Introduction

The 32L100CDISCOVERY helps you to discover the features of the STM32L100 Value Line 32-bit ARM® Cortex™-M3 microcontrollers and to develop your applications easily. It is based on STM32L100RCT6 and includes an ST-LINK/V2 embedded debug tool, LEDs, and push buttons.

Figure 1. 32L100CDISCOVERY
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1 Conventions

*Table 1* provides the definition of some conventions used in the present document.

**Table 1. ON/OFF conventions**

<table>
<thead>
<tr>
<th>Convention</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jumper JP1 ON</td>
<td>Jumper fitted</td>
</tr>
<tr>
<td>Jumper JP1 OFF</td>
<td>Jumper not fitted</td>
</tr>
<tr>
<td>Solder bridge SBx ON</td>
<td>SBx connections closed by solder</td>
</tr>
<tr>
<td>Solder bridge SBx OFF</td>
<td>SBx connections left open</td>
</tr>
</tbody>
</table>
2 Quick start

The 32L100CDISCOVERY is a low-cost and easy-to-use development kit to quickly evaluate and start development with an STM32L100 Value Line series.


For more information on the 32L100CDISCOVERY and for demonstration software, visit www.st.com/stm32l1-discovery.

2.1 Getting started

Follow the sequence below to configure the 32L100CDISCOVERY board and launch the DISCOVER application:

1. Check jumper position on the board, JP2 on, CN2 on (Discovery selected).
2. Connect the 32L100CDISCOVERY board to a PC with a USB cable ‘type A to mini-B’ through USB connector CN1 to power the board. Red LED LD1 (PWR) and LD2 (COM) light up and green LED LD3 blinks.
3. Press user button B1 (bottom left corner of the board).
4. Observe how the green LED LD3 blinking changes according to USER button B1 clicks.
5. Each click on USER button B1 is confirmed by the blue LED LD4.
6. To study or modify the DISCOVER project related to this demo, visit www.st.com/stm32l1-discovery and follow the tutorial.
7. Discover the STM32L100 Value Line features, download and execute programs proposed in the list of projects.
8. Develop your own application using available examples.

2.2 System requirements

- Windows PC (XP, Vista, 7)
- USB type A to Mini-B USB cable

2.3 Development toolchain supporting the 32L100CDISCOVERY

- Altium®, TASKING™ VX-toolset
- ARM®, Atollic TrueSTUDIO®
- IAR™, EWARM (IAR Embedded Workbench®)
- Keil™, MDK-ARM™

2.4 Order code

To order the STM32L100 Value Line Discovery kit, use the order code STM32L100CDISCO.
3 Features

The 32L100CDISCOVERY kit offers the following features:

- STM32L100RCT6 microcontroller featuring 256 KB Flash, 16 KB RAM in an LQFP64 package
- On-board ST-LINK/V2 with selection mode switch to use the kit as a standalone ST-LINK/V2 (with SWD connector for programming and debugging)
- Board power supply: through USB bus or from an external 5 V supply voltage
- External application power supply: 3 V and 5 V
- Four LEDs:
  - LD1 (red) for 3.3 V power on
  - LD2 (red/green) for USB communication
  - LD3 (green) for PC9 output
  - LD4 (blue) for PC8 output
- Two push buttons (user and reset)
- Extension header for LQFP64 I/Os for quick connection to prototyping board and easy probing.
- An additional board is provided with the kit which can be connected to the extension connector for even easier prototyping and probing.
- A large number of free ready-to-run application firmware examples are available on www.st.com/stm32l1-discovery to support quick evaluation and development.
The 32L100CDISCOVERY is designed around the STM32L100RCT6 microcontroller in a 64-pin LQFP package. 

*Figure 2* illustrates the connections between the STM32L100RCT6 and its peripherals (ST-LINK/V2, push button, LEDs and connectors). 

*Figure 3* and *Figure 4* help you to locate these features on the 32L100CDISCOVERY.
1. Pin 1 of CN2, CN3, P1 and P2 connectors are identified by a square.
Figure 4. Bottom layout

- SB5, SB7, SB9, SB11 (RESERVED)
- SB6, SB8, SB10, SB12 (DEFAULT)
- SB13 (STM_RST)
- SB14, SB15 (RX, TX)
- SB16, SB17 (X2 crystal)
- SB18 (MCO)
- SB19 (NRST)
- SB20, SB21 (X3 crystal)
- SB22 (T_SWO)
- SB22 (T_SWO)
4.1 STM32L100RCT6 microcontroller

The Value Line STM32L100RCT6 incorporates the connectivity power of the universal serial bus (USB) with the high-performance ARM Cortex™-M3 32-bit RISC core operating at a 32 MHz frequency, a memory protection unit (MPU), high-speed embedded memories (256 Kbytes of Flash memory and 16 Kbytes of RAM) and an extensive range of enhanced I/Os and peripherals connected to two APB buses.

The STM32L100RCT6 device offers one 12-bit ADC, two DACs, two ultra-low-power comparators, six general-purpose 16-bit timers and two basic timers, which can be used as time bases.

Moreover, the STM32L100RCT6 device contains standard and advanced communication interfaces: two I2Cs, three SPIs, two I2S, three USARTs and a USB.

It also includes a real-time clock and a set of backup registers that remain powered in Standby mode.

Finally, the integrated LCD controller has a built-in LCD voltage generator that allows you to drive up to 8 multiplexed LCDs with contrast independent of the supply voltage.

The ultra-low-power STM32L100RCT6 operates from a 1.8 to 3.6 V power supply with BOR. It is available in the -40 to +85 °C temperature range. A comprehensive set of power-saving modes allows the design of low-power applications.

Figure 5. STM32L100RCT6 package
Figure 6. STM32L100RCT6 block diagram
4.2 Embedded ST-LINK/V2

The ST-LINK/V2 programming and debugging tool is integrated on the 32L100CDISCOVERY. The embedded ST-LINK/V2 can be used in 2 different ways according to the jumper states (see Table 2):

- Program/debug the MCU on board,
- Program/debug an MCU in an external application board using a cable connected to SWD connector CN3.

The embedded ST-LINK/V2 supports only SWD for STM32 devices. For information about debugging and programming features refer to user manual UM1075 (ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32) which describes in detail all the ST-LINK/V2 features.

Figure 7. Typical configuration

Table 2. Jumper states

<table>
<thead>
<tr>
<th>Jumper state</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both CN2 jumpers ON</td>
<td>ST-LINK/V2 functions enabled for on board programming (default)</td>
</tr>
<tr>
<td>Both CN2 jumpers OFF</td>
<td>ST-LINK/V2 functions enabled for application through external CN3 connector (SWD supported)</td>
</tr>
</tbody>
</table>
### 4.2.1 Using ST-LINK/V2 to program/debug the STM32L100 Value Line on board

To program the STM32L100 Value Line microcontroller on board, simply plug in the two jumpers on CN2, as shown in Figure 8 in red, but do not use the CN3 connector as that could disturb communication with the STM32L100RCT6 of the 32L100CDISCOVERY.

![Figure 8. 32L100CDISCOVERY connections](image-url)
4.2.2 Using ST-LINK/V2 to program/debug an external STM32 application

It is very easy to use the ST-LINK/V2 to program the STM32 on an external application. Simply remove the 2 jumpers from CN2 as shown in Figure 9, and connect your application to the CN3 debug connector according to Table 3.

Note: SB19 and SB22 must be OFF if you use CN3 pin 5 in your external application.

Table 3. Debug connector CN3 (SWD)

<table>
<thead>
<tr>
<th>Pin</th>
<th>CN3</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD_TARGET</td>
<td>VDD from application</td>
</tr>
<tr>
<td>2</td>
<td>SWCLK</td>
<td>SWD clock</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>4</td>
<td>SWDIO</td>
<td>SWD data input/output</td>
</tr>
<tr>
<td>5</td>
<td>NRST</td>
<td>RESET of target MCU</td>
</tr>
<tr>
<td>6</td>
<td>SWO</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

Figure 9. ST-LINK connections
4.3 Power supply and power selection

The power supply is provided either by the host PC through the USB cable, or by an external 5V power supply.

The D1 and D2 diodes protect the 5V and 3V pins from external power supplies:

• 5V and 3V can be used as output power supplies when another application board is connected to pins P1 and P2.
  In this case, the 5V and 3V pins deliver a 5V or 3V power supply and power consumption must be lower than 100 mA.
• 5V can also be used as input power supplies e.g. when the USB connector is not connected to the PC.
  In this case, the 32L100CDISCOVERY board must be powered by a power supply unit or by auxiliary equipment complying with standard EN-60950-1: 2006+A11/2009, and must be Safety Extra Low Voltage (SELV) with limited power capability.

4.4 LEDs

• LD1 PWR: Red LED indicates that the board is powered.
• LD2 COM: Tricolor LED (COM) advises on the communication status as follows:
  – Slow blinking Red LED/Off: At power on before USB initialization
  – Fast blinking Red LED/Off: After the first correct communication between PC and ST-LINK/V2 (enumeration)
  – Red LED On: When initialization between PC and ST-LINK/V2 is successfully finished
  – Green LED On: After successful target communication initialization
  – Blinking Red/Green LED: During communication with target
  – Red LED On: Communication finished and OK
  – Orange LED On: Communication failure
• User LD3: Green user LED connected to the I/O PC9 of the STM32L100RCT6.
• User LD4: Blue user LED connected to the I/O PC8 of the STM32L100RCT6.

4.5 Push buttons

• B1 USER: User push button connected to the I/O PA0 of the STM32L100RCT6.
• B2 RESET: Push button used to RESET the STM32L100RCT6.

4.6 JP2 (IDD)

Jumper JP2, labeled IDD, allows the consumption of STM32L100RCT6 to be measured by removing the jumper and connecting an ammeter.

• Jumper on: STM32L100RCT6 is powered (default).
• Jumper off: an ammeter must be connected to measure the STM32L100RCT6 current, (if there is no ammeter, the STM32L100RCT6 is not powered).
4.7 Oscillator clock (OSC)

4.7.1 OSC clock supply

PH0 and PH1 can be used as GPIO or as HSE oscillator. By default these I/Os are configured as GPIO, so SB16 and SB17 are closed, SB18 is open and R22, R23, C13 and C14 are not populated.

An external HSE clock can be provided to the MCU in three ways:

- **MCO from ST-LINK.** From MCO of the STM32F103. This frequency cannot be changed, it is fixed at 8 MHz and connected to PH0-OSC_IN of the STM32L100RCT6. Configuration needed:
  - SB16, SB18 CLOSED
  - R22, R23 removed
  - SB17 OPEN

- **Oscillator onboard.** From X2 crystal (not provided). For typical frequencies and its capacitors and resistors, please refer to the STM32L100RCT6 Datasheet. Configuration needed:
  - SB16, SB17 SB18 OPEN
  - R22, R23, C13, C14 soldered

- **Oscillator from external PH0.** From external oscillator through pin 7 of the P1 connector. Configuration needed:
  - SB16, SB17 CLOSED
  - SB18 OPEN
  - R22 and R23 removed

4.7.2 OSC 32 KHz clock supply

PC14 and PC15 can be used as GPIO or as LSE oscillator. By default these I/Os are configured as GPIO, so SB20 & SB21 are closed and X3, R24, R25 are not populated.

An external LSE clock can be provided to the MCU in two ways:

- **Oscillator onboard.** From X3 crystal (not provided). Configuration needed:
  - SB20, SB21 OPEN
  - C15, C16, R24 and R25 soldered.

- **Oscillator from external PC14.** From external oscillator through the pin 5 of P1 connector. Configuration needed:
  - SB20, SB21 CLOSED
  - R24 and R25 removed
## 4.8 Solder bridges

**Table 4. Solder bridge settings**

<table>
<thead>
<tr>
<th>Bridge</th>
<th>State(1)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB16,17 (X2 crystal)</td>
<td>OFF</td>
<td>X2, C13, C14, R22 and R23 provide a clock. PH0, PH1 are disconnected from P1.</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>PH0, PH1 are connected to P1 (R22, R23 and SB18 must not be fitted).</td>
</tr>
<tr>
<td>SB6,8,10,12 (Default)</td>
<td>ON</td>
<td>Reserved, do not modify.</td>
</tr>
<tr>
<td>SB5,7,9,11 (Reserved)</td>
<td>OFF</td>
<td>Reserved, do not modify.</td>
</tr>
<tr>
<td>SB20,21 (X3 crystal)</td>
<td>OFF</td>
<td>X3, C15, C16, R24 and R25 deliver a 32 KHz clock. PC14, PC15 are not connected to P1.</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>PC14, PC15 are only connected to P1 (R24, R25 must not be fitted).</td>
</tr>
<tr>
<td>SB4 (B2-RESET)</td>
<td>ON</td>
<td>B2 push button is connected to the NRST pin of the STM32L100RCT6 MCU.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>B2 push button is not connected the NRST pin of the STM32L100RCT6 MCU.</td>
</tr>
<tr>
<td>SB3 (B1-USER)</td>
<td>ON</td>
<td>B1 push button is connected to PA0.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>B1 push button is not connected to PA0.</td>
</tr>
<tr>
<td>SB1 (VBAT powered from VDD)</td>
<td>ON</td>
<td>VBAT is permanently powered from VDD.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>VBAT is not powered from VDD but pin3 of P1.</td>
</tr>
<tr>
<td>SB14,15 (RX,TX)</td>
<td>OFF</td>
<td>Reserved, do not modify.</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>Reserved, do not modify.</td>
</tr>
<tr>
<td>SB19 (NRST)</td>
<td>ON</td>
<td>NRST signal of the CN3 connector is connected to the NRST pin of the STM32L100RCT6 MCU.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>NRST signal of the CN3 connector is not connected to the NRST pin of the STM32L100RCT6 MCU.</td>
</tr>
<tr>
<td>SB22 (T_SWO)</td>
<td>ON</td>
<td>SWO signal of the CN3 connector is connected to PB3.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>SWO signal is not connected.</td>
</tr>
<tr>
<td>SB13 (STM_RST)</td>
<td>OFF</td>
<td>No incidence on STM32F103C8T6 (ST-LINK/V2) NRST signal.</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>STM32F103C8T6 (ST-LINK/V2) NRST signal is connected to GND.</td>
</tr>
<tr>
<td>SB2 (BOOT0)</td>
<td>ON</td>
<td>BOOT0 signal of the STM32L100RCT6 MCU is held low through a 510 Ohm pull-down resistor.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>BOOT0 signal of the STM32L100RCT6 MCU can be set high through a 10 K Ω pull-up resistor R27 to solder.</td>
</tr>
<tr>
<td>SB18 (MCO)</td>
<td>ON</td>
<td>Provides the 8 MHz for OSC_IN from MCO of STM32L100RCT6.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>See SB16, SB17 description.</td>
</tr>
</tbody>
</table>

1. Default SBx state is shown in bold.
2. OSC_IN clock comes from MCO if SB18 is ON and SB16,17 are OFF and comes from X2 if SB18 is OFF and SB16,17 are ON.
4.9 Extension connectors

The male headers P1 and P2 can connect the 32L100CDISCOVERY to a standard prototyping/wrapping board. STM32L100RCT6 GPI/Os are available on these connectors. P1 and P2 can also be probed by an oscilloscope, logical analyzer or voltmeter.

Table 5. MCU pin description versus board function

<table>
<thead>
<tr>
<th>MCU pin</th>
<th>Board function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main function</td>
<td>Alternate functions</td>
</tr>
<tr>
<td>BOO T0</td>
<td>BOOT0</td>
</tr>
<tr>
<td>NRST</td>
<td>NRST</td>
</tr>
<tr>
<td>PA0</td>
<td>WKUP1/RTC_TAMP2/TIM2_CH1_ETR/USART2_CTS/ADC_IN0/COMP1_INP</td>
</tr>
<tr>
<td>PA1</td>
<td>TIM2_CH2/USART2_RTS/LCD_SEG0/ADC_IN1/COMP1_INP/OPAMP1_VINP</td>
</tr>
<tr>
<td>PA2</td>
<td>TIM2_CH3/TIM9_CH1/USART2_TX/LCD_SEG1/ADC_IN2/COMP1_INP/OPAMP1_VINM</td>
</tr>
<tr>
<td>PA3</td>
<td>TIM2_CH4/TIM9_CH2/USART2_RX/LCD_SEG2/ADC_IN3/COMP1_INP/OPAMP1_VOUT</td>
</tr>
<tr>
<td>PA4</td>
<td>SPI1_NSS/SPI3_NSS/I2S3_WS/USART2_CK/ADC_IN4/DAC_OUT1/COMP1_INP</td>
</tr>
<tr>
<td>PA5</td>
<td>TIM2_CH1_ETR/SPI1_SCK/ADC_IN5/DAC_OUT2/COMP1_INP</td>
</tr>
<tr>
<td>PA6</td>
<td>TIM3_CH1/TIM10_CH1/SPI1_MISO/LCD_SEG3/ADC_IN6/COMP1_INP/OPAMP2_VINP</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5. MCU pin description versus board function (continued)

<table>
<thead>
<tr>
<th>Main function</th>
<th>Alternate functions</th>
<th>LQFP64</th>
<th>Push button</th>
<th>LED</th>
<th>SWD</th>
<th>OSC</th>
<th>Free I/O</th>
<th>Power supply</th>
<th>CN3</th>
<th>P1</th>
<th>P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA7</td>
<td>TIM3_CH2/TIM11_CH1/ SPI1_MOSI/LCD_SEG4/ADC_IN7/COMP1_INP/OPAMP2_VINM</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>PA8</td>
<td>USART1_CK/MCO/LCD_COM0</td>
<td>41</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>PA9</td>
<td>USART1_TX/LCD_COM1</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>PA10</td>
<td>USART1_RX/LCD_COM2</td>
<td>43</td>
<td></td>
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<td>23</td>
<td></td>
</tr>
<tr>
<td>PA11</td>
<td>USART1_CTS/USB_DM/SPI1_MISO</td>
<td>44</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>PA12</td>
<td>USART1_RTS/USB_DP/SPI1_MOSI</td>
<td>45</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>PA13</td>
<td>JTMS-SWDAT</td>
<td>46</td>
<td></td>
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<td></td>
<td></td>
<td>4</td>
<td></td>
<td>20</td>
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</tr>
<tr>
<td>PA14</td>
<td>JTCK-SWCLK</td>
<td>49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>PA15</td>
<td>TIM2_CH1_ETR/SPI1_NSS/SPI3_NSS/I2S3_WS/LCD_SEG17</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PB0</td>
<td>TIM3_CH3/LCD_SEG5/ADC_IN8/COMP1_INP/VREF_OUT/OPAMP2_VOUT</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>PB1</td>
<td>TIM3_CH4/LCD_SEG6/ADC_IN9/COMP1_INP/VREF_OUT</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
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5 Mechanical drawing

Figure 10. 32L100CDISCOVERY mechanical drawing
Figure 11. 32L100CDISCOVERY

Electrical schematics
Figure 12. ST-LINK/V2 (SWD only)
Figure 13. MCU

STM32L100 Discovery MCU

C21 100nF
C19 100nF
VD D
C20 100nF

PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PA8
PA9
PA10
PA11
PA12
PA13
PA14
PA15
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
PB8
PB9
PB10
PB11
PB12
PB13
PB14
PB15
PC0
PC1
PC2
PC3
PC4
PC5
PC6
PC7
PC8
PC9
PC10
PC11
PC12
PC13
PC14
PC15
PH0
PH1
PD2
C15 6.8pF
C16 6.8pF
R24 0
R25 0
C13 20pF
C14 20pF
R22 390
R27 10K

VDD 1
X2 8MHz
X3
MC306-G -06Q -32.768 (JFVNY)

SB2
BOOT0

PA14
PA15
PC10
PC11
PC12
PD2
PB3
PB4
PB5
PB6
PB7
PB8
PB9
PB10
PB11
PB12
PB13
PB14
PB15
PC6
PC7
PC8
PC9
PA8
PA9
PA10
PA11
PA12
PA13

LD3 green
PC 9
R30 330
LD4 blue
PC 8
R31 660
C22 100nF
R29 220K

R26 510
SB3
R28 330

R32 100K

USER & WAKE-UP Button

PA0 Not Fitted
NRST

PC 9 TAMPER1 WKUP2
PC 14 OS C32 IN3
PC 15 OS C32 OUT4
PH0 OSC IN5
PH1 OS C OUT6
NRST 7
PC 0 8
PC 1 9
PC 2 10
PC 3 11
VSSA VREF 12
VDDA VREF+ 13
PA0 TAMPER2 WKUP1
PA1 15
PA2 16
PA3 17
VSS_4 18
VDD_4 19
PA4 20
PA5 21
PA6 22
PA7 23
PC4 24
PC5 25
PB0 26
PB1 27
PB2 or NPOR (1.8V mode) 28
PB10 29
PB11 30
VSS_1 31
VDD_1 32
PB12 33
PB13 34
PB14 35
PB15 36
PC6 37
PC7 38
PC8 39
PC9 40
PA8 41
PA9 42
PA10 43
PA11 44
VSS_2 45
VDD_2 46
PA14 49
PA15 50
PC10 51
PC11 52
PC12 53
PD2 54
PB3 55
PB4 56
PB5 57
PB6 58
PB7 59
BOOT0 60
PB8 61
PB9 62
VSS_3 63
VDD_3 64

SB1
SW- PUSH- C M S

SB20

SB17

SB16

MCU

STM32L 100RCT6

U3

VDD

VSS
7 Revision history

Table 6. Document revision history

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