XC800 Family

AP08133

DALI Control Device using XC836 DALI Board

Application Note

V1.1, 2012-10

Microcontrollers

Edition 2012-10

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XC83x
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Previous Version(s): 1.0

Page	Subjects (major changes since last revision)
-	Updated DALI Control Board Schematic - Part 1; Changed R5 from 1K to 560R.

Trademarks

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Table of Contents

1 Overview

Digital Addressable Lighting Interface (DALI) is a communication protocol for lighting control in buildings. The interface was first described in Annex E, IEC60929 standard for fluorescent lamp ballast. Subsequently, it was updated to the new standard IEC-62386, to include other lighting devices, such as LED, HID, and so on. The complete standard for control interface of electronic control gears was published in June 2009. The standard for lighting control devices is scheduled to be published in 2012.

DALI requires only a pair of wires to form the bus for communication to all devices on a single DALI network. Each piece of operating equipment with a DALI interface can be communicated with, over DALI, individually. Using a bi-directional data exchange, a DALI controller can query and set the status of each connected lighting device. As a standalone system, DALI can be operated with a maximum of 64 devices. Alternatively, DALI can be used as a subsystem via DALI gateways for connection to building management systems.

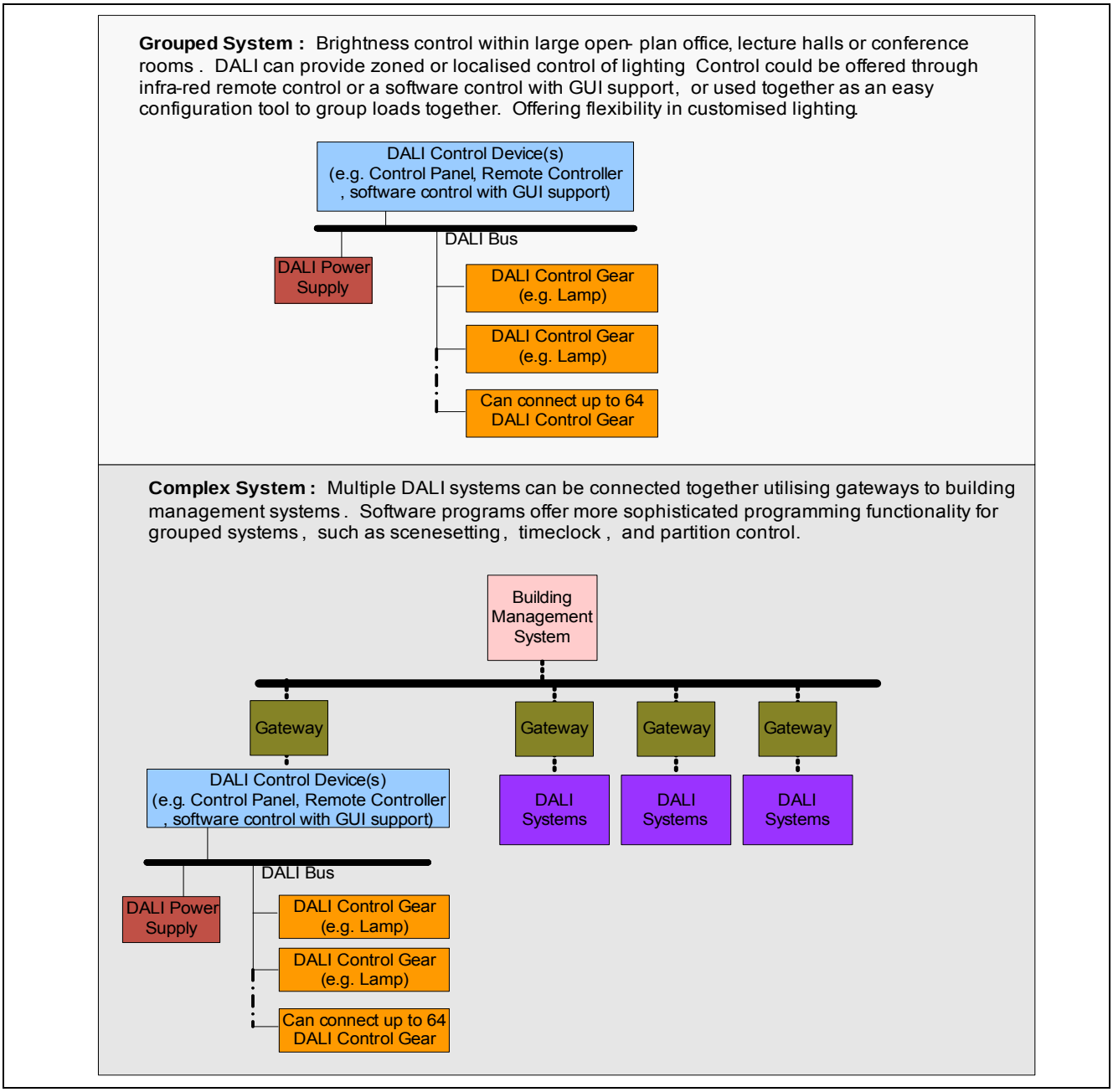


Figure 1 DALI system types

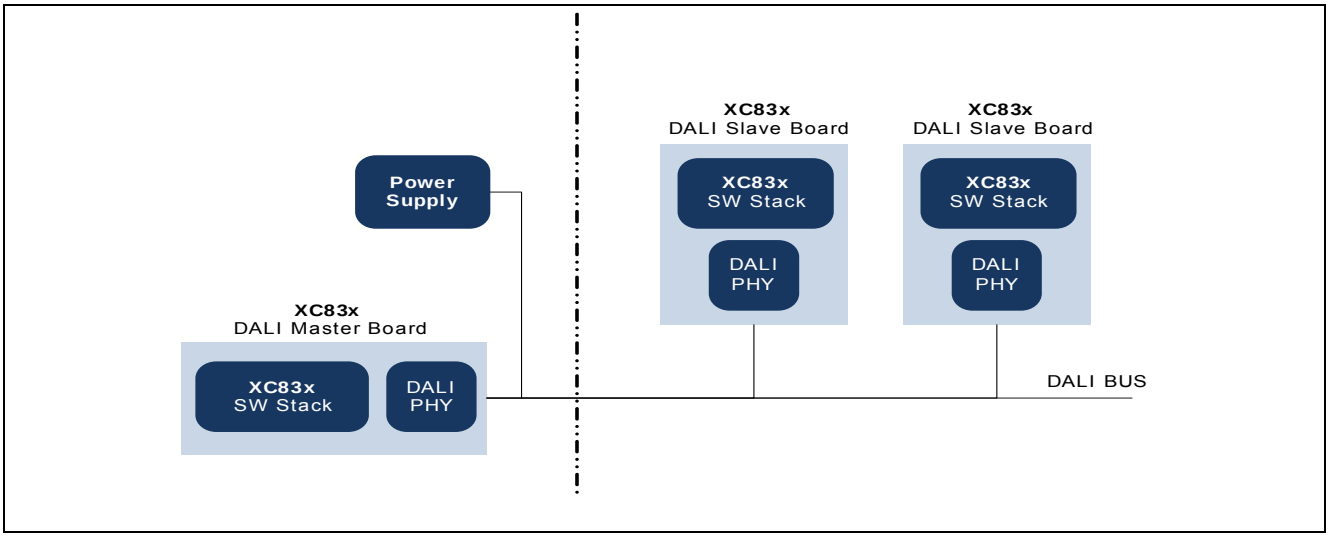


Figure 2 Block Diagram for DALI Control Device and Control Gear

An example solution for a DALI control device[1)] has been created using the Infineon XC836 DALI Board. This solution makes use of the available DIP switch on the XC836 DALI Board (KIT_DALI_RGB_XC836_DKV1) to send user commands to the connected DALI control gear.

This document describes how the DALI control device software has been constructed and demonstrates the supported software functions.

The following items are required for use with this application note:

- 2 sets of XC836 DALI Board (KIT_DALI_RGB_XC836_DKV1) including DALI Control Gear Software Stack (AP08102)

1) IEC-62386 Part 300 for Control Devices is scheduled to be published in September 2012. This application example is targeted at providing a method for the user to send out DALI commands frames.

2 Hardware Setup

This section describes the hardware setup required for this example application. The control device, which makes use of the XC836 DALI Board, has a standard 4 position DIP switch for user command decoding.

Details on the DALI control gear software and setup can be found in AP08102 DALI Control Gear Software Stack.

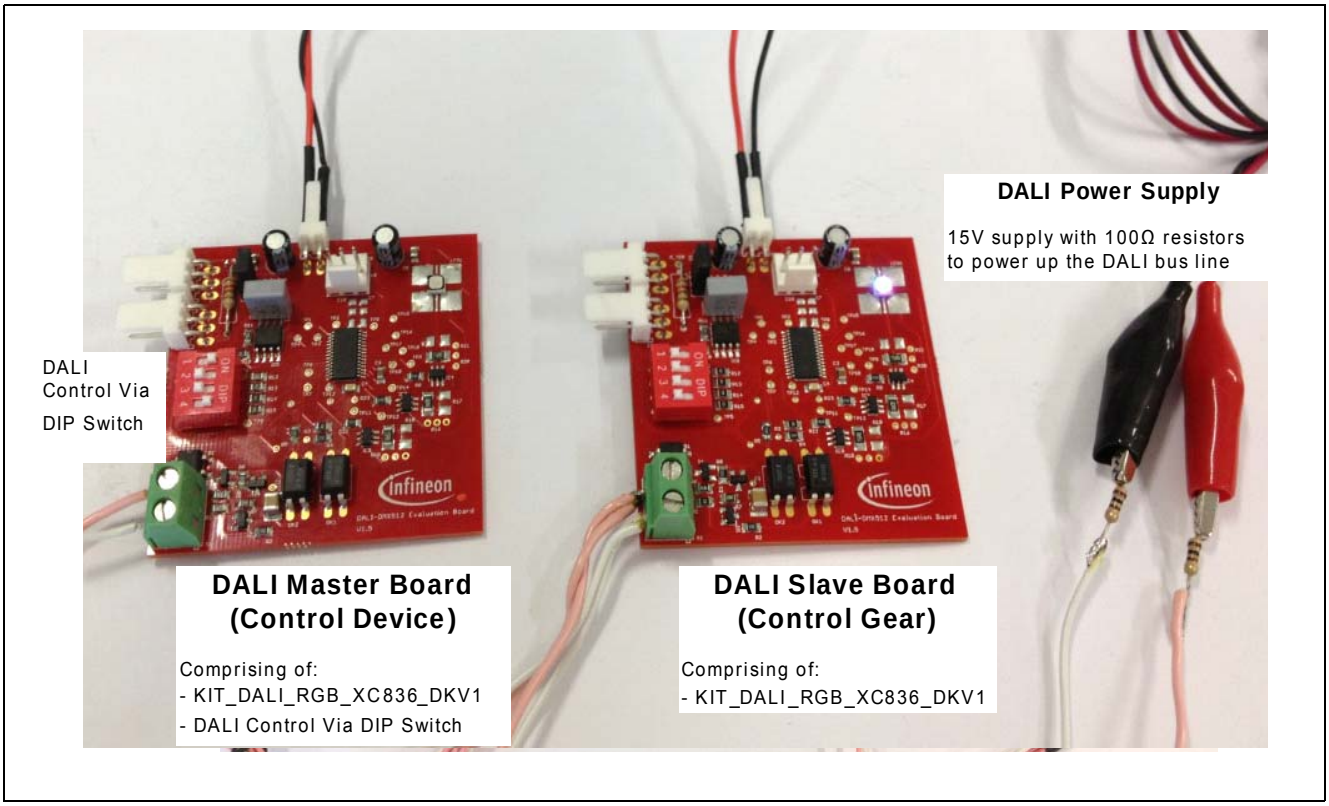


Figure 3 Hardware Setup for Infineon Control Device and Control Gear

The hardware setup for control device and control gear can be setup using the following steps:

1. Connect the DAP MiniWiggler to the DALI Control board and download the generated hexfile using XC800 FLOAD in DAVEBENCH™ or KEIL UVision4. (Control Device file: DALIKIT_Master.hex, Control Gear file: AP08102_v1_2_Slave.hex).
2. To supply power for the DALI bus, connect 100Ω resistors in series to each terminal of a power supply unit supplying 15VDC. This supplies the DALI bus for the DALI network devices.
3. Connect the DALI Control Device (Master) and Control Gear (Slave) to the DALI bus. This completes the DALI setup to control the device!

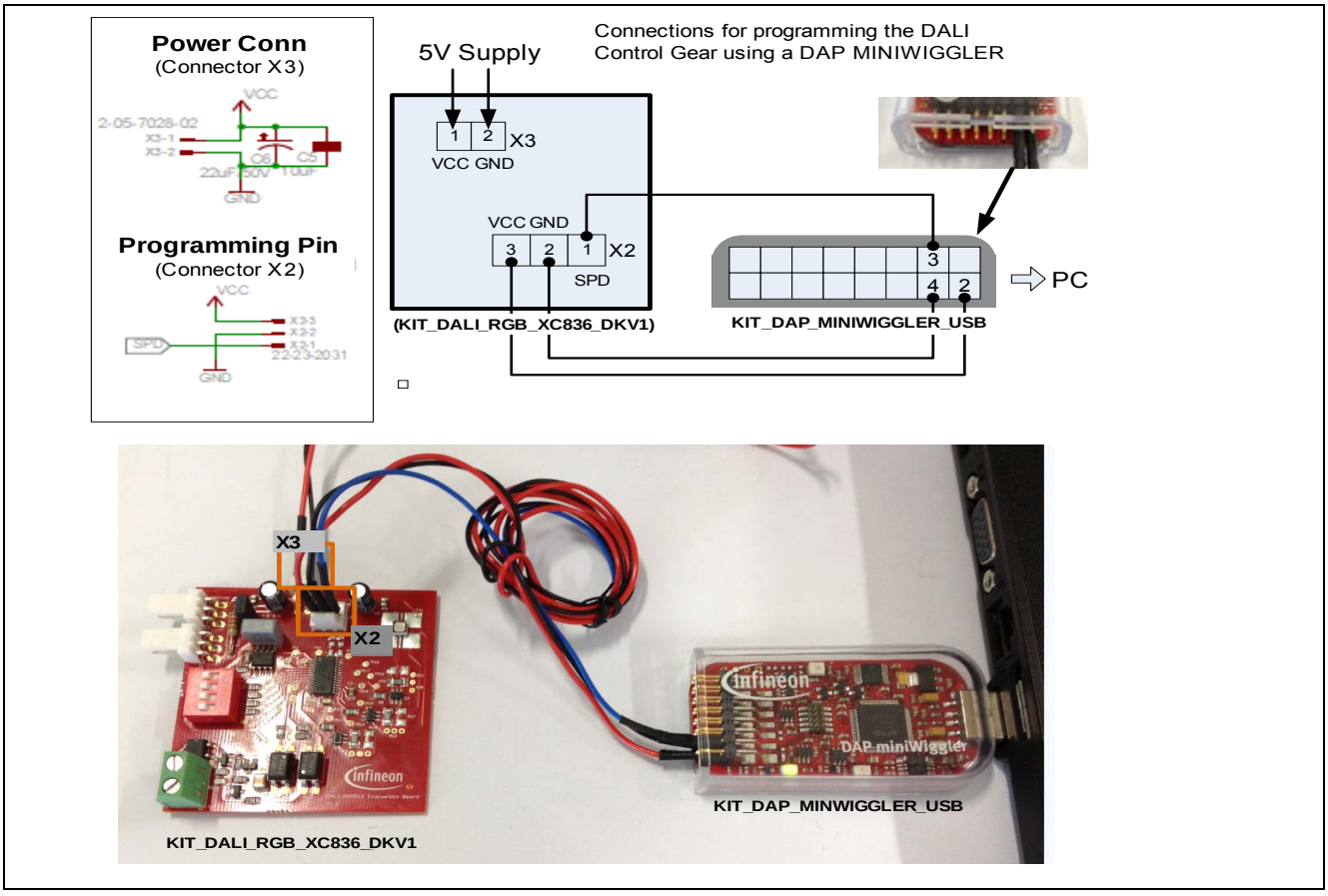


Figure 4 Programming the DALI Control Board using the DAP MiniWiggler

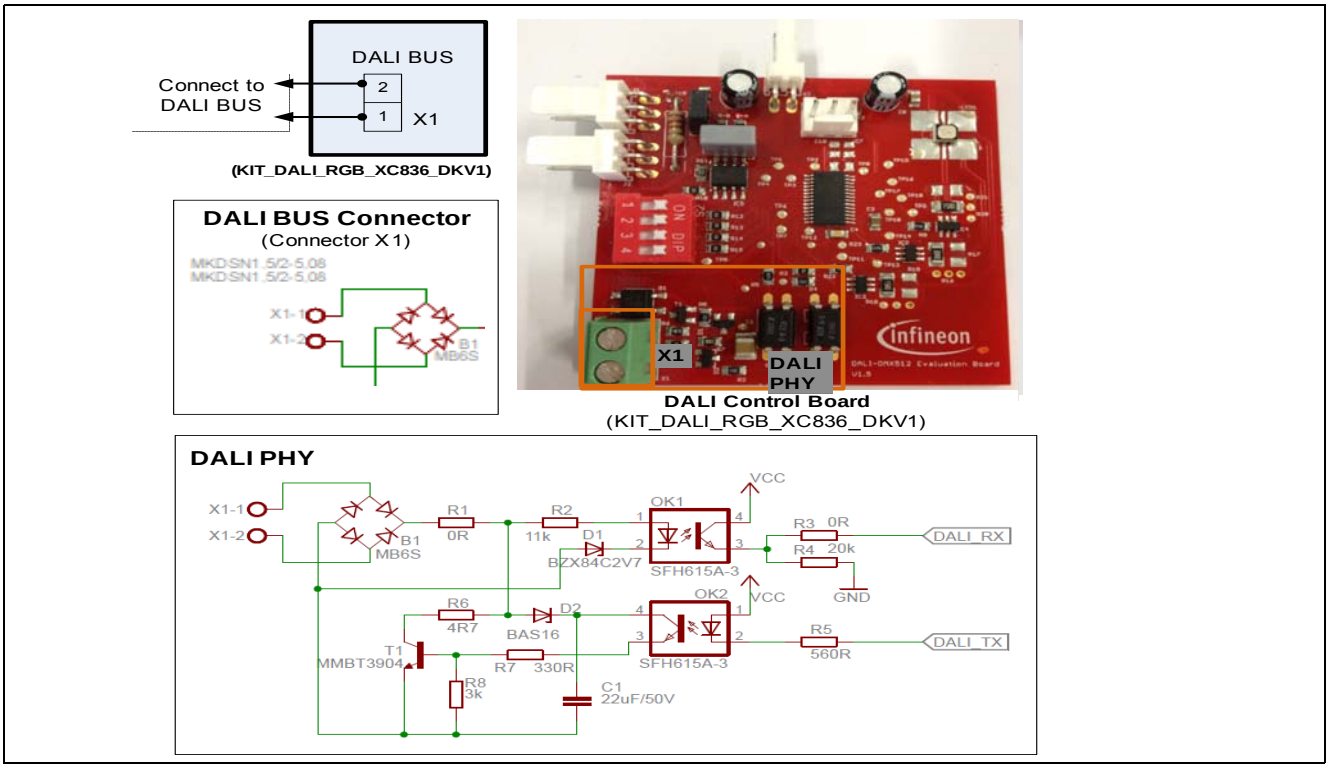


Figure 5 XC836 DALI Control Board

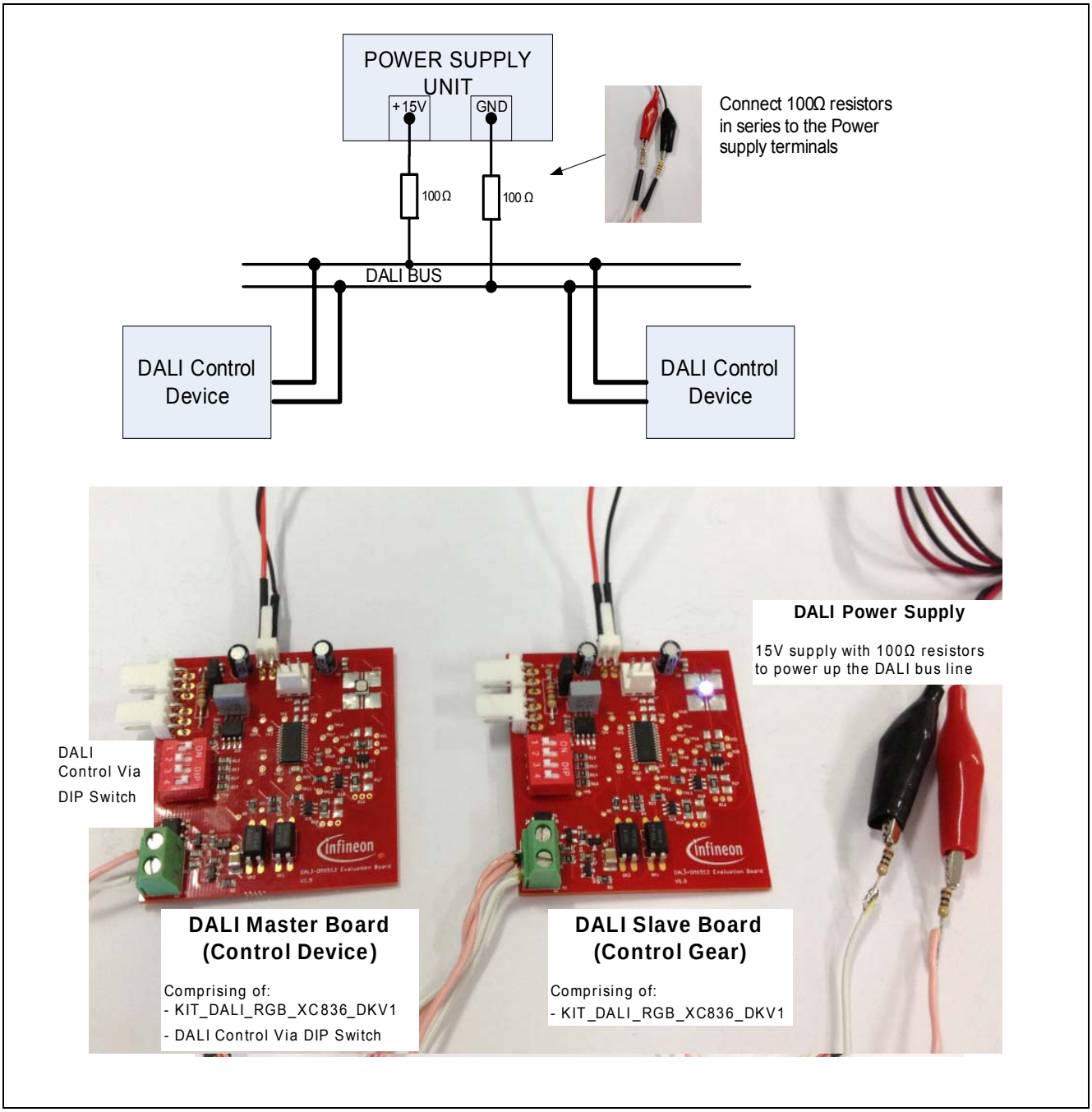


Figure 6 DALI Network Hardware Connection

3 DALI Control Device Software

This section describes the program operational flow and the software structure used for developing this example solution. This operation is presented in **Figure 7**.

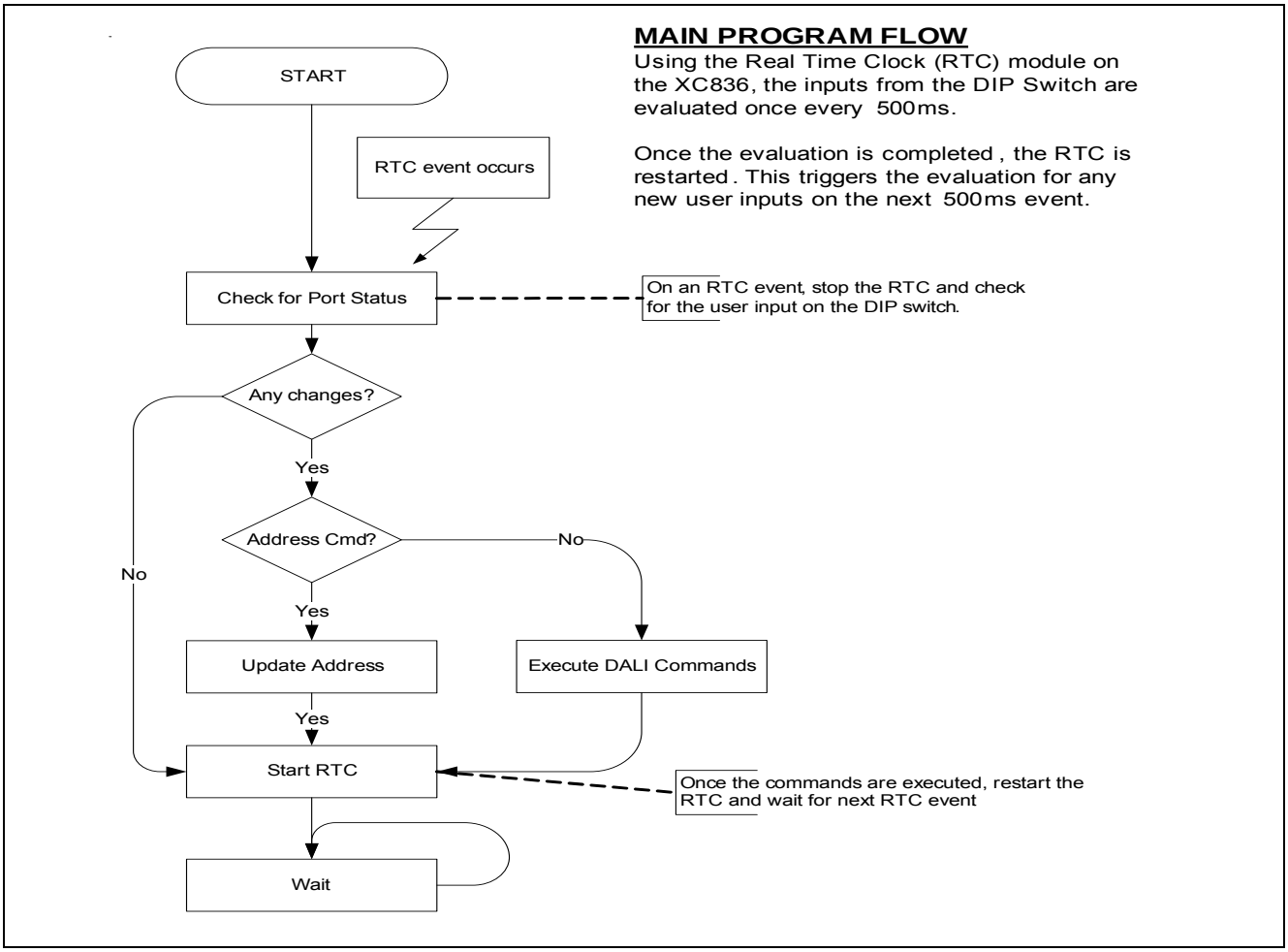


Figure 7 Main Program Flow

For code implementation, we have divided the software into two main layers:

- **DALI protocol layer**
  - Supports the translation of user commands into the desired DALI format to be sent through the DALI bus.
- **Application code layer**
  - Evaluates the user commands through the inputs from the DIP Switch on the XC836 DALI Board once every 500ms.

The following XC83x device modules are required for the implementation:

- GPIO for DALI
- Timer 0
- Timer 2
- GPIO for User Input
- Real-Time Clock (RTC)

Note: Configuration is performed via Infineon's Technologies' free tool DAvE™ 2, which generate the skeleton code based on the configurations set. The screen shots that follow are taken from DAvE™ 2.

3.1 DALI Protocol Layer

In the control device, the DALI protocol layer provides the translation of user commands into the desired DALI format to be sent and received through the DALI bus. For our example, the DALI bus chosen is P0.4 (Rxd) and P0.5 (Txd).

3.1.1 GPIO for DALI

Port 0.5 and Port 0.4 is used to transmit and receive DALI frames respectively.

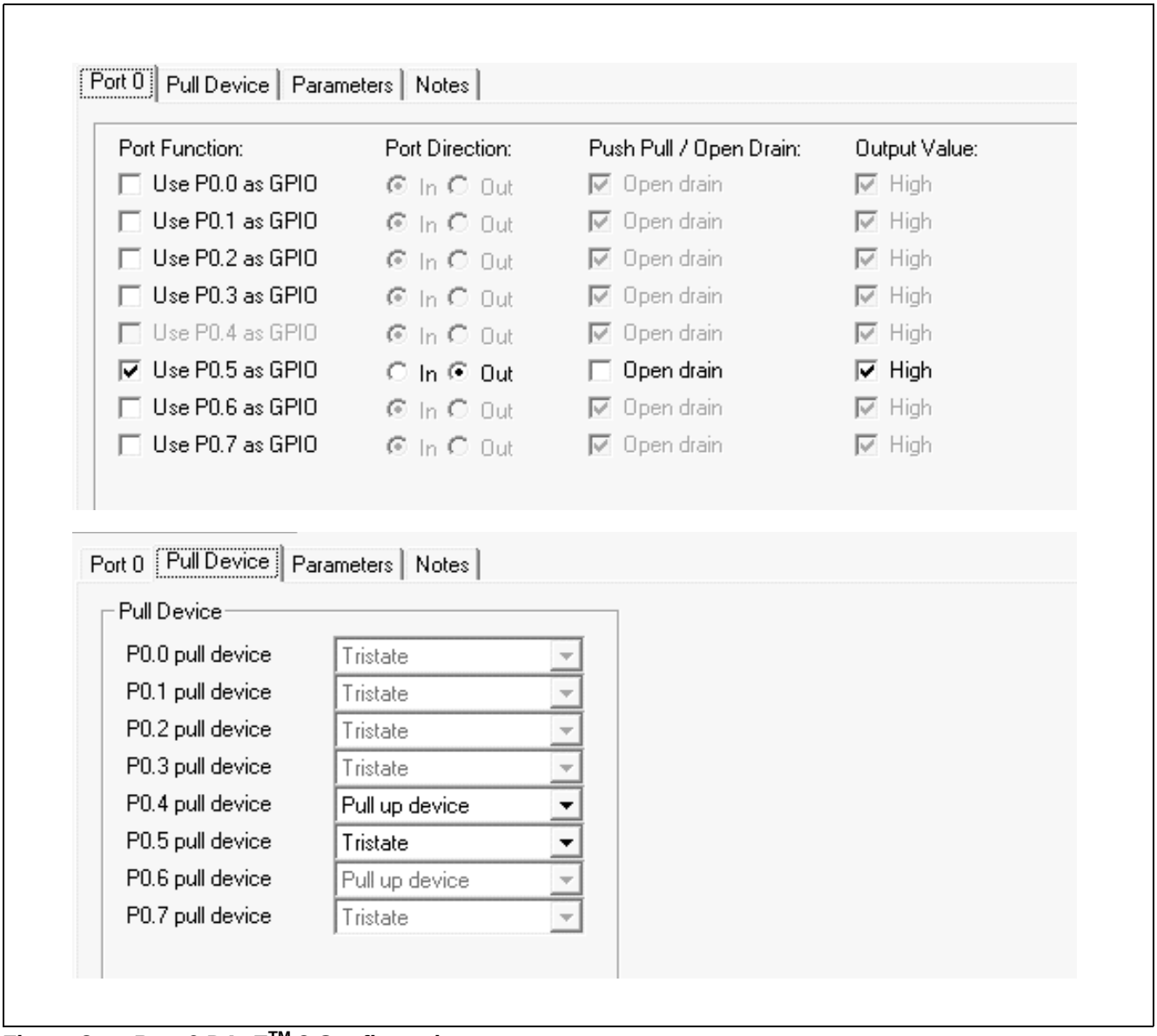


Figure 8 Port 0 DAvE™ 2 Configurations

3.1.2 Timer 0

Timer 0 module is used to send DALI command frames. Mode 1: 16 bit timer is selected for this purpose.

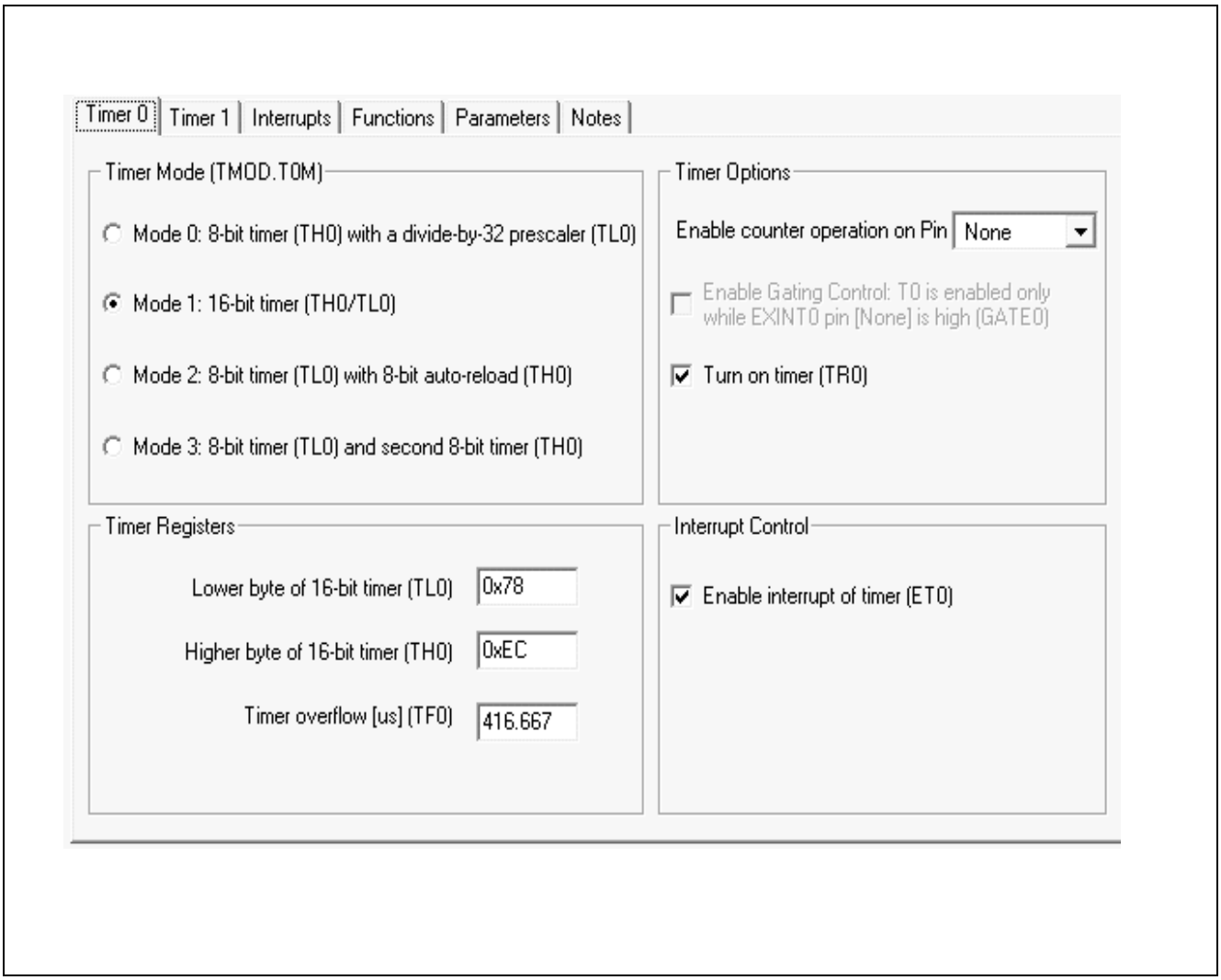


Figure 9 Timer 0 DAvE™ 2 Configurations

3.1.3 Timer 2

Timer 2 module is selected for reception of DALI command frames. The 16 bit timer function capture mode is selected. Timer 2 is started on a falling edge on T2EX input.

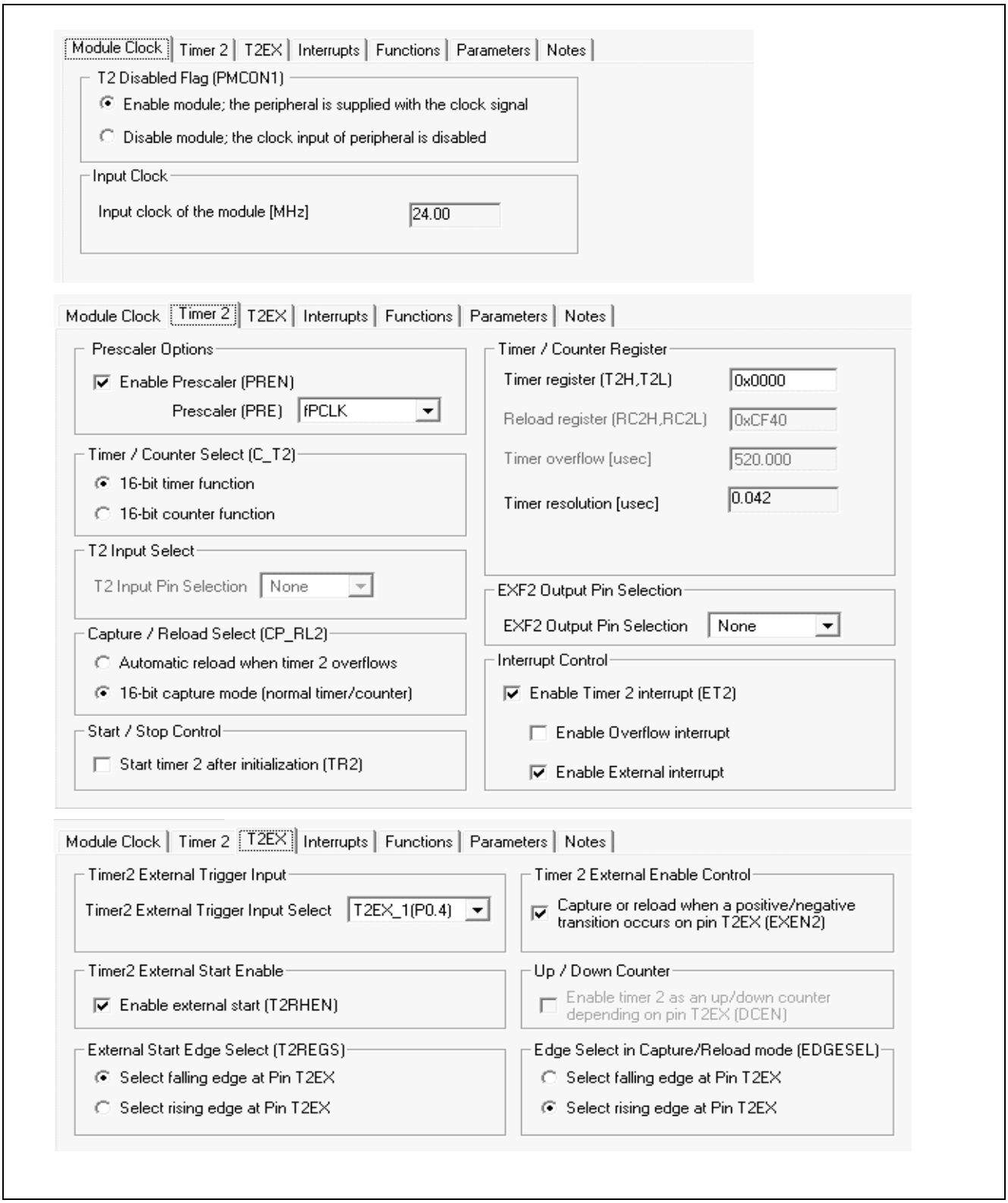


Figure 10 Timer 2 DAvE™ 2 Configurations

3.2 Application Protocol Layer

The application layer provides the user interface control through the DIP switch on the XC836 DALI board. By making use of the real-time clock, the user input is evaluated once every 500ms.

3.2.1 GPIO for User Input

Port 2 [0:3] are used to read in the user input from the DIP switch.

Note: Debouncing is not required for this application as the inputs are read once every 500ms. However, if the user's application requires more frequent assessments, external debouncing circuits or software debouncing methods, may be added for input consistency.

Figure 11 Port 2 DAvE™ 2 Configurations

3.2.2 Real-Time Clock (RTC)

The RTC module is used to support sending DALI commands after a user defined time period. For this purpose, “Mode 1: Periodic wake-up mode with 75KHz oscillator clock” is selected for the RTC.

Interrupt on compare counter match (ECRTC) is enabled, where a timer match of 500ms is selected. This is used as a time base for evaluating the DIP Switch inputs. The user can also configure the time base towards minute, hour or day timer matches.

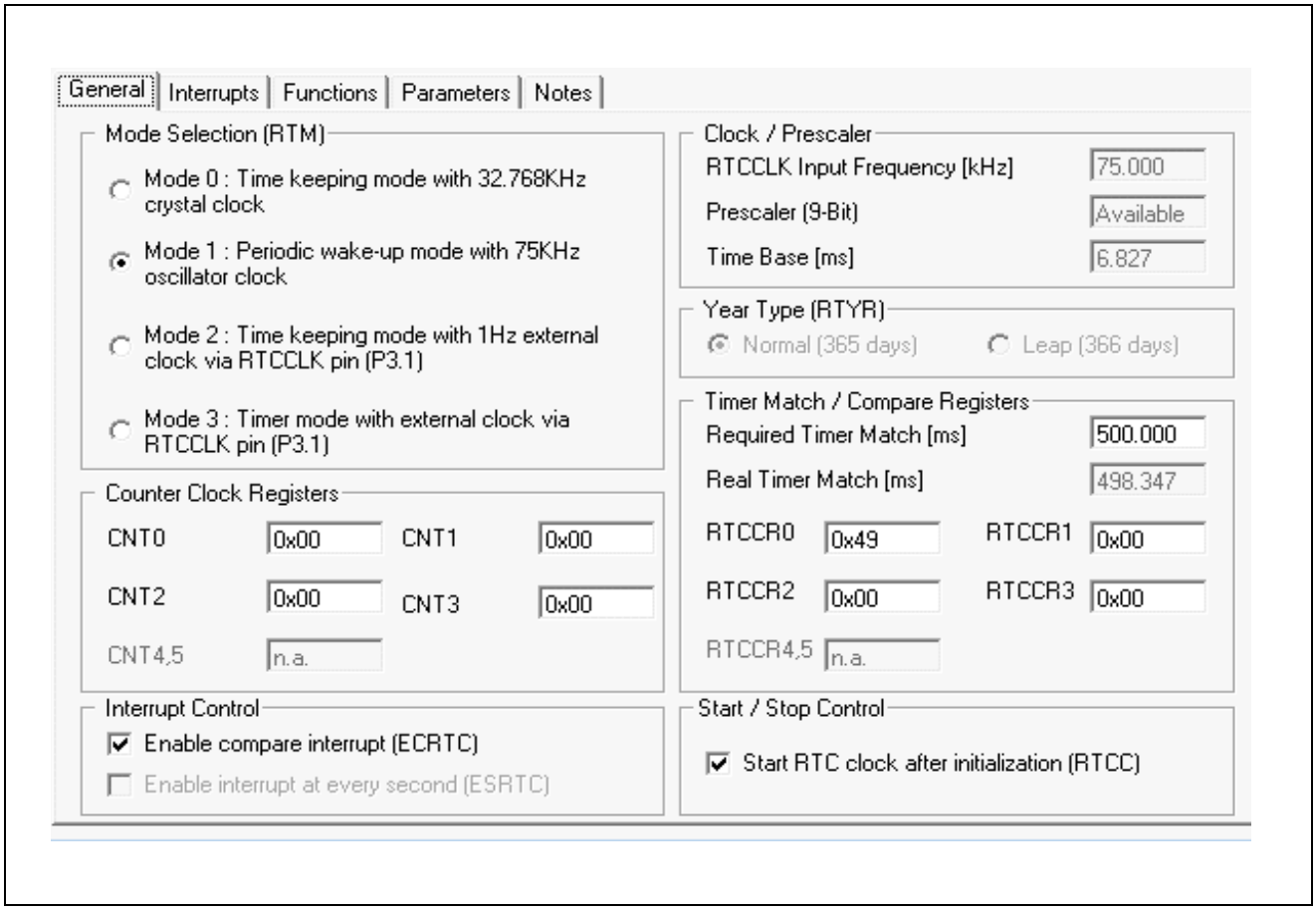


Figure 12 RTC DAvE™ 2 Configurations

4 Getting Started

This section provides an overview on how the user can use this application. Information on the software package contents and customization details are also included.

4.1 Supported Commands

This section describes the usage of the DALI Control Device, which has a 4 position DIP switch used for user command selection. **Figure 13** shows the user command selection available on the DIP switch.

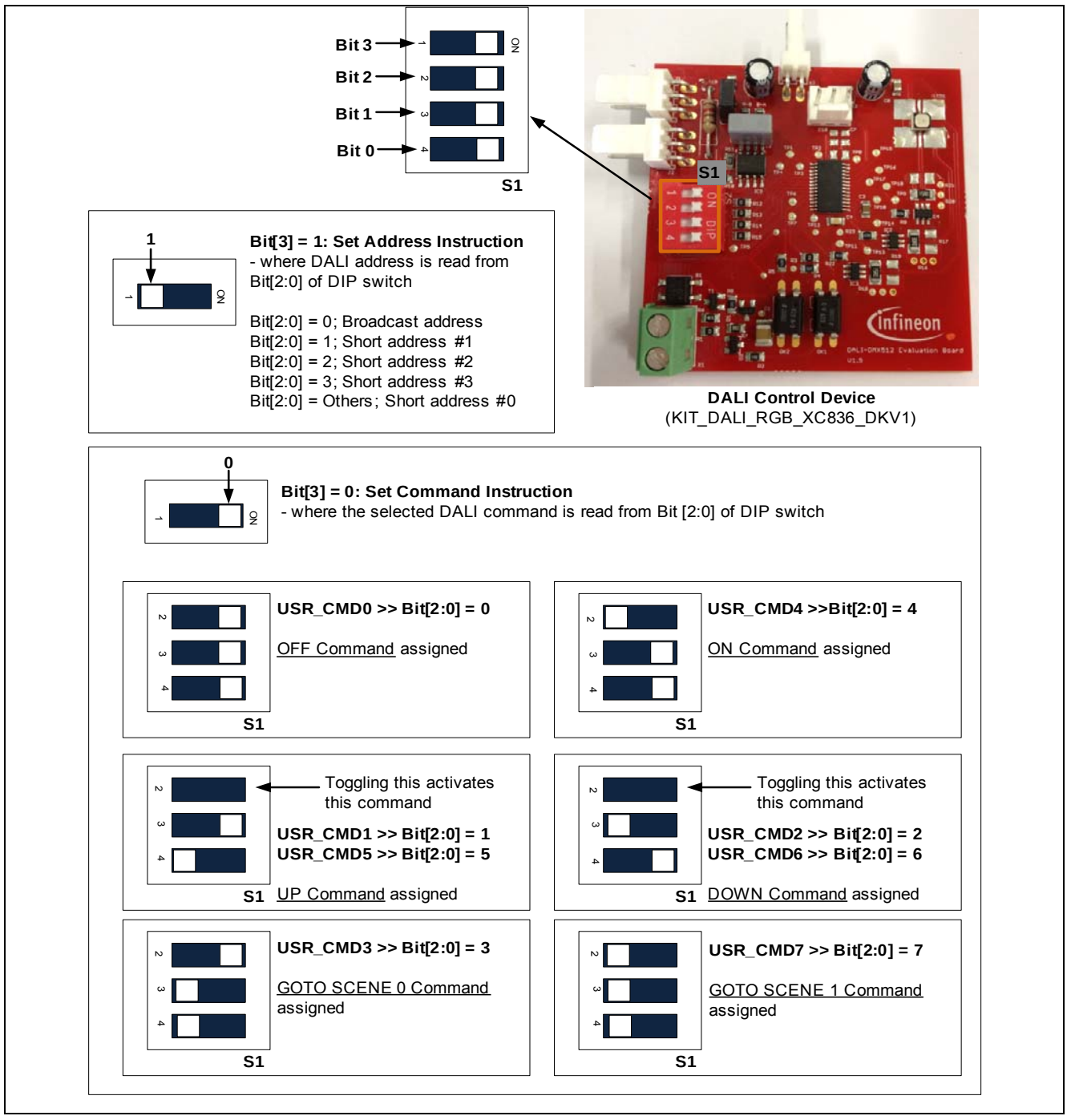


Figure 13 Control Device DIP Switch Commands

4.2 Customising Automated Commands

DALI functions are assigned to the DIP Switch controls via a user configuration file (config.h). **Table 1** shows the supported DALI commands and **Table 2** gives the customisation possibility to the command assignments.

Table 1 Supported DALI commands

Supported Commands	Description
DALI_OFF	Turns light off
DALI_DIM_UP	Set lighting level up by 1 level
DALI_DIM_DOWN	Set lighting level down by 1 level
DALI_STEP_UP	Fades lighting level up for 200ms
DALI_STEP_DOWN	Fades lighting level down for 200ms
DALI_RECALL_MIN	Sets connected lighting device level to minimum level
DALI_RECALL_MAX	Sets connected lighting device level to maximum supported level
DALI_STEP_DOWN_OFF	Set lighting level down by 1 level. If already at minimum, turn lights off.
DALI_ON_AND_STEP_UP	Turns on connected lighting device. If already on, set the arc power level up one level.
DALI_GOTO_SCENE_XX	This is a Scene Selection commands. Choosing this enables device for user configured Scene XX, where XX represents 00 to 15.

Table 2 Customising the commands

DALI Commands	Description
Customising the DALI Command list	In the file: config.H, the timed command to be executed can be configured by the user at compile time. A list of supported DALI commands can be referenced from **Table 1**. • To add supported address: #define USR_ADDX <ADDRESS> • To add supported DALI command: #define USR_CMDX <DALI COMMAND> where DALI commands can be referenced from **Table 1**. **Default command selection for file: config.H** *#define USR_ADD0 BROADCAST_ADDR* *#define USR_ADD1 SHORT_ADDR1* *#define USR_ADD2 SHORT_ADDR2* *#define USR_ADD3 SHORT_ADDR3* *#define USR_ADD4 SHORT_ADDR0* *#define USR_ADD5 SHORT_ADDR0* *#define USR_ADD6 SHORT_ADDR0* *#define USR_ADD7 SHORT_ADDR0* *#define USR_CMD0 DALI_OFF* *#define USR_CMD1 DALI_DIM_UP* *#define USR_CMD2 DALI_DIM_DOWN* *#define USR_CMD3 DALI_GOTO_SCENE_00* *#define USR_CMD4 DALI_ON_AND_STEP_UP* *#define USR_CMD5 DALI_DIM_UP* *#define USR_CMD6 DALI_DIM_DOWN* *#define USR_CMD7 DALI_GOTO_SCENE_01*

4.3 Software Package

The file description for the software package is documented in **Table 3** and **Table 4**.

Table 3 Source files description

Filename	Description
DALIKIT_Master.dav	DAvE project
DALIKIT_Master.uvproj	Uvision project
MAIN.c	Performs main program initialisation
IO.c	Performs GPIO module initialisation
RTC.c	Performs RTC module initialisation
T01.c	Performs Timer 0 module initialisation for application control functions inclusive of DALI frame transmission activities.
T2.c	Performs Timer 2 module initialisation for DALI command interpreter functions inclusive of DALI frame reception activities.
START_XC.A51	Start up code for XC8xx device. This is part of the C51 Compiler package.
INT.c	Performs Interrupt functions initialisation
BOOTROM_ADDR.A51	Library address for bootrom user routines
SHARED_INT.c	Shared interrupts; LEDTS and RTC interrupt handling sections;

Table 4 Header files description

Filename	Description
MAIN.h	SFR Header file for XC836 Microcontroller
IO.h	GPIO function prototypes and macros
RTC.h	RTC prototypes and macros
T01.h	Timer 01 function prototypes and macros
T2.h	Timer 2 function prototypes and macros
INT.h	Interrupt function prototypes and macros
SHARED_INT.h	Shared interrupt function prototypes and macros
config.h	Definitions of Address and DALI command assignments

5 Summary

Infineon microcontrollers provides a great deal of flexibility for the creation of a wide variety of robust applications for the users. This application note demonstrates the ease of creating a DALI control device, using the general purpose port module and real-time clock module in the XC836. With the given instructions, the user can customise this solution to their application, making it easy to use in any DALI network.

6 References

[1] IEC 62386 Digital addressable lighting interface; Part 101: General requirements - System (Edition 1.0, 2009-06)

[2] IEC 62386 Digital addressable lighting interface; Part 102: General requirements - Control gear (Edition 1.0, 2009-06)

[3] AP08102 DALI Control Gear Software Stack

[4] XC836 User Manual 1.0

APPENDIX - DALI Control Board

Schematic for KIT_DALI_RGB_XC836_DKV1

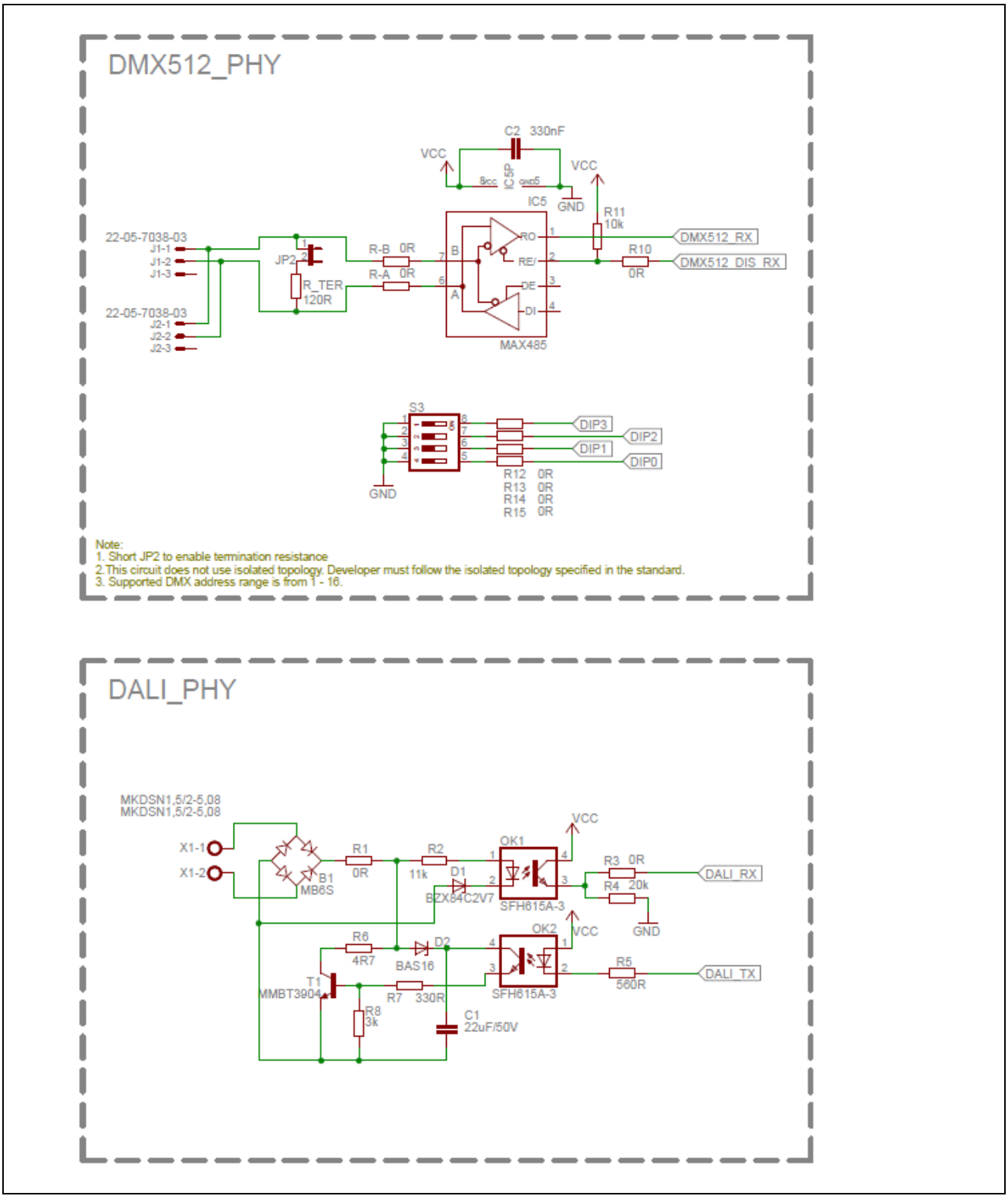


Figure 14 DALI Control Board Schematic - Part 1

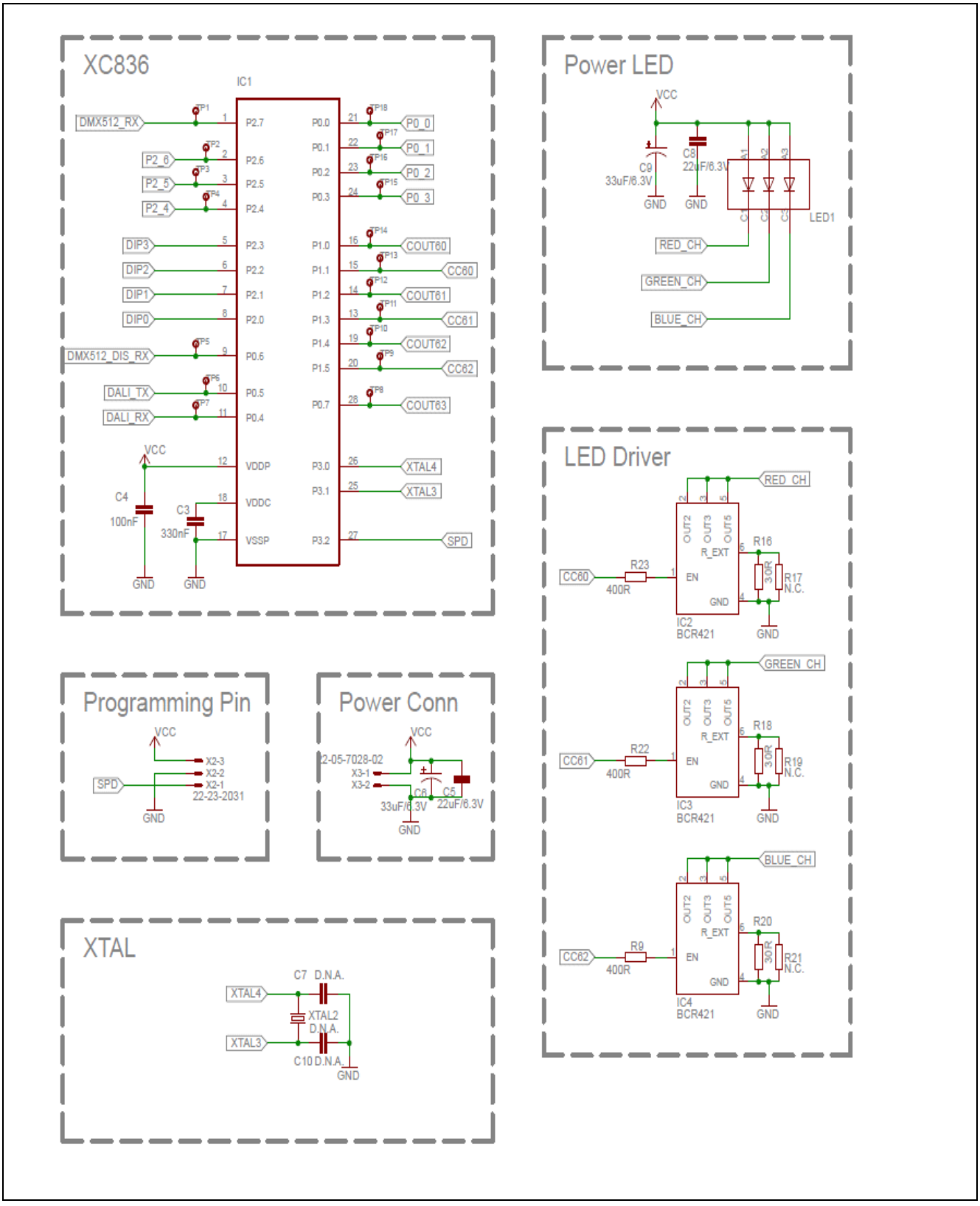
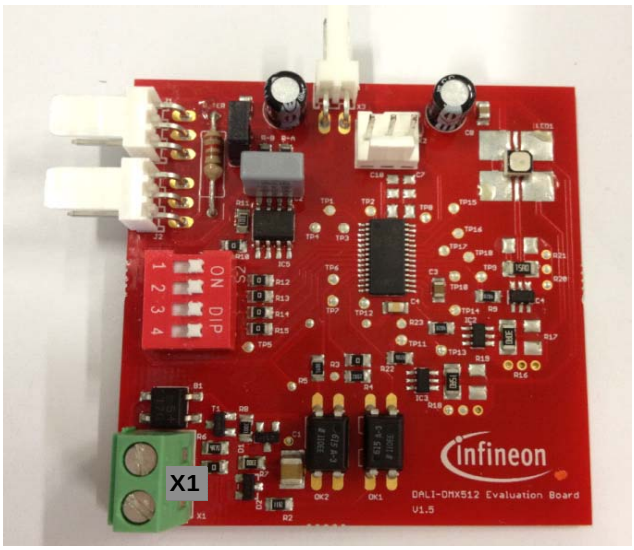
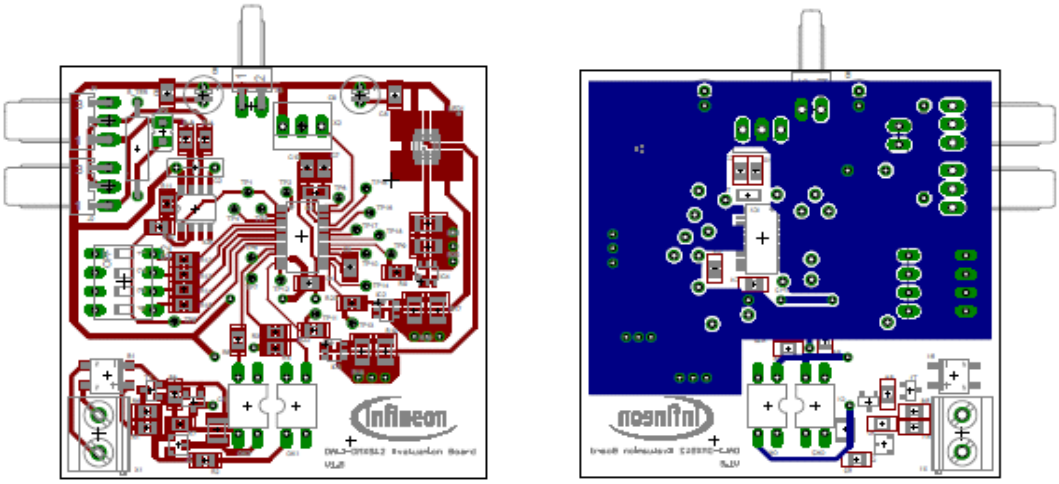


Figure 15 DALI Control Board Schematic - Part 2



DALI Control Board
(KIT_DALI_RGB_XC836_DKV1)



FRONT **BACK**

Figure 16 DALI Control Board Layout

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