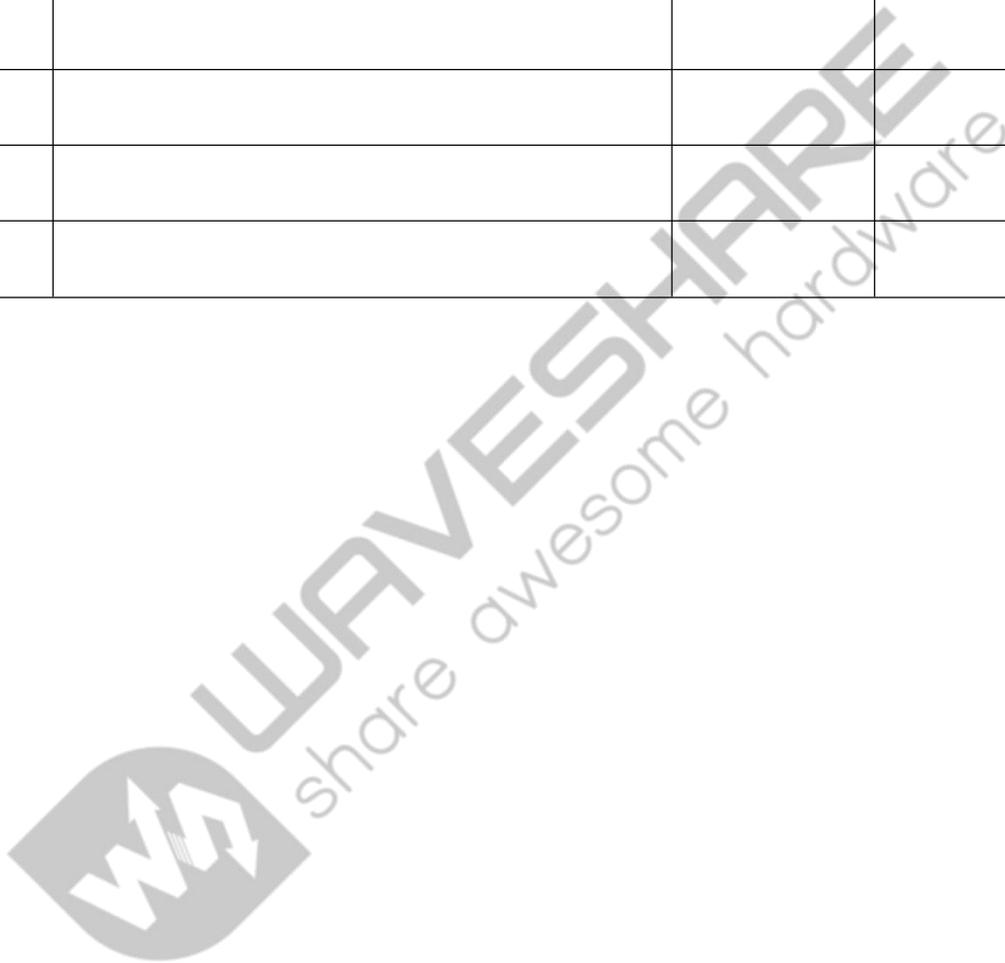


5inch e-Paper User Manual



Revision History

Version	Content	Date	Page
1.0	New creation	2025/11/1	All



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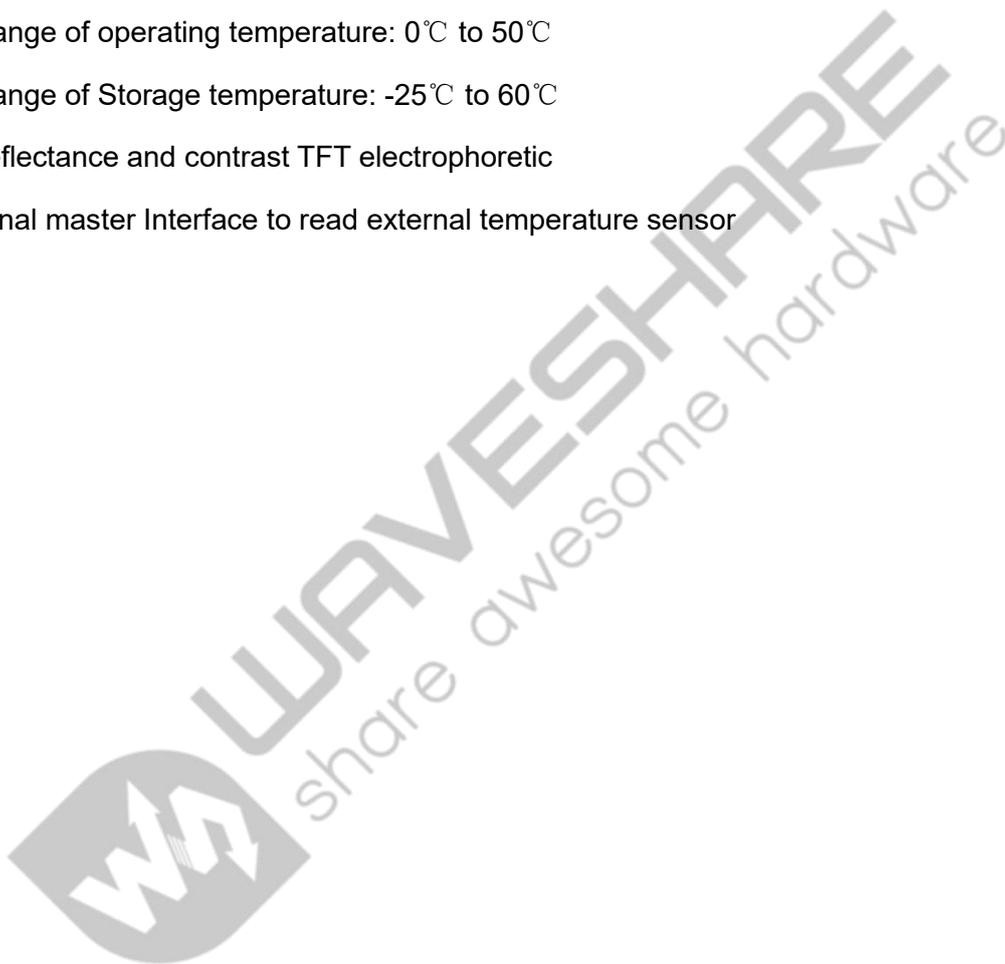
1. OVERVIEW

The 5inch e-Paper is a reflective electrophoretic display module on an active matrix TFT substrate. The diagonal length of the active area is 5" and contains 552 x 960 pixels. The panel is capable of displaying 1-bit black and white images depending on the associated lookup table used. The circuitry on the panel includes an integrated gate and source drivers, timing controller, oscillator, DC-DC boost circuit, and memory to store the frame buffer and lookup tables, and additional circuitry to control VCOM and border settings.



2. FEATURES

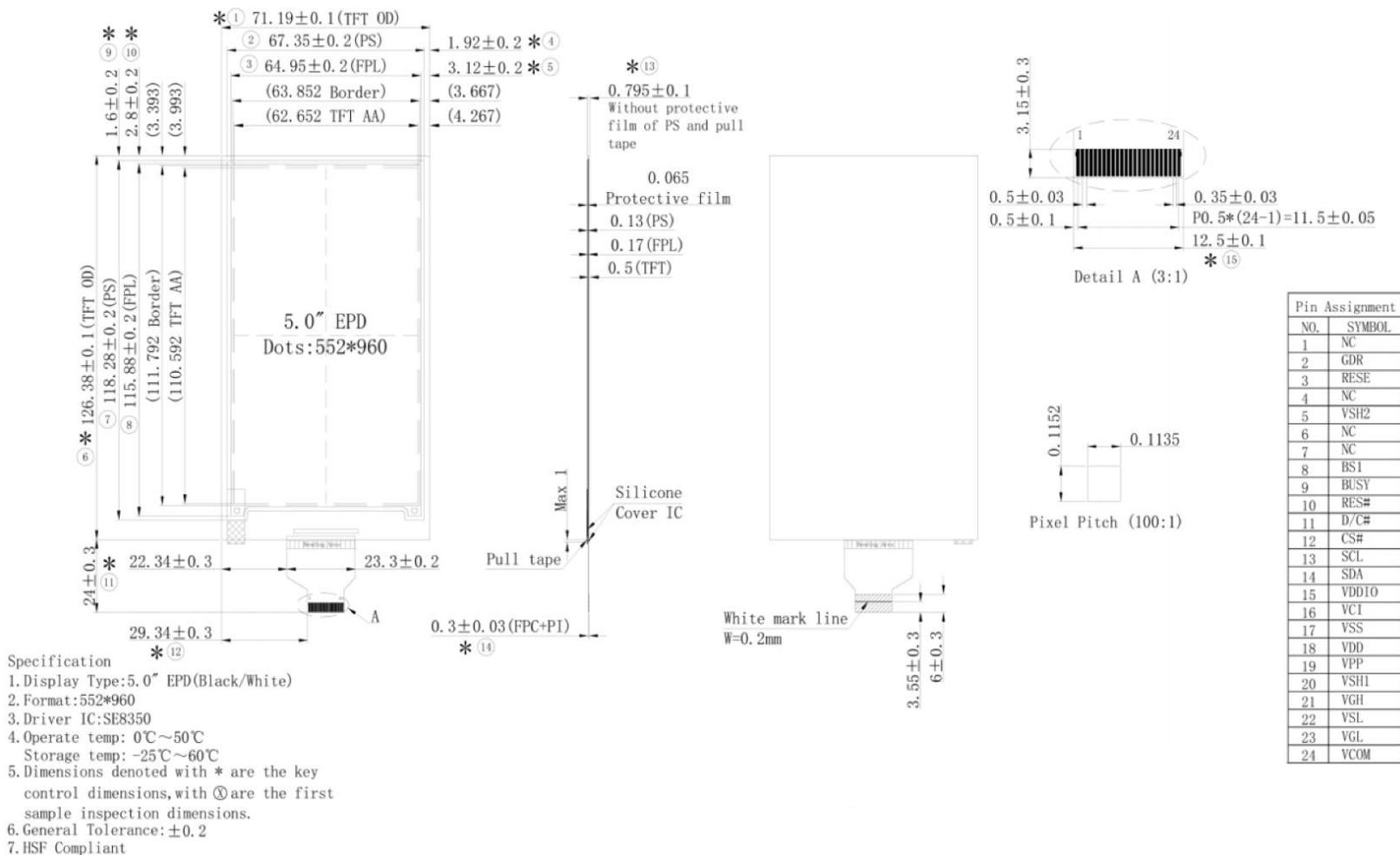
- ✧ Ultra-low power consumption
- ✧ Ultra-wide viewing angle
- ✧ On-chip display RAM
- ✧ Interface: 4-Wire SPI or 3-Wire SPI
- ✧ Wide range of operating temperature: 0°C to 50°C
- ✧ Wide range of Storage temperature: -25°C to 60°C
- ✧ High reflectance and contrast TFT electrophoretic
- ✧ I2C signal master Interface to read external temperature sensor



3. MECHANICAL SPECIFICATIONS

No.	Parameter	Specifications	Unit
1	Dot Matrix	552(H)×960(V)	-
2	Screen Size	5.0	Inch
3	Active Area	62.652 (H)×110.592(V)	mm
4	Pixel Pitch	0.1135×0.1152	mm
5	Pixels Per Inch	221	-
6	TFT Area	71.19(H)×126.38(V)	mm
7	Outline Dimension	71.19(H)×150.38(V) ×0.795(D)	mm
8	Pixel Configuration	Square	-
9	Driver IC	SE8350	-
10	Module Weight	TBD±10%	g

4. MECHANICAL DRAWING OF EPD MODULE



5. PIN ASSIGNMENT

NO.	Name	Description
1	NC	No Connection
2	GDR	This pin is N-MOS gate control
3	RESE	Current Sense Input for the control loop
4	NC	No Connection
5	VSH2	This pin is Positive Source driving voltage regulation
6	NC	No Connection
7	NC	No Connection
8	BS1	This pin is for selecting 3-wire(H active) or 4-wire(L active) SPI interface
9	BUSY	This pin is Busy state output pin. When Busy is High, the operation of the chip should not be interrupted, and the command should not be sent. For example, the chip would output Busy pin as High when - Outputting display waveform; or - Programming with OTP Communicating with digital temperature sensor in the cascade mode, the BUSY pin of the slave chip should be left open
10	RES#	Global reset pin. Low: active. When RST_N becomes low, the driver will be reset. All registers will be reset to default values. The driver's all functions will be disabled
11	D/C#	This pin is Data/Command control pin connecting to the MCU
12	CS#	Serial communication chip select
13	SCL	This pin is serial clock pin for interface
14	SDA	This pin is serial data pin for interface
15	VDDIO	IO power
16	VCI	Digital power
17	VSS	Ground
18	VDD	Digital power input
19	VPP	Power Supply for OTP Programming
20	VSH1	This pin is Positive Source driving voltage regulation
21	VGH	This pin is Positive Gate driving voltage
22	VSL	Negative source driving voltage
23	VGL	This pin is Negative Gate driving voltage
24	VCOM	This pin is VCOM driving voltage. Connect a stabilizing capacitor between VCOM and VSS in the application circuit

Note:

I: Input, O: Output, P: Power, D: Dummy, S: Short circuit, M: Mark, PI: Power input, PO: Power output, I/O: Input / Output, PS: Power Setting, C: Capacitor pin.

6. ELECTRICAL CHARACTERISTICS

6.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remark
Logic supply voltage	V_{CI}, V_{DDIO}	-0.5	+4.0	V	-
Digital Output voltage	V_O	-0.5	$V_{DDIO} + 0.5$	V	-
Digital Input voltage	V_I	-0.5	$V_{DDIO} + 0.5$	V	-
Operating Temp	T_{OP}	0	+50	°C	-
Storage Temp	T_{STG}	-25	+60	°C	-

Notes:

- (1) All of the voltages are on the basis of "VSS = 0V".
- (2) Maximum ratings are those values beyond which damages to the device may occur. Functional operation should be restricted to the limits in the Panel DC Characteristics tables.

6.2 DC CHARACTERISTICS

The following specifications apply for: $V_{SS}=0V$, $V_{CI}=3.0V$, $V_{DD}=1.8V$, $T_{OPR}=25^{\circ}C$.

Parameter	Symbol	Condition	Applicable pin	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CI}	-		2.2	3.0	3.3	V
DCDC driver supply	V_{DD}			1.7	1.8	1.9	V
OTP Program voltage	V_{PP}			7.25	7.5	7.75	V
High level input voltage	V_{IH}	-	SDA, SCL, CS#, D/C#, BS1	0.8*	-	-	V
Low level input voltage	V_{IL}	Digital input pins		-	-	0.2*	V
High level output voltage	V_{OH}	$I_{OH}=-100\ \mu A$	SDA, BUSY	0.9*	-	-	V
Low level output voltage	V_{OL}	$I_{OL}=100\ \mu A$		-	-	0.1*	V
Typical power panel	P_{TYP}	-	-	-	TBD		mW
Standby power panel	P_{STPY}	-	-	-	TBD		mW
Typical operating current (white state)	$I_{OPR_V_{CI}}$	-	-	-	5	-	mA
Image update time	-	23°C	-	-	5	-	sec
Sleep mode current	$I_{SLP_V_{CI}}$	$V_{CI}=3.3V$	V_{CI}	-	30	70	μA

		DC/DC OFF No clock No output load Ram data retain					
Deep sleep mode current	$I_{DSL P_V_{CI}}$	VDD OFF	V_{CI}	-	2	6	μA

Note:

The V_{PP} , V_{CI} , V_{DDIO} input must be kept in a stable value; ripple and noise are not allowed.

6.3 PANEL DC CHARACTERISTICS (DRIVER IC INTERNAL REGULATORS)

The following specifications apply for: $V_{SS}=0V$, $V_{DD}=3.3V$, $T_{OPR}=25^{\circ}C$.

Parameter	Symbol	Condition	Applicable pin	Min.	Typ.	Max.	Unit
VCOM output voltage	V_{COM}	-	V_{COM}	-2.2	-2.0	-1.8	V
Positive Source output voltage	V_{SH}	-	$S_0 \sim S_{551}$	14.8	15	15.2	V
Negative Source output voltage	V_{SL}	-	$S_0 \sim S_{551}$	-15.2	-15	-14.8	V
Positive gate output voltage	V_{GH}	-	$G_0 \sim G_{959}$	19.5	20	20.5	V
Negative gate output voltage	V_{GL}	-	$G_0 \sim G_{959}$	-20.5	-20	-19.5	V

6.4 AC ELECTRICAL CHARACTERISTICS

The following specifications apply for: $V_{DDIO} - V_{SS} = 2.2V$ to $3.7V$, $T_{OPR} = 25^{\circ}C$, $CL=30Pf$

Serial Peripheral Interface Timing Characteristics

Write mode

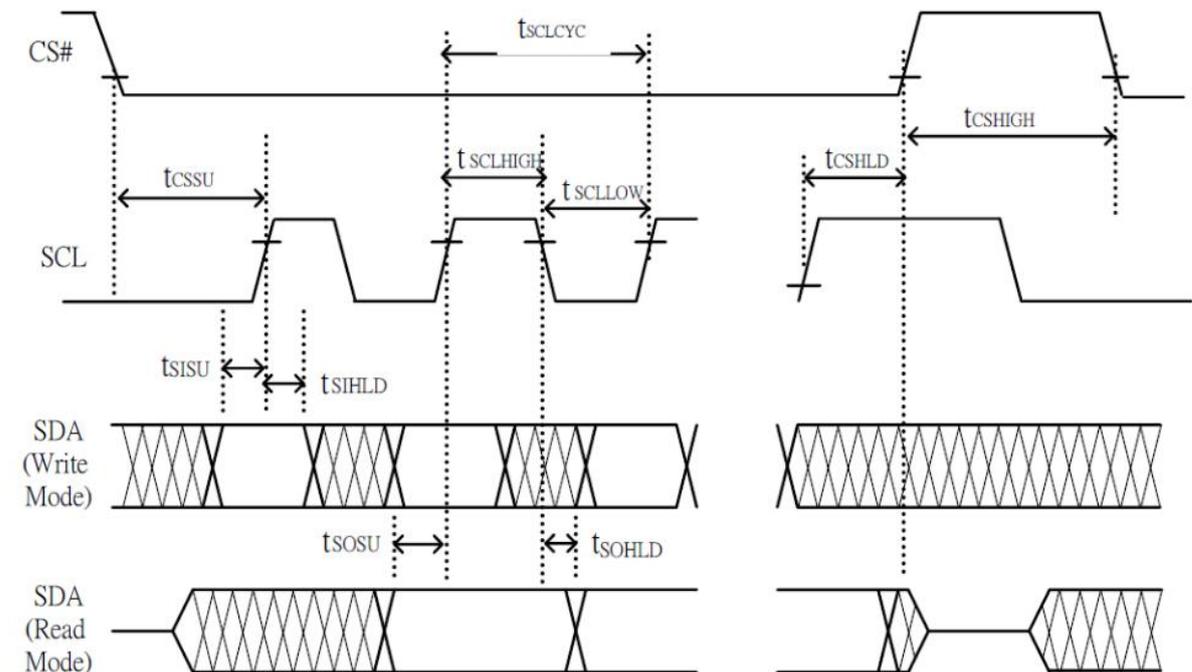
Symbol	Parameter	Min	Typ	Max	Unit
f_{SCL}	SCL frequency (Write Mode)			20	MHz
t_{CSSU}	Time CS# has to be low before the first rising edge of SCLK	20			ns
t_{CSHLD}	Time CS# has to remain low after the last falling edge of SCLK	20			ns
t_{CSHIGH}	Time CS# has to remain high between two transfers	100			ns
t_{SCLCYC}	SCL cycle time	50			ns
$t_{SCLHIGH}$	Part of the clock period where SCL has to remain high	25			ns
t_{SCLLOW}	Part of the clock period where SCL has to remain low	25			ns
t_{SISU}	Time SI (SDA Write Mode) has to be stable before the next rising edge of SCL	10			ns
t_{SIHLD}	Time SI (SDA Write Mode) has to remain stable after the rising edge of SCL	40			ns

Read mode

Symbol	Parameter	Min	Typ	Max	Unit
f_{SCL}	SCL frequency (Read Mode)			2.5	MHz
t_{CSSU}	Time CS# has to be low before the first rising edge of SCLK	100			ns
t_{CSHLD}	Time CS# has to remain low after the last falling edge of SCLK	50			ns
t_{CSHIGH}	Time CS# has to remain high between two transfers	250			ns
$t_{SCLHIGH}$	Part of the clock period where SCL has to remain high	180			ns
t_{SCLLOW}	Part of the clock period where SCL has to remain low	180			ns
t_{SOSU}	Time SO(SDA Read Mode) will be stable before the next rising edge of SCL		50		ns
t_{SOHLD}	Time SO (SDA Read Mode) will remain stable after the falling edge of SCL		0		ns

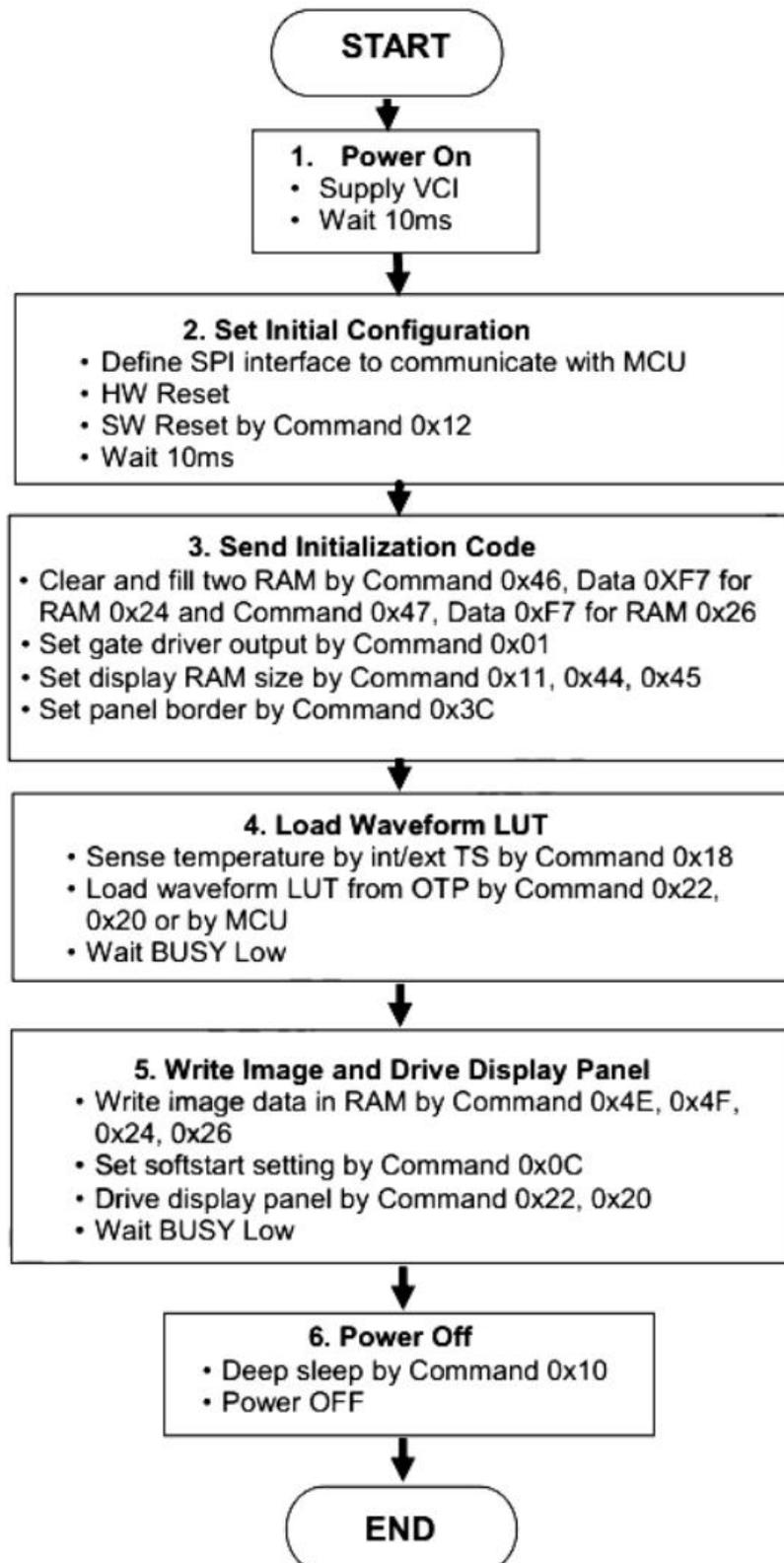
Note: All timings are based on 20% to 80% of $V_{DDIO} - V_{SS}$

Figure 12-1: SPI timing diagram



7. OPERATIONAL FLOW AND CODE SEQUENCE

General operation flow to drive display panel



8. OPTICAL SPECIFICATIONS

Measurements are made with that the illumination is under an angle of 45 degree, the detection is perpendicular unless otherwise specified.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Notes
White Reflectivity	R	White	30	35	-	%	Note 1
Contrast Ratio	CR	Indoor	8:1	-	-	-	Note 2
Image update time	T _{update}	23°C	-	5	-	sec	-
Life	T _{life}	T _{OPR}	-	1000,000 times or 5years	-	-	-

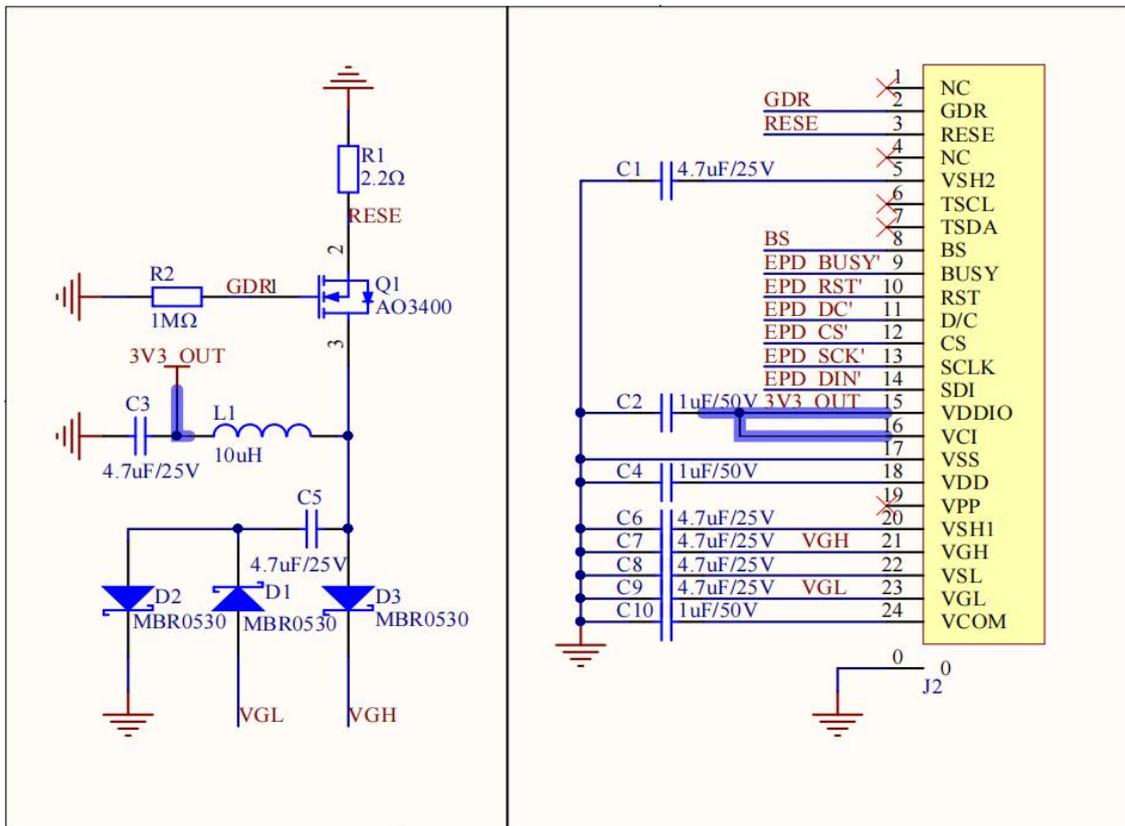
Notes:

- (1) Luminance meter: Eye-One Pro Spectrophotometer.
- (2) CR=Surface Reflectance with all white pixel/Surface Reflectance with all black pixels.



9. TYPICAL APPLICATION CIRCUIT

(1) Schematic of application circuit:



(2) Component list for application circuit:

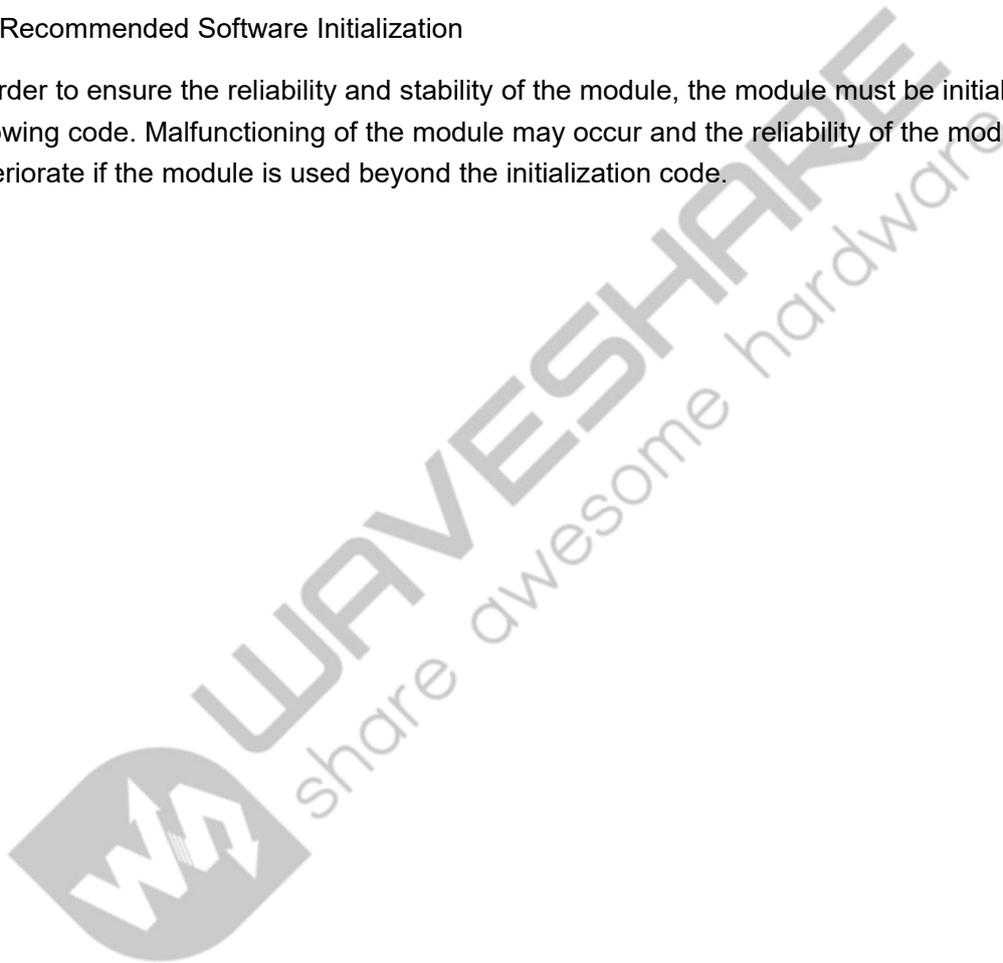
Part Name	Description	Reference Part/Requirement
C1-C5, C8	Chip Ceramic Capacitor	4.7uF 50V X5R/X7R ±10%
C6, C7, C10	Chip Ceramic Capacitor	1uF 50V X5R/X7R ±10%
C9	Chip Ceramic Capacitor	10uF 50V X5R/X7R ±10%
R0, R2	Chip Resistor	10KΩ1% 1/20W ±10%
R3	Chip Resistor	2.2Ω1% 1/20W ±10%
D1-D3	Schottky Rectifier Diode	Vishay MBR0530 1) Reverse DC voltage ≥30V 2) I _o ≤500mA 3) Forward voltage ≤430mV
Q1	N-Channel MOSFET	OnSemi Si1308EDL 1) Drain-Source breakdown voltage ≥30V 2) V _{gs(th)} = 0.9V (Typ), 1.3V (Max) 3) R _{ds on} ≤2.1Ω@ V _{gs} = 2.5V
L1	Chip Inductor	47uH, I _o =500(max)

(3) Display Control Instruction

Refer to SE8350IC Specifications.

(4) Recommended Software Initialization

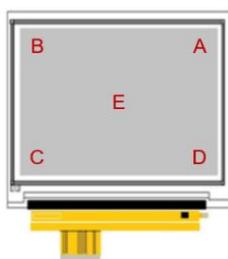
In order to ensure the reliability and stability of the module, the module must be initialized to use the following code. Malfunctioning of the module may occur and the reliability of the module may deteriorate if the module is used beyond the initialization code.



10. RELIABILITY TEST

No.	Test Items	Test Conditions	Quantity
1	Low-Temperature Storage	T= -25°C, low temperature film T= -30°C; White screen state, for 240h	5pcs
2	Low-Temperature Operation	T= 0°C, 240h; Put the product into the experimental procedure, run it in the temperature box, and check it every 24 hours	5pcs
3	High-Temperature Operation	T= 40°C, RH=35%, 240h; Put the product into the experimental procedure, run it in the temperature box, and check it every 24 hours	5pcs
4	High-Temperature Storage	T=60°C, RH=35%; White screen state, for 240h	5pcs
5	Temperature Cycle	1 cycle:[-25°C 30min]→[+60 °C 30 min]; 100 cycles	5pcs
6	High-Temperature, High-Humidity Storage	T= 50°C, RH=90%; White screen state, for 240h	5pcs
7	UV exposure Resistance	765W/m ² for 168hrs,T = 40°C, RH=35%	5pcs
8	ESD Contact discharge	±200V, Test 5 point; Each point discharge 10 times. Time interval is not less than 1 second	5pcs

ESD test location



Test and measurement conditions

After the end of the experiment, the sample was taken out of the temperature chamber, and stood at room temperature for 1h, and then the sample was inspected for appearance, function and optical inspection.

Criteria for qualification (pass the test if all qualified) :

- (1) The product can be normally refreshed.
- (2) There are no new point defects or line defects in the display screen.
- (3) No discoloration, blurred handwriting and barcodes can be read on the complex screen.

11. OUTGOING QUALITY CONTROL SPECIFICATIONS

11.1 SAMPLING METHOD

- (1) GB/T 2828.1, inspection level II , normal inspection, single sample inspection
- (2) AQL: Major 0.4; Minor 0.65

11.2 INSPECTION CONDITIONS

The environmental conditions for test and measurement are performed as follows.

Temperature: $23 \pm 3^{\circ}\text{C}$

Humidity: $55 \pm 15\% \text{R.H}$

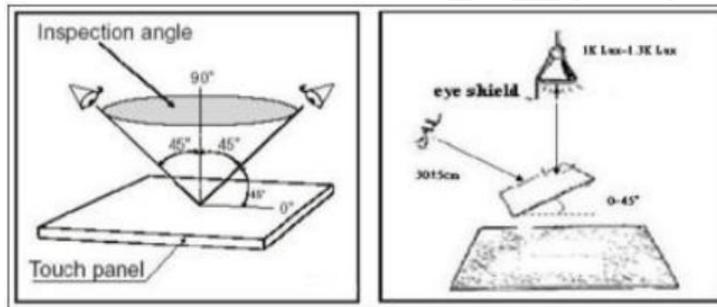
Inspection of illuminance: 800~1500Lux

Inspection time: signal face 5S-10S

Distance between the Panel & Eyes: $30 \pm 10 \text{cm}$

Viewing angle from the vertical in each direction: $\pm 45^{\circ}$

(See the sketch below)



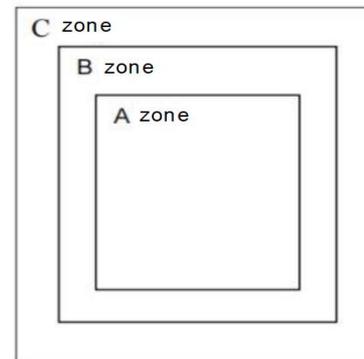
11.3 QUALITY ASSURANCE ZONES

Zone A: Active Area

Zone B: Black Frame Area

Zone C: Outside Black Frame Area

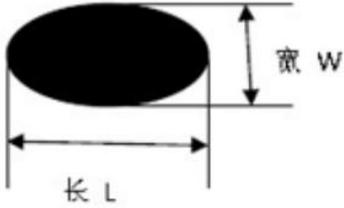
Panel edge



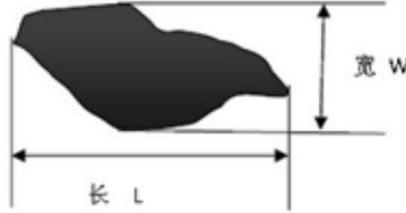
11.4 INSPECTION STANDARDS

Defects Definition of Φ &L&W (Unit: mm)

11.4.1 Dot defects:

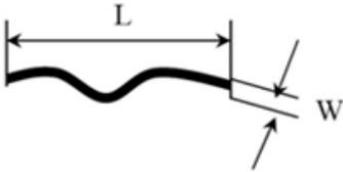


$$\Phi D = \text{Max}(L, W)$$

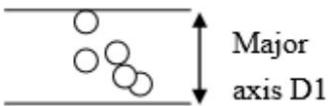


$$\Phi D = \text{Max}(L, W)$$

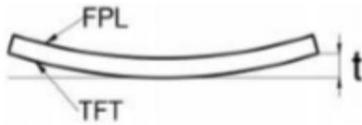
11.4.2 line defect:



11.4.3 Small bubble aggregation and large bubble definition:

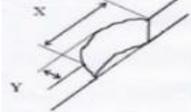
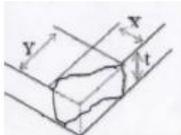


11.4.4 TFT warpage:



11.5 GENERAL INSPECTION STANDARDS FOR PRODUCTS

11.5.1 Appearance Defects

NO.	ITEM	CRITERIA	Acceptable range	Method	Defect level	Area
1	Spotty (black spots, white spots, foreign bodies, air bubbles, bumps)	$D \leq 0.25\text{mm}$	Ignore	Film Card	Minor	Zone A
		$0.25\text{mm} < D \leq 0.5 \text{ mm}$, Distance $\geq 5\text{mm}$	$N \leq 4$			
		$D > 0.5 \text{ mm}$	$N = 0$			
		$0.1\text{mm} < D \leq 0.25 \text{ mm}$ (Dense point)	$N \leq 3/\text{cm}^2$			
2	POOR LINEAR SHAPE (foreign body, glass scratch)	$L \leq 2\text{mm}$, $W \leq 0.1\text{mm}$	Ignore	Film Card	Minor	Zone A
		$2\text{mm} < L \leq 8\text{mm}$, $0.1 < W \leq 0.5\text{mm}$	$N \leq 4$			
		$L > 8\text{mm}$, $W > 0.5\text{mm}$ Note: FPL Lacerations are not allowed	$N = 0$			
	steel pit	Long strip pits are not allowed	$N = 0$	Sight Check	Minor	Zone A
3	Glass Crack	Extensional cracks are not allowed 	$N = 0$	Sight Check	Major	Zone B,C
4	Edge breakage	$X \leq 3\text{mm}$, $Y \leq 0.5\text{mm}$, It does not affect the electrode 	$N \leq 2$	Sight Check/ <u>Microsc</u> <u>ope</u>	Minor	Zone C
5	Chip Package Chip Off	$X \leq 2\text{mm}$, $Y \leq 2\text{mm}$, It does not affect the electrode(FPC edge) $X \leq 1\text{mm}$, $Y \leq 1\text{mm}$, It does not affect the electrode((Not FPC edge) 	$N \leq 2$	Sight Check/ <u>Microsc</u> <u>ope</u>	Minor	Zone C
6	Dirt	No dirt (finger print, dust, residual glue, etc.)	$N = 0$	Sight Check	Minor	Zone ABC
7	Silicone	The maximum diameter of a single bubble cannot exceed 2mm	$N \leq 2$	Sight Check/ Film card	Minor	Zone C
		Crack is not allowed and there are no visible impurities in the glue of the lead part	$N = 0$			
		The adhesive must completely cover the ACF, lead area and IC and should be applied evenly	$N = 0$			
		No glue leakage, no obvious lack of glue in the lead area	$N = 0$			

NO.	ITEM	CRITERIA	Acceptable range	Method	Defect level	Area
		Glue height exceeds PS surface	N=0			
		FPC Front overflow glue width>0.5mm or Back side overflow glue width>1mm	N=0			
8	Edge Sealing Adhesive	No glue leakage	N=0	Sight Check/ Film card	Major	Zone C
		The height of sealant exceeds PS surface	N=0		Minor	
		The edge sealing adhesive shall not leak the TFT glass substrate	N=0			
		Judging Ok of water-blocking area ≥ 0.7 mm of PS edge sealant	N=0		Minor	
9	Protective film	Foreign body in protective film	N=0	Sight Check	Minor	Zone A
		The protective film punctures and injures FPL	N=0			
10	Pull Tape	Attachment position is wrong Cannot tear up the protective film	N=0	Sight Check	Minor	Zone C
11	FPC	FPC has break, scratch, gold finger stripping or oxidation, dirty, residual glue	N=0	Sight Check	Major	Zone C
12	Glass edge bulge	$X \leq 3\text{mm}$, $Y \leq 0.3\text{mm}$	$N \leq 1$	Sight Check	Minor	Zone C
13	Warping	$t > 1\text{mm}$ (3.5inch below) $t > 3\text{mm}$ (3.5inch above)	N=0	Plug Gage	Minor	Zone C
14	Chromatism	Color difference in silver paste area (Not in Zone A)	Ignore	Sight Check	Minor	Zone C
		FPL Peeling occurs, chromatic aberration occurs	N=0	Sight Check	Major	Zone A
		The color difference of side loss of FPL in zone B $\geq 1/2$ width	N=0	Sight Check	Major	Zone A,B
15	Silver pulp point	FPL and TFT substrate conduction, silver point $< 1.0\text{mm}$ (Both single silver point and double silver point should meet this specification)	N=0	Film card	Major	Zone C
16	Inkjet code	The ink jet printing font is clear, identifiable, and cannot be missing	N=0	Sight Check	Minor	Zone C

11.5.2 Displaying Defects

NO.	ITEM	CRITERIA	Acceptable range	Method	Defect level	Area
1	Poor DOT SHAPE (black, white, group White)	$D \leq 0.25\text{mm}$	Ignore	Film Card	Major	Zone A
		$0.25\text{mm} < D \leq 0.5\text{mm}$, Distance $\geq 5\text{mm}$	$N \leq 4$			
		$D > 0.5\text{mm}$	$N = 0$			
		$0.1\text{mm} < D \leq 0.25\text{mm}$ (Dense point)	$N \leq 3/\text{cm}^2$			
2	Line defects	White or black lines running through the entire screen under any operation interface 	$N = 0$	Sight Check	Major	Zone A
3	<u>ghost</u>	Ghosts appear only during screen switching	Ignore	Sight Check	Major	Zone A
4	Flash Point	Flash point occurs during screen switching only	Ignore	Sight Check	Major	Zone A
5	Flash Line	Flash line occurs during screen switching only	$N = 0$	Sight Check	Major	Zone A
6	Display screen error	Unable to display a fixed screen correctly	$N = 0$	Sight Check	Major	Zone A
7	Display abnormal	No display, The red matrix darkens, Note fuzzy, bar code can not be scanned,	$N = 0$	Sight Check	Major	Zone A
8	Residual image	Residual Image Inspection (visual, final judgment reference optical specification)	$N = 0$	Sight Check	Major	Zone A
9	Mura Anomaly	White/gray. Mura doesn't allow it	$N = 0$	Sight Check	Major	Zone A



11.5.3 Identification and packaging inspection

NO.	ITEM	CRITERIA	Method	Defect level
1	Package	(1). The products are completely placed in the anti-static tray without overlapping. (2). Products with different models cannot be mixed in one internal packaging bag. (3) There is a desiccant in the packaging bag, with good internal packaging and no expansion of the packaging bag. (4) The Tray model, quantity and way used for packaging meet the requirements of product specifications.	Sight Check	Minor
2	Inner and outer packing	(1) No obvious deformation, damage, dampness or dirt on the packing case; (2) The type, quantity and method of the packing case used shall meet the requirements of the product specification. (3) There is no font or unclear design in the outer packing box.	Sight Check	Minor
3	Labels for inner and outer cases	(1). Any unnecessary marks or marks are not allowed to exist; (2). The label information such as model, specification, quantity, weight, material number, month label and environmental protection label should be clear and correct, which should be in line with product specifications or marked according to customer requirements.	Sight Check	Minor



12. HANDLING, SAFETY, AND ENVIRONMENTAL REQUIREMENTS

WARNING

The display glass may break when it is dropped or bumped on a hard surface. Handle with care. Should the display break, do not touch the electrophoretic material. In case of contact with electrophoretic material, wash with water and soap.

CAUTION

The display module should not be exposed to harmful gases, such as acid and alkali gases, which corrode electronic components.

Disassembling the display module can cause permanent damage and invalidate the warranty agreements.

Observe general precautions that are common to handling delicate electronic components. The glass can break and front surfaces can easily be damaged. Moreover the display is sensitive to static electricity and other rough environmental conditions.

Data sheet status

Product specification	The data sheet contains final product specifications.
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Limiting values

Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information

Where application information is given, it is advisory and does not form part of the specification.

Storage condition

Under the conditions of temperature 10~30°C and humidity 30~70%, The storage time was 12 months.

13. PRECAUTIONS

- (1) Do not apply pressure to the EPD panel in order to prevent damaging it.
- (2) Do not connect or disconnect the interface connector while the EPD panel is in operation.
- (3) Do not touch IC bonding area. It may scratch TFT lead or damage IC function.
- (4) Please be mindful of moisture to avoid its penetration into the EPD panel, which may cause damage during operation.
- (5) If the EPD Panel / Module is not refreshed every 24 hours, a phenomena known as “Ghosting” or “Image Sticking” may occur. It is recommended to refreshed the ESL /EPD Tag every 24 hours in use case. It is recommended that customer ships or stores the ESL / EPD Tag with a completely white image to avoid this issue.
- (6) High temperature, high humidity, sunlight or fluorescent light may degrade the EPD panel’s performance. Please do not expose the unprotected EPD panel to high temperature, high humidity, sunlight, or fluorescent for long periods of time.