INFRA, INDUSTRIAL AND IoT STRATEGY

FEBRUARY 17, 2020

SAILESH CHITTIPEDDI
EVP AND GENERAL MANAGER
IIBU
RENESAS ELECTRONICS CORPORATION

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MEGA TRENDS
DRIVING GROWTH FOR IOT AND INFRA BU

DATA-CENTER DISAGGREGATION

- ***33% cloud data CAGR***
- Optimizing underutilized resources / Power / thermal inefficiencies
- Rise of data-centric computing

5G RAMP

- ***~0% penetration in 2019 → ~20% in 2023***
- ~40% content expansion from 4G to 5G
- Sub-6GHz / mmWave

INTELLIGENCE MOVING TO ENDPOINT

- ***1T connected devices***
- Industry 4.0 / 150MM industrial edge devices enabled with AI shipped annually by 2022
- ~34% IoT sensors long-term growth forecast

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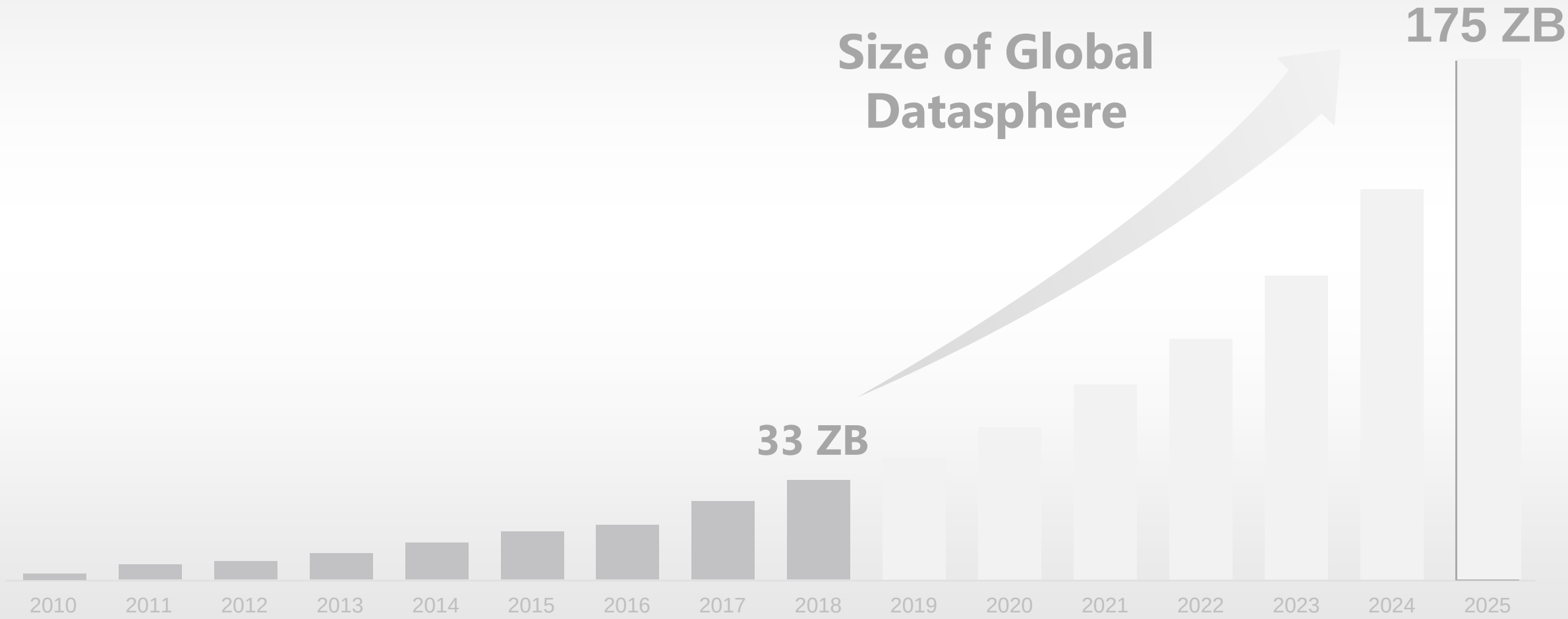
DATA EXPLOSION FUELING LONG TERM GROWTH

> "Every **two days** we create as much information as we did in the entire course of human history up until 2003"
>
> **- Eric Schmidt** Google



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DATA EXPLOSION FUELING LONG TERM GROWTH

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Data Moving From Core to Endpoint …

Core

Scale

- Massive amounts of information
- Architecture centered around compute
- Batch analytics, weather forecasting, genomics research, predictive modeling, etc.

Endpoint

Real-Time Intelligence

Low Latency

- Immediate decisions
- Architecture centered around real-time data
- Real-time analytics, wearable diagnostics, home automation, IoT, etc.

…Driving Shift in Industry Architecture

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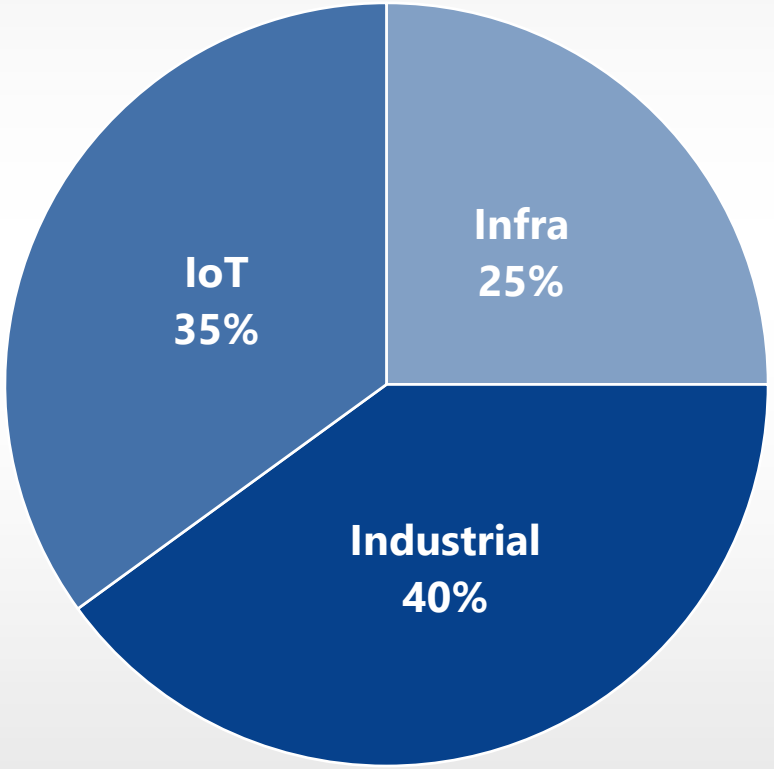
BIG IDEAS FOR EVERY SPACE RENESAS

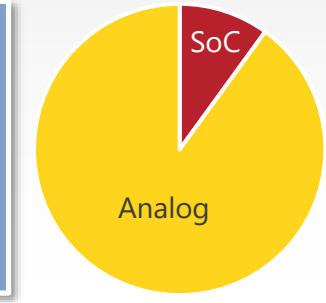
IIBU BUSINESS OVERVIEW

By Application



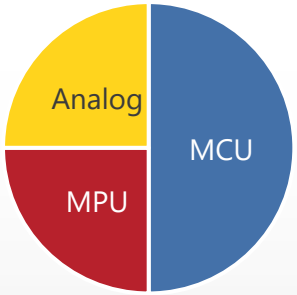
By Product

Infra



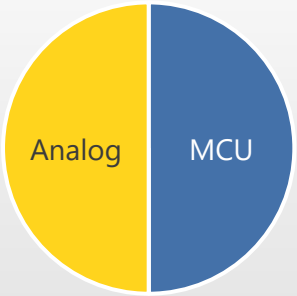
- Number one memory interface supplier
- Technology leader in RF, timing and optical for 5G solutions
- Leading digital power controller and power stage provider

Industrial



- Leading MCU & SOC Supplier + security differentiated MCU/MPU with HMI
- Rich and extensive technology offerings such as motor control, rad-hard power, Time-Sensitive Networking (TSN) and real-time processing

IoT



- Leading provider of both proprietary and ARM MCUs
- Comprehensive portfolio of solutions including wireless power, SOTB, e-AI and security

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CUSTOMER OVERVIEW

By Application

Infra

amazon, cisco, ERICSSON, facebook, HPL, Microsoft, Micron, NOKIA, SK hynix, TOSHIBA

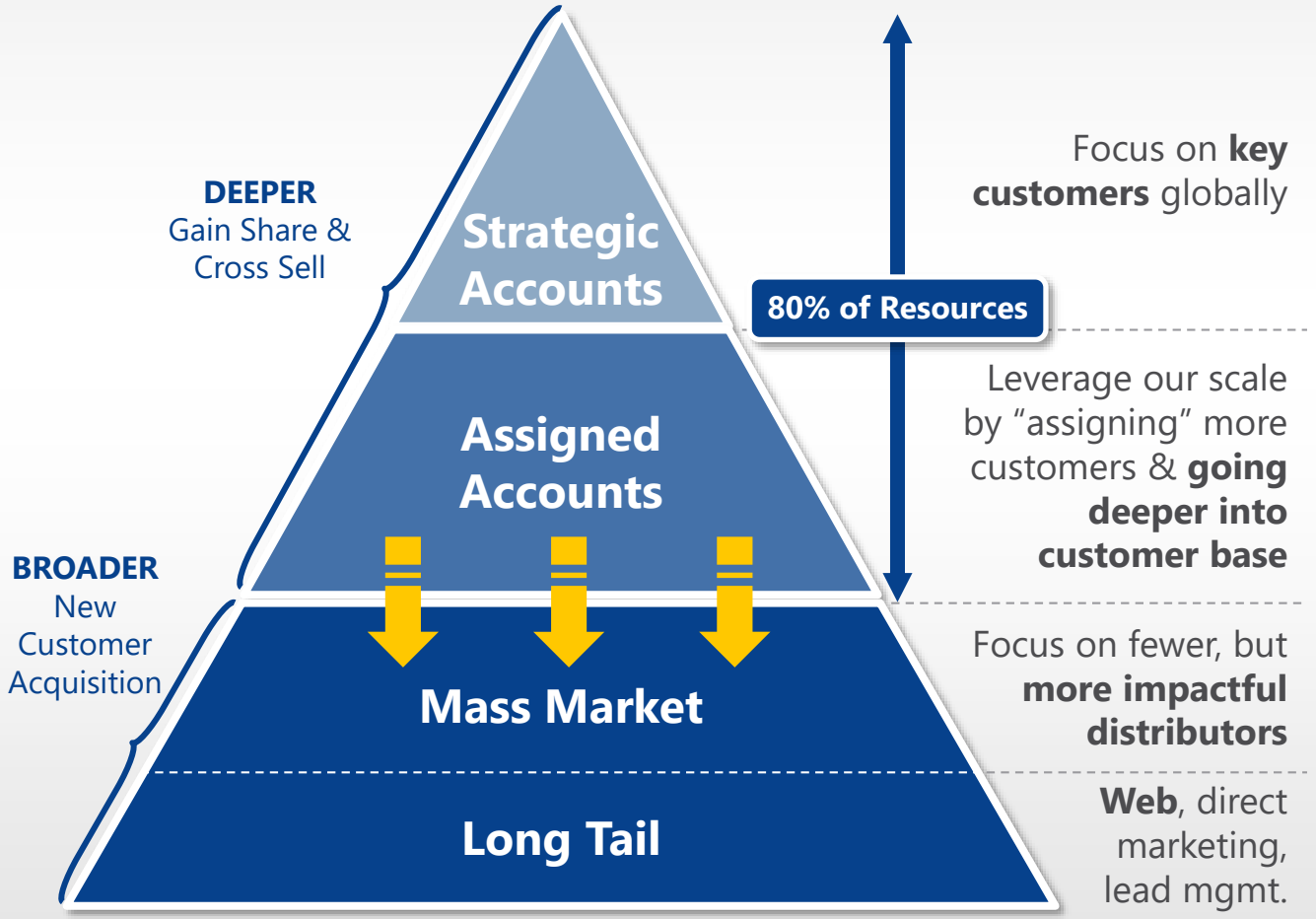
Industrial

FANUC, MITSUBISHI ELECTRIC (Changes for the Better), Rockwell Automation, Schneider Electric, SIEMENS

IoT

Google, Haier, SAMSUNG, Midea, SONY

Channel Reach



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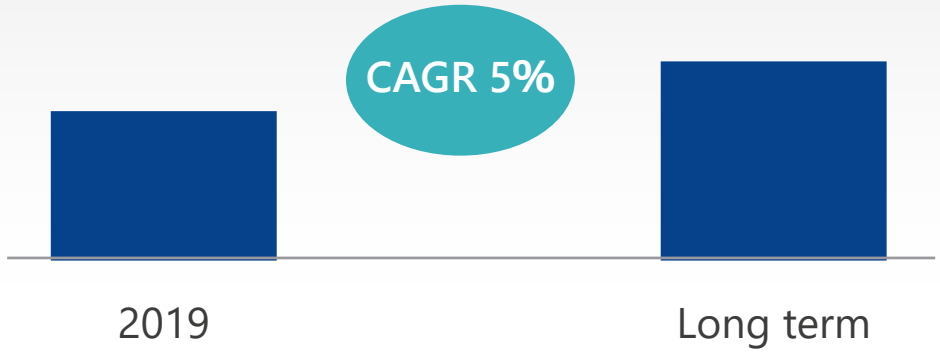
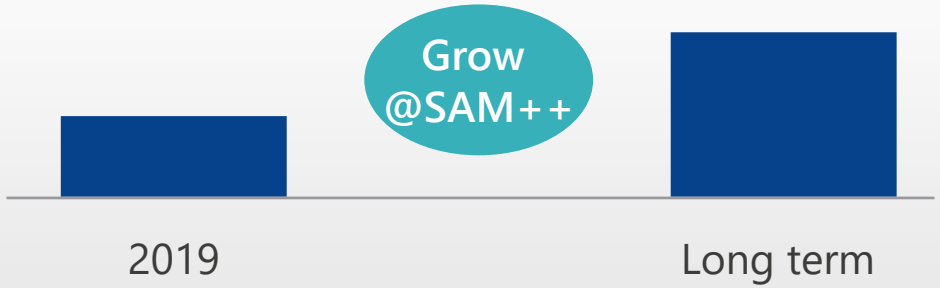
INFRA

Market
($m)



Revenue
(oku-yen)



Growth Driver

- Data Explosion
- 5G Ramp Accelerating
- Evolving DC/Cloud Driving New Power Mgmt. and Persistent Memory

* Market CAGR: Renesas estimate based on Gartner research, Semiconductor Forecast Database, Worldwide, 4Q19 Update

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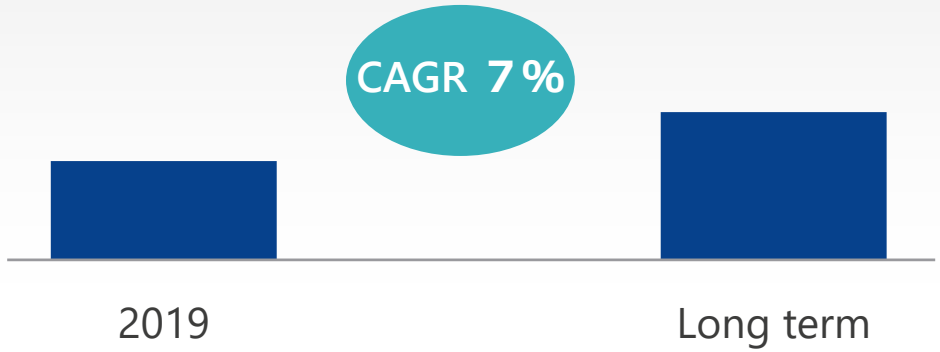
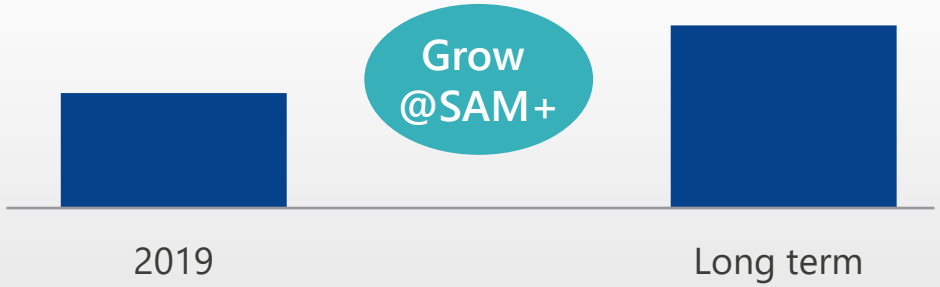
BIG IDEAS FOR EVERY SPACE RENESAS

INDUSTRIAL

Market
($m)



Revenue
(oku-yen)



Growth Driver

- Industry 4.0 – Industrial Automation
- Human-Machine Interaction
- Robotics Application

* Market CAGR: Renesas estimate based on Gartner research, Semiconductor Forecast Database, Worldwide, 4Q19 Update

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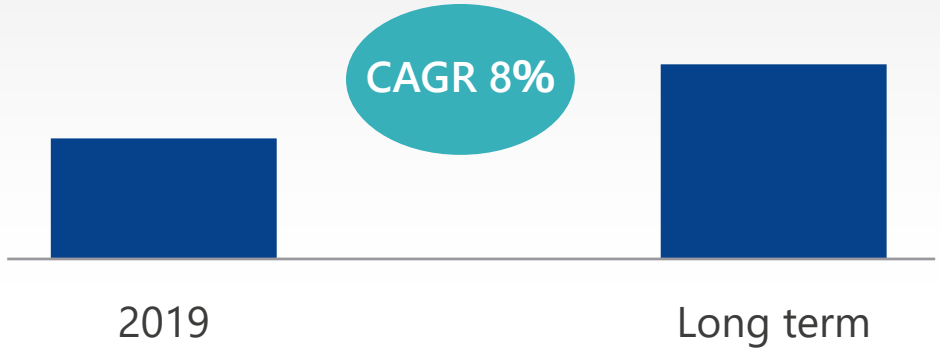
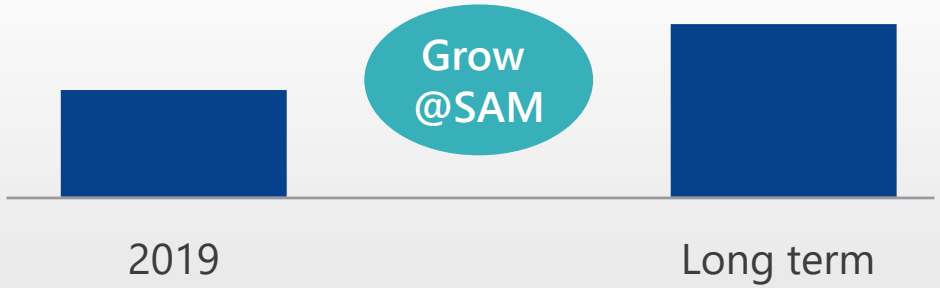
BIG IDEAS FOR EVERY SPACE RENESAS

IoT

Market
($m)



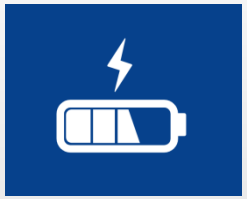
Revenue
(oku-yen)



Growth Driver

E-AI – Intelligence Moving to Endpoint

1 Trillion Connected Devices



Wireless Charging Adoption

* Market CAGR: Renesas estimate based on Gartner research, Semiconductor Forecast Database, Worldwide, 4Q19 Update

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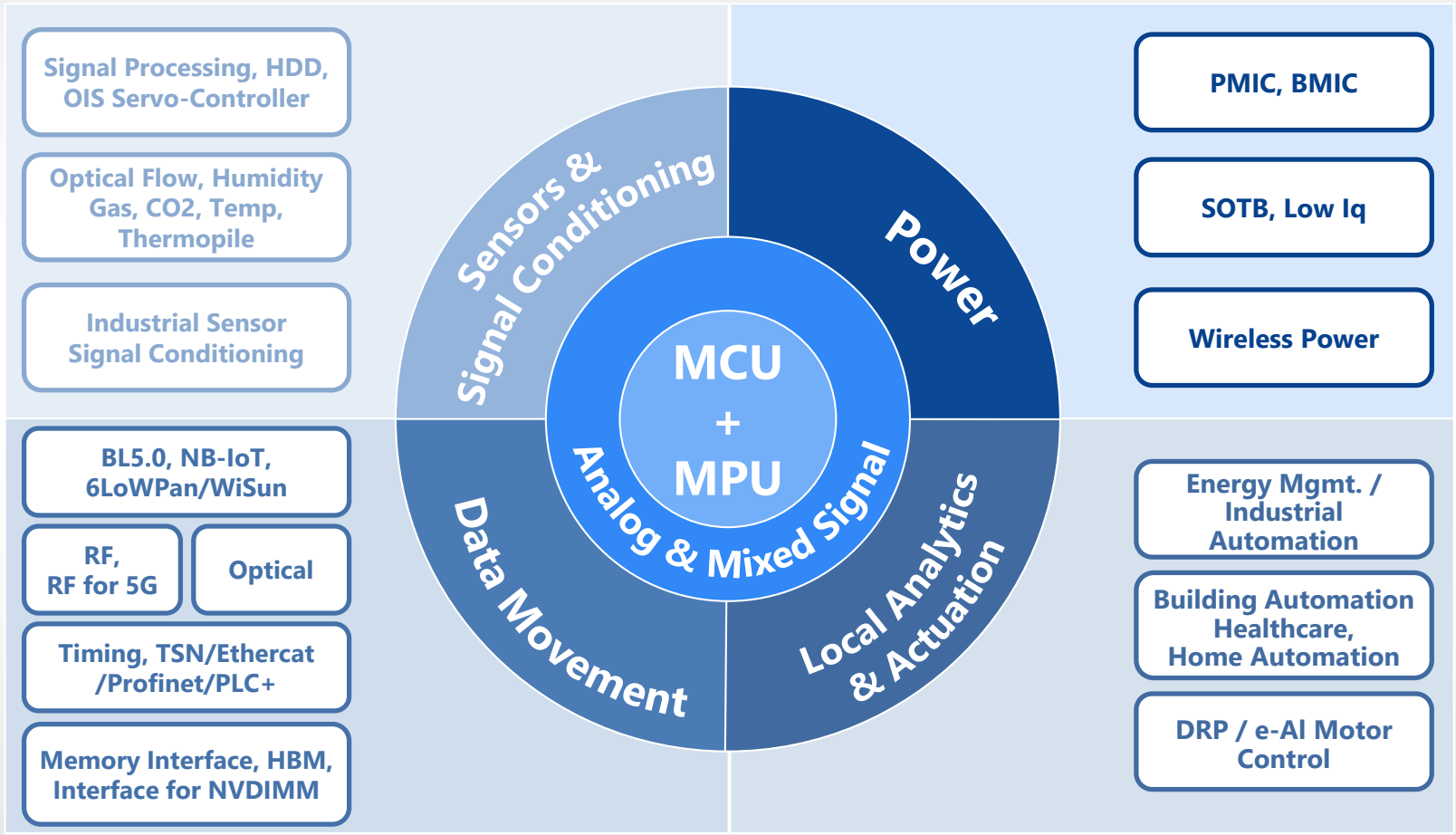
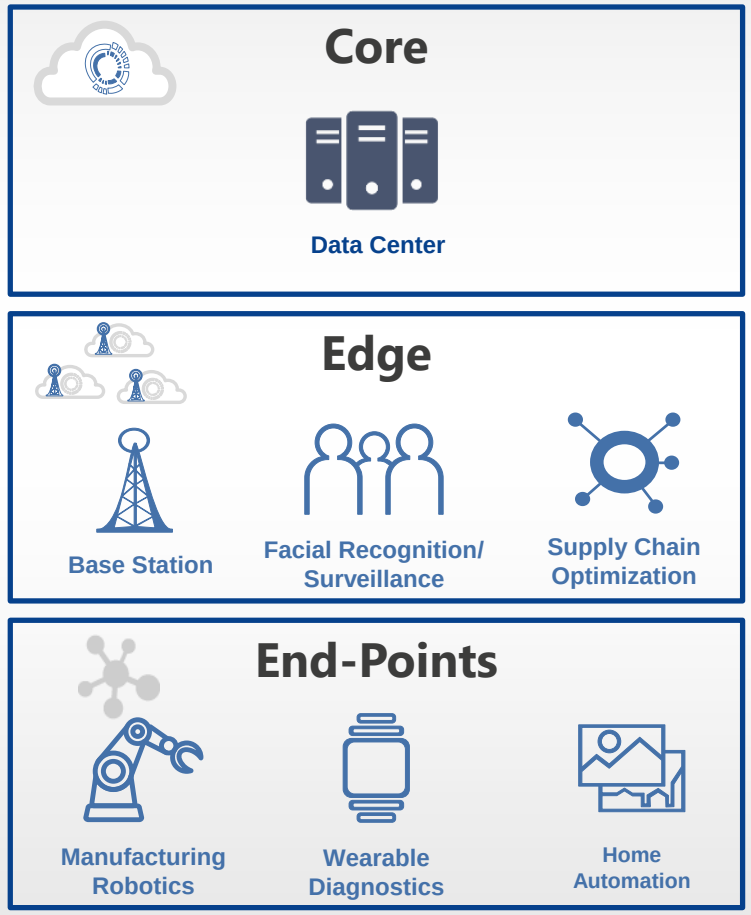
PRODUCT PORTFOLIO

LEADING MCU + ANALOG & POWER SOLUTIONS FOR A DATA-CENTRIC WORLD





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HOW WE WIN

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HOW WE WIN

1. Differentiated Portfolio of Products
2. Content Expansion
3. Winning Combinations & Focused Sales Strategy
4. Scalable & Complete Solution Offerings
5. Ecosystem Partnerships

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BIG IDEAS FOR EVERY SPACE RENESAS

HOW WE WIN

1. **Differentiated Portfolio of Products**
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BROAD & DIFFERENTIATED PRODUCT PORTFOLIO

Microcontrollers and Microprocessors

RENESAS RL78
8/16-bit Ultra-low energy Sensing and Motor Control

RENESAS RX
32-bit High power efficiency Motor Control

RENESAS RZ
32/64-bit Arm-based High-End HMI Network

RENESAS RA
32-bit Arm-based Cortex-M Core

...and more

Analog & Mixed Signal, Power Management

Analog Products

Battery Mgmt. IC

Clock & Timing, Digital Logic

Display IC

Interface & Connectivity

Memory interface Products

Optoelectronics

Power Mgmt. Devices

RF Products

Sensor Products

Space & Harsh Environment

Wireless Power

...and more

Other Technologies

RENESAS RE

RENESAS R-IN
Factory Automation

Renesas Synergy
Complete HW + SW solutions for IoT and IIoT

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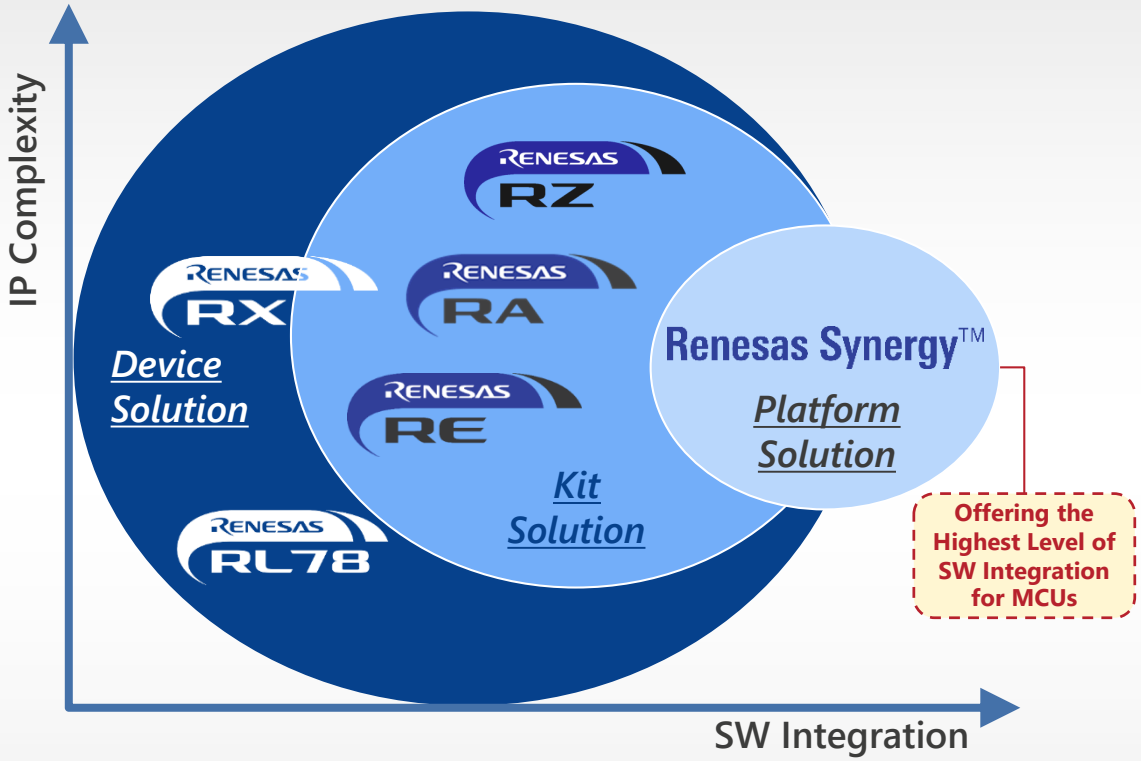
RENESAS DIFFERENTIATION

MCU & MPU EXCELLENCE



RENESAS RA

High-Performance, High Security, Broad Connectivity, Wide Line Up

- High Performance Using Arm Cortex Cores
- High Flash Memory Integration
- Leading Security IP

Just Launched

RENESAS RE

Energy Harvesting

- Extreme Low Current
- Battery-Less System
- Smart Sensing

RENESAS RZ

High-End Embedded AI & Networking

- Power of MPU, Simplicity of MCU
- DRP Tech Powering HMI, Iris Recognition, Etc.
- On-Chip Graphics – 10x Performance Improvement

Electronic Products Product of the Year 2018 Award Winner

MCU

- ✓ **Security**
- ✓ **Efficient Power Consumption**
- ✓ **Lower BOM Cost**

MPU

- ✓ **Realtime Control**
- ✓ **Image Recognition**
- ✓ **Energy Harvesting**

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RENESAS DIFFERENTIATION

ANALOG / MIXED SIGNAL & POWER LEADERSHIP

Core Power

Tiny Footprint

Low Cost

Industrial Grade Reliability

Wireless Power

>90%

End to End Efficiency

Portable Power

>400M

Devices Shipped

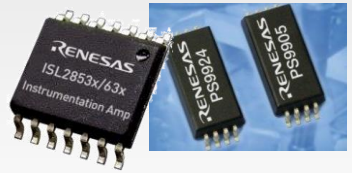
Timing

<1-msec

Industry Leading Performance

Broadest Portfolio

Low Power

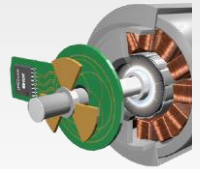


RF/Optical

Complete Platform Solution

Highly Integrated Solutions with Exclusive IP

Higher Data Rates & More Efficient Systems



Sensors

AI-Based Human Presence Detection

Cloud-Integrated

Robust in Harsh Environments

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RENESAS DIFFERENTIATION
BY APPLICATION

Infra

Leading Memory Interface Products

Leadership in Power

RF Strength for Enabling 5G

Industrial

Security-Differentiated MCUs

Advanced Communication Protocols

Market Leadership – Motor Control

IoT

Cloud Provider Partnerships

SOTB for Energy-Harvesting MCUs

MONOS Based Embedded Flash

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HOW WE WIN

1. Differentiated Portfolio of Products
2. **Content Expansion**
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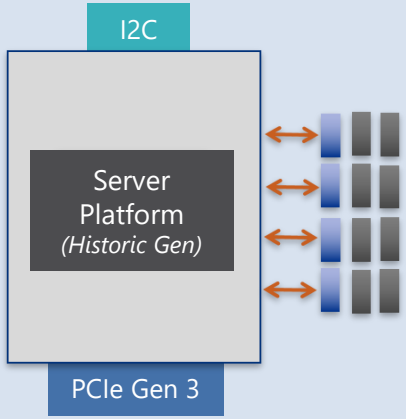
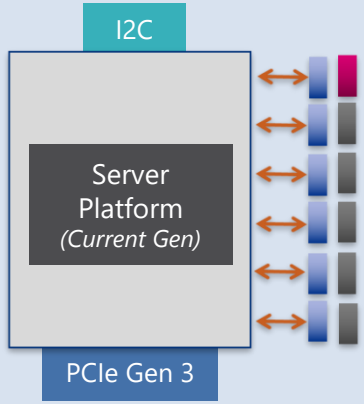
CONTENT EXPANSION FOR DATA CENTER

SERVER MAIN SYSTEMS



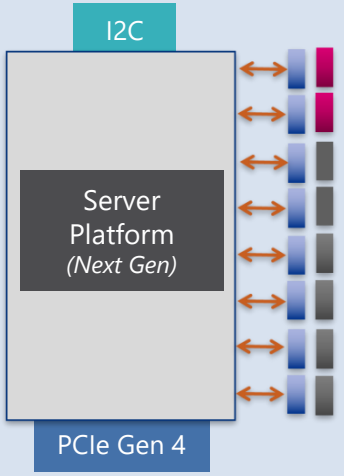
12 slots per CPU
4 slots used (DDR4 DRAM)
0 slots used (NVDIMM)
Gen 3 Retimer

~$X
per server SAM



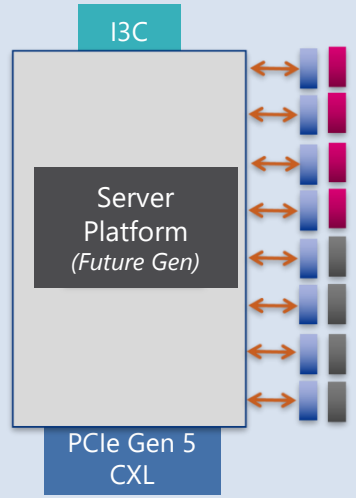
12 slots per CPU
6 slots used (DDR4 DRAM)
0.25 slots used (NVDIMM)
Gen 3 Retimer

~$1.5X
per server SAM



16 slots per CPU
8 slots used (DDR4 DRAM)
1.5 slots used (NVDIMM)
Gen 4 Retimer

~$2X
per server SAM



16 slots per CPU
8 slots used (DDR5 DRAM)
3.5 slots used (NVDIMM)
Gen 5 Retimer/I3C

~$3X
per server SAM

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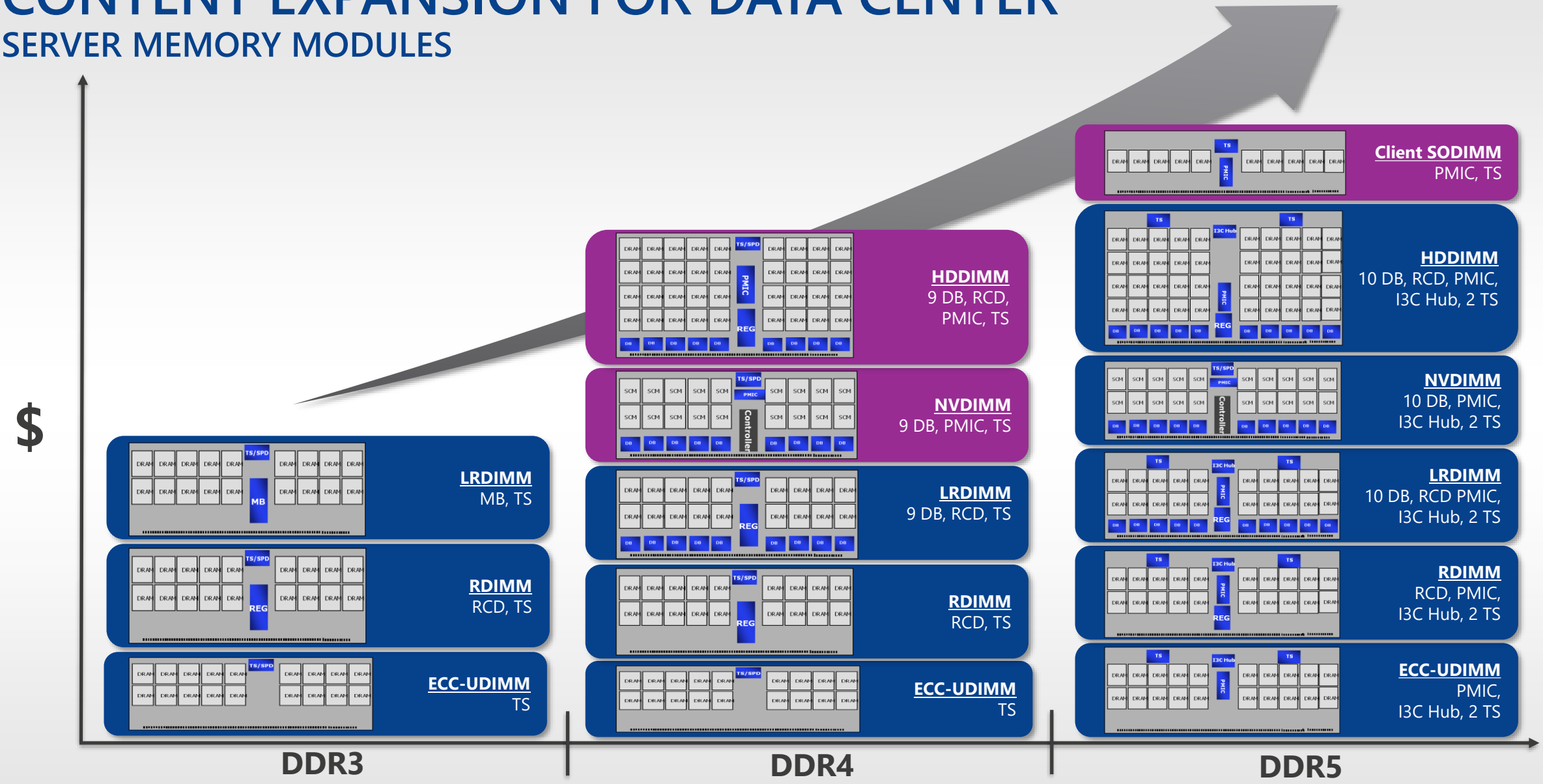
BIG IDEAS FOR EVERY SPACE RENESAS

CONTENT EXPANSION FOR DATA CENTER

SERVER MEMORY MODULES



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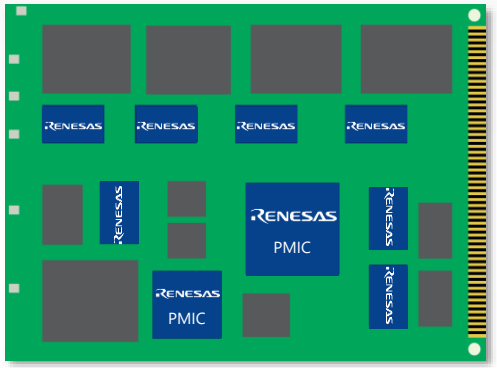
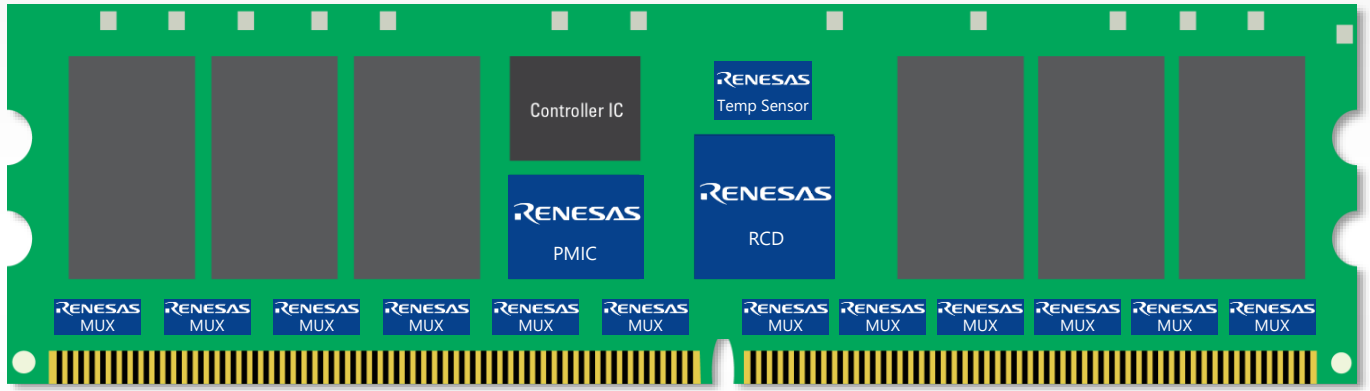
BIG IDEAS FOR EVERY SPACE RENESAS

CONTENT EXPANSION FOR DATA CENTER

SERVER MEMORY MODULE (NON-VOLATILE MEMORY EXAMPLE)

Enterprise SSD and NVDIMM content





2 PMIC

7 Distributed Power Units

1 Register | **1** Temp Sensor

12 MUXes | **1** PMIC

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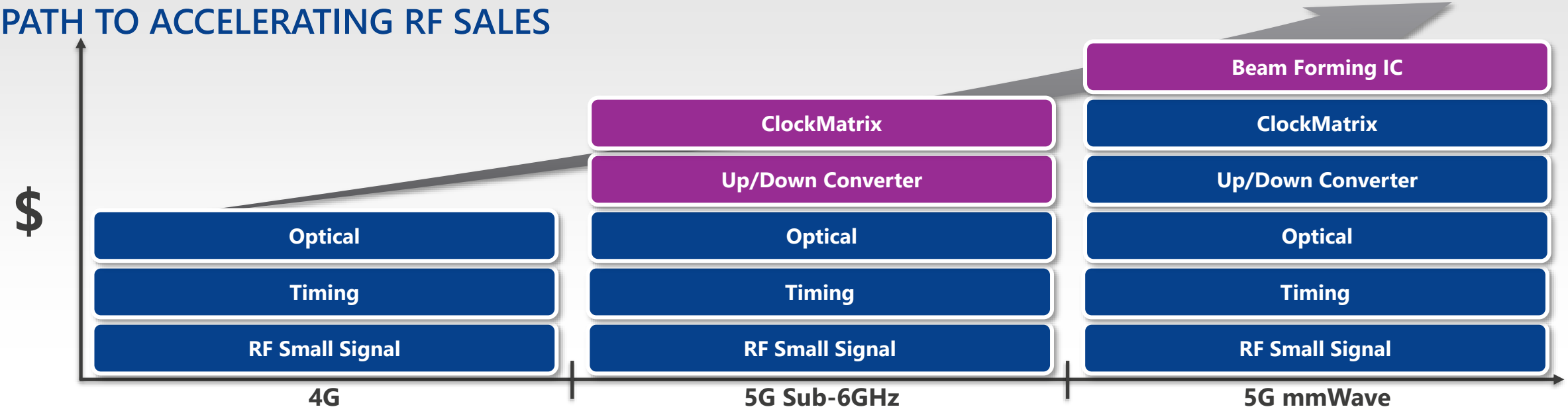
CONTENT EXPANSION FOR 5G

PATH TO ACCELERATING RF SALES



Renesas Portfolio Enabling 5G

January 22, 2020

"First Central London Hotspot 2.0 Wi-Fi Network Launches in Trafalgar Square with Seamless Roaming Connections"

Comprehensive Optical Portfolio from Front-Haul to Back-Haul

	FH/MH	MH	BH
Laser Diodes	NRZ DML I-Temp	PAM4 DML	PAM4 DML
LD Drivers		PAM4 Driver	PAM4/Coherent Driver
Pin PDs	NRZ PD	PAM4 PD	PAM4 PD
APDs		PAM4 APD	PAM4 APD
TIAs		PAM4 TIA	PAM4/Coherent TIA

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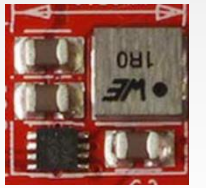
CONTENT EXPANSION FOR INDUSTRIAL

Driving new industrial growth opportunities

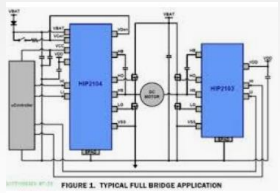
Attaching Analog/Mixed Signal to MCU

MCU

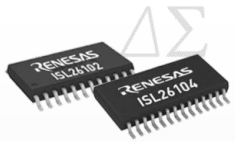
+



Power Management



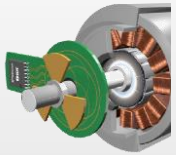
MOSFET Drivers



ADCs & DACs

Op Amps

Opto-Couplers



Sensors

Selected Applications

Conveyor Tool

Sorting Stage

Orthogonal Stage

Motor Built-In Roller

Conveyor

Power Tool

Pump

Water Saving Toilet

Water Pump

High Pressure Washing Machine

Water Pump

Industrial Fan/Blowers

Cooker

Ceramic Art

Blower Fan

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ENHANCED 64-BIT MPU & AI ACCELERATOR STRATEGY

Industrial | **HMI** | **+ "Vision"** | **+ "AI"**

RZ/T & RZ/N Series | **RZ/G Series** 64bit | **RZ/A and New Series** 64bit

Optimized MPU for the industrial market

HMI market enhancement with AI technology

HMI Well Positioned to Gain Share

Product development focused on the industrial market

Addition of AI technology

Deeper Coverage of System

Sell more solutions and cross sell

- Renesas sales opportunity up to 2x – 5x
- Easy to develop by reference design

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MCU & MPU POSITIONING

Performance

RL78 MCU

Industry-Leading Low Power

RX MCU

Higher Performance for Industrial Connectivity & Motor Control

RA MCU

Security, HMI, Wireless Connectivity (BLE, NB-IoT)

RZ/G MPU

High Graphics Performance Including 3D Graphics

RZ/A & New Series MPU + AI

Vision AI with AI Accelerator (e/AI - DRP)

Integrated AI Accelerator (e/AI - DRP)

Power Management | Meter | Touch | Motor | Connection | HA | Security | BA | HMI | Vision | IA | AI

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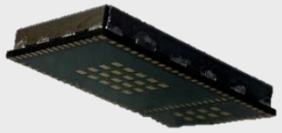
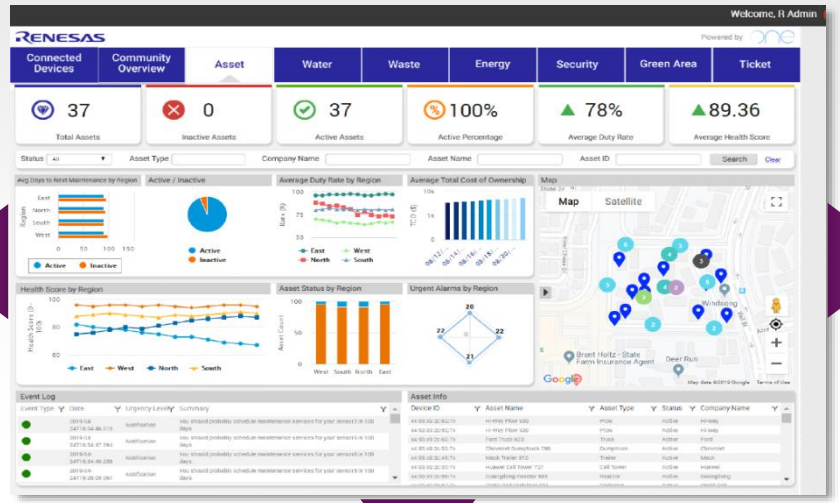
CONTENT EXPANSION FOR IoT SYSTEMS *(1 OF 2)*

COMBINING SENSORS WITH MCUS

Water & Irrigation Management



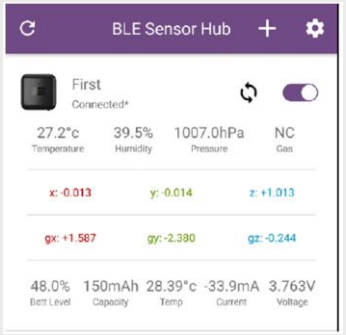
- RYZ011 CAT-M/NB1 + BLE 5 Module
- RL78 MCU
- Verizon + AT&T initial deployment

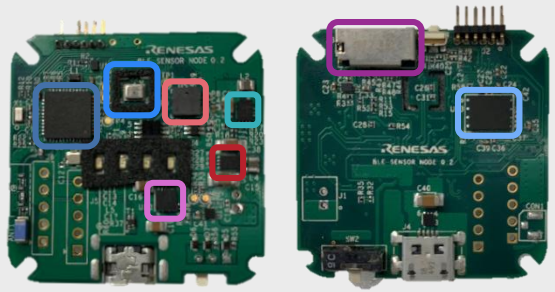


LED Lighting Control

- BLM25 Module
- BLE 5 with Zigbee support, MESH
- DALI-2 support
- Extended Industrial temperature operation

Connected Devices | Asset Tracking | Data Storage





- MRAM Non-volatile memory
- High speed Quad SPI
- 3V supply voltage, -40°C to 105°C
- 8-pin SOIC, 8-pin WSON

- Bluetooth 5
- HS3001 RH/Temp Sensor
- M300x MRAM
- ISL9122 Buck/Boost Regulator
- ISL9123 Buck Regulator
- ISL9301 Battery Charger
- Micro-SD Sensor Expansion Card (ZMOD4410 tVOC sensor)
- 7-Axis Motion/Pressure Sensor
- Battery Fuel Gauge

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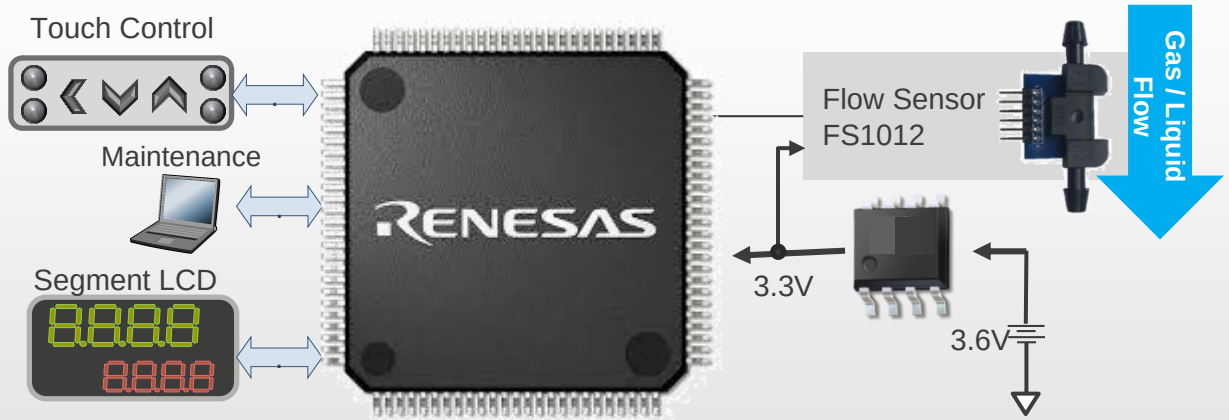
CONTENT EXPANSION FOR IoT SYSTEMS *(2 OF 2)*

COMBINING SENSORS WITH MCUS

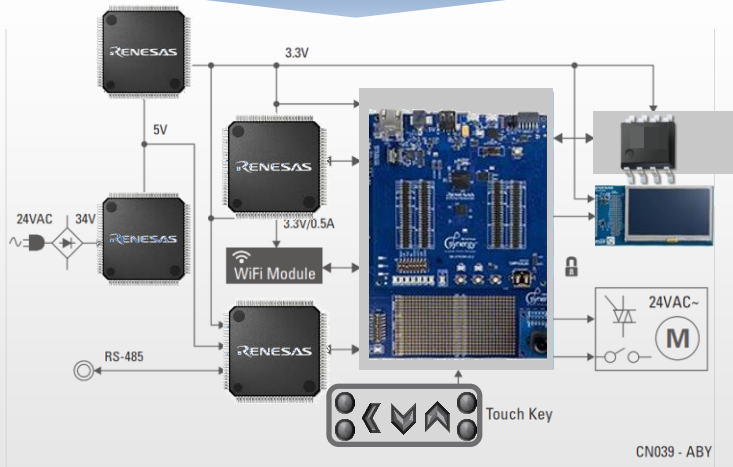
Home Based Water Meter: Block Diagram

MCU RX113	+	RTC	+	Temperature Sensor
Flow Sensor FS1012	+	LDO ISL9001A	+	MCU



Smart Home: Color Touchscreen Thermometer with Cloud Conn.

3.3V LDO ISL80510	+	DC/DC ISL854102	+	Voice Recognition Module RZ231
RS-485 Transceiver ISL32704E	+	System Control Synergy S5D9	+	Temperature Humidity Sensor HS3001



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HOW WE WIN

1. Differentiated Portfolio of Products
2. Content Expansion
3. **Winning Combinations & Focused Sales Strategy**
4. Scalable & Complete Solution Offerings
5. Ecosystem Partnerships

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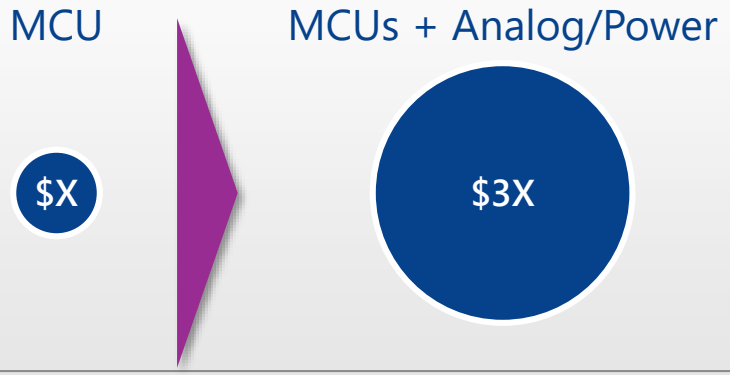
BIG IDEAS FOR EVERY SPACE RENESAS

EXAMPLES OF WINNING COMBINATIONS

Electronic Valve with Flowmeter

- MCU
- Analog
- Power
- Sensor
- Motor Control

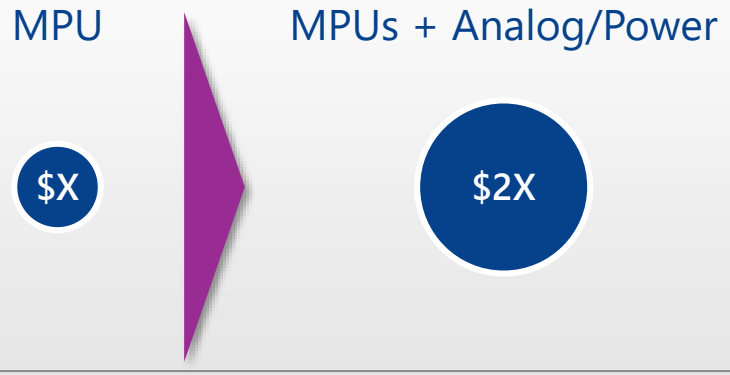
$ Opportunity



HMI SOM using RZ/G2E

- MPU
- Power
- Timing
- Analog

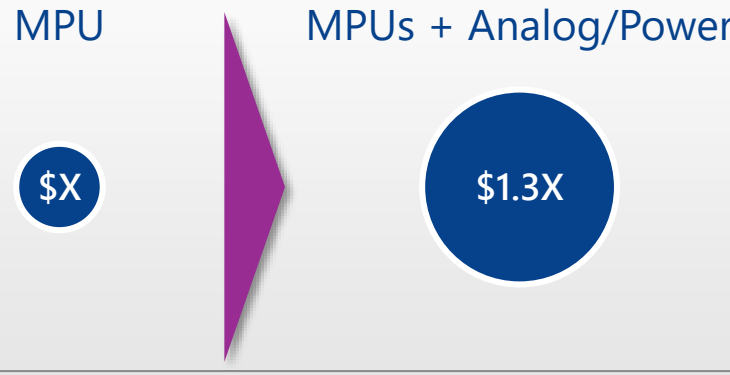
$ Opportunity



Chinese AC Servo Market

- MPU
- Power
- Timing
- Analog

$ Opportunity



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BIG IDEAS FOR EVERY SPACE RENESAS

SALES STRATEGY

DEEPER

Maximize cross sell with winning combinations

&

BROADER

New customers and seed new technology

- Direct sales force – Assign more customers
- Lean & efficient distribution network – Extend reach
- Maximize cross sell with winning combinations & solutions
- Web & catalog distributors
- Digital marketing
- Solution & block diagram selling

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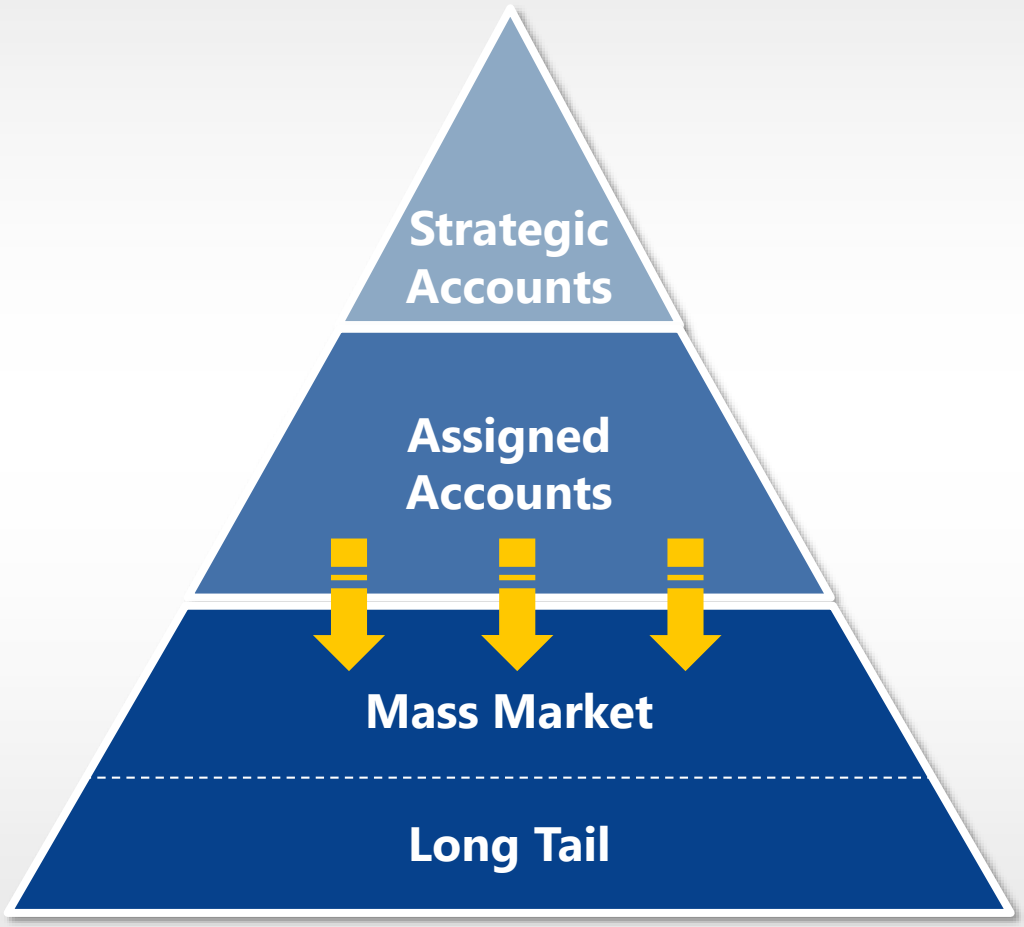
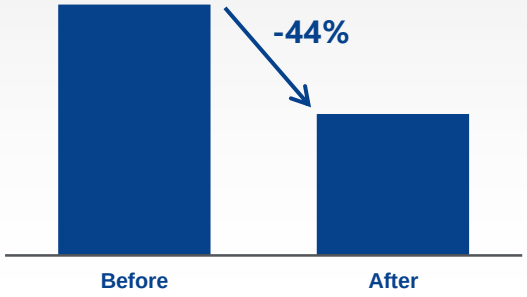
EVOLVING CHANNEL STRATEGY

REACHING BROADER BASE OF CUSTOMERS



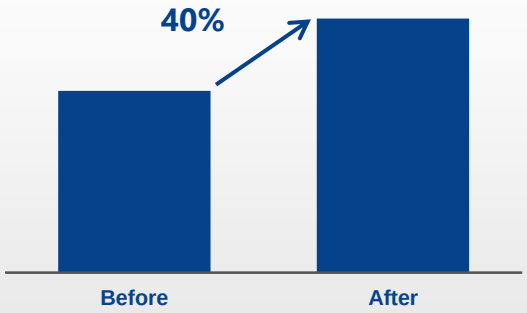
- Leverage our scale by "assigning" more customers & going deeper into customer base
- >80% of resources direct sales
- 1,125 Assigned Accounts now covered globally
- Fewer distributors, carrying the entire Renesas portfolio
- Remaining distributors have committed to increased investment: agreed to add more Renesas-dedicated resources
- Full field engagement in mass market: local sales in each geography

Fewer Distributors…



# of Distributors

… But More Committed to Renesas



# of Renesas-Dedicated Resources @ Distributors

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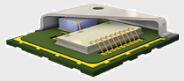
DEEPER
MORE $$$ PER CUSTOMER

Pulling MCU into an Existing Analog Customer

Korean Industrial Customer

SSC Humidity Sensor

+


Gas sensor

+

MCU

Combo sensor for Industrial & Consumer

- Industrial & Consumer Markets require combo sensor modules
- Renesas supports total solution
- On-site supports with a long term relationship with Samyoung

Pulling Analog into an Existing MCU Customer

US Smart Home Customer

MCU

+

Indoor Air Quality (IAQ) Sensor

Smart home monitoring

- Accelerating adoption of smart home solutions globally
- Combined offering provides safety, comfort, and energy savings
- Long history of RZ600 / RX200 MCU

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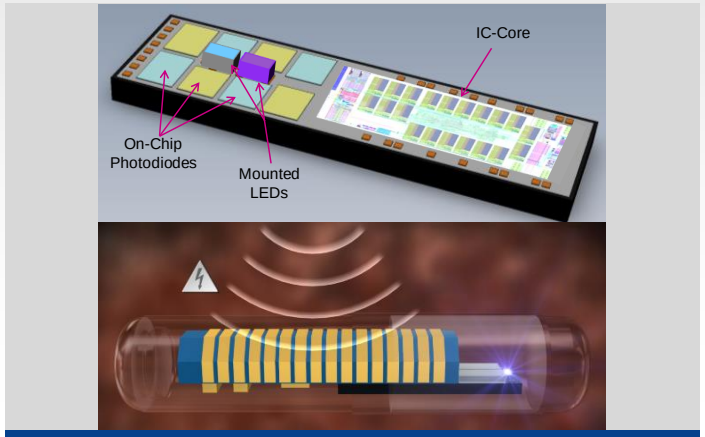
BIG IDEAS FOR EVERY SPACE RENESAS

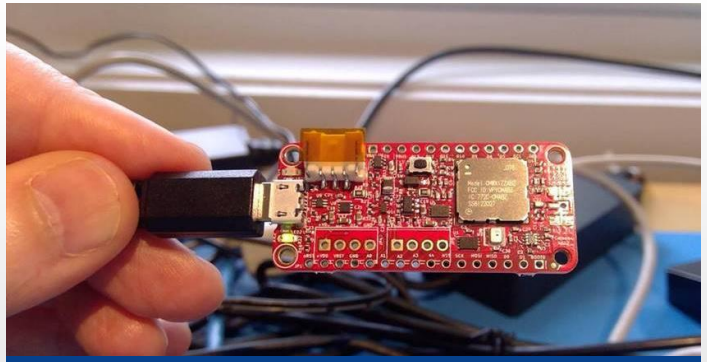
BROADER
GOING BROADER TO EXTEND CUSTOMER REACH

Jaewon CNC Air Purifier



Senseonics Eversense CGM

LEVL Fat/Ketone Burning Measurement



MCCI- Smart Building Sensors

Sharp/Foxconn Module for AQM

MIYO Smart Home Irrigation System

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HOW WE WIN

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BIG IDEAS FOR EVERY SPACE RENESAS

SCALABLE SOLUTIONS FOR PREDICTIVE ANALYTICS *(1 OF 2)*

CASE STUDY - FACIAL RECOGNITION

Low Touch

General Purpose MCU

RENESAS RX / Renesas Synergy

Performance: 3.5fps (280ms) *1

Low Cost and Low Power

Sample Available

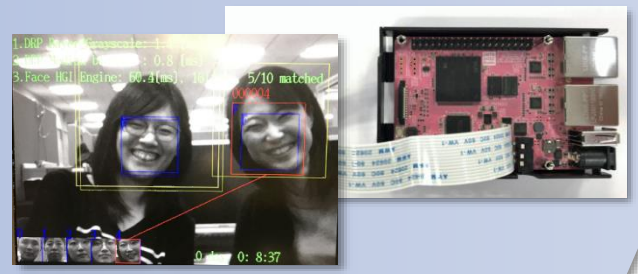
Mid Touch

Imaging Micro Processor

RENESAS RZ / A2M Series

Performance: 16fps (64ms) *1

Low BOM Cost and Low Power



Sample Available

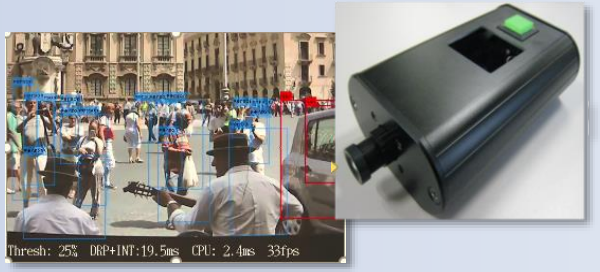
High Touch

AI Integrated Processor

RENESAS RZ / New Series

Performance: 375fps (2ms) *1

High Power Efficiency for "AI"



Sample Apr 2020

*1: For Face recognition: image size: 320 x 240 pixels

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SCALABLE SOLUTIONS FOR PREDICTIVE ANALYTICS *(2 OF 2)*

CASE STUDY - MOTOR CONTROL

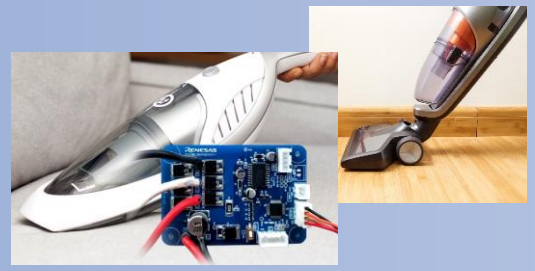
Low Touch

Low End Motor Control

RENESAS RL78

Suitable for Trapezoidal Drive Control

Low Cost and Low Power



Over 1,000 Products Available

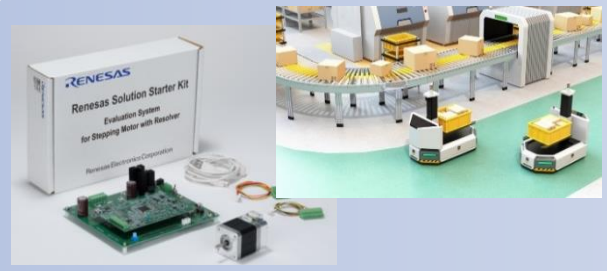
Mid Touch

Wide Range Inverter Control

RENESAS RA RENESAS RX

Suitable for Vector Control (FOC)

Motor Control Accelerator



Over 1,000 Products Available

High Touch

High Speed Motor Control

RENESAS RZ / T Series

Suitable for Motion Control

1 Chip Solution for AC Servo Control

16 Products Available

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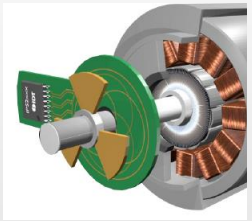
COMPLETE MCU/MPU + ANALOG SOLUTIONS FOR TARGETED END MARKETS

Motor Control for Industrial & Robotics

Blower Fan

Motorized Bicycle

Power Tools



Sensors

Health & Environment

Air Purifier

Cleaner / Vacuum

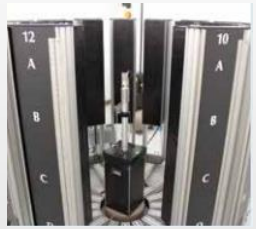
Water pumps

Water saving toilet pump

Sat. Comm. & Aero

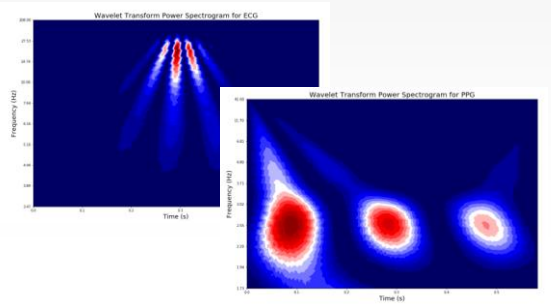
Rad tolerant multiplexers

Rad hardened sequencers



Wafer production testing

Predictive Analytics



Blood Pressure Sensor System

Human Presence Detection

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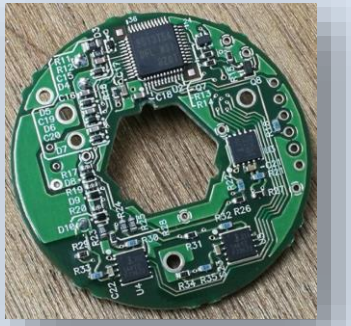
HOW WE WIN WITH INTEGRATED OFFERINGS

SERVER FAN COMPETITIVE COMPARISON

RENESAS



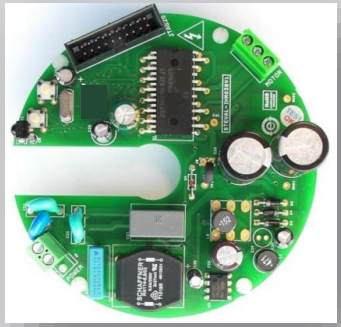
Targets BLDC **48V Server Cooling Fan Application**

Supports **50W** Motor

Sensor Less **Vector Control**

Lower Cost for Key Customers

Competitor



Targets BLDC **Ceiling Fan Application**

Supports **30W** Motor and **24V** Motor

Sensor Less **Trapezoidal**

$65 on Competitor Website

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HOW WE WIN

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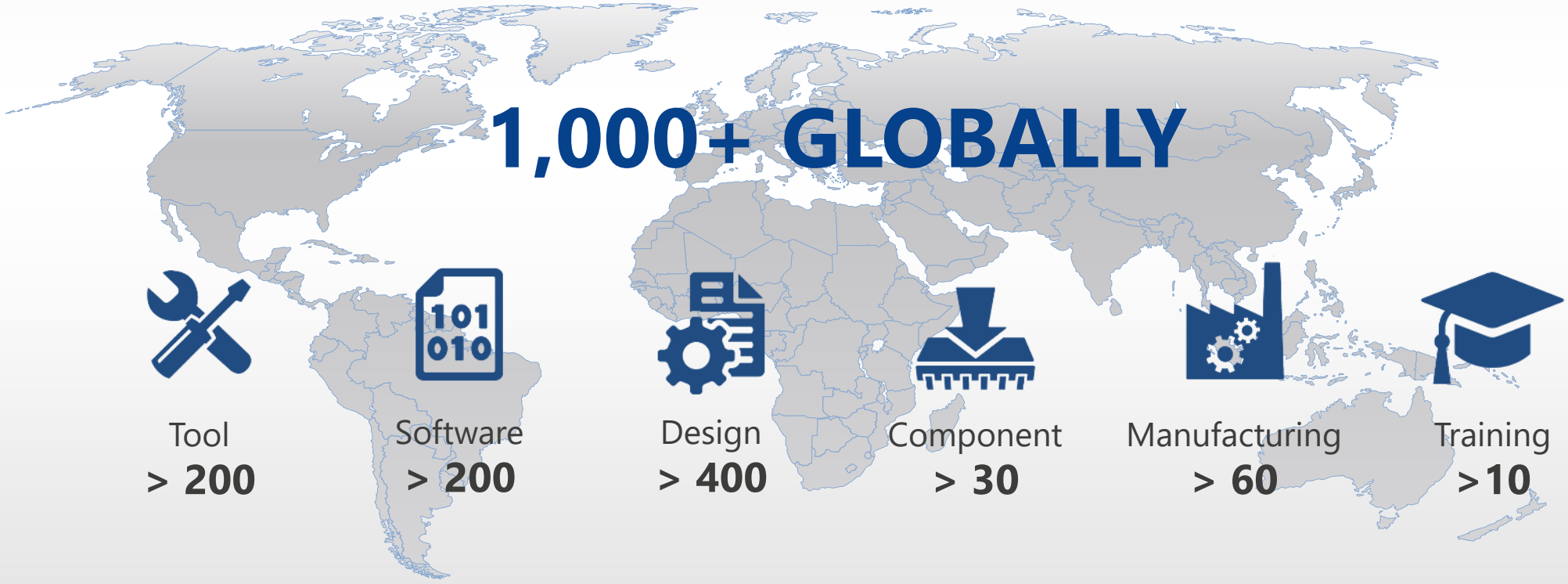
ROBUST ECOSYSTEM
ESTABLISHED ALLIANCE PARTNER PROGRAM

The Renesas Alliance Partner Program

– a **network of thousands** of trained and certified design service partners –

supports every stage in the customer design cycle and **offers opportunities** to create new business



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BIG IDEAS FOR EVERY SPACE RENESAS

ECOSYSTEM PARTNERS – ENABLING SOLUTIONS ACROSS SEGMENTS

Select Partnerships

MCU

Connectivity & Cloud

Alibaba Cloud
aws
MEDIUM ONE
Microsoft Azure
miromico
QUECTEL
RELOC DESIGN & INTEGRATION
silex technology
Telit
ublox

MPU

AI

L&T Technology Services
NEC
Ubiquitous AI Corporation
CASIO
Advanced Media, Inc.
Neusoft Beyond Technology
PATHPARTNER
PILOT.AI

Data Center

OEM/ODM

CISCO
DELL
hp
HUAWEI
IBM
inspur 浪潮
Inventec
lenovo
ORACLE
SUPERMICRO
Sugon
wiwynn

Technology Partnerships

Altair A Sony Group Company — NB-IoT
ANAGOG — Contextual Awareness
avalanchetechnology — MRAM
DeXter Research Center — Thermopile Sensors
Panthronics — NFC
Telink — BLE 5.0
3db — UWB
VENTIVA — Electrostatic Cooling - Wireless Power

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P&L MODEL FOR IIBU

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TARGET FINANCIAL MODEL

LONG-TERM TARGET

Revenue
Grow > Market Rate

Gross Margin
55 – 60%

Operating Margin
25 – 30%

Businesses will gain market share in each target market within 3 years (Infra gaining share now)

Year 1	• **Launch initiatives for margin improvement** • **New product launch**
Year 2	• **Measure progress on Design-in & GPM & OI**
Year 3+	• **Deliver Target Model!**

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BIG IDEAS FOR EVERY SPACE RENESAS

ORGANIZATIONAL SYNERGY

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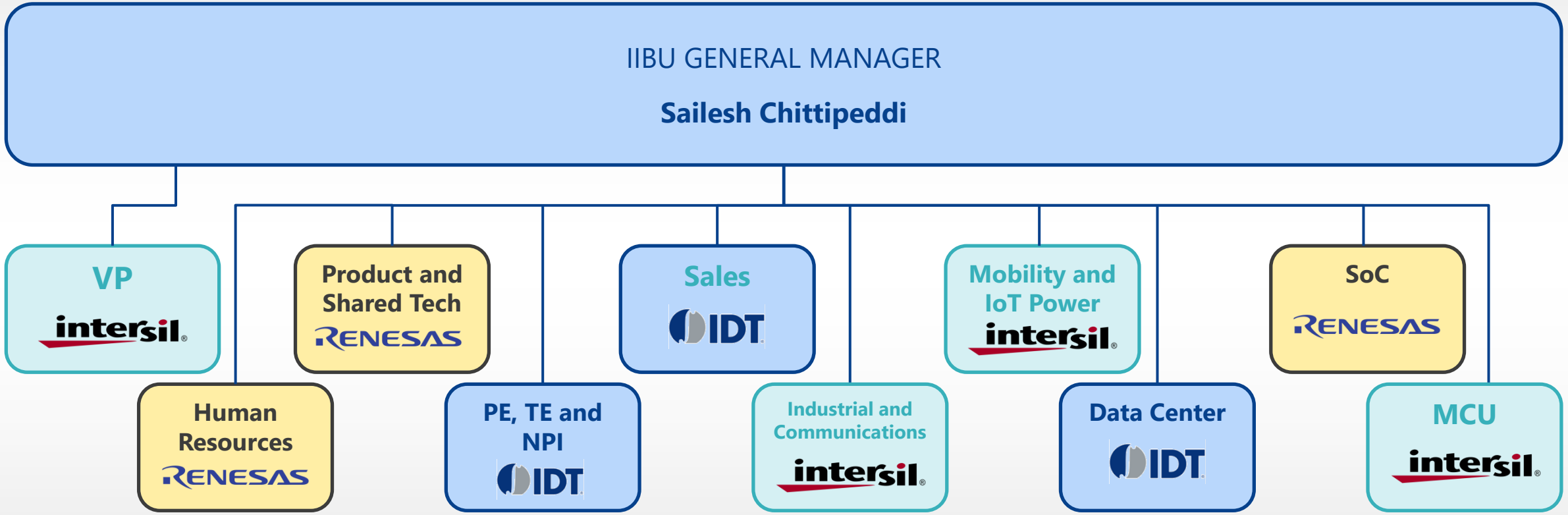
A Well-Blended Team



Note: As of January 2020

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SUMMARY

- **Data traffic growth** and **migration of data analytics from big data to fast data** are major growth drivers for IIBU business

- We are **well-positioned** to win in **upcoming marketplace inflections**:
  - **Data-center disaggregation** at core of network
  - Move to **5G at edge**
  - **IoT explosion** and **e-AI at endpoint**

- **Our winning edge** is based on:
  - **Differentiated portfolio of products**
  - **Content expansion**
  - **Winning combinations & focused sales strategy**
  - **Scalable & complete solution offerings**
  - **Ecosystem partnerships**

Renesas is on path to be most desired, required and admired solution provider for Infra, Industrial and IoT markets

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