General Description

The iP2970 provides a single-chip total solution for the camera control processor, which interfaces with various CMOS sensor in the USB 2.0 full-speed applications. It incorporates all the necessary digital functions, such as ISP (Image Signal Processing) and Motion JPEG compression, motion detection. Image quality is enhanced by proprietary algorithms for AWB, AE, and gamma correction.. It supports various VGA sensors from different suppliers, with 9-bit raw data or 8-bit YUV422 format. Furthermore, built-in ADC can support Audio function. Only a single 3.3V voltage supply is required for the chip operation, and off-chip memory is not required. In power consumption, it implements low power due to proper power scheme.
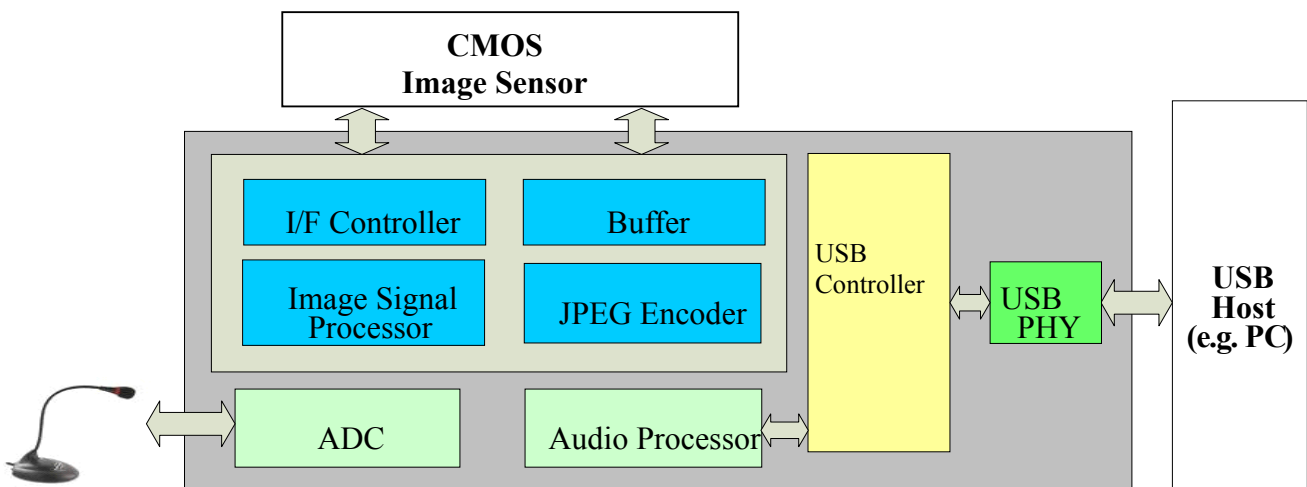
Features

- Support CMOS sensor : VGA(350K Pixel) resolution
- Support Motion Detection function.
- Built-in JPEG encoder with adjustable compression ratios to achieve optimal image quality and data
- Support input data formats of 9-bit raw data and 8-bit YUV422 of CMOS Sensor

Features (Cont.)

- Auto gain control for each R/G/B channel
- Enhanced image process engine
- Frame rate up to 30fps @ 640x480 resolution
- Gamma correction function
- Auto white balance function (AWB)
- Auto exposure function (AE)
- On chip 1 channel ADC support audio function
- Support customer device descriptors (VID/PID/String) with external EEPROM
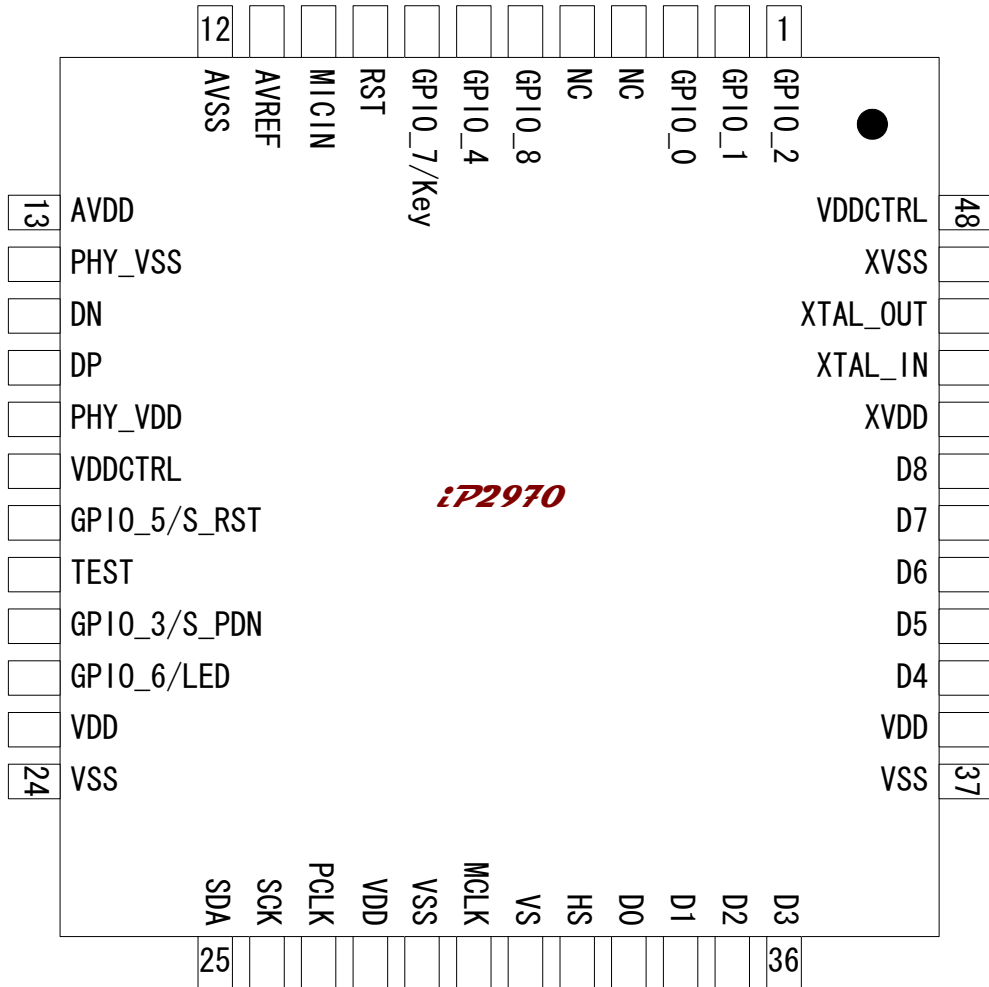- 48 pin LQFP package

Block Diagram

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Pin Configuration

```
         12                                                    1
          ┌──┐ ┌┐ ┌┐ ┌┐ ┌┐ ┌┐ ┌┐ ┌┐ ┌┐ ┌┐ ┌──┐
          │  │                                          │  │      ●
    ┌─────┴──┴──────────────────────────────────────────┴──┴──────┐
 13 │ AVDD                                              VDDCTRL    │ 48
    │ PHY_VSS                                               XVSS   │
    │ DN                                                XTAL_OUT   │
    │ DP                                                 XTAL_IN   │
    │ PHY_VDD                                               XVDD   │
    │ VDDCTRL          iP2970                                  D8   │
    │ GPIO_5/S_RST                                            D7   │
    │ TEST                                                    D6   │
    │ GPIO_3/S_PDN                                            D5   │
    │ GPIO_6/LED                                              D4   │
    │ VDD                                                    VDD   │
 24 │ VSS                                                    VSS   │ 37
    └─────┬──┬──────────────────────────────────────────┬──┬──────┘
        25 └──┘                                          └──┘ 36
```

Top pins (left to right, 12 to 1): AVSS, AVREF, MICIN, RST, GPIO_7/Key, GPIO_4, GPIO_8, NC, NC, GPIO_0, GPIO_1, GPIO_2

Bottom pins (left to right, 25 to 36): SDA, SCK, PCLK, VDD, VSS, MCLK, VS, HS, D0, D1, D2, D3

Pin Description

Pin No.	Name	Attribution	Description
1	GPIO_2	B	General purpose IO pin
2	GPIO_1	B	General purpose IO pin
3	GPIO_0	B	General purpose IO pin
4	NC		No connection
5	NC		No connection
6	GPIO_8	B	General purpose IO pin
7	GPIO_4	B	General purpose IO pin
8	GPIO_7/ KEY	B I	General purpose IO pin Used for Snapshot function
9	RESET	I	Reset, active high
10	MICIN	I	ADC Microphone input
11	AVREF	I	ADC reference voltage
12	AVSS	P	ADC analog ground, 0V
13	AVDD	P	ADC analog power, 3.3V
14	PHY_VSS	P	Ground pin for PHY
15	DN	B	USB differential pin
16	DP	B	USB differential pin
17	PHY_VDD	P	3.3V power for PHY
18	VDDCTRL	P	Power control pin
19	GPIO_5/ S_RST	B O	General purpose IO pin Sensor reset pin
20	TEST	I	Test pin
21	GPIO_3/ S_PDN	B O	General purpose IO pin Sensor power down
22	GPIO_6/ LED	B O	General purpose IO pin Used for LED light
23	VDD	P	3.3V power pin
24	VSS	P	Ground pin
25	SDA	B	SDA signal of the I2C interface
26	SCL	B	SCL signal of the I2C interface
27	PCLK	B	Pixel clock to/from sensor
28	VDD	P	3.3V power pin
29	VSS	P	Ground pin
30	MCLK	O	Master clock (to sensor)
31	VS	O	Vertical synchronous from sensor
32	HS	O	Horizontal synchronous from sensor
33	D0	I	Data input from the sensor, Raw data
34	D1	I	Data input from the sensor, Raw data or YUV
35	D2	I	Data input from the sensor, Raw data or YUV
36	D3	I	Data input from the sensor, Raw data or YUV
37	VSS	P	Ground pin
38	VDD	P	3.3V power pin
39	D4	I	Data input from the sensor, Raw data or YUV

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40	D5	I	Data input from the sensor, Raw data or YUV
41	D6	I	Data input from the sensor, Raw data or YUV
42	D7	I	Data input from the sensor, Raw data or YUV
43	D8	I	Data input from the sensor, Raw data or YUV
44	VDD	P	3.3V power pin
45	XTAL_IN	I	Crystal input, 12MHz
46	XTAL_OUT	O	Crystal output
47	VSS	P	Ground pin
48	VDDCTRL	P	Power control pin

Reset Timing

T1 : 200 uSec (Min)
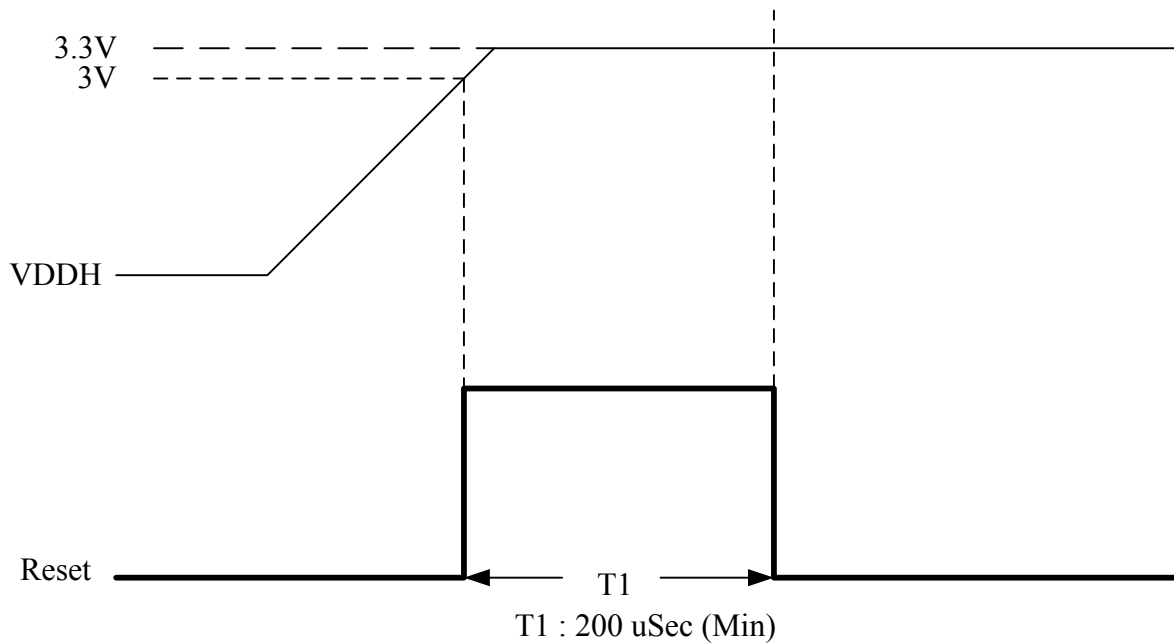
Recommended Operating Conditions

Operating Conditions	Min	Typ	Max
I/O DC supply Voltage	3.0V	3.3V	3.6V
VDDCTRL	1.62V	1.8V	1.98V
Temperature	0℃	25℃	70℃

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DC Electrical Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IL}	Low level Input Voltage	CMOS interface			0.8	V
V_{IH}	High level Input Voltage	CMOS interface	2.0			V
V_{OL}	Low level Output Voltage	I_{OL}= 4mA			0.4	V
V_{OH}	High level Output Voltage	I_{OH}= 4mA	2.4			V
V_{TH}	Switch threshold	CMOS ibterface	1.2	1.3	1.4	V
		Schmitt-falling-trigger	0.8	0.9	1.0	V
		Schmitt-rising-trigger	1.45	1.55	1.65	V
R_{PU}	Input pull-up resistance	V_{IN}=0	34	41	64	kΩ
R_{PD}	Input pull-down resistance	V_{IN}=VDDH	33	44	79	kΩ
I_I	Input Current	V_{DD} =MAX, $0V \leqq V_{IN} \leqq 3.6V$	-10		10	μA
	Input Current with 40kΩ pull-down	V_{IN}=Vdd	40		160	μA
	Input Current with 40kΩ pull-up	V_{IN}=0	-160		40	μA
I_{VPP}	Normal Program Current	$V_{PP}=V_{PPMAX}$, PTM=0x02, $V_{DD}=V_{DDMAX}$, POEB=V_{DD}, PCEB=PWEB=0		2	5	mA
	Accelerated Program Current	$V_{PP}=V_{PPMAX}$, PTM=0x03, $V_{DD}=V_{DDMAX}$, POEB=V_{DD}, PCEB=PWEB=0		8	20	mA
	Standby Current	PA=0/V_{DD}, PTM=0x00, $V_{DD}=V_{PP}=V_{DD MAX}$, PCLK=0/V_{DD}, POEB=V_{DD}, PCEB=PWEB=V_{DD}			1	μA

AC Electrical Characteristics

Symbol	Description	Mode	Maximum operating frequency	Unit
MCLK	Master clock	-	48	MHz
XTAL_IN	Crystal Input	-	12	MHz
SCL	Serial I/F clock	SPI	2	MHz
PCLK	Pixel Clock		27	MHz

Package Information

- **48 Pin LQFP**
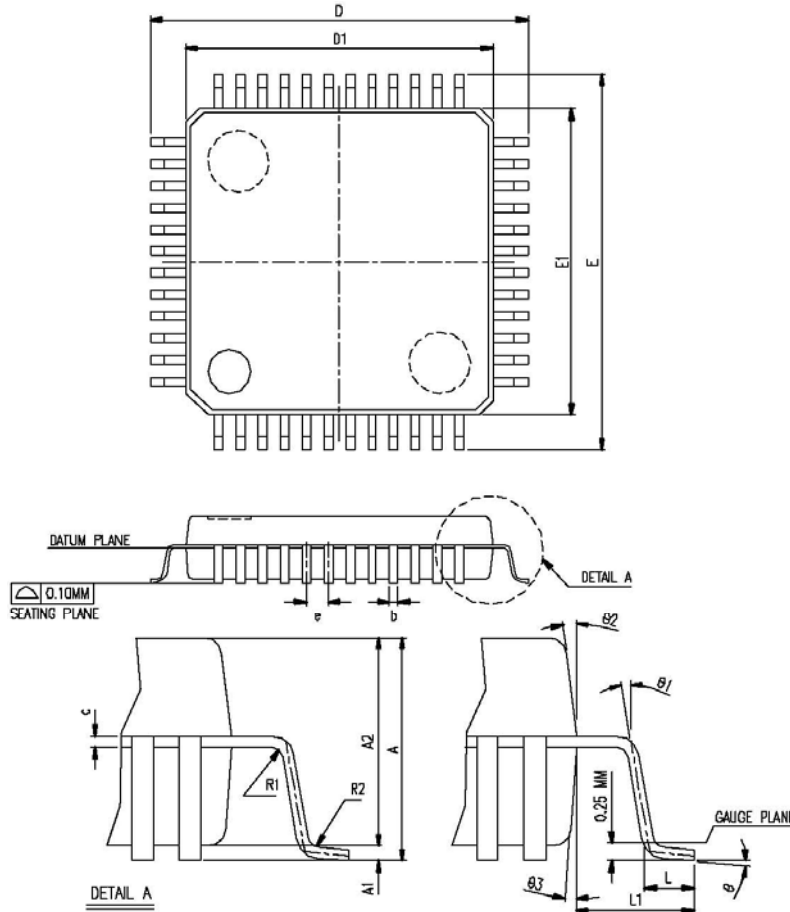
SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A			1.60			0.063
A1	0.05		0.15	0.001		0.006
A2	1.35	1.40	1.45	0.053	0.055	0.057
b	0.17	0.22	0.27	0.007	0.009	0.011
c	0.09		0.20	0.004		0.008
e	0.50 BASIC			0.020 BASIC		
D	9.00 BASIC			0.354 BASIC		
D1	7.00 BASIC			0.276 BASIC		
E	9.00 BASIC			0.354 BASIC		
E1	7.00 BASIC			0.276 BASIC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00 REF.			0.039 REF.		
R1	0.08			0.003		
R2	0.08		0.20	0.003		0.008
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°			0°		
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°
JEDEC	MS-026 (BBC)					

*NOTES : DIMENSIONS " D1 " AND " E1 " DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 mm PER SIDE. " D1 " AND " E1 " ARE MAXIMUM PLASTIC BODY SIZE DIMENSIONS INCLUDING MOLD MISMATCH.