

# 1-channel BTL driver for CD players

## BA6195FP-Y / BA6195

The BA6195FP-Y and BA6195 are ICs for CD players and have one internal BTL power driver circuit and one operational amplifier circuit with a wide output dynamic range. The wide dynamic range and internal operational amplifier make these ICs ideal for low voltage drive. The driver's internal level shift circuit reduces the number of attached components needed.

### ●Applications

CD players, CD-ROM drives and other optical disc devices

### ●Features

- 1) HSOP 25-pin power package allows for miniaturization of applications (BA6195FP-Y).
- 2) Wide dynamic range. (typically 5.4V when  $V_{CC} = 8V$ ,  $R_L = 8\Omega$ )
- 3) Internal thermal shutdown circuit with hysteresis.
- 4) Internal level shift circuit, for a minimal number of attached components.
- 5) Internal operational amplifier with wide dynamic range.

### ●Absolute maximum ratings ( $T_a = 25^\circ\text{C}$ )

| Parameter             |            | Symbol    | Limits          | Unit             |
|-----------------------|------------|-----------|-----------------|------------------|
| Power supply voltage  |            | $V_{CC}$  | 18              | V                |
| Power dissipation     | BA6195FP-Y | $P_d$     | 1450*1          | mW               |
|                       | BA6195     |           | 1250*2          |                  |
| Operating temperature |            | $T_{opr}$ | $-35 \sim +85$  | $^\circ\text{C}$ |
| Storage temperature   |            | $T_{stg}$ | $-55 \sim +150$ | $^\circ\text{C}$ |

\*1 When mounted on a  $50 \times 50 \times 1.0$  mm PCB board.

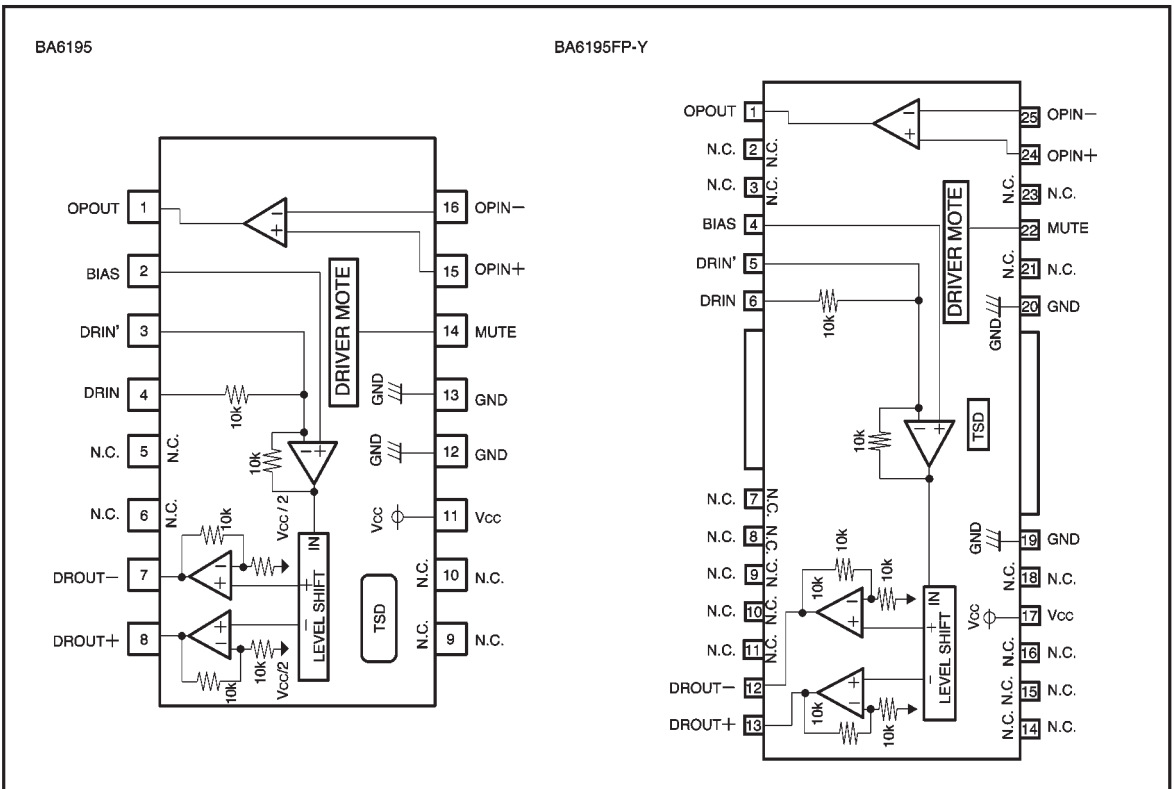
Reduced by 11.6 mW for each increase in  $T_a$  of  $1^\circ\text{C}$  over  $25^\circ\text{C}$ .

\*2 Reduced by 10 mW for each increase in  $T_a$  of  $1^\circ\text{C}$  over  $25^\circ\text{C}$ .

### ●Recommended operating conditions ( $T_a = 25^\circ\text{C}$ )

| Parameter            | Symbol   | Min. | Typ. | Max. | Unit |
|----------------------|----------|------|------|------|------|
| Power supply voltage | $V_{CC}$ | 4.5  | —    | 13.5 | V    |

## ● Block diagram



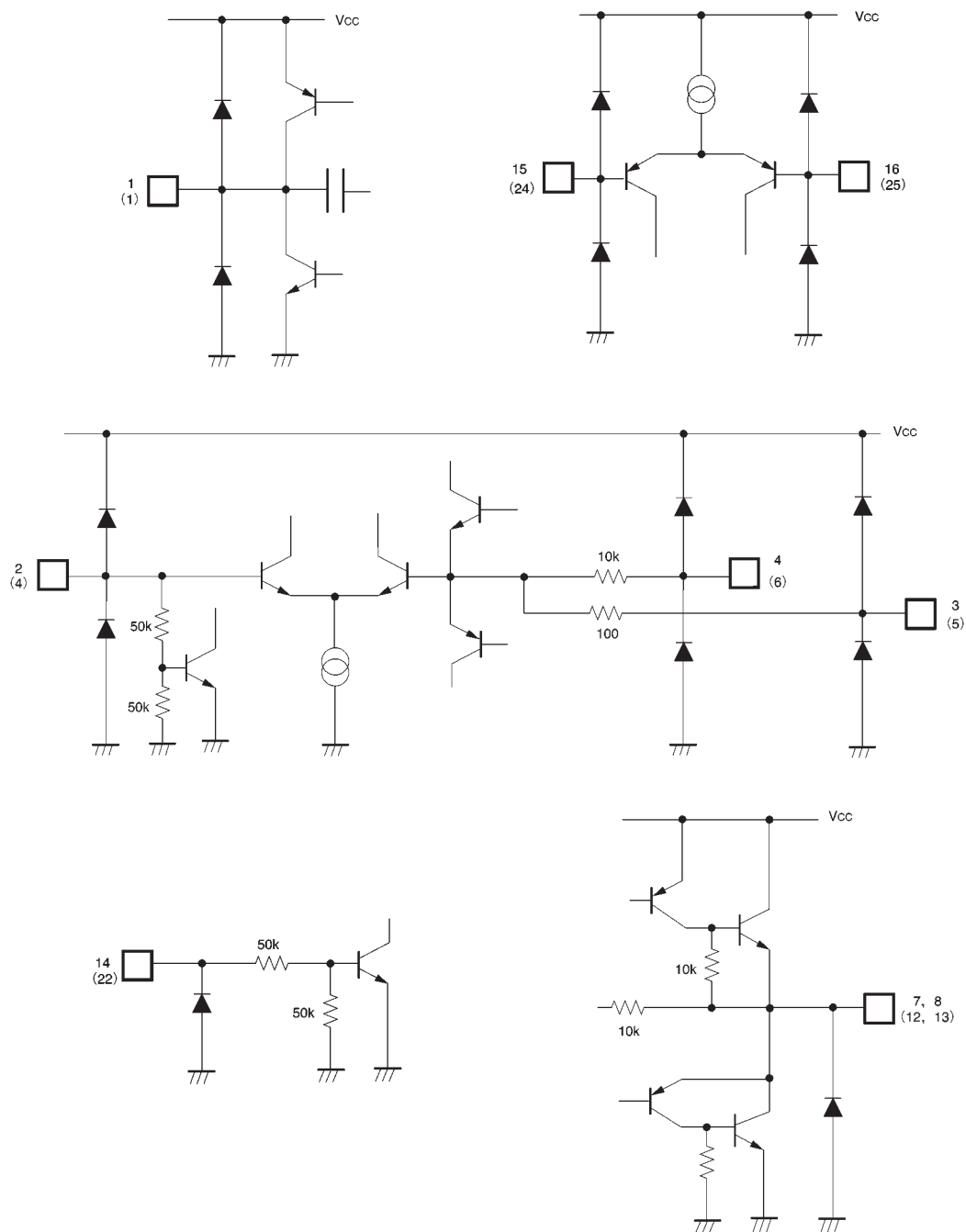
## ● Pin descriptions (BA6195)

| Pin No. | Pin name | Function                                   |
|---------|----------|--------------------------------------------|
| 1       | OPOUT    | Operational amplifier output               |
| 2       | BIAS     | Bias pin                                   |
| 3       | DRIN'    | Driver gain adjustment                     |
| 4       | DRIN     | Driver gain input                          |
| 5       | N.C.     | N.C (not connected internally)             |
| 6       | N.C.     | N.C (not connected internally)             |
| 7       | DROUT-   | Driver negative (relative to input) output |
| 8       | DROUT+   | Driver positive (relative to input) output |
| 9       | N.C.     | N.C. (not connected internally)            |
| 10      | N.C.     | N.C. (not connected internally)            |
| 11      | Vcc      | Vcc                                        |
| 12      | GND      | Substrate ground                           |
| 13      | GND      | Substrate ground                           |
| 14      | MUTE     | Mute                                       |
| 15      | OPIN+    | Operational amplifier noninverting input   |
| 16      | OPIN-    | Operational amplifier inverting input      |

## ● Pin descriptions (BA6195FP-Y)

| Pin No. | Pin name           | Function                                   |
|---------|--------------------|--------------------------------------------|
| 1       | OPOUT              | Operational amplifier output               |
| 2       | N.C.               | —                                          |
| 3       | N.C.               | —                                          |
| 4       | BIAS               | Bias                                       |
| 5       | DRIN <sup>+</sup>  | Driver gain adjustment                     |
| 6       | DRIN               | Driver gain input                          |
| 7       | N.C.               | —                                          |
| 8       | N.C.               | —                                          |
| 9       | N.C.               | —                                          |
| 10      | N.C.               | —                                          |
| 11      | N.C.               | —                                          |
| 12      | DROUT <sup>—</sup> | Driver negative (relative to input) output |
| 13      | DROUT <sup>+</sup> | Driver positive (relative to input) output |
| 14      | N.C.               | —                                          |
| 15      | N.C.               | —                                          |
| 16      | N.C.               | —                                          |
| 17      | V <sub>cc</sub>    | V <sub>cc</sub>                            |
| 18      | N.C.               | —                                          |
| 19      | GND                | Substrate ground                           |
| 20      | GND                | Substrate ground                           |
| 21      | N.C.               | —                                          |
| 22      | MUTE               | Mute                                       |
| 23      | N.C.               | —                                          |
| 24      | OPIN <sup>+</sup>  | Operational amplifier noninverting input   |
| 25      | OPIN <sup>—</sup>  | Operational amplifier inverting input      |

## ● Input / output circuits



Parentheses indicate pin numbers for BA6195FP-Y

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V<sub>CC</sub> = 8V, f = 1kHz, R<sub>L</sub> = 8Ω)

| Parameter                     | Symbol            | Min. | Typ. | Max.            | Unit   | Conditions                                                    | Measurement Circuit |
|-------------------------------|-------------------|------|------|-----------------|--------|---------------------------------------------------------------|---------------------|
| Quiescent current dissipation | I <sub>Q</sub>    | —    | 6.5  | 9.0             | mA     | No load                                                       | Fig.1, 2            |
| Output voltage, offset        | V <sub>OO</sub>   | −40  | —    | 40              | mV     | V <sub>IN</sub> =BIAS=2.5V                                    | Fig.1, 2            |
| Max. output amplitude         | V <sub>OM</sub>   | 5.0  | 5.4  | —               | V      | —                                                             | Fig.1, 2            |
| Closed loop voltage gain      | G <sub>VC</sub>   | 10.5 | 12.0 | 13.5            | dB     | V <sub>IN</sub> =2V, 3V BIAS=2.5V                             | Fig.1, 2            |
| Ripple rejection              | RR                | —    | 60   | —               | dB     | V <sub>IN</sub> =0.1V <sub>rms</sub> , 100Hz                  | Fig.1, 2            |
| Slew rate                     | SR                | —    | 2    | —               | V / μs | 100 kHz square wave, 3 V <sub>P-P</sub> output                | Fig.1, 2            |
| Mute-off voltage              | V <sub>MOFF</sub> | GND  | —    | 0.5             | V      | —                                                             | Fig.1, 2            |
| Mute-on voltage               | V <sub>MON</sub>  | 2.0  | —    | V <sub>CC</sub> | V      | —                                                             | Fig.1, 2            |
| 〈Operational amplifier〉       |                   |      |      |                 |        |                                                               |                     |
| Offset voltage                | V <sub>OFOF</sub> | −6   | 0    | 6               | mV     | —                                                             | Fig.1, 2            |
| Input bias current            | I <sub>B</sub>    | —    | 30   | 300             | nA     | —                                                             | Fig.1, 2            |
| Synch. input voltage          | V <sub>ICM</sub>  | 0    | —    | 6.8             | V      | —                                                             | Fig.1, 2            |
| Output high level voltage     | V <sub>OH</sub>   | 7.1  | 7.8  | —               | V      | V <sub>IN</sub> = GND, inversion amplifier conf.              | Fig.1, 2            |
| Output low level voltage      | V <sub>OL</sub>   | —    | 0.2  | 0.9             | V      | V <sub>IN</sub> = V <sub>CC</sub> , inversion amplifier conf. | Fig.1, 2            |
| Out. drive curr. (source)     | I <sub>OH</sub>   | 1    | 3    | —               | mA     | GND at 50 Ω output                                            | Fig.1, 2            |
| Out. drive curr. (sink)       | I <sub>OL</sub>   | 10   | 30   | —               | mA     | V <sub>CC</sub> at 50 Ω output                                | Fig.1, 2            |
| Slew rate                     | SR <sub>OP</sub>  | —    | 1    | —               | V / μs | 100 kHz square wave, 3 V <sub>P-P</sub> output                | Fig.1, 2            |
| Ripple rejection              | RR                | —    | 60   | —               | dB     | V <sub>IN</sub> =0.1V <sub>rms</sub> , 100Hz                  | Fig.1, 2            |

◎Not designed for radiation resistance.

## ● Measurement circuit switch table

| Symbol            | Switch |     |      |      |        |       |    | Input   |         |         |         |        |      |      | Note                        |
|-------------------|--------|-----|------|------|--------|-------|----|---------|---------|---------|---------|--------|------|------|-----------------------------|
|                   | RIP    | RL  | VREF | DRIN | OP OUT | OP IN | NF | DRIN DC | DRIN AC | OPIN DC | OPIN AC | RIPPLE | BIAS | MUTE |                             |
| I <sub>Q</sub>    | ON     | OFF | ON   | A    | A      | OFF   | A  | 2.5V    | 0V      | 0V      | 0V      | 0V     | 2.5V | 2.0V |                             |
| V <sub>OO</sub>   | ↓      | ON  | ↓    | ↓    | ↓      | ↓     | ↓  | ↓       | ↓       | ↓       | ↓       | ↓      | ↓    | ↓    |                             |
| V <sub>OM</sub>   | ↓      | ↓   | ↓    | ↓    | ↓      | ↓     | ↓  | Note    | ↓       | ↓       | ↓       | ↓      | 4V   | ↓    | 0V, 8V                      |
| G <sub>VC</sub>   | ↓      | ↓   | ↓    | ↓    | ↓      | ↓     | ↓  | Note    | ↓       | ↓       | ↓       | ↓      | 2.5V | ↓    | 2V, 3V                      |
| RR                | OFF    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓  | 2.5V    | ↓       | ↓       | ↓       | Note   | ↓    | ↓    | 0.1V <sub>rms</sub> , 100Hz |
| SR                | ON     | ↓   | ↓    | B    | ↓      | ↓     | ↓  | 0V      | Note    | ↓       | ↓       | 0V     | ↓    | ↓    | 100 kHz, square wave        |
| V <sub>MOFF</sub> | ↓      | ↓   | ↓    | ↓    | ↓      | ↓     | ↓  | ↓       | Note    | ↓       | ↓       | ↓      | ↓    | ↓    | Desired sine wave           |
| V <sub>MON</sub>  | ↓      | ↓   | ↓    | ↓    | ↓      | ↓     | ↓  | ↓       | Note    | ↓       | ↓       | ↓      | ↓    | 0.5V | Desired sine wave           |
| (OP-AMP)          |        |     |      |      |        |       |    |         |         |         |         |        |      |      |                             |
| V <sub>OFOP</sub> | ON     | OFF | ON   | A    | A      | OFF   | A  | 2.5V    | 0V      | 0V      | 0V      | 0V     | 2.5V | 2.0V |                             |
| I <sub>B</sub>    | ↓      | ↓   | OFF  | ↓    | ↓      | ↓     | C  | ↓       | ↓       | ↓       | ↓       | ↓      | ↓    | ↓    |                             |
| V <sub>ICM</sub>  | ↓      | ↓   | ON   | ↓    | ↓      | ↓     | A  | ↓       | ↓       | ↓       | ↓       | ↓      | ↓    | ↓    |                             |
| V <sub>OH</sub>   | ↓      | ↓   | ↓    | ↓    | ↓      | ON    | B  | ↓       | ↓       | ↓       | ↓       | ↓      | ↓    | ↓    |                             |
| V <sub>OL</sub>   | ↓      | ↓   | ↓    | ↓    | ↓      | ↓     | ↓  | ↓       | ↓       | 8V      | ↓       | ↓      | ↓    | ↓    |                             |
| I <sub>OH</sub>   | ↓      | ↓   | ↓    | ↓    | C      | OFF   | A  | ↓       | ↓       | 0V      | ↓       | ↓      | ↓    | ↓    |                             |
| I <sub>OL</sub>   | ↓      | ↓   | ↓    | ↓    | B      | ↓     | ↓  | ↓       | ↓       | ↓       | ↓       | ↓      | ↓    | ↓    |                             |
| S <sub>ROP</sub>  | ↓      | ↓   | ↓    | ↓    | A      | ↓     | ↓  | ↓       | ↓       | ↓       | Note    | ↓      | ↓    | ↓    | 100 kHz, square wave        |
| R <sub>ROP</sub>  | OFF    | ↓   | ↓    | ↓    | ↓      | ↓     | ↓  | ↓       | ↓       | ↓       | 0V      | Note   | ↓    | ↓    | 0.1V <sub>rms</sub> , 100Hz |

## ● Measurement circuits

BA6195

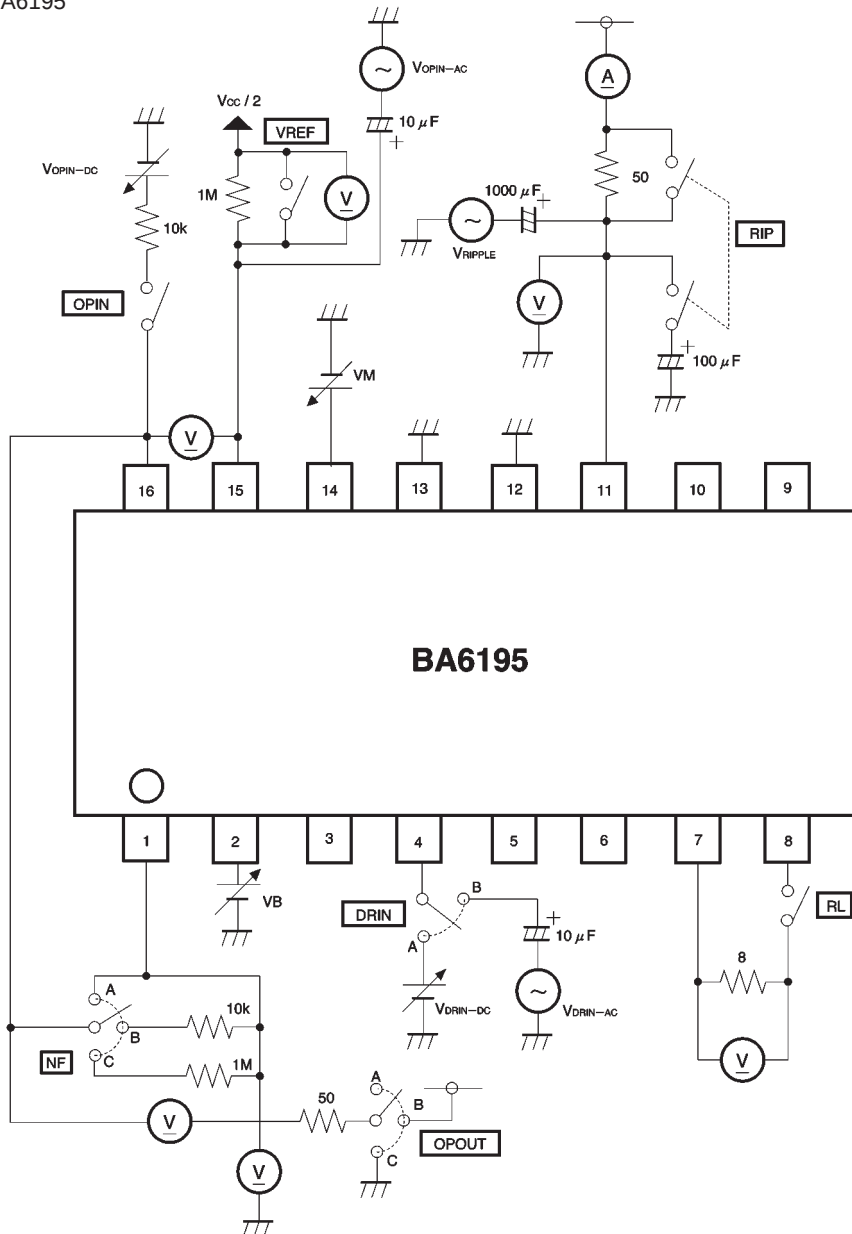


Fig. 1

BA6195FP-Y

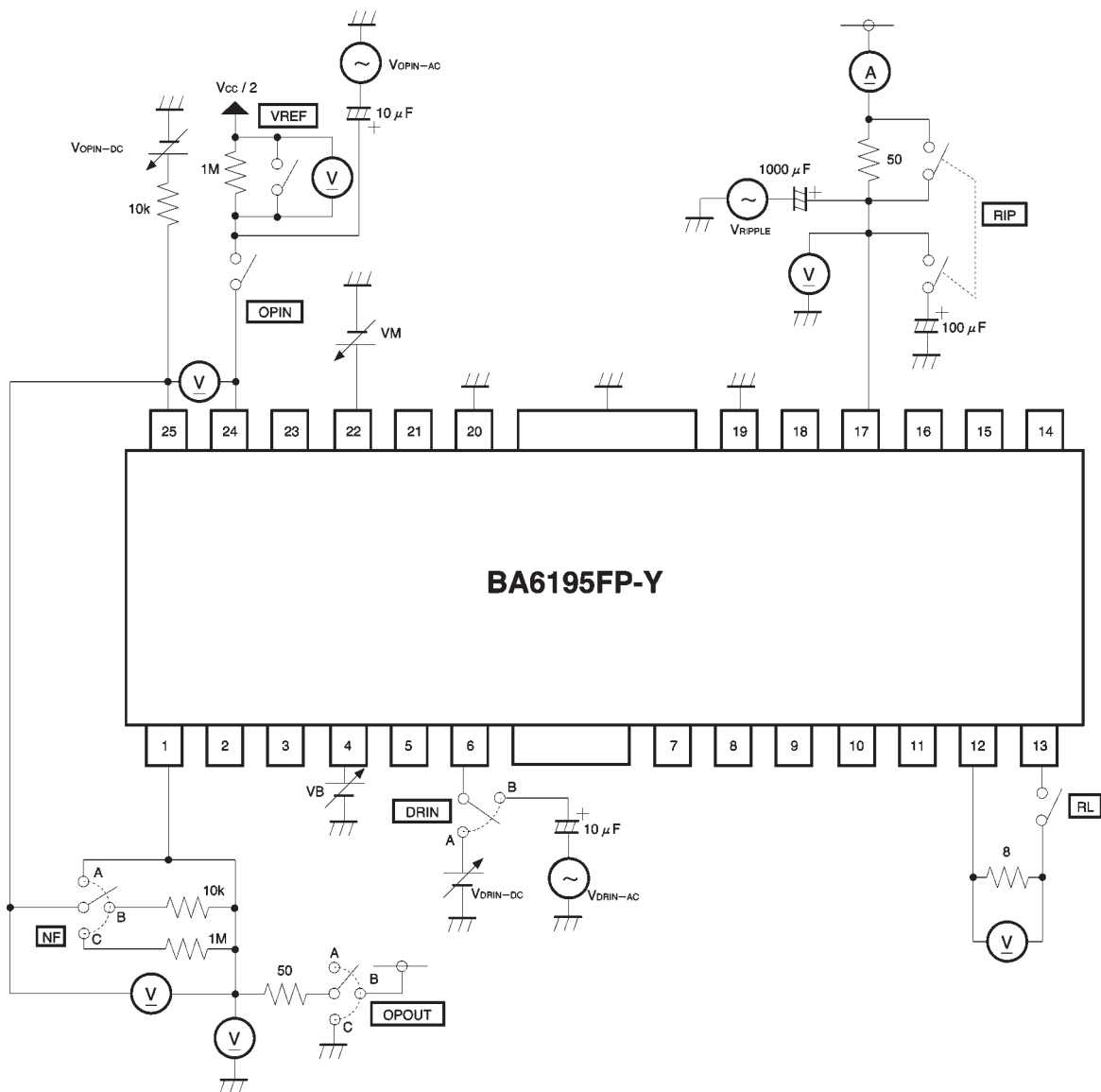


Fig. 2

## ● Application examples

## BA6195

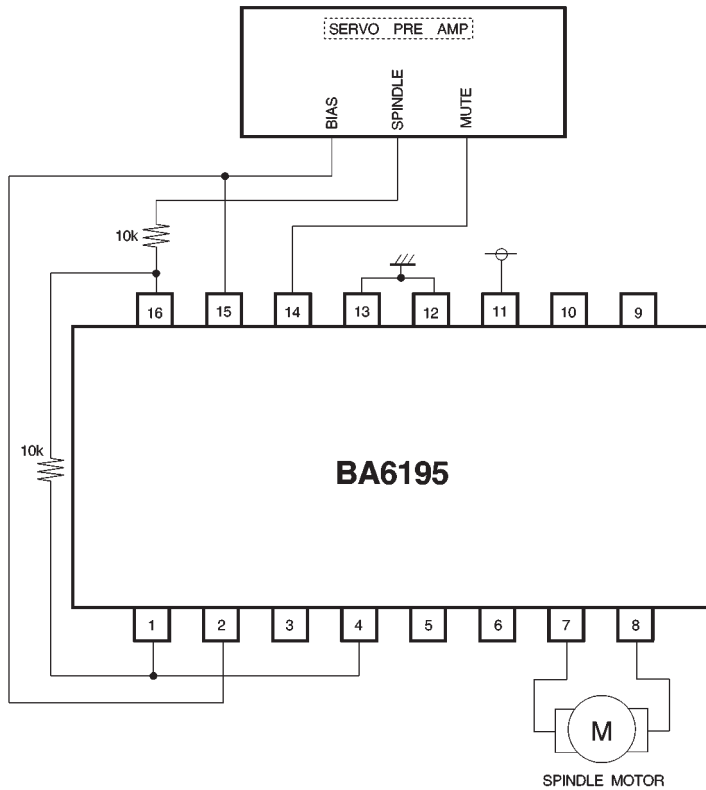


Fig. 3

BA6195FP-Y

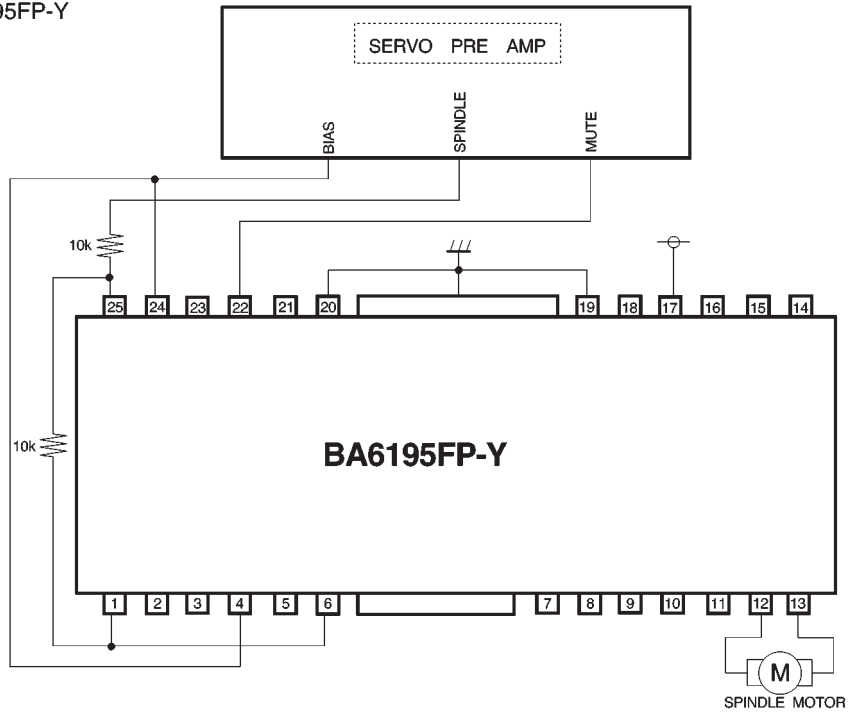


Fig. 4

## ● Operation notes

- 1) The thermal shutdown circuit mutes the output current when the chip temperature rises above 175°C (typically). Hysteresis width is set at 25°C (typically), and muting is canceled when the chip temperature drops below 150°C.
- 2) The output current can be muted by raising the external mute pin above 2.0V. Pin 14 should be pulled down below 0.5V during normal operation.

- 3) Muting occurs during thermal shutdown and external muting. In each case, only the drivers are muted. During muting, the output pins remain at the internal bias voltage, roughly ( $V_{CC} / 2$ ).
- 4) Connect the IC to a 0.1μF bypass capacitor to the power supply, at the base of the IC.
- 5) Connect the radiating fin to an external ground (BA6195FP-Y).

## ● Electrical characteristic curves

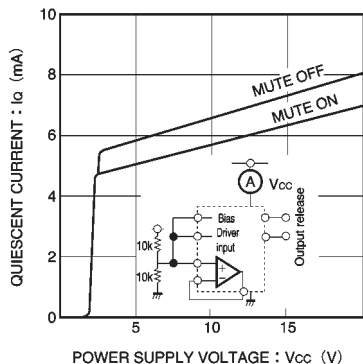


Fig. 5 Power supply voltage vs. quiescent current

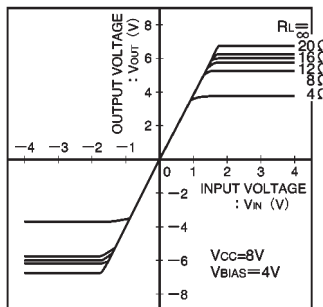


Fig. 6 I/O characteristics (variable load)

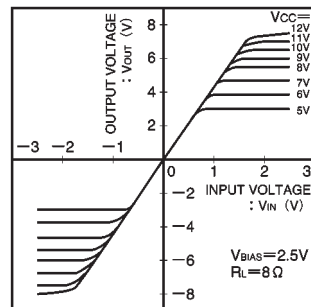


Fig. 7 I/O characteristics (variable supply voltage)

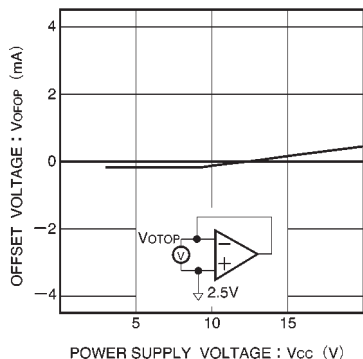


Fig. 8 Power supply voltage vs. input offset voltage

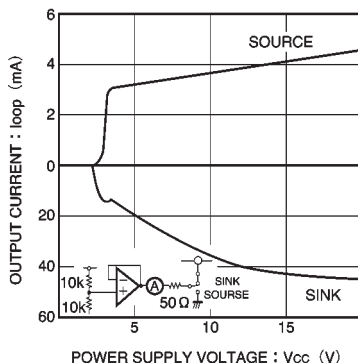


Fig. 9 Power supply voltage vs. operational amplifier output drive current

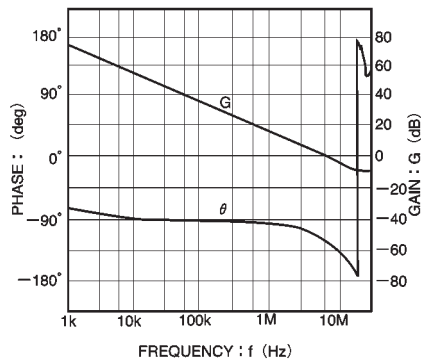


Fig. 10 Operational amplifier vs. openloop

● External dimensions (Units: mm)

