



TFT LCD MODULE

1.28 inch 240RGB*240DOTS

MODULE NUMBER: IE-E-2531CO05S-C0-1

REVISION:= A

Contents

- 1. General Description**
 - 2. Mechanical Drawing**
 - 3. Pin Description**
 - 4. Electrical Characteristics**
 - 5. Optical characteristics**
 - 6. Reliability**
 - 7. Package Specifications**
 - 8. Precaution Relating Product Handling**
 - 9. Warranty**
 - 10. Notice**
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1. General Description

1.1 Description

IE-E-2531CO05S-C0-1 is a 240RGBX240 dot-matrix TFT LCD module. This module is composed of a TFT LCD Panel, driver ICs, FPC and a Backlight unit.

1.2 Features

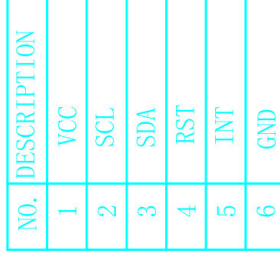
NO.	Item	Contents	Unit
1	LCD Size	1.28	inch
2	Display Mode	Normally black	-
3	Resolution	240(H)RGB x 240(V)	pixels
4	Dot pitch	0.135(H) x 0.135(V)	mm
5	Active area	32.4(H) x 32.4(V)	mm
6	Module size	35.6(H) x 38.1(V) x1.5 (D)	mm
7	Color arrangement	RGB Vvertical stripe	-
8	Interface	4 Line SPI	-
9	Drive IC	GC9A01	-
10	Luminance(cd/m2)	400 (TYP)	Cd/m2
11	Viewing Direction	All View	O'Clock
12	Backlight	2 LED Parallel	-
13	Operating Temp.	-20°C~ + 70°C	°C
14	Storage Temp.	-30°C~+ 80°C	°C
15	Weight	TBD	g



2. Mechanical Drawing

[illegible]

9. All materials comply with ROHS



InterElcom

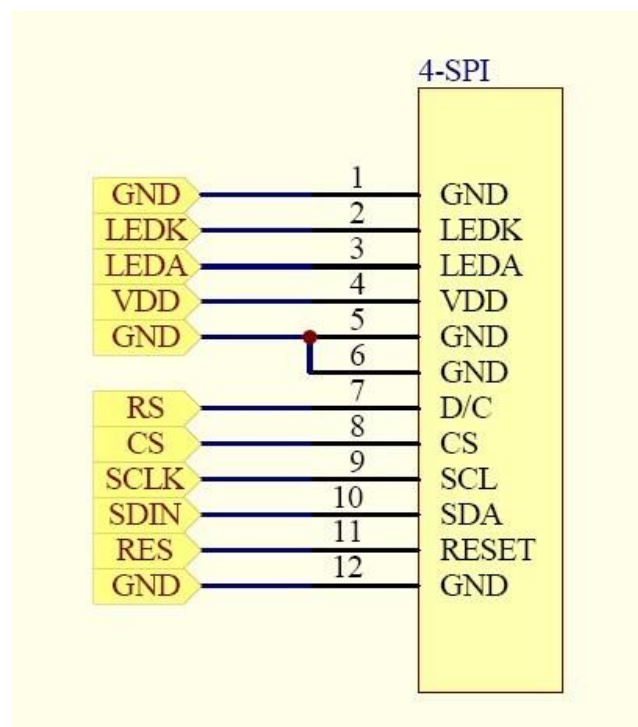
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3. Pin Definition

FPC Connector is used for the module electronics interface.

NO.	Symbol	Description
1	GND	Power Ground
2	LEDK	LED Cathode
3	LED A	LED Anode
4	VDD	Power Supply for Analog
5	GND	Power Ground
6	GND	Power Ground
7	D/C	Display data/command selection pin in 4-line serial interface.
8	CS	Chip selection pin;Low enable,high disable.
9	SCL	This pin is used to be serial interface clock
10	SDA	SPI interface input/output pin.the data is latched on the rising edge of the SCL signal.
11	RESET	This signal will reset the device and it must be applied to properly initialize the chip.Signal is active low.
12	GND	Power Ground

Note:



4. Electrical Characteristics

4.1 Absolute Maximum Ratings

Parameter	Symbol	Min	MAX	Unit	Notes
Supply Voltage (I/O)	VDD	-0.3	4.0	V	
Analog Supply Voltage	VDDIO	-0.3	4.0	V	
Logic Input Voltage	VIN	-0.3	VDDIO+0.5	V	
Operation Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	

4.2 Operating Conditions

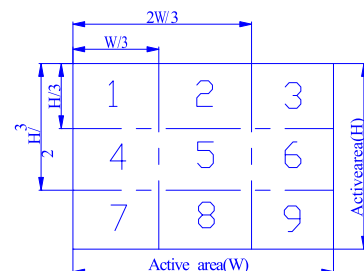
Parameter	Symbol	Min	TYP	MAX	Unit	Notes
System Voltage	VDD	2.4	2.8	3.3	V	
Interface Operation Voltage	VDDIO	1.65	1.8	3.3	V	
Gate Driver High Voltage	VGH	8	-	16.5	V	
Gate Driver Low Voltage	VGL	-10	-	-5	V	
Operating Current for V _{DD}	IDD	-	8	10	mA	
Sleep_In Mode VDD	I _{dd}	-	15	30	uA	
Sleep_In Mode VDDIO	I _{ddio}	-	5	10	uA	

4.3 Backlight Unit

Parameter	Symbol	Min	TYP	MAX	Unit	Notes
Voltage for LED backlight	VLED	2.9	3.0	3.1	V	
Current for LED backlight	ILED	-	40	60	mA	2 LED Parallel
Power Consumption	Pbl	-	120	186	mW	1
Brightness	Lbr	350	400	-	cd/m ²	2
LED Life time	-	20000	-	-	hr	3

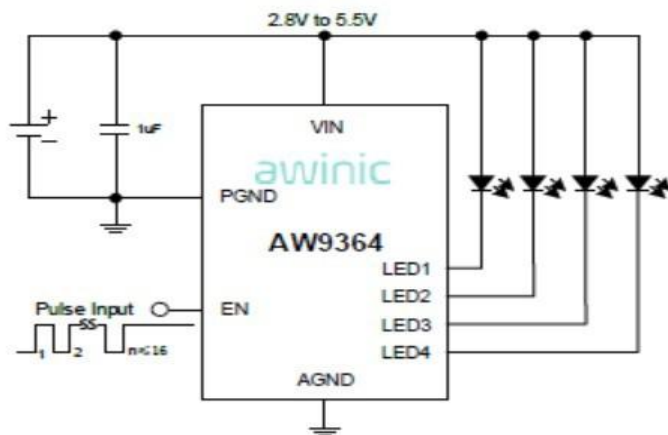
Note:

- Where ILED =40mA , VLED=3.0V , Pbl= ILED x VLED
- Uniform measure condition:
a:Measure 9 point, Measure location is show below:
b:Uniform=(Minbrightness/Maxbrightness)x100%
c:Best Contrast.
- The environmental conducted under ambient air flow ,at
Ta=25±2°C,60%RH±5%

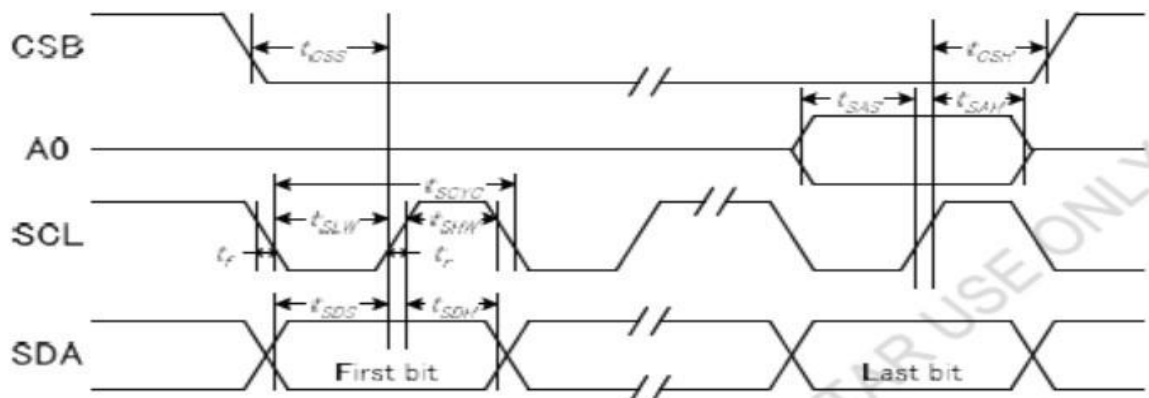


4.4 Backlight Recommended Circuit

Motherboard driver backlight is need constant current circuit , if threated voltage screen after light brightness difference . Current and power consumption of the machine are inconsistent , so recommend a backlight driving circuit is best rated current . It is recommended to use IC (AW9364) . The reference circuit is as follows:



4.5 AC Timing Characteristic of The LCD



5.

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCL	tSCYC		30	—	ns
SCLK "H" pulse width		tSHW		15	—	
SCLK "L" pulse width		tSLW		15	—	
Address setup time	A0	tSAS		10	—	
Address hold time		tSAH		10	—	
Data setup time	SDA	tSDS		10	—	
Data hold time		tSDH		10	—	
CSB-SCLK time	CSB	tCSS		10	—	
CSB-SCLK time		tCSH		10	—	

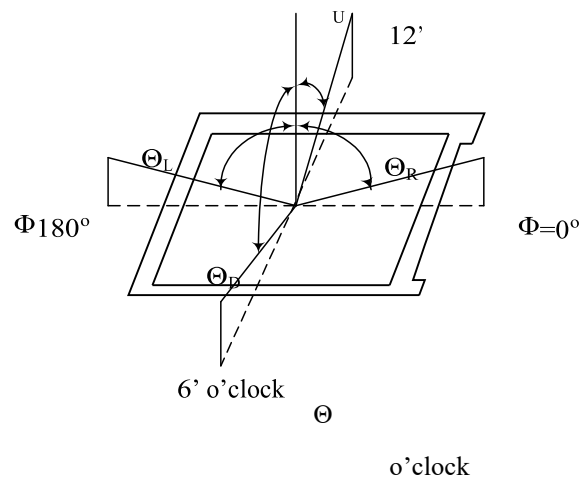
Note:

- The input signal rise and fall time (t_r , t_f) are specified at 15 ns or less.
- All timing is specified using 20% and 80% of VDDI as the standard.

OPTICAL CHARACTERISTICS

Item	Symbol	Measuring Conditions		Min.	Typ.	Max.	Unit	Remark
Viewing Angle	θ	$\phi=0^\circ$	25 °C	80	85	-	Deg	Note1
		$\phi=180^\circ$	25 °C	80	85	-		
	θ	$\phi=90^\circ$	25 °C	80	85	-		
		$\phi=270^\circ$	25 °C	80	85	-		
Brightness	Lbr	--	-	350	400	-	Cd/m2	
Luminand Uniformity	ΔL	--	-	70	75	-		
Contrast Ratio	CR	--	25 °C	900	1100	-	--	Note2
Response Time	Tr+Tf	$\phi=0^\circ$ $\phi=0^\circ$	25 °C	-	30	35	ms	Note3
Color of CIE Coordinate	White	X	25 °C		0.324		--	BM-7A
		Y	25 °C		0.347			
	Red	X	25 °C		0.644			
		Y	25 °C	-0.02	0.333	+0.02		
	Green	X	25 °C		0.325			
		Y	25 °C		0.566			
	Blue	X	25 °C		0.134			
		Y	25 °C		0.124			
Transmittance (with polarizer)	--	--	--	4.4	4.9	-	%	--

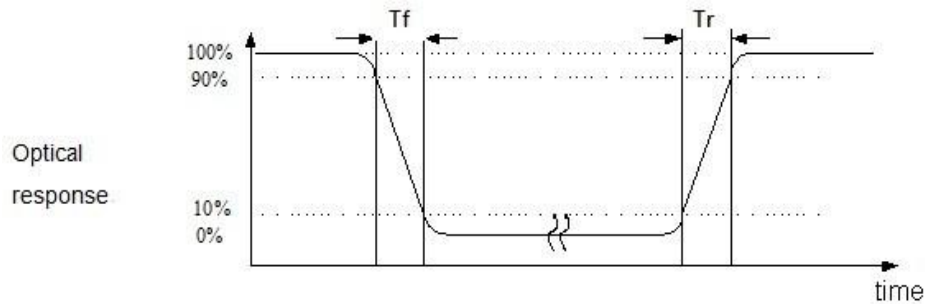
Note 1 Definition of Viewing Angle:



Note 2 Definition of Contrast Ratio (CR) : $\Phi=270^\circ$
 measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

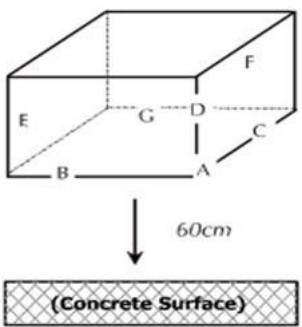
Note 3 Definition of Response Time : Sum of T_r and T_f :



6. Reliability

Contents of Reliability Tests

No.	Item	Conditions	Note
1	High Temperature Operation	$70^\circ\text{C} \pm 2^\circ\text{C}$, 120 hrs	
2	Low Temperature Operation	$-20^\circ\text{C} \pm 2^\circ\text{C}$, 120 hrs	
3	High Temperature Storage	$80^\circ\text{C} \pm 2^\circ\text{C}$, 120 hrs	
4	Low Temperature Storage	$-30^\circ\text{C} \pm 2^\circ\text{C}$, 120 hrs	
5	High Temperature /Humidity Operation	$60^\circ\text{C} \pm 2^\circ\text{C}$, 90% RH, 120 hrs	
6	Temperature Cycling	$-10^\circ\text{C} \rightarrow 25^\circ\text{C} \rightarrow 60^\circ\text{C} \rightarrow 25^\circ\text{C} \rightarrow -10^\circ\text{C}$ 30min 5min 30min 5min 30min 10 cycle.	
7	Vibration Test	Total fixed amplitude:1.5mm. Vibration Frequency:10~55Hz One cycle 60 seconds to 3 direction of X,Y,Z each 15 minutes.	
8	ESD Test	Air Discharge:Apple $\pm 4\text{KV}$ with 5 times.	
		Contact Discharge:Apple $\pm 2\text{KV}$ with 5 times.	

9	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.  <i>Dropping method corner dropping:</i> <i>A corner: Once edge dropping.</i> <i>B, C, D edge: Once face dropping.</i> <i>E, F, G face: Once.</i>	
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Note:

No charge on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

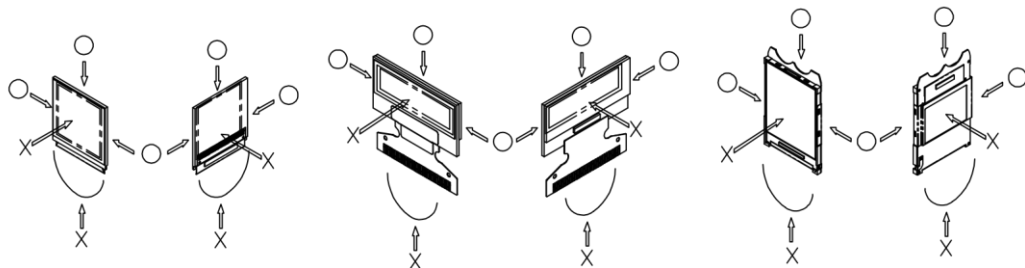
Humidity: $65 \pm 5\% \text{RH}$.

Tests will be not conducted under functioning state.

8. Precautions When Using These TFT Display Modules

8.1 Handling Precautions

- 1) Since the display panel is being made of glass, do not apply mechanical impacts such as dropping from a high position.
- 2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
- 3) If pressure is applied to the display surface or its neighborhood of the TFT display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
- 4) The polarizer covering the surface of the TFT display module is soft and easily scratched. Please be careful when handling the TFT display module.
- 5) When the surface of the polarizer of the TFT display module has soil, clean the surface. It takes advantage of by using following adhesion tape. * Scotch Mending Tape No. 810 or an equivalent. Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy. Also, pay attention that the following liquid and solvent may spoil the polarizer:
 - * Water
 - * Ketone
 - * Aromatic Solvents
- 6) Hold TFT display module very carefully when placing TFT display module into the system housing. Do not apply excessive stress or pressure to TFT display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases.



- 7) Do not apply stress to the driver IC and the surrounding molded sections.
- 8) Do not disassemble nor modify the TFT display module.
- 9) Do not apply input signals while the logic power is off.
- 10) Pay sufficient attention to the working environments when handling TFT display modules to prevent occurrence of element breakage accidents by static electricity.
 - * Be sure to make human body grounding when handling TFT display modules.
 - * Be sure to ground tools to use or 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 TFT display module. Be careful since static electricity may be generated when exfoliating the protective film.
- 11) 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 TFT 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 removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).
- 12) If electric current is applied when the TFT display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

8.2 Storage Precautions

- 1) When storing TFT display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps. and, also, avoiding high temperature and high humidity environment or low temperature (less than 0 °C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Limito technology Inc.)
At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
- 2) If electric current is applied when water drops are adhering to the surface of the TFT display module, when the TFT display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

8.3 Designing Precautions

- 1) The absolute maximum ratings are the ratings which cannot be exceeded for TFT display module, and if these values are exceeded, panel damage may be happen.
- 2) 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.
- 3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (V_{DD}). (Recommend value: 0.5A)
- 4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.
- 5) As for EMI, take necessary measures on the equipment side basically.
- 6) When fastening the TFT display module, fasten the external plastic housing section.
- 7) If power supply to the TFT display module is forcibly shut down by such errors as taking out the main battery while the TFT display panel is in operation, we cannot guarantee the quality of this OEL display module.
- 8) The electric potential to be connected to the rear face of the IC chip should be as follows:
 - * Connection (contact) to any other potential than the above may lead to rupture of the IC.

8.4 Precautions when disposing of the TFT display modules

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

8.5 Other Precautions

- 1) When an TFT display module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur.
Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module.
 - 2) To protect TFT display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the TFT display modules.
 - * Pins and electrodes
 - * Pattern layouts such as the FPC
 - 3) With this TFT display module, the TFT 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 TFT driver is exposed to light, malfunctioning may occur.
 - * Design the product and installation method so that the TFT driver may be shielded from light in actual usage.
 - * Design the product and installation method so that the TFT driver may be shielded from light during the inspection processes.
 - 4) Although this TFT 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. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
 - 5) We recommend you to 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.
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