# Edge Computing for Security Systems

## ▪ Overview

With over a trillion IoT devices expected to connect to the cloud in the coming years, the challenge is that there is not enough bandwidth to process all the information within central data centers. To alleviate this pipeline limitation, there will be an increasing focus on data processing at the edge of the network to provide useful and actionable insights at the local application level. An example of this problem is intelligent security, which provides monitoring and surveillance either through audio or video processing.

This edge computing design demonstrates a full security control solution capability utilizing Renesas MPU devices for fast local processing. The RZ/A2M features high-capacity internal RAM (4MB), a DRP that delivers 10x image processing performance to enable edge computing features, and strong connectivity via MIPI/LVDS/2 port Ethernet.
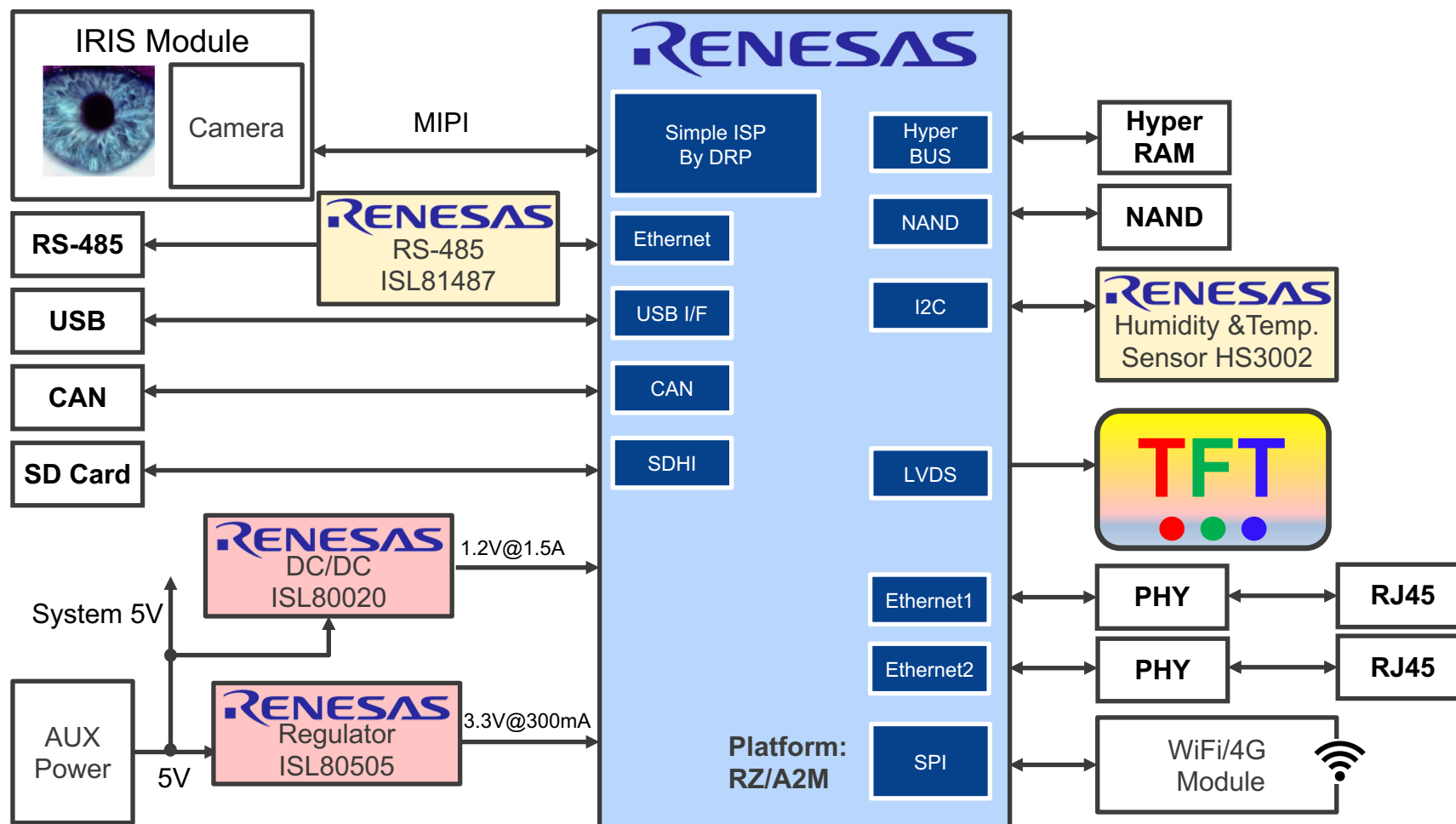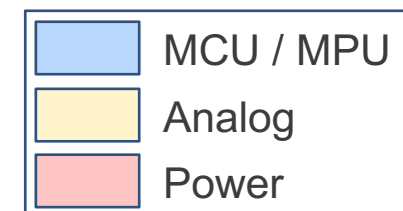
This high-performance power and analog system utilizes Renesas' DC/DC, LDO, RS-485/422 transceiver, and sensors that provide leading accuracy and excellent stability across humidity and temperature.

## ▪ System Benefits

- High performance and suitable MPU RZ/A2M with embedded 4MB RAM, Dynamically Reconfigurable Processor (DRP) technology
- Rich connection interface, including MIPI for camera, 2Port Ethernet, RS-485, USB, CAN, Hyper-Bus
- Full Renesas RS-485 transceiver, DC/DC, LDO, temperature/humidity sensor device portfolio

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# Edge Computing for Security Systems

**Legend:**
- MCU / MPU
- Analog
- Power

## IRIS Module

Camera

**RS-485**

**USB**

**CAN**

**SD Card**

RENESAS — RS-485 ISL81487

System 5V

RENESAS — DC/DC ISL80020 → 1.2V@1.5A

AUX Power — 5V

RENESAS — Regulator ISL80505 → 3.3V@300mA

MIPI

**Platform: RZ/A2M** (RENESAS)

- Simple ISP By DRP
- Ethernet
- USB I/F
- CAN
- SDHI
- Hyper BUS
- NAND
- I2C
- LVDS
- Ethernet1
- Ethernet2
- SPI

**Hyper RAM**

**NAND**

RENESAS — Humidity &Temp. Sensor HS3002

TFT

**PHY** ↔ **RJ45**

**PHY** ↔ **RJ45**

WiFi/4G Module

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# Edge Computing for Security Systems

| Device Category | P/N | Key Features |
|---|---|---|
| MPU | RZ/A2M R7S9210xxVCBG | The RZ/A2M MPU is designed for e-AI based imaging in smart appliances, networked cameras, service robots, scanner products, and industrial machinery that require high-speed image processing. It features a unique hybrid approach to image recognition and machine vision by combining proprietary DRP technology for fast pre-processing of image data and feature extraction, closely coupled to an Arm® Cortex®-A9 CPU for AI inferencing |
| Power | ISL80505 | 500mA output current and output voltage can be programmed from 0.8V to 5.5V. (TJ= -40°C to +125°C). |
| Power | ISL80020 | Highly efficient, monolithic, synchronous step-down DC/DC converters that can deliver up to 2A of continuous output current |
| Analog | HS3002 | Silicon Carbide capacitive sensing element, excellent stability against aging, temperature sensor accuracy of ±0.2°C |
| Analog | ISL81487 | 5V, Half Duplex, 5Mbps, RS-485/RS-422 Transceiver |

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# ISL80505/510 – High Performance 0.5A/1A LDO
## Low Noise for Instrument, Industrial, Medical applications

## Stable Output Voltage

- ±1.8% $V_{OUT}$ accuracy guaranteed over line, load
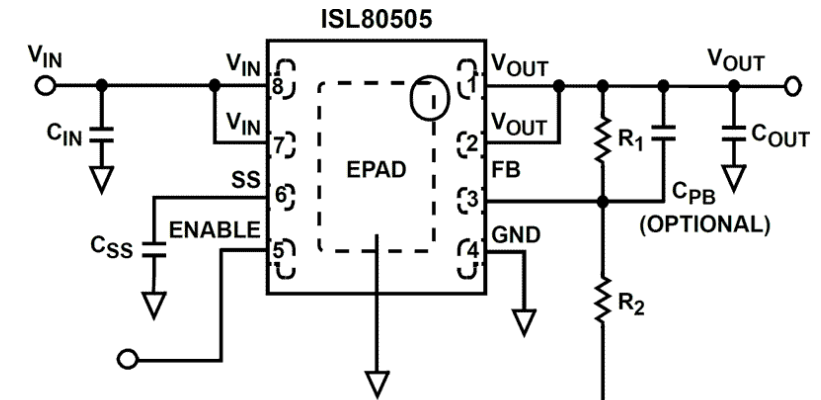- Stable with a 4.7µF output ceramic capacitor

## High Efficiency

- Very low 45mV dropout voltage at $V_{OUT}$ = 2.5V
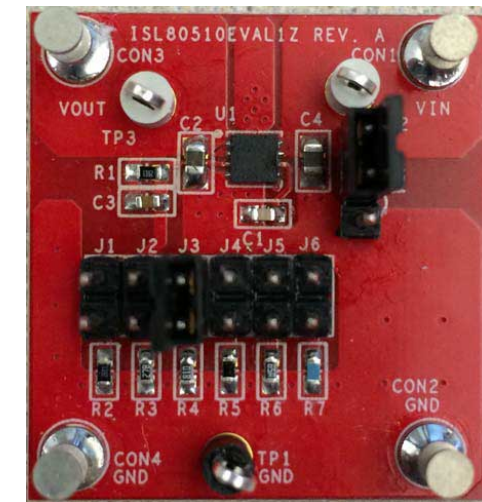- Very fast transient response

## High Performance

- Excellent PSRR over wide frequency range
- Programmable output soft-start time

## Excellent Safety

- Current limit protection
- Thermal shutdown function



**Typical Application Circuit**



**ISL80510EVAL1Z 1A LDO Eval Board**

| Part # | Vin (V) | Iout (A) | Package |
|--------|---------|----------|---------|
| ISL80505 | 1.8V to 6V | 0.5 | 3x3 DFN |
| ISL80510 | 2.2V to 6V | 1 | 3x3 DFN |

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# ISL80020/20A – Vin 5.5V/2A Sync Buck DC/DC
## Compact Synchronous Buck Converters with High Efficiency

## Compact for Space Limited Applications

- 8 pin 2mmx2mm TDFN
- 1MHz or 2MHz switching frequency, allowing for the use of small inductors
- The high-side PMOS reduce the external Boot capacitor

## High Efficiency

- Integrate very low $r_{DS(ON)}$ MOSFETs maximize efficiency up to 95%
- 100% duty cycle(1MHz)

## Excellent Safety

- Overcurrent and short circuit protection
- Over-temperature/thermal protection
- $V_{IN}$ Undervoltage Lockout and $V_{OUT}$ Overvoltage Protection
- Negative current protection

| Part # | Iout (MAX)(A) | $f_{SW}$(MHZ) | $V_{IN}$ Range(V) | $V_{OUT}$ Range(V) | Package |
|---|---|---|---|---|---|
| ISL80020FRZ-T | 2 | 1 | 2.7 to 5.5 | 0.6 to 5.5 | 2x2 TDFN |
| ISL80020AFRZ-T | 2 | 2 | 2.7 to 5.5 | 0.6 to 5.5 | 2x2 TDFN |
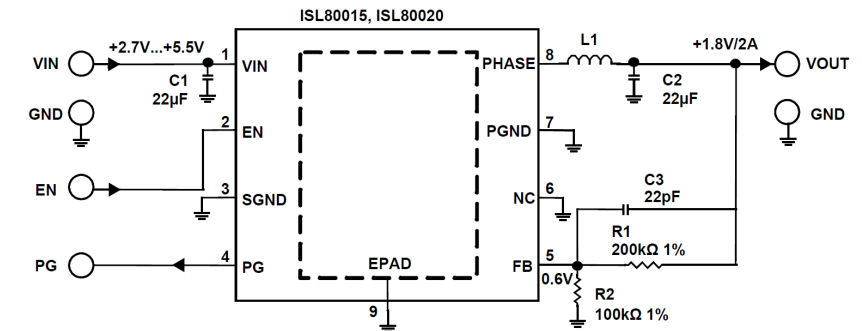


**Typical Application Circuit**



**ISL80020ADEMO1Z Evaluation Board**

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# RZ/A2M – Arm® Cortex®-A9 MPU with Embedded SRAM

## Unique DRP Technology for Image Processing

### No External Memory Required
- Embedded 4MB SRAM inside
- Benefit cost and board size

### High Speed on Image Processing
- With 2D graphic accelerator
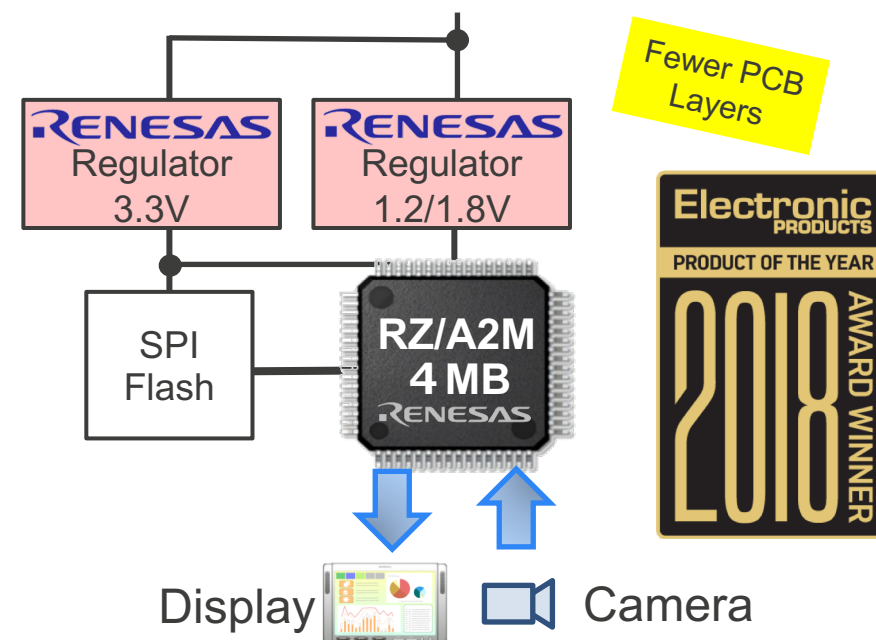- DRP tech with specific library

### Low Power Consumption
- Eco-friendly DRP tech on real time processing comparing to common FPGA

### Multi Interface and Security
- Support MIPI interface
- Double channel Ethernet interface
- On-chip hardware encryption

| Part # | Feature | Package |
|--------|---------|---------|
| R7S921040VCBG | No DRP, no trusted secure IP | PLBG0176GA-B |
| R7S921045VCBG | No DRP, w/ trusted secure IP | PLBG0176GA-B |
| R7S921051VCBG | w/ DRP, no trusted secure IP | PLBG0256KA-B |
| R7S921056VCBG | w/ DRP, w/ trusted secure IP | PLBG0256KA-B |

Fewer PCB Layers

RENESAS Regulator 3.3V

RENESAS Regulator 1.2/1.8V

SPI Flash

RZ/A2M 4 MB RENESAS

Display    Camera

**Typical Application Diagram**

Electronic PRODUCTS
PRODUCT OF THE YEAR
2018 AWARD WINNER

RENESAS RZ RZ/A2M

**RZ/A2M Evaluation Board**

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# HS3002 – Digital Relative Humidity & Temperature Sensor
## Highly-accurate, Fully-calibrated, Fast Response Time, and Excellent Stability

## High Accurate:

- RH accuracy: ±1.8% RH typical
- Temperature sensor accuracy: ±0.2°C typical (-10 to +80°C)
- 14-bit resolution: 0.01% RH (typical)

## Fast Response and Low Power:

- Fast RH response time (typical 6 seconds)
- Low power consumption: 1.0µA average (one RH+T measurement per second, 8-bit resolution, 1.8V supply)

## Easy to Use:

- Internally corrected and compensated for accurate operation over a wide range of temperature and humidity levels. No user calibration of the output data is required
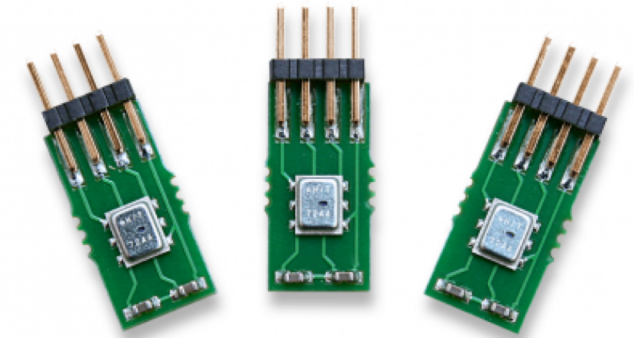


HS300x ICs (relative)

| Part # | Description | Package |
|--------|-------------|---------|
| HS3001 | ±1.5%RH (Typical) | 3.0 × 2.41 × 0.8mm, 6-LGA (LHG6D1) |
| HS3002 | ±1.8%RH (Typical) | 3.0 × 2.41 × 0.8mm, 6-LGA (LHG6D1) |
| HS3003 | ±2.8%RH (Typical) | 3.0 × 2.41 × 0.8mm, 6-LGA (LHG6D1) |
| HS3002 | ±3.8%RH (Typical) | 3.0 × 2.41 × 0.8mm, 6-LGA (LHG6D1) |



SDAH02 Evaluation Kit

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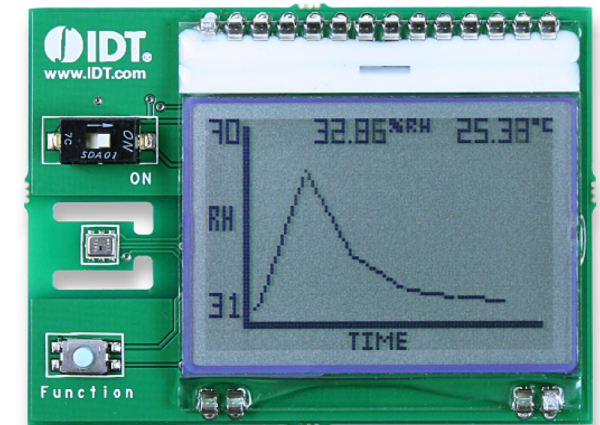
# ISL81487 – 5V, Half Duplex, RS-485/RS-422 Transceiver

## 5Mbps RS485/422 Transceiver for Industrial Networks

### High Speed 1/8 Unit Load to the RS-485 Bus

- Fractional unit load up to 256 devices
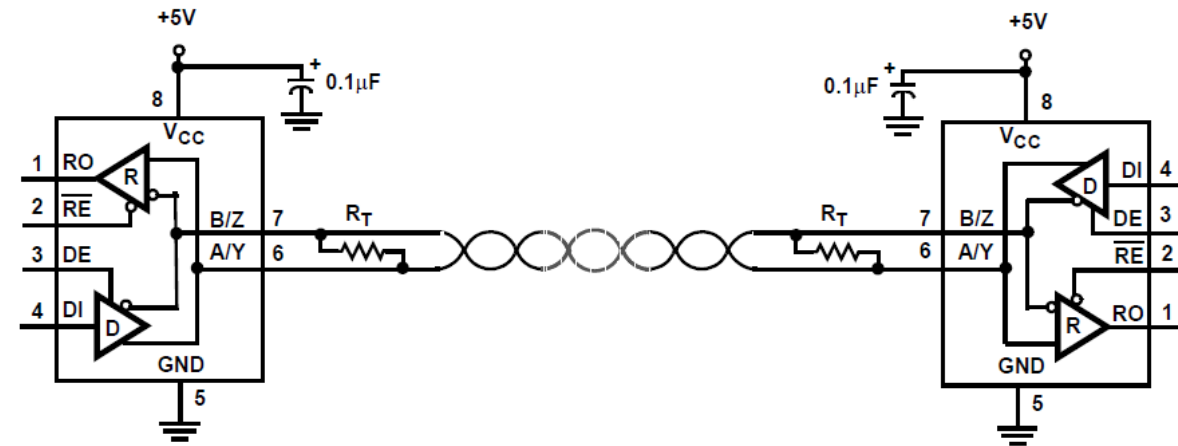- High data rate version up to 5Mbps

### Robust ESD Optimized

- Class 3 ESD protection (HBM) on all pins >7kV
- ISL81487E I/O pin ESD protection: ±15kV HBM
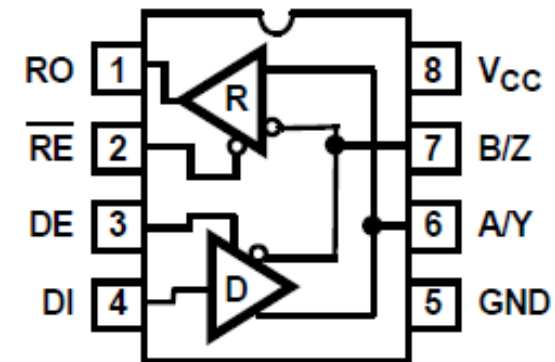
### Low Power Mode

- Low quiescent supply current:420uA(Max.)

### Fail Safe Design

- Three state Rx and Tx outputs
- Specified for 10% tolerance supplies
- Current limiting and thermal shutdown for driver overload protection



**Typical Operation Circuits**



**Pin Assignment**

| Part # | Half/Full Duplex | No. of Devices | Data Rate Mbps | I/O ESD Protect | Package |
|---|---|---|---|---|---|
| ISL81487IBZ | Half | 256 | 5 | >7KV | 8L 5x6 SOIC |
| ISL81487EIBZ | Half | 256 | 5 | +/-15KV | 8L 5x6 SOIC |

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