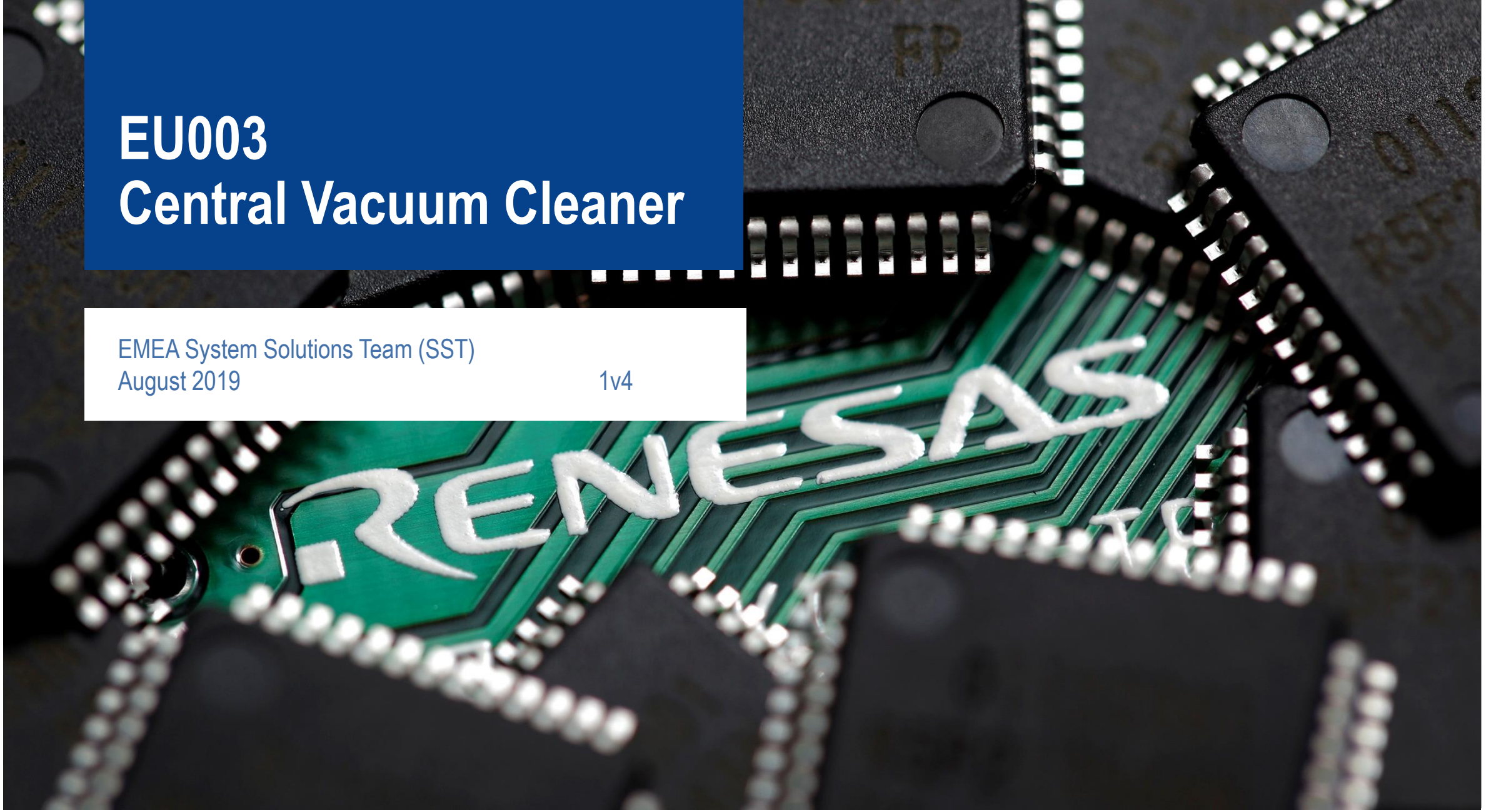
EU003
Central Vacuum Cleaner



EMEA System Solutions Team (SST)
August 2019 1v4

EU003 CENTRAL VACUUM CLEANER

Centralized vacuum cleaners need a strong suction power, as they must bring the suction power trough long piping in the house to the outlets and suction head. Standard systems consist of linear AC motors which are controlled via a simple 12V line running parallel with the vacuum piping in the house. This allows to switch the motor on/off at the hose-end; motor power ratings are in the range of 1000W~1700W for household systems.

This proposal uses a BLDC motor which allows the electric power to the motor to be dramatically reduced, while keeping the same suction power. The additional benefit of the BLDC motor is the ability to change the rotation speed (suction power) using the control electronics. This allows then to always have the optimal suction power for the task at hand, without the need to 'bleed off' the air intake. This can then be done using a simple (potentiometer) regulation at the hose handle, an information that need to be communicated to the motor control.

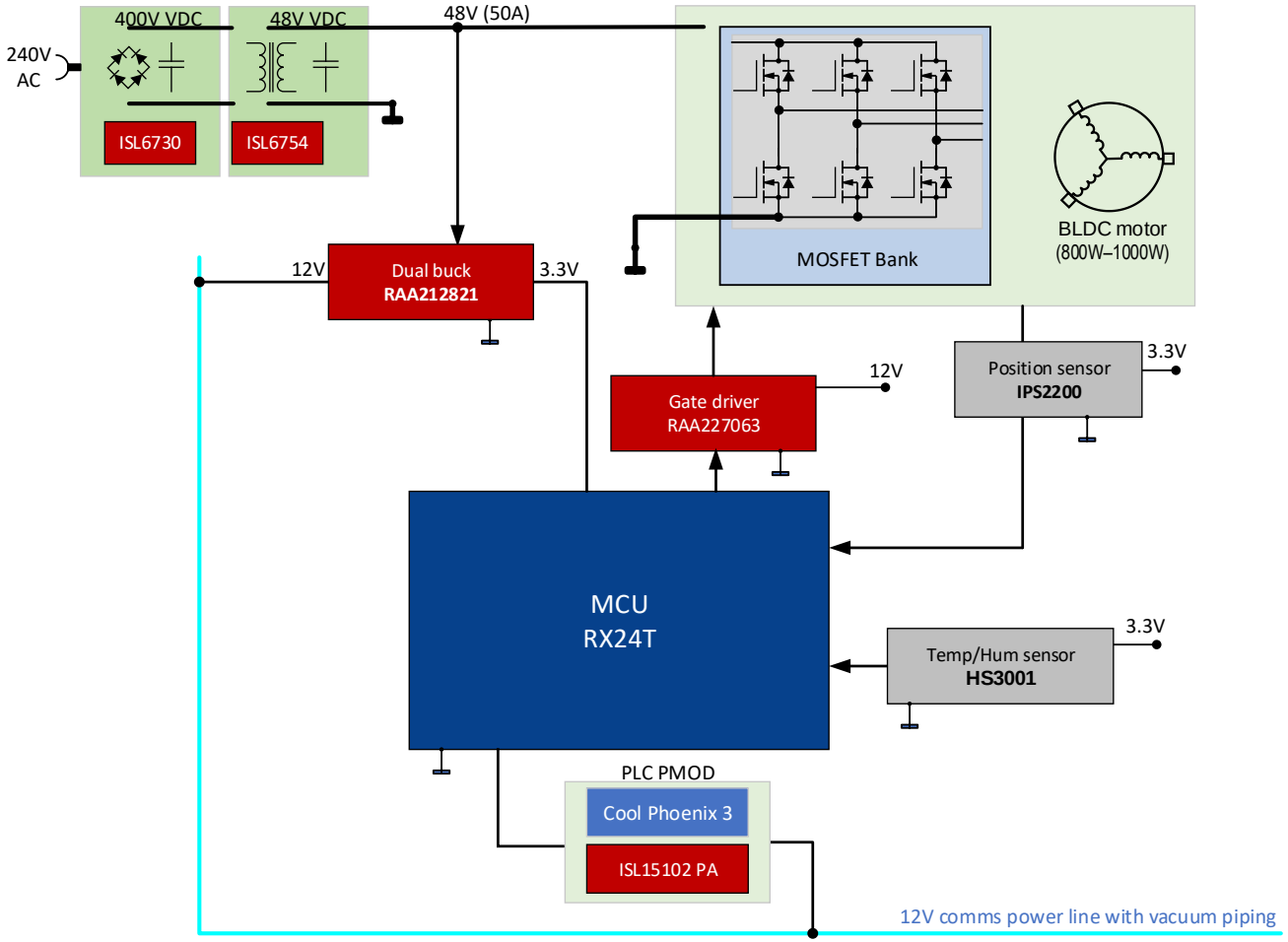
Key Features:

- Allows to re-use existing in-house vacuum cleaner infrastructure
- Using BLDC motor has a higher performance while keeping same vacuum power
- PLC communication allows for bi-directional data transfer, showing the motor performance and maintenance status at the handle

Block Diagram #EU003
August 2019

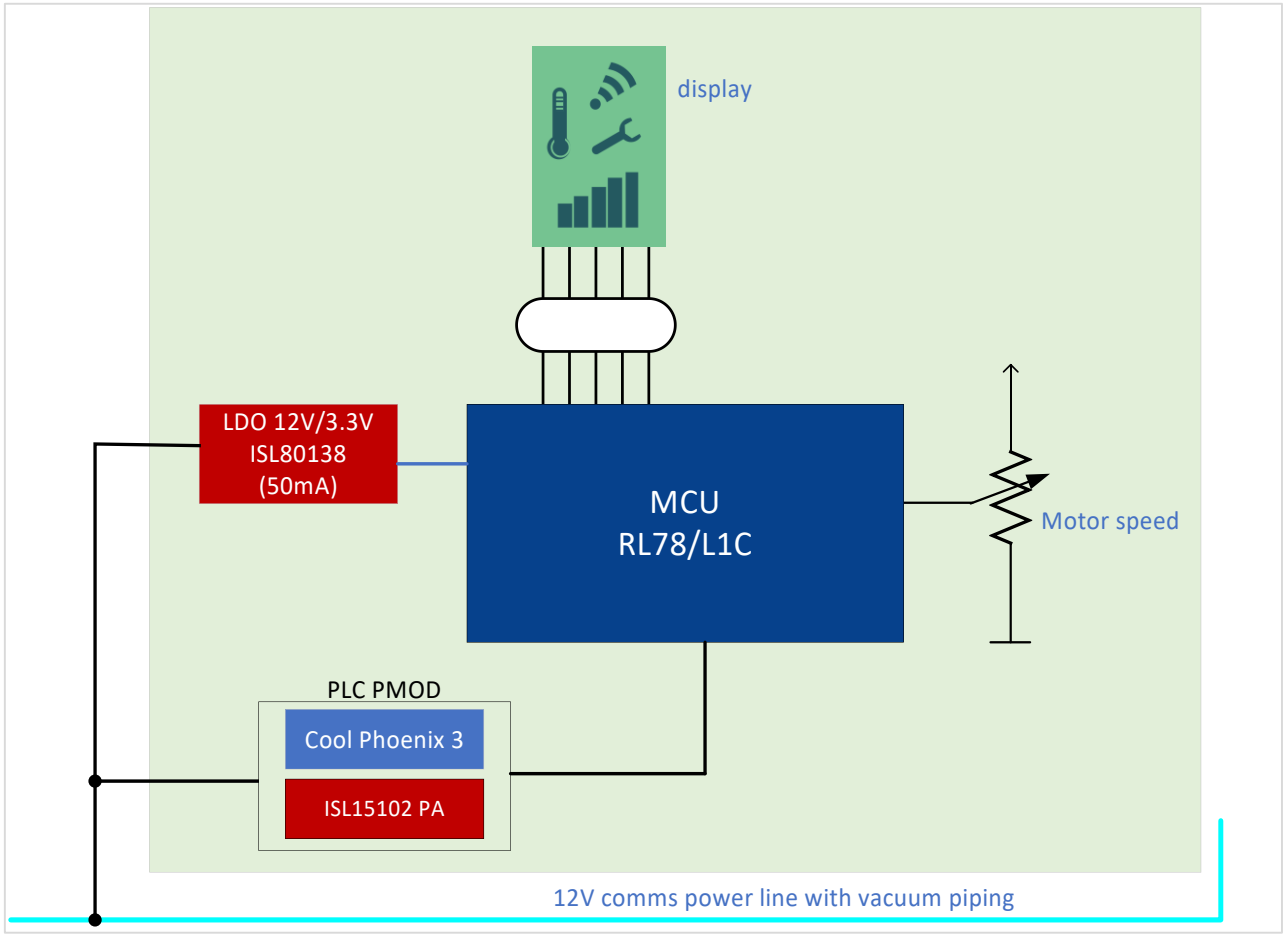
EU003 CENTRAL VACUUM CLEANER

BLOCK DIAGRAM: MOTOR BLOCK

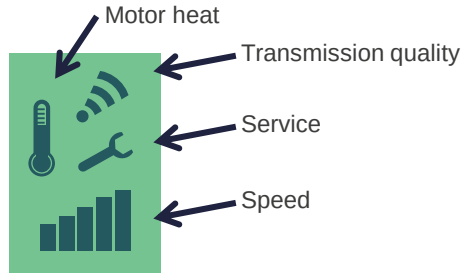


Block Diagram #EU003
August 2019

EU003 CENTRAL VACUUM CLEANER
BLOCK DIAGRAM: HANDLE CONTROL



Example for display



Block Diagram #EU003
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EU003 CENTRAL VACUUM CLEANER

Device Category	P/N	Key Features
MCU	RL78/L1C	Low power 16-bit LCD MCU
	RX24T	32 Bit, wide Vin MCU with built-in FPU for motor control
SoC	Cool Phoenix 3 R9A06G037	Power Line Communication, Cool Phoenix 3
Power	ISL6730	First stage 48V Power Supply
	ISL6754	Isolated full bridge as 2nd stage 48V/50A power supply
	RAA212821	2-Channel PMIC Switching Regulator with Low Quiescent Current
	ISL15102	PLC Power Amplifier
	ISL227063	independently driven, adjustable dead time, 3-Phase Motor driver
	ISL80138	Low Quiescent Power LDO 12V/3.3V
Sensor	HS3001	Relative humidity and temperature sensor
	IPS2200	Contactless Position Sensor

Block Diagram #EU003
August 2019

Renesas.com

RX24T: 32 BIT, WIDE V_{IN} MCU WITH BUILT-IN FPU

Motor Control MCU series within the RX Family

Features

- 32-bit MCU @ 80MHz
- RX24T microcontrollers operate in a broad voltage range from 2.7 V to 5.5 V
- Great set of timers to support Inverter Control
- Incorporating a floating point unit (FPU), able to control up to 3 inverters
- Up to 512kB Flash and 32kB RAM
- 64pin, 80pin and 100pin LQFP packages

Benefits

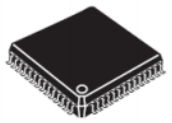
- The RX24T Group is 32-bit microcontroller with built-in FPU (floating-point processing unit) that enables it to easily program complex inverter control algorithms. RX24T Group enables simultaneous control of up to 3 motors by max 80 MHz operating frequency CPU core and motor control peripherals.

Applications

- Industrial automation
- Industrial process control
- Office Automation
- Home Appliance
- Inverter Control
- Motor Control

Typical application and key performances

80-MHz 32-bit RX MCUs, built-in FPU, 153.6 DMIPS, 12-bit ADC (equipped with three S/H circuits, double data registers, and comparator), Simultaneous sampling up to 5 channels ADC, CAN, 80MHz PWM (Up 3-phase complementary output × 3ch)



PLQP0100KB-B	14 x 14 mm, 0.5 mm pitch
PLQP0080JA-A	14 x 14 mm, 0.65 mm pitch
PLQP0080KB-B	12 x 12 mm, 0.5 mm pitch
PLQP0064KB-C	10 x 10 mm, 0.5 mm pitch

Renesas Motor Workbench 2.0:
Motor Control Development Tool 2.0

RL78 / L1X: LOW POWER 16-BIT LCD MCU

LCD multiplexed segment drive MCU series within the RL78 Family

Features

- True Low Power 16bit 24MHz uC
- Supports many segment LCD panel types upto 416segments
- Broad Scalability w/ pin/FLASH/RAM options
- High Performance w/ 1.6V to 5.5V operation
- Comprehensive Tools and Support
  - Advanced Tools, 3rd Party, Online resources and training

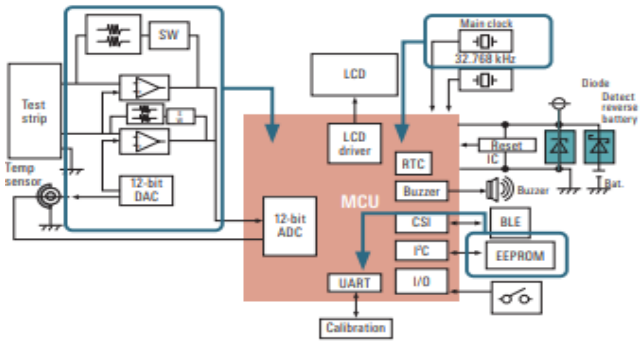
Benefits

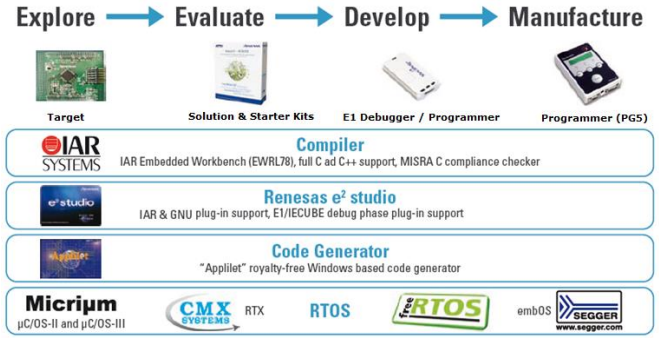
- RL78 provide many options in-order to scale power based on application requirements by using combination of the clock selection and advanced power modes
- RL78 offer scalability with wide pin count, packages, I/O peripheral mapping and large memory options
- Integrated LCD controller/driver allow drive types options such as charge pump (boost) and split capacitor operation with very low LCD operating currents

Applications

- LCD displays
- Healthcare and Fitness
- Industrial and home automation
- Electric/compact household appliances
- Measuring devices
- Fitness trackers
- Athletic garments
- Worker safety
- Mobile or tabletop pulse oximetry devices

RL78/L1X Low Power MCU





R9A06G037 (COOL PHOENIX 3)

Power Line Communication PMOD module

Features

- R9A06G037 is a high-performance NB-PLC (Narrow Band Power Line Communication) modem IC.
- Certified software stacks include G3-PLC (Cenelec A, Cenelec-B, ARIB and FCC bands), PRIME (1.36 and 1.4) as well as Meters&More.
- Stand alone PLC modem including all required active and passive parts as well as the PLC communication stack

Benefits

- Simple power supply, 3.3V digital
- Pre-build, tested PLC modules
- Wealth of stack choices depending on the use-case
- Point to point, point to multipoint and mesh communication possible.
- On the fly change of band plan (G3-PLC only)

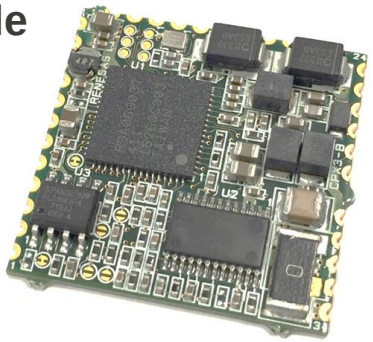
Applications

Data communication for:

- Smart meter
- HVAC (air conditioning)
- Fire & Safety
- Building Security
- Lighting equipment control
- Solar power system
- Voice over PLC

Typical application and key performances

PMOD communication module



- The CPX3 PLC modem module is a pre-assembled, small form-factor (25.4mm square), narrow-band PLC modem based around the Renesas R9A06G037 LSI.
- The module integrates the PLC processing MCU and DSP core, the line transceiver (power amplifier and line receiver), and all passive components required to complete the modem, except for the high-voltage line coupler, without this, the module can be used in DC power lines as well.

HIP4086:INDEPENDENTLY DRIVEN, ADJUSTABLE DEAD TIME

80V, 500mA, 3-Phase Motor driver

Features

- Independently drives 6 N-channel MOSFETs in 3-phase bridge configuration
- Bootstrap supply maximum voltage up to 95VDC with bias supply from 7V to 15V
- 1.25A peak turn-off current
- User programmable dead time
- Bootstrap and optional charge pump maintain the high-side driver bias voltage
- Programmable bootstrap refresh time
- Programmable undervoltage set point

Benefits

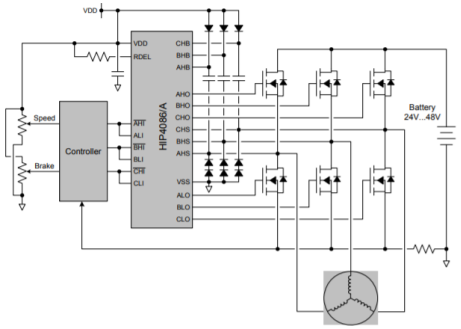
- The HIP4086 has a wide range of programmable dead times (0.5µs to 4.5µs) which makes them very suitable for the low frequencies (up to 100kHz) typically used for motor drives
- It has flexible input protocol for driving every possible switch combination. The user can even override the shoot-through protection for switched reluctance applications.

Applications

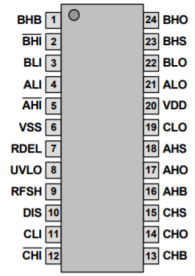
- Brushless Motors (BLDC)
- 3-phase AC motors
- Switched reluctance motor drives
- Battery powered vehicles
- Battery powered tools

Typical application and key performances

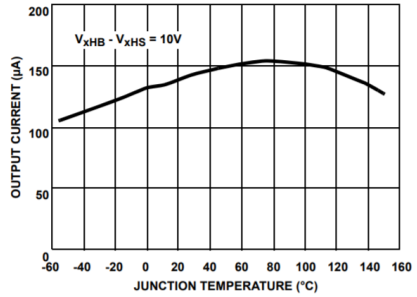
Typical application circuit



Pinout
24LD PDIP, SOIC



Charge pump output current



HS3001: 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

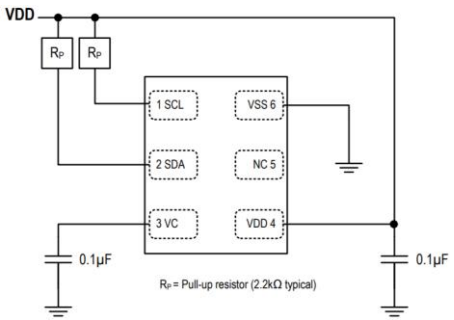
- Silicon-carbide capacitive sensing element
- Excellent stability against aging
- Highly robust protection from harsh environmental conditions and mechanical shock
- Very low power consumption
- Digital I2C Output

Applications

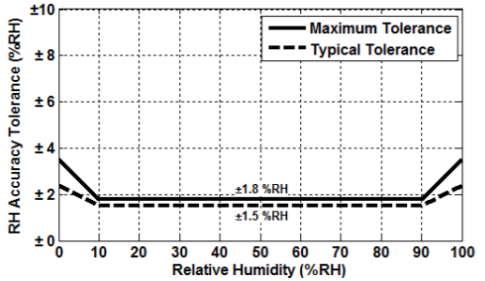
- Climate control systems
- Home appliance
- Weather stations
- Industrial automation
- Process controls and monitoring
- Automotive climate control
- Medical equipment

Typical application and key performances

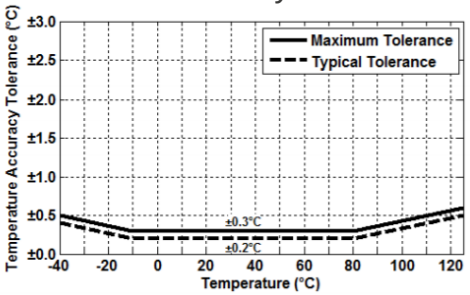
Typical application circuit



HS3001 RH Accuracy Tolerance at 25°C



HS3001 Temperature Sensor Accuracy Tolerance



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