DC-DC CONVERTER UNIT

PRODUCT SPECIFICATION

ALD-214012PM132

MITSUBISHI ELECTRIC Corp.

Date: Aug.17,'10

TDK·Lambda

MESSRS : **Mitsubishi Electric Corporation**

Product Drawing

CUSTOMER'S PRODUCT NAME:

TDK-Lambda
PRODUCT NAME: **DC/DC CONVERTER UNIT ALD-214012PM132**

◈TDK

TDK-Lambda Corporation

PREPARED BY	APPROVED BY	AUTHORIZED BY

DWG.No.	CTR-3816-A

Precautionary Notes Regarding the Use of This Converter

When using this product, give due consideration to the precautionary notes described below and ensure a safe design. Inappropriate use may result in electric shock, injury or fire.

⚠ Caution

- This product is designed for the driving LED backlight system.

  Do not use it with any other load.

- Store this product under the conditions defined in the specification document.

- Do not store this product in an environment where dust, dirt or corrosive gas (salt, acid, base, etc.) is present.

- This product is designed for use with general electronic equipment.

  If it is to be used with medical equipment that directly affects human life or for the control of

  transportation equipment to which passengers entrust their lives, provide thorough fail-safe measures.

- Avoid using this product under high temperatures or high humidity or in an environment in which

  dust, dirt or any corrosive gas (salt, acid, base, etc.) is present.

  Also, be careful not to allow the formation of dew condensation. It may result in damage or electric shock.

- If the product does not have a built-in protective circuit (circuit breaker, fuse, etc.),

  it is recommended that a fuse be used at the input stage to prevent the generation of

  smoke or fire in the event of a malfunction.

  Even when the product has a built-in protective circuit (circuit breaker, fuse, etc.),

  the circuit may not function properly due to inappropriate operating conditions or power-supply capacity.

  It is recommended that an appropriate protective circuit (circuit breaker, fuse, etc.)

  be provided separately from the built-in circuit.

- Use the product only within the specified input voltage, output power, output voltage

  and operating temperature ranges. Exceeding these values may result in damage, etc.

- Provide a measure for the prevention of surge voltage due to lightning, etc.

  Abnormal voltage may result in damage, etc.

- This product is not designed to provide resistance to radiation.

- Ripples could be superimposed on the voltage and the current in the input source connected to the inverter ,

  depending on the impedance in the input source, wiring, etc.

  When you select an input source, please check waveforms, etc on the final set.

- Please use all the mounting holes, because to defend the converter from vibration and impact.

Handling Precautions

- Do not stack multiple products on top of one another.

- Do not allow the product to come in contact with tools, etc.

- Do not apply excessive stress during installation.

  It may cause chipping and cracking,resulting in damage, etc.

- Please do not use the product, when dropping it, since there is a possibility of the parts damage.

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This product is conformity to RoHS directive.(*)

      (*)Conformity to RoHS Directive: This means that, in conformity with EU Directive 2002/95/EC,
      lead, cadmium, hexavalent chromium, and specific bromine-based flame retardants,
      PBB and PBDE, have not been used, except for exempted applications.

1. Range of Application

    This specification applies to Mitsubishi Electric Corporation.

2. Product Name

    The product name is DC-DC converter unit ALD-214012PM132.

3. Contents

	PRODUCT NAME or MODEL, TITLE		
	DC-DC CONVERTER UNIT ALD-214012PM132		
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<Product Summary>

*This product is DC-DC converter that is designed for LED driver.
*This product has PWM DC dimming (Apply external DC power source or resistance), Analog dimming (Apply external DC power source) and remote on/off function.
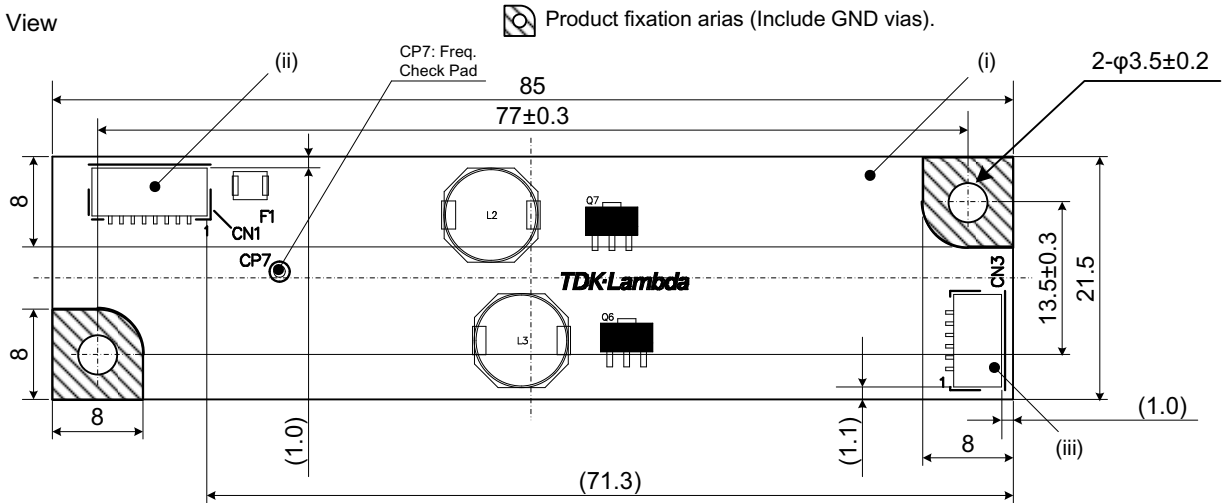*This product has alarm function for safety operation. When load open is happened, this product limit the output voltage and output the alarm voltage.
 *This product has alarm function for LED open detection. If any strings are open, CN1-8 pin outputs around 5V. When all strings are connected normally, CN1-8 pin outputs around 0V.
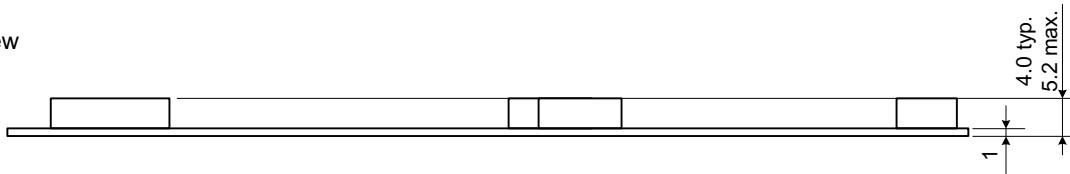
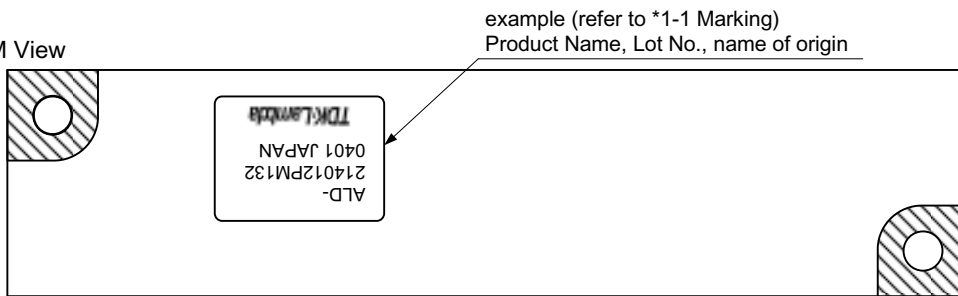[1] Appearance, Structure and Dimensions

1-1. Outline

TOP View

⬙ Product fixation arias (Include GND vias).

SIDE View

BOTTOM View

example (refer to *1-1 Marking)
Product Name, Lot No., name of origin

When LED driver is fixing, please confirm screw head and plate form is located within above hatching area include any tolerances.
If all the GND vias connected to the case such as sheet metals, EMI may decrease.
Then, Please insulate the unhatching area from the case.

Unit in mm
Mass: 9g (max)
Tolerance is ±0.5mm unless otherwise specified.

No.	Part Description	Item/Material	Qty.	Remark	corresponding connector
(i)	Input Connector: CN1	SM08B-SRSS-TB(LF)(SN)	1	JST	SHR-08V-S-B
(ii)	Output Connector: CN3	SM06B-SRSS-TB(LF)(SN)	1	JST	SHR-06V-S-B
(iii)	Print Circuit Board: PCB	FR-4	1	UL 94V-0 t=1.0mm	-

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1-2. Pin Configuration

CN1: Input Connector

Pin No.	Symbol	Remark
CN1-1~CN1-2	Vin	Input Voltage
CN1-3~CN1-4	GND	GND
CN1-5	Vrmt	OFF: 0-0.4(V) or OPEN / ON: 2.5-Vin(V)
CN1-6	Vbr/Rbr	PWM Dimming MIN. Brightness : 2.5(V) or 50(kΩ) PWM Dimming MAX. Brightness : 0(V) or 0(kΩ)
CN1-7	ADIM	Analog Dimming MIN. Brightness : 2.5(V) Analog Dimming MAX. Brightness : 0(V)
CN1-8	Vst	Normal : 0(V) / Abnormal : 5(V)

CN3: Output Connector

Pin No.	Symbol	Remark
CN3-1	LED_C2	CH2 - Cathode Side
CN3-2	LED_A2	CH2 - Anode Side
CN3-3	LED_A1	CH1 - Anode Side
CN3-4	LED_C1	CH1 - Cathode Side
CN3-5	NC	no connection
CN3-6	NA	Tie to GND internally. Do not connect to other circuits.

LCD Module Wiring Example

Our company doesn't handle the cable that connects between the ALD and the LCD module. Please inquire of the Assembly maker of the cable suitable for customer's usage. The wiring example is shown as follows.
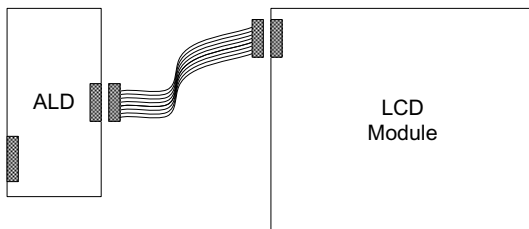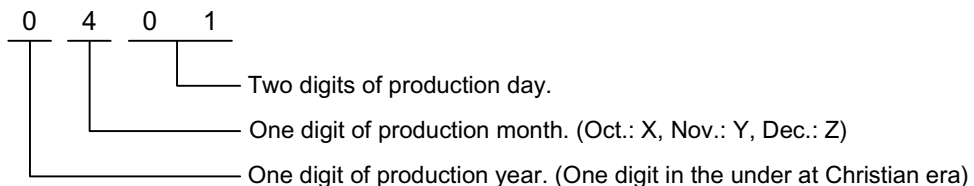

*Please use the cable that satisfies necessary condition for the maximum load voltage, the maximum working temperature, the output current, and RoHS, etc. (Example; UL10368 AWG32)
*Please confirm the LCD panel before use. Flickering or malfunction may occur when the cable is too long.

*1-1 Marking
Product name, Lot No., Country of origin

1) Marking is attached on bottom side by the label.
2) Example (Apr. 1st, 2010)

        0   4   0   1

                              Two digits of production day.

                         One digit of production month. (Oct.: X, Nov.: Y, Dec.: Z)

                    One digit of production year. (One digit in the under at Christian era)

3) Country of origin code (JAPAN, CHINA , MALAYSIA)

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*1-2 For proper operation of circuit protection (IC Protector), Please use minimum of 5A capacity power supply for input.

*1-3 This product has 2.5A IC protector inside. Please confirm input ripple peak current within 2.5A in any conditions.

*1-4 FUSE installed in this product is selected to assuming 100,000 hours (25 degC) in continuous operation time.

*1-5 When rising time of input voltage is very slow, please turn on the remote terminal after the input voltage rise enough. And please turn off the remote terminal before the decrease of the input voltage.

*1-6 Please use the product only within the specified input voltage, output power, output voltage and operating temperature ranges. Do not short-circuit between the output terminals or the output terminal-GND. When deviating from these, the product might be caused the damage.

[2] Use conditions

2-1. Absolute Maximum Ratings

Item	Symbol	Specification	Unit	Remark
Input Voltage	Vin	0 ~ 13.2	V	
	Vrmt	0 ~ Vin		
	Vbr/Rbr	0 ~ 5		
	ADIM	0 ~ 3		
	Vst	This terminal is output terminal. Don't apply external voltage.		
Load Voltage	Vout1,2	12.8 (at Vin=10.8V) ~44	V	Minimum load Voltage > Vin+2V

2-2. Environmental condition

Item	Symbol	Specification	Unit	Remark
Operating Temperature Range	Ta	-30 ~ 85	degC	Please confirm the surface temperature of the L3 inductor is 115℃ or less in worst condition (input voltage, load voltage, mounting instruction, and temperature) when it uses it.
Storage Temperature Range	Ts	-40 ~ 85	degC	
Humidity Limit	RH	95	%RH	A maximum wet-bulb temperature is 38 degC. No dew.

2-3. Rating condition

Item	Symbol	Specification	Unit	Item	Symbol	Specification	Unit
Rating input Voltage	Vin	12	V	Load voltage	Vout1,2	32	V
	Vbr/Rbr	0					
	ADIM	0					

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[3] Electrical Characteristics

Item	Symbol	Ta(degC)	Vin(V)	Vrmt(V)	Vbr(V)	ADIM(V)	RL1,2(Ω)	MIN.	TYP.	MAX.	Unit
Input Current1	Iin1	25±10	12±0.1	3±0.05	0	0	230	0.75	0.85	0.95	A
		-30~85	10.8~13.2					0.6	0.85	1.2	
Input Current2	Iin2	25±10	12±0.1	0	0			-	-	1	mA
Output Current1	Iout1-1, Iout2-1,	25±10	12±0.1	3±0.05				126	140	154	mA
		-30~85	10.8~13.2					120	140	165	
Output Current2 (PWM Dimming)	Iout1-2, Iout2-2				2.5			5	12	20	mA
Output Current3 (Analog Dimming)	Iout1-3, Iout2-3			3±0.05	0	2.5	1800	4	12	24	mA
PWM Burst Frequency	F	25±10	12±0.1		2.5		230	160	200	240	Hz
Alarm Output *3-1	Vst1				0	0		-	0.1	0.5	V
	Vst2				0		∞	4.5	5.0	5.5	V

*3-1 This converter has alarm output function. If converter detects OVP or any strings open, Vst terminal outputs around 5V. If a string open condition occurs, other strings keep on working.

[4] Measurement Circuit
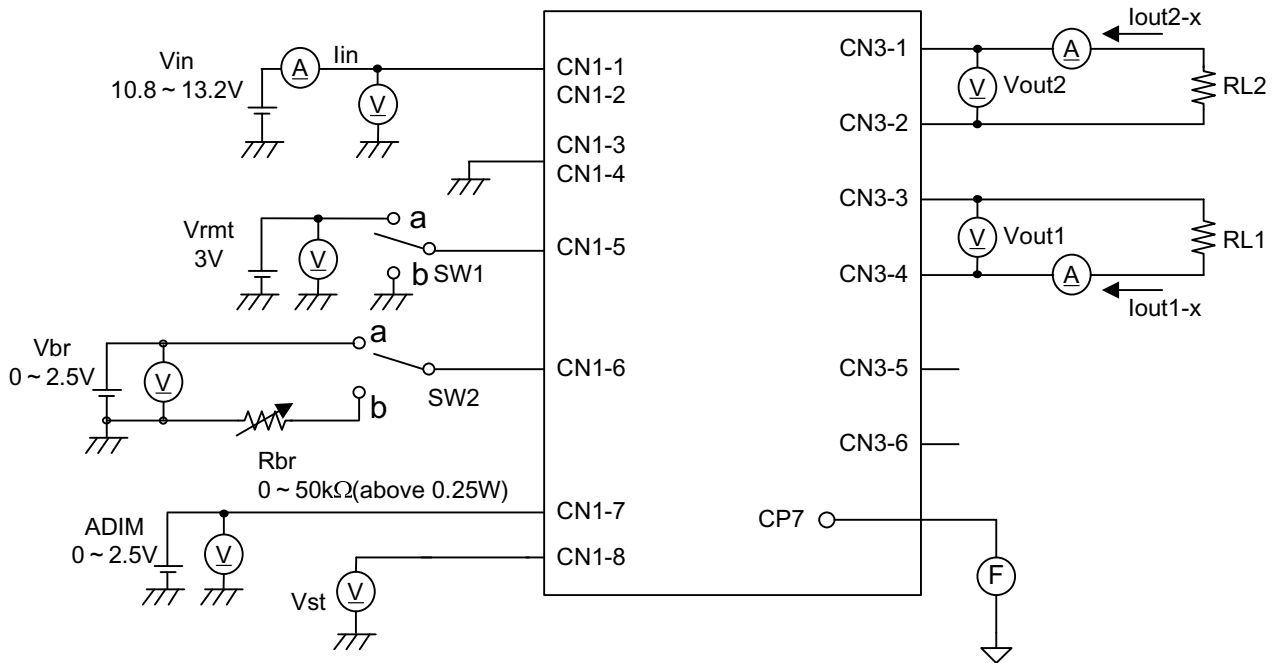
*Please refer to 1-1 Pin configuration in detail.

RL1,2: Equivalent Load (above 15W)

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*4-1 SW1 function

SW1	ON/OFF control
a	Operating
b	Not operating
Open	Not operating

*4-2 SW2 function

SW2	PWM Dimming
a	*PWM DC Dimming Vbr=0 ~ 2.5V
b	*PWM Volume Dimming VR=0 ~ 50kΩ

* Vbr=0V: maximum brightness
Rbr=0Ω: maximum brightness

*4-3 Measurement Equipment

(V) : DC Voltage Meter
(ADVANTEST R6452A or equivalent)

(A) : DC Current Meter
(ADVANTEST R6452A or equivalent)

(F) : Frequency Counter
(ADVANTEST R6452A or equivalent)

*4-4 Protection Circuit Behavior

Load Condition	Alarm output (CN1-8)*1	Output status
normal	0.5V max.	CC
any strings open	4.5V min.	Open string: CV Others: CC
all strings open	4.5V min.	CV

*1 Alarm output keeps under 0.5V In the steady state.
If any strings open or all strings open condition
occurs, alarm output goes high around 5V.
*2 This converter does not shutdown in any conditions.

*4-5 Notice of the alarm output
The alarm output might be generated at the
transition state of ON/OFF by Vrmt or Vin.

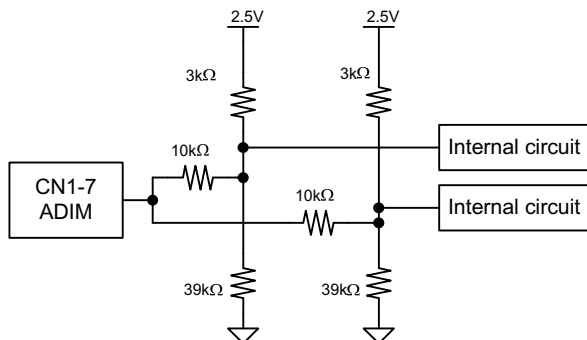***4-6 Internal circuit connection (It is not a guaranteed value)**
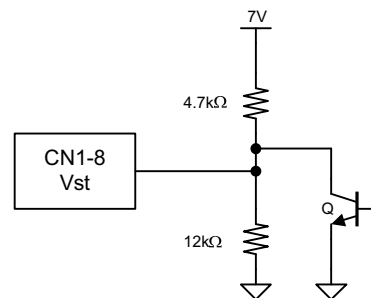
Vrmt terminal
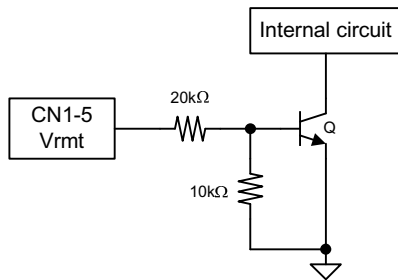
Vbr/Rbr terminal
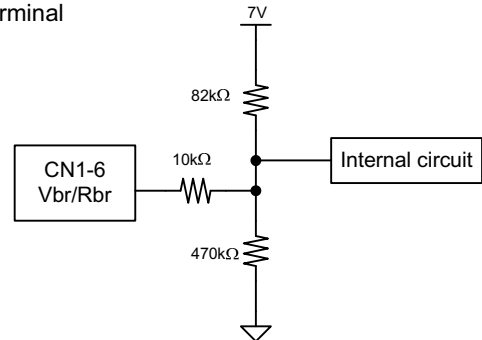
ADIM terminal

Vst terminal

*4-7 In PWM or Analog Dimming operation, please confirm the LCD panel before use. Flickering may occur due to ripple noise is on Dimming pin (CN1-6, CN1-7).

*4-8 When the output is turned on and off directly with a mechanical switch etc., the LED string may occur shutdown by the increase in voltage on output terminal (CN3-1, CN3-4).

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TDK-Lambda

[5] Reliability Test

This product is satisfied following reliability test.

Item	Condition	Judgment Standard	
High Temperature Continuous Operation	85degC 500hrs Operation condition: rating condition	Electrical and appearance should be in the spec.	
Heat Shock	-40degC <-> 85degC 30min /each 100cycles		
Humidity Environment Off and on Operation	60degC 90%RH On 1hr / Off 3hrs 100cycles Operation condition: rating condition		
Vibration	5 ~ 10Hz Amplitude 10mm 10 ~ 200Hz Accelerated velocity 21.6m/s^2(2.2G) Log sweep: 10min X, Y, Z direction 60min /each total 3hrs.		
Shock	588m/s^2 (60G) 11ms Half-sine wave once each axis X, Y, Z, -X, -Y, -Z total 6times		

[6] Others

6-1   Test Conditions
Unless otherwise specified test environment is determined as temperature is 15 ~ 35 degC and humidity is 25 ~ 75 %RH.
6-2   Warranty
One year after shipment. This covers defects in material or TDK-Lambda workmanship. Defects units will be replaces at no charge.
6-3   Others
TDK-Lambda and customer are to discuss changes, problems, and modifications when needed.

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TDK-Lambda

TDK·Lambda

MESSRS : MITSUBISHI ELECTRIC CORPORATION

Instruction Manual

CUSTOMER PRODUCT NAME:

TDK–Lambda
PRODUCT NAME:

DC/DC CONVERTER UNIT ALD Series
ALD-214012PM132 ALD-414012PM133

⟁TDK
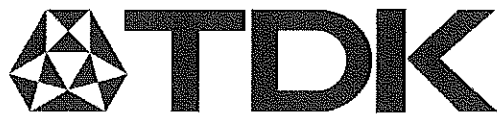
TDK-Lambda Corporation

PREPARED BY	APPROVED BY	AUTHORIZED BY

DWG.No.	CTR-4014-X

Precautionary Notes Regarding the Use of This Converter

When using this product, give due consideration to the precautionary notes described below and ensure a safe design. Inappropriate use may result in electric shock, injury or fire.

⚠ Caution

- This product is designed for driving LED backlight systems.
  Do not use it with any other load.
- Store this product under the conditions defined in the specification document.
- Do not store this product in an environment where dust, dirt or corrosive gas(salt,acid,base, etc.) is present.
- This product is designed for use with general electronic equipment.
  If it is to be used with medical equipment that directly affects human life or for the control of
  transportation equipment to which passengers entrust their lives, provide thorough fail-safe measures.
- Avoid using this product under high temperatures or high humidity or in an environment in which
  dust, dirt or any corrosive gas (salt,acid,base, etc.) is present.
  Also,be careful not to allow the formation of dew condensation. It may result in damage or electric shock.
- If the product does not have a built-in protective circuit (circuit breaker, fuse, etc.),
  it is recommended that a fuse be used at the input stage to prevent the occurrence of
  smoke or fire in the event of a malfunction.
  Even when the product has a built-in protective circuit (circuit breaker, fuse, etc.),
  the circuit may not function properly due to inappropriate operating conditions or power-supply capacity.
  It is recommended that an appropriate protective circuit (circuit breaker, fuse, etc.)
  be provided separately from the built-in circuit.
- Use the product only within the specified input voltage, output voltage, and operating temperature ranges.
  Exceeding these values may result in damage, etc.
- Provide a measure for the prevention of surge voltage due to lightning, etc.
  Abnormal voltage may result in damage, etc.
- This product is not designed to provide resistance to radiation.
- Ripples could be superimposed on the voltage and the current in the input source connected to the inverter ,
   depending on the impedance in the input source, wiring, etc.
  When you select an input source, please check waveforms, etc on the final set.
- This product doesn't have the input overvoltage protection circuit. If there is a possibility that the surge voltage is
  impressed to the input, please do the serge prevention measures.
- Please do not remodel and do not process it. Our company doesn't assume the responsibility of those things.
- Please attentionnote the safe design enough. Especially, do not cause the troubles such as the accident causing injury or
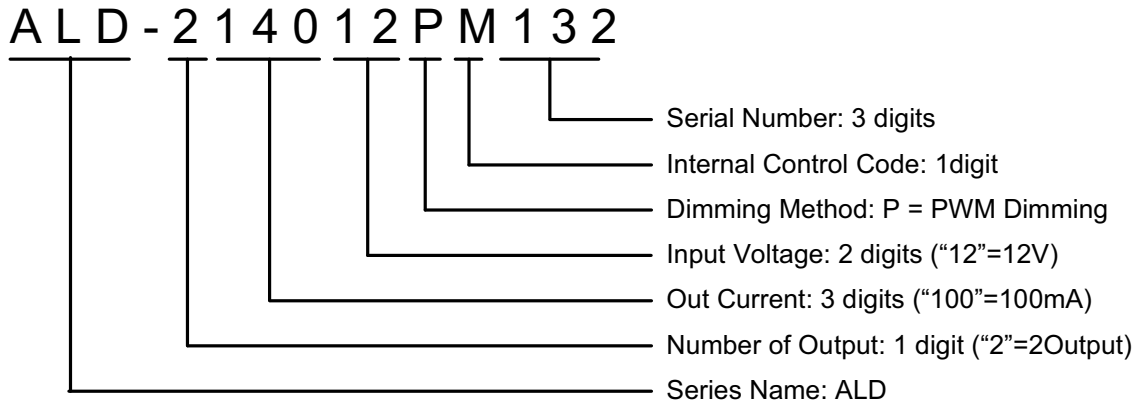 deaths and fire accidents.

Handling Precautions

- Do not stack multiple products on top of one another.
- Do not allow the product to come in contact with tools, etc.
- Do not apply excessive stress during installation.
  It may cause chipping and cracking, resulting in damage, etc.
- Please do not use the product, if it has been dropped because there is the possibility of component damage.

1 Product Name

A L D - 2 1 4 0 1 2 P M 1 3 2

- Serial Number: 3 digits
- Internal Control Code: 1digit
- Dimming Method: P = PWM Dimming
- Input Voltage: 2 digits ("12"=12V)
- Out Current: 3 digits ("100"=100mA)
- Number of Output: 1 digit ("2"=2Output)
- Series Name: ALD

2 Product Summary

*The ALD Series Lineup is as follows:

Item Name	# of Strings	Input Voltage (Vdc)	Output Current (mA)	Burst Freq. (Hz)	Dimming Analog DC(V)	PWM DC(V)	Vopen max (V)	Dimensions
ALD-214012PM132	2	10.8~13.2	140	200	2.5~0	2.5~0	44	85.0(typ.)x21.5(typ.)x5.2(max)
ALD-414012PM133	4	10.8~13.2	140	200	2.5~0	2.5~0	44	100.0(typ.)x50.0(typ.)x5.2(max)

3 Terminal Connection

*Please be careful when connecting the input terminal. The converter may be damaged if there is a mistake in the terminal connection or polarity.

The connector used for each product is different so make sure that you use only the connector indicated in the Product Specifications.

Please refer to Table 3-1 which indicates the connector to be used with each product.

Table 3-1

Product Name	Input Connector	Corresponding	Vendor	Output Connector	Corresponding	vendor
ALD-214012PM132	SM08B-SRSS-TB	SHR-08V-S-B	JST	SM06B-SRSS-TB	SHR-06V-S-B	JST
ALD-414012PM133	SM14B-SRSS-TB	SHR-14V-S-B	JST	SM10B-SRSS-TB	SHR-10V-S-B	JST

The connection diagrams are provided and the input connector functions are explained in Tables 3-2~3-3 and Figures 3-1~3-2.

*The Vbr terminal has a low internal impedance setting because the ALD series takes dimming by resistor into consideration.
If you apply voltage to the Vbr terminal, we recommend a voltage follower connection or a low output impedance connection.
When you have no choice but to connect a high impedance circuit to Vbr terminal, please consider Vbr input impedance indicated in Figures 3-5~3-6.

Fig. 3-1 ALD-214012PM132
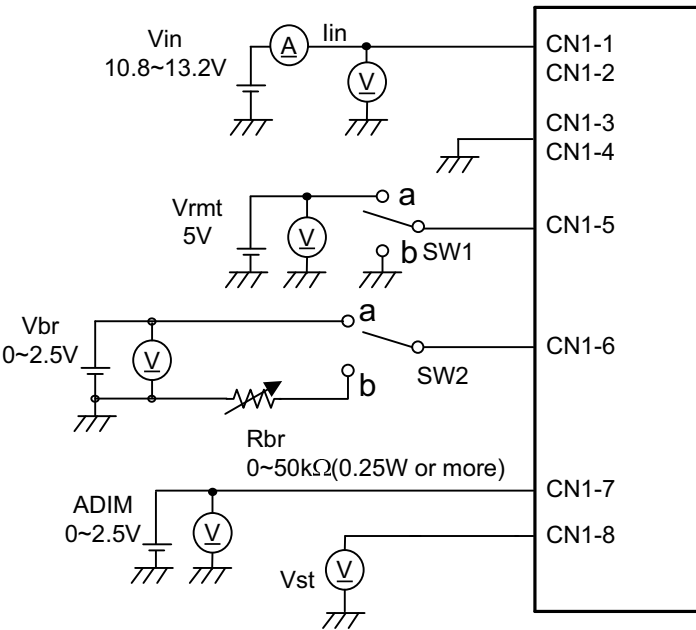
Fig. 3-2 ALD-414012PM133
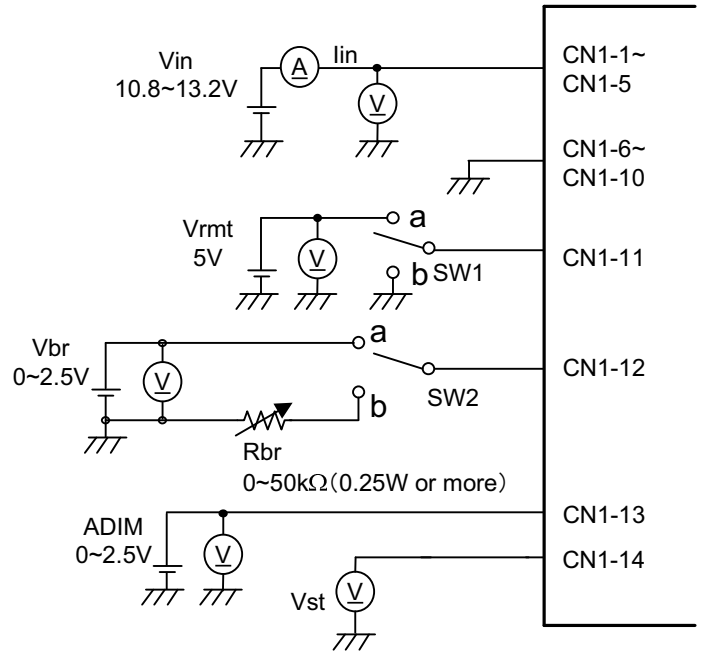
*The connector used is different for each product. Please refer to the following table.

Table 3-2 ALD-214012PM132

CN1: SM08B-SRSS-TB /JST

Pin	Symbol	Specification	Note
CN1-1	Vin	10.8~13.2(Vdc)	Input Voltage
CN1-2			
CN1-3	GND	0(V)	GND
CN1-4			
CN1-5	Vrmt	0~0.4(Vdc) : OFF 2.5~Vin(Vdc): ON	ON/OFF Control
CN1-6	Vbr	0~2.5(Vdc)	PWM dimming*1
	Rbr	0~50(kΩ)	
CN1-7	ADIM	0~2.5(Vdc)	Analog dimming*2
CN1-8	Vst (Output)	0(V) / 5(Vdc)	Alarm output*3

*1 Maximum brightness is Vbr=0V or Rbr=0Ω. Minimum brightness is Vbr=2.5V or Rbr=50kΩ.

*2 Maximum brightness is ADIM=0V. Minimum brightness is ADIM=2.5V.

*3 Alarm output is 0V at normal operation and 5V at abnormal operation. However, alarm output becomes irregular in state that Vrmt is not turning on.

Table 3-3 ALD-414012PM133

CN1: SM14B-SRSS-TB /JST

Pin	Symbol	Specification	Note
CN1-1	Vin	10.8~13.2(Vdc)	Input Voltage
CN1-2			
CN1-3			
CN1-4			
CN1-5			
CN1-6			
CN1-7	GND	0(V)	GND
CN1-8			
CN1-9			
CN1-10			
CN1-11	Vrmt	0~0.4(Vdc) : OFF 2.5~Vin(Vdc): ON	ON/OFF Control
CN1-12	Vbr	0~2.5(Vdc)	PWM dimming*7
	Rbr	0~50(kΩ)	
CN1-13	ADIM	0~2.5(Vdc)	Analog dimming*8
CN1-14	Vst (Output)	0(V) / 5(Vdc)	Alarm output*9

*7 Maximum brightness is Vbr=0V or Rbr=0Ω. Minimum brightness is Vbr=2.5V or Rbr=50kΩ.

*8 Maximum brightness is ADIM=0V. Minimum brightness is ADIM=2.5V.

*9 Alarm output is 0V at normal operation and 5V at abnormal operation. However, alarm output becomes irregular in state that Vrmt is not turning on.

*Output connector is different for each product. Please refer to the following table.

Table 3-4 ALD-214012PM132

CN3: SM06B-SRSS-1 /JST

Pin	Symbol	Note
CN3-1	LED_C2	line2-cathode side
CN3-2	LED_A2	line2-anode side
CN3-3	LED_A1	line1-anode side
CN3-4	LED_C1	line1-cathode side
CN3-5	N.C.	Not connected
CN3-6	N.A.	Tie to GND internally

Table 3-5 ALD-414012PM133

CN3: SM10B-SRSS-1 /JST

Pin	Symbol	Note
CN3-1	LED_C4	line4-cathode side
CN3-2	LED_A4	line4-anode side
CN3-3	LED_A3	line3-anode side
CN3-4	LED_C3	line3-cathode side
CN3-5	LED_C2	line2-cathode side
CN3-6	LED_A2	line2-anode side
CN3-7	LED_A1	line1-anode side
CN3-8	LED_C1	line1-cathode side
CN3-9	N.C.	Not Connected
CN3-10	N.C.	Not Connected

*Vst terminal is alarm output terminal. Vst outputs around 0V at steady state, around 5V at open LED condition.
Alarm output terminal circuit is different depending on the model.
If you use the alarm output signal of the DC-DC converter, we recommend high input impedance device like a operation amplifier or a comparator input.
If you use the Vst terminal(Alarm output) for emitting a signal, please take Vst terminal output impedance into consideration.
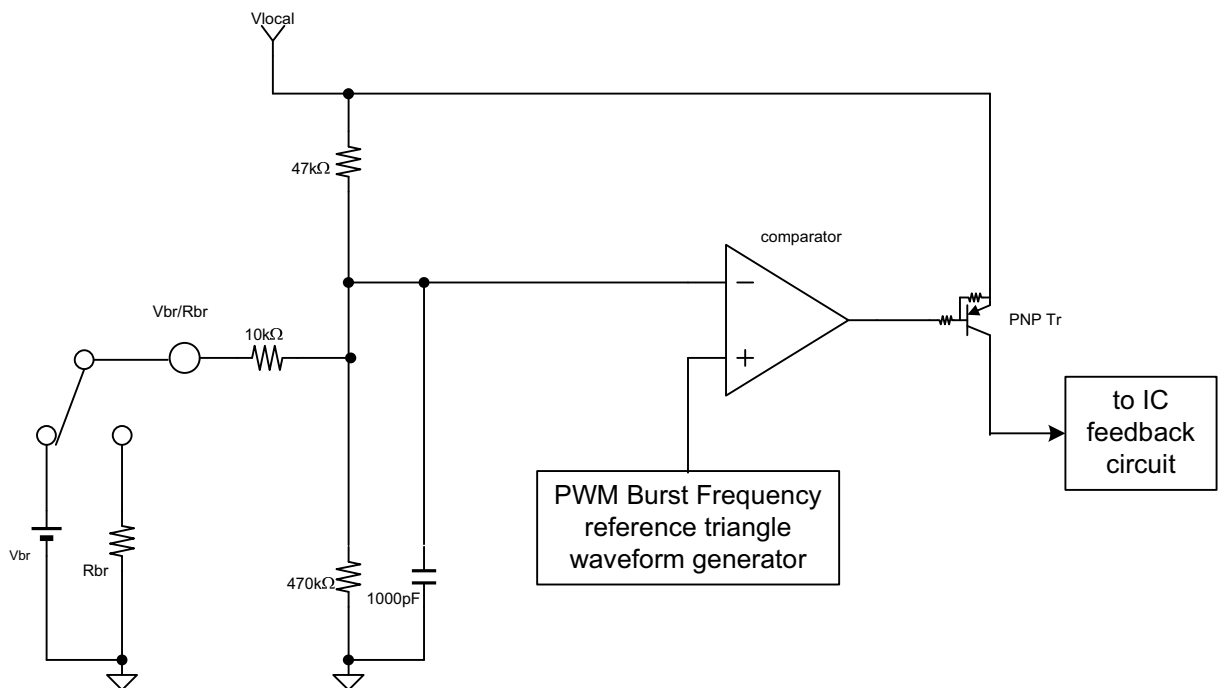
Fig. 3-3
ALD-214012PM132
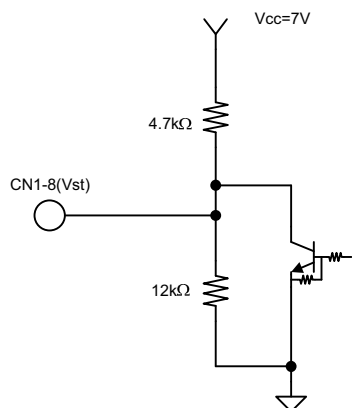
Fig. 3-4
ALD-414012PM133
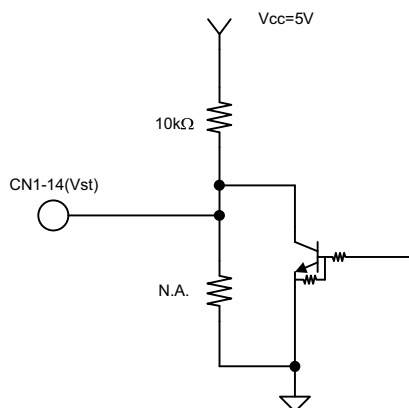
*The PWM dimming circuit is different for each product. Please confirm the specifications for each product.

Fig. 3-5 ALD-214012PM132
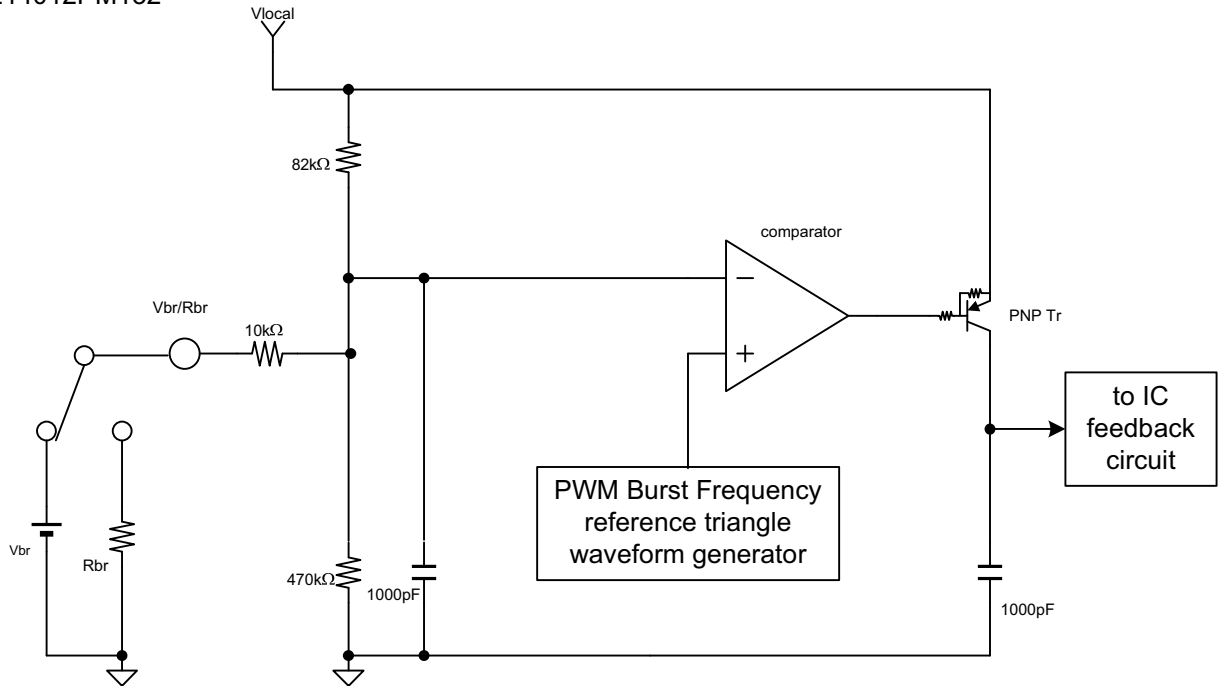
* Maximum brightness is Vbr=0V or Rbr=0Ω. Minimum brightness is Vbr=2.5V or Rbr=50kΩ.

Fig. 3-6 ALD-414012PM133

* Maximum brightness is Vbr=0V or Rbr=0Ω. Minimum brightness is Vbr=2.5V or Rbr=50kΩ.

*We recommend that the converter GND terminal and LCD backlight frame connected to each other.
If you operate LCD backlight at floating, the converter may be damaged by contact discharge.
When contact discharge apply to the LCD backlight, Over voltage apply LED to the converter because LED is placed near the LCD backlight panel.
If the converter GND fixing terminal cannot be connected directly to the LCD backlight panel, please connect from the converter GND fixing terminal to the LCD backlight frame in some way.

Fig. 3-7
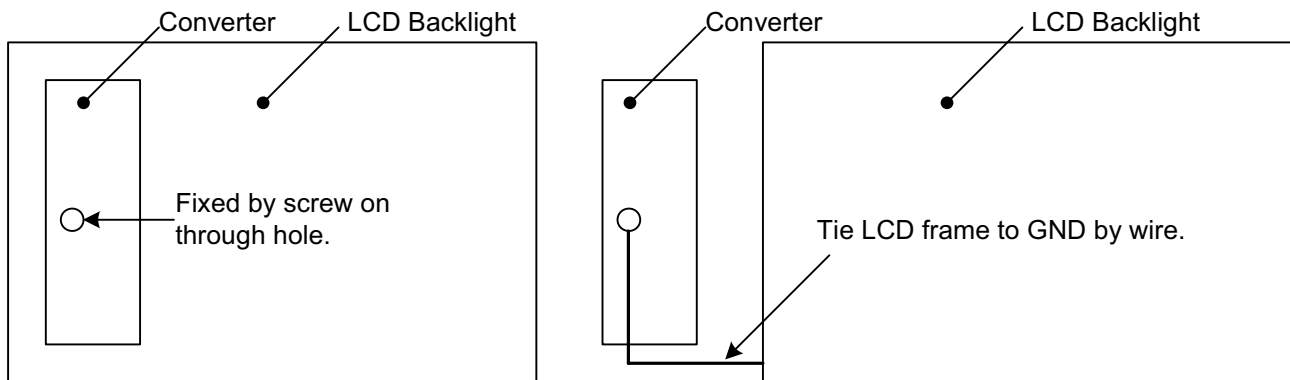
4 Noise Reduction

*The following noise system summarizes the converter noise generation.

(1) Ripple noise between input terminals
(2) Switching noise generated by main switch
(3) Induction noise generated by inductor leakage flux

4-1 Ripple Noise between Input Terminals

The Input terminal of the ALD series has the following circuit Figures 4-1~4-2 depending on the model.
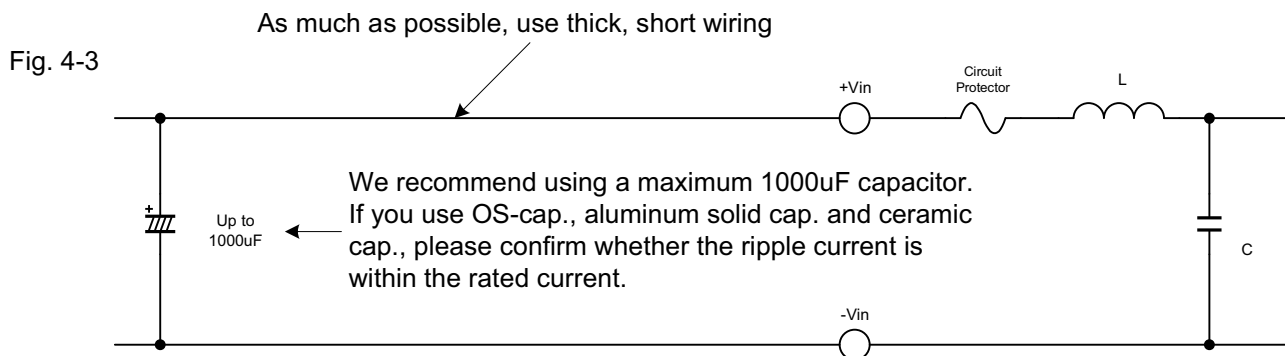
Fig. 4-1 ALD-214012PM132

DC-DC Converter Unit ALD Series: Instruction Manual
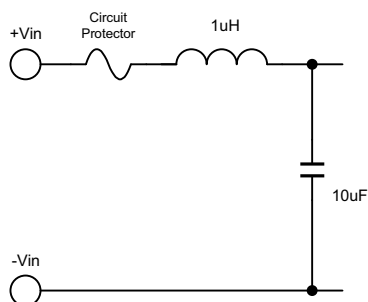
Fig. 4-2 ALD-414012PM133
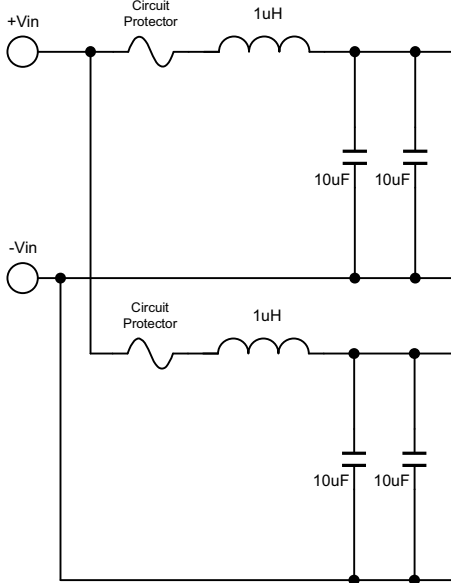
π-type low pass filter is available by attaching an external capacitor to the input terminal.
This filter is effective against ripple voltage and current at the input terminal.
And this filter is not susceptible to ESR and capacitance because an inductor is on the input line.
We evaluate ripple voltage and current as follows:
We attached a Nippon Chemicon type LXZ35V-1000uF(φ12.5,L=20mm) 15cm from the converter.
The ripple voltage and current is determined by external capacitance, ESR, wire length and wiring impedance.
Please confirm ripple voltage is within the rated voltage and ripple peak current is within rated current of circuit protector before using.

Fig. 4-3

As much as possible, use thick, short wiring

We recommend using a maximum 1000uF capacitor.
If you use OS-cap., aluminum solid cap. and ceramic cap., please confirm whether the ripple current is within the rated current.

4-2 Switching Noise Generated by Main Switch

The ALD series adopts the boost up chopper topology.
The switching frequency is between 500kHz and 800kHz. It is different depending on the model. The internal burst dimming frequency is about 200Hz.

Noise may appear at basic frequency and odd number times of frequency.
Please confirm that the final set is not affected by this noise.

If the conduction noise level becomes a problem, please insert the low-pass filter, the normal mode filter, and the common mode filter of the multistage configuration in the input side according to the kind of the noise, and please use the clamping filter for the I/O cable to decrease the line noise in the power supply, as shown in Figure 4-4.

If the radiation noise level becomes a problem, please shield or separate the distance from electrical loop with main MOSFET, diode, and capacitor.

Fig. 4-4
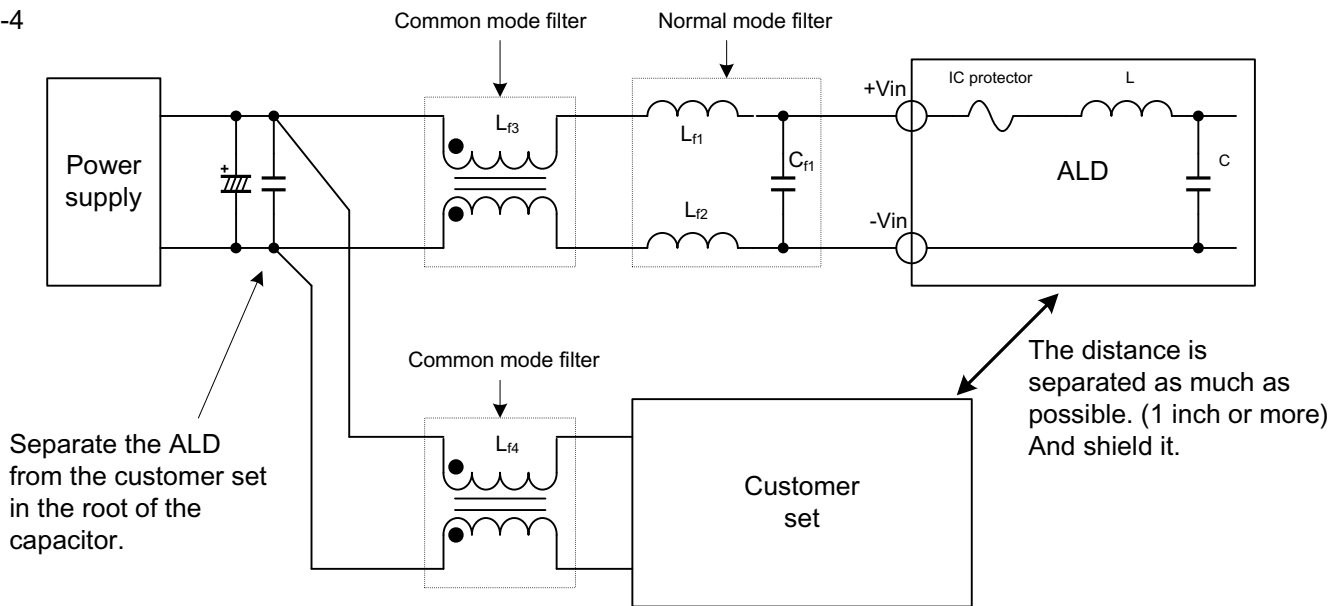
Please measure the noise as follows,
1. Remove the clip in the probe head, the clip of GND is not used. It is the measurement method to minimize the loop of signal- GND. However, there is a possibility that the noise gets on according to the measuring method.
2. Measure it with the following cables,
JEITA(Japan Electronics and Information Technology Industries Association), RC9141, 7.13 Fig.C
http://www.jeita.or.jp/english/
We uses the measuring method of 2.

4-3 Induction Noise Generated by Inductor Leakage Flux
In the ALD series, the choke inductor is the component that generates leakage flux.
The inductor may affect the high impedance line of near field because of the huge leakage flux.
Please be careful don't place signal path near field of inductor.
And if you shield leakage flux by high permeability material at close range of inductor top, eddy current losses by leakage flux occurs. As a result, it reduces circuit efficiency and causes unexpected heat up.
Please be sure to keep enough space between shield materials and the inductor.

5 Dimming Function

*The ALD series is able to adjust the PWM dimming brightness by the Vbr/Rbr terminal and current amplitude dimming by the ADIM terminal.

5-1 ALD-214012PM132

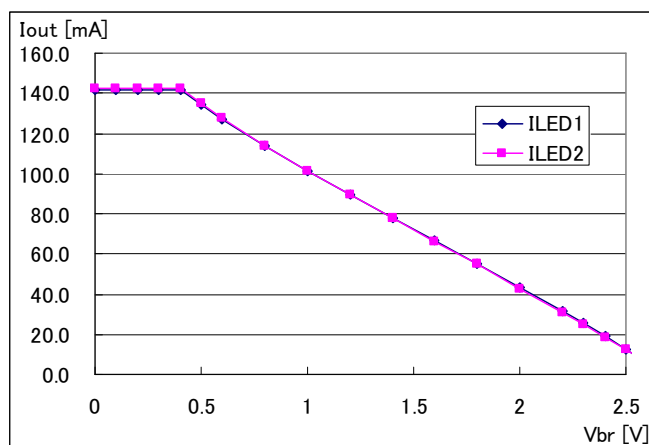Fig. 5-1 PWM DC dimming characteristics(Vbr vs Iout)

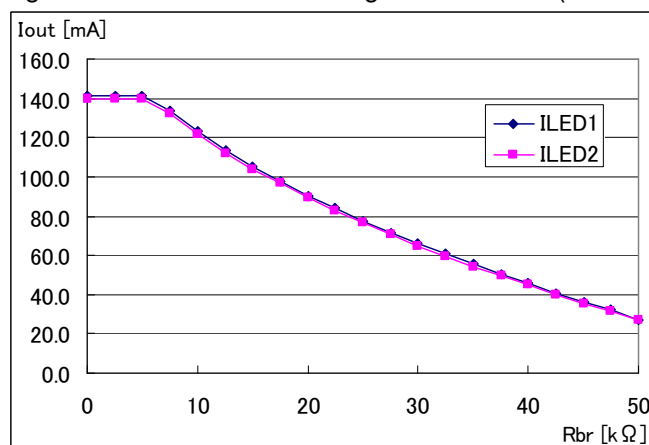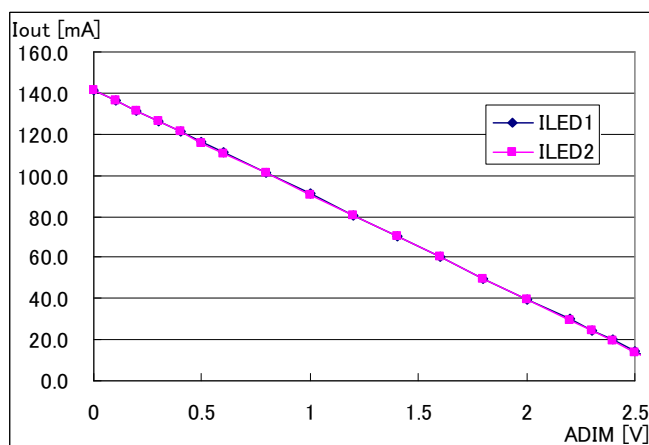Fig. 5-2 PWM Resister dimming characteristics(Rbr vs Iout)

Fig. 5-3 Current Amplitude dimming characteristics(ADIM vs Iout)

5-2 ALD-414012PM133
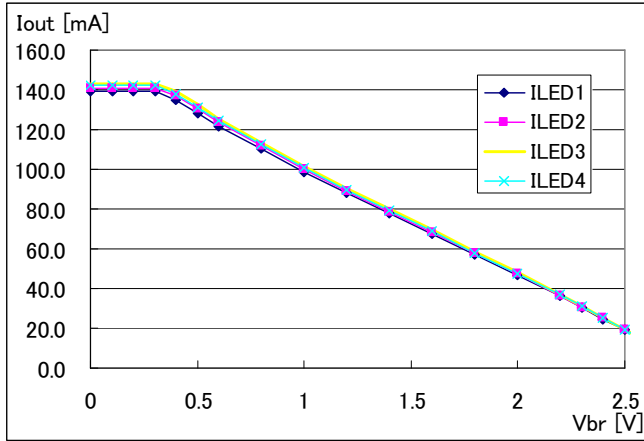
Fig. 5-4 PWM DC dimming characteristics(Vbr vs Iout)

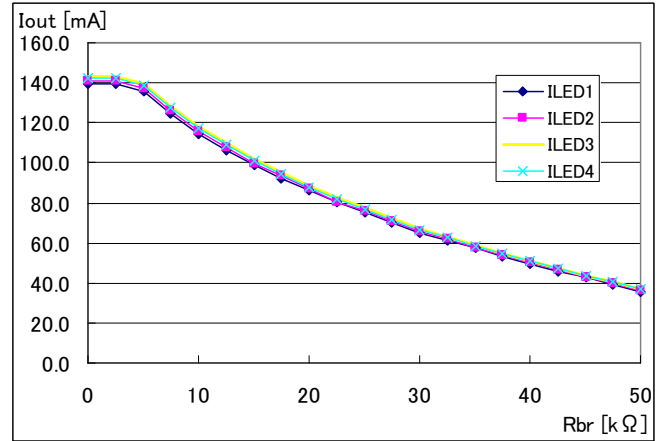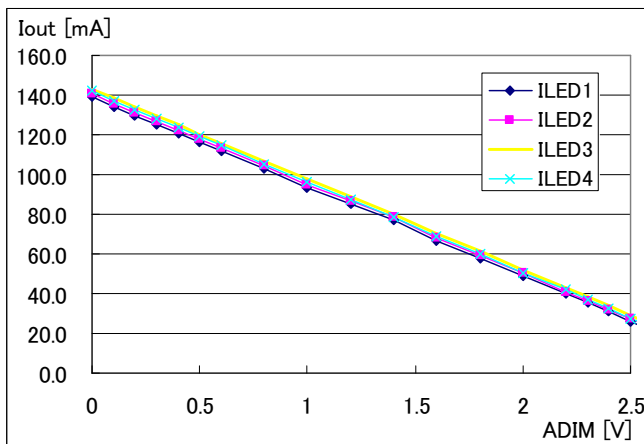Fig. 5-5 PWM Resistor dimming characteristics(Rbr vs Iout)

Fig. 5-6 Current Amplitude dimming characteristics(ADIM vs Iout)

6 Protection function

*The ALD series is equipped with the following protection circuits:

(1) Open LED protection circuit (Alarm output)
(2) Over voltage protection circuit (Alarm output)
(3) Input over current protection circuit (Fuse blows)
(4) Output A-C short protection circuit

6-1 Open LED protection circuit

The Open LED protection circuit and the over voltage protection circuit are the same circuit.
If one of the LED strings is open, the opened string keeps working in an over voltage condition and the other strings work normally.
The alarm output is active(around 5V) when any string is in an open condition.

6-2 Over voltage protection circuit

When over voltage protection circuit works, the unit keeps on working at over voltage threshold voltage.
The alarm output is active(around 5V) when any strings work at over voltage condition.
If the unit switches from an over voltage condition to a normal condition, the alarm output automatically inactivates.

6-3 Input over current protection circuit

The ALD series has an internal over current protector for the input.
Please ensure power supply capacity on the specifications for proper operation of over current protector.
Please confirm input current on the final products doesn't exceed the standard value of the specifications in any conditions.
When you cannot guaranty the power supply capacity, please prepare other external over current protection device because the circuit protector may not work properly.

6-4 Output A-C short protection circuit

This ALD series has a short protection circuit between the Anode and the Cathode output terminal.
The function doesn't guarantee that the product doesn't break.
Please do not use the short-circuited product even once.

7 Alarm Output Function

*The ALD series has an alarm output function. The Alarm output is 0~1V at normal condition and around 5V at abnormal condition.
Please confirm the following precautions about the alarm output that is generated internally:

7-1 Recommended Power On/Off Sequence

*Turn On Sequence
1) apply input voltage
2) apply Vbr and ADIM voltage (recommend low impedance output like operation amplifier output etc.)
3) apply remote on/off voltage (recommend high level signal at open collector or logic output)
 *Please provide mask for the alarm signal at turn on when you control external product by monitoring alarm output. (Please refer to Fig.7-1:recommended sequence)
*Turn Off Sequence
1) turn off remote on/off voltage(recommend Low level signal at open collector or logic output)
2) turn off Vbr and ADIM voltage (recommend low impedance output like operation amplifier output etc.)
3) turn off input voltage
 *Please provide mask for the alarm signal at turn off when you control external product by monitoring alarm output. (Please refer to Fig.7-1:recommended sequence)

7-2 Turn on input voltage and remote on/off voltage simultaneously

*Turn On Sequence
When input voltage is lower than working voltage of IC, the alarm signal may activate.
When the rise time of input voltage is long, the alarm signal may activate.
 *Please provide mask for the alarm signal at turn on when you control external product by monitoring alarm output. (Please refer to Fig.7-1:recommended sequence)
*Turn Off Sequence
When input voltage is lower than working voltage of IC, alarm signal may activate.
When the fall time of input voltage is long, the alarm signal may activate.
 *Please provide mask for the alarm signal at turn off when you control external product by monitoring alarm output. (Please refer to Fig.7-1:recommended sequence)

7-3 Turn on or turn off remote control voltage slowly

*Turn On Sequence
When the rise time of remote on/off voltage is long, the alarm signal may activate.
We recommend slew rate apply to the remote on/off terminal is faster than 0.1V/μsec.
*Turn Off Sequence
When the fall time of remote on/off voltage is long, the alarm signal may activate.
We recommend that the slew rate applied to the remote on/off terminal is faster than 0.1V/μsec.

7-4 Actual Alarm Output Behavior
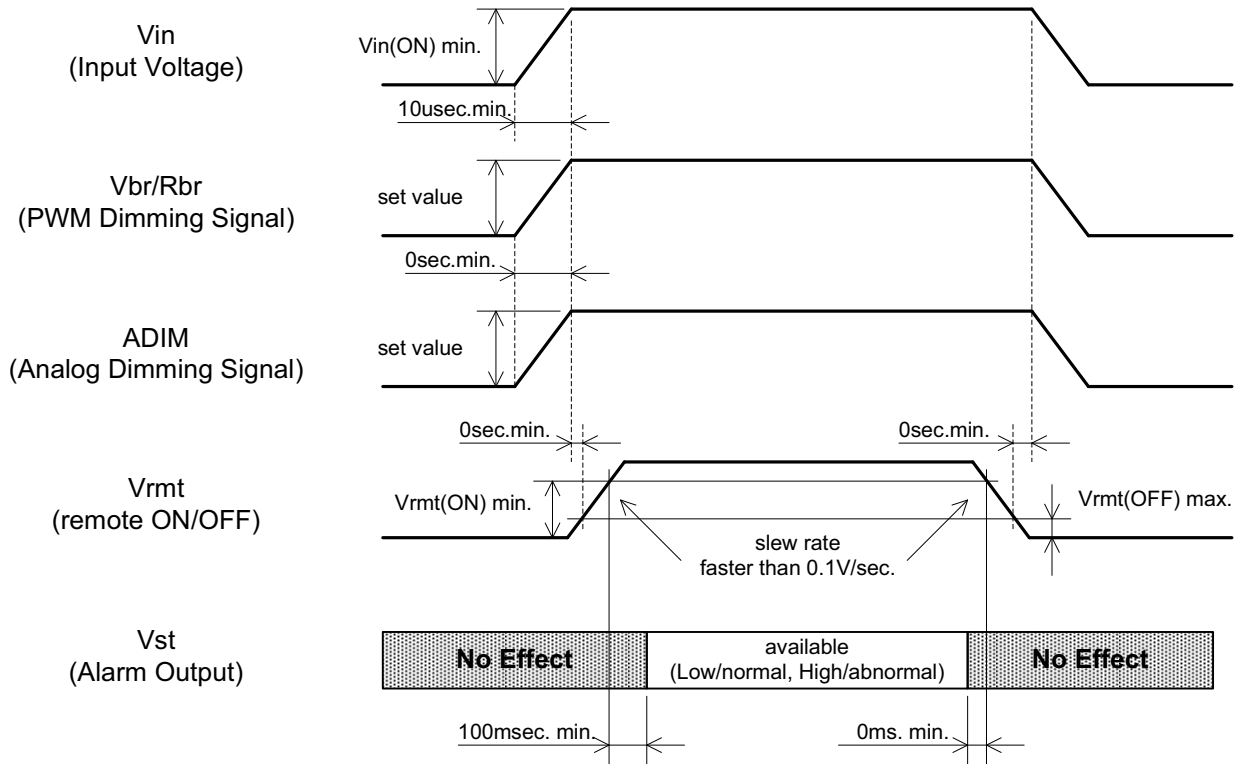
Alarm output behavior is different for each model.
Please refer to the Product Drawing "*4-4. Protection Circuit Behavior" for each model.

Fig.7-1. Recommended Power On/Off Sequence

Vin
(Input Voltage)

Vin(ON) min.

10usec.min.

Vbr/Rbr
(PWM Dimming Signal)

set value

0sec.min.

ADIM
(Analog Dimming Signal)

set value

0sec.min.   0sec.min.

Vrmt
(remote ON/OFF)

Vrmt(ON) min.   Vrmt(OFF) max.

slew rate
faster than 0.1V/sec.

Vst
(Alarm Output)

No Effect | available (Low/normal, High/abnormal) | No Effect

100msec. min.   0ms. min.

Vin(ON) min.   : minimum of recommended working input voltage
Vrmt(ON) min.   : minimum Vrmt on voltage
Vrmt(OFF) max.   : maximum Vrmt off voltage

8 Connection Diagram

Fig. 8-1 ALD-214012PM132

Vin 10.8~13.2V — Iin — CN1-1, CN1-2, CN1-3, CN1-4, CN1-5, CN1-6, CN1-7, CN1-8

Vrmt 3V — SW1 a/b
Vbr 0~2.5V — SW2 a/b
Rbr 0~50kΩ (0.25Wmin.)
ADIM 0~2.5V
Vst

CN3-1 — Io2 — RL2
CN3-2
CN3-3 — RL1
CN3-4 — Io1
CN3-5
CN3-6
CP7 — F

RL1,2：Load Resistance(15Wmin.)
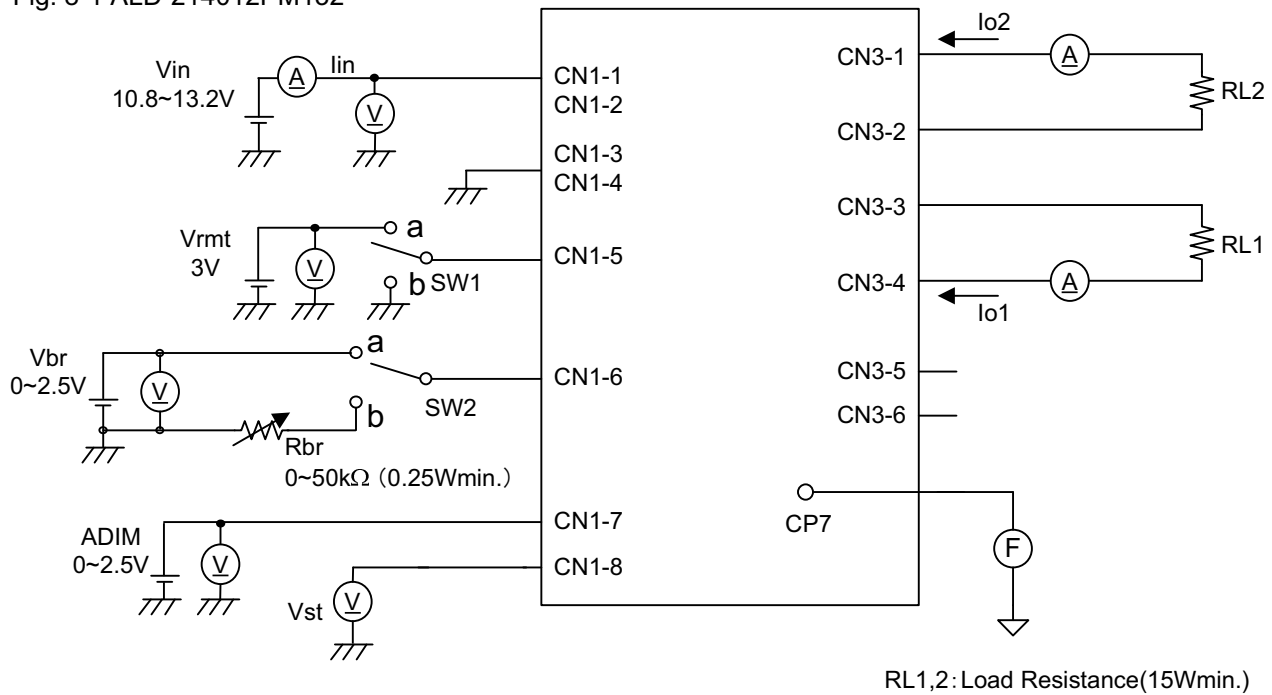
Note 8-1 SW1 function

SW1	Unit Behavior
a	Working
b	Not Working
open	Not Working

Note 8-2 SW2 function

SW2	Unit Behavior
a	PWM DC Dimming Vbr=0~2.5V
b	PWM Resistor Dimming Rbr=0~50kΩ

* Vbr=0V：maximum brightness
Rbr=0Ω：maximum brightness

Note 8-3 Test Equipment

Ⓥ ：DC Voltage Meter （ADVANTEST R6452A or equivalent）

Ⓐ ：DC Current Meter （ADVANTEST R6452A or equivalent）

Ⓕ ：Frequency Counter （ADVANTEST R6452A or equivalent）

Note 8-4 Protection Ciruit

Load Condition	Alarm Output (CN1-8)	Output status
steady state	0.5V max.	CC
1string open	4.5V min.	Open string: CV Others: CC
All strings open	4.5V min.	CV

Fig. 8-2 ALD-414012PM133

RL1~4：Load Resistance (15Wmin.)

Note 8-5 SW1 function

SW1	Unit Behavior
a	Working
b	Not Working
open	Not Working

Note 8-6 SW2 function

SW2	Unit Behavior
a	PWM DC Dimming Vbr=0~2.5V
b	PWM Resistor Dimming VR=0~50kΩ

* Vbr=0V：maximum brightness
Rbr=0Ω：maximum brightness

Note 8-7 Test Equipment

Ⓥ ：DC Voltage Meter
（ADVANTEST R6452A or equivalent）

Ⓐ ：DC Current Meter
（ADVANTEST R6452A or equivalent）

Ⓕ ：Frequency Counter
（ADVANTEST R6452A or equivalent）

Note 8-8 Protection Circuit

Load Condition	Alarm Output (CN1-14)	Output status
steady state	0.5V max.	CC
1string open	4.5V min.	Open string: CV Others: CC
All strings open	4.5V min.	CV

9 Other Caution Instructions

Please avoid to control dimming by Vrmt terminal. When you want to use dimming, please use Vbr or ADIM terminal.
When you handle the unit, please be careful to keep unit's components from coming in contact with anything.
This unit does not allow hot plugging. When the unit is operating don't plug in or plug out the connector.

10 Flicker Considerations

In PWM or Analog Dimming operation, please confirm the LCD panel before use. Flickering may occur due to ripple noise is on Dimming pin (Vbr / Rbr / ADIM).

11 Dimming Noise Considerations

In PWM Dimming operation, please confirm whether to hear the noise before use. Noise may occur according to the state of the substrate installation when the PWM Dimming pin (Vbr / Rbr) is used.

12 Converter Layout Considerations

Please consider unit's layout to prevent long cabling. Don't use cable connector extensions.
In order to protect the ALD against vibration and shock, be sure to use all mounting holes when installing the ALD.
Please confirm the clearance between screw head and layout pattern.
If all the GND vias connected with the frame of LCD panel electrically, EMI may decrease.
Please refer to Fig.12-1~Fig.12-2 before installing the unit.
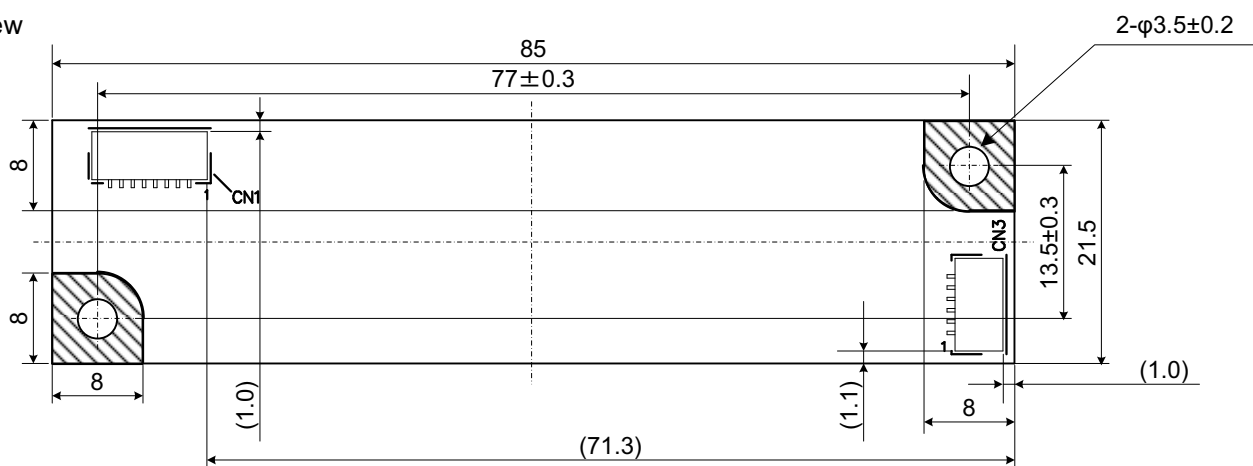Please don't put the unit on top of the back light directly without isolation.

(18/21)   CTR-4014-X_00

Fig.12-1 ALD-214012PM132

*tolerance is ±0.5mm unless otherwise specified

Product fixation arias (Include GND vias).
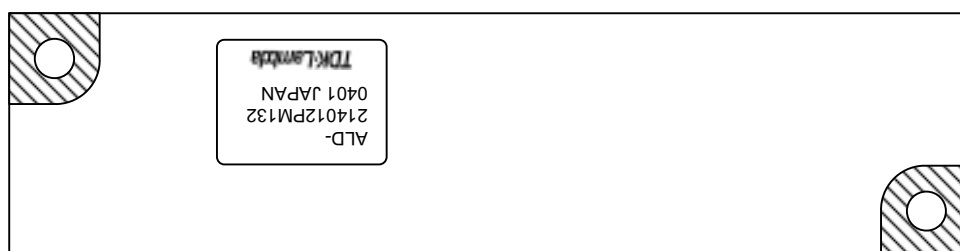
Top View

Bottom View

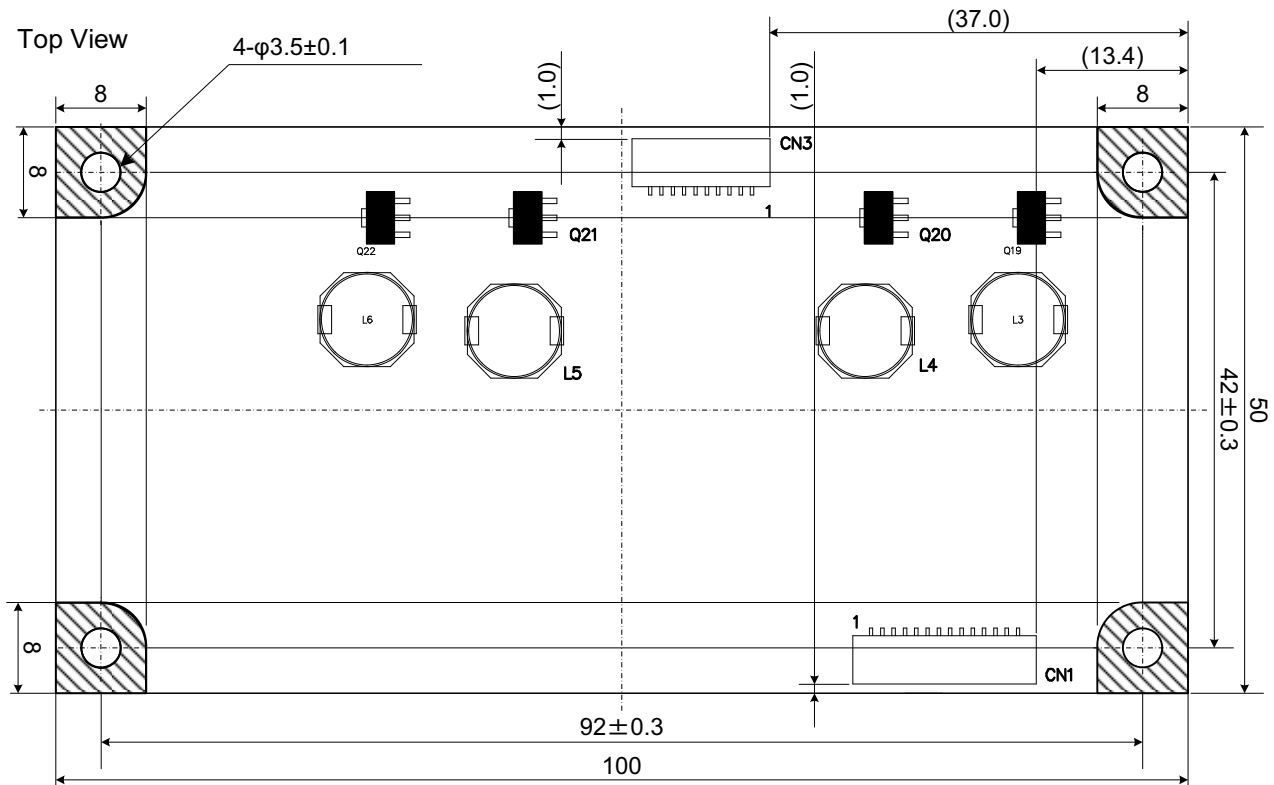Fig.12-2 ALD-414012PM133

*tolerance is ±0.5mm unless otherwise specified

Product fixation arias (Include GND vias).

Top View

4-φ3.5±0.1

Bottom View

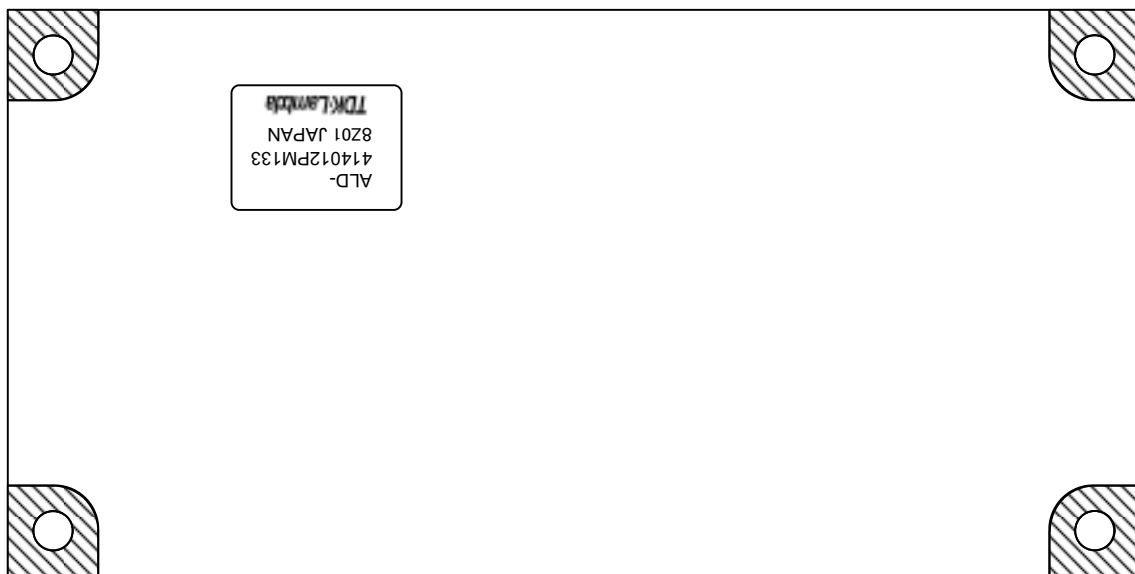**DC-DC Converter Unit ALD Series: Instruction Manual**

13 Output voltage derating

Please refer to Figure 13-1 and 13-2 for the voltage derating of the product.
Please use the product in the derating curve of the Ambient (near by CN1) and the Vout condition.

Please confirm the surface temperature of the L3 inductor (please refer to Figure 12-1) is 115℃ or less in worst condition (input voltage, load voltage, mounting instruction, and temperature) when it uses it. [ALD-214012PM132]

Please confirm the surface temperature of the L5 inductor (please refer to Figure 12-2) is 115℃ or less in worst condition (input voltage, load voltage, mounting instruction, and temperature) when it uses it. [ALD-414012PM133]
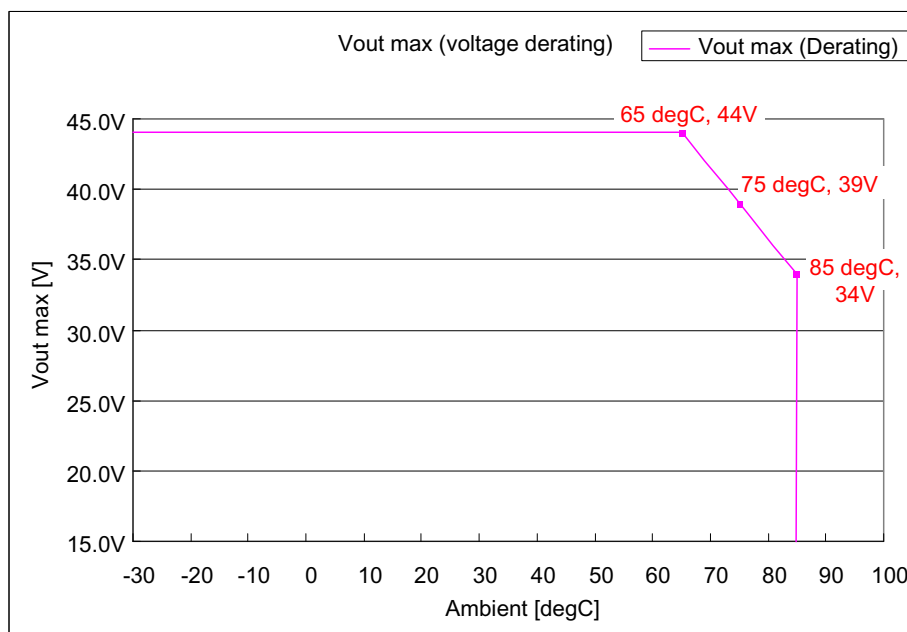
Fig.13-1 ALD-214012PM132

Fig.13-2 ALD-414012PM133