NEWHAVEN DISPLAY INTERNATIONAL

Product Specification

NHD- C12864A1Z-FSW-FBW-HTT

COG (chip-On-Glass) Liquid Crystal Display Module

NHD-	Newhaven Display
C12864-	128 x 64 Pixels
A1Z-	Model
F-	Transflective
SW-	Side White LED Backlight
F-	FSTN (+)
B-	6:00 Optimal View
W-	Wide Temperature
HTT-	With 12V Heater (-40°C to +70°C)

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REACH Compliant

RoHS Compliant

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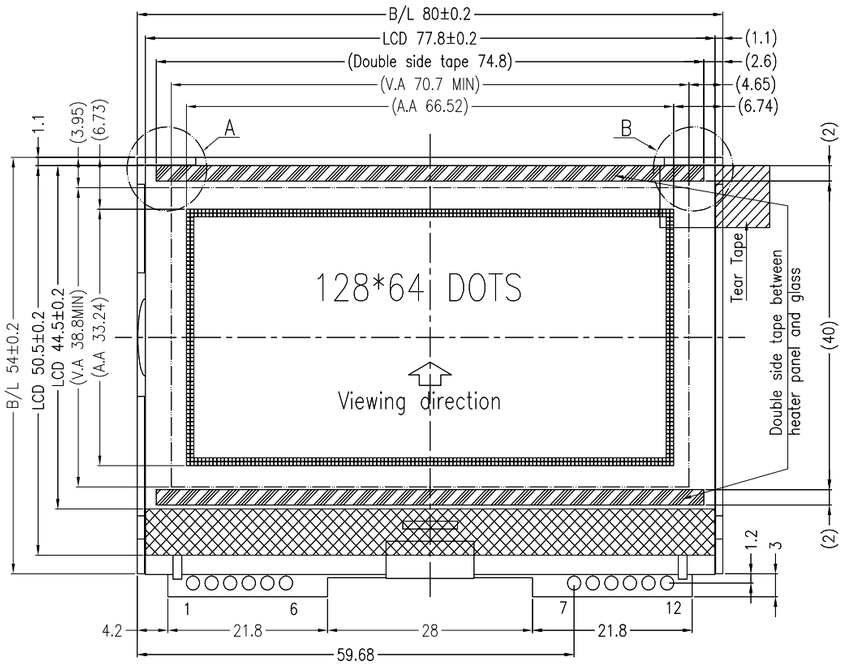
Additional Resources

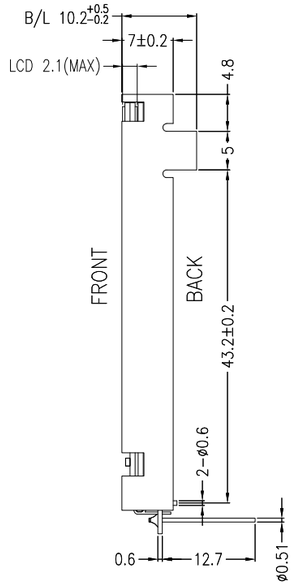
- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics
- **GitHub:** https://github.com/newhavendisplay
- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **Quality Center:** https://www.newhavendisplay.com/quality_center.html
- **Precautions for using LCDs/LCMs:** https://www.newhavendisplay.com/specs/precautions.pdf
- **Warranty / Terms & Conditions:** https://www.newhavendisplay.com/terms.html

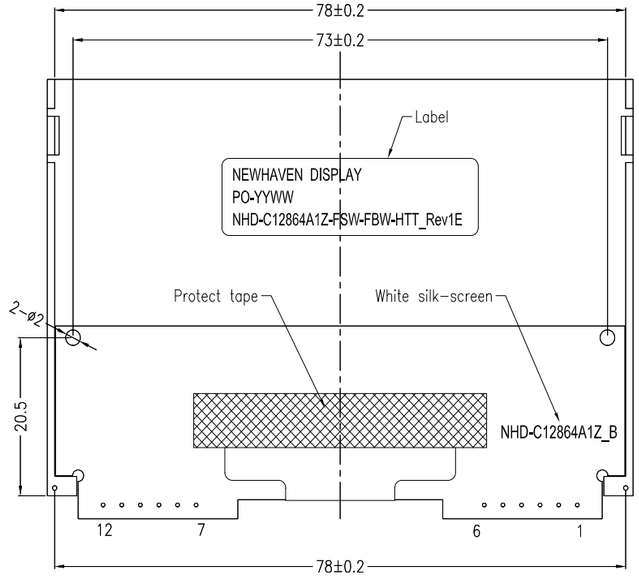
Document Revision History

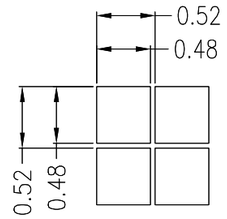
Revision	Date	Description	Changed By
0	07/17/2008	Initial Release	-
1	09/28/2009	User Guide Reformat	BE
2	10/14/2009	Updated Electrical Characteristic	MC
3	11/20/2009	Updated Backlight Supply Current	MC
4	10/26/2010	Updated Backlight Current	BE
5	10/27/2010	Supply Current Updated	BE
6	08/31/2015	Electrical characteristics, Optical Characteristics, Mechanical Drawings Updated	SB
7	08/03/2016	Updated Electrical Characteristics and Quality Info	TM
8	09/23/2016	Updated Electrical Characteristics	TM
9	03/30/2017	Updated Electrical Characteristics	TM
10	12/20/2018	Updated Heater Resistance, Response time & Double-Sided Tape added to drawing	SB
11	03/21/2019	Heater Resistance Updated	SB
12	05/14/2019	Heater Resistance Modified, Backlight Current Updated	SB
13	05/23/2019	Heater Note Added	SB
14	06/04/2019	Added PCB Footprint Drawing	AS
15	01/24/2020	Heater Resistance, Backlight Design & Electrical Characteristics Updated	SB
16	07/16/2020	Updated Serial Interface Timing Characteristics	AS
17	10/09/2020	Updated LCD Contrast Range from 8.7V/9.0V/9.3V to 8.8V/9.0V/9.2V Part Revision Upgraded to Rev1D	AS
18	03/26/2021	Updated MIN Backlight Current & MAX Supply Voltage	AS
19	04/08/2021	Updated the Electrical, Optical Characteristics, Table of Commands, Quality Information and Mechanical Drawing	JT
20	04/20/2023	Date Code Format Updated on Mechanical Drawing	KL

Mechanical Drawing

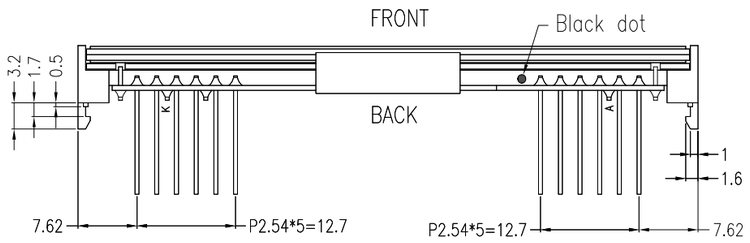


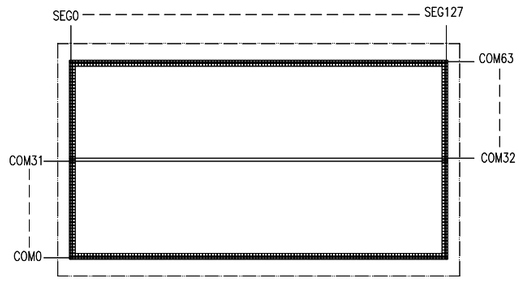


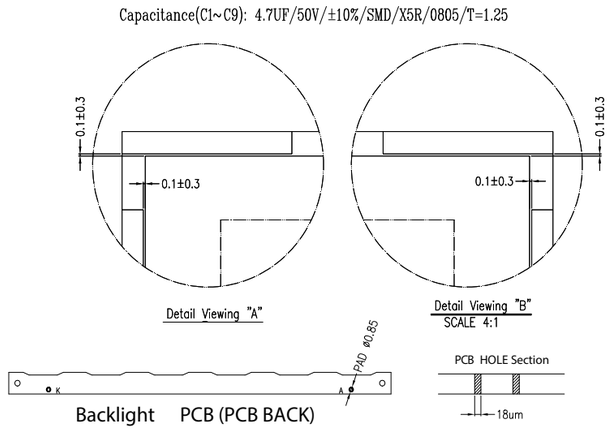




DOTS DETAIL
SCALE 10:1







Pin assignment	
NO.	Symbol
1	SCL
2	SI
3	VDD
4	A0
5	/RESET
6	/CS
7	VSS
8	H−
9	H+
10	LED−
11	LED+
12	NC

Product Description: 128x64 Graphic COG LCD

1. Driver IC: ST7565P
2. Driving Mode: 1/65 Duty, 1/9 Bias
3. Interface: SPI
4. Power Requirement: 3.0V
5. Optical Features: FSTN (+), Transflective, 6:00 View, White Backlight
6. Built in Heater

Standard Tolerance:
(Unless otherwise specified)
Linear: ±0.3mm

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Drawing/Part Number: NHD-C12864A1Z-FSW-FBW-HTT
Revision: 1E

Unless otherwise specified:
• Dimensions are in Millimeters
• Third Angle Projection

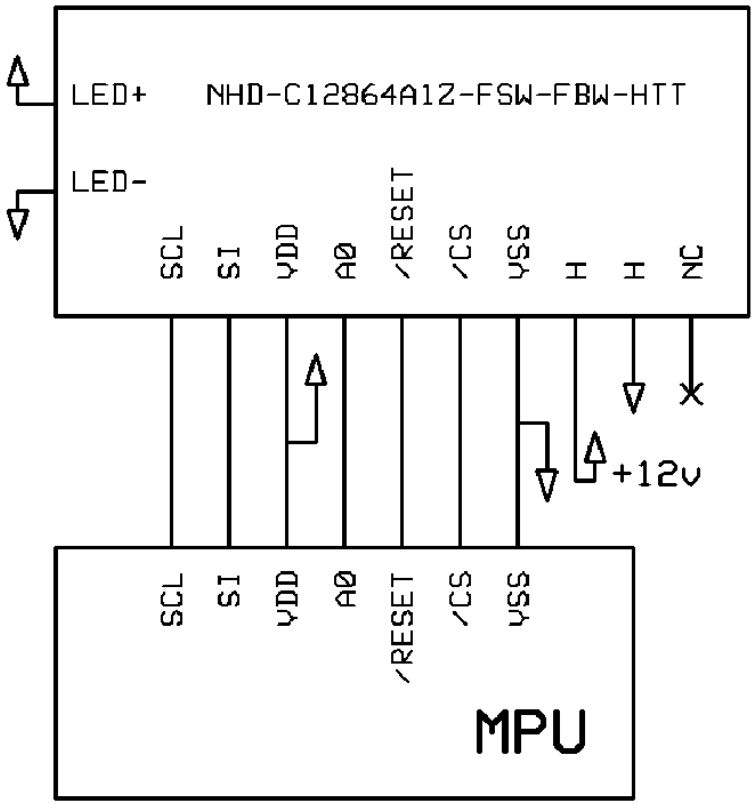
Drawn By: K. Lewis
Approved By: K. Lewis
Drawn Date: 04/20/2023
Approved Date: 04/20/2023

Pin Description

Pin No.	Symbol	External Connection	Function Description
1	SCL	MPU	Serial Clock input
2	SI	MPU	Serial Data input
3	V_{DD}	Power Supply	Supply Voltage for LCD and logic (+3.0V)
4	A0	MPU	Register Select. 0: instruction; 1: data
5	/RESET	MPU	Operation Active LOW Reset signal
6	/CS	MPU	Active LOW Chip Select Signal
7	V_{SS}	Power Supply	Ground
8	H	Power Supply	Heater Connection (+12V)
9	H	Power Supply	Heater Connection (GND)
10	LED-	Power Supply	Backlight Cathode (Ground)
11	LED+	Power Supply	Backlight Anode (+3.3V)
12	NC	-	No Connect

Recommended LCD connector: 2.54mm pitch thru-hole connection on PCB
Backlight connector: --- **Mates with**: ---
Recommended Breakout Board: NHD-PCB40

Wiring Diagram



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range[1]	T_{OP}	V_H = 0V	-20	-	+70	°C
		V_H = 12.0V	-40	-	+70	°C
Storage Temperature Range	T_{ST}	-	-40	-	+80	°C
Supply Voltage	V_{DD}	-	2.8	3.0	3.2	V
Supply Current	I_{DD}	V_{DD} = 3.0V	0.1	0.2	1.0	mA
Supply for LCD (contrast)	V_{LCD}	T_{OP} = 25°C	8.8	9.0	9.2	V
"H" Level input	V_{IH}	-	0.8*V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	0	-	0.2*V_{DD}	V
"H" Level output	V_{OH}	-	0.8*V_{DD}	-	V_{DD}	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.2*V_{DD}	V
Backlight Supply Voltage	V_{LED}	-	3.2	3.3	3.4	V
Backlight Supply Current	I_{LED}	V_{LED} = 3.3V	20	50	60	mA
Heater Panel Resistance[2]	R_H+/-	T = 25°C	5	20	35	Ω
Heater Voltage Supply	V_H	-	-	12	15	V

[1]Heater **MUST** be activated when operating temperature drops below -20°C

[2]Heater measured using digital multi-meter

Optical Characteristics

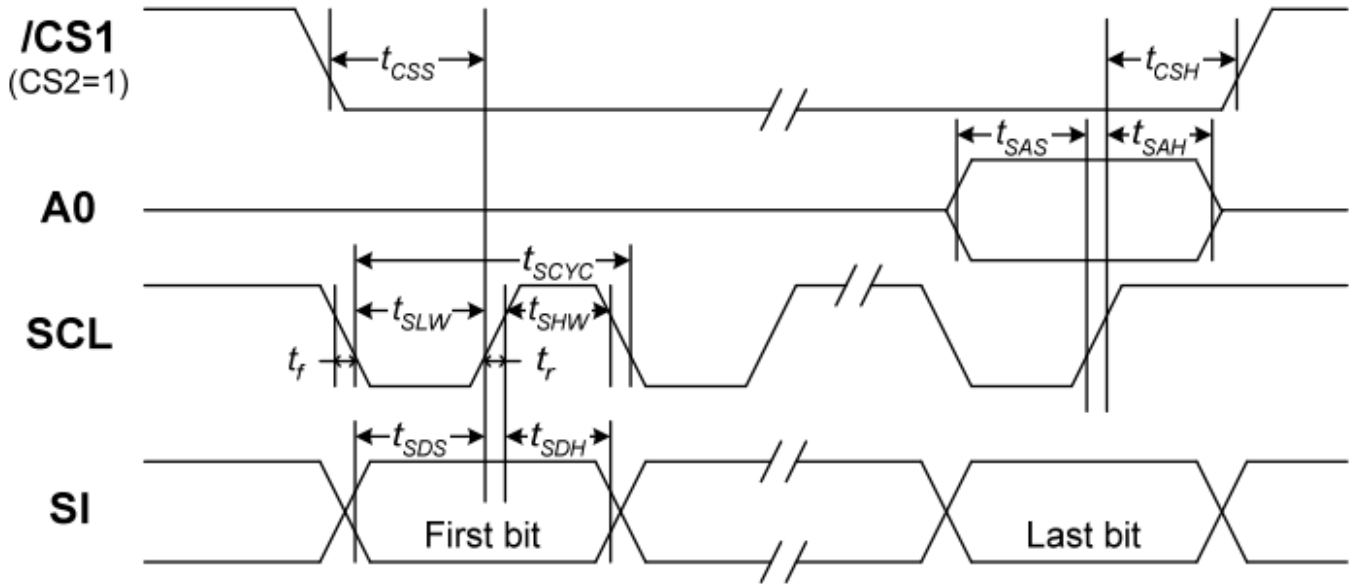
Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 3	-	20	-	°
	Bottom	φY-		-	40	-	°
	Left	θX-		-	40	-	°
	Right	θX+		-	40	-	°
Contrast Ratio		CR	-	2	4	10	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	135	240	ms
	Fall	T_F		-	235	325	ms
	Rise	T_R	T_{OP} = -40°C	-	7.3	-	s
	Fall	T_F	V_H = 12V	-	6.7	-	s

Controller Information

Built-in ST7565P Controller: https://support.newhavendisplay.com/hc/en-us/articles/4414878951703-ST7565P

Timing Characteristics

The Serial Interface



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	t_{SCYC}		50	—	ns
SCL "H" pulse width		t_{SHW}		25	—	
SCL "L" pulse width		t_{SLW}		25	—	
Address setup time	A0	t_{SAS}		20	—	
Address hold time		t_{SAH}		10	—	
Data setup time	SI	t_{SDS}		20	—	
Data hold time		t_{SDH}		10	—	
CS-SCL time	CS	t_{CSS}		20	—	
CS-SCL time		t_{CSH}		40	—	

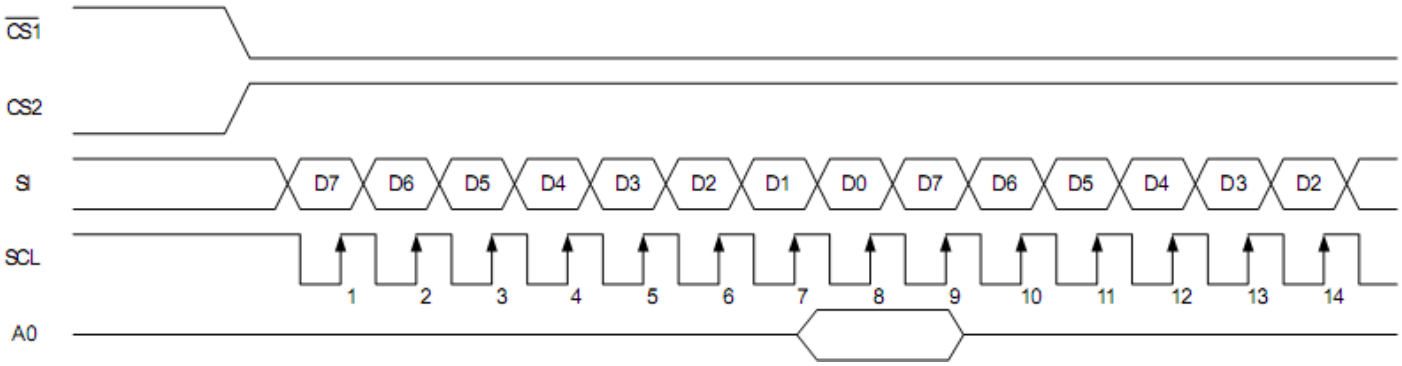


Table of Commands

Command	Command Code										Function
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0 1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565P)
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0 1	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V_0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V_0 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value						
(20) Booster ratio set	0	1	0	1 0	1 0	1 0	1 0	1 0	0 0	0 step-up value	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) Power saver												Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

Example Initialization Program

```
''''''''''''''''''''''''''''''''''''''''''''''''''''''
Sub Command
 Reset P3.7
 Reset P3.4
 For Writecount = 1 To 8
  Rotate A , Left , 1
  Reset P3.1
  P1 = A
  Set P3.1
 Next Writecount
 Set P3.7
End Sub
''''''''''''''''''''''''''''''''''''''''''''''''''''''
Sub Write
 Reset P3.7
 Set P3.4
 For Writecount = 1 To 8
  Rotate A , Left , 1
  Reset P3.1
  P1 = A
  Set P3.1
 Next Writecount
 Set P3.7
End Sub
''''''''''''''''''''''''''''''''''''''''''''''''''''''
Sub Init
 Waitms 100
 A = &HA0
 Call Command
 A = &HAE
 Call Command
 A = &HC0
 Call Command
 A = &HA2
 Call Command
 A = &H2F
 Call Command
 A = &H26
 Call Command
 A = &H81
 Call Command
 A = &H11
 Call Command
 A = &HAF
 Call Command
End Sub
''''''''''''''''''''''''''''''''''''''''''''''''''''''
```

Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80°C , 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-40°C , 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C , 96hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-40°C /-20°C, 96hrs	1,2
High Temperature / Humidity Operation	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+50°C , 90% RH , 96hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-40°C /-20°C , 60min --> 70°C , 60min = 1 cycle For 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz , Acceleration of Gravity:5G 30 min in each of 3 directions X,Y,Z	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±8kV 150pF/330Ω, 5 Times	
		Contact: ±4kV 150pF/330Ω, 5 Times	

Note 1: No condensation to be observed.
Note 2: Conducted after 4 hours of storage at 25°C, 0%RH.
Note 3: Test performed on product itself, not inside a container.