

# AN3890FBS

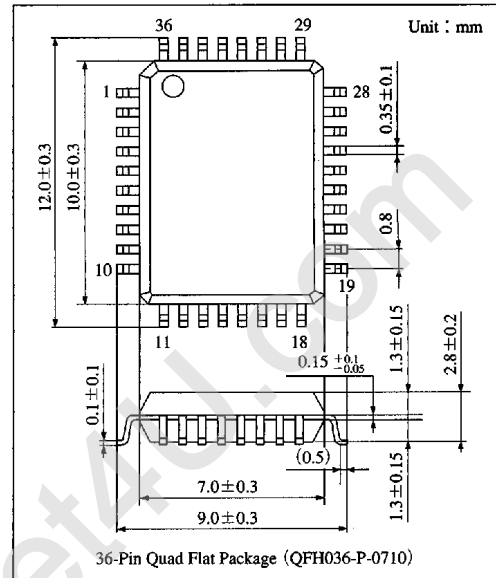
## Capstan Motor Drive IC for VCR

### Overview

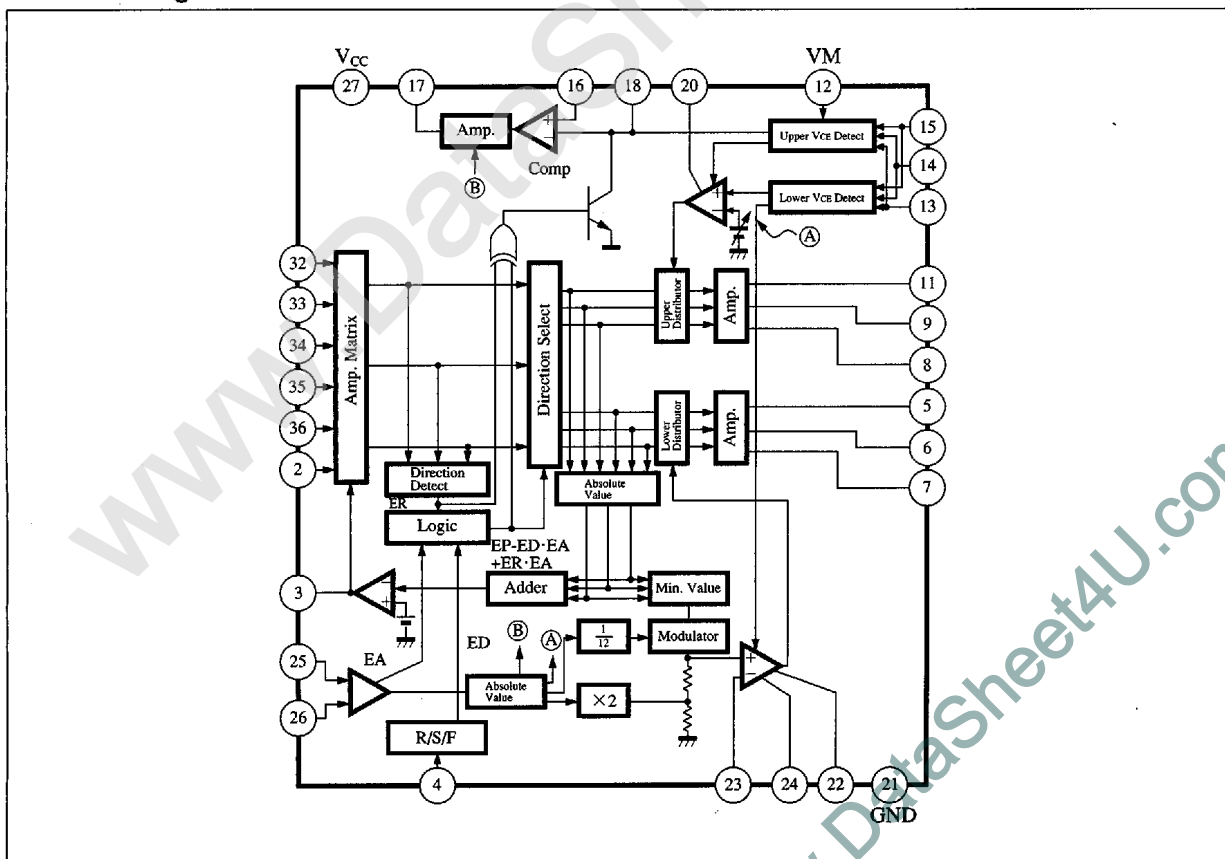
The AN3890FBS is an IC designed as a VCR capstan motor drive. It is particularly optimum for camera combined VCR.

### Features

- Controls the output transistors (external) at low  $V_{CE}$ .
- Built-in torque ripple cancellation circuit.
- Overlap drive.
- Provided with predrive output for switching regulator control.
- Output pin electrolytic capacitor unrequired.



### Block Diagram



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### ■ Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Rating	Unit	Note
Supply voltage	V <sub>CC</sub>	6	V	
Power dissipation	P <sub>D</sub>	500	mW	
Operating ambient temperature	T <sub>opr</sub>	-20 to +70	°C	
Storage temperature	T <sub>stg</sub>	-55 to +125	°C	
Motor supply voltage	V <sub>12</sub>	20	V	
Output pin voltage	V <sub>1</sub>	20	V	V <sub>1</sub> =13,14,15
Pin voltage	V <sub>m</sub>	-0.3 to V <sub>CC</sub>	V	m=2,4,16,24, 25,26,32, 33,34,35,36

### ■ Recommended Operating Range (Ta=25°C)

Parameter	Symbol	Range
Operating supply voltage range	V <sub>CC</sub>	4.5V to 5.5V

### ■ Electrical Characteristics (V<sub>CC</sub>=5V, Ta=25°C)

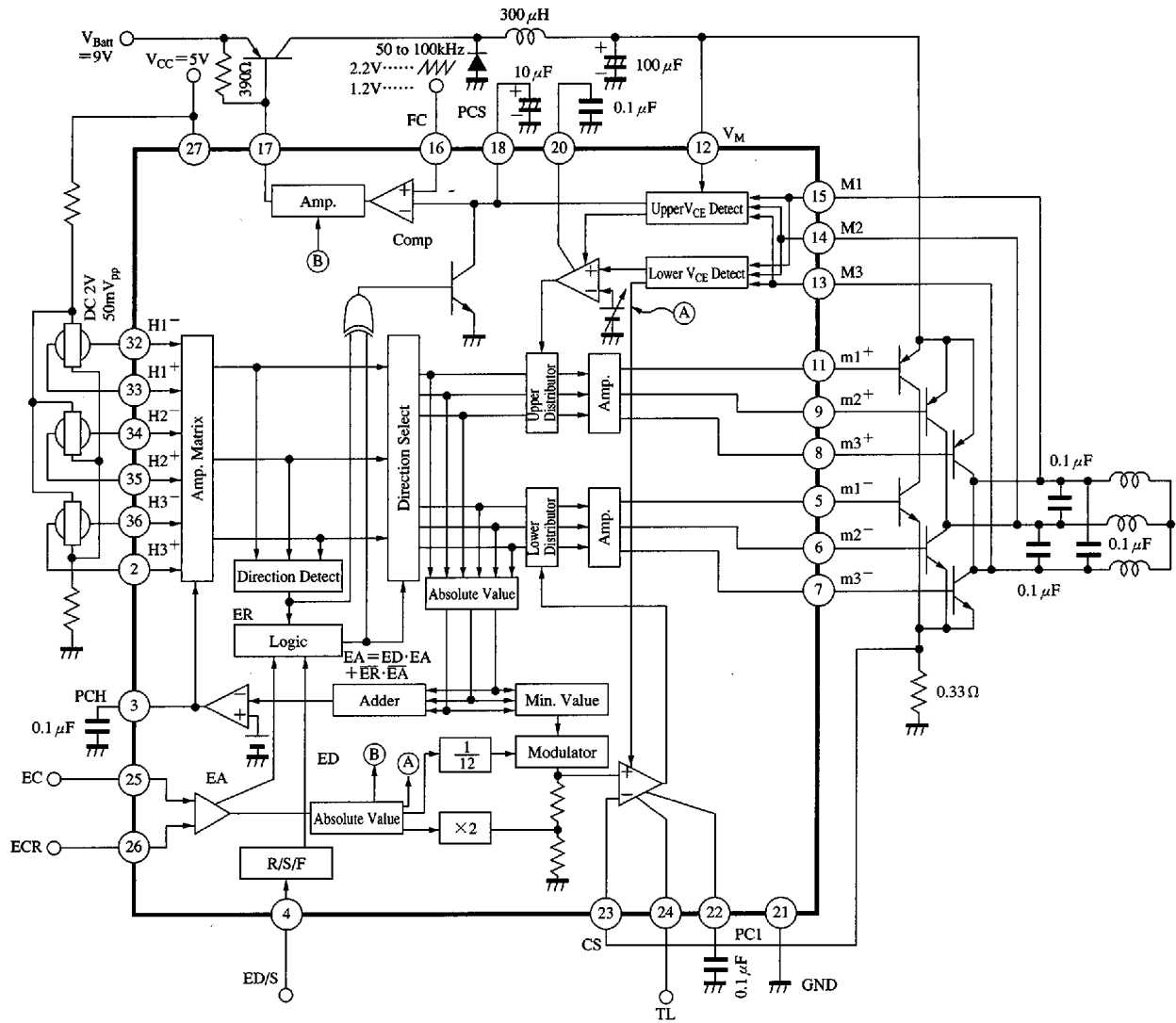
Parameter	Symbol	Condition	min	typ	max	Unit
Circuit current	I <sub>CC</sub>		—	—	15	mA
Torque command ref. voltage	ECR		2	—	3	V
Torque command voltage	EC		0.5	—	4	V
Torque command input current	I <sub>EC</sub>	EC=ECR=2.5V	-1	—	0	μA
Torque command input offset voltage	EC <sub>off</sub>		-150	—	150	mV
Torque command dead zone	EC <sub>DZ</sub>		30	—	150	mV
Output idle voltage	ATC <sub>idle</sub>		0	—	4	mV
I/O gain	G <sub>io</sub>		0.19	0.24	0.28	times
Output max. voltage	ATC <sub>max</sub>		0.3	—	—	V
Forward command voltage	ED <sub>F</sub>		—	—	0.9	V
Stop command voltage	ED <sub>S</sub>		1.3	—	3.1	V
Reverse command voltage	ED <sub>R</sub>		3.5	—	—	V
Hall element input allowable voltage	H <sub>in</sub>		1.1	—	3.5	V
Hall element input conversion offset	H <sub>offset</sub>		-8	—	8	mV
Lower output voltage (1)	VN (1)	ATC=66mV	0.25	0.37	0.55	V
Lower output voltage (2)	VN (2)	EC=0.5V	—	—	1.2	V
TL-CS offset	TL <sub>offset</sub>	TL=0.2V	0	7	15	mV
Ripple cancellation rate	α	V <sub>ATC</sub> =66mV	6	10.5	15	%
Upper drive max. current	I <sub>MP</sub>		15	—	—	mA
Lower drive max. current	I <sub>MIN</sub>		—	—	-15	mA
Switching power supply control output operating point	PCS	PCS=1.7V at V <sub>M</sub> =6V. Value of V <sub>M</sub> -MI Times	0.25	0.4	0.55	V
Switching power supply control output gain	G <sub>PCS</sub>	V <sub>M</sub> =6V	6.5	9	11	times
Output drive max. current for switching power supply	I <sub>SW</sub>	EC=0.5V	8	—	—	mA
Output rise time for switching power supply	t <sub>on</sub>		—	—	1	μs
Output fall time for switching power supply	t <sub>off</sub>		—	—	1	μs
Switching power supply comparator input offset	ΔV <sub>FC</sub>		-10	—	10	mV
Switching power supply comparator input current	I <sub>FC</sub>	FC=1.7V	-10	—	0	μA

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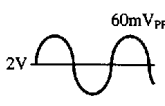
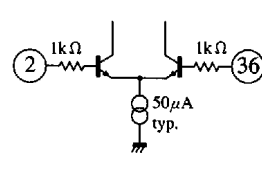

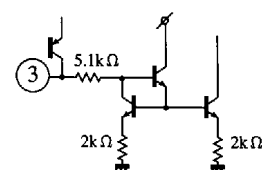
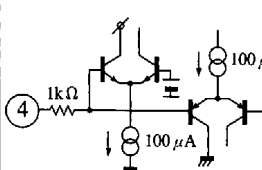
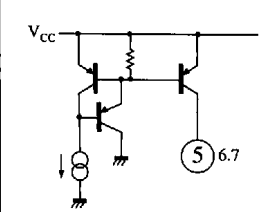
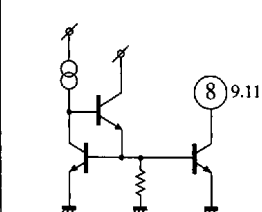
Application Circuit



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Pin Descriptions

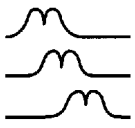
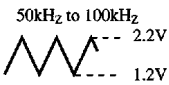
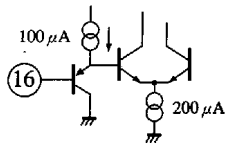
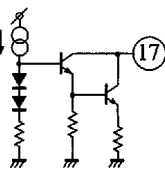
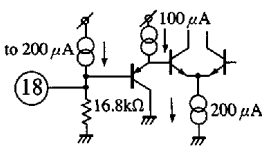
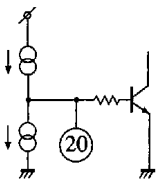
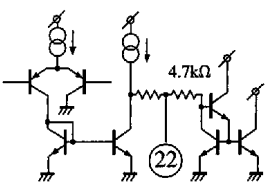
Pin No.	Pin name	Typ. waveform	Description	I/O impedance	Equivalent circuit
1	NC	—	—	—	—
2	H <sub>3</sub> <sup>+</sup> Hall element input		Inputs signal for the Hall element of the motor.	—	
3	PCH Hall amp. phase compensation		AGC loop phase-compensation pin of the Hall amplifier	—	
4	ED/S direction command input	—	Gives motor rotary direction or stop command with 3-valued input.	—	
5	m <sub>2</sub> <sup>-</sup> lower predrive output 1	—	Pre-drive output for output transistor of the sink side (lower side)	—	
6	m <sub>2</sub> <sup>-</sup> lower predrive output 2				
7	m <sub>3</sub> <sup>-</sup> lower predrive output 3				
8	m <sub>3</sub> <sup>+</sup> upper predrive output 3	—	Pre-drive output for output transistor of the source side	—	
9	m <sub>2</sub> <sup>+</sup> upper predrive output 2				
11	m <sub>1</sub> <sup>+</sup> upper predrive output 1				
10	NC	—	—	—	—
12	V <sub>M</sub> motor power pin	—	Motor power input pin	—	—

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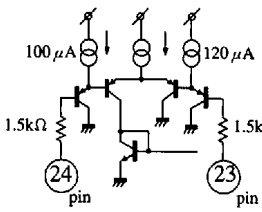
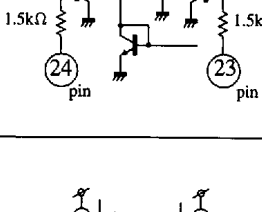
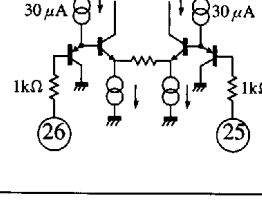
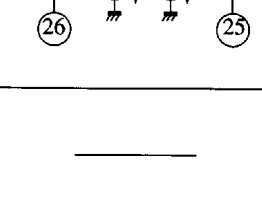
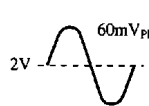
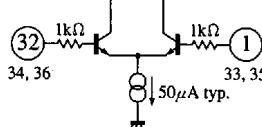
### Pin Descriptions (cont.)

Pin No.	Pin name	Typ. waveform	Description	I/O impedance	Equivalent circuit
13 14 15	M3 motor coil pin 3 M2 motor coil pin 2 M1 motor coil pin 1		Connect to the motor coil.	—	—
16	FC switching power triangular wave input pin		Inputs switching power supply control triangular wave from external.	—	
17	SW switching power output	—	Power transistor pre-drive output for switching power supply	—	
18	PCS switching power control output	—	Outputs a voltage proportional to $V_{CE}$ of the output on the source side. It also serves as a phase compensation pin for the switching power supply loop.	16.8k $\Omega$	
19	NC	—	NC	—	—
20	PCV voltage feedback system phase compensation	—	Phase compensation pin of the control system for the output transistor on the source side	—	
21	GND pin	—	Ground pin	—	—
22	PCI current feedback phase compensation	—	Phase compensation pin of the control system for the output transistor on the sink side.	—	

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■ Pin Descriptions (cont.)

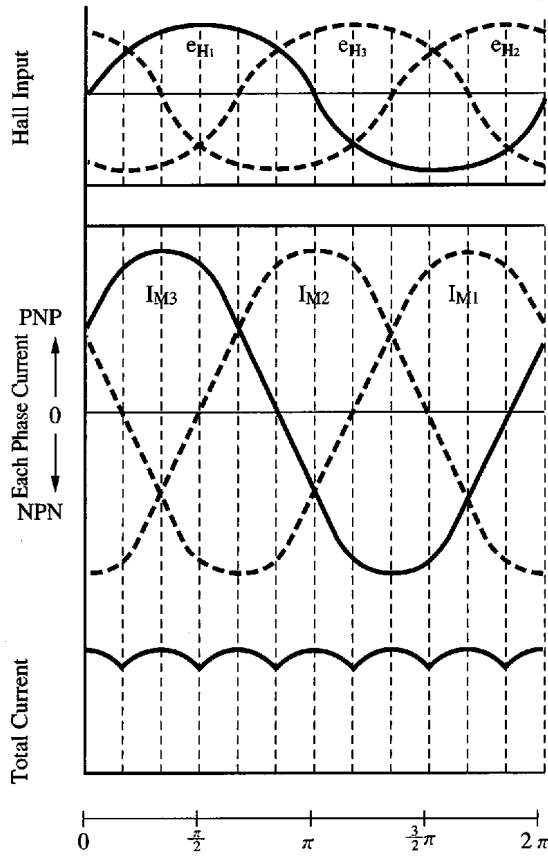
Pin No.	Pin name	Typ. waveform	Description	I/O impedance	Equivalent circuit
23	CS current detection pin	_____	Inputs the value detected by a current detection resistor.	—	
24	TL torque limit pin	_____	Inputs an output current limit value.	—	
25	EC torque command input pin	_____	Inputs a torque command.	—	
26	ECR torque command ref. input pin	_____	Inputs a torque command ref. voltage.	—	
27	V <sub>CC</sub> power pin	_____	Inputs the supply voltage.	—	_____
28, 29 30, 31	NC	_____	NC	—	_____
32 33 34 35 36	H <sub>1</sub> <sup>-</sup> Hall element input H <sub>1</sub> <sup>+</sup> Hall element input H <sub>2</sub> <sup>+</sup> Hall element input H <sub>2</sub> <sup>-</sup> Hall element input H <sub>3</sub> <sup>-</sup> Hall element input		Inputs a signal for the Hall elements of the motor.	—	

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■ Supplementary Explanation

● Hall Input and Output Current Phases for AN3890FBS

ED/S=0V EC<ECR



• Torque Direction Setting Logic

The direction of generated torque is determined by the following information.

- Information from the rotary direction detection circuit : ER  
High :  $H_1 \rightarrow H_3 \rightarrow H_2$
- Brake information from the torque command circuit : EA  
High :  $ECR > EC$

• Rotary direction command : ED

- High :  $H_1 \rightarrow H_3 \rightarrow H_2$   
 $H_1 \rightarrow H_3 \rightarrow H_2$  (forward rotation) at  $ED/S=0V$
- Direction of generated torque : EP  
High : Generates a torque rotating in the direction of  $H_1 \rightarrow H_3 \rightarrow H_2$   
EP is determined as follows, depending on ER, EA, or ED  
 $EP = ED \cdot EA + \overline{EA} \cdot \overline{EA}$

	<u>EA</u>	EA		<u>EA</u>
ED	H	H	H	L
<u>ED</u>	H	L	L	L
	<u>ER</u>		ER	

Torque Direction Setting Logic Carnot's Diagram