Refference Specification

Description   Liquid Crystal Display Module

Customer's Parts No.

Parts No.   EDMMRG2KAS

Approval by customer
Date Company Name Title Signature

This product is Environment Friendly

Arima Display Japan Co., Ltd.			
Quality Assurance Dept.		R & D Dept.	
Approval	Check	Approval	Draw

No.	Date	Revisions	Check	Change	Remarks
		Enactment			

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Arima   Display   Japan   Co.,Ltd

1 APPLICATION
   These specifications will describe quality requirements for the liquid crystal display module of the
   following model number, manufactured by Arima Display Japan Co, Ltd.

2 MODEL NUMBER(Production Code)   EDMMRG2KAS(1.8inch STN-Color)

3 MECHANICAL CHARACTERISTICS

   3.1. OUTLINE DIMENSIONS   see attached drawing at: 1A1M-0046 (17-17)

   3.2   DISPLAY CHARACTERISTICS
        -Display Mode   :STN-Color Transmissive mode
                                           (Normally black with white LED Backlight)
                                           *The following specifies 65K color mode.

        -Number of Pixels   :128($\times$ 3)$\times$ 160 Dots

        -Active Area(A Area)   :29.55 mm $\times$ 36.98 mm

        -Visible Area   :32.05 mm $\times$ 40.20 mm

        -Driving Method   :1/160 duty 1/11bias

   3.3 MASS (WEIGHT)   10.4gTYP

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4   ABSOLUTE   MAXIMUM   RATINGS (VSS,LED-Vss = 0V :GND, T a =+ 25 degree C)

NO	Items	Symbols	Min	Typ	Max	Unit	Remarks
1	Power supply for Logic	VDD	-0.3		4.6	V	(1),(2),(3)
2	Power supply for LED Driver	LED-V LED-S HDNX	-0.3		7.0	V	(1),(2),(4)
3	Input Voltage	Vi	-0.3		VDD 0.3	V	(1),(2),(3)
4	Operating Temperature	Topr	-0		50	deg-C	(1),(5),(6),(8)
5	Storage Temperature	Tstg	-30		60	deg-C	(1),(5) (7)

Remarks
(1)   No condensation is allowed.
(2)   Several input voltage is required on the VSS on the ground level.
(3)   The following relationship has to be kept: VDD>GND
(4)   The following relationship has to be kept: LED-V, LED-SHDNX>GND.
(5)   <=40 degree C : <=95%RH, =>40 degree C : <=40 degree C 95%RH ,<=0 degree C : no freezing , =>60 degree C : within 240 hounrs
(6)   Optical characteristics of LCD will be changed depending on the temperature. The confirmation of display quality and characteristics has to be done after temperature is set to 25 degree C and it becomes stable.
(7)   Deterioration of polarizer at higher than 61 degree C is taken no notice.
(8)   Life time of LEDs at higher than 41 degree C is taken no notice

5 Electrical   characteristics
   5.1   DC   characteristics   of   LCD   module(VSS = 0V :GND, T a =+ 25 degree C)

Items	Symbol	Conditions	Spec.			Unit	Remarks
			MIN	TYP	MAX		
Power supply for Logic	VDD		3.0		3.49	V	
input ”High” level voltage	VIH		0.7VDD		VDD	V	
input "Low” level voltage	VIL		-0.3		0.15VDD	V	
output "High" level voltage	VOH	IOH=-0.4mA	0.75VDD			V	
output "Low" level voltage	VOL	IOL=0.1mA	0		0.15VDD	V	
input/output leak current	ILi	Vin=0 VDD	-10		1	μA	

   5.2   DC   characteristics   of   LED   Driver(VSS,LED-Vss = 0V :GND, T a =+ 25 degree C)

Items	Symbol	Conditions	MIN.	TYP.	MAX.	unit	Remarks
Power supply for Driver	LED-V		3.5	-	5.9	V	
LED-SHDNX ”High” level voltage	EIH		1.4	-	-	V	
LED-SHDNX "Low" level voltage	EIL		-	-	0.4	V	
LED-SHDNX "High" level current.	IIH	LED-SHDNX =5.5V		18.3	30.0	μ A	

5.3 Power supply current (VDD=3.3V+/-5%,Ta=25 degreeC)

Items	Symbol	Conditions	MIN.	TYP.	MAX.	unit	Remarks
Power supply current for Vdd	Idd	VDD=3.3V	-	1.0	5.0	mA	*1
Power supply current for LED-V	Iled	LED-V=5.5V	-	45	-	mA	
Power rush current of LED-V	Irush	LED-V=5.5V	-	-	400	mA	t<20us

*1.VDD = 3.3 V , 1/160duty , 1/11bias , AC driving = 57line inversion.

5.4 AC characteristics of system bus (80CPU-Interface)
(VDD=2.4-3.45V, Ta=-0-50 degree C)

Items		Symbols	Condition	Spec			Unit	Remarks
				MIN	TYP	MAX		
Address set up time		tAS80	Write	0	-	-	ns	
			Read	10	-	-	ns	
Address hold time		tAH80		2	-	-	ns	
Rise time / Fall time		tr / tf		-	-	25	ns	
Write Data set up time		tDS80		60	-	-	ns	
Write Data hold time		tDH80		2	-	-	ns	
Read data access time		tRDD80	CL=50pF	-	-	100	ns	
Read data hold time		tRDH80	CL=50pF	5	-	-	ns	
Write Action	"L" width of cntl. pulse	tWRLW80		40	-	-	ns	
	"H" width of cntl. pulse	tWRHW80	HWM=0	100	-	-	ns	
			HWM=1	40	-	-	ns	
	System cycle time	tCYC80	HWM=0	200	-	-	ns	
			HWM=1	100	-	-	ns	
Read action	"L" width of cntl. pulse	tWRLR80		150	-	-	ns	
	"H" width of cntl. pulse	tWRHR80		100	-	-	ns	
	system cycle time	tCYC80		300	-	-	ns	

* Each timing is specified based on 20% and 80% of VDD.

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5.5   Reset input timing

Vdd

min 1ms   min 0

RSTB

min 10ms   min 0

SIGNAL

5.6   Pin assignment of Backlight

LED-V(2) ——— LED CONTROLLER

LED-SHDNX(1) ———

LED-Vss(5)

LED Characteristic

Items	Symbols	Condition	Spec			Unit	Remarks
			MIN	TYP	MAX		
LED forward voltage	Vf	If=20mA		3.6	4.0	V	Ta=25deg C
LED reverse current	Ir	Vr=5.0V			50	μA	
LED Life time	tlife			(10000)		H	

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5.7   Power supply on-off sequence

The following paragraphs(5.8) describes the power supply ON/OFF sequences to prevent high current
flowing into the LSI, otherwise the current may cause a permanent damage to the LSI.

5.8   Referential instruction sequences

5.8.1   Initialization in using the internal power supply circuits

```
                          ( Power on the VDD )
                                  │
  1ms                             ▼
                          ┌──────────────────────┐
                          │   Power on the Reset  │
  more than 10ms(oscillation      │
  circuit stabilization on time.) ▼
                          ┌──────────────────────┐      Power on Initialized bits
                          │ Issue use-stateinstruction(1) │  Set VC2-0 bit
                          └──────────────────────┘      Set BT2-0 bit
                                  │                      Set DC2-0 bit
                                  ▼                      Set AP1-0 bit
                          ┌──────────────────────┐
                          │ Issue use-stateinstruction(2) │
  more than 50ms(set-up           │
  circuit 1,2stabilization time.) ▼
                          ┌──────────────────────┐      Voltage poiarity inverting
                          │ Issue use-stateinstruction(3) │  circuit operation starting bit
  more than 200ms(set-up          │                      Set BT3 bit
  circuit 2/voltage inverting     ▼
  circuit stabilization time.)
                          ┌──────────────────────┐
                          │   Dsplay on sequence  │
                                  │
                                  ▼
                          ┌──────────────────────┐      Display on
                          │      Dsplay on        │      d1-0="11"
                          └──────────────────────┘
```

5.8.2   Power off

```
                          ┌──────────────────────┐
                          │    Nomal Dsplay       │
                          └──────────────────────┘
                                  │
                                  ▼
                          ┌──────────────────────┐
                          │  Dsplay off sequence  │
                          └──────────────────────┘
                                  │
                                  ▼
                          ┌──────────────────────┐      Bits for display off
                          │      Dsplay off       │      D1-0="00"
                          └──────────────────────┘
                                  │
                                  ▼                      Power off setting bit
                          ┌──────────────────────┐      Power supply circuit off
                          │   use-stateinstruction │      control set by AP1-0
                          └──────────────────────┘
                                  │
                                  ▼
                          ( Power off the VDD )
```

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5.9   Pin assignment of LCD module

Pin No.	Symbol	Function
1	LED-SHDNX	LED enable pin. (L:off H:on)
2	LED-V	LED Power.
3	VDD	Power supply for logic
4	VSS	Ground for logic circuit.
5	LED-Vss	Ground for LED driver circuit.
6	DB7	Data7.
7	DB6	Data6
8	DB5	Data5
9	DB4	Data4
10	DB3	Data3
11	DB2	Data2
12	DB1	Data1
13	DB0	Data0
14	RDB	Select data read / write operation.
15	WDB	Active data read / write operation.
16	RS	Select the register.
17	RSTB	Reset pin.
18	CS1B	Chip select.

18FLZX-RSM1-A-TB(LF)(SN) [JST]

5.10   Pin discriptions

5.10.1   Power supply pins

Pin name	I/O	Function
VDD	Power	Power supply for logic circuits
VSS	Power	GND for logic and high voltage circuits

5.10.2   System bus pins

Pin name	I/O	Function
D0 – D7	I/O	8bit parallel bi-directional bus
/CS	I	Chip select Active "0"

RS	I	Resister select
		   This signal distinguishes an instruction data and display data for transferred data
		      RS = "H" : Instruction
		      RS = "L" : Display data

/RD	I	/RD signal Active "0"
/WR	I	/WR signal Active "0"
/RES	I	Reset Active "0"

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5.10.3   Backlight pins

Pin name	I/O	Function
LED-SHDNX	I	LED enable pin. (L:off H:on)
LED-V	Power	LED Power.
LED-Vss	Power	Ground for LED driver circuit.

5.10.4   Recommended Driver setting sequence

Index	Parameter	Delay[ms]
0x0000	0x0001	10
0x0007	0x0000	0
0x0003	0x8068	50
0x000c	0x0011	0
0x0004	0x0440	0
0x0001	0x0113	0
0x0002	0x0206	0
0x0005	0x0028	0
0x0006	0x0000	0
0x0007	0x0001	0
0x000b	0x3000	0
0x0014	0x9f00	0
0x0016	0x8304	0
0x0017	0x9f00	0
0x0003	0x8868	50
0x0003	0x8a68	50
0x0003	0x8c68	200
0x0021	0x0083	0
0x0022	Pic data	-
0x0007	0x0003	0

Attention.

With the using of detailed function at this LSI, refer to the specification of NT7553[NOVATEK].
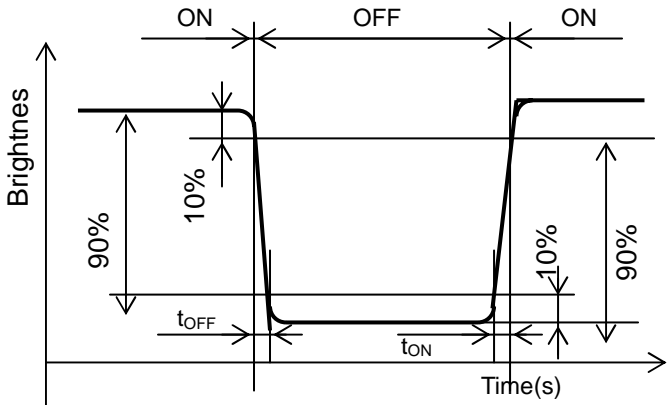
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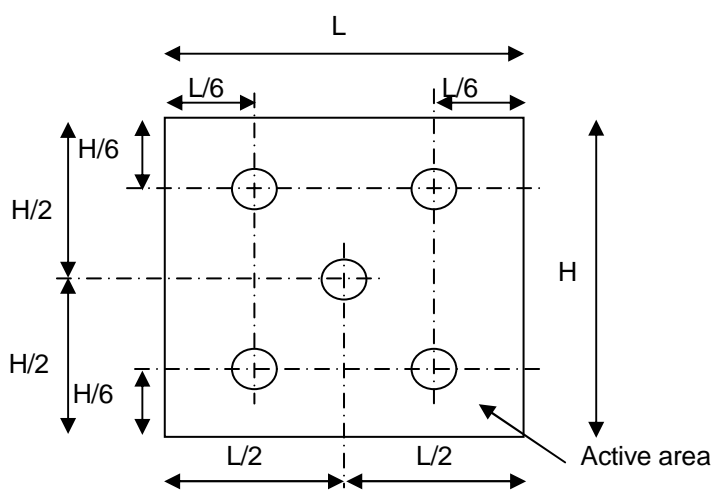
6   Optical characteristics (Ta=25 degree C,1/160duty,1/11bias)
   Refer to Section 9 for measurement method.

(VDD=3.3V+/-5%,   Ta=25 degreeC)

No.	Characteristics	Symbols	Conditions	MIN.	TYP.	MAX.	Unit	Remarks
6.1	Response time	tON	VOPR　14.0V		440	580	ms	
		tOFF			160	200		
6.2	Viewing angle (vertical)		CR　1.5 , At　　Maximum Contrast state		-40/20		degree	
6.3	Viewing angle (horizontal)		CR　1.5 At　　Maximum Contrast state		-40/40		degree	
6.4	Contrast Ratio	CR	At　　Maximum Contrast state	15	30			
6.5	Brightness @ white	B	If　24mA/LED1chip VOPR　14.0V	120	150		cd/	*1

*1;Measure at the condition of displaying All ON mode.

7 Quality and reliability (Refer to Section 9 for measurement method.   Ta=25 degree C)

No.	Item	Test conditions	Judgement
7.1	Load life at high Temp.	In the thermal chamber at 50± 2 degreeC, display the characters under VDD=3.3V for 240hours.	Shall operate normally, after test.
7.2	Load life at low Temp.	In the thermal chamber at 0± 2 degree C, display the characters under VDD=3.3V for 240hours.	
7.3	Exposure at High Humidity	In the thermal chamber at 40± 2 degree C, and 90-95%RH, expose without applying any load for 240 hours	
7.4	Exposure at High Temp.	In the thermal chamber at 60± 2 degree C, expose without applying any load for 240hours.	
7.5	Exposure at Low Temp.	In the thermal chamber at −30± 2 degree C, expose without applying any load for 240hours.	
7.6	Heat cycle	In the thermal chamber at-30± 2<=25± 3=>60± 2 (30min each)/1cyc., expose without applying any load for 50cyc.	
7.7	Shock	490m/s2 10ms half-sin pulse. Test should be conducted with 3 axes and 1 time.	
7.8	Vibration	Test should be conducted with 3 axes, 1.5mm and 10 to 5 100Hz/3min each.	
7.9	Load life at High Temp. and Humidity	In the thermal chamber at 40± 2 degree C, and 90-95%RH, display under applying any load for 240hours.	

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8 Printings and package

8.1 Printings

The following marking should be labeled on the module.

LABEL (size :18x8mm)

EDMMRG2KAS

ABxxx****** ← Manufacture code

8.2 Package

LCD Module

Packaging tray
(Polystyrene)

Aluminum Packing

Corrugated paper

Cardboard box
Length : 472mm
Width : 315mm
Height : 195mm
Weight : 7.3Kg TYP

2

1

After folding this corrugated paper and packing with 2 desiccants in the aluminum bag, pack 2 FOLDs to the cardboard box.

Place the following label or printing on the outside of the cardboard box.
* MAX   420Pcs/ 1 carton

Customer	
Customer Part No.	
Part No.	EDMMRG2KAS
Quantity	(Quantity)
Remarks	

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9   Measurement method of optical characteristics

9.1   Condition of measurement
Before measuring characteristics, specimen shall be kept under the following condition for 4 hours before and after each test.
- Temp.   25± 1degreeC, -Humidity 40-70%RH, -atmosphere 85-110kPa

9.2   Measurement method of optical characteristics
9.2.1   Measuring equipment and specimen
-LCD7000(Optical measurement equipment for LCD panel : Ohtsuka electronics)
-Oscilloscope
-CS-1000 (Brightness measurement system : Minolta Co,Ltd.)
- Specimen (Test LCD panel) : Measuring at only LCD panel (measurement diameter= 8)

9.2.2   Definition of Items

Normal	The line which is perpendicular to the surface of front glass at cross point of VCL and HCL. This is the reference line for all angles.
VCL	The vertical center line which connects the center of top and bottom margins. This vertical line equally divides effective area.
HCL	The horizontal center line which connects center of left and right margins. This horizontal line equally divides effective area.
Optimum Angle	The angle which deflects degrees from Normal.
V-Plane	The plane which includes Normal and VCL
H-Plane	The plane which includes Optimum and HCL. The angle toward Normal plane is shone by .

9.3   Measurement of LCD driving voltage (Vopr) and Contrast Ratio (CR)
-Set the measuring equipment to 25degreeC, and place the LCD panel at normal position
(=0,   =0 degree) in the LCD7000.
-Display selective data (screen:WHITE) and non-selective data (screen:BLACK) of specified duty ratio alternatively, and measure brightness at each data. Increase driving voltage gradually and measure brightness Y2 at selective state and Y1 at non-selective state.
-Calculate Contrast Ratio (CR=(Y2-Y0)/(Y1-Y0)) at each voltage and determine voltage which gives the maximum CR as Vopr. (Vopr=V0-Vss,Vss=GND)
* note Y0 : Brightness from ambient lighting

9.4   Measure of Vertical viewing angle (=0 degree)
- Set the measuring equipment (LCD7000) to 25 degreeC, and apply the above Vopr to the LCD panel. Then change the   angle (=0 degree), measure brightness at selective state Y2 and non-selective state Y1 and calculate Contrast Ratio. (CR=(Y2-Y0)/Y1-Y0))
-Angles above CR=> 1.5 is defined as vertical viewing angle.

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9.5 Measurement of horizontal viewing angle (=0 degree)
-Set the measuring equipment (LCD7000) to 25 degreeC, and apply the above Vopr to the LCD panel. Then change the angle (=0 degree), measure brightness at selective state Y2 and non-selective state Y1 and calculate Contrast Ratio. (CR=(Y2-Y0)/Y1-Y0))
- Angles above CR=> 1.5 is defined as horizontal viewing angle.

9.6 Measurement of response time (tON,tOFF)
-Set the measuring equipment to 25 degreeC, and place the LCD panel at normal position (=0, =0 degree) in the LCD7000.
-Apply the driving voltage at Vopr of 6.3 and repeat display data =1(selective signal) and display data =0 (non-selective signal) continuously as shown below.
-Read the tON and tOFF from changes in brightness shown on the oscilloscope.

9.7 Measurement of brightness (B) and brightness uniformity(B)
-Set the measuring equipment (CS-100) to 25 degreeC, and places the LCD panel at normal position (=0, =0 degree) and sets the measuring tool above 35cm height to the LCD panel.
-Apply the driving voltage at Vopr of 6.3and display WHITE (selective signal) and measures at the condition of lighting LED Backlight.
-Brightness(B) defines the average of 5 points as shown below figure.
-Brightness uniformity (B) defines following formula.
B=Min.value/Max.value*100

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10   Diagram of internal connection at LCD panel

Com159

Com1

Seg1

160x128xRGB

Seg384

Com2

Com160

11   Precautions for use

11.1 Precaution for designing to assembly LCD module to your target machine.

(1) This LCD panel uses front polarizer with cut filter to ultra-violet because of covering direct sunlight, so this LCD module requires to assemble with the front cover.

(2) Glass-made LCD panel must be well secured to withstand vibration and shocks.

(3) When storing the LCD module, avoid any stress on the printing circuit, FPC, LSI and LCD panel. Do not undo the frame because of the dust, scratches and dirt between Back-light and rear polarizer .

(4) Light and electromagnetic wave may cause some errors in operation. Install shields if necessary.

(5) The LCD module mounts a LCD driver with controller whose has a static memory. With this LCD module causes some error because of the electrostatic discharge, the display may not recover its pattern. So, the testing against electrostatic discharge should be confirmed on the condition of measurement method or mounting at your side of the machine.

(6) If the LCD temperature exceeds the upper limit (Tni= approx. 105degreeC), the liquid crystal changes into liquid and the LCD will not operate.The original condition can be restored by lowering the temperature below the Tni point with your machine turned off.

11.2 Precaution for handling

(1) The space between upper and lower glass sheets of the LCD is as thin as approximately 10um, and the inside of the glass is subjected to special treatment (aligning treatment). So, the following precaution should be taken in handling them.
- Do not press the surface of display.
- Refrain from strong temperature shock while power is applied or not.

(2) Polarizer which covers the front face of the display portion is very sensitive to scratches. Pay full attention in handling. In addition, for cleaning the display surface gently, use soft cloth such as gauze moistened with either of the following;
-Isopropyl alcohol   -Ethyl alcohol
Avoid wiping the polarizer surface with dry cloth. Never use the following solvents.
-Ketones (ex, Acetone)   -Aromatic compounds(ex. xylene, toluene) –Water

(3) Do not use products which is dropped on to a hard surface. These should be regarded as faulty.

(4) Careless handling of the connection between LCD panel and TAB may cause disturbance. When storing the LCD module, especially fixing the LCD panel, strong stress to the connection may cause disturbance. Careful handling is needed.

(5) Do not touch input terminal with bare hands. Oil or salt from hands may cause connection disturbance.

(6) Organic substances are used to connect the LCD panel and TAB. If organic solvents touch this area, it prevents the products from functioning properly. When using organic solvents, take a special care.

(7) Do not handle the FPC with bending more than 1mm except original bend.

(8) Do not hold or press the LSI on the FPC.

11.3 C-MOS and its handling

This LCD module uses C-MOS drivers and white-LEDs, the following precautions have to be taken.

(1) Do not send any input signal before power is turned on.

(2) All the unused input terminals have to be connected to Vdd or Vss.

(3) The following precaution for electrostatic discharge requires if you need.
-Upon handling LCD modules, wear anti-static-electricity work clothing and gloves to the clean finger.
-Install ground board or ground wire on the floors, doors and tables of work space in order to discharge static electricity.
- Tools such as soldering irons should be grounded.Rev.1

11.4 Other precautions

(1) Prolonged exposure of LCD panels to high temperature or humidity (over 75%RH), causes increase in current consumption. Store the panels in the condition, 25± 5 degreeC and below 45 %RH for keeping to connect well.

(2) Using on the condition of being corrosive gas, such as chlorine (Cl) and sulfur (S) is not guaranteed. With this LCD module, it requires not to influence of their gas in your machine using.

(3) All the items of use, be cautions with the points shown by circled numbers.

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⚠ SAFETY PRECAUTIONS	
⚠ CAUTION	1. The wires between the inverter output terminal and FL or EL have very high voltage. Do not work while operating the system in order to avoid electric shock. Do not harm the cables and connectors.
	2. It should be designed that the inverter output voltage be stopped automatically because high voltage is generated when there is no load from the inverter output to FL.
	3. Be aware that there may be burrs at the frame edges of LCD module. Be careful not to touch cables on the frame edges when designing.
	4. Avoid injury by touching the edges of LCD panels. When designing, pay special attention not to damage wiring and components by touching the glass edges.
	5. Install a fuse or shutdown circuit at power supply section because there is no protected circuit inside the LCD module to cope with short circuit issues of power supply.

15. RoHS
   All components of this product not include any prohibited substance of RoHS.

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Arima   Display   Japan   Co.,Ltd

sym	date	Revision		signed	checked
·					
·					

Dimension	Tolerance
dim. ≦ 5	±0.20
5 < dim. ≦ 15	±0.30
15 < dim. ≦ 30	±0.40
30 < dim.	±0.50

Tolerance unless otherwise specified.

37.85
3.725±0.40
4.145±0.40
0.65
32.05(V/A)
29.56(A/A)
(4.15)
4.7
4
51.5
40.2(V/A)
36.95(A/A)

128RGB × 160 Dots
Dot Pitch : 0.077 x 0.231
Dot Size : 0.067 x 0.221

Viewing Direction
6o'clock
(1,1)

(2:tab)
6.5
(24.8:tab)

5.8
4.7
(1.7)
(22.2)
>PC<1
4.7
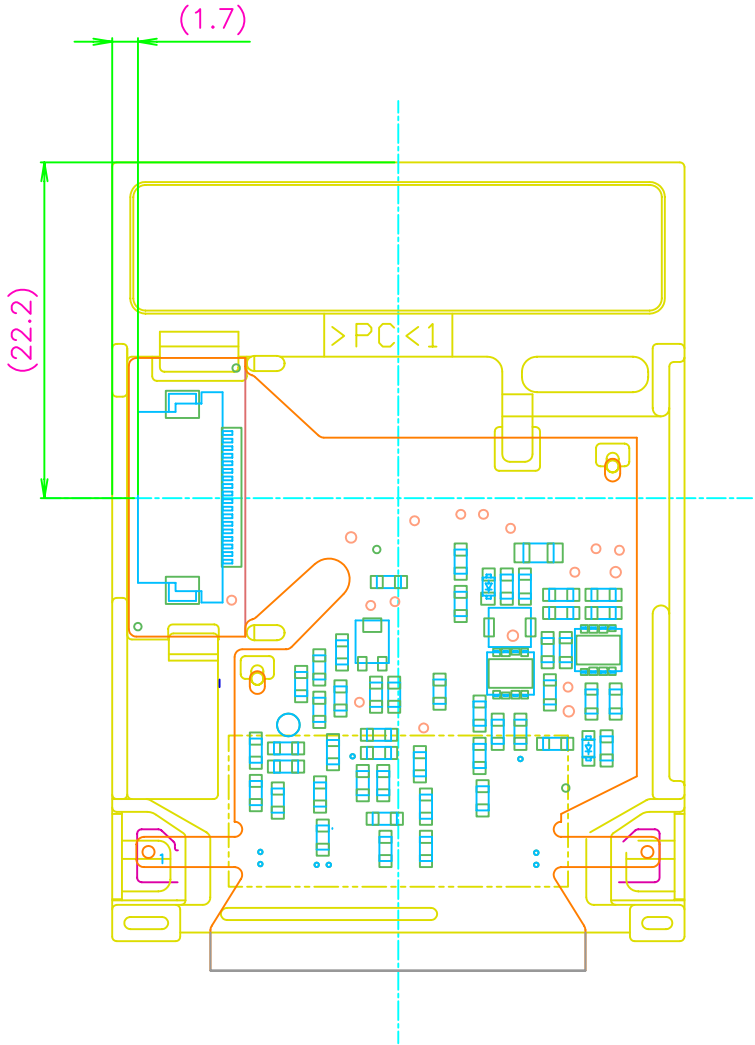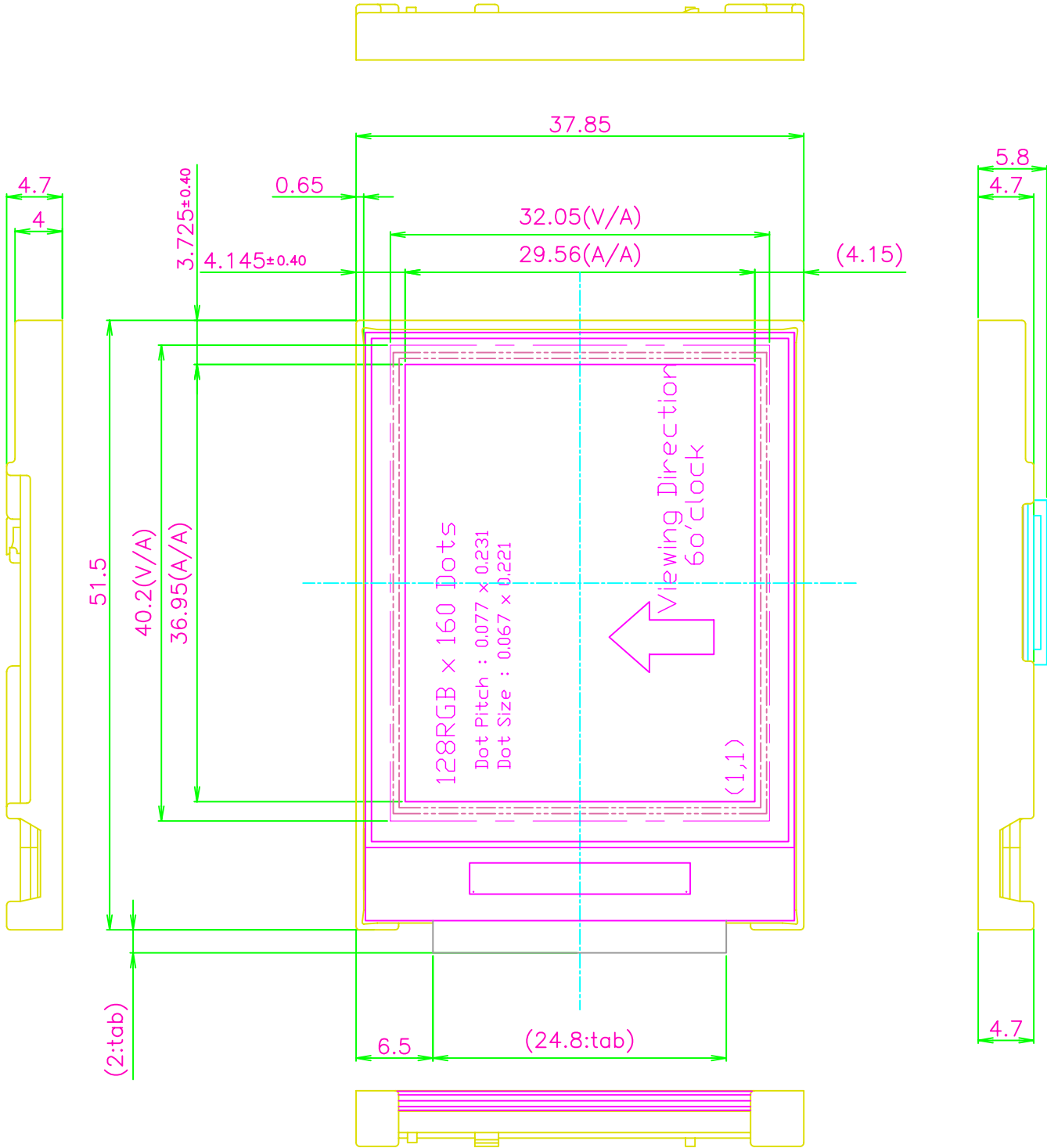
	LCD module	1			
sym	Item or Code No,	Qt	Material & Size		sym
	1.86" C-STN		Model		EDMMRG2KAS
Scale	Designed	Drawn	Checked	Approved	Name
2 : 1	H.Mizuno	H.Mizuno	—	S.Nakaga	
				14-Jun-2006	Drawing No. 1A1M-0046 (17-17)

Model: EDMMRG2KAS
OUTLINE DIMENSIONS

A3   Arima Display Japan Co.,Ltd   3rd Angle