

# ST1117A/B/C

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*Single Coil Brushless DC Motor Drivers*

*( 1.5 to 8.5 Volts )*



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## ST1117A / ST1117B / ST1117C

### Single Coil Brushless DC Motor Drivers ( 1.5 to 8.5 Volts )

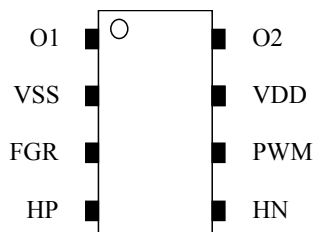
#### General Specifications

The device is a single coil DC brushless motor driver IC with PWM control, lock protection, power polarity reverse protection and frequency generator. The driver is optimal for single coil fan applications with less external components.

#### Features and Benefits

- Support single-phase full wave Brushless DC Motor Driver
- Built-in Hall sensor input amplifier
- Low voltage startup (VDD=1.5V)
- High output sinking and driving capability
- Lock detection and automatic self-restart
- Without external timing capacitor,  
Reduces the numbers of external component required
- External PWM control signal input
- With FG/2 output, suitable for 8-poles fan motor for ST1117A  
With FG output, suitable for 4-poles fan motor for ST1117B  
With RD output for ST1117C
- Thin, compact, highly reliable package (SOT-28)

#### Pin Description



NO.	NAME	DESCRIPTION
1	O1	Output driving & sinking pin
2	VSS	Ground pin
3	FGR	Frequency generator or rotating detector ST1117A : FG/2 ST1117B : FG ST1117C : RD
4	HP	Hall sensor in+
5	HN	Hall sensor in-
6	PWM	Input pin for PWM Control
7	VDD	Power supply pin
8	O2	Output driving & sinking pin

### Absolute Maximum Ratings ( Unless otherwise noted, $T_A = 25\text{ }^\circ\text{C}$ )

Characteristic	Symbol	Rating	Unit
Supply Voltage	$V_{DD}$	7.5	V
Input Voltage from a Hall Effect Latch Output	$V_{IN}$	$V_{DD}+0.4$	V
Output Current	$I_{OUT}$	400	mA
Output Current at Lock	$I_{OL}$	700	mA
Power Dissipation	$P_D$	350	mW
Operating Temperature Range	$T_{OPR}$	-40 ~ 125	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-65 ~ 150	$^\circ\text{C}$
Operating Junction Temperature	$T_J$	125	$^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$\theta_{JA}$	218	$^\circ\text{C/W}$

Notes:\* The maximum power supply voltage & output current must be under the allowable package power dissipation.

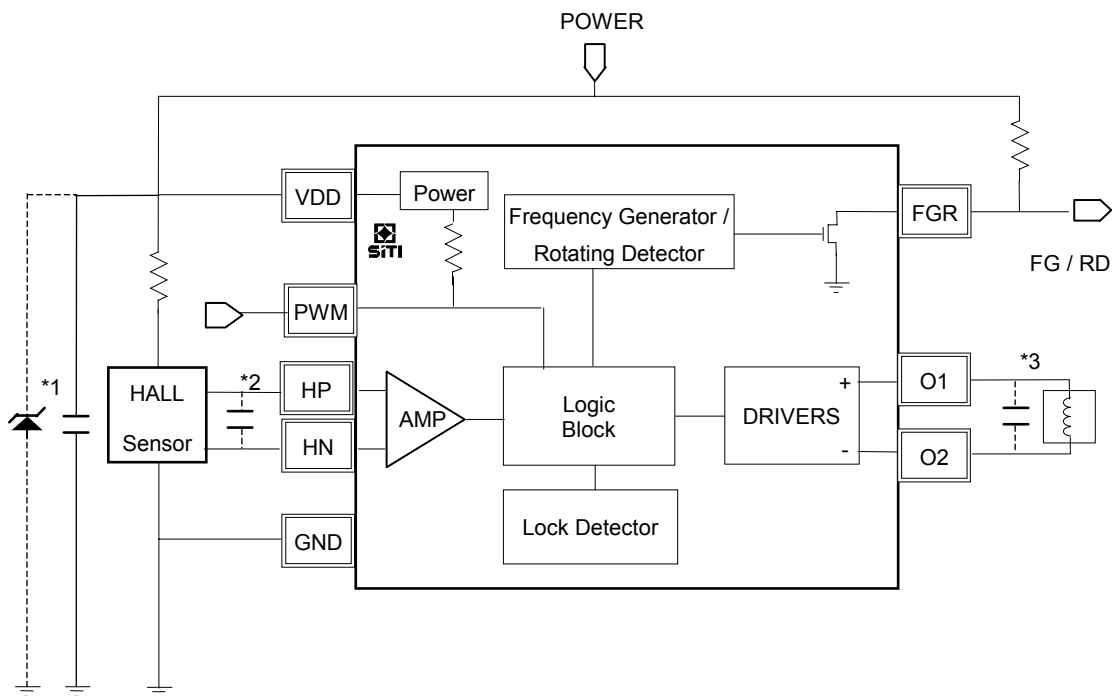
### Electrical Characteristics ( $T_A = 25\text{ }^\circ\text{C}$ , $V_{DD} = 5\text{V}$ )

Characteristic	Sym.	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	$V_{DD}$	Operating	1.5	5	7.5	V
HP/HN input Terminal ( $T_J = 25\text{ }^\circ\text{C}$ )						
Hall input sensitivity	$V_{HN}$	Zero to peak	-	7	25	mV
PWM input Terminal ( $T_J = 25\text{ }^\circ\text{C}$ )						
Input Voltage "H"	$V_{IH}$	-	$0.5 \cdot V_{DD}$	-	$V_{DD}+0.4$	V
Input Voltage "L"	$V_{IL}$	-	-0.4	-	$0.15 \cdot V_{DD}$	V
Input Current "H"	$I_{IH}$	$V_{IN} = V_{DD}$	-	-	$\pm 1$	$\mu\text{A}$
Input Current "L"	$I_{IL}$	$V_{IN} = 0\text{V}$	-	-	$\pm 1$	mA
O1/O2 Output Terminal ( $T_J = 25\text{ }^\circ\text{C}$ )						
Output Voltage High	$V_{OH}$	$I_{OUT} = 300\text{ mA}$	4.6	-	-	V
Output Voltage Low	$V_{OL}$	$I_{OUT} = 300\text{ mA}$	-	-	0.3	V
Output Current	$I_{OUT}$	$R_L = 30\ \Omega$	-	150	-	mA
FGR Open-Drain Terminal ( $T_J = 25\text{ }^\circ\text{C}$ )						
Output Leakage Current	$I_{Leak}$	$V_{FGR} = 5\text{V}$	-	-	1	$\mu\text{A}$
Output Current	$I_{FGR}$	$V_{FGR\text{ROL}} = 0.4\text{V}$	5	-	-	mA
Output Voltage Low	$V_{FGR\text{ROL}}$	$I_{FGR} = 5\text{ mA}$	-	-	0.4	V
Automatic Self-Restart Circuit						
On Time	$T_{ON}$	-	-	175	-	ms
Duty Ratio	$R_{DR}$	$T_{OFF} / T_{ON}$	6	7	8	

### Truth Table

HP	HN	PWM	O1	O2
H	L	H	H	L
L	H	H	L	H
-	-	L	OFF	OFF

### Block Diagram & Application Circuit

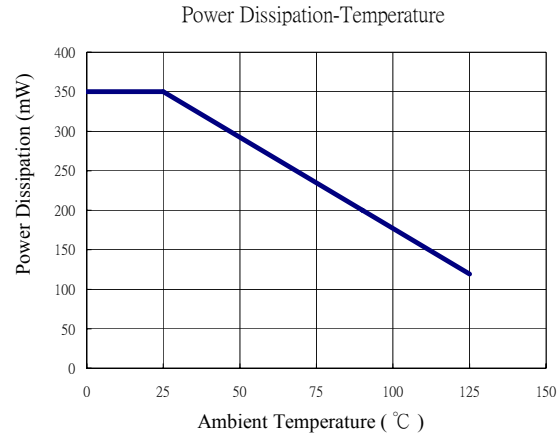


\*1, \*2, \*3 : The Zener diode and capacitors will increase system stability, if required.

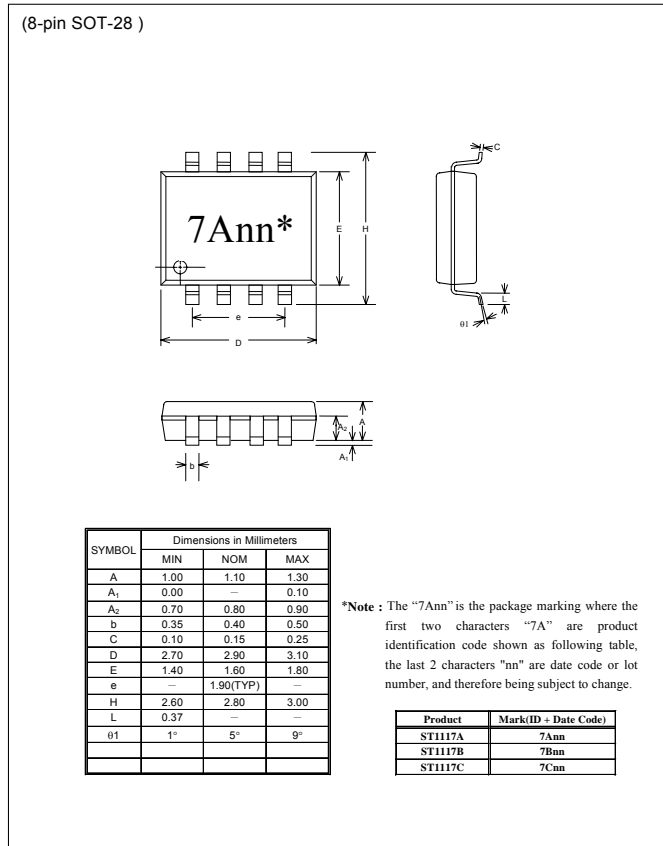
## Application Notes

- With low voltage start-up feature, the device is operated within wide supply voltage range from 1.5 to 7.5 Volts. The design, specifications and performance have been optimized for 3V and 5V brushless DC motor applications.
- The output driver node O1/O2 will be “turned to sink/drive” for V(HIN) = logic low. Similarly, the output O1/O2 will be “turned to drive/sink” for V(HIN) = logic high .
- The **FGR** pin is an open-drained output. The output frequency is dividing the hall switching frequency with 2 for ST1117A, the same frequency with hall switching for ST1117B, and the rotating detection for ST1117C. With suitable pull up, the fan tachometer output can be used directly with bipolar or MOS logic for motor speed monitoring/control. To get better FG signal output, increasing stability of power system is required.
- The pull up resistor about 20K $\Omega$  is connected to PWM pin. The PWM command is active high. If low acoustic noise is desired, the PWM frequency range below 200Hz or 20KHz ~ 40KHz is recommended.
- There is no need of external timing capacitor for lock protection and auto-restart function. For 5V application, the drivers will be shut down roughly 1 to 3 seconds after the motor is locked. When the drivers have been shut down, the automatic self-restart circuit will try to power up the drivers every 1 to 3 seconds until lock is released.
- There is no requirement of protection diode for power reverse fault in normal applications. The power polarity reverse protection circuit is built-in.
- The capacitor between two ends of coil ( \*3 in application circuit) is proposed to connect 0.1 $\mu$ F for PWM application and 1 $\mu$ F for full-speed application.
- The connection of the capacitor or Zener Diode (\*1 in application circuit) between VDD and GND, the capacitor (\*2 in application circuit) between two Hall sensor output and the capacitor (\*3 in application circuit) between two ends of coil will increase system stability when motor is rotating.

- The power dissipated by the IC varies widely with the supply voltage, the output current, and loading. It is important to ensure the application does not exceed the allowable power dissipation of the IC package. The recommended motor driver power dissipation versus temperature is depicted as follows:



## Package Specifications ( SOT-28 )



The products listed herein are designed for ordinary electronic applications, such as electrical appliances, audio-visual equipment, communications devices and so on. Hence, it is advisable that the devices should not be used in medical instruments, surgical implants, aerospace machinery, nuclear power control systems, disaster/crime-prevention equipment and the like. Misusing those products may directly or indirectly endanger human life, or cause injury and property loss.

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