## **Optical disc ICs**

# 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 minicomponent systems.

#### Features

- 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.
- 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.
- CLV sequencer automatically determines the CLV mode.

- 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.

Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	7	V
Power dissipation	Pd	400*	mW
Operating temperature	Topr	-25~+70	Ĵ
Storage temperature	Tstg	-55~+125	C

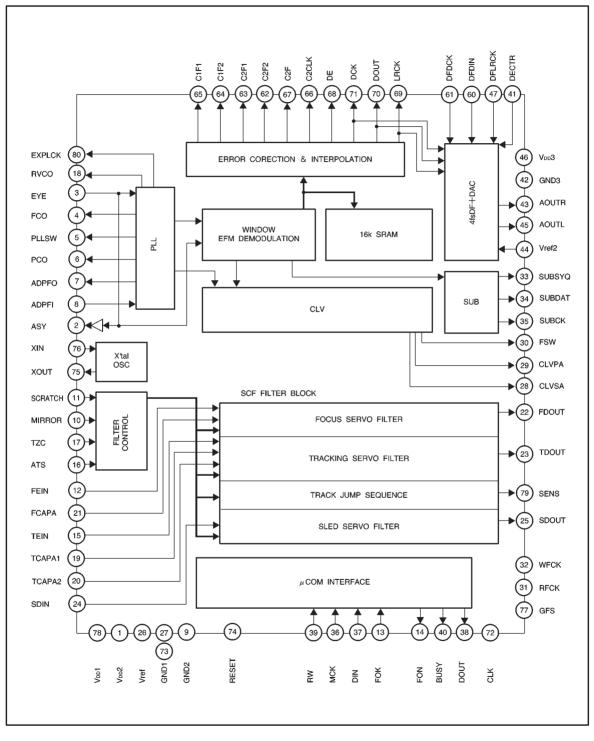
•Absolute maximum ratings (Ta =  $25^{\circ}$ C)

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

•Recommended operating conditions (Ta =  $25^{\circ}$ C)

Parameter	Symbol	Min.	Тур.	Max.	Unit
Power supply voltage	Vcc	3.0	_	5.5	V

#### Block diagram



## Pin descriptions

Pin No.	Pin name	Analog / digital	1/0	Function	I / O circuit
1	Vdd2	_	_	PLL and servo filter block power supply	-
2	ASY	Digital	0	EFM signal slice level control output	5
3	EYE	Digital	I	EFM signal input pin from the RF amplifier	4
4	FCO	Analog	0	PLL phase comparison error voltage output	7
5	PLLSW	Digital	0	PLL time constant switch pin	3
6	PCO	Analog	0	PLL phase comparison error voltage output	7
7	ADPFO	Analog	0	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	1	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	0	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	1	PLL VCO free-run resistor	1
18	RVCO	Analog	0	Tracking/zero cross comparator input	1
19	TCAPA1	Analog	1/0	For connection of switch 1 for tracking servo filter	11
20	TCAPA2	Analog	1/0	For connection of switch 2 for tracking servo filter	3
21	FCAPA	Analog	1/0	For connection of capacitor for focus servo filter	11
22	FDOUT	Analog	0	Focus drive output	1
23	TDOUT	Analog	0	Tracking drive output	1
24	SDIN	Analog	I	Sled amplifier input	1
25	SDOUT	Analog	0	Sled drive output	2
26	Vref	Analog	I	Bias voltage input	6
27	GND1	_	_	Digital ground	-
28	CLVSA	Analog	0	Spindle motor drive speed control output (analog)	1
29	CLVPA	Analog	0	Spindle motor drive rough control or phase control output (analog)	1
30	FSW	Digital	0	Spindle motor output filter time constant switching output	3
31	RFCK	Digital	0	Read frame clock output (X'tal 7.35kHz)	5
32	WFCK	Digital	0	Write frame clock output (7.35kHz when locked to X'tal)	5
33	SUBSYQ	Digital	0	Sub-code sync signal S0+S1 output	
34	SUBDATA	Digital	0	Sub-code serial output	5
35	SUBCK	Digital	1	Clock input for sub-code read	4

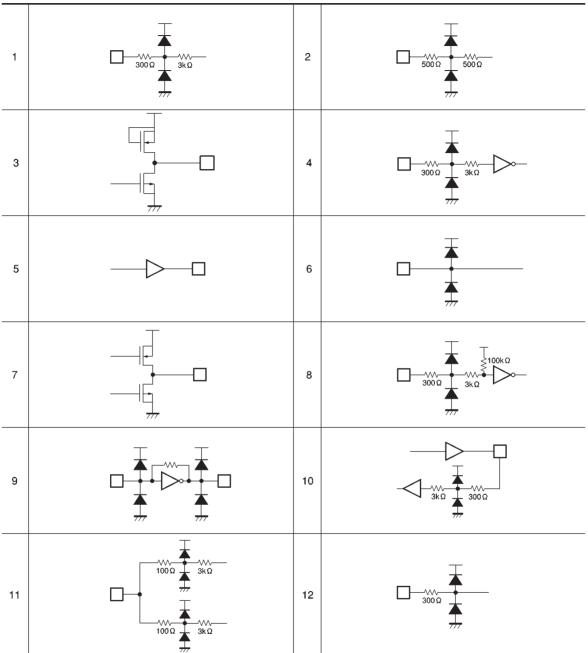


Pin No.	Pin name	Analog / digital	1/0	Function	I / O circuit
36	MCK	Digital	I	Clock for reading serial data from CPU or sub Q-code	4
37	DIN	Digital	I	Input for serial data from clock	4
38	DOUT	Digital	0	Sub Q-code or internal status serial output	7
39	RW	Digital	I	Read/write switch input (outputs data from DOUT when High and inputs data to DIN when Low)	4
40	BUSY	Digital	0	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	0	Lch analog audio output	12
44	Vref2	Analog	0	Reference voltage for D/A converter (connect capacitor between this pin and GND)	6
45	AOUTR	Analog	0	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	0	C22 correction flag output	5
63	C2F1	Digital	0	C21 correction flag output	5
64	C1F2	Digital	0	C12 correction flag output	5
65	C1F1	Digital	0	C11 correction flag output	5
66	C2CLK	Digital	0	Strobe signal (f=176.4kHz)	5
67	C2F	Digital	0	Correction status output	5
68	DE	Digital	0	Strobe signal (f=88.2kHz)	5
69	LRCK	Digital	0	Strobe signal (f=44.1kH)	5



Pin No.	Pin name	Analog / digital	1/0	Function	I / O circuit
70	DOUTA	Digital	0	Audio data output (2'SCOMP)	5
71	DOCK	Digital	0	Bit clock for DOUT (f=2.1168MHz)	5
72	CLK	Digital	0	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 100k $\Omega$ resistor)	8
75	XOUT	Digital	0	X'tal oscillation circuit output (f=16.9MHz)	9
76	XIN	Digital	1	X'tal oscillation circuit input (f=16.9MHz)	9
77	GFS	Digital	0	GFS monitor output (select from four types using &hE4 command)	5
78	Vdd1	—	-	Digital power supply	_
79	SENS	Digital	0	Status output of signal specified by &hE4 command)	5
80	EXPLCK	Digital	1/0	PLL playback clock output or external PLL playback clock input	10

## Input / output circuits



\*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 =  $25^{\circ}$ C and V<sub>DD</sub> = 5V)

Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions	Applicable pin
Input high level voltage	ViH	3.5	-	—	V	-	*1
Input low level voltage	VIL	_	-	0.3	V	-	*1
Output high level voltage	Vон	4.0	-	VDD	V	Іон=—1mA	*2
Output low level voltage	Vol	0	-	0.4	V	loL=1mA	*2, 4
Input resistance 1	Vo1	80	100	120	kΩ	Between Voo1 pin	*3
Input resistance 2	V <sub>O2</sub>	60	75	90	kΩ	Between BIAS pin	TZC
Input resistance 3	Vo3	180	230	280	kΩ	Between BIAS pin	ATS
Input resistance 4	Vo4	20	25	30	kΩ	Between BIAS pin	*5
Input leak current	lu	_	_	±5	μA	VI=0~5.25V	*1
Output leak current	ILO	_	-	±5	μA	VI=0~5.25V	*4
Vref2 output voltage	Vret2	_	2.5	—	V	-	Vref2

# **Optical disc ICs**

# **BU9314KS**

$\langle Focus servo \rangle$ DC voltage gain $G_{FD1}$ 17       20       23       dB $V_{IN}=1Hz$ , 100mVP.P       &h10XF, 1462         AC voltage gain 1 $G_{FDF1}$ $-0.7$ 2.3       5.3       dB $V_{IN}=1kHz$ , 100mVP.P       &h10XF, 1462         AC voltage gain 2 $G_{FDF2}$ $-5.1$ $-2.1$ $0.9$ dB $V_{IN}=300Hz$ , 100mVP.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 $V_{FD2}$ $ -2.1$ $-1.5$ $V$ $ -$ Offset voltage $V_{FD7}$ $-350$ $0$ $350$ mV $ -$ Offset voltage gain $G_{TD1}$ $23$ $26$ $29$ dB $V_{IN}=1Hz$ , $20mV_{P.P}$ &h10DX, 1159, 120         AC voltage gain 1 $G_{TDF1}$ $-0.5$ $2.5$ $5.5$ dB $V_{IN}=300Hz$ , $20mV_{P.P}$ &h10DX, 1159, 120         AC voltage gain 2 $G_{TDF2}$	Analog system cha	aracteristi	cs (unless	otherwise	e noted, Ta	a = 25°C,	$V_{\text{DD}}$ = 5V, and $V_{\text{C}}$ reference	)
	Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions	Setting command
AC voltage gain 1         Groen $-0.7$ $2.3$ $5.3$ dB         Vm=1kHz, 100mVeP         &h10XF, 1462           AC voltage gain 2         Groen $-5.1$ $-2.1$ $0.9$ dB         Vm=300Hz, 100mVeP         &h10XF, 1462           Maximum output voltage         Vrop $1.5$ $2.1$ $-$ V $ -$ Minimum output voltage         Vrop $1.5$ $2.1$ $-$ V $ -$ Offset voltage         Vrop $1.5$ $2.1$ $-$ V $ -$ Offset voltage         Vrop $-350$ $0$ $350$ mV $  -$ Coltage gain 2         Groen $2.3$ $26$ $29$ dB         Vm=1kHz, 20mVeP         & & & & & & & & & & & & & & & & & & &	$\langle Focus \ servo \rangle$							
Act Voltage gain 2         Grave Maximum output voltage         Verb Verb         1.5         2.1          V	DC voltage gain	GFD1	17	20	23	dB	VIN=1Hz, 100mVP-P	&h10XF, 1462
Maximum output voltage         Vrpti         1.5         2.1         -         V         -         -           Minimum output voltage         Vrpc         -         -2.1         -1.5         V         -         -           Offset voltage         Vrpc         -350         0         350         mV         -         A           Offset voltage gain         Grpri         23         26         29         dB         Vin=1Hz, 20mVer         &h10XF, 1462           AC voltage gain 1         Grpri         -0.5         2.5         5.5         dB         Vin=1Hz, 20mVer         &h10DX, 1159, 120           AC voltage gain 3         Grpris         28         31         34         dB         Vin=1Hz, 20mVer         &h10DX, 1159, 120           AC voltage gain 3         Grors         28         31         34         dB         Vin=1KHz, 20mVer         &h10DX, 1159, 120           AC voltage gain 4         Grors         28         31         34         dB         Vin=1AHz, 20mVer         &h10DX, 1159, 120           AC voltage gain 4         Grors         21.5         24.5         27.5         dB         Vin=300Hz, 20mVer         &h10DX, 1159, 120           AC voltage gain 4         Grors         1.5 <td>AC voltage gain 1</td> <td>GFDF1</td> <td>-0.7</td> <td>2.3</td> <td>5.3</td> <td>dB</td> <td>VIN=1kHz, 100mVP-P</td> <td>&amp;h10XF, 1462</td>	AC voltage gain 1	GFDF1	-0.7	2.3	5.3	dB	VIN=1kHz, 100mVP-P	&h10XF, 1462
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	AC voltage gain 2	GFDF2	-5.1	-2.1	0.9	dB	VIN=300Hz, 100mVP-P	&h10XF, 1462
Offset voltage         Vrop $-350$ 0 $350$ mV $-$ &h10XF, 1462           (Tracking servo)         DC voltage gain         Grop1         23         26         29         dB         Vm=1Hz, 20mVep         &h10DX, 1159, 120           AC voltage gain 1         Grop1 $-0.5$ 2.5         5.5         dB         Vm=1KHz, 20mVep         &h10DX, 1159, 120           AC voltage gain 2         Grop2 $-4$ $-1$ 2         dB         Vm=300Hz, 20mVep         &h10DX, 1159, 120           AC voltage gain 3         Grop2 $-4$ $-1$ 2         dB         Vm=300Hz, 20mVep         &h10DX, 1159, 120           AC voltage gain 4         Grop2 $21.5$ 24.5         27.5         dB         Vm=300Hz, 20mVep         &h10DX, 1159, 120           AC voltage gain 4         Grop2 $21.5$ 24.5         27.5         dB         Vm=300Hz, 20mVep         &h10DX, 1159, 120           AC voltage gain 4         Grop2 $                -$ </td <td>Maximum output voltage</td> <td>VFD1</td> <td>1.5</td> <td>2.1</td> <td>_</td> <td>V</td> <td>-</td> <td>-</td>	Maximum output voltage	VFD1	1.5	2.1	_	V	-	-
Creacking servol       Vin       Vin       Vin       Vin       Vin       Vin         Creacking servol       Creacking servol       B       Vin=1kL, 20mVe-p       &h10DX, 1159, 120         AC voltage gain 1       Grop: $-0.5$ 2.5       5.5       dB       Vin=1kHz, 20mVe-p       &h10DX, 1159, 120         AC voltage gain 3       Grop: $-4$ $-1$ 2       dB       Vin=300Hz, 200mVe-p       &h10DX, 1159, 120         AC voltage gain 4       Grop: $28$ 31       34       dB       Vin=1kHz, 20mVe-p       &h10DX, 1159, 120         AC voltage gain 4       Grop: $28$ 31       34       dB       Vin=300Hz, 20mVe-p       &h10DX, 1159, 120         AC voltage gain 4       Grop: $21.5$ $24.5$ $27.5$ dB       Vin=300Hz, 20mVe-p       &h10DX, 1159, 120         Mainum output voltage       Vrop $1.5$ $2.1$ $-$ V $ -$ Minimum output voltage       Vrop $-500$ 0       500       mV $  -$ Jump output voltage 1       Vire $-1.3$ $-1.1$ V $    -$ <	Minimum output voltage	VFD2	-	-2.1	-1.5	V	-	-
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Offset voltage	VFOF	-350	0	350	mV	-	&h10XF, 1462
AC voltage gain 1         Gror 1 $-0.5$ $2.5$ $5.5$ dB         VIN=1kHz, 200mVP.P $kh10DX, 1159, 120$ AC voltage gain 2         Gror 2 $-4$ $-11$ $2$ dB         VIN=1kHz, 200mVP.P $kh10DX, 1159, 120$ AC voltage gain 3         Gror 3 $28$ $31$ $34$ dB         VIN=1kHz, 20mVP.P $kh10DX, 1159, 120$ AC voltage gain 4         Gror 4 $21.5$ $24.5$ $27.5$ dB         VIN=300Hz, 20mVP.P $kh10DX, 1159, 120$ AC voltage gain 4         Gror 4 $21.5$ $24.5$ $27.5$ dB         VIN=300Hz, 20mVP.P $kh10DX, 1159, 120$ AC voltage gain 4         Gror 4 $21.5$ $24.5$ $27.5$ dB         VIN=300Hz, 20mVP.P $kh10DX, 1159, 120$ Maximum output voltage 1         Vir 1 $1.5$ $2.1$ $-1.5$ V $ -$ Jump output voltage 2         Vir 1 $1.2$ $1.8$ $-$ V $ -$ Jum output voltage 2         Vir 2 $-25$ $0$ $0^{-1}$ $ -$	〈Tracking servo〉						1	
AC voltage gain 2         GTDF2         -4         -1         2         dB         VIN=300Hz, 200mVP.P         &h10DX, 1159, 120           AC voltage gain 3         GTDF3         28         31         34         dB         VIN=300Hz, 200mVP.P         &h10DX, 1159, 120           AC voltage gain 4         GTDF4         21.5         24.5         27.5         dB         VIN=300Hz, 20mVP.P         &h10DX, 1159, 120           Maximum output voltage         VTD1         1.5         2.1         -         V         -         -           Minimum output voltage         VTD1         1.5         2.1         -         V         -         -           Minimum output voltage         VTD2         -         -2.1         -1.5         V         -         -           Minimum output voltage         VTD1         1.5         2.1         -         V         -         &h10DX, 1159, 120           Jump output voltage         VTD2         -         -2.1         -1.5         V         -         &h10DX, 1159, 120           Jump output voltage 2         Vars1         10         25         40         mV         -         -           ATS threshold voltage 2         Vars2         -40         -25         <	DC voltage gain	GTD1	23	26	29	dB	VIN=1Hz, 20mV <sub>P-P</sub>	&h10DX, 1159, 1207
AC voltage gain 3         GTDF3         28         31         34         dB         VIN=1kHz, 20mVP-P         kh10DX, 1159, 120           AC voltage gain 4         GTDF4         21.5         24.5         27.5         dB         VIN=300Hz, 20mVP-P         kh10DX, 1159, 120           Maximum output voltage         VTD1         1.5         2.1         -         V         -         -           Minimum output voltage         VTD2         -         -2.1         -1.5         V         -         -           Offset voltage         VTD2         -         -2.1         -1.5         V         -         -           Offset voltage         VTD2         -         -2.1         -1.5         V         -         -         -           Jump output voltage 1         VuP1         1.2         1.8         -         V         -         &h13XF           Jump output voltage 2         VuP2         -         -1.9         -1.1         V         -         &h13FX           ATS threshold voltage 1         VuP2         -25         10         mV         -         -         -           Cled servo)          1.4         2         -         V         -         &h12	AC voltage gain 1	GTDF1	-0.5	2.5	5.5	dB	VIN=1kHz, 200mVP-P	&h10DX, 1159, 1207
AC voltage gain 4       Grove4       21.5       24.5       27.5       dB       Vm=300Hz, 20mVP.P       &h10DX, 1159, 120         Maximum output voltage       Vro1       1.5       2.1       -       V       -	AC voltage gain 2	GTDF2	-4	-1	2	dB	VIN=300Hz, 200mV <sub>P-P</sub>	&h10DX, 1159, 1207
Maximum output voltage         V TD1         1.5         2.1         -         V         -         <	AC voltage gain 3	GTDF3	28	31	34	dB	V <sub>IN</sub> =1kHz, 20mV <sub>P-P</sub>	&h10DX, 1159, 1207
Minimum output voltage         VTD2         -         -2.1         -1.5         V         -         -           Offset voltage         VToF         -500         0         500         mV         -         &h10DX, 1159, 128           Jump output voltage 1         VJP1         1.2         1.8         -         V         -         &h13XF           Jump output voltage 2         VJP2         -         -1.9         -1.1         V         -         &h13XF           Jump output voltage 2         VJP2         -         -1.9         -1.1         V         -         &h13XF           Jump output voltage 2         VJP2         -         -1.9         -1.1         V         -         &h13XF           Jump output voltage 2         VJP2         -         0         25         mV         -         -           ATS threshold voltage 2         VATC         -25         0         25         mV         -         -         -           VStore -         -25         0         25         mV         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	AC voltage gain 4	GTDF4	21.5	24.5	27.5	dB	VIN=300Hz, 20mVp-p	&h10DX, 1159, 1207
Markade voltage         VTOF $-500$ O         500         mV $-$ &h10DX, 1159, 128           Jump output voltage 1         VJP+         1.2         1.8 $-$ V $-$ &h13XF           Jump output voltage 2         VJP+         1.2         1.8 $-$ V $-$ &h13XF           Jump output voltage 2         VJP+         1.2         1.8 $-$ V $-$ &h13XF           Jump output voltage 2         VJP+         1.2         1.8 $-$ V $-$ &h13XF           Jump output voltage 2         VJP+         1.2         1.8 $-$ V $-$ &h13XF           Jump output voltage 2         VArs1         10         25         40         mV $ -$ ATS threshold voltage         VArs2 $-40$ $-25$ 10         mV $  -$ Cite servo         Vrcc $-25$ 0         25         mV $  -$ Otigate gain         Gso1         1.4         2 $-$ V	Maximum output voltage	VTD1	1.5	2.1	_	V	_	_
Jump output voltage 1VJP11.21.8 $-$ V $-$ &h13XFJump output voltage 2VJP2 $ -1.9$ $-1.1$ V $-$ &h13FXATS threshold voltage 1VATS1102540mV $ -$ ATS threshold voltage 2VATS2 $-40$ $-25$ 10mV $ -$ ATS threshold voltage 2VATS2 $-40$ $-25$ 10mV $ -$ ATS threshold voltage 2VATS2 $-40$ $-25$ 10mV $ -$ ATS threshold voltage 2VATS2 $-40$ $-25$ 10mV $ -$ ATS threshold voltage 2VATS2 $-40$ $-25$ 10mV $ -$ ATS threshold voltage 2VATS2 $-40$ $-25$ 10mV $ -$ Cised servo> $ -25$ 025mV $ -$ DC voltage gainGsD1242730dBVIN=100Hz, 20mVP.P&h124XMaximum output voltageVsD1 $1.4$ 2 $-$ V $ -$ Minimum output voltageVsD2 $ -2.1$ $-1.5$ V $ -$ Misiter + VoltageVsoc $-220$ 0220mV $-$ &h124XKick output voltage 1Vsc1 $1.5$ $2.0$ $-$ V $-$ &h18XFKick output voltage 2Vsc2 $ -1.8$ $-1.3$ V $ -$ &	Minimum output voltage	Vtd2	_	-2.1	-1.5	V	-	-
Char productions         Constraint         Constant         Constraint         Co	Offset voltage	VTOF	-500	0	500	mV	-	&h10DX, 1159, 1287
ATS threshold voltage 1         VATS1         10         25         40         mV             ATS threshold voltage 2         VATS1         10         25         40         mV              ATS threshold voltage 2         VATS2         -40         -25         10         mV              ATS threshold voltage 2         VATS2         -25         0         25         mV              ZC threshold voltage gain         GSD1         24         27         30         dB         VIN=100Hz, 20mVP.P         &h124X           Maximum output voltage         VSD1         1.4         2          V              Minimum output voltage         VSD2          -2.1         -1.5         V              Minimum output voltage         VSOF         -220         0         220         mV          &h124X           Kick output voltage 2         VKC2         -         -1.8         -1.3         V          &h185X           Voligital filter+D / CONVERTER         (RES	Jump output voltage 1	VJP1	1.2	1.8	_	V	_	&h13XF
ATS threshold voltage 2         VATS2 $-40$ $-25$ $10$ mV $ -$ ATS threshold voltage 2         VTZC $-25$ $0$ $25$ mV $ -$ ZC threshold voltage 2         VTZC $-25$ $0$ $25$ mV $ -$ QSted servo> $ 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$ $ \& h124X$ Kick output voltage 2 $V_{KC2}$ $ -1.8$ $-1.3$ $V$ $  \& h18FX$ (Digital filter+D / A converter)         (RL=10-K $U_L$ usin	Jump output voltage 2	VJP2	_	-1.9	-1.1	V	-	&h13FX
TZC threshold voltage         VTzc        25         0         25         mV             (Sled servo)           24         27         30         dB         VIN=100Hz, 20mVP-P         &h124X           Maximum output voltage         Vsb1         1.4         2          V             Minimum output voltage         Vsb2          -2.1         -1.5         V             Minimum output voltage         Vsb2          -2.1         -1.5         V             Offset voltage         Vsor          2.0         0         220         mV          &h124X           Kick output voltage 1         VKc1         1.5         2.0         -         V          &h124X           Kick output voltage 2         Vkc2         -         -1.3         V         -         &h18FX           (Digital filter+D / A converter)         (RL=10K $\Omega$ , using DIN-AUD/O filter)         -         &h18FX            Resolution         RES         -         -         16         bit         -         -           Maximum output	ATS threshold voltage 1	Vats1	10	25	40	mV	-	-
	ATS threshold voltage 2	Vats2	-40	-25	10	mV	_	-
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	TZC threshold voltage	Vtzc	-25	0	25	mV	_	-
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\langle { m Sled \ servo}  angle$							
voltage         Vsp1         1.4         2         -         V         -         <	DC voltage gain	GsD1	24	27	30	dB	VIN=100Hz, 20mVP-P	&h124X
voltage $V_{SD2}$ $ -2.1$ $-1.3$ $V$ $  -$ 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)(RL=10k $\Omega$ , using DIN-AUDIO filter)ResolutionRES $  16$ bit $ -$ Maximum output amplitude $V_{MAX}$ $1.7$ $1.9$ $ V$ Data pattern: 1kHz, 2VP-P $-$ DistortionTHD $ 0.02$ $0.3$ %Data pattern: 1kHz, 2VP-P $-$		VSD1	1.4	2	_	v	_	-
Kick output voltage 1Vkc11.52.0-V-&h18XFKick output voltage 2Vkc21.8-1.3V-&h18XFKick output voltage 2Vkc21.8-1.3V-&h18FX $\langle Digital filter+D / A converter \rangle$ (RL=10k $\Omega$ , using DIN-AUDIO filter)Ah18FXResolutionRES16bitMaximum output amplitudeVMAX1.71.9-VData pattern: 1kHz, 2VP-P-DistortionTHD-0.020.3%Data pattern: 1kHz, 2VP-P-CrosstalkCT90-70dBData pattern: 1kHz, 2VP-P-		VSD2	_	-2.1	-1.5	V	_	-
Kick output voltage 2 $V_{KC2}$ $ -1.8$ $-1.3$ $V$ $ kh18FX$ (Digital filter+D / A converter)(RL=10k $\Omega$ , using DIN-AUDIO filter)ResolutionRES $ -$ 16bit $ -$ Maximum output amplitude $V_{MAX}$ 1.71.9 $ V$ Data pattern: 1kHz, 2VP-P $-$ DistortionTHD $-$ 0.020.3%Data pattern: 1kHz, 2VP-P $-$ CrosstalkCT $ -90$ $-70$ dBData pattern: 1kHz, 2VP-P $-$	Offset voltage	VSOF	-220	0	220	mV	_	&h124X
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Kick output voltage 1	VKC1	1.5	2.0	—	V	_	&h18XF
Resolution       RES       -       -       16       bit       -       -         Maximum output amplitude       V <sub>MAX</sub> 1.7       1.9       -       V       Data pattern: 1kHz, 2VP-P       -         Distortion       THD       -       0.02       0.3       %       Data pattern: 1kHz, 2VP-P       -         Crosstalk       CT       -       -90       -70       dB       Data pattern: 1kHz, 2VP-P       -	Kick output voltage 2	VKC2	_	-1.8	-1.3	V	_	&h18FX
Maximum output amplitudeV MAX1.71.9-VData pattern: 1kHz, 2VP-P-DistortionTHD-0.020.3%Data pattern: 1kHz, 2VP-P-CrosstalkCT90-70dBData pattern: 1kHz, 2VP-P-	〈Digital filter+D / A	converter	) (RL=10	$0 k \Omega$ , using	DIN-AUDI	O filter)		
amplitudeVMAX1.71.9-VData pattern: 1kHz, 2VP-P-DistortionTHD-0.020.3%Data pattern: 1kHz, 2VP-P-CrosstalkCT90-70dBData pattern: 1kHz, 2VP-P-	Resolution	RES		-	16	bit	-	_
Crosstalk CT – –90 –70 dB Data pattern: 1kHz, 2VP-P –		VMAX	1.7	1.9	_	v	Data pattern: 1kHz, 2V <sub>P-P</sub>	_
	Distortion	THD		0.02	0.3	%	Data pattern: 1kHz, 2VP-P	_
S / N ratio S / N90 -70 dB	Crosstalk	СТ		-90	-70	dB	Data pattern: 1kHz, 2VP-P	_
	S / N ratio	S/N	-	-90	-70	dB	-	

◎Not designed for radiation resistance.

## External dimensions (Units: mm)

