

**Version: 1.0**

**TECHNICAL SPECIFICATION**

**MODEL NO: ED060XC5**

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

Approved By

魏漢寧

Confirmed By

傅淑貞

Prepared By

李穎銘

## Revision History

Rev.	Issued Date	Revised Contents
1.0	Oct.24,2011	New

# ***TECHNICAL SPECIFICATION***

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## 1. Application

The display is a TFT active matrix electrophoretic display, with associated interface and control logic, and a reference system design.

The 6" active area contains 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 used.

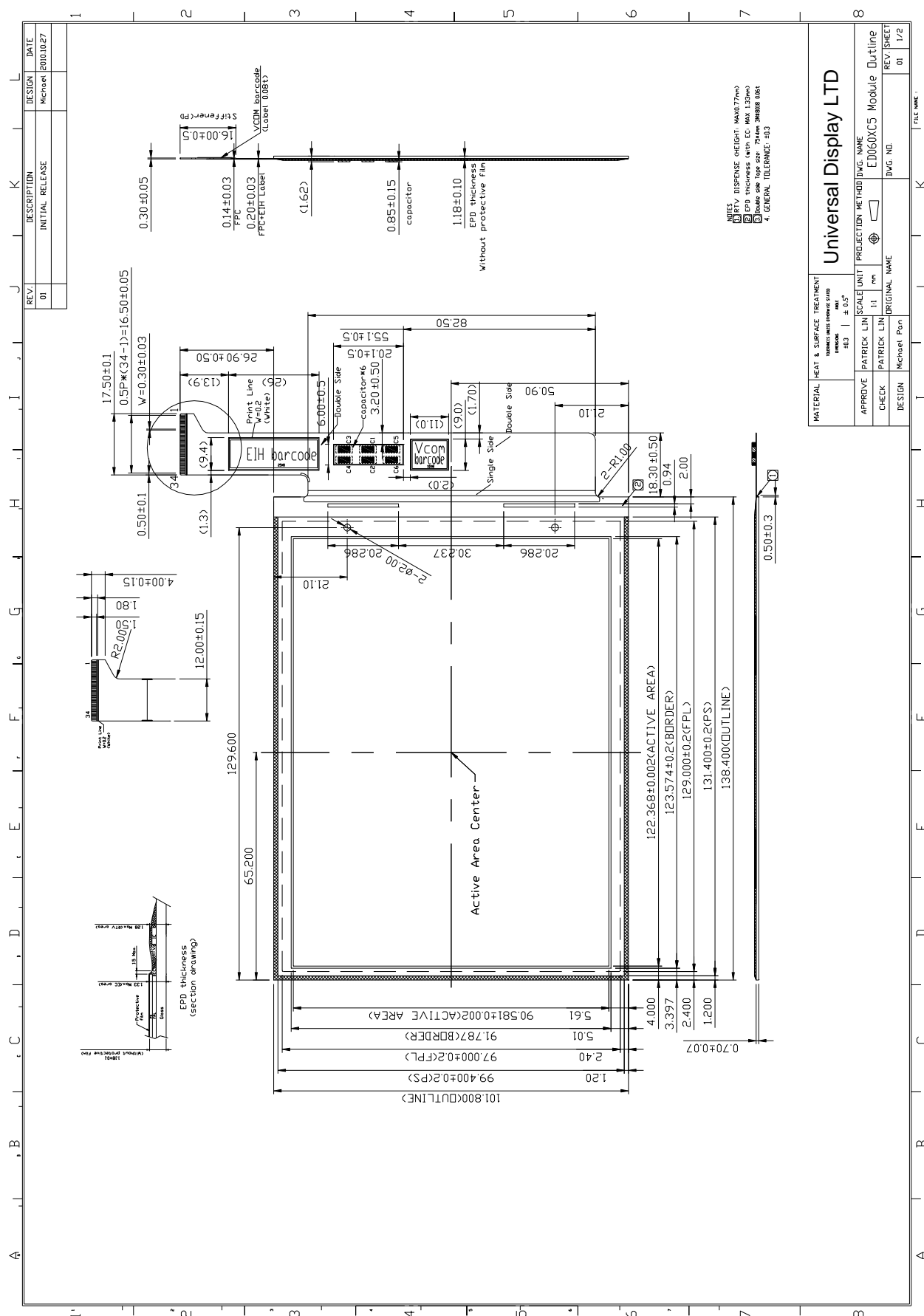
## 2. Features

- High contrast TFT electrophoretic
- 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

## 3. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	6.0 (3:4 diagonal)	Inch	
Display Resolution	758 (H)×1024(V)	Pixel	
Active Area	90.581 (H)×122.368 (V)	mm	
Pixel Pitch	0.1195 (H)×0.1195 (V)	mm	
Pixel Configuration	Square		
Outline Dimension	101.80(W)×138.40(H)×1.18(D)	mm	
Module Weight	34±3.4	g	
Number of Gray	16 Gray Level (monochrome)		
Display operating mode	Reflective mode		

#### 4. Mechanical Drawing of EPD Module



## 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	

## 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 <sub>POS</sub>	-0.3 to +18	V	--
Negative Supply Voltage	V <sub>NEG</sub>	+0.3 to -18	V	--
Max .Drive Voltage Range	V <sub>POS</sub> - V <sub>NEG</sub>	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	°C	--
Storage Temperature	TSTG	-25 to +70	°C	--

### 6-2) Panel interface description

This panel is driven by Boardsheet display controller ASIC.

## ED060XC5

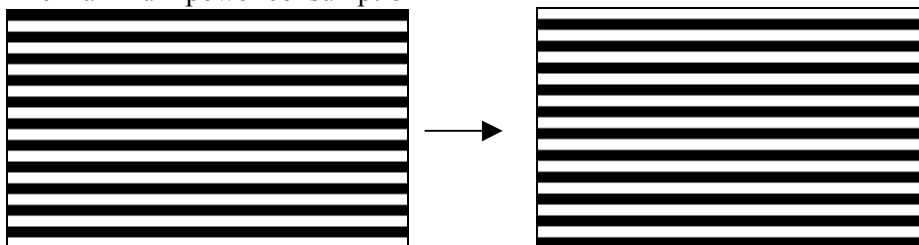
### 6-3) Panel DC characteristics

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	°C
Storage temperature			-25	-	70	°C

- 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.
- 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  $\pm 0.1V$ .
- The maximum  $I_{COM}$  inrush current is about 600 mA

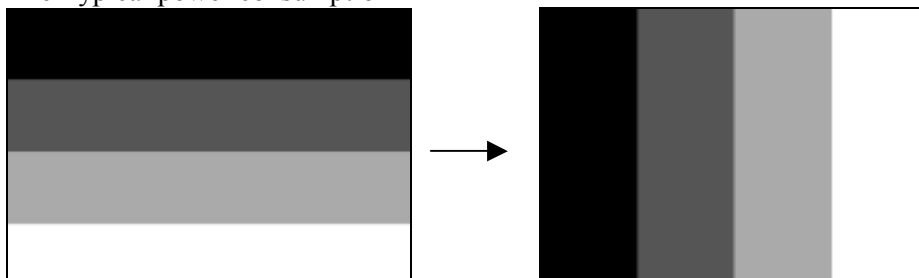
#### Note 6-1

The maximum power consumption



#### Note6-2

The Typical power consumption



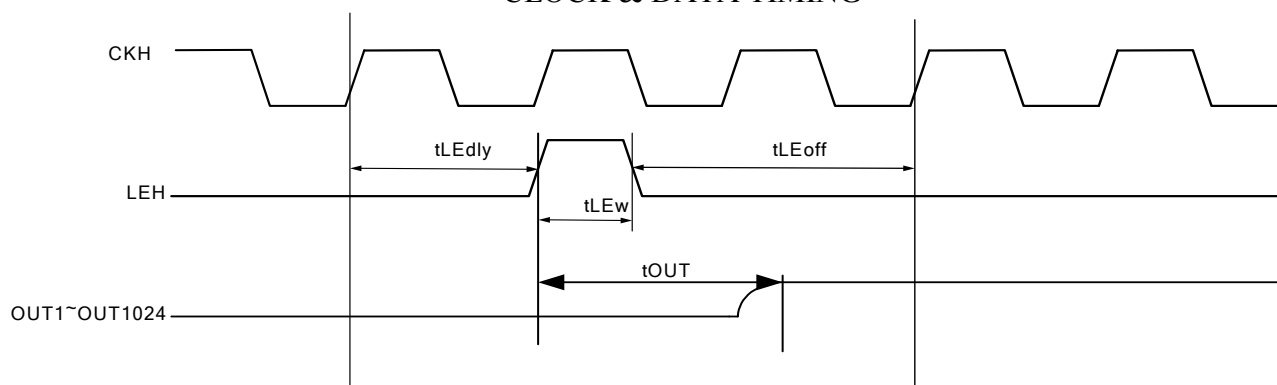
## ED060XC5

### 6-4 )Panel AC characteristics

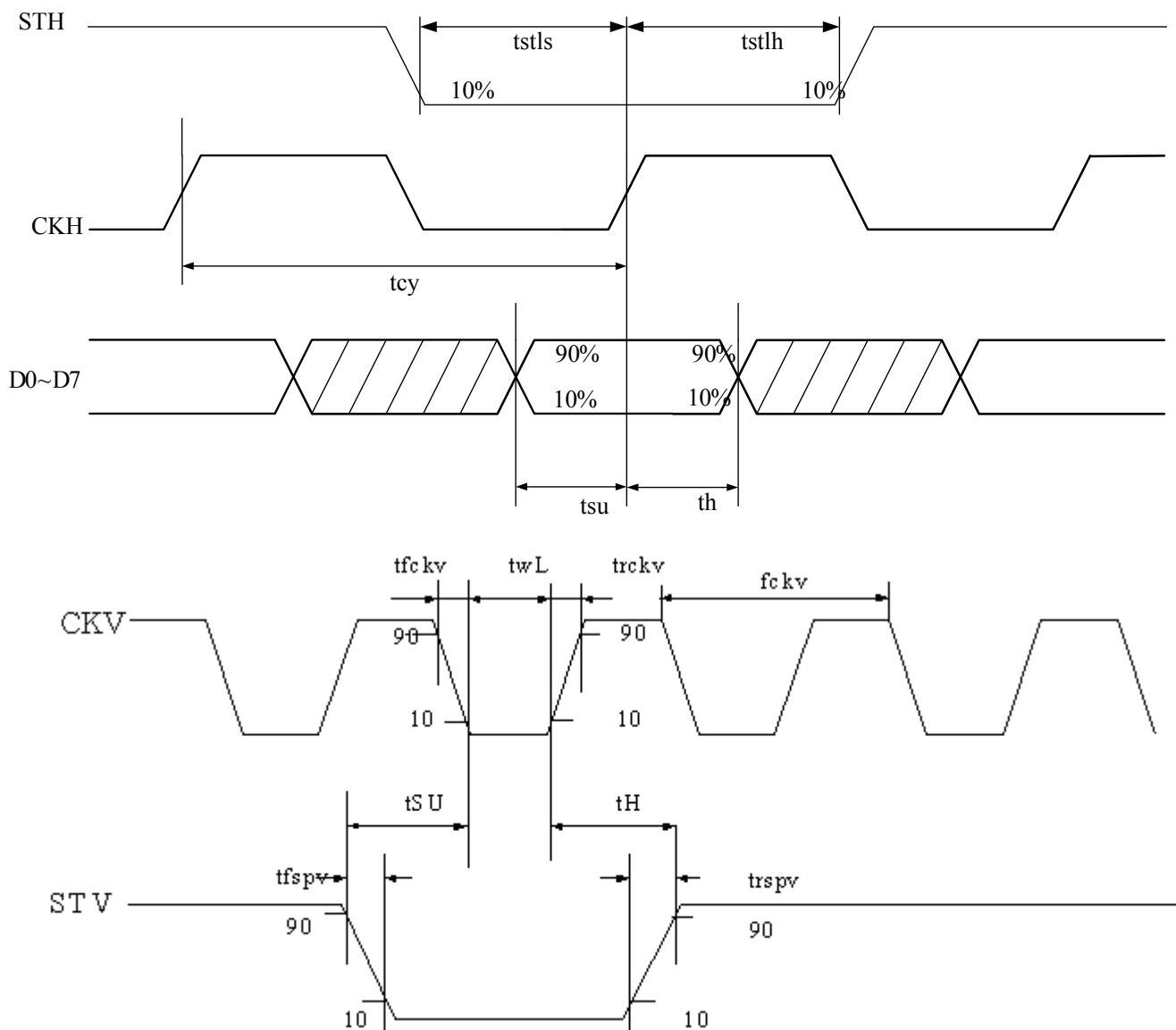
VDD=3.0V to 3.6V, unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	fckv	-	-	200	kHz
Minimum “L” clock pulse width	twL	0.5	-	-	us
Clock rise time	trckv	-	-	100	ns
Clock fall time	tfckv	-	-	100	ns
Data setup time	tSU	100	-	-	ns
Data hold time	tH	100	-	-	ns
Pulse rise time	trspv	-	-	100	ns
Pulse fall time	tfspv	-	-	100	ns
Clock CKH cycle time	tcy	25	-	DC	ns
D0 .. D7 setup time	tsu	12	-	-	ns
D0 .. D7 hold time	th	12	-	-	ns
STH setup time	tstls	12	-	-	ns
STH hold time	tstls	12	-	-	ns
LEH on delay time	tLEdly	40	-	-	ns
LEH high-level pulse width (When VCC=3.0V to 3.6V)	tLEw	150	-	-	ns
LEH off delay time	tLEoff	200	-	-	ns
Output setting time to +/- 30mV(C <sub>load</sub> =200pF)	tout	-	-	12	us

### CLOCK & DATA TIMING



### OUTPUT LATCH CONTROL SIGNALS



### 6-5) Power Consumption

Parameter	Symbol	Conditions	TYP	Max	Unit	Remark
Panel power consumption during update	-	-	197	1770	mW	
Power consumption in standby mode	-	-	-	0.4	mW	

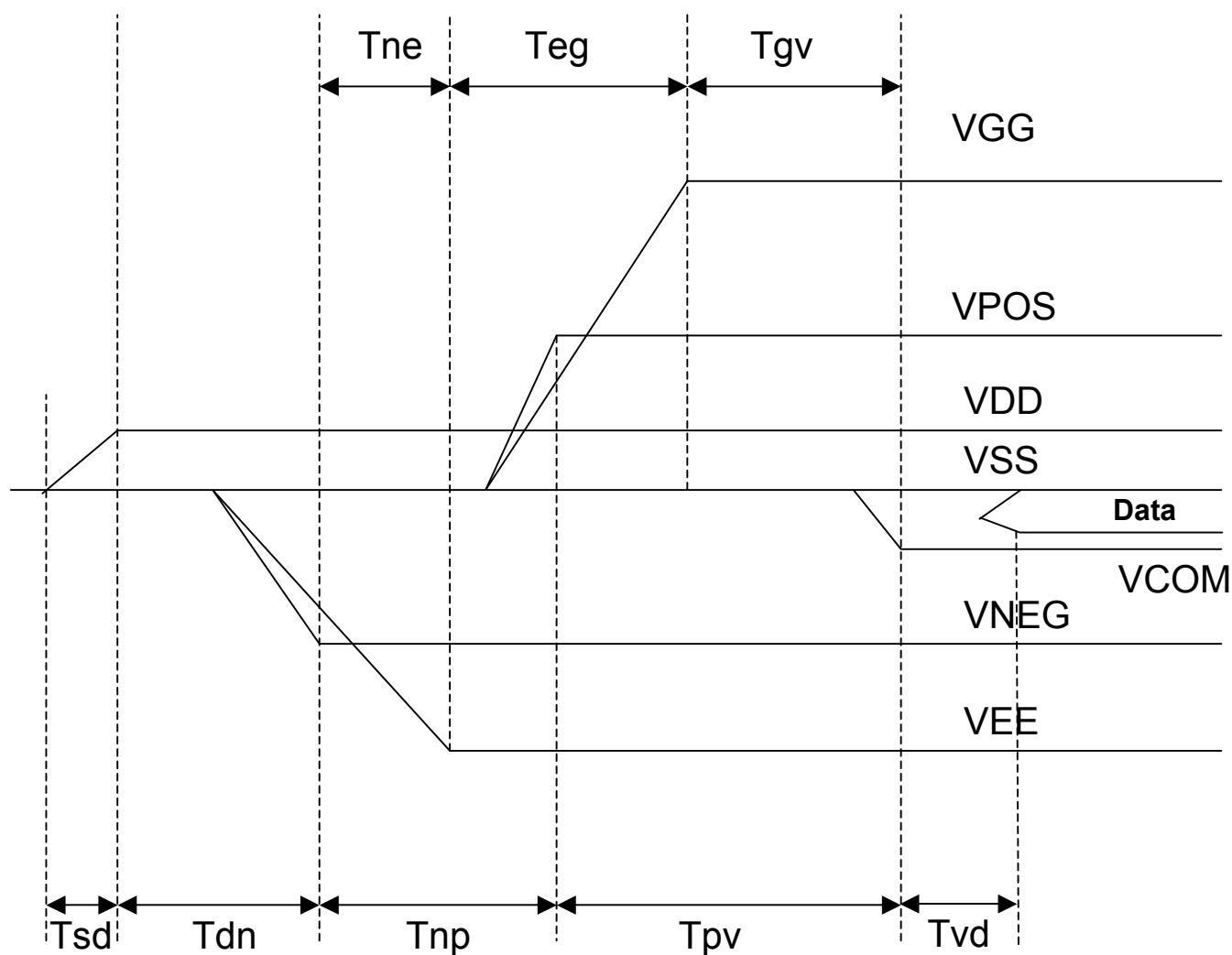
## 7. Power on Sequence

Power Rails must be sequenced in the following order :

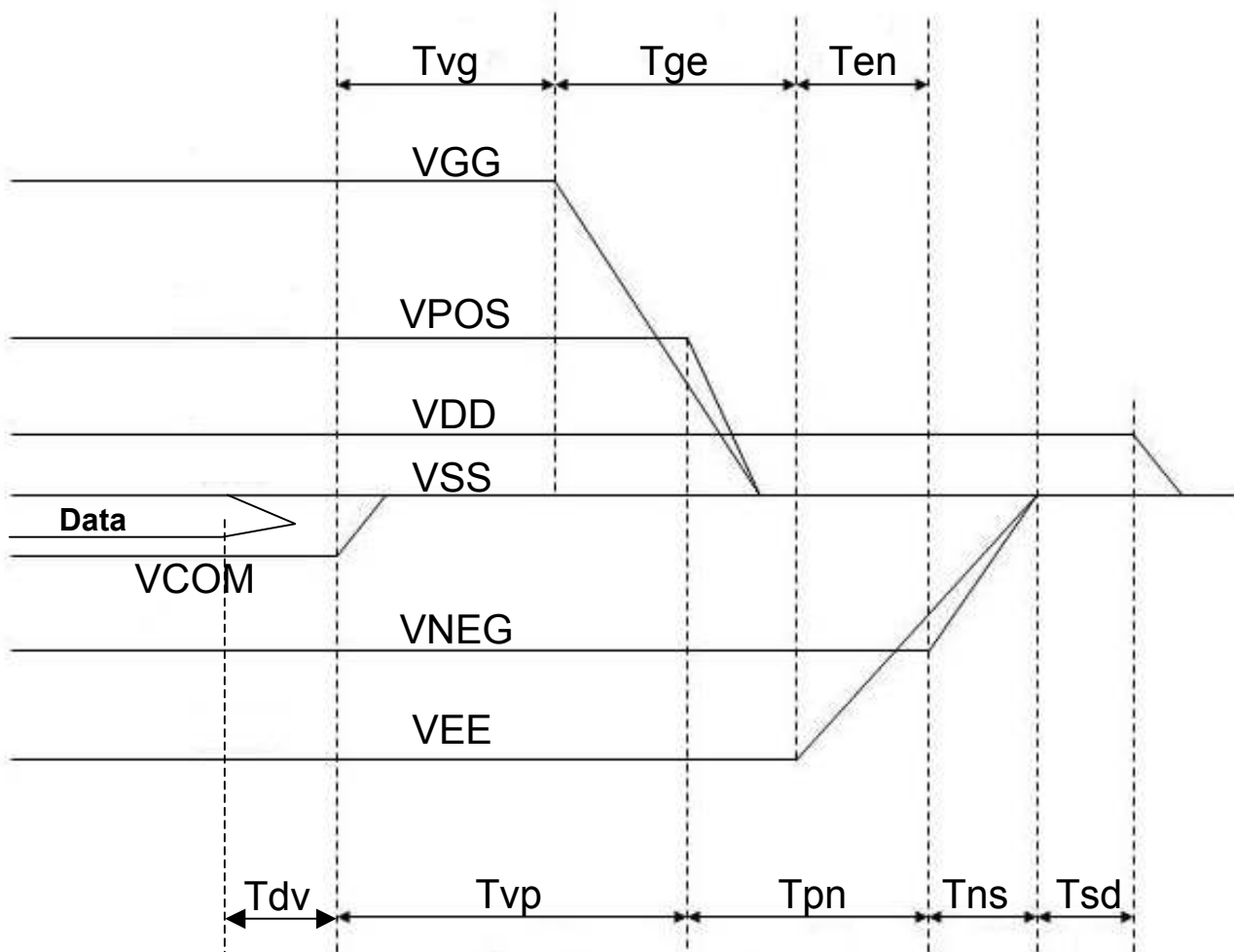
1. VSS → VDD → VNEG → VPOS (Source driver) → VCOM

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

### POWER ON

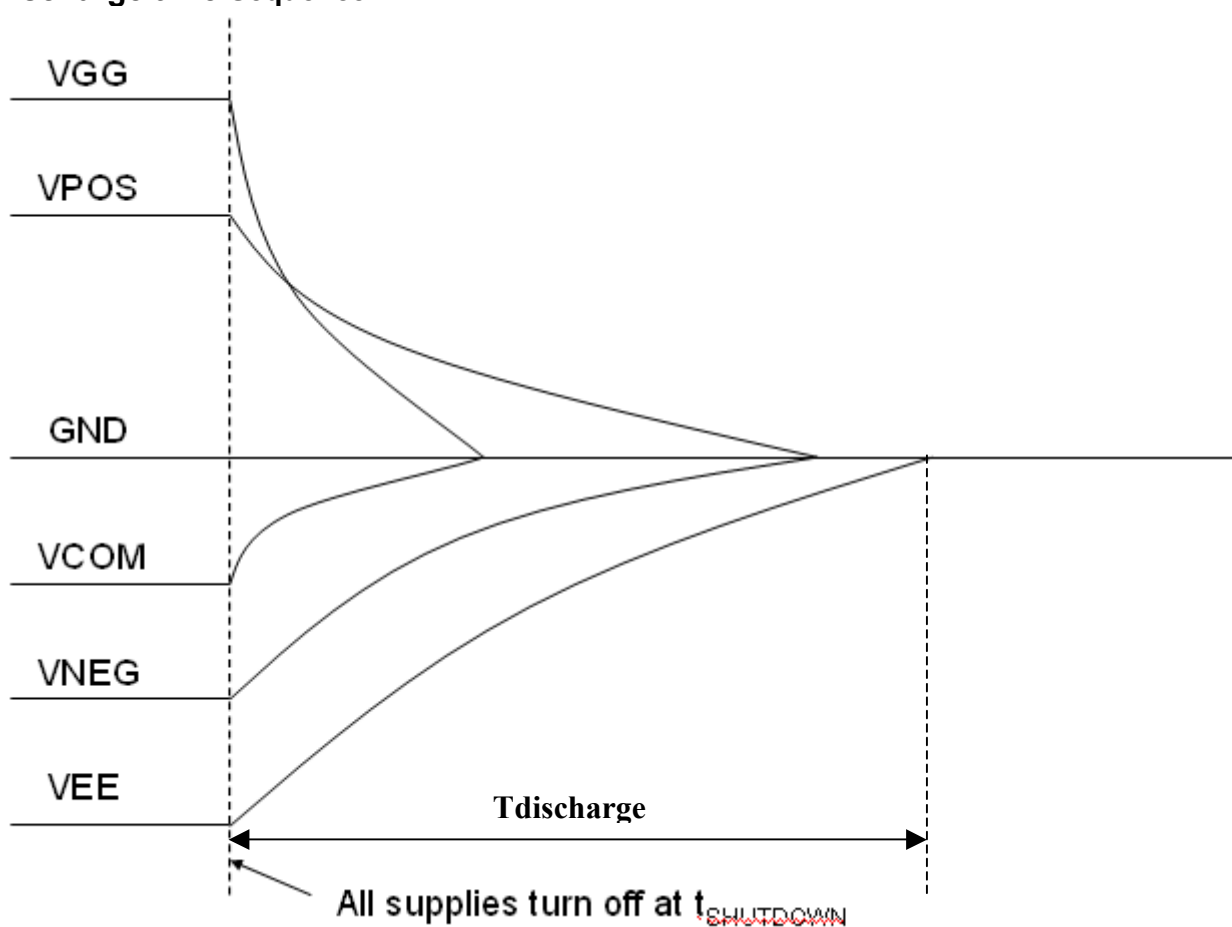


	Min	Max
Tsd	100us	-
Tdn	100us	-
Tnp	1000us	-
Tpv	100us	-
Tvd	100us	-
Tne	0us	-
Teg	1000us	-
Tgv	100us	-

**POWER DOWN**


	Min	Max
Tdv	100 $\mu$ s	-
Tvp	0 $\mu$ s	-
Tpn	0 $\mu$ s	-
Tns	-	1000ms
Tsd	100 $\mu$ s	-
Tvg	0 $\mu$ s	-
Tge	0 $\mu$ s	-
Ten	0 $\mu$ s	-

## 8. Discharge time Sequence



Note8-1 : Supply voltages decay through pulldown resistors.

Note8-2 : VEE must remain negative of Vcom during decay period.

### 8-1) Refresh Rate

The module ED060XC5 is applied at a maximum screen refresh rate of 85Hz.

	Min	Max
<b>Refresh Rate</b>	-	85Hz

## 9. Optical characteristics

### 9-1) Specifications

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

T = 25°C

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit	Note
R	Reflectance	White	30	35	-	%	Note 9-1
Gn	N <sub>th</sub> Grey Level	-	-	$DS + (WS - DS) \times n / (m - 1)$	-	L*	-
CR	Contrast Ratio	-	10	12	-		-

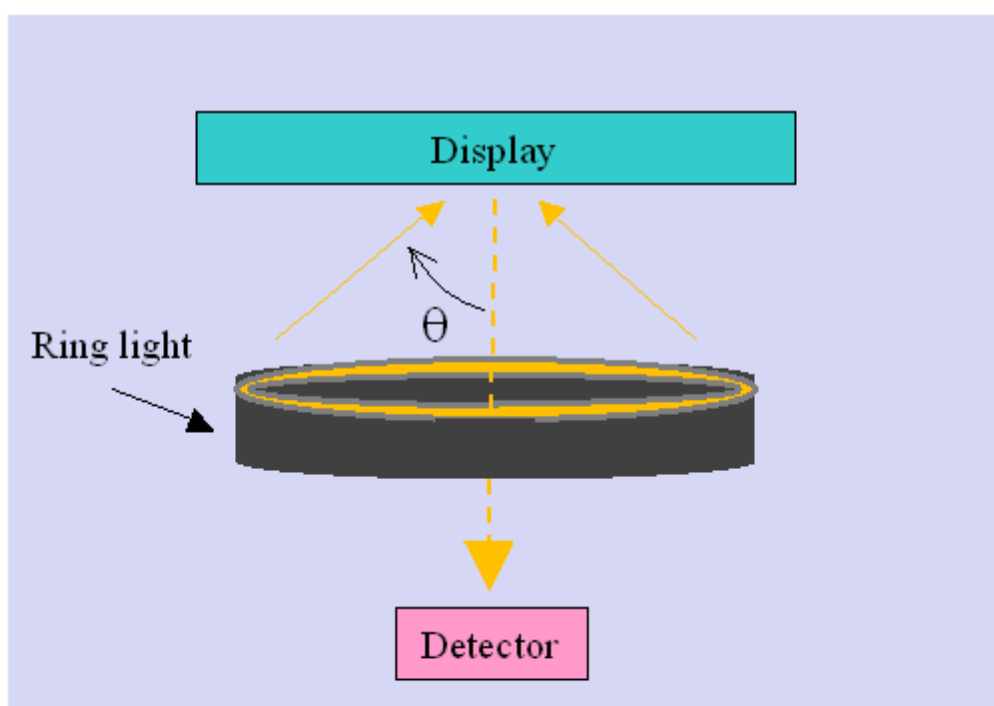
WS: White state , DS: Dark state, Gray state from Dark to White :DS 、 G1 、 G2... 、 Gn... 、 Gm-2 、 WS  
m:4 、 8 、 16 when 2 、 3 、 4 bits mode

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

### 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:

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

$L_{\text{center}}$  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.

## 10. 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.

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 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°C, RH=80% for 240hrs Test in white pattern	IEC 60 068-2-3CA	
7	Temperature Cycle	-25°C → +70°C, 100 Cycles 30min 30min Test in white pattern	IEC 60 068-2-14	
8	Solar radiation test	765 W/m <sup>2</sup> for 168hrs, 40°C 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

E61   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:

ED060XC5: E61

2 : Internal control codes:

3 : FPL reversion code

V220:6   V220E:8

4 : FPL batch code:

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

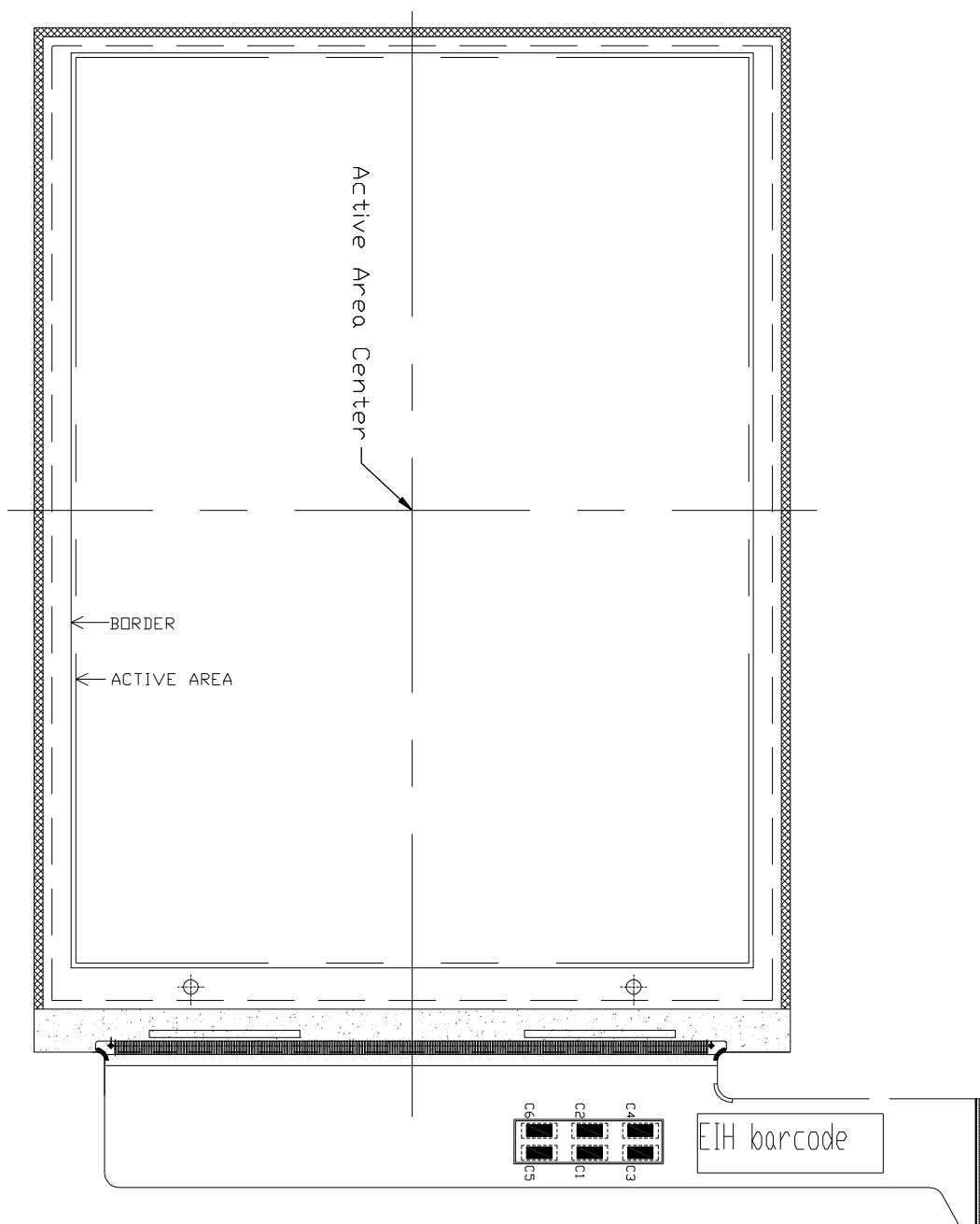
7 : Serial number

00000-99999

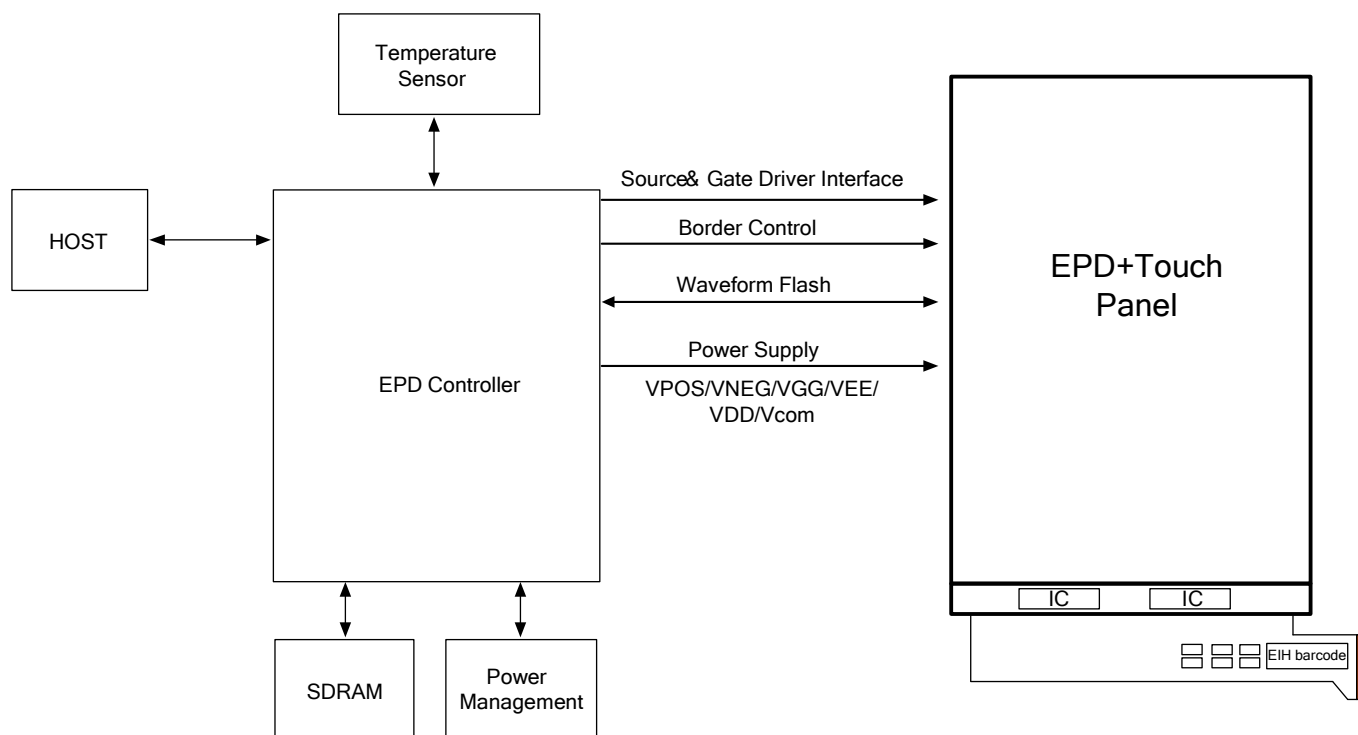
8 : MFG code:

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

### 13. Border definition



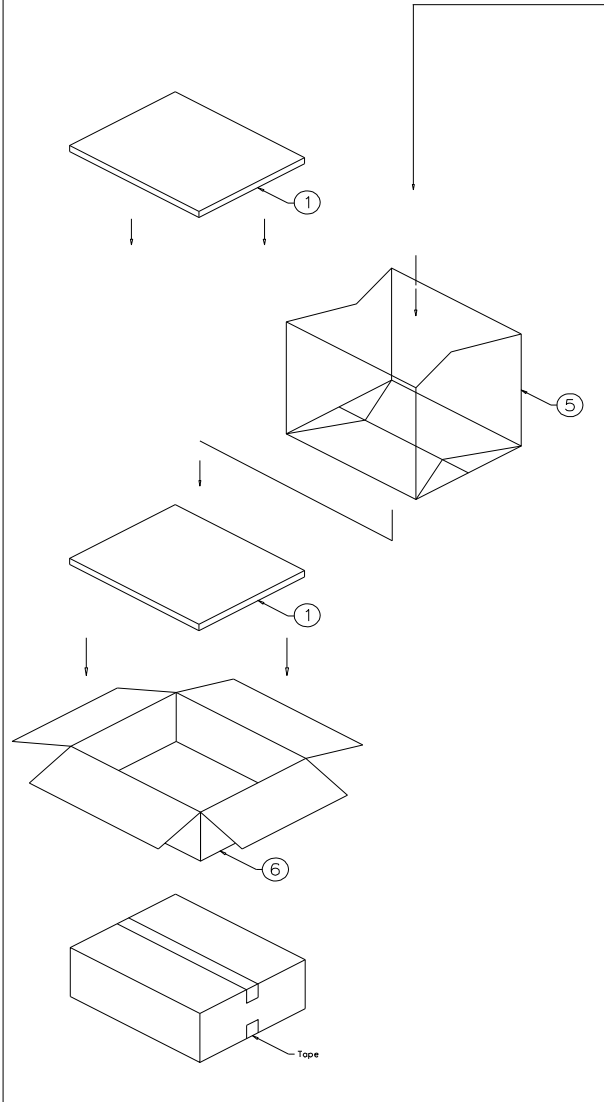
## 14. Block Diagram

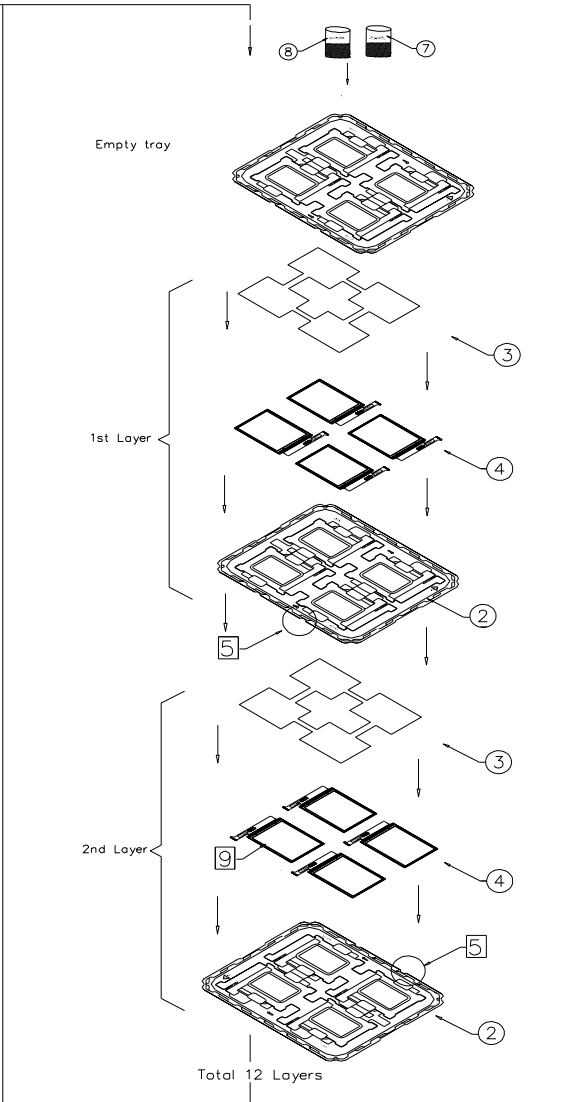


# ED060XC5

## 15.Packing

REV	DESCRIPTION	DESIGN	DATE
00	INITIAL RELEASE	Michael	'11.08.08





**NOTE:**

- One layer include: 1 piece of cushion sheet, 4 pcs module & 1 piece of tray.
- Q'TY: 48 pcs panel/carton.
- Dimension: 455\*375\*190mm
- Weight: 4.8 KG
- Make sure tray stacked with 180° rotation. We can check this by lateral side view.

9	EASY TAPE	48	For Remove Protect Sheet
8	30g加厚導合紙(5層)總厚7.3*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	ED060XC5	48	
3	EPE CUSHION SHEET	12	抗靜電
2	TRAY	13	抗靜電
1	EPE FOAM	2	
ITEM	DESCRIPTION	QTY	REMARK

MTL.SPEC.

UNSPECIFIED TOL'S ±5.0mm

ANGLE

ROUGHNESS

REMARK

Universal Display LTD

ED060XC5 PACKING Dim

APPROVE	Patrick Lin	'11.08.08	SCALE	UNIT	SHEET	DWG.TITLE
CHECK	Patrick Lin	'11.08.08	1:1	mm	1 OF 1	ED060XC5 PACKING Dim
DESIGN	Michael Par	'11.08.08	MTL.NO.		DWG.NO.	REV. 01
						A4 SIZE