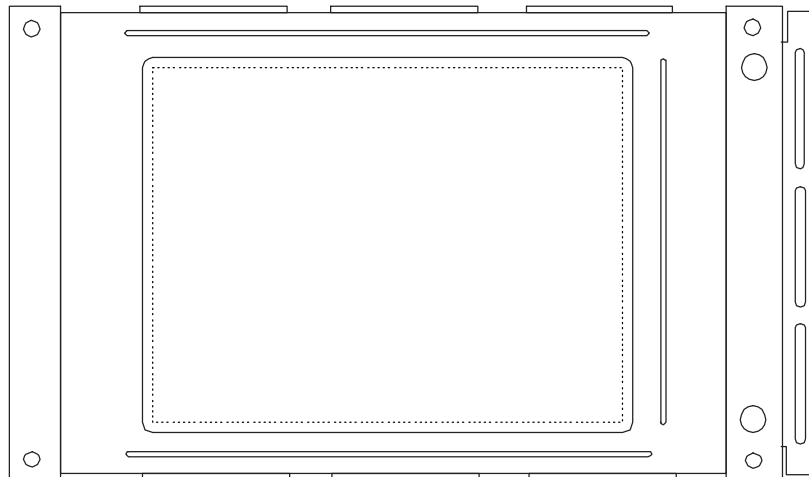


PRODUCT SPECIFICATION

HDM3224ATS-1

320X240 (1/4 VGA) GRAPHICS
LCD DISPLAY MODULE
WITH TOUCH SCREEN



| | | | | |
|---|-------|-------|---------------------|----------------|
| HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014 | Q.A.: | REV.: | HDM3224ATS-1 | SHEET 1 OF 17 |
| | JK | 1.0 | | DATE: 06/29/01 |

1. MECHANICAL DATA

| | |
|--------------------------------|---|
| (1) Product No. | HDM3224ATS-1 |
| (2) Module Size | 167.1 (W)mm x 109.0 (H)mm x MAX 12.5 (D)mm (CCFT B.L.) |
| (3) Dot Size | 0.33 (W)mm x 0.33 (H)mm |
| (4) Dot Pitch | 0.36 (W)mm x 0.36 (H)mm |
| (5) Number of Dots | 320 (W) x 240 (H)Dots |
| (6) Duty | 1/240 |
| (7) LCD Display Mode | FSTN: Black and White(Normally White) |
| | Rear Polarizer: Transmissive |
| (8) Viewing Direction | 6 O'clock |
| (9) Backlight | CCFT |
| (10) Recommended CCFL Inverter | TDK CORP. CXA-L10L |
| (11) Weight | 237.0 g(approx.) |

| | | | | |
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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V STANDARD

| ITEM | SYMBOL | MIN | MAX | UNIT | COMMENT |
|------------------------|---------|------|------|--------|---------|
| Power Supply for Logic | VDD-VSS | -0.3 | 7.0 | V | |
| Power Supply for LCM | VDD-VEE | 0 | 30.0 | V | |
| Input Voltage | VI | -0.3 | VDD | V | |
| CCFL Driving Voltage | VFL | 0 | 500 | Vrms | |
| CCFL Input Current | IFL | - | 7.0 | mA rms | |
| Static Electricity | - | - | - | - | Note 1 |

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM | OPERATING | | STORAGE | |
|--------------------------------|-----------|------|----------|------|
| | MIN. | MAX. | MIN. | MAX. |
| Ambient Temperature | -20 | 70 | -30 | 80 |
| Humidity(Without Condensation) | Note 2,4 | | Note 3,4 | |

Note 1 LCM should be grounded during handling LCM.

Note 2 $T_a \leq 70^\circ\text{C}$: 75%RH max

$T_a > 70^\circ\text{C}$: Absolute humidity must be lower than the humidity of 75%RH at 70°C

Note 3 T_a at -30°C will be < 48hrs, at 80°C will be < 120hrs

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

| | | | | |
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3. ELECTRICAL CHARACTERISTICS

(VDD = 5V±5%)

| ITEM | | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | |
|---|-------------------|---------|---|--------|-------|--------|-------------------|---|
| Power Supply for Logic | | VDD-VSS | - | 4.75 | 5.0 | 5.25 | V | |
| Recommended LC Driving Voltage (High Contrast Ratio LC LCM) | | VDD-VO | Duty=1/240 Bias=1/13 | -20°C | 24.2 | 24.6 | 25.0 | V |
| | | | | 0°C | 22.9 | 23.3 | 23.7 | |
| | | | | 25°C | 22.1 | 22.5 | 22.9 | |
| | | | | 50°C | 21.2 | 21.6 | 22.0 | |
| | | | | 70°C | 20.2 | 20.6 | 21.0 | |
| Input Voltage | | VH | H level | 0.8VDD | - | VDD | V | |
| | | VIL | L level | 0 | - | 0.2VDD | V | |
| Power Supply Current | | IDD | FLM = 70 Hz VDD = 5.0 V VEE = -24.0 V VDD-VO = 22.5V | - | 5.0 | 8.0 | mA | |
| | | IEE | PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □ | - | 4.5 | 7.0 | mA | |
| CCFL LAMP | Starting Voltage | Vs | - | - | 450 | 1000 | Vrms | |
| | Lamp Voltage | VL | | - | 260 | - | Vrms | |
| | Lamp Current | IL | | 4 | 5 | 6 | mArms | |
| | Lamp Consumption | PL | | - | 1.3 | - | W | |
| | Lamp Frequency | FL | | - | 35 | - | KHz | |
| | Lamp Life | LL | | - | 60000 | - | hr | |
| LCM | Surface Luminance | L | ALL ON | - | 33.2 | - | cd/m ² | |
| | | | ALL OFF | - | 109.5 | - | | |

4. OPTICAL CHARACTERISTICS

AT Vop

| MODE | ITEM | Cr(Contrast Ratio) | | | | | | | | | | θ(Viewing Angle) | | φ(Viewing Angle) | |
|------|------|--------------------|------|------|------|------|------|------|------|------|------|------------------|------|------------------|------|
| | | -20℃ | | 0℃ | | 25℃ | | 50℃ | | 70℃ | | 25℃ | | 25℃ | |
| | | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. | MIN. | TYP. |
| R | A | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | C | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | J | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| S | A | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | C | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | J | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| T | E,F | - | 3.8 | - | 6.4 | 9.2 | 10.8 | - | 8.5 | - | 7.3 | 35 | 65 | 20 | 30 |
| | G,H | - | 20.7 | - | 30.4 | 48 | 56 | - | 13.5 | - | 9.21 | 40 | 70 | 25 | 35 |
| NOTE | | NOTE 6 | | | | | | | | | | NOTE 5 | | | |

NOTE :

R : REFLECTIVE
 S : TRANSFLECTIVE
 T : TRANSMISSIVE
 A : GRAY
 C : YELLOW
 E,F : BLUE
 G,H : NORMALLY BLACK
 J : NORMALLY WHITE

* The Contrast Ratio Is Measured Not Include Touch Panel.

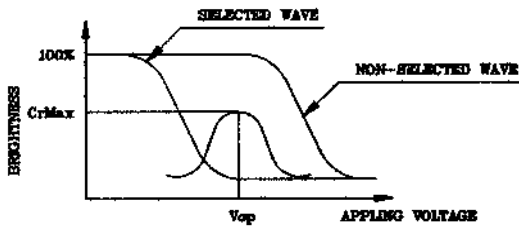
AT $\theta=0^\circ$ $\phi=0^\circ$

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------------|--------|-----------|------|------|------|------|--------|
| Response Time (rise) | Tr | -20℃ | - | 1000 | 2000 | ms | NOTE 2 |
| | | 0℃ | - | 820 | 1640 | | |
| | | 25℃ | - | 200 | 400 | | |
| | | 50℃ | - | 160 | 320 | | |
| | | 70℃ | - | 80 | 160 | | |
| Response Time (fall) | Tf | -20℃ | - | 500 | 1000 | ms | NOTE 2 |
| | | 0℃ | - | 360 | 720 | | |
| | | 25℃ | - | 210 | 420 | | |
| | | 50℃ | - | 70 | 140 | | |
| | | 70℃ | - | 50 | 100 | | |

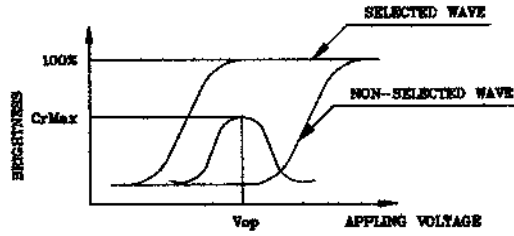
| | | | | |
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(NOTE 1)

Definition of Operation Voltage(V_{op})



(positive type)



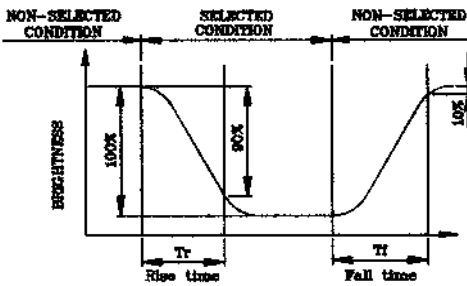
(negative type)

*Conditions

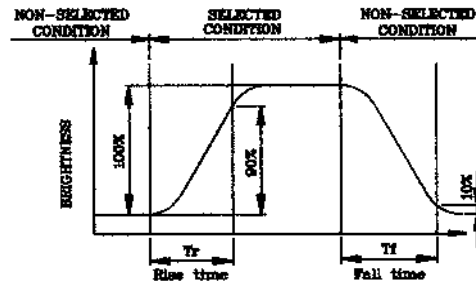
Viewing Angle : 0
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(T_r, T_f)



(positive type)



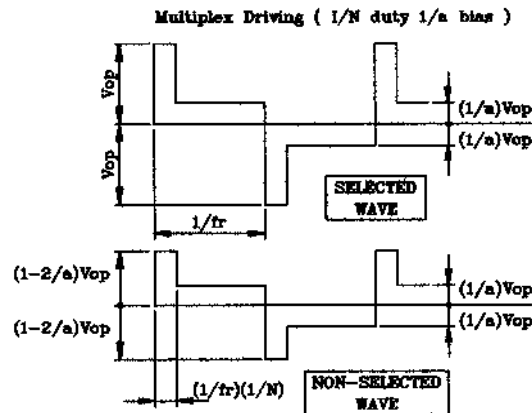
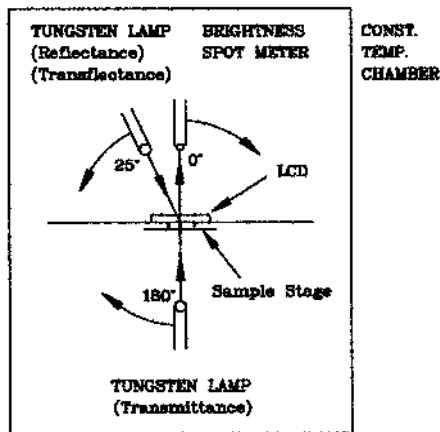
(negative type)

*Conditions

Operating Voltage : V_{op}
 Viewing Angle (θ, ϕ) : (0,0)
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias

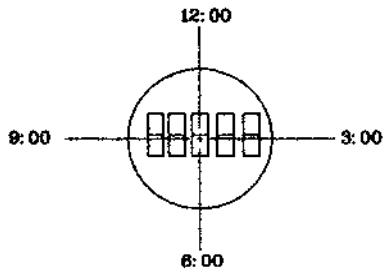
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



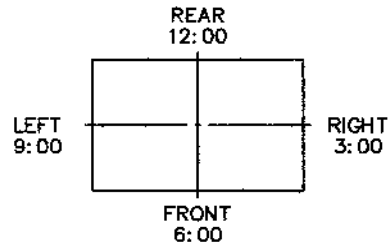
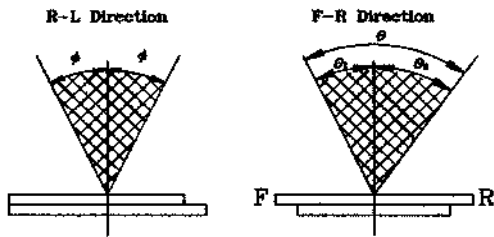
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



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

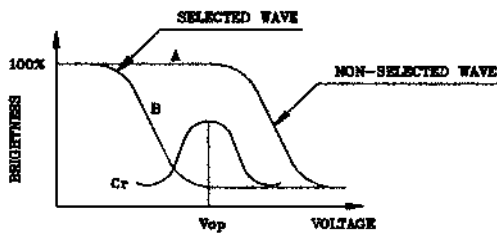
$$\theta = \theta_1 + \theta_2$$

*Conditions

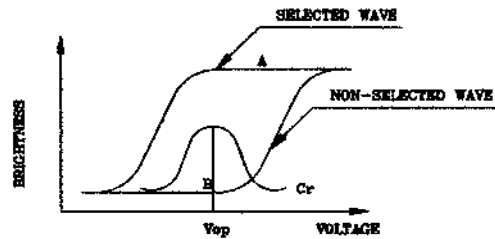
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

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

*Conditions

Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

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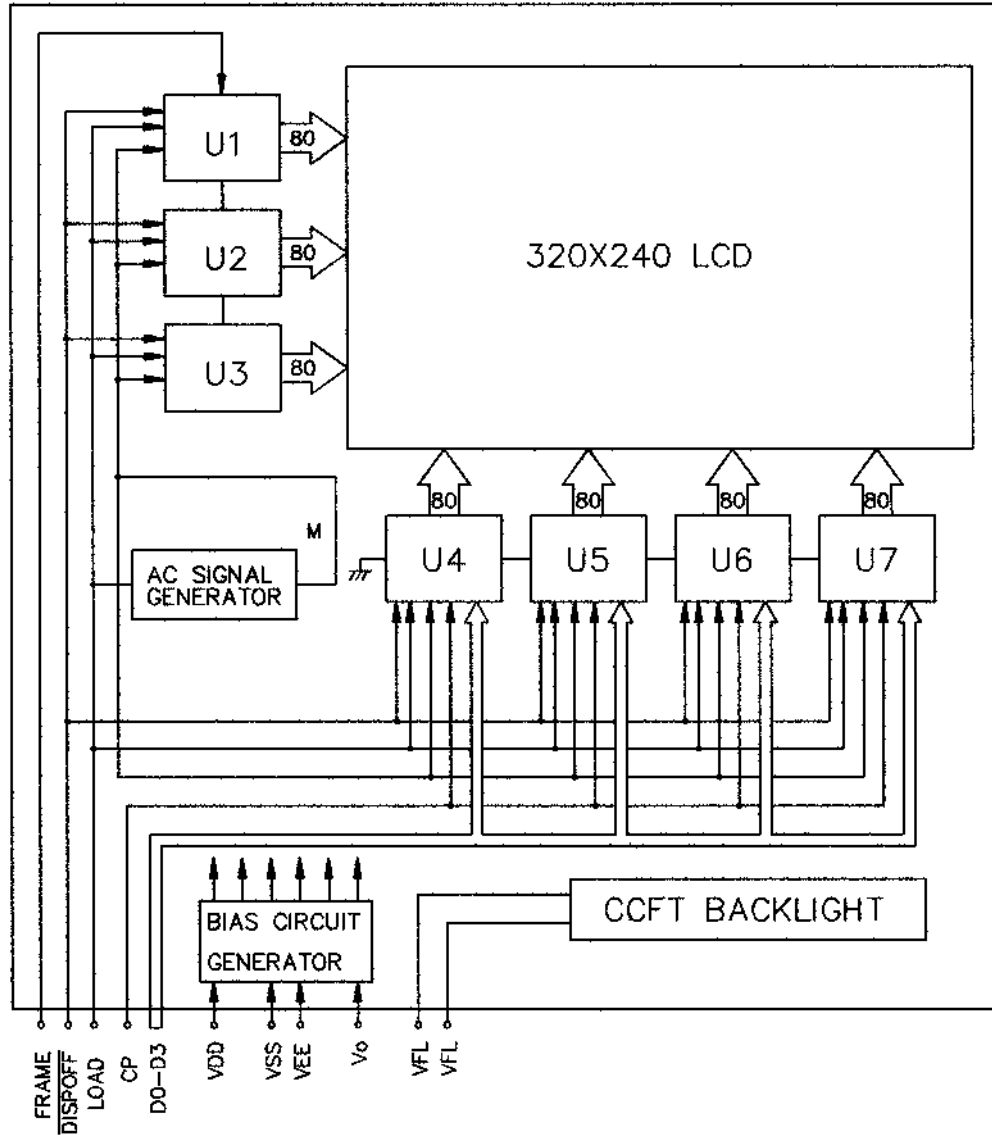
REV.:
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5. BLOCK DIAGRAM



* AC SIGNAL SETTING

| J1 | J2 | J3 | J4 | J5 | J6 | J7 | J8 |
|----|----|----|----|----|----|----|----|
| L | H | H | L | L | L | L | L |

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6.INTERNAL PIN CONNECTION

INTERFACE CONNECTOR : FFC PITCH 1.25mm

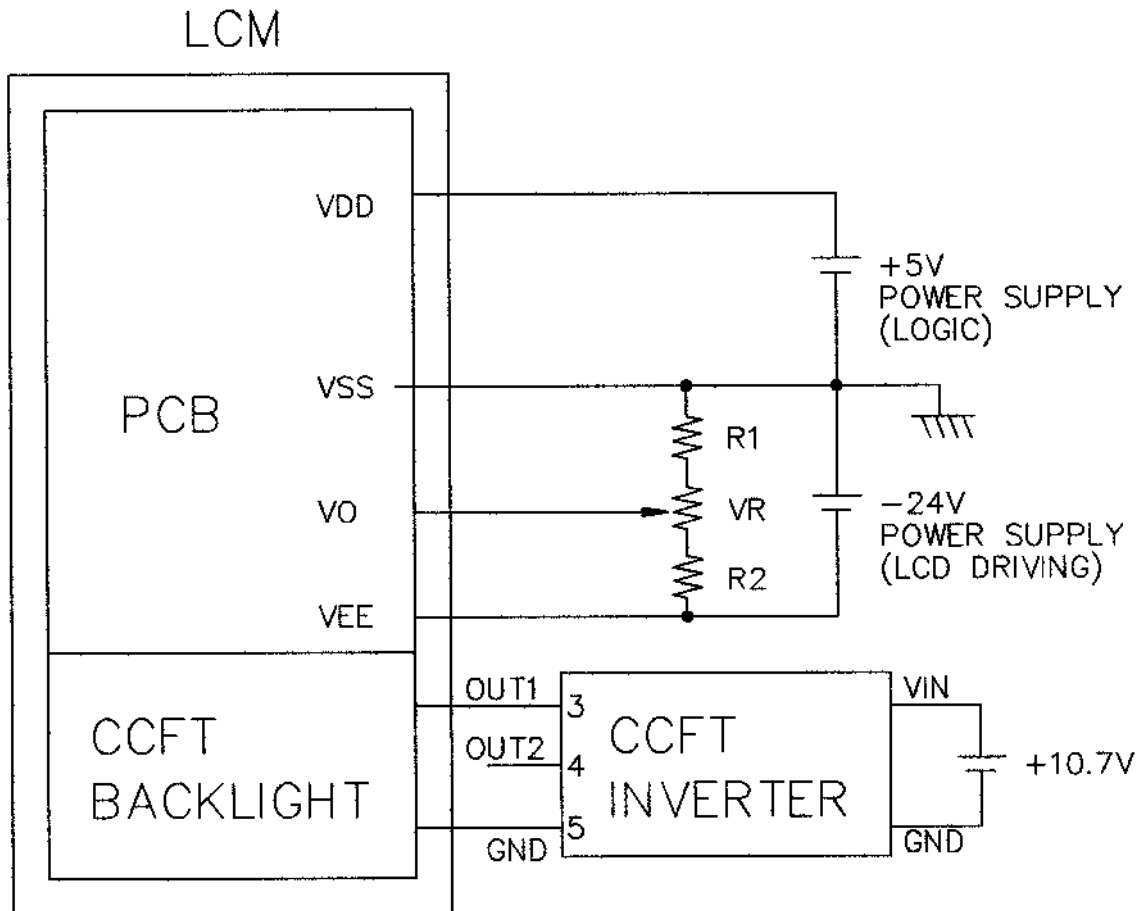
| PIN NO. | SYMBOL | LEVEL | FUNCTION |
|---------|---------|-------|-----------------------------|
| 1 | D0 | H/L | DISPLAY DATA SIGNAL |
| 2 | D1 | | |
| 3 | D2 | | |
| 4 | D3 | | |
| 5 | DISPOFF | H/L | H: ON/L: OFF |
| 6 | FRAME | H | SCAN START-UP SIGNAL |
| 7 | NC | - | NO CONNECTION |
| 8 | LOAD | H-L | INPUT DATA LATCH SIGNAL |
| 9 | CP | H-L | DATA INPUT CLOCK SIGNAL |
| 10 | VDD | - | POWER SUPPLY FOR LOGIC(+5V) |
| 11 | VSS | - | SIGNAL GROUND(0V) |
| 12 | VEE | - | POWER SUPPLY FOR LCD |
| 13 | VO | - | LCD CONTRAST ADJUST VOLTAGE |
| 14 | FGND | - | FRONT PANEL GROUND |

CCFL CONNECTOR : J.A.E./IL-G-4S-S3C2

| PIN NO. | SYMBOL | LEVEL | FUNCTION |
|---------|--------|-------|---------------------------------|
| 1 | HV | - | POWER SUPPLY FOR CCFT BACKLIGHT |
| 2 | NC | - | - |
| 3 | NC | - | - |
| 4 | GND | - | GND FOR CCFT BACKLIGHT |

| | | | | |
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7. POWER SUPPLY



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

2. RECOMMENDED CCFT INVERTER : CXA-L10L(TDK)
(OPERATING TEMP. $-10^{\circ} \sim 60^{\circ}C$)

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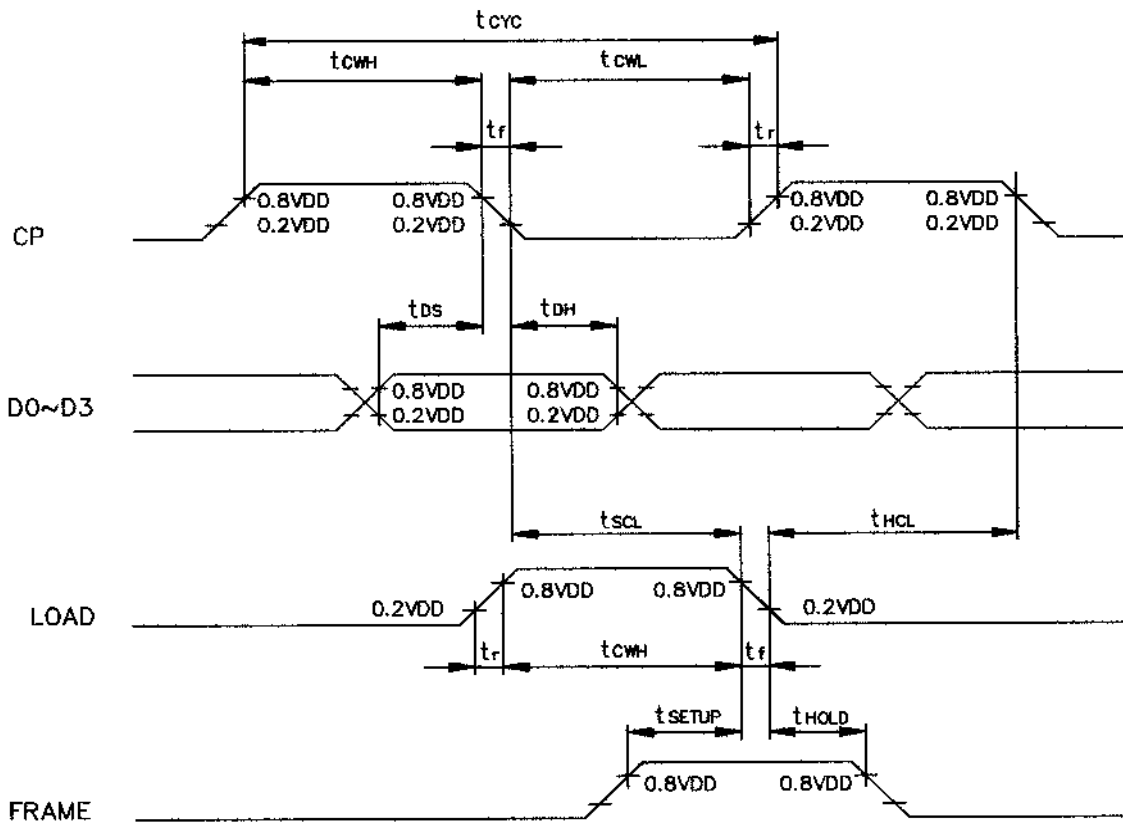
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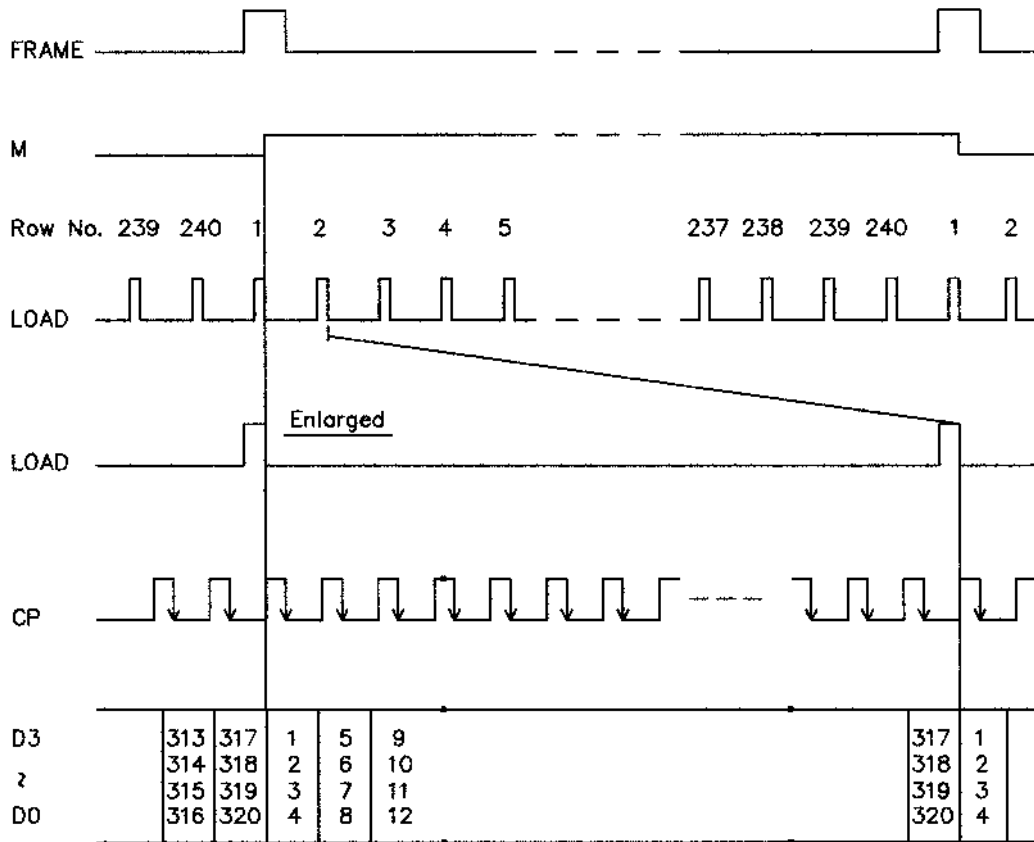
DATE:
06/29/01

8-1. TIMING CHARACTERISTICS

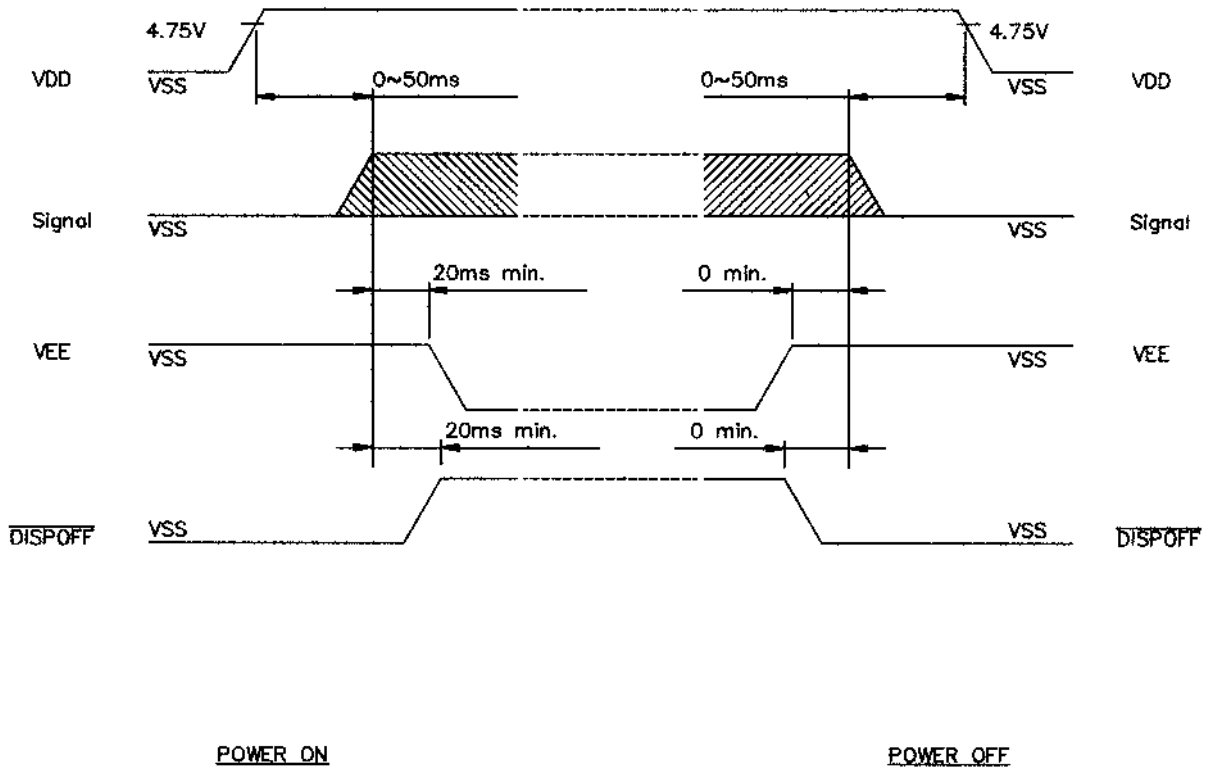
| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|------------------------|-------------|------|------|------|------|
| CLOCK CYCLE TIME | t_{CYC} | 125 | - | - | ns |
| CLOCK HIGH LEVEL WIDTH | t_{CWH} | 45 | - | - | ns |
| CLOCK LOW LEVEL WIDTH | t_{CWL} | 45 | - | - | ns |
| CLOCK RISE TIME | t_r | - | - | 30 | ns |
| CLOCK FALL TIME | t_f | - | - | 30 | ns |
| DATA SETUP TIME | t_{DS} | 30 | - | - | ns |
| DATA HOLD TIME | t_{DH} | 30 | - | - | ns |
| CLOCK SETUP TIME | t_{SCL} | 80 | - | - | ns |
| CLOCK HOLD TIME | t_{HCL} | 80 | - | - | ns |
| FRAME SETUP TIME | t_{SETUP} | 30 | - | - | ns |
| FRAME HOLD TIME | t_{HOLD} | 30 | - | - | ns |



8-2. TIMING CHART OF INPUT SIGNALS



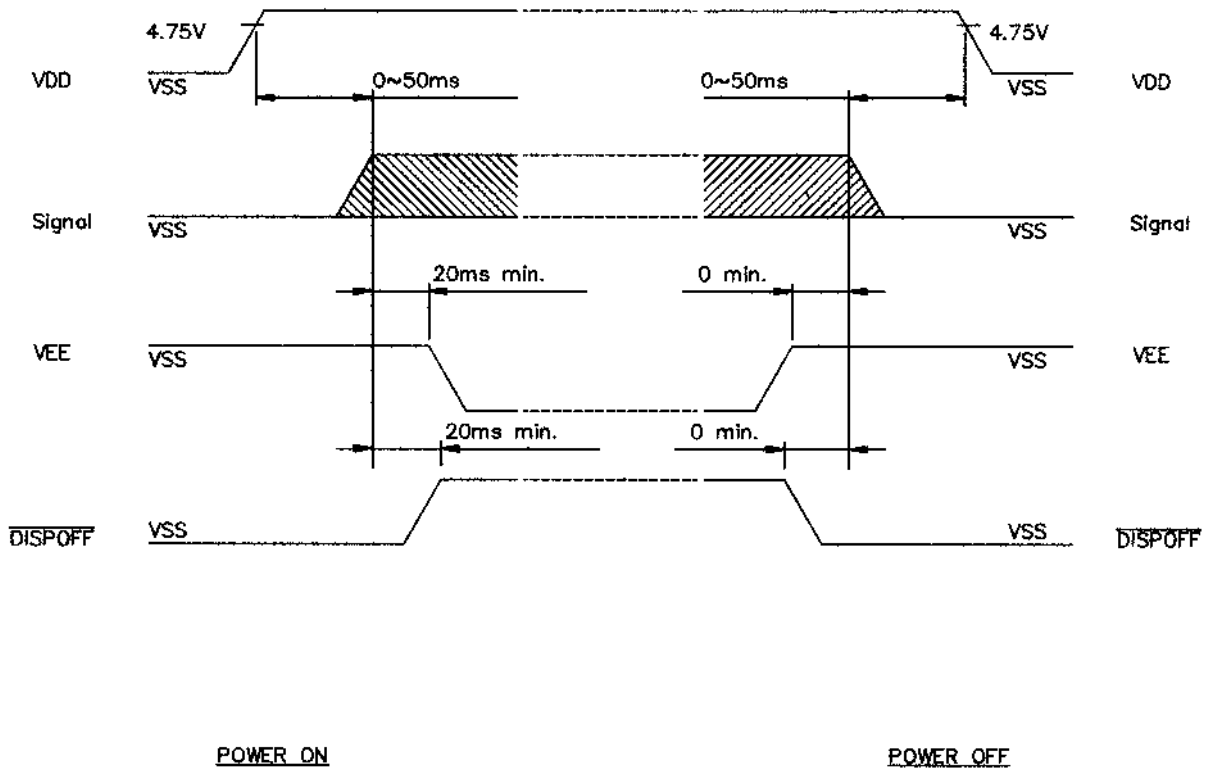
8-4. POWER ON/OFF TIMING



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

| | | | | |
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8-4. POWER ON/OFF TIMING



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

| | | | | |
|---|-------|-------|---------------------|----------------|
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9. RELIABILITY TEST

| NO | ITEM | CONDITION | | | STANDARD | NOTE |
|----|---------------------------------|---|-------|--|---------------------------|----------|
| 1 | High Temp. Storage | 70°C | 120HR | | Appearance without defect | |
| 2 | Low Temp. Storage | -20°C | 120HR | | Appearance without defect | |
| 3 | High Temp. & High Humi. Storage | 40°C 90%RH | 120HR | | Appearance without defect | |
| 4 | Thermal Shock | -20°C, 30min → 25°C.5min → 70°C, 30min → 25°C.5min (1cycle) | | | Appearance without defect | 5 cycles |

| | | | | |
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NOTE:

• SAFETY

- 1.If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
- 2.If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

• HANDLING

- 1.Avoid static electricity which can damage the CMOS LSI.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate of the display is very fragile. So, please handle it very carefully.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- 5.Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

• STORAGE

- 1.Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
- 2.Do not place the module near organics solvents or corrosive gases.
- 3.Do not crush, shake, or jolt the module.

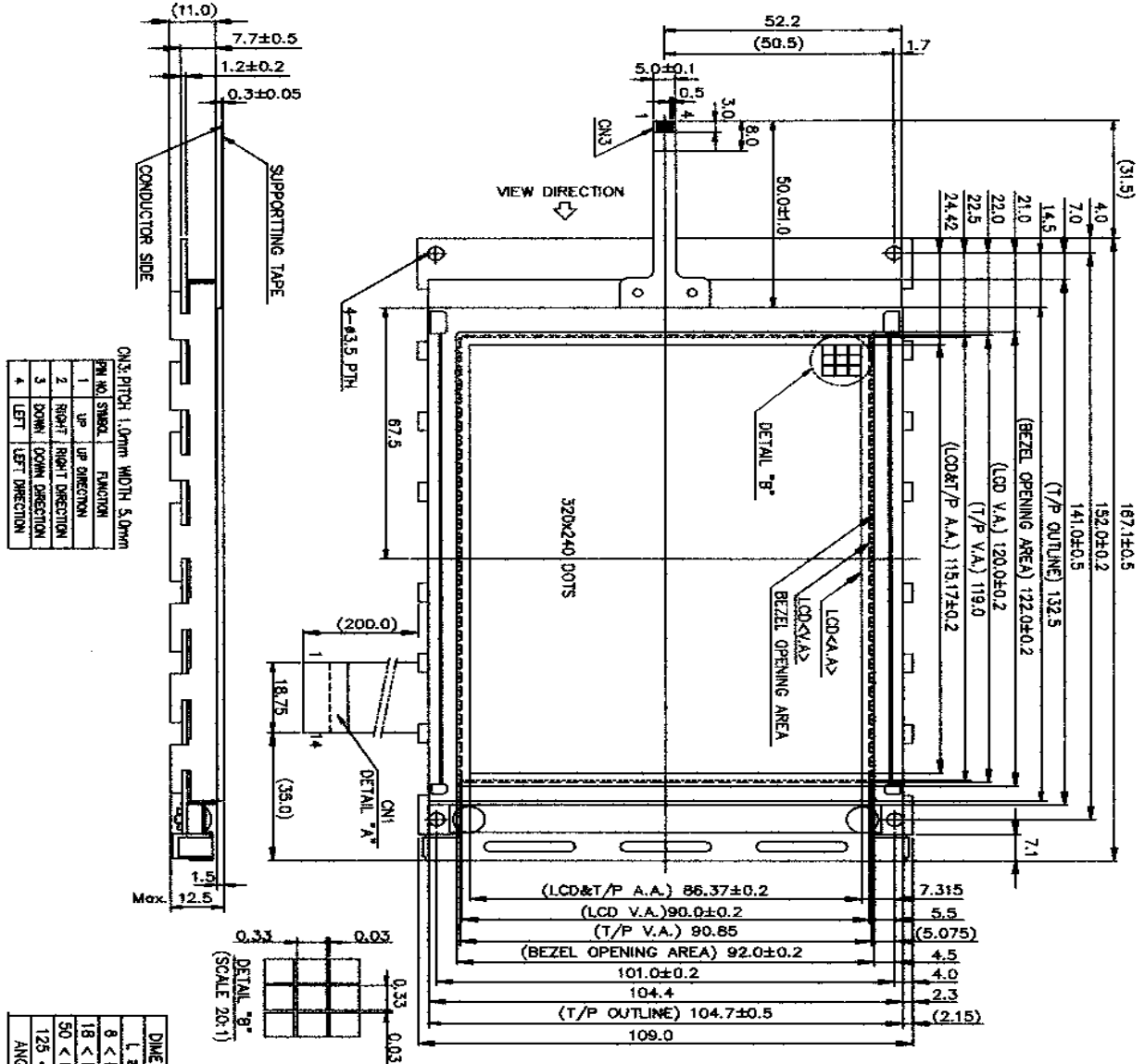
• TERMS OF WARRANT

- 1.Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.

• THE OPERATING LIFE TIME OF BACK LIGHT

- CCFT : 20,000hrs for lamp—current 5mA, 35KHz, 25°C
(Operating life time is defined as follows : The final brightness is at 50% of original brightness.)

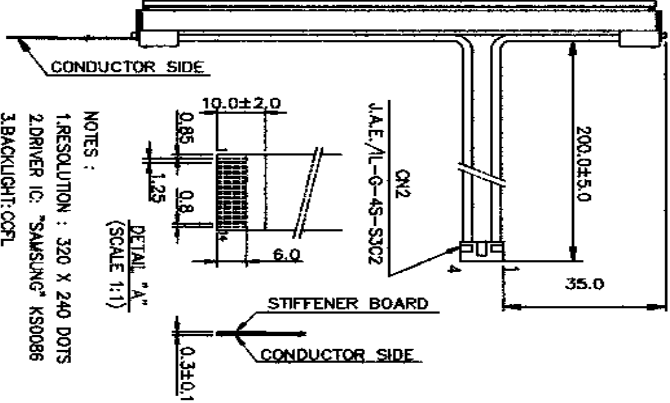
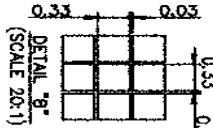
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ON:3 PITCH 1.0mm WIDTH 5.0mm

| ROW NO. | STROKE | FUNCTION |
|---------|--------|-----------------|
| 1 | UP | UP DIRECTION |
| 2 | RIGHT | RIGHT DIRECTION |
| 3 | DOWN | DOWN DIRECTION |
| 4 | LEFT | LEFT DIRECTION |

| 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) |



NOTES :

- 1.RESOLUTION : 320 X 240 DOTS
- 2.DRIVER IC: "SAMSUNG" KS0086
- 3.BACKLIGHT:CCFL
- 4.FRAME: SECC (0.5mm t)
- 5.TOUCH PANEL: (1.4mmt) Anti-glare
Light Transmissivity : 80%