

Datasheet

FORTEC Integrated

FI-HIDDEN-15.6-WD







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REVISION RECODE

Revision	Description	Date
1.0	Initial Release	2024/08/02



1. GENERAL INFORMATION (W/O WOOD FILM)

Item	Contents	Unit
LCD Size	15.6	inch
Driver element	a-Si TFT active matrix	
Viewing direction	Normally black	
Module size	350.66(W)* 205.25 (H)*3.0(T)mm (Without PCB) 350.66(W)* 215.62 (H)*3.0(T)mm (With PCB)	mm
Panel Active Area	344.16(W)*193.59(H)	mm
Pixel pitch	0.179(W)*0.179(H)	mm
Number of Dots	1920*RGB*1080	pixel
Colors	16.7M	
Surface Treatment	anti-glare	
Interface	eDP 1.2	
Brightness	350cd/m²(typ)	
NTSC	45%	
Backlight power consumption	4.0W(typ)	W
Panel power consumption	TBD	W
Weight	TBD	g
Backlight Type	LED	
Operating Temperature	0°℃50°℃	°C
Storage Temperature	-20℃60℃	°C



2. BIOCK DIAGRAM





3. OPERATION SPECIFTCATIONS

3.1 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2. <Table 2. Absolute Maximum Ratings>

					Ta=25+/-2 ℃
Parameter	Symbol	Min.	Тур.	Unit	Remark
Supply Voltage	VDD	-0.3	4.0	V	
Input Signal	Vs	-0.3	2.4	V	eDP Signals
Operating Temperature	TOP	0	50	°C	Note
Operating Humidity	HOP	10	80	%RH	Note
Storage Temperature	TST	-20	60	°C	Note
Storage Humidity	HST	10	90	%RH	Note

Note: (A)Maximum Wet-Bulb temperature should be 39°C and no condensation of water.
 (B)When you apply the LCD module for OA system. Please make sure to keep the temperature of LCD module under 60°C.

(C)Storage /Operating temperature & humidity.





3.2 Pixel Format Image

Figure shows the relationship of the input signals and LCD pixels format image. Figure Pixel Format

	1			2			3				_		19	19		19	20	
1	R	G		R	Ĝ		R	Ģ		 	 	 	R	G		R	G	
2	R	G		R	G		R	G			 		R	G		R	G	
3	R	G.		R	G		R	G		 	 •••	 	R	G		R	G	
4	R	G		R	G		R	Ģ			 		R	G		R	G	
5	R	G		R	G		R	G		•	 •	 	R	G		R	G	
		-6-	- 60	4	1.0		:							•	1		- 6-	:
	:				196			*						- 44				
								•										
		•			1.0			•		T			0.6					
			-	1000		N. C							1.1	- 0	1.0	100		
1079	R	Ģ	В	R	G	В	R	G	В	 	 		R	G	В	R	G	В
1080	R	Ġ.		R	G		R	G		 	 	 	R	G		R	Ģ	



3.3 Electrcical Conditions

Input power specifications are as follows.

The power specification are measured under 25° C and frame frequency under 60Hz

<Table 3. Electrical Specifications>

Ta=25+/-2°C

Parameter	Symbol	Min.	Тур.	Max.	Unit	Remark
Logic/LCD Drive Voltage	VDD	3.0	3.3	3.6	V	
VDD Current	IDD	-	180	260	mA	Note A
VDD Current	IDD _{MAX}	-	-	260	mA	Note B,C
VDD Power	PDD	-	0.594	0.858	W	Note A,B,C
Inrush Current	IRush	-	-	2	A	Note D,E
Allowable Logic/LCD Drive Ripple Voltage	VDDrp			100	mV	Vp-р

Note A: IDD_{Black} measurement condition f_{dck} =138.5MHz, f_v =60Hz, VDD=3.3V, Normal pattern.

Note B: IDD_{MAX} measurement condition f_{dck} =138.5MHz, f_v =60Hz, VDD=3.3V, V-Stripe pattern.

Note C: Description of the V-Stripe pattern





Note D: Measure Condition Figure 4



Figure 4. Inrush Measure Condition

Note E: When the IRush Measure Condition at VDD rising time=1.5ms, the value of IRush(typ.)=1A.



3.4 Blacklight Units

						Ta=25+/-2°C
Doromotor	Symbol		Values		Lloit	Pomork
Falameter	Symbol	Min.	Тур.	Max.	Unit	Remark
LED Forward Voltage	VDD	2.9	3.3	3.4	V	
LED Forward Current	VLED	7	12	21	V	
Current Consumption	I _{VDD}	-	20	-	mA	
Power Consumption	PLCD	-	-	4	W	
LED Life Time	LT	10000	-	-	Hours	
LED EN Control Loval	On	2.0	3.3	3.6	V	
LED_EN CONTO Lever	Off	0		0.5	V	
DW/M Control Loval	Н	2.0	3.3	3.6	V	
PVVIVI Control Level	L			0.5	V	
PWM Control Frequency	f	100	200	30K	Hz	

<Table 4. LED Driving Guideline Specifications>

Note A: Calculator value for LED chip specification.

Note B: The LED life time define as the cstimated time to 50% degradation of initial luminous.

Note C: I_{LED}=20mA(Per LED)



4. Interface Signal

The electronics interface connector is IPEX 20455-030E-66 or Compatible.

The connector interface pin assignments are listed in Table 6.

Terminal	Symbol	Functions			
Pin No.	Symbol	Description			
1	NC	No Connection			
2	H_GND	Ground			
3	LANE1_N	eDP RX Channel 1 Negative			
4	LANE1_P	eDP RX Channel 1 Positive			
5	H_GND	Ground			
6	LANE0_N	eDP RX Channel 0 Negative			
7	LANE0_P	eDP RX Channel 0 Positive			
8	H_GND	Ground			
9	AUX_CH_P	eDP AUX CH Positive			
10	AUX_CH_N	eDP AUX CH Negative			
11	H_GND	Ground			
12	LCD_VCC	Power Supply, 3.3V (typ.)			
13	LCD_VCC	Power Supply, 3.3V (typ.)			
14	NC	No Connection			
15	H_GND	Ground	12		
16	H_GND	Ground			
17	HPD	Hot Plug Detect Output			
18	BL_GND	LED Ground			
19	BL_GND	LED Ground			
20	BL_GND	LED Ground			
21	BL_GND	LED Ground			
22	BL_ENABLE	LED Enable Pin			
23	BL_PWM	System PWM Signal Input			
24	NC	No Connection			
25	NC	No Connection			
26	BL_POWER	LED Power Supply 12V-21V			
27	BL_POWER	LED Power Supply 12V-21V			
28	BL_POWER	LED Power Supply12V-21V			
29	BL_POWER	LED Power Supply12V-21V			
30	NC	No Connection			

<Table 8. Pin Assignments for the Interface Connector>



5. SIGNAL Electrical CHARACTERISTICS

Input signals shall be low or High-impedance state when VDD is off.

It is recommended to refer the specifications of VESA Display Port Standard V1.2 in detail.

Parameter	Description	Min.	Тур.	Max.	Unit
Vсм	Differentia Common Mode Voltage	0	-	2.0	V
V _{Diff P-P} Level 1	Differential Peak to Peak Voltage Level 1	0.34	0.40	0.46	V
V _{Diff P-P} Level 2	Differential Peak to Peak Voltage Level 2	0.51	0.60	0.68	V
V _{Diff P-P} Level 3	Differential Peak to Peak Voltage Level 3	0.69	0.80	0.92	V
V _{Diff P-P} Level 4	Differential Peak to Peak Voltage Level 4	1.02	1.20	1.38	V

Display Port Main Link

Note: Fallow as VESA display port standard V1.2 at both 1.62 and 2.7Gbps link rates.



Display Port AUX_CH

Parameter	Description	Min.	Тур.	Max.	Unit
Vсм	Differentia Common Mode Voltage	0	VDD/2	2	V
VDiff P-P	Differential Peak to Peak Voltage	0.39	-	1.38	V

Note: Fallow as VESA display port standard V1.2.

Display Port VHPD

Parameter	Description	Min.	Тур.	Max.	Unit
Vhpd	HPD Voltage	2.25	-	3.60	V

Note: Fallow as VESA display port standard V1.2.





Display Port Interface Power Up/Down Sequence, Normal System Operation

Display Port Interface Power Up/Down Sequence, Aux Channel Transaction Only





eDP Panel Power Sequence Timing Parameters

Timing	Decerintian	Reqd.	Lii	nits	Notos
Parameter	Description	Ву	Min.	Max.	Notes
T1	Power rail rise time, 10% to 90%	Source	0 . 5ms	10ms	-
Τ2	Delay from LCD VCC to black video generation	Sink	0ms	200ms	Prevents display noise until valid video data is received from the Source.(see note 1 below)
тз	Delay from LCD VCC to HPD high	Sink	0ms	200ms	Sink Aux Channel must be operational upon HPD high.
Τ4	Delay from HPD high to link training initialization	Source	-	-	Allows for Source to read Link capability and initialize.
Т5	Link training duration	Source	-	-	Dependant on Source link training protocol.
Т6	Link idle	Source	-	-	Min accounts for required BS-Idle pattern. Max allows for Source frame synchronization.
Τ7	Delay from valid video data from Source to video on display	Sink	0ms	50ms	Max allows Sink validate video data and timing.
Т8	Delay from valid video from Source to backlight enable	Source	-	-	Source must assure display video is stable.
Т9	Delay from backlight disable to end of valid video data	Source	-	-	Source must assure backlight is no longer illuminated.(see note 1 below)
T10	Delay from end of valid video data from Source to power off	Source	0ms	500ms	-



T11	Power rail fall time, 90% to 10%	Source	-	10ms	-
T12	Power off time	Source	500ms	-	-

Note1: The Sink must include the ability to generate black video autonomously. The Sink must automatically enable black video under the following conditions:

-Upon LCDVCC power-on(within T2 max)

-When the "NoVideoStream_Flag" (VB-ID Bit 3) is received from the Source (at the end of T9)

-When no Main Link data, or invalid video data, is received from the Source. Black video must be displayed within 50ms (max) from the start of either condition. Video data can be deemed invalid based on MSA and timing information, for example.

Note2: The Sink may implement the ability to disable the black video function, as described in Notes 1, above, for system development and debugging purposes.

Note3: The Sink must support Aux Channel polling by the Source immediately following LCDVCC power-on without causing damage to the Sink device(the Source can re-try if the Sink is not ready). The Sink must be able to respond to an Aux Channel transaction with the time specified within T3 max.

6. Interface Timings

Timing Cararcteristics

Basically, interface timings should match the 1920 x 1080/60Hz manufacturing guide line timing

Parameter	Symbol	Min.	Тур.	Max.	Unit
Signal Clock Frequency	f dck	132	138.5	140	MHz
H Total Time	T_{hp}	2020	2080	2400	clocks
H Active Time	HA		1920		clocks
H Blanking	T_{hfp}	-	160	-	clocks
H Frequency	f _h	65	66	72	kHz
V Total Time	T _{vp}	1090	1111	1200	lines
V Active Time	VA		1080		lines
V Blanking	T _{vfp}	-	31	-	lines
V Frequency	f _v	55	60	65	Hz



7. Power ON/OFF Sequence

VDD power 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.



Powe Sequencing Requirements

Parameter	Unit	Min.	Max.
T1	ms	0.5	10
T2	ms	0	10
ТЗ	ms	0	200
Τ4	ms	0	50
Т5	ms	300	-
Т6	ms	200	-
Т7	ms	0.5	10
Т8	ms	0	10
Т9	ms	10	-
T10	ms	10	-
T11	ms	10	-
T12	ms	0	-
T13	ms	500	-



8. ELECTRO-OPTICAL CHARACTERISTICS (W/O WOOD FILM)

ltem		Symbol	Condition	Min	Тур	Max	Unit	Remark	
Response time		Tr+Tf	θ=0°	-	-	30	ms	Note 2 Note 3	
Contrast ratio		Cr		-	1500	-	-	Note 2 Note 4	
Luminance uniformity(9 pc	oints)	δ WHITE	Ta=25℃	-	75	-	%	Note 2 Note 6	
Center Lumina	nce	LV		300	350	-	cd/m ²	Note 2	
			=90°	-	80	-	deg		
Viewing angle range	A	=270°	-	80	-	deg	Note1		
	0	=0°	-	80	-	deg			
			=180°	-	80	-	deg		
	Dod	х			0.60	-	-		
	Reu	у			0.33		-		
	Green	x				0.29		-	
CIE(x,y)	Oreen	у		Тур	0.52	Тур +0.05	-	Note 2 Note 5	
chromaticity	Blue	x	⊎=0° Ta=25℃	-0.05	0.14		-		
	Diue	у			0.15		-		
	\M/bito	x	1		0.30		-		
	vvnite	у			0.32		-		



Note 1: Definition of viewing angle range

Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface



Definition of viewing angle.

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Viewing angle is measured by AL-100

contrast/Height :1.2mm ,Response time is measured by Photo detector TOPCON BM-7, other items are measured by AL-100/

Field of view: 1° /Height: 500mm.)





Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_R) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_F) is the time between photodetector output intensity changed from 10% to 90%.



Definition of response time-

Note 4: Definition of contrast ratio

 $Contrast ratio (CR) = \frac{Luminance measured when LCD on the "White" state}{Luminance measured when LCD on the "Black" state}$

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity ("White" state)

Active area is divided into 9 measuring areas. Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (Yu) =
$$\frac{B_{min}}{B_{max}}$$



Definition of measuring points-

B_{max}: The measured maximum luminance of all measurement position. B_{min}: The measured minimum luminance of all measurement position.



9. RELIABILITY TEST

Reliability test conditions (Polarizer characteristics null)

No.	Test Items	Test Condition	Remarks	
1	High Temperature Storage	T = 60℃ for 96hr		
2	Low Temperature Storage	T = -20 $^\circ C$ for 96hr	Module (Without Contamination)	
3	High Temperature Operating	T = 50°C for 96hr		
4	Low Temperature Operating	T = 0° C for 96hr (But no condensation of dew)		
5	High Temp. and High Humidity	T = 50° C /80% for 96hr (But no condensation dew)		
6	Thermal Shock	0±2°C~25~50±2°C×10cycles (30min.) (5min.) (30min.)		
7	Packing Shock	1corner, 3edge, 6face / 76cmDrop		
8	Packing Vibration	Random 1.06Grms XYZ 30min for each direction	Packing	
9	Electrostatic Discharge	Contact: ±4KV Air: ±8KV 150PF/330Ω,5Points/panel,5times	Class B.Note1	

% 1) No.1~ No.6 : No guarantee for panel, only for module with the above test conditions. %2) No.7~ No.8 : Refer to 7-1) Packing Ass'y on page 19.

Note1

Class	Performance
Α	All functions perform as designed during and after exposure to interference
В	Temporary degradation or less of performance which is self-recoverable
C	Degradation or less of performance which requires operator intervention or system reset
C	to recover
D	Degradation or less of function which is not recoverable

Result Evaluation Criteria

TFT- LCD Panel should be at room temperature for 2 hours when the display quality test is over. There should be no particular change which might affect the practical display function and the display quality test should be conducted under normal operating condition.



10. Capacitive Touch Panel Specification

10.1 Construction 結構

Construction	Materials used	Code No.	Comment
Front protective film	PET	1	Thickness ÷ 0.06mm
Cover Glass	Strengthened glass	2	Thickness: 1.10mm
Optical transparent adhesive	SCA	3	Thickness : 0.20mm
ITO Glass	DITO Glass	4	ITO Glass Thickness: 1.10mm
Double sided adhesive	3M 300LSE	8	Thickness : 0.175mm

10.2 Environment Conditions

Items	Value
Operating temperature & Humidity	-10°C ~+60°C : 45% ~85%RH
Storage temperature & Humidity	-20°C ~+70°C : 45% ~95%RH

10.3 Optical Characteristics

Items	Value		
Optical Characteristics	Transparency> 85% (550nm)		
Hardness	≧6H (750gf)		

10.4 Mechanical Characteristics

Item	Description	Unit
Outline Size	377.30 (L) x247.27 (W) x2.40 (T)	mm
View Area	345.06 (L) x194.49 (W)	mm
Sensor Area	347.46 (L) ×196.89 (W)	mm
Interface Type	USB	
Aspect Ratio	9:5	
Connector Type	USB	
Control Type	COF(SIS9509)	

CTP Interface Description

PIN FUNCTIONS		
1	+5V	
	VDD	
2	D-	
3	D+	
4	GND	
5	NC	



10.5 Electric Characteristics & Interface

10.5.1 Chip Schematic



Figure 1 SiS9509 Touch System Diagram

10.5.2 I2C

5. Electrical Characteristics

5.1 Absolute Maximum Ratings

Table 1 shows SIS9509 stress ratings only. Extended exposure to the maximum ratings might degrade device reliability. Although SIS9509 has protective circuitry to resist damage from electrostatic discharge (ESD), precautions should always be taken to avoid high voltage or electric field.

	Table 1 Absolute Maximum	Ratings	5	i	3.2
Symbol	Parameter	Min	Max	Unit	Notes
Tstorage	Storage Temperature	-40	90	СС	
Ta	Ambient Operating Temperature	-40	85	°C	
OVDD33	2.2V Suzzlu Voltana			V	
AVDD33	5.5V Supply Voltage		73.6	v	



5.2 DC Characteristics

OVDD33 = 3.3V

AVDD33 = 3.3V

AVSS = LVSS = DVSS = GND =

Symbol		For 3.3V I/O			
	Parameter	Min.	Тур.	Max.	
Vil (V)	Input low voltage			0.8	
Vih (V) 🔬 🦰	Input high voltage	2.0			
Vol (V)	 Output low voltage 			0.4	
	Output high voltage	VDDIO-			
Voir (V)	Oulput high voltage	0.4			
Lil (aA)	Input leakage current	-10		+10	
∖√hiz (uA)	Output tri-state leakage current	-10		+10	
Pull-up (kohm)	Internal Pull-up resistor		39		
Pull-down (kohm)	Internal Pull- down resistor		39		

Table 2 DC Characteristics of I/O Interface

5.5 Power Consumption Information

Mode	Power Current	Note
Normal Operation Mode	32 mA @ Max.	
Idle Mode	13 mA	
Sleep Mode	6.3 mA	

5.6 Power Sequence



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Description	Min	Мах	Unit
VDD power on rising time from 0.1"VDD to 0.9"VDD	-	2	ms
External reset pulse width	5		ms
From VDD stable at 3.3V to RESET# reach at 2V	5	-	ms
Time of starting to report point after Reset# reach at 3.3V	100	÷4. +	ms

5.7 I2C Interface

SIS
0x5c(7-bits addressing, programmable)
@400 kHz (fast mode)
Default active low, level trigger
PNP0C50
3CDFF6F7-4267-4555-AD05-B30A3D8938DE
0x0000





Item	• Symbol	Value	Part NO.	Quantity	Package
1	J 1	Aces-6P-P0.6-(50376)	-	1	
2	2 E1,E2,E3,E4	5V-TVS	PDAB050120	4	SOT236
3	R1,R2,R3	0R	-	3	0402
4	R4,R5	1.5K	-	2	0402
5	R6	4.7K		1	0402



10.6. Reliant Condition

No.	Item	Test Condition	Note
1	High	Afterexposingat70°C for120 hours and at	
	Temperature	normal temperature and humidity for	
	Storage	24 hours.	
2	Low	After exposing at -20 $^\circ\!\mathrm{C}$ for 120 hoursand	
	Temperature	at normal temperature and humidityfor 24	
	Storage	hours.	
3	High	After exposing at 65℃,90%RH for 120	
	Temperature 🕥	hours and at normal temperature and	
	High Humidity	humidity for 24 hours.(except for dew	
	Storage	gathering)	
4	Thermal	After exposing under the conditions	
	Shock.(Non	between-20 $^{\circ}$ C (30min)and65 $^{\circ}$ C (30min)by	
	Operating)	50 cycles (taking out at 70 $^\circ\!\mathbb{C}$) and at	
		normal temperature and humidity for 24	
		hours.(except for dew gathering)	
5	Touch panel	Condition: steel ball of diameter=25.4mm,	
	surface Intensity	weight=64g, Height=50cm, dropped once	
	test	on the center of TP, TP protection glass is	
		not allowed to break.	



Front

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Back





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