FEMA ELECTRONICS CORPORATION

# DATASHEET



Fema Part Number

| GM240320W-28-TTX2NLW-12 | |
|---|---|
| Description | Color TFT Display |
| | 2.8" Diagonal Size |
| | 240X320 Resolution |
| | 12 O' clock viewing |
| | RoHS Compliant |

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# 1.GENERAL DESCRIPTION

## 1.1 Description

GM240320W-28-TTX2NLW-12 is a transmissive type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that used amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit, and a back-light unit. The resolution of 2.8” contains 240 x 320 pixels and can display up to 262K colors.

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## 1.2 Features

| | | |
|---|---|---|
| LCD Type | : | Transmissive color active matrix LCD panel<br>TN (Twisted Nematic) mode |
| Drive IC | : | SPFD5408 or Compatible IC(ILI9325) |
| Built-in Drive Power | | Low power consumption |
| System Interface | : | 80 System Interface (16 bit bus) |
| Internal RAM Capacity | : | 172,800 bytes max. |
| Color Mode | : | 262,144 colors |
| Outline Dimensions | : | 50 (W) × 69.2 (H) × 2.9 (D) mm |
| Active Area | : | 43.2 (W) × 57.6 (H) mm |
| Pixel Size | : | 0.06 (W) × 0.18 (H) mm |
| Viewing Direction | : | 12 O’ Clock |

## 1.3 Environmental impact substances controlled for containing in products

The environmental impact substances we control are classified into 2 types as described below.

a. Prohibited substances:

   FEMA, in principle, does not produce any products containing or contaminated by substances of this type.

   - Cadmiun (Cd) < 100 ppm
   - Mercury (Hg) < 1000 ppm
   - Hexavalent-Chromiun ($Cr^{+6}$) < 1000 ppm
   - Polybrominated biphenylethers (PBDE) < 1000 ppm
   - Polybrominated biphenyls (PBB) < 1000 ppm

b. Prohibited substances:

   Desired not to be contained in or contaminate our products as far as possible and abolished by a targeted date. FEMA moderately produces products containing substances of this type.

   - Lead (Pb) < 1000 ppm

# 2.ABSOLUTE MAXIMUM RATINGS

## 2.1 Electrical absolute maximum ratings

| Item | Symbol | Value | Unit | Note |
|---|---|---|---|---|
| Power Supply for Logic | $V_{CI}$ - GND | -0.3 to 4.6 | V | |
| Humidity | - | 90(Max) | %RH | (1) |

Note:

(1) $T_A \leqq 40℃$ without dewing.

## 2.2Environmental absolute maximum ratings

| Item | Symbol | Min. | Max. | unit | Note |
|---|---|---|---|---|---|
| Storage Temperature | $T_{STG}$ | (-30) | (80) | ℃ | (1) |
| Operating Temperature (Ambient Temperature) | $T_{OPR}$ | (-20) | (70) | ℃ | (1),(2) |

Note:

(1) 90 % RH Max. ( 40 ℃ ≧ Ta )

(2) In Case of below 0℃, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one.

# 3.ELECTRICAL CHARACTERISTIC

Typical operating conditions ( GND=AVSS=0V)

| Item | Symbol | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| IC Power Voltage | VCI | 2.5 | 2.8 | 3.3 | V | |
| High-level input Voltage | VIHC | 0.8VDD | | VDD | V | |
| Low-level input Voltage | VILC | -0.3 | | 0.2VDD | V | |
| TFT Gate Voltage | VGH | 10 | | 20 | V | |
| TFT Gate Voltage | VGL | -4.5 | | 13.5 | V | |
| Consumption current of Vci | IDD | | 8.25 | 16.5 | mA | |
| Consumption current of $V_{LED-A}$ | ILED | | 80 | | mA | |

# 4.DC characteristics of the LED back-light

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|
| Forward voltage | Vf | If=80mA | 3.5 | 4 | 3.5 | V | Note1 |
| Forward current | IF | | - | 80 | - | mA | Note1 |

Note: (1) Four LEDs are in parallel type.

# 5. OPTICAL CHARACTERISTICS

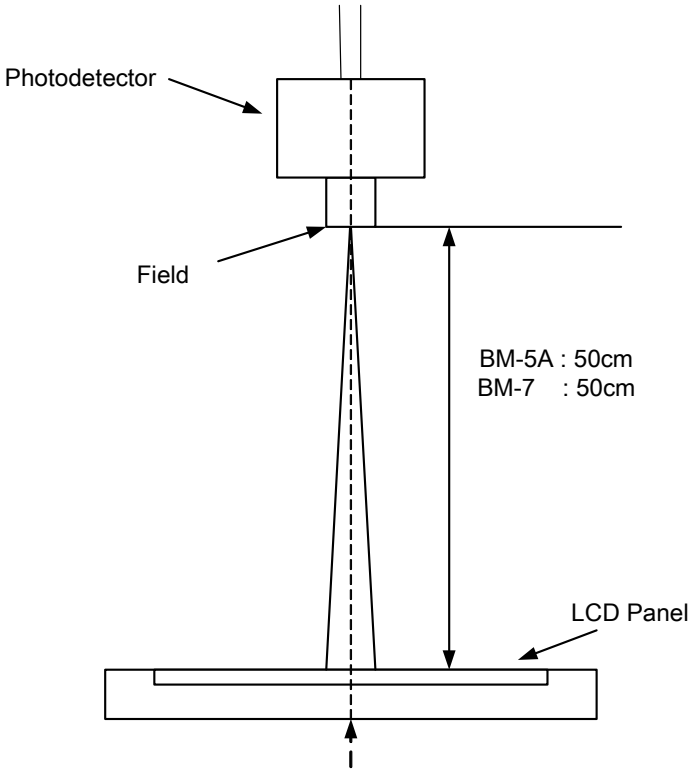
The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).
Measuring equipment: BM-5A, BM-7

(Ta = 25 +/- 2°C, Vcc = Vci = 2.8V)

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle | Hor. | ΘR | C/R≧10 B/L On | - | (65) | - | Degree | (1)(6) BM-5A |
| | | ΘL | | - | (65) | - | | |
| | Ver. | ΦH | | - | (65) | - | | |
| | | ΦL | | - | (55) | - | | |
| Contrast Ratio (Center Point) | | C/R | Note (1) Θ = 0 Φ = 0 Normal Viewing Angle B/L On | - | (125) | (200) | - | (1)(2) BM-5A |
| Brightness | | B | | - | - | (200) | - | (1)(3) BM-5A |
| Response Time | Rising: Tr | Tr | | - | (10) | (20) | ms | (1)(4) BM-7 |
| | Falling: Tf | Tf | | - | (20) | (30) | | |
| Chromaticity Coordinate | White | Wx | | 0.26 | 0.31 | 0.36 | - | (1)(5) BM-5A |
| | | Wy | | 0.27 | 0.32 | 0.37 | | |
| | Red | Rx | | 0.58 | 0.63 | 0.68 | | |
| | | Ry | | 0.30 | 0.35 | 0.40 | | |
| | Green | Gx | | 0.32 | 0.37 | 0.42 | | |
| | | Gy | | 0.51 | 0.56 | 0.61 | | |
| | Blue | Bx | | 0.10 | 0.15 | 0.20 | | |
| | | By | | 0.04 | 0.09 | 0.14 | | |

Note: (1) Test Equipment Setup

After stabilizing and leaving the module alone at a given temperature for 30 min, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room 30 min after lighting the back-light. This should be measured in the center of screen with a viewing cone of 1° by photo detector.




(2) Definition of Contrast Ratio (C/R): Ratio of gray max (Gmax) & gray min (Gmin) at the center point:

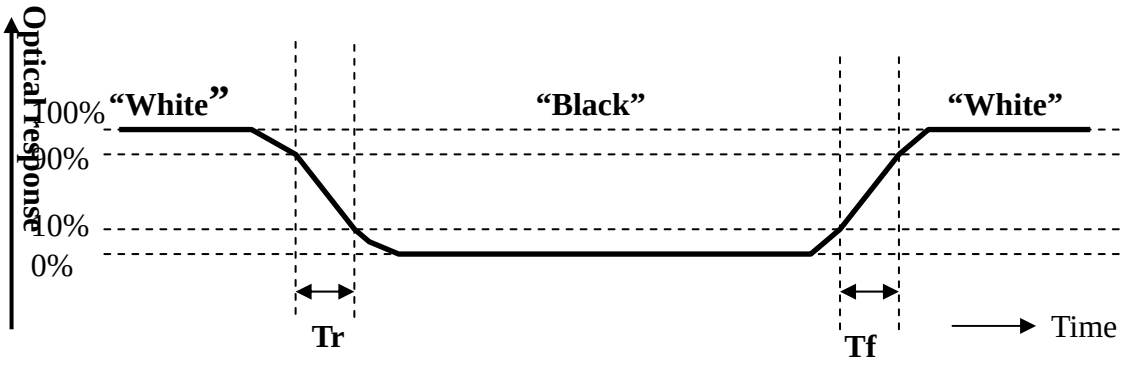
$$CR = \frac{Gmax}{Gmin}$$

* Gmax: Luminance with all pixels white

Gmin: Luminance with all pixels black

(3) Definite of Luminance of White: Luminance of white at the center point

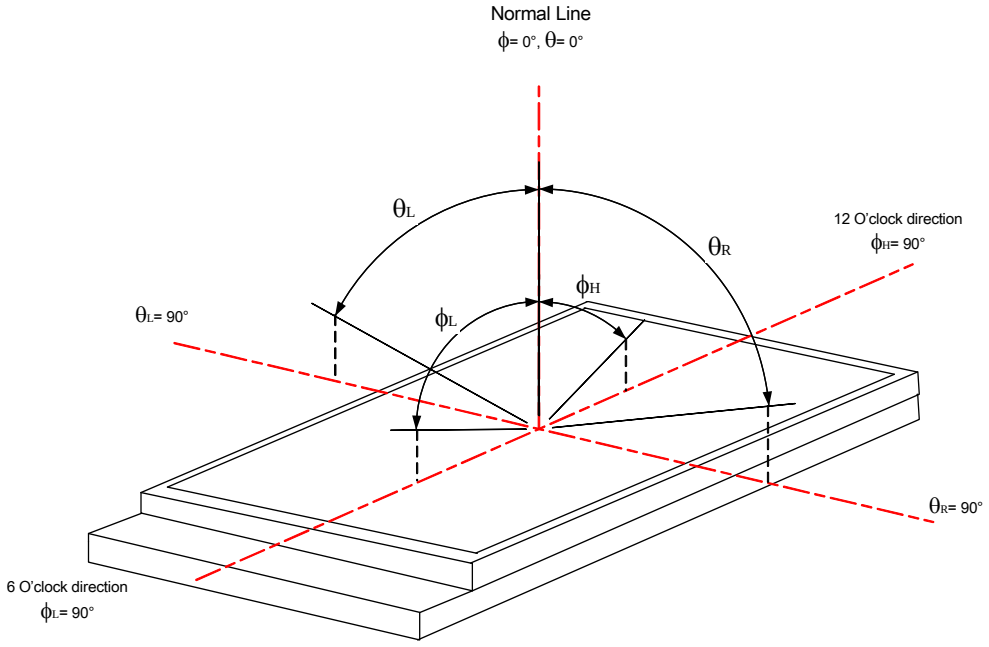
(4) Definition of Response time: Sum of Tr, Tf



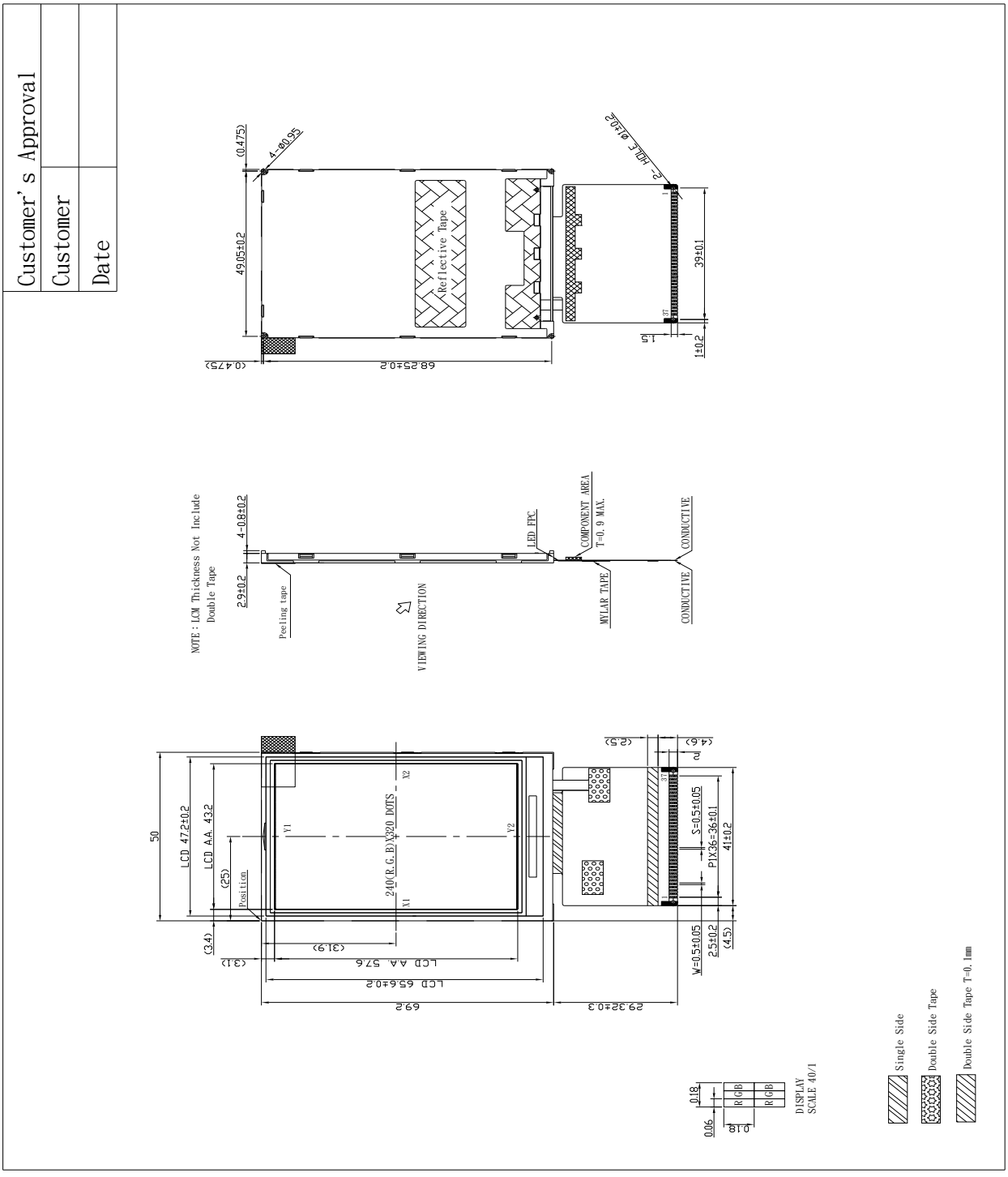
(5) Definition of Color Chromaticity (CIE 1931)

Color coordinate of white & red, green, blue at center point.

(6) Definition of Viewing Angle: Viewing angle range ( CR ≧ 10)



# 6 OUTLINE DIMENSION



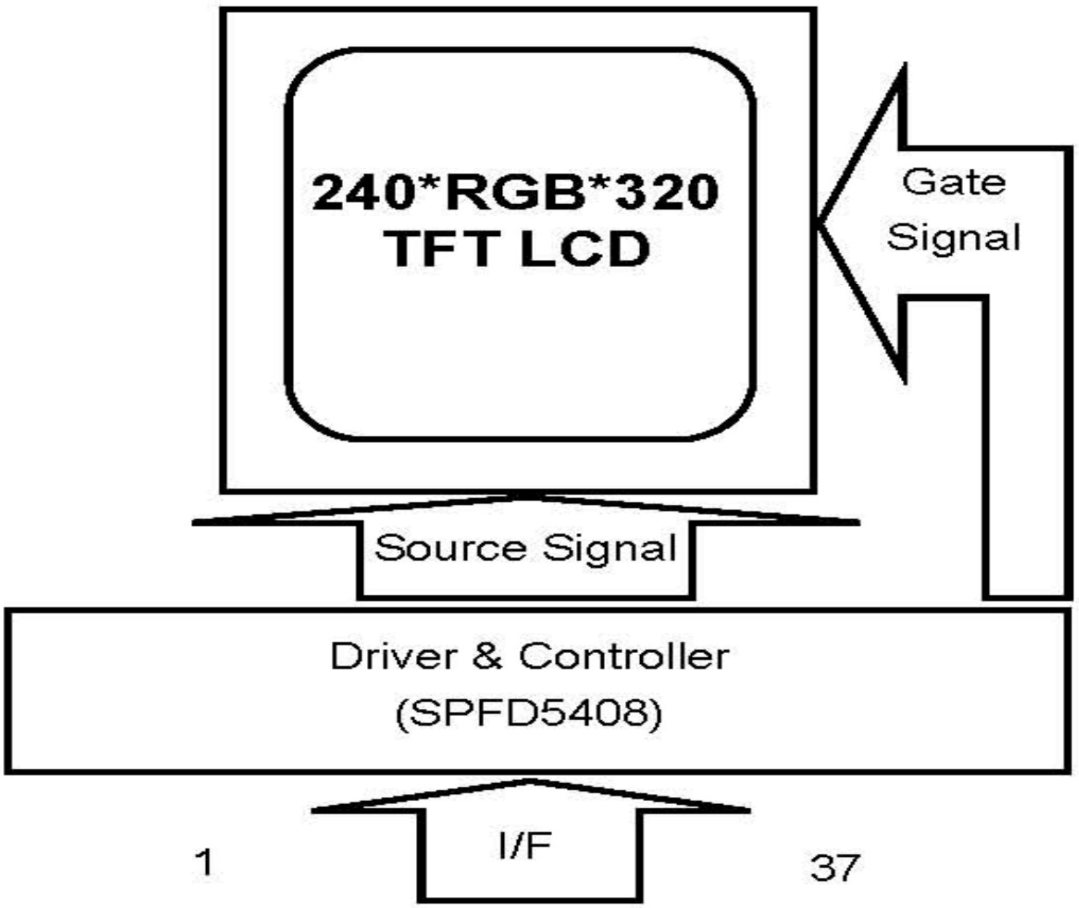
# 7 INTERFACE PIN CONNECTION

TFT LCD module interface

| | Symbol | Function |
|---|---|---|
| 1 | DB0 | Data Bus Bit 0 |
| 2 | DB1 | Data Bus Bit 1 |
| 3 | DB2 | Data Bus Bit 2 |
| 4 | DB3 | Data Bus Bit 3 |
| 5 | GND1 | Ground |
| 6 | VCC1 | Power input |
| 7 | /CS | Chip select signal active “L” |
| 8 | RS | Command / Display data selection |
| 9 | /WR | I80 system: serves as a write signal and writes data at the rising edge |
| 10 | /RD | I80 system: serves as a read signal and reads data at the low level |
| 11 | IM0 | Dummy |
| 12 | NC | Dummy |
| 13 | NC | Dummy |
| 14 | NC | Dummy |
| 15 | NC | Dummy |
| 16 | LED_A | Backlight LED Anode input pin (A) |
| 17 | LED_K1 | Backlight LED cathode input pin(K1) |
| 18 | LED_K2 | Backlight LED cathode input pin(K2) |
| 19 | LED_K3 | Backlight LED cathode input pin(K3) |

| | Symbol | Function |
|---|---|---|
| 20 | LED_K4 | Backlight LED cathode input pin(K4) |
| 21 | IM3 | Dummy |
| 22 | DB4 | Data Bus Bit 4 |
| 23 | DB10 | Data Bus Bit 8 |
| 24 | DB11 | Data Bus Bit 9 |
| 25 | DB12 | Data Bus Bit 10 |
| 26 | DB13 | Data Bus Bit 11 |
| 27 | DB14 | Data Bus Bit 12 |
| 28 | DB15 | Data Bus Bit 13 |
| 29 | DB16 | Data Bus Bit 14 |
| 30 | DB17 | Data Bus Bit 15 |
| 31 | /RESET | Reset input pin for TFT LCD when /RESET is “L” initialization is executed |
| 32 | VCI | Power supply for internal reference circuits |
| 33 | VCC2 | Power supply voltage |
| 34 | GND | System Ground(0V) |
| 35 | DB5 | Data Bus Bit 5 |
| 36 | DB6 | Data Bus Bit 6 |
| 37 | DB7 | Data Bus Bit 7 |

## 8. BLOCK DIAGRAM



# 9 RELIABILITY

| No. | Test Items | Test Conditions |
|---|---|---|
| 1 | High Temperature Storage Test | Ta=80℃, 240 Hrs |
| 2 | Low Temperature Storage Test | Ta=-30℃, 240Hrs |
| 3 | High Temperature and High Humidity Operating Test | Ta=60℃, 90%RH, 240Hrs<br>(No condensation of dew) |
| 4 | High Temperature Operating Test | Ta=70℃, 240Hrs |
| 5 | Low Temperature Operating Test | Ta=-20℃, 240Hrs |
| 6 | Heat Shock Test | Ta=-30℃ (0.5H) ~ 80℃ (0.5H) / 50 cycles |
| 7 | Electro Static Discharge Test | +200V, 200pF (0Ω), 1 time for each terminal |

Note: (1) Evaluation should be tested after storage at room temperature for 24 hours.

(2) There should be no change that might affect the practical display function when the display quality test is conducted under normal operating conditions.

(3) Judgment:

a. In the standard condition, there shall be no practical problems that may affect the display function.

b. No serious image quality degradation.