

## RF Amplifier for CD Player and CD-ROM

### Description

The CXA2525M/N is an IC for RF signal processing of CD player and CD-ROM.

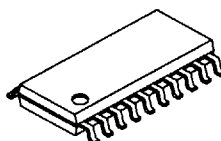
### Features

- Wide-band RF amplifier. (RF signal  $f_c \geq 12\text{MHz}$ )
- RF equalizer (T type)
- EFM time constant can be adjusted (with switching function)
- APC (Automatic Power Control) function
- Power saving function

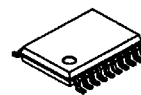
### Functions

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

CXA2525M  
20 pin SOP (Plastic)



CXA2525N  
20 pin SSOP (Plastic)



### Absolute Maximum Ratings

|                               |           |             |    |
|-------------------------------|-----------|-------------|----|
| • Supply voltage              | $V_{CC}$  | 7           | V  |
| • Storage temperature         | $T_{stg}$ | -65 to +150 | °C |
| • Allowable power dissipation | $P_D$     | 500         | mW |

### Operating Conditions

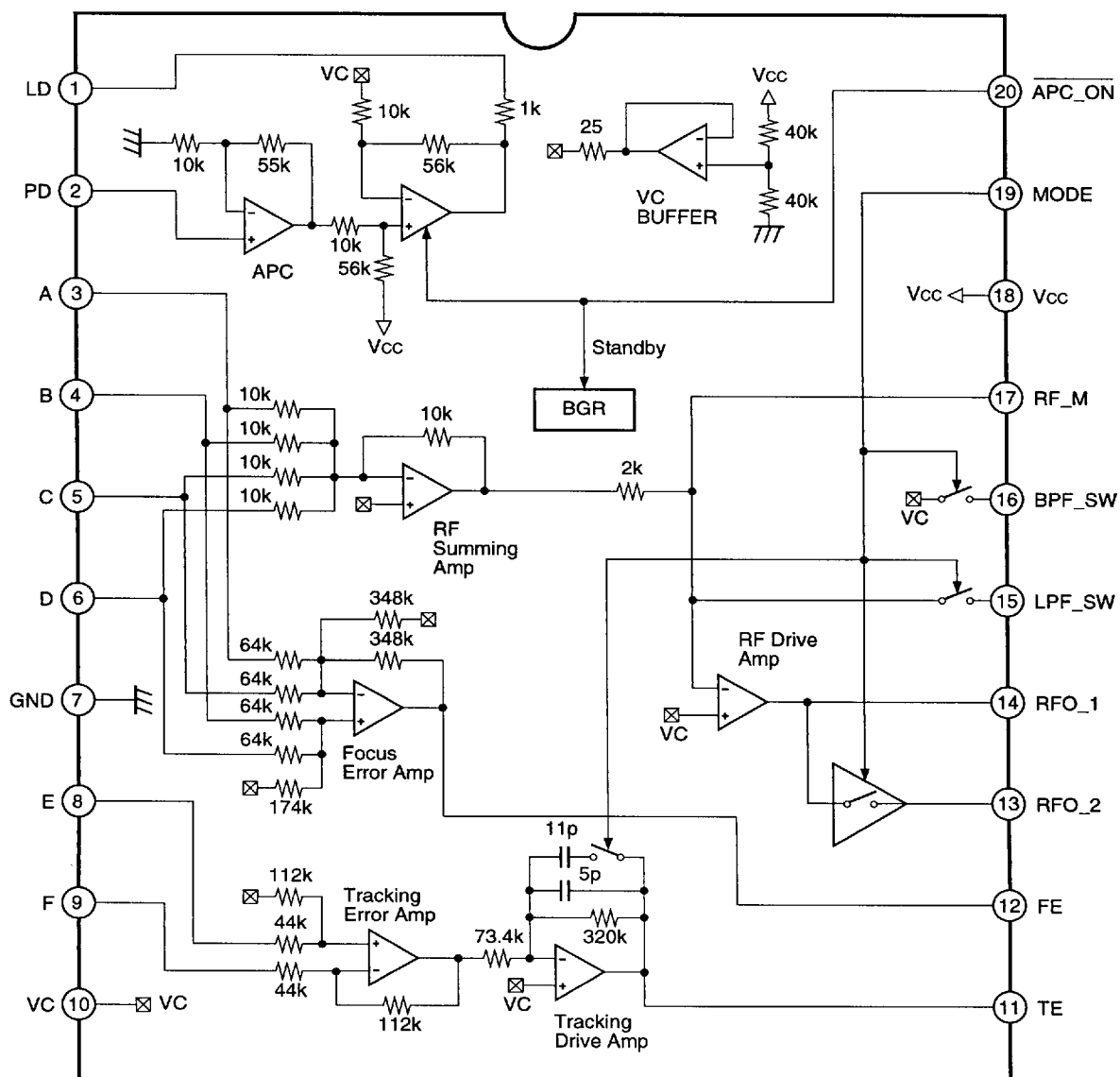
|                         |              |              |    |
|-------------------------|--------------|--------------|----|
| • Supply voltage        | $V_{CC}-GND$ | +3.0 to +5.5 | V  |
| • Operating temperature | $T_{opr}$    | -20 to +75   | °C |

### Applications

- CD players
- CD-ROM drives

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## Block Diagram



## 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<br>5<br>6 | A<br>B<br>C<br>D | I   |                    | Input of RF summing amplifier and focus error amplifier. |
| 7                | GND              |     |                    | Ground.                                                  |

| Pin No.      | Symbol        | I/O    | Equivalent circuit | Description                                                                                                                                                                                         |
|--------------|---------------|--------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8<br>9<br>11 | E<br>F<br>TE  | I<br>O |                    | Tracking error amplifier input for Pins 8 and 9; tracking error drive output for Pin 11.                                                                                                            |
| 10           | VC            | O      |                    | $(V_{CC} + GND) / 2$ DC voltage output.                                                                                                                                                             |
| 12           | FE            | O      |                    | Focus error amplifier output for Pin 12.                                                                                                                                                            |
| 13           | RFO_2         | O      |                    | Buffer switch output which sets the RF signal time constant.<br>OFF when Pin 19 is connected to Vcc, ON when it is connected to GND.                                                                |
| 14<br>17     | RFO_1<br>RF_M | O<br>I |                    | Non-inversion input of RF drive amplifier for Pin 17; RF signal output for Pin 14; resistance value connected between Pins 14 and 17 which determines the low frequency gain of RF drive amplifier. |

| Pin No. | Symbol | I/O | Equivalent circuit | Description                                                                                                                                         |
|---------|--------|-----|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 15      | LPF_SW | O   |                    | Transistor switch output which sets the LPF cut-off frequency of RF amplifier. OFF when Pin 19 is connected to Vcc, ON when it is connected to GND. |
| 16      | BPF_SW | O   |                    | Transistor switch output which sets the RF amplifier BPF boost. OFF when Pin 19 is connected to Vcc, ON when it is connected to GND.                |
| 18      | Vcc    |     |                    | Vcc.                                                                                                                                                |
| 19      | MODE   | I   |                    | Multiple-speed mode switching input.<br>Vcc : High multiple-speed mode<br>GND: Low multiple-speed mode                                              |
| 20      | APC_ON | I   |                    | APC amplifier ON/OFF switching.<br>OFF when connecting to Vcc;<br>ON when connecting to GND.                                                        |

(Ta = 25°C, Vcc = 2.5V, GND = VC, VEE = -2.5V)

## Electrical Characteristics

| Measure-<br>ment No. | Measurement item           | Symbol           | SW conditions |    |    |    | Bias conditions |       |      |       | Measure-<br>ment<br>point | Description of output waveform<br>and measurement method | Min.                                           | Typ. | Max. | Unit |    |
|----------------------|----------------------------|------------------|---------------|----|----|----|-----------------|-------|------|-------|---------------------------|----------------------------------------------------------|------------------------------------------------|------|------|------|----|
|                      |                            |                  | S1            | S2 | S3 | S4 | E1              | E2    | E3   | E4    |                           |                                                          |                                                |      |      |      |    |
| 1                    | Current consumption        | Icc              |               |    |    |    | 0V              | 300mV | 2.0V | -2.0V | 18                        | Pin DC current measurement                               | —                                              | 6.6  | 12   | mA   |    |
| 2                    | Current consumption        | I <sub>EE</sub>  |               |    |    |    |                 | 300mV |      | ▼     | 7                         | Pin DC current measurement                               | -12                                            | -6.6 | —    | mA   |    |
| 3                    | Standby current            | I <sub>stb</sub> |               |    |    |    |                 | 300mV |      | 2.0V  | 18                        | Pin DC current measurement                               | —                                              | 1.65 | 3    | mA   |    |
| 4                    | Offset voltage             | V1-1             |               |    |    |    |                 |       | 0V   | ▼     | -2.0V                     | 14                                                       | Pin DC current measurement                     | -80  | -5   | 150  | mV |
| 5                    | Offset voltage             | V1-2             |               |    |    |    |                 |       |      | -2.0V |                           | 13                                                       | Pin DC current measurement                     | -100 | 50   | 200  | mV |
| 6                    | Voltage gain               | G1-1             | O             | O  |    |    |                 |       |      | 2.0V  |                           | 14                                                       | V1 = 100mVpp, f = 100kHz                       | 16.5 | 20   | 23   | dB |
| 7                    | Voltage gain               | G1-2             | O             | O  |    |    |                 |       |      | -2.0V |                           | 14                                                       | V1 = 100mVpp, f = 100kHz                       | 16.5 | 20   | 23   | dB |
| 8                    | Voltage gain               | G1-3             | O             | O  |    |    |                 |       |      | -2.0V |                           | 13                                                       | V1 = 100mVpp, f = 100kHz                       | 16.5 | 20   | 23   | dB |
| 9                    | Frequency response         | F1-1             | O             | O  |    |    |                 |       |      | 2.0V  |                           | 14                                                       | V1 = 50mVpp, f = 12MHz<br>Difference for G1-1  | -3   | —    | —    | dB |
| 10                   | Frequency response         | F1-2             | O             | O  |    |    | ▼               |       |      | -2.0V |                           | 13                                                       | V1 = 50mVpp, f = 4MHz<br>Difference for G1-2   | -3   | —    | —    | dB |
| 11                   | Maximum output amplitude H | V1-2             | O             | O  |    |    | 300mV           |       |      | 2.0V  |                           | 14                                                       | DC voltage measurement                         | 1.3  | —    | —    | V  |
| 12                   | Maximum output amplitude L | V1-3             | O             | O  |    |    | -300mV          |       |      |       | ▼                         |                                                          | DC voltage measurement                         | —    | —    | -0.3 | V  |
| 13                   | Offset voltage             | V2-1             |               |    |    |    |                 | 0V    |      |       |                           | 12                                                       | DC voltage measurement                         | -50  | -15  | 50   | mV |
| 14                   | Voltage gain 1             | G2-1             | O             |    |    |    |                 |       |      |       |                           |                                                          | V1 = 100mVpp, f = 1kHz                         | 17.7 | 20.7 | 23.7 | dB |
| 15                   | Voltage gain 2             | G2-2             |               | O  |    |    |                 |       |      |       |                           |                                                          | V1 = 100mVpp, f = 1kHz                         | 17.7 | 20.7 | 23.7 | dB |
| 16                   | Voltage gain difference    | G2-3             |               |    |    |    |                 |       |      |       |                           |                                                          | G2-1 to G2-2                                   | -3   | 0    | 3    | dB |
| 17                   | Frequency response 1       | F2-1             | O             |    |    |    |                 |       |      |       |                           |                                                          | V1 = 100mVpp, f = 20kHz<br>Difference for G2-1 | -4   | —    | —    | dB |
| 18                   | Frequency response 2       | F2-2             |               | O  |    |    | ▼               |       |      |       |                           |                                                          | V1 = 100mVpp, f = 20kHz<br>Difference for G2-2 | -4   | —    | —    | dB |
| 19                   | Maximum output amplitude H | V2-2             |               | O  |    |    | 300mV           |       |      |       |                           |                                                          | DC voltage measurement                         | 1.9  | —    | —    | V  |
| 20                   | Maximum output amplitude L | V2-3             | O             |    |    |    | 300mV           | ▼     | ▼    | ▼     | ▼                         |                                                          | DC voltage measurement                         | —    | —    | -1.9 | V  |

| Measure-<br>ment No. | Measurement item           | Symbol | SW conditions |    |    |    | Bias conditions |       |       |       | Measure-<br>ment<br>point | Description of output waveform<br>and measurement method | Min. | Typ. | Max. | Unit |
|----------------------|----------------------------|--------|---------------|----|----|----|-----------------|-------|-------|-------|---------------------------|----------------------------------------------------------|------|------|------|------|
|                      |                            |        | S1            | S2 | S3 | S4 | E1              | E2    | E3    | E4    |                           |                                                          |      |      |      |      |
| 21                   | Offset voltage             | V3-1   |               |    |    |    | 0V              | 0V    | 2.0V  | -2.0V | 11                        | DC voltage measurement                                   | -50  | 0    | 50   | mV   |
| 22                   | Voltage gain 1             | G3-1   |               |    |    |    |                 |       |       |       |                           | V1 = 100mVpp, f = 1kHz                                   | 17.9 | 20.9 | 23.9 | dB   |
| 23                   | Voltage gain 2             | G3-2   |               |    |    | O  |                 |       |       |       |                           | V1 = 100mVpp, f = 1kHz                                   | 17.9 | 20.9 | 23.9 | dB   |
| 24                   | Voltage gain difference    | G3-3   |               |    |    |    |                 |       |       | ▼     |                           | G3-1 to G3-2                                             | -3   | 0    | 3    | dB   |
| 25                   | Frequency response 1       | F3-1   |               |    |    | O  |                 |       | -2.0V |       |                           | V1 = 100mVpp, f = 20kHz<br>Difference for G3-1           | -4   | —    | —    | dB   |
| 26                   | Frequency response 2       | F3-2   |               |    |    | O  |                 |       | -2.0V |       |                           | V1 = 100mVpp, f = 20kHz<br>Difference for G3-2           | -4   | —    | —    | dB   |
| 27                   | Frequency response 3       | F3-3   |               |    |    | O  |                 |       | 2.0V  |       |                           | V1 = 100mVpp, f = 70kHz<br>Difference for G3-1           | -4   | —    | —    | dB   |
| 28                   | Frequency response 4       | F3-4   |               |    |    | O  |                 | ▼     |       |       |                           | V1 = 100mVpp, f = 70kHz<br>Difference for G3-2           | -4   | —    | —    | dB   |
| 29                   | Maximum output amplitude H | V3-2   |               |    |    | O  | 300mV           |       |       |       |                           | DC voltage measurement                                   | 1.9  | —    | —    | V    |
| 30                   | Maximum output amplitude L | V3-3   |               |    |    | O  | 300mV           | ▼     |       |       | ▼                         | DC voltage measurement                                   | —    | —    | -1.9 | V    |
| 31                   | Offset voltage 1           | V4-1   |               |    |    |    | 0V              | 69mV  |       |       | 1                         | DC voltage measurement                                   | —    | -1.6 | -0.1 | V    |
| 32                   | Offset voltage 2           | V4-2   |               |    |    |    |                 | 123mV |       |       |                           | DC voltage measurement                                   | -1.2 | 0.1  | 1.6  | V    |
| 33                   | Offset voltage 3           | V4-3   |               |    |    |    |                 | 177mV |       | ▼     |                           | DC voltage measurement                                   | 0.8  | 2.1  | —    | V    |
| 34                   | Offset voltage 4           | V4-4   |               |    |    |    |                 | 0V    |       | 2.0V  |                           | DC voltage measurement                                   | 1.8  | 2    | —    | V    |
| 35                   | Offset voltage 5           | V4-5   |               |    |    |    |                 |       |       | -2.0V | ▼                         | I1 = 0.8mADC,<br>DC voltage measurement                  | —    | —    | 0    | V    |
| 36                   | Offset voltage             | V5-1   |               |    |    |    | ▼               | ▼     | ▼     | ▼     | 10                        | DC voltage measurement                                   | -0.1 | —    | 0.1  | V    |





[illegible]

Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

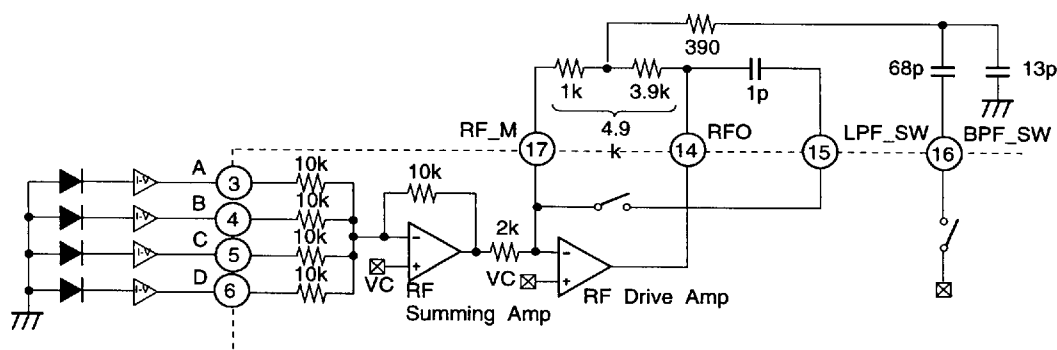
## Note on Operation

The RF AC maximum output amplitude is 1.3 Vpp when Pin 13 and 14 are capacitor-coupled shown in Application Circuit.

## Description of Operation

### RF Amplifier

The signal currents from the photodiodes A, B, C and D are I-V converted, and input to Pins 3, 4, 5 and 6. These signals are added at the RF summing amplifier and inverted at the RF drive amplifier and then output to Pin 14.



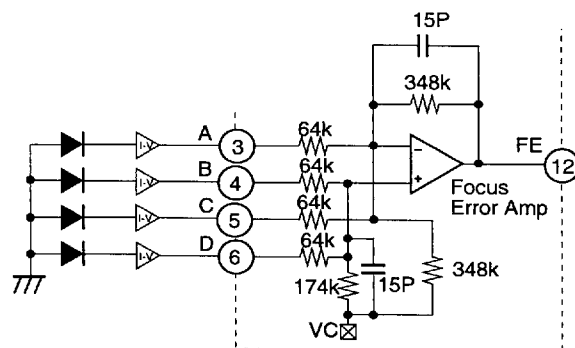
The low frequency component of RFO output voltage is as follows:

$$V_{RFO} = \frac{10k}{10k} \times \frac{4.9k}{2k} \times (A + B + C + D)$$

$$= 2.45 \times (A + B + C + D)$$

### Focus Error Amplifier

The operation of  $(B + D) - (A + C)$  is performed and the resulting signal is output to Pin 12.



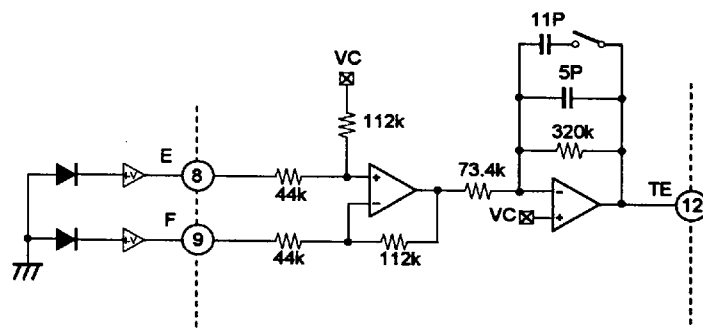
The low frequency component of FE output voltage is as follows:

$$V_{FE} = \frac{348k}{64k} \times (B + D - A - C)$$

$$= 5.43 \times (B + D - A - C)$$

### Tracking Error Amplifier

Each signal current from the photodiodes E and F is I-V converted and input to Pins 8 and 9. These signals undergo operational amplification at the tracking error amplifier and tracking drive amplifier, and are output to Pin 12.



The low frequency component of TE output voltage is as follows:

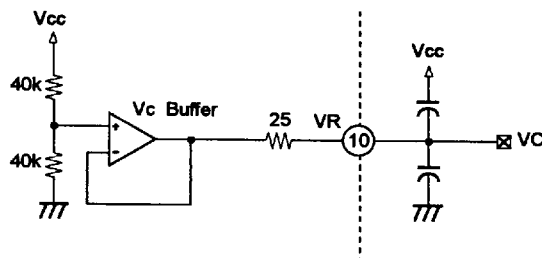
$$V_{TE} = \frac{112k}{44k} \times \frac{320k}{73.4k} \times (F - E)$$

$$= 11.1 \times (F - E)$$

### Center Voltage Generation Circuit

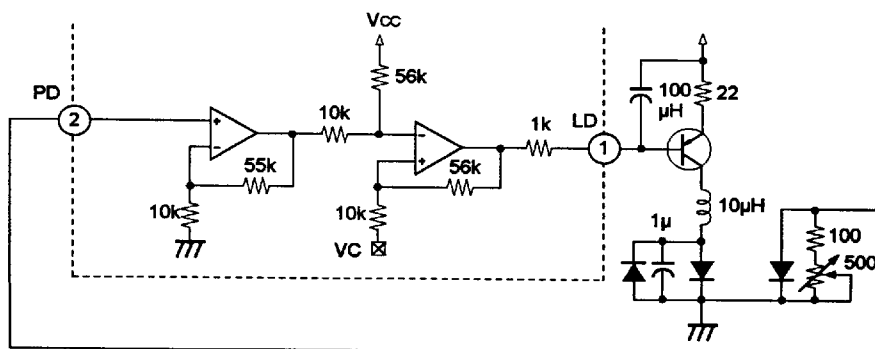
The center voltage of VR = (V<sub>CC</sub> + GND) is supplied.

The maximum current is approximately ±3mA.



### APC Circuit

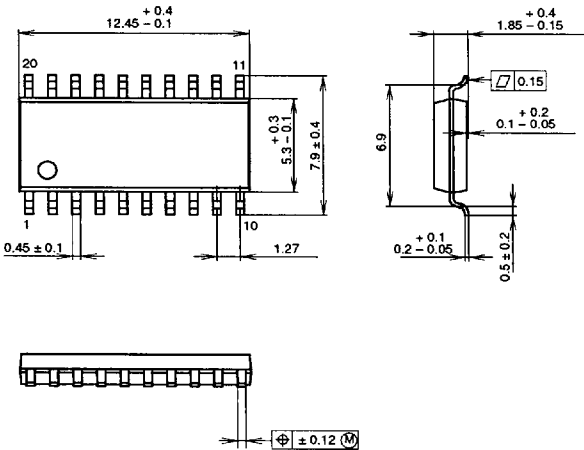
When the laser diode is driven with constant current, the optical output possesses large negative temperature characteristics. Therefore, the current must be controlled with the monitor photodiode to ensure the output remains constant. When APC\_ON pin is connected to GND, APC is ON; connected to V<sub>CC</sub>, it is OFF.



Package Outline      Unit: mm

CXA2525M

20PIN SOP (PLASTIC) 300mil

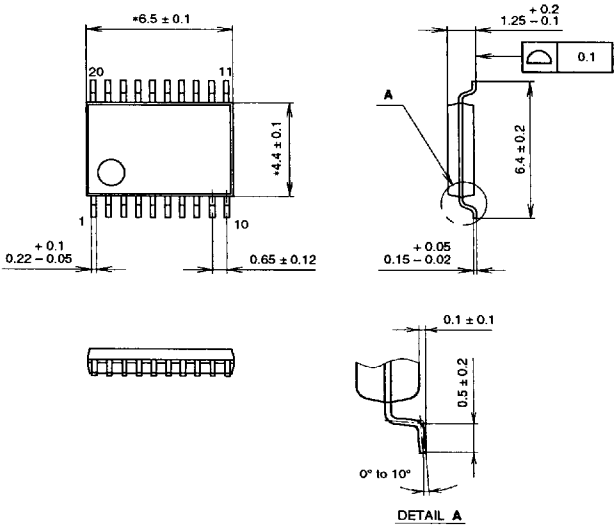


PACKAGE STRUCTURE

|            |                  |                  |                      |
|------------|------------------|------------------|----------------------|
| SONY CODE  | SOP-20P-L01      | PACKAGE MATERIAL | EPOXY / PHENOL RESIN |
| EIAJ CODE  | *SOP020-P-0300-A | LEAD TREATMENT   | SOLDER PLATING       |
| JEDEC CODE |                  | LEAD MATERIAL    | COPPER ALLOY         |
|            |                  | PACKAGE WEIGHT   | 0.3g                 |

CXA2525N

20PIN SSOP (PLASTIC)



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

PACKAGE STRUCTURE

|            |                |                  |                            |
|------------|----------------|------------------|----------------------------|
| SONY CODE  | SSOP-20P-L01   | PACKAGE MATERIAL | EPOXY RESIN                |
| EIAJ CODE  | SSOP020-P-0044 | LEAD TREATMENT   | SOLDER / PALLADIUM PLATING |
| JEDEC CODE |                | LEAD MATERIAL    | COPPER / 42 ALLOY          |
|            |                | PACKAGE WEIGHT   | 0.1g                       |