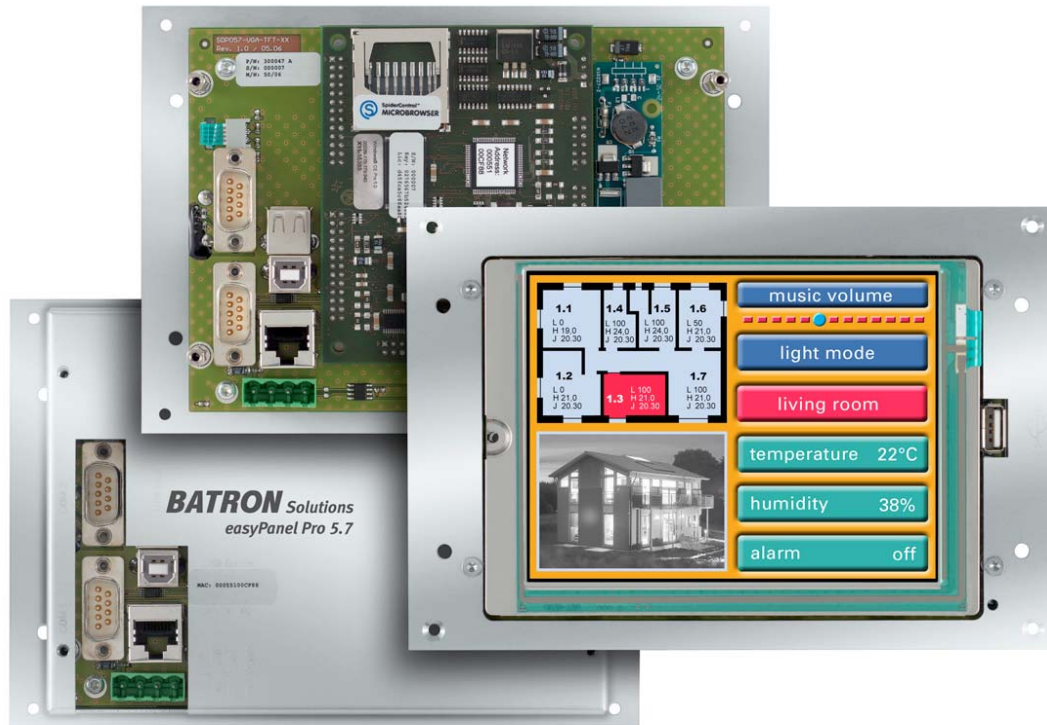


Specification

Batron easyPanel Pro 5.7 Full version (5.7F)

Version 1 - July 2008

Batron Solutions easyPanel Pro5.7F (full version)



The easyPanel Pro5.7F is a complete display-solution, including an ARM9 based single board computer, a touch screen and a aluminum casing, ready to be integrated in nearly any industrial or medical solution.

All versions of the easyPanel Pro series come with 2xRS232, SD-Card slot and USB host and device interfaces.

In addition, the full version (5.7F) features a screen resolution of 640x480 pixels, 10/100Mbps Ethernet and CAN Bus interface. The energy-efficient and flexible design makes it easy to integrate in nearly any application.

The pre-installed and licensed Windows CE operating system enables the maximum flexibility for building all kinds of software applications (Linux versions available on request).

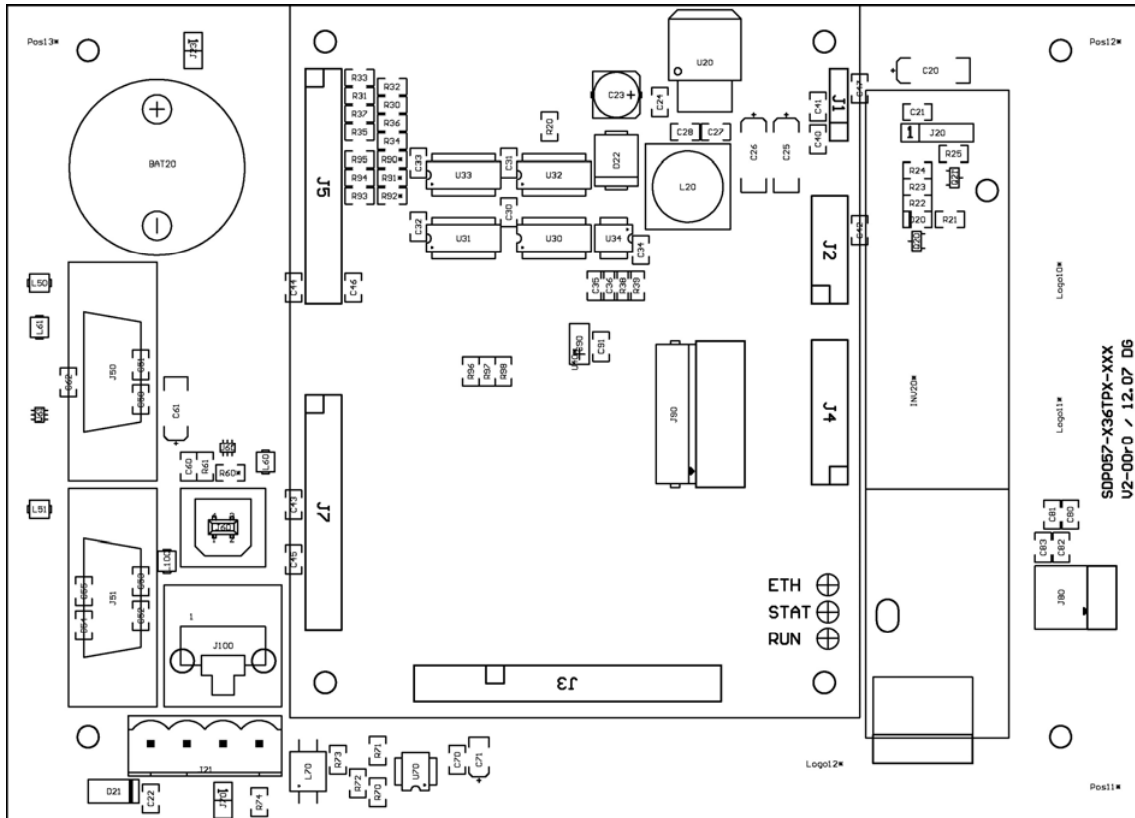
The flexible design allows to build customized versions for specific requirements in a very short time frame (from 100pcs on, depending on complexity).

Chapter Index

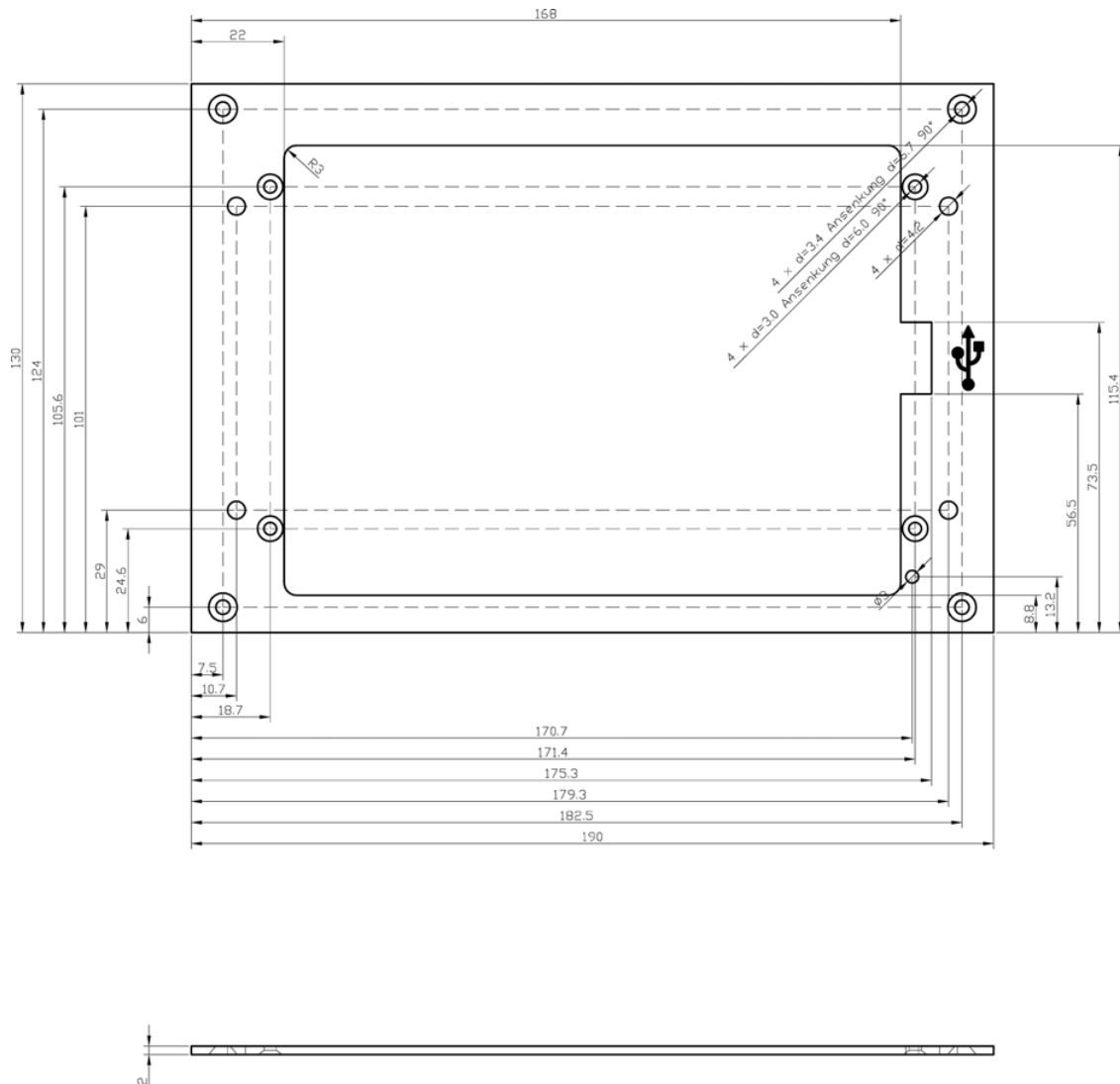
A) Specification easyPanel Pro 5.7 (Drawing/Connectors)	4
B) Specification TCG057VG1AC-G00	10
C) Specification for NetDCU8	28
D) Specification for Touch Panel AST057	54
E) Specification for Inverter PS8m053167F.....	65

A) Specification easyPanel Pro 5.7 (Drawing/Connectors)

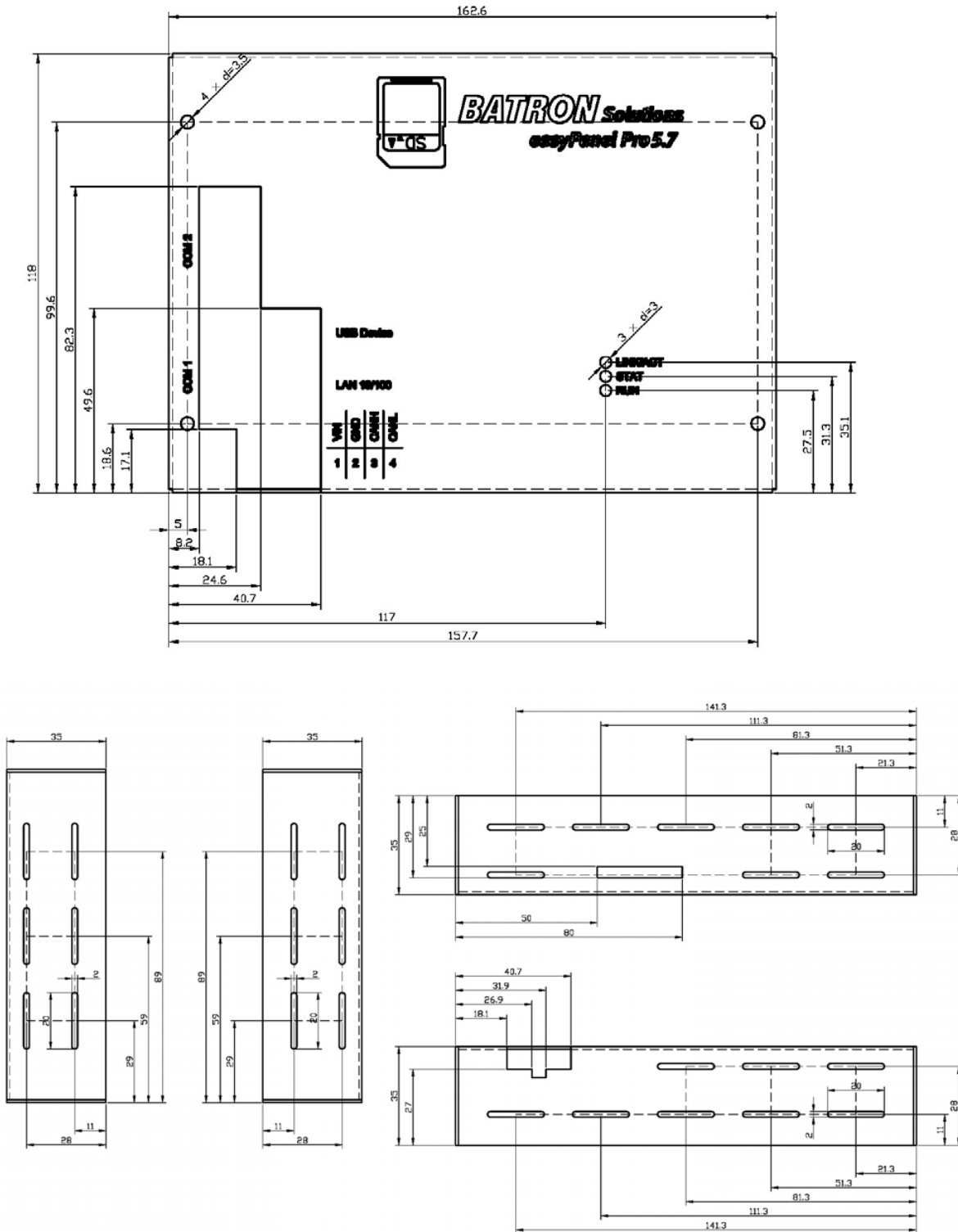
Baseboard:



Mounting Plate:



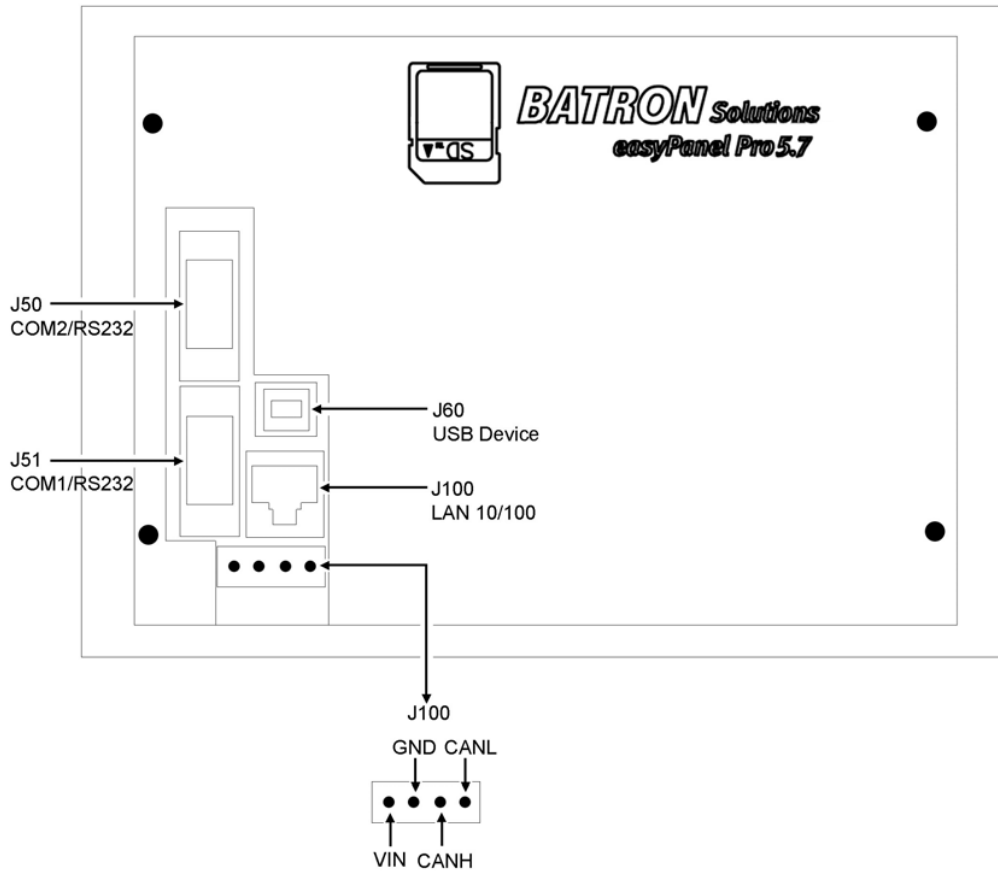
Back Cover:



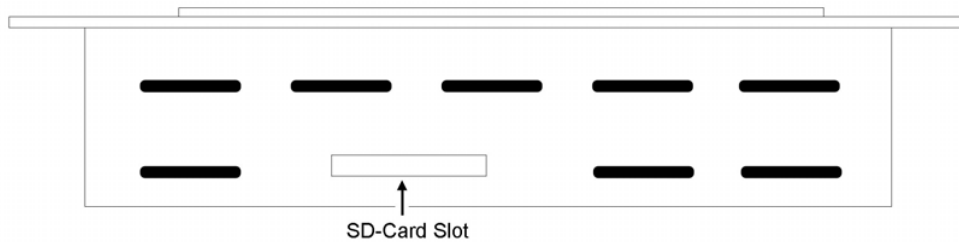
Connectors: Front



Connectors: Back



SD-Card Slot:Top



Absolute Maximum Ratings

Supply Voltage	9-36V(DC)
Power Consumption	10W (max)
Operating Temperature	0...70 °C
Storage Temperature	-20...70 °C
Weight	615g

B) Specification TCG057VG1AC-G00

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2. Construction and Outline.....	11
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1. Application

This data sheet defines the specification for a $(640 \times R.G.B) \times 480$ dot, amorphous silicon TFT transmissive color dot matrix type Liquid Crystal Display with CFL backlight.

『RoHS Compliant』

2. Construction and Outline

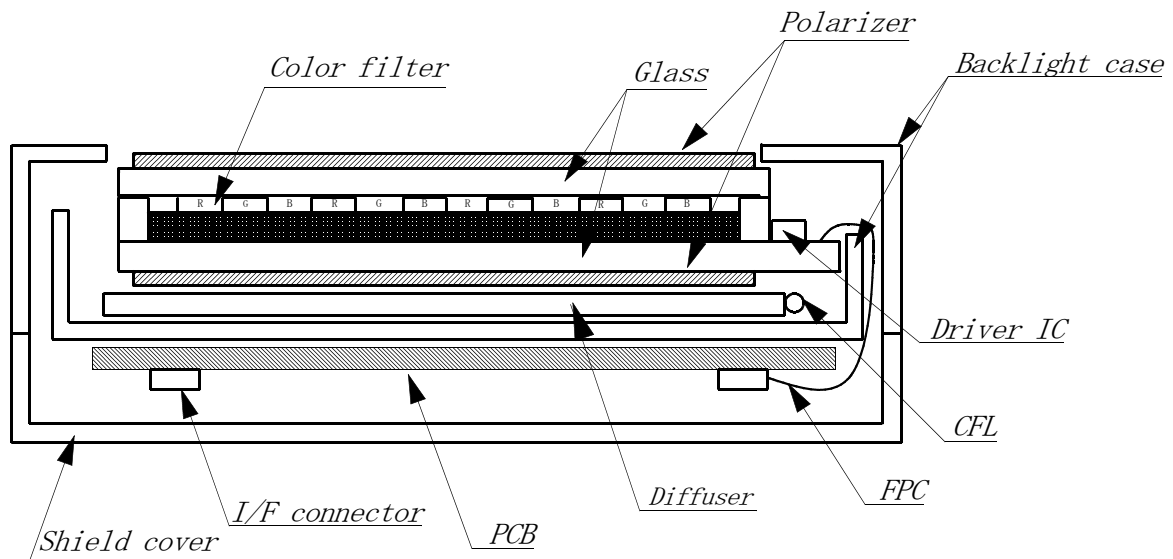
$(640 \times R.G.B) \times 480$ dots, COG type LCD with CFL backlight.

Backlight system : "U" figured type CFL (1 tube).

Inverter : Option.
Recommended Inverter : CXA-L0612A-VJL (TDK)
or Equivalent.

Polarizer : Glare treatment.

Additional circuits : Timing controller, Power supply (3.3V input)



This drawing is showing conception only.

3. Mechanical Specifications

ITEM	SPECIFICATION	UNIT
Outline dimensions	144 (W) × (104.8) (H) × 13.0 (D)	mm
Effective viewing area	117.2 (W) × 88.4 (H)	mm
Dot number	(640×R.G.B) (W) × 480 (H)	Dots
Dot pitch	0.06 (W) × 0.18 (H)	mm
Display mode *1	Normally white	—
Mass	(220)	g

*1 Due to the characteristics of the LCD material, the color vary with environmental temperature.

4. Absolute Maximum Ratings

4-1. Electrical absolute maximum ratings

ITEM	SYMBOL	Min.	Max.	UNIT
Power input voltage	VDD	0	4.0	V
Input signal voltage *1	Vin	-0.3	6.0	V

*1 Input signals : CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, R/L, U/D, V/Q

4-2. Environmental absolute maximum ratings

ITEM	SYMBOL	Min.	Max.	UNIT
Operating temperature *1	Top	-10	70	°C
Storage temperature *2	Tsto	-30	80	°C
Operating humidity *3	Hop	10	*4	%RH
Storage humidity *3	Hsto	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 Temp. = -30 °C < 48 h , Temp = 80 °C < 168 h
Store LCD panel at normal temperature/humidity.
Keep it free from vibration and shock.
LCD panel that is kept at low or high temperature for a long time can be defective due to the other conditions, even if the temperature satisfies standard.
(Please refers to 12. Precautions for use as detail).

*3 Non-condensation.

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

*5

Frequency	10~55 Hz	Converted to acceleration value : (0.3~9 m/s ²)
Vibration width	0.15 mm	
Interval	10-55-10 Hz	1 minute

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

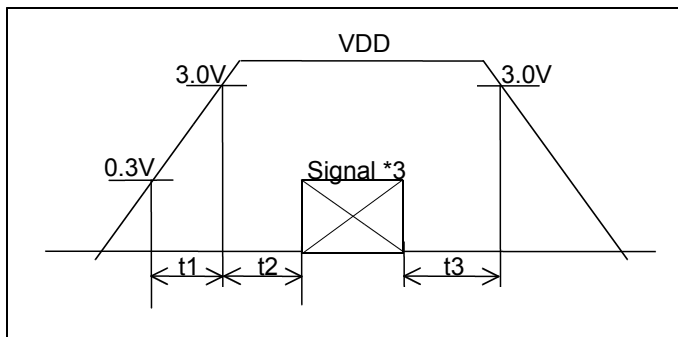
*6 Acceleration: 490m/s²
Pulse width : 11 ms
3 times in each direction : ±X/±Y/±Z.
EIAJ ED-2531

5. Electrical Characteristics

Temp. = -10~70°C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Power input voltage *1	VDD	3.0	3.3	3.6	V
Current consumption *2	IDD	—	210	270	mA
VDD=3.3V Temp. =25°C					
Permissive input ripple voltage(VDD=3.3V)	VRP	—	—	100	mVp-p
Input signal voltage (Low) *3	VIL	0	—	0.3VDD	V
Input signal voltage (High) *3	VIH	0.7VDD	—	VDD	V

*1 VDD-turn-on conditions



$$0 < t_1 \leq 20 \text{ ms}$$

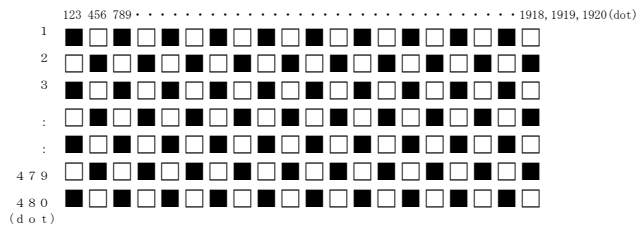
$$0 < t_2 \leq 50 \text{ ms}$$

$$0 < t_3 \leq 1 \text{ s}$$

*2 Power consumption

Black & White pattern :

VDD = 3.3V, V/Q=H



*3 Input signal : CK, R0~R5, G0~G5, B0~B5, Hsync, Vsync, ENAB, R/L, U/D, V/Q

6. Optical Characteristics

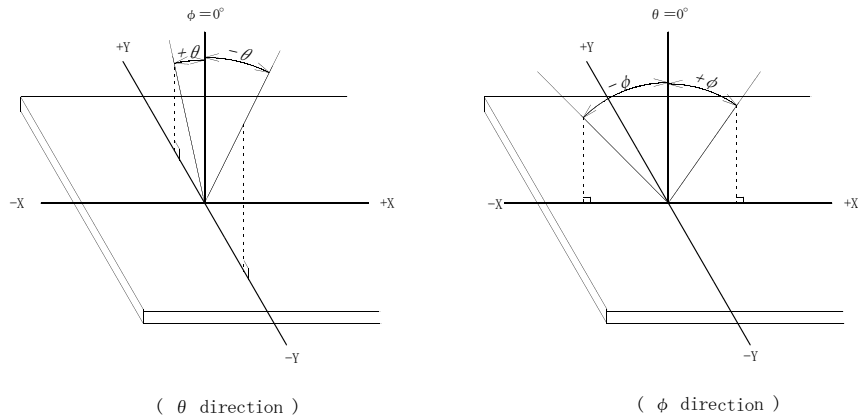
 Measuring points = ϕ 6.0mm , Temp. = 25°C

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	
Response time	Rise	τr	$\theta = \phi = 0^\circ$	—	(10)	—	ms	
	Down	τd	$\theta = \phi = 0^\circ$	—	(25)	—	ms	
Viewing angle range		θ	$CR \geq 5$	Upper	—	(80)	—	deg.
				Lower	—	(70)	—	
		ϕ		Left	—	(80)	—	deg.
				Right	—	(80)	—	
Contrast ratio		CR	$\theta = \phi = 0^\circ$	(280)	(400)	—	—	
Brightness		L	IL=4.0mArms.	(250)	(350)	—	cd/m ²	
Chromaticity coordinates	Red	x	$\theta = \phi = 0^\circ$	(0.56)	(0.61)	(0.66)	—	
		y		(0.29)	(0.34)	(0.39)		
	Green	x	$\theta = \phi = 0^\circ$	(0.26)	(0.31)	(0.36)		
		y		(0.49)	(0.54)	(0.59)		
	Blue	x	$\theta = \phi = 0^\circ$	(0.10)	(0.15)	(0.20)		
		y		(0.08)	(0.13)	(0.18)		
	White	x	$\theta = \phi = 0^\circ$	(0.27)	(0.32)	(0.37)		
		y		(0.28)	(0.33)	(0.38)		

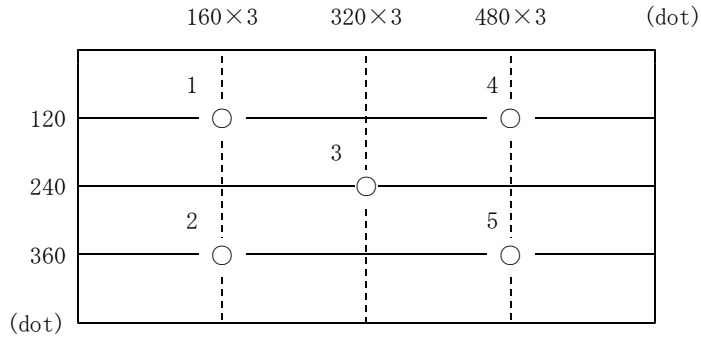
6-1. Contrast ratio is defined as follows:

$$CR = \frac{\text{Brightness at all pixels "White"}}{\text{Brightness at all pixels "Black"}}$$

6-2. Definition of viewing angle



6-3. Measuring points



- 1) Rating is defined as the average brightness inside the viewing area.
- 2) 30 minutes after CFL is turned on. (Ambient Temp. = 25°C)
- 3) The inverter should meet the CFL rating condition.
Sine, symmetric waveform without spike in positive and negative.

7. Interface signals

7-1. LCD

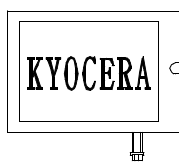
PIN NO.	SYMBOL	DESCRIPTION	I/O	Note
1	GND	GND	-	
2	CK	Clock signal for sampling each data signal	I	
3	Hsync	Horizontal synchronous signal (negative)	I	
4	Vsync	Vertical synchronous signal (negative)	I	
5	GND	GND	-	
6	R0	RED data signal (LSB)	I	
7	R1	RED data signal	I	
8	R2	RED data signal	I	
9	R3	RED data signal	I	
10	R4	RED data signal	I	
11	R5	RED data signal (MSB)	I	
12	GND	GND	-	
13	G0	GREEN data signal (LSB)	I	
14	G1	GREEN data signal	I	
15	G2	GREEN data signal	I	
16	G3	GREEN data signal	I	
17	G4	GREEN data signal	I	
18	G5	GREEN data signal (MSB)	I	
19	GND	GND	-	
20	B0	BLUE data signal (LSB)	I	
21	B1	BLUE data signal	I	
22	B2	BLUE data signal	I	
23	B3	BLUE data signal	I	
24	B4	BLUE data signal	I	
25	B5	BLUE data signal (MSB)	I	
26	GND	GND	-	
27	ENAB	Signal to settle the horizontal display position (positive)	I	*1
28	VDD	3.3V power supply	-	
29	VDD	3.3V power supply	-	
30	R/L	Horizontal display mode select signal L : Normal , H : Left / Right reverse mode	I	*2
31	U/D	Vertical display mode select signal H : Normal , L : Up / Down reverse mode	I	*2
32	V/Q	H : Normal	I	
33	GND	GND	-	

LCD connector : 08-6210-033-340-800+ (ELCO)

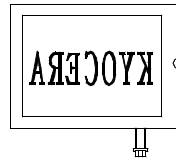
Recommended matching connector : 0.5 mm pitch FFC or FPC

*1 The horizontal display start timing is settled in accordance with a rising timing of ENAB signal. In case ENAB is fixed "Low", the horizontal start timing is determined as described in 8-2. Don't keep ENAB "High" during operation.

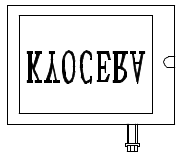
*2



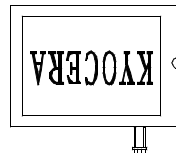
R/L = L
U/D = H



R/L = H
U/D = H



R/L = L
U/D = L



R/L = H
U/D = L

7-2. CFL

PIN NO.	SYMBOL	DESCRIPTION
1	HOT	Inverter output high voltage side
2	NC	—
3	COLD	Inverter output low voltage side

LCD side connector : BHR-03VS-1 (JST)

Recommended matching connector : SM02-(8.0)B-BHS-1 (JST)

: SM02-(8.0)B-BHS-1-TB(LF)(SN) (JST) . . . RoHS

* Please be careful NOT to connect inversely an inverter-output high voltage side to the CFL low voltage side. It may result in damage or electric shock.

8. Timing Characteristics of input signals

8-1. Timing characteristics

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Clock	Frequency	1/Tc	—	25.18	28.33	MHz	V/Q=H
	Duty ratio	Tch/Tc	40	50	60	%	
Data	Set up time	Tds	5	—	—	ns	
	Hold time	Tdh	10	—	—	ns	
Horizontal sync. signal	Cycle	TH	30.0	31.8	—	μs	V/Q=H
			770	800	900	clock	
	Pulse width	THp	2	96	200	clock	
Vertical sync. signal	Cycle	TV	515	525	560	line	V/Q=H
	Pulse width	TVp	2	—	34	line	
Horizontal display period		THd	640			clock	
Hsync.-Clock phase difference		THc	10	—	Tc-10	ns	
Hsync.-Vsync. phase difference		TVh	0	—	TH-THp	ns	
Vertical sync.signal start position		TVs	34			line	V/Q=H
Vertical display period		TVd	480			line	

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

8-2. Horizontal display position

The horizontal display position is determined by ENAB signal.

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Enable signal	Set up time	Tes	5	—	Tc-10	ns	
	Pulse width	Tep	2	640	TH-10	clock	
Hsync.-Enable signal phase difference		The	44	—	104	clock	V/Q=H

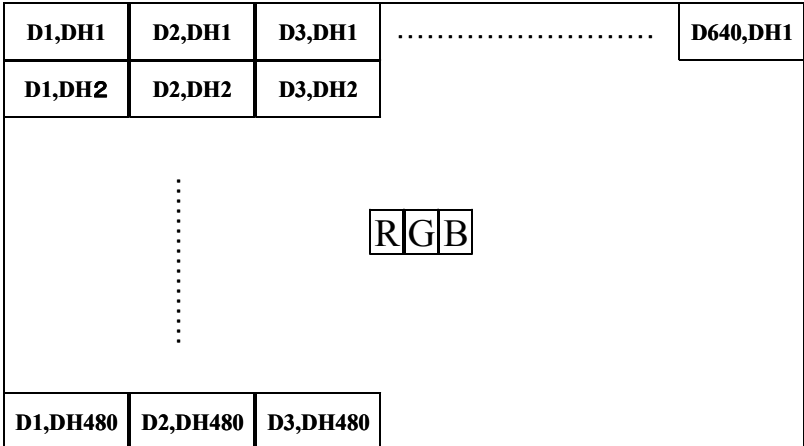
* When ENAB is fixed at "Low", the display starts from the data of C104 (clock) as shown in 8-5.

8-3. Vertical display position

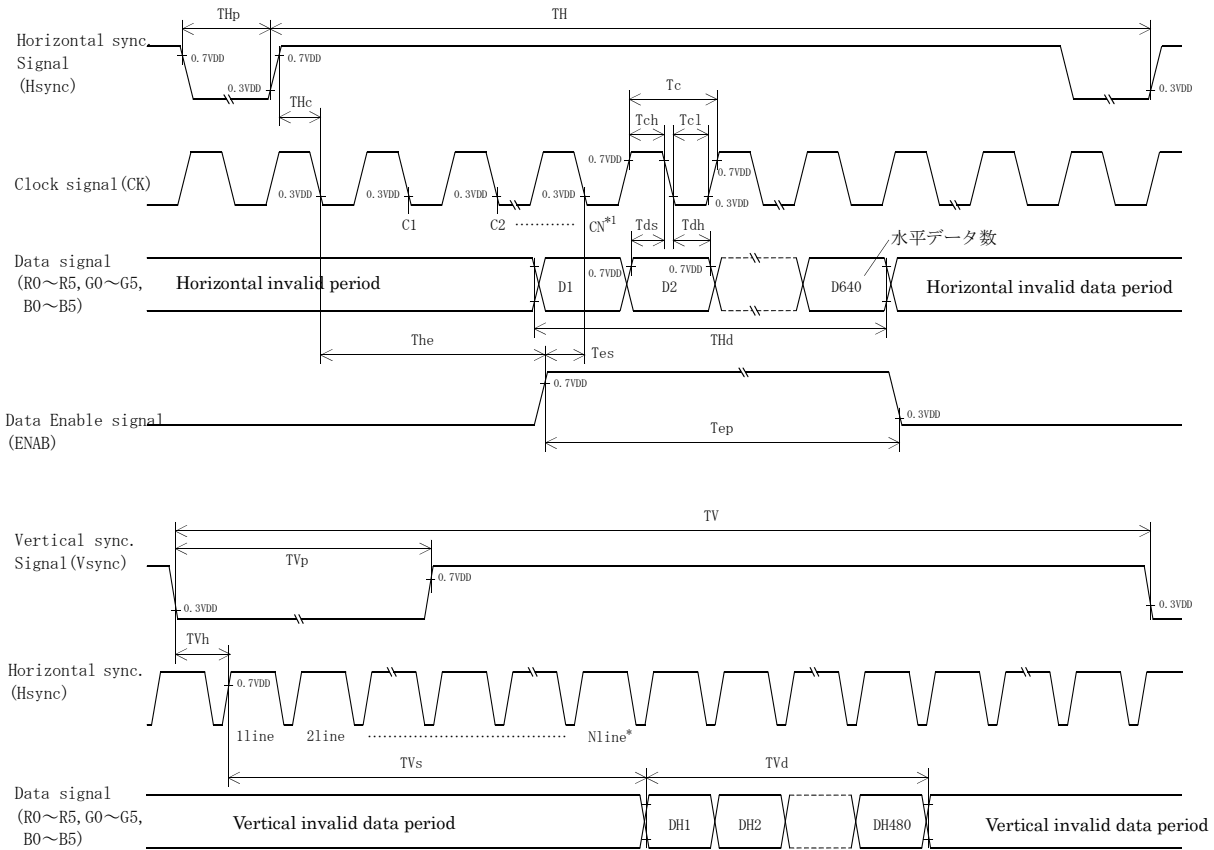
The vertical display position (TVs) is fixed at 34th line. (V/Q=H)

Note) ENAB signal is independent of vertical display position.

8-4. Input Data Signals and Display position on the screen



8-5. Input Timing Characteristics



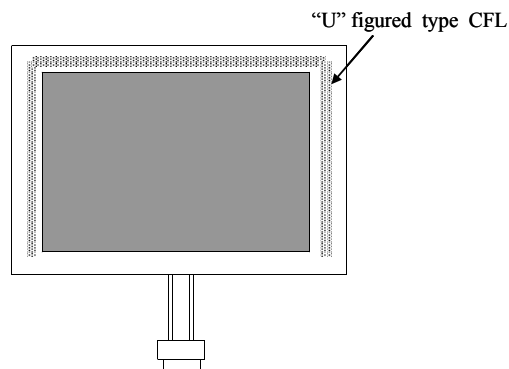
*1 When ENAB is fixed "Low" the display starts from the data of C104(Clock)
*2 The vertical display position(TVs) is fixed at 34th line.

9. Backlight Characteristics

Temp. = 25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	NOTE
Starting discharge Voltage *1	VS	—	—	1,550 Vrms.	-10 °C
		—	—	1,035 Vrms.	25 °C
Discharging tube current *2	IL	3.0 mArms.	4.0 mArms.	5.0 mArms.	—
Discharging tube voltage	VL	—	685 Vrms.	—	IL=4.0 mArms.
Operating life *3	T	60,000 h	75,000 h	—	IL=4.0 mArms.
Operating frequency *4	F	30 kHz	—	100 kHz	—

- *1 The Non-load output voltage (VS) of the inverter should be 1.3 times the maximum VS at the low temperature to provide margin to assure that the CFL will start, because actual VS may increase due to leakage current from the CFL cables. (Reference value: 2,015 Vrms Min.)
- *2 We recommend that you should set the discharging tube current at lower than typical value so as to prevent the heat accumulation of CFL tube from deteriorating a performance of the LCD.
- *3 End of life is defined as when the illuminance or quantity of light has decreased to 50% of the initial value. Illuminance of light will drastically decrease when LCD is operated at lower temperature for long hours.
- *4 The driving frequency of the CFL may interfere with the horizontal synchronous signal, leaving interference stripes on the display. So please evaluate LCD panels beforehand. To avoid interference stripes, we recommend to separate as far as possible the CFL frequency from the horizontal synchronous signal and its high harmonic frequency.
- * There may be cases where interface noise on LCD PCB, generated by high-voltage products such as inverters, may leave stripes on the display. Please be careful when designing a mold to take into consideration that the inverter shall be located as far as possible from PCB. Shield protection may be effective.
- * CFL arrangement figure



1 0. Lot Number Identification

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

TCG057VG1AC-G00 - □ □ - □ □ - □ MADE IN □ □ □ □ □

↓ ↓ ↓ ↓ ↓
 ① ② ③ ④ ⑤

- ①YEAR
- ②MONTH
- ③DATE
- ④Version Number
- ⑤Country of origin(Japan or China)

YEAR	2006	2007	2008	2009	2010	2011
CODE	6	7	8	9	0	1

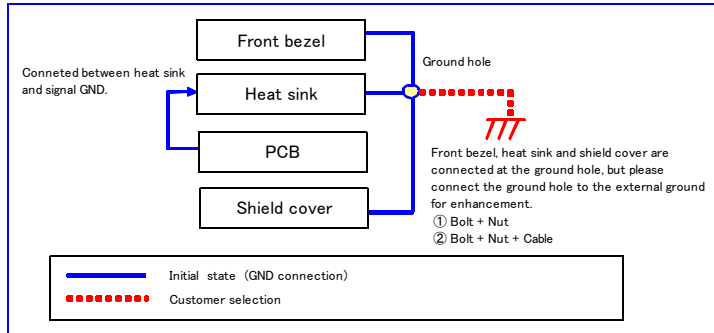
MONTH	JAN.	FEB.	MAR.	APR.	MAY.	JUN.
CODE	1	2	3	4	5	6

MONTH	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
CODE	7	8	9	X	Y	Z

11. Precautions for use

11-1. Installation of the LCD

- The LCD's bezel must be grounded. The heat sink and shield cover are connected at the ground hole. The ground hole is located on the right side of the LCD when viewed from the front. The ground hole must be connected to an external ground.



- A transparent protection sheet shall be added to protect the LCD and its polarizers.
- The LCD shall be installed so that there is no pressure on the LSI chips.
- The LCD shall be installed flat, without twisting or bending.
- The display window size should be the same as the effective viewing area.
- In case you use outside frame of effective viewing area as outward appearance of your product, unevenness of its outward appearance is out of guarantee.
- Please refer to the following our recommendable value of Clamp-down torque when installing. Clamp-down torque: $3.3 \pm 0.3 \text{ kgf.cm}$ Please set up 'SPEED-LOW', 'SOFT START-SLOW' when using electric driver .
 Recommendable screw P-TITE screw nominal dia. 3.0mm
 installing boss hole depth $3.5 \pm 0.5 \text{ mm}$
 Please be careful not to use high torque which may damage LCD module in installation.
- A transparent protection sheet is attached to the polarizer. Please remove the protection film slowly before use, paying attention to static electricity.
- Do not pull the CFL lead wires and do not bend the root of the wires.
 Housing should be designed to protect CFL lead wires from external stress.
- 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.

11-2. Static Electricity

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

11-3. LCD Operation

- The LCD shall be operated within the limits specified. Operation at values outside of these limits may shorten life, and/or harm display images.
- Adjust "LCD driving voltage" to obtain optimum viewing angle and contrast.
 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.

11-4. Storage

- The LCD shall be stored within normal temperature and humidity.
 Store in a dark area, and protected the LCD from direct sunlight or fluorescent light.
- Always store the LCD so that it is free from external pressure onto it.

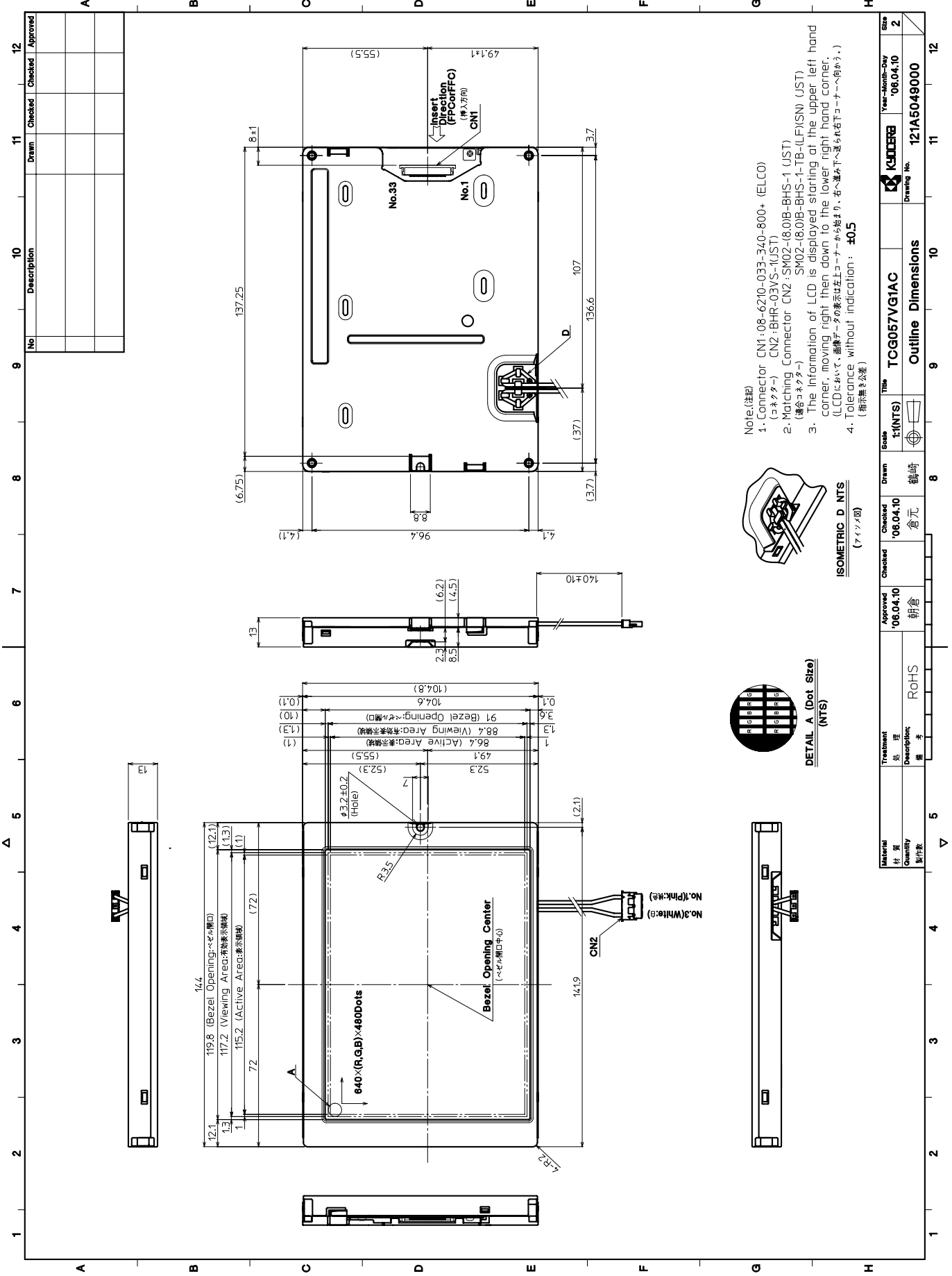
11-5. Caution items when handling the LCD.

1. DO NOT store in a high humidity environment for extended periods.
Image degradation, bubbles, and/or peeling off of 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 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.
6. Do not disassemble LCD module because it will result in damage.
7. Please do not use solid-base image pattern for long hours because a temporary afterimage may appear. We recommend to use screen saver etc. in cases where a solid-base image pattern must be used.
8. 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 Data / Environmental Test

TEST ITEM	TEST CONDITION	TEST TIME	RESULT
High Temp. Atmosphere	(80°C)	240 h	Display Quality : No defect Display Function : No defect Current Consumption : No defect
Low Temp. Atmosphere	(-30°C)	240 h	Low Temp. Bubble : None Solid Crystallization of Liquid Crystal : None Display Quality : No defect Display Function : No defect Current Consumption : No defect
High Temp. Humidity Atmosphere	(40°C) (90%RH)	240 h	Display Quality : No defect Display Function : No defect Peel-off of Organic Sealing : None Current Consumption : No defect
Temp. Cycle	(-30°C 0.5 h) (R. T. 0.5 h) (80°C 0.5 h)	10 cycles	Display Quality : No defect Display Function : No defect Peel-off of Organic Sealing : None Bubble on Cell : None
High Temp. Operation	(70°C) Vop	240 h	Display Quality : No defect Display Function : No defect Current Consumption : No defect

- * Each test item uses a test LCD only once. The tested LCD is not used in any other tests.
- * The LCD is tested in circumstances in which there is no condensation.
- * The tested LCD is inspected after 24 hours of storage at room temperature and room humidity after each test is finished.
- * The reliability test is not an out-going inspection.
- * The results of the reliability test are for your reference purpose only.
The reliability test is conducted only to examine the LCD's capability.



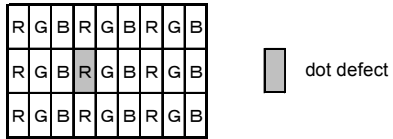
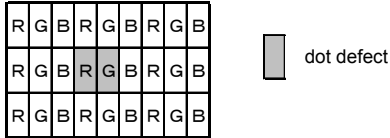
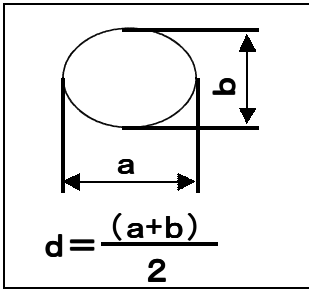
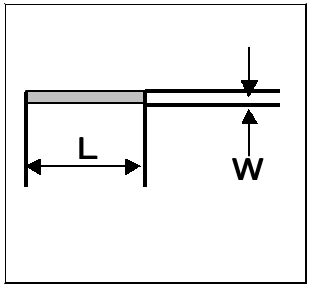
Note: (注記)

- Connector CN1: 08-6210-033-340-800+ (ELCO) (コネクタ) CN2: BHR-03VS-1(JST) (適合コネクタ)
- Matching Connector CN2: SM02-(8.0)B-BHS-1 (JST) SM02-(8.0)B-BHS-1-TB-(LF)(SN) (JST)
- 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、画素データの表示は上コーナーから始まり、右へ進み下へ進む右下コーナーへ向かう。)
- Tolerance without indication: ± 0.5 (指示無公差)

No	Description	Drawn	Checked	Approved

Material	Treatment	Approved	Checked	Drawn	Scale	Title	Year-Month-Day	Size
材 質	処理	'06.04.10	'06.04.10	嶋崎	1:1(NTS)	TCG057VG1AC	'06.04.10	2
Quantity	Description	輔倉	倉元	嶋崎	Outline Dimensions			
製作数	備考	RoHS			Drawing No. 121A5049000			

14. Inspection Standard Note

		Note		
General	<p>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.</p> <p>2. Inspection Conditions Luminance : 500 Lux minimum Inspection distance : 300 mm (from the sample) Temperature : 25 ± 5 °C Direction : directly above</p>			
Definition of Inspection item	Dot defect	Bright dot defect	<p>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.</p> 	
		Black dot defect	<p>The dot is constantly "off" when power applied to the LCD, even when all "white" data sent to the screen.</p>	
		Adjacent dot	<p>Adjacent dot defect is defined as two or more bright dot defects or black dot defects.</p> 	
	External inspection	Bubble, Scratches, 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.	
	Others	CFL wires	Damaged to the CFL wires, connector, pin, functional failure or appearance failure.	
Definition of size	<p>Definition of circle size</p> 	<p>Definition of linear size</p> 		

15. Inspection Standard

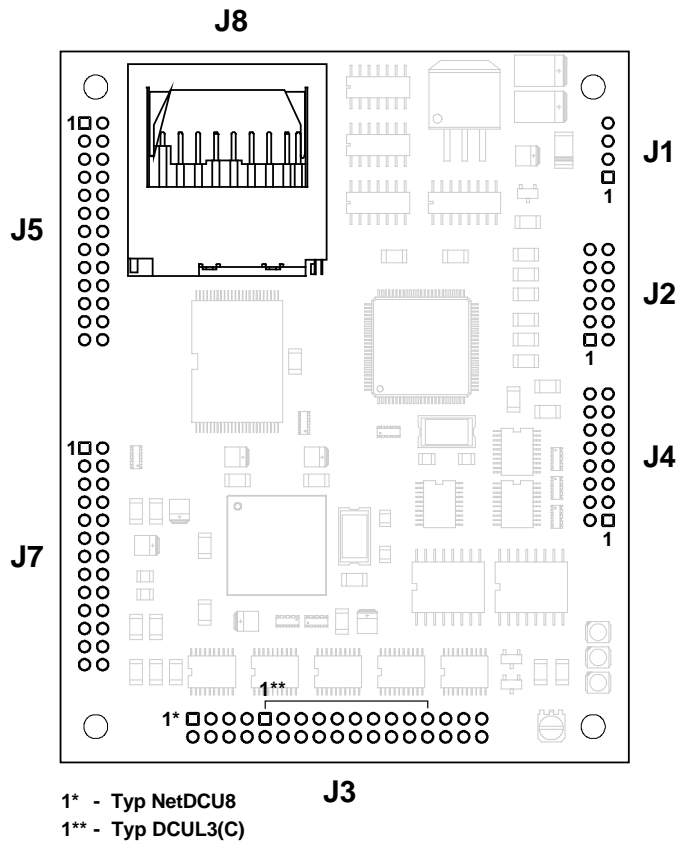
Classification		Inspection item	Judgement standard																
defect (in LCD glass)	Dot defect	Bright dot defect	Acceptable number : 4 bright dots defects Bright dot spacing : 5 mm or more																
		Black dot defect	Acceptable number : 5 black dots defects Black dot spacing : 5 mm or more																
		2 dots join	Bright dot defect	Acceptable number : 2															
			Black dot defect	Acceptable number : 3															
		3 or more dots join	Acceptable number : 0																
	Total dot defects	Acceptable number : 5 Max																	
	Others	White dot, Dark dot (Circle)	<table border="1" style="width: 100%;"> <thead> <tr> <th>Size (mm)</th> <th>Acceptable Number</th> </tr> </thead> <tbody> <tr> <td>$d < 0.2$</td> <td>(neglected)</td> </tr> <tr> <td>$0.2 < d \leq 0.4$</td> <td>5</td> </tr> <tr> <td>$0.4 < d \leq 0.5$</td> <td>3</td> </tr> <tr> <td>$0.5 < d$</td> <td>0</td> </tr> </tbody> </table>			Size (mm)	Acceptable Number	$d < 0.2$	(neglected)	$0.2 < d \leq 0.4$	5	$0.4 < d \leq 0.5$	3	$0.5 < d$	0				
Size (mm)	Acceptable Number																		
$d < 0.2$	(neglected)																		
$0.2 < d \leq 0.4$	5																		
$0.4 < d \leq 0.5$	3																		
$0.5 < d$	0																		
External inspection (Defect on Polarizer or between Polariz- er and LCD glass)	Polarizer (Scratches)	<table border="1" style="width: 100%;"> <thead> <tr> <th>Width (mm)</th> <th>Length (mm)</th> <th>Acceptable Number</th> </tr> </thead> <tbody> <tr> <td>$W \leq 0.1$</td> <td>-</td> <td>(neglected)</td> </tr> <tr> <td rowspan="2">$0.1 < W \leq 0.3$</td> <td>$L \leq 5.0$</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> </tbody> </table>			Width (mm)	Length (mm)	Acceptable Number	$W \leq 0.1$	-	(neglected)	$0.1 < W \leq 0.3$	$L \leq 5.0$	(neglected)	$5.0 < L$	0	$0.3 < W$	-	0	
		Width (mm)	Length (mm)	Acceptable Number															
		$W \leq 0.1$	-	(neglected)															
		$0.1 < W \leq 0.3$	$L \leq 5.0$	(neglected)															
	$5.0 < L$		0																
	$0.3 < W$	-	0																
	Polarizer Touch panel (Bubble, Dent)	<table border="1" style="width: 100%;"> <thead> <tr> <th>Size (mm)</th> <th>Acceptable Number</th> </tr> </thead> <tbody> <tr> <td>$d < 0.2$</td> <td>(neglected)</td> </tr> <tr> <td>$0.2 < d \leq 0.3$</td> <td>5</td> </tr> <tr> <td>$0.3 < d \leq 0.5$</td> <td>3</td> </tr> <tr> <td>$0.5 < d$</td> <td>0</td> </tr> </tbody> </table>			Size (mm)	Acceptable Number	$d < 0.2$	(neglected)	$0.2 < d \leq 0.3$	5	$0.3 < d \leq 0.5$	3	$0.5 < d$	0					
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		$d < 0.2$	(neglected)																
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$0.3 < d \leq 0.5$	3																		
$0.5 < d$	0																		
Foreign Particle (Circular shape)	<table border="1" style="width: 100%;"> <thead> <tr> <th>Size (mm)</th> <th>Acceptable Number</th> </tr> </thead> <tbody> <tr> <td>$d < 0.2$</td> <td>(neglected)</td> </tr> <tr> <td>$0.2 < d \leq 0.4$</td> <td>5</td> </tr> <tr> <td>$0.4 < d \leq 0.5$</td> <td>3</td> </tr> <tr> <td>$0.5 < d$</td> <td>0</td> </tr> </tbody> </table>			Size (mm)	Acceptable Number	$d < 0.2$	(neglected)	$0.2 < d \leq 0.4$	5	$0.4 < d \leq 0.5$	3	$0.5 < d$	0						
	Size (mm)	Acceptable Number																	
	$d < 0.2$	(neglected)																	
	$0.2 < d \leq 0.4$	5																	
$0.4 < d \leq 0.5$	3																		
$0.5 < d$	0																		
Foreign Particle (Linear shape), Scratches	<table border="1" style="width: 100%;"> <thead> <tr> <th>Width (mm)</th> <th>Length (mm)</th> <th>Acceptable Number</th> </tr> </thead> <tbody> <tr> <td>$W \leq 0.03$</td> <td>-</td> <td>(neglected)</td> </tr> <tr> <td rowspan="3">$0.03 < W \leq 0.1$</td> <td>$L \leq 2.0$</td> <td>(neglected)</td> </tr> <tr> <td>$2.0 < L \leq 4.0$</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> </tbody> </table>			Width (mm)	Length (mm)	Acceptable Number	$W \leq 0.03$	-	(neglected)	$0.03 < W \leq 0.1$	$L \leq 2.0$	(neglected)	$2.0 < L \leq 4.0$	3	$4.0 < L$	0	$0.1 < W$	-	(According to Circular shape)
	Width (mm)	Length (mm)	Acceptable Number																
	$W \leq 0.03$	-	(neglected)																
	$0.03 < W \leq 0.1$	$L \leq 2.0$	(neglected)																
		$2.0 < L \leq 4.0$	3																
$4.0 < L$		0																	
$0.1 < W$	-	(According to Circular shape)																	

C) Specification for NetDCU8

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1 Arrangement of Connectors

Figure 1.1: Top View



2 Connectors

2.1 Counting of the connector pins

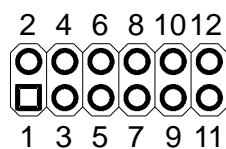
All connections prepared for two-row connectors on the Net-DCU8 are treated as follow.

Pin 1 is marked by a square pad.

The row with pin 1 contains all odd-numbered pins (1, 3, 5, 7, etc.), and, corresponding to this, the row without pin 1 contains all even-numbered pins (2, 4, 6, 8, etc.).

Figure 2.1 shows the counting of connector J2 of the Net-DCU8 as an example.

Figure 2.1: Counting on connector J2



2.2 J1 Power Supply

J1 Power Supply	
Pin	Function
1	+3V ... +15V / max. 2A DC (CFL- Converter)
2	+5V \pm 5% DC at max. 0,6A (*)
3	+3V...+3,6V DC (Battery buffering RTC) (**)
4	GND (Ground Power Supply)

(*) \emptyset No Display connected.

(**) \emptyset Can be left out depending on application.

2.3 J2 Ethernet Interface

J2 Ethernet Interface		
Pin	Signal	Function
1	RxD	Pin 6 of RJ45 connector
2	RxD	Pin 3 of RJ45 connector
3	- - -	
4	- - -	
5	- - -	
6	- - -	
7	TxD	Pin 2 of RJ45 connector
8	TxD	Pin 1 of RJ45 connector
9	GND	Signal Ground
10	V _{CC}	+5V DC
11	- - -	
12	- - -	

(- - -) \emptyset Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

2.4 J2 Serial RS232 Port 1

J2 serial RS232 port 1			
Pin	Signal	Function	I/O
1	---		
2	---		
3	RxD1	Received Data	I
4	RTS1	Request To Send	O
5	TxD1	Transmitted Data	O
6	CTS1	Clear To Send	I
7	---		
8	---		
9	GND	Signal Ground	Power
10	V _{CC}	+5V DC	Power
11	---		
12	---		

(- - -) ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

2.5 J2 CAN Interface

J2 CAN Interface			
Pin	Signal	Function	I/O
1	---		
2	---		
3	---		
4	---		
5	---		
6	---		
7	---		
8	---		
9	GND	Signal Ground	Power
10	V _{CC}	+5V DC	Power
11	CAN-RxD	Receive signal	I
12	CAN-TxD	Transmit signal	O

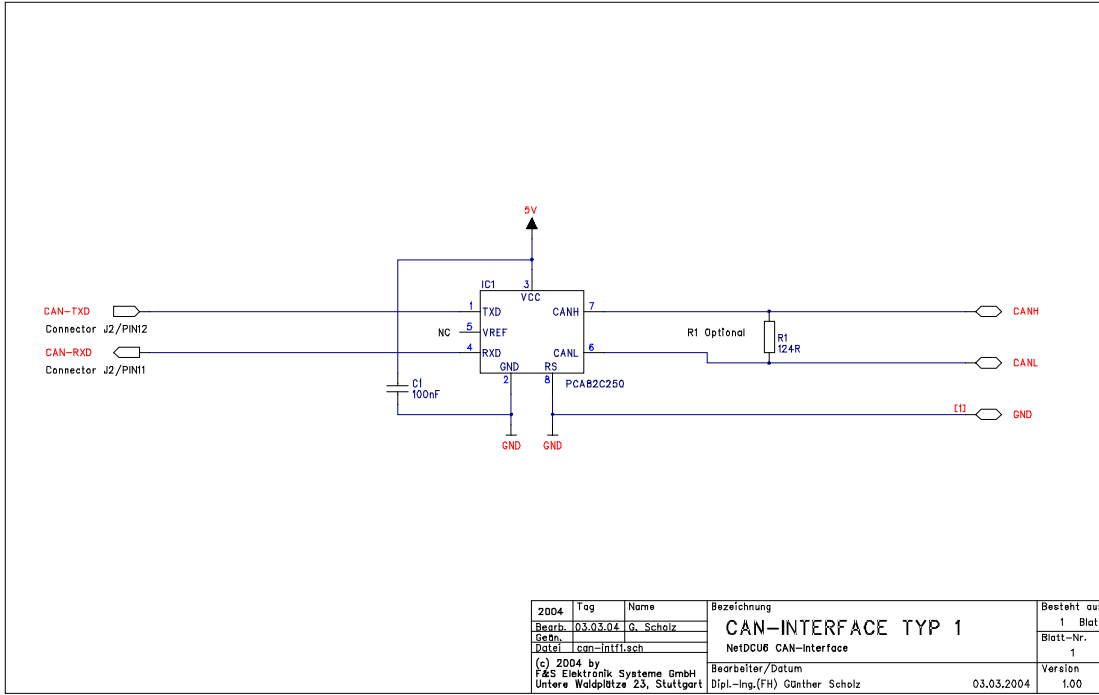
(- - -) ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

Note:

The two CAN signals can NOT be connected directly to the CAN bus. You need a special interface logic to doing this. Take a look at the following to examples to get an idea how to connect the CAN bus.

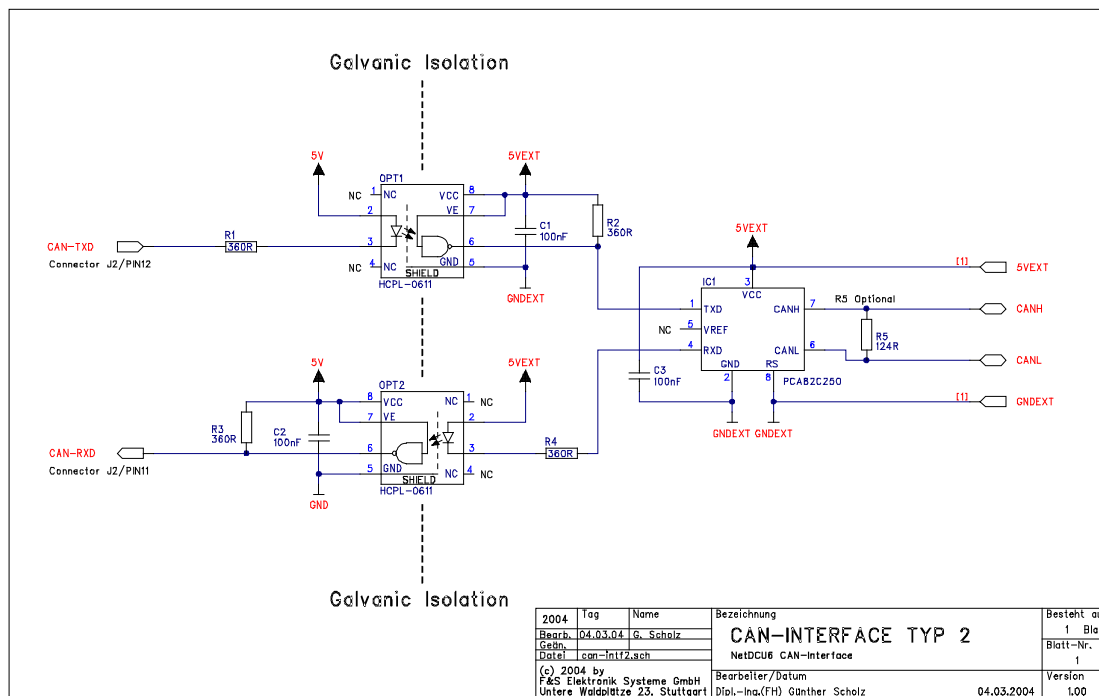
2.5.1 Example CAN-Interface type 1

The following schematic shows the needed interface between NetDCU8 and CAN bus. It has no galvanic isolation.



2.5.2 Example CAN-Interface type 2

The following schematic shows the needed interface between NetDCU8 and CAN bus. It has galvanic isolation.



2.6 J3 Display Interface

J3 Display Interface		
Pin	Signal	Function
1	GND	Signal Ground
2	R1	Red Bit 1
3	R0	Red Bit 0 (LSB)
4	G5	Green Bit 5 (MSB)
5	G4	Green Bit 4
6	G3	Green Bit 3
7	G2	Green Bit 2
8	GND	Signal Ground
9	B3	Blue Bit 3
10	B2	Blue Bit 2
11	B1	Blue Bit 1
12	B0	Blue Bit 0 (LSB)
13	G1	Green Bit 1
14	G0	Green Bit 0 (LSB)
15	B5	Blue Bit 5 (MSB)
16	B4	Blue Bit 4
17	GND	Signal Ground
18	V _{EEK}	(*)
19	CLP	Data clock pulse
20	FRP	Frame Impulse

J3 Display Interface		
Pin	Signal	Function
21	M	Display data valid signal
22	LIP	Line Impulse
23	DEN	Display ON
24	GND	Signal Ground
25	V _{LCD}	Power supply LCD +5V (+3,3V)
26	-V _{EE}	Negative LCD Voltage
27	V _{ADJ}	Contrast Adjustment
28	GND	Signal Ground
29	+V _{EE}	Positive LCD Voltage
30	V _{CFL}	Max. +12V for CFL converter
31	R2	Red Bit 2
32	R3	Red Bit 3
33	R4	Red Bit 4
34	R5	Red Bit 5 (MSB)

(*) ⌀ Through software adjustable output voltage
0V ... +3,3V (up rev. 1.10).

2.7 J3 LCD Connection

J3	Mono STN		Color STN	Color TFT	
	Single		8 bit	12 bit	18 bit
	4 bit	8 bit	8 bit		
FRP	FRAME (VSYNC)				
LIP	LINE (HSYNC)				
CLP	SHIFT (CLK)				
M	MOD (M)			DRDY (DE)	
DEN	DEN (/DISP OFF)			---	
R0	---	---	---	---	R0
R1	---	---	---	---	R1
R2	---	---	---	R0	R2
R3	---	---	---	R1	R3
R4	---	---	---	R2	R4
R5	---	---	---	R3	R5
G0	---	D5 (LD1)	D5	---	G0
G1	---	D4 (LD0)	D4	---	G1
G2	---	---	---	G0	G2
G3	---	---	---	G1	G3
G4	---	---	---	G2	G4
G5	---	---	---	G3	G5
B0	D3	D3 (UD3)	D3	---	B0
B1	D2	D2 (UD2)	D2	---	B1
B2	D1	D1 (UD1)	D1	B0	B2
B3	D0	D0 (UD0)	D0	B1	B3
B4	---	D7 (LD3)	D7	B2	B4
B5	---	D6 (LD2)	D6	B3	B5
+/- V _{EE} Contrast-Voltage	+/- V _{EE}			---	

(- - -) ⌀ Please note: These pins carry active signals. Any *invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

2.8 J4 FS-Bus (8 bit Extension interface)

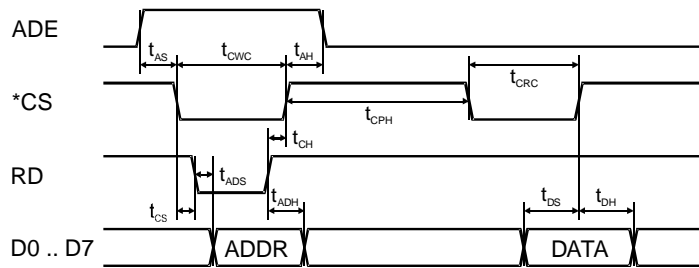
J4 parallel extension interface		
Pin	Signal	Function
1	D0	Data Bit D0, I/O (*)
2	D1	Data Bit D1, I/O (*)
3	D2	Data Bit D2, I/O (*)
4	D3	Data Bit D3, I/O (*)
5	D4	Data Bit D4, I/O (*)
6	D5	Data Bit D5, I/O (*)
7	D6	Data Bit D6, I/O (*)
8	D7	Data Bit D7, I/O (*)
9	V _{IO}	IO Voltage, +3,3V or +5V (***)
10	RD	Read, output, active High (*)
11	NCS	Chip Select, output, active Low (*)
12	ADE	Address Enable, output, active High (*)
13	NIRQ	Interrupt, input, active Low (*)
14	NRES	Reset, input, active Low (**)
15	V _{EXT}	External +V _{EEK} voltage for LCD
16	GND	Signal Ground

(*) \bar{O} Input/output with Pull Up resistor 4,7k \bullet at +3,3V or +5V (-> configuration parallel port).

(**) \bar{O} Input with Pull Up resistor 3k \bullet at +3,3V.

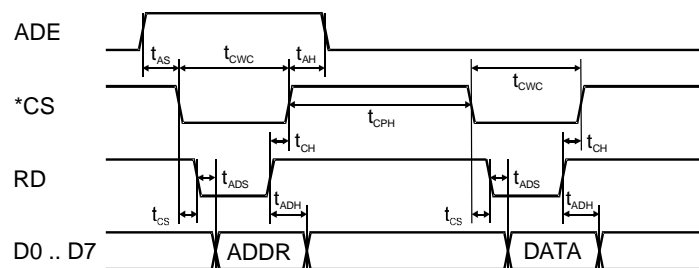
(***) \bar{O} See also configuration of the parallel port.

2.8.1 FS-Bus Timing Read Cycle



Item	Symbol	Min.	Typ.	Max.	Unit
ADE set up time	t_{AS}	20	-	-	ns
ADE hold time	t_{AH}	20	-	-	ns
CS cycle write time	t_{CWC}	180	200	-	ns
CS set up time	t_{CS}	0	-	-	ns
CS hold time	t_{CH}	0	-	-	ns
ADDR set up time	t_{ADS}	2	-	-2	ns
ADDR hold time	t_{ADH}	0	-	-	ns
CS pulse high width	t_{CPH}	100	-	-	ns
CS cycle read time	t_{CRC}	180	-	-	ns
DATA set up time	t_{DS}	25	-	-	ns
DATA hold time	t_{DH}	0	-	-	ns

2.8.2 FS-Bus Timing Write Cycle



Item	Symbol	Min.	Typ.	Max.	Unit
ADE set up time	t_{AS}	20	-	-	ns
ADE hold time	t_{AH}	20	-	-	ns
CS cycle write time	t_{CWC}	180	200	-	ns
CS set up time	t_{CS}	0	-	-	ns
CS hold time	t_{CH}	0	-	-	ns
ADDR set up time	t_{ADS}	2	-	-2	ns
ADDR hold time	t_{ADH}	0	-	-	ns
CS pulse high width	t_{CPH}	100	-	-	ns

2.9 J5 Matrix Keyboard

J5 Matrix Keyboard			
Pin	Signal	Function	I/O
1	- - -		
2	GPIO7	Row 7 - Matrix key	O
3	GPIO6	Row 6 - Matrix key	O
4	GPIO5	Row 5 - Matrix key	O
5	GPIO4	Row 4 - Matrix key	O
6	GPIO3	Row 3 - Matrix key	O
7	GPIO2	Row 2 - Matrix key	O
8	GPIO1	Row 1 - Matrix key	O
9	GPIO0	Row 0 - Matrix key	O
10	GPIO9	Column 8 - Matrix key	I (*)
11	GPIO10	Column 9 - Matrix key	I (*)
12	- - -		
13	GPIO11	Column 10 - Matrix key	I (*)
14	- - -		
15	GPIO12	Column 11 - Matrix key	I (*)
16	GND	Signal Ground	Power
17	KBIN0	Column 0 - Matrix key	I (*)
18	KBIN1	Column 1 - Matrix key	I (*)
19	KBIN2	Column 2 - Matrix key	I (*)
20	KBIN3	Column 3 - Matrix key	I (*)

J5 Matrix Keyboard			
Pin	Signal	Function	I/O
21	KBIN4	Column 4 - Matrix key	I (*)
22	KBIN5	Column 5 - Matrix key	I (*)
23	KBIN6	Column 6 - Matrix key	I (*)
24	KBIN7	Column 7 - Matrix key	I (*)
25	V _{CC}	+5V DC	Power
26	V _{DD}	+3,3V (0,1A max.) DC	Power

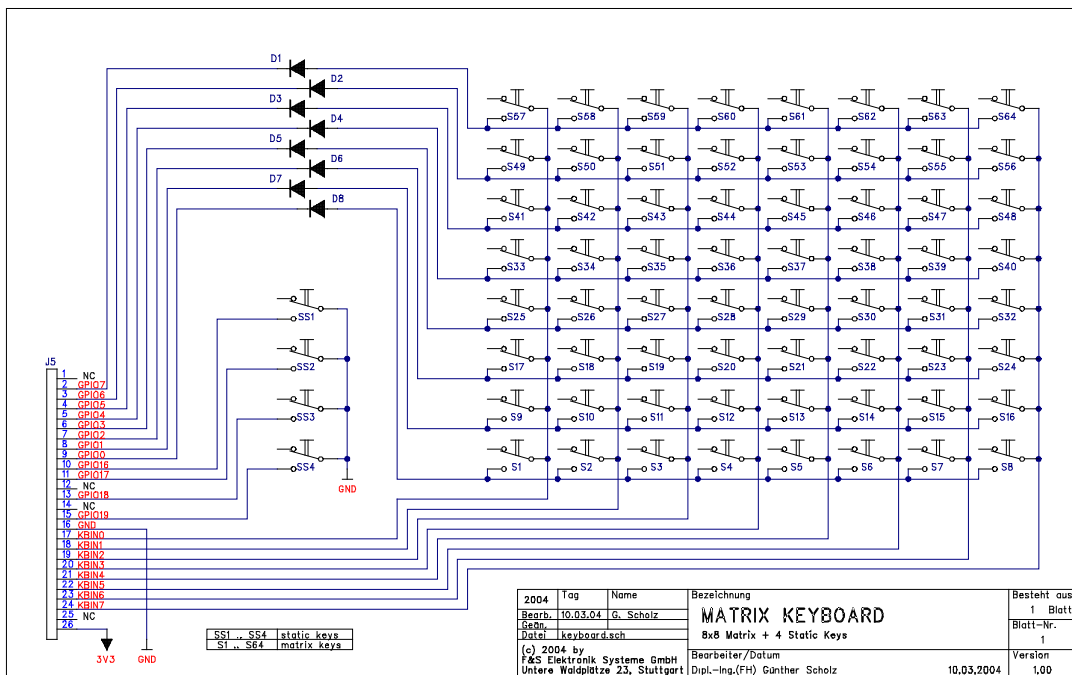
(*) ⚠ Note: I/O pins have pull-up resistor 4,7k Ω to +3,3V.

(- - -) ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

All voltage levels of the input and output signals must be compatible to the LVC (3,3V) specification !

2.9.1 Matrix Keyboard example connection

The following schematic show the connection of a keyboard with a 8x8 matrix and four static keys.



2.10 J5 I/O interface

J5 I/O Interface			
Pin	Signal	Function	I/O
1	GPIO8	Interrupt	I/O (*)
2	GPIO7	IO-Port 7	I/O
3	GPIO6	IO-Port 6	I/O
4	GPIO5	IO-Port 5	I/O
5	GPIO4	IO-Port 4	I/O
6	GPIO3	IO-Port 3	I/O
7	GPIO2	IO-Port 2	I/O
8	GPIO1	IO-Port 1	I/O
9	GPIO0	IO-Port 0	I/O
10	GPIO9	IO-Port 9	I/O (*)
11	GPIO10	IO-Port 10	I/O (*)
12	---		
13	GPIO11	IO-Port 11	I/O (*)
14	---		
15	GPIO12	IO-Port 12	I/O (*)
16	GND	Signal Ground	Power
17	KBIN7	Input-Port 7	I (*)
18	KBIN6	Input-Port 6	I (*)
19	KBIN5	Input-Port 5	I (*)
20	KBIN4	Input-Port 4	I (*)

J5 I/O Interface			
Pin	Signal	Function	I/O
21	KBIN3	Input-Port 3	I (*)
22	KBIN2	Input-Port 2	I (*)
23	KBIN1	Input-Port 1	I (*)
24	KBIN0	Input-Port 0	I (*)
25	V _{CC}	+5V DC	Power
26	V _{DD}	+3,3V (0,1A max.) DC	Power

(*) ⚠ Note: I/O pins have pull-up resistor 4,7k• at +3,3V.

(- - -) ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

All voltage levels of the input and output signals must be compatible to the LVC (3,3V) specification !

2.11 J5 serial RS232 port 2

J5 serial RS232 Interface			
Pin	Signal	Function	I/O
1	---		
.	---	.	.
.	.	.	.
.	.	.	.
12	RxD2	Received Data	I
13	---		
14	TxD2	Transmitted Data	O
15	---		
16	GND	Signal Ground	Power
.	---	.	.
.	.	.	.
.	.	.	.
25	V _{CC}	+5V DC	Power
26	V _{DD}	+3,3V (0,1A max.) DC	Power

(- - -) ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

2.12 J7 serial RS232 port 3

J7 serial RS232 Interface			
Pin	Signal	Function	I/O
1	---		
.	---	.	.
.	.	.	.
.	.	.	.
9	RxD3	Received Data	I
10	TxD3	Transmitted Data	O
.	---	.	.
.	.	.	.
.	.	.	.
13	V _{CC}	+5V DC	Power
14	GND	Signal Ground	Power
.	---	.	.
.	.	.	.
.	.	.	.
19	V _{DD}	+3,3V (0,1A max.) DC	Power
.	---	.	.
.	.	.	.
.	.	.	.

(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

2.13 J7 Touchpanel Interface

J7 Touchpanel Interface		
Pin	Signal	Function
1	- - -	
.	- - -	.
.	.	.
.	.	.
13	V _{CC}	+5V DC
14	GND	Signal Ground
15	TOUCH X+	X- Voltage Measurement
16	TOUCH Y+	Y- Voltage Measurement
17	TOUCH X-	X- Set Active Measurement
18	TOUCH Y-	Y- Set Active Measurement
19	V _{DD}	+3,3V DC
20	GND	Signal Ground
.	- - -	.
.	.	.
.	.	.
26	- - -	

(- - -) ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

2.14 J7 USB Interface 1

J7 USB Interface 1		
Pin	Signal	Function
1	---	
.	---	.
.	.	.
13	V _{CC}	+5V DC
14	GND	Signal Ground
.	---	.
.	.	.
19	V _{DD}	+3,3V DC
20	GND	Signal Ground
21	---	
22	---	
23	M2	USB negative
24	P2	USB positive
25	---	
26	W2	USB power supply

(- - -) ⚠ Please note: These pins carry active signals. Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!

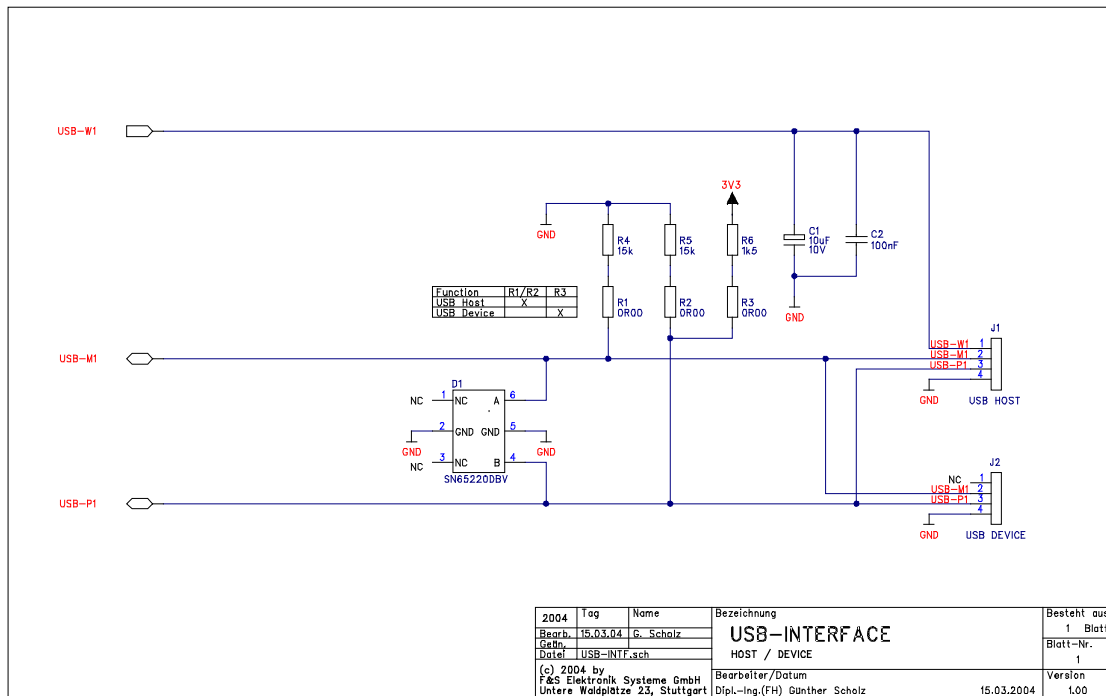
2.15 J7 USB Interface 2

J7 USB Interface 2		
Pin	Signal	Function
1	---	
.	---	
.	.	
13	V _{CC}	+5V DC
14	GND	Signal Ground
.	---	.
.	.	.
19	V _{DD}	+3,3V DC
20	GND	Signal Ground
21	M1	USB negative (Host/Device)
22	P1	USB positive (Host/Device)
23	---	
24	---	
25	W1	USB power supply (Host)
26	---	

(---) ⚠ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

2.15.1 Example USB Interface (Host/Device)

The following schematic shows the usage of the USB host or device interface.



2.16 J7 Analog Input

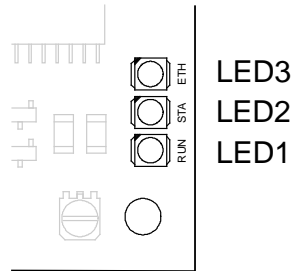
J7 analog Input		
Pin	Signal	Function
1	- - -	
.	- - -	.
.	.	.
9	AD2	Analog Input 2 (*) / altern. RxD3
10	AD3	Analog Input 3 (*) / altern. TxD3
11	AD0	Analog Input 0 (*)
12	AD1	Analog Input 1 (*)
13	V _{CC}	+5V DC
14	GND	Signal Ground
.	- - -	.
.	.	.
19	V _{DD}	+3,3V DC
20	GND	Signal Ground
.	- - -	.
.	.	.
26	- - -	

- (*) ⌀ Input Voltage: 0V to 7,5V (max. 8V)
 AD-Converter Resolution: 10 Bit, Error ±1 LSB
 47k• Pull Down resistor to GND.
- (- - -) ⌀ Please note: These pins carry active signals. *Any invalid connection of these signals may result in unexpected behavior or even destruction of the component!*

3 Status Indicators

The NetDCU8 comprises three LED status indicators. They are located on the top side of the board in the bottom right corner

Figure 3.1: Status LED



The following status information is displayed:

Status LED		
LED	Signal	Description
1	RUN	CPU in Run-Mode
2	STATUS	Status indicator(see SW documentation)
3	LINK	Ethernet: connection online

4 Configuration NetDCU8

By hardware-configuration of NetDCU8 some settings for peripheral devices could be done.

Figure 4.1: Top View

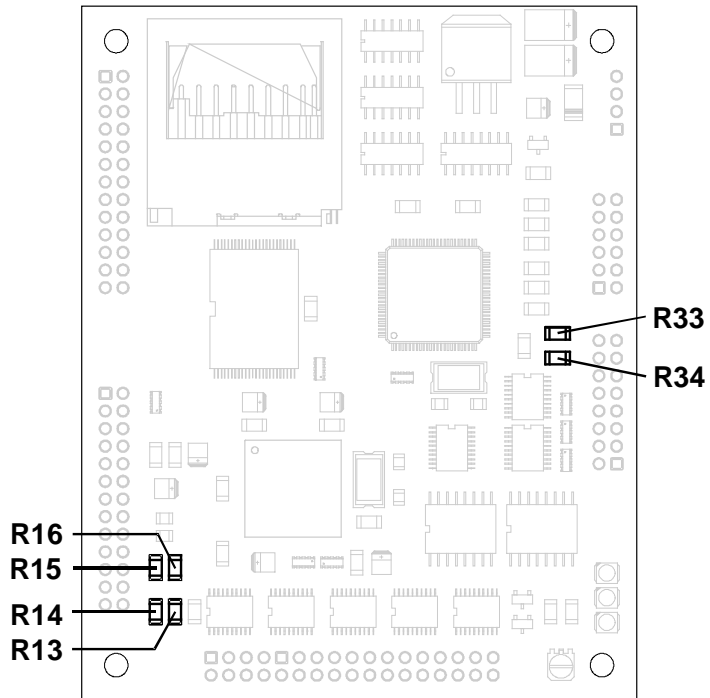
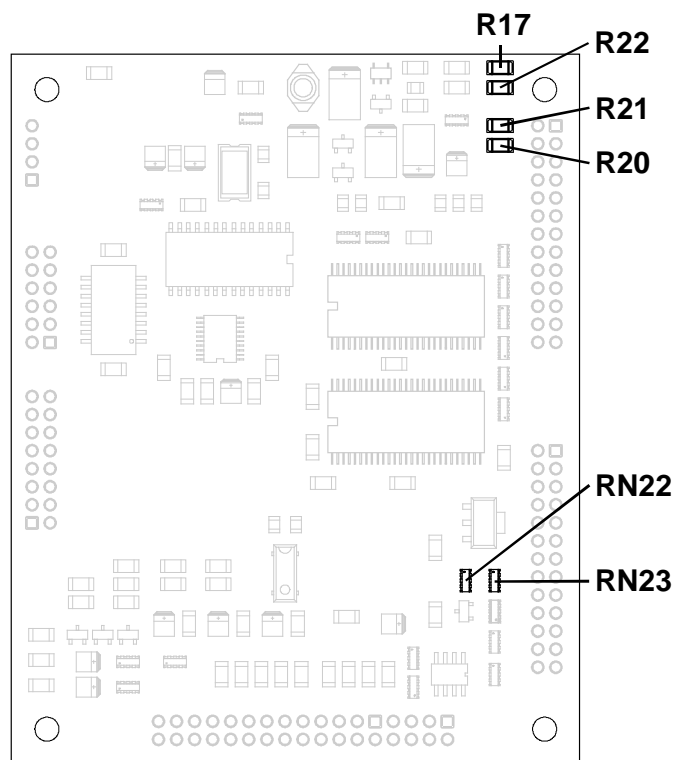


Figure 4.2: Bottom View



4.1 Configuration Display Interface

Power supply for the display and display type are configured with jumpers

Configuration	Rxx
LCD Power Supply +5V (*)	R13
LCD Power Supply +3,3V	R14
CSTN-LCD (Passiv LCD)	R15
TFT-LCD (*)	R16

Meaning: (*) Default Setting
Rxx Jumper, 0Ω Resistor Type 1206

Passive LCDs take a positive or negative contrast voltage. This voltage is generated on the NetDCU8.

If there is an additional V-Adjust voltage needed (sometimes called BIAS or V₀-Adjustment), this can be configured for positive or negative voltage.

In regular operation of the NetDCU8 the contrast voltage is controlled by a software command. But this can also be done by an external contrast voltage supply (V_{EXT}, Connector J4, Pin 15, see also notes for connector J4).

The following table shows all possible configurations. The positions of the jumpers can be taken from the schematics above (see configuration NetDCU8).

Configuration	R17	R22	R20	P1	R21
V _{ADJ} positive Internal V _{EE} Adjustment	X	-	X	X	-
V _{ADJ} negative (*)	-	X	X	X	-

Internal V _{EE} Adjustment					
V _{ADJ} positive External V _{EE} Adjustment	X	-	-	X	X
V _{ADJ} negative External V _{EE} Adjustment	-	X	-	X	X

Meaning: V_{EE} Contrast voltage
V_{ADJ} V- Adjust voltage(V_{BIAS}/V₀)
V_{EXT} External Adjust voltage 0V...3,3V
(*) Default Configuration
P1 Trim-Potentiometer 10kΩ
Rxx Jumper, 0Ω Resistor, Type 1206

4.2 Configuration parallel System Interface

High- Level of parallel Port (J4) could set by the Jumper R33, R44 respective to 5V or 3,3V.

Configuration	Rxx
5V I/O Parallel Interface	R33
3.3V I/O Parallel Interface (*)	R34

Meaning: (*) Default Setting
Rxx Jumper, 0Ω Resistor, Type 1206

4.3 Configuration RS232 Interface 3

With this option you can select between serial port 3 and two additional analog inputs.

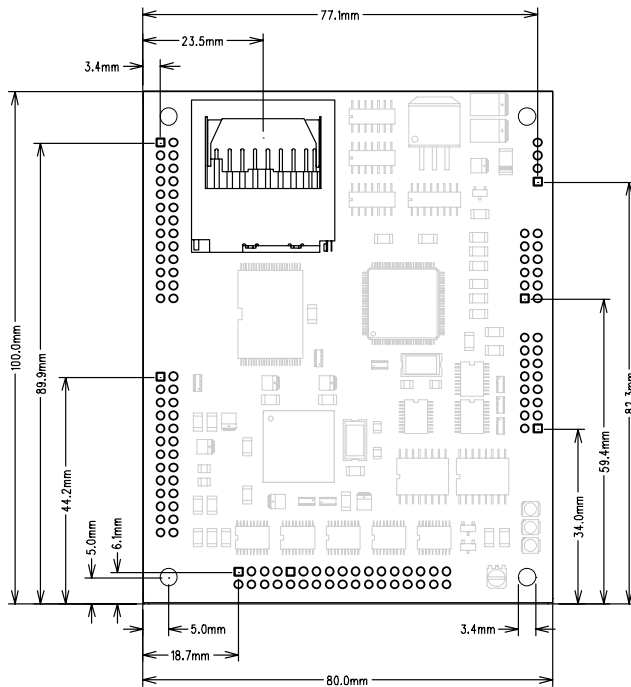
Configuration	Rxx
AD2 / AD3, J7, Pin 9/10	RN22
RS232 Interface 3, J7, Pin 9/10 (*)	RN23

Meaning: (*) Default Setting
Rxx resistor network, 4 x 0Ω resistor,
Type 1206

5 Dimensions NetDCU8

Board thickness:	1,5 mm
Height of parts on top side:	6,0 mm
Height on parts on bottom side:	6,0 mm
Pin grid of connectors	2,54 mm

Figure 5.1: Top View



All values can have tolerances of $\pm 0.5\text{mm}$.

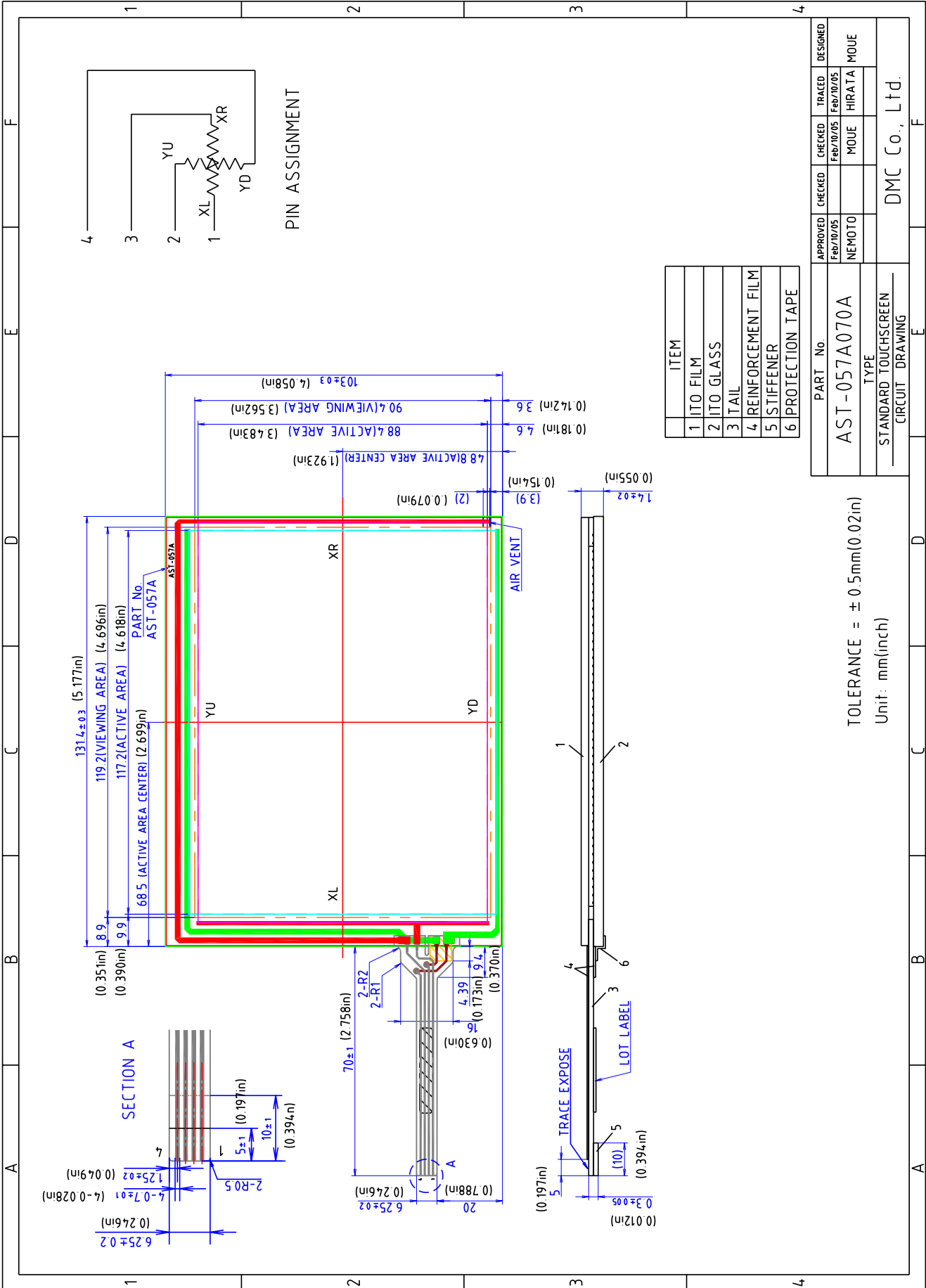
6 Technical Data NetDCU8

Power Supply:	+5V _{DC} / ±5%
Current Consumption:	<0.5A (excluding Display)
Touch-Screen:	4 wire, analog resistive
Keyboard:	8 x 12 matrix keyboard alternative Digital-I/O
Inputs/Outputs:	max. 21 I/O ports alternative matrix keyboard 8 bit FS-Bus (hw extension bus) 1x SD-Card-Slot 2x (4x)* analog input, 10 bit
Interfaces:	3x RS232 (1x with RTS/CTS) 2x USB1.1 (1x Host/Device) 1x Ethernet 10/100 Mbit (Option) 1x CAN2.0 (Option)
LCD Interface:	STN: up to 640x480 Pixel Single/Dual Scan, 16 gray scales CSTN: up to 640x480 Pixel Single / Dual Scan 256 Colors from 65536 TFT: up to 640x480 Pixel 256 / 65536 colors
RAM:	32 MByte SDRAM Optional: 64/128 MByte
Flash:	16 MByte Flash Optional: 32/64/128 MByte
CPU:	Samsung S3C2440 300 MHz Optional: 400 MHz
Temperature:	0°C . . . +70°C Optional: -25°C . . . +85°C
Dimensions:	100 x 80 x 10 mm (l x w x d)
Weight:	60 gr.

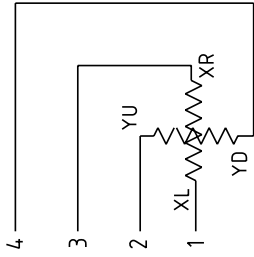
- * ⌀ Note: If you want to use 4 analog inputs than serial line 3 can not be used.

D) Specification for Touch Panel AST057

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2. Product Specifications.....	56
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PIN ASSIGNMENT



ITEM
1 ITO FILM
2 ITO GLASS
3 TAIL
4 REINFORCEMENT FILM
5 STIFFENER
6 PROTECTION TAPE

PART No	APPROVED	CHECKED	TRACED	DESIGNED
AST-057A070A	NEMOTO	MOUE	HIRATA	MOUE
TYPE				
STANDARD TOUCHSCREEN				
CIRCUIT DRAWING				
DMC Co., Ltd.				

TOLERANCE = ± 0.5mm(0.02in)
Unit: mm(inch)

2. Product Specifications

2-1. Product Applicable

§ This specification is applied to the analog resistive touchscreen: ATP/AST Series.

2-2. Structure

§ Dimensions, structure, and shape are referred on the drawing attached.

2-3. Environmental Specifications

Specification	Value
Operating Temperature	-20°C to 70°C (no condensation)
Operating Humidity	-20°C to 60°C Less than 90%RH (no condensation) Exceeding 60°C 133.8g/m ³ (no condensation)
Storage Temperature	-40°C to 80°C (no condensation)
Storage Humidity	-40°C to 60°C Less than 95%RH (no condensation) Exceeding 60°C 142.9g/m ³ (no condensation)
Chemical Resistance (top surface)	Toluene, Trichloroethylene, Athetone, Alcohol, Gasoline, Machine Oil, Ammonia, Glass Cleaner, Mayonnaise, Ketchup, Wine, Salad Oil, Vinegar, Lipstick, etc.

2-4. Mechanical Characteristics

Specification	Value
Activation Force	0.05N to 0.8N
Operating Life	Input (finger) 10,000,000 hits
	Character Input (pen) 100,000 characters
Light Transmittance	Over 80% (typical value at full wavelength)
Surface Hardness	Over 2H (by JIS pencil hardness)

2-5. Electrical Characteristics

Specification	Value
Maximum Voltage	DC6V
Maximum Current	Top Electrode 100mA
	Bottom Electrode 100mA
	Between the Top and Bottom 0.5mA
Linearity	Under ±2% (Under ±1% (typical value))
Terminal Resistance	Top Electrode Less than 1kΩ
	Bottom Electrode Less than 1kΩ
Insulation Resistance	Neighboring Terminals Over 20MΩ at 25V
	Active Area Electrodes Over 20MΩ at 25V
Chattering	Less than 10msec at ON/OFF.

2-6. Appearance

§ Scratch, dust (W = width, L = length, D = average diameter = (longest + shortest) / 2)

Item	Width (mm)	Length (mm)	Acceptable Numbers	Total
Scratch	$0.1 \geq W > 0.05$	$4 \geq L$	1pcs in $\phi 30\text{mm}$	Within 5pcs per product.
	$0.05 \geq W > 0.03$	$10 \geq L$	2pcs in $\phi 20\text{mm}$	
	$0.03 \geq W$	$20 \geq L$	Acceptable	
Dust (Linear)	$0.1 \geq W > 0.05$	$5 \geq L$	2pcs in $\phi 30\text{mm}$	
	$0.05 \geq W$	Acceptable	Acceptable	
Dust (Circular)	$0.4 \geq D > 0.3$ *1		1pcs in Viewing Area *1	
	$0.3 \geq D > 0.2$		2pcs in $\phi 30\text{mm}$	
	$0.2 \geq D$		Acceptable	

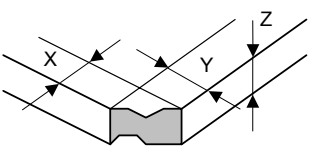
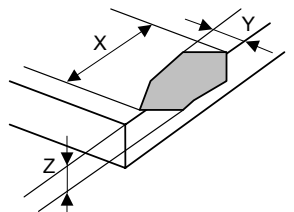
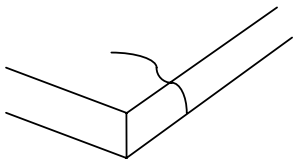
Applied only in the Active Area. Scratches or dusts in the outside of the Active Area are acceptable unless the electrical characteristics are affected.

*1 Applied to the size of 14 inches or more.

§ Dirt

Acceptable if not noticeable on a black mat.

§ Tip, crack (t = glass thickness) (applicable only for the glass)

Item	Size (mm)	Acceptable Numbers	
Corner 	X	≤ 3	2pcs /panel
	Y	≤ 3	
	Z	$\leq t$	
Side 	X	≤ 5	2pcs /side
	Y	≤ 3	
	Z	$\leq t$	
Crack		0pcs (acceptable)	

3. Testing Regulation

3-1. Testing Regulation

§ If the regulation is not specified, the test is performed under the supplier's regulation.

§ Tests are performed under the room temperature unless specified. The room temperature is referred as follows:

Temperature: 20°C±5°C

Humidity: 65%±10%RH

3-2. Environmental Specifications

§ Chemical Resistance Test

Condition: Tested after leaving the chemical on the surface for 12 hours being wiped off by cloth.

Judgement: Must be no effect in appearance.

3-3. Mechanical Characteristics

§ Activation Force Test

Condition: Measured by depressing the point between the dots to the conduction by the testing rod (Figure 1).

Judgement: Must satisfy the specification.

§ Operating Life Test (Finger)

Condition: Testing rod: Refer to Figure 1
Voltage: DC5V
Load: 300g
Cycle: 2 hits/sec

Judgement: Must satisfy the following:

Activation Force: Within ±50% of the specification.

Linearity: Must satisfy the specification.

Terminal Resistance: Must satisfy the specification.

Insulation Resistance: Must satisfy the specification.

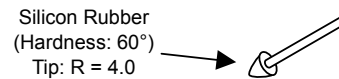


Figure 1. Testing rod 1

§ Operating Life Test (Pen)

Condition: Testing rod: Refer to Figure 2
Voltage: DC5V
Load: 250g
Input size: 10 x 10 mm
Input character: A to Z/minute

Judgement: Must satisfy the following:

Activation Force: Within ±50% of the specification.

Linearity: Must satisfy the specification.

Terminal Resistance: Must satisfy the specification.

Insulation Resistance: Must satisfy the specification.

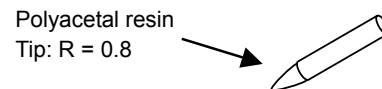


Figure 2. Testing rod 2

3-4. Electrical Characteristics

§ Terminal Resistance Test

Condition: Top and bottom electrodes are measured at the terminal.

Judgement: Must satisfy the specification.

§ Insulation Resistance Test

Neighboring Terminals: Measured by applying the reference voltage to the terminals

Active Area Electrodes: Measured by applying the reference voltage to the top and bottom electrodes.

Judgement: Must satisfy the specification.

3-5. Appearance

§ Appearance Test

Condition: Tested by an examiner with over 1.0 eyesight at 30cm away from the product under the transmittable light at over 60° the surface of the product.

Judgement: Must satisfy the specification.

4. Reliability Condition

4-1. Temperature Condition

§ Temperature Condition Test

Following test are performed in the condition with no dew condensation:

Cold Test: Tested after leaving the parts in $-30^{\circ}\text{C}\pm 3^{\circ}\text{C}$ for 240 hours and in the room temperature for 2 hours.

Heat Test: Tested after leaving the parts in $80^{\circ}\text{C}\pm 3^{\circ}\text{C}$ for 240 hours and in the room temperature for 2 hours.

Humidity Test: Tested after leaving the parts in the temperature $60^{\circ}\text{C}\pm 3^{\circ}\text{C}$, humidity 90 to 95% for 240 hours and in the room temperature for 2 hours.

Cycle Test: Tested after 5 cycles of leaving the parts in the temperature $-30^{\circ}\text{C}\pm 3^{\circ}\text{C}$ for 1 hour and in the room temperature for 0.5 hours, then leaving the parts in the temperature $70^{\circ}\text{C}\pm 3^{\circ}\text{C}$ for 1 hour and in the room temperature for 0.5 hours.

Judgement: Must satisfy the following:

Activation Force: Within $\pm 50\%$ of the specification.

Linearity: Must satisfy the specification.

Terminal Resistance: Must satisfy the specification.

Insulation Resistance: Must satisfy the specification.

Appearance: Must satisfy the specification.

5. Recommended Connector

5-1. Recommended Connector

Part No.	Pins	Pitch
KCA-K4R	4 pin Double-sided	1.25mm

6. Handling Notes

6-1. Precautions

§ This product is intended for use in standard applications (computers, office automation, and other office equipment, industrial, communications, and measurement equipment, personal and household devices, etc.) Please avoid using this product for special applications where failure or abnormal operation may directly affect human lives, or cause physical injury or property damage, or where extremely high levels of reliability are required (such as aerospace systems, vehicle operating control, atomic energy controls, medical devices for life support, etc.).

6-2. Handling Notes

§ Do not depress or scratch the product with any object with a sharp edge or end.

§ Do not forcibly bend or fold the product.

§ When the product is stored, make sure it is packed in a packing box and stored in a storage temperature range, eliminating any outside load.

§ Do not use or store the product under a condition where the product will be exposed to water, organic solution or acid.

§ Do not use the product under the direct sunlight.

§ Do not disassemble the product.

§ When you handle the product, Hold the product by its body. Do not hold by the tail.

§ Clean the product with a soft cloth or a soft cloth with neutral detergent or alcohol. When contaminated by chemicals, wipe them off immediately with caution not to cause injury to human body.

§ The edge of the glass is not rounded and may cause injury.

6-3. Construction Notes

§ The environmental specifications, mechanical characteristics, and electrical characteristics are only applied to the Active Area.

§ Do not use the touchscreen when the condensation occurs. The condensation inside of the touchscreen is a natural phenomenon and should disappear after the touchscreen is warmed up.

6-4. Electrical & Software Notice

The best performance can be obtained when used with the original analog resistive touchscreen controller, "TSC-10" Series. If the touchscreen controller or controller software is to be developed by the customer, please note the following:

§ There is a contact resistance between the top and bottom electrodes and it changes by the pressure of a finger or a pen. The data must be read after the contact resistance becomes stabilized.

§ The terminal resistance of the analog resistive touchscreen varies by the individual, time, and environment. The controller software must have the calibration function to adjust the input position and the display position.

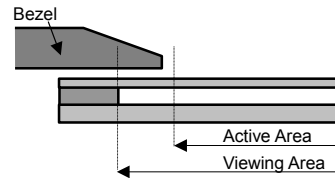
§ The analog resistive touchscreen outputs 2 point input as 1 point in between the 2 points. The controller software must not be designed to have the 2 point input function.

§ For drawing applications, the line may be intermittent when the pen comes on the dot spacers. A software compensation is needed.

6-5. Mounting Notes

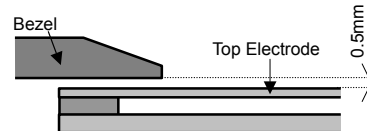
§ Bezel Edge

Bezel edge must be positioned in the area between the Active Area and the Viewing Area. The bezel may press the touchscreen and cause input if the edge enters the Active Area.



§ Gap between the Bezel and Touchscreen

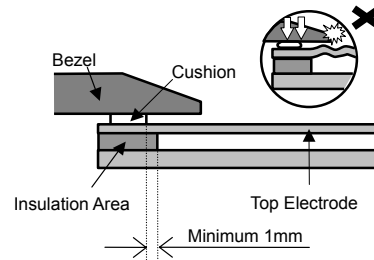
A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected input if the gap is too narrow.



§ Cushion

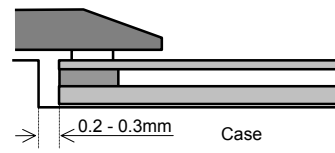
If a cushion is used between the bezel and the top electrode, the cushion must be free enough to absorb the expansion and contraction difference between the bezel and the top electrode. If the cushion is squashed too hard, the expansion and the contraction difference may cause the distortion to the top electrode.

The cushion must be positioned more than 1mm outward from an inside of the insulation area. (Please refer to right figure)



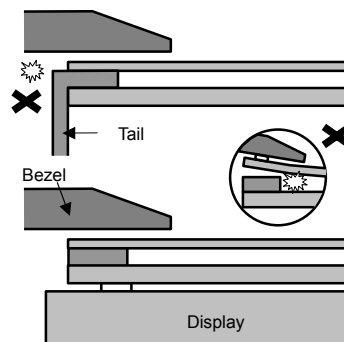
§ Tolerance

There is a tolerance of 0.2 to 0.3mm for the dimensions of the touchscreen and the tail. A gap must be made to absorb the tolerance in the case and the connector.



§ Tail

The tail must not be forcibly stressed or bent too hard to avoid the conduction in the insulated area and wire breaking.

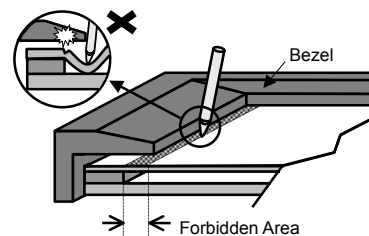


§ Mounting

Touchscreen must be held from the bottom such as the structure gluing the touchscreen onto the display. If the touchscreen is glued to the bezel, the adhesion between the top and bottom electrode is stressed and may come off.

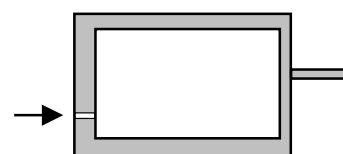
§ Forbidden Area

The area within 2mm from the insulation area is structurally weak for the pressure, especially for pen use. The film may be forcibly bent and may cause deflection. This area must be protected by the bezel and input must be avoided.



§ Air Vent

Most of the touchscreens have the air vent to equalize the inside air pressure to the outside one. The air vent must be open and liquid contact must be avoided as the liquid may be absorbed if the liquid is accumulated near the air vent. The top electrode must not be swelled by the air pressure from inside of the case.



7. Revision history

Rev1 (April 15, 1998)

Initial release

Rev2 (June 1, 1999)

The overall revision by specification review.

Rev3 (April 1, 2002)

The address in the office was changed by the move.

Rev4 (August 16, 2002)

1-4.Activation Force is changed "50g± 30g" to "0.5N±0.3".

1-4.Light Transmission is changed 76% to 80%(TYP).

Rev5 (September 3, 2002)

1-3.Operating Temperature is changed "0°C to 60°C" to "-20°C to 70°C".

1-3.Storing Temperature is changed "-20°C to 70°C" to "-40°C to 80°C"

1-4.Operating Life is changed "1,000,000 hits" to "10,000,000 hits".

1-5.Linearity is changed "Under ±2%" to "Under ±1% (typical value)".

Rev6 (June 28, 2004)

1-3.Operating Humidity is changed "Less than 90%RH (no condensation)" to "-20°C to 60°C Less than 90%RH (no condensation) Exceeding 60°C 133.8g/m³ (no condensation)".

1-3.Storing Humidity is changed "Less than 95%RH (no condensation)" to "-40°C to 60°C Less than 95%RH (no condensation), Exceeding 60°C 142.9g/m³ (no condensation)".

1-5.Maximum Voltage is changed "DC5V" to "DC6V".

1-5.Linearity is changed "Under ±1% (typical value)" to "Under ±2% (Under ±1% (typical value))".

Rev7 (October 15, 2004)

4-4.Electrical & Software Notice: Changed "FIT-10 series" to "TSC-10 series".

Rev8 (April 7, 2005)

Added Item4 Recommended Connector.

Rev9 (September 6, 2005)

2-3.Mechanical Characteristics: Added Operating Life Test (Pen).

Rev10 (November 10, 2006)

The specification item name was changed.

1-3."Storing Temperature" to "Storage Temperature"

1-3."Storing Humidity" to "Storage Humidity"

1-4."Operating Load" to "Activation Force"

1-4."Light Transmissivity" to "Light Transmittance"

1-4."Top Surface Hardness" to "Surface Hardness"

2-3."Operating Load Test" to "Activation Force Test"

2-3."Operating Load" to "Activation Force"

3-1."Operating Load" to "Activation Force"

1-4.Operating Force is changed " $0.5N \pm 0.3N$ " to "0.05N to 0.8N".

1-5.Insulation Resistance is changed "Over $100M\Omega$ at 25V" to "Over $20M\Omega$ at 25V".

1-6.Tip, crack: Deleted "Applied only in the Active Area. Scratches or dusts in the outside of the Active Area are acceptable unless the electrical characteristics are affected."

2-3. § Operating Life Test (Pen) Load: 300g to 250g

5-5. § Cushion: Added an installation position of a cushion.

7.Added Revision History.

E) Specification for Inverter PS8m053167F



Endicott Research Group, Inc.

2601 Wayne St., Endicott, NY 13760
607-754-9187 Fax 607-754-9255
http://www.ergpower.com

Specifications and Applications Information

12/30/05

Preliminary

The ERG 8m053167F (**8m Class**) low profile dc to ac inverter is specifically designed to power the Kyocera TCG057QV1AA-G00 LCD display module to a moderate brightness level from a +5 volt dc source.

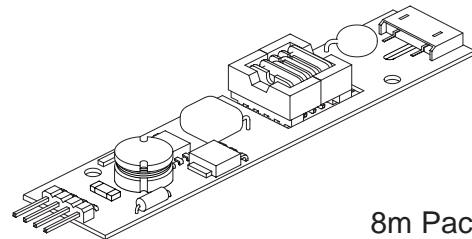
This low profile inverter features:

- ✓ Less Than 8 mm in Height
- ✓ LCD Module Specific
- ✓ Display Compatible Output Connector
- ✓ Firm Specifications
- ✓ Application Information
- ✓ Designed, Manufactured and Supported in the USA
- ✓ Custom Input and Output Voltages
- ✓ Flexible System Interface
- ✓ Notebook Display Head Compatible

8m053167F



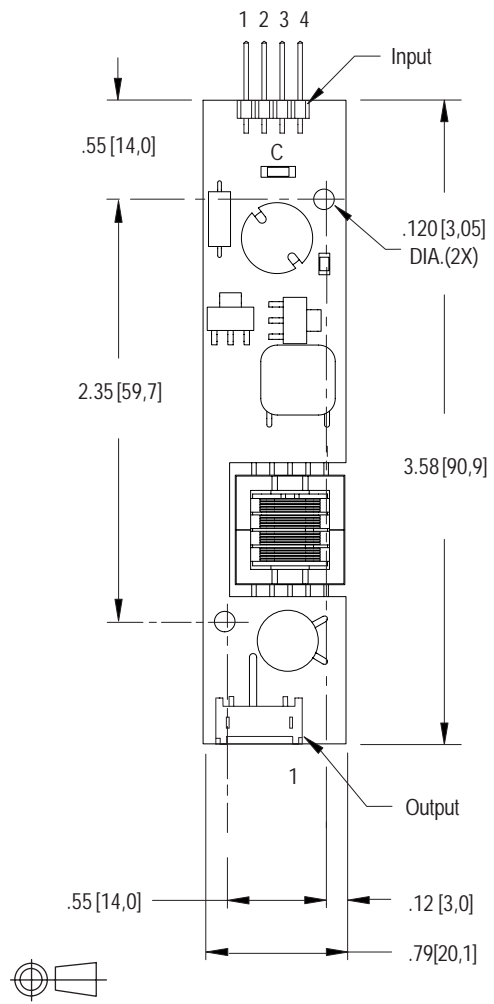
8m Class DC to AC Inverter



8m Package

PCB components are shown for reference only. Actual product may differ from that shown.

Package Configuration



PCB components are shown for reference only. Actual product may differ from that shown.

Connectors

Input Connector	Output Connector
4 pins are 0.315" [8,00] Long, 0.025" [0,63] Square and are on 0.100" [2,54] Centers.	JST SM02(8.0)B-BHS-1-TB
J1-1 Vin(+) J1-2 GND J1-3 Enable * J1-4 N/C	J2-1 ACout J2-2 ACout
* Valid with the "C" jumper removed	



Absolute Maximum Ratings

Rating	Symbol	Value	Units
Input Voltage Range	Vin	-0.3 to +5.5	Vdc
Operating Temperature	To	-10 to +70	°C
Storage Temperature	Tstg	-40 to +85	°C

Recommended Operating Conditions

Rating	Symbol	Value	Units
Input Voltage	Vin	+4.50 to 5.25	Vdc

Electrical Characteristics

Unless otherwise noted Vin = 5.00 Volts dc and Ta = 25°C

Characteristic	Symbol	Min	Typ	Max	Units
Input Current ^(note 1)	Iin	-	.70	.81	Adc
Operating Frequency	Fo	35	40	45	KHz
Minimum Output Voltage	Vout (min)	1550	-	-	Vrms
Efficiency	h	-	82	-	%
Output Current (per lamp)	Iout	-	4.2	-	marms
Output Voltage (When powering a load simulating the referenced display)	Vout	-	685	-	Vrms
Pin3 Input Current Requirement	-	-	9	-	madc

After lamp has been allowed to warm-up for 5 minutes.
External Disable Circuit shown on page 3.

Specifications subject to change without notice.

(Note 1) Input current in excess of maximum may indicate a load/inverter mismatch condition, which can result in reduced reliability. Please contact ERG technical support.

Application Notes:

- 1) The minimum distance from high voltage areas of the inverter to any conductive material should be .12 inches per kilovolt of starting voltage.
- 2) Mounting hardware should be non-conductive.
- 3) Open framed inverters should not be used in applications at altitudes over 10,000 feet.
- 4) Contact ERG for possible exceptions.



Endicott Research Group, Inc.

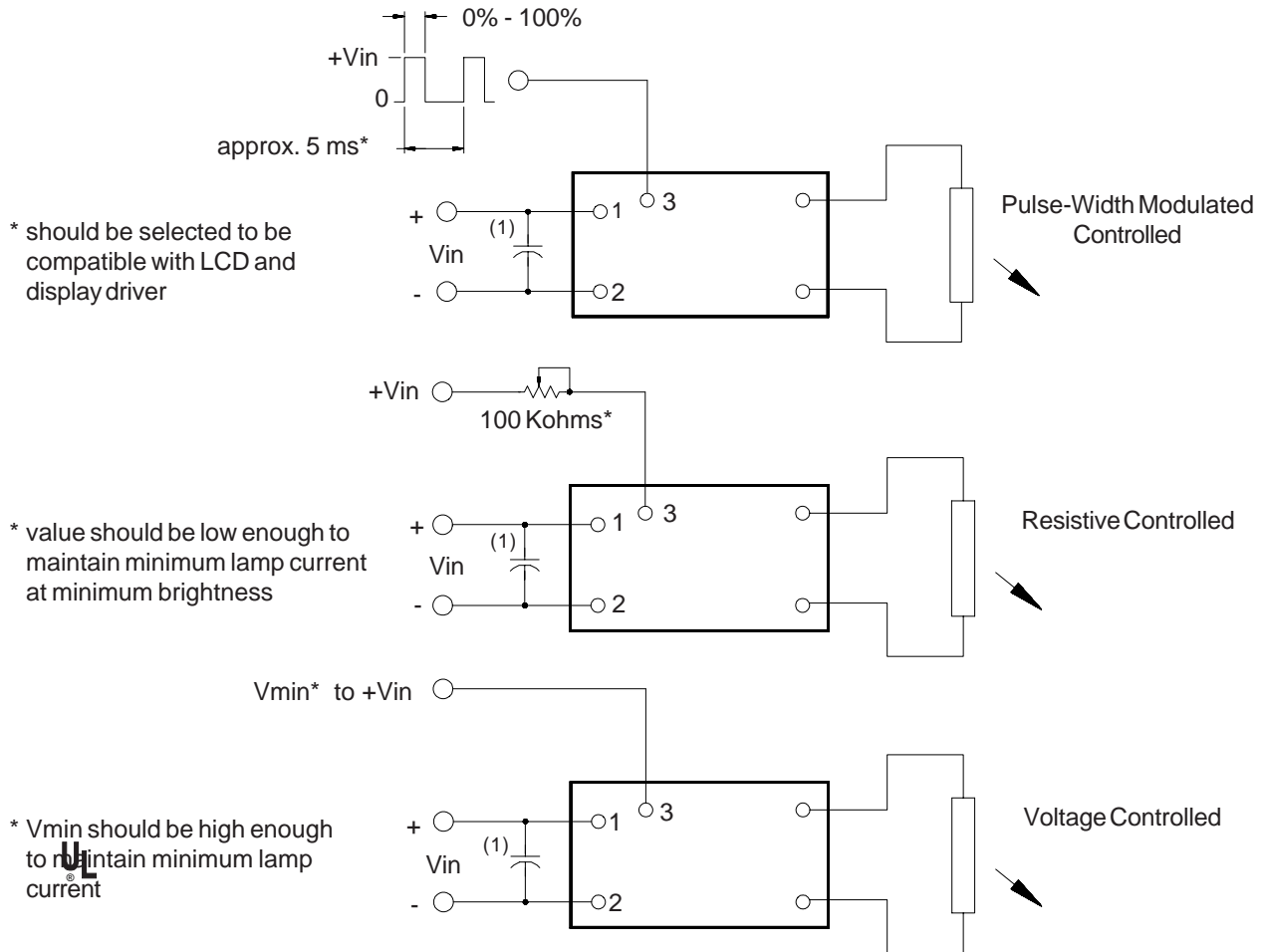
2601 Wayne St., Endicott, NY 13760
607-754-9187 Fax 607-754-9255
<http://www.ergpower.com>



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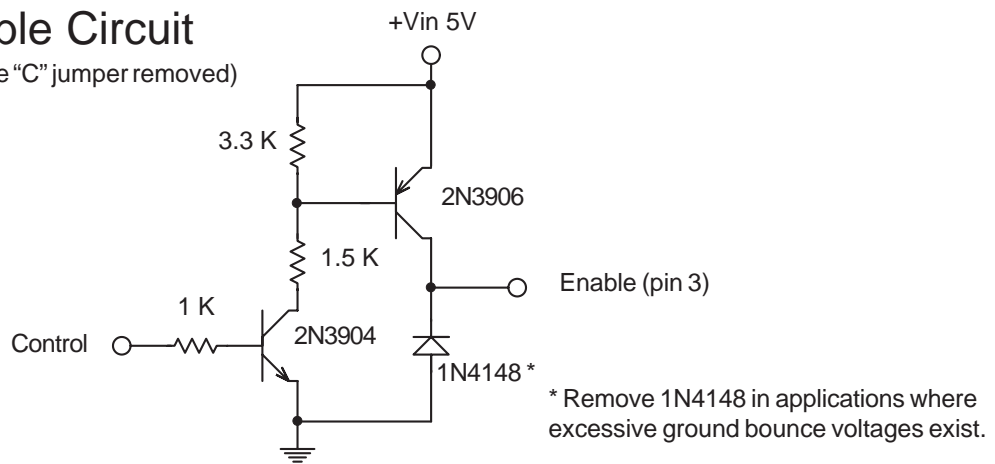
3 Dimming Options (valid with the "C" jumper removed)



Note 1 Low ESR type Input by-pass capacitor (22 uf - 100 uf) may be required to reduce reflected ripple.

Disable Circuit

(Valid with the "C" jumper removed)



Endicott Research Group, Inc. (ERG) reserves the right to make changes in circuit design and/or specifications at any time without notice. Accordingly, the reader is cautioned to verify that data sheets are current before placing orders. Information furnished by ERG is believed to be accurate and reliable. However, no responsibility is assumed by ERG for its use.



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