

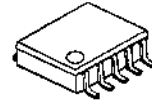
## Single-phase DC Brushless Motor Driver IC

### ■ GENERAL DESCRIPTION

The NJU7329B 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. Further it has a frequency generator (FG) output useful for various control systems and protection circuits such as a lock protection, auto-recovery circuit and thermal shutdown useful for high-current applications.

The NJU7329B is available in a small and thin surface mount package of MSOP10 (TVSP10), which proves downsizing and thinning in motor applications.

### ■ PACKAGE OUTLINE

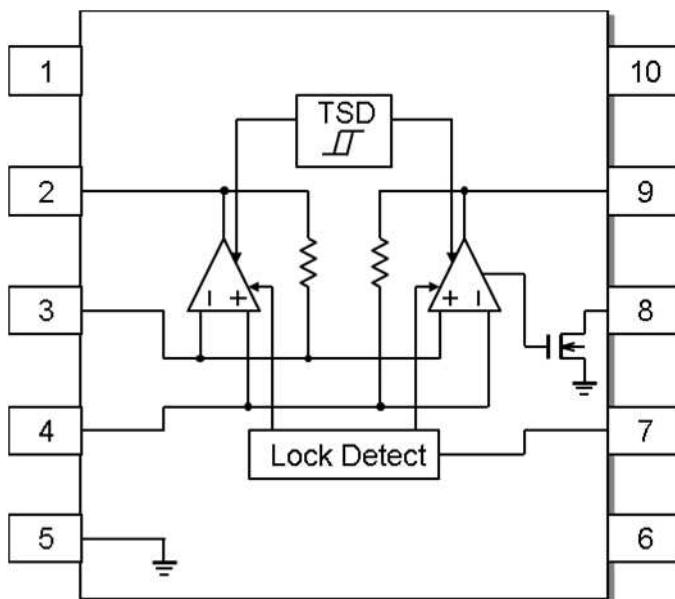


**NJU7329BRB2**  
(MSOP10(TVSP10))

### ■ FEATURES

- Operating Voltage  $V_{DD}=2.4$  to  $5.5V$
- Low Operating Current  $I_{DD}=3mA$  typ.
- Low Saturation Output Voltage  
 $V_{OM}=\pm 0.35V$  at  $I_O=\pm 350mA$
- Internal Thermal Shutdown Circuit (with hysteresis)
- Internal Lock Detect / Auto Recovery Circuit  
(with idling prevention function )
- FG Output (open drain)
- C-MOS Technology
- Package Outline  $MSOP10$  (TVSP10)\*  
\*MEET JEDEC MO-187-DA / THIN TYPE

### ■ BLOCK DIAGRAM



### ■ PIN CONFIGURATION

- 1: N.C.
- 2: OUT A
- 3: IN-
- 4: IN+
- 5: GND
- 6: N.C.
- 7: Ct
- 8: FG
- 9: OUT B
- 10:  $V_{DD}$

# NJU7329B

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	RATINGS	SYMBOL(unit)	NOTES
Supply Voltage	+7.0	V <sub>DD</sub> (V)	
Input Voltage	-0.3 ~ V <sub>DD</sub> +0.3	V <sub>ID</sub> (V)	
Output Current (Peak)	600	I <sub>OPEAK</sub> (mA)	
Operating Temperature Range	-40 ~ +85	T <sub>opr</sub> (°C)	
Storage Temperature Range	-50 ~ +150	T <sub>stg</sub> (°C)	
Power Dissipation	400	P <sub>D</sub> (mW)	Device itself

## ■ RECOMMENDED OPERATING CONDITIONS

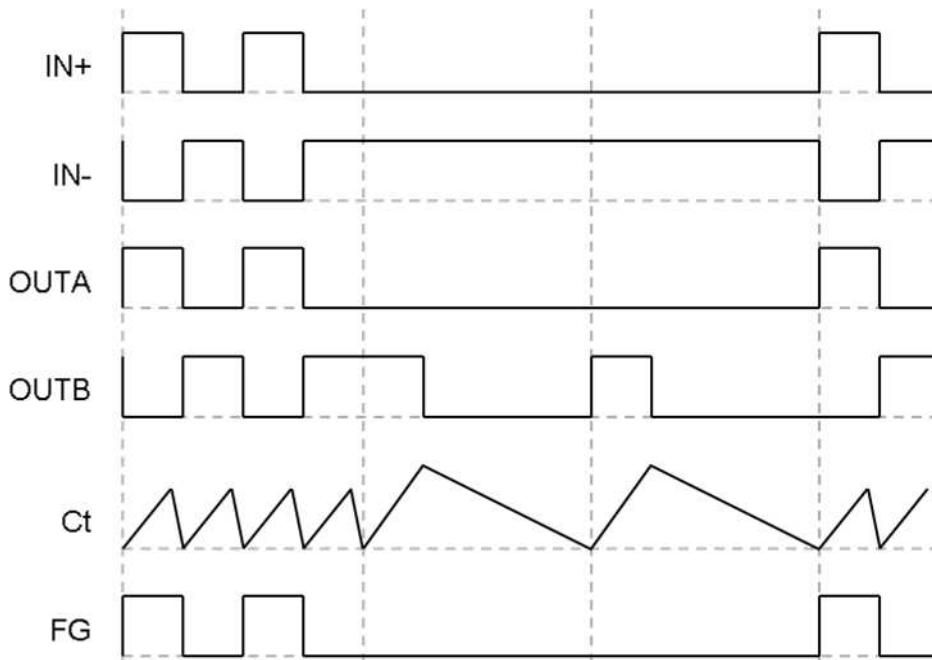
V<sub>DD</sub>=2.4V to 5.5V

## ■ ELECTRICAL CHARACTERISTICS

(V<sub>DD</sub>=5V, Ta=25°C)

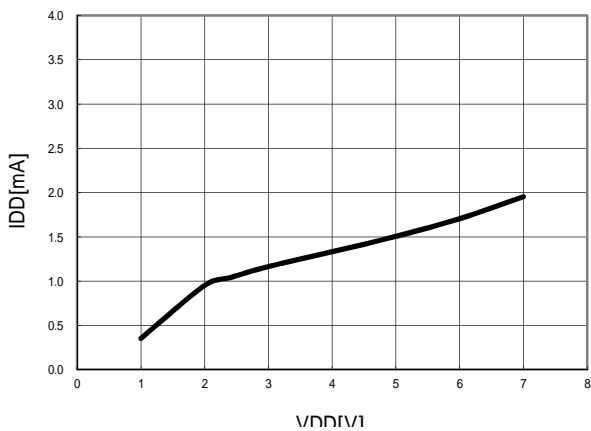
項目	記号	条件	最小	標準	最大	単位
Operating Current	I <sub>DD</sub>	-	-	3.0	4.0	mA
Input Offset Voltage	V <sub>IO</sub>	-	-10	-	10	mV
Input Common Mode Voltage Range	V <sub>ICM</sub>	-	0.4 to 4.0	-	-	V
Maximum Output Voltage Range	V <sub>OM</sub>	I <sub>O</sub> =+350mA	4.55	4.65	-	V
		I <sub>O</sub> =-350mA	-	0.35	0.45	
Lock Protect Operating Voltage	V <sub>LOP</sub>	-	4.0	-	-	V
Lock Detect Charge Current	I <sub>CHG</sub>	-	-	1.5	-	μA
Lock Detect Discharge Current	I <sub>DCHG</sub>	-	-	0.5	-	μA
Clamp Voltage	V <sub>CL</sub>	-	-	2.6	-	V
Detect Voltage	V <sub>ID</sub>	-	-	0.6	-	V
Thermal Shutdown Temperature	T <sub>TSDON</sub>	-	-	180	-	°C
Thermal Shutdown Restart Temperature	T <sub>TSDOFF</sub>	-	-	140	-	°C
Feedback Resistance	R <sub>F</sub>	-	22.0	27.5	33.0	kΩ
FG H Leak Current	I <sub>FG-LEAK</sub>	4pin=0V, 3pin=5V, R <sub>P</sub> =10kΩ	-	-	1.0	μA
FG L Voltage	V <sub>FG</sub>	4pin=5V, 3pin=0V, R <sub>P</sub> =10kΩ	-	-	0.3	V

## ■ TIMING CHART

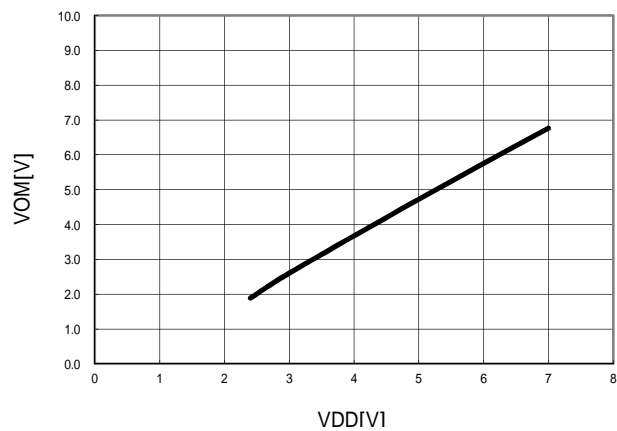


## ■ TYPICAL CHARACTERISTICS

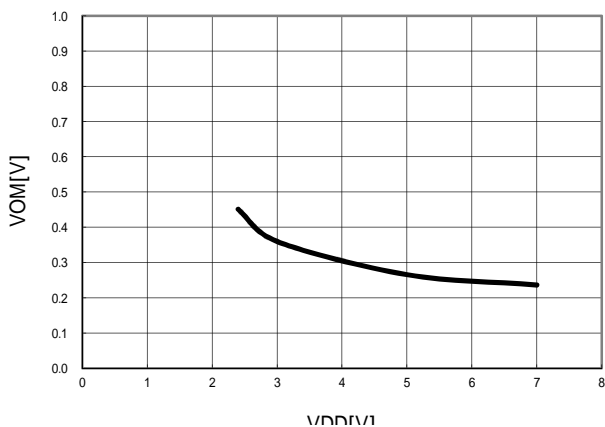
VDD-IDD  
IN-=VDD, IN+=0V, Ct=0V, VSS=0V



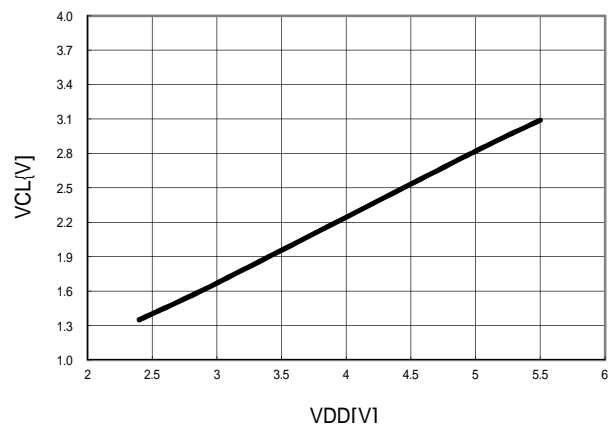
VDD-VOM(BTL)[AMPA=H]  
Iout=350mA, IN-=0V, IN+=VDD/2, Ct=0V, VSS=0V



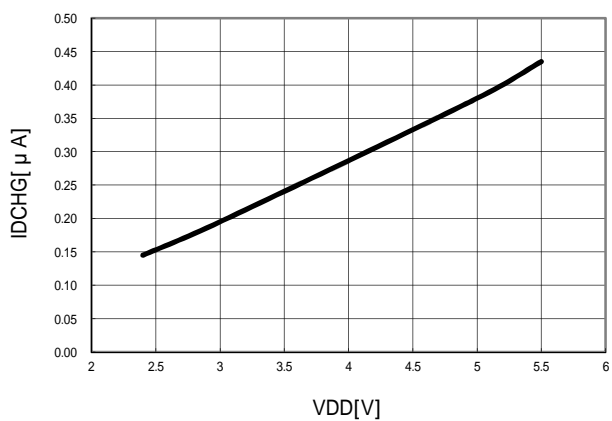
VDD-VOM(BTL)[AMPB=L]  
Iout=350mA, IN-=0V, IN+=VDD/2, Ct=0V, VSS=0V



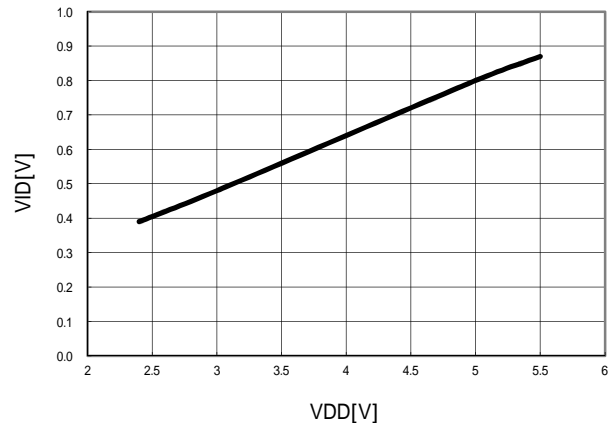
VDD-VCL  
IN-=VDD/2, IN+=0V, VSS=0V, Ct=L H



VDD-IDCHG  
IN-=VDD, IN+=0V, VSS=0V

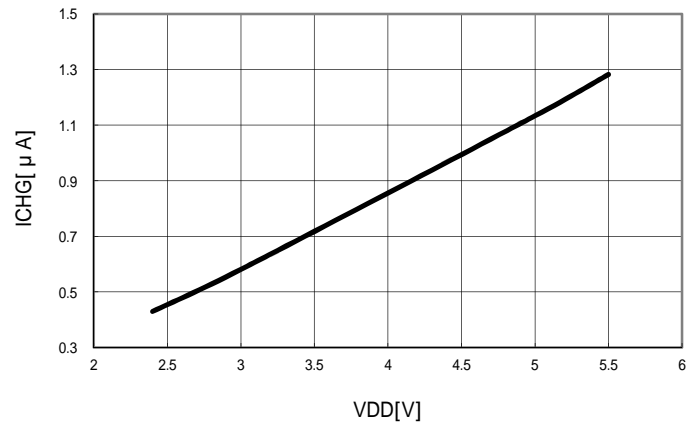


VDD-VID  
IN-=VDD, IN+=0V, VSS=0V, Ct=L L

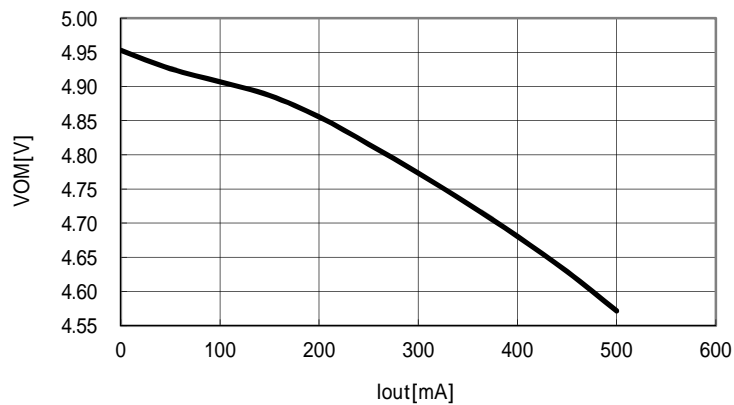


## ■ TYPICAL CHARACTERISTICS

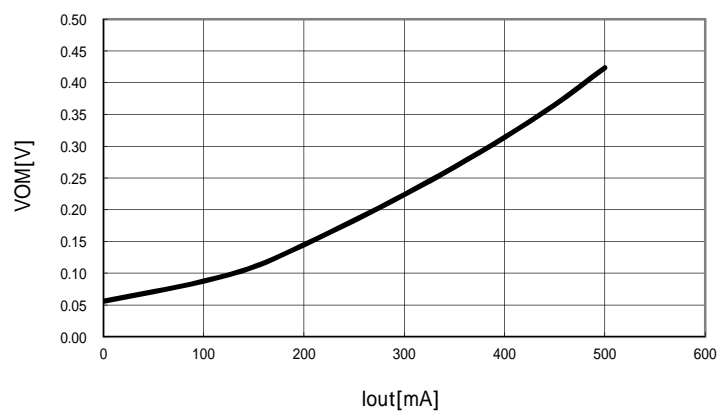
VDD-ICHG  
IN=-VDD, IN+=0V, VSS=0V



Iout-VOM(BTL)[AMPA=H]  
VDD=5V, IN-=0V, IN+=VDD/2, Ct=0V, VSS=0V



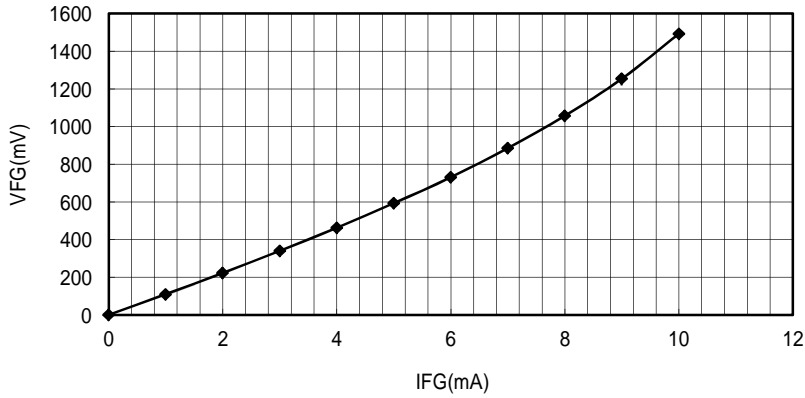
Iout-VOM(BTL)[AMPB=L]  
VDD=5V, IN-=0V, IN+=VDD/2, Ct=0V, VSS=0V



# NJU7329B

## ■ TYPICAL CHARACTERISTICS

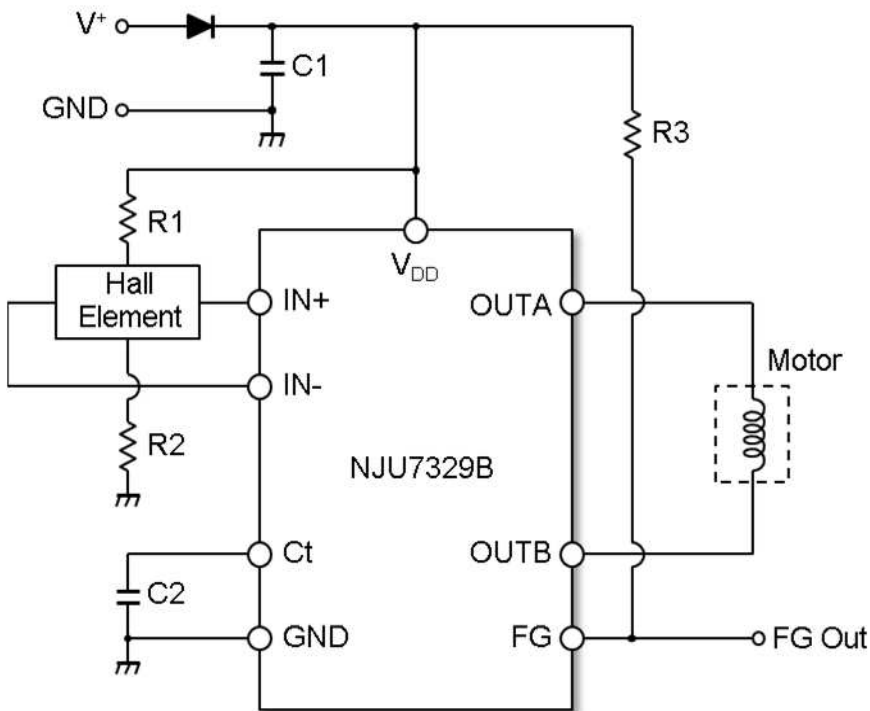
IFG-VFG  
 VDD=5V, VSS=0V, IN-=VDD/2, IN+=0V, Ct=0V



## ■ APPLICATION NOTE

The NJU7329B is a single-phase DC brushless motor driver IC using a CMOS technology. It is suitable for fan motor drivers in a small equipment such as note personal computers.

[Application Circuit Example]



**[Design Notes]**

Above application example is designed for 5V operation with motor current of 350mA.  
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 0.1µF.

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. Lock Protection Function (Design of C2 value):**

Lock Protection Function, consists of Motor Lock Detection and Auto Resume Function, is a safety feature to protect a motor and a driver circuit from fatal destruction in case of motor halt.

Motor Lock Detection detects motor halt due to irregular load conditions and then cuts motor driving current for safety operation. A value of C2 determines Lock detection time ( $T_{on}$ ) and Auto Resume Time ( $T_{off}$ ).

Lock detection time ( $T_{on}$ ) is given by:

$$T_{ON} = C2 \frac{V_{CL} - V_{ID}}{I_{CHG}} [\text{sec}]$$

Where C2 is 0.47µF:

$$T_{ON} = 0.47 \times 10^{-6} \times \frac{2.6 - 0.6}{1.5 \times 10^{-6}} = 0.62 [\text{sec}]$$

Auto Resume Time ( $T_{off}$ ) is given by:

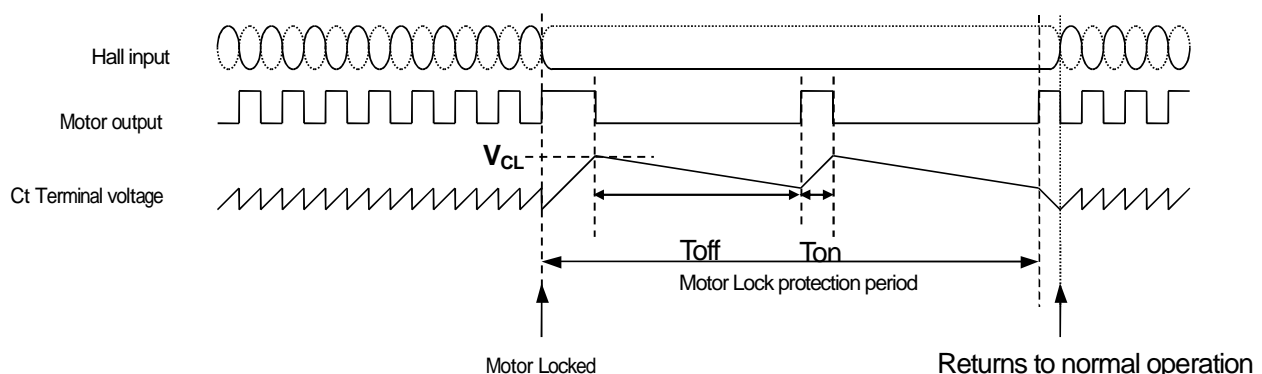
$$T_{OFF} = C2 \frac{V_{CL} - V_{ID}}{I_{DCHG}} [\text{sec}]$$

Where C2 is 0.47µF:

$$T_{OFF} = 0.47 \times 10^{-6} \times \frac{2.6 - 0.6}{0.5 \times 10^{-6}} = 1.88 [\text{sec}]$$

In actual application, Lock detection time ( $T_{on}$ ) is affected by the mechanical time constant of a motor. Therefore, constant start up must be confirmed in actual evaluation taking operating variations (i.e. Temperature, Voltage change and so on) in consideration.

A typical value of C2 is either 0.47µF or 1µF depending on a motor.



### 3. Design of hall element bias resistance (R1 and R2)

Hall amplifier is a differential amplifier with hysteresis characteristics (24mV typical).

The common-mode input voltage is between 0.4V and  $V_{DD}-1V$  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:

$$R1 + R2 + Rin = \frac{V_{DD}}{I_{hbias}} = \frac{5}{5 \times 10^{-3}} = 1k\Omega$$

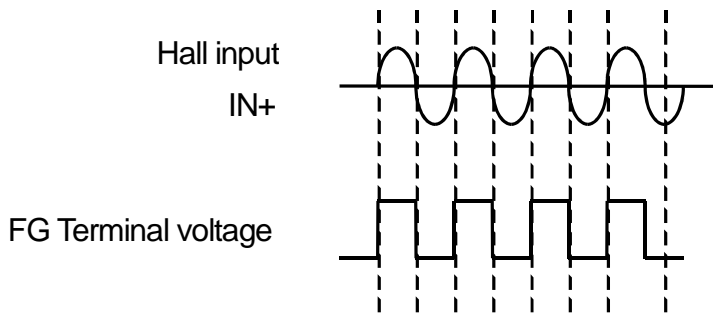
$$R1 = R2 = 300\Omega$$

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

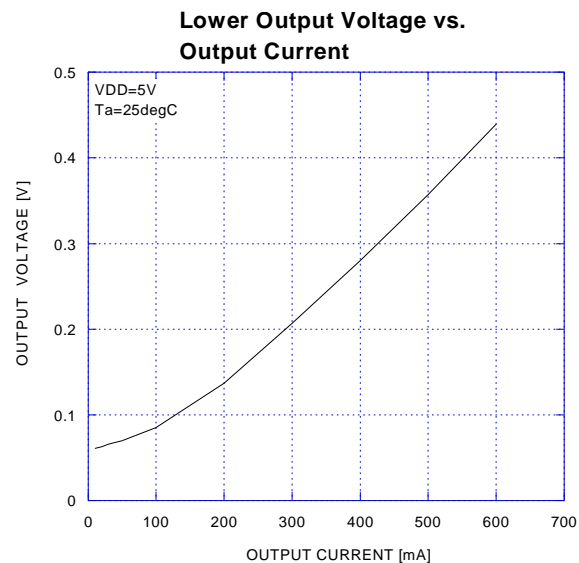
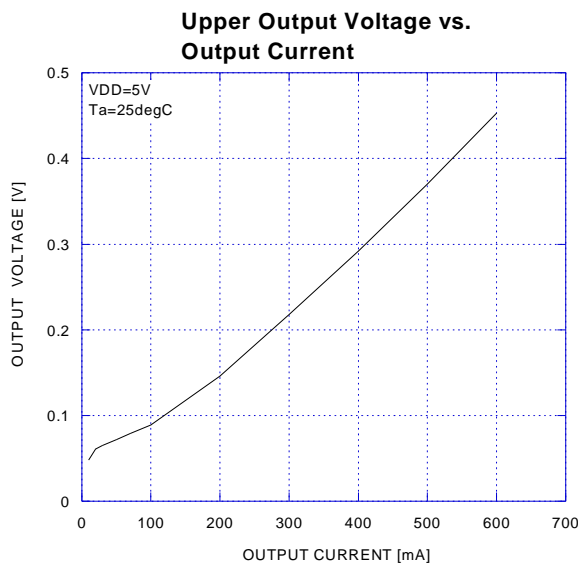
The optimum input voltage of NJU7329B is 100mVp-p and higher. With such input voltage, the highest efficiency can be obtained.

### 4. Design of FG output resistance (R3)

FG Out(FG:Pin8) is an 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.



## ■ OUTPUT VOLTAGE and OUTPUT CURRENT TYPICAL CHARACTERISTICS





**[CAUTION]**

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