Simplifying Design of Wireless Chargers

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AGENDA

• Qi Wireless Transmitter Diversity Advantage
• What a Transmitter is Made of
• RT3181 as Universal Transmitter Building Block
• Simple Design Examples
  • A11
  • A6, A19
  • MP-A5
• Wireless Power Receivers
• Summary
Qi Wireless Transmitter Diversity

• WPC transmitter portfolio accounts several dozen of transmitter types
• System integrators have great level of flexibility addressing practical wireless power implementations
• Two major transmitter groups
  • Single coil, Like A10, A11, MP-A5, etc.
  • Multi coil, A6, A19, etc.
• Addressing TX variety presents technical and economical problems
What Wireless Power Transmitter is Made Of

- Typical WPTX takes DC input
- Regulates it down to power control circuitry
- The MCU controls all TX functions
- Interface chips demodulate RX feedback signals
- The Power Amplifier converts DC voltage to square wave AC that energizes the resonant network
- The resonant network drives sine wave current through TX coil
- All these functions in many cases are done by the individual discrete components making TX design complex and expensive
RT3181A – Universal Single Chip WPTX Inverter

- RT3181 Does:
  - Regulates DC input down to power control circuitry and PA
  - Incorporates MCU that controls all TX functions and digitally processes RX feedback signals
  - Incorporates Power Amplifier that converts DC voltage to the square-wave AC voltage that energizes the resonant network
  - Supports two FOD methods – before power transfer and during power transfer
  - Controls LED indicators and buzzers
  - Reduces TX BOM by more than 50%

Integrating Most of WPTX Functions into a Single IC Provides Highly Functional and Economical WPTX Solution
RT3181A – WPC Transmitter Examples

- **RT3181A**
  - Support LP-A11 & MP-A5
  - Supports External PA
  - Package, 6x6 QFN48

**LP-A11 Single Chip**
- Most Economical

**LP-A11 Efficiency Enhanced**
- 5V IN
- HB
- Buck Cntl
- LP-A11
- DrMOS RT9682A
- HB
- Buck Cntl
- RT3181A

**MP-A5 (WPC Medium Power)**
- 12V IN
- MP-A5
- Buck Cntl
- RT3181A
- HB
- DrMOS RT9682A
- HB
- DrMOS RT9682A
Temperature Measurement by Configuration

**RT3181**
- Internal PA

**RT9680**
- PA

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**C0G*4**
- KUPIIN A11 TX Charging Temperature (RT3181 2L PCB w/ C0G*4)
- 25 degC hottest spot temperature reduction

**C0G*1 + X7R*3**
- KUPIIN A11 TX Charging Temperature (RT3181 2L PCB w/ C0G*1+X7R*3)
- 20 degC hottest spot temperature reduction
A6/A19

- **A6 (3 coil)**
  - External selection FET
  - High efficiency by 2 HB parallel operation.
  - Optional Boost controller for 5V input

- **A19 (2 coil)**
  - Simple BOM
  - Trade off of BOM cost and charging area
  - Optional Boost controller for 5V input
RT3181A Based A11 TX Module

- **Module Design**
  - WPC Registered Product
  - Commercial production ready
  - Optional external DrMOS (RT9682A) for efficiency enhancement
  - Module Supplier, Kupiin
Remote Drive RT3181A Based A11 TX Module
RT3181A Based A19 TX Module
RT3181A Based MP-A5 TX Module

- Module Design
  - External RT9680 based PA
  - 4L PCB Ref design
  - Shortest BOM for MP TX Designs
RT3180, RT6150, RT6152

WIRELESS POWER RECEIVERS
RT3180 Operation Mode – 1/2

**Rectifier**

- **Full Sync (FS)**
- **Half Sync (HS)**
- **Diode Mode**

**A5V Configuration**

- LDO mode is recommended for Vrect > 6V application, ie, MI single mode.
RT3180 Operation Mode – 2/2

**DC Conversion**

- **Auto Selection**
  - For Multi mode design, wide dynamic Vrect range
  - Criteria by TX type at start up

- **Buck**
  - For high Vrect to Vo drop

- **LDO/Bypass**
  - LDO: Regulated output, e-fuse option
  - Bypass: bypass for Vo <12V, Vo=12V for Vrect >12V
  - Optimized for MI Mode

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Auto Selection | Buck | LDO/Bypass
---|---|---
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System Efficiency with RT3180A EPP RX

WPC - System Efficiency (TX+RX)

- MT3180 (Bypass @ Vrect=9V)
- MT3180 (Buck 5V @ Vrect=9V)
- MT3180 (LDO 5V @ Vrect=5.3V)
- MT3188 (Buck 5V@ Vrect=9V)
- BQ51221 (LDO 5V@ Vrect=5.3V)

Note:
LPP TX -- A10
EPP TX – MP-A5
RT1650 – WPC LP Receiver

- **RT1650/A**
  - WPC1.1 Compliant Receiver
  - Output up to 7.5W (5V/1.5A)
  - Package, CSP48 3x3.4mm², 0.5mm max height, 0.4mm pitch
  - OVP @ 11.5V (typ)

<table>
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<tr>
<th>Version</th>
<th>Standard</th>
<th>Status</th>
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<tbody>
<tr>
<td>RT1650</td>
<td>WPC</td>
<td>MP</td>
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<tr>
<td>RT1650A*</td>
<td>WPC</td>
<td>ES available</td>
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(TOP VIEW)

- **Matching Network**
- **MCU & System Monitoring**
- **FOD**
- **I2C (Option)**

WL-CSP-48B 3x3.4 (BSC)
RT1652 – WPC LP Receiver

- **RT1652**
  - WPC1.2 Low Power Compliant Receiver
  - Output power up to 5W
  - Adjustable 3V~12V output voltage
  - Package, CSP36 2.8x2.6mm2, 0.5mm max height, 0.4mm pitch
  - Option to Direct Charge to Battery pack
SUMMARY

• Simplify your next wireless power product design
• Choose Qi SOC transmitters for reduced system BOM
• Look for these part numbers

RT3181  RT3180  RT1650  RT1652
RICHTEK
your power partner.

thank you.