User Manual

RH850 Evaluation Platform

# RH850 Family SENT Application Board

## Y-RH850-SENT-EXT-BRD-V2



Renesas Electronics
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# General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between $V_{IL}$ (Max.) and $V_{IH}$ (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between $V_{IL}$ (Max.) and $V_{IH}$ (Min.).

7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

## Table of Contents

# 1. Introduction

The RH850 family SENT application board is a part of the RH850 Evaluation Platform and serves as a simple and easy to use platform for evaluating the features and performance of Renesas Electronics 32-bit RH850 family microcontrollers with build in SENT I/F (RSENT) as well as the powerful Signal Conditioner IC ZSSC4161D.

This extension board is especially designed to be used with the following PCBs:

**Table 1. Related PCBs**

| Order Code | Description |
|---|---|
| **Y-RH850-SENT-EXT-BRD-V2** | This application board |
| **Y-ASK-RH850F1KM-S1-V3 & Y-BLDC-SK-RH850F1KM-S1-V2** | RH850/F1KM-S1 Starter Kit V3 |
| **Y-RH850-X2X-MB-Tx-Vx** | RH850/X2X Main Board |

But it also can be used in combination with other Renesas Electronics evaluation tools like the Piggy Back boards or the different RH850 Family Starter Kit boards.

Main features:

- Build in Signal Conditioner IC ZSSC4161D
- Build in sensor dummy circuit which can be disconnected by jumper settings
- Test point for “SENT DATA”
- Common ground connector for measurement or testing purposes
- Connector for different external sensor circuits
- Four different error types can be simulated by dedicated buttons or jumpers
- Sub-D connector for easy interconnection with the RH850/F1KM-S1 Starter Kits V3 and the RH850/X2X Mother Board
- The necessary cable for this connection is included in the package

The application board is optimized to work in combination with the RH850/F1KM-S1 Starter Kit V3 and the related SENT Sample Software, which are described in the following Application Note.

**Table 2. Related Documents**

| Doc Number | Description |
|---|---|
| **R01AN3963ED0300** | Application Note for the RH850/F1KM-S1 Starter Kit V3 SENT Sample Software |
| **R12UT0004EDxxxx** | RH850/F1KM-S1 Starter Kit V3 (Y-ASK-RH850F1KM-S1-V3) User Manual |
| **R12UT0015EDxxxx** | RH850/F1KM-S1 Motor Control Starter Kit (Y-BLDC-SK-RH850F1KM-S1-V2) |

The first document describes the theoretical backgrounds and the SENT software functionality and guides the user through its operation.

# 2. Overview

The following figure provides an overview of the RH850 Family SENT application board.

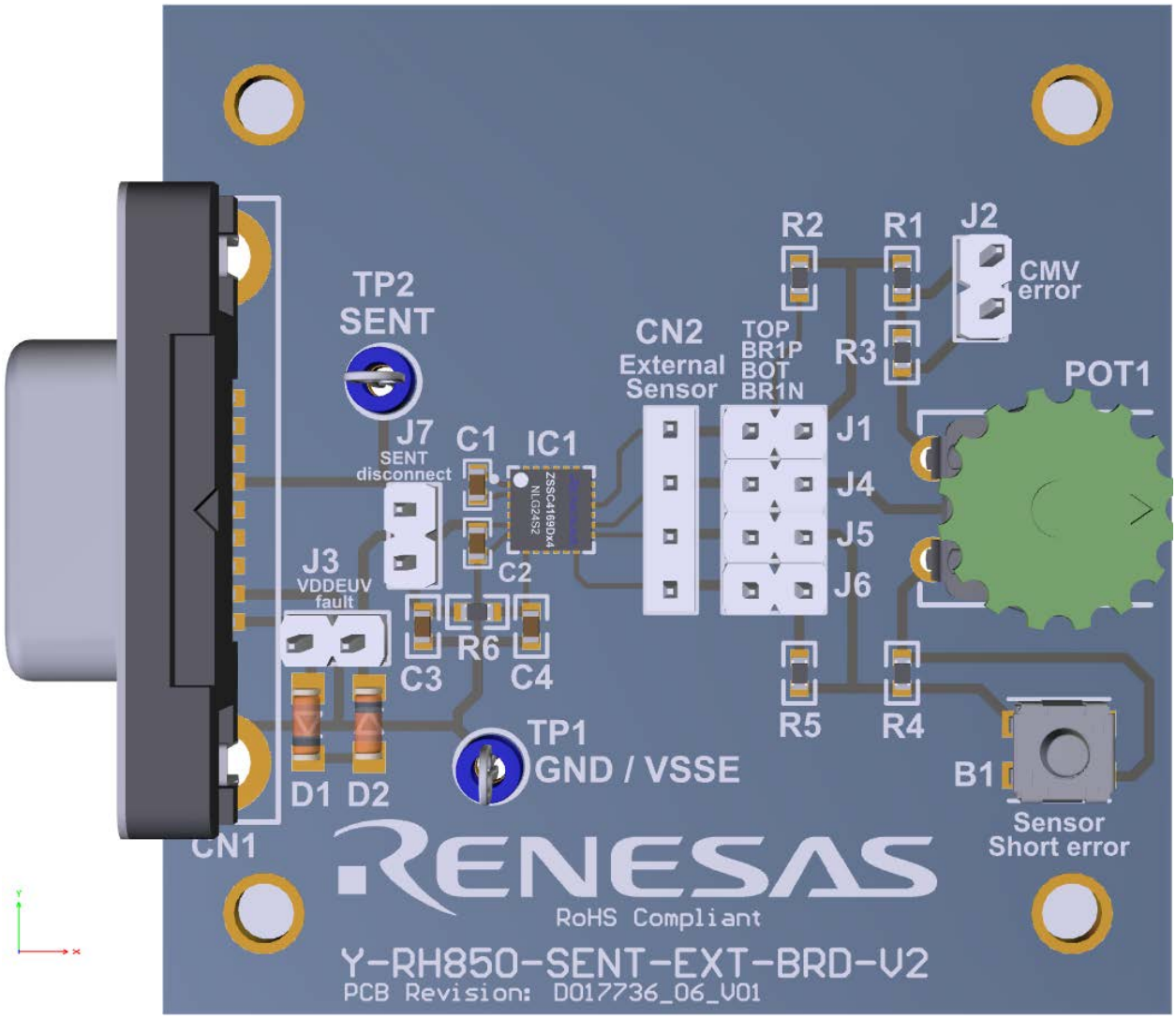



**Figure 1: RH850 SENT Application Board Overview**

# 3. Getting Started

## 3.1 Bill of Materials

The SENT application board package contains the following type and quantity of materials.

**Table 3. Bill of Materials**

| # | Name | Quantity |
|---|---|---|
| 1 | RH850 SENT Application Board | 1 |
| 2 | Jumper (in separate bag) | 5 |
| 3 | Rubber Pads | 4 |
| 4 | Ribbon cable for X1X Main Board | 1 |

## 3.2 Basic Setup for the SENT Extension Board

Before you start to operate with the SENT application board, please check the initial jumper settings according to the following table.

**Table 4: Initial Jumper Settings**

| Name | Signal/Jumper name | Jumper setting |
|---|---|---|
| **Board Sensor Disconnect** | TOP (J1) | CLOSE |
| | BR1P (J4) | CLOSE |
| | BOT (J5) | CLOSE |
| | BR1N (J6) | CLOSE |
| **SENT disconnect** | J7 | CLOSE |
| **CMV error** | J2 | CLOSE |
| **VDDEUV fault** | J3 | CLOSE |
| **External Sensor** | TOP (CN2) | OPEN |
| | BR1P (CN2) | OPEN |
| | BOT (CN2) | OPEN |
| | BR1N (CN2) | OPEN |

## 3.3 Basic Setup for the RH850/F1KM-S1 Starter Kit

The board is mainly designed to operate with the RH850/F1KM-S1 Starter Kit. To setup the connection to the Starter Kit board please use the 9-Pin Sub-D connector to establish the interconnection.

When you use the demo software for the SENT application board together with the RH850/F1KM-S1 Starter Kit V3, please be sure that the SENT software example is loaded onto the RH850 MCU device on the Starter Kit.

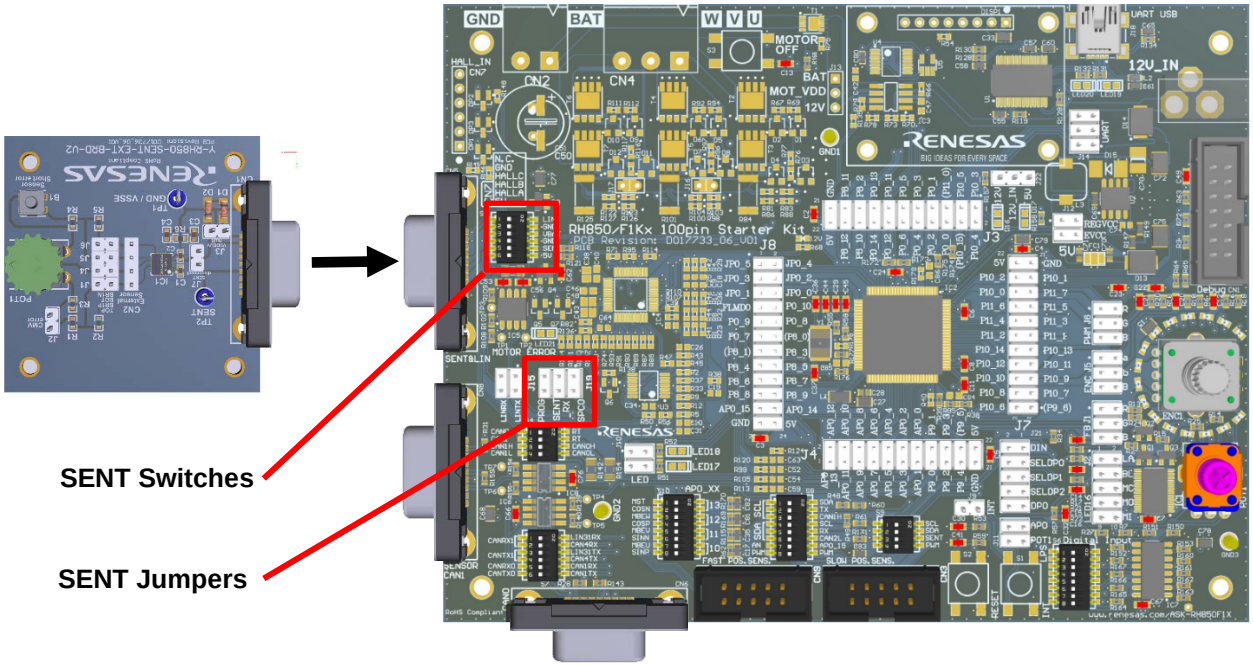



**Figure 2: Interconnection with the Y-ASK-RH850F1KM-S1-V3**

**Table 5: Initial Jumper and Switch Settings on Starter Kit**

| Name | (No) Name | Jumper setting |
|---|---|---|
| **Switch S5** | 1 LIN | OFF |
| | 2 GND | OFF |
| | 3 VBAT | OFF |
| | 4 GND | ON |
| | 5 SENT | ON |
| | 6 5V | ON |
| **Jumper J19** | PROG | CLOSE |
| | SENT_RX | CLOSE |
| | SPCO | CLOSE |

## 3.4 Power Supply

After connecting the two boards, please supply the necessary voltage to the starter kit board to support a correct operation.

**Please notice that the SENT application board will only operate with 5V DC power supply. If you supply the starter kit only via the E1/E2, please make sure you don’t supply it with 3.3V.**

# 4. Board Description

This chapter will explain the functions of the board in detail. The figure below shows an overview of the board. To provide a better explanation to the user the different functional groups are highlighted with numbers which are mentioned in the following sub chapters.

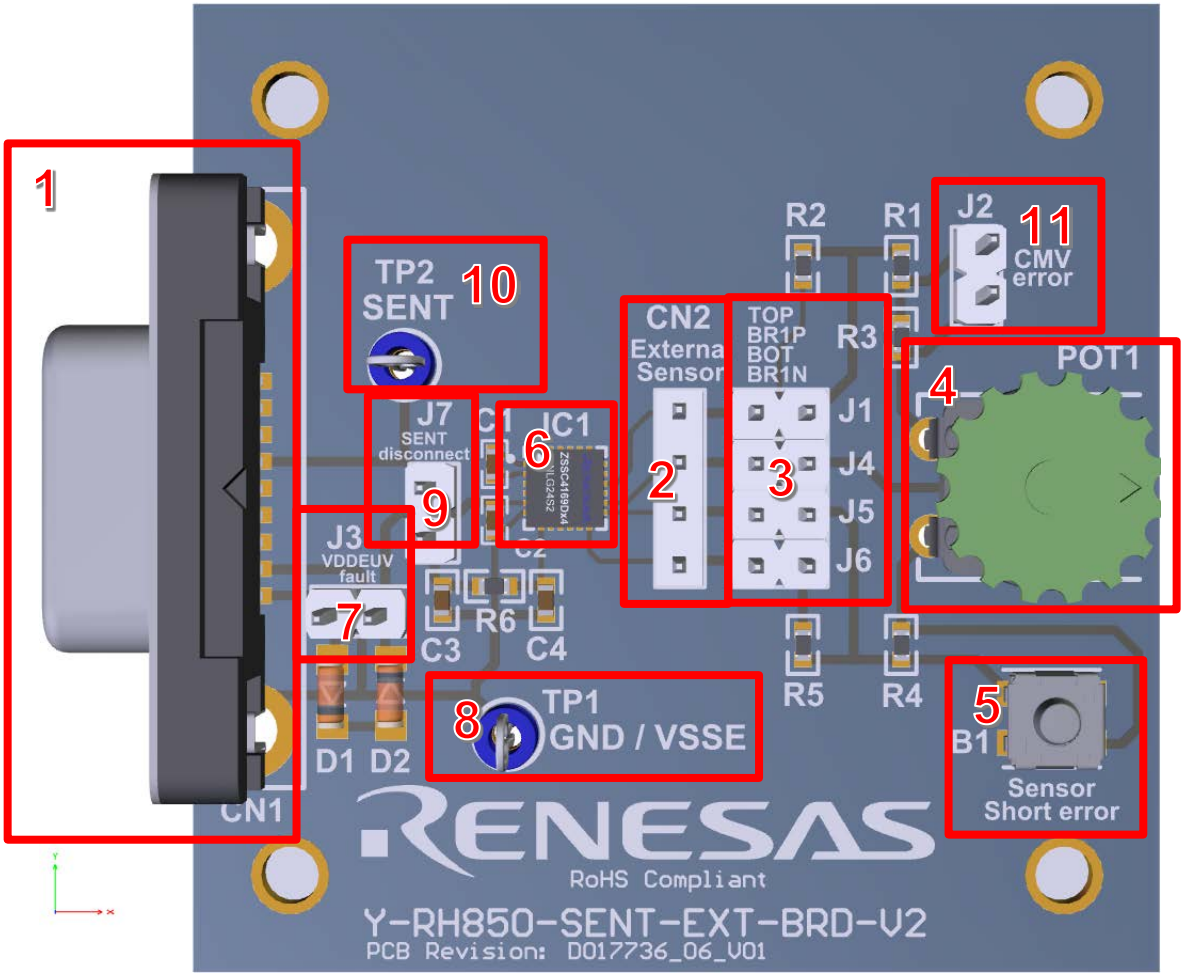



**Figure 3: RH850 SENT Application Board with Functional Groups**

## 4.1 Connectors

The board offers the following connectors to the user.

### 4.1.1 Main Connector CN1 [1]

This is the main connector for the board. The power supply and SENT bus line will be provided via this DB9 connector.

### 4.1.2 External Sensor Connector [2]

The connector is used when you want to connect an external sensor circuit to the board. Make sure that the built-in sensor circuit is disconnected by the “Board Sensor Disconnect” jumpers [3] when using an external sensor.

Depending on the used sensor type and its individual characteristics you need to reconfigure the ZSSC4161D so that the IC can process the measured signals with correct internal calculation values. For more information on the Signal Conditioner IC please refer to chapter 4.5.1.

## 4.2 Jumpers

Some jumpers can be used to trigger errors. Please find a more detailed description in the Application Note for the RH850/F1KM-S1 Starter Kit V3 SENT Sample Software in Table 2. Related Documents.

### 4.2.1 Board Sensor Disconnect [3]

These jumpers are normally closed to connect the board sensor circuit [4] to the ZSSC4161D. You must disconnect the jumpers when you use an external sensor which is attached to the External Sensor Connector [2].

### 4.2.2 CMV ERROR J2 [11]

This Jumper can be used to trigger a Common Mode Voltage (CMV) range check fault.

### 4.2.3 SENT disconnect J7 [9]

To simulate a “No SENT Communication” error this jumper can be used. The jumper opens the SENT data line from the Signal Conditioner IC to the main connector.

### 4.2.4 VDDEUV fault J3 [7]

With this jumper you can lower the boards power supply.

## 4.3 Buttons

### 4.3.1 Sensor Short Error Button B1 [5]

By pressing the button, you can generate a short circuit between the potentiometer and the ground signal. This injects an error which is signalled on SENT protocol level.

## 4.4 Test Points

The board is equipped with two different test points for measurement purposes.

### 4.4.1 SENT TP2 [10]

At this test point you can monitor the SENT communication with applicable measurement equipment.

### 4.4.2 Ground TP1 [8]

This test point offers the common ground potential for the board by an easily accessible Test point.

## 4.5 Integrated Circuits

### 4.5.1 Renesas ZSSC4161D IC [6]

The measured sensor value from the external or internal sensor circuit is processed via a Renesas Signal Conditioner IC which improves the signal and transforms the value according to the SENT protocol standard. Besides that, the IC performs several diagnostics on the sensor circuit, which are covered partly by the board hardware.

For the latest documentation regarding the ZSSC4161D or sales related questions please follow this link.

## 4.6 Circuits

### 4.6.1 Board Sensor Circuit [4]

The board is equipped with a built-in sensor circuit. The circuit simulates a pressure or torque sensor by using a resistive Wheatstone Bridge. The resistance can be modified by a potentiometer.

The processing of the measured signal is carried out by the Signal Conditioner IC, which transforms the value according to the SENT protocol standard.

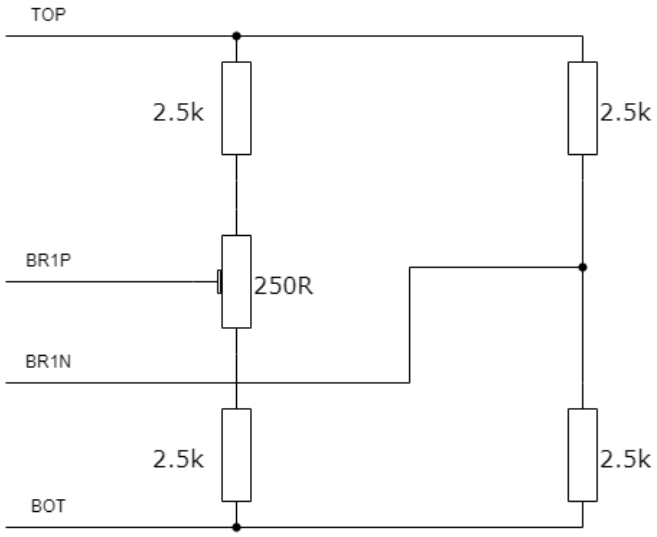



Figure 4: Schematic of the Board Sensor Circuit [4]

# 5. Mechanical dimensions

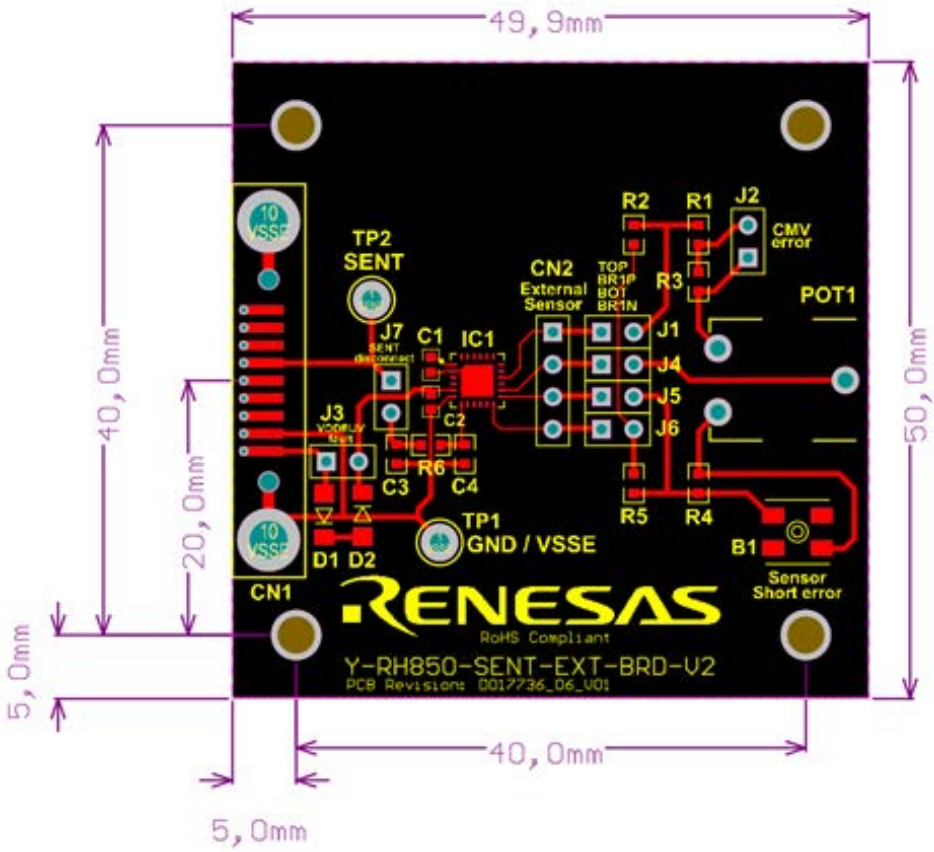
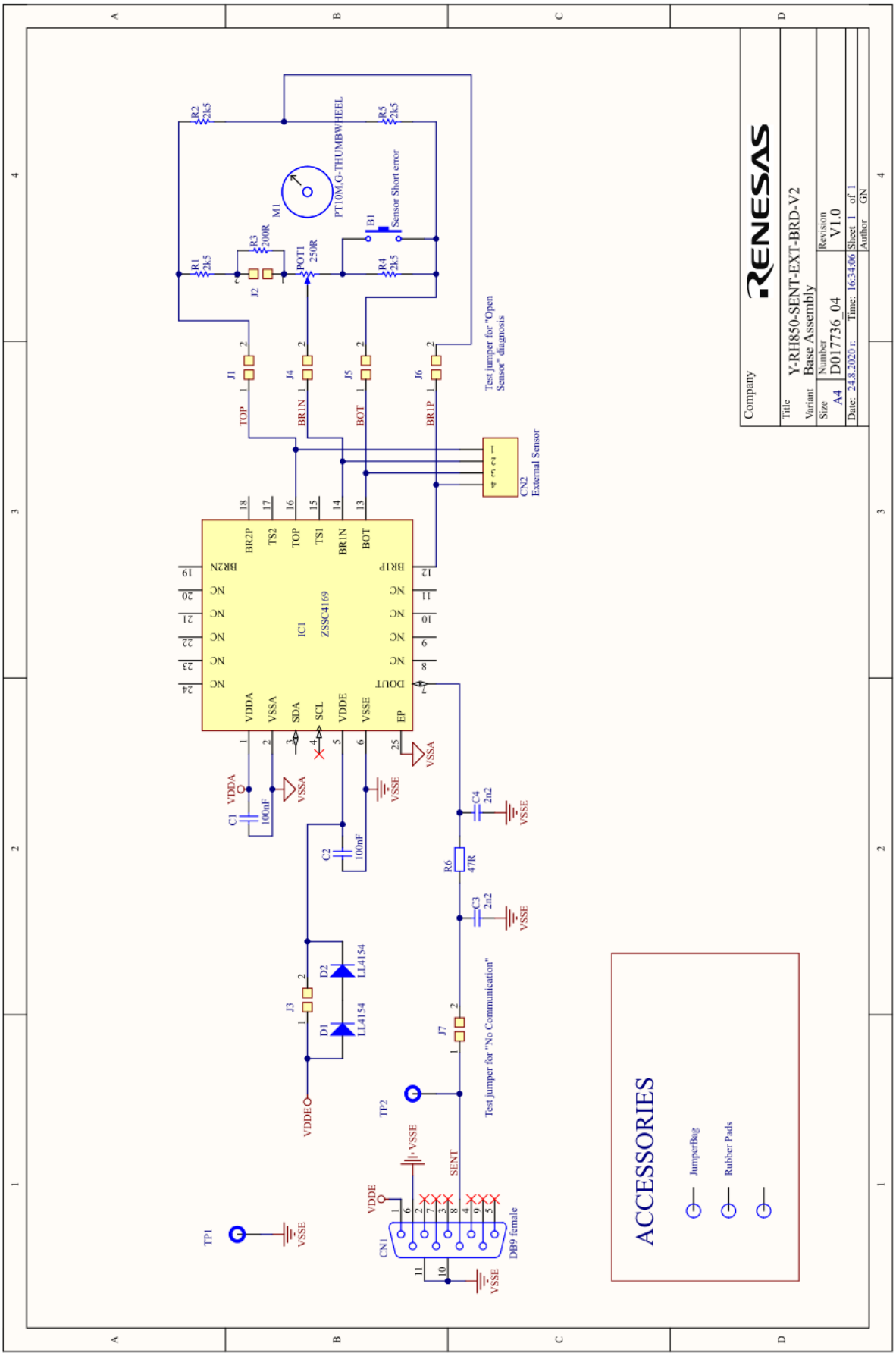



Figure 5: RH850 SENT Application Board dimensions

# 6. Schematic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RENESAS
Title
Y-RH850-SENT-EXT-BRD-V2
Variant
Base Assembly
Size
A4
Number
D017736_04
Revision
V1.0
Date: 24.8.2020 r.
Time: 16:34:06
Sheet 1 of 1
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ACCESSORIES
JumperBag
Rubber Pads
IC1
ZSSC4169
CN1
DB9 female
CN2
External Sensor
M1
PT10MJG-THUMBWHEEL
B1
Sensor Short error
Test jumper for "Open Sensor" diagnosis
Test jumper for "No Communication"
SENT
VDDA
VDDE
VSSA
VSSE

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# RH850 Group

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