

RF Amplifier for CD Players

Description

The CXA1791M/N is an IC developed for compact disc players. This IC incorporates an APC circuit and amplifiers for 3-spot optical pick-up output, focus error, and tracking error.

Features

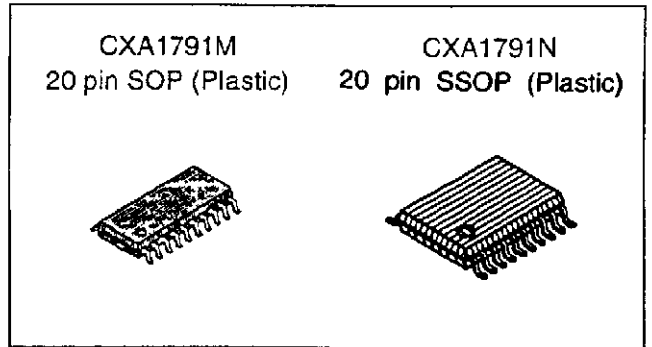
- Low power consumption (40mW at  $\pm 2.5V$ ).
- Supports the RF amplifier at double speed.
- APC circuit.
- Operates at dual  $\pm 5V$  power supply or single +5V power supply.
- The gains for APC circuit and each amplifier are interchangeable with these of the CXA1571.

Absolute Maximum Ratings

- Supply voltage  $V_{CC}-V_{EE}$  12 V
- Operating temperature  $T_{opr}$  -20 to +85 °C
- Storage temperature  $T_{stg}$  -65 to +150 °C
- Allowable power dissipation  $P_D$  (SOP) 600 mW  
(SSOP) 375 mW

Operating Conditions

- Supply voltage  $V_{CC}-V_{EE}$  3.0 to 11.0 V



Functions

- RF amplifier
- Focus error amplifier
- Tracking error amplifier
- APC circuit

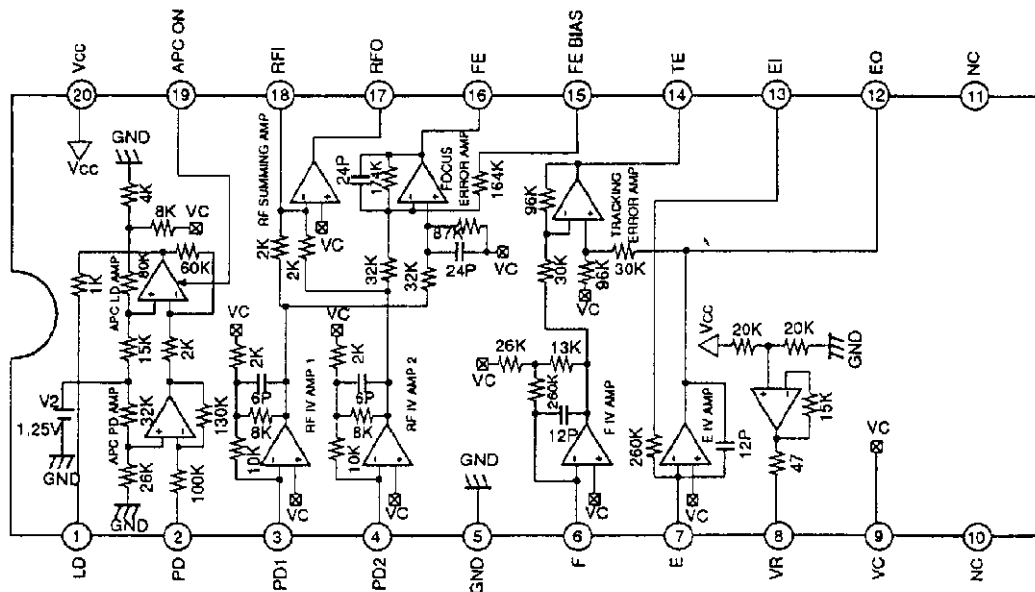
Applications

Compact disc players

Structure

Bipolar silicon monolithic IC

Block Diagram and Pin Configuration (Top View)



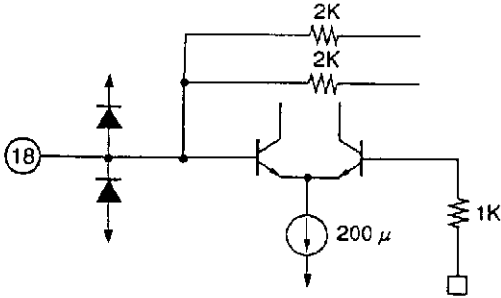
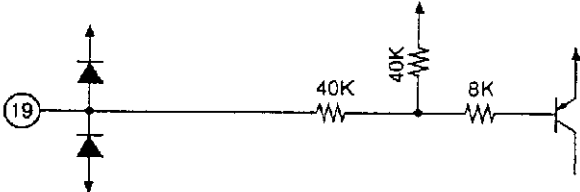
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Pin Description

| Pin No. | Symbol     | I/O    | Equivalent circuit | Description   |
|---------|------------|--------|--------------------|---|
| 1       | LD         | O      |                    | APC amplifier output.   |
| 2       | PD         | I      |                    | APC amplifier input.  |
| 3<br>4  | PD1<br>PD2 | I<br>I |                    | Inversion input for RF I-V amplifiers. Connect these pins to the photodiode A+C and B+D pins respectively. Input the current. |
| 6<br>7  | F<br>E     | I<br>I |                    | Inversion input for F and E I-V amplifiers. Connect these pins to the photodiode F and E respectively. Input the current.     |

| Pin No. | Symbol | I/O | Equivalent circuit | Description  |
|---------|--------|-----|--------------------|--|
| 8       | VR     | O   |                    | (V <sub>CC</sub> +V <sub>EE</sub> )/2<br>DC voltage output.  |
| 9       | VC     | I   |                    | Center voltage input for VC.<br>Connect this pin to GND for dual ±5V power supply; to VR pin for single 5V power supply. |
| 12      | EO     | O   |                    | Monitoring output for I-V amplifier E.   |
| 13      | EI     | —   |                    | Gain adjustment for I-V amplifier E.   |

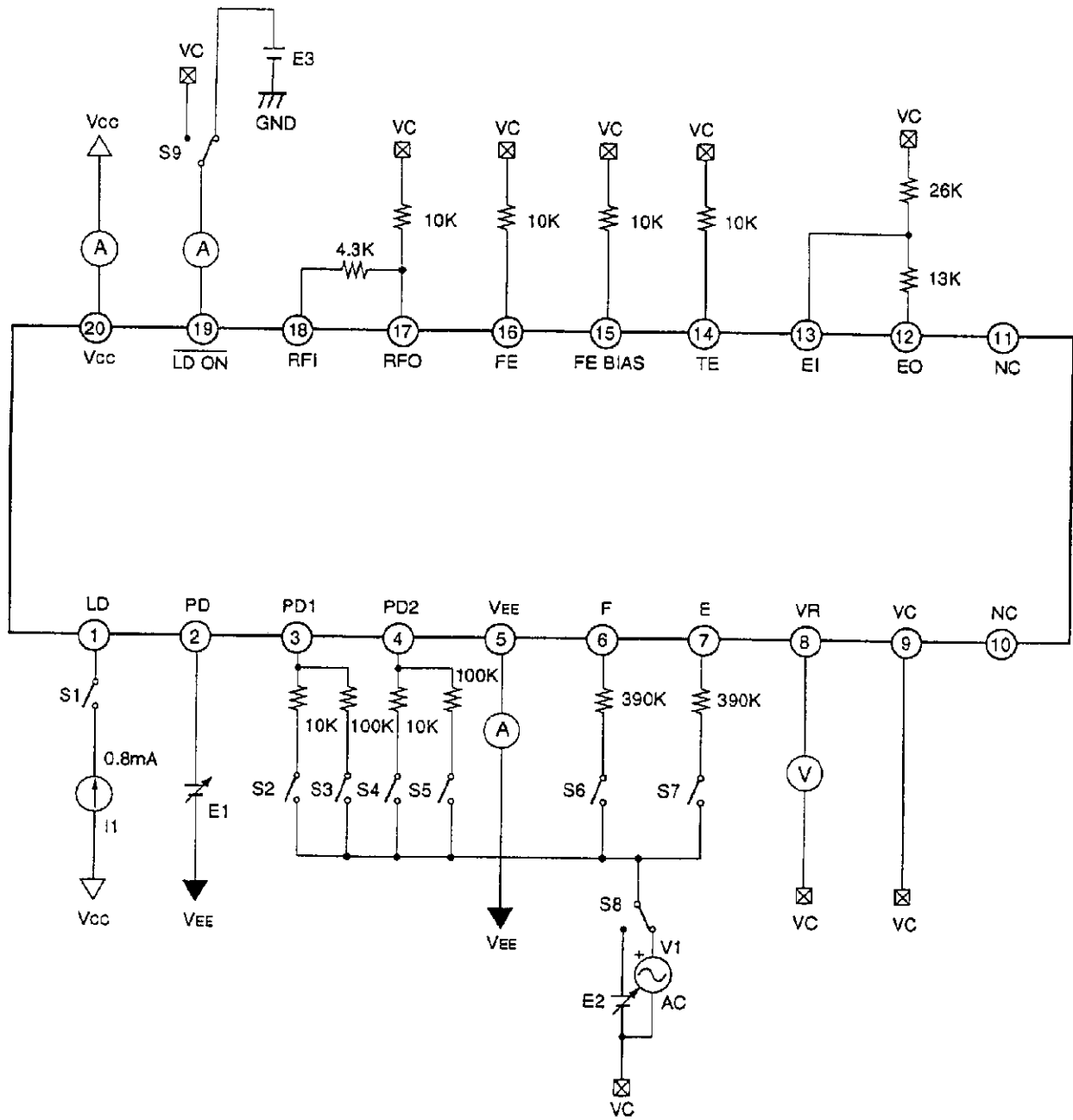
| Pin No. | Symbol  | I/O | Equivalent circuit | Description   |
|---------|---------|-----|--------------------|---|
| 14      | TE      | O   |                    | Tracking error amplifier output. Outputs the E-F signal.    |
| 15      | FE-BIAS | I   |                    | Bias adjustment for inverted side of focus error amplifier. |
| 16      | FE      | O   |                    | Focus error amplifier output.                               |
| 17      | RFO     | O   |                    | RF amplifier output.  |

| Pin No. | Symbol | I/O | Equivalent circuit   | Description   |
|---------|--------|-----|--|---|
| 18      | RFI    | I   |  | <p>Inverted side input of RF amplifier.<br/>RF amplifier gain is determined by the resistor connected between this pin and RFO pin.</p> |
| 19      | LD-ON  | I   |  | <p>APC amplifier ON/OFF switching.<br/>ON for GND;<br/>OFF for Vcc</p>  |

±2.5V power supply (V<sub>CC</sub>=2.5V, V<sub>EE</sub>=-2.5V, V<sub>C</sub>=GND)

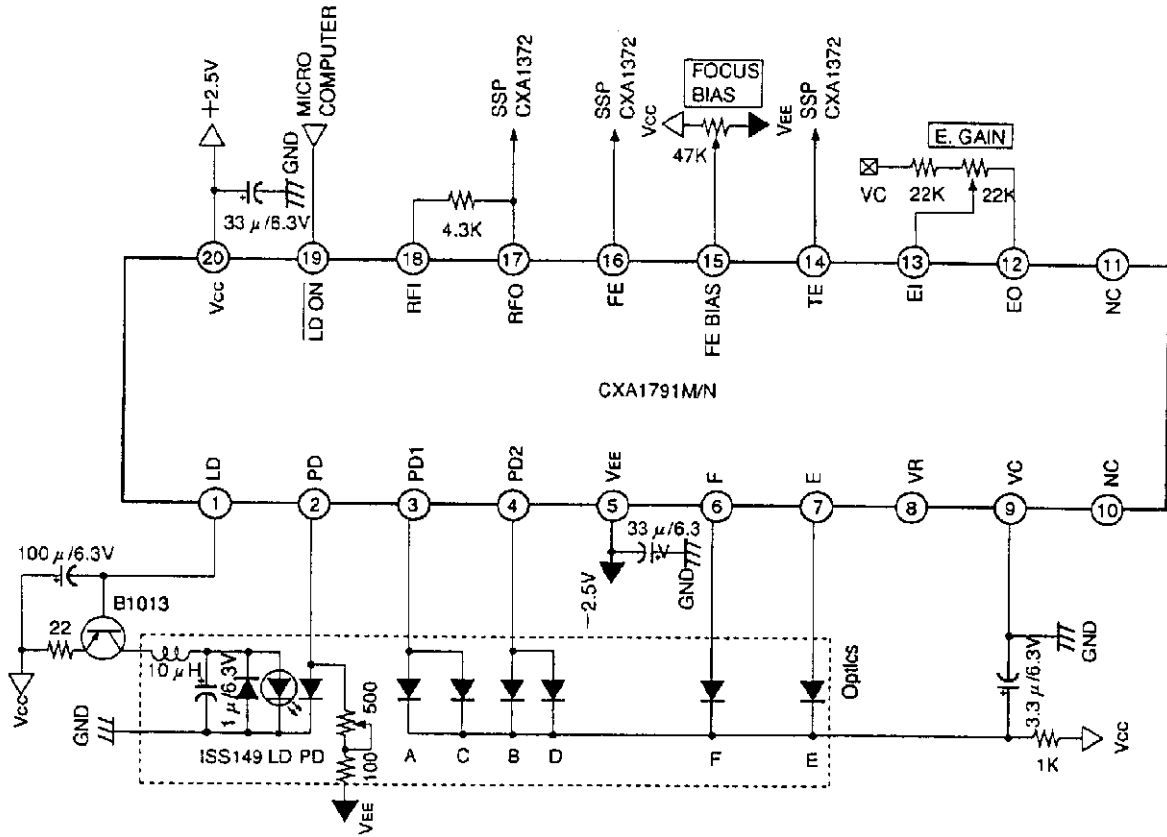
| Measurement No. | Measurement item           | Symbol             | SW Conditions |   |   |   |   |   |   |   |   | Bias conditions |    |    | Measurement point | Description of output waveform and measurement method | Min. | Typ. | Max. | Unit |   |  |       |      |      |    |
|-----------------|----------------------------|--------------------|---------------|---|---|---|---|---|---|---|---|-----------------|----|----|-------------------|---|------|------|------|------|---|--|-------|------|------|----|
|                 |                            |                    | 1             | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | E1              | E2 | E3 |                   |   |      |      |      |      |   |  |       |      |      |    |
| 1               | Current consumption        | I <sub>CC</sub>    |               |   |   |   |   |   |   |   |   |                 |    |    |                   | 300mV   |      |      |      | 20   | V <sub>CC</sub> =2.5V, V <sub>EE</sub> =-2.5V, V <sub>C</sub> =0V | -  | 8.0   | 12.0 | mA   |    |
| 2               |                            | I <sub>EE</sub>    |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      | 5   | The followings are the same as above conditions. | -12.0 | -8.0 | -    | mA |
| 3               | Offset voltage 1           | V <sub>17-1</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   | 0V  |      |      |      | 17   |   | -50  | 0     | 50   | mV   |    |
| 4               | Voltage gain               | V <sub>17-2</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      | V <sub>1</sub> =2kHz, 400mVpp                                     | 5.1  | 8.1   | 11.1 | dB   |    |
| 5               | Frequency response         | FV <sub>17-2</sub> |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      | V <sub>1</sub> =3MHz, 400mVpp, ratio to V <sub>17-2</sub>         | -3   | -     | -    | dB   |    |
| 6               | Maximum output amplitude H | V <sub>17-3</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | 1.7  | -     | -    | V    |    |
| 7               | Maximum output amplitude L | V <sub>17-4</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -  | -     | -1.3 | V    |    |
| 8               | Offset voltage             | V <sub>16-1</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -120   | 0     | 120  | mV   |    |
| 9               | Voltage gain 1             | V <sub>16-2</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | 7.0  | 10.0  | 13.0 | dB   |    |
| 10              | Voltage gain 2             | V <sub>16-3</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | 7.0  | 10.0  | 13.0 | dB   |    |
| 11              | Voltage gain difference    | V <sub>16-4</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -3.0   | 0     | 3.0  | dB   |    |
| 12              | Maximum output amplitude H | V <sub>16-5</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | 2.0  | -     | -    | V    |    |
| 13              | Maximum output amplitude L | V <sub>16-6</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -  | -     | -2.0 | V    |    |
| 14              | Offset voltage 1           | V <sub>14-1</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -50  | 0     | 50   | mV   |    |
| 15              | Voltage gain 1             | V <sub>14-2</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | 7.0  | 10.0  | 13.0 | dB   |    |
| 16              | Voltage gain 2             | V <sub>14-3</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | 7.0  | 10.0  | 13.0 | dB   |    |
| 17              | Voltage gain difference    | V <sub>14-4</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -3.0   | 0     | 3.0  | dB   |    |
| 18              | Maximum output amplitude H | V <sub>14-5</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | 2.0  | -     | -    | V    |    |
| 19              | Maximum output amplitude L | V <sub>14-6</sub>  |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -  | -     | -2.0 | V    |    |
| 20              | Output voltage 1           | V <sub>1-1</sub>   |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -  | -     | -1.6 | -0.9 | V  |
| 21              | Output voltage 2           | V <sub>1-2</sub>   |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -1.2   | 0.1   | 1.4  | V    |    |
| 22              | Output voltage 3           | V <sub>1-3</sub>   |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | 0.8  | 2.1   | -    | V    |    |
| 23              | Output voltage 4           | V <sub>1-4</sub>   |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | 2.1  | 2.3   | -    | V    |    |
| 24              | Output voltage 5           | V <sub>1-5</sub>   |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -  | -     | 0    | V    |    |
| 25              | Output voltage 1           | V <sub>B-1</sub>   |               |   |   |   |   |   |   |   |   |                 |    |    |                   |   |      |      |      |      |   | -100   | 0     | 100  | mV   |    |

Electrical Characteristics Measurement Circuit

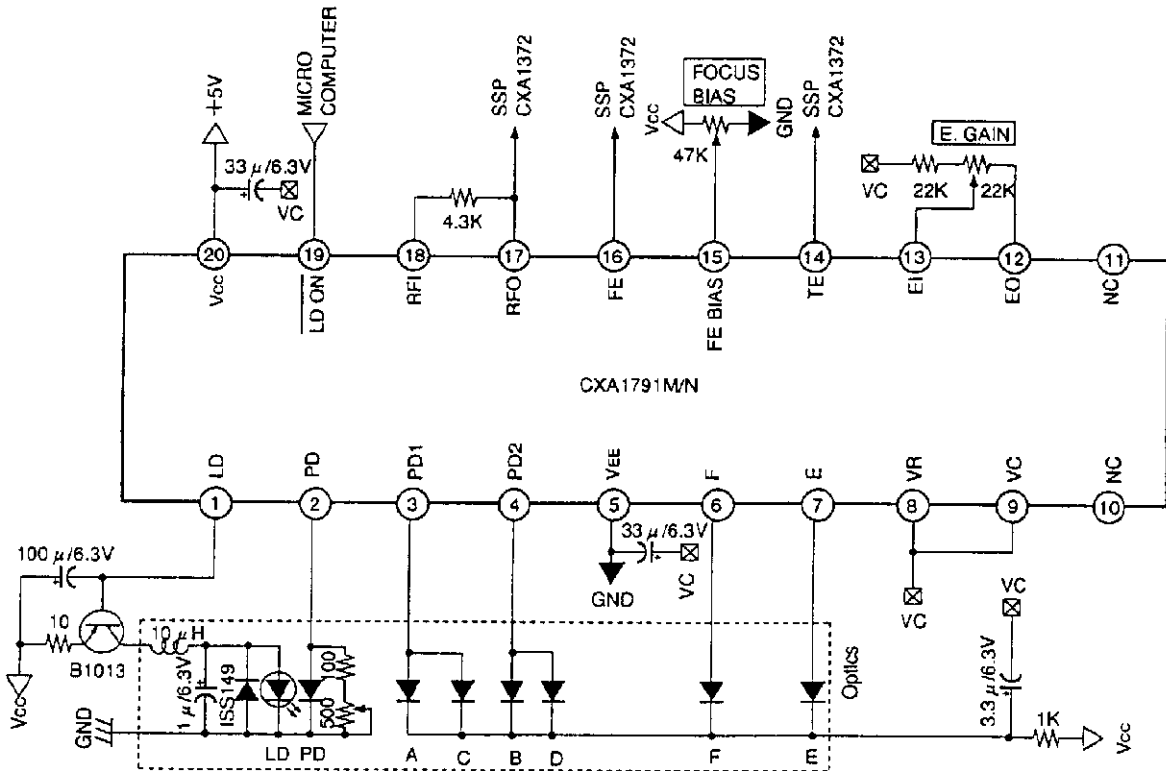


Application Circuit

- For dual  $\pm 2.5V$  power supply



- For single +5V power supply

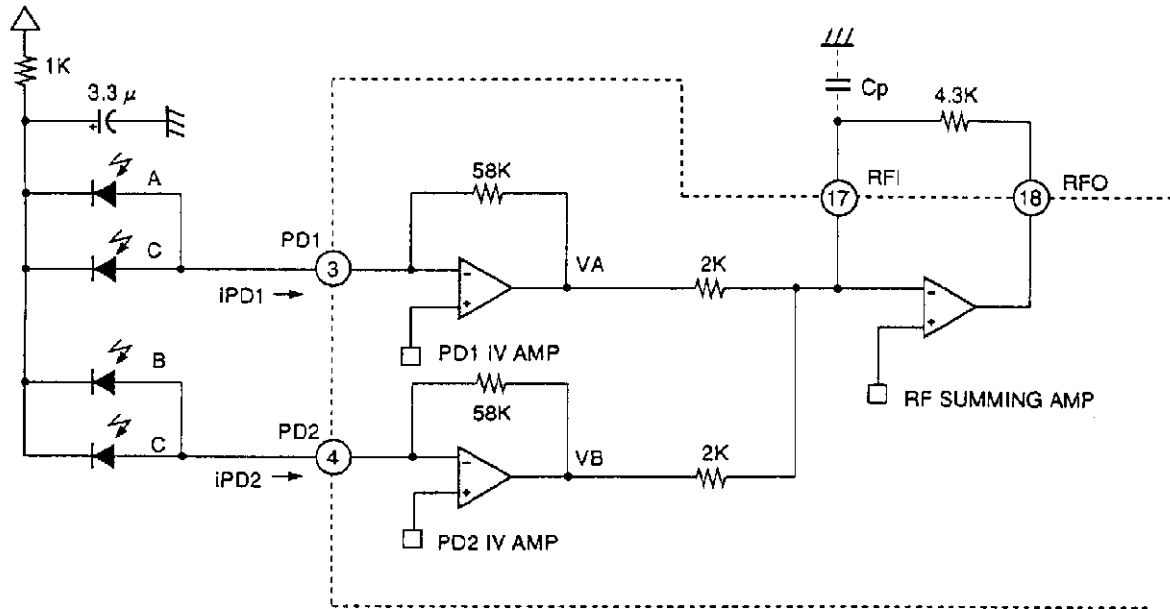




Description of Functions

RF Amplifier

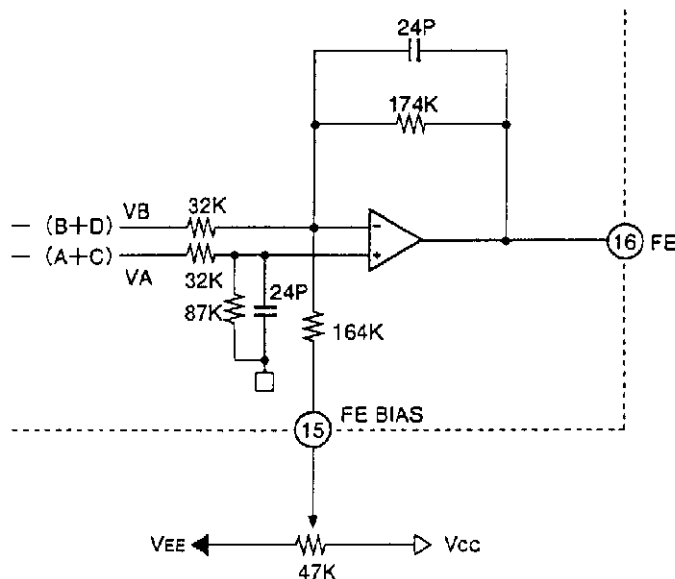
The photodiode current input to input pins (PD1, PD2) is I-V converted at the 58kΩ equivalent resistors, respectively. Then, it is added at the RF summing amplifier and I-V converted output voltage of photodiode (A+B+C+D) is output to RFO pin. This pin can check the eye-pattern.



The frequency response of RF output signal can be equalized by adding the capacitor (Cp) to RFI pin. The low frequency component of RFO output voltage is as follows:  $V_{RFO} = 2.15 \times (V_A + V_B) = 124.7k\Omega \times (i_{PD1} + i_{PD2})$

Focus Error Amplifier

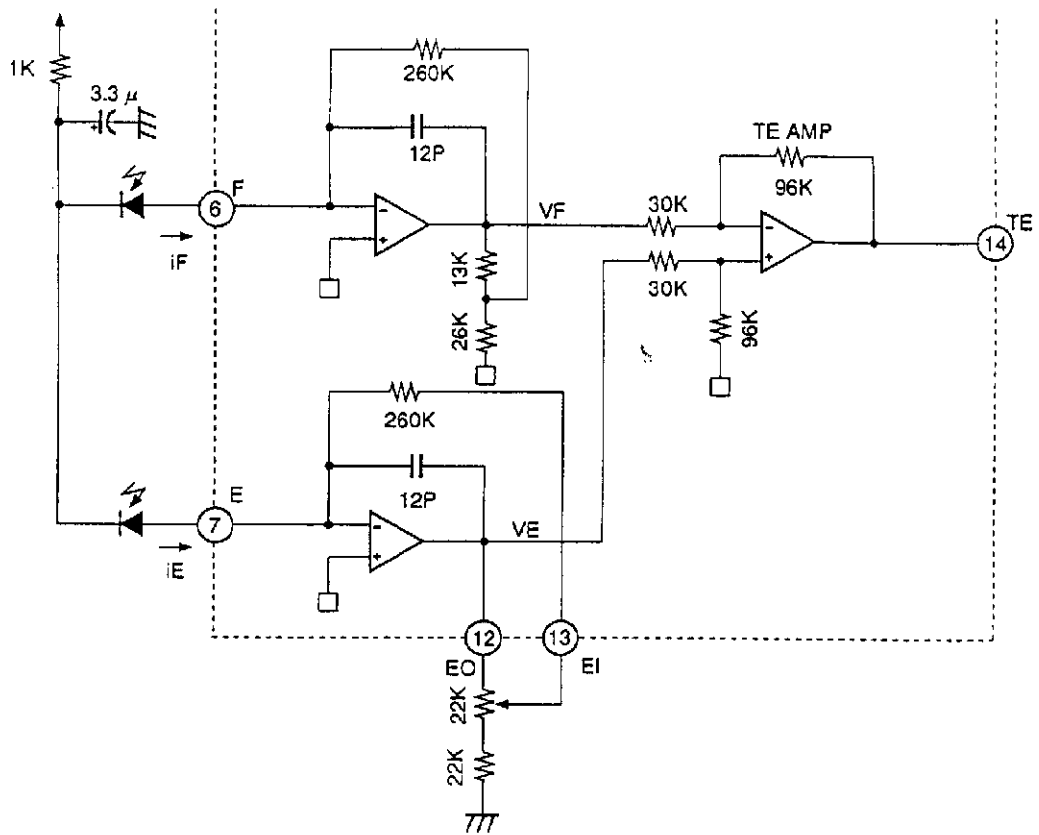
The difference between RF I-V amplifier outputs VA and VB is obtained, and the I-V converted voltage of photodiode (A+B-C-D) is output.



FE output voltage (low frequency component) is as follows:  $V_{FE} = 5.4 \times (V_A - V_B) = (i_{PD2} - i_{PD1}) \times 315k\Omega$

**Tracking Error Amplifier**

The photodiode current input to E and F pins is I-V converted at F IV amplifier.



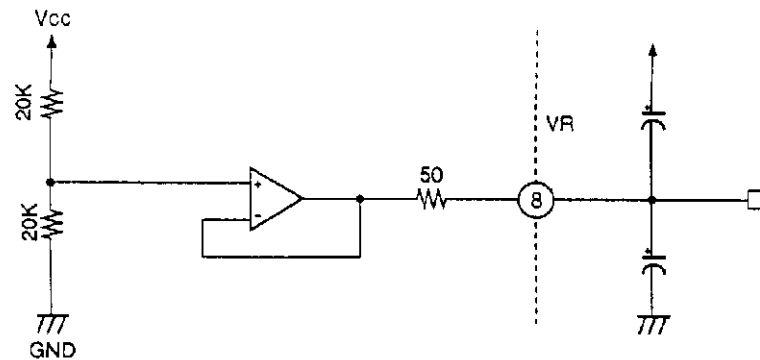
VE and VF difference is obtained at the tracking error amplifier.

$$V_{FE} = (V_E - V_F) \times 3.2$$

$$= (i_F - i_E) \times 1290k\Omega$$

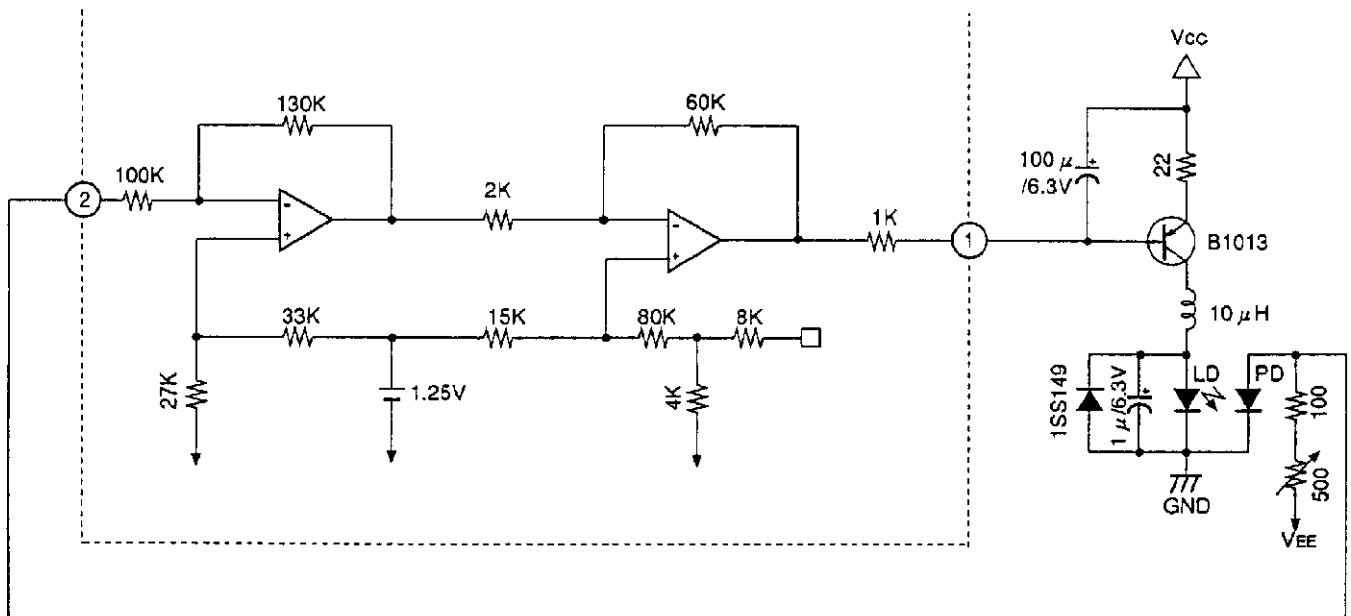
**Center Voltage Generation Circuit**

The center voltage, used for this IC at single power supply, is supplied. The output impedance is approximately 50Ω.



**APC Circuit**

When driving a constant current, the optical power output by the laser diode possesses large negative temperature characteristics. Therefore, the current must be controlled with the monitor photodiode to ensure the output remains constant. When LD ON pin is connected to GND, APC is ON; connected to Vcc, it is OFF.



**Notes on Operation**

**1. Power supply**

The CXA1791 can be used at dual power supply or single power supply. The connection of power supply for each case is as follows:

|                     | Vcc           | VEE           | VR   | VC  |
|---------------------|---------------|---------------|------|-----|
| Dual power supply   | +power supply | -power supply | OPEN | GND |
| Single power supply | Power supply  | GND           | VC   | VR  |

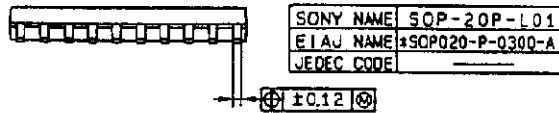
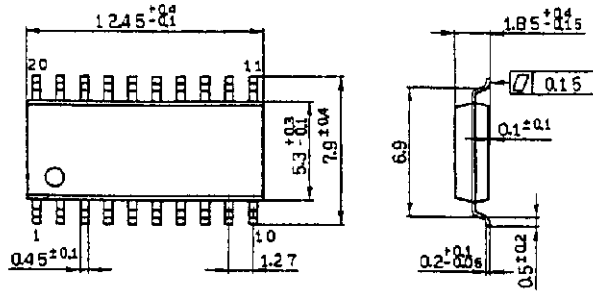
**2. RF amplifier**

Wiring for PD1 and PD2 input pins should be as short as possible because they are high-impedance. RF band narrows through the capacitance between RFO and RFI.

Package Outline Unit : mm

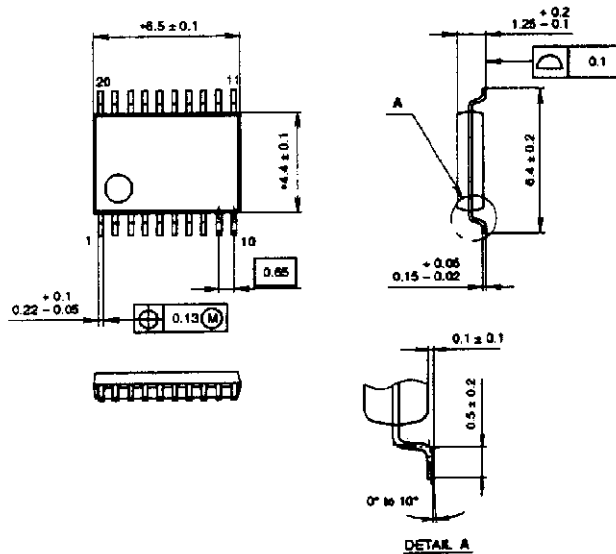
CXA1791M

20pin SOP (Plastic) 300mll 0.3g



20PIN SSOP (PLASTIC)

CXA1791N



NOTE: Dimension "\*" does not include mold protrusion.

| PACKAGE STRUCTURE |                          |
|-------------------|--------------------------|
| PACKAGE MATERIAL  | EPOXY RESIN              |
| LEAD TREATMENT    | SOLDER/PALLADIUM PLATING |
| LEAD MATERIAL     | 43/COPPER ALLOY          |
| PACKAGE MASS      | 0.1g                     |

|            |               |
|------------|---------------|
| SONY CODE  | SSOP-20P-L01  |
| EIAJ CODE  | SSOP20-P-0044 |
| JEDEC CODE |               |

NOTE : PALLADIUM PLATING  
This product uses S-PdPPF (Sony Spec.-Palladium Pre-Plated Lead Frame).