AP1302

Single-Phase Full-Wave Fan Motor Driver (Preliminary)

■ Features

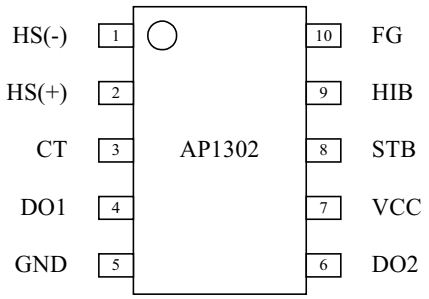
• Operating voltage: 3.8V to 16.8V
• Built-in regenerative circuit allows use of reverse-connection protection diode
• Built-in Hall amplifier with hysteresis (supports core without auxiliary electrode)
• Built-in rotor-lock shutdown and automatic recovery
• Frequency generator (FG) output
• Hall bias pin and start/stop pin allow reduced current drain in standby mode
• Built-in thermal shutdown protection
• Package: MSOP-10L

■ General Descriptions

The AP1302 is single-phase full-wave drive design and a compact package makes these ICs optimal for small fans (especially cooling fans). The benefits are low switching noise and effective motor drive. To avoid coil burning, rotor-lock detection shut down the output driver and then automatic recovery circuits try to restart during locked state. HIB and STB pin allow reduced current drain in standby mode. Besides, the AP1302 features a rotation frequency generator (FG) output for monitoring RPM and thermal shutdown for preventing temperature from damaging the IC.

■ Pin Assignments

(Top view)



MSOP-10L

■ Pin Descriptions

Pin Name	Function
HS(+)	Hall sensor input
HS(-)	Hall sensor input
CT	Timing capacitor
DO1	Bipolar Driver Output
DO2	Bipolar Driver Output
VCC	Power input
STB	Standby Mode
FG	Frequency Generator
HIB	Hall Current Bias
GND	Ground

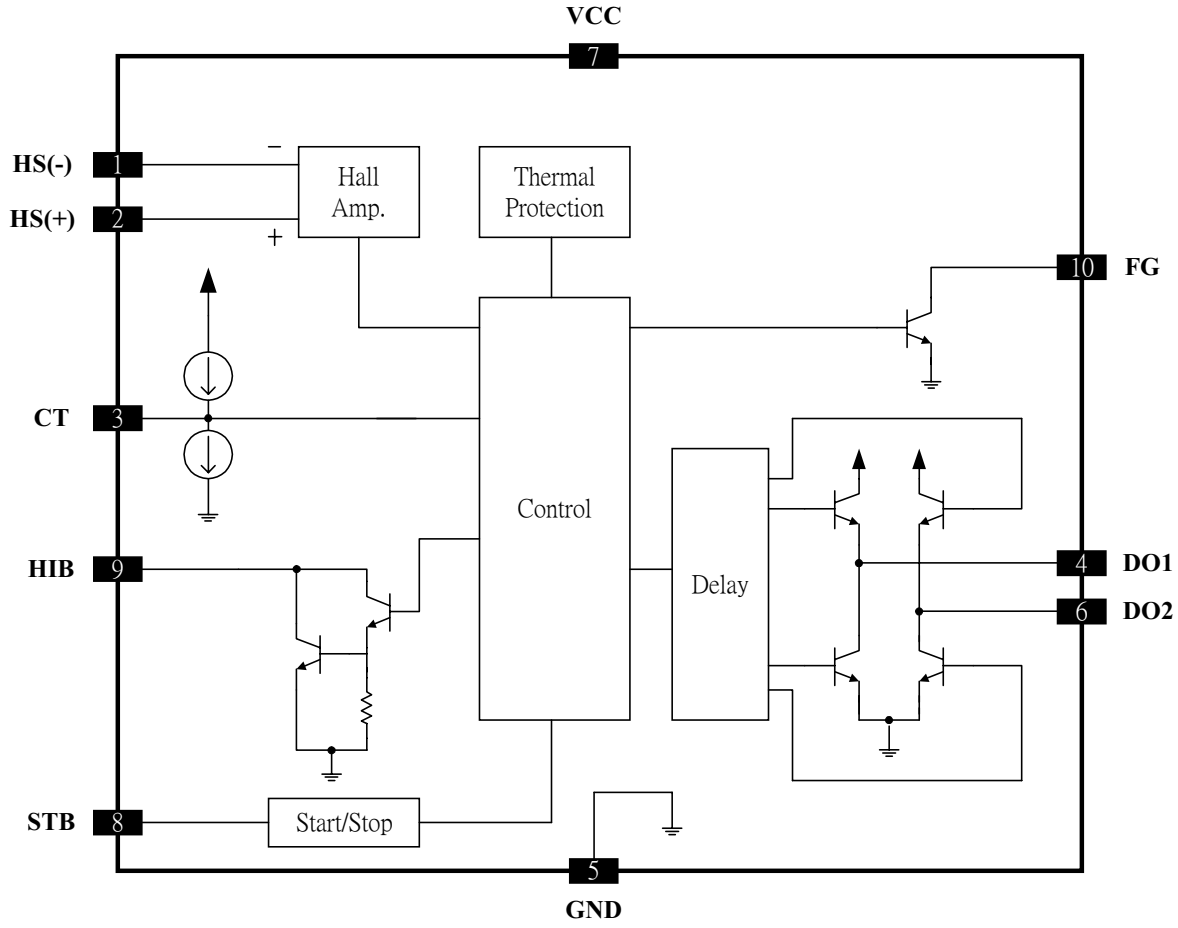
■ Ordering Information

AP1302 X X

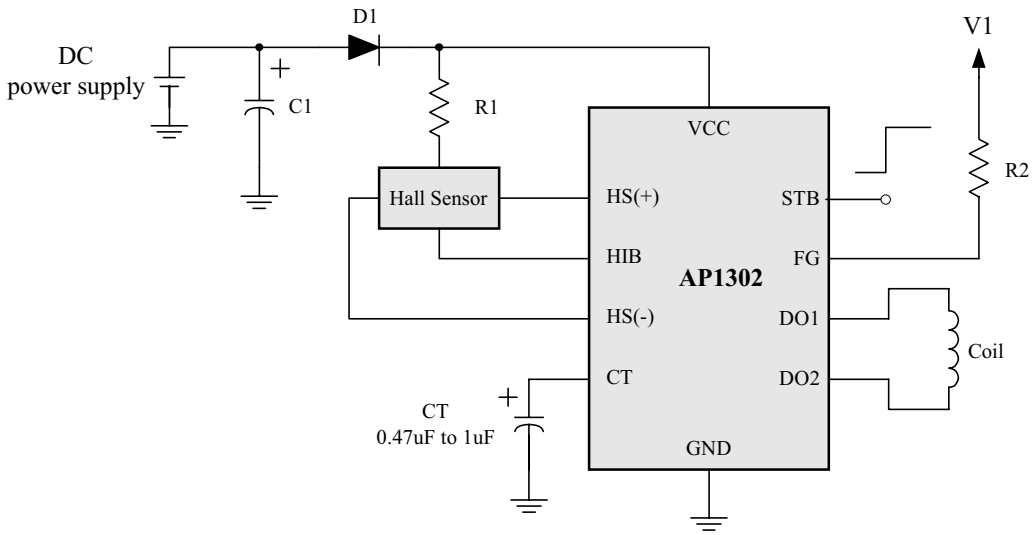
Function	Package	Packing
- Standby mode control - Lockup and automatic recovery - FG - Thermal Shutdown	MS: MSOP-10L	Blank : Tube A : Taping

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■ Block Diagram



■ Application Circuit



■ Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Maximum supply voltage	$V_{CC(max)}$	17	V
Maximum output current	$I_{out(max)}$	0.5	A
Maximum output withstand voltage	$V_{out(max)}$	15	V
FG maximum output withstand voltage	$V_{R(max)}$	15	V
	$V_{F(max)}$	17	V
FG maximum output current	$I_{R(max)}$	5	mA
	$I_{F(max)}$	5	mA
STB maximum input voltage	$V_{STB(max)}$	15	V
HIB maximum output current	$I_{B(max)}$	10	mA
Allowable power dissipation	$P_{D(max)}$	500	mW
Thermal resistance (Junction to Ambient)	ϑ_{JA}	150	ºC/W
Operating temperature	T_{opr}	–30 to +85	ºC
Storage temperature	T_{stg}	–55 to +150	ºC

■ Allowable Operating Conditions (Ta=25ºC)

Parameter	Symbol	Rating	unit
Supply voltage	V_{CC}	3.8 to 16.8	V
STB input high level voltage	V_{STH}	3 to 14	V
STB input low level voltage	V_{STL}	-0.3 to 0.4	V
Hall input common mode voltage range	V_{HCM}	0.2 to (VCC-1.5)	V

■ Electrical Characteristics (Ta=25ºC, VCC=5V)

Parameter	Symbol	Conditions	Ratings			Unit
			Min.	Typ.	Max.	
Current drain	I_{CC}	Drive mode (CT=L)		6.5	9.1	mA
		Lockup protection mode (CT=H)		2.2	3.1	mA
		Standby mode(STB=H)		110	150	uA
Lockup detection Capacitor charge current	I_{CT1}		1.9	2.8	3.7	uA
Capacitor discharge current	I_{CT2}		0.32	0.46	0.60	uA
Capacitor change/discharge current ratio	R_{CT}	$R_{CT}=\frac{I_{CT1}}{I_{CT2}}$	5	6	7	
CT charge voltage	V_{CT1}		2.55	2.75	2.95	V
CT discharge voltage	V_{CT2}		1.6	1.8	2.0	V
Output Low level voltage	V_{OL}	I_O=200mA		0.2	0.3	V
Output High level voltage	V_{OH}	I_O=200mA	3.9	4.1		V
Hall input sensitivity	V_{HN}	Zero Peak value (including offset and hysteresis)		7	15	mV
FG output pin low voltage	V_{FG}	I_{FG}=5mA		0.1	0.3	V
FG output pin leakage current	I_{FGL}	V_{FG}=15V			30	uA
HIB output low voltage	V_{HBL}	I_{HB}=5mA		1.0	1.3	V
STB pin input current	I_{ST}	V_{ST}=5V		75	100	uA

■ Truth Table

Mode	HS(+)	HS(-)	CT	DO1	DO2	FG	STB	HIB
Standby	-	-	-	Off	Off	Off	H	H
Rotating	H	L	L	H	L	L	L	L
	L	H		L	H	H		
Lock	-	-	H	Off	Off	-		L

■ Pin Descriptions

(1). HS(+) , HS(-) pins
Hall input signal pins
The Hall signal is amplified into a square wave by the Hall amplifier with hysteresis characteristics of ±3.5 mv (typ.). The Hall input signal amplitude should be 70 mV or more.

(2). VCC pin
Power supply pin for control block and motor drive. Accepts a wide operation voltage range from 3.8 to 16.8V, for 5V/12V dual power supply support.

(3) DO1, DO2 pins
Single-coil output pins.
Bipolar driver output with upper side inverted and lower side single output. Built-in regenerative circuit regenerates kickback current between lower side NPN outputs when a diode is used for protection against reverse connection.

(4) CT pin
This pin serves for connecting a capacitor between CT and GND.
The capacitor determines the characteristics of the built-in lockup protection circuit for preventing coil burnout in the case of motor restraint. Once normal motor load is restored, the automatic recovery circuit resets itself. Changing the capacitance alters the lockup detection time. When a 0.47 uF capacitor is connected between CT and GND

Lockup detection time : approx. 0.5s
Lockup protection time/automatic recovery time : approx. 0.16s (output ON)
approx. 1s (output OFF)

When not using lockup protection function, this pin should be connected to ground.

(5) FG pin
Open-collector output pin for rotation frequency detection.
When HS(–) = High and HS(+) = Low, then FG = Low
When HS(–) = Low and HS(+) = High, then FG = High

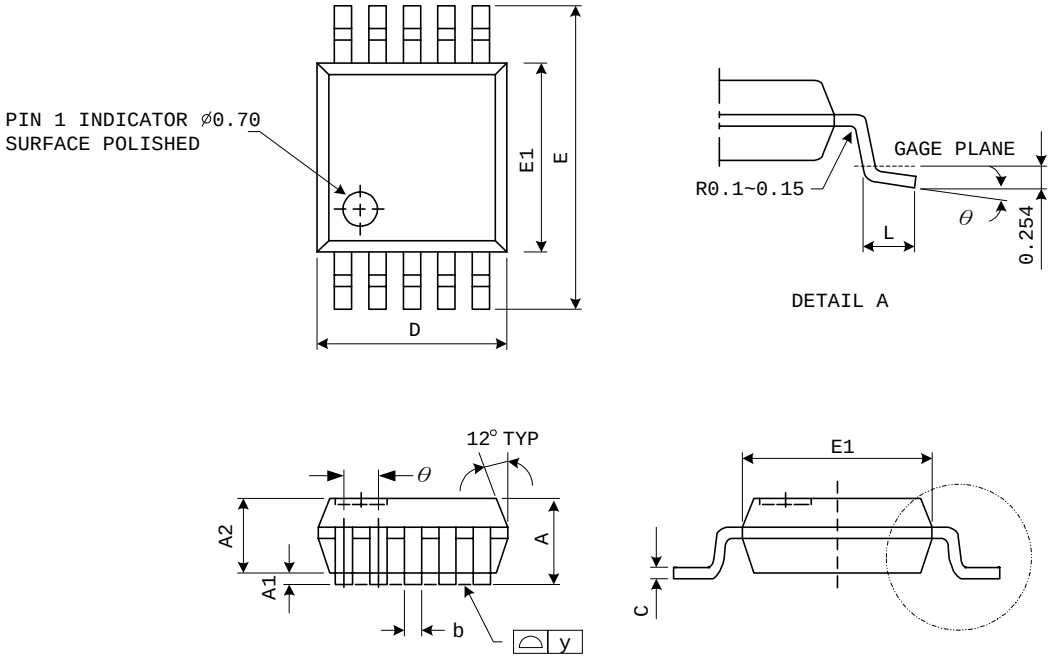
(6) HIB pin
Hall bias switching pin. At STB pin High input, Hall bias is switched to reduce current drain in standby mode. If not used, this pin should be open.

(7) STB pin
When input to this pin is high, motor driver is stopped (DO is high impedance). If not used, this pin should be open.

(8) Thermal protection circuit
When internal temperature Tj of IC reaches 180°C, output current limiter is activated to protect against damage.

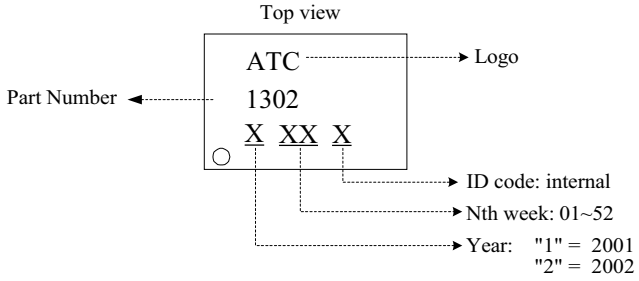
■ Package Diagrams

- MSOP-10L Package



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.81	1.02	1.22	0.032	0.040	0.048
A1	0.05	---	0.15	0.002	---	0.006
A2	0.76	0.86	0.97	0.030	0.034	0.038
b	0.15	0.20	0.25	0.0059	0.0078	0.0098
C	0.13	0.15	0.23	0.005	0.006	0.009
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.80	4.90	5.00	0.189	0.193	0.197
E1	2.90	3.00	3.10	0.114	0.118	0.122
e	---	0.50	---	---	0.0196	---
L	0.40	0.53	0.66	0.016	0.021	0.026
y	---	---	0.076	---	---	0.003
θ	0°	3°	6°	0°	3°	6°

■ Marking Information



(MSOP-10L)