

Real-Time Industrial Ethernet Switch with RZ/N1D

■ Overview

Customers in the industrial arena often require real-time Ethernet solutions, also called industrial Ethernet. Common standards are EtherCat, Powerlink, Sercos III, ProfiNet, Modbus TCP and others.

For an industrial Ethernet switch or similar setup, the RZ/N1D MPU is a perfect fit because of its high integration, calculation power and rich interfaces. The RZ/N1D features an integrated Arm® Cortex®-M3 based R-In engine that offloads the main cores by working as a dedicated Gigabit Ethernet hardware RTOS/accelerator.

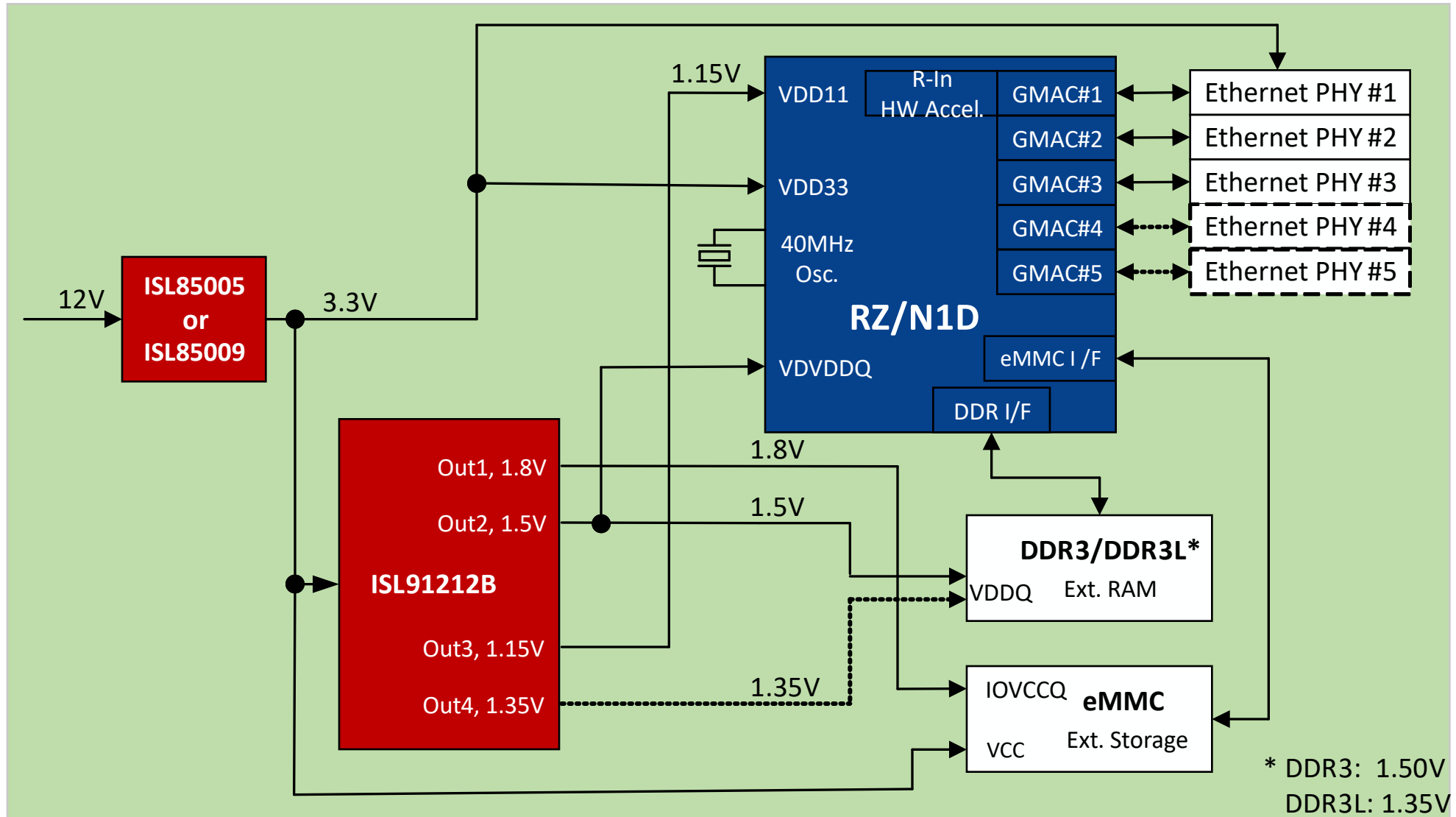
A typical setup for an industrial Ethernet switch requires external storage (eMMCs or QSPI), external RAM (DDR3 or DDR3L) and up to five Ethernet PHYs. Powering this setup requires up to four precise power rails. This can easily be achieved by using the Renesas ISL91212B PMIC, which provides up to four power levels in one chip and includes flexible voltage selections for DDR3 / DDR3L. The ISL91212B includes power-up sequencing and the complete solution has a small PCB footprint because it only uses one additional DC/DC (ISL85005).

■ System Benefits

- Highly integrated industrial Ethernet (switch) solution with R-In offload engine/HW accelerator
- Easy to use, preconfigured PMIC setup, providing all required voltages and sequencing, alternatively using either DDR3 or DDR3L memory
- Low BOM count and small PCB space

EU012

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Device Category	P/N	Key Features
MCU	RZ/N1D	Industrial Ethernet MPU with Dual Cortex® A7 + Single Cortex® M3
Power	ISL91212B	Quad Output PMIC with I2C Interface 2.5 - 5.5V supply voltage; 5A per phase
	ISL85005 OR	Buck Regulator VIN 4.5-18V / 5A Part of our 12V Buck Regulator Family (small solution size, high efficiency)
	ISL85009	Buck Regulator VIN 3.8-18V / 9A Part of our 12V Buck Regulator Family (small solution size, high efficiency)

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RZ/N1D Industrial Ethernet MPU

Dual Arm® Cortex®-A7 + Single Arm® Cortex®-M3

2x 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

DDR interface for external RAM

- Allows to interface with cost efficient external memory

Integrated up to 5 port Ethernet Switch

External Storage interface

- 1x QSPI, 2x SDIO/eMMC
- Several storage devices can be chosen based on application requests

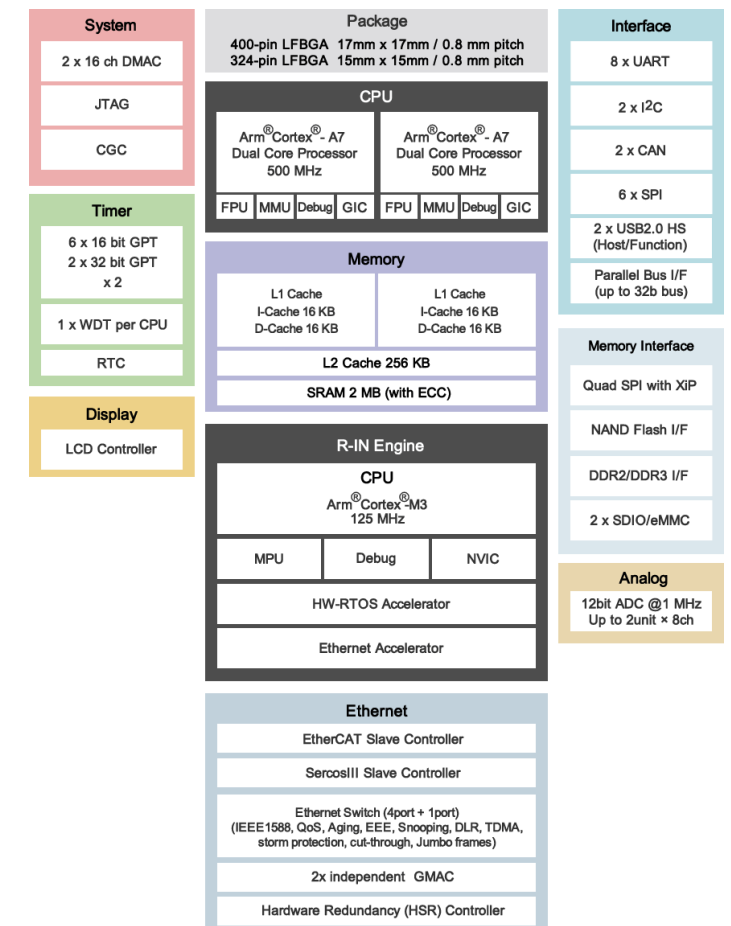
LCD controller, Multiple Timers, RTC

Rich interfaces:

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

Temperature range -40..+110°C

Name	P/N	Package	PRP/HSR IEC62439-3
RZ/N1D	R9A06G032VGBG	400BGA	--
	R9A06G032VGBA	324BGA	--
	R9A06G032NGBG	400BGA	PRP/HSR-compliant



ISL91212B – Quad Output PMIC with I²C Interface

2.5 - 5.5V supply voltage, 5A per phase

Small Package: 7x10mm² for 4-phase design

- Overall: 7x10mm² total solution size for 4 outputs or phases

Efficiency: Superior R5 Technology

- Efficiency: e.g. 94.7% for 3.8V_{IN} / 1.8V_{OUT}

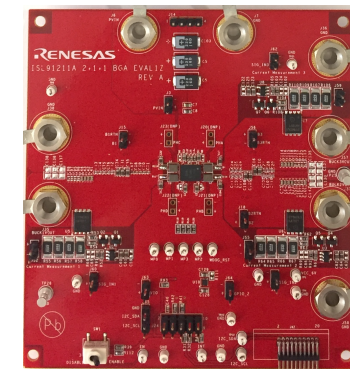
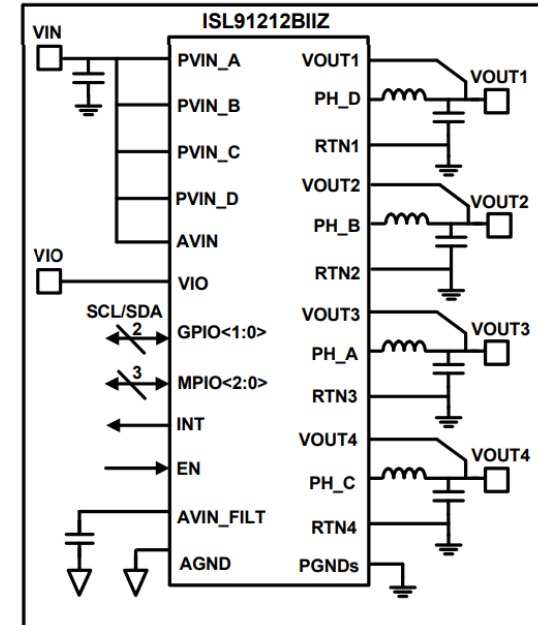
4MHz frequency

- Reduces board space, e.g. supports less than 2 x 2 x 1mm inductors

Highly Integrated

- No external components for compensation, V_{OUT} setting, etc.

I²C programmable output: 0.3V to 2V



Part Number	Phase Configuration	Max DC I _{OUT} /Phase	Package Type	Package Size (mm x mm)
ISL91212B	1+1+1+1	5A	WLCSP, 7x5 bumps, 0.5mm pitch	2.55 x 3.67

ISL85005 – Buck Regulator V_{IN} 4.5-18V / 5A

12V Buck Regulator Family (small solution size, high efficiency)

Wide Input Voltage range 4.5 - 18V

- Can be used for any point-of-load (POL) from 5V and 12V rails

High Integration

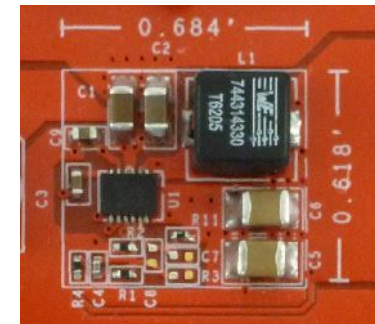
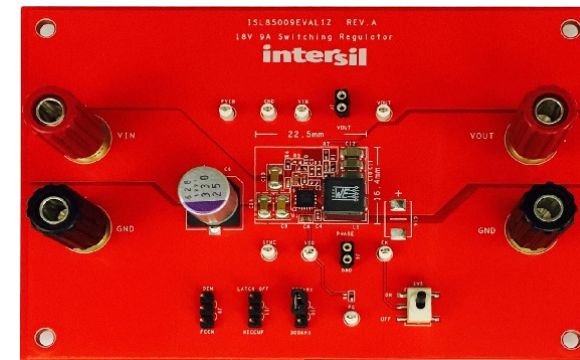
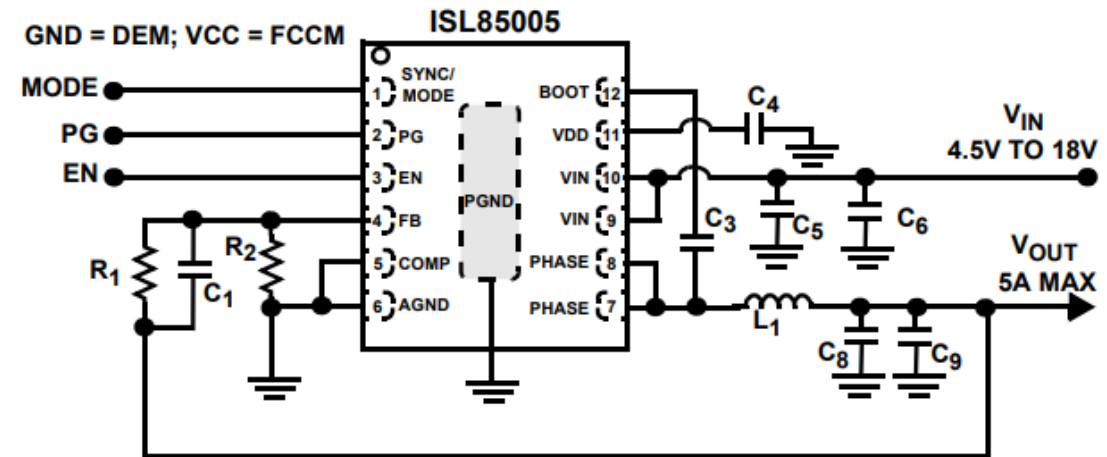
- Internal 5A MOSFETs
- Smaller Solution Size

Switching Frequency up to 2 MHz

- Smaller passive components, thus solution size.
- Better transient response

Internal/External compensation

- Design simplicity and flexibility



Part #	V_{IN}	I_{OUT}	Option	Package
ISL85005AFRZ	4.5 – 18V	5A	Softstart	3 x 4mm, DFN12
ISL85005FRZ	4.5 – 18V	5A	Sync	3 x 4mm, DFN12

ISL85009 – Buck Regulator V_{IN} 3.8-18V / 9A

12V Buck Regulator Family (small solution size, high efficiency)

Wide Input Voltage range 3.8 - 18V

- Can be used for any point-of-load (POL) from 5V and 12V rails

High Integration

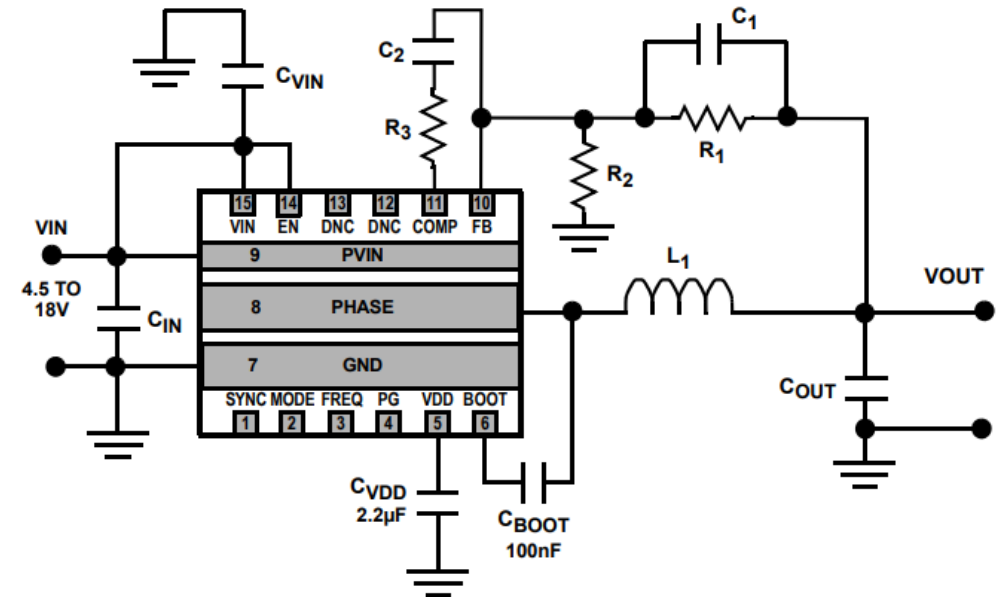
- Internal 9A MOSFETs
- Smaller Solution Size

Switching Frequency up to 1 MHz

- Smaller passive components, thus solution size
- Better transient response

Internal/External compensation

- Design simplicity and flexibility



Part #	V_{IN}	I_{OUT}	Package
ISL85009FRZ	3.8 – 18V	9A	3.5 x 3.5mm, TQFN15