THERMOSTAT WITH COLOR SCREEN AND CLOUD CONNECTION: OVERVIEW

In home appliances, the thermostat is used for central control. In traditional thermostats, the mechanical thermostat is being replaced by the segment-LCD screen, but the control keys are still essentially mechanical.

This thermostat design enables users to connect to the cloud and increase to a larger size color screen for ease of use and a better Human Machine Interface (HMI). The Synergy S5D9 MCU supports cloud connectivity as well as LCD control. The RX231 MCU voice recognition reference design enables customers to quickly evaluate and implement voice control. The ISL32704E supports a fully isolated ESD RS-485 interface which adds robustness in the electronically noisy environment that exists in modern homes. The HS300x provides high accuracy and excellent stability for measuring humidity and temperature.

Key Features:

- Voice recognition reference design
- Easy cloud connection
- High performance Arm® Cortex® MCU S5D9 with built-in TFT-LCDC, capacitive touch with qualified SSP
- Fully-isolated robust RS-485 interface

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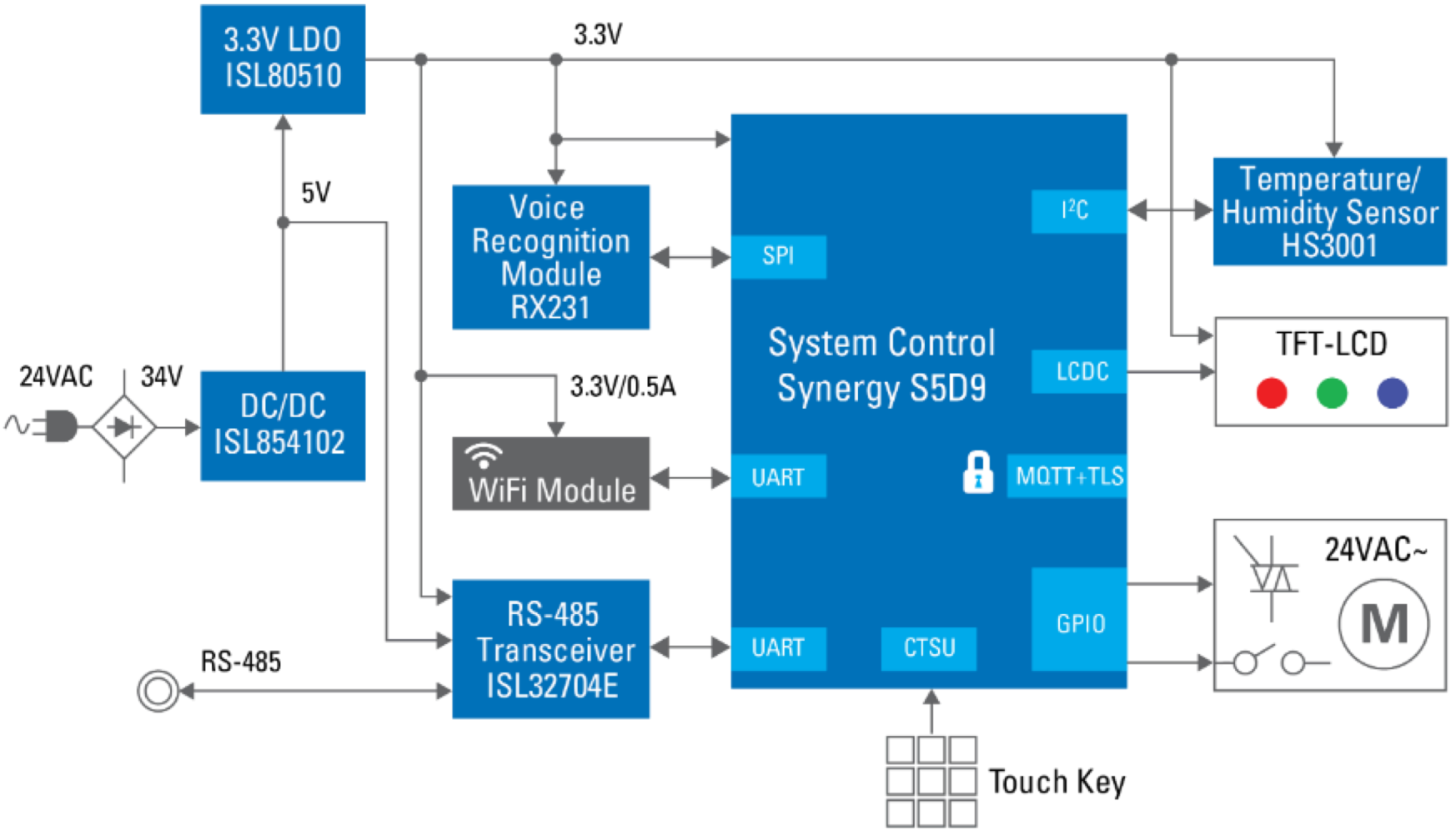
THERMOSTAT WITH COLOR SCREEN AND CLOUD CONNECTION: BLOCK DIAGRAM



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THERMOSTAT WITH COLOR SCREEN AND CLOUD CONNECTION: SUMMARY

- **System benefits**
  - Rich MCU resource support voice recognize algorithm & on-chip LCDC+MQTT+TLS
  - ISL32704E ultra-low EMI, smallest package isolated RS-485 transceiver, +/-15KV ESD
  - HS3001 is highly-accurate, fully-calibrated relative humidity and temperature sensor

Device Category	P/N	Key Features
MCU	RX231	RXv2 core, FPU, DSP, 512K Flash suitable to voice recognize algorithm
MCU	R7FS5D9	Arm® Cortex®-M4, FPU, Max to 120 MHz, 640K RAM, can support both TFT-LCD+MQTT+TLS on chip, SSP support to quick development. Integrated cap touch.
Power	ISL854102	1.2A/40V DC/DC, synchronous buck regulator, wide Vin 3-40V, Vout 0.6-34V
Power	ISL80510	1A adjustable Vout 0.8-5.5V LDO
Analog	ISL32704E	Ultra-Low EMI, smallest package isolated RS-485 transceiver, +/-15KV ESD
Analog	HS3001	A highly-accurate, fully-calibrated relative humidity and temperature sensor

RX231: 32 BIT, WIDE VIN MCU WITH BUILT-IN FPU

Motor control MCU series within the RX Family

Features

- 32-bit MCU @ 54MHz
- RX231 microcontrollers operate in a broad voltage range from 2.7 V to 5.5 V
- Has a rich communication interface such as SD host interface, USB, and CAN
- Integrated with security function, encryption function, and touch key.
- Up to 512kB Flash and 64kB RAM
- 48pin, 64pin and 100pin LQFP packages

Benefits

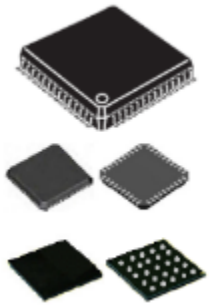
- The RX231 family is 32-bit microcontroller with built-in FPU (floating-point processing unit) that enables it to easily program complex inverter control algorithms. The RX24T family enables simultaneous control of up to 3 motors by max 80 MHz operating frequency CPU core and motor control peripherals.

Applications

- Industrial automation
- Industrial process control
- Office automation
- Home appliances
- Healthcare
- IoT

Typical application and key performances

54-MHz 32-bit RX MCUs, built-in FPU, 88.56 DMIPS, up to 512-KB flash memory, up to 14 communication functions including USB 2.0 full-speed host/function/OTG, CAN, SD host interface, serial sound interface, cap-touch, 12-bit A/D, 12-bit D/A, RTC, AES, MPU security functions



PLQP0100KB-B 14 × 14 mm, 0.5 mm pitch
PLQP0064KB-C 10 × 10 mm, 0.5 mm pitch
PLQP0048KB-B 7 × 7 mm, 0.5 mm pitch

PWQN0064KC-A 9 × 9 mm, 0.5 mm pitch
PWQN0048KB-A 7 × 7 mm, 0.5 mm pitch

PTLG0100KA-A 5.5 × 5.5 mm, 0.5 mm pitch
PWLG0064KA-A 5 × 5 mm, 0.5 mm pitch

Capacitive Touch Development Tool: “QE for Capacitive Touch“ or ” Workbench6”

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S5D9 SYNERGY PRODUCT SNAPSHOT

Performance MCU Series

Features

- High performance 40nm Arm® Cortex®-M4F cores
- Up to 2MB flash / 640KB SRAM
- High integration including Ethernet, USBHS, LCD controller, capacitive touch
- Secure crypto engine: 128-Bit Unique ID, TRNG, AES, 3DES, ECC/RSA/DSA, SHA &GHASH (built-in hardware)
- Built-in safety: ECC in SRAM, Flash area protection, IWDT plus more
- Comprehensive tools and support

Benefits

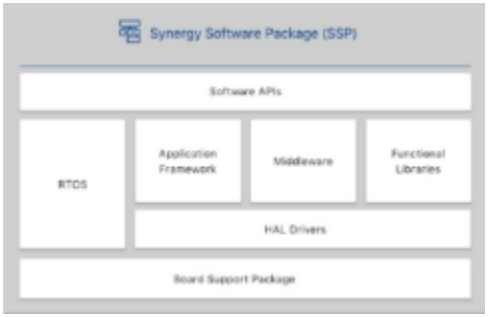
- Full access to the Synergy Software Package (SSP), which includes a commercial grade RTOS, middleware, frameworks, HAL drivers and the accompanying board support packages
- Fully integrated and tested software with no licensing, royalties or maintenance fees
- Unlimited usage for any Synergy device
- Hardware and software scalability: Pin compatibility across packages and feature compatibility
- All tech support for hardware and software done through Renesas

Applications

- Graphical HMI
- Connectivity hub
- Medical instrumentation
- Motor & position control
- Security gateway/peripheral
- Building automation
- Industrial automation

Typical application and key performances

Fully integrated Promotion Kits



Fully tested SSP and library for your use

Full support for either IDE, your choice

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ISL854102: WIDE VIN 1.2A SYNCHRONOUS BUCK REGULATOR

1.2A synchronous buck regulator with an input range of 3V to 40V

Features

- Wide input voltage range: 3V to 40V
- 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 frequency (500kHz) or adjustable switching frequency (300kHz to 2MHz)
- Frequency 300kHz to 2MHz
- Continuous output current up to 1.2A
- Internal or external soft-start
- Minimal external components required
- Power-good and enable functions available

Benefits

- It provides an easy to use, high efficiency low BOM count solution for a variety of applications.
- It will provide a very robust design for high voltage Industrial applications as well as an efficient solution for battery-powered applications

Applications

- Industrial control
- Medical devices
- Portable instrumentation
- Distributed power supplies
- Cloud infrastructure

Typical application and key performances

Typical application circuit

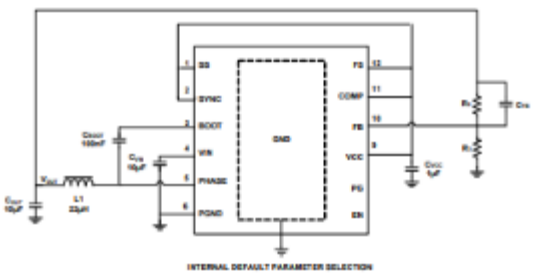


FIGURE 1. TYPICAL APPLICATION

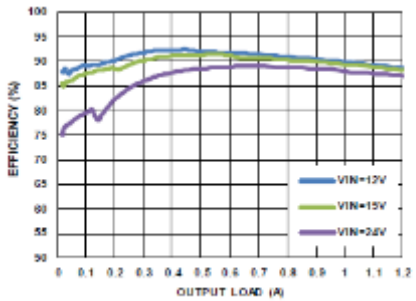


FIGURE 6. EFFICIENCY vs LOAD, PFM, V_{OUT} = 5V, L_1 = 22µH

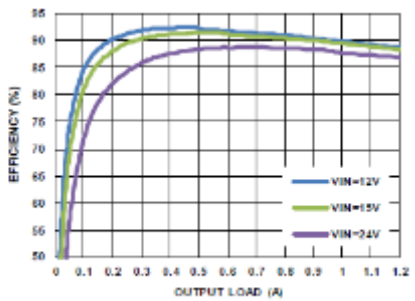


FIGURE 7. EFFICIENCY vs LOAD, PWM, V_{OUT} = 5V, L_1 = 22µH

ISL80510: SINGLE OUTPUT LOW DROPOUT REGULATOR

High performance 5V/1A LDO

Features

- Input voltage 2.2V to 6V
- Output voltage 0.8V to 5.5V
- ±1.8% Vout accuracy over line, load and temperature variation
- Very low 130mV dropout voltage at VOUT = 2.5V
- Programmable output soft-start time

Benefits

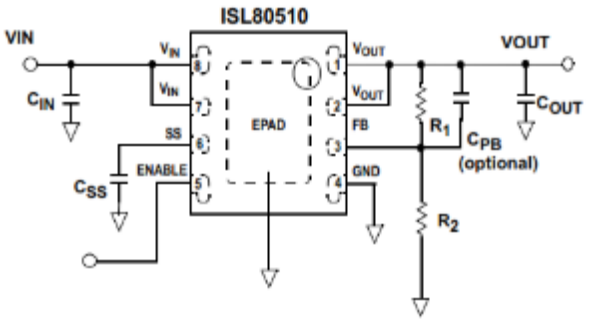
- Thermally enhanced 8LD DFN package
- Programmable soft start
- Very fast transient response
- It achieves a very fast load transient response and excellent PSRR

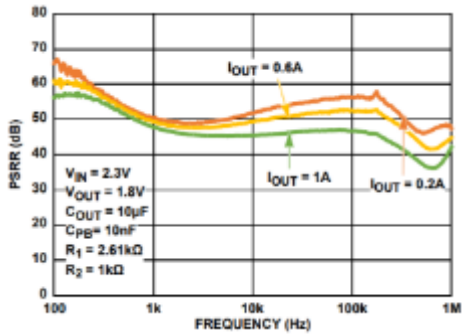
Applications

- Noise-sensitive instrumentation systems
- Post regulation of switched mode power supplies
- Industrial systems
- Medical equipment
- Telecommunications and networking equipment
- Servers
- Hard disk drives (HD/HDD)

Typical application and key performances

Typical application circuit





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ISL32704E: HIGH DRIVE CAPABILITY, ROBUST ESD

Ultra-low EMI, smallest package isolated RS-485 transceiver

Features

- 4Mbps data rate
- 2.5kVRMS isolation per UL 1577
- 600VRMS working voltage per VDE 0884
- Single unit load receiver input
- Driver drives up to 150 unit loads
- 50kV/µs (typical), 30kV/µs (minimum) common-mode transient immunity
- 44000 years barrier life
- 15kV ESD bus-pin protection
- Thermal shutdown protection
- Meets or exceeds ANSI RS-485
- VDE V0884-10 certified

Benefits

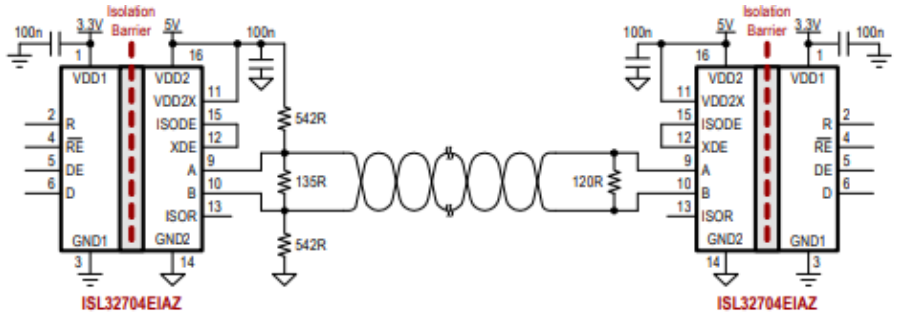
- The device uses Giant Magnetoresistance (GMR) as isolation technology. A unique ceramic/polymer composite barrier provides excellent isolation and virtually unlimited barrier life.
- The device is compatible with 3V and 5V input supplies, enabling it to interface to standard microcontrollers without additional level shifting.

Applications

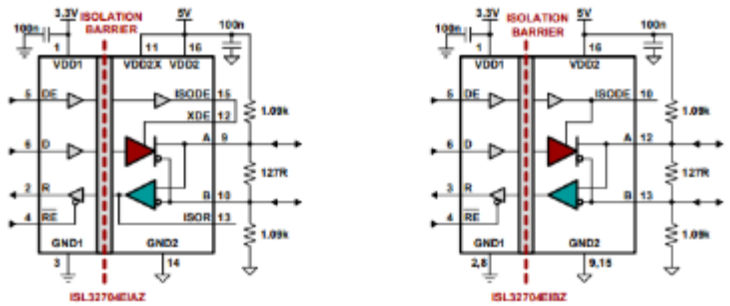
- Factory automation
- Security networks
- Building environmental control systems
- Industrial/process control networks
- Level translators (i.e., RS-232 to RS-485)

Typical application and key performances

TYPICAL ISOLATED HIGH-SPEED RS-485 APPLICATIONS



TYPICAL OPERATING CIRCUITS



HS300X: RELATIVE HUMIDITY AND TEMPERATURE SENSOR

Humidity sensor with industry-leading accuracy, response time, and excellent stability

Features

- ±1.5% relative humidity accuracy (HS3001)
- Fast RH response time (Typical 6 seconds)
- 14-bit resolution, 0.01%RH (Typical)
- Low power consumption, 1.0µA average (one RH + T measurement per second)
- Temperature sensor accuracy of ±0.2° C (HS3001, HS3002)
- Extended supply voltage, 1.8V to 5.5V

Benefits

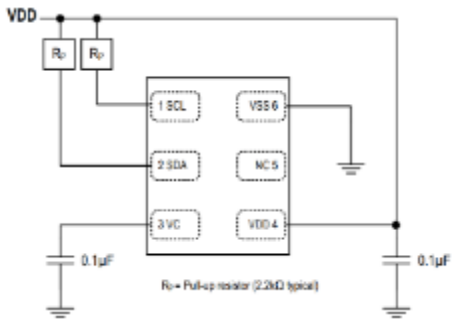
- Silicon-carbide capacitive sensing element
- Excellent stability against aging
- Highly robust protection from harsh environmental conditions and mechanical shock
- Very low power consumption
- Digital I^2C Output

Applications

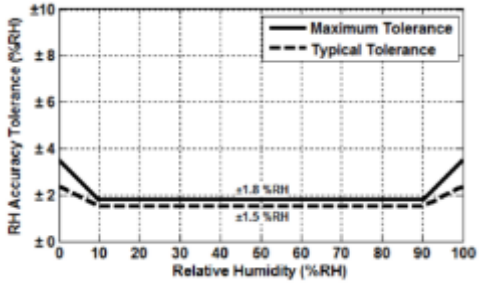
- Climate control systems
- Home appliance
- Weather stations
- Industrial automation
- Process controls and monitoring
- Automotive climate control
- Medical equipment

Typical application and key performances

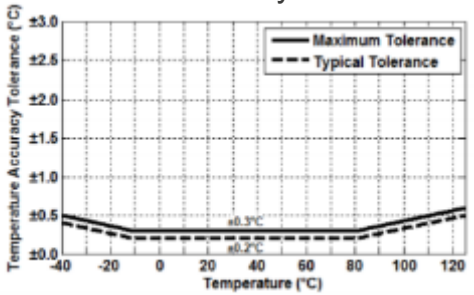
Typical application circuit



HS3001 RH Accuracy Tolerance at 25°C



HS3001 Temperature Sensor Accuracy Tolerance



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