



SPECIFICATION



EL133UR1

13.3", 1600x1200, TTL

Version: 1.0

Date: 27.10.2020

Note: This specification is subject to change without prior notice

www.data-modul.com

Version: 1.0

Technical Specification

**MODEL NO: EA2220-NCC
(EL133UR1)**

The content of this information is subject to be changed without notice.

Please contact E Ink or its agent for further information.

☐ Customer's Confirmation

Customer _____

Date _____

By _____

☐ E Ink's Confirmation

Approve By

Sean Chen

Confirmed By

Miso Tsai

Prepared By

Joe Li

Revision History

Rev.	Issued Date	Revised Contents
0.1	2020.09.28	Tentative
1.0	2020.10.27	Update 3. Mechanical Specifications Update 5. Input/Output Interface Update 6. Power Sequence Update 7. Electrical Characteristics Update 8. Optical Characteristics

TECHNICAL SPECIFICATION

CONTENTS

1. Application.....	1
2. Features.....	1
3. Mechanical Specifications	1
4. Mechanical Drawing of EPD Module.....	2
5. Input/Output Interface.....	3
6. Power Sequence.....	6
7. Electrical Characteristics.....	8
8. Optical Characteristics.....	13
9. Handling, Safety and Environmental Requirements and Remark	15
10. Reliability Test	17
11. Block Diagram	18
12. Packing.....	19

1. Application

EA2220-NCC is a reflective electrophoretic E Ink® technology display module based on active matrix TFT substrate. The diagonal length of active area is 13.3" and contains 1600 x 1200 pixels. The display is capable to display 1-bit black, white and red images depending on the display controller and the associated lookup table used.

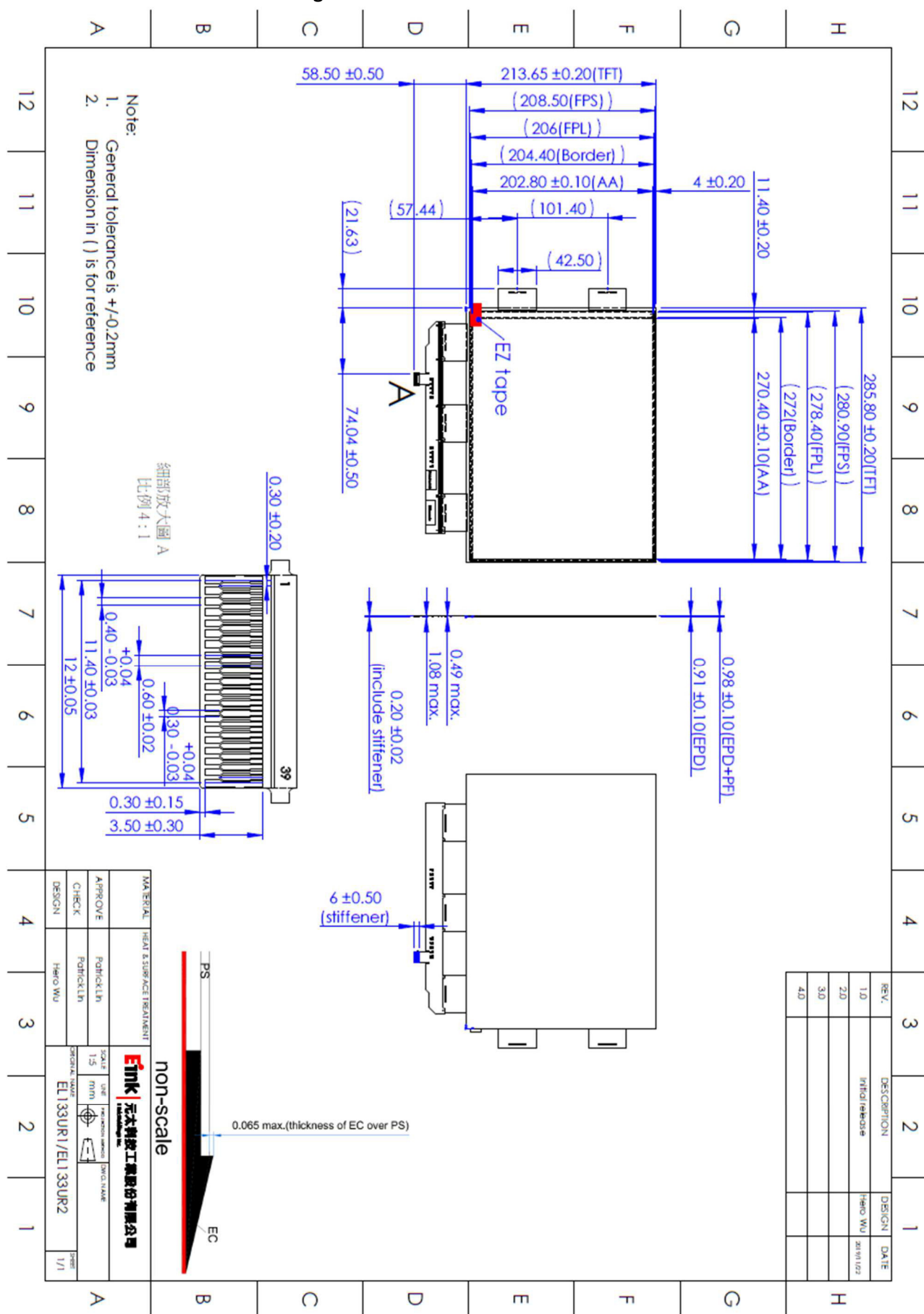
2. Features

- Highlight Red
- High contrast
- High reflectance
- Ultra wide viewing angle
- Pure reflective mode
- Bi-stable
- Commercial temperature range
- Landscape, portrait mode
- Antiglare hard-coated front-surface

3. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	13.3	Inch	
Display Resolution	1600 (H)×1200(V)	Pixel	DPI: 150
Active Area	270.4 (H)×202.8 (V)	mm	
Pixel Pitch	0.169 (H)×0.169 (V)	mm	Square
Outline Dimension	285.8(W)×213.65(H)×0.91(D)	mm	Without masking film
Module Weight	110 ± 5.5	g	

4. Mechanical Drawing of EPD Module

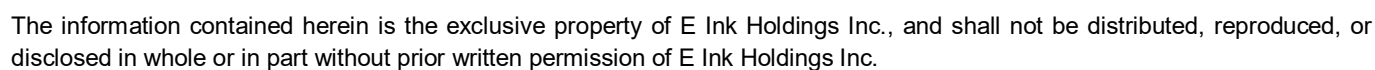


5. Input/Output Interface

5.1 Pin Assignment

Pin	Signal	I/O	Description	Remark
1	VNEG	P	Negative power supply source driver	
2	VPOS	P	Positive power supply source driver	
3	VSS	P	Ground	
4	VDD	P	Digital power supply drivers	
5	XCL	I	Clock source driver	
6	XLE	I	Latch enable source driver	
7	XOE	I	Output enable source driver	
8	VSS	P	Ground	
9	VSS	P	Ground	
10	NC	-	No Connection	
11	XSTL	I	Start pulse source driver	
12	D0	I	Data signal source driver	
13	D1	I	Data signal source driver	
14	D2	I	Data signal source driver	
15	D3	I	Data signal source driver	
16	D4	I	Data signal source driver	
17	D5	I	Data signal source driver	
18	D6	I	Data signal source driver	
19	D7	I	Data signal source driver	
20	VSS	P	Ground	
21	NC	-	No Connection	
22	VCOM	P	Common connection	
23	VGH	P	Positive power supply gate driver	
24	VGL	P	Negative power supply gate driver	
25	NC	-	No Connection	
26	NC	-	No Connection	
27	NC	-	No Connection	
28	MODE1	I	Output mode selection gate driver	
29	VSS	P	Ground	
30	VSS	P	Ground	
31	VSS	P	Ground	
32	SPV	I	Start pulse gate driver	
33	CKV	I	Clock gate driver	
34	BORDER	I	Border connection	
35	VSS	P	Ground	
36	VSS	P	Ground	
37	VSS	P	Ground	
38	VSS	P	Ground	
39	VSS	P	Ground	

SERVICE	CONNECTOR	TYPE NUMBER	NUMBER OF PINS	MATING CONNECTOR
Interface	JST	39FXL-RSM1-S-H-TB	39	Copper foil 0.3mm pitch



5-4) The relationship of input data and output

Output	S1	S2	S3	S4
Data	D7	D5	D3	D1
	D6	D4	D2	D0

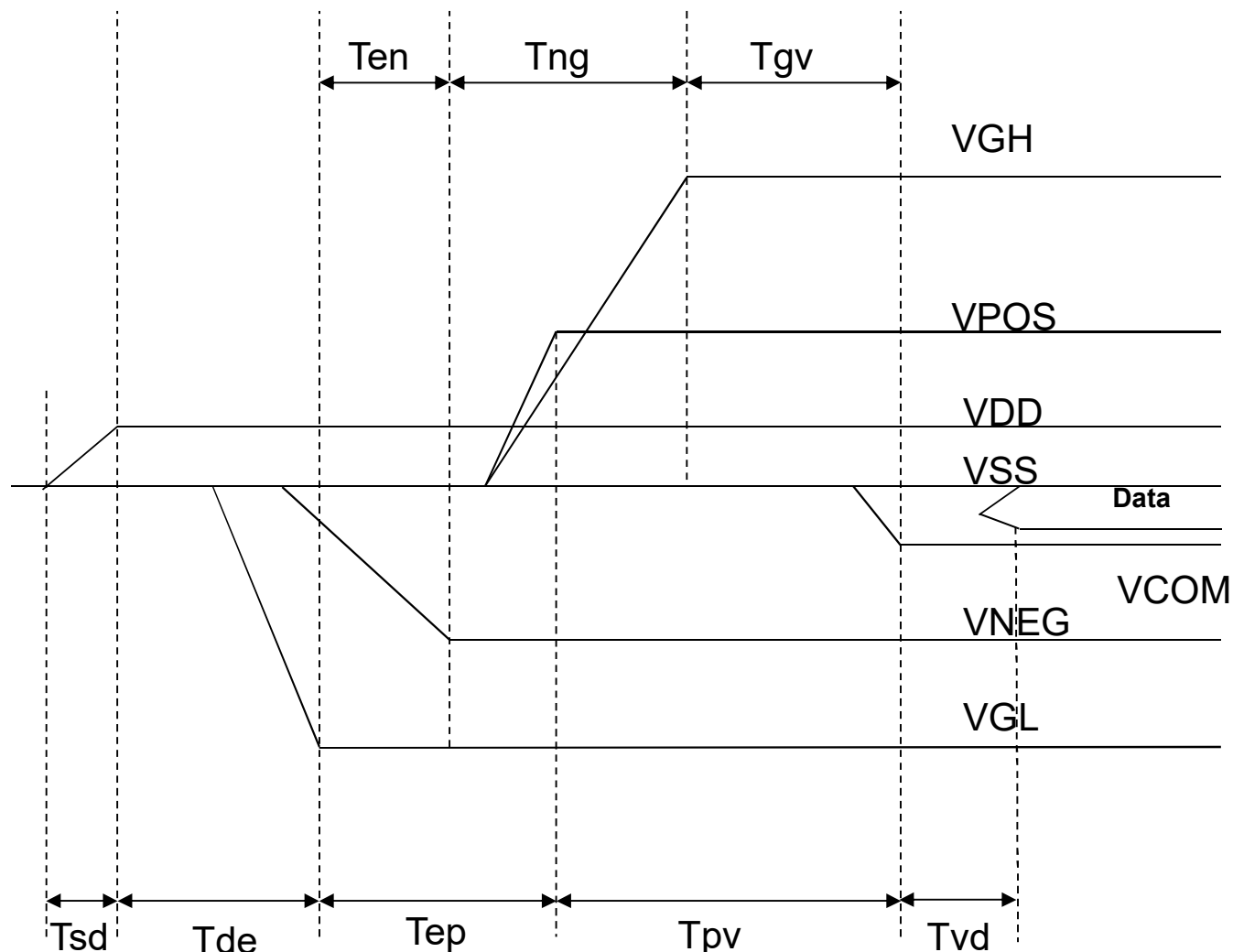
6. Power Sequence

Power Rails must be sequenced in the following order :

1. VSS → VDD → VNEG → VPOS (Source driver) → VCOM

2. VSS → VDD → VGL → VGH (Gate driver)

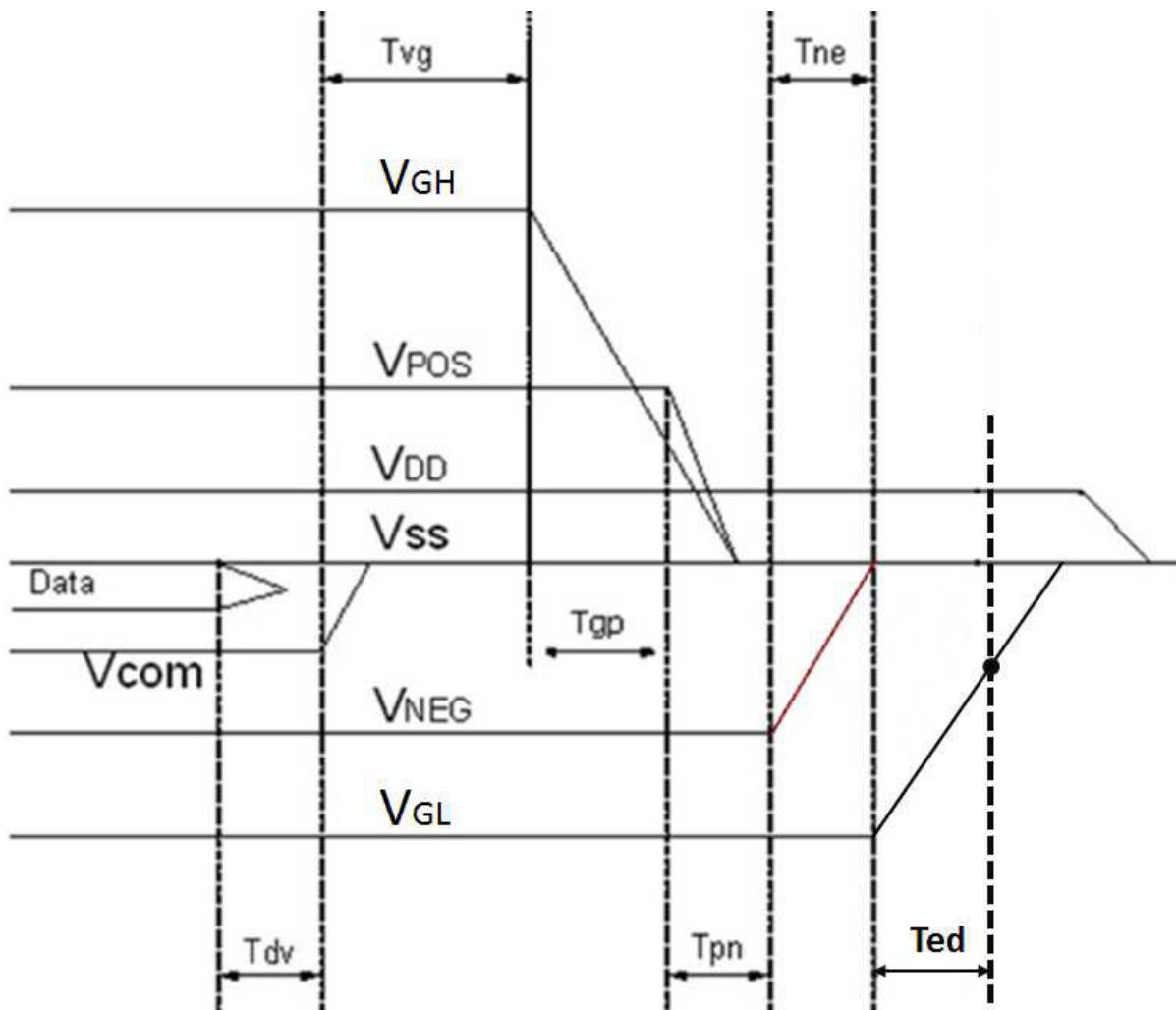
POWER ON



	Min	Max
Tsd	30us	-
Tde	100us	-
Tep	1000us	-
Tpv	100us	-
Tvd	100us	-
Ten	0us	-
Tng	1000us	-
Tgv	100us	-

Note : Voltage scales here are just for reference. For valid voltage scales, please refer to the section of Panel DC characteristics.

POWER OFF



	Min	Max	Remark
Tdv	100μs	-	-
Tvg	0μs	-	-
Tgp	0μs	-	-
Tpn	0μs	-	-
Tne	0μs	-	-
Ted	0.5s	-	Discharged point @ -7.4 Volt

Note : Voltage scales here are just for reference. For valid voltage scales, please refer to the section of Panel DC characteristics.

7. Electrical Characteristics

7-1) Absolute maximum rating

Parameter	Symbol	Rating	Unit
Logic Supply Voltage	VDD	-0.3 to +7	V
Positive Supply Voltage	V _{POS}	-0.3 to +18	V
Negative Supply Voltage	V _{NEG}	+0.3 to -18	V
Max .Drive Voltage Range	V _{POS} - V _{NEG}	36	V
Supply Voltage	VGH	-0.3 to +55	V
Supply Voltage	VGL	-32 to +0.3	V
Supply Range	VGH-VGL	-0.3 to +55	V
Operating Temp. Range	TOTR	0 to +40	°C
Storage Temperature	TSTG	-25 to +60	°C

- Note: Maximum ratings are those values beyond which damages to the device may occur.

Functional operation should be restricted to the limits in the Electrical Characteristics chapter

7-2) Panel DC characteristics

The following specifications apply for: VDD = 3.3V, TA = 25°C

Parameter	symbol	conditions	Min	Typ	Max	Unit
Signal ground	Vss			0		V
Logic voltage supply	Vdd		2.75	3.3	3.6	V
	Ivdd	Vdd=3.3V		3.4	8	mA
Gate negative supply	GVgl		-19	-20	-21	V
	GIgl	Gvgl=-20V		1.5	4	mA
Gate Positive supply	GVgh		26	27	28	V
	GIgh	GVgh=27V		1.5	4	mA
Source negative supply	Vneg		-15.4	-15	-14.6	V
	Ineg	Vneg=-15V		6.5	135	mA
Source Positive supply	Vpos	Vpos1=15V	14.6	15	15.4	V
		Vpos2		Adjusted		V
	Ipos	Vpos=15V		6.3	150	mA
Border supply	Vcom		-3.5	Adjusted	-0.3	V
Asymmetry source	Vasm	Vpos+Vneg	-800		800	mV
Common voltage(DC)	Vcom		-3.5	Adjusted	-0.3	V
	Icom			0.8	1	mA
Maxmum Power panel	Pmax				4508	mW
Typcal power panel	Ptyp			275		mW
Standby power panel	Pstby				0.4	mW

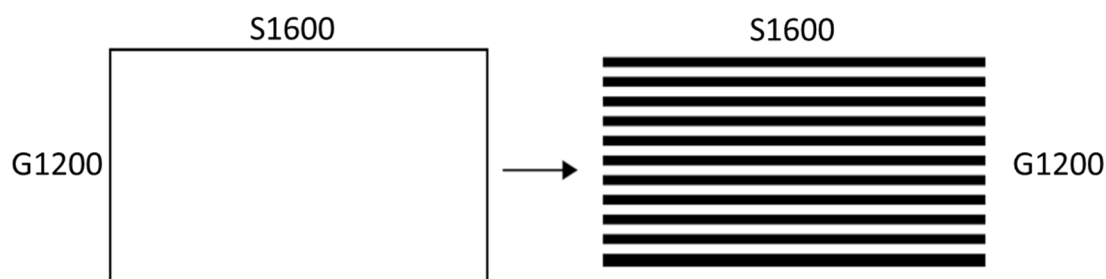
- Note: The above data is measured by using volt-ohm meter, and extract the max value.
- Note: The VPOS is composed of VPOS 1 & VPOS2.

VPOS2 must follow E Ink waveform definition of each FPL batch by the tolerance of $\pm 0.2V$.

- The Maximum power consumption is measured using associated 25C waveform with following pattern transition: from full white pattern to pattern of repeated 1 consecutive white scan lines followed by 1 consecutive black scan lines. (Note 7-1)
- The Typical power consumption is measured using associated 25C waveform with following pattern transition: from full white pattern to black, white and red stripe pattern.(Note 7-2)
- The standby power is the consumed power when the panel controller is in standby mode. The standby power is the consumed power when the panel controller is in standby mode.
- The listed electrical/optical characteristics are only guaranteed under the controller & waveform provided by E Ink.
- Vcom is recommended to be set in the range of assigned value $\pm 0.1V$

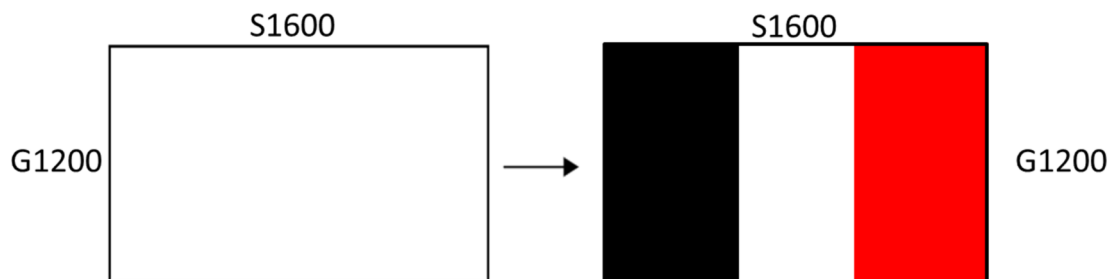
Note 7-1

The maximum power consumption



Note 7-2

The Typical power consumption



7-3) Refresh Rate

The module EL133UR1 is applied at maximum screen refresh rate of 75Hz.

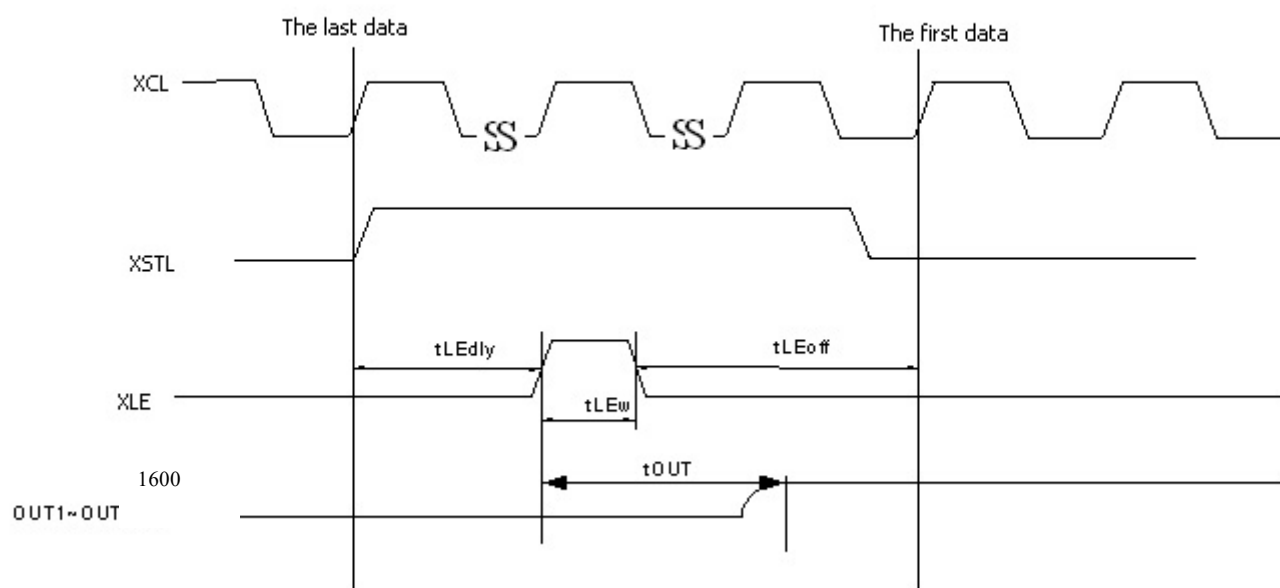
	Min	Max
Refresh Rate	-	75Hz

7-4) Panel AC characteristics

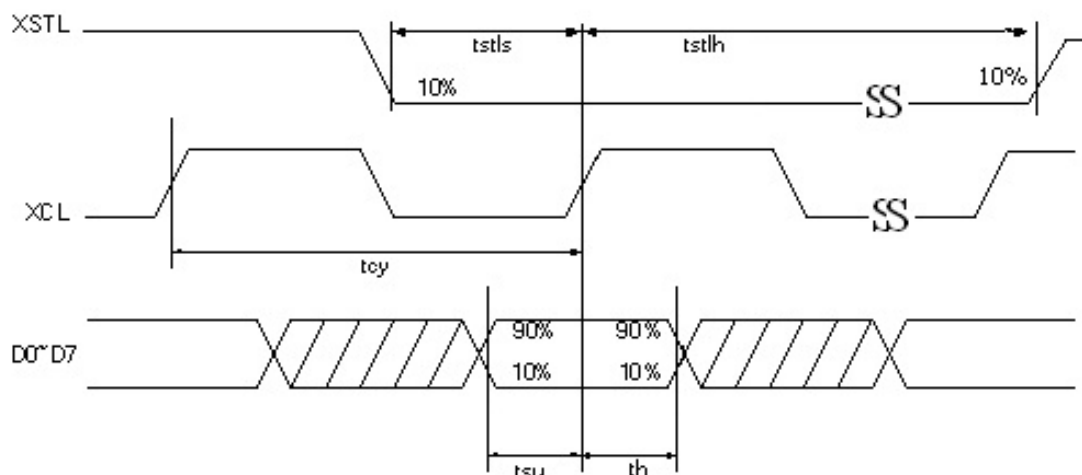
VDD=2.73V to 3.6V, unless otherwise specified.

8. Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	fckv	-	-	200	kHz
Minimum “L” clock pulse width	twL	0.5	-	-	us
Minimum “H” clock pulse width	twH	0.5	-	-	us
Clock rise time	trckv	-	-	100	ns
Clock fall time	tfckv	-	-	100	ns
SPV setup time	tSU	100	-	twH-100	ns
SPV hold time	tH	100	-	twH-100	ns
Pulse rise time	trspv	-	-	100	ns
Pulse fall time	tfspv	-	-	100	ns
Clock XCL cycle time	tcy	16.7	-	-	ns
D0 .. D7 setup time	tsu	8	-	-	ns
D0 .. D7 hold time	th	8	-	-	ns
XSTL setup time	tstls	8.35	-	-	ns
XSTL hold time	tstlh	8.35	-	-	ns
XLE on delay time	tLEdly	40	-	-	ns
XLE high-level pulse width (When VDD=2.73V to 3.6V)	tLEw	40	-	-	ns
XLE off delay time	tLEoff	200	-	-	ns
Output setting time to +/- 30mV(C _{load} =200pF)	tout	-	-	12	us
Frame Sync Length (Mode 1)	t1	1			1 line

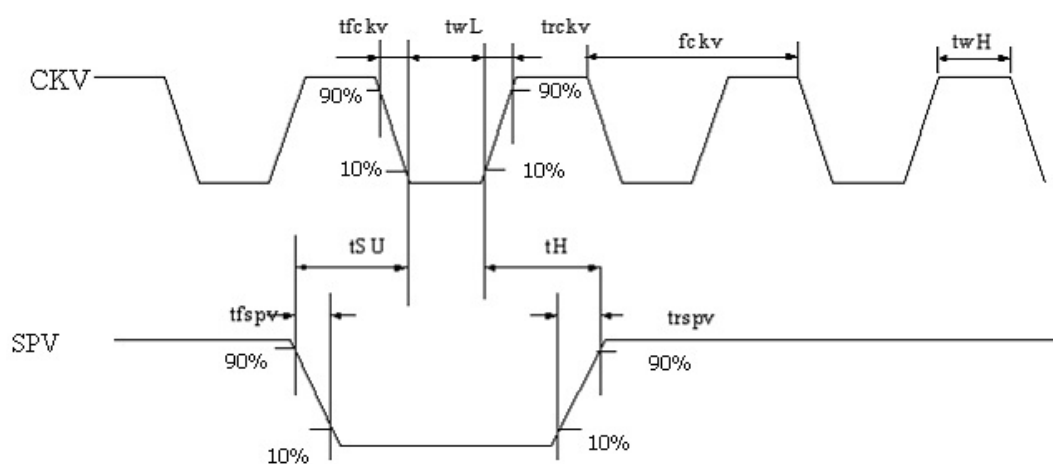
OUTPUT LATCH CONTROL SIGNALS



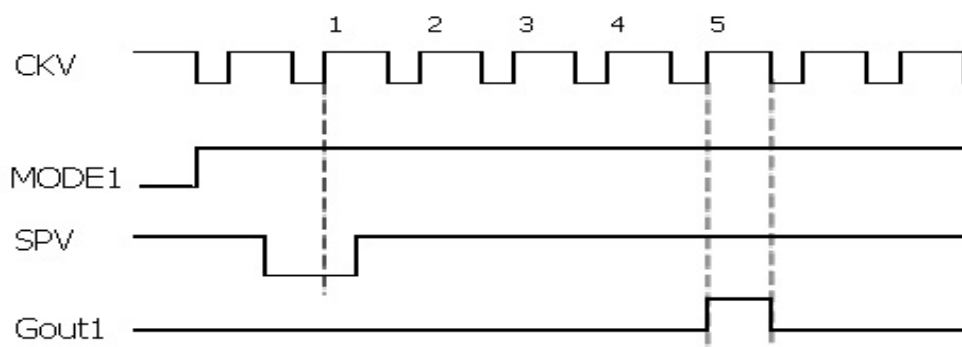
CLOCK & DATA TIMING



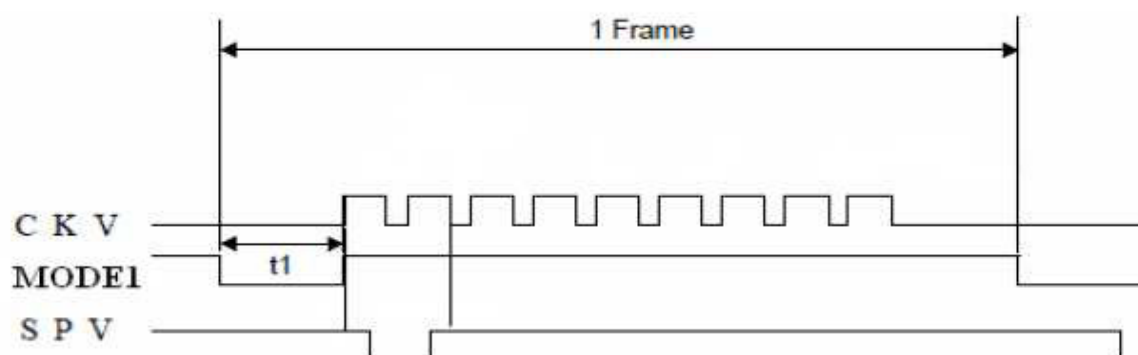
CKV & SPV TIMING



GATE OUTPUT TIMING



Frame Sync Length



Note : First gate line on timing

After 5CKV , gate line is on .

8. Optical Characteristics

8-1) Specification

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

Symbol	Parameter	Conditions	Temperature	Min	Typ.	Max	Unit	Note
R	Reflectance	White	25°C	30	33	-	%	Note 8-1
CR	Contrast Ratio	-	25°C	10	15	-		-
RS_L*	Red State L*value	Red	25°C	24	26			Note 8-1
RS_a	Red State a* value	Red	25°C	34	39	-		Note 8-1
Tupdate_RS	Update time	Red	25°C		18		sec	
RS_a	Red State a* value	Red	0°C	30	35			Note 8-1

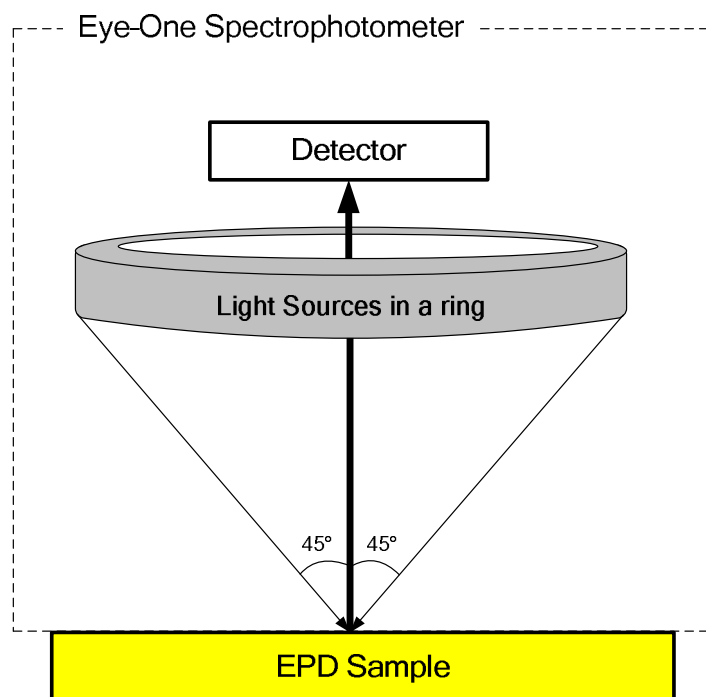
WS: White state, DS: Dark state, RS: Red state

Note 8-1 : Luminance meter : Eye – One Pro Spectrophotometer

8-2) Definition of contrast ratio

The contrast ratio (CR) is the ratio between the reflectance in a full white area (Rl) and the reflectance in a dark area (Rd) :

$$CR = Rl/Rd$$



8-3) Reflection Ratio

The reflection ratio is expressed as :

$$R = \text{Reflectance Factor}_{\text{white board}} \times (L_{\text{center}} / L_{\text{white board}})$$

L_{center} is the luminance measured at center in a white area. $L_{\text{white board}}$ is the luminance of a standard white board. Both are measured with equivalent illumination source. The viewing angle shall be no more than 2 degrees.

9. Handling, Safety and Environmental Requirements and Remark

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.
IPA solvent can only be applied on active area and the back of a glass. For the rest part, it is not allowed.

Mounting Precautions
(1) It's recommended that you consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module.
(2) It's recommended that you attach a transparent protective plate to the surface in order to protect the EPD. Transparent protective plate should have sufficient strength in order to resist external force.
(3) You should adopt radiation structure to satisfy the temperature specification.
(4) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the PS at high temperature and the latter causes circuit break by electro-chemical reaction.
(5) Do not touch, push or rub the exposed PS with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of PS for bare hand or greasy cloth. (Some cosmetics deteriorate the PS)
(6) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach the PS. Do not use acetone, toluene and alcohol because they cause chemical damage to the PS.
(7) Wipe off saliva or water drops as soon as possible. Their long time contact with PS causes deformations and color fading.

Data sheet status	
Product specification	This data sheet contains final product specifications subjected to changes without notice.
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 at 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.	

10. Reliability Test

	TEST	CONDITION	REMARK
1	High Temperature Storage	Ta= 60°C 40% RH, 240Hrs	(Test in White pattern)
2	Low Temperature Storage	Ta= -25°C, 240Hrs	(Test in White pattern)
3	High Temperature Operation	Ta= 40°C 35% RH, 240Hrs	
4	Low Temperature Operation	Ta= 0°C, 240Hrs, 240Hrs	
5	High-Temperature, High-Humidity Operation	T = +40°C, RH = 80%, 168Hrs	
6	High-Temperature, High-Humidity Storage	T = +50°C, RH = 80%, 240Hrs	(Test in White pattern)
7	Temperature Cycle	-25°C(30 min) ~60°C(30 min), 50 cycle, 1Hr/cycle	(Test in White pattern)
8	Electrostatic Discharge	(Machine model)+/- 200V 0Ω, 200pF	Non-operation

Actual EMC level to be measured on customer application.

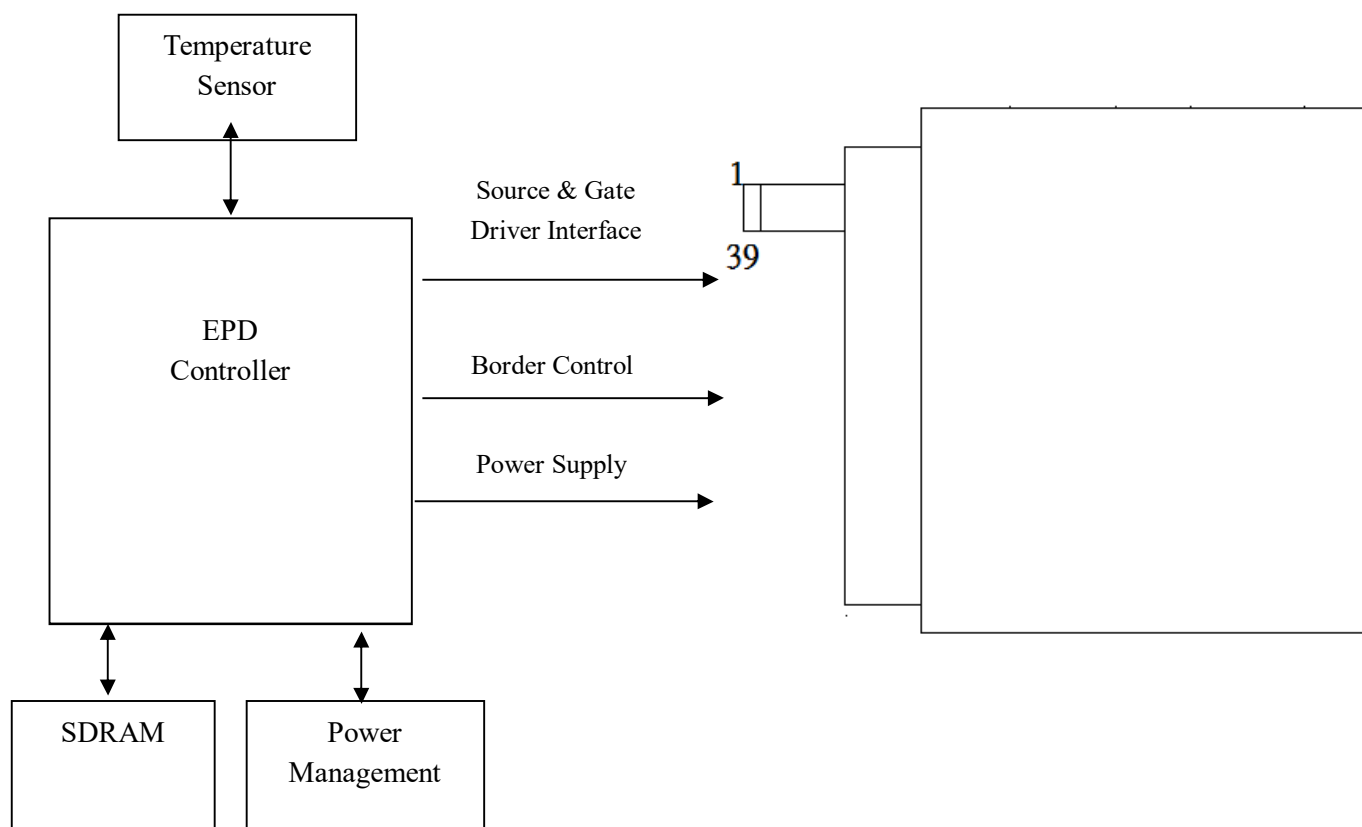
Note : The protective film must be removed before temperature test.

< Criteria >

In the standard conditions, there is not display function NG issue occurred.

All the cosmetic specification is judged before the reliability stress.

11. Block Diagram



12. Packing

REV	DESCRIPTION	DESIGN	DATE
01	INITIAL RELEASE	Hero Wu	20191125

NOTE:

- One layer include: 1 piece of cushion sheet, 1pcs panel & 1 piece of tray.
- Q'TY: 12 pcs panel/carton.
- Dimension: 455*375*190mm
- Weight: 5.0 KG

ITEM	DESCRIPTION	QTY	REMARK
9			
8	EASY TAPE	12	For internal protect sheet
7	30g EPE FOAM 455*375*190mm (EINK0030)	2	
6	CARTON INTERNAL	1	
5	開口袋 450*380*700mm	1	防静电
4	EPE D	12	
3	EPE CUSHION SHEET	12	防静电
2	PET TRAY	13	防静电
1	EPE FOAM	2	

MTL SPEC.		UNSPECIFIED TOL'S		REMARK	
		ANGLE			
		ROUGHNESS			

元太科技工業股份有限公司 E Ink Holdings Inc.					
APPROVE	Patrick Lin	SCALE	UNIT	SHEET	DWG. TITLE
CHECK	Patrick Lin	1:1	mm	1 OF 1	EL133UR1/UR2 PACKING
DESIGN	Hero Wu	MTL NO.		DWG. NO.	
					A ₄ SIZE



ALL TECHNOLOGIES. ALL COMPETENCIES. ONE SPECIALIST.



DATA MODUL AG
Landsberger Straße 322
DE-80687 Munich
Phone: +49-89-56017-0

DATA MODUL WEIKERSHEIM GMBH
Lindenstraße 8
DE-97990 Weikersheim
Phone: +49-7934-101-0



More information and worldwide locations can be found at

www.data-modul.com