Structure Silicon monolithic integrated circuit

Product Name System LSI for Event data recorder

Type **BU1511KV2**

Function BU1511KV2 is a system LSI for event data recorder that makes developing it easier

BU1511KV2 have built-in specific hardware to communicate and control with a 3-axis accelerometer and a camera module, SD card, etc. that are recommended for event data recorder.

The specific hardware are controllerable by built-in ARM946E-S, which can execute various applications.

The following function blocks are built-in.

- ARM946E-S
- External Memory Interface
- GPIO(16ch, PWM 4ch(shared), IRQ 4ch(shared))
- SD Card Interface/SD Card Controller
- SSI(Synchronous Serial Interface)
- Watch Dog Timer
- ADPCM Audio Codec with IIS Interface
- TV Encoder(within 75Ω driver)
- Interrupt Controller
- Timer/Timer Counter
- UART(2ch)
- I2C Master Controller
- Camera Interface (up to 2M pixels)
- JPEG Codec
- Clock Controller/PLL
- A/D Converter(4ch)

○ Absolute maximum ratings

Parameter	Symbol	Rating	Unit
Power supply voltage 1 (DAC)	DAVDD	-0.3～+4.2	V
Power supply voltage 2 (ADC)	ADVDD	-0.3～+4.2	V
Power supply voltage 3 (I2C-1)	I1VDD	-0.3～+4.2	V
Power supply voltage 4 (I2C-2)	I2VDD	-0.3～+4.2	V
Power supply voltage 5 (SD-CARD)	SDVDD	-0.3～+4.2	V
Power supply voltage 6(CAMERA)	CAVDD	-0.3～+4.2	V
Power supply voltage 7(Other IO)	IOVDD	-0.3～+4.2	V
Power supply voltage 8(Digital CORE)	DVDD	-0.3～+2.1	V

Parameter	Symbol	Rating	Unit
Input voltage（ADC）	VIN1	-0.3～ADVDD+0.3	V
Input voltage（I2C-1）	VIN2	-0.3～I1VDD+0.3	V
Input voltage（I2C-2）	VIN3	-0.3～I2VDD+0.3	V
Input voltage（SD-CARD）	VIN4	-0.3～SDVDD+0.3	V
Input voltage（CAMERA）	VIN5	-0.3～CAVDD+0.3	V
Input voltage（Other IO）	VIN6	-0.3～IOVDD+0.3	V
Storage temperature range	Tstg	-40～+150	ºC
Power dissipation	PD	1200*1, 1700*2	mW

*1 IC only. In the case of exceeding 25°C, 12.0 mW should be reduced at the rating 1°C.
*2 When packaging a glass epoxy board of 270x70x1.6mm. If exceeding 25ºC, 17mW should be reduced at the rating 1ºC.
* Has not been designed to withstand radiation.

○ Recommended operating conditions

Parameter	Symbol	Min	Typ	Max	Unit
Power supply voltage 1 (DAC)	DAVDD	3.00	3.30	3.60	V
Power supply voltage 2 (ADC)	ADVDD	3.00	3.30	3.60	V
Power supply voltage 3 (I2C-1)	I1VDD	2.40	3.30	3.60	V
Power supply voltage 4 (I2C-2)	I2VDD	2.40	3.30	3.60	V
Power supply voltage 5 (SD-CARD)	SDVDD	2.70	3.30	3.60	V
Power supply voltage 6 (CAMERA)	CAVDD	2.30	2.85	3.30	V
Power supply voltage 7 (Other IO)	IOVDD	1.70	3.30	3.60	V
Power supply voltage 8 (Digital CORE)	DVDD	1.45	1.50	1.55	V

Parameter	Symbol	Min	Typ	Max	Unit
Input voltage range（ADC）	VIN1	-0.3	-	ADVDD +0.3	V
Input voltage range（I2C-1）	VIN2	-0.3	-	I1VDD +0.3	V
Input voltage range（I2C-2）	VIN3	-0.3	-	I2VDD +0.3	V
Input voltage range（SD-CARD）	VIN4	-0.3	-	SDI1 VDD+0.3	V
Input voltage range（CAMERA）	VIN5	-0.3	-	CAVDD +0.3	V
Input voltage range（Other IO）	VIN6	-0.3	-	IOVDD +0.3	V
Output "H" Current *1	IOH	-13	-	-	mA
Output "L Current *1	IOL	-	-	13	mA
Operating temperature range	Topr	-40	-	85	ºC

*1 Sum of absolute current of IOs in IOVDD system must be less than 100mA, and every sum of absolute current of IOs in CAVDD, SDVDD, I1VDD and I2VDD system must be less than 26mA.
* Please supply power source in order of CORE(DVDD) → IO（IOVDD,CAVDD,SDVDD,I1VDD,I2VDD,ADVDD,DAVDD）
* Please keep RESETB terminal is LOW, until power supply is stable.

○ Electric characteristics

(Unless otherwise specified, DVDD=1.50V, DAVDD=ADVDD=I1VDD=I2VDD=SDVDD=IOVDD=3.30V, CAVDD=2.85V, DAVSS=ADVSS=DVSS=0.0V, Ta=25ºC, fXIN=13.5MHz, fAXIN=16.384MHz, fSYS=41.0MHz(Internal Clock with PLL)
IOPWR is a generic name of I1VDD,I2VDD,SDVDD,CAVDD,IOVDD.)

Parameter	Symbol	Specification		Unit	Conditions
		Min	Max		
Common					
Input frequency 1	fXIN	5.0	30.0	MHz	XIN (Duty 50±10%), When PLL is ON.
Input frequency 2	fAXIN	8.284	32.768	MHz	AXIN(Duty 50±10%)
Internal clock frequency 1	fSYS	-	41.0	MHz	When PLL is ON, Except I2S Audio Block
Internal clock frequency 2	f AUD	-	32.768	MHz	I2S Audio Block
Static consumption current	IDDST	-	200	μA	When all clock stop
Logic Block					
Input "H" Leakcurrent	IIHL	-10	10	μA	VIH=IOPWR
Input "L" Leak current	IIHL	-10	10	μA	VIL= 0 V
Input Pull down "H" current 1	IIHPD1	25	100	μA	Pull down pin, VIH=IOVDD
Input Pull down "H" current 2	IIHPD2	25	100	μA	Pull down pin, VIH=CAVDD
Input Pull down "L" current	IILPD	-10	10	μA	Pull down pin, VIL= 0 V
Input ”H” voltage 1	VIH1	IOPWR × 0.8	IOPWR+0.3	V	Normal Input
Input ”L” voltage 1	VIL1	-0.3	IOPWR × 0.2	V	Normal Input
Input ”H” voltage 2	VIH2	IOPWR × 0.85	IOPWR+0.3	V	Hysteresis input pin
Input ”L” voltage 12	VIL2	-0.3	IOPWR × 0.15	V	(TIM_TRIG,NTRST,RESETB,BIT_SEL,TCM_SEL,AUTO_READ)
Output ”H” voltage 1	VOH1	IOPWR-0.4	IOPWR	V	IOH=-2.0mA(DC), Output except SD_CLK, When CAVDD=3.3V
Output ”L” voltage 1	VOL1	0.0	0.4	V	IOL=2.0mA(DC), Output except SD_CLK, When CAVDD=3.3V.
Output ”H” voltage 2	VOH2	IOPWR-0.4	IOPWR	V	IOH=-4.0mA(DC)、SD_CLK
Output ”L” voltage 2	VOL2	0.0	0.4	V	IOL=4.0mA(DC)、SD_CLK
DACBlock					
DAC Bit Width	RES_DA	-	10	bits	
DAC Operating current	IDDDA	32	42	mA	R_L=37.5Ω、R_{IREF}=2.4kΩ、DAVDD Pin current
DAC Static consumption current	IDDSTDA	-	5	uA	R_L=37.5Ω、R_{IREF}=2.4kΩ、DAVDD Pin current
Integral Non-linearity	INL_DA	-8.0	+8.0	LSB	R_L=37.5Ω、R_{IREF}=2.4kΩ
Differential Non-linearity	DNL_DA	-2.0	+2.0	LSB	R_L=37.5Ω、R_{IREF}=2.4kΩ
Full scale voltage	VFS_DA	1.1	1.4	V	R_L=37.5Ω、R_{IREF}=2.4kΩ
ADCBlock					
ADC Bit Width	RES_AD	-	8	bits	
Input voltage range(Upper Limit)	VIN_AD_T	ADVDD × 0.85	ADVDD × 0.95	V	
Input voltage range(Lower Limit)	VIN_AD_B	ADVDD × 0.05	ADVDD × 0.15	V	
Integral Non-linearity	INL_AD	-2.0	+2.0	LSB	
Differential Non-linearity	DNL_AD	-2.0	+2.0	LSB	
Change Standard clock cycle	f ADC	4.0	16.0	MHz	
Change cycle	fsps	30.8K	123K	sps	Sample per second Need 130*ADC_CLK for conversion by sweeping

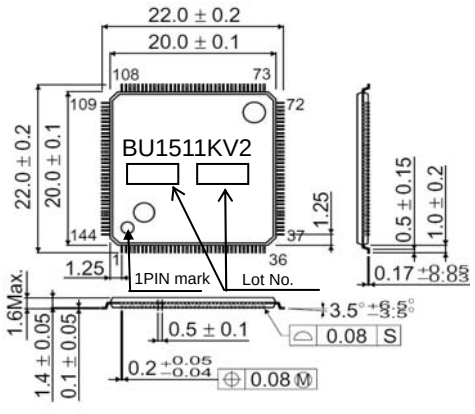
○Pin Function Descriptions

PIN No.	Pin Name	Function
1	EXT_ADR20	External Bus
2	EXT_ADR19	
3	EXT_ADR18	
4	EXT_ADR17	
5	EXT_ADR16	
6	EXT_ADR15	
7	EXT_ADR14	
8	EXT_ADR13	
9	EXT_ADR12	
10	EXT_ADR11	
11	EXT_ADR10	
12	EXT_ADR9	
13	EXT_ADR8	
14	EXT_ADR7	
15	EXT_ADR6	
16	EXT_ADR5	
17	IOVDD	--
18	DVSS	--
19	EXT_ADR4	External Bus
20	EXT_ADR3	
21	EXT_ADR2	
22	EXT_ADR1	
23	EXT_DATA15	
24	EXT_DATA14	
25	EXT_DATA13	
26	EXT_DATA12	
27	IOVDD	--
28	DVSS	--
29	EXT_DATA11	External Bus
30	EXT_DATA10	
31	EXT_DATA9	
32	EXT_DATA8	
33	EXT_DATA7	
34	EXT_DATA6	
35	EXT_DATA5	
36	EXT_DATA4	
37	EXT_DATA3	
38	EXT_DATA2	
39	EXT_DATA1	
40	EXT_DATA0	
41	EXT_CSB2	
42	EXT_CSB1	
43	EXT_CSB0	
44	EXT_WEB	
45	EXT_OEB	
46	EXT_WPB	
47	SSI_CLK	Serial
48	SSI_CSB1	

PIN No.	Pin Name	Function
49	SSI_CSB0	Serial
50	SSI_WPB	
51	SSI_DOUT	
52	SSI_DIN	
53	DVDD	--
54	TIM_TRIG	Counter trigger
55	GPIO15	GPIO
56	GPIO14	
57	GPIO13	
58	GPIO12	
59	GPIO11	
60	GPIO10	
61	GPIO9	
62	GPIO8	
63	GPIO7	GPIO/PWM
64	GPIO6	
65	GPIO5	
66	GPIO4	
67	IOVDD	--
68	DVSS	--
69	GPIO3	GPIO/IRQ
70	GPIO2	
71	GPIO1	
72	GPIO0	
73	TX1	UART1
74	RX1	
75	RTS1	
76	CTS1	
77	TX2	UART2
78	RX2	
79	TDI	JTAG
80	TDO	
81	TCK	
82	TMS	
83	NTRST	
84	AUDCKI	I2S input Interface
85	AUDLRI	
86	AUDDTI	
87	AUDCKO	I2S output Interface
88	AUDLRO	
89	AUDDTO	
90	AUDMCKO	
91	IOVDD	--
92	DVSS	--
93	DVDD	--
94	RESETB	System setting
95	TEST	
96	BIT_SEL	

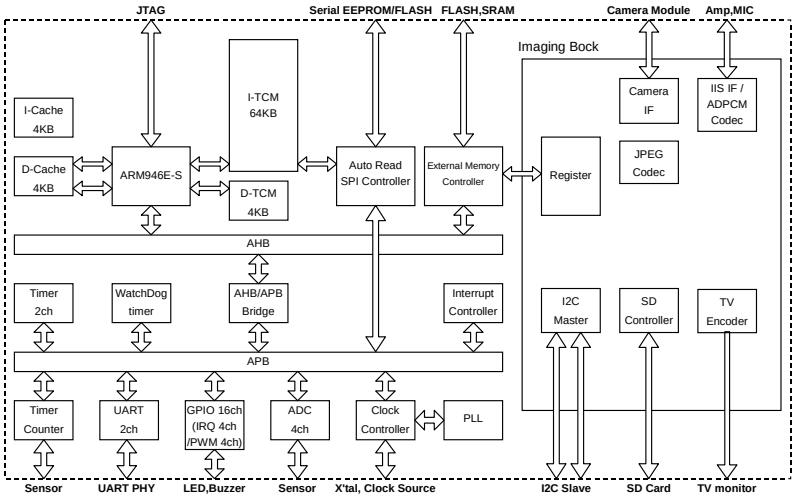
PIN No.	Pin Name	Function
97	TCM_SEL	System setting
98	AUTO_READ	
99	ADVDD	--
100	ADVSS	--
101	ADIN3	ADC input
102	ADIN2	
103	ADIN1	
104	ADIN0	
105	VOUT	Video output (75Ω)
106	DAVSS	--
107	IREF	Video output Reference
108	DAVDD	--
109	I1VDD	--
110	DVSS	--
111	SDC1	I2C Master Interface
112	SDA1	
113	SDC2	
114	SDA2	
115	I2VDD	--
116	CAMCKO	Camera Interface
117	CAVDD	--
118	CAMHS	Camera Interface
119	CAMVS	
120	CAMD7	
121	CAMD6	
122	CAMD5	
123	CAMD4	
124	DVDD	--
125	CAMD3	Camera Interface
126	CAMD2	
127	CAMD1	
128	CAMD0	
129	CAMCKI	
130	SD_CLK	SD card Interface
131	SD_CMD	
132	SD_DAT3	
133	SD_DAT2	
134	SD_DAT1	
135	SD_DAT0	
136	SDVDD	--
137	DVSS	--
138	AXIN	Clock input or X'tal
139	AXOUT	
140	IOVDD	--
141	XIN	Clock input or X'tal
142	XOUT	
143	DVSS	--
144	EXT_ADR21	External Bus

○ Physical dimensions



VQFP-T144 (Unit:mm)

○ Block diagram



○ Cautions on use

(1) Absolute Maximum Ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.

(2) Recommended Operating conditions

These conditions represent a range within which characteristics can be provided approximately as expected. The electrical characteristics are guaranteed under the conditions of each parameter.

(3) Reverse connection of power supply connector

The reverse connection of power supply connector can break down ICs. Take protective measures against the breakdown due to the reverse connection, such as mounting an external diode between the power supply and the IC's power supply terminal.

(4) Power supply line

Design PCB pattern to provide low impedance for the wiring between the power supply and the GND lines.
In this regard, for the digital block power supply and the analog block power supply, even though these power supplies has the same level of potential, separate the power supply pattern for the digital block from that for the analog block, thus suppressing the diffraction of digital noises to the analog block power supply resulting from impedance common to the wiring patterns. For the GND line, give consideration to design the patterns in a similar manner.
Furthermore, for all power supply terminals to ICs, mount a capacitor between the power supply and the GND terminal. At the same time, in order to use an electrolytic capacitor, thoroughly check to be sure the characteristics of the capacitor to be used present no problem including the occurrence of capacity dropout at a low temperature, thus determining the constant.

(5) GND voltage

Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage including an actual electric transient.

(6) Short circuit between terminals and erroneous mounting

In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the ICs can break down.

(7) Operation in strong electromagnetic field

Be noted that using ICs in the strong electromagnetic field can malfunction them.

(8) Inspection with set PCB

On the inspection with the set PCB, if a capacitor is connected to a low-impedance IC terminal, the IC can suffer stress. Therefore, be sure to discharge from the set PCB by each process. Furthermore, in order to mount or dismount the set PCB to/from the jig for the inspection process, be sure to turn OFF the power supply and then mount the set PCB to the jig. After the completion of the inspection, be sure to turn OFF the power supply and then dismount it from the jig. In addition, for protection against static electricity, establish a ground for the assembly process and pay thorough attention to the transportation and the storage of the set PCB.

(9) Input terminals

In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals, such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.

(10) Ground wiring pattern

If small-signal GND and large-current GND are provided, It will be recommended to separate the large-current GND pattern from the small-signal GND pattern and establish a single ground at the reference point of the set PCB so that resistance to the wiring pattern and voltage fluctuations due to a large current will cause no fluctuations in voltages of the small-signal GND. Pay attention not to cause fluctuations in the GND wiring pattern of external parts as well.

(11) External capacitor

In order to use a ceramic capacitor as the external capacitor, determine the constant with consideration given to a degradation in the nominal capacitance due to DC bias and changes in the capacitance due to temperature, etc.

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