Mobile Systems
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Forward Looking Statements

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Mobile Systems Market Opportunity

New Markets

PMIC & Chargers
- IoT
- Computing
  - Gaming
  - Storage
- Automotive

Haptics Market
- Computing
- Gaming

Mobile Systems SAM ($B)

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<thead>
<tr>
<th></th>
<th>2017</th>
<th>2021</th>
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<tbody>
<tr>
<td>PMICs and Charger ICs</td>
<td>$5.5B</td>
<td>$6.2B</td>
</tr>
<tr>
<td>Haptics</td>
<td>+3% CAGR</td>
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Source: 2018 Gartner & Dialog internal
### Dialog is at the Forefront of PMIC Technology

- Investing in leading power-efficient technologies
- Integration of system functions including haptics & low-noise power management

### New Product Development

- Highly integrated PMICs
- Ultra-high efficiency in-device chargers
- Nanopower power management
- Haptics

### Focused Partnerships for Custom PMIC Platforms

- Diversifying application areas to accelerate revenue growth
- Demonstrated value proposition: performance, BoM cost, efficiency
Power Management Leadership

Understanding Technology Trends Before They Happen

2013  Announced the DA9210 scalable PMIC for multicore processors
      ▪ Industry leading 12A Multiphase architecture

2015  Introduced the DA9214 flagship PMIC
      ▪ 20A Multiphase

2017  World’s first 10A, 98% efficient inductor-less power converter DA9313

2017  World’s first wall-to-battery fast charging solution with adaptive direct charging DA9318

2018  Industry’s first Nanopower PMICs for IoT applications with dynamic voltage scaling DA9230 & DA9231
Ongoing Relationship with Apple

Relationship expanding into new product categories

PMIC

- Dialog to retain revenue and gross profit from all in-production products shipping to Apple
- Dialog to continue shipping current generation of main PMICs to Apple
- Dialog expects to continue shipping current and future generations of sub-PMICs for all platforms to Apple

Product Extensions

- Awarded a broad range of new contracts for the development and supply of power management, audio subsystem, charging and other mixed-signal integrated circuits
- Revenue from new contracts is expected to be realized starting in 2019 and accelerate in 2020
- Dialog expects growth from collaboration on future projects with Apple beyond announced contracts
- Targeting growth CAGR of 30%-35% across ongoing Apple business from 2018-2022
Tier One Customer Success

Focused Customer Partnerships

- Samsung Charger
- Toshiba PMIC
- Canon PMIC
- Oppo PMIC
- Bosch PMIC
- Fossil PMIC
# Mobile Device Trends

## Fast Charging
- Required with increasing smartphone usage and larger battery sizes

## Increasing Battery Life for Always-On Applications
- Most important feature for consumer adoption

## HD Haptics
- Enhancing user experience
PMIC Design Challenges

SoC Process Migration from 10nm to 7nm

- Lower voltages
- Higher currents
- Additional power outputs required for new functionality

PMIC Requirements

- High current, high density multiphase core regulators
- Low noise power supplies
- Integrated audio and/or haptics
A Broad Product Portfolio to Serve all Customer Power Needs

From Nanopower to High Performance Computing

- Ultimate Efficiency
- Best Power Density
- Super Converter
- Lowest Heat-up
- Less Inductors
- Less Capacitors
- Nanopower

- IoT PMU
- High Frequency Buck
- Core Regulator
- Battery Charger
- Bus Converter
- Automotive Regulator
- Current Doubler

Power:
- 1 µW
- 1W
- 10W
- 100W

Innovation Award 2017
Demand for Performance

- Average daily smart phone usage: 3hrs 20mins*
- Mobile processor performance: 10x in 7 years

Cost of Performance

- Battery capacity needs to increase with emerging smartphone usage & CPU performance
- 3000mAh - 4000mAh batteries typical but these larger batteries take hours to charge

Industry Response

- USB-C connector increase current 1.5A to 3.0A
- Adoption of fast charging technology

*Source: Kleiner Perkins

Battery Fast Charge Speed

Source: Tom’s Guide
iPhones tested with optional 29-watt adapter and USB-C to Lightning cable.
Fast Charging Application: Adaptive Direct Charging

High Performance Innovation

AC/DC adaptor outputs twice the battery voltage

DA9318L delivers double the adaptor current to the battery

Device temperature < 40°C at 6A charging current

2X

Travel Adaptor

Standard 3A USB cable & connector lowers system cost by 35%

12 2018 Capital Markets Day © 2018 Dialog Semiconductor
Fast Charging Application: Adaptive Direct Charging for Two-Cell Products

Industry Moving to Two-Cell Architecture

Benefit of Two-Cell Architecture

- Can charge a battery twice as fast for the same level of charging current
- Full charging in under one hour achieved by Dialog customers

Design Challenge

- All phone power circuitry designed for single Li-Ion battery

Dialog Solution

- High-efficiency switched capacitor, DA9313, converter enabling simple phone architecture change from single Li-Ion battery to two-cell
Custom PMIC Products: Game Consoles and Controllers

Application: Game Controller

Customer Design Challenge

- Required integration of multiple functions in a single PMIC
  - Battery charger
  - High number of DC-DC power outputs (>10)
  - Haptics driver

Dialog Value Proposition

- Smallest solution size
- Highest efficiency DC-DC buck regulators
- Low noise linear regulators

2017 Game Console Market Share

49MU Shipped with 2-3 Controllers per Console

- Sony Playstation 4: 42%
- Nintendo Switch: 25%
- Xbox One: 18%
- Ninteddo 3DS: 13%
- Others: 2%

Source: 2018 Gartner
Computing & Storage: Solid State Drive (SSD)

PMIC for flash and SSD Controller

Customer Design Challenge

- Fast transient response
- Lowest solution cost
- Short development cycle

Dialog Value Proposition

- High current DC-DC regulators exceed transient performance requirements while providing lowest BoM cost
- Global design teams provide close customer collaboration to meet required schedule

HDD and SSD Market Units (M)

Source: IDC December 2017
Customer Design Challenge

- Complex power sequencing requirements
- Need solution with flexibility for re-use
- Best in-class quality and reliability

Dialog Value Proposition

- Configurable architecture via digital interface
- Single integrated power solution for reuse in multiple platforms
- Strong automotive quality track record

Power Management SAM ($M)

Source: Databeans Q218, Bosch, Aptiv
Nanopower Power Management

Design Requirements

Maximize battery life
- Reduce frequency of charging for rechargeable systems

Reduce solution size
- Smaller form factors

Minimize product cost
Nanopower Power Management Application: Hybrid Smartwatch

DA9070: Configurable Nanopower PMIC

Customer Design Challenge

- Small solution size and external component height
- Need solution for rechargeable Li-Ion battery as previous generation used coin-cell battery

Dialog Value Proposition

- Complete integration of all power management functions including battery charger & fuel gauge
- Configurable power states extend battery life
- Seamless integration into platform including Dialog’s Bluetooth low energy SoC
Haptics

Market Developments

- Focus on user experience shifting towards high definition haptics
- Key feature for gaming and VR systems
- Android OS Oreo now opening up app developers to stream custom, real time haptic patterns
  - Smartphones use haptics like subwoofer
Haptics Application: Gaming

**DA7280: High Definition Haptics**

**Customer Design Challenge**
- Drive stronger and sharper haptic feedback
- Upgrade from “slow, spinning” rumbles to haptics that provide differentiated sensations based on in-game actions and environments

**Dialog Value Proposition**
- Wide bandwidth haptics driver enables crisp feedback for entire range of gaming experiences
- Extended battery life
  - Standby power is 80% lower than competition
  - Optimized drive signal provides the same haptic strength with only 25% of the power consumption
Key Takeaways

- Extending technology leadership into IoT, Gaming, Storage, Automotive and Charging markets
- Highly differentiated technologies defined by high power-efficiency
- A strengthened relationship with Apple
Powering the Smart Connected Future

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