Ordering number : EN*4982A

CMOS LSI

LC82101

Image Processing Circuit for FAX, Copier, and OCR Products

Preliminary

Overview

The LC82101 converts an analog image signal from a CCD or contact sensor to high-quality binary image data. The LC82101 uses an internal 8-bit A/D converter for A/D conversion, and in addition to the orthodox dithering technique, also supports an error diffusion technique that allows an even higher quality image to be acquired. These techniques apply to the whole range of processing supported by the LC82101, including full-pixel distortion correction, gamma conversion for arbitrary gamma curves, image compression processing, two-dimensional filtering, halftone processing, and image separation processing to separate documents into text, photograph, and halftone regions. Thus this LSI implements the image processing required by FAX, copier, and OCR systems.

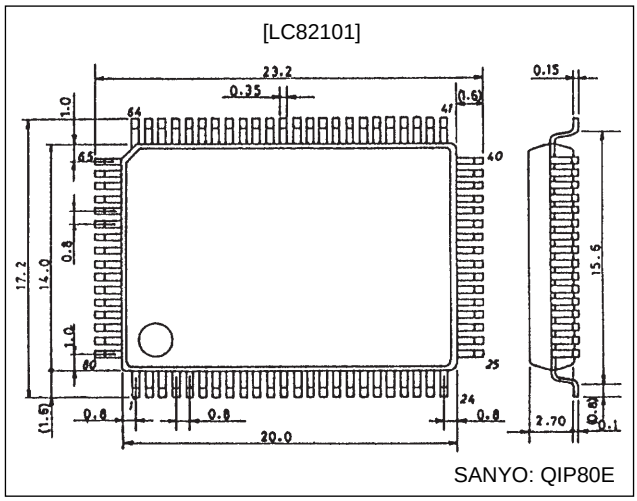
Features

- Number of pixels processed
  2048 pixels/line (64 KB memory, white correction only)
  4096 pixels/line (256 KB memory, both white and black correction)
  8192 pixels/line (256 KB memory, white correction only)
- Processing speed
  500 ns/pixel maximum (The processing time for 1 pixel is 16/SYSCLK.)
- Supports medium speed products with a single external memory chip
  100 ns access time memory allows 800 ns/pixel processing, and 60 ns access time memory allows 500 ns/pixel processing.
- AGC (The A/D converter high-level reference voltage is varied from 1.2 to 4.2 V in 0.2 V steps.)
- Built-in 8-bit A/D converter (includes a sensor signal delay adjustment function)
- Sensor drive circuit (supports CCD and all CIS types)
- Digital clamp (single-point clamp, even/odd clamp)
- Distortion correction (white correction, black correction, full-pixel correction)
- Gamma correction (supports user-defined curves)
- Image area separation (text, photographs, halftone)
- Simple binary-conversion processing (fixed threshold level, density-adaptive threshold level)
- Halftone processing
  Structural dithering (64 levels), settable dithering threshold level
  Error diffusion technique (64 levels)
- Image reduction (thinning, fine black line retaining, fine white line retaining)
- Single-voltage 5 V supply and low power due to CMOS process fabrication

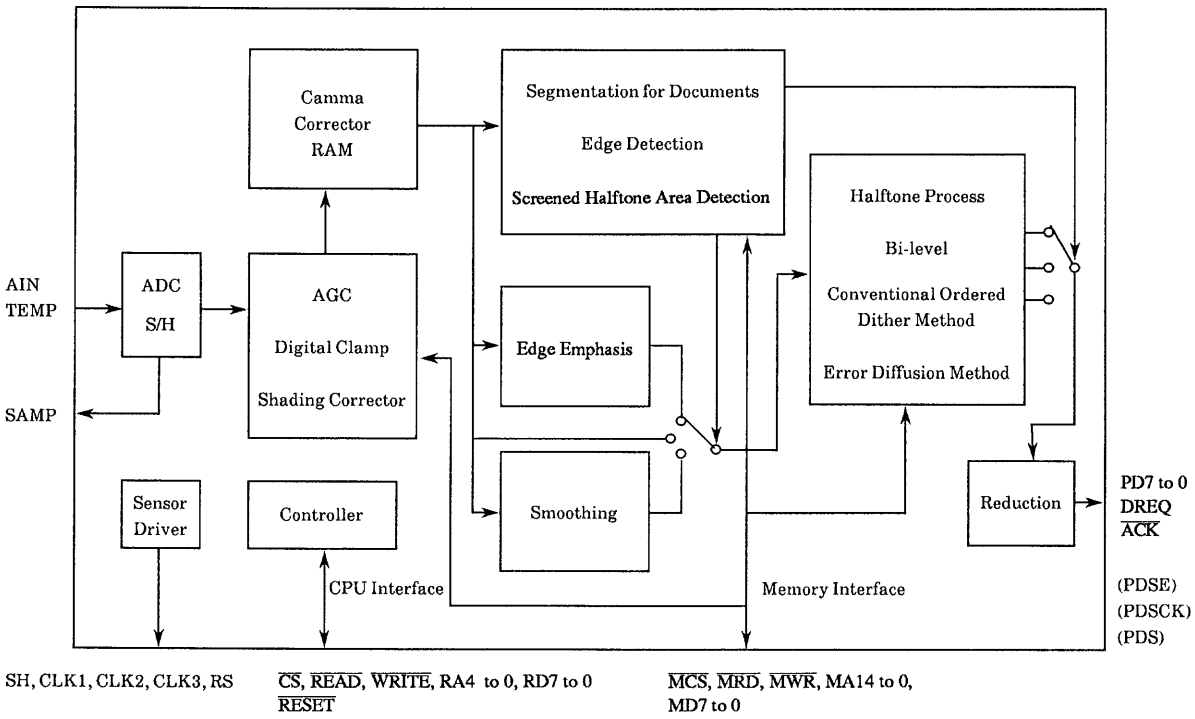
Package Dimensions

unit: mm

3174-QFP80E



Block Diagram



Pin Functions

Type: I: Input pin, O: Output pin, B: Bidirectional pin, P: Power supply pin, NC: No connection

Pin No.	Symbol	I/O	Function
1	DREQ	O	DMA data request signal output
2	$\overline{ACK}$	I	DMA acknowledge signal input
3	PD0	O	Binary image data parallel data bus The data order is set by the MSBF register. Pin 8 can be switched to function as the serial data output valid period signal. Pin 9 can be switched to function as the serial data transfer clock. Pin 10 can be switched to function as the serial data output.
4	PD1	O	
5	PD2	O	
6	PD3	O	
7	PD4	O	
8	PD5/SDE	O	
9	PD6/SDCK	O	
10	PD7/SD	O	
11	MD0	B	External memory data bus
12	DV_{DD}	P	Digital system power supply
13	DGND	P	Digital system ground
14	MD1	B	External memory data bus MD7 is the MSB and MD0 is the LSB.
15	MD2	B	
16	MD3	B	
17	MD4	B	
18	MD5	B	
19	MD6	B	
20	MD7	B	
21	DGND	P	Digital system ground
22	MA0	O	External memory address MA14 is the MSB and MA0 is the LSB.
23	MA1	O	
24	MA2	O	
25	MA3	O	
26	MA4	O	
27	MA5	O	
28	MA6	O	
29	MA7	O	
30	MA8	O	

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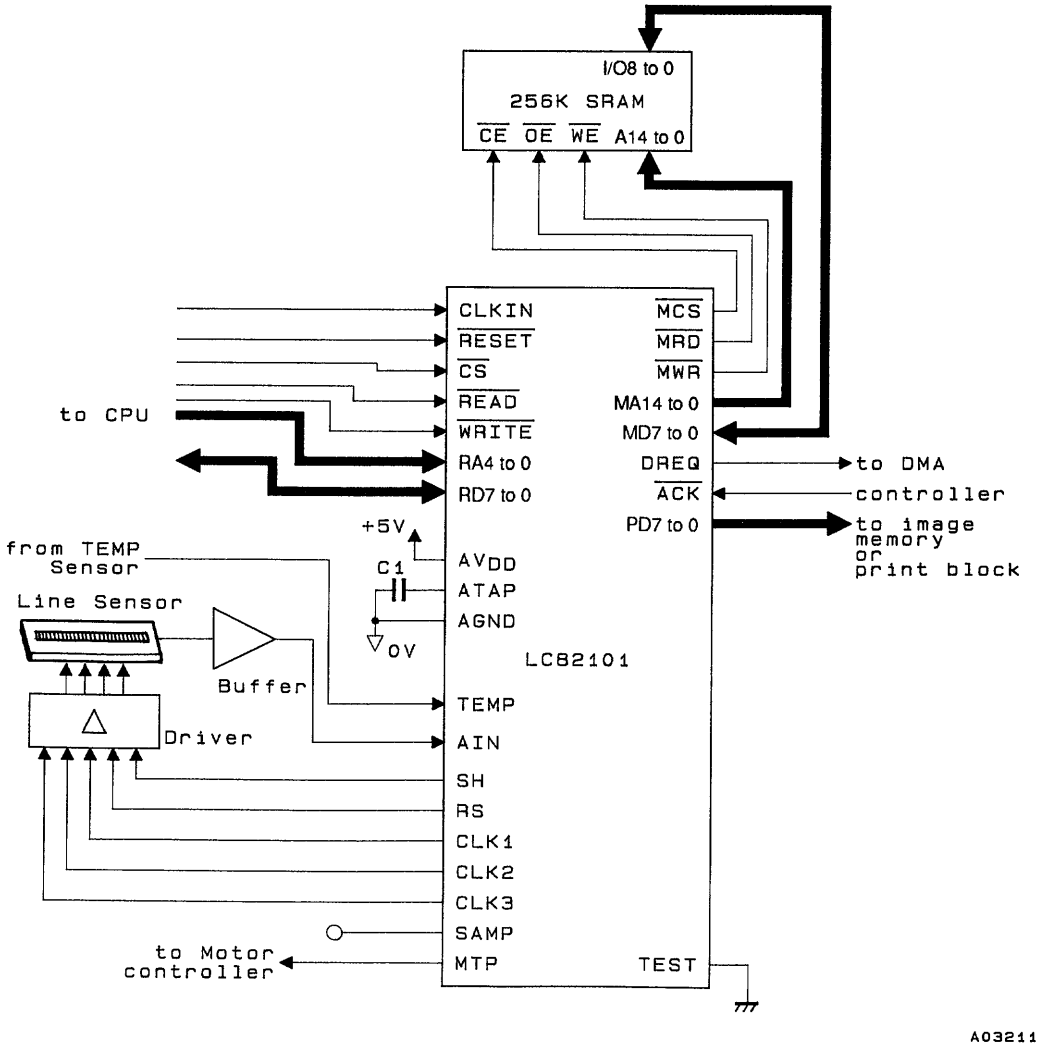
Type: I: Input pin, O: Output pin, B: Bidirectional pin, P: Power supply pin, NC: No connection

Pin No.	Symbol	I/O	Function
31	DV_{DD}	P	Digital system power supply
32	DGND	P	Digital system ground
33	MA9	O	External memory address bus MA14 is the MSB and MA0 is the LSB.
34	MA10	O	
35	MA11	O	
36	MA12	O	
37	MA13	O	
38	MA14	O	
39	$\overline{MCS}$	O	External memory CS signal
40	$\overline{MRD}$	O	External memory READ signal
41	$\overline{MWR}$	O	External memory WRITE signal
42	DGND	P	Digital system ground
43	MTP	O	Motor drive timing signal output
44	SH	O	Sensor drive signal outputs
45	RS	O	
46	CLK1	O	
47	CLK2	O	
48	CLK3	O	
49	SAMP	O	Sampling clock monitor
50	CLKIN	I	System clock input
51	DV_{DD}	P	Digital system power supply
52	DGND	P	Digital system ground
53	NC	NC	
54	NC	NC	
55	NC	NC	
56	TEST	I	Test input (Connect to ground in normal use.)
57	AGND	P	Analog system ground
58	ATAP	O	Analog mid-level connection
59	AIN	I	Sensor signal input
60	TEMP	I	Temperature signal input
61	AV_{DD}	P	Analog system power supply
62	RD0	B	CPU interface data bus RD7 is the MSB and RD0 is the LSB.
63	RD1	B	
64	RD2	B	
65	RD3	B	
66	RD4	B	
67	RD5	B	
68	RD6	B	
69	RD7	B	
70	RA0	I	CPU interface address bus RA4 is the MSB and RA0 is the LSB.
71	RA1	I	
72	RA2	I	
73	DV_{DD}	P	Digital system power supply
74	DGND	P	Digital system ground
75	RA3	I	CPU interface address bus
76	RA4	I	
77	$\overline{CS}$	I	CPU interface CS signal
78	$\overline{READ}$	I	CPU interface READ signal
79	$\overline{WRITE}$	I	CPU interface WRITE signal
80	$\overline{RESET}$	I	System reset

Sample Application Circuit



1. C1: Use a 0.01 µF laminated ceramic capacitor.
2. Set up the polarity of the image signal from the sensor so that white data is represented by the highest potential and black data by the lowest potential. A level conversion circuit can allow the whole dynamic range of the built-in A/D converter to be used effectively if the maximum output level of the peaks in the image signal from the sensor does not reach 4.2 V.
3. When a 64 K SRAM is used as the distortion correction memory, leave MA11 and MA12 unused and connect MA13 and MA14 to the memory A11 and A12 lines.
4. Although AGND and DGND are completely isolated internally in this LSI, AV_{DD} and DV_{DD} are connected through the substrate. Therefore, the power supply system must be designed so that no potential difference between AV_{DD} and DV_{DD} can occur. Also, when power is applied or removed, the time lag between the power supplies must be under 3 ms.

Specifications

Absolute Maximum Ratings at Ta = 25°C, GND = 0 V

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{DD} max		–0.3 to +7.0	V
I/O voltages	V_I, V_O		–0.3 to V_{DD} + 0.3	V
Allowable power dissipation	Pd max	Ta ≤ 70°C	450	mW
Operating temperature	Topr		–30 to +70	°C
Storage temperature	Tstg		–55 to +125	°C
Soldering conditions		Hand soldering: 3 seconds	350	°C
		Reflow soldering: 10 seconds	235	°C

Allowable Operating Conditions at Ta = –30 to +70°C, GND = 0 V

Parameter	Symbol	Conditions	min	typ	max	Unit
Supply voltage	V_{DD}		4.5		5.5	V
Input voltage	V_{IN}		0		V_{DD}	V

DC Characteristics at Ta = –30 to +70°C, GND = 0 V, V_{DD} = 4.5 to 5.5 V

Parameter	Symbol	Conditions	min	typ	max	Unit
Input high-level voltage	V_{IH}		2.2			V
Input low-level voltage	V_{IL}				0.8	V
Input leakage current	I_L	V_{IN} = V_{DD}, V_{SS}	–25		+25	µA
Output high-level voltage	V_{OH}	I_{OH} = 3 mA	2.4			V
Output low-level voltage	V_{OL}	I_{OL} = 3 mA			0.4	V
Output leakage current	I_L	When in the high-impedance state	–100		+100	µA
Current drain	I_{DD}	V_{DD} = 5.0 V, SYSCLK = 32 MHz		40	60	mA

Analog Characteristics

The minimum signal level in analog input signals must be matched to AGND, and the maximum signal level must not exceed the maximum AGC potential.

Parameter	Symbol	Conditions	min	typ	max	Unit
[When AGND = 0 V]						
Maximum potential			0.82	0.84	0.86	AV_{DD} V
Minimum potential			0.22	0.24	0.26	AV_{DD} V
[When AV_{DD} = 5.0 V, AGND = 0 V, and the AGC is at the maximum potential]						
Resolution				8		bit
Linearity error					±1	LSB
Differential linearity error					±1	LSB