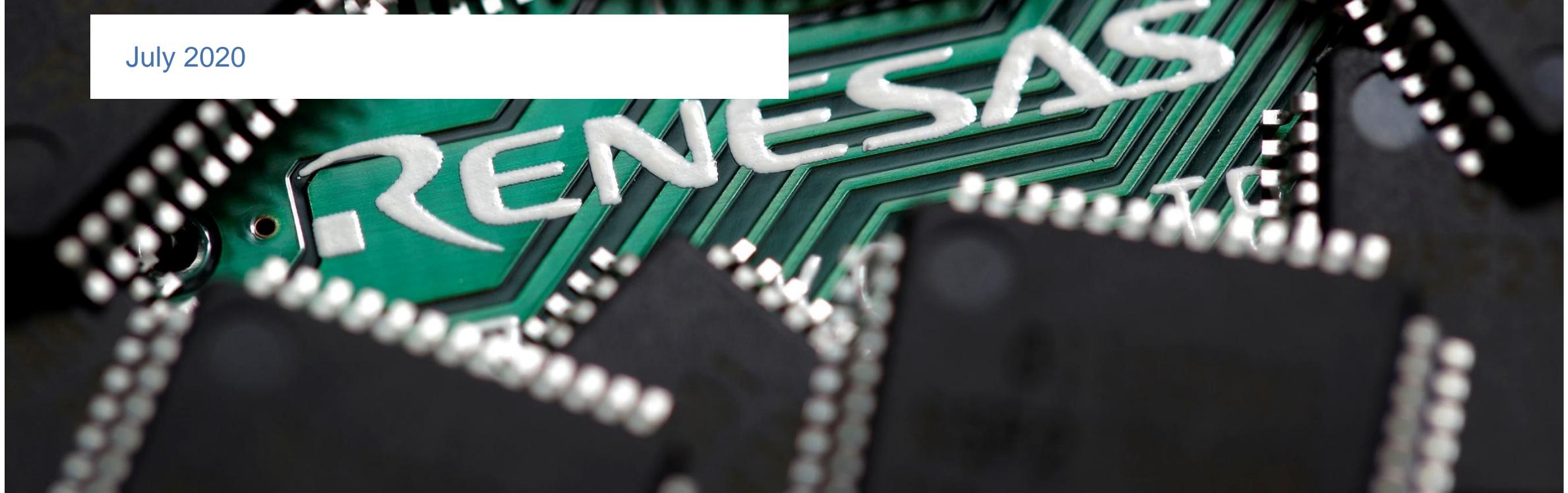


# JP136

## Industrial Sensor Network Solution

July 2020



# Industrial Sensor Network Solution

## ▪ Overview

This is a complete sensor slave reference solution for temperature controllers, transmitters, data loggers, etc. For IO-Link applications, sensing parameter settings can be done through the IO-Link tool on a PC connected to the user's IO-Link master board. The slave board will be expanded as a universal board, which will be able to connect with various MCU evaluation boards, some RS-485 interfaces, and a controller area network (CAN) with industrial fieldbus. Each connection is independent and the user can select the appropriate connection for their application.

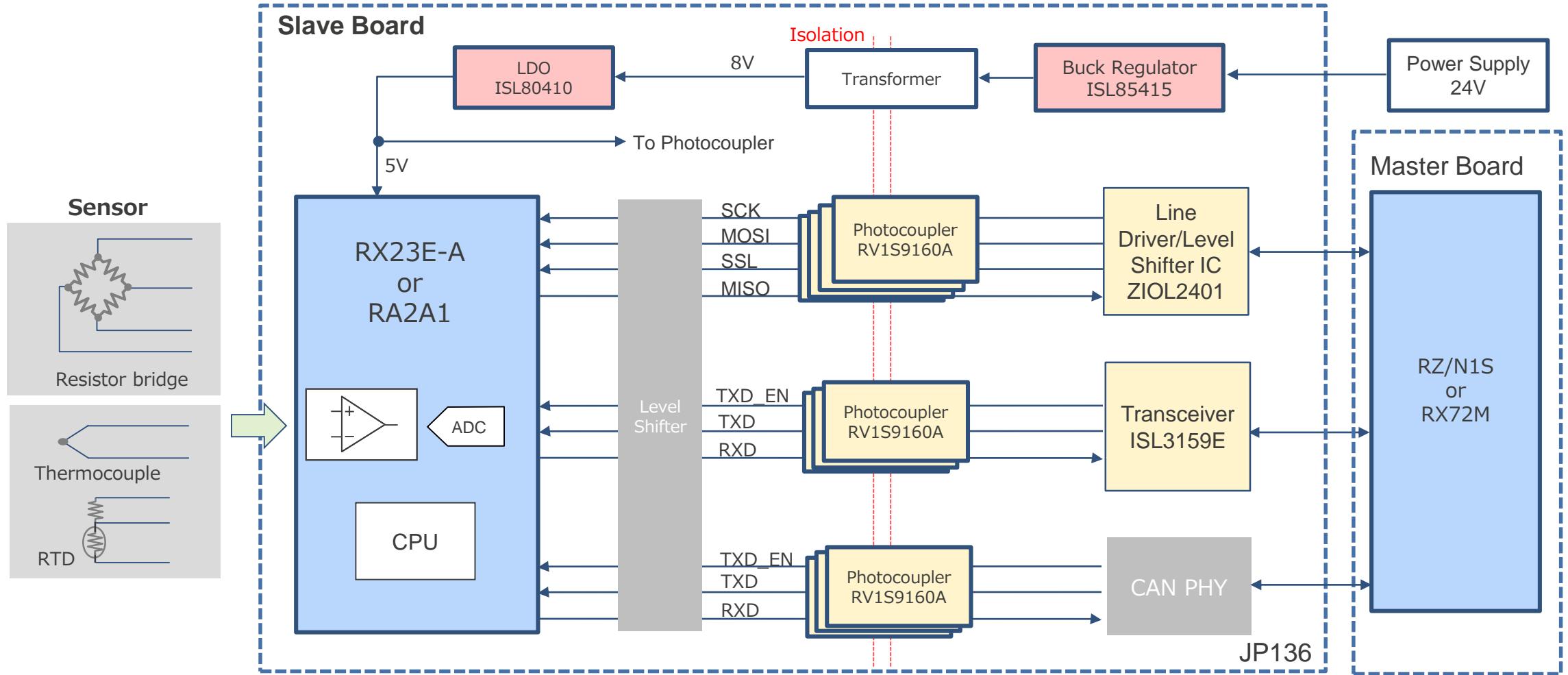
## ▪ System Benefits

- Cost-effective two-way communication
- Parameters are factory programmed
- Real-time sensing status monitoring
- Compact solution can be attached to small sensor devices

JP136

# Industrial Sensor Network Solution

MCU / MPU      Analog      Power



# Industrial Sensor Network Solution

Device Category	Part Number	Key Features
MCU	RX23E-A	Analog front end mounted 32-bit MCU 32 MHz RX v2 core with 2 low-noise and low-drift 24-bit delta-sigma A/D converters
	RA2A1	Ultra-low power 48-MHz Arm® Cortex®-M23 core Complete analog solution for signal conditioning and measurement
	RZ/N1S	Industrial Ethernet MPU Arm® Cortex®-A7 + Cortex®-M3
	RX72M	240MHz RXv3 MCU with EtherCAT® slave controller High-performance 32-bit microcontroller for industrial network solutions
Power	ISL80410	High voltage adjustable VOUT LDO Low quiescent current and 40V/150mA output
	ISL85415	0.5A regulator with integrated high side FET Supports 3V-36V input voltage range for buck output
Analog	ZIOL2401	Dual channel IO-Link HV line driver
	ISL3159E	High ESD protected RS-485/RS-422 transceivers
	RV1S9160A	High-speed CMOS output optocouplers High CMR, 15Mbps, low forward-current (IF) 3.3V/5V operation 5-Pin SOP photocoupler

JP136

# RX23E-A – Analog Front-End Mounted 32-bit MCU

32 MHz RX v2 Core with 2 Low-noise and Low-drift 24-bit Delta-sigma A/D Converters

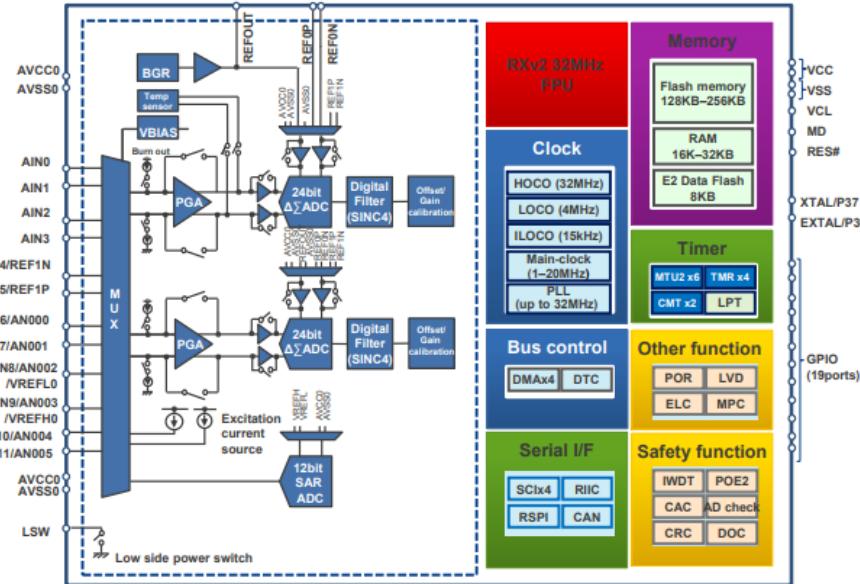
## Analog Front-End Features

- Max. operating frequency: 32MHz
- Dual 24-bit delta sigma A/D converters: Up to 23-bit effective resolution, Programmable data rate 7.6 sps to 15,625 ksps
- PGA: Rail-to-rail analog input, Gain 1 to 128, Offset drift 10 nV/°C, Gain drift 1 ppm/°C
- Voltage Reference: Low drift 4ppm/°C with good temperature stability
- Excitation Current Source: Matched programmable current source

## MCU Functions

- CPU: 32-bit RXv2 (64 DMIPS @ 32 MHz), DSP/FPU for digital signal processing
- Up to 256KB Flash, 32KB RAM, 8KB Data Flash (1M write/erase cycles)
- Interface: SPI x 1 ch, UART x 4 ch, I2C x 1 ch, CAN x 1 ch

Part #	ROM (Kbytes)	RAM (Kbytes)	Temp.(°C)	Package
<a href="#">R5F523E6AxFL</a>	256	32	-40 to 85/105	LFQFP/48/0.50
R5F523E6AxNF	256	32	-40 to 85/105	HWQFN/40/0.50
R5F523E5AxFL	128	16	-40 to 85/105	LFQFP/48/0.50
R5F523E5AxNF	128	16	-40 to 85/105	HWQFN/40/0.50



System Block



RTK0ESXB10C00001BJ RX23E-A Evaluation Kits

# RA2A1 – Ultra-Low Power 48-MHz Arm® Cortex®-M23 Core

## Complete Analog Solution for Signal Conditioning and Measurement

### High Performance

- 48MHz Arm® Cortex®-M23 CPU

### Highly Integrated, High-Accuracy Analog Capabilities

- Op amp x3
- 24-Bit S/D ADC (10 ch.) /16-Bit SAR ADC (17 ch.)
- 12-Bit DAC (1 ch.)/8-Bit DAC (2 ch.)
- Temperature Sensor (TSN)
- High-Speed Comparator x2
- Low-Power Comparator x2

### Communication Interfaces

- USB 2.0 (Full Speed)
- CAN
- SCI x3/SPIx2/IICx2

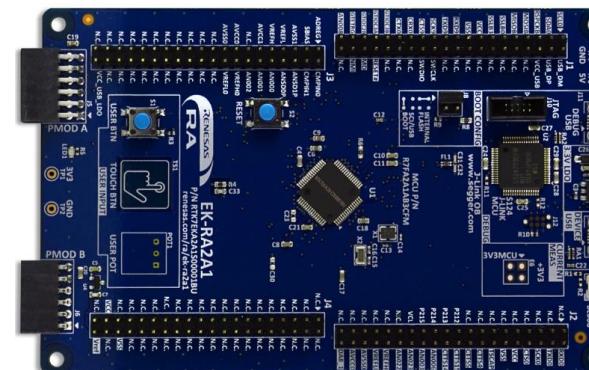
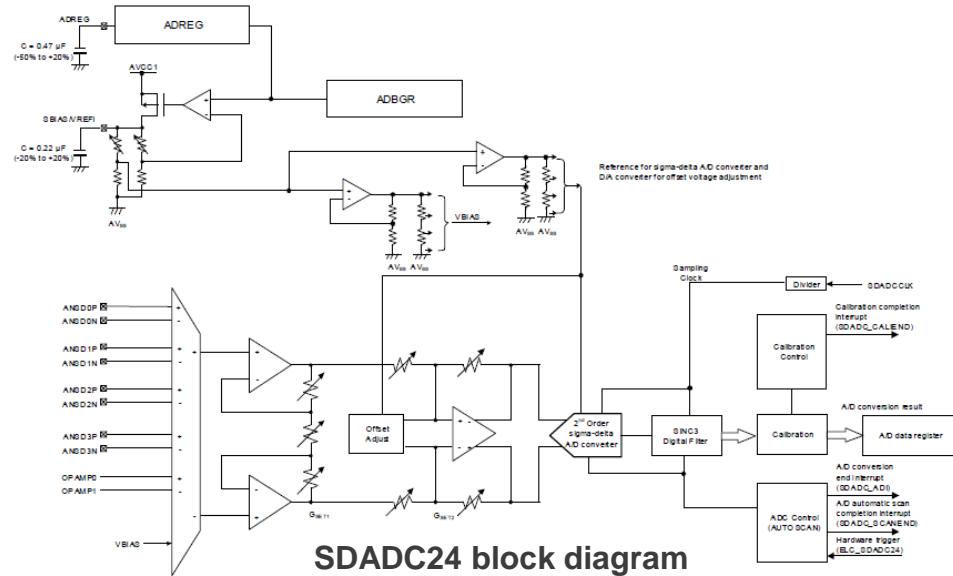
### HMI Interface

- Capacitive Touch Sensing Unit (26 ch.)

### Wide Voltage and Low Power Consumption

- Wide operating voltage range of 1.6V to 5.5V
- Various Low Power Modes

Part #	Flash Memory	RAM	Temp	Package
R7FA2A1AB3CFJ#AA0	256KB	32KB	40~105°C	32 LQFP
R7FA2A1AB3CFM#AA0	256KB	32KB	40~105°C	64 LQFP



RTK7EKA2A1S00001BU

# RZ/N1S – Industrial Ethernet MPU

Arm® Cortex®-A7 + Cortex®-M3

## 500 MHz Cortex®-A7 + R-IN Engine 125 MHz Cortex®-M3

- Proven R-IN engine as HW accelerator for Industrial Ethernet communication
- Internal oscillator for 40MHz crystal, i.e. no external clock required

## 6MB SRAM Integrated

- Additional RAM can be attached by QSPI, but in many cases not needed

## Integrated up to 5 port Ethernet Switches

## External Storage interface

- 2x QSPI, 2x SDIO/eMMC
- Several storage devices can be chosen based on application requests

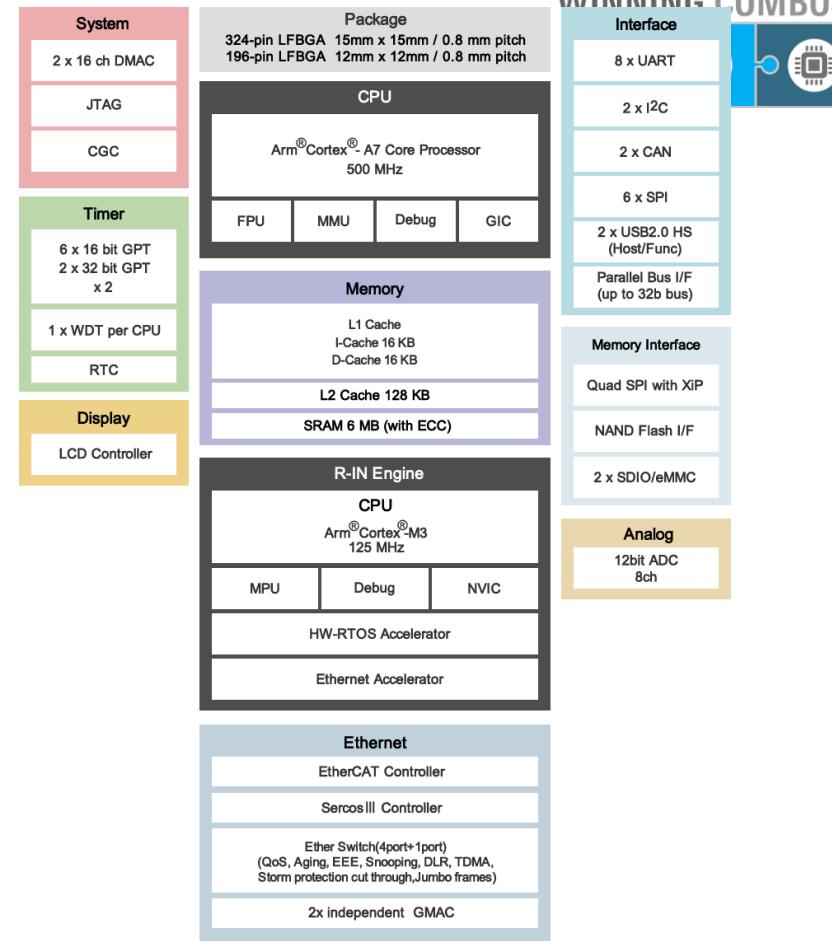
## LCD controller, Multiple Timers, RTC

## Rich interfaces:

- up to 2x USB2.0, 2x CAN, 8x UART, 6x SPI etc.

Temperature range -40..+110°C

Name	P/N	Package	PRP IEC62439-3
RZ/N1S	R9A06G033VGBA	196BGA	--
	R9A06G033NGBG	324BGA	PRP compliant





# RX72M – 240MHz RXv3 MCU with EtherCAT® Slave Controller

## High-Performance 32-bit Microcontroller for Industrial Network Solutions

### High Performance and Built in Functions

- 240MHz RXv3 core, double-precision FPU, and register bank save function
- Up to 4MB ROM with dual-bank structure /1MB SRAM
- Up to 29 extended-function timers (MTU3a x 9 ch), 182 general I/O ports
- SCI x 13/RIICa x 3
- DMACAa x 8 ch/DTCb x 1ch/EXDMAC x 2ch/ DMAC for the Ethernet x 3
- 12-bit ADC: 29ch in 2 units, 12-bit DAC: 2ch
- Encryption engines (AES, 3DES, RSA, ECC, SHA, TRNG), key management, flash memory protection
- Useful functions for IEC60730 compliance

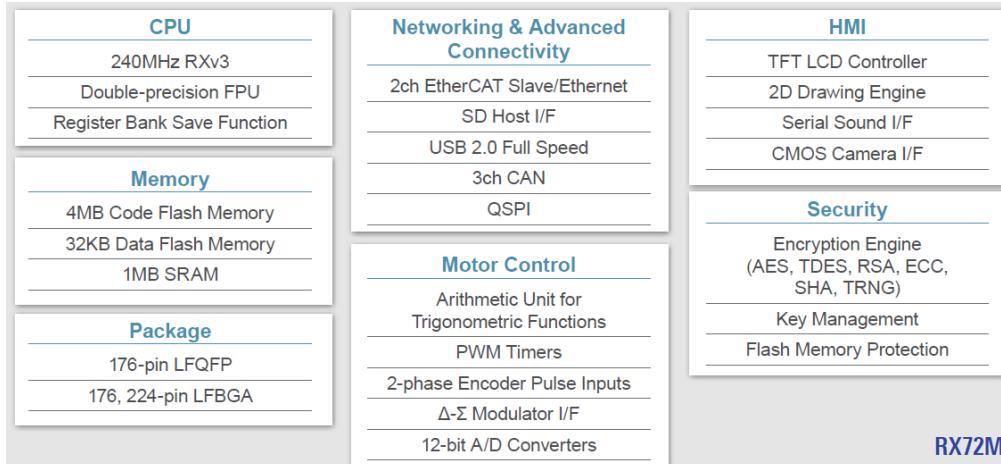
### High-end HMI Function and Motor Control

- Graphic-LCD controller (GLCDC), 2D drawing engine
- Serial sound interface and CMOS camera interface
- Arithmetic unit for trigonometric functions accelerating vector controls for motors
- 2-phase Encoder Pulse Inputs, Δ-Σ Modulator I/F

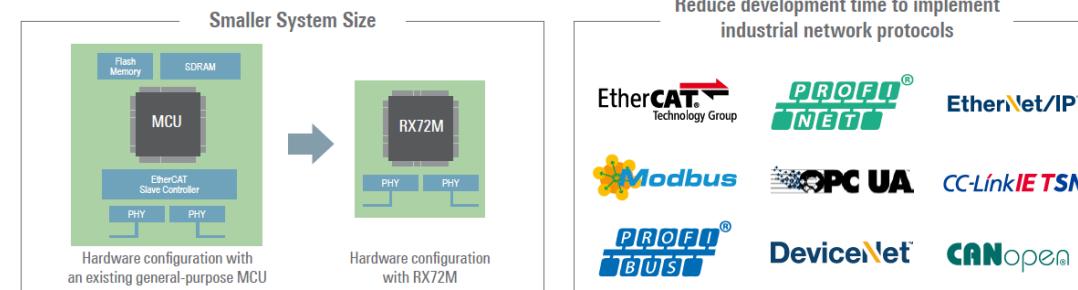
### Networking and Advanced Connectivity

- EtherCAT slave controller (2 ports), Ethernet MAC compliant with IEEE 1588 (2ch)
- SD host interface, quad SPI, RSPIc, MMCIF, USB 2.0 full speed and CAN x 3

Part #	ROM	RAM	Trusted Secure IP	Package
R5F572MxDxFc	2/4MB	1MB	No	LFQFP/176/0.50
R5F572MxHxFc	2/4MB	1MB	Yes	LFQFP/176/0.50
<a href="#"><u>R5F572MxDxBG</u></a>	2/4MB	1MB	No	LFBGA/176/0.80
R5F572MxHxBG	2/4MB	1MB	Yes	LFBGA/176/0.80
R5F572MxDxBD	2/4MB	1MB	No	LFBGA/224/0.80
R5F572MxHxBD	2/4MB	1MB	Yes	LFBGA/224/0.80



**RX72M Block Diagram**



**Benefits for Industrial Network Solution**

# ISL80410 – High Voltage Adjustable $V_{OUT}$ LDO

Low Quiescent Current and 40V/150mA Output

## High Performance and Wide Input Range

- Wide  $V_{IN}$  range of 6V to 40V
- Adjustable output voltage from 2.5V to 12V
- Ensured 150mA output current
- $\pm 1\%$  accurate voltage reference (over temperature, load)

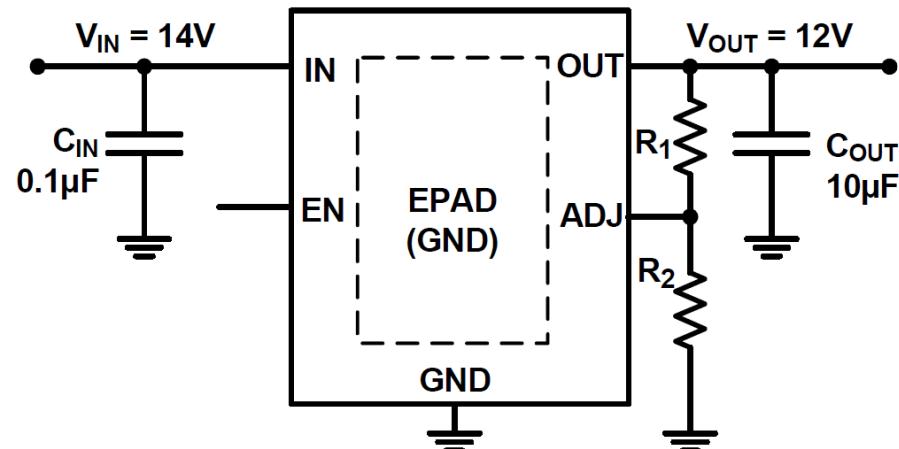
## High Efficiency

- Ultra low 18 $\mu$ A typical quiescent current
- Low 2 $\mu$ A of typical shutdown current
- Low dropout voltage of 295mV at 150mA
- Low 26 $\mu$ VRMS noise

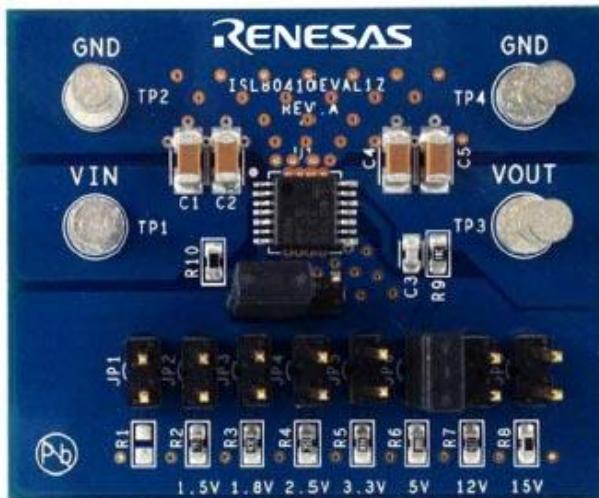
## Excellent Safety

- 40V tolerant logic level (TTL/CMOS) enable input
- 5kV ESD HBM rated
- Thermal shutdown and current limit protection

Part #	$V_{IN}$ Range(V)	$V_{OUT}$ Range(V)	Enable Pin	Package
ISL80410IBEZ	6 to 40	ADJ	Yes	8 Ld EPSOIC
ISL80410IBEZ-T	6 to 40	ADJ	Yes	8 Ld EPSOIC
<u>ISL80410IBEZ-T7A</u>	6 to 40	ADJ	Yes	8 Ld EPSOIC



Typical Application Circuit



ISL80410EVAL1Z Evaluation Board

# ISL85415 – 0.5A Regulator w/ Integrated High Side FET

Supports 3V-36V Input Voltage Range for Buck Output

## Wide Working Range

- Power input voltage range from 3V to 36V
- The device provides an easy-to-use high-efficiency, low BOM-count solution for a variety of applications.
- Up to 0.5A load over full temperature range

## High Efficiency and Performance (low board space)

- Synchronous operation for high efficiency
- No compensation required
- Integrated High-side and Low-side NMOS devices
- Selectable PFM or forced PWM mode at light loads
- Internal fixed (500kHz) or adjustable switching frequency 300kHz to 2MHz

Part #	V <sub>IN</sub> Range(V)	Temp.(°C)	Package
<a href="#">ISL85415FRZ</a>	3 to 36	-40 to 125	12 Ld DFN 4x3

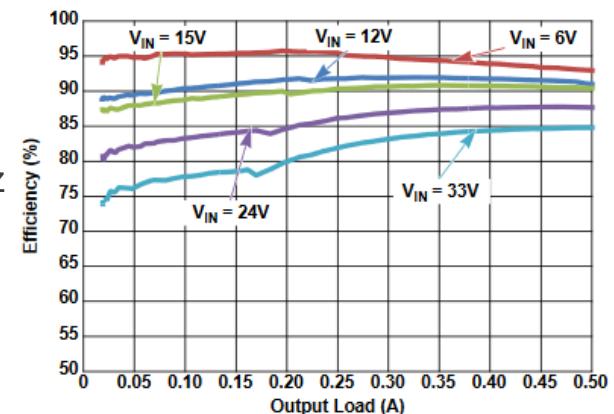
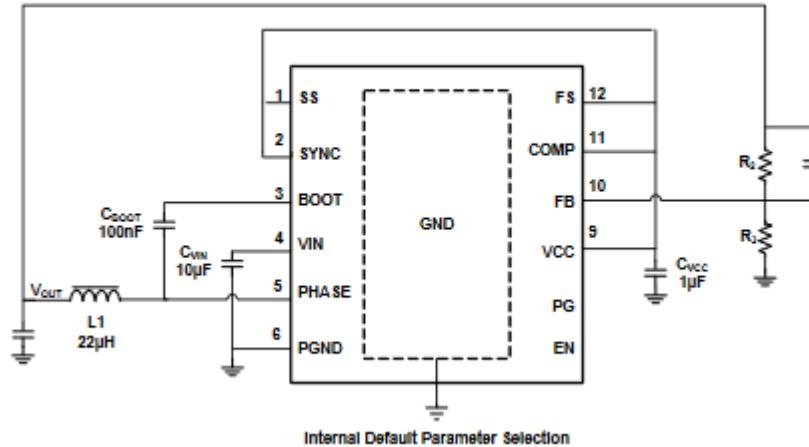


Figure 6. Efficiency vs Load, PFM, V<sub>OUT</sub> = 5V



FIGURE 1. FRONT OF EVALUATION BOARD ISL85415DEMO2Z



# ZIOL2401 – Dual Channel IO-Link HV Line Driver

Specifically Designed to Support the Communication Standard IO-Link with DC/DC Converter

## Specifically Designed to Support IO-Link

- Standard cable driver/ physical layer transceiver for IO-Link (master and device)
- 24V line driver/level shifter
- IO-Link-specific WURQ‡ detection

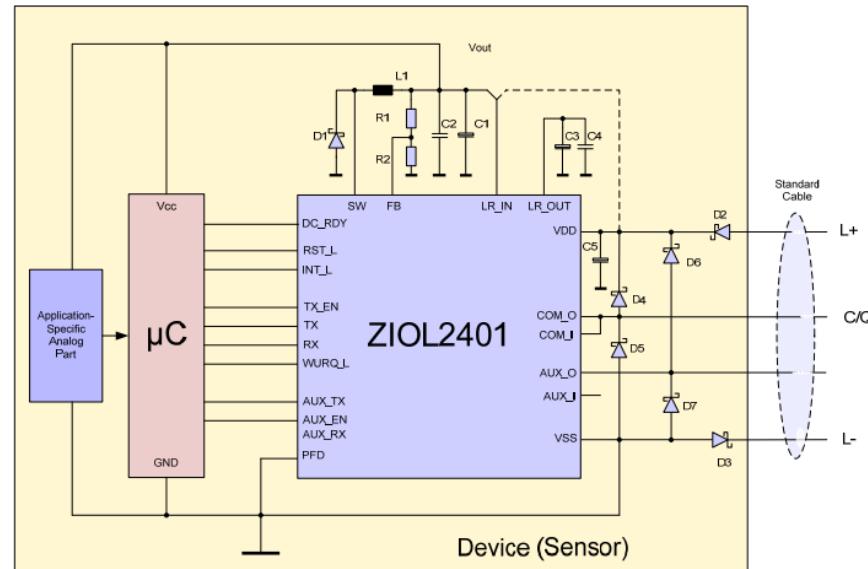
## Flexible Usage with Configurable Feature Set

- Configurable output current limitation 56mA to 410mA per channel
- Wide range for configurable feature set, which is automatically loaded after power on reset
- On-chip registers and EEPROM for system configuration and status information
- Digital interface: 3.3V output, 5V tolerant inputs

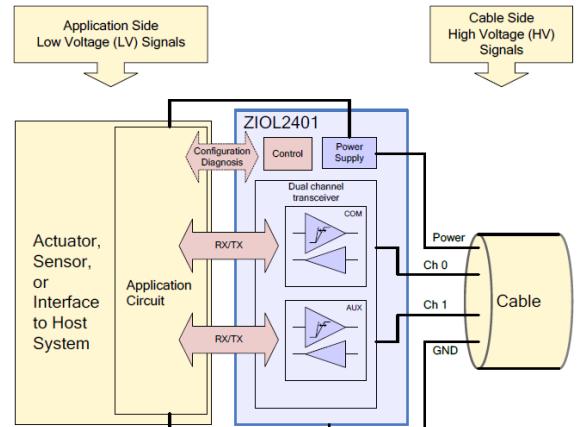
## Integrated and Protection Functions

- On-board DC/DC converter
- SPI interface for accessing on-chip registers and EEPROM
- IC temperature monitoring/diagnosis
- Over-current and over-temperature indication
- Slew-rate controlled drivers

Part #	Carrier Type	Temp Range (°C)	Package
ZIOL2401BI1R	13" reel	-40 to +85	4x4mm QFN-24
<a href="#">ZIOL2401BI1W</a>	7" reel	-40 to +85	4x4mm QFN-24



ZIOL2401 Typical Application



ZIOL2401 Block Diagram



# ISL3159E – High ESD Protected RS-485/RS-422 Transceivers

**±15kV ESD Protected, 5V, 40Mbps, Profibus, Full Fail-Safe**

## High ESD Performance

- IEC61000 ESD protection on RS-485 I/O pins: ±15kV
- Class 3 HBM ESD level on all other pins : >9kV

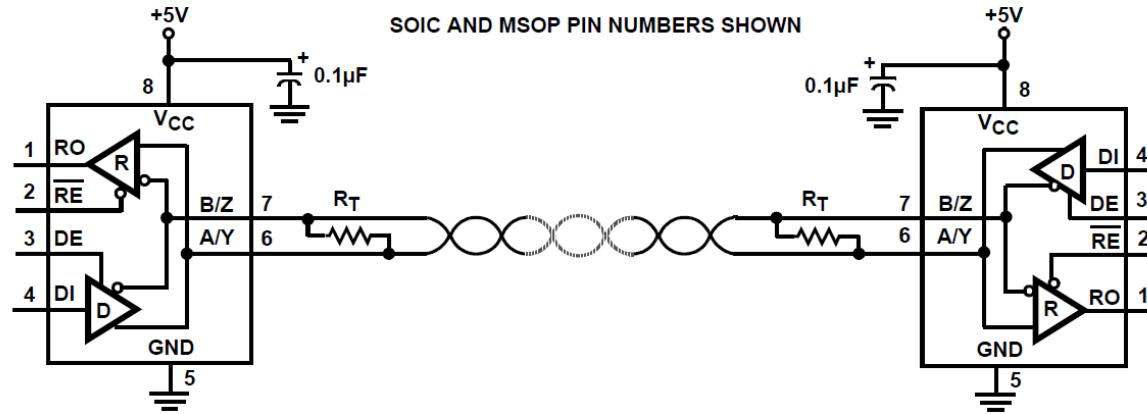
## High Performance and Low Power

- High data rates: up to 40Mbps
- Large differential V<sub>OUT</sub>: 2.8V into 54Ω, better noise immunity, or drive up to 6 terminations
- Specified for +125°C operation
- 11/13ns (maximum) Tx/Rx propagation delays; 1.5ns (maximum) skew
- True 1/5 unit load allows up to 160 devices on the bus
- 7V to +12V common-mode input/output voltage range
- Low quiescent supply current: 4mA (Max), low shutdown supply current: 1µA

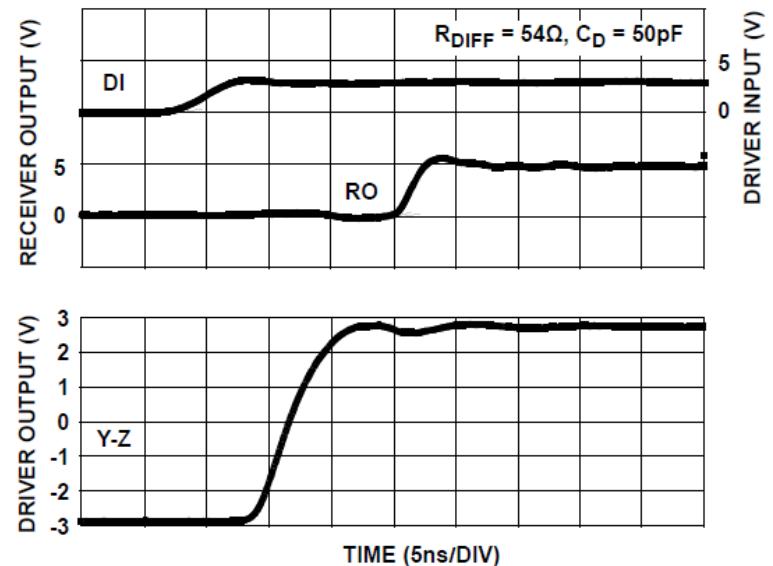
## Protection Function

- Current limiting and thermal shutdown for driver overload protection
- Full fail-safe (open, shorted, terminated/undriven) receiver

Part #	Temp. Rang(°C)	Data rate (Mbps)	VCC(V)	VOD(V)	Package
ISL3159EIBZ	-40 to +85	40	5	2.1	8 Ld SOIC
ISL3159EIUZ	-40 to +85	40	5	2.1	8 Ld MSOP
ISL3159EIRZ	-40 to +85	40	5	2.1	10 Ld DFN
ISL3159EFBZ	-40 to +125	40	5	2.1	8 Ld SOIC
ISL3159EFUZ	-40 to +125	40	5	2.1	8 Ld MSOP
ISL3159EFRZ	-40 to +125	40	5	2.1	10 Ld DFN



Typical System Block



Driver and Receive Waveforms, Low to High

# RV1S9160A – High-Speed CMOS Output Photocouplers

High CMR, 15Mbps, Low Forward-Current (IF) 3.3V/5V Operation 5-Pin SOP Photocoupler

## High Isolation Voltage and High Speed

- High speed communication (15 Mbps)
- High isolation voltage ( $BV = 3750$  Vr.m.s.)

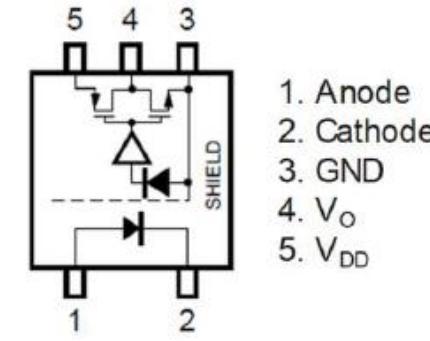
## High Performance with Low Power

- High common mode ( $dv/dt$ ) tolerant ( $CM_H, CM_L = \pm 50$  kV/ $\mu$ s MIN.)
- Low input drive current ( $IF_{HL} = 2.0$  mA MAX.)
- Low voltage power supply operation ( $V_{DD} = 2.7$  V~5.5 V)
- Low pulse width distortion ( $PWD = 20$  ns MAX.)
- High temperature operation (-40 to +125°C)

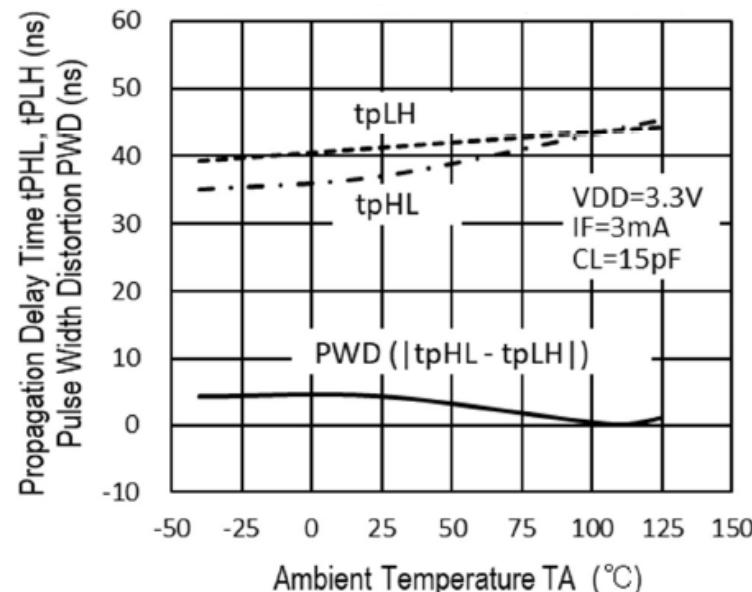
## Safety Standards

- UL approved: UL1577, double protection
- CSA approved: CAN/CSA-C22.2 No.62368-1, basic insulation
- VDE approved: DIN EN 60747-5-5 (Option)

Part #	Temp. Rang(°C)	Safety Standard	Package
RV1S9160ACCSP-100C	-40 to +125	UL, CSA	5-Pin SOP
RV1S9160ACCSP-100V	-40 to +125	UL, CSA, DIN EN 60747-5-5	5-Pin SOP



PIN Connection



Propagation Delay Time, Pulse Width Distortion vs. Forward Current

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[Renesas.com/win](https://Renesas.com/win)