



SPECIFICATION FOR LCD PRODUCT N° 903.02120

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1. PURPOSE

This specification covers the delivery requirements for the liquid crystal display module delivered by EM Microelectronic-Marin SA..

2. PRODUCT SPECIFICATIONS

2.1 BASIC SPECIFICATION

| ITEM | CHARACTERISTICS |
|----------------------|-------------------------|
| Display mode | Blue-Gray |
| Display type | STN positive reflective |
| Viewing angle | 6 o'clock |
| Driving | 1/17 duty 1/5 bias |
| LCD Driver | EM 6124 |
| LCD Module structure | COG with HSC |
| Printing | No printing |

2.2 MECHANICAL CHARACTERISTICS

| ITEM | CHARACTERISTICS |
|-----------------------------|---------------------------|
| Dots configuration | 2 x 16 characters + icons |
| Dots dimensions (mm) | 0.74 H x 0.58 W |
| Dot gap (mm) | 0.1 |
| Module size (L x W x T, mm) | 68.3 x 33.5 x 2.93 |
| Viewing area (L x W, mm) | 65 x 25 |
| Weight (g) | 13 |

2.3 ABSOLUTE MAXIMUM RATINGS

Vss = 0 V, Ambient Temp.= 25 °C

| Item | Symbol | Condition | Min | Max | Unit |
|-----------------------|--------|-----------|-------|-----------|------|
| Power supply voltage | Vdd | 25 °C | -0.3 | 6.0 | V |
| | Vlcd | 25 °C | 0.3 | 7.0 | V |
| Input voltage | Vin | 25 °C | -.0.3 | Vdd + 0.3 | V |
| Operating temperature | Topr | --- | 0 | 50 | °C |
| Storage temperature | Tstg | --- | -20 | 60 | °C |

* Bubbles may occur at low temperature, but they disappear within two hours in room temperature, thus the LCD is not defective.

2.4 ELECTRICAL CHARACTERISTICS

Vss = 0 V, Ambient Temp.= 25 °C

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---------------------------------------|------------|--------------------------------|-----|-----|-----|------|
| Power supply voltage | VDD | 25 °C | 2 | 3.0 | 5.5 | V |
| Operating Voltage (Vdd- Vlcd) | Vop | 25 °C | | 4.0 | | V |
| Operating frequency (frame frequency) | fopr (FRM) | 25 °C | | 70 | | Hz |
| Current consumption | Idd | Checker board pattern at 25 °C | - | 200 | - | µA |

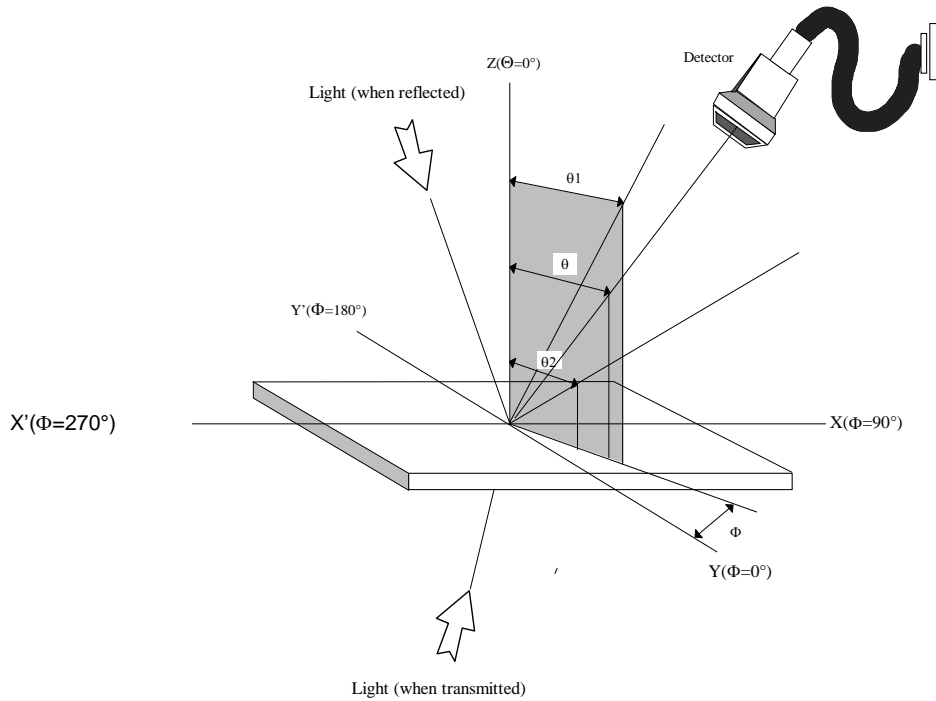


2.5 LCD ELECTRICAL & OPTICAL CHARACTERISTICS

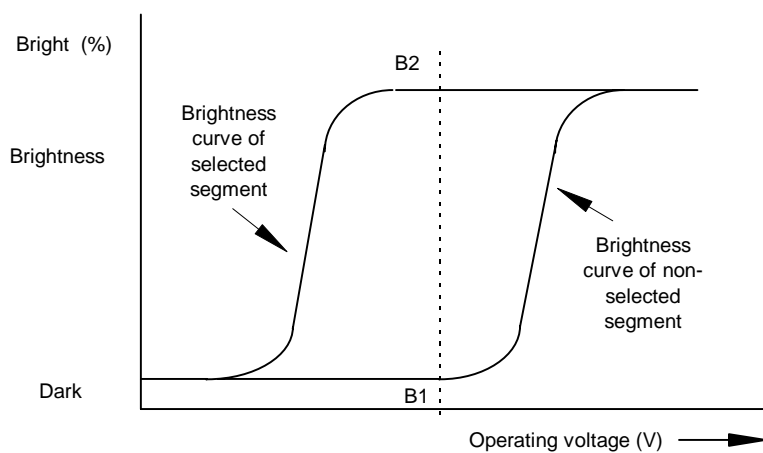
| ITEM | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNIT |
|---------------|---------------------|---|------|-----|------|-----|------|
| Contrast | C | $\theta = 10^\circ$ $\Phi = 0^\circ$ $V_{opr} = 4.0V \pm 3\%$ | 25°C | - | 4 | - | - |
| Viewing angle | $\theta 1$ | $C \geq 2.0$ | | - | - | -20 | deg. |
| | $\theta 2$ | $F = 180^\circ$ | 25°C | 30 | - | - | |
| | $\theta 2-\theta 1$ | $V_{opr} = 4.0V \pm 3\%$ | | 50 | - | - | |
| Response time | ton | $V_{opr} = 4.0V \pm 3\%$ | 25°C | | 250 | | ms |
| | | $V_{opr} = 4.0V \pm 3\%$ | 0°C | | 1000 | | |
| | | | | | - | - | |
| | toff | $V_{opr} = 4.0V \pm 3\%$ | 25°C | | 200 | | |
| | | $V_{opr} = 4.0V \pm 3\%$ | 0°C | | 1500 | | |
| | | | | | - | - | |

Measuring equipment: Autronic

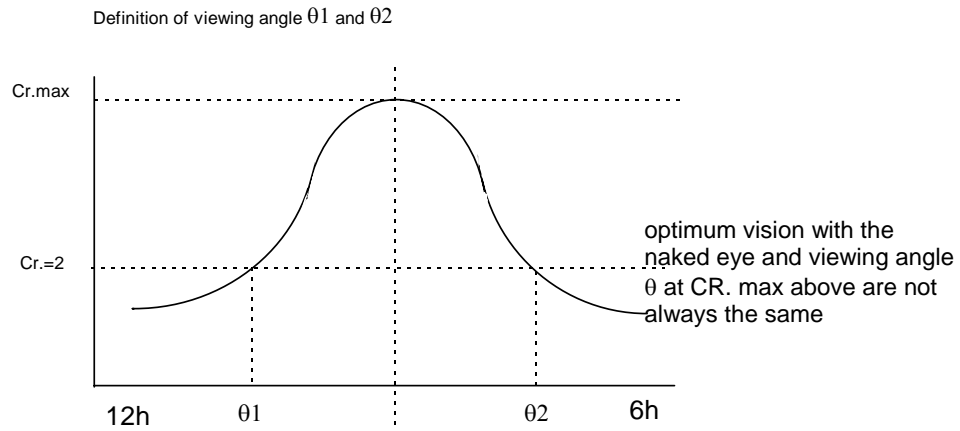
2.5.1 Definition of optical characteristics



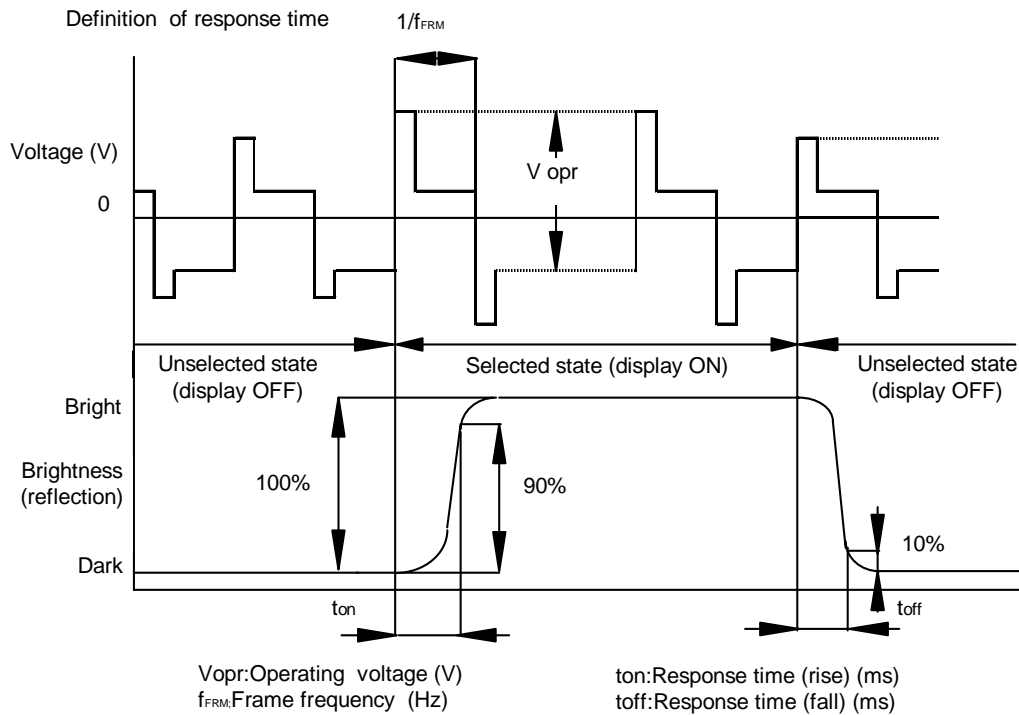
Definition of contrast Cr.
$$Cr. = \frac{B1}{B2} = \frac{\text{Brightness of not selected segment}}{\text{Brightness of selected segment}}$$



2.5.2 Definition of viewing angle

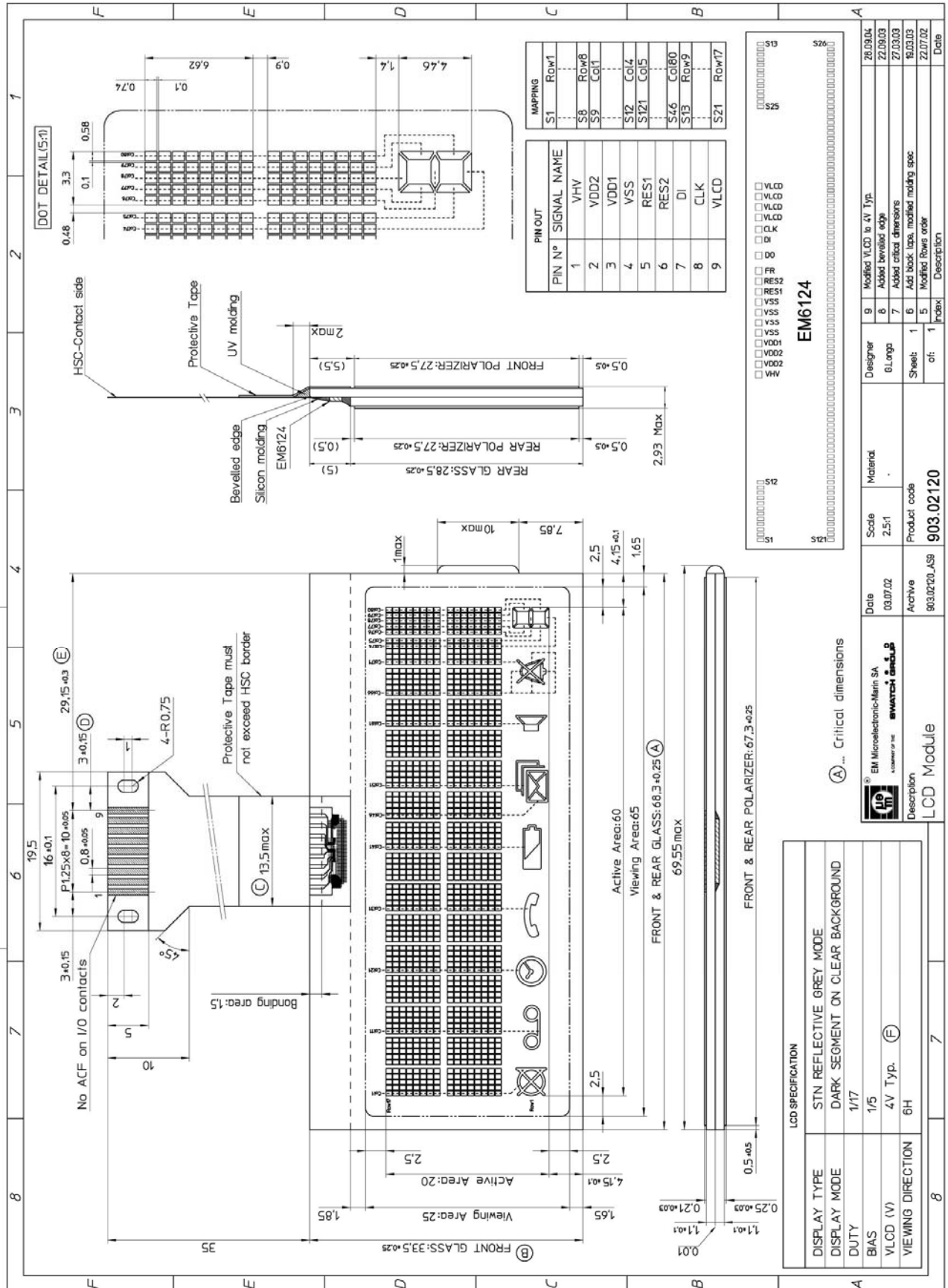


2.5.3 Definition of response time



2.6 MECHANICAL DIMENSIONS

2.6.1 Electrical and Assembly Drawing



| LCD SPECIFICATION | |
|-------------------|----------------------------------|
| DISPLAY TYPE | STN REFLECTIVE GREY MODE |
| DISPLAY MODE | DARK SEGMENT ON CLEAR BACKGROUND |
| DUTY | 1/17 |
| BIAS | 1/5 |
| VLCD (V) | 4V Typ. (F) |
| VIEWING DIRECTION | 6H |

EM Microelectronic-Marín SA
 a company of the **swatch group**

| Date | Scale | Material | Designer | Modified VLCD to 4V Typ. |
|---------------|--------------|----------|----------|--------------------------|
| 03.07.02 | 2.5:1 | . | El Longo | Z2.09.03 |
| Archive | Product code | Sheet | of | Date |
| 903.02120_A59 | 903.02120 | 1 | 1 | Z2.03.03 |
| | | | | Z2.07.02 |
| | | | | Date |



2.7 PIN CONNECTION (SIGNAL FUNCTION)

See assembly drawing

3. RELIABILITY

3.1 RELIABILITY

| Storage Condition | Contents | Current Consumption | Oozing | Contrast | Other Appearances |
|--|--------------------|-------------------------------------|--------|--------------------------------|-------------------|
| Operation at high temperature and humidity | 40°C/90%RH 240h | Twice the initial value or less | None | More than 50% of initial value | No abnormality |
| High temperature storage | 60° ± 2°C 240h | Twice the initial value or less | None | More than 50% of initial value | No abnormality |
| Low temperature storage | -10° ± 2°C 240h | 1.5 times the initial value or less | None | More than 50% of initial value | No abnormality |

4. MARKINGS

4.1 MARKINGS

No marking is required.

5. SHIPMENT METHOD

5.1 INTERNAL PACKAGING

The products are packaged with partitions or cushions, to protect them from touching each other and from ESD.

5.1.1 Labels

Following information is described:

- 1. Lot No.: Shipping lot number
- 2. Part: EM 903.02120
- 3. Quantity: Quantity of pcs

5.2 EXTERNAL PACKAGING

Products are shipped in labelled cartons.

5.2.1 Label Format

The format on the label is shown below.

A progressive number is added near the label.

| | | |
|-------------|---|--------------|
| Cal. | ← | Model name |
| QTY | ← | Quantity |
| N/W | ← | Net weight |
| G/W | ← | Gross weight |

6. ACCEPTANCE INSPECTION

6.1 ACCEPTANCE INSPECTION

Inspect the quality and quantity of the product that you have ordered within 2 weeks after having received it. This completes the acceptance inspection. Inform EM of the results.

6.2 ACCEPTANCE INSPECTION

Any products that do not conform to the LCD drawing and the delivery specification are dealt with in accordance with EM General Terms and Sales

7. QUALITY ASSURANCE

Also refer to EM General Terms of Sales and EM Web Site

7.1 CONFORMITY

The performance, functions and reliability of the shipped products conform to the product specifications.

7.2 RESPONSIBILITY

Customer is responsible for any defects in quality caused after receiving inspection.

7.3 SHIPPING INSPECTION STANDARDS

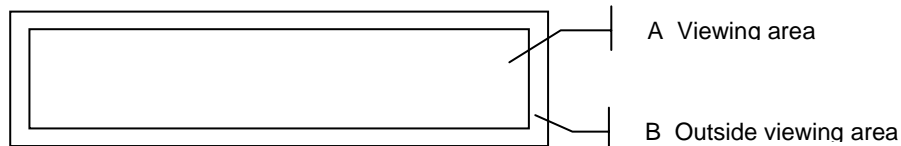
7.3.1 Shipping Inspection Standards

The sampling inspection plan is in accordance with MIL-STD-105D, single sampling, Inspection Level II and normal inspection. The quality assurance levels are shown below.

| RANK | DEFECT | A.Q.L. |
|--------------|--|--------|
| Major defect | No display Short circuit Outside dimensions | 0.25% |
| Minor defect | Display missing Pattern misalignment Pattern protrusion Black spots, black streaks Bubbles Chromaticity and uniformity Polarizer defects Glass defects Dirt, spots | 0.65% |

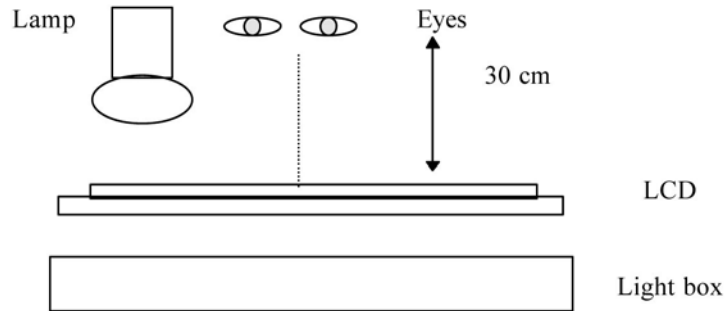
7.3.2 Zone Definitions

Shipment inspection is performed under dividing zone A and B.



7.3.3 *Visual Inspection*

Inspect under 30W fluorescent lamp, leaving 30cm between panel and eyes, and between panel and lights.



7.3.4 *Limit Sample*

If a judgement cannot be made according to the delivery specification, take limit samples.

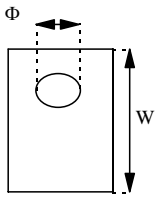
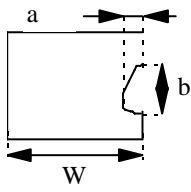
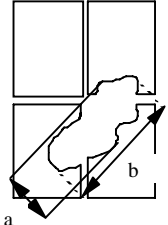


7.3.5 Individual Appearance Defects Standards (Display OFF)

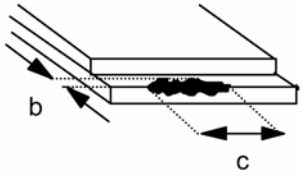
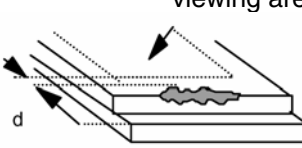
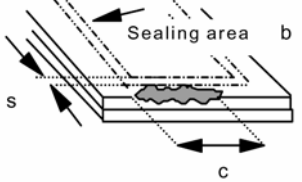
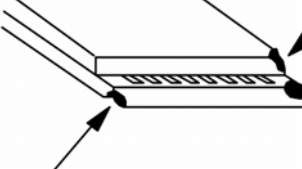
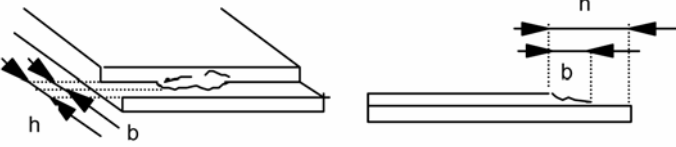
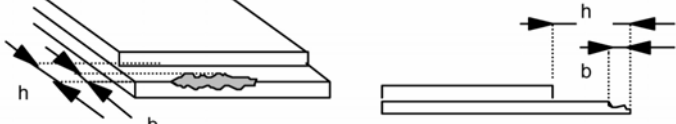
Φ Average diameter (mm), W: Width (mm), L: Length (mm)

| No | Item | Details | Section | Standards, max no. of defects | | |
|----|-----------------------------|--|-------------------------|-------------------------------|---|------------|
| | | | | Zone A | Zone B | |
| 1 | Black spots | | $< \Phi \leq 0.10$ | Any number | | |
| | | | $0.10 < \Phi \leq 0.25$ | 3 | | |
| | | | $0.25 < \Phi \leq$ | 0 | | |
| | | | Total number of defects | 3 | | |
| 2 | Black streaks | | $W \leq 0.01$ | | Any number | Any number |
| | | | $W \leq 0.03$ | $L \leq 5.0$ | 3 | |
| | | | $W \leq 0.05$ | $L \leq 2.0$ | 2 | |
| | | | $W \leq 0.05$ | - | 0 | |
| | | | Other than above | | 0 | |
| | | | Total number of defects | | 3 | |
| 3 | Chromaticity and Uniformity | Streaks and uneven colour caused by uneven gap between glasses | | | See limit sample | |
| 4 | Bubbles in polarizer | Bubbles between polarizer and glass | $0.20 < \Phi \leq 0.50$ | | 3 | Any number |
| | | | $0.50 < \Phi \leq 1.0$ | | 1 | Any number |
| | | | $1.0 < \Phi$ | | 0 | Any number |
| | | | $W \leq 0.15$ | $L \leq 5.0$ | 2 | Any number |
| | | | $W \leq 0.15$ | $L \leq 10.0$ | 1 | Any number |
| 5 | Scratched on the polarizer | Spots | $< \Phi \leq 0.10$ | Any number | | Any number |
| | | | $0.10 < \Phi \leq 0.25$ | 3 | | |
| | | | $0.25 < \Phi \leq 0.30$ | 1 | | |
| | | | $0.30 < \Phi$ | 0 | | |
| | | Lines | See limit samples | | | |
| 6 | Dirt on the polarizer | | | | See N.1, 2 | |
| 7 | Polarizer dislocation | | | | Products pass if the dislocation is out of viewing area | |
| 8 | End seal position | | | | n/a | |

7.3.6 Individual appearance defects standards (display ON)

| No | Item | Detail | Section (mm) | Standard. Max No of defects |
|----|---------------------|---|-----------------------------|-----------------------------|
| 1 | No display | Part or all of the screen doesn't light because of an open or a short circuit | | Must not occur. |
| 2 | Display missing | Part of display segment missing because of pin holes or an open.  | | W=0.44 |
| | | | $\Phi \leq 0.10$ | Any number |
| | | | $0.10 < \Phi \leq 0.25$ | 3 |
| | | | $0.25 < \Phi$ | 0 |
| | | | | |
| 3 | Display missing | Part of display segment missing because of pin holes or an open.  | | W=0.425 |
| | | | $a \leq 0.10$ $b \leq 0.10$ | Any number |
| | | | $a \leq 0.20$ $b \leq 0.25$ | 3 |
| | | | $a \leq 0.25$ $b \leq 0.30$ | 0 |
| | | | $a > 0.25$ $b > 0.30$ | 0 |
| 4 | Display missing a,b | Thin part of display segment / common missing  | $a \leq 0.03$ | Any number |
| | | | $a \leq 0.05$ $b < 0.5$ | 3 |
| | | | $a \leq 0.10$ $b \leq 0.3$ | 2 |
| | | | $a \leq 0.20$ $b \leq 0.3$ | 1 |
| | | | Other than above | 0 |
| | | | | |

7.3.7 Chipped Glass Defect Standard

| No | Item | Details | Section | Standards, max no. of defects |
|----|-----------------------------------|--|---------|---|
| 1 | Chipped glass at lead terminals |  | | More than 30% of lead terminal must remain |
| 2 | Chipped glass excluding terminals |  | | Acceptable if the distance d between chip and the limit of the viewing area is $\geq 0.25\text{mm}$ |
| 3 | Chipped glass on end face |  | | Width 's' of seal remaining must be $\geq 0.5\text{mm}$; 'c' must be $< 10.0\text{mm}$ |
| 4 | Chipped glass Other cases |  | | Acceptable |
| 5 | Glass rest or insulating layer |  | | $b \leq h/3$ |
| 6 | Irregular cut |  | | $b \leq h/3$ No glass rest |



8. OPERATIONS PRECAUTIONS

8.1 SAFETY

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth or in your eyes.
- If the liquid crystal touches your skin or clothes, wash it off using soap and water.

8.2 HANDLING

- The LCD is plate glass; do not hit or crush it.
- The polarizer of the display is very fragile; handle it very carefully.
- Do not soil or damage the LCD terminals.
- Keep the display surface clean. Do not touch it with your skin.

8.3 MOUNTING AND DESIGN

- When mounting, fix the external glass surface from sealing edge. If any force is applied where the liquid crystal is enclosed, uneven colour may occur because of the fluctuating of the LCD gap.
- If any force is applied to the polarizer, bubbles or separation may occur.
- Leave a gap so that the LCD, excluding the fixing portion, does not touch other components.
- Make a window smaller than the viewing area.
- To protect the LCD from external pressure, place a transparent plate (acrylic or glass) over the display surface having a small gap.
- Avoid condensation, otherwise the transparent electrodes may break.
- Drive with alternating drive, because the direct drive shortens the life of the LCD.

8.4 STORAGE

- For long-time storage, keep in a dark place at $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$, 65% RH maximum.
- Do not store the LCD near organic solvents or corrosive gases.

8.5 CLEANING

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with a soft cloth soaked with a perfluorine-hexane or iso-propanol.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the plastic cover plate.



9. SPECIFICATION HISTORY

| Rev. | E.C.N. | Pages | Date | Resp. | Description |
|------|--------|---------|-----------|-------|--|
| A | 02844 | 1-15 | oct. 2002 | VIGE | First revision |
| B | 03184 | 6 | 21.03.03 | HA | Update Assembly Drawing |
| C | 04687 | 2-3,6-7 | 29.09.04 | HA | General update of §2.1, 2.4, 2.5, §3 & V _{LCD} (Assembly drawing) |

10. ATTACHMENTS

| | |
|------------|---|
| Minispecs: | - |
| Forms: | - |

11. CUSTOMER APPROVAL

Customer (print company name): _____

Approved by (print name): _____

Signature: _____

Title: _____

Date: _____

Please complete and return to:

**LCD & Module Department
EM Microelectronic-Marin S.A.
Rue des Sors 3
CH-2074 Marin**

Fax.: +41 32 755.59.18