
ENGINEERING, QUALITY AND RELIABILITY SPECIFICATION

NTSC Monochrome Video Display Module

Model NDP-0090-MV5
Revision A

DISPLAYTECH CONFIDENTIAL

Displaytech, Inc.
2602 Clover Basin Drive
Longmont, Colorado 80503-7604 USA
303-772-2191
303-772-2193 fax
800-397-8124 USA toll free
www.displaytech.com



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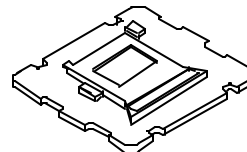
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NTSC Monochrome Video Display Module

Model NDP-0090-MV5



Features

- Monochrome LCOS microdisplay
- Fast switching FLC (Ferroelectric Liquid Crystal) technology
- Contrast Ratio > 100:1
- 400 (H) x 225 (V) Display Panel resolution
- Pixel size: 12 x 16 mm
- Active array diagonal: 0.24''
- Low power sleep mode

Applications

- Camcorder viewfinders
- Portable DVD viewers

Introduction

The NTSC Monochrome Video Display Module Model NDP-0090-MV5 is a 0.24" diagonal reflective LCOS microdisplay for NTSC monochrome video viewfinder applications. An illumination source is included for easy integration into a video display module. Compact and lightweight, the Display Module is specially designed for portable battery-operated devices. The Display Module includes a power-saving mode, dramatically reducing power consumption. Only polarization optics and a magnifying lens are required to create a complete viewfinder solution.

System Overview

The NDP-0090-MV5 Display Module provides a unique display solution, incorporating the Display Module and control circuitry in a compact optical-mechanical package. Like all Displaytech products, our Monochrome Video Display Module takes advantage of the fast switching speeds and superior optical qualities of our patented ferroelectric liquid crystal (FLC) materials. The FLC enables bright, high-contrast images over a broad temperature range.

The NDP-0090-MV5 video interface is designed to communicate with standard NTSC video sources. The video interface requires an analog luminance signal and separate horizontal and vertical sync signals and displays NTSC video signals with a gamma value of 2.3. Display Module power consumption is typically less than 160 mW. Excellent optical efficiency is provided with both a high aperture ratio and a top metal reflectance that is greater than 85%.

The Display Module specification is summarized in Table 1.

Parameter	Specification
Grayscale	Analog
Resolution	400 (H) x 225 (V)
Contrast Ratio	100:1 (Display Panel without an illuminator at 23 °C)
Pixel Size	12 x 16 μ m
Active Display Area	4.80 x 3.60 mm
Display Diagonal	6.00 mm (0.24")
Physical Dimensions	20 x 18.3 x 7.5 mm
Pixel Fill Factor	88.7%
Aspect Ratio	4:3
Reflectivity	>85%

Table 1: Display Module Specification Summary

Electrical Specification

This Engineering Quality and Reliability Specification for the NTSC Monochrome Display Module Model NDP-0090-MV5 is a detailed explanation of our product and its benefits. Figure 1 and Table 2 through Table 8 outline the basic specifications of the Display Module.

The NDP-0090-MV5 Display Module delivers vivid black and white video in a 400-pixel by 225-line format, using 4×3 aspect ratio pixels. The Display Module connects directly to any standard NTSC video source without the need for frame buffers or digital-to-analog converters. De-interlacing is accomplished by a simple time-domain sequencing algorithm.

The Display Module requires standard 3.3V and 5V supplies with typical power consumption being 160 mW under nominal operating conditions.

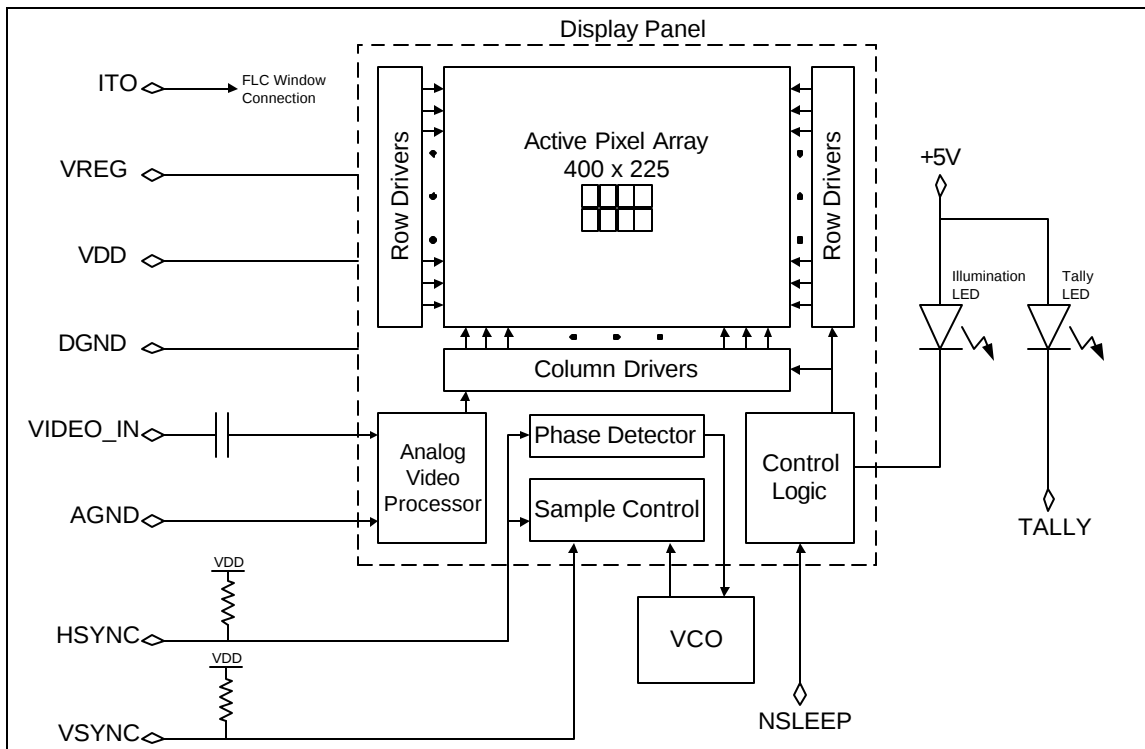


Figure 1 : NTSC Monochrome Video Display Module Model NDP-0090-MV5 Block Diagram

Absolute Maximum Ratings

Parameter	Conditions	Range	Units
+3.3V Supply (VDD)	DGND=0V	-0.7 to 4.25	V
+5.0V Supply	DGND=0V	-0.7 to 6.0	V
Digital Input	DGND=0V	-0.7 to VDD +0.7	V
Analog Input	AGND=0V	-0.7 to VDD +0.7	V

Table 2: Absolute Maximum Ratings

Recommended Operating Conditions

Parameter		Conditions	Min.	Typ.	Max.	Units
+3.3V Supply Voltage (VDD)		DGND=0V	3.2	3.3	3.4	V
+5.0V Supply voltage		DGND=0V	4.5	5.0	5.5	V
HSYNC, VSYNC, NSLEEP input	VIL	DGND=0V	-0.5	0.0	0.5	V
	VIH	VDD=3.3V	2.8	3.3	3.8	
Analog Input*	Sync level	AGND=0V	-0.125	-0.116		V
	Black level	DGND=0	0	0	—	
	White level		—	0.350	0.350	

Table 3: Recommended Operating Conditions

*Synchronization tips are not required on the Analog Input

Video Interface and Display Module Operation

The Display Module is controlled through a simple set of standard video signals. The VIDEO_IN signal is the analog luminance signal, which must be free of chroma information. High frequency video content exceeding the sample frequency of the Display Module may result in the aliasing of the video information. The VSYNC and HSYNC inputs are used to control the sampling rate of the video signal and must conform to the NTSC standards summarized in Table 4. The video sampling is performed so as to result in vertical and horizontal-overscan of 7%.

Pin Descriptions

Signal Name	Pin	Description
+3.3V (VDD)	10	+3.3 V Supply
+5.0V	8	+5.0 V Supply
DGND	4,11	Return Signals for Sync and power
HSYNC	7	Horizontal Sync Input, Negative Polarity
VSYNC	6	Vertical Sync Input, Negative Polarity
VIDEO_IN	5	Analog Monochrome Video Input
AGND	1,2,3	Return for VIDEO_IN
NSLEEP	9	Low Power Mode Control, Active Low
TALLY LED	12	TALLY LED
VREG	13	Window voltage output
ITO	14	Window Connection

Table 4: Pin Descriptions

Horizontal and Vertical Sync Inputs

The NDP-0090-MV5 Display Module requires separate horizontal and vertical synchronization inputs. The NDP-0090-MV5 Display Module can accept standard NTSC composite SYNC signals at the HSYNC input, but a separate VSYNC input will always determine the vertical synchronization signal. The current configuration for the NDP-0090-MV5 Display Module is with active low SYNC signals.

The NDP-0090-MV5 Display Module supports standard NTSC synchronization timing. Equalization and broad pulses on the HSYNC input are automatically detected and eliminated.

The control logic in the NDP-0090-MV5 Display Module requires certain minimum and maximum time intervals for the horizontal and vertical sync inputs. This ensures that the NDP-0090-MV5 Display Module can correctly sample the input and synchronize the Display Module with the incoming video. Table 5 lists these timing requirements.

With some degradation to picture quality, the NDP-0090-MV5 Display Module can accept video with missing HSYNC pulses, the wrong number of HSYNC pulses per VSYNC, and the repetition of the same Display Module field. However, these modes of operation are considered abnormal and no specific level of performance is guaranteed. Inconsistent numbers of HSYNCs per VSYNC will cause unstable illumination timing and may cause the Display Module to drop video fields. Abnormal video may trigger the sleep mode of operation. See the sleep mode section for details. Under no circumstances will the NDP-0090-MV5 Display Module allow the liquid crystal to be damaged.

Parameter	Min	Nom	Max
Vertical Synchronization			
Vertical Frequency		59.994 Hz	
Vertical Total	242H	262.5H	282H
Vertical Blanking	19H		21H
Vertical Sync	3H	3H	3H
Horizontal Synchronization			
Horizontal Frequency	13.333 kHz	15.734 kHz	17.241 kHz
Horizontal Blanking	10.7 us	10.9 us	11.1 us
Horizontal Sync	4.6 us	4.7 us	4.8 us
Horizontal Front Porch	1.27 us		2.22 us
Horizontal Back Porch	3.68 us		5.23 us
Composite Synchronization			
Pre-equalization Pulses		6	
Broad Pulses		6	
Post-equalization Pulses		6	
Equalization Pulse Width	2.2 us	2.3 us	2.4 us
Broad Pulse Width		27.1 us	

Table 5: Horizontal and Vertical Sync Inputs

Horizontal Timing

The NDP-0090-MV5 Display Module generates a sample clock from the HSYNC signal with a phase detector on the Display Module and VCO on the PCB. The Display Module includes logic to strip composite sync information on the VIDEO_IN signal as well as clamp the video black level during the horizontal back porch. The sync strip, black level clamp, and video sample window are shown in Figure 2.

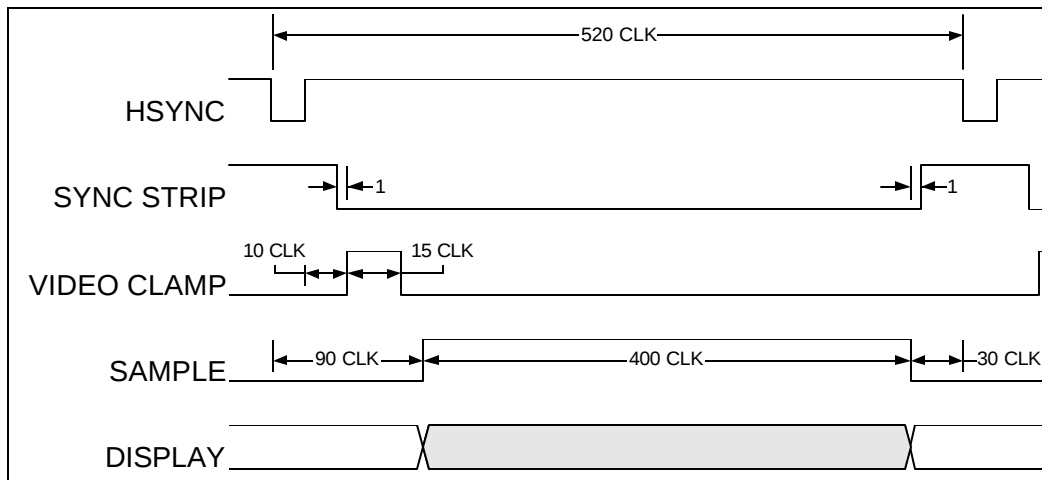


Figure 2: NTSC Horizontal Line Timing

Odd/Even Field Sequencing

The NDP-0090-MV5 recognizes even and odd fields by the delay between the start of the vertical SYNC pulse and the first horizontal SYNC pulse. This delay is labeled T_FIELD. The following equation describes the NDP-0090-MV5's display field detection method.

If $T_{\text{horiz_min}} < T_{\text{field}} < T_{\text{horiz_max}}$

Even Field detected

Else

Odd Field detected

The value for T_MHORIZ_MIN is 130 and the value for T_HORIZ_MAX is 390. The following timing diagram shows the beginning of odd and even fields assuming active low SYNC signal inputs. Note that the line number of the first line after VSYNC is defined for the NTSC NDP-0090-MV5.

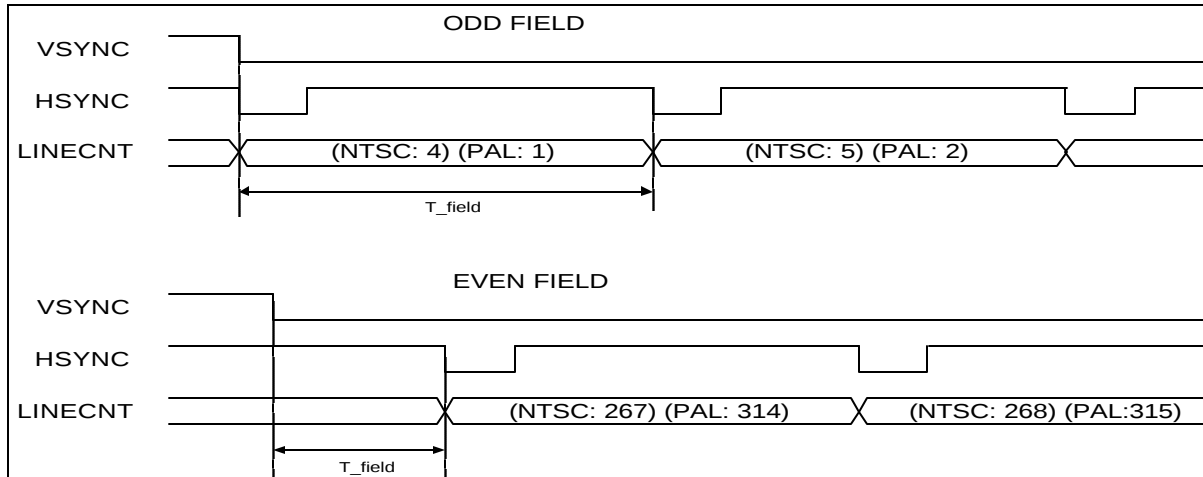


Figure 3: Odd/Even Field Sequencing

Displayed Lines

Table 6 shows the first and last lines displayed for each field. These define the active display area. For NTSC, the NDP-0090-MV5 displays 225 continuous lines of the active display area per field.

Displayed Lines	NTSC	
	Odd Field	Even Field
First Line Displayed	30	292
Last Line Displayed	254	516

Table 6: First and Last Displayed Lines

Sleep Mode

The sleep mode of operation is a feature of the Display Module specifically targeted for battery-powered applications. During sleep mode, the NDP-0090-MV5 Display Module will dissipate less than 20 mW. This sleep mode is achieved by disabling all non-essential functions in the NDP-0090-MV5 Display Module and turning off all LED power.

The sleep mode of operation is entered in one of two ways. It is entered by either pulling input NSLEEP low, or by the sleep auto-detect logic, which monitors the HSYNC and VSYNC signals. The sleep auto-detect logic is intended to detect the loss of a video signal input, while being tolerant to momentary disruptions of the video input signals. The device will enter sleep mode if any of the following sleep criteria are found.

SLEEP Criteria

1. Fewer than 31 HSYNCs in a frame (2 fields), or
2. More than 1875 HSYNCs in a frame (2 fields), or
3. Three or more successively dropped HSYNCs.

Once the device is in sleep mode, two criteria must be met before the device will wake up from sleep mode:

1. The NSLEEP mode pin must be driven high, and
2. The sleep auto-detect logic must not find any of the sleep criteria.

DC Balance of the FLC material is achieved by powering down the pixels and reducing the ITO voltage to zero in order to eliminate any DC field across the liquid crystal.

Mechanical Specification

Package Outline

Figure 3 shows the mechanical outline drawing of the NDP-0090-MV5 Display Module and the location of the active area. The package is designed to be mounted by simply clamping the edges of the PCB. Like all LCD devices, the Display Module is subject to artifacts caused by strain placed on the Display Module cell. Forces that cause any twisting or undue compression of the PCB must be minimized. The operating and storage temperatures are shown in Table 10.

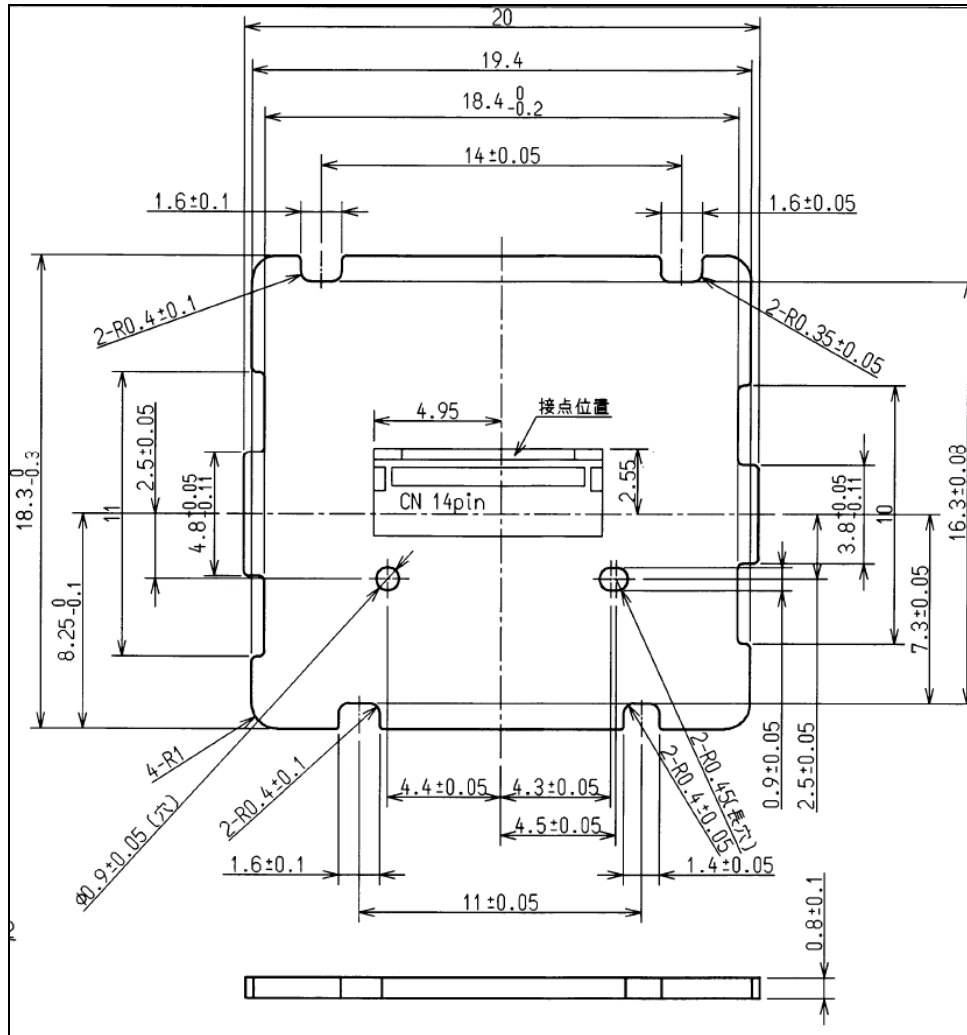


Figure 4: NDP-0090-MV5 Display Module Mechanical Outline

Electrical Components Comprising the FR4 Printed Circuit Board

Name	Value	Ref	Miyota comp.	Mfr type	Mfr.	#
Chip Condensers	0.1 μ F	C1	CACC-58-104Z1C	GRP155F11C104ZD01E	Murata	1
	0.1 μ F	C2	CACC-58-104Z1C	GRP155F11C104ZD01E	Murata	1
	0.1 μ F	C3	CACC-58-104Z1C	GRP155F11C104ZD01E	Murata	1
	0.1 μ F	C9	CACC-58-104Z1C	GRP155F11C104ZD01E	Murata	1
	0.1 μ F	C11	CACC-58-104Z1C	GRP155F11C104ZD01E	Murata	1
	560 pF	C4	CBCC-05-561J1H	GRM1882C1H561JA01D	Murata	1
	100 pF	C5	CACC-50-101J1H			1
	3.00 nF	C7	CBCC-57-332K1H	GRP155B11H332KA01E	Murata	1
	3.3 μ F	C8	CBCC-14-335K0J	GRM21BB10J335KA11L	Murata	1
Chip LED		D1	DATQ-57-NSCW100	NSCW100 (ST)	Nichia	1
		D2	DATQ-77-221HR	CL-22HR	Citizen	1
Baricap diode		D3	DBTV-15-365	MA365	Panasonic	1
			DBTV-15-288	1SV288	Toshiba	
Chip inductors	12 μ H	L1	LBLC-07-120J	NL322522T-120J	TDK	1
			LBLC-43-120J	ELJFA120JF	Panasonic	
Chip resisters	10 K Ω	R1	8BRH-09-103JiJ	CRG16GST103J	Tama Elec	4
	10 K Ω	R2	8BRH-09-103JiJ	CRG16GST103J	Tama Elec	1
	10 K Ω	R3	8BRH-09-103JiJ	CRG16GST103J	Tama Elec	1
	10 K Ω	R16	8BRH-09-103JiJ	CRG16GST103J	Tama Elec	1
	330 Ω	R5	8BRH-09-331JiJ	CRG16GST331J	Tama Elec	1
	1.5 K Ω	R11	8BRH-09-152JiJ	CRG16GST152J	Tama Elec	1
	820 Ω	R9	8BRH-09-821JiJ	CRG16GST821J	Tama Elec	1
	5.6 K Ω	R10	8BRH-09-562JiJ	CRG16GST562J	Tama Elec	1
	6.65 K Ω	R12	8BRH-09-6651JiJ	CRG16GST6651J	Tama Elec	1
	5.1 K Ω	R14	8BRH-09-512JiJ	CRG16GST512J	Tama Elec	1
	5.1 K Ω	R15	8BRH-09-512JiJ	CRG16GST512J	Tama Elec	1
	470 Ω	R17	8BRH-09-474JiJ	CRG16GST474J	Tama Elec	1
	750 Ω	R18	8BRH-09-751JiJ	CRG16GST751J	Tama Elec	1
	22 K Ω	R19	8BRH-09-223JiJ	CRG16GST223J	Tama Elec	1
	27 K Ω	R20	8BRH-09-273JiJ	CRG16GST273J	Tama Elec	1
	12 K Ω	R22	8BRH-09-123JiJ	CRG16GST123J	Tama Elec	1
	0 K Ω	R28	8BRH-09-000JiJ	CRG16GSR00	Tama Elec	1
	0 K Ω	R29	8BRH-09-000JiJ	CRG16GSR00	Tama Elec	1

	0 K Ω	R30	8BRH-09-000JiJ	CRG16GSR00	Tama Elec	1
Chip variable	47 K Ω	RV2	VAZE-12-47KBR	MVR32HXBRN473	Rohm	1
Registers	47 K Ω	RV2	VAZE-26-47KBR	EVM3ESX50BQ4	Panasonic	
	470 Ω	RV3	CAZE-12-470BR	MVR32HXBRN471	Rohm	1
	470 Ω	RV3	VAZE-26-470BR	EVM3ESX50BQ2	Panasonic	
FPC connector	CN1		CAZD-A0-14FLT	14FLT-SM1-TB(A)	JST	1
	14 pin	CN1	VAZE-A7-014	04 6244 014 000 800	Kyocera	
PCB			PA27-97	Rev.2B panel board	Hitachi AIC	1

Table 7: Electrical Components Comprising the NDP-0090-MV5 PCB

Optical Quality Specification

Introduction

As delivered, the NDP-0090-MV5 is only a portion of the complete display system. The NDP-0090-MV5 consists of an LCOS panel attached to an FR4 substrate, which includes all necessary external components and an illumination LED. The NDP-0090-MV5 customer must then take the LED light and shine it into an integrated light chamber. The light chamber must diffuse and polarize the light before directing it on to the LCD cell with a beam splitter. Light reflecting from the LCOS cell must then pass through another polarizer prior to passing through magnifying optics.

Many of the visual parameters typically reported for a liquid crystal display cannot be given here without referencing a typical light chamber since they are only visible after the NDP-0090-MV5 is built into a complete display module. As necessary, measurement methods and measurement equipment, including the type of light chamber, are referenced for each optical parameter. Changes in methods or equipment may require different specifications. Changes resulting in new specifications must be reviewed to determine whether they are the result of continuous improvement or represent a new product.

Quality Policy

Displaytech is committed to providing product that will meet or exceed our customer expectations by providing quality assurance through test, inspection, reliability and continuous improvement programs.

Measured Specifications

Measuring Equipment Needed:

- 5 and 3.3 Volt power supply
- Typical camcorder video source
- Polarized microscope with stable DC illumination possessing a system contrast of greater than 3000:1; with adjusted aperture control to make the ON state output level as measured by the photodetector to be around 3V
- Photodetector with low noise power supply
- Digital oscilloscope: frequency > 10Mhz, gauge precision higher than 2 Mv

Parameter	Temperature	Method	Minimum	Typical	Maximum
Contrast Ratio w/o skylight	$-10 \pm 2^{\circ}\text{C}$	1	50	80	90
Contrast Ratio w/o skylight	$23 \pm 2^{\circ}\text{C}$	1	80	140	160
Contrast Ratio w/o skylight	$60 \pm 2^{\circ}\text{C}$	1	400	700	800
Reflectivity w/o skylight	$-10^{\circ}\text{C} ? 65^{\circ}\text{C}$	2	85%		

Table 8: Optical Specification Summary

- **Contrast ratio measurement:** Procedure used is “Electrooptic Property Measurement Methods for FLC Qualification and Its Display Device Quality Check” by Yang, Gough & Parghi with the following exception:
 - a. Fix the stage so that the microscope polarizer is parallel to the pixel rows and the perpendicular parallel to pixel columns, that is, ‘crossed’.

Visual Inspection Specification

Figure 5 below describes the two regions of interest in the active area of the Display Module. These two regions have different visual inspection tolerances as described in Table 9.

Inspection Equipment Needed:

- Miyota Co., Ltd. Skylight part number EX4E-03
- 5 and 3.3 volt power supply
- Typical camcorder video source
- Hand held 15× magnifying lens with and f number of 2.0

The NDP-0090-MV5 Display Module includes a white LED for illumination of the LCOS cell. This LED is intended for use in conjunction with an integrating light chamber, then diffused and polarized, before being directed on to the LCD cell via a beam splitter. Light reflecting from the LCOS cell should then pass through a crossed polarizer prior to passing through magnifying optics.

The NDP-0090-MV5 consists of an LCOS panel attached to an FR4 substrate, which includes all necessary external components and an illumination LED. As delivered, the NDP-0090 is only a portion of the complete display system. To construct an entire display module, the NDP-0090-MV5 must be combined with polarization and magnifying optics. Thus many of the parameters typically reported for a liquid crystal display cannot be given here, as they are only measurable after the NDP-0090-MV5 is built into a display assembly. The measurement parameters of the NDP-0090-MV5 that contribute to the final display module’s optical parameters are specified in this document and the measurement methods are explained below.

The critical optical characteristics of the NDP-0090-MV5 that influence overall picture quality are measured prior to shipment of each Display Module. These characteristics include contrast ratio and Display Module uniformity. The summary of the optical specifications is given in Table 8.

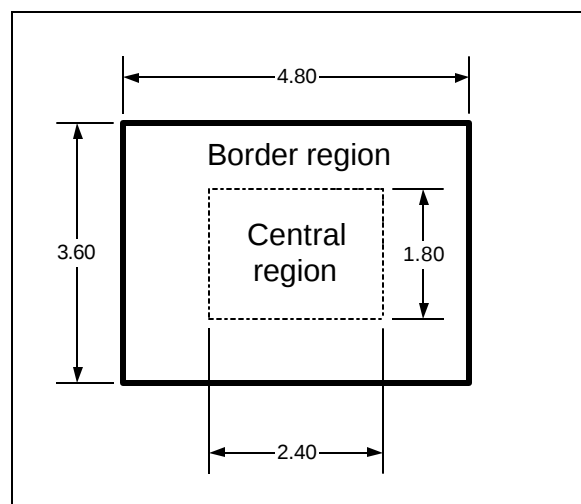


Figure 5: Central and Border Regions

Parameter	Temp. °C	Method	Specification	Tolerance Central	Tolerance Border
Bright Spot (small & medium)	23 ± 2	A	Bright spot size = 1 pixel	None	1 Spot
Bright Spot (large)	23 ± 2	A	1 pixel < spot	None	None
Medium Spot (small)	23 ± 2	A	Bright spot size < ½ pixel	O.K.	O.K.
Medium Spot (medium)	23 ± 2	A	½ pixel = spot = 1 pixel	2	2
Medium Spot (large)	23 ± 2	A	1 pixel < spot < 2 pixel	0	0
Dark Spot (small)	23 ± 2	B	Bright spot size < ½ pixel	O.K.	O.K.
Dark Spot (medium)	23 ± 2	B	½ pixel = spot = 1 pixel	2 Spots Maximum	2 Spots Maximum
Dark Spot (large)	23 ± 2	B	1 pixel < spot < 2 pixel	None	None
Scratch in Active Area (silicon or glass)	23 ± 2	A	Limit Sample	—	—
Color bands	-10 ± 2	B	Slight color bands visible / Limit Sample	O.K.	O.K.
Color bands	23 ± 2	B	No visible color bands	—	—
Color bands	65 ± 2	B	Slight color bands visible / Limit Sample	O.K.	O.K.
Dark State Uniformity	-10 ± 2	C	Slight variation in visible contrast / Limit Samples	O.K.	O.K.
Dark State Uniformity	23 ± 2	C	No visible contrast variation	—	—
Dark State Uniformity	65 ± 2	C	Slight variation in visible contrast / Limit Samples	O.K.	O.K.
Image Sticking	23 ± 2	D	8 Hours / Limit Sample	O.K.	O.K.
Image Sticking	40 ± 2	D	2 Hours / Limit Sample	O.K.	O.K.

Table 9: Visual Inspection Summary

A: Inspect the Display Module with an “all black” field using a skylight and hand held magnifying lens. A bright spot is defined as a spot that is bright enough to be visible when the entire Display Module is written as a 60% grayscale. A medium spot is defined as a spot that is bright enough to be visible when the entire Display Module is written as a 30% grayscale.

B: Inspect the Display Module with an “all white” field using a skylight and a hand held magnifying lens. A dark spot is defined as a spot that is dark enough to be visible when the entire Display Module is written as a 50% grayscale.

C: Inspect the Display Module with an “all black” field using a skylight and a hand held magnifying lens. The Display Module must meet dark state uniformity requirements within 10 seconds of power up.

- D*:**
1. 5 panels from a 24-hour production period are pulled from the manufacturing line for image sticking tests
 2. The image-sticking test requires a video image from a camcorder in the "Player" mode (gray background with white characters in the upper left corner).
 3. The image is Display Moduleed for two hours at 40C +/-2C degrees.
 4. Within an hour after the image is turned off, the panel is inspected using a dark field image at room temperature.
 5. Pass/Fail criteria are based on limit samples. Very little permanent image sticking is allowed.

*Note: If the panel passes this test, the panel is also guaranteed to pass an eight-hour image-sticking test at room temperature.

Reliability Specifications

Environmental Ratings

Qualification Test	Test Standard	Test Conditions
Lifetime	MIL-HDBK-781	MTBF @ 80% confidence, 1000 hours
High Temperature Storage	JEDEC JESD22-A103-A	83 °C, unbiased, 240 hours
Low Temperature Storage	JEDEC JESD22-A103-A (modified temperature)	-30 °C, unbiased, 240 hours
High Temp/High Humidity Storage	JEDEC JESD22-A103-A (modified temp & humidity)	60 °C, 90% R.H., unbiased, 240 hours
Air to Air Thermal Cycle Storage	JEDEC JESD22-A104-A (modified temperatures)	-30°C to 80°C, 10 minute transfer, 30 minute dwell, 10 cycles
Moisture Resistance Operation	MIL-STD-202 (modified)	40 °C, 85% R.H., biased, 240 hrs
High Temperature Operation	JEDEC JESD22-A103-A (modified temperature)	65 °C, 240 hours
Low Temperature Operation	JEDEC JESD22-A103-A (modified temperature)	-10 °C, 240 hours
ESD/Static	JEDEC JESD22-A114A	Class 1, 1000 volts
High Altitude		0.3 atm., 2 hours
Vibration/Shock	JEDEC JESD22-B103-A, B104-A	20 – 1 kHz, 10G (vib); 300G, 1ms (shock)
Free Fall & Crash Test		Height = 20 cm; 3 times

Table 10: Operating and Storage Temperature Range

A reliability test shall be considered a pass only if it meets all optical parameters from the measured criteria in the test specification to $\pm 20\%$ of original values (see Table 8).

A reliability test shall be considered a pass only if it passes all inspection parameters from the visual inspection specifications (see Table 9).

JEDEC is from Solid State Technology Association – www.jedec.org

Appendix A: General Display Module Handling

General Handling

The Display Module should be treated carefully, as any other precision device. This section provides guidelines for proper handling of the Display Module.

Cleanliness

The Display Module should be handled and assembled in a class 10,000 clean room or under a positive pressure, laminar flow bench filtering to 1 μ m. Use dry, ionized air (from a hand-held pressurized air cleaner) to remove dust or debris from the panel.

Electrostatic Discharge (ESD)

All clothing of personnel working with the Display Module should be static free and non-chargeable. Display Module handlers should always be fully grounded and follow standard ESD procedures. All work areas must have grounded, conductive flooring (or mats) and a grounded, conductive work surface. Personnel handling Display Module components should wear a ground heel strap or a grounded, conductive wristband.

UV Radiation

Limit the exposure of the Display Module to unfiltered ultraviolet (UV) radiation. Long periods of exposure may degrade the Display Module components and performance and have negative effects on the device materials.

Mechanical

It is important not to touch nor contact the polarizing film.

Environmental

During either integration or storage, do not allow condensation to form on the Display Module. Be sure to follow recommended storage temperatures for the panel assembly of -30 to 83 °C during both integration and storage procedures.

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Product Specification Summary

NTSC Monochrome Video Display Module

Model NDP-0090-MV5

General

Format	
Resolution	400 x 225 Monochrome Pixels
Array Diagonal	6.00 mm (0.24)
Pixel Pitch	12 μ m
Fill Factor	88.7%
Grayscale	Analog
Pixel Size	12 x 16 μ m

Opto-Mechanical

Contrast Ratio	>100:1
Reflectivity	>85%

Electrical

Interface	Analog Luminance, H & V Sync
Display Panel Supply	3.3 $\pm$ 0.1 V
LED Illumination Supply	5.0 $\pm$ 0.5 V
Power Consumption	
Total, Module	160mW
Sleep, Module	20mW

Physical

Dimensions	(20 x 5.25 x 18.30 mm)
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Thermal

Operating Temperature	-10 to 65 °C
Storage Temperature	-30 to 83 °C

Corporate Profile

Displaytech, Inc. makes and sells microdisplays with superior image quality to performance-driven consumer electronics companies, providing sustainable competitive advantages to their digital still cameras, camcorders, business projectors, projection TVs, and mobile communication devices. Displaytech offers high-quality, patented Ferroelectric Liquid Crystal (FLC) display products using less power and with smaller form factors that allow product design innovation and meet tough manufacturing demands. Established partnerships with industry-leading manufacturers and proven manufacturing capabilities also position Displaytech to keep pace with the challenges of the high volume consumer electronics market.

For additional information, please contact:

Displaytech, Inc.
2602 Clover Basin Drive
Longmont, Colorado 80503-7604
USA

Telephone	303-772-2191
Toll-free (USA)	800-397-8124
Fax	303-772-2193
Email	neareyesupport@displaytech.com
Web Site	www.displaytech.com

