

# AZ DISPLAYS, INC.

## 1. MECHANICAL DATA

(1) Product No.	<b>AGM3224S</b>
(2) Module Size	154.6 (W)mm x 114.8 (H)mm x 9.0 (D)mm
(3) Dot Size	0.09 (W)mm x 0.33 (H)mm
(4) Dot Pitch	0.12 (W)mm x 0.36 (H)mm
(5) Number of Dots	320 (W)xRGB x 240 (H)DOTS
(6) Duty	1/240
(7) LCD	F-STN: Color STN module Rear Polarizer: Color Transmissive Type
(8) Viewing Direction	6 O'clock
(9) Backlight	CCFL
(10) Controller	Excluded
(11) DC/DC Converter	Excluded
(12) Weight	195 g(approx.)

Date: December 6, 2002

# AZ DISPLAYS, INC.

AGM3224S

## 2. ABSOLUTE MAXIMUM RATINGS

### (1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	6.5	V	
Power Supply for LCD Drive	VEE-VSS	0	30	V	
Input Voltage	VI	-0.3	VDD+0.3	V	
Static Electricity	-	-	-	-	Note 1

### (2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	-20	70
Humidity (Without Condensation)	Note 2,4		Note 3,4	

Note 1 LCM should be grounded during handling .

Note 2 Ta  $\leq$  50°C : 85%RH max

Ta > 50°C : Absolute humidity must be lower  
than the humidity of 85%RH at 50°C

Note 3 Ta at -20°C will be < 48 hrs, at 70°C will be < 120 hrs

Note 4 Background color will change slightly depending on ambient temperature.  
This phenomenon is reversible.

## 3. ELECTRICAL CHARACTERISTICS

### 3-1. ELECTRICAL CHARACTERISTICS OF LCM

T<sub>a</sub>=25°C, VDD=5V±5%

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Logic Circuit Power Supply	VDD-VSS	T <sub>a</sub> = 25°C	4.75	5.0	5.25	V	
Input Voltage	VIH	H level	0.8VDD	-	VDD	V	
	VIL	L level	0	-	0.2VDD	V	
Recommended LCD Driving Voltage	VEE-VSS (Vop)	Duty=1/240 VDD=5.0V	0°C	25.6	25.9	26.2	V
			25°C	25.3	25.6	25.9	
			50°C	24.3	24.6	24.9	
Supply Current for Logic	IDD	VDD-VSS=5.0V VEE-VSS=25.8V FLM=120Hz T <sub>a</sub> =25°C	-	0.8	1.2	mA	
Supply Current for LCD	IEE	PATTERN : <div style="display: flex; justify-content: space-around; font-family: monospace; font-size: 0.8em;"> <span>■ □ ■ □ ■ □ ■ □</span> <span>□ ■ □ ■ □ ■ □ ■</span> </div>	-	4.8	7.2	mA	
LCM Surface Luminance	L	VDD-VSS =5.0V VEE-VSS =25.8V T <sub>a</sub> =25°C I <sub>L</sub> =5mA  Transmissive, STN	PATTERN: (Dots All On of White Color) <div style="display: flex; justify-content: space-around; font-family: monospace; font-size: 0.8em;"> <span>□ □ □ □</span> <span>□ □ □ □</span> </div>	-	201	-	cd/m <sup>2</sup>
			PATTERN: (Dots All Off) <div style="display: flex; justify-content: space-around; font-family: monospace; font-size: 0.8em;"> <span>■ ■ ■ ■</span> <span>■ ■ ■ ■</span> </div>	-	11.6	-	
Recommended Frame Frequency for Optimum Contrast	FLM	-	120	140	150	Hz	

## 3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

### Lamp Rating

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	V <sub>L</sub>	—	474	—	Vrms	—
Lamp current	I <sub>L</sub>	2	5	6	mArms	
Lamp power consumption	P <sub>L</sub>	—	2.37	—	W	(*1)
Starting Voltage	V <sub>S</sub>	670	—	—	Vrms	Ta=25°C
		880	—	—	Vrms	Ta=0°C
Lamp frequency	F <sub>L</sub>	35	50	65	KHz	
Lamp life time	L <sub>L</sub>	—	40000	—	hrs	IL = 5 mArms(*2)

(\*1) Power consumption excluded inverter loss .

(\*2) CCFL lifetime is defined as the time taken for the brightness to reduce to 50% of original value.

### Recommend CCFL Inverter Electrical Characteristics :

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Output Current	I <sub>rms</sub>	4.1	5	6.6	mA	—
Input Current	I <sub>dc</sub>	—	0.5	0.73	A	—
Output power	P <sub>out</sub>	—	—	4	W	—
Starting Voltage	V <sub>open</sub>	900	1400	—	Vrms	Ta=0 to +50°C
Oscillation Frequency	F	35	50	65	KHz	—

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## 4. OPTICAL CHARACTERISTICS

### 4-1. Optical Char. of Normal Temp. Mode

AT Vop

ITEM MODE		Cr(Contrast Ratio)						$\theta$ (Viewing Angle)		$\phi$ (Viewing Angle)	
		0°C		25°C		50°C		25°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	M	20	30	25	35	5	10	—	F: 60 R: 40	—	±55
NOTE		NOTE 6						NOTE 5			

note:

T: TRANSMISSIVE

M: FOR 6 O'CLOCK STN MODULE

AT  $\phi=0^\circ$   $\theta=0^\circ$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	—	750	900	ms	NOTE 2
		25℃	—	300	400		
		50℃	—	130	160		
Response Time (fall)	Tf	0℃	—	350	450	ms	NOTE 2
		25℃	—	80	120		
		50℃	—	60	70		

## 4-2. Color of CIE Coordinate

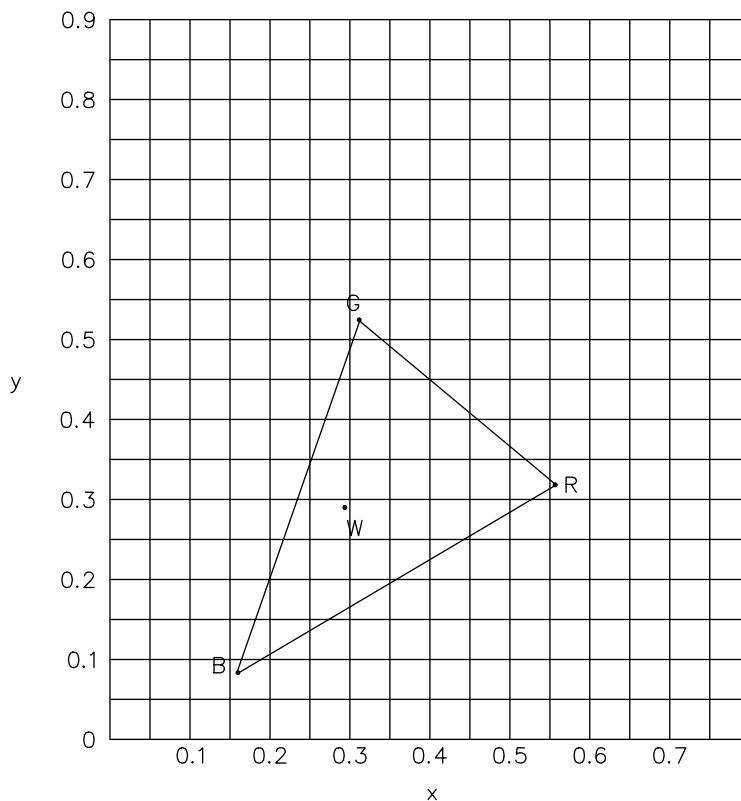
Ta = 25°C

ITEM		SYMBOL	CONDITION	VALUE	NOTE
Color of CIE Coordinate	Red	X	$\phi=0^\circ, \theta=0^\circ$	0.561	Fig.1
		y		0.321	
	Green	X	$\phi=0^\circ, \theta=0^\circ$	0.315	
		y		0.520	
	Blue	X	$\phi=0^\circ, \theta=0^\circ$	0.155	
		y		0.081	
	White	X	$\phi=0^\circ, \theta=0^\circ$	0.292	
		y		0.293	

Tolerance :  $\pm 0.05$

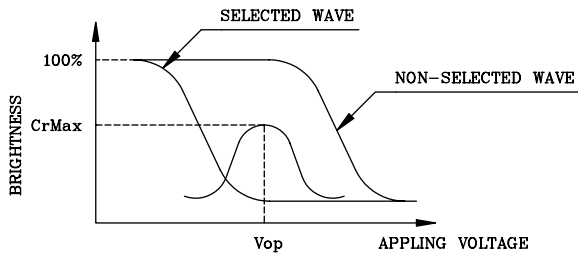
Fig.1

CIE chromaticity diagram

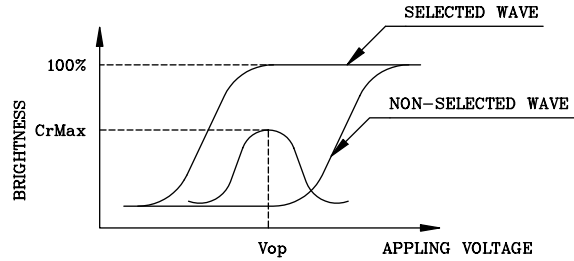


(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



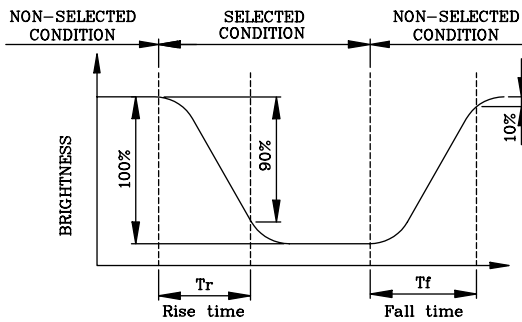
(negative type)

\*Conditions

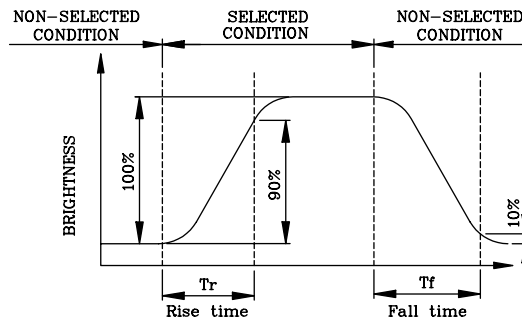
- Viewing Angle : 0
- Frame Frequency : 140Hz
- Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



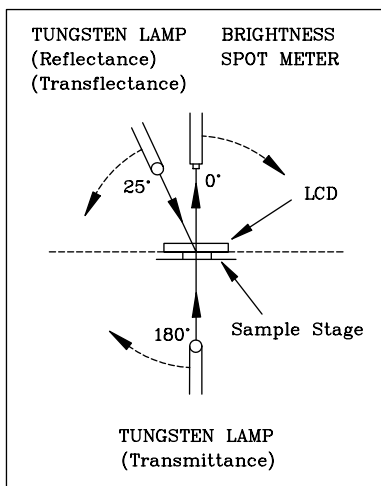
(negative type)

\*Conditions

- Operating Voltage : Vop
- Viewing Angle (θ,φ) : (0,0)
- Frame Frequency : 140Hz
- Applying Waveform : 1/N duty 1/a bias

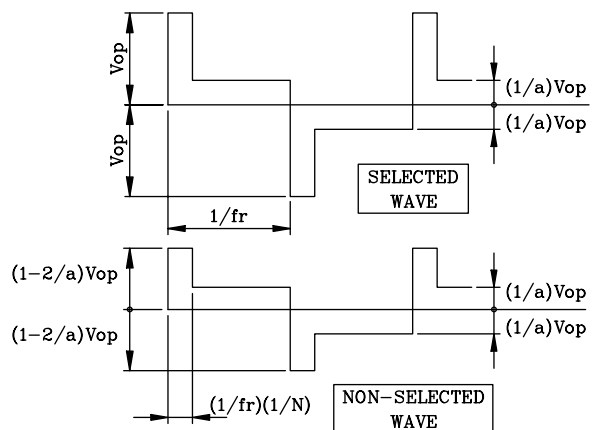
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



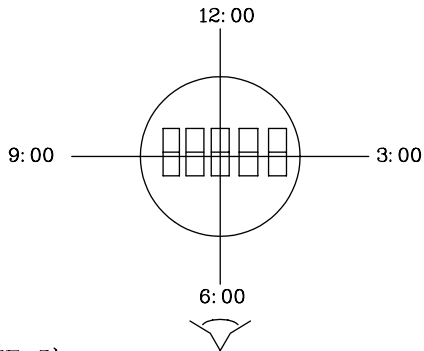
CONST.  
TEMP.  
CHAMBER

Multiplex Driving ( 1/N duty 1/a bias )



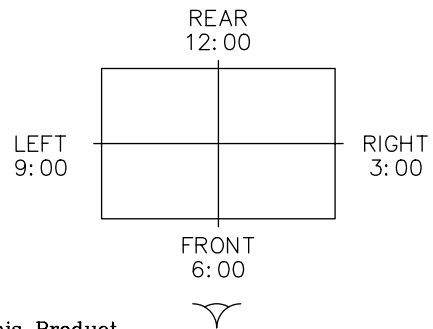
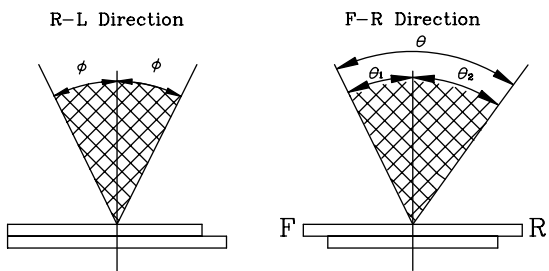
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



\*For This Product  
The Viewing Direction Is 6 O'clock  
So  $\theta_1 > \theta_2$

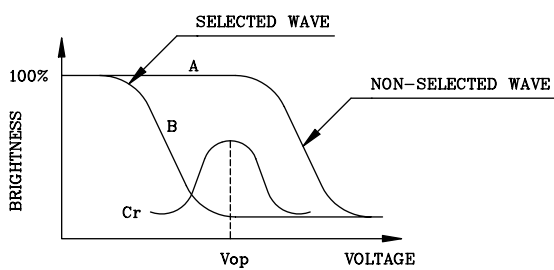
$$\theta = \theta_1 + \theta_2$$

\*Conditions

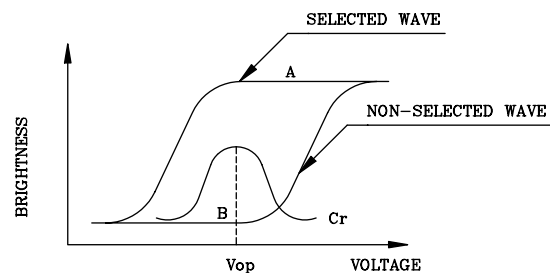
Operating Voltage :  $V_{op}$   
Frame Frequency : 140Hz  
Applying Waveform : 1/N duty 1/a bias  
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

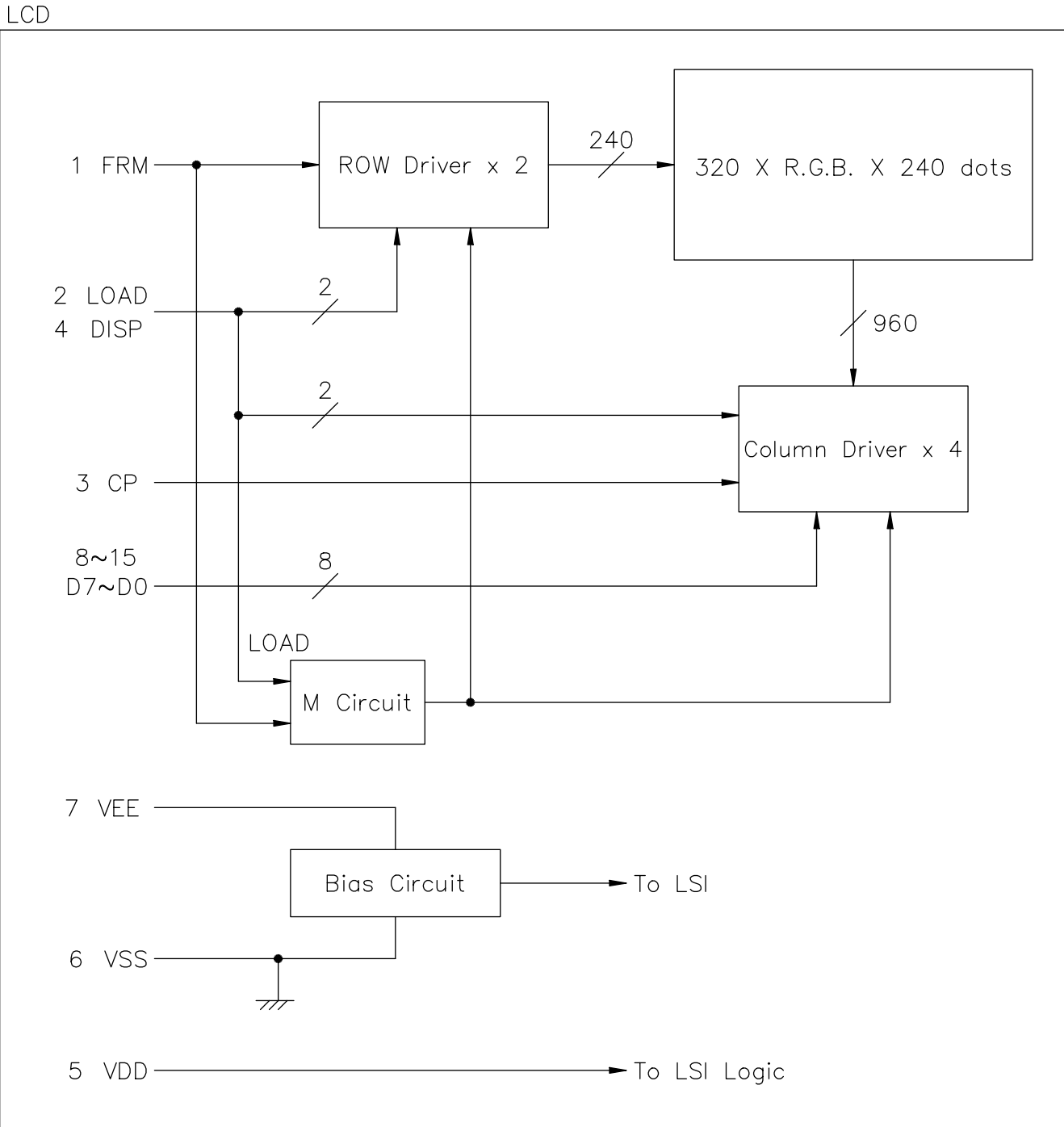
$$\text{Contrast Ratio : } Cr = A/B$$

\*Conditions

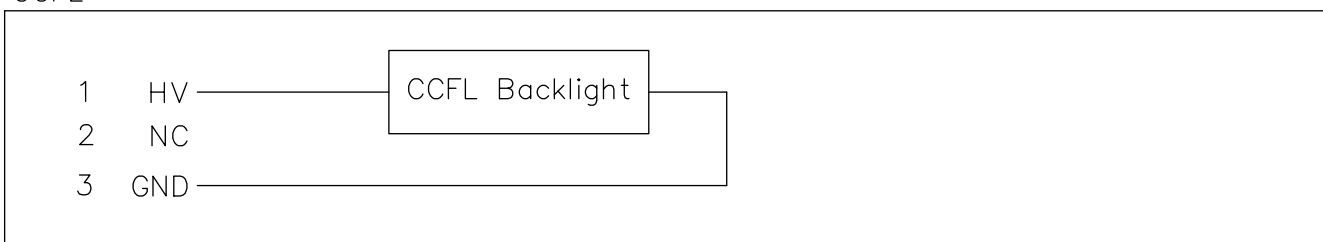
Viewing Angle : 0  
Frame Frequency : 140Hz  
Applying Waveform : 1/N duty 1/a bias



## 5. BLOCK DIAGRAM



### CCFL



## 6. INTERNAL PIN CONNECTION

### LCD

Pin No.	Symbol	Level	Function
1	FRM	H	Synchronous Signal for Driving Scanning Line
2	LOAD	H→L	Data Signal Latch Clock
3	CP	H→L	Data Signal Shift Clock
4	DISP	H/L	Display Control Signal, H :Display on L :Display off
5	VDD	—	Power Supply for Logic
6	VSS	—	Power Supply (0V,GND)
7	VEE	—	Power Supply for LCD Drive
8	D7	H/L	Display Data
9	D6	H/L	Display Data
10	D5	H/L	Display Data
11	D4	H/L	Display Data
12	D3	H/L	Display Data
13	D2	H/L	Display Data
14	D1	H/L	Display Data
15	D0	H/L	Display Data

CN1 : 53261-1510(Molex)

Recommended Matching Connector : 51021-1500(Molex) or Compatible

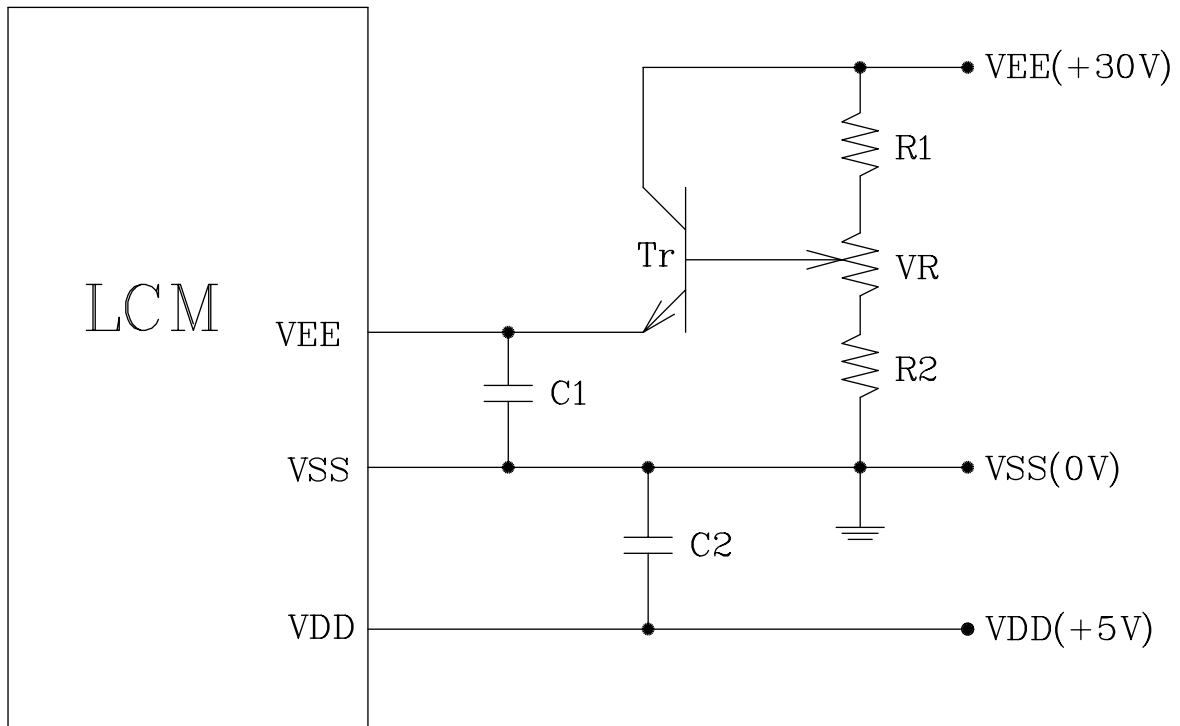
### CCFL

Pin No.	Symbol	Level	Function
1	HV	AC	Power Supply for CCFL(HOT)
2	NC	—	Non-connection
3	GND	—	Power Supply for CCFL(GND)

CN2 : BHR-03VS-1(JST)

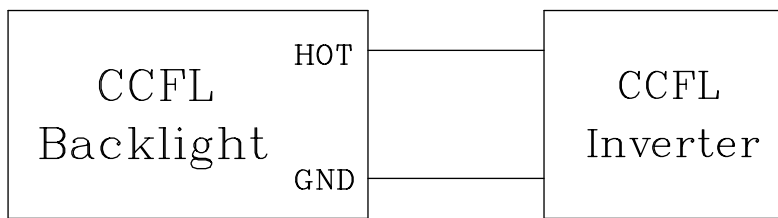
Recommended Matching Connector : SM02-(8.0)B-BHS-1(JST) or Compatible

## 7. POWER SUPPLY



$$R1 + R2 + VR = 10 \sim 20K \Omega$$

$$C1, C2 = 10 \mu F$$



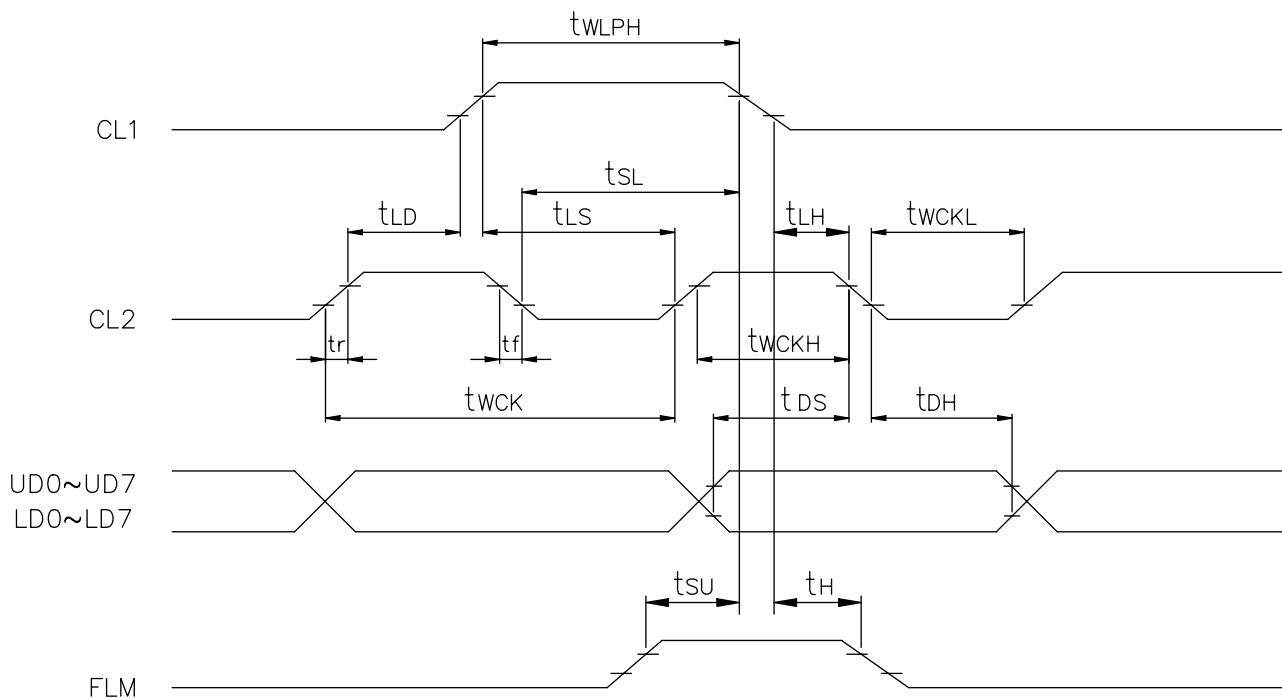
Recommended CCFL Inverter : TDK TAD347

## 8. TIMING CHARACTERISTICS

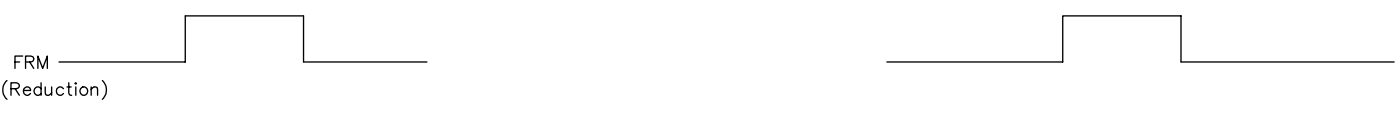
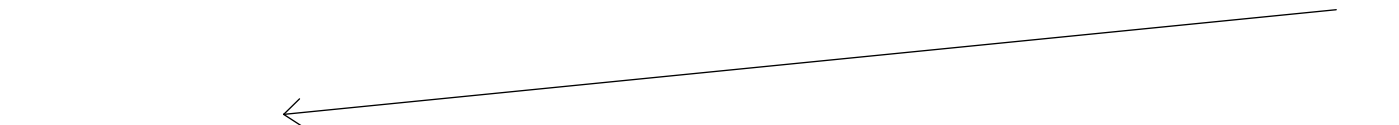
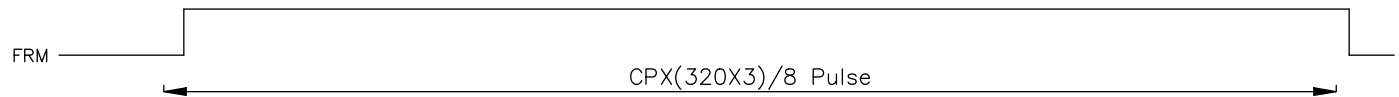
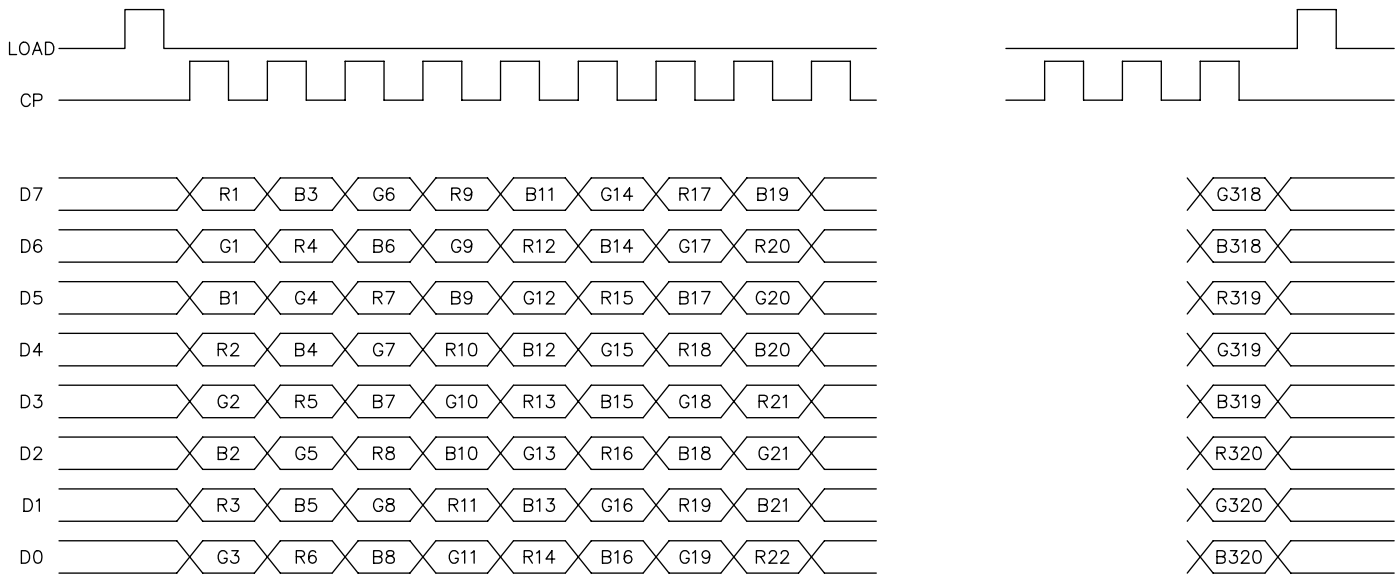
### 8-1. INTERFACE TIMING

VDD=5.0V ± 10%

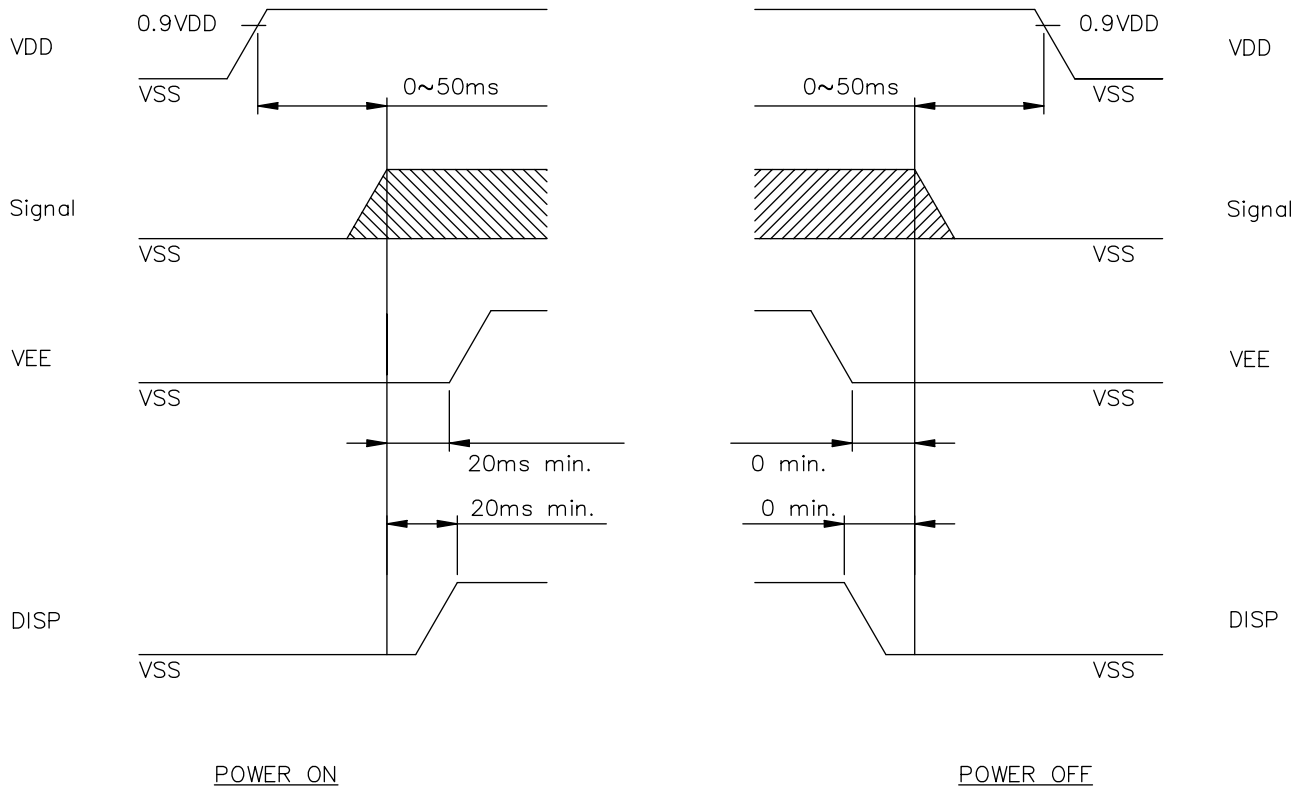
Parameter	SYMBOL	MIN.	MAX.	UNIT
CLOCK PULSE CYCLE TIME	$t_{wck}$	50	—	ns
CLOCK PULSE HIGH LEVEL WIDTH	$t_{wckH}$	15	—	ns
CLOCK PULSE LOW LEVEL WIDTH	$t_{wckL}$	15	—	ns
LATCH PULSE HIGH LEVEL WIDTH	$t_{wLPH}$	20	—	ns
CL2→CL1 RISE TIME	$t_{LD}$	0	—	ns
CL2→CL1 FALL TIME	$t_{SL}$	25	—	ns
CL1→CL2 RISE TIME	$t_{LS}$	25	—	ns
CL1→CL2 FALL TIME	$t_{LH}$	25	—	ns
CLOCK PULSE RISE/FALL TIME	$t_r, t_f$	—	30	ns
DATA SETUP TIME	$t_{DS}$	10	—	ns
DATA HOLD TIME	$t_{DH}$	10	—	ns
FLM SETUP TIME	$t_{SU}$	100	—	ns
FLM HOLD TIME	$t_H$	30	—	ns



## 8-2. TIMING CHART



## 8-3. POWER ON/OFF TIMING



The missing pixels may occur when the LCM is driven beyond the above power interface timing sequence.

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## 8-4.DISPLAY PATTERN

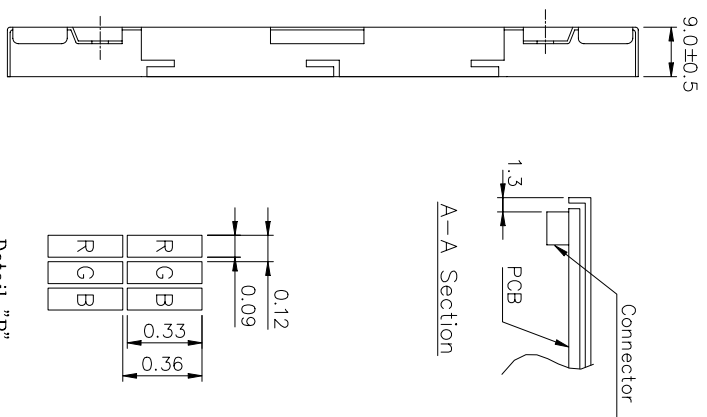
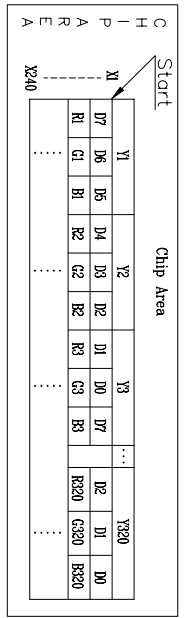
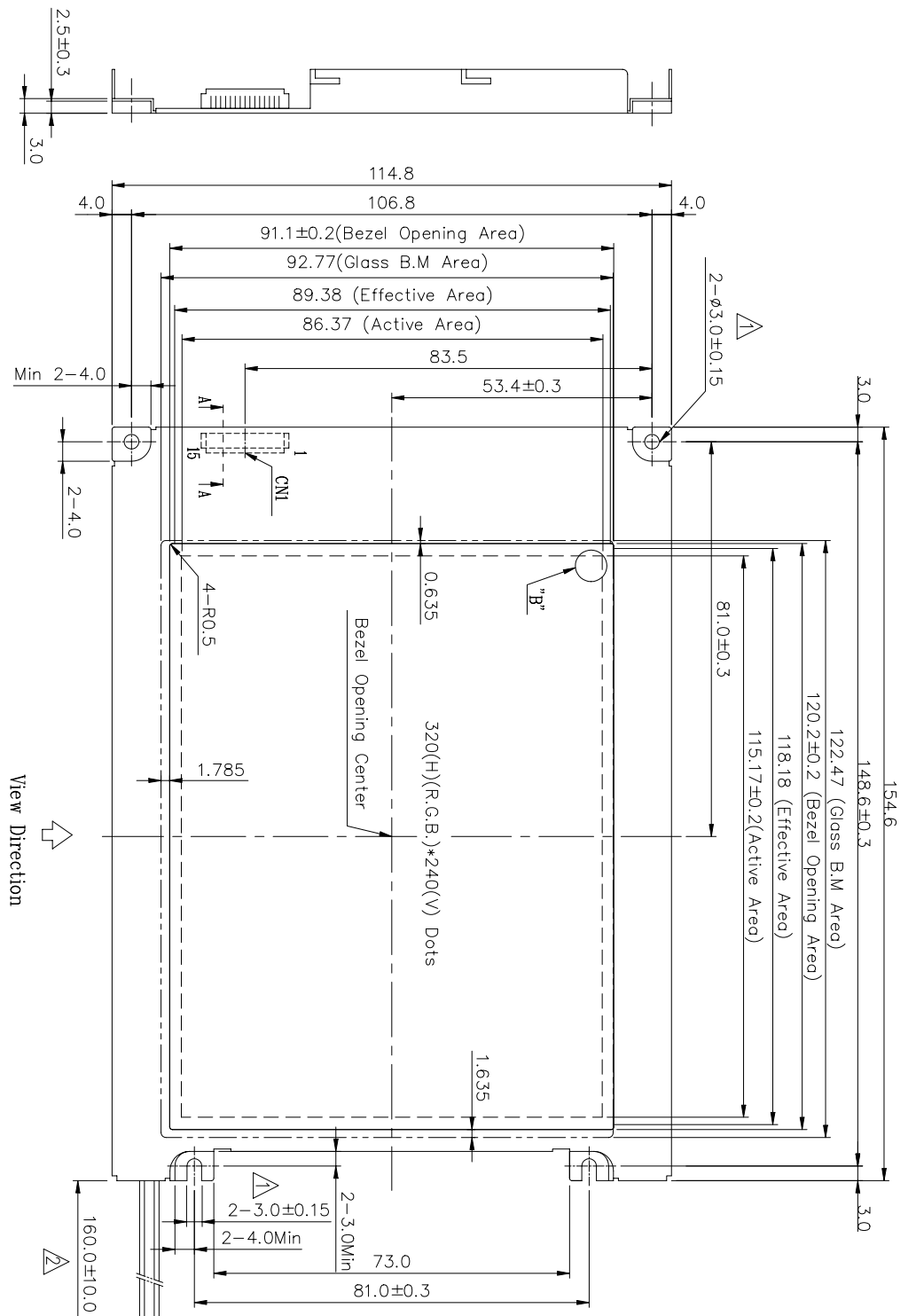
START DATA

	Y1			Y2			Y3		
X1	R1	G1	B1	R2	G2	B2	R3	G3	B3
	D7	D6	D5	D4	D3	D2	D1	D0	D7
X2	R1	G1	B1	R2	G2	B2	R3	G3	B3
	D7	D6	D5	D4	D3	D2	D1	D0	D7

	Y318			Y319			Y320		
R318	G318	B318	R319	G319	B319	R320	G320	B320	
D0	D7	D6	D5	D4	D3	D2	D1	D0	
R318	G318	B318	R319	G319	B319	R320	G320	B320	
D0	D7	D6	D5	D4	D3	D2	D1	D0	

X239	R1	G1	B1	R2	G2	B2	R3	G3	B3
	D7	D6	D5	D4	D3	D2	D1	D0	D7
X240	R1	G1	B1	R2	G2	B2	R3	G3	B3
	D7	D6	D5	D4	D3	D2	D1	D0	D7

R318	G318	B318	R319	G319	B319	R320	G320	B320
D0	D7	D6	U5	D4	D3	D2	D1	D0
R318	G318	B318	R319	G319	B319	R320	G320	B320
D0	D7	D6	U5	D4	D3	D2	D1	D0



- Notes :
- 1.Resolution : 320(H)(R;G;B) x 240(V) Dots
  - 2.Backlight : CCFL ; LCM Surface Luminance : 201 cd/m<sup>2</sup>
  - 3.Frame Material : SECC (t=0.5)

CN1 : 53261-1510 (Molex)

Pin No	Symbol	Function	Level
1	FRM	Synchronous signal for driving scanning line	H
2	LOAD	Data signal latch clock	H → L
3	CP	Data signal shift clock	H → L
4	DISP	Display control signal	H(ON),L(OFF)
5	VDD	Power supply for logic	-
6	VSS	GND	-
7	VBE	Power supply for LCD	-
8	D7	Power supply for LCD	-
9	D6		

Pin No	Symbol	Function	Level
10	D5	Display data	H(ON),L(OFF)
11	D4		
12	D3		
13	D2		
14	D1	Display data	H(ON),L(OFF)
15	D0		

Pin No	Symbol	Function	Level
1	HV	Power supply for CFL	AC
2	NC	Display data	-
3	GND	Ground line (from inverter)	-

DIMENSION	TOLERANCE
L ≤ 6	±0.25 (mm)
6 < L ≤ 18	±0.3 (mm)
18 < L ≤ 50	±0.4 (mm)
50 < L ≤ 125	±0.5 (mm)
125 < L	±0.6 (mm)
ANGLE	±1° (DEG)

REV. NO.	DESCRIPTION	DATE	DESIGN	CHECK	APPROVE	DWG. NO.
1	Modified P/N:CN1(CBPB1510)	9/10/18	J.Y.IUN			M161-D13A
2	Modified the Length of CFL Output Line	9/01/07	J.S.HUANG	Y.C.LIU	TONY CHOU	
3	Modified Dimension	9/01/07	J.S.HUANG	Y.C.LIU	TONY CHOU	

NAME	DATE	THIRD ANGLE P.
APPROVE	TONY CHOU	90.08.09
CHECK	Y.C.LIU	90.08.09
DESIGN	J.S. HUANG	90.08.09
DRAWN	J.S. HUANG	90.08.09

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