

						REV A.1					
Product Specification											
	(RoHS Compliant)										
	Customer : Model No. : HD-480G800-40MTW-F2										
	Designed by Checked by DEPT. Approved by										
	Final Approval by	Customer									
		blom survov:									
		blem sulvey.									
-	Approved By										
	Hyundai LCD (HK) Co., Ltd.										
MOD	EL HD-480G80	00-40MTW-F2	1	Pr	oduct Specificat	ions					



Record of Revision

Version	Contents		Date	Note
A.0	Initial Release		2013.11.06	
A.1	modify fpc 18bit to 24bit modify pol, anti-glare to glare		2014.02.12	P4,5,6,7,13
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1. GENERAL SPECIFICATION

1.1 Description

The HD-480G800-40MTW-F2 is a color active matrix Thin Film Transistor (TFT) Liquid Crystal Display (LCD) that uses amorphous silicon(a-Si) TFT as a switching device. This model is composed of a single 4.0 inches transmissive type main TFT-LCD panel. The resolution of the panel is 480 x 800 pixels and can display up to 16.7M color.

1.2 Feature

- MVA type for main TFT-LCD panel
- Structure COG+FPC+BL+CTP
- Full, Normal (Still), Partial, Sleep, Standby mode are available

1.3 Application

- Display terminals for Smart phone, Smart PDA etc..

1.4 General Specification

No.	ltem	Specification	Unit	Remark
1	LCD Size	4.0	inch	-
2	Panel Type	a-Si TFT active matrix	-	-
3	Resolution	480 x (RGB) x 800	pixel	-
4	Display Mode	Normally Black, Transmissive	-	-
5	Display Number of Colors	262K/16.7M	-	-
6	Viewing Direction	All	-	Note
7	Contrast Ratio	500(Typ)	-	-
8	Luminance	250(Typ)	cd/m ²	-
9	Module Size	63.5(W)x115.85(L)x1.95(T)	mm	Note
10	Active Area	51.84(W) x 86.4(L)	mm	Note
11	Pixel Pitch	0.108(W) x 0.108(L)	mm	-
12	Matching connector type	BL125-39RL-TAGF	g	-
13	Driver IC	NT35510	-	-
14	Driver IC RAM Size	480x24x800	bit	-
15	Light Source	8 LEDs White	-	-
16	Interface	24 bit RGB	-	-
17	Operating Temperature	-20~70	°C	-
18	Storage Temperature	-30~80	°C	-

Note: Please refer to the mechanical drawing.

MODE



2. BLOCK DIAGRAM





3. MECHANICAL DRAWING





4. INTERFACE ASSIGNMENT

PIN NO.	SYMBOL	I/O	FUNCTION DESCRIPTIONS			
1	GND	Р	System ground			
2	LED-	Р	Power supply Cathode input for backlight			
3	LED+	Р	Power supply Anode input for backlight.			
4	VDD	Р	Power supply for analog circuit, 2.3~4.8v			
5	VDDIO	Р	Supply voltage to the interface pins:1.65~3.3V			
			Chip select signal.			
6	CS	I	Low: chip can be accessed;			
			High: chip cannot be accessed.			
7	SCL	I	Serial Clock/ write strobe signal			
8	SDI	I	Serial data input pin in serial interface operation.			
9	SDO	0	Serial data output pin in serial interface operation.			
10~17	B0~B7	I	Data bus B0~B7			
18~25	G0~G7	I	Data bus G0~G7			
26~33	R0~R7	I	Data bus R0~R7			
34	DEN	I	A data enable signal in RGB I/F mode.			
35	DOTCLK	I	Dot clock signal.			
36	HSYNC	I	Line synchronizing signal.			
37	VSYNC	I	Serves VS signal pin on RGB interface.			
38	RESET	1	Reset input Pin Initializes with a low input. Be sure			
00		· ·	to execute a power-on reset after supplying power.			
39	GND	Р	System ground			

Note: The voltage power of the interface logic pin depend on " IOVCC " and " GND ",Such as $\mathsf{DB}_{n,}$ IM ${\tt n},$ and function pins

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5. ELECTRICAL SPECIFICATION 5.1. APPLICATION CIRCUIT





5.2. ABSOLUTE MAXIMUM RATINGS

ITEM			STAN			
	STIVIDUL	CONDITION	MIN	ΤΥΡ	MAX	
Power Supply for Analog	V _{DD}	Ta=25 ⁰C	-0.3	-	5.5	V
Power Supply for Digital IO	IOVDD	Ta=25 ⁰C	-0.3	-	5.5	V

Note: Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is applied.

5.3. TYPICAL OPERATION CONDITION

5.3.1 DC Characteristics

ITCM			STAND				
	STMBOL	CONDITION	MIN	ТҮР	MAX		
Power Supply for Analog	V _{DD}	Ta=25 ⁰C	2.3	2.8	4.8	V	
Power Supply for Digital IO	IoV _{DD}	Ta=25 ⁰C	1.65	1.8	3.3	V	
Input Signal "H" Level	Vih	-	0.7IoV _{DD}	-	IoV _{DD}	V	
Input Signal "L" Level	VIL	-	VSSI	-	0.3IoV _{DD}	V	
Output Signal "H" Level	V _{он}	I _{он} =-1.0mA	0.8IoV _{DD}	-	IoV _{DD}	V	
Output Signal "L" Level	V _{OL}	I _{OL} =1.0mA	VSSI	-	0.2IoV _{DD}	V	

Note: To prevent IC latch up or DC operation in LCD panel, the power on/off sequence should follow the driver IC specification.



5.4. BACKLIGHT SPECIFICATION 5.4.1 BACKLIGHT CIRCUIT

5.4.2 ELECTRICAL CHARACTERISTICS

(T=25 ℃)

	SYMBOL		STANDARD V		VALUE	UNIT	
FARAMETER	STMBOL	CONDITION	MIN	ТҮР	MAX		
FORWARD VOLTAGE (Single Chip)	VF	IF=20mA	23.2	24.8	26.4	v	

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5.5. INTERFACE TIMING CHARACTERISTICS

5.5.1 RGB Interface Characteristics



Fig. 7.6.4 RGB interface characteristics

(VSS=VSSI=DVSS=0V, VDDI=1.65V to 3.3V, VDD=2.3V to 4.8V,Ta = -30 to 70°C)

Signal	Symbol	Parameter	MIN	ТҮР	MAX	Unit	Description
tvsyns		VSYNC setup time	10	-	-	ns	
V3	t vsynh	VSYNC hold time	10	-	-	ns	
	t HSYNS	HSYNC setup time	10	-	-	ns	
HS	t SCYCR	HSYNC hold time	10	-	-	ns	
t hvpd		HSYNC to VSYNC falling edge	0	-	-	ns	
	t DCYC	PCLK cycle time	33	-	125	ns	
DOLK	tolw	PCLK "L" pulse width	11	-	-	ns	
PULK	tонw	PCLK "H" pulse width	11	-	-	ns	
	f dfreq	PCLK frequency	8	-	30	MHz	
	tDCSS	DE setup time	10	-	-	ns	
DE	t DCSH	DE hold Time	10	-	-	ns	
00 000	tDDS	RGB Data setup time	10	-	-	ns	
D0~D23	t DDH	RGB Data hold time	10	-	-	ns	

Note 1) VDDI=1.65 to 3.3V, VDD=2.3 to 4.8V, VSS=VSSI=DVSS=0V, Ta=-30 to 70 °C (to +85 °C no damage) VDD means VDDA, VDDR, VDDB and VSS means VSSA, VSSR, VSSB

Note 2) The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

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5.5.2 RGB Interface Bus Width Set

All 3-kinds of bus width can be available during RGB interface mode (selected by the COLMOD command (3A00h): VIPF[3:0]).

3A00h	D23	D22	D21	D20	D19	D18	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Bus Width
50h	х	х	х	R4	R3	R2	R1	R0	х	х	G5	G4	G3	G2	G1	G0	х	х	х	B 4	B 3	B2	B1	B0	16-bit data
60h	х	х	R5	R4	R3	R2	R1	R0	х	х	G5	G4	G3	G2	G1	G0	х	х	B5	B 4	B 3	B2	B1	B0	18-bit data
70h	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B 7	B6	B5	B4	B 3	B2	B1	B0	24-bit data

NOTES:

1. "x": Unused RGB data bus connected with VSSI.

2. R0 is the LSB for the red component; G0 is the LSB for the green component, etc.

3. For 16-bit pixels, R primary color MSB is R4, G primary color MSB is G5 and B primary color MSB is B4.

4. For 18-bit pixels, R primary color MSB is R5, G primary color MSB is G5 and B primary color MSB is B5.

5. For 24-bit pixels, R primary color MSB is R7, G primary color MSB is G7 and B primary color MSB is B7







5.6. RESET TIMING CHARACTERISTICS



Fig. 7.6.12 Reset input timing

(VSS=VSSI=DVSS=0V, VDDI=1.65V to 3.3V, VDD=2.3V to 4.8V,Ta = -30 to 70°C)

Signal	Symbol	Parameter	MIN	TYP	MAX	Unit	Description
	tresw	Reset "L" pulse width (Note 1)	10	-	-	μs	
RESX	4	Reset complete time (Note 2)	-	-	5	ms	When reset applied during Sleep In Mode
	t REST		-	-	120	ms	When reset applied during Sleep Out Mode

Note 1) Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 5µs	Reset Rejected
Longer than 10µs	Reset
Between 5µs and 10µs	Reset Start

Note 2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In–mode) and then return to Default condition for H/W reset.

- Note 3) During Reset Complete Time, values in OTP memory will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (t_{REST}) within 5ms after a rising edge of RESX.
- Note 4) Spike Rejection also applies during a valid reset pulse as shown below:



Note 5) It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec



6. OPTICAL CHARACTERISTICS

 $(T_a=+25^{\circ}C, VCC=+2.8V IOVCC=+1.8V, I_B=20mA)$

Itom		Symbol	Condition		Values		l Init	Domork	
Item		Symbol	Condition	Min.	Тур.	Max.	Unit	Remark	
	Left	θ∟		-	85	-			
Viewing	Right	θ _R		-	85	-	dograa	Note 1,2	
Angle Range	Тор	Φτ	GR≙10	-	85	-	uegree		
	Botto	Φ _B		-	85	-			
Response Tim	ne	T _{on} +T _{off}	Normal θ=Φ=0°	-	35	-	ms	Note 2,3	
Contrast Ratio		CR	Normal θ=Φ=0°	300	500	-	-	Note 2,4	
Luminance		L	Normal θ=Φ=0°	350	400		cd/m ²	Note 2,5	
	\//bito	Wu		0.1754	0.2354	0.2854			
	vvnite	Wv		0.2576	0.3076	0.3576			
	Red	Ru		0.5451	0.5951	0.6451			
Color		Rv	Normal	0.3052	0.3552	0.4052			
Chromaticity	Groop	Gu	$\theta = \Phi = 0^{\circ}$	0.1722	0.2222	0.2522	-	Note 2,6	
(CIE1931)	Green	Gv		0.5959	0.6459	0.6959			
		Bu		0.0973	0.1473	0.1973			
	Blue	Bv		0.0073	0.0573	0.1073			
Color Gamut		NTSC	CIE1931	-	69.01	-	%	-	
Luminance Uniformity		UL	Normal θ=Φ=0°	80	-	-	%	Note 2,7	







Note 2: Definition of optical measurement system

The optical characteristics should be measured in a dark room with ambient temperature $T_a=+25$ °C. The optical properties are measured at the center point of the LCD screen after 5 minutes operation. (Equipment: Photo detector TOPCON BM-5AS 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_{on}) is the time between photo detector output intensity changed from 90% to 10%, and fall time (T_{off}) is the time between photo detector output intensity changed from 10% to 90%.





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 luminance

Measured at the center area of the panel when LCD panel is driven at "white" state.

Note 6: Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD when panel is driven at "White", "Red", "Green" and "Blue" state respectively.

Note 7: Definition of luminance uniformity

To test for uniformity, the tested area is divided into 3 rows and 3 columns. The measurement spot is placed at the center of each circle as below.



L-----Active area length

W----- Active area width



Fig. 5 Definition of luminance uniformity

 L_{min} : The measured minimum luminance of all measurement position.

 L_{max} : The measured maximum luminance of all measurement position.

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7. RELIABILITY TESTS

ITEM	CONDITION	CRITERION		
Operating Temperature Test	High Temperature: +70 °C±3°C, 72 hrs	No defects in display and		
	Low Temperature: -20 °C±3°C, 72 hrs	operational functions		
Storago Tomporaturo Tost	High Temperature: +80 ⁰C±3℃, 120 hrs	No defects in display and		
Storage temperature test	Low Temperature: -30 °C±3°C, 120 hrs	operational functions		
Humidity Endurance Test	50℃±5℃×90%RH/96 hours	No defects in display and		
	$20 + 2 \approx (20 \text{min}) - 25(\text{Emin}) - 70(20 \text{min}) + 1$	Operational functions		
Thermal Shock Test	$2^{\circ} \pm 2^{\circ} (30^{\circ} \text{min.}) \approx 2^{\circ} (30^{\circ} \text{min.}) \pm 2^{\circ} \approx 25(5^{\circ} \text{min.}) 2^{\circ} \text{ cycles}$	operational functions		
Vibration Resistance Test	Frequency 10Hz~55Hz~10Hz Amplitude 1.5mm, X, Y, Z direction for total 0.5hours (packing condition)	No defects in display and operational functions		
Drop test	Drop to the ground fron 1.0m height,one time,every side of carton.(packing condition)	No defects in display and operational functions		
Electro Static Discharge	Voltage:±8KV R:330ΩC:150pF Air discharge,10time	No defects in display and operational functions		

NOTE:

1) The samples must be free from defect before test, must be restored at room condition at least for 2 hours after reliability test before any inspection.

2) Before test the function of TP, the sample must be placed in room temperature for 24hrs after RA test.



8. PRECAUTIONS

8.1. HANDLING

8.1.1. Polarizer Cleaning, Petroleum ether (or N-hexane) is recommended for cleaning the front/rear polarizers and reflectors, acetone, toluene and ethanol are not allowed to avoid damaging the surface.

8.1.2. Body grounding, must wear Anti-ESD wrist strap while pick up LCDs.

8.1.3. FPC Soldering, less than 300°C/3S, solder must be grounding on grounding bench.

8.1.4. If use electric Screwdriver to do assembly, screwdriver must be grounding.

8.2. STORAGE

8.2.1. Keep in a sealed polyethylene bag.

8.2.2. Keep in a dark place.

8.2.3. Keep in temperature between 0°C and 35°C.

8.3. SAFETY

If liquid crystal leak out of a damaged glass cell, **DO NOT** put it in your mouth or touch eyes, if the liquid crystal touch your skin or clothes, please wash it off immediately using soap and water.

9. LIMITED WARRANTY

Unless otherwise agreed between Hyundai LCD and customer, Hyundai LCD will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Hyundai LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects over specs must be returned to Hyundai LCD within 30 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Hyundai LCD limited to repair and/or replacement on the terms set forth above. Hyundai LCD shall not be responsible for any subsequent or consequential events.

9.1. RETURNING LCM UNDER WARRANTY – TERMS AND CONDITIONS

9.1.1. No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.

- Circuit modified in any way, including addition of components.

9.1.2. Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB's eyelet, conductors and terminals.

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10. LCD MODULE OUT-GOING QUALITY LEVEL

10.1 MIL-STD-105E LEVEL II

No.	Items	FQC (FQC Sampling Lev	el) Tools
1	Cosmetic inspection	Major: 0.65% Minor: 1.5	Magnifier, Spot gauge,
2	Electrical inspection	Major: 0.65% Minor: 1.5	% Light-on tester

10.2 COSMETIC INSPECTION

Item					Judgment				
	Item			Cinterna			Major	Minor	
			Blemish Size	Мах	. Number				
			(mm)	Active Area	Non-A	.A.			
1	l Bubble		D≦0.2	Ignore	Ignor	e		0	
			$0.2 < D \le 0.35$	2					
			D > 0.35	0					
			Blemish Size	Мах	. Number				
			(mm)	Active Area	Non-A	.A.			
2	Den	it	D≦0.2	Ignore	Ignor	e		0	
			0.2 < D≦0.3	1					
			D > 0.3	0					
			Width (mm)		Length (mm)	gth (mm) Max. Numb			
			W≦0.1	L≦0.5	Ignor	e			
2		Scratch 0.1 < W ≦ 0.3		0.5 < L≦3	2				
3	Scrate	;n	W > 0.3	-	0			0	
			-	L > 3	0				
			Remark: Scratch on protective film is to be ignored.						
			Blemish Size	Max	. Number				
		Davind	(mm)	Active Area	Non-A	.A.			
		Round $I < AW$	D≦0.2	Ignore	Ignor	e		0	
		L=4VV	0.2 < D≦0.3	1					
	Black or		D > 0.3	0					
1			Width (mm)	Length (mm)	Max. N	umber			
4	, Foreign				Active Area	Non-A.A.			
	Material	Lincor	W≦0.05	L≦0.5	Ignore	Ignore			
			0.05 < W≦	$0.5 < L \le 3$	1			0	
		L / 4VV	0.1						
			W > 0.1	-	0				
			-	L > 3	0				

MO	DEL
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Note :

- (1) Environmental conditions as bellows,
 - a. Room Temperature : $23 \pm 5^{\circ}$ C.
 - b. Lighting :
 - -. Cosmetic Inspection: 350Lux~800Lux.
 - -. Electrical Inspection: Under 200Lux.
- (2) Distance between the objective and eyes is 30 ± 5 cm.
- (3) Those which can be wiped out, e.g. Fingerprint, dust etc, is not counted as foreign material.
- (4) D=(L+W)/2



10.3. ELECTRICAL INSPECTION

ltem		Criteria				Judgment	
						Major	Minor
	Dot defect	Category	Max. Number	Min. Number			
		Bright dots	1	-			
		Dark dots	2	-			
1		Total dots defect	2				
1							
		Two or more	0	-			
		continuous dots					
	Black or White spot / Foreign Material	Blemish Size	Max. Number				
		(mm)	Active Area	Non-A.A.			
2		D≦0.2	Ignore	Ignore			0
		0.2 < D≦0.3	1				
		D > 0.3	0				
3	Line defect	Line defect is not allowed.				0	
4	Display function	Abnormal displaying is not allowed.					
5	No Display	No Displaying is not allowed.					

Note:

(1) Dot defect is defined as the defective area of the dot area is larger than

50% of the dot area.

(2) D=(L+W)/2



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