

# AN8813NSB

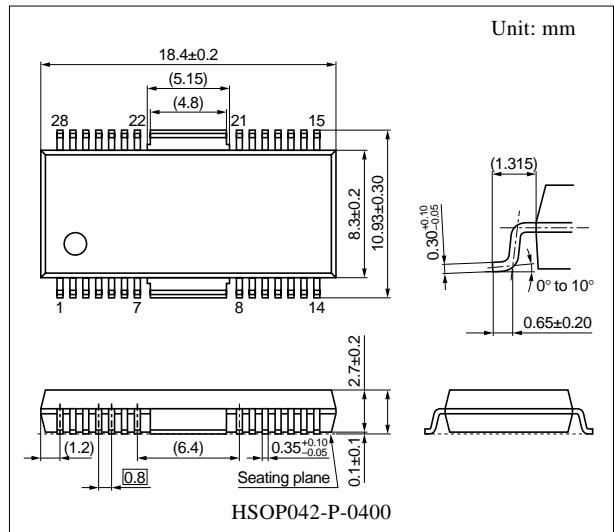
## 4-channel driver IC for optical disk drive

### ■ Overview

The AN8813NSB is a 4-channel driver IC of the BTL method. Ch.1 is used only for the loading motor with little gain dispersion.

### ■ Features

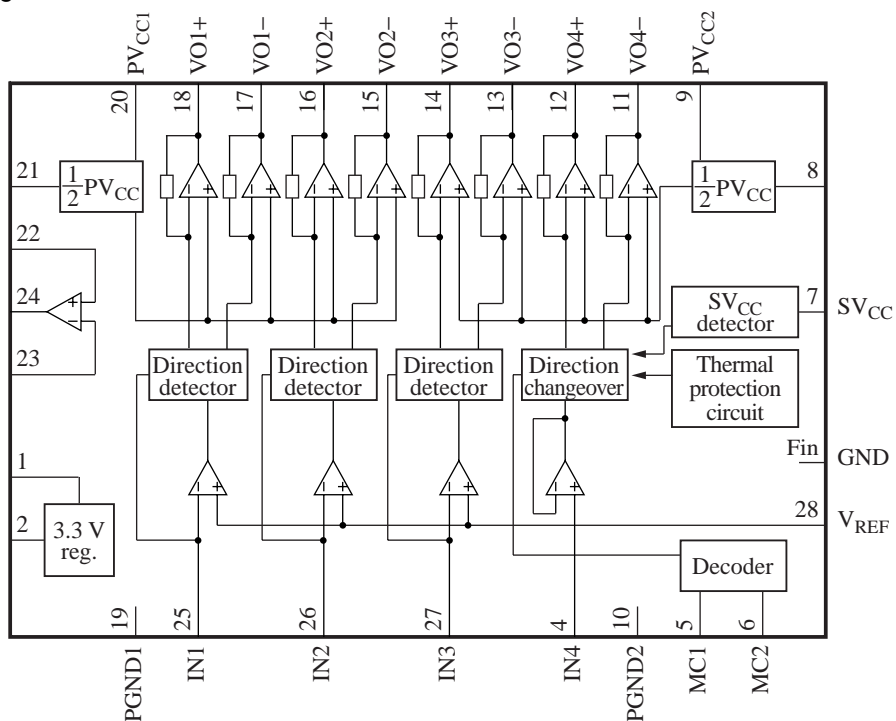
- For the loading motor channel, there are 4 modes, that is, forward rotation, reverse rotation, brake and standby modes, and you can select a mode among them. The gain of it is fixed to 6 dB ( $\pm 0.5$  dB) with a small dispersion among the products.
- 3.3 V supply voltage is available due to an external PNP-tr.
- Driver I/O gain setting is possible with an additional external resistor
- Since the output and input lines are separated and respectively collected together, pattern designing is relatively easy.



### ■ Applications

- CD/CD-ROM drive
- DVD/DVD-ROM drive

### ■ Block Diagram



### ■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	Base control pin for an external transistor of 3.3 V regulator	15	Motor driver-2 reverse rotation output pin
		16	Motor driver-2 forward rotation output pin
2	3.3 V regulator output monitor pin	17	Motor driver-1 reverse rotation output pin
3	N.C. pin	18	Motor driver-1 forward rotation output pin
4	Motor driver-4 input pin	19	Driver GND pin 1 (PGND1)
5	Motor driver-4 control pin 1	20	Driver power supply pin 1 (PV <sub>CC1</sub> )
6	Motor driver-4 control pin 2	21	1/2 PV <sub>CC</sub> output pin 1
7	Power supply pin (SV <sub>CC</sub> )	22	Op-amp. non-inverted input pin
8	1/2 PV <sub>CC</sub> output pin 2	23	Op-amp. inverted input pin
9	Driver power supply pin 2 (PV <sub>CC2</sub> )	24	Op-amp. output pin
10	Driver GND pin 2 (PGND2)	25	Motor driver-1 input pin
11	Motor driver-4 reverse rotation output pin	26	Motor driver-2 input pin
12	Motor driver-4 forward rotation output pin	27	Motor driver-3 input pin
13	Motor driver-3 reverse rotation output pin	28	V <sub>REF</sub> input pin
14	Motor driver-3 forward rotation output pin	Fin	GND pin

### ■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	SV <sub>CC</sub>	18	V
Supply current	I <sub>CC</sub>	—	mA
Power dissipation *2	P <sub>D</sub>	542	mW
Operating ambient temperature *1	T <sub>opr</sub>	-30 to +85	°C
Storage temperature *1	T <sub>stg</sub>	-55 to +150	°C

Note) \*1: Except for the power dissipation, operating ambient temperature and storage temperature, all ratings are for T<sub>a</sub> = 25°C.

\*2: T<sub>a</sub> = 85°C. For the independent IC without a heat sink.

Referring to "■ Application Circuit Example", following the allowable power dissipation characteristic curve of "■ Application Notes".

### ■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	SV <sub>CC</sub> , PV <sub>CC1</sub> , PV <sub>CC2</sub>	4.5 to 14	V

**■ Electrical Characteristics at  $T_a = 25^\circ\text{C}$** 

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Current consumption with no load	$I_{\text{TOT}}$	$V_{\text{CC}} = 8 \text{ V}$ , $V_{\text{IN4}} = 1 \text{ V}$	5	10	15	mA
<b>Motor driver 1 to motor driver 3</b>						
Input offset voltage	$V_{\text{IOF}}$	$V_{\text{CC}} = 8 \text{ V}$ , $R_{\text{L1}}$ to $R_{\text{L3}} = 8 \Omega$ , $R_1$ to $R_3 = 10 \text{ k}\Omega$	-10	0	10	mV
Output offset voltage	$V_{\text{OOF}}$	$V_{\text{CC}} = 8 \text{ V}$ , $R_{\text{L1}}$ to $R_{\text{L3}} = 8 \Omega$ , $R_1$ to $R_3 = 10 \text{ k}\Omega$	-50	0	50	mV
Gain	G	$V_{\text{CC}} = 8 \text{ V}$ , $R_{\text{L1}}$ to $R_{\text{L3}} = 8 \Omega$ , $R_1$ to $R_3 = 10 \text{ k}\Omega$	18.0	20.0	22.0	dB
Maximum output amplitude (+)	$V_{\text{L+}}$	$V_{\text{CC}} = 8 \text{ V}$ , $R_{\text{L1}}$ to $R_{\text{L3}} = 8 \Omega$ , $R_1$ to $R_3 = 10 \text{ k}\Omega$	4.4	5.0	—	V
Maximum output amplitude (-)	$V_{\text{L-}}$	$V_{\text{CC}} = 8 \text{ V}$ , $R_{\text{L1}}$ to $R_{\text{L3}} = 8 \Omega$ , $R_1$ to $R_3 = 10 \text{ k}\Omega$	—	-5.0	-4.4	V
<b>Motor driver 4 For loading motor</b>						
Input bias current	$I_{\text{IN4}}$	$V_{\text{CC}} = 8 \text{ V}$ , $V_{\text{IN4}} = 1 \text{ V}$	—	150	500	nA
Forward rotation gain	$G_{4+}$	$V_{\text{IN4}} = 1 \text{ V}$ , $V_{\text{CC}} = 8 \text{ V}$ $R_{\text{L4}} = 8 \Omega$ , $V_{\text{MC}} = 5 \text{ V}$	5.0	5.5	6.0	dB
Reverse rotation gain	$G_{4-}$	$V_{\text{IN4}} = 1 \text{ V}$ , $V_{\text{CC}} = 8 \text{ V}$ $R_{\text{L4}} = 8 \Omega$ , $V_{\text{MC}} = 5 \text{ V}$	5.0	5.5	6.0	dB
Maximum output amplitude (+)	$V_{4\text{L+}}$	$V_{\text{IN4}} = 4 \text{ V}$ , $V_{\text{CC}} = 8 \text{ V}$ $R_{\text{L4}} = 8 \Omega$ , $V_{\text{MC}} = 5 \text{ V}$	4.4	5.0	—	V
Maximum output amplitude (-)	$V_{4\text{L-}}$	$V_{\text{IN4}} = 4 \text{ V}$ , $V_{\text{CC}} = 8 \text{ V}$ $R_{\text{L4}} = 8 \Omega$ , $V_{\text{MC}} = 5 \text{ V}$	—	-5.0	-4.4	V
Output leak current at standby	$I_{\text{OL(STB)}}$	$V_{\text{IN4}} = 1 \text{ V}$ , $V_{\text{CC}} = 8 \text{ V}$ $R_{\text{L4}} = 8 \Omega$ , $V_{\text{MC}} = 5 \text{ V}$	—	—	10	$\mu\text{A}$
Output offset voltage at braking	$V_{\text{OF(BRK)}}$	$V_{\text{IN4}} = 1 \text{ V}$ , $V_{\text{CC}} = 8 \text{ V}$ $R_{\text{L4}} = 8 \Omega$ , $V_{\text{MC}} = 5 \text{ V}$	-80	0	80	mV
MC1 pin, MC2 pin high-level threshold voltage	$V_{\text{MCH}}$	$V_{\text{IN4}} = 1 \text{ V}$ , $V_{\text{CC}} = 8 \text{ V}$ $R_{\text{L4}} = 8 \Omega$	2.0	—	—	V
MC1 pin, MC2 pin low-level threshold voltage	$V_{\text{MCL}}$	$V_{\text{IN4}} = 1 \text{ V}$ , $V_{\text{CC}} = 8 \text{ V}$ $R_{\text{L4}} = 8 \Omega$	—	—	0.3	V
<b>Reset circuit</b>						
Reset operation release supply voltage	$V_{\text{RST}}$	$I_{\text{IN}} = 10 \mu\text{A}$ , $R_1$ to $R_3 = 10 \text{ k}\Omega$	3.0	3.2	3.3	V
<b>3.3 V regulator</b>						
Output voltage	$V_{\text{REG}}$	$V_{\text{CC}} = 8 \text{ V}$	3.1	3.3	3.5	V
Output load fluctuation	$\Delta V_{\text{R}}$	$V_{\text{CC}} = 8 \text{ V}$	-50	0	50	mV
Supply voltage fluctuation	$\Delta V_{\text{V}}$	$V_{\text{CC}} = 8 \text{ V}$ to $12 \text{ V}$	-5	0	5	mA
<b>Op-amp.</b>						
Input offset voltage	$V_{\text{OF}}$	$V_{\text{CC}} = 8 \text{ V}$	-5	0	5	mV
Input bias current	$I_{\text{BOP}}$	$V_{\text{CC}} = 8 \text{ V}$	—	150	500	nA

### ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OP-amp. (continued)						
High-level output voltage	$V_{OH}$	$V_{CC} = 8\text{ V}$	6.0	—	—	V
Low-level output voltage	$V_{OL}$	$V_{CC} = 8\text{ V}$	—	—	1.7	V
Output driving current sink	$I_{SIN}$	$V_{CC} = 8\text{ V}$	2.0	—	—	mA
Output driving current source	$I_{SOU}$	$V_{CC} = 8\text{ V}$	2.0	—	—	mA

#### • Design reference data

Note) The characteristics listed below are theoretical values based on the IC design and are not guaranteed.

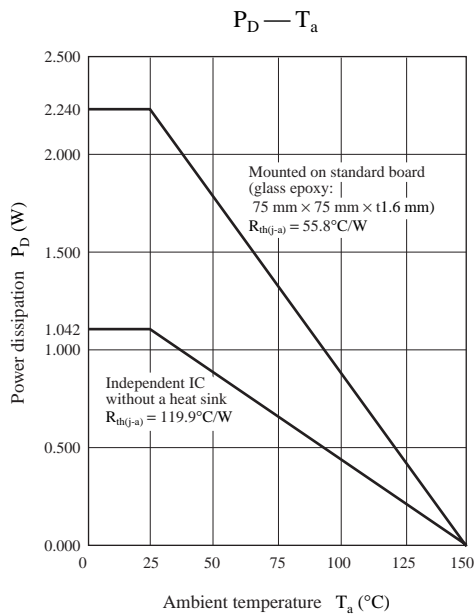
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Thermal protection circuit						
Operating temperature equilibrium value	$T_{THD}$		—	180	—	$^\circ\text{C}$
Operating temperature hysteresis width	$\Delta T_{THD}$		—	45	—	$^\circ\text{C}$
Motor driver 4						
IN4 pin input setting range	$V_{IN4}$		0.5	—	2.5	V

### ■ Usage Notes

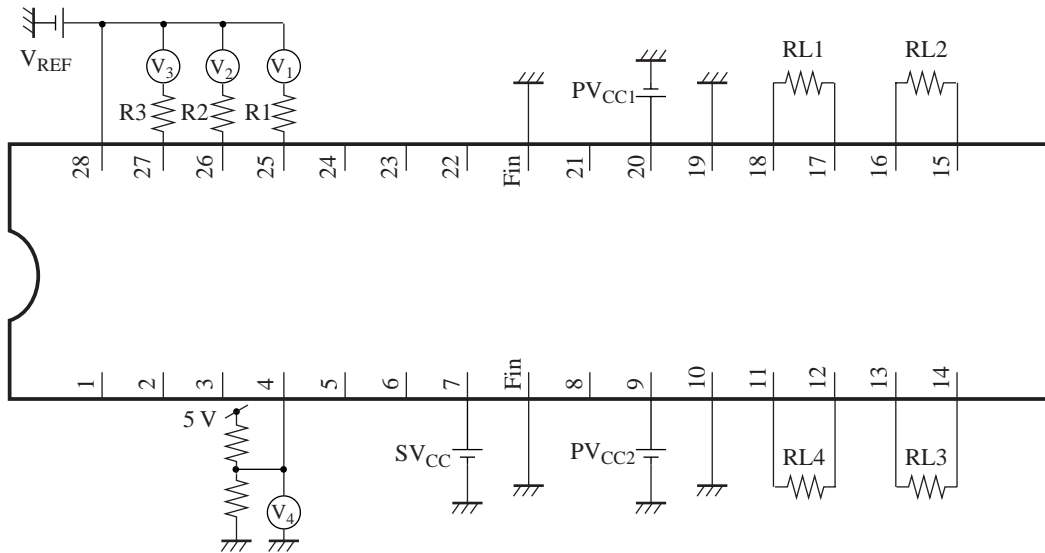
1. This IC has no output short-circuit protection circuit and is likely to emit smoke and break down when there is a short-circuit between output and  $V_{CC}$  or output and GND.
2. An appropriate prior study should be done for use of dip soldering.

### ■ Application Notes

- $P_D - T_a$  curves of HSOP042-P-0400



### ■ Application Circuit Example



When the AN8813NSB is used, take into account the following cautions and follow the power dissipation characteristic curve.

1. Load current  $I_{P1}$  flowing into load  $RL1$ ,  $RL2$  is supplied through pin 20.

$$I_{P1} = \frac{|V_{18} - V_{17}|}{R_{L1}} + \frac{|V_{16} - V_{15}|}{R_{L2}}$$

2. Load current  $I_{P2}$  flowing into load  $RL3$ ,  $RL4$  is supplied through pin 9.

$$I_{P2} = \frac{|V_{14} - V_{13}|}{R_{L3}} + \frac{|V_{12} - V_{11}|}{R_{L4}}$$

3. Dissipation increase ( $\Delta P_D$ ) inside the IC (power output stage) caused by loads  $RL1$ ,  $RL2$ ,  $RL3$  and  $RL4$  is as follows:

$$\begin{aligned} \Delta P_D &= (PV_{CC1} - |V_{18} - V_{17}|) \times \frac{|V_{18} - V_{17}|}{R_{L1}} + (PV_{CC1} - |V_{16} - V_{15}|) \times \frac{|V_{16} - V_{15}|}{R_{L2}} \\ &= (PV_{CC2} - |V_{14} - V_{13}|) \times \frac{|V_{14} - V_{13}|}{R_{L3}} + (PV_{CC2} - |V_{12} - V_{11}|) \times \frac{|V_{12} - V_{11}|}{R_{L4}} \end{aligned}$$

4. Dissipation increase ( $\Delta P_S$ ) inside the IC (signal block supplied from pin 7) caused by loads  $RL1$ ,  $RL2$ ,  $RL3$  and  $RL4$  comes roughly as follows:

$$\begin{aligned} \Delta P_S &= 3 \times \left\{ \frac{V_1}{R_1} \times (2 \times SV_{CC} + |V_{18} - V_{17}|) + \frac{V_2}{R_2} \times (2 \times SV_{CC} + |V_{16} - V_{15}|) \right. \\ &\quad \left. + \frac{V_3}{R_3} \times (2 \times SV_{CC} + |V_{14} - V_{13}|) \right\} + \frac{V_4}{R_4} \times (3 \times SV_{CC} + |V_{12} - V_{11}|), \text{ where } R_4: \text{ Internal resistor } 12.3 \text{ k}\Omega \end{aligned}$$

5. Dissipation increase in a driver operating mode is  $\Delta P_D + \Delta P_S$ .
6. Allowable power dissipation without load ( $P_{D1}$ ) can be found as follows:
 
$$P_{D1} = SV_{CC} \times I_{(SVCC)} + PV_{CC1} \times I_{(PVCC1)} + PV_{CC2} \times I_{(PVCC2)}$$
7. Allowable power dissipation in a load operating mode ( $P_D$ ) comes roughly as follows:

$$P_D = P_{D1} + \Delta P_D + \Delta P_S$$