NEWHAVEN DISPLAY INTERNATIONAL

Product Specification

NHD-C12864KGZ-FSW-GBW

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

NHD-	Newhaven Display
C12864-	128x64 Pixels
KGZ-	Model
F-	Transflective
SW-	Side White LED Backlight
G-	STN (+) Gray
B-	6:00 Optimal View
W-	Wide Temperature

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REACH Compliant

RoHS Compliant

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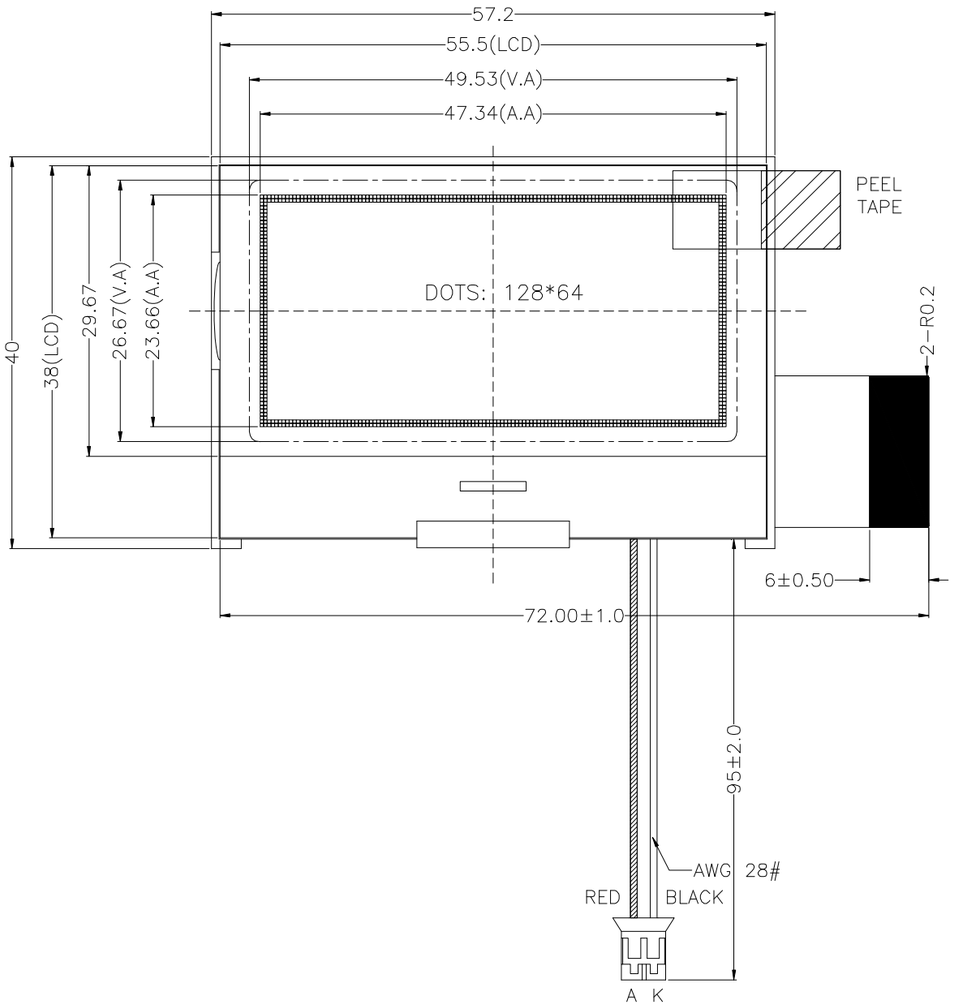
Additional Resources

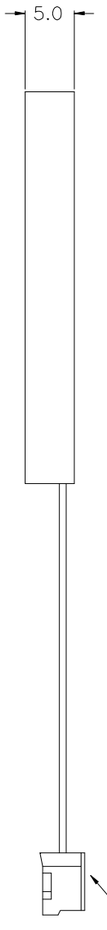
- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics
- **GitHub:** https://github.com/newhavendisplay
- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **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

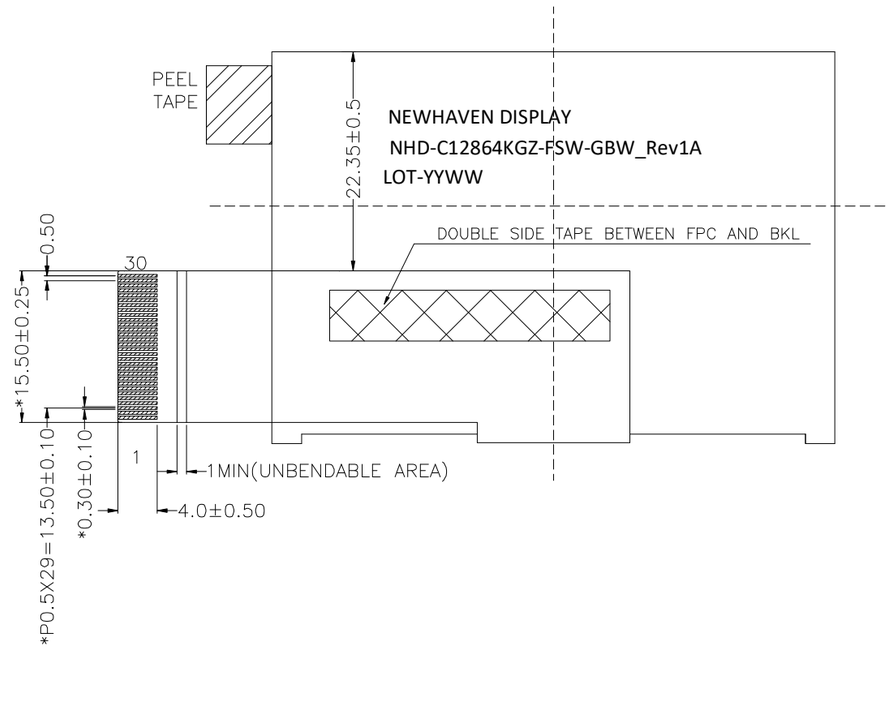
Document Revision History

Revision	Date	Description	Changed By
0	03/19/2012	Initial Release	-
1	05/11/2012	Electrical and Optical Characteristics Updated	AK
2	04/04/2013	Backlight Mating Connector Part Number Updated	AK
3	10/03/2013	Example Code Updated	ML
4	11/01/2017	Mechanical Drawing and Electrical Characteristics Updated	SB
5	12/01/2020	Updated Mechanical Drawing	AS
6	05/30/2023	Part Changed to REV1A	KL
7	08/01/2023	Mechanical Drawing, Electrical Characteristics, and Quality Information Updated	KL

Mechanical Drawing

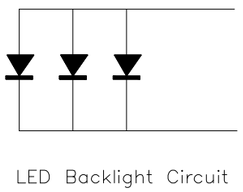


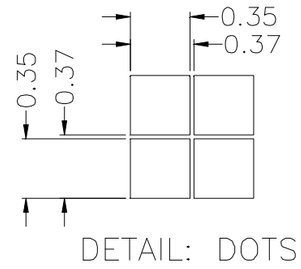


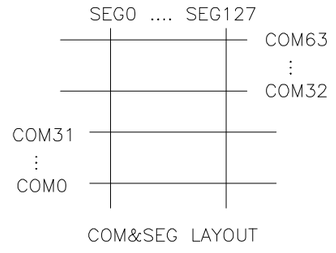


PIN

NO.	SIGNAL
1	ESD-GND
2	/CS1
3	/RES
4	A0
5	/WR
6	/RD
7	D0
8	D1
9	D2
10	D3
11	D4
12	D5
13	D6
14	D7
15	VDD
16	VSS
17	VOUT
18	CAP3P
19	CAP1N
20	CAP1P
21	CAP2P
22	CAP2N
23	CAP4P
24	V4
25	V3
26	V2
27	V1
28	V0
29	ESD-GND
30	NC







Product Description: 128x64 Graphic COG LCD

1. Driver IC: ST7565R
2. Driving Mode: 1/65 Duty, 1/9 Bias
3. Interface: 8080 Parallel
4. Power Requirement: 3.0V
5. Optical Features: STN (+) Gray, Transflective, 6:00 View, White Backlight
6. Recommended FFC Connector: 30pin 0.5mm pitch

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

NEWHAVEN DISPLAY INTERNATIONAL

Drawing/Part Number: NHD-C12864KGZ-FSW-GBW
Revision: 1A

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

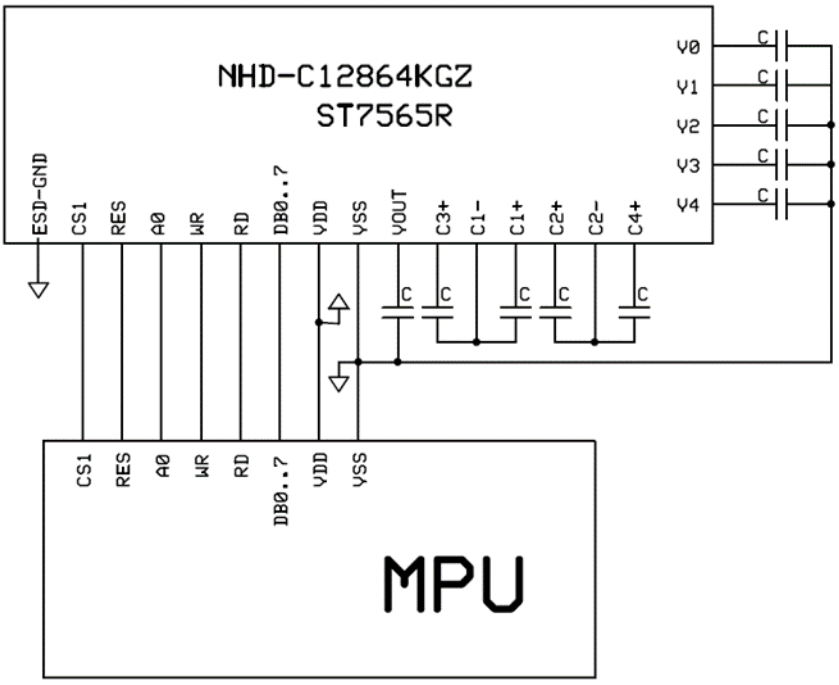
Drawn By: K. Lewis
Approved By: K. Lewis
Drawn Date: 08/01/2023
Approved Date: 08/01/2023

Pin Description

Pin No.	Symbol	External Connection	Function Description
1	ESD-GND	Power Supply	Ground (can be a No Connect)
2	/CS1	MPU	Active LOW Chip Select signal
3	/RES	MPU	Active LOW Reset signal
4	A0	MPU	Register Select: '0' = Command, '1' = Data
5	/WR	MPU	Active LOW Write signal
6	/RD	MPU	Active LOW Read signal
7-14	D0-D7	MPU	8-bit bi-directional data bus
15	V_{DD}	Power Supply	Supply Voltage for LCD and Logic (3.0V)
16	V_{SS}	Power Supply	Ground
17	V_{OUT}	Power Supply	1.0uF-2.2uF Capacitor to V_{SS}
18	C_{3+}	Power Supply	1.0uF-2.2uF Capacitor to C1- (Pin-19)
19	C_{1-}	Power Supply	1.0uF-2.2uF Capacitor to C3+ (Pin-18) and C1+ (Pin-20)
20	C_{1+}	Power Supply	1.0uF-2.2uF Capacitor to C1- (Pin-19)
21	C_{2+}	Power Supply	1.0uF-2.2uF Capacitor to C2- (Pin-22)
22	C_{2-}	Power Supply	1.0uF-2.2uF Capacitor to C2+(Pin-21) and C4+ (Pin-23)
23	C_{4+}	Power Supply	1.0uF-2.2uF Capacitor to C2- (Pin-22)
24	V_4	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
25	V_3	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
26	V_2	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
27	V_1	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
28	V_0	Power Supply	0.1uF-1.0uF Capacitor to V_{DD} or V_{SS}
29	ESD-GND	Power Supply	Ground (can be a No Connect)
30	NC	-	No Connect

Recommended LCD connector: 0.5mm pitch, 30 conductor FFC. Molex p/n: 52892-3095
Backlight connector: A2001H-2P **Mates with**: A2001WR-2P, A2001WR-S-2P, A2001WV-2P, A2001WV-S-2P

Wiring Diagram



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T_{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T_{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V_{DD}	-	2.8	3.0	3.3	V
Supply Current	I_{DD}	V_{DD}=3.0V	0.05	0.5	1.0	mA
Supply for LCD (contrast)*	V_{LCD}	T_{OP} =25°C	8.6	8.8	9.0	V
"H" Level input	V_{IH}	-	0.7*V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	V_{SS}	-	0.3*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 Current**	I_{LED}	-	30	60	90	mA
Backlight Supply Voltage	V_{LED}	I_{LED} = 60mA	2.8	3.0	3.2	V

*User should employ SW/HW methods for tuning contrast. (Refer to Electronic Volume Register)
**The LED of the backlight is driven by current; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	40	-	°
	Bottom	φY-		-	60	-	°
	Left	θX-		-	60	-	°
	Right	θX+		-	60	-	°
Contrast Ratio		CR	-	2	5	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	150	250	ms
	Fall	T_F		-	200	300	ms

Controller Information

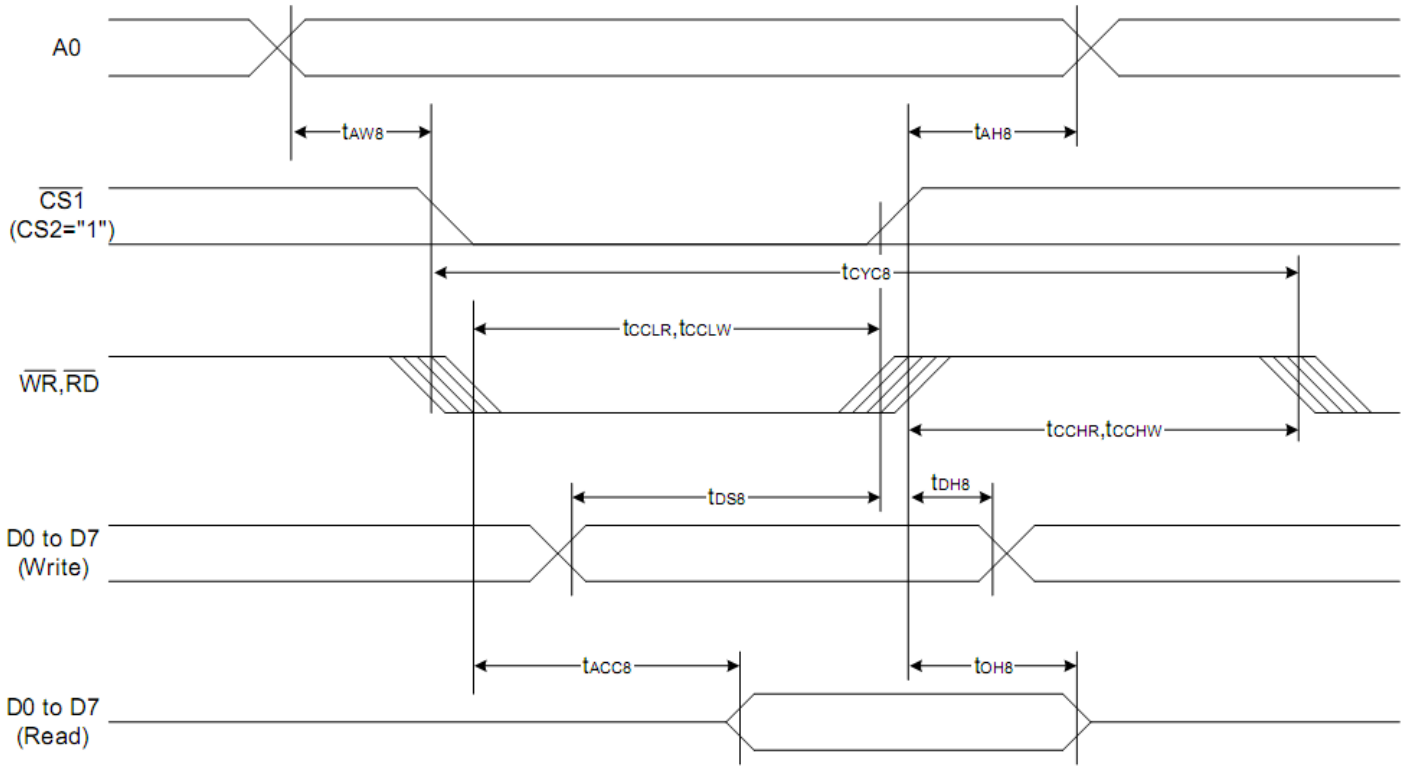
Built-in ST7565R Controller: https://support.newhavendisplay.com/hc/en-us/articles/4414899357591-ST7565R

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 Column address set lower bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.
				0	0	0	0	Least significant 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 (ST7565R)
(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 Electronic volume register set	0	1	0	1	0	0	0	0	0	0	1	Set the V_0 output voltage electronic volume register
				0	0	Electronic volume value						
(19) Sleep mode set	0	1	0	1	0	1	0	1	1	0	0 1	0: Sleep mode, 1: Normal mode
				*	*	*	*	*	*	0	0	
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	step-up value		
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(22) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

Timing Characteristics

8080 MPU Interface (VDD=3.3V)



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	—	Ns
Address setup time		t_{AW8}		0	—	
System cycle time		t_{CYC8}		240	—	
Enable L pulse width (WRITE)	WR	t_{CCLW}		80	—	
Enable H pulse width (WRITE)		t_{CCHW}		80	—	
Enable L pulse width (READ)	RD	t_{CCLR}		140	—	
Enable H pulse width (READ)		t_{CCHR}		80		
WRITE Data setup time	D0 to D7	t_{DS8}		40	—	
WRITE Address hold time		t_{DH8}		0	—	
READ access time		t_{ACC8}	C_L = 100 pF	—	70	
READ Output disable time		t_{OH8}	C_L = 100 pF	5	50	

Example Initialization Code

```
/*********************************************************************/

void comm_out(unsigned char c)
{
        CS1 = 0;
        AO = 0;                         //LOW = command
        WRT = 0;
        P1 = c;
        WRT = 1;
        CS1 = 1;
}

/*********************************************************************/

void data_out(unsigned char d)
{
        CS1 = 0;
        AO = 1;                         //HIGH = data
        WRT = 0;
        P1 = d;
        WRT = 1;
        CS1 = 1;
}

/*********************************************************************/

void disp()
{
        unsigned int i, j;
        unsigned char page=0xB0;
        for(i=0;i<8;i++)                //fill display with checkerboard pattern
        {
                comm_out(0x10);         //set column address
                comm_out(0x00);         //set column address
                comm_out(page);         //set page address
                for(j=0;j<64;j++)
                 {
                                data_out(0xAA);
                                data_out(0x55);
                 }
                page++;
        }
}

/*********************************************************************/
```

```
/*********************************************************************/
/***************  NHD-C12864KGZ DISPLAY INITIALIZATION  ******************/
/*********************************************************************/

void init()
{
        RDD = 1;
        WRT = 1;
        CS1 = 0;
        RST = 0;
        delay(150);
        RST = 1;
        delay(150);

        comm_out(0xA2);     //added 1/9 bias
        comm_out(0xA0);     //ADC segment driver direction (A0=Normal)
        comm_out(0xC0);     //COM output scan direction (C0=Normal)
        comm_out(0x25);     //resistor ratio
        comm_out(0x81);     //electronic volume mode set
        comm_out(0x15);     //electronic volume register set
        comm_out(0x2F);     //operating mode
        comm_out(0x40);     //start line set
        comm_out(0xAF);     //display ON

        delay(10);
}

/*********************************************************************/
```

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.	-30°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.	-20°C , 96hrs	1,2
High Temperature / Humidity Storage	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+40°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.	-0°C 30min -> 25°C 5min -> 50°C 30min = 1 cycle For 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 1.5mm amplitude. 2g Acceleration. 60 sec in each of 3 directions X,Y,Z For 30 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±8KV, Contact: ±4KV	

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.