Outline

• Smart Convergence – A ZTE’s Perspective
• Analog Opportunities for Communication IC Design
• Analog Opportunities for Power IC Design
• Conclusion
ZTE’s Product Lines

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- ZTE’s products and solutions portfolio is the most comprehensive in the industry, and meets the diverse needs of customers.
- The company is the leading supplier in the wireless, wired and terminal fields and its new businesses, including telecom and Internet services, are growing fast.
ZTE Terminals Proliferate, Smartphone Sales Grow

World **TOP 4** in 2011 Terminal Shipments

- Handset overall sales grew 50% in 2011, growth rate of smartphone ranked **NO.1**
- World **TOP 4** Terminal Shipments in Q1, 2012 (Source: IDC)

2012, Focus on Smart Terminals

- Over **10** years of handset design experience
- Nearly **400** professional design experts
- World **TOP 5** Smartphone Shipments in Q2, 2012
  (Source: IDC)

**Grand lineup**

ZTE Blade 880 shipment was over **10** million, the best-selling of smartphone in 1,000 RMB-level in China
ZTE Wireless: Innovation for Tier 1 Operators

Steady growth for 2G/3G

**No. 1**
- **TDD** - Comprehensive competence ranked **No. 1 globally** (Source: F&S)
- **CDMA** - **No. 1** for 5 consecutive years in terms of base station shipments (Source: IDC)
- **Core Network** - lead softswitching technology (Source: Gartner)

**TOP 3**
- UMTS/LTE – Ranked No.1 in terms of 2T4R shipments (ZTE Research)
- GSM – No.1 growth rate in terms of shipments worldwide (ZTE Research)

A Tier-1 vendor for LTE/LTE-A

- **30** LTE commercial networks globally
- Supplying trial LTE networks to over **100** operators worldwide
- **8** networks have been commercially launched as of April 2012

**New LTE Contracts as of April 2012**

- Hutchison Telecom
- SoftBank
- bharti
- telenor
ZTE Wireline: Creating New Opportunities for Clients

1st OLT (Shipment & Market share)

1st DSL/PON CPE (Sales & Shipment)

2nd IP/Ethernet (Market share)

1st PON (Market share)

1st Aggregation Product (Growth rate)

3rd Optical Network (Market share)
ZTE’s Role in Smart Convergence

- Sensors
- Mobile Gateway
- Home Gateway
- Home Multimedia Center
- Base Station
- Switch Network
- The Cloud
- Bearer
Key Analog Technology Enablers

• Communication
  – Higher speed; more bandwidth
  – Multimode; multiband
  – Low power

• Power Management
  – More efficient power delivery
  – Less standby power
  – Better battery management
  – Higher power density
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Analog Opportunities in Communication

• RF
  – Cellular Transceiver
  – Transceiver for Connectivity (Wifi/BT/GPS) IC

• AD/DA
  – Analog baseband ADC for 4G cell phone
  – Ultra high speed ADC for 100G network

• Serdes
  – Backplane
  – Optical
  – Inter-chip connect
Communications Around a Smartphone

- **RF Transceiver**
- **WIFI/BT/GPS**
- **PMIC**
- **CP**
- **AP**
- **Memories**
- **Sensors & Accessories**

- 2G/3G/4G
- Base Station
- GPS
- BT
- WIFI
Cellular RF Transceiver

- Cellular RF Transceiver
  - Multimode
    - 2G: GSM, GPRS, EDGE
    - 3G: UMTS(WCDMA/HSPA/HSPA+), CDMA2000, TD-SCDMA
    - 4G and beyond: TDD-LTE, FDD-LTE, LTE Advanced
  - Multiband
  - MIMO
  - Carrier Aggregation
  - Saw-less
Cellular RF Transceiver
Cellular RF Transceiver

• Major design challenges
  – Integration of 2G into 3G/4G
  – Reconfigurable, easy-to-share channels
  – High channel bandwidth (up to 100Mhz)
  – Carrier frequency spreading from 600Mhz to 2.6Ghz
  – Saw-less
  – Spur Control
Analog Baseband ADC

- Higher data speed requires higher bandwidth (20Mhz or more)
- Better spectral efficiency requires better resolution (12bits or more)
- Low power
- Continuous DS or pipeline

Data Rate (b/s)

- GSM, GPRS, EDGE, CDMA, etc
- WCDMA, HSPA, CDMA2000, TD-SCDMA, etc
- TD-LTE, FDD-LTE, HSPA+, LTE Advanced, etc

2G & 2.5G
3G
4G & Beyond
ADC for 100G Network

- Sampling rate: 50Gs/s or more
- Resolution 8bit (~6bit ENOB)
- Bandwidth: 15Ghz or more
- SAR or Pipeline
- 65nm or below

High capacity waveform for 100G WDM
Serdes

- Optical: 10G -> 20G
- Backplane: 3G -> 6G -> 10G
- Inter-chip: 5G, low power
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Analog Opportunities in Power Design

• Information technology helps to increase the energy efficiency in the traditional world
• Content (information) creation, delivery and consumption all require energy
• No limit in sight for content creation
• Data generation currently outpaces the efficiency improvement for data processing
Analog Opportunities in Power Design

• Terminal
  – Power management
  – Charging/Battery management
  – LED backlight, flash

• System
  – AC/DC
  – DC/DC
Power management Concept

- Adaptive Voltage and Frequency Control
  - PVT sensors sense the working condition and feed the engine to find the optimum supply and clock
  - PMU adjust the supply and clock accordingly
PMIC for Mobile Handsets

• DCDC
  – 2~6 bucks: 1A~3A, DVS
  – 1boost: LED backlight driver
• LDO
  – 10~20 channels
  – Low noise requirement on RF supplies
• Charger
  – Linear charger for sub 1A charging current
  – Switching charger for 1A~2A charging current
• Housekeeping
  – POR, RTC, etc.
• Others
  – Audio Codec
  – USB Phy
  – Touch screen control
PMIC for Mobile Handsets

- Feature Phone PMIC
  - 2 Buck DCDC with DVS
  - 12 LDO
  - Integrated Charger
  - Integrated Audio Codec and PA
  - 10bit General Purpose ADC
  - Power on/down sequence control
  - Real Time Clock
  - I2C Interface
  - LED, Motor Drive, etc.
PMIC for Mobile Handsets

• Design Challenges
  – DCDC:
    • efficiency (both high and low load), standby power,
    • output adjustment resolution and response time
    • Cross interference
  – LDO: low noise, low standby power
  – Overall efficiency and heat management
  – Low cost
PMIC for Set-top box

- DCDC buck
  - 12v to 1.2v/below (Core), DVS, 3A
  - 12v to 5v (accessories), 3A
  - 12v to 1.8v/1.5v (DDR), 1.5A
- LDO
  - 5V to 3.3v/2.5v/1.8v, hundreds of mA
- Power on/down sequence control
- Digital interface
- High efficiency, low standby power
- Low cost
PMIC for Set-top box

- Design challenges
  - DCDC efficiency
  - Heat management
  - Efficient standby supplies (Energy Star)
  - Low cost
Switching Charger

Lithium Battery Charging Profile

- Voltage
- Current
- Time

Current (A)

Battery Capacity (mA*Hour)

- Smartphone
- UFI
- Tablet

4 Hours
Switching Charger

- Design Challenges
  - Loop stability under various charging conditions
  - Efficiency and heat management
  - Fast charging
Wireless charging

- WPC Standard: Qi
- ~100khz
- Pros: convenience
- Cons: efficiency, charging current, convenience
Powering the Data Center

- Smart convergence drives the growth of data centers
- Densely clustered servers require huge amount of power (1~20kw/rack)
- A typical power plant (coal or hydraulic) outputs ~100MW
Powering the Data Center

• For every W delivered to the IT equipment, equal amount of wattage is required for the air conditioning
• Low power design for processor and other data processing unit
• Size does matter for the power delivering modules
• Efficiency is important for heat and cost concerns
• Need components to work under higher temperature

Source: “Guidelines for Specification of Data Center Power Density”, APC Whitepaper #120
High Current DCDC Power Module

- Monolithic integration of DCDC controller and driver
- High efficiency and low thermal resistance
- Small form factor of inductors, capacitors, etc.
- High reliability
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Conclusions

• Exciting analog opportunities from smart convergence, especially in communication and power
• Challenges to be met by design innovations as well as the advancement in processing technologies
• ZTE has been and will continue to be one of the most prominent players
Thank you