

**ARM[®] Cortex[®]-M
32-bit Microcontroller****NuMicro[®] Family
DALI 2nd Slave
User Manual**

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1 GENERAL DESCRIPTION

The Nuvoton DALI 2nd Slave is the specific development tool for DALI application. DALI is a protocol for digital addressable lighting device. The Arm[®] Cortex[®]-M0 core NuMicro[®] NDA102 series microcontroller is used as the main microcontroller in the demo board.

The NuMicro[®] NDA102 series 32-bit microcontrollers are embedded with ARM[®] Cortex[®]-M0 core for industrial applications which need high performance, high integration, and low cost. It runs up to 48 MHz and offers 29.5 KB embedded program Flash, size configurable Data Flash (shared with program Flash), and 4 KB SRAM. The NDA102 series has many system level peripheral functions, such as I/O Port, Timer, UART, SPI, I²C, PWM, ADC, Watchdog Timer, Analog Comparator, Hardware Divider and Brown-out Detector. These useful functions make the demo board suitable for DALI standard implementations, and helps users to accelerate the development process. The NDA102's fast computing ability allows faster device control and compound applications.

1.1 Feature

- Compliance
 - IEC 62386-102:2014
 - IEC 62386-207:2009
 - IEC 62386-206:2009
 - IEC 62386-209:2011 (Colour Type Tc)
 - Future support: IEC 62386-103:2014, IEC 62384-2XX, IEC 62384-3XX
- Color and dimming control for RGB LED
- ADC, ECAP and UART interface for secondary development
- Easily connect to Nuvoton DALI Master and software tool - DALI Controller on PC

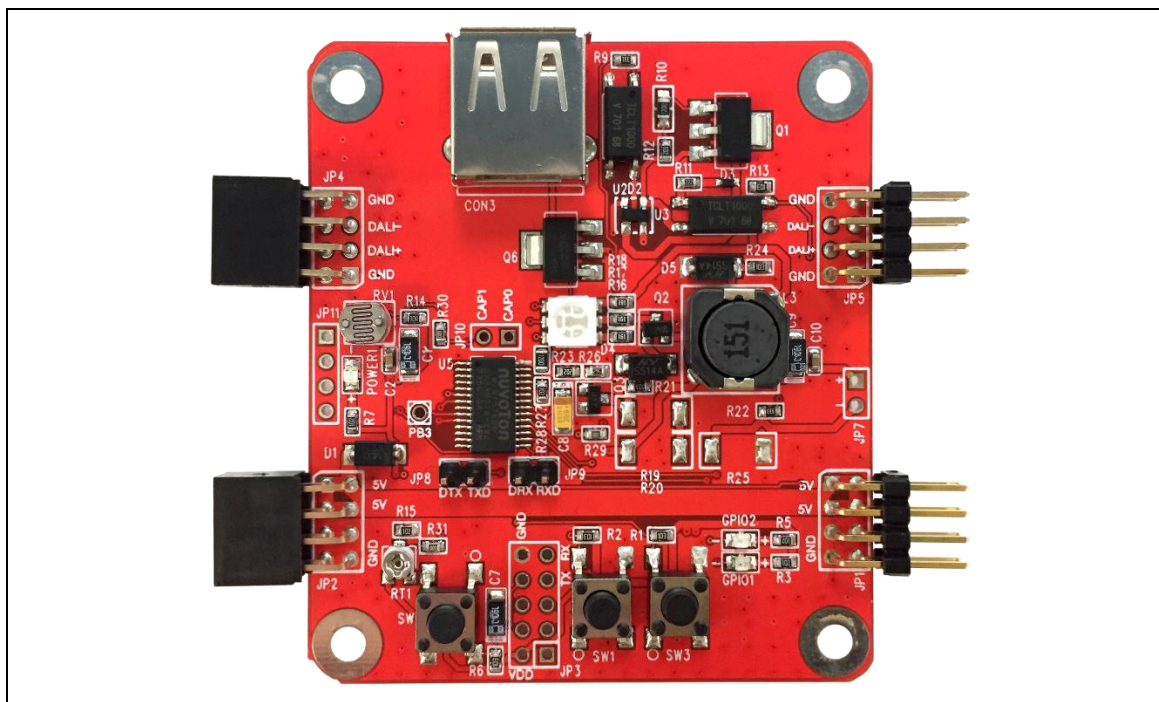


Figure 1-1 DALI 2nd Slave

1.2 NuMicro[®] NDA102 Series Feature

- ARM[®] Cortex[®]-M0 core running up to 48 MHz
- Memory
 - 29.5 KB Flash memory for program memory (APROM)
 - Configurable Flash memory for data memory (Data Flash)
 - 2 KB Flash memory for loader (LDROM)
 - Three 0.5 KB Flash memory for security protection (SPROM)
 - 4 KB SRAM for internal scratch-pad RAM (SRAM)
- Up to 8-ch PWM output with 16-bit resolution
- Fast computing ability by using hardware divider
- Up to 8 single-end ADC input channel with 12-bit resolution and 10-bit accuracy guaranteed
- The A/D converters can be started by software, external pin or PWM trigger
- Operating temperature: -40°C ~105°C

2 NUVOTON DALI 2nd SLAVE HARDWARE INTRODUCTION

The Nuvoton DALI 2nd Slave uses NuMicro® NDA102 series NDA102EC1 as the main microcontroller. The demo board can connect to a DALI system through the DALI bus. The demo board contains one RGB LED, one photoresistor, one potentiometer, one ICE interface and peripheral interfaces. It is suitable for DALI standards implementations.

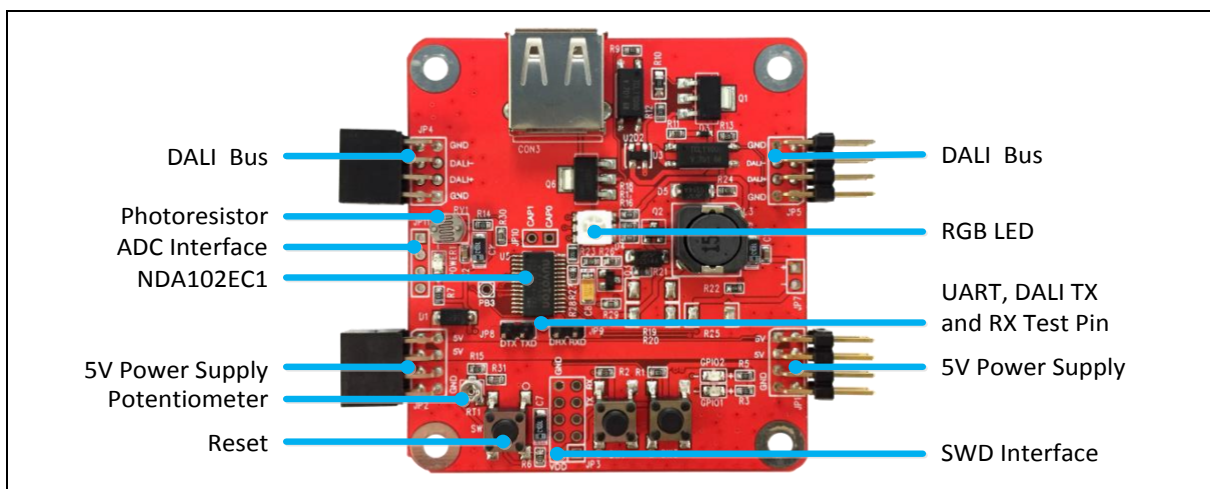


Figure 2-1 Nuvoton DALI 2nd Slave

2.1 Jumper Description

2.1.1 Power Interface

JP1 & JP2	Interface Signal Name	MCU Pin Assignment
Pin 1, 2, 3, 4	5 V	VDD
Pin 5, 6, 7, 8	GND	VSS

2.1.2 ICE interface for Nu-Link

JP3	Interface Signal Name	MCU Pin Assignment
Pin 2	VDD	VDD
Pin 4	ICE_DAT	ICE_DAT
Pin 6	ICE_CLK	ICE_CLK
Pin 7	UART0_TX	UART0_TX
Pin 8	ICE_RST	nRESET
Pin 9	UART0_RX	UART0_RX
Pin 10	GND	VSS

2.1.3 DALI Bus Interface

JP4 & JP5	Interface Signal Name	MCU Pin Assignment
Pin 1, 2, 7, 8	GND	VSS
Pin 3, 4	DALI+	DALI+
Pin 5, 6	DALI-	DALI-

2.1.4 DALI Interface and UART Interface

JP8	Interface Signal Name	MCU Pin Assignment
Pin 1	DTX	PC.2
Pin 2	TXD	UART1_TX / PD.3

JP9	Interface Signal Name	MCU Pin Assignment
Pin 1	DRX	PB.0
Pin 2	RXD	UART1_RX / PD.4

2.1.5 Peripheral Interface

JP10	Interface Signal Name	MCU Pin Assignment
Pin 1	CAP0	ECAP_P0 / PC.4
Pin 2	CAP1	ECAP_P1 / PB.1

JP11	Interface Signal Name	MCU Pin Assignment
Pin 1	ADC0_CH2	ADC0_CH2 / PB.2
Pin 2	ADC1_CH0	ADC1_CH0 / PB.4
Pin 3	ADC0_CH4	ADC0_CH4 / PC.1
Pin 4	ADC0_CH3	ADC0_CH3 / PC.0

3 HOW TO START NUVOTON DALI 2nd SLAVE ON THE KEIL μ VISION[®] IDE

3.1 Keil μ Vision[®] IDE Software Download and Install

Please visit the Keil company website (<http://www.keil.com>) to download the Keil μ Vision[®] IDE and install the RVMDK.

3.2 Nuvoton Nu-Link Driver Download and Install

Please visit the Nuvoton company NuMicro[®] website (<http://www.nuvoton.com/NuMicro>) to download “NuMicro[®] Keil μ Vision[®] IDE driver” file. When the Nu-Link driver has been well downloaded, please unzip the file and execute the “Nu-Link_Keil_Driver.exe” to install the driver.

3.3 Hardware Setup

The hardware setup is shown as Figure 3-1.



Figure 3-1 Hardware Setup

4 HOW TO START NUVOTON DALI 2nd SLAVE ON THE IAR EMBEDDED WORKBENCH

4.1 IAR Embedded Workbench Software Download and Install

Please connect to IAR company website (<http://www.iar.com>) to download the IAR Embedded Workbench and install the EWARM.

4.2 Nuvoton Nu-Link Driver Download and Install

Please visit the Nuvoton company NuMicro[®] website (<http://www.nuvoton.com/NuMicro>) to download the “NuMicro[®] IAR EWARM Driver” file. When the Nu-Link driver has been well downloaded, please unzip the file and execute the “Nu-Link_IAR_Driver.exe” to install the driver.

4.3 Hardware Setup

The hardware setup is shown as Figure 4-1.



Figure 4-1 Hardware Setup

5 NUVOTON DALI 2nd SLAVE QUICK START

5.1 Hardware Setup

Connect the Nuvoton DALI 2nd Slave. DALI Bus interface JP4 or JP5 to the DALI control device as Figure 5-1. The DALI Bus can be connected at any position.

Connect the power supply 5 V to the Nuvoton DALI 2nd Slave JP1 or JP2 as Figure 5-1.

It is recommended to use Nuvoton DALI Master as the DALI control device as Figure 5-2.

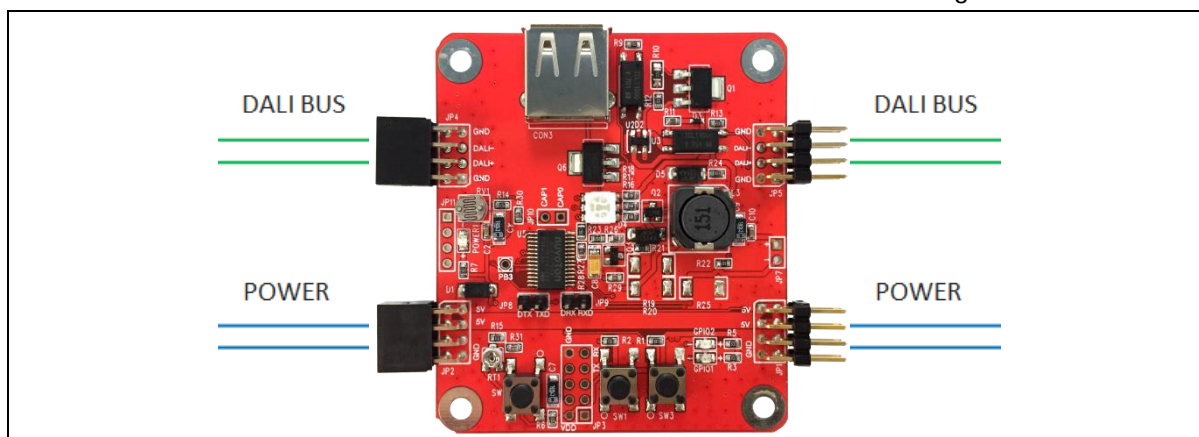


Figure 5-1 Connections of DALI Bus and Power Supply

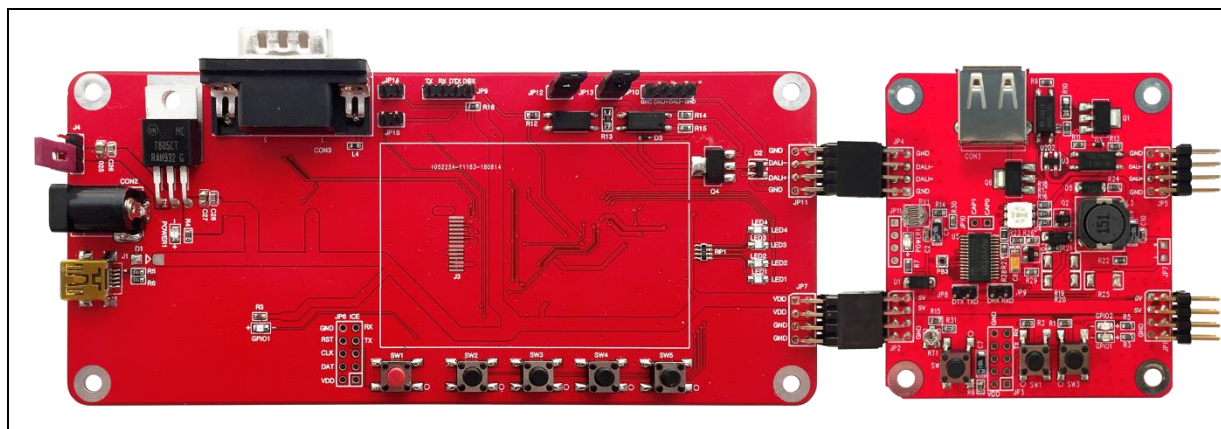


Figure 5-2 Nuvoton DALI Master with Nuvoton DALI 2nd Slave

5.2 Initialisation

Use the software tool - DALI Controller to do the initialisation. The DALI Controller can auto-detect the Nuvoton DALI Master through USB interface. Choose “New Initialization” to discover all control gear on the line. It will assign particular short address to each control gear as Figure 5-3.

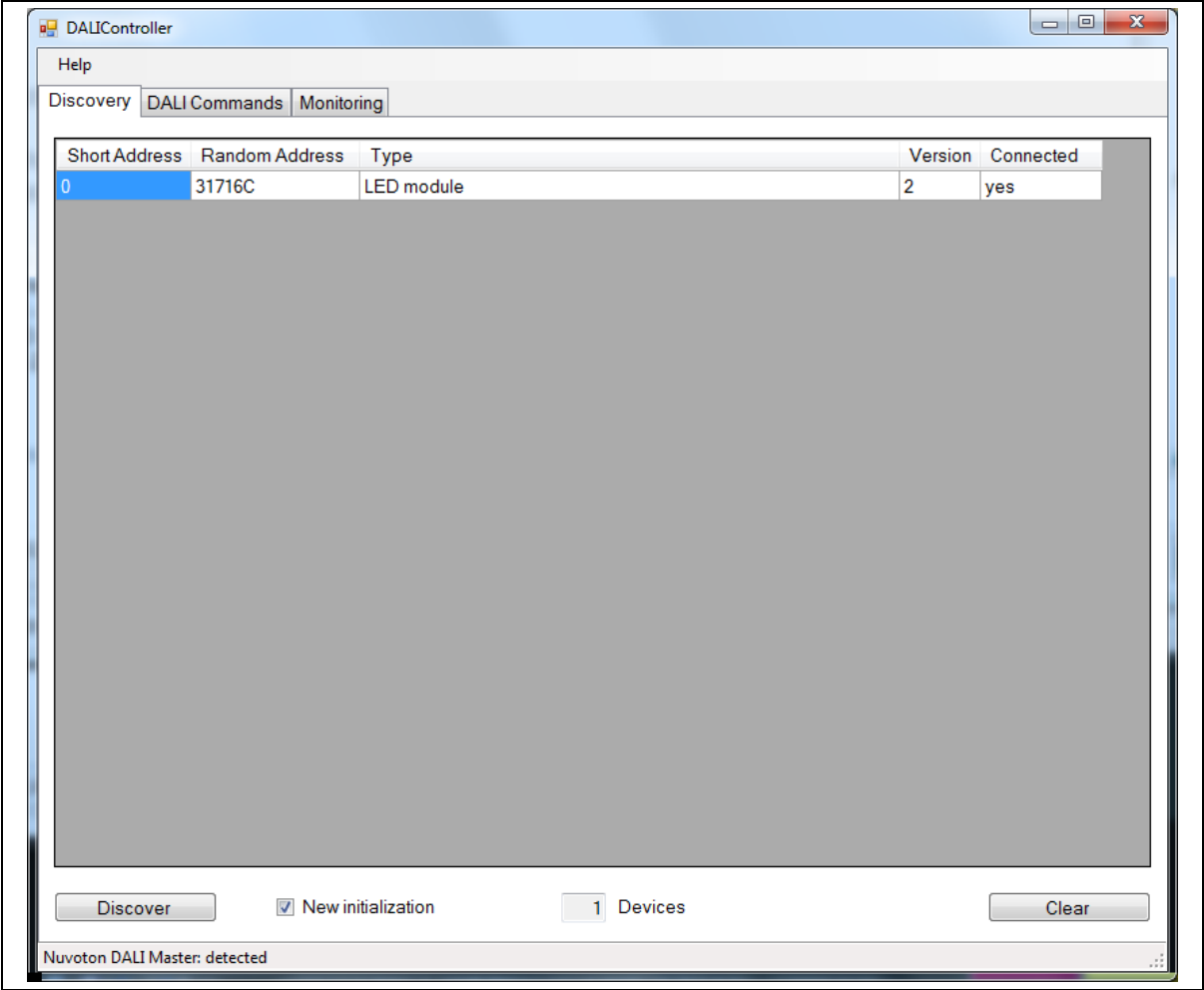


Figure 5-3 Initialisation

5.3 DALI Commands

Figure 5-4 shows the DALI command page in DALI Controller. Set up the DALI command and the destination, and then click “Send” button. Nuvoton DALI Master will send out the command to the DALI devices. The DALI command raw data will shown in the “Command send” text box. The DALI device’s answer will shown in the “Response” text box.

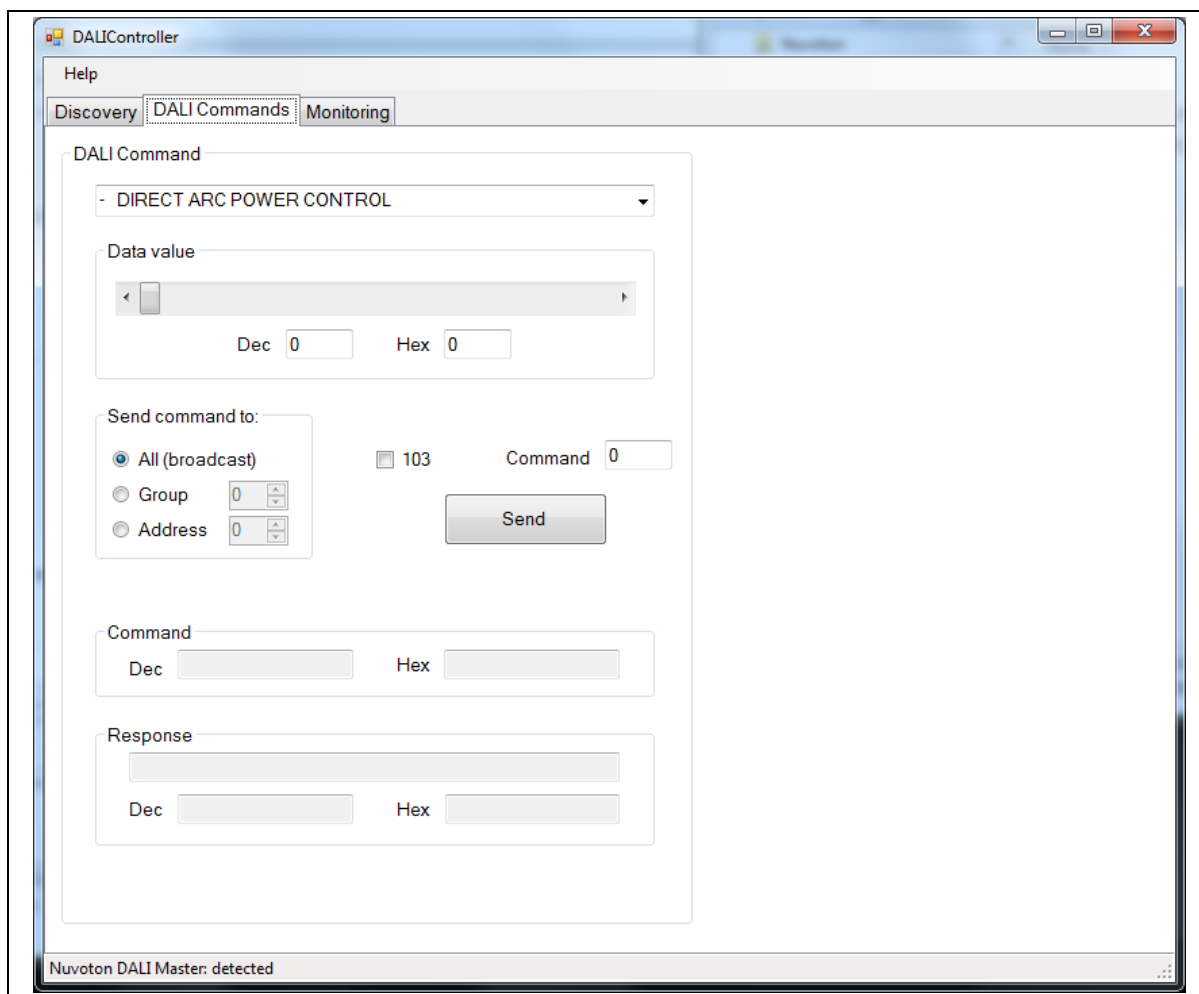


Figure 5-4 DALI Command Page

5.4 Monitoring Page

Figure 5-5 shows the monitoring page in DALI Controller. Every frame on DALI bus is shown in the monitoring page in real time.

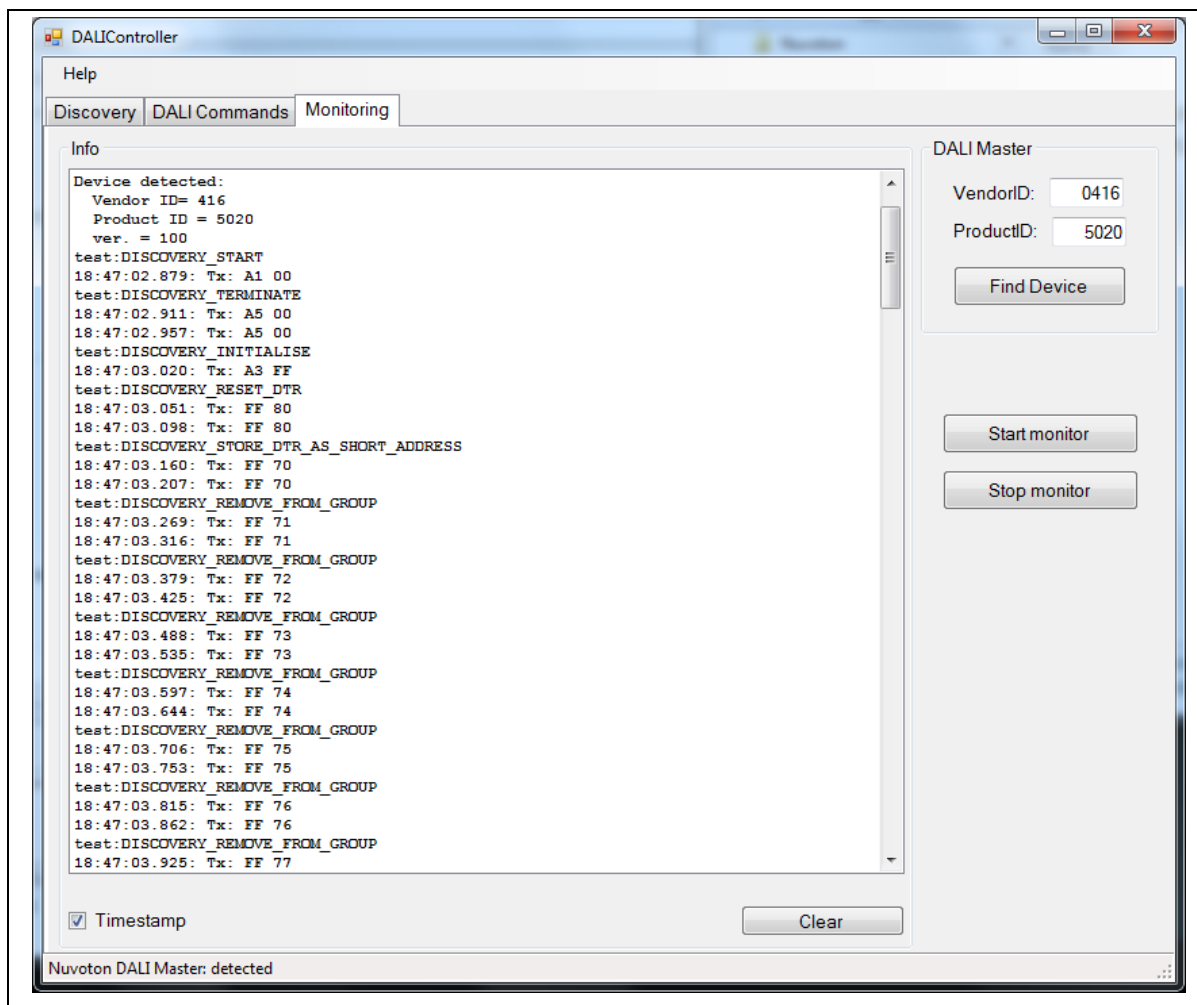


Figure 5-5 Monitoring Page

5.5 Button Function

The DALI 2nd Slave is not a fully-featured DALI device. Press SW3 button to simulate the “Lamp Failure” condition.

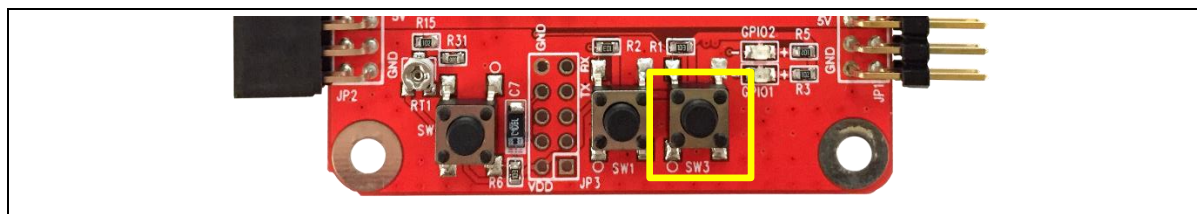


Figure 5-6 Lamp Failure Simulation

6 NUVOTON DALI 2nd SLAVE SCHEMATIC

6.1 NDA102EC1 Control Unit Schematic

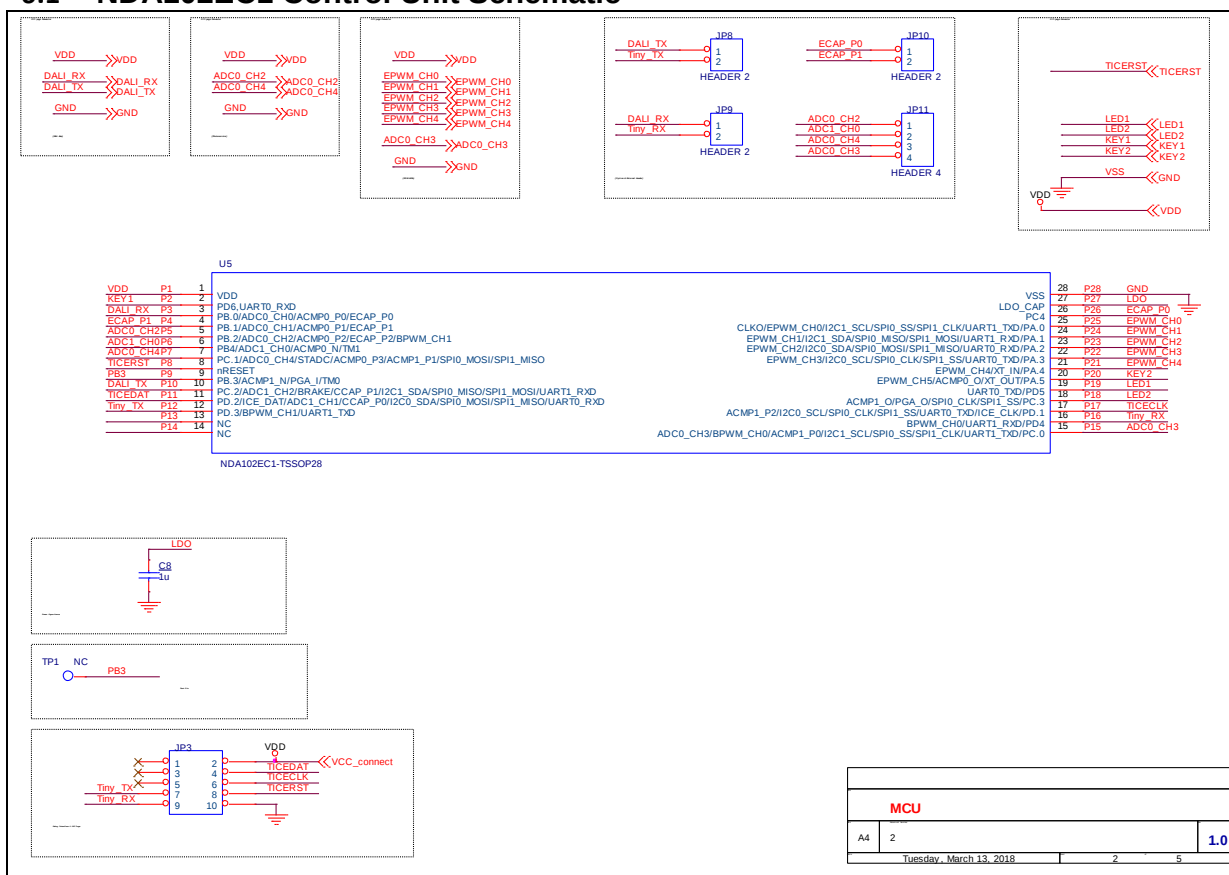


Figure 6-1 NDA102EC1 Control Unit

6.2 DALI Bus Schematic

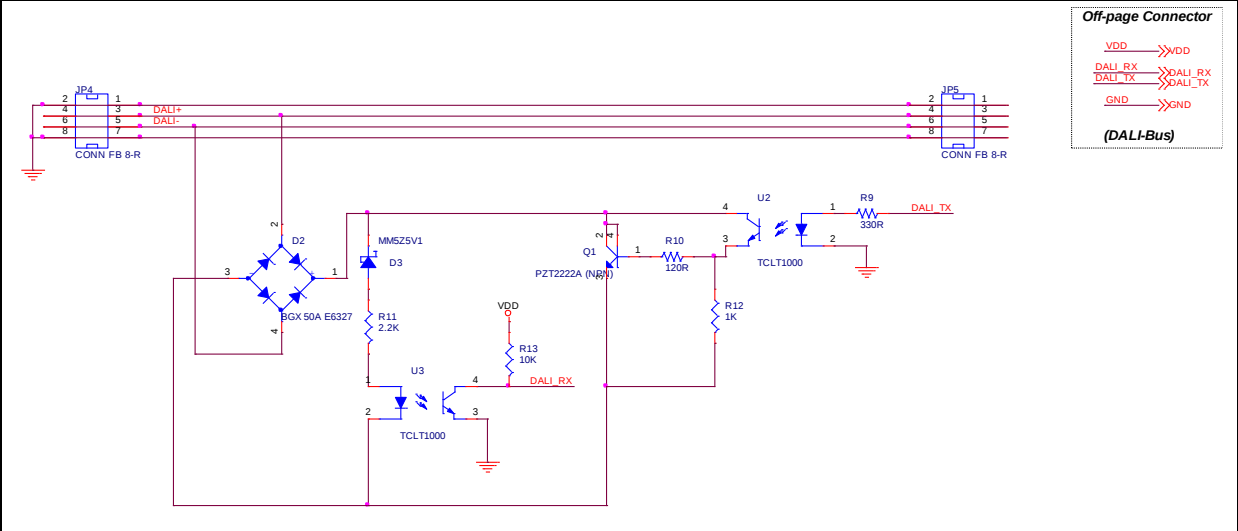


Figure 6-2 DALI Bus Schematic

6.3 LED Schematic

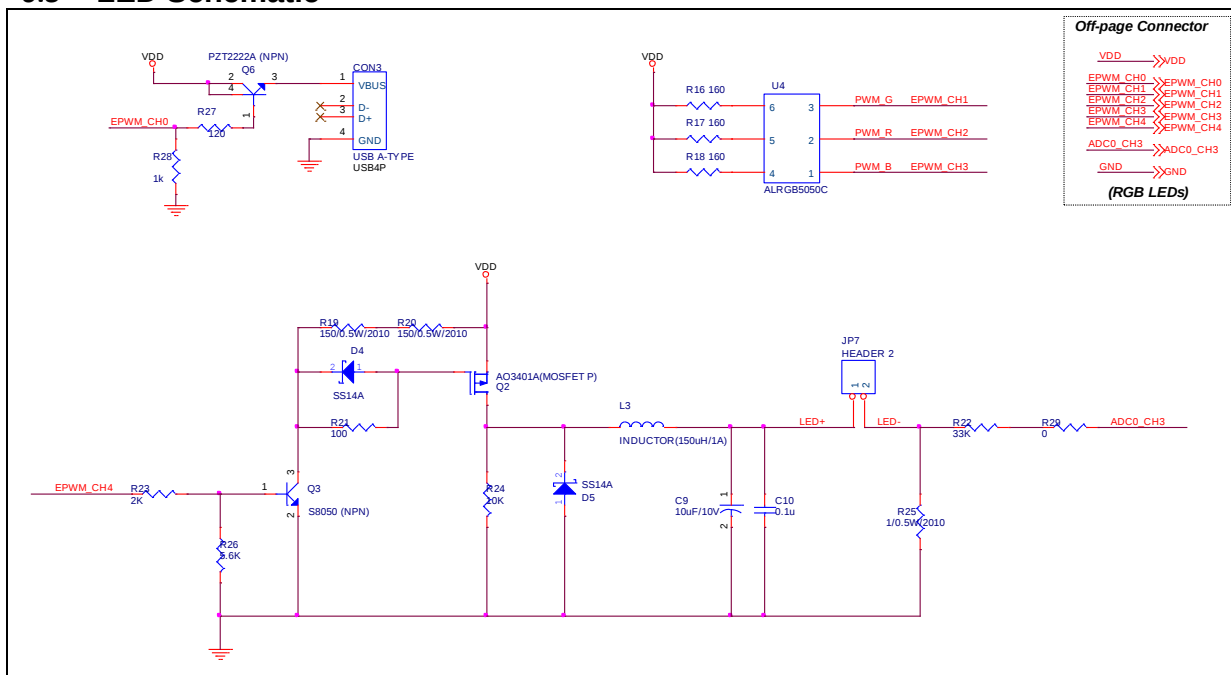


Figure 6-3 LED Schematic

6.4 Power and Peripheral Schematic

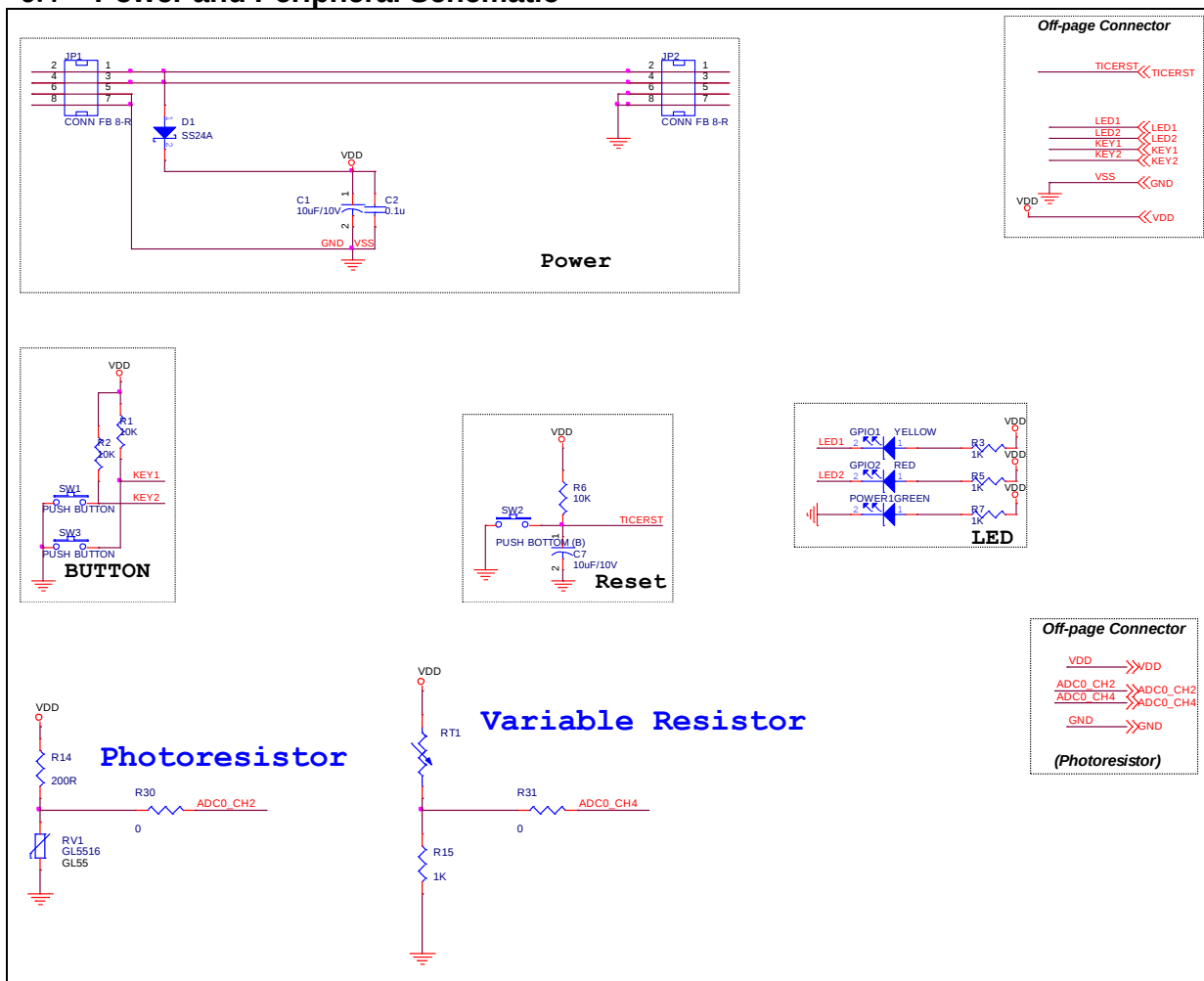


Figure 6-4 Power and Peripheral Schematic

7 REVISION HISTORY

Date	Revision	Description
2019.07.11	1.00	1. Initially issued.

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