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)

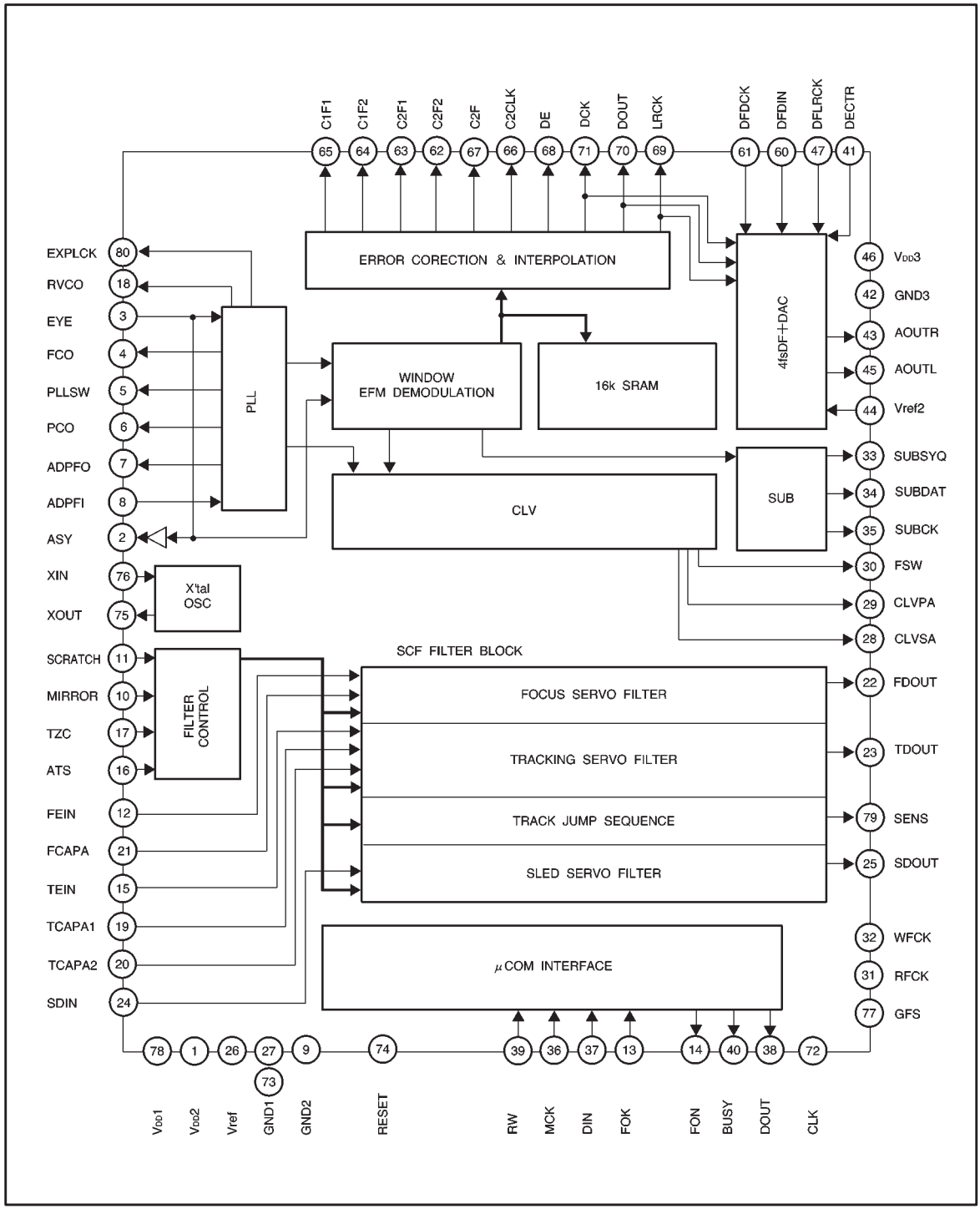
Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	7	V
Power dissipation	Pd	400*	mW
Operating temperature	Topr	−25～+70	℃
Storage temperature	Tstg	−55～+125	℃

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

●Recommended operating conditions (Ta = 25°C)

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

●Block diagram



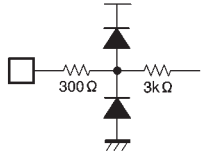
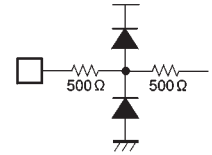
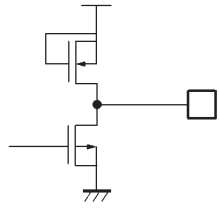
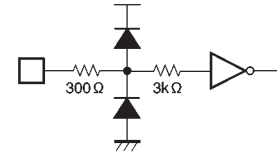
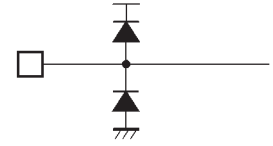
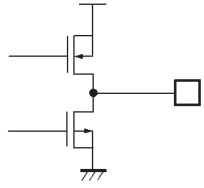
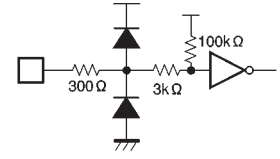
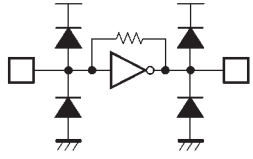
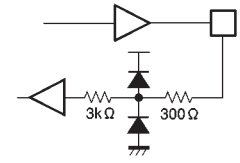
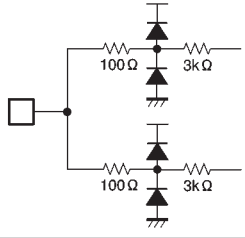
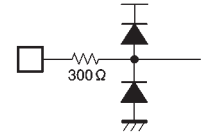
●Pin descriptions

Pin No.	Pin name	Analog / digital	I / O	Function	I / O circuit
1	$V_{DD}2$	—	—	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	Vref	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	$V_{DD}3$	—	—	—	—
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=44.1kH)	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	$V_{DD}1$	—	—	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)

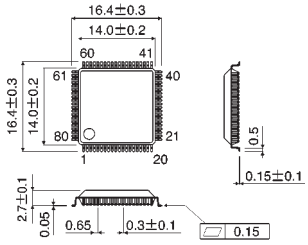
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Applicable pin
Input high level voltage	V_{IH}	3.5	—	—	V	—	∗1
Input low level voltage	V_{IL}	—	—	0.3	V	—	∗1
Output high level voltage	V_{OH}	4.0	—	V_{DD}	V	I_{OH}=−1mA	∗2
Output low level voltage	V_{OL}	0	—	0.4	V	I_{OL}=1mA	∗2, 4
Input resistance 1	V_{O1}	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	VI=0～5.25V	∗1
Output leak current	I_{LO}	—	—	±5	μA	VI=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)



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