SPECIFICATION

KYOCERA

TCG057VGLCAANN-GN20

5.7" - VGA - LVDS

Version:
Date: 19.02.2024

Note: This specification is subject to change without prior notice

www.data-modul.com

SPEC for Sample Production

Spec No.	TQ3C-8EAF0-E1YBD90-00
Date	February 19, 2024

TYPE : TCG057VGLCAANN-GN20

< 5.7 inch VGA transmissive color TFT with LED backlight
and constant current circuit for LED backlight >

CONTENTS

1. Application
2. Construction and outline
3. Mechanical specifications
4. Absolute maximum ratings
5. Electrical characteristics
6. Optical characteristics
7. Interface signals
8. Input timing characteristics
9. Lot number identification
10. Warranty
11. Precautions for use
12. Reliability test data
13. Outline drawing

KYOCERA CORPORATION

This specification is subject to change without notice.
Consult Kyocera before ordering.

Warning

1. This Kyocera LCD module has been specifically designed for use only in electronic devices and industrial machines in the area of audio control, office automation, industrial control home appliances, etc. The module should not be used in applications where the highest level of safety and reliability are required and module failure or malfunction of such module results in physical harm or loss of life, as well as enormous damage or loss. Such fields of applications include, without limitation, medical, aerospace, communications infrastructure, atomic energy control. Kyocera expressly disclaims any and all liability resulting in any way to the use of the module in such applications.

2. Customer agrees to indemnity, defend and hold Kyocera harmless from and against any and all actions, claims, damages, liabilities, awards, costs, and expenses, including legal expenses, resulting from or arising out of Customer's use, or sale for use, or Kyocera modules in applications.

Caution

1. Kyocera shall have the right, which Customer hereby acknowledges, to immediately scrap or destroy tooling for Kyocera modules for which no Purchase Orders have been received from the Customer in a two-year period.

2. Please note that we may not be able to respond to new environmental regulations after receiving the final mass production order for this product.

Revision record

Date	Designed by：Engineering dept.			Confirmed by：QA dept.
	Prepared	Checked	Approved	Approved

Rev.No.	Date	Page	Descriptions

1. Application

This document defines the specification of TCG057VGLCAANN-GN20. (RoHS Compliant)

2. Construction and outline

LCD	: Transmissive color dot matrix type TFT
Backlight system	: LED
Polarizer	: Glare treatment
Interface	: LVDS
Additional circuit	: Timing controller, Power supply (3.3V input) (with constant current circuit for LED Backlight)

3. Mechanical specifications

Item	Specification	Unit
Outline dimensions	127.2 (W)× 100.4 (H) × 5.7 (D)	mm
Active area	115.2 (W) × 86.4 (H) (14.4cm / 5.7 inch (Diagonal))	mm
Dot format	640×(B,G,R) (W) × 480 (H)	dot
Dot pitch	0.06 (W) × 0.18 (H)	mm
Base color 1)	Normally White	-
Mass	110	g

1) Projection not included. Please refer to outline for details.

2) Due to the characteristics of the LCD material, the color varies with environmental temperature.

4. Absolute maximum ratings

4-1. Electrical absolute maximum ratings

Item		Symbol	Min.	Max.	Unit
Supply voltage(+3.3V)		V_{DD}	-0.3	4.0	V
Supply voltage(+5V)		V_{IN}	-0.3	6.0	V
Input signal voltage 1)	RxINi+, RxINi- 2)	V_{I1}	-0.3	V_{DD}+0.3	V
	CK IN+, CK IN-	V_{I2}	-0.3	V_{DD}+0.3	V
	SC	V_{I3}	-0.3	V_{DD}+0.3	V
	BLEN, BLPWM, VBRT	V_{I4}	-0.3	V_{IN}+0.3	V
LED OPEN Pin current		I_{OPLED}	0	100	mA

1) V_{DD} must be supplied correctly within the range described in 5-1.
2) i=0,1,2

4-2. Environmental absolute maximum ratings

Item	Symbol	Min.	Max.	Unit
Operating temperature 1)	T_{OP}	-20	70	°C
Storage temperature 2)	T_{STO}	-30	80	°C
Operating humidity 3)	H_{OP}	10	4)	%RH
Storage humidity 3)	H_{STO}	10	4)	%RH
Vibration	-	5)	5)	-
Shock	-	6)	6)	-

1) Operating temperature means a temperature which operation shall be guaranteed. Since display performance is evaluated at 25°C, another temperature range should be confirmed.
2) Ta (Ambient Temperature) = -30°C＜48h, Ta = 80°C＜168h
Store LCD panels at normal temperature/humidity. Keep them free from vibration and shock. An LCD panel that is kept at a low or a high temperature for a long time can be defective due to other conditions, even if the low or high temperature satisfies the standard.
(Please refer to "Precautions for Use" for details.)
3) Non-condensing
4) Ta ≦40°C, 85%RH Max.
Ta ＞40°C, Absolute humidity shall be less than 85%RH at 40°C.
5)

Frequency	10～55 Hz	Acceleration value (0.3～9 m/s^2)
Vibration width	0.15mm	
Interval	10-55-10 Hz 1 minute	

2 hours in each direction X, Y, Z (6 hours total)
EIAJ ED-2531

6) Acceleration: 490 m/s^2, Pulse width: 11 ms
3 times in each direction: ±X, ±Y, ±Z
EIAJ ED-2531

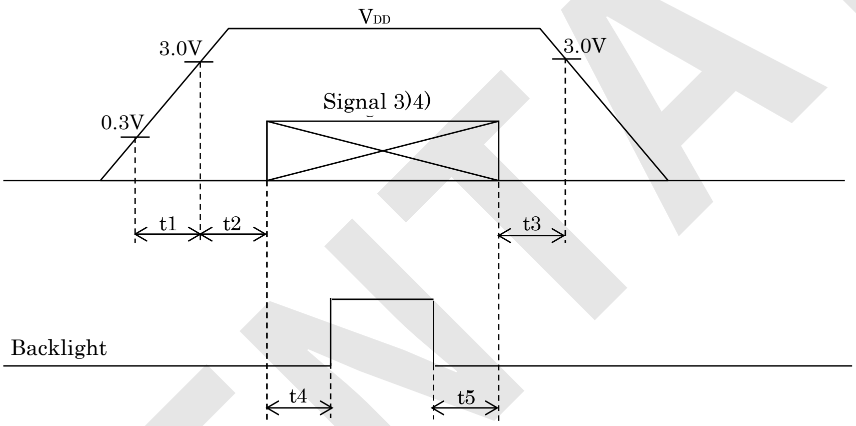
5. Electrical characteristics

5-1. LCD

Ta = -20～70°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage for logic 1)	V_{DD}	—	3.0	3.3	3.6	V
Current consumption for logic	I_{DD}	2)	—	(180)	(235)	mA
Permissive input ripple voltage	V_{RP}	—	—	—	100	mVp
Input signal voltage 3)	V_{IL}	"Low" level	0	—	$0.2V_{DD}$	V
	V_{IH}	"High" level	$0.8V_{DD}$	—	V_{DD}	V
LVDS Input voltage 4)	V_{TL}	"Low" level	-0.1	—	—	V
	V_{TH}	"High" level	—	—	0.1	V
	$\lvert V_{ID} \rvert$	—	0.1	—	0.45	V
	V_{ICM}	—	$0.15+\lvert V_{ID} \rvert/2$	—	$2.25-\lvert V_{ID} \rvert/2$	V
Terminal resistance	R_1	—	—	100	—	Ω

1) V_{DD}-turn-on conditions


V_{DD}
3.0V
0.3V
3.0V
Signal 3)4)
t1
t2
t3
Backlight
t4
t5

0＜t1≦20ms

0＜t2≦50ms

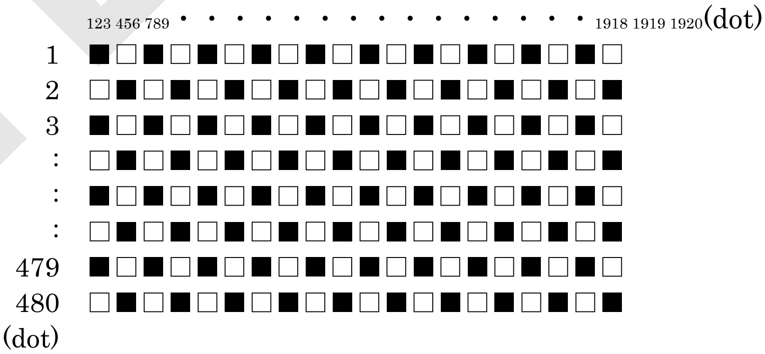
0＜t3≦1s

25 frame refresh ≦t4

0≦t5

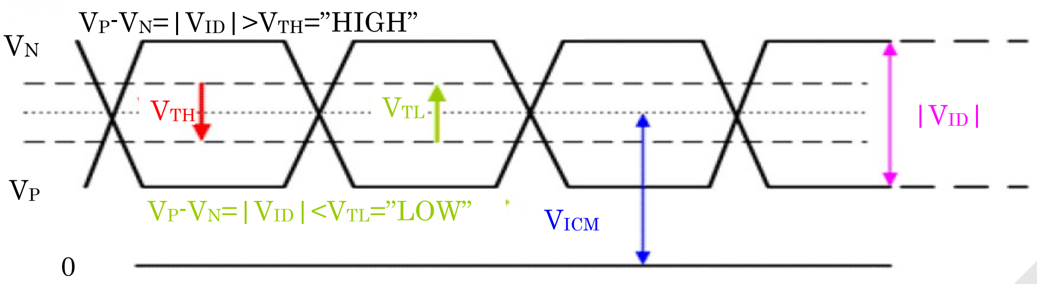
2) Display pattern:

V_{DD} = 3.3V, Ta = 25°C


123 456 789 · · · · · · · · · · · · · · 1918 1919 1920(dot)
1
2
3
:
:
:
479
480
(dot)

3) Input signal : SC

4) Input signal : RxIN0-/+、RxIN1-/+、RxIN2-/+、CK IN-/+

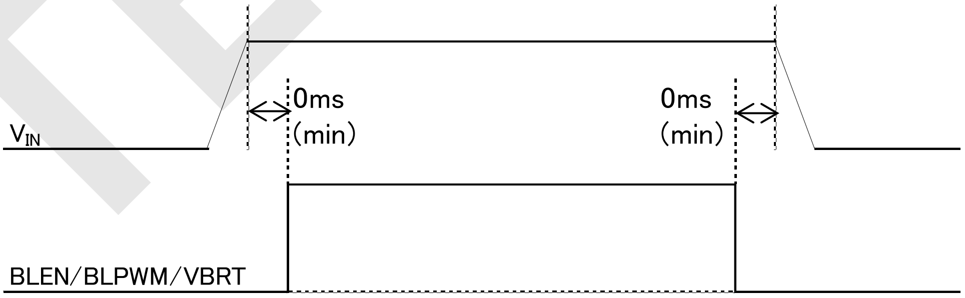

V_P-V_N=|V_{ID}|>V_{TH}="HIGH"
V_N
V_{TH}
V_{TL}
|V_{ID}|
V_P
V_P-V_N=|V_{ID}|<V_{TL}="LOW"
V_{ICM}
0

5-2. Constant current circuit for LED Backlight

Ta= -20～70°C

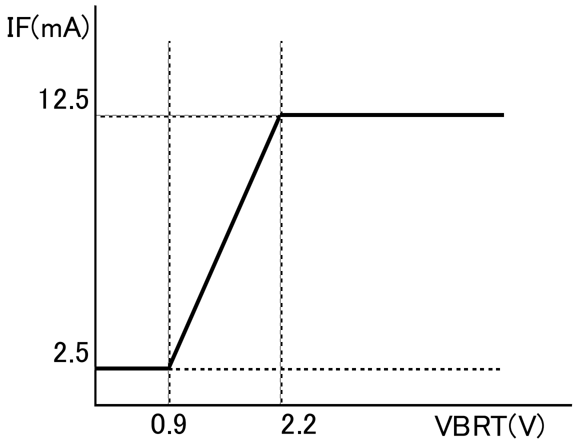
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage 1)	V_{IN}	-	3.0	5.0	5.5	V
Current consumption	I_{IN}	2)	-	(300)	(400)	mA
BLEN Input signal voltage	V_{IL_BLEN}	Backlight OFF	0	-	0.8	V
	V_{IH_BLEN}	Backlight ON	2.3	-	V_{IN}	V
VBRT Input signal voltage	V_{IL_VBRT}	"Low" level	0	-	0.8	V
	V_{IH_VBRT}	"High" level	2.3	-	V_{IN}	V
VBRT "Low" level threshold	L th	3)	0.8	0.9	-	V
VBRT "High" level threshold	H th	3)	-	2.2	2.3	V
LED Forward current	IF	VBRT: Low level	2.0	2.5	3.0	mA
		VBRT: High level	11.5	12.5	13.5	mA
BLPWM Input signal voltage	V_{IL_BLPWM}	Backlight OFF	0	-	0.8	V
	V_{IH_BLPWM}	Backlight ON	2.3	-	V_{IN}	V
PWM Frequency 4)	f_{PWM}	-	100	-	-	Hz
PWM Duty ratio 4)	D_{PWM}	PWM Ton	5	-	-	μs
Operating life time 5), 6)	T	Temp.=25°C	-	50,000	-	h

1) V_{IN}-turn-on conditions



2) V_{IN} = 5V, Ta = 25℃, VBRT=2.3V～、BLPWM = 100%

3) VBRT



Within the range of Typ. 0.9～2.2V, consecutive dimming is possible.

4) In case of lower frequency, the deterioration of the display quality, flicker etc., may occur.

5) When brightness decrease 50% of minimum brightness.
The average life of a LED will decrease when the LCD is operating at higher temperatures.

6) Life time is estimated data. (Condition: IF=12.5mA, Temp.=25°C in chamber).

5-3. LED open detection

Ta = -20～70°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
BLPWM frequency of LED open detection	-	BLPWM Ton≧5μs	100	-	-	Hz
BLPWM Ton of LED open detection	-	PWM Frequency≧100Hz	5.0	-	-	μs
LED open Sink current	I sink	-	-	-	100	mA
Leak current	I leak	-	-	-	1.0	mA
Recovery time from LED open state *	Rtime	-	-	-	1	s

* When abnormal condition is resolved in the middle of the operation, OPLED terminal return to normal operating condition from open detection condition within one second.

1) OPLED terminal detected abnormal state when LED forward current does not flow caused by opening more than one out of three LED lines or other failures.
2) OPLED terminal keeps FET's open drain inside the circuit, FET comes to turn on at abnormal state.
3) IF you use OPLED terminal, you must connect with outside terminal of voltage through pull-up resistance. At abnormal state, OPLED terminal threshold voltage changes from "H" level to "L" level.
4) LED open detecting function is effective at only working condition of LED driving circuit.
5) By driving PWM dimming, LED open detecting function comes to be effective under some conditions.
6) A small amount of current would appear at in-build FET's drain leakage at normal state.
7) LED driving circuit is unstable a period of 20ms from V_{IN} and BLEN turning on, or to stop driving by BLEN off. Therefore, LED open detecting may occur malfunction.

6. Optical characteristics

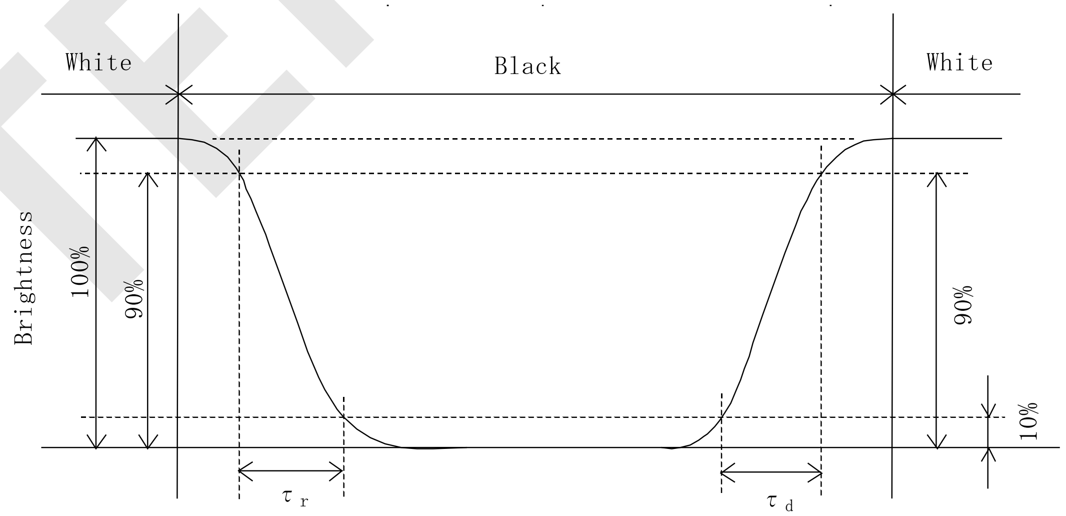
Measuring spot = ϕ 6.0mm, Ta = 25°C

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Response time	Rise	τ_r	$\theta=\phi=0°$	-	10	-	ms
	Down	τ_d	$\theta=\phi=0°$	-	25	-	ms
Viewing angle range View direction : 6 o'clock (Gray inversion)		θ UPPER	CR≧5	-	80	-	deg.
		θ LOWER		-	80	-	
		ϕ LEFT		-	80	-	deg.
		ϕ RIGHT		-	80	-	
Contrast ratio		CR	$\theta=\phi=0°$	300	500	-	-
Brightness		L	IF=12.5mA/Line	400	600	-	cd/m^2
Chromaticity coordinates	Red	x	$\theta=\phi=0°$	0.56	0.61	0.66	-
		y		0.32	0.37	0.42	
	Green	x	$\theta=\phi=0°$	0.29	0.34	0.39	
		y		0.52	0.57	0.62	
	Blue	x	$\theta=\phi=0°$	0.09	0.14	0.19	
		y		0.06	0.11	0.16	
	White	x	$\theta=\phi=0°$	0.27	0.32	0.37	
		y		0.29	0.34	0.39	

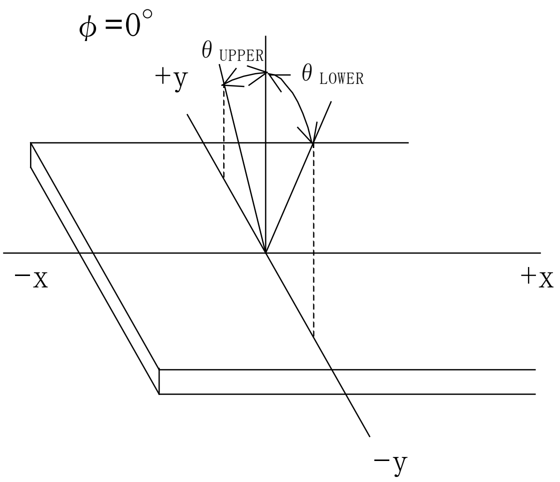
6-1. Definition of contrast ratio

$$\text{CR(Contrast ratio)} = \frac{\text{Brightness with all pixels "White"}}{\text{Brightness with all pixels "Black"}}$$

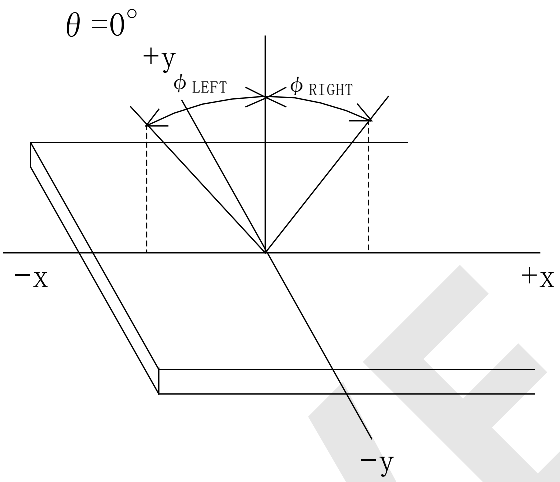
6-2. Definition of response time



6-3. Definition of viewing angle

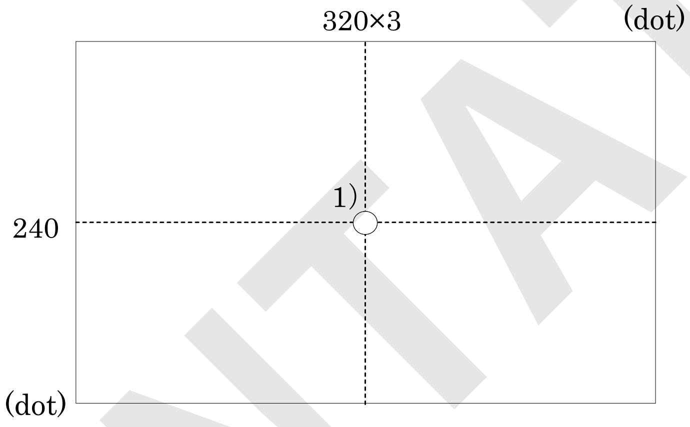

ϕ =0°
θ UPPER
θ LOWER
+y
−x
+x
−y

θ direction


θ =0°
+y
ϕ LEFT
ϕ RIGHT
−x
+x
−y

ϕ direction

6-4. Brightness measuring point


320×3
(dot)
1)
240
(dot)

1) Rating is defined as the white brightness at center of display screen.
2) Measured 5 minutes after the LED is powered on. (Ta = 25°C)

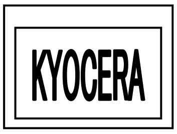
7. Interface signals

No.	Symbol	Description	I/O	Note
1	NC	No connect	-	
2	NC	No connect	-	
3	NC	No connect	-	
4	SC	Scan direction control(High or Open: Normal、GND: Reverse)	I	1)
5	RxIN0-	LVDS receiver signal CH0(-)	I	LVDS
6	RxIN0+	LVDS receiver signal CH0(+)	I	LVDS
7	GND	GND	-	
8	RxIN1-	LVDS receiver signal CH1(-)	I	LVDS
9	RxIN1+	LVDS receiver signal CH1(+)	I	LVDS
10	GND	GND	-	
11	RxIN2-	LVDS receiver signal CH2(-)	I	LVDS
12	RxIN2+	LVDS receiver signal CH2(+)	I	LVDS
13	GND	GND	-	
14	CK IN-	LVDS receiver signal CK(-)	I	LVDS
15	CK IN+	LVDS receiver signal CK(+)	I	LVDS
16	GND	GND	-	
17	NC	No connect	-	
18	NC	No connect	-	
19	GND	GND	-	
20	GND	GND	-	
21	V_{DD}	+3.3V power supply	-	
22	V_{DD}	+3.3V power supply	-	
23	OPLED	OPEN LED detection	-	
24	BLPWM	PWM signal (Brightness adjustment)	I	
25	BLEN	ON/OFF terminal voltage	I	
26	VBRT	Analog dimming	I	
27	V_{IN}	+5.0V power supply	-	
28	V_{IN}	+5.0V power supply	-	
29	GNDB	GND (Backlight)	-	
30	GNDB	GND (Backlight)	-	

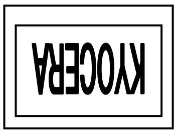
LCD connector	:	DF19G-30P-1H(52)	(HIROSE)
Recommended matching connector	:	DF19G-30S-1C(06)	(HIROSE)

1) SC Pin

① Open or High



② Low

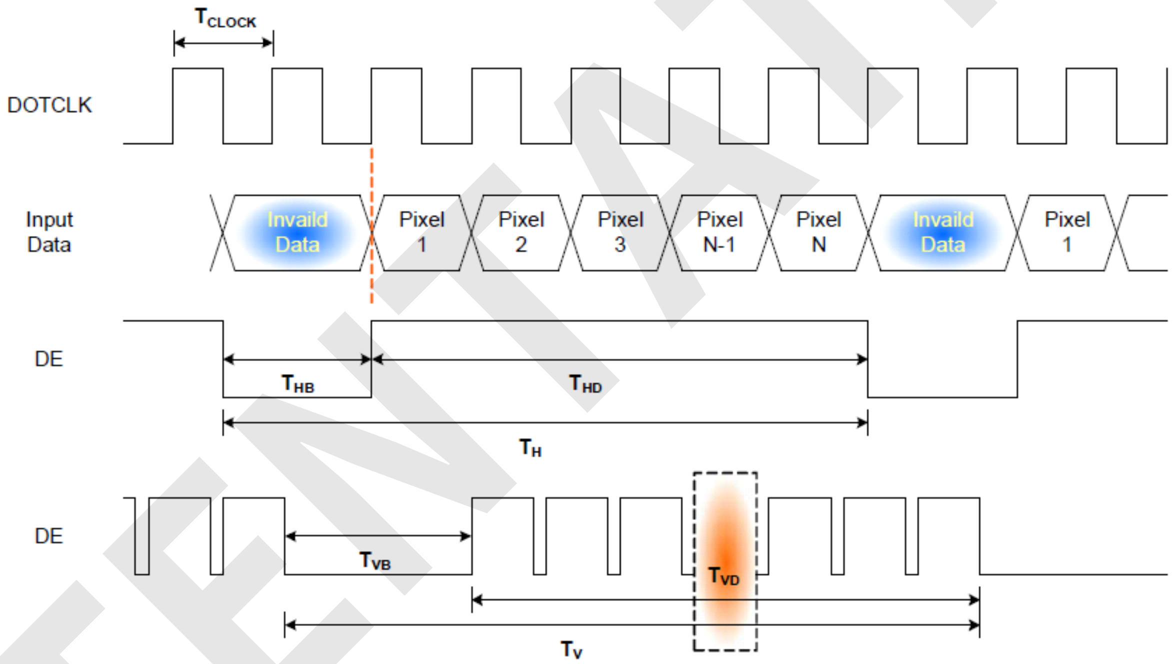


8. Input timing characteristics

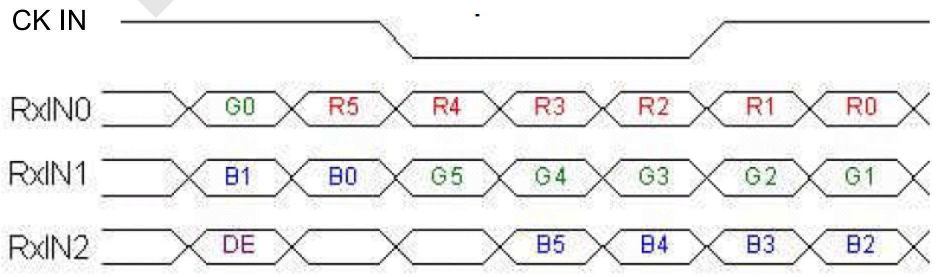
8-1. Timing characteristics 1)

Item		Symbol	Min.	Typ.	Max.	Unit
Clock (CK)	Frequency	1/T_{Clock}	20	25.2	28.33	MHz
Vertical	Period	T_V	520	525	560	T_H
	Display period	T_{VD}	-	480	-	
	Blank period	T_{VB}	40	45	80	
Horizontal	Period	T_H	770	800	900	T_{Clock}
	Display period	T_{HD}	-	640	-	
	Blank period	T_{HB}	130	160	260	

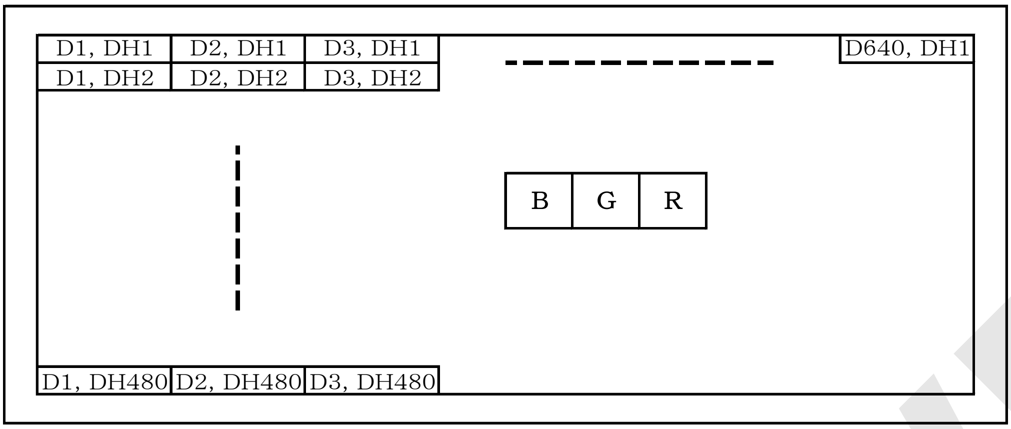
1) If the display is used under the condition which is out of specifications such as higher clock frequency than specified value, there is a possibility phenomenon such as display error including white display, malfunction and no image may occur. Please use the display under the conditions written in the specification.
2) Frame frequency 60Hz.


T_{CLOCK}
DOTCLK
Input Data
Invaild Data
Pixel 1
Pixel 2
Pixel 3
Pixel N-1
Pixel N
Invaild Data
Pixel 1
DE
T_{HB}
T_{HD}
T_H
DE
T_{VB}
T_{VD}
T_V

8-2. Data mapping


CK IN
RxIN0
G0
R5
R4
R3
R2
R1
R0
RxIN1
B1
B0
G5
G4
G3
G2
G1
RxIN2
DE
B5
B4
B3
B2

8-3. Input data signals and display position on the screen


D1, DH1
D2, DH1
D3, DH1
D640, DH1
D1, DH2
D2, DH2
D3, DH2
B
G
R
D1, DH480
D2, DH480
D3, DH480

9. Lot number identification

The lot number shall be indicated on the back of the backlight case of each LCD.

▦ TCG057VGLCAANN-GN20:□□-□□ ▭ MADE IN ▭
↓ ↓↓ ↓ ↓ ↓
① ②③ ④ ⑤ ⑥

No① – No⑥ above indicate
- ① Data matrix (For internal control purpose only)
- ② Year code (The last digit of the year)
- ③ Month code
- ④ Day code
- ⑤ Version number (Max. 7 characters)
- ⑥ Country of origin

③ Month code

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.
Code	1	2	3	4	5	6

Month	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Code	7	8	9	X	Y	Z

10. Warranty

10-1. Incoming inspection

Please inspect the LCD within one month after your receipt.

10-2. Production warranty

Kyocera warrants its LCD's for a period of 12 months from the ship date. Kyocera shall, by mutual agreement, replace or re-work defective LCD's that are shown to be Kyocera's responsibility.

11. Precautions for use

11-1. Installation of the LCD

1) A transparent protection plate shall be added to protect the LCD and its polarizer.
2) The LCD shall be installed so that there is no pressure on the LSI chips.
3) The LCD shall be installed flat, without twisting or bending.
4) A transparent protection sheet is attached to the polarizer. Please remove the protection film slowly before use, paying attention to static electricity.

11-2. Static electricity

1) Since CMOS ICs are mounted directly onto the LCD glass, protection from static electricity is required.
2) Workers should use body grounding. Operator should wear ground straps.

11-3. LCD operation

1) The LCD shall be operated within the limits specified. Operation at values outside of these limits may shorten life, and/or harm display images.

11-4. Storage

1) The LCD shall be stored within the temperature and humidity limits specified.
   Store in a dark area, and protect the LCD from direct sunlight or fluorescent light.
2) Always store the LCD so that it is free from external pressure onto it.

11-5. Usage

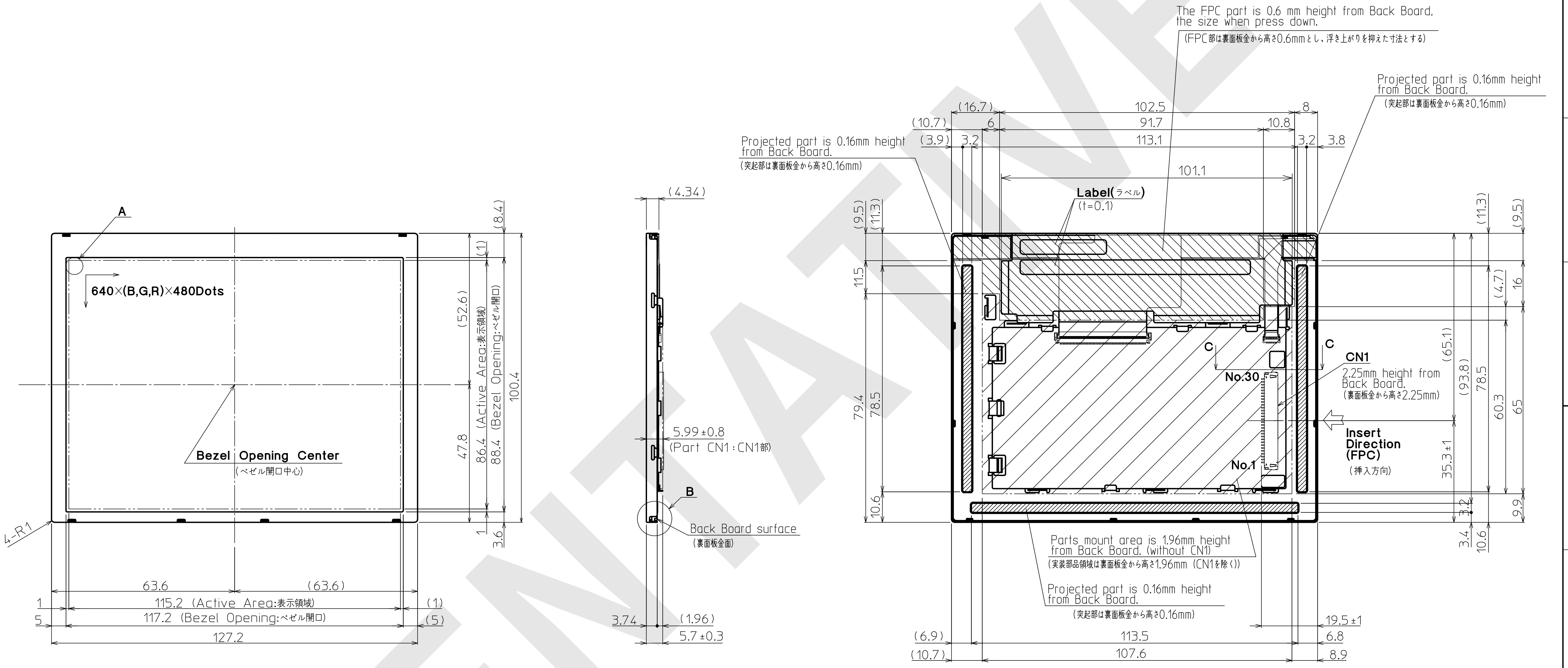
1) DO NOT store in a high humidity environment for extended periods. Polarizer degradation bubbles, and/or peeling off of the polarizer may result.
2) The front polarizer is easily scratched or damaged. Prevent touching it with any hard material, and from being pushed or rubbed.
3) The LCD screen may be cleaned by wiping the screen surface with a soft cloth or cotton pad using a little Ethanol.
4) Water may cause damage or discoloration of the polarizer. Clean condensation or moisture from any source immediately.
5) Always keep the LCD free from condensation during testing. Condensation may permanently spot or stain the polarizer.
6) Do not disassemble LCD module because it will result in damage.
7) This Kyocera LCD module has been specifically designed for use in general electronic devices, but not for use in a special environment such as usage in an active gas. Hence, when the LCD is supposed to be used in a special environment, evaluate the LCD thoroughly beforehand and do not expose the LCD to chemicals such as an active gas.
8) Please do not use solid-base image pattern for long hours because a temporary afterimage may appear. We recommend using screen saver etc. in cases where a solid-base image pattern must be used.
9) Liquid crystal may leak when the module is broken. Be careful not to let the fluid go into your eyes and mouth. In the case the fluid touches your body; rinse it off right away with water and soap.

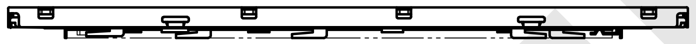
12. Reliability test data

Test item	Test condition	Test time	Judgement
High temp. atmosphere	80°C	240h	TBD
Low temp. atmosphere	-30°C	240h	TBD
High temp. humidity atmosphere	40°C 90% RH	240h	TBD
Temp. cycle	-30°C 0.5h R.T. 0.5h 80°C 0.5h	10cycles	TBD
High temp. operation	70°C	500h	TBD

1) Each test item uses a test LCD only once. The tested LCD is not used in any other tests.
2) The LCD is tested in circumstances in which there is no condensation.
3) The reliability test is not an out-going inspection.
4) The result of the reliability test is for your reference purpose only.
The reliability test is conducted only to examine the LCD's capability.

No	Description	Drawn	Checked	Checked	Approved


A
640×(B,G,R)×480Dots
Bezel Opening Center
（ベゼル開口中心）
4-R1
(8.4)
(1)
(52.6)
47.8
86.4 (Active Area:表示領域)
88.4 (Bezel Opening:ベゼル開口)
100.4
1
3.6
63.6
(63.6)
1
115.2 (Active Area:表示領域)
(1)
5
117.2 (Bezel Opening:ベゼル開口)
(5)
127.2
(4.34)
5.99±0.8
(Part CN1:CN1部)
B
Back Board surface
（裏面板金面）
3.74
(1.96)
5.7±0.3
The FPC part is 0.6 mm height from Back Board, the size when press down.
（FPC部は裏面板金から高さ0.6mmとし、浮き上がりを抑えた寸法とする）
Projected part is 0.16mm height from Back Board.
（突起部は裏面板金から高さ0.16mm）
Projected part is 0.16mm height from Back Board.
（突起部は裏面板金から高さ0.16mm）
(16.7)
102.5
8
(10.7)
6
91.7
10.8
(3.9)
3.2
113.1
3.2
3.8
101.1
Label(ラベル)
(t=0.1)
(9.5)
(11.3)
11.5
79.4
78.5
10.6
C
C
CN1
No.30
No.1
2.25mm height from Back Board.
（裏面板金から高さ2.25mm）
Insert Direction (FPC)
（挿入方向）
(11.3)
(9.5)
(4.7)
16
(65.1)
(93.8)
78.5
60.3
65
35.3±1
3.2
3.2
9.9
3.4
10.6
Parts mount area is 1.96mm height from Back Board. (without CN1)
（実装部品領域は裏面板金から高さ1.96mm (CN1を除く)）
Projected part is 0.16mm height from Back Board.
（突起部は裏面板金から高さ0.16mm）
19.5±1
(6.9)
113.5
6.8
(10.7)
107.6
8.9

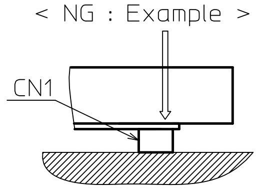


HANDLING ATTENTION(取扱い注意)

Please take care of not overload to connector .

コネクターに過度な負荷を加えないように注意お願いします。

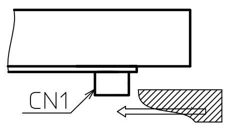
< NG : Example >



Overload on the hard unit, when connector is put below.

コネクター部を下にして、硬質な台の上に置いて過負荷をかける。

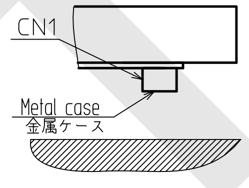
< NG : Example >



Hit against connector.

コネクターをぶつける。

< NG : Example >

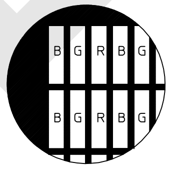

CN1
Metal case
金属ケース

Connector will occur electric conduction when touch other metal parts.

コネクター外装は、金属ケースのため接触すると導通する可能性有。

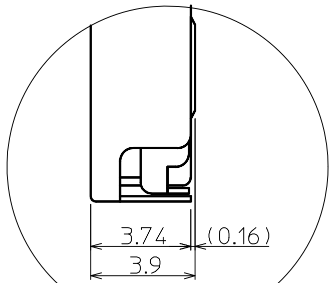
SECTION C-C

(NTS)


B
G
R
B
G
B
G
R
B
G

DETAIL A (Dot Size)

(NTS)



DETAIL B (5:1)

Note.（注記）

1. Connector CN1: DF19G-30P-1H(52) (HIROSE)
   （コネクター）
2. Matching Connector CN1: DF19G-30S-1C(06) (HIROSE)
   （適合コネクター）
3. The Information of LCD is displayed starting at the upper left hand corner, moving right then down to the lower right hand corner.
   （LCDにおいて、画像データの表示は左上コーナーから始まり、右へ進み下へ送られ右下コーナーへ向かう。）
4. Tolerance without indication：±0.5
   （指示無き公差）
5. Do not add excessive load so that PCB would not move when inserting or removing the I/F-CN. (PCB-FPC connection disorder avoidance)
   （I/F-CNの挿抜作業については、PCBにずれが生じるような過度の負荷が加わらないこと。）
   (PCB-FPC接続不具合回避)

Material 材質
Quantity 製作数
Treatment 処理
Description; 備考 RoHS 121A8082300-2
Approved '23.10.24 倉元
Checked
Checked '23.10.24 本間
Drawn 蔭山
Scale 1:1(5:1,NTS)
Title TCG057VGLCAANN
Outline Dimensions
KYOCERA
Year-Month-Day '23.09.29
Size 2
Drawing No. 121A9032300

Spec No.	TQ3C-8EAF0-E2YBD90-00
Date	February 19, 2024

KYOCERA INSPECTION STANDARD

TYPE : TCG057VGLCAANN-GN20

KYOCERA CORPORATION

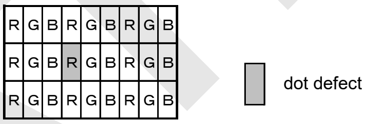
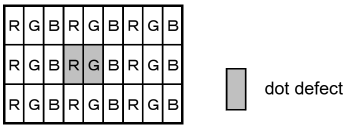
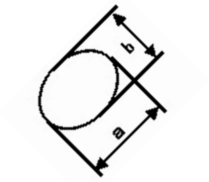
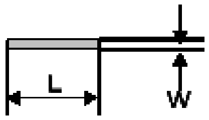
Revision record

Date	Designed by : Engineering dept.			Confirmed by : QA dept.
	Prepared	Checked	Approved	Approved

Rev.No.	Date	Page	Descriptions

Visuals specification

1) Note

	Note		
General	1. Customer identified anomalies not defined within this inspection standard shall be reviewed by Kyocera, and an additional standard shall be determined by mutual consent. 2. This inspection standard about the image quality shall be applied to any defect within the active area and shall not be applicable to outside of the area. 3. Inspection conditions Luminance : 500 Lux min. Inspection distance : 300 mm. Temperature : 25 ± 5℃ Direction : Directly above		
Definition of inspection item	Dot defect	Bright dot defect	The dot is constantly "on" when power applied to the LCD, even when all "Black" data sent to the screen. Inspection tool: 5% Transparency neutral density filter. Count dot: If the dot is visible through the filter. Don't count dot: If the dot is not visible through the filter.  R G B R G B R G B R G B R G B R G B R G B R G B R G B dot defect
		Black dot defect	The dot is constantly "off" when power applied to the LCD, even when all "White" data sent to the screen. Similar size compared to bright dot.
		White dot (Circular/foreign particle)	Pixel works electrically, however, circular/foreign particle makes dot appear to be "on" even when all "Black" data is sent to the screen.
		Adjacent dot	Adjacent dot defect is defined as two or more bright dot defects or black dot defects.  R G B R G B R G B R G B R G B R G B R G B R G B R G B dot defect
	External inspection	Bubble, Scratch, Foreign particle (Polarizer, Cell, Backlight)	Visible operating (all pixels "Black" or "White") and non operating.
		Appearance inspection	Does not satisfy the value at the spec.
	Definition of size	Definition of circle size  a: major axis, b: minor axis d = (a + b) / 2	Definition of linear size 

2) Standard

<table>
<tr><th colspan="2">Classification</th><th colspan="2">Inspection item</th><th>Judgement standard</th></tr>
<tr><td rowspan="7">Defect
(in LCD glass)</td><td rowspan="2">Single dot</td><td colspan="2">Bright dot defect</td><td>Acceptable number : 4
Bright dot spacing : 5 mm or more</td></tr>
<tr><td colspan="2">Black dot defect</td><td>Acceptable number : 5
Black dot spacing : 5 mm or more</td></tr>
<tr><td rowspan="3">Adjacent dot</td><td rowspan="2">2 dots</td><td>Bright dot defect</td><td>Acceptable number : 2</td></tr>
<tr><td>Black dot defect</td><td>Acceptable number : 3</td></tr>
<tr><td colspan="2">3 or more dots</td><td>Acceptable number : 0</td></tr>
<tr><td colspan="3">Total dot defects</td><td>Acceptable number : 5 Max</td></tr>
<tr><td>Others</td><td colspan="2">White dot, Dark dot
(Circle)</td><td>
<table>
<tr><th>Size (mm)</th><th>Acceptable number</th></tr>
<tr><td>$d \leqq 0.2$</td><td>(Neglected)</td></tr>
<tr><td>$0.2 < d \leqq 0.4$</td><td>5</td></tr>
<tr><td>$0.4 < d \leqq 0.5$</td><td>3</td></tr>
<tr><td>$0.5 < d$</td><td>0</td></tr>
</table>
</td></tr>
<tr><td colspan="2" rowspan="5">External inspection
(Defect on Polarizer or between Polarizer and LCD glass)</td><td colspan="2">Polarizer (Scratch)</td><td>
<table>
<tr><th>Width (mm)</th><th>Length (mm)</th><th>Acceptable number</th></tr>
<tr><td>$W \leqq 0.1$</td><td>–</td><td>(Neglected)</td></tr>
<tr><td rowspan="2">$0.1 < W \leqq 0.3$</td><td>$L \leqq 5.0$</td><td>(Neglected)</td></tr>
<tr><td>$5.0 < L$</td><td>0</td></tr>
<tr><td>$0.3 < W$</td><td>–</td><td>0</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Polarizer (Bubble)</td><td>
<table>
<tr><th>Size (mm)</th><th>Acceptable number</th></tr>
<tr><td>$d \leqq 0.2$</td><td>(Neglected)</td></tr>
<tr><td>$0.2 < d \leqq 0.3$</td><td>5</td></tr>
<tr><td>$0.3 < d \leqq 0.5$</td><td>3</td></tr>
<tr><td>$0.5 < d$</td><td>0</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Foreign particle
(Circular shape)</td><td>
<table>
<tr><th>Size (mm)</th><th>Acceptable number</th></tr>
<tr><td>$d \leqq 0.2$</td><td>(Neglected)</td></tr>
<tr><td>$0.2 < d \leqq 0.4$</td><td>5</td></tr>
<tr><td>$0.4 < d \leqq 0.5$</td><td>3</td></tr>
<tr><td>$0.5 < d$</td><td>0</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Foreign particle
(Linear shape)
Scratch</td><td>
<table>
<tr><th>Width (mm)</th><th>Length (mm)</th><th>Acceptable number</th></tr>
<tr><td>$W \leqq 0.03$</td><td>–</td><td>(Neglected)</td></tr>
<tr><td rowspan="3">$0.03 < W \leqq 0.1$</td><td>$L \leqq 2.0$</td><td>(Neglected)</td></tr>
<tr><td>$2.0 < L \leqq 4.0$</td><td>3</td></tr>
<tr><td>$4.0 < L$</td><td>0</td></tr>
<tr><td>$0.1 < W$</td><td>–</td><td>(According to circular shape)</td></tr>
</table>
</td></tr>
<tr><td colspan="2">Color variation
(Mura)</td><td>Not to be significantly visible.
Consultation shall be held as necessary.</td></tr>
</table>

DATA MODUL

ALL TECHNOLOGIES. ALL COMPETENCIES. ONE SPECIALIST.

DATA MODUL AG

Landsberger Straße 322
DE-80687 Munich
Phone: +49-89-56017-0

DATA MODUL WEIKERSHEIM GMBH

Lindenstraße 8
DE-97990 Weikersheim
Phone: +49-7934-101-0

More information and worldwide locations can be found at

www.data-modul.com