FOCUS LCDs
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TFT | OLED | CHARACTER | GRAPHIC | UWVD | SEGMENT | CUSTOM

Graphic Display Module

Part Number

G160128A-FTW-DW635

Overview:

- 160x128 Graphic LCD
- FSTN Positive, Gray
- 129.0x103.5mm Module
- Parallel Interface(s)
- White LED Backlight

- Transflective
- Wide Temp Range
- 5.0V
- LCD IC: RW1095
- RoHS Compliant

Graphic LCD Features

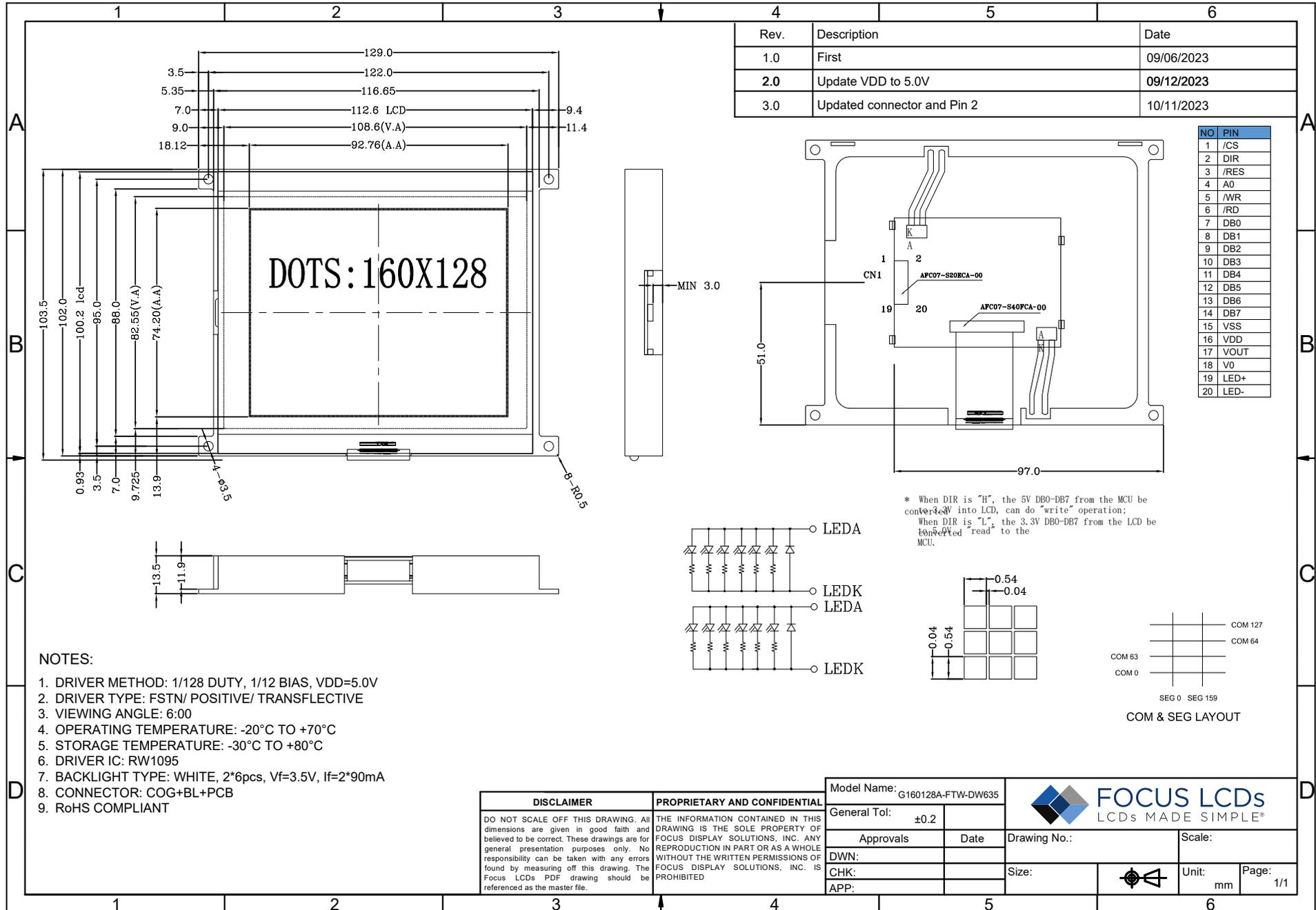Resolution: 160x128 Dots

Interface(s): Parallel

RoHS Compliant.

General Information Items	Specification Main Panel	Unit	Note
Viewing Area (VA)	108.60 (H) x 82.55 (V)	mm	--
LCD Type	FSTN Positive	--	--
Viewing Angle	6:00	O'Clock	--
Polarizer	Transflective	--	--
Backlight Type	LED	--	--
Backlight Color	White Side	--	--
LCD IC	RW1095	--	--
Drive Mode	1/128 Duty, 1/12 Bias	--	--
Operating Temperature	-20 to +70	°C	--
Storage Temperature	-30 to +80	°C	--

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	129.00	--	mm	--
	Vertical (V)	--	103.50	--	mm	--
	Depth (D)	--	13.50	--	mm	--
Weight		--	132.2	--	g	Approximate

1. Outline Dimensions

DOTS:160X128

MIN 3.0

Rev.	Description	Date
1.0	First	09/06/2023
2.0	Update VDD to 5.0V	**09/12/2023**
3.0	Updated connector and Pin 2	10/11/2023

NO	PIN
1	/CS
2	DIR
3	/RES
4	A0
5	/WR
6	/RD
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	VSS
16	VDD
17	VOUT
18	V0
19	LED+
20	LED-

CN1   AFC07-S20ECA-00

AFC07-S40FCA-00

* When DIR is "H", the 5V DB0-DB7 from the MCU be converted 5V into LCD, can do "write" operation; When DIR is "L", the 3.3V DB0-DB7 from the LCD be converted 5.0V "read" to the MCU.

LEDA
LEDK
LEDA
LEDK

COM 127
COM 64
COM 63
COM 0
SEG 0   SEG 159

COM & SEG LAYOUT

NOTES:
1. DRIVER METHOD: 1/128 DUTY, 1/12 BIAS, VDD=5.0V
2. DRIVER TYPE: FSTN/ POSITIVE/ TRANSFLECTIVE
3. VIEWING ANGLE: 6:00
4. OPERATING TEMPERATURE: -20°C TO +70°C
5. STORAGE TEMPERATURE: -30°C TO +80°C
6. DRIVER IC: RW1095
7. BACKLIGHT TYPE: WHITE, 2*6pcs, Vf=3.5V, If=2*90mA
8. CONNECTOR: COG+BL+PCB
9. RoHS COMPLIANT

Model Name: G160128A-FTW-DW635

General Tol: ±0.2

Approvals	Date
DWN:	
CHK:	
APP:	

Drawing No.:

Scale:

Size:

Unit: mm

Page: 1/1

2. Input Terminal Pin Assignment

NO.	Symbol	Description	I/O
1	/CS	Chip select. "L" active.	I
2	DIR	Data (D0-D7) transfer direction control. "H": MCU 5V to LCD 3.3V; "L": LCD 3.3V to MCU 5V.	I
3	/RES	Reset signal.	I
4	A0	A0="H": Indicates that D[7:0] are display data; A0="L": Indicates that D[7:0] are control data; There is no A0 pin in 3-Line SPI and I2C interface. A0 should be fixed to "H" by VDD1.	I
5	/WR	Write signal.	I
6	/RD	Read signal.	I
7	DB0	When using 8-bit parallel interface: 8080 or 6800 mode 8 bit bi-directional data bus. Connect to the data bus of 8-bit microprocessor. When CSB is "H", D[7:0] are high impedance.	I/O
8	DB1		
9	DB2		
10	DB3		
11	DB4		
12	DB5		
13	DB6		
14	DB7		
15	VSS	Power ground.	P
16	VDD	Power supply + (5.0V).	P
17	VOUT	DC/DC voltage converter output.	P
18	V0	Power supply for LCD.	P
19	LED+	Backlight power +.	P
20	LED-	Backlight power -.	P

I: Input, O: Output, P: Power

3. LCD Optical Characteristics

Item		Symbol	Condition	Min	Typ.	Max	Unit
Contrast Ratio		CR	--	--	4	--	--
Response Time	On	T_{on}	--	--	150	300	ms
	Off	T_{off}		--	180	330	ms
Viewing Angle $C_r \geq 2$, 25°C	Hor.	Θ_L	Φ=270°, 9H	-30	--	30	degree
		Θ_R	Φ=90°, 3H	-30	--	30	
	Ver.	Θ_T	Φ=180°, 12H	-15	--	30	
		Θ_B	Φ=0°, 6H	-15	--	30	

4. Electrical Characteristics

4.1 Absolute Maximum Rating

Characteristics	Symbol	Min	Max	Unit
Supply Voltage	VDD	-0.3	5.2	V
	Vin	-0.3	VDD	V
Operating Temperature	TOP	-20	+70	°C
Storage Temperature	TST	-30	+80	°C

NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. Be sure to use the product within the range of the absolute maximum ratings.

4.2 DC Electrical Characteristics

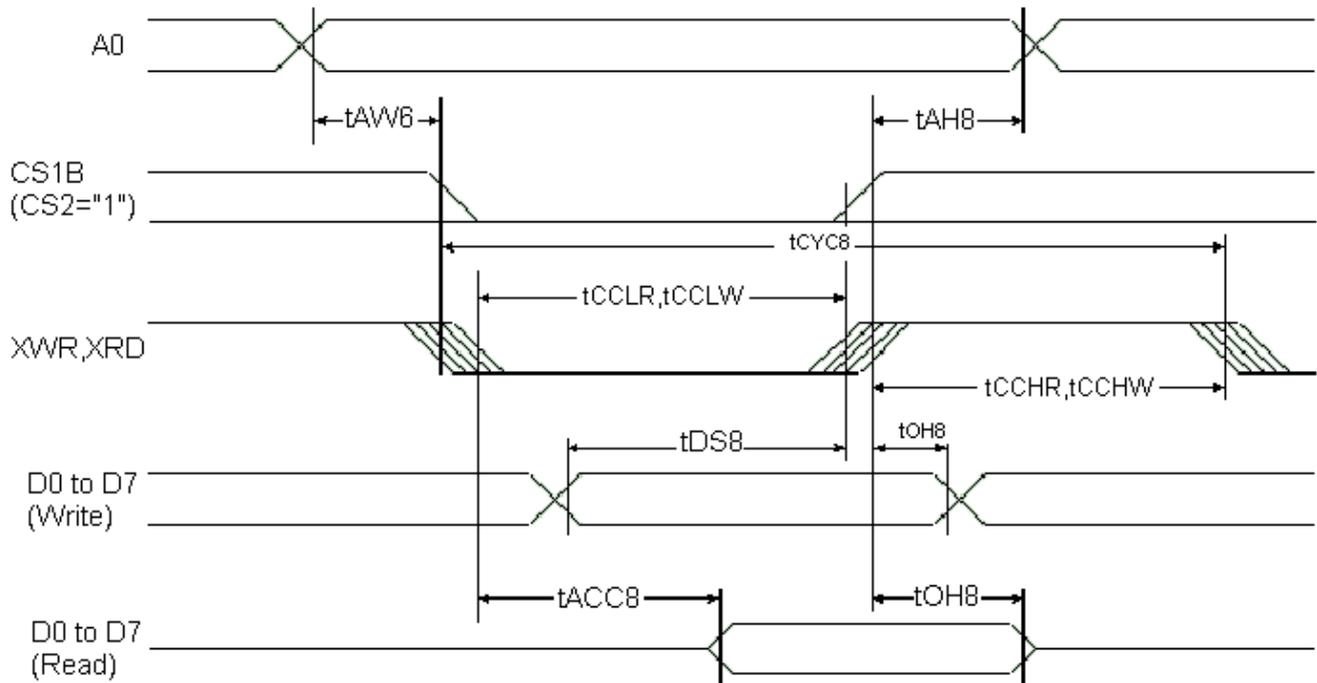| Characteristics		Symbol	Condition	Min	Typ.	Max	Unit
Supply Voltage		VDD	--	4.2	--	5.2	V
Input Voltage	H Level	V_{IH}	--	0.7VDD	--	VDD	V
	L Level	V_{IL}	--	VSS	--	0.3VDD	V

Condition:
1. VDD = 5.0V
2. 1/128 Duty, 1/12 Bias

5. Module Function

5.1 Timing Characteristics

System Bus Read/Write Characteristics 1(For the 8080 Series MPU)

(VDD=3.3V, Ta=25°C)

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
Address hold time	A0	t_{AH8}		0	--	
Address setup time		t_{AW8}		0	--	
System cycle time		t_{CYC8}		240	--	
Enable L pulse width (WRITE)	WR	t_{CCLW}		80	--	
Enable H pulse width (WRITE)		t_{CCHW}		80	--	
Enable L pulse width (READ)	RD	t_{CCLR}		140	--	ns
Enable H pulse width (READ)		t_{CCHR}		80		
WRITE data setup time	D0 to D7	t_{DS8}		40	--	
WRITE address hold time		t_{DH8}		0	--	
READ access time		t_{ACC8}	CL = 100 pF	--	70	
READ output disable time		t_{OH8}	CL = 100 pF	5	50	

5.2 LCM Application

Please see information on pages 43-52 of the data sheet for LCD controller RW1095. The data sheet can be found here: https://focuslcds.com/wp-content/uploads/Drivers/RW1095.pdf

5.3 Command Table

Instruction	A0	E	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
EXT=0 or 1												
Mode Set	0	1	0	1	1	0	1	0	0	0	EXT	EXT register set
EXT=0												
(1)Read display data	1	0	1	**Read data**								Read data into DDRAM
(2)Write display data	1	1	0	**Write data**								Write data into DDRAM
(3)Read status	0	0	1	BUSY	ADC	ON/OFF	RESET	0	0	0	0	Read the internal status
(4)Set Page Address	0	1	0	1	0	1	1	0	0	0	0	Set page address
				0	0	0	P4	P3	P2	P1	P0	
(5)Set Page Address for KS0719 mode	0	1	0	1	0	1	1	P3	P2	P1	P0	Set page address for KS 0719 mode
(6)Set Column Address MSB	0	1	0	0	0	0	1	0	0	0	0	Set column address MSB
				0	0	0	Y8	Y7	Y6	Y5	Y4	
(6-1)Set Column Address LSB	0	1	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB
(7)Set Column Address MSB for KS0719 mode	0	1	0	0	0	0	1	Y7	Y6	Y5	Y4	Set column address MSB for KS0719 mode
(7-1)Set Column Address LSB for KS0719 mode	0	1	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB for KS0719 mode
(8)Set read-modify-write	0	1	0	1	1	1	0	0	0	0	0	Set read-modify-write (default=0)
(9)Reset read-modify-write	0	1	0	1	1	1	0	1	1	1	0	Release read –modify-write
(10)Display ON/OFF	0	1	0	1	0	1	0	1	1	1	D	D=0:Display OFF(default) D=1:Display ON

Command Table (Continued)

Instruction	A0	E	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
EXT=0 or 1												
Mode Set	0	1	0	1	1	0	1	0	0	0	EXT	EXT register set
EXT=0												
(11)Set initial display register	0	1	0	0	1	0	0	0	0	X	X	2-bytes instruction to specify the initial display line to realize vertical scrolling
				S7	S6	S5	S4	S3	S2	S1	S0	
(12)Set initial COM0 register	0	1	0	0	1	0	0	0	1	X	X	2-bytes instruction to specify the initial COM0 to realize window scrolling
				C7	C6	C5	C4	C3	C2	C1	C0	
(13)Set partial display duty ratio	0	1	0	0	1	0	0	1	0	X	X	2-bytes instruction to set partial display duty ratio
				D7	D6	D5	D4	D3	D2	D1	D0	**(valid for 8~104,128,160)**
(14)Set N-line inversion register	0	1	0	0	1	0	0	1	1	X	X	2-bytes instruction to set N-line inversion
				X	X	X	N4	N3	N2	N1	N0	**(N-line number should be smaller than partial duty ratio)**
(15)Release N-line inversion register	0	1	0	1	1	1	0	0	1	0	0	Release N-line inversion mode
(16)Reverse display ON/OFF	0	1	0	1	0	1	0	0	1	1	REV	REV=0:normal display(default) REV=1:revese display
(17)Entire display ON/OFF	0	1	0	1	0	1	0	0	1	0	ALL ON	ALLON=0:normal display(default) ALLON=1:entire display ON
(18)Power control set	0	1	0	0	0	1	0	1	VB	VR	VF	Control power circuit operation
(19)Select DC-DC Set-up	0	1	0	0	1	1	0	0	DC2	DC1	DC0	Select the step-up of internal voltage converter
(20)Select Regulator resistor	0	1	0	0	0	1	0	0	R2	R1	R0	Select internal resistor ratio(Rb/Ra) mode
(21)Select electronic volume register	0	1	0	1	0	0	0	0	0	0	1	Set the V0 output voltage electronic volume register
				X	X	EV5	EV4	EV3	EV2	EV1	EV0	
(22)Select LCD bias	0	1	0	0	1	0	1	B3	B2	B1	B0	Select bias 1/2~1/14 bias

Command Table (Continued)

Instruction	A0	E	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
EXT=0 or 1												
Mode Set	0	1	0	1	1	0	1	0	0	0	**EXT**	EXT register set
EXT=0												
(23)SHL select	0	1	0	1	1	0	0	SHL	X	X	X	COM bi-direction selection SHL=0:normal (default) SHL=1:reverse
(24)ADC select	0	1	0	1	0	1	0	0	0	0	ADC	SEG bi-direction selection ADC=0:normal (default) ADC=1:reverse
(25)Oscillator on start	0	1	0	1	0	1	0	1	0	1	1	Start the built-in oscillator
(26)Set Power Save mode	0	1	0	1	0	1	0	1	0	0	P	P=0:standby mode P=1:sleep mode
(27)Release Power Save mode	0	1	0	1	1	1	0	0	0	0	1	Release power save mode
(28)Set Data Length for 3-SPI	0	1	0	0 / SPA7	1 / SPA6	1 / SPA5	1 / SPA4	0 / SPA3	0 / SPA2	0 / SPA1	0 / SPA0	Set data length for 3-SPI (only valid for 3-SPI mode)
(29)Frame Frequency adjustment	0	1	0	1 / 0	1 / 0	1 / 0	1 / FRR*2	0 / DFR3	0 / DFR2	1 / DFR1	1 / DFR0	FRR*2=0: normal (default) FRR*2=1: double Frame frequency DFR3~DFR0:Frame frequency adjustment.**(FRR*2 only support duty under 1/81)**
(30)Inductor type regulator circuit ON/OFF	0	1	0	1 / 1	1 / 1	1 / LVON	1 / 0	0 / 0	1 / 0	0 / 0	0 / SWON	LVON:LV follower on/off SWON:=0:switching regulator off SWON=1:switching regulator on
(31)Reset	0	1	0	1	1	1	0	0	0	1	0	Initial the internal function
(32)Nop	0	1	0	1	1	1	0	0	0	1	1	No operation
EXT=1												
(33)Set Gray scale mode	0	1	0	1	0	0	1	1	0	1	GRAY	Set mono mode and 4-gray mode
(34) Set White mode and light gray mode pulse width	0	1	0	1 / WA3	0 / WA2	0 / WA1	1 / WA0	1 / LA3	0 / LA2	0 / LA1	0 / LA0	Set white mode and light gray mode
(35) Set dark gray mode and black mode pulse width	0	1	0	1 / DA3	0 / DA2	0 / DA1	1 / DA0	1 / BA3	0 / BA2	0 / BA1	1 / BA0	Set dark gray and black mode

5.4   Initialization Code

The initialization code for G160128A-FTW-DW635 is available upon request.

6. Cautions and Handling Precautions

6.1   Handling and Operating the Module

1. When the module is assembled, it should be attached to the system firmly. Do not warp or twist the module during assembly work.

2. Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

3. Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

4. Do not allow drops of water or chemicals to remain on the display surface. If you have the droplets for a long time, staining and discoloration may occur.

5. If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

6. The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

7. If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

8. Protect the module from static; it may cause damage to the CMOS ICs.

9. Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

10. Do not disassemble the module.

11. Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

12. Pins of I/F connector shall not be touched directly with bare hands.

13. Do not connect, disconnect the module in the "Power ON" condition.

14. Power supply should always be turned on/off by the item Power On Sequence & Power Off Sequence.

6.2   Storage and Transportation

1. Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%.

2. Do not store the TFT-LCD module in direct sunlight.

3. The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

4. It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

5. This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.