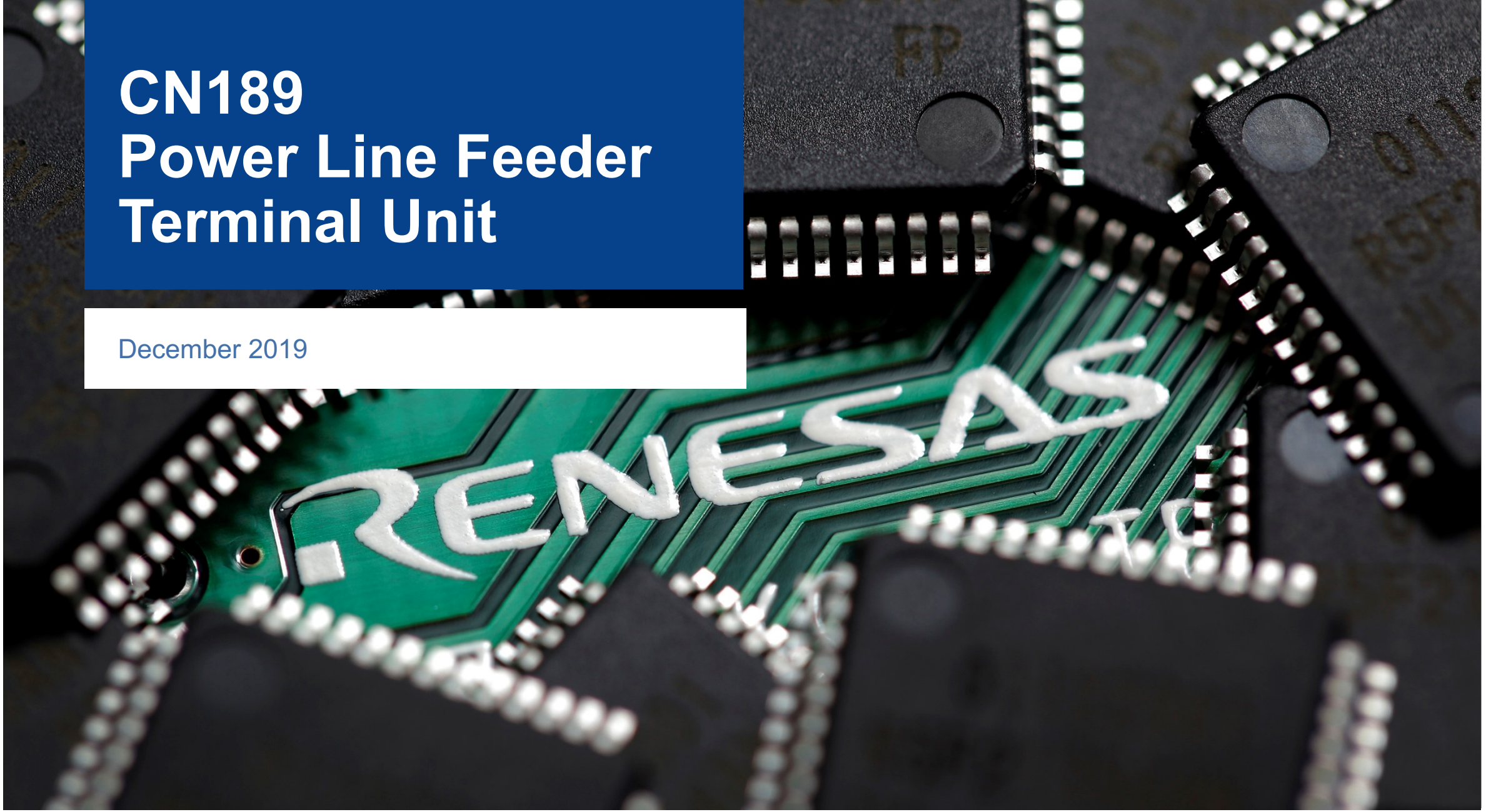
CN189
Power Line Feeder Terminal Unit

December 2019



Power Line Feeder Terminal Unit

Overview

A feeder terminal unit (FTU) is a device that is used to remotely monitor the voltage, current, active power, and reactive power status of high-voltage power lines. The data is measured and stored in the unit before being uploaded to a central location via either Ethernet, GPRS or PLC.

In the event of any abnormal power directions, the FTU will take immediate action, including disconnecting the power and reporting the error.

System Benefits

- Integrated power system solution to simplify customer design
- High-accuracy humidity sensor
- MCU provides direct-access storage device (DSAD), flexible to fulfill customized algorithms

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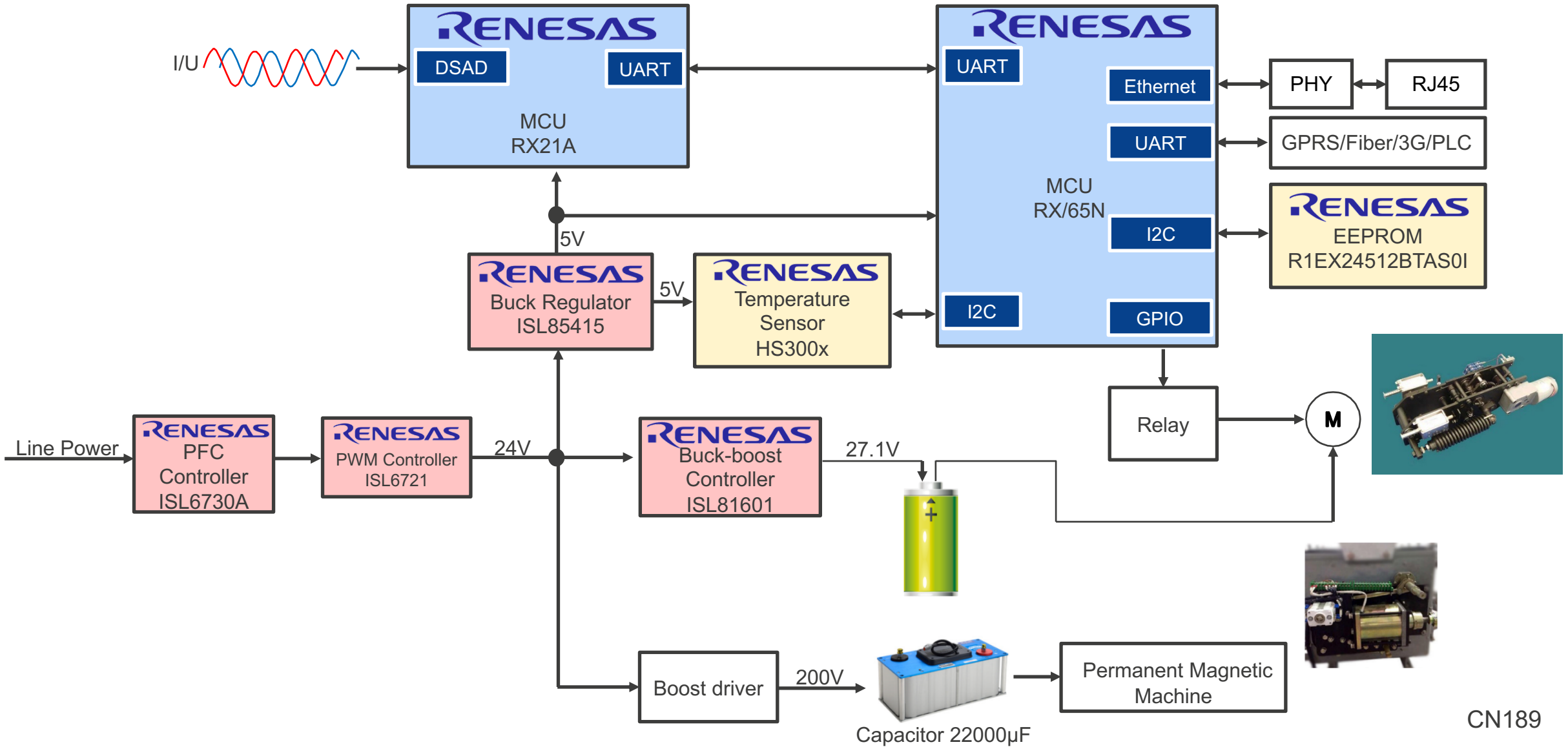
Power Line Feeder Terminal Unit



Power Line Feeder Terminal Unit

Device Category	P/N	Key Features
MCU	RX21A	-32-bit MCU up to 50MHz, 512KROM/64KB RAM as max -Up to 7ch 24-bit Delta-sigma A/D converter with 64tims PGA
	RX65N	32bit MCU up to 120MHz, 2MB/640KB as max ROM/RAM, Ethernet I/F support
Power	ISL85415	-3-36V input, adjustable output voltage -High current drive ability enable one power to cover all system usage
	ISL6730A	-Active Power Factor Correction (PFC) controller -Excellent power factor over line and load regulation -Internal current compensation
	ISL6721	-Single-ended Pulse Width Modulating (PWM) current mode controller -Low operating current, adjustable operating frequency up to 1MHz, adjustable soft-start
	ISL81601	-Synchronous buck-boost controller -Wide input voltage range: 4.5V to 60V -Wide output voltage range: 0.8V to 60V
Analog	R1EX24512BxAS0I	512KB industry-grade EEPROM
	HS3001	-RH accuracy: ±1.5% RH typical -Temperature sensor accuracy: ±0.2°C typical (-10 to +80°C) -Lowest power consumption: 1.0μA average

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RX21A – 32-bit 50MHz MCU with 24-bit ΔΣ A/D converter

For Measuring Instruments Including Smart Meters

High Performance and Rich Peripheral Functions

- 50MHz 32-bit RX MCU
- 256/384/512K ROM, 32/64K RAM 64/80/100 Pins
- DEU(Data Encryption Unit) enable to use Encryption/decryption functions of the AES standard
- Rich Peripheral, DSAD/MTU2a/TMR/CMT/DMA/DTC/ELC/UART/SPI/Smart card
- 4 low power consumption modes

High Metrology Performance

- 7ch ΔΣ A/D for voltage/current sampling
- Up to 85dB SNDR
- Up to x 64 PGA gain for differential input
- 81.92 µs A/D conversion time

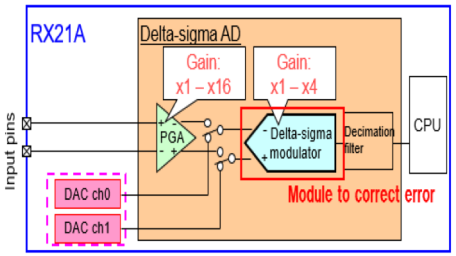
Typical Applications

- Power meter
- Current/voltage measurement
- Small signal sampling

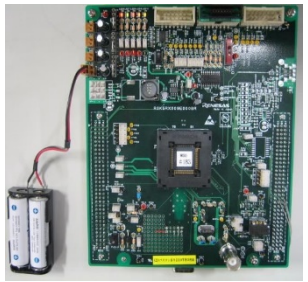
*The maximum specifications for the group are shown.

RX21A Block Diagram

Part #	Flash ROM	RAM	DSAD	Package
R5F521A6BDFM	256K	32K	3ch	64-pin LQFP 10 x 10mm 0.5 mm pitch
R5F521A7BDFN	384k	64k	4ch	80-pin LQFP 12 x 12mm 0.5 mm pitch
R5F521A8BDFP	512K	64K	7ch	100-pin LQFP 14 x 14mm 0.5 mm pitch
R5F521A8BDLJ	512K	64K	7ch	100-pin TFLGA 7 x 7mm 0.65 mm pitch



RX21A application block



Customer Board for RX21A

BIG IDEAS FOR EVERY SPACE RENESAS

RX65N – 120MHz RXv2 Core MCU

Large ROM/RAM, Enhanced Security, Connectivity and HMI

High Performance and Wide Product Lineup

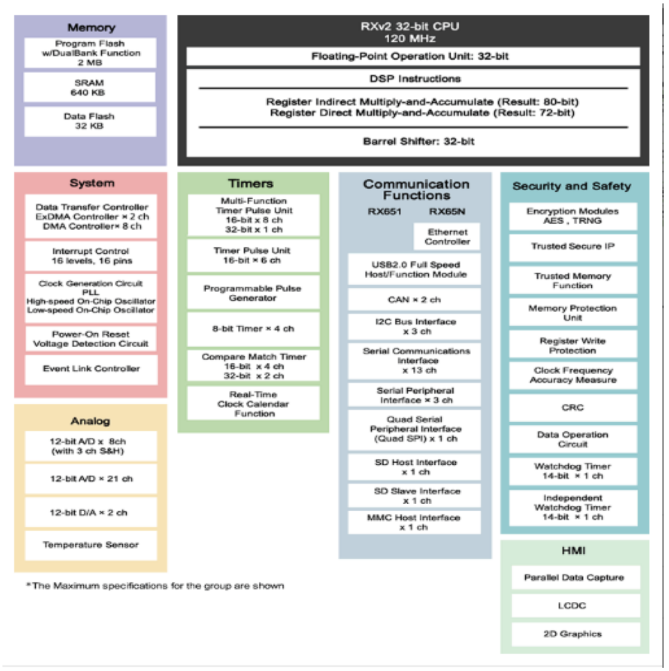
- RXv2 Core 120 MHz operation (34 CoreMark/mA), on-chip FPU
- Up to 2M ROM / 640K RAM, supportive of the dual bank function
- Wide package lineup : 64-pin (4.5mm x 4.5mm, BGA) to 176-pin

Rich Peripheral/Security Functions

- 16-bit TPUa, MTU3a, 8-bit TMRa (4ch), 16-bit CMT(4ch), 32-bit CMTW(2ch)
- 12-bit A/D (8 ch for unit 0, 21ch for unit 1), 12-bit D/A (2ch)
- DMACAa (8ch), DTCb (1ch), EXDMAC(2ch), DMAC for Ethernet controller(1ch)
- Various communication peripheral such as Ethernet, USB, CAN, SD host/slave interface, and quad SPI
- Security: AES、TRNG、TDES、RSA、SHA

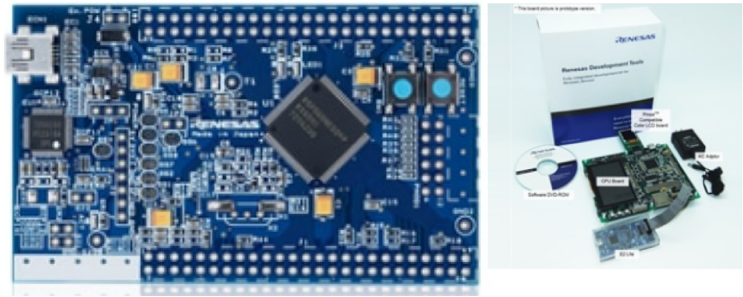
Low Power Design and Architecture

- Operation from a single 2.7- to 3.6-V supply
- Low power consumption: A product that support all peripheral functions draws only 0.19mA/MHz(Typ.)
- RTC is capable of operation from a dedicated power supply
- Four low-power modes



System Block

Part #	ROM	RAM	Data Flash	Package
R5F565N4xDxx	512K	256k	None	64-LFQFP,64-LFBGA,100-LFQFP,100-TFLGA, 144-LFQFP, 145-TFLGA
R5F565N7xDxx	768K	256K	None	64-LFQFP,64-LFBGA,100-LFQFP,100-TFLGA, 144-LFQFP, 145-TFLGA
R5F565N9xDxx	1M	256K	None	64-LFQFP,64-LFBGA,100-LFQFP,100-TFLGA, 144-LFQFP, 145-TFLGA
R5F565NCxDxx	1.5M	640K	32K	64-LFQFP,64-LFBGA,100-LFQFP,100-TFLGA, 144-LFQFP, 145-TFLGA,176-LFQFP,176-LPBFA,177-TFLGA
R5F565NExDxx	2M	640K	32K	64-LFQFP,64-LFBGA,100-LFQFP,100-TFLGA, 144-LFQFP, 145-TFLGA,176-LFQFP,176-LPBFA,177-TFLGA



Renesas Starter Kit for RX65N

ISL85415 – 0.5A Regulator with Integrated High Side FET

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

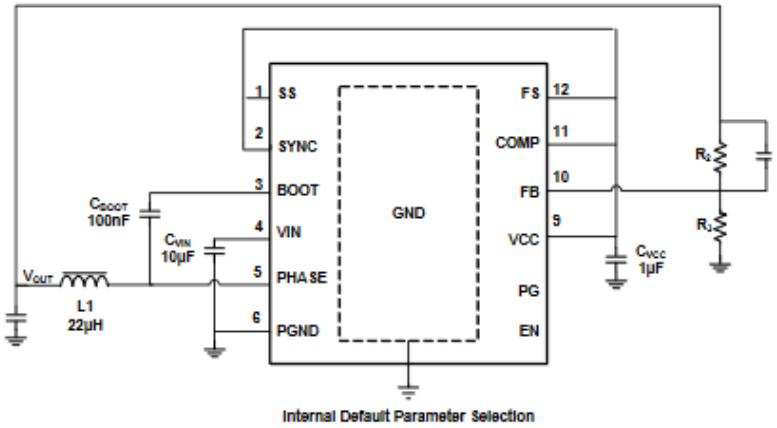
Wide Working Range

- 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_{IN} Range(V)	Temp.(℃)	Package
ISL85415FRZ	3 to 36	-40 to 125	12 Ld DFN 4x3



Typical Application Circuit

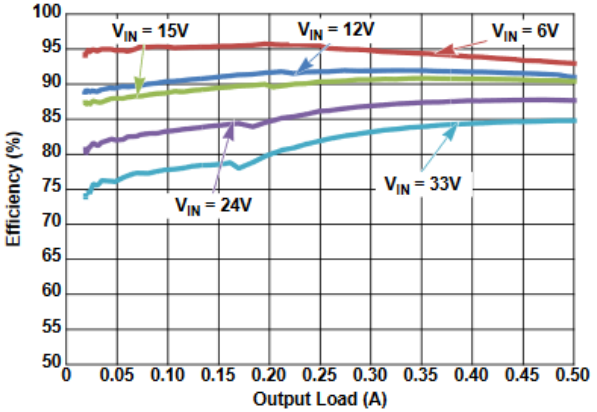


Figure 6. Efficiency vs Load, PFM, V_{OUT} = 5V

IGURE 1. FRONT OF EVALUATION BOARD ISL85415DEMO2Z

ISL6730x – Active Power Factor Correction (PFC) Controller

Up to 2kW and Over the Universal Line Input

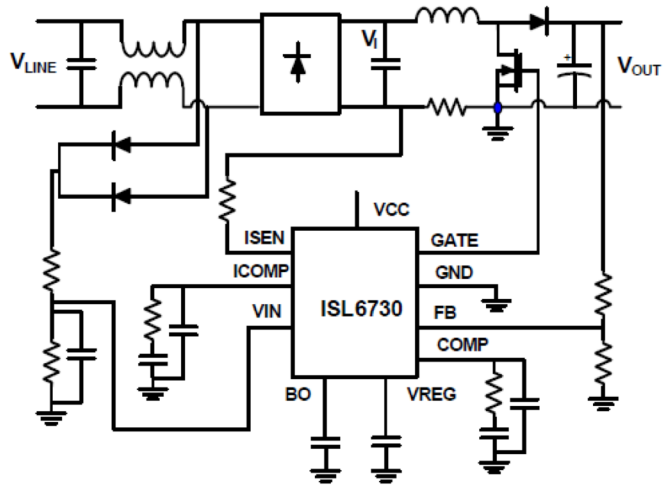
High Performance

- Zero crossing distortion and the magnetic components size are both reduced
- Internally clamped 12.5V gate driver delivers 1.5A peak current to the external power MOSFET
- Protection features include cycle-by-cycle overcurrent, over power limit, over-temperature, input brownout, output overvoltage and undervoltage protection

Key Features

- Two switching frequency options are provided: 62K/124KHz
- Work in Continuous Conduction Mode (CCM)
- Programmable or automatic shutdown
- Small 10 Ld MSOP package

Part #	Switch Frequency(kHz)	Skip Mode	Package
ISL6730AFUZ	124	Yes-Fixed	10 Ld MSOP
ISL6730BFUZ	62	Yes-Fixed	10 Ld MSOP
ISL6730CFUZ	124	No	10 Ld MSOP
ISL6730DFUZ	62	No	10 Ld MSOP



Typical Application Circuit

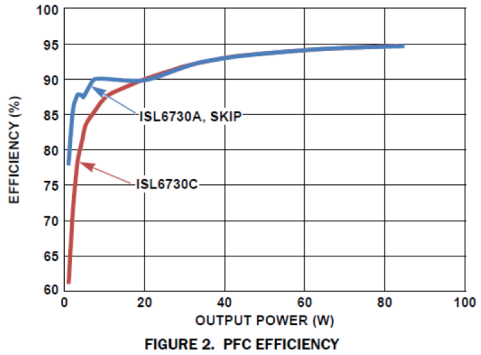


FIGURE 2. PFC EFFICIENCY

PFC Efficiency Chart

ISL6730 Evaluation Board

BIG IDEAS FOR EVERY SPACE RENESAS

ISL6721 –Flexible Single Ended Current Mode PWM Controller

A design for a wide range of DC/DC Conversion Applications

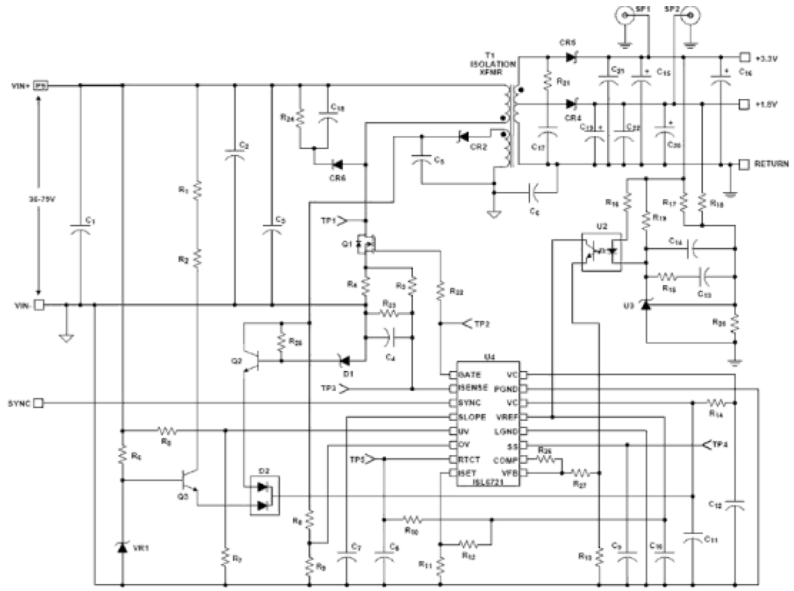
Key Specification

- 1A MOSFET gate driver
- 100µA start-up current
- Adjustable switching frequency up to 1MHz
- Build in boost, flyback and isolated output configurations

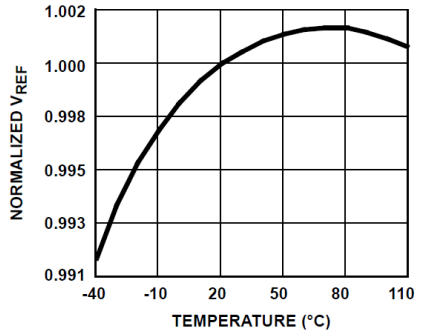
High Performance

- Supply current drops to less than 200µA during overvoltage and overcurrent shutdown faults
- 1% tolerance voltage reference
- Peak current mode control effectively handles power transients and provides inherent overcurrent protection
- Adjustable slope compensation/soft-start/ overcurrent shutdown threshold/ UV and OV monitors

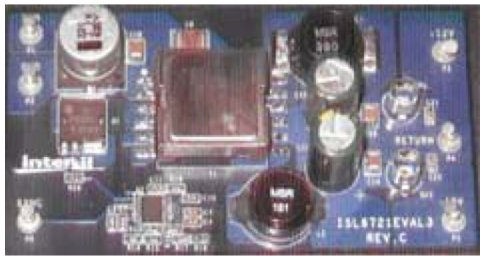
Part #	UVLO Threshold (Start/Stop)(V)	UV Threshold(V)	Temp.(℃)	Package
ISL6721ABZ	8.25/7.7	1.45	-40 to 105	16 Ld SOIC
ISL6721AVZ	8.25/7.7	1.45	-40 to 105	16 Ld TSSOP



Typical Application Circuit



V_{REF} Reference Voltage vs Temperature



ISL6721EVAL3Z Evaluation Board

ISL81601 – High Voltage Buck-Boost Controller

60V Bi-Directional 4-Switch Synchronous Buck-Boost Controller

Bi-directional Buck-Boost

- Peak & average current sensing and monitoring at input & output
- 4 independent controls for input/output voltages and currents
- 4-switch design with smooth transition between buck & boost mode

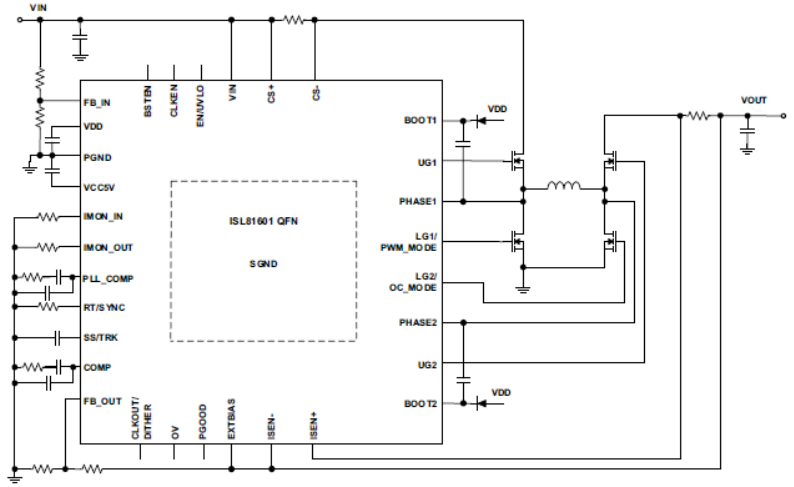
Wide Working Range

- Input voltage range: 4.5V to 60V
- Output voltage range: 0.8V to 60V
- Adjustable switching frequency from 100 to 600 kHz
- Ability to sync to external clock

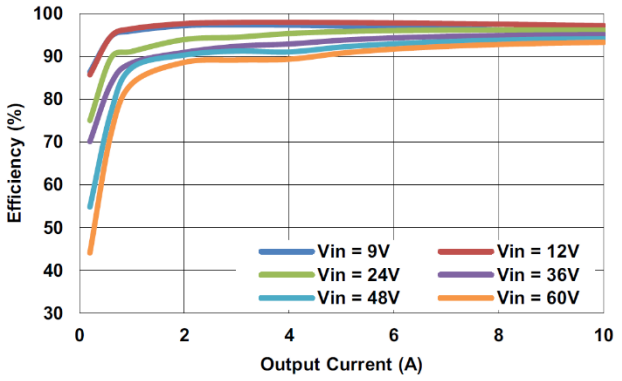
Complete Application Protection

- Multiple protection features: OVP, UVP, OTP, SCP
- Current limits on both input & output
- Adaptive shoot-through protection

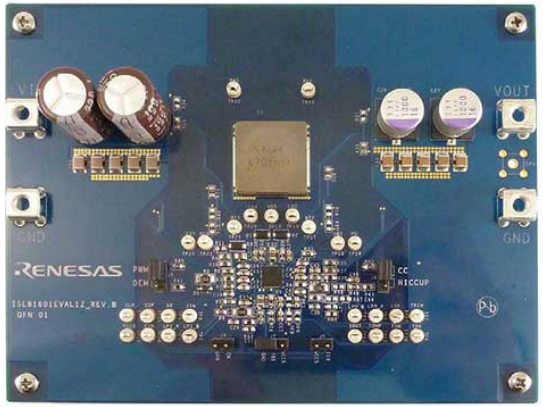
Part #	Vin Range (V)	Vout Range (V)	Package
ISL81601FRZ-T	4.5-60	0.8-60	32Ld 5x5 DFN
ISL81601FVEZ-T	4.5-60	0.8-60	38Ld HTSSOP



Typical Operation Circuits



Efficiency (VOUT = 12V, DE Mode)



ISL81601EVAL1Z Evaluation Board

R1EX24512BxAS0I – 512KB Industry-Grade EEPROM

I²C Interface Series EEPROM for Industrial Segment

High Speed Memory

- Clock frequency: 1 MHz (2.5 V to 5.5 V) / 400 kHz (1.8 V to 5.5 V)
- Automatic page write: 128-byte/page
- Write cycle time: 5 ms

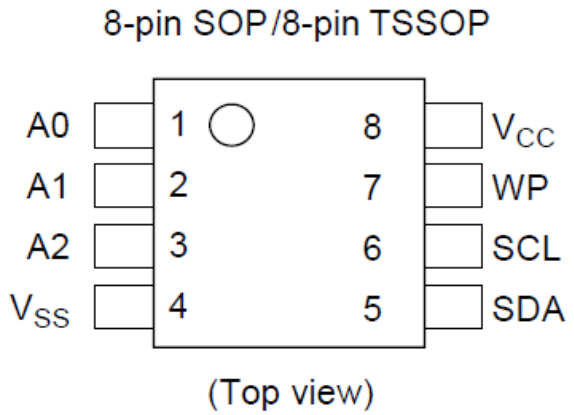
Robust Industry Grade

- Endurance: 1,000k or more Cycles
- Data retention: 100 or more Years

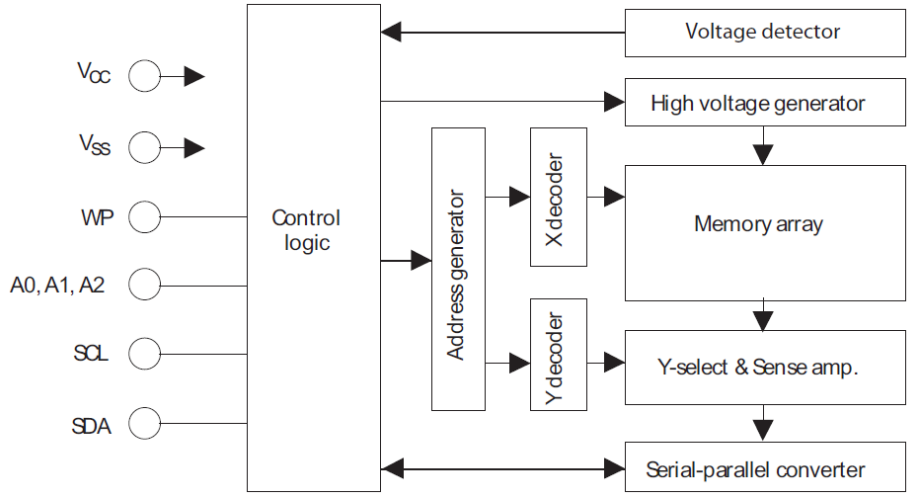
Low Power Mode

- Power dissipation:
  - Standby: 2.0 µA (max)
  - Active (Read): 1.0 mA (max)
  - Active (Write): 5.0 mA (max)

Part #	Internal Organization	Temp. Rang	Interface	Package
R1EX24512BSAS01	512k bit	-40 to +85	I2C	SOP-8
R1EX24512BTAS01	512k bit	-40 to +85	I2C	TSSOP-8



Pin assignment



Block Diagram

HS300x – Relative Humidity and Temperature Sensor

High Accuracy Humidity and Temperature Measurement for Environmental Monitoring

High Accuracy

- ±1.5%RH accuracy (HS3001)
- ±0.2°C temperature accuracy (HS3001, HS3002)

Excellent Stability

- 0.1%RH per year drift
- MEMS silicon-carbide sensor technology

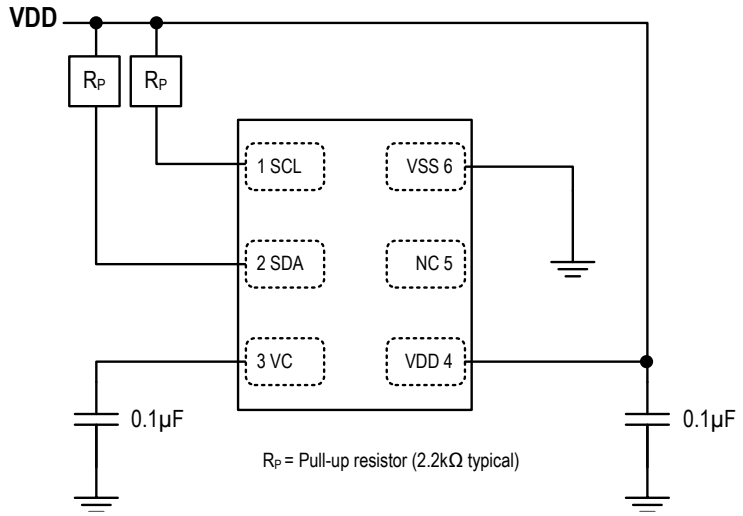
Fast Response

- Less than 6 seconds humidity response, in still air
- Less than 2 seconds temperature response

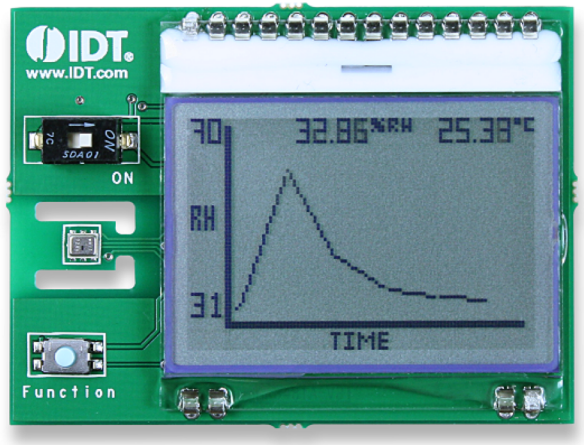
Extended Supply Voltage

- 2.3V to 5.5V, 24.4µA at 3.3V (one RH+Temp per second)
- 1.8V custom order

Part #	Feature	Package
HS3001	±1.5%RH	3×2.41×0.8 LGA
HS3002	±1.8%RH	3×2.41×0.8 LGA
HS3003	±2.8%RH	3×2.41×0.8 LGA
HS3004	±3.8%RH	3×2.41×0.8 LGA



Typical Operating Circuit



SDAH02 Evaluation Kit

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