Version: 0.2

TECHNICAL SPECIFICATION

MODEL NO: ED060XG1

The content of this information is subject to be changed without notice.
Please contact Universal Display LTD for the confirmation.

☐Customer's Confirmation

Customer _____

Date _____

By _____

☐E Ink's Confirmation

Dep	PM	FAE	Panel Design	Electronic Design	Mechanical Design	Product Verification	Prepared By
Sign							

Revision History

Rev.	Issued Date	Revised Contents
0.1	July 11 ,2012	Preliminary
0.2	August 7,2012	Modify Page 5 4. Mechanical Drawing of EPD module Add Page 20 9. Optical characteristics Change Uniformity, add CR Page 27 14. Block Diagram Page 28 15. Packing

TECHNICAL SPECIFICATION

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1. Application

ED060XG1 is a reflective electrophoretic technology display module based on active matrix TFT substrate featuring capacitive touch panel. It has 6” active area with 758 x 1024 pixels, the display is capable to display images at 2-16 gray levels (1-4 bits) depending on the display controller and the associated waveform file it used.

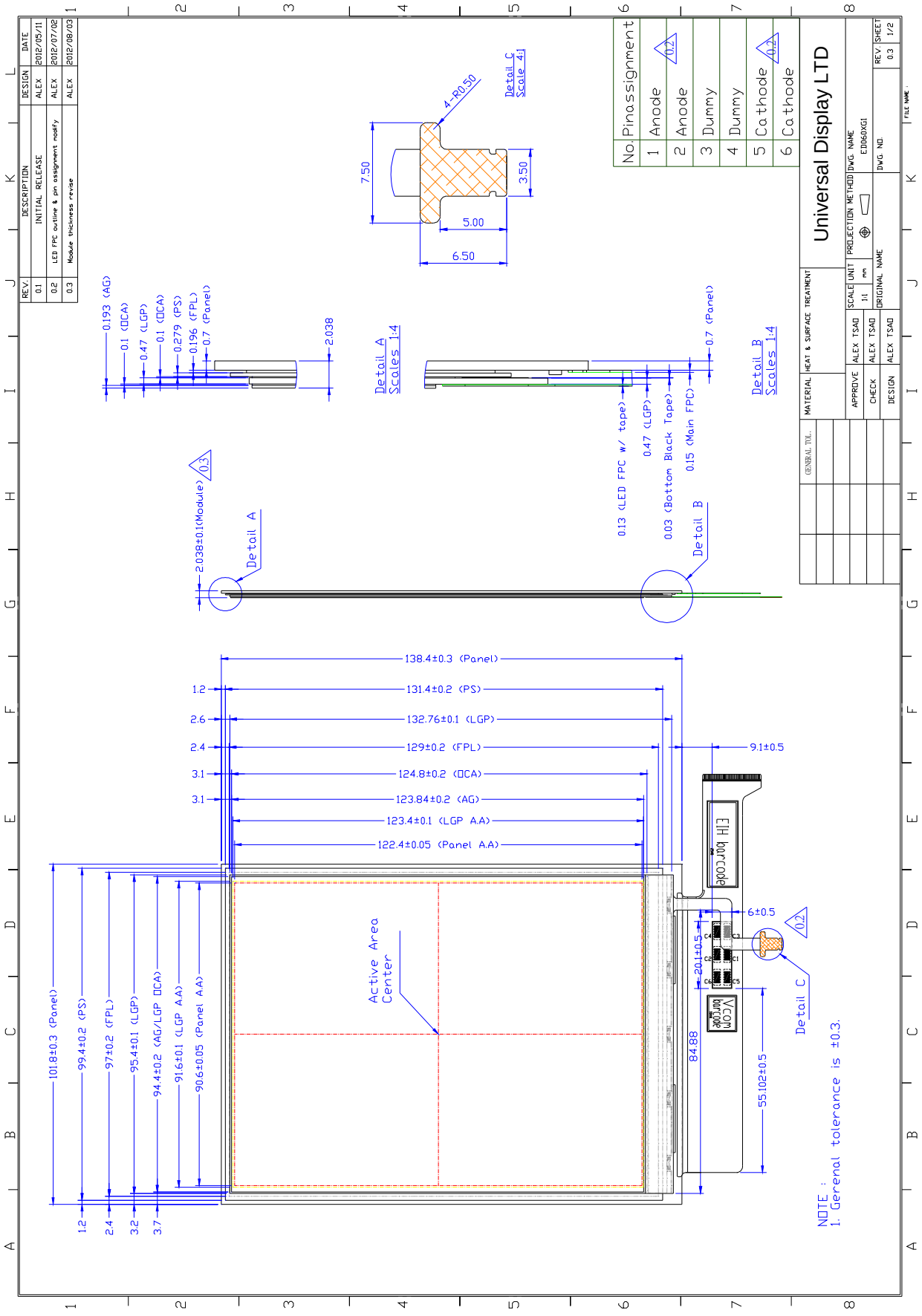
2. Features

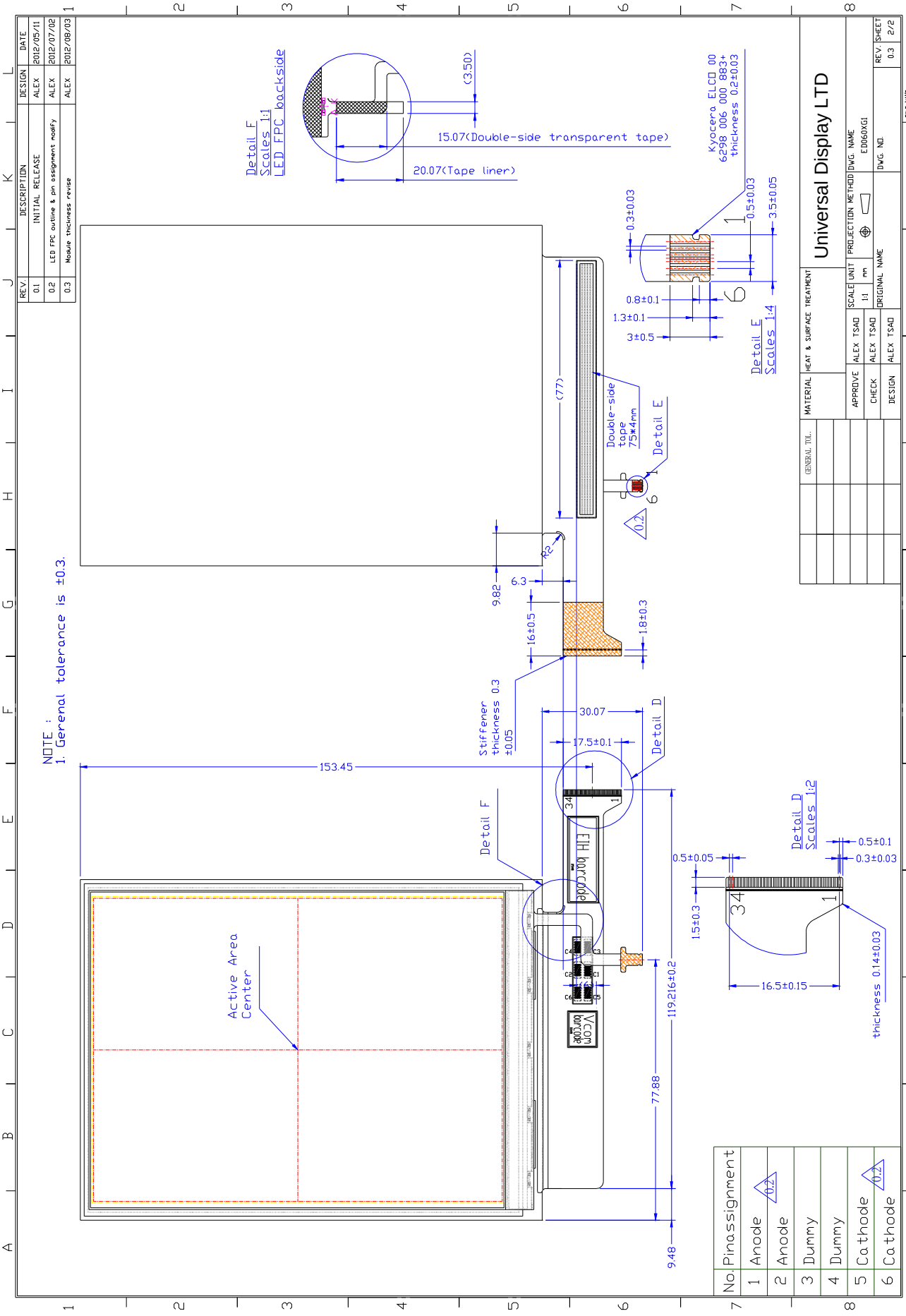
- High contrast reflective/electrophoretic technology
- 758 x 1024 display
- High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable
- Commercial temperature range
- Landscape, portrait mode
- Front Light Module

3. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	6.0 (3:4 diagonal)	Inch	
Display Resolution	758 (H)×1024(V)	Pixel	
Active Area	90.6 (H)×122.4 (V)	mm	
Pixel Pitch	0.1195 (H)×0.1195 (V)	mm	
Pixel Configuration	Square		
Outline Dimension	101.800(W)×138.400(H)×2.038(D)	mm	
Module Weight	46±4.6	g	
Number of Gray	16 Gray Level (monochrome)		
Display operating mode	Reflective mode		
Surface Treatment	Anti-glare treatment for protective sheet		

4. Mechanical Drawing of EPD Module




NOTE :
1. General tolerance is ±0.3.
Detail F
Scales 1:1
LED FPC backside
(3.50)
15.07(Double-side transparent tape)
20.07(Tape liner)
Kyocera ELCD 00
6298 006 883+
thickness 0.2±0.03
Detail E
Scales 1:4
Double-side tape 75x4mm
(77)
Detail D
Scales 1:2
Stiffener thickness 0.3 ±0.05
153.45
30.07
17.5±0.1
119.216±0.2
77.88
9.48
Active Area Center
thickness 0.14±0.03
16.5±0.15
Universal Display LTD
DESCRIPTION
INITIAL RELEASE
LED FPC outline & pin assignment modify
Module thickness revise
DESIGN
DATE
ALEX 2012/05/11
ALEX 2012/07/02
ALEX 2012/08/03
MATERIAL HEAT & SURFACE TREATMENT
APPROVE ALEX TSAO
CHECK ALEX TSAO
DESIGN ALEX TSAO
SCALE 1:1
UNIT mm
PROJECTION METHOD
ORIGINAL NAME
DWG. NAME ED060XG1
DWG. NO.
REV. 0.3
SHEET 2/2
No. Pinassignment
1 Anode
2 Anode
3 Dummy
4 Dummy
5 Cathode
6 Cathode

5.Input/Output Interface

5-1) Connector type: FH34S-34S-0.5SH(50)-Hirose

Pin Assignment

Pin #	Signal	Description	Remark
1	VNEG	Negative power supply source driver	
2	VEE	Negative power supply gate driver	
3	VSS	Ground	
4	NC	NC	
5	NC	NC	
6	VDD	Digital power supply drivers (3.3V)	
7	VSS	Ground	
8	XCL	Clock source driver	
9	VSS	Ground	
10	XLE	Latch enable source driver	
11	XOE	Output enable source driver	
12	XSTL	Start pulse source driver	
13	D0	Data signal source driver	
14	D1	Data signal source driver	
15	D2	Data signal source driver	
16	D3	Data signal source driver	
17	D4	Data signal source driver	
18	D5	Data signal source driver	
19	D6	Data signal source driver	
20	D7	Data signal source driver	
21	VCOM	Common connection	
22	NC	NC	
23	NC	NC	
24	NC	NC	
25	NC	NC	
26	VSS	Ground	
27	MODE 1	Output mode selection gate driver	
28	CKV	Clock gate driver	
29	SPV	Start pulse gate driver	
30	NC	NC	
31	BORDER	Border connection	
32	VSS	Ground	
33	VPOS	Positive power supply source driver	
34	VGG	Positive power supply gate driver	

5-2) Pin assignment of LED circuit

No.	Pin assignment
1	Anode
2	Anode
3	Dummy
4	Dummy
5	Cathode
6	Cathode

6.Electrical Characteristics

6-1)Absolute Maximum Ratings:

Parameter	Symbol	Rating	Unit	Remark
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	VGG	-0.3 to +45	V	--
Supply Voltage	VEE	-25.0 to +0.3	V	--
Supply Range	VGG-VEE	-0.3 to +45	V	--
Operating Temp. Range	TOTR	0 to +50	℃	--
Storage Temperature	TSTG	-25 to +70	℃	--

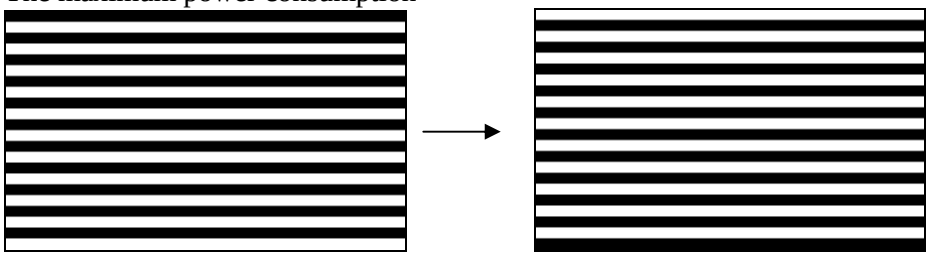
6-2) Panel DC characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Signal ground	V_{SS}		-	0	-	V
Logic Voltage supply	V_{DD}		3.0	3.3	3.6	V
	I_{VDD}	V_{DD}=3.3V	-	1.0	2.5	mA
Gate Negative supply	V_{EE}		-21	-20	-19	V
	I_{EE}	V_{EE} =-20V	-	0.7	5.3	mA
Gate Positive supply	V_{GG}		21	22	23	V
	I_{GG}	V_{GG} = 22V	-	0.6	0.7	mA
Source Negative supply	V_{NEG}		-15.4	-15	-14.6	V
	I_{NEG}	V_{NEG} = -15V	-	5.7	52.3	mA
Source Positive supply	V_{POS}		14.6	15	15.4	V
	I_{POS}	V_{POS} = 15V	-	5.4	57.3	mA
Border supply	V_{Border}	V_{POS} = 15V	14.6	15	15.4	V
		V_{NEG} = -15V	-15.4	-15	-14.6	V
Asymmetry source	V_{Asym}	V_{POS}+V_{NEG}	-800	0	800	mV
Common voltage	V_{COM}		-4.0	Adjusted	-0.3	V
	I_{COM}		-	0.2	-	mA
Panel Power	P		-	197	1770	mW
Standby power panel	P_{STBY}		-	-	0.4	mW
Operating temperature			0	-	50	℃
Storage temperature			-25	-	70	℃

- The maximum power consumption is measured using 85Hz waveform with following pattern transition: from pattern of repeated 1 consecutive black scan lines followed by 1 consecutive white scan line to that of repeated 1 consecutive white scan lines followed by 1 consecutive black scan lines. (Note 6-1)
- The Typical power consumption is measured using 85Hz waveform with following pattern transition: from horizontal 4 gray scale pattern to vertical 4 gray scale pattern. (Note 6-2)
- The standby power is the consumed power when the panel controller is in standby mode.
- Vcom is recommended to be set in the range of assigned value ± 0.1V.
- The maximum I_{COM} inrush current is about 600 mA

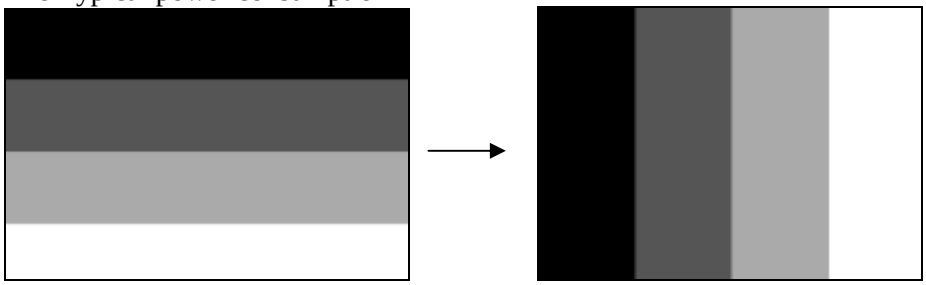
Note 6-1

The maximum power consumption



Note6-2

The Typical power consumption

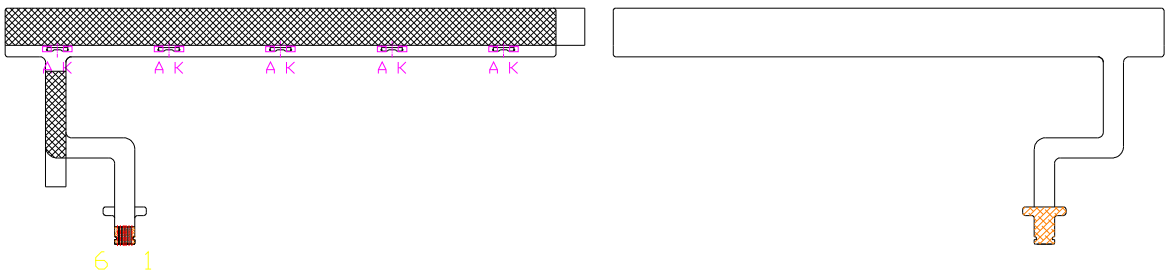


6-3) Recommended driving condition for Front light

GND = 0 V， Ta = 25℃

Parameter	Symbol	Min	TYP	MAX	Unit	Remark
Supply voltage of LED Front light	V_{LED}	-	-	16.5	V	Serial 5 pcs
Supply current of LED Front light	I_{LED}	-	-	20	mA	
Front light Power Consumption	P_{LED}	-	-	330	mW	Note 6-1

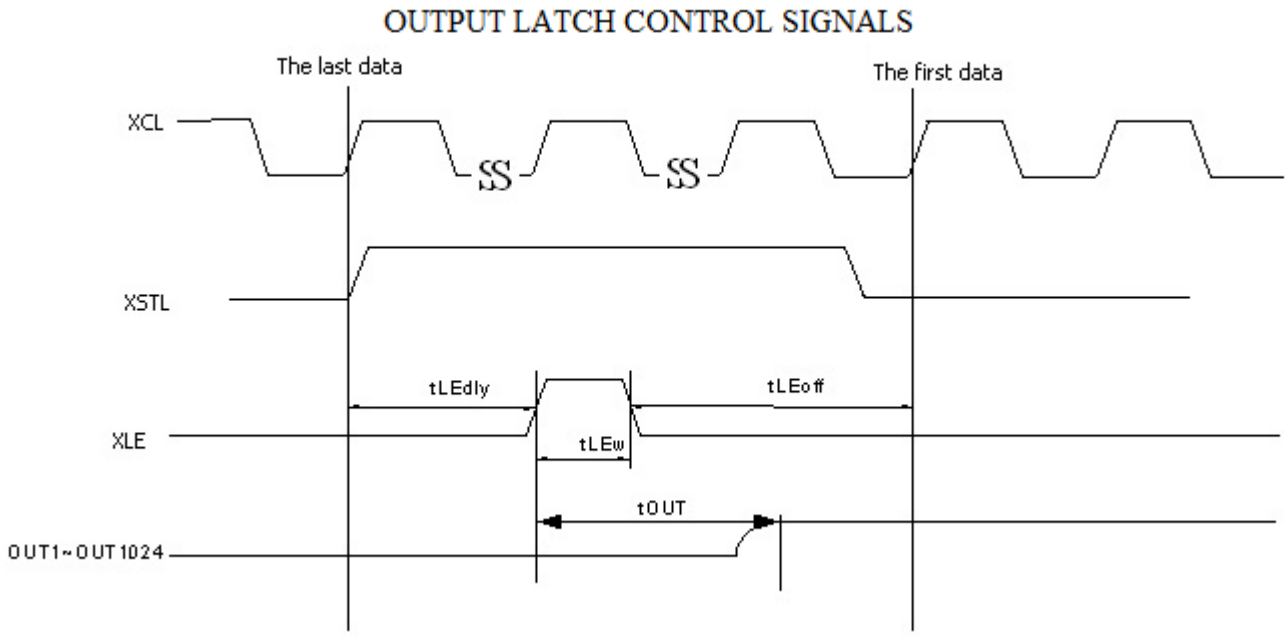
Note 6-1 : I_{LED}=20 mA with 1-serial LED circuit(5 LEDs)



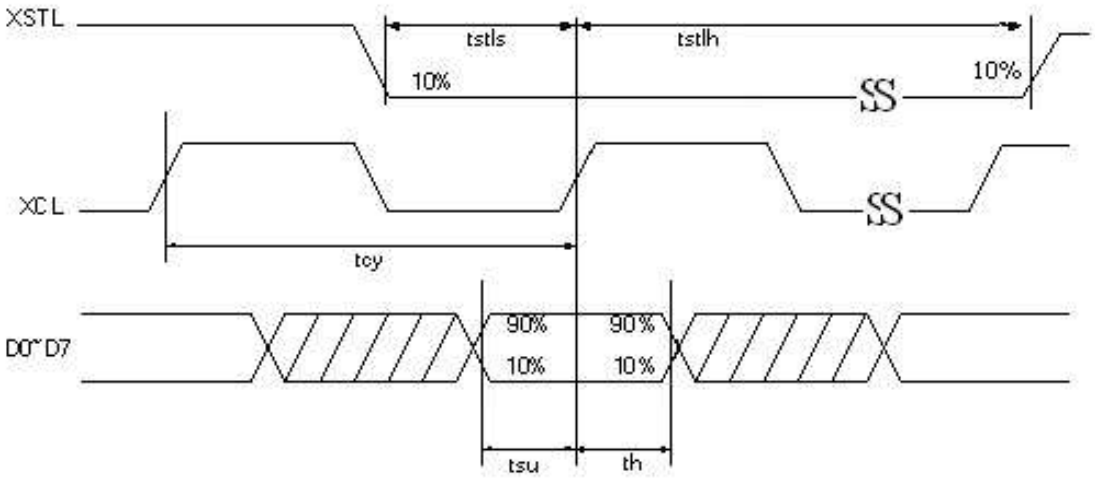
6-4)Panel AC characteristics

VDD=3.0V to 3.6V, unless otherwise specified.

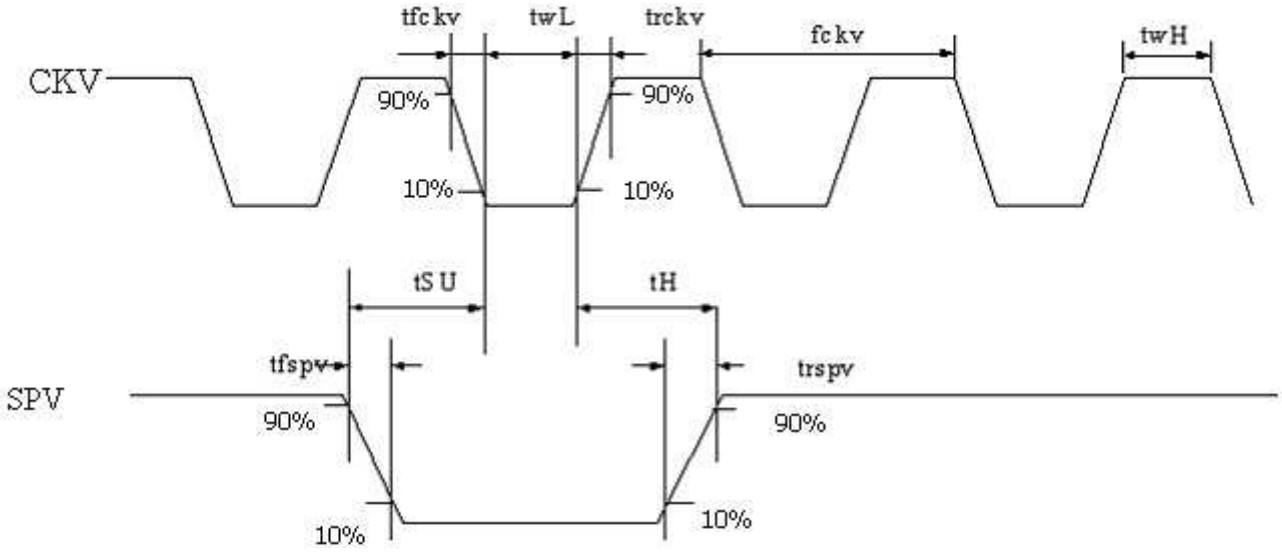
Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	fckv	-	-	200	kHz
Minimum “L” clock pulse width	twL	0.5	-	-	us
Minimum “H” clock pulse width	twH	0.5	-	-	us
Clock rise time	trckv	-	-	100	ns
Clock fall time	tfckv	-	-	100	ns
SPV setup time	tSU	100	-	twH-100	ns
SPV hold time	tH	100	-	twH-100	ns
Pulse rise time	trspv	-	-	100	ns
Pulse fall time	tfspv	-	-	100	ns
Clock XCL cycle time	tcy	25	-	-	ns
D0 .. D7 setup time	tsu	12	-	-	ns
D0 .. D7 hold time	th	12	-	-	ns
XSTL setup time	tstls	12	-	-	ns
XSTL hold time	tstlh	12	-	-	ns
XLE on delay time	tLEdly	40	-	-	ns
XLE high-level pulse width (When VCC=3.0V to 3.6V)	tLEw	150	-	-	ns
XLE off delay time	tLEoff	200	-	-	ns
Output setting time to +/- 30mV(C_{load}=200pF)	tout	-	-	12	us



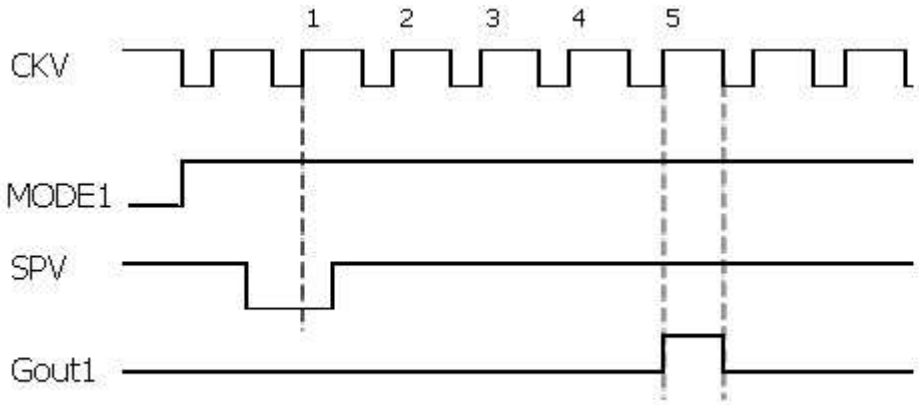
CLOCK & DATA TIMING



CKV & SPV TIMING



GATE OUTPUT TIMING



Note：First gate line on timing

After 5CKV，gate line is on .

7-4) Controller Timing for WJ-4BIT Waveform

This timing mode is depicted on Figure 1 and Figure 2 and it refers to timing of Source Driver Output Enable (SDOE) and Gate Driver Clock (GDCK). Note, that in this mode LGON follows GDCK timing.

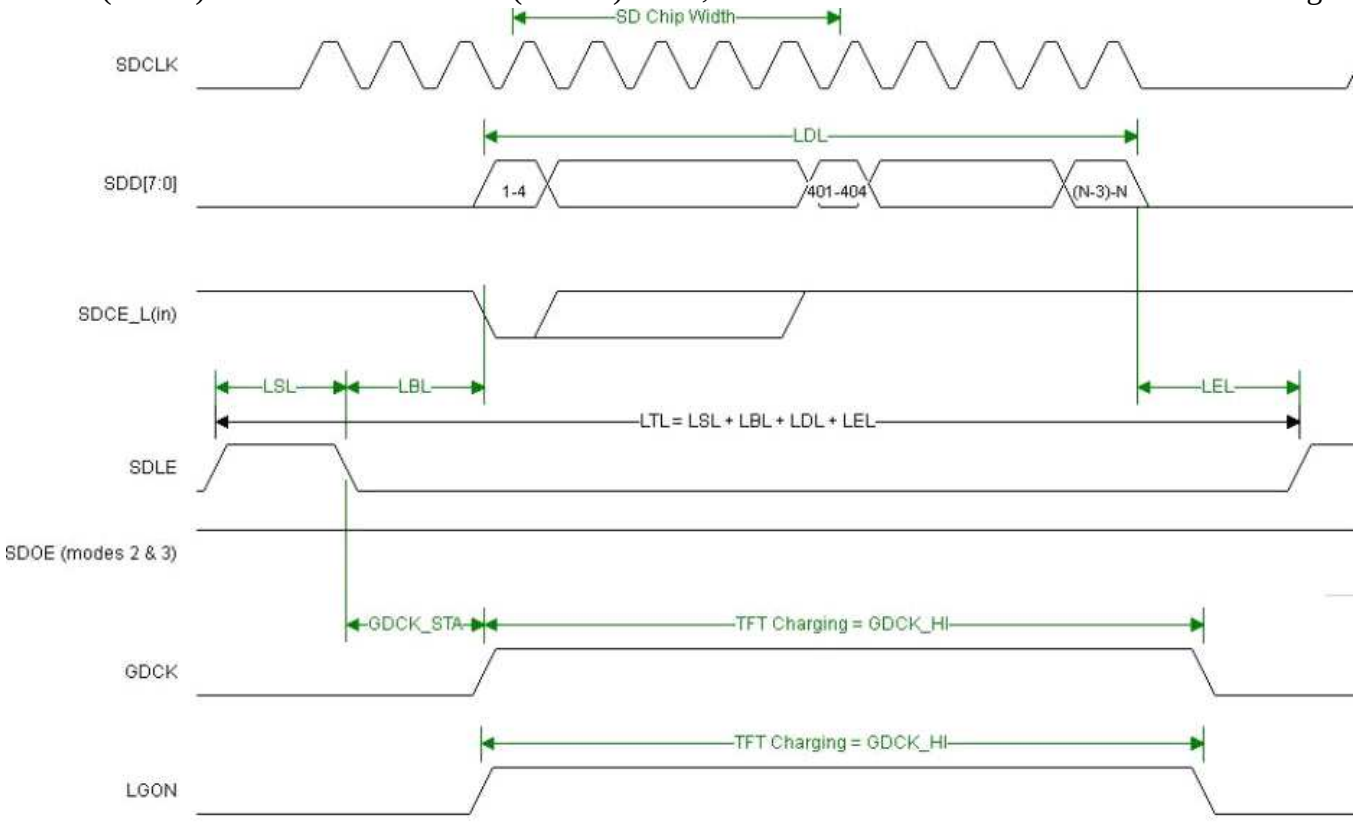


Figure 1 Line Timing in Mode 3

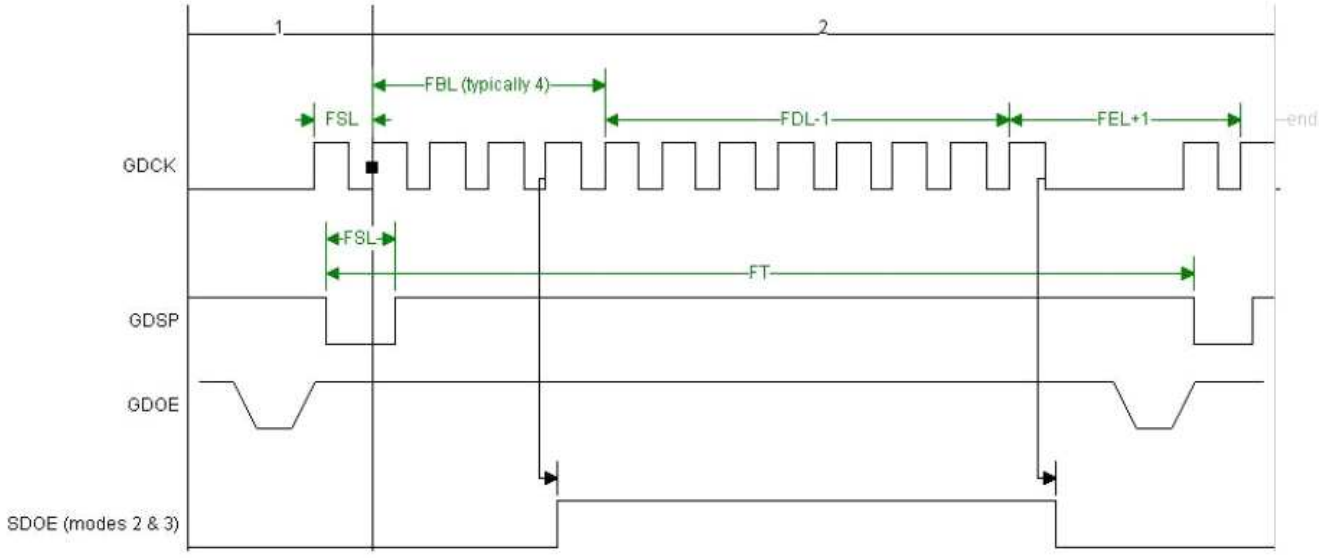


Figure 2 Frame Timing in Mode 3

Table Timing Parameters Table

Mode	3	**Resolution** 1024x758				
SDCK [MHz]	20					
Pixels Per SDCK	4					
Line	**LSL**	**LBL**	**LDL**	**LEL**	**GDCK_STA**	**LGONL**
Parameters[SDCK]	6	6	256	38	4	262
Line	-	-	-	-	-	-
Parameters[us]	0.3	0.3	12.8	1.9	0.2	13.10
Frame	**FSL**	**FBL**	**FDL**	**FEL**	-	**FR [Hz]**
Parameters [lines]	2	4	758	5	-	84.99
Frame					-	-
Parameters [us]	30.60	61.20	11597.4	76.50	-	-

Note 1: For parameters definition, see Section 6. Active Matrix Electronic Paper Display Timings

Note 2: For Isis Controller GDCK_STA and LGONL are not settable parameters; GDCK_STA = LBL, LGONL = LDL+0.5

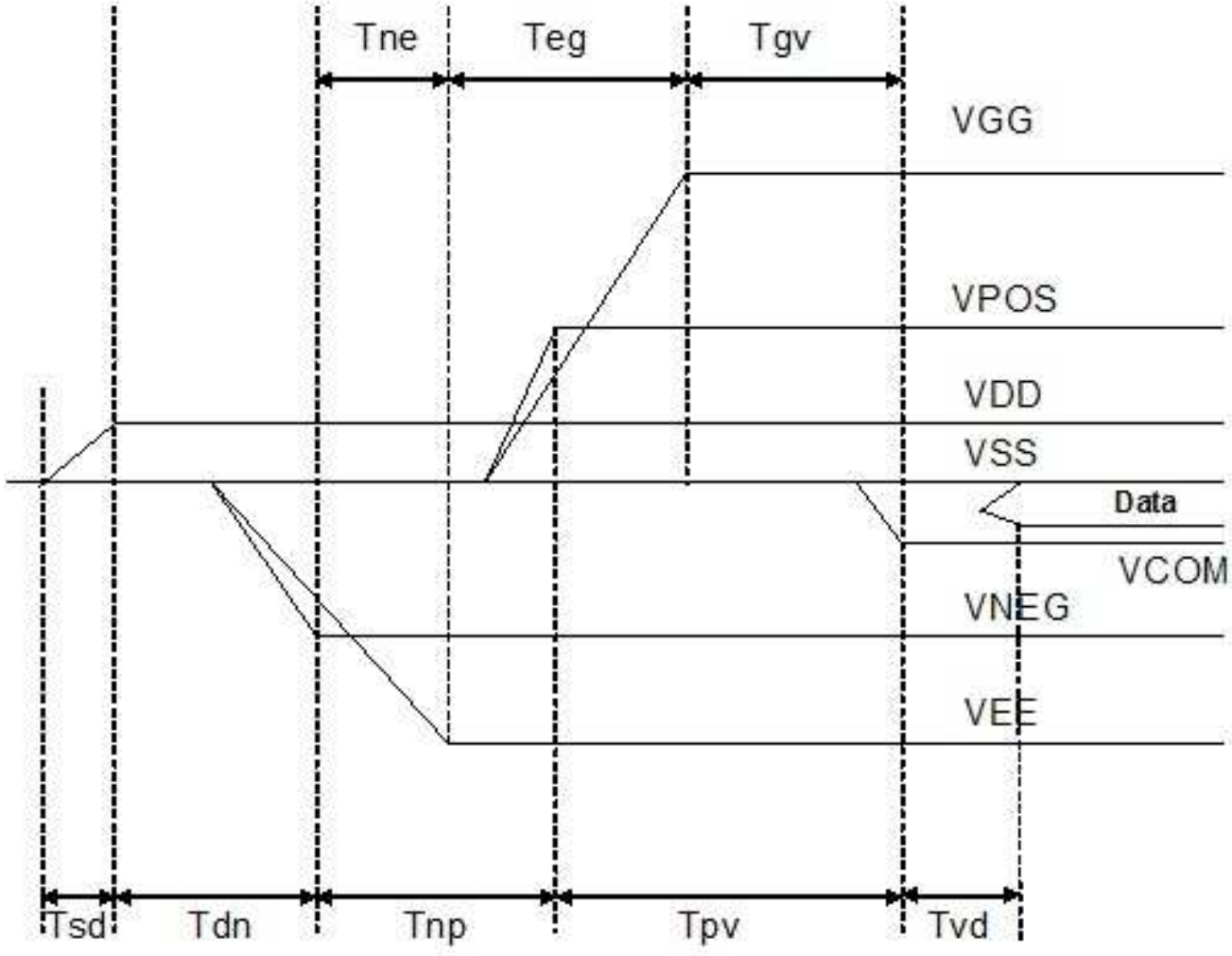
Note 3: For Freescale SoC GDOE Low pulse represent FSL and GDSP pulses with the first period of FBL

8. Power Sequence

Power Rails must be sequenced in the following order：
1. VSS → VDD → VNEG → VPOS (Source driver) → VCOM

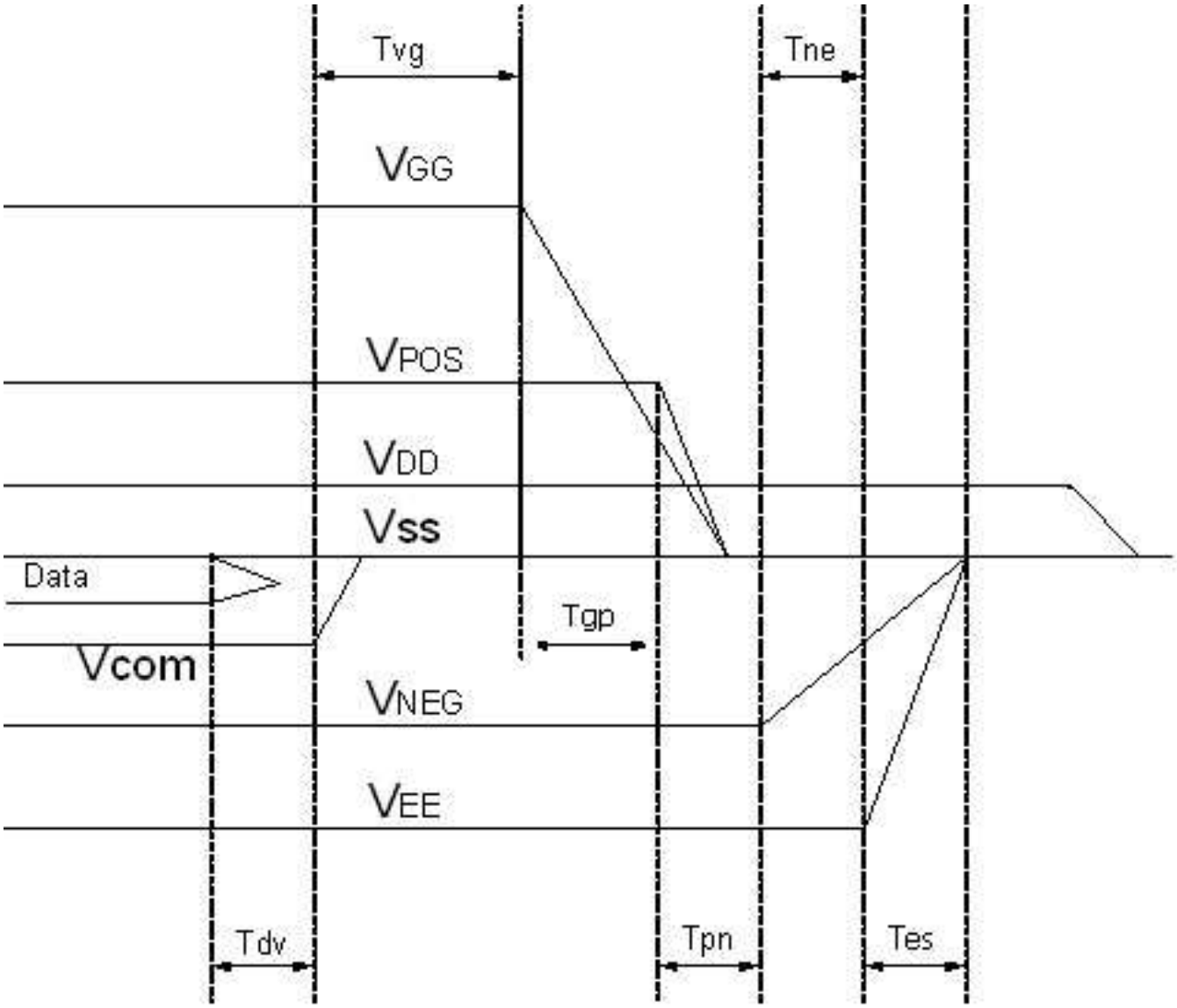
2. VSS → VDD → VEE → VGG (Gate driver)

POWER ON



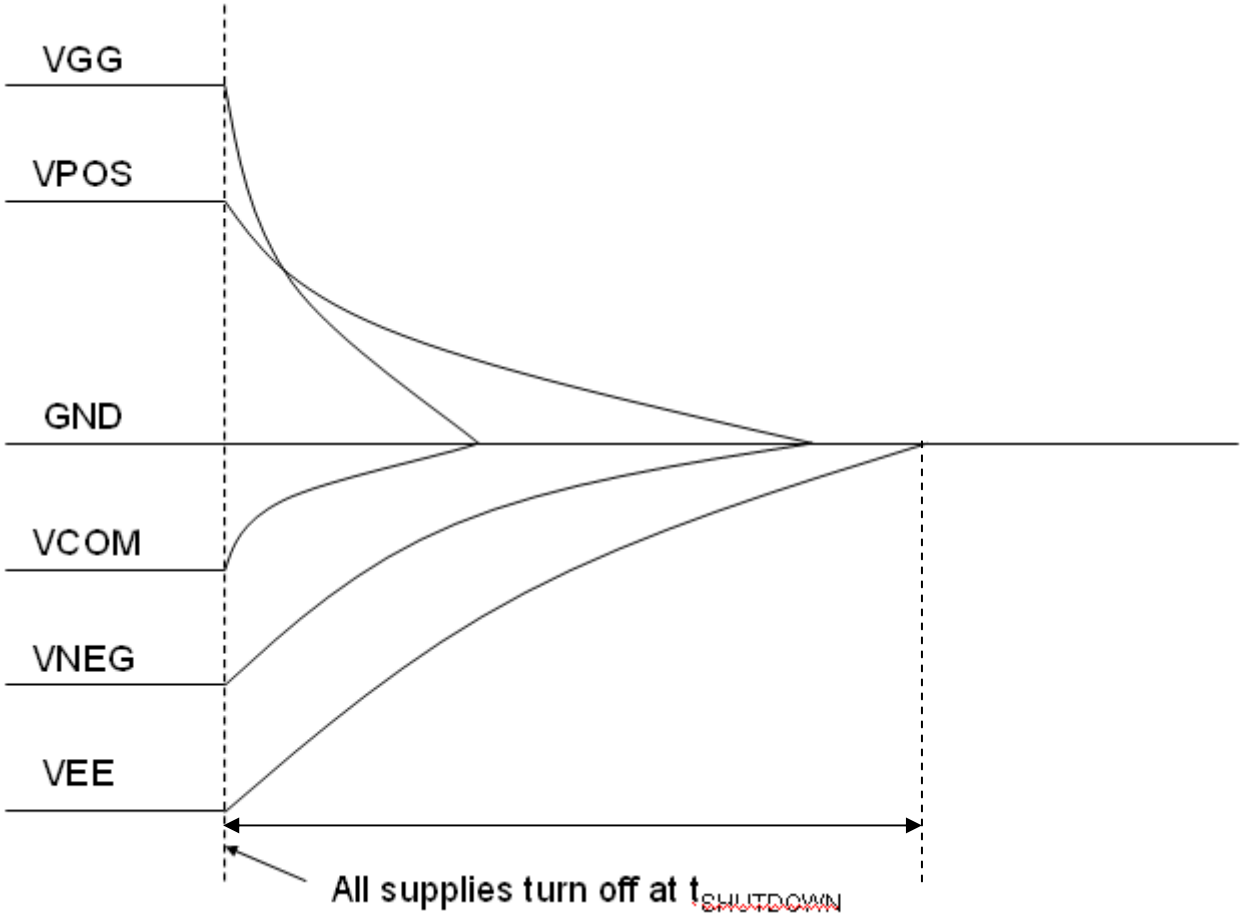
	Min	Max
Tsd	30us	-
Tdn	100us	-
Tnp	1000us	-
Tpv	100us	-
Tvd	100us	-
Tne	0us	-
Teg	1000us	-
Tgv	100us	-

POWER DOWN



	Min	Max
Tdv	100 μ s	-
Tvg	0 μ s	-
Tgp	0 μ s	-
Tpn	0 μ s	-
Tne	0 μ s	-
Tes	0.5s	-

9. Discharge time Sequence



Note9-1：Supply voltages decay through pulldown resistors.
Note9-2：VEE must remain negative of Vcom during decay period.

8-1) Refresh Rate

The module ED060XG1 is applied at a maximum screen refresh rate of 85Hz.

	Min	Max
Refresh Rate	-	85Hz

9. Optical characteristics

9-1) Specifications

Measurements are made by PR655 with MS-75 or equivalent SepctaScan Colorimeter with that the illumination is at an angle 45° from the perpendicular at the center of sample surface, and the detector is perpendicular unless otherwise specified

T = 25°C

Symbol	Parameter	Conditions		Min	Typ.	Max	Unit	Note
R	Reflectance	White	Front Light off	(32)	(40)	-	%	Note 9-1
Gn	N_{th} Grey Level	-		-	DS+(WS-DS)×n /(m-1)	-	L*	-
CR	Contrast Ratio	-		(8)	(12)	-	-	Note 9-2
Brightness		θ=0°	Front Light On	20	100	-	cd/㎡	Note 9-4
White Chromaticity	x	θ=0°		-	0.31	-	-	-
	y			-	0.33	-	-	
Luminance Uniformity		θ=0°		(75)	(80)	-	%	Note 9-5
CR	Contrast Ratio	θ=0°		(7)	(10)	-	-	Note 9-6

*( ):reference only

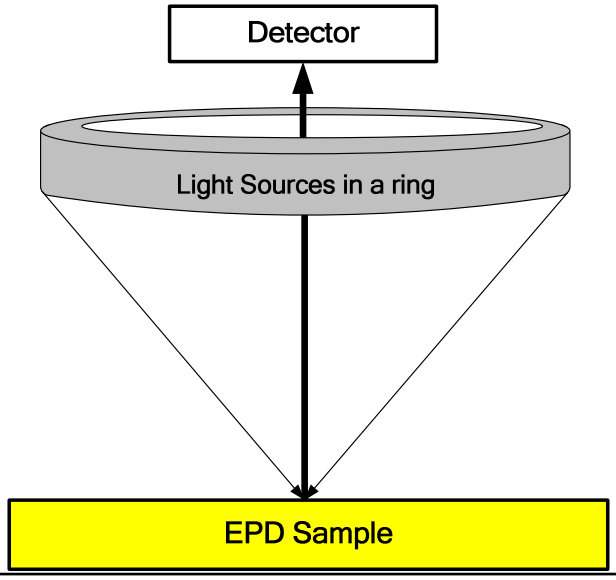
WS: White state , DS: Dark state, Gray state from Dark to White :DS、G1、G2…、Gn…、Gm-2、WS

m:4、8、16 when 2、3、4 bits mode

9-2) 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



9-3) Reflection Ratio

The reflection ratio is expressed as:

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

L_{center} is the luminance measured at center in a white area (R=G=B=1). $L_{\text{white board}}$ 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.

9-4) Optical characteristics are determined after the front light has been 'ON' and stable for approximately 60 minutes in a dark environment at 25℃. The values specified are at an approximate distance 50cm from the EPD display surface at a viewing angle of Φ and θ equal to 0°.

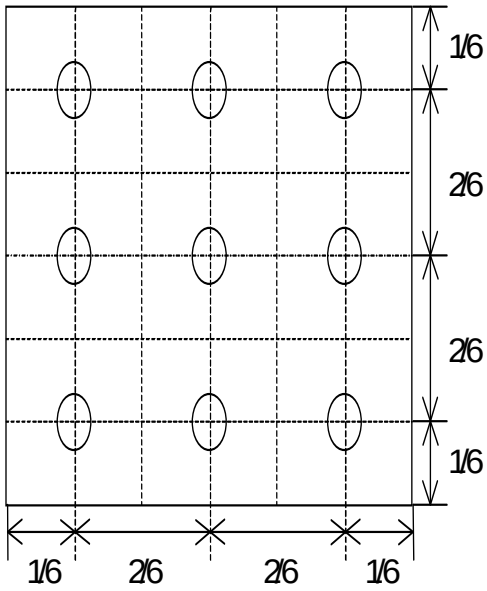
9-5) The uniformity is defined as

$$U = \frac{\text{The Minimum Brightness of the 9 testing Points}}{\text{The Maximum Brightness of the 9 testing Points}}$$

Ambient illumination : < 1 Lux

Measuring direction : Perpendicular to the surface of module

The test pattern is white



Note 9-6:

$$CR = \frac{\text{Luminance when Testing point is White}}{\text{Luminance when Testing point is Black}}$$

10.HANDLING, SAFETY AND ENVIROMENTAL 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.
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.
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	

Data sheet status
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.

11. Reliability test

	TEST	CONDITION	METHOD	REMARK
1	High-Temperature Operation	T = +50°C, RH = 30% for 240 hrs	IEC 60 068-2-2Bp	
2	Low-Temperature Operation	T = 0°C for 240 hrs	IEC 60 068-2-2Ab	
3	High-Temperature Storage	T = +70°C, RH=23% for 240 hrs Test in white pattern	IEC 60 068-2-2Bp	
4	Low-Temperature Storage	T = -25°C for 240 hrs Test in white pattern	IEC 60 068-2-1Ab	
5	High-Temperature, High-Humidity Operation	T = +40°C, RH = 90% for 168 hrs	IEC 60 068-2-3CA	
6	High Temperature, High- Humidity Storage	T = +60℃, RH=80% for 240hrs Test in white pattern	IEC 60 068-2-3CA	
7	Temperature Cycle	-25℃→+70℃, 100 Cycles 30min 30min Test in white pattern	IEC 60 068-2-14	
8	Solar radiation test	765 W/m^2 for 168hrs,40℃ Test in white pattern	IEC60 068-2-5Sa	
9	Package Vibration	1.04G, Frequency: 10~500Hz Direction: X,Y,Z Duration: 1 hours in each direction	Full packed for shipment	
10	Package Drop Impact	Drop from height of 122 cm on concrete surface. Drop sequence: 1 corner, 3 edges, 6 faces One drop for each.	Full packed for shipment	
11	Electrostatic Effect (non-operating)	(Machine model)+/- 250V 0Ω, 200pF	IEC 62179, IEC 62180	
12	Altitude test Operation	700hPa (= 3000m),48Hr		
13	Altitude test Storage	260hPa (= 10000m),48Hr Test in white pattern		
14	Stylus Tapping	POLYACETAL Pen: Top R:0.8mm Load: 300gf Speed: 2 times/sec Total 13,500times,		Test with bezel and device to simulate full product test.

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. (including : line defect ,no image). All the cosmetic specification is judged before the reliability stress.

12.Bar Code definition

E7B	00	4	01	1	I	7	4	00361	A	T
1	2	3	4	2	5	6	2	7	2	8

1：EPD model code:

ED060XG1: E7B / E7G

2：Internal control codes: Do not care

3：FPL reversion code

V220:6 V220E:8

4：FPL batch code:

01~99	001~099	**G0~G9**	160~169	**Q0~Q9**	230~239	**X0~X9**	300~309
A0~A9	100~109	**H0~H9**	170~179	**R0~R9**	240~249	**Y0~Y9**	310~319
B0~B9	110~119	**J0~J9**	180~189	**S0~S9**	250~259	**Z0~Z9**	320~329
C0~C9	120~129	**K0~K9**	190~199	**T0~T9**	260~269		
D0~D9	130~139	**L0~L9**	200~209	**U0~U9**	270~279		
E0~E9	140~149	**M0~M9**	210~219	**V0~V9**	280~289		
F0~F9	150~159	**N0~N9**	220~229	**W0~W9**	290~299		

5：Year:

F: 2005 / G: 2006 / H: 2007 / I: 2008 /... / Z: 2024

6：Month:

1:Jan. 2:Feb. ... 9:Sep. A:Oct. B:Nov. C:Dec.

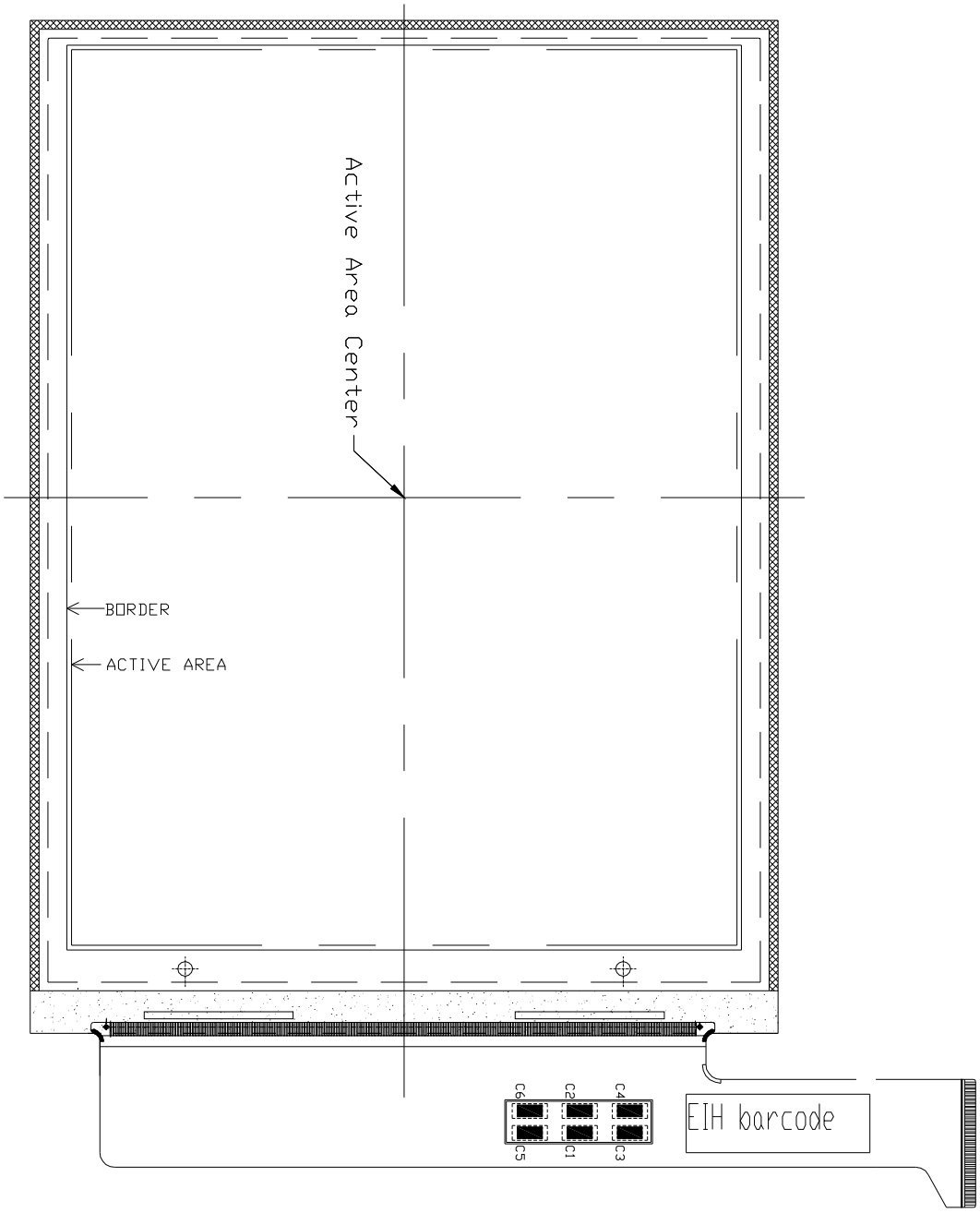
7：Serial number

00000-99999

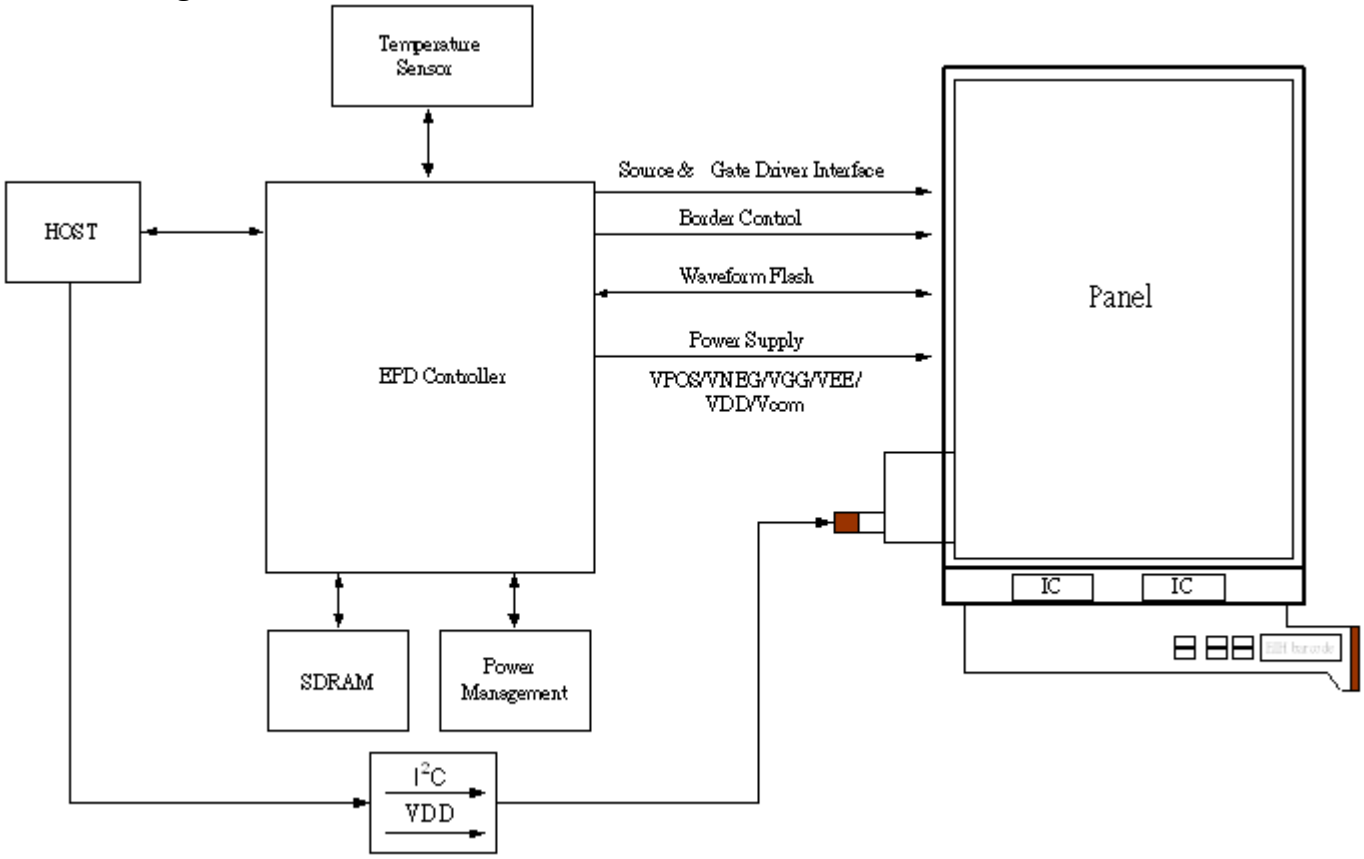
8：MFG code:

TOC FAB3 : T；TOC FAB2 : Y；TOC FAB1 : K；EIH : P；MOS : S；Microveiw : G；
TYT FAB5 : G；TYT FAB4 : L

13. Border definition

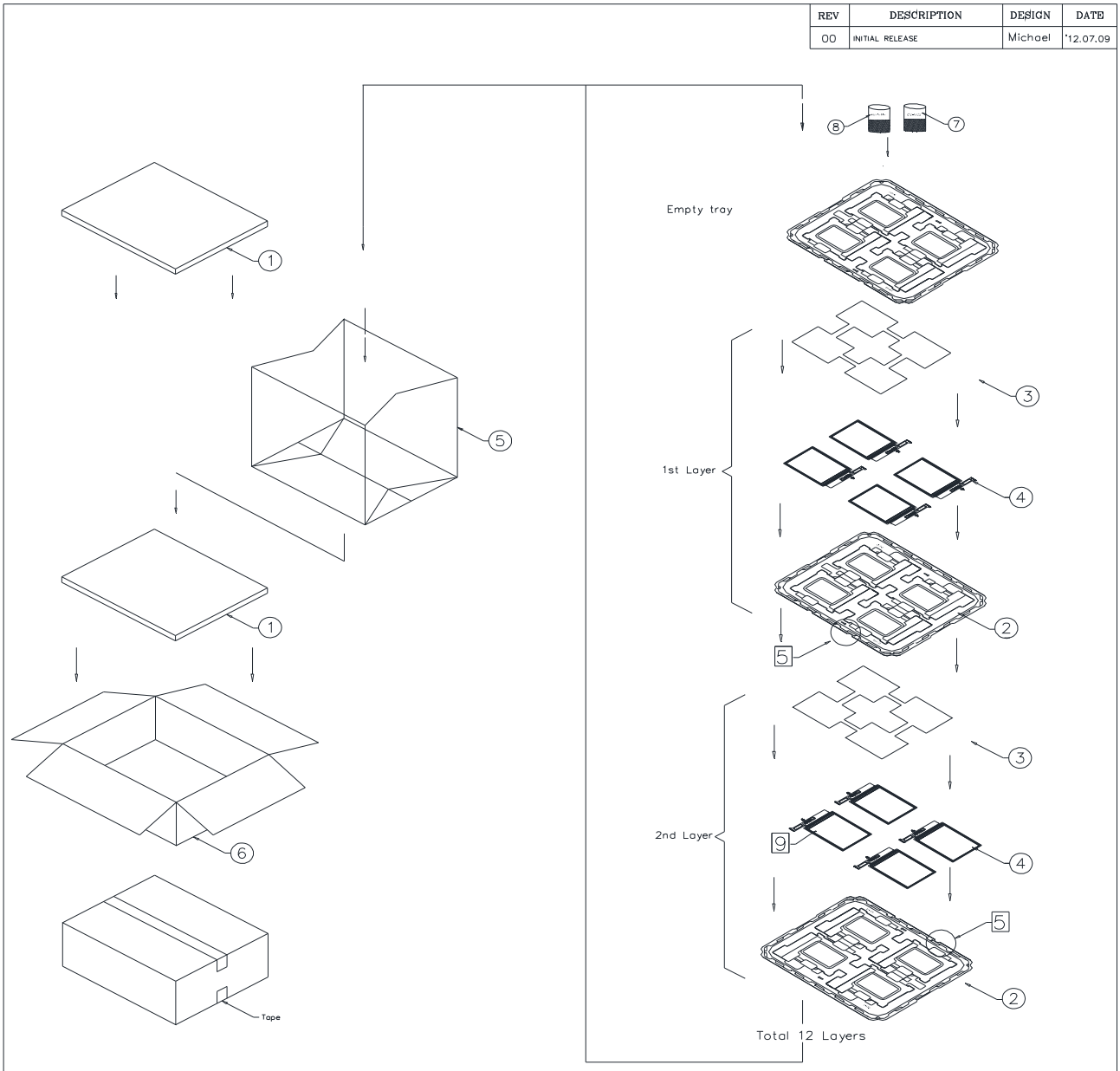


14.Block Diagram



15.Packing

REV	DESCRIPTION	DESIGN	DATE
00	INITIAL RELEASE	Michael	'12.07.09



NOTE:
1. One layer include: 1 piece of cushion sheet, 4 pcs module & 1 piece of tray.
2. Q'TY: 48 pcs panel/carton.
3. Dimension: 455*375*190mm
4. Weight: 5.7 KG
5. Make sure tray stacked with 180° rotation. We can check this by lateral side view.

ITEM	DESCRIPTION	QTY	REMARK
9	EASY TAPE	48	For Remove Protect Sheet
8	30g加厚複合紙活礦乾燥劑73*95mm	2	
7	防鏽劑(保護容積25L)	3	
6	CARTON INTERNAL	1	
5	摺口袋450*380*700mm	1	抗靜電
4	ED060XG1	48	
3	EPE CUSHION SHEET	12	抗靜電
2	TRAY	13	抗靜電
1	EPE FOAM	2	

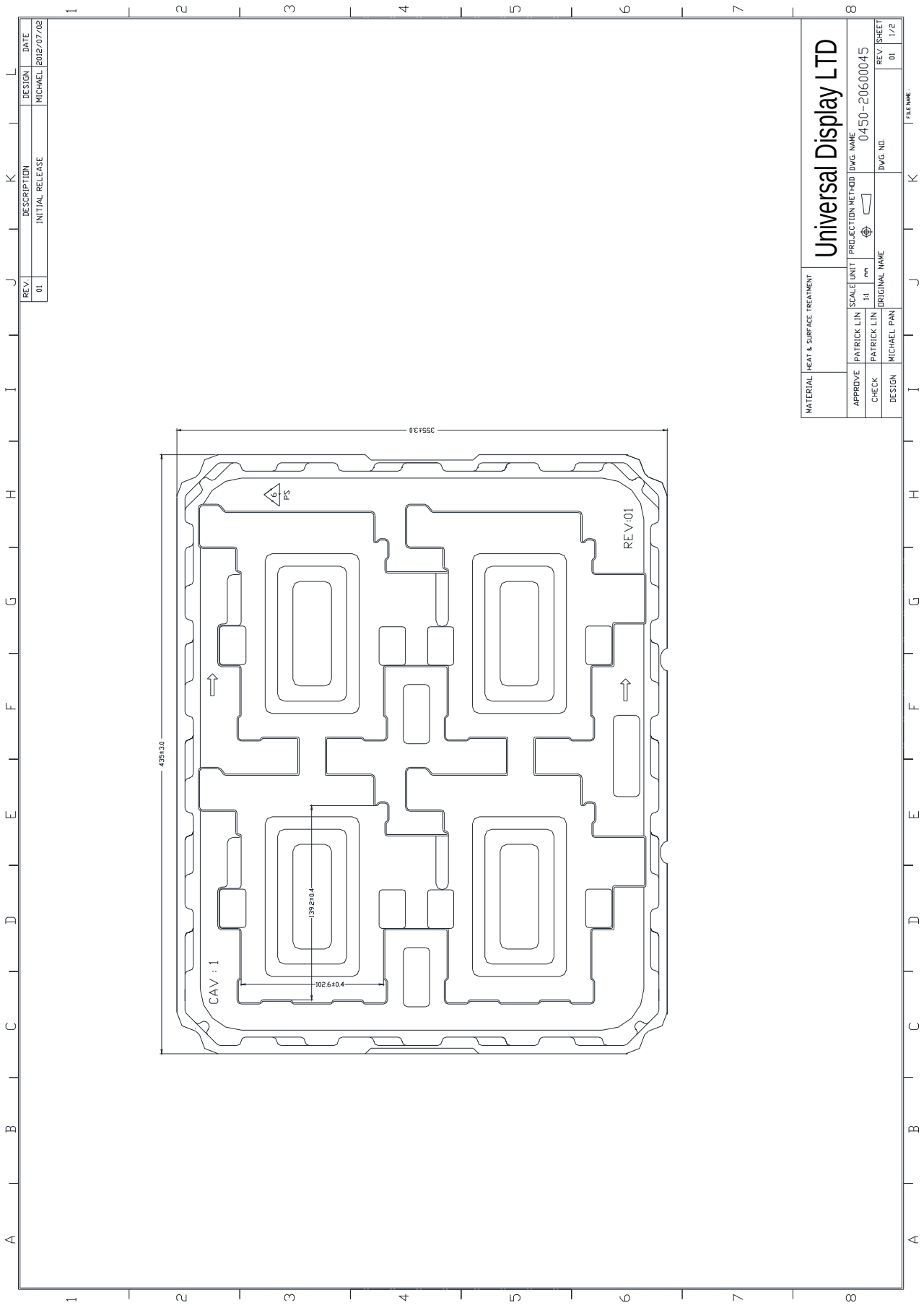
MTL.SPEC.	UNSPECIFIED TOL'S ±5.0mm ANGLE ROUGHNESS	REMARK

Universal Display LTD

APPROVE	Jimmy Chen	'12.07.09	SCALE 1:1	UNIT mm	SHEET 1 OF 1
CHECK	Jimmy Chen	'12.07.09			
DESIGN	Michael Pan	'12.07.09			

DWG.TITLE: ED060XG1 PACKING Dim

MTL.NO. | DWG.NO. | REV. 01 | A4 SIZE


REV:01
CAV : 1
139.2±0.4
102.6±0.4
435±3.0
355±3.0
Universal Display LTD
0450-20600045
DESCRIPTION
INITIAL RELEASE
MICHAEL
2012/07/02