製 品 標 準

(LTA400HC05-001)

V0.0

LCD 總括
開發 2G

■ Revision History

No	일자	페이지	개정전 사양	개정후 사양	비고
0.0	2008.04.03	All	최초 제품표준 제정		

1. 목적

제품 정보를 정의하고 개발제품 Target을 설정하며, 이를 부서간에 공유하기 위함.

2. 적용범위

TFT LCD LTA400HC05-001

3. 일반개요

3.1 개요

LTA400HC05-001는 비정질 실리콘(Amorphous Silicon) 박막 트랜지스터(TFT :Thin Film Transistor)를 스위칭 소자로 사용한 컬러 능동 행렬(Color active matrix) 방식의 TFT 액정 표시 소자(LCD;Liquid Crystal Display) Module이다. Module은 Panel, 구동 회로부와 Backlight부로 구성되며, Interface방법은 Digital 영상정보를 직렬로 고속 전송하는 방식의 일종인 LVDS방식을 채용하였다. 본 제품은 1,920 * 1080 (16:9) 화소를 포함하고, 10bit data를 처리하여 dispay하며 1.07billion의 색상을 지원한다.

그리고 독자 기술인 SPVA Mode 기술을 적용하여 시야각은 상하좌우 89°이상을 제공하는 광시야각 제품이다.

3.2 특징

① High Contrast Ratio & High aperture structure
② 고속 응답 특성(DCC 적용 회로 채용)
③ Wide UXGA (1920 x 1080 화소) 지원 (16:9)
④ SPVA (Super Patterned Vertical Align) Mode 광시야각(±178°)
⑤ 22 CCFL B/L Unit 설계 적용
⑥ Sync Format : DE(Data Enable) Mode 지원, H/V-sync only 지원 불가
⑦ LVDS 직렬 인터페이스 (2 pixel/clock)

3.3 응용분야

① Home-alone Multimedia TFT-LCD TV
② High Definition TV Ready (HD TV Ready)
③ AV 제품의 화상 표시 단말기

3.4 일반사양

항 목	사 양	단 위	비 고
유효표시면적	885.6(H) X 498.15 (V) (대각선 40.0")	mm	
구동소자	a-Si TFT Active matrix		
표현가능색 수	1.07 Billion (10bit True)	color	
화소수	1,920 × 1080	pixel	16:09
화소배열	RGB Vertical Stripe		
화소크기	0.46125 (H) × 0.15375 (V)	mm	
표시모드	Normally Black		
표면처리	Haze 0.5 % , Hard-Coating (3H)		

4. 기구사양

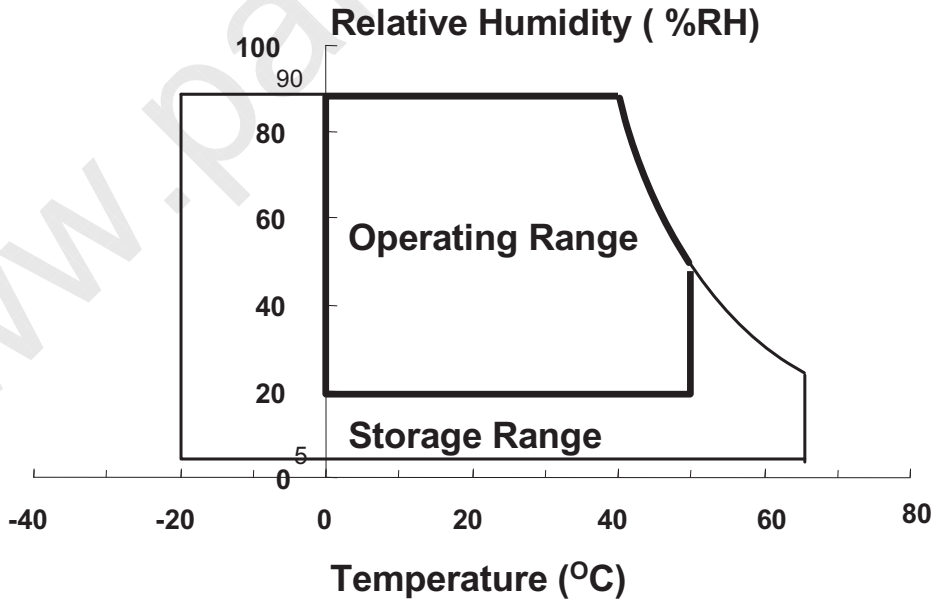
항 목	사 양	단위	NOTE
모듈외곽크기	911.7(W)±1.0× 524.2(H)±1.0 × 58.3±1.0(D)	㎜	인버터포함
무게	11,000 (Typ.)	g	11,500(MAX)

5. 절대 최대 정격

5.1 환경 사양 절대 정격

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperature	TSTG	-20	65	℃	**(1)**
Operating temperature	TOPR	0	50	℃	**(1)**
Shock(Non-operating)	Snop	-	50	G	**(2)**
Vibration(Non-operating)	Vnop	-	1.5	G	**(3)**

NOTE (1) 온도와 상대습도 관계는 아래 그림에 따른다.
(최대습구 온도는 39℃임 <40℃에서 93.8%RH에 해당>)



NOTE (2) 11ms ±X,Y,Z (6방향 / 1회)

NOTE (3) 10~300Hz/1.5G /10 min SR, XYZ, 30 min/axis

5.2 전기적 사양 절대 정격

5.2.1 TFT LCD MODULE 절대 정격

(V_{SS} = 0 V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage/ Display	V_{DD}	V_{SS}-0.3	16.5	V	(1)

NOTE(1) 동작온도 범위안에서.

5.2.2 BACK-LIGHT UNIT 절대정격

(Ta:25±2℃)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Input voltage	V_L	21.6	26.4	V	(1)
Lamp Current	I_L	2.3	7.5	mA_{rms}	(1),(2)
Lamp Frequency	F_L	40	80	kHz	(1)

NOTE(1) 최대치를 초과할 경우, 영구적인 결함이 발생할 수 있음. 명시된 정상조건 내에서 구동되어야함.

NOTE(2) Single Lamp 기준.

6. 광학 특성

6.1 측정 환경

-. 환경 조건

온도 : 25℃±2℃ / 습도 : 25%~85% RH / 압력 : 86kPa~106kPa / 암실 : 1Lux이하 / 무풍(직접적인 바람 제거) / 무진동

-. Warm-Up Time : ① 최소 30분 이상

② 주기적(약 15초 간격)으로 center 휘도를 측정하여 10분전 휘도 와 현재 휘도 차이의 비가 0.5%이하가 되는 최초 시점

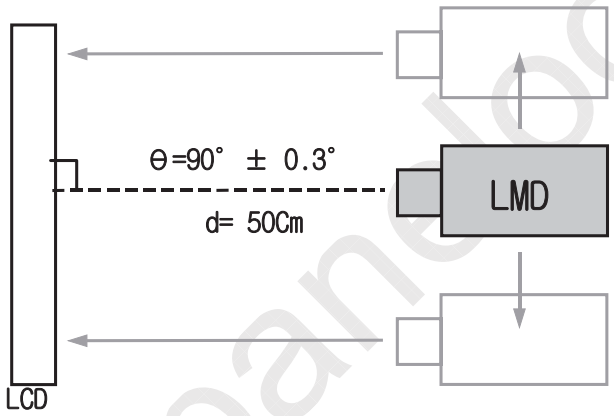
$$T_{warm\text{-}up} = \left(\left| Lum_{t\text{-}10} - Lum_{now} \right| / Lum_{now} \right) \times 100 < 0.5 \text{ 가 되는 시간}$$

where , $Lum_{t\text{-}10}$는 10분전 휘도 , Lum_{now}는 현재 휘도

6.2 측정 장비(LMD : Light Measurement Device)

-. 종류 : BM-5A(TOPCON社), BM-7(TOPCON社), PR-650(Photo Reserch社)

-. 측정 거리 및 방향 :



LMD	Field
BM-5A	2°
BM-7	2°/ 1°
PR-650	1°

6.3 구동 조건

-. TFT LCD Module : VCC = 12.0 V, fV = 60 Hz, fDCLK = 74.25 MHz

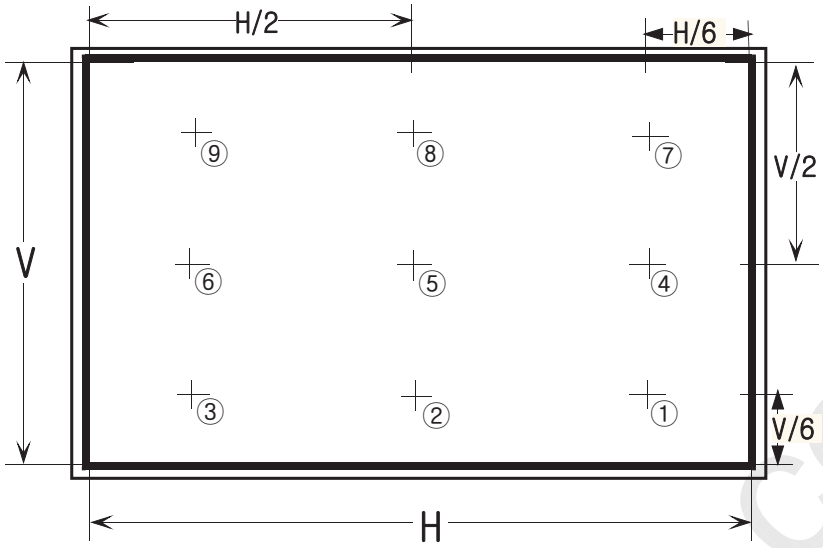
-. BACK-LIGHT UNIT : Lamp Current = 7.0 mA / INVERTER = 48.5 (KHz ±2KHz)

6.4 광학 특성

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	LMD	NOTE
Luminance of White (center)		$Y_{L,AVG}$	400	500	-	cd/㎡	BM-5A	(1)
Contrast Ratio (center)		CR	2000	3000	-	-		
Brightness Uniformity (9point or 13Point)		Buni	-	-	25	%		
Color Chromaticity (CIE 1931)	Red	Rx	typ. -0.03	0.648	typ. +0.03	-	PR-650	Center Point
		Ry		0.324				
	Green	Gx		0.205				
		Gy		0.672				
	Blue	Bx		0.147				
		By		0.070				
	White	Wx		0.280				
		Wy		0.290				
Color Gamut		-	87.0	90.0	-	%		
Color Temperature		CCT	8000	10000	12000	K		
Viewing Angle (CR≥10)	Hor.	θ_L	75	89	-	Degrees	BM-5A	(2)
		θ_R	75	89	-			
	Ver.	θ_H	75	89	-			
		θ_L	75	89	-			
Crosstalk		D_{SHA}	-	-	5.0	%		(3)
Flicker		F	-	6	8	-	BM-7	(4)
Gamma		-	1.9	2.2	2.5	-		PI 기재 불가
Response time		G to G 평균	-	6	12	ms		(5)
MPRT		MPRT	-	8	11	ms	VG- 848	당사 MPRT 측정 방법 기준

NOTE (1)

▶ 측정위치 : 판넬상 측정위치는 Active Area내 9개 점으로 한다.(하기의 그림 참조)



① WHITE 평균 휘도의 정의 (Y_L)

: 측정위치 중앙 Point⑤ 에서 WHITE 휘도(Y_L)

② 대비비(C/R : Contrast Ratio)

: 측정위치 중앙 Point⑤에서 WHITE(G_{MAX}) 휘도와 BLACK(G_{MIN}) 휘도의 비로 정의.

$$CR = \frac{G\max(5)}{G\min(5)}$$

여기서, ( ) 안의 수는 측정 Point 임.

③ Brightness Unifomity(Buni)

: Panel 全面 WHITE 일때 9개(13개) point의 휘도를 측정하여 아래식과 같이 정의.

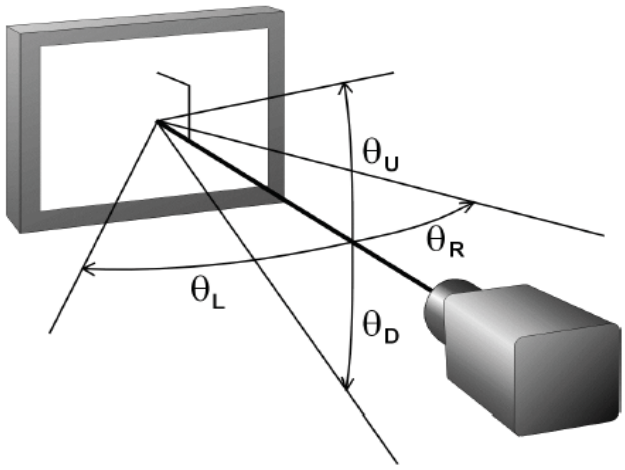
$$Buni = \frac{B\max - B\min}{B\max} \times 100$$

where, Bmax = Maximum Brightness

Bmin = Minimum Brightness

NOTE (2)

▶ 시야각(Viewing angle)의 정의 : C/R이 10이상되는 시각의 범위



NOTE (3)

▶ 상호 혼선(Crosstalk;Cross modulation)의 정의(D_{SHA}): 화소간의 신호간섭에 의하여 대비비가 저하되는 현상.

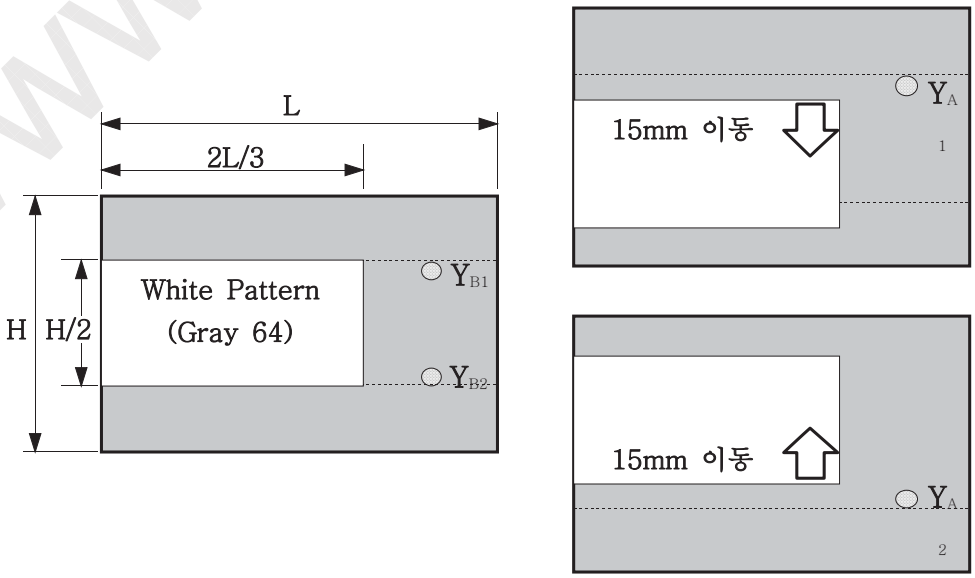
$$Crosstalk\ Modulation\ Ratio(D_{SHA}) = \frac{|Y_{normal} - Y_{abnormal}|}{Y_{normal}} \times 100(\%)$$

* White Box 이외의 back ground pattern은 Gray1~ Gray64 까지 4Gray 간격으로 측정
* Horizontal Crosstalk 과 Vertical Crosstalk을 모두 측정
* 측정 결과중 가장 큰값을 Crosstalk라고 정의

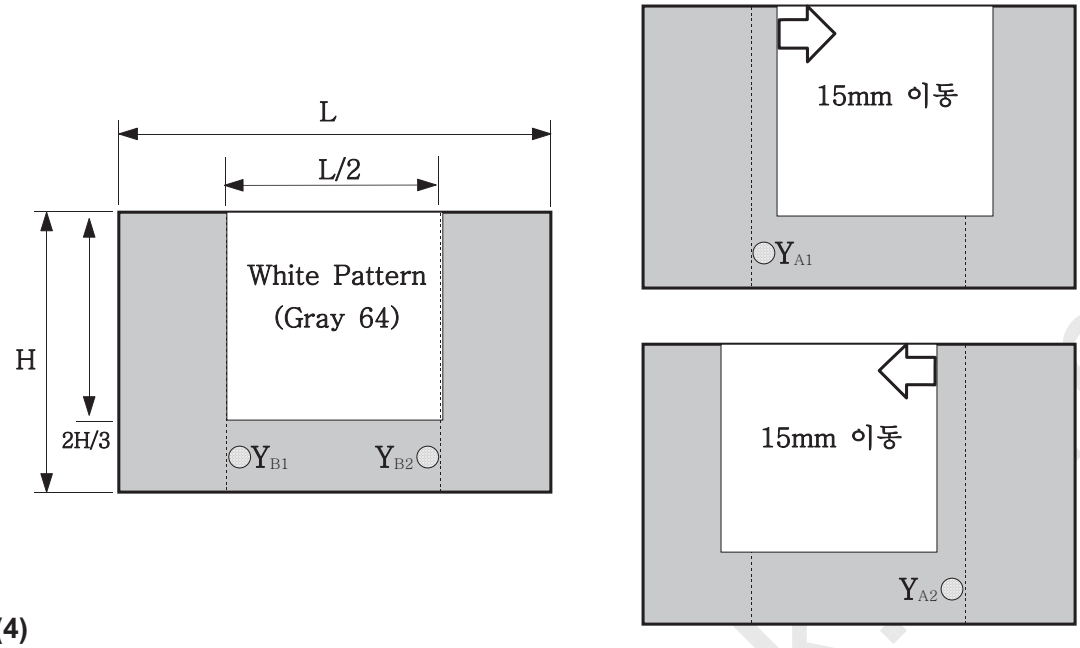
참고 : Normally White mode시 Box는 Black(Gmin) /Normally Black mode시 Box는 white(Gmax)

* Crosstalk 측정 Pattern 및 Point

Horizontal Crosstalk



Vertical Crosstalk

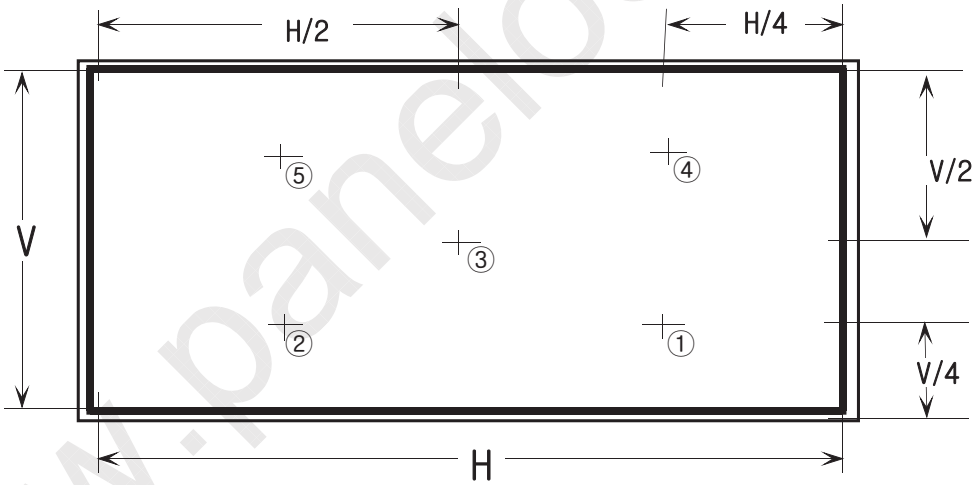


NOTE (4)

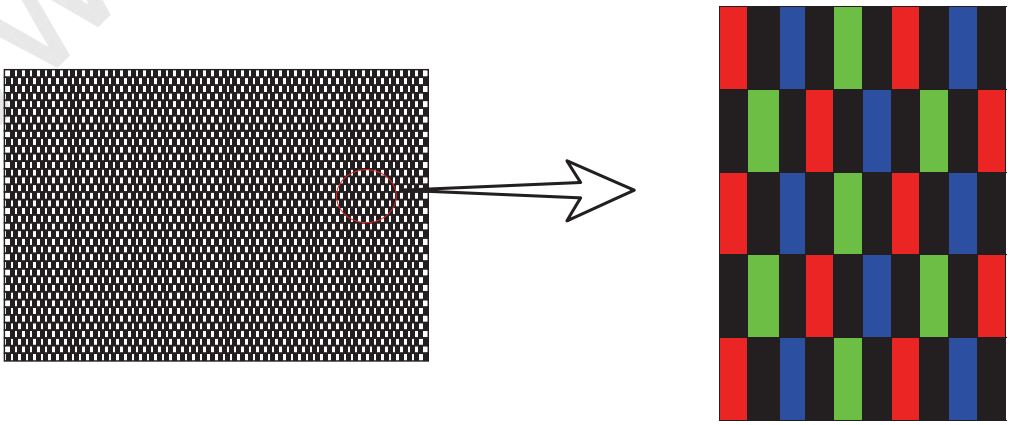
▶ 화면의 번쩍 거림(Flicker)의 정의 : LCD Panel의 화면이 깜박거리는 현상.

① 계산식은 Flicker 측정표준에 준함.

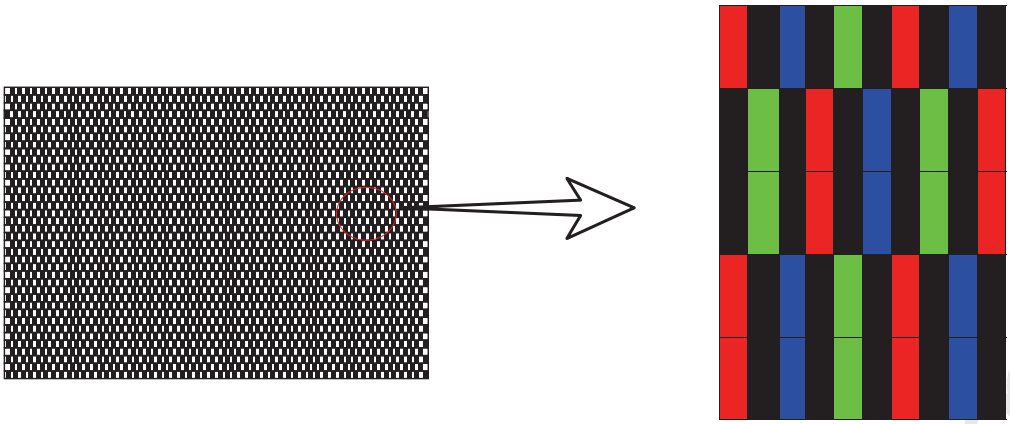
② 측정위치



③ Flicker 측정 Pattern :



Dot Inversion 구동일 경우

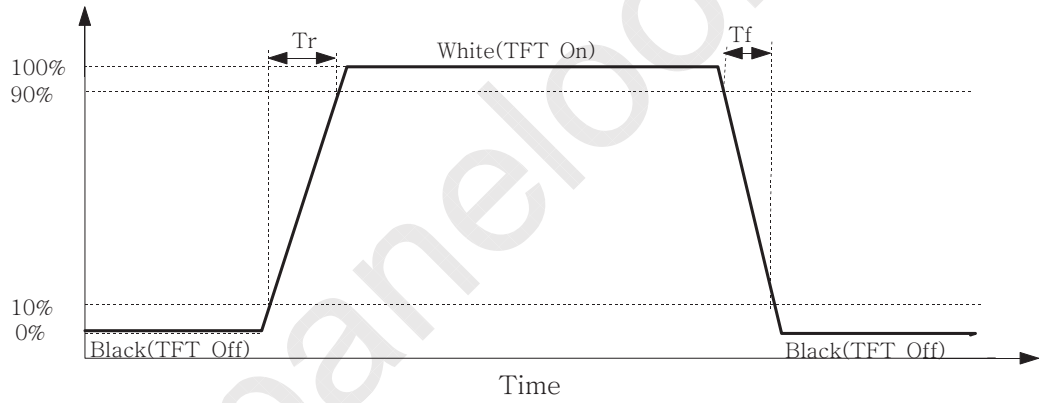


2 Dot Inversion 구동일 경우

NOTE (5)

▶ 응답시간(Response time)의 정의: 화면이 어두워 질 때와 밝아질 때에 투과율이 10%와 90% 사이로 변화하는 시간의 합

- Normally Black mode일 경우



Gray to Gray Response Time											
	Gray	End									
		0	31	63	95	127	159	191	223	255	
Start	0		Tr(0-31)	Tr(0-63)	Tr(0-95)	Tr(0-127)	Tr(0-159)	Tr(0-191)	Tr(0-223)	Tr(0-255)	Ton
	31	Tf(31-0)		Tr(31-63)	Tr(31-95)	Tr(31-127)	Tr(31-159)	Tr(31-191)	Tr(31-223)	Tr(31-255)	
	63	Tf(63-0)	Tf(63-31)		Tr(63-95)	Tr(63-127)	Tr(63-159)	Tr(63-191)	Tr(63-223)	Tr(63-255)	
	95	Tf(95-0)	Tf(95-31)	Tf(95-63)		Tr(95-127)	Tr(95-159)	Tr(95-191)	Tr(95-223)	Tr(95-255)	
	127	Tf(127-0)	Tf(127-31)	Tf(127-63)	Tf(127-95)		Tr(127-159)	Tr(127-191)	Tr(127-223)	Tr(127-255)	
	159	Tf(159-0)	Tf(159-31)	Tf(159-63)	Tf(159-95)	Tf(159-127)		Tr(159-191)	Tr(159-223)	Tr(159-255)	
	191	Tf(191-0)	Tf(191-31)	Tf(191-63)	Tf(191-95)	Tf(191-127)	Tf(191-159)		Tr(191-223)	Tr(191-255)	
	223	Tf(223-0)	Tf(223-31)	Tf(223-63)	Tf(223-95)	Tf(223-127)	Tf(223-159)	Tf(223-191)		Tr(223-255)	
	255	Tf(255-0)	Tf(255-31)	Tf(255-63)	Tf(255-95)	Tf(255-127)	Tf(255-159)	Tf(255-191)	Tf(255-223)		
		Toff									

T*(X-Y) : Response time from level of gray(X) to level of gray(Y)

Response time 정의 = Σ [T*(X-Y)] / 72

7. 전기적 특성

7.1 TFT LCD 모듈

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Power Supply Voltage	V_{DD}	10.8	12.0	13.2	V	(1)
Power Consumption	(a) Black	-	1700	2000	mA	(2),(3) (5)
	(b) White	-	1650	1950	mA	
	(c) H-stripe	-	2800	3100	mA	
Vsync Frequency	f_V	49	60	61	Hz	
Hsync Frequency	f_H	61	67.5	69.5	kHz	
Main Frequency	f_{DCLK}	120	148.5	157	MHz	
Rush Current	I_{RUSH}	-	6	8	A	(4)

NOTE(1) 디스프레이 데이터 및 타이밍 신호용 콘넥터는 연결되어 있을 것(V_{SS} = 0V)

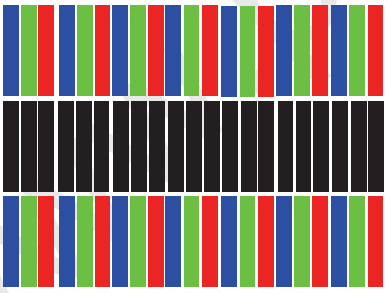
(2) f_V = 60 Hz, f_{DCLK} = 74.25 MHz, V_{DD} = 12V, DC current

(3) 소비전력 체크 패턴

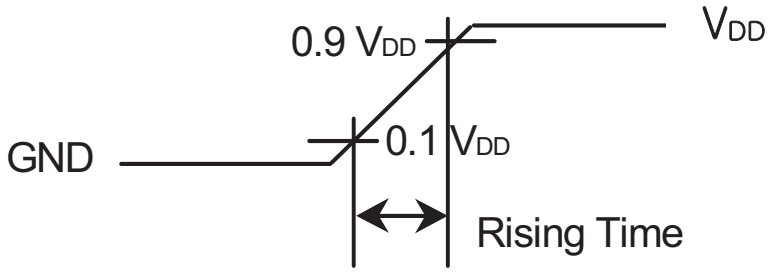
(a) Black 패턴

(b) White 패턴

(c) H-stripe



(4) 측정조건 (12V 구동, rising time =470㎲)



(5) Inverter의 소비전류는 포함하지 않은 상태임.

7.2 Inverter

No.	Item	SYM	Condition	Min.	Typ.	Max.	Unit
1	Input Voltage	V_{IN}	-	21.6	24	26.4	Vdc
2	Input Current	I_{IN}	Vin=24V DIM : 3.3V	-	-	9.25	A
3	Output Current (Note1)	I_{OMAX}	Vin=24V DIM : 3.3V (After 30 minutes aging)	6.5	7.0	7.5	mArms
		I_{OMIN}	Vin=24V DIM : 0V	2.3	2.8	3.3	mArms
4	Lamp Frequency	f_O	Vin=24V, DIM : 3.3V	46.5	48.5	50.5	KHz
5	ENABLE Control Voltage	ENABLE	ON	2.4	-	5.25	V
			OFF	-0.3	-	0.8	V
6	Open Lamp Voltage (Note2)	V_{OPEN} $V_{o(T104)}$	Vin : 21.6V ~ 26.4V DIM : 0 ~ 3.3V	2080	-	-	Vrms
7	Burst Mode(PWM) Signal Frequency	F_{PWM} $F_{(2,7)}$	Vin=24V, VDIM= 0V (PWM signal frequency depends on synchronizing signal from 110 to 170Hz)	110	-	170	Hz
8	Shut-down Time	T_{sd} $T_{s(2,7)}$	Vin : 21.6V ~ 26.4V DIM : 0 ~ 3.3V	1	1.5	2	sec

Note1) Output Current Test Condition : It is measured the Iout HOT side, After running 60 minute

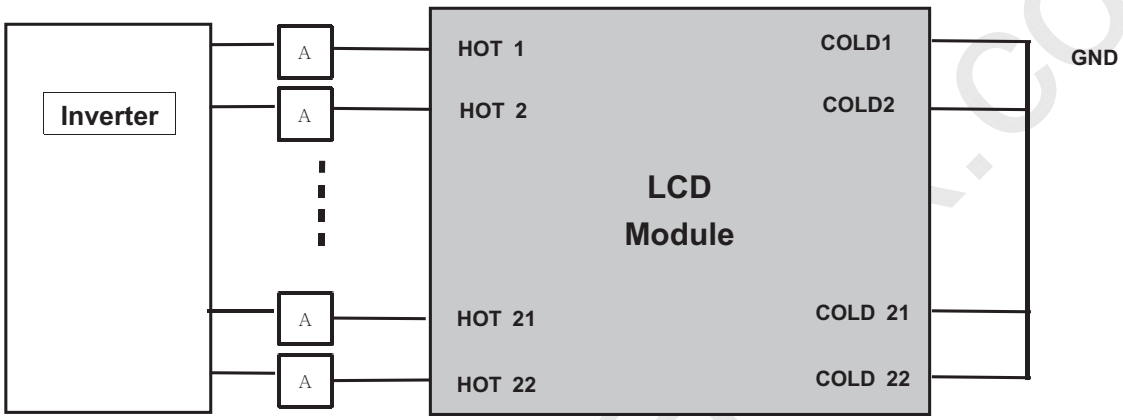
Note2) High Voltage Probe :P6015(Tektronix)

7.3 백 라이트 유닛(BackLight Unit)

(Ta:25±2℃)

Parameter	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Lamp Current	I_L	2.3	6.0	7.5	mA_{rms}	**(1)**
Lamp Frequency	f_L	40	–	80	kHz	
Operating Life Time	Hr	30,000	-	-	Hour	**(2)**
Start Up Voltage	Vs	-	-	0℃:2270 25℃:2040	Vrms	**(3)**

NOTE(1) Lamp의 동작 보증 범위로 램프 전류는 고주파수용 전류계로 아래 그림처럼 측정함.



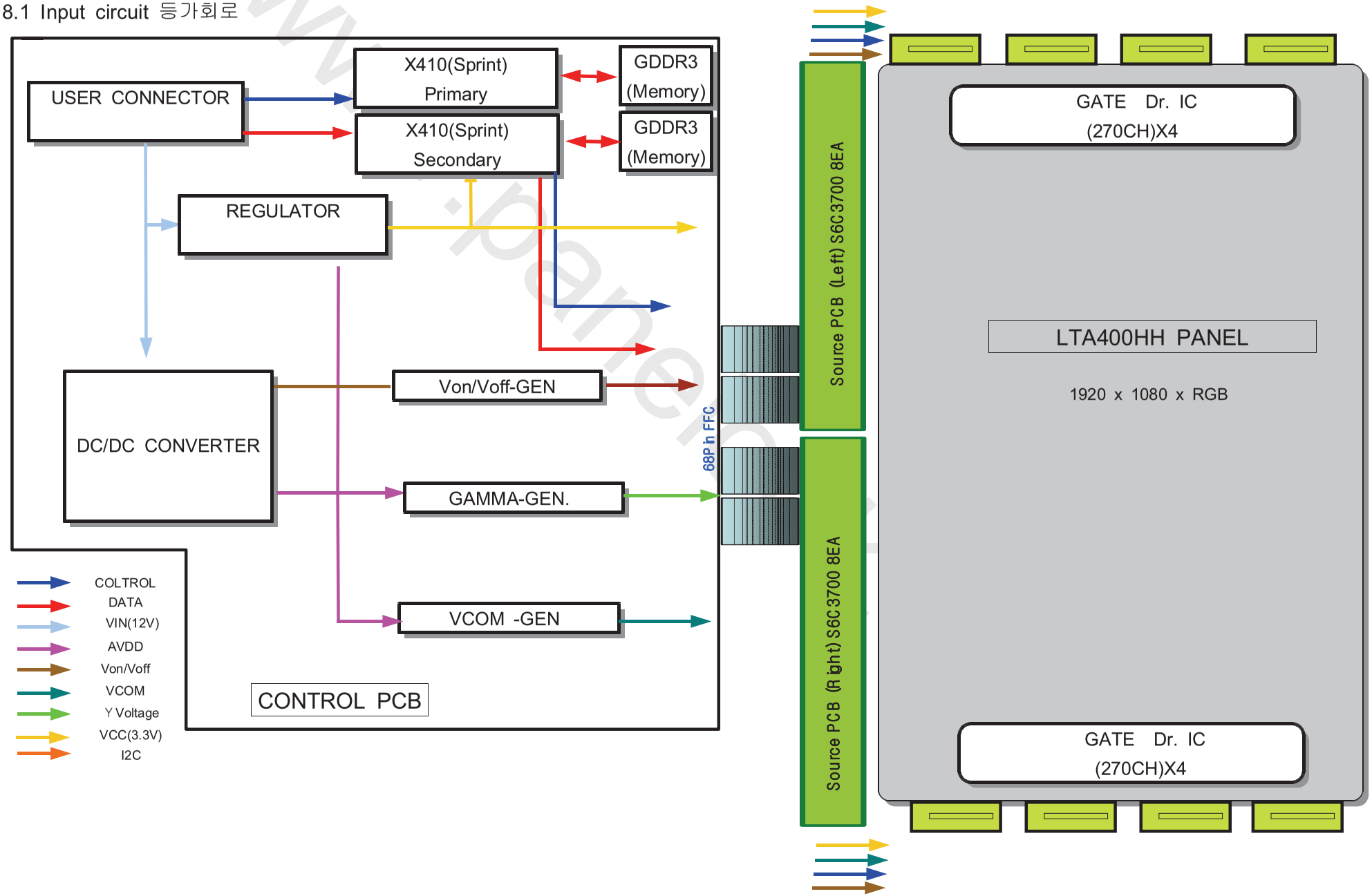
(2) 램프수명은 램프 전류 보증범위에서 연속구동시 표준상태에서 휘도가 원래 밝기의 50%이하 밝기로 될때까지의 시간으로 정의함.(Ta=25℃)

- 상기 수명은 Lamp 단품 수명임

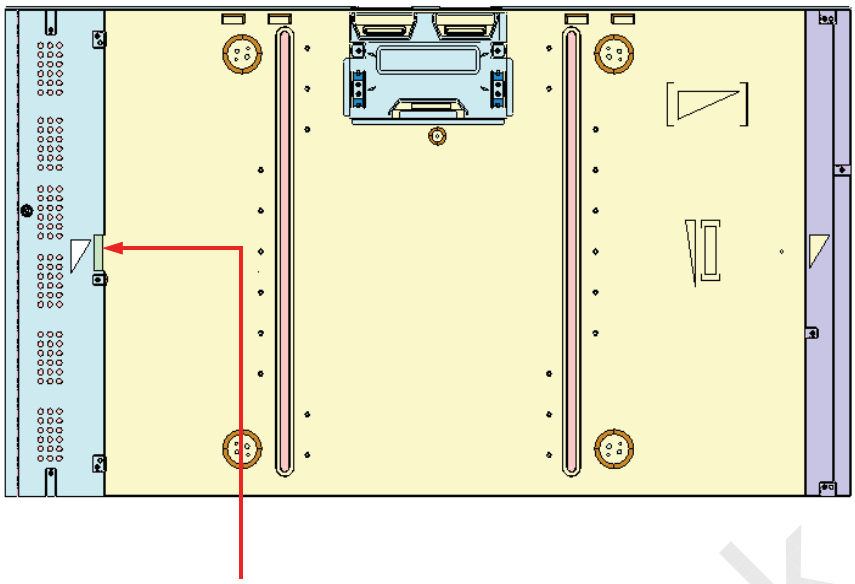
(3) 명기된 값 이상의 전압이 Lamp를 start시키기 위하여 Lamp에 1초 이상 인가되어야 함. 그렇지 않을 경우 Lamp가 점등되지 않을 수 있음.

8. 블럭 다이어그램(Block Diagram)

8.1 Input circuit 등가회로



8.2 Back Light



Inverter(socket2 type)
입력 전원 단

9. 입력단 신호 순서(Input Terminal Pin Assignment)

9.1 TFT LCD 모듈(Interface signal & power) connector : **FI-RE51S-HF (JAE)**

Pin	Description		Pin	Description		
1	Vdd (12V)		26	Even LVDS Signal	RE[0]P	
2	Vdd (12V)		27		RE[1]N	
3	Vdd (12V)		28		RE[1]P	
4	Vdd (12V)		29		RE[2]N	
5	Vdd (12V)		30		RE[2]P	
6	GND		31		GND	
7	GND		32		No connection	
8	GND		33		No connection	
9	GND		34		GND	
10	Odd LVDS Signal	RO[0]N	35		RE[3]N	
11		RO[0]P	36		RE[3]P	
12		RO[1]N	37		RE[4]N	
13		RO[1]P	38		RE[4]P	
14		RO[2]N	39	GND		
15		RO[2]P	40	No connection		NOTE1
16		GND	41	No connection		
17		ROCLK-	42	No connection		
18		ROCLK+	43	No connection		
19		GND	44	No connection		
20		RO[3]N	45	LVDS_SEL		NOTE2
21		RO[3]P	46	No connection		NOTE1
22		RO[4]N	47	No connection		
23		RO[4]P	48	No connection		
24	GND		49	No connection		
25	Even LVDS	RE[0]N	50	No connection		
			51	No connection		

(NOTE1) NOT CONNECTED : THIS PINS ARE ONLY USED FOR SEC INTERNAL OPERATIONS.
(NOTE2) LVDS_SEL : IF THIS PIN : HIGH (3.3V) → NORMAL NS LVDS FORMAT
: LOW (GND) → JEIDA LVDS FORMAT

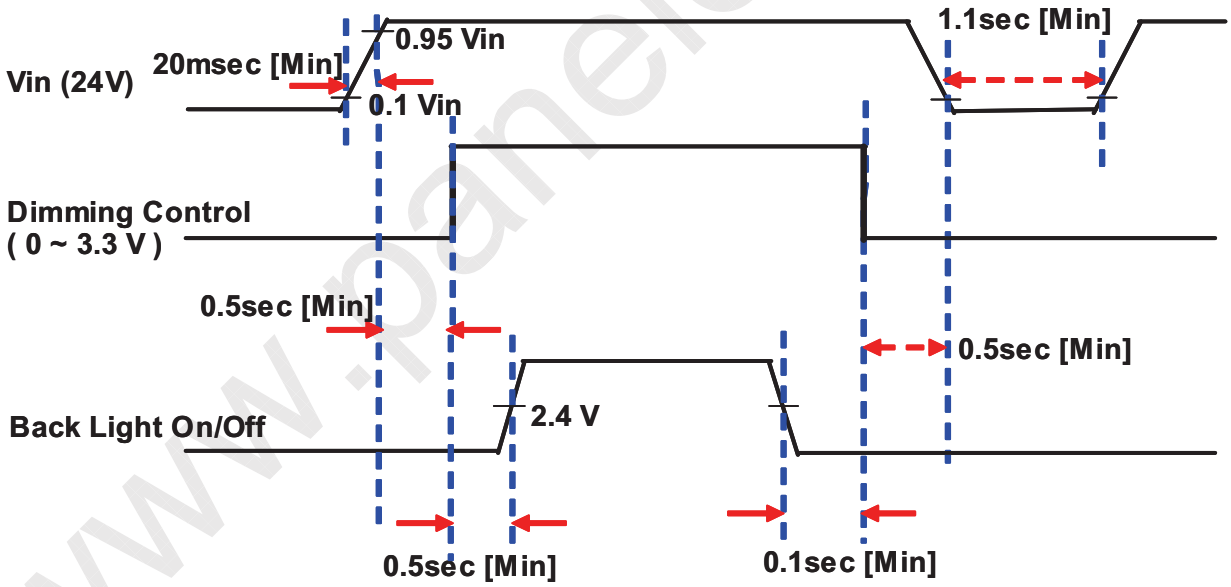
9.2 INVERTER UNIT

9.2.1 Inverter input pin Configuration

Connector : JST, S14B-PHA-SM-TB(LF)

PIN NO.	PIN Configuration (FUNCTION)
1	AWG24 24 V
2	AWG24 24 V
3	AWG24 24 V
4	AWG24 24 V
5	AWG24 24 V
6	AWG24 GND
7	AWG24 GND
8	AWG24 GND
9	AWG24 GND
10	AWG24 GND
11	ERROR_OUT Normal(GND),Abnormal(Open collector)
12	BACKLIGHT ON 5V / OFF GND
13	INPUT DIMMING VOLTAGE. / 3.3V (Max. Dim) ~ 0V(Min. Dim)
14	Reserved (External PWM), High(3.3~5.5), Low(-0.3~0.8)

9.2.2 Inverter input Power Sequence



9.3 입력신호와 표시색상과의 관계

COLOR	DISPLAY	DATA SIGNAL																														GRAY SCALE LEVEL
		RED										GREEN										BLUE										
		R0	R1	R2	R3	R4	R5	R6	R7	R8	R9	G0	G1	G2	G3	G4	G5	G6	G7	G8	G9	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R1020
	↓ LIGHT	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1021
		0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1022
	RED	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1023
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G1020
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G1021
		0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G1022
	GREEN	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G1023
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B1020
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	B1021
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	B1022
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	B1023

NOTE

(1) Gray 정의 :

Rn : 빨강색 Gray, Gn : 녹색 Gray, Bn : 파란색 Gray (n=Gray level)

(2) 입력신호 : 0=Low level voltage, 1=High level voltage

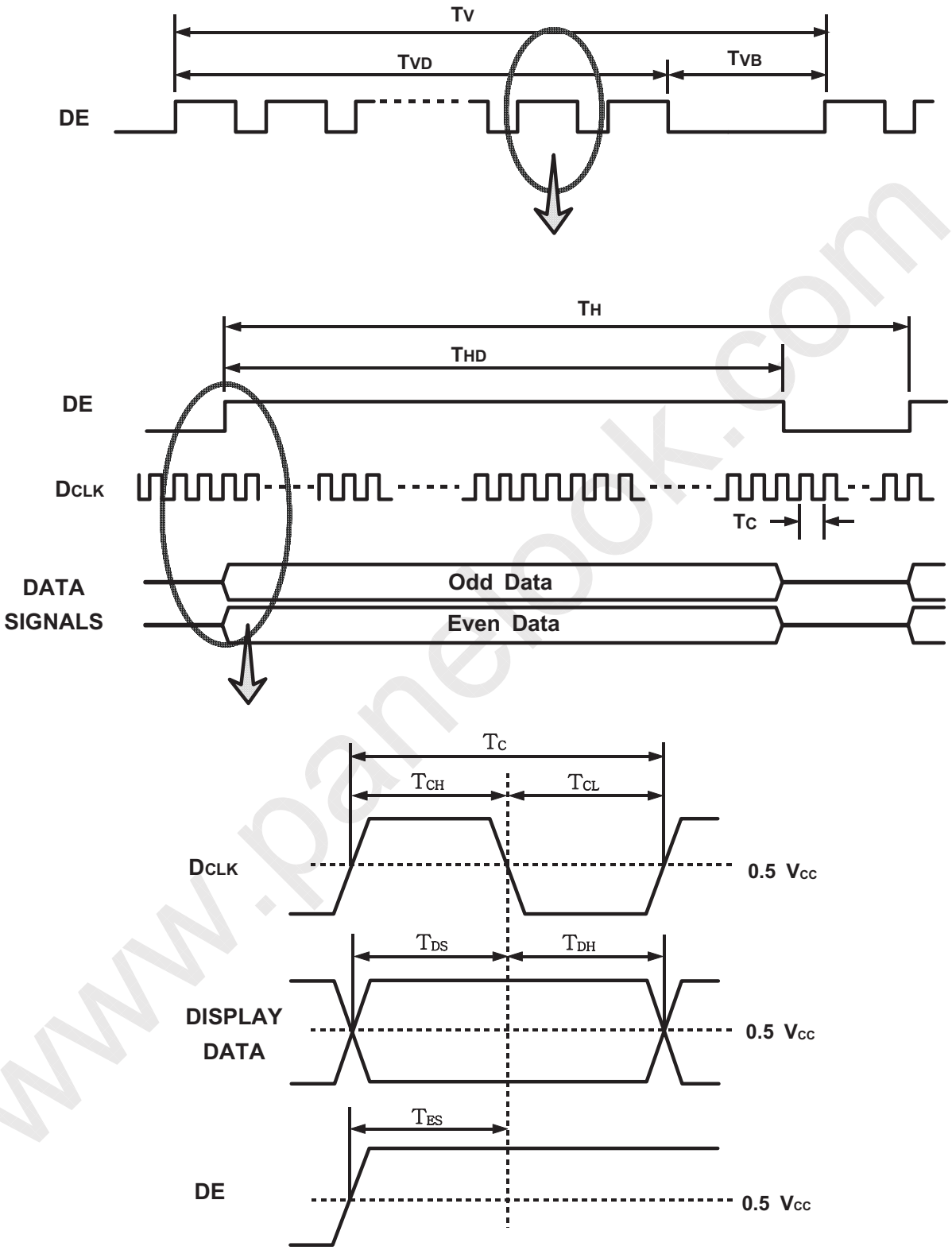
10. 인터페이스 타이밍

10.1 Time parameter(DE Mode)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Clock	Frequency	1/TC	120	148.5	157	MHz	2CH LVDS
Hsync		Fh	61	67.5	69.5	KHz	-
Vsync		Fv	49	60	61	Hz	-
Vertical Active Disply Term	Display Period	TVD	-	1080	-	lines	-
	Vertical Total	TVB	1090	1125	1350	lines	-
Horizontal Active Display Term	Display Period	THD	-	1920	-	clocks	-
	Horizontal Total	TH	2130	2200	2350	clocks	-

→ 본 제품은 DE only mode로 동작하며, H-sync와 V-sync신호의 입력여부는 정상적인 동작에 영향을 주지 않음.

10.3 인터페이스 신호의 타이밍 다이어그램(DE Mode)

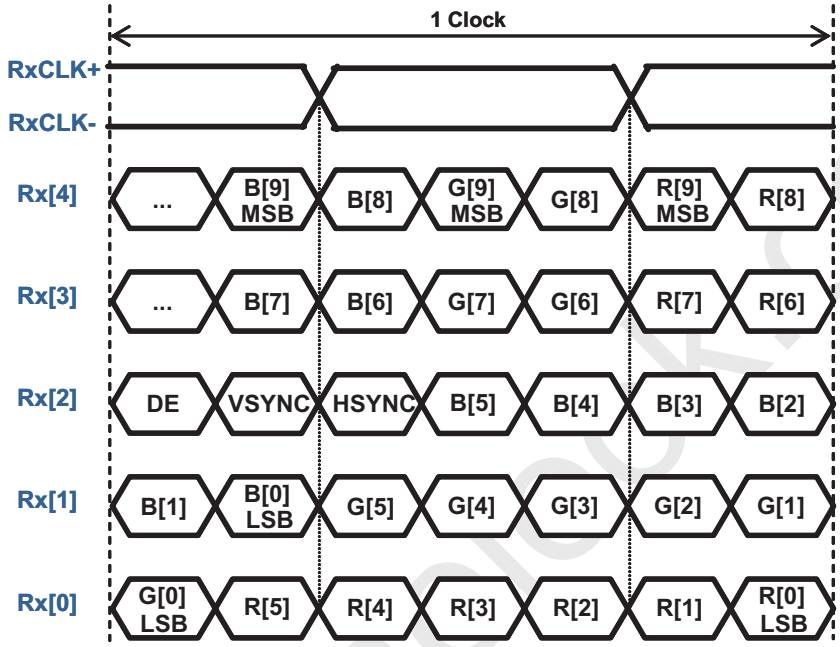


10.4 LVDS Interface

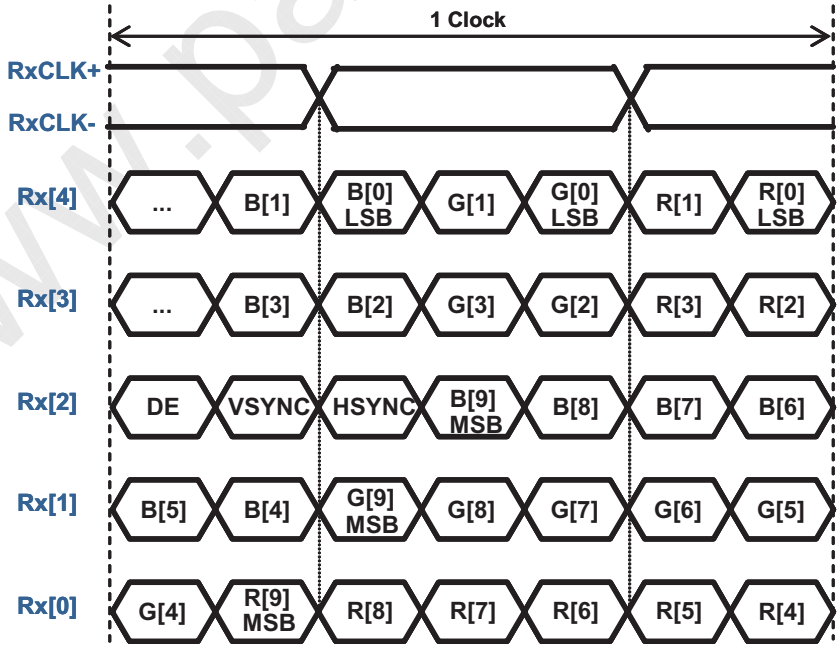
- LVDS Receiver : Tcon내장형
- Normal Data Format

LVDS OPTION(입력 45pin) : IF THIS PIN : HIGH (3.3 V) → NORMAL NS LVDS FORMAT : LOW (GND) → JEIDA LVDS FORMAT

NORMAL FORMAT (Each Channel)

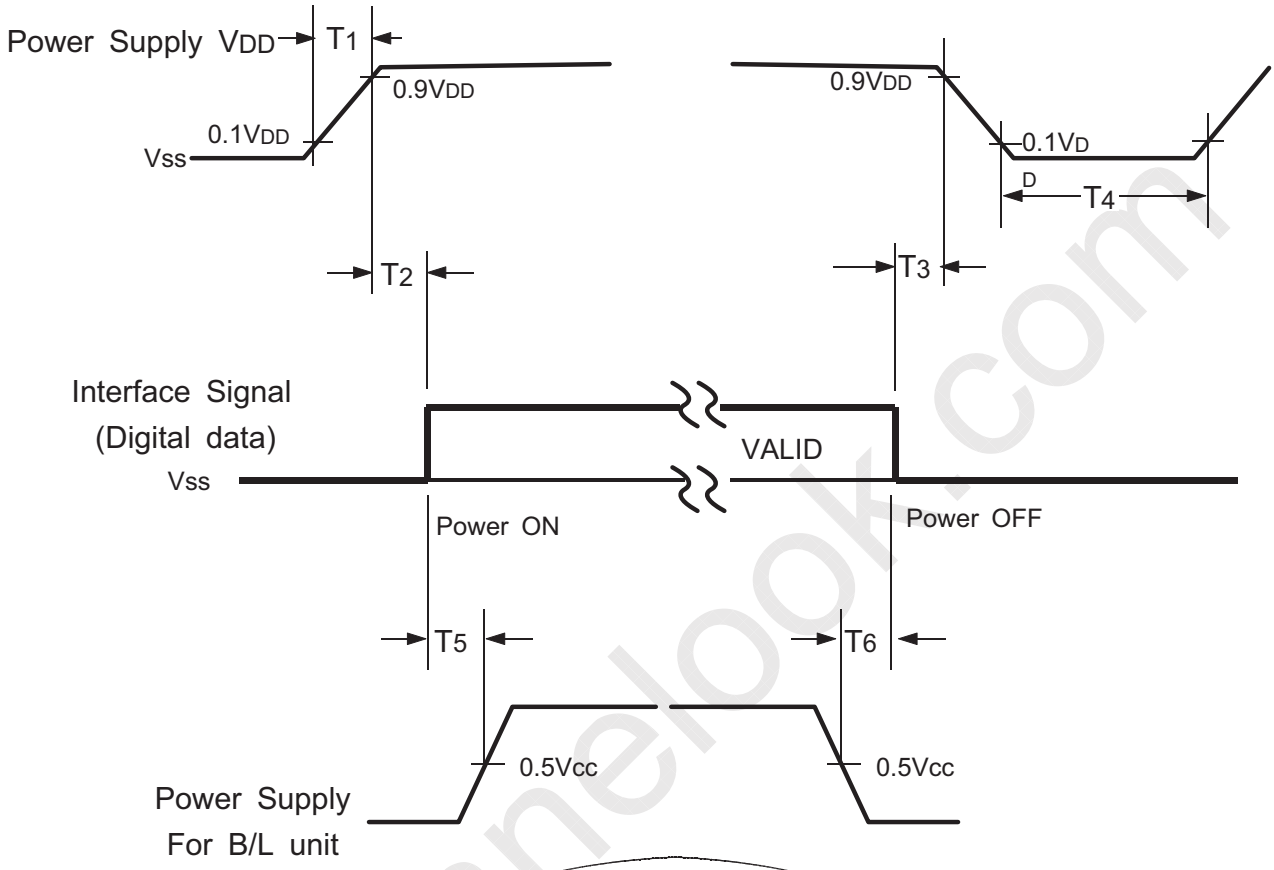


JEIDA FORMAT (Each Channel)



10.5 전원 온/오프 순서(Power ON/OFF Sequence)

: Latch-up이나 LCD 모듈의 DC operation을 막기위해 전원 온/오프 순서는 아래와 같아야 함.



0<T1≤10msec
0<T2≤50msec
0<T3≤50msec
1sec≤T4
1000 msec ≤ T5 (Recommend Value)
100 msec ≤ T6 (Recommend Value)

NOTE

(1) 모듈에 신호를 인가하는 외부장치의 전원은 V_{DD}와 같아야 한다.

(2) LCD 동작 범위내에서 램프의 전압을 인가 할 것. LCD가 동작되기 전에 램프를 켜거나 램프를 끄기전에 LCD를 끌 때, 화면에 NOISE가 발생함..

(3) V_{DD}가 인가된 후 인터페이스 신호가 들어가지 않는 상태(Interface Signal High Impedence)로 장시간 두지 말 것.

(4) Power Off후 재 Power On하기 전에 제품이 완전히 방전후 측정.

11. 신뢰성 수명 시험조건

시험항목	시험 조건	시료수
온도특성	0 ~ 50℃, 20Cycle (10cycle 판정)	4매
HTOL	50℃, 1000HR (500hr 판정)	8매
LTOL	0℃, 1000HR (500hr 판정)	4매
RTOL	25℃, 계속 ~	4매
HTS	70℃, 1000HR (500hr 판정)	4매
LTS	-30℃, 1000HR (500hr 판정)	4매
THB	40℃ / 95%RH, 1000HR (500hr 판정)	4매
WHTS	60℃ / 75%RH, 1000HR (500hr 판정)	4매
T/C	-20 ℃ ~ 60 ℃, 200Cycle (100cycle 판정)	4매
ESD (비구동)	C D M : ±10 kV,150pF/330 Ω,9Point,3회/Point	3매
ESD(구동)	접촉 : ±8 kV ,150pF/330Ω,100Point,1회/Point 비접촉 : ±15 kV,200pF/100Ω,100Point,1회/Point	6매
Input Con. ESD	접촉 : ±2kV,150pF/330,Input Con.Pin,3회/Pin	3매
POWER ON/OFF	30초(on) / 30초(off) : 12,000 회	4매
진 동	10~300Hz/1.5G/10minSR, XYZ, 30min/axis	3매
충 격	50G, 11msec, ±XYZ 1time/axis	3매
Box 진동	1.146Grms, 2~200Hz, Random, 30min / ±XYZ축	1Box(9매)
Box Drop	20cm, 1Angle, 3Edge, 6Face	1Box(9매)

HTOL/LTOL : High/Low Temperature Operating Life

THB : Temperature Humidity Bios

HTS/LTS : High/Low Temperature Storage

WHTS : Wet High Temperature Storage

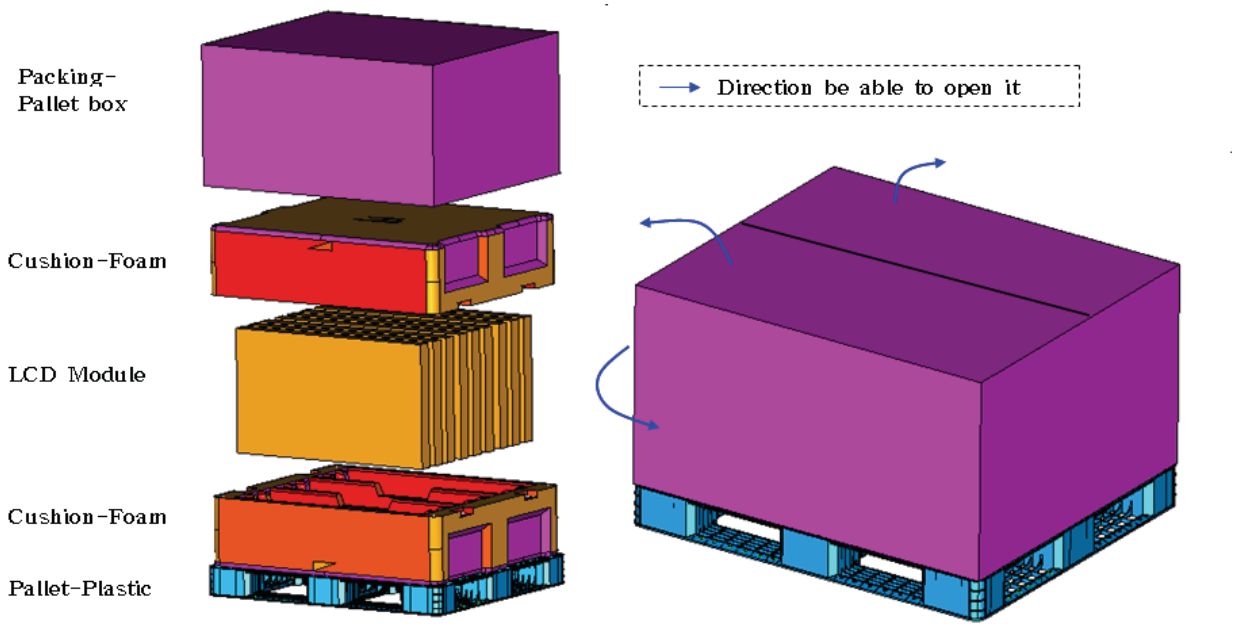
12. PACKING

12.1 Carton

(1) Packing Form

Corrugated fiberboard box and EPS cushion as shock absorber

(2) Packing 방법



12.2. Packing Specification

ITEM	Specification	Remark
LCD Packing	9ea / Box (Packing-Pallet Box)	1. 99 Kg / LCD (9ea) 2. 7 Kg / Cushion-pallet (2ea) 3. 6.7 Kg / Packing-Pallet Box (1ea) 4. Cushion-pallet Material : EPS 5. Packing-Pallet Box Material : DW4
Pallet-Plastic	1Box / Pallet (PE,W1150,L985,H125,BLUE)	1. Pallet weight = 8kg
Packing Direction	Vertical	
Pallet size	H x V x height	1150mm(H) x 985mm(V) x 609mm(height)
Pallet weight	120.7kg	Pallet (8kg) + Cushion-Foam (7kg) + Module (99kg) + Packing-Pallet Box (6.7kg)

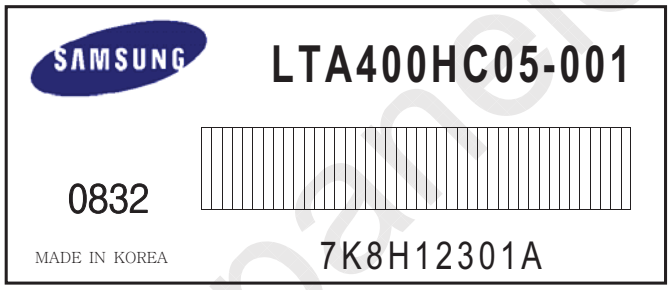
13. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1) Parts number : LTA400HC05-001
(2) Revision : One letter
(3) Control : One letter
(4) Lot number : 7 K 8 H 123 01 A
1 2 3 4 5 6 7

① 7 : Line
② K : Device
③ 8 : Year
④ H : Month
⑤ 123 : LOT NO
⑥ 01 : GLASS NO
⑦ A : CELL NO

(5) Nameplate Indication



(6) Bar code marking for Customer

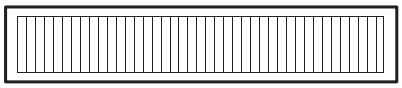
The bar code marking is attached to module backside.

1) MODEL NAME : LTA400HC05 - 001
2) SAMSUNG
3) MADE IN KOREA
4) PRODUCTION NUMBER
5) USER MODEL NAME

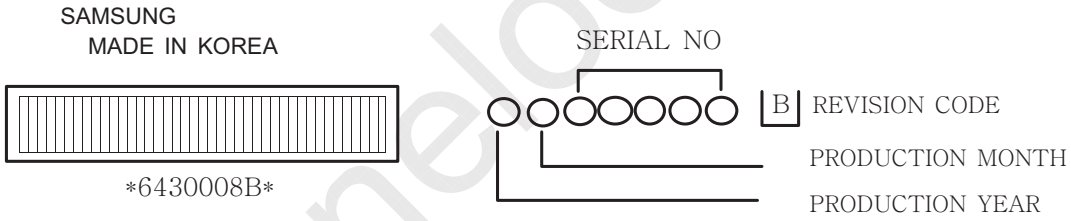
Bar code shows a) user model name, b) production number

a) User model name

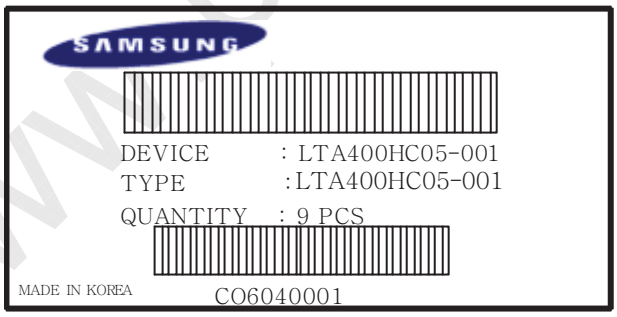
LTA400HC05 - 001



b) Production Number



(7) Packing box attach



14. General Precautions

14.1 Handling

(a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFL back-light.

(c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane.
Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(h) Protect the module from static , it may cause damage to the CMOS Gate Array IC.

(i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(j) Do not disassemble the module.

(k) Do not pull or fold the lamp wire.

(l) Do not adjust the variable resistor which is located on the module.

(m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(n) Pins of I/F connector shall not be touched directly with bare hands.

14.2 Storage

(a) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35C and relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

14.3 Operation

(a) Do not connect,disconnect the module in the "Power On" condition.

(b) Power supply should always be turned on/off by the item 6.3 "Power on/off sequence"

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(d) The cable between the back-light connector and its inverter power supply shall be a minimized length and be connected directly . The longer cable between the back-light and the inverter may cause lower luminance of lamp(CCFL) and may require higher startup voltage(Vs).

14.4 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the module may be damaged.

(d) If the module displays the same pattern continuously for a long period of time,it can be the situation when the image "Sticks" to the screen.

(e) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.