

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 ($T_a = 25^\circ\text{C}$)

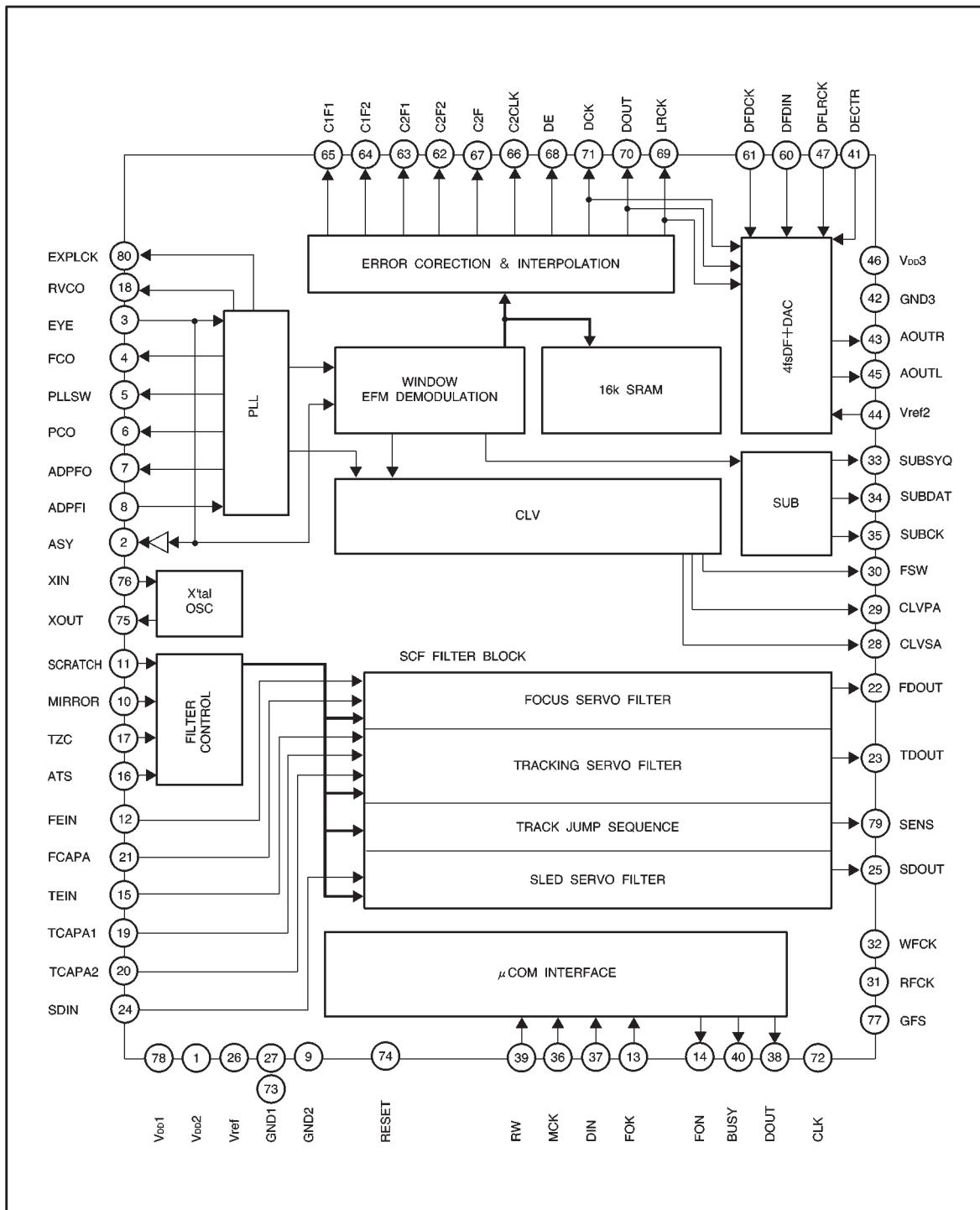
Parameter	Symbol	Limits	Unit
Power supply voltage	V_{cc}	7	V
Power dissipation	P_d	400*	mW
Operating temperature	T_{opr}	$-25 \sim +70$	°C
Storage temperature	T_{stg}	$-55 \sim +125$	°C

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

● Recommended operating conditions ($T_a = 25^\circ\text{C}$)

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 _{DB2}	—	—	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	FDO	Analog	O	Focus drive output	1
23	TDO	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 _{DD3}	—	—	—	—
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	V _{DD1}	—	—	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, $T_a = 25^\circ\text{C}$ and $V_{DD} = 5\text{V}$)

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	$I_{OH} = -1\text{mA}$	*2
Output low level voltage	V_{OL}	0	—	0.4	V	$I_{OL} = 1\text{mA}$	*2, 4
Input resistance 1	V_{o1}	80	100	120	$\text{k}\Omega$	Between V_{DD1} pin	*3
Input resistance 2	V_{o2}	60	75	90	$\text{k}\Omega$	Between BIAS pin	TZC
Input resistance 3	V_{o3}	180	230	280	$\text{k}\Omega$	Between BIAS pin	ATS
Input resistance 4	V_{o4}	20	25	30	$\text{k}\Omega$	Between BIAS pin	*5
Input leak current	I_{LI}	—	—	± 5	μA	$VI = 0 \sim 5.25\text{V}$	*1
Output leak current	I_{LO}	—	—	± 5	μA	$VI = 0 \sim 5.25\text{V}$	*4
V_{ref2} output voltage	V_{ref2}	—	2.5	—	V	—	V_{ref2}

Analog system characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_{DD} = 5\text{V}$, and V_C reference)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Setting command
<Focus servo>							
DC voltage gain	G_{FD1}	17	20	23	dB	$V_{IN}=1\text{Hz}, 100\text{mV}_{P-P}$	&h10XF, 1462
AC voltage gain 1	G_{FD1F}	-0.7	2.3	5.3	dB	$V_{IN}=1\text{kHz}, 100\text{mV}_{P-P}$	&h10XF, 1462
AC voltage gain 2	G_{FD2F}	-5.1	-2.1	0.9	dB	$V_{IN}=300\text{Hz}, 100\text{mV}_{P-P}$	&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	$V_{IN}=1\text{Hz}, 20\text{mV}_{P-P}$	&h10DX, 1159, 1207
AC voltage gain 1	G_{TDF1}	-0.5	2.5	5.5	dB	$V_{IN}=1\text{kHz}, 200\text{mV}_{P-P}$	&h10DX, 1159, 1207
AC voltage gain 2	G_{TDF2}	-4	-1	2	dB	$V_{IN}=300\text{Hz}, 200\text{mV}_{P-P}$	&h10DX, 1159, 1207
AC voltage gain 3	G_{TDF3}	28	31	34	dB	$V_{IN}=1\text{kHz}, 20\text{mV}_{P-P}$	&h10DX, 1159, 1207
AC voltage gain 4	G_{TDF4}	21.5	24.5	27.5	dB	$V_{IN}=300\text{Hz}, 20\text{mV}_{P-P}$	&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	$V_{IN}=100\text{Hz}, 20\text{mV}_{P-P}$	&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> ($R_L=10\text{k}\Omega$, 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)

