AUTOMOTIVE STRATEGY

MAY 19, 2023
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ANALOG AND POWER SOLUTIONS GROUP
RENEAS ELECTRONICS CORPORATION
MARKET OUTLOOK

Content Growth continues to increase per Vehicle with autonomous, electrification and enhanced architectures

Global light vehicle production

Source: LMC Automotive Global Light Vehicle Forecast (Q1 2023)

Content per vehicle

Source: TechInsights Automotive Semiconductor Demand Forecast 2020 to 2029 – January 2023

TAM of auto semiconductor

Source: TechInsights Automotive Semiconductor Demand Forecast 2020 to 2029 – January 2023

TAM is defined by Renesas  FX 1USD=100JPY
FINANCIALS AT A GLANCE

- **Revenue**
  - 2020: 3,000 (oku yen)
  - 2021: 6,000 (oku yen)
  - 2022: 9,000 (oku yen)

- **GM**
  - 2020: 30%
  - 2021: 50%
  - 2022: 70%

- **CAGR**
  - 26%

**Categories**

- **Control**
  - 26% CAGR

- **Cockpit/Others**
  - 31% CAGR

- **ADAS/EV/Gateway**
  - 49% CAGR
OVERVIEW OF AUTOMOTIVE BUSINESS DIRECTION

Focus applications
- E/E architecture
- AD / ADAS
- EV

Going broader
- Enhance Cross SG collaborations to define products that can be used in both segments
- Automotive assets: MCU, SoC, Analog, Power
- Industrial, Infrastructure and IoT assets
E/E ARCHITECTURE
RENESAS GROWTH IN E/E ARCHITECTURE MARKET

Growth expected by expanding the processor and product portfolio

Revenue growth

SAM growth

Source: Renesas Estimation based on TechInsights

CAGR 43%

CAGR 16%
ACCELERATING GROWTH IN E/E ARCHITECTURE

Investment and leadership in processors

Low power entry processing to high performance computing
Scalable HW, Reusable SW, Open, Broad ecosystem

Expand & Evolve

HPC & AI UX
Cross Domain Compute
Sensor/Actuator
Zonal Domain
Introducing Arm® in control apps

Automotive processor SAM*

2.2x

Today
Long term

*TechInsight_1Q23
SHIFT LEFT: VIRTUAL UNIFIED ENVIRONMENT

- Virtual cloud development environment enables early SW/HW co-design
- Accelerating application development & product market introduction

**Customer pain points**

<table>
<thead>
<tr>
<th>Real environment</th>
<th>Virtual SDK for cloud environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>System problems are found at the later stage</td>
<td>SW-first approach with multi-abstract simulators</td>
</tr>
<tr>
<td>Costly and time-consuming due to rework</td>
<td></td>
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</table>

Early stage

- HW Dev
- SW Dev
- System validation

Later stage

- Early stage
- HW Dev
- SW Dev
- System validation
- Later stage

Rework

- System problems

Distributed environments on premise

**Renesas solution**

<table>
<thead>
<tr>
<th>Cloud expertise</th>
<th>Cloud environment configurator</th>
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<tr>
<td>Need knowledge to build cloud environment</td>
<td>Automatically build cloud environment</td>
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**Virtual SDK for cloud environment**

- High speed Sim
- High accurate Sim
- Real SoC

**Real environment**

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**Cloud expertise**

- System problems are found at the later stage
- Costly and time-consuming due to rework
- Need knowledge to build cloud environment

**Real SoC**

- HW
- SW
- System problems

**Virtual SDK**

- Reference applications
- MW/Drivers
- BSP

**Single unified environment on cloud**

- Early stage
- Later stage

- SW
- HW
AD/ADAS
RENESAS GROWTH IN AD/ADAS MARKET

Revenue increase expected by strengthening high-performance compute, sensors, and product portfolio

Source: Renesas Estimation based on TechInsights

CAGR 36%
CAGR 21%
ADVANCING RADAR SOLUTIONS WITH SUPERIOR DIGITAL ASSETS

More digital integration and higher compute power for ADAS/AD continuous challenges

- Radar industrial grade
- Steradian integration

- Radar automotive grade samples delivery
- Multiple customers engagement in progress
- PoC with R-Car

- Satellite radar*
- Smart radar**

2022 | 2023 | 2024-2027

*front-end pairs with a separate SoC
**front-end and SoC integrated in 1 device
TRANSFORMING ADAS/AD WITH AI INVESTMENT

- Enhance high performance compute
- Improve development environment to simplify customer journey.

### Customer experiences

**Increase compute w/ flexibility**
- Enhance high performance compute
- Improve development environment to simplify customer journey.

**Reduced development cost and TAT**
- Cloud based development tools
  - OEM/Tier1 single point of access to all dev’t tools, SW, and AI toolchain
  - Easily enable global dev’t teams

**Changing network architecture**
- Agile network support
  - Continuous improvement for network support, including new networks
  - Cycle: Simulate, Port to HW, Optimize

### Renesas initiatives

**Next Gen AI performance**
- State-of-the-art performance with flexible HW accelerators
- Ease of use with a complete SW suite

**Cloud based development tools**
- OEM/Tier1 single point of access to all dev’t tools, SW, and AI toolchain
- Easily enable global dev’t teams

**Agile network support**
- Continuous improvement for network support, including new networks
- Cycle: Simulate, Port to HW, Optimize
EV
RENESSAS GROWTH IN EV MARKET

Accelerate market growth by investment in optimized systems as well as power solutions

Revenue growth

SAM growth

CAGR 36%

CAGR 24%

Source: Renesas Estimation based on TechInsights
OPTIMIZED APPLICATIONS SOLUTIONS FOR EV

Turnkey solutions to meet the demand of emerging EV manufacturers.

Key buying factors
- Turnkey solutions
- Lower development cost
- Faster time to market

Customer benefit
- System-level optimized
- Turnkey solution

New players in EV field
- Emerging markets
- Emerging OEMs

Optimized solutions for EV
- EV inverter reference solution
- EV inverter model & SW
- BMS model & SW
- Battery management
- FuSa for EV inverter
- Motor generator system
- 12/48V DCDC converter
- Monitoring function extension (motor)
- Inverter for 2/3 wheeler traction motor
- EV inverter reference solution w/ IPS
- 48V auxiliary inverter
- Wireless BMS

...more solutions coming soon
COMPREHENSIVE PRODUCT PORTFOLIO FOR EV
Innovative technology enabling highest range, highest power efficiency

Inverter
- State of the art IGBT/SiC enabling more range

On-Board charger
- Advanced GDU providing lower power losses and faster charging

DC/DC
- Total solutions provide higher efficiency

MCU + PMIC + Sensing
- Scalable portfolio for any sub-system

BMS/wBMS
- Leading edge HW Systems and SW algorithms
- Best in class lifetime accuracy
- Pack SOH (%): 69
- Pack SOC (%): 84

ADDRESSING MULTIPLE EV SYSTEM TREND: X-IN-1

Leveraging MCU vast lineup, wide analog & power portfolio and system-level knowledge to address different system configurations.

Independent multiple ECUs

Integrated ECU functions in E-Axle

X-in-1: different system aggregation to shrink motor size
POWER: STRATEGY ACCELERATION

- Accelerate investment for capacity
  - New technologies for enhanced efficiency and performance

### 300mm IGBT
- Next-gen IGBT (AE5) development on track
  - K6 300mm Fab on track (Mass production 2025)
  - Started sampling from 2022

### SiC
- New investment for in-house fab (Mass production 2025)
  - Best in class performance for EV inverter
  - Automotive qualified (Working sample 3Q/2023)

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<tr>
<th>Technology generation</th>
<th>Competitor A</th>
<th>Competitor B</th>
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<tr>
<td>AE3</td>
<td>Red</td>
<td>Pink</td>
</tr>
<tr>
<td>AE4</td>
<td>Purple</td>
<td>Pink</td>
</tr>
<tr>
<td>AE5</td>
<td>Purple</td>
<td>Blue</td>
</tr>
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Efficiency performance Trend

- Competitor A
- Competitor B

### Product line up

<table>
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<tr>
<th>Voltage ratings (V)</th>
<th>650-750</th>
<th>1,200</th>
<th>1,700</th>
</tr>
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<td>On-state resistance (mOhm)</td>
<td>15</td>
<td>10-500</td>
<td>1,000</td>
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Focus applications

- AE3
- AE4
- AE5

### Efficiency performance

- On-state Resistance (mOhm)

- Total loss: [a.u.]

- Switching loss: [a.u.]

- High Performance

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CROSS-SELL/CONNECTIVITY OPPORTUNITY
MAXIMIZING RENESAS GROWTH
LEVERAGING ASSETS FROM NON-AUTO TO AUTO

Using IP from industrial and consumer electronics to create new business and growth
CONNECTED TECHNOLOGY FROM NON-AUTO TO AUTO

By auto-qualifying connectivity ICs more applications can be addressed
SUMMARY

- Investing in high performance compute
- Introduction of Arm based MCU processors
- Enhance software, AI and infrastructure
- Expand power devices portfolio and invest in manufacturing
- Leverage non-auto technology and IP assets to auto
THANK YOU
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