Features

- **Data Rate up to 50 MHz (2 Outputs at 25 MHz Each)**
- **Pixel Size: 10 µm x 10 µm (10 µm Pitch)**
- **300 to 1100 nm Spectral Range**
- **High Sensitivity and Lag Free Photodiodes**
- **Very Low Noise (30 pJ/cm^2 Noise Equivalent Illumination)**
- **Antiblooming**
- **Exposure Control**
- **20-lead 0.4" DIL Package**

50 MHz 4096 Linear CCDs

TH7815ACC

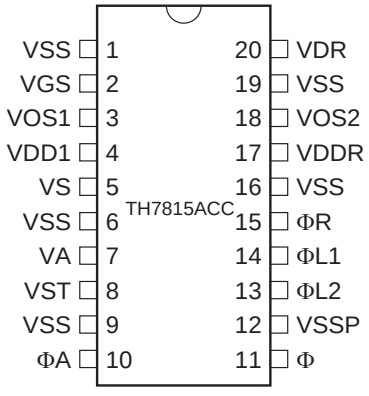
Description

TH7815 linear arrays are based on Atmel's most recent technology in terms of design and performance. The flexibility and performance of these devices provide the opportunity to use them in most vision systems for industrial applications (web inspection, process control, sorting and inspection of various parts), document scanning up to 200 dpi and metrology.

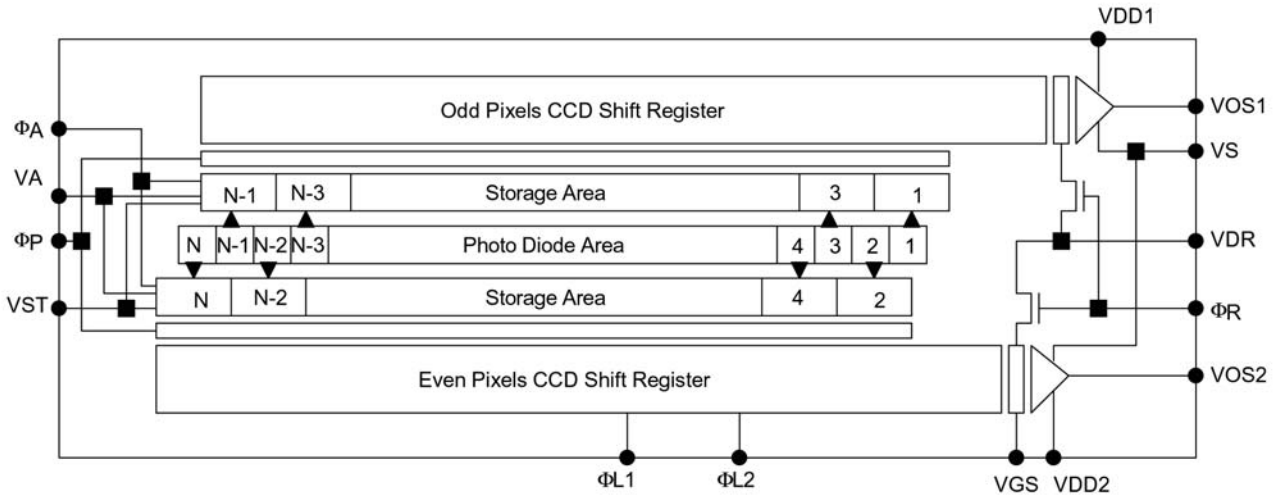
Pin Identification

All pins must be connected.

Pin Number	Symbol	Function
4, 17	VDD1,2	Output Amplifiers Drain Supply
3, 18	VOS1,2	Video Outputs
5	VS	Output Amplifiers Substate Bias
20	VDR	Reset Drain Supply
2	VGS	Output Gate Bias
14	ΦL1	Readout Register Clocks
13	ΦL2	
15	ΦR	Reset Clock
10	ΦA	Antiblooming Gate Bias/Clock
7	VA	Antiblooming Drain Bias
8	VST	Storage Gate Bias
11	ΦP	Transfer Gate Clock
1, 6, 9, 12, 16, 19	VSS	Ground, Optical Grounding (Internally Connected)



Rev. 1995A–IMAGE–04/02



Absolute Maximum Ratings*

Storage Temperature Range	-55°C to +150°C
Operating Temperature Range	-40°C to +85°C
Thermal Cycling	15°C/min
Maximum Applied Voltages:	
• Pins 2, 8, 10, 11, 13, 14, 15	-0.3 to 15V
• Pins 4, 5, 7, 17, 20	-0.3 to 16V
• Pins 1, 6, 9, 12, 16, 19	0V (ground)

Note: Stresses above those listed under absolute maximum ratings may cause permanent device failure. Functionally at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

– Operating range defines the limits within which the functionality is guaranteed.

– Electrical limits of applied signals are given in operating conditions section.

Operating Precautions

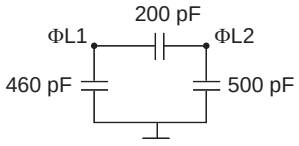
Shorting the video outputs to any other pin, even temporarily, can permanently damage the on-chip output amplifier.

Operating Conditions

Table 1. DC Characteristics

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Output Amplifier Drain Supply	VDD1, VDD2	14.5	15	15.5	V
Storage Gate Bias	VST	2.2	2.4	2.6	V
Antiblooming Gate (See Pixel Saturation Adjustment)	ΦA	2	4	7	V
Reset Bias	VDR	13.5	14	14.5	V
Antiblooming Diode Bias	VA	14.5	15	15.5	V
Register Output Gate Bias	VGS	2.2	2.4	2.6	V
Output Amplifier Source Supply	VS		0		V
Ground	VSS		0		V

Table 2. Drive Clocks Characteristics

Parameter	Symbol	Value			Unit	Remarks
		Min.	Typ.	Max.		
Reset Gate	ΦR					Clock Capacitance < 50 pF
High Level		8.5	9	9.5	V	
Low Level		-0.1	0	0.4	V	
Transfer Gate	ΦP					Clock Capacitance < 200 pF
High Level		8.5	9	9.5	V	
Low Level		-0.1	0	0.4	V	
Readout Register Clocks	ΦL1, 2					
High Level		8.5	9	9.5	V	
Low Level		-0.1	0	0.4	V	
Maximum Readout Register Frequency	F_H		10	25	MHz	

Timing Diagrams

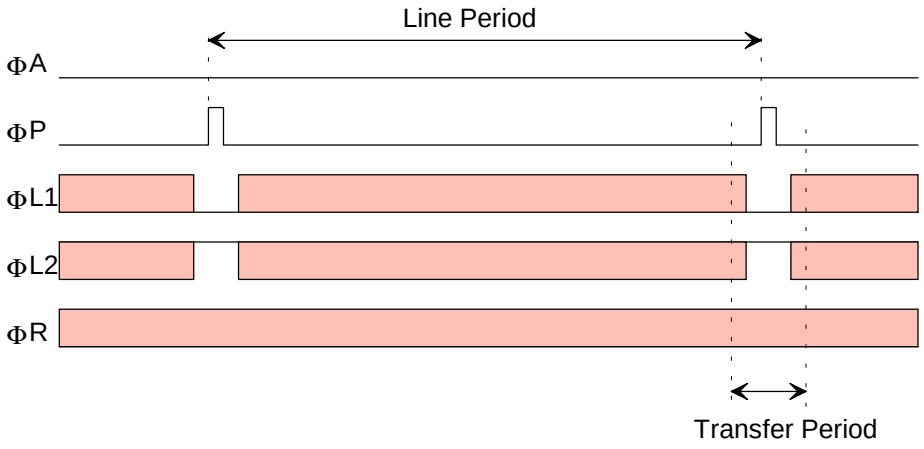
The following diagram shows the general clocking scheme for TH7815ACC.

The line is composed as follows:

Synopsis	Number of Prescan Pixels Per Output	Number of Useful Pixels Per Output	Total Number of Pixels Per Output
TH7815ACC	4	2048	2052

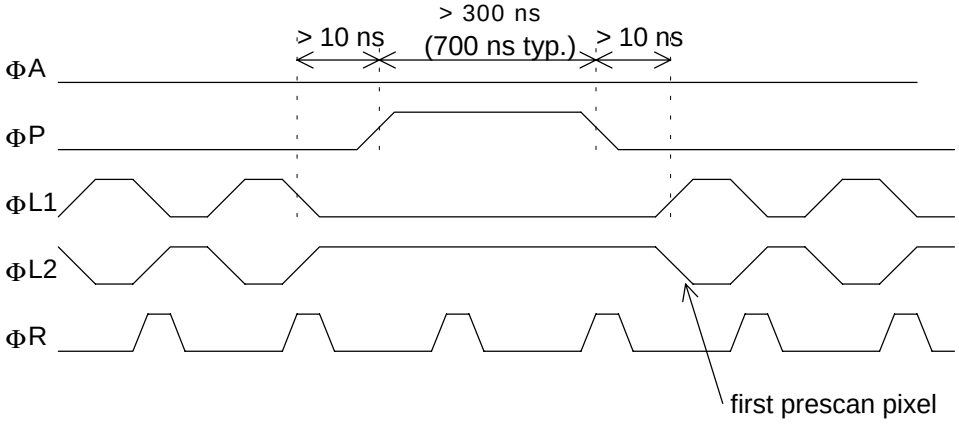
Postscan elements may be added in order to either increase the exposure time, or to provide a voltage reference level.

Figure 1. Line Timing Diagram



The following diagram shows the timing for the transfer period:

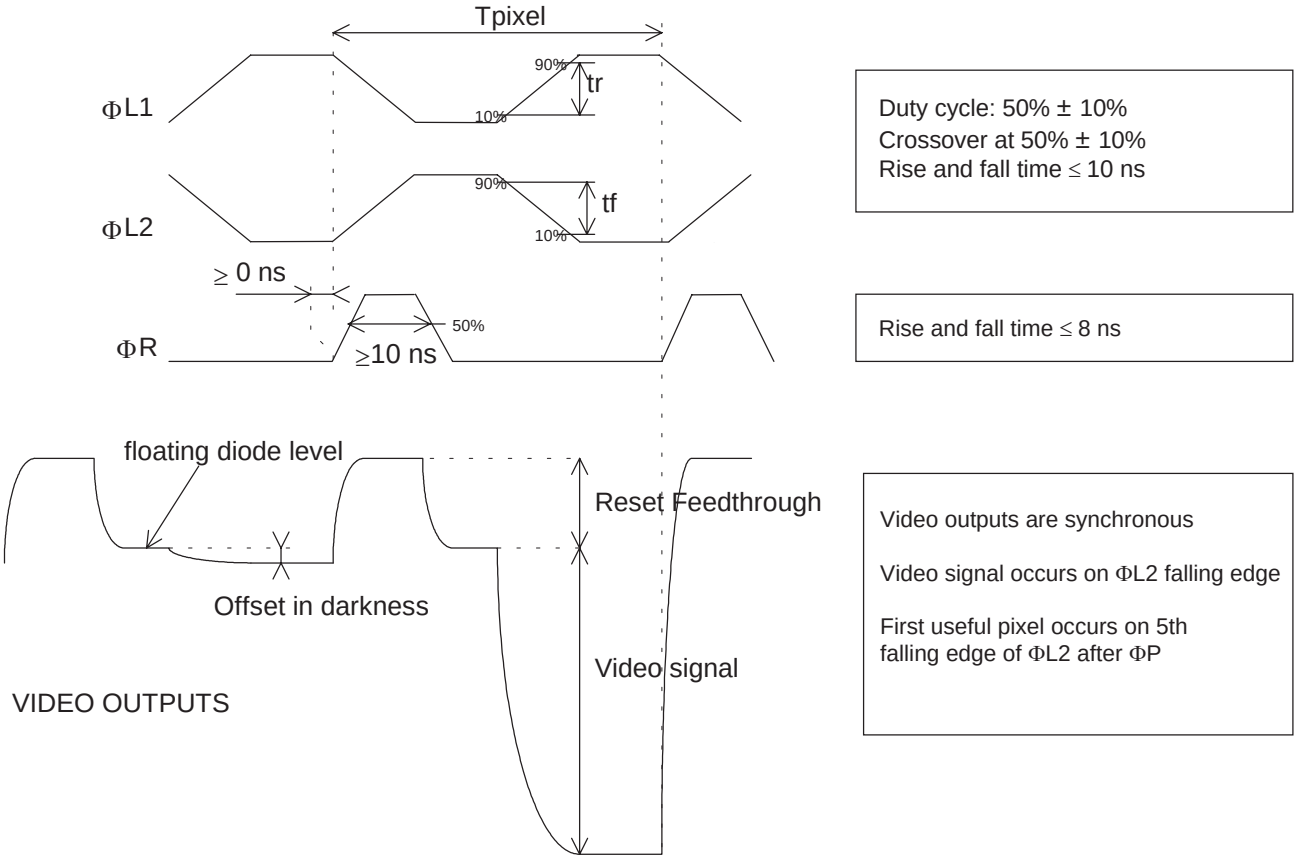
Figure 2. Line Transfer Period



ΦR clock may also be held in high state during line transfer period.

The following diagram shows the detailed timing for the pixel readout:

Figure 3. Pixel Readout Timing Diagram

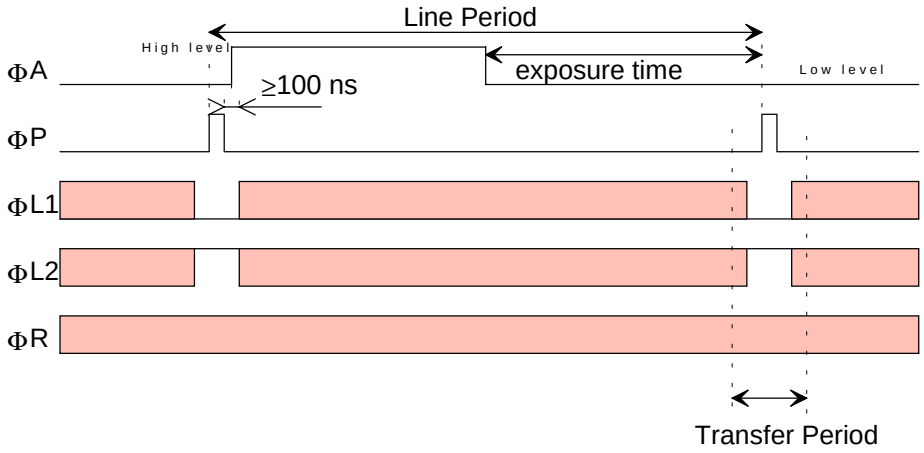


Exposure Time Reduction

The TH7815ACC antiblooming structure provides an electronic shutter capability by clocking phase ΦA during the line period. The timing diagram is described below:

Antiblooming Gate	ΦA	Min.	Typ.	Max.	Unit	Clock Capacitance < 200 pF
High Level		8.5	9	9.5	V	Low Level Sets Saturation Level
Low Level		2	4	7	V	See Pixel Saturation Adjustment
Pulse Min.		200 ns				

Figure 4. Exposure Time Reduction



Electro-optical Performance

General test conditions

T_{CASE} = 25°C

Light source: 2854K with 2 mm BG38 filter (unless specified) + F/11 optical aperture.

Typical operating conditions: 2 x 10 MHz.

All values are referred to prescan pixels level.

Parameter	Symbol	Value			Unit	Remarks
		Min.	Typ.	Max.		
Saturation Output Voltage	V_{SAT}	1.3	1.6	3	V	
Responsivity	R	7.5	8.5		V/µJ/cm^2	
Responsivity Unbalance			2	5	%	
Photo Response Non-uniformity Peak-to-peak	PRNU		±5	±10	% V_{OS}	$\overline{V}_{OS}$ = 50 mV to 1.2V
Dark Signal	DS		0.1	0.4	mV/ms	
Dark Signal Non-uniformity (1σ)	DSNU			0.1	mV/ms	
Temporal RMS Noise in Darkness	V_N		300		µV	
Dynamic Range	DR	4,300	5,300			
CTF	CTF		65		%	
LAG	LAG			1	%	
Charge Transfer Inefficiency (Per Stage)	HCTI			8.10^{-5}		

Static and Dynamic Electrical Characteristics

Parameter	Symbol	Value			Unit	Remarks
		Min.	Typ.	Max		
Output Amplifier Supply Current	I_{DD}		10		mA	per amplifier
Output Impedance	Z_S	200	225	250	Ω	
DC Output Level	V_{REF}		10		V	
Output Conversion Factor	CVF		5		µV/e-	
Offset In Darkness	DC off		30		mV	
Reset Feedthrough	Vft		400		mV	

Electro-optical Performances Without Infrared Cut-off Filter

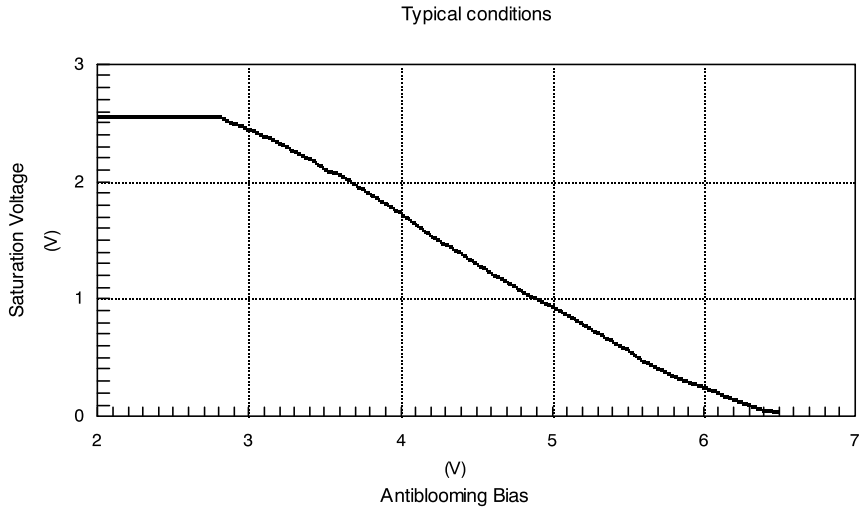
The TH7815ACC special semiconductor process enables to exploit the silicon's high near infrared sensitivity while maintaining good imaging performances in terms of response uniformity and resolution. Typical changes in performance with and without OR filtering are summarized below:

Parameter	With IR Cut-off Filter	Without IR Cut-off Filter
Average Video Signal Due to a Given Scene Illumination	V_{OS}	6 x V_{OS}
PRNU (Single Defects Excluded)	±5%	±5%
CTF at Nyquist Frequency	65%	40%

Pixel Saturation Adjustment

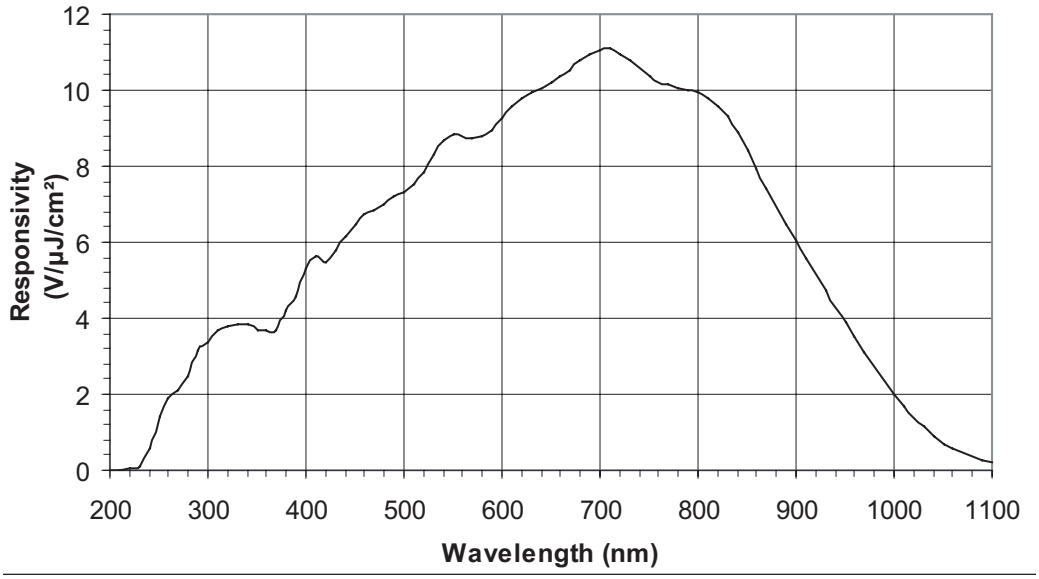
TH7815ACC antiblooming structure can be used to adjust the maximum saturation voltage, by adjusting the ΦA bias voltage. The following curve shows the relationship between V_{SAT} and VΦA.

Figure 5. Pixel Saturation Antiblooming Bias (Typical conditions)

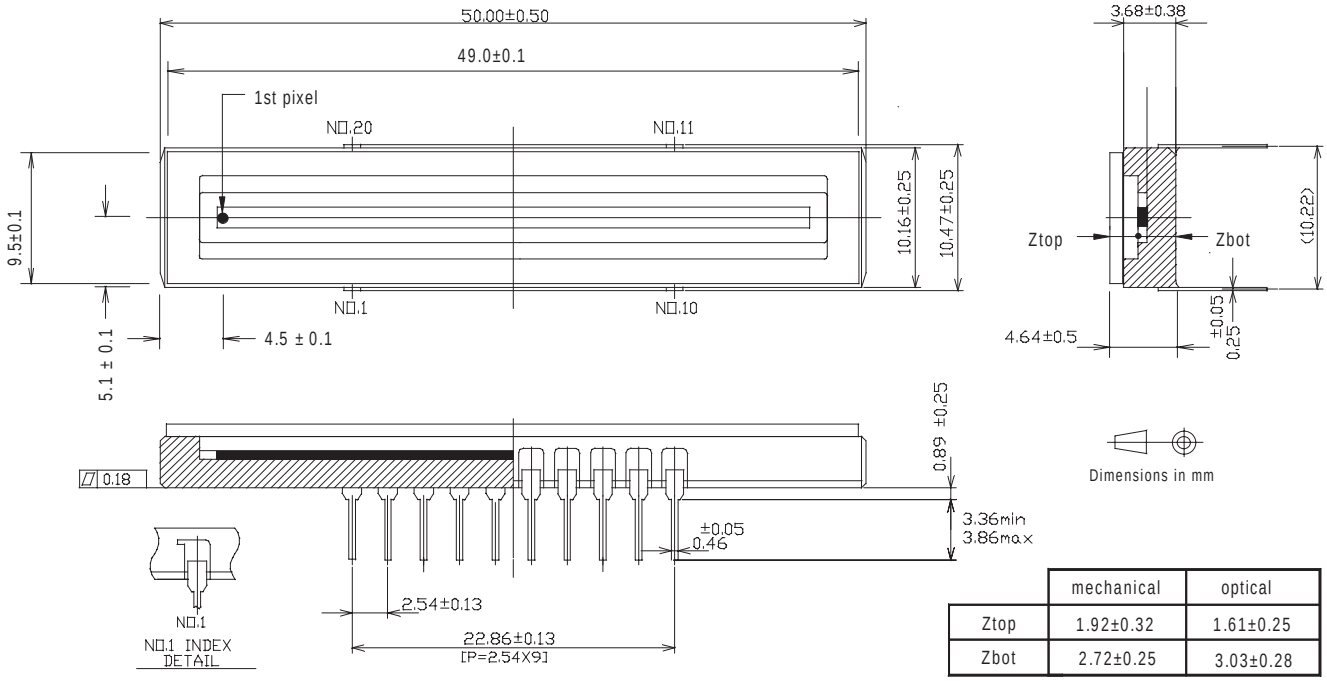


Spectral Responsivity

The following curve shows the typical spectral responsivity for TH7815ACC:



Packaging Drawing



	mechanical	optical
Ztop	1.92±0.32	1.61±0.25
Zbot	2.72±0.25	3.03±0.28

Ordering Code

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