Digital Single Phase BLDC All in one Motor Controller

1. Description

The iT1300E is a single phase, brushless DC motor controller. It is composed of hall element, MOSFET, gate driver and control logic which can provide minimal components of total BOM to save total cost.

The iT1300E provides various parameters to tune motor efficiently and quickly, ex: poles, Lead Angel, target speed and PWM duty …etc. All the parameters shall be set via inergy's software "INGUI"

The iT1300E is equipped TSD, OCP, OVP, UVP, Lockout protections

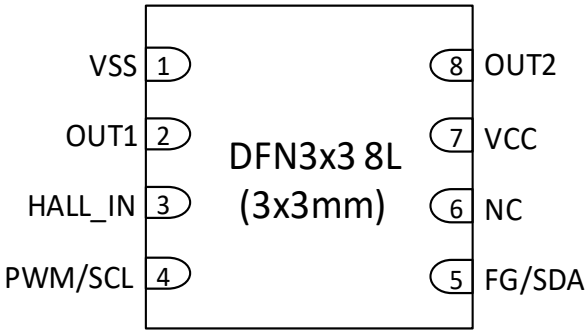
2. Applications

BLDC motors and fans

3. Features

- Direct PWM control
- Embedded Hall Sensor
- Wide Range 3.5V to 16V Operating Input
- Integrated Power MOSFETs
- Programmable Speed Curve
- Adjustable Lead Angle ± 90°
- Adjustable Lockout Detection and Automatic Recovery
- Adjustable Silence Current Control
- Selectable FG/Alarm/RD Signal Output
- 1KHz~100KHz PWM Input Frequency Range
- 25K/50KHz Output Switching Frequency
- Cycle by Cycle Current Limit
- Selectable Open Loop and Close Loop
- Adjustable Input Duty and Output Duty Slope
- Soft Start and Kick Start
- TSD, OCP, OVP, UVP, and Automatic Recovery

4. Pin Assignments



5. Marking Information

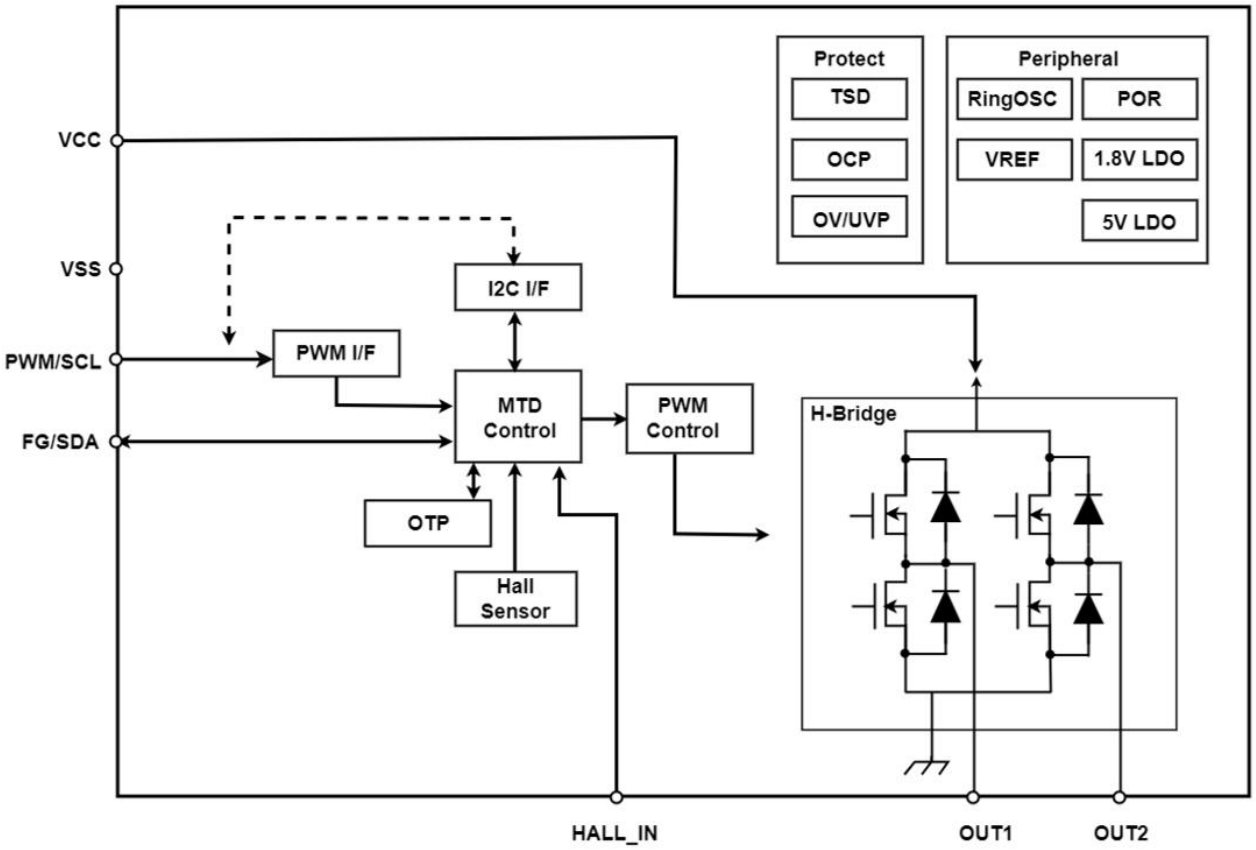
Ordering code	Marking
iT1300E	iNERGY 1300XXX □□-YYYY ● X：Date code Y：Checksum □□：Internal code

Note: inergy defines "Green" as lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900 ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500 ppm by weight; Follow IEC 61249-2-21 and IPC / JEDEC J-STD-020C)

6. Pin Definitions

Pin No.	Symbol	Description
1	VSS	Ground pin
2	OUT1	Driving motor output
3	HALL_IN	External hall IC signal in
4	PWM/SCL	Direct PWM input/ SCL
5	FG/SDA	Speed signal output / SDA
6	NC	-
7	VCC	Power supply pin
8	OUT2	Driving motor output

7. Block Diagram



8. Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to GND, all currents are defined positive into any lead. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

Symbol	Parameter	Min	Max.	Unit
V_{CC}	Supply Voltage	-0.3	20	V
V_O	Output Voltage	-0.3	18	V
I_O	Output Current		1.2	A
P_D	Package power dissipation @ $T_A \leq +25℃$		2.50	W
V_{PWM}	PWM/SCL signal input voltage	-0.3	6	V
V_{FG}	FG/Alarm/RD signal output voltage	-0.3	18	V
I_{FG}	FG/Alarm/RD signal sink current		0.01	A
R_{thJA}	Thermal resistance, junction to ambient		50	℃ / W
T_J	Junction temperature		150	℃
T_S	Storage temperature	-55	150	
T_L	Lead temperature (soldering 10 seconds)		260	

9. Recommended Operating Conditions

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Operating supply voltage	3.5	16	V
V_{PWM}	PWM input voltage	-0.3	5.5	V
V_{FG}	FG/Alarm/RD signal output voltage	-0.3	16	V
D_{PWM}	Duty of PWM input	0	100	%
F_{PWMIN}	Frequency of PWM input	1K	100K	Hz
T_A	Ambient temperature (*1)	- 40	125	℃

*1 Note：Please do not exceed T_j limitation

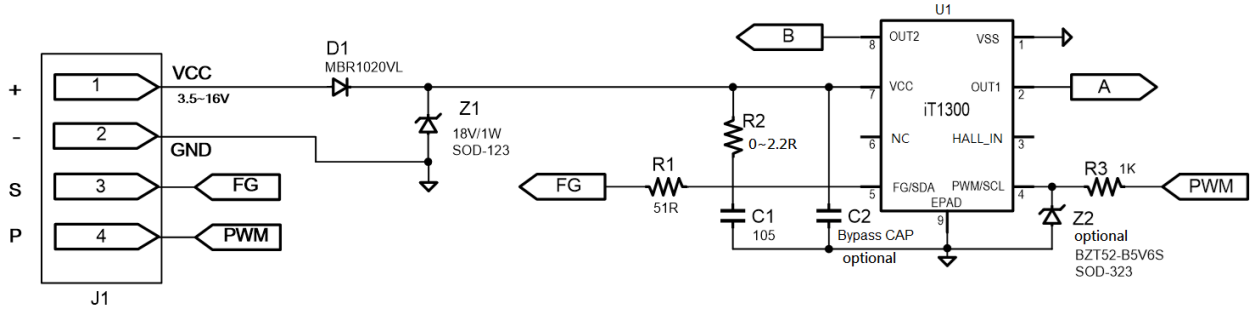
10. Electrical Characteristics

V_{CC}=12V, T_A = 25ºC, unless otherwise specified.

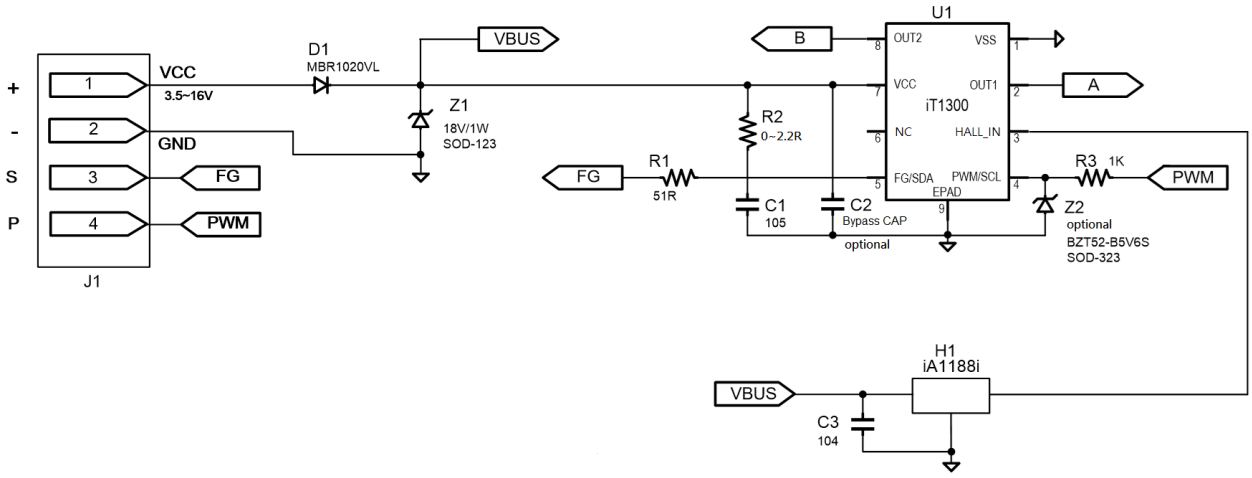
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{cc}	Circuit Current	Vcc=12V		6		mA
TH_{PG}	Vcc power good threshold		-15%	3	+15%	V
HYS_{PG}	Vcc power good hysteresis		0.1	0.4	0.6	V
TH_{ov}	Vcc over voltage threshold			19.5		V
HYS_{ov}	Vcc over voltage hysteresis			1		V
TH_{uv}	Vcc under voltage threshold			8		V
HYS_{uv}	Vcc under voltage hysteresis			1		V
TH_{tsd}	Thermal shutdown threshold		140	150	160	℃
HYS_{tsd}	Thermal shutdown hysteresis			25		℃
TH_{tam}	Thermal alarm threshold		115	125	135	℃
HYS_{tam}	Thermal alarm hysteresis			25		℃
V_{PWMH}	PWM input high voltage		2.6		5.5	V
V_{PWML}	PWM input low voltage		-0.3		0.8	
F_{PWM}	PWM input frequency		1		100	kHz
R_{PWM_UP}	PWM input internal pull-up resistance			20		kΩ
R_{PWM_Down}	PWM input internal pull-down resistance			800		kΩ
R_{on}	High side + Low side resistance	I_O=0.5A/Vcc=12V Ta=25℃		0.9		Ω
R_{FG}	Internal resistance of FG			20		Ω
I_{oc}	Over current threshold				1.2	A
I_{lim}	Output current limit range	0.2A/step	0.2		1.2	A
F_{osc}	Internal oscillator frequency		-5%	26	+5%	MHz
F_{PWM}	PWM output frequency		-5%	25	+5%	kHz
			-5%	50	+5%	
LA	Lead Angle		-90		+90	°
T_{locd}	Lockout detect time	0.25/0.5sec	-5%	0.25	+5%	sec
T_{lodr}	Lock recovery time	2.5/5/7.5/10sec	-5%	2.5	+5%	sec
B_{OP}	Operate magnetic field		15		35	Gauss
B_{RP}	Release magnetic field		-35		-15	Gauss
B_{HYS}	magnetic field hysteresis	ABS(B_{OP}- B_{RP})		50		Gauss

11. Application Circuit

<Typical>



<To use external hall IC>

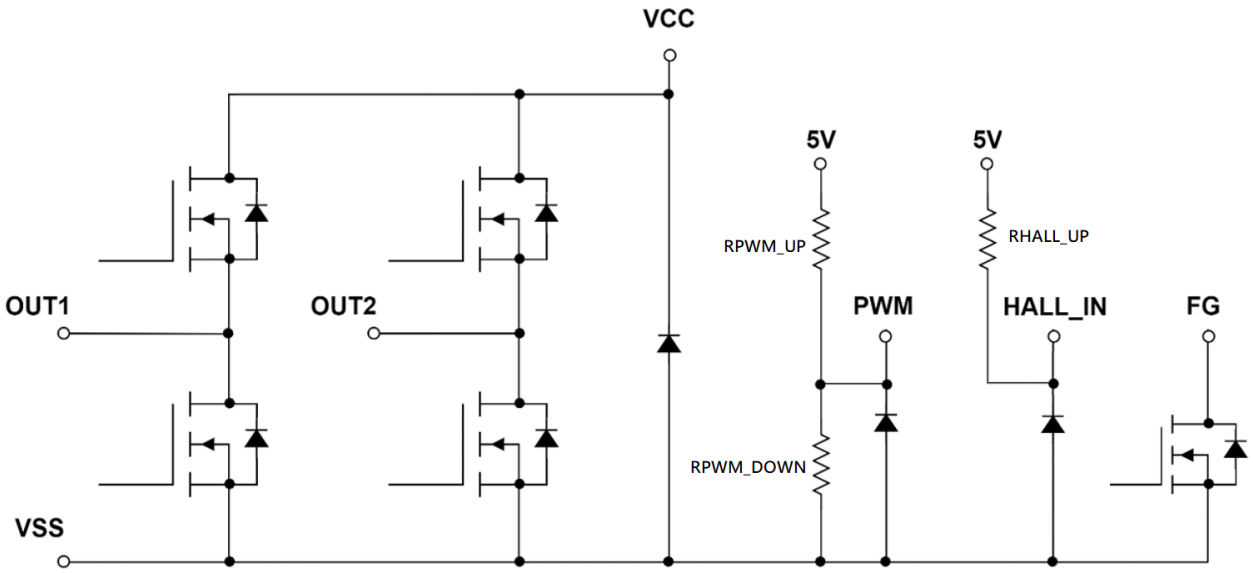


Note：

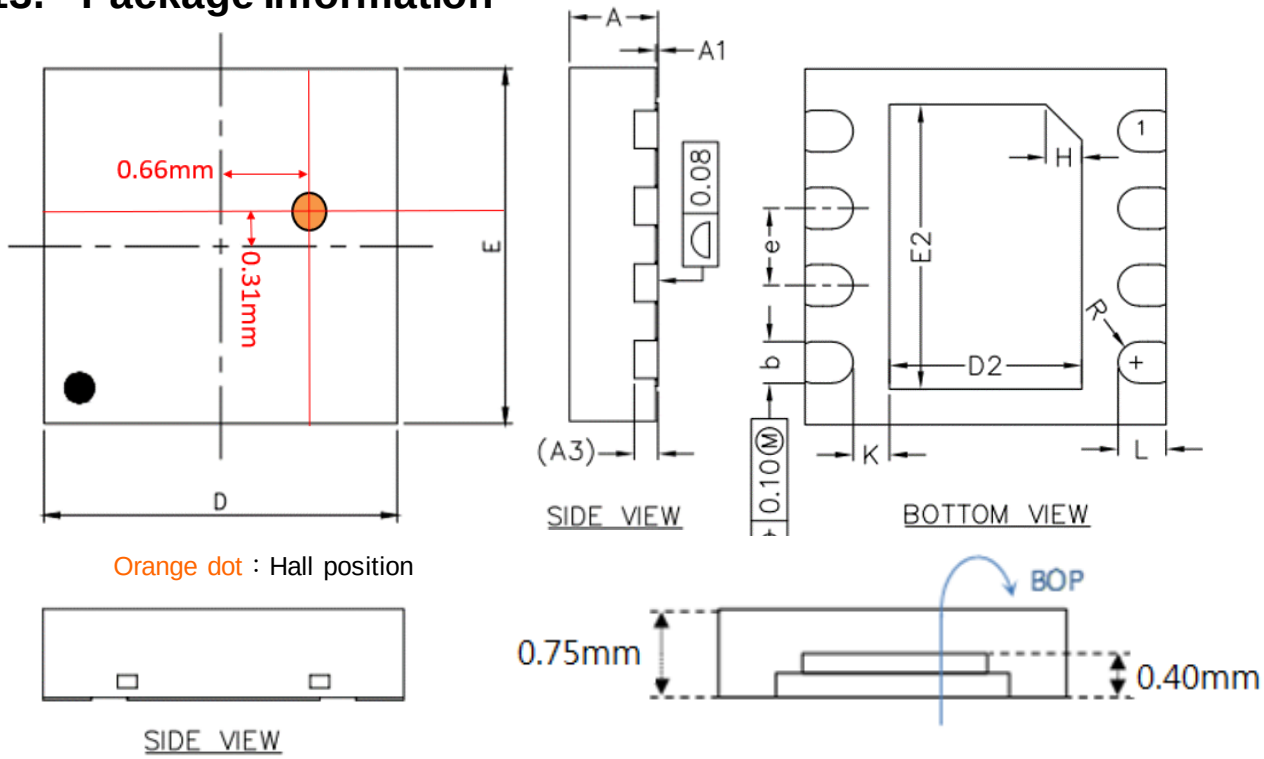
1. (IMPORTANT) C1 must be placed as close as possible to VCC pin.
2. C2 is optional. It must be placed as close as possible to VCC pin.
3. Z2 is optional. It can be removed if PWM input voltage will not exceed to 5.5V.
4. R1 and R3 are for ESD protection.
5. The value of R3 will affect V_{PWMH} and V_{PWML} of PWM.

12. I/O Equivalent Circuit

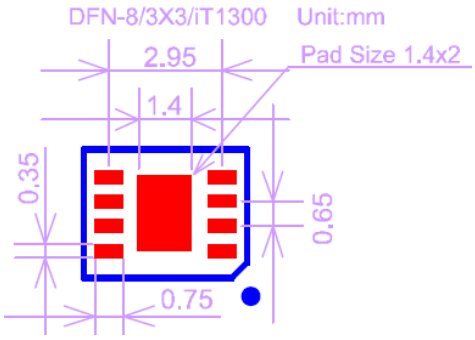
ESD Protection



13. Package Information



SYMBOL	Dimension in mm		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.90
A1	0.00	0.02	0.05
A3		0.20 REF	
b	0.25	0.35	0.40
D	2.90	3.00	3.10
E	2.90	3.00	3.10
D2	1.50	1.60	1.85
E2	1.95	2.40	2.55
e	0.55	0.65	0.75
H		0.30 REF	
K	0.20	0.30	0.40
L	0.30	0.40	0.50
R	0.16	-	-



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