Ordering number : EN ———

CMOS IC

LC99501-RB5

CCD Controller/Signal Processor

Preliminary

Overview

The LC99501-RB5 is an analog/digital composite IC that provides all the circuits and functions required to implement a CCD digital camera system, and integrates a large number of functions on a single chip. Although the A/D converter, AGC, and CDS (correlation dual sampling circuit) required for analog processing are normally provided by separate chips, the LC99501-RB5 integrates all these circuits along with an A/D converter on a single chip. Additionally, this IC also includes on the same chip the pulse generator circuit required for CCD drive, logic cirçuits including an electronic iris control circuit, and a digital color signal-processing circuit that creates the digital YUV signals.

A CCD digital camera system can be formed from just three chips: the LC99160GL as the CCD, the LC89903 vertical driver, and the LC99501-RB5.

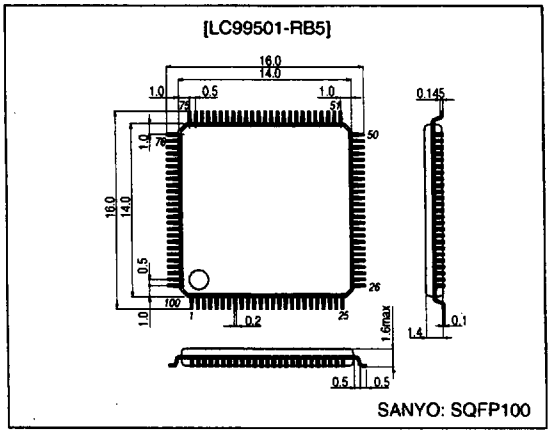
Functions

- CCD Driving
  - — Scanning/internal CCD driving/external CCD driving
- Auto iris/auto gain control
  - — Auto iris/AGC
- Line FIFO
  - — Noise reduction/external YUV read out/mirror out
- Picture coordinates
  - — Y (Luminance)/UV (Color difference)/auto white balance
- Output format
  - — ITU-R BT.601/ITU-R BT.656/4:4:4/4:1:1/4:2:0
  - — VGA/QVGA/CIF/For NTSC encode/cropping
- Power saving
  - — Standby mode/power saving mode
- I²C-bus
  - — Register interface/external ROM

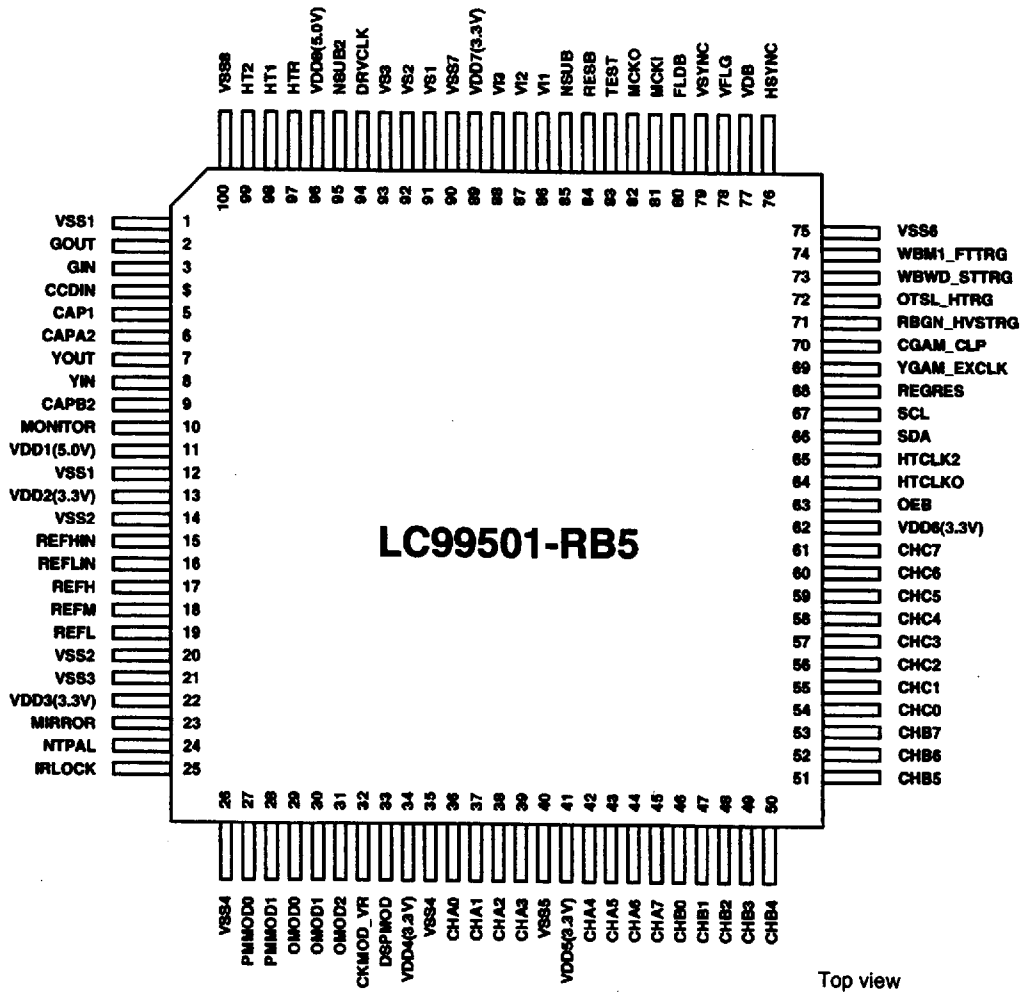
Package Dimensions

unit: mm

3181B-SQFP100



Pin Assignment



Top view

Specifications

Absolute Maximum Ratings at V_{SS} = 0 V

Parameter	Symbol	Conditions	Ratings	Unit	Applicable pins
Supply voltage 1	V_{DD1} max		–0.3 to +4.6	V	1
Supply voltage 2	V_{DD2} max		–0.3 to +7.0	V	2
Input and output voltages 1	V_I1, V_O1		–0.3 – $V_{DD}1$ + 0.3	V	3
Input voltage H1	V_{I1H}		–0.3 to +7.3	V	4
Input and output voltages 2	V_I2, V_O2		–0.3 to $V_{DD}2$ + 0.3	V	5
Allowable power dissipation	Pdmax			mW	
Operating temperature	Topr		–15 to +60	°C	
Storage temperature	Tsty		–55 to +125	°C	
Soldering conditions: hand soldering	—	3 seconds	350	°C	
Soldering conditions: reflow soldering	—	10 seconds	235	°C	
Input and output current	I_i, I_o		±20 *	mA	

[Applicable pins]
1: 3.3-V power supply (power supply pins other than pins 11 and 96)
2: 5.0-V power supply (pins 11 and 96)
3: Pins other than those stipulated in (4) and (5).
4: The SDA, SCL, and REGRES pins
5: The GIN, CCDIN, CAP1, CAPA2, YOUT, YIN, CAPB2, REFHIN, REFLIN, MONITOR, NSUB, VI1 to VI3, VS1 to VS3, DRVCLK, HTR, HT1, and HT2 pins
Note: * Per single input or output cell.

Allowable Operating Ranges at Ta = –15 to +60°C, V_{SS} = 0 V

Parameter	Symbol	Conditions	Ratings			Unit	Applicable pins
			min	typ	max		
Supply voltage 1	$V_{DD}1$		3	3.3	3.6	V	1
Supply voltage 2	$V_{DD}2$		4.75	5	5.25	V	2
Input voltage range 1	$V_{IN}1$		0		$V_{DD}1$	V	3
Input voltage range 1H	$V_{IN}1H$		0		5.3	V	4
Input voltage range 2	$V_{IN}2$		0		$V_{DD}2$	V	5

[Applicable input pins]
1: 3.3-V power supply (power supply pins other than pins 11 and 96)
2: 5.0-V power supply (pins 11 and 96)
3: Pins other than those stipulated for (4) and (5).
4: The SDA, SCL, and REGRES pins
5: The GIN, CCDIN, CAP1, CAPA2, CAPB2, YIN, REFHIN, and REFLIN pins

Logic Block Electrical Characteristics

• DC characteristics

Ta = −15 to +60°C, $V_{DD}1$ = 3.0 to 3.6 V, $V_{DD}2$ = 4.75 to 5.25 V, V_{SS} = 0 V

Parameter	Symbol	Conditions	Ratings			Unit	Applicable pins
			min	typ	max		
High-level input voltage	V_{IH}	CMOS level inputs	0.7 $V_{DD}1$			V	1
Low-level input voltage	V_{IL}				0.2 $V_{DD}1$	V	
High-level input voltage	V_{IH}	CMOS level inputs	0.75 $V_{DD}1$			V	2
Low-level input voltage	V_{IL}	Schmitt inputs			0.15 $V_{DD}1$	V	
High-level output voltage	V_{OH}	I_{OH} = −2 mA	$V_{DD}1$ − 0.8			V	3
Low-level output voltage	V_{OL}	I_{OL} = 2 mA			0.4	V	
High-level output voltage	V_{OH}	I_{OH} = −4 mA	$V_{DD}1$ − 0.8			V	4
Low-level output voltage	V_{OL}	I_{OL} = 4 mA			0.4	V	
High-level output voltage	V_{OH}	I_{OH} = −4 mA	$V_{DD}2$ − 2.1			V	5
Low-level output voltage	V_{OL}	I_{OL} = 4 mA			0.4	V	
High-level output voltage	V_{OH}	I_{OH} = −8 mA	$V_{DD}2$ − 2.1			V	6
Low-level output voltage	V_{OL}	I_{OL} = 8 mA			0.4	V	
High-level output voltage	V_{OH}	I_{OH} = −25 mA	$V_{DD}1$ − 0.8			V	7
Low-level output voltage	V_{OL}	I_{OL} = 25 mA			0.4	V	
High-level output voltage	V_{OH}	I_{OH} = −8 mA	$V_{DD}2$ − 2.1			V	8
Low-level output voltage	V_{OL}	I_{OL} = 4 mA			0.4	V	
Low-level output voltage	V_{OL}	I_{OL} = 4 mA			0.4	V	9
Low-level output voltage	V_{OL}	I_{OL} = 8 mA			0.4	V	10
Input leakage current	I_L	V_I = V_{DD}, V_{SS}	−10		+10	μA	1, 2
Output leakage current	I_{OZ}	When in the high-impedance output state	−10		+10	μA	9, 10

[Applicable pins]

INPUT
1: MIRROR, NTPAL, IRLOCK, PMMOD0, PMMOD1, OMOD0, OMOD1, OMOD2, OEB, CLPIN, TEST, RESB, MCKI
2: CKMOD_VR, DSPMOD, SDA, SCL, REGRES, YGAM_EXCLK, CGAM_CLP, RBGN_HVSTRG, OTSL_HTRG, WBWD_STTRG, WBM1_FTTRG

OUTPUT
3: CHA[7:0], CHB[7:0], CHC[7:0]
4: HTCLK0, HTCLK2, HSYNC, VDB, VFLG, VSYNC, FLDB
5: NSUB, VI1 to 3, VS1 to 3, DRVCLK
6: HTR
7: HT1, HT2
8: MCKO
9: SDA (Open drain)
10: NSUB2 (Open drain)
Note: The GOUT, GIN, CCDIN, CAP1, CAPA2, YOUT, YIN, CAPB2, MONITOR, REFHIN, REFLIN, REFH, and REFM, REFL pins are not included in the DC characteristics.

Analog Block Electrical Characteristics

• Gain control D/A converter electrical characteristics at Ta = 25°C, V_{DD} = 3.3 V, V_{SS} = 0 V

The D/A converter output signal is output from pin 2.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Resolution					8	Bits
Linearity error					0.5	LSB
Differential linearity error					0.5	LSB
Reference resistance				1.4		kΩ

Block Diagram