



SANYO Semiconductors

## DATA SHEET

# LA1800

 — Monolithic Linear IC  

## FM / AM Single-Chip Radio

### Functions

- FM : Front end, low-pass filter, IF amplifier, quadrature detector, muting.
- AM : RF amplifier, detector.
- AM : AF driver (earphone driver).

### Features

- Minimum number of external parts required : One tuning circuit each for FM, AM
- Low current dissipation : 5.6mA/FM, 3.2mA/AM
- Low-voltage operation :  $V_{CC}$  min=2.5V

### Specifications

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

| Parameter                   | Symbol       | Conditions | Ratings     | Unit             |
|-----------------------------|--------------|------------|-------------|------------------|
| Maximum supply voltage      | $V_{CC}$ max | Pin 3      | 6.0         | V                |
| Allowable power dissipation | $P_d$ max    |            | 200         | 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     | $V_{CC}$    |            | 3.0        | V    |
| Operating supply voltage range | $V_{CC}$ op |            | 2.5 to 5.0 | V    |

Operating Characteristics at  $T_a=25^\circ\text{C}$ ,  $V_{CC}=3\text{V}$ , See specified Test Circuit.

| Parameter      | Symbol           | Conditions | Ratings |     |     | Unit |
|----------------|------------------|------------|---------|-----|-----|------|
|                |                  |            | min     | typ | max |      |
| [AM]           |                  |            |         |     |     |      |
| Current drain  | I <sub>cco</sub> |            |         | 3.6 | 5.5 | mA   |
| Pin 2 voltage  | V <sub>2</sub>   |            | 1.9     | 2.4 | 2.9 | V    |
| Pin 14 voltage | V <sub>14</sub>  |            | 0.4     | 0.9 | 1.6 | V    |
| Pin 21 voltage | V <sub>21</sub>  |            | 0.6     | 0.9 | 1.2 | V    |

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SANYO Electric Co.,Ltd. Semiconductor Company

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| Parameter      | Symbol           | Conditions | Ratings |      |     | Unit |
|----------------|------------------|------------|---------|------|-----|------|
|                |                  |            | min     | typ  | max |      |
| [FM]           |                  |            |         |      |     |      |
| Current drain  | I <sub>cco</sub> |            |         | 5.6  | 8.0 | mA   |
| Pin 2 voltage  | V <sub>2</sub>   |            | 1.9     | 2.6  | 2.9 | V    |
| Pin 4 voltage  | V <sub>4</sub>   |            | 1.7     | 2.3  | 2.9 | V    |
| Pin 5 voltage  | V <sub>5</sub>   |            | 1.7     | 2.3  | 2.9 | V    |
| Pin 6 voltage  | V <sub>6</sub>   |            | 1.1     | 1.7  | 2.3 | V    |
| Pin 7 voltage  | V <sub>7</sub>   |            | 1.1     | 1.7  | 2.3 | V    |
| Pin 8 voltage  | V <sub>8</sub>   |            | 1.1     | 1.7  | 2.3 | V    |
| Pin 9 voltage  | V <sub>9</sub>   |            | 1.9     | 2.6  | 2.9 | V    |
| Pin 10 voltage | V <sub>10</sub>  |            | 1.8     | 2.5  | 2.9 | V    |
| Pin 13 voltage | V <sub>13</sub>  |            |         | 0    | 0.6 | V    |
| Pin 14 voltage | V <sub>14</sub>  |            | 0.5     | 1.0  | 1.7 | V    |
| Pin 16 voltage | V <sub>16</sub>  |            | 1.6     | 2.3  | 2.9 | V    |
| Pin 17 voltage | V <sub>17</sub>  |            | 1.6     | 2.3  | 2.9 | V    |
| Pin 19 voltage | V <sub>19</sub>  |            | 0.6     | 0.86 | 14  | V    |
| Pin 20 voltage | V <sub>20</sub>  |            | 0.6     | 0.86 | 14  | V    |
| [AF]           |                  |            |         |      |     |      |
| Pin 11 current | I <sub>11</sub>  |            | 0.5     | 1.0  | 1.5 | mA   |
| Pin 12 voltage | V <sub>12</sub>  |            |         | 0    | 0.5 | V    |

[Reference characteristics]

**Operating Characteristics** at Ta=25°C, V<sub>CC</sub>=3V, See specified Test Circuit 2.

| Parameter                             | Symbol               | Conditions                      | Ratings |     |     | Unit |
|---------------------------------------|----------------------|---------------------------------|---------|-----|-----|------|
|                                       |                      |                                 | min     | typ | max |      |
| [AM: f <sub>C</sub> =1MHz, fm=400Hz]  |                      |                                 |         |     |     |      |
| Current drain                         | I <sub>cco</sub>     | Quiescent                       |         | 3.6 |     | mA   |
| Detection output                      | V <sub>O1</sub>      | V <sub>IN</sub> =40dBμ, 30% mod |         | 10  |     | mV   |
|                                       | V <sub>O2</sub>      | V <sub>IN</sub> =70dBμ, 30% mod |         | 100 |     | mV   |
| Signal-to-noise ratio                 | S/N                  | V <sub>IN</sub> =70dBμ, 30% mod |         | 47  |     | dB   |
| [FM: f <sub>C</sub> =90MHz, fm=400Hz] |                      |                                 |         |     |     |      |
| Current drain                         | I <sub>cco</sub>     | Quiescent                       |         | 5.6 |     | mA   |
| Input limiting sensitivity            | -3dB <sub>L.S.</sub> | 3dB down, 30% mod               |         | 16  |     | dBμ  |
| Demodulation output                   | V <sub>O</sub>       | V <sub>IN</sub> =80dBμ, 30% mod |         | 90  |     | mV   |
| Total harmonic distortion             | THD                  | V <sub>IN</sub> =80dBμ, 30% mod |         | 0.8 |     | %    |
| Signal-to-noise ratio                 | S/N                  | V <sub>IN</sub> =80dBμ          |         | 59  |     | dB   |
| [AF: fm=400Hz]                        |                      |                                 |         |     |     |      |
| Voltage gain                          | V <sub>G</sub>       | V <sub>O</sub> =50mV            |         | 24  |     | dB   |
| Total harmonic distortion             | THD                  | V <sub>O</sub> =50mV            |         | 0.3 |     | %    |

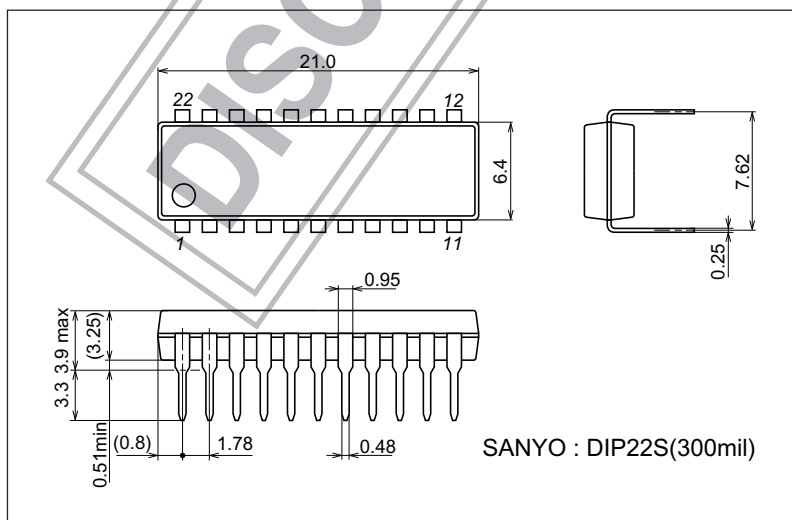
Note : 1. Current drain for FM, AM includes current of AF driver stage.

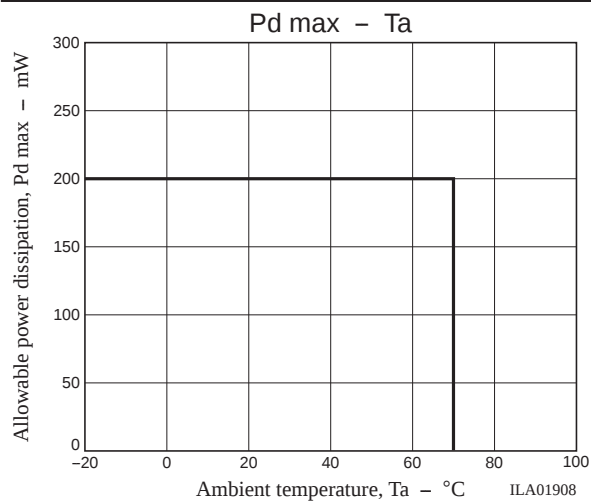
2. When handling the IC, be careful not to cause dielectric breakdown.

**Package Dimensions**

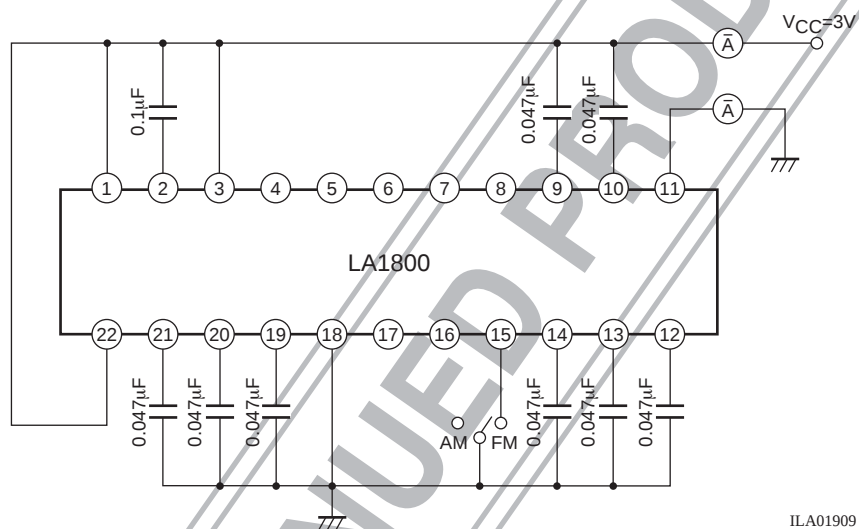
unit : mm

3059A

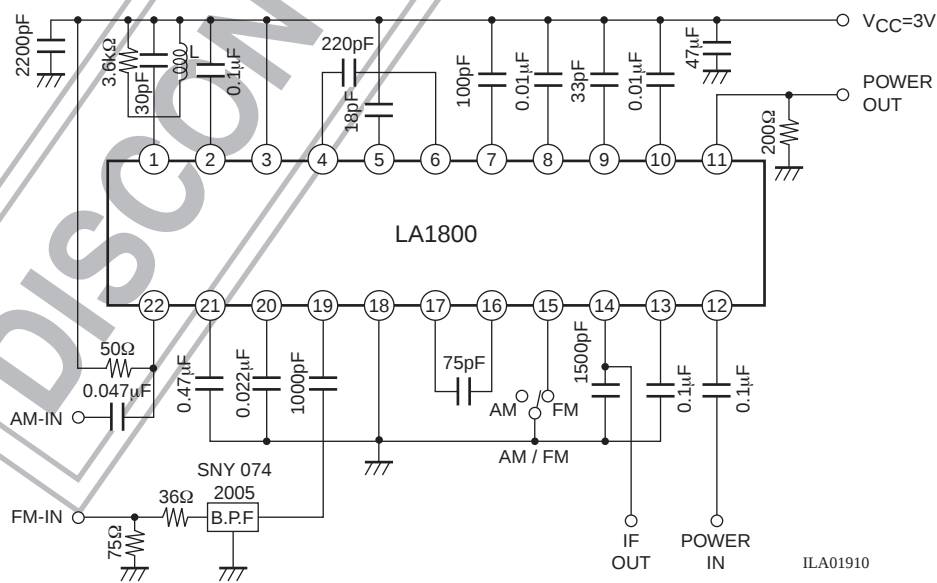




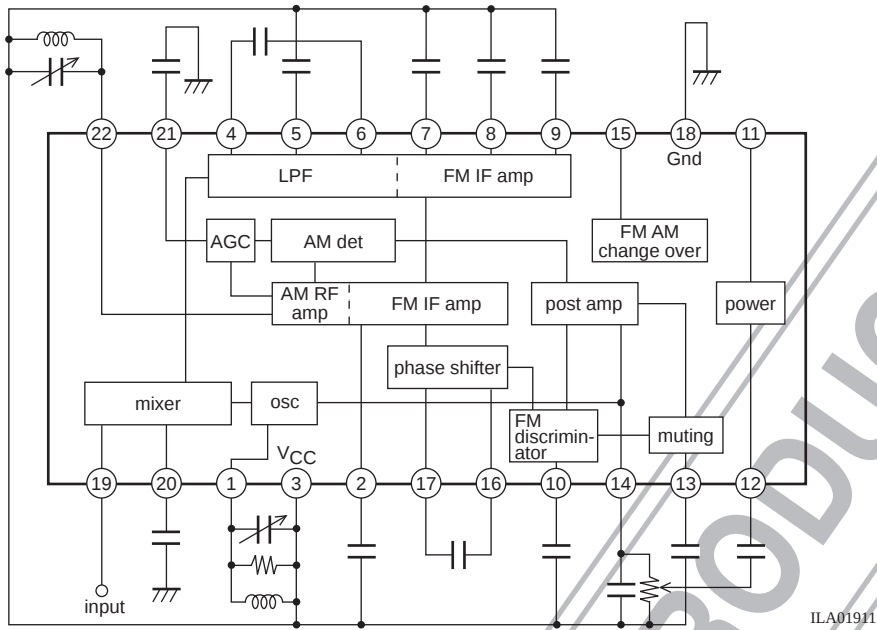
**DC Test Circuit**



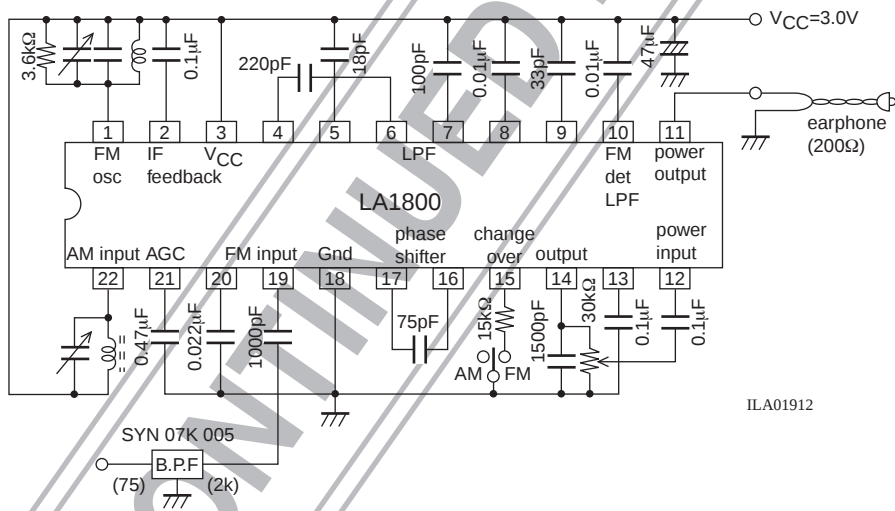
**AC Test Circuit**



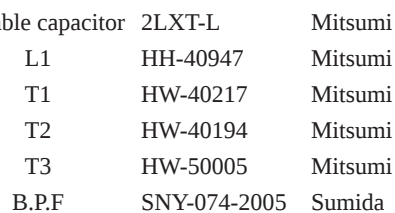
## Equivalent Circuit Block Diagram



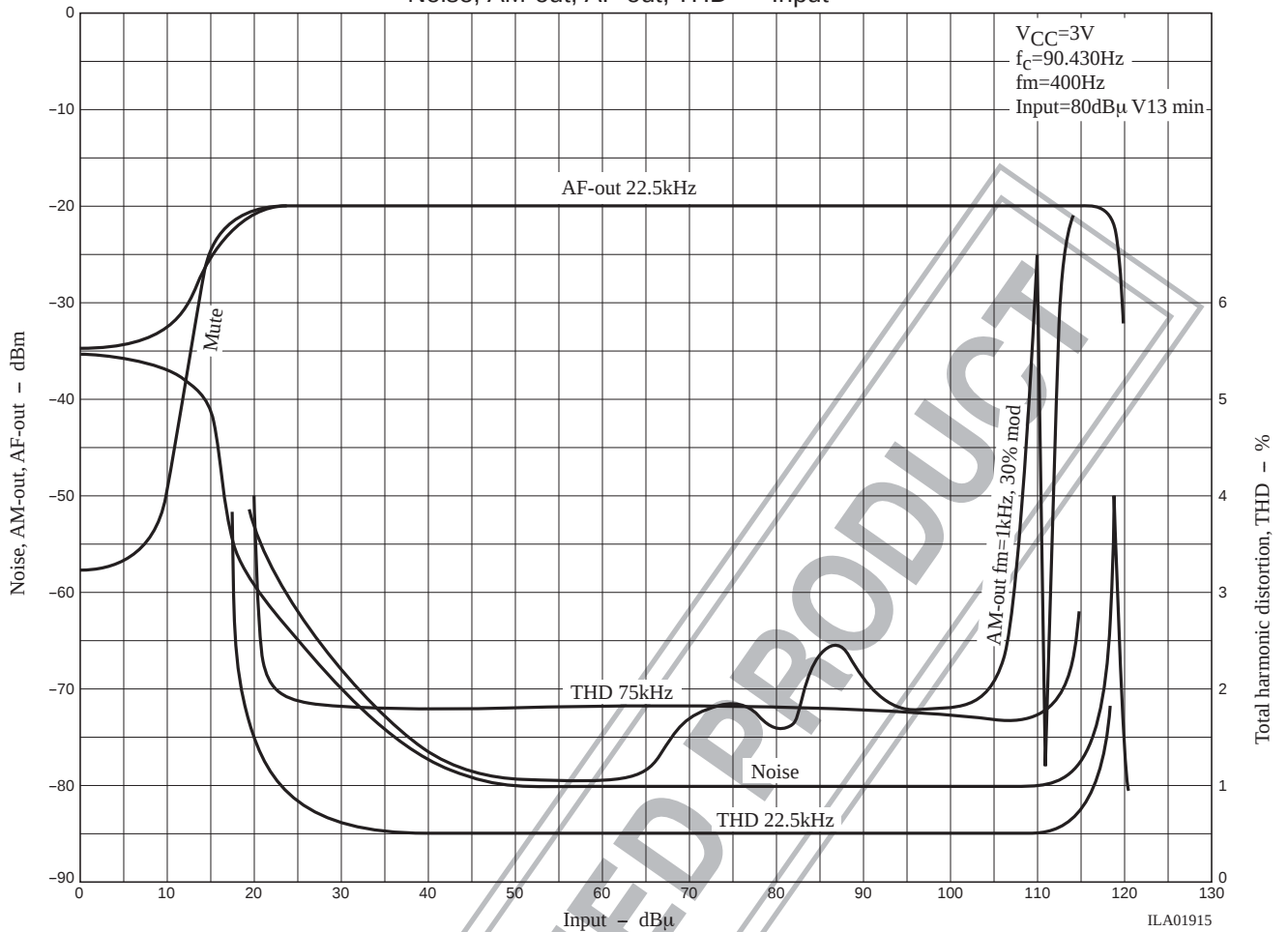
## Sample Application Circuit



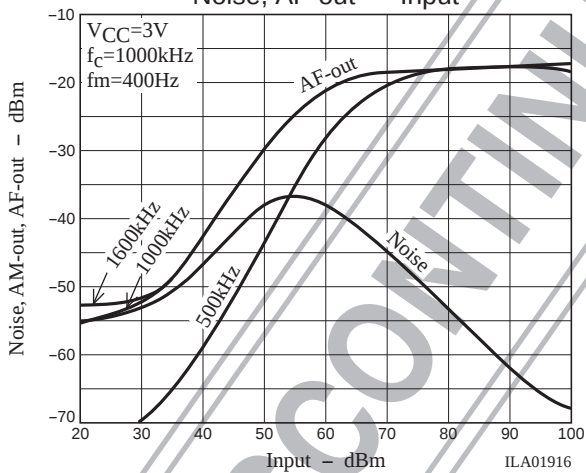
### Sample Printed Circuit Pattern (Cu-foiled side)



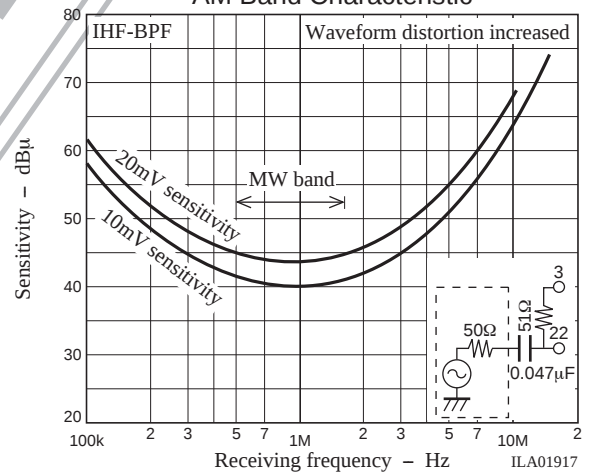
## Noise, AM-out, AF-out, THD - Input



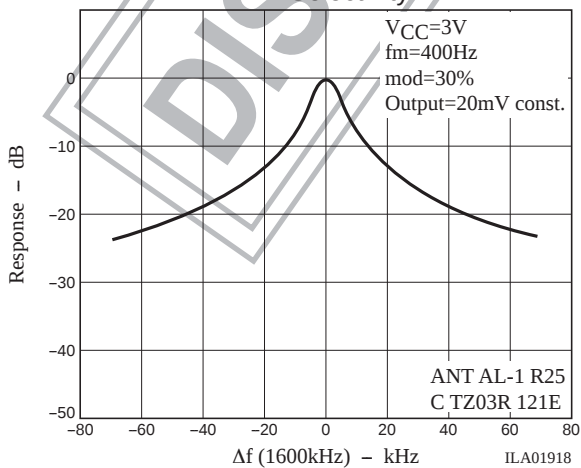
Noise, AF-out - Input



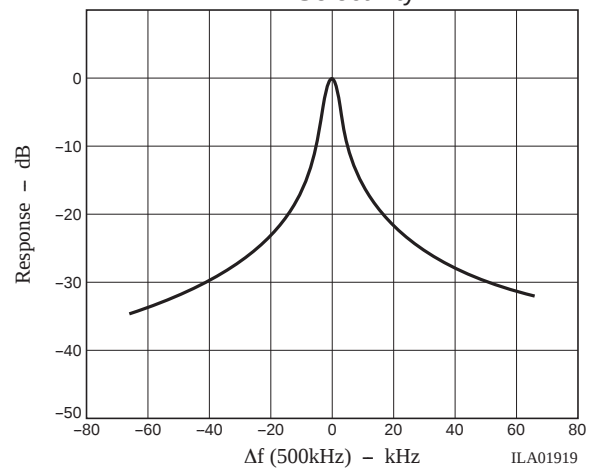
AM Band Characteristic

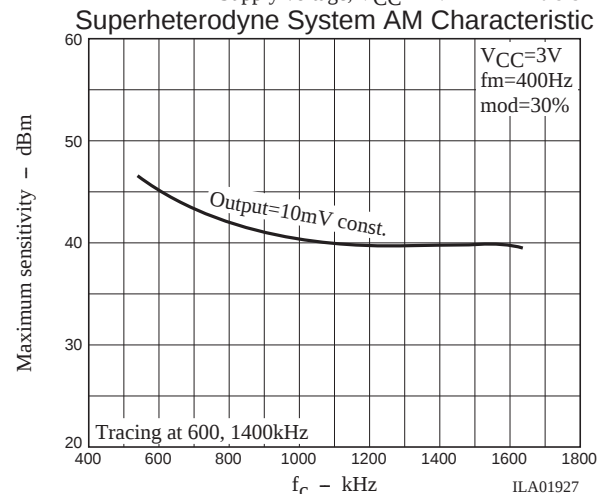
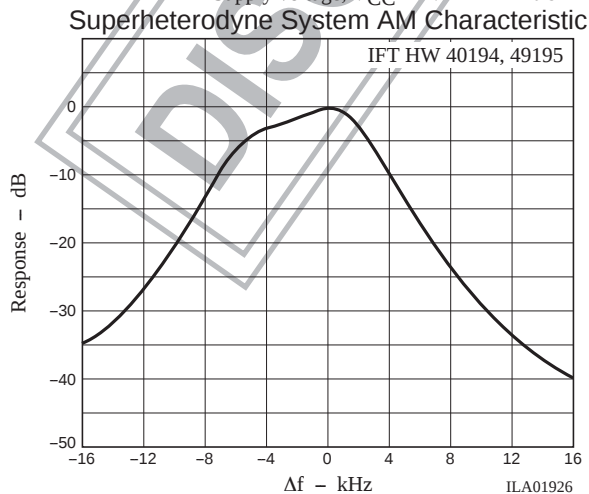
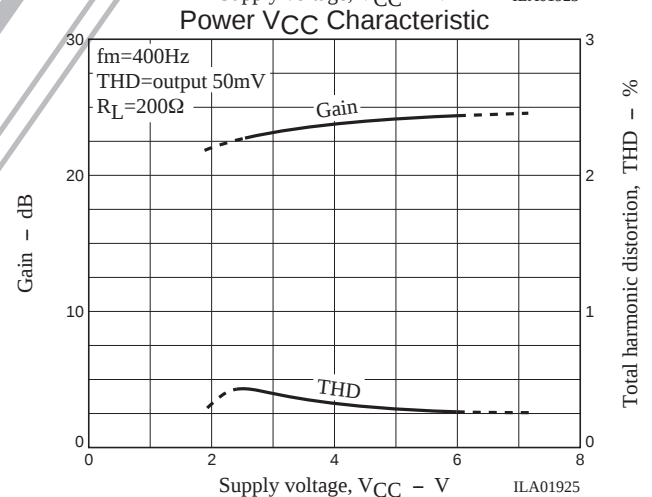
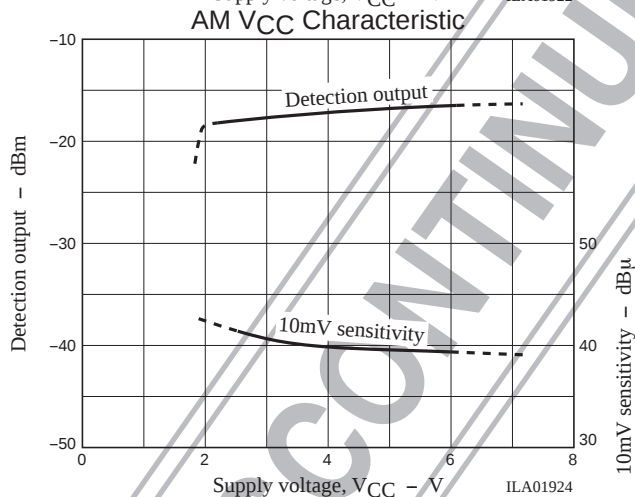
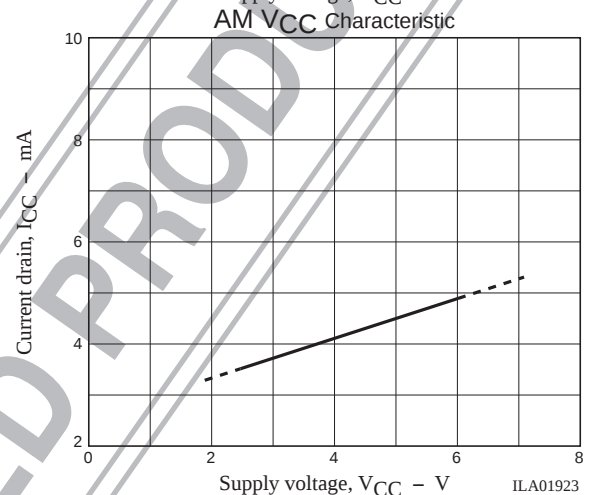
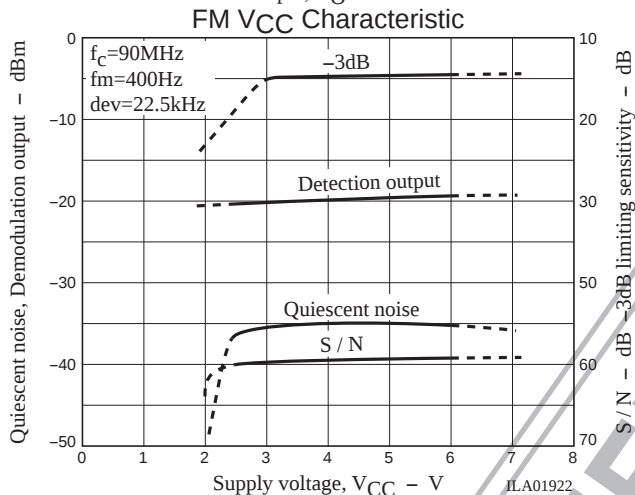
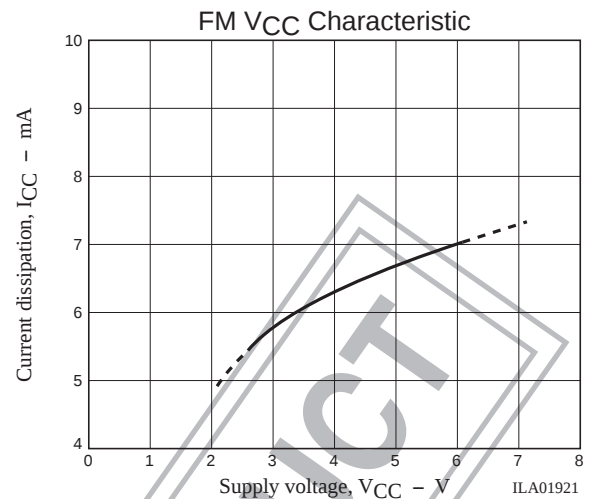
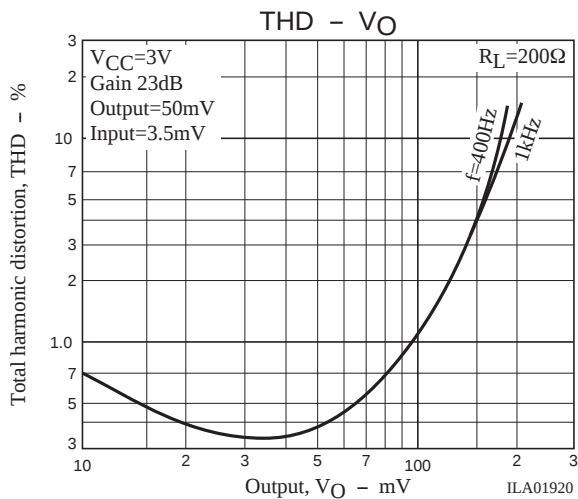


AM Selectivity

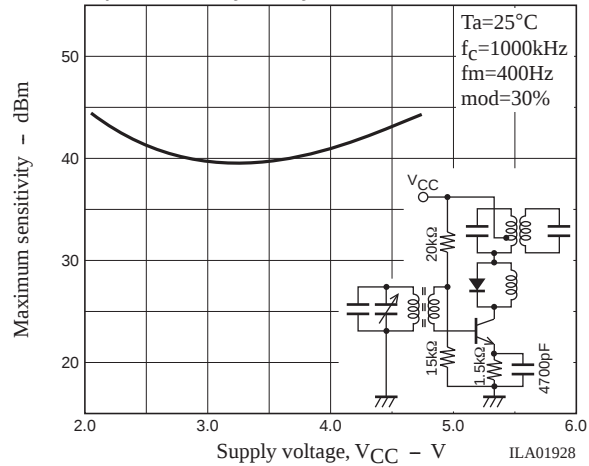


AM Selectivity

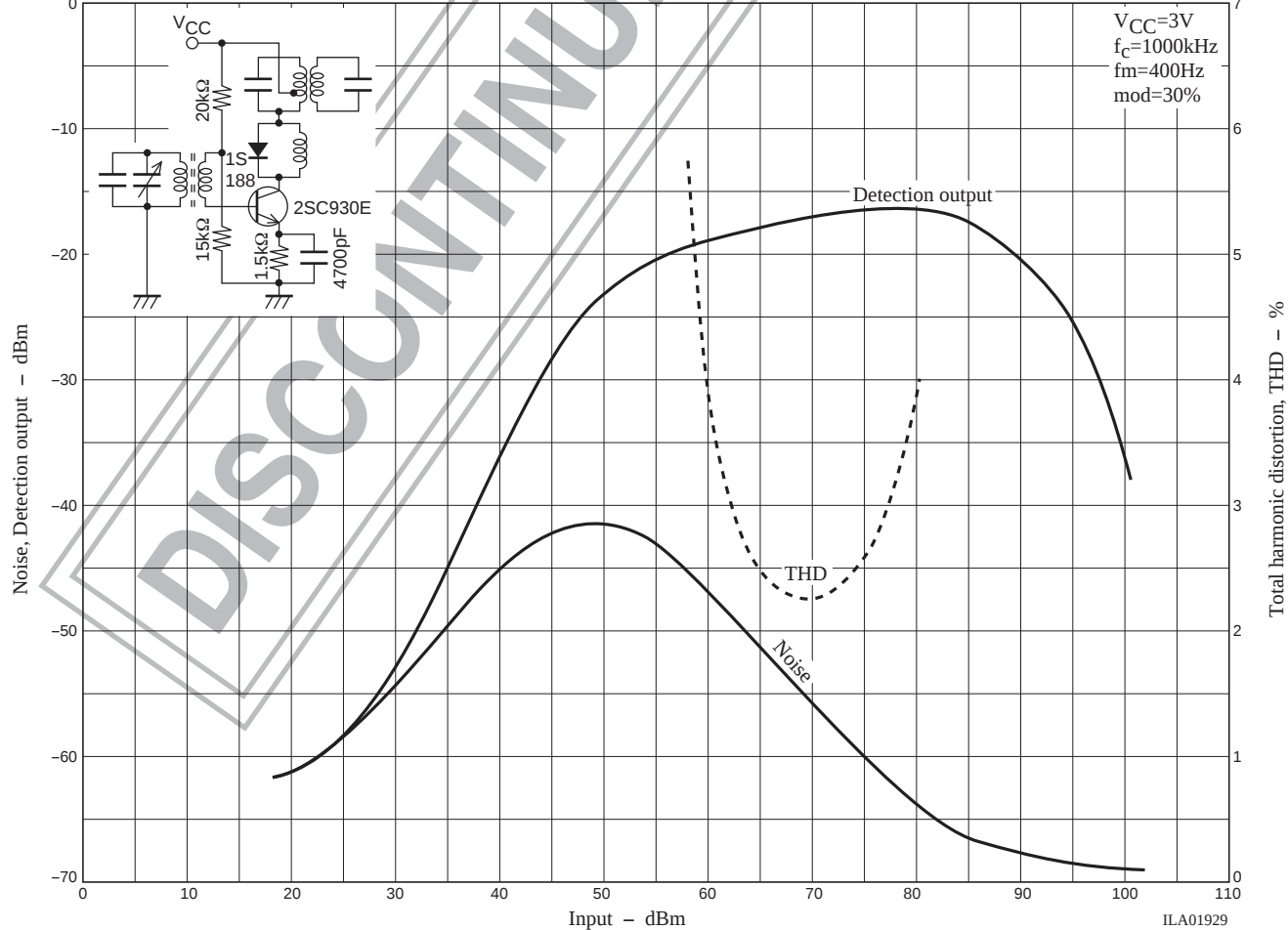


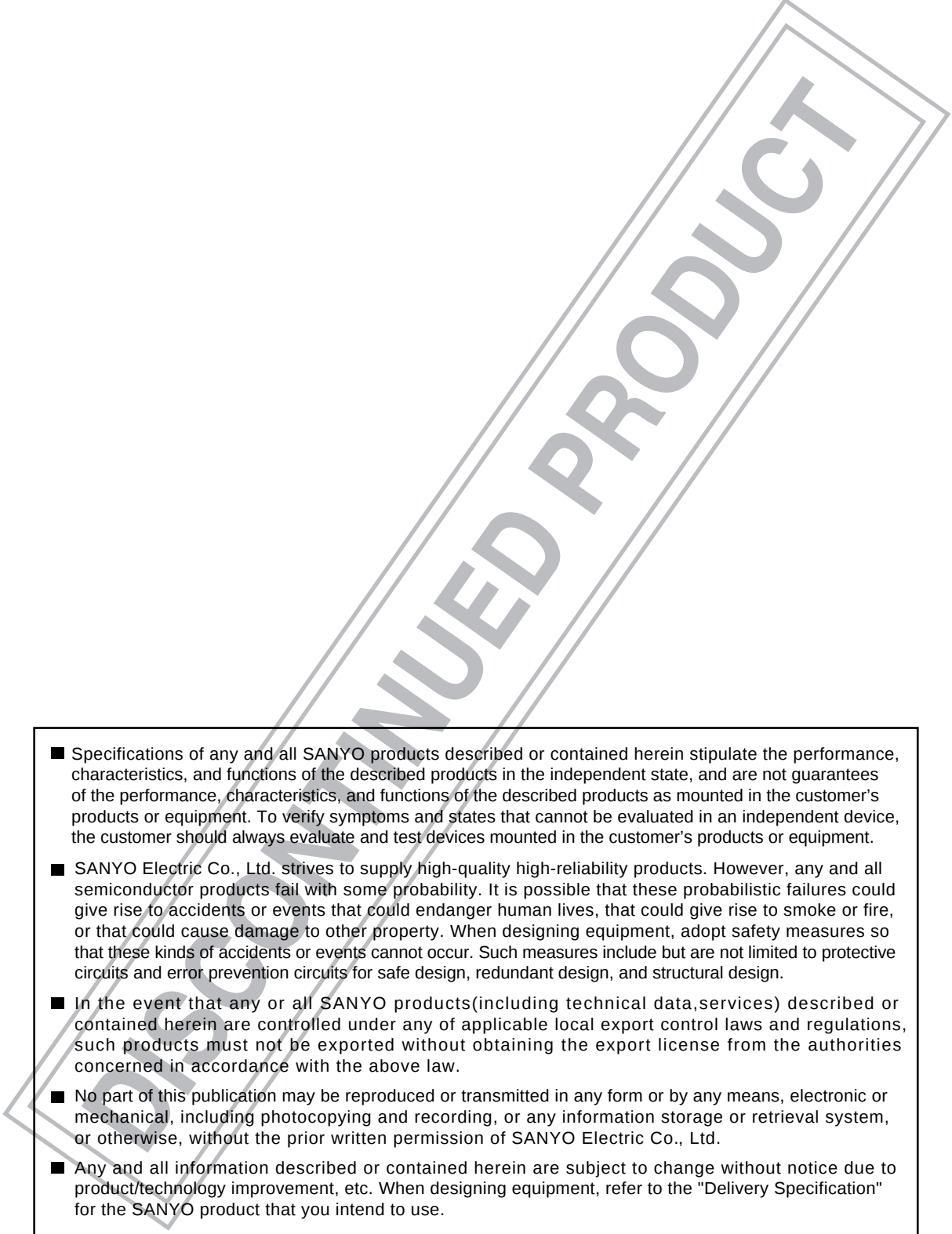


Superheterodyne System AM Characteristic



Superheterodyne System AM Characteristic



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