

# LA3335M — Monolithic Linear IC — PLL FM Multiplex Demodulator for 3V Headphone Stereos and Radio-cassette Recorders

## Overview

The LA3335M is PLL FM stereo multiplex demodulator IC designed for use in headphone stereos, etc. which operate from a low supply voltage.

## Applications

- FM Multiplex IC for 3 V headphones, radio-cassette recorders

## Functions

- PLL FM stereo decoder, VCO stop, stereo indicator

## Features

- Wide operating voltage range : 1.8 to 6 V
- Low current dissipation : 1.6 mA
- Minimum number of external parts required

## Specifications

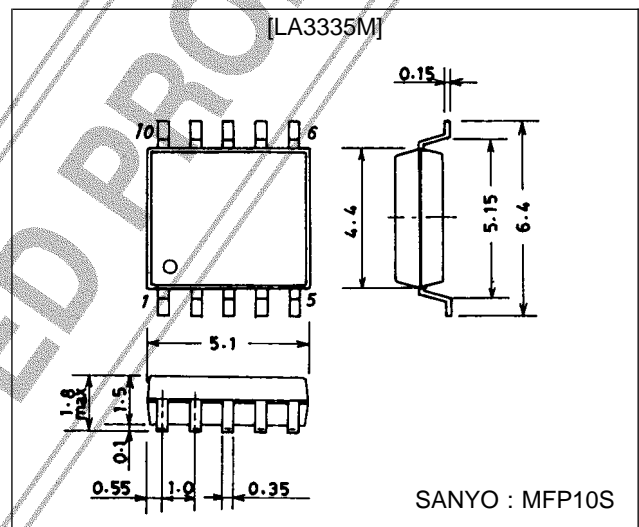
### Maximum Ratings at $T_a = 25^\circ\text{C}$

| Parameter                   | Symbol               | Conditions                  | Ratings            | Unit             |
|-----------------------------|----------------------|-----------------------------|--------------------|------------------|
| Maximum supply voltage      | $V_{CC \text{ max}}$ |                             | 8                  | V                |
| Lamp drive current          | $I_L \text{ max}$    |                             | 10                 | mA               |
| Allowable power dissipation | $P_d \text{ max}$    | $T_a \leq 70^\circ\text{C}$ | 50                 | mW               |
| Operating temperature       | $T_{op}$             |                             | $\pm 20$ to $+70$  | $^\circ\text{C}$ |
| Storage temperature         | $T_{stg}$            |                             | $\pm 40$ to $+125$ | $^\circ\text{C}$ |

## Package Dimensions

unit : mm

### 3086A-MFP10S



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

| Parameter                  | Symbol              | Conditions | Ratings  | Unit |
|----------------------------|---------------------|------------|----------|------|
| Recommended supply voltage | $V_{CC}$            |            | 3        | V    |
| Operating voltage range    | $V_{CC \text{ op}}$ |            | 1.8 to 6 | V    |
| Input signal voltage       | $V_{IN}$            |            | 150      | mV   |

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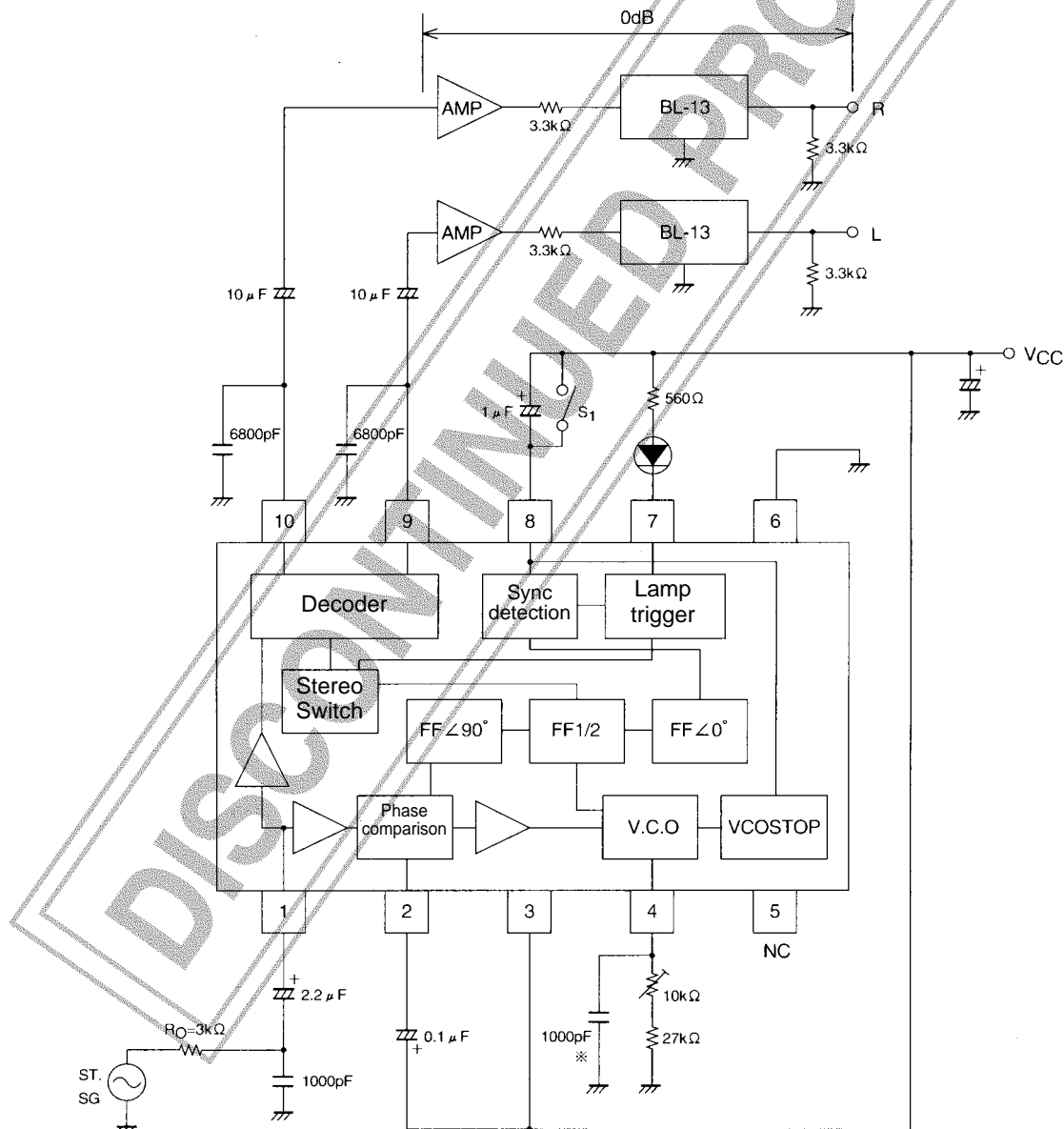
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# LA3335M

Operating Characteristics at  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 3\text{ V}$ , input 150 mV,  $L + R = 90\%$ , pilot = 10%,  $f = 1\text{ kHz}$ , See specified Test Circuit.

| Parameter                 | Symbol              | Conditions         | min | typ     | max | Unit      |
|---------------------------|---------------------|--------------------|-----|---------|-----|-----------|
| Quiescent current         | $I_{CCO}$           | No input           |     | 1.6     | 2.5 | mA        |
| Input resistance          | $R_i$               |                    | 35  | 50      | 65  | $k\Omega$ |
| Output resistance         | $R_o$               |                    | 5.3 | 7.5     | 9.7 | $k\Omega$ |
| Channel separation        | CHsep               |                    | 30  | 45      |     | dB        |
| Total harmonic distortion | THD                 | Monaural           |     | 0.6     | 1.5 | %         |
|                           |                     | Stereo main        |     | 0.3     | 1.5 | %         |
| Output voltage            | $V_O$               | Monaural           | 90  | 130     | 180 | mV        |
| Channel balance           | CB                  | Monaural           |     | 0       | 1.5 | dB        |
| Lamp lighting level       | $V_L$               | Pilot              | 1.5 | 3.5     | 6   | mV        |
| Lamp hysteresis           | hy                  |                    |     | 3.5     |     | dB        |
| Capture range             | CR                  | Pilot 15 mV        |     | $\pm 3$ |     | %         |
| Allowable input level     | $V_{IN\text{ max}}$ | Monaural, THD = 5% |     | 350     |     | mV        |
| Signal to noise ratio     | S/N                 | Monaural           |     | 82      |     | dB        |

## Equivalent Circuit Block Diagram and Test Circuit



S1: VCO STOP when ON

AMP: Bandwidth of 100 kHz or more, THD = 0.01% or less, input impedance of 330  $k\Omega$  or more


\* Styrol capacitor

A06081

External Parts

| Part Name          | Symbol | Kind                   | Value   | Remarks                    |
|--------------------|--------|------------------------|---------|----------------------------|
| Resistor           | R1     | Carbon resistor        | 27 kΩ   | VCO time constant          |
|                    | R2     | Carbon resistor        | 560 Ω   | Limiting resistor          |
| Semifixed resistor | VR1    | Carbon resistor        | 10 kΩ   | VCO OSC frequency adjust   |
| Capacitor          | C1     | Electrolytic capacitor | 2.2 μF  | DC blocking                |
|                    | C2     | Electrolytic capacitor | 0.1 μF  | Loop filter                |
|                    | C3     | Polystyrol capacitor   | 1000 pF | VCO time constant          |
|                    | C4     | Electrolytic capacitor | 1 μF    | Pilot detection            |
|                    | C5     | Ceramic capacitor      | 6800 pF | De-emphasis                |
|                    | C6     | Ceramic capacitor      | 6800 pF | De-emphasis                |
|                    | C7     | Electrolytic capacitor |         | Power supply ripple filter |

Typical Voltage and Name of Each Pin

| Pin No. | Voltage                | Name                        | Remarks  |
|---------|------------------------|-----------------------------|--|
| 1       | 1.2 V                  | Input                       |  |
| 2       | V <sub>CC</sub> -0.7 V | PLL loop filter             |  |
| 3       | V <sub>CC</sub>        | Power supply                |  |
| 4       | —                      | VCO                         |  V <sub>CC</sub> -0.2 V<br>0.65 V <sub>CC</sub> |
| 5       | —                      | NC                          |  |
| 6       | 0 V                    | GND                         |  |
| 7       | —                      | Stereo indicator            | Open collector   |
| 8       | V <sub>CC</sub> -0.7 V | Pilot sync detection filter |  |
| 9       | 1.3 V                  | Decoder output (low)        |  |
| 10      | 1.3 V                  | Decoder output (high)       |  |

Proper cares in using IC

1. VCO stop method  
Short pin 7 and pin 3 (V<sub>CC</sub> pin) to stop the VCO.  
(Note) The maximum voltage to be applied to pin 7 must not exceed the voltage on pin 3.
2. Free-running frequency check method : Use either of the following two methods.
  - a) Connect pin 4 to a frequency counter through the high input impedance amplifier.

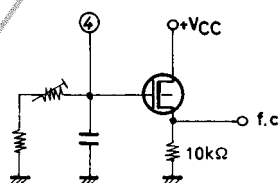


Figure 1

- b) Connect the connection point of the semifixed resistor connected to pin 4 and the fixed resistor to a frequency counter through the  $R_X$  of 240 k $\Omega$ . Fig. 2 shows how the error changes as the  $R_X$  value is decreased.

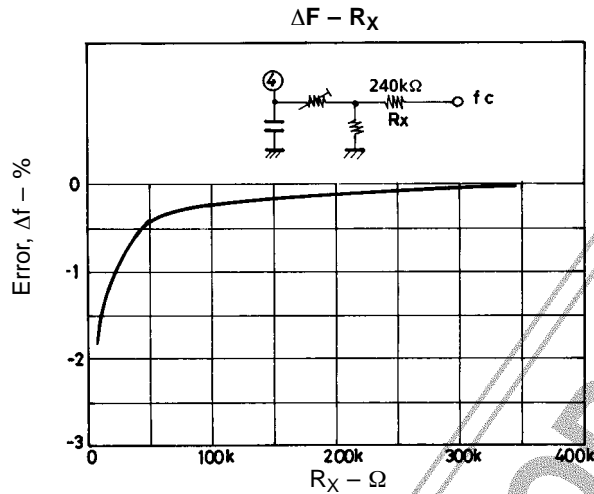


Figure 2

3. Separation setting method

The LA3335M is so designed that the sub-signal gain is approximately 1.25 times as high as the main signal gain. The separation can be set by attenuating the sub-signal of the FM detection output. (See Figure 3)



$R_o \equiv$  Output impedance

Figure 3

The value of capacitor  $C_o$  depends on the attenuation of the sub-signal of the FM detection output and the IF IC output impedance  $R_o$ . Fig. 4 shows the value of separation setting capacitor  $C_o$  when  $R_o$  is set to 3 k $\Omega$ .

For example, when the attenuation of sub-signal of the IF IC output is 0.9 time that of the main signal, it is seen from Figure 4 that the value of  $C_o$  is approximately 500 pF.

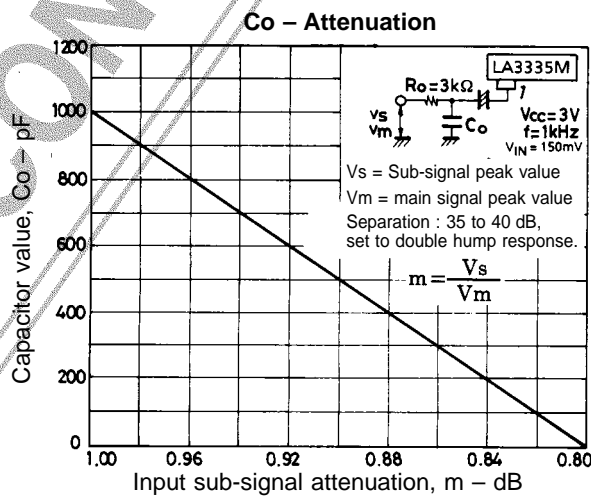
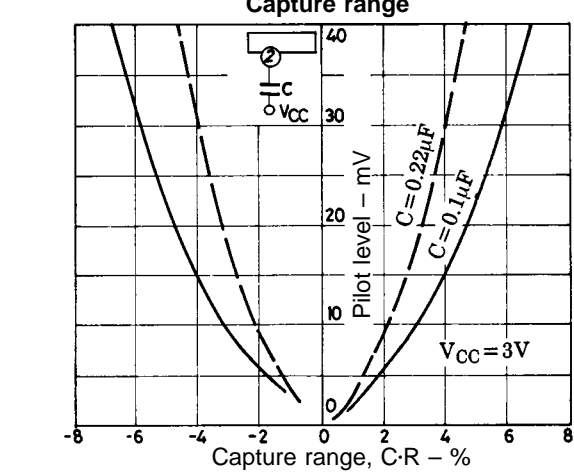
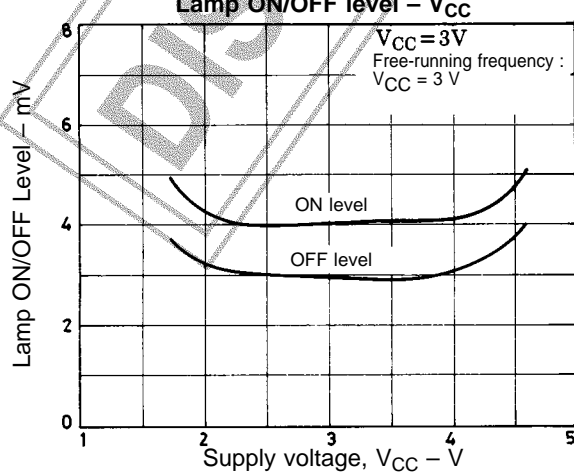
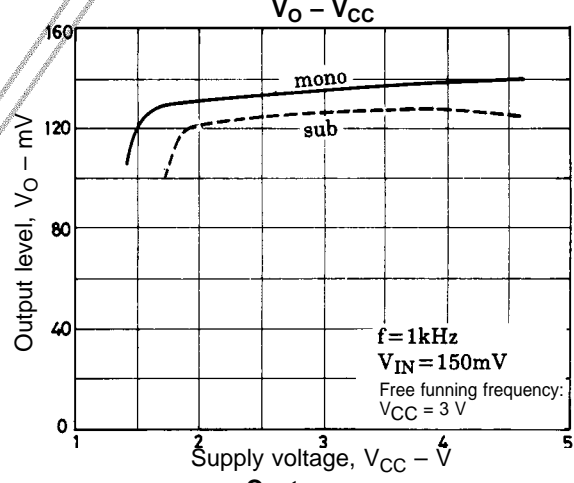
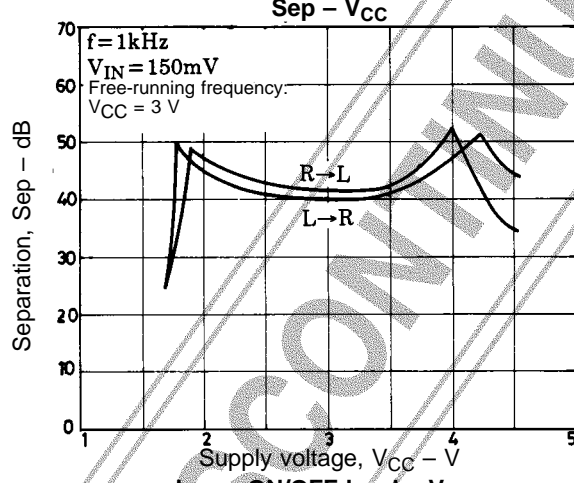
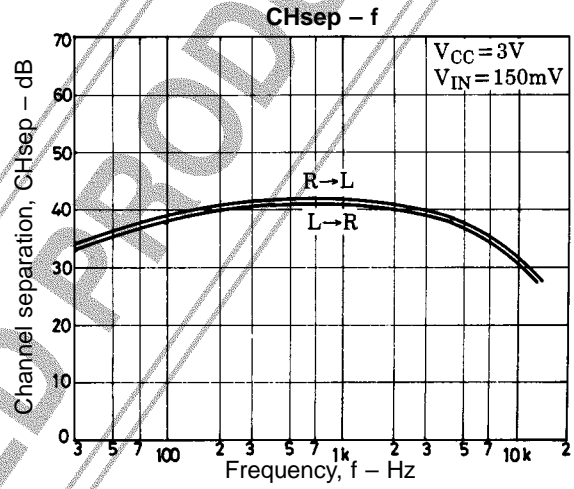
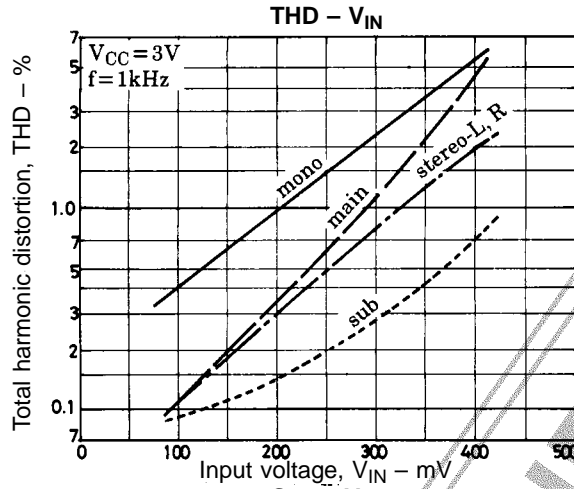
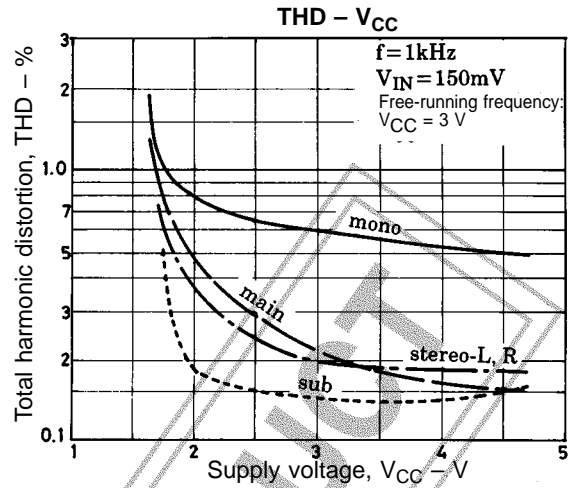
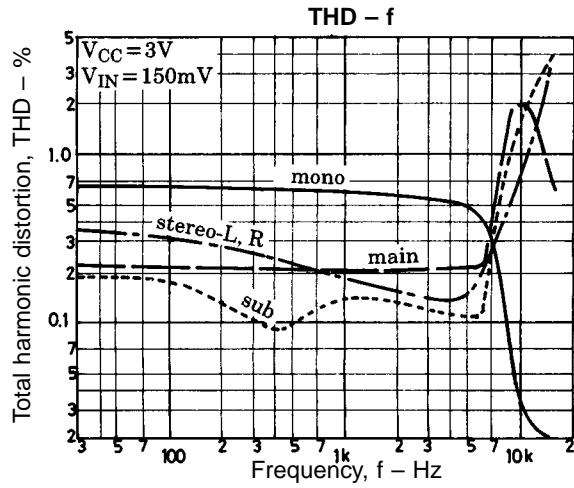
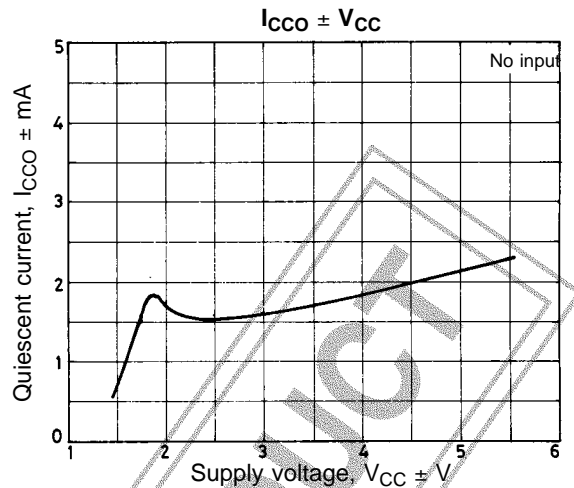
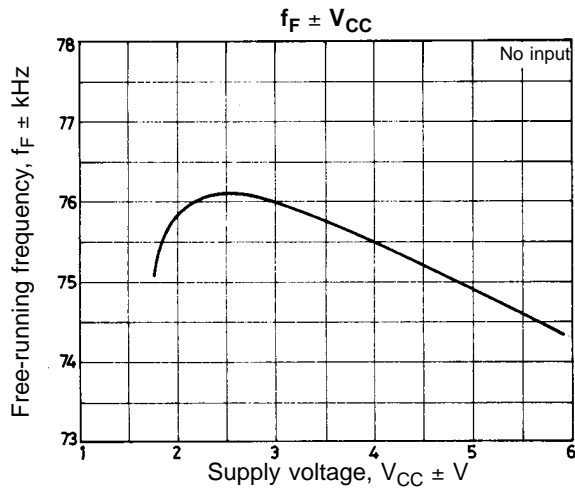


Figure 4





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