This presentation contains forward-looking statements under the Private Securities Litigation Reform Act of 1995 including those relating to Rambus’ expectations regarding product and service offerings, the expected benefits of our merger, acquisition and divestiture activity, growth for 2019 and financial guidance for the third quarter of 2019, including revenue, operating costs and expenses, earnings per share and estimated, fixed, long-term projected tax rates. Such forward-looking statements are based on current expectations, estimates and projections, management’s beliefs and certain assumptions made by Rambus’ management. Actual results may differ materially. Our business is subject to a number of risks which are described more fully in our periodic reports filed with the Securities and Exchange Commission. Rambus undertakes no obligation to update forward-looking statements to reflect events or circumstances after the date hereof.

Effective January 1, 2018, the Company adopted Accounting Standards Update No. 2014-09, Revenue from Contracts with Customers in ASC 606. The adoption of ASC 606 materially impacted the timing of revenue recognition for the Company's fixed-fee intellectual property licensing arrangements. The adoption of ASC 606 did not have a material impact on the Company's other revenue streams, net cash provided by operating activities, or its underlying financial position.

This presentation contains non-GAAP financial measures, including operating costs and expenses, operating margin, operating income (loss) and net income (loss). In computing these non-GAAP financial measures, stock-based compensation expenses, acquisition-related transaction costs and retention bonus expense, amortization expenses, non-cash interest expense and certain other one-time adjustments were considered. The non-GAAP financial measures should not be considered a substitute for, or superior to, financial measures calculated in accordance with GAAP, and the financial results calculated in accordance with GAAP and reconciliations from these results should be carefully evaluated. Management believes the non-GAAP financial measures are appropriate for both its own assessment of, and to show investors, how the Company’s performance compares to other periods. Reconciliation from GAAP to non-GAAP results are made available and more fully described on our website as well as the back of this deck and in the earnings release.
Rambus at a Glance

### Market Megatrends

- Renaissance of computer architectures, **memory critical and driving innovation**
- Internet giants moving **SoC design in-house**, enabling TAM expansion
- **Secure semiconductor HW, SW and supply chain essential** for global commerce

### Rambus Offerings

<table>
<thead>
<tr>
<th>Category</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>Licenses</td>
</tr>
<tr>
<td>IP Cores</td>
<td>Memory &amp; SerDes PHYs; Secure Cores</td>
</tr>
<tr>
<td>Chips</td>
<td>Memory Buffers</td>
</tr>
<tr>
<td>Key Management</td>
<td>Secure Supply Chain Provisioning</td>
</tr>
<tr>
<td>High-speed IO &amp; DPA Countermeasures</td>
<td></td>
</tr>
</tbody>
</table>

### Financial Performance

**Revenue**
- Q219: $58.3M
- 2018: $231.2M
  - $401.1M (ASC 605)

**Cash from Operations**
- Q219: $38.7M
- 2018: $87.1M
All Growth Markets Are Impacted by These Megatrends

Artificial Intelligence
Accurate training requires enormous amounts of data - memory bandwidth is key

Data Center
Explosion of data from connect devices and real-time processing needs pushing demands on interconnects to move data faster

Autonomous/ADAS Automotive
Real-time decisions from multiple inputs increase demand on processing and trust in the data

Edge Compute (5G)
Near edge (base stations) drive performance and far edge (gateways and routers) demand power efficiency and trust

Internet of Things
Billions of connected endpoints make device-level security critical to enabling trust across the ecosystem

Defense
Trusted device authentication is critical to global supply chain
Semiconductor Industry Ecosystem Built on Leading-Edge IP
Rambus Semiconductor Solutions Built on Leading-Edge IP

- **High growth; differentiated margin**
  - Provisioning
  - Secure Supply Chain Provisioning
- **High margin; predictable; fuels investment**
  - IP Cores
  - High-speed Interfaces and Embedded Security
- **Architecture License**
  - Foundational Patents
Rambus Solutions Throughout the Data Center

Memory Interface IP

SerDes Interface IP

Secure Cores

Buffer Chips

CryptoManager Root of Trust

Custom RISC-V CPU
Secure Memory
Crypto Accelerators (AES, SHA, others…)

Networking Line Card Example

Backplane Interface

SerDes
Serial Links
Memory
SerDes

Rambus Solutions Throughout the Data Center

Registered DIMM (RDIMM)
Load Reduced DIMM (LRDIMM)
RCD
DB DB DB DB DB DB DB DB DB DB DB
Register Clock Driver (RCD)
Data Buffer

Register
Clock Driver
(RCD)

Interposer

Logic Die

PHY

SOC

Package

Interposer

PHY

HBM DRAM

HBM DRAM

HBM DRAM

HBM DRAM

Logic Die

PHY

Interposer

PHY

HBM

SerDes

SerDes

SerDes

ASIC

ASIC

ASIC

ASIC

ASIC

ASIC

ASIC

ASIC

ASIC

ASIC

ASIC

ASIC
Delivering More Data, Faster: High-speed IP Cores and Chips

High-speed memory and SerDes interfaces are critical for performance in data-intensive applications.

Memory buffers are the key to expanding capacity for data centers and high-performance computing.

SAM ($M)

2017 SAM | 2019 SAM | 2021 SAM
Architecture Licenses and Cores | Chips

Revenue Growth

2015 | 2016 | 2017 | 2018
IP Cores | Chips

65% CAGR
54% CAGR
Keeping Data Safe: Secure Silicon IP and Provisioning

Embedding secure roots of trust in silicon and siloing secure processing from general processing is critical to creating trust across connected devices.
Rambus R&D Drives Datacenter Innovation in Foundational Areas

- Extending the performance of DRAM for future generations
- Next-generation hybrid memory subsystems for cost-effective performance
- Application-specific memory solutions for Artificial Intelligence and Machine Learning
Executing on Strategy to Focus on Semiconductors

Announcement of agreement to sell Payments and Ticketing Business to Visa

Announcement of agreement to acquire leading digital controller provider, Northwest Logic
Predictable Revenue Base

Large portion of our revenue is fixed & predictable

- Continue to leverage our high margin historic businesses to fuel growth in adjacent areas
- Revenue does not reflect billings related to fixed-fee licensing arrangements

<table>
<thead>
<tr>
<th>($)</th>
<th>Q2’18</th>
<th>Q3’18</th>
<th>Q4’18</th>
<th>Q1’19</th>
<th>Q2’19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licensing Billings</td>
<td>$73.2</td>
<td>$75.4</td>
<td>$76.7</td>
<td>$75.4</td>
<td>$64.9</td>
</tr>
<tr>
<td>Royalty Revenue</td>
<td>$30.0</td>
<td>$33.6</td>
<td>$45.4</td>
<td>$24.8</td>
<td>$27.1</td>
</tr>
<tr>
<td>Delta</td>
<td>$43.2</td>
<td>$41.8</td>
<td>$31.3</td>
<td>$50.6</td>
<td>$37.8</td>
</tr>
</tbody>
</table>
## Non-GAAP Income Statement

<table>
<thead>
<tr>
<th></th>
<th>ASC 606 Q2 2018</th>
<th>ASC 606 Q3 2018</th>
<th>ASC 606 Q4 2018</th>
<th>ASC 606 Q1 2019</th>
<th>ASC 606 Q2 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td>$56.5</td>
<td>$59.8</td>
<td>$68.5</td>
<td>$48.4</td>
<td>$58.3</td>
</tr>
<tr>
<td><strong>Total Operating Expenses¹</strong></td>
<td>$66.8</td>
<td>$67.6</td>
<td>$61.6</td>
<td>$67.3</td>
<td>$64.1</td>
</tr>
<tr>
<td><strong>Operating Income (Loss)¹</strong></td>
<td>($10.3)</td>
<td>($7.9)</td>
<td>$6.9</td>
<td>($18.9)</td>
<td>($5.8)</td>
</tr>
<tr>
<td><strong>Cash from Operations</strong></td>
<td>$3.6</td>
<td>$31.6</td>
<td>$35.1</td>
<td>$28.8</td>
<td>$38.7</td>
</tr>
</tbody>
</table>

Driven by the structure and timing of key deals. Year over year growth from product revenue, royalties and incremental licensing agreements.

Managed expenses through refocus on core growth initiatives. Adoption of ASC 842 in Q1’19 increased operating expense with corresponding decrease in interest expense.

Operating results under ASC 606 do not reflect significant cash flow from fixed-fee licensing arrangements.

Consistent performance in line with expectations.

¹Please refer to reconciliations of non-GAAP financial measures included in this presentation and in our earnings release.
## Financial Strength

<table>
<thead>
<tr>
<th>In Millions</th>
<th>Q2 2018</th>
<th>Q3 2018</th>
<th>Q4 2018</th>
<th>Q1 2019</th>
<th>Q2 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cash &amp; Marketable Securities</td>
<td>$298.3</td>
<td>$248.2</td>
<td>$277.8</td>
<td>$305.9</td>
<td>$337.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issued $172.5M convert and extinguished $56.8M of debt in Q4 2017 and $81.2M of debt in Q3 2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Assets</td>
<td>$1,525.8</td>
<td>$1,344.0</td>
<td>$1,361.1</td>
<td>$1,321.4</td>
<td>$1,312.2</td>
</tr>
<tr>
<td>Stockholders’ Equity</td>
<td>$1,105.5</td>
<td>$1,008.3</td>
<td>$1,012.1</td>
<td>$999.9</td>
<td>$973.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$629M and $597M contract assets in Q1 and Q2 2019 respectively, related to ASC 606 adoption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash from Operations</td>
<td>$3.6</td>
<td>$31.6</td>
<td>$35.1</td>
<td>$28.8</td>
<td>$38.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continued strong cash performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Strong Cash From Operations

Low Capital Expenditure, Consistent Return to Shareholders

- Predictable revenue stream provides consistent cash flow
- Returned $200M of cash to shareholders from 2015 through 2018 through Accelerated Share Repurchase programs

Cash Flow from Operations
Free Cash Flow
Return of Capital (Share Buyback)
Free Cash Flow/share

Data • Faster • Safer

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Rambus Investment Summary

• **Focus on core strength in semiconductor**
  Targeting high-growth data center, networking, artificial intelligence, IoT and automotive markets

• **Optimizing for operational efficiency and profitability**
  Leveraging synergies across businesses and customer base

• **Strong balance sheet and cash generation**
  Supports strategic initiatives to amplify our market and technology position

• **Large portion of cash flows are predictable and committed long term**
Thank you
## Reconciliation of Non-GAAP Financial Measures

### Net Income (Loss) in Millions

<table>
<thead>
<tr>
<th></th>
<th>Q2 2018 (ASC 606)</th>
<th>Q3 2018 (ASC 606)</th>
<th>Q4 2018 (ASC 606)</th>
<th>Q1 2019 (ASC 606)</th>
<th>Q2 2019 (ASC 606)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAAP Net Loss</td>
<td>($15)</td>
<td>($105)</td>
<td>($2)</td>
<td>($27)</td>
<td>$(37)</td>
</tr>
<tr>
<td><strong>Adjustments:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock-based compensation</td>
<td>$2</td>
<td>$6</td>
<td>$6</td>
<td>$7</td>
<td>$7</td>
</tr>
<tr>
<td>Acquisition-related costs</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Amortization</td>
<td>$9</td>
<td>$5</td>
<td>$5</td>
<td>$5</td>
<td>$5</td>
</tr>
<tr>
<td>Restructuring charges (recoveries)</td>
<td>($1)</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$3</td>
</tr>
<tr>
<td>Non-cash interest expense</td>
<td>$3</td>
<td>$2</td>
<td>$2</td>
<td>$2</td>
<td>$2</td>
</tr>
<tr>
<td>Provision for (benefit from) income taxes</td>
<td>($0)</td>
<td>$90</td>
<td>($2)</td>
<td>$3</td>
<td>$4</td>
</tr>
<tr>
<td>Impairment on assets held for sale</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$17</td>
</tr>
<tr>
<td>Escrow settlement refund</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>($0)</td>
</tr>
<tr>
<td><strong>Non-GAAP Net Income (Loss)</strong></td>
<td>($3)</td>
<td>($1)</td>
<td>$9</td>
<td>($9)</td>
<td>$1</td>
</tr>
</tbody>
</table>

### Operating Income (Loss) in Millions

<table>
<thead>
<tr>
<th></th>
<th>Q2 2018 (ASC 606)</th>
<th>Q3 2018 (ASC 606)</th>
<th>Q4 2018 (ASC 606)</th>
<th>Q1 2019 (ASC 606)</th>
<th>Q2 2019 (ASC 606)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAAP Operating Loss</td>
<td>($20)</td>
<td>($19)</td>
<td>($4)</td>
<td>($31)</td>
<td>($37)</td>
</tr>
<tr>
<td><strong>Adjustments:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock-based compensation</td>
<td>$2</td>
<td>$6</td>
<td>$6</td>
<td>$7</td>
<td>$7</td>
</tr>
<tr>
<td>Acquisition-related costs</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Amortization</td>
<td>$9</td>
<td>$5</td>
<td>$5</td>
<td>$5</td>
<td>$5</td>
</tr>
<tr>
<td>Restructuring charges (recoveries)</td>
<td>($1)</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$3</td>
</tr>
<tr>
<td>Impairment on assets held for sale</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$17</td>
</tr>
<tr>
<td>Escrow settlement refund</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>($0)</td>
</tr>
<tr>
<td><strong>Non-GAAP Operating Income (Loss)</strong></td>
<td>($10)</td>
<td>($8)</td>
<td>$7</td>
<td>($19)</td>
<td>($6)</td>
</tr>
<tr>
<td>Depreciation</td>
<td>$3</td>
<td>$3</td>
<td>$3</td>
<td>$3</td>
<td>$3</td>
</tr>
<tr>
<td><strong>Adjusted EBITDA</strong></td>
<td>($7)</td>
<td>($5)</td>
<td>$10</td>
<td>($16)</td>
<td>($3)</td>
</tr>
</tbody>
</table>

Certain amounts may be off $1.0M due to rounding.
## GAAP & Non-GAAP P&L

<table>
<thead>
<tr>
<th>ASC 606</th>
<th>GAAP Actual Q2'19</th>
<th>Pro Forma Actual Q2'19</th>
<th>Delta to GAAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>58.3</td>
<td>58.3</td>
<td>-</td>
</tr>
<tr>
<td>Cost of revenue</td>
<td>13.0</td>
<td>9.2</td>
<td>(3.8)</td>
</tr>
<tr>
<td>Research and development</td>
<td>37.9</td>
<td>34.8</td>
<td>(3.1)</td>
</tr>
<tr>
<td>Sales, general and administrative</td>
<td>24.9</td>
<td>20.1</td>
<td>(4.8)</td>
</tr>
<tr>
<td>Impairment of assets held for sale</td>
<td>17.0</td>
<td>0.0</td>
<td>(17.0)</td>
</tr>
<tr>
<td>Restructuring charges</td>
<td>2.5</td>
<td>0.0</td>
<td>(2.5)</td>
</tr>
<tr>
<td>Total operating cost and expenses</td>
<td>95.3</td>
<td>64.1</td>
<td>(31.2)</td>
</tr>
<tr>
<td>Operating income (loss)</td>
<td>(37.0)</td>
<td>(5.8)</td>
<td>31.2</td>
</tr>
<tr>
<td>Interest and other income (expense), net</td>
<td>4.4</td>
<td>6.1</td>
<td>1.7</td>
</tr>
<tr>
<td>Income (loss) before income taxes</td>
<td>(32.6)</td>
<td>0.3</td>
<td>32.9</td>
</tr>
<tr>
<td>Provision for income taxes</td>
<td>4.4</td>
<td>0.1</td>
<td>(4.3)</td>
</tr>
<tr>
<td>Net income (loss)</td>
<td>(37.0)</td>
<td>0.2</td>
<td>37.2</td>
</tr>
</tbody>
</table>

Certain amounts may be off $0.1M due to rounding.
## Non-GAAP Provision for (Benefit from) Income Taxes

<table>
<thead>
<tr>
<th>606 In $ Millions</th>
<th>Actual Q2'19</th>
<th>Actual Q1'19</th>
<th>Variance QoQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision for income taxes (GAAP)</td>
<td>4.4</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Adjustment to GAAP provision for income taxes</td>
<td>(4.3)</td>
<td>(3.2)</td>
<td></td>
</tr>
<tr>
<td><strong>Non-GAAP provision for (benefit from) income tax</strong></td>
<td><strong>0.1</strong></td>
<td><strong>(2.9)</strong></td>
<td><strong>3.0</strong></td>
</tr>
</tbody>
</table>

### Supplemental Reconciliation of GAAP to Non-GAAP Effective Tax Rate (1)

<table>
<thead>
<tr>
<th></th>
<th>Actual Q2'19</th>
<th>Actual Q1'19</th>
<th>Variance QoQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAAP effective tax rate</td>
<td>(13)%</td>
<td>(1)%</td>
<td></td>
</tr>
<tr>
<td>Adjustment to GAAP effective tax rate</td>
<td>37%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td><strong>Non-GAAP effective tax rate</strong></td>
<td><strong>24%</strong></td>
<td><strong>24%</strong></td>
<td><strong>0%</strong></td>
</tr>
</tbody>
</table>

(1) For purposes of internal forecasting, planning and analyzing future periods that assume net income from operations, the Company estimates a fixed, long-term projected tax rate of approximately 24 percent for 2019, which consists of estimated U.S. federal and state tax rates, and excludes tax rates associated with certain items such as withholding tax, tax credits, deferred tax asset valuation allowance and the release of any deferred tax asset valuation allowance. Accordingly, the Company has applied these tax rates to its non-GAAP financial results for all periods in the relevant year to assist the Company’s planning. Certain amounts may be off by $0.1M due to rounding.
# Revenue Breakdown

## In Millions

<table>
<thead>
<tr>
<th></th>
<th>Rambus</th>
<th>MID</th>
<th>RSD</th>
<th>RLD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1'18</td>
<td>Q2'18</td>
<td>Q3'18</td>
<td>Q4'18</td>
</tr>
<tr>
<td>Royalty Revenue</td>
<td>$21.4</td>
<td>$30.0</td>
<td>$33.6</td>
<td>$45.4</td>
</tr>
<tr>
<td>Product Revenue</td>
<td>$7.3</td>
<td>$8.1</td>
<td>$11.8</td>
<td>$11.5</td>
</tr>
<tr>
<td>Contract and Other Revenue</td>
<td>$17.7</td>
<td>$18.3</td>
<td>$14.4</td>
<td>$11.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$46.4</td>
<td>$56.5</td>
<td>$59.8</td>
<td>$68.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>ASC 606</th>
<th>ASC 606</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royalty Revenue</td>
<td>Q1'18</td>
<td>Q2'18</td>
</tr>
<tr>
<td>Product Revenue</td>
<td>$8.2</td>
<td>$9.1</td>
</tr>
<tr>
<td>Contract and Other Revenue</td>
<td>$8.5</td>
<td>$9.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$34.0</td>
<td>$35.0</td>
</tr>
</tbody>
</table>

---

Certain amounts may be off $0.1M due to rounding.
### Revenue and Licensing Billings

**In Thousands**

<table>
<thead>
<tr>
<th>Rambus</th>
<th>ASC 606</th>
<th>ASC 605</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1'18</td>
<td>Q2'18</td>
</tr>
<tr>
<td>Royalty Revenue</td>
<td>$21,374</td>
<td>$30,049</td>
</tr>
<tr>
<td>Product Revenue</td>
<td>$7,313</td>
<td>$8,087</td>
</tr>
<tr>
<td>Contract and Other Revenue</td>
<td>$17,739</td>
<td>$18,322</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$46,426</td>
<td>$56,458</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rambus</th>
<th>ASC 606</th>
<th>ASC 605</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1'18</td>
<td>Q2'18</td>
</tr>
<tr>
<td>Royalty Revenue</td>
<td>$21,374</td>
<td>$30,049</td>
</tr>
<tr>
<td>Licensing Billings¹</td>
<td>$75,924</td>
<td>$73,210</td>
</tr>
<tr>
<td><strong>Delta</strong></td>
<td>$54,550</td>
<td>$43,161</td>
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<tr>
<th>Rambus</th>
<th>ASC 606</th>
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<tr>
<td>ASC606 Interest Income²</td>
<td>Q1'18</td>
<td>Q2'18</td>
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<tr>
<td></td>
<td>$7,514</td>
<td>$7,041</td>
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¹ Licensing billings is an operational metric that reflects amounts invoiced to our patent and technology licensing customers during the period, as adjusted for certain differences.

² Interest income associated with the significant financing component of licensing agreements as a result of the adoption of ASC 606.
The Data Center

Data • Faster

- **Cores**
  - SerDes PHYs
    - Move data from chip to chip
  - Memory PHYs
    - Move data between chips and memory

- **Chips**
  - Server DIMM Chipsets
    - Enables more capacity at high performance
Optimized for power and area, our line-up of SerDes Interface solutions deliver maximum performance and flexibility for today’s most challenging systems.

**Fully Standards-Compatible**
- Compliant with the latest industry-standard specifications
- Support for multi-modal functionality

**Enhanced Design Flexibility**
- Support for multiple packaging options
- Enhanced margin and yield

**Reduced Power**
- Improved power efficiency
- Lower signaling and stand-by power

**Improved Performance**
- Increased data rates
- Improved bandwidth
- Higher capacity
Rambus High-Speed SerDes PHY Solutions

Complete Solutions: SerDes PHY + Digital Controller

16G
28nm & 14nm
- PCIe 4/3/2
- CEI 11/6
- XFI/XAUI
- SATA
- SAS

28G
14nm
- CEI-28/25/11
- 100/10GbE
- FC28
- XFI/XAUI

56G
10nm
- CEI-56G MR
- CEI-56G LR
- CEI-28/25/11
- 400/100GbE
- PAM-4/NRZ

112G
7nm
- CEI-112G LR
- CEI-56/28/25
- 800/400/200/100GbE
- PAM-4/NRZ

LEAD CUSTOMERS

- Northwest Logic

Integrated tools for easy bring-up and characterization

- Easy-to-use PC Interface
- Interface to 3rd party software
- Pre-defined test scripts
- PHY control settings
- External instrument control
- System characteristics and analysis

LabStation Platform

Digital Controllers

ROAD MAP:
- CEI-112G XSR
Memory PHYs

With their reduced power consumption and industry-leading data rates, our line-up of enhanced memory interface solutions support a broad range of industry standards with improved margin and flexibility.

**Fully Standards-Compatible**  
- Compliant with the latest JEDEC and industry-standard specifications  
- Support for multi-modal functionality

**Enhanced Design Flexibility**  
- Support for multitude packaging options  
- Enhanced margin and yield

**Reduced Power**  
- Improved power efficiency  
- Lower signaling and stand-by power

**Improved Performance**  
- Increased data rates  
- Improved bandwidth  
- Higher capacity
Rambus Memory PHY Solutions

Memory PHY and Digital Controller Solutions

**DDR4/3**
- 28nm & 14nm
- 3200Mbps
- x16 – x72-bits
- 1-4 Ranks
- DFI 4.0

**HBM2**
- 14nm
- 2000Mbps
- 1024-bit
- 2.5D design architecture

**GDDR6**
- 12-16 Gbps
- 2x 16-bit channels

**DDR5 & HBM3**

---

Integrated tools for easy bring-up and characterization

- Easy-to-use PC Interface
- Interface to 3rd party software
- Pre-defined test scripts
- PHY control settings
- External instrument control
- System characteristics and analysis

**LabStation Platform**

---

Digital Controllers

---

Data • Faster • Safer
## Complementary Physical and Digital IP Portfolios

<table>
<thead>
<tr>
<th>Rambus</th>
<th>DDR4</th>
<th>GDDR6</th>
<th>HBM2</th>
<th>PCIe</th>
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<table>
<thead>
<tr>
<th>Northwest Logic</th>
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### Markets

<table>
<thead>
<tr>
<th>Rambus</th>
<th>Data Center</th>
<th>Networking</th>
<th>Edge</th>
<th>Automotive</th>
<th>AI + ML</th>
<th>IoT</th>
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</table>
Built for speed, power efficiency and reliability, the DDRn chipsets for RDIMM, LRDIMM and NVDIMM server modules delivers the top-of-the-line performance and capacity needed to meet the growing demands on enterprise and data center systems.

**Industry-leading Performance**
- Fully-compliant with the latest JEDEC standards
- Operational speeds up to 3200 Mbps

**Enhanced Margin**
- Wide margin I/O design with advanced programmability
- Exceed JEDEC reliability standards for ESD and EOS

**Optimized Power**
- Advanced power management
- Frequency-based, low-power optimization

**Superior Debug and Serviceability**
- Integrated tools for bring-up and debug
- Works out-of-the-box with no BIOS changes required
# Rambus Server DIMM Chipset Solutions

## Server DIMM Chipsets: enabling performance and capacity

<table>
<thead>
<tr>
<th></th>
<th>DDR3</th>
<th>DDR4</th>
<th>NV</th>
<th>DDR5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DB &amp; RCD</strong></td>
<td>Available in production</td>
<td>Available in production</td>
<td>Available in production</td>
<td>Under development</td>
</tr>
<tr>
<td><strong>Jedec Compliant</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Speeds up to</strong></td>
<td>2133</td>
<td>3200</td>
<td>3200</td>
<td>2133</td>
</tr>
<tr>
<td><strong>Multiple OEM</strong></td>
<td>Qualifications</td>
<td>Qualifications</td>
<td>Qualifications</td>
<td>Qualifications</td>
</tr>
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</table>

### Smart tools for easy integration and reduced time to market

- LabStation Platform
- and Buffer BIOS Integration Tool

### Validated solutions with partners

- **Samsung**
- **SK hynix**
- **Micron**
The Mobile Edge

Data • Safer

Embedded Security

Secure Cores
Embedded device protection

CryptoManager Platform
Secure provisioning and key management
Secure Silicon IP

DPA Countermeasures
Cores, Software, and Workstation
- Cores and services
- Accelerate integration & TTM

Anti-Counterfeiting
CryptoFirewall Cores
- Consumable authentication
- Major printer OEMs

Hardware Root of Trust
CryptoManager Root of Trust
- Siloed, layered security co-processor
- Designed with security as the #1 priority, not speed

Cores, Software, and Workstation
- Cores and services
- Accelerate integration & TTM

CryptoManager Root of Trust
- Siloed, layered security co-processor
- Designed with security as the #1 priority, not speed
From security cores to high-performance secure device provisioning, the CryptoManager Security platform is a family of hardware security cores and provisioning infrastructure that creates a trusted path from the SoC manufacturing supply chain to downstream service providers with a complete silicon-to-cloud security solution.

**Improved Profitability**
- Improved time-to-market and reduced inventory waste
- Dynamic SKU and feature management lowers inventory costs
- Reduced operating costs through unified manufacturing and provisioning systems

**Superior Security**
- Provide a robust hardware root-of-trust
- Secure valuable secret keys, identity credentials, intellectual property, and other sensitive data
- Protect against cloning, counterfeiting, and reverse engineering

**Control the Value Chain**
- Actively monitor production status, availability, and inventory levels
- Validate process information through secure logs
- Proven in today’s high-volume manufacturing facilities
Root of Trust: Implementing Trust by Design in Silicon

**Design Freedom**
- Root of trust designed from the bottom up for security
- Control all implementation starting with open RISC-V Instruction Set Architecture

**Siloed**
- Separate general and secure processing
- Optimize independently for performance and security

**Layered Security**
- Strongest security enforced in hardware at inner layer
- Outer layers are more flexible, but less trusted
CryptoManager Root of Trust

Secure Functionality:

- Secure Boot
- Remote Attestation
- Authentication
- Runtime Integrity

[Diagram showing secure processing and cryptographic accelerators]
## CryptoManager Root of Trust Standard Configurations

<table>
<thead>
<tr>
<th>Model</th>
<th>Feature Set</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT-610</td>
<td>Compact</td>
<td>Ideal for designs where security is important but silicon space is at an absolute premium</td>
</tr>
<tr>
<td>RT-620</td>
<td>Full</td>
<td>Expands on 610 with a higher-capability set of crypto accelerators</td>
</tr>
<tr>
<td>RT-630</td>
<td>Cloud/AI/ML</td>
<td>Targets specific needs of Cloud, AI, and ML users</td>
</tr>
<tr>
<td>RT-650</td>
<td>FIPS CMVP Cert</td>
<td>FIPS 140-2 version of RT-620</td>
</tr>
<tr>
<td>RT-660</td>
<td>Government</td>
<td>Expanded version of RT-650 aimed at higher security government applications</td>
</tr>
<tr>
<td>RT-670</td>
<td>Military</td>
<td>Highest level of security aimed at the most sensitive military uses</td>
</tr>
<tr>
<td>RT-730</td>
<td>Automotive</td>
<td>ISO-26262 certified Root of Trust core for automotive deployment</td>
</tr>
</tbody>
</table>
CryptoManager Embedded Security Infrastructure

**Offline Root Server**
System Root-of-Trust, manages high value keys, kept in secure facility, authorizes all provisioning activity

**CryptoManager Service**
Control center used for monitoring and managing all provisioning activity, typically located in chip maker data center

**CryptoManager Appliances**
Tamper proof HSM-enabled devices that connect directly to testers in the manufacturing facility

---

**Diagram:**
- **CryptoManager Control Center**
- **Offline Root Server**
- **CryptoManager Server**
- **Admin Console**
- **CryptoManager Appliance Cluster**
Thank You