



TFT DISPLAY MODULE DATASHEET



Datasheet Release Date 2017-06-20
for
CFAF320240F-035T-TS

Crystalfontz America, Inc.

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CONTENTS

1. General Information	3
2. Module Description	4
3. Features	4
4. Mechanical Data	4
5. Mechanical Drawings	5
6. Interface Pin Function	9
7. Series Pin Table	10
8. Series Carrier Board Pin Table	11
9. System Block Diagram	12
10. Absolute Maximum Ratings	12
11. Electrical Characteristics	13
12. Optical Characteristics	13
13. Backlight Characteristics	14
14. LCD Module Precautions	15

1. General Information

Datasheet Revision History

Datasheet Release: **2017-06-20**

Datasheet for the CFAF320240F-035T-TS TFT graphic display module.

Product Change Notifications

You can check for or subscribe to [Part Change Notices](#) for this display module on our website.

Variations

Slight variations between lots are normal (e.g., contrast, color, or intensity).

Volatility

This display module has volatile memory.

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2. Module Description

This is a 3.5-inch diagonal full color TFT graphic display module with a white LED backlight. This display only requires a single source 3.3v for both power supply and logic. This display has a built-in Solomon Systech SSD2119 controller.

Please see [Solomon Systech SSD2119 LCD Controller Datasheet](#) for further reference.

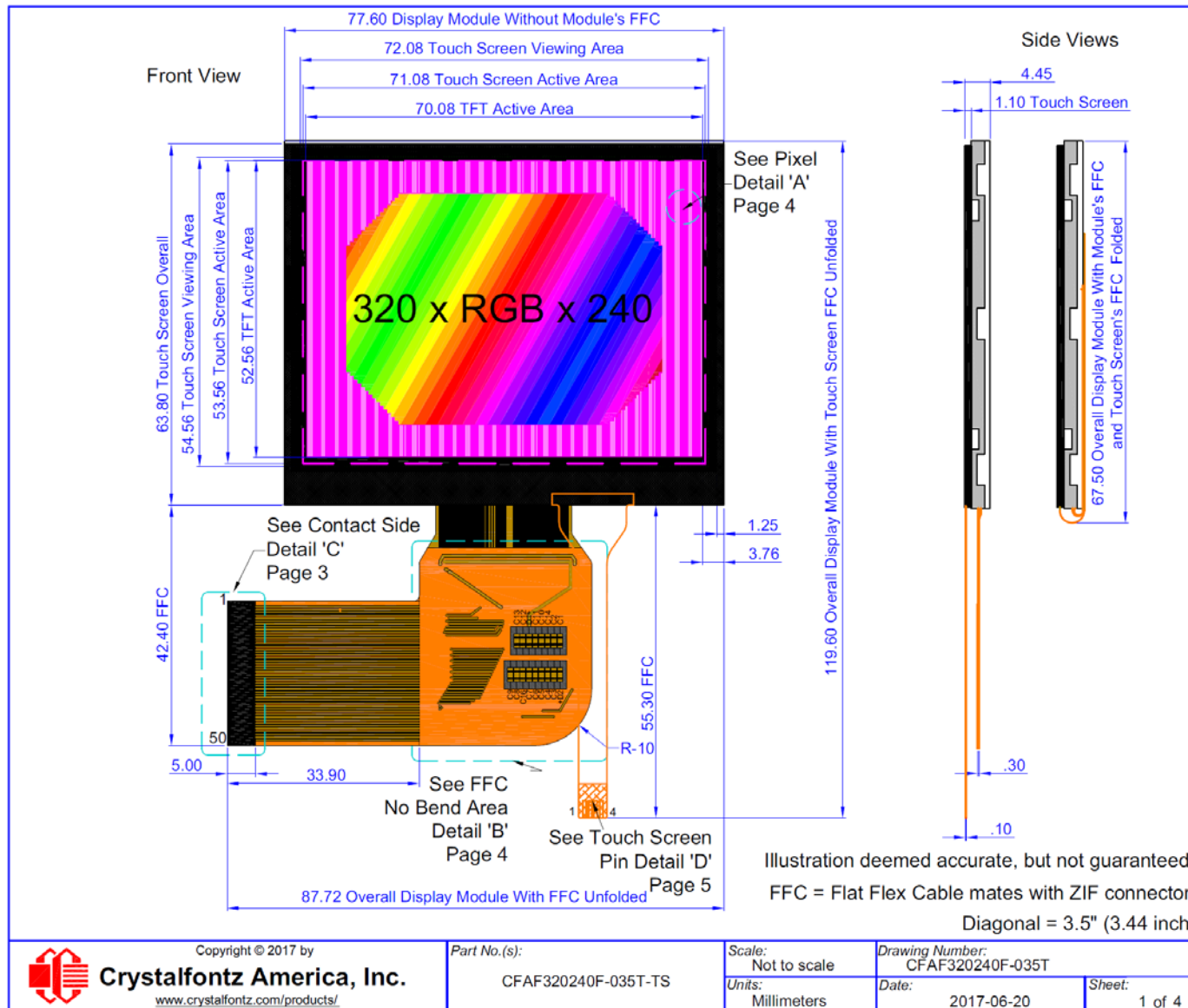
3. Features

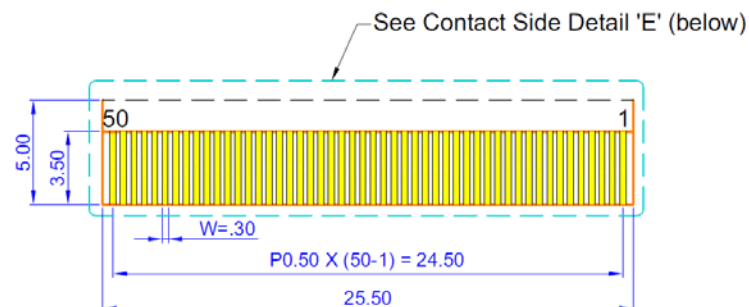
- 320*240 Dot Matrix
- Built-in Controller: SSD2119 (or equivalent)
- Built-in DC-DC Converter for Panel Voltage
- +3V Power Supply
- Viewing Direction: 6 o'clock
- 1/16 Duty
- Polarized
- Operating Temperature: -20°C to +70°C
- Interface: 6800, 8080, SPI, DOTCLK RGB

4. Mechanical Data

Item	Specification (mm)	Specification (inch, reference)
Overall Module Dimension	77.60 (W) x 64.40 (H) x 4.45 (D)	3.055 (W) x 2.535 (H) x 0.175 (D)
Viewing Area	72.08 (W) x 54.56 (H)	2.838 (W) x 2.148 (H)
Active Area	70.08 (W) x 52.56 (H)	2.759 (W) x 2.069 (H)
Dot Pitch	0.22 (W) x 0.22 (H)	0.009 (W) x 0.009 (H)
Dot Size	0.06 (W) x 0.21 (H)	0.002 (W) x 0.008 (H)
Module Connector Pitch	0.5 mm	
Touch Screen Connector Pitch	1.0 mm	
FFC Bend Radius	>R.5.0 mm	
Weight (Typical)	38 grams	1.34 ounces
NOTE: The display module's 50-pin FPC mates with standard 0.5mm ZIF connectors such as HFJ150CT-ND and HFK150CT-ND available from Digi-Key.		

5. Mechanical Drawings





Contact Side Detail 'C'

1	GND
2	NC
3	NC
4	GND
5	GND
6	GND
7	RD _{AVDD} (E _{AVDD})
8	SD0
9	RST
10	CS
11	SCL
12	SOL
13	D/C
14	WR _{AVDD} (RW _{AVDD})
15	PS3
16	PS2
17	PS1
18	PS0
19	DB17
20	DB16
21	DB15
22	DB14
23	DB13
24	DB12
25	DB11
26	DB10
27	DB9
28	DB8
29	DB7
30	DB6
31	DB5
32	DB4
33	DB3
34	DB2
35	DB1
36	DB0
37	DEN
38	HSYNC
39	VSYNC
40	CLK
41	NC
42	GND
43	GND
44	V _{LOGIC}
45	V _{LOGIC}
46	NC
47	K ₁ (LED ₊)
48	A ₁ (LED ₊)
49	A ₁ (LED ₊)
50	K ₁ (LED ₋)

* Both V_{LOGIC} pins (44,45)
need to be connected.

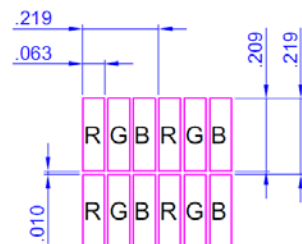
Contact Side Detail 'E'

Illustration deemed accurate, but not guaranteed.

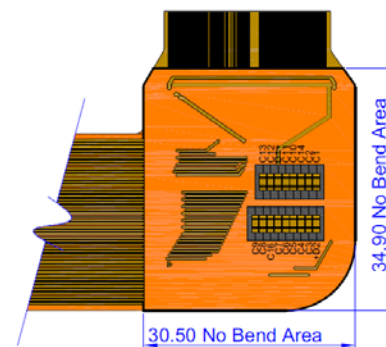
FFC = Flat Flex Cable mates with ZIF connector.

Diagonal = 3.5" (3.44 inch)





Pixel Detail 'A'



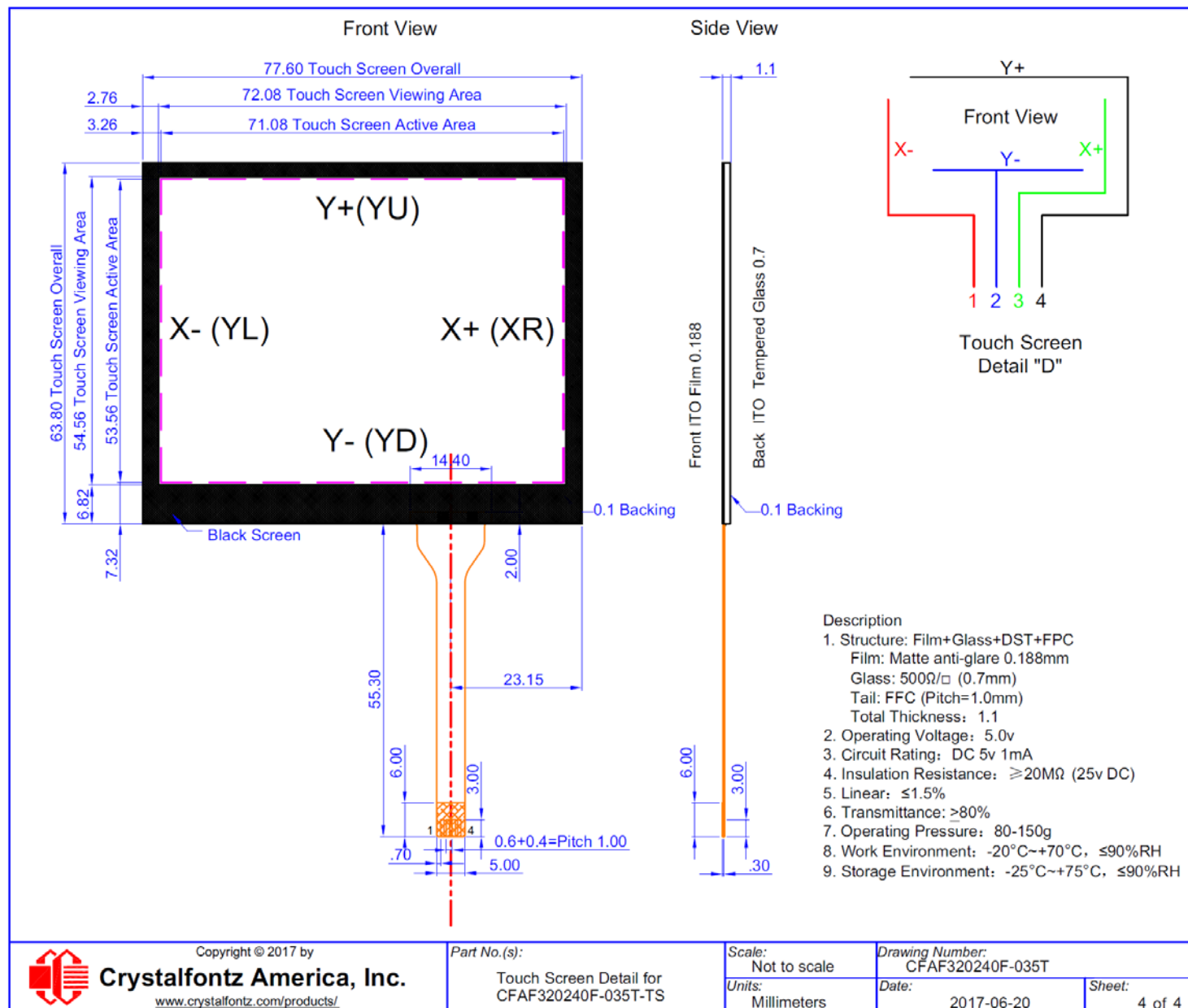
FFC No Bend Area
Detail 'B'

Illustration deemed accurate, but not guaranteed.

FFC = Flat Flex Cable mates with ZIF connector.

Diagonal = 3.5" (3.44 inch)





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Part No.(s):
Touch Screen Detail for
CFAF320240F-035T-TS

Scale:
Not to scale
Units:
Millimeters

Drawing Number:
CFAF320240F-035T

Date:
2017-06-20

Sheet:
4 of 4

6. Interface Pin Function

Pin	Symbol	Level	Direction	Function
1	GND	L	-	Power Supply and Signal Ground. Must be connected to an external ground.
2-3	NC		-	No Connection
4-6	GND	L	-	Ground. Must be connected to an external ground.
7	RD ₈₀₈₀ (E ₆₈₀₀)	H/L	I	Host Interface Input. 8080 Host: Active low. Signal on the data bus is latched at the rising edge of RD. 6800 Host: Enable control signal input active high. E = High: Read or Write operation is active. E = Low: No operation
8	SDO	H/L	O	Data Output Pin in Serial Interface. (Serial Data Out/MISO)
9	RST	H/L	I	Reset Signal. Low: Display controller is reset. The RST pin should be pulsed low shortly after power is applied. High: The RST pin should be brought high for normal operation.
10	CS	H/L	I	Chip Select Input. Low: Controller chip is selected. Communications with the host is possible. High: Controller chip is not selected. Host interface signals are ignored by the controller.
11	SCL	H/L	I	Serial Clock Input.
12	SDI	H/L	I	Data Input Pin in Serial Interface. (Serial Data In/MISO)
13	D/C	H/L	I	Data/Command Control. Determines whether data bits are data or command. 1 – High: Addresses the data register. 0 – Low: Addresses the command register.
14	WR ₈₀₈₀ (RW ₆₈₀₀)	H/L	I/O	Host Interface Input. 8080 Host: Active low. Signal on the data bus is latched at the rising edge of WR signal. 6800 Host: Read/Write control signal output. R/W = High. Read (Host ← Module) R/W = Low. Write (Host → Module)
15-18	PS3-PS0	H/L		Notice the descending order. Click here to view the Interface Pin Usage Table.
19-36	DB17-DB0	H/L	I/O	Parallel data bus. (Notice the descending order.)
37	DEN	H/L	I	Display Enable Pin from Controller. (RGB interface only)
38	H _{SYNC}	H/L	I	Line Synchronization Input. (RGB interface only)
39	V _{SYNC}	H/L	I	Frame/RAM Write Synchronization Input. (RGB interface only)
40	DCLK	H/L	I	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.
41	NC		-	No Connection
42-43	GND	L	-	Ground. Must be connected to an external ground.
44-45	V _{LOGIC}	H	I	Power Supply Input. Must be connected to an external source. NOTE: Both pins must be connected.
46	NC		-	No Connection
47	K ₂ (LED ₂₋)	L	-	Supply Pin for LED. "K" (cathode or kathode for German and original Greek spelling), or "-" of LED backlight.
48	A ₂ (LED ₂₊)	H	-	Supply Pin for LED. "AL (anode) or "+" of LED backlight.
49	A ₁ (LED ₁₊)	H	-	Supply Pin for LED. "AL (anode) or "+" of LED backlight.
50	K ₁ (LED ₁₋)	L	-	Supply Pin for LED. "K" (cathode or kathode for German and original Greek spelling), or "-" of LED backlight.

CFAF320240F Series Pin Table

Label	Pin	6800 – 8 Bit	6800 – 9 Bit	6800 – 16 Bit	6800 – 18 bit	8080 – 8 Bit	8080 – 9 Bit	8080 – 16 Bit	8080 – 18 Bit	SPI – 4 Wire	SPI – 3 Wire	RGB – 262K	RGB – 64K
GND	1	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
NC	2	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect
NC	3	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect
GND	4	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
GND	5	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
GND	6	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
RD/E	7	Enable	Enable	Enable	Enable	Read Strobe	Read Strobe	Read Strobe	Read Strobe	Ground	Ground	Ground	Ground
SDO	8	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect
Reset	9	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset
CS	10	Chip Select	Chip Select	Chip Select	Chip Select	Chip Select	Chip Select	Chip Select	Chip Select	Serial Chip Select	Serial Chip Select	Serial Chip Select	Serial Chip Select
SCL	11	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	Serial Clock Input	Serial Clock Input	Serial Clock Input	Serial Clock Input
SDA	12	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	Data Input	Data Input	Data Input	Data Input
D/C	13	Data / Command	Data / Command	Data / Command	Data / Command	Data / Command	Data / Command	Data / Command	Data / Command	Serial Data / Command	No Connect	No Connect	No Connect
WR/RW	14	Read / Write	Read / Write	Read / Write	Read / Write	Write / Read	Write / Read	Write / Read	Write / Read	No Connect	No Connect	Ground	Ground
PS3	15	0	1	0	1	0	1	0	1	1	1	0	0
PS2	16	0	0	0	0	0	0	0	0	1	1	1	1
PS1	17	0	0	0	0	1	1	1	1	1	1	1	0
PS0	18	1	1	0	0	1	1	0	0	1	0	0	1
DB17	19	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR5	RR4
DB16	20	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR4	RR3
DB15	21	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR3	RR2
DB14	22	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR2	RR1
DB13	23	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR1	RR0
DB12	24	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR0	GG5
DB11	25	x	x	x	x	x	x	x	x	NC or GND	NC or GND	GG5	GG4
DB10	26	x	x	x	x	x	x	x	x	NC or GND	NC or GND	GG4	GG3
DB9	27	NC or GND	x	NC or GND	x	NC or GND	x	NC or GND	x	NC or GND	NC or GND	GG3	NC or GND
DB8	28	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	GG2	GG2
DB7	29	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	GG1	GG1
DB6	30	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	GG0	GG0
DB5	31	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB5	BB4
DB4	32	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB4	BB3
DB3	33	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB3	BB2
DB2	34	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB2	BB1
DB1	35	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB1	BB0
DB0	36	NC or GND	NC or GND	NC or GND	x	NC or GND	NC or GND	NC or GND	x	NC or GND	NC or GND	BB0	NC or GND
DEN	37	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Data Enable	Data Enable
H _{SYNC}	38	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Line Sync	Line Sync
V _{SYNC}	39	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Frame / RAM Sync	Frame / RAM Sync
DCLK	40	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Dot Clock	Dot Clock
NC	41	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect
GND	42	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
GND	43	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
V _{LOGIC}	44	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v
V _{LOGIC}	45	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v
NC	46	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect
K2 (LED 2-)	47	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -
A2 (LED 2+)	48	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +
A1 (LED 1+)	49	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +	Backlight +
K1 (LED 1-)	50	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -	Backlight -
Label	Pin	6800 – 8 Bit	6800 – 9 Bit	6800 – 16 Bit	6800 – 18 bit	8080 – 8 Bit	8080 – 9 Bit	8080 – 16 Bit	8080 – 18 Bit	SPI – 4 Wire	SPI – 3 Wire	RGB – 262K	RGB – 64K

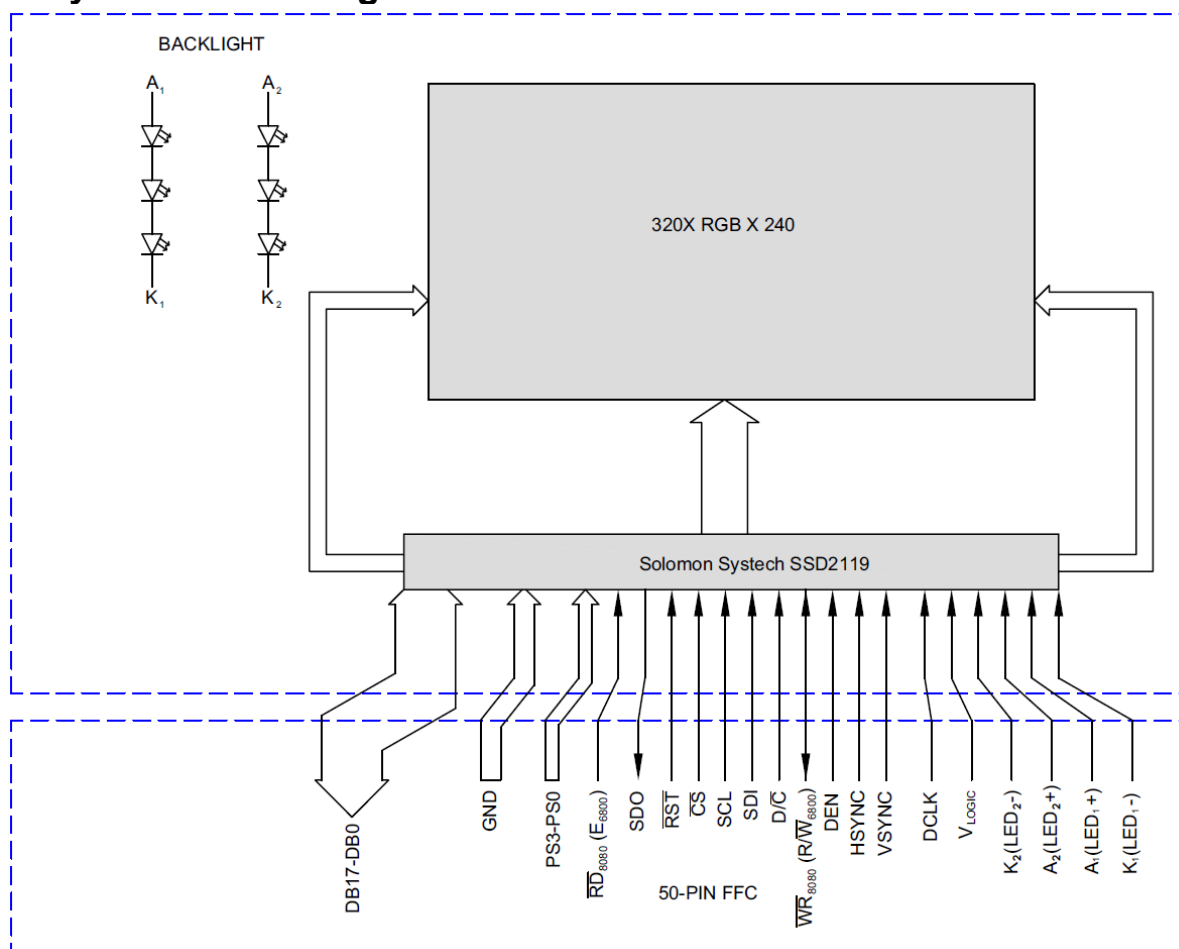
Usage	Pin
X- (XL)	1
Y- (YD)	2
X+ (XR)	3
Y+ (YU)	4

CFAF320240F Series Carrier Board Pin Table

Label	Pin	6800 – 8 Bit	6800 – 9 Bit	6800 – 16 Bit	6800 – 18 bit	8080 – 8 Bit	8080 – 9 Bit	8080 – 16 Bit	8080 – 18 Bit	SPI – 4 Wire	SPI – 3 Wire	RGB – 262K	RGB – 64K
VDD	1	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v	+3v
GND	2	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
BL	3	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$	Enable / $\overline{\text{Disable}}$
RESET	4	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset	Chip Reset
RD	5	Enable	Enable	Enable	Enable	Read Strobe	Read Strobe	Read Strobe	Read Strobe	Ground	Ground	Ground	Ground
CS	6	Chip Select	Chip Select	Chip Select	Chip Select	Chip Select	Chip Select	Chip Select	Chip Select	Serial Chip Select	Serial Chip Select	Serial Chip Select	Serial Chip Select
SDO	7	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect
SCL	8	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	Serial Clock Input	Serial Clock Input	Serial Clock Input	Serial Clock Input
RS	9	Data / Command	Data / Command	Data / Command	Data / Command	Data / Command	Data / Command	Data / Command	Data / Command	Serial Data / Command	No Connect	No Connect	No Connect
SDI	10	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	Data Input	Data Input	Data Input	Data Input
WR	11	Read / Write	Read / Write	Read / Write	Read / Write	Write / Read	Write / Read	Write / Read	Write / Read	No Connect	No Connect	Ground	Ground
PS3	12	0	1	0	1	0	1	0	1	1	1	0	0
PS2	13	0	0	0	0	0	0	0	0	1	1	1	1
PS1	14	0	0	0	0	1	1	1	1	1	1	1	0
PS0	15	1	1	0	0	1	1	0	0	1	0	0	1
DB17	16	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR5	RR4
DB16	17	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR4	RR3
DB15	18	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR3	RR2
DB14	19	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR2	RR1
DB13	20	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR1	RR0
DB12	21	x	x	x	x	x	x	x	x	NC or GND	NC or GND	RR0	GG5
DB11	22	x	x	x	x	x	x	x	x	NC or GND	NC or GND	GG5	GG4
DB10	23	x	x	x	x	x	x	x	x	NC or GND	NC or GND	GG4	GG3
DB9	24	NC or GND	x	NC or GND	x	NC or GND	x	NC or GND	x	NC or GND	NC or GND	GG3	NC or GND
DB8	25	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	GG2	GG2
DB7	26	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	GG1	GG1
DB6	27	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	GG0	GG0
DB5	28	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB5	BB4
DB4	29	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB4	BB3
DB3	30	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB3	BB2
DB2	31	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB2	BB1
DB1	32	NC or GND	NC or GND	x	x	NC or GND	NC or GND	x	x	NC or GND	NC or GND	BB1	BB0
DB0	33	NC or GND	NC or GND	NC or GND	x	NC or GND	NC or GND	NC or GND	x	NC or GND	NC or GND	BB0	NC or GND
DEN	34	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Data Enable	Data Enable
HSYNC	35	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Line Sync	Line Sync
VSYNC	36	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Frame / RAM Sync	Frame / RAM Sync
DCLK	37	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Dot Clock	Dot Clock
Y- (YD)	38	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
X+ (XR)	39	Right	Right	Right	Right	Right	Right	Right	Right	Right	Right	Right	Right
Y+ (YU)	40	Top	Top	Top	Top	Top	Top	Top	Top	Top	Top	Top	Top
X- (XL)	41	Left	Left	Left	Left	Left	Left	Left	Left	Left	Left	Left	Left
NC	42	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect	No Connect
Label	Pin	6800 – 8 Bit	6800 – 9 Bit	6800 – 16 Bit	6800 – 18 bit	8080 – 8 Bit	8080 – 9 Bit	8080 – 16 Bit	8080 – 18 Bit	SPI – 4 Wire	SPI – 3 Wire	RGB – 262K	RGB – 64K

Usage	Pin
X- (XL)	38
Y- (YD)	39
X+ (XR)	40
Y+ (YU)	41

9. System Block Diagram



10. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage	V _{LOGIC I/O}	-0.3	4	V	(1)(2)
Supply Voltage for Logic	V _{LOGIC}	-0.3	4	V	(1)(2)
Operating Temperature	T _{OP}	-20	+70	°C	-
Storage Temperature	T _{ST}	-30	+80	°C	-
Humidity	RH	0	90	%	-

Notes:

- (1) These are stress ratings only. Extended exposure to the absolute maximum ratings listed above may affect device reliability or cause permanent damage.
- (2) Functional operation should be restricted to the limits in the Electrical Characteristics table below.

11. Electrical Characteristics

This table contains the module's major operating parameters. For more detailed information please see the [Solomon Systech SSD2119 LCD Controller Datasheet](#) on our website.

Item	Symbol	Condition	Min	Typical	Max	Unit
Supply Voltage for Logic	V_{LOGIC}	$T_{\text{OP}} = -20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$	+2.5	+3.0	3.6	V
Supply Voltage for I/O Signals	$V_{\text{LOGIC I/O}}$	$T_{\text{OP}} = -20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$	+1.4	+3.0	3.6	V
High-level Input	V_{IH}	-	$0.8 \times V_{\text{DD}}$	-	V_{LOGIC}	V
Low-level Input	V_{IL}	-	0v (GND)	-	$0.2 \times V_{\text{LOGIC}}$	V
High-level Output	V_{OH}	$I_{\text{OUT}} = 100\mu\text{A}$ 3.3MHz	$0.9 \times V_{\text{DD}}$	-	V_{LOGIC}	V
Low-level Output	V_{OL}	$I_{\text{OUT}} = 100\mu\text{A}$ 3.3MHz	0v (GND)	-	$0.1 \times V_{\text{LOGIC}}$	V
Power Supply Current for TFT	I_{DD}	-	-	43	-	mA
Current for Normal Operation	I_{OP}	-	0.05	-	-	mA
Current for Standby Operation	I_{ST}	-	0.03	-	0.2	mA
NOTE: If you use a 3.3v power supply you will need to step up the power supply for the LED backlight because it requires a 9.9v power supply.						

12. Optical Characteristics

Item	Symbol	Condition	Min	Typical	Max	Unit
Color Depth	-	-	-	262	-	K
Transmittance	T	With Polarizer	5.7	6.76	-	%
Contrast Ratio (CR)	-	-	320	400	-	-
TFT Response Time	T rise	-		8	12	ms
	T fall			17	23	ms
Red Chromaticity	x	-	0.627	0.647	0.667	ms
	y		0.316	0.336	0.356	ms
Green Chromaticity	x	-	0.116	0.136	0.156	ms
	y		0.556	0.576	0.596	ms
Blue Chromaticity	x	-	0.116	0.136	0.156	ms
	y		0.109	0.129	0.149	ms
White Chromaticity	x	-	0.285	0.305	0.325	ms
	y		0.314	0.334	0.354	ms
Viewing Direction	6 o'clock					



13. Backlight Characteristics

Parameter	Symbol	Min	Typical	Max	Unit
Supply Current	I_{LED}	10	12	12	mA
Supply Voltage	V_{LED}	+8.4	+9.6	10.2	V
Luminous Intensity $I_{LED} - 25mA$	I_v	115	150	185	cd/m ²
Reverse Voltage	V_R	-	-	15	V
LED Lifetime	-	-	10K	-	Hrs

Notes:

- (1) Supply current minimum value is only for reference since the LED brightness efficiency keeps enhancing. Current consumption becomes less and less to achieve the same luminance.
- (2) Lifetime is defined as the amount of time when the luminance has decayed to <50% of the initial value (10K hours is an estimate for reference only).

14. LCD Module Precautions

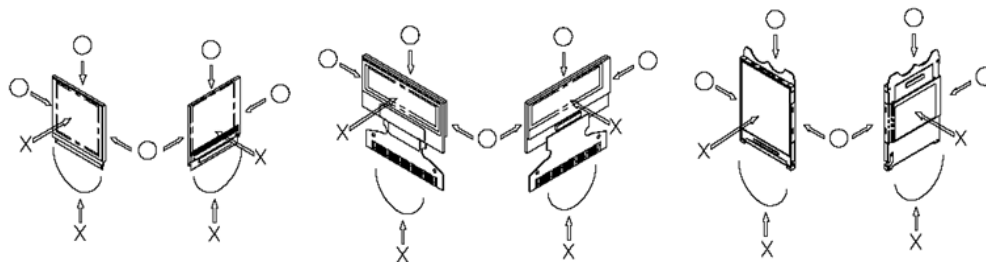
The precautions below should be followed when using LCD modules to help ensure personal safety, module performance, and compliance of environmental regulations.

14.1. Modules

- Avoid applying excessive shocks to module or making any alterations or modifications to it.
- Do not make extra holes on the printed circuit board, modify its shape or change the components of LCD display module.
- Do not disassemble the LCD display module.
- Do not operate the LCD display module above the absolute maximum rating.
- Do not drop, bend or twist the LCD display module.
- Soldering: only to the I/O terminals.
- Store in an anti-static electricity container and clean environment.
- It is common to use the "screen saver" to extend the lifetime of the LCD display module.
 - Do not use the fixed information for long periods of time in real application.
 - Do not use fixed information in LCD panel for long periods of time to extend "screen burn" effect time.
- Crystalfontz has the right to change the passive components, including R3, R6 & backlight adjust resistors. (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.)
- Crystalfontz have the right to change the PCB Rev. (In order to satisfy the supplying stability, management optimization and the best product performance, etc., under the premise of not affecting the electrical characteristics and external dimensions, Crystalfontz has the right to modify the version.).

14.2. Handling Precautions

- Since the display panel is made of glass, do not apply mechanical impacts such as dropping from a high position.
- If the display panel is accidentally broken, and the internal organic substance leaks out, be careful not to inhale or touch the organic substance.
- If pressure is applied to the display surface or its neighborhood of the LCD display module, the cell structure may be damaged, so be careful not to apply pressure to these sections.
- The polarizer covering the surface of the LCD display module is soft and can be easily scratched. Please be careful when handling the LCD display module.
- Clean the surface of the polarizer covering the LCD display module if it becomes soiled using following adhesion tape.
 - Scotch Mending Tape No. 810 or an equivalent
 - Never breathe the soiled surface or wipe the surface using a cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
 - The following liquids/solvents may spoil the polarizer:
 - Water
 - Ketone
 - Aromatic Solvents
- Hold the LCD display module very carefully when placing the LCD display module into the system housing.
- Do not apply excessive stress or pressure to the LCD display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, be sure to secure the sufficient rigidity for the outer cases.





- Do not apply stress to the LSI chips and the surrounding molded sections.
- Do not disassemble or modify the LCD display module.
- Do not apply input signals while the logic power is off.
- Pay sufficient attention to the working environments when handling the LCD display module to prevent occurrence of element breakage accidents by static electricity.
 - Be sure to make human body grounding when handling LCD display modules.
 - Be sure to ground tools to use for assembly such as soldering irons.
 - To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
 - Protective film is being applied to the surface of the display panel of the LCD display module. Be careful since static electricity may be generated when exfoliating the protective film.
- Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the LCD display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after the film has been removed. In such a case, remove the residue material by the method discussed above.
- If electric current is applied when the LCD display module is being dewed or when it is placed under high humidity environments, the electrodes may become corroded. If this happens proceed with caution when handling the LCD display module.

14.3. Storage Precautions

- When storing the LCD display modules put them in static electricity preventive bags to avoid exposure to direct sunlight and fluorescent lamps. Also avoid high temperature and high humidity environments and low temperatures (less than 0°C) environments. (We recommend you store these modules in the packaged state when they were shipped from Crystalfontz). Be careful not to let water drops adhere to the packages or bags, and do not let dew gather on them.
- If electric current is applied when water drops are adhering to the surface of the LCD display module the LCD display module may have become dewed. If a dewed LCD display module is placed under high humidity environments it may cause the electrodes to become corroded. If this happens proceed with caution when handling the LCD display module.

14.4. Designing Precautions

- The absolute maximum ratings are the ratings that cannot be exceeded for LCD display module. If these values are exceeded, panel damage may happen.
- To prevent occurrence of malfunctioning by noise pay attention to satisfy the V_{IL} and V_{IH} specifications and, at the same time, to make the signal line cable as short as possible.
- We recommend that you install excess current preventive unit (fuses, etc.) to the power circuit (V_{DD}). (Recommend value: 0.5A)
- Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.
- As for EMI, take necessary measures on the equipment side.
- When fastening the LCD display module, fasten the external plastic housing section.
- If the power supply to the LCD display module is forcibly shut down, by such errors as taking out the main battery while the LCD display panel is in operation, we cannot guarantee the quality of this LCD display module.
 - Connection (contact) to any other potential than the above may lead to rupture of the IC.

14.5. Disposing Precautions

- Request the qualified companies to handle the industrial wastes when disposing of the LCD display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.

14.6. Other Precautions

- When an LCD display module is operated for a long period of time with a fixed pattern, the fixed pattern may remain as an after image or a slight contrast deviation may occur.



- If the operation is interrupted and left unused for a while, normal state can be restored.
 - This will not cause a problem in the reliability of the module.
- To protect the LCD display module from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the LCD display modules.
 - Pins and electrodes
 - Pattern layouts such as the TCP & FPC
- With this LCD display module, the LCD driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this LCD driver is exposed to light, malfunctioning may occur.
 - Design the product and installation method so that the LCD driver may be shielded from light in actual usage.
 - Design the product and installation method so that the LCD driver may be shielded from light during the inspection processes.
- Although this LCD display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. Therefore, it is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
- We recommend that you construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data), to cope with catastrophic noise.
- Resistors, capacitors, and other passive components will have different appearance and color caused by the different supplier.
- Crystalfontz has the right to upgrade and modify the product function.
- The limitation of FPC bending:

