GRAPHIC OLED MODULE DATA SHEET

Preliminary Data Sheet Release 2014-09-08
for
CFAL12864QX-G and CFAL12864QX-Y

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Data Sheet Revision History

Preliminary Data Sheet Release: 2014-09-08
Data Sheet revised to reflect that CFAL12864QX-G and CFAL12864QX-Y are now available on the Crystalfontz website. Display module specifications have not changed.

- Photos added to title page.
- Expanded Module Reliability (Pg. 12) information.

Data Sheet Preliminary Release: 2014-03-24
Preliminary Data Sheet for theCFAL12864QX-G and CFAL12864QX-Y display modules. Possible special customer request. These modules are not available on the Crystalfontz website.

Hardware Updates

To see updates, look for the Product Notices tab on the product's web page. If there is no Product Notices tab, the product does not have any updates.

About Variations

We work continuously to improve our products. Because display technologies are quickly evolving, these products may have component or process changes. Slight variations (for example, contrast, color, or intensity) between lots are normal. If you need the highest consistency, whenever possible, order and arrange delivery for your production runs at one time so your displays will be from the same lot.

The Fine Print

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All specifications in Data Sheets and on our website are, to the best of our knowledge, accurate but not guaranteed. Corrections to specifications are made as any inaccuracies are discovered.

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About Volatility

The Crystalfontz CFAL12864QX-G and CFAL12864QX-Y modules have volatile memory.

CONTENTS

PHYSICAL CHARACTERISTICS

CFAL12864QX-G

Item	Dimension	Unit
Dot Matrix	128 x 64	—
Module dimension	73.0 × 41.86 × 3.0	mm
Active Area	61.41 × 30.69	mm
Pixel Size	0.45 × 0.45	mm
Pixel Pitch	0.48 × 0.48	mm
Display Mode	Passive Matrix	
Display Color	Monochrome (Green)	
Drive Duty	1/64 Duty	
IC	SSD1325	

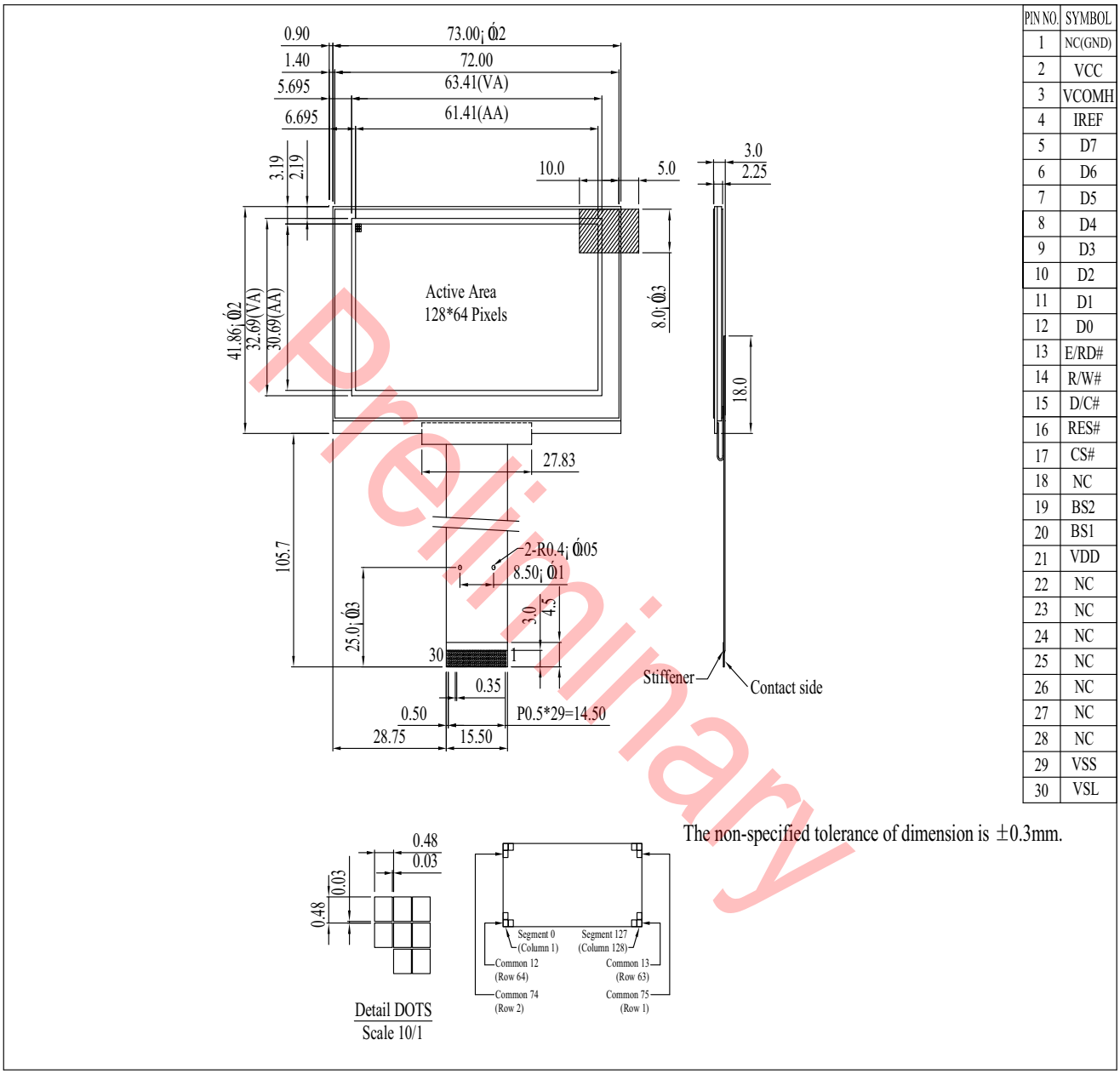
CFAL12864QX-Y

CFAL12864QX-Y has the same physical characteristics as CFAL12864QX-G shown above, except display color is yellow monochrome.

ADDITIONAL FEATURES

- ❑ These modules have a Solomon Systech SSD1325 128 x 80, 16-level grayscale dot matrix OLED/PLED segment/ common driver with controller. For interface information and other details, see controller datasheets on our website.
- ❑ Interface choices are 8-bit parallel (8080 or 6800) or SPI.
- ❑ RoHS compliant. Factory is ISO certified.

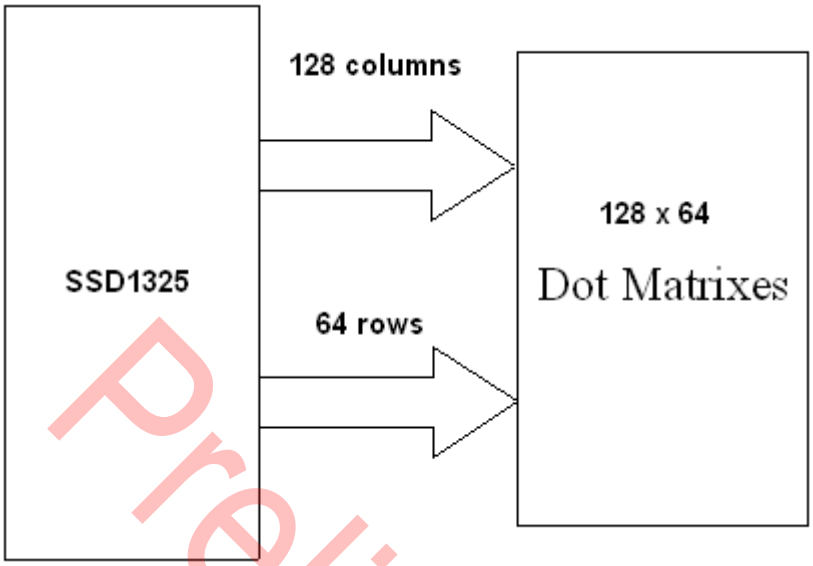
MODULE OUTLINE DRAWING



PIN NO.	SYMBOL
1	NC(GND)
2	VCC
3	VCOMH
4	IREF
5	D7
6	D6
7	D5
8	D4
9	D3
10	D2
11	D1
12	D0
13	E/RD#
14	R/W#
15	D/C#
16	RES#
17	CS#
18	NC
19	BS2
20	BS1
21	VDD
22	NC
23	NC
24	NC
25	NC
26	NC
27	NC
28	NC
29	VSS
30	VSL

The non-specified tolerance of dimension is ±0.3mm.

SYSTEM BLOCK DIAGRAM



DETAILS OF INTERFACE PIN FUNCTIONS

No.	Symbol	I/O	Function
1	NC(GND)		Reserved Pin (Supporting Pin) The supporting pin can reduce the influences from stresses on the function pins. This pin must be connected to external ground.
2	VCC	P	Power Supply for OLED Panel This is the most positive voltage supply pin of the chip. It must be supplied externally.
3	VCOMH	P	Voltage Output High Level for COM Signal This pin is the input pin for the voltage output high level for COM signals. It can be supplied externally or internally. When VCOMH is generated internally, a capacitor should be connected between this pin and VSS.
4	IREF	I	Current Reference for Brightness Adjustment This pin is segment current reference pin. A resistor should be connected between this pin and VSS. Set the current at 10µA.
5~12	D7~D0	I/O	Host Data Input/Output Bus These pins are 8-bit bi-directional data bus to be connected to the microprocessor's data bus. When serial mode is selected, D1 will be the serial data input SDIN and D0 will be the serial clock input SCLK
13	E/RD#	I	Read/Write Enable or Read This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as the Enable (E) signal. Read/write operation is initiated when this pin is pulled high and the CS# is pulled low. When connecting to an 80XX-microprocessor, this pin receives the Read (RD#) signal. Data read operation is initiated when this pin is pulled low and CS# is pulled low.
14	R/W#	I	Read/Write Select or Write This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as Read/Write (R/W#) selection input. Pull this pin to "High" for read mode and pull it to "Low" for write mode. When 80XX interface mode is selected, this pin will be the Write (WR#) input. Data write operation is initiated when this pin is pulled low and the CS# is pulled low.
15	D/C#	I	Data/Command Control This pin is Data/Command control pin. When the pin is pulled high, the input at D7~D0 is treated as display data. When the pin is pulled low, the input at D7~D0 will be transferred to the command register. For detail relationship to MCU interface signals, please refer to

DETAILS OF INTERFACE PIN FUNCTIONS, CONT'D

<table>
<tr><td></td><td></td><td></td><td>the
Timing Characteristics Diagrams.
When the pin is pulled high and serial interface mode is selected, the data at SDIN is treated as data. When it is pulled low, the data at SDIN will be transferred to the command register.</td></tr>
<tr><td>16</td><td>RES#</td><td>I</td><td>Power Reset for Controller and Driver
This pin is reset signal input. When the pin is low, initialization of the chip is executed.</td></tr>
<tr><td>17</td><td>CS#</td><td>I</td><td>Chip Select
This pin is the chip select input. The chip is enabled for MCU communication only when CS# is pulled low.</td></tr>
<tr><td>18</td><td>NC</td><td></td><td>Reserved Pin
The N.C. pins between function pins are reserved for compatible and flexible design.</td></tr>
<tr><td>19</td><td>BS2</td><td rowspan="2">I</td><td rowspan="2">Communicating Protocol Select
These pins are MCU interface selection input. See the following table:<table><tr><td></td><td>68XX-parallel</td><td>80XX-parallel</td><td>Serial</td></tr><tr><td>BS1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>BS2</td><td>1</td><td>1</td><td>0</td></tr></table></td></tr>
<tr><td>20</td><td>BS1</td></tr>
<tr><td>21</td><td>Vdd</td><td>P</td><td>Power Supply for Logic Circuit
This is a voltage supply pin. It must be connected to external source.</td></tr>
<tr><td>22</td><td>NC</td><td></td><td rowspan="7">Reserved Pin
The N.C. pins between function pins are reserved for compatible and flexible design.</td></tr>
<tr><td>23</td><td>NC</td><td></td></tr>
<tr><td>24</td><td>NC</td><td></td></tr>
<tr><td>25</td><td>NC</td><td></td></tr>
<tr><td>26</td><td>NC</td><td></td></tr>
<tr><td>27</td><td>NC</td><td></td></tr>
<tr><td>28</td><td>NC</td><td></td></tr>
<tr><td>29</td><td>Vss</td><td>P</td><td>Ground of OLED System
This is a ground pin. It also acts as a reference for the logic pins, the OLED driving voltages, and the analog circuits. It must be connected to external ground.</td></tr>
<tr><td>30</td><td>VSL</td><td>0</td><td>Voltage Output Low Level for SEG Signal
This pin is the output pin for the voltage output low level for SEG signals. A capacitor should be connected between this pin and VSS.</td></tr>
</table>

OPTICAL CHARACTERISTICS

CFAL12864QX-G

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V)θ		160			deg
	(H)φ		160			deg
Contrast Ratio	CR	Dark	2000:1		—	—
Response Time	T rise	—		10		µs
	T fall	—		10		µs
Display with 50% check Board Brightness			60	80		cd/m2
CIEx(Green)		(CIE1931)	0.24	0.28	0.32	
CIEy(Green)		(CIE1931)	0.59	0.63	0.67	

CFAL12864QX-Y

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V)θ		160			deg
	(H)φ		160			deg
Contrast Ratio	CR	Dark	2000:1		—	—
Response Time	T rise	—		10		µs
	T fall	—		10		µs
Display with 50% check Board Brightness			60	80		cd/m2
CIEx(Yellow)		(CIE1931)	0.45	0.47	0.49	
CIEy(Yellow)		(CIE1931)	0.48	0.50	0.52	

ABSOLUTE MAXIMUM CHARACTERISTICS

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for Logic	VDD	-0.3	4	V	1, 2
Supply Voltage for Display	VCC	0	15	V	1, 2
Operating Temperature	TOP	-40	+80	°C	-
Storage Temperature	TSTG	-40	+80	°C	-

Note 1: All the above voltages are on the basis of “VSS = 0V”.
Note 2: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. Also, for normal operations, it is desirable to use this module under the conditions according to Section 6 ‘’Electrical Characteristics’’. If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate

RECOMMENDED DC CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	VDD	—	2.8	3.0	3.3	V
Supply Voltage for Display	VCC	—	10	12	15	V
High Level Input	VIH	—	$0.8\times V_{DD}$	—	V_{DD}	V
Low Level Input	VIL	—	0	—	$0.2\times V_{DD}$	V
High Level Output	VOH	—	$0.9\times V_{DD}$	—	V_{DD}	V
Low Level Input	VOL	—	0	—	$0.1\times V_{DD}$	V
50% Check Board operating Current		VCC =12 V	26	28	32	mA

ESD (ELECTRO-STATIC DISCHARGE)

The circuitry is industry standard CMOS logic and is susceptible to ESD damage. Please use industry standard antistatic precautions as you would for any other static sensitive devices such as expansion cards, motherboards, or integrated circuits. Ground your body, work surfaces, and equipment.

PRODUCT RELIABILITY AND LONGEVITY

MODULE RELIABILITY

PART NUMBER	SPECIFICATION
CFAL12864QX-G and *CFAL12864QX-Y*	Brightness will be >50% of a new module's initial brightness for at least 50,000 hours of operation when supply to each LED is below TBD mA.
Under operating and storage temperature specification limitations, humidity noncondensing) RH up to 65%, and no exposure to direct sunlight. Value listed above is approximate and represent typical lifetime.	

MODULE LONGEVITY (EOL / REPLACEMENT POLICY)

Crystalfontz is committed to making all of our OLED modules available for as long as possible. Occasionally, a supplier discontinues a component, or a process used to make the module becomes obsolete, or the process moves to a more modern manufacturing line. In order to continue making the module, we will do our best to find an acceptable replacement part or process which will make the "replacement" fit, form, and function compatible with its predecessor.

We recognize that discontinuing a module may cause problems for some customers. However, rapidly changing technologies, component availability, or low customer order levels may force us to discontinue ("End of Life", EOL) a module. For example, we must occasionally discontinue a module when a supplier discontinues a component or a manufacturing process becomes obsolete. When we discontinue a module, we will do our best to find an acceptable replacement module with the same fit, form, and function.

In most situations, you will not notice a difference when comparing a "fit, form, and function" replacement module to the discontinued module it replaces. However, sometimes a change in component or process for the replacement module results in a slight variation, perhaps an improvement, over the previous design.

Although the replacement module is still within the stated Data Sheet specifications and tolerances of the discontinued module, changes may require modification to your circuit and/or firmware. Possible changes include:

- *Controller.* A new controller may require minor changes in your code.
- *Component tolerances.* Module components have manufacturing tolerances. In extreme cases, the tolerance stack can change the visual or operating characteristics.

Please understand that we avoid changing a module whenever possible; we only discontinue a module if we have no other option. We publish Part Change Notices (PCN) as soon as possible.

CARE AND HANDLING PRECAUTIONS

For optimum operation of the module and to prolong its life, please follow the precautions below. Excessive voltage will shorten the life of the module. You must drive the display within the specified voltage limit. See *Absolute Maximum Ratings* in ABSOLUTE MAXIMUM CHARACTERISTICS (Pg. 11).

HANDLING CAUTION FOR MODULES SHIPPED IN TRAYS

If you receive modules packed in trays, handle trays carefully by supporting the entire tray. Trays were made to immobilize the modules inside their packing carton. Trays are not designed to be rigid. Do not carry trays by their edges; trays and modules may be damaged.

ESD (ELECTRO-STATIC DISCHARGE)

The circuitry is industry standard CMOS logic and susceptible to ESD damage. Please use industry standard antistatic precautions as you would for any other static sensitive devices such as expansion cards, motherboards, or integrated circuits. Ground your body, work surfaces, and equipment.

DESIGN AND MOUNTING

- The exposed surface of the “glass” is actually a polarizer laminated on top of the glass. To protect the soft plastic polarizer from damage, the module ships with a protective film over the polarizer. Please peel off the protective film slowly. Peeling off the protective film abruptly may generate static electricity.
- The polarizer is made out of soft plastic and is easily scratched or damaged. When handling the module, avoid touching the polarizer. Finger oils are difficult to remove.
- To protect the soft plastic polarizer from damage, place a transparent plate (for example, acrylic, polycarbonate, or glass) in front of the module, leaving a small gap between the plate and the display surface. We use HP-92 Lexan, which is readily available and works well.
- Do not disassemble or modify the module.
- The display can be mounted vertically onto a front panel using a variety of methods. If the enclosure is plastic, it can be molded to have the display snap into place. A metal enclosure can use a milled faceplate with mounting tabs to secure the module. Adhesives can be used, as long as they are not similar to "super-glue" because these emit vapors that can damage the display over time.
- Use care to keep the exposed terminals clean. Contamination, including fingerprints, may make soldering difficult and the reliability of the soldered connection poor.
- Do not reverse polarity to the power supply connections. Reversing polarity will immediately ruin the module.
- Sharp bends can damage the panel Do not crease the cables. Do not bend the cables tightly against the edge of the module. Do not repeatedly bend the cable beyond its elastic region. Limit bend radius to at least R5.00 mm.

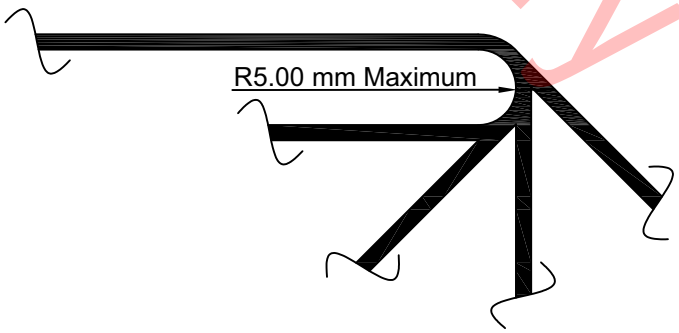


Figure 1. Limit Bend Radius Of FPC And FFC Cables

- Do not repeatedly bend the FFC/FPC beyond its elastic region.

AVOID SHOCK, IMPACT, TORQUE, OR TENSION

- Do not expose the module to strong mechanical shock, impact, torque, or tension.
- Do not drop, toss, bend, or twist the module.

- Do not place weight or pressure on the module.

CAUTION

All electronics may contain harmful substances. Avoid contamination by using care to avoid damage during handling. If any residues, gases, powders, liquids, or broken fragments come in contact with your skin, eyes, mouth, or lungs, immediately contact your local poison control or emergency medical center.

HOW TO CLEAN

1. Turn display off.
2. Use the removable protective film to remove smudges (for example, fingerprints) and any foreign matter. If you no longer have the protective film, use standard transparent office tape (for example, Scotch® brand “Crystal Clear Tape”).
3. If the polarizer is dusty, you may carefully blow it off with clean, dry, oil-free compressed air.
4. If you must clean with a liquid, never use glass cleaners, as they may contain ammonia or alcohol that will damage the polarizer over time. Never apply liquids directly on the polarizer. Long contact with moisture may permanently spot or stain the polarizer. Use filtered water to slightly moisten a clean lint-free microfiber cloth designed for cleaning optics. (For example, use a cloth sold for cleaning plastic eyeglasses.)
5. The plastic is easily scratched or damaged. Use a light touch as you clean the polarizer. Wipe gently.
6. Use a dry microfiber cloth to remove any trace of moisture before turning on the display module.
7. Gently wash the microfiber cloths in warm, soapy water and air dry before reuse.

OPERATION

- We do not recommend connecting this module to a PC's parallel port as an “end product.” This module is not “user friendly” and connecting it to a PC's parallel port is often difficult, frustrating, and can result in a “dead” display due to mishandling. For more information, see our forum thread at http://www.crystalfontz.com/forum/showthread.php?s=&threadid=3257.
- Your circuit should be designed to protect the module from ESD and power supply transients.
- Observe the operating temperature limitations: a minimum of -40°C to a maximum of +80°C noncondensing with minimal fluctuation. Operation outside of these limits may shorten life and/or harm display. Changes in temperature can result in changes in contrast.
  - At lower temperatures of this range, response time is delayed.
  - At higher temperatures of this range, display becomes dark. (You may need to adjust the contrast.)
- Operate away from dust, moisture, and direct sunlight.

STORAGE AND RECYCLING

- Store in an ESD-approved container away from dust, moisture, and direct sunlight, fluorescent lamps, or any ultraviolet ray with humidity less than 90% noncondensing.
- Observe the storage temperature limitations: from -40°C minimum to +80°C maximum with minimal fluctuations. Rapid temperature changes can cause moisture to form, resulting in permanent damage.
- Do not allow weight to be placed on the modules while they are in storage.
- Please recycle your outdated modules at an approved facility.

APPENDIX A: QUALITY ASSURANCE STANDARDS

INSPECTION CONDITIONS

- Environment
  - Temperature: 25±5°C
  - Humidity: 30~85% RH (noncondensing)
- For visual inspection of active display area
  - Source lighting: two 20-Watt or one 40-Watt fluorescent light
  - Display adjusted for best contrast
  - Viewing distance: 30±5 cm (about 12 inches)
  - Viewing angle: inspect at 45° angle of vertical line right and left, top and bottom

COLOR DEFINITIONS

We try to describe the appearance of our display modules as accurately as possible. For the photos, we adjust the backlight (if any) and contrast for optimal appearance. Actual display appearance may vary due to (1) different operating conditions, (2) small variations of component tolerances, (3) inaccuracies of our camera, (4) color interpretation of the photos on your monitor, and/or (5) personal differences in the perception of color.

ACCEPTANCE SAMPLING

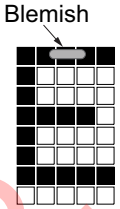
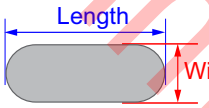
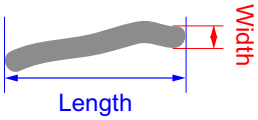
DEFECT TYPE	AQL*
Major	≤.65%
Minor	<1.0%
* Acceptable Quality Level: maximum allowable error rate or variation from standard	

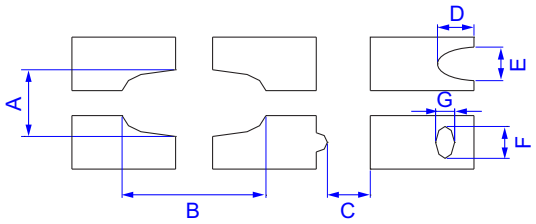
DEFECTS CLASSIFICATION

Defects are defined as:

- Major Defect: results in failure or substantially reduces usability of unit for its intended purpose
- Minor Defect: deviates from standards but is not likely to reduce usability for its intended purpose

ACCEPTANCE STANDARDS

#	DEFECT TYPE	ACCEPTANCE STANDARDS CRITERIA			MAJOR / MINOR
1	Electrical defects	1. No display, display malfunctions, or shorted segments. 2. Current consumption exceeds specifications.			Major
2	Viewing area defect	Viewing area does not meet specifications.			Major
3	Contrast adjustment defect	Contrast adjustment fails or malfunctions.			Major
4	Blemishes or foreign matter on display segments		*Defect Size* ≤0.30 mm ≤2 defects within 10 mm of each other	*Acceptable Qty* 3	Minor
5	Blemishes or foreign matter outside of display segments	Defect Size = (Width + Length)/2 	*Defect Size* ≤0.15 mm 0.15 to 0.20 mm 0.20 to 0.25 mm > 0.30 mm	*Acceptable Qty* Ignore 3 2 1	Minor
6	Dark lines or scratches in display area 	*Defect Width* ≤0.03 mm 0.03 to 0.05 0.05 to 0.08 0.08 to 0.10 ≥0.10	*Defect Length* ≤3.0 mm ≤2.0 mm ≤2.0 mm ≤3.0 mm >3.0 mm	*Acceptable Qty* 3 2 1 0 0	Minor
7	Bubbles between polarizer film and glass		*Defect Size* ≤0.20 mm 0.20 to 0.40 mm 0.40 to 0.60 mm ≥0.60 mm	*Acceptable Qty* Ignore 3 2 0	Minor

<table>
<tr><th>#</th><th>DEFECT TYPE</th><th>ACCEPTANCE STANDARDS CRITERIA (Continued)</th><th>MAJOR / MINOR</th></tr>
<tr><td>8</td><td>Display pattern defect</td><td> 

<table>
<tr><th>Dot Size</th><th>Acceptable Qty</th></tr>
<tr><td>((A+B)/2)≤0.20 mm</td><td rowspan="4">≤3 total defects
≤2 pinholes per digit</td></tr>
<tr><td>C>0 mm</td></tr>
<tr><td>((D+E)/2)≤0.25 mm</td></tr>
<tr><td>((F+G)/2)≤0.25 mm</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>9</td><td>Backlight defects</td><td>1. Light fails or flickers.*
2. Color and luminance do not correspond to specifications.*
3. Exceeds standards for display’s blemishes, foreign matter, dark lines or scratches.
*Minor if display functions correctly. Major if the display fails.</td><td>Minor</td></tr>
<tr><td>10</td><td>PCB defects (if module has PCB)</td><td>1. Oxidation or contamination on connectors.*
2. Wrong parts, missing parts, or parts not in specification.*
3. Jumpers set incorrectly.
4. Solder (if any) on bezel, LED (if module has LEDs) pad, zebra pad, or screw hole pad is not smooth.
*Minor if display functions correctly. Major if the display fails.</td><td>Minor</td></tr>
<tr><td>11</td><td>Soldering defects</td><td>1. Unmelted solder paste.
2. Cold solder joints, missing solder connections, or oxidation.*
3. Solder bridges causing short circuits.*
4. Solder balls.
*Minor if display functions correctly. Major if the display fails.</td><td>Minor</td></tr>
</table>

APPENDIX B: TERMS AND SYMBOLS

The first (top) term / symbol listed in this table is the term used by Crystalfontz.

Term / Symbol	Description
A (LED +)	Supply pin for LED. “A” (anode) or “+” of LED backlight. If more than one, may be labeled as A_1, A_2, ...
cd/m^2 lumen nits	Candela per square meter. A unit of measurement used to measure Luminous Intensity. cd/m^2 = 1 lumen.
$\overline{CS}$ CS# CSX	Chip select input. *Low:* Controller chip is selected. Communications with host are possible. *High:* Controller chip is not selected. Host interface signals are ignored by the controller.
COF	Chip On Flex. Controller is on the FPC. Similar in appearance to “TAB”. The flex circuit on COF is typically much thinner than the flex of a “flex tail”.
COG	Chip On Glass. Controller is on the glass panel.
DB0 ~ DB*n* D0 ~ D*n*	Parallel databus.
D/$\overline{C}$ RS DCX A0 CD D/C#	Data/Command control. Determines whether data bits are data or command. *1 – High:* Addresses the data register. *0 – Low:* Addresses the command register.
DE DEN	Data Enable signal for RGB / DPI mode.
DPI DOTCLK parallel	Displays Pixel Interface
DCLK	Dot-clock signal and oscillator source. A non-stop external clock must be provided to that pin even at front or back porch non-display period. RGB interface only.
ESD	Electro-Static Discharge. Sudden and brief electrical current that flows between two objects. ESD between a human and a module can cause permanent damage.
FFC	Flat Flexible Cable. Also called “flex tail” or “pigtail”. Typically thinner than the “flex” film of COG (Chip On Glass).
FPC	Flexible Printed Circuit. Also called “flex tail”. Typically much thicker than the “flex” film of COF (Chip On Flex).
GND V_{SS}	Ground. Must be connected to an external ground.
H_{SYNC}	Horizontal frame/RAM write synchronizing signal used for RGB mode only.

Term / Symbol	Description
I_{DD}	Typical power supply current for TFT module. Total electrical current (I) in the Drains of a CMOS circuit
I_{LED}	Current used by LED backlight.
IM*n*	Interface mode select pin where *n* is the corresponding number.
I_{OP} V_{CCI}	Current for normal OPeration, typically measured in milliamperes (mA). 1 mA = 0.001A (Ampere)
I_{ST}	Current for STandby mode, typically measured in microampere (µA). 1 µA = 0.000001A (Ampere)
I/O IO	Input/Output
K (LED -)	Supply pin for LED. "K" (cathode or kathode for German and original Greek spelling) or "-" of LED backlight. If more than one, may be labeled as K_1, K_2, ...
MIPI	Mobile Industry Processor Interface. See MIPI Alliance.
MISO SDO D_{OUT}	Data output signal in serial SPI interface: Master In Slave Out. Serial Data Out.
MOSI SDI SI DINI_SDA	Data output signal in serial SPI interface: Master Out Slave In. Serial Data In.
mm	Millimeter or millimetre. Unit of length equal to one thousandth of a meter. 1 millimeter = 0.0394 inches.
mW	Milliwatt is equal to one thousandth of a Watt. Watts = Volts x Amps.
NC nc	Make No Connection.
P_{CLK}	Pixel clock signal for RGB / DPI mode.
PS*n*-PS0	<table><tr><th>PS3</th><th>PS2</th><th>PS1</th><th>PS0</th><th>Interface Mode</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>16-bit 6800 parallel interface. (if available)</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>8-bit 6800 parallel interface. (if available)</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>16-bit 8080 parallel interface.</td></tr><tr><td colspan="5">. . . . . .</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>8-bit 8080 parallel interface. (if available)</td></tr></table>

Term / Symbol	Description
PWM	Pulse Width Modulation is a way to simulate intermediate levels by switching a level between full on and full off. PWM is typically used to control the brightness of LED backlights, relying on the natural averaging by the human eye.
$\overline{RD}_{8080}$ (E_{6800}) $\overline{RD}$ (E) E ($\overline{RD}$) E RDX	Host interface input. *8080 Host:* Active low. Signal on the databus is latched at the rising edge of $\overline{RD}$. *6800 Host (if available):* Enable control signal input active high. E = *High:* Read or Write operation is active E = *Low:* No operation
RGB	Typically used to indicate that Red, Green, and Blue are combined to produce a broad array of colors.
RH Rh	Relative Humidity
RoHS	Restriction of Hazardous Substances Directive, an environmental standard.
$\overline{RST}$ $\overline{RES}$ RST# RES# RESET#	Reset signal. *Low:* Display controller is reset. The $\overline{RST}$ pin should be pulsed low shortly after power is applied. *High:* The $\overline{RST}$ pin should be brought high for normal operation.
SCK SCL	Serial Clock
Ta TA	“Ambient temperature” is the temperature of the air that surrounds a component.
Tf	Unit of measurement for display module response time. f = falling edge. See *Definition of Response Time* in DETAILS OF INTERFACE PIN FUNCTIONS, CONT’D (Pg. 9).
TFT	Thin-Film Transistor fabricated directly on the display substrate.
T_{OP}	OPerating Temperature.
Tr	Unit of measurement for display module response time. r = rising edge. See *Definition of Response Time* in DETAILS OF INTERFACE PIN FUNCTIONS, CONT’D (Pg. 9).
T_{ST} T_{STG}	STorage Temperature.
V_{ANALOG} V_{CI}	Analog supply,
V_{IH} V_{ICH}	High level input voltage.
V_{IL} V_{LCH}	Low level input voltage.

Term / Symbol	Description
V_{IN} V_T	Input voltage
V_{LED}	Forward voltage for LED backlight.
V_{LOGIC} V_{CC} V_{DD} V_{CI}	Power supply input. Must be connected to an external source.
$V_{LOGIC\ I/O}$ V_{CCIO} IO_{VCC}	Digital Logic Supply and Input/Output Supply
V_{OH} V_{OHC}	High level output voltage.
V_{OL} V_{OLC}	Low level output voltage.
V_{SSD}	Digital ground.
V_{SYNC}	Vertical frame/RAM write synchronizing signal used for RGB mode only.
$\overline{WR}_{8080}$ R/$\overline{W}$ ($\overline{WR}$) $\overline{WR}$ (R/$\overline{W}$) R/W#	Host interface input. *8080 Host:* Active low. Signal on the databus is latched at the rising edge of $\overline{WR}$ signal. *6800 Host (if available):* Read/Write control signal output. *R/$\overline{W}$* = High: Read (Host←Module) *R/$\overline{W}$* = Low: Write (Host→Module)
$\overline{WR}$_SCK	*DBI Type-B:* Serves as a write signal and write data at the low level. *DBI Type-C:* it serves as SCK (Serial Clock). If unused, tie to $V_{LOGIC\ I/O}$.