NEWHAVEN DISPLAY INTERNATIONAL

Product Specification

NHD-C12832A1Z-FS(RGB)-FBW-3V

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

NHD-	Newhaven Display
C12832-	128 x 32 Pixels
A1Z-	Model
F-	Transflective
SRGB-	Side Red/Green/Blue LED Backlight
F-	FSTN (+)
B-	6:00 Optimal View
W-	Wide Temperature
3V-	3.0V LCD

Newhaven Display International, Inc.
2661 Galvin Court, Elgin, IL 60124 USA

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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

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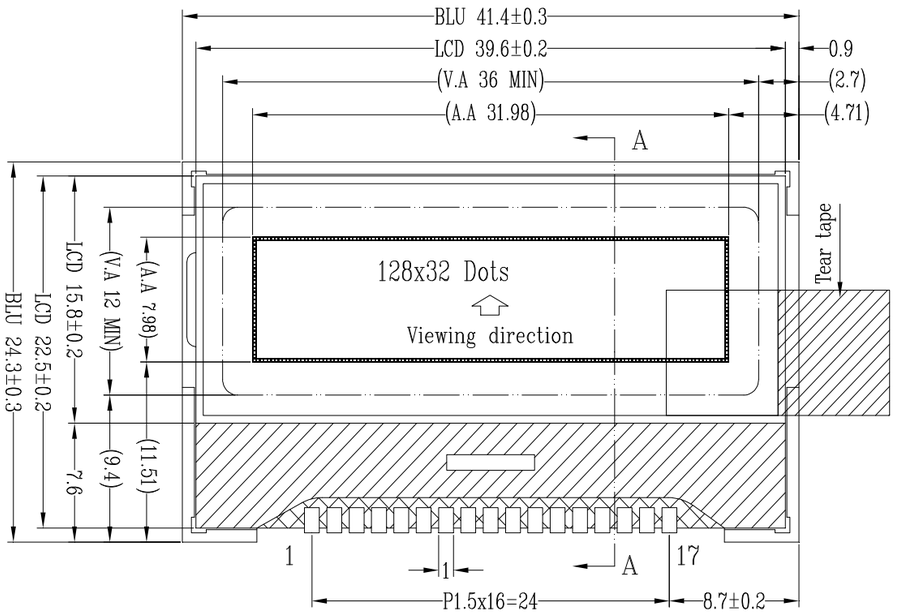
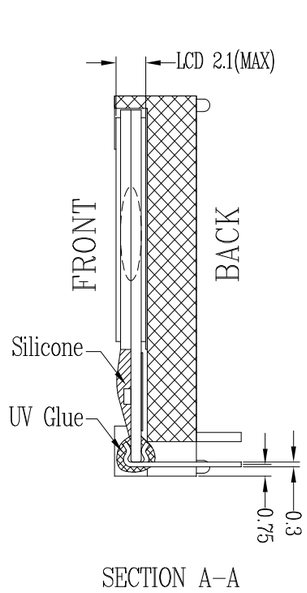
Document Revision History

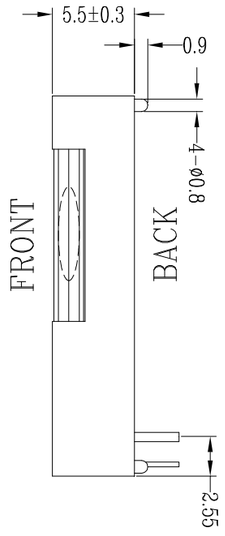
Revision	Date	Description	Changed By
0	10/23/2012	Initial Release	AK
1	06/15/2016	Mechanical Drawing, Electrical & Optical Char., Quality Information Updated	SB
2	01/23/2017	Mechanical Drawing & Electrical Characteristics Updated	SB
3	04/14/2017	Backlight Characteristics Updated	SB
4	08/04/2017	Backlight Characteristics Updated	SB
5	04/02/2018	Electrical Characteristics Updated	SB
6	06/24/2019	Added PCB Footprint Drawing	AS
7	01/30/2020	Glass Panel Updated	SB
8	06/17/2020	Updated 2D Mechanical Drawing, Backlight Current for Red LED, & Quality Information	AS
9	04/20/2021	Updated Wiring Diagram	ZP
10	08/24/2023	Date Code Format Updated on Mechanical Drawing	KL

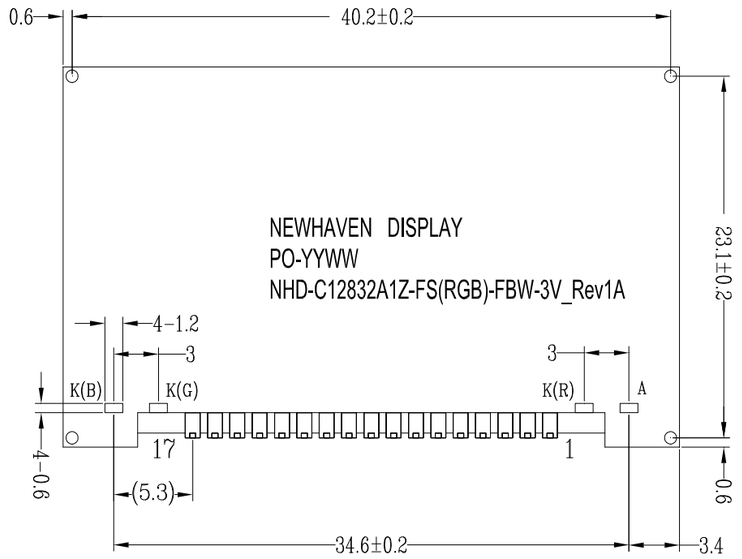
Mechanical Drawing

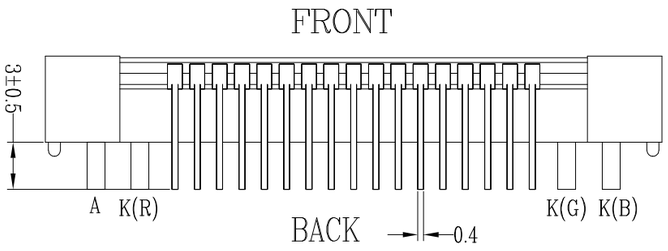


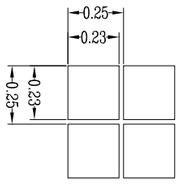


SECTION A–A

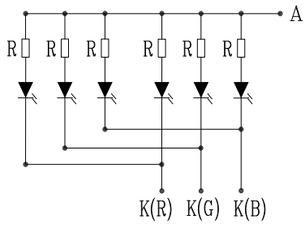




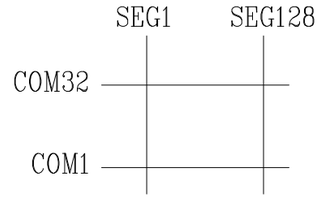




DOTS Detail
Scale 20:1



LED backlight circuit



COM & SEG Layout

Pin Assignment	
NO.	Symbol
1	V0
2	V1
3	V2
4	V3
5	V4
6	C2-
7	C2+
8	C1+
9	C1-
10	VOUT
11	VSS
12	VDD
13	SI
14	SCL
15	A0
16	/RES
17	CS1B

Product Description: 128x32 Graphic COG LCD

1. Driver IC: ST7565R
2. Driving Mode: 1/33 Duty, 1/6 Bias
3. Interface: 4-wire SPI
4. Power Requirement: 3.0V LCD
5. Optical Features: FSTN (+), Transflective, 6:00 View, RGB Backlight

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

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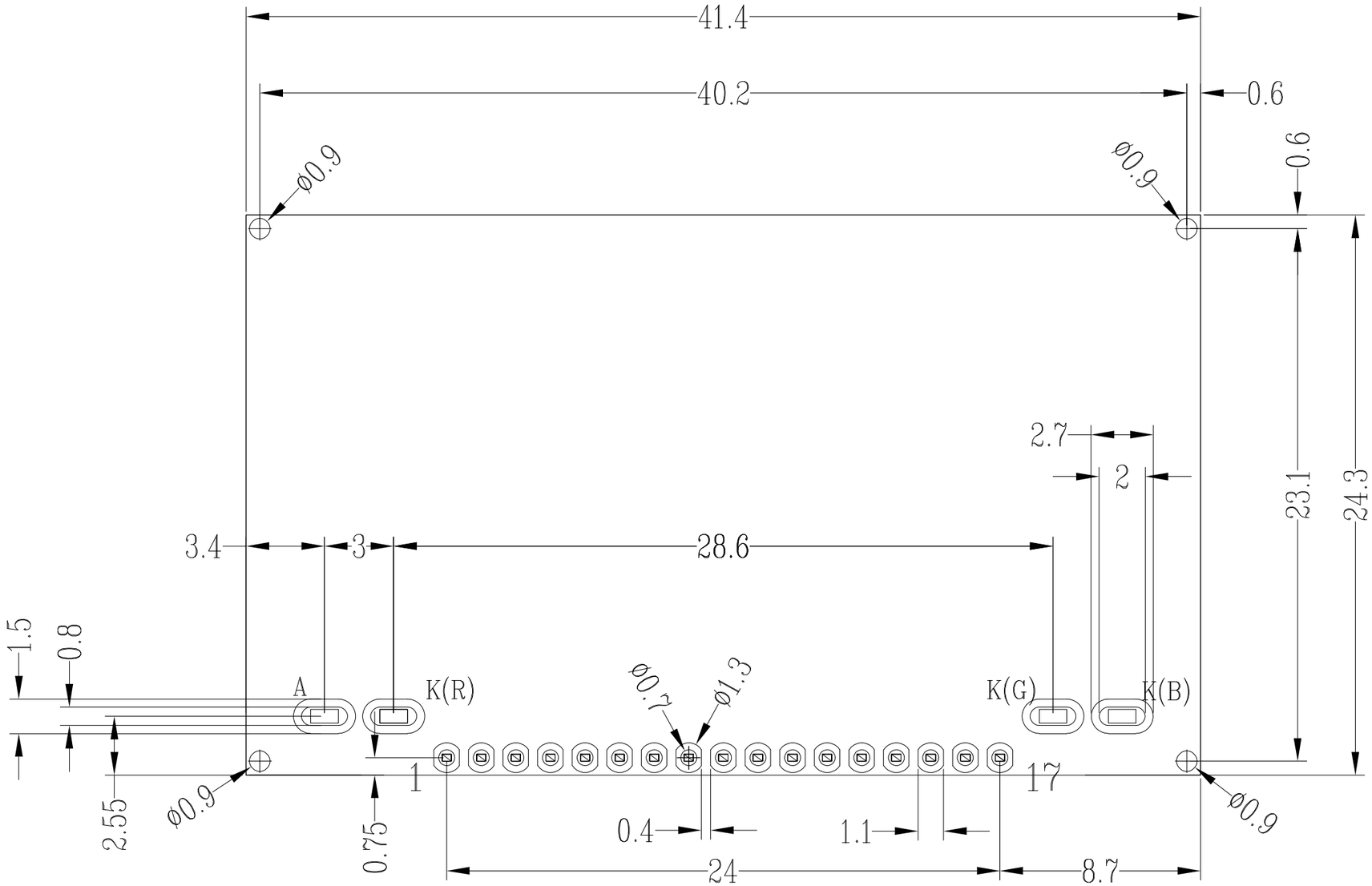
Drawing/Part Number:	Revision:
NHD-C12832A1Z-FS(RGB)-FBW-3V	1A

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

Drawn By:	Approved By:
K. Lewis	K. Lewis
Drawn Date: 08/24/2023	Approved Date: 08/24/2023

Recommended PCB Footprint



Applicable Displays:

1) NHD-C12832A1Z-FS(RGB)-FBW-3V

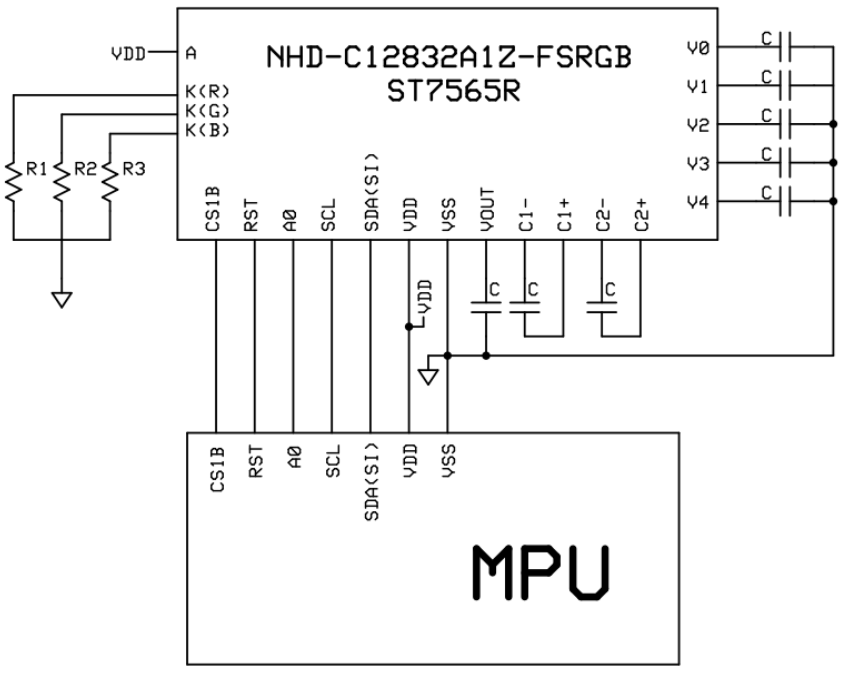
Standard Tolerance: (Unless otherwise specified) Linear: ±0.3mm	NEWHAVEN DISPLAY INTERNATIONAL	
	Drawing/Part Number: NHD-C12832A1Z-RGB-Footprint	Revision: 1.0
Unless otherwise specified: • Dimensions are in Millimeters • Third Angle Projection	Drawn By: K. Lewis	Approved By: K. Lewis
	Drawn Date: 08/24/2023	Approved Date: 08/24/2023

Pin Description

Pin No.	Symbol	External Connection	Function Description
1	V_0	Power Supply	0.1µF – 1µF Capacitor to V_{SS}
2	V_1	Power Supply	0.1µF – 1µF Capacitor to V_{SS}
3	V_2	Power Supply	0.1µF – 1µF Capacitor to V_{SS}
4	V_3	Power Supply	0.1µF – 1µF Capacitor to V_{SS}
5	V_4	Power Supply	0.1µF – 1µF Capacitor to V_{SS}
6	C2-	Power Supply	Connect 1µF – 2.2µF Capacitor to C2+ (pin 7)
7	C2+	Power Supply	Connect 1µF – 2.2µF Capacitor to C2- (pin 6)
8	C1+	Power Supply	Connect 1µF – 2.2µF Capacitor to C1- (pin 9)
9	C1-	Power Supply	Connect 1µF – 2.2µF Capacitor to C1+ (pin 8)
10	V_{OUT}	Power Supply	Connect 1µF – 2.2µF Capacitor to VSS (pin 11)
11	V_{SS}	Power Supply	Ground
12	V_{DD}	Power Supply	Supply Voltage for LCD and Logic (+3V)
13	SDA(SI)	MPU	Serial Data
14	SCL	MPU	Serial Clock
15	A0	MPU	Register Select. A0=0: Instruction, A0=1: Data
16	RST	MPU	Active LOW Reset signal
17	CS1B	MPU	Active LOW Chip Select signal
A	LED+	Power Supply	Backlight Anode
K(R)	(R)LED-	Power Supply	Red Backlight Cathode (Ground)
K(G)	(G)LED-	Power Supply	Green Backlight Cathode (Ground)
K(B)	(B)LED-	Power Supply	Blue Backlight Cathode (Ground)

Recommended LCD connector: 1.5mm pitch pins, solder directly into PCB
Backlight connector: 1.5mm wide pins solder directly into PCB **Mates with**: ---
Recommended Breakout Board: NHD-PCB40

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}	-	2.7	3.0	3.3	V
Supply Current	I_{DD}	V_{DD}=3.0V	0.1	0.4	1	mA
Supply for LCD (contrast)	V_{LCD}	T_{OP} =25°C	5.8	6.0	6.2	V
"H" Level input	V_{IH}	-	0.8 *V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	V_{SS}	-	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 – Red	V_{LED}	-	2.0	2.1	2.2	V
Backlight supply current – Red	I_{LED}	V_{LED} = 2.1V	3	10	15	mA
Backlight supply voltage – Green	V_{LED}	-	2.9	3.0	3.1	V
Backlight supply current – Green	I_{LED}	V_{LED} = 3.0V	5	30	36	mA
Backlight supply voltage – Blue	V_{LED}	-	2.9	3.0	3.1	V
Backlight supply current – Blue	I_{LED}	V_{LED} = 3.0V	5	30	36	mA

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR≥2	-	20	-	º
	Bottom	φY-		-	40	-	º
	Left	θX-		-	40	-	º
	Right	θX+		-	40	-	º
Contrast Ratio		CR	-	2	4	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	200	250	ms
	Fall	T_F		-	250	320	ms

Controller Information

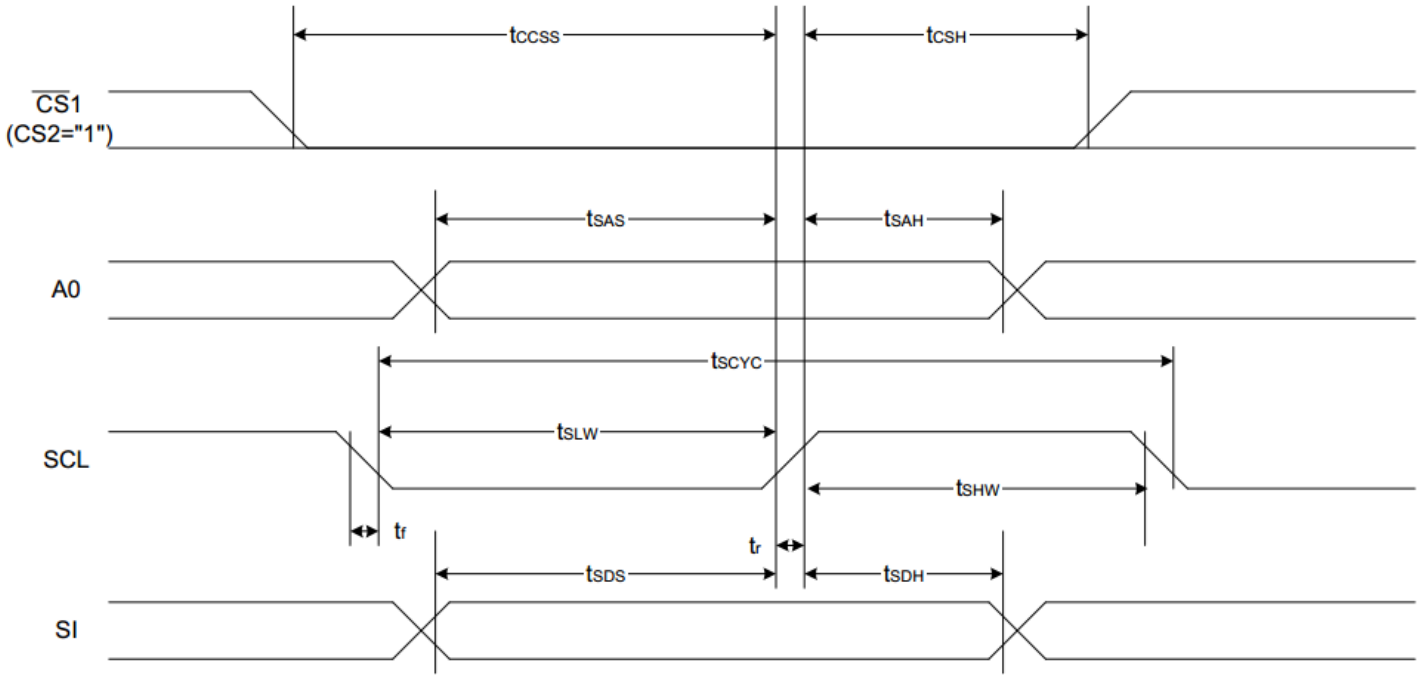
Built-in ST7565R Controller: https://support.newhavendisplay.com/hc/en-us/articles/4414899357591-ST7565R

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

The 4-line SPI Interface



(VDD = 3.3V,Ta = –30 to 85℃)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	Tscyc		50	—	ns
SCL “H” pulse width		Tshw		25	—	
SCL “L” pulse width		TSLW		25	—	
Address setup time	A0	TSAS		20	—	
Address hold time		Tsah		10	—	
Data setup time	SI	Tsds		20	—	
Data hold time		TSDH		10	—	
CS-SCL time	CS	Tcss		20	—	
CS-SCL time		Tcsh		40	—	

Example Initialization Program

```
 void data_out(unsigned char i) //Data Output Serial Interface
{
            unsigned int n;
            CS = 0;
            A0 = 1;
            for(n=0; n<8; n++){
   i <<=1;
            SCL = 0;
            P1  = i;
            delay(2);
            SCL = 1;
            }
            CS = 1;
}
void comm_out(unsigned char j) //Command Output Serial Interface
{
            unsigned int n;
            CS = 0;
            A0  = 0;
            for(n=0; n<8; n++){
   j <<=1;
            SCL = 0;
            P1  = j;
            delay(2);
            SCL = 1;
            }
            CS = 1;
}

/*****************************************************
*        Initialization For controller         *
*****************************************************/
void init_LCD()
{
comm_out(0xA0);
comm_out(0xAE);
comm_out(0xC0);
comm_out(0xA2);
comm_out(0x2F);
comm_out(0x26);
comm_out(0x81);
comm_out(0x2F);
}
/*****************************************************/
```

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 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.	-20°C,60min -> 70°C,60min = 1 cycle 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz 5G Acceleration. 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.