



# SANYO Semiconductors

## DATA SHEET

# LA6559

Monolithic Linear IC  
For CD  
**5-Channel Driver**  
(BTL : Four-Channel, H Bridge : One-Channel)

### Overview

The LA6559 is a 5-channel driver (BTL : 4-channel, H bridge : 1-channel) for CD players.

### Functions

- Power amplifier 5-channel built-in. (Bridge-connection (BTL) : 4-channel, H bridge : 1-channel)
- $I_O$  max 1A
- Level shift circuit built-in (except H bridge).
- Mute circuit (output ON/OFF) built-in.  
(Operable with BTL AMP with MUTE1 : CH1 and MUTE2 : CH2 to 4 and not operable for the H bridge of 3.3VREG)
- 3.3V regulator built-in (external PNP transistor).
- With a function to set the loading output voltage
- Overheat protection circuit (thermal shutdown) built-in.

### Specifications

**Maximum Ratings** at  $T_a = 25^\circ\text{C}$

| Parameter                   | Symbol       | Conditions                                | Ratings     | Unit             |
|-----------------------------|--------------|-------------------------------------------|-------------|------------------|
| Supply voltage              | $V_{CC}$ max |                                           | 14          | V                |
| Allowable power dissipation | $P_d$ max    | Independent IC                            | 0.8         | W                |
|                             |              | Mounted on a standard board. *            | 2           | W                |
| Maximum output current      | $I_O$ max    | Each output for H bridge, channel 1 to 4. | 1           | A                |
| Maximum input voltage       | $V_{INB}$    |                                           | 13          | V                |
| MUTE pin voltage            | $V_{MUTE}$   |                                           | 13          | V                |
| Operating temperature       | $T_{opr}$    |                                           | -30 to +85  | $^\circ\text{C}$ |
| Storage temperature         | $T_{stg}$    |                                           | -55 to +150 | $^\circ\text{C}$ |

\* Standard board size :  $76.1 \times 114.3 \times 1.6\text{mm}^3$ , glass epoxy.

**Recommended Operating Conditions** at  $T_a = 25^\circ\text{C}$

| Parameter      | Symbol   | Conditions              | Ratings   | Unit |
|----------------|----------|-------------------------|-----------|------|
| Supply voltage | $V_{CC}$ | Same for $V_{CC}$ -VREG | 5.6 to 13 | V    |

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**Electrical Characteristics** at  $T_a = 25^\circ\text{C}$ ,  $V_{CC1} = V_{CC2} = 8\text{V}$ ,  $V_{REF} = 1.65\text{V}$ , unless especially specified.

| Parameter                                         | Symbol                 | Conditions                                                                                 | Ratings |      |                      | Unit  |
|---------------------------------------------------|------------------------|--------------------------------------------------------------------------------------------|---------|------|----------------------|-------|
|                                                   |                        |                                                                                            | min     | typ  | max                  |       |
| ALL Blocks                                        |                        |                                                                                            |         |      |                      |       |
| No-load current drain ON                          | I <sub>CC</sub> -ON    | BTL-AMP output ON,<br>LOADING block OFF *1                                                 |         | 30   | 50                   | mA    |
| No-load current drain OFF                         | I <sub>CC</sub> -OFF   | All outputs OFF *1                                                                         |         | 10   | 20                   | mA    |
| VREF input voltage range                          | VREF-IN                |                                                                                            | 1       |      | V <sub>CC</sub> -1.5 | V     |
| Thermal shutdown temperature                      | TSD                    | *2                                                                                         | 150     | 175  | 200                  | °C    |
| BTL AMP Block (CH1 to CH4)                        |                        |                                                                                            |         |      |                      |       |
| Output offset voltage                             | V <sub>OFF</sub>       | Voltage difference between outputs for BTL<br>AMP, each channel. *3                        | -60     |      | 60                   | mV    |
| Input voltage range                               | V <sub>IN</sub>        | Input voltage range for input for OP-AMP.                                                  | 0       |      | V <sub>CC</sub> -1.5 | mA    |
| Output voltage                                    | V <sub>O</sub>         | Each voltage between V <sub>O</sub> + and V <sub>O</sub> - when<br>R <sub>L</sub> = 8Ω. *4 | 5.7     | 6.5  |                      | V     |
| Closed-circuit voltage gain                       | VG                     | Input and output gain. *3                                                                  | 5.4     | 6    | 6.6                  | Times |
| Slew rate                                         | SR                     | AMP Independent<br>Multiply 2 between outputs. *2                                          |         | 0.5  |                      | V/μs  |
| MUTE ON voltage                                   | VMUTE-ON               | Each MUTE *5                                                                               | 2       |      |                      | V     |
| MUTE OFF voltage                                  | VMUTE-OFF              | Each MUTE *5                                                                               |         |      | 0.5                  | V     |
| Input AMP Block (CH1 to 4)                        |                        |                                                                                            |         |      |                      |       |
| Input voltage range                               | V <sub>IN</sub> -OP    |                                                                                            | 0       |      | V <sub>CC</sub> -1.5 | V     |
| Output current (SINK)                             | SINK-OP                |                                                                                            | 2       |      |                      | mA    |
| Output current (SOURCE)                           | SOURCE-OP              | *6                                                                                         | 300     | 500  |                      | μA    |
| Output offset voltage                             | V <sub>OFF</sub> -OP   |                                                                                            | -10     |      | 10                   | mV    |
| Loading Block (CH5, H bridge)                     |                        |                                                                                            |         |      |                      |       |
| Output voltage                                    | V <sub>O</sub> -LOAD   | Forward, reverse,<br>R <sub>L</sub> = 8Ω, V <sub>CONT</sub> =8V *4                         | 5.7     | 6.5  |                      | V     |
| Break output saturation voltage                   | V <sub>CE</sub> -BREAK | Output voltage at braking *7                                                               |         |      | 0.3                  | V     |
| Input low level                                   | V <sub>IN</sub> -L     |                                                                                            |         |      | 1                    | V     |
| Input high level                                  | V <sub>IN</sub> -H     |                                                                                            | 2       |      |                      | V     |
| Output set voltage                                | V <sub>CONT</sub>      | I <sub>O</sub> = 200mA (Between outputs),<br>V <sub>CONT</sub> = 3V                        | 2.9     | 3.15 | 3.4                  | V     |
| Power Supply Block (PNP transistor : 2SB632K-use) |                        |                                                                                            |         |      |                      |       |
| 3.3V supply voltage                               | V <sub>OUT</sub>       | I <sub>O</sub> = 200mA                                                                     | 3.15    | 3.3  | 3.45                 | V     |
| REG-IN SINK current                               | REG-IN-SINK            | Base current of external PNP *8                                                            |         | 10   |                      | mA    |
| Line regulation                                   | ΔV <sub>O</sub> LN     | 6V ≤ V <sub>CC</sub> ≤ 12V                                                                 |         | 20   | 150                  | mV    |
| Load regulation                                   | ΔV <sub>O</sub> LD     | 5mA ≤ I <sub>O</sub> ≤ 200mA                                                               |         | 50   | 200                  | mV    |

Note \*1 : Current dissipation that is a sum of  $V_{CC1}$  and  $V_{CC2}$  and  $S-V_{CC}$  at no load.

\*2 : Design guarantee value

\*3 : Input AMP is a BUFFER AMP.

\*4 : Voltage difference between both ends of load ( $8\Omega$ ). Output saturated.

\*5 : Output ON with MUTE : [H] and OFF with MUTE : [L] (HI impedance).

\*6 : The source of input OP-AMP is a constant current. As the  $11\text{k}\Omega$  resistance to the next stage is a load, pay due attention when setting the input OP-AMP gain.

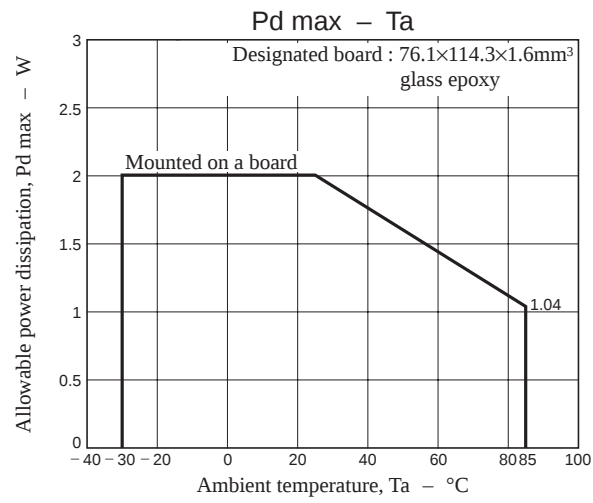
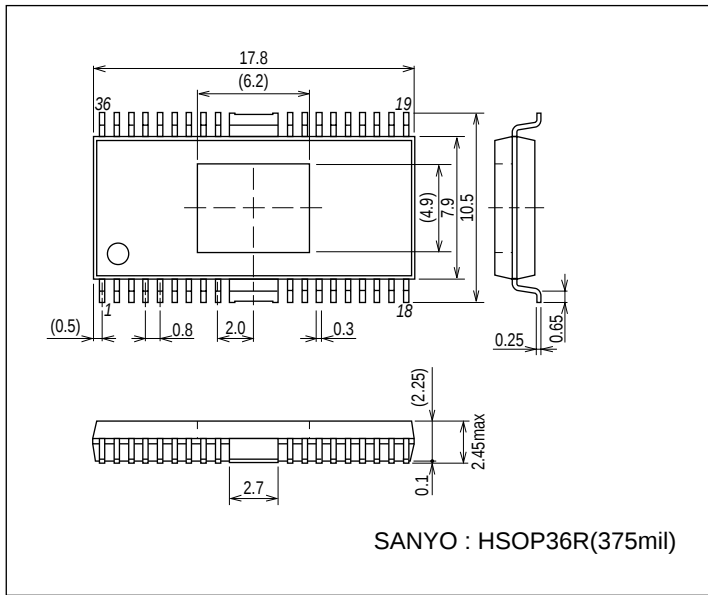
\*7 : Short (GND) brake used. SINK side output ON.

\*8 : 3.3VREG incorporates a drooping protection circuit and operated when the base current is  $10\text{mA}$  (TYP).

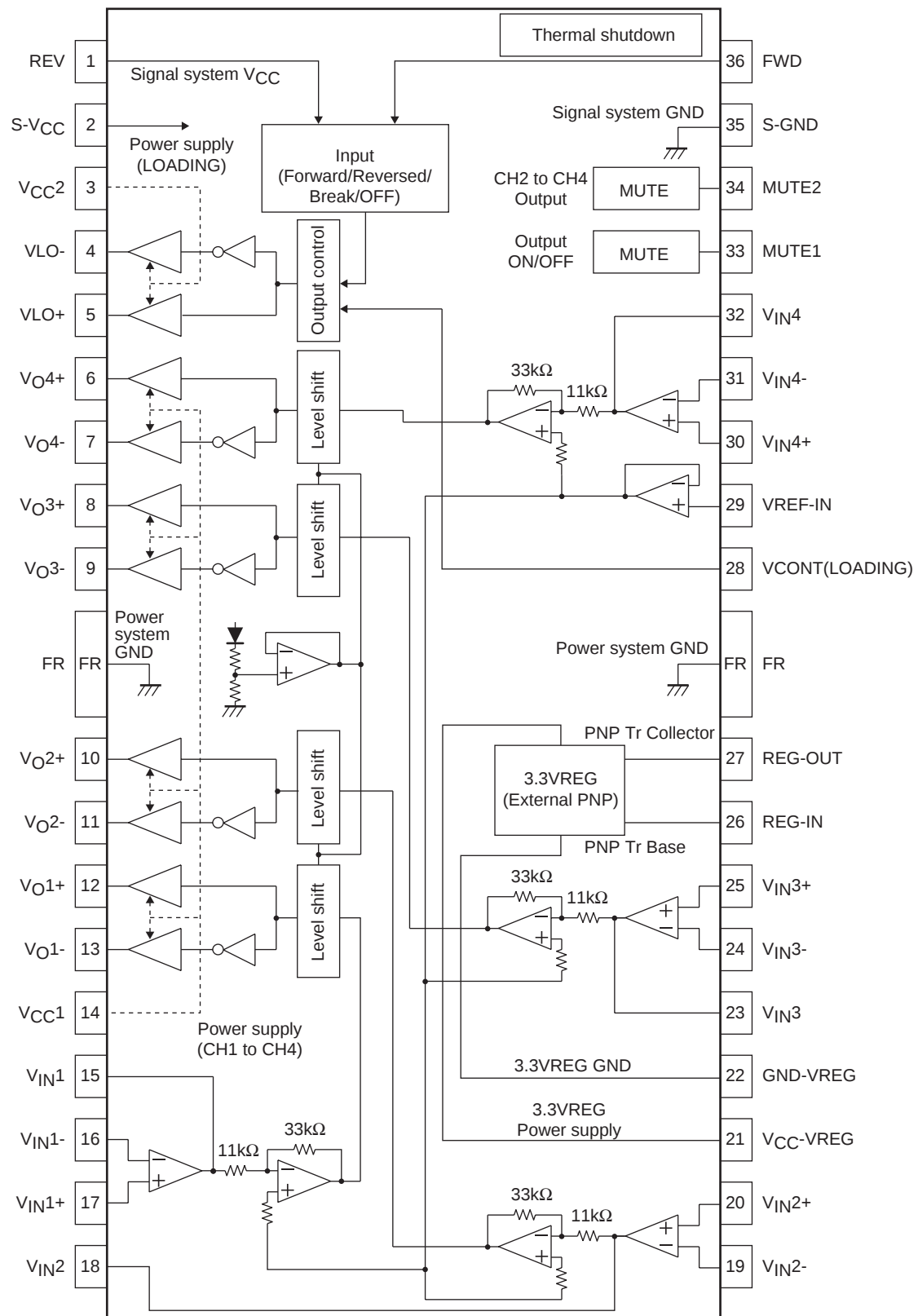
## Package Dimensions

unit : mm (typ)

3251



## Block Diagram



## Pin Functions

| Pin No. | Symbol                | Pin descriptions                                                                    |
|---------|-----------------------|-------------------------------------------------------------------------------------|
| 1       | REV                   | 5CH (VLO) Output change pin (REV), logic input for loading block.                   |
| 2       | S-V <sub>CC</sub>     | Signal system power supply (BTL-AMP : CH1 to 4)                                     |
| 3       | V <sub>CC</sub> 2     | Power supply for loading block                                                      |
| 4       | VLO-                  | Loading output (-)                                                                  |
| 5       | VLO+                  | Loading output (+)                                                                  |
| 6       | V <sub>O</sub> 4+     | Output pin (+) for channel 4                                                        |
| 7       | V <sub>O</sub> 4-     | Output pin (-) for channel 4                                                        |
| 8       | V <sub>O</sub> 3+     | Output pin (+) for channel 3                                                        |
| 9       | V <sub>O</sub> 3-     | Output pin (-) for channel 3                                                        |
| 10      | V <sub>O</sub> 2+     | Output pin (+) for channel 2                                                        |
| 11      | V <sub>O</sub> 2-     | Output pin (-) for channel 2                                                        |
| 12      | V <sub>O</sub> 1+     | Output pin (+) for channel 1                                                        |
| 13      | V <sub>O</sub> 1-     | Output pin (-) for channel 1                                                        |
| 14      | V <sub>CC</sub> 1     | CH1 to CH4 (BTL-AMP) output stage power supply                                      |
| 15      | V <sub>IN</sub> 1     | Input pin for channel 1                                                             |
| 16      | V <sub>IN</sub> 1-    | OP-AMP input AMP-A input pin (-)                                                    |
| 17      | V <sub>IN</sub> 1+    | OP-AMP input AMP-A input pin (+)                                                    |
| 18      | V <sub>IN</sub> 2     | Input pin for channel 2, input AMP output                                           |
| 19      | V <sub>IN</sub> 2-    | Input pin (-) for channel 2                                                         |
| 20      | V <sub>IN</sub> 2+    | Input pin (+) for channel 2                                                         |
| 21      | V <sub>CC</sub> -VREG | 3.3VREG power supply                                                                |
| 22      | GND-VREG              | 3.3VREG GND                                                                         |
| 23      | V <sub>IN</sub> 3     | Input pin for channel 3, input AMP output                                           |
| 24      | V <sub>IN</sub> 3-    | Input pin (-) for channel 3                                                         |
| 25      | V <sub>IN</sub> 3+    | Input pin (+) for channel 3                                                         |
| 26      | REG-IN                | PNP transistor base connected                                                       |
| 27      | REG-OUT               | 3.3V power output to which the PNP transistor collector connected.                  |
| 28      | VCONT (LOADING)       | Output voltage set pin for loading block                                            |
| 29      | VREF-IN               | Reference voltage applied pin                                                       |
| 30      | V <sub>IN</sub> 4+    | Input pin (+) for channel 4                                                         |
| 31      | V <sub>IN</sub> 4-    | Input pin (-) for channel 4                                                         |
| 32      | V <sub>IN</sub> 4     | Input pin for channel 4, input AMP output                                           |
| 33      | MUTE1                 | Output ON/OFF, channel 1 (BTL AMP)                                                  |
| 34      | MUTE2                 | Output ON/OFF, channel 2 to 4 (BTL AMP)                                             |
| 35      | S-GND                 | Signal system GND                                                                   |
| 36      | FWD                   | Output change pin (FWD) for loading output (VLO+ -), logic input for loading block. |

Note 1 : Center frame (FR) becomes GND for the power system (P-GND). Set this to the minimum potential together with S-GND.

Note 2 : Short-circuit each of V<sub>CC</sub>1, V<sub>CC</sub>2, V<sub>CC</sub>-VREG, and S-V<sub>CC</sub> power pins externally.

## Pin Description

| Pin No.                                                              | Symbol                                                                                                                                                           | Pin function         | Description                                                                                                                               | Equivalent circuit |
|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 17<br>16<br>15<br>20<br>19<br>18<br>25<br>24<br>23<br>30<br>31<br>32 | $V_{IN1+}$<br>$V_{IN1-}$<br>$V_{IN1}$<br>$V_{IN2+}$<br>$V_{IN2-}$<br>$V_{IN2}$<br>$V_{IN3+}$<br>$V_{IN3-}$<br>$V_{IN3}$<br>$V_{IN4+}$<br>$V_{IN4-}$<br>$V_{IN4}$ | Input<br>(CH1 to 4)  | Input pin (CH1 to 4)                                                                                                                      |                    |
| 36<br>1                                                              | FWD<br>REV                                                                                                                                                       | Input<br>(LOADING)   | Logic input pin.<br>By combining H and L<br>of this pin, any one of<br>four modes (forward/<br>reversed/brake/idling)<br>can be selected. |                    |
| 12<br>13<br>10<br>11<br>8<br>9<br>6<br>7                             | $V_{O1+}$<br>$V_{O1-}$<br>$V_{O2+}$<br>$V_{O2-}$<br>$V_{O3+}$<br>$V_{O3-}$<br>$V_{O4+}$<br>$V_{O4-}$                                                             | Output<br>(CH1 to 4) | Output for channel<br>1 to 4.                                                                                                             |                    |
| 33<br>34                                                             | MUTE1<br>MUTE2                                                                                                                                                   | MUTE                 | BTL AMP output.<br>Output ON/OFF for<br>CH1 to CH4.<br>MUTE : H Output OFF<br>MUTE : L Output OFF                                         |                    |
| 5<br>4<br>28                                                         | VLO-<br>VLO+<br>VCONT                                                                                                                                            | Output<br>(LOADING)  | Output voltage set pin<br>for loading block                                                                                               |                    |

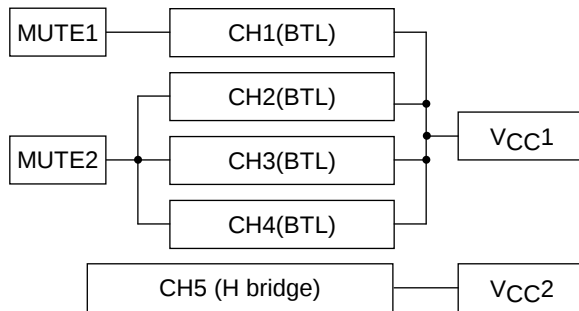
**Truth Table** (loading (H bridge) section)

| FWD | REV | Loading output   |
|-----|-----|------------------|
| L   | L   | OFF *1           |
|     | H   | Forward          |
| H   | L   | Reversed         |
|     | H   | (Short) brake *2 |

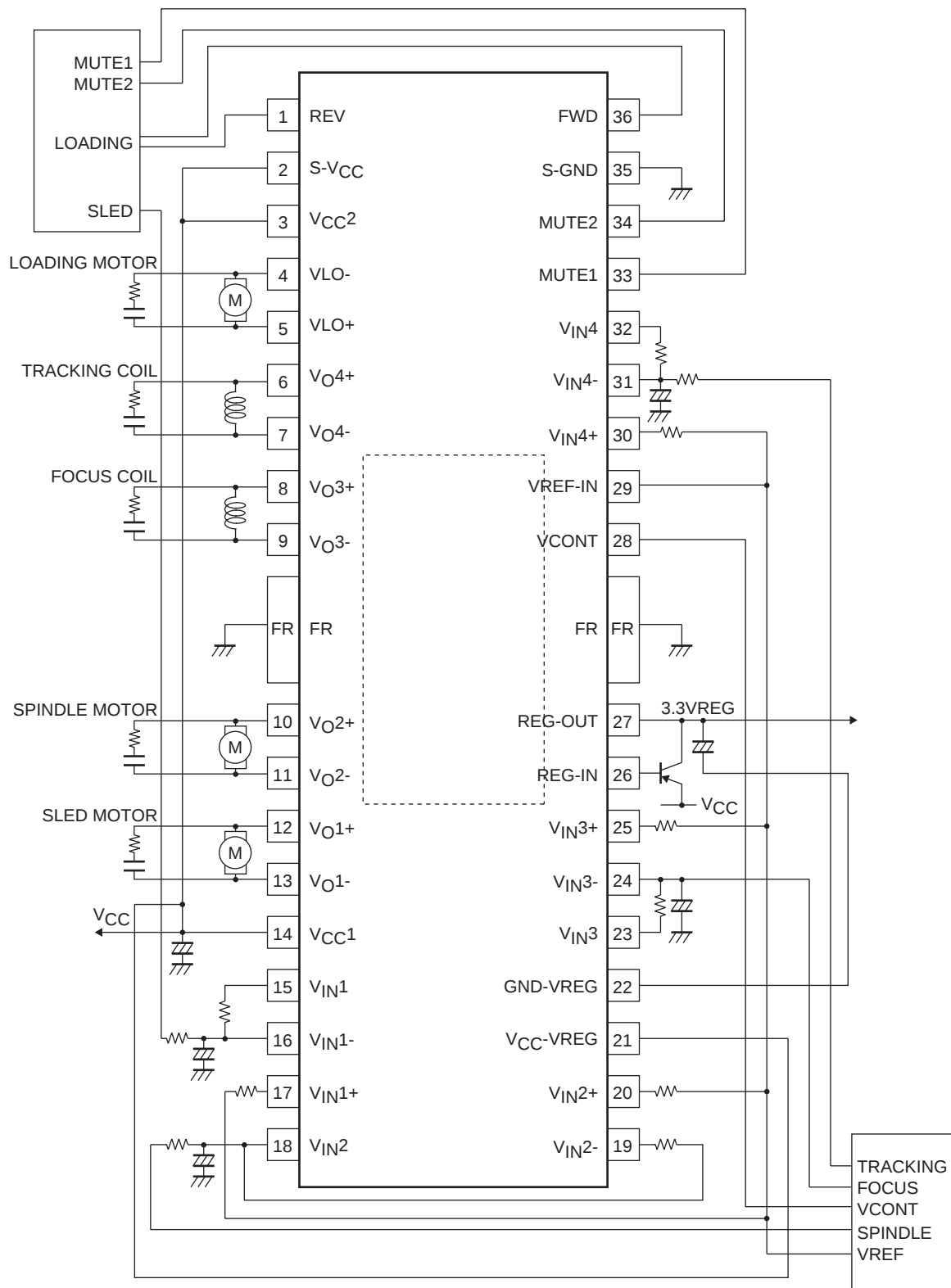
\*1 The output has a high impedance.

\*2 At brake, the SINK side transistor is ON (short brake).

VLO+ and VLO- are approximately on the GND level.

**Relation of MUTE and Power (VCC\*)**

# Sample Application Circuit



Note : Add CR between outputs or to a circuit to GND when oscillation occurs in the output  
(Example : R = 2.2Ω, C = 0.1μF). Apply 4.5V or more to the external PNPT<sub>r</sub> emitter pin.

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