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AFFIDAVIT OF CHRISTOPHER BUTLER

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7. I declare under penalty of perjury that the foregoing is true and correct.

DATE: 2/12/20



Christopher Butler

Exhibit A



Leading the Way in Electronic **VISION**

VISION is the world's leading producer of cost-effective, highly integrated camera and vision systems based on CMOS imaging technology.

These Web Pages provide information on our products and services. If you have any questions that are not answered here, or would like to find out more about our custom products, contact us via the reply form supplied:



VISION
have recently announced a
number of exciting new
developments in CMOS imaging.

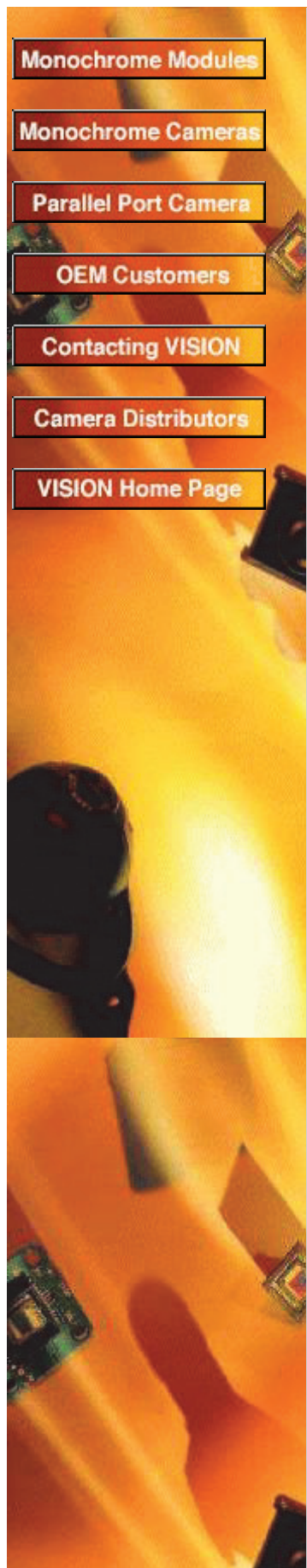
Check them out at

What's New!



Last Updated 6/3/97





Camera Products Home Page

Welcome to the **VISION** Camera Products Group



The Camera Products Group is responsible for the design and development of a series of products from [Camera Modules](#), i.e. VISION CMOS image sensors on PCBs, through to [full function cameras](#) and [PC Peripherals](#).

If you would like more information on some of these products, or other camera related information please select a topic to the left. If you do not find what you are looking for contact VISION using the [reply form](#)

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Last Updated 11/2/97



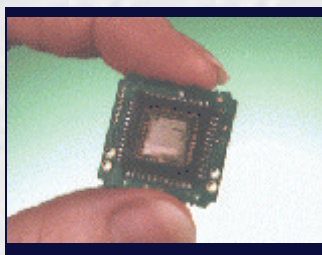
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Analog Monochrome Modules

VISION CMOS Imaging sensors are available on PCBs with all support circuitry for immediate use as Monochrome Composite-Video cameras. This makes them suitable for [OEMs](#) to design into their own products.

Various different modules are available depending on the required functionality.



VM5402 Module

Connections - 9v DC in, Video out

[View a brief spec](#)

[Download a detailed spec in PDF format](#)

VL5402 Lensed Module

Connections - 9v DC in, Video out with fixed focus narrow or wide angle lens

[View a brief spec](#)

[Download a detailed spec in PDF format](#)

VL5430 lensed Module

Connections- 5v in, video plus pixel clock, frame and line signal serial comms bus out

[View a brief spec](#)

[Download a detailed spec in PDF format](#)

VV5402C001 Sensor

48 pin LCC CMOS sensor

[Download a detailed spec in PDF format](#)

VV5430C001 Sensor

48 pin LCC CMOS sensor with support for external ADC and serial bus control

[Download a detailed spec in PDF format](#)

VM5400 Module

Connections - 9v DC in, Video out

[View a brief spec](#)

[Download a detailed spec in PDF format](#)

VL5400 Lensed Module

Connections - 9v DC in, Video out with fixed focus narrow or wide angle lens

[View a brief spec](#)

[Download a detailed spec in PDF format](#)



<https://web.archive.org/web/19970608180516/http://www.vvl.co.uk/camera/anmommod/fda/t5402/cd11401c.pdf>

VISION VM5402 Camera Module

Dual-standard Monochrome CMOS Image Sensor,
available with or without lens.

PRODUCT DATASHEET

DISTINCTIVE CHARACTERISTICS

- Complete Video Camera on a PCB module
- EIA/CCIR standard compatible options
- Linear or Gamma corrected output option
- Low power operation (250mW Typical)
- Integral 75Ω driver
- Low light operation to 0.5 lux
- Automatic Exposure and Gain Control
- Automatic Black Level Calibration

GENERAL DESCRIPTION

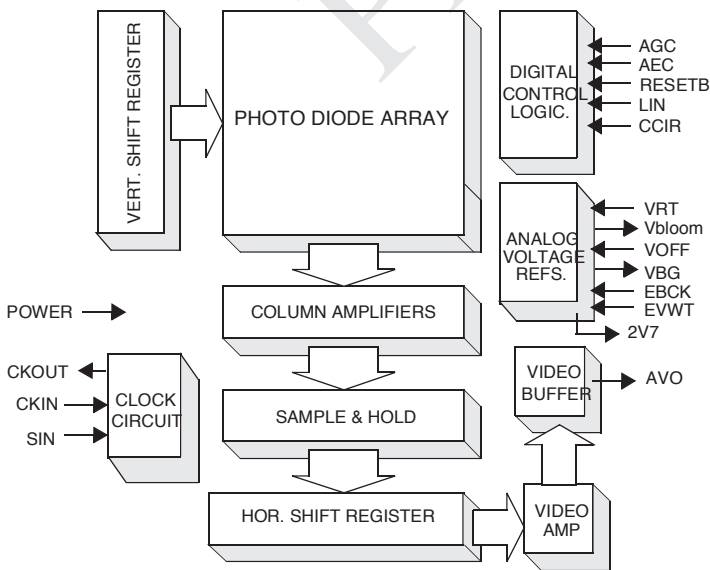
The VM5402 is a complete video camera based on VISION's highly-integrated VV5402 CMOS sensor device. The module is suitable for applications requiring a composite video output with minimum external circuitry.

The camera incorporates a 388 x 295 pixel image sensor and all the necessary support circuits to generate fully formatted composite video into a 75Ω load.

Automatic control of exposure, gain and black level allow use of a single fixed-aperture lens over a wide range of operating conditions.

Linear Correction Mode select is available at a connector pad, giving maximum flexibility with ease of use. The VM5402 offers a complete camera system in a self-contained module.

BLOCK DIAGRAM



Pixel Format	384 x 287 (CCIR) 320 x 243 (EIA)
Pixel Size	12μm x 12μm
Array Size	4.66mm x 3.54mm
Min. illumination	0.5 lux (Standard Clock)
S/N	Typically 52dB
Exposure control	Automatic (to 146000:1)
Gain Control	Automatic (to +20dB)
Power Supply	+8 TO +12v DC
Power	< 300 mW
Temperature	0°C - 40°C

MAIN FEATURES

Video Output

The VM5402 delivers a fully-formatted composite monochrome video signal. Standards options include EIA (320 x 244) and CCIR (384 x 287). On chip signal conditioning allows user-selection of linear or gamma-corrected output.

The integrated 75Ω driver eliminates the need for additional active components to drive standard loads, including double terminated lines.

Exposure and Gain Control

Automatic exposure and gain control are enabled with AEC=1 (pin 21) and AGC=1 (pin22). The VM5402 module is supplied configured with both AEC and AGC enabled.

Automatic Exposure Control (AEC)

The VV5402 controls exposure over a range of 99,000:1 in EIA mode and 146,000:1 in CCIR mode, and operates at illumination levels as low as 0.5 lux at standard clock frequencies.

Automatic exposure control is achieved by varying pixel current integration time according to the average light level on the sensor. This integration time can vary from one pixel clock period to one frame period.

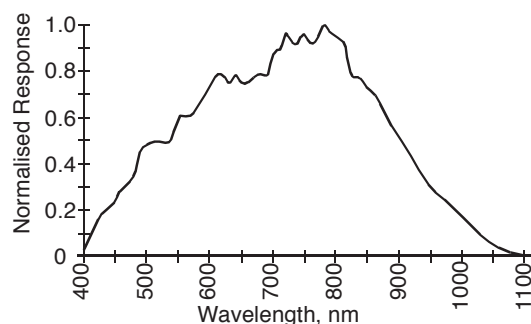
Pixels above a threshold white level are counted every frame, and the number at the end of the frame defines the image exposure. If the image is other than correctly exposed, a new value for integration time is calculated and applied for the next frame. Corrections are either $\pm 1/8$ or $\pm 1/64$, depending upon the degree of over or under exposure.

Automatic Gain Control (AGC)

The VV5402 sensor automatically increases the system gain of its output stage if with the current gain setting and maximum exposure the image is too dark. Gain can be varied from x1 to x16 in times-two steps, giving five different gain settings.

If the scene is too dark and the integration period has almost reached its maximum value, the gain value is incremented by one step (times two). In the same frame period the exposure value is divided by two, halving the integration period. The exposure controller then increases the exposure value as necessary. Similarly if the image is too bright and the integration period is short then gain will be reduced by one step (divide by two) and the exposure value will be doubled. The exposure controller can then adjust the exposure value as necessary to provide a correctly exposed image.

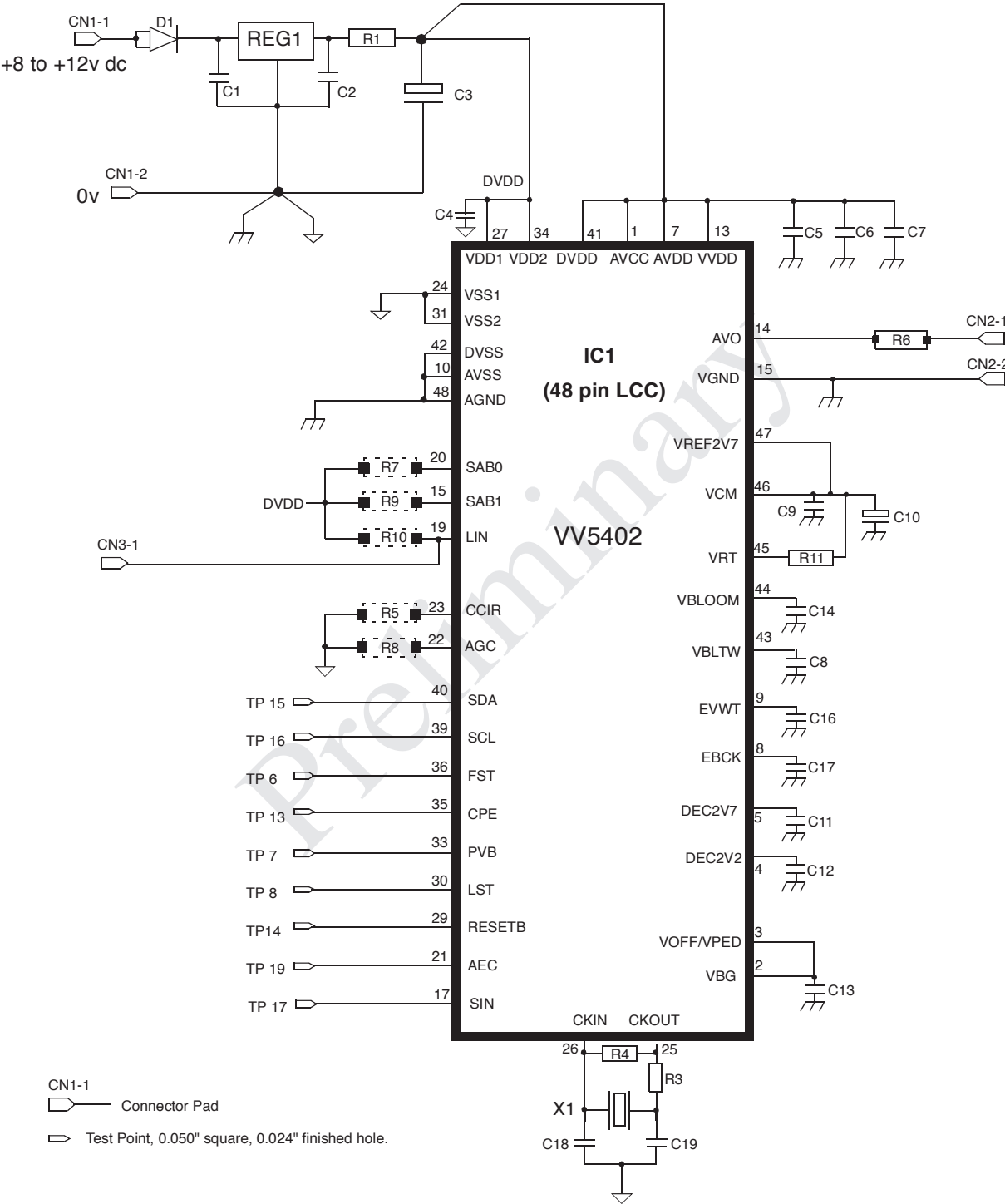
Spectral Response



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MODULE SCHEMATIC

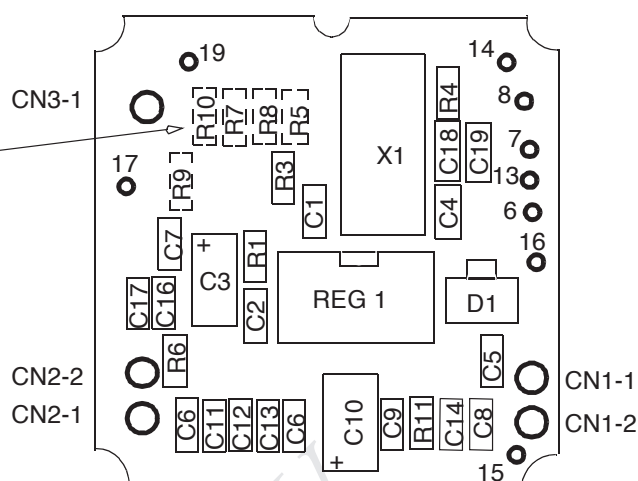


PCB LAYOUT

NOTE:

The resistor sites shown with dotted outlines are only populated for certain module options. See Parts List for details.

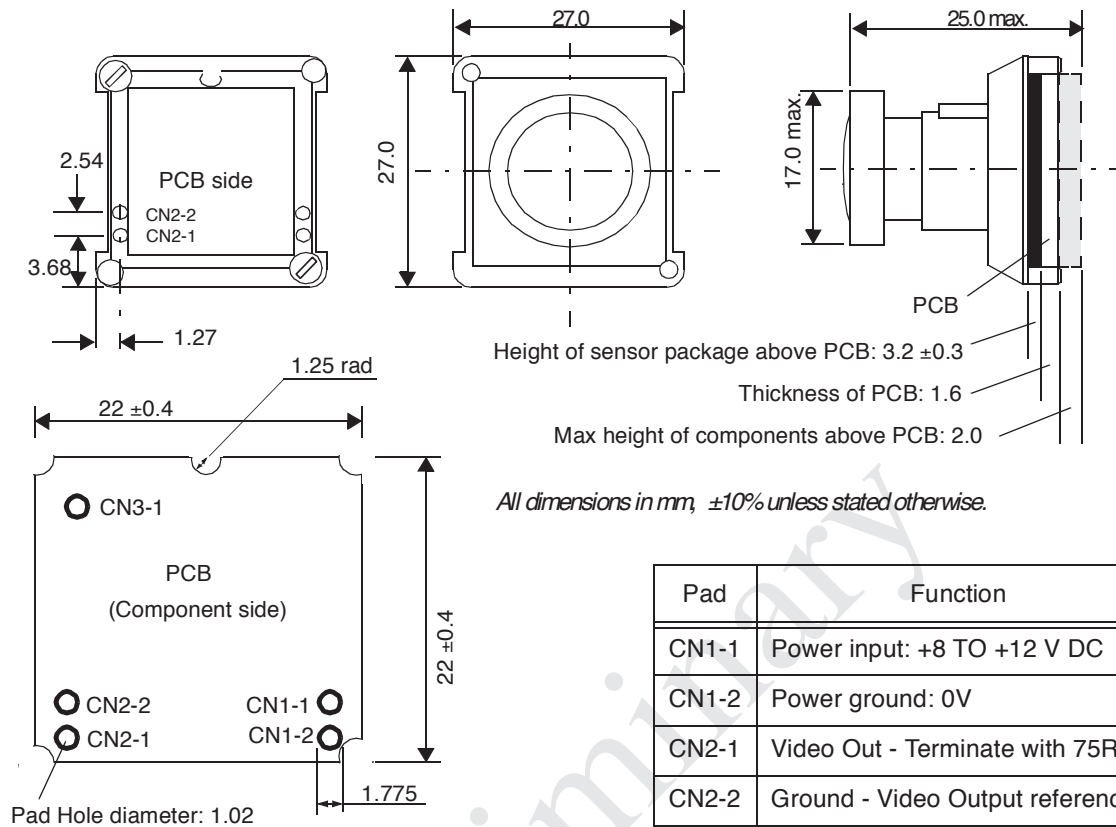
PCB view from Component side



Parts List

Cct.Ref.	Description	Value	Comments
IC1	Image Sensor	VV5402	48 pin LCC package (..A001 or ..C001)
REG1	SMD Fixed Voltage Regulator	78L05ACD	7-12V DC input, +5.0V output
D1	SOT-23 Diode	BAS16	100mA, high speed
C1,2,4-9, 11-17	0603 Ceramic Capacitor	100nF	50V -20%/+80%
C3, C10	'A' case Tant. Capacitor	10 μ F, 16V	-20%/+80%
C13	0603 Ceramic Capacitor	10nF	50V -20%/+80%
C18, C19	0603 Ceramic Capacitor	47pF	50V \pm 5%
R1	0603 Resistor, \pm 5%	5R6	
R3	0603 Resistor, \pm 5%	510R	
R4	0603 Resistor, \pm 5%	1M0	
R5	0603 Resistor, \pm 5%	0R	Optional - only fitted for EIA module
R6	0603 Resistor, \pm 5%	75R	Sets Output Impedance
R7, R9	0603 Resistor, \pm 5%	0R	Optional - Serial I/F Addressing
R10	0603 Resistor, \pm 5%	0R	Optional - fitted to force Linear mode
R11	0603 Resistor, \pm 5%	33R	
X1	Ceramic Resonator (AVX)	CSACS12.00	= 12.000MHz for EIA mode
		CSACS14.74	= 14.7456MHz for CCIR mode

PACKAGE DETAILS



Pad	Function
CN1-1	Power input: +8 TO +12 V DC
CN1-2	Power ground: 0V
CN2-1	Video Out - Terminate with 75R
CN2-2	Ground - Video Output reference
CN3-1	LIN - Select Linear/Gamma mode

Module Options

Lens	Output Mode	Part Number
No Lens	CCIR, Gamma Correction	VM5402-S-001
	EIA, Gamma Correction	VM5402-S-002
	CCIR, Linear Correction	VM5402-S-003
	EIA, Linear Correction	VM5402-S-004
Narrow Angle (46° x 37°)	CCIR, Gamma Correction	VL5402-S-001
	EIA, Gamma Correction	VL5402-S-003
Wide Angle (95° x 46°)	CCIR, Gamma Correction	VL5402-S-002
	EIA, Gamma Correction	VL5402-S-004

SPECIFICATIONS

Absolute Maximum Ratings

Parameter	Value
DC Supply Voltage	+12 volts
Voltage on other input pins	-0.5 to $V_{DD} + 0.5$ volts
Temperature under bias	-15°C to 85°C
Storage Temperature	-30°C to 125°C
Maximum DC TTL output Current Magnitude	10mA (per o/p, one at a time, 1sec. duration)

Note: Stresses exceeding the Absolute Maximum Ratings may induce failure. Exposure to absolute maximum ratings for extended periods may reduce reliability. Functionality at or above these conditions is not implied.

DC Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Units	Notes
V_{DD}	Operating supply voltage	7.0		12.0	Volts	
V_{IH}	Input Voltage Logic "1"	2.4		$V_{DD}+0.5$	Volts	
V_{IL}	Input Voltage Logic "0"	-0.5		0.8	Volts	
T_A	Ambient Operating Temperature	0		70	°C	Still air

Electrical Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Notes
I_{DCC}	Digital supply current		10		mA	1
I_{ADD}	Analog supply current		25		mA	1
I_{DD}	Overall supply current		35		mA	1
V_{OH}	Output Voltage Logic "1"	2.4			Volts	$I_{OH} = 2mA$
V_{OL}	Output Voltage Logic "0"			0.6	Volts	$I_{OL} = -2mA$
I_{ILK}	Input Leakage current	-1			μA	V_{IH} on input
				1	μA	V_{IL} on input

Typical conditions, $V_{DD} = 5.0$ V, $T_A = 27^\circ C$

1. Digital and Analogue outputs unloaded - add output current.

Operating Characteristics

Parameter	min.	typ.	max.	units	Note
Dark Current Signal		50		mV/Sec	Modal pixel voltage due to photodiode leakage under zero illumination with Gain=1 ($V_{\text{dark}} = (V_{t1} - V_{t2}) / (t1 - t2)$), averaged over two different frames)
Sensitivity		6		V/Lux·Sec	$V_{\text{Ave}} / \text{Lux} \cdot 10\text{ms}$, where Lux gives 50% saturation with Gain=1 and Exposure=10ms
Min. Illumination		0.5		Lux	Standard CCIR clock
Shading		TBA		%	Variance of V_{ave} over eight equal blocks at 50% saturation level illumination
Random Noise		-52		dB	RMS variance of all pixels, at 66% saturation, over four frames
Smear		TBA		%	Ratio of V_{ave} of the area outside a rectangle 25 lines high illuminated at 500x $V_{50\%}$ level to V_{Ave} of the rectangle
Flicker		TBA		%	Variation of V_{ave} of one line from field to field at 66% saturation level illumination
Lag		TBA		%	Average residual signal with no illumination in the field following one field of 66% sat. illumination
Blooming		TBA			Ratio of spot illumination level that produces 0.1x V_{sat} output from immediately around the spot to the V_{sat} spot illumination level (pin-hole target)

Note: Devices are normally not 100% tested for the above characterisation parameters, other than Dark Current Signal (see Blemish Specification below).

All voltage (V_A , V_{ave} , V_{sat} , $V_{xx\%}$) measurements are referenced to the black level, V_{black} , and spot blemishes are excluded (see Blemish Specification below). $V_{xx\%}$ refers to the output that is xx% of saturation, that is peak white.

Test Conditions

The sensor is tested using the example support circuit illustrated later in this document. Standard imaging conditions used for optical tests employ a tungsten halogen lamp to uniformly illuminate the sensor (to better than 0.5%), or to illuminate specific areas. A neutral density filter is used to control the level of illumination where required.

Illumination Colour Temp.	3200° K
Clock Frequency	Std. CCIR
Exposure	Maximum
Gain	x1
Auto. Gain Control (AGC)	Off
Correction mode	Linear

Blemish Specification

A Blemish is an area of pixels that produces output significantly different from its surrounding pixels for the same illumination level. The definition of a Blemish Pixel varies according to testing conditions as follows:

Test	Exposure	Illumination	Blemish Pixel output definition
1 - Black Frame	Minimum	Black	Differing more than $\pm 100\text{mV}$. from modal value.
2 - Dark Current	Maximum	Black	Output more than three times the modal value (see Dark Current Signal above).
3 - Pixel Variation	Mid range	66% Sat.	Differing more than $\pm 35\text{mV}$ from modal value. Note: The mode of pixel values must be within $\pm 70\text{ mV}$ of 66% of V_{sat} for all devices.

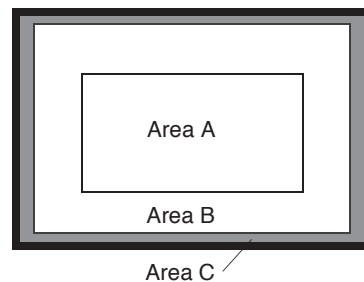
Note: Gain is set to Minimum and Correction set to Linear for all tests; measurement of blemishes for Test 3 is conducted under standard illumination (see above), set to produce average output of 66% saturation level.

The pixel area of the sensor is divided into the following areas to qualify the blemish specification:

Area A is the central area of the array as defined by the box with sides 50% of the linear height and 50% of the linear width of the array.

Area C is 10 vertical pixels by 10 horizontal pixels around the edge of the array.

Area B is the remaining area of the array.



The blemish specification is then defined as follows:

Image Area	Max. No. of Blemishes	Notes
Area A	0	This is the most critical image area
Area B	4	Unconnected single pixels
	1	Of up to four connected pixels (2x2 max.)
Area C	Any number	Blemishes in this area are not significant, but the device shall, however, have no row or column (>50% of row or column) faults in any area.

VIDEO STANDARDS

The VV5402 has 2 different video format modes, producing CCIR or EIA standard composite Monochrome video output. Line standards and frequencies are as follows:

Video Mode	Format	Image (Pixels)	Crystal Frequency	CCIR pin
CCIR	4:3	384 x 287	14.7456 MHz	1
EIA	4:3	320 x 243	12.0000 MHz	0

VV5402 Video Modes

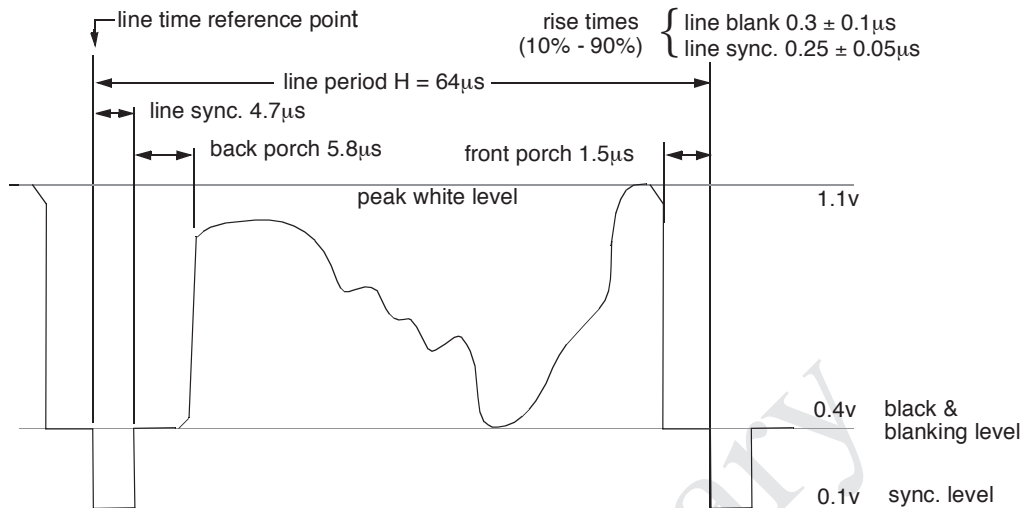
Video signal Characteristics

The following table summarises the composite video output levels (AVO) for the two standards, which are graphically illustrated on the following pages:

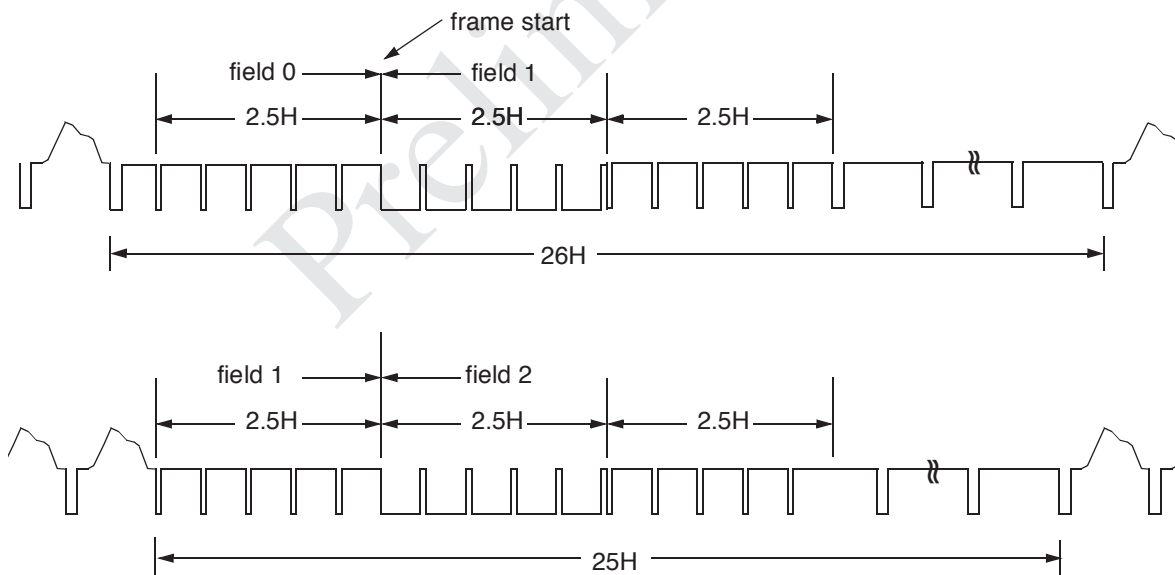
Symbol	Parameter	Min.	Typ.	Max.	Units	Notes
V_{Sync}	CCIR, EIA Sync. level		0.1		V	
V_{blank}	CCIR, EIA Blanking level		0.4		V	DC reference level
V_{black}	CCIR Black level		0.4		V	
	EIA Black level		0.5		V	
V_{Sat}	CCIR Saturation level		1.1		V	Peak White; AVO clipped at this level
	EIA Saturation level		1.2		V	

Note: All measurements are made with AVO driving one 75 Ω load.

CCIR Timing Diagram

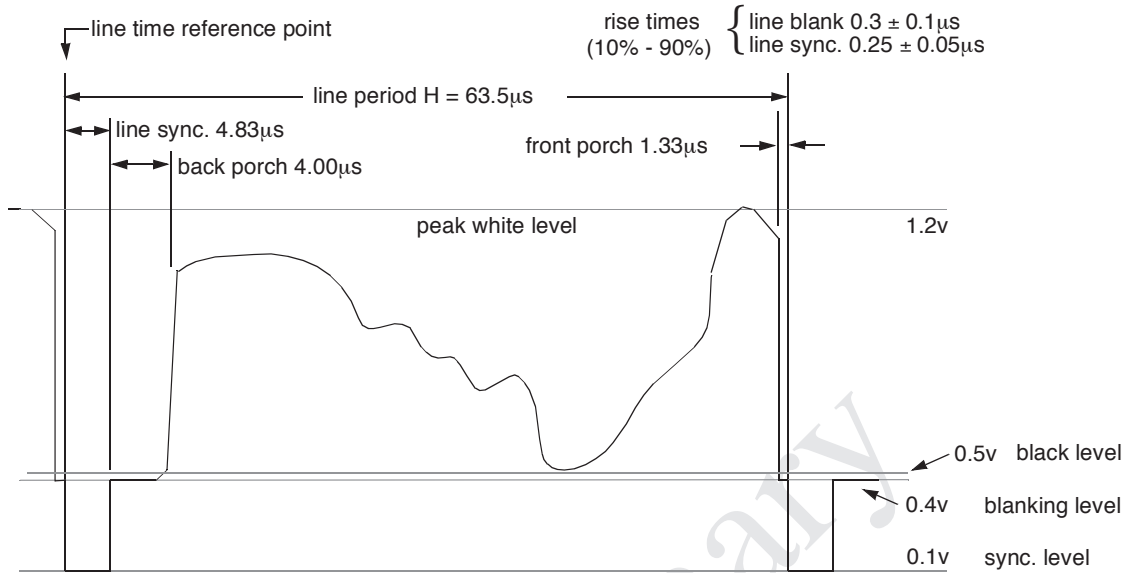


CCIR composite video signal - line level timing

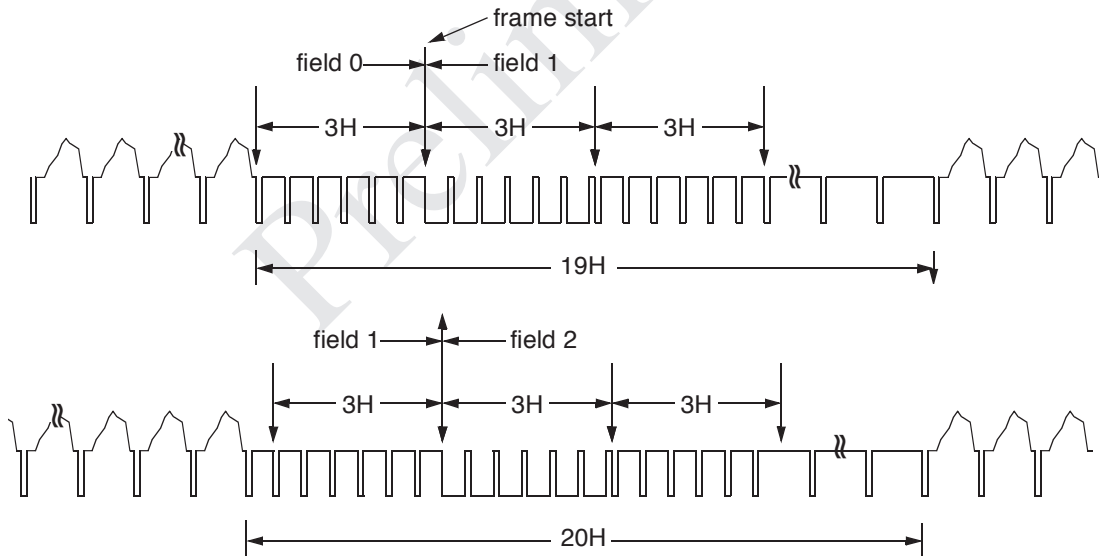


CCIR composite video signal - field level timing

EIA Timing Diagrams



EIA composite video signal - line level timing



EIA composite video signal - field level timing

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