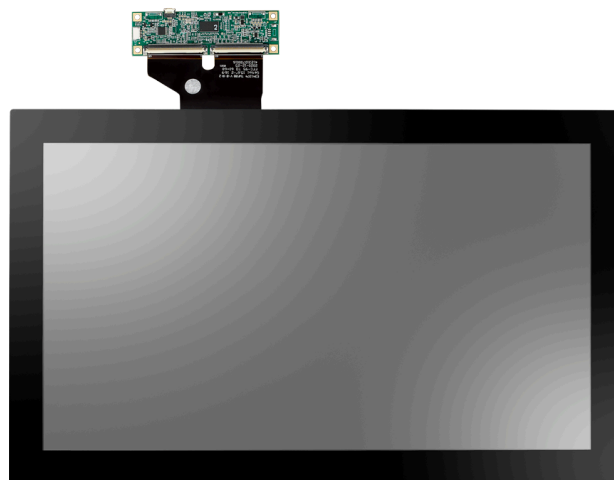


User Manual

IDK-1115WP-45FHA2

**15.6" FHD Industrial Display Kit
with Projected Capacitive Touch
Solution**



ADVANTECH

Enabling an Intelligent Planet

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Chapter 1

Overview

1.1 Introduction

The Advantech IDK-1115WP series comes with a 15.6" industrial grade Projected Capacitive touch (PCAP) LCD display. This series PCAP screen leverages low power consumption technology and is ideal for embedded applications that require maximum flexibility for mechanical design.

1.2 Specifications

1.2.1 LCD Panel

Table 1.1: LCD Panel

Display Size	15.6", 16: 9
Resolution	1920 x 1080
Display mode	Normally Black (IPS like)
Viewing Angle (U/D/L/R)	170° / 170°
Brightness (cd/m ²)	450
Backlight Life (hrs)	50,000 min
Contrast Ratio	800:1
Response Time (ms)	25
Colors	16.2M (8bit)
LCD Nominal Input Voltage / Current	3.3V / 1.22A
Backlight Input Voltage/ Current	12V / 1A
Power Consumption	16W (White Pattern)
Signal Interface	2 channel LVDS
Weight (kg/lb)	1.05 (2.31 lb)
Dimensions (W x H x D) (mm)	363.8 x 215.9 x 9.3 mm (14.3 x 8.5 x 0.36 in)


1.2.2 Touch Screen

- **Touch Screen:** Projected Capacitive (PCAP)
- **Light Transmission:** 88 ± 3%
- **Interface:** USB
- **Surface Treatment:** Anti-fingerprint coating
- **Black Border Print:** Yes

1.2.3 Environment

- **Operating Temperature:** -20 ~ 70 °C (-4 ~ 158 °F)
- **Storage Temperature:** -30 ~ 70 °C (-22 ~ 158 °F)

Note! *Temperature and relative humidity range is shown in the figure below.*

 (a) 90 %RH Max. ($T_a \leq 40\text{ °C}/104\text{ °F}$).

(b) Wet-bulb temperature should be 39 °C/102 °F Max. ($T_a > 40\text{ °C}/104\text{ °F}$).

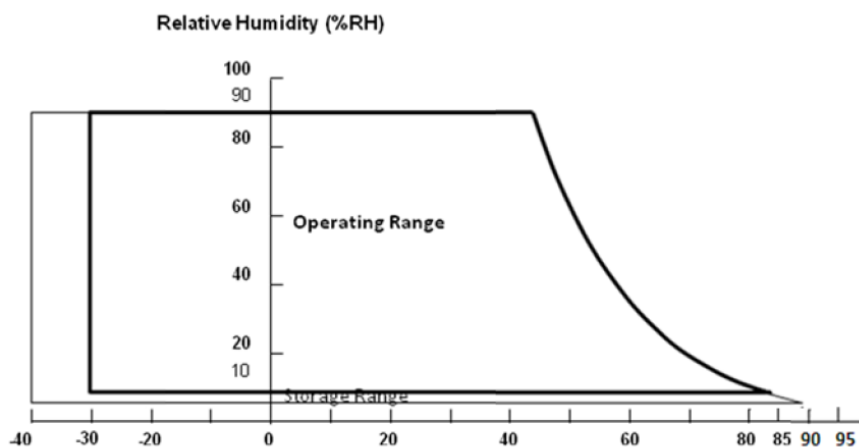


Figure 1.1 LCD Operating Range

1.3 Mechanical Characteristics

Front View

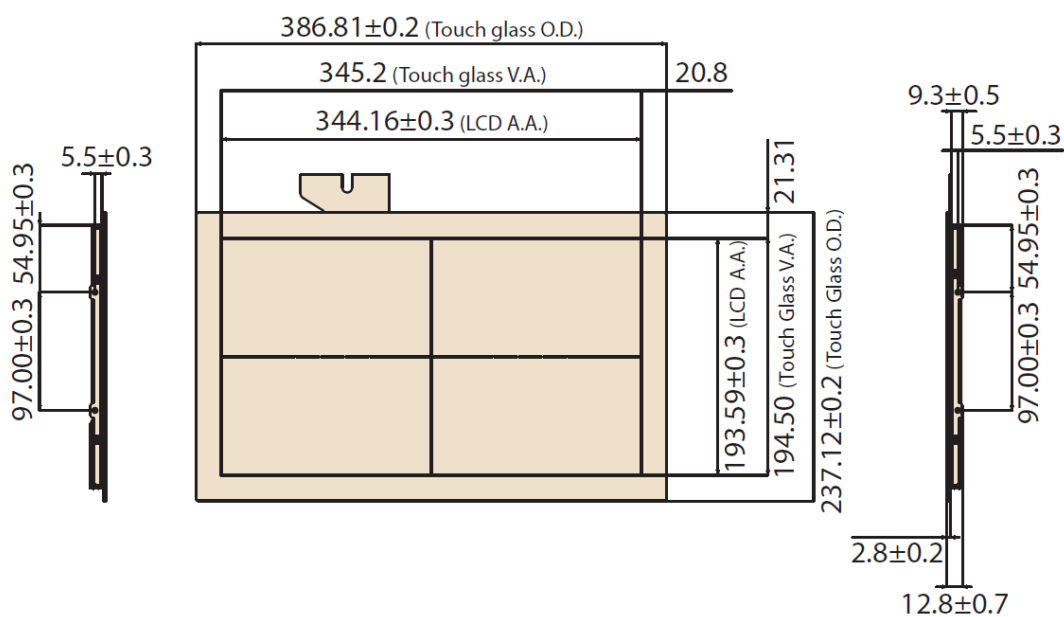


Figure 1.2 Front View

Rear View

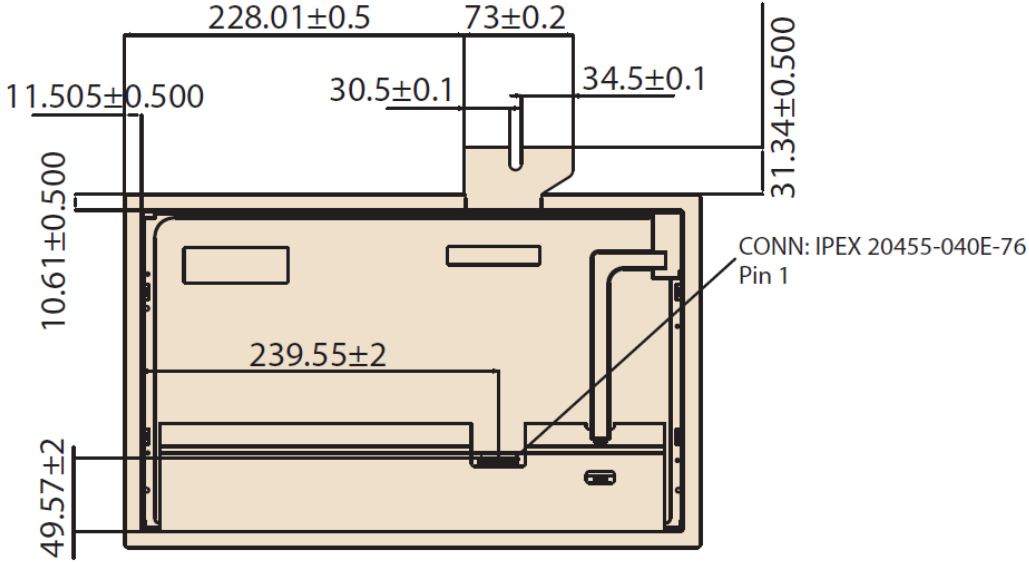


Figure 1.3 Rear View

Touch Control Board

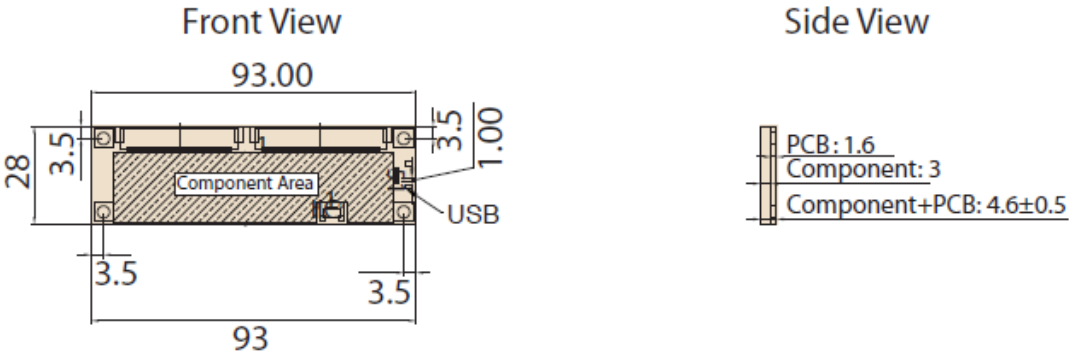


Figure 1.4 Touch Control Board

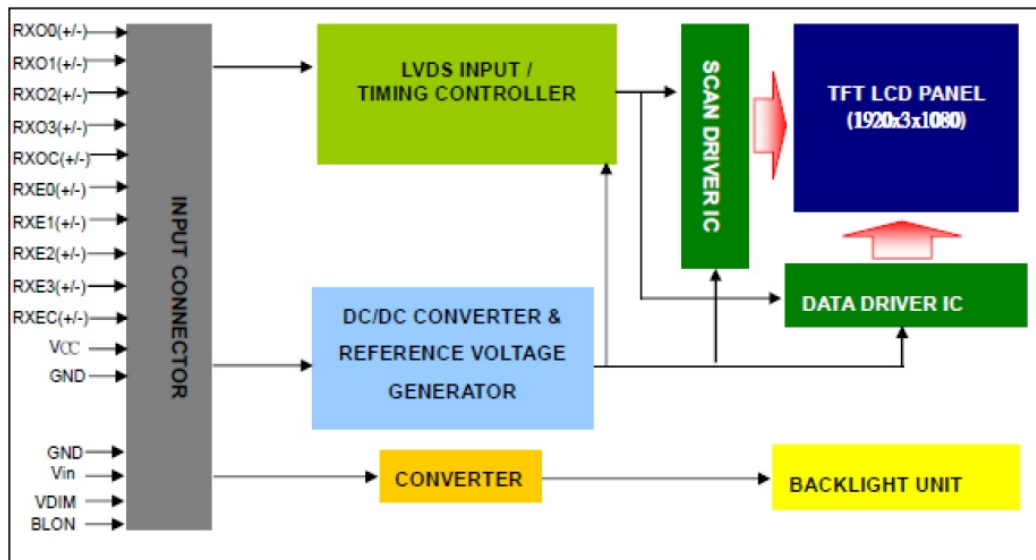
Note: Tolerances unless marked are ± 0.5 mm/.01 in

Chapter 2

LCD Display

2.1 Functional Block Diagram

The following diagram details the 15.6" FHD Color TFT-LCD Module functional block.



2.2 Absolute Maximum Ratings

Item	Symbol	Value		Unit	Note
		Min.	Max		
Power Supply Voltage	V _{dc}	-0.3	3.6	V	(1)
Logic Input Voltage	V _{IN}	-0.3	4	V	

2.2.1 TFT LCD Module

2.2.1.1 Backlight Unit

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Converter Voltage	LED_Vin	0	12	18	V	
Enable Voltage LED	LED_EN	0	3.3/5	7	V	(1), (2) Duty=100%
Backlight Adjust	LED_PWM	0	3.3/5	7	V	(1), (2) PulseWidth≤10msec. and Duty≤10%

Note (1) *Permanent damage to the device may occur if maximum values are exceeded. Operation should be restricted to the conditions described under Normal Operating Conditions.*



Note (2) *Specified values are for input pin of LED light bar at Ta= 25 ± 2 °C (75 ± 3.6 °F)*



2.3 LCD Electronics Specifications

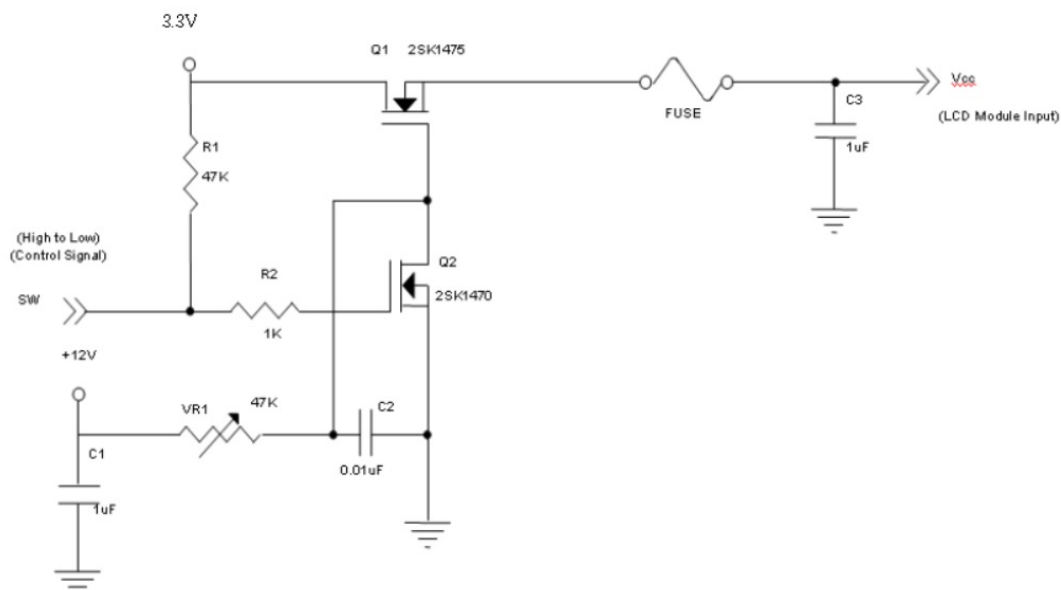
2.3.1 LCD Electronics Specifications

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	Vcc	3.15	3.3	3.6	V	-
Ripple Voltage	VRP	-	-	150	mV	-
Rush Current	IRUSH	-	-	3	A	(2)
Power Supply Current	White	-	1.22	1.5	A	(3)a
	Black	-	0.51	0.7	A	(3)b
	Vertical Stripe	-	0.82	1	A	(3)c
Power Consumption	PLCD	-	4	5	Watt	(4)
LVDS differential input voltage	Vid	200		600	mV	(5)
LVDS common input voltage	Vic	1	1.2	1.4	V	(5)
LVDS terminating resistor	RT	-	100		ohm	

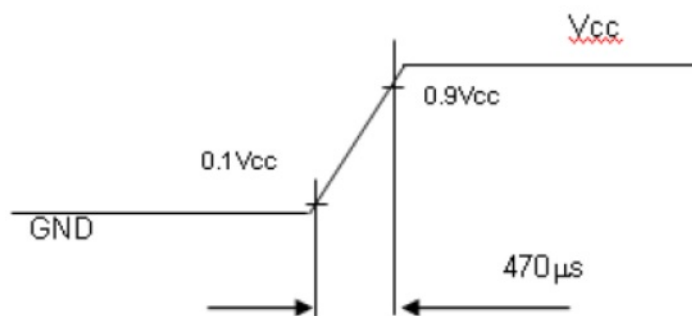
Note (1) The ambient temperature is $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ ($75 \pm 3.6 \text{ }^\circ\text{F}$).



Note (2) Measurement Conditions:



V_{cc} rising time is 470μs



Note (3) *The specified power supply current is under conditions at V_{cc} = 3.3 V, T_a = 25 ± 2 °C (75 ± 3.6 °F), F_r = 60Hz, for power dissipation check the diagram displayed below.*

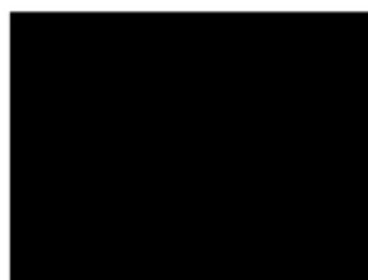


a. White Pattern



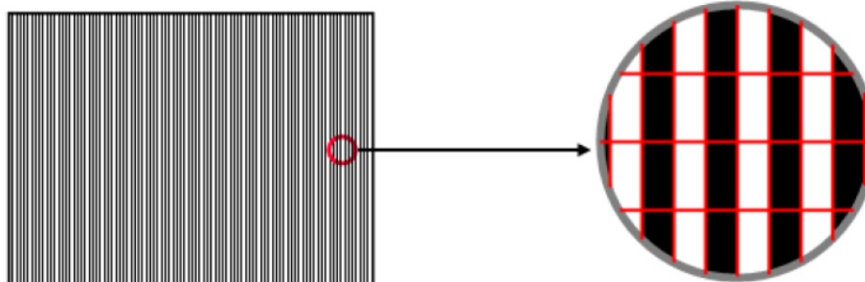
Active Area

b. Black Pattern



Active Area

c. Vertical Stripe Pattern

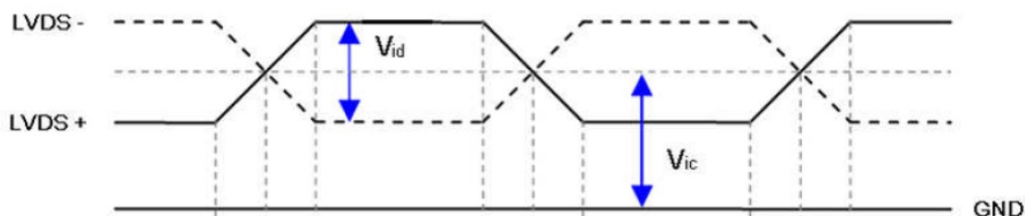


Active Area

Note (4) *The power consumption is specified at the pattern with the maximum current.*



Note (5) VID waveform conditions



2.4 Backlight Unit

Parameter	Symbol	Value			Unit	Note	
		Min.	Typ.	Max.			
Converter Power Supply Voltage	LED_Vin	10.8	12	13.2	V		
Converter Power Supply Current	li	0.8	1	1.2	A	@LED_Vin = 12V Duty=100 %	
Converter Input Rush Current	lirsh	-	-	3	A	@LED_Vin rising = 1mS	
Power Consumption	PLED	-	12		W	@ LED_Vin = 12V Duty=100 %	
EN Control Level	Backlight on	LED_EN	2	5	5.5	V	
	Backlight off		0	0	0.15		
PWM Control Level	PWM High Level	LED_PWM	2	3.3	5	V	
	PWM Low Level		M	0	0		
PWM Control Duty Ratio			10	--	100	%	
PWM Control Frequency	fPWM		190	200	20k	Hz	
LED Life Time	LL		50,000			Hrs	(2)

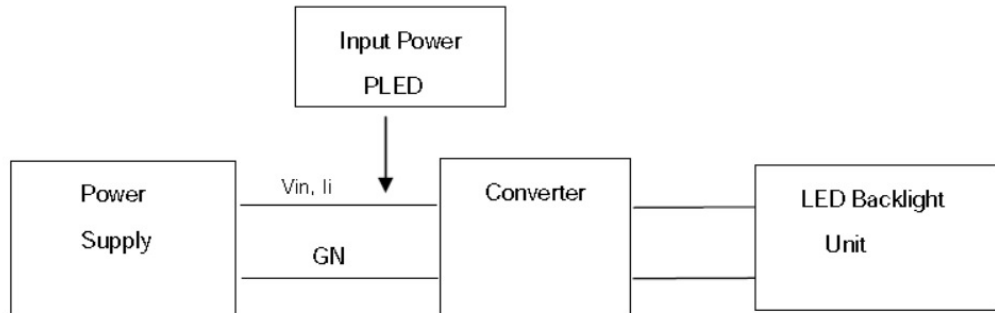
Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:



Note (2) *The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ ($75 \pm 3.6 \text{ }^\circ\text{F}$) and Duty 100% until the brightness becomes $\leq 50\%$ of its original value.*



Operating LED under high temperature environment will reduce life time and lead to color shift



2.5 LVDS Input Signal Specifications

2.5.1 LVDS Data Mapping Table

LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6
LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6

2.5.2 Color Data Input Assignment

The brightness of each primary color (red, green, and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Gray Scale Of Red"	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Gray Scale Of Green"	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0		
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0			
Gray Scale Of Blue"	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0		
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0		
Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1			

Note(1)! 0: Low Level Voltage, 1: High Level Voltage



2.6 Display Timing Specifications

The input signal timing specifications are shown in the following table and timing diagram.

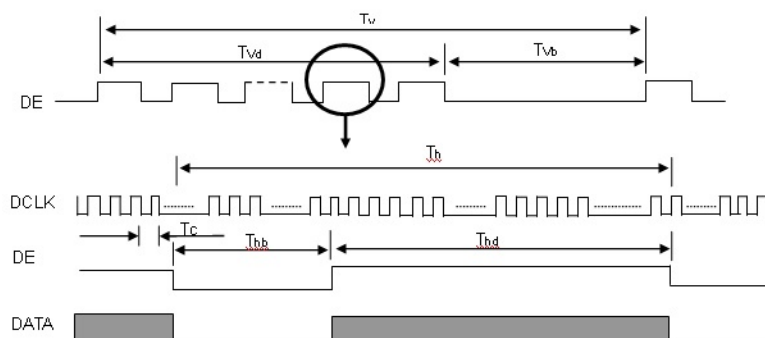
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	60	70.93	75	MHz	
	Period	Tc	-	14.1	-	ns	
	Input cycle to cycle jitter	Trcl	-0.02*Tc	-	0.02*Tc	ns	(3)
	Input clock to data skew	TLVCCS	-0.02*Tc	-	0.02*Tc	ns	(4)
	Spread spectrum modulation range	Fclkin _{mod}	FC*98%	-	FC*102%	MHz	(5)
	Spread spectrum modulation frequency	FSSM	-	-	200	KHz	
	Vertical Display Term	Frame Rate	Fr	50	60	60	Hz
Total		Tv	1090	1110	1130	Th	
Active Display		Tvd	1080	1080	1080	Th	
Blank		Tvb	Tv-Tvd	30	Tv-Tvd	Th	
Horizontal Display Term	Total	Th	1050	1065	1075	Tc	Th=Thd+Thb
	Active Display	Thd	960	960	960	Tc	
	Blank	Thb	Th-Thd	105	Th-Thd	Tc	

Note(1)! Because this module is operated by DE only mode, Hsync, and Vsync input signals are ignored.

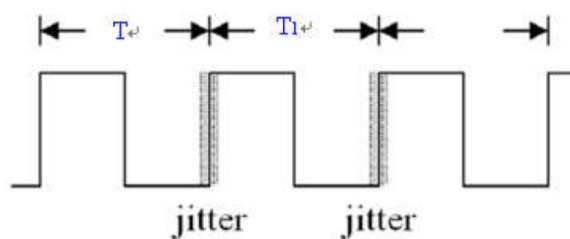


Note(2)! The Tv(Tvd+Tvb) must be integer, otherwise, this module would operate abnormally.

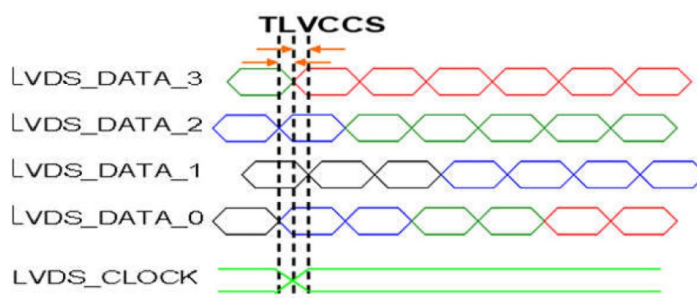




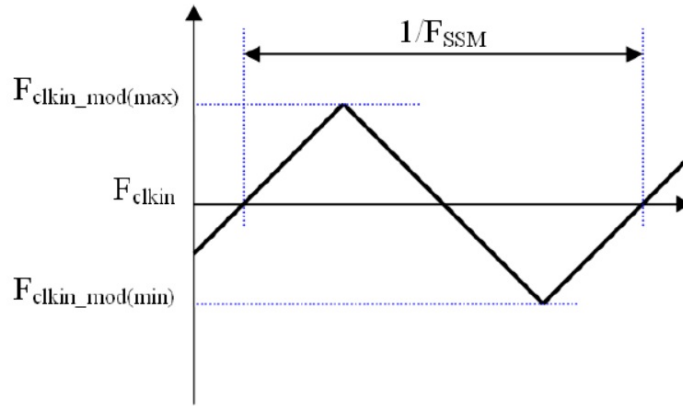
Note(3)! The input clock cycle-to-cycle jitter is defined in the following figures.
 $Trcl = |T1 - Tl|$.



Note(4)! Input Clock to data skew is defined in the following figures.



Note(5)! The SSCG (Spread spectrum clock generator) is defined in the following figures.



2.7 Power On/Off Sequence

The power sequence specifications are shown in the following table and diagram.

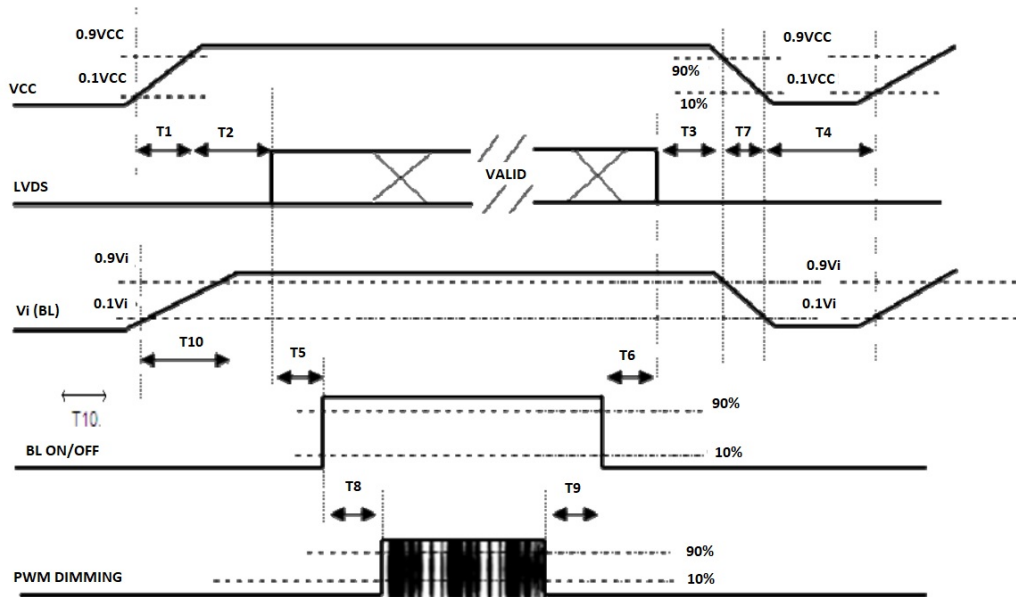


Table 2.1: Timing Specifications:

Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	450	-	-	ms
T6	200	-	-	ms
T7	10	-	100	ms
T8	10	-	-	ms
T9	10	-	-	ms
T10	20	-	50	ms

Note1!

1. *The supply voltage of the external system for the module input should be the same as the definition of Vcc.*
2. *When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become an abnormal screen.*
3. *In case of VCC = off level, please keep the level of input signals on low or keep a high impedance.*
4. *T4 should be measured after the module has been fully discharged between power off and on period.*
5. *Interface signal shall not be kept at high impedance when the power is on.*
6. *INX won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.*
7. *There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this , we suggest using " Vcc falling timing" to follow "T7 spec".*

2.8 Pin Description

Table 2.2: Pin Assignment

Pin	Name	Description
1	LED_Vcc	+12V Vi power supply
2	LED_Vcc	+12V Vi power supply
3	LED_Vcc	+12V Vi power supply
4	LED_Vcc	+12V Vi power supply
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	LED_EN	Enable pin
10	LED_PWM	Backlight Adjust
11	LCD_VCC	LCD logic and driver power 3.3V
12	LCD_VCC	LCD logic and driver power 3.3V
13	LCD_VCC	LCD logic and driver power 3.3V
14	NC	No connection, this pin should be open
15	NC	No connection, this pin should be open
16	NC	No connection, this pin should be open
17	LCD GND	LCD logic and driver ground
18	RX00-	Negative LVDS differential data input. Channel O0 (odd)
19	RX00+	Positive LVDS differential data input. Channel O0 (odd)
20	RX01-	Negative LVDS differential data input. Channel O1 (odd)
21	RX01+	Positive LVDS differential data input. Channel O1 (odd)
22	RX02-	Negative LVDS differential data input. Channel O2 (odd)
23	RX02+	Positive LVDS differential data input. Channel O2 (odd)
24	LCD GND	LCD logic and driver ground
25	RXOC-	Negative LVDS differential clock input. (odd)
26	RXOC+	Positive LVDS differential clock input. (odd)
27	LCD GND	LCD logic and driver ground
28	RX03-	Negative LVDS differential data input. Channel O3(odd)
29	RX03+	Positive LVDS differential data input. Channel O3 (odd)
30	RXE0-	Negative LVDS differential data input. Channel E0 (even)
31	RXE0+	Positive LVDS differential data input. Channel E0 (even)
32	RXE1-	Negative LVDS differential data input. Channel E1 (even)
33	RXE1+	Positive LVDS differential data input. Channel E1 (even)
34	LCD GND	LCD logic and driver ground
35	RXE2-	Negative LVDS differential data input. Channel E2 (even)
36	RXE2+	Positive LVDS differential data input. Channel E2 (even)
37	RXEC-	Negative LVDS differential clock input. (even)
38	RXEC+	Positive LVDS differential clock input. (even)
39	RXE3-	Negative LVDS differential data input. Channel E3 (even)
40	RXE3+	Positive LVDS differential data input. Channel E3 (even)

Note(1)! Connector Part No.: I-PEX 20455-040E-76 or equivalent.



Note(2)! User's connector Part No.: I-PEX 20453-040T-03 or equivalent.



Chapter 3

Touchscreen & Touch
Controller

3.1 Touchscreen

3.1.1 Touch Characteristics

IDK-1115WP series products use projected capacitive (PCAP) touch screens.

3.1.2 Optical Characteristics

Table 3.1: Optical Characteristics

Item	Specifications
Transparency	88±3%
Haze	5±3%

3.1.3 Mechanical Characteristics

Table 3.2: Mechanical Characteristics

Item	Specifications
Surface Hardness	7H (The hardness test follows up the JIS-5400 Serils industry standard)
Cover Lens Thickness	1.9 mm; 0.74 in
Overall Thickness	2.8 ± 0.20 mm 0.11 ± 0.007 in
Static Load	500g within 10cm 2 area for 30sec
Controller and Tail Type	COB (Chip on Board)
FPC Tail Bending Radius	FPC bending 10 times or more by R1mm angle 500g, each bending 180° Meet electrical specs after test.
Holding Force for Tail	500 g (Peeling at an angle 90° towards the film)
Top Surface Finish Type	Anti-Fingerprint (water contact angle>105°)
DecorationLensArtwork	Black border

3.2 Touch Control Board

Advantech's IDK-1115WP-45FHA2 projected capacitive touch screen adopts a COB (Chip on Board FPC) design with EETI EXC80H84 touch controller. An extra touch control board is required and bundled in this model. This communicates with a PC directly through USB connectors. This superior design is sensitive, accurate, and user friendly.

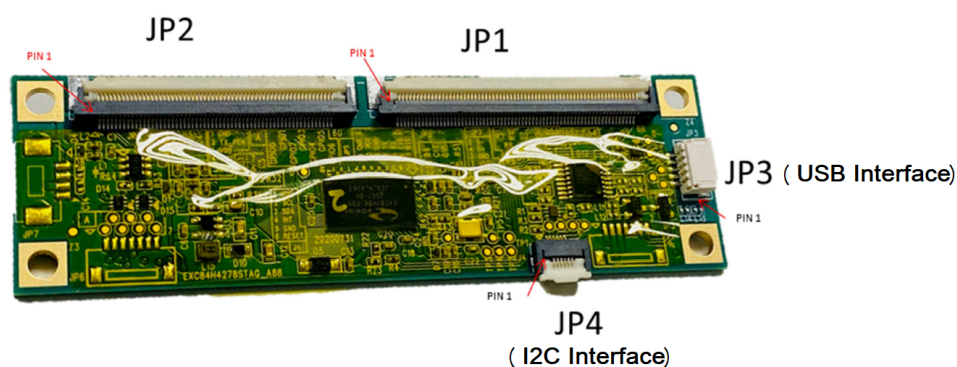
3.2.1 Electrical Specifications

Table 3.3: Electrical Specifications

Item	Specifications
Line drawing accuracy:	1pt +/- 2mm offset /10mm Touch (point) accuracy: 1pt +/- 2mm
Operating voltage	3.5V~5.5V. Typical 5V
Chattering	Less than 25 ms
Interface	USB (I2C Optional)
Power consumption	Active Mode: < 90mA Idle Mod : depends on firmware
Report rate	> 100Hz

3.2.2 Pin Assignment and Description

There are 2 x interfaces — USB and I2C (Optional). Connectors and Pin assignments are displayed below.



Pin	I2C
1	VCC/3.3V
2	SCL
3	SDL
4	INT
5	GND
6	RESET

ACES
51619-00601-002

PIN	USB
1	GND
2	VCC(5V)
3	GND
4	D+
5	D-

ACES
50224-00501-005

Figure 3.1 Connectors and Pin Assignment

Appendix **A**

LCD Optical
Characteristics

A.1 LCD Module Optical Characteristics

The optical characteristics are measured under stable conditions at 25 °C (75 °F) (Room Temperature):

Table A.1: Optical Characteristics						
Item	Conditions	Min.	Typ.	Max.	Unit	Note
Viewing Angle	Horizontal CR \geq 10	160	170	-	[degree]	
	Vertical CR \geq 10	160	170	-		
Luminance Uniformity		70	-	-	[%]	
Color coordinates (CIE 1931)	White x	Typ -	0.313	Typ +	-	
	White y	0.045	0.329	0.045		
Response Time	Rising	-	13	18	[ms]	
	Falling	-	12	17		
White Luminance		360	450	-	[cd/m ²]	
Contrast Ratio		600	800	-		

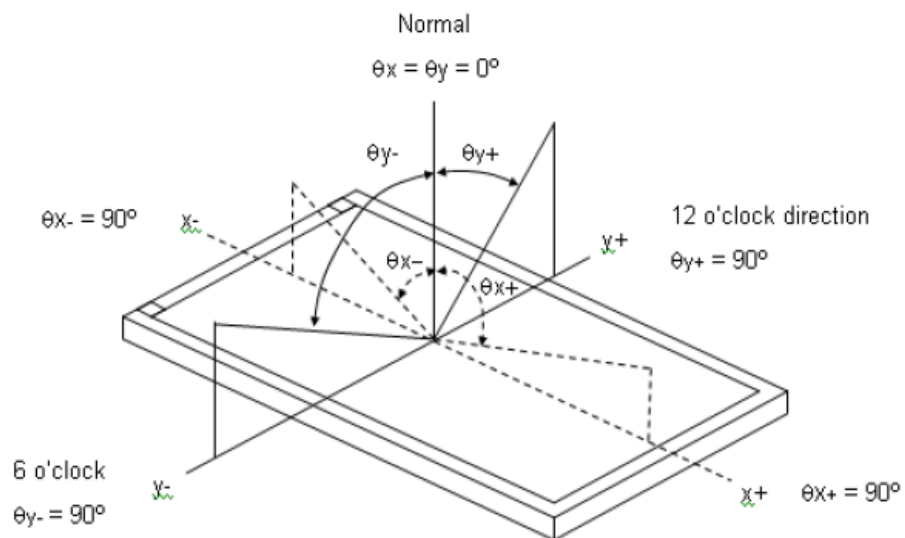


Figure A.1 Optical Characteristics

Note! 9-points position



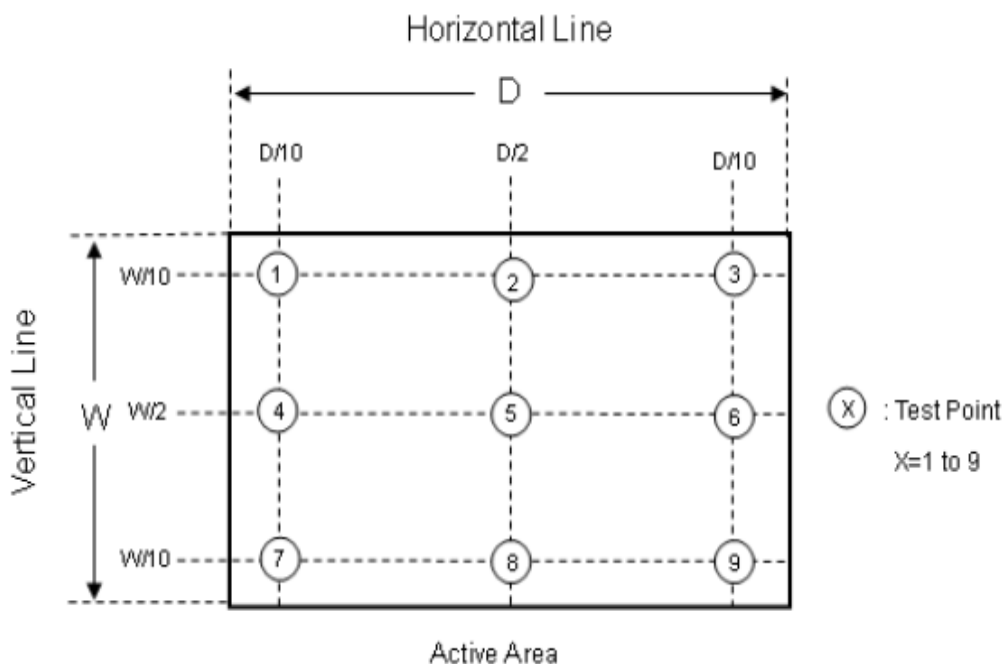


Figure A.2 9-Points Position

Note! 9-point luminance uniformity is defined by dividing the maximum luminance values by the minimum test point luminance



$$\delta_{w5} = \frac{\text{Minimum [L (1) ~ L (9)]}}{\text{Maximum [L (1) ~ L (9)]}}$$

Note! Measurement method



The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature changes during measurement. In order to stabilize the luminance, the measurement should be executed after lighting the backlight for 20 minutes in a stable, windless, and dark room.

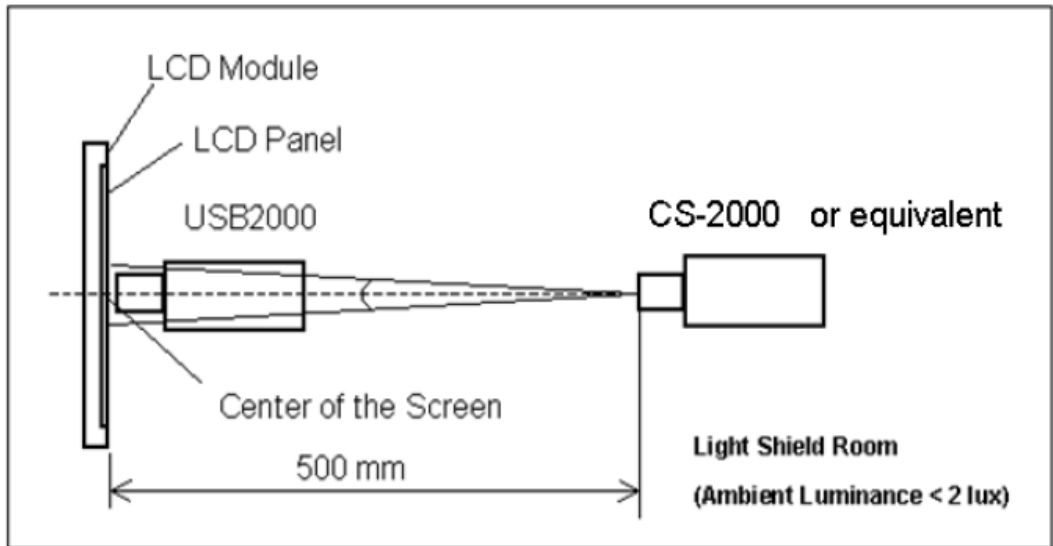


Figure A.3 Measurement Method

Note! Definition of response time



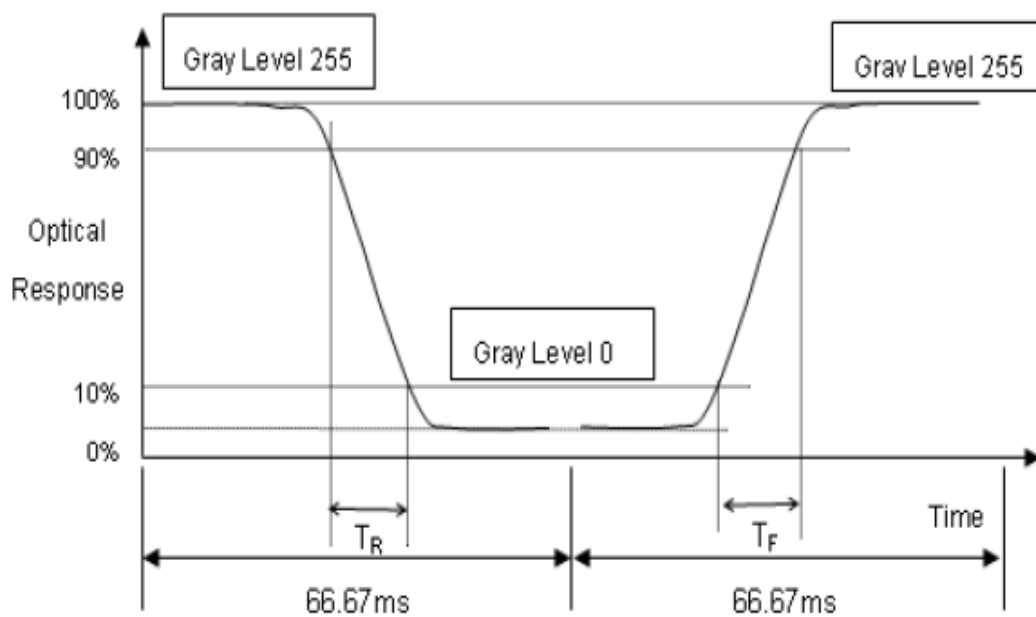


Figure A.4 Response Time Definition

Note! *Definition of Contrast Ratio (CR): The contrast ratio can be calculated by the following expression.*



$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L₂₅₅: Luminance of gray level 255

L₀: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X

Appendix **B**

Safety Precautions

B.1 Assembly and Handling Precautions

1. Do not apply rough force — such as bending or twisting — to the module during assembly.
2. Assemble or install module into user's system in clean working areas. Dust and oil ingress may result in an electrical short or damage to the polarizer.
3. Do not pressure or force the module as doing so may damage the LCD panel and/or backlight.
4. Always follow the correct power sequence when the LCD module is connecting and operating. This prevents damage to the CMOS LSI chips during latch-up.
5. Do not pull the I/F connector in or out during module operation.
6. Do not disassemble the module.
7. Use a soft dry cloth without chemicals for cleaning.
8. Allowing moisture to enter or contact the LCD module is dangerous. Moisture may damage the LCD module when operating.
9. High temperatures or humidity may reduce the module's performance. Store the LCD module in specified storage conditions.
10. Ambient temperatures lower than 10 °C; 50 °F may reduce the display quality. For example, the response time may grow slower.

B.2 Storage Precautions

1. Do not leave the module in high temperatures or humidity for long periods of time. We advise storing the module in environments with temperatures between 0 ~ 35 °C; 32 ~ 95 °F and relative humidity of less than 70%.
2. Do not store the module in direct sunlight.
3. The module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storing.

B.3 Operation Precautions

1. The LCD product should be operated under normal condition.
Normal condition is defined as below:
Temperature: 20 ± 15 °C; 68 ± 59 °F
Humidity: 65 ± 20%
Display pattern: continually changing pattern (not stationary)
2. Direct sun light will shorten the life of the product. Please avoid.
3. If the product will be used in extreme conditions such as those with high temperatures, humidity, altitude, or display pattern or operation time etc. We strongly recommend contacting Advantech for application engineering advice. Otherwise, its reliability and functionality is not be guaranteed.

B.4 Safety Precautions

1. 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, skin or clothes, it has to be washed away thoroughly with soap.
2. After the module' end of life, it is not harmful in case of normal operation and storage.

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