EEI TECHNOLOGY ElecStudio

05P-FLUORITE

EPC-INBN0BV1287UD

256x50 UNIVERSAL VFD GRAPHIC DOTMATRIX

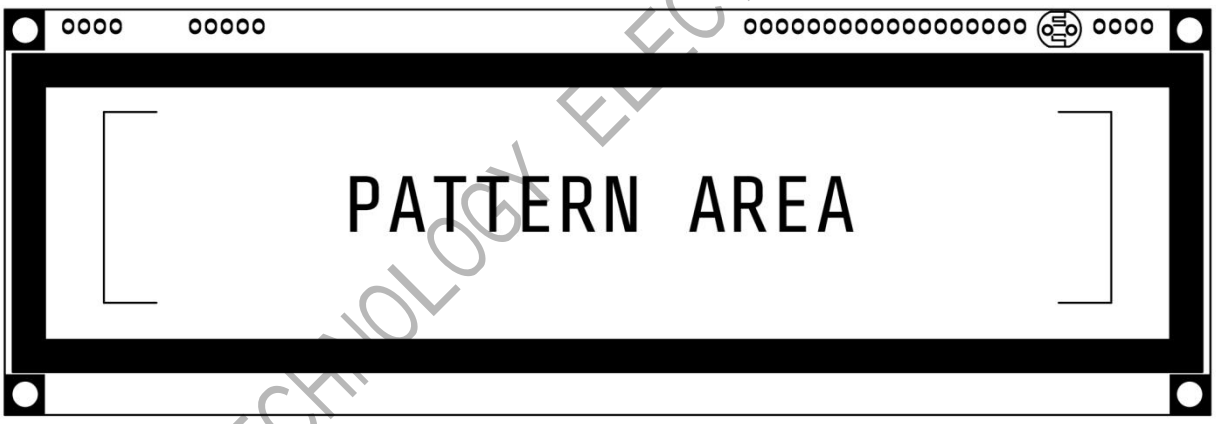
Features

- Internal Controller IC with 256x80 GRAM.
- High Brightness Phosphor.
- 1024 Step Brightness Adjust.
- Maximum Power consumption as low as 5W.
- Wide Voltage Input 4.5 - 20V.
- On board Light Sensor.
- On board Audio Interface.

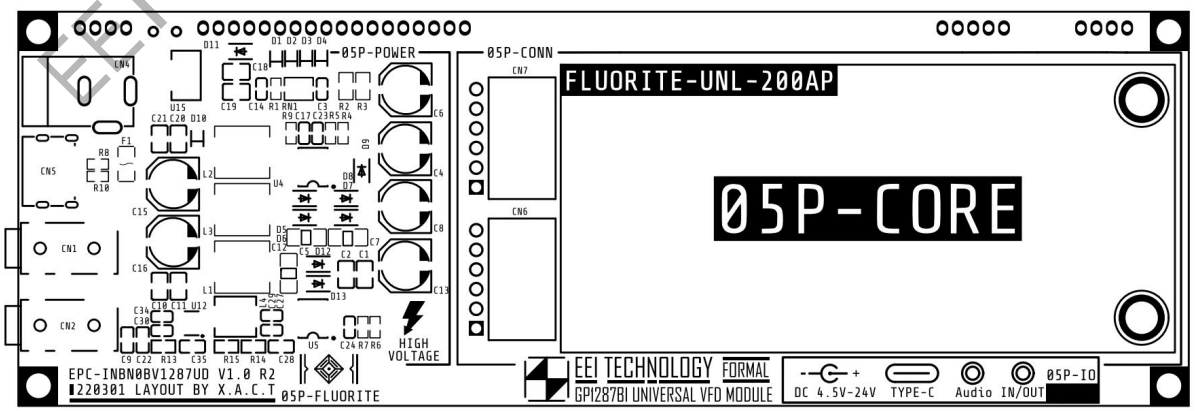
Applications

- Audio equipment.
- industrial equipment
- Instrumentation.
- Alarm CLOCK
- Car Radio

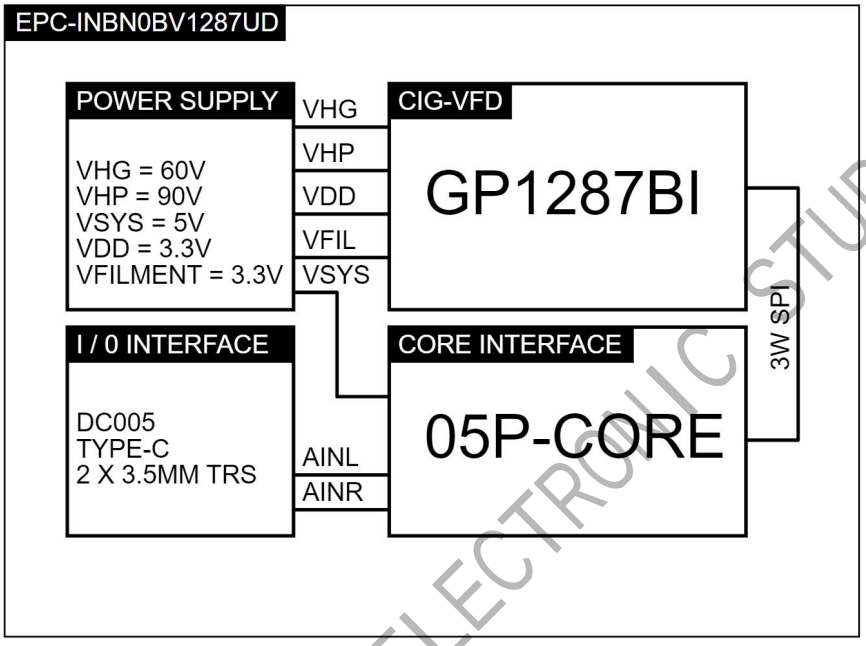
MODULE DIAGRAM (TOP)



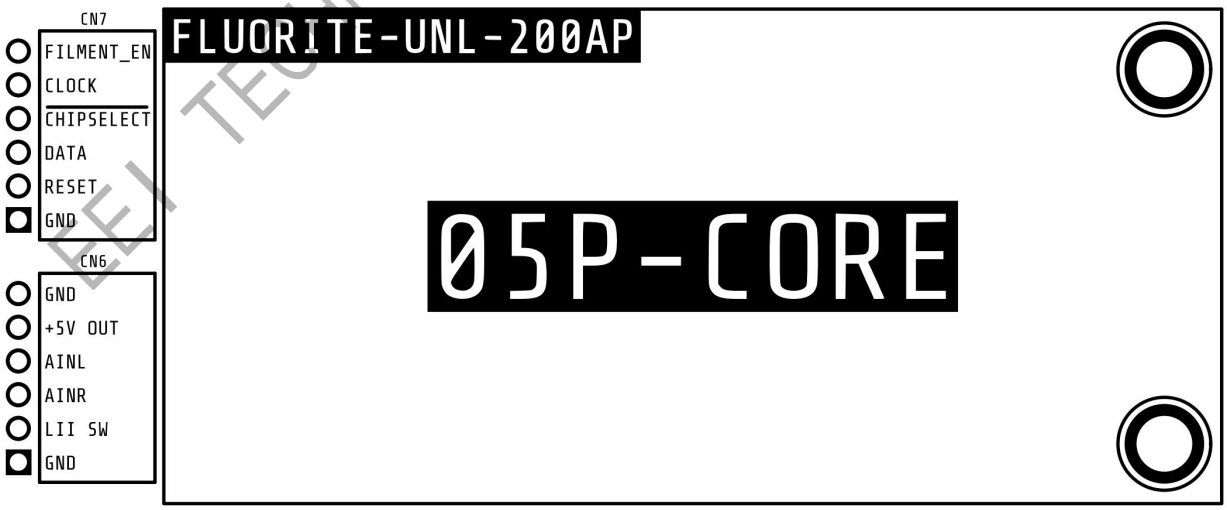
MODULE DIAGRAM (BOTTOM)



Function DIAGRAM



Interface DIAGRAM



Pin Function

Pin		I/O	Description
Name	NO.		
FILMENT_EN	1	INPUT	The VFD Filament Enable,high active.
CLOCK	2	INPUT	SPI clock input.
CHIPSELECT	3	INPUT	SPI chip select,low active.
DATA	4	INPUT	SPI data input,LSB First.
RESET	5	INPUT	VFD Reset,low active.
GND	6	--	Ground.
GND	7	--	Ground.
+5V OUT	8	OUTPUT	+5V Power supply output.
AINL	9	OUTPUT	Audio Left Channel signal.
AINR	10	OUTPUT	Audio Right Channel signal.
LII_SW	11	OUTPUT	Light Sensor Pin,GL5506 Pull down.
GND	12	--	Ground.

Absolute Maximum Ratings

*Exceeding absolute maximum ratings can cause permanent damage to the module

Item	Min	Max	Unit
DC005 Power input	-0.3	24	V
TYPE-C Power input	-0.3	24	V
CLOCK, CHIPSELECT, DATA, RESET to GND	-0.3	5.5	V
FILMENT_EN to GND	-0.3	6	V
Storage Temperature	-40	80	C
Onboard +5V Power supply output current	--	800	mA
LII_SW Current	--	20	mA

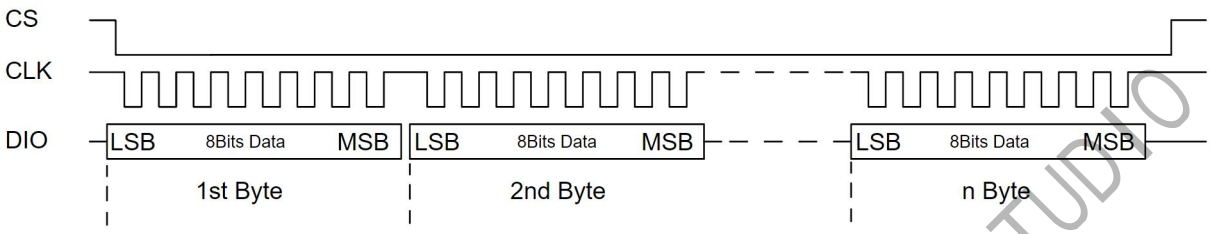
Recommended Operating Conditions

Item	Min	Max	Unit
DC005 Power input	4.5	20	V
TYPE-C Power input	4.5	20	V
CLOCK, CHIPSELECT, DATA, RESET to GND	3.3	5	V
FILMENT_EN to GND	3.3	5	V
Storage Temperature	-20	70	C

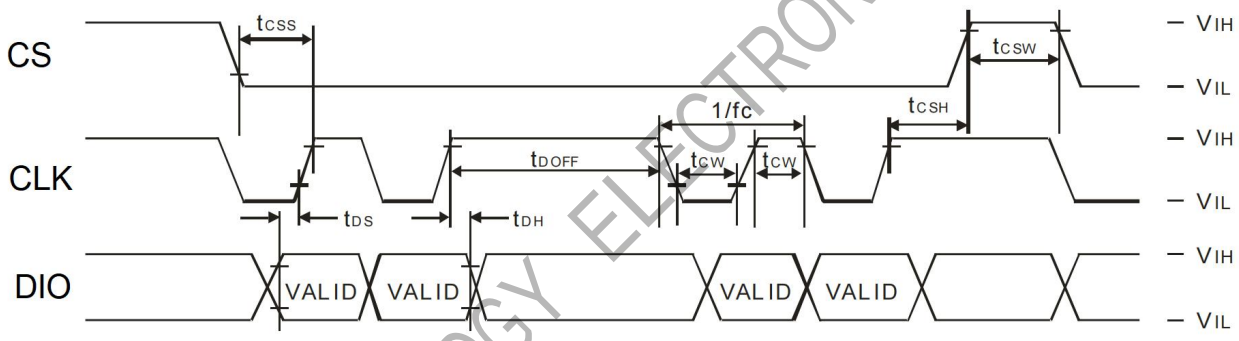
Electrical Characteristics

Parameter		Test Conditions	Min	Typ	Max	Unit
DISPLAY POWER SUPPLY						
I_{STDBY1}	VIN Standby Current	VIN = 5V, FILMENT_EN = 0V	--	8.5	12	mA
I_{STDBY2}	VIN Standby Current	VIN = 5V, FILMENT_EN = 3.3V, ALL Clear	--	360	380	mA
I_{ON}	VIN POWER ON Current	VIN = 5V, FILMENT_EN = 3.3V, ALL Light, DIMMING Set 1023	--	1200	1500	mA
SYSTEM POWER SUPPLY						
V_{SYS}	SYS POWER	VIN = 5V, Open Load	4.95	5	5.25	V
I_{MAX}	MAX Output Current	VIN = 5V	--	--	600	mA
UVLO						
V_{UVP}	UVLO Voltage		3.2	3.3	--	V
LOGIC LEVEL						
V_{IL} max	Logic Low Threshold		--	--	0.6	V
V_{IH} min	Logic High Threshold		2.3	--	--	V
FILAMENT ENABLE CONTROL						
V_{IL} max	EN Low Threshold		--	--	0.3	V
V_{IH} min	EN High Threshold		2	--	--	V
R_{EN}	EN Pull- down Resistance		--	10	--	KOhm
DATA INTERFACE						
F_{CLK}	CLK Frequency		--	--	4.167	MHz
T_{PR}	Power on Reset Time		1	--	--	ms
T_{RW}	Reset Hold Time		100	--	--	us
T_{RTH}	Reset Wait Time		1	--	--	ms
LIGHT SENSOR						
R_{BS}	Sensor Bright Resistance		4	--	7	Kohm
R_{DS}	Sensor Dark Resistance		--	--	500	Kohm
T_{RR}	Response Time (Rise)		--	30	--	ms
T_{RF}	Response Time (Fall)		--	30	--	ms
P_{DMAX}	Power Dissipation (max)		--	--	90	mW

Serial Data Transmission Timing Chart



AC Characteristics



Item	Symbol	Condition	Min	Max	Unit
CLK Frequency	fc	--	--	4.167	MHz
CLK Pulse width	tCW	--	120	--	ns
DIO Setup Time	tDS	--	60	--	ns
DIO Hold Time	tDH	--	60	--	ns
CS Setup Time	tCSS	--	240	--	ns
CS Hold Time	tCSH	Oscillation state	120	--	ns
CS Wait Time	tCSW	--	120	--	ns
Data Processing Time	tDOFF	Oscillation state	360	--	ns
Data Wait Time	tRSOFF	--	--	--	

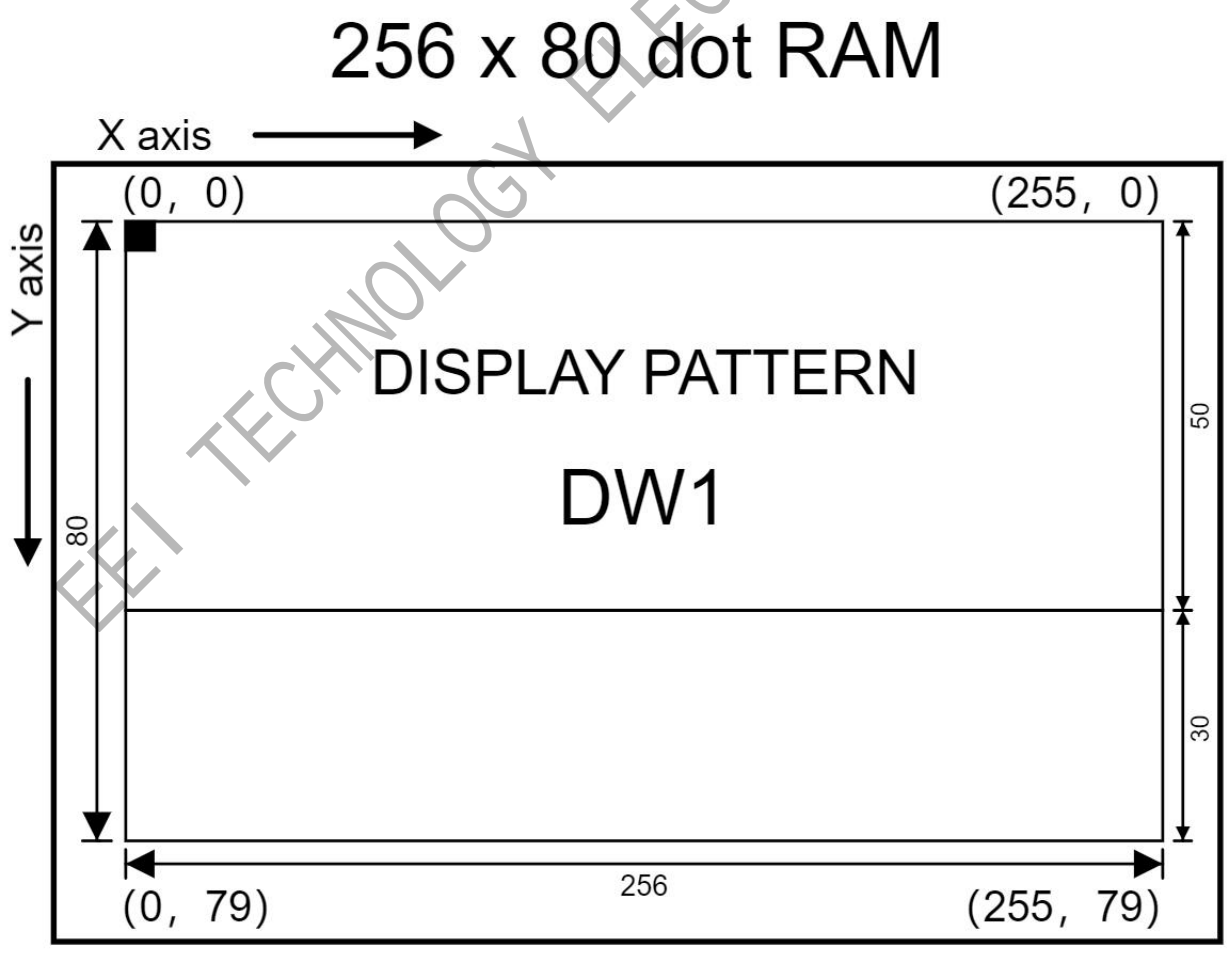
Command List(1/2)

NO.	Command	Byte	MSB							LSB	Hex	Description
			B7	B6	B5	B4	B3	B2	B1	B0		
1	SWRST	1st	1	0	1	0	1	0	1	0	0xAA	Software Reset
2	RAMCLR	1st	0	1	0	1	0	1	0	1	0x55	Clear GRAM
3	VFDMODE	1st	1	1	0	0	1	1	0	0	0xCC	Initialize setting
		2nd	0	0	0	0	0	0	1	0	0x02	
		3rd	0	0	0	0	0	0	0	0	0x00	
4	DISPAREA	1st	1	1	1	0	0	0	0	0	0xE0	
		2nd	1	1	1	1	1	1	1	1	0xFF	
		3rd	0	0	1	1	0	0	0	1	0x31	
		4th	0	0	0	0	0	0	0	0	0x00	
		5th	0	0	1	0	0	0	0	0	0x20	
		6th	0	0	0	0	0	0	0	0	0x00	
		7th	0	0	0	0	0	0	0	0	0x00	
		8th	1	0	0	0	0	0	0	0	0x80	
5	FRAMECTR	1st	1	0	1	1	0	0	0	1	0xB1	
		2nd	0	0	1	0	0	0	0	0	0x20	
		3rd	0	0	1	1	1	1	1	1	0x3F	
		4th	0	0	0	0	0	0	0	0	0x00	
		5th	0	0	0	0	0	0	0	1	0x01	
6	DIMMCTR	1st	1	0	1	0	0	0	0	0	0xA0	Dimming Level Setting
		2nd	0	0	0	0	0	0	L9	L8	--	
		3rd	L7	L6	L5	L4	L3	L2	L1	L0		
7	RAMWR	1st	1	1	1	1	0	0	0	0	0xF0	Write GRAM
		2nd	X7	X6	X5	X4	X3	X2	X1	X0	--	
		3rd	*	Y6	Y5	Y4	Y3	Y2	Y1	Y0		
		4th	*	C6	C5	C4	C3	C2	C1	C0		
		5th	D7	D6	D5	D4	D3	D2	D1	D0		
8	DISPPOS	1st	1	1	0	0	0	0	0	0	0xC0	Display Offset Setting
		2nd	X7	X6	X5	X4	X3	X2	X1	X0	--	
		3rd	*	Y6	Y5	Y4	Y3	Y2	Y1	Y0		
9	DISPMODE	1st	1	0	0	0	0	0	0	0	0x80	Display Mode Setting
		2nd	0	0	*	SC	HS	LS	*	NP	--	

Command List(2/2)

NO.	Command	Byte	MSB							LSB	Hex	Description
			B7	B6	B5	B4	B3	B2	B1	B0		
10	T1CTR	1st	0	0	0	0	1	0	0	0	0x08	T1 Output Setting
		2nd	*	*	*	*	*	*	ACT	INT	--	INT=0:INT is LOW Output ACT=0,INT=1:INT LOW Active ACT=1,INT=1:INT HIGH Active
11	OSCCTR	1st	0	1	1	1	1	0	0	0	0x78	Oscillation Initialization
		2nd	0	0	0	0	1	0	0	0	0x08	
12	DISPON	1st	0	1	1	0	1	1	0	1	0x6D	Display ON
13	DISPOFF	1st	0	1	1	0	0	0	0	1	0x61	Display OFF

Display Memory Map



Command Features

0xAA	SWRST (Software Reset)								
Bit	B7	B6	B5	B4	B3	B2	B1	B0	Hex
SWRST	1	0	1	0	1	0	1	0	0xAA
Parameter	--								--
Description	"-" Don't care -The display module performs a software reset, registers are written with their SW reset default values. It will be necessary to wait 10msec before sending new command following software reset. The display loads all default values to the registers and Clear GRAM during this 10msec.								

0x55	RAMCLR (Clear GRAM)								
Bit	B7	B6	B5	B4	B3	B2	B1	B0	Hex
RAMCLR	0	1	0	1	0	1	0	1	0x55
Parameter	--								--
Description	"-" Don't care -The display module performs a clear display memory -It will be necessary to wait 10msec before sending new command following clear display memory. The display Clear GRAM during this 10msec.								

0xA0		DIMMCTR (Dimming Control)								
Bit		B7	B6	B5	B4	B3	B2	B1	B0	Hex
DIMMCTR		1	0	1	0	0	0	0	0	0xA0
2nd BYTE	MSB	0	0	0	0	0	0	L9	L8	--
3rd BYTE	LSB	L7	L6	L5	L4	L3	L2	L1	L0	--
Description		-The display module performs a brightness adjustment operation -In order to delay the aging of the display module, it is recommended to control the brightness value below 300 (DEC)								

L[9:0]	Range (DEC)
Brightness adjust	0-1023

0xF0		RAMWR (Write GRAM)								
Bit		B7	B6	B5	B4	B3	B2	B1	B0	Hex
RAMWR		1	1	1	1	0	0	0	0	0xF0
2nd BYTE	Xpos	X7	X6	X5	X4	X3	X2	X1	X0	--
3rd BYTE	Ypos	--	Y6	Y5	Y4	Y3	Y2	Y1	Y0	--
4th BYTE	Return Length	--	C6	C5	C4	C3	C2	C1	C0	--
5th BYTE .. N BYTE	Data	D7	D6	D5	D4	D3	D2	D1	D0	--

Description (1/2)

"--" Don't care

-This command is used to transfer data from MCU to display memory.

-When this command is accepted, the X/Y positions are reset

-The start X/Y positions are different in accordance with X[7:0],Y[6:0] setting.

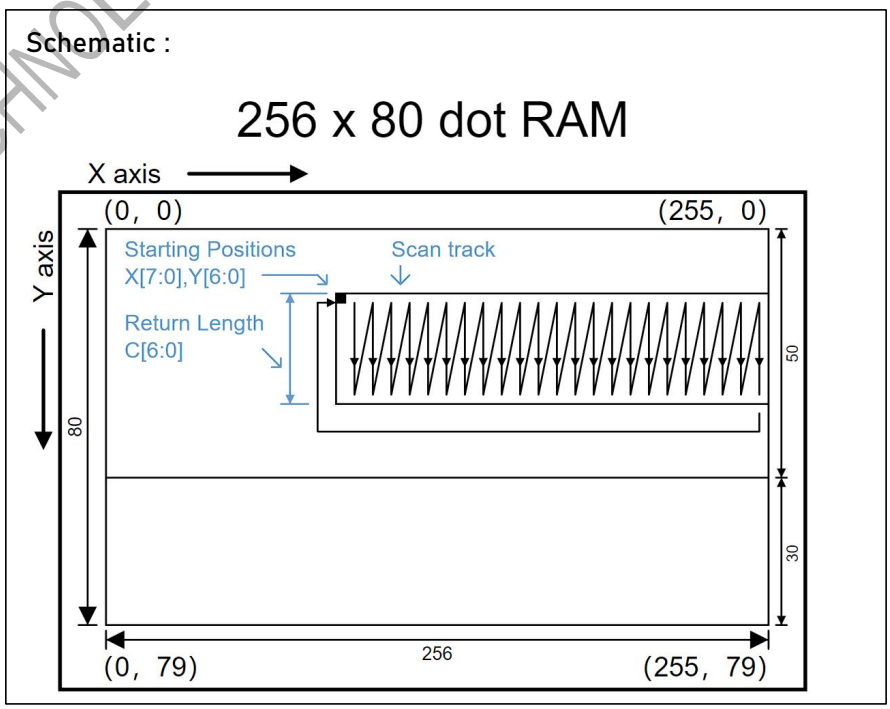
-The Electron gun scans GRAM data top-down onto the screen, When the scan reaches the set return length [C6:0], the Y coordinate returns to the initial value, and the X coordinate automatically increments by one pixel,

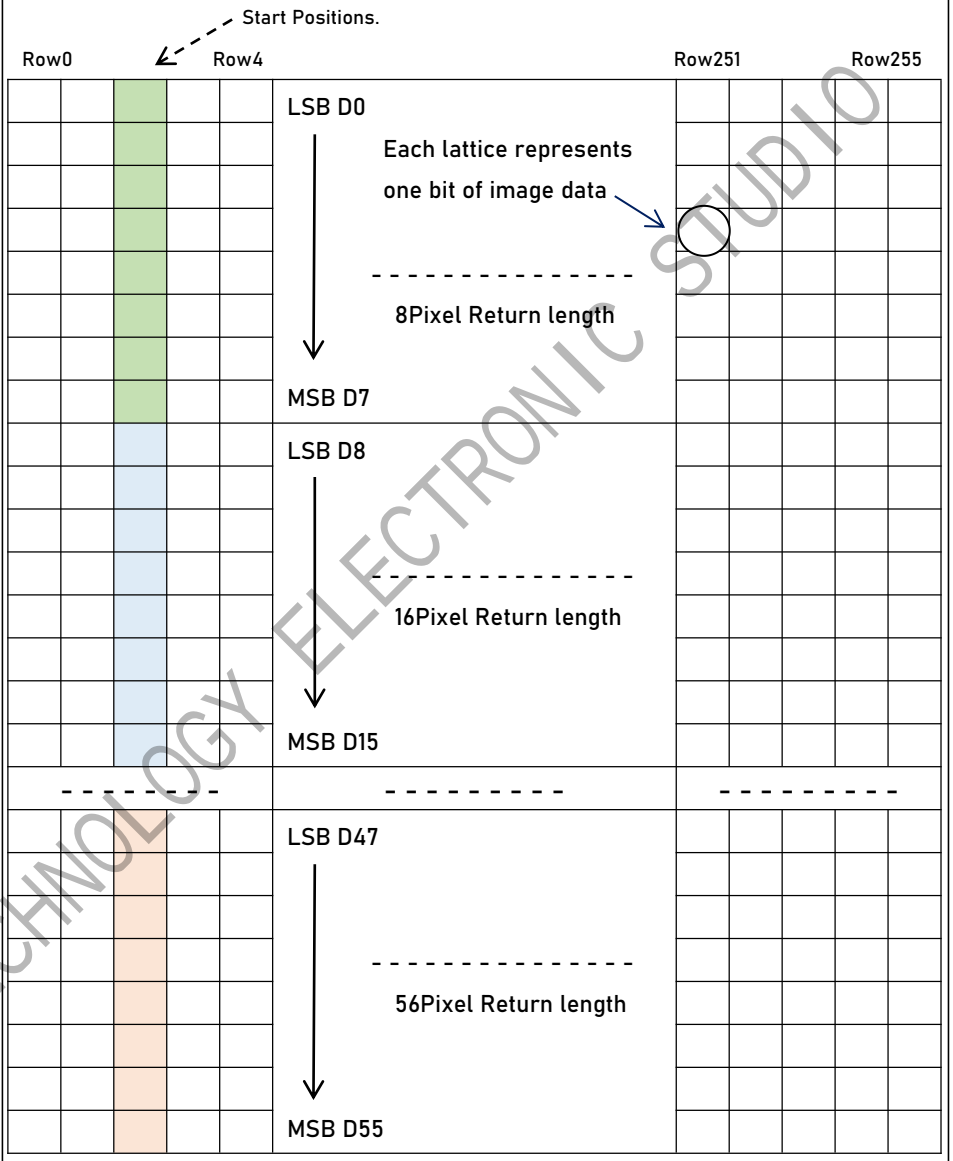
When the X coordinate exceeds 255, the X coordinate returns to the initial value.

-The Return length must be an integer multiple of 8.

-Sending any other command can stop frame write.

Schematic :



0xF0	RAMWR (Write GRAM)
Description (2/3)	Example of GRAM  When data length = Return length, the X position will be incremented by 1 pixel, and the Y position will be zeroed.

0xF0	RAMWR (Write GRAM)

Description (3/3)

2nd BYTE : Set start X Positions.

Hex	Bit								DEC
	X7	X6	X5	X4	X3	X2	X1	X0	
00h	0	0	0	0	0	0	0	0	0
01h	0	0	0	0	0	0	0	1	1
---	.----------								----------
FEh	1	1	1	1	1	1	1	0	254
FFh	1	1	1	1	1	1	1	1	255

3rd BYTE : Set start Y Positions.

Hex	Bit								DEC
	--	Y6	Y5	Y4	Y3	Y2	Y1	Y0	
00h	--	0	0	0	0	0	0	0	0
01h	--	0	0	0	0	0	0	1	1
---	.----------								----------
7Eh	--	1	1	1	1	1	1	0	126
7Fh	--	1	1	1	1	1	1	1	127

4th BYTE : Set Return Length .

Hex	Bit								DEC
	--	C6	C5	C4	C3	C2	C1	C0	
07h	--	0	0	0	0	1	1	1	8
0Fh	--	0	0	0	1	1	1	1	16
---	.----------								----------
7Eh	--	1	1	1	0	1	1	1	120
7Fh	--	1	1	1	1	1	1	1	128

5th ~ n BYTE : Write GRAM

NO.	Bit								--
1st	D7	D6	D5	D4	D3	D2	D1	D0	
	---								
n	D7	D6	D5	D4	D3	D2	D1	D0	

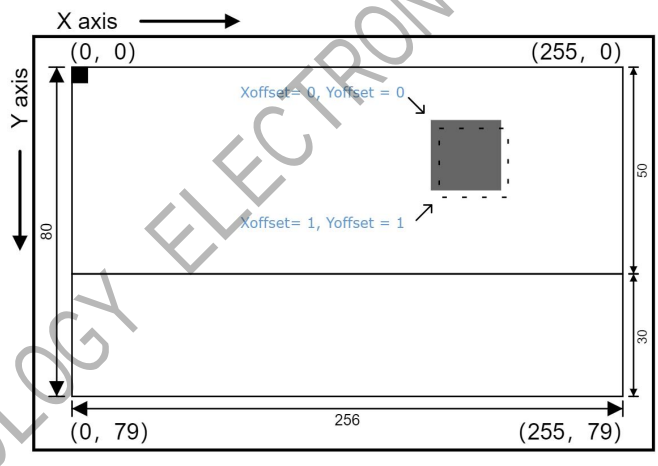
0xC0		DISPPOS (Set Display Area offset)								
Bit		B7	B6	B5	B4	B3	B2	B1	B0	Hex
DISPPOS		1	1	0	0	0	0	0	0	0xC0
2nd BYTE	X offset	X7	X6	X5	X4	X3	X2	X1	X0	--
3rd BYTE	Y offset	--	Y6	Y5	Y4	Y3	Y2	Y1	Y0	--

Description (1/2)

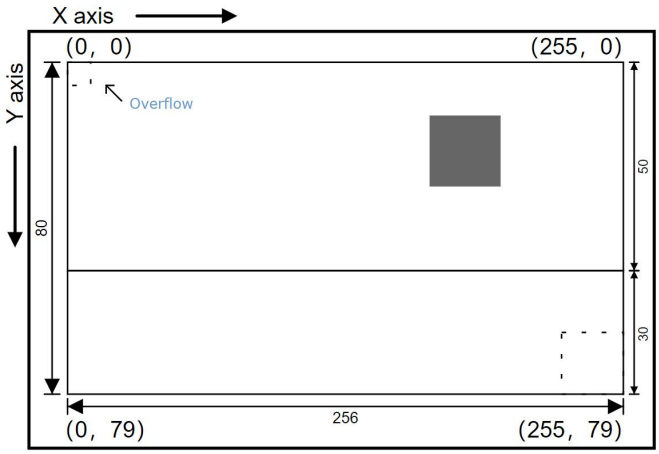
"--" Don't care

- This command is used to set the offset of the display area.
- Wherein the X direction offset depends on X[7:0], Y direction [Y6:0].
- When the offset is too large to cause the display area to exceed the GRAM size, the extra display content will overflow from X0 or Y0.

Schematic (Normal) :



Schematic (Image overflow) :



0xC0	DISPPOS (Set Display Area offset)

Description (2/2)

2nd BYTE : Set X offset

Hex	Bit								DEC
	X7	X6	X5	X4	X3	X2	X1	X0	
00h	0	0	0	0	0	0	0	0	0
01h	0	0	0	0	0	0	0	1	1
---	.----------								----------
FEh	1	1	1	1	1	1	1	0	254
FFh	1	1	1	1	1	1	1	1	255

3rd BYTE : Set Y Offset

Hex	Bit								DEC
	--	Y6	Y5	Y4	Y3	Y2	Y1	Y0	
00h	--	0	0	0	0	0	0	0	0
01h	--	0	0	0	0	0	0	1	1
---	.----------								----------
7Eh	--	1	1	1	1	1	1	0	126
7Fh	--	1	1	1	1	1	1	1	127

0x80		DISPMODE								
Bit		B7	B6	B5	B4	B3	B2	B1	B0	Hex
DISPMODE		1	0	0	0	0	0	0	0	0x80
2nd BYTE	Setting	0	0	*	SC	HS	LS	*	NP	--

Description

"--" Don't care

- This command is used to set the working mode of the display

bit				Function
SC	HS	LS	NP	
1	*	*	*	Scan stop
0	*	1	*	All light off
0	1	0	*	All light on
0	0	0	0	Positive Scan
0	0	0	1	Invert Scan

0x08		T1CTR (Frame sync interrupt settings)								
Bit		B7	B6	B5	B4	B3	B2	B1	B0	Hex
T1CTR		0	0	0	0	1	0	0	0	0x08
2nd BYTE	Setting	0	0	*	SC	HS	LS	*	NP	--

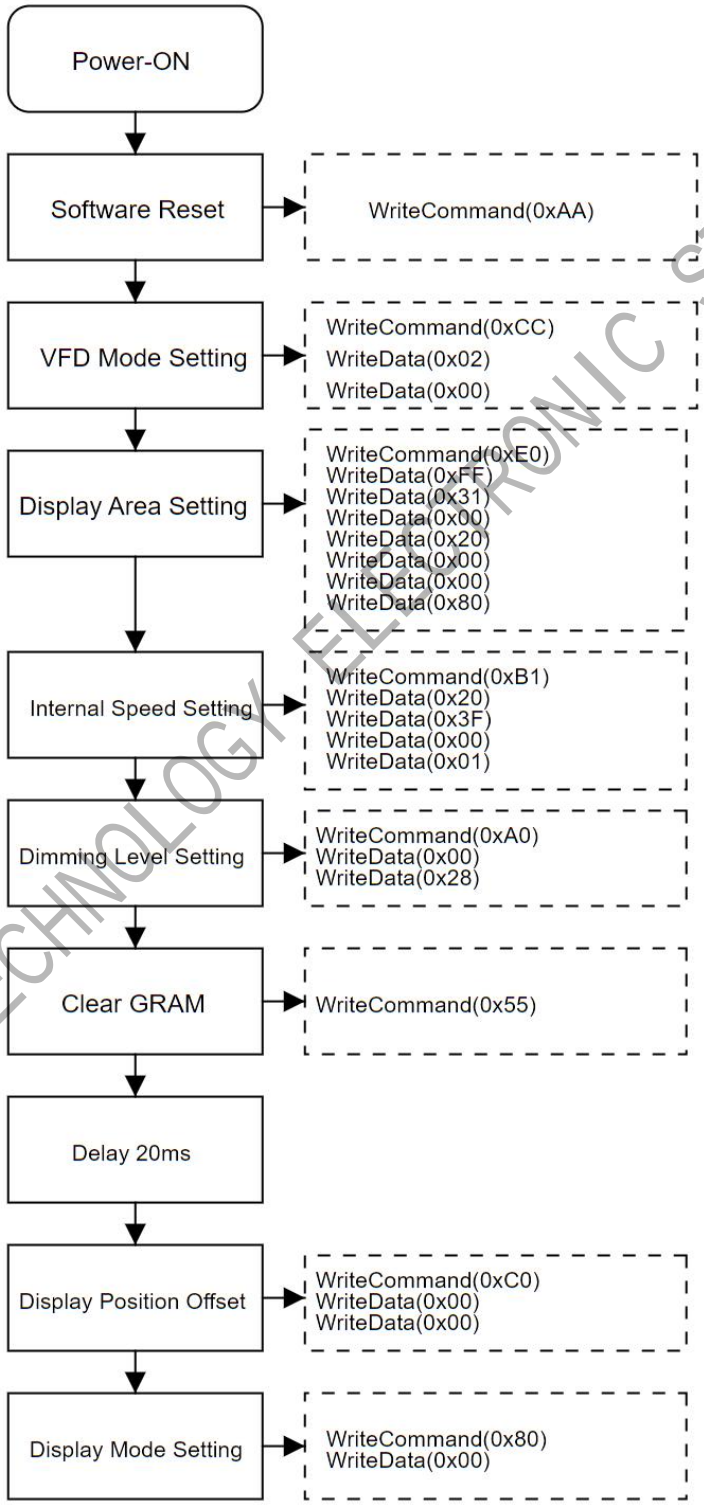
Description

"--" Don't care

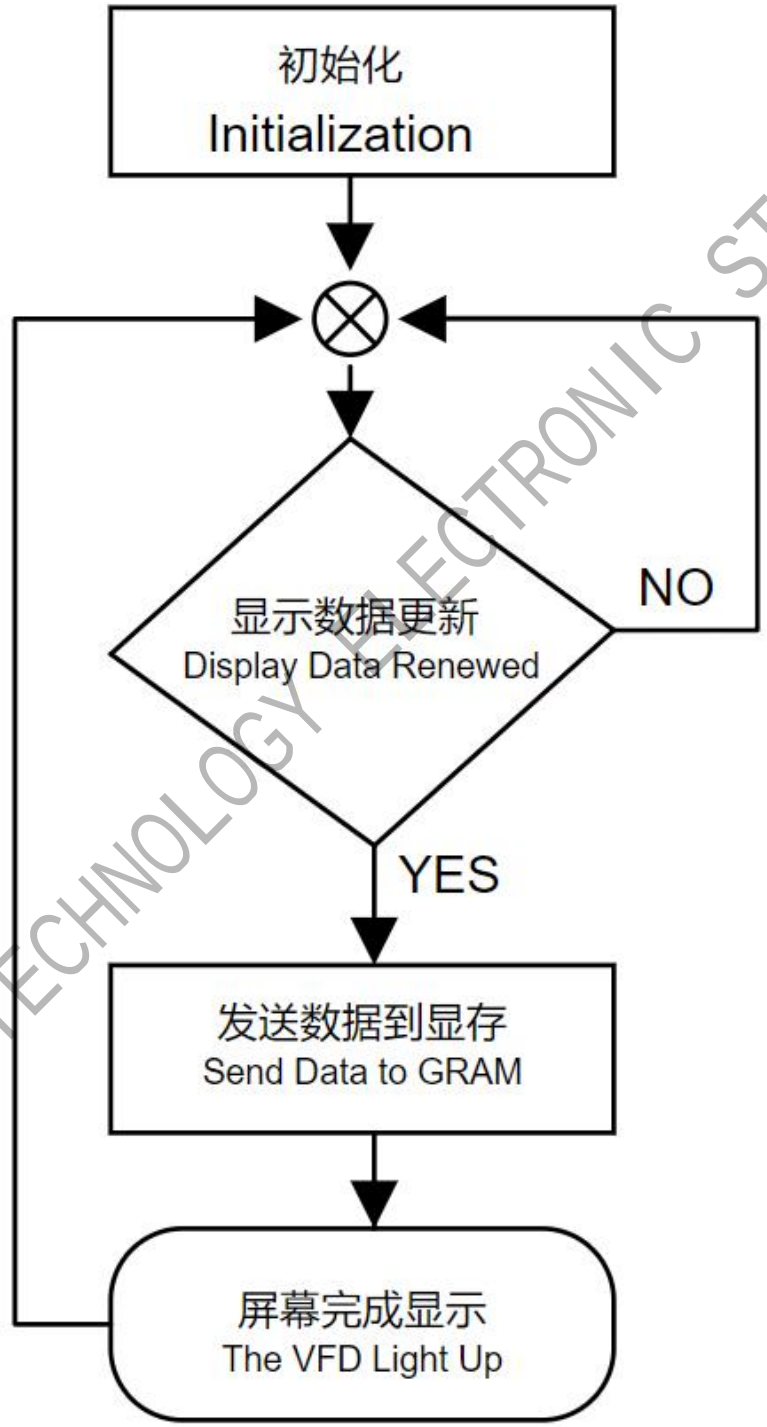
- This command is used to set the output mode of the INT pin
- When the screen starts scanning from 1G, the frame sync interrupt will be triggered.

bit		Function
ACT	INT	
*	0	INT Pin normal Low
0	1	INT Pin High active
1	1	INT Pin Low active

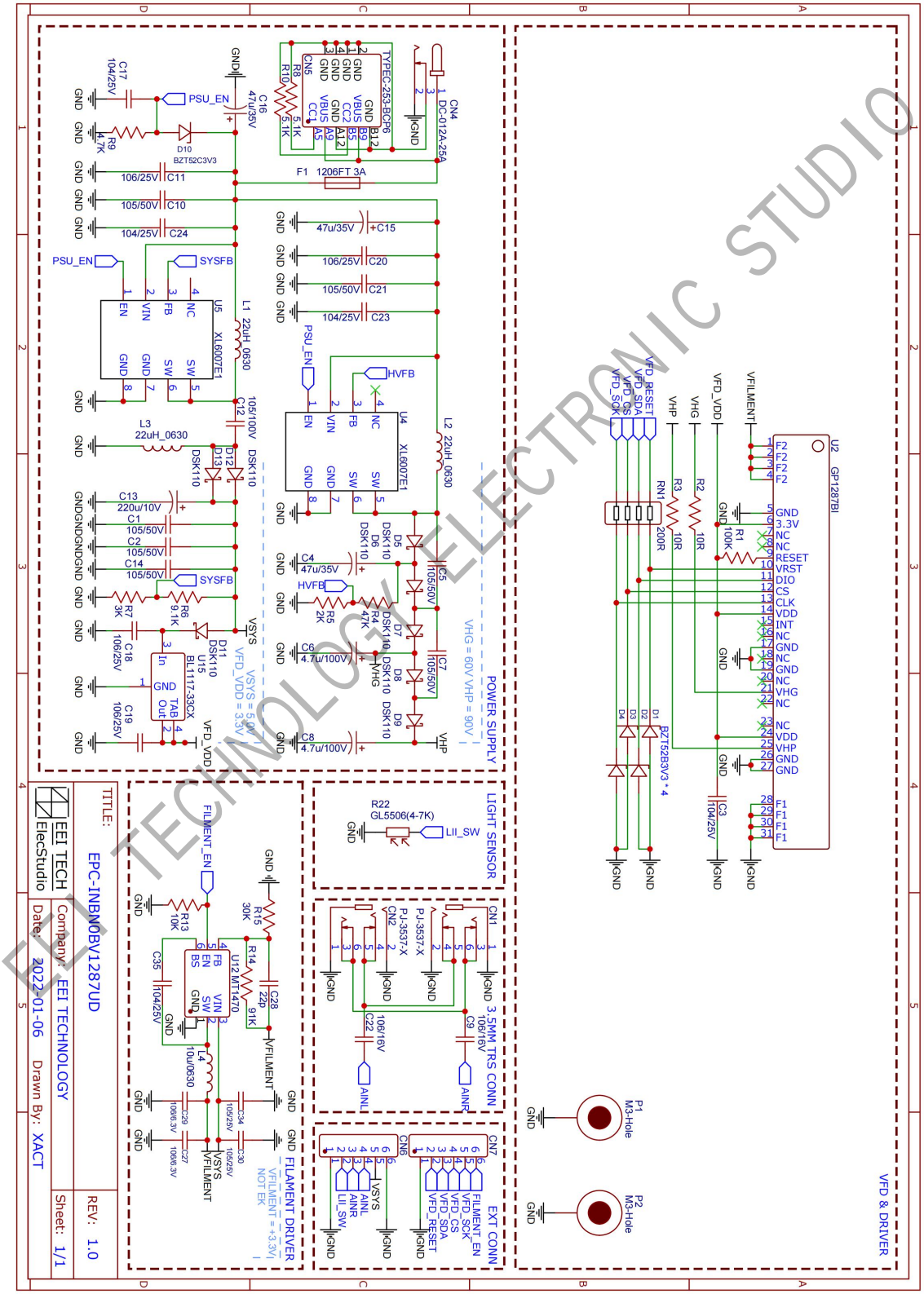
Example of Display initialization



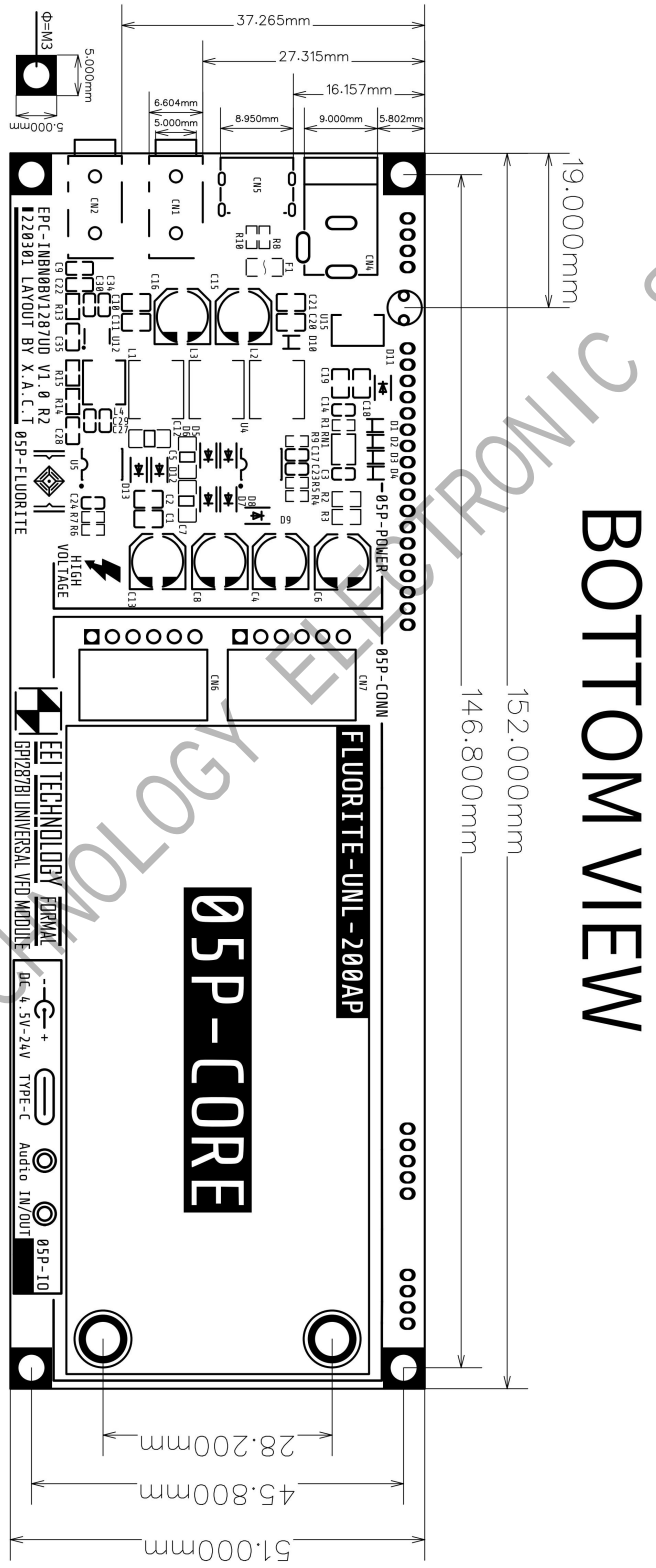
Example of Display logic



Module Schematic



Module Outline DIAGRAM



05P-CORE Board Outline DIAGRAM