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Product Specification

2.45" COLOR TFT-LCD MODULE

MODEL NAME: A025CN02 V0

<◆>Preliminary Specification

< > Final Specification

Note: The content of this specification is subject to change.

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A. Physical specifications

NO.	Item	Specification	Remark
1	Display resolution(dot)	480(W) x234(H)	
2	Active area(mm)	49.2(W)x38.142(H)	
3	Screen size(inch)	2.45(Diagonal)	
4	Dot pitch(mm)	0.1025(W)x0.163(H)	
5	Color configuration	R. G. B. delta	
6	Overall dimension(mm)	59.2(W) x49.7(H) x3.4(D)	Note 1
7	Weight(g)	21.0 (typ)	
8	Panel surface treatment	Anti-Glare	

Note 1: Refer to Fig. 2

B. Electrical specifications

1. Pin assignment

a. TFT-LCD panel driving section

Pin no	Symbol	I/O	Description	Remark
1	VSCL2	I	VCAC level Selection	Note 6
2	VSCL1	I	VCAC level Selection	Note 6
3	VSCL0	I	VCAC level Selection	Note 6
4	GND	P	Digital ground for gate	
5	VCC	PI	Digital Power for gate (+3.3V)	
6	VCAC	PS	VCOM level supply	
7	VGoff_H	PS	Negative power supply (High) for gate	
8	VCOM	SO	Frame polarity output for panel VCOM	
9	VGoff_L	PS	Negative power supply (Low) for gate	
10	C3M	C	Power setting capacitor connect pin	
11	C3P	C	Power setting capacitor connect pin	
12	VGH	PI	Positive power supply for gate (+15V)	Option Note 7
13	GND	-	Ground	
14	FB_G	FI	Main boost regulator feedback input. FB threshold is 0.6V	
15	GND	-	Ground	
16	DRV_G	O	Power transistor gate signal for the boost converter	
17	GLED1		LED module 1 Cathode	
18	VLED1	PI	LED module 1 Anode	Option Note 7
19			N/C	
20			N/C	
21	DRV_S	O	Power transistor gate signal for the boost converter	
22	FB_S	FI	Main boost regulator feedback input. FB threshold is 0.6V	
23	GND	P	Digital ground for source	
24	SHL	I	Selects left or right shift (Default="H")	Note 1
25	STB	I	Standby mode (Normal operation="H", Default setting)	Note 2
26	VCC	PI	Digital power supply for source (+3.3V)	

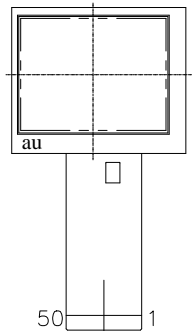
27	SHDB	I	Shutdown input (SHDB="L" DRV_S is off, Default="L")	Note 3
28	AVDD	PI	Analog power supply (+3.3V)	
29	AGND	P	Analog ground	
30	VSYNC	I	Vertical sync input (Negative polarity)	
31	HSYNC	I	Horizontal sync input (Negative polarity)	
32	GND	-	Ground	
33	DCLK	I	Clock Signal	
34	GND	-	Ground	
35	D07	I	Data input (MSB)	
36	D06	I	Data input	
37	D05	I	Data input	
38	D04	I	Data input	
39	D03	I	Data input	
40	D02	I	Data input	
41	D01	I	Data input	
42	D00	I	Data input (LSB)	
43	GND	-	Ground	
44	RSTB	I	Global reset pin (Default="H", Normal operation)	Note 5
45	SEL0	I	Data format selection (Default="L")	Note 4
46	SEL1	I	Data format selection (Default="L")	Note 4
47	SEL2	I	Data format selection (Default="L")	Note 4
48	U/D	I	Shift up or down control. (Default="H")	Note 1
49	Q1H	O	Data sequence control. Data sequence information	
50	VCOM_O	SI	VCOM Output	

I: Digital signal input, O: Digital signal output, P: GND, PI: Power input
C: Power setting capacitor connect pin, FI: Feedback input, PS: Power setting,
SO: VCOM signal output, SI: VCOM_O signal input,

Note 1: Selection of scanning mode

Mode	Setting of scan control input		Scanning direction
	U/D	SHL	
Normal mode	L	H	From up to down, and from left to right.
Reverse mode	H	L	From down to up, and from right to left.

Refer to figure as below:



Note 2: Stand by mode(STB). If STB high, it is normal operation. If it is low, it is standby function. Normally pulled high.

Note 3: Shutdown input (SHDB). Active low, DC-DC converter for White LED is off when SHDB is low, normally pulled low.

Note 4: Interface select pin. Suggest to pull Low for A025CN02 V0 Model.

Note 5: RSTB="L", the controller is reset.

RSTB="H", normal operation (RSTB should be connected to VCC). Default setting

SEL2	SEL1	SEL0	Data input format	Operating frequency
0	0	0	UPS051 path, special data format : DDX , 8-bits	9.7MHz (NTSC)
0	0	1	UPS051 path, special data format : DDX , 8-bits	9.7MHz (PAL1/6,8)
1	0	0	UPS052 path, normal data format : DIN , 8-bits	24.54MHz (NTSC)
1	0	1	UPS052 path, normal data format : DIN, 8-bits	24.54MHz (PAL1/6,8)

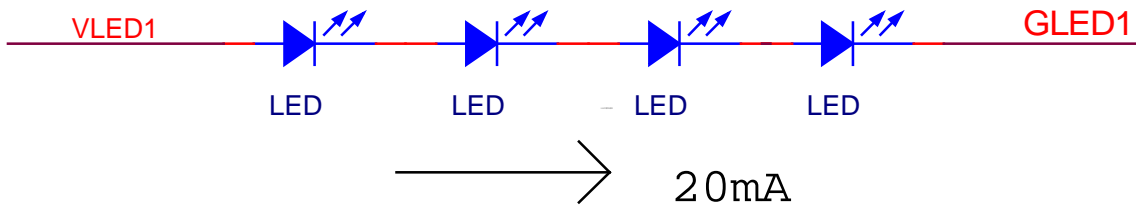
Note 6: Selection of VCAC level

VCSL2	VCSL1	VCSL0	Level (unit:V)
0	0	0	4.4
0	0	1	4.6
0	1	0	4.8
0	1	1	5.0
1	0	0	5.2
1	0	1	5.4
1	1	0	5.6(Default)
1	1	1	5.8

b. LED driving section

No.	Symbol	I/O	Description	Remark
Pin 17	GLED1	-	LED Cathode	
Pin 18	VLED1	-	LED Anode	

Refer to figure as below:



Note 7: A025CN02 V0 SIA (Smart Integration Advanced) solution provides internal PWM driving circuit (for V_{GH} , V_{GL} and LED backlight), application circuit as Fig10. Customer can use these internal driving circuit or provides private power supply as Fig 11~13.

2. Equivalent circuit of I/O

Pin no & Pin name	Schematics
21.DRV_S	TBD
22.FB_S 24.L/R 25.STB 27.SHDB	TBD

30.HSYNC	
31.VSYNC	
33.DCLK	
35.D07	
36.D06	
37.D05	
38.D04	
39.D03	
40.D02	
41.D01	
42.D00	
44.RSTB	
45.SEL0	
46.SEL1	
47.SEL2	
48.U/D	

3. Absolute maximum ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	V _{CC}	GND=0	-0.5	5	V	
	AV _{DD}	AV _{SS} =0	-0.5	7	V	
	V _{GH}	GND=0	13	17	V	
Operating temperature	Topa		0	60	°C	Ambient temperature
Storage temperature	Tstg		-25	80	°C	Ambient temperature

4. Electrical characteristics

a. Typical operating conditions (GND=AV_{SS}=0V)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply	V _{CC}	2.7	3.3	3.6	V	
	AV _{DD}	3.0	3.3	5	V	
	V _{GH}	14	15	16	V	
	VGoff_H	---	-10+VCAC	---	Vp-p	
	VGoff_L	---	-10	---	V	
VCOM	V _{CAC}	4.4		5.8	Vp-p	AC component, Note 1
	V _{CDC}		TBD		V	Note 2
Output Signal voltage	H Level	V _{OH}	V _{CC} -0.4		V	
	L Level	V _{OL}	GND	GND+0.4	V	
Input Signal voltage	H Level	V _{IH}	0.8V _{CC}	-	V _{CC}	V
	L Level	V _{IL}	GND	-	0.2V _{CC}	V
DRV output voltage	V _{DRV}	0		V _{CC}	V	
DRV output	IDRV			10	mA	

Feedback voltage	V_{FB}	0.55	0.6	0.65	V	
Output current	H Level	I_{OH}		10	μA	
	L Level	I_{OL}		-10	μA	
Analog stand by current	I_{st}			200	μA	DCLK is stopped
FRP output current	H Level	I_{OHF}		20	mA	For Vcom circuits.
	L Level	I_{OLF}		20	mA	

Note 1: The brightness of LCD panel could be adjusted by the adjustment of the AC component of VCOM.

Note 2: V_{CDC} could be adjusted so as to minimize vertical straight line, flicker and maximum contrast on each module.

b. Current consumption (GND=AVss=0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Current for driver	I_{GH}	$V_{GH}=15V$	---	---	1.5	mA	
	I_{CC}	$V_{CC}=3.3V$	---	3.0	3.5	mA	
	I_{DD}	$AV_{DD}=3.3V$	---	1.5	2	mA	CLK=9.7MHz

c. LED driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current			20		mA	
LED voltage	V_L			16	V	
LED Life Time	L_L	10000			Hr	Note 1,2

Note 1 : $T_a = 25^\circ C$, $I_L = 20mA$

Note 2 : Brightness to be decreased to 50% of the initial value.

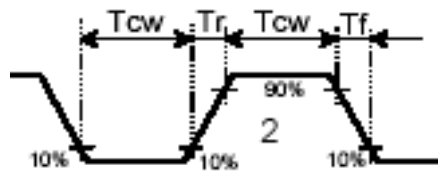
5. AC Timing

a. Timing conditions

Parameter		Symbol	Min.	Typ.	Max.	Unit.	Remark
DCLK	Frequency	$1/T_{vc}$	-	9.7	-	MHz	
	Duty cycle	T_{cw}	40	50	60	%	
	Rising time	t_r	-		10	ns	
	Falling time	t_f	-		10	ns	
HSYNC	Period	TH	60	63.56	67	μs	Note 2
				617		DCLK	
	Display period	THd		49.4		μs	
	Pulse width	THp	5	44		DCLK	
	HSYNC-Clk timing	THc	20		$T_{vc}-20$	ns	
Hsync setup time		Thst	12			ns	
Hsync hold time		Thhd	12			ns	
Horizontal lines per field		t_v	256	262	268	t_H	
VSYNC	Period	TV		16.6		ms	Note 2
					262		

	Display period	TVd		14.83		ms	
	Pulse width	TVp	1			DCLK	
			3			TH	
Vsync setup time		Tvst	12			ns	
Vsync hold time		Tvhd	12			ns	
DATA D00~D07	DCLK-DATA timing	Tds	12	-	-	ns	
	DATA-CLK timing	Tdh	-	-	10	ns	
	Rising time Falling time	Tdrf	-	-	10	ns	

Note 1 DCLK Tr and Tf is defined at 10%~90%. Refer to figure as below:



Note 2: Display position

A.. Horizontal display position

The display starts from the data of (105DCLK, TH=105DCLK) as shown in Fig 5.

(THE : From Hsync falling edge to 1st displayed data.)

B. Vertical display position

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Vertical display position	TVS		18		TH	NTSC

b. Timing diagram

Please refer to the attached drawing, from Fig.5 to Fig.8.

6. Boost Converter

A025CN02 V0 main boost converter uses a boost PWM architecture to produce a positive regulated voltage. Please refer to the below figures to see the block diagram.

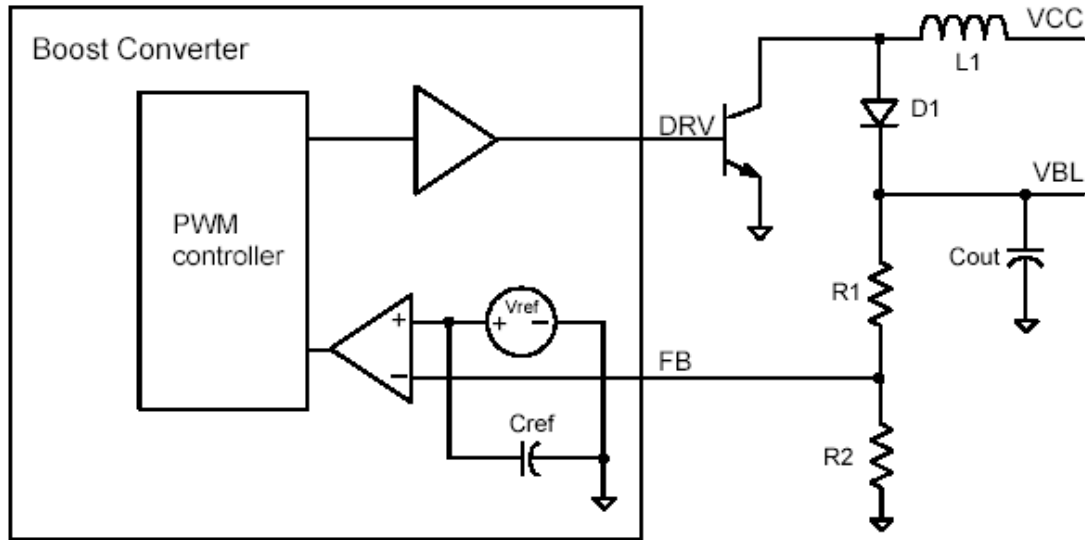


Fig 1 DC-DC converter block diagram

C. Optical specification (Note 1, Note 2, Note 3)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	$\theta = 0^\circ$	-	25	50	ms	Note 4
	Fall		-	30	60	ms	
Contrast ratio	CR	At optimized viewing angle	100	150	-		Note 5,6
Viewing angle	Top	$CR \geq 10$	10	-	-	deg.	Note 7
	Bottom		30	-	-		
	Left		45	-	-		
	Right		45	-	-		
Brightness	Y_L	$\theta = 0^\circ$	200	230	-	cd/m^2	Note 8
White chromaticity	X	$\theta = 0^\circ$		TBD			
	y	$\theta = 0^\circ$		TBD			

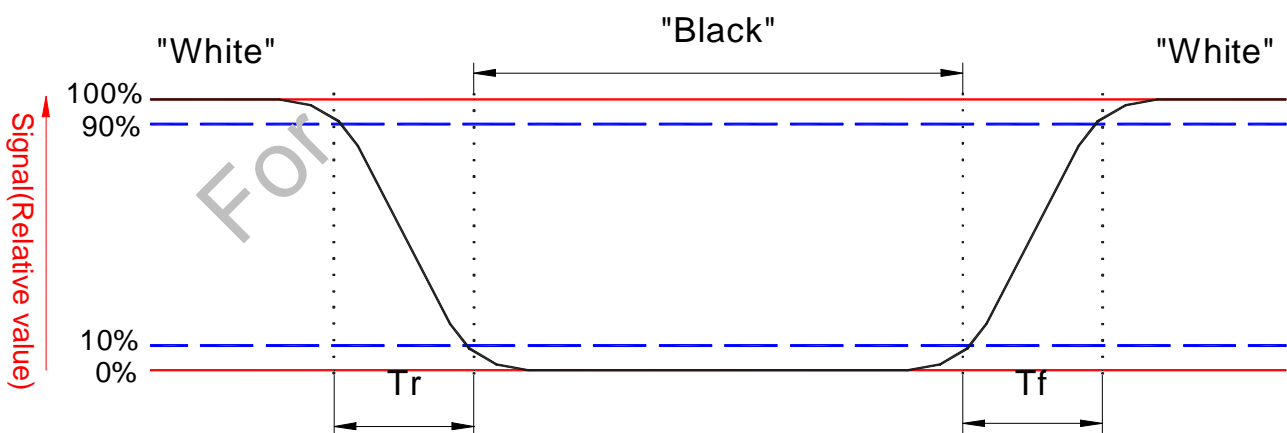
Note 1. Ambient temperature = 25°C. And backlight current $I_L = 20\text{ mA}$

Note 2. To be measured in the dark room.

Note 3. To be measured on the center area of panel with a field angle of 1° by Topcon luminance meter BM-7, after 10 minutes operation.

Note 4. Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note 6. White $V_i = V_{i50} \mp 1.5V$

Black $V_i = V_{i50} \pm 2.0V$

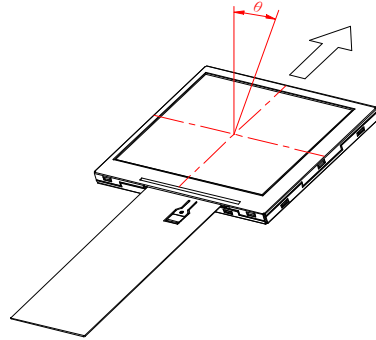
"±" Means that the analog input signal swings in phase with COM signal.

“ $\bar{}$ ” Means that the analog input signal swings out of phase with COM signal.

V_{i50}^+ : The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 7. Definition of viewing angle:, refer to figure as below.



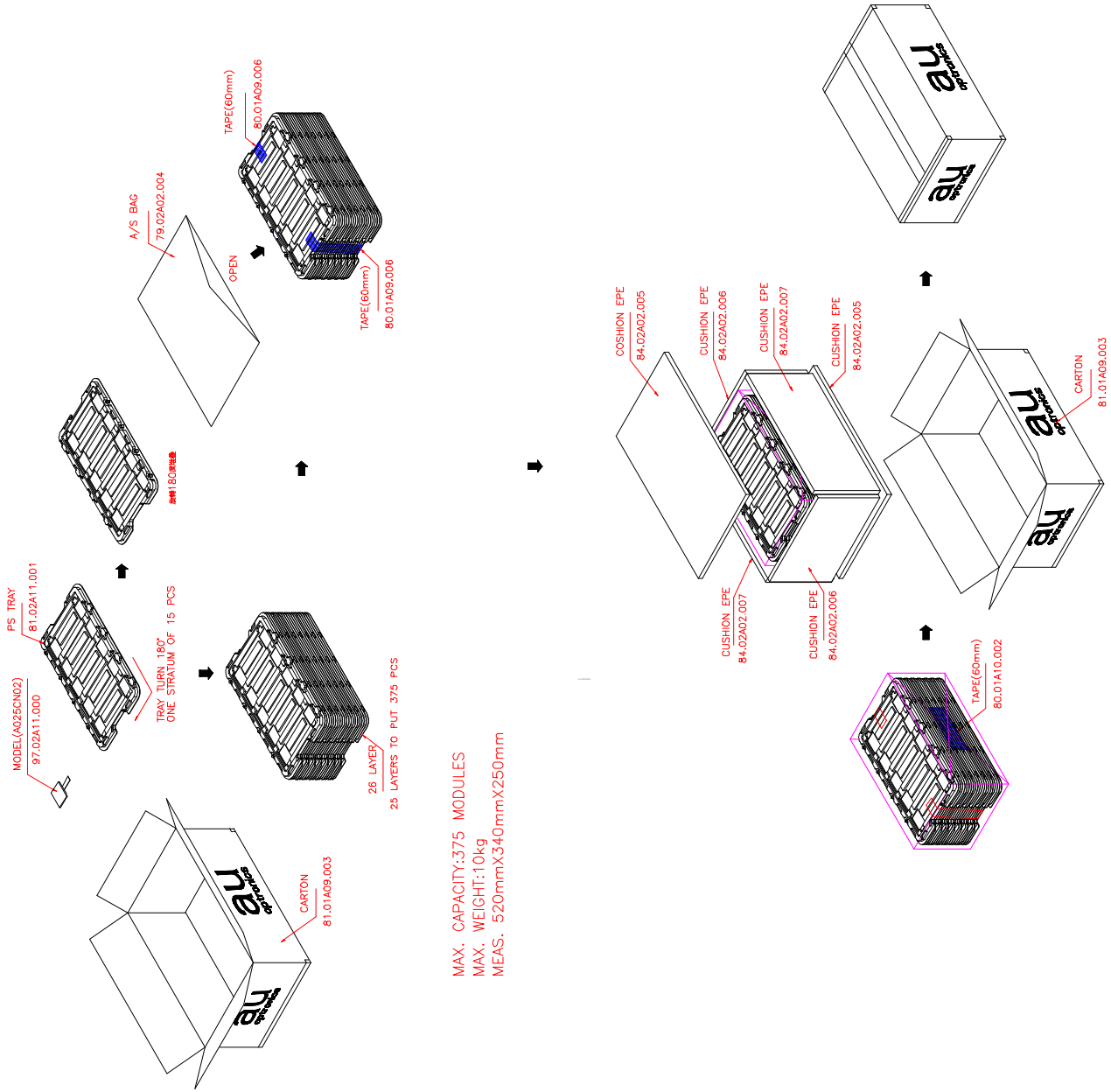
Note 8. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

D. Reliability test items:

No.	Test items	Conditions	Remark
1	High temperature storage	Ta= 80°C 240Hrs	
2	Low temperature storage	Ta= -25°C 240Hrs	
3	High temperature operation	Ta= 60°C 240Hrs	
4	Low temperature operation	Ta= 0°C 240Hrs	
5	High temperature and high humidity	Ta= 60°C . 90% RH 240Hrs	Operation
6	Heat shock	-25°C~80°C, 50 cycle, 2Hrs/cycle	Non-operation
7	Electrostatic discharge	±200V,200pF(0Ω), once for each terminal	Non-operation
8	Vibration	Frequency range : 10~55Hz Stoke : 1.5mm Sweep : 10~55Hz~10Hz 2 hours for each direction of X,Y,Z (6 hours for total)	Non-operation JIS C7021, A-10 condition A
9	Mechanical shock	100G . 6ms, ±X,±Y,±Z 3 times for each direction	Non-operation JIS C7021, A-7 condition C
10	Vibration (with carton)	Random vibration: 0.015G ² /Hz from 5~200Hz -6dB/Octave from 200~500Hz	IEC 68-34
11	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	

Note: Ta: Ambient temperature.

E. Packing form



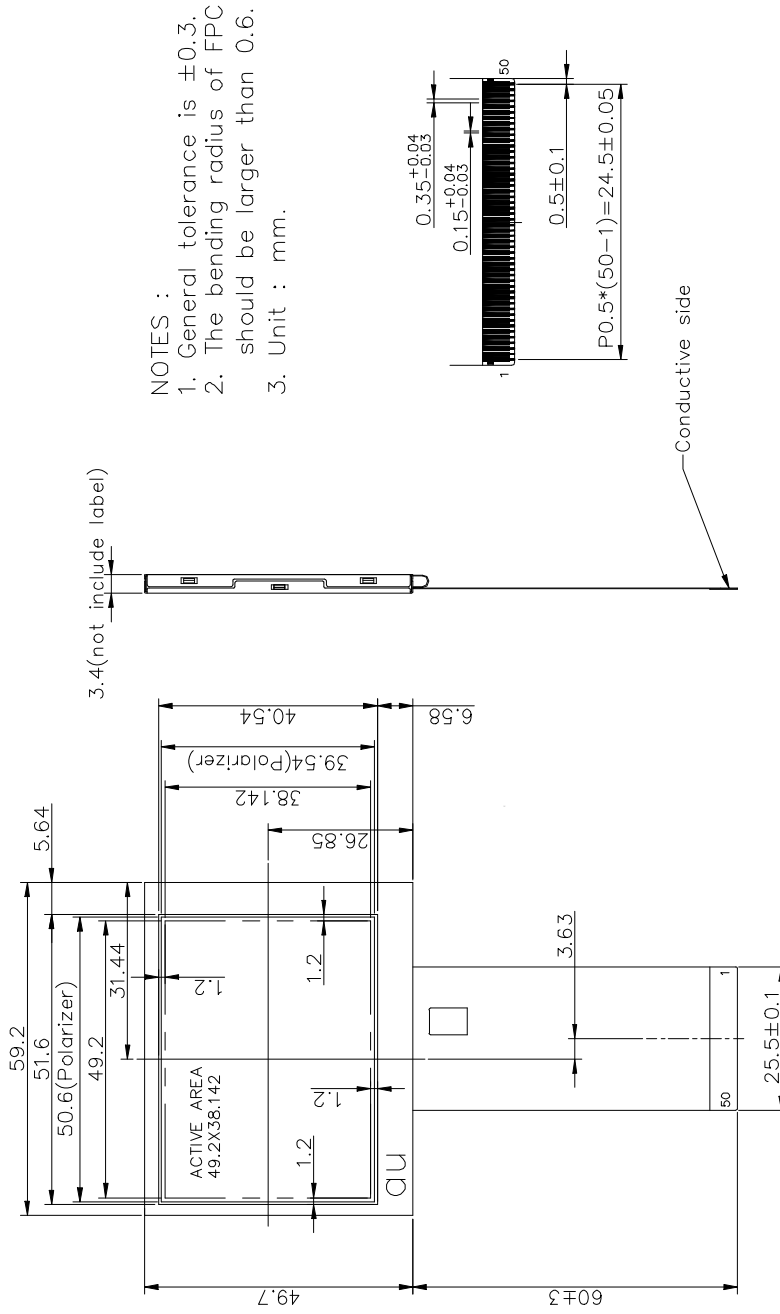


Fig. 4 outline dimension of TFT-LCD module

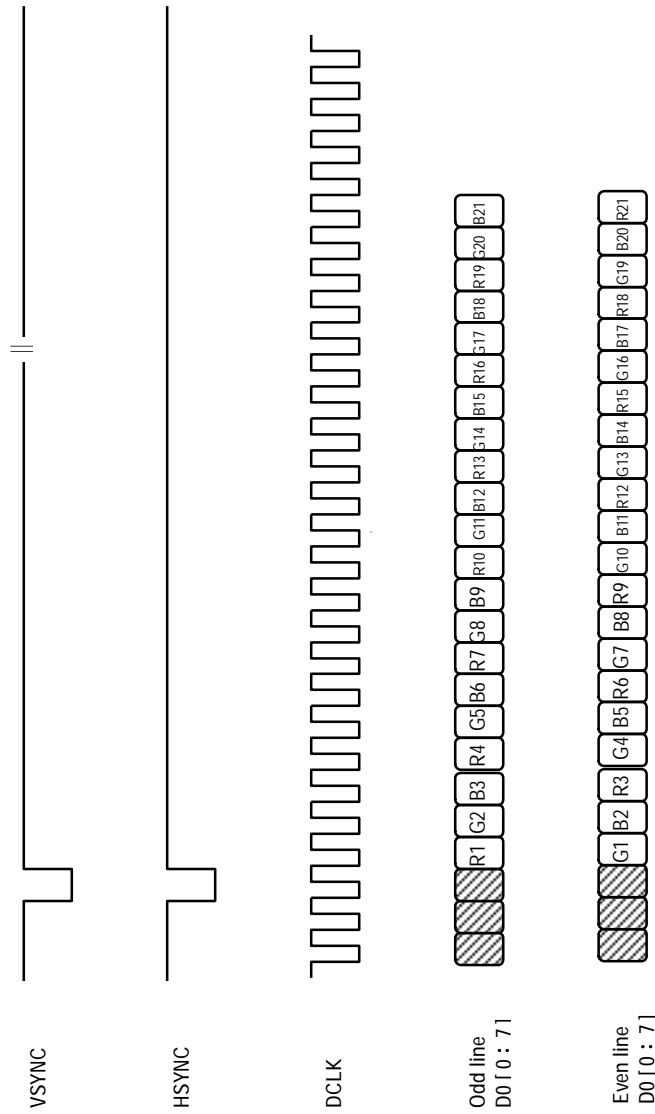


Fig. 5 Input signals timing relationship

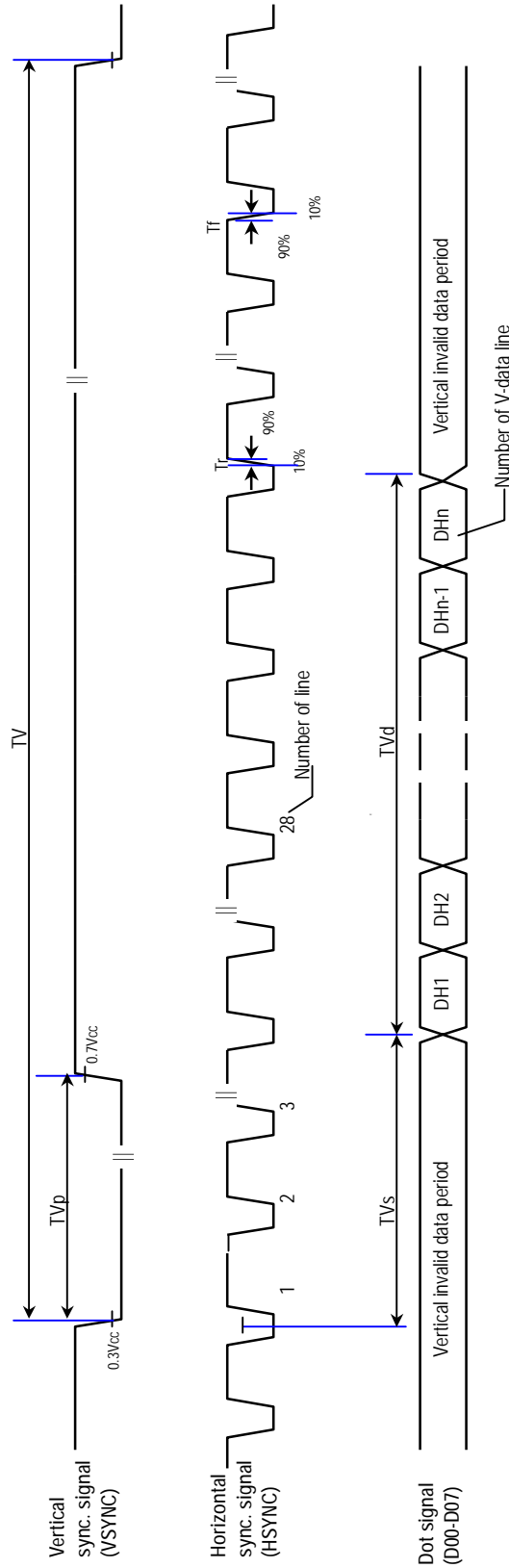


Fig. 6 Input Vertical Timing

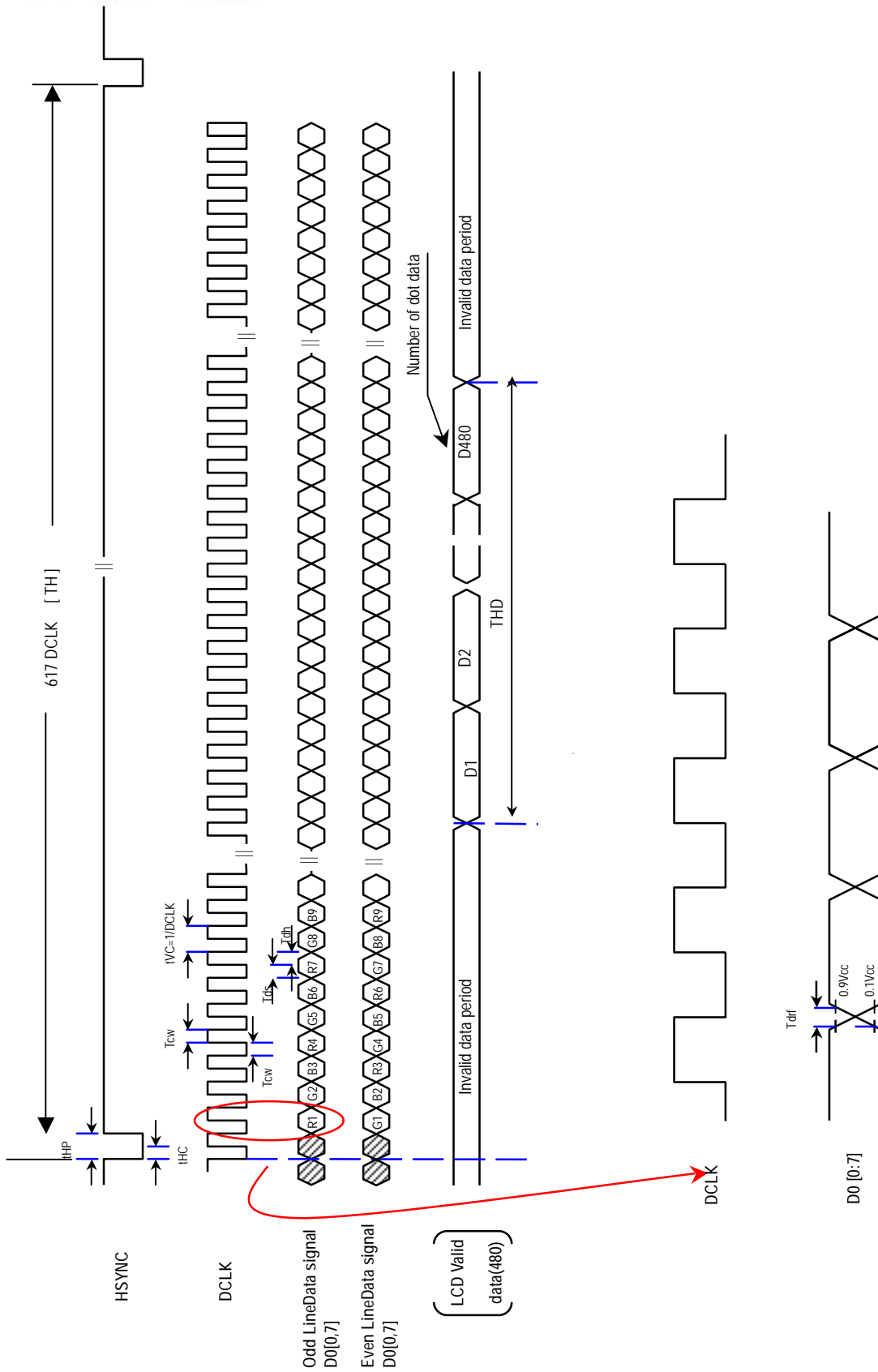
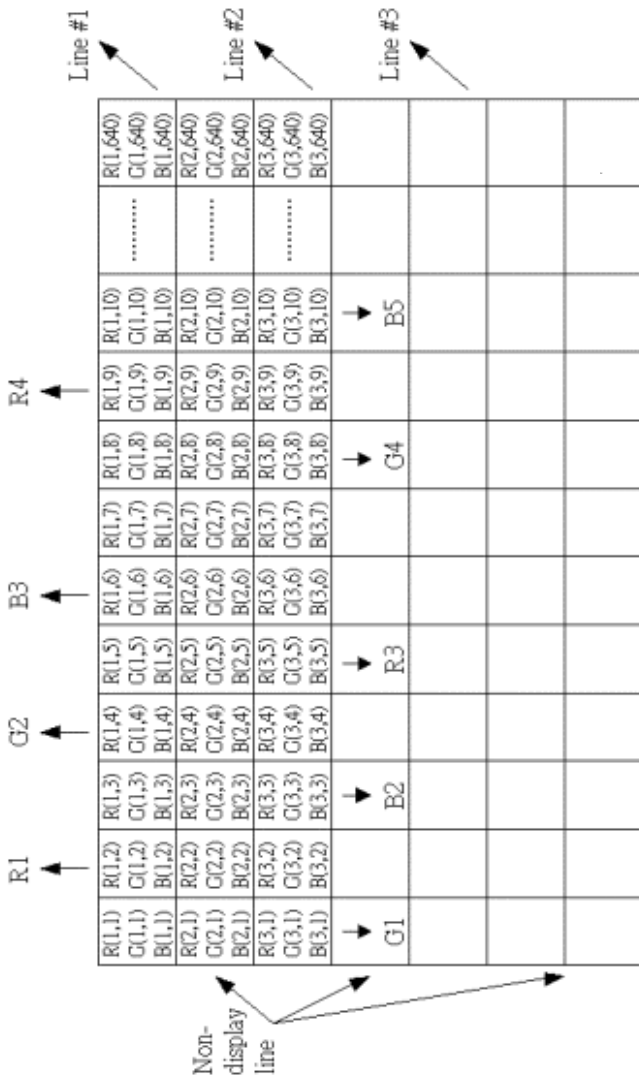
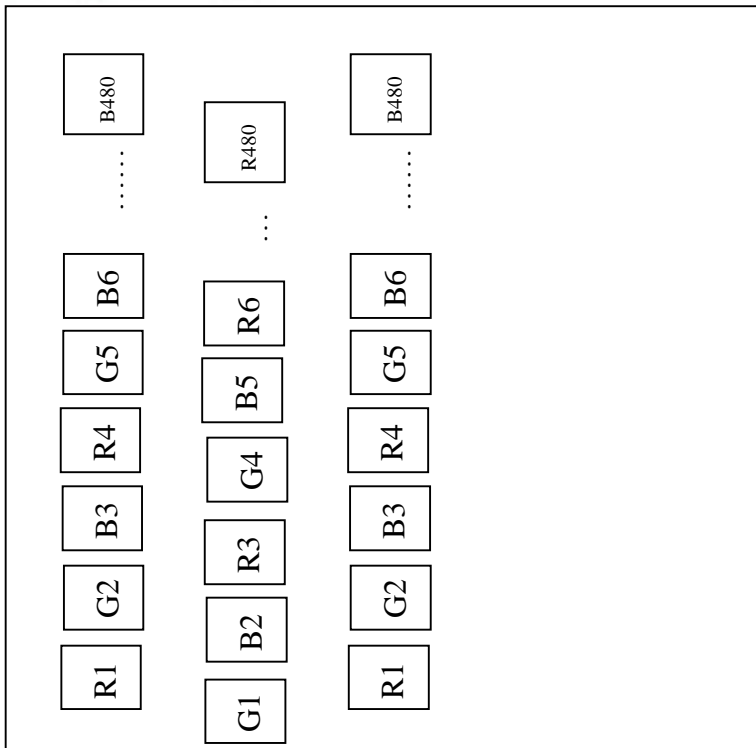


Fig. 7 Horizontal Input Timing



VGA Memory

Fig. 8 Extraction of display data from memory to panel

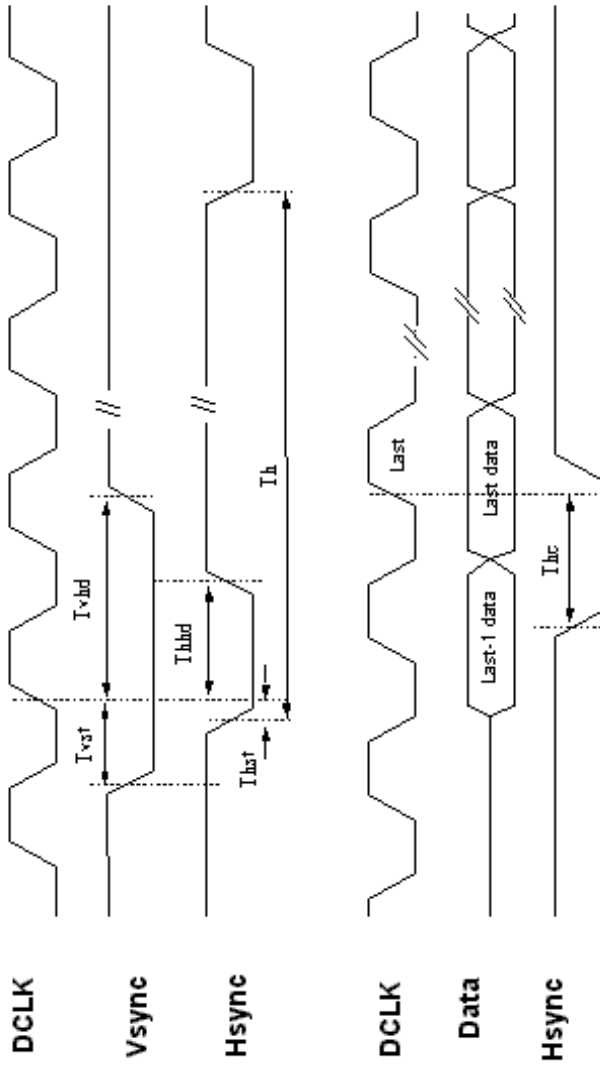
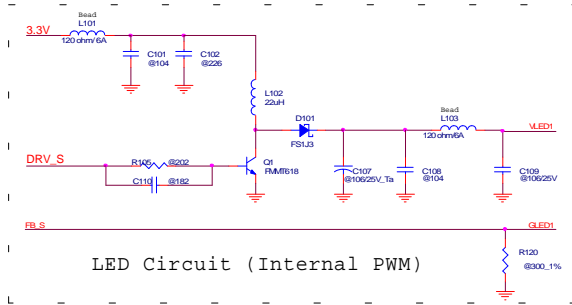
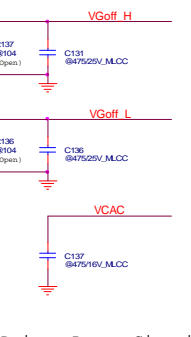
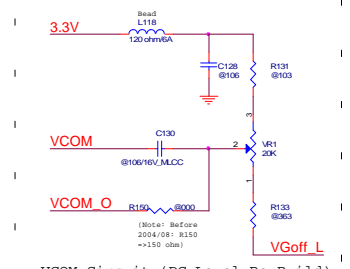
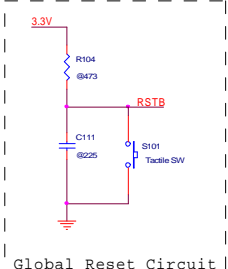
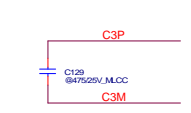
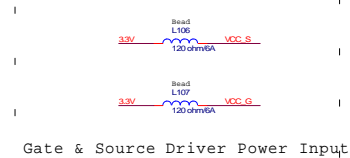
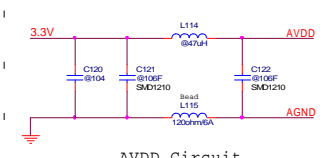
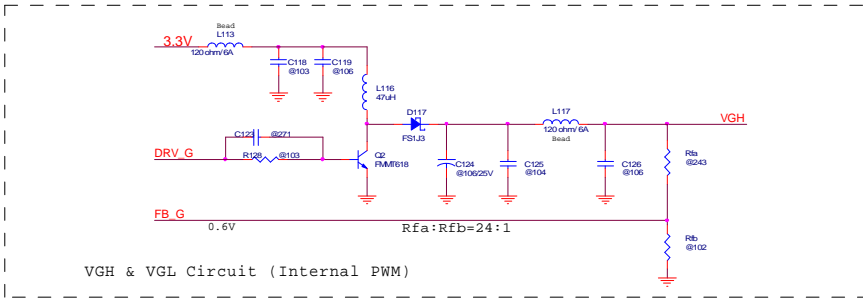


Fig. 9 Hsync, Vsync, Data, DCLK relationship



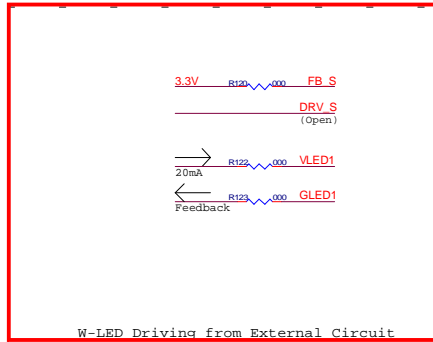
VCOM_O	50	J102
VCOM_L	49	VCOM_L
Q1H	48	Q1H
Q1D	47	Q1D
Q1C	46	Q1C
SEL1	45	SEL1
SEL0	44	SEL0
RSTB	43	RSTB
D00	42	GND
D01	41	D01
D02	40	D02
D03	39	D03
D04	38	D04
D05	37	D05
D06	36	D06
D07	35	D07
D08	34	D08
D09	33	GND
D10	32	D10
HSYNC	31	GND
VSYNC	30	HSYNC
VCOM2	29	VSYNC
AGND	28	AGND
AVDD	27	AVDD
STB	26	STB
VCC_S	25	VCC
STB	24	STB
STL	23	STL
FB_S	22	GND
FB_S	21	FB_S
GLED2	20	DRV_S
GLED1	19	GLED2
VLED2	18	VLED2
VLED1	17	VLED1
DRV_G	16	DRV_G
FB_G	15	FB_G
GND	14	GND
VGH	13	VGH
VST	12	VST
CSP	11	CSP
CSP	10	CSP
VGH_L	09	VGH_L
VCOM	08	VCOM
VCOM	07	VCOM
VGH_H	06	VGH_H
VCC_G	05	VCC_G
GND	04	GND
GND	03	GND
VCOM_O	02	VCOM_O
VCOM_L	01	VCOM_L
VCOM2	01	VCOM2

Connect950

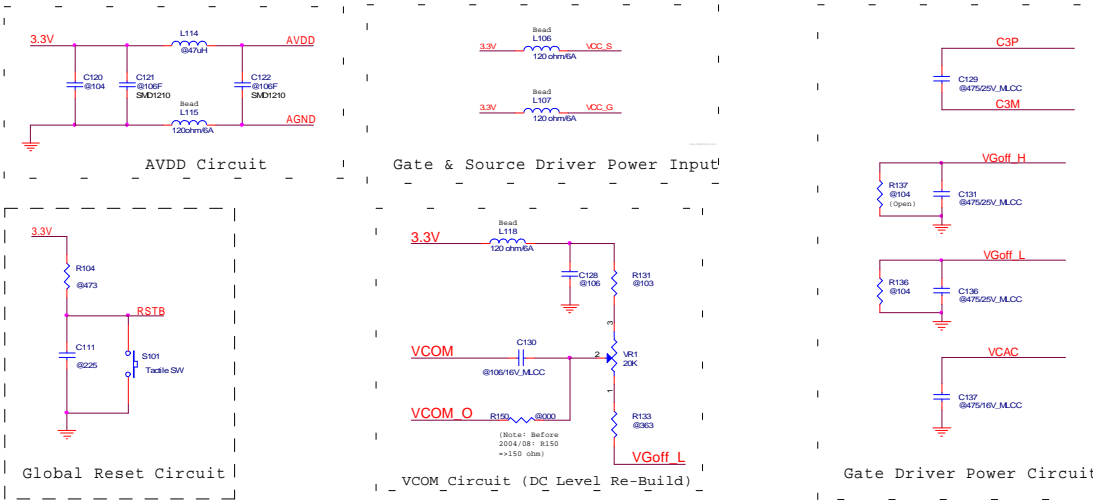
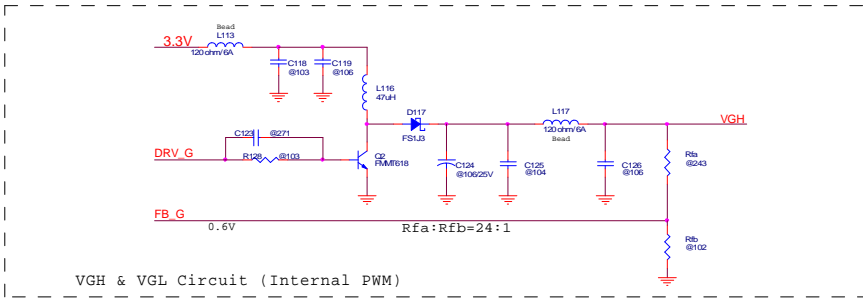


Note: Application circuit for using internal V_{GH} & V_{GL}, LED backlight driving function of drive IC

Fig. 10 Typical application circuit

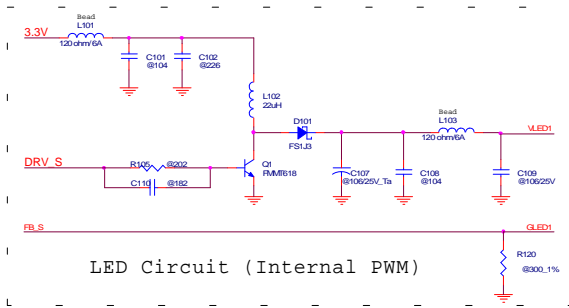


J102	
VCOM_O	50
G1H	49
UID	48
VCC	47
SEL2	46
SEL1	45
SEL0	44
RSTB	43
GNP	42
D00	41
D01	40
D02	39
D03	38
D04	37
D05	36
D06	35
D07	34
GNP	33
DCLK	32
GNP	31
HSYNC	30
VCOM	29
AVDD	28
AGND	27
VCC	26
STB	25
STL	24
GNP	23
FB_S	22
DRV_S	21
GLEDD	20
GLEDD	19
VLED1	18
VLED1	17
DRVS	16
FB_G	15
GNP	14
GNP	13
VGH	12
CSP	11
CSP	10
VCC_L	09
DRVS	08
VCOM	07
VCC_G	06
VCC	05
GNP	04
VCC_L0	03
VCC_L1	02
VCC_L2	01



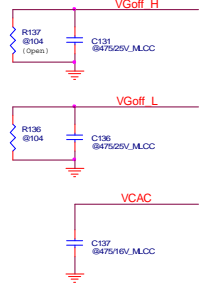
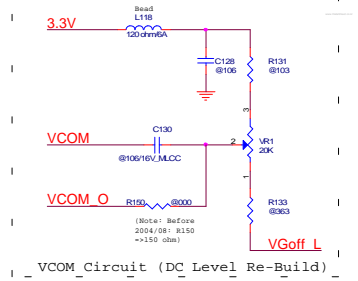
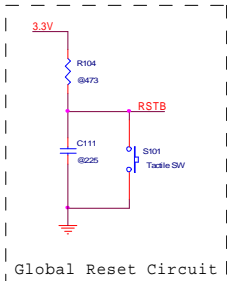
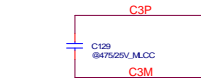
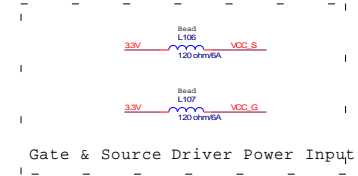
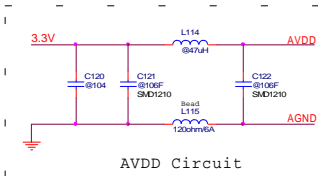
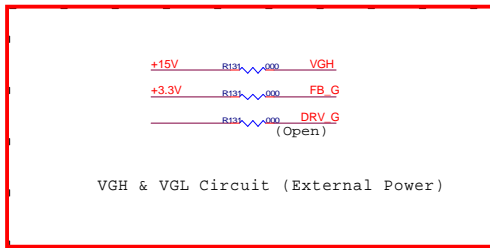
Note: Application circuit for only using internal V_{GH} & V_{GL} driving function of drive IC. Customer provides private LED driving circuit.

Fig. 11 Application circuit for LED driving circuit unused



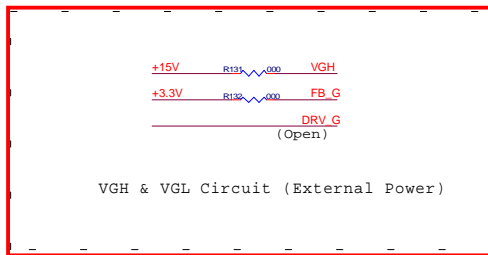
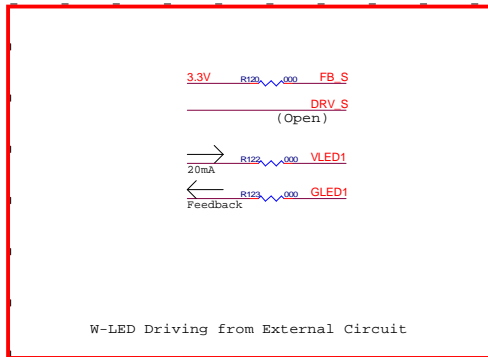
VCOM_O	50	J102
DPH	49	VCOM_O
LD	48	Q1H
LD	47	LED
SEL1	46	SEL2
SEL1	45	SEL0
RSTB	44	RSTB
DD	43	DD
DD	42	DD
DD1	41	DD1
DD2	40	DD2
DD3	39	DD3
DD4	38	DD4
DD5	37	DD5
DD6	36	DD6
DD7	35	DD7
GND	34	GND
CLK	33	CLK
GND	32	CLK
HSYNC	31	GND
VSNC	30	HSYNC
GND	29	VSNC
AUD	28	AGND
SPB	27	AGND
VCC_S	26	SPB
SPB	25	VCC_S
STB	24	STB
GND	23	GND
FB_S	22	FB_S
DRV_S	21	DRV_S
GLED2	20	GLED2
VLED2	19	VLED2
GLED1	18	VLED1
VLED1	17	GLED1
DRV_G	16	DRV_G
FB_G	15	FB_G
FB_G	14	FB_G
GND	13	GND
VGH	12	VGH
CSP	11	CSP
CSP	10	CSP
CSP	9	CSP
VCC_H	8	VCC_H
VCC_H	7	VCC_H
VCC	6	VCC
VCC	5	VCC
GND	4	GND
VCSL0	3	VCSL0
VCSL1	2	VCSL1
VCSL2	1	VCSL2

Connecte50



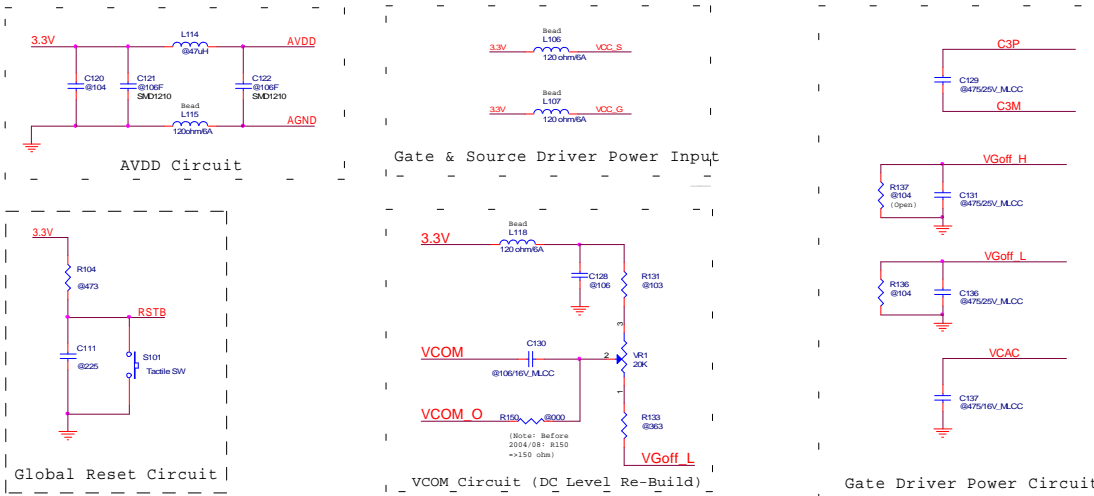
Note: Application circuit for only using internal LED driving function of drive IC. Customer provides private V_{GH} & V_{GL} driving circuit.

Fig. 12 Application circuit for V_{GH} & V_{GL} driving circuit unused



J102	
VCOM_O	50
G1H	49
G1H	48
U10	47
SEL1	46
SEL2	45
SEL3	44
RSTB	43
GND	42
DO0	41
DO1	40
DO2	39
DO3	38
DO4	37
DO5	36
DO6	35
DO7	34
GND	33
DO8	32
DO9	31
HSYNC	30
VSYNC	29
AGND	28
AGND	27
VCC_S	26
VCC_S	25
STB	24
GND	23
FB_S	22
DRV_S	21
GLED2	20
VLED2	19
VLED1	18
GLED1	17
DRV_G	16
GND	15
FB_G	14
GND	13
VGH	12
GND	11
CSP	10
CSP	09
VCOM_L	08
VCOM_H	07
VCOM	06
VCOM	05
VCC_G	04
GND	03
VSEL0	02
VSEL1	01
VSEL2	01

Connected50



Note: Application circuit for that customer provides private both LED driving V_{GH} & V_{GL} driving circuit.

Fig. 13 Application circuit for both LED driving and V_{GH} & V_{GL} driving circuit unused