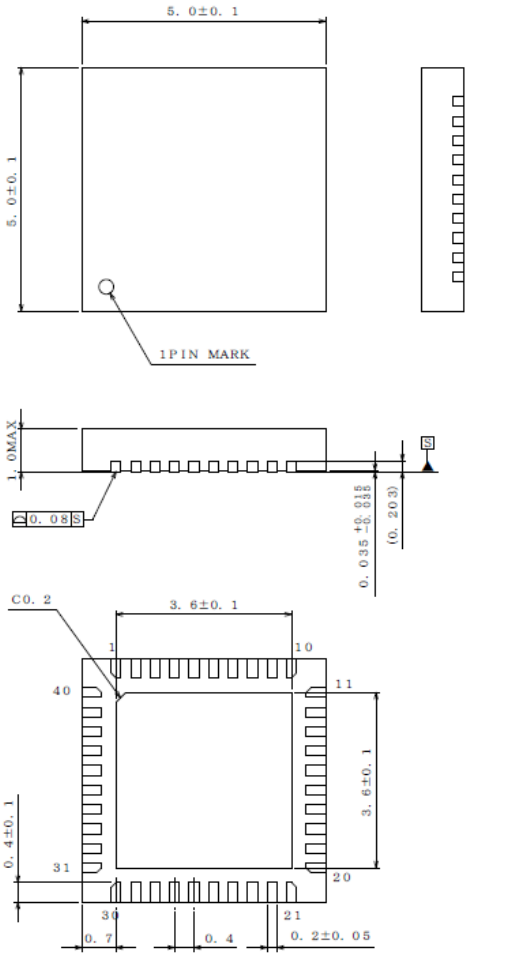
Features

- ■USB Type-C Spec 1.1 compliant
- ■USB PD Spec 2.0 compliant(BMC-PHY)
- ■Power-Path Nch-FET Control Drivers (x2 Ch.)
- ■Plug and Orientation Detection
- ■Built-in VCONN Switch and VCONN controller
- ■Supports Deep-Sleep-Mode (PC Application)
- ■Supports DFP/UFP/DRP mode.
- ■Supports Dead Battery operation.
- ■SMBus Interface for Host Communication

Block Diagram



Package Detail



- ■ UQFN40V5050A
- ■ 40 Pins / 5.0 x 5.0 x 1.0mm(0.4mm pitch)

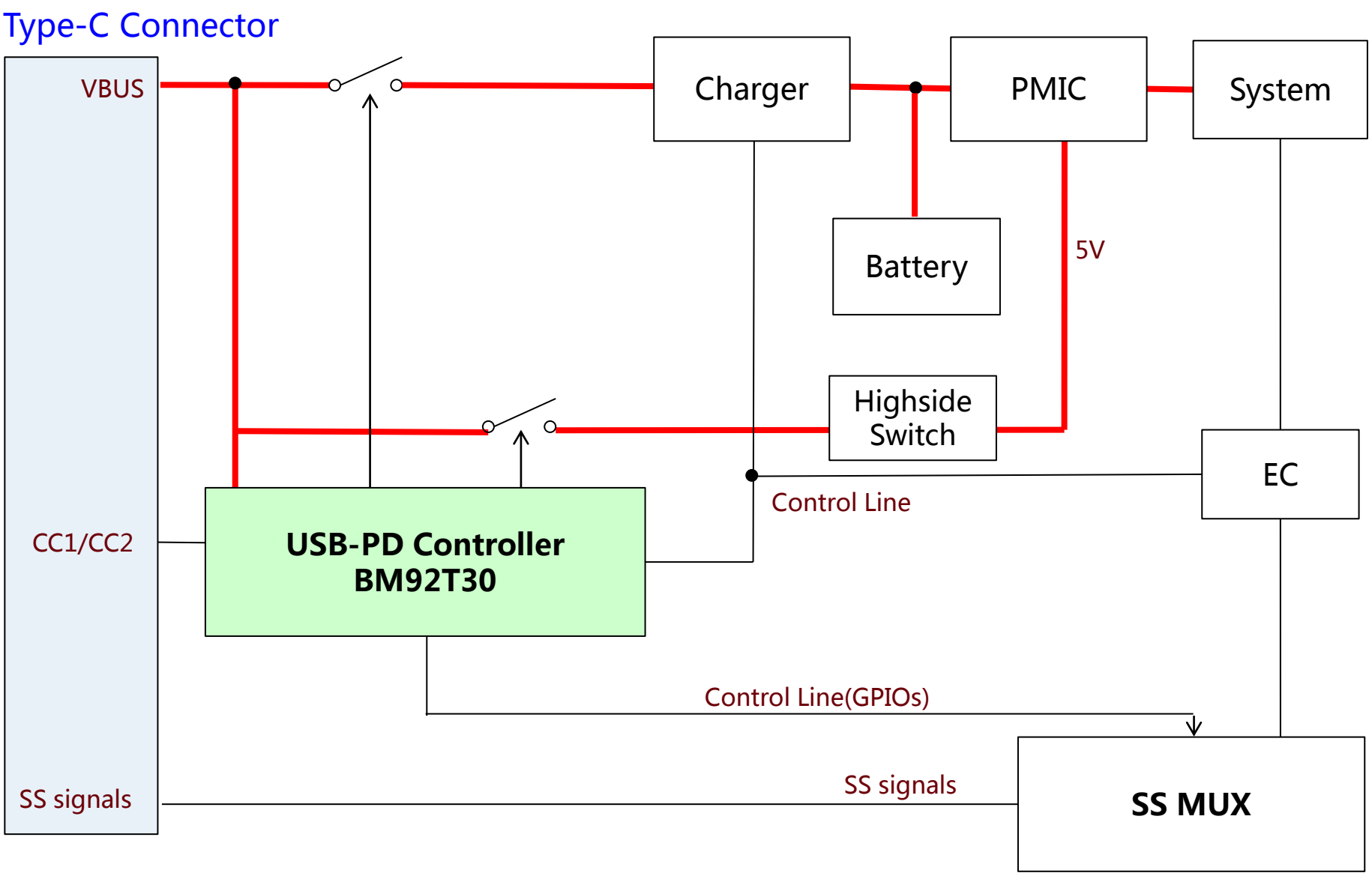
(UINT : mm)

USB-C Power Delivery Controller – BM92Tx0MWV

用途 		应用代表例
BM92T10MWV	受电/供电	 受电/供电
BM92T30MWV	受电/供电 支持 AlternateMode	 受电/供电 + Alternate-Mode
BM92T20MWV	AC适配器 ACDC供电专用	 供电专用
BM92T50MWV	利用内置 DC电源 供电专用	 供电专用

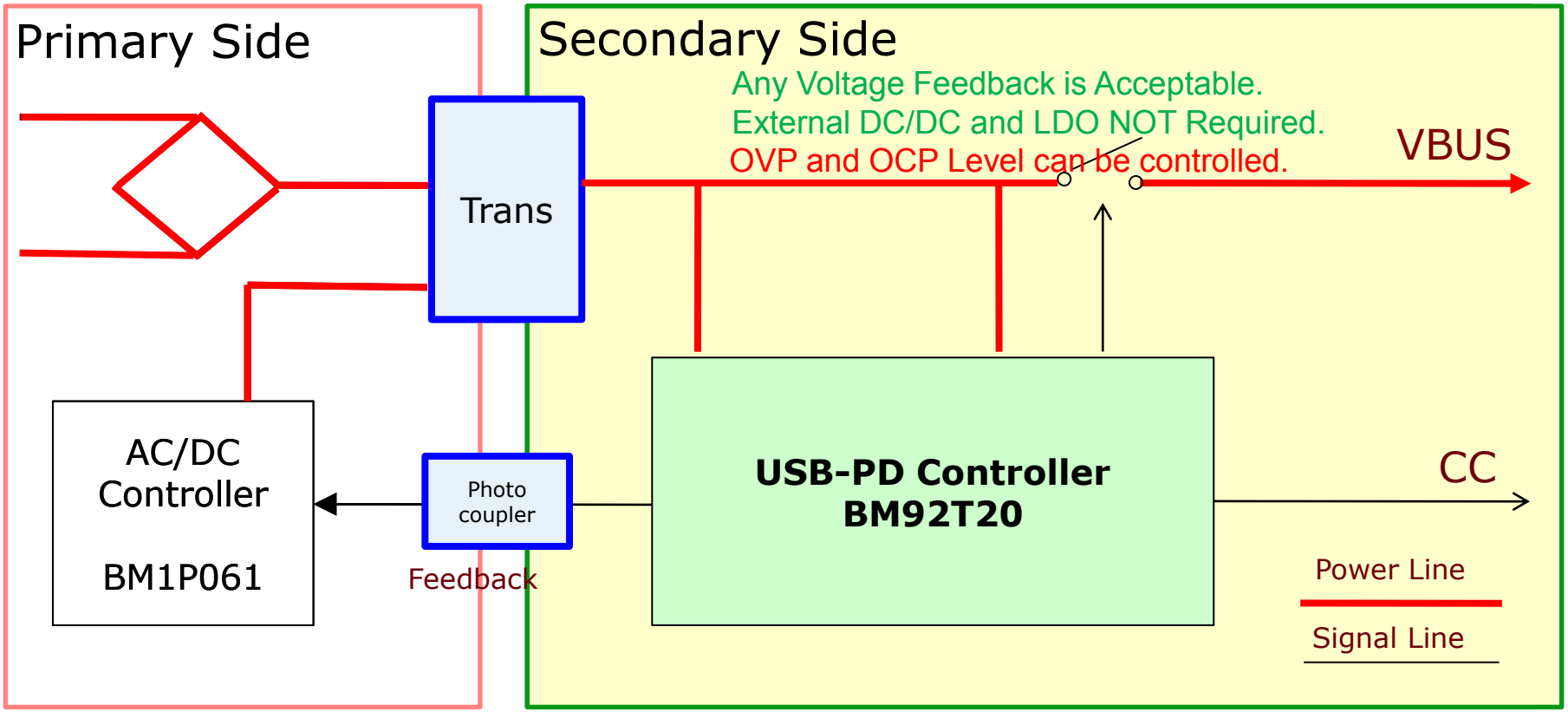
※Alternate-Mode: Transferring data signal and supplying power at the same time on one cable

Laptop PC Block System with BM92T30MWV



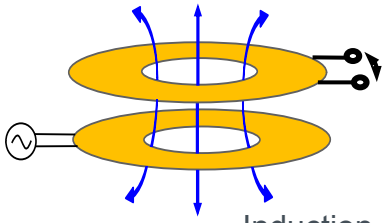
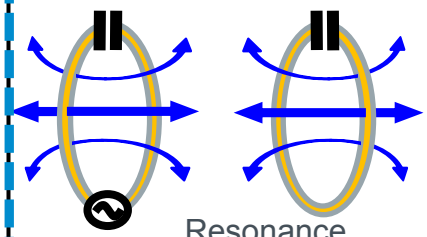
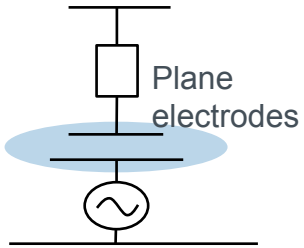
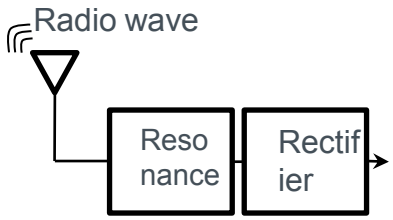
Smart AC adapter System with BM92T20MWV

- Elegant Design (Small PCB area / Simple circuit / Protection)
- Small Total PCB Solution / Under 24mm x 19mm on secondary side * Tentative
- OVP and OCP Control on Secondary Side
- External DC/DC and LDO NOT Required



Wireless Power Method

Confidential

	Electromagnetic induction	Magnetic resonance	Capacitive coupling	Radio wave
standards	WPC, AirFuel	WPC, AirFuel	-	-
	Qi, PMA	Qi, Rezence	-	-
Physical principle	 Induction	 Resonance	 Plane electrodes	 Radio wave Reso nance Rectif ier
Power Efficiency	○ (~90 %)	△ (~60 %)	○ (~90 %)	×
Z-distance	△ (~cm)	○ (~m)	△ (~cm)	○ (~m)

Inductive type Merit

- Simple architecture・・・Compact, Low cost
- High efficiency

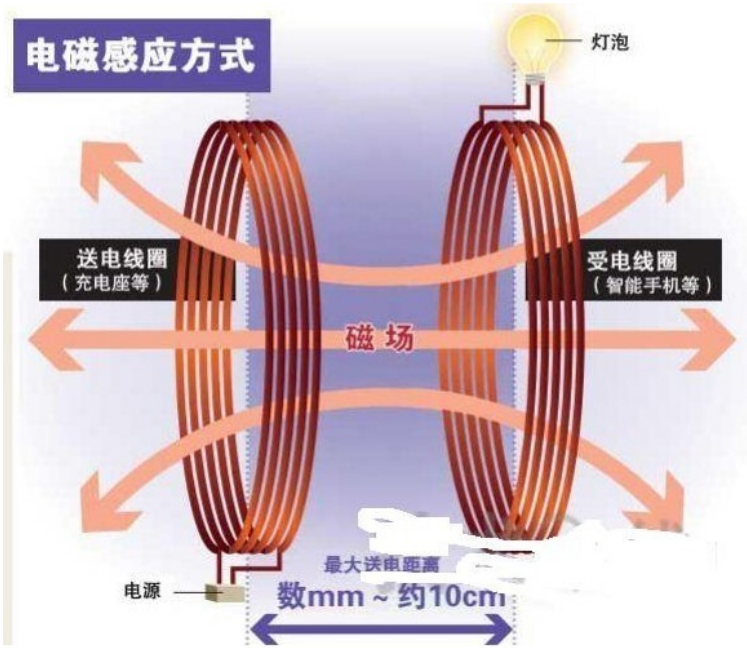
无线充电实现方式的优劣比较

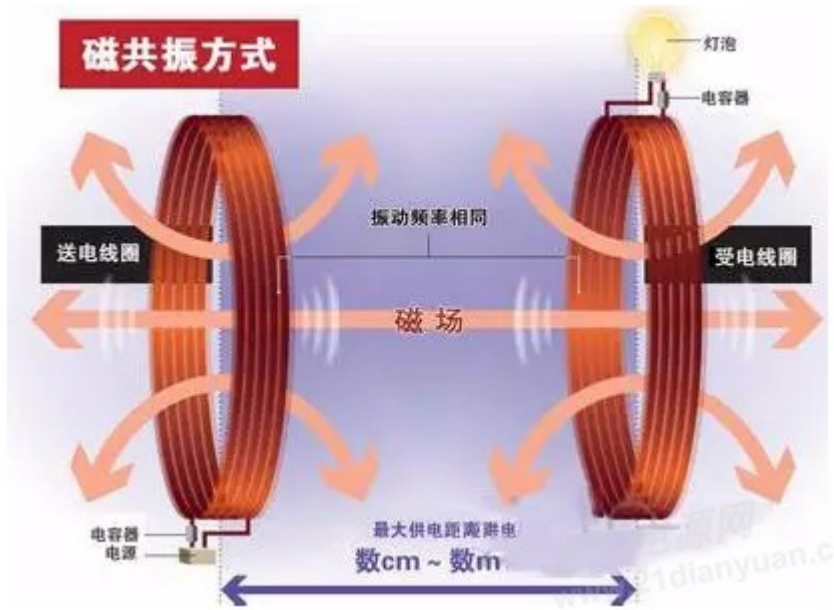
Confidential

	磁感应	磁共振	电场耦合	微波技术
传输功率	较大	大	小	小
传输距离	短（1cm以内）	较长（数米）	短（数cm）	长（可达10m）
传输效率	高（80-90%）	较高（50-90%）	较高（70-80%）	低（30-40%）
优点	功率大、转化效率高	传输距离较远、功率大	效率较高，对位置要求不严格	传输距离最远、对位置无要求
缺点	距离短，需要精确对位	转换效率不高、成本高	功率小、体积大	功率小、效率低

Wireless Power Method Main Trend

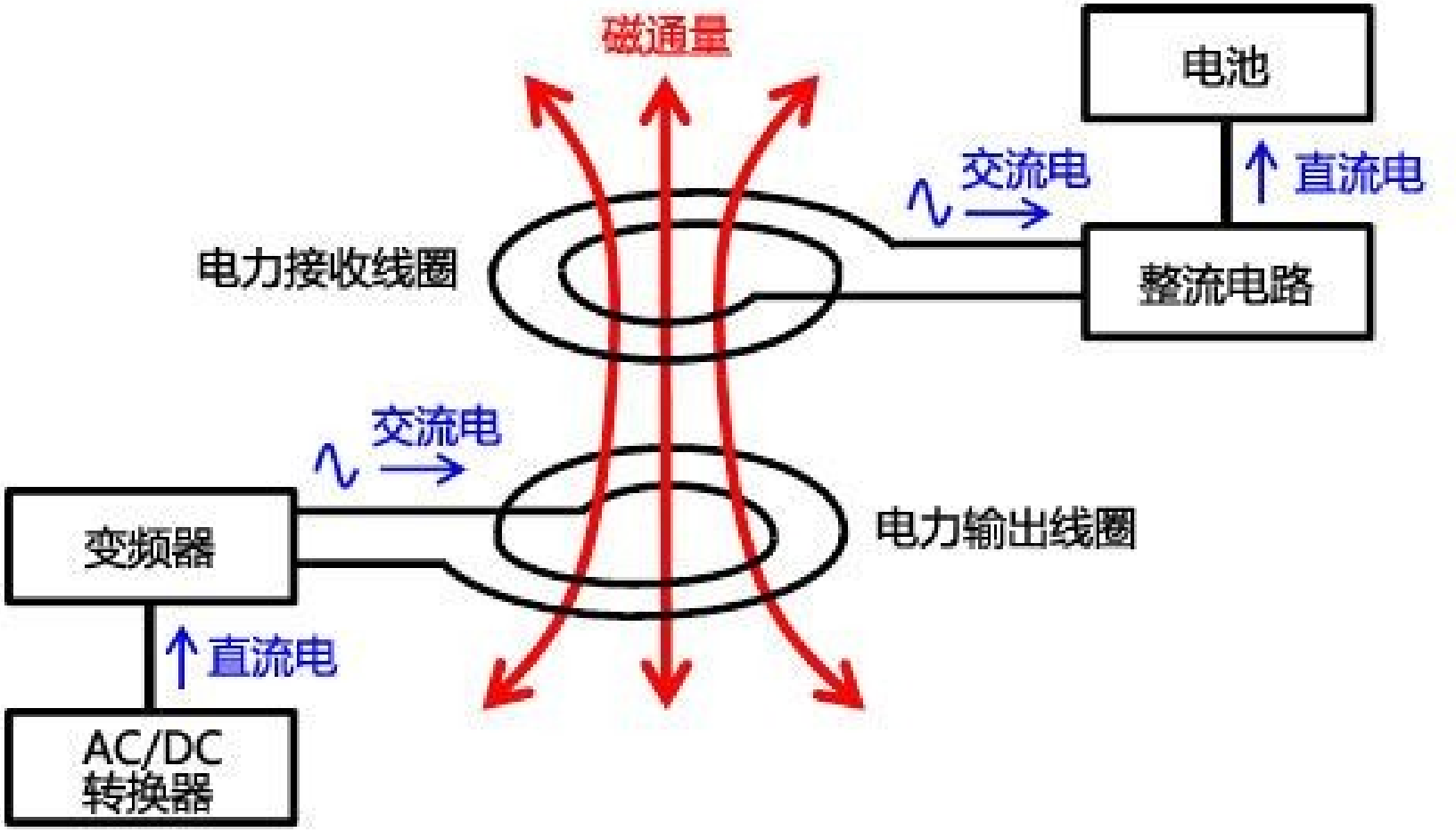
Confidential





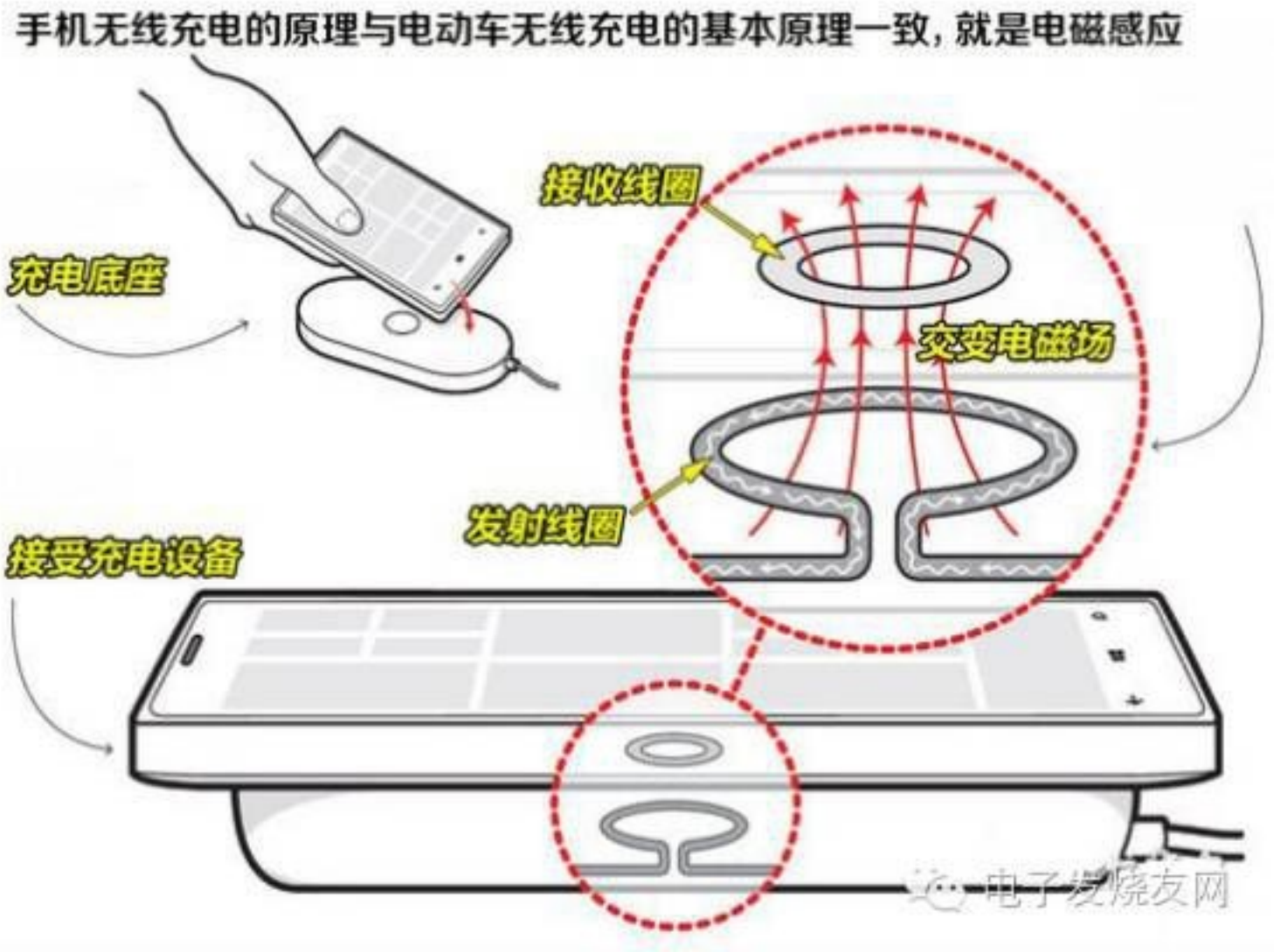
电磁感应方式机理（电生磁，磁生电）

Confidential



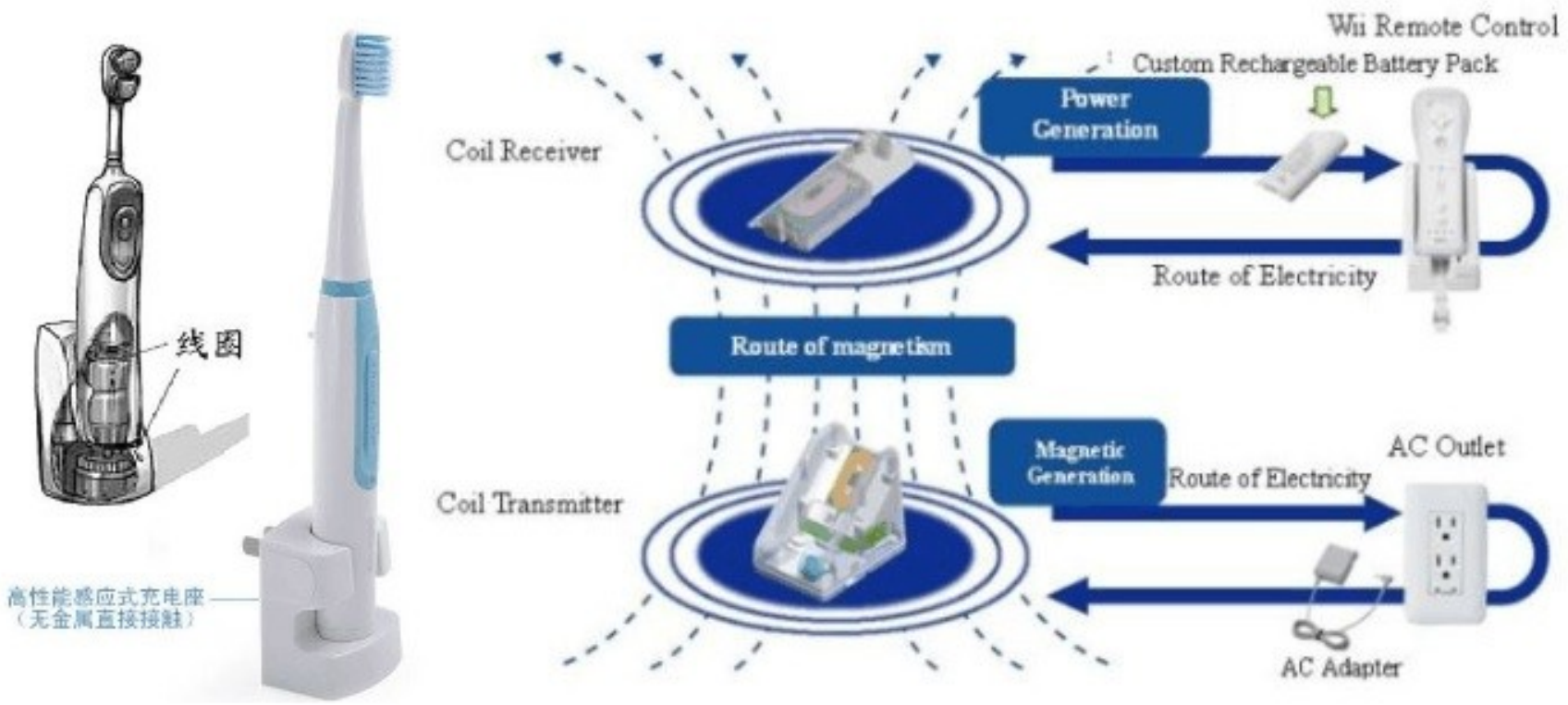
无线充电在手机上具体应用

Confidential



无线充电在电子设备上具体应用

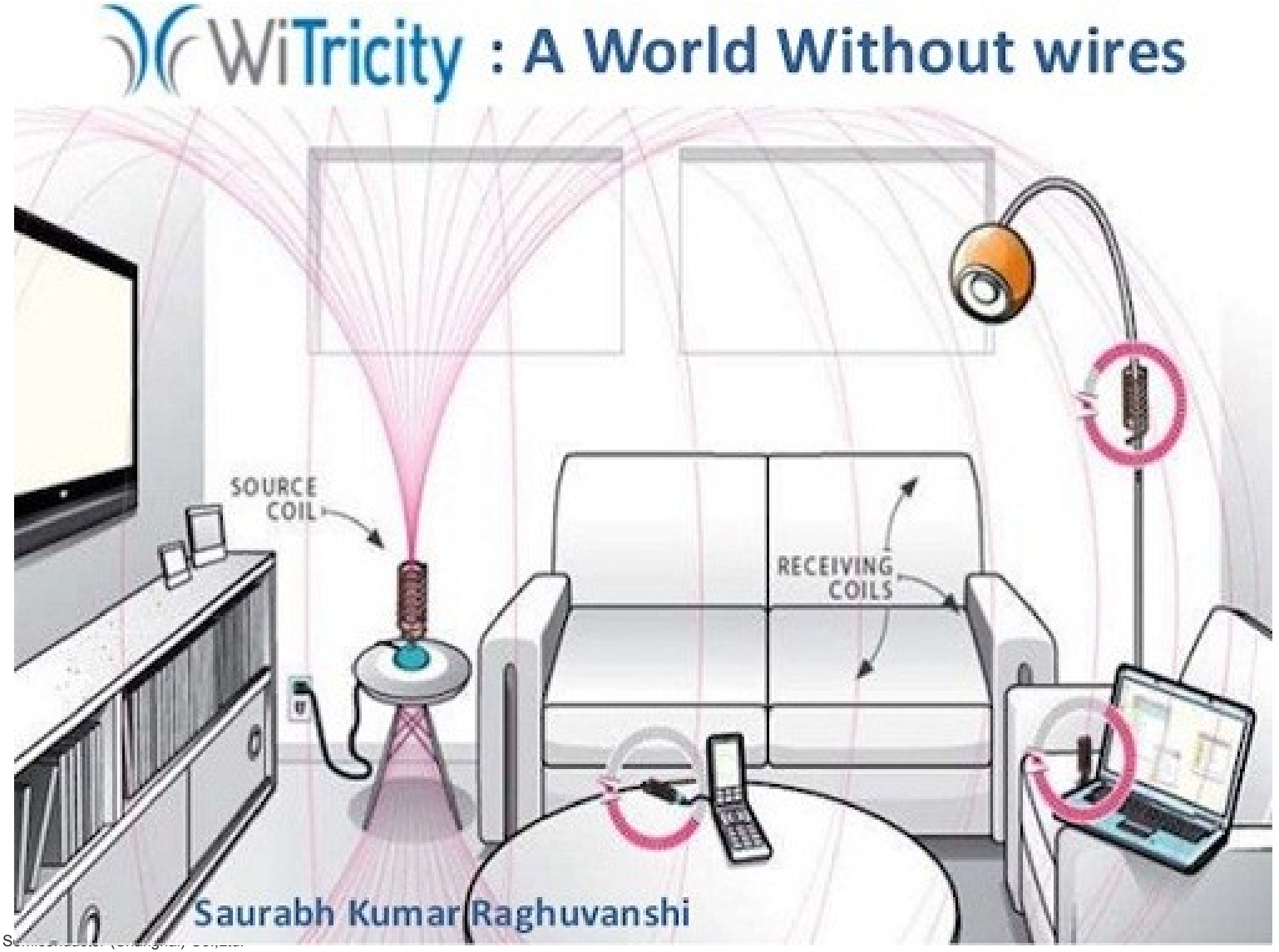
Confidential



电动牙刷无线充电示意图

磁共振方式实现的无线充电（科研阶段）

Confidential

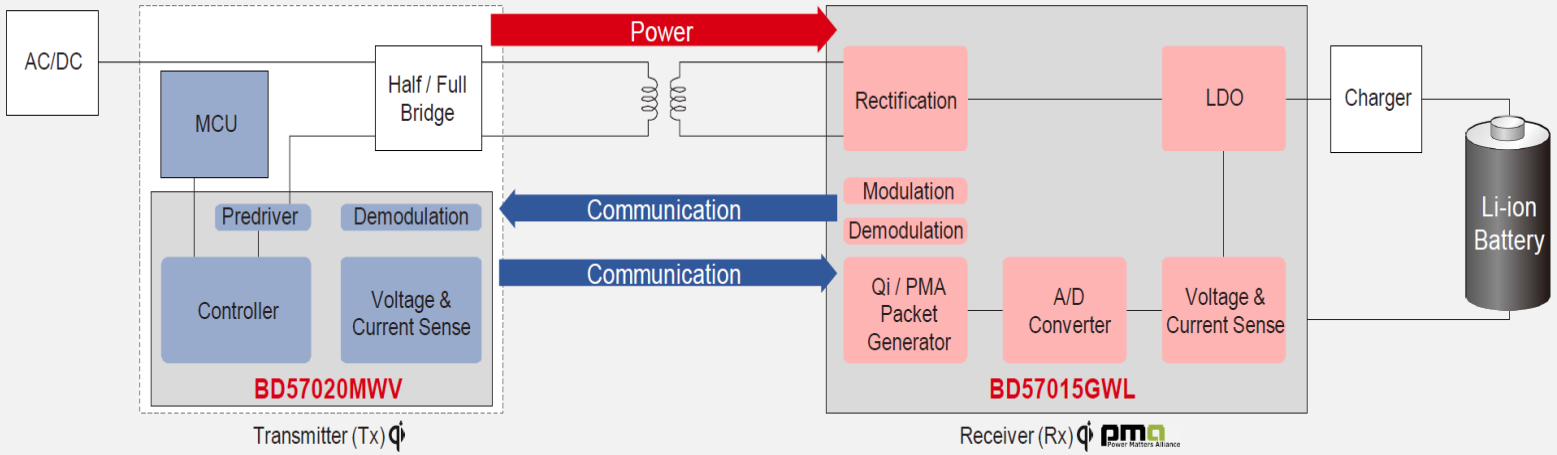


Wireless Power System Core Technologies

Confidential

Transmitter（Tx）
- Half-bridge/Full-bridge inverter
- Communication De-modulator
- Power control
- ADC
- Protection: Voltage, Current, Temperature, Foreign object

Receiver（Rx）
- Synchronous Rectifier
- ADC
- Communication control
- Power control
- Protection: Voltage, Current, Temperature, Foreign object



- Rohm holds all the core technologies required for the wireless power system
- Rohm has capability of its total solution

Wireless Power Standardization Roadmap

Confidential

CY2013	CY2014	CY2015	CY2016	CY2017	CY2018

WPC BPP (up to 5W) — Baseline Power Profile

f =110KHz-205KHz

Electro Magnetic Induction

WPC EPP (up to **15W**) — Extended Power Profile

f =110KHz-205KHz

WPC Medium Power
60W/120W Under spec. making

f <480KHz

PMA (up to 5W)

AirFuel Alliance

A4WP (up to 6W)

Magnetic Field Resonance

f =6.78MHz

NFC (up to 3W)

f =13.56MHz

WPC Members

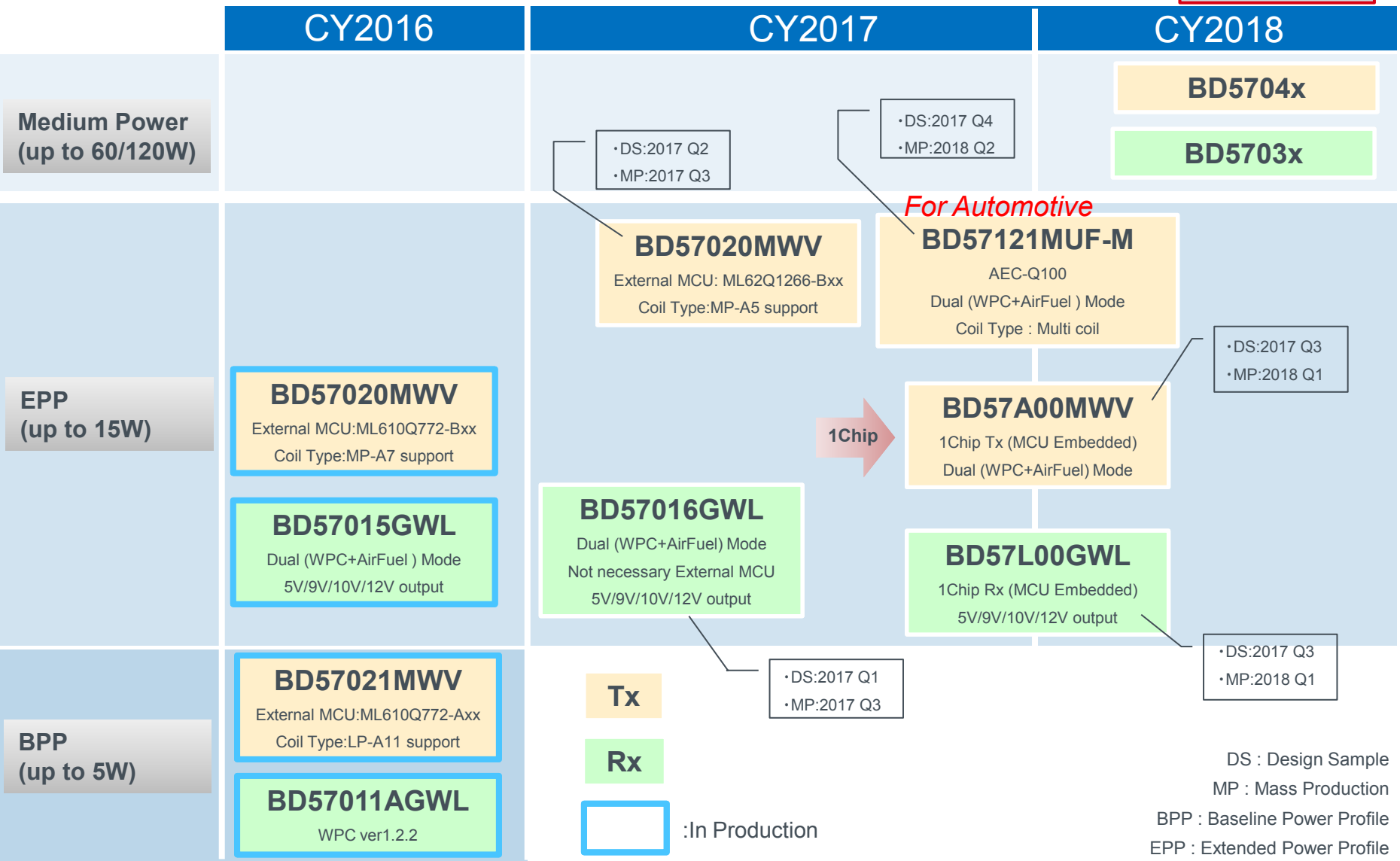
Confidential

WPC member：211 Companies,　Regular member：25 Companies

ROHM is a regular member and
Leading position of spec. making

Rohm Wireless Power Roadmap

Confidential

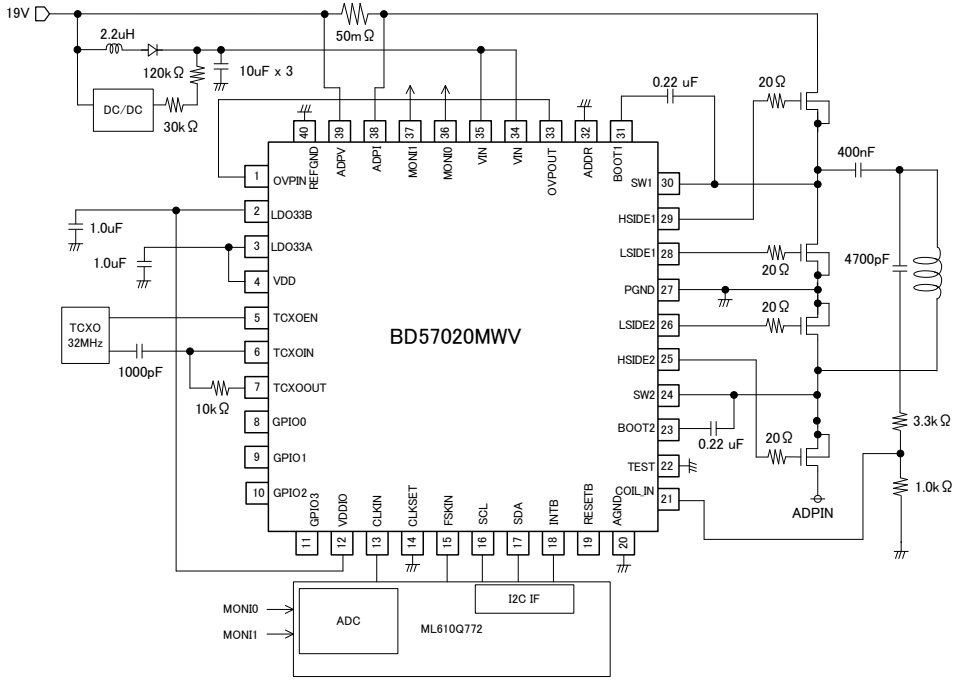


BD57020MWV: Mid-Power(15W) Transmitter

Features

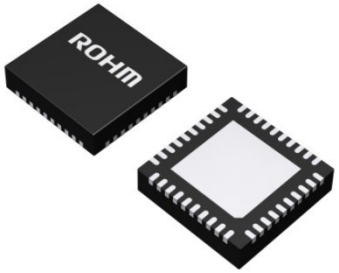
- Controller for WPC Transmitter
- 2 chip solution (B57020MWV + MCU)
- WPC Compliant, Low Power(1.1) and Medium Power(0.9)

Typical application circuit



Key Specifications

- Maximum Input Voltage : 4.2～5.3V
- Switching Frequency : 110kHz～205kHz (Typ.)
- WPC Medium Power Coil Type MP_A1 or MP_A2
- WPC Compliant, Including Foreign Object Detection (FOD)
- Standard protection built-in
  - : Over Voltage Protection (OVP)
  - : Over Current Protection (OCP)
  - : Thermal Shut Down Function(TSD)
  - : Under Voltage Lock Out (UVLO)
- A demodulation circuit built-in
- A TCXO is used.
- Package: UQFN040V5050
  - : 5.0mm × 5.0mm × 1.0mm (Max.)
    0.4mm Pitch



Applications

WPC compliant Device

- Wireless Charging Pad
- PC

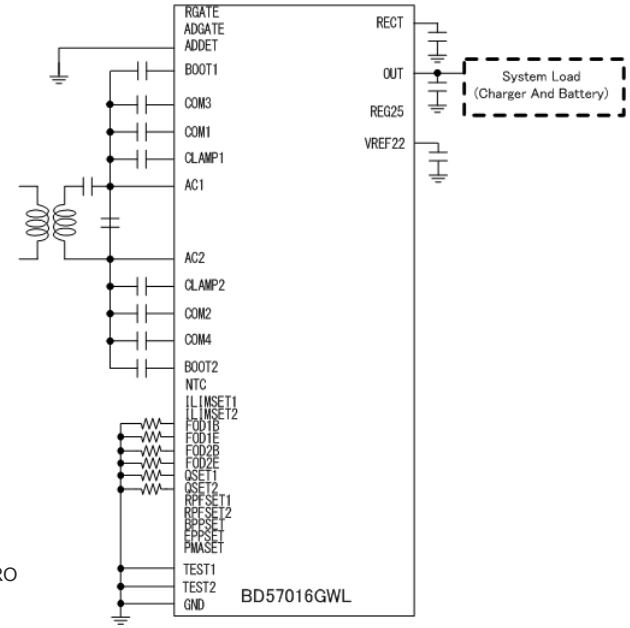
BD57016GWL Dual Mode(15W) Receiver

Under Development **Confidential**

Features

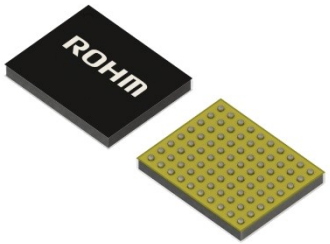
- WPC Compliant, BPP and EPP Ver.1.2
- AirFuel Inductive compliant communication & control.
- Selectable WPC or AirFuel or Dual mode.
- High efficiency rectifier
- Supports 20V maximum input.
- Foreign object detection
- Package : WLCSP
- Adjustable output voltage : 5V to 12V

Typical application circuit



Key Specifications

- Maximum input voltage : 20V
- Adjustable output voltage : 5,5.3,6,7,9,10,11 and 12.0V
- Maximum output current : 1.5A(10V)
- AC input frequency : 110kHz～480kHz(Qi, AirFuel)
- GPIO terminals : 2
- Various protection systems
  - : Over Voltage Protection (OVP)
  - : Over Current Protection (OCP)
  - : Thermal Shutdown(TSD)
  - : Under Voltage Lock Out (UVLO)



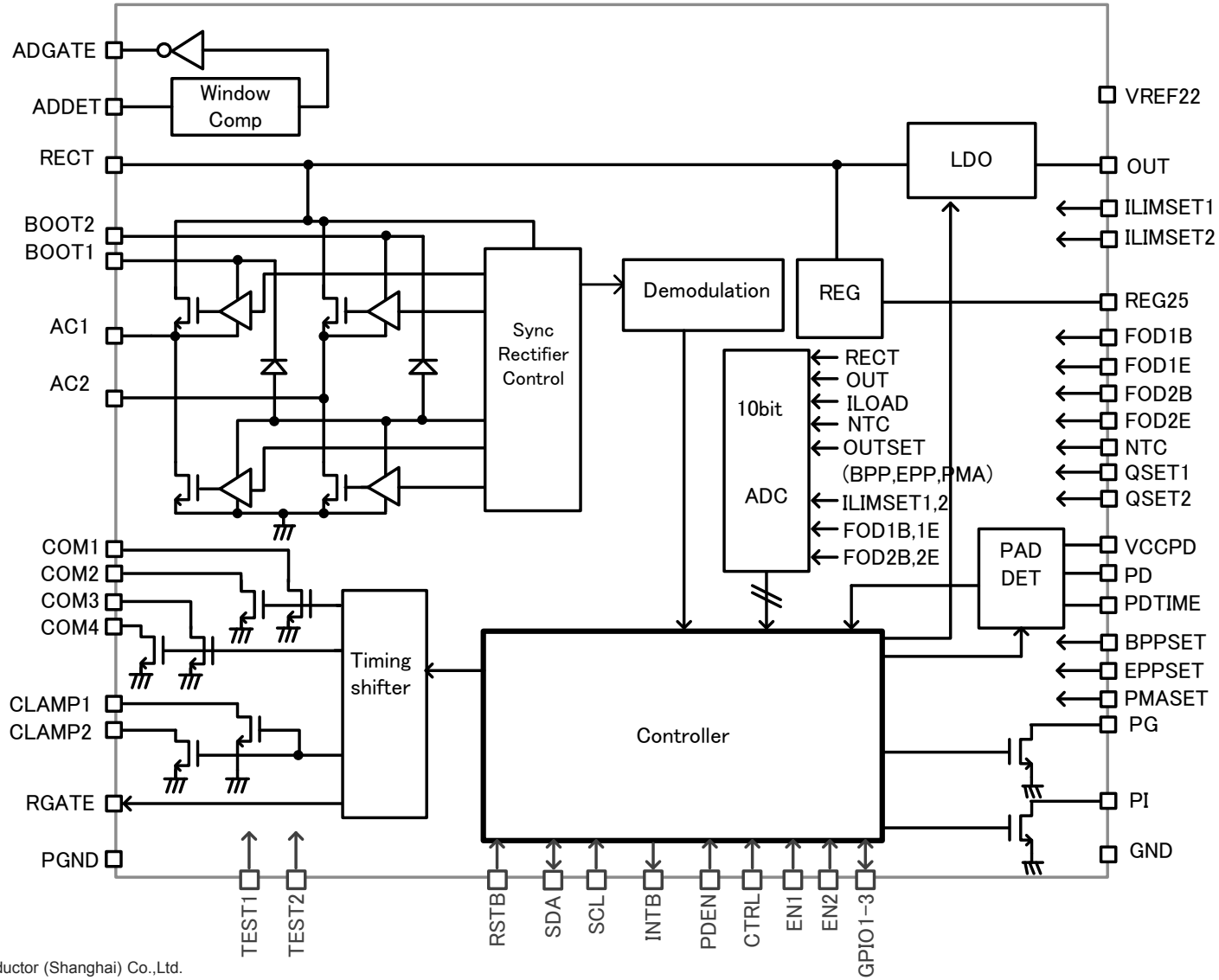
UCSP50L4C
4.2mm × 3.4mm × 0.57mm
(0.4mm pitch)

ーション

- Wireless Power Device Complies with WPC 1.2 / AirFuel
- Smart phones
- Cell phones
- Handheld mobile devices

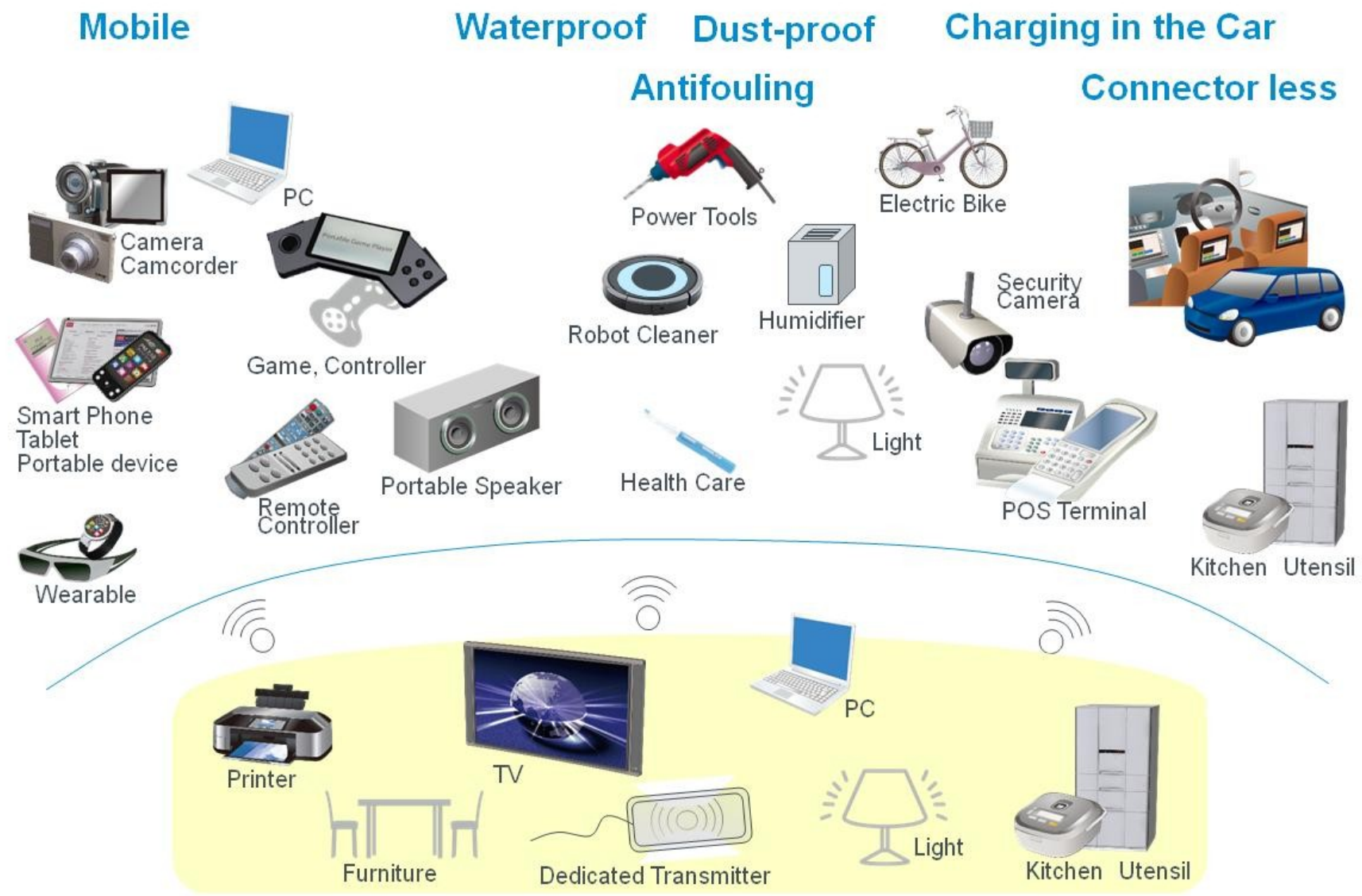
Wireless RX IC BD57016GWL Qi BPP/EPP & PMA

Block Diagram

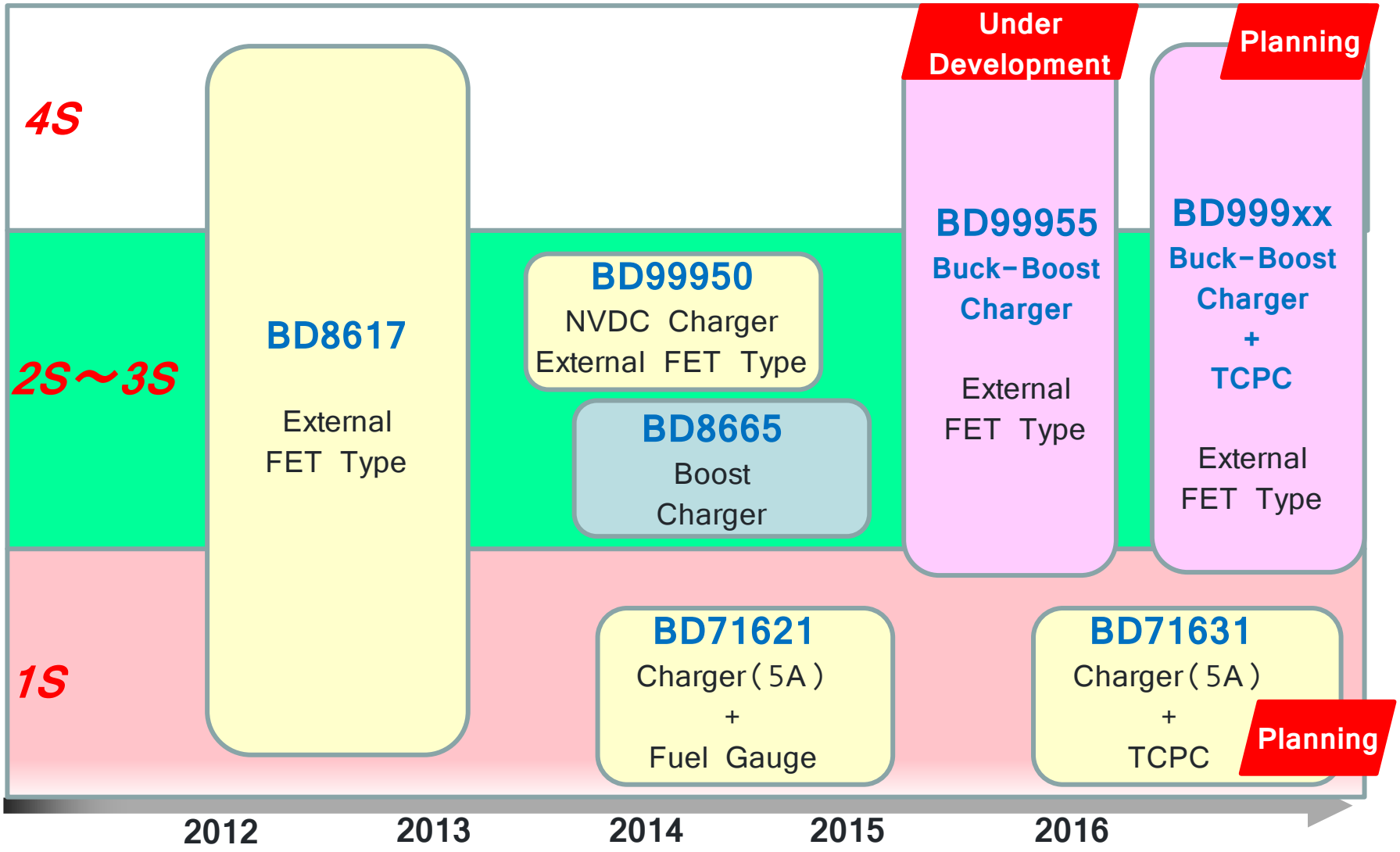


Wireless Power Application

Wireless Power Application



ROHM Charger lineup & Roadmap



Charger with Coulomb Counter – BD71621

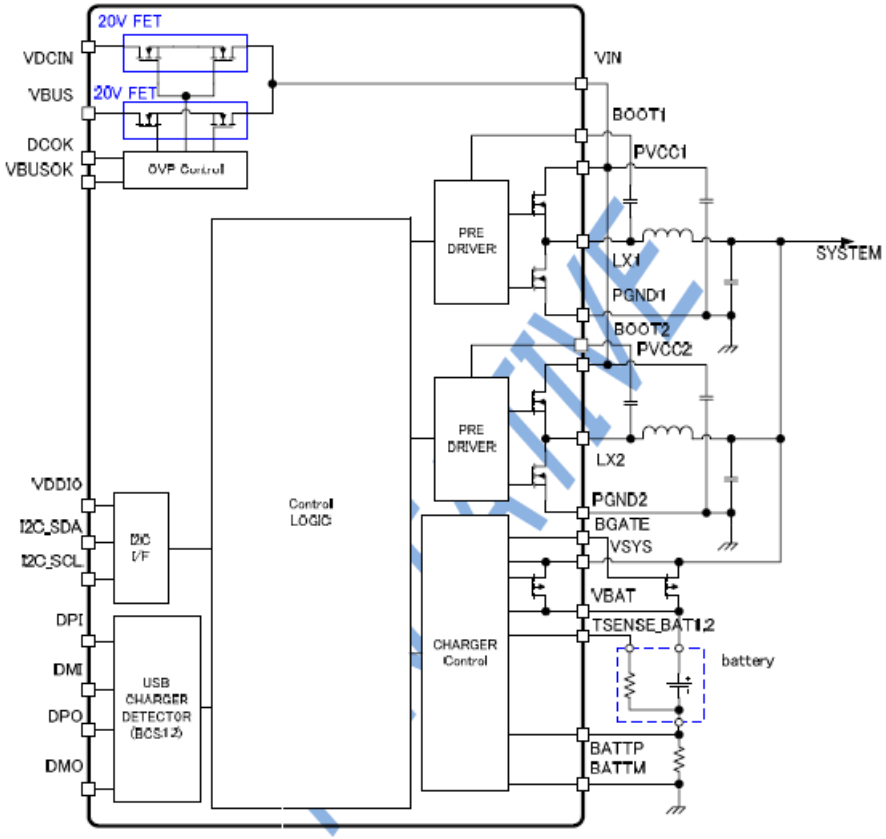
Features

- High efficiency 5A switching charger
- Two separate input sources for USB and DC adapter
- JEITA compliant charging profile
- Supports USB BC 1.2, (ACA, ID pin), and OTG
- Supports Power Delivery at 12V/2A 3A
- Over Voltage Protection up to 20V
- Over Voltage Protection for Battery
- Battery Short Circuit Detection
- Supports Battery Supplement Mode
- Reverse Boost Option for USB charging up to 36W
- High integration reduces the total area

Basic Specifications

- VBUS Input Voltage Range : 3.0V to 15V
- AC adaptor Input Voltage Range : 3.0V to 15V
- Battery Input Voltage Range : 0V to 4.35V
- Input Limit Current Range : 0.1A to 3.0A
- Charge Current Range : 0.5A to 5.0A
- Operating temperature : -30℃～+85℃
- Protection circuits
  - Thermal Shutdown Protection (TSD)
  - Under Voltage Lock Out (UVLO)
  - Over Voltage Lock Out (OVLO)
- **4.3mm x 4.3mm 0.4mm pitch 100pin WL-CSP**

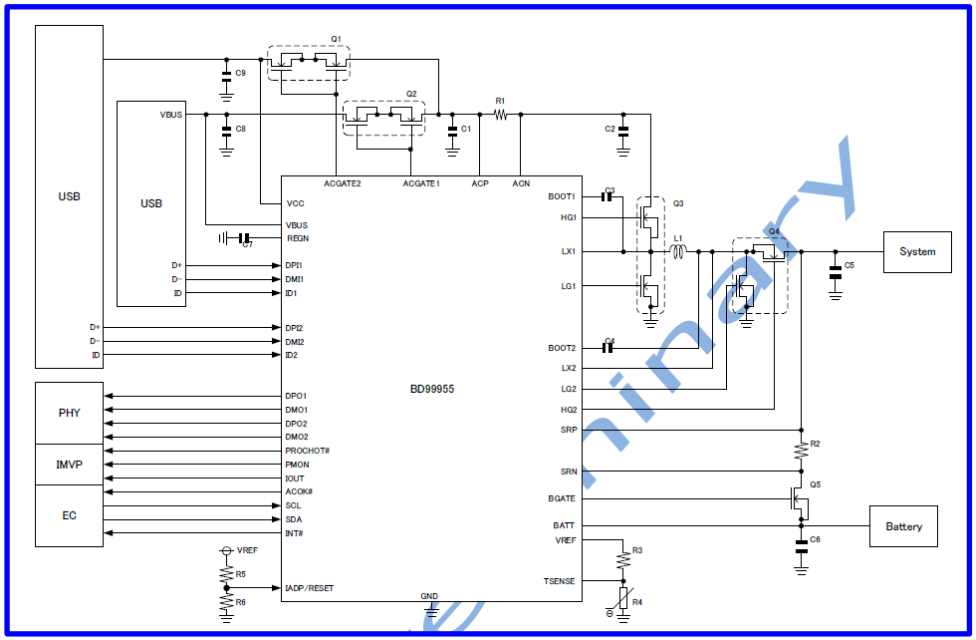
Specification Overview



Applications

- High capacity Battery charger for Tablet PC, Smartphone with or without USB-Power Delivery

Buck/Boost Charger for 1S~4S --- BD9995X



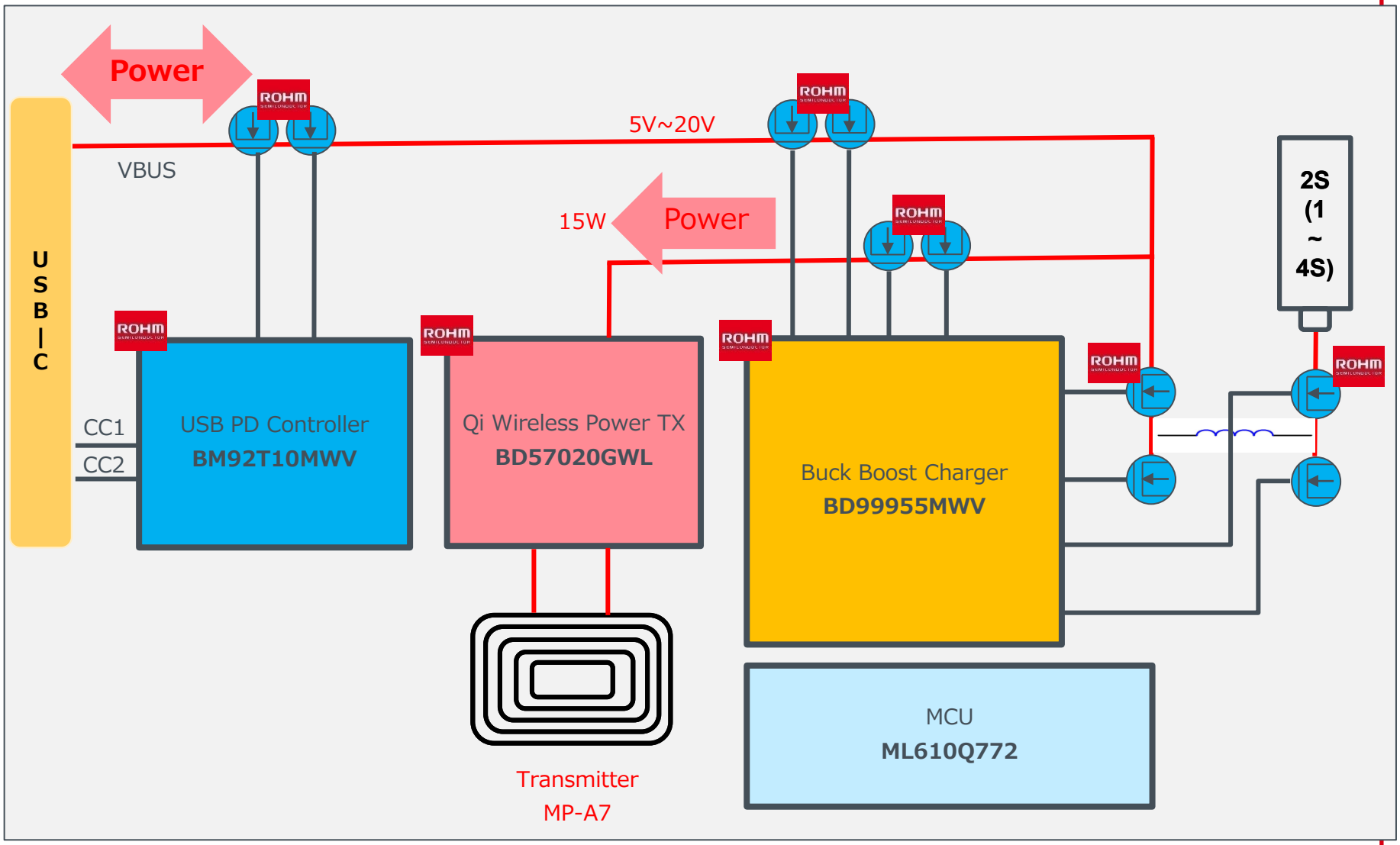
Features

- NVDC Charger for 1S-4S Battery Buck Boost Switching Controller
- **Dual Input NMOS Power Path Sources for USB and AC** Adapter (or Wireless Power Supply) integrated control
- **Inbuilt JEITA compliant charging profile (no EC firmware reqd)**
- **Supports USB Type C**
- Supports USB PD 20V/5A Profile
- Over Voltage Protection for Battery
- Battery Short Circuit Detection
- **Reverse Buck/Boost Option for USB Charging (to OTG Device 5V/1.5A)**
- PSYS Output
- PROCHOT# Output
- **Programmable parameters: pre-conditioning, pre-charge current, fast-charge current, charge voltage**
- Application diagram for >2 charging input, >1 battery case

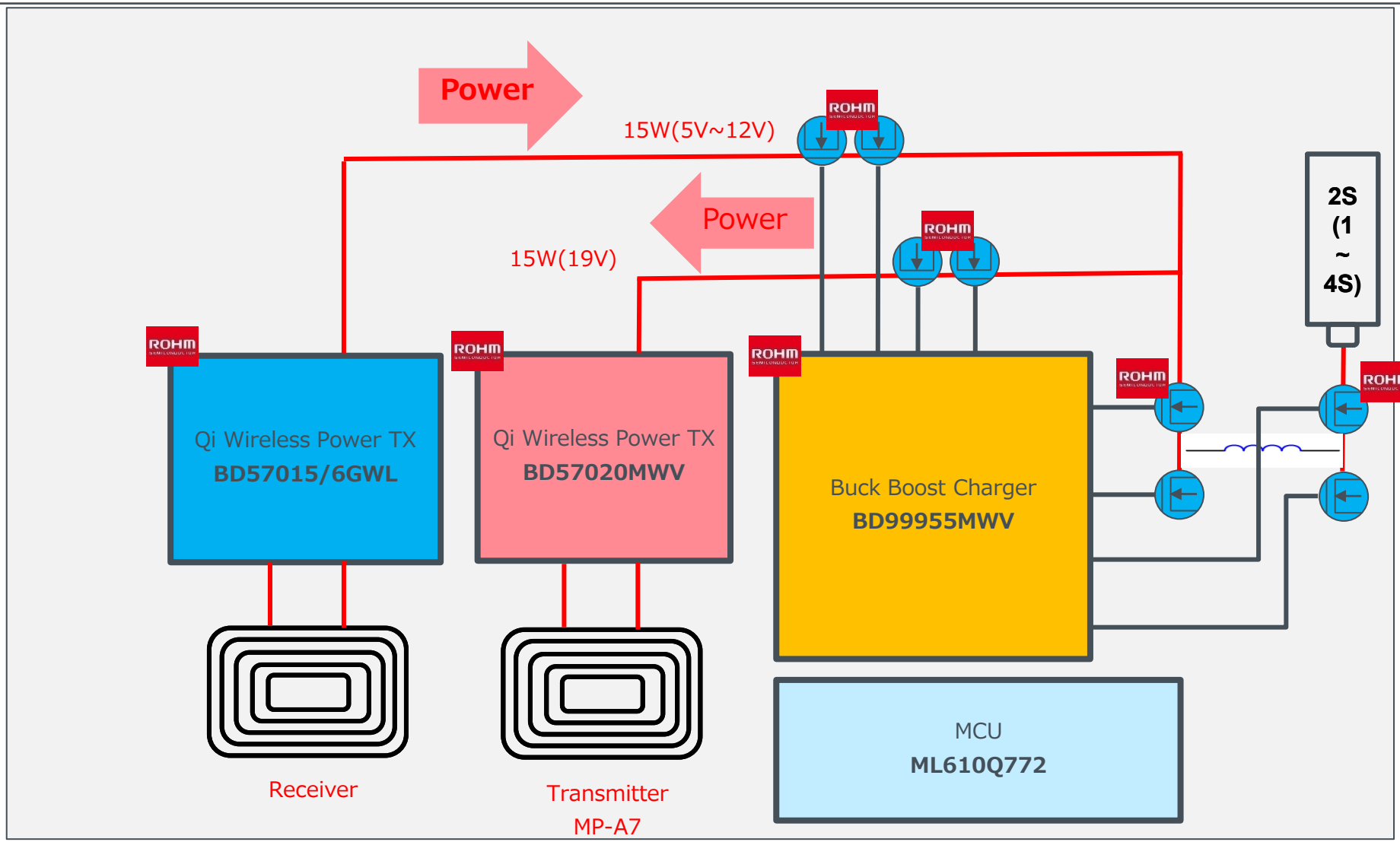
Basic Specifications

- Input Voltage Range : 3.8V to 25V
- Battery Voltage Range : Up to 19.2V
- Input Limit Current Range : Up to 16A
- Charge Current Range : Up to 16A
- Charge Voltage Range : 4.1V to 19.2V
- Switching frequency : 600kHz-1.2MHz
- **Will support all your Type-4 and Type-3 board designs:**
- **2.6mm x 3.0mm CSP Package & 5mm x 5mm QFN package options**

Block Diagram of Smart Power Bank (One Type-C)



Block Diagram of Smart Power Bank (No I/F)



联系方式：

E-mail : faesupport@rohm.com.cn

ROHM Semiconductor (Shanghai) Co.,Ltd.