

# KA9258D

## 4-Channel Motor Driver

### Features

- 1-phase, full-wave, linear DC motor driver
- Output gain adjustable
- Built in OP-amp
- Built in mute function
- Built in level shift circuit
- Built in thermal shutdown circuit (TSD)
- Operating range 6~13.2V

### Description

The KA9258D is a monolithic integrated circuit, suitable for 4-CH motor driver which drives tracking actuator, focus actuator, sled motor and loading motor of CD/CD-ROM/DVD system, and can also drive spindle motor of CD system.



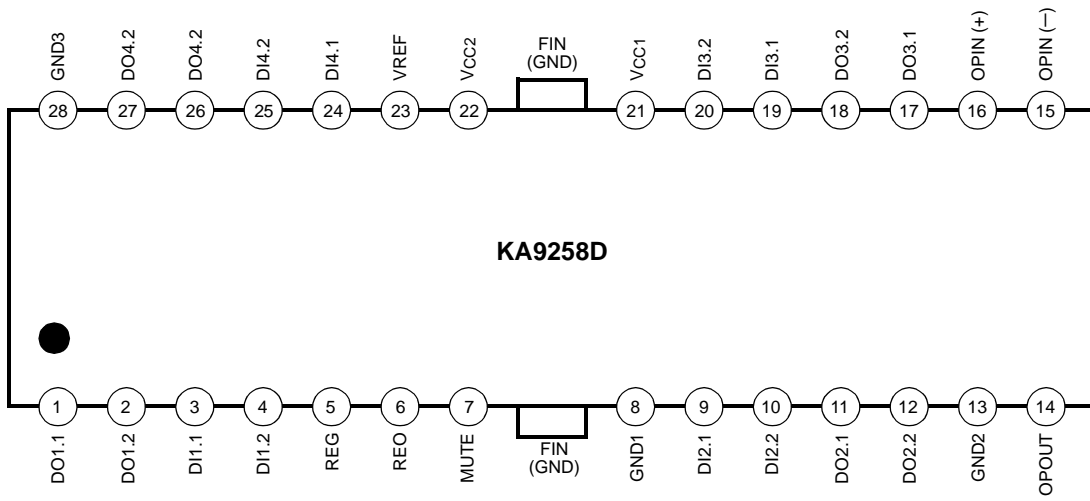
### Typical Applications

- Compact disk player (CDP)
- Video compact disk player (VCD)
- Automotive compact disk player
- Other compact disk media

### Ordering Information

Device	Package	Operating Temp.
KA9258BD	28-SSOPH-375	-40°C ~ +85°C
KA9258BDTF	28-SSOPH-375	-40°C ~ +85°C

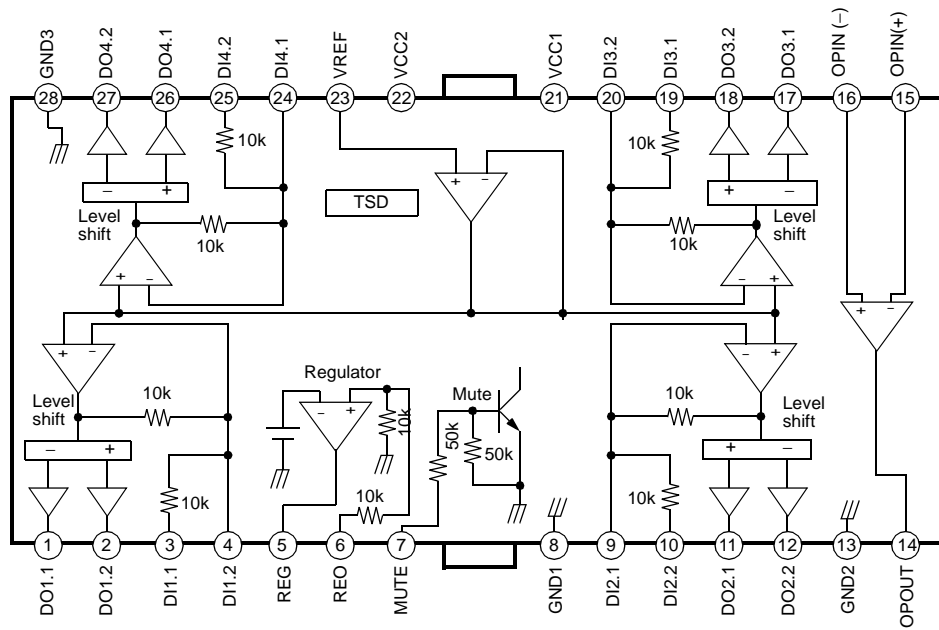
# Pin Assignments



## 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
25	DI4.2	I	Drive input
26	DO4.1	O	Drive output
27	DO4.2	O	Drive output
28	GND3	-	Ground 3

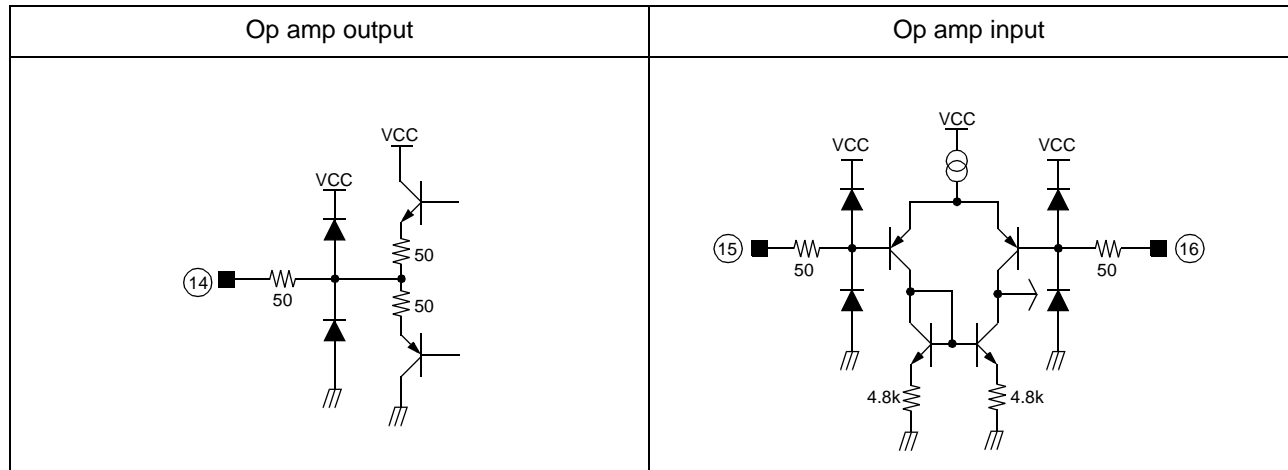
# Internal Block Diagram



## Equivalent Circuits

Driver input	Driver output
Regulator	Regulator output
Mute input	Bias input

## Equivalent Circuits (Continued)



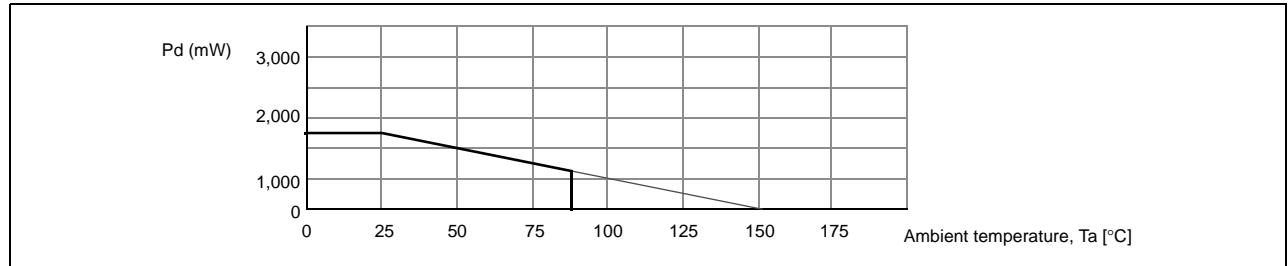
## Absolute Maximum Ratings (Ta = 25°C)

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

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

## Power Dissipation Curve



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

Parameter	Symbol	Value	Unit
Operating supply voltage	VOPR	6 ~ 13.2	V

## Electrical Characteristics (Ta = 25°C)

### A. Regulator

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Regulator output voltage	V <sub>REG</sub>	I <sub>L</sub> =100mA	4.75	5	5.25	V
Load regulation	ΔV <sub>RL</sub>	I <sub>L</sub> =0 ~ 200mA	-40.0	0	10.0	mV
Line regulation	ΔV <sub>VCC</sub>	I <sub>L</sub> =200mA, V <sub>CC</sub> =6 ~ 9V	-10.0	0	20.0	mV

### B. Drive

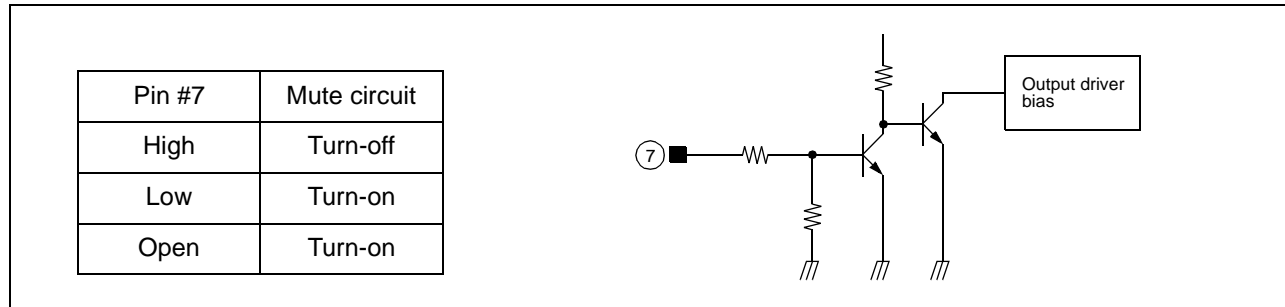
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Quiescent circuit current	I <sub>CCQ</sub>	V <sub>I</sub> =0	5.5	9.5	13.5	mA
Input offset voltage	V <sub>OF</sub>	-	-5.0	0	5.0	mV
Output offset voltage	V <sub>OO</sub>	-	-30	0	30	
Maximum sink current	I <sub>SINK</sub>	R <sub>L</sub> =4Ω, V <sub>CC</sub>	0.5	0.8	-	A
Maximum source current	I <sub>SOURCE</sub>	R <sub>L</sub> =4Ω, GND	0.5	0.8	-	
Maximum output voltage	V <sub>OM</sub>	V <sub>I</sub> =2V <sub>RMS</sub> , 1kHz	2.5	3.0	-	V
Closed loop voltage gain	A <sub>VF</sub>	V <sub>I</sub> =0.1V <sub>RMS</sub> , 1kHz	4.5	6.5	7.5	dB
Ripple rejection ratio	RR	V <sub>I</sub> =-20dB, 120Hz	60.0	80.0	-	
Slew rate	SR	100Hz, Square wave	1.0	2.0	-	V / μs

### C. OP AMP

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input offset voltage	V <sub>OF1</sub>	-	-5	-	+5	mA
Input bias current	I <sub>B1</sub>	-	-	-	300	nA
High level output voltage	V <sub>OH1</sub>	-	6	-	-	V
Low level output voltage	V <sub>OL1</sub>	-	-	-	1.8	V
Output sink current	I <sub>SINK1</sub>	R <sub>L</sub> =50Ω, GND	10	40	-	mA
Output source current	I <sub>SOURCE1</sub>	R <sub>L</sub> =50Ω, V <sub>CC</sub>	10	50	-	mA
Open loop voltage gain	G <sub>VO1</sub>	V <sub>IN</sub> =-75dB, f=1kHz	65	78	-	dB
Ripple rejection ratio	RR1	V <sub>IN</sub> =-20dB, f=120kHz	50	70	-	dB
Slew Rate	SR1	Square, V <sub>OUT</sub> =2V <sub>p-p</sub> , f=120kHz	0.5	1	-	V / μs
Common mode rejection ratio	CMRR1	V <sub>IN</sub> =-20dB, f=1kHz	70	84	-	dB

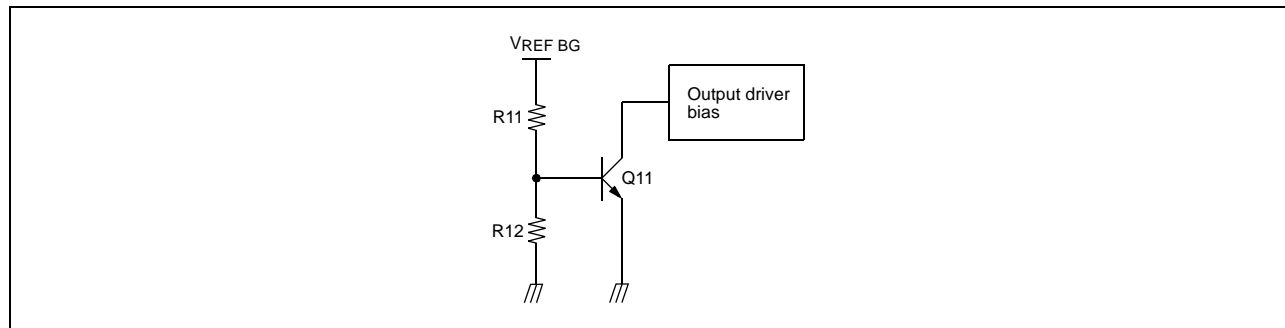
## Application Information

### 1. MUTE



- When the mute pin #7 is open or the voltage of the mute pin #7 is below 0.5V, the mute circuit is activated so that the output circuit will be muted.
- When the voltage of the mute pin is above 2V, the mute circuit is disabled and the output circuit operates normal.
- 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)



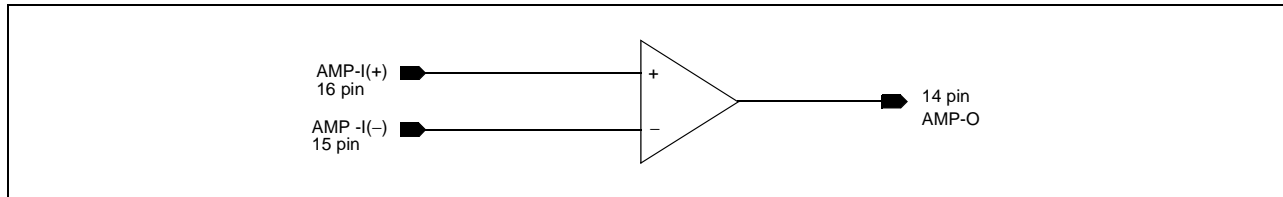
- The  $V_{REF\ BG}$  is the output voltage of the band-gap-referenced biasing circuit and acts as the input voltage of the TSD circuit.
- The base-emitter voltage of the TR, Q11 is designed to turn-on at below voltage.  

$$V_{BE} = V_{REF\ BG} \times R12 / (R11 + R12) = 460mV$$
- 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.

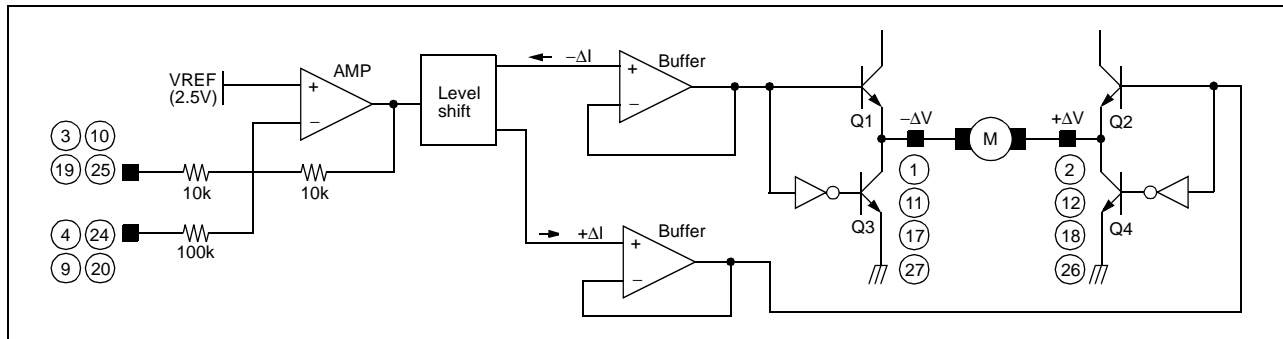


### 3. OP-AMP

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

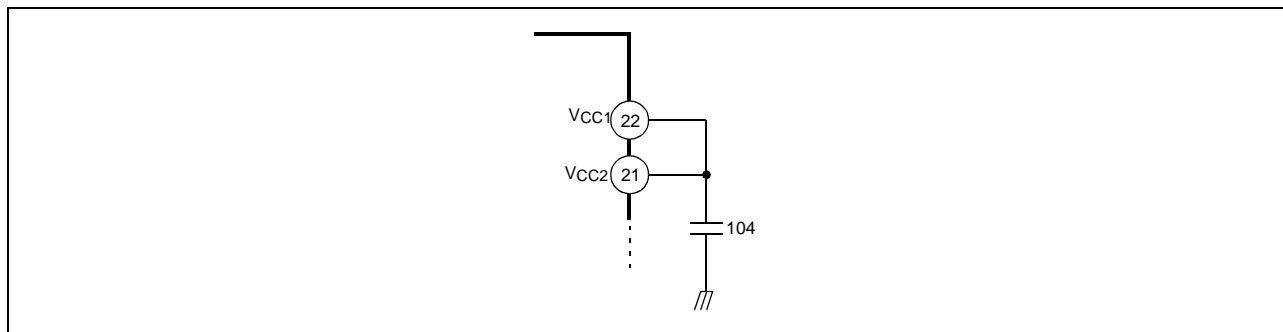


### 4. DRIVER



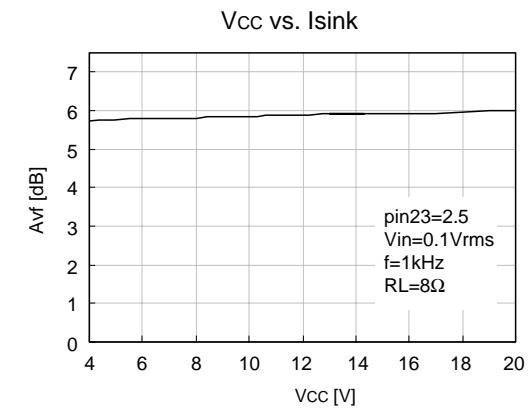
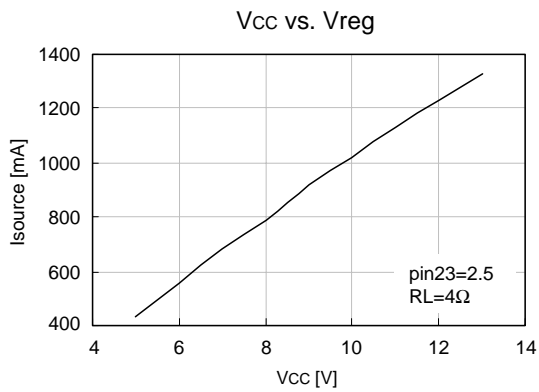
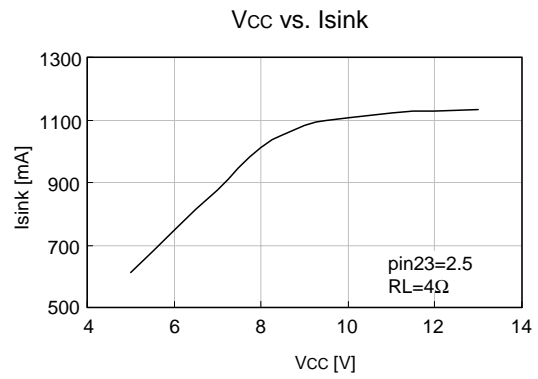
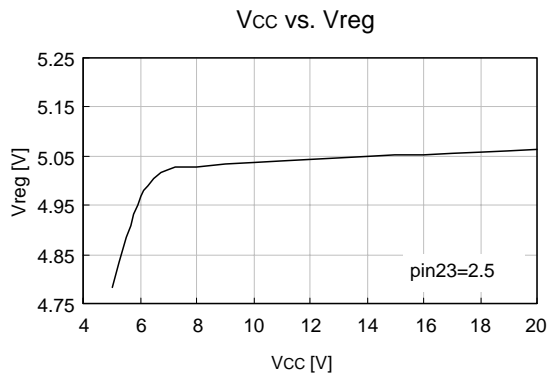
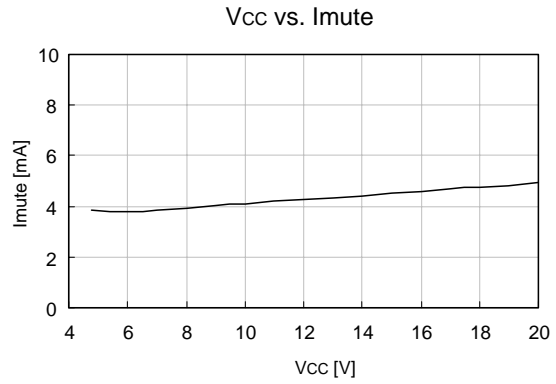
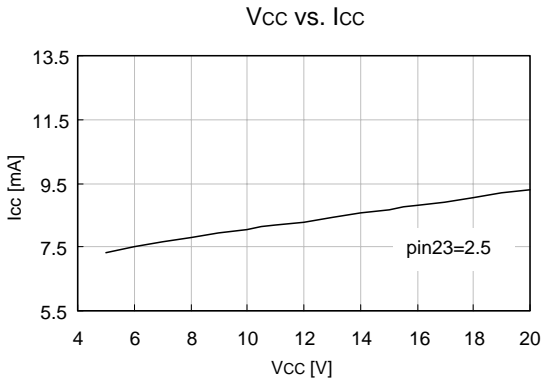
- The voltage,  $V_{REF}$ , is the reference voltage given by the bias voltage of the pin #23.
- The input signal through the pin #3 is amplified by 10k/10k times and then fed to the level shift.
- The level shift produces the current due to the difference between the input signal and the arbitrary reference signal. The current produced as  $+\Delta I$  and  $-\Delta I$  is fed into the driver buffer.
- Driver Buffer operates the power TR of the output stage according to the state of 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 pin #3 is below the  $V_{REF}$ , then the direction of the motor in forward direction.
- When the input voltage through the pin #3 is above the  $V_{REF}$ , then the direction of the motor in reverse direction.
- If it is desired to change the gain, then the pin #4 or #24 can be used.

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

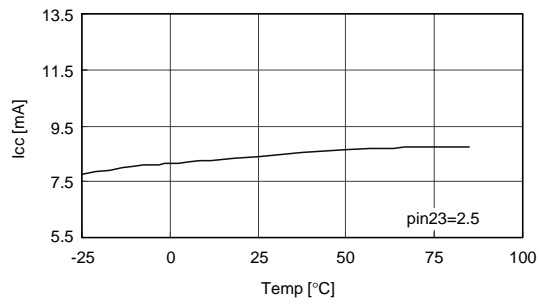
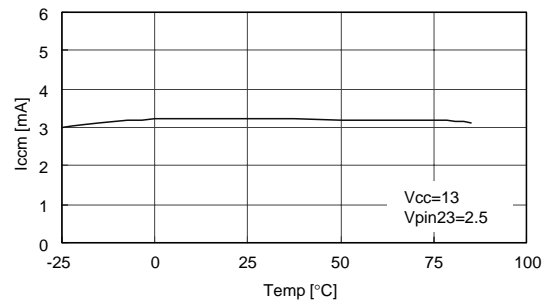
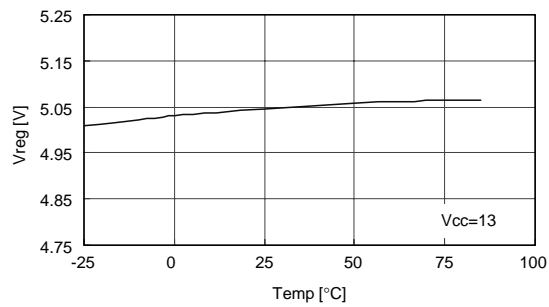
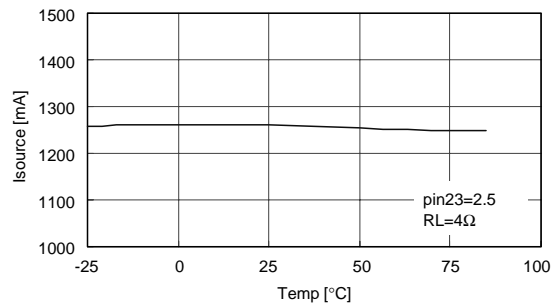
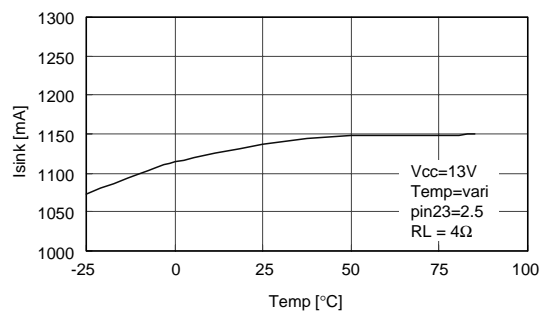


- ### 6. Radiation fin is connecting to the internal GND of the package. Connect the fin to the external GND.

# Typical Performance Characteristics

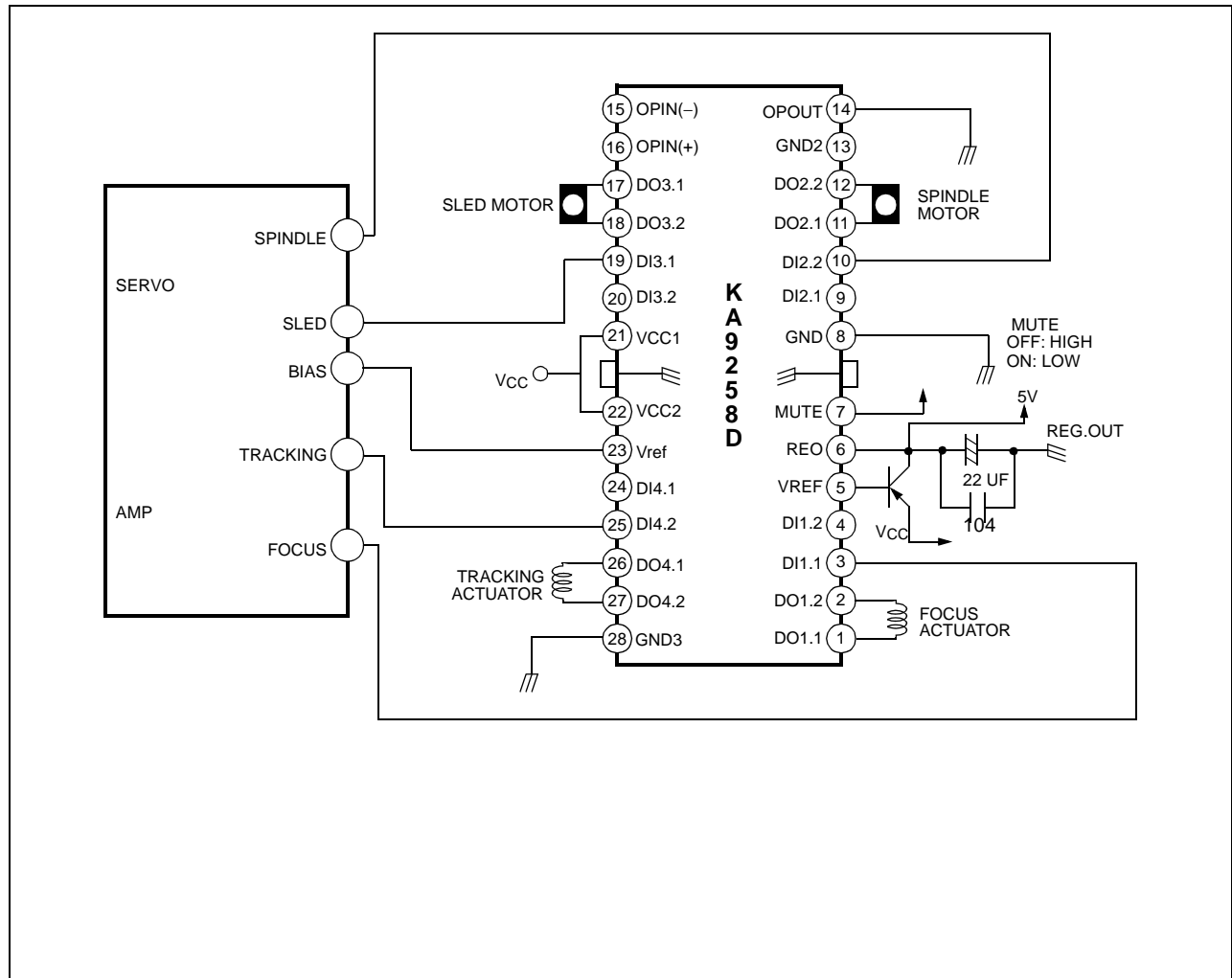


## Typical Performance Characteristics (Continued)

Temp vs I<sub>cc</sub>Temp vs I<sub>ccm</sub>Temp vs V<sub>reg</sub>Temp vs I<sub>source</sub>Temp vs I<sub>sink</sub>



## Application Circuits



### Thermal Shut Down Circuit

The IC breaks down by over heating when overload condition continues for a long time. KA9258D has built-in thermal shut down circuit to prevent this case. When IC temperature rises over 175°C, the circuit operates and protects the IC from break-down.

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

# KA9258D

## 4-Channel Motor Driver

### Features

- 1-phase, full-wave, linear DC motor driver
- Output gain adjustable
- Built in OP-amp
- Built in mute function
- Built in level shift circuit
- Built in thermal shutdown circuit (TSD)
- Operating range 6~13.2V

### Description

The KA9258D is a monolithic integrated circuit, suitable for 4-CH motor driver which drives tracking actuator, focus actuator, sled motor and loading motor of CD/CD-ROM/DVD system, and can also drive spindle motor of CD system.



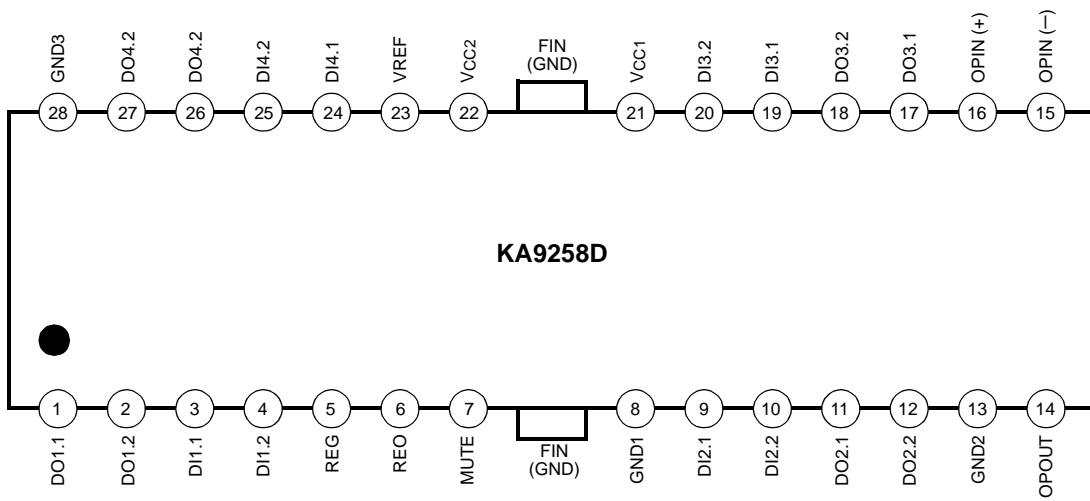
### Typical Applications

- Compact disk player (CDP)
- Video compact disk player (VCD)
- Automotive compact disk player
- Other compact disk media

### Ordering Information

Device	Package	Operating Temp.
KA9258BD	28-SSOPH-375	-40°C ~ +85°C
KA9258BDTF	28-SSOPH-375	-40°C ~ +85°C

## Pin Assignments

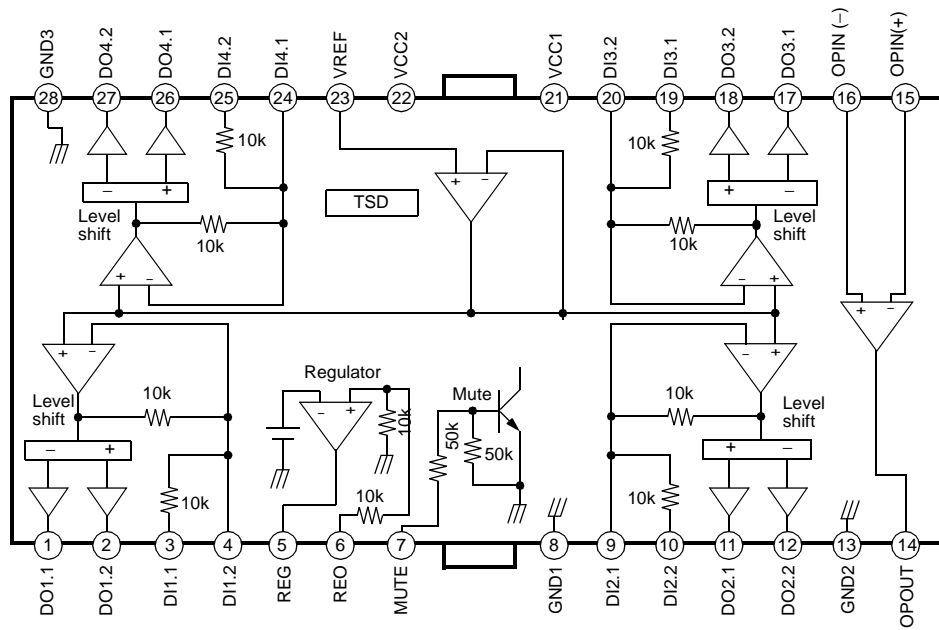




## Pin Definitions

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
25	DI4.2	I	Drive input
26	DO4.1	O	Drive output
27	DO4.2	O	Drive output
28	GND3	-	Ground 3

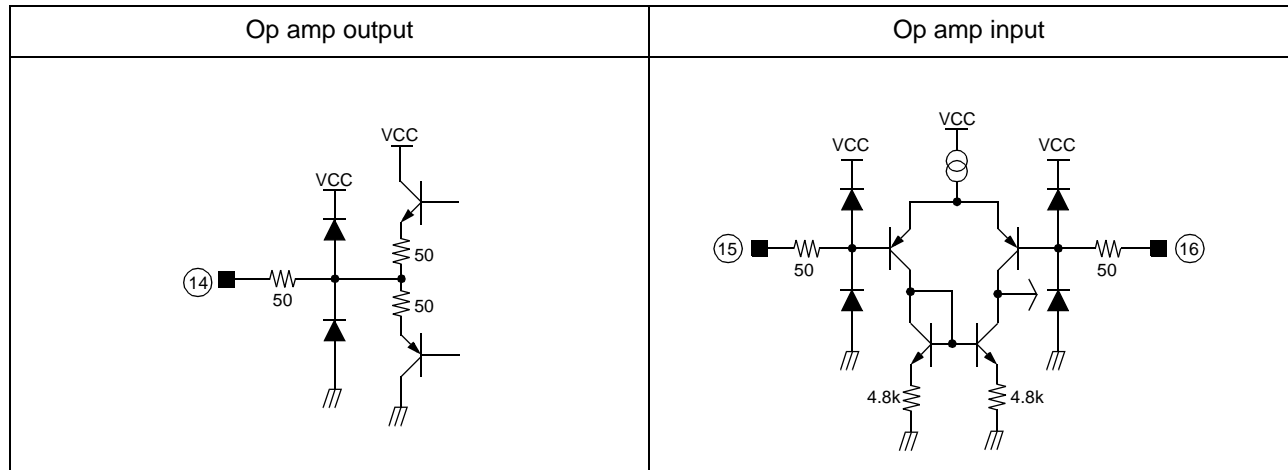
# Internal Block Diagram



## Equivalent Circuits

Driver input	Driver output
Regulator	Regulator output
Mute input	Bias input

## Equivalent Circuits (Continued)



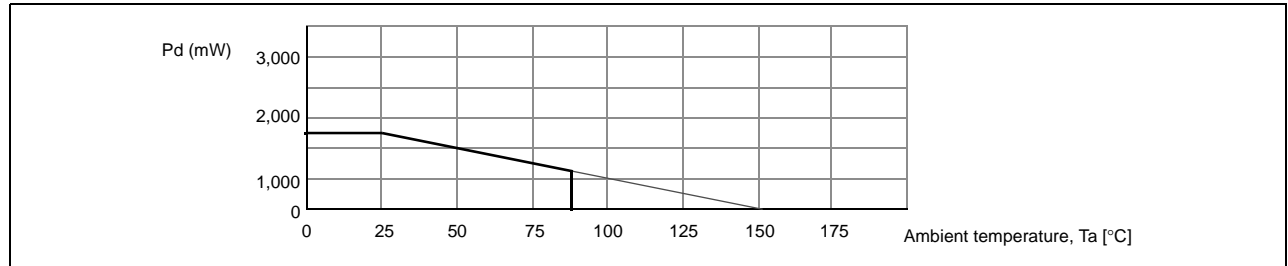
## Absolute Maximum Ratings (Ta = 25°C)

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

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

## Power Dissipation Curve



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

Parameter	Symbol	Value	Unit
Operating supply voltage	VOPR	6 ~ 13.2	V

## Electrical Characteristics (Ta = 25°C)

### A. Regulator

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Regulator output voltage	V <sub>REG</sub>	I <sub>L</sub> =100mA	4.75	5	5.25	V
Load regulation	ΔV <sub>RL</sub>	I <sub>L</sub> =0 ~ 200mA	-40.0	0	10.0	mV
Line regulation	ΔV <sub>C</sub>	I <sub>L</sub> =200mA, V <sub>C</sub> =6 ~ 9V	-10.0	0	20.0	mV

### B. Drive

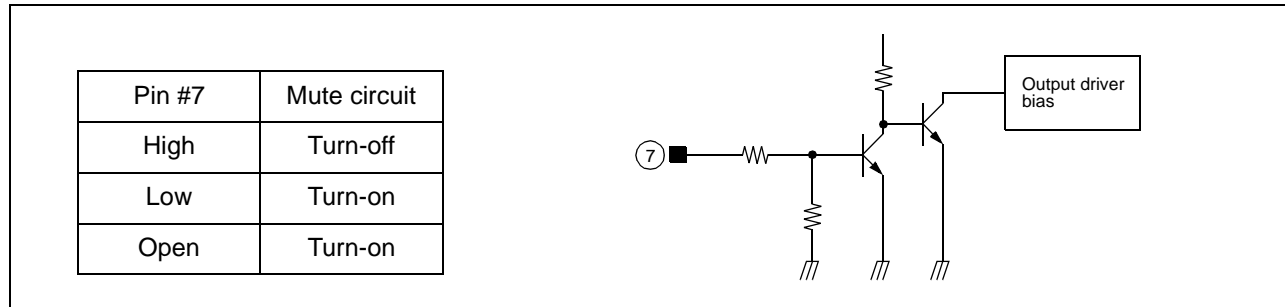
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Quiescent circuit current	I <sub>CCQ</sub>	V <sub>I</sub> =0	5.5	9.5	13.5	mA
Input offset voltage	V <sub>OF</sub>	-	-5.0	0	5.0	mV
Output offset voltage	V <sub>OO</sub>	-	-30	0	30	
Maximum sink current	I <sub>SINK</sub>	R <sub>L</sub> =4Ω, V <sub>C</sub>	0.5	0.8	-	A
Maximum source current	I <sub>SOURCE</sub>	R <sub>L</sub> =4Ω, GND	0.5	0.8	-	
Maximum output voltage	V <sub>OM</sub>	V <sub>I</sub> =2V <sub>RMS</sub> , 1kHz	2.5	3.0	-	V
Closed loop voltage gain	A <sub>VF</sub>	V <sub>I</sub> =0.1V <sub>RMS</sub> , 1kHz	4.5	6.5	7.5	dB
Ripple rejection ratio	RR	V <sub>I</sub> =-20dB, 120Hz	60.0	80.0	-	
Slew rate	SR	100Hz, Square wave	1.0	2.0	-	V / μs

### C. OP AMP

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input offset voltage	V <sub>OF1</sub>	-	-5	-	+5	mA
Input bias current	I <sub>B1</sub>	-	-	-	300	nA
High level output voltage	V <sub>OH1</sub>	-	6	-	-	V
Low level output voltage	V <sub>OL1</sub>	-	-	-	1.8	V
Output sink current	I <sub>SINK1</sub>	R <sub>L</sub> =50Ω, GND	10	40	-	mA
Output source current	I <sub>SOURCE1</sub>	R <sub>L</sub> =50Ω, V <sub>C</sub>	10	50	-	mA
Open loop voltage gain	G <sub>VO1</sub>	V <sub>IN</sub> =-75dB, f=1kHz	65	78	-	dB
Ripple rejection ratio	RR1	V <sub>IN</sub> =-20dB, f=120kHz	50	70	-	dB
Slew Rate	SR1	Square, V <sub>OUT</sub> =2V <sub>p-p</sub> , f=120kHz	0.5	1	-	V / μs
Common mode rejection ratio	CMRR1	V <sub>IN</sub> =-20dB, f=1kHz	70	84	-	dB

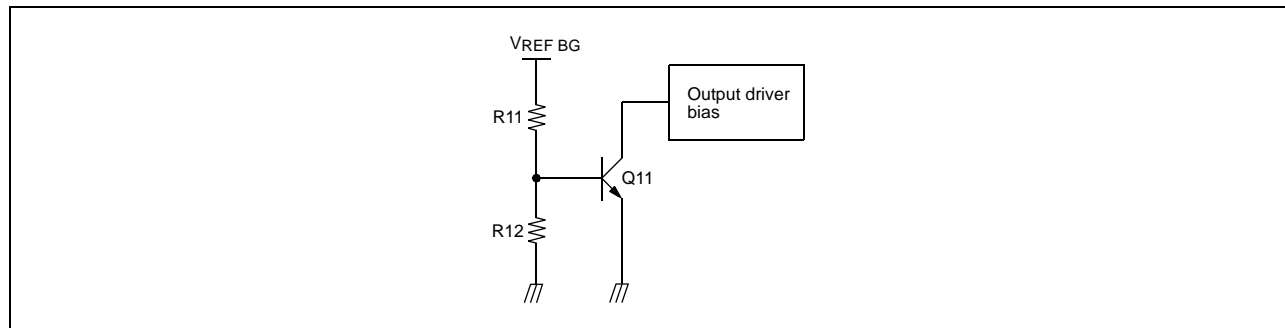
## Application Information

### 1. MUTE



- When the mute pin #7 is open or the voltage of the mute pin #7 is below 0.5V, the mute circuit is activated so that the output circuit will be muted.
- When the voltage of the mute pin is above 2V, the mute circuit is disabled and the output circuit operates normal.
- 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)

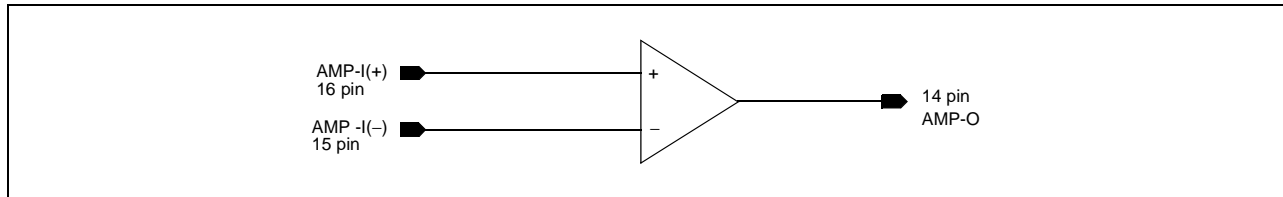


- The  $V_{REF\ BG}$  is the output voltage of the band-gap-referenced biasing circuit and acts as the input voltage of the TSD circuit.
- The base-emitter voltage of the TR, Q11 is designed to turn-on at below voltage.  

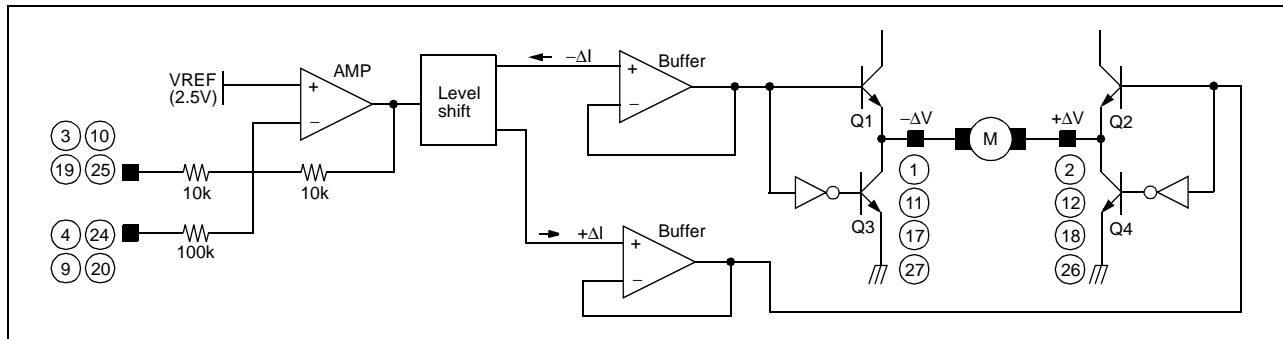
$$V_{BE} = V_{REF\ BG} \times R12 / (R11 + R12) = 460mV$$
- When the chip temperature rises up to 175°C, then the turn-on voltage of the Q11 would drop down to 460mV. (Hysteresis: 25°C)  
 Hence, the Q11 would turn on so the output circuit will be muted.

### 3. OP-AMP

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

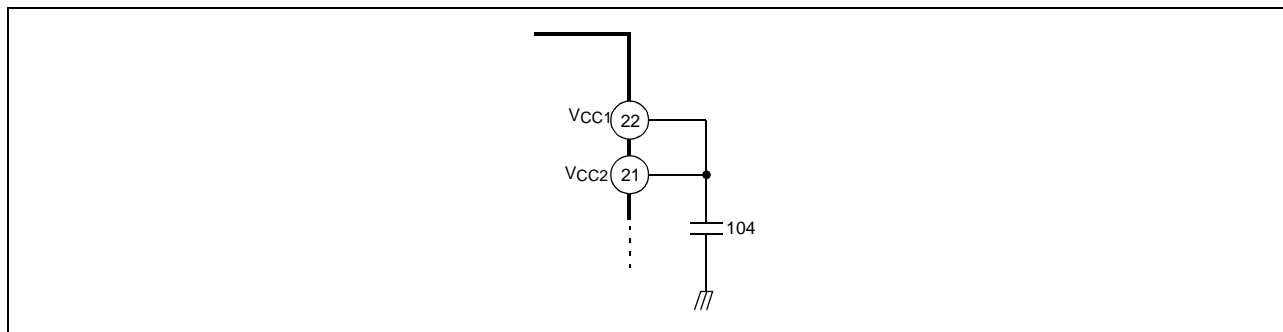


### 4. DRIVER



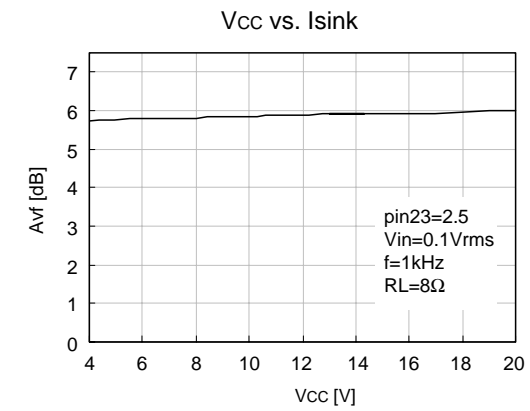
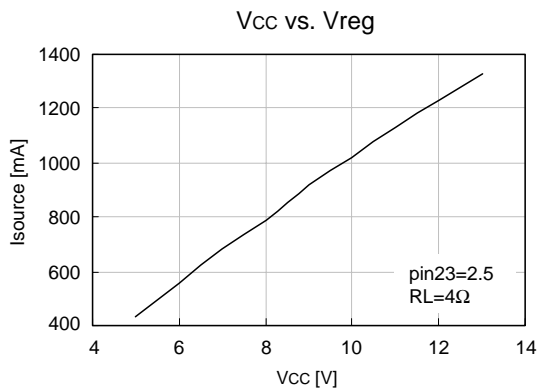
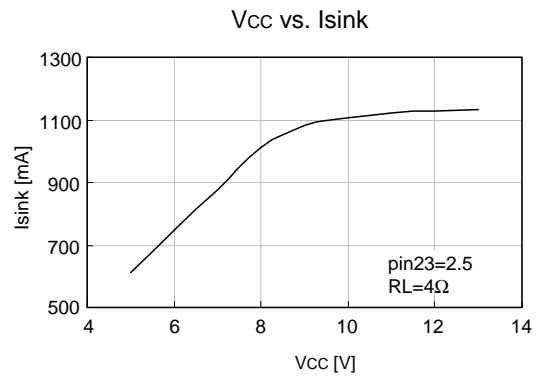
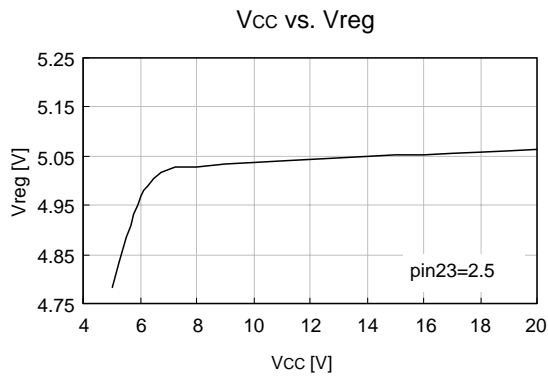
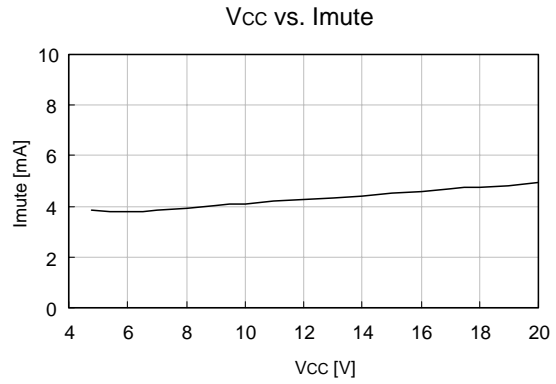
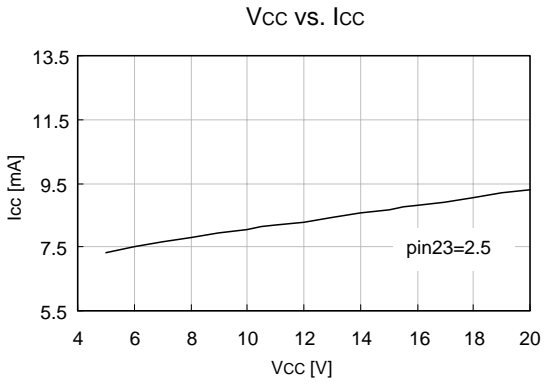
- The voltage,  $V_{REF}$ , is the reference voltage given by the bias voltage of the pin #23.
- The input signal through the pin #3 is amplified by 10k/10k times and then fed to the level shift.
- The level shift produces the current due to the difference between the input signal and the arbitrary reference signal. The current produced as  $+\Delta I$  and  $-\Delta I$  is fed into the driver buffer.
- Driver Buffer operates the power TR of the output stage according to the state of 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 pin #3 is below the  $V_{REF}$ , then the direction of the motor in forward direction.
- When the input voltage through the pin #3 is above the  $V_{REF}$ , then the direction of the motor in reverse direction.
- If it is desired to change the gain, then the pin #4 or #24 can be used.

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



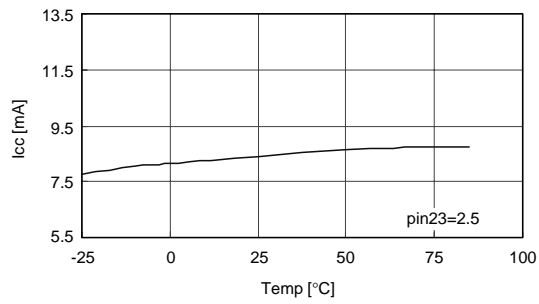
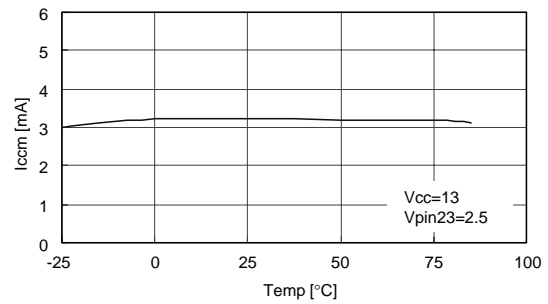
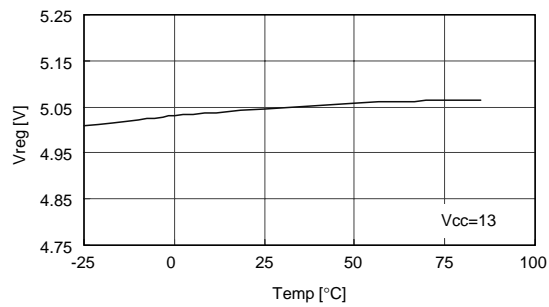
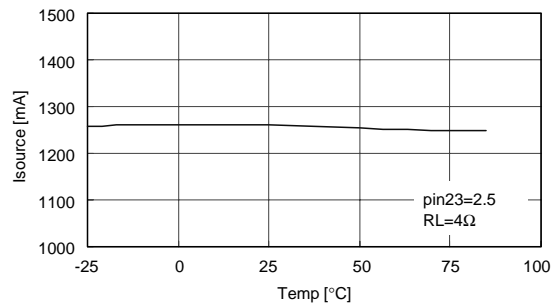
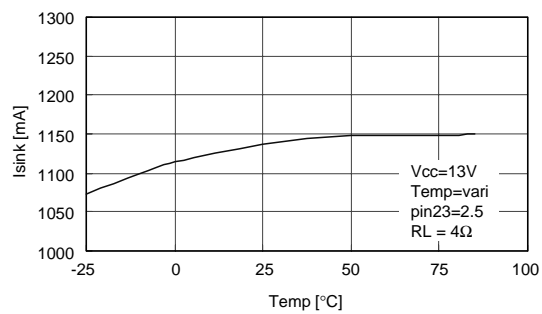
- 6. Radiation fin is connecting to the internal GND of the package.  
Connect the fin to the external GND.

# Typical Performance Characteristics

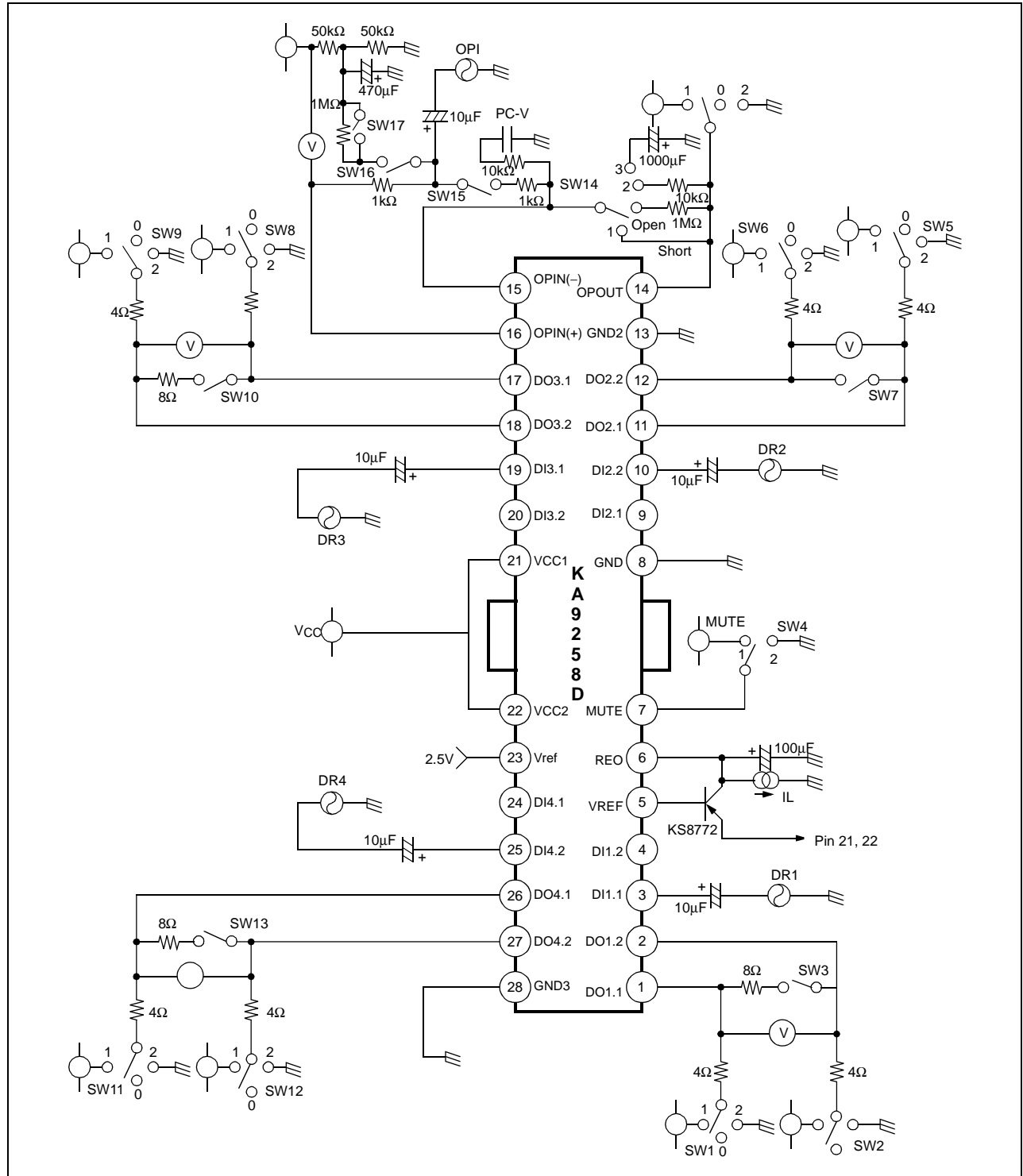




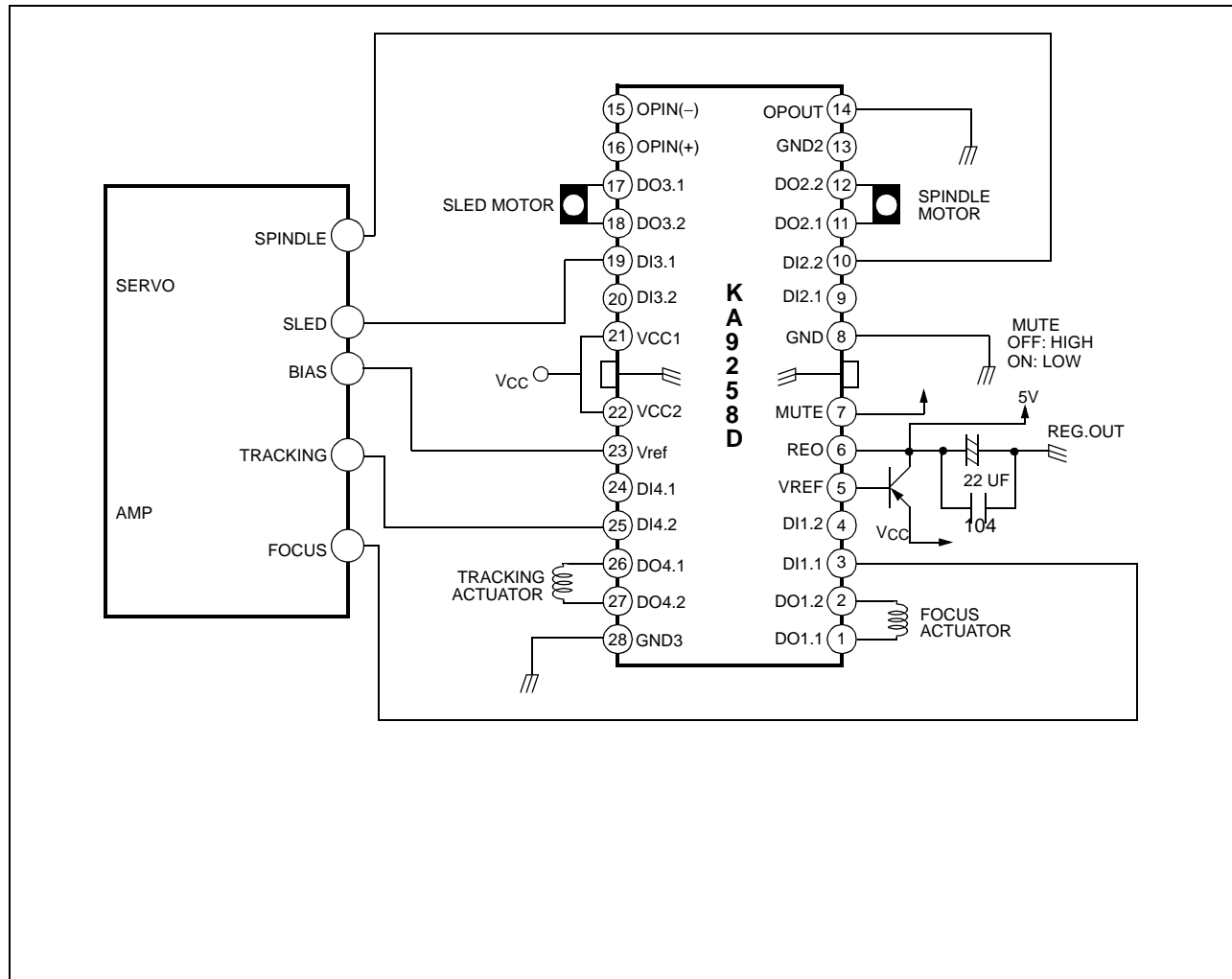
## Typical Performance Characteristics (Continued)

Temp vs I<sub>cc</sub>Temp vs I<sub>ccm</sub>Temp vs V<sub>reg</sub>Temp vs I<sub>source</sub>Temp vs I<sub>sink</sub>

# Test Circuits



## Application Circuits



### Thermal Shut Down Circuit

The IC breaks down by over heating when overload condition continues for a long time. KA9258D has built-in thermal shut down circuit to prevent this case. When IC temperature rises over 175°C, the circuit operates and protects the IC from break-down.

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