

DATA SHEET



GPCV1248A

Vehicle Camera Recorder SOC Solution

Preliminary

Oct. 15, 2014

Version 0.1

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VEHICLE CAMERA RECORDER SOC SOLUTION

1. GENERAL DESCRIPTION

The GPCV1248A, a highly integrated SoC (System-On-a-Chip) for vehicle camera recorder, is based on a high performance and power efficient ARM7TDMI core operating at up to 144MHz and is enhanced with image, video processing, power saving, and system peripherals.

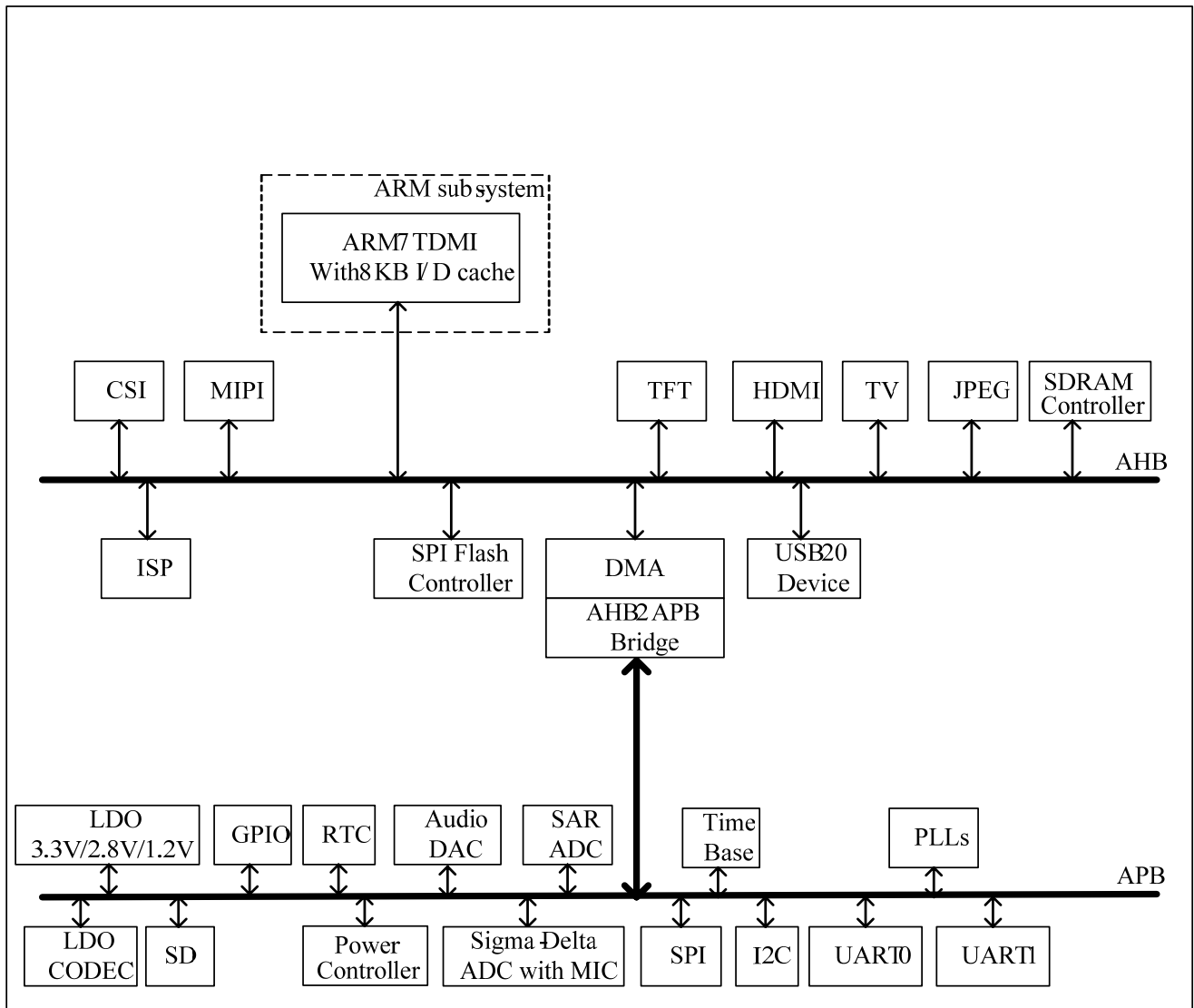
The high-speed MJPEG engine is capable of supporting up to 720P 30fps video compression. Other main features include a high-performance Image Signal Processing (ISP) hardware-accelerating pipeline to boost the conventional raw-data CMOS sensor up to 3M pixels and an HDMI Tx for HDTV output to deliver high-resolution graphics. The GPCV1248A processor is designed to connect with various types of memory card interfaces such as SD, SDHC, SDIO, and MMC.

These fully featured peripherals and functions make GPCV1248A one of the best vehicle camera SoC solutions in the industry-making your products more competitive in today's market.

2. FEATURES

- ARM7TDMI CPU with 8KB unified ID-cache, embedded JTAG ICE, and working frequency up to 144MHz.
- JPEG CODEC supports MJPEG 1280x720 30fps encode/decode function.
- ISP for CMOS sensor raw data processing.
- SPI Flash controller which supports 1-bit/2-bit/4-bit IO mode. The max. freq. of SPI clock is 70MHz.
- HDMI V1.2 supports both 480p and 720p
- TV encoder with 10-bit VDAC
- Video-in & CMOS sensor interface and CCIR601/CCIR656 standard supported.
- MIPI RX with one data lane supported.
- TFT-LCD controller.
 - UPS051. (serial RGB)
 - UPS052. (serial RGB dummy)
 - Parallel-RGB with 18/16/8-bit data(6-6-6,5-6-5,8)
 - I80 (8-bit system bus) I/F type.
 - CCIR601/CCIR656.
- Universal Serial Bus (USB) 2.0 high/full speed compliance device.
- Watchdog timer.
- SD/ SDHC/ SDIO/ MMC card interfaces.
- SPI (master/slave) interface with data rate up to 24Mbps.
- Two UART (asynchronous serial I/O) interfaces with baud rate up to 1.8432Mbps and 115.2Kbps. The UART interface can be configured as smart card interface(ISO7816)
- I2C controller
- Built-in power control macro which provide two power control pin for power on/off control and 2 PWM output for driving LED.
- 3.6V(BAT_IN) to 3.3V LDO for I/O
- 3.3V to 1.2V LDO for core logic
- 3.6V(BAT_IN) to 2.8V LDO for CMOS sensor
- Dedicated 3.6V(BAT_IN) to 3.3V LDO for ADC/DAC.
- Independent power Real-time clock (RTC).
- Internal 12MHz generator(XCKGEN) with 32768Hz Crystal input.
- 16-bit stereo DAC (2-channel) for audio playback.
- 12-bit ADC with four line-in channels and two internal channels for battery and 1.2V measurement.
- 16-bit Sigma-Delta ADC with MIC and PGA
- LQFP128

3. BLOCK DIAGRAM



4. SIGNAL DESCRIPTION

PKG No	Name	Group	Type	Normal Function Description
1	X32KO	RTC	AO	X'tal 32768Hz output
2	PLL_V33	PLL	P	3.3V PLL Power
3	X12MI	PLL	AI	X'tal 12MHz input
4	V12	CORE PWR	P	1.2V Core Power
5	VSS	Digital GND	P	Digital ground
6	IOD15	SD	IO	SD DATA2
7	IOD12	SD	IO	SD DATA3
8	IOD10	SD	IO	SD CMD
9	IOD11	SD	IO	SD CLK
10	IOD13	SD	IO	SD DATA0
11	IOD14	SD	IO	SD DATA1
12	IOA8	GPIO	IO	IOA8
13	IOA9	I2C	IO	I2C_SCL
14	IOA10	I2C	IO	I2C_SDA
15	V33	IO PWR	P	3.3V IO Power
16	IOA11	TFT	IO	TFT CS
17	IOA12	GPIO	IO	IOA12
18	IOA13	GPIO	IO	IOA13
19	VSS	Digital GND	P	Digital ground
20	IOA14	GPIO	IO	IOA14
21	IOA15	GPIO	IO	IOA15
22	IOB5	GPIO	IO	IOB5
23	IOB4	TFT	IO	TFT TE
24	IOB3	TFT	IO	TFT CLK
25	IOB2	TFT	IO	TFT VSYNC
26	IOB1	TFT	IO	TFT HSYNC
27	IOB0	TFT	IO	TFT DE
28	IOC12	ICE	IO	JTAG TDI
29	IOC13	ICE	IO	JTAG TDO
30	V12	CORE PWR	P	1.2V Core Power
31	IOC14	ICE	IO	JTAG TCK
32	V33	IO PWR	P	3.3V IO Power
33	IOC15	ICE	IO	JTAG TMS
34	VSS	Digital GND	P	Digital ground
35	IOB8	GPIO	IO	IOB8
36	IOB9	GPIO	IO	IOB9
37	IOB10	GPIO	IO	IOB10
38	IOB11	GPIO	IO	IOB11
39	IOB12	GPIO	IO	IOB12
40	IOB13	GPIO	IO	IOB13
41	IOB14	GPIO	IO	IOB14
42	IOB15	GPIO	IO	IOB15
43	USB_VDA_V33	USB	P	3.3V USB Power
44	DM	USB	AIO	USB DM

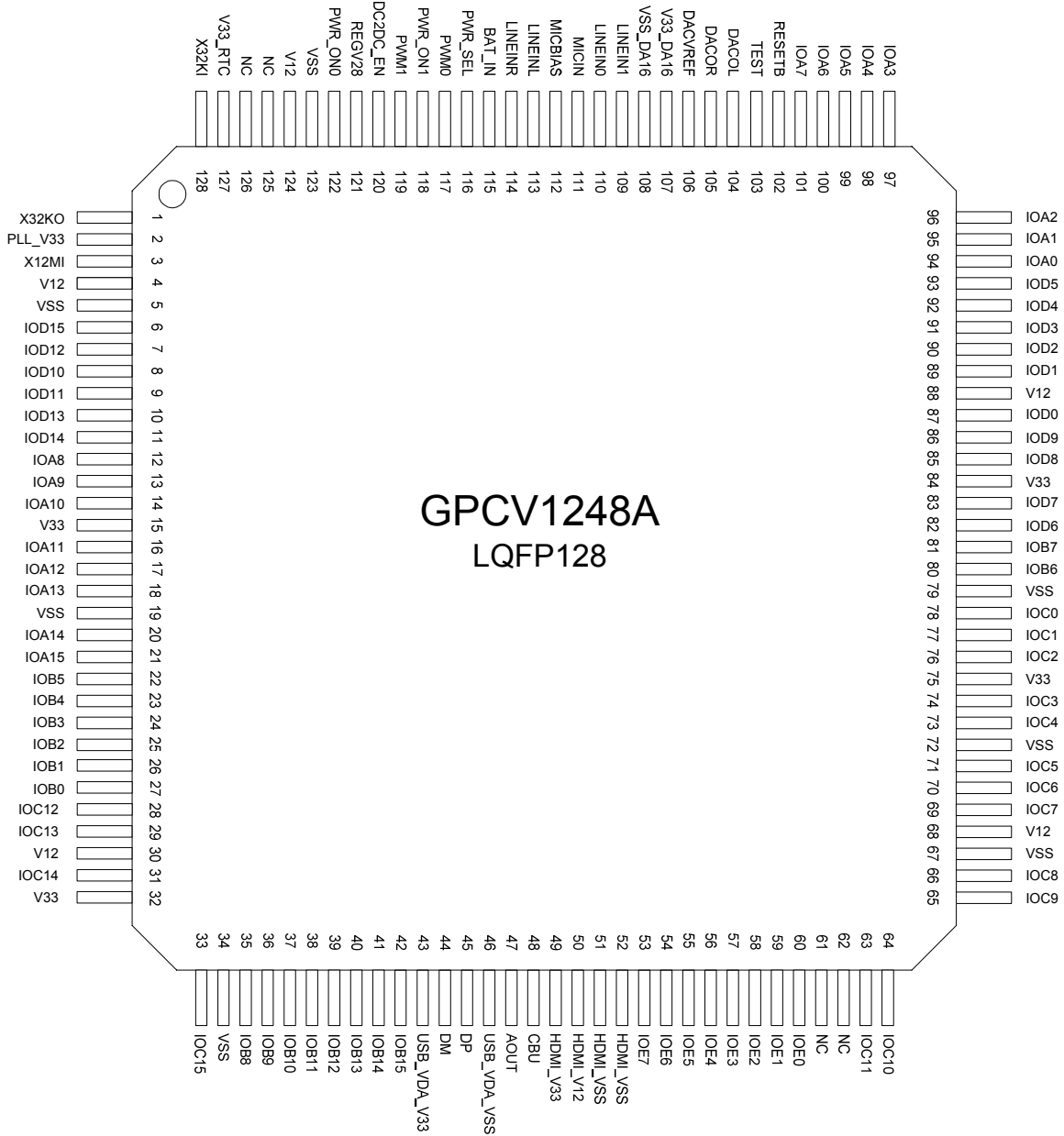
PKG No	Name	Group	Type	Normal Function Description
45	DP	USB	AIO	USB DP
46	USB_VDA_VSS	USB	P	USB Ground
47	AOUT	VDAC	AO	VDAC AOUT
48	CBU	VDAC	AO	VDAC CBU
49	HDMI_V33	HDMI	P	3.3V HDMI Power
50	HDMI_V12	HDMI	P	1.2V HDMI Power
51	HDMI_VSS	HDMI	P	HDMI ground
52	HDMI_VSS	HDMI	P	HDMI ground
53	IOE7	HDMI	IO	HDMI TXP2
54	IOE6	HDMI	IO	HDMI TXN2
55	IOE5	HDMI	IO	HDMI TXP1
56	IOE4	HDMI	IO	HDMI TXN1
57	IOE3	HDMI	IO	HDMI TXP0
58	IOE2	HDMI	IO	HDMI TXN0
59	IOE1	HDMI	IO	HDMI TXCP
60	IOE0	HDMI	IO	HDMI TXCN
61	NC			
62	NC			
63	IOC11	CSI	IO	CSI VSYNC
64	IOC10	CSI	IO	CSI HSYNC
65	IOC9	CSI	IO	CSI CLKO
66	IOC8	CSI	IO	CSI CLKI
67	VSS	Digital GND	P	Digital ground
68	V12	CORE PWR	P	1.2V Core Power
69	IOC7	CSI	IO	CSI D9
70	IOC6	CSI	IO	CSI D8
71	IOC5	CSI	IO	CSI D7
72	VSS	Digital GND	P	Digital ground
73	IOC4	CSI	IO	CSI D6
74	IOC3	CSI	IO	CSI D5
75	V33	IO PWR	P	3.3V IO Power
76	IOC2	CSI	IO	CSI D4
77	IOC1	CSI	IO	CSI D3
78	IOC0	CSI	IO	CSI D2
79	VSS	Digital GND	P	Digital ground
80	IOB6	CSI	IO	CSI D0
81	IOB7	CSI	IO	CSI D1
82	IOD6	SPI	IO	SPI CS
83	IOD7	SPI	IO	SPI CLK
84	V33	IO PWR	P	3.3V IO Power
85	IOD8	SPI	IO	SPI TX
86	IOD9	SPI	IO	SPI RX
87	IOD0	SPIF	IO	SPI Flash CSB
88	V12	CORE PWR	P	1.2V Core Power
89	IOD1	SPIF	IO	SPI Flash CLK

PKG No	Name	Group	Type	Normal Function Description
90	IOD2	SPIF	IO	SPI Flash RX0
91	IOD3	SPIF	IO	SPI Flash RX1
92	IOD4	SPIF	IO	SPI Flash RX2
93	IOD5	SPIF	IO	SPI Flash RX3
94	IOA0	TFT	IO	TFT D0
95	IOA1	TFT	IO	TFT D1
96	IOA2	TFT	IO	TFT D2
97	IOA3	TFT	IO	TFT D3
98	IOA4	TFT	IO	TFT D4
99	IOA5	TFT	IO	TFT D5
100	IOA6	TFT	IO	TFT D6
101	IOA7	TFT	IO	TFT D7
102	RESETB	SYSTEM	I	External RESETB(Low active)
103	TEST	SYSTEM	I	Test enable(High active)
104	DACOL	AuDAC	AO	Audio DAC left channel output
105	DACOR	AuDAC	AO	Audio DAC right channel output
106	DACVREF	AuDAC	AO	Audio DAC/CODEC ADC VREF
107	V33_DA16	AuDAC	P	3.3V Power for AuDAC/CODEC ADC/SAR ADC
108	VSS_DA16	AuDAC	P	Ground for AuDAC/CODEC ADC/SAR ADC
109	LINEIN1	SAR ADC	AI	SAR ADC LINEIN1
110	LINEIN0	SAR ADC	AI	SAR ADC LINEIN0
111	MICIN	CODEC ADC	AI	CODEC ADC microphone input
112	MICBIAS	CODEC ADC	AO	CODEC ADC microphone bias output
113	LINEINL	CODEC ADC	AI	CODEC ADC left channel input
114	LINEINR	CODEC ADC	AI	CODEC ADC right channel input
115	BAT_IN	SYSTEM	P	Battery input
116	PWR_SEL	SYSTEM	I	Power mode selection 0: enable internal LDO33 1: disable internal LDO33
117	PWM0	SYSTEM	AO	PWM0 output; PWM0 can work even 3.3V and 1.2V is off. Only sink current capability.
118	PWR_ON1	SYSTEM	AI	Power on key 1
119	PWM1	SYSTEM	AO	PWM1 output; PWM0 can work even 3.3V and 1.2V is off. Only sink current capability.
120	DC2DC_EN	SYSTEM	AO	DC2DC_EN output for external DC2DC or LDO control
121	REGV28	SYSTEM	P	2.8V LDO output
122	PWR_ON0	SYSTEM	A1	Power on key 0
123	VSS	Digital GND	P	Digital ground
124	V12	CORE PWR	P	1.2V Core Power
125	NC			
126	NC			
127	V33_RTC	RTC	P	3.3V RTC power; Don't short V33_RTC with other 3.3V power.
128	X32KI	RTC	AI	X'tal 32768

Note: AO: Analog Output, AI: Analog Input

4.1. Package Pin Sequence

LQFP128 Package Top View



5. ELECTRICAL SPECIFICATIONS

5.1. Absolute Maximum Rating

Rating	Symbol	Value	Unit
Supply Voltage 1	BAT_IN	-0.3 to 3.6	V
Supply Voltage 2	V33_RTC	-0.3 to 3.6	V
Supply Voltage 3	V33	-0.3 to 3.6	V
Supply Voltage 4	PLL_V33	-0.3 to 3.6	V
Supply Voltage 5	USB_VDA_V33	-0.3 to 3.6	V
Supply Voltage 6	HDMI_V33	-0.3 to 3.6	V
Supply Voltage 7	V33_DA16	-0.3 to 3.6	V
Supply Voltage 8	REG28	-0.3 to 3.6	V
Supply Voltage 9	HDMI_V12	-0.3 to 1.32	V
Supply Voltage 10	V12	-0.3 to 1.32	V
Input Voltage	V _{IN}	-0.3 to 3.6	V
Operating Temperature	T _A	-40~70	°C
Storage Temperature	T _{STG}	-40 to +150	°C

5.2. DC Characteristics

Characteristic	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
Supply Voltage 1	BAT_IN	2.7	3.3	3.6	V	-
Supply Voltage 2	V33_RTC	2.7	3.3	3.6	V	-
Supply Voltage 3	V33	2.7	3.3	3.6	V	-
Supply Voltage 4	PLL_V33	2.7	3.3	3.6	V	-
Supply Voltage 5	USB_VDA_V33	3.0	3.3	3.6	V	-
Supply Voltage 6	HDMI_V33	2.7	3.3	3.6	V	-
Supply Voltage 7	V33_DA16	2.7	3.3	3.6	V	-
Supply Voltage 8	REG28	2.7	3.3	3.6	V	-
Supply Voltage 9	HDMI_V12	1.08	1.2	1.32	V	-
Supply Voltage 10	V12	1.08	1.2	1.32	V	-
Operating Current	I _{OP}	-	180	-	mA	@144MHz, V33=3.3V, V12=1.32V, Sensor + ISP + JPEG encode 720p@30fps with 64Mb SDRAM; USB/VDAC/ADAC/CODEC ADC/SAR ADC/HDMI OFF; Not including external SD card, TFT and sensor.
Sleep Current	I _{PD}	-	2	8.8	mA	BAT_IN=3.6V, V33=3.3V, V12=1.32V All clock and all macro are turn off.
Power Down Current	I _{PD}	-	18	25	μA	All power is off except RTC and power control macro(BAT_IN=3.6V, V33=0V, V12=0V)

Characteristic	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
High Input Voltage	V _{IH}	0.7V33	-	V33	V	-
Low Input Voltage	V _{IL}	VSS	-	0.3V33	V	-
Crystal Frequency 1	-	-	32768	-	Hz	-
Crystal Frequency 2	F _{CRYSTAL}	-	12	-	MHz	-
System Clock	F _{SYS}	256Hz ¹	-	144	MHz	-

Note1: By setting clock divider and changing system clock to SLOW mode (32768Hz).

5.3. Audio DAC Characteristics

Characteristic	Limits			Unit	Condition
	Min.	Typ.	Max.		
Resolution	-	-	16	Bit	-
Full Scale Output Voltage	-	0.6*V33_DA16	-	Vp-p	-
THD+N (Fin = 0.997kHz)	-	0.1	-	%	-
Dynamic Range	71	74	-	dB	Fin=0.997KHz w/ -60dB output loading=32 ohm
Output Loading	32	-	-	ohm	-
Frequency Response	20	-	19200	Hz	-

5.4. Video DAC Characteristics

Characteristic	Limits			Unit	Condition
	Min.	Typ.	Max.		
Resolution	-	9	10	Bit	Load=37.5Ohm
INL	-	±2	-	LSB	-
DNL	-	±0.3	-	LSB	-
Voltage Reference Range	1.14	1.235	1.33	V	-

5.5. CODEC ADC/MIC Characteristics

Characteristic	Limits			Unit	Condition
	Min.	Typ.	Max.		
Resolution	-	-	16	Bit	-
Input Voltage Range	2.7	-	3.6	V	-
SNR	-	85	-	dB	Boost=0dB, PGA=0dB, filter: 20K LPF + A weighting@V33_DA16=3.3V
THD+N	-	78	-	dB	Boost=0dB, PGA=0dB, Fin=0.997KHz, Fs=48kHz @V33_DA16=3.3V
Dynamic Range	-	84.7	-	dB	Boost=0dB, PGA=0dB, filter: 20K LPF + A weighting @V33_DA16=3.3V
MICBIAS	-	2.45	-	V	-
VREF	-	1.65	-	V	-

5.6. SAR ADC Characteristics

Characteristics	Symbol	Limits			Unit
		Min.	Typ.	Max.	
SAR ADC Input Voltage Range	VIN_RANGE	2.7	-	3.6	V
Resolution of ADC	RESO	-	12	-	bits
Signal-to-Noise Plus Distortion of ADC from Line in	SINAD (Note 1)	-	59.88	-	dB
Effective Number of Bit	ENOB (Note 2)	-	9.66	-	bits
Integral Non-Linearity of ADC	INL	-	7	-	LSB (Note 4)
Differential Non-Linearity of ADC	DNL (Note 3)	-	6	-	LSB
No Missing Code		-	10	-	bits
AD Conversion Rate=ADCCLK/16	F _{CONV}	-	-	125K	Hz

Note1: The SINAD testing condition at VINLp-p = 0.8 * V33_AD, F_{CONV} = 62.5KHz, Fin = 1.0KHz Sine waves at V33_AD = 3.0V from the ADC input.

Note2: ENOB = (SINAD - 1.76) / 6.02.

Note3: This ADC can guarantee no missing code at 10 bits resolution.

Note4: LSB means Least Significant Bit (at 12 bits resolution).

5.7. 3.6V-to-3.3V Regulator for IO Characteristics

Characteristics	Symbol	Limits			Unit
		Min.	Typ.	Max.	
Input Voltage	VREGI	3.0	-	3.6	V
Maximum Current Output	IREGO	-	-	300	mA
Output Voltage	VREGO	3.0	-	3.3	V
Standby Current	IREGS	-	-	2	uA

5.8. 3.3V-to-1.2V Regulator for Core Characteristics

Characteristics	Symbol	Limits			Unit
		Min.	Typ.	Max.	
Input Voltage	VREGI	2.7	-	3.3	V
Maximum Current Output	IREGO	-	-	120	mA
Output Voltage	VREGO	1.08	1.2	1.32	V
Standby Current	IREGS	-	-	2	uA

5.9. 3.6V-to-2.8V Regulator for Sensor Characteristics

Characteristics	Symbol	Limits			Unit
		Min.	Typ.	Max.	
Input Voltage	VREGI	3.0	-	3.6	V
Maximum Current Output	IREGO	-	-	60	mA
Output Voltage	VREGO	2.8	3.3	3.3	V
Standby Current	IREGS	-	-	2	uA

5.10. 3.6V-to-3.3V Regulator for CODEC ADC/SAR ADC/Audio DAC Characteristics

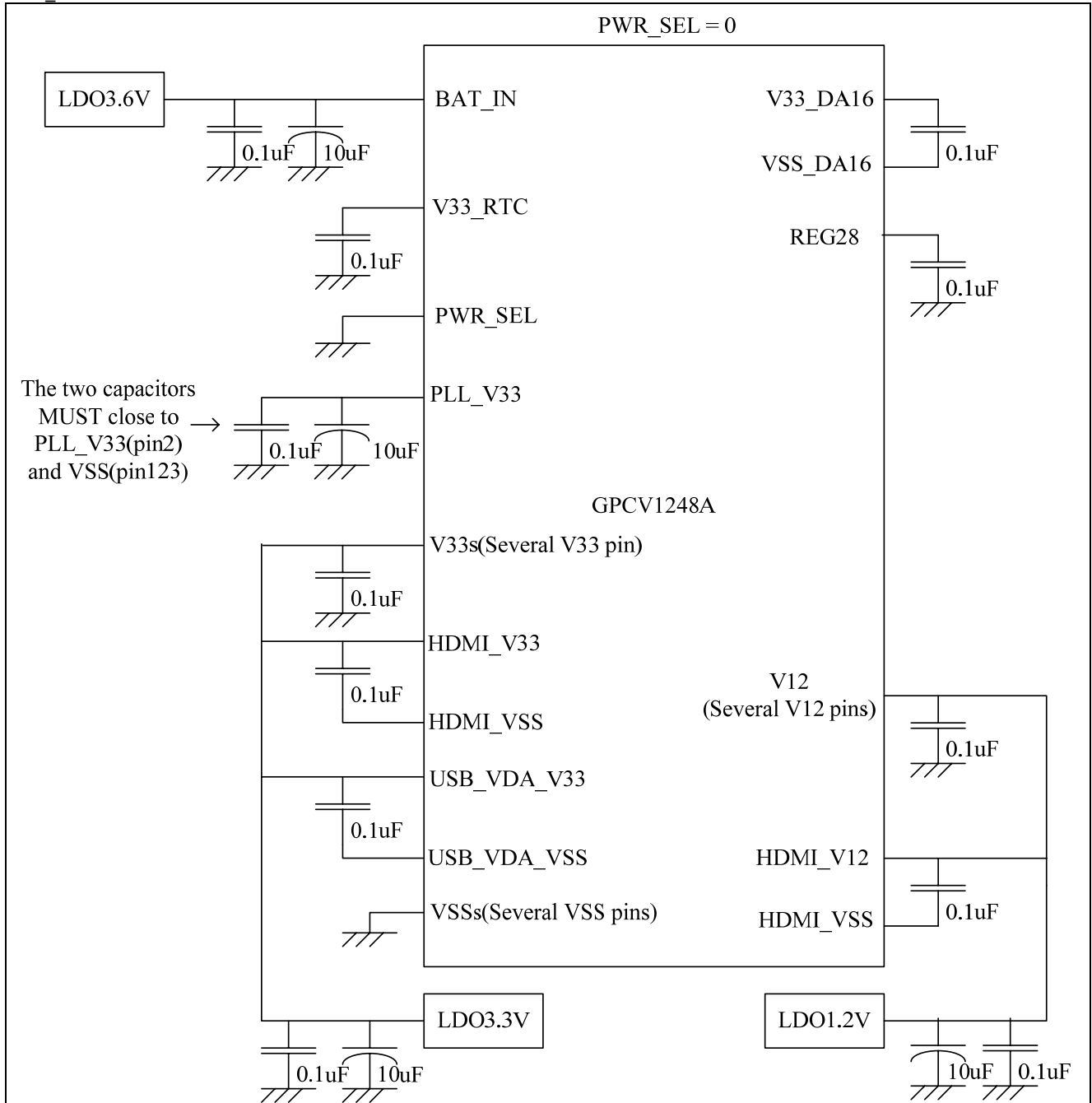
Characteristics	Symbol	Limits			Unit
		Min.	Typ.	Max.	
Input Voltage	VREGI	3.0	-	3.6	V
Maximum Current Output	IREGO	-	-	20	mA

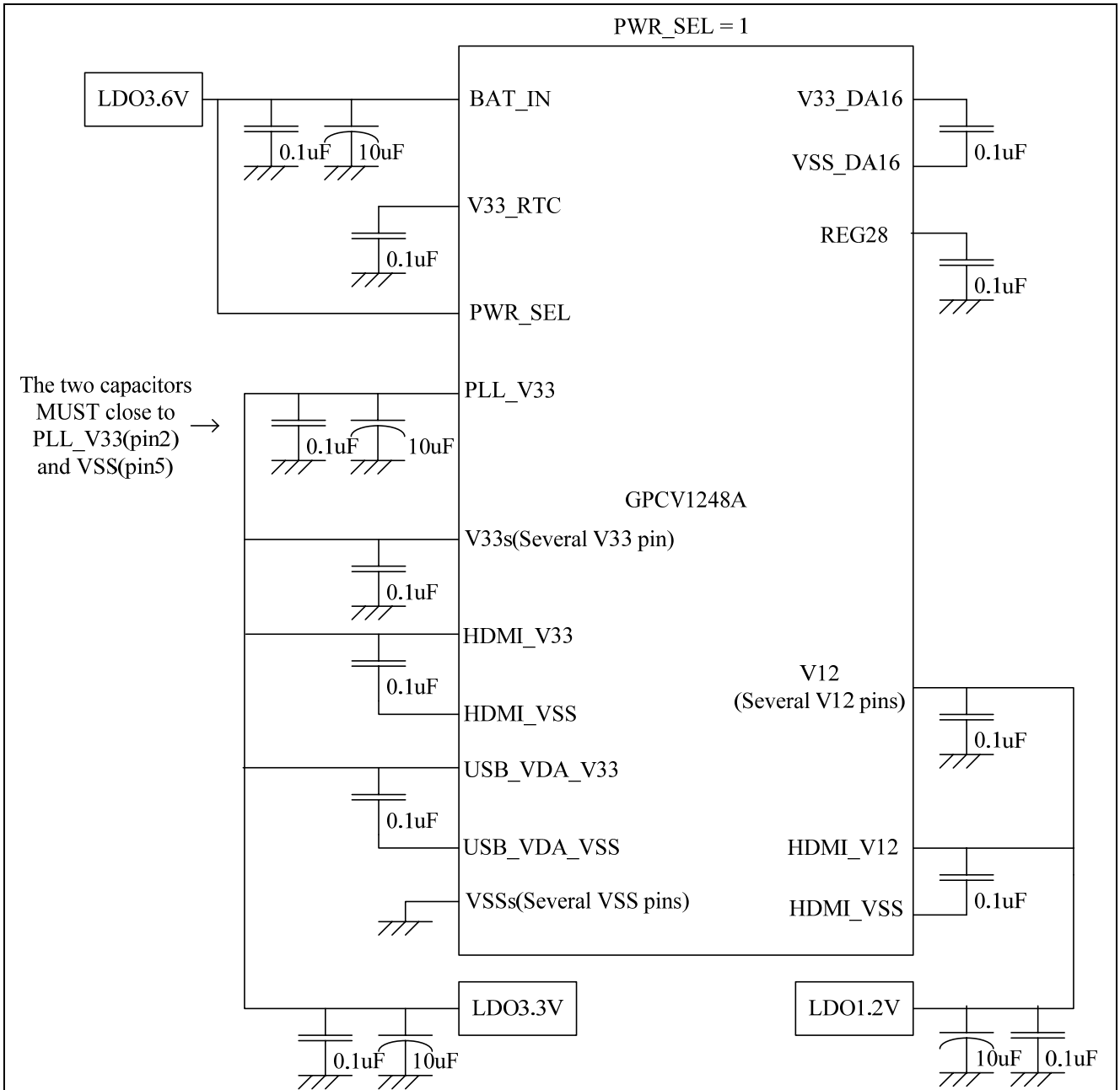
Characteristics	Symbol	Limits			Unit
		Min.	Typ.	Max.	
Output Voltage	VREGO	3.0	3.3	3.3	V
Standby Current	IREGS	-	-	2	uA

6. RECOMMENDED BOARD LAYOUT

6.1. Power and Ground

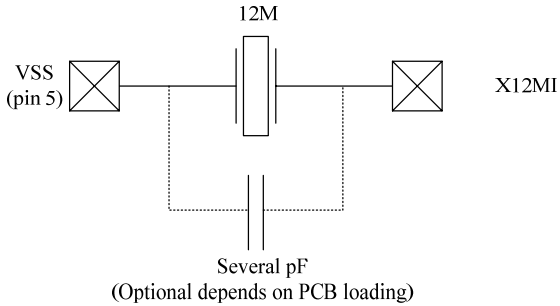
All power and ground pins are connected as in the following diagram for general application. The decoupling capacitor of 0.1μF and 10μF should be connected to each corresponding power pin of the IC and 0.1μF capacitor must be as close as possible to the power pin. Each V33/V12 needs one 0.1μF capacitor and must be as close as possible to the power pin. There are two power settings which can be selected by PWR_SEL pin. With PWR_SEL=0, the internal LDO33 will be enabled. Internal LDO33 will always be disabled if PWR_SEL=1.



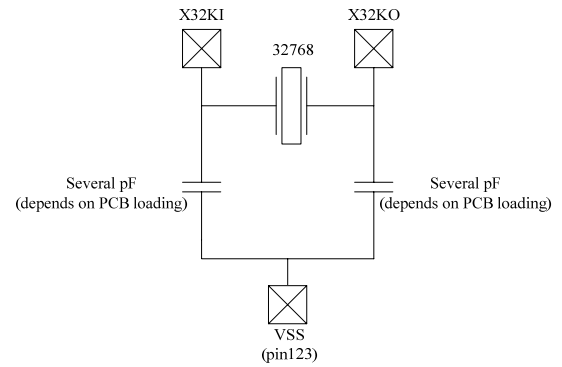


6.2. Crystal and PLL

When the 12MHz crystal is applied in the system, please connect the crystal circuit as indicated in the following diagram.



Note*: Please refer to the crystal's application circuit.



A Crystal (32768Hz) may be used for applications requiring precise time clocks. See the above diagram for details.

Note*: Please refer to the crystal's application circuit.

7. PACKAGE/PAD LOCATIONS

7.1. Ordering Information

Product Number	Package Type
GPCV1248A-NnnV-QL09x	Halogen Free Package

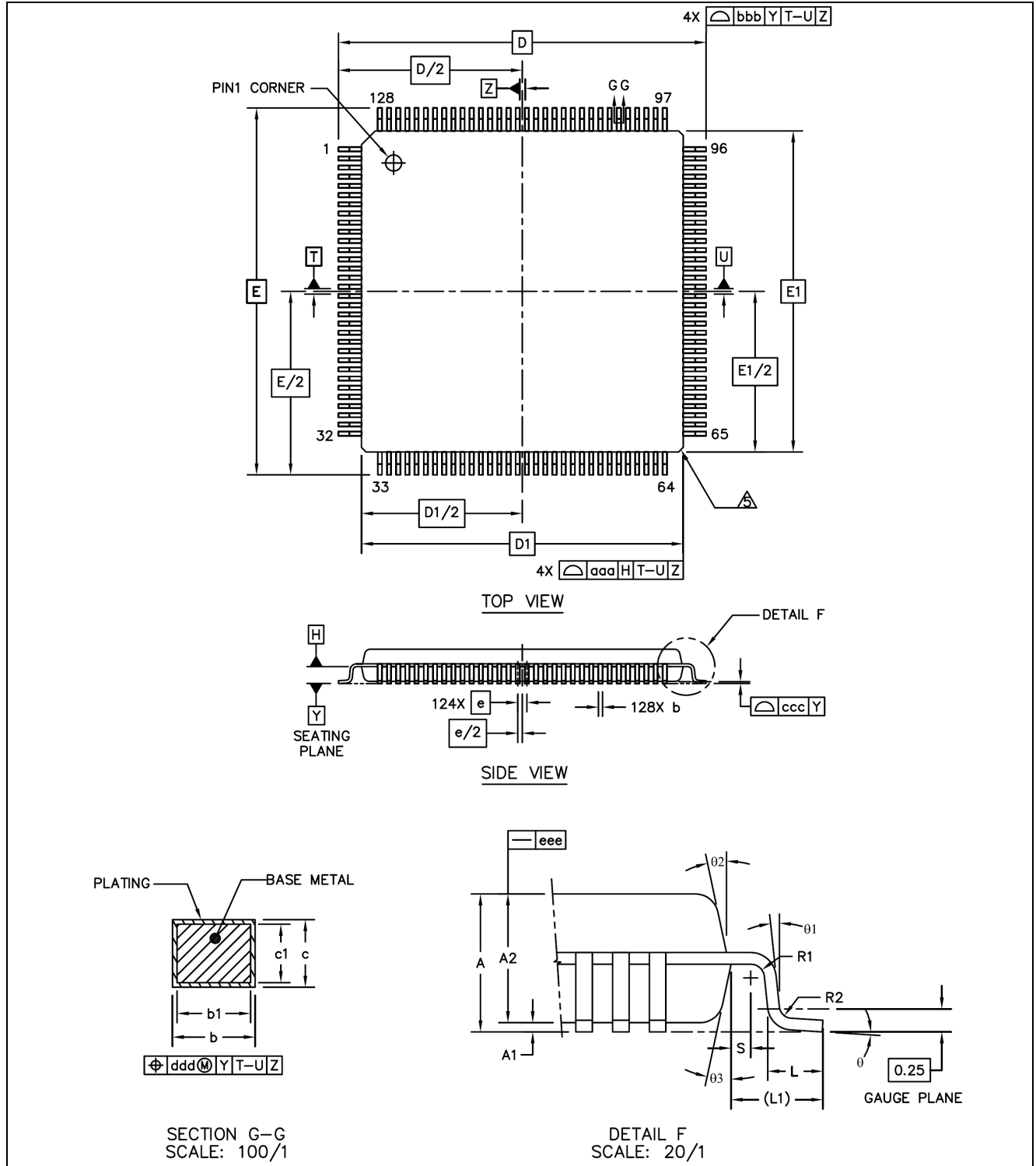
Note1: Code number is assigned for customer.

Note2: Code number (N = A - Z or 0 - 9, nn = 00 - 99); version (V = A - Z).

Note3: Package form number (x = 1 - 9, serial number).

7.2. Package Information

LQFP 128



Symbol	Millimeter		
	Min.	Nom.	Max.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45

Symbol	Millimeter		
	Min.	Nom.	Max.
b	0.13	0.16	0.23
b1	0.13	-	0.19
c	0.09	-	0.20
c1	0.09	-	0.16
D	16.00 BSC		
E	16.00 BSC		
D1	14.00 BSC		
E1	14.00 BSC		
e	0.40 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
θ	0°	3.5°	7°
θ1	0°	-	-°
θ2	11°	12°	13°
θ3	11°	12°	13°
R1	0.08	-	-
R2	0.08	-	0.20
S	0.20	-	-
aaa	0.10		
bbb	0.20		
ccc	0.08		
ddd	0.07		
eee	0.05		

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9. REVISION HISTORY

Date	Revision #	Description	Page
Oct. 15, 2014	0.2	Modify pin67 and pin68 pad sequence	6,8
Aug. 28, 2014	0.1	Preliminary version.	20