

# AN8473SA

## Spindle motor driver IC for optical disk

### ■ Overview

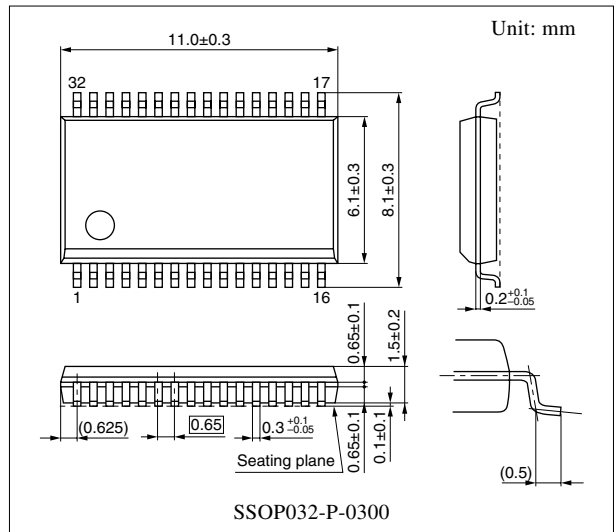
The AN8473SA is an optical disk driver IC, featuring direct PWM drive, DMOS power drive, low ON resistance of output power MOS and 120° of duty-factor.

### ■ Features

- $R_{ON} = 0.5 \Omega$  (for both upper and lower)
- 5 V single power source
- Circuit current 7 mA (including step-up circuit current)

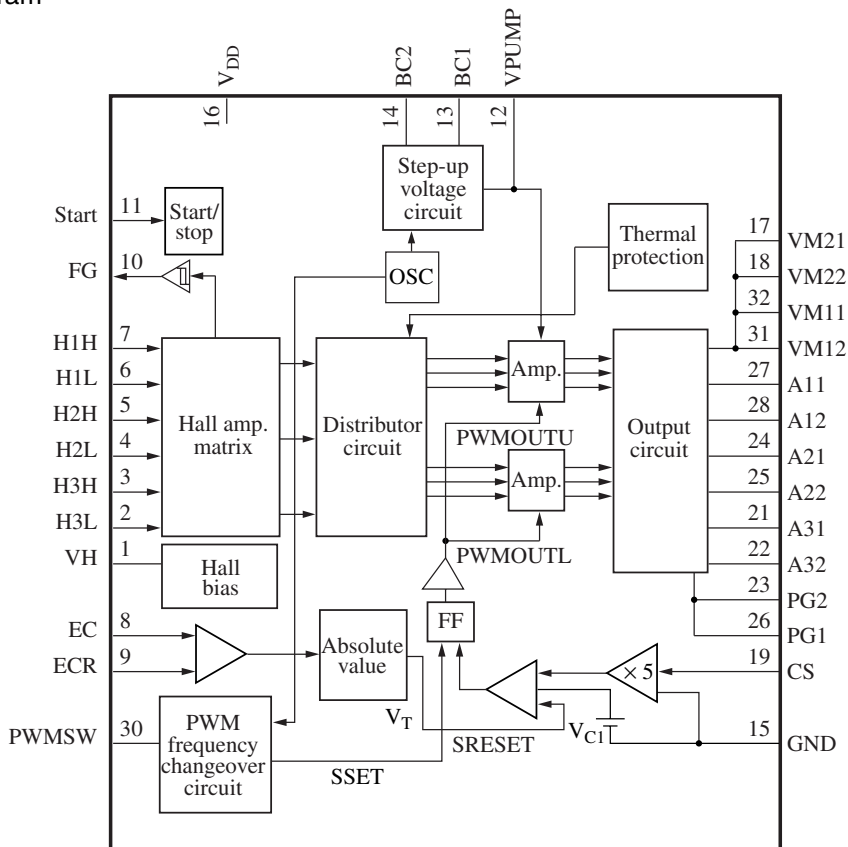
### ■ Applications

- Optical disk



Note) The package of this product will be changed to lead-free type (SSOP032-P-0300B). See the new package dimensions section later of this datasheet.

### ■ Block Diagram



## Pin Descriptions

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	VH	Hall bias pin	17	VM21	Motor supply voltage pin 2
2	H3L	Hall element-3 negative input pin	18	VM22	Motor supply voltage pin 2
3	H3H	Hall element-3 positive input pin	19	CS	Current det. pin
4	H2L	Hall element-2 negative input pin	20	N.C.	N.C.
5	H2H	Hall element-2 positive input pin	21	A31	Drive output 3
6	H1L	Hall element-1 negative input pin	22	A32	Drive output 3
7	H1H	Hall element-1 positive input pin	23	PG2	Power current det. pin 2
8	EC	Torque command input pin	24	A21	Drive output 2
9	ECR	Torque command reference input pin	25	A22	Drive output 2
10	FG	FG signal output pin	26	PG1	Power current det. pin 1
11	Start	Start/stop changeover pin	27	A11	Drive output 1
12	VPUMP	Booster pin	28	A12	Drive output 1
13	BC1	Booster capacitor connection pin 1	29	N.C.	N.C.
14	BC2	Booster capacitor connection pin 2	30	PWMSW	PWM frequency changeover pin
15	GND	Ground pin	31	VM12	Motor supply voltage pin 1
16	V <sub>DD</sub>	Supply voltage pin	32	VM11	Motor supply voltage pin 1

## Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage *2	V <sub>DD</sub>	6.5	V
	V <sub>M11, 12</sub>		
	V <sub>M21, 22</sub>		
Drive output voltage *5	V <sub>(m)</sub>	15	V
Control signal input voltage *6	V <sub>(n)</sub>	0 to V <sub>DD</sub>	V
Supply current	I <sub>DD</sub>	30	mA
Drive output current *4	I <sub>(o)</sub>	±1 200	mA
Hall bias current *7	I <sub>HB(n)</sub>	30	mA
Power dissipation *3	P <sub>D</sub>	293	mW
Operating ambient temperature *1	T <sub>opr</sub>	-30 to +85	°C
Storage temperature *1	T <sub>stg</sub>	-55 to +150	°C

Note) Do not apply external currents or voltages to any pins not specifically mentioned.

For circuit currents, '+' denotes current flowing into the IC, and '-' denotes current flowing out of the IC.

\*1: Except for the operating ambient temperature and storage temperature, all ratings are for T<sub>a</sub> = 25°C.

\*2: The voltage in the step-up voltage circuit exceeds the supply voltage.

For the allowable value of the step-up voltage, refer to "Electrical Characteristics".

\*3: The power dissipation shown is the value of independent IC without a heat sink at T<sub>a</sub> = 70°C. Refer to the P<sub>D</sub> — T<sub>a</sub> curves of the "Application Notes" for details.

\*4: o = 17, 18, 21, 22, 23, 24, 25, 26, 27, 28, 31, 32

\*5: m = 21, 22, 24, 25, 27, 28

\*6: n = 2, 3, 4, 5, 6, 7, 8, 9, 11, 30

\*7: n = 1

### ■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	$V_{DD}$	4.5 to 5.5	V
	$V_{M11, 12}$		
	$V_{M21, 22}$		

### ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Overall</b>						
Circuit current 1	$I_{DD1}$	$V_{DD} = 5\text{ V}$ in power save mode	—	0	0.2	mA
Circuit current 2	$I_{DD2}$	$V_{DD} = 5\text{ V}$ including step-up circuit	—	7	14	mA
<b>Start/stop</b>						
Start voltage	$V_{START}$	Voltage with which a circuit operates at $V_{DD} = 5\text{ V}$ and $L \rightarrow H$	2.7	—	—	V
Stop voltage	$V_{STOP}$	Voltage with which a circuit becomes off at $V_{DD} = 5\text{ V}$ and $H \rightarrow L$	—	—	0.7	V
<b>Hall bias</b>						
Hall bias voltage	$V_{HB}$	$V_{DD} = 5\text{ V}$ , $I_{HB} = 20\text{ mA}$	0.7	1.2	1.6	V
<b>Hall amplifier</b>						
Input bias current	$I_{BH}$	$V_{DD} = 5\text{ V}$	—	1	5	$\mu\text{A}$
In-phase input voltage range	$V_{HBR}$	$V_{DD} = 5\text{ V}$ , except for H2H, H2L	1.5	—	4.0	V
Minimum input level	$V_{INH}$	$V_{DD} = 5\text{ V}$	60	—	—	mV[p-p]
<b>Torque command</b>						
In-phase input voltage range	EC	$V_{DD} = 5\text{ V}$	0.5	—	3.9	V
Offset voltage	$EC_{OF}$	$V_{DD} = 5\text{ V}$	-100	0	100	mV
Dead zone	$EC_{DZ}$	$V_{DD} = 5\text{ V}$	0	75	150	mV
Input current	$EC_{IN}$	$V_{DD} = 5\text{ V}$ , $EC = ECR = 2.5\text{ V}$	-5	-1	—	$\mu\text{A}$
Input/output gain	$A_{CS}$	$V_{DD} = 5\text{ V}$ , $R_{CS} = 0.33\ \Omega$	0.36	0.48	0.60	A/V
<b>Output</b>						
High-level output saturation voltage	$V_{OH}$	$V_{DD} = 5\text{ V}$ , $I_O = -500\text{ mA}$	—	0.15	0.30	V
Low-level output saturation voltage	$V_{OL}$	$V_{DD} = 5\text{ V}$ , $I_O = 500\text{ mA}$	—	0.15	0.30	V
Torque limit current	$I_{TL}$	$V_{DD} = 5\text{ V}$ , $R_{CS} = 0.33\ \Omega$	455	570	685	mA
<b>FG</b>						
FG output high-level	$FG_H$	$V_{DD} = 5\text{ V}$ , $I_{FG} = -0.01\text{ mA}$	3	—	—	V
FG output low-level	$FG_L$	$V_{DD} = 5\text{ V}$ , $I_{FG} = 0.01\text{ mA}$	—	—	0.5	V
In-phase input voltage range	$V_{FGR}$	$V_{DD} = 5\text{ V}$	1.5	—	3.0	V
FG hysteresis width	$H_{FG}$	$V_{DD} = 5\text{ V}$	5	10	20	mV
<b>Step-up circuit</b>						
Step-up voltage	$V_{PUMP}$	$V_{DD} = 5\text{ V}$	7	—	10	V

### ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
PWM oscillation changeover						
Input high-level	$PWM_H$	$V_{DD} = 5\text{ V}$	4.5	—	—	V
Input low-level	$PWM_L$	$V_{DD} = 5\text{ V}$	—	—	0.5	V

#### • Design reference data

Note) The characteristics listed below are theoretical values based on the IC design and are not guaranteed.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
PWM oscillation changeover						
PWM frequency high-level	$f_{PWMH}$	$V_{DD} = 5\text{ V}$ , PWMSW = Low	—	80	—	kHz
PWM frequency low-level	$f_{PWML}$	$V_{DD} = 5\text{ V}$ , PWMSW = High	—	40	—	kHz
Thermal protection						
Thermal protection operating temperature	$T_{SDON}$	$V_{DD} = 5\text{ V}$	—	150	—	$^\circ\text{C}$
Thermal protection hysteresis width	$\Delta T_{SD}$	$V_{DD} = 5\text{ V}$	—	40	—	$^\circ\text{C}$

### ■ Usage Notes

- Prevent this IC from being line-to-ground fault.

(To be concrete, do not short-circuit any of A31 (pin 21), A32 (pin 22), A21 (pin 24), A22 (pin 25), A11 (pin 27) and A12 (pin 28) with GND pin (pin 15).)

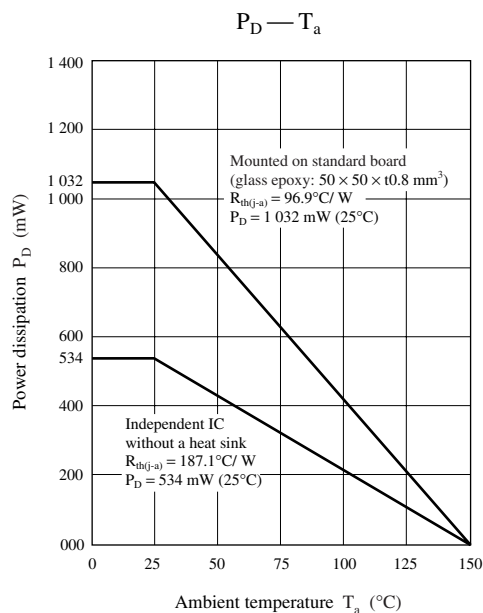
- Be careful of the following three pins because their static breakdown voltages are low. ( $C = 200\text{ pF}$ ,  $R = 0\ \Omega$ )

Pin 23: breakdown at 120 V

Pin 26: breakdown at 120 V

### ■ Application Notes

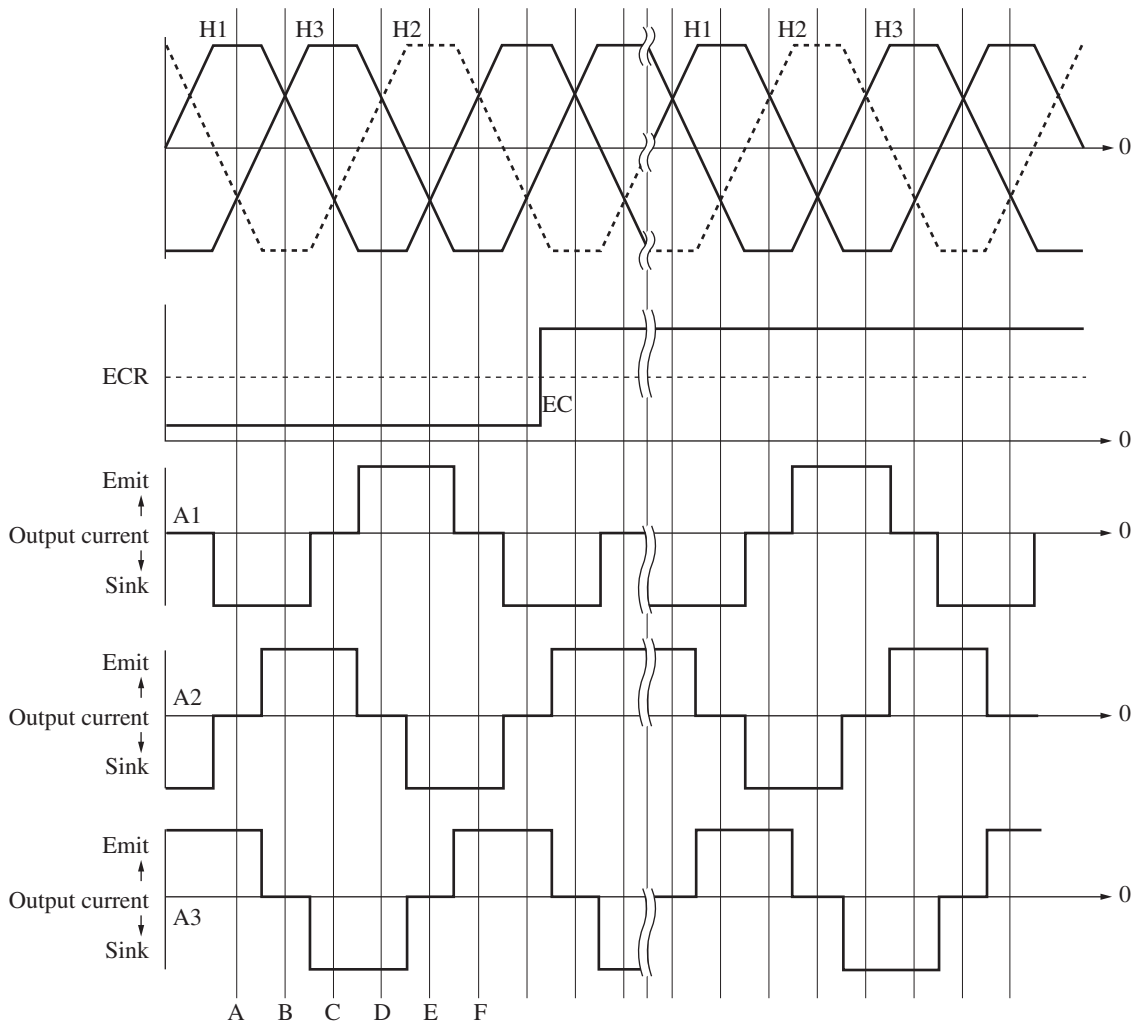
- $P_D - T_a$  curves of SSOP032-P-0300



■ Application Notes (continued)

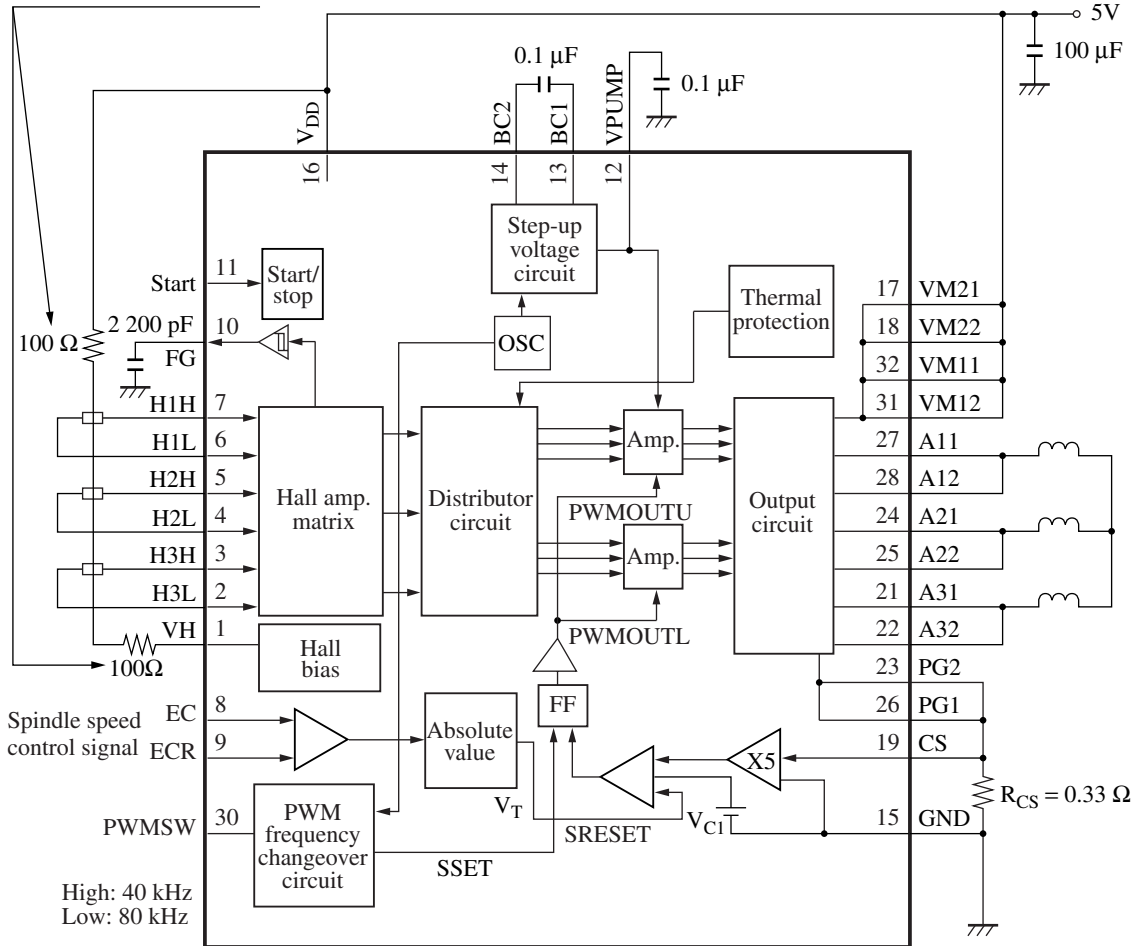
- Phase conditions between Hall input and output current

Phase of Hall pin			
	H1H	H2H	H3H
A	H	ML	ML
B	MH	L	MH
C	ML	ML	H
D	L	MH	MH
E	ML	H	ML
F	MH	MH	L



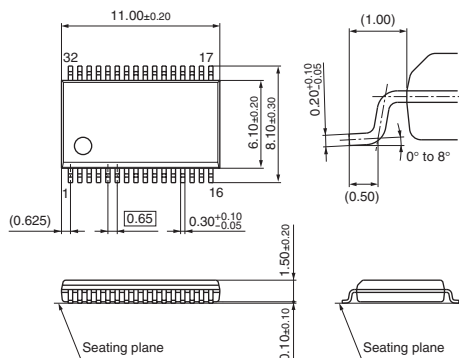
■ Application Circuit Example

(Check the stipulated value of electrical characteristics and then determine resistance value.)



■ New Package Dimensions (Unit: mm)

- SSOP032-P-0300B (Lead-free package)



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