

INVERTER

150PW231

DATA SHEET

DOD-PD-1355 (2nd edition)

**This DATA SHEET is updated document from
DOD-PD-0924(1).**

**All information is subject to change without
notice. Please confirm the sales representative
before starting to design your system.**

INTRODUCTION

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The products are classified into three quality grades: "**Standard**", "**Special**", and "**Specific**" of the highest grade of a quality assurance program at the choice of a customer. Each quality grade is designed for applications described below. Any customer who intends to use a product for application other than that of Standard quality grade is required to contact an NEC sales representative in advance.

The **Standard** quality grade applies to the products developed, designed and manufactured in accordance with the NEC standard quality assurance program, which are designed for such application as any failure or malfunction of the products (sets) or parts/components incorporated therein a customer uses are, directly or indirectly, free of any damage to death, human bodily injury or other property, like general electronic devices.

Examples: Computers, office automation equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment, industrial robots, etc.

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Examples: Control systems for transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, medical equipment not specifically designed for life support, safety equipment, etc.

The **Specific** quality grade applies to the products developed, designed and manufactured in accordance with the standards or quality assurance program designated by a customer who requires an extremely higher level of reliability and quality for such products.

Examples: Military systems, aircraft control equipment, aerospace equipment, nuclear reactor control systems, medical equipment/devices/systems for life support, etc.

The quality grade of this product is the "**Standard**" unless otherwise specified in this document.

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1. OUTLINE

This 150PW231 inverter is for LCD modules. Adaptable LCD modules are as follows.

Adaptable LCD modules
NL10276BC30-17
NL10276BC30-18



2. SPECIFICATION

2.1 GENERAL SPECIFICATIONS

Item	Specification	Unit
Size	See "5.OUTLINE DRAWINGS".	mm
Weight	70 (max.)	g
Delivery unit	10 (min.)	set

2.2 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Remarks	
Power supply voltage	VDDB	0 to +14.0	V	-	
Input voltage	BRTC signal	VBC	-1.0 to VDDB+1.0		V
	B RTP signal	VBP	0 to +6.0		V
	PWSEL signal	VPSL			V
	BRTI signal	VBI	0 to +5.0		V
Storage temperature	Tst	-20 to +80	°C	-	
Operating temperature	Top	-10 to +75	°C	-	
Relative humidity Note1	RH	≤ 95	%	Ta ≤ 40°C	
		≤ 85	%	40 < Ta ≤ 50°C	
		≤ 70	%	50 < Ta ≤ 55°C	
Absolute humidity Note1	AH	≤ 73 Note2	g/m ³	Ta > 55°C	

Note1: No condensation

Note2: Water amount at Ta=55°C and RH=70%

2.3 ELECTRICAL CHARACTERISTICS

(Ta=25°C)

Parameter		Symbol	min.	typ.	max.	Unit	Remarks	
Power supply voltage		VDDB	11.4	12.0	12.6	V	Note1, Note2	
Power supply current		IDDB	-	1,550	1,900	mA	VDDB= 12.0V, at the maximum luminance control Note2	
Input voltage	BRTC signal	High	VBCH	2.5	-	VDDB	V	-
		Low	VBCL	0	-	0.4	V	
	BRTP signal	High	VBPH	2.0	-	5.0	V	
		Low	VBPL	0	-	0.4	V	
	PWSEL signal	High	VPSLH	2.0	-	5.0	V	
		Low	VPSLL	0	-	0.4	V	
BRTI signal		VBI	0	-	2.5	V		
Input current	BRTC signal	High	IBCH	-	-	0.6	mA	-
		Low	IBCL	-1.0	-	-	mA	
	BRTP signal	High	IBPH	-	-	1.0	mA	
		Low	IBPL	-1.0	-	-	mA	
	PWSEL signal	High	IPSLH	-	-	1.0	mA	
		Low	IPSLL	-1.0	-	-	mA	
BRTI signal		IBI	-1.0	-	4.7	mA		
Output voltage	Open lamp voltage		VO	850	-	-	Vrms	-10 to +75°C Note3
	Lamp voltage (at steady state)		VBLH	-	620	-	Vrms	-
	AM signal	High	VAMH	5.0	5.3	5.6	V	at malfunction
		Low	VAML	-	0	0.5	V	at normal
Output current	Lamp current (per lamp)		IBL	5.5	6.0	6.5	mArms	-
Oscillation frequency		FO	38	43	48	kHz	-	
Luminance control frequency		FB	271	279	287	Hz	-	

Note1: When designing of the power supply, take the measures for the prevention of surge voltage.

Note2: The power supply lines (VDDB and GNDB) have large ripple voltage during luminance control of LCD lamps. There is the possibility that the ripple voltage produces acoustic noise and signal wave noise in audio circuit and so on. Put a capacitor (5,000 to 6,000µF) between the power supply lines (VDDB and GNDB) to reduce the noise, if the noise occurred in the circuit.

Note3: Measured value with high voltage probe of a load capacitance of 3pF.

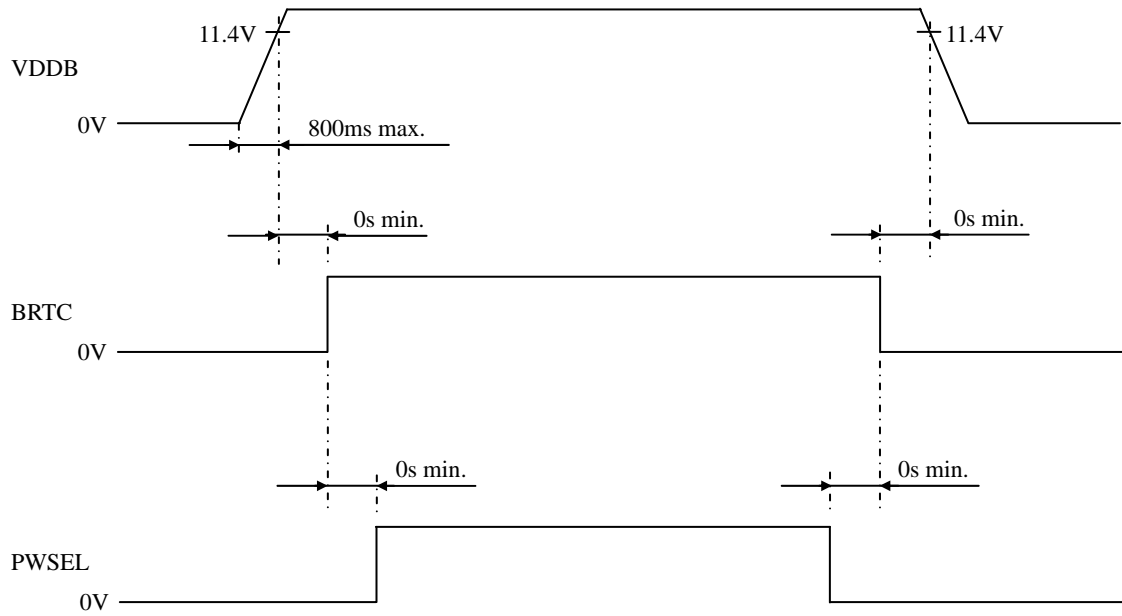
It is guaranteed that the adaptable LCD module can be turned on at Ta= -10 to +75°C.

2.4 FUSE

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VDDB	11CT3.15A	SOC Corporation	3.15A	6.3A 60s max.	Note1
			72V		

Note1: The power supply capacity should be more than the fusing current. If it is less than the fusing current, the fuse may not blow in a short time, and then nasty smell, smoke and so on may occur.

2.5 POWER SUPPLY VOLTAGE SEQUENCE



2.6 CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS

CN1 socket (Inverter side): 53261-1171 (MOLEX Inc.)

Adaptable plug: 51021-1100 (MOLEX Inc.)

Pin No.	Symbol	Function	Remarks
1	VDDB	Power supply	Note1
2	VDDB	Power supply	
3	GNDB	Ground	
4	GNDB	Ground	
5	BRTC	Backlight ON/OFF signal	High or Open: Backlight ON Low: Backlight OFF This pin is pulled-up to VDDB in the product. Pull-up resistance: 66kΩ
6	BRTI	Luminance control terminal	Note2
7	BRTH		
8	AM	Alert signal output at malfunction	Note3
9	N.C.	-	Keep this pin Open.
10	PWSEL	Selection signal of luminance control method	This pin is pulled-down to GNDB in the product. Pull-down resistance: 16kΩ Note2
11	B RTP	B RTP signal	Note2

Note1: All GNDB and VDDB terminals should be used without any non-connected lines.

Note2: See "2.7 LUMINANCE CONTROL".

Note3: If anyone of terminals Pin No.1 or 2 (CN2-CN5) opens, then the alert signal (+5.3V typ.) is output.

CN2-CN5 socket (Inverter side): SM02(8.0)B-BHS-1-TB(LF)(SN) (J.S.T. Mfg Co., Ltd.)

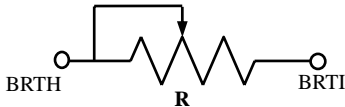
Adaptable plug (Backlight side): BHR-03VS-1 (J.S.T. Mfg Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage (Hot)	-
2	N. C.	-	Keep this pin Open.
3	VBLC	Low voltage (Cold)	-

Note1: VBLH and VBLC must be connected correctly. Wrong connections will cause electric shock and also break down of the product.

2.7 LUMINANCE CONTROL

2.7.1 Luminance control methods

Method	Adjustment and luminance ratio	PWSEL terminal	BRTP terminal						
<p>Variable resistor control</p> <p>Note1</p>	<ul style="list-style-type: none"> • Adjustment <p>The variable resistor (R) for luminance control should be 10kΩ ±5%, 1/10W. Minimum point of the resistance is the minimum luminance and maximum point of the resistance is the maximum luminance.</p> <p>The resistor (R) must be connected between BRTH-BRTI terminals.</p>  <p>(BRTH is connected to GNDB in the product.)</p> <ul style="list-style-type: none"> • Luminance ratio Note3 <table border="1"> <thead> <tr> <th>Resistance</th> <th>Luminance ratio</th> </tr> </thead> <tbody> <tr> <td>0Ω</td> <td>20% (Min. luminance)</td> </tr> <tr> <td>10kΩ</td> <td>100% (Max. luminance)</td> </tr> </tbody> </table>	Resistance	Luminance ratio	0Ω	20% (Min. luminance)	10kΩ	100% (Max. luminance)	Low or Open	Open
Resistance	Luminance ratio								
0Ω	20% (Min. luminance)								
10kΩ	100% (Max. luminance)								
<p>Voltage control</p> <p>Note1</p>	<ul style="list-style-type: none"> • Adjustment <p>Voltage control method works, when BRTH terminal is 0V and VBI voltage is input between BRTI-BRTH terminals. This control method can carry out continuation adjustment of luminance.</p> <p>Luminance is the maximum when BRTI terminal is Open.</p> <ul style="list-style-type: none"> • Luminance ratio Note3 <table border="1"> <thead> <tr> <th>BRTI signal (VBI)</th> <th>Luminance ratio</th> </tr> </thead> <tbody> <tr> <td>0V</td> <td>20% (Min. luminance)</td> </tr> <tr> <td>2.5V</td> <td>100% (Max. luminance)</td> </tr> </tbody> </table>	BRTI signal (VBI)	Luminance ratio	0V	20% (Min. luminance)	2.5V	100% (Max. luminance)		
BRTI signal (VBI)	Luminance ratio								
0V	20% (Min. luminance)								
2.5V	100% (Max. luminance)								
<p>Pulse width modulation</p> <p>Note1 Note2 Note4</p>	<ul style="list-style-type: none"> • Adjustment <p>Pulse width modulation (PWM) method works, when PWSEL signal is High and PWM signal (BRTP signal) is input into BRTP terminal. The luminance is controlled by duty ratio of BRTP signal.</p> <ul style="list-style-type: none"> • Luminance ratio Note3 <table border="1"> <thead> <tr> <th>Duty ratio Note4</th> <th>Luminance ratio</th> </tr> </thead> <tbody> <tr> <td>0.2</td> <td>20% (Min. luminance)</td> </tr> <tr> <td>1.0</td> <td>100% (Max. luminance)</td> </tr> </tbody> </table>	Duty ratio Note4	Luminance ratio	0.2	20% (Min. luminance)	1.0	100% (Max. luminance)	High	BRTP signal
Duty ratio Note4	Luminance ratio								
0.2	20% (Min. luminance)								
1.0	100% (Max. luminance)								

Note1: In case of the resistor control method and the voltage control method, noises may appear on the display image depending on the input signals timing for LCD panel signal processing board.

Use PWM method, if interference noises appear on the display image!

Note2: The inverter will stop working, if the Low period of BRTP signal is more than 1s while BRTC signal is High or Open. Then the backlight will not turn on anymore, even if BRTP signal is input again. This is not out of order. The inverter will start to work when power is supplied again.

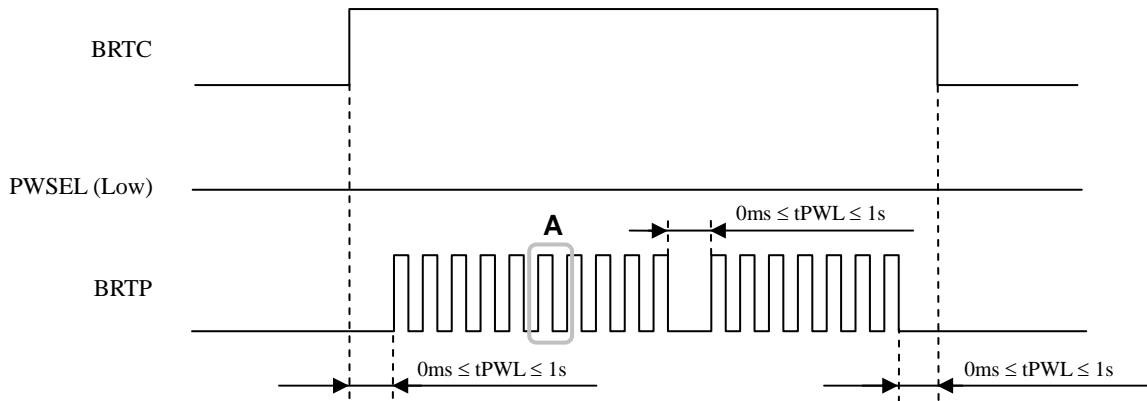
Note3: These data are the target values.

Note4: See "2.7.2 Detail of BRTP timing".

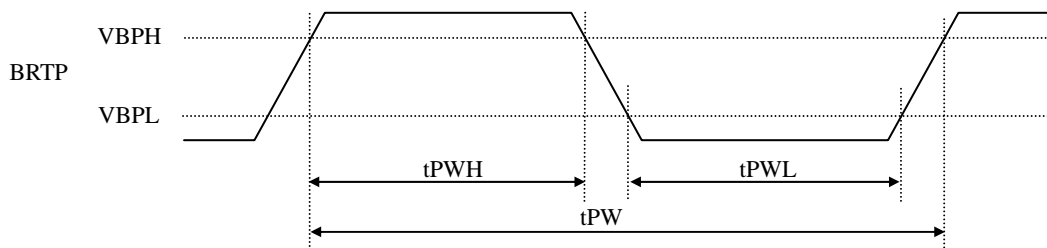
2.7.2 Detail of B RTP timing

(1) Timing diagrams

• Outline chart



• Detail of A part



(2) Each parameter

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Luminance control frequency	FL	271	279	287	Hz	Note1, Note2
Duty ratio	DL	0.2	-	1.0	-	Note1, Note3
Low period	tPWL	0	-	1	s	Note4

Note1: Definition of parameters is as follows.

$$FL = \frac{1}{tPW}, \quad DL = \frac{tPWH}{tPW}$$

Note2: See the following formula for luminance control frequency.

Luminance control frequency = $1/tv \times (n+0.25)$ [or $(n+0.75)$]

$n = 1, 2, 3 \dots$

tv: Vertical cycle

The interference noise of luminance control frequency and input signal frequency for LCD panel signal processing board may appear on a display. Set up luminance control frequency so that the interference noise does not appear!

Note3: See "2.7.1 Luminance control methods".

Note4: If tPWL is more than 1s, the backlight will be turned off by a protection circuit for inverter. The inverter will start to work when power is supplied again.


3. RELIABILITY TEST


This test is in accordance with the Reliability Test of the adaptable LCD module. Refer to Reliability Test of the adaptable LCD module.


4. PRECAUTIONS

4.1 MEANING OF CAUTION SIGNS

The following caution signs have very important meaning. **Be sure to read "4.2 CAUTIONS" and "4.3 ATTENTIONS", after understanding these contents!**



- 

This sign has the meaning that customer will be injured by himself or the product will sustain a damage, if customer has wrong operations.
- 

This sign has the meaning that customer will get an electrical shock, if customer has wrong operations.
- 

This sign has the meaning that customer will be injured by himself, if customer has wrong operations.

4.2 CAUTIONS

- 
 - * Do not touch the inverter while the inverter is working, because there is a danger of an electric shock.
 - * Do not remove the inverter protection sheet, because there is a danger of an electric shock.
 - * Be sure to wait some time after turning power OFF before starting replacement work, because the inverter is charged at a high voltage after working.
- 
 - * Be sure to wait some time after turning power OFF before starting replacement work, because the inverter is hot after working.
 - * Do not shock the inverter, because there is a danger of breaking.

4.3 ATTENTIONS



4.3.1 Handling of the product

- ① Take hold of both ends without touching the circuit board when the product (LCD module) is picked up from inner packing box to avoid broken down or misadjustment, because of stress to mounting parts on the circuit board.
- ② When handling the product, take the measures of electrostatic discharge with such as earth band, ionic shower and so on, because the product may be damaged by electrostatic.
- ③ Do not push nor pull the interface connectors while the product is working.
- ④ Do not hook nor pull cables such as lamp cable, and so on, in order to avoid any damage.
- ⑤ Properly connect the adaptable plug (backlight side) to socket (inverter side) without incomplete connection. After connecting, be careful not to hook the lamp cables because incomplete connection may occur by hooking the lamp cables. This incomplete connection may cause abnormal operation of high voltage circuit.

4.3.2 Environment

- ① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in packing box with antistatic pouch in room temperature to avoid dusts and sunlight, when storing the product.
- ② In order to prevent dew condensation occurring by temperature difference, the product packing box should be opened after enough time being left under the environment of an unpacking room. Evaluate the leaving time sufficiently because a situation of dew condensation occurring is changed by the environmental temperature and humidity. (Recommended leaving time: 6 hours or more with packing state)
- ③ Do not operate in high magnetic field. Product may be broken down by it.
- ④ This product is not designed as radiation hardened.

4.3.3 Other

- ① All GNDB and VDDB terminals should be used without any non-connected lines.
- ② Do not disassemble a product.
- ③ Pack the product with original shipping package, in order to avoid any damages during transportation, when returning the product to NEC.
- ④ Put the spacer of 1.0mm thickness or more on a product rear side, because of the protection for contortion.

Spacer example: Thickness= 1.0mm (min.)
Diameter (ϕ) = 5.0mm (Recommendation)

