

Preliminary

Linear Image Sensor

Linear Image Sensor	
Product Name	S218CLCC24 (1200/600/300 dpi sensor)

Approval		Notes	
CMOS Sensor Inc. 20045 Stevens Creek Blvd., # 1A Cupertino, CA., 95014 Tel: (408) 366-2898 Fax: (408) 366-2841		Approved	Checked
		Designed	
Issued	October 21, 2009	Revision No.	V1.0
All specifications of this device are subject to change without notice.			

Revision control sheet

Rev	Date	From	Description
V1.0	Oct. 21, 2009		Preliminary C218 Single Chip Datasheet

C218 Single Chip

PRODUCT SPECIFICATIONS

Introduction	4
Terminal Description	5
Functional Block Diagram	5
Single Chip Package Layout Diagram	6
Electro-Optical Characteristics	7
Absolute Maximum Rating	9
Recommended Operating Conditions	9
Resolution Select Timing Diagram	9
Timing Diagram	10
Switching Characteristics	12
Switching Waveforms	12
Application Schematic	13
24 pin CLCC Package Outline	15

Introduction

1. Features:

- High Speed up to 4 MHz Pixel rate
- Sensitivity up to 150 V/Lux-Sec for 1200 dpi resolution
- 688 x 1 image sensing elements
- 1200 dots per inch (dpi) resolution
- 1200 / 600 / 300 dpi selectable
- 21.15 μm pixel center-to-center spacing
- On-chip timing and clock driver
- On chip OP amplifier
- Very low fixed pattern noise
- Single 5 V power supply
- 5 V input signal interface
- One analog output

2. Description:

S218CLCC24 linear image sensor consists of buffer circuitry, timing generator, shift register, active pixel element array, chip selector, and on-chip differential amplifier. The timing generator provides all the timing circuitry to operate the device. The active element array consists of 688 active pixel sensors (APS), correlated doubled sampling (CDS) circuitry, and buffer circuitry. The CDS circuitry is made by S/H1 and S/H2 for reset noise cancellation. On chip differential amplifier is used to cancel DC voltage and achieve a very high sensitivity of the analog video output. The on chip differential amplifier is also built-in a power down circuitry that controlled by chip selector to reduce the power consumption when the device is not activated. The center-to-center spacing between two adjacent pixels is 21.15 μm . The photodiodes are parallel-dump and serial-readout controlled by a series of active shift registers. The device is easy to operate. In addition to the power supply, only 2 clock signals (input pulse IP and clock pulse input CP) are required to operate this device.

The length of the sensor chip is about 14.56 mm. This device can be used in a wide variety of applications such as counterfeit, check reader, mark reader, bar code reader, OCR, edge detector, positioning and optical encoding, ..., etc.

Terminal Description

No	Symbol	I/O	Description
1	NC		Not connect
2	IP	I	Input start pulse input
3	CP	I	Clock pulse input
4	RS_SEL	I	1200/ 600/ 300 dpi resolution select Lo: 1200 dpi; Hi: 600 dpi; Pulse*: 300dpi
5	DVDD	I	Logic power supply; 5V
6	DVSS	I	Logic ground; 0V
7	AVSS	I	Analog ground; 0V
8	AVDD	I	Analog power supply; 5V
9	NC		Not connect
10	NC		Not connect
11	VOUT	O	Analog (Video) signal output
12	VREF	I	External reference voltage; Typically 0 ~1V

* See timing block diagram

Table 1. Terminal Description

Functional Block Diagram

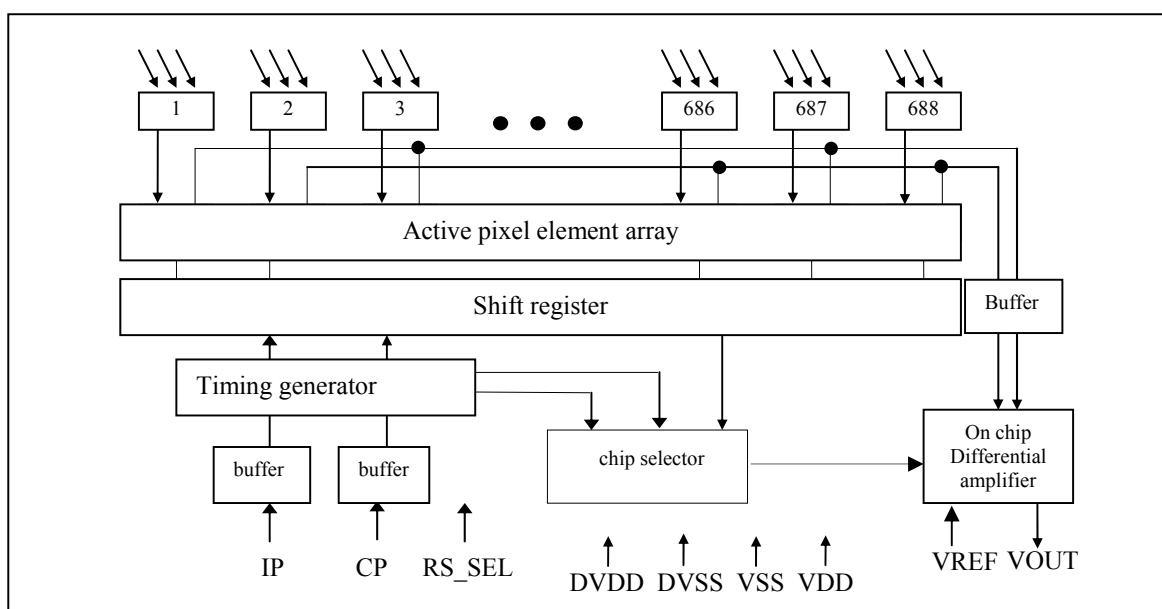


Figure 1. Functional Block Diagram

Single chip package layout diagram



Figure 2. Single chip package layout diagram

Electro-Optical Characteristics

Test conditions:

Measured at $\phi_{CP} = 2$ MHz, $V_{DD} = 5V$, $t_{int}^{*(1)} = 0.66$ ms, $\lambda^{*(2)} = 565$ nm, $Gain^{*(3)} = 1$,
 $TA^{*(4)} = 25$ °C, light intensity = 10 LUX.

[See readout circuitry (unless otherwise noted).]

Symbol	Description	Test Conditions	Min	Typ	Max	Unit
	Sensitivity			150		V/lux s
V_{ref}	Reference voltage			1.0		V
f_{clk}	Clock frequency			4		MHz
f_{pix}	Pixel rate			4		MHz
V_n	Random noise			-		mVrms
$V_c^{*(5)}$	Compensated analog output voltage	Light on		1.0		V
$U_c^{*(6)}$	Compensated non-uniformity	Pixel 2 ~ 687**	-10	---	+10	%
$U_{p_5pix}^{*(7)}$	8 pixel white level non-uniformity	Every 8 pixels	-10	---	10	%
$U_{cadj}^{*(8)}$	Compensated adjacent pixel non-uniformity		-10	---	10	%
$V_d^{*(9)}$	Analog output voltage at dark level	Light off		1.0		V
$U_d^{*(10)}$	Dark signal non-uniformity				100	mV
	Image lag				5	%

Table 2. Electro-Optical characteristics

Definition:

- t_{int} is the integration time. It is equal to the interval between two start pulses.
- λ is the wavelength of the light source
- Gain is the gain of an off-chip video operation amplifier.
- TA is the ambient temperature.
- $V_c = (V_{cmax} + V_{cmin}) / 2$
 where V_{cmax} is the maximum compensated voltage of the whole array.
 V_{cmin} is the minimum compensated voltage of the whole array.
- U_c is the pixel-to-pixel compensated photo response nonuniformity within a chip.
 $U_c = [(V_{cmax} - V_{cmin}) / 2] / V_c \times 100\%$
- $U_{p_8pix} = \text{Max} \{ \text{Max}[(V_p(i), V_p(i+1), \dots, V_p(i+7))] - \text{Min}[(V_p(i), V_p(i+1), \dots, V_p(i+7))] \} /$
 $\{ \text{Max}[V_p(i), V_p(i+1), \dots, V_p(i+7)] + \text{Min}[V_p(i), V_p(i+1), \dots, V_p(i+7)] \}$
 $(i = 1, 2, \dots,)$
 where $V_p(i)$ is the video signal output of a pixel # i
 $V_p(i+1)$ is the video signal output of a pixel # (i+1)
 \vdots
 \vdots
 $V_p(i+7)$ is the video signal output of a pixel # (i+7)
- $U_{cadj} = \text{Max} [(V_c(i) - V_c(i+1)) / V_c(i)] \times 100\%$, $(i = 2, 3, \dots, 687)$
 where $V_c(i)$ is the compensated video signal output of a pixel # i
 $V_c(i+1)$ is the compensated video signal output of a pixel # (i+1)
- $V_d = (V_{dmax} + V_{dmin}) / 2$

S218CLCC24

where V_{dmax} is the maximum dark voltage of the whole array.

V_{dmin} is the minimum dark voltage of the whole array.

10. $U_d = V_{dmax} - V_{dmin}$

** Pixel # 1 and # 688 measured by U_{p_8pix}

Absolute maximum ratings:

Power supply voltage, V_{DD}	-----	7 V
Power supply current, I_{DD}	-----	20 mA
Digital input voltage range, V_{ih}	-----	V_{DD}
Digital input current range, I_{ih}	-----	-10 mA to 10 mA
Operating free-air temperature range, T_A	-----	0 °C ~ 50 °C
Storage temperature range, T_{stg}	-----	25 °C ~ 70 °C

≠ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress rating only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Recommended operating conditions:

Item	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V_{DD}	4.5	5	5.5	V
Power supply current	I_{DD}		10		mA
Input voltage	V_i			V_{DD}	V
High level input voltage	V_{ih}	$V_{DD} \times 0.7$		V_{DD}	V
Low level input voltage	V_{iL}	0		$V_{DD} \times 0.3$	V
Clock frequency	f		4		MHz
Sensor integration time	t_{int}		0.2		ms
Wavelength of light source	λ	450		950	nm
Clock pulse high duty cycle		25	50	75	%
Operating free-air temperature	T_A	0		50	°C

Table 3 Recommended operating conditions.

Resolution select timing diagram

RS_SEL Value	At 4th Clock Rising Edge	At 20th Clock Rising Edge	Mode
RS_SEL=Lo	L	L	1200dpi
RS_SEL=Hi	H	H	600dpi
RS_SEL=Pulse	L	H	300dpi

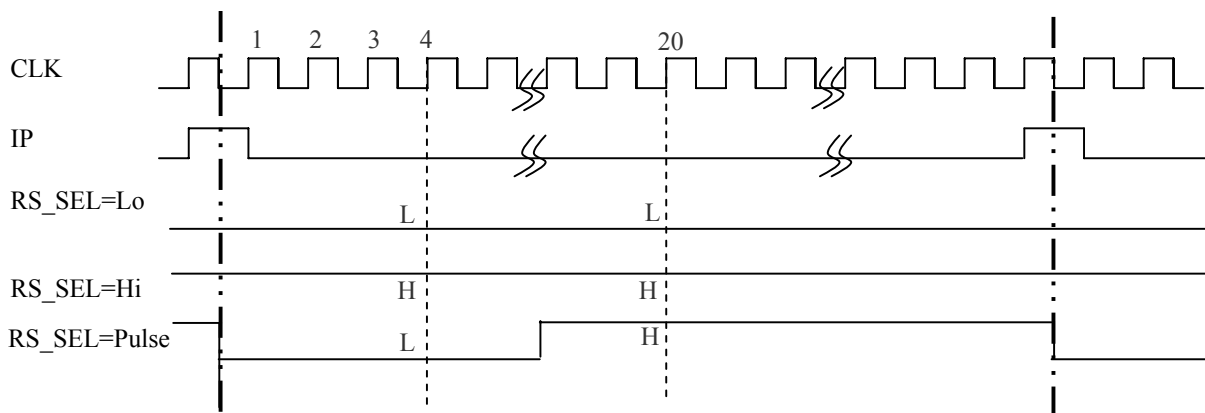


Figure 3. Resolution Select

External Interface Timing Diagram for 1200dpi

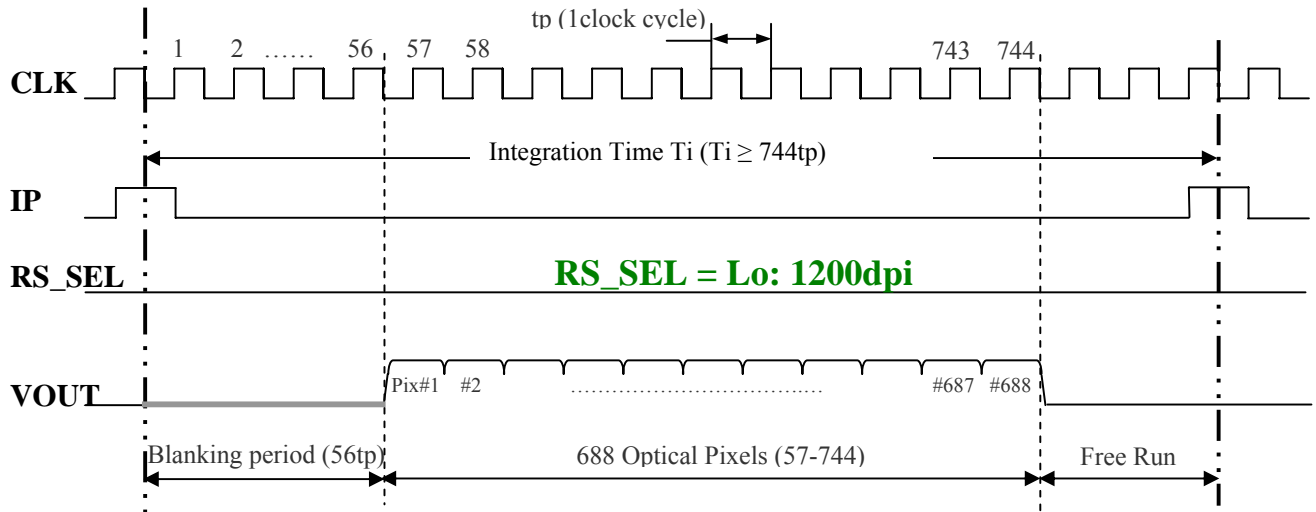


Figure 4. Timing block diagram for 1200dpi

External Interface Timing Diagram for 600dpi

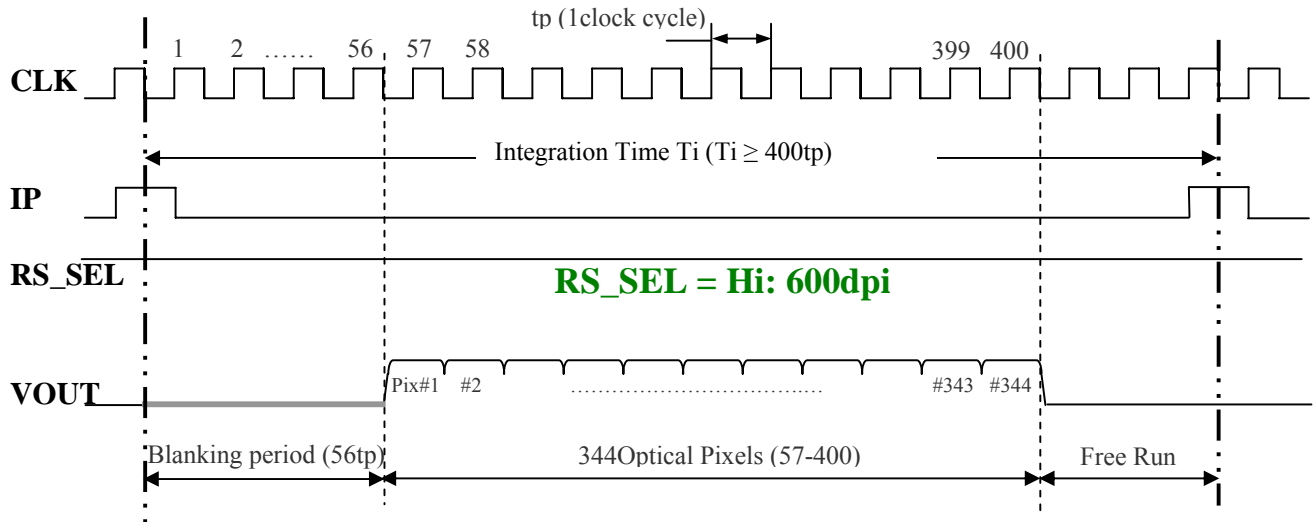


Figure 5. Timing block diagram for 600dpi

External Interface Timing Diagram for 300dpi

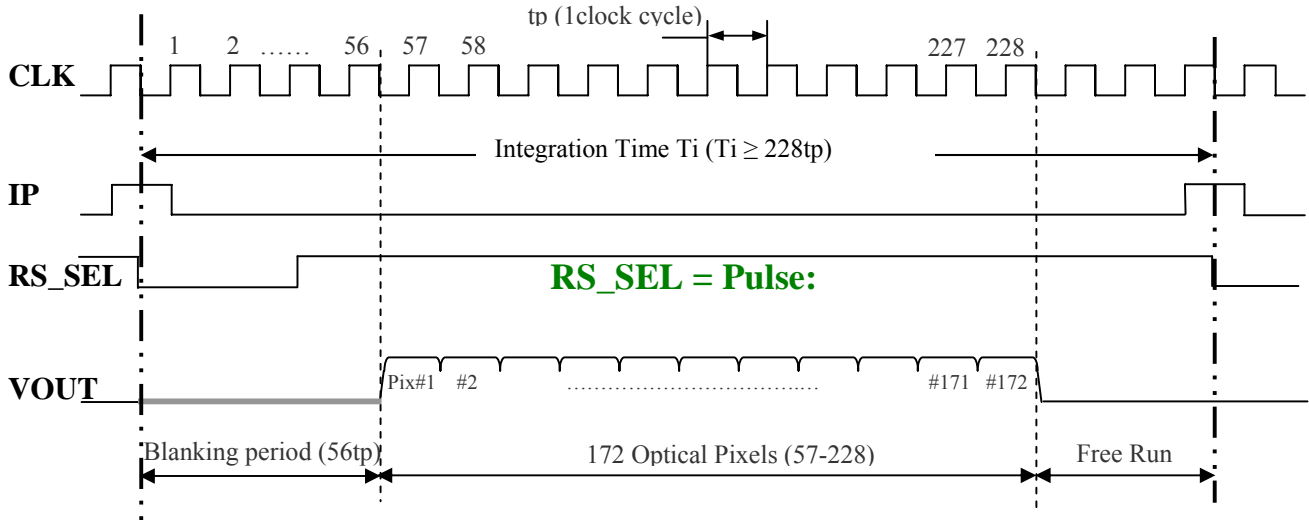


Figure 6. Timing block diagram for 300dpi

Switching Characteristics

Item	Description	Symbol	Min	Typ.	Max	Unit
1	Clock cycle time	t_o		250		ns
2	Clock pulse duty cycle: t_w / t_o			50		%
3	Clock pulse width	t_w		100		ns
4	ϕ_{Sp} setup time	t_{ss}	50			ns
5	ϕ_{Sp} hold time	t_{sh}	50			ns
6	Video digital delay time	t_{pd}		50		ns
8	Video signal stable time	t_s		100		ns

Table 4. Switching characteristics

Switching Waveforms

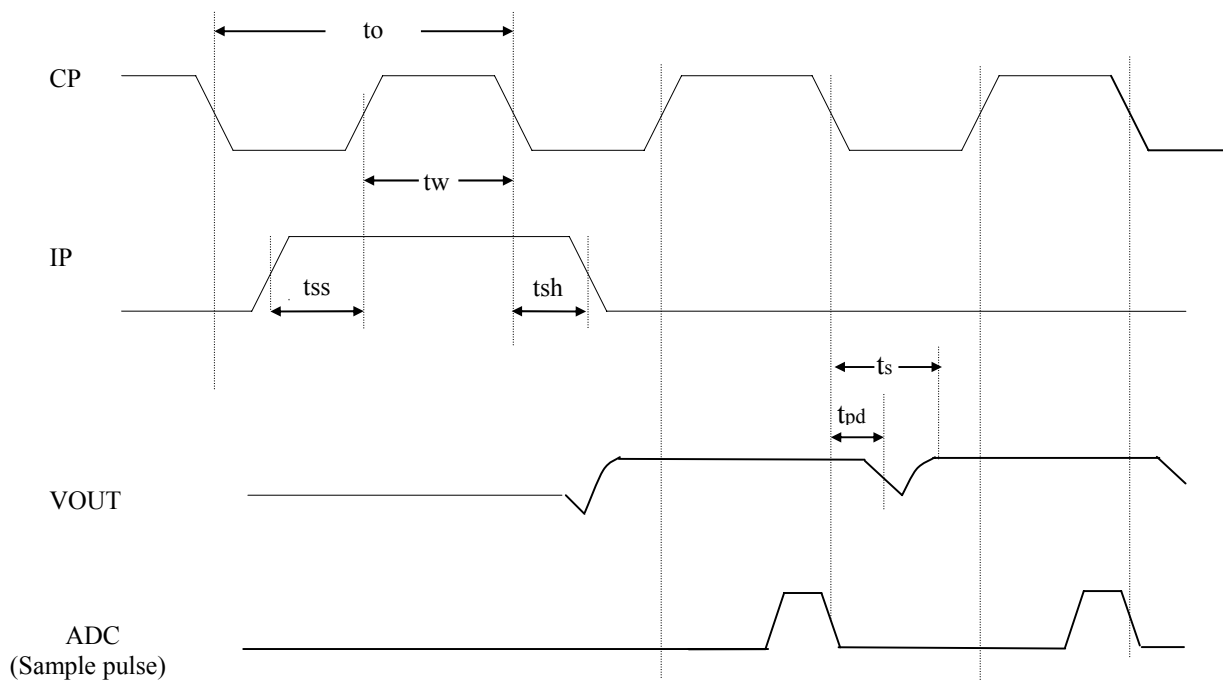


Figure 7. Switching waveforms

Application Schematic

Figure 8 and 9 shows the typical application schematic of the sensor chip.

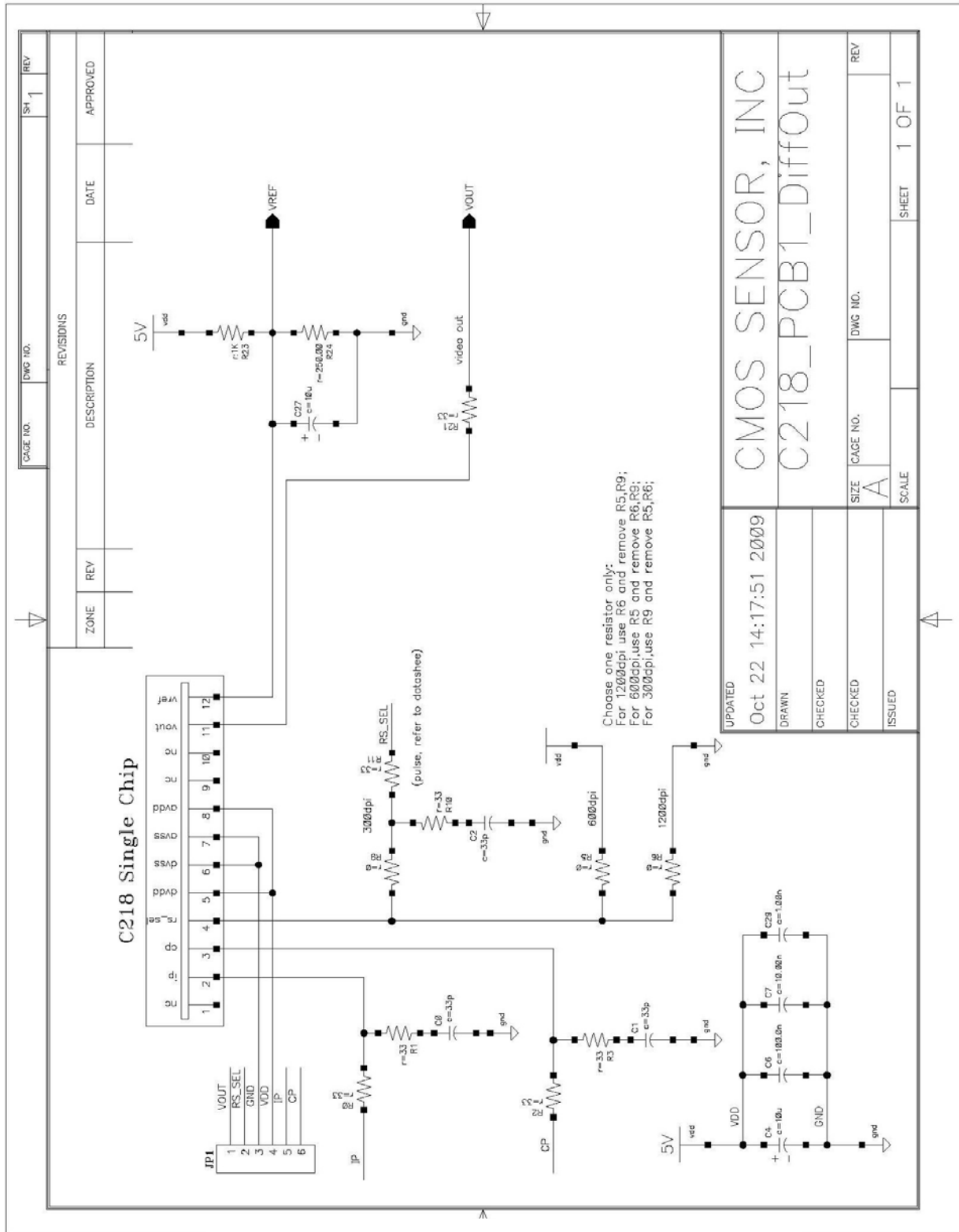


Figure 8. Typical application for differential output

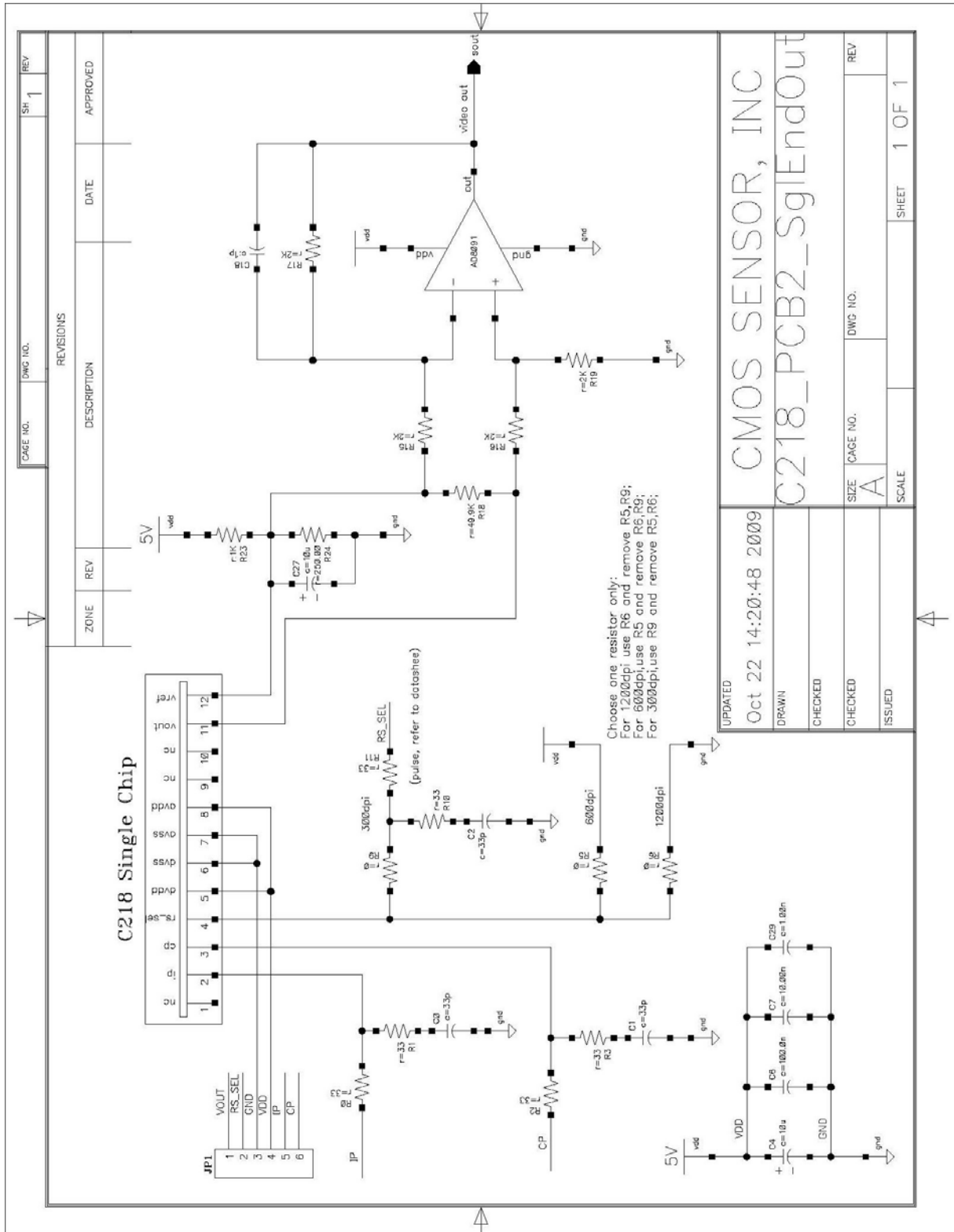
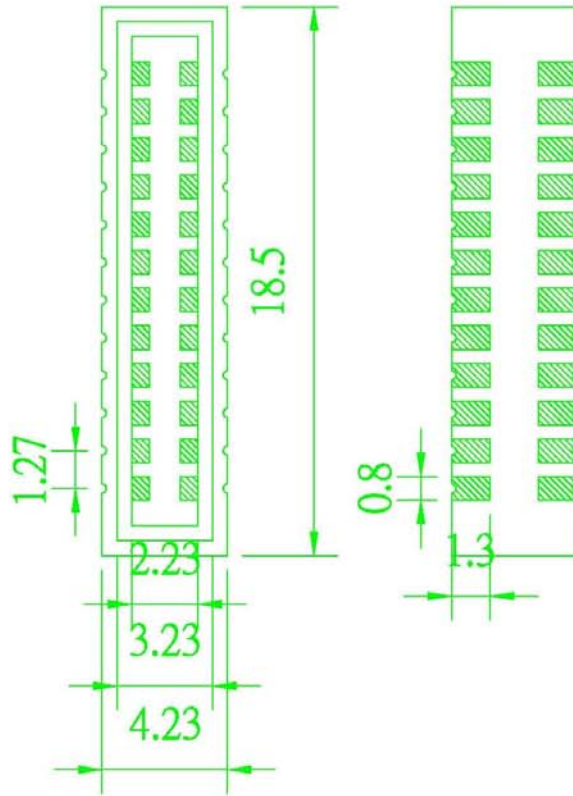
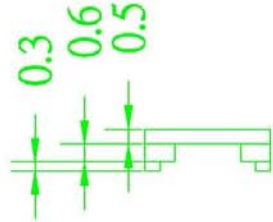


Figure 9. Typical application for differential output



Attachment: 24 pin CLCC Package Outline

Device		CMOS SENSOR INC.	
24 pin package		Date	Version
Unit	mm	Designer	Tom_Hsiao
		Drawing	

CMOS Sensor, Inc. reserves the right to make changes to its products or to discontinue any semiconductor product without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

CMOS Sensor, Inc. assumes no liability for application assistance, customer product design, or infringement of patents or services described herein. Nor does CMOS Sensor, Inc.'s warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of CMOS Sensor Inc. covering or relating to any combination, machine, or process in which such products or services might be or are used.