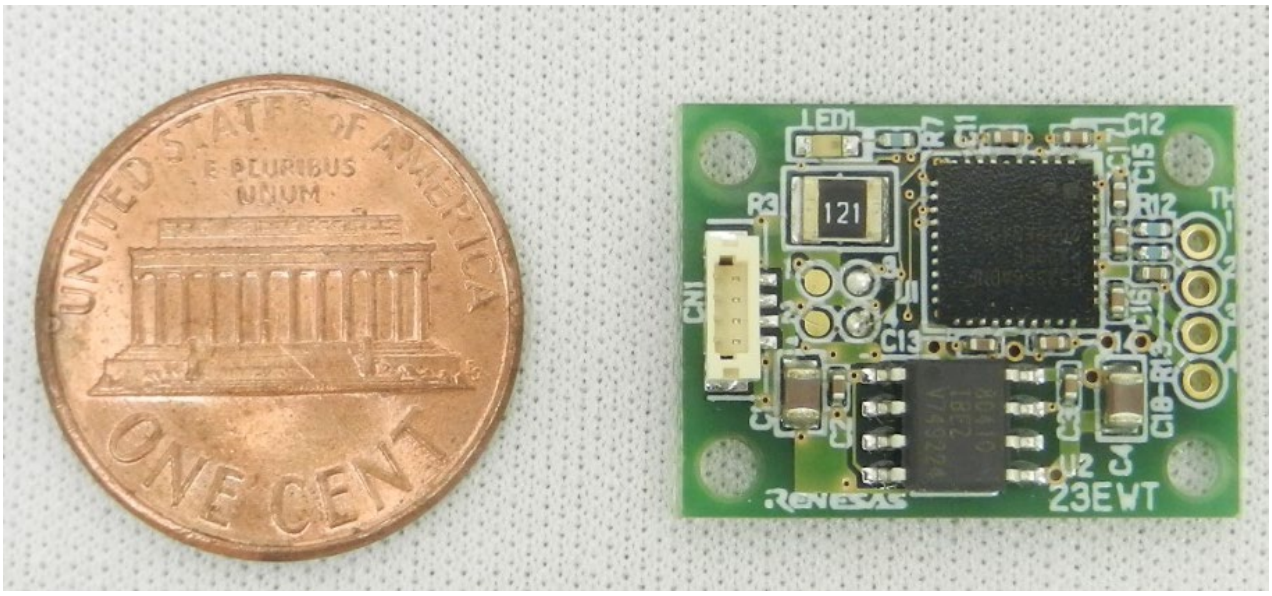
# RX23E-AQFN40W/T

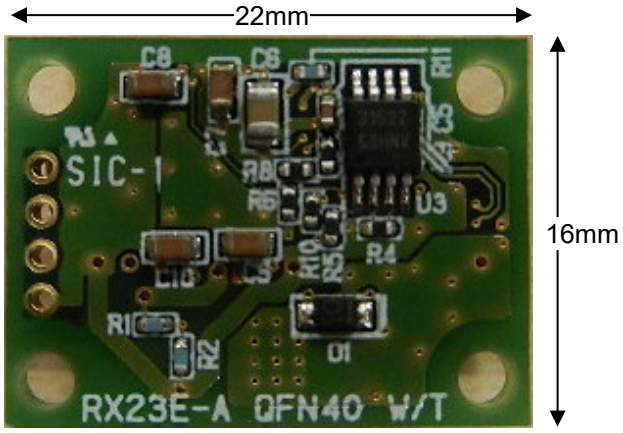
## Tiny Board for Digital Load Cell

### Introduction

This document describes the RX23E-AQFN40W/T which is a board for a digital load cell using Renesas MCU, RX23E-A. This board is miniaturized to be incorporated into a digital load cell, using RX23E-A, MCU with AFE in 40 pin HQFN package, ISL80410 as LDO power supply, ISL3152 as RS-485 driver.

Refer to ”Application Note RX23E-A Group Weight Measurement Example Using a Load Cell” for the details of weight measurement using a load cell.




Top: Parts side Bottom: Solder side

**Appearance of the board**

## Contents

# 1. Specifications

**Table 1-1 RX23E-AQFN40W/T specifications**

| Item | Specifications |
|---|---|
| External dimensions | 22mm x 16mm |
| Layer structure | 4 layers, Laminating order: Signal - GND - Power supply - Signal |
| Operating voltage | Recommended operating voltage: 6~18 V<br>Maximum operating voltage: 20 V |
| Current consumption | Typ. 19mA (When connecting to 350Ω load cell) |
| Operating temperature | -40℃~+85℃ |
| Communication I/F | RS-485, Half-duplex communication<br>Maximum communication speed: 20Mbps<br>Terminating resistor: 120Ω |
| MCU | RX23E-A (R5F523E6ADNF) |
| Compatible emulator | Renesas E1, E2, E2Lite |

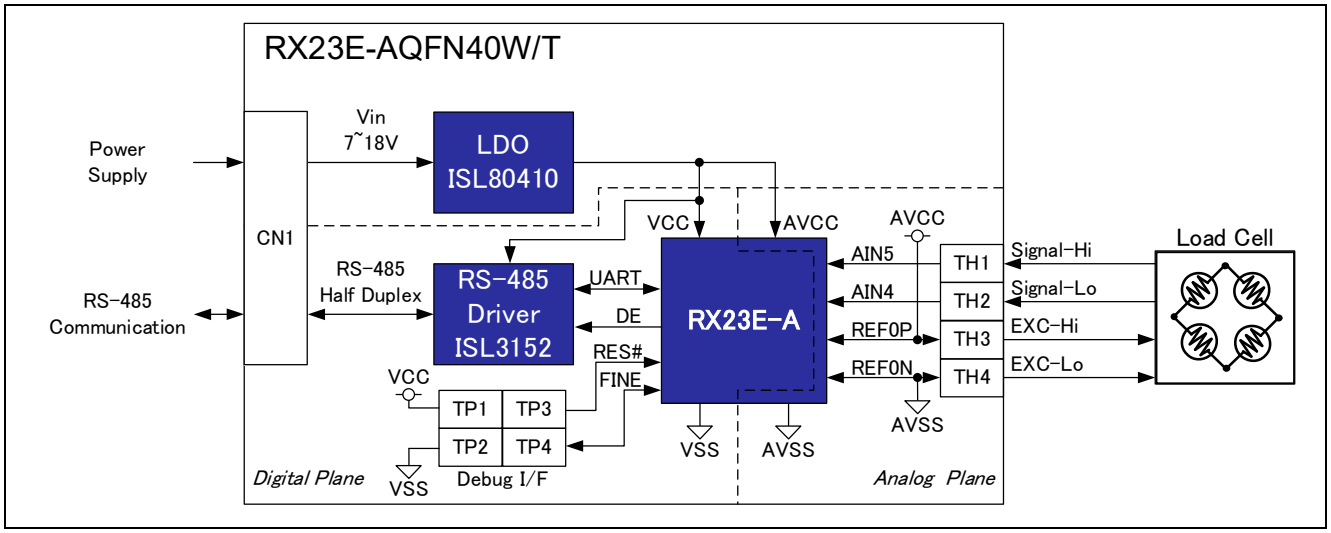



**Figure 1-1 System Configuration Diagram**

# 2. Board Data

## 2.1 Circuit Diagram

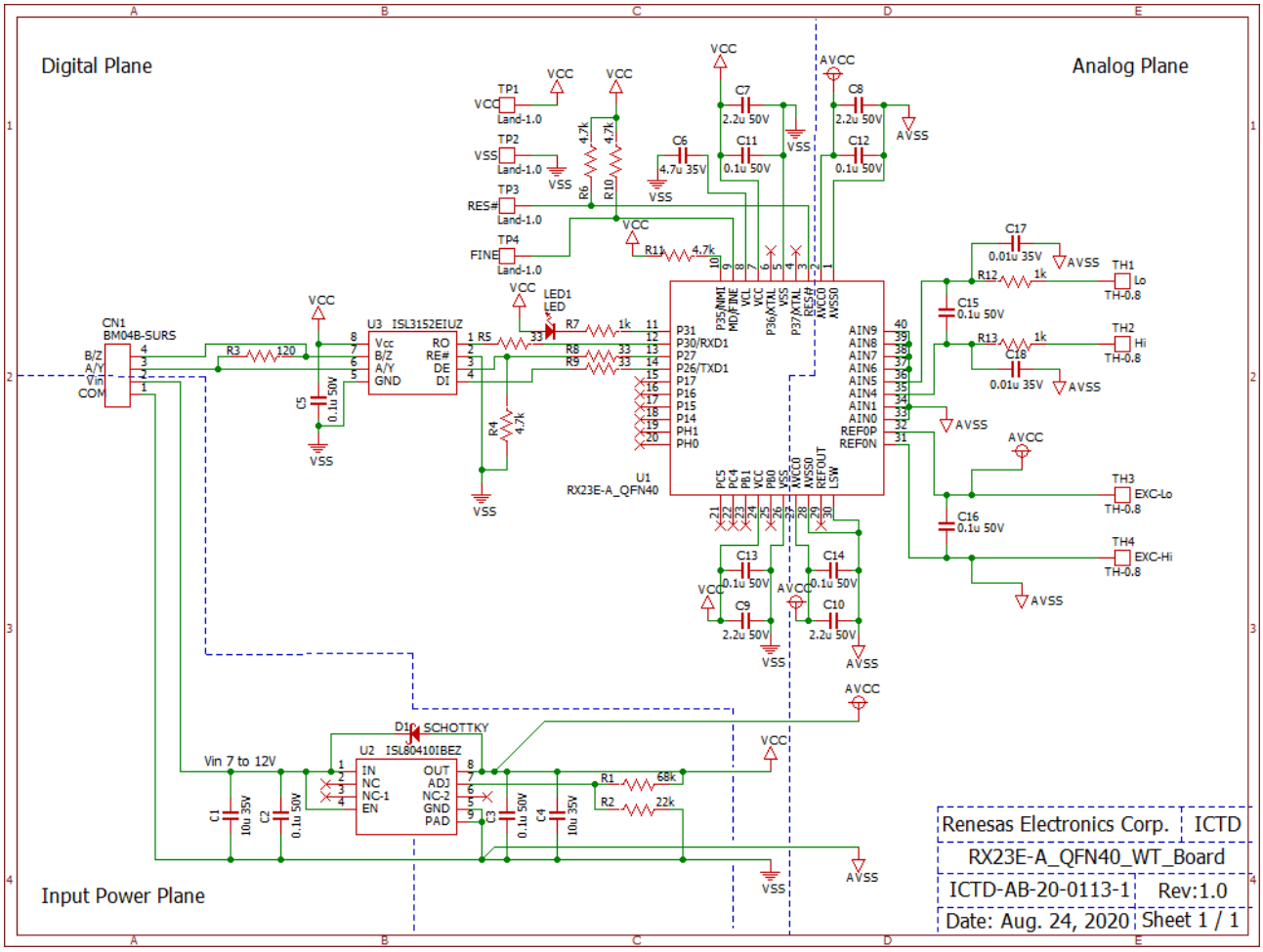



**Figure 2-1 RX23E-AQFN40W/T Circuit Diagram**

## 2.2 Bill of Materials

| No. | Q'ty | Reference Designator | Description | Part Name | Manufacturer Part Name | Maker Name |
|---|---|---|---|---|---|---|
| 1 | 1 | U1 | RX23E-A_QFN40 | IC | R5F523E6ADNF#U0 | Renesas |
| 2 | 1 | U2 | ISL80410IBEZ | IC | ISL80410IBEZ | Renesas |
| 3 | 1 | U3 | ISL3152EIUZ | IC | ISL3152EIUZ | Renesas |
| 4 | 1 | CN1 | BM04B-SURS | Connector | BM04B-SURS(LF)(SN) | JST |
| 5 | 2 | C1,C4 | 10u 35V | Ceramic Capacitor | GRM21BR6YA106KE43 | Murata |
| 6 | 9 | C2,C3,C5,C11,C12, C13,C14,C15,C16 | 0.1u 50V | Ceramic Capacitor | CGA2B3X7R1H104K050BB | TDK |
| 7 | 1 | C6 | 4.7u 35V | Ceramic Capacitor | GRM219R6YA475KA73 | Murata |
| 8 | 4 | C7,C8,C9,C10 | 2.2u 50V | Ceramic Capacitor | GRM188R61H225KE11 | Murata |
| 9 | 2 | C17,C18 | 0.01u 35V | Ceramic Capacitor | GRM1555CYA103GE01 | Murata |
| 10 | 1 | D1 | SCHOTTKY | Diode | RB551VM-30 | Rohm |
| 11 | 1 | LED1 | Green | LED | SML-D13FWT86C | Rohm |
| 12 | 1 | R1 | 68k | Resistor | RK73H1ETTP6802F | KOA |
| 13 | 1 | R2 | 22k | Resistor | RK73H1ETTP2202F | KOA |
| 14 | 1 | R3 | 120 | Resistor | RK73B2ETTD121J | KOA |
| 15 | 3 | R4,R6,R10 | 4.7k | Resistor | RK73B1ETTP472J | KOA |
| 16 | 3 | R5,R8,R9 | 33 | Resistor | RK73B1ETTP330J | KOA |
| 17 | 4 | R7,R11,R12,R13 | 1k | Resistor | RK73H1ETTP1001F | KOA |

Note: This list may be changed without notice

## 2.3 Pattern Diagram

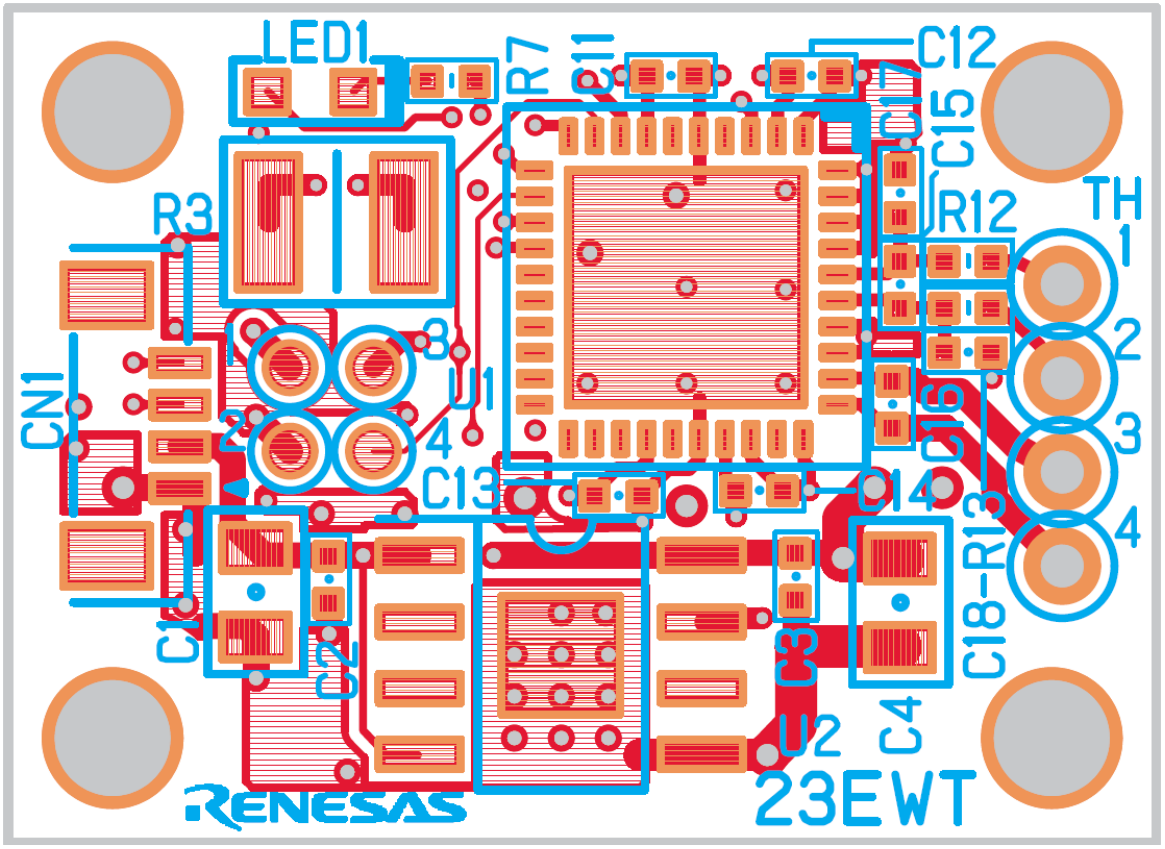



Figure 2-2 Layer 1

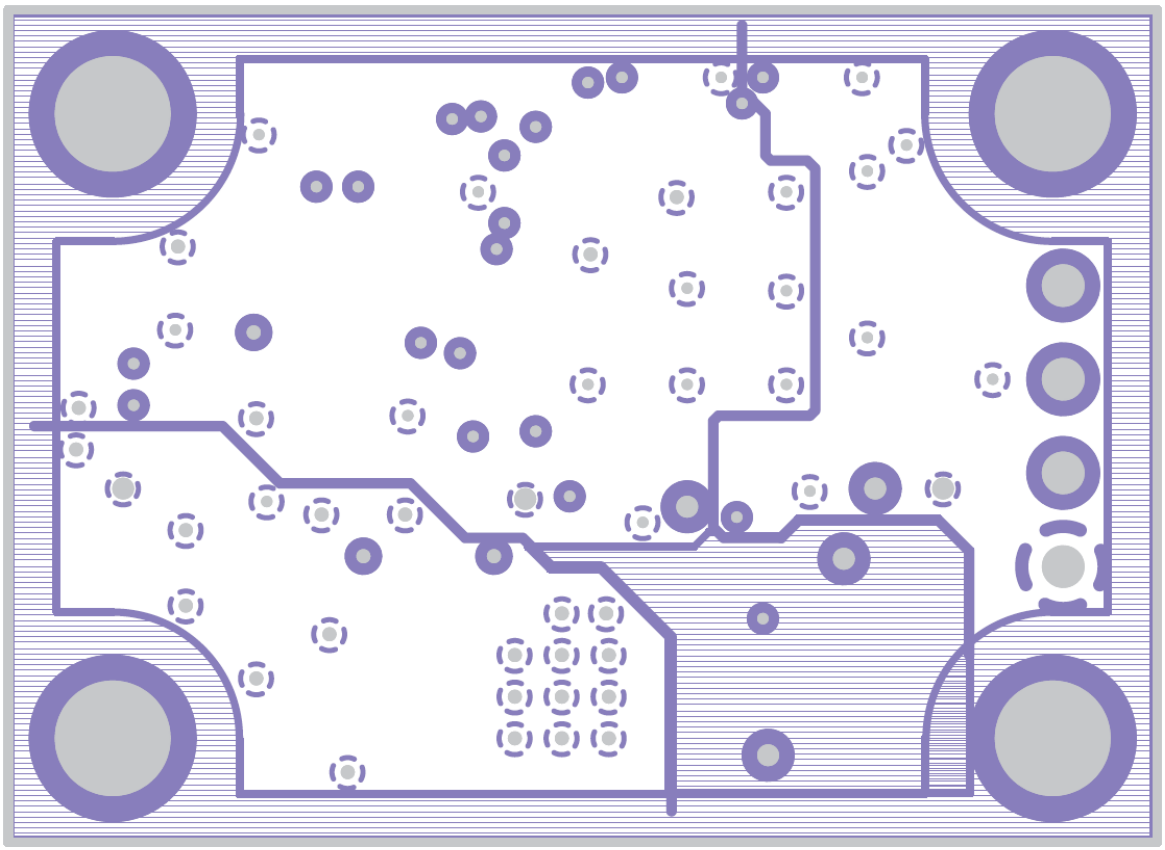


Figure 2-3 Layer 2

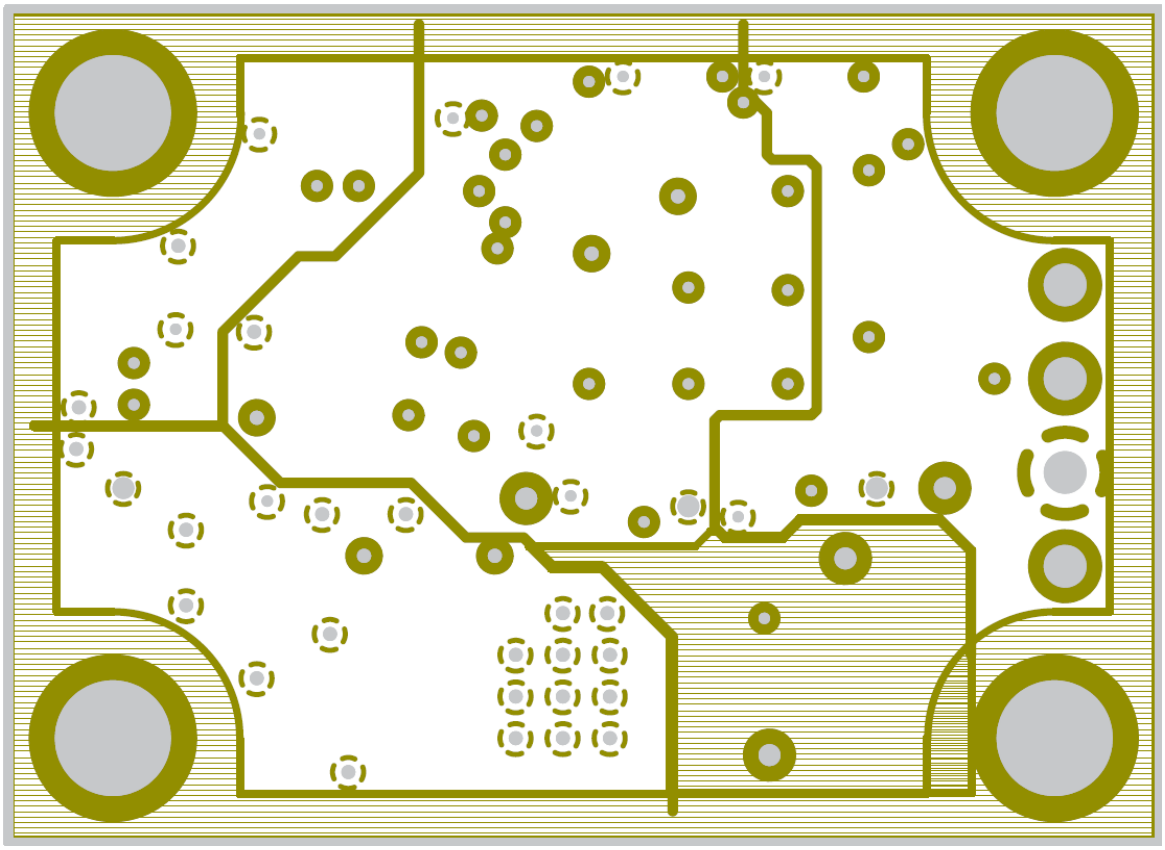


Figure 2-4 Layer 3

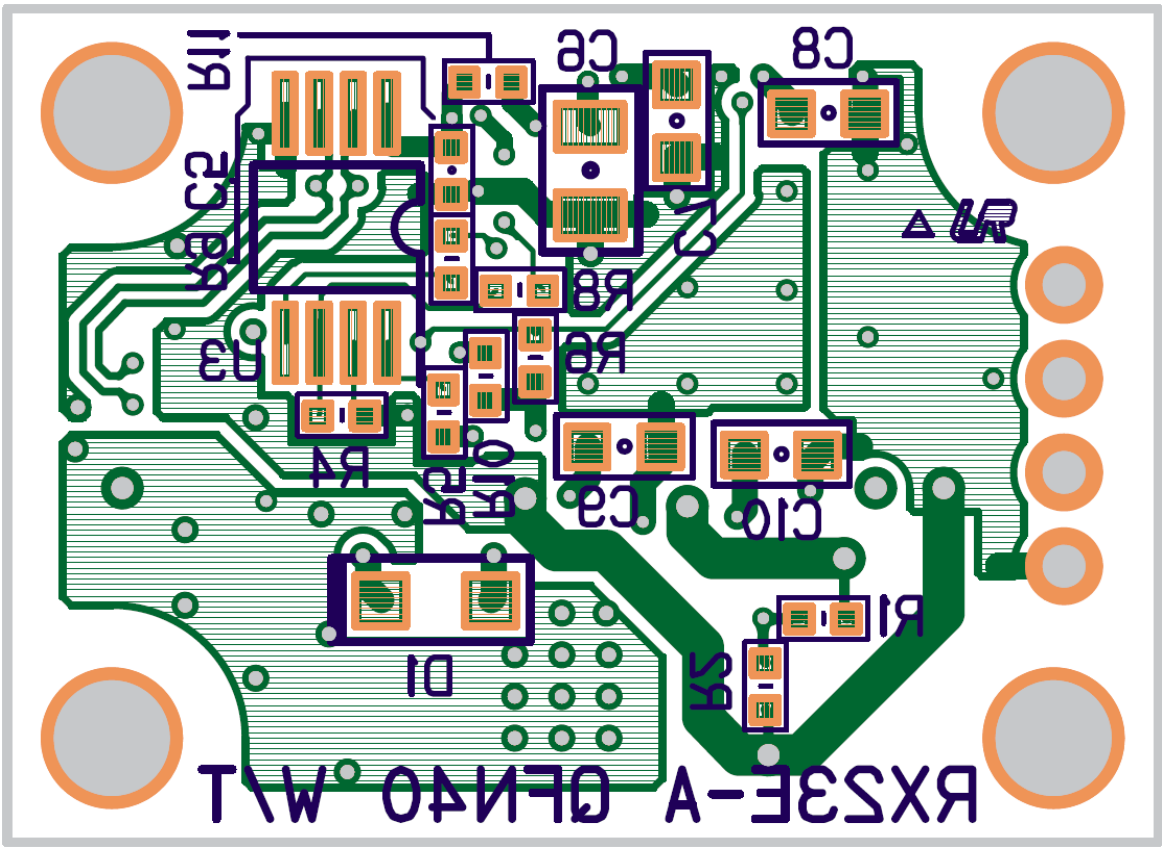



Figure 2-5 Layer 4

## 3. Weight Measurement

The configuration of the weight measurement system is shown in Figure 3-1, and devices used for the measurement are shown in Table 3-1. This system outputs a weight measured by RX23E-A with RS-485. The measurement result is obtained with a PC tool program of RSSKRX23E-A by connecting with the PC via the RS-485-USB conversion board.

Calibration is performed on two points, 0 gram (no load, including tare) and 250 grams.

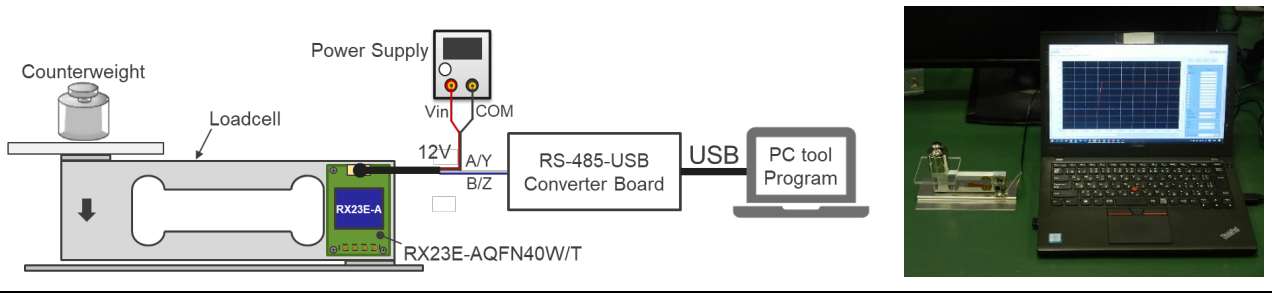



**Figure 3-1 Weight Measurement Configuration by Road Cell and the State of the Measurement**

**Table 3-1 Devices Used for the Weight Measurement by a Road Cell**

| Item | Model | Manufacturer |
|---|---|---|
| DC Power Supply | PW18-1T | KENWOOD Corporation |
| Counterweight | 738-65-53-04 | Tokyo Garasu Kikai Co., Ltd. |
| Load Cell | Model-1004 300g | Tedea Huntleigh |
| RS-485-USB Converter Board | USB-COM485-PLUS2 | FTDI |

An error of the measurement value is obtained from the weight measurement result. The result obtained from dividing the errors by 250 grams which is the full scale of the load cell output is shown in Figure 3-2. The measurement weights are within the tolerance of the counterweight, which shows this system has sufficient measurement accuracy.

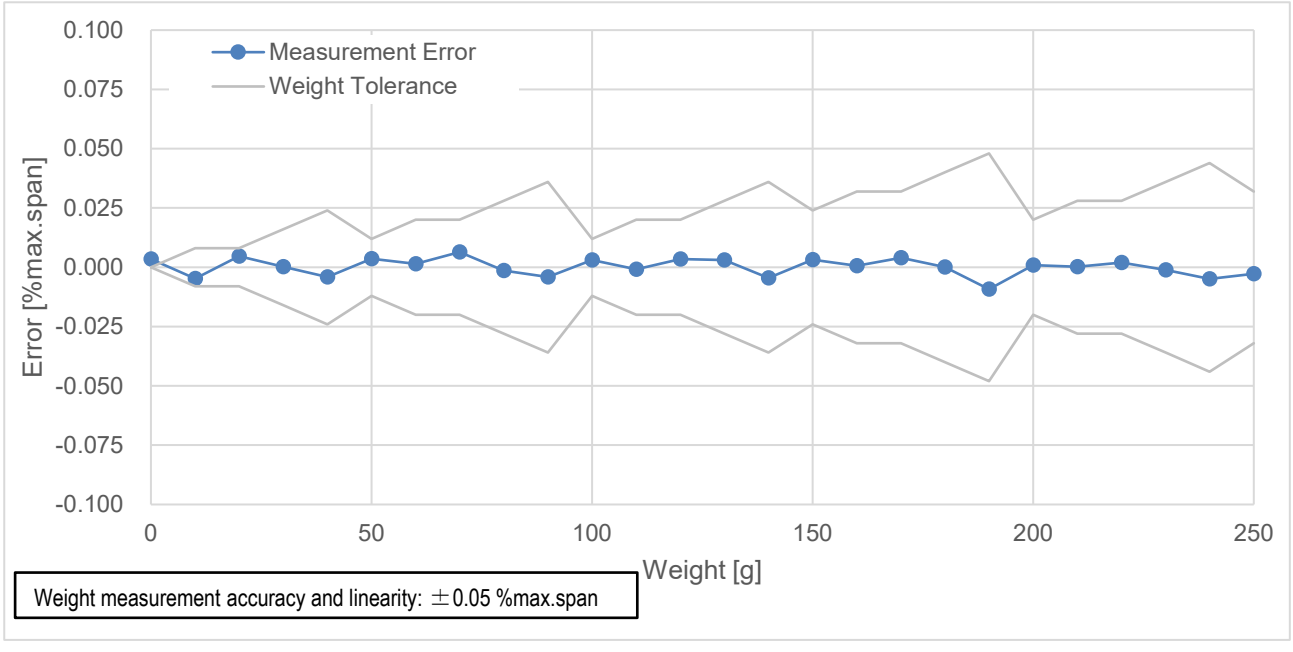



**Figure 3-2 Weight Measurement Error (Ambient Temperature: 25℃)**

## 4. Related Documents

- R01UH0801 RX23E-A Group User's Manual: Hardware
- R01AN4789 Application Note RX23E-A Group Weight Measurement Example Using a Load Cell
- R20AN0540 Application Note RSSKRX23E-A PC Tool Program Operation Manual

## Revision History

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| Rev.1.00 | Mar.5.21 | | First release |
| | | | |

# 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.

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