

JP084 Time of Flight (ToF) Sensor Module

March 2020

Time of Flight (ToF) Sensor Module

- **Overview**

This Time of Flight (ToF) sensor module can cover a wide range and can adjust the distance based on the requirement of each situation (e.g. 2m for functional safety). To meet Industry 4.0 communication level standards, all of the information from the sensors include an external proximity sensor that can route information directly to cloud.

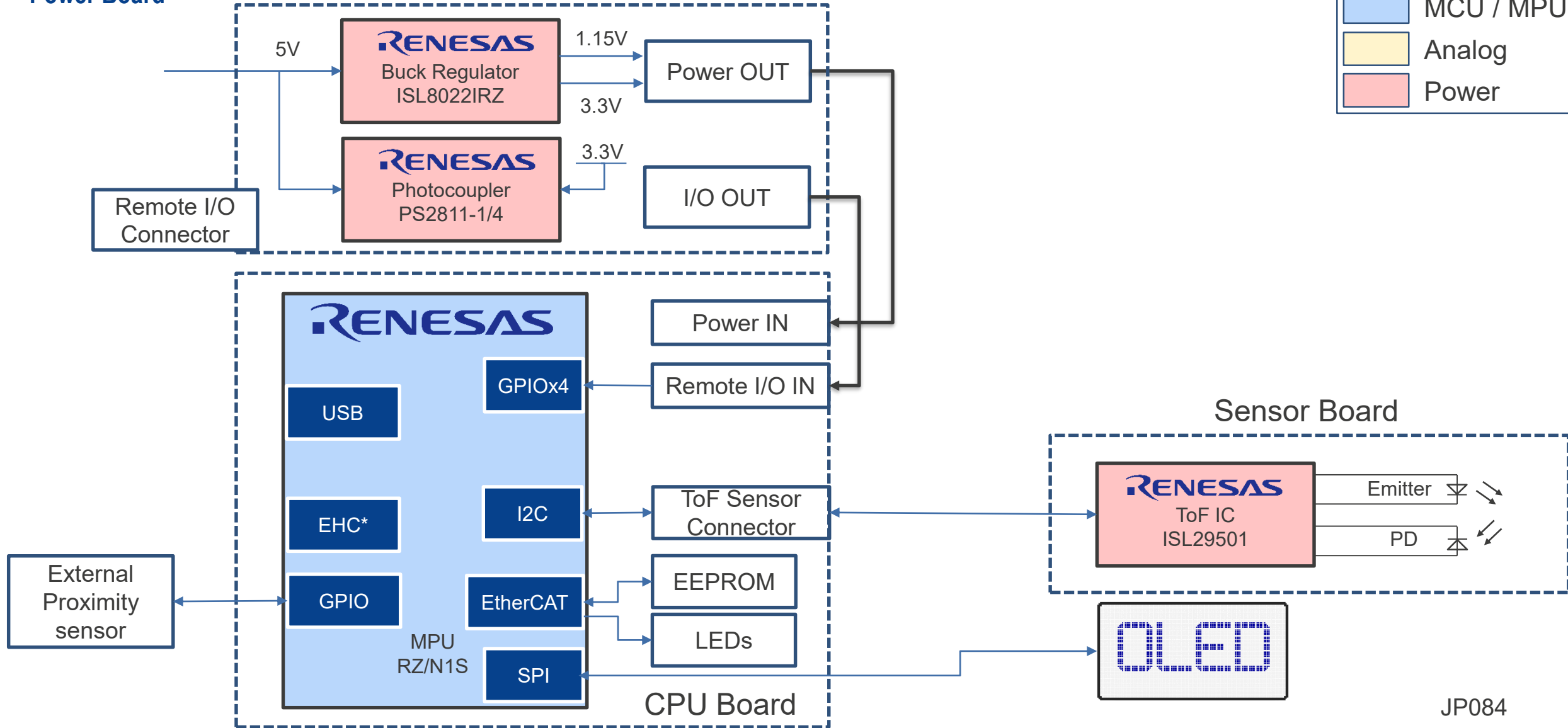
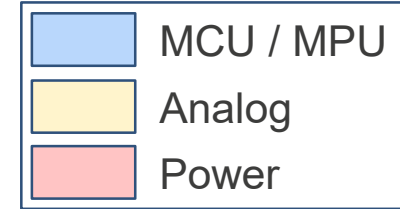
- **System Benefits**

- Customers can easily implement their product with this small and extensible module
- The ISL29501 has a built-in current DAC circuit that drives an external LED. The modulated light from the emitter is reflected off the target and is received by the photodiode. This provides better sensing accuracy than infrared sensors, as well as lower cost and power than image sensors that have cameras.

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Power Board



Time of Flight Sensor Module

Device Category	P/N	Key Features
MCU	RZ/N1S	RZ/N1S features an Arm® Cortex®-A7 core and a large size of built-in RAM in a small package. Since peripheral parts can be reduced, it can be used for small PLC, HMI, etc. In addition, since it has a proven R-IN engine as an accelerator for industrial Ethernet communication, it can be used for a protocol gateway, sensor hub, etc.
Power	ISL8022IRZ	The ISL8022 is a high efficiency, dual synchronous step-down DC/DC regulator that can deliver up to 2A/1.7A continuous output current per channel. The channels are 180° out-of-phase for input RMS current and EMI reduction
Analog	ISL29501	The ISL29501 is a Time of Flight (ToF) based signal processing integrated circuit. The sensor enables low cost, low power, and long range optical distance sensing when combined with an external emitter and detector.
	PS2811-1/4	The PS2811-1 and PS2811-4 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon phototransistor in a plastic SSOP for high density applications.

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 Switch

External Storage Interface

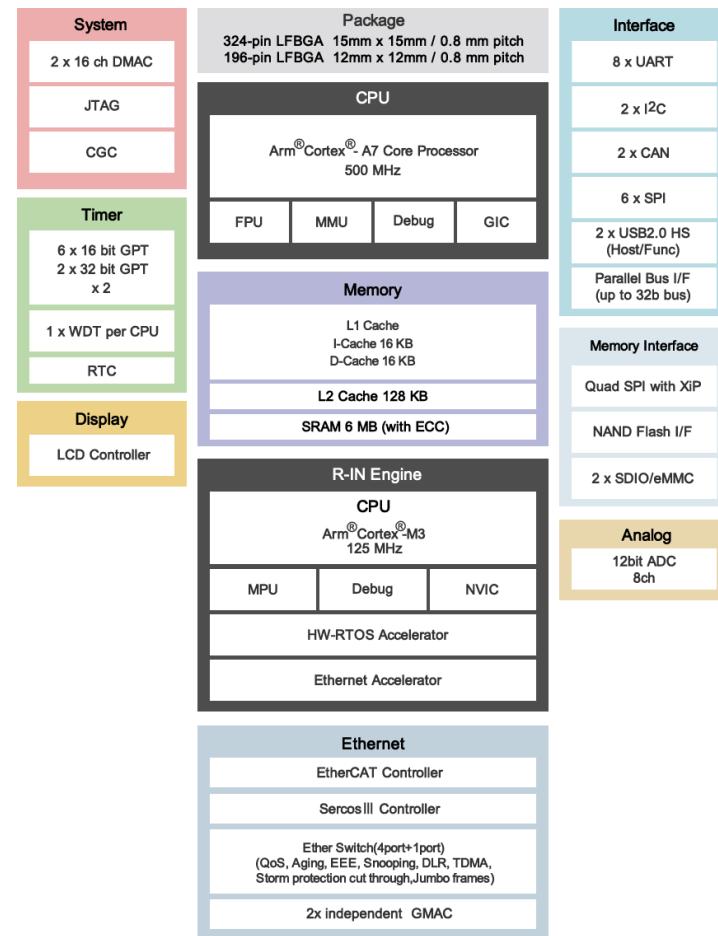
- 2x QSPI, 2x SDIO/eMMC
- Several storage devices can be chosen based on application requests

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/N1D	R9A06G033VGBA	196BGA	--
	R9A06G033NGBG	324BGA	PRP compliant

ISL8022 – Dual Synchronous Step-down DC/DC

Dual 2A/1.7A Low Quiescent Current 2.25MHz High Efficiency Synchronous Buck Regulator

Wide Working Range

- Wide input voltage range: 2.8V to 5.5V
- Wide output voltage range: 0.6V to 5.5V

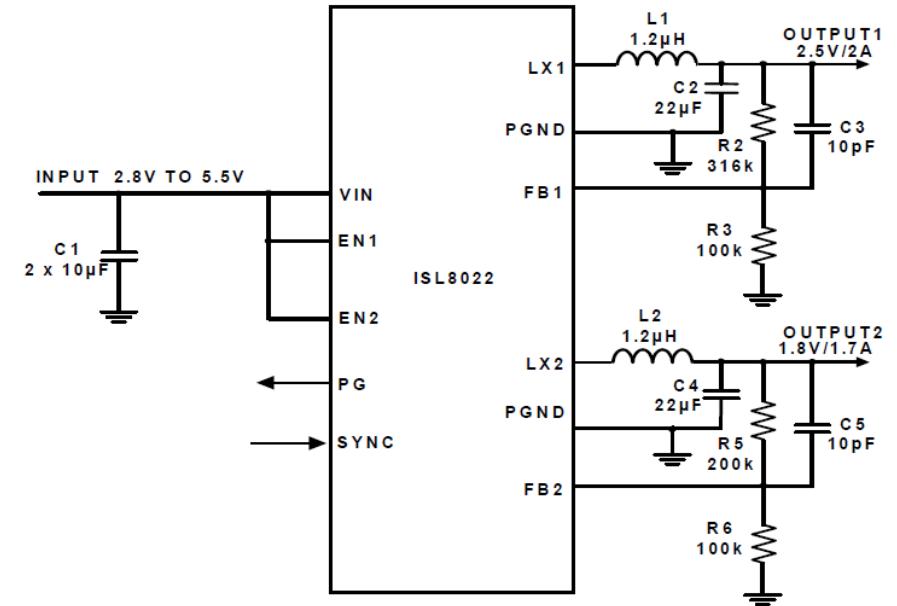
High Efficiency and Low Supply Current

- Dual 2A & 1.7A high efficiency synchronous buck regulator with up to 97% efficiency, low I_q (40μA)

System Safe Design

- The ISL8022 offers a 1ms Power-Good (PG) to monitor both outputs at power-up. When it is shutdown, the ISL8022 discharges the output capacitors.
- Other features include internal digital soft-start, enable for power sequence, overcurrent protection, and thermal shutdown

Part #	No. of Outputs	V _{in} Range(V)	I _{out} (max)(A)	V _{out} Range(V)	Package
ISL8022IRZ	Dual (2)	2.7-5.5	2 & 1.7	0.6-V _{in}	12Ld 4x3 DFN



Typical Operation Circuits



ISL80022EVAL1Z Evaluation Board

ISL29501-Time of Flight (ToF) Signal Processing IC

Low Cost, Low Power, and Long Range Optical Distance Sensing

Application-Level Integrated

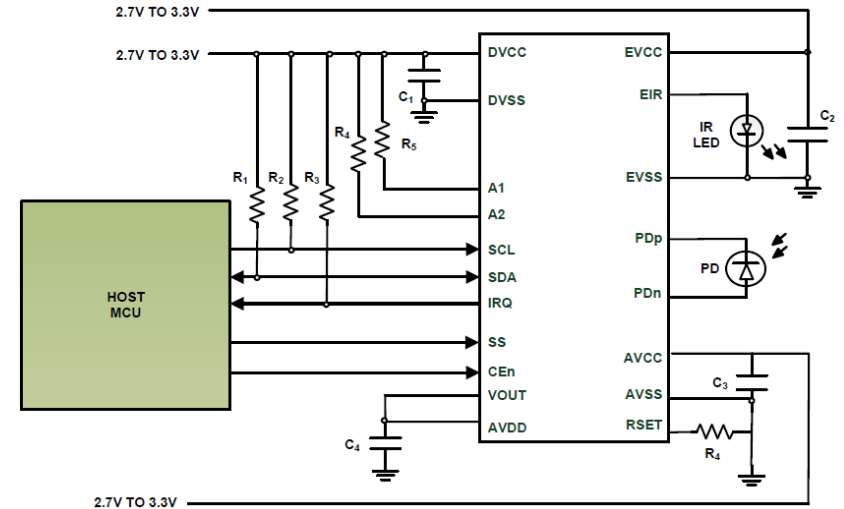
- On-chip Digital Signal Processor calculates the time of flight
- Built-in current DAC circuit that drives the LED or laser
- On-chip active ambient light rejection

Easy Control

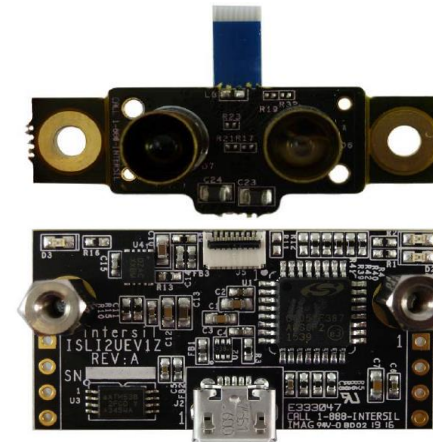
- I²C interface for configuration and control
- Operates in Continuous and Single Shot mode
- Auto gain control mechanism
- Interrupt controller
- Modulation frequency of 4.5MHz

Suitable for Different Designs

- Enables proximity detection and distance measurement
- Allows for optimization of performance/ power/ distance, etc.
- Wavelength agnostic
- Emitter DAC with programmable current up to 255mA
- I²C interface supporting 1.8V and 3.3V bus
- Low profile 24 Ld 4x5 QFN package



Typical Application Circuit



ISL29501-CS-EVKIT1Z Cat Shark



ISL29501-ST-EV1Z Sand Tiger

Part #	VDD RANGE (V)	TEMP RANGE (°C)	Package
ISL29501IRZ-T7	2.7V to 3.3V	-40 to +85	24 Ld QFN
ISL29501IRZ-T7A	2.7V to 3.3V	-40 to +85	24 Ld QFN

PS2811-1/4 – DC Input/Single Output Photocouplers

Low Input Current, High CTR 4, 16-Pin SSOP Photocoupler

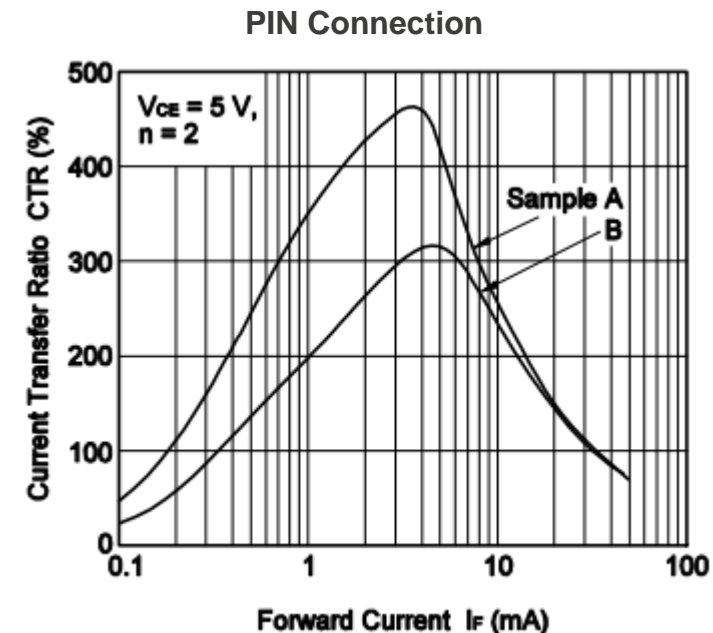
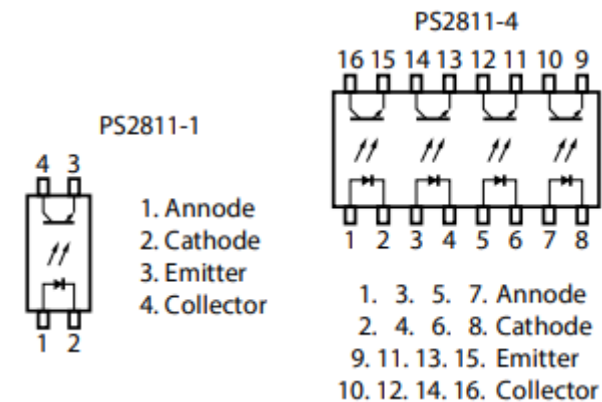
High Performance and Small Package

- High current transfer ratio (CTR = 200% TYP. @ $I_F = 1\text{mA}$)
- High isolation voltage (BV = 2500 Vr.m.s.)
- Small and thin package (4, 16-pin SOP)

Safety Standards

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

Part #	Forward Current(mA)	Safety Standard	Package
PS2811-1-A	50	UL, CSA	4-PIN SSOP
PS2811-1-F3-A	50	UL, CSA, DIN EN 60747-5-5	4-PIN SSOP
PS2811-4-A	50	UL, CSA	16-PIN SSOP
PS2811-4-F3-A	50	UL, CSA, DIN EN 60747-5-5	16-PIN SSOP



Current Transfer Ratio vs Forward Current

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