

**LA1838**

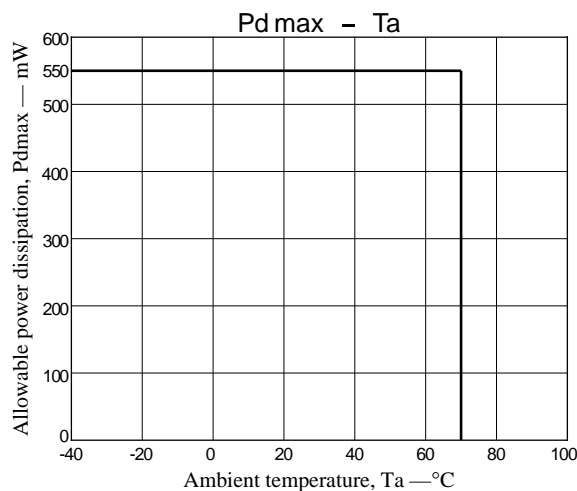
## Single-Chip Home Stereo IC with Electronic Tuning Support

### Overview

The LA1838 is designed for use in home stereo systems and is a single-chip tuner IC that provides electronic tuning functions for AM, FM IF, and MPX reception. It is optimal for use in products that adopt an automatic tuning system based on an IF count.

### Functions

- AM: RF amplifier, mixer, oscillator, IF amplifier, detector, AGC, oscillator buffer, S-meter, narrow-band SD, IF buffer
- FM IF: IF amplifier, quadrature detector, S-meter, SD (signal detection), S-curve detection, IF buffer output
- MPX: PLL stereo decoder, stereo display, forced monaural, VCO stop, post amplifier, audio muting, adjacent channel interference rejection function

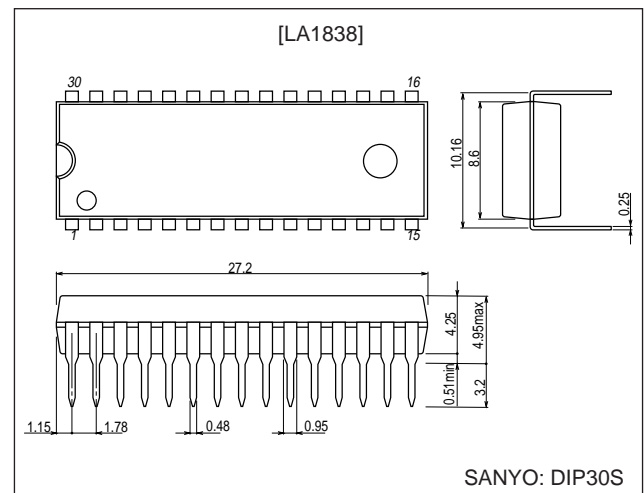


### Features

- Integrated MPX VCO (External components are no longer required.)
- Built-in adjacent channel interference rejection function (third and fifth order)
- Adjustment-free FM detector circuit (Uses a ceramic discriminator.)
- The AM and FM SD sensitivities can be set independently.
- The AM and FM output levels can be set independently.
- Improved useable AM sensitivity and strong field distortion characteristics.

### Package Dimensions

unit: mm

**3061-DIP30S**

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40999RM (OT) No. 5888-1/9

## Specifications

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

| Parameter                   | Symbol       | Conditions                  | Ratings     | Unit             |
|-----------------------------|--------------|-----------------------------|-------------|------------------|
| Maximum supply voltage      | $V_{CC}$ max |                             | 12          | V                |
| Allowable power dissipation | $P_d$ max    | $T_a \leq 70^\circ\text{C}$ | 550         | mW               |
| Operating temperature       | $T_{opr}$    |                             | -20 to +70  | $^\circ\text{C}$ |
| Storage temperature         | $T_{stg}$    |                             | -40 to +125 | $^\circ\text{C}$ |

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

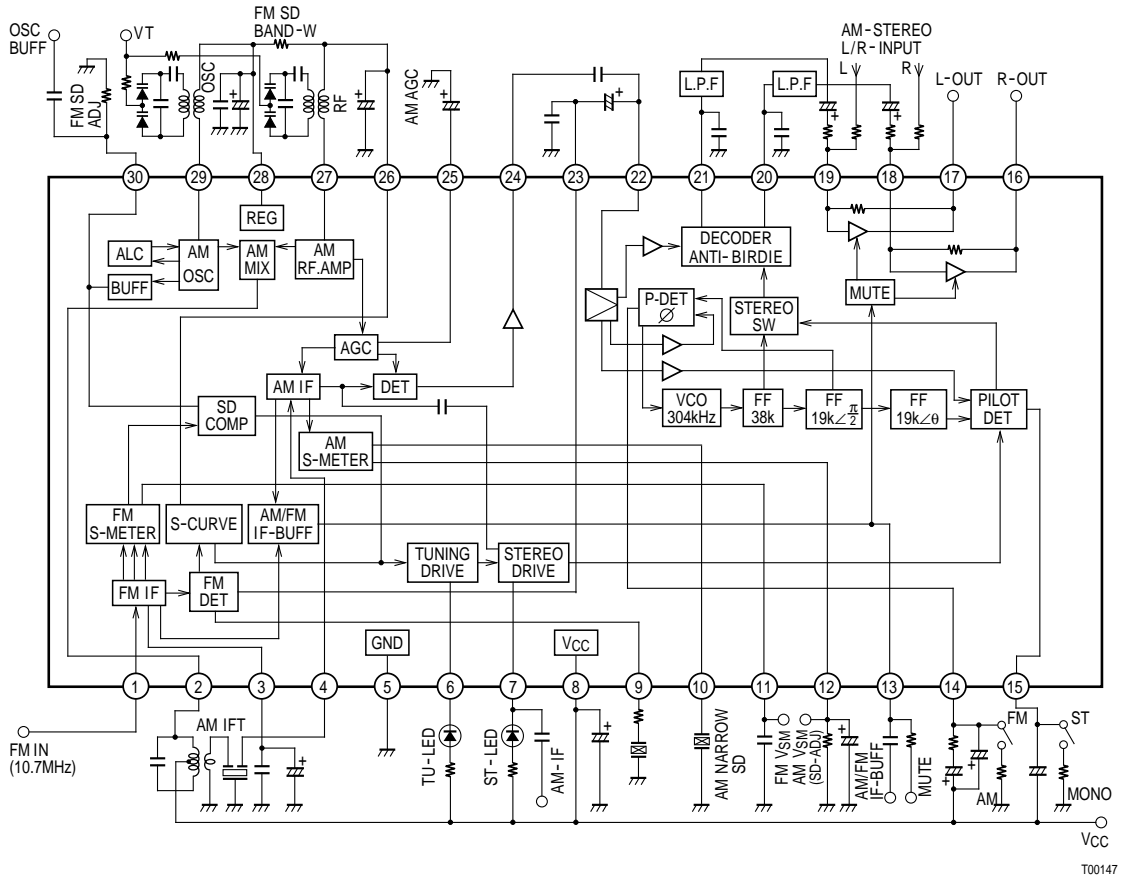
| Parameter                      | Symbol     | Conditions | Ratings | Unit |
|--------------------------------|------------|------------|---------|------|
| Recommended supply voltage     | $V_{CC}$   |            | 9       | V    |
| Operating supply voltage range | $V_{CCop}$ |            | 7 to 11 | V    |

### Operating Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 9\text{ V}$ , in the specified test circuit.

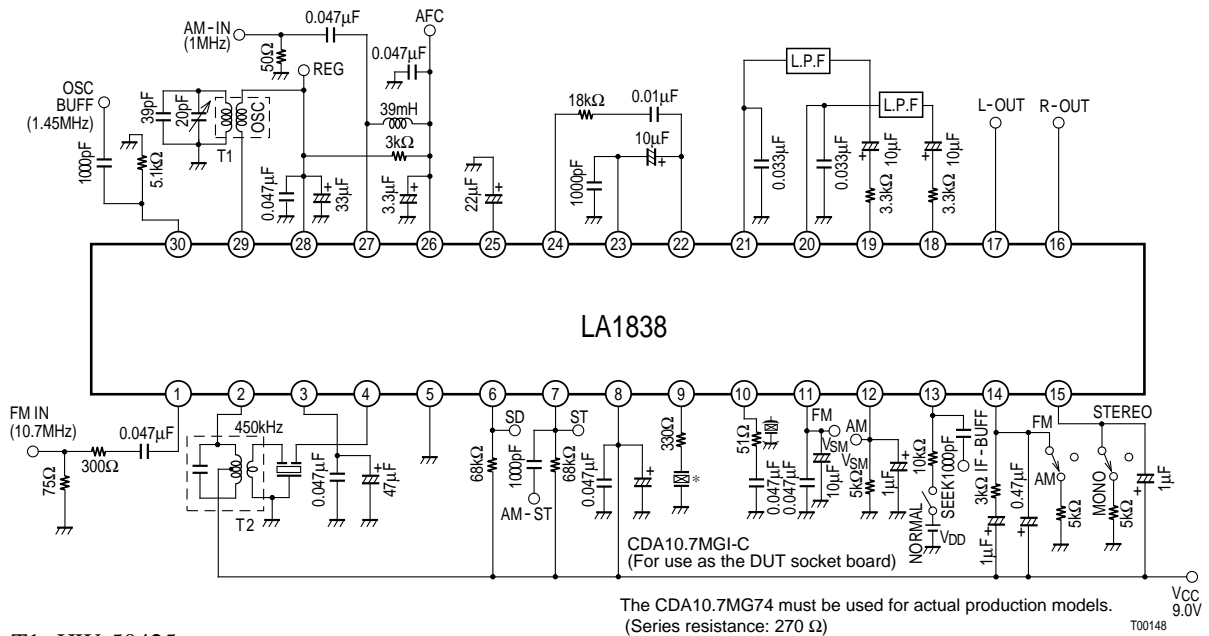
| Parameter   | Symbol          | Conditions  | Ratings |      |      | Unit     |
|---|-----------------|---|---------|------|------|----------|
|   |                 |   | min     | typ  | max  |          |
| [FM Mono Characteristics] $f_c = 10.7\text{ MHz}$ , $f_m = 1\text{ kHz}$  |                 |   |         |      |      |          |
| Current drain   | $I_{CCO-FM}$    | With no input signal  | 18      | 31   | 44   | mA       |
| Demodulator output  | $V_{OFM}$       | 100 dB $\mu$ , 100% modulation, the pin 16 output   | 730     | 1100 | 1460 | mVrms    |
| Channel balance   | C.B-mono        | 100 dB $\mu$ , 100% modulation, the pin 16 output/the pin 17 output   | -1.5    | 0    | +1.5 | dB       |
| Total harmonic distortion (mono)  | $THD_{FM}$      | 100 dB $\mu$ , 100% modulation, the pin 16 output   |         | 0.3  | 1.5  | %        |
| Signal-to-noise ratio   | $S/N_{FM}$      | 100 dB $\mu$ , 100% modulation, the pin 16 output   | 70      | 77   |      | dB       |
| AM rejection ratio  | AMR             | 100 dB $\mu$ , AM 30% modulation, the pin 16 output   | 40      | 55   |      | dB       |
| Input limiting voltage  | -3dBLS          | 100 dB $\mu$ , 100% modulation, referenced to the output, the input when the output is down by -3 dB  | 26      | 32   | 38   | dB $\mu$ |
| LED indicator on sensitivity  | $SD_{On-FM}$    |   | 47      | 57   | 67   | dB $\mu$ |
| LED indicator on bandwidth  | $SD_{BW}$       | 100 dB $\mu$  | 130     | 210  | 300  | kHz      |
| IF counter buffer output  | $V_{IFBuff-FM}$ | 100 dB $\mu$ , the pin 13 output  | 80      | 120  | 160  | mVrms    |
| S-meter output  | $V_{SM-FM1}$    | 0 dB $\mu$ , the pin 11 output  | 0       | 0.1  | 0.5  | V        |
|   | $V_{SM-FM2}$    | 100 dB $\mu$ , the pin 11 output  | 3.6     | 4.3  | 5.0  | V        |
| Mute attenuation  | Mute-Att        | 100 dB $\mu$ , 100% modulation, the pin 16 output   | 75      | 85   |      | dB       |
| [FM Stereo Characteristics] $f_c = 10.7\text{ MHz}$ , $f_m = 1\text{ kHz}$ , L + R = 90%, Pilot = 10%, 100 dB $\mu$ |                 |   |         |      |      |          |
| Separation (left)   | $Sep_L$         | Left channel modulated. The pin 16 output/the pin 17 output   | 30      | 45   |      | dB       |
| Separation (right)  | $Sep_R$         | Right channel modulated. The pin 17 output/the pin 16 output  | 30      | 45   |      | dB       |
| Stereo on level   | $ST_{ON}$       | The pilot modulation such that V7 falls under 0.7 V   | 1.3     | 2.7  | 5    | %        |
| Stereo off level  | $ST_{OFF}$      | The pilot modulation such that V7 rises to over 4.5 V   |         | 1.5  |      | %        |
| Total harmonic distortion (main)  | $THD_{-main}$   | Left + right modulation. The pin 16 output.   |         | 0.3  | 1.5  | %        |
| Adjacent channel rejection ratio  | Brej-3rd        | $f_s = 113\text{ kHz}$ , $V_s = 90\%$ , pilot = 10%<br>The left - right modulation 1 kHz demodulated output with respect to the pin 16 output |         | 40   |      | dB       |
|   | Brej-5th        | $f_s = 189\text{ kHz}$ , $V_s = 90\%$ , pilot = 10%<br>The left - right modulation 1 kHz demodulated output with respect to the pin 16 output |         | 40   |      | dB       |
| [AM Characteristics] $f_c = 1000\text{ kHz}$ , $f_m = 1\text{ kHz}$   |                 |   |         |      |      |          |
| Current drain   | $I_{CCO-AM}$    | With no input signal  | 15      | 25   | 35   | mA       |
| Detector output   | $V_{OAM1}$      | 23 dB $\mu$ , 30% modulation, the pin 16 output   | 100     | 180  | 360  | mVrms    |
|   | $V_{OAM2}$      | 80 dB $\mu$ , 30% modulation, the pin 16 output   | 200     | 320  | 500  | mVrms    |
| Signal-to-noise ratio   | $S/N_{AM1}$     | 23 dB $\mu$ , 30% modulation, the pin 16 output   | 18      | 22   |      | dB       |
|   | $S/N_{AM2}$     | 80 dB $\mu$ , 30% modulation, the pin 16 output   | 49      | 55   |      | dB       |
| Total harmonic distortion   | $THD_{AM1}$     | 80 dB $\mu$ , 30% modulation, the pin 16 output   |         | 0.4  | 1.2  | %        |
|   | $THD_{AM2}$     | 80 dB $\mu$ , 80% modulation, the pin 16 output   |         | 1.0  | 4.0  | %        |
| LED indicator on sensitivity  | $SD_{On-AM}$    |   | 17      | 27   | 37   | dB $\mu$ |
| Local oscillator buffer output  | $V_{OSC-AM}$    | With no input signal, the pin 30 output   | 110     | 160  | 220  | mVrms    |
| IF counter buffer output  | $V_{IFBuff-AM}$ | 80 dB $\mu$ , 100% modulation, the pin 13 output  | 160     | 220  | 300  | mVrms    |
| ST - IF output  | $V_{STIF-AM}$   | 80 dB $\mu$ , 100% modulation, the pin 7 output   | 16      | 34   | 48   | mVrms    |
| S-meter output  | $V_{SM-AM}$     | 0 dB $\mu$ , 100% modulation  | 0       | 0    | 0.2  | V        |

# LA1838

## Block Diagram



## AC Test Circuit



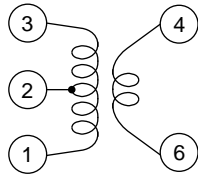
T1: HW-50425  
T2: YD-1073-1

The CDA10.7MG74 must be used for actual production models.  
(Series resistance: 270 Ω)

T00148

**Coil Specifications**

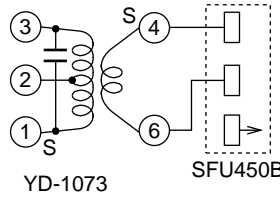
- AM oscillator (for the DUT)  
HW-50425 (Mitsumi)



A10633

③ - ② 2T  
④ - ⑥ 9T  
② - ① 86T  
 $Q_0 \geq 80$   
 $L = 270 \mu\text{H}$

- IFT  
YD-1073-1 (Mitsumi)



A10634

② - ① 58T  
④ - ⑥ 7T  
② - ③ 94T  
 $f_0 = 450 \text{ kHz}$   
 $Q_0 = 110$

A 180-pF capacitor is built in  
With an external SFU450B

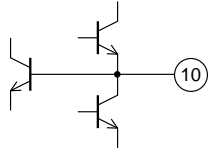
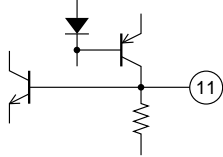
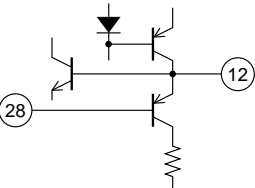
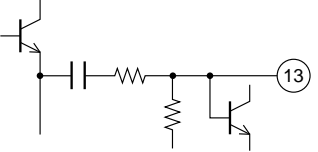
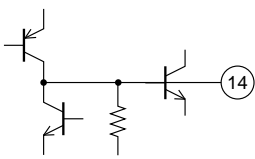
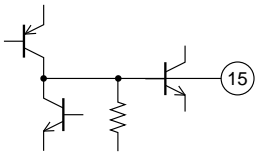
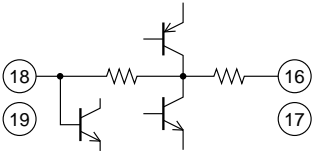
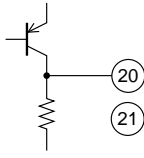
**Pin Functions**

| Pin No. | Pin function                      | Pin voltage                        | Notes   | Equivalent circuit |
|---------|-----------------------------------|------------------------------------|---|--------------------|
| 1       | FM IF input                       | Vreg                               | Input impedance $r_i = 330 \Omega$  | <br>A10635         |
| 2       | AM mixer output                   | V <sub>CC</sub>                    | Connect the mixer coil between this pin and V <sub>CC</sub>   | <br>A10636         |
| 3       | FM IF input bypass                | Vreg                               | Also used for the MPX regulator filter  | <br>A10635         |
| 4       | AM IF input                       | Vreg                               | Input impedance $r_i = 2 \text{ k}\Omega$   | <br>A10637         |
| 5       | GND                               | 0 V                                |   |                    |
| 6<br>7  | TU-LED<br>ST-LED,<br>AF-IF output | V <sub>CC</sub><br>V <sub>CC</sub> | Active low<br>Open collector<br>AM stereo IF output (pin 7)<br>The influx current must be held under 150 $\mu\text{A}$ .                              | <br>A10638         |
| 8       | V <sub>CC</sub>                   | V <sub>CC</sub>                    |   |                    |
| 9       | FM detector                       | Vreg - 1.4                         | The CDA10.7 MG74 (Murata Mfg. Co., Ltd.) is recommended as the ceramic discriminator. A device with a series resistance of 270 $\Omega$ must be used. | <br>A10639         |

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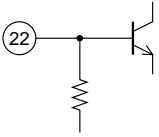
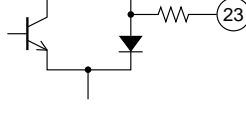
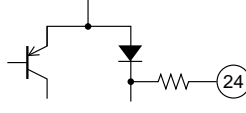
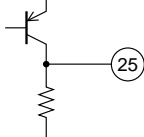
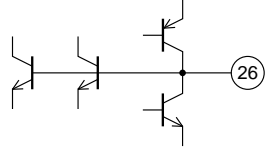
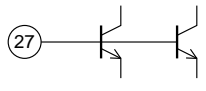
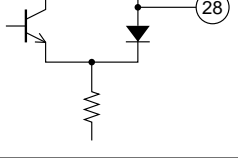
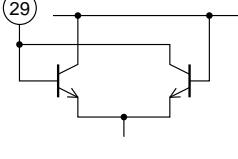
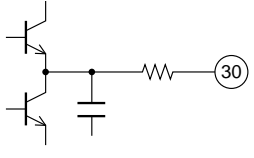
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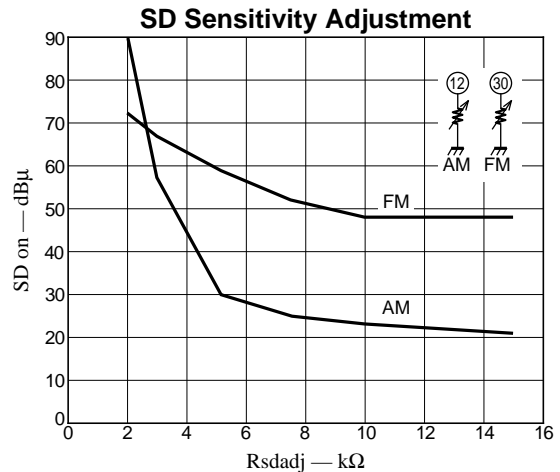
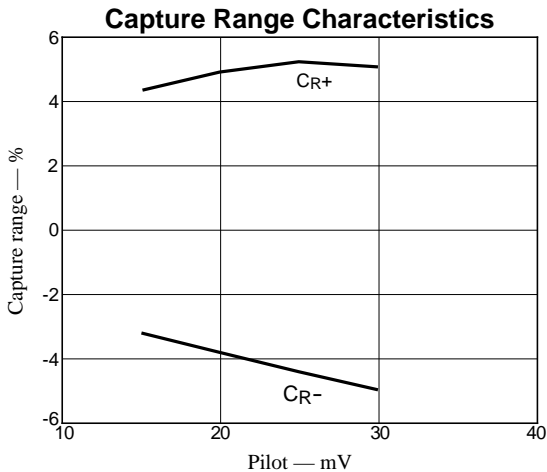
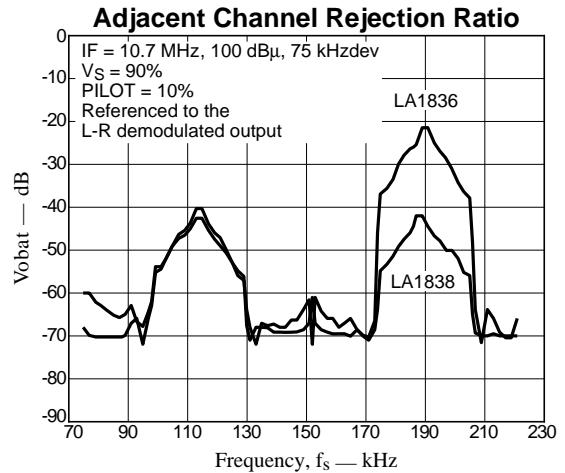
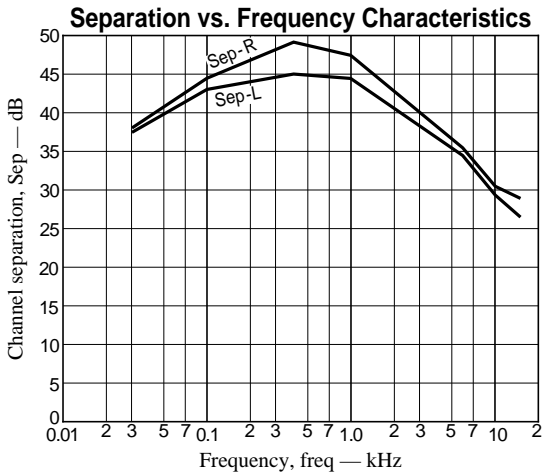
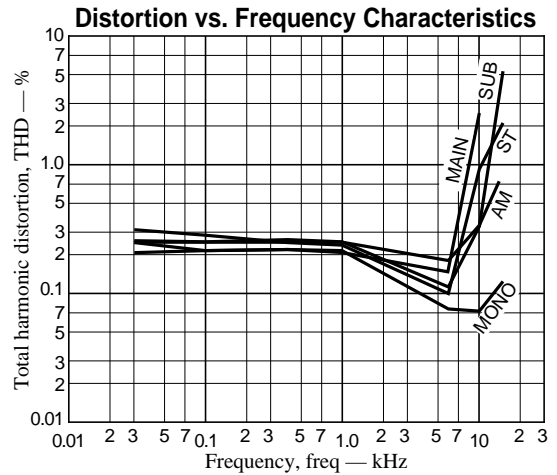
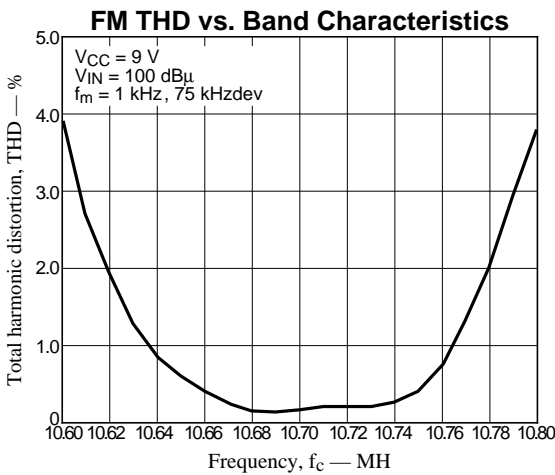
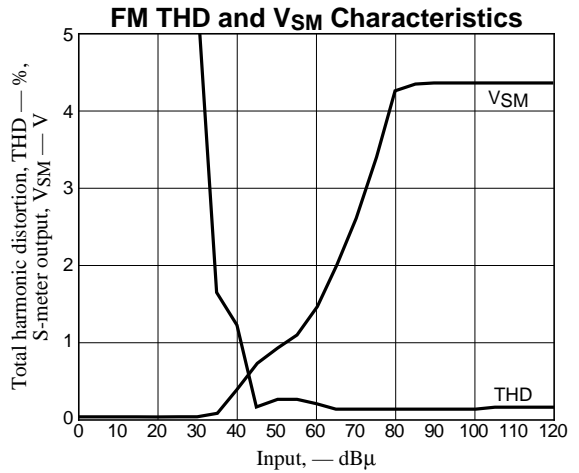
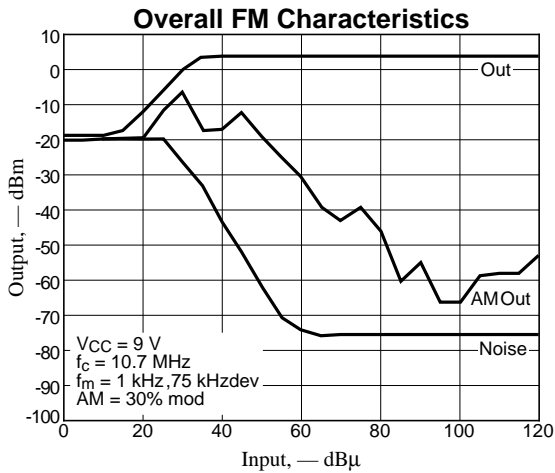
| Pin No.              | Pin function   | Pin voltage                     | Notes   | Equivalent circuit  |
|----------------------|--|---------------------------------|---|---|
| 10                   | AM narrow band CF connection                                   | 1.3 V                           | Recommended narrow band CF: BFU450 C4N (Murata Mfg. Co., Ltd.)<br>When the narrow band SD function is not used, bypass this circuit with a 50 Ω resistor and a 0.047 μF capacitor in series.                                    | <br>A10640   |
| 11                   | FM S-meter output  | 0 V                             | $R_L = 8\text{ k}\Omega$  | <br>A10641   |
| 12                   | AM S-meter output  | 0 V (AM)                        | The AM SD sensitivity is adjusted with an external resistor connected between this pin and ground   | <br>A10642   |
| 13                   | AM/FM IF buffer output,<br>Output control switch (mute switch) | 0 V                             | $V_{13} \leq 0.5\text{ V}$ : Reception state<br>$1.4\text{ V} \leq V_{13} \leq 2.2\text{ V}$ : IF buffer output on<br>$V_{13} \geq 3.5\text{ V}$ : IF buffer output and muting on   | <br>A10643  |
| 14                   | Phase comparator low-pass filter (AM/FM switching)             | $V_{CC} - 1.4$ (FM)<br>0 V (AM) | The device operates in AM mode when this pin is connected to ground through a resistor.<br>Limit values for the resistor:<br>2.7 kΩ (When $V_{CC} = 7\text{ V}$ )<br>3.9 kΩ (8 V), 5.1 kΩ (9 V)<br>6.2 kΩ (10 V), 7.5 kΩ (11 V) | <br>A10644 |
| 15                   | Pilot detector low-pass filter (Forced mono) (VCO stop)        | $V_{CC} - 1.0$                  | The device is forced to monaural when a current of over 50 μA flows from this pin.<br>The VCO is stopped if this pin is connected to ground.<br>The limit values for the resistor are the same as those for pin 14.             | <br>A10645 |
| 16<br>17<br>18<br>19 | Post-amplifier inputs and outputs                              | Vreg<br>Vreg                    | Output impedance $r_o = 200\ \Omega$<br>Pin 16: Right output, pin 17: Left output<br>Inverting input pins<br>Pin 18: Right input, pin 19: Left input<br>$R_{NF} = 33\text{ k}\Omega$  | <br>A10646 |
| 20<br>21             | MPS outputs  | 3.5 V<br>3.5 V                  | Output impedance $r_o = 3.3\text{ k}\Omega$<br>Pin 20: Right deemphasis<br>Pin 21: Left deemphasis  | <br>A10647 |

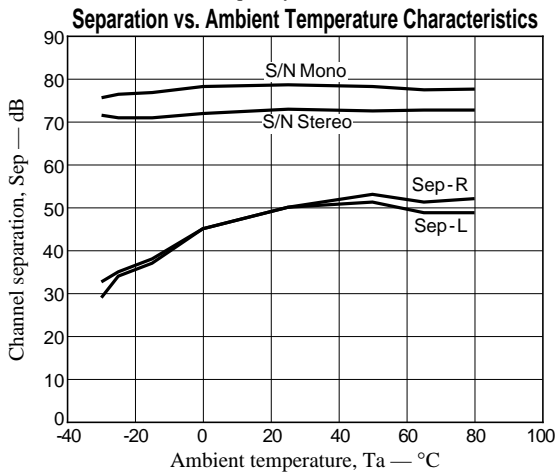
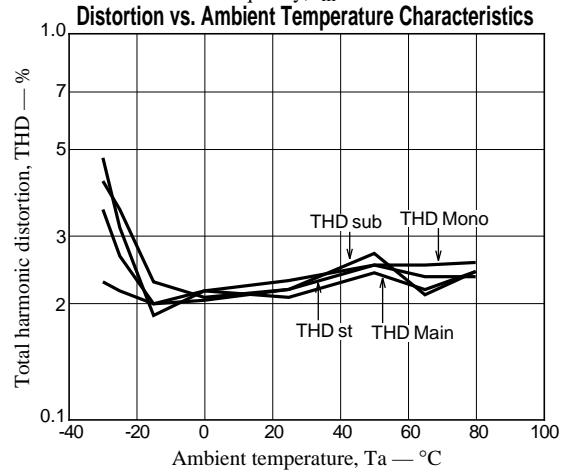
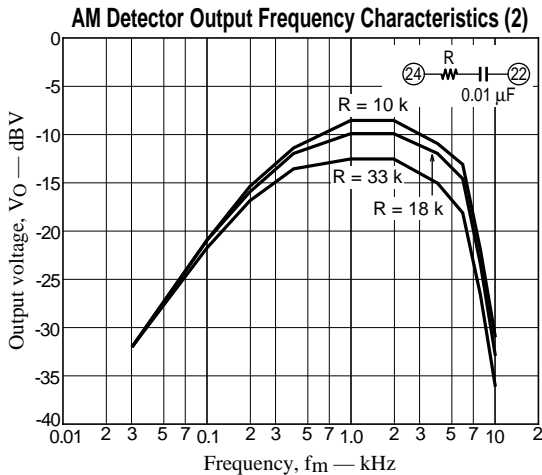
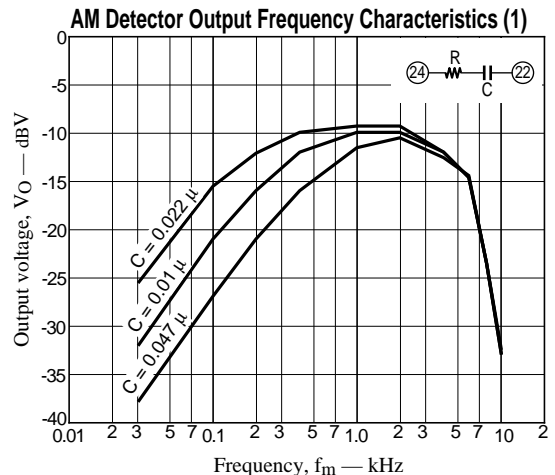
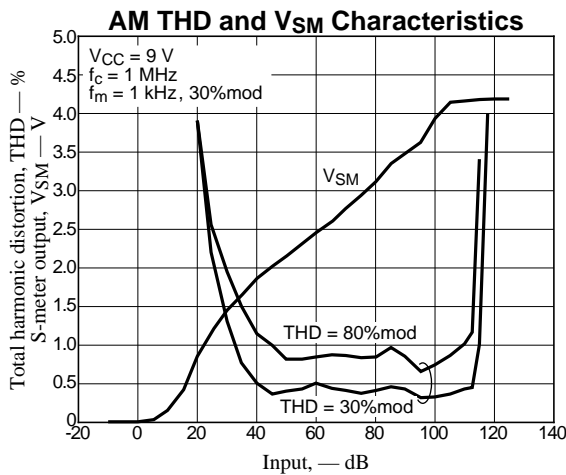
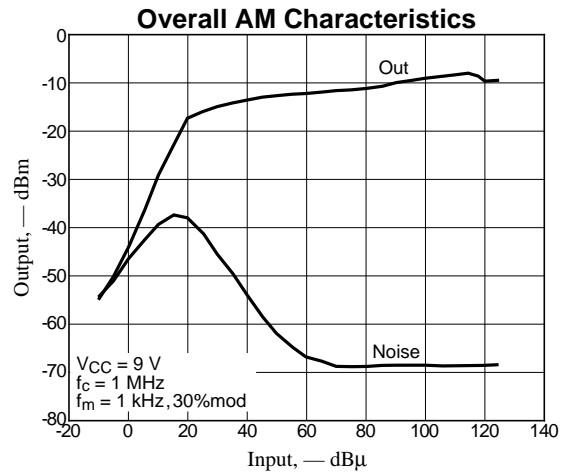
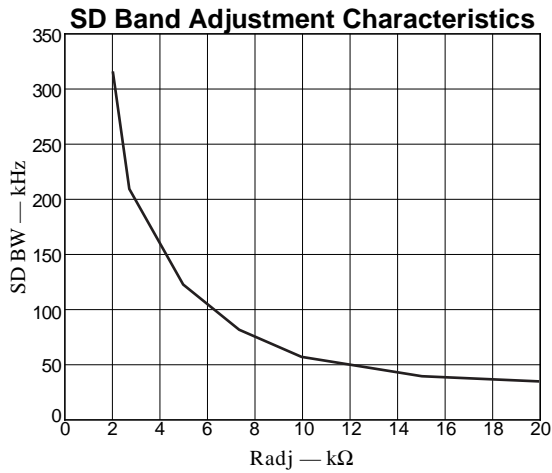
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| Pin No. | Pin function  | Pin voltage              | Notes   | Equivalent circuit  |
|---------|---|--------------------------|---|---|
| 22      | MPX input   | 2.9 V                    | Input impedance $r_i = 20 \text{ k}\Omega$  |  <p>A10648</p>   |
| 23      | FM demodulator output                                     | 2.8 V (FM)<br>2.8 V (AM) | Output impedance $r_o = 3.0 \text{ k}\Omega$<br>The channel separation can be adjusted with an external capacitor connected between this pin and ground.<br>The $V_O \text{ sub}/V_O \text{ main}$ ratio is set to be about 0 dB. |  <p>A10649</p>   |
| 24      | AM detector output  | 0 V (FM)<br>0.5 V (AM)   | Output impedance $r_o = 3.3 \text{ k}\Omega$<br>The AM frequency characteristics can be adjusted by modifying the time constant of the circuit connected between this pin and pin 22 and between this pin and ground.             |  <p>A10650</p>   |
| 25      | AM AGC  | 0 V (FM)<br>0.5 V (AM)   | The resistance of the built-in resistor R is 11 kΩ  |  <p>A10651</p>  |
| 26      | AFC   | Vreg                     | The FM SD bandwidth can be adjusted with the external resistor connected between this pin and pin 28  |  <p>A10652</p> |
| 27      | AM RF input   | Vreg                     | Must be used at the same potential as pin 28  |  <p>A10653</p> |
| 28      | REG   | Vreg                     | Vreg = 3.6 V  |  <p>A10654</p> |
| 29      | OSC   | Vreg                     | Connect the oscillator coil between this pin and pin 28   |  <p>A10655</p> |
| 30      | Oscillator buffer output,<br>FM SD sensitivity adjustment | 1.6 V (FM)<br>1.3 V (AM) | The FM SD sensitivity can be adjusted with an external resistor connected between this pin and ground.<br>Output impedance $r_o = 200 \Omega$   |  <p>A10656</p> |







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