SPEC. NO.	TQ3C-8EAC0-E1AATB12-00
DATE	April 1, 1997

For Reference Only

SPEC

15" DSTN

TYPE: KCT150XG4BA-A09

(OLD PART NO. KCT10276BSTT-X4) ←
(STBKWOTTOCXX101)

CONTENTS

KYOCERA CORPORATION
KAGOSHIMA HAYATO PLANT

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

Original Issue Date	Designed by: Engineering Dept.			Confirmed by: QA Dept.	
	Prepared	Checked	Approved	Checked	Approved
April 1, 1997	H. Taike	S. Matsumoto	A. Nishino	T. Uchinono	Y. Yoshida

Revision Record

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

Rev. No.	Date	Page	Descriptions

1. Application

This data sheet defines the specification for a (1024 x 3) x 768 dot, STN color, dot matrix type Liquid Crystal Display with CFL backlight.

2. Construction and Outline

(1024 x 3) x 768 dots. COG type LCD with CFL backlight.

Backlight system:	Side-edge type CFL (4 tubes)
Inverter:	Optional Recommended Inverter: KCI-09 (Minebea Electronics) or equivalent
Polarizer:	Non-Glare treatment
Additional Circuit:	Bias voltage circuit, Randomizing circuit DC/DC Converter

3. Mechanical Specifications

ITEM	SPECIFICATION	
Outline dimensions	355.0 (W) x 261.0 (H) x 19.0 (D)	mm
Effective viewing area	307.11 (W) x 231.08(H)	mm
Dot number	(1024 x 3) (W) x 768 (H)	Dots
Dot size	0.079 (W) x 0.277 (H)	mm
Dot pitch	0.099 (W) x 0.297 (H)	mm
Display color *1	White *2	-
Base color *1	Black *2	-
Weight	2100	g

*1 Due to the characteristics of the LC material, the colors vary with environmental temperature.

*2 Negative-type display

Display data "H": R, G, B Dots ON: White
Display data "L": R, G, B, Dots OFF: Black

4. Absolute Maximum Ratings

4.1 Electrical absolute maximum ratings

Temp. = 25°C

ITEM	SYMBOL	MIN.	MAX.	UNIT
Supply voltage for logic	VDD	0	6.0	V
Supply voltage for LCD driving	VCONT	0	VDD	V
Input signal voltage	Vin	0	VDD+0.3	V

4.2 Environmental absolute maximum ratings

ITEM	SYMBOL	MIN.	MAX.	UNIT
Operating temperature	Top	0	40	°C
Storage temperature *1	Tsto	-20	60	°C
Operating humidity *2	Hop	10	85	%RH
Storage humidity *2	Hsto	10	*3	%RH
Vibration	-	*4	*4	-

*1 Temp. = -20°C < 24 Hr.; Temp. = 60°C < 24 Hr.
No vibration and shock

*2 Non-condensing

*3 Temp. ≤ 40°C, 85% RH Max.
Temp. > 40°C, Absolute Humidity shall be less than 85% RH at 40°C.

*4

Frequency	10 ~ 55 Hz	Converted to acceleration value: (0.03 ~ 0.91G)
Vibration width	0.15 mm	
Interval	10 - 55 - 10 Hz 1 minute	

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

5. Electrical Characteristics

Temp. = 25°C, VDD = 5.0V ± 5%

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply voltage for logic	VDD	-	4.75	5.0	5.25	V
LCD driving voltage *1	Vop = VCONT	0 °C	0.80	-	-	V
		25 °C	1.35	1.95	2.55	V
		40 °C	-	-	2.80	V
Input voltage	Vin	"H" Level	0.8VDD	-	VDD	V
		"L" Level	0	-	0.2VDD	V
Clock frequency	fcp		-	17.6	(18.0)	MHz
Frame frequency *2	fFRM		-	120	-	Hz
Current consumption for logic	IDD	#3	-	(320)	(480)	mA
Power consumption	Pdisp		-	(1,600)	(2,400)	mW

*1 Maximum contrast ratio is obtained by adjusting the LCD supply voltage (Vop = VCONT) for driving the LCD.

*2 In consideration of display quality, it is recommended that the frame frequency is set in the range of 70-80Hz. When higher frame and clock frequencies have to be used, confirm the LCD's performance and display quality before finalizing the frequency values. Generally, as frame and clock frequencies increase, current consumption increases and display quality degrades.

*3 Display high frequency pattern (see below).
VDD = 5V, Vop = VCONT, fFRM = 120Hz, CP = 17.6MHz
Pattern:

6. Optical Characteristics

Temp. = 25°C

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Response time	Rise	Tr	θ = ϕ = 0°	-	(150)	(200)	ms
	Down	Tf	θ = ϕ = 0°	-	(50)	(100)	ms
Viewing angle range		θ	CR ≥ 2, ϕ = 0°	(-20)	-	(30)	deg.
		ϕ	CR ≥ 2, θ = 0°	(-40)	-	(40)	deg.
Contrast ratio		CR	θ = ϕ = 0°	(10.0)	(20.0)	-	-
Chromaticity coordinates	Red	x	θ = ϕ = 0°	(.45)	(0.50)	(.55)	-
		y	θ = ϕ = 0°	(.29)	(.34)	(.39)	-
	Green	x	θ = ϕ = 0°	(.24)	(.29)	(.34)	-
		y	θ = ϕ = 0°	(.50)	(.55)	(.60)	-
	Blue	x	θ = ϕ = 0°	(.12)	(.17)	(.22)	-
		y	θ = ϕ = 0°	(.11)	(.16)	(.21)	-
	White	x	θ = ϕ = 0°	(.25)	(.30)	(.35)	-
		y	θ = ϕ = 0°	(.31)	(.36)	(.41)	-
	Black	x	θ = ϕ = 0°	(.24)	(.29)	(.34)	-
		y	θ = ϕ = 0°	(.29)	(.34)	(.39)	-

Optimum contrast is obtained by adjusting the LCD driving voltage (Vop) while at the viewing angle of θ = ϕ = 0°.

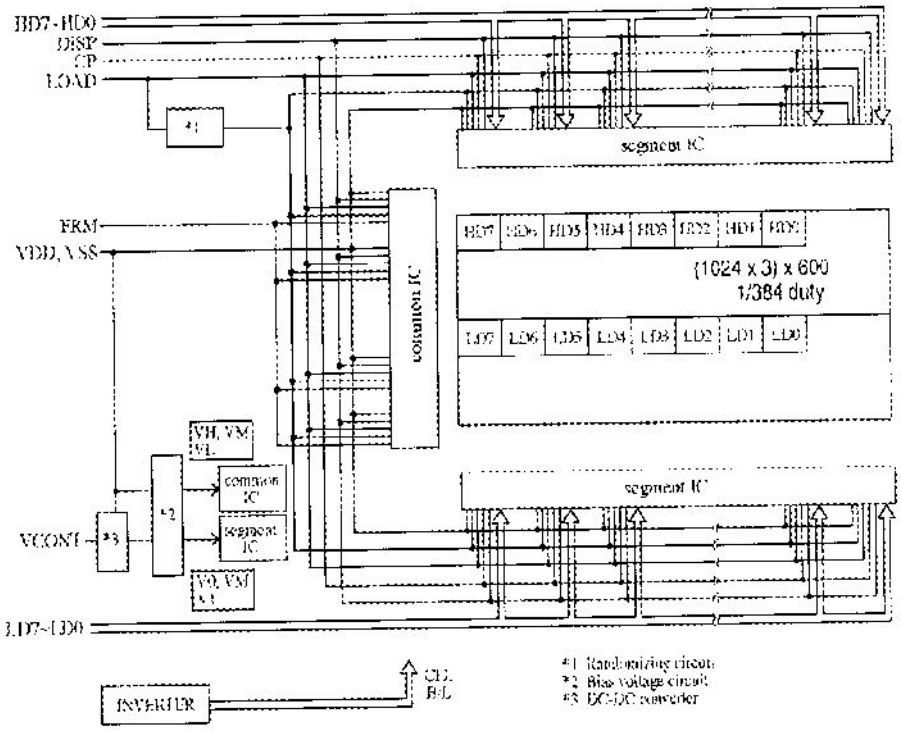
6.1 Contrast ratio is defined as:

6.2 Definition of viewing angle

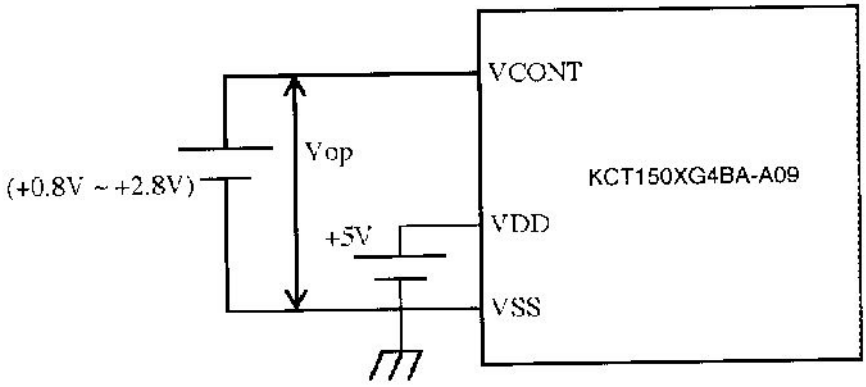
6.3 Definition of response time

6.4 Definition of Vop

7. Circuit Block Diagram



7.1 Power Supply



8. Interface Signals 8.1 LCD

PIN NO.	SYMBOL	DESCRIPTION	LEVEL
1	VSS	GND	-
2	VSS	GND	-
3	CP	Data signal shift clock	H → L
4	VSS	GND	-
5	VSS	GND	-
6	VCONT	LCD adjust voltage	-
7	LOAD	Data signal latch clock	H → L
8	VDD	Power supply for logic	-
9	FRM	Synchronous signal for driving scanning line	H
10	VDD	Power supply for logic	-
11	VSS	GND	-
12	VSS	GND	-
13	DISP	Display control signal	H (ON), L (OFF)
14	VSS	GND	-
15	NC	-	-
16	NC	-	-
17	NC	-	-
18	NC	-	-
19	NC	-	-
20	NC	-	-
21	NC	-	-
22	NC	-	-
23	LD7	Display data (Lower column)	H (ON), L (OFF)
24	HD7	Display data (Lower column)	H (ON), L (OFF)
25	LD6	Display data (Lower column)	H (ON), L (OFF)
26	HD6	Display data (Lower column)	H (ON), L (OFF)
27	LD5	Display data (Lower column)	H (ON), L (OFF)
28	HD5	Display data (Lower column)	H (ON), L (OFF)
29	LD4	Display data (Lower column)	H (ON), L (OFF)
30	HD4	Display data (Lower column)	H (ON), L (OFF)
31	LD3	Display data (Lower column)	H (ON), L (OFF)
32	HD3	Display data (Lower column)	H (ON), L (OFF)
33	LD2	Display data (Lower column)	H (ON), L (OFF)
34	HD2	Display data (Lower column)	H (ON), L (OFF)
35	LD1	Display data (Lower column)	H (ON), L (OFF)
36	HD1	Display data (Lower column)	H (ON), L (OFF)
37	LD0	Display data (Lower column)	H (ON), L (OFF)
38	HD0	Display data (Lower column)	H (ON), L (OFF)
39	VSS	GND	
40	VSS	GND	

LCD side connector :SD-53505-4091 (Molex)
Recommended matching connector :SD-51127-4005 (Molex)

8.2 BACKLIGHT

PIN NO.	SYMBOL	DESCRIPTION	LEVEL
1	HV	Power supply for CFL	AC
2	HV	Power supply for CFL	AC
3	NC	No connect	-
4	GND	Ground (from inverter)	-

LCD side connector: BHR-04VS-1 (JST)
Recommended matching connector: SM04(4.0)B-BHS-TB (JST)

9. Interface Timing Chart

10. Data and Screen

11. Input Timing Characteristics

11.1 Switching characteristics

Input characteristics: VDD = +5.0V ± 5% Temp. = 25°C

ITEM	SYMBOL	MIN.	MAX.	UNIT
CP Cycle *1	tCCL	(56)	-	ns
CP "H" Pulse Width	tWCLH	(15)	-	ns
CP "L" Pulse Width	tWCLL	(15)	-	ns
CP Rise Time *2	trCP	-	(50)	ns
CP Fall Time *2	tfCP	-	(50)	ns
Data Set-up Time	tDS	(10)	-	ns
Data Hold Time	tDH	(10)	-	ns
Load "H" Pulse Width	tWLPH	(100)	-	ns
Load "L" Pulse Width	tWLPL	(100)	-	ns
LOAD Cycle	tLCL	(10)	-	µs
Data Strobe Set-Up Time	tSUr	(20)	-	ns
Data Strobe Set-Up Time	tSUf	(20)	-	ns
Data Strobe Hold Time	tHr	(5)	-	ns
Data Strobe Hold Time	tHf	(20)	-	ns
Input Signal Rise Time	tr	-	(30)	ns
Input Signal Fall Time	tf	-	(30)	ns
FRM Data Set-up Time	tFS	(100)	-	ns
FRM Data Hold Time	tFH	(100)	-	ns

*1 Adjust CP Cycle so that the FRM signal is 120Hz
*2 The formula for the condition is:
(1) trCP, tfCP < [tCCL - (tWCLH + tWCLL)] / 2
This condition must be met.
Please use on condition that (1) is filled.

12. Supply Voltage Sequence Condition

DO NOT apply DC voltage to the LCD panel. A DC voltage will induce an irreversible electro-chemical reaction and reduce LCD life. Always follow the power supply ON/OFF sequence of VDD first, input signal second, VCONT third, and finally DISP as shown below. This will prevent DC driving of the LCD or CMOS LSI latch-up.

*1 Take interval time for minimum 500ms once you cut off the Disp signal.

*Control the supply voltage sequence to prevent the signal lines from floating when the LCD panel is driving.

13. Backlight Characteristics

13.1 CFL ratings (For one lamp)

Inverter: KCI09 (Hitachi Media Electronics) Temp. = 25°C

ITEM	SYM.	MIN.	TYP.	MAX	NOTE
Starting Discharge Voltage *1	VS	-	-	(1,010) Vrms	0 °C
		-	-	(1300) Vrms	25 °C
Discharging tube current	IL	(2.0) mArms	(5) mArms	(6.0) mArms	*2
Discharging tube voltage	VL	-	(570) Vrms	-	-
Operating life (IL =5mArms) *2	T	-	(25,000) Hr.	-	*3
Operating frequency	F	(30) kHz	-	(100) kHz	-

*1 The Non-load output voltage (VS) of the inverter should be designed to have some margin, because VS may increase due to leakage current that may be caused by the wiring of the CFL cables. (Reference value: 1,313 Vrms MIN.),

*2 It is recommended that IL be not more than 5.0 mArms so that radiation of CFL backlight may least affect the display quality.

*3 When the illuminance or quantity of light has decreased to 50% of the initial value.

13.2 Surface brightness of the LCD (IL = 5 mArms), Temp. = 25 °C

ITEM	MIN.	TYP.	MAX.	UNIT	NOTE
Brightness	(80)	(120)	-	cd/m^2	IL=5mArms
	(100)	(150)	-	cd/m^2	IL=6mArms

(Measuring points)

1) The rating is defined as the average brightness inside the viewing area.
2) Measurements are taken 30 min. after the CFL is turned on.
(Ambient Temp. = 25 °C)
3) The inverter should meet the eccentric conditions:
-Sine, symmetric waveform without a positive or negative spike

14. Lot Number Identification

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

KC~150XG4BA-A09-

15. Warranty

15.1 Please inspect the LCD within 30 days of your receipt.

15.2 Production Warranty

Kyocera warrants its LCDs for a period of 12 months after receipt by the purchaser, and within the limits specified herein. Kyocera shall, by mutual agreement, replace or rework defective LCDs that are shown to be Kyocera's responsibility.

16. Precautions in Use

16.1 Installation of the LCD

1. Please ground either of the mounting (screw) holes located at each corner of an LCD module in order to stabilize brightness and display quality.
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. The display window size should be the same as the effective viewing area.
5. Image quality outside the effective viewing area is not warranted.

16.2 Static electricity

1. Since CMOS ICs are mounted directly onto the LCD glass, protection from static electricity is required. Operators should wear ground straps.

16.3 LCD operation

1. The LCD shall be operated within the limits specified. Operation at values outside of the specified limits may shorten life and/or harm display images.
2. V_{OP} must be adjusted to optimize viewing angle and contrast.
3. Operation of the LCD at temperatures below the limit specified may cause image degradation and/or bubbles. It may also change the characteristics of the liquid crystal. This phenomenon may not recover. The LCD shall be operated within the temperature limits specified.

16.4 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. The LCD should be packaged to prevent damage.

16.5 Screen surface

1. DO NOT store in a high humidity environment for extended periods. Image degradation, bubbles, and/or peeling off of polarizers 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 with a soft cloth or cotton pad. Methanol or Isopropyl Alcohol may be used, but insure that all solvent residue is removed.
4. Water may cause damage or discoloration of the polarizer. Clean any condensation or moisture from any source immediately.
5. Always keep the LCD free from condensation during testing. Condensation may permanently spot or stain the polarizers.

17. Reliability Data / Environmental Test

TEST ITEM	TEST CONDITION	TEST TIME	RESULT	
High Temp. Atmosphere	70°C	240 hr.	Display Quality: Display Function: Current Consumption:	No defect No defect No defect
Low Temp. Atmosphere	-20 °C	240 hr.	Low Temp. Bubble: Crystalization of Liquid Crystal Material: Display Quality: Display Function: Current Consumption:	None None No defect No defect No defect
High Temp. & High Humidity Atmosphere	40 °C 90% RH	240 hr.	Display Quality: Display Function: Peeling of Organic Sealant: Current Consumption:	No defect No defect None No defect
Temp. Cycle	-20 °C; 0.5 hr. RT: 0.5 hr. 70 °C; 0.5 hr.	10 cycles	Display Quality: Display Function: Peeling of Organic Sealant: Bubble on Cell:	No defect No defect None None
High Temp. Operation	50 °C Vop	500 hr.	Display Quality: Current Consumption:	No defect No defect

- Each test item uses a test LCD only once. The tested LCD is not used in any other test.
- The LCD is tested in circumstances in which there is no condensation.
- The test specimen is allowed to stabilize for 24 hours, at room temperature and room humidity, before post test measurements are taken.
- Reliability tests are NOT outgoing inspection tests.
- The results of reliability tests are for reference purposes only. Reliability tests are conducted only to examine an LCD's capability.