RH850/P1M

Main Oscillator application note

ACC-AB-15-0222
Rev.1.00
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Overview

This application note explains notes regarding crystal resonator usage of RH850/P1M.

Contents

1. Implementation notes of crystal resonator

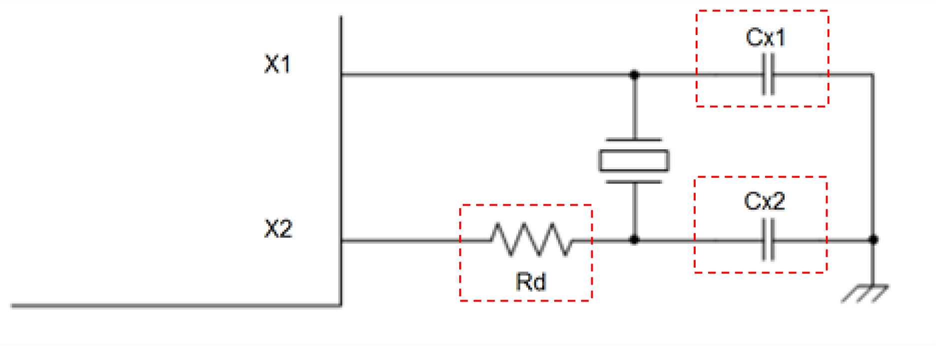
When a board around the crystal oscillator circuit is designed, it is necessary to refer this application note to prevent oscillation margin from declining and suppress EMI level.

1.1 Recommended crystal oscillation circuit

Picture 1 shows crystal oscillation circuitconnection of crystal.

Basically damping resistor (Rd) and load capacitor (Cx1, Cx2) implementation is not needed. However, depend on crystal resonator and parasitic capacitance of the board, damping resistor and load capacitor implementation might be needed. Please consult with crystal resonator manufacturer and decide the details.

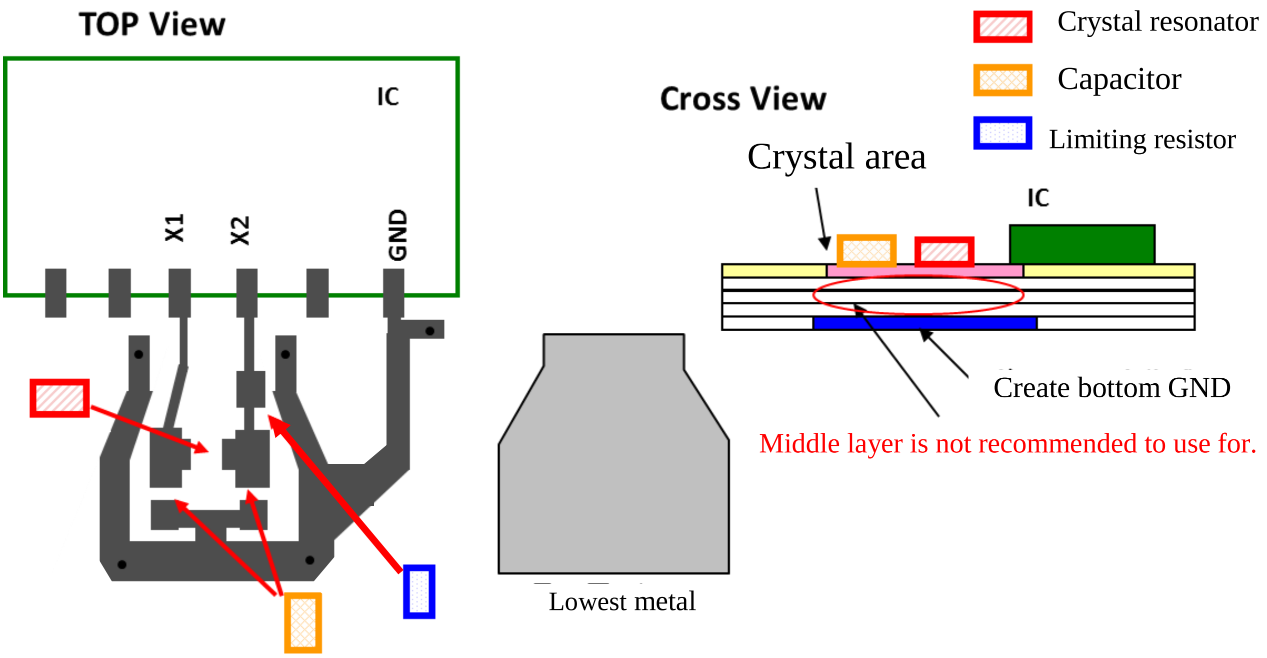
Please use AT-Cut type of crystal resonator.



【Note】 Basically damping resistor (Rd) and load capacitor (Cx1, Cx2) implementation is not needed. However, depend on crystal resonator and parasitic capacitance of the board, damping resistor and load capacitor implementation might be needed. As feedback resistor is built in the microcomputer, the implementation on the board is not necessary.

Picture 1 example of crystal oscillation circuit

1.2 Board pattern example for stable oscillation



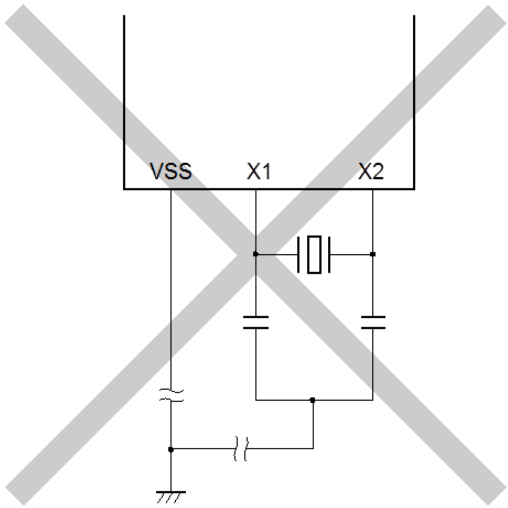
Picture 2 Board pattern example for stable oscillation

Recommended wiring structure for stable oscillation

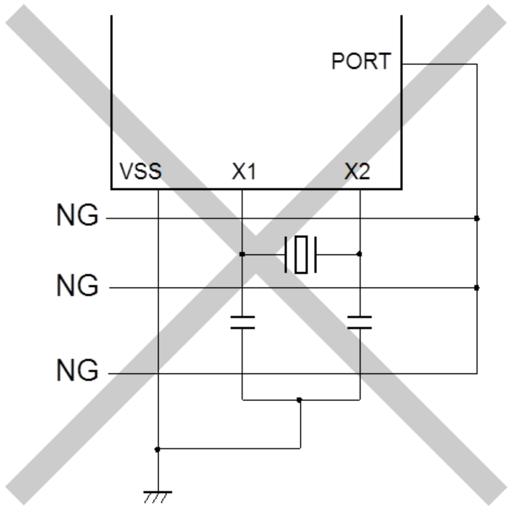
- Wiring at the top metal on the board(GND shield is needed)
- Apply GND shield at the lowest on the board
- Middle layers of the board is not used.
- Wiring length from terminal of the microcontroller to crystal is within 10mm.
- Signal wiring wide is 0.1-0.3mm.
- More than 0.3mm space from signal wiring and other wiring is needed.
  (X1, X2 wire space is also more than 0.3mm.)
- X1, X2 wiring resistance＜2Ω
- X1, X2wiring capacity＜2pF

1.3 Unfavorable crystal oscillation circuit

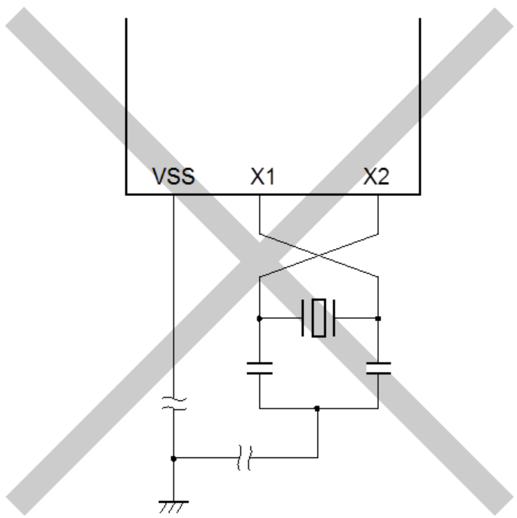
Picture 3 shows unfavorable crystal oscillation circuit.



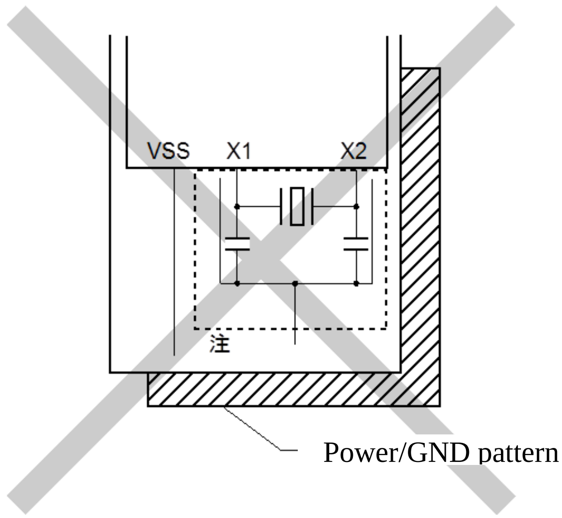
(a)Wiring length of connection is long



(b) Signal wires are crossing



(c)X1, X2 signal wires are crossing

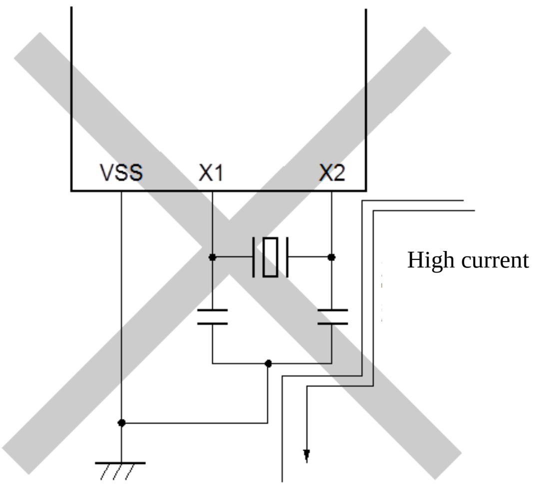


(d)Power/GND pattern in middle layer under X1,X2 wiring
Space to ground shield is narrow.

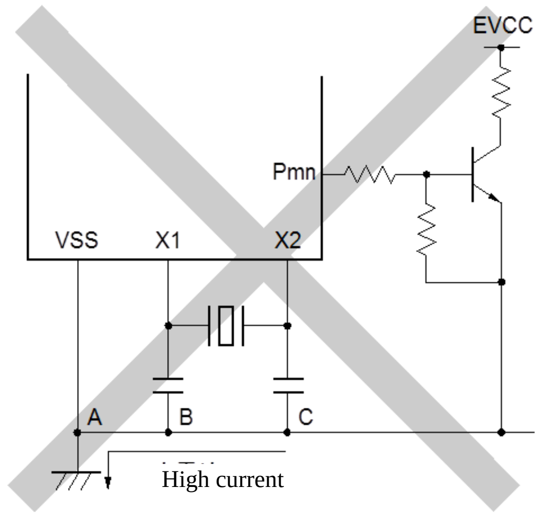
Note There is a concern that capacitance between pin X1 and pin X2 causes degradation of oscillation characteristics. Therefore, please avoid signal crossing. In case of parallel wiring, it is important to note wiring space and parallel length in order not to have the capacitance increase between the pins.

Note At multi-layer board, Please do not set power/GND pattern under X1, X2 terminals and crystal wire area.(Dotted line in the picture) Also please keep space more than 0.5mm from ground shield. If the space cannot be secured, there might be some impact on the oscillation characteristics due to parasitic capacitance increase.

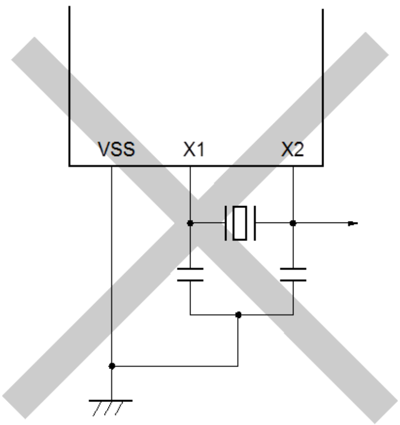
Picture 3 Unfavorable crystal oscillation circuit (1/2)



(e)Varied high current is near signal wiring



（f） Current is on ground line in the oscillation circuit.
(The potentials of A, B and C vary.)

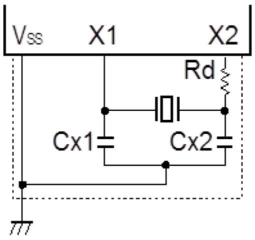


(g)Signal is taken out

Picture 3 Unfavorable crystal oscillation circuit.

1.4 Verified crystal resonator and reference oscillation circuit parameter

Verified crystal resonator and reference circuit parameters are shown below. This reference oscillation circuit parameter are measured by the oscillator resonator manufacturers under the certain conditions and using our evaluation board. To confirm the oscillation characteristics with actual application, please consult with oscillator resonator manufacturers to perform evaluation with actual product board.



Picture 4 External circuit example

Table 1 Verified crystal resonator and reference circuit parameter

Manufacturer	Product name	CL (pF)	SMD/ reed	Frequency (MHz)	Oscillation circuit parameter(reference)note2		
					Cx1(pF)	Cx2(pF)	Rd(kΩ)
KYOCERA Crystal Device Corporation	CX3225GA	8	SMD	16	No	No	No
	CX5032GA	8	SMD	16	No	No	No
Daishinku Corp.	DSX320G/DSX320GE	8	SMD	16	No	No	No
	DSX530GK	8	SMD	16	No	No	No
NIHON DENPA KOGYO CO., LTD.	NX3225GB-16MHz-CHP-CRA-4	8	SMD	16	No	No	No
	NX5032GA-16MHz-STD-CSU-2	8	SMD	16	No	No	No

Note1. Verified crystal resonator and circuit parameter reference shown above is based on the information by the crystal resonator manufacturers as reference, so no guarantee for its contents. Oscillation circuit parameter references are measured by the oscillator manufacturers under the certain condition and using our evaluation board. Crystal oscillation depends on the crystal resonator itself and the board design, so please ask crystal resonator manufactures to perform the evaluation using actual board. Also the above is the conditions when crystal resonator which is connected to a microcomputer can oscillate, not conditions for microcomputer’s operations. As for the operation conditions of the microcomputer, please use within DC, AC characteristic.

Note2. As feedback resistor is built in the microcomputer, the implementation on the board is not necessary.

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Revisions

Rev.	Issued date	Revised contents	
		Page	contents
1.00	2015.10.05	10	First edition

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. 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the 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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Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HALII Stage, Indiranagar, Bangalore, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

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