

# FAN8000D (KA9268D)

## 4-CH Motor Driver

### Features

- Built in 4-CH balanced transformerless(BTL) driver
- Output gain adjustable
- Built in normal OP-amp
- Built in mute function
- Built in level shift circuit
- Built in thermal shutdown function
- Operating range 4.5~13.2V

### Description

The FAN8000D is a monolithic integrated circuit, suitable for 4-CH motor driver which drives tracking actuator, focus actuator, sled motor and tray motor of CD/CD-ROM/DVD system.



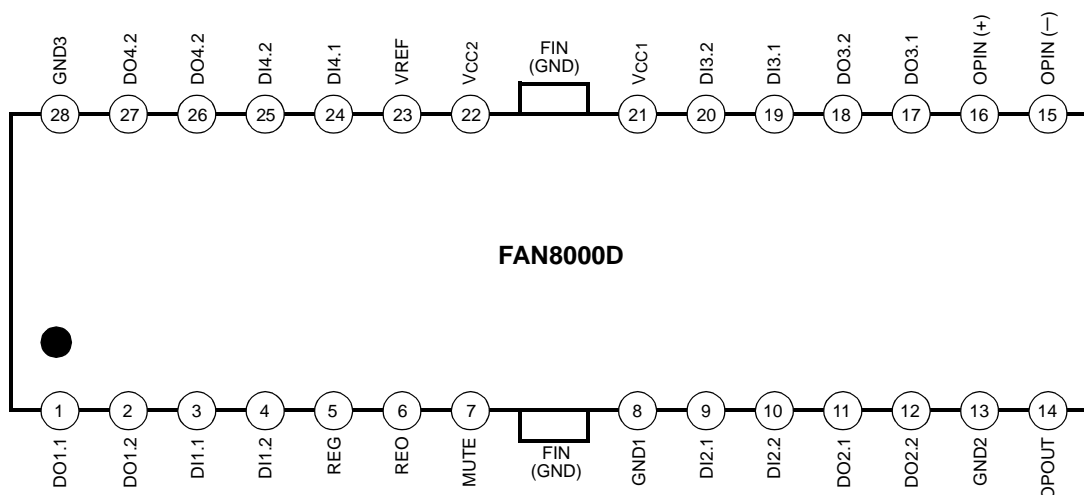
### Target Application

- Compact disk player
- Video compact disk player
- Digital Video Disk Player
- Car compact disk player

### Ordering Information

Device	Package	Operating Temp.
FAN8000D	28-SSOPH-375	-40°C ~ +85°C
FAN8000DTF	28-SSOPH-375	-40°C ~ +85°C

## Pin Assignments



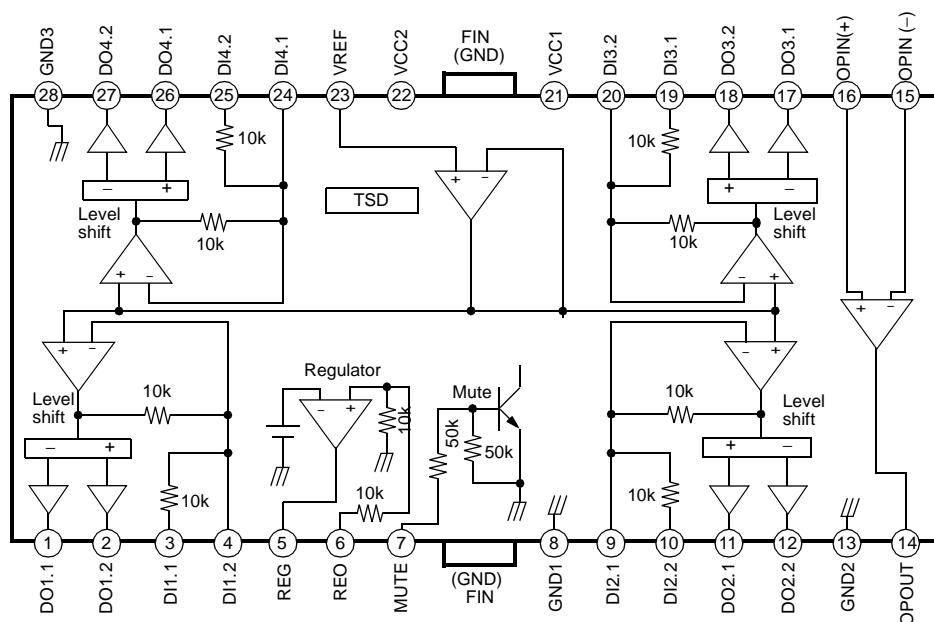
## Pin Definitions

Pin Number	Pin Name	I/O	Pin Function Description
1	DO1.1	O	Drive output
2	DO1.2	O	Drive output
3	DI1.1	I	Drive input
4	DI1.2	I	Drive input
5	REG	-	Regulator
6	REO	O	Regulator output
7	MUTE	I	Mute
8	GND1	-	Ground 1
9	DI2.1	I	Drive input
10	DI2.2	I	Drive input
11	DO2.1	O	Drive output
12	DO2.2	O	Drive output
13	GND2	-	Ground 2
14	OPOUT	O	Op-amp output
15	OPIN(-)	I	Op-amp input (-)
16	OPIN(+)	I	Op-amp input (+)
17	DO3.1	O	Drive output
18	DO3.2	O	Drive output
19	DI3.1	I	Drive input
20	DI3.2	I	Drive input
21	VCC1	-	Supply voltage
22	VCC2	-	Supply voltage
23	VREF	I	2.5V bias voltage
24	DI4.1	I	Drive input

## Pin Definitions (Continued)

Pin Number	Pin Name	I/O	Pin Function Description
25	DI4.2	I	Drive input
26	DO4.1	O	Drive output
27	DO4.2	O	Drive output
28	GND3	-	Ground 3

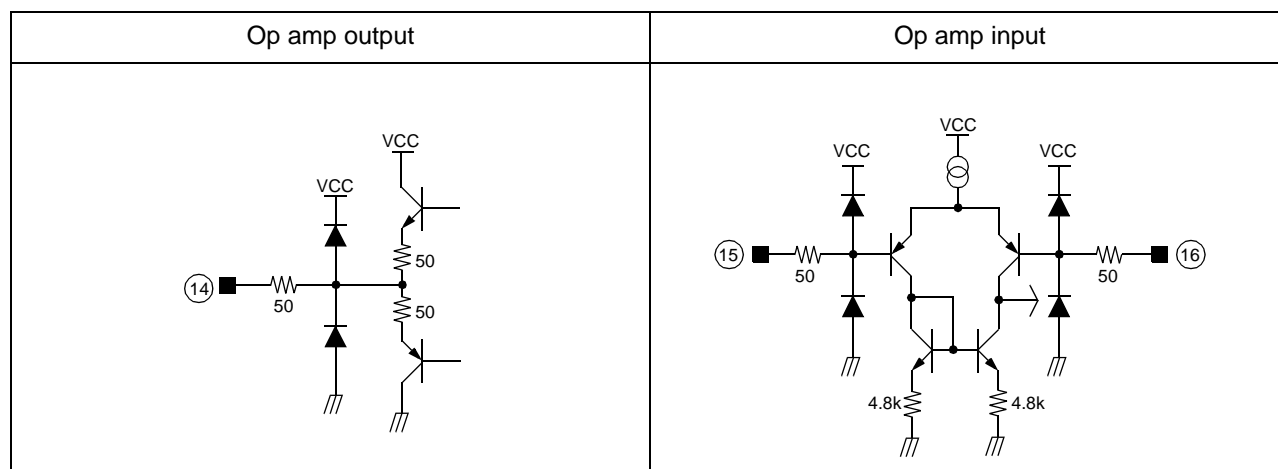
## Internal Block Diagram



## Equivalent Circuits

Driver input	Driver output
Regulator	Regulator output
Mute input	Bias input

## Equivalent Circuits (Continued)

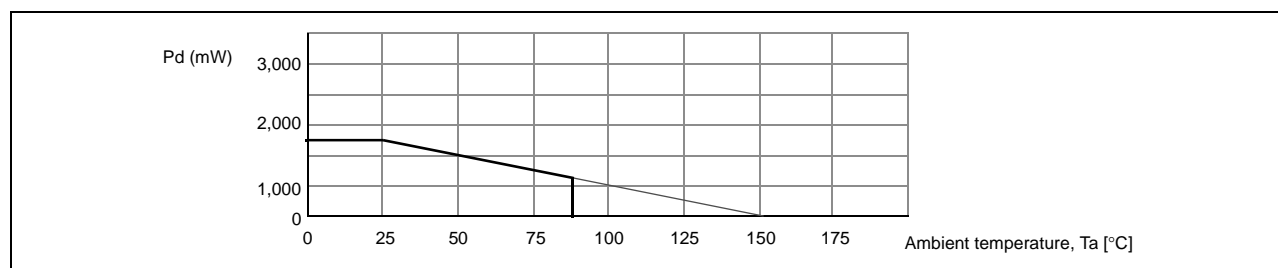


## Absolute Maximum Ratings ( Ta=25°C)

Parameter	Symbol	Value	Unit
Supply voltage	VCC	18	V
Power dissipation	PD	1.7 <sup>note</sup>	W
Operating temperature	TOPR	-40 ~ +85	°C
Storage temperature	TSTG	-55 ~ +150	°C
Maximum output current	IOMAX	1	A

### Notes:

- When mounted on 76.2mm × 114mm × 1.57mm PCB (Phenolic resin material).
- Power dissipation reduces 13.6mW / °C for using above Ta=25°C
- Do not exceed Pd and SOA (Safe Operating Area).



## Recommended Operating Condition ( Ta=25°C)

Parameter	Symbol	Value	Unit
Operating supply voltage	VCC	4.5 ~ 13.2	V

## Electrical Characteristics

(Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 8\text{V}$ ,  $R_L = 8\Omega$ )

### REGULATOR CIRCUIT

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Regulator output voltage	$V_{REG}$	$I_L = 100\text{mA}$	4.75	5	5.25	V
Load regulation	$\Delta V_{RL}$	$I_L = 0 \sim 200\text{mA}$	-40.0	0	10.0	mV
Line regulation	$\Delta V_{CC}$	$I_L = 200\text{mA}$ , $V_{CC} = 6 \sim 9\text{V}$	-10.0	0	20.0	mV

### DRIVE CIRCUIT

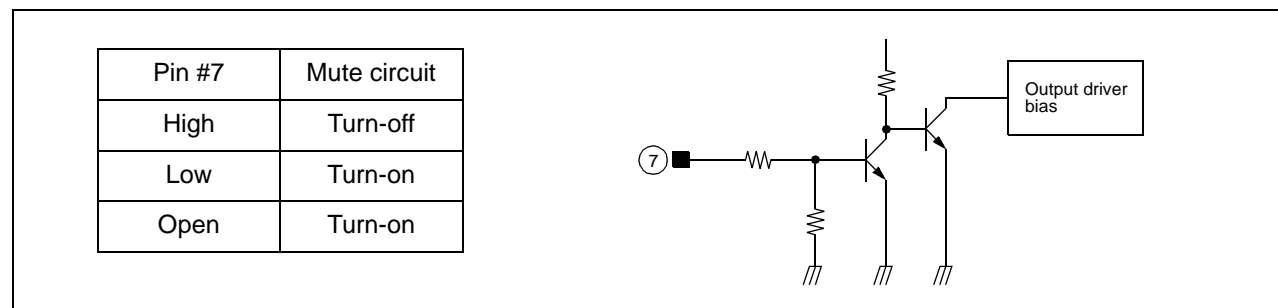
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Quiescent circuit current	$I_{CCQ}$	$V_I = 0$	5.5	9.5	13.5	mA
Input offset voltage	$V_{OF}$	-	-5.0	0	5.0	mV
Output offset voltage	$V_{OO}$	-	-30	0	30	
Maximum sink current	$I_{SINK}$	$R_L = 4\Omega$ , $V_{CC}$	0.5	0.8	-	A
Maximum source current	$I_{SOURCE}$	$R_L = 4\Omega$ , GND	0.5	0.8	-	
Maximum output voltage	$V_{OM}$	$V_I = 2V_{RMS}$ , 1kHz	2.5	3.0	-	V
Closed loop voltage gain	$A_{VF}$	$V_I = 0.1V_{RMS}$ , 1kHz	10.5	12.0	13.5	dB
Ripple rejection ratio	RR	$V_I = -20\text{dB}$ , 120Hz	60.0	80.0	-	
Slew rate	SR	100Hz, Square wave	1.0	2.0	-	V / $\mu\text{s}$

### OP AMP CIRCUIT

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input offset voltage	$V_{OF1}$	-	-5	-	+5	mV
Input bias current	$I_{B1}$	-	-	-	300	nA
High level output voltage	$V_{OH1}$	-	6	-	-	V
Low level output voltage	$V_{OL1}$	-	-	-	1.8	V
Output sink current	$I_{SINK1}$	$R_L = 50\Omega$ , GND	10	40	-	mA
Output source current	$I_{SOURCE1}$	$R_L = 50\Omega$ , $V_{CC}$	10	50	-	mA
Open loop voltage gain	$G_{VO1}$	$V_{IN} = -75\text{dB}$ , $f = 1\text{kHz}$	65	78	-	dB
Ripple rejection ratio	RR1	$V_{IN} = -20\text{dB}$ , $f = 120\text{kHz}$	50	70	-	dB
Slew Rate	SR1	Square, $V_{OUT} = 2V_{p-p}$ , $f = 120\text{kHz}$	0.5	1	-	V / $\mu\text{s}$
Common mode rejection ratio	CMRR1	$V_{IN} = -20\text{dB}$ , $f = 1\text{kHz}$	70	84	-	dB

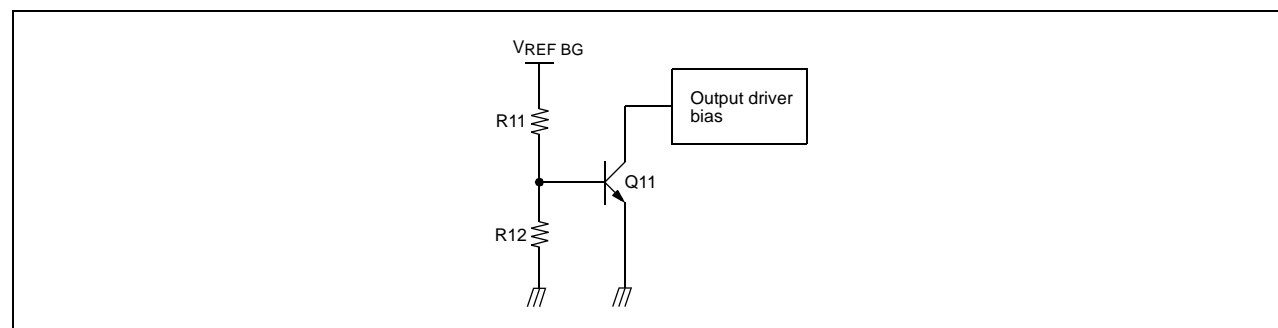
## Application Information

### 1. MUTE



- When the pin7 is open or the voltage of the pin7 is below 0.5V, the mute circuit is activated so that the output circuit is muted.
- When the voltage of the pin7 is above 2V, the mute circuit is deactivated and the output circuit operates normally.
- If the chip temperature rises above 175°C, then the TSD (Thermal Shutdown) circuit is activated and the output circuit is muted.

### 2. TSD (THERMAL SHUTDOWN)

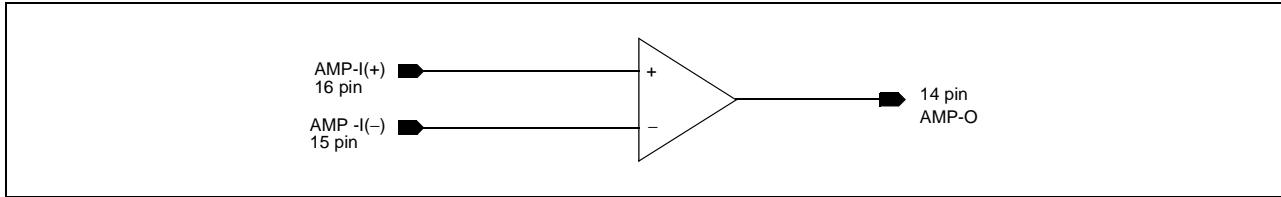


- The  $V_{REF\ BG}$  is the output voltage of the band-gap-referenced biasing circuit and acts as the input voltage of the TSD circuit.
- The base-emitter voltage of the TR, Q11 is designed to turn-on at below voltage.  

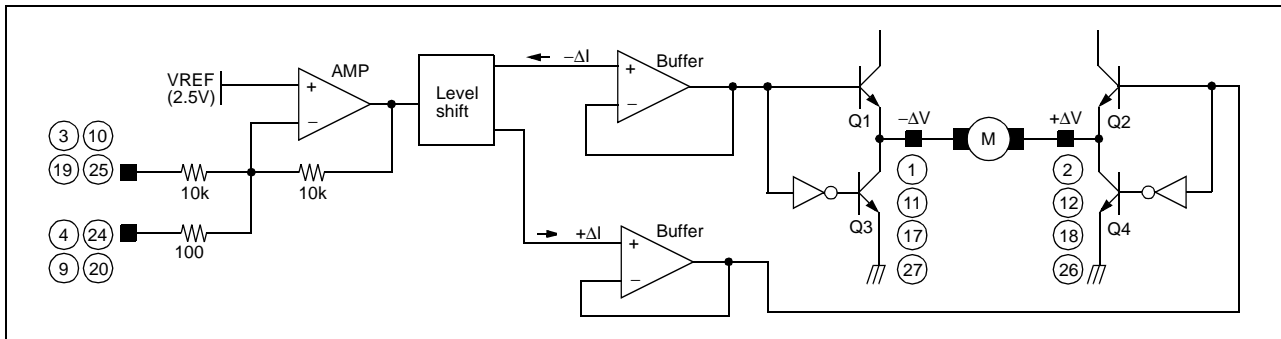
$$V_{BE} = V_{REF\ BG} \times R12 / (R11 + R12) = 460mV$$
- When the chip temperature rises up to 175°C, then the turn-on voltage of the Q11 would drop down to 460mV. (Hysteresis: 25°C)  
 Hence, the Q11 would turn on so the output circuit will be muted.

### 3. OP-AMP

OP-amp is integrated in the IC for user's convenience.

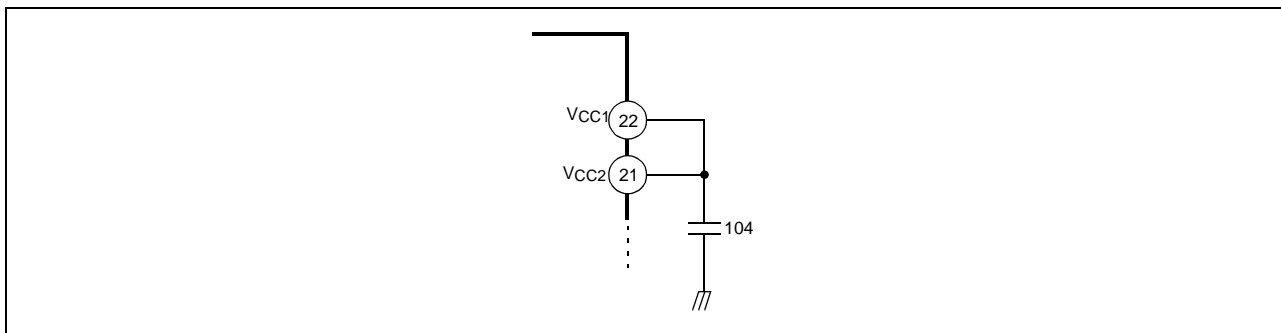


### 4. DRIVER



- The voltage,  $V_{REF}$ , is the reference voltage given by the bias voltage of the pin23.
- The input signal through the pin3 is amplified by 10k/10k times and then fed to the level shift.
- The level shift produces the current due to the difference between the input signal and the arbitrary reference signal. The current produced as  $+\Delta I$  and  $-\Delta I$  is fed into the driver buffer.
- Driver Buffer drives the power TR of the output stage according to the input signal.
- The output stage is the BTL driver and the motor is rotating in forward direction by operating TR Q1 and TR Q4. On the other hand, if TR Q2 and TR Q3 is operating, the motor is rotating in reverse direction
- When the input voltage through the pin3 is below the  $V_{REF}$ , the motor rotates in forward direction.
- When the input voltage through the pin3 is above the  $V_{REF}$ , the motor rotates in reverse direction.
- To change the gain, pin4 or 24 can be used.

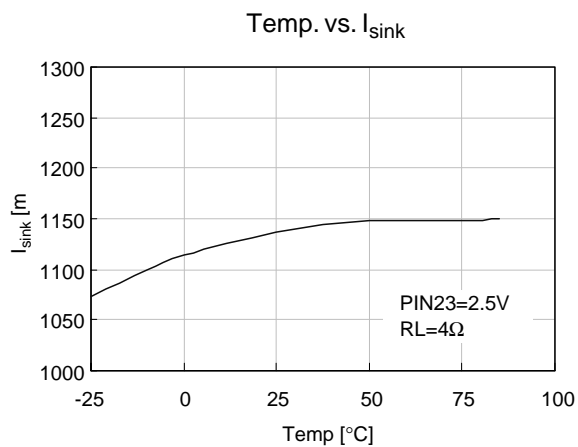
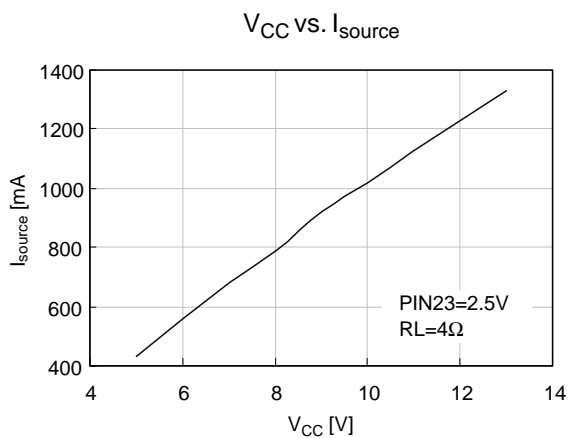
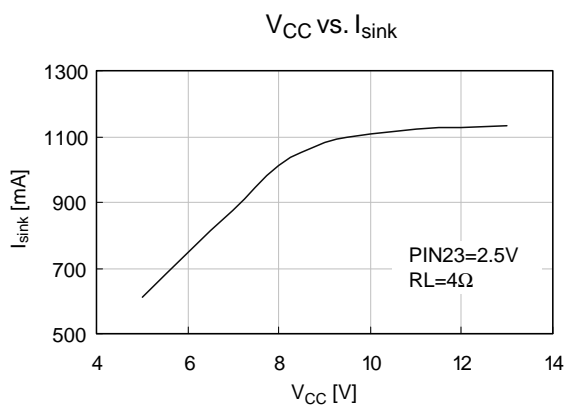
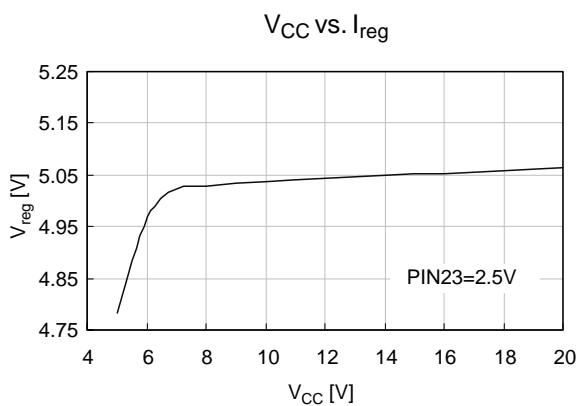
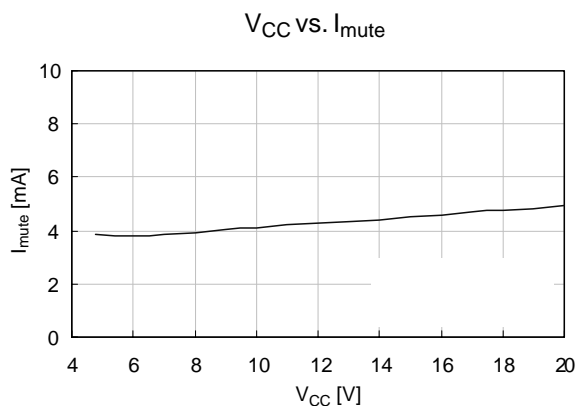
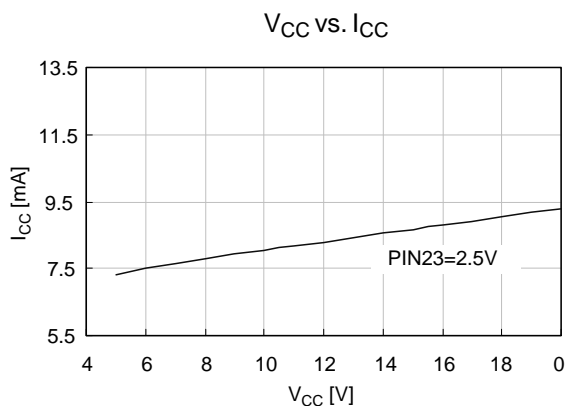
### 5. Connect a by-pass capacitor, 0.1 $\mu$ F between the supply voltage source.



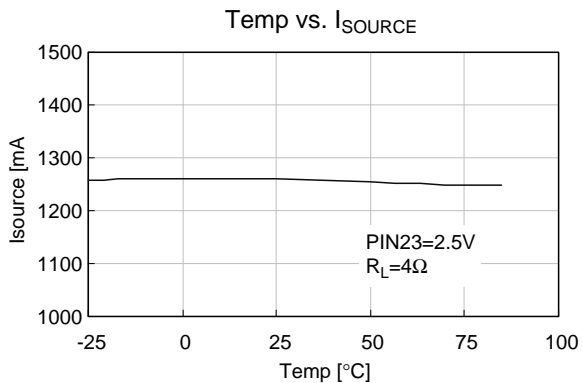
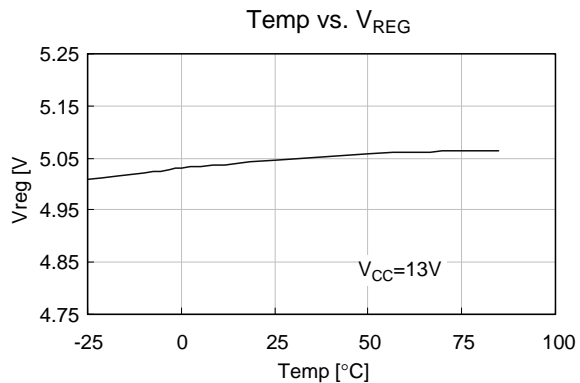
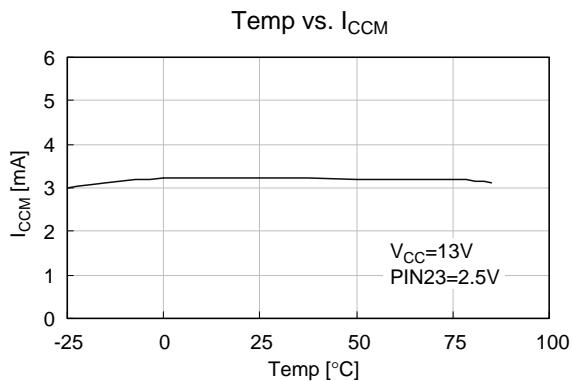
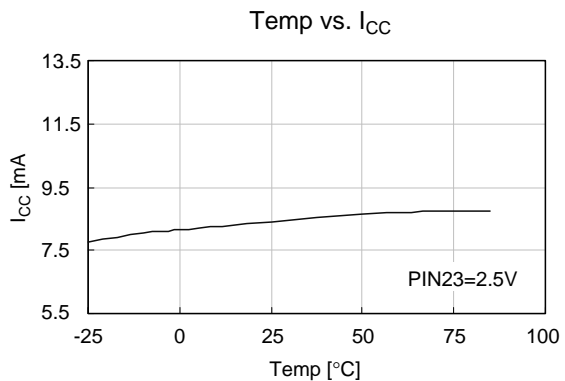
### 6. Radiation fin is connecting to the internal GND of the package. Connect the fin to the external GND.



## Typical Performance Characteristics

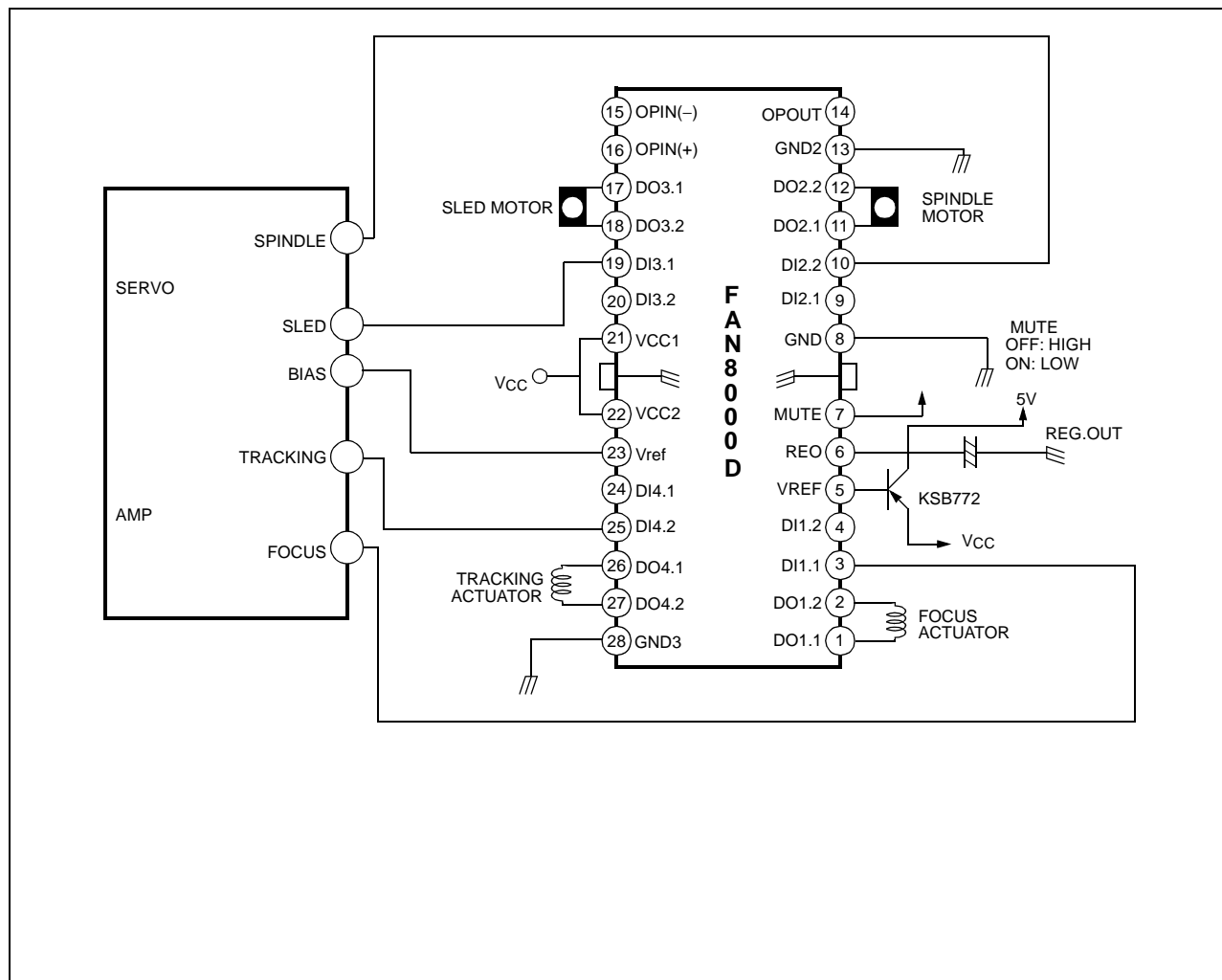


## Typical Performance Characteristics (Continued)





## Application Circuits



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