製 品 標 準

LTF320HF01-A01

LTF320HF01-A02

LTF320HF01-A03

V0.1

LCD 總括
開發 3G

항번	개정전 (From)	개정후 (To)
V00	최초 제정	
V01	Inverter Input Voltage 24V	Inverter Input Voltage 25V

1. 목적

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

2. 적용범위

TFT LCD LTF320HF01- A01 /A02 /A03

3. 일반개요

3.1 개요

LTF320HF01은 비정질 실리콘(Amorphous Silicon) 박막 트랜지스터(TFT; Thin Film Transistor)를 스위칭 소자로 사용한 컬러 능동 행렬(Color active matrix) 방식의 TFT 액정 표시소자(LCD:Liquid Crystal Display) Module이다. Module은 Panel, 구동 회로부와 Backlight 부로 구성되며, Interface방법은 Digital 영상정보를 직렬로 고속 전송하는 방식의 일종인 LVDS방식을 채용하였다. 본 제품은 1,920 * 1080(16:9) 화소를 포함하고, 16.7M의 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 FHD (1,920 * 1080 화소) 지원 (16:9)
④ SPVA (Super Patterned Vertical Align) Mode 광시야각(±178°)
⑤ 4U Lamp B/L Unit 설계 적용
⑥ Sync Format : DE(Data Enable) Mode 지원, H/V-sync 지원 불가
⑦ 2CH-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	698.4 (H) ×392.85 (V) (대각선 31.54")	mm	
구동소자	a-Si TFT Active matrix		
표현가능색 수	16.7M (8 Bits-True)	color	16,777,216
화소수	1,920 × 1080	pixel	16:09
화소배열	RGB Vertical Stripe		
화소크기	0.12125 (H) × 0.36375 (V)	mm	
표시모드	Normally Black		
표면처리	Haze 0 % ,표면 경도(2H)		

4. 기구사양

Item		Min.	Typ.	Max.	Note
Module size	Horizontal(H)	759	760	761	mm
	Vertical(V)	449	450	451	mm
	Depth(D)	48.2	49.2	50.2	mm (With Inverter)
Weight (With Inverter)		-	5100	5500	g

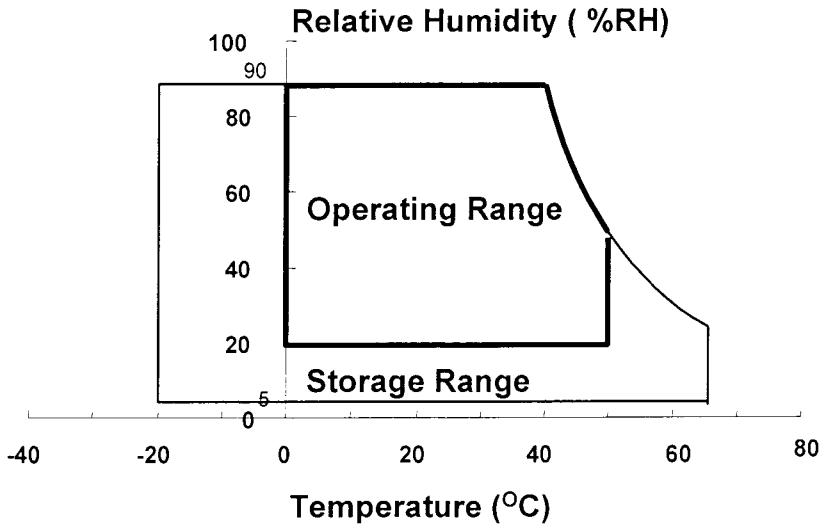
5. 절대 최대 정격

5.1 환경 사양 절대 정격

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperature	T_{STG}	-20	65	℃	**(1)**
Operating temperature	T_{OPR}	0	50	℃	**(1)**
	Tsur	0	65	℃	**(2)**
Shock(Non-operating)	Snop	-	50	G	**(3)**
Vibration(Non-operating)	Vnop	-	1.5	G	**(4)**

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

NOTE (2) 동작중 Panel의 표면온도로서 일부범위에서는 화질상의 문제가 발생할수 있지만, 편광판등의 자재가 영구적인 손상을 받지 않는 범위임.



NOTE (3) 20ms ±X,Y,Z (6방향 / 1회)

NOTE (4) 10~300Hz/1.5G /11 min SR, XYZ, 30 min/axis

5.2 전기적 사양 절대 정격

5.2.1 TFT LCD MODULE 절대 정격

(V_{DD} = 12 V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage/ Display	V_{DD}	10.8	13.2	V	**(1)**

NOTE(1) 동작온도 범위안에서.

5.2.2 BACK-LIGHT UNIT 절대정격

(Ta:25±2℃)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage/ Inverter	V_{dc}	22	26	V	(1)
Lamp Frequency	F_L	40	80	kHz	(2)

NOTE(1) AC전원

NOTE(2) 최대치를 초과할 경우, 영구적인 결함이 발생할 수 있음. 명시된 정상조건 내에서 구동되어야함.

NOTE(3) 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 60분 이상

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

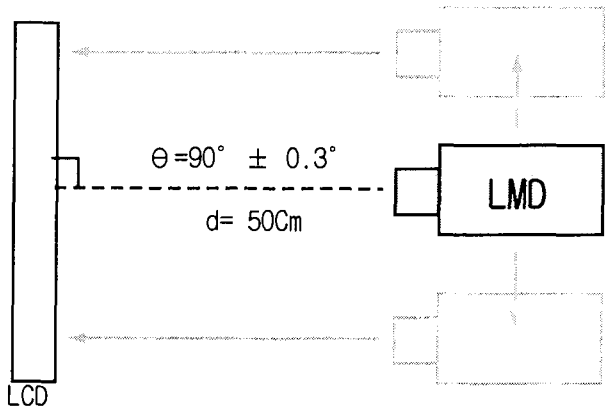
$$T_{warm\text{-}up} = (\,|\,Lum_{t-10} - Lum_{now}\,|\,/\,Lum_{now}\,) \times 100 < 0.5 \text{ 가 되는 시간}$$

where , Lum_{t-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°
SR-3	1°

6.3 구동 조건

-. TFT LCD Module : VDD = 12.0 V, fV = 120 Hz, fDCLK = 297 MHz

-. BACK-LIGHT UNIT : INVERTER =62.5 (KHz ±2.5Khz), DUTY 100%

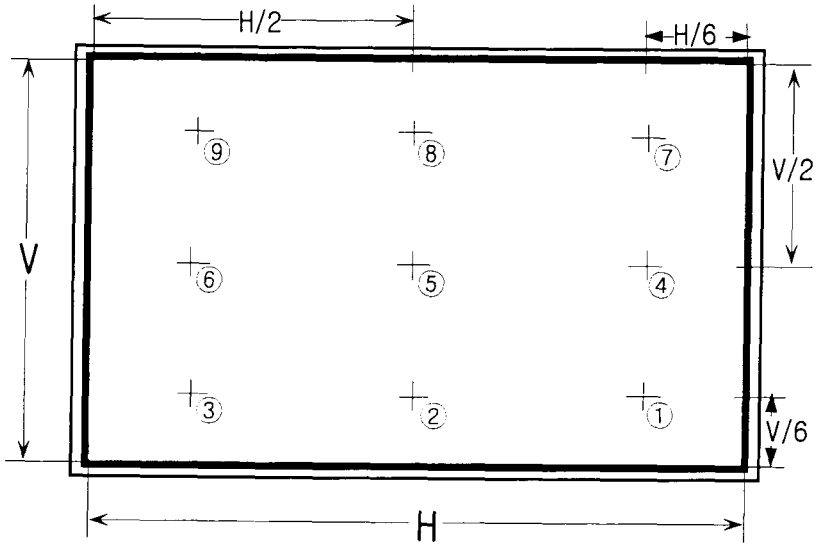
6.4 광학 특성

ITEM		SYMBOL		MIN.	TYP.	MAX.	UNIT	LMD	NOTE
Luminance of White (center)		$Y_{L.AVG}$		450	500	-	cd/㎡	SR-3	(1)
Contrast Ratio (center)		CR		5,000	6,000	-	-		
Brightness Uniformity (9point or 13Point)		Buni		-	-	25	%		
Color Chromaticity (CIE 1931)	Red	Rx		typ. -0.025	0.636	typ. +0.025	-	SR-3	Center Point
		Ry			0.336				
	Green	Gx			0.289				
		Gy			0.599				
	Blue	Bx			0.148				
		By			0.068				
	White	Wx			0.280				
		Wy			0.290				
Color Gamut		-		69	72	-	%		
Color Temperature		CCT		7,000	10,000	13,000	K		
Viewing Angle (CR≥10)	Hor.	θL		79	89	-	Degrees	EZ	(2)
		θR		79	89	-			
	Ver.	θH		79	89	-			
		θL		79	89	-			
Crosstalk		D_{SHA}	101-255	-	-	5.0	%		(3)
			20-100	-	-	15.0			
			0 - 19	-	-	X(관리안함)			
Flicker		F		-	6	10	-	BM-7	(4)*
GAMMA				1.9	2.2	2.5			PI 기재 불가
Response time	G to G 평균	-		-	6	9	ms		(5)

*내부 관리 (생산시 최소 조절)

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.

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

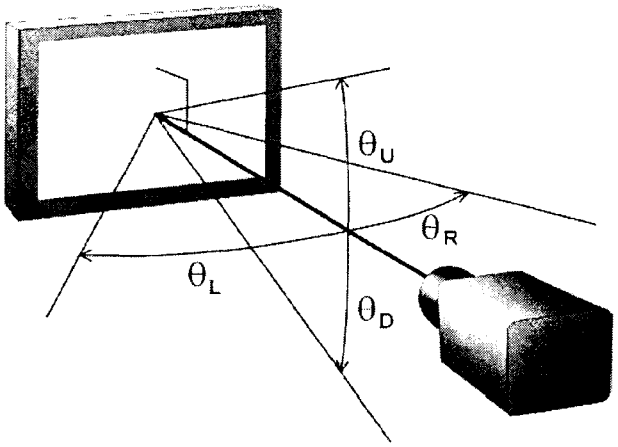
where, Bmax = Maximum Brightness

Bmin = Minimum Brightness

④ 권장 Dimming 전압 범위 : **3.3V(휘도 500cd/㎡ 조건)**

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.

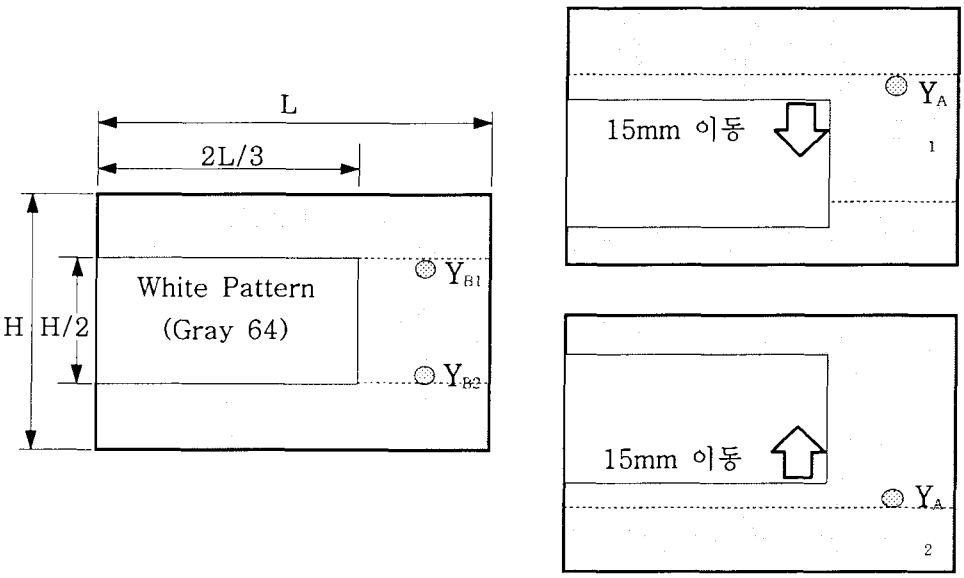
$$Crosstalk\ Modulation\ Ratio(D_{SHA}) = \frac{|Y_{normal} - Y_{abnormal}|}{Y_{normal}} \times 100(\%)$$

* 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

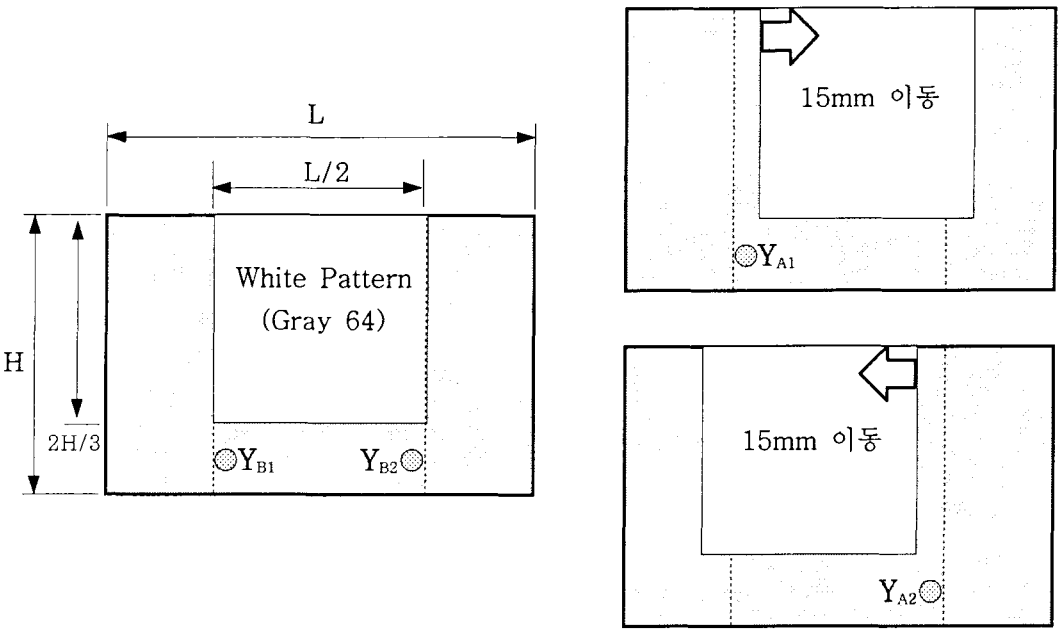
참고 : Normally White mode시 Box는 Black(Gmin) /Normally Black mode시 Box는 white(Gmax)

* Crosstalk 측정 Pattern 및 Point

Horizontal Crosstalk



Vertical Crosstalk

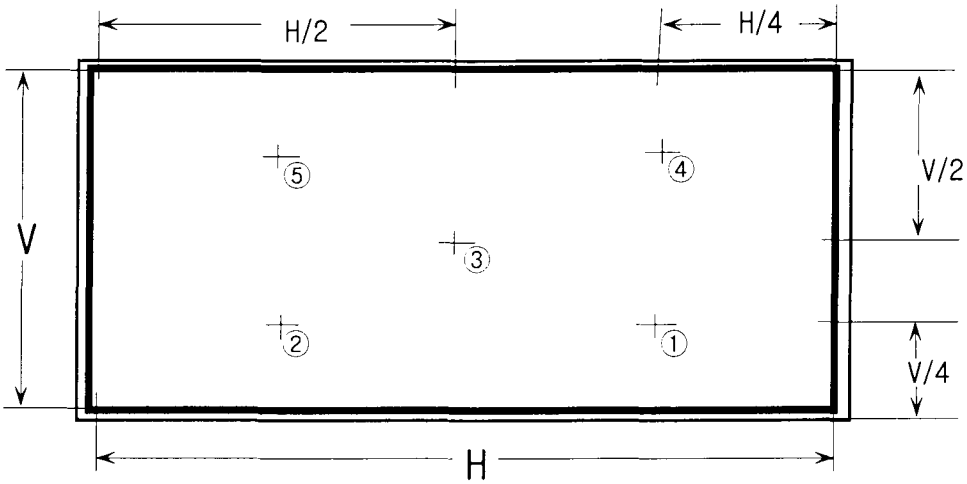


NOTE (4)

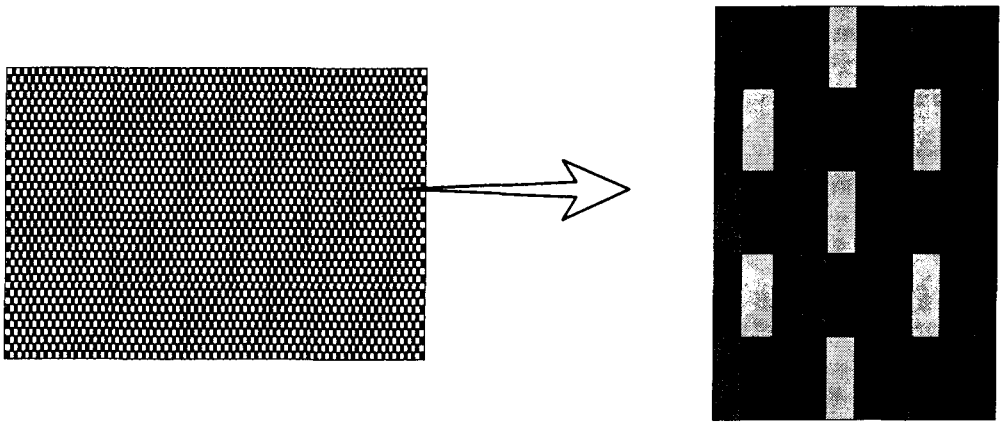
▶ 화면의 번쩍 거림(Flicker)의 정의 : LCD Panel의 화면이 깜박거리는 현상.

① 계산식은 Flicker 측정표준에 준함.

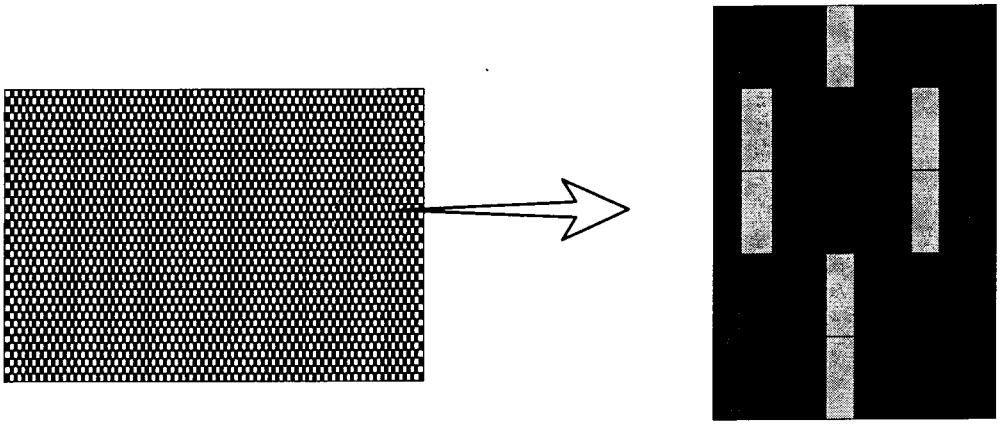
② 측정위치



③ Flicker 측정 Pattern :



Dot Inversion 구동일 경우

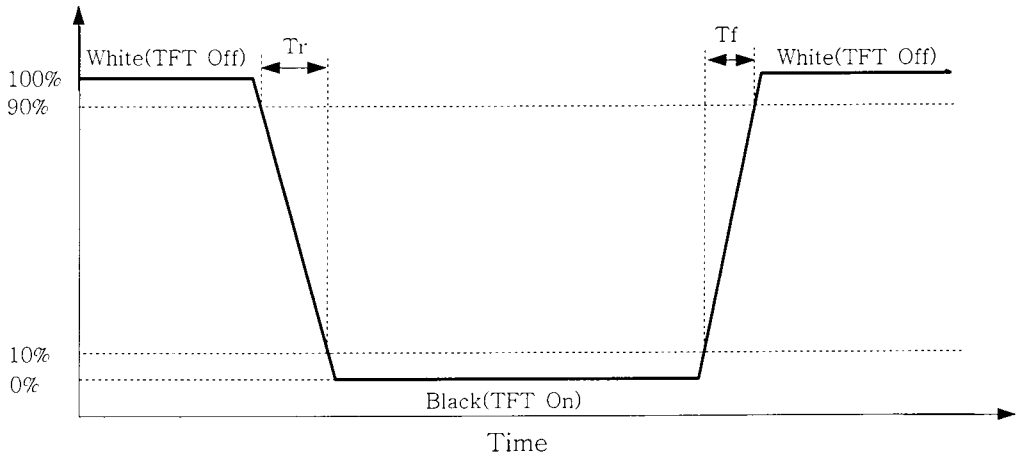


2 Dot Inversion 구동일 경우

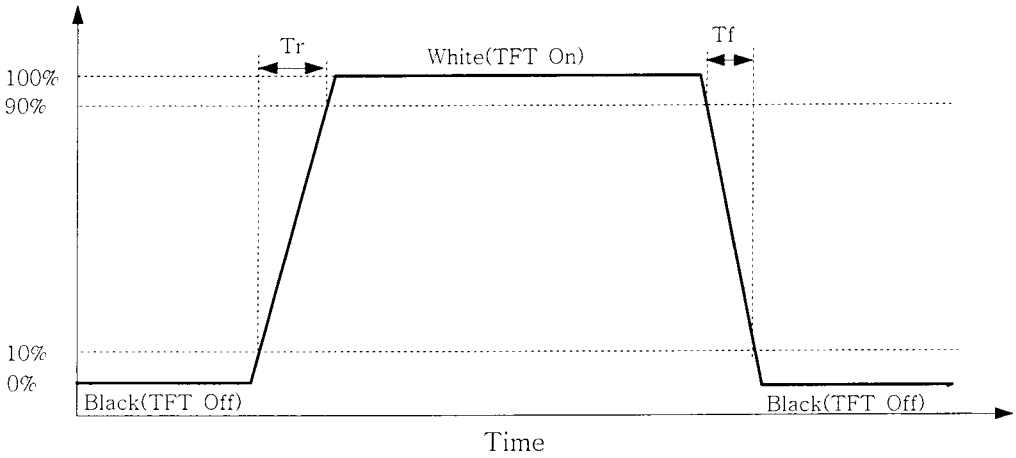
NOTE (5)

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

① Normally White mode일 경우



② Normally Black mode일 경우



③ 응답속도 6ms는 전 gray to gray 의 평균치를 의미 함.

7. 전기적 특성

7.1 TFT LCD 모듈

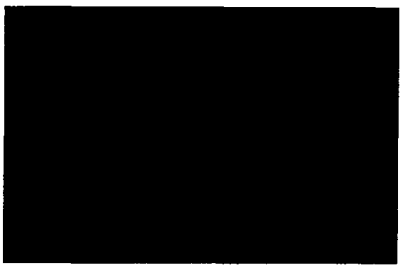
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Power Supply Voltage	V_{DD}	10.8	12	13.2	V	(1)
Interface Type	LVDS	Tcon 내장형				
Power Consumption	(a) Black	-	700	900	mA	(2),(3),(5)
	(b) White	-	700	900	mA	
	(c) N-pattern	-	900	1100	mA	
Vsync Frequency	f_V	95	120	125	Hz	
Hsync Frequency	f_H	120	135	140	kHz	
Main Frequency	f_{DCLK}	260	297	310	MHz	
Rush Current	I_{RUSH}	-	-	7	A	(4)

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

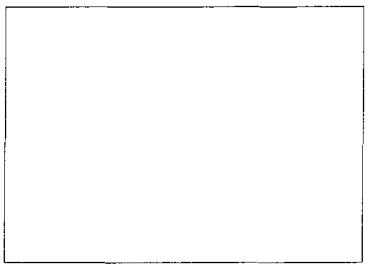
(2) f_V = 120 Hz, f_{DCLK} = 297 MHz, V_{DD} = 12.0V, V_{CC} = 12.0V, DC current

(3) 소비전력 체크 패턴

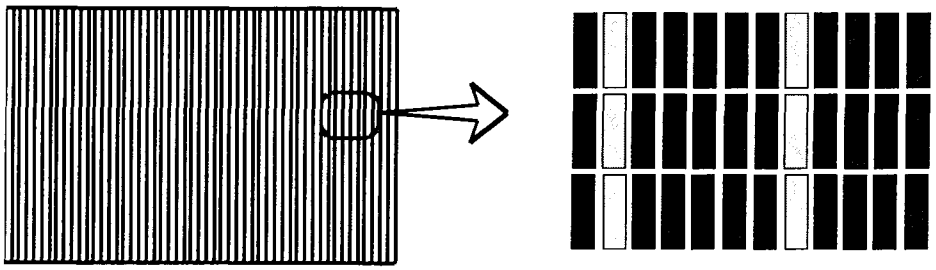
(a) Black 패턴



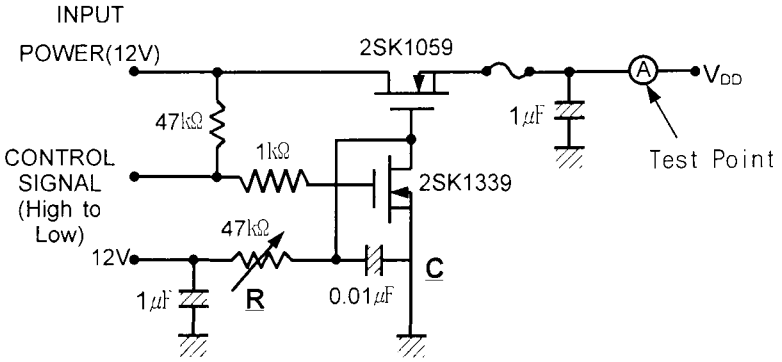
(b) White 패턴



(c) N-패턴



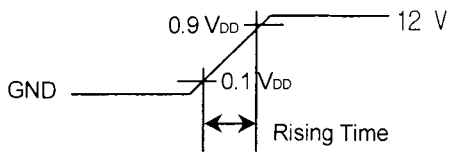
(4) 측정조건 (12V 구동, rising time =470㎲)



Note : Control Signal : High(+12 V) -->Low(Ground)

All Signal lines to panel except for power 12V : Ground

The rising time of supplied voltage is controlled to 470us by R and C value.



(5) Inverter의 소비전류는 포함하지 않은 상태임.

7.2 Inverter

7.2.1 Specification for Customer

ITEM	SYMBOL	CONDITION	SPECIFICATION			UNIT
			MIN	TYP	MAX	
Supply Voltage & Current						
Input Voltage	Vin		21.6	24	26.4	Vdc
Input Current	IIN				4.3	ADC
Output Section						
Output Current (Note1)	$I_{O,1}$~$I_{O,14}$ (I-MAX)	Vin =24V,Dim=3.3V (After 1Hr aging)	11.8	12.5	13.2	mA (rms)
Open Lamp Voltage (Note2)	$V_{OPEN,1}$~$V_{OPEN,14}$	Vin =24V Dim=3.3V, All-lamp is NC	2540			Vrms
ENABLE						
Enable Logic	V_{ON}		2.4		5.25	VDC
Disable Logic	V_{OFF}		-0.3		0.8	VDC
EXTERNAL PWM DIMMING						
HIGH Logic	V_{HIGH}		3.3		5.2	VDC
LOW Logic	V_{LOW}		-0.3		0.4	
FREQUENCY (Note4)	$F_{EXT,PWM}$	Vin =24V	156	166	176	Hz
PWM Duty range	$D_{INT,\ PWM}$	Vin =24V	15		100	%
SWITCHING CHARACTERISTICS						
FREQUENCY	Fop	Vin =24V, Dim=3.3V	61	63	65	kHz
Shut-down time	$T_{SD,1}$ ~ $T_{SD,14}$	Vin =24V, Dim=0~3.3V	1.0	1.5	2.0	sec

Note1) Open Voltage Measure Method

Note2) When EX-DIM(Pin 14) is used, DIM(Pin13) has to be open or connected to ground.

Note3) EX-PWM Frequency is selected not to interfere the Waterfall & Acoustic Noise.

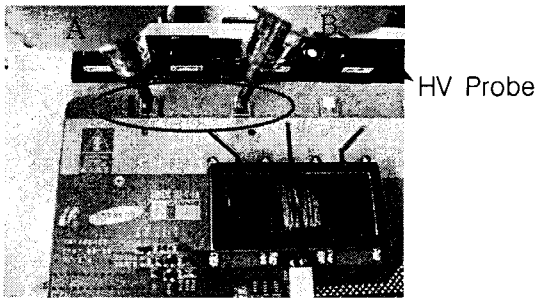


Figure1 (O)

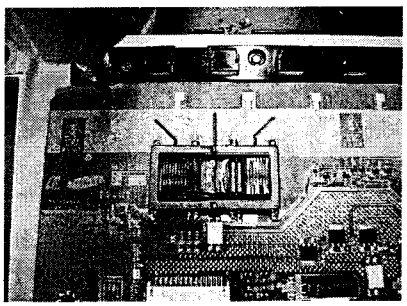
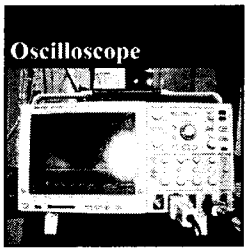
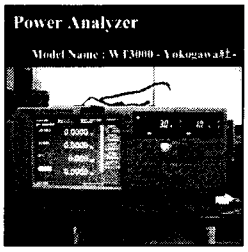


Figure2 (X)

APPENDIX : Input Current

정의	OverShoot : 1Hr Aging 하여 측정된 입력전류 값 중 초기 Max 값 Saturation : 1Hr Aging 후의 입력전류
측정장비	 
측정조건	입력조건 : Vin=24(V), Vdim=Max(V) 환경조건 : 상온(25도), 1시간 Aging후, Typ Torr Lamp BLU
측정 결과	

	Typ	Max	UNIT
Overshoot	3.42	3.65	A
Saturation	3.12	3.32	A

7.3 백 라이트 유닛(BackLight Unit)

7.3.1 Specification for Customer

(Ta:25±2℃)

Parameter	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Operating Life Time	Hr	50,000	-	-	Hour	**(1)**

7.3.2 Internal Specification

Parameter	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Lamp Current	I_L	12.0	12.5	13.0	mA_{rms}	**(2)**
Lamp Voltage	V_L	-	1615		V_{rms}	
Lamp Frequency	f_L	-	62.5	-	kHz	
Start Up Voltage	Vs	-	-	0℃:2670 25℃:2140	Vrms	**(3)**

NOTE (1) 램프수명은 램프 전류 보증범위에서 연속구동시 표준상태에서 휘도가 원래 밝기의 50%이하 밝기로 될때까지의 시간으로 정의함.(Ta=25℃)

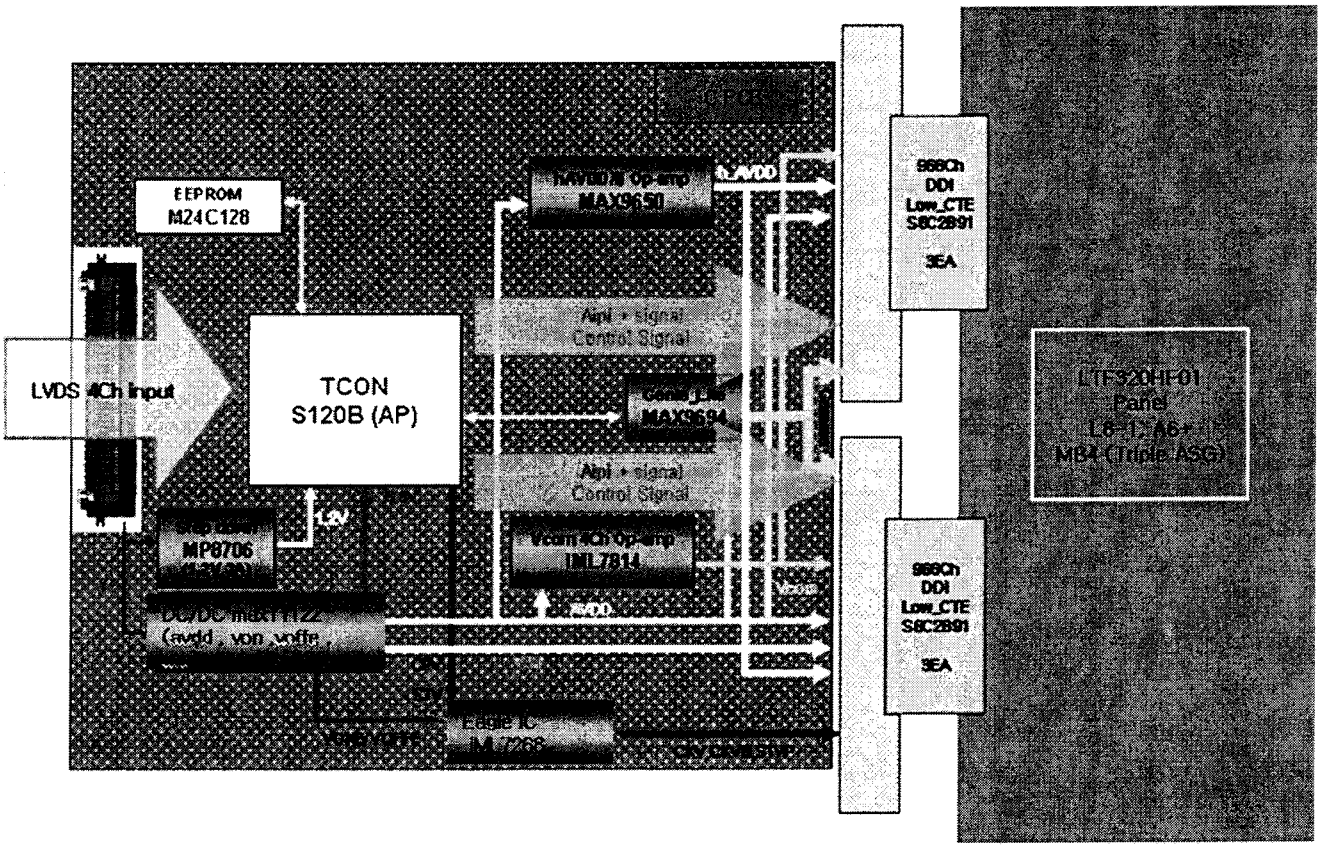
- 상기 수명은 Lamp 단품 수명임

(2) INVERTER HOT 기준

(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

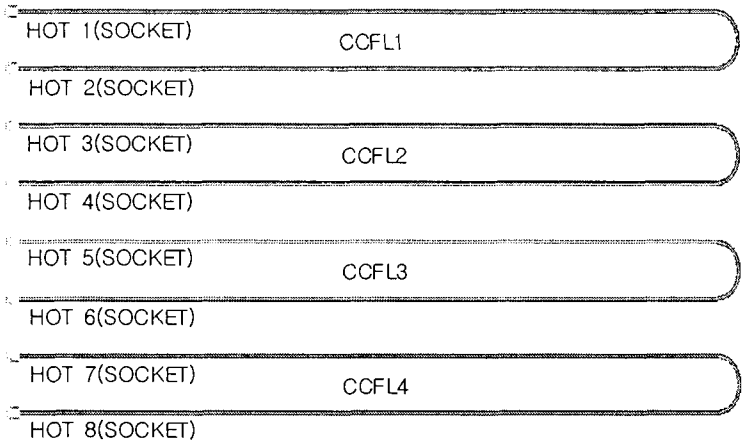


< LCD Circuit Block (Control) >

< LCD Panel >

8.2 Back Light

□ HOT 사양 : Socket(Inverter 삽입부 有)



9. 입력단 신호 순서(Input Terminal Pin Assignment)

9.1 TFT LCD 모듈(Interface signal & power)

connector : **82PIN (UJU))**

No		No	
1	DC power supply V_{DD}(+12[V])	26	Even LVDS Signal +
2	DC power supply V_{DD}(+12[V])	27	Even LVDS Signal -
3	DC power supply V_{DD}(+12[V])	28	Even LVDS Signal +
4	DC power supply V_{DD}(+12[V])	29	Even LVDS Signal -
5	DC power supply V_{DD}(+12[V])	30	Even LVDS Signal +
6	Not Connected *	31	GND
7	GND	32	Even LVDS Clock -
8	GND	33	Even LVDS Clock +
9	GND	34	GND
10	Odd LVDS Signal -	35	Even LVDS Signal -
11	Odd LVDS Signal +	36	Even LVDS Signal +
12	Odd LVDS Signal -	37	Even LVDS Signal -
13	Odd LVDS Signal +	38	Even LVDS Signal +
14	Odd LVDS Signal -	39	GND
15	Odd LVDS Signal +	40	SCL_I
16	GND	41	Not Connected *

No	
82	Not Connected
81	Odd LVDS Signal -
80	Odd LVDS Signal +
79	Odd LVDS Signal -
78	Odd LVDS Signal +
77	Odd LVDS Signal -
76	Odd LVDS Signal +
75	GND
74	Odd LVDS Clock -
73	Odd LVDS Clock +
72	GND
71	Odd LVDS Signal -
70	Odd LVDS Signal +
69	Odd LVDS Signal -
68	Odd LVDS Signal +
67	GND
66	Even LVDS Signal -
65	Even LVDS Signal +
64	Even LVDS Signal -
63	Even LVDS Signal +
62	Even LVDS Signal -

*	NOT CONNECTED : THIS PINS ARE ONLY USED FOR SEC INTERNAL OPERATIONS
**	LVDS OPTION : IF THIS PIN : LOW (GND V) : JEIDA LVDS FORMAT
	OTHERWISE : HIGH (3.3V) : NORMAL NS LVDS FORMAT
Sequence	On = Vdd(T1) → LVDS Option → Interface Signal(T2)
	OFF = Interface Signal(T3) → LVDS Option → Vdd

9.2 INVERTER UNIT

9.2.1 Inverter input pin Configuration(1)

Connector :20022WR-14AML (연호)

PIN NO.	**PIN** Configuration (FUNCTION)
1	Vin (24V)
2	Vin (24V)
3	Vin (24V)
4	Vin (24V)
5	Vin (24V)
6	GND
7	GND
8	GND
9	GND
10	GND
11	Error Out : ERROR OUT SIGNAL
12	ON/OFF : (CCFL Drive SIGNAL (Active HIGH))
13	No connect
14	EXT DIM :EXTERNAL PWM DIMMING SIGNAL (PULSE)

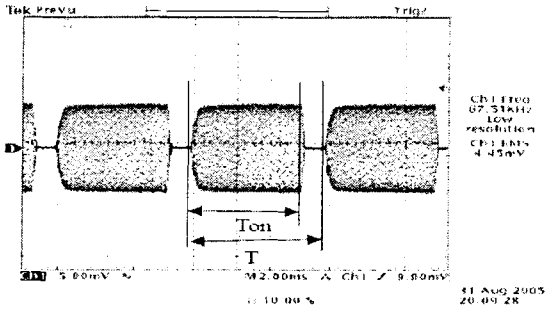
*Harness의 wire는 AWG24 type을 사용할 것.

9.2.2 Inverter input condition

Parameter	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Vin	Vin	21.6	24	26.4	V	
	Iin	-	-	4.3	Arms	
EX_Dim	Duty	15	-	100	%	**(1)**
	High(on)	3.3	-	5.25	V	
	Low(off)	-0.3	-	0.4		
	Fpwm	156	166	176	Hz	
ENA	on	2.4 ~ 5.25			V	
	off	0 ~ 0.8				

Note(1) High-duty = Ton/T * 100

※: **Duty Condition(Iout)**



D(%) = Ton ÷ T × 100

9.3 입력신호와 표시색상과의 관계

COLOR	DISPLAY	DATA SIGNAL																								GRAY SCALE LEVEL
		RED								GREEN								BLUE								
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	
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	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	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	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	0	0	0	0	0	0	0	0	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	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	-
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	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	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	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R252
	↓ LIGHT	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255
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	G0
	DARK ↑	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G252
	↓ LIGHT	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G254
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G255
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	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B252
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B254
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B255

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)

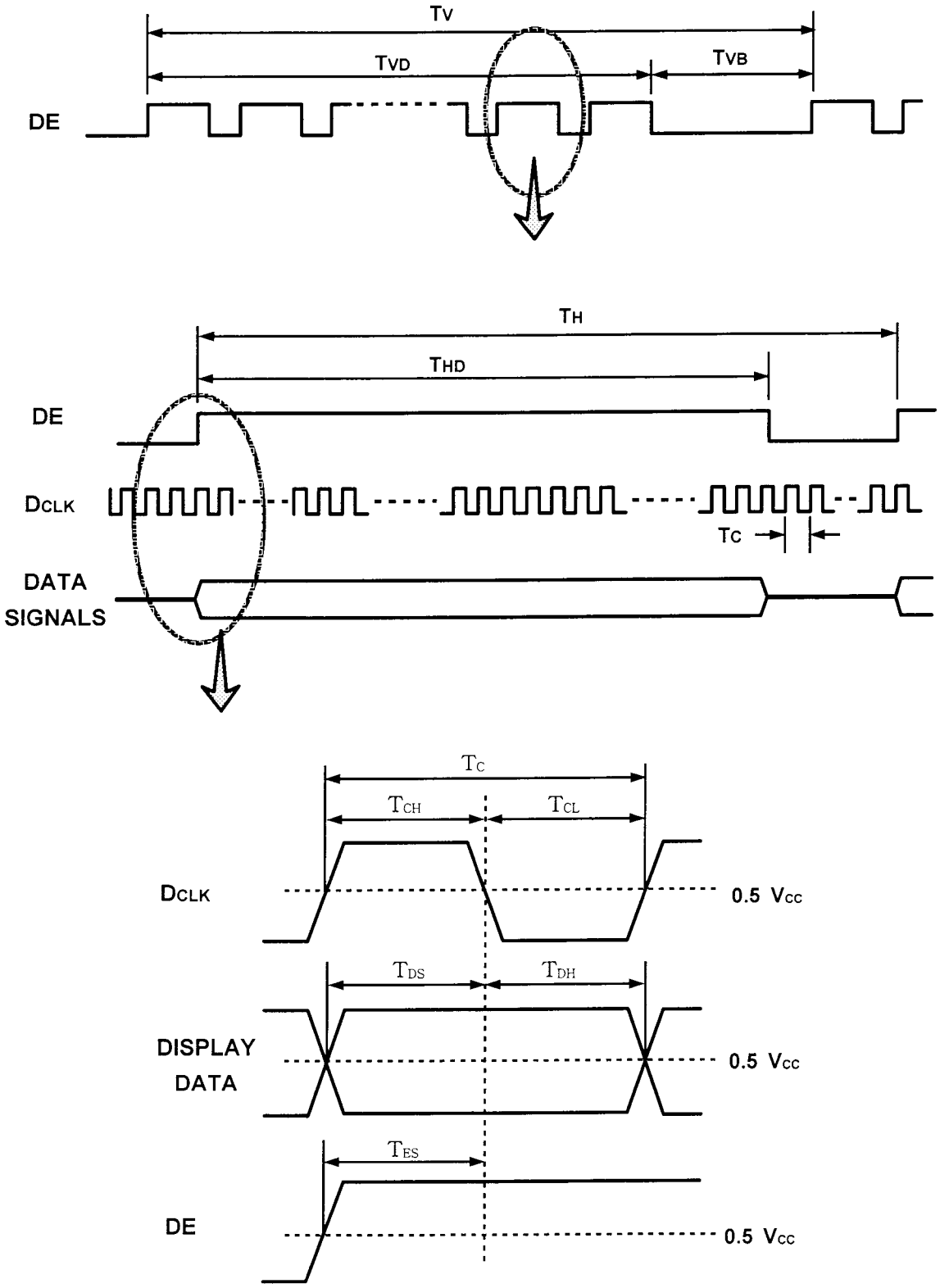
SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Clock	Frequency	1/Tc	240	297	310	MHz	-
Hsync		Fh	100	135	140	KHz	-
Vsync		Fv	90	120	125	Hz	-
Vertical Active Disply Term	Display Period	TVD	-	1080	-	lines	-
	Vertical Total	TVB	1092	1125	1350	lines	-
Horizontal Active Display Term	Display Period	THD	-	1920	-	clocks	-
	Horizontal Total	TH	2090	2200	2350	clocks	-

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

10.2 Spread Spectrum 적용범위

Spread Spectrum 방식	Modulation Rate (max)	Modulation Frequency (max)
Input SS	±1.5%	300KHz

10.2 인터페이스 신호의 타이밍 다이어그램(DE Mode)

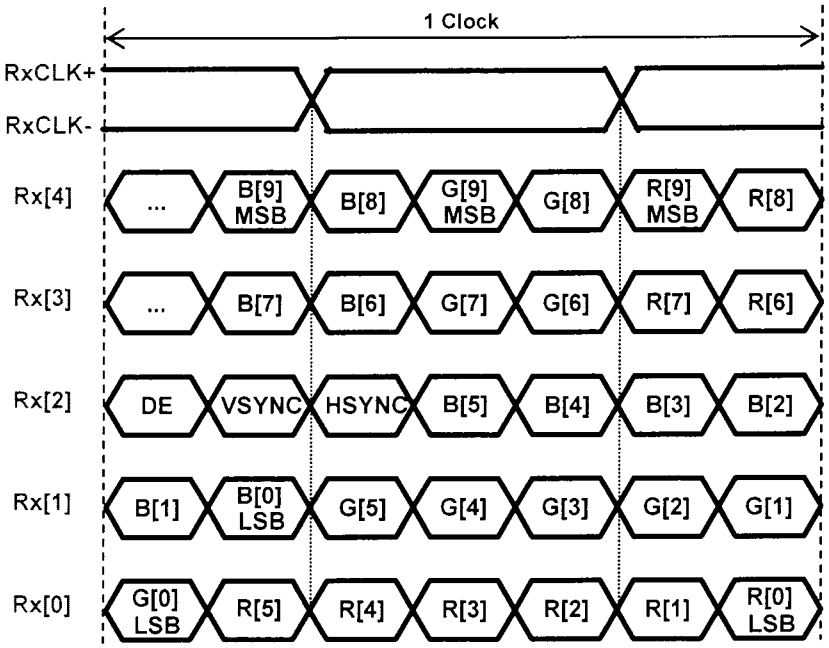


10.4 LVDS Interface

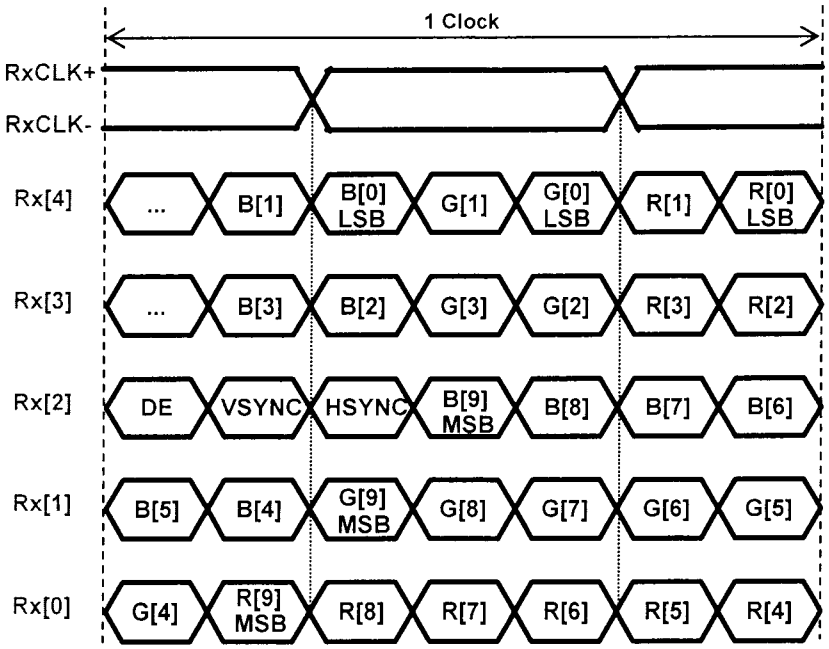
- LVDS Receiver : Tcon내장형
- Normal Data Format

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

NORMAL FORMAT (Each Channel)

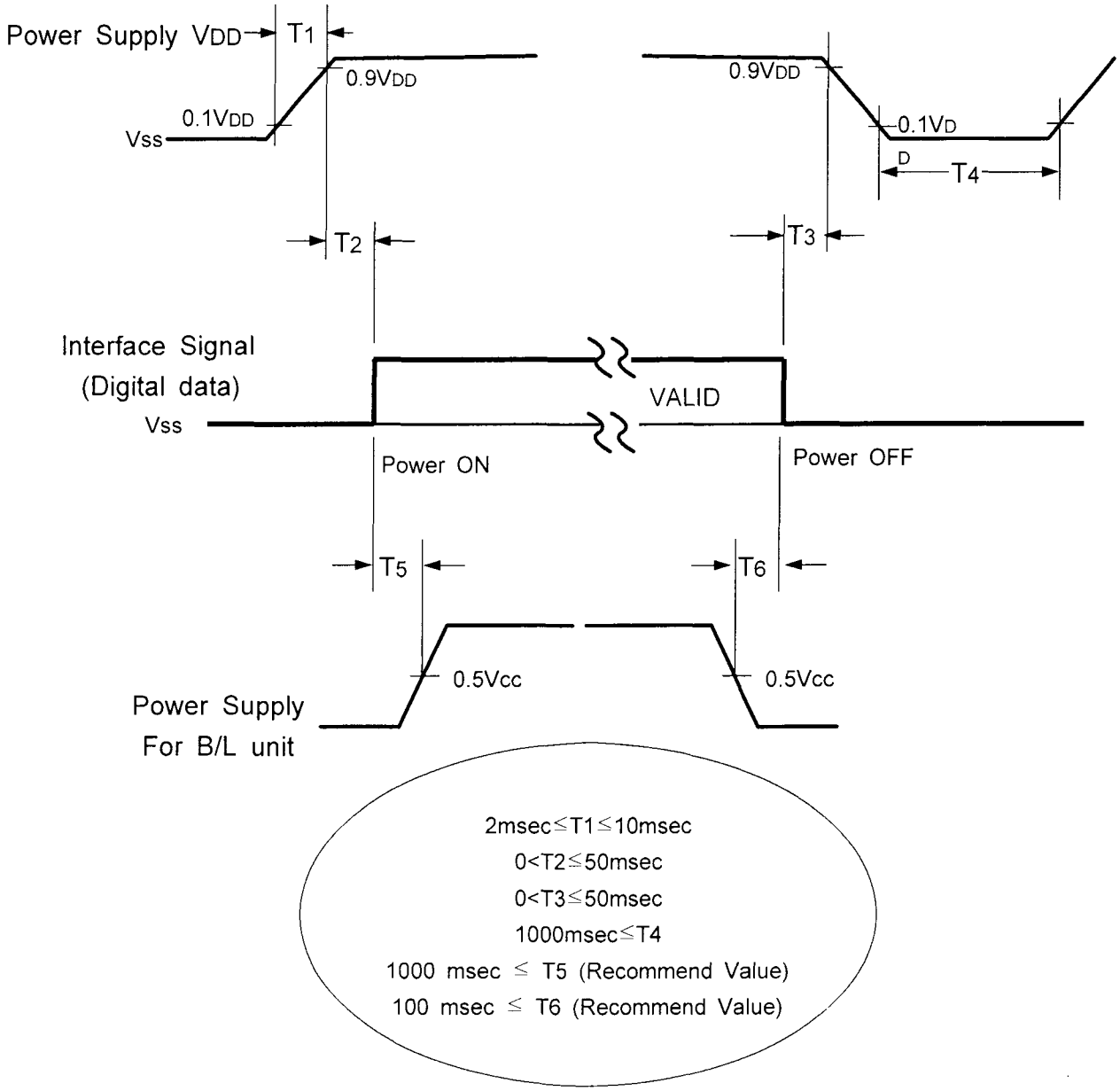


JEIDA FORMAT (Each Channel)



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

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



NOTE

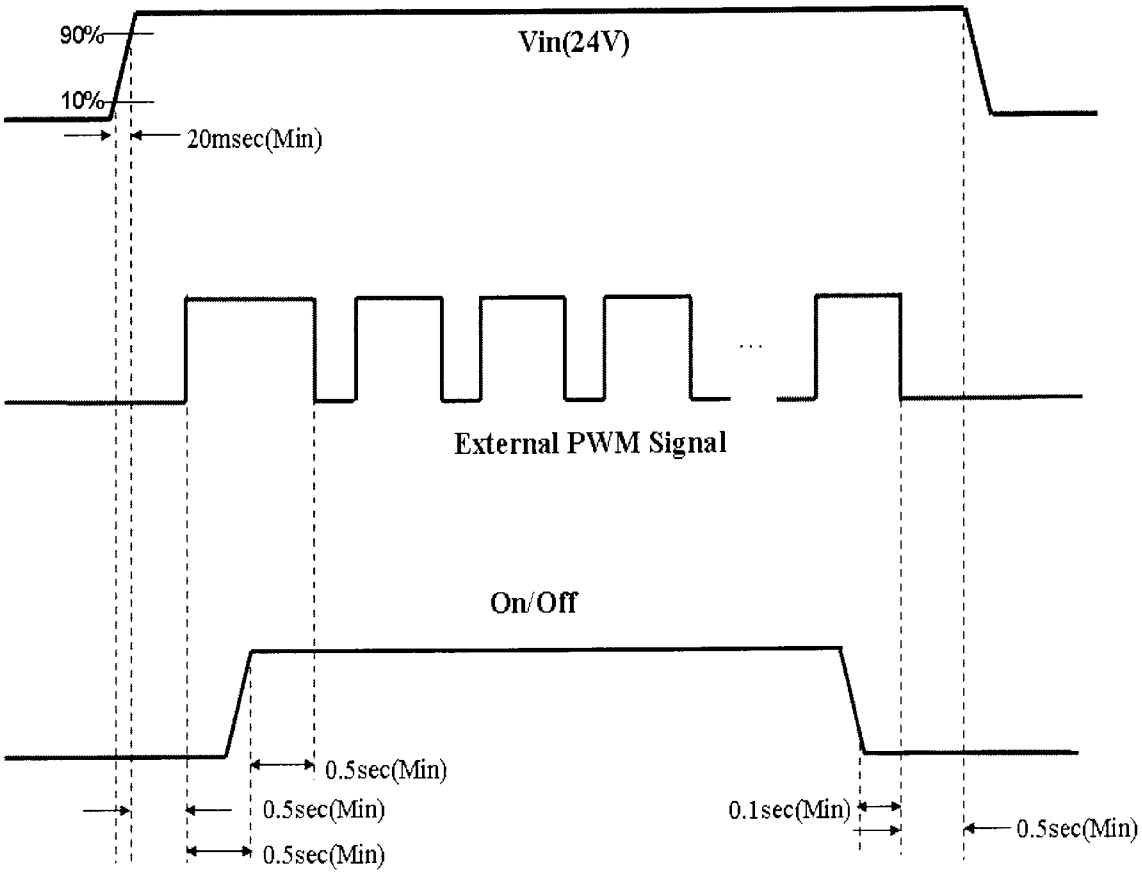
(1) 모듈에 신호를 인가하는 외부장치의 전원은 V_{DD}와 같아야 한다.

(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.

10.5 INVERTER B/D SEQUENCE



11. 신뢰성 수명 시험조건

시험항목	시험 조건	시료수
온도특성	-20 ~ 60℃, 10cycle	4EA
HTOL	50℃, 1000HR	8EA
LTOL	0℃, 1000HR	4EA
RTOL	25℃, 계속 ~	4EA
HTS	70℃, 500hr	4EA
LTS	-30℃, 500hr	4EA
THB	40℃ / 95%RH, 500hr	4EA
WHTS	60℃ / 75%RH, 500hr	4EA
T/C	-20 ℃ ~ 60 ℃, 200Cycle	4EA
ESD (비구동)	C D M : ±10 kV,150pF/330 Ω,9Point,3회/Point	3EA
ESD(구동)	접촉 : ±8 kV ,150pF/330Ω,200Point,1회/Point 비접촉 : ±15 kV,200pF/100Ω,200Point,1회/Point	각 3EA
POWER ON/OFF	30초(on) / 30초(off) : 12,000 회	4EA
진 동	10~300Hz/1.5G/10minSR, XYZ, 30min/axis	3EA
충 격	50G, 11msec, ±XYZ 1time/axis	3EA
PALLET 진동	1.05 Grms, Random, Z축 1Hr	1PALLET(20EA)
PALLET Drop	밑면 4능 : 20 cm	1PALLET(20EA)

HTOL/LTOL : High/Low Temperature Operating Life

THB : Temperature Humidity Bios

HTS/LTS : High/Low Temperature Storage

WHTS : Wet High Temperature Storage