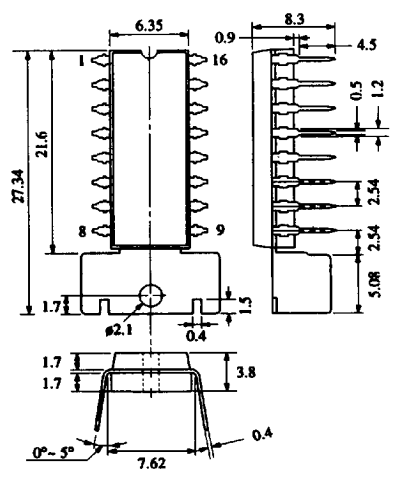
AN8377N

3 Channel Linear Driver

Unit : mm



16-Lead DIL Plastic Package with Fin (16-DIP-F)

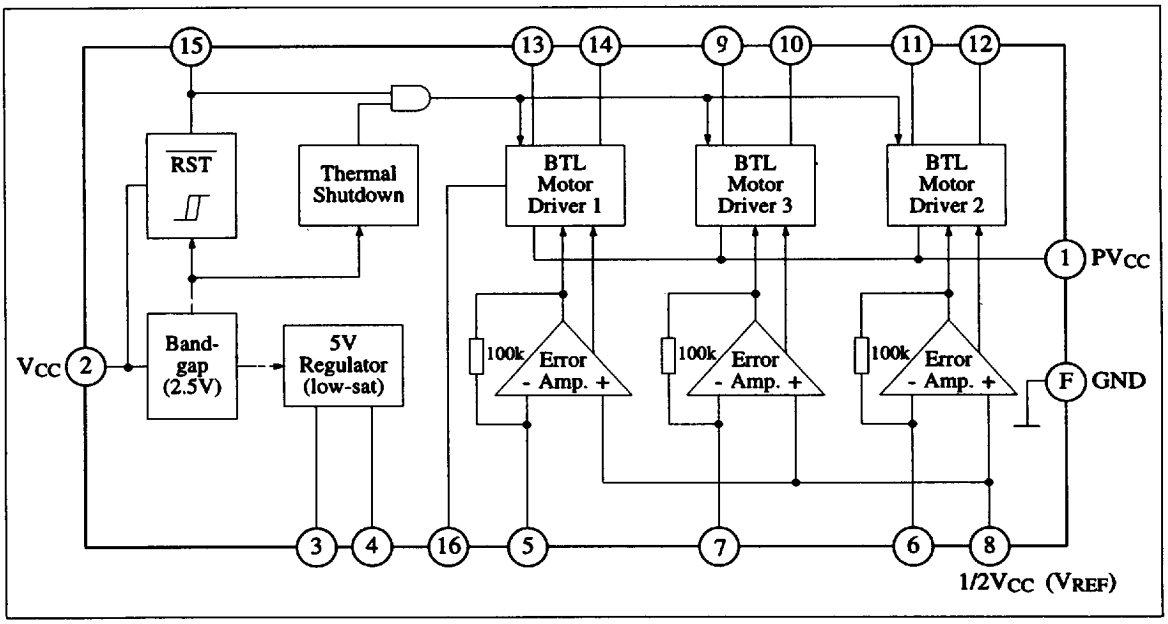
■ Description

The AN8377N is a monolithic integrated circuit which incorporates 3 circuits of BTL drivers for driving various DC motors such as actuators (focus, tracking, traverse), spindles, and loading of the CD players, and the 5V low drop type power supply.

■ Features

- Wide supply voltage range, V_{CC} = 5.5V ~ 18V
- Built-in 3Voltage BTL drivers (maximum drive current : 500mA)
- Stable circuit operation against supply voltage change and temperature change due to the built-in stabilized power supply
- Built-in 5V low drop power supply (external PNP power transistor)
- Built-in reset circuit (reset voltage : 4.82V)
- Built-in thermal protective circuit (operating temperature 159°C typical)
- Built-in power cut circuit (motor driver 1 only)

■ Block Diagram



■ Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Rating	Unit
Supply Voltage	V_{CC}	20	V
Power Dissipation	P_D	1500	mW
Operating Ambient Temperature	Topr	-25 ~ +80	°C
Storage Temperature	Tstg	-55 ~ +150	°C

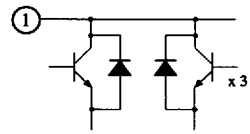
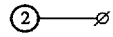
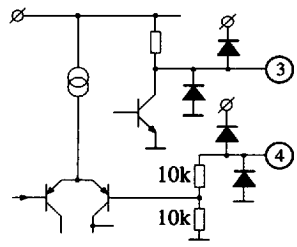
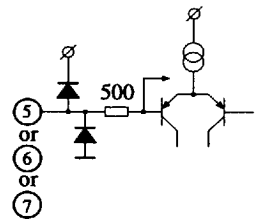
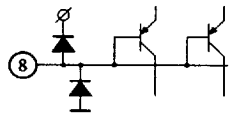
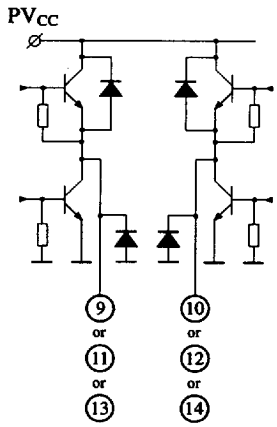
Operating Supply Voltage Range: V_{CC} = 5.5V ~ 18.0V

■ Electrical Characteristics (Ta=25°C)

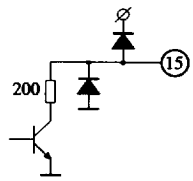
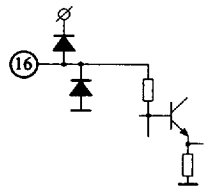
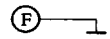
Item	Symbol	Condition	min.	typ.	max.	Unit
No Load Current	I_{CC}	V_{CC} = 12V	7	10.5	15	mA
5V Regulator Output Voltage	V_{RO}	V_{CC} = 12V, R_L = 50Ω	4.75	5	5.25	V
5V Regulator Load Change	ΔV_{RI}	V_{CC} = 12V, R_L = 50Ω ~ 25Ω	-15		30	mV
5V Regulator Input Change	ΔV_{RVC}	V_{CC} = 15.5V ~ 5.5V, R_L = 50Ω	-15		50	mV
Reset Threshold Voltage	V_{RST}		4.55	4.82	5.1	V
Reset Threshold Hysteresis Width	V_{HYS}		90	170	310	mV
Reset Operating Minimum Voltage	$V_{R(min)}$	Minimum V_{CC} voltage at which V_{15} = Low	3.1			V
Input Offset Voltage	V_{IOF}	V_{CC} = 18V, R_L = 20Ω, R_{in} = 10kΩ	-7		7	mV
Output Offset Voltage	V_{OOF}	V_{CC} = 18V, R_L = 20Ω, R_{in} = 10kΩ	-50		50	mV
Gain (+)	G_+	V_{CC} = 18V, R_L = 20Ω, R_{in} = 10kΩ	16.5	20	22.5	dB
(+) (-) Relative Gain	G_R	V_{CC} = 18V, R_L = 20Ω, R_{in} = 10kΩ	-0.85		0.85	dB
Limit Voltage (+)	V_{L+}	V_{CC} = 18V, R_L = 20Ω, R_{in} = 10kΩ	7.1		10.9	V
Limit Voltage (-)	V_{L-}	V_{CC} = 18V, R_L = 20Ω, R_{in} = 10kΩ	-10.9		-7.1	V
Dead Zone Width	V_{DZ}	V_{CC} = 18V, R_L = 20Ω, R_{in} = 10kΩ	-10		30	mV
PC Input Threshold (L)	V_{PCL}	V_{CC} = 18V			1.2	V
PC Input Threshold (H)	V_{PCH}	V_{CC} = 18V	2.8			V
Motor Driver 2 Output Voltage at Reset	V_{2RS}	V_{CC} = 3.5V, R_L = 10kΩ	-50		50	mV
Motor Driver 3 Output Voltage at Reset	V_{3RS}	V_{CC} = 3.5V, R_L = 10kΩ	-50		50	mV
Motor Driver 1 Output Voltage at Reset	V_{1RS}	V_{CC} = 3.5V, R_L = 10kΩ	-50		50	mV
5V Regulator External Transistor Base Current Limit Value	I3LIM		9	12	16	mA
Thermal Protective Circuit Operating Temperature Balancing Value	T_{THD}			159		°C
Thermal Protective Circuit Operating Temperature Hysteresis Width	ΔT_{THD}			64		°C

Note : The specified values of V_{IOF}, V_{OOF}, G_+, G_R, V_{L+}, V_{L-} and V_{DZ} are common ones for each of the motor driver 1, motor driver 2 and motor driver 3 circuits.

■ Pin Descriptions (The following description applies when the 3 channels for the motor drivers 1, 2 and 3 are used)

Pin No.	Symbol	I/O	DC Voltage (V_{CC}/12V)	Equivalent Circuit	Description
1	PV_{CC}	I	12V		Power V_{CC} pin. Supplies a current flowing to the output power transistor.
2	V_{CC}	I	12V		V_{CC} pin. Not connected to the power V_{CC} pin.
3	TB	O	11.3V		External PNP transistor base connection pin.
4	V_{MON}	I	5V		External PNP transistor collector connection pin (= 5V output pin).
5	TVDI	I	2.5V		Driver 1 error input pin.
6	FDI	I	2.5V		Driver 2 error input pin.
7	TDI	I	2.5V		Driver 3 error input pin.
8	V_{REF}	I	2.5V		V_{REF} input pin.
9	TD-	O	0.3V		BTL driver 3 inverting output pin.
10	TD+	O	0.3V		BTL driver 3 non-inverting output pin.
11	FD-	O	0.3V		BTL driver 2 inverting output pin.
12	FD+	O	0.3V		BTL driver 2 non-inverting output pin.
13	TVD-	O	0V		BTL driver 1 inverting output pin.
14	TVD+	O	0V		BTL driver 1 non-inverting output pin.

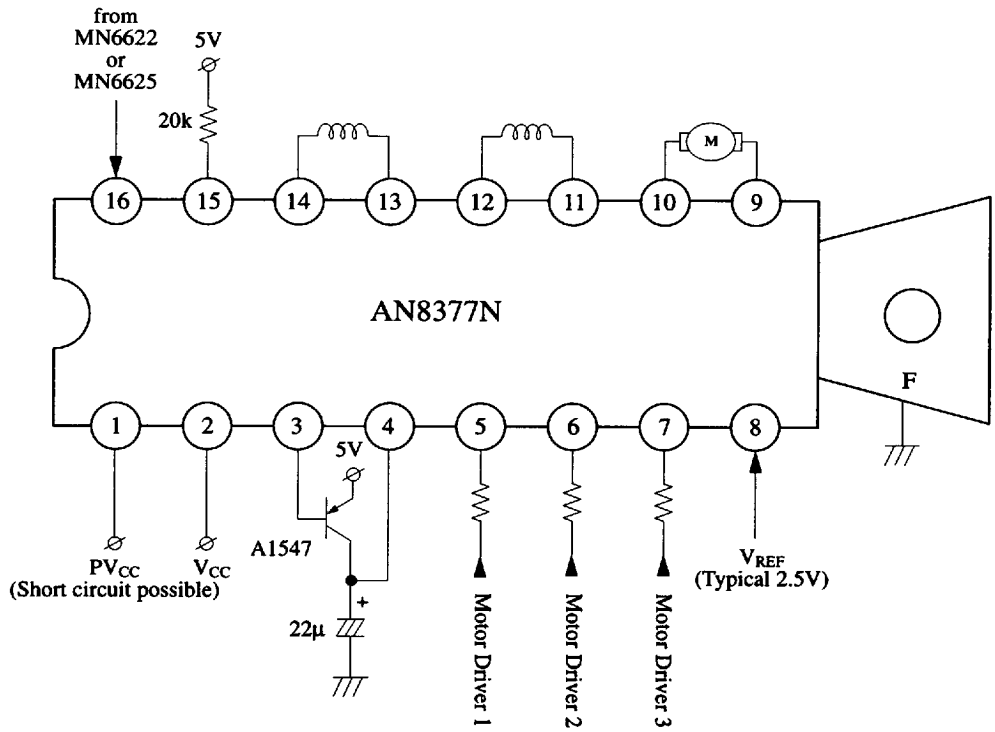
■ Pin Descriptions (Continue)

Pin No.	Symbol	I/O	DC Voltage (Vcc/12V)	Equivalent Circuit	Description
15	$\overline{RST}$	O			Reset output pin. Open collector output type.
16	PC	I	0V		PC (power cut) input pin.
F	GND	I	0V		GND pin.

(The above description applies when the 3 channels for the motor drivers 1, 2 and 3 are used)

■ Application Circuit

(Used when driving the focus, tracking actuator and traverse motor)



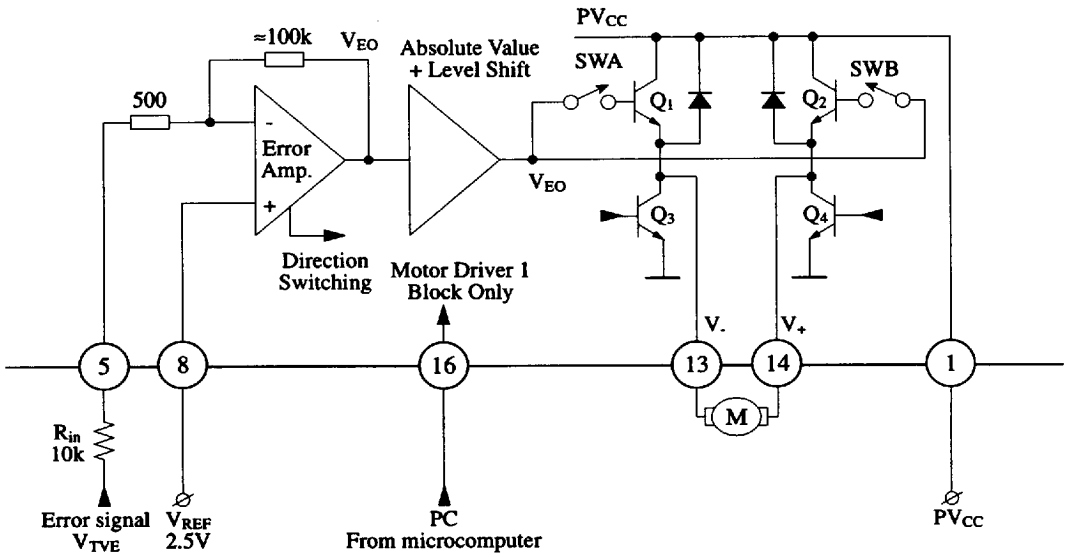
■ Supplementary Explanation

● Operational Description

All the three channels for the drivers are exactly identical circuits, but only the motor driver 1 incorporates the PC (Power Cut) circuit.

The following uses the motor-driver 1 block to describe the functioning.

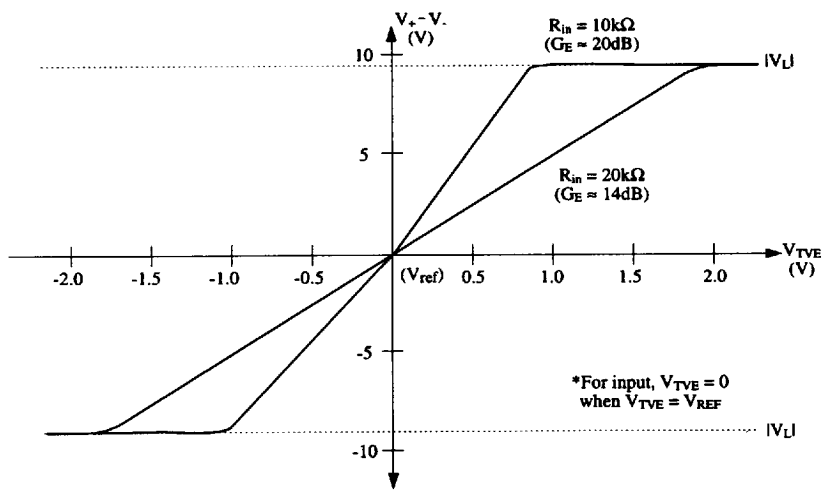
1) Motor driver 1



An error signal input from the pin 5 is amplified by the error amplifier. Suppose the input resistance R_{in} is 10kΩ, the error amplifier gain G_E is as follows.

$$G_E = \frac{100k\Omega}{R_{IN} + 500\Omega}$$

$$= \frac{100k}{10.5k\Omega} \approx 10 \approx 20dB$$



Motor Driver 1 I/O Characteristics

● Operational Description (Continue)

The error signal input V_{TVE} is input centering around the reference V_{REF} (=2.5V) of the servo circuit.

i) When $V_{TVE}>V_{REF}$
Q1, Q4, SW A: off
Q2, Q3, SW B: on

ii) When $V_{TVE}<V_{REF}$
Q1, Q4, SW A: on
Q2, Q3, SW B: off

Suppose the voltage generated at the output pins are V_+ and V_-, the output voltage (V_+-V_-) is;

$(V_+-V_-) = G_E \times (V_{TVE} - V_{REF})$

That is, **the input voltage is multipled by the error amplifier gain and results in the output voltage.** Although the output driver incorporates the voltage limiter, this limiter works for the output voltage, regardless of the error amplifier gain.

The preceeding figure shows an example of input/output characteristics when the input resistance R_{in} is 10kΩ and 20kΩ.

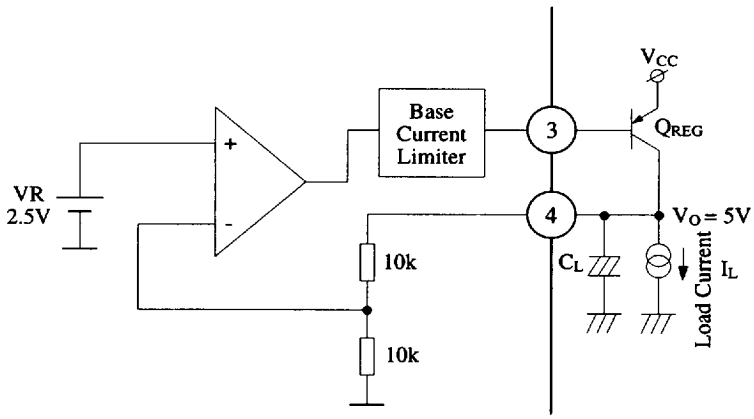
Suppose the limit voltage is $|V_L|$ and load resistance is R_L, the driver's maximum current I_{Lmax} is determined as follows.

$$I_{Lmax} = \frac{|V_L|}{R_L}$$

However, it is recommended to use under the condition of $I_{Lmax}<500mA$.

As mentioned above, only the motor driver 1 block incorporates the PC (Power Cut) circuit; the power cut mode is put into effect at PC=H and no current flows to the load.

2) **+5V regulator (low saturation type)**



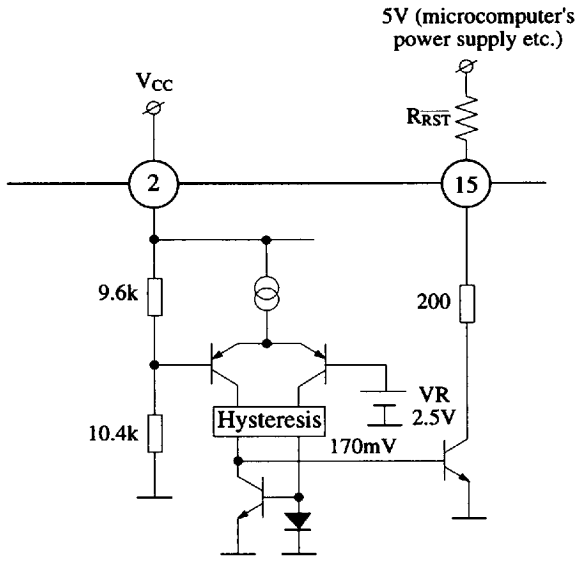
The +5V regulator is a low saturation type regulator, and its output voltage range is the same as the general purpose voltage regulator (4.75V to 5.25V).

Although +5V is generated by comparing with the internal stabilized power supply against V_R, the output voltage V_O of the stabilized power supply is stable against supply voltage change and temperature change.

C_L is a phase compensating capacitor. This regulator also incorporates the base current limiter which limit the base current of the external PNP transistor Q_{REG}; it is activited to limit the base current when V_{CC} drops and Q_{REG} enters a saturation range.

● Operational Description (Continue)

3) **Reset Circuit**



The reset detects a voltage drop of the pin 2 = V_{CC}. An output from the pin 15 is an open collector output and as follows.

Pin 15 = L at reset
Pin 15 = H (high impedance)

It also has hysteresis of about 170mV. At reset time, all the drivers (3channels) are turned off and no current flows to the load, but the 5V regulator is not turned off.

4) **Thermal shutdown circuit**

This IC incorporates the thermal protective circuit which operates at about 150°C. When the thermal protective circuit operates, all the drivers (3 channels) are turned off, but the 5V regulator is not turned off, just like at reset time.