

To : _____

Specifications of INVERTER for FUJITSU LCD module

FLC V -15

Approval
Date :
By :

This Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (hereinafter "High Safety Required Use"), including without limitation, nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system. If customer's product possibly falls under the category of High Safety Required Use, please consult with our sales representatives in charge before such use. In addition, Fujitsu shall not be liable against the Customer and/or any third party for any claims or damages arising in connection with the High Safety Required Use of the Product without permission.

Specification No. : Tech Bes LCD-00111

Issue Date : Feb. 19, 2002

Issued by : 

T. Naka

Director
LCD Design Dep.
LCD Technology Div.
LCD Group

FUJITSU LIMITED

REVISION HISTORY

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Revision	Date	Prepared	Checked			Approved	Summary
01A	Feb. 4, 2002	M.Miyahara	M.Fujita	F.Yamada		T.Naka	1st edition

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DOCUMENT CONTROL SECTION

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FLCV-15

Tech Bes LCD-00111

CUST.

02	20020219	Miyahara	Fujita	Yamada	Revised p7			
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DESIG.	20020204	Miyahara	CHECK	Takahashi	Fujita	APPR.	Yamada	

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1. APPLICATIONS

This specification is applied to the INVERTER unit suited for TFT-LCD unit shown on Table 1-1.

Table 1-1 Applied Model Number

	Model Number	Product Drawing Number	Remark
1	FLC43XWC6V-02	NA19020-C553	43cm (17.0-inch) XGA-Wide
2			
3			

2. PRODUCT NAME AND MODEL NUMBER

2-1 Product Name : INVERTER
 2-2 Model Name : FLCV-15
 2-3 Product Drawing Number : NA19002-4238

3. OVERVIEW

This inverter unit can drive four Cold Cathode Fluorescent Lamps (CCFLs) of the backlight. This inverter can control ON and OFF, and the brightness of CCFL by external signals. The power supply of this inverter unit is +15.8V DC.

The block diagram is shown in the attached figure-1.

4. ABSOLUTE MAXIMUM RATINGS

Table 4-1 shows the absolute maximum ratings.

Table 4-1 Absolute Maximum Ratings

Item	Symbol	Condition	MIN.	MAX.	Units	Remark
Supply Voltage	Vin		0	25	V	*1
Temperature	Operation	Top	Ha≤90%RH	0	60	
	Storage	Tstg	Ha≤95%RH	-20	80	
Humidity	Operation	Hop	Ta=0~55	20	90	%RH
	Storage	Hstg	Ta=-20~80	5	95	%RH
ON/OFF Control Voltage	Vent		-0.3	6.0	V	
Brightness Control Voltage	Vvr		-0.3	6.0	V	

*1 This inverter can tolerate only within 10msec for 20 to 25V of supply voltage.

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5. RECOMMENDED OPERATING CONDITIONS

Table 5-1 shows the recommended operating conditions.

Table 5-1 Recommended Operating Conditions

Item		Symbol	MIN.	TYP.	MAX.	Units	Remark
Supply Voltage		Vin	14.2	15.8	17.6	V	
Temperature	Operation	To	0		50		
	Storage	Ts	-20		60		
Humidity	Operation	Ho	20		85	RH	No condensation
	Storage	Hs	5		85	RH	
ON and OFF Control Voltage	ON	Vent	2.0	---	5.5	V	CCFL is on.
	OFF	Vent	0	---	0.8	V	CCFL is off.
Brightness Control Signal	High level	BKLR1/BKLR2	2.0	---	5.5	V	CCFL is on.
	Low level	BKLR1/BKLR2	0		0.8	V	CCFL is off.
	Frequency	fc	187	189	191	Hz	
	Duty		36		100	%	
Power supply capacity (User side)		Ic	4.0	---	---	A	*1

*1 Minimum 4.0 ampere current is required for meltdown of fuse when abnormal circumstance has happened.

6. MECHANICAL SPECIFICATIONS

6-1 Overview

Table 6-1 shows the mechanical specifications.

Table 6-1 Mechanical specifications

Item	Specifications	Unit	Remark
Demention	170 × 80 × 11.6(TYP)	mm	
Weight	83.5(TYP)	g	

6-2 Structure and Dimension

See the attached figure-3.

6-3 FG-SG

Short circuited.

6-4 Recommended mounting condition

See the attached figure-4.

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7. ELECTRICAL SPECIFICATIONS

Table 7-1 shows the electrical specifications.

Unless otherwise specified, typical LCD unit (or equivalent impedance : 60k \parallel (10pF) is connected to individual output pin. The power supply is +15.8V DC. $V_{ent}=5.5V$, $BKLR1/BKLR2=5.5V$. Measurement is to be done after 20 minutes from lighting on.

Table 7-1 Electrical Specifications

Item		Symbol	Condition	MIN.	TYP.	MAX.	Units	Note
Supply Current	Max Power Supply	Iin1	Vin=17.6V	---	2000	2300	mA	
	Min Power Supply		Vin=14.2V		2400	2700	mA	
	Non-lighting	Iinf	Vent=0V	---	0	---	mA	
Lighting Frequency		fr		40	50	60	kHz	*1
Tube current		Iout1		19.5	21.3	22.8	mA	*2
		Iout2		---	12.3	---	mA	*3
Output voltage without load		Vt1	Vin=15.8V	1400	1500	1600	Vrms	*4
		Vt2	Vin=17.6V	---	---	1600		
		Vt3	Vin=14.2V	1400	---	---		
IF current for On/Off control	Lighting	Ic	Vent=5.5V	---	---	1.5	mA	*5
	Non-lighting	Ic	Vent=0V	- 1.5	---	---	mA	
IF current for brightness control	High	Id	BKLR1/BKLR2=5.5V	---	---	1.5	mA	*6
	Low	Id	BKLR1/BKLR2=0V	- 1.5	---	---	mA	
Open detection		Iop		16.0		---	mArms	*7

*1. Same frequency for CN2, CN3 each.

*2. Tube current means the current that flows into two CCFLs. (or tube equivalent impedance)

*3. Average tube current for two CCFLs at brightness control frequency=189Hz and duty ratio (D)=36%.

$D : (\text{Time at high for BKLR1/2}) / [(\text{Time at high for BKLR1/2}) + (\text{Time at low for BKLR1/2})] \times 100\%$

*4. Transformer output.

*5. Supply current for On/Off control pin. + means flow into inverter.

*6. Supply current for brightness control pin. + means flow into inverter.

*7. Open detection for each CCFL, and detection makes all the output of CCFL off.

It returns to normal state automatically by the power off and on.

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8. INTERFACE CONNECTOR

Table 8-1 and 8-2 show pin assignment and function of interface connector.

Table 8-1 Input Signals [CN1:S9B-PH-SM3-TB (JST/SMT)]

Pin	Name	Function	Remark
1	Vin	Power Supply (+15.8V)	
2	Vin	Power Supply (+15.8V)	
3	Vin	Power Supply (+15.8V)	
4	GND	Ground	
5	GND	Ground	
6	Vcnt	ON and OFF Control Voltage	CCFL is on for Vcnt=High. CCFL is off for Vcnt=Low or Open.
7	BKLR1	Brightness Control 1	
8	SGND	Signal Ground	
9	BKLR2	Brightness Control 2	

Table 8-2 Output Signals [CN2,3: SM04(4.0)B-BHS-1-TB (JST/SMT)]

Pin	Name	Function
1	OUT-H1	Power supply for CCFL1/CCFL3 (HOT)
2	OUT-H2	Power supply for CCFL2/CCFL4 (HOT)
3	N.C.	Open
4	OUT-1	Power supply for CCFLs (GND)

User's connector : BHR-04VS-1 (JST)

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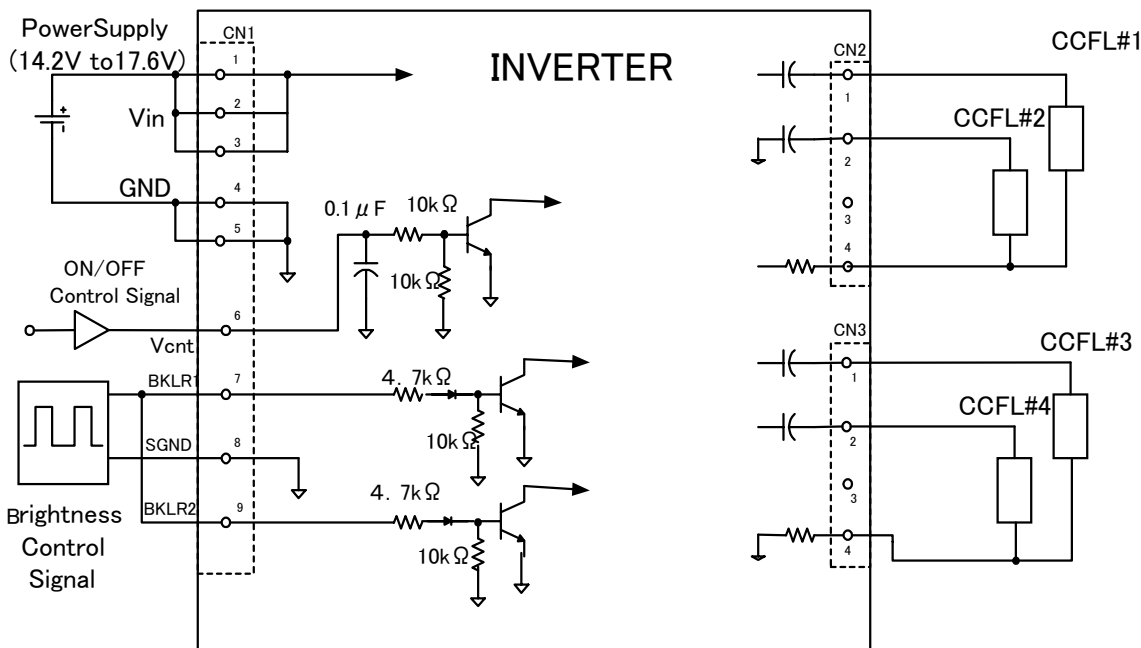
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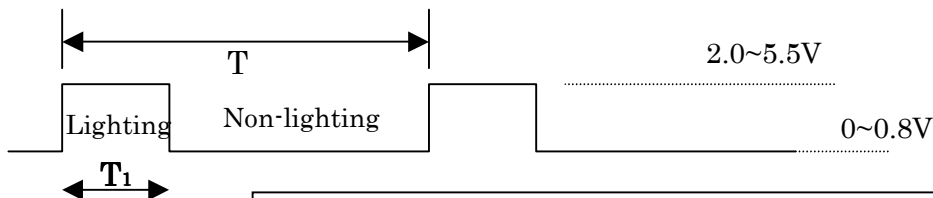
9. ON/OFF AND BRIGHTNESS CONTROL

- (1) ON/OFF of CCFL can be controlled by applying control signal to Vcnt (pin No.6) of CN1.
- (2) Brightness of CCFL can be controlled by applying same PWM signal to BKLR1 (pin No.7) and BKLR2 (pin No.9) of CN1 simultaneously.
- (3) Signal interfaces between the inverter and user's device are shown on Fig. 9-1.

Fig. 9-1 Signal interface



- (4) Recommended signal level for ON/OFF and brightness control is referred to 5.
- (5) Brightness of CCFL can be controlled by varying pulse width of PWM signal.



$1/T=189\pm 2\text{Hz}$: Brightness control frequency
 Duty $D=T1/T \times 100\%$
 $D=100\% \sim 36\%$

Brightness is maximum at duty $D=100\%$. Brightness becomes darker by decreasing Duty D . (See Fig.9-2)

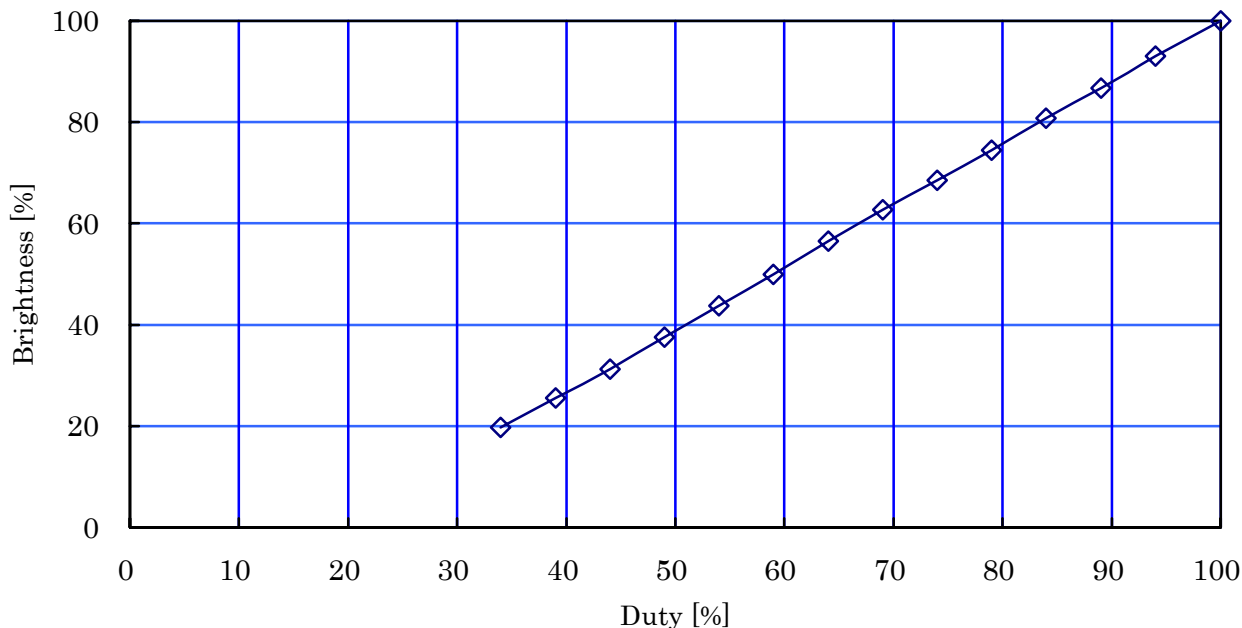
Note: When duty D becomes below about 20%, CCFL may be turned off by open detection circuit.

- (6) Although brightness control frequency is valid from 150 to 300 Hz, beat (flicker) or flashing on display may be generated at some frequency.

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Fig.9-2 Duty-Brightness (Typical Value)



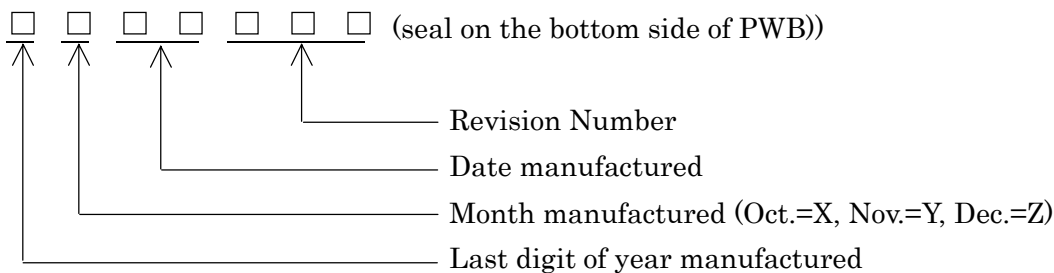
10. MARKING

This inverter has the following markings.


② (1) Model Name : FLCV-15 (seal on the bottom side of PWB))

② (2) Product Drawing Number : NA19002-4238 (seal on the bottom side of PWB))

② (3) Manufacturing Number and Revision Number



② (4) Company Name :
FUJITSU LIMITED (seal on the bottom side of PWB))

(5) Warning :
 CAUTION HIGH VOLTAGE (silkscreen marking on the top side of PWB)
 UL number (silkscreen marking on the top side of PWB)

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02 20020219						Revised 10(1)~(4) marking	
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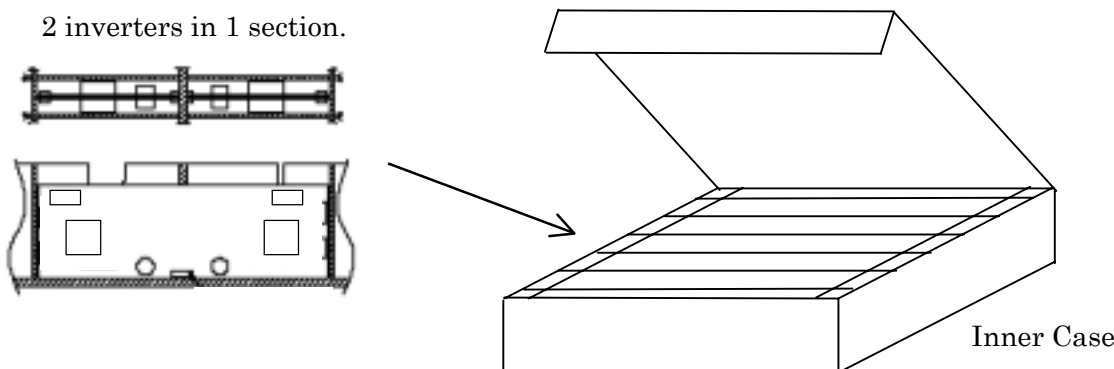
11. PACKAGING

Inverters are accommodated in the inner case which has capacity of maximum 10. Then, they are packed in the outer carton (corrugated carton) and shipped. (See Fig. 11)

The size of the outer carton is not specified because it depends on the quantity of the shipping inverters. In case the number of inverter is less than 10, the inverter may be packed individually in the antistatic material without using the inner case.

[Inner box] -Size : 250 x 170 x 90mm
-Material : corrugated carton

Fig.11 Packaging (Inner case)



12. WARRANTY

The warranty period is one year from the manufactured date. Fujitsu shall repair or provide new product free of charge in case of product failure during this period due to the causes other than the intentional acts of damage or negligence by user.

13. PRECAUTIONS

This inverter module generates a high voltage, and incorrect operations may cause electric shock, smoke, or fire.

Please adhere to the following precautions to secure high reliability and safety.

13-1 Fail safe design

Inverter has an inherent chance of failure. Customers must protect against accident into injury or death, fire accident or social loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current or other abnormal operating conditions.

13-2 Condition for use

(1) This product is not intended to be used for the equipment which requires extremely high reliability, such as aerospace equipment, nuclear control system, or medical equipment for life support.

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- (2) Please keep the inverter out of water drop and dust because it may give any trouble. Avoid using the inverter which shows evidence of accretion of water drop and dust.
- (3) Do not store this product in an environment of dust or corrosive gas (salt, acid, alkali etc.).
- (4) Be sure to use this product under recommended operating conditions specified in section5. Do not use this product over absolute maximum ratings specified in section4.

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13-3 Mounting

B

- (1) When designing equipment, high voltage part of inverter, that is the wiring between transformer and output connector, must keep the distance of 4mm or more from any other conductive materials. If there are any conductive materials around the inverter, we recommend to insert insulator.
- (2) Do not bundle the high side and the low side of the cable between the output connector and the lamp not to increase leakage current which does not contribute to light generation. Do not twist the cable.
- (3) Make sure that foreign particles do not get into the module to prevent malfunction caused by short-circuit of high voltage part of inverter.

B

13-4 Protective circuit

C

- (1) This product has built-in fuse to prevent from smoking or firing caused by over current. To make sure this operation, use the power supply with capacity of more than twice of rated current.

C

13-5 Handling

D

- (1) Be careful of electric shock, for there stays a high voltage in the internal circuit. Turn off the power supply before pushing in and pulling out the input or output connectors.
- (2) Do not touch the exposed part of the transformer on the inverter. It may cause electric shock.
- (3) Excessive mechanical force to the electric parts and printed circuit board of the inverter may become the cause of any trouble such as pattern exfoliation. Handle this inverter carefully.
- (4) Please don't give any shock to the transformer of the inverter or don't hurt the signal cable. Even rare short-circuit may become the cause of smoke or fire.
- (5) Do not stack the inverters.

D

13-6 Indication

- (1) There is no indication to warn you about the high voltage. Make sure that only authorized technician should handle the inverter.
If the equipment is designed so that the inverter is possibly touched by outsider, it is requested to indicate warnings clearly for fear of electric shock or burns.

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14. PRECAUTION FOR USE

This Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (hereinafter "High Safety Required Use"), including without limitation, nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system. If customer's product possibly falls under the category of High Safety Required Use, please consult with our sales representatives in charge before such use. In addition, Fujitsu shall not be liable against the Customer and/or any third party for any claims or damages arising in connection with the High Safety Required Use of the Product without permission.

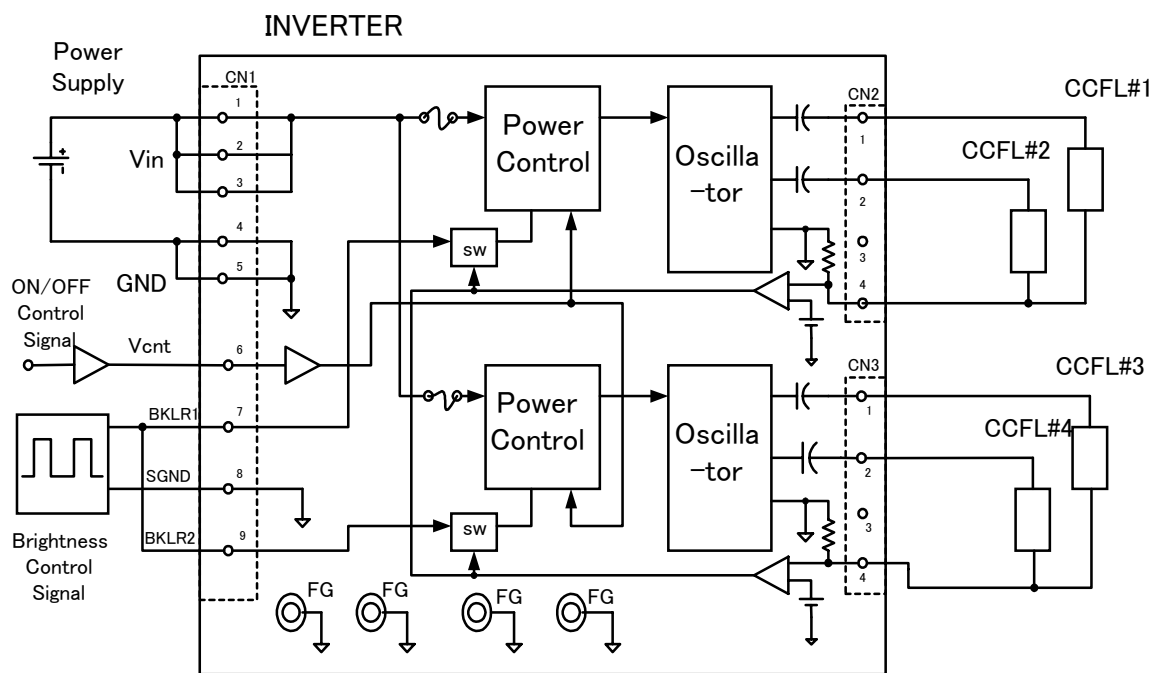
15. MISCELLANEOUS

Specifications of this product are subject to change. In such cases, both parties shall discuss together preceding the change.
Both parties shall discuss together and make the best effort to reach agreement in case of rising of any doubt to the contents of the specifications and any subject not referred to in this specifications.

16. ATTACHED FIGURES

- Attached figure-1 : Block diagram
- figure-2 : Test circuit
- figure-3 : Structure and Dimension
- figure-4 : Recommended mounting condition

Fig-1:Block diagram



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Fig-2 Test circuit

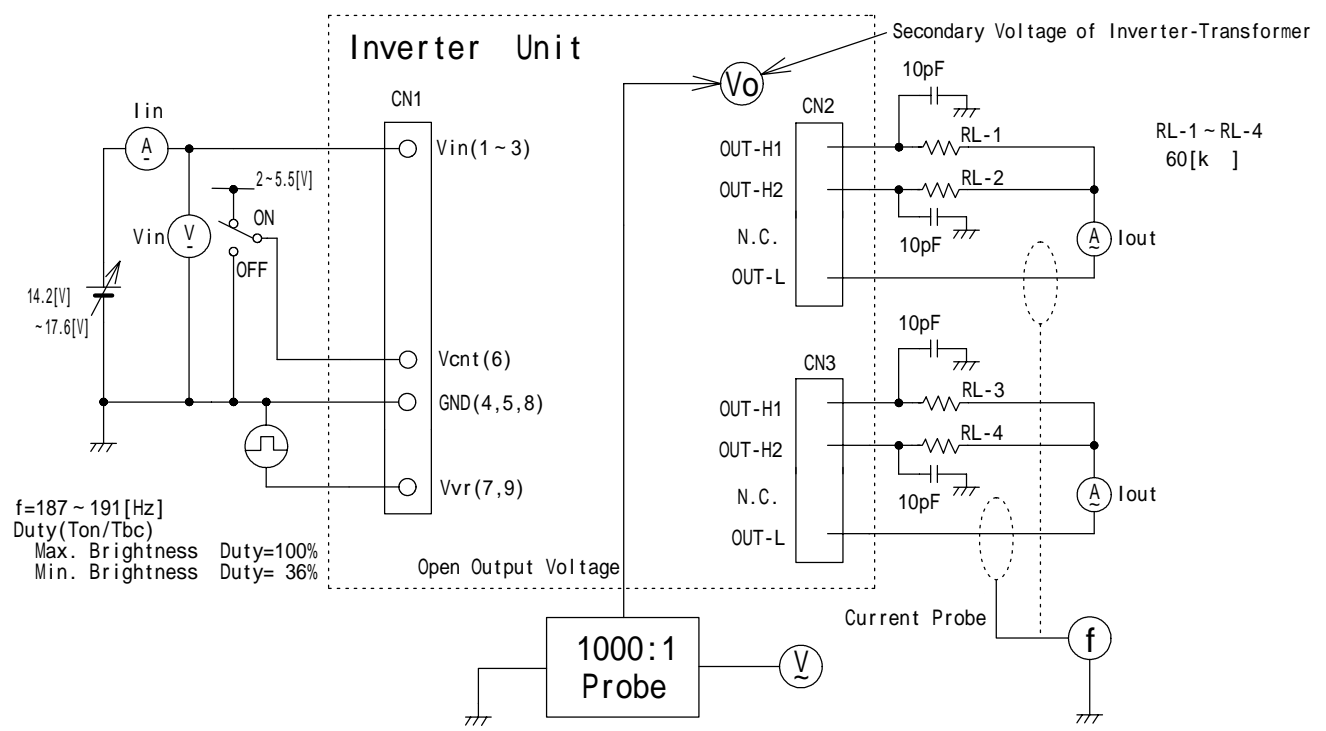
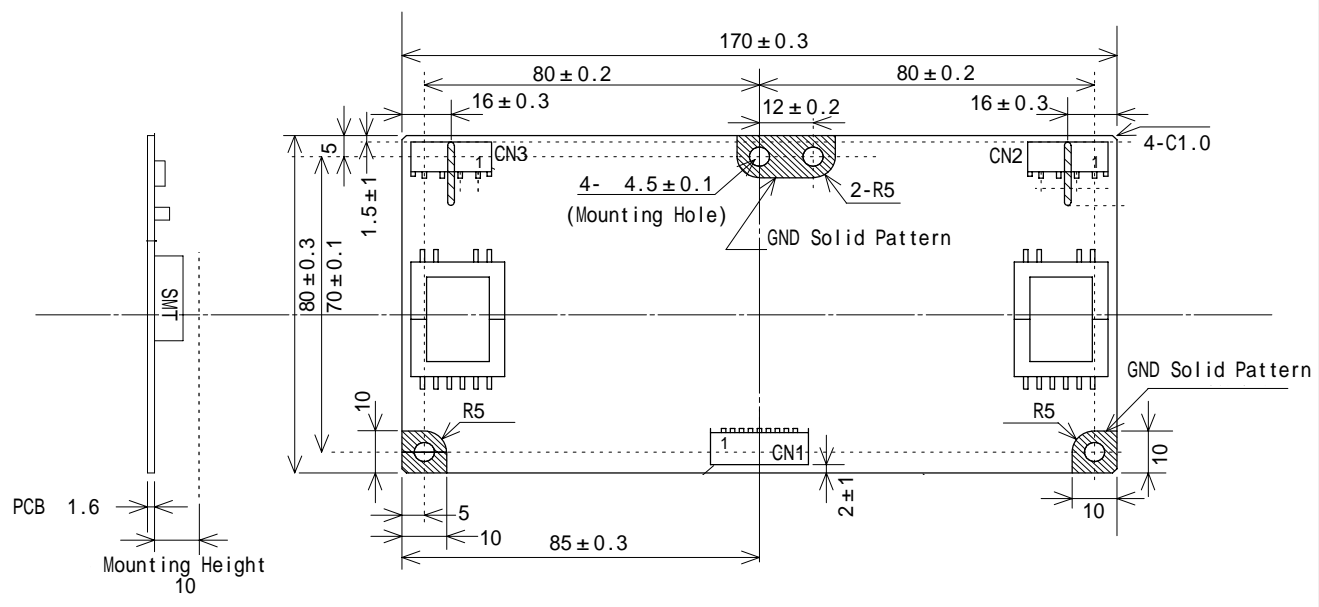


Fig-3 Structure and Dimension

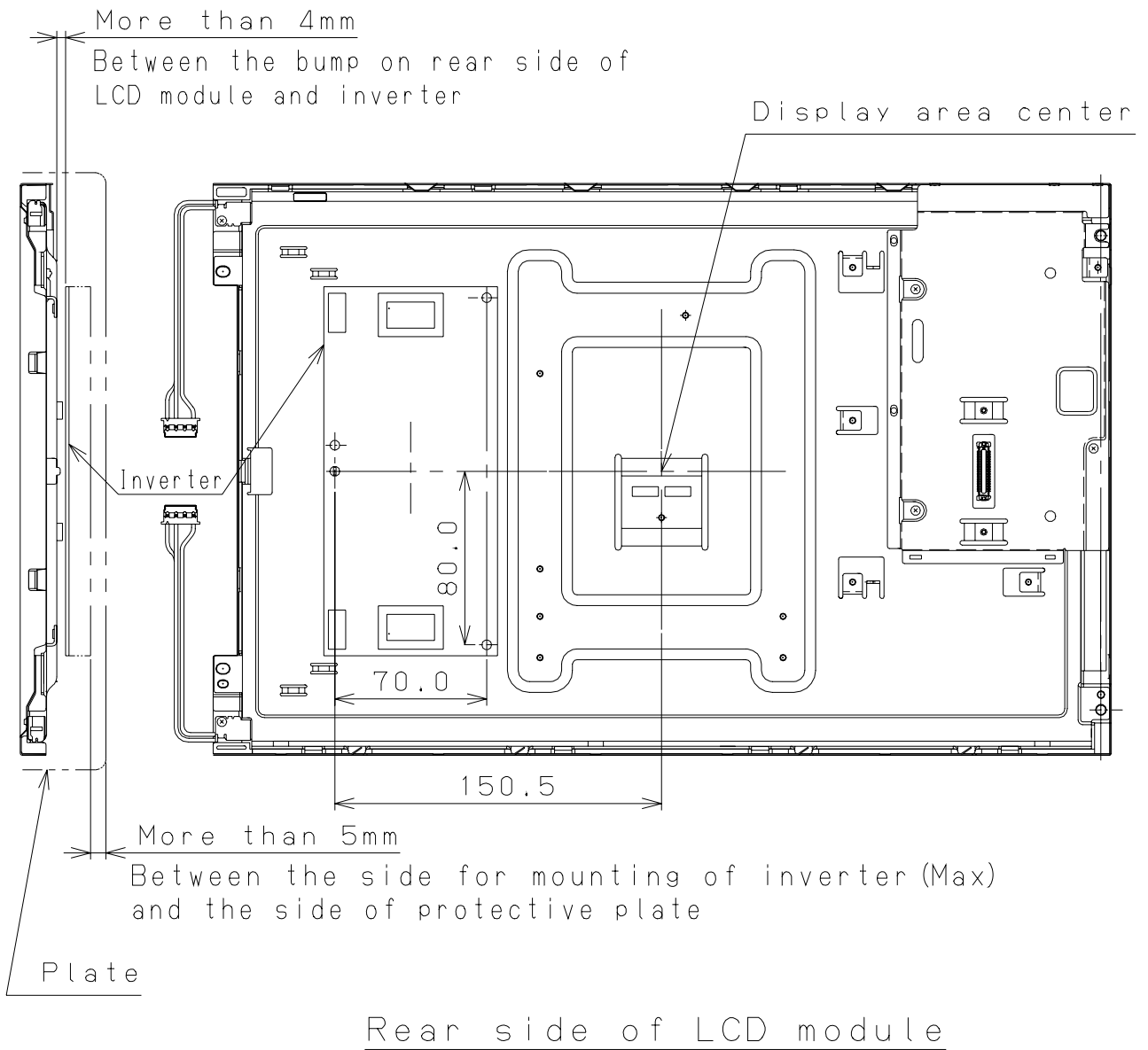


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Fig-4 Recommended mounting condition



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