User’s Manual

EZ-0007

uPD168804 Buck converter HBLED Evaluation board

RK-UD-09-0062

Data Published March 2009

EZ-0007

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Safety Precautions

This document explains matters to be noted for safe use of this evaluation board. Be sure to read this document before using this evaluation board.

- Be sure to observe all dangers, warnings, cautions, and other instructions contained herein when using this evaluation board.
- This document should be kept handy at all times for ready reference.

Symbols used

This document used the following symbols for matters to be observed for the safe use of the unit.

The symbols are followed by a brief explanation of the possible extent of problems which may occur if the notices are not observed.

Danger	The user may suffer death or serious injury and it's risk is high if the warning is not observed.
Warning	The user may suffer death or serious injury if the warning is not observed.
Caution	Human injury or property damage may occur if the caution is not observed.

The following symbols express matters which are prohibited in order to prevent injury or accident.

General prohibition The action mentioned is prohibited.	**Do not touch** Touching the specified location may cause injury.	**Do not disassemble** Disassembly may cause a problem such as electrical shock or product failure.
Keep away from water Use near water poses the risk of electrical shock or product failure if moisture were to contact the unit.	**Flammable** A nearby flame may cause the unit to catch fire.	**Do not touch with wet hands** Touching with wet hands may cause electric shock or product failure.

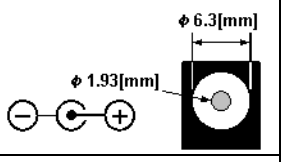
The following symbols are used for cautions to prevent product failure and accidents.

General caution Unspecified general cautions.	**Caution Hot** Human injury by high temperature may occur.

The following symbols are used for instructions to prevent product failure and accidents.

Compulsory action based on an instruction for the user.	Instruction to unplug from AC power supply.

Warnings

Warning	
	**Be careful to burns.** The part of board around LED becomes high temperature.
	**Be careful to brightness of LEDs and On/Off period of LEDs.** Stimulating of strong light may cause symptoms such as epilepsy by constitution.
	**Do not heat the board or expose it to fire, and do not short the terminals.** Doing so may cause product failure, generation of heat, fire, or rupture.
	**Do not disassemble or modify the board.** Doing so may cause product failure, emission of smoke, fire, or electric shock.
	**Do not touch with wet hands.** Doing so cause product failure or electrical shock.
	**Do not look LEDs on this board directly.** Doing so may cause weakening eyesight.
	Do not drop or jolt the board. Doing so may break or damage the board, causing fire or electric shock.
	Do not turn on power switch in insufficient state of cable connection such as AC adapter, interface cable. Doing so may cause product failure, generation of heat, fire or electric shock.
	Do not plug in or unplug a connector or cable with power applied to the board. Doing so may cause product failure, generation of heat, fire or rupture.
	Do not carry this board with connecting AC adapter and any cable. Doing so may cause damage of cable and cause product failure, generation of heat, fire or electric shock.
	Do not use this board in the purpose except the evaluation of Driver IC. This board does not take safety measures or anti-EMI measures required for lighting equipment.
	**Use this board with spacer and on the isolated bench.** In case conductor contact to the board, it may cause product failure, generation of heat, fire or electric shock.
	Use AC adapter adapted to safety standard of each county. Using non-adopt AC adapter cause product failure, generation of heat, fire or electric shock.
	Use specified power supply. Using power supply except specified cause product failure, generation of heat, fire or electric shock.
	Use AC adapter with following size and polarity of DC plug. Using another type of AC adapter may cause product failure, generation of heat, fire or electric shock. 
	**If smoke or an abnormal smell or sound is emitted, or heating occurs, promptly switch off the board power and unplug from AC power supply.** Using the board in such a state poses a risk of fire, burning, or electric shock.

Cautions

Caution	
	**Do not use or store this board in any of the following locations.** - Environments with copious water, humidity, steam, dust, fumes, etc. - Environments where static electricity or electrical noise is readily generated. Such influences can lead to electric shock or product failure. In case liquid enters the board, cut the power supply, and consult your dealer or NEC Electronics sales representative. Even if the unit appears to be dry, internal moisture may remain.
	**Do not touch LEDs on this board directly.** Doing so may cause product failure.
	**To prevent static electricity damage, guard against energizing when touching metal parts such as the connector.** Static electricity can cause product failure.

Table of contents

Chapter 1 Overview

This board is for evaluation of uPD168804 :4ch LED driver IC. This board is using buck converter topology. (uPD168804 support both buck and boost topology.)

Since this board has regulator which generate DC5V from DC12V for driver IC operation, it is possible to drive by single power supply from AC adapter (12V is recommended with operating range from 9V to 16V).

By connecting MCU board to this board, it is also possible to evaluate PWM dimming control by MCU.

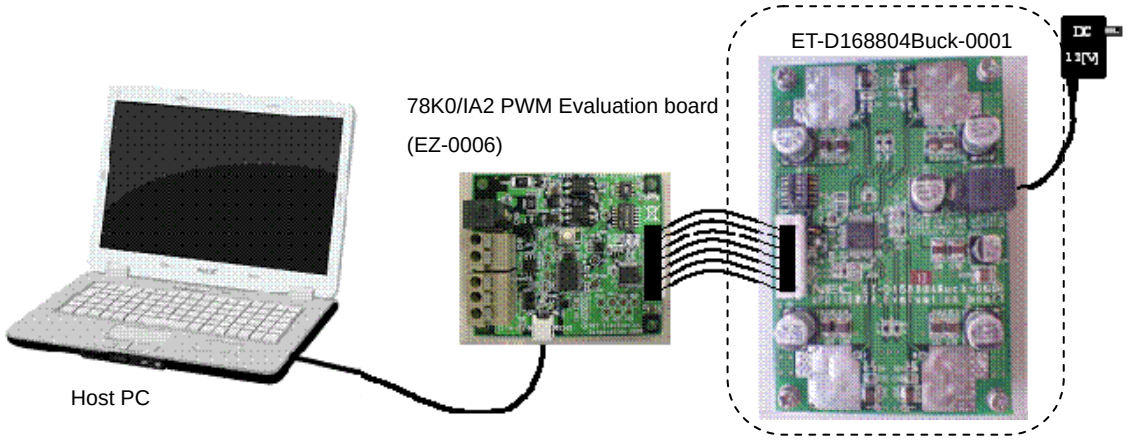


Figure1 Evaluation environment example

1.1 Features of this board

The features of this board is as follows.

- 4ch LED driver IC : uPD168804GA
- Buck converter topology. Possible to use only single DC12V power supply
- Four LEDs are mounted (Lumileds K2; R,G,B,W)
- MCU interface connector enable for easy dimming evaluation by PWM

1.2 Support Modes

This board has two modes; stand alone mode and MCU control mode

- Stand alone mode

  By setting DIP switch, it is possible to evaluate LED constant current drive.

- MCU control mode

  By connecting MCU board such as “78K0/IA2 PWM Evaluation board (EZ-0006)”, it is possible to evaluate PWM dimming control by MCU.

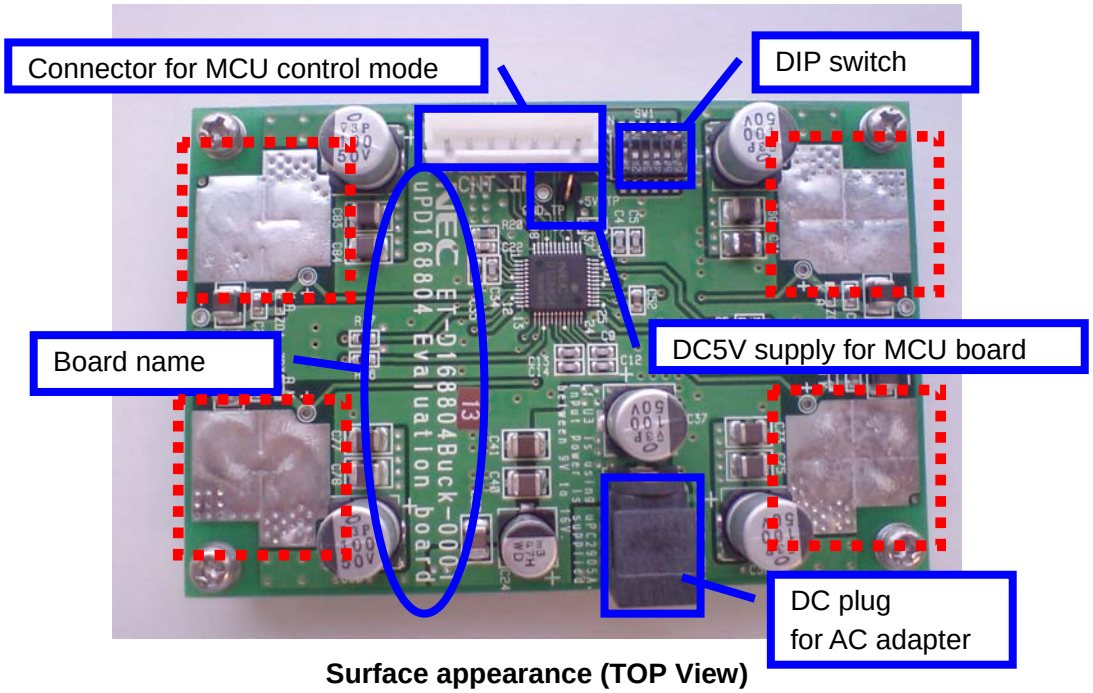
1.3 Related product information

As for the information of related products for this board, please see NEC Electronics Web site.

URL: http://www.necel.com/micro/en/solution/lighting/index.html

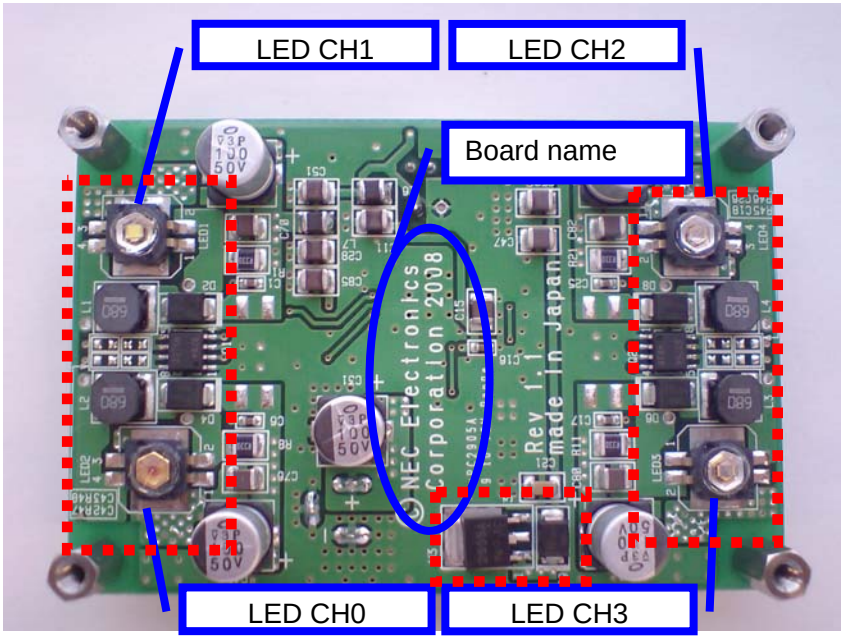
Chapter 2 Specification

2.1 Appearance of the board



Surface appearance (TOP View)

Warning	
	**Be careful to burns.** The part of board especially the area enclosed with dot line becomes high temperature.



Surface appearance (Bottom View)

Warning	
	**Be careful to burns.** The part of board especially the area enclosed with dot line becomes high temperature.
	**Do not look LEDs on this board directly.** Doing so may cause weakening eyesight. Use this board so that LED mounting surface becomes the lower (the back).

Caution	
	**Do not touch LEDs on this board directly.** Doing so may cause product failure.

2.2 Board Specification

Board name	: ET-D168804Buck -0001
Input voltage	: 9V to 16V
Driver IC	: uPD168804GA-8EU-A
Drive topology	: Buck
LEDs	: Lumileds
	CH0: LXK2-PW14-V00(White)
	CH1: LXK2-PD12-S00(Red)
	CH2: LXK2-PM13-U00(Green)
	CH3: LXK2-PR14-R00(Blue)
LED current	: 350mA(typ) per channel
DC plug	: Switchcraft RAPC722
	(Center pin ϕ 1.93mm, Plug ϕ 6.3mm (max))

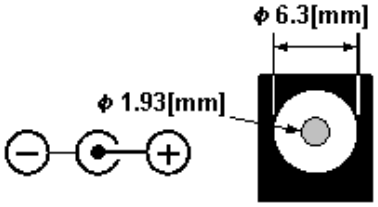


Figure2 Polarity and shape of DC plug

2.3 Power supply

Please prepare following AC adapter or DC power supply.

- AC adapter

Output voltage	: DC12V (recommend), maximum range; 9V to 16V
Output current	: more than 2A
Connecter	: match to the plug shown in figure 2
Type	: Switching regulator type with over current protect circuit
	Do not use AC adapter whose output voltage is guaranteed only when rated load current flows.

- DC power supply

Output voltage	: DC12V (recommend), maximum range; 9V to 16V
Output current	: more than 2A
Connecter	: match to the plug shown in figure 2

Warning	
	Use AC adapter adapted to safety standard of each county. Using non-adopt AC adapter cause product failure, generation of heat, fire or electric shock.

As for circuit diagram, please see NEC Electronics Web site.

URL: http://www.necel.com/micro/en/solution/lighting/index.html

2.4 DIP Switch setting and Connecter pin assign

Table1. DIP Switch setting

Bit	Name	Function
1	ENABLE	Mode setting [Stand alone mode] Turn to “ON” after power is supplied Turn to “OFF” before power supply becomes off [MCU control mode] Keep this switch to “OFF”
2	N.C.	Not used
3	CH0	ON/OFF switch for each LED channel [Stand alone mode] Turn to “ON” after ENABLE it turn to “ON” [MCU control mode] Keep these switches to “OFF”
4	CH1	
5	CH2	
6	CH3	

Table2. Connector pin assign

Pin	Name	Function	MCU pins Note1
1	EN	ENABLE signal input	ANI5/P25/CMP1+
2	CH0Note2	PWM input for CH0 dimming	P31/TOX00/INTP2/TOOLC
3	CH1Note2	PWM input for CH1 dimming	P32/TOX01/INTP3/TOOLD
4	CH2Note2	PWM input for CH2 dimming	P33/TOX10
5	CH3Note2	PWM input for CH3 dimming	P34/TOX11
6	SH	Thermal Shutdown detect signal output	P00/TI000/INTP0
7	GND	GND	VSS

Note1. MCU pins when “78K0/IA2 PWM evaluation board (EZ-0006)” is used.

Note2. Channel number might be changed by software of MCU.

Note3. Connect the power supply for MCU board to “DC5V supply pin for MCU board”.

Chapter 3 How to use

Caution	
	**Confirm all DIP switch is “OFF” before connecting power supply and cables.** In case DIP switch is “ON”, LED will turn on when power is supplied, and it may cause product failure when MCU board is connected.

3.1 Stand alone mode

3.1.1 When start evaluation

1) Turn ENABLE bit and CH0~CH3 bit of DIP switch to “OFF”
2) Plug AC adapter or turn on DC power supply
3) Connect DC power to DC plug of this board
4) Turn ENABLE bit of DIP switch to “ON”
5) Turn CHn bit of DIP switch to “ON”

3.1.2 When stop evaluation

1) Turn CH0~CH3 bit of DIP switch to “OFF”
2) Turn ENABLE bit of DIP switch to “OFF”
3) Unplug DC power from DC plug of this board
4) Unplug AC adapter or turn off DC power supply

3.2 MCU control mode

Example when using “78K0/IA2 PWM evaluation board (EZ-0006)”

3.2.1 When start evaluation

1) Connect this board and MCU board by connector cable, and connect power supply of MCU board to DC5V pin of this boar.
2) Plug AC adapter or turn on DC power supply
3) Connect DC power to DC plug of this board
   In case of using DALI or DMX communication, connect all cables before power is supplied.
4) Connect MCU board to PC by USB cable
5) Program software to MCU
6) Evaluation by running MCU

3.1.2 When stop evaluation

1) Stop MCU operation
2) Unplug DC power from DC plug of this board
3) Unplug AC adapter or turn off DC power supply
4) remove all cables

Caution	
	**In case of using “78K0/IA2 PWM evaluatin board” and power of MCU board is supplied from this board, do not supply power for DC plug of MCU board.** It may cause product failure.

Appendix A　Revision History

Revision	Modified Points	Page
Rev.1.0		

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