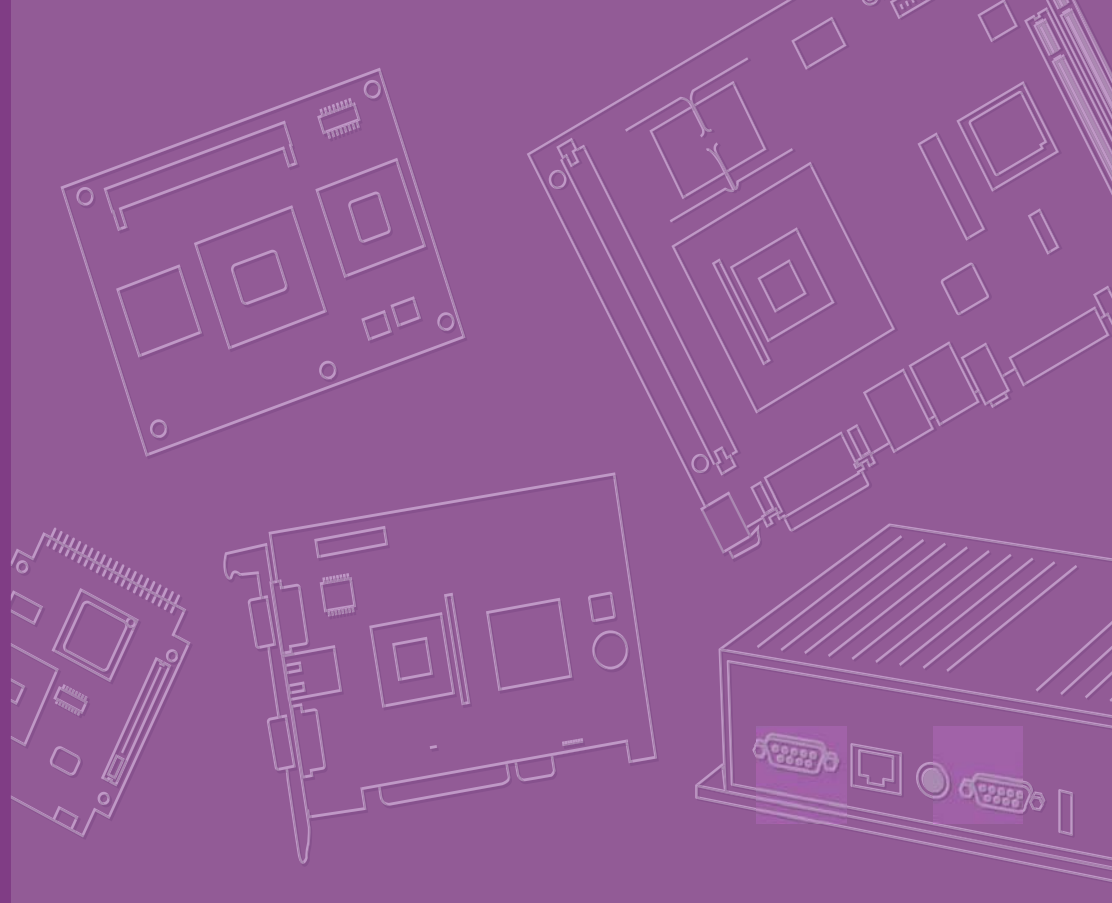


User Manual



Rev083123

IDK-1110R-series

TFT-LCD 10.4" SVGA (LED Backlight)



coastipc.com | 866-412-6278 | info@coastipc.com

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Chapter 1

Overview

1.1 General Description

This specification applies to the 10.4 inch color TFT LCD module IDK-1110R-series. IDK-1110R-series designed with wide viewing angle; wide operating temperature and long life LEDs backlight is well suited to be the display units for Industrial Applications.

LED driving board for backlight unit is included in this panel and the structure of the LED units is replaceable.

Also, IDK-1110R-series has LVDS interface and 4 wire resistive touch solution.

The screen format is intended to support the SVGA (800(H) x 600(V)) screen and 16.2M (RGB8-bits) or 262k colors (RGB 6-bits). IDK-1110R-series is a RoSH product.

1.2 Display Characteristics

The following items are characteristics summary on the table under 25°C condition.

Items	Specifications	Unit
Screen Diagonal	10.4	inch
Active Area	211.2(H) x 158.4(V)	mm
Pixels H x V	800x3(RGB) x 600	-
Pixel Pitch	0.264x 0.264	mm
Pixel Arrangement	R.G.B. Vertical Stripe	-
Display Mode	TN, Normally White	-
Nominal Input Voltage VDD	3.3 (typ)	Volt
Typical Power Consumption	4.8W (typ) (for IDK-1110R-40SVA1E) 3.5W (typ) (for IDK-1110R-23SVA1E)	Watt

1.3 Mechanical Specification

For IDK-1110R-40SVA1E:

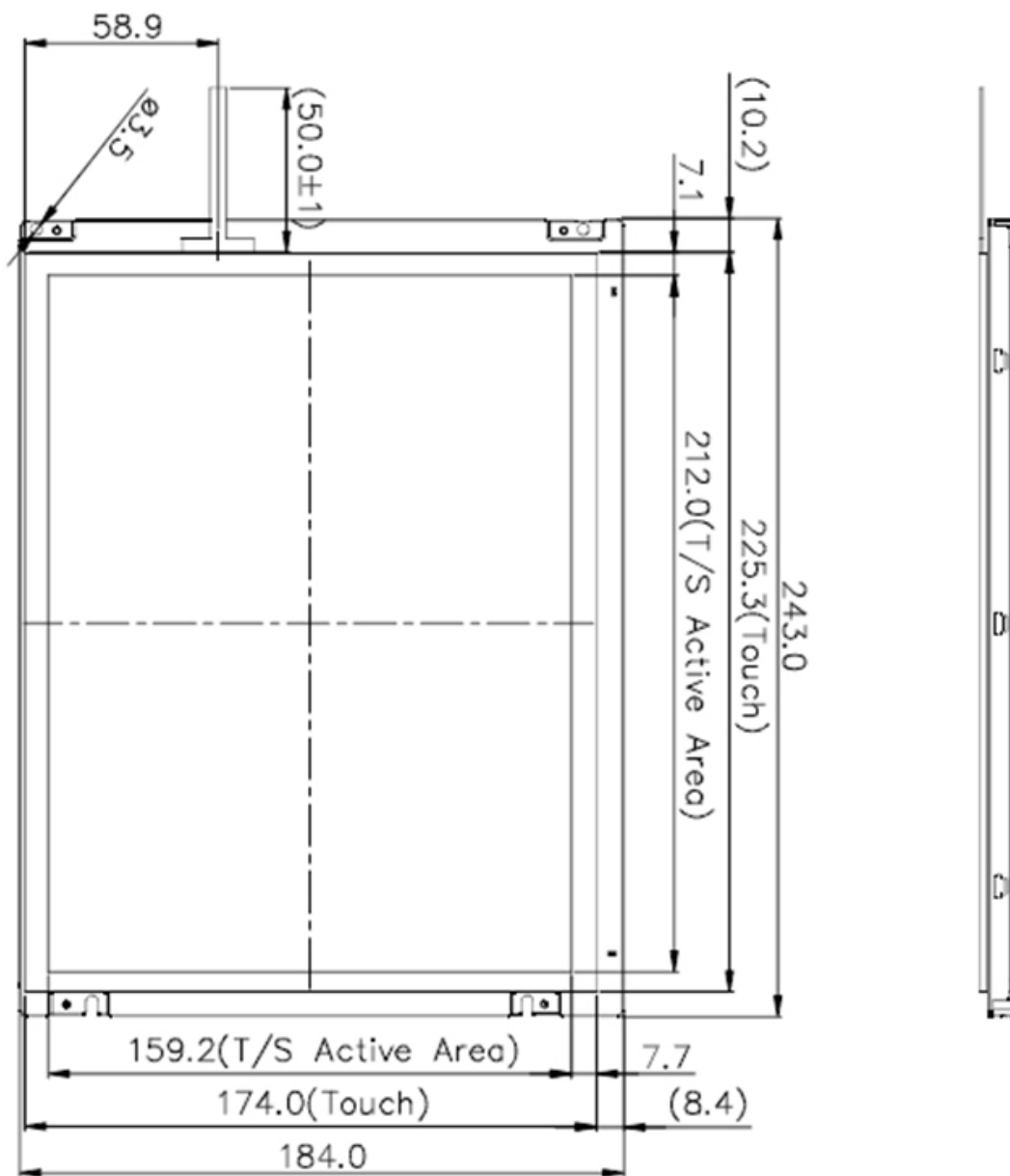
Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	243	-	mm	
	Vertical(V)	-	184	-	mm	
	Depth(D)	-	10.6	-	mm	
Weight		-	530	-	g	-

For IDK-1110R-23SVA1E:

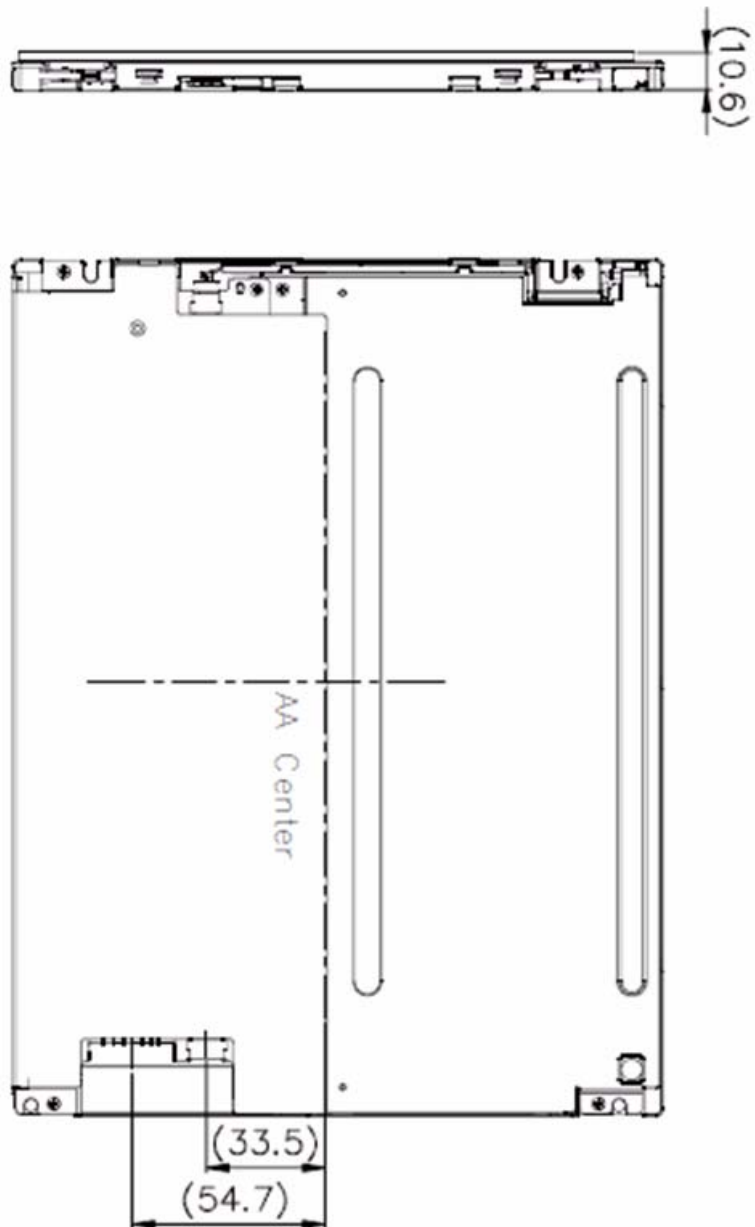
Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	236	-	mm	
	Vertical(V)	-	176.9	-	mm	
	Depth(D)	-	8.3	-	mm	
Weight		-	470	-	g	-

1.4 Mechanical Dimension

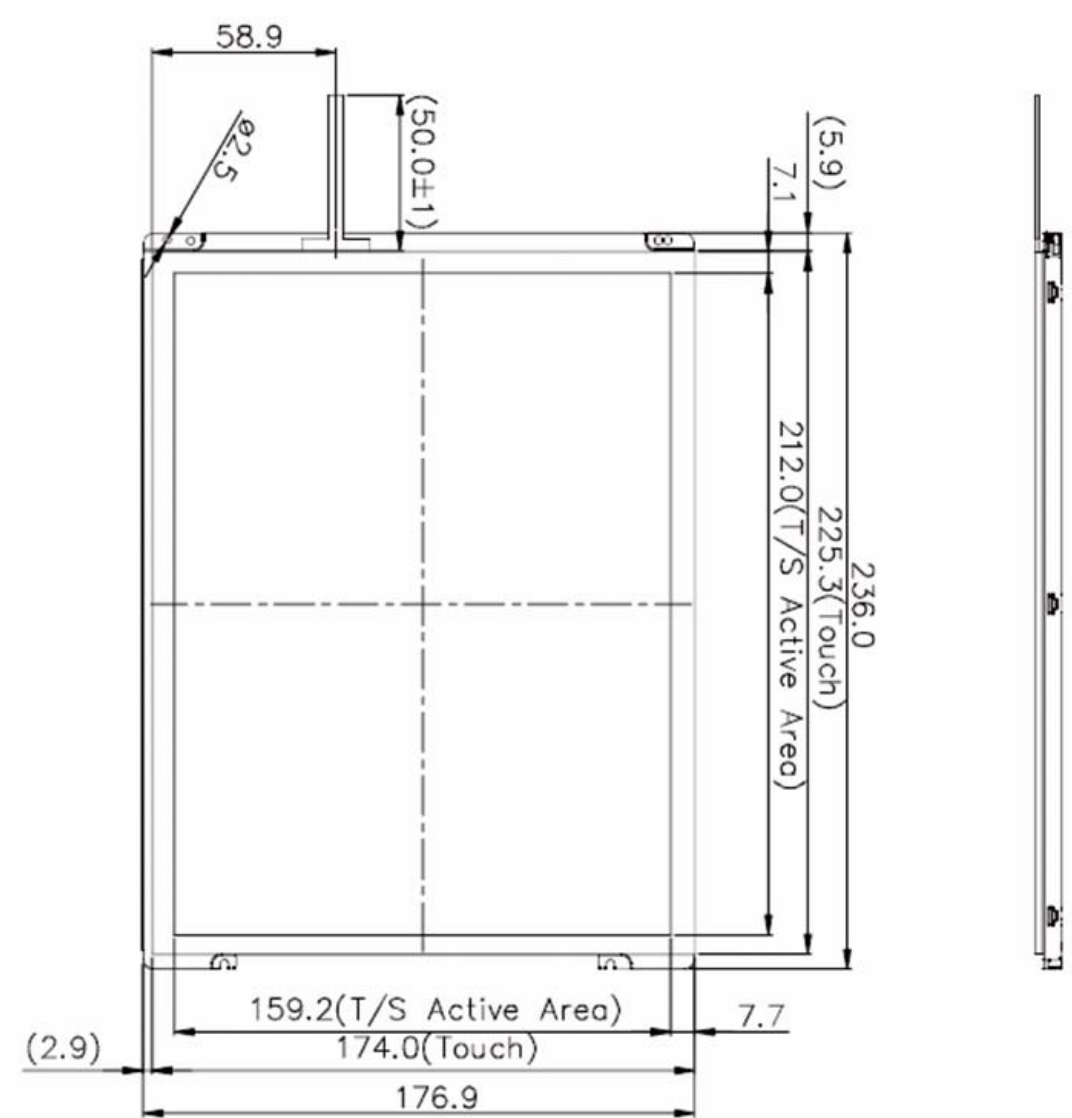
1.4.1 Front (For IDK-1110R-40SVA1E)



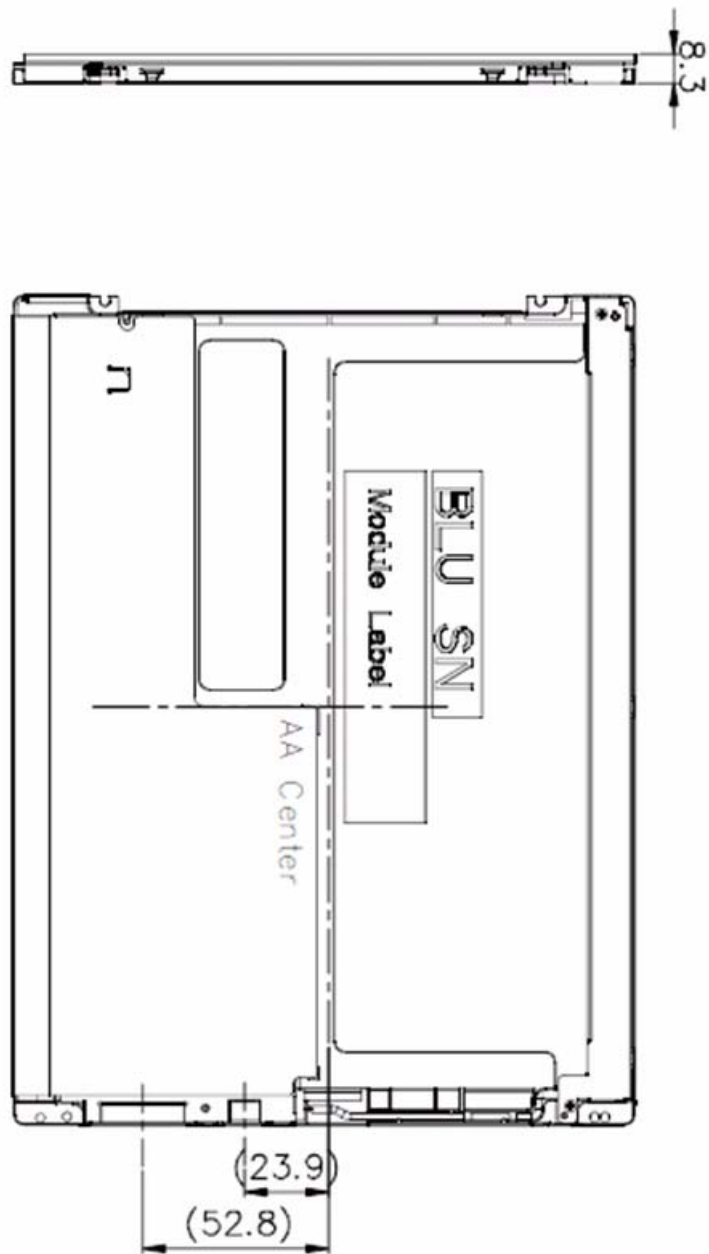
1.4.2 Rear (For IDK-1110R-40SVA1E)



1.4.3 Front (For IDK-1110R-23SVA1E)



1.4.4 Rear (For IDK-1110R-23SVA1E)



1.5 Absolute Maximum Ratings

1.5.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Value		Unit	Conditions
		Min.	Max.		
Logic/LCD Drive Voltage	VDD	-0.3	+4.0	[Volt]	For IDK-1110R-40SVA1E

Item	Symbol	Value		Unit	Conditions
		Min.	Max.		
Logic/LCD Drive Voltage	VDD	-0.3	+3.6	[Volt]	For IDK-1110R-23SVA1E

1.5.2 Absolute Ratings of Environment

Item	Symbol	Value		Unit	Conditions
		Min.	Max.		
Operating Temperature	TOP	-10	+60	°C	For IDK-1110R-40SVA1E
Operation Humidity	HOP	20	90	[%RH]	
Storage Temperature	TST	-30	+70	°C	For IDK-1110R-40SVA1E
Storage Temperature	TST	-20	+70	°C	For IDK-1110R-23SVA1E
Storage Humidity	HST	10	90	[%RH]	

Note: Maximum Wet-Bulb should be 39°C and no condensation.

1.6 Block Diagram

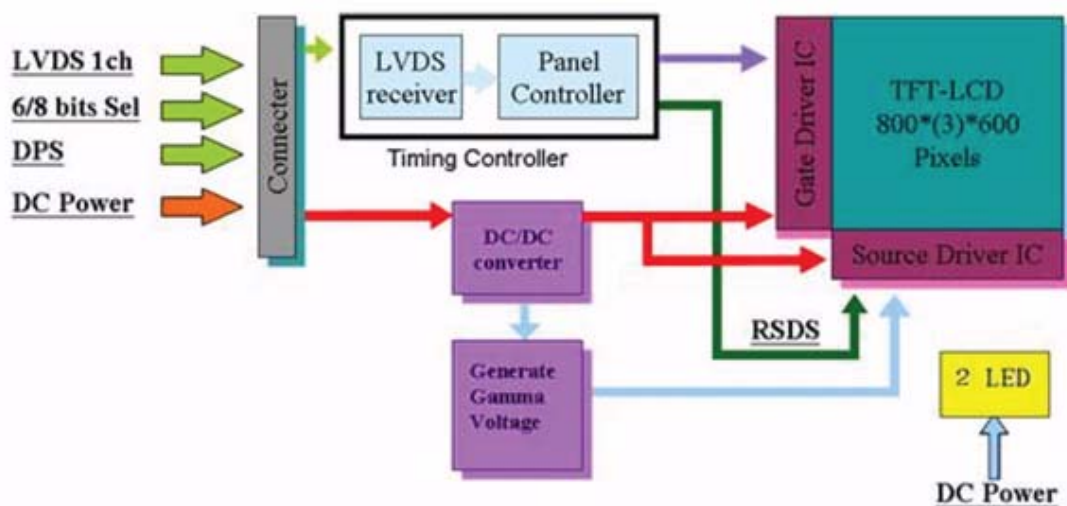


Figure 1.1 TFT LCD module

Chapter 2

Electrical
Characteristics

2.1 TFT LCD Module

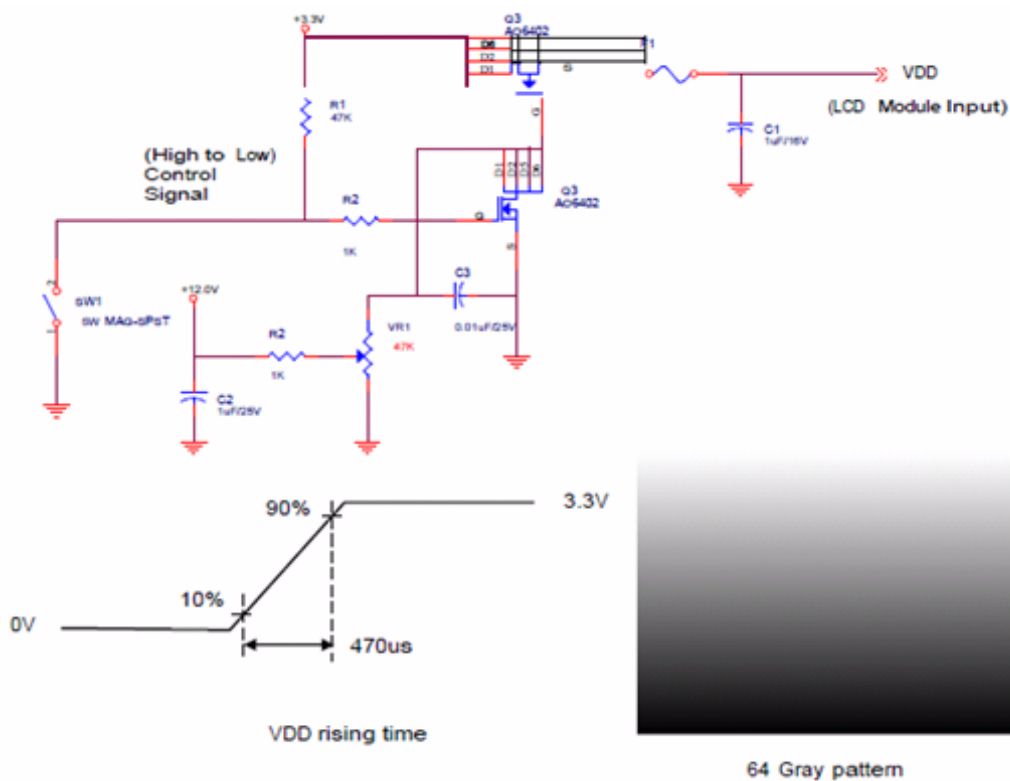
2.1.1 Power specification (For IDK-1110R-40SVA1E)

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Logic/LCD Drive	VDD	3.0	3.3	3.6	[Volt]	-
VDD Current	IDD	-	280	-	[mA]	All Black Pattern (VDD=3.3V, at 60Hz)
LCD Inrush Current	Irush	-	-	1.5	[A]	Note 1, Black Pattern, Rising time=470us
VDD Power	PDD	-	0.924	-	[Watt]	All Black Pattern (VDD=3.3V, at 60Hz)
Allowable Logic/LCD Drive Ripple Voltage	VDDrp	-	-	100	[mV]	All Black Pattern (VDD=3.3V, at 60Hz)

2.1.2 Power specification (For IDK-1110R-23SVA1E)

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Logic/LCD Drive	VDD	3.0	3.3	3.6	[Volt]	-
VDD Current	IDD	-	320	-	[mA]	All Black Pattern (VDD=3.3V, at 60Hz)
LCD Inrush Current	Irush	-	-	1.5	[A]	Note 1
VDD Power	PDD	-	1.06	-	[Watt]	All Black Pattern (VDD=3.3V, at 60Hz)
Allowable Logic/LCD Drive Ripple Voltage	VDDrp	-	-	100	[mV]	All Black Pattern (VDD=3.3V, at 60Hz)

Note Measurement condition:

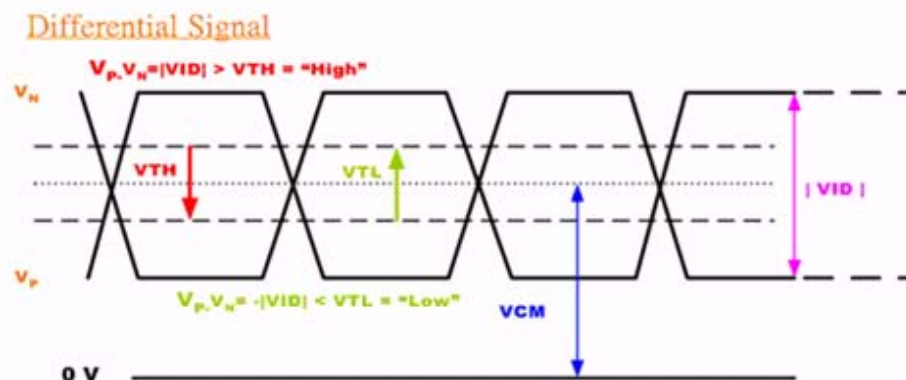


2.1.3 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off.

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Differential Input High Threshold	VTH	-	-	100	[mV]	VICM=1.2V
Differential Input Low Threshold	VTL	100	-	-	[mV]	VICM=1.2V
Input Differential Voltage	VID	100	400	600	[mV]	
Differential Input Common Mode Voltage	VICM	1.1	-	1.45	[V]	VTH/VTL=±100mV (For IDK-1110R-40SVA1E)
Differential Input Common Mode Voltage	VICM	1.125	1.125	1.375	[V]	VTH/VTL=±100mV (For IDK-1110R-23SVA1E)

Note LVDS Signal Waveform.



2.2 Backlight Unit

2.2.1 Parameter guideline for LED backlight (For IDK-1110R-40SVA1E)

Following characteristics are measured under a stable condition using an inverter at 25°C (Room Temperature):

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Input Voltage	VCC	10.8	12	12.6	[Volt]	
Input Current	I _{VCC}	-	0.32	-	[A]	100% PWM Duty
Power Consumption	P _{VCC}	-	3.8	-	[Watt]	100% PWM Duty
Dimming Frequency	F _{PWM}	200	-	20K	[Hz]	
Swing Voltage		3	3.3	5.5	[Volt]	
Dimming Duty Cycle		5	-	100	%	
Operation Lifetime		50,000	-	-	Hrs	IF = 80mA, Ta = 25°C

2.2.2 Parameter guideline for LED backlight (For IDK-1110R-23SVA1E)

Following characteristics are measured under a stable condition using an inverter at 25°C (Room Temperature):

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Input Voltage	VCC	10.8	12	12.6	[Volt]	
Input Current	I _{VCC}	-	0.12	-	[A]	100% PWM Duty
Power Consumption	P _{VCC}	-	1.44	-	[Watt]	100% PWM Duty
Dimming Frequency	F _{PWM}	200	-	10K	[Hz]	
Swing Voltage		3	3.3	5.5	[Volt]	
Dimming Duty Cycle		5	-	100	%	
Dimming Voltage		0.6	-	3	[Volt]	
		5	-	100	%	
LED Forward Current	I _F	-	25	-	mA	Ta = 25°C

LED Forward Voltage	V_F	-	26	29.2	[Volt]	$I_F = 25\text{mA}$, $T_a = 25^\circ\text{C} - 30^\circ\text{C}$
LED Power Consumption	P_{LED}	-	1.92	-	[Watt]	$I_F = 25\text{mA}$, $T_a = 25^\circ\text{C}$ (total power)
Operation Lifetime		25,00 0	30,00 0	-	Hrs	$T_a = 60^\circ\text{C}$ RH<60% $I_F = 25\text{mA}$ $T_j < 70^\circ\text{C}$

Note1 T_a means ambient temperature of TFT-LCD module.

Note2 VCC, I_{VCC} , P_{VCC} , are defined for LED B/L.(100% duty of PWM dimming)

Note3 I_F , V_F are defined for each channel of LED Light Bar. There are two LED channels (AN1-CA1-CA2) in backlight unit.

Note4 If IDK-1110R-series module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

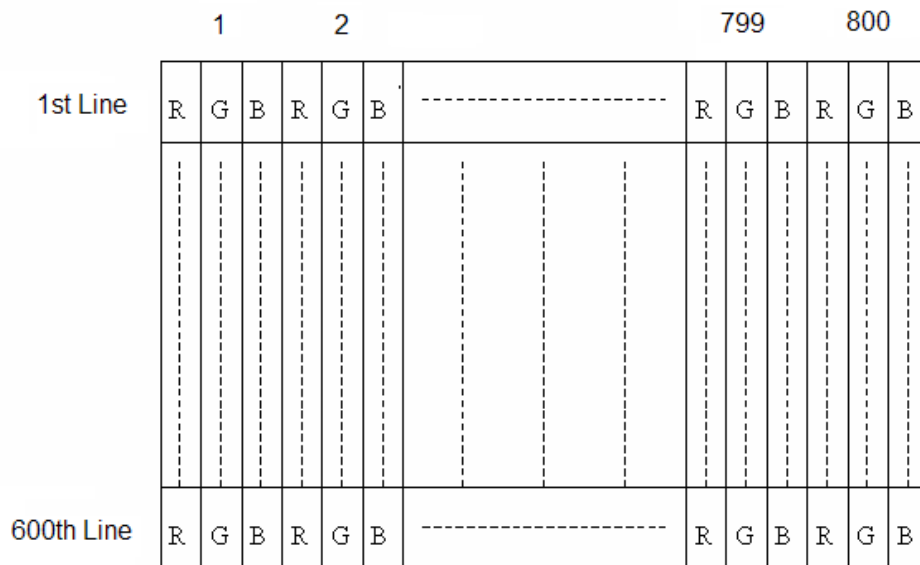
Note5 Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

Chapter 3

Signal Characteristics

3.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.



3.2 Pin Description

LVDS is a differential signal technology for LCD interface and high speed data transfer device. The connector pin definition is as below.

Note “Low” stands for 0V. “High” stands for 3.3V. “NC” stands for “No Connected.”

Table 3.1: Pin Description

Pin No.	Symbol	Description
1	VDD	Power Supply,3.3V(typical)
2	VDD	Power Supply,3.3V(typical)
3	GND	Ground
4	DPS	Reverse Scan Function [H: Enable; L/NC: Disable]
5	RxIN0-	LVDS differential signal channel 0
6	RxIN0+	LVDS Differential Data Input (R0, R1, R2, R3, R4, R5, G0)
7	GND	Ground
8	RxIN1-	LVDS differential signal channel 1
9	RxIN1+	LVDS Differential Data Input (G1, G2, G3, G4, G5, B0, B1)
10	GND	Ground
11	RxIN2-	LVDS differential signal channel 2
12	RxIN2+	LVDS Differential Data Input (B2, B3, B4, B5, DE)
13	GND	Ground
14	RxCLKIN-	LVDS differential signal clock
15	RxCLKIN+	
16	GND	Ground
17	RxIN3-	LVDS receiver signal channel 3, NC for 6 bit LVDS Input
18	RxIN3+	LVDS Differential Data Input (R6, R7, G6, G7, B6, B7, RSV)
19	RSV	Reserved for AUO internal test. Please treat it as NC.

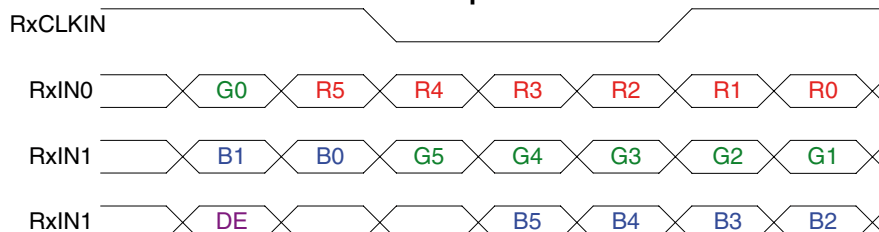
Table 3.1: Pin Description

20	SEL68	6/ 8bits LVDS data input selection [H: 8bits L/NC: 6bit]
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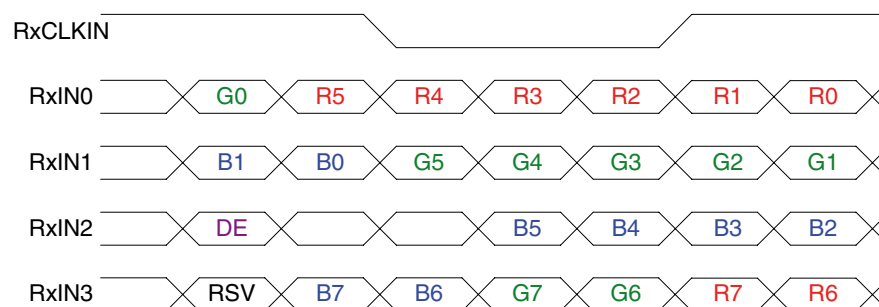
3.3 The Input Data Format

3.3.1 SEL68

SEL68 = "Low" or "NC" for 6 bits LVDS Input



SEL68 = "High" for 8 bits LVDS Input



Note1 Please follow PSWG.

Note2 R/G/B data 7:MSB, R/G/B data 0:LSB

Signal Name	Description	Remark
R7	Red Data 7	
R6	Red Data 6	Red-pixel Data
R5	Red Data 5	
R4	Red Data 4	For 8 bits LVDS input, MSB: R7; LSB:R0
R3	Red Data 3	
R2	Red Data 2	For 6 bits LVDS input, MSB: R5; LSB:R0
R1	Red Data 1	
R0	Red Data 0	
G7	Green Data 7	
G6	Green Data 6	Green-pixel Data,
G5	Green Data 5	
G4	Green Data 4	For 8 bits LVDS input, MSB: G7; LSB:G0
G3	Green Data 3	
G2	Green Data 2	For 8 bits LVDS input, MSB: G5; LSB:G0
G1	Green Data 1	
G0	Green Data 0	

B7	Blue Data 7	
B6	Blue Data 6	Blue-pixel Data
B5	Blue Data 5	
B4	Blue Data 4	For 8 bits LVDS input, MSB: B7; LSB:B0
B3	Blue Data 3	
B2	Blue Data 2	For 6 bits LVDS input, MSB: B5; LSB:B0
B1	Blue Data 1	
B0	Blue Data 0	
RxCLKIN	LVDS Data Clock	
DE	Data Enable Signal	When the signal is high, the pixel data shall be valid to be displayed.

Note: Output signals from any system shall be low or Hi-Z state when VDD is off.

3.4 Interface Timing

3.4.1 Timing Characteristics

DE mode only (For IDK-1110R-40SVA1E)

Table 3.2: Timing Characteristics(For IDK-1110R-40SVA1E)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency	$1/T_{\text{Clock}}$	30	40	50	MHz	
Vertical Section	Period	T_V	608	628	1024	
	Active	T_V	-	600	-	T_H
	Blanking	T_V	8	28	424	
Horizontal Section	Period	T_H	960	1056	1060	
	Active	T_H	-	800	-	T_{Clock}
	Blanking	T_H	160	256	260	

DE mode only (For IDK-1110R-23SVA1E)

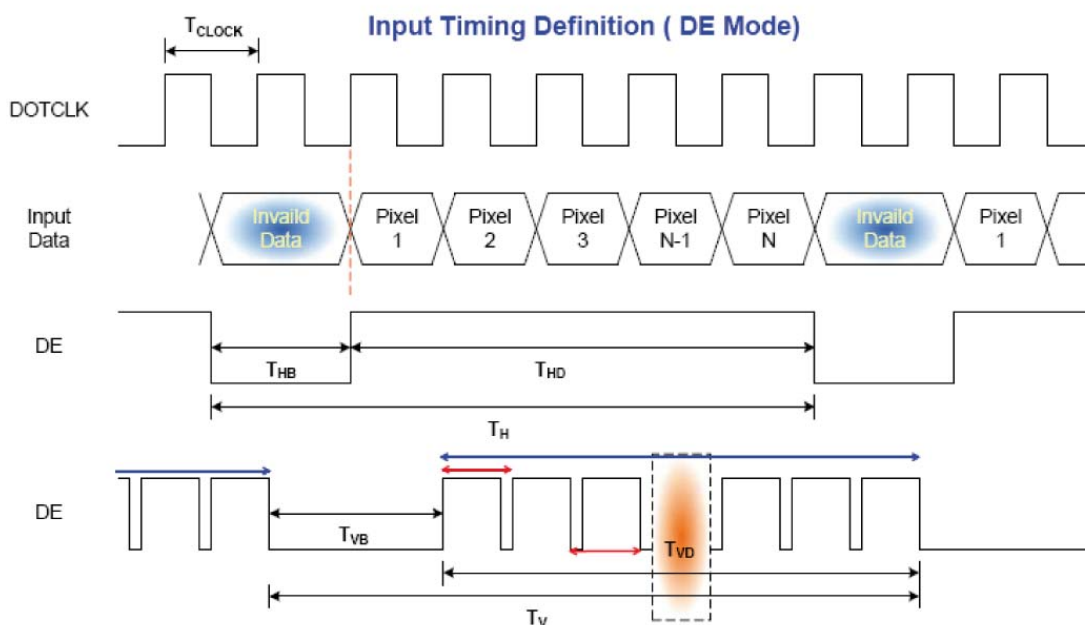
Table 3.3: Timing Characteristics(For IDK-1110R-23SVA1E)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency	$1/T_{\text{Clock}}$	30	40	50	MHz	
Vertical Section	Period	T_V	608	628	1024	
	Active	T_V	-	600	-	T_H
	Blanking	T_V	8	28	424	
Horizontal Section	Period	T_H	960	1056	1060	
	Active	T_H	160	256	260	T_{Clock}
	Blanking	T_H	50	60	75	

Note Frame rate is 60 Hz.

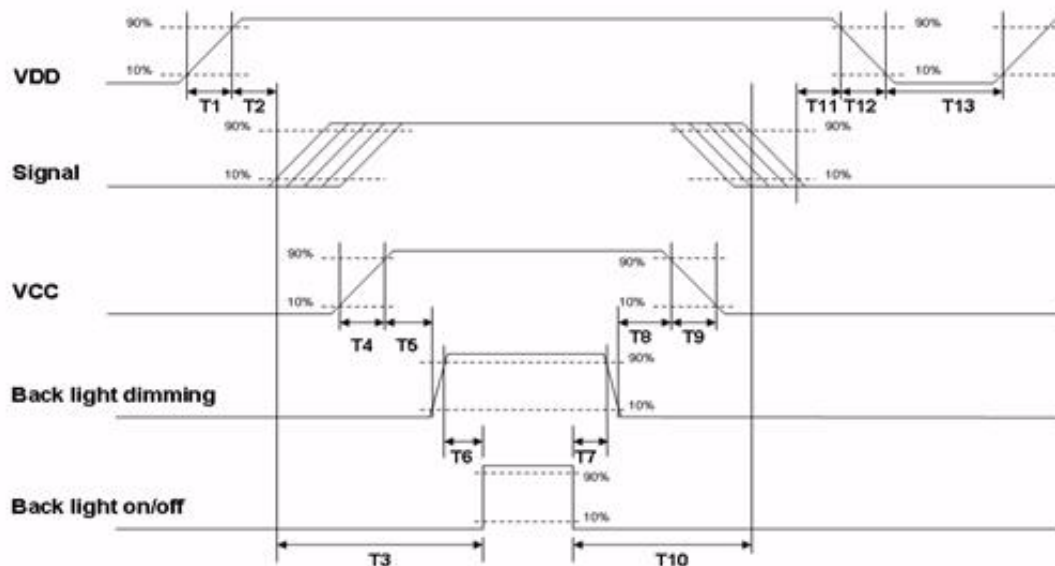
Note DE mode.

3.4.2 Input Timing Diagram



3.5 Power ON/OFF Sequence

VDD power and lamp on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Power Sequence Timing(For IDK-1110R-40SVA1E)

Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	30	40	50	[ms]
T3	200	-	-	[ms]

T4	10	-	-	[ms]
T5	10	-	-	[ms]
T6	0	-	-	[ms]
T7	1	-	-	[ms]
T8	10	-	-	[ms]
T9	0	16	50	[ms]
T10	-	-	10	[ms]
T11	0	16	50	[ms]
T12	-	-	10	[ms]
T13	1000	-	-	[ms]

Power Sequence Timing(For IDK-1110R-23SVA1E)

Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	30	40	50	[ms]
T3	200	-	-	[ms]
T4	0.5	-	10	[ms]
T5	10	-	-	[ms]
T6	10	-	-	[ms]
T7	0	-	-	[ms]
T8	10	-	-	[ms]
T9	-	-	10	[ms]
T10	110	-	-	[ms]
T11	0	16	50	[ms]
T12	-	-	10	[ms]
T13	1000	-	-	[ms]

The above on/off sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

Chapter 4

Display Connector Definition

4.1 TFT LCD Signal(CN1): LVDS Connector

Table 4.1: Connector

Connector Name / Description	Signal Connector
Manufacture	STM, Hirose or compatible
Connector Model Number	STM-MSB24013P20HA or Compatible
Adapable Plug	STM-P24013P20 or compatible

Table 4.2: Pin Assignment

Pin No.	Signal Name	Pin No.	Signal Name
1	VDD	2	VDD
3	GND	4	DPS
5	RxIN0-	6	RxIN0+
7	GND	8	RxIN1-
9	RxIN1+	10	GND
11	RxIN2-	12	RxIN2+
13	GND	14	RxCLKIN-
15	RxCLKIN+	16	GND
17	RxIN3-	18	RxIN3+
19	RSV	20	SEL68

4.2 LED Backlight Unit (CN2): LED Driver Connector

Connector Name / Designation	LED Light Bar Connector / Backlight lamp
Manufacturer	ENTERY or compatible
Connector Model Number	3808K-F05N-02R or compatible
Mating Model Number	H208K-P05N-02B or compatible

Pin No.	Symbol	Description
Pin1	VCC	12V input
Pin2	GND	GND
Pin3	On/OFF	5V-ON,0V-OFF
Pin4	Dimming	PWM
Pin5	NA	

4.3 LED Light Bar Input Connector (CN3)

4.3.1 Connector specification (For IDK-1110R-40SVA1E)

Connector Name / Description	Signal Connector
Manufacture	ENTERY or compatible
Connector Model Number	H208K-P03N-02B or compatible
Mating Model Number(CN3)	3808K-F03N-02R or compatible

Pin No.	Symbol	Description	Color
Pin1	H	LED anode	Red
Pin2	L	LED cathode	White
Pin3	L	LED cathode	Black

4.3.2 Connector Specification((For IDK-1110R-23SVA1E)

Connector Name / Description	Signal Connector
Manufacture	ENTERY or compatible
Connector Model Number	Entery H203K-D05N-02Bor compatible
Mating Model Number(CN3)	Entery 3800K-F05N-03Ror compatible

Pin No.	Symbol	Description	Color
Pin1	AN	RED	LED anode
Pin2	CA1	BLACK	LED Cathode 1
Pin3	CA2	WHITE	LED Cathode 2
Pin4	CA3	BLUE	LED Cathode 3

Figure 4.1 Dimension

Chapter 5

Touch Screen

5.1 Touch Characteristics

TOUCH PANEL is resistance type that customer uses with flat display like LCD. Once operator touches it by resin PEN with round end or FINGER, the circuit for TOUCH PANEL sends coordinate point to PC from voltage at contact point.

5.2 Optical Characteristics

Item	Specification	Remarks
1 TRANSPARENCY	82.5% Typ. 80% Min. (Active area) (Inside of guaranteed active area)	JIS K-7105
2 HAZE	8.0% Typ. (Anti-glare)	JIS K-7105

5.3 Environment Characteristics

Item	Specification	Remarks
1 Operation temperature	-10°C ~ 60°C	
2 Storage temperature	-30°C ~ 70°C	Max. wet Temp is
3 Operation Humidity	20% ~ 90%RH	38°C(No dew)
4 Storage humidity	10% ~ 90%RH	

5.4 Mechanical Characteristics

Item	Specification	Remarks
1 Hardness of surface	Pencil hardness 3H.	JIS K-5600-5-4 150gf, 45 degree
2 FPC peeling strength	1) 5N (5N Min.) 2) 19.6N (19.6N Min.)	1) Peeling upward by 90° 2) Peeling downward by 90°
3 Operation force	Pen 0.05N~1.96N (5~200gf) Finger	Dot-Spacer Within "guaranteed active area", but not on the age and Dot-Spacer.

5.5 Electronic Characteristics

Item	Specification	Remarks
1 Rated Voltage	DC 7V max.	
2 Resistance	X axis: 200Ω ~ 500Ω(Glass side) Y axis: 200Ω ~ 800Ω(Film side)	FPC connector
3 Linearity	±1.5% max(initial value) ±2.0% max(after environmental & life test)	Reference: 250gf
4 Chattering	20ms Max At connector pin	
5 Insulation Resistance	10MΩ min(DC 25V)	

Chapter 6

Touch Controller

6.1 Touch Controller Characteristics

Advantech ETM-RES05C Touch Control Board, the ultimate combo board. This touch panel controller provides the optimistic performance of your analog resistive touch panels for 4 wire models. It communicates with PC system directly through USB and RS-232 connector. You can see how superior the design is in sensitivity accuracy and friendly operation. The touch panel driver emulates mouse left and right button function and supports operation systems as following.

6.2 Specifications

Electrical Features

- +5 Vdc/ 100 mA typical, 50mV peak to peak maximum ripple and noise.
- Bi-directional RS-232 serial communication and USB 1.1 full speed
- Report rate of RS-232 is 180 points/sec (max.). And, USB is 200 points/sec (max.)
- Unaffected by environmental EMI
- Panel resistance of 4-wire resistive model is from 50 to 200 ohm (Pin to pin on same layer)
- Touch resistance under 3K ohm

Serial Interface

- EIA 232E (Serial RS-232)
- No parity, 8 data bits, 1 stop bit, 9600 baud (N, 8, 1, 9600)
- Support Windows 2000/ Vista/ XP/ 7, Windows CE 5.0/ 6.0/ 7.0, Windows NT4, Linux, DOS, QNX

USB Interface

- Conforms to USB Revision 1.1 full speed.
- If the USB is connected to the controller, the controller will communicate over the USB, and will not communicate over the serial port.
- Support Windows 2000/ Vista/ XP/ 7, Windows CE 5.0/ 6.0/ 7.0, Linux, QNX

Touch Resolution

- 2,048 x 2,048 resolution

Response Time

- Max. 20 ms

6.3 Environmental Feature

Reliability

- MTBF is 200,000 hours

Temperature Ranges

- Operating : -25°C ~ 85°C
- Storage: -25°C ~ 85°C

Relative Humidity

- 95% at 60°C, RH Non-condensing

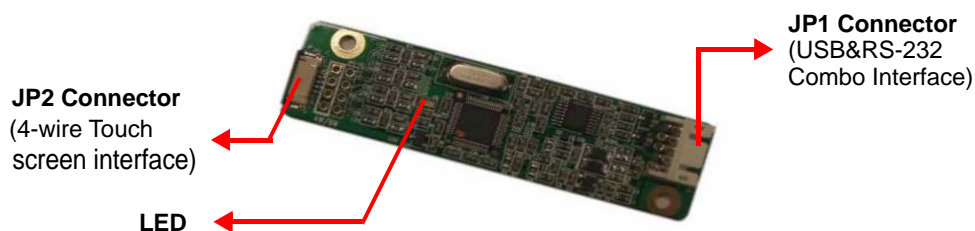
Acquired RoHS certificate

Regulatory FCC-B, CE approvals

Dimension: 75 mm x 20 mm x 10 mm

6.4 Pin Assignment and Description

6.4.1 Connector and LED Location



6.4.2 Combo Interface Connector, JP1, Pins and Signal Descriptions

The combo interface connector, USB and RS-232, is a box 2.0mm 10-pins 90 degree, Male type with lock connector, intended to be used with single wired pins in 5+5 pins header. The pins are numbered as shown in the table below.

USB Pin#	Signal Name	Signal Function	RS-232 Pin#	Signal Name	Signal Function
1	G	Ground	1	G	Ground
2	V	USB Power	2	V	Power
3	G	Ground	3	G	Ground
4	D+	USB D+	4	TxD	Serial Port
5	D-	USB D-	5	RxD	Serial Port

Signal Name	DB-9 pin #	RS-232 pin #	Sourced by	Signal Description
RxD	2	5	ctrl	serial data from controller to host
TxD	3	4	host	serial data from host to controller

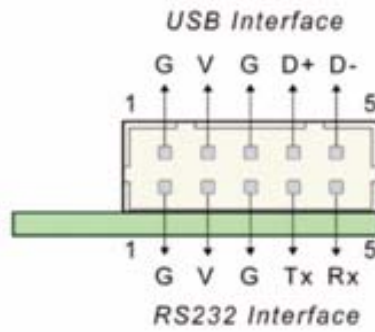
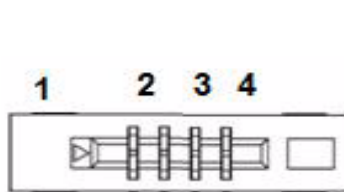


Figure 6.1 Board mounted header

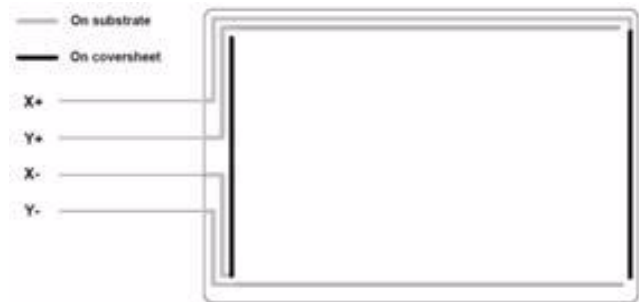
6.4.3 Touch Screen Connector, JP2, Pins and Signal Descriptions

The Touch Screen connector, JP2, is a FFC/FPC SMD 1.0mm 4-pins 90 degree, Female type connector. The pins are numbered as shown in the table below.

TS4 Pin #	Signal Name	Signal Description
1	YB	Bottom
2	XL	Left
3	YT	Top
4	XR	Right



4-Wire Touch Screen ZIF connector



4-Wire Screen viewed from coversheet side

Appendix **A**

Optical Characteristics

A.1 Optical Characteristics (for IDK-1110R-40SVA1E)

The optical characteristics are measured under stable conditions at 25°C (Room Temperature):

Item	Conditions	Min.	Typ.	Max.	Unit	Note
White Luminance	IF= 50mA (center point)	300	400	-	[cd/m2]	1
Uniformity	9 Points	75	-	-	%	1, 2, 3
Contrast Ratio		500	700	-		4
Response Time	Rising	-	10	20	[msec]	5
	Falling	-	20	30	[msec]	
	Raising + Falling	-	30	50	[msec]	
Viewing Angle	Horizontal (Right)	70	80	-	[degree]	6
	CR ≥ 10 Left)	70	80	-	[degree]	
	Vertical (Upper)	50	60	-	[degree]	
	CR ≥ 10 (Lower)	70	80	-	[degree]	
Color / Chromaticity Coordinates (CIE 1931)	Red x	0.559	0.609	0.659		1
	Red y	0.283	0.333	0.383		
	Green x	0.315	0.365	0.415		
	Green y	0.520	0.570	0.620		
	Blue x	0.101	0.151	0.201		
	Blue y	0.056	0.106	0.156		
	White x	0.28	0.31	0.34		
	White y	0.30	0.33	0.36		
Color Gamut			50	-	%	1

A.2 Optical Characteristics (for IDK-1110R-23SVA1E)

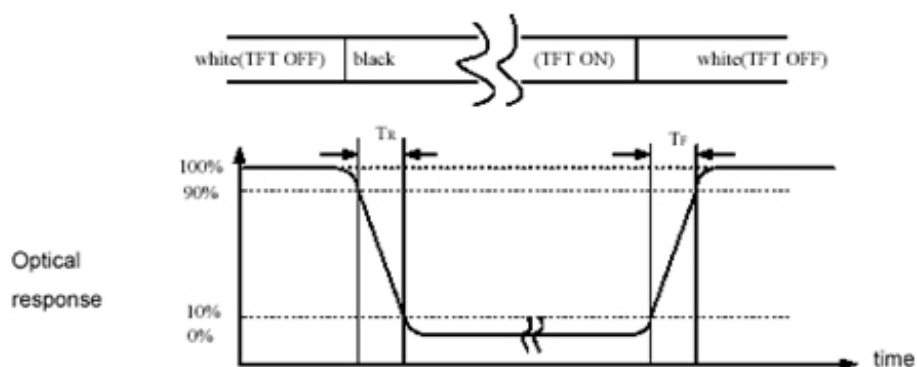
The optical characteristics are measured under stable conditions at 25°C (Room Temperature):

Item	Conditions	Min.	Typ.	Max.	Unit	Note
White Luminance	IF= 50mA (center point)	190	230	-	-	1
Uniformity	9 Points	65	75	-	%	1, 2, 3
Contrast Ratio		400	500	-		4
Response Time	Rising	-	25	30	[msec]	5
	Falling	-	10	20	[msec]	
	Raising + Falling	-	35	50	[msec]	
Viewing Angle	Horizontal (Right)	70	80	-	[degree]	6
	CR ≥ 10 Left)	70	80	-	[degree]	
	Vertical (Upper)	50	60	-	[degree]	
	CR ≥ 10 (Lower)	60	70	-	[degree]	

Color / Chromaticity Coordinates (CIE 1931)	Red x	0.559	0.609	0.659	1
	Red y	0.283	0.333	0.383	
	Green x	0.315	0.365	0.415	
	Green y	0.520	0.570	0.620	
	Blue x	0.101	0.151	0.201	
	Blue y	0.056	0.106	0.156	
	White x	0.28	0.31	0.34	
	White y	0.30	0.33	0.36	
Color Gamut		50	-	%	1

Note These items are measured by BM-5A(TOPCON) or CA-1000(MINOLTA) in the dark room (no ambient light) After 5 minutes operation, the optical properties are measured at the center point of the LCD screen.

Note1 Definition of Response Time (White-Black)



Note2 Definition of Contrast Ratio

Contrast ratio is calculated with the following formula :

Contrast Ratio(CR)=(White)Luminance of ON ÷ (Black)Luminance of OFF

Note3 Definition of Luminance:

Measure the luminance of white state at center point.

Note4 Definition of Luminance Uniformity:

Measured Maximum luminance [L(MAX)] and Minimum luminance[L(MIN)] on the 9 points

Luminance Uniformity is calculated with the following formula:

$\Delta L = [L(MIN) / L (MAX)] \times 100\%$

Note5 Definition of Viewing Angle

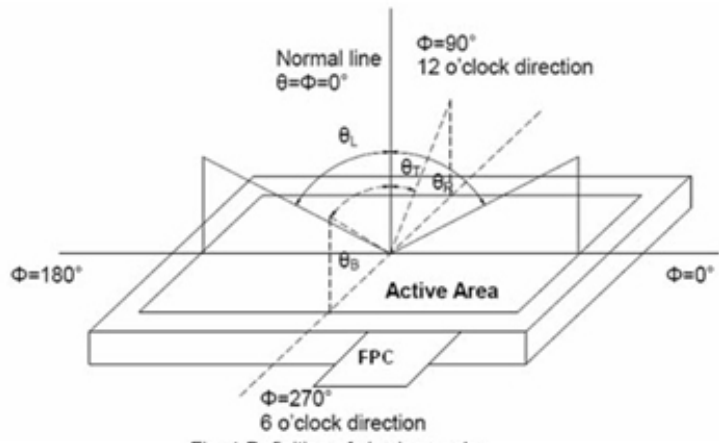


Fig. 1 Definition of viewing angle

Appendix **B**

Handling Precautions

B.1 Handling Precautions

The optical characteristics are measured under stable conditions at 25°C (Room Temperature)

1. Since front polarizer is easily damaged, pay attention not to scratch it.
2. Be sure to turn off power supply when inserting or disconnecting from input connector.
3. Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
4. When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
5. Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
6. Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
7. Do not open or modify the Module Assembly.
8. Do not press the reflector sheet at the back of the module to any directions.
9. In case if a Module has to be put back into the packing container slot after once it was taken out from the container, please press at the far ends of the LED light bar reflector edge softly. Otherwise the TFT Module may be damaged.
10. At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
11. After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.
12. Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.

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