

# AN3860SA

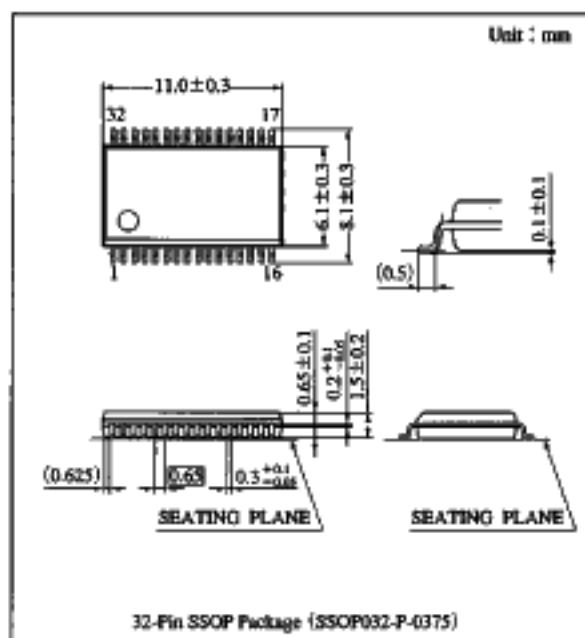
## Cylinder Motor Driver IC for Video Camera

### Overview

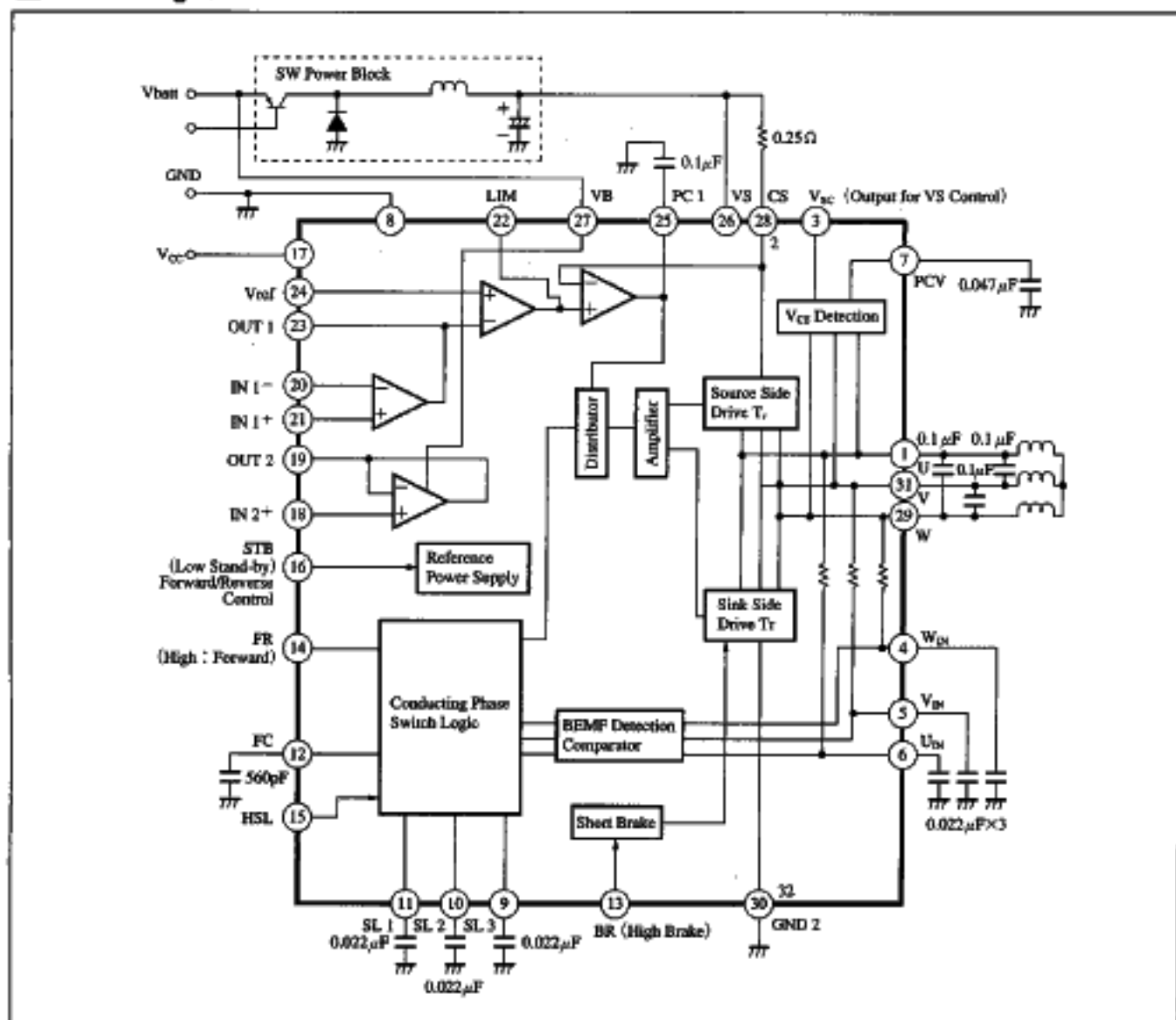
The AN3860SA is a cylinder sensorless-motor driver IC for Video Camera.

### Features

- Operating voltage range :  $V_{CC}=3.0$  to  $5.5V$
- Reduction of noise generated at current switching by 3-phase full-wave overlapping drive and built-in power transistors
- Standby mode for reducing power consumption
- Switching regulator control output



### Block Diagram



### Pin Descriptions

Pin No.	Pin name and Symbol	Pin No.	Pin name and Symbol
1	U-phase drive output U	17	Power supply V <sub>CC</sub>
2	Drive current output CS	18	Operational amplifier (2) input IN2H
3	Switching regulator control output VSC	19	Operational amplifier (2) output OUT2
4	W-phase detection WIN	20	Operational amplifier (1) reverse input IN1 <sup>-</sup>
5	V-phase detection VIN	21	Operational amplifier (1) normal input IN1 <sup>+</sup>
6	U-phase detection UIN	22	Output maximum current switching LIM
7	Voltage feedback phase correction PCV	23	Operational amplifier (1) output OUT1
8	Ground GND1	24	Servo reference voltage input V <sub>ref</sub>
9	Slope generation (3) SL3	25	Current feedback phase correction PCI
10	Slope generation (2) SL2	26	Motor drive power supply V <sub>S</sub>
11	Slope generation (1) SL1	27	Unregulated power supply V <sub>B</sub>
12	Oscillation FC	28	Drive current output CS
13	Dynamic brake control BR	29	W-phase drive output W
14	Forward/reverse switching FR	30	Ground for driver circuits GND2
15	Slope current switching HSL	31	V-phase drive output V
16	Standby input STB	32	Ground for driver circuits GND2

### Absolute Maximum Ratings (T<sub>a</sub> = 25°C)

Parameter	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	6.0	V
Unregulated voltage supply	V <sub>B</sub>	11	V
Motor supply voltage (within V <sub>B</sub> )	V <sub>S</sub>	11	V
Output terminal voltage n = 1, 29, 31	V <sub>a</sub>	11	V
Output current n = 1, 29, 31	I <sub>CO</sub>	1000	mA
Power dissipation	P <sub>O</sub>	668	mW
Operating ambient temperature <sup>(max)</sup>	T <sub>op</sub>	-25 to +70	°C
Storage temperature	T <sub>stg</sub>	-55 to +150	°C

Note) T<sub>a</sub> = 25°C except operating ambient temperature and storage temperature.

### Recommended Operating Range (T<sub>a</sub> = 25°C)

Parameter	Symbol	Range
Operating supply voltage range	V <sub>CC</sub>	3.0V to 5.5V
	V <sub>B</sub>	4.0V to 10.5V
	V <sub>S</sub>	1.5V to V <sub>B</sub>

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**Electrical Characteristics** ( $V_{CC}=3.3V$ ,  $V_B=6V$ ,  $V_S=6V$ ,  $T_a=25\pm 2^\circ C$ )

Parameter	Symbol	Condition	min	typ	max	Unit
<b>Drive Section</b>						
Drive gain	$G_{IO}$	$\frac{\Delta V_{CS}}{\Delta OUT1}$	0.11	0.14	0.17	times
Drive amp. offset	$V_{IOCS}$	Input offset voltage OUT1 and Vref	-100	6	100	mV
Max. output current (1)	$I_{Omax}(1)$	LIM : H $R_{CS}=0.25\Omega$	480	560	640	mA
Max. output current (2)	$I_{Omax}(2)$	LIM : L $R_{CS}=0.25\Omega$	625	750	875	mA
Brake current	IBR		200	500	—	mA
Sink side output voltage	$V_{CE}$	$I_O=100mA$	0.15	0.25	0.35	V
Sink side saturation voltage	$V_{SAT(1)}$	$I_O=500mA$	—	0.25	0.35	V
Source side saturation voltage	$V_{SAT(2)}$	$I_O=500mA$	—	0.90	1.3	V
<b>Bernf Detection Section</b>						
Comparator hysteresis width	$V_{HCDM}$		9	14	21	mV
<b>Oscillator</b>						
Triangular wave oscillation frequency	$f_{FC}$	$C_{FC}=560pF$	11.0	16.3	22.8	kHz
<b>Slope Section</b>						
Slope terminal charging current (1)	$I_{SLC(1)}$	HSL : L $C_{FC}=560pF$ $f_{emf}<160Hz$	-26	-20	-14	$\mu A$
Slope terminal discharging current (1)	$I_{SLD(1)}$		14	20	26	$\mu A$
Slope terminal charging current (2)	$I_{SLC(2)}$	HSL : L $C_{FC}=560pF$ $f_{emf}>181Hz$	-52	-40	-28	$\mu A$
Slope terminal discharging current (2)	$I_{SLD(2)}$		28	40	52	$\mu A$
Slope terminal charging current (3)	$I_{SLC(3)}$	HSL : H $C_{FC}=560pF$ $f_{emf}<160Hz$	-52	-40	-28	$\mu A$
Slope terminal discharging current (3)	$I_{SLD(3)}$		28	40	52	$\mu A$
Slope terminal charging current (4)	$I_{SLC(4)}$	HSL : H $C_{FC}=560pF$ $f_{emf}>181Hz$	-78	-60	-42	$\mu A$
Slope terminal discharging current (4)	$I_{SLD(4)}$		42	60	78	$\mu A$
<b>Operation Amplifier 1 Only</b>						
Common mode input voltage range	$V_{ICR(1)}$		0.2	—	$V_B$ to 1.4 or $V_{CC}$	V
Input offset voltage	$I_{IOAI}$		-50	5	50	nA
Voltage gain	$G_{AI}$		60	67	—	dB
Output sink current (1)	$I_{OSI(1)}$	OUT1=0.2V	20	140	—	$\mu A$
<b>Operation Amplifier 2 Only</b>						
Common mode input voltage range	$V_{ICR(2)}$		0	—	$V_B-1.4$	V
<b>Operation Amplifier 1, 2 Common</b>						
Input offset voltage	$V_{IOAI,2}$		-20	-3	20	mV
Output sink current 1 - (2)	$I_{OSI(2)}$		1.8	4	—	mA
Output sink current 2 - (2)	$I_{OSI(2)}$		2	4	—	mA
Output source current (2)	$I_{OSAI,2}$		—	-15	-2	mA
<b>Mode Switch=HSL, STB, FR, BR, LIM</b>						
Input high level	$V_{SWH}$		2.0	—	—	V
Input low level	$V_{SWL}$		—	—	0.6	V
Input bias current	$I_{BSW}$	$V_{SW}=2V$	—	25	100	$\mu A$
<b>Motor Supply Control</b>						
Input output gain	$G_{IOS}$	$\frac{\Delta V_{SC}}{\Delta U}$	1.4	2.0	2.6	times
Output impedance	$Z_{OS}$		12	18	24	k $\Omega$
Operation point (1)	$V_{S-U(1)}$	$V_S-V_U$ at $V_{SC}=1.6V$ in case of OUT1=Vref	0.1	0.35	0.6	V

**Electrical Characteristics (cont.)** ( $V_{CC}=3.3V$ ,  $V_B=6V$ ,  $V_S=6V$ ,  $T_a=25\pm 2^\circ C$ )

Parameter	Symbol	Condition	min	typ	max	Unit
Operation point (2)	$V_{S-U(2)}$	$V_S - V_U$ at $V_{SC}=1.6V$ in case of $OUT1 = V_{ref} + 1$	0.35	0.63	0.9	V

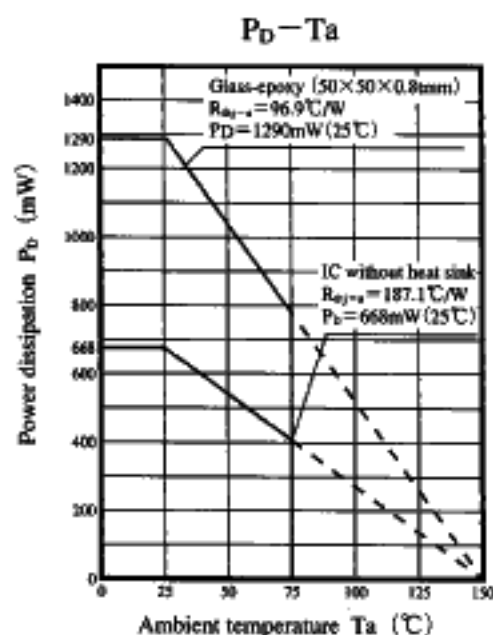
**Supply Current**

Supply current at operation	$I_{CC(1)}$	STB : H	—	10	15	mA
Supply current in STB	$I_{CC(2)}$	STB : L	—	6	10	mA
Unregulated supply current (1)	$I_{BB(1)}$	$V_{CC}=0V$	—	0.1	10	$\mu A$
Unregulated supply current (2)	$I_{BB(2)}$	$V_{CC}=3.3V$ , $In2^+ = 0V$	—	0.3	1.5	mA

**Electrical Characteristics ( $T_a=25\pm 2^\circ C$ ) [for reference only]**

Parameter	Symbol	Condition	for reference only	Unit
Over heat-protection-circuit operation-temperature	$T_{SD}$	$V_{CC}=3.3V$	175	$^\circ C$

Note) The value in the above characteristics is not a guaranteed value, but reference one on design.

**Reference**


### Pin Descriptions

Pin No.	Symbol	Equivalent circuit	Pin No.	Symbol	Equivalent circuit
1 31 29 2 30 32	U V W CS GND2 GND2		3	VSC	
4 5 6	Uin Vin Win		7	PCV	
9 10 11	SL1 SL2 SL3		12	FC	
13	BR		14	FR	
15	SHL		16	STB	

### ■ Pin Descriptions (cont.)

Pin No.	Symbol	Equivalent circuit	Pin No.	Symbol	Equivalent circuit
18	lin2+		19	OUT2	
21 20	lin1+ lin1-		23	OUT1	
24	Vref		25	PCI	
28	CS		22	LIM	

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