RC21012A/RC31012A

This document describes the following topics about the RC21012A/RC31012A programmer board:

- Basic hardware and GUI setup
- Instructions to burn OTP memory of a device from the GUI

Computer Requirements

- USB 2.0 or USB 3.0 Interface
- Processor: Minimum 1GHz
- Memory:
  - Minimum: 512MB
  - Recommended: 1GB
- Available disk space:
  - Minimum: 600MB (1.5GB 64-bit)
  - Recommended: 1GB (2GB 64-bit)

Board Contents

- RC21012A/RC31012A programmer board
- Programmer board manual
- Configuration software (Renesas IC Toolbox)
- Board schematic and BOM

Features

- USB power supply
- Specialized device socket
- Access to two differential input clocks
- Test points for eight differential output clocks
- XIN terminal can use laboratory signal generator or OCXO/TCXO/XO components and board
- Serial port for configuration and register read out

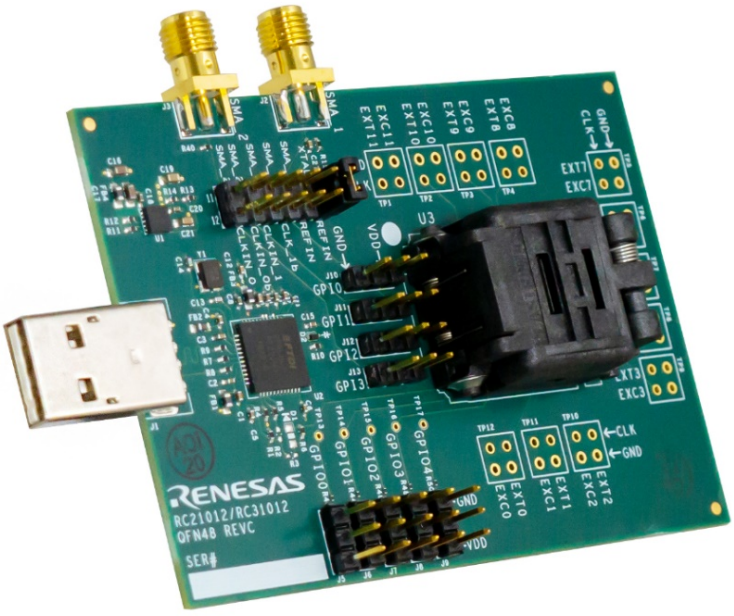


Figure 1. RC21012A/RC31012A Programmer Board

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1. Functional Description

This programmer board is used to program blank RC21012A/RC31012A devices with on-board USB interface and the RICBox GUI (for more information about RICBox, see the RICBox product page). The kit can also be used to test general device configuration output frequency and GPI/GPIO settings.

Note: The RC21012A/RC31012A programmer board is not intended to evaluate device performance. For information about the device evaluation kit, visit the RC21012A/RC31012A EVK product page.

1.1 Operational Characteristics

The RC21012A/RC31012A programmer board is equipped with a single on-board LDO that takes voltage in from USB and supplies 3.3V to all device domains. The board is designed to plug directly into any PC and be ready for use with the RICBox GUI and blank part.

A 25MHz crystal is mounted onto the board for testing without external clock input. Up to two input clocks can be configured for use through selection jumpers (J4). A 48-pin socket is mounted to the top of the board for easy replacement of blank devices.

The RC21012A/RC31012A programmer board is compatible with most 48-pin variants of the RC21012A/RC31012A.

Note: It is recommended to use a high-speed USB interface to allow for higher current draw.

Note: Use proper grounding to avoid ESD damage to the devices and the programmer board.

1.2 Hardware Setup and Configuration

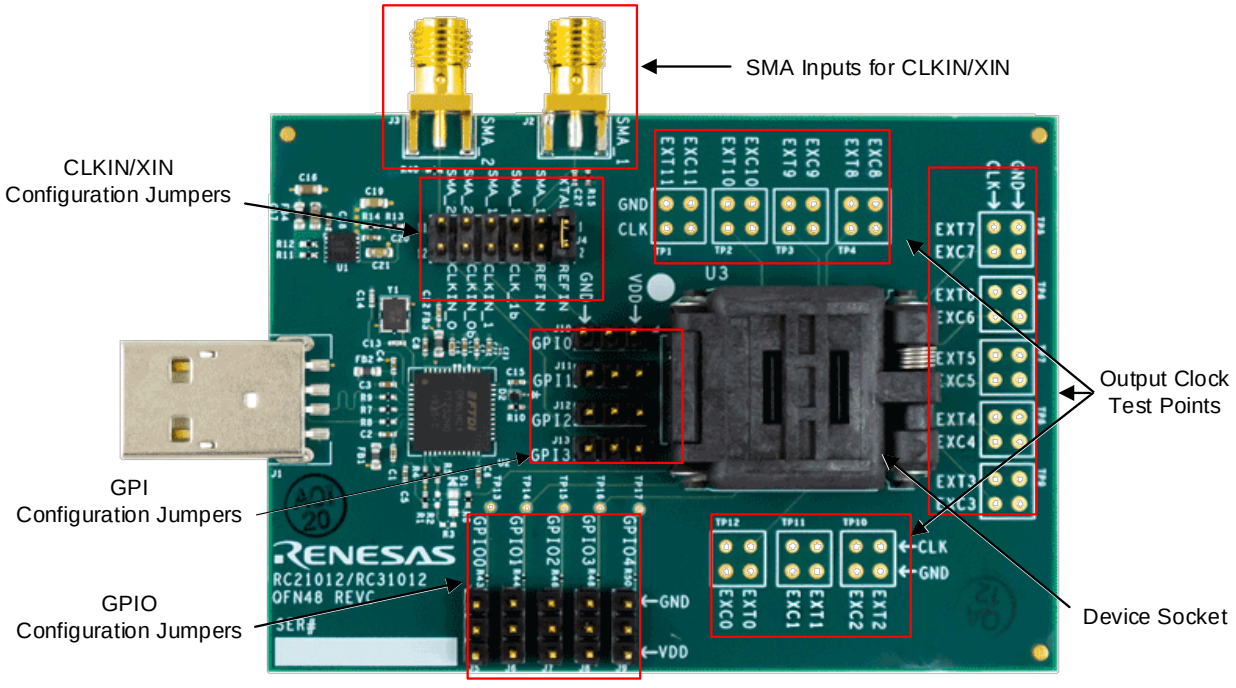


Figure 2. Programmer Board with Labels

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1.2.1. Part Placement

Part placement should follow the first pin marked on both the programmer board socket and blank part. Ensure both markings match before placing the part into the socket.

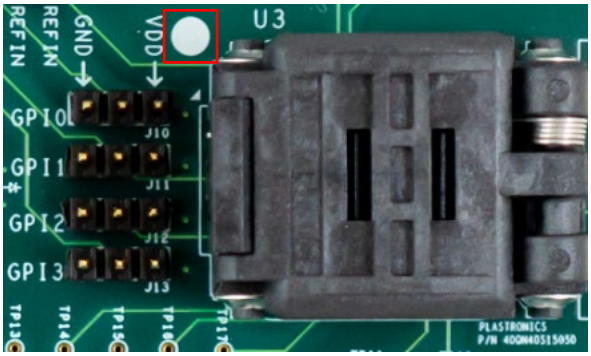


Figure 3. Pin 1 Location

Note: It is *critical* to ensure that pin 1 markings match between the board and device; otherwise, this may cause electrical shorting and possible damager/harm!

The socket opens by gently pushing in the small tab on the front side of the socket to release lid.

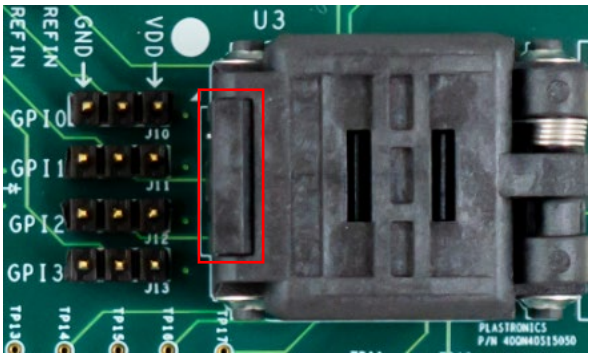


Figure 4. Socket Open Tab

To close, align the top of the socket with the bottom and press down until the socket clicks in place.

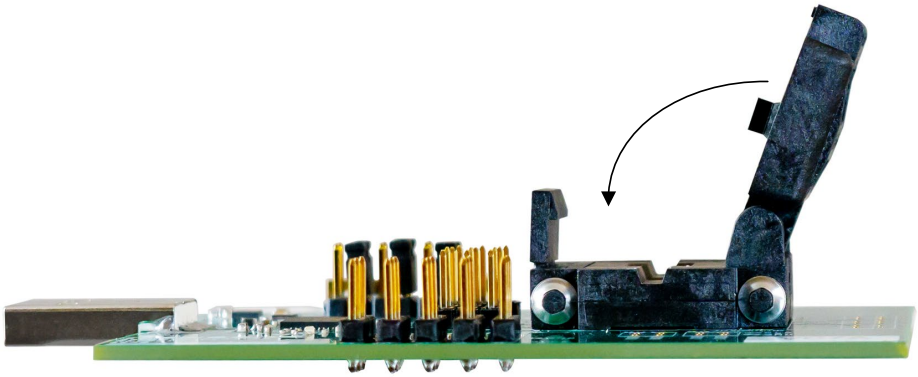


Figure 5. Closing Socket

Note: Do not force the socket lid down onto a part. This may damage the part or the socket itself.

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1.2.2. Jumper Selection

The RC21012A/RC31012A programmer board is equipped with five GPIO selection jumpers (J5-J9), four GPI selection jumpers (J10-J13), and a jumper strip for XIN/CLKIN trace paths (J4).

The GPIO and GPI jumpers can be pulled high or low by placing a jumper shunt between the center pin and VDD, or GND accordingly.

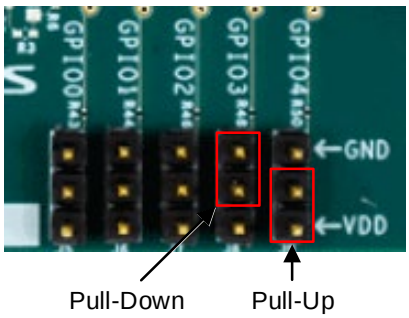


Figure 6. GPIO Jumper Settings

Jumper pins at J4 can configure CLKIN and XIN traces to the socket pins. Table 1 shows the different orientations for J4. CLKIN traces can be directed to GPIO.

Table 1. J4 Jumper Selection

Pins	Description
1/2	Connect the onboard crystal to pin 2 (XIN_REFIN)
3/4	Connect J2 (SMA_1_IN) to pin 2 (XIN_REFIN)
5/6	Connect J2 (SMA_1_IN) to pin 5 (CLKIN0_GPI0)
7/8	Connect J2 (SMA_1_IN) to pin 8 (CLKIN1_GPI2)
9/10	Connect J3 (SMA_2_IN) to pin 6 (CLKIN0B_GPI1)
11/12	Connect J3 (SMA_2_IN) to pin 9 (CLKIN1B_GPI3)

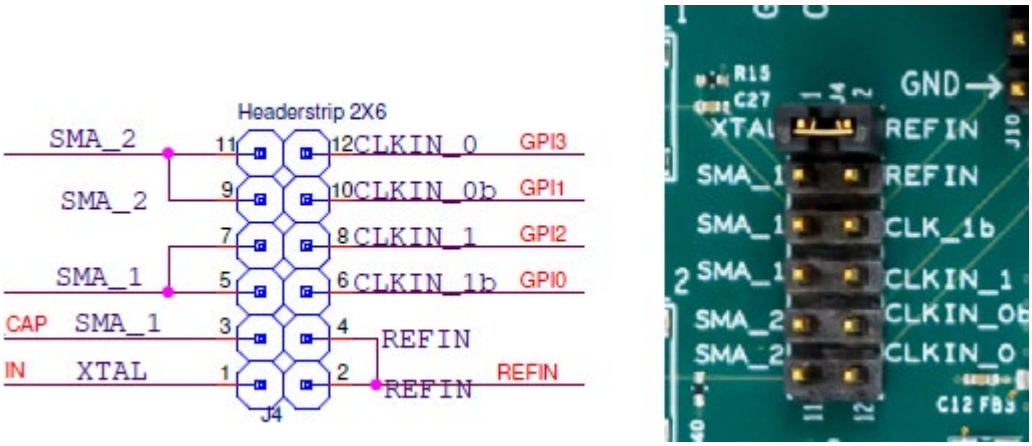


Figure 7. J4 Side-by-Side View

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1.3 Software Setup and Configuration

1.3.1. Software Installation

The RC21012A/RC31012A programmer board is compatible with the RICBox VersaClock 7 plugin. The plugin can be used to interface with the device via register read/writes. For instructions regarding installation of RICBox or any of the device plug-ins, see the RICBox product page.

Note: Be sure to update to the latest version of the RICBox GUI and VersaClock 7 plug-in before interfacing with the RC21012A/RC31012A programmer board.

1.3.2. Programming OTP Memory

Programming OTP memory can be done easily inside the RICBox GUI. The RC21012A/RC31012A can program up to 27 configurations into OTP memory. To ensure that OTP memory is programmed correctly, complete the following procedure:

1. Place a device in the socket and connect the programmer board to a PC, with RICBox and the VersaClock 7 plug-in installed, via the USB connector.
2. Open RICBox and navigate to an existing RC21008A or RC31008A settings file, or create a new configuration.

   Ensure that the correct XIN and CLKIN settings are set based on J4, and the signals are driven in the programmer board depending on the configuration loaded.
3. Once a configuration is open, go to the block diagram view.
4. Click on the OTP/EEPROM button in the lower left corner to view the OTP/EEPROM pop-up.

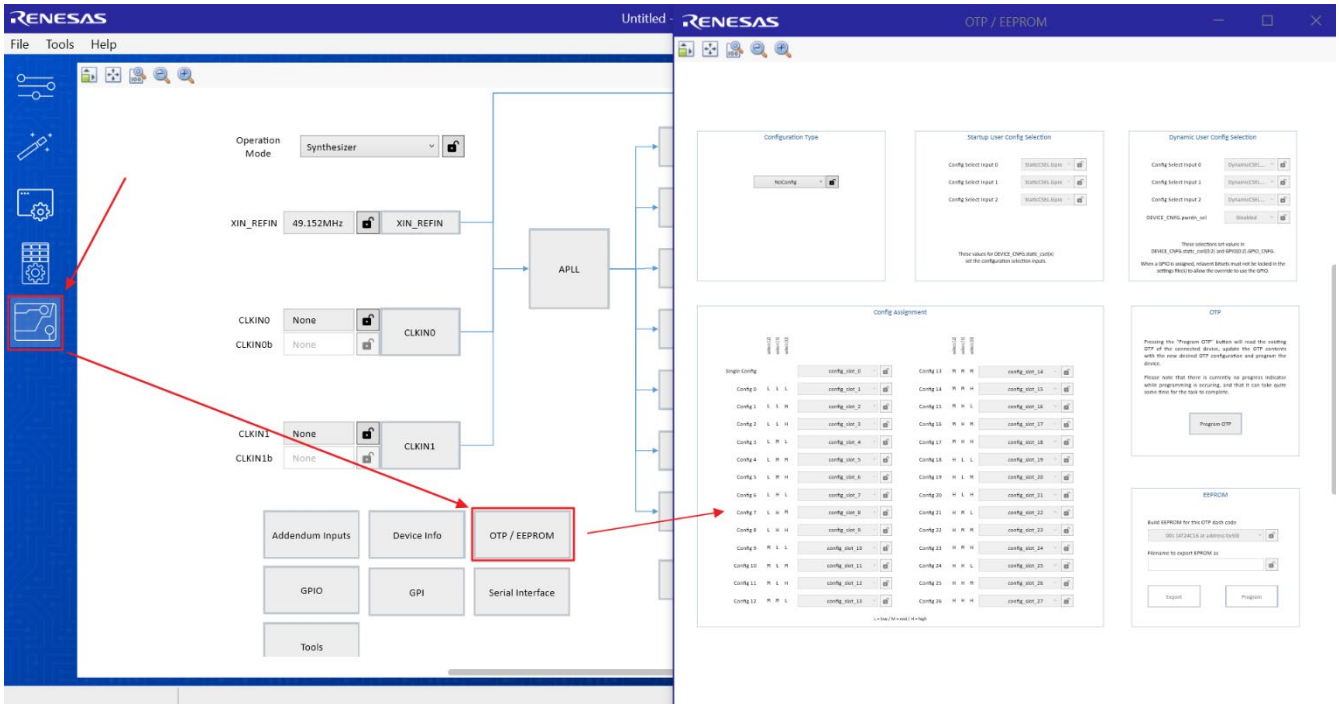


Figure 8. OTP Pop-up Page

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5. Use the Configuration Type drop-down menu to select between the following:
   - NoConfig – Nothing will be programmed to OTP memory.
   - SingleConfig – Program a single configuration into the OTP common configuration.
   - StaticMultiConfig – Program multiple configurations into a device that can be selectable at device start-up.
   - DynamicMultiConfig – Program multiple configurations into a device that can be selectable at start-up and runtime.

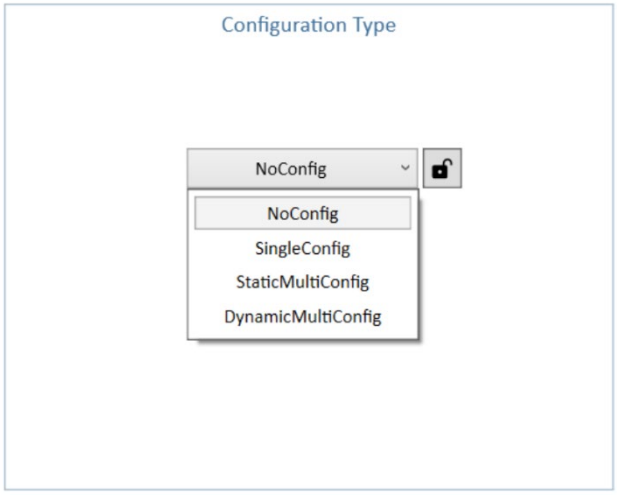


Figure 9. Configuration Type Menu

6. If *StaticMultiConfig* is selected in the configuration type menu, the Startup User Config Selection section can now be used to set configuration selection bits. Bits can either be hard coded to a low, middle, or high values, or bits can be selected through GPIO at start-up.

   Select the setting that best matches how the configuration selection bits should be arranged for this application.

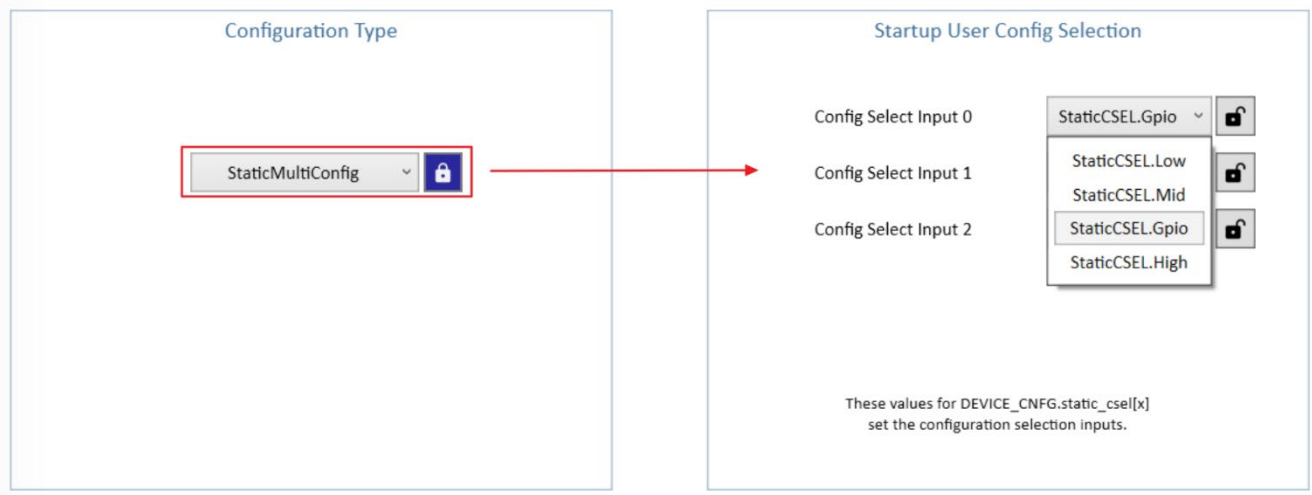


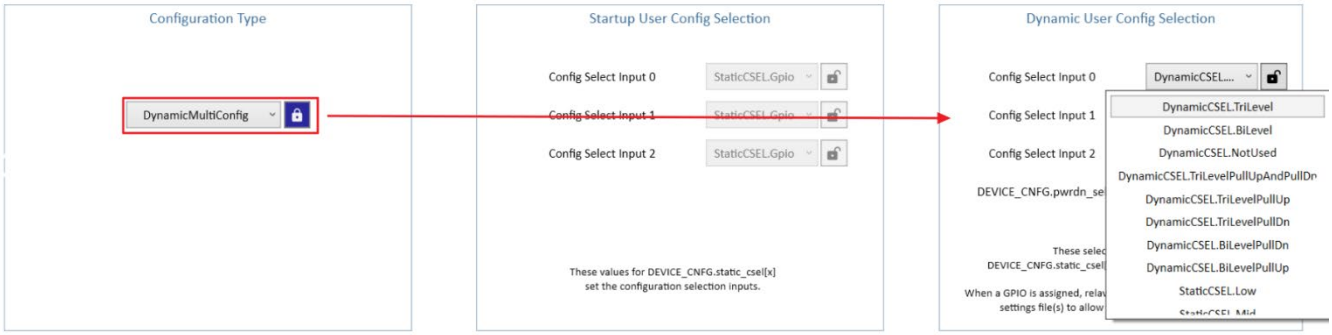
Figure 10. StaticMultiConfig Menu

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7. If *DynamicMultiConfig* is selected in the configuration type menu, the Dynamic User Config Selection section can now be used to set configuration selection bits. These have the same options as in StaticMultiConfig, except there are additional options to allow for differing types of input.

   Select the setting that best suits how the configuration selection bits should be arranged for this application.

Figure 11. DynamicMultiConfig Menu



8. Select the configs to load into OTP from RICBox.
   - Default setting is for the current working configuration.
   - Ensure all necessary configs are selected and all warnings/errors are cleared.

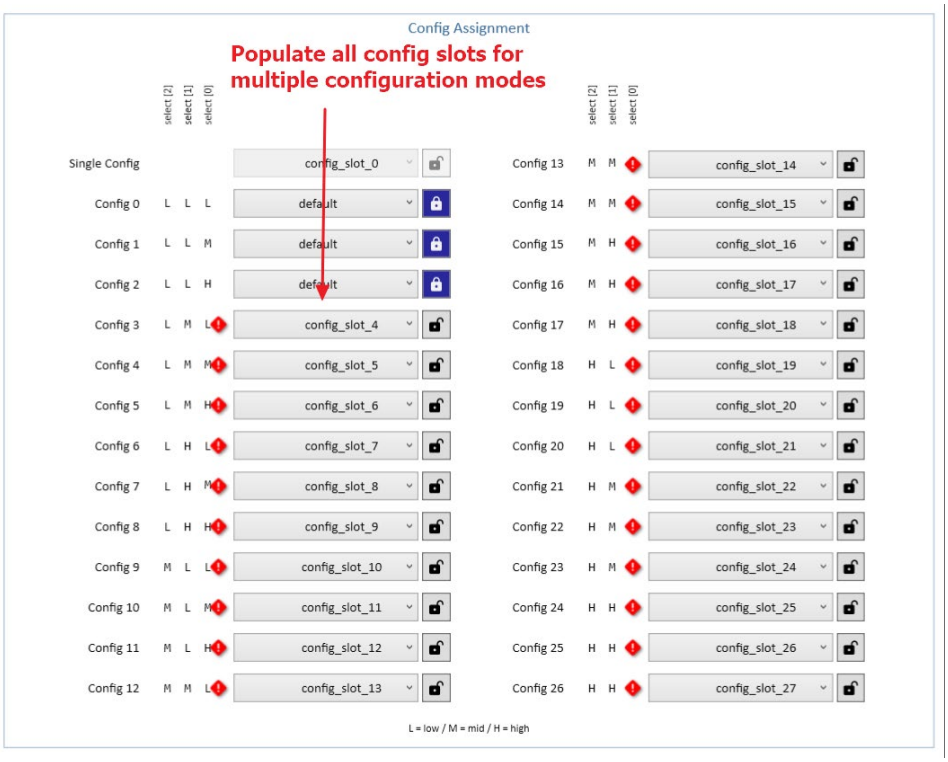


Figure 12. Config Selection Options

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9. Establish a connection to the device in socket.



Figure 13. Device Connection

10. Press the “Program OTP” button on the OTP/EEPROM page.

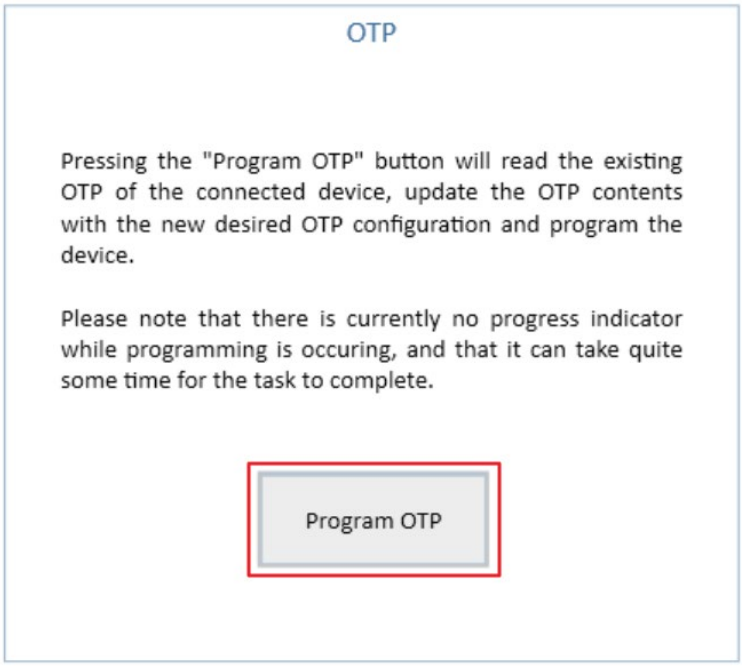


Figure 14. Program OTP

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2. Board Design

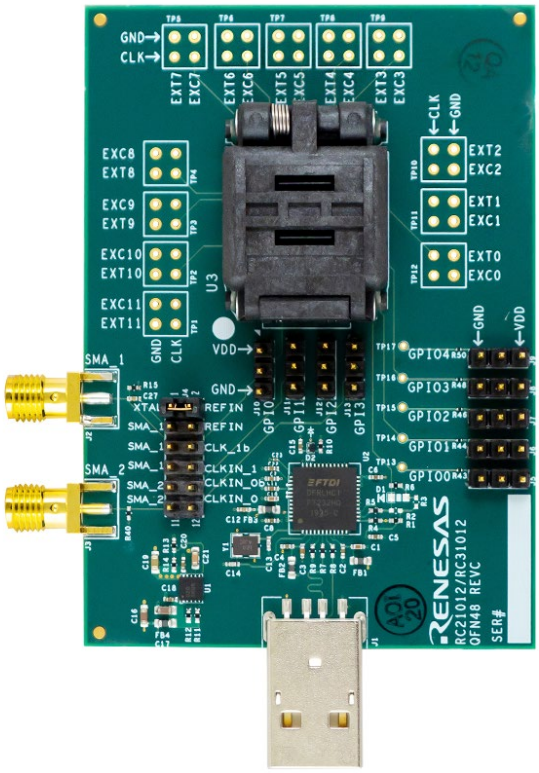


Figure 15. RC21012A/RC31012A Evaluation Board (Top)

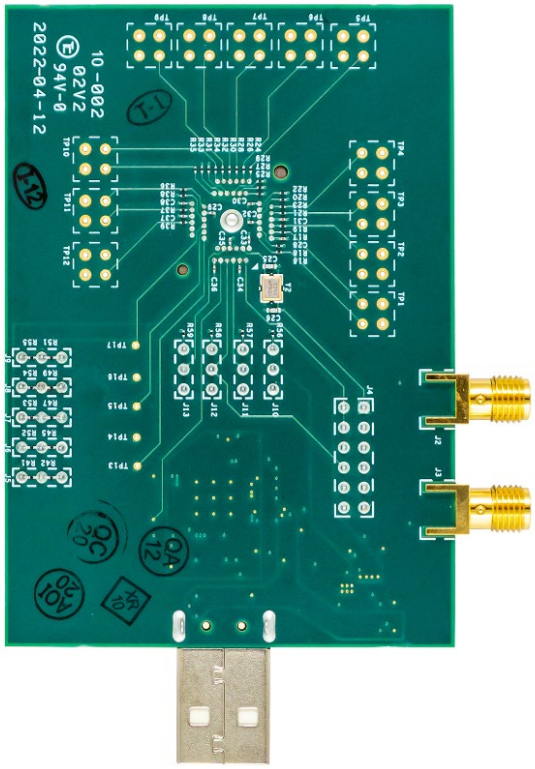


Figure 16. RC21012A/RC31012A Evaluation Board (Bottom)

2.1 Schematic Diagrams

The RC21012A/RC31012A schematic diagrams are located at the end of this document.

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2.2 Bill of Materials

Table 2. Bill of Materials

Qty.	Reference Designator	Description	Manufacturer	Part Number
3	C1 C3 C10	X5R Surface Mount Capacitor	Murata Electronics	ZRB15XR61A475ME01
11	C2 C4 C5 C6 C7 C8 C11 C15 C18 C20 C22	X7R Surface Mount Capacitor	Murata Electronics	GRM155R71C104KA88D
1	C12	COG Surface Mount Capacitor	Murata Electronics	GRM155R71E103J
2	C13 C14	COG Surface Mount Capacitor	Murata Electronics	GRM1555C1E270J
2	C16 C17	X7T Surface Mount Capacitor	Murata Electronics	GRM188D70J106MA73D
1	C19	X5R Surface Mount Capacitor	Murata Electronics	GRM188R60J226M
1	C21	X7R Surface Mount Capacitor	Murata Electronics	GCM188R71E105KA64D
12	C23 C28 C29 C30 C31 C32 C33 C34 C35 C36 C37 C38	X6S Surface Mount Capacitor	Kemet	C0603X6S1C104K030
2	C25 C26	COG Surface Mount Capacitor	Murata Electronics	GCM1555C1H6R8BA16D
1	C27	X7R Surface Mount Capacitor	Murata Electronics	GRM155R71H102KA01D
1	D1	OSRAM: LED Green Diffused 0603	OSRAM	LG L29K-G2J1-24-Z
1	D2	Surface Mount Fast Switching Diode: Io=95mA, Vr=80V, trr=4ns	Diodes Incorporated	1N4448HLP
4	FB1 FB2 FB3 FB4	MURATA: Ferrite Bead 600 Ohm 0603	Murata	BLM18AG601SN1D
1	J1	TE: USB-A (USB TYPE-A) USB 2.0 Plug Connector 4 Position Surface Mount, Right Angle; Through Hole	TE Connectivity	1734028-1
2	J2 J3	Samtec: SMA JACK STR 50 OHM EDGE MNT, Fits 0.062” board	Samtec	SMA-J-P-H-ST-EM1
1	J4	Molex C-Grid Header Dual, Gold, Unshrouded, Breakaway, 100mil pitch	Molex	10-89-7120
9	J5 J6 J7 J8 J9 J10 J11 J12 J13	Molex: Header, Gold, Unshrouded, Breakaway, 100mil pitch, 0.240 inch contact mating length	Molex	22-28-4033
6	R1 R6 R10 R11 R12 R14	Surface Mount Resistor	Yageo	RC0402JR-0710KL
1	R2	Surface Mount Resistor		DNI
1	R3	Surface Mount Resistor	Yageo	RC0402JR-071KL

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Qty.	Reference Designator	Description	Manufacturer	Part Number
4	R4 R5 R7 R8	Surface Mount Resistor	Panasonic	ERJ-2GEJ100X
1	R9	Surface Mount Resistor	Panasonic	ERJ-2GEJ123X
1	R13	Surface Mount Resistor	Vishay	CRCW040227K0FK
2	R15 R40	Surface Mount Resistor	Panasonic	ERJ-2RKF49R9X
24	R16 R17 R18 R19 R20 R21 R22 R23 R24 R25 R26 R27 R28 R29 R30 R31 R32 R33 R34 R35 R36 R37 R38 R39	Surface Mount Resistor	Panasonic	ERJ-1GEJ330C
19	R41 R42 R43 R44 R45 R46 R47 R48 R49 R50 R51 R52 R53 R54 R55 R56 R57 R58 R59	Surface Mount Resistor	Yageo	RC0201JR-0710KL
1	U1	Renesas: Low noise, high PSRR, low dropout voltage regulator.	Renesas	RAA214020
1	U2	FTDI: Single Channel Hi-Speed USB to Multipurpose UART/FIFO IC	FTDI	FT232HQ-REEL
1	Y2	TXC: 25MHz ±30ppm Crystal 8pF 60 Ohms 4-SMD, No Lead	TXC	7M-25.000MAHV-T

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3. Ordering Information

Part Number	Description
RC21012_31012-PROG	RC21012A/RC31012A Programmer Board

4. Revision History

Revision	Date	Description
1.01	Feb 28, 2023	Corrected two typos in “Operational Characteristics”; both required changing 40-pin to 48-pin.
1.00	Aug 18, 2022	Initial release.

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