

# AP1303

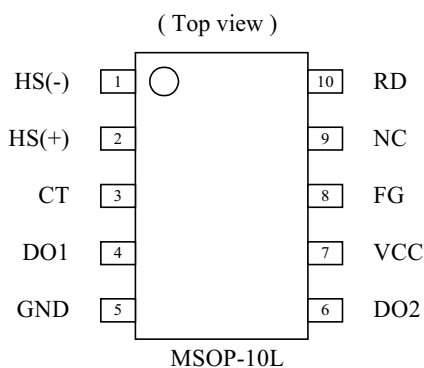
## Single-Phase Full-Wave Fan Motor Driver

( 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
- Rotation detection (RD) output
- Frequency generator (FG) output
- Built-in thermal shutdown protection

### ■ Pin Assignments



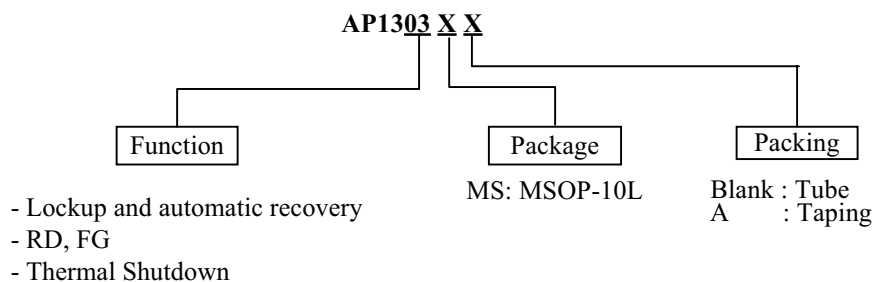
### ■ General Descriptions

The AP1303 is single-phase full-wave drive design and a compact package makes the IC optimal for small fans (especially cooling fans). Low switching noise and effective motor drive are further advantages. To avoid coil burning, rotor-lock detection shut down the output driver and then automatic recovery circuit will restart during locked state. The AP1303 features the RD, FG outputs and thermal shutdown for protecting the IC.

### ■ Pin Descriptions

Name	Function
HS(+)	Hall sensor input
HS(-)	Hall sensor input
CT	Timing capacitor
DO1	Bipolar Driver Output
DO2	Bipolar Driver Output
VCC	Power input
FG	Frequency Generation
RD	Rotation Detection
NC	No Connecting
GND	Ground

### ■ Ordering Information



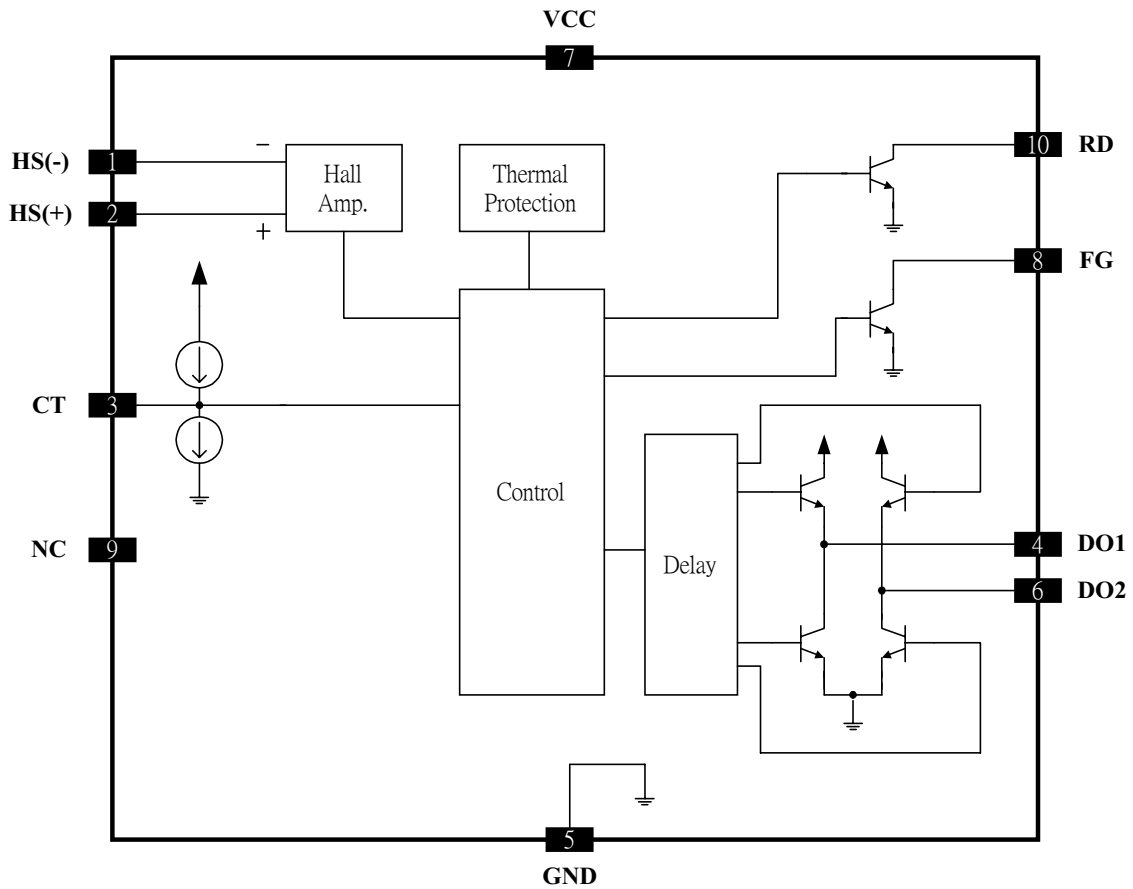
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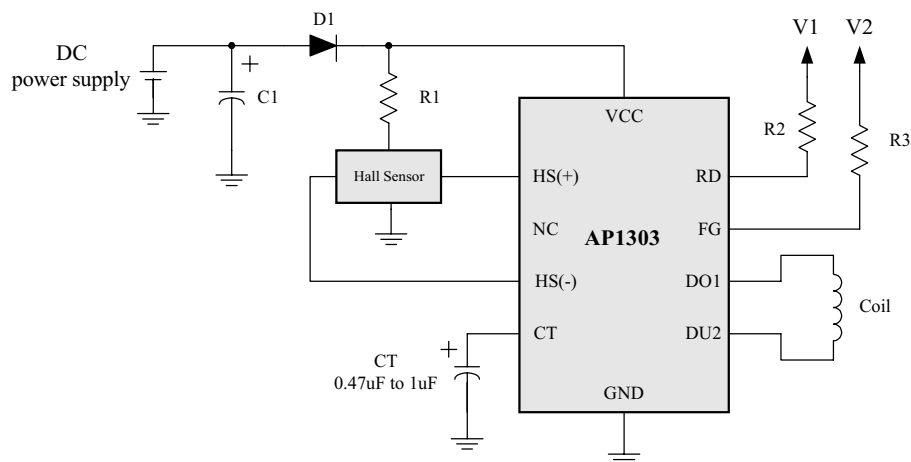


( Preliminary )

## ■ 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
RD/FG maximum output withstand voltage	$V_{R(max)}$	15	V
	$V_{F(max)}$	17	V
RD/FG maximum output current	$I_{R(max)}$	5	mA
	$I_{F(max)}$	5	mA
Allowable power dissipation	$P_{D(max)}$	500	mW
Thermal resistance (Junction to Ambient)	$\vartheta_{JA}$	150	°C/W
Operating temperature	$T_{opr}$	-30 to +85	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

### ■ Allowable Operating Conditions (Ta=25°C)

Parameter	Symbol	Rating	unit
Supply voltage	$V_{CC}$	3.8 to 16.8	V
Hall input common mode voltage range	$V_{HCM}$	0.2 to (VCC-1.5)	V

### ■ Electrical Characteristics ( Ta=25°C, VCC=5V)

Parameter	Symbol	Conditions	Ratings			Unit
			Min.	Typ.	Max.	
Current drain	I <sub>CC</sub>	Drive mode (CT=L)		6.5	9.1	mA
		Lock protection mode (CT=H)		2.2	3.1	mA
Lock detection Capacitor charge current	I <sub>CT1</sub>		1.9	2.8	3.7	uA
Capacitor discharge current	I <sub>CT2</sub>		0.32	0.46	0.60	uA
Capacitor charge/discharge current ratio	R <sub>CT</sub>	$R_{CT} = \frac{I_{CT1}}{I_{CT2}}$	5	6	7	
CT charge voltage	V <sub>CT1</sub>		2.55	2.75	2.95	V
CT discharge voltage	V <sub>CT2</sub>		1.6	1.8	2.0	V
Output Low level voltage	V <sub>OL</sub>	I <sub>O</sub> =200mA		0.2	0.3	V
Output High level voltage	V <sub>OH</sub>	I <sub>O</sub> =200mA	3.9	4.1		V
Hall input sensitivity	V <sub>HN</sub>	Zero Peak value ( including offset and hysteresis)		7	15	mV
RD/FG output pin low voltage	V <sub>RD</sub> , V <sub>FG</sub>	I <sub>RD</sub> , I <sub>FG</sub> =5mA		0.1	0.3	V
RD/FG output pin leakage current	I <sub>RDL</sub> , I <sub>FGL</sub>	V <sub>RD</sub> , V <sub>FG</sub> =15V			30	uA

### ■ Truth Table

Mode	HS(+)	HS(-)	CT	DO1	DO2	RD	FG
Rotating	H	L	L	H	L	L	L
	L	H		L	H		H
Lock	-	-	H	Off	Off	Off	-

### ■ Function 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  $\pm 3.5$  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 Lock 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 lock detection time. When a 0.47  $\mu$ F capacitor is connected between CT and GND

Lock detection time : approx. 0.5s

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

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

#### (5) RD pin

Open-collector output pin for rotation detection.

This pin is pulled low during rotation and pulled high when rotor-lock is detected.

#### (6) 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

#### (7) Thermal protection circuit

When internal temperature  $T_j$  of IC reaches  $180^\circ\text{C}$ , output current limiter is activated to protect against damage.

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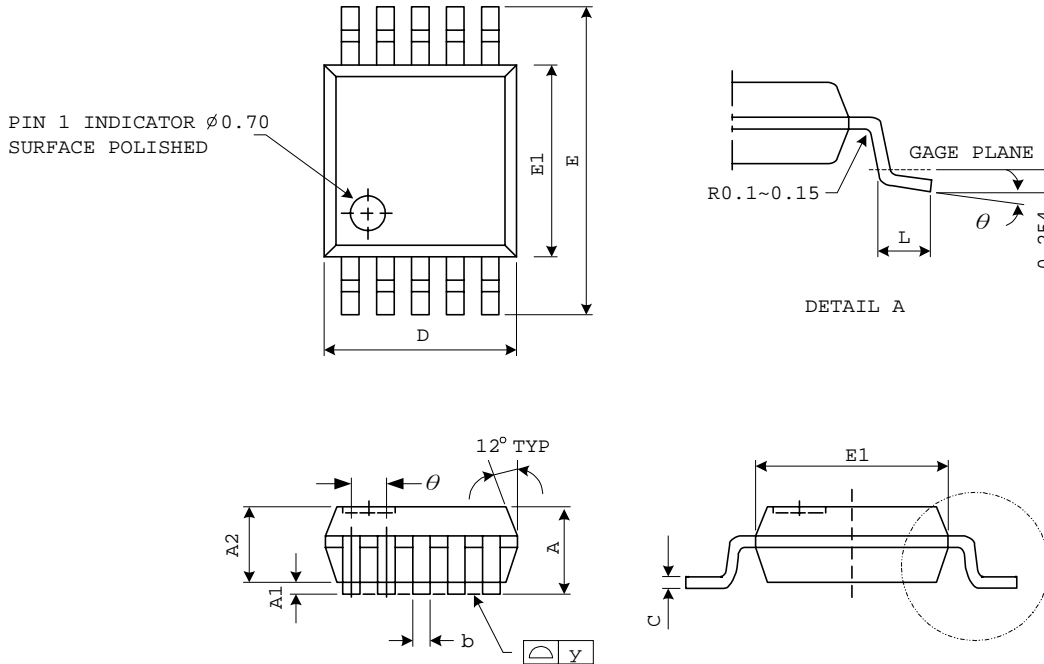
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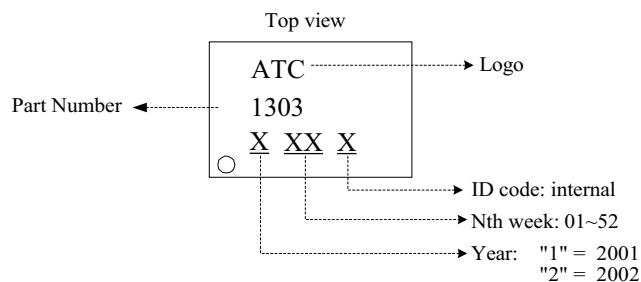
### ■ Package Diagrams

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
$\theta$	0°	3°	6°	0°	3°	6°

### ■ Marking Information



( MSOP-10L )