AN3890FBS

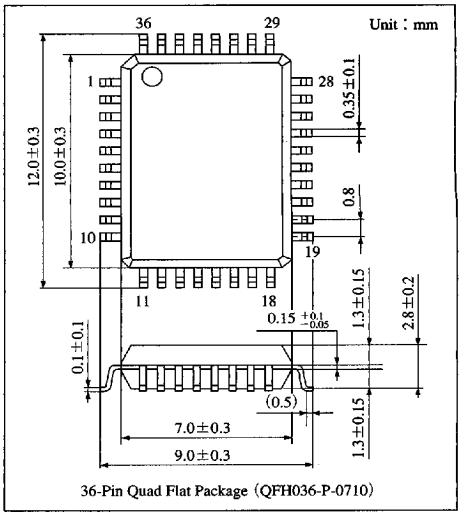
Capstan Motor Drive IC for VCR

■ Overview

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

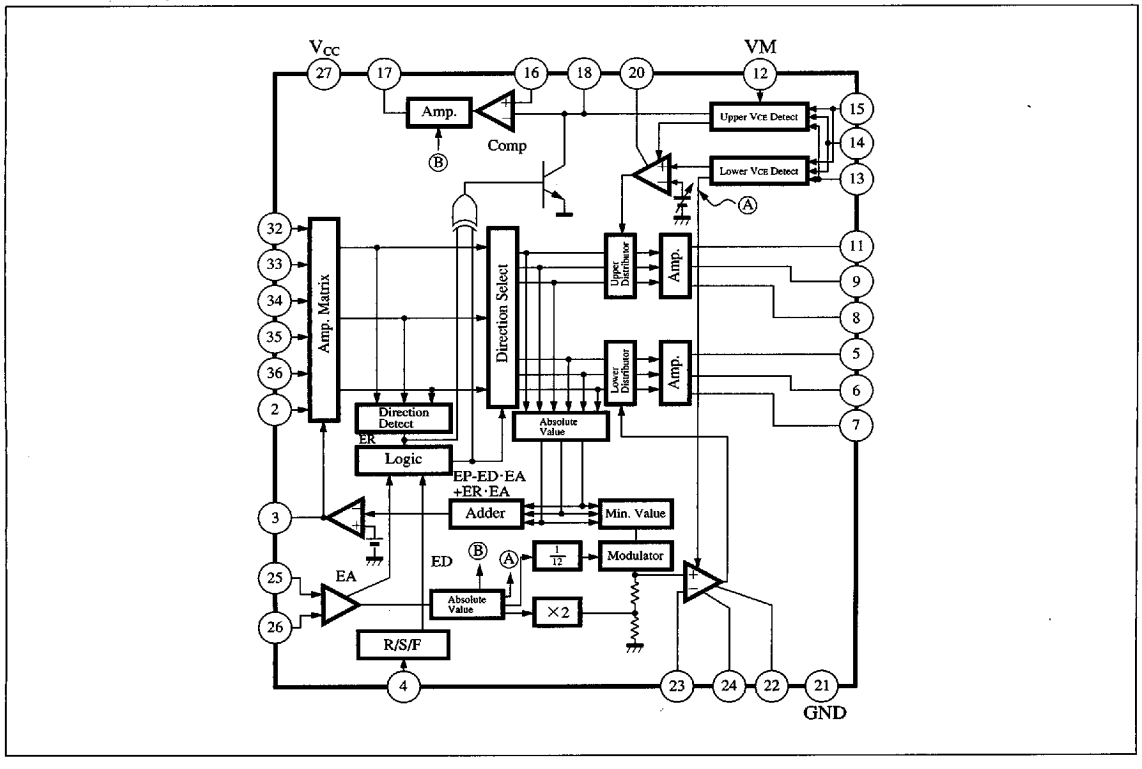
■ Features

- 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.



36-Pin Quad Flat Package (QFH036-P-0710)

■ Block Diagram



■ Absolute Maximum Ratings (Ta=25℃)

Parameter	Symbol	Rating	Unit	Note
Supply voltage	V_{CC}	6	V	
Power dissipation	P_D	500	mW	
Operating ambient temperature	T_{opr}	−20 to +70	℃	
Storage temperature	T_{stg}	−55 to +125	℃	
Motor supply voltage	V_{12}	20	V	
Output pin voltage	V_I	20	V	V_I=13,14,15
Pin voltage	V_m	−0.3 to V_{CC}	V	m=2,4,16,24, 25,26,32, 33,34,35,36

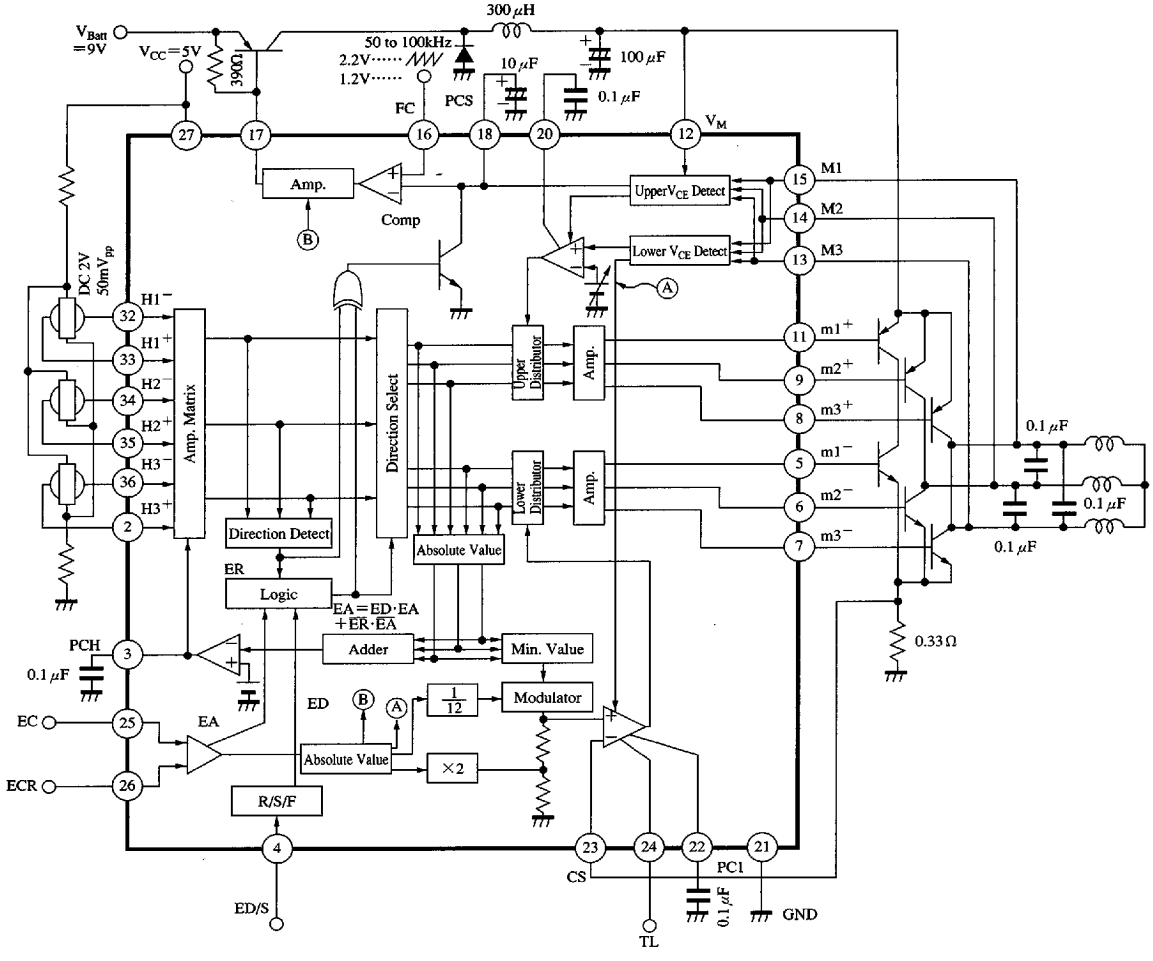
■ Recommended Operating Range (Ta=25℃)

Parameter	Symbol	Range
Operating supply voltage range	V_{CC}	4.5V to 5.5V

■ Electrical Characteristics (V_{CC}=5V, Ta=25℃)

Parameter	Symbol	Condition	min	typ	max	Unit
Circuit current	I_{CC}		—	—	15	mA
Torque command ref. voltage	ECR		2	—	3	V
Torque command voltage	EC		0.5	—	4	V
Torque command input current	I_{EC}	EC=ECR=2.5V	−1	—	0	μA
Torque command input offset voltage	EC_{off}		−150	—	150	mV
Torque command dead zone	EC_{DZ}		30	—	150	mV
Output idle voltage	ATC_{idle}		0	—	4	mV
I/O gain	G_{io}		0.19	0.24	0.28	times
Output max. voltage	ATC_{max}		0.3	—	—	V
Forward command voltage	ED_F		—	—	0.9	V
Stop command voltage	ED_S		1.3	—	3.1	V
Reverse command voltage	ED_R		3.5	—	—	V
Hall element input allowable voltage	H_{in}		1.1	—	3.5	V
Hall element input conversion offset	H_{offset}		−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_{offset}	TL=0.2V	0	7	15	mV
Ripple cancellation rate	α	V_{ATC}=66mV	6	10.5	15	%
Upper drive max. current	I_{MP}		15	—	—	mA
Lower drive max. current	I_{MN}		—	—	−15	mA
Switching power supply control output operating point	PCS	PCS=1.7V at V_M=6V. Value of V_M−MI Times	0.25	0.4	0.55	V
Switching power supply control output gain	G_{PCS}	V_M=6V	6.5	9	11	times
Output drive max. current for switching power supply	I_{SW}	EC=0.5V	8	—	—	mA
Output rise time for switching power supply	t_{on}		—	—	1	μs
Output fall time for switching power supply	t_{off}		—	—	1	μs
Switching power supply comparator input offset	ΔV_{FC}		−10	—	10	mV
Switching power supply comparator input current	I_{FC}	FC=1.7V	−10	—	0	μA

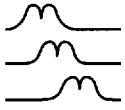
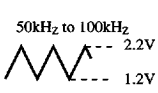
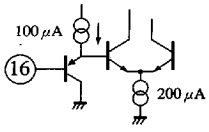
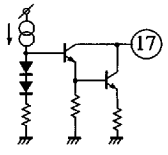
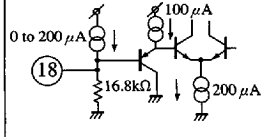
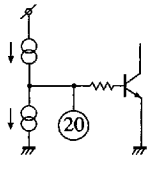
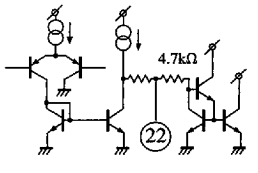
■ Application Circuit



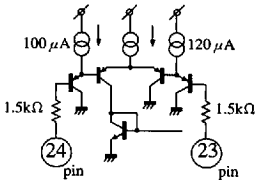
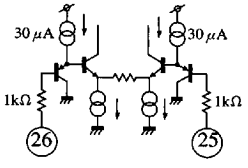
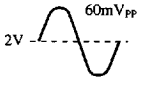
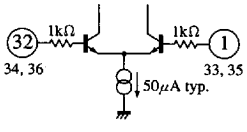
Pin Descriptions

Pin No.	Pin name	Typ. waveform	Description	I/O impedance	Equivalent circuit
1	NC	———	———	—	———
2	H_3^+ Hall element input	60mV$_{PP}$, 2V	Inputs signal for the Hall element of the motor.	—	1kΩ, 1kΩ, 2, 36, 50μA typ.
3	PCH Hall amp. phase compensation		AGC loop phase-compensation pin of the Hall amplifier	—	3, 5.1kΩ, 2kΩ, 2kΩ
4	ED/S direction command input	———	Gives motor rotary direction or stop command with 3-valued input.	—	4, 1kΩ, 100μA, 100μA
5	m_2^-lower predrive output 1	———	Pre-drive output for output transistor of the sink side (lower side)	—	V_{CC}, 5, 6.7
6	m_2^-lower predrive output 2				
7	m_3^-lower predrive output 3				
8	m_3^+upper predrive output 3	———	Pre-drive output for output transistor of the source side	—	8, 9.11
9	m_2^+upper predrive output 2				
11	m_1^+upper predrive output 1				
10	NC	———	———	—	———
12	V_M motor power pin	———	Motor power input pin	—	———

■ 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.	16.8kΩ	
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.	—	

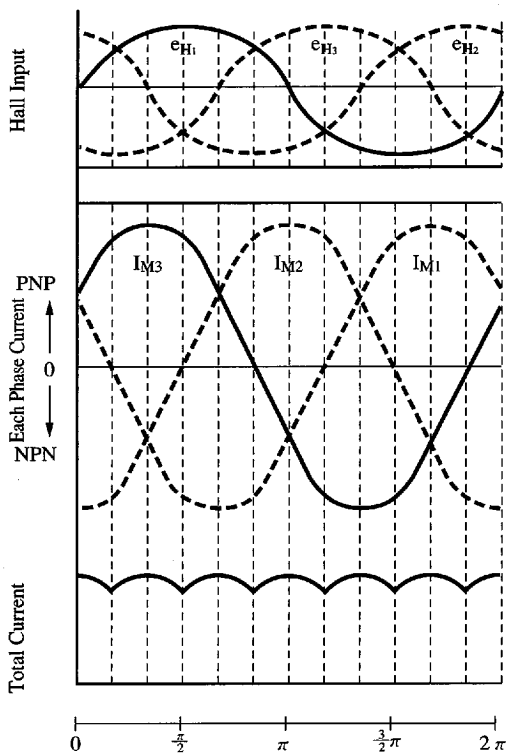
■ Pin Descriptions (cont.)

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_{CC} power pin	———	Inputs the supply voltage.	—	———
28, 29 30, 31	NC	———	NC	—	———
32 33 34 35 36	H_1^- Hall element input H_1^+ Hall element input H_2^+ Hall element input H_2^- Hall element input H_3^- Hall element input		Inputs a signal for the Hall elements of the motor.	—	

■ 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 rotaing in the direction of $H_1 \rightarrow H_3 \rightarrow H_2$
  EP is determined as follows, depending on ER, EA, or ED

$EP = ED \cdot EA + \overline{EA} \cdot \overline{EA}$

	$\overline{EA}$	EA		$\overline{EA}$
ED	H	H	H	L
$\overline{ED}$	H	L	L	L
	$\overline{ER}$		ER	

Torque Direction Setting Logic Carnot's Diagram