

# *Development of Eclipse '02 Model AVN8802D*

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DVD Video • built-in Navigation DVD/CD/MD VGA-AV System 「AVN8802D」

Satellite images provided by Japan Space Imaging Corporation. 

Car navigation is headed toward multiple, more sophisticated functions.

But even as progress is made with such functions, there is increasing dissatisfaction with software performance (operability, design) and hardware performance (display equipment, depiction performance).

Last year we achieved a highly-appraised groundbreaking improvement in operability through touch-switches. This year we have engaged in improvements for a display performance that appeals directly to the user's eyes.

Below we present the user-enjoyable application software technology incorporated in the present product, plus several of the VGA/TFT, depiction ASIC and other hardware technologies that realize such software.

## 1

**Introduction**

In 1997 we commercialized and launched on the market AVN (audio visual navigation) integrating audio, visuals and car navigation in 2DIN size. This is a product concept unparalleled in our rivals and has been highly appraised, not only contributing to our own company's sales but creating the product category "AVN" in the commercial market. Naturally other companies are entering the competition in this category and we must prepare by achieving heightened differentiation and performance of our product.

With the 2001 model equipped with 3 decks (DVD, CD, MD) and employing a touch panel, additional hardware for sophisticated AVN functions (2DIN size) entered the stage of maturity. For the 2002 model therefore we have taken "high quality and aesthetics appealing directly to the user" as our focal point for differentiation. The aim is a product achieving unprecedented high quality and functional sophistication while maintaining and enhancing earlier functions.

Accordingly we have developed the AVN8802D, equipped with a VGA (visual video graphics array) display realizing resolution 4 times higher than conventional displays, plus functions that exploit VGA, namely satellite shot functions (display of images from the IKONOS satellite) and multi-window functions (split-screen displays of TV, destination locality information, audio, driving information, clock and so on simultaneously with navigation displays).



Satellite images provided by Japan Space Imaging Corporation. 



Fig.1 AVN8802D

Note: IKONOS is the world's first global observation satellite for commercial use. It was launched from the USA's Vandenberg Air Force Base on 25th September 1999.

## 2

**Overview of product**

An overview of the Eclipse '02 model "AVN8802D" is given below.

**Common component**

- Outer dimension size: 2DIN (width 178 x height 100 x depth 165 mm)
- Weight: 3.5 kg
- Decks: DVD/CD/MD
- Control operation methods: on-equipment control operation (via touch panel and front panel switches)/ remote control operation

**Display component**

- 6.5 inch wide VGA display  
Screen size: width 144 x height 78.2 mm  
Number of pixels: 1,152,000 (horizontal 2400 x vertical 480)
- Display functions: multi-window functions

**AV component**

Fig.2 Audio menu

- Radio (AM/FM/FM multiplex)
- TV (up to 62 channels, multi-channel compatible)
- CD (CD-R/RW compatible)
- MD (MDLP compatible)
- DVD video playback
- MP3 playback
- VTR input, rear seat TV output

**Navigation component**

- DVD navigation (set of 2 DVDs)
- Satellite shot functions
- Multi-window functions
- Built-in FM-VICS
- Equipped with 2-media VICS unit

**Sound quality component**

- Acoustic field control/graphic equalizer/position selector

- 50 W amp × 4

**System enhancement equipment**

- CD changer
- MD changer
- ETC (electronic toll collection system) unit
- Backeye camera

**3**

**Main features**

Here we describe the main features of the equipment.

The new functions were made possible by the newly developed ASIC. Details of the ASIC will be presented in our next paper "Development of ASIC for VGA display."

**3.1 Satellite shots (displays of IKONOS satellite images)**

This equipment is the first in the world to employ IKONOS satellite images for car navigation.

"IKONOS satellite images" refers to 1-meter resolution digital images taken from 6.8 million kilometers above the Earth by the IKONOS high-resolution imaging satellite launched in September 1999.

Compared to conventional aerial photographs these satellite images are practically distortion-free, and they have accuracy permitting determination of shapes of buildings and configurations of roads on the Earth's sur-



Regular map plus IKONOS image of destination locality



Satellite images provided by Japan Space Imaging Corporation. 

Full screen display

Fig.3 Sample navigation screen displays

face, as well as presence/absence/volume of traffic along roads.

Displaying these images on a navigation screen gives a visual aesthetic and realism appeal never before experienced with conventional car navigation. (Refer to Fig. 3.)

**3.2 Multi-windows**

Functions displaying navigation and AV sources on dual screens have become popular since the advent of wide displays. The present equipment however goes beyond displaying an AV source on the right side while displaying a navigation screen on the left side; it also permits switching between channels and other operations as function enhancement.

Besides AV sources it is also able to display finely-depicted analog clocks and driving information. (Refer to Fig. 4.)



Menu for multi-screen displays



Navigation screen plus TV screen



Sample finely-depicted images (driving information)

Fig.4 Sample multi-window displays

### 3.3 Multi-channel viewing

This function simultaneously displays up to 8 preset broadcasting channels (that are receivable at the time) in the TV mode. It permits users to ascertain in an instant the reception status and program content of each channel. (Refer to Fig. 5.)



Fig.5 Sample multi-channel display

The features described above fully exploit the merits of VGA display and sustain the equipment's product appeal.

## 4

### System configuration

Here we present the system configuration of the AVN8802D.

The product packs the functions shown in Fig. 6 at high density into the limited space of the 2DIN size.

The photographs in Fig. 7 show how the newly developed VGA display and navigation circuit boards are configured with the audio boards and with the decks (CD, DVD, MD), TV tuner, radio tuner and power units.

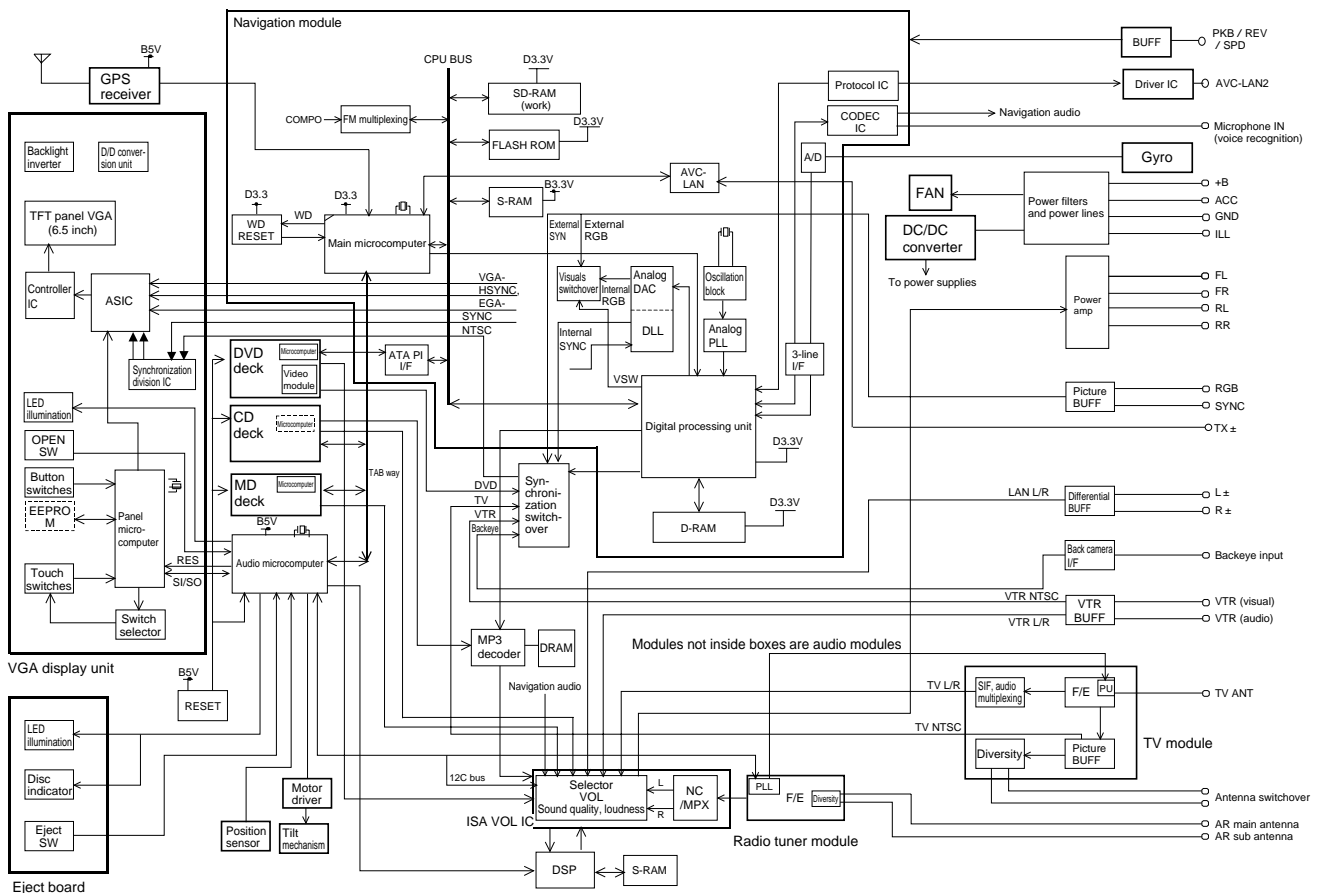


Fig.6 Block diagram



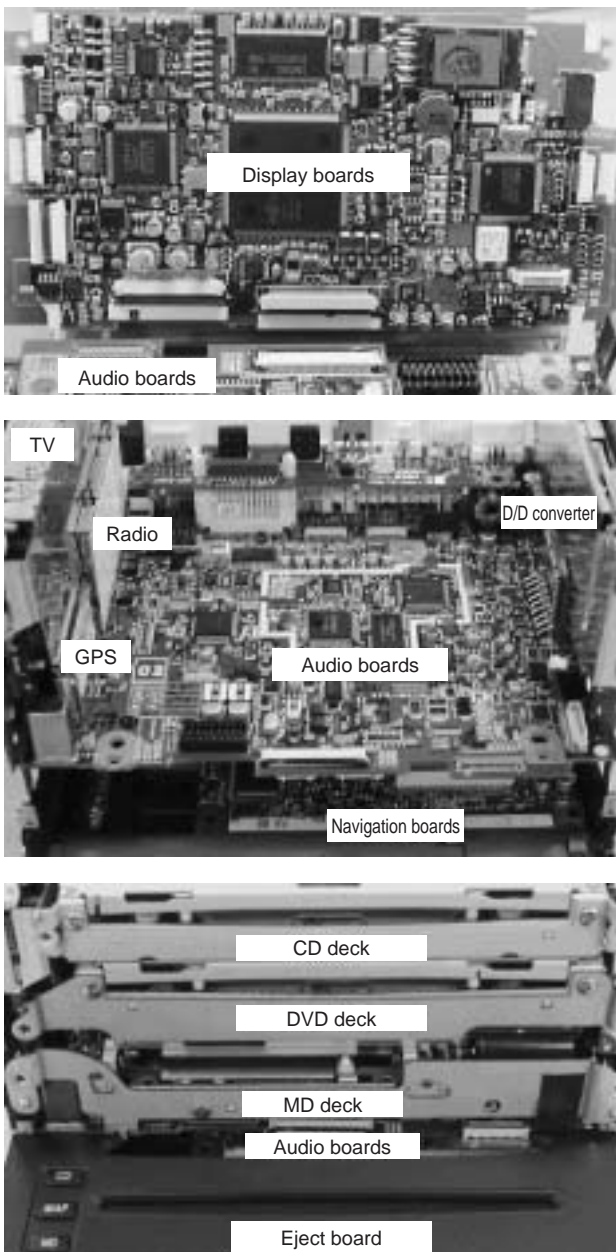


Fig.7 Circuit board and deck configurations for navigation and TV screens

## 5 Technological development items

In earlier papers dealing with AVN product development technology we described '00 model technologies including realization of 3 decks through development of a thin DVD deck, plus front panel tilt mechanism and heat dissipation measures, and '01 model technologies such as front panel construction incorporating touch panel.

In the present paper we present the items newly developed for the '02 model, namely the technology for the VGA display and associated heat rise countermeasures plus the map DVDs with satellite shot capability.

## 5.1 Visual signal processing with VGA display

Unlike the conventional EGA display, VGA display converts all of the visual signals to digital before performing depiction processing. Because of this it realizes high-clarity pictures.

Fig. 8 is a block diagram of visual signal processing with VGA display.

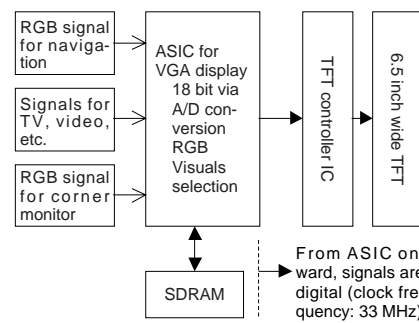


Fig.8 Block diagram of VGA picture processing

The ASIC that we have newly developed for VGA display selects the input analog signals appropriate for the succession of screens, then converts the signals into digital visual signals and outputs them to the TFT controller.

The TFT controller IC performs control for depicting the visuals on the 6.5 inch wide TFT.

Details of the ASIC for VGA display are given in our next paper "Development of ASIC for VGA display." Here we present the features of the TFT controller IC.

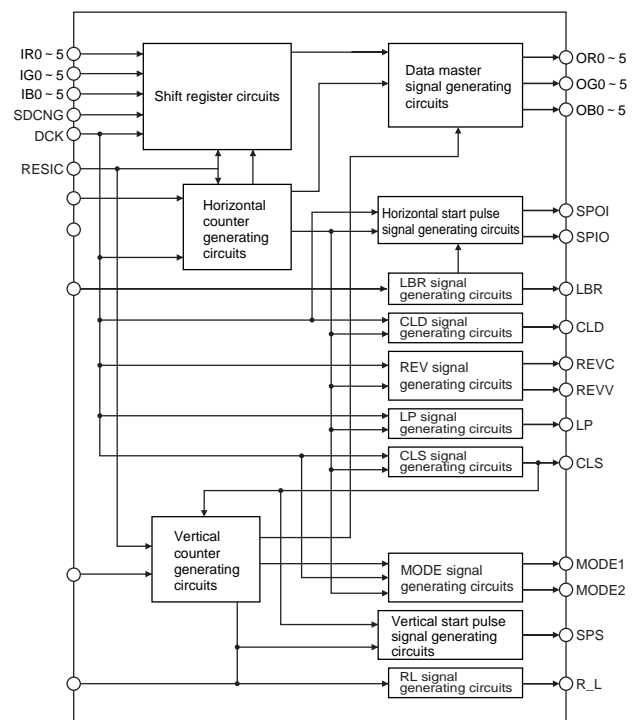


Fig.9 Block diagram of controller IC

The TFT controller IC has the following 2 features:

- 1) It has low susceptibility to the influence of noise because its input and output visual signals are digital signals.
- 2) It permits setting of a depiction start position signal, enabling depiction to start from any desired position.

**Key to signal name abbreviations**

- RL (output) : Vertical scan direction switchover signal
- LBR (output) : Horizontal scan direction switchover signal
- MODE 1,2 (output) : Gate clock mode switchover signal
- CLS (output) : Clock signal for gate driver
- LP (output) : Source driver latch strobe signal
- REVC (output) : Signal for COM signal generation
- REVV (output) : Signal for gradation voltage generation
- CLD (output) : Clock signal for source driver
- SDCNG (input) : Signal for determination of matching source driver

**5.2 DC/DC converter for 6.5 inch wide TFT**

VGA display requires around twice as many parts as EGA display, but due to the nature of the product the available circuit board area is the same.

Therefore we have switched from the conventional, planar packaging DC/DC converter (necessary for the positive and negative power supplies for the TFT) to one that employs HICs which can be configured 3-dimensionally, thus realizing compactness and higher circuit density. (Refer to Fig. 10.)

As a result the DC/DC converter's area is now around 1/4 that of the conventional item, and this space saving permits the required increase in the number of

Table 1 Comparison of D/D converters

	Output power supplies	Area	Max. height
EGA	4 systems	40mm x 35mm approx.	5mm
VGA	5 systems	20mm x 20mm approx.	5mm

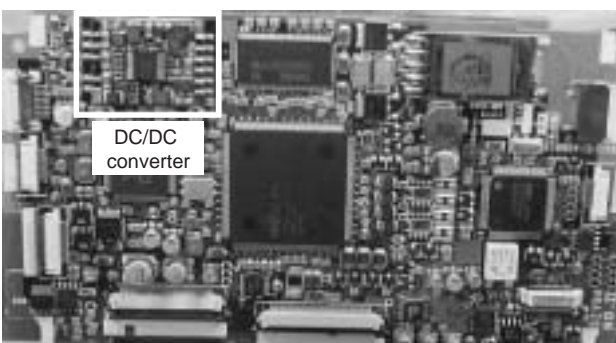


Fig.10 DC/DC converter

packaged parts.

Table 1 provides a comparison of EGA and VGA.

**5.3 Brightness improvement for VGA display**

Normally a VGA TFT unit has 4 times as many pixels as an EGA TFT unit, which means that with VGA TFT the panel's transmittance is low and brightness falls to around 70% compared to EGA (VGA transmittance = EGA transmittance/1.38).

To remedy this we have employed in the backlight component of the VGA TFT unit used in the present equipment an "LC display brightness enhancing sheet" that collects light together by means of a polarizing capability.

Use of this sheet increases the brightness at the panel surface by around 38%, securing brightness more or less on a par with that of an EGA TFT unit.

**5.4 Countermeasures for temperature rise with VGA display**

VGA display has various parts that emit large amounts of heat, including the ASIC for VGA display, the power regulator, the inverter transformer, and the VGA TFT unit's backlight cold cathode tube.

In the trial product evaluation stage the temperature rise in the VGA display interior and product interior proved greater than anticipated, exceeding the standard values.

The following were implemented as measures to counter such temperature rise:

- 1) The power regulator was shifted to a different circuit board so as to spread out the heat emissions.
- 2) The matching of the backlight cold cathode tube and inverter transformer was revised so as to improve the luminous efficiency (decrease thermal loss).
- 3) The air suction path of the fan installed at the rear of the product was revised so as to enhance the heat exhaust efficiency.

Table 2 lists the effects of these countermeasures.

Table 2 Effects of temperature countermeasures

	Temperature( )		
	Trial product evaluation stage	Final product with countermeasures	Effect
ASIC surface temperature	101.8	84.2	17.6
MD surface temperature	77.9	66.6	11.3
Touch panel center surface temperature	52.3	45.7	6.6
Touch panel top left surface temperature	54.3	48.9	5.4

These countermeasures have brought improved temperatures that meet the standard values. And although

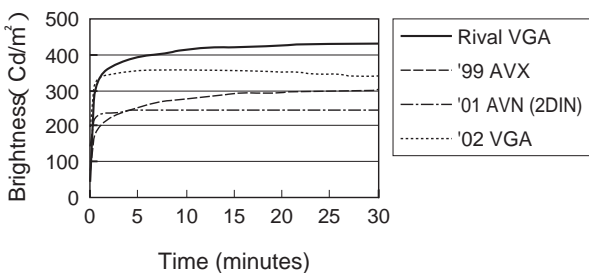
there was anxiety that the measures would cause the optical characteristics to deteriorate as a side effect, it has been determined that no such deterioration occurs.

Screen brightness: This is 310 to 370 cd/m<sup>2</sup>, on the same level or better than an EGA TFT unit with the conventional pixels. (Refer to Fig. 11.)

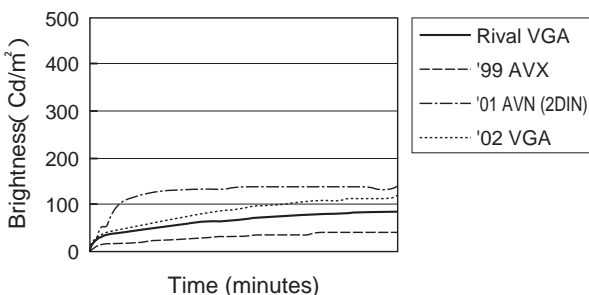
Brightness buildup: The product's -20 brightness buildup performance is slightly poorer than that of our earlier equipment but is better than that of the rival commercial-market 7-inch VGA monitor that we investigated as benchmark for our VGA product development. Thus the product is able to secure ample performance for practical use. (Refer to Fig. 12.)



Fig.11 Screen brightness distribution at VGA display surface



Comparison of brightness buildup times at 25



Comparison of brightness buildup times at -20

Fig.12 Brightness buildup characteristics

### 5.5 Map DVDs with satellite shot display capability

Due to increased function sophistication and competition among companies to pack larger numbers of map data items, map DVDs now use almost all of their 1-side dual-layer capacity (8.5 gigabytes) for conventional map data. Satellite shots (IKONOS satellite images) provide high definition but on the other hand entail large volumes of data. Even by compressing their data into JPEG format, it was impossible to load it into a single DVD.

Accordingly we switched to use of 2 DVDs, one for eastern Japan and the other for western Japan. But measures have been taken to prevent this from impairing user convenience. For example both discs pack basic data for route search/guidance and information search, etc., in common, while each packs its own particular regional street maps and IKONOS satellite image capability.

Display of satellite shots is possible in those areas for which IKONOS satellite images are available, which are shown in Table 3.

Table 3 Areas covered by DVDs for IKONOS satellite shots

Eastern Japan DVD	Western Japan DVD
Tokyo...23 Districts of Tokyo and surrounding areas	Aichi prefecture...Nagoya City and surrounding areas
Kanagawa prefecture... Yokohama City, Kawasaki City	Kyoto prefecture...Kyoto City
Aichi prefecture...Nagoya City and surrounding areas	Osaka Prefecture...Osaka City
Street maps (25 m scale)	Hyogo Prefecture...Kobe City
	Fukuoka Prefecture... Fukuoka City
Street maps (25 m scale)	
Basic data (data for 50 m or larger scale maps covering the whole nation) is contained in both discs. Basic functions such as destination locality search can be used with either disc.	

Satellite shots can be switched between detailed (1 : 6250 scale) and wide-area (1 : 12500 scale) views, but the fact that (unlike vector maps) IKONOS satellite images are raster images makes such switching difficult to execute smoothly. Therefore data for both detailed and wide-area views have been loaded into the discs to realize smooth switching.(Refer to Fig. 13)



Detailed map ( 1/6250 )



wide-area map ( 1/12500 )

Satellite images provided by Japan Space Imaging Corporation. 

Fig.13 Switching between 2 display scales

6

**Conclusion**

Above we have described the development aims and design essentials of the Eclipse '02 model AVN8802D employing VGA display.

We hope that the market will appraise highly not just the aesthetic appeal of the product's VGA display powered screens, but also its satellite shots and the ease of use and enjoyment provided by its multi-screen functions with their successively changing displays.

In the future as before we will be pursuing development of aesthetically appealing, easily-understood "enjoyable" products exploiting the features of VGA.

**Profiles of Writers**



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