



CN258 Smart Clotheshorse

June 2020

Smart Clotheshorse

■ Overview

In some indoor areas, the environment is very moist, making it difficult to dry clothes efficiently. With today's technology, there are now additional features for electronic-type dryers, like remote and voice control, and a local touch panel that automatically turns off to save energy.

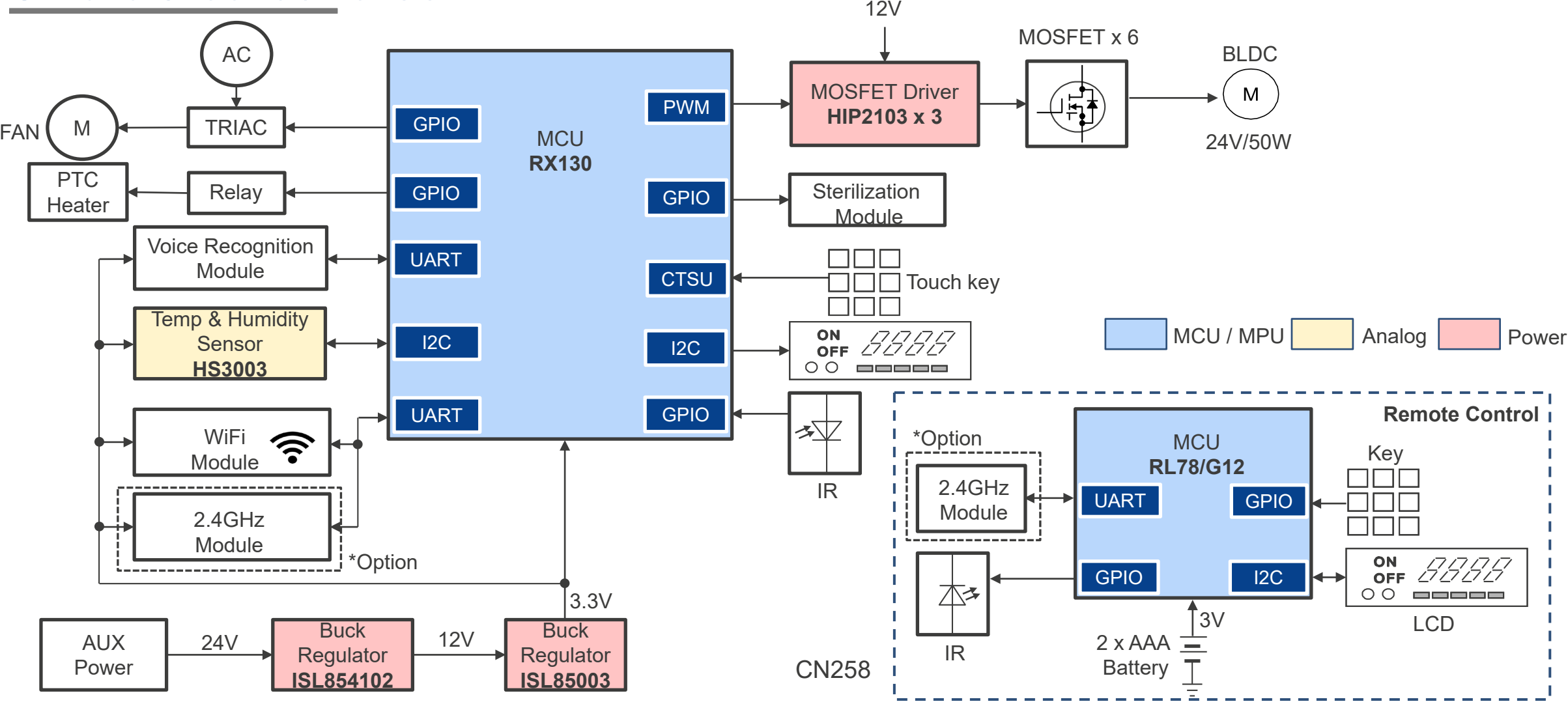
This reference design provides a cost optimized RX130 32-bit microcontroller (MCU) with a capacitive touch sensing unit (CTSUS). The buck regulator and LDO power the MCU and other peripheral modules. A humidity and temperature sensor and half-bridge drivers are also integrated into this solution. Voice recognition and Wi-Fi modules are used for smart home applications.

■ System Benefits

- Cost optimized RX130 MCU provides capacitive touch for touch control
- Humidity and temperature sensor with high accuracy and excellent stability
- Low cost and high performance, multiprocessor (MP) level voice recognition module

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Device Category	P/N	Key Features
MCU	RX130 R5F5130xxxxx	32-MHz, 32-bit RX MCUs, 50 DMIPS, up to 512-KB flash memory, up to 36 pins capacitive touch sensing unit, up to 6 comms channels, 12-bit A/D, D/A, RTC, IEC60730 compliance
	RL78/G12 R5F10Rxx	24MHz, 16-bit MCU, compact, low power, high function general-purpose microcontrollers ideal for sub-microcontrollers, extreme low end to save cost
Power	ISL85003	Input voltage range 4.5V to 18V, Efficient 3A Synchronous Buck Regulator
	ISL854102	1.2A synchronous buck, power input voltage range from 3V to 40V, 4mm x 3mm DFN package
	HIP2103	Half bridge drivers designed for applications using DC motors, three-phase brushless DC motor
Analog	HS3003	High Accuracy Humidity and Temperature Measurement for Environmental Monitoring

RX130 – 32-bit MCU with Up to 36 Touch Key Channels

Cost Optimized and High Performance RX MCU 5V Operation Support

Cost Optimized and High Performance

- Max. operating frequency: 32MHz
- Accumulator support DSP instructions
- Up to 512 Kbytes code flash and 48 Kbytes SRAM, no wait states
- Incorporating external components into MCU like POR/LVD, RTC, E2 data flash, temperature sensor and port with 5V support

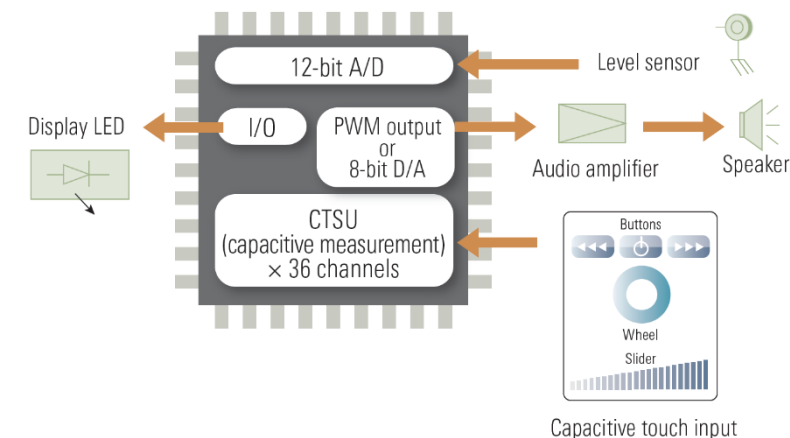
Capacitive Touch Sensors with Sensitivity and Noise Tolerance

- Up to 36 capacitive touch sensors (CTSUs) channels
- Improved noise immunity, sensitivity and water resistance
- Support wet environment, support a variety of materials like wood, acrylic, glass or stone
- Operation possible when wearing gloves

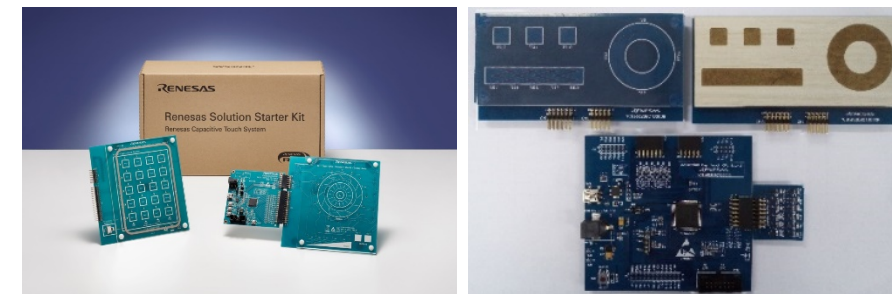
Rich Peripheral Functions and Low Power Design

- 3 low power consumption modes
- Low power timer (LPT) that operates during the software standby states
- Supply current: high-speed operating mode: 96 μ A/MHz software standby mode: 0.37 μ A
- Up to 6 communication functions, up to 12 extended-function timers, 12-bit ADC, 8-bit DAC, comparator, remote control signal reception

Part #	ROM (Kbytes)	RAM (Kbytes)	E2 DataFlash (Kbytes)	Package
R5F51308AGFP	512	48	8	LFQFP100/0.50
R5F51307AGFN	384	48	8	LFQFP80/0.50
R5F51306BGFM	256	32	8	LFQFP64/0.50
R5F51305AGFL	128	16	8	LFQFP48/0.50
R5F51303AGNE	64	10	8	HWQFN48/0.50



System Block



Evaluation Kits

RL78/G12 – General Purpose 16bit MCU

Compact, Low power, High Function General-purpose, Ideal for sub-microcontrollers

High Performance Peripheral Functions

- 16bit MCU with high performance: 32.4 DMIPS (24 MHz).
- On-chip oscillator, data flash, 10-bit A/D converter, CSI/UART/IIC
- Built-in safety features enable support for the household appliance safety standard (IEC/UL 60730)

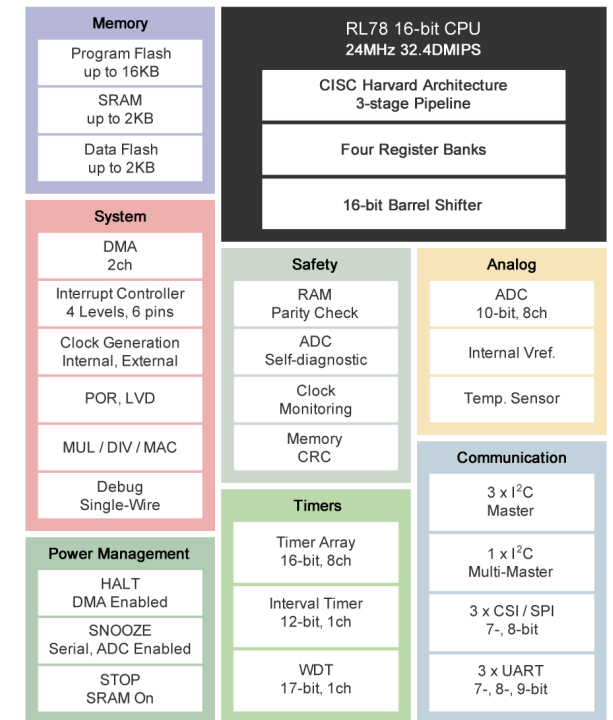
Lowest Power Consumption

- CPU: 63 μ A/MHz
- Standby (stop mode): 230 nA
- HALT, STOP, SNOOZE, 3 kind of mode to save power

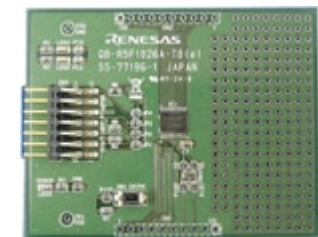
Low Cost

- 20 to 30 pin compact is perfect for sub-microcontrollers of small appliances and consumer and industrial equipment

Part #	Flash ROM	RAM	Package(mm)
R5F1026x R5F1036x	2 ~ 16 KB	256B ~ 1.5 KB	20-LSSOP(4.4 x 6.5mm, 0.65mm pitch)
R5F1027x R5F1037x	4 ~ 16 KB	512B ~ 1.5 KB	24-HWQFN(4 x 4mm, 0.5mm pitch)
R5F102Ax R5F103Ax	4 ~ 16 KB	512B ~ 2 KB	30-LSSOP(7.62mm(300), 0.65mm pitch)



RL78/G12 Block Diagram



QB-R5F1026A-TB Easy Evaluation Kit

ISL85003 – Efficient 3A Synchronous Buck Regulator

Network and communication equipment, Industrial control, Point-of-load regulators

Flexible Power

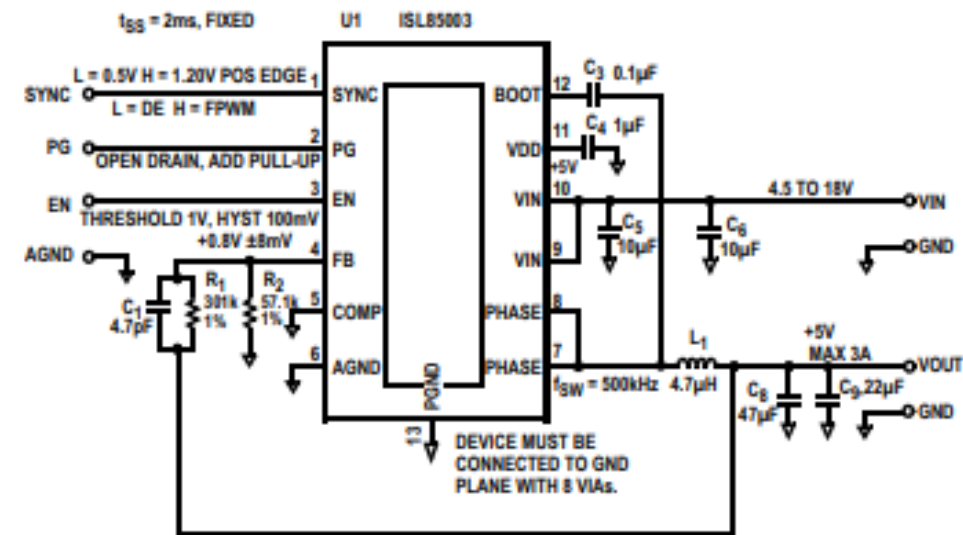
- Input voltage range 4.5V to 18V
- Adjustable output voltage as low as 0.8V
- DCM/CCM

High Efficiency and Accuracy

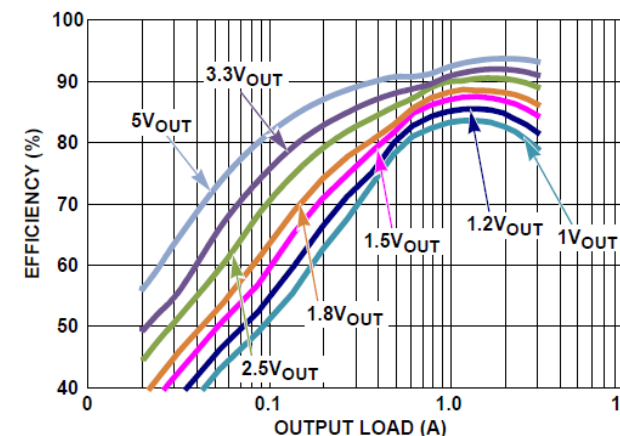
- Efficiency up to 95%
- High-side NFET $R_{ds(on)}$ of 65m Ω and low-side NFET $R_{ds(on)}$ of 45m Ω
- Precision 0.8V, $\pm 1\%$ accurate voltage reference

Built-in protection

- Positive and negative overcurrent protection
- Overvoltage and thermal protection



Typical Operation Circuits



Efficiency vs Load, 12V_{IN} DCM

Part #	External clock synchronization	Programmable soft start	Package
ISL85003FRZ	Yes	No	12L 3x4mm DFN
ISL85003AFRZ	No	Yes	12L 3x4mm DFN

ISL854102 – 1.2A Synchronous Buck with Integrated FETs

Support 3V-40V Input Voltage Range for Buck Output

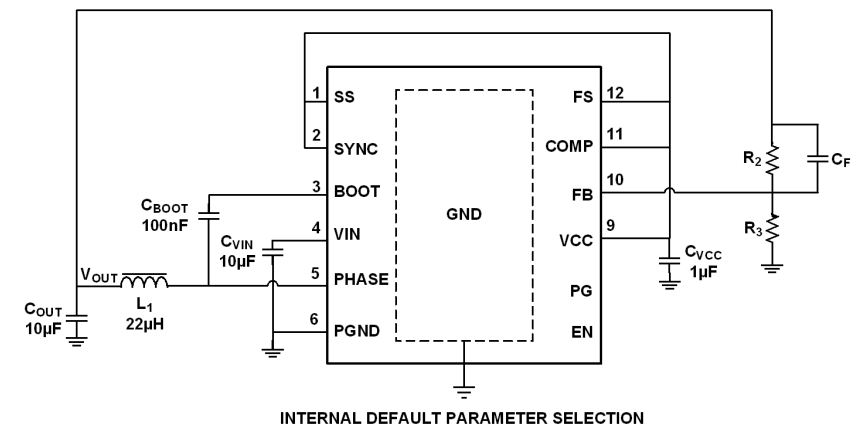
Wide Working Range and Space-Limited Applications

- Power input voltage range from 3V to 40V
- Up to 1.2A load over full temperature range
- 4mm x 3mm DFN package
- Minimal external components required

High Efficiency and Performance

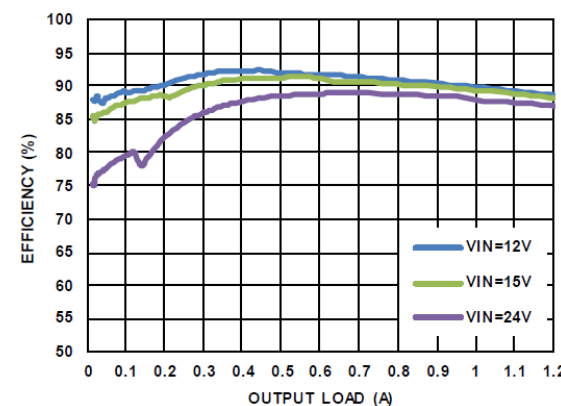
- Synchronous operation for high efficiency
- No compensation required
- Integrated High-side and Low-side NMOS devices
- Selectable PFM or forced PWM mode at light loads
- Internal fixed (500kHz) or adjustable switching frequency 300kHz to 2MHz

Part #	V _{IN} Range(V)	Temp.(°C)	Package
ISL854102FRZ	3 to 40	-40 to 125	12 Ld DFN 4x3



INTERNAL DEFAULT PARAMETER SELECTION

Typical Application Circuit



Efficiency vs Load, PFM,
V_{OUT} = 5V, L₁ = 22µH



ISL8541xDEMO1Z
Evaluation Board

HIP2103/4 – 60V, 1A/2A, Half-Bridge Driver

High Voltage Drivers for Industrial Motor Control

Flexible Half-Bridge Drivers

- Supports half bridge, full bridge, and 3-phase configurations
- Enables DC and 3-phase BLDC motors

Independent High & Low Inputs

- Reduces connections to MCU and lowers cost
- Supports 3.3V and 5V signals

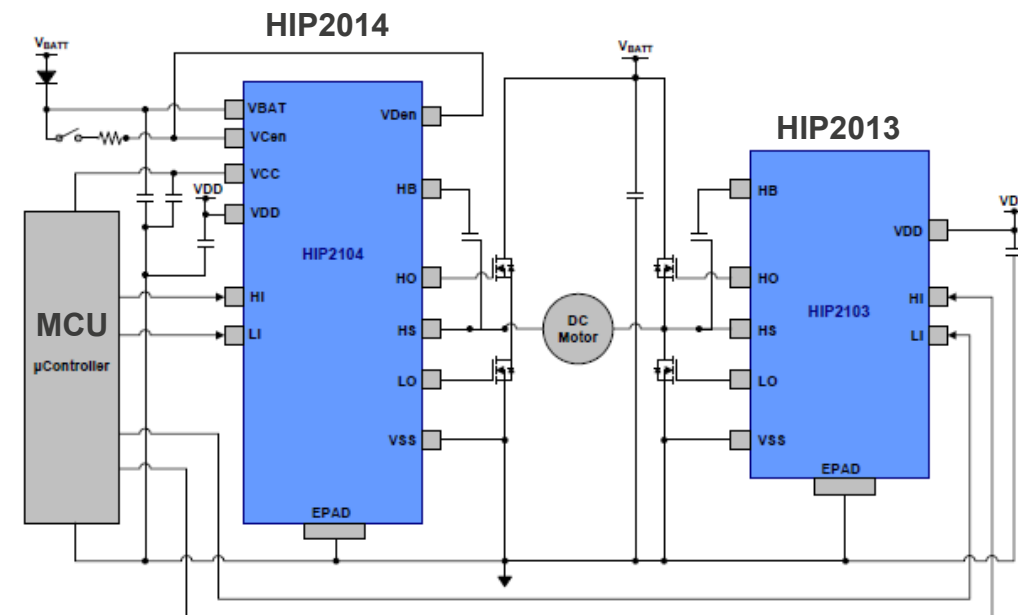
Sleep Mode

- Low quiescent current (5uA) with unique sleep mode
- Allows direct connection to battery without disconnect switch

Integrated LDO (HIP2104)

- HIP2104 includes integrated 12V & 3.3V LDOs
- Provides bias to external MCU plus HIP2103 & HIP2104 drivers

Part #	UVLO	VCC Reg	VDD Reg	Package
HIP2103FRTAAZ-T	4.0V	N/A	N/A	8L 3x3 TDFN
HIP2104FRTAAZ-T	4.0V	3.3V	12V	12L 4x4 DFN



Typical Application Circuit

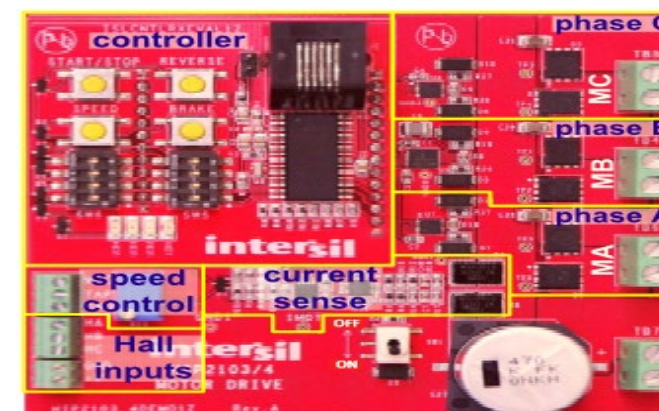


FIGURE 1. HIP2103-4DEMO1Z INPUTS AND OUTPUTS

HS300x – Relative Humidity and Temperature Sensor

High Accuracy Humidity and Temperature Measurement for Environmental Monitoring

High Accuracy

- $\pm 1.5\%$ RH accuracy (HS3001)
- $\pm 0.2^\circ\text{C}$ temperature accuracy (HS3001, HS3002)

Excellent Stability

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

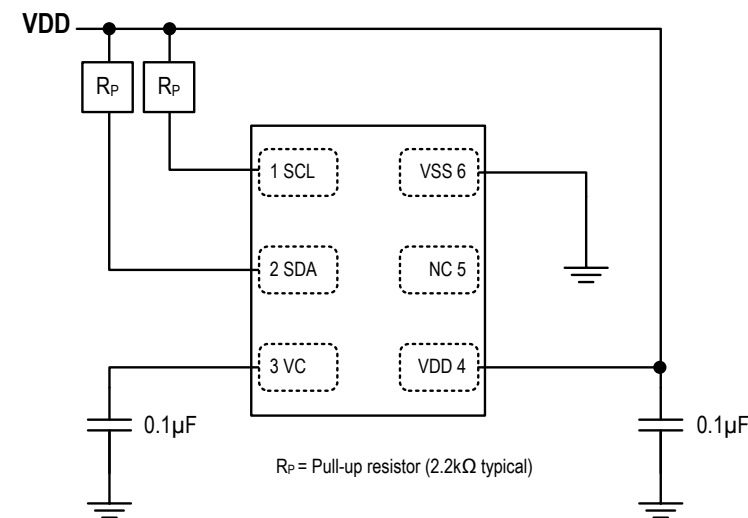
Fast Response

- Less than 4 seconds humidity response, in still air
- Less than 2 seconds temperature response

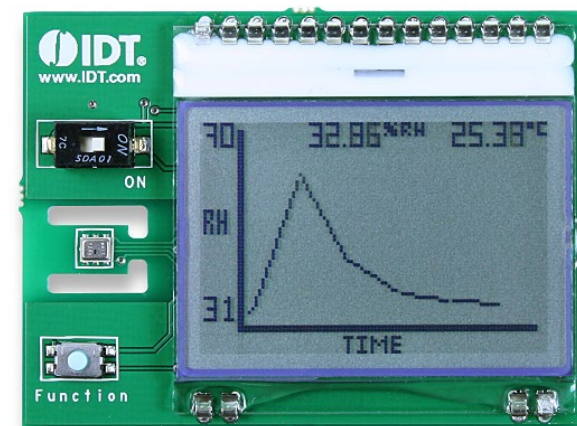
Extended Supply Voltage

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

Part #	Feature	Package
HS3001	$\pm 1.5\%$ RH	3 \times 2.41 \times 0.8 LGA
HS3002	$\pm 1.8\%$ RH	3 \times 2.41 \times 0.8 LGA
HS3003	$\pm 2.8\%$ RH	3 \times 2.41 \times 0.8 LGA
HS3004	$\pm 3.8\%$ RH	3 \times 2.41 \times 0.8 LGA



Typical Operating Circuit



SDAH02 Evaluation Kit

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