

INFRA, INDUSTRIAL AND IoT STRATEGY

FEBRUARY 17, 2020
SAILESH CHITTIPEDDI
EVP AND GENERAL MANAGER
IIBU
RENESAS ELECTRONICS CORPORATION

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



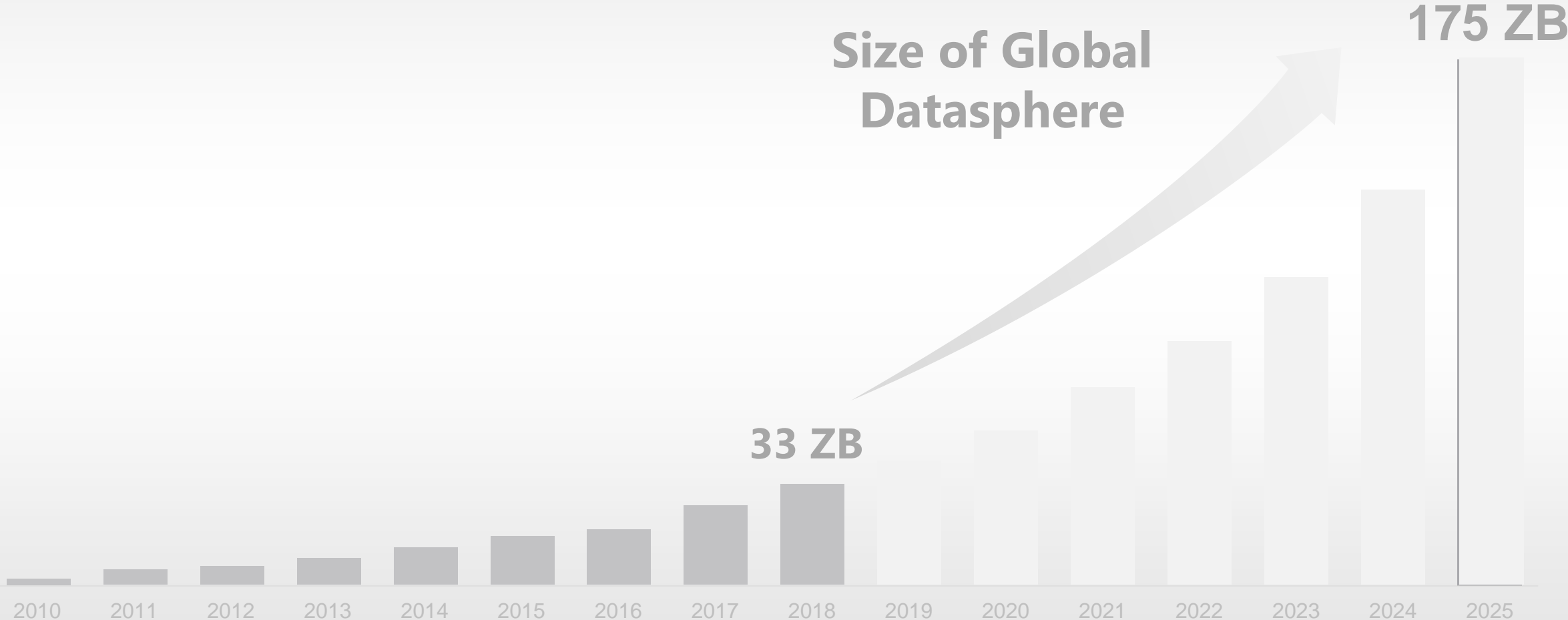
INTELLIGENCE MOVING TO ENDPOINT

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

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

Size of Global Datasphere



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

Data Moving From Core to Endpoint ...



Core

Big Data

Scale



Massive amounts of information



Architecture centered around compute



Batch analytics, weather forecasting, genomics research, predictive modeling, etc.

Size of Global Data Sphere

175 ZB



Real-Time Intelligence



Low Latency



Immediate decisions



Architecture centered around real-time data



Real-time analytics, wearable diagnostics, home automation, IoT, etc.

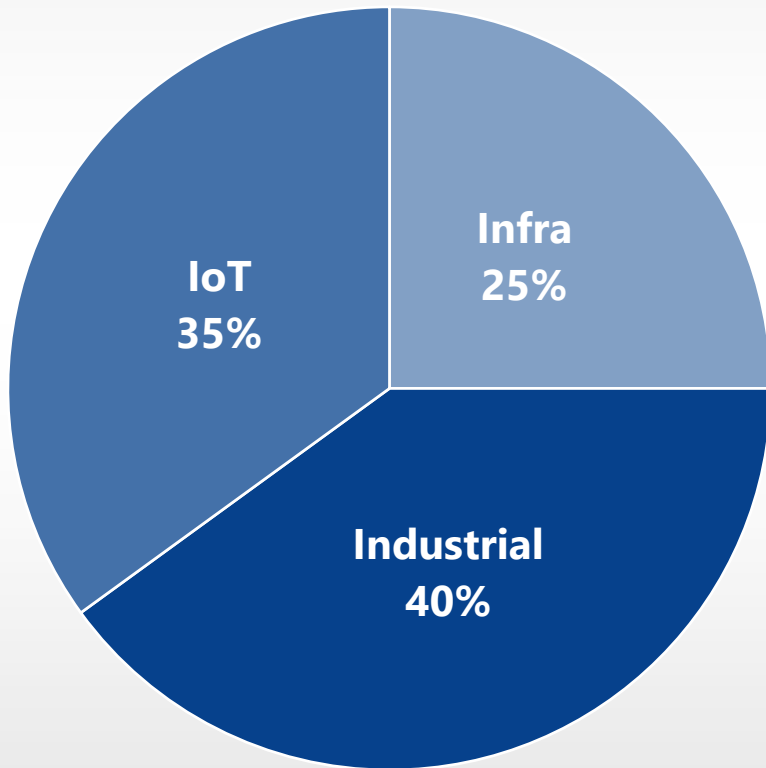
33 ZB

2010 2011 2012 2013 2014 2015 2016 ... 2021 2022 2023 2024

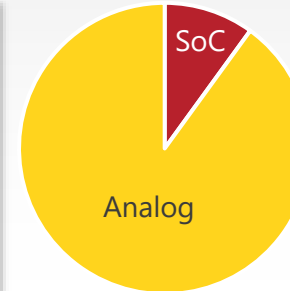
... Driving Shift in Industry Architecture

IIBU BUSINESS OVERVIEW

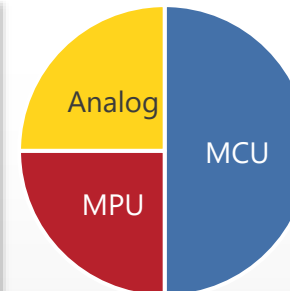
By Application



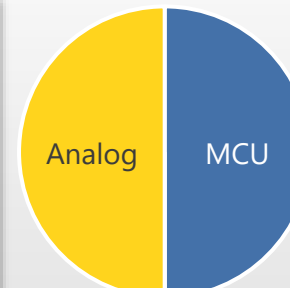
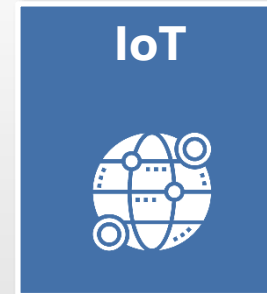
By Product



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



- 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



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

CUSTOMER OVERVIEW

By Application

Infra

amazon CISCO ERICSSON
 facebook HPL Microsoft
 Micron NOKIA SK hynix
 TOSHIBA

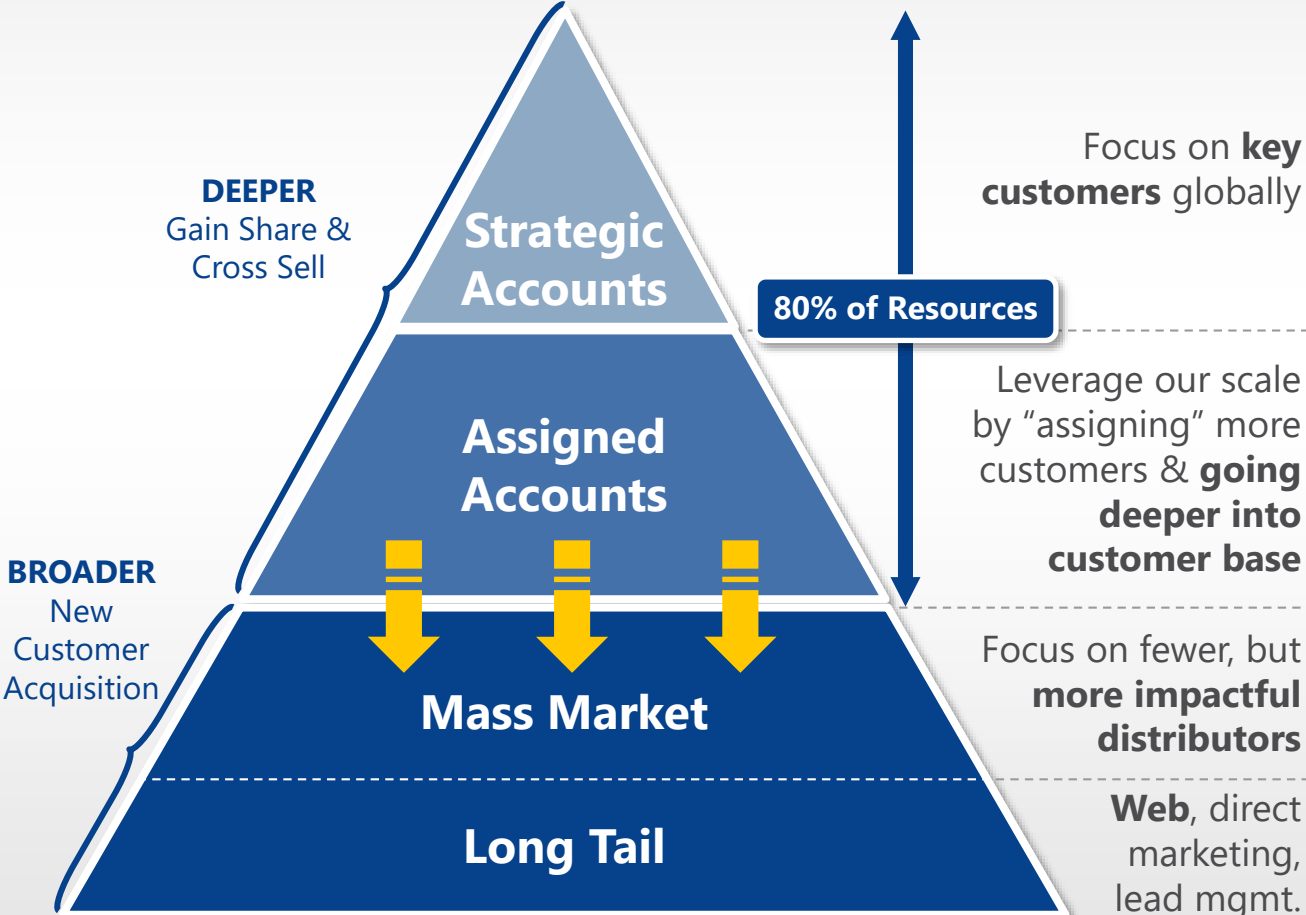
Industrial

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

IoT

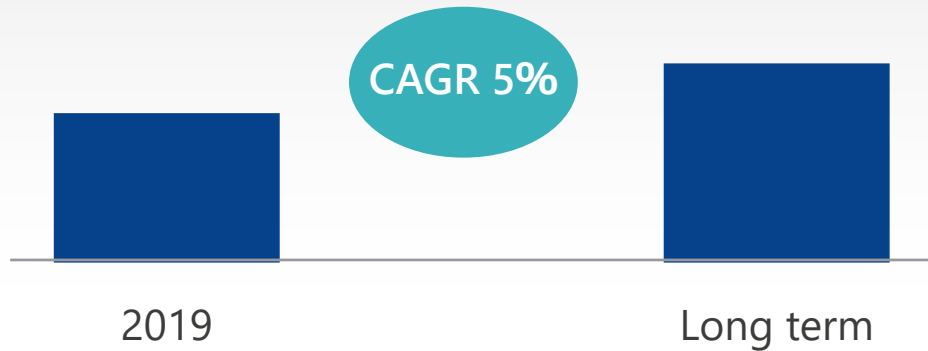
Google Haier
 SAMSUNG Midea
 SONY

Channel Reach

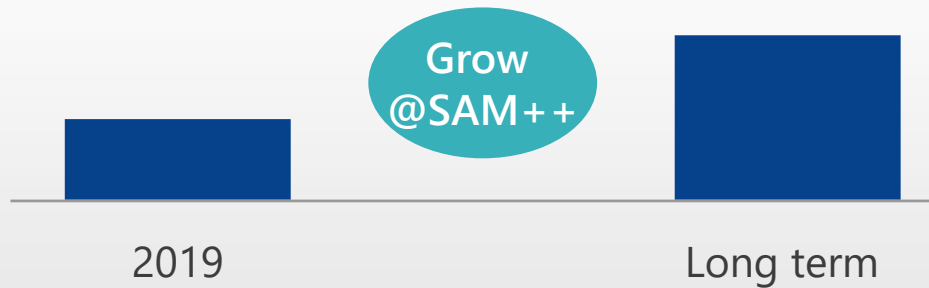


INFRA

Market
(\$m)



Revenue
(oku-yen)



Growth Driver



Data Explosion



5G Ramp Accelerating

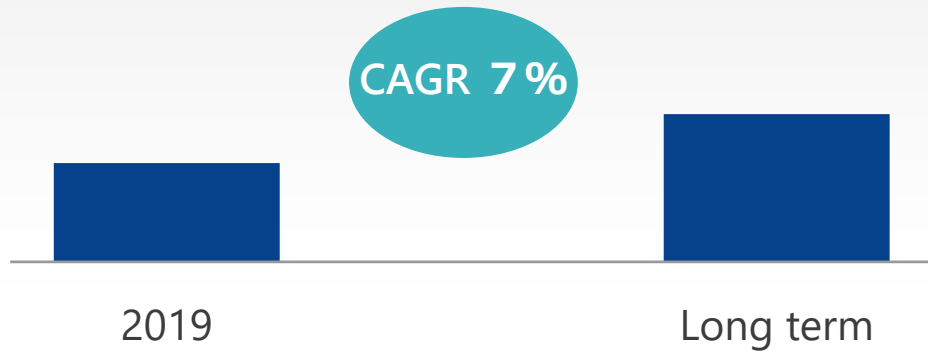


Evolving DC/Cloud Driving
New Power Mgmt. and
Persistent Memory

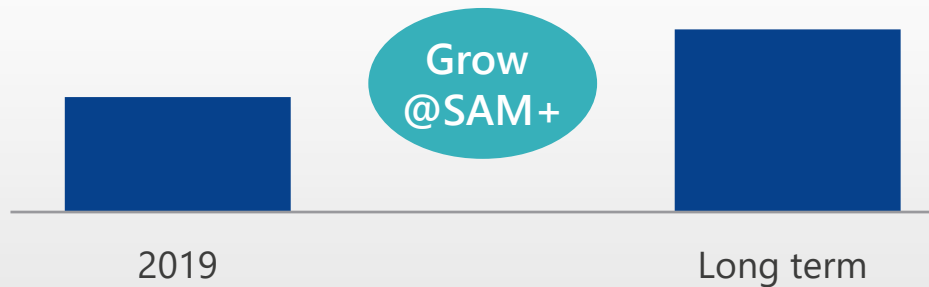
* Market CAGR: Renesas estimate based on Gartner research, Semiconductor Forecast Database, Worldwide, 4Q19 Update

INDUSTRIAL

Market
(\$m)



Revenue
(oku-yen)



Growth Driver



Industry 4.0 – Industrial Automation



Human-Machine Interaction

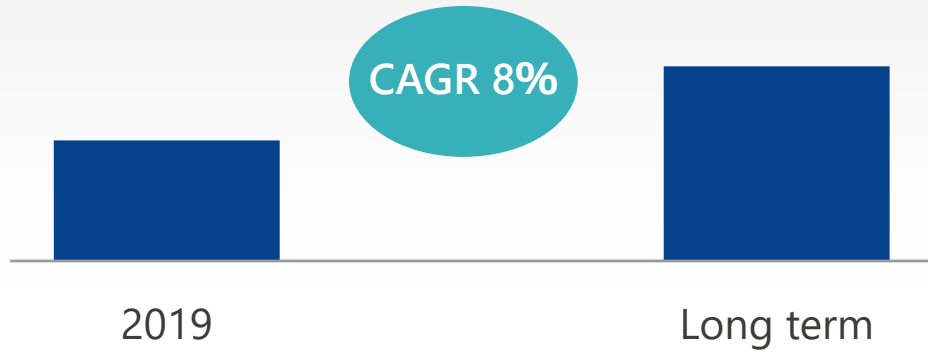


Robotics Application

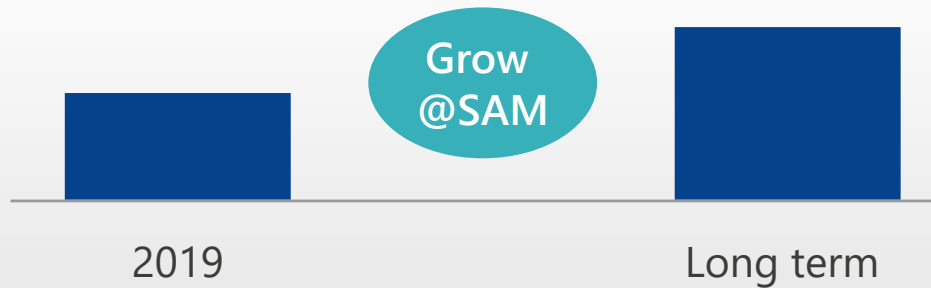
* Market CAGR: Renesas estimate based on Gartner research, Semiconductor Forecast Database, Worldwide, 4Q19 Update

IoT

Market
(\$m)



Revenue
(oku-yen)



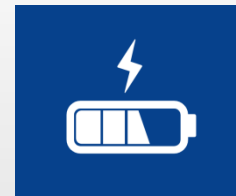
Growth Driver



E-AI – Intelligence Moving to Endpoint



1 Trillion Connected Devices

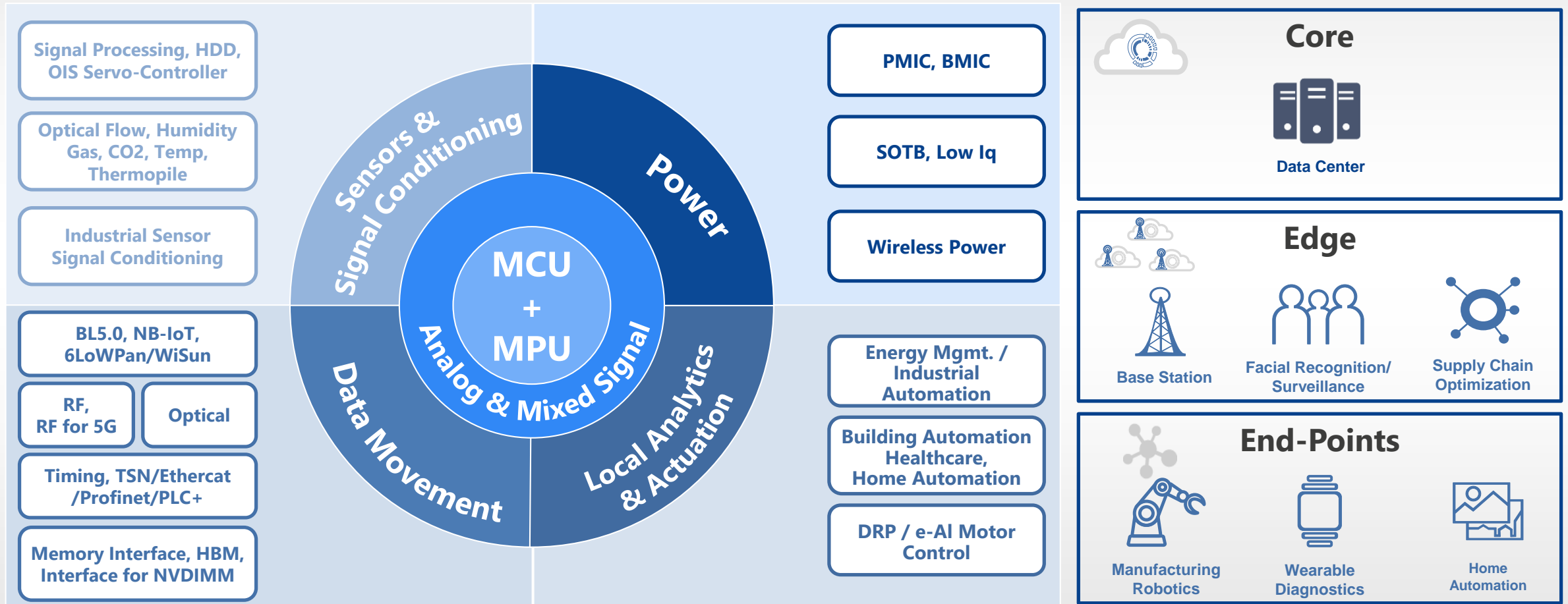


Wireless Charging Adoption

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

PRODUCT PORTFOLIO

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



HOW WE WIN

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**

HOW WE WIN

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BROAD & DIFFERENTIATED PRODUCT PORTFOLIO

Microcontrollers and Microprocessors



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



32-bit High power efficiency Motor Control



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



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



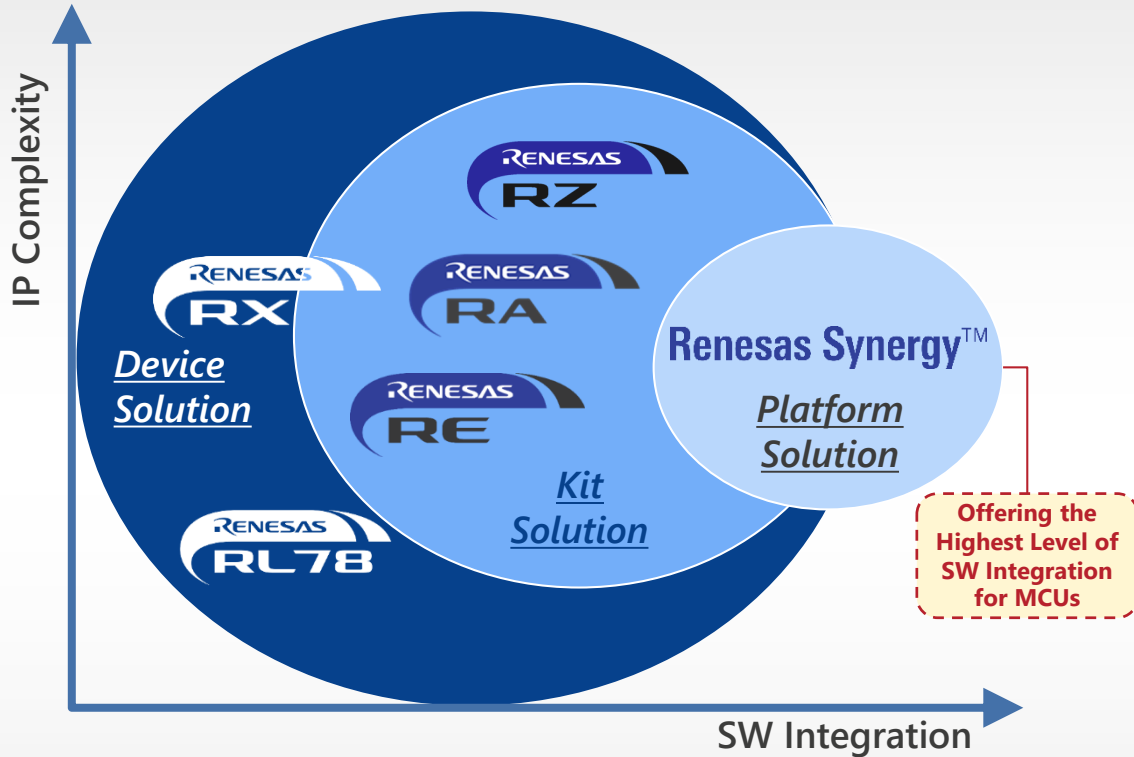
Factory Automation

Renesas Synergy

Complete HW + SW solutions for IoT and IIoT

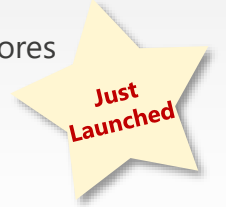
RENESAS DIFFERENTIATION

MCU & MPU EXCELLENCE



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

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



Energy Harvesting

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



High-End Embedded AI & Networking

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



MCU

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

MPU

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

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

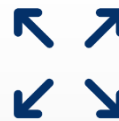
Devices Shipped



Timing

< 1-msec

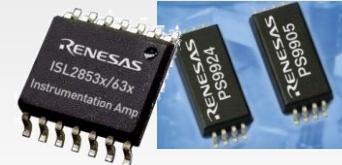
Industry Leading Performance



Broadest Portfolio



Low Power



RF/Optical



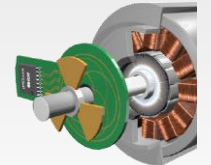
Complete Platform Solution



Highly Integrated Solutions
with Exclusive IP



Higher Data Rates & More
Efficient Systems



Sensors



AI-Based Human Presence
Detection



Cloud-Integrated



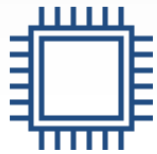
Robust in Harsh
Environments

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



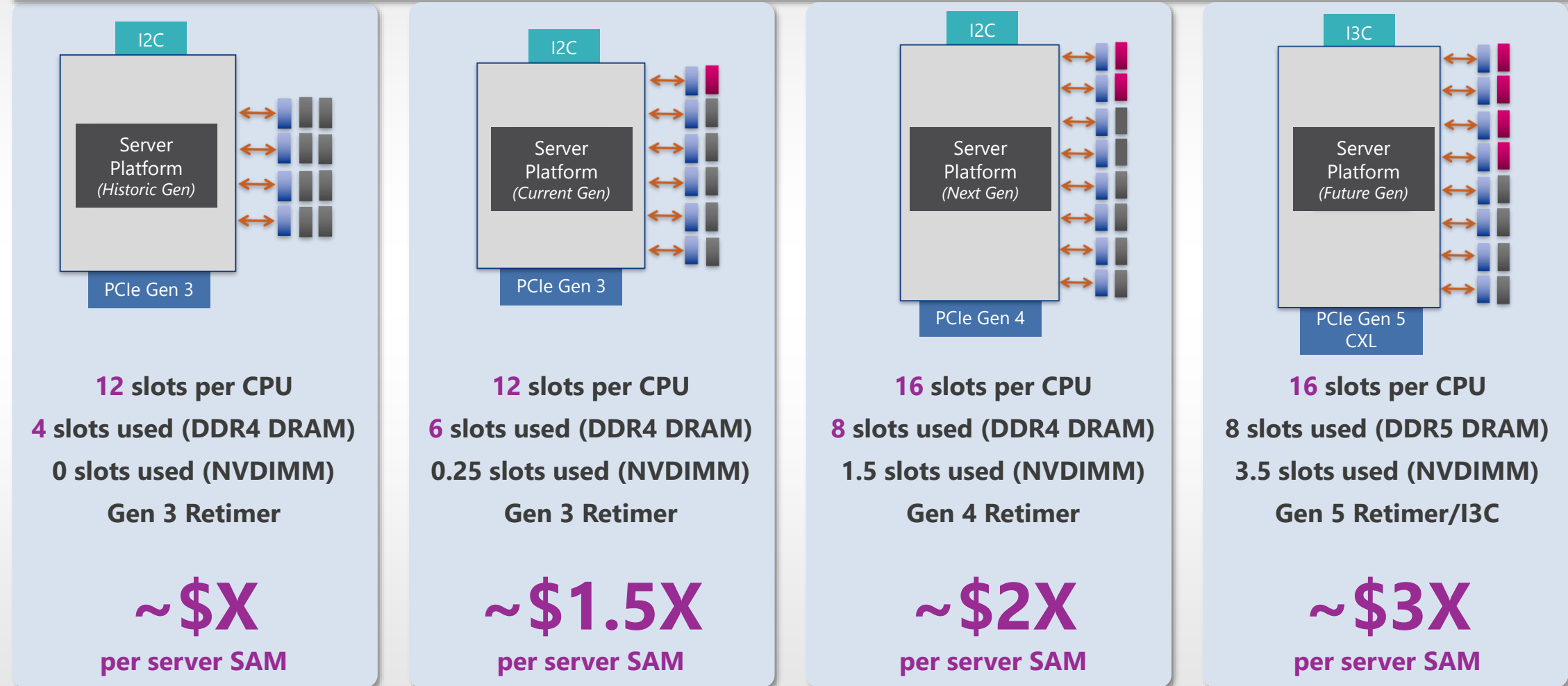
MONOS Based Embedded Flash

HOW WE WIN

- 1 Differentiated Portfolio of Products
- 2 **Content Expansion**
- 3 Winning Combinations & Focused Sales Strategy
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- 5 Ecosystem Partnerships

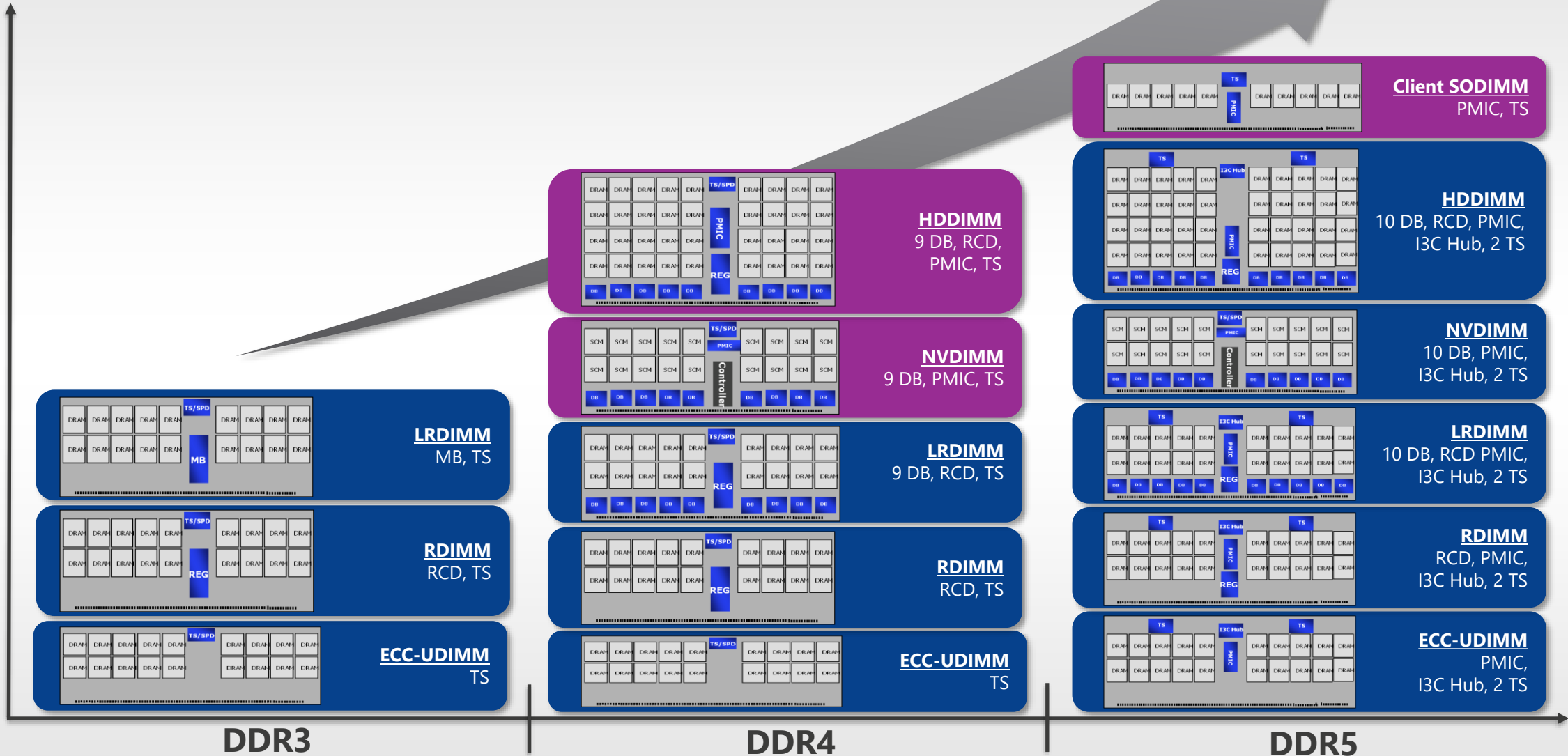
CONTENT EXPANSION FOR DATA CENTER

SERVER MAIN SYSTEMS



CONTENT EXPANSION FOR DATA CENTER SERVER MEMORY MODULES

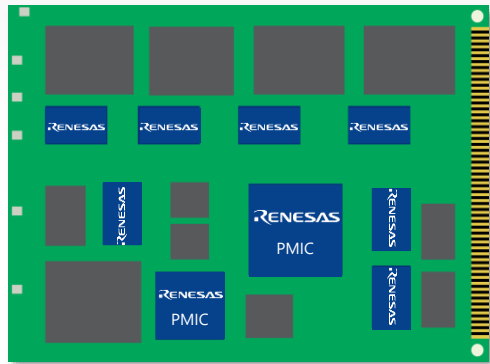
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CONTENT EXPANSION FOR DATA CENTER

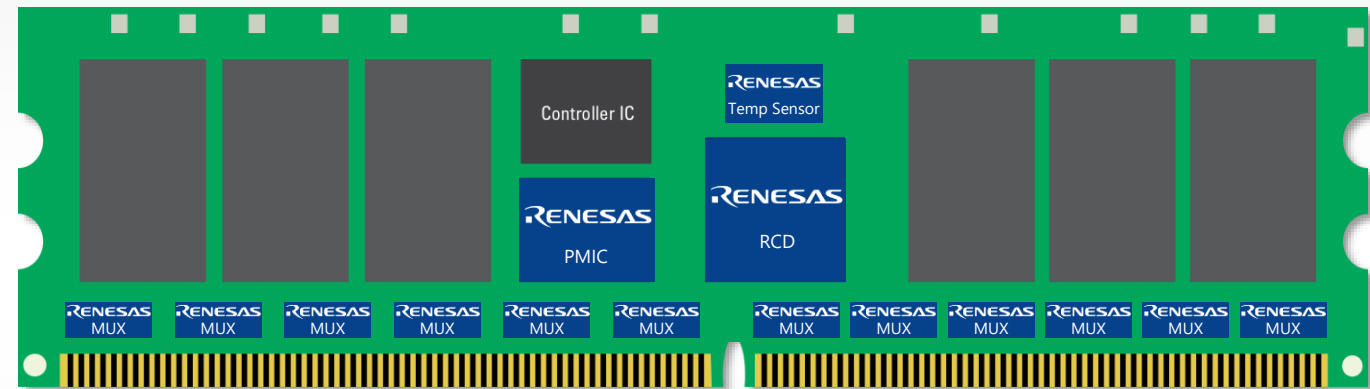
SERVER MEMORY MODULE (NON-VOLATILE MEMORY EXAMPLE)

Enterprise SSD and NVDIMM content



2 PMIC

7 Distributed Power Units

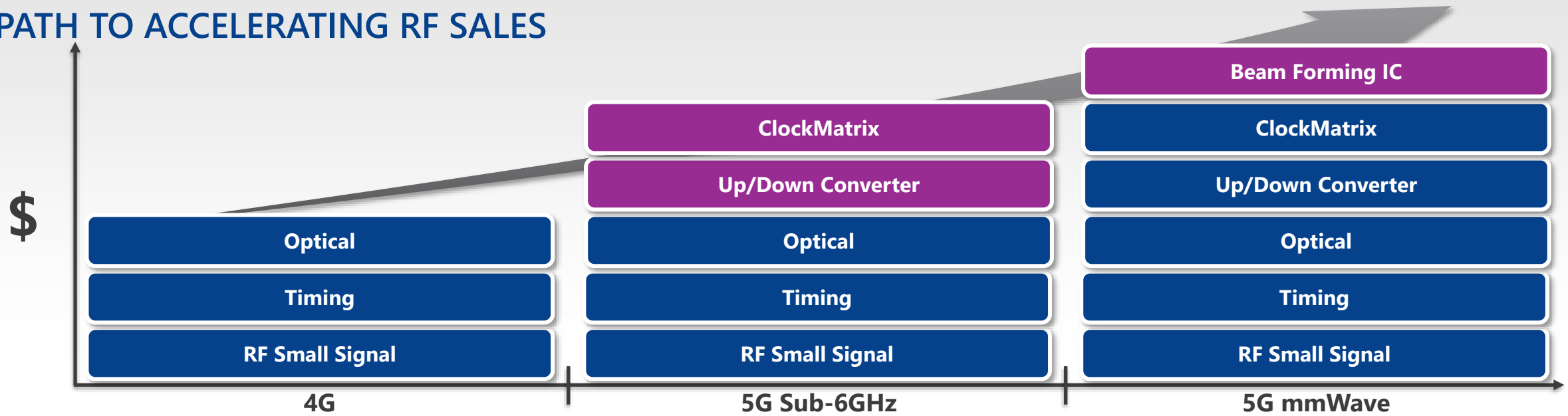


1 Register | 1 Temp Sensor

12 MUXes | 1 PMIC

CONTENT EXPANSION FOR 5G

PATH TO ACCELERATING RF SALES



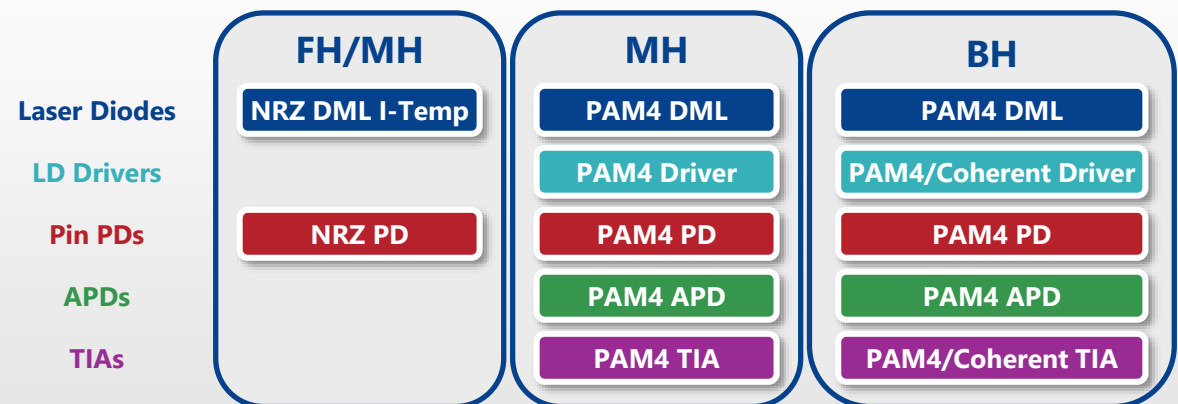
Renesas Portfolio Enabling 5G



January 22, 2020

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

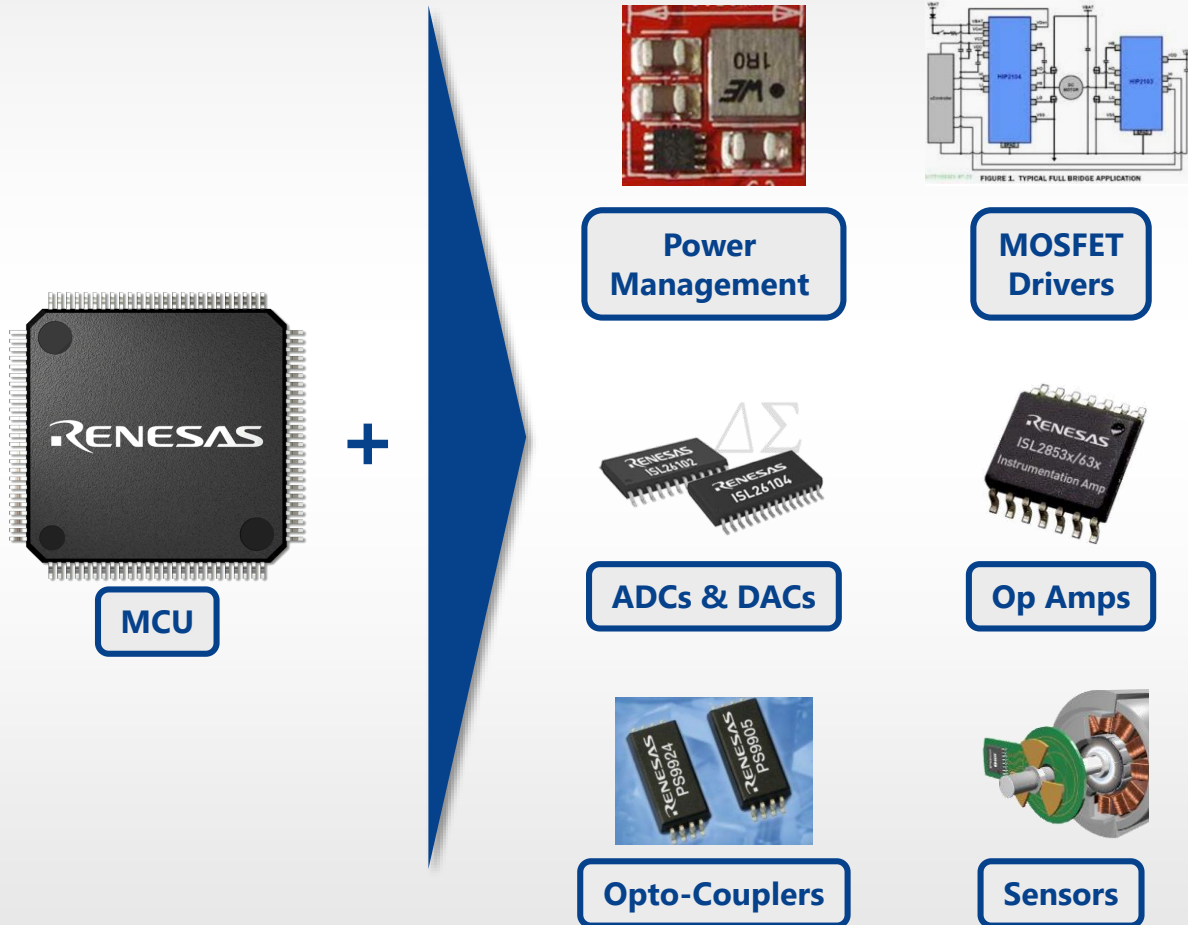
Comprehensive Optical Portfolio from Front-Haul to Back-Haul



CONTENT EXPANSION FOR INDUSTRIAL

Driving new industrial growth opportunities

Attaching Analog/Mixed Signal to MCU



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

ENHANCED 64-BIT MPU & AI ACCELERATOR STRATEGY

Industrial **HMI**

RZ/T & RZ/N Series **RZ/G Series** 64bit



Optimized MPU for the industrial market

+ "Vision" **+ "AI"**

RZ/A and New Series 64bit



HMI market enhancement with AI technology

HMI Well Positioned to Gain Share



Product development focused on the industrial market

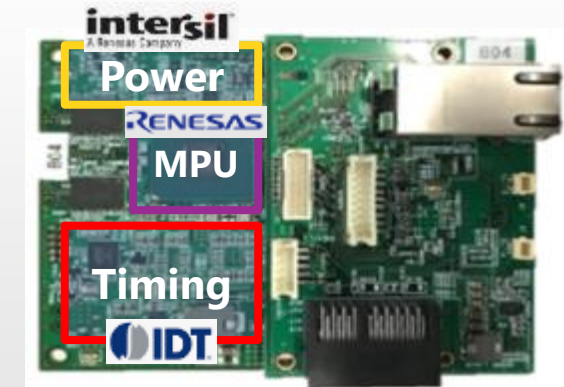


Addition of AI technology

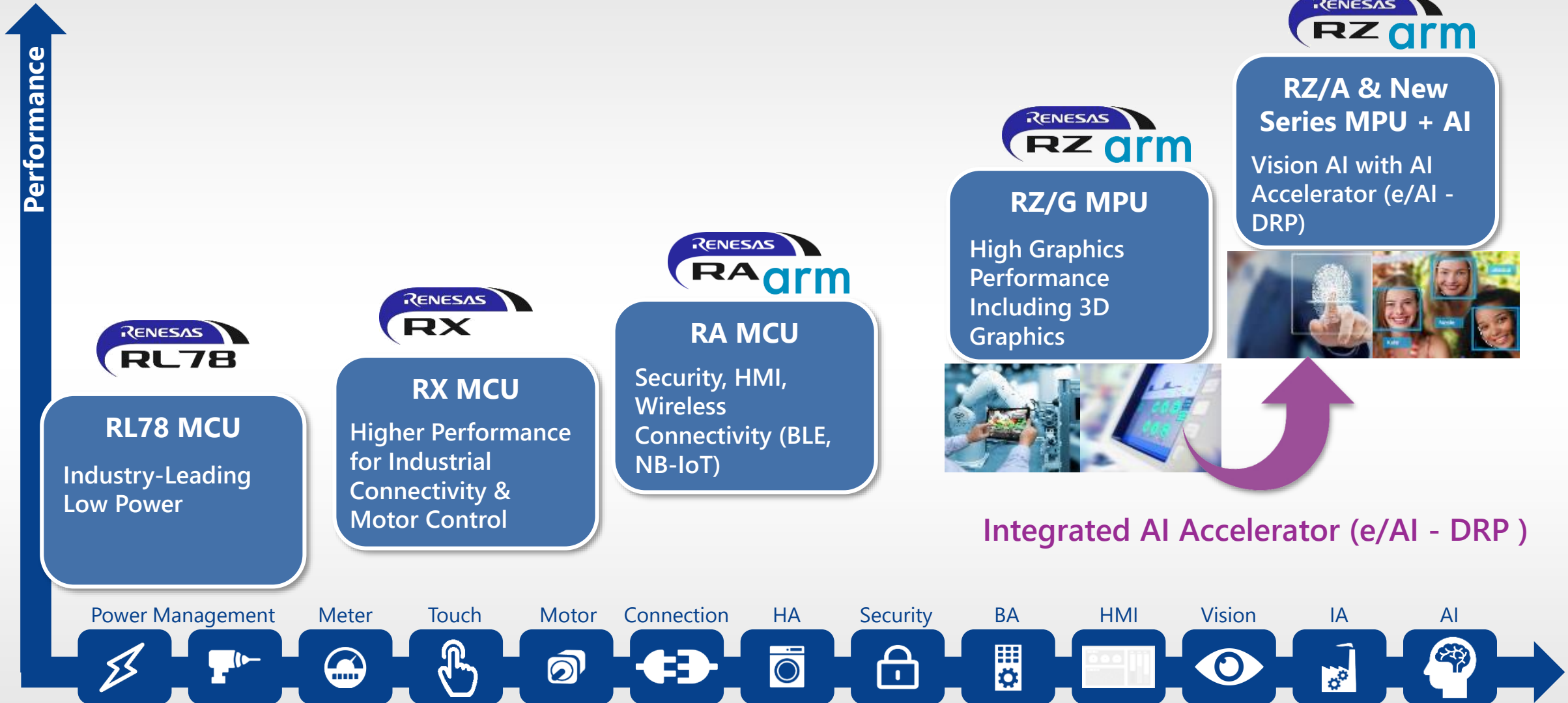
Deeper Coverage of System

Sell more solutions and cross sell

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



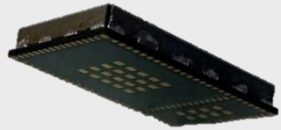
MCU & MPU POSITIONING



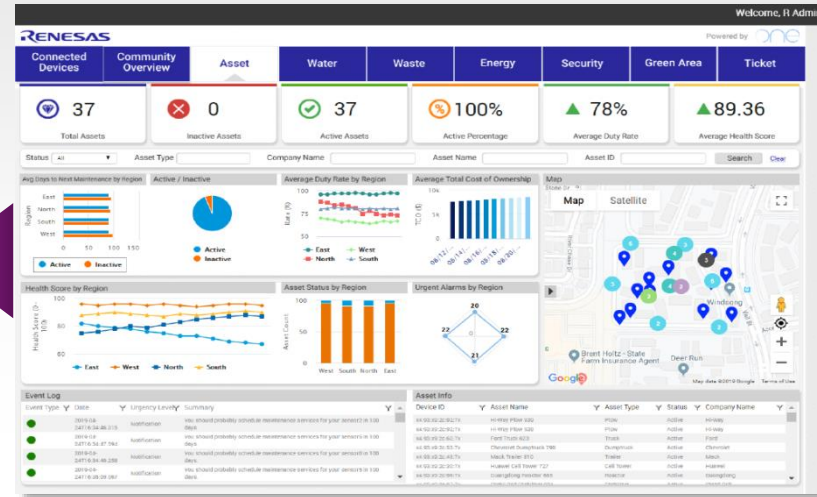
CONTENT EXPANSION FOR IoT SYSTEMS (1 OF 2)

COMBINING SENSORS WITH MCUS

Water & Irrigation Management



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

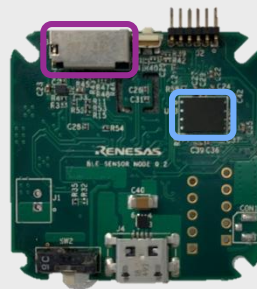
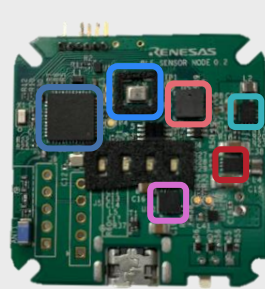
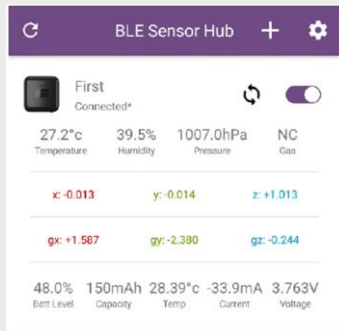


LED Lighting Control



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

Connected Devices | Asset Tracking | Data Storage



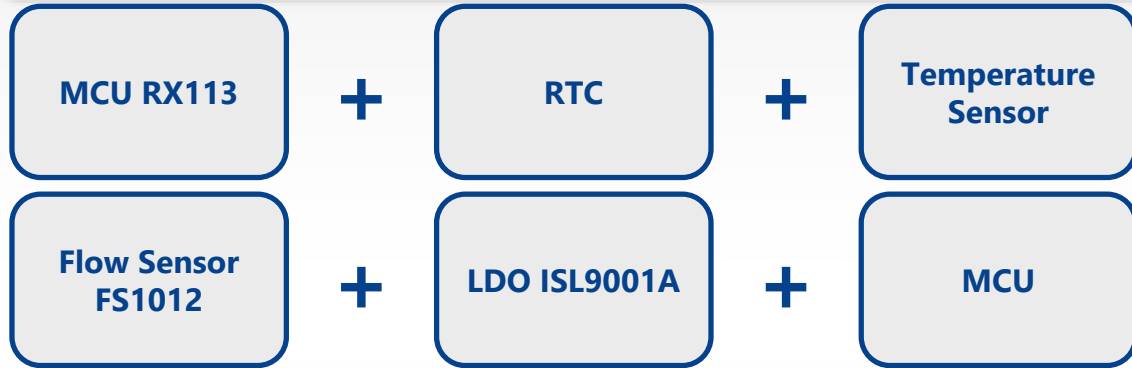
- MRAM Non-volatile memory
- High speed Quad SPI
- 3V supply voltage, -40°C to 105°C
- 8-pin SOIC, 8-pin WSON

- 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

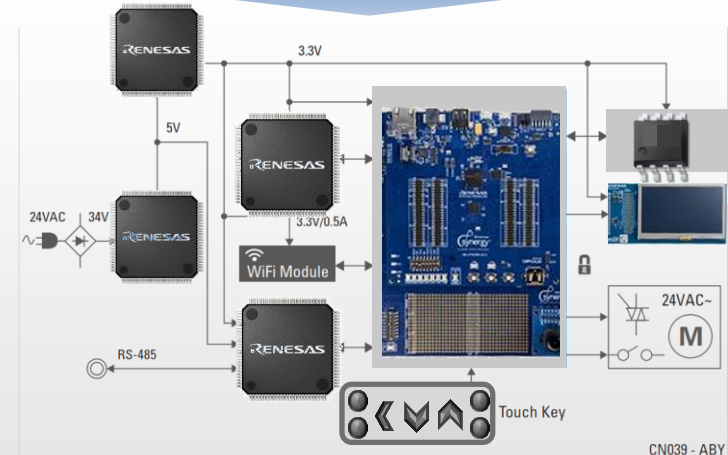
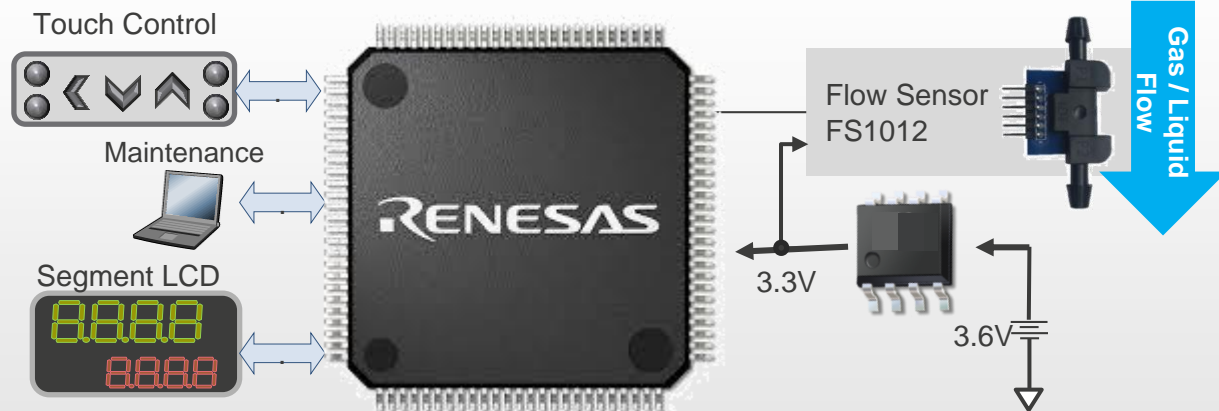
CONTENT EXPANSION FOR IoT SYSTEMS (2 OF 2)

COMBINING SENSORS WITH MCUS

Home Based Water Meter: Block Diagram



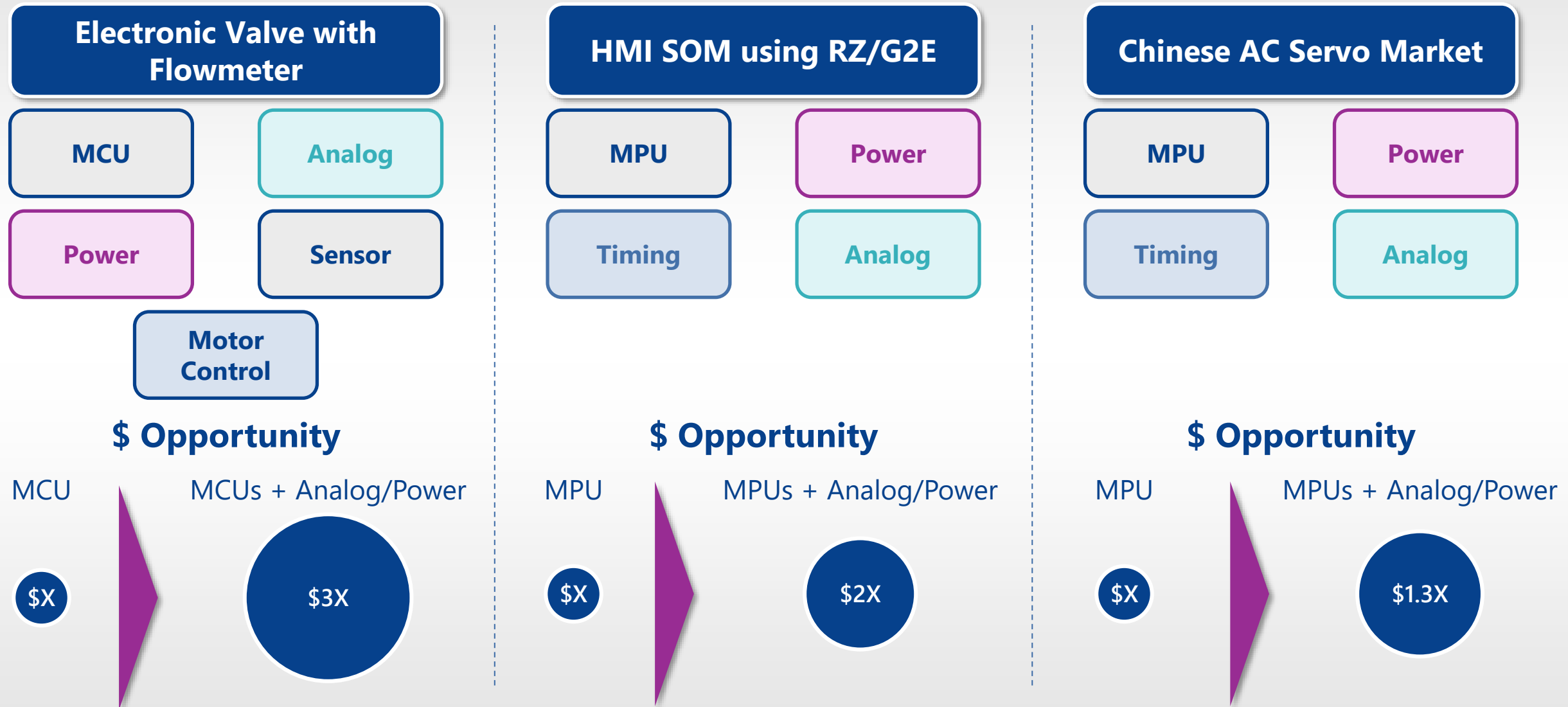
Smart Home: Color Touchscreen Thermometer with Cloud Conn.



HOW WE WIN

- 1 Differentiated Portfolio of Products
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- 4 Scalable & Complete Solution Offerings
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EXAMPLES OF WINNING COMBINATIONS



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



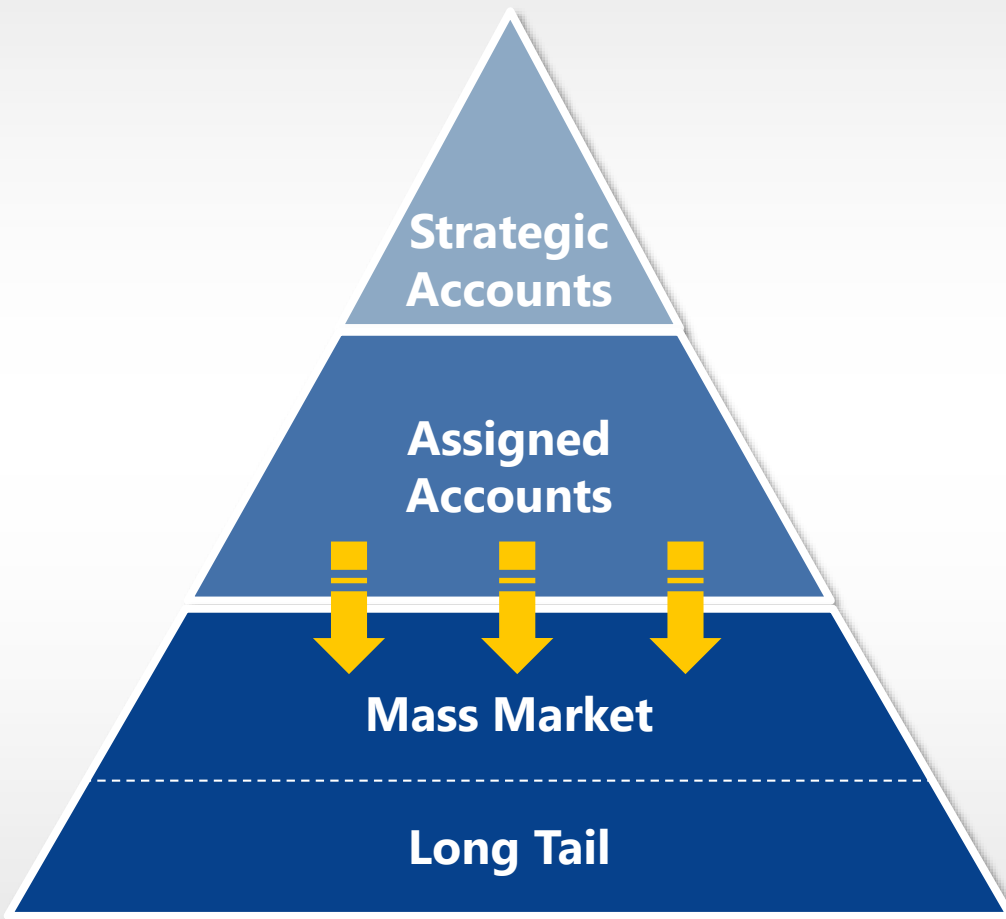
Digital marketing



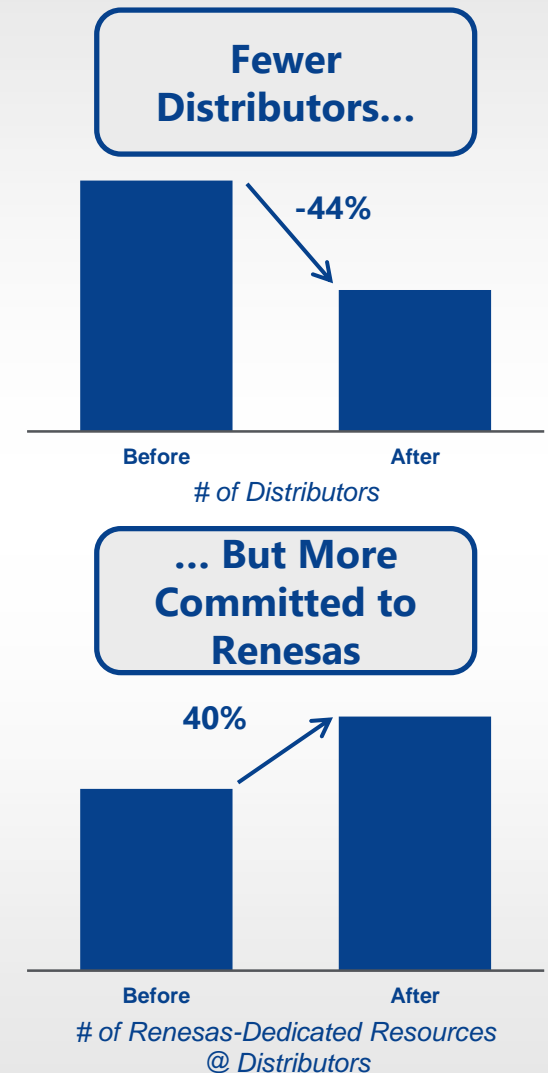
Solution & block diagram selling

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

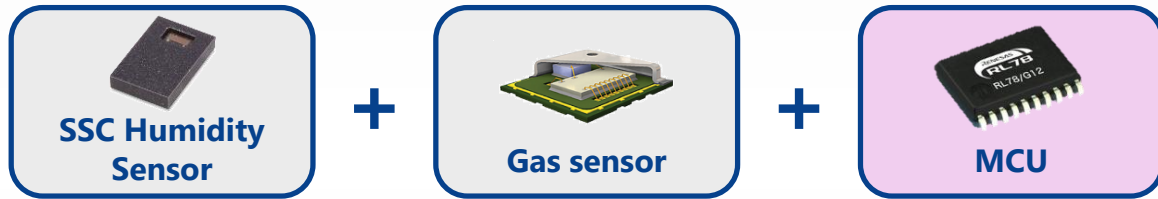


DEEPER

MORE \$\$\$ PER CUSTOMER

Pulling MCU into an Existing Analog Customer

Korean Industrial Customer



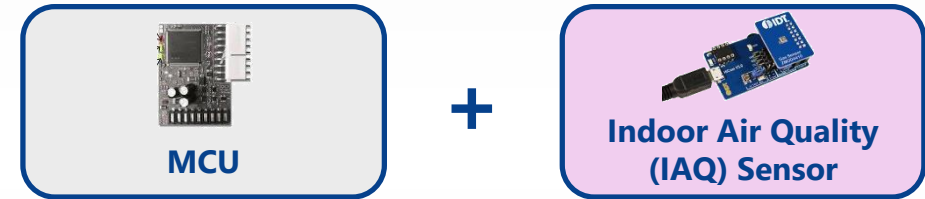
Combo sensor for Industrial & Consumer



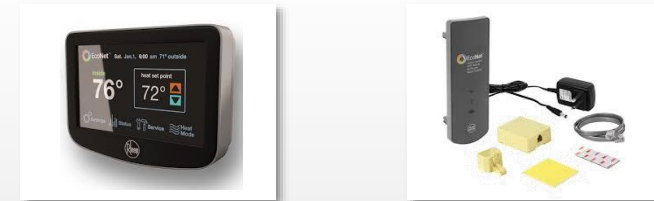
- Industrial & Consumer Markets require combo sensor modules
- Renesas supports total solution
- On-site supports with a long term relationship with Samyoung

Pulling Analog into an Existing MCU Customer

US Smart Home Customer



Smart home monitoring



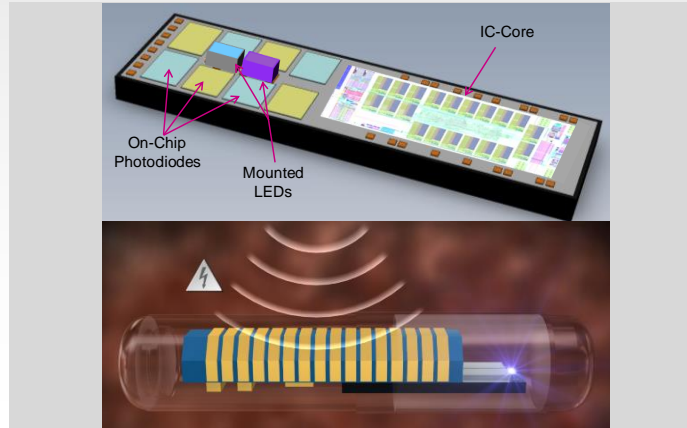
- Accelerating adoption of smart home solutions globally
- Combined offering provides safety, comfort, and energy savings
- Long history of RZ600 / RX200 MCU

BROADER

GOING BROADER TO EXTEND CUSTOMER REACH



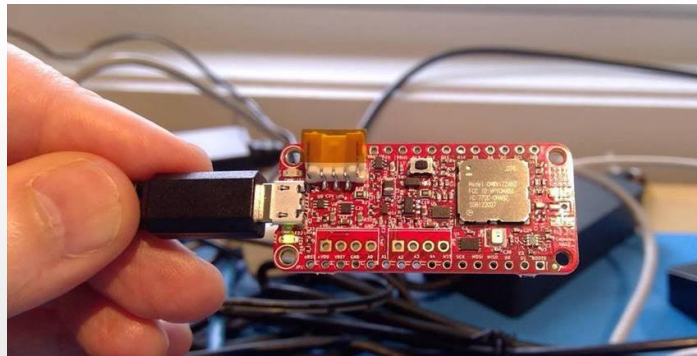
Jaewon CNC Air Purifier



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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SCALABLE SOLUTIONS FOR PREDICTIVE ANALYTICS (1 OF 2)

CASE STUDY - FACIAL RECOGNITION

Low Touch

General Purpose MCU



Performance: 3.5fps (280ms) *1

Low Cost and Low Power



Sample Available

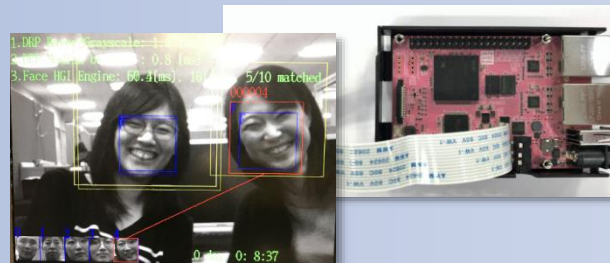
Mid Touch

Imaging Micro Processor



Performance: 16fps (64ms) *1

Low BOM Cost and Low Power



Sample Available

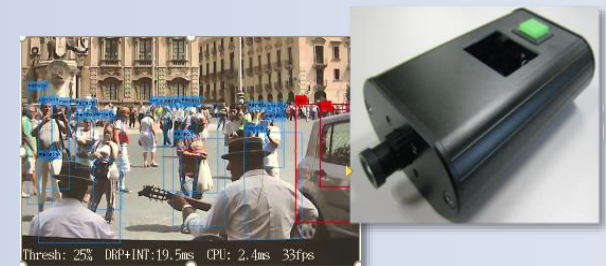
High Touch

AI Integrated Processor



Performance: 375fps (2ms) *1

High Power Efficiency for "AI"



Sample Apr 2020

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

SCALABLE SOLUTIONS FOR PREDICTIVE ANALYTICS (2 OF 2)

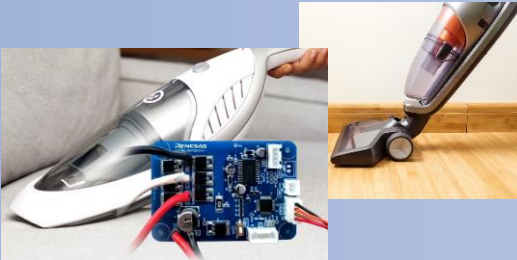
CASE STUDY - MOTOR CONTROL

Low Touch

Low End Motor Control



Suitable for Trapezoidal Drive Control
Low Cost and Low Power



Over 1,000 Products Available

Mid Touch

Wide Range Inverter Control



Suitable for Vector Control (FOC)
Motor Control Accelerator



Over 1,000 Products Available

High Touch

High Speed Motor Control



Suitable for Motion Control
1 Chip Solution for AC Servo Control



16 Products Available

COMPLETE MCU/MPU + ANALOG SOLUTIONS FOR TARGETED END MARKETS

Motor Control for Industrial & Robotics



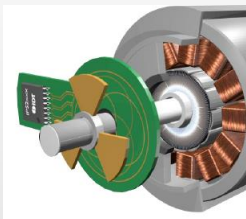
Blower Fan



Motorized Bicycle



Power Tools



Sensors

Health & Environment



Air Purifier



Cleaner / Vacuum



Water pumps



Water pumps



Water saving toilet pump

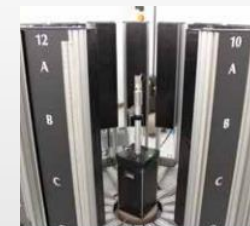
Sat. Comm. & Aero



Rad tolerant multiplexers

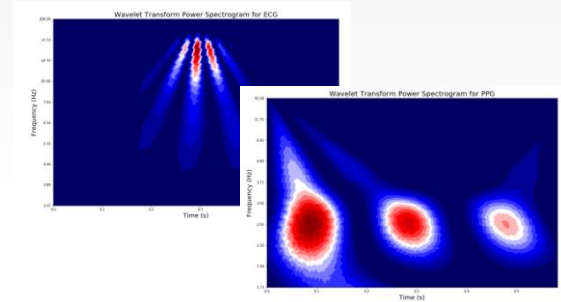


Rad hardened sequencers



Wafer production testing

Predictive Analytics



Blood Pressure Sensor System



Human Presence Detection

HOW WE WIN WITH INTEGRATED OFFERINGS

SERVER FAN COMPETITIVE COMPARISON

RENESAS



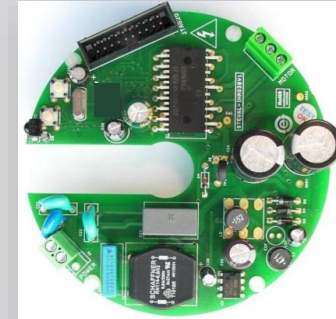
Targets BLDC **48V Server Cooling Fan Application**

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

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

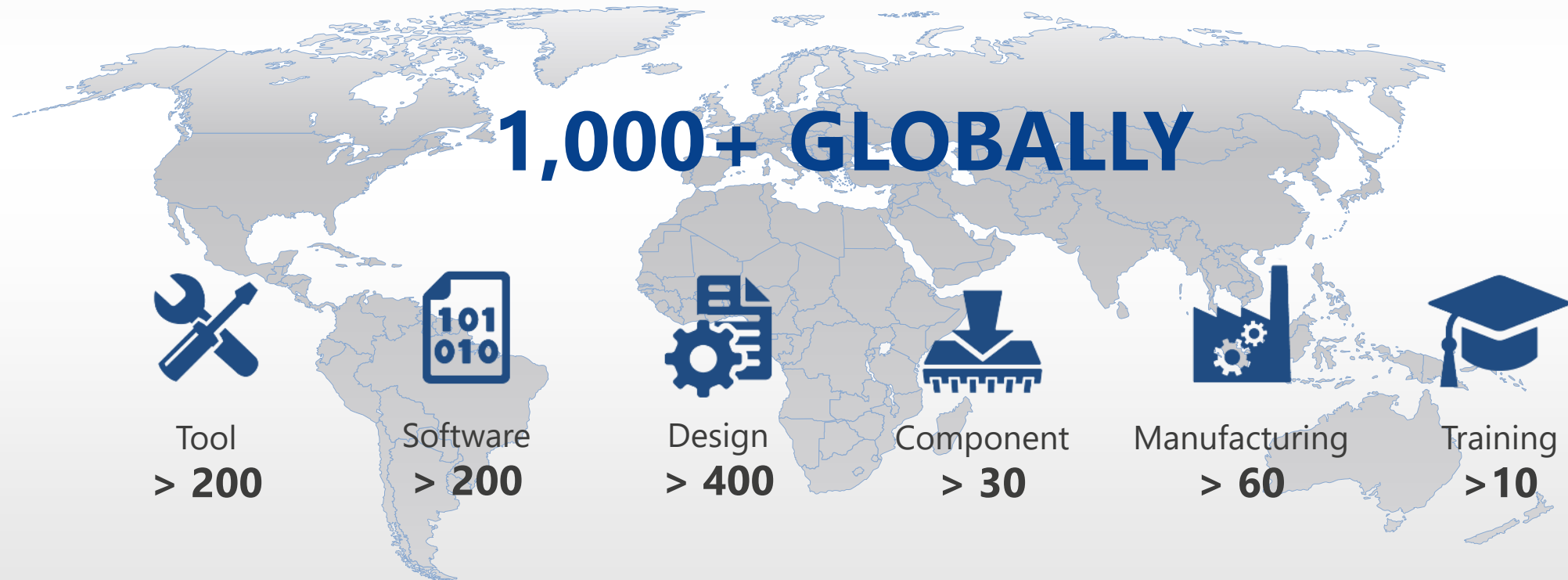
ROBUST ECOSYSTEM

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



ECOSYSTEM PARTNERS – ENABLING SOLUTIONS ACROSS SEGMENTS

Select Partnerships

MCU

Connectivity & Cloud



MPU

AI



Data Center

OEM/ODM



Technology Partnerships



P&L MODEL FOR IIBU

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

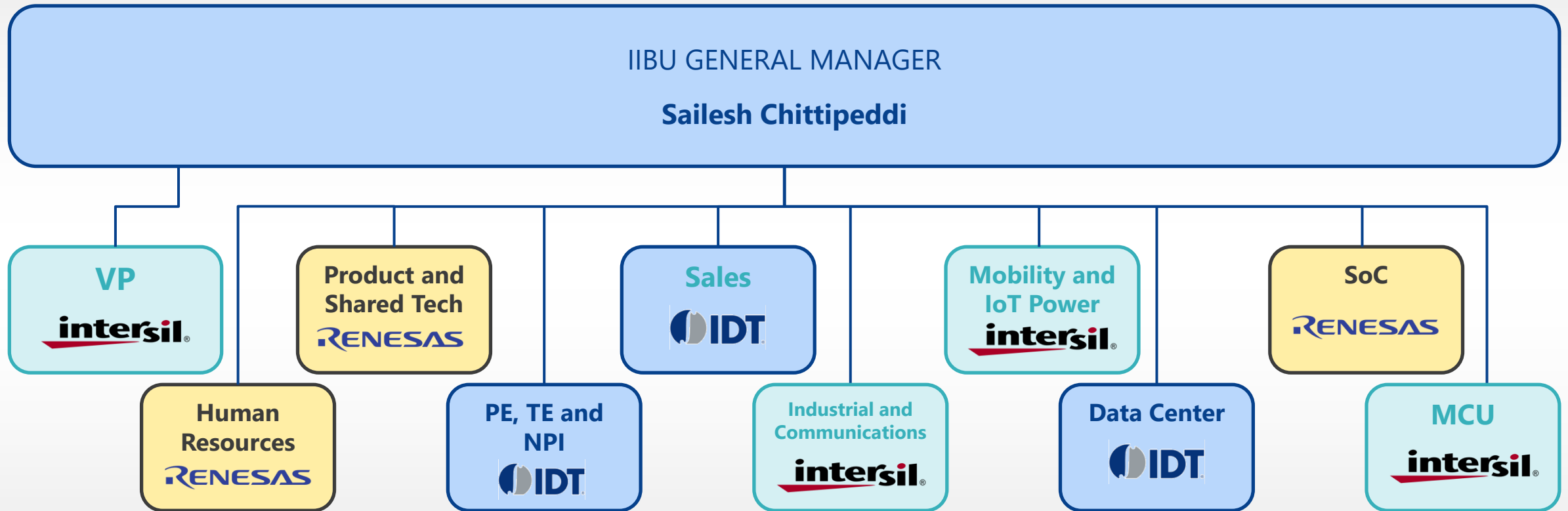
- Measure progress on Design-in & GPM & OI

Year 3+

- Deliver Target Model!

ORGANIZATIONAL SYNERGY

A Well-Blended Team



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

[Renesas.com](https://www.renesas.com)