NEC
NEC Electronics Inc.

μPD795
1024-BIT CCD IMAGE SENSOR

PRELIMINARY INFORMATION

Description

The μPD795 is a CCD (charge-coupled device) linear image sensor that changes optical images to electrical signals. It has 1024 photo-elements, two lines of 525-bit CCD charge transfer registers, a drive unit, a sample-and-hold circuit, and an output amplifier. The drive unit simplifies the external circuit and reduces total drive power. The sample-and-hold circuit substantially reduces output signal noise.

The photo-elements have excellent response characteristics because of their PN junction construction. They are 14 by 9 μm separated by 5-μm channel stoppers.

The CCD charge transfer registers have very high transfer efficiency, above 99.996 percent.

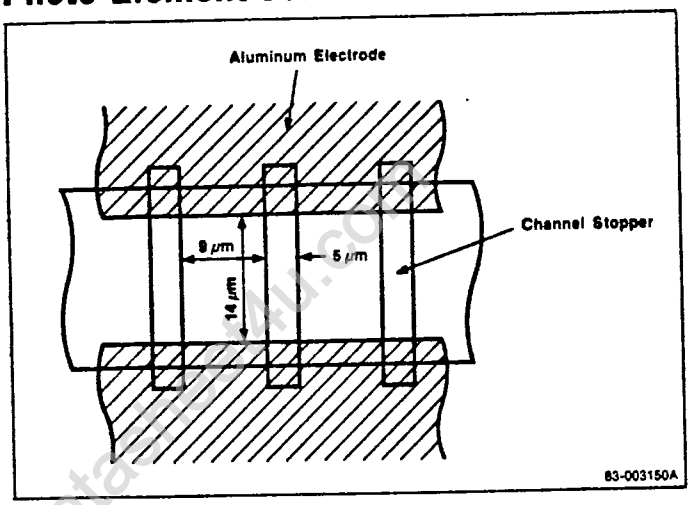
Features

- ☐ Excellent photo-electrical characteristics
- ☐ Single 12-volt power supply
- ☐ On-chip drive unit and sample-and-hold circuit
- ☐ High resolution of 8 dots per mm across 12.8-cm page
- ☐ Transfer efficiency above 99.996 percent
- ☐ 20-pin ceramic DIP

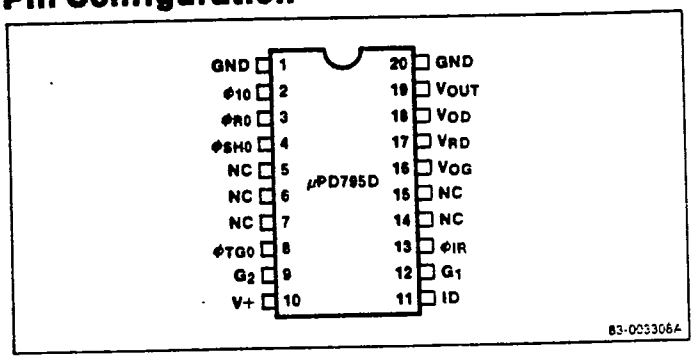
Applications

Facsimile
OCR (optical character reader)
Instrumentation

Photo-Element Construction



Pin Configuration



Pin Identification

Pin	Name	*Function
1	GND	Ground
2	ϕ_{10}	Register clock input
3	ϕ_{RO}	Reset gate clock input
4	ϕ_{SHO}	Sample-and-hold clock input
5, 6, 7	NC	No connection
8	ϕ_{TGO}	Transfer gate clock input
9	G_2	Test input
10	V+	Drive unit power supply input
11	ID	Test input
12	G_1	Test input
13	ϕ_{IR}	Test input
14, 15	NC	No connection
16	V_{OG}	Output gate bias input
17	V_{RD}	Reset part power supply input
18	V_{OD}	Output amplifier power supply input
19	V_{OUT}	Output
20	GND	Ground

*All NC pins should be connected to ground.

Ordering Information

Part Number	Package	Operating Ambient Temperature
μPD795D	20-pin ceramic DIP	−25 to +55 °C

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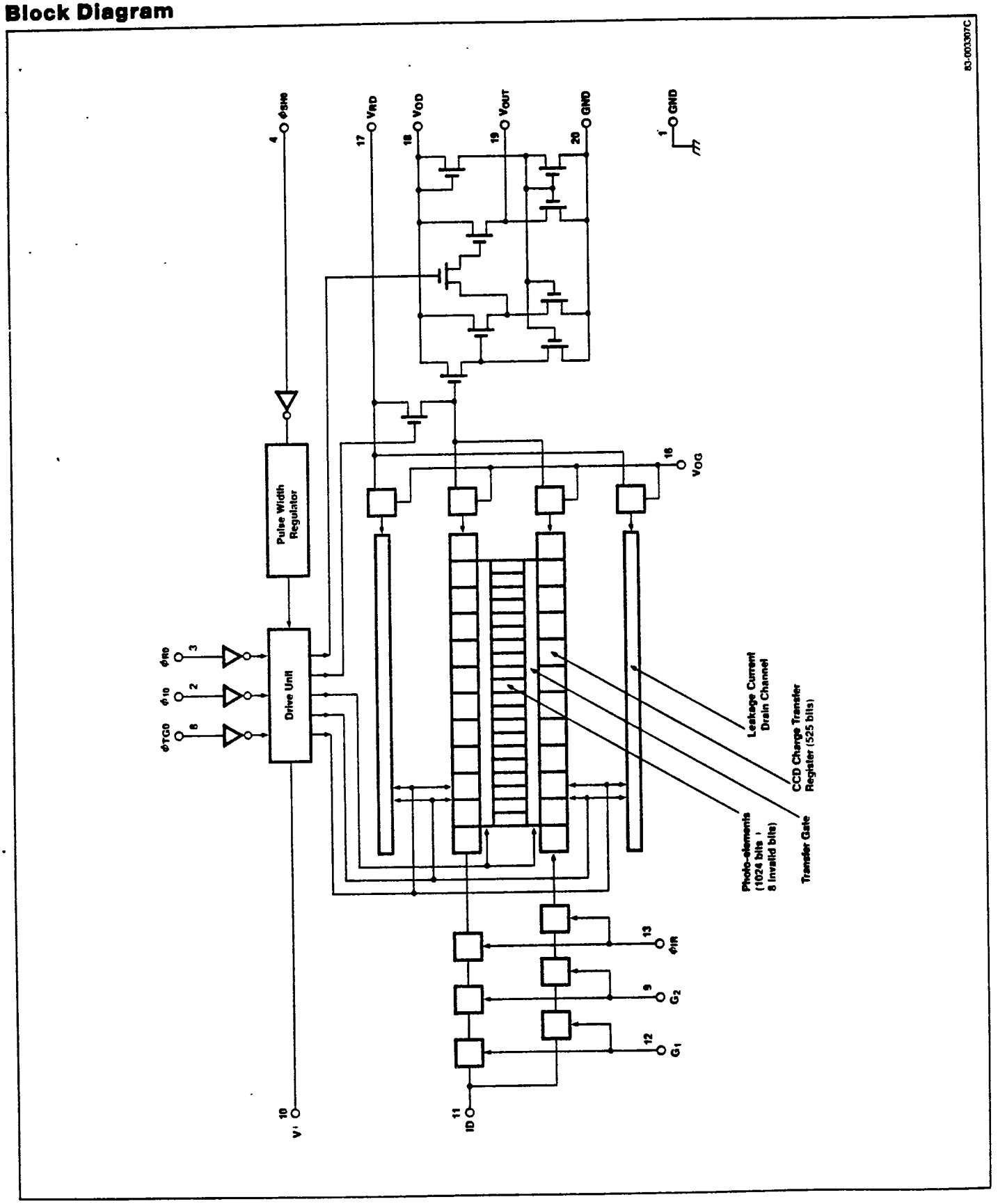
Block Diagram



Electrical Characteristics

T_A = +25°C; source of light, 2856 K tungsten lamp; exposure period = 5.0 ms; V_{GG}, V_{OD}, and V_{RD} = 12.0 V; $f_{\phi 10}$ = 250 kHz; $f_{\phi RO}$ = 500 kHz.

Parameter	Symbol	Limits Min	Typ	Max	Unit	Test Conditions
Saturation Output Voltage	V_{SAT}	400	650		mV	
Saturation Exposure	SE	0.15	0.20		lx•s	
Photo-Response Nonuniformity	PRNU		±5	±10	%	V_{OUT} = 200 mV; infrared cut filter, Corning 1-75
Average Dark Signal	ADS		3	10	mV	No exposure
Dark Signal Nonuniformity	DSNU		5	15	mV	No exposure
Working Power Consumption	P_D		200		mW	Current of pins 10, 17, and 18 x supply voltage
Spectral Response Range Limits	SR	0.3		1.1	μm	
Sensitivity	S	2000	3250	4500	mV/lx•s	
Offset Voltage	V_{IO}		4.0		V	0% level of V_{OUT} in timing waveforms
Feed-Through Delay Time	t_D		50	100	ns	See timing waveforms.
Feed-Through Level	V_{FT}		70	120	mV	
Feed-Through Pulse Width	t_{PW}		70	120	ns	

Reference Characteristics

Parameter	Limits Min	Typ	Max	Unit
Input Capacitance at ϕ_{10}, ϕ_{RO}, ϕ_{SHO}, or ϕ_{TGO} (pins 2, 3, 4, 8)		5	10	pF
Rise Time and Fall Time of Feed-Through Pulse		50	100	ns
Output Impedance at V_{OUT} (pin 19)	0.5	1.0	2.0	kΩ

Absolute Maximum Ratings

T_A = +25°C

Output Amplifier Supply Voltage, V_{OD}	−0.3 to +15 V
Reset Part Supply Voltage, V_{RD}	−0.3 to +15 V
Drive Unit Supply Voltage, V+	−0.3 to +15 V
Output Gate Voltage, V_{OG}	−0.3 to +15 V
Register Clock Signal Voltage, $V_{\phi 10}$	−0.3 to +15 V
Transfer Gate Clock Signal Voltage, $V_{\phi TGO}$	−0.3 to +15 V
Reset Gate Clock Signal Voltage, $V_{\phi RO}$	−0.3 to +15 V
Sample-and-Hold Clock Signal Voltage, $V_{\phi SHO}$	−0.3 to +15 V
Operating Temperature, T_{OPT}	−25 to +55°C
Storage Temperature, T_{STG}	−40 to +100°C

Comment: Stress above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

T_A = −25 to +55°C

Parameter	Symbol	Limits Min	Typ	Max	Unit
Output Amplifier Supply Voltage	V_{OD}	11.4	12.0	12.6	V
Reset Part Supply Voltage	V_{RD}	11.4	12.0	12.6	V
Drive Unit Supply Voltage	V+	11.4	12.0	12.6	V
Output Gate Bias Voltage	V_{OG}	1.0	1.25	1.50	V
Test Terminal G_1 Voltage	V_{G1}		0		V
Test Terminal G_2 Voltage	V_{G2}		0		V
Test Terminal ID Voltage	V_{ID}		12.0		V
Test Terminal ϕ_{IR} Voltage	$V_{\phi IR}$		0		V
High Level of Register Clock Signal	$V_{\phi 1H}$	2.4	4.5	5.5	V
Low Level of Register Clock Signal	$V_{\phi 1L}$	−0.3	0	0.5	V
High Level of Transfer Gate Clock Signal	$V_{\phi TGH}$	2.4	4.5	5.5	V
Low Level of Transfer Gate Clock Signal	$V_{\phi TGL}$	−0.3	0	0.5	V
High Level of Reset Gate Clock Signal	$V_{\phi RH}$	2.4	4.5	5.5	V
Low Level of Reset Gate Clock Signal	$V_{\phi RL}$	−0.3	0	0.5	V
High Level of Sample-and-Hold Clock Signal	$V_{\phi SHH}$	2.4	4.5	5.5	V
Low Level of Sample-and-Hold Clock Signal	$V_{\phi SHL}$	−0.3	0	0.5	V
Register Clock Signal Frequency	$f_{\phi 10}$		250	500	kHz
Reset Gate Clock Signal Frequency	$f_{\phi RO}$		500	1000	kHz

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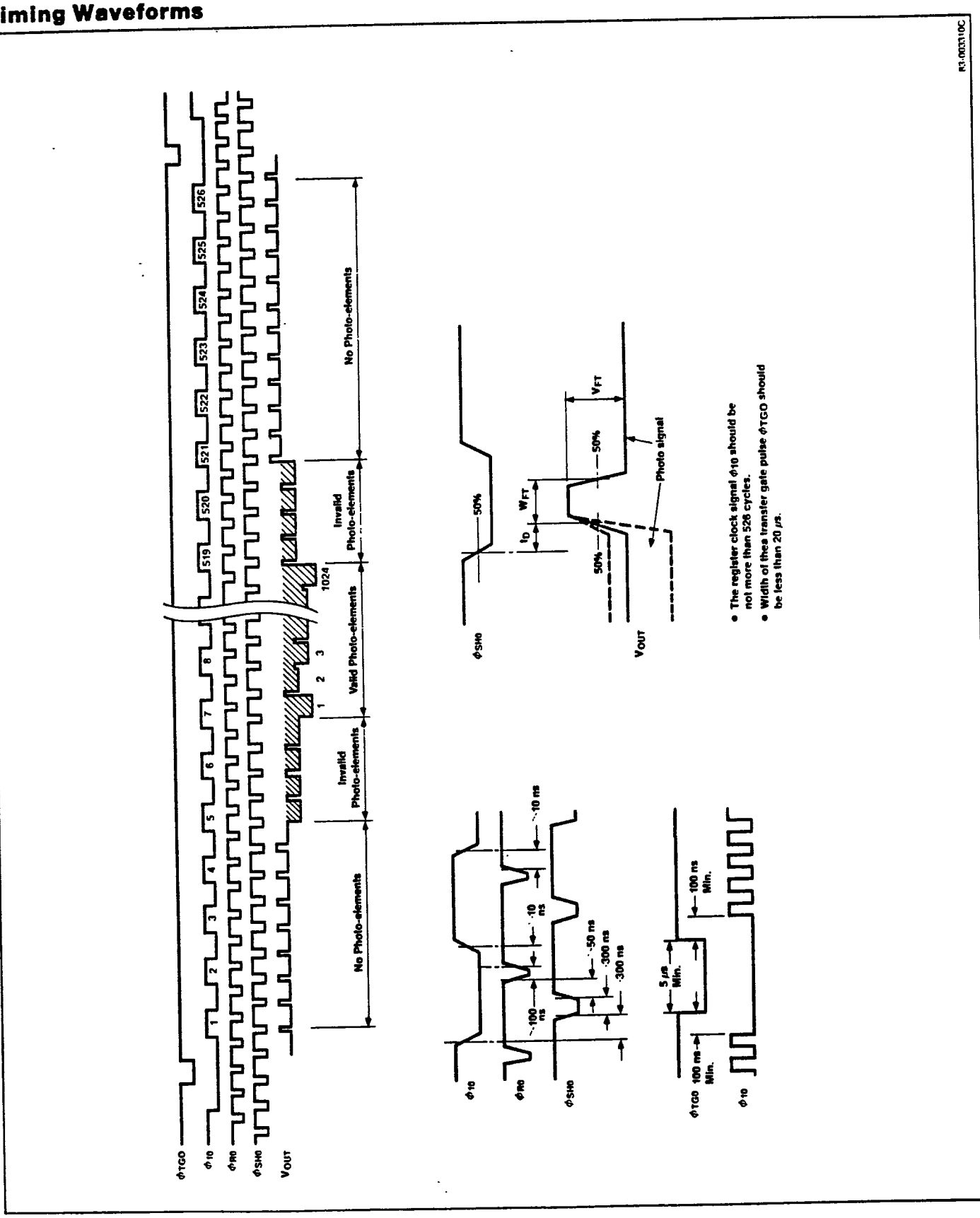
Timing Waveforms



Definitions of Electrical Parameters

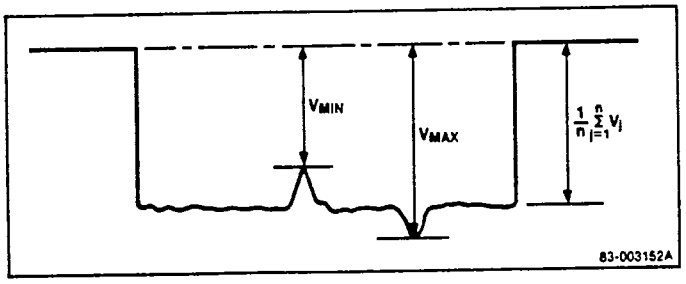
Saturation Output Voltage [V_{SAT}]. An output signal level above which the PRNU (photo-response nonuniformity) is ≥10% or the response is nonlinear.

Saturation Exposure [SE]. Product of illuminance (lx) and exposure period (s) in which the output is saturated.

Photo-Response Nonuniformity [PRNU]. Percentage of peak output level and bottom output level against average output level of all valid photo-elements in static and uniform light.

$$PRNU\ (\%) = \left(\frac{V_{MAX} \text{ or } V_{MIN}}{\frac{1}{n}\sum_{j=1}^{n} V_j} - 1\right) \times 100$$

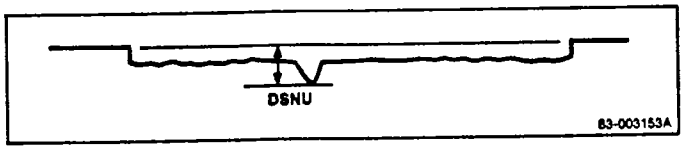
where
n = number of valid photo-elements
V_j = output voltage of each photo element



Average Dark Signal [ADS]. Average output level of valid photo-elements with no exposure.

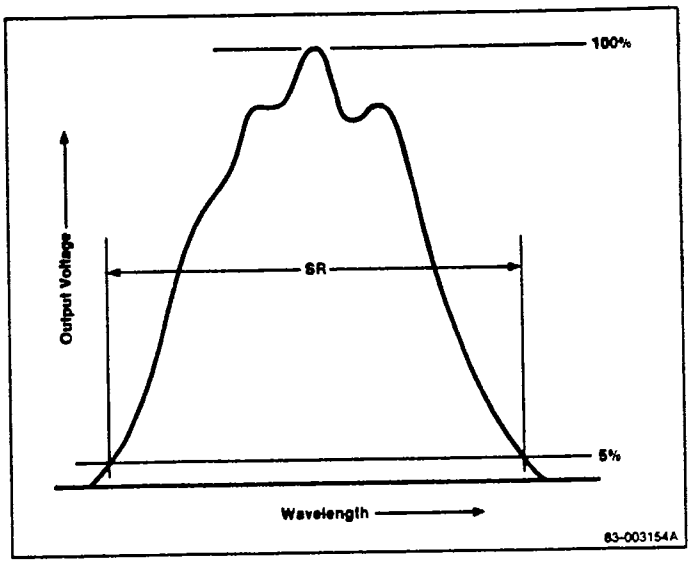
$$ADS\ (mV) = \frac{1}{n}\sum_{j=1}^{n} V_j$$

Dark Signal Nonuniformity [DSNU]. Peak output level with no exposure.



Working Power Consumption [P_W]. Product of supply voltage and current when supply voltage is 12.0 V.

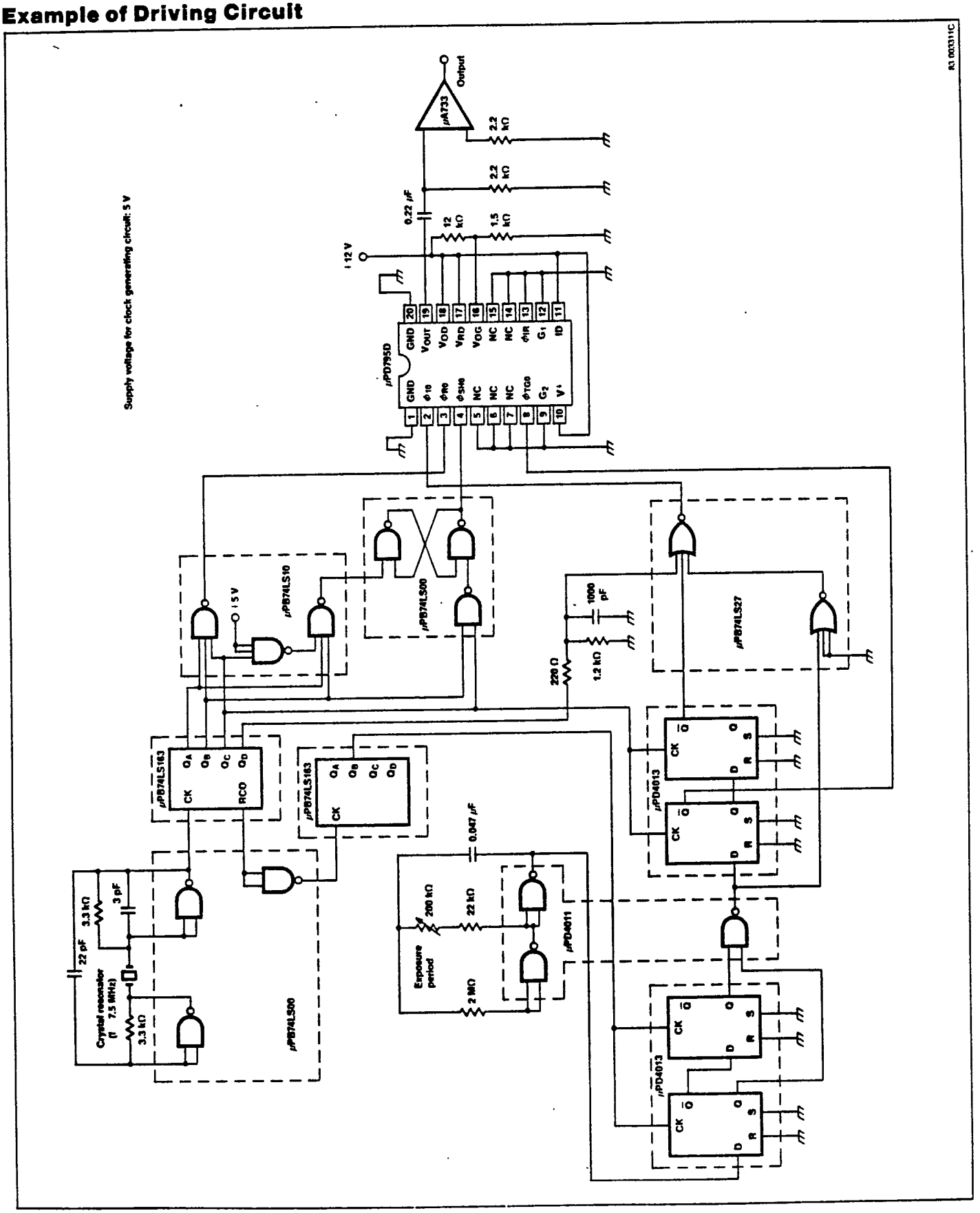
Spectral Response Range Limits [SR]. Short side and long side limits of response spectral range having sensitivity above 5 percent of sensitivity of most sensitive wavelength.



Sensitivity [S]. Quotient of the output level divided by exposure (lx•s).

Offset Voltage [V_{OS}]. Output terminal potential with no exposure.

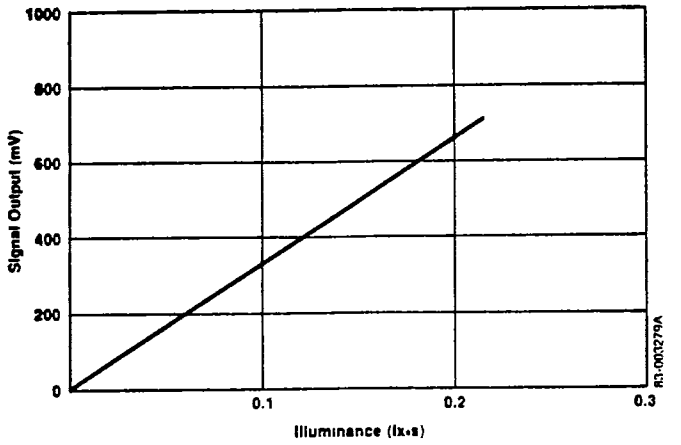
Example of Driving Circuit



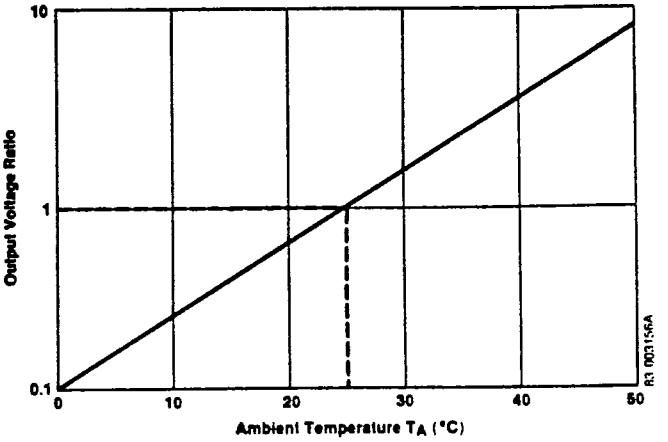
Operating Characteristics

$T_A = 25°C$

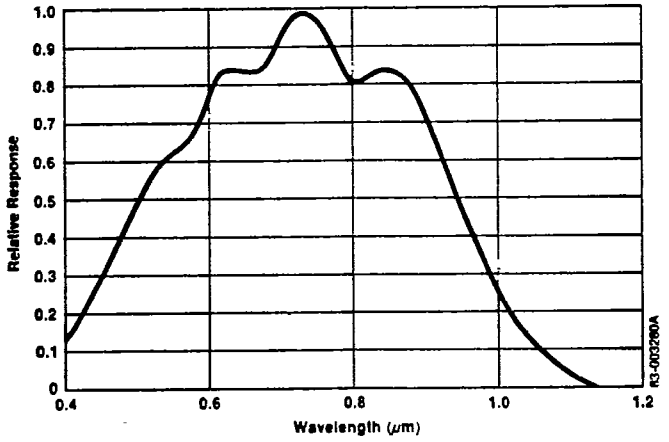
Signal Output



Dark Signal



Relative Spectrum Response



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