

Servo signal processor for CD use

BU9314KS

The BU9314KS is a servo signal processor for CD players that incorporates a double-speed, no-adjustment PLL, program servo, and signal processing block, and D/A converter on one chip. It operates off a low power supply voltage, and has low power consumption.

●Applications

Portable CD players, radio cassette players, and mini-component systems.

●Features

- 1) PLL on chip. Bit clock extraction possible with just a few external components. EFM data modulation is possible.
- 2) Frame synchronizing signal detection and protection.
- 3) Servo filters for focus, tracking, and sled are on chip. Characteristics can be controlled using commands from the controller.
- 4) Sub-code serial output pin provided.
- 5) Output pins for both P-code and Q-code.
- 6) CLV sequencer automatically determines the CLV mode.
- 7) Track jump sequencer on chip. Possible to jump any number of tracks.
- 8) De-interleave function, and 2-level error detection, correction and flag processing for C1 and C2.
- 9) The signal to the D/A converter is output by the MSB first 2'SCOMP serial out, and offset circuit ON and OFF can be controlled for CD-ROM compatibility.
- 10) 16k bits of on-chip SRAM absorb ± 4 frames of jitter.
- 11) Double-speed playback is possible.
- 12) Built-in 8Fs digital filter and 16-bit D/A converter.
- 13) Built-in digital de-emphasis function.

●Absolute maximum ratings (Ta = 25°C)

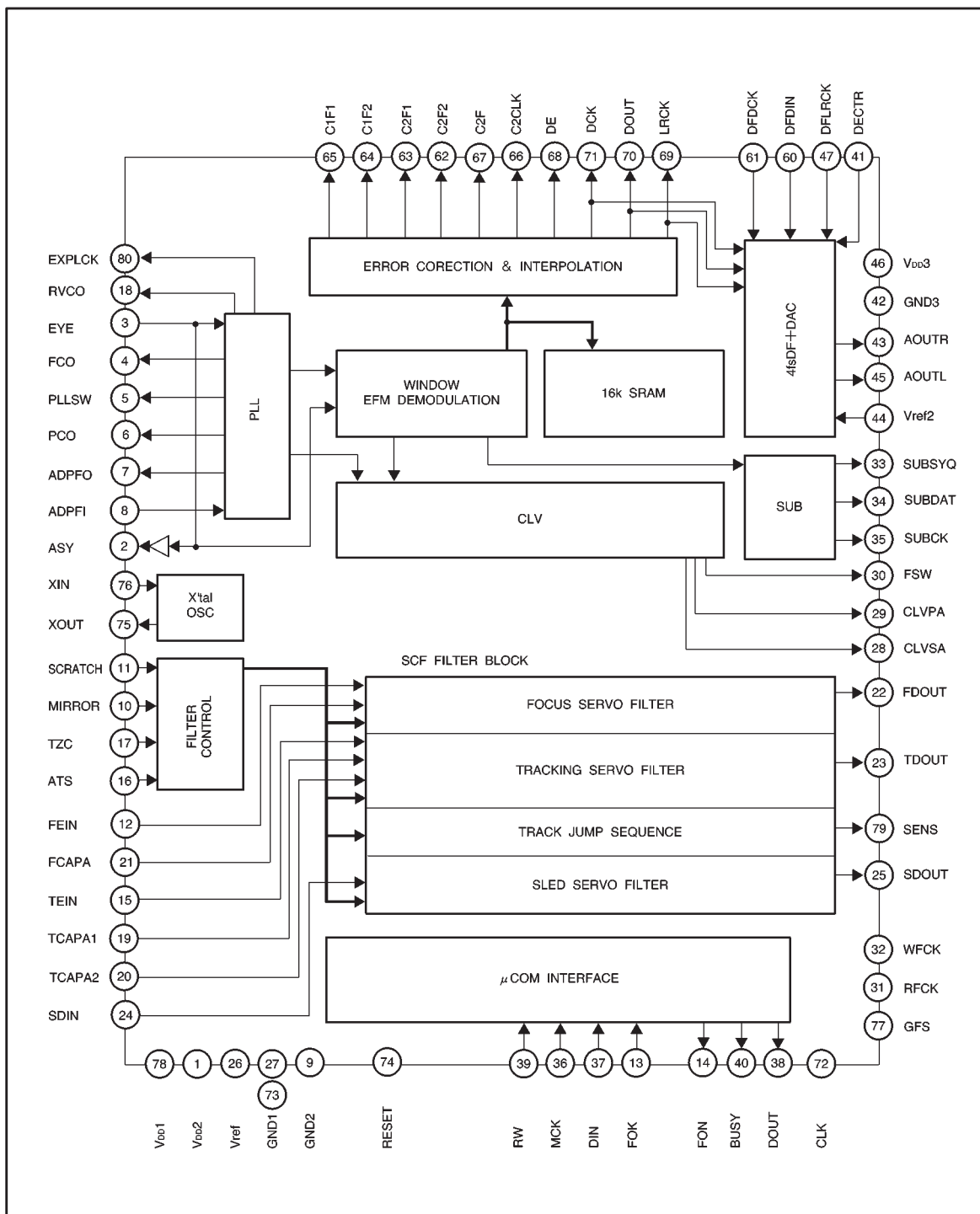
Parameter	Symbol	Limits	Unit
Power supply voltage	V _{cc}	7	V
Power dissipation	P _d	400*	mW
Operating temperature	T _{opr}	-25~+70	°C
Storage temperature	T _{stg}	-55~+125	°C

* Reduced by 4 mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V _{cc}	3.0	—	5.5	V

● Block diagram



● Pin descriptions

Pin No.	Pin name	Analog / digital	I / O	Function	I / O circuit
1	V _{DD2}	—	—	PLL and servo filter block power supply	—
2	ASY	Digital	O	EFM signal slice level control output	5
3	EYE	Digital	I	EFM signal input pin from the RF amplifier	4
4	FCO	Analog	O	PLL phase comparison error voltage output	7
5	PLLSW	Digital	O	PLL time constant switch pin	3
6	PCO	Analog	O	PLL phase comparison error voltage output	7
7	ADPFO	Analog	O	PLL addition amplifier output	2
8	ADPFI	Analog	I	PLL addition amplifier inversion signal	1
9	GND2	—	—	PLL servo filter block ground	—
10	MIRROR	Digital	I	Mirror signal input	4
11	SCRATCH	Digital	I	Scratch signal input	4
12	FEIN	Analog	I	Focus error signal input	1
13	FOK	Digital	I	Focus OK signal input	4
14	FON	Digital	O	Focus on signal output	5
15	TEIN	Analog	I	Tracking error signal input	1
16	ATS	Analog	I	Anti-shock detector window comparator input	1
17	TZC	Analog	I	PLL VCO free-run resistor	1
18	RVCO	Analog	O	Tracking/zero cross comparator input	1
19	TCAPA1	Analog	I / O	For connection of switch 1 for tracking servo filter	11
20	TCAPA2	Analog	I / O	For connection of switch 2 for tracking servo filter	3
21	FCAPA	Analog	I / O	For connection of capacitor for focus servo filter	11
22	FDOUT	Analog	O	Focus drive output	1
23	TDOUT	Analog	O	Tracking drive output	1
24	SDIN	Analog	I	Sled amplifier input	1
25	SDOUT	Analog	O	Sled drive output	2
26	V _{ref}	Analog	I	Bias voltage input	6
27	GND1	—	—	Digital ground	—
28	CLVSA	Analog	O	Spindle motor drive speed control output (analog)	1
29	CLVPA	Analog	O	Spindle motor drive rough control or phase control output (analog)	1
30	FSW	Digital	O	Spindle motor output filter time constant switching output	3
31	RFCK	Digital	O	Read frame clock output (X _{tal} 7.35kHz)	5
32	WFCK	Digital	O	Write frame clock output (7.35kHz when locked to X _{tal})	5
33	SUBSYQ	Digital	O	Sub-code sync signal S0+S1 output	5
34	SUBDATA	Digital	O	Sub-code serial output	5
35	SUBCK	Digital	I	Clock input for sub-code read	4

Pin No.	Pin name	Analog / digital	I / O	Function	I / O circuit
36	MCK	Digital	I	Clock for reading serial data from CPU or sub Q-code	4
37	DIN	Digital	I	Input for serial data from clock	4
38	DOUT	Digital	O	Sub Q-code or internal status serial output	7
39	RW	Digital	I	Read/write switch input (outputs data from DOUT when High and inputs data to DIN when Low)	4
40	BUSY	Digital	O	Busy output ("L" during track jump)	5
41	DECTR	Digital	I	De-emphasis control (de-emphasis filter on when High)	4
42	GND3	—	—	—	—
43	AOUTL	Analog	O	Lch analog audio output	12
44	Vref2	Analog	O	Reference voltage for D/A converter (connect capacitor between this pin and GND)	6
45	AOUTR	Analog	O	Rch analog audio output	12
46	VDD3	—	—	—	—
47	DFLRCK	Digital	I	External serial data L/R switching signal input	4
48	N.C.	—	—	—	—
49	N.C.	—	—	—	—
50	N.C.	—	—	—	—
51	N.C.	—	—	—	—
52	N.C.	—	—	—	—
53	N.C.	—	—	—	—
54	N.C.	—	—	—	—
55	N.C.	—	—	—	—
56	N.C.	—	—	—	—
57	N.C.	—	—	—	—
58	N.C.	—	—	—	—
59	N.C.	—	—	—	—
60	DFDIN	Digital	I	External serial data input	4
61	DFDCK	Digital	I	Bit clock input for external serial data	4
62	C2F2	Digital	O	C22 correction flag output	5
63	C2F1	Digital	O	C21 correction flag output	5
64	C1F2	Digital	O	C12 correction flag output	5
65	C1F1	Digital	O	C11 correction flag output	5
66	C2CLK	Digital	O	Strobe signal (f=176.4kHz)	5
67	C2F	Digital	O	Correction status output	5
68	DE	Digital	O	Strobe signal (f=88.2kHz)	5
69	LRCK	Digital	O	Strobe signal (f=44.1kHz)	5

Pin No.	Pin name	Analog / digital	I / O	Function	I / O circuit
70	DOUTA	Digital	O	Audio data output (2'SCOMP)	5
71	DOCK	Digital	O	Bit clock for DOUT (f=2.1168MHz)	5
72	CLK	Digital	O	Clock output (select from four types using &hE4 command)	5
73	GND1	—	—	Digital ground	—
74	RESET	Digital	I	Internal circuit reset (pull up with internal 100kΩ resistor)	8
75	XOUT	Digital	O	X'tal oscillation circuit output (f=16.9MHz)	9
76	XIN	Digital	I	X'tal oscillation circuit input (f=16.9MHz)	9
77	GFS	Digital	O	GFS monitor output (select from four types using &hE4 command)	5
78	VDD1	—	—	Digital power supply	—
79	SENS	Digital	O	Status output of signal specified by &hE4 command)	5
80	EXPLCK	Digital	I / O	PLL playback clock output or external PLL playback clock input	10

● Input / output circuits

1		2	
3		4	
5		6	
7		8	
9		10	
11		12	

*1 MIRROR, SCRATCH, FOK, SUBCK, MCK, DIN, RW, RESET, EXPLCK, EYE, DECTR, DFLRCK, DFDIN, DFDCK

*2 FON, RFCK, WFCK, SUBSYQ, SUBDATA, DOUT, BUSY, XOUT, SENS, GFS, ASY, C1F1, C1F2, C2F1, C2F2, C2CLK, C2F, DE, LRCK, DOCK, CLK

*3 RESET

*4 PLLSW, TCAPA2, FSW

*5 FEIN, TEIN

●Electrical characteristics

Digital system characteristics (unless otherwise noted, Ta = 25°C and V_{DD} = 5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Applicable pin
Input high level voltage	V _{IH}	3.5	—	—	V	—	*1
Input low level voltage	V _{IL}	—	—	0.3	V	—	*1
Output high level voltage	V _{OH}	4.0	—	V _{DD}	V	I _{OH} = -1mA	*2
Output low level voltage	V _{OL}	0	—	0.4	V	I _{OL} = 1mA	*2, 4
Input resistance 1	V _{O1}	80	100	120	kΩ	Between V _{DD} 1 pin	*3
Input resistance 2	V _{O2}	60	75	90	kΩ	Between BIAS pin	TZC
Input resistance 3	V _{O3}	180	230	280	kΩ	Between BIAS pin	ATS
Input resistance 4	V _{O4}	20	25	30	kΩ	Between BIAS pin	*5
Input leak current	I _{LI}	—	—	±5	μA	V _I = 0~5.25V	*1
Output leak current	I _{LO}	—	—	±5	μA	V _I = 0~5.25V	*4
V _{ref2} output voltage	V _{ref2}	—	2.5	—	V	—	V _{ref2}

Analog system characteristics (unless otherwise noted, Ta = 25°C, V_{DD} = 5V, and V_C reference)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Setting command
〈Focus servo〉							
DC voltage gain	G _{FD1}	17	20	23	dB	V _{IN} =1Hz, 100mV _{P-P}	&h10XF, 1462
AC voltage gain 1	G _{FDF1}	−0.7	2.3	5.3	dB	V _{IN} =1kHz, 100mV _{P-P}	&h10XF, 1462
AC voltage gain 2	G _{FDF2}	−5.1	−2.1	0.9	dB	V _{IN} =300Hz, 100mV _{P-P}	&h10XF, 1462
Maximum output voltage	V _{FD1}	1.5	2.1	—	V	—	—
Minimum output voltage	V _{FD2}	—	−2.1	−1.5	V	—	—
Offset voltage	V _{FOF}	−350	0	350	mV	—	&h10XF, 1462
〈Tracking servo〉							
DC voltage gain	G _{TD1}	23	26	29	dB	V _{IN} =1Hz, 20mV _{P-P}	&h10DX, 1159, 1207
AC voltage gain 1	G _{TDF1}	−0.5	2.5	5.5	dB	V _{IN} =1kHz, 200mV _{P-P}	&h10DX, 1159, 1207
AC voltage gain 2	G _{TDF2}	−4	−1	2	dB	V _{IN} =300Hz, 200mV _{P-P}	&h10DX, 1159, 1207
AC voltage gain 3	G _{TDF3}	28	31	34	dB	V _{IN} =1kHz, 20mV _{P-P}	&h10DX, 1159, 1207
AC voltage gain 4	G _{TDF4}	21.5	24.5	27.5	dB	V _{IN} =300Hz, 20mV _{P-P}	&h10DX, 1159, 1207
Maximum output voltage	V _{TD1}	1.5	2.1	—	V	—	—
Minimum output voltage	V _{TD2}	—	−2.1	−1.5	V	—	—
Offset voltage	V _{TOF}	−500	0	500	mV	—	&h10DX, 1159, 1287
Jump output voltage 1	V _{JP1}	1.2	1.8	—	V	—	&h13XF
Jump output voltage 2	V _{JP2}	—	−1.9	−1.1	V	—	&h13FX
ATS threshold voltage 1	V _{ATS1}	10	25	40	mV	—	—
ATS threshold voltage 2	V _{ATS2}	−40	−25	10	mV	—	—
TZC threshold voltage	V _{TZC}	−25	0	25	mV	—	—
〈Sled servo〉							
DC voltage gain	G _{SD1}	24	27	30	dB	V _{IN} =100Hz, 20mV _{P-P}	&h124X
Maximum output voltage	V _{SD1}	1.4	2	—	V	—	—
Minimum output voltage	V _{SD2}	—	−2.1	−1.5	V	—	—
Offset voltage	V _{SOF}	−220	0	220	mV	—	&h124X
Kick output voltage 1	V _{KC1}	1.5	2.0	—	V	—	&h18XF
Kick output voltage 2	V _{KC2}	—	−1.8	−1.3	V	—	&h18FX
〈Digital filter+D / A converter〉 (R _L =10kΩ, using DIN-AUDIO filter)							
Resolution	RES	—	—	16	bit	—	—
Maximum output amplitude	V _{MAX}	1.7	1.9	—	V	Data pattern: 1kHz, 2V _{P-P}	—
Distortion	THD	—	0.02	0.3	%	Data pattern: 1kHz, 2V _{P-P}	—
Crosstalk	CT	—	−90	−70	dB	Data pattern: 1kHz, 2V _{P-P}	—
S / N ratio	S / N	—	−90	−70	dB	—	—

©Not designed for radiation resistance.

●External dimensions (Units: mm)

