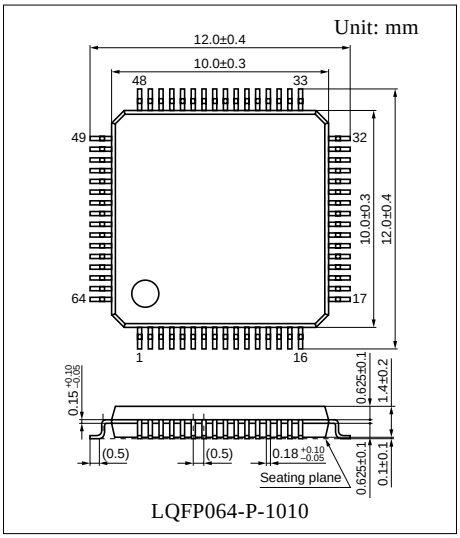
AN3895FHQ

Cylinder/capstan motor driver IC for video camera

■ Overview

The AN3895FHQ is an IC designed for driving a cylinder/capstan motor for a video camera.



LQFP064-P-1010

■ Features

- Operating supply voltage range: V_{CC} = 3.1 V to 5.5 V

Cylinder block

- Reduction of magnetic sound due to 3-phase full wave overlap driving
- Built-in standby mode for power saving
- Built-in PG·FG and waveform shaping circuit
- Built-in switching power supply control circuit

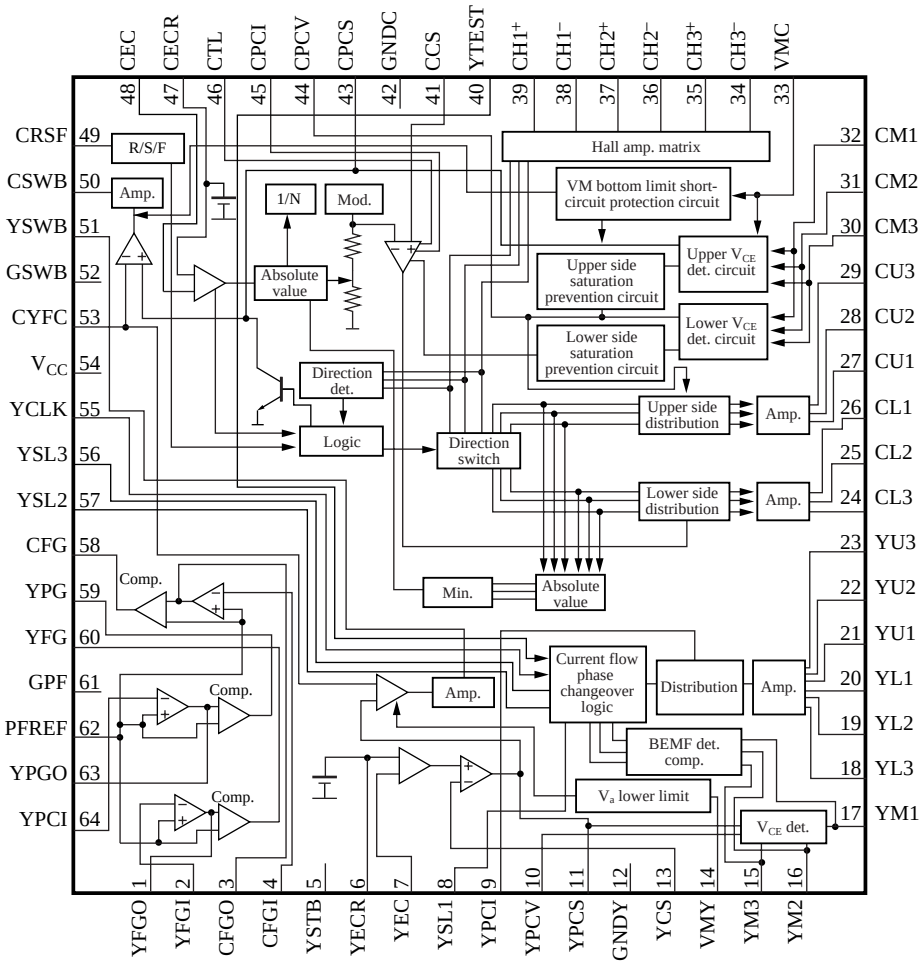
Capstan block

- Overlap driving
- Built-in torque ripple cancel circuit
- Built-in switching power supply control circuit
- Built-in output transistor saturation prevention circuit for both lower and upper sides
- Forward/reverse rotations

■ Applications

- Video camera

■ Block Diagram



■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	YFGO: CYL-FG amp. output	34	$CH3^-$: CAP-Hall element input
2	YFGI: CYL-FG amp. input	35	$CH3^+$: CAP-Hall element input
3	CFGO: CAP-FG amp. output	36	$CH2^-$: CAP-Hall element input
4	CFGI: CAP-FG amp. input	37	$CH2^+$: CAP-Hall element input
5	YSTB: CYL-standby input changeover	38	$CH1^-$: CAP-Hall element input
6	YECR: CYL-torque command reference input pin	39	$CH1^+$: CAP-Hall element input
		40	YTEST: CYL-test mode changeover input
7	YEC: CYL-torque command input pin	41	CCS: CAP-current det. pin
8	YSL1: CYL-current flow waveform slope pin 1	42	GNDC: CAP-grounding pin
9	YPCI: CYL-current feedback phase compensation	43	CPCS: CAP-switching power supply control output
10	YPCV: CYL-voltage feedback phase compensation	44	CPCV: CAP-voltage feedback phase compensation
11	YPCS: CYL-switching power supply control output	45	CPCI: CAP-current feedback phase compensation
12	GNDY: CYL-grounding pin	46	CTL: CAP-torque limit
13	YCS: CYL-CS current det. pin	47	CECR: CAP-torque command reference voltage
14	VMY: CYL-motor power supply pin	48	CEC: CAP-torque command input pin
15	YM3: CYL-motor coil pin 3	49	CRSF: CAP-direction command input pin
16	YM2: CYL-motor coil pin 2	50	CSWB: CAP-SW-power supply pre-drive output
17	YM1: CYL-motor coil pin 1		
18	YL3: CYL-lower side pre-drive output 3	51	YSWB: CYL-SW-power supply pre-drive output
19	YL2: CYL-lower side pre-drive output 2		
20	YL1: CYL-lower side pre-drive output 1	52	GSWB: CAP, CYL-SW power supply grounding pin
21	YU1: CYL-upper side pre-drive output 1	53	CYFC: CAP, CYL-SW comparater triangular wave input
22	YU2: CYL-upper side pre-drive output 2		
23	YU3: CYL-upper side pre-drive output 3	54	V_{CC} -power supply pin
24	CL3: CAP-lower side pre-drive output 3	55	YCLK: CYL-clock input
25	CL2: CAP-lower side pre-drive output 2	56	YSL3: CYL-current flow waveform slope pin 3
26	CL1: CAP-lower side pre-drive output 1	57	YSL2: CYL- current flow waveform slope pin 2
27	CU1: CAP-upper side pre-drive output 1	58	CFG: CAP-FG amp. waveform shaping output
28	CU2: CAP-upper side pre-drive output 2	59	YPG: CYL-PG amp. waveform shaping output
29	CU3: CAP-upper side pre-drive output 3	60	YFG: CYL-FG amp. waveform shaping output
30	CM3: CAP-motor coil pin 3	61	GPF: FG, PG-grounding pin
31	CM2: CAP-motor coil pin 2	62	PFREF: FG, PG-reference voltage
32	CM1: CAP-motor coil pin 1	63	YPGO: CYL-PG amp. output
33	VMC: CAP-motor power supply pin	64	YPCI: CYL-PG amp. input

■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	6.0	V
Supply current	I_{CC}	—	mA
Power dissipation	P_D	582	mW
Operating ambient temperature *1	T_{opr}	–20 to +70	°C
Storage temperature *1	T_{stg}	–55 to +125	°C
Motor supply voltage *2	V_m	12.0	V
Output pin voltage *3	V_n	12.0	V
Switching power supply driving output pin voltage *4	V_l	12.0	V
Pin voltage *5	V_o	– 0.3 to V_{CC} +0.3	V

Note) 1. ∗1: Except for the operating ambient temperature and storage temperature, all ratings are for T_a = 25°C.
∗2: m = 14, 33
∗3: n = 15 to 32
∗4: l = 50, 51
∗3: o = 2, 4, 5, 7, 8, 13, 34 to 41, 46 to 49, 53, 55 to 57, 59, 62, 64
2. Do not apply external currents or voltages to any pins not specifically mentioned.
3. For circuit currents, '+' denotes currents flowing into the IC, and '–' denotes current flowing out of the IC.

■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V_{CC}	3.1 to 5.5	V

■ Electrical Characteristics at T_a = 25°C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Cylinder block						
Supply current 1	$I_{CC(1)}$	Common for both cylinder and capstan in operation	—	22	30	mA
Supply current 2	$I_{CC(2)}$	At STB mode of cylinder	—	12	20	mA
Torque command reference voltage	V_{YECR}		2.14	2.24	2.54	V
Torque command input current	I_{YEC}		–5	– 0.7	—	µA
Torque command input offset voltage	ΔYEC		–100	–40	100	mV
Input/output gain	YG_{io}		0.13	0.15	0.17	times
Output maximum voltage	YCS_{max}	YR_{CS} = 0.27 Ω	150	180	210	mV
Lower side output voltage 1	YVL(1)	YV_{CS} = 54 mV	0.20	0.40	0.60	V
Lower side output voltage 2	YVL(2)	YECR = 2.24 V, YEC = 0 V	0.50	0.71	0.90	V
Upper side driving current 1	YI_U		10	30	—	mA
Lower side output current 2	YI_L		—	–23	–10	mA

■ Electrical Characteristics at T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Cylinder block (continued)						
SW power supply control output voltage 1	$V_{YUD(1)}$	YEC = 2.14 V, YECR = 2.24 V, V_{YPCS} = 1.75 V	0.26	0.37	0.48	V
SW power supply control output voltage 2	$V_{YUD(2)}$	YEC = 0 V, YECR = 2.24 V, V_{YPCS} = 1.75 V	0.43	0.61	0.81	V
SW power supply control output gain	G_{YPCS}	YEC = 2.14 V, YECR = 2.24 V	6.5	9	11	times
SW reg. driving current 1	$I_{YSW(1)}$	YEC = YECR = 2.24 V	3	9	—	mA
SW reg. driving current 2	$I_{YSW(2)}$	YEC = 0 V, YECR = 2.24 V	11	23	—	mA
SW reg. comparator on time	Yt_{ON}		—	0.2	1.0	µs
SW reg. comparator off time	Yt_{OFF}		—	0.2	1.0	µs
SW reg. comparator offset voltage	ΔV_{YFC}		–5	4	25	mV
FG amp. gain	YG_{FG}	V[p-p] = 1.5 mV, f = 1 kHz	45	48	—	dB
YFG high-level	YFG(H)	IYFG = –100 µA	2.0	2.6	—	V
YFG low-level	YFG(L)	IYFG = 100 µA	—	0.7	1.5	V
PG amp. gain	YG_{PG}	V[p-p] = 1.5 mV, f = 1 kHz	45	48	—	dB
PG amp. offset voltage	ΔYPG_{IN}		0.45	0.52	0.62	V
YPG high-level	YPG(H)	IYPG = –10 µA	2.0	2.9	—	V
YPG low-level	YPG(L)	IYPG = 100 µA	—	0.3	1.0	V
Standby voltage	$YSTB_{ON}$		2.15	1.4	—	V
Standby reset voltage	$YSTB_{OFF}$		—	1.4	0.6	V
Standby input current	I_{YSTB}	V_{YSTB} = 0 V	–100	—	—	µA
Capstan block						
Torque command input current	I_{CEC}	CEC = CECR = 1.75 V	–1	0.2	—	µA
Torque command reference voltage	V_{CECR}		1.55	1.75	1.95	V
Torque command input voltage	V_{CEC}		0.5	—	3.0	V
Output maximum voltage	CCS_{max}	R_{CS} = 0.3 Ω	0.19	0.22	—	V
Torque command I/O gain	CG_{IO}		0.21	0.24	0.27	times
Output idle voltage	CCS_{IDLE}		—	0	4	mV
Torque command input offset voltage	CEC_{OFC}		–100	–40	100	mV
Torque command dead zone	CEC_{DZ}		50	90	140	mV
Lower side V_{CE} voltage 1	$CV_{LL(1)}$	CCS = 60 mV	0.19	0.29	0.47	V
Lower side V_{CE} voltage 2	$CV_{LL(2)}$	CEC = 0 V, CTL = 0.2 V	0.40	0.61	0.77	V
Hall element input allowable voltage	CH_{IN}		1.2	—	2.4	V
Offset referred to Hall element input	CH_{OFS}		–8	0	8	mV

■ Electrical Characteristics at T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Capstan bock (continued)						
TL-CS offset 1	$CTL_{OFS(1)}$		6	10	14	mV
Forward rotation command voltage	V_F		—	1.0	0.87	V
Stop command voltage	V_S		1.27	—	2.23	V
Reverse rotation command voltage	V_R		2.63	2.45	—	V
Ripple rejection factor	α	CS = 60 mV	8	13	18	%
Upper side driving max. current	CI_U		10	40	—	mA
Lower side driving max. current	CI_L		—	–20	–10	mA
SW power supply input offset	SW_{OFS}		–25	0	15	mV
SW power supply output gain	G_{CPCS}		8.0	10.6	13.0	times
SW power supply output voltage 1	$V_{UD(1)}$	CEC = CECR, CPCS = 1.7 V	0.20	0.29	0.40	V
SW power supply output voltage 2	$V_{UD(2)}$	CEC = 0 V, CTL = 0.2 V, CPCS = 1.7 V	0.47	0.72	1.10	V
SW reg. driving current 2	$I_{SWB(2)}$	CEC = 0 V, CTL = 0.2 V	15	22	—	mA
SW power supply comparator on time	t_{ON}		—	0.2	1	µs
SW power supply comparator off time	t_{OFF}		—	0.2	1	µs
FG-PG amp. reference voltage	PFREF		1.7	2.0	2.3	V
FG amp. loop gain	CG_{FG}	External 1 kΩ, 300 kΩ, input 3 mV[p-p], 1 kHz	45	48	—	dB
FG amp. high-level output voltage	CFGH	I_{CFG} = −100 µA	2.0	2.6	—	V
FG amp. low-level output voltage	CFGL	I_{CFG} = 100 µA	—	0.8	1.5	V
V_M under limit	CV_{ML}		1.13	1.45	1.88	V
V_M short-circuit protection	CV_{MS}		0.26	0.44	1.00	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
Slope pin charge current	I_{YSCH}		—	–25	—	µA
Slope pin discharge current	I_{YSDCH}		—	25	—	µA

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