

AN8387S

2-channel Linear Driver

■ Overview

The AN8387S is an IC which incorporates 2 circuits of BTL drivers for driving various DC motors such as actuators (focus, tracking traverse), spindles, and loading of the CD players.

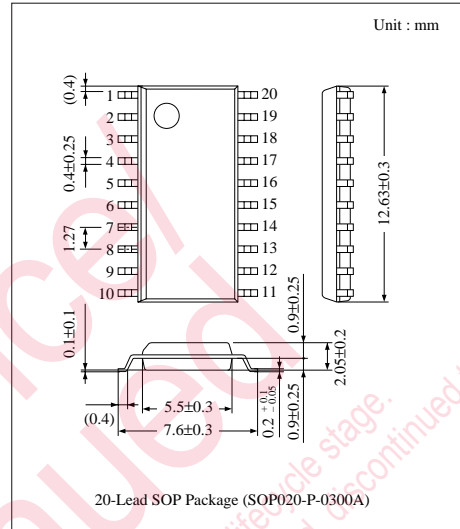
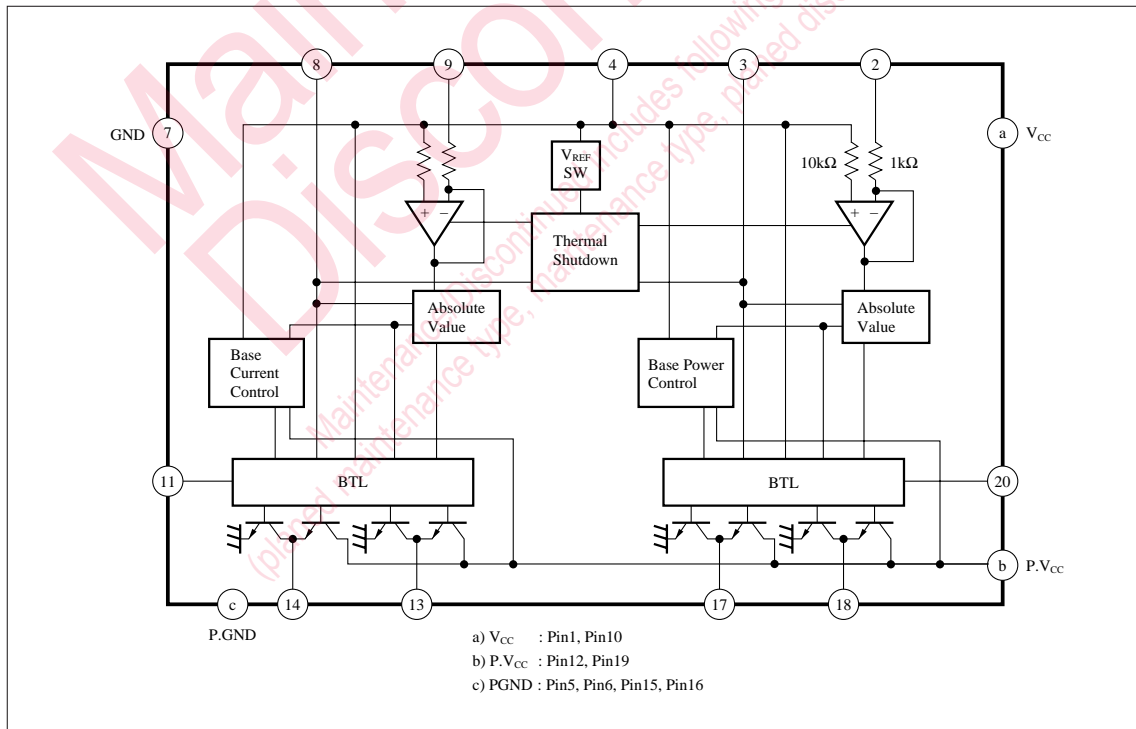
■ Features

- Operating supply voltage range ; $V_{CC}=3.5V$ to $9V$
 $PV_{CC}=1.5V$ to $9V$
- Built-in 2 circuits of voltage driven BTL drivers
(maximun drive current : $500mA$)
- Quiescent current (current consumption at no input) ; $3.2mA$
- Provided with power control pin
- Provided with driver output voltage limiting pin
- Built-in thermal protective circuit
(operating temperature : $160^{\circ}C$ typ.)

■ Applications

Linear driving of the DC motors and actuators of the CD players. CD radio cassette tape recorders, and so on.

■ Block Diagram



■ Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Rating	Unit
Supply Voltage	V _{CC}	10	V
Power Dissipation	P _D	1,200 ^{Note)}	mW
Operating Ambient Temperature	T _{opr}	-30 ~ +85	°C
Storage Temperature	T _{stg}	-55 ~ +125	°C

Note) When mounted onto the glass epoxy PCB (50mm × 50mm × 0.8mm)

■ Recommended Operating Range (Ta=25°C)

Parameter	Symbol	Range
Operating Supply Voltage Range	V _{CC}	3.5V ~ 9V
	P.V _{CC}	1.5V ~ 9V

■ Electrical Characteristics (Ta=25°C)

Parameter	Symbol	Condition	min.	typ.	max.	Unit
Current Consumption at No Input (V _{CC})	I _{VCCQ}	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V	1	2	3.5	mA
Current Consumption at No Input (PV _{CC})	I _{PVCCQ}	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V	0.7	1.2	3.5	mA
PV _{CC} Leak Current	I _{PVCL}	V _{CC} =0V, V _{ref} =OPEN, PV _{CC} =10V	—	—	1	μA
V _{ref} Threshold (H) ^{Note 1)}	V _{refH}	V _{CC} =3V, PV _{CC} =10V, V _{IN} =0V	1.45	—	—	V
V _{ref} Threshold (L) ^{Note 2)}	V _{refL}	V _{CC} =3V, PV _{CC} =10V, V _{IN} =0V	—	—	1	V
Input Amp. Input Impedance	R _{AIN}	V _{CC} =5V, V _{ref} =2.5V, V _{IN} =2.4→2.6V	0.75	1	1.25	kΩ
Driver Input Offset Voltage ^{Note 3)}	V _{I offset}	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V	-10	0	10	mV
Driver Output Offset Voltage ^{Note 3)}	V _{O offset}	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V	-55	0	55	mV
Driver Dead Zone Width ^{Note 3)}	V _{DZ}	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V	-10	—	19	mV
Driver Transfer Gain (+) ^{Note 3)}	G ⁺	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V	13	15.1	17	dB
Driver (+), (-) Transfer Gain Ratio ^{Note 3)}	RG	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V	-1.9	-0.9	0.5	dB
Driver Output Voltage	V _{OLG}	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V, V _{LIM} =0V	-130	—	130	mV
Driver Output Voltage Absolute Value	V _{OL}	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V, V _{LIM} =3V	2.25	—	3	V
Driver Power Transistor Saturation Voltage	V _{sat}	V _{CC} =9V, V _{ref} =4.5V, PV _{CC} =9V, I _O =300mA	—	0.29	0.38	V
PC Input Pin Threshold Voltage (H) ^{Note 4)}	V _{PC THH}	V _{CC} =9V, V _{ref} =2.5V, PV _{CC} =5V, V _{IN} =2.3V	2.8	—	—	V
PC Input Pin Threshold Voltage (L) ^{Note 5)}	V _{PC THL}	V _{CC} =9V, V _{ref} =2.5V, PV _{CC} =5V, V _{IN} =2.3V	—	—	0.8	V
Protective Diode Forward Voltage	V _{PD}	I _O =300mA	0.9	1.5	1.8	V
Thermal Protective Circuit Operating Temperature	T _{THD}		—	160	—	°C

Note1) V_{ref} voltage required to operate the driver.

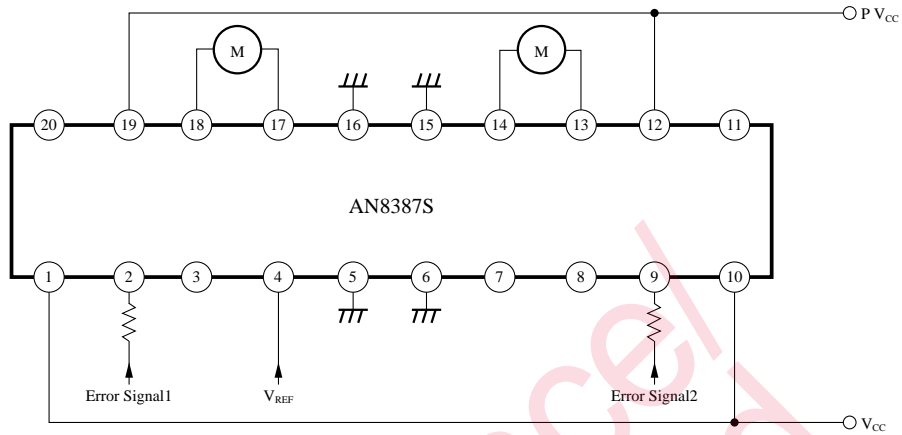
Note2) If V_{ref} is made lower than this voltage, the driver dose not operate.

Note3) Refer to the driver input/output characteristics chart.

Note4) If the PC pin voltage is made higher than this voltage, there will be no output voltage from the driver. Both (+) and (-) outputs are pulling in the current.

Note5) If the PC pin voltage is made lower than this voltage, the driver operates normally.

■ Application Circuit



■ Pin Descriptions

Pin No.	Symbol	I/O	DC Voltage	Equivalent Circuit	Description
1 10	V _{cc}	I	4.8V		V _{cc} pin. Not connected to the PV _{cc} pin.
2	IN1	I	2.5V		Error signal input pin for the channel-1 driver
9	IN2	I	2.5V		Error signal input pin for the channel-2 driver
3	PC1	I	0V		Input pin for the PC (inter-output voltage of the channel-1 driver OFF)
8	PC2	I	0V		Input pin for the PC (inter-output voltage of the channel-2 driver OFF)

■ Pin Descriptions (Cont.)

Pin No.	Symbol	I/O	DC Voltage	Equivalent Circuit	Description
4	V _{ref}	I	2.5V		V _{ref} input pin
5 6 15 16	P.GND	O	0V		P.GND pin
7	GND	O	0V		GND pin
11	VLIM2	I	V _{cc}		VLIM pin for the channel-2 driver. Used when limiting the output voltage of the pins 13 and 14
20	VLIM1	I	V _{cc}		VLIM pin for the channel-1 driver. Used when limiting the output voltage of the pins 17 and 18
12 19	PV _{cc}	I	3V		Power V _{cc} pin. Supplies the driver current.

■ Pin Descriptions (Cont.)

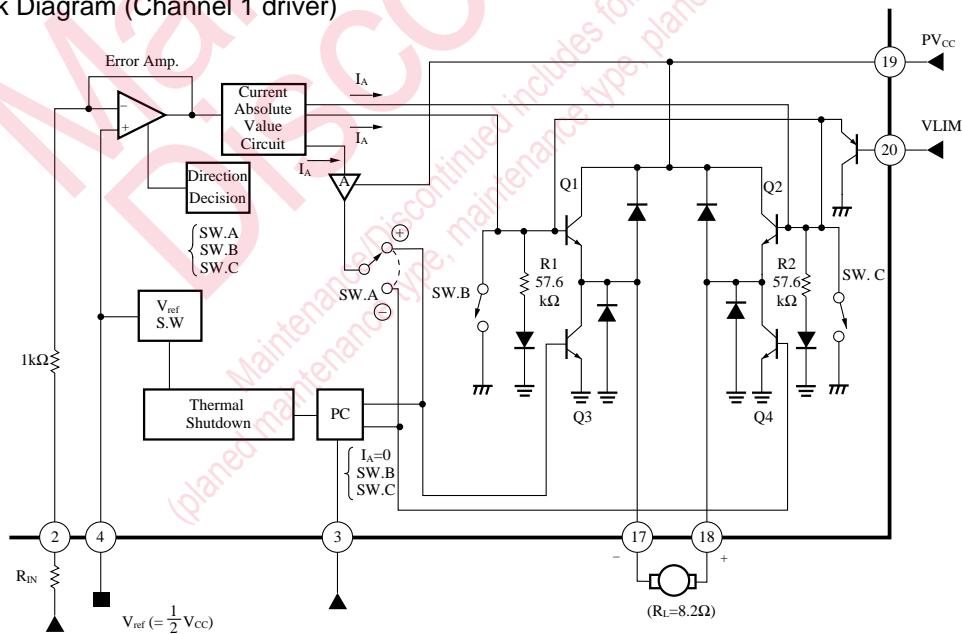
Pin No.	Symbol	I/O	DC Voltage	Equivalent Circuit	Description
13	D2+	O	(2.7V)		Non-inverting output pin for the channel-2 driver
14	D2-	O	(0.3V)		Inverting output pin for the channel-2 driver
17	D1-	O	(0.3V)		Inverting output pin for the channel-1 driver
18	D1+	O	(2.7V)		Non-inverting output pin for the channel-1 driver

■ Supplementary Explanation

• Operational Description

The AN8387S incorporates the two channels of drivers. Since both channels have the identical functions, the following describes the channel-1 driver.

• Block Diagram (Channel 1 driver)



An error signal (V_{IN}) input to the pin2 is converted into the absolute value input current I_A through the error amplifier and current absolute value circuit. The value of I_A is as follows.

$$I_A = \frac{|V_{IN} - V_{ref}|}{R_{IN} + 1k\Omega}$$

1) When $V_{IN} > V_{ref}$, the direction determining circuit operates so that the following conditions are met.

- SW.A : ⊕
- SW.B : ON
- SW.C : OFF

2) When $V_{IN} < V_{ref}$, the direction determining circuit operates so that the following conditions are met.

- SW.A : ⊖
- SW.B : OFF
- SW.C : ON

The output ($V_+ - V_-$) between the pins18 and 17 has the following relation with the input ($V_{IN} - V_{ref}$) between the pins 2 and 4.

$$(V_+ - V_-) = \frac{57.6k\Omega}{R_{IN} + 1k\Omega} (V_{IN} - V_{ref})$$

Therefore, the driver's gain G will be as follows. (when the motor load R_L is 8.2Ω)

$$G = \frac{(V_+ - V_-)}{(V_{IN} - V_{ref})} = \frac{57.6k\Omega}{1k\Omega + R_{IN}}$$

The output voltage V_- of the pin17 and V_+ of the pin18 can be limited by applying a voltage to the VLIM pin20.

For example, if a voltage of 3V is applied to the pin20 when $V_{CC} = 9V$ and $R_L = 8.2\Omega$, the maximum value of $|V_+$

$-V_-|$ is limited within the following range.

$$2.25V \leq |V_+ - V_-| \leq 3V$$

When the pin20 is short-circuited to GND,

$|V_+ - V_-| \leq 130mV$ results regardless of an input error signal (V_{IN}).

If the pin20 is prepared to short-circuit to GND at power-on of the set, it can be used to prevent operation error at power-on of the motor or actuator.

When the pin20 is not used, short-circuit it to the pins1 and 10.

The pin3 is a PC pin. If a voltage of 2.8V or more is applied to this pin, SW.B and SW.C are turned on, I_A becomes 0mA, and the base current flows to the bases of Q3 and Q4 simultaneously to turn on Q3 and Q4. As a result, the pins17 and 18 are almost short-circuited to P.GND.

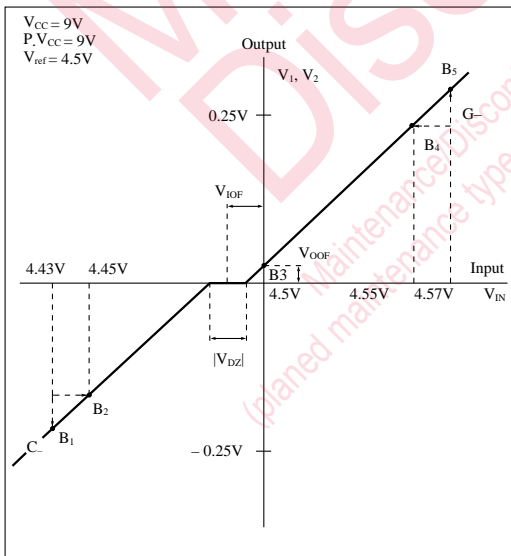
This IC incorporates the thermal shutdown circuit. If the chip temperature of the IC comes to about 160°C, both drivers of the two channels are turned off. (the output pins17, 18, 14, and 13 are short-circuited to P.GND)

Similarly, if the applied voltage (V_{ref}) of the V_{ref} pin4 comes to 1V or less, both drivers of the two channels are turned off.

• Driver Input/Output Characteristics

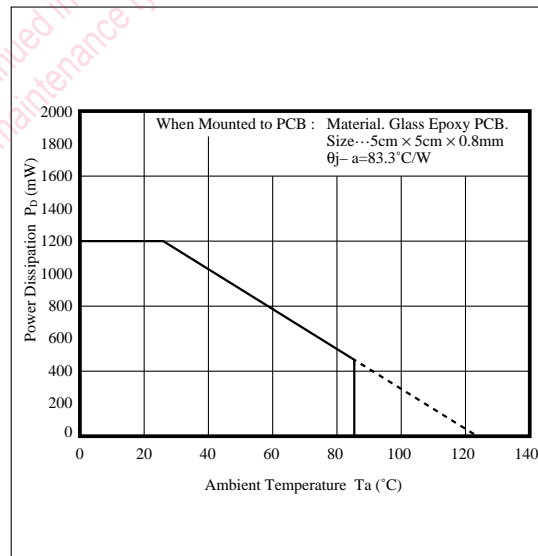
- Input Offset (V_{IOF})
- Output Offset (V_{OOF})
- Dead Zone ($|V_{DZ}|$)
- Transfer Gain (+) (G_+)
- (+), (-) Transfer Gain Ratio (R_G)

• Characteristics Curve



$$G_+ = \frac{B_5 - B_4}{20mV}, G_- = \frac{B_2 - B_1}{20mV}, R_G = \frac{G_+}{G_-}$$

P_D-T_a



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