LED Backlight

Power Supply Substrate

KSLBC-2

Instruction Manual

(First Edition)

02/12/2008

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■ Installation Precautions

This section covers the precautions when installing the KSLBC-2 (LED backlight power supply substrate).

Static Electricity Precautions

- As CMOS-IC is used in the device, take proper measures to deal with static electricity when handling.
- Consider grounding for workers handling the device. For example, the use of an anti-static wrist strap/mat is recommended.

Handling Precautions

- When connecting the LED backlight, be careful of the polarity (anode, cathode).
- When connecting the power, also be careful of the polarity.
- Always power off before removing and inserting connectors.
- Check the LCD data sheet (lifespan of the backlight LED with forward current, etc.), and use the appropriate settings.

Warranty and Disclaimer

Warranty

- From a manufacturing standpoint, in order to warrant the functionality and reliability of the Product, Kenic System (the "Company") may issue a delivery specification to the purchaser of the Product (the "Customer"). The warranty covers the items outlined in the delivery specification.
- Any modifications to the Product by the Customer will not be covered by the warranty.

Disclaimer

The Customer agrees that the Company shall not be held liable for accidents and damages caused by the Product under the following circumstances.

- Use of the Product in conditions not specified in this instruction manual (the "Manual").
- Breakdown or damage to the Product caused by third-party products not approved and provided by the Company.
- Maintenance and repair work using parts not approved by the Company.
- The Customer did not follow the precautions or operating instructions as set forth in the Manual.
- Use of the Product in situations where the power source, installation environment, and other conditions are beyond the specifications as outlined in the Manual.
- Accidents and damages caused by natural disasters such as fires, earthquakes, floods, and lightning storms.

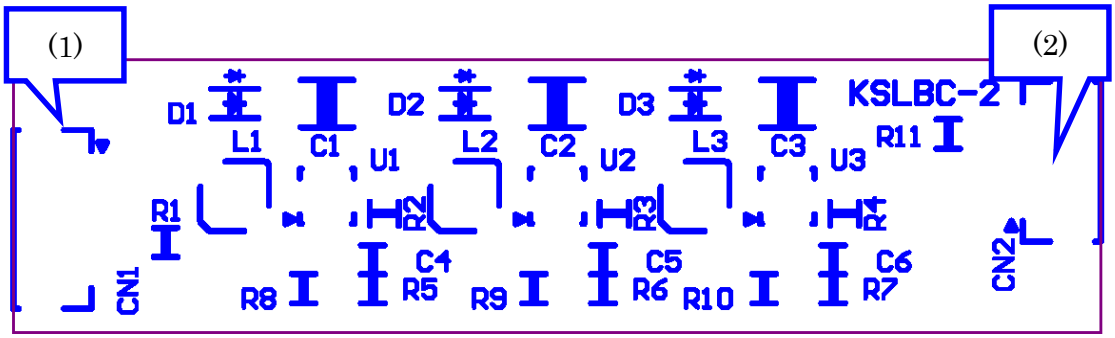
※ Component specifications and external appearance may change without notice. However, if previously agreed to installation dimensions and electrical interface need to be changed due to unforeseen circumstances, the Company will contact the Customer to resolve the issue.

■ Overview and Features of the Product

1. Option (sold separately)

Power supply cable (model number : KSLBC-2-7CB)　　for CN1

2. Name and Function for the Circuit Board Connectors



(1)　CN1　Connector for power supply

(2)　CN2　Connector for LED backlight output

3. Intended Purpose of Product

KSLBC-2 is a LED backlight power supply substrate for LED backlight LCD.
KSLBC-2 can be used by “TCG0057VGLAD” series, “TCG057QVGLAC” series manufactured by Kyocera.

Please refer to the following block diagram.

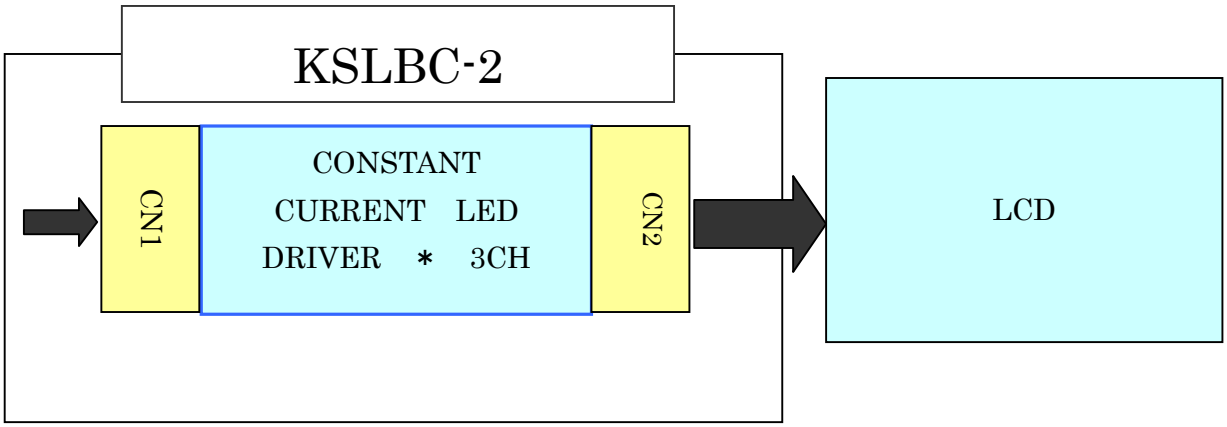


Diagram 1 Block Diagram

4. Main Features

- As the device is equipped with a built-in overvoltage protection function, damage to the device is prevented even if the LED is cutoff.
- Since an output ON/OFF function is installed, it is possible to control ON/OFF for the LED backlight by the Host-CPU I/O or the backlight ON/OFF port of our LCD controller.
- Since a brightness control function is installed, it is possible to control the LED backlight brightness by PWM output of the pre-set volume, the Host-CPU, or our LCD controller (RC filter is necessary).
- Compact and lightweight, the Product dimensions are 60mm×15mm.

■ Basic Specifications

1. Absolute Maximum Ratings

Item	Sign	Standard	Units	Note
Input voltage	VIN	-0.3~7	V	
Output voltage	VOUT	30	V	

2. Recommended Operating Conditions

Item	Sign	Standard	Units	Conditions
Input voltage	VIN	4.5~5.5	V	
Input current	IIN	0.6	A	TA=25℃, VIN=5V,IOUT=27mA,VF=27V
Output voltage	VOUT	21~27	V	TA=25℃, IOUT=25mA
Operating ambient temperature (Min.)	TA	-10	℃	IOUT=25mA,VF=27V
Operating ambient temperature (MAX.)	TA	70	℃	IOUT=25mA,VF=25V

3. Electrical Characteristics

Table 1 Measurement when connecting an LCD of VF=23.1V (IF=25mA, Ta=25℃)

Item	Units	Sign	Standard			Conditions			note
			Min.	Typ.	Max.	VIN[V]	Vadj[V]	Ta[℃]	
Output current	mA	IOUT1	26.5	26.6	26.7	5±0.5	0	-10~70	Maximum brightness
		IOUT1	0.1	0.2	0.3	5±0.5	3.3	-10~70	Minimum brightness
		IOUT2	26.8	26.9	27.0	5±0.5	0	-10~70	Maximum brightness
		IOUT2	0.6	0.7	0.8	5±0.5	3.3	-10~70	Minimum brightness
		IOUT3	26.7	26.8	26.9	5±0.5	0	-10~70	maximum brightness
		IOUT3	0.6	0.7	0.8	5±0.5	3.3	-10~70	Minimum brightness
Input current	A	IIN	0.01		0.49	5±0.5	0~3.3	-10~70	

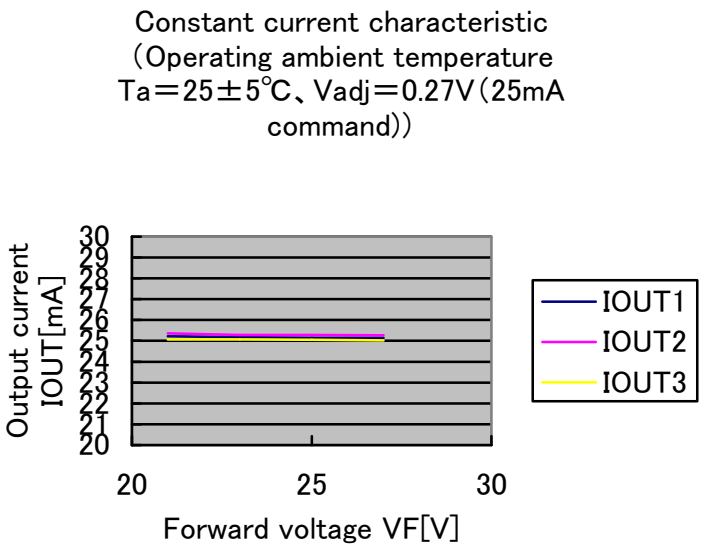


Diagram 1　Constant Current Characteristic

4. Brightness Control

The relation between the brightness control signal "Vadj" and the output current "IOUT" is determined according to the following formulas.

IOUT[mA]＝(0.272-0.082＊Vadj) ÷10　　・・・　(1)
Vadj[v]＝(0.272－IOUT*10) ÷　0.082　　・・・　(2)

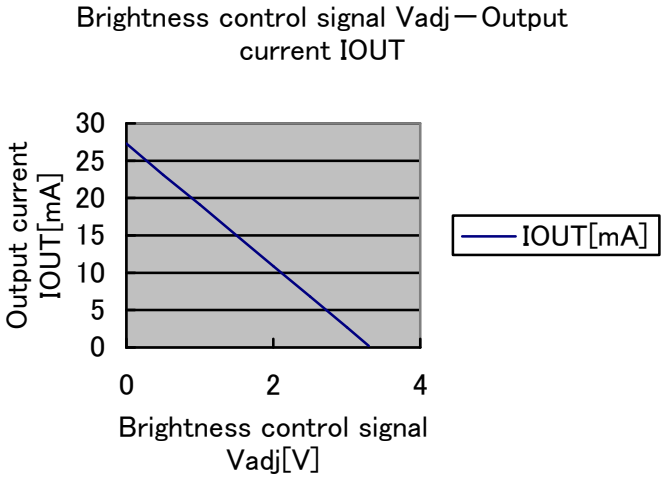


Diagram 2　Brightness control signal Vadj－Output current IOUT characteristic (calculation value)

Adjust the brightness control signal Vadj by referring to the above formulas. Diagram 2 is a graphical representation of Formula (1).

For example, when setting IOUT at 15[mA], Formula (2) is as follows.

Vadj [V] = (0.272-0.015*10) ÷　0.082　≒　1.5[V]

When controlling brightness by a pre-set volume as in Diagram 4, adjust the voltage of Vadj so it comes out to about 1.5V.
Additionally, when controlling by PWM as in Diagram 5, calculate the ON duty of PWM using the following formula.

PWM ON duty[%]＝(Vadj÷3.3[V])＊　100　・・・　(3)

For example, when setting IOUT at 15 [mA]：

PWM ON duty[%]＝(1.5÷3.3[V])＊　100　≒　45　[%]

When the PWM cycle is 100kHz, the ON width of the signal　(width of HIGH) is 4.5 [μSEC].
Our LCD controller with PWM output function features a register for brightness control, and the PWM duty can be adjusted by a resolution of 7-bits (0~127) (For register information, check the LCD controller specifications). Calculate the value setting for the brightness control register using the following formula.

Register setting value for brightness control
＝　(PWM ON duty＊127)÷　100　・・・(4)

For example, when setting the PWM ON duty at 45[%] (assuming an output current IOUT of 15mA), set the register at the following value.

Register setting value for brightness control
＝　(45＊127)÷　100　≒　57

For our LCD controller with PWM output function, the default value for the brightness control register is 0. After powering on, if the register value is not changed, the output current of the LED power supply board is at a maximum (about 27mA). Check the LCD data sheet, and adjust using the appropriate value.

5. CN1 Signal Table for Power Supply Connector

Pin number	Name of signal	Function
1,2	VCC	Pin for power. +5V supply pin.
3,4	GND	Pin for power. Ground connection pin.
5	CTRL	Backlight ON/OFF signal.(H:ON, L:OFF)
6	VADJ	Brightness control signal of backlight (0V: Max. brightness 3.3V: Min. brightness)
7	NC	No connection

Connector used: SM07B-SHLS-TF (LF) (SN) (JST Mfg. Co., Ltd.)

Compatible connector: SHLP-07V-S-B (JST Mfg. Co., Ltd.)

6. CN2 Signal Table for LED Output Connector

Pin number	Name of signal	Function
1	LED1+	Connection to anode side of LED1
2	LED2+	Connection to anode side of LED2
3	LED3+	Connection to anode side of LED3
4	LED1-	Connection to cathode side of LED1
5	LED2-	Connection to cathode side of LED2
6	LED3-	Connection to cathode side of LED3

Connector used: SM06B-SHLS-TF (LF) (SN) (JST Mfg. Co., Ltd.)

Compatible connector: SHLP-06V-S-B (JST Mfg. Co., Ltd.)

7. Connection Example and Reference Circuit Diagram

Diagram 3 is a connection circuit diagram example for KSLBC-2.

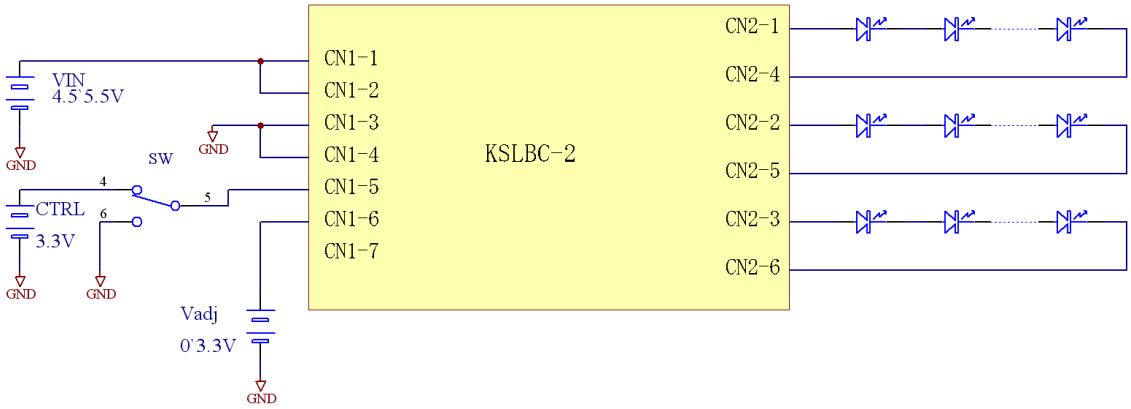


Diagram 3 Entire connection diagram

Diagram 4 is a circuit diagram example when controlling the backlight ON/OFF using our LCD controller and adjusting the brightness using a pre-set volume.

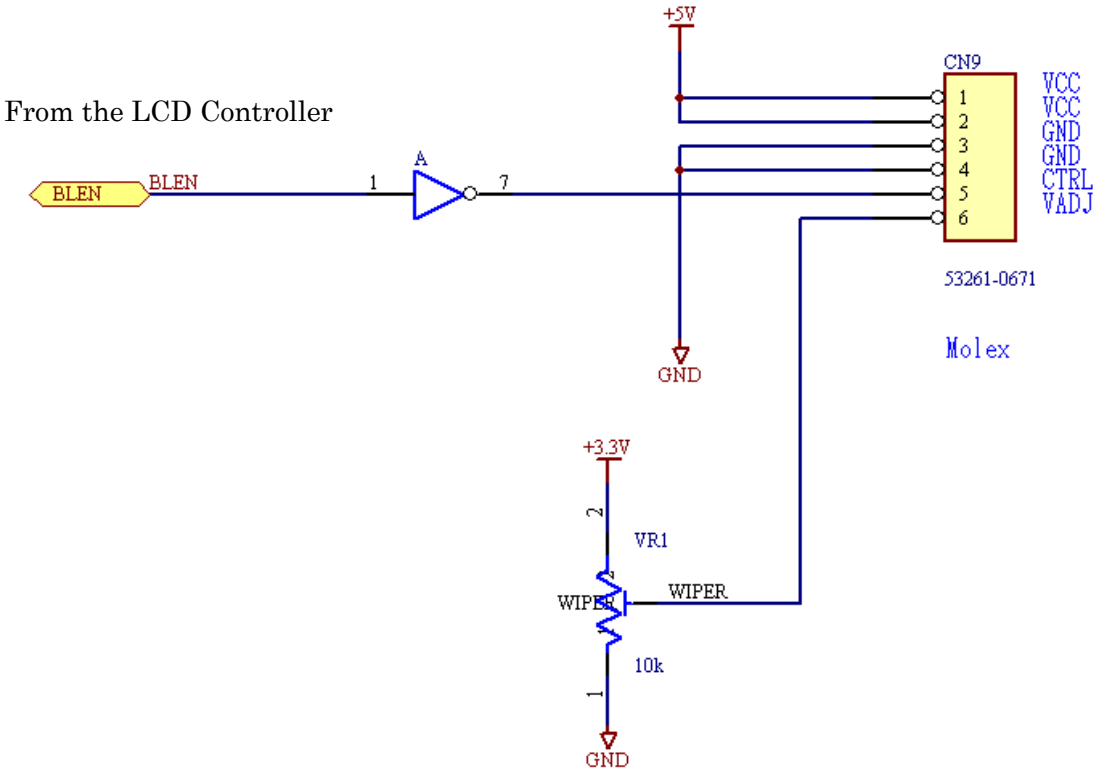


Diagram 4 Circuit Example using a Pre-set Volume

Diagram 5 is a circuit diagram example when controlling backlight ON/OFF using our LCD controller and adjusting the brightness using the RC filter-smoothed signal from the PWM output of the LCD controller (PWM output is standard on only certain LCD controllers).
Regarding the RC filter constant, when controlling using the PWM output of your Host-CPU, choose an optimum constant (with minimal ripple) according to the PWM cycle. In addition, if the value of resistor R becomes bigger, the Vadj voltage margin of error increases due to the internal resistance of the LED backlight power supply board. Therefore, fix the value of resistor R at about 1k~1.2k and adjust the value of capacitor C to achieve an optimum value.

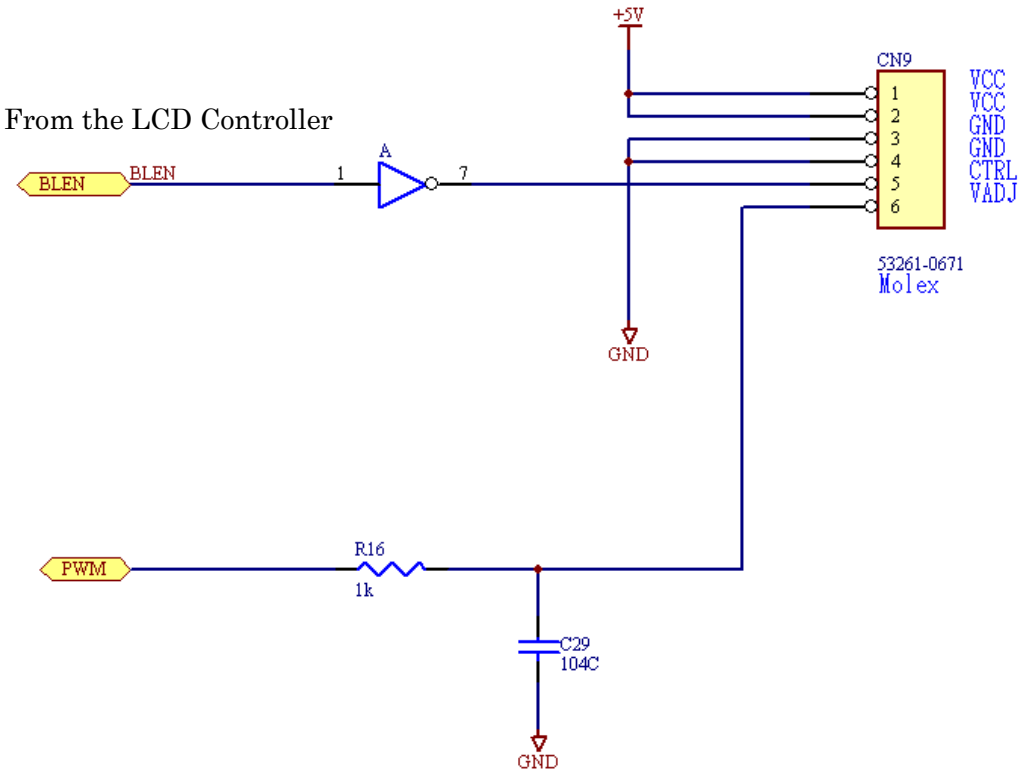


Diagram 5 PWM signal circuit example

8. Technical Documentation about the Product

Technical information about the Product is continually updated and posted on the Kenic system website. Please feel free to browse at the URL below.

http://www.kenic.co.jp/w/

9. Dimension drawing of the board