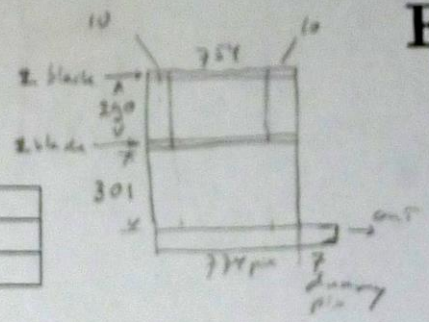
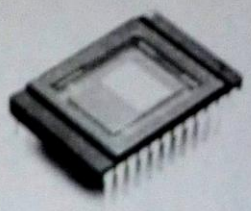
FT800P





Philips Imaging Technology

Data sheet		
status	:	Product specification
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Solid-state image sensors

Philips solid-state image sensors are the result of 15 years of dedicated research into electronic imaging. These highly advanced products are suitable for many consumer and professional applications such as professional RGB camera's, CCTV, machine vision, optical character recognition and medical imaging. This data sheet describes the FT800P image sensor.

General description

The FT800P frame transfer sensor is a solid-state imaging device which produces two interlaced 290-line B/W fields with an aspect ratio of 4:3. The device is compatible with CCIR TV standards and has an 8 mm image diagonal matching the half-inch camera tube format. This sensor was originally designed for use in professional broadcast cameras. The high demands of the professional market have made the FT800P a powerful device for various applications.

Applications

- Broadcast camera's, studio and ENG. The high sensitivity, the high dynamic range and the special measures to prevent optical reflections make this sensor suitable for high-end 3-chip camera's.
- Surveillance camera's. The solid-state reliability, high resolution and sensitivity provide the quality for excellent CCTV camera's.
- Character and pattern recognition, robotics. The excellent linearity and uniformity recommends this sensor as a first choice for these applications.
- Medical imaging, where the high dynamic range of the FT800P is highly appreciated.

Features

- Effective number of elements: 774 horizontal x 580 vertical.
- Dark reference: 2 lines per field for black clamping. One line per field is located at the top of the image section and one line per field is located at the bottom of the image section.
- The FT800P handles 10,000 x overexposure without blooming.
- No reflective bonding wires in the vicinity of the image section. The aluminum at the sides of the image section is covered with a black anti-reflection coating.
- High sensitivity, high dynamic range, low noise.
- Freedom from lag, burn-in, geometrical distortion and microphonics.
- Simple and low-cost application. Only one potentiometer is necessary with a simple adjustment procedure.
- Image area: 6.4 x 4.8 mm^2.
- The FT800P is also available for the EIA TV standards (FT800N).

Caution

An image sensor is a MOS device which can be destroyed by static charging of the gates. Always store the device with short-circuiting clamps or on conductive foam plastic. The ESD protections made in the CCD image sensor process are not as good as the ESD protections of standard CMOS circuits. When cleaning the glass window only use alcohol or acetone. Rub the window carefully and slowly. Dry rubbing of the window may cause static charges which can destroy the device.

Functional description

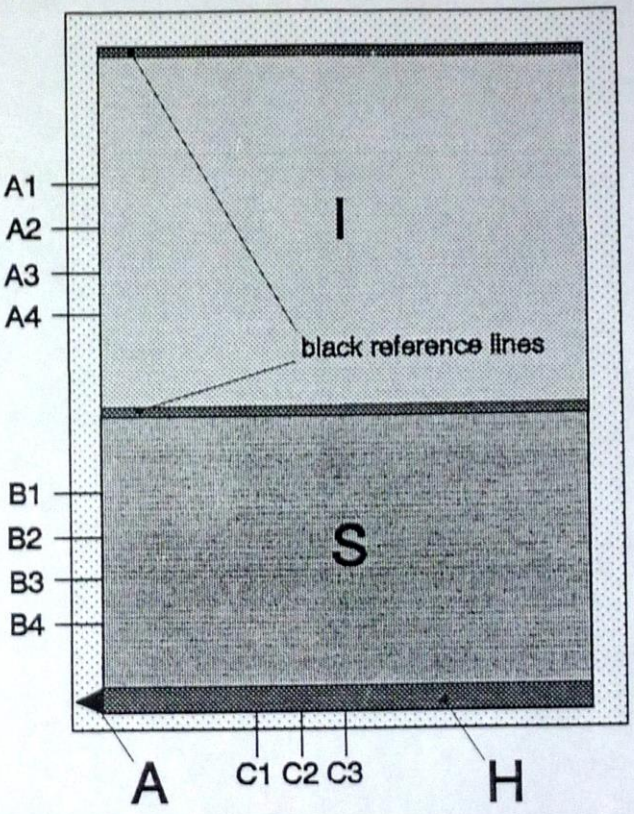
Figure 1 shows the layout of the FT800P. It comprises 4 functional areas:

1. **A matrix of photo-sensitive picture elements**, the image section. In this image section the projected scene is converted into an electron image. The image section is controlled by the four A electrodes (A1..A4).

2. **A matrix of storage elements**, the storage section. After an integration time of approximately 19.7 ms the complete image is shifted into the storage section. The storage section is not sensitive for light because it is covered with aluminum and a black anti-reflection coating. The storage section is controlled by the four B electrodes (B1..B4).

3. **A horizontal shift register.** Every horizontal line blanking period one line of electron packets of the storage part is shifted into the horizontal register. In the thereafter active linetime it is shifted out towards the output amplifier. The horizontal register is controlled by three C electrodes (C1..C3). It is a three-phase buried channel CCD register.

4. **An output amplifier.** One by one the charge packets are dumped on a small conductive area called the floating diffusion (FD). There the charge packets change the FD potential by an amount equal to nq/C, where n is the number of electrons, q is the elementary electron charge and C is the FD capacitance. The FD voltage is sensed and buffered by a three stage FET source-follower buffer.



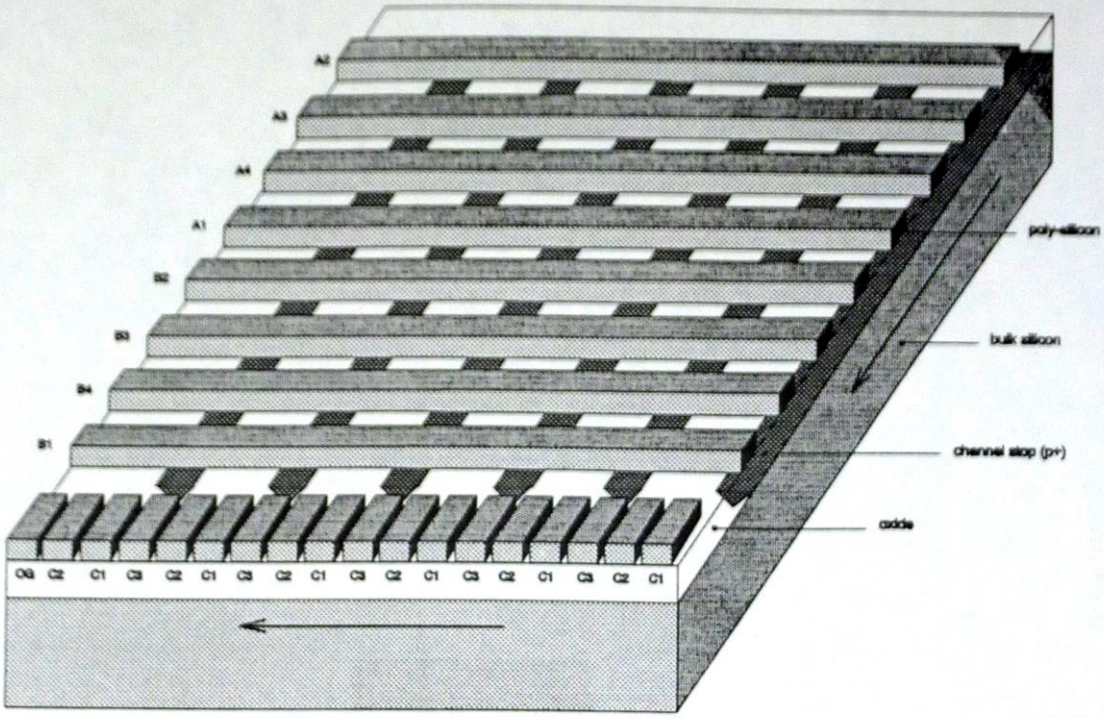
I- image section
S- storage section
H- horizontal register
A- output amplifier

fig. 1

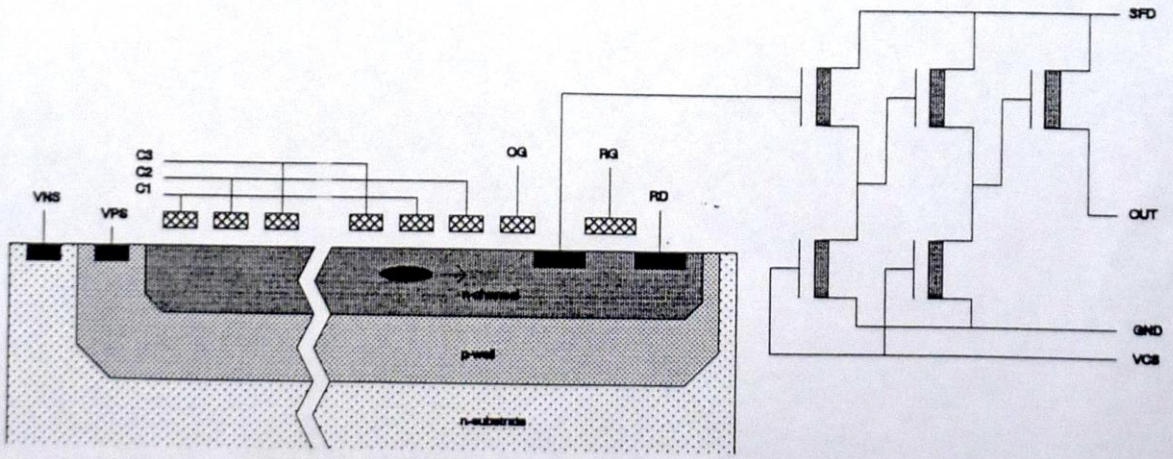
Ratings

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Parameter	Min	Max	Unit
Voltage with respect to VPS:			
RD	-0.5	+25	V
VCS, GND	-8	+5	V
VNS	-0.5	+25	V
all other pins	-5	+15	V
Voltages with respect to VNS:			
RD	-10	+0.5	V
VCS, GND	-24	+0.5	V
VPS	-24	+0.5	V
all other pins	-27	+0.5	V
Output current (sink) (no short circuit protection)		4	mA
storage temperature	-55	+80	°C
operating ambient temp. range	-40	+60	°C



Layout of the FT800P
Only one image line, one storage line and six columns are shown.
The aluminum lightshield above the storage section and the horizontal register is not shown.



Horizontal register and output structure of the FT800P

Specifications[1], all specs at 333 K

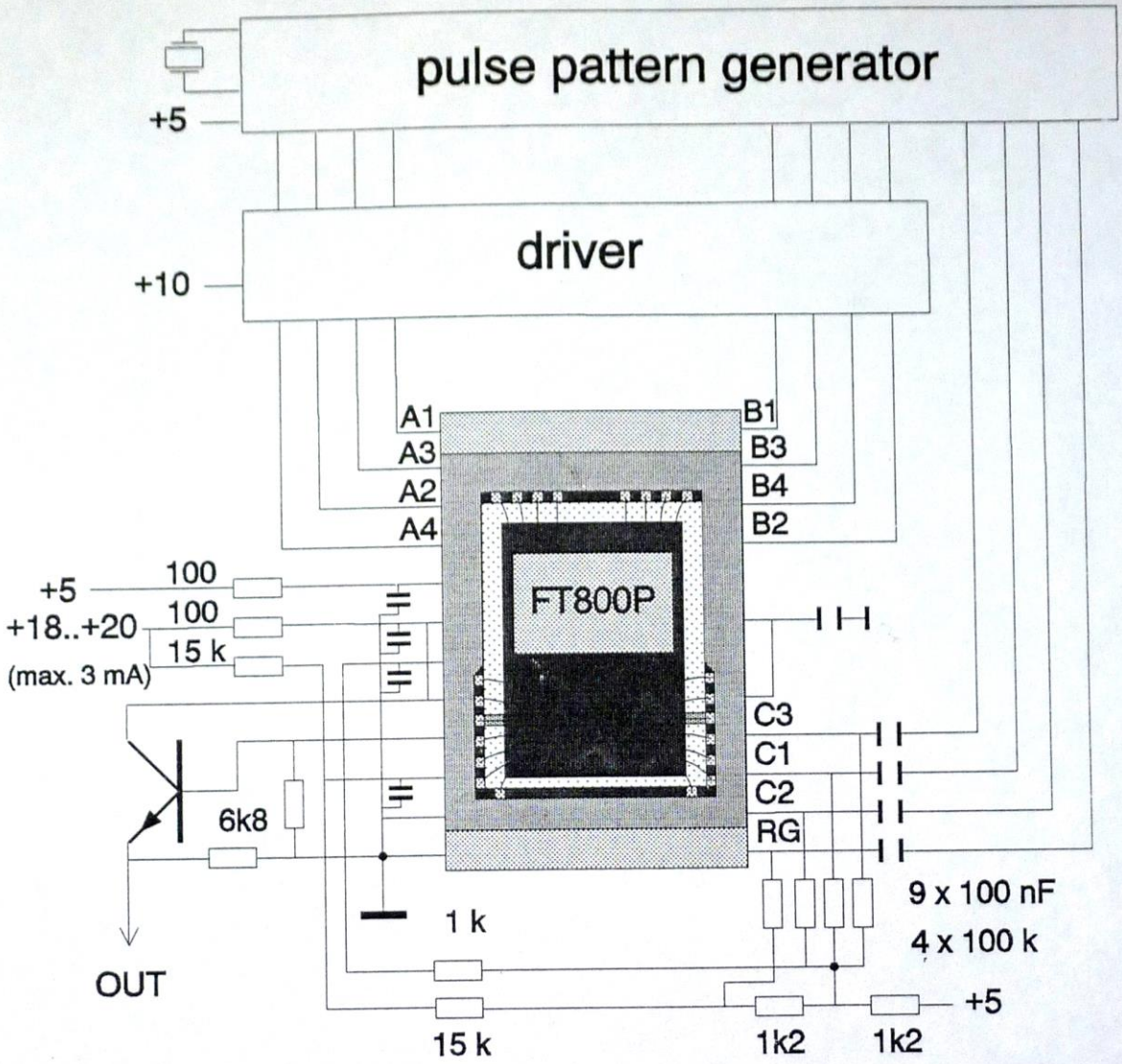
Parameter	Min	Typical	Max	Unit
General				
chip size		7.43 x 11.21		mm^2
package: DIL 24, 0.7E pitch		22.6 x 15		mm^2
output registers		1		
potmeters (VNS)		1		
resolution, MTF at 5 MHz	65			%
frame shift frequency		906		kHz
smear without shutter		0.16		%
image lag		0		%
sensitivity 3200 K, with Hoya C500S IR filter		30		mV/lux
charge reset (CR)		yes		
overexposure (VAB)	200000			lux
max. signal		500		mV
shading in saturation level			30	%
RMS noise (without dark current, using CDS processing, in 5 MHz bandwidth)			0.11	mV
VNS voltage, adjustment range	18	20	22	V
VNS current			3	mA
VPS voltage	4.5	5	5.5	V
VPS current (absolute value)			1	mA
DC current through any clock phase (absolute value)			0.2	μA
5 Lux illumination				
random non uniformity, sigma value (0.2-5 MHz)			1.0	%
maximum pixel deviation (max. 5 pixels with a 5 to 10 % deviation at a minimum mutual distance of 5% of the image height)	- 10		10	%
stripes			0.5	%
shading, sigma value			1.4	%
field flicker			0.2	%
No Illumination, 333 K[2]				
dark signal			5	mV
fixed pattern noise, sigma value (0.2-5 MHz)			0.5	mV
maximum pixel deviation			9	mV
field flicker			0.07	mV
stripes			0.07	mV
horizontal shading			0.8	mV
vertical shading			2.2	mV
Output amplifier				
bandwidth	80			MHz
RD voltage		13		V
OG voltage		5.5		V
RG amplitude	4.5	5	7	V
RG DC level		6		V
RG crosstalk			450	mV
RG capacitance			10	pF

[1] The FT800 is available in various quality grades; this specification describes the highest grade.

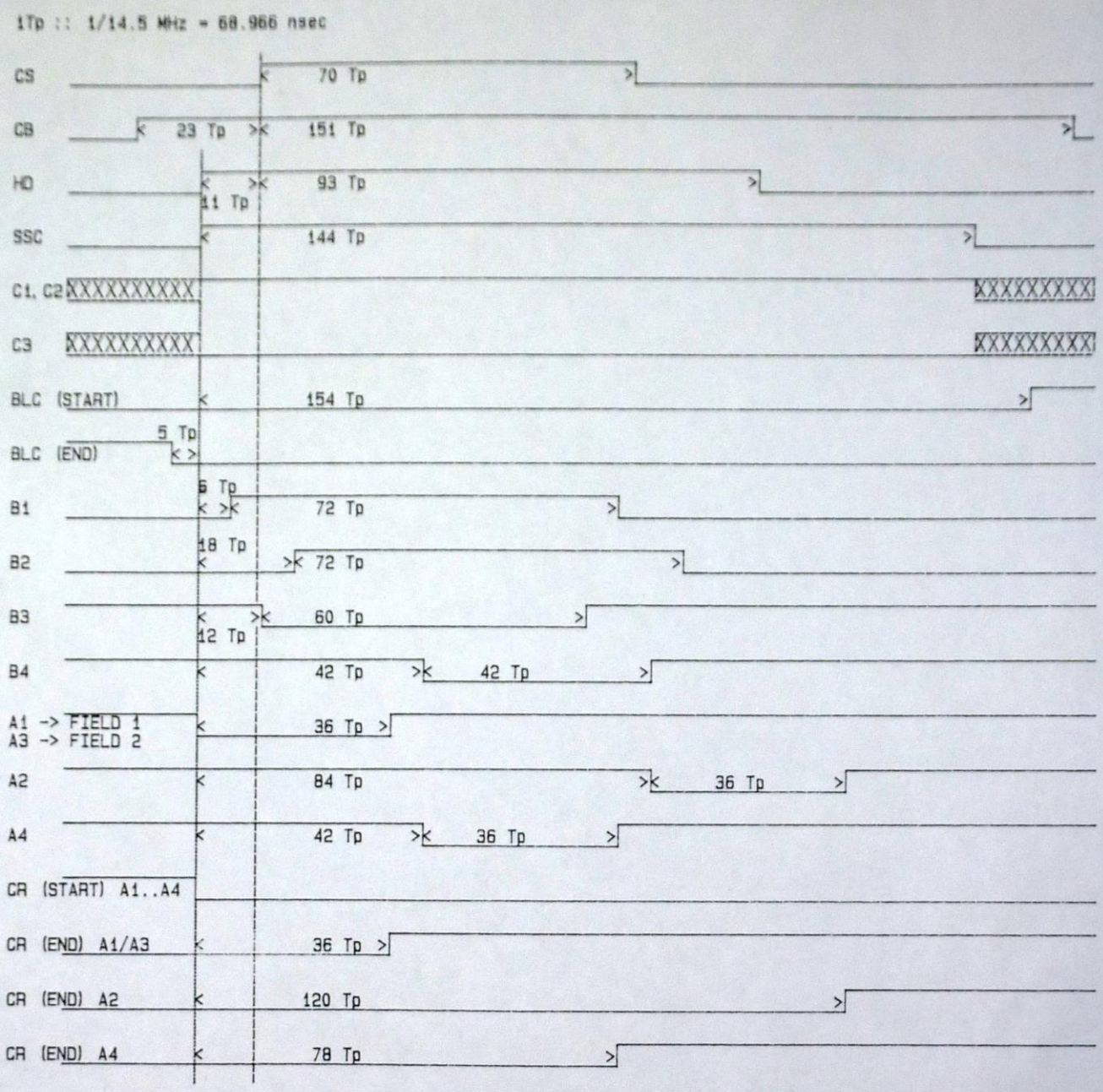
[2] These specifications are temperature dependent and improve drastically at lower temperatures.

Specifications, all specs at 333 K

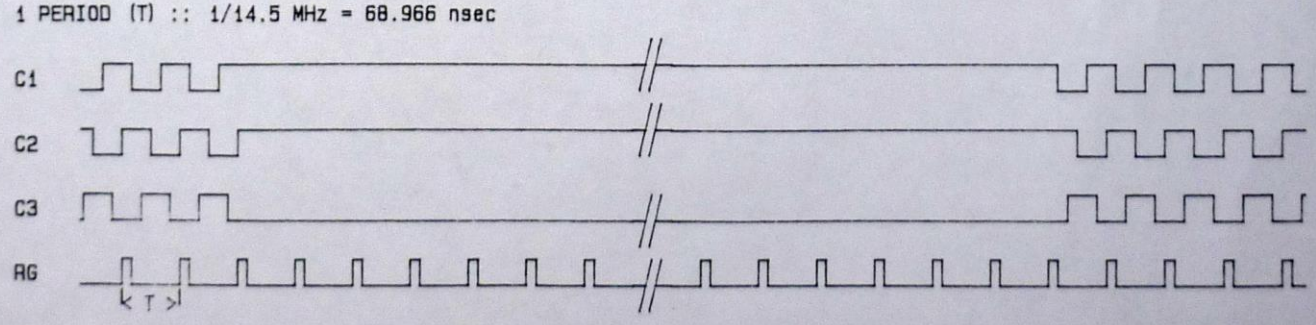
Parameter	Min	Typical	Max	Unit
Image section				
optical format		1/2		inch
image diagonal (active part)		8.020		mm
total image height		5.044		mm
total image width		6.579		mm
pixel height		16.8		μm
pixel width		8.5		μm
quantum efficiency at:				
423 nm		21		%
540 nm		23		%
637 nm		16		%
phases		4		
active pixels		774		
active pixels within active linetime		754		
black ref. pixels		0		
horizontal overscan pixels left		10		
horizontal overscan pixels right		10		
active lines		2 x 290		
black reference lines		2 x 2		
capacitance A phases		800	1000	pF
amplitude A phases	9.5	10	10.5	V
duty cycle		5/8		
Storage section				
storage heigth		4.335		mm
storage width		6.579		mm
pixel heigth		14.4		μm
pixel width		8.5		μm
phases		4		
nr. of pixels		774		
nr. of lines		301		
capacitance B phases		1.7	2.0	nF
amplitude B phases	9.5	10	10.5	V
duty cycle		5/8		
Horizontal register				
nr. of pixels		774		
nr. of dummy pixels		7		
phases		3		
capacitance C phases		55	70	pF
amplitude C phases	4.5	5	7	V
D.C. level		5.5		V
clock frequency (4x fsc)		14.500		MHz
duty cycle		1/2		



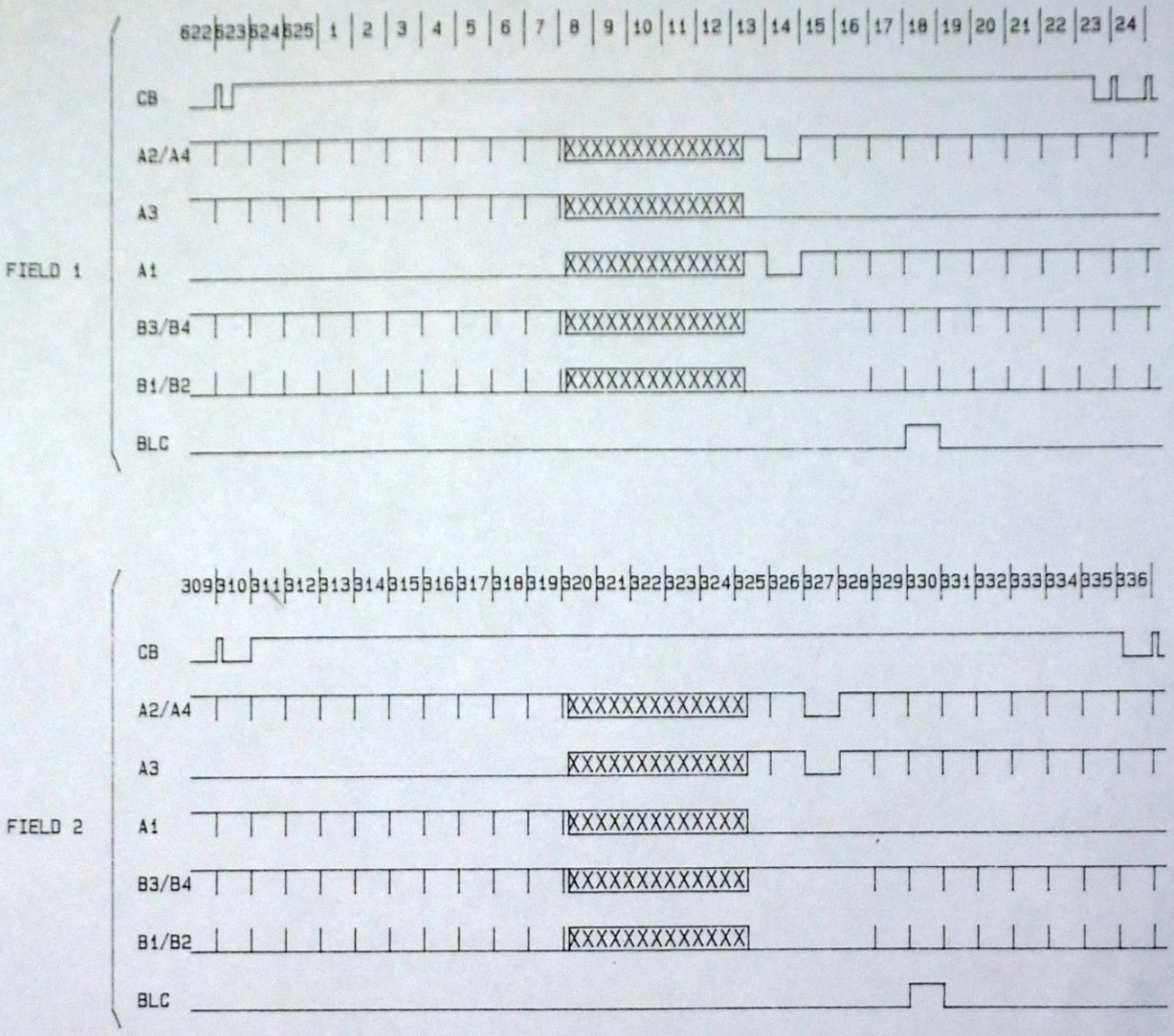
Application diagram



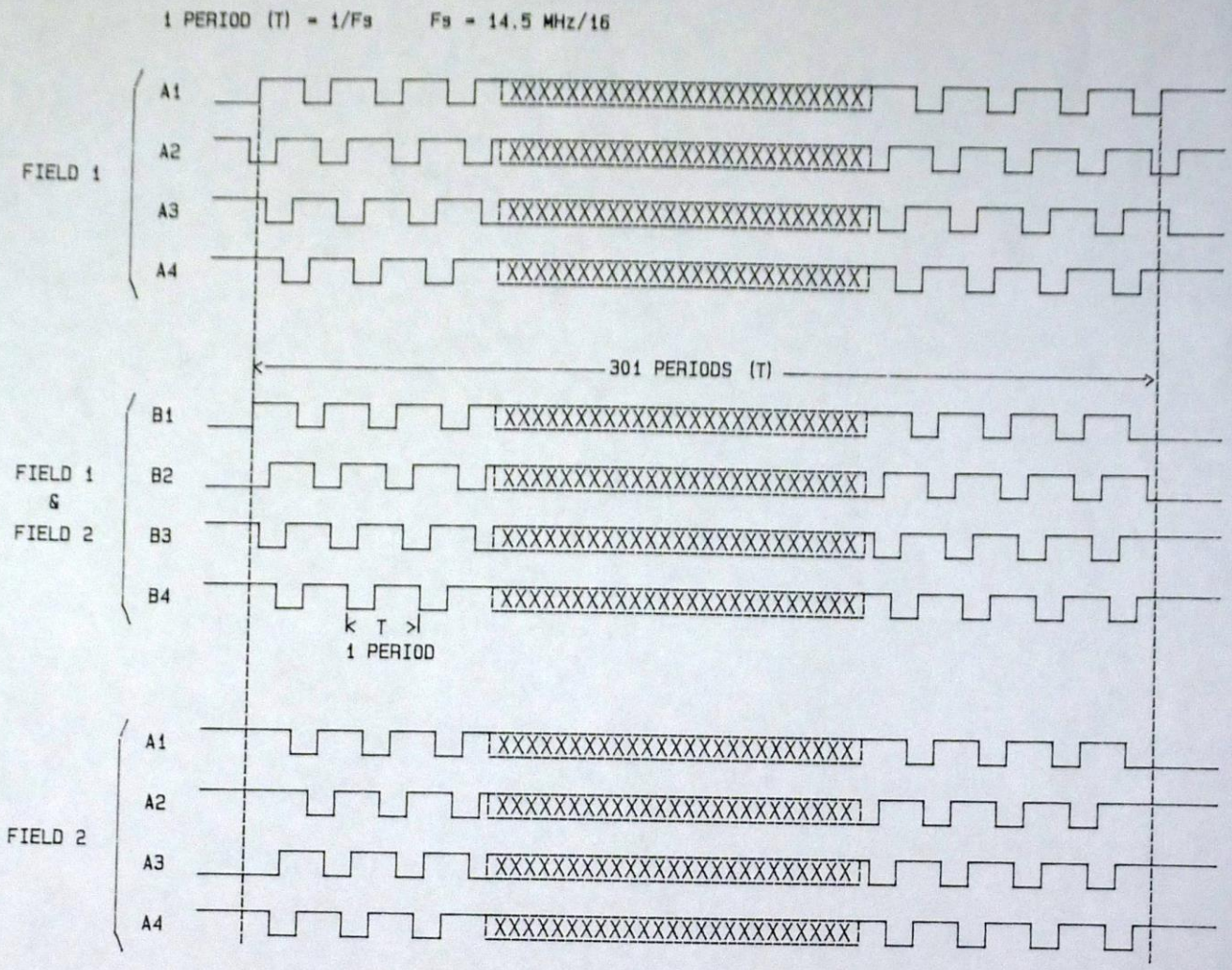
Timing waveform FT800P (horizontal blanking)



Detailed timing of C-clocks and RG



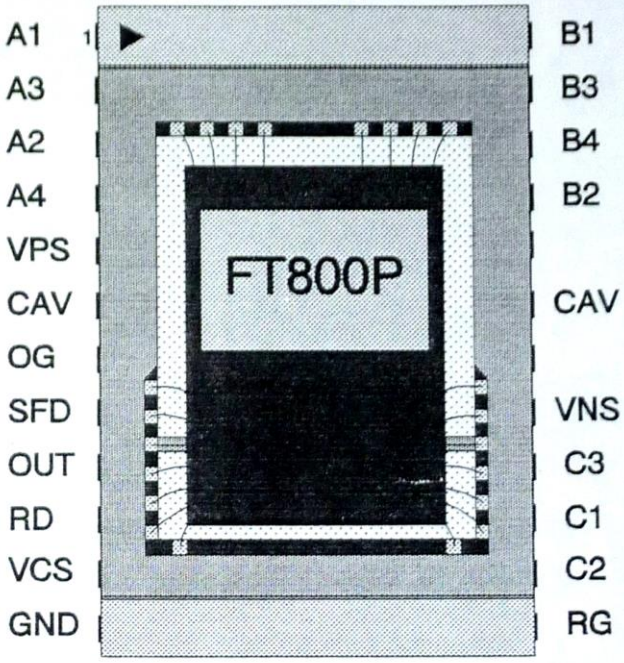
Timing waveforms FT800P (vertical blanking)

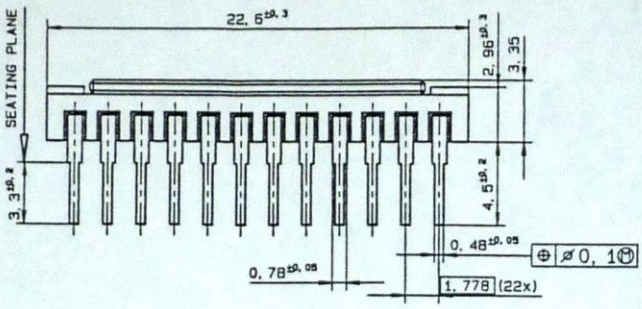


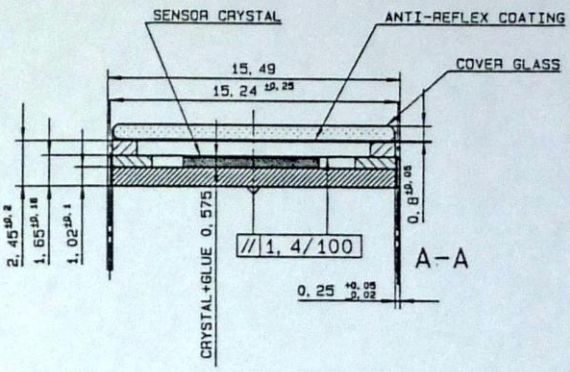
Detailed timing of vertical transport

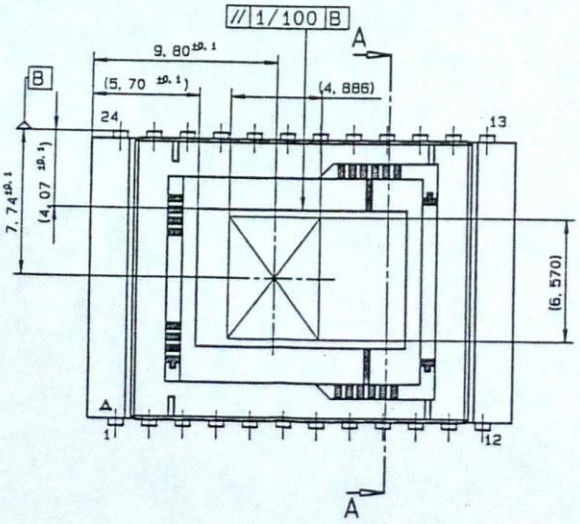
Pin configuration

No.	Symbol	Name and function
1	A1	Vertical transfer clocks for image part
2	A3	
3	A2	
4	A4	
5	VPS	P-Substrate supply Voltage
6	CAV	Cavity (= VNS)
7	OG	Output Gate
8	SFD	Source Follower Drain Voltage
9	OUT	Output
10	RD	Reset Drain
11	VCS	Current Source gate Voltage
12	GND	Ground
13	RG	Reset Gate
14	C2	Clocks for output register
15	C1	
16	C3	
17	VNS	N-substrate supply Voltage
18		Not connected
19	CAV	Cavity (= VNS)
20		Not connected
21	B2	Vertical transfer clocks for storage part
22	B4	
23	B3	
24	B1	









// 1/100	PARALLELISM 1MM DEVIATION AT 100MM
⊕	POSITIONAL ACCURACY
Ⓜ	MAXIMUM MATERIAL CONDITION

Mechanical data