Single-phase DC Brushless Motor Driver IC

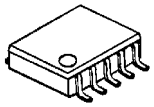
■ GENERAL DESCRIPTION

The NJU7346 is a single-phase DC brushless motor driver IC designed for small and high power fan-motor applications.

It provides a low operating current of 3mA (typ.) and low saturation output voltage at high output current operation, which offers a high efficiency motor driving. It has a FG (frequency generator) output useful for various control systems and thermal shutdown circuit useful for high-current applications. Further it incorporates feed-back resistances to provide optimized output wave for low noise motor driving.

The NJU7346 is available in a small and thin surface mount package of MSOP10 (TVSP10), which provides downsizing and thinning in motor applications.

■ PACKAGE OUTLINE



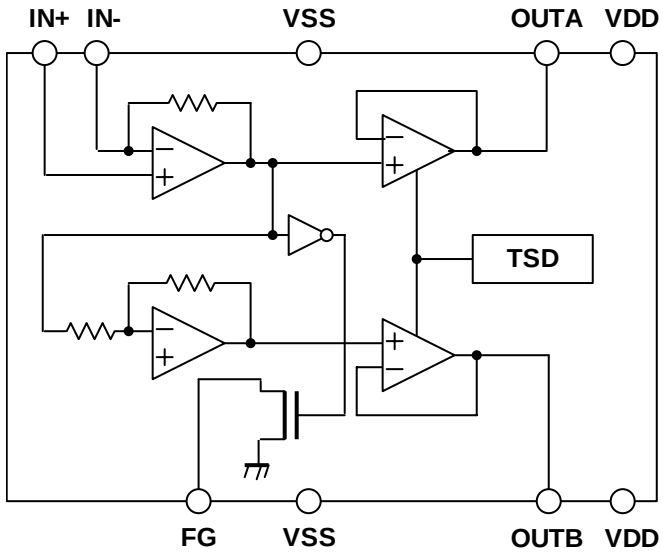
NJU7346R
(MSOP10 (VSP10))

■ FEATURES

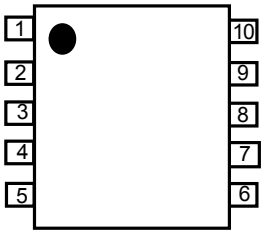
- Operating Voltage 3.5 to 14V
- Frequency Generator Output
- Thermal Shutdown Circuit
- Low Operating Current
- Low Saturation Output Voltage
- Vsat=±0.3V @Io=±200mA
- CMOS Technology
- Package Outline MSOP10 (VSP10)*

*MEET JEDEC MO-187-DA

■ BLOCK DIAGRAM



■ **PIN FUNCTION**



MSOP10 (VSP10)

1:NC
2:FG
3:V_{SS}
4:OUTB
5:V_{DD}
6:V_{DD}
7:OUTA
8:V_{SS}
9:IN-
10:IN+

(Note)
All V_{DD} pins should be connected to the power supply and all V_{SS} pins should be connected to the ground. Otherwise, the electrical characteristics may not satisfy specifications.

■ **ABSOLUTE MAXIMUM RATINGS** (Ta=25°C)

PARAMETER	RATINGS	SYMBOL (unit)	NOTE
Supply Voltage	+15.0	V_{DD} (V)	
Input Voltage	-0.3 to V_{DD}	V_{ID}(V)	
Output Current (Peak)	600	$I_{O\ PEAK}$ (mA)	
Operating Temperature Range	-40 to +85	Topr (°C)	
Storage Temperature Range	-50 to +150	Tstg (°C)	
Power Dissipation	400	P_D (mW)	Device itself

■ **RECOMMENDED OPERATING CONDITIONS** (V_{DD} =12V, Ta=25°C)

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{DD}	-	3.5	-	14	V
Output Current	I_O	-	-	-	200	mA

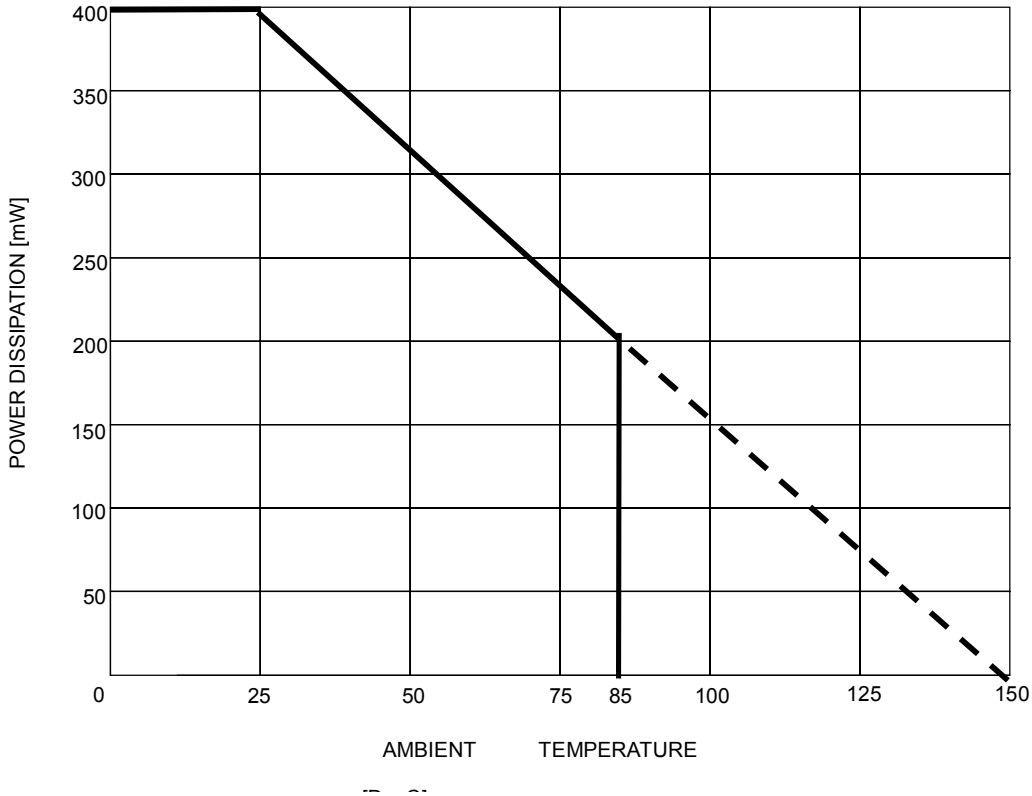
■ **ELECTRICAL CHARACTERISTICS** (V_{DD} =12V, Ta=25°C)

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
General						
Operating Current	I_{DD}	-	-	3.0	4.0	mA
Thermal Shutdown Temperature	T_{TSD}	-	-	180	-	°C
Thermal Shutdown Hysteresis	T_{HYS}	-	-	60	-	°C
Hall Amplifier						
Input Offset Voltage	V_{IO}	-	-18	-	18	mV
Feedback Resistance	R_F	-	-	37.5	-	kΩ
Input Common Mode Voltage Range	V_{ICM}	-	0.2 to 10.5	-	-	V
Output						
Maximum Output Voltage Range	V_{OH}	Io=+200mA	11.55	11.70	-	V
	V_{OL}	Io=-200mA	-	0.30	0.45	
Output Resistance	R_{ONH}	Io=+200mA	-	1.5	-	Ω
	R_{ONL}	Io=-200mA	-	1.5	-	
FG L Output Voltage	V_{FG}	I_{FGL}=5mA	-	-	0.6	V
FG H Leak Current	$I_{FG-LEAK}$	V_{FGL}=12V	-	-	1.0	μA

■ **INPUT-OUTPUT TRUTH TABLE**

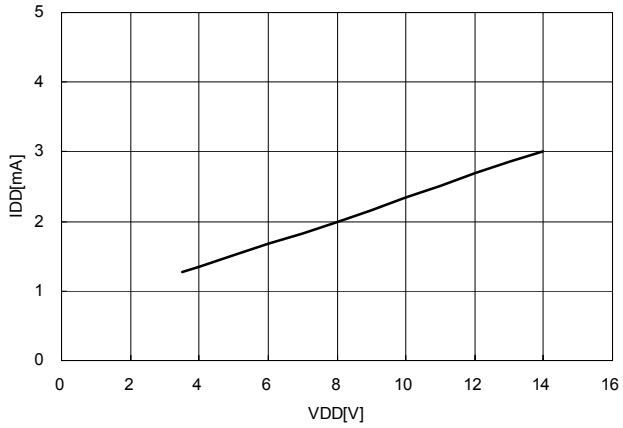
Input		Output		
IN+	IN-	OUTA	OUTB	FG
H	L	H	L	H
L	H	L	H	L

■ **POWER DISSIPATION**

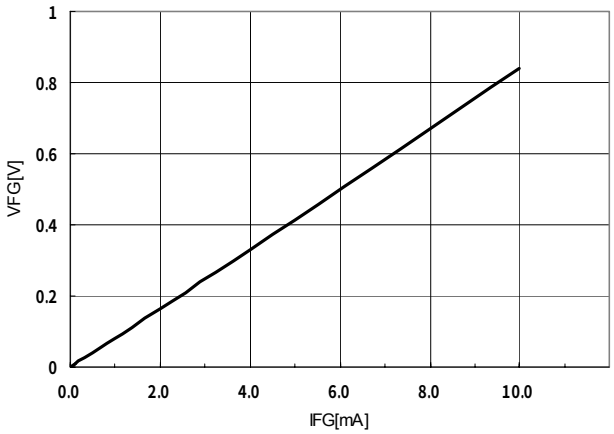


■ TYPICAL CHARACTERISTICS

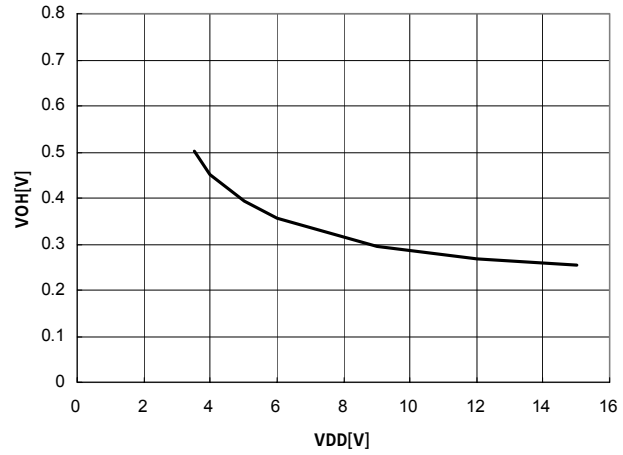
VDD-IDD
IN+=VDD,IN-=VDD



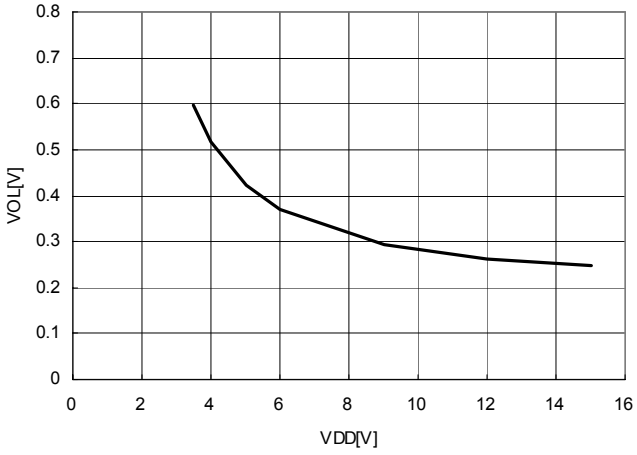
VFG—IFG
VDD=12V



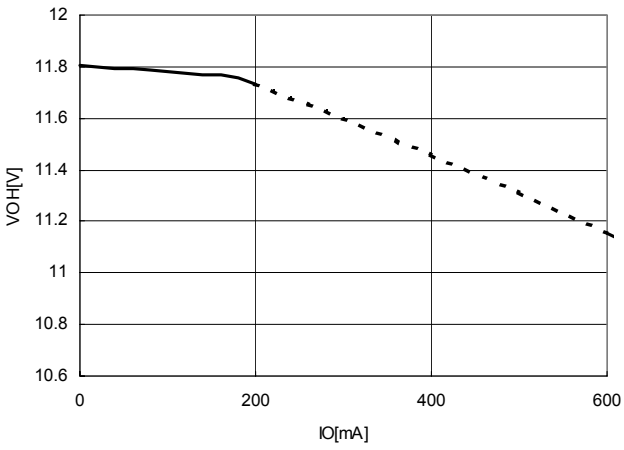
VDD - VOH
Io=+200mA



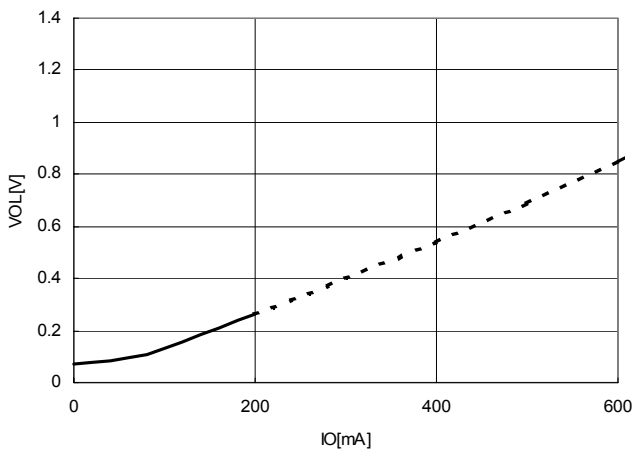
VDD - VOL
Io=-200mA



IO-VOH
VDD=12V



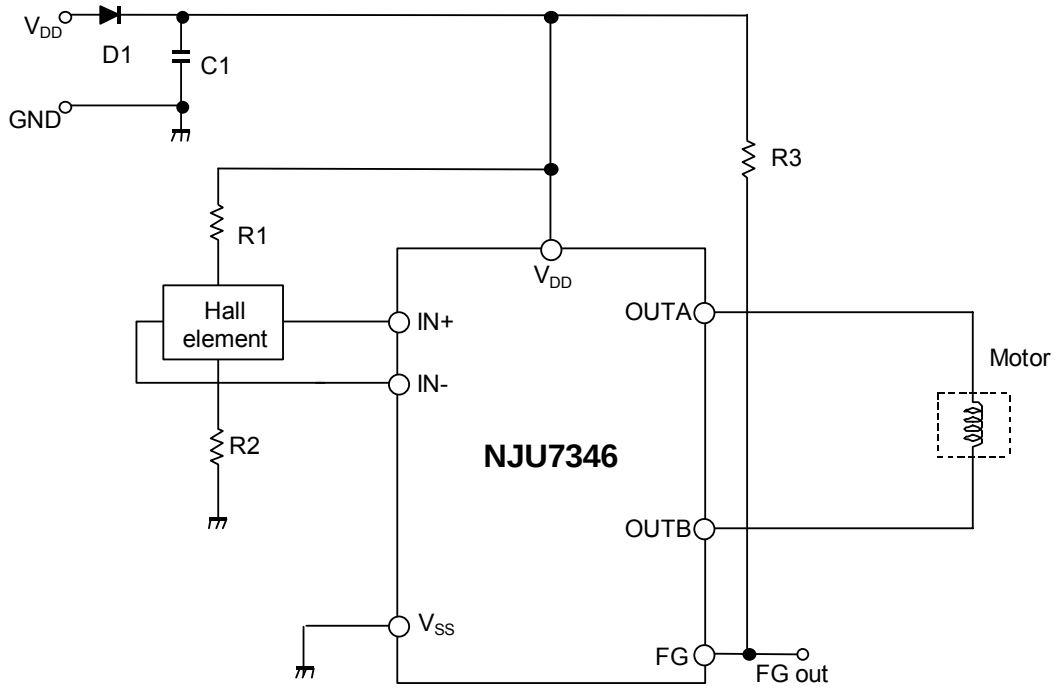
IO-VOL
VDD=12V



■ APLICATION NOTE

The NJU7346 is a single-phase DC brushless motor driver IC in small MSOP10 (VSP10) package.
With minimal external components, It can drive up to 200mA of motor current for small fan application.

[Application Circuit Example]



[Design Notes]

Above application example is designed for 12V operation with motor current of 200mA. It uses the following components:

Hall elements: HW101A (AKE)

1. Selection of **C1** and **D1**:

C1 is used for a noise reduction purpose. A typical value is 0.1uF.

Optimize the value in actual operating conditions if necessary. D1 is a diode for protection against reverse voltage supply. Silicon rectifier diode (WO3C, 10D1 and equivalent) is appropriate.

2. Design of hall element bias resistance (**R1** and **R2**)

Hall amplifier is a differential amplifier.

The common-mode input voltage is between 0.2V and V_{DD}-1.5V and the input signal must be within the range. Non-excitation hall bias voltage is to be set at a half of V_{DD} for effective use of common-mode input voltage range. Therefore the same value of hall bias resistors is selected for R1 and R2.

Given that the bias current is set to be 5mA by HW101A datasheet, R1 and R2 can be determined as follows:

$$R1 + R2 + Rin = \frac{V_{DD}}{Ihbias} = \frac{12}{5 \times 10^{-3}} = 2.4k\Omega$$

$$R1 = R2 = 1k\Omega$$

The output voltage of hall elements is influenced by the bias current and magnetic flux density of hall elements.

The optimum input voltage of NJU7346 is 100mVp-p and higher. With such input voltage, the highest efficiency can be obtained.

3. Design of FG output resistsnce (**R3**)

FG Out(FG:Pin2) is a open drain output and R3 is a pull up register. A typical value of R3 is 10kΩ. The timing chart of FG Out is as follows.

Note that the pull up resistance shall be connected to below supply voltage.