

# AN14507

将LVGL模拟器与FreeMASTER结合使用

第1.0版—2025年1月6日

应用笔记

## 文档信息

信息	内容
关键词	AN14507、MCXA153、LVGL、GUI Guider、FreeMASTER
摘要	本应用笔记介绍了如何使用GUI Guider生成集成了FreeMASTER的LVGL模拟器。



1 介绍

本文档介绍了如何使用GUI Guider和FreeMASTER准备和搭建一个运行时调试面板演示软件。创建了一个基于FRDM-MCXA153开发板的简单LED闪烁演示，用于与FreeMASTER和GUI Guider配合使用。该演示具有多个参数，例如闪烁模式。亮度可由FreeMASTER进行控制。

1.1 系统要求

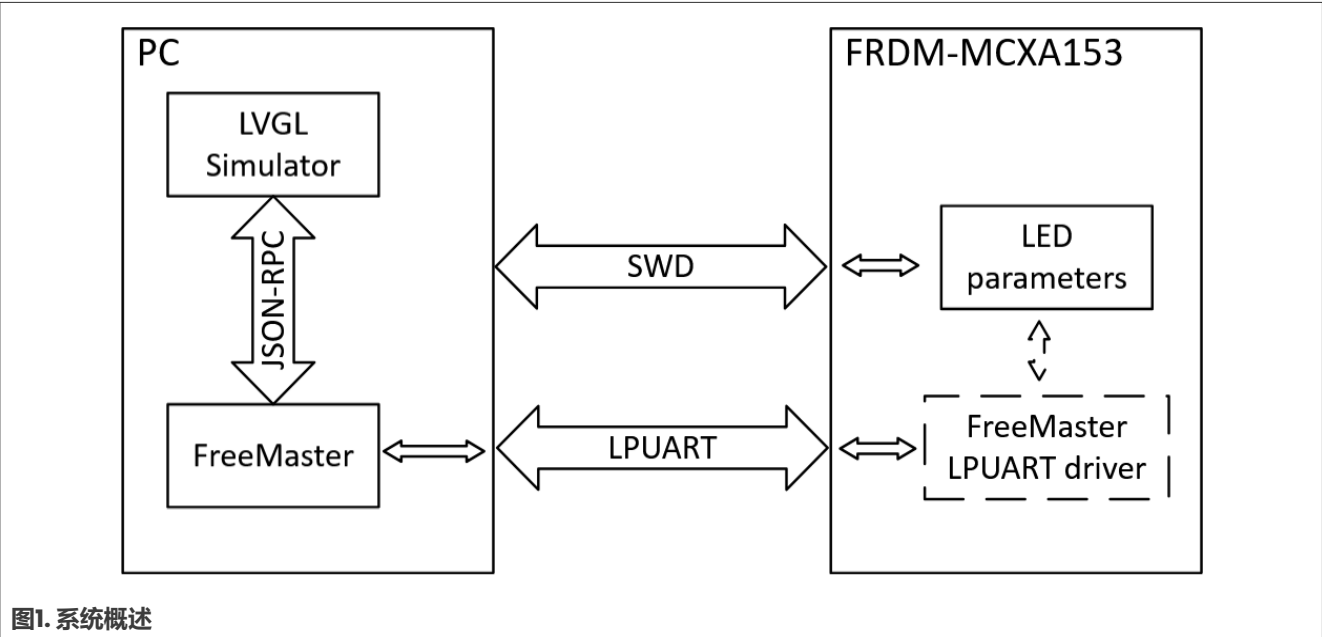
硬件要求如下：

- FRDM-MCXA153
- Windows PC
- Type-C USB线缆

软件要求如下：

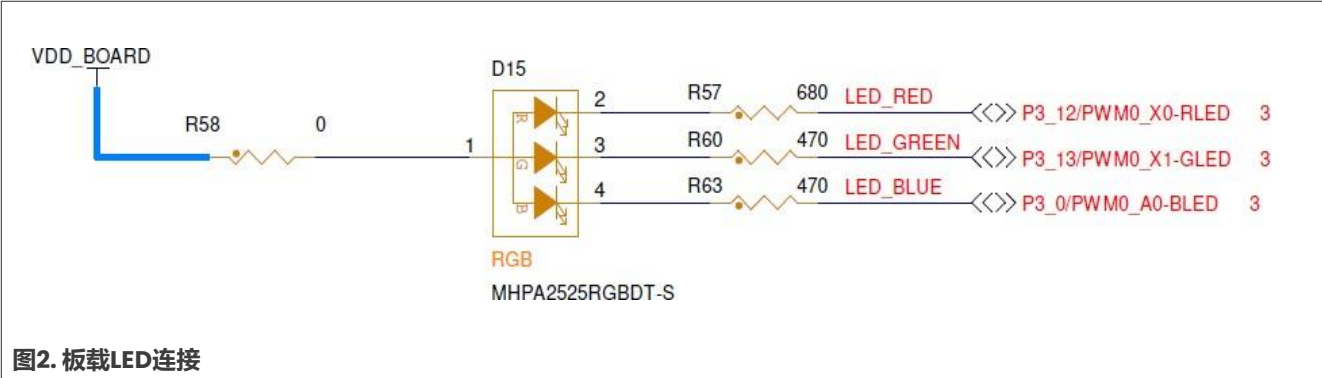
- MCUXpressoIDE v11.10.0
- Windows OS
- FreeMASTER 3.2
- GUI Guider 1.8.0

1.2 系统概述



在本演示中，LVGL模拟器和FreeMASTER均在Windows PC上运行，而FreeMASTER通过SWD或LPUART接口与FRDM-MCXA153开发板进行通信。LVGL模拟器和FreeMASTER可以修改FRDM-MCXA153开发板上的LED参数来控制LED状态。整个系统如图1所示。

在本演示中，LED有3种工作模式（OFF、LOGIC和PWM）。在OFF模式下，LED熄灭；在LOGIC模式下，LED以给定的时间间隔闪烁；在PWM模式下，LED以给定的亮度点亮。图2所示为FRDM-MCXA153的LED连接。为了将3个LED设置为PWM模式，使用了FLEXPWM和CTIMER模块来生成PWM信号。



固件设置了3个FreeRTOS任务来控制LED状态并监控LED参数的变化。如果LED模式发生更改，这些任务会将LED重新初始化为所选的模式，并按照参数来运行，如延迟时间（以微秒为单位）或PWM占空比。

## 2 软件的搭建

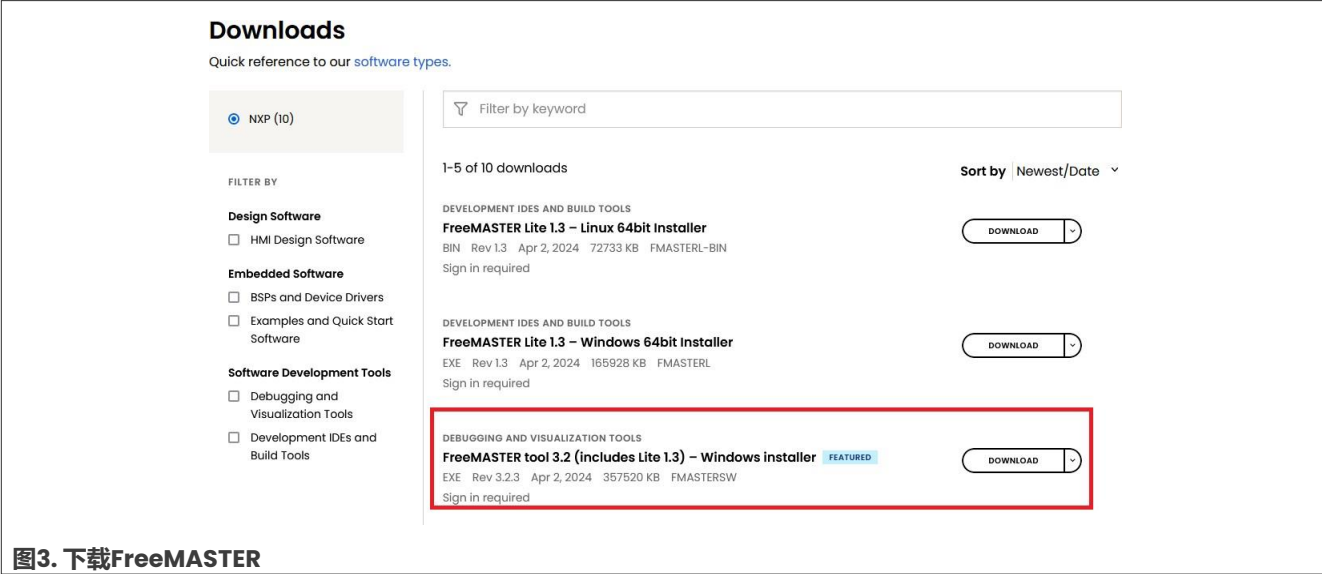
本节介绍如何搭建该软件。

### 2.1 安装FreeMASTER

FreeMASTER是一款调试工具，主要用于嵌入式系统的实时调试、数据可视化和参数调整。FreeMASTER为Windows用户提供了一个图形用户界面，使开发人员能够监控和控制嵌入式系统的变量。

按以下步骤安装FreeMASTER：

1. 访问<https://www.nxp.com.cn/design/design-center/software/development-software/freemaster-run-time-debugging-tool:FREEMASTER>，并下载FreeMASTER。



2. 安装该软件。FreeMASTER Lite需要许可证。安装程序会自动跳转到许可证注册页面。请阅读并接受软件条款与条件以获取许可证。当安装程序要求时，请输入许可证。

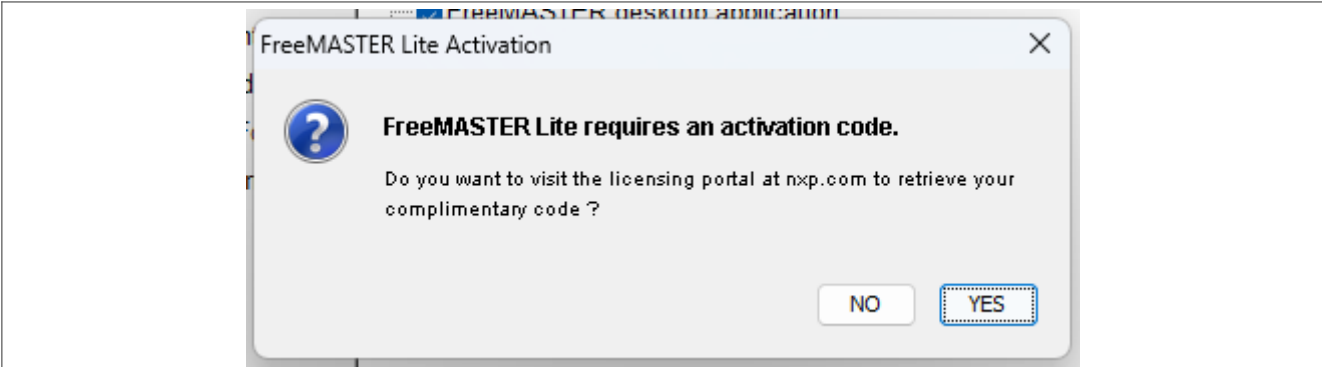


图4. 激活码通知

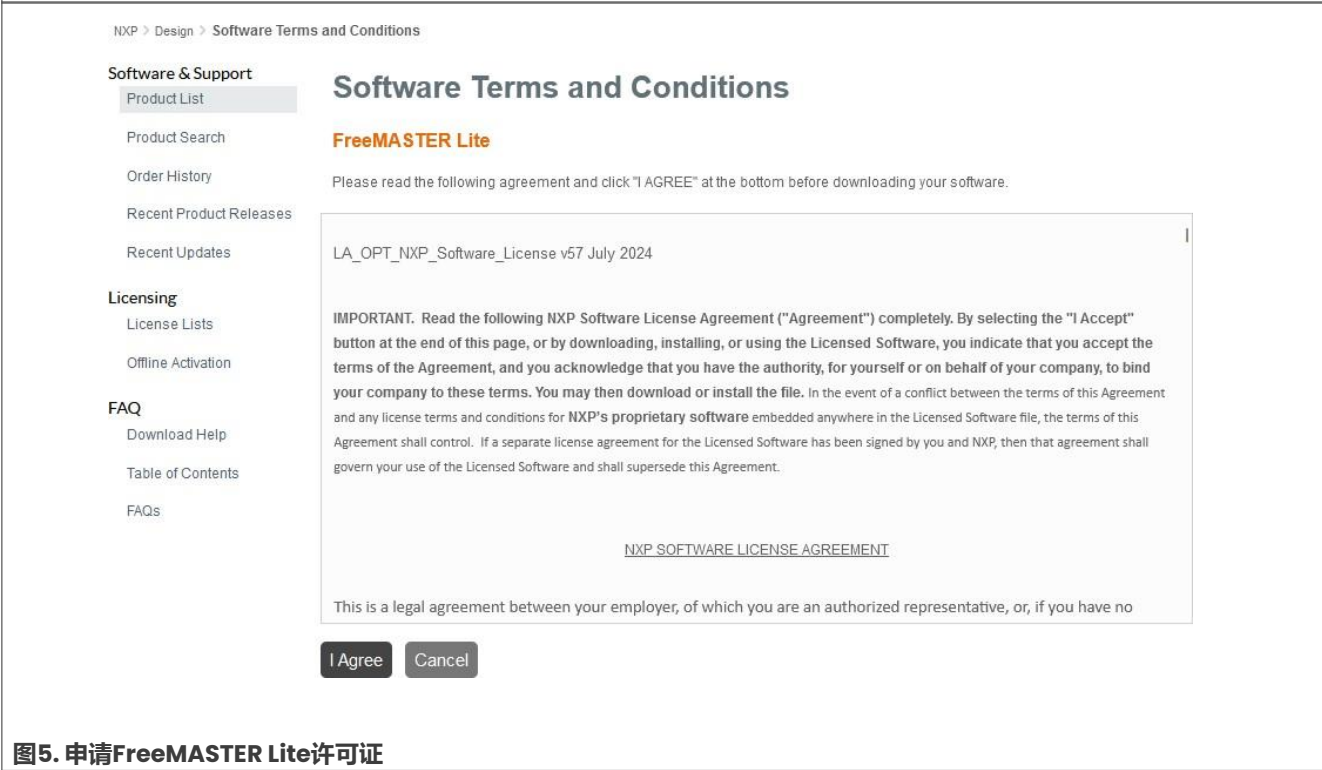


图5. 申请FreeMASTER Lite许可证

## 2.2 安装GUI Guider

GUI Guider是一款图形用户界面开发工具。用户可以使用GUI Guider快速设计出一个高质量的GUI工程。要安装GUI Guider，请访问以下页面来下载并安装GUI Guider: <https://www.nxp.com.cn/design/design-center/software/development-software/gui-guider:GUI-GUIDER>。

## 3 在开发板上设置FreeMASTER

FreeMASTER支持多种通信接口，如UART、以太网和调试器。

在本演示中，用户可以使用板载调试器或LPUART。FreeMASTER始终可通过板载调试器使用。用户必须打开source/main.c文件中的OPTION\_USE\_FREEMASTER\_SERIAL选项，才能在FreeMASTER中使用LPUART。

3.1 UART

在本演示中，FreeMASTER通过MCUXpresso配置工具进行配置。用户可以在MCUXpresso配置工具中查看具体配置：

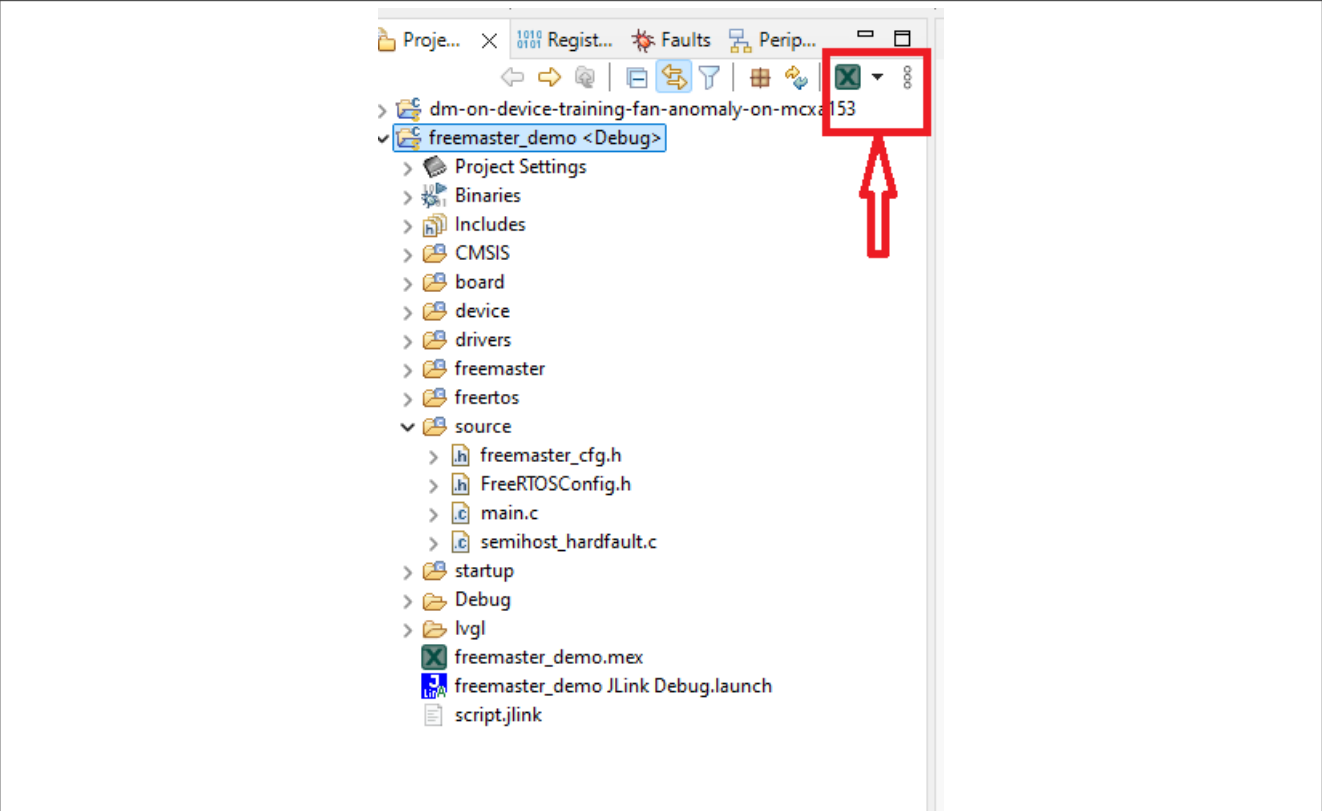


图6. MCUXpresso配置工具

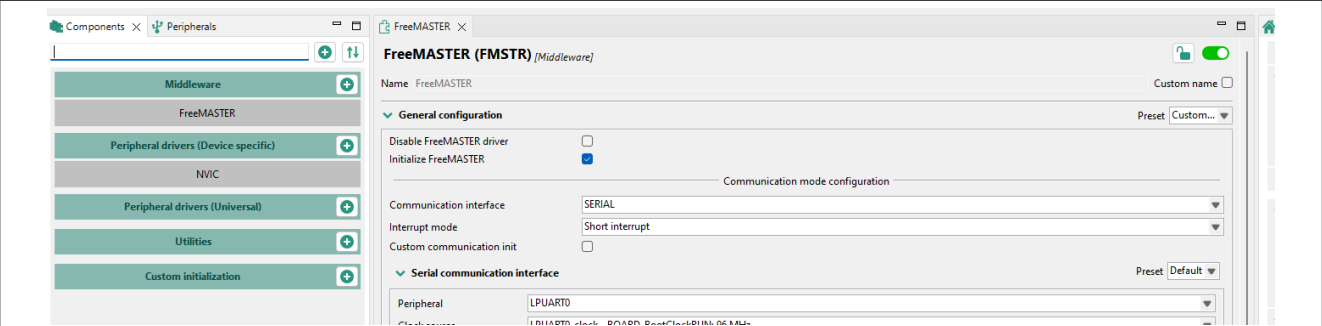


图7. MCUXpresso配置工具中的FreeMASTER

要启用FreeMASTER的LPUART驱动，请打开source/main.c文件中的OPTION\_USE\_FREEMASTER\_SERIAL选项。这是一个软件实现，不是由MCUXpresso配置工具生成的。将此定义值改为1可启用FreeMASTER的LPUART驱动程序，而改为0则可禁用FreeMASTER的LPUART驱动程序。

```
17
18 #define OPTION_USE_FREEMASTER_SERIAL 1
19
```

图8. FreeMASTER LPUART选项

用户还可以在MCUXpresso配置工具中更改FreeMASTER配置，以启用一些高级特性，例如密码保护和应用命令等。

3.2 调试器

用户还可以将FRDM-MCXA153开发板上的板载调试器与FreeMASTER配合使用。当调试器连接上时，FreeMASTER总是可以通过调试器使用，无需用户操作。然而，通过这种方式，FreeMASTER仅支持基本的功能，例如读取/写入内存。

4 FreeMASTER工程

FreeMASTER演示工程保存在Debug/Project.pmpx文件中。双击该文件可打开FreeMASTER工程。

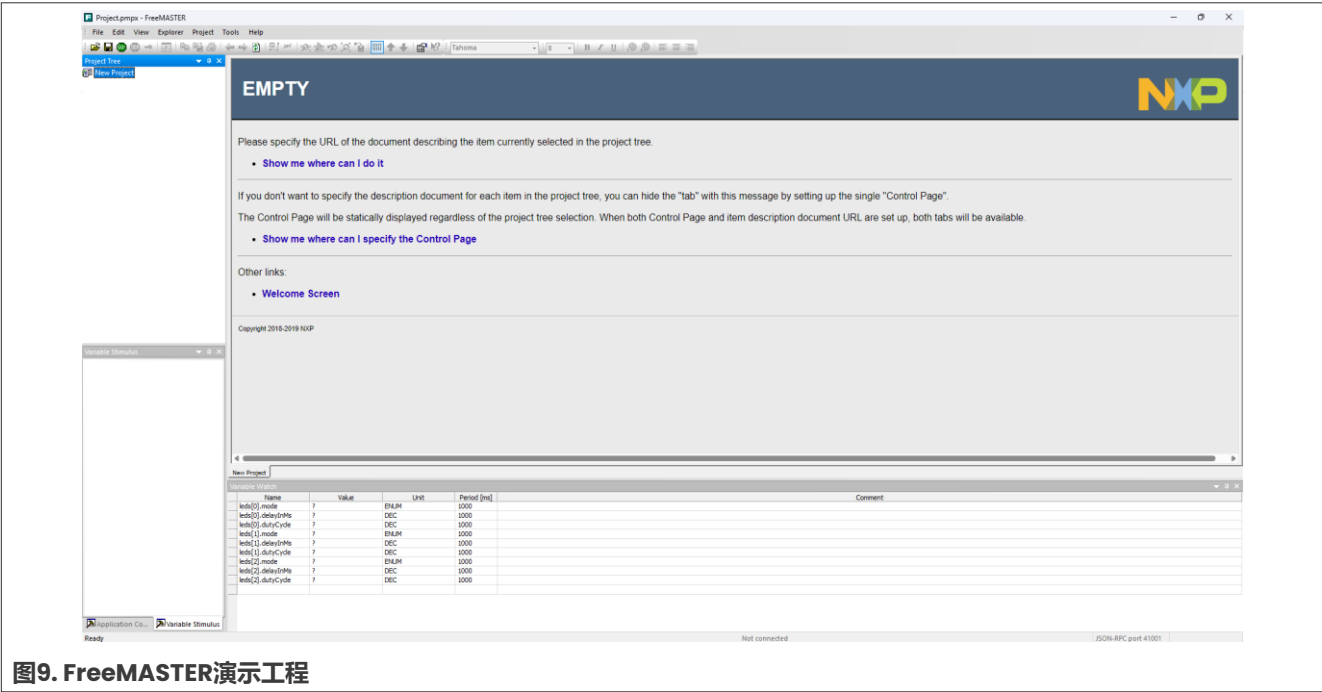
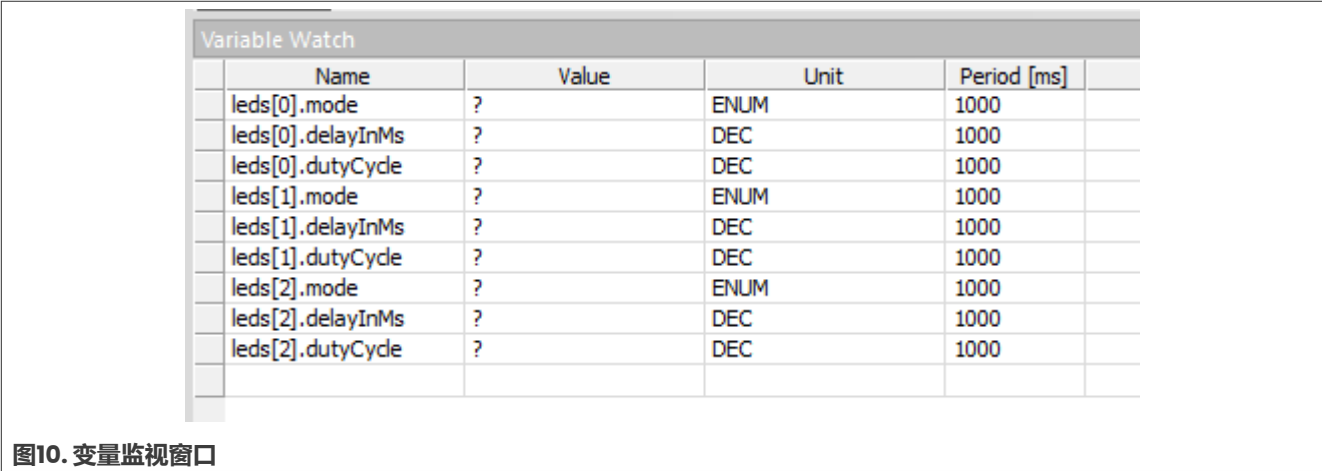
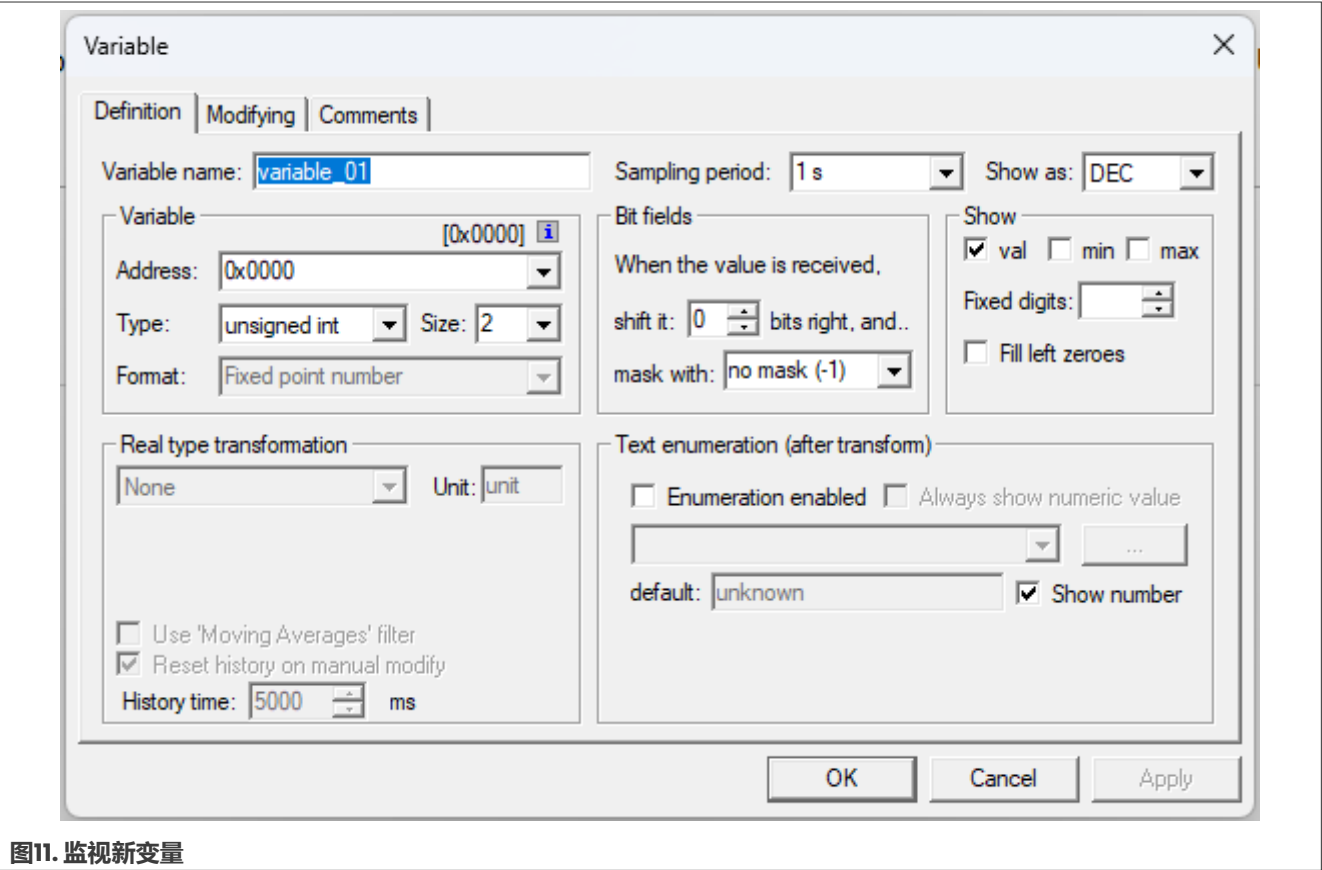


图9. FreeMASTER演示工程

打开此工程后，会出现“Variable Watch”窗口。该窗口包含演示工程所用的参数变量。“Value”列初始显示为“?”，因为FreeMASTER尚未建立通信。“Unit”列显示变量类型，而“Period”列显示变量的刷新周期。



用户可以通过双击空行来监视一个新变量。如果映射文件已正确加载，用户可以直接在 “Address” 字段中访问所需的变量。此外，还可以通过设置正确的地址和大小来添加自定义变量。



在本演示工程中，FreeMASTER使用CMSIS-DAP板载调试器与FRDM-MCXA153开发板通信。如果用户想使用LPUART连接此开发板，则需要执行以下步骤。打开 “Project -> Options” 菜单，选择 “RS232” 并输入正确的端口和波特率。点击绿色的 “GO” 按钮，或使用快捷键 “Ctrl + G” 来启动通信。

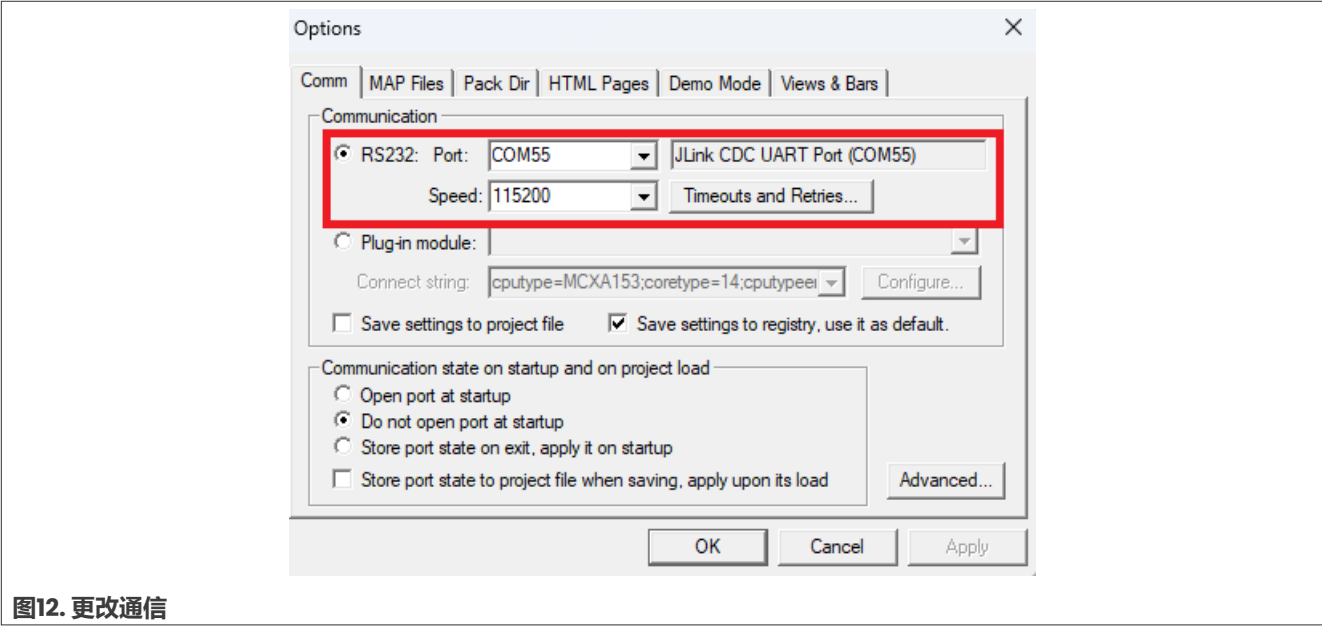


图12. 更改通信

通信建立后，“Variable Watch”窗口会自动刷新变量。

Variable Watch					
	Name	Value	Unit	Period [ms]	
	leds[0].mode	OFF	ENUM	1000	
	leds[0].delayInMs	500	DEC	1000	
	leds[0].dutyCycle	50	DEC	1000	
	leds[1].mode	OFF	ENUM	1000	
	leds[1].delayInMs	500	DEC	1000	
	leds[1].dutyCycle	50	DEC	1000	
	leds[2].mode	OFF	ENUM	1000	
	leds[2].delayInMs	500	DEC	1000	
	leds[2].dutyCycle	50	DEC	1000	

图13. 刷新的变量

现在可以编辑这些变量，板载 LED 的状态会随之改变。例如，如果将 “leds[0].mode” 字段改为 “PWM”，蓝色LED会以50%的亮度点亮。要改变亮度，可以将 “leds[0].dutyCycle” 字段的值编辑为0到100之间。如果 “leds[0].mode” 字段的值为 “LOGIC”，LED会以500毫秒的间隔闪烁。要更改延迟时间，可以将 “leds[0].delayInMs” 字段的值编辑为0到1000之间，步长为10毫秒。其他LED的操作方法与此相同。





Name	Value	
leds[0].mode	PWM	E
leds[0].delayInMs	500	D
leds[0].dutyCycle	25	D
leds[1].mode	PWM	E
leds[1].delayInMs	500	D
leds[1].dutyCycle	37	D
leds[2].mode	PWM	E
leds[2].delayInMs	500	D
leds[2].dutyCycle	49	D

图14. LED状态

## 5 GUI Guider工程

GUI Guider演示工程位于lvgl/lvgl.guiguider。要打开此工程，请双击此文件或在 “Import a local project” 字段中选择此文件。

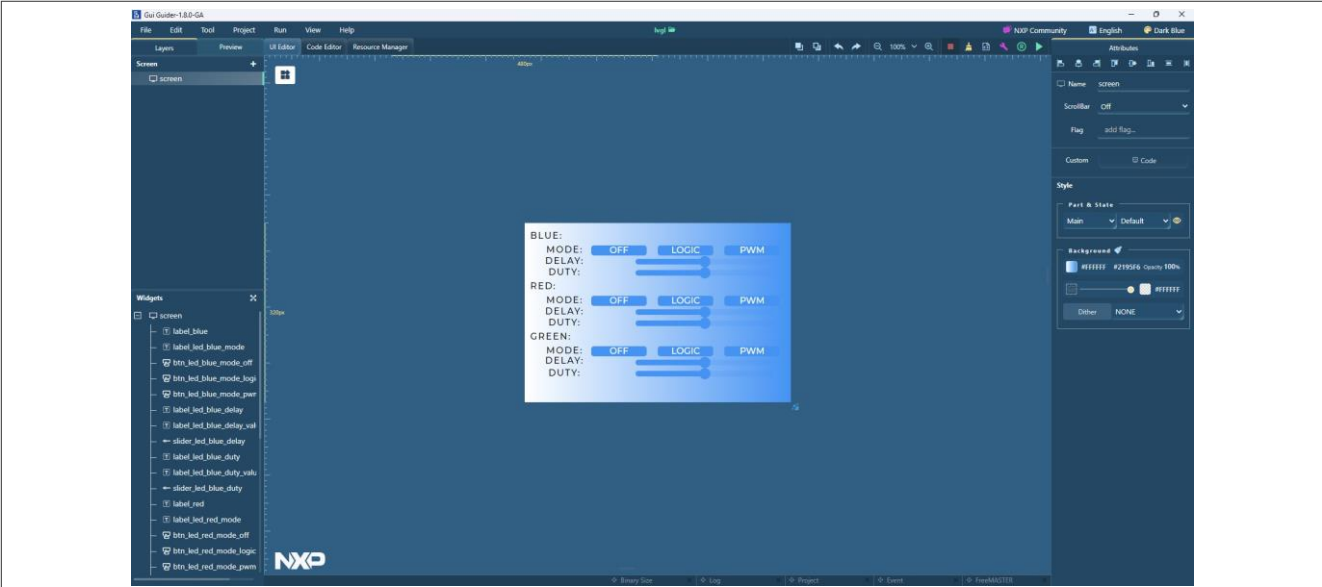


图15. GUI Guider工程

在本演示工程中，按钮和滑块均可与FreeMASTER配合使用。按钮可以写入所选的 LED 工作模式，而滑块可以更改延迟间隔或占空比。查看“Event”窗口以添加或修改事件。例如，下图显示了按钮和滑块事件。LED蓝色OFF模式按钮将“leds[0].mode”变量设置为枚举值“OFF”。滑块比较复杂。它在“released”事件中添加自定义代码。该代码会获取当前滑块值，将其乘以10作为延迟间隔，并将其写入“leds[0].delayInMs”变量。这样就能简单地更改滑块的属性。我们想要一个10毫秒的步长，因此我们编写了一段自定义代码。用户可以编写更复杂的代码，以适应应用需求。

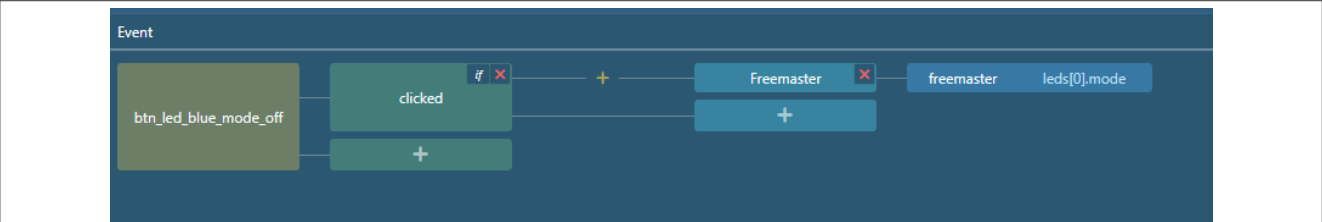


图16. LED蓝色OFF模式按钮事件

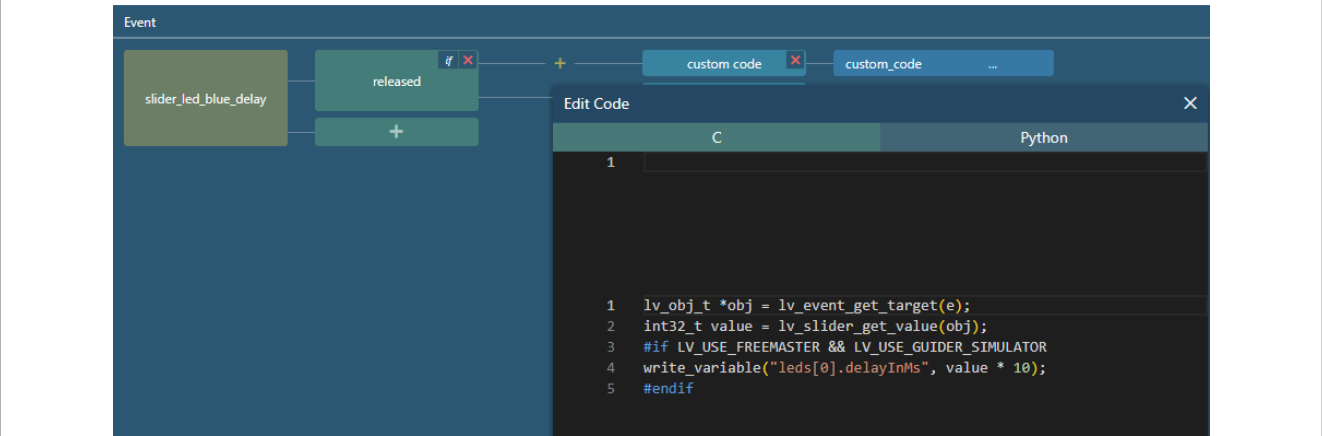


图17. LED蓝色延迟间隔滑块事件

要连接FreeMASTER，请打开FreeMASTER并按照前述方式加载工程。打开GUI Guider右下角的“FreeMASTER”窗口，点击“Link To FreeMASTER Server”按钮。如果修改了连接参数，请进行相应的更改；否则请保留默认值。

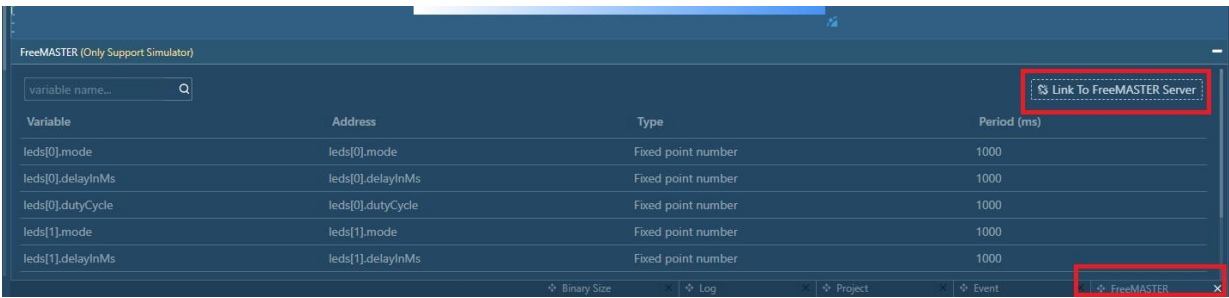


图18. FreeMASTER窗口

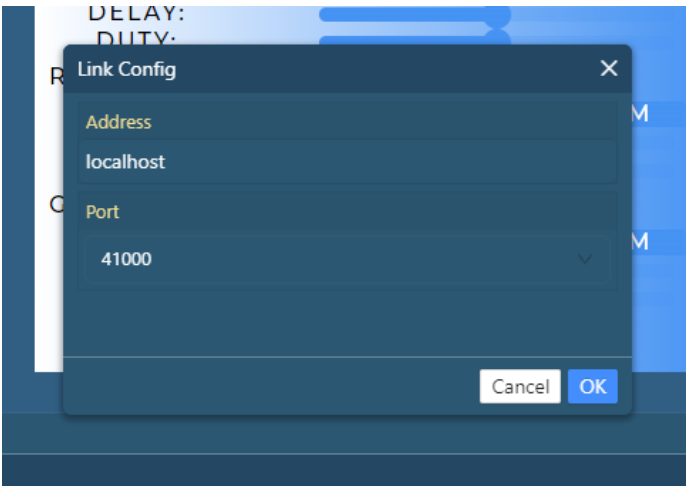


图19. 正在连接FreeMASTER服务器

连接到 FreeMASTER 服务器后，使用FreeMASTER运行模拟器。否则，模拟器将无法通过FreeMASTER进行读取或写入。要运行模拟器，请点击“Generate Code & Build & Run”按钮，或按下“Ctrl + Q”快捷键。请运行C语言模拟器，而不是MicroPython模拟器。本工程使用了自定义代码，该代码仅使用C语言实现。

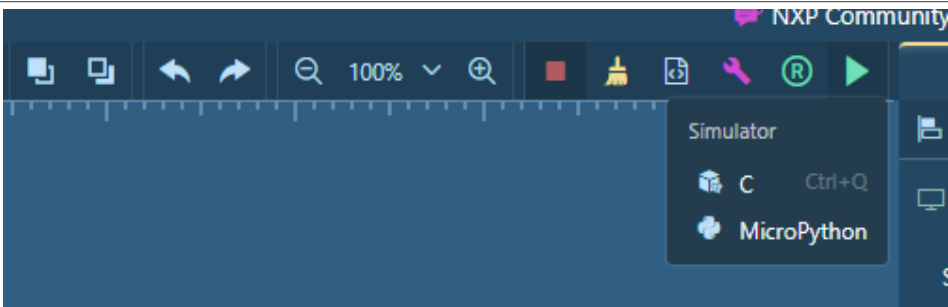


图20. 运行模拟器

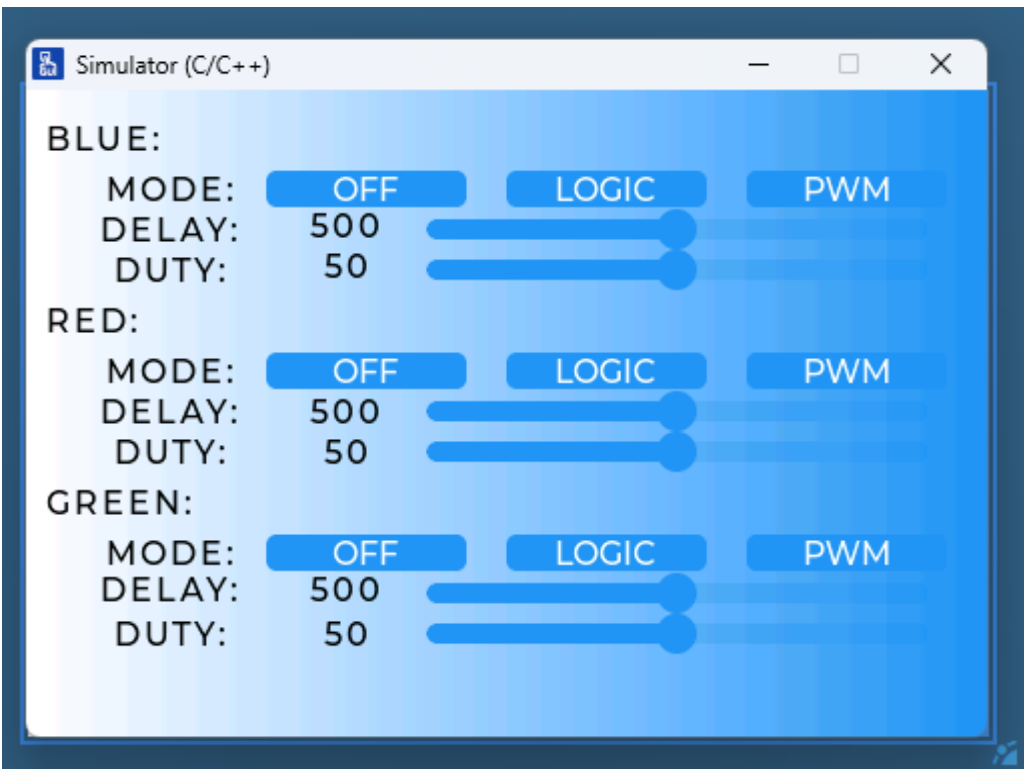
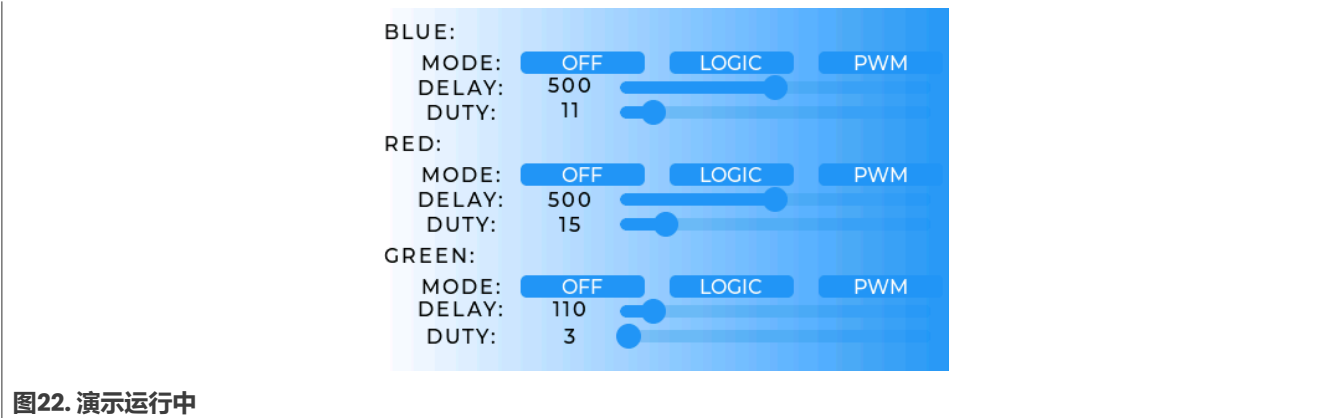


图21. 模拟器选项

点击按钮或拖动滑块来更改所选LED的工作状态。





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文档编号	发布日期	说明
AN14507 v.1.0	2025年1月6日	• 初始版本

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