AN3860SA

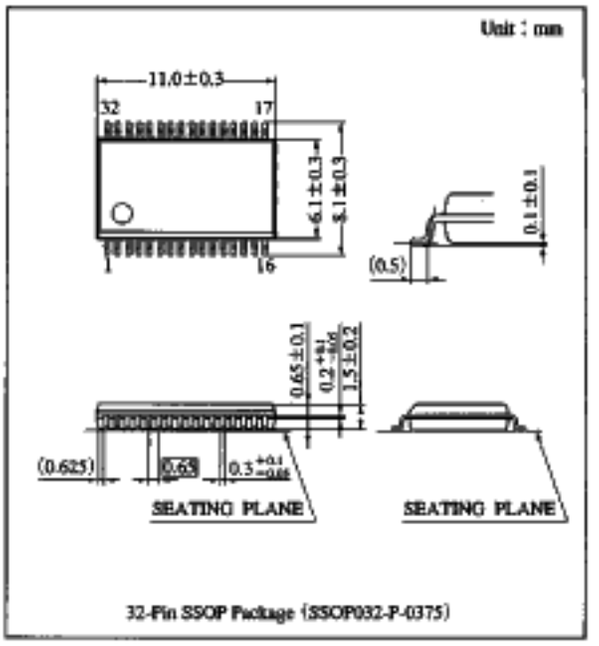
Cylinder Motor Driver IC for Video Camera

■ Overview

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

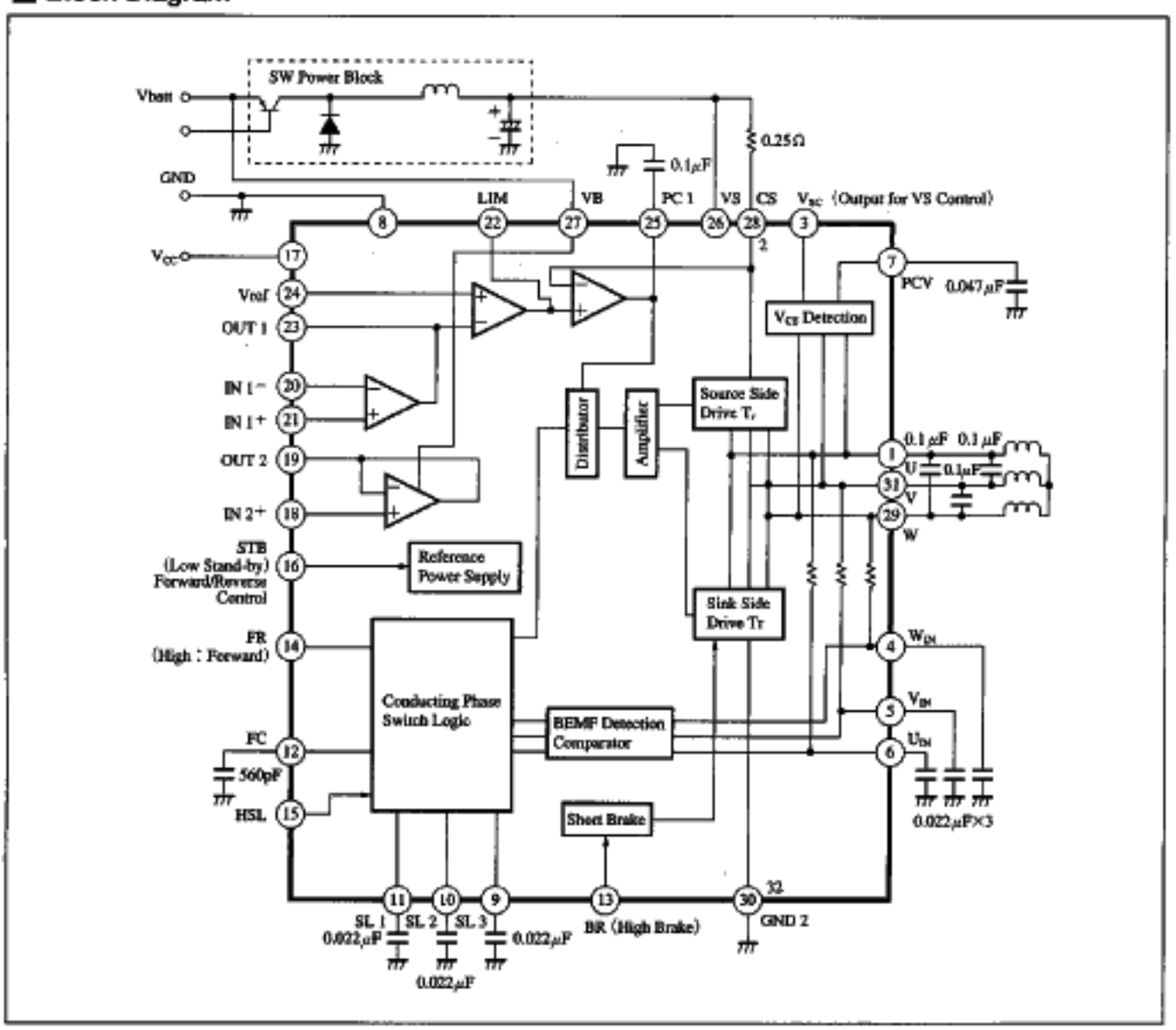
■ Features

- 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



32-Pin SSOP Package (SSOP032-P-0375)

■ 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_{CC}
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⁻
5	V-phase detection	VIN	21	Operational amplifier (1) normal input	IN1⁺
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	Vref
9	Slope generation (3)	SL3	25	Current feedback phase correction	PCI
10	Slope generation (2)	SL2	26	Motor drive power supply	VS
11	Slope generation (1)	SL1	27	Unregulated power supply	VB
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 (Ta=25℃)

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	6.0	V
Unregulated voltage supply	V_B	11	V
Motor supply voltage (within V_B)	V_S	11	V
Output terminal voltage n=1, 29, 31	V_n	11	V
Output current n=1, 29, 31	I_{On}	1000	mA
Power dissipation	P_D	668	mW
Operating ambient temperature *note)	T_{opr}	−25 to +70	℃
Storage temperature	T_{stg}	−55 to +150	℃

Note) Ta=25℃ except operating ambient temperature and storage temperature.

■ Recommended Operating Range (Ta=25℃)

Parameter	Symbol	Range
Operating supply voltage range	V_{CC}	3.0V to 5.5V
	V_B	4.0V to 10.5V
	V_S	1.5V to V_B

■ Electrical Characteristics (V_{CC}=3.3V, V_B=6V, V_S=6V, Ta=25±2℃)

Parameter	Symbol	Condition	min	typ	max	Unit
Drive Section						
Drive gain	Gio	$\frac{\Delta V_{CS}}{\Delta OUT1}$	0.11	0.14	0.17	times
Drive amp. offset	Viocs	Input offset voltage OUT1 and Vref	−100	6	100	mV
Max. output current (1)	I_{max}(1)	LIM : H R_{CS}=0.25Ω	480	560	640	mA
Max. output current (2)	I_{max}(2)	LIM : L R_{CS}=0.25Ω	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
Bemf Detection Section						
Comparator hysteresis width	V_{HCOM}		9	14	21	mV
Oscillator						
Triangular wave oscillation frequency	f_{FC}	C_{FC}=560pF	11.0	16.3	22.8	kHz
Slope Section						
Slope terminal charging current (1)	$I_{SLC(1)}$	HSL : L C_{FC}=560pF femf<160Hz	−26	−20	−14	μA
Slope terminal discharging current (1)	$I_{SLD(1)}$		14	20	26	μA
Slope terminal charging current (2)	$I_{SLC(2)}$	HSL : L C_{FC}=560pF femf>181Hz	−52	−40	−28	μA
Slope terminal discharging current (2)	$I_{SLD(2)}$		28	40	52	μA
Slope terminal charging current (3)	$I_{SLC(3)}$	HSL : H C_{FC}=560pF femf<160Hz	−52	−40	−28	μA
Slope terminal discharging current (3)	$I_{SLD(3)}$		28	40	52	μA
Slope terminal charging current (4)	$I_{SLC(4)}$	HSL : H C_{FC}=560pF femf>181Hz	−78	−60	−42	μA
Slope terminal discharging current (4)	$I_{SLD(4)}$		42	60	78	μA
Operation Amplifier 1 Only						
Common mode input voltage range	$V_{ICR(1)}$		0.2	—	V_B to 1.4 or V_{CC}	V
Input offset voltage	I_{IOA1}		−50	5	50	nA
Voltage gain	G_{A1}		60	67	—	dB
Output sink current (1)	$I_{OSI1(1)}$	OUT1=0.2V	20	140	—	μA
Operation Amplifier 2 Only						
Common mode input voltage range	$V_{ICR(2)}$		0	—	V_B−1.4	V
Operation Amplifier 1, 2 Common						
Input offset voltage	$V_{IOA1,2}$		−20	−3	20	mV
Output sink current 1−(2)	$I_{OSI1(2)}$		1.8	4	—	mA
Output sink current 2−(2)	$I_{OSI1(2)}$		2	4	—	mA
Output source current (2)	$I_{OSA1,2}$		—	−15	−2	mA
Mode Switch=HSL, STB, FR, BR, LIM						
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	μA
Motor Supply Control						
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	kΩ
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, Ta=25±2℃)

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=Vref+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	μA
Unregulated supply current (2)	$I_{BB(2)}$	V_{CC}=3.3V, $In2^+$=0V	—	0.3	1.5	mA

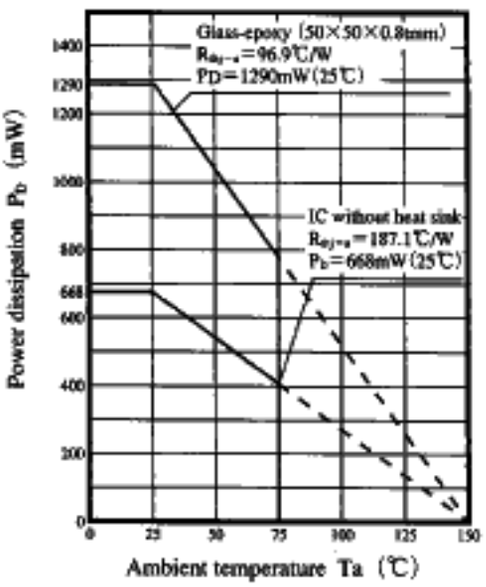
■ Electrical Characteristics (Ta=25±2℃) [for reference only]

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

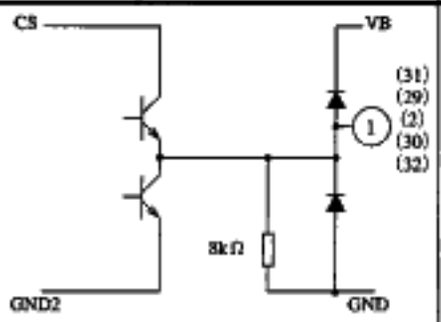
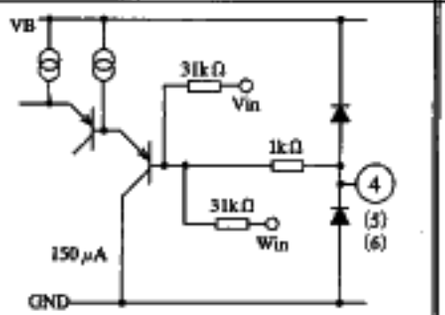
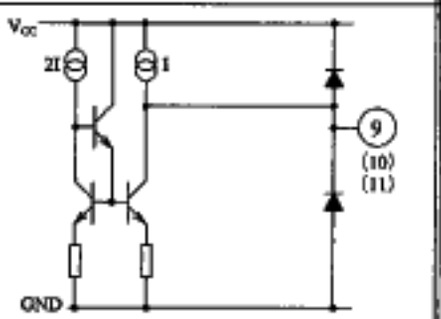
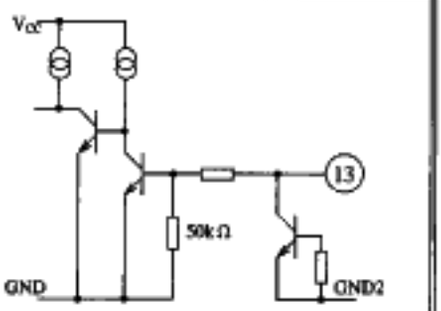
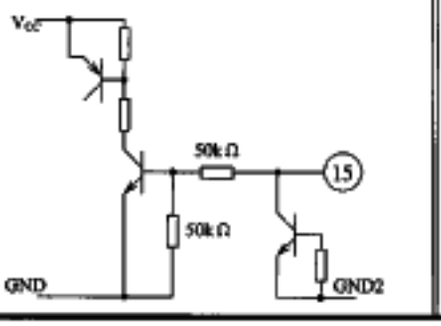
Note) The value in the above characteristics is not a guaranteed value, but reference one on design.

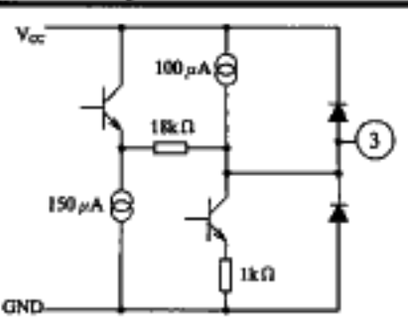
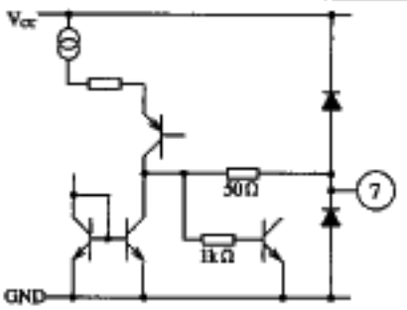
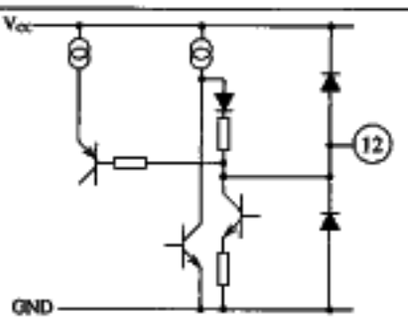
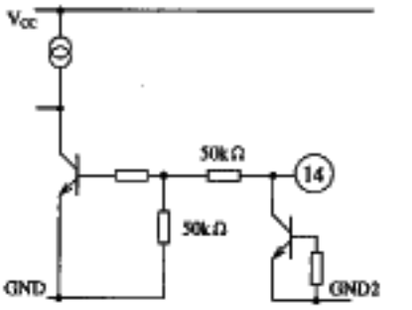
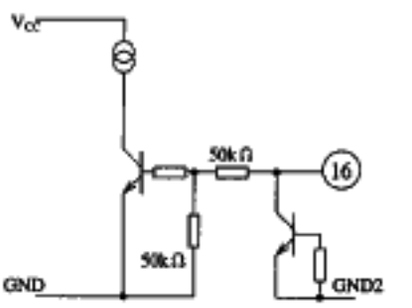
■ Reference

P_D-Ta

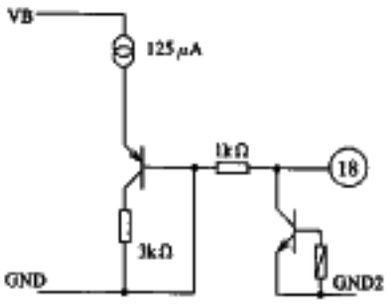
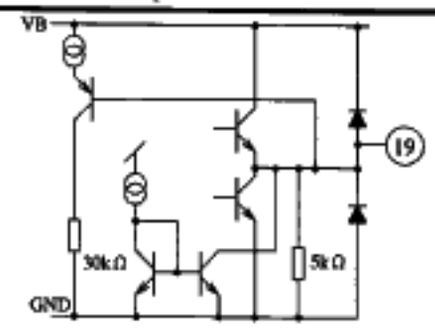
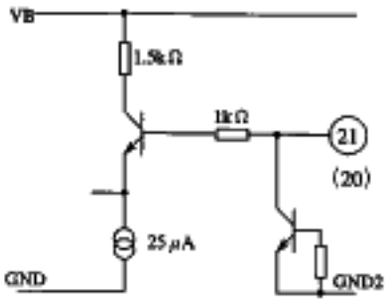
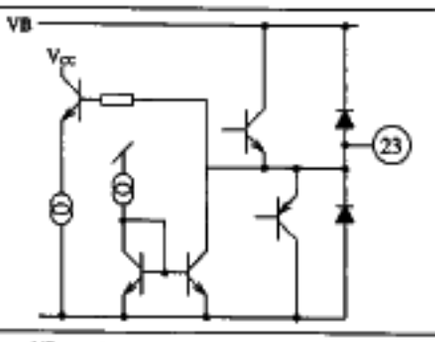
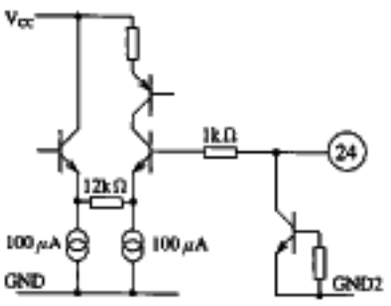
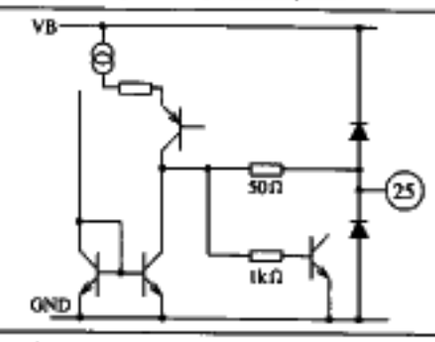
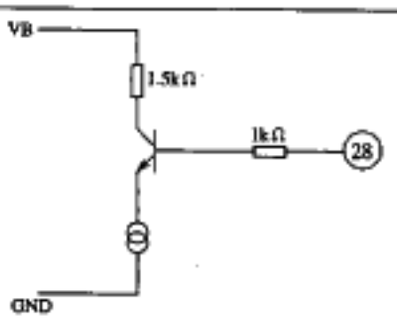


■ Pin Descriptions

Pin No.	Symbol	Equivalent circuit
1 31 29 2 30 32	U V W CS GND2 GND2	
4 5 6	Uin Vin Win	
9 10 11	SL1 SL2 SL3	
13	BR	
15	SHL	

Pin No.	Symbol	Equivalent circuit
3	VSC	
7	PCV	
12	FC	
14	FR	
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	