

**SANYO****LA1851N****DTS Single-chip Tuner IC**

## Overview

The LA1851N is a tuner IC designed for home-use stereo equipment which supports the SD system and IF counter system and incorporates AM/FM IF/MPX functions on a single chip.

## Features

- AM/FM tuner and multiplex demodulator on a single chip
- No multiplexer adjustments required
- Output (FM/AM) for IF counter buffer compatible with electronic tuning
- Stereo separation control
- Forced monaural and VCO stop functions
- Minimal multiplexer carrier leakage
- Excellent VCO temperature characteristics:  $f_o = 0.1\%$  typ. with  $\pm 50$  deg. variation

## Functions

### [FM Block]

- IF amplifier
- Quadrature detector
- IF counter buffer
- S-meter output
- Tuner indicator (variable sensitivity)

### [AM Block]

- RF amplifier
- Mixer
- Oscillator
- Oscillator buffer
- IF amplifier
- Detector
- AGC
- IF counter buffer
- Tuner indicator (variable sensitivity)

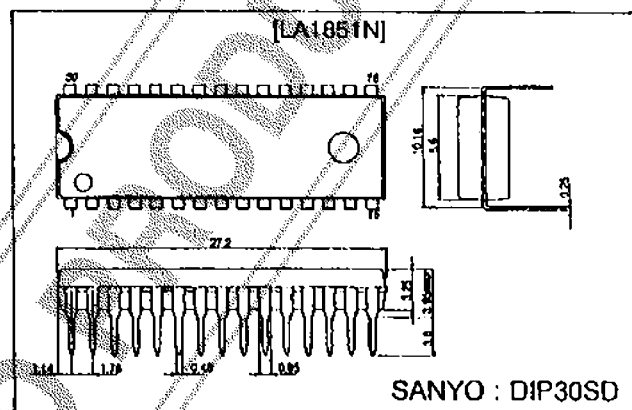
### [MPX Block]

- PLL decoder
- ST indicator
- VCO stop
- Mute
- Separation control
- No VCO adjustment
- Forced monaural (VCO stop)

## Package Dimensions

unit : mm

### 3196-DIP30SD



## Specifications

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

| Parameter                   | Symbol               | Conditions                   | Rating      | Unit             |
|-----------------------------|----------------------|------------------------------|-------------|------------------|
| Maximum supply voltage      | $V_{CC \text{ max}}$ | Pins 3, 7, 10, 21, 22 and 26 | 14          | V                |
| Maximum supply current      | $I_{CC \text{ max}}$ | Pin 3                        | 40          | mA               |
|                             |                      | Pins 21 and 22               | 20          | mA               |
| Allowable power dissipation | $P_d \text{ max}$    | $T_a = 70^\circ\text{C}$     | 480         | mW               |
| Operating temperature       | $T_{opr}$            |                              | -20 to +70  | $^\circ\text{C}$ |
| Storage temperature         | $T_{stg}$            |                              | -40 to +125 | $^\circ\text{C}$ |

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43096HA(II)/40594HK/N0621'S No. 3231-1/15

# LA1851N

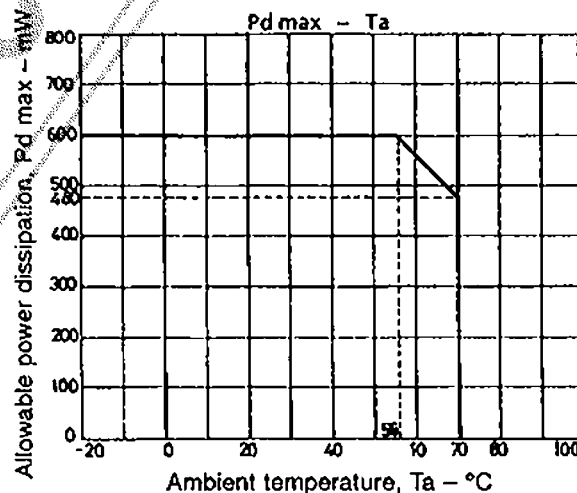
## Operating Conditions at Ta = 25 °C

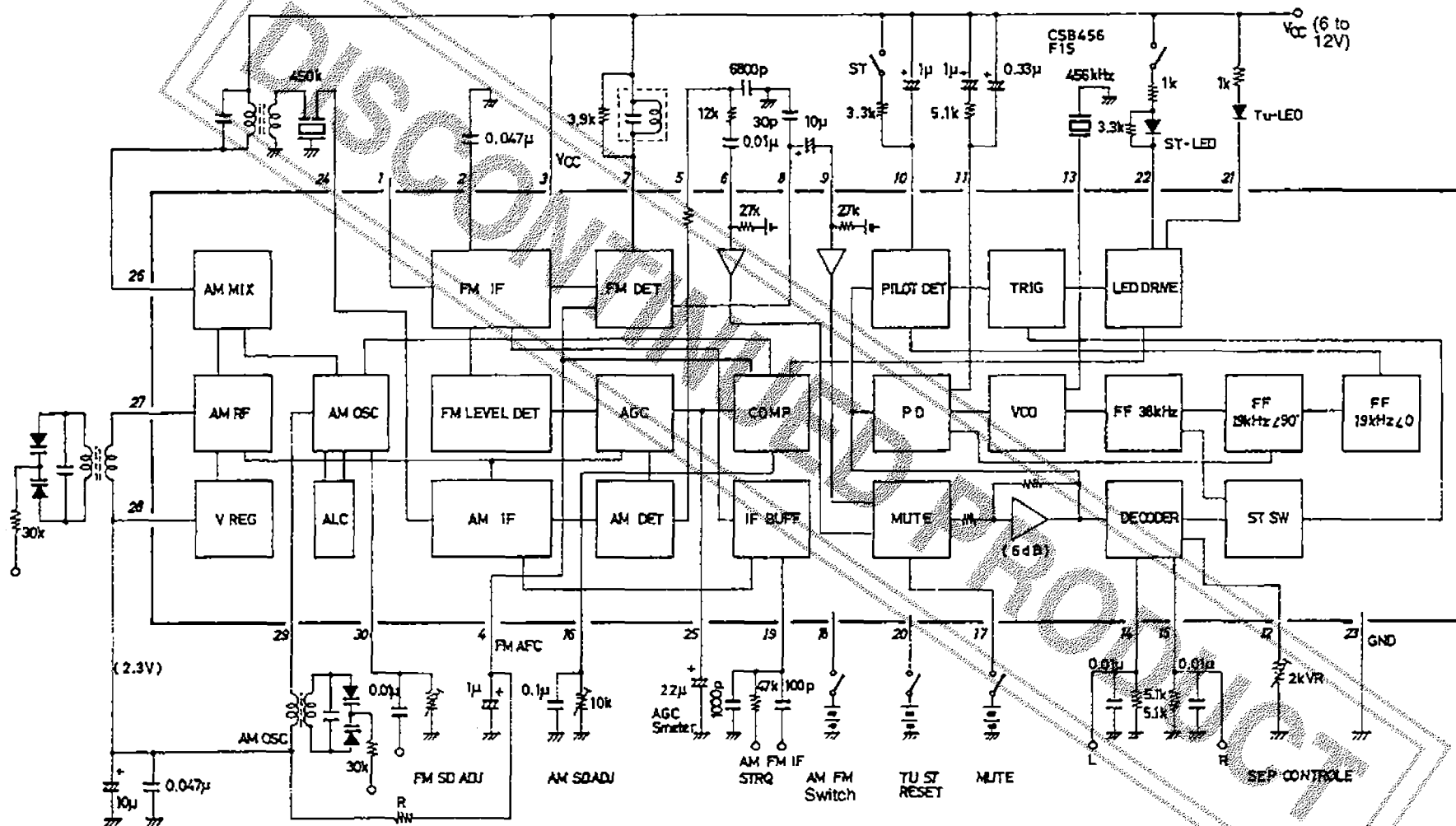
| Parameter                      | Symbol             | Conditions | Ratings | Unit |
|--------------------------------|--------------------|------------|---------|------|
| Recommended supply voltage     | V <sub>CC</sub>    |            | 8.5     | V    |
| Operating supply voltage range | V <sub>CC</sub> op |            | 6 to 12 | V    |

## Operating Characteristics at Ta = 25°C, V<sub>CC</sub> = 8.5 V

| Parameter                                                                                | Symbol           | Conditions                                    | min  | typ   | max | Unit |
|------------------------------------------------------------------------------------------|------------------|-----------------------------------------------|------|-------|-----|------|
| [AM: f <sub>in</sub> = 1 MHz, 1 kHz tone]                                                |                  |                                               |      |       |     |      |
| Quiescent current                                                                        | I <sub>CCO</sub> | No Input                                      |      | 26    | 37  | mA   |
| Detector output                                                                          | V <sub>O1</sub>  | V <sub>IN</sub> = 23 dBμ, 30% AM              | 70   | 140   | 260 | mV   |
|                                                                                          | V <sub>O2</sub>  | V <sub>IN</sub> = 80 dBμ, 30% AM              | 170  | 280   | 390 | mV   |
| Signal-to-noise ratio                                                                    | S/N1             | V <sub>IN</sub> = 23 dBμ, 30% AM              | 15   | 19    |     | dB   |
|                                                                                          | S/N2             | V <sub>IN</sub> = 80 dBμ, 30% AM              | 45   | 50    |     | dB   |
| Total harmonic distortion                                                                | THD1             | V <sub>IN</sub> = 80 dBμ, 30% AM              |      | 0.5   | 1.2 | %    |
|                                                                                          | THD2             | V <sub>IN</sub> = 100 dBμ, 30% AM             |      | 0.6   | 1.3 | %    |
| IF buffer output                                                                         | V <sub>IF</sub>  | V <sub>IN</sub> = 20 dBμ                      | 110  | 170   | 230 | mV   |
| Local oscillator buffer output                                                           | V <sub>OSC</sub> | f <sub>OSC</sub> = 1.450 MHz                  | 290  | 350   | 420 | mV   |
| Tuner turn-on sensitivity                                                                | V <sub>S</sub>   | Variable sensitivity                          |      | (13)  |     | dBμ  |
| [FM mono: f <sub>in</sub> = 10.7 MHz, 1 kHz tone]                                        |                  |                                               |      |       |     |      |
| Quiescent current                                                                        | I <sub>CCO</sub> | No input                                      |      | 27    | 38  | mA   |
| Input limiting sensitivity                                                               | LMS              | 3 dB down, 100% FM                            |      | 32    | 38  | dBμ  |
| Demodulation output                                                                      | V <sub>O</sub>   | V <sub>IN</sub> = 100 dBμ, 100% FM            | 380  | 560   | 750 | mV   |
| Signal-to-noise ratio                                                                    | S/N              | V <sub>IN</sub> = 100 dBμ                     | 71   | 77    |     | dB   |
| Amplitude modulation rejection ratio                                                     | AMR              | V <sub>IN</sub> = 100 dBμ, 30% AM, 1 kHz tone | 48   | 61    |     | dB   |
| Total harmonic distortion                                                                | THD              | V <sub>IN</sub> = 100 dBμ, 100% FM            |      | 0.2   | 1.0 | %    |
| Signal meter output                                                                      | V <sub>SM1</sub> | No input                                      | 0    | 0.1   | 0.3 | %    |
|                                                                                          | V <sub>SM2</sub> | V <sub>IN</sub> = 70 dBμ                      | 0.7  | 1.2   | 1.8 | V    |
|                                                                                          | V <sub>SM3</sub> | V <sub>IN</sub> = 100 dBμ                     | 2.1  | 2.9   | 3.3 | V    |
| IF buffer output                                                                         | V <sub>IF</sub>  | V <sub>IN</sub> = 50 dBμ                      | 170  | 260   | 350 | mV   |
| Tuner turn-on sensitivity                                                                | V <sub>S</sub>   | Variable sensitivity                          |      | (59)  |     | dBμ  |
| [FM stereo: L + R = 90%, pilot = 10%, V <sub>IN</sub> = 100 dBμ, f <sub>m</sub> = 1 kHz] |                  |                                               |      |       |     |      |
| Channel separation                                                                       | Sep 1K           |                                               | 30   | 45    |     | dB   |
| Total harmonic distortion                                                                | THD main         | Stereo, main                                  |      | 0.3   | 1.0 | %    |
| Bandwidth                                                                                | BW               | Stereo, main                                  | 160  | 210   | 280 | kHz  |
| Channel balance                                                                          | CB               | Mono AM                                       | -1.0 | 0     | 0.1 | dB   |
| Mute attenuation                                                                         | ATT              | Mono                                          | 67   | 82    |     | dB   |
| Lamp turn-on level                                                                       | Pilot            | Stereo, main                                  | 1.2  | 3.1   | 4.5 | %    |
| Lamp hysteresis                                                                          | Hs               | Stereo, main                                  |      | (2.5) |     | dB   |

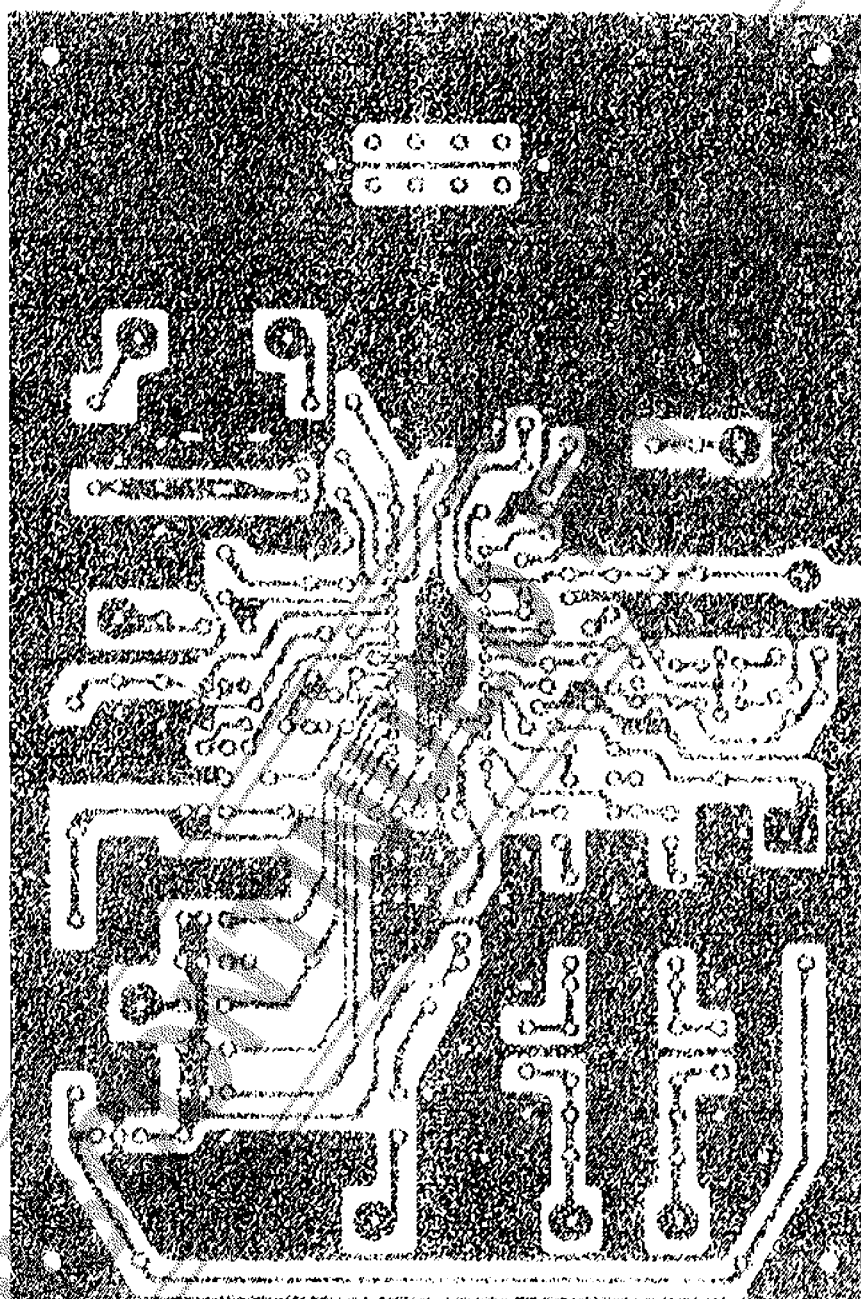
Note: Figures in parenthesis denote design guarantee values.



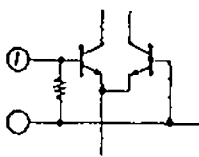
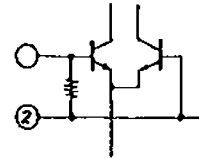
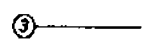
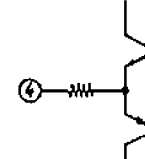
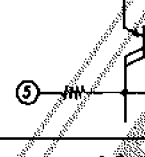
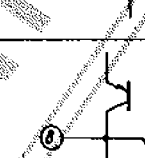
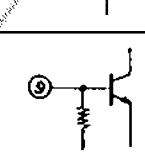
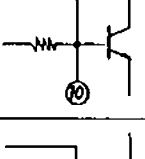
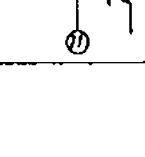
Unit (resistance:  $\Omega$ , capacitance: F)



Printed Circuit Board Layout



## Pin Functions

| Pin no. | Function                        | Internal equivalent circuit                                                         | Remarks                                                                                                                                         |
|---------|---------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | FM IF input                     |    | Input impedance: 330 $\Omega$                                                                                                                   |
| 2       | FM IF bias                      |    |                                                                                                                                                 |
| 3       | V <sub>CC</sub>                 |    |                                                                                                                                                 |
| 4       | FM AFC output                   |    | Forced monaural mode is established in synchronization with the extinguishing of ST LED during FM AFC detuning.                                 |
| 5       | AM demodulation output          |   |                                                                                                                                                 |
| 6       | MPX AM DET input                |  | MPX block AM demodulation input pin<br>Input impedance: 27 k $\Omega$                                                                           |
| 7       | FM discriminator output         |  |                                                                                                                                                 |
| 8       | FM demodulation output          |  | Output impedance: 5 k $\Omega$                                                                                                                  |
| 9       | MPX FM DET output               |  | MPX block FM demodulation input pin<br>Input impedance: 27 k $\Omega$                                                                           |
| 10      | MPX pilot sync detection filter |  | MPX VCO is stopped by shorting the V10 voltage in the V3 V <sub>CC</sub> line. However, a 3.3 k $\Omega$ current-limiting resistor is required. |
| 11      | MPX PLL loop filter             |  |                                                                                                                                                 |

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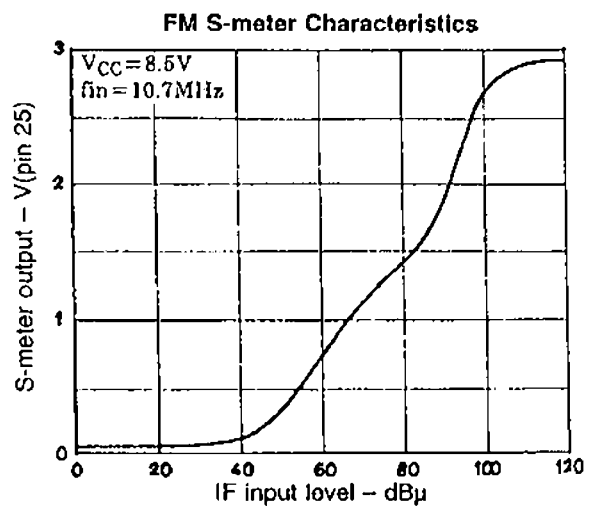
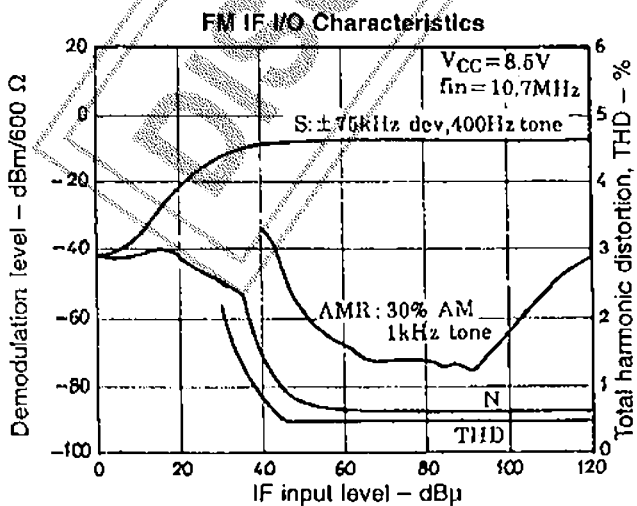
| Pin no. | Function                                    | Internal equivalent circuit | Remarks                                                                                                                                                 |
|---------|---------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12      | MPX<br>Separation control                   |                             |                                                                                                                                                         |
| 13      | MPX<br>VCO                                  |                             | Ceramic oscillator connection pin.<br>CSB456F15 (Murata) recommended                                                                                    |
| 14      | MPX<br>Left channel output                  |                             |                                                                                                                                                         |
| 15      | MPX<br>Right channel output                 |                             |                                                                                                                                                         |
| 16      | AM SD ADJ                                   |                             |                                                                                                                                                         |
| 17      | MPX<br>AF muting drive                      |                             | $V_{HI} (\geq 1.5 \text{ V})$ : Mute on<br>$V_{LO} (< 1.5 \text{ V})$ : Mute off<br>( $\mu$ -COM direct control enabled)                                |
| 18      | AM/FM switch                                |                             | $V_{HI} (\geq 1.5 \text{ V})$ : FM<br>$V_{LO} (< 1.5 \text{ V})$ : AM<br>( $\mu$ -COM direct control enabled)                                           |
| 19      | AM/FM<br>IF counter output/<br>switch       |                             | $V_{HI} (\geq 1.5 \text{ V})$ : IF CNT ON<br>$V_{LO} (< 1.5 \text{ V})$ : IF CNT OFF<br>( $\mu$ -COM direct control enabled)                            |
| 20      | Forced TU/ST LED<br>extinguishing drive pin |                             | $V_{HI} (\geq 1.5 \text{ V})$ : LED forced OFF<br>(forced monaural mode)<br>$V_{LO} (< 1.5 \text{ V})$ : Normal<br>( $\mu$ -COM direct control enabled) |
| 21      | AM/FM TU LED                                |                             |                                                                                                                                                         |
| 22      | MPX<br>ST LED                               |                             |                                                                                                                                                         |

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# LA1851N

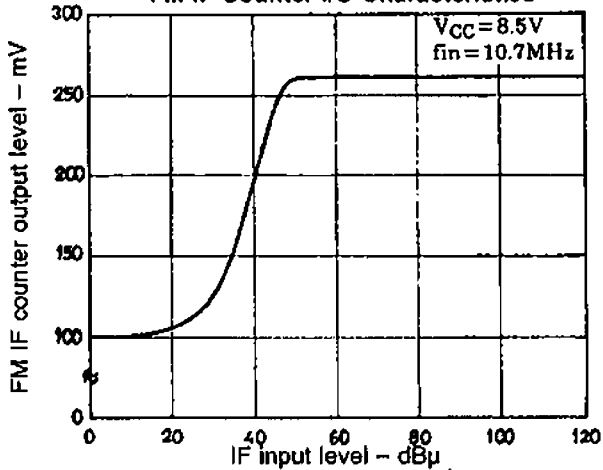
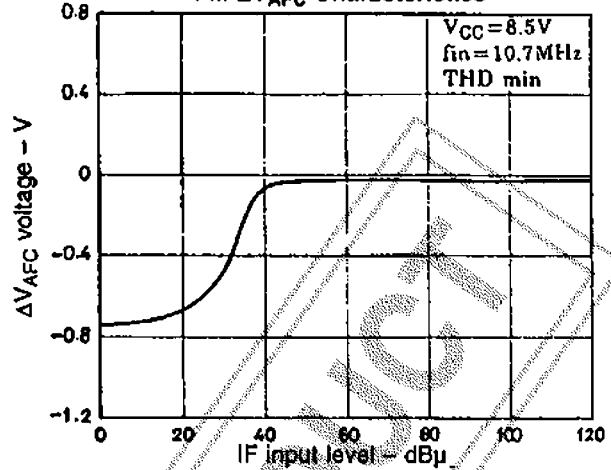
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| Number | Symbol                             | Equivalent circuit | Description                   |
|--------|------------------------------------|--------------------|-------------------------------|
| 23     | AM/FM MPX GND                      |                    |                               |
| 24     | AM IF input                        |                    | Input impedance: 2 k $\Omega$ |
| 25     | AM AGC output<br>FM S-meter output |                    |                               |
| 26     | AM MIXER output                    |                    |                               |
| 27     | AM RF input                        |                    |                               |
| 28     | V Reg                              |                    | V <sub>reg</sub> = 2.3 V      |
| 29     | AM OSC                             |                    |                               |
| 30     | AM OSC buffer output/<br>FM SD ADJ |                    |                               |

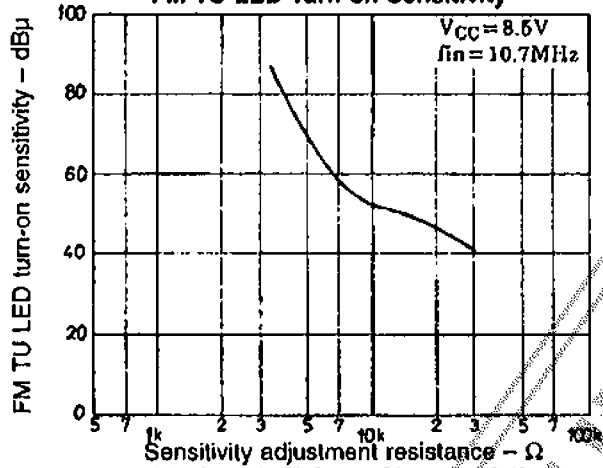




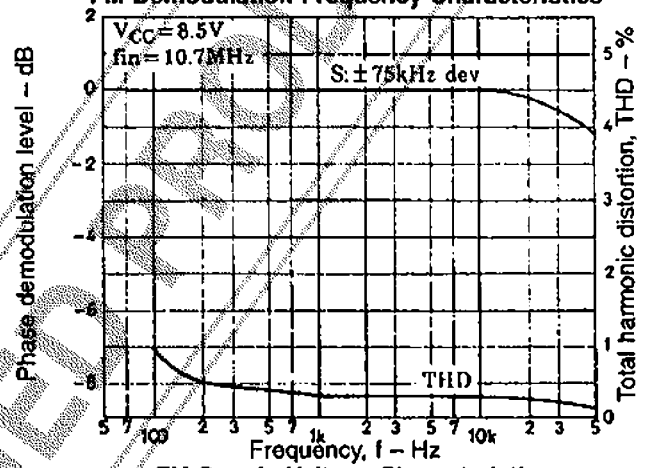
FM IF Counter I/O Characteristics

FM  $\Delta V_{AFC}$  Characteristics

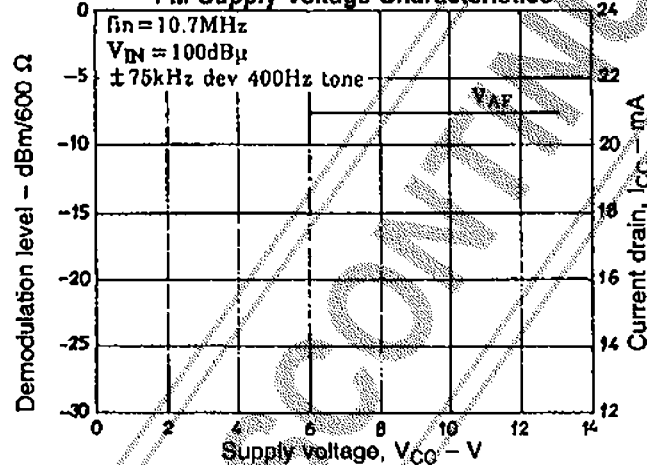
FM TU LED Turn-on Sensitivity



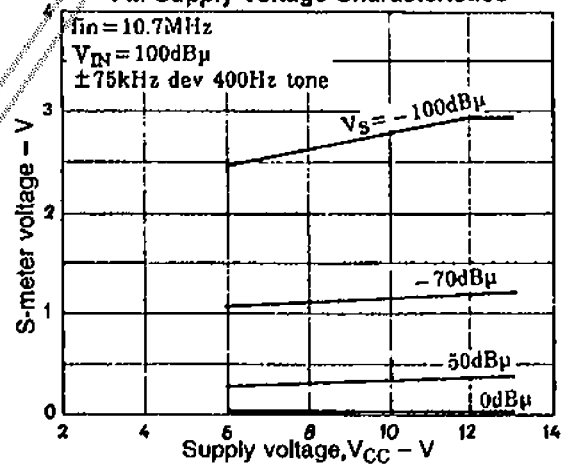
FM Demodulation Frequency Characteristics



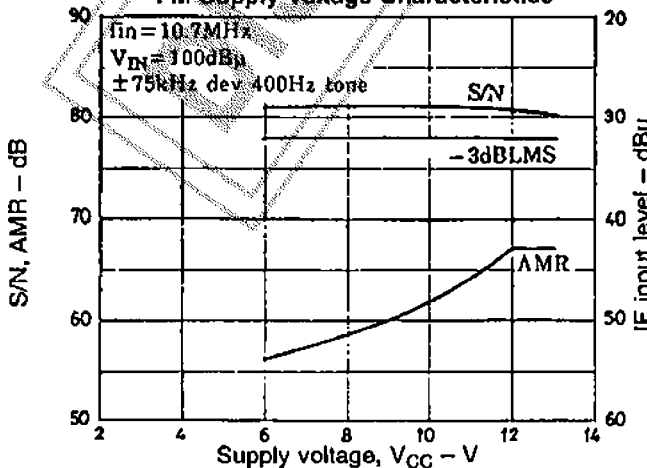
FM Supply Voltage Characteristics



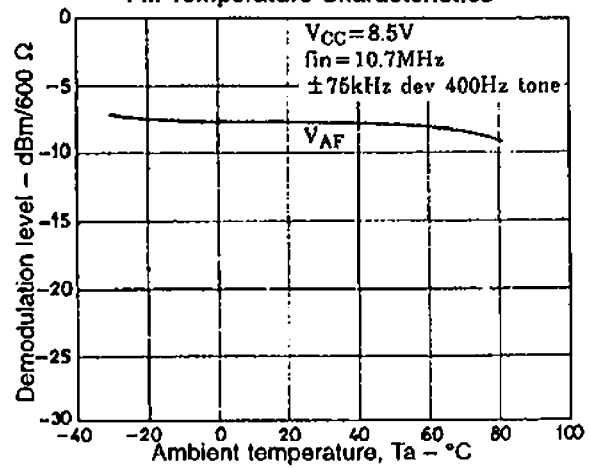
FM Supply Voltage Characteristics

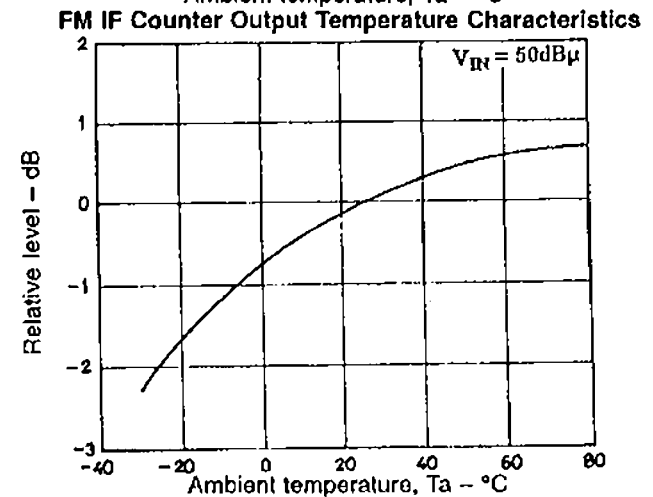
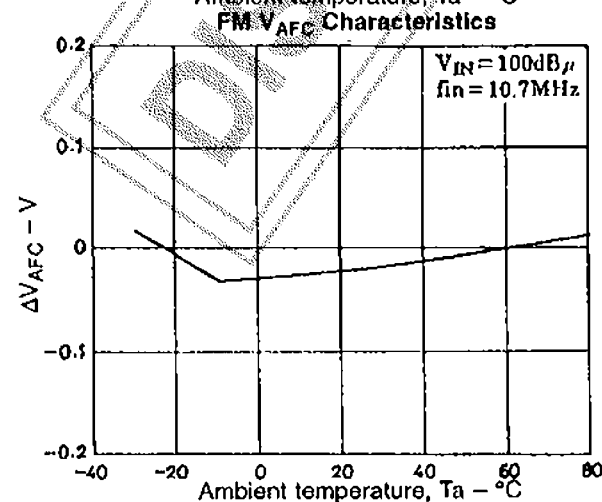
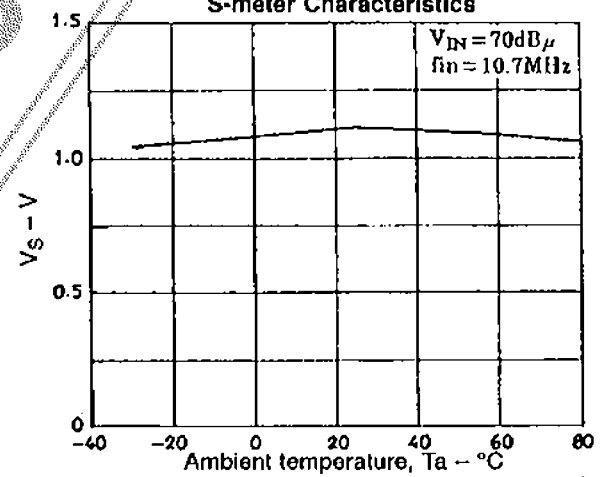
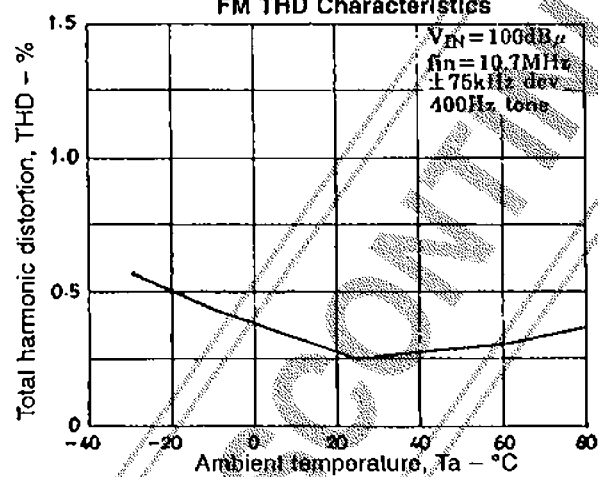
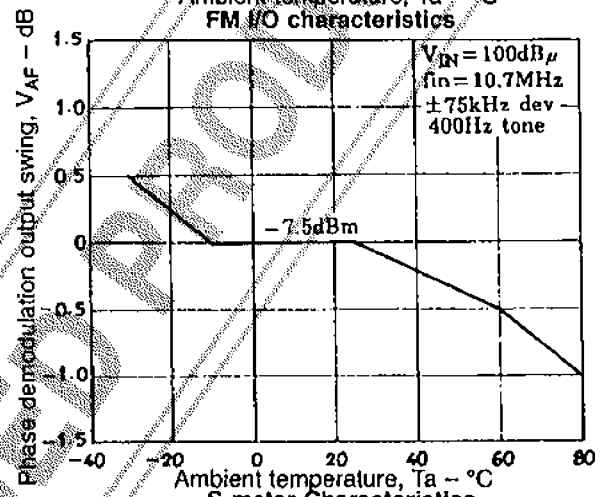
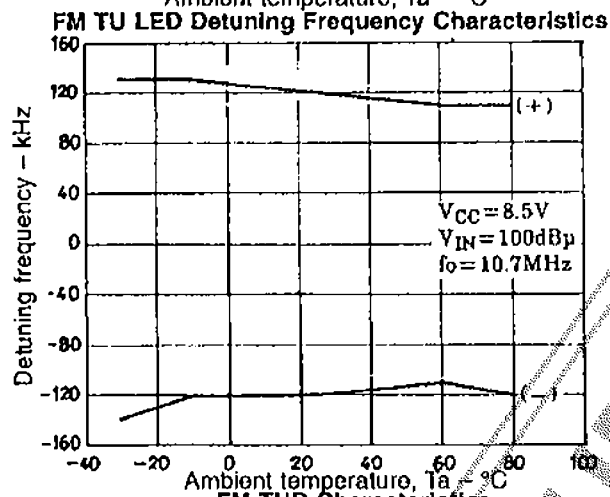
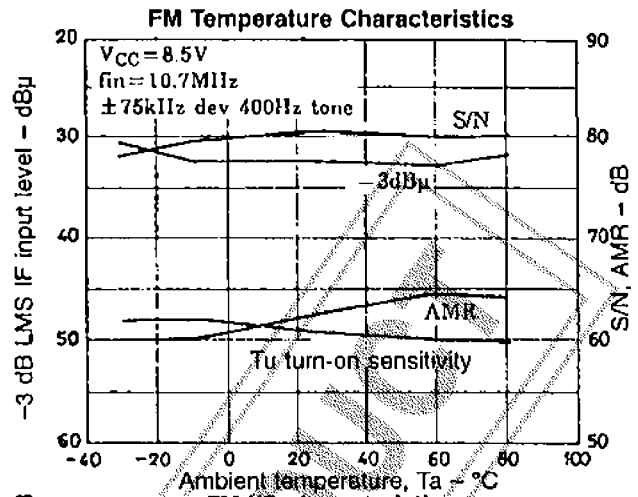
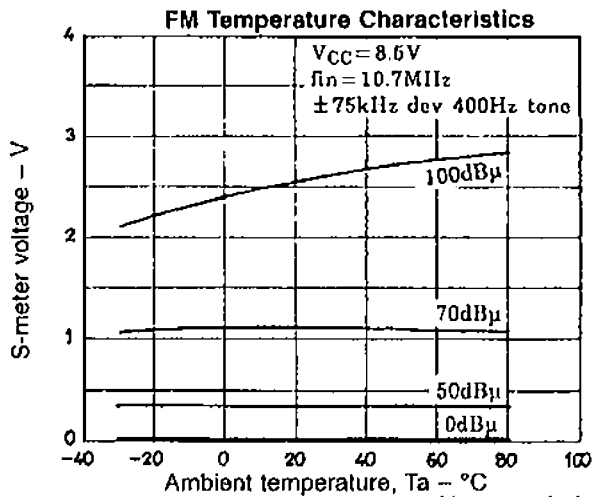


FM Supply Voltage Characteristics

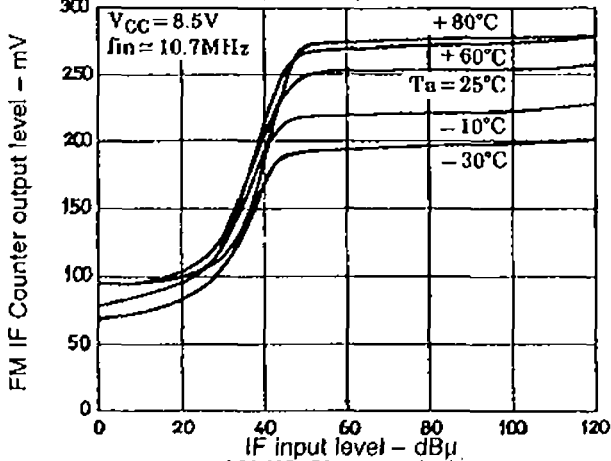


FM Temperature Characteristics

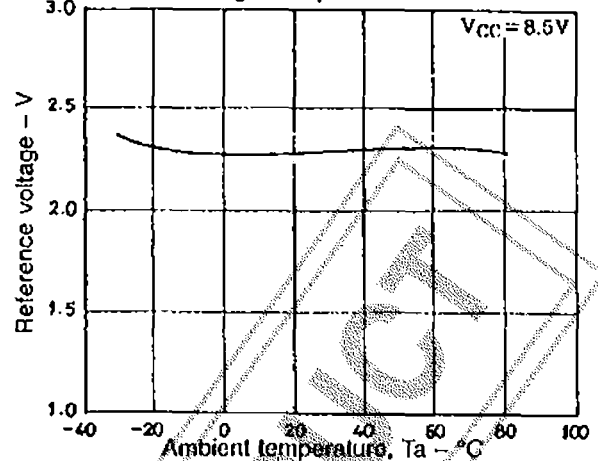




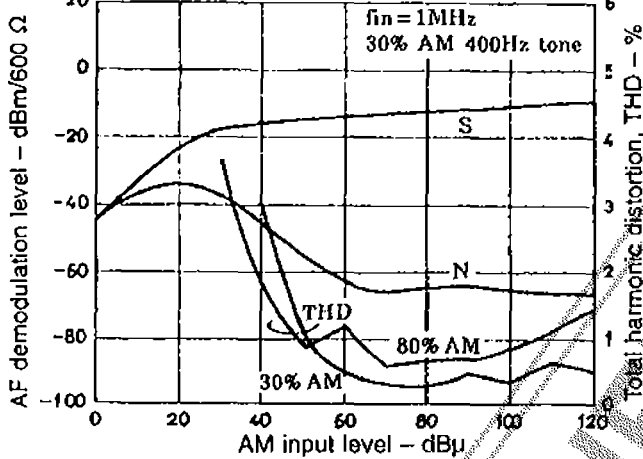
FM IF Counter Output Temperature Characteristics



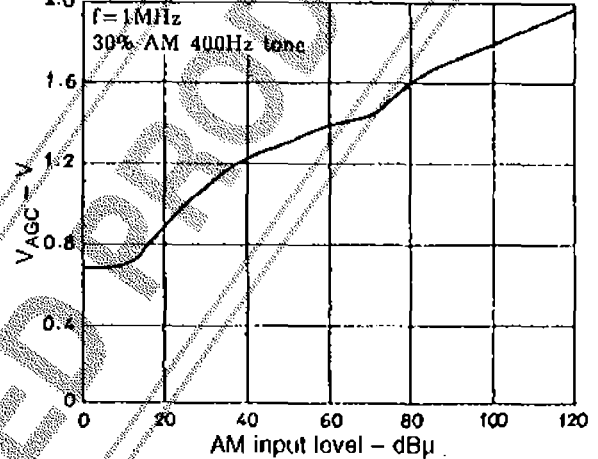
Reference Voltage Temperature Characteristics



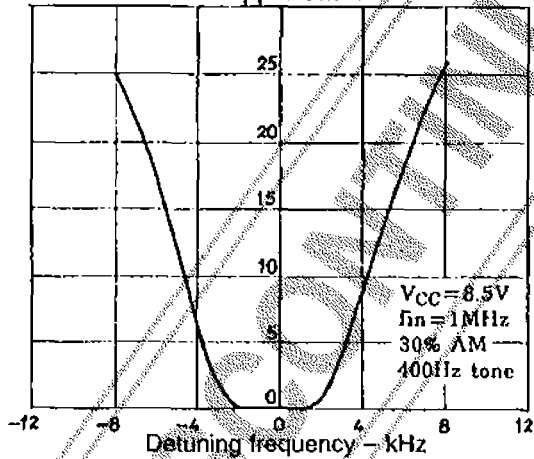
AM I/O Characteristics



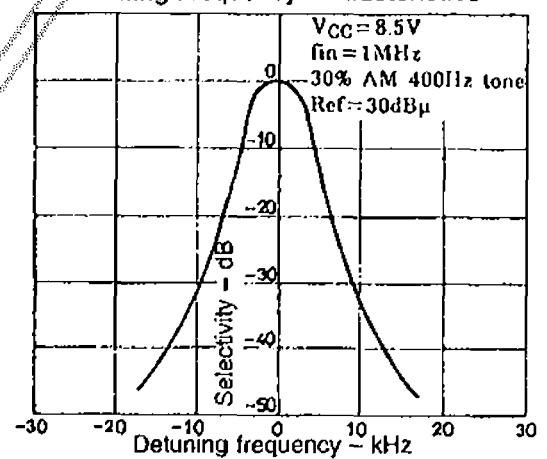
AM AGC Characteristics



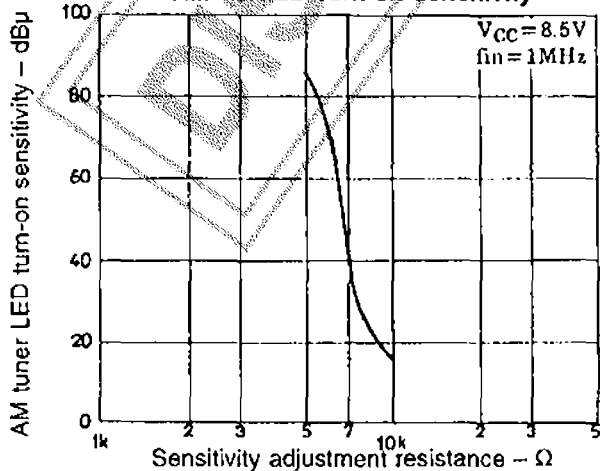
Passband Ripple Characteristics



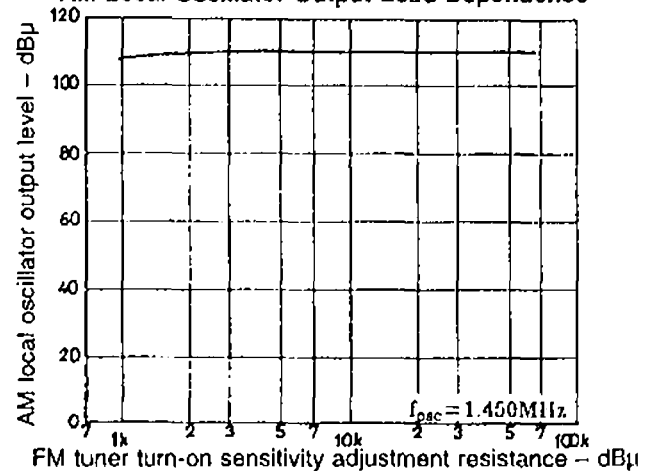
Detuning Frequency Characteristics



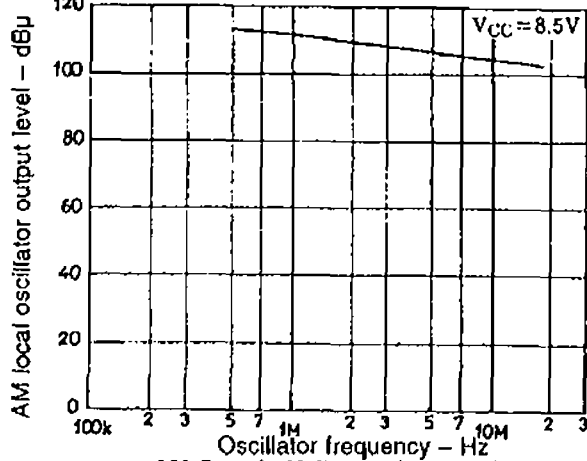
AM TU LED Turn-on Sensitivity



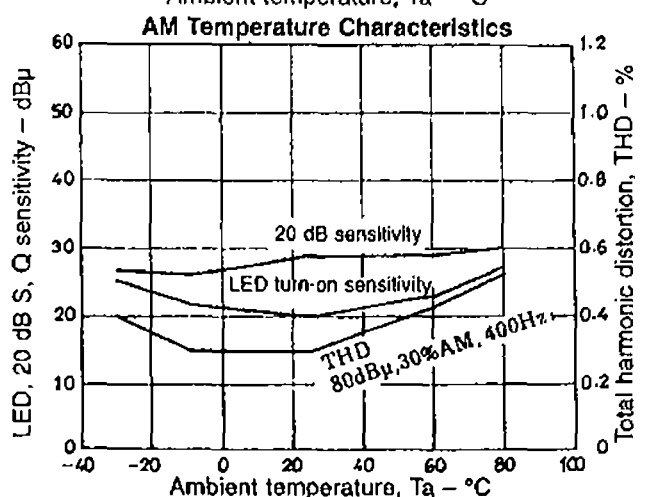
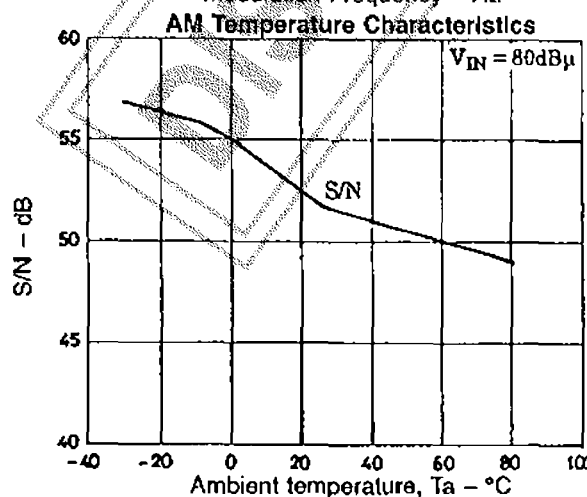
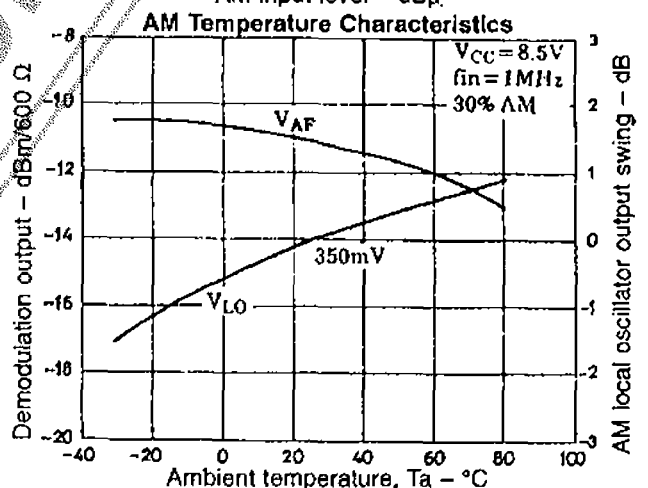
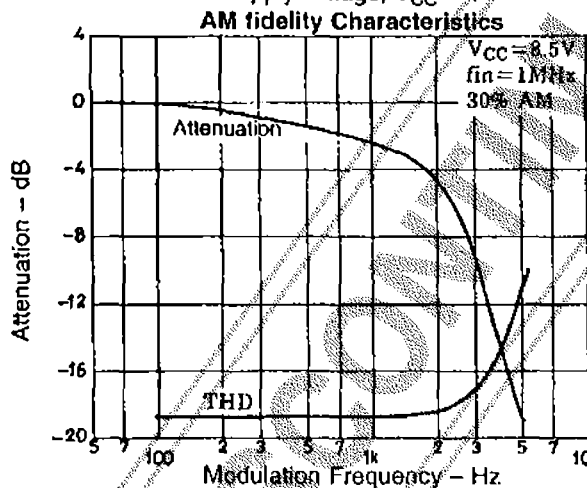
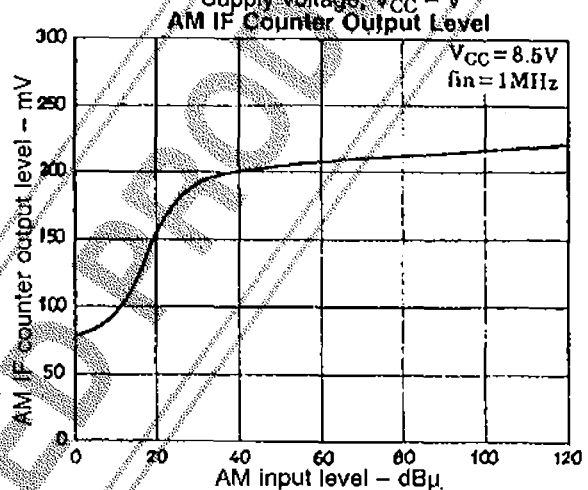
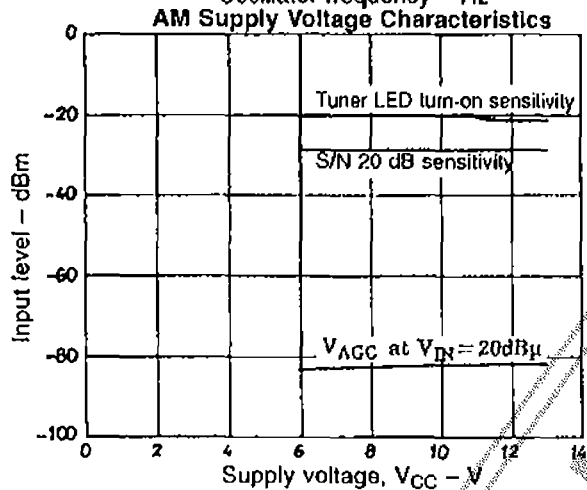
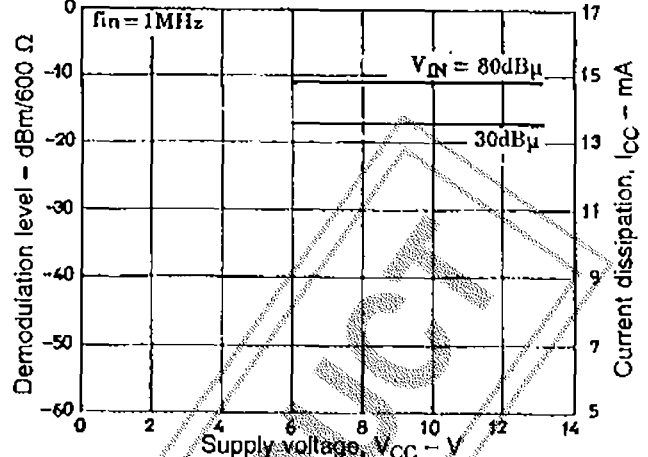
AM Local Oscillator Output Load Dependence

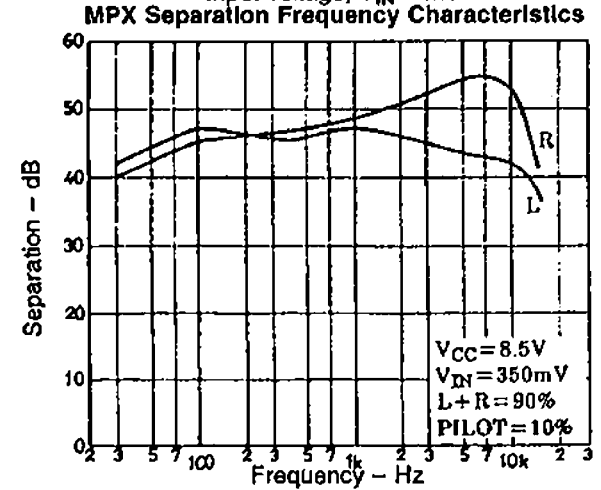
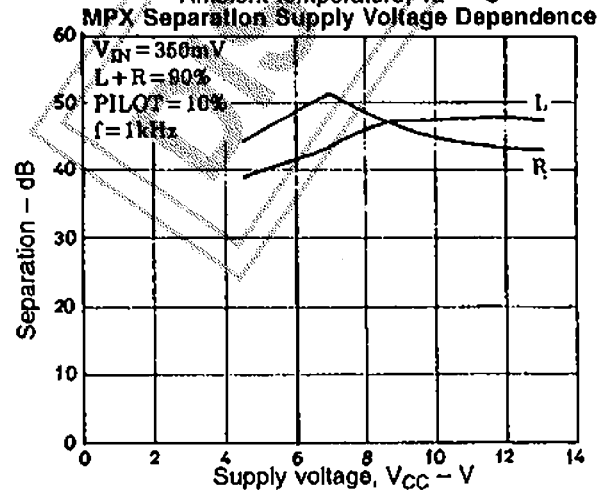
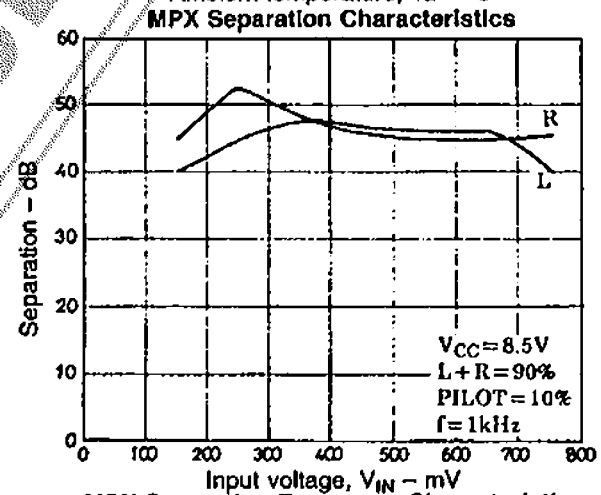
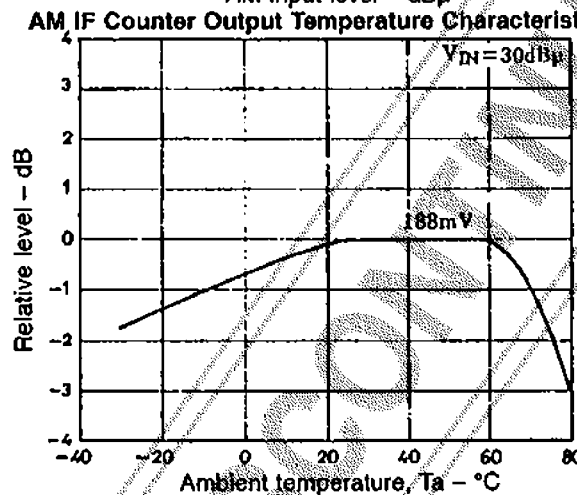
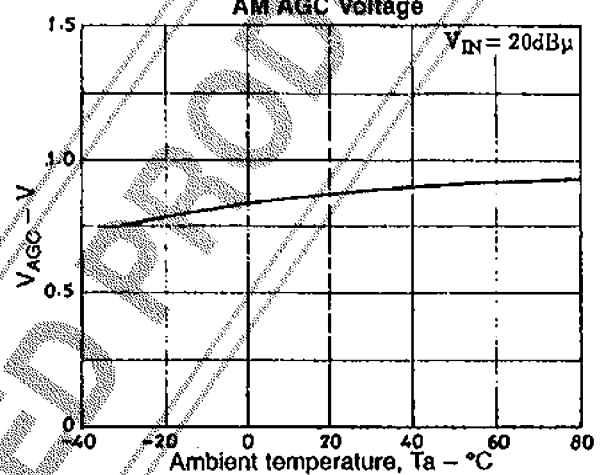
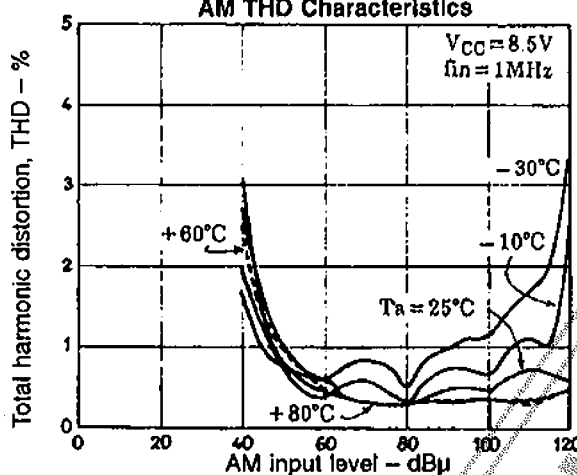
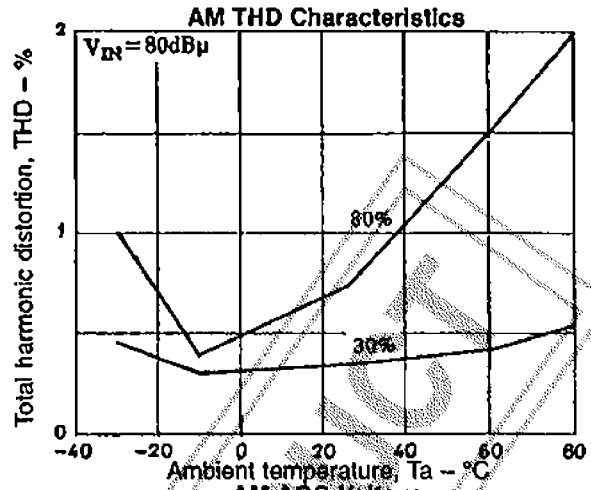
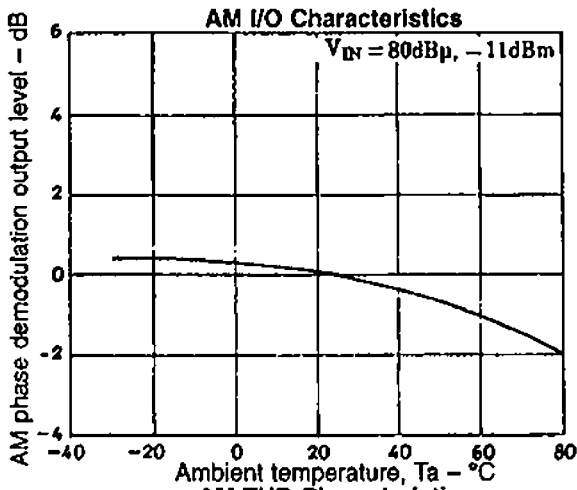


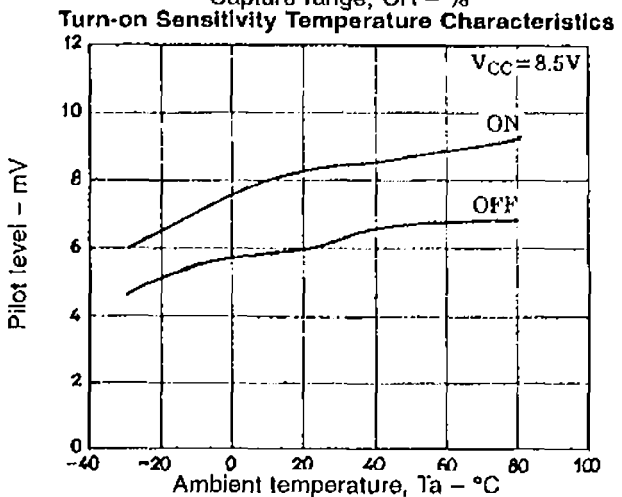
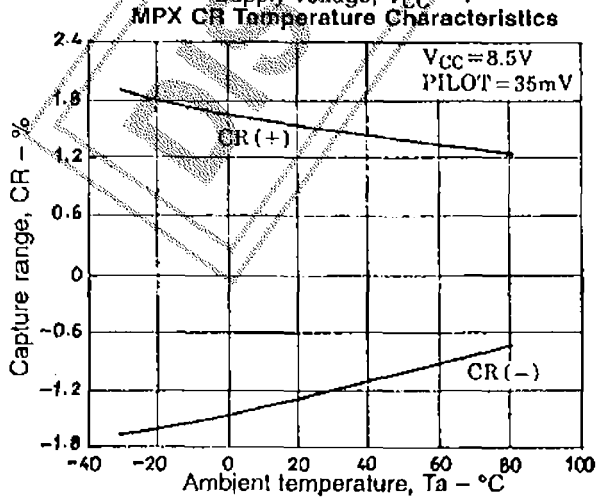
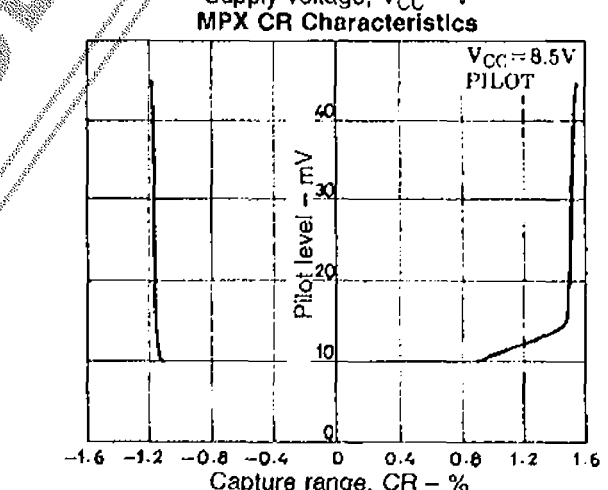
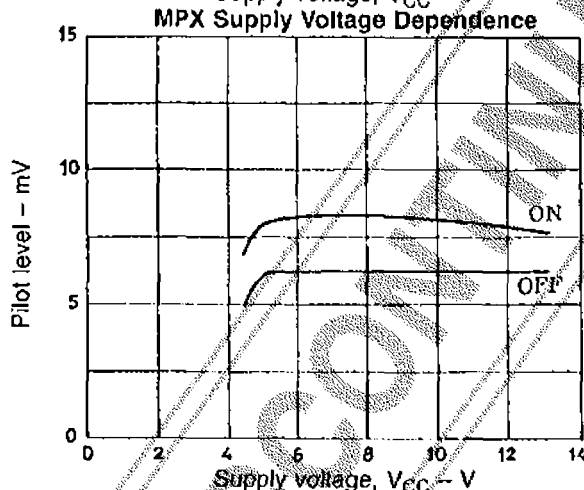
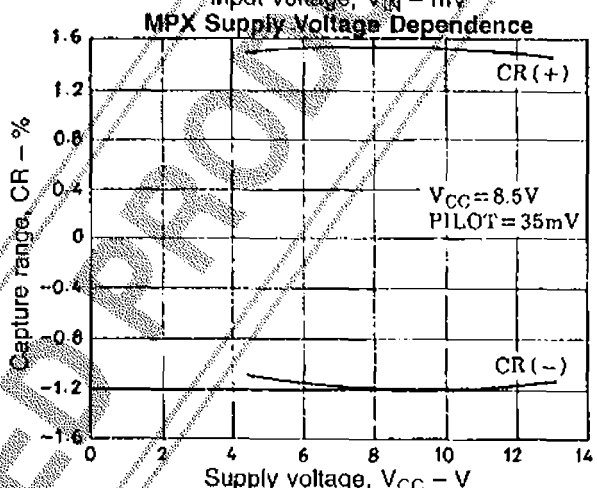
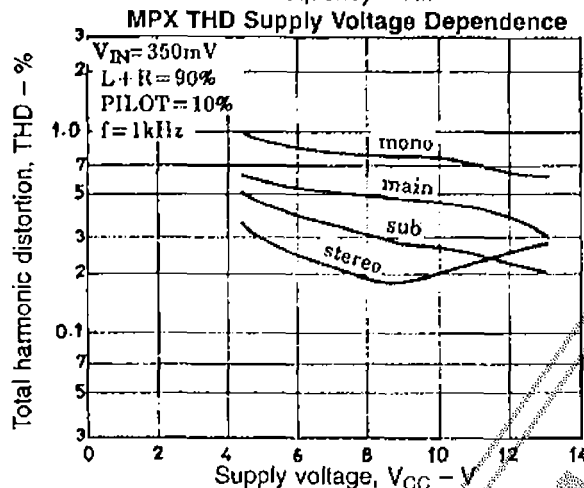
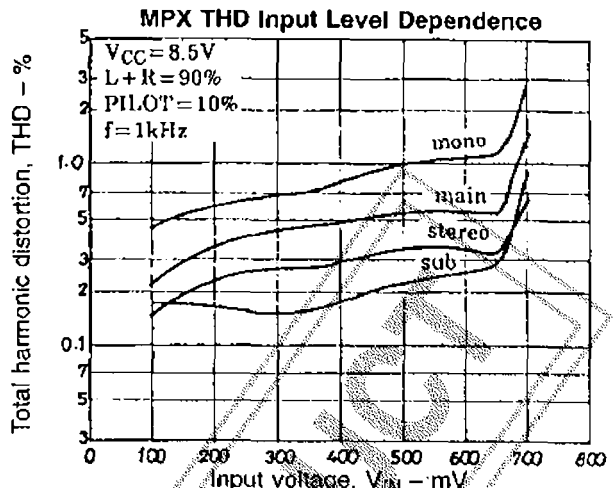
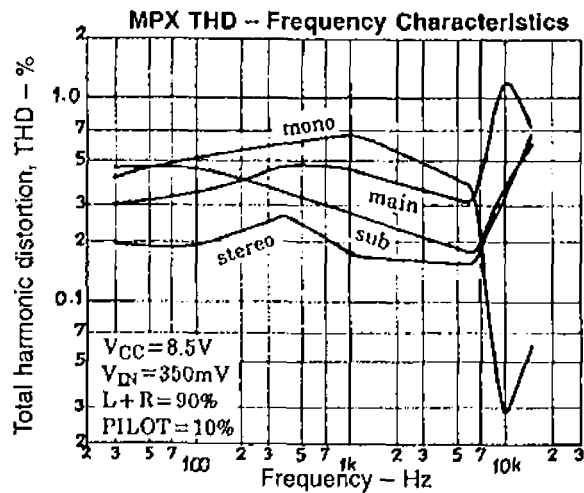
AM Local Oscillator Output Level Characteristics



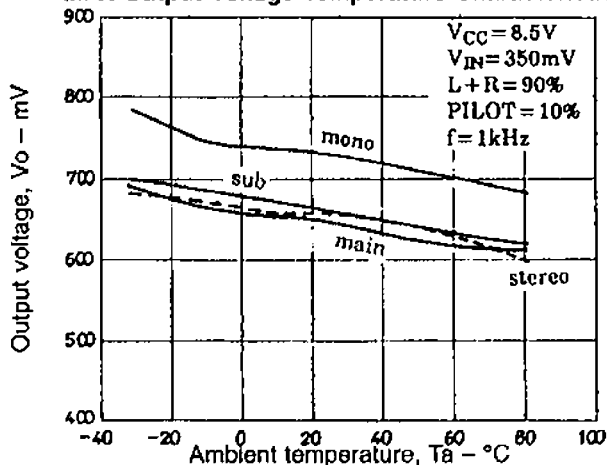
AM Supply Voltage Characteristics



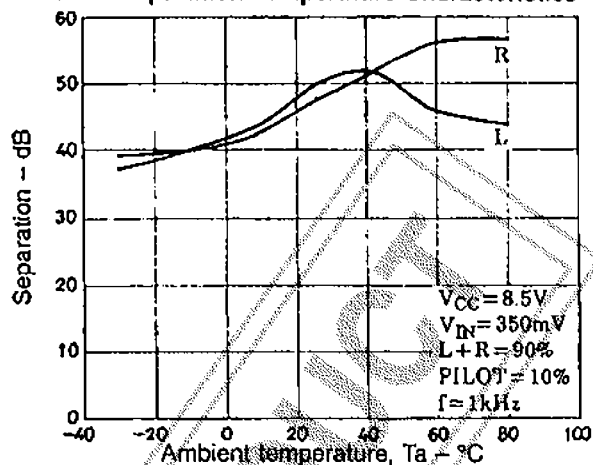




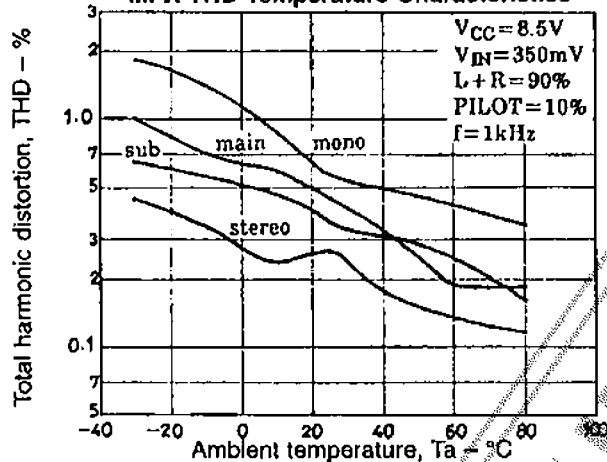
MPX Output Voltage Temperature Characteristics



MPX Separation Temperature Characteristics



MPX THD Temperature Characteristics



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