Features

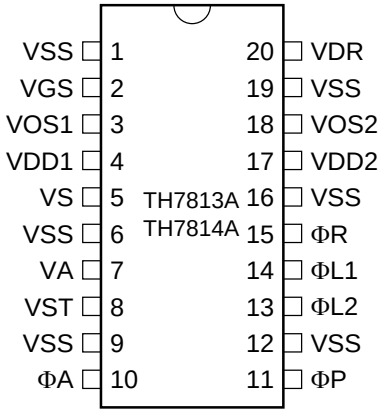
- **Data Rate up to 50 MHz (2 Outputs at 25 MHz Each)**
- **Pixel Size: 10 µm x 10 µm (10 µm Pitch)**
- **300 to 1100 nm Spectral Range**
- **High Sensitivity and Lag-free Photodiodes**
- **Very Low Noise (30 pJ/cm^2 Noise Equivalent Illumination)**
- **Antiblooming**
- **Exposure Control**
- **20-lead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

The TH7813 and TH7814 linear arrays are based on Atmel's most recent know-how in terms of design and technology. Flexibility and performance of these devices give 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, metrology, etc.

Pin Identification

All pins must be connected

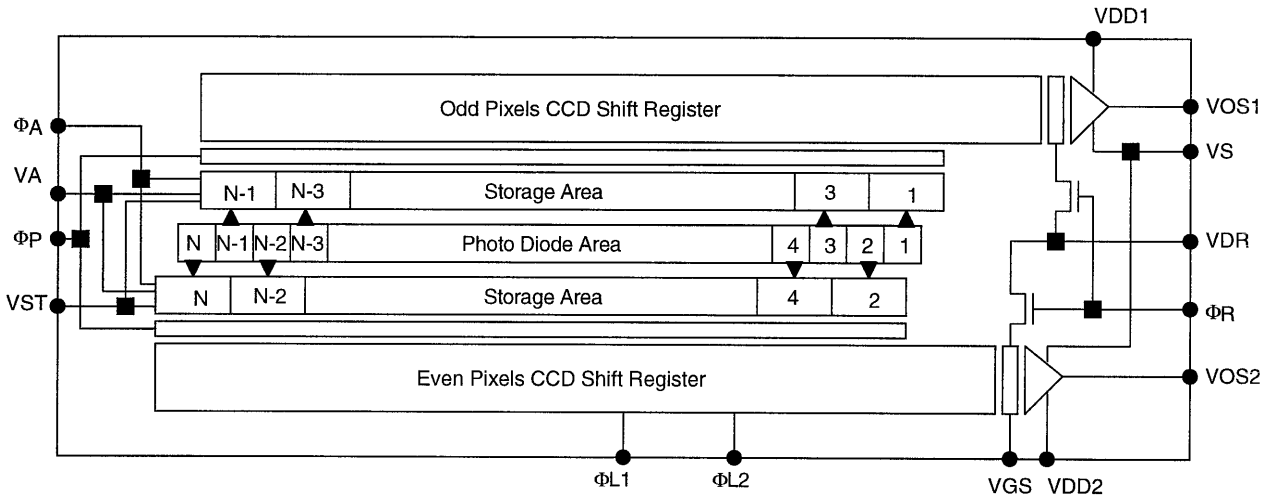
Pin Number	Symbol	Function
4, 17	VDD1,2	Output Amplifiers Drain Supply
3, 18	VOS1,2	Video Outputs
5	VS	Output Amplifiers Substrate Bias
20	VDR	Reset Drain Supply
2	VGS	Output Gate Bias
14	ΦL1	Readout Register Clocks
13	ΦL2	
15	ΦR	Reset Clock
10	ΦA	Antiblooming Gate Bias/Clock
7	VA	Antiblooming Drain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



50 MHz 1024/2048 Linear CCDs

TH7813A TH7814A

Rev. 1990A–IMAGE–05/02



Absolute Maximum Ratings*

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

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

Note: 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

Table 1. DC Characteristics (Continued)

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Register Output Gate Bias	VGS	2.2	2.4	2.6	V
Output Amplifier Source Supply	VS		0		V
Ground	VSS		0		

Table 2. Drive Clocks Characteristics

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Reset gate	ΦR					
High level		8.5	9	9.5	V	Clock Capacitance < 25 pF
Low level		-0.1	0	0.4	V	
Transfer gate	ΦP			9.5		Clock Capacitance < 100 pF
High level		8.5	9	0.4	V	
Low level		-0.1	0		V	
Readout register clocks	ΦL1, 2			9.5		see Figure 1 and Figure 2
Hilgh level		8.5	9	0.4	V	
Low level		-0.1	0		V	
Maximum readout register frequency	F_H		10	25	MHz	

Figure 1. Readout Register Clocks Capacitance TH7813

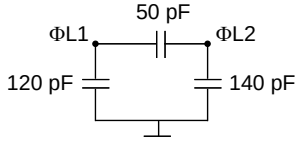
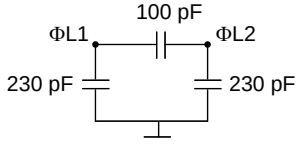


Figure 2. Readout Register Clocks Capacitance TH7814



Timing Diagrams

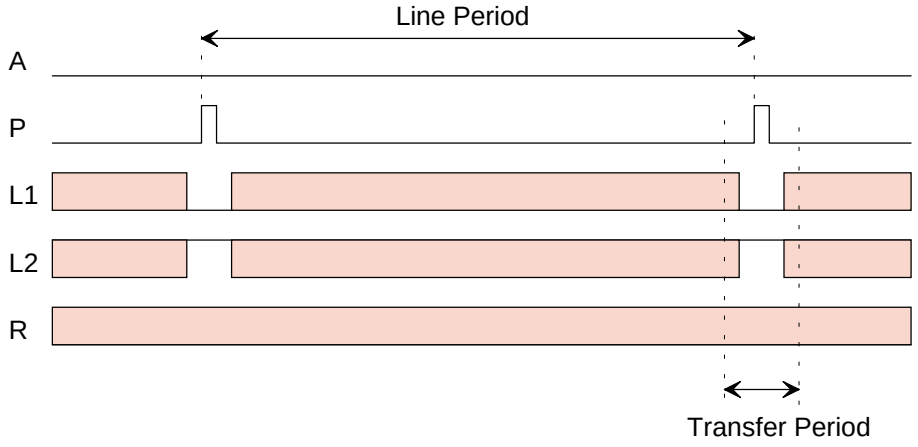
The following diagram shows the general clocking scheme for the TH7813A and TH7814A.

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
TH7813A	4	512	516
TH7814A	4	1024	1028

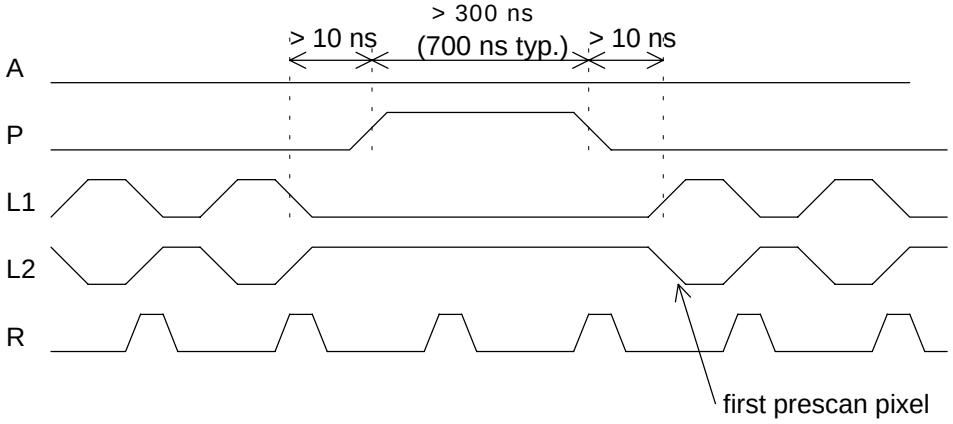
Postscan elements may be added in order to either increase the exposure time, or to provide a voltage reference level.

Figure 3. Line Timing Diagram



The following diagram shows the timing for the transfer period:

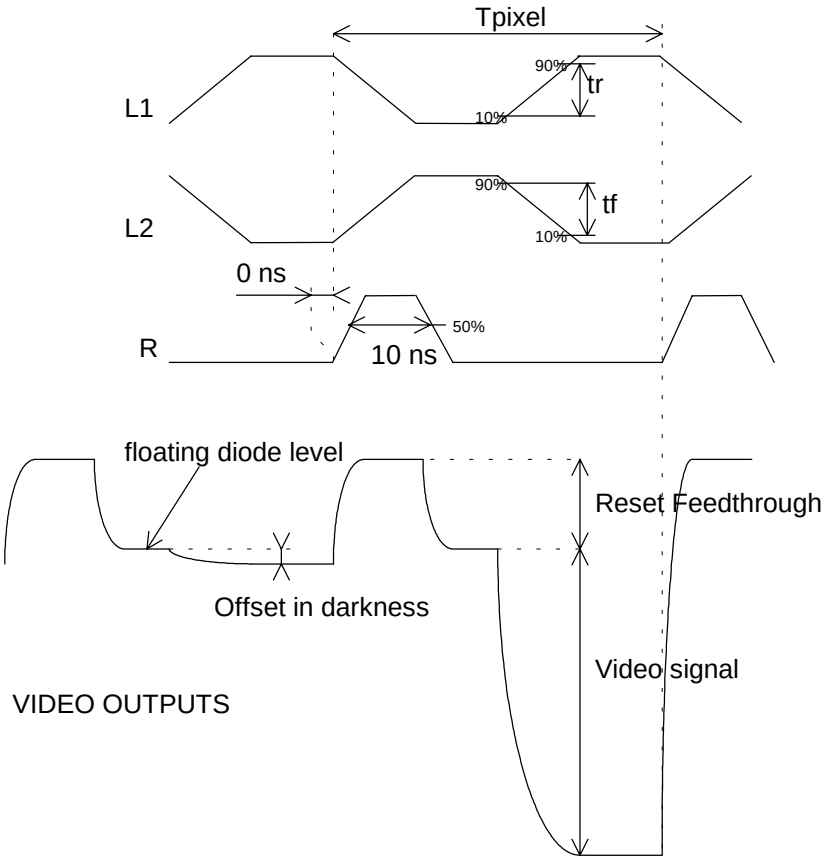
Figure 4. Line Transfer Period



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 5. Pixel Readout Timing Diagram



Duty cycle: 50% ± 10%
Crossover at 50% ± 10%
Rise and fall time 10 ns

Rise and fall time 8 ns

Video outputs are synchronous

Video signal occurs on L2 falling edge

First useful pixel occurs on 5th falling edge of L2 after P

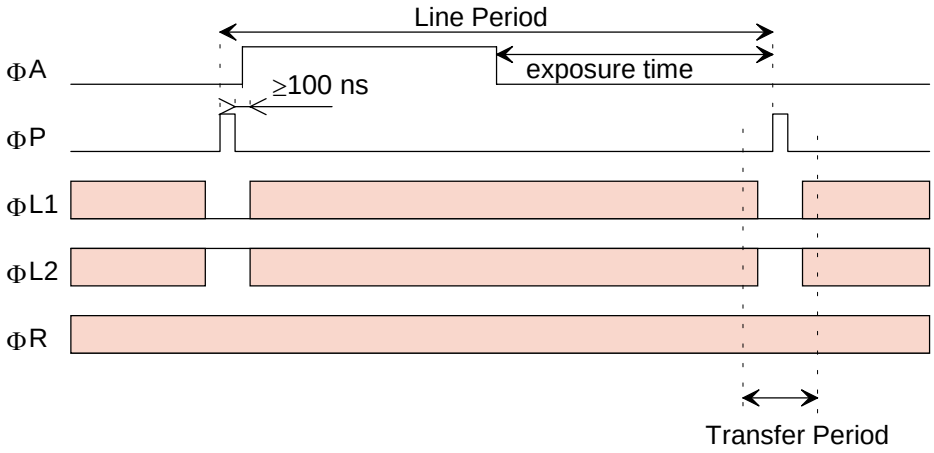
Exposure Time Reduction

The antiblooming structure of the TH7813A and TH7814A provides an electronic shutter capability by clocking phase fA during the line period. The timing diagram is described below:

Antiblooming Gate	ΦA	Min	Typ	Max	Unit	Clock Capacitance (see note)
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	

Note: Clock capacitance: TH7813A = 50 pF, TH7814A = 100 pF

Figure 6. 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}	1.65	2	3	V	
Responsivity	R	7.5	8.5		$V/\mu J/cm^2$	
Responsivity Unbalance			2	5	%	
Photo Response Non Uniformity Peak-to-peak	PRNU		±5	±10	$\%V_{OS}$	$\overline{V}_{OS}$ = 50 mV to 1.5V
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	5,500	6,600			
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	259	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

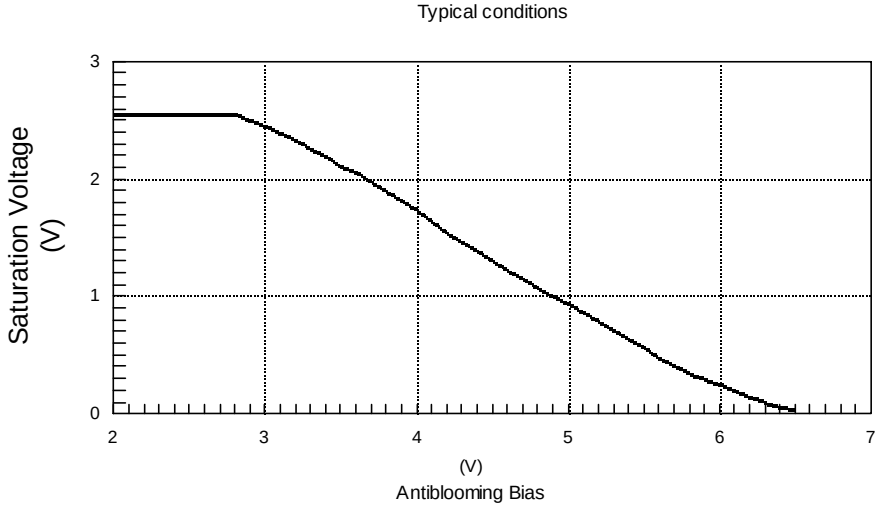
The TH7813A and TH7814A special semiconductor process enables to exploit the silicon's high near infrared sensitivity while maintaining good imaging performances in terms of response uniformity and resolution. Typical changes in performance with and without IR filtering are summarized below:

Parameter	With IR Cut-off Filter	Without IR Cut-off Filter
Average Video Signal Due to a Given Illumination	V_{OS}	6 x V_{OS}
PRNU (Single Defects Excluded)	±5%	5%
CTF at Nyquist Frequency	65%	49%

Pixel Saturation Adjustment

The TH7813A and TH7814A antiblooming structure can be used to adjust the maximum saturation voltage, by adjusting the ΦA bias voltage. The following curve shows the relation between V_{SAT} and VΦA.

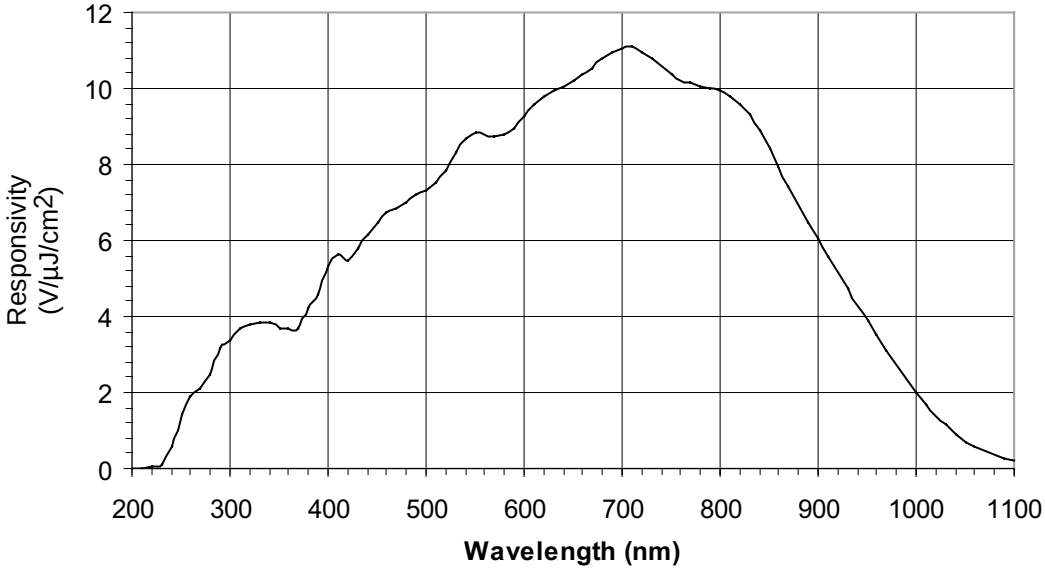
Figure 7. Pixel Saturation vs. Antiblooming Bias (Typical Conditions)



Spectral Responsivity

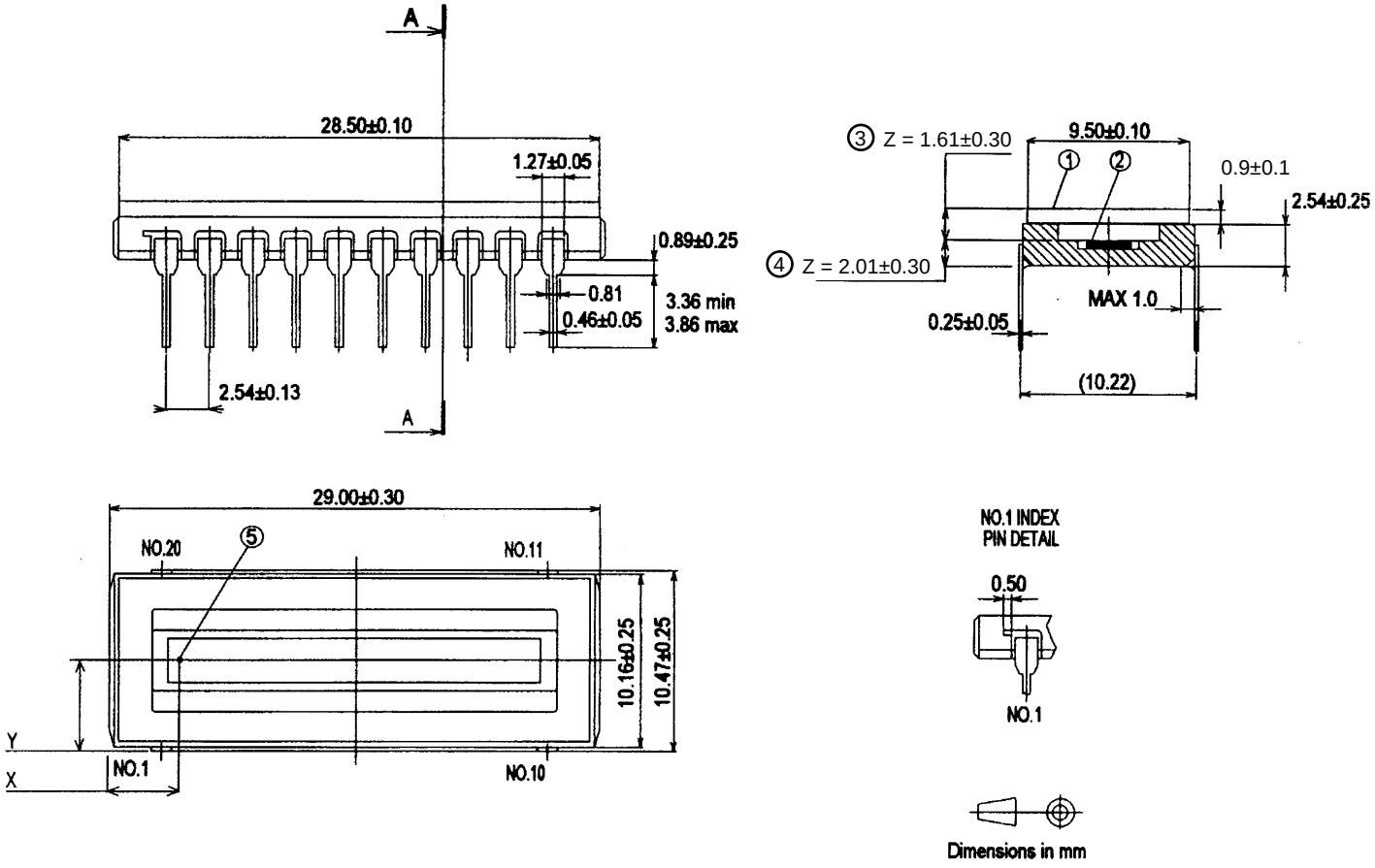
The following curve shows the typical responsivity for TH7813A and TH7814A.

Figure 8. Spectral Responsivity



Package Drawing

Both devices have the same optical center



Notes:
1. Window
2. Photosensitive area
3. Optical distance between external face of window and photosensitive area
4. Optical distance between backside of package and photosensitive area
5. First pixel position (mm):

TH7813A	TH7814A
X = 9.6 ± 0.4	X = 4.5 ± 0.4
Y = 5.2 ± 0.35	Y = 5.2 ± 0.35

Ordering Code

TH7813ACC

TH7814ACC

Atmel Headquarters

Corporate Headquarters
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 487-2600

Europe
Atmel Sarl
Route des Arsenaux 41
Case Postale 80
CH-1705 Fribourg
Switzerland
TEL (41) 26-426-5555
FAX (41) 26-426-5500

Asia
Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimhatsui
East Kowloon
Hong Kong
TEL (852) 2721-9778
FAX (852) 2722-1369

Japan
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
TEL (81) 3-3523-3551
FAX (81) 3-3523-7581

Atmel Operations

Memory
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 436-4314

Microcontrollers
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 436-4314

La Chantrerie
BP 70602
44306 Nantes Cedex 3, France
TEL (33) 2-40-18-18-18
FAX (33) 2-40-18-19-60

ASIC/ASSP/Smart Cards
Zone Industrielle
13106 Rousset Cedex, France
TEL (33) 4-42-53-60-00
FAX (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
TEL 1(719) 576-3300
FAX 1(719) 540-1759

Scottish Enterprise Technology Park
Maxwell Building
East Kilbride G75 0QR, Scotland
TEL (44) 1355-803-000
FAX (44) 1355-242-743

RF/Automotive
Theresienstrasse 2
Postfach 3535
74025 Heilbronn, Germany
TEL (49) 71-31-67-0
FAX (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
TEL 1(719) 576-3300
FAX 1(719) 540-1759

Biometrics/Imaging/Hi-Rel MPU/
High Speed Converters/RF Datacom
Avenue de Rochepleine
BP 123
38521 Saint-Egreve Cedex, France
TEL (33) 4-76-58-30-00
FAX (33) 4-76-58-34-80

e-mail
literature@atmel.com

Web Site
http://www.atmel.com

1990A–IMAGE–05/02 0M