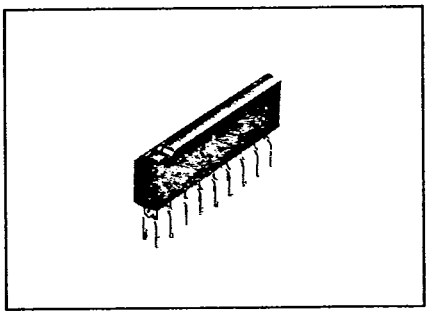
T-77-05-07

3V FM/AM IF System

BA4228L



The BA4228L is a single-chip FM/AM IF system designed for use in 3V radios. The FM block of the device consists of a differential IF amplifier, quadrature detector, and IF soft muting circuit for weak input. The AM block consists of a local oscillator, double-balanced mixer, IF amplifier, detector, and AGC network. The device also contains an audio amplifier.

Features

1. Capable of withstanding supply voltage drops (down to V_{CC}=1.5V typ. when V_{OUT}=−3 dB).
2. Built-in FM muting network suppresses inter-station noise and off-tuned side peaks. The muting level can be adjusted with an external resistor.
3. Single-pin output for FM and AM circuits allows coupling to the following stage (MPX, etc.) without the need for a selector switch.
4. Low-pass filter pin dedicated to the AM circuitry enables independent frequency response settings for FM and AM blocks. This facilitates coupling to the demultiplexer circuit.
5. Switching between FM and AM modes can be controlled by a DC level (on/off).

Applications

FM/AM portable radios
Headphone radio cassette recorders

Dimensions (Unit : mm)

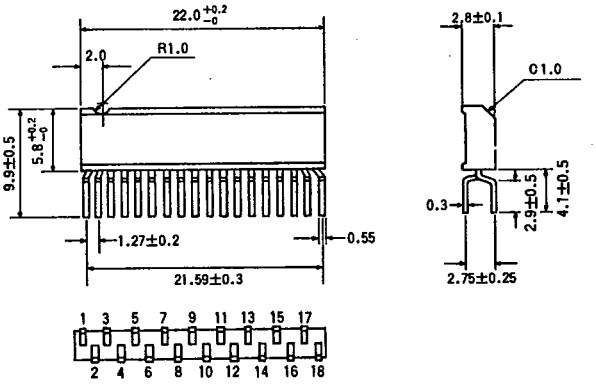


Fig. 1

Block Diagram

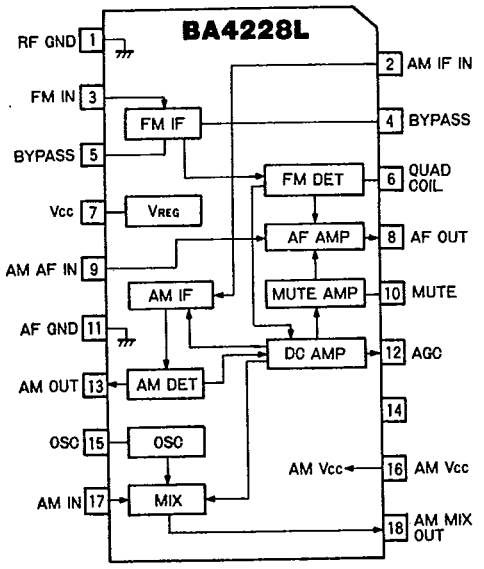


Fig.2

Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Limits	Unit
Supply voltage	Vcc	4.5	V
Power dissipation	Pd	500*	mW
Operating temperature range	Topr	−25~75	°C
Storage temperature range	Tstg	−55~125	°C

* Derating is done at 5mW/°C for operation above Ta=25°C

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply voltage	Vcc	1.8	3	3.6	V	–

Electrical Characteristics / FM Block (Ta=25°C, V_{CC}=3V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current	I_Q	–	7	12	mA	Muting off
Detector output	V_{OUT}	55	85	115	mV	V_{IN}=100 dBμV, 10.7 MHz Δf=22.5 kHz, fm=1 kHz
Total harmonic distortion	THD	–	0.25	0.75	%	V_{IN}=100 dBμV, 10.7 MHz Δf=22.5 kHz, fm=1 kHz
Signal-to-noise ratio	S / N	60	68	–	dB	V_{IN}=100 dBμV, 10.7 MHz Δf=22.5 kHz, fm=1 kHz
Limiting sensitivity	$V_{IN(lim)}$	30	35	40	dBμV	V_{OUT}=−3 dB
Minimum supply voltage	V_{CC}	–	1.5	1.7	V	V_{OUT}=−3 dB

Electrical Characteristics / AM Block (Ta=25°C, V_{CC}=3V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current	I_Q	–	6	10	mA	–
Detector output	V_{OUT}	55	80	110	mV	V_{IN}=74 dBμV, 1 MHz fm=1 kHz, 30 %
Total harmonic distortion	THD	–	0.5	2.5	%	V_{IN}=74 dBμV, 1 MHz fm=1 kHz, 30 %
Signal-to-noise ratio	S / N	42	50	–	dB	V_{IN}=100 dBμV, 1 MHz fm=1 kHz,30 %
Limiting sensitivity	S	7	12	17	dBμV	V_{OUT}=10 mV
Minimum supply voltage	V_{CC}	–	1.5	1.7	V	V_{OUT}=−3 dB

Test Circuit

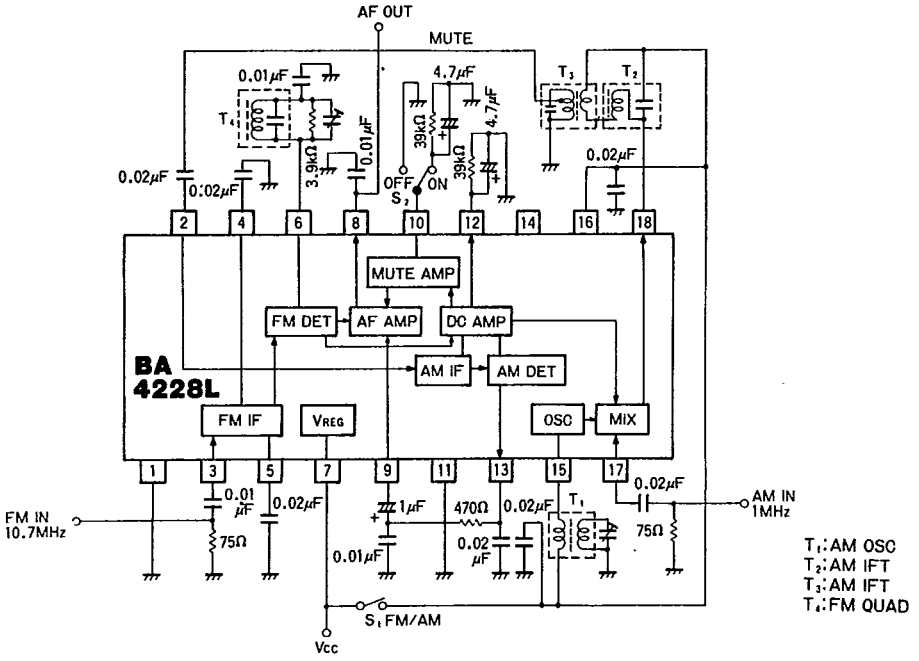


Fig. 3

Note : Pin 14 should be either grounded or left open.

Precautions for Use

1. Leakage from AM local oscillation or noise applied to the AM IF input (pin 2) may reduce sensitivity. To prevent this, locate the ground point for the AM IF ceramic filters in the close vicinity of pin 1, and use the shortest posssible wiring path between the ceramic filter output and IF input pin (pin 2).
   Use AM ceramic filters with low spurious response, and connect a capacitor of 100 to 220 pF across the IF input pin (pin 2) and the GND.
2. Locate the ground point for the bypass capacitors used for the IF amplifiers in the close vicinity of pin 1.
3. When observing the S-shaped discrimination curve of the FM block with an oscilloscope and sweep generator, turn off muting. Otherwise, observation error will occur due to the time constant in the muting network.
4. Note that the FM muting level will vary according to the noise level at the front end.
5. The valve of the AM local oscillator's stabilizing resistor, R_S, should be between 0 and 100Ω.
6. Pin 14 should be grounded or left open. Do not connect it to any other point. (Fig. 4)

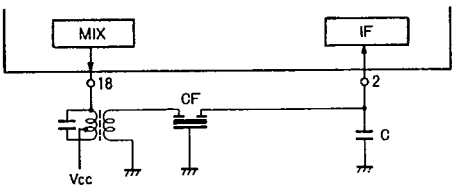


Fig. 4

Application Example

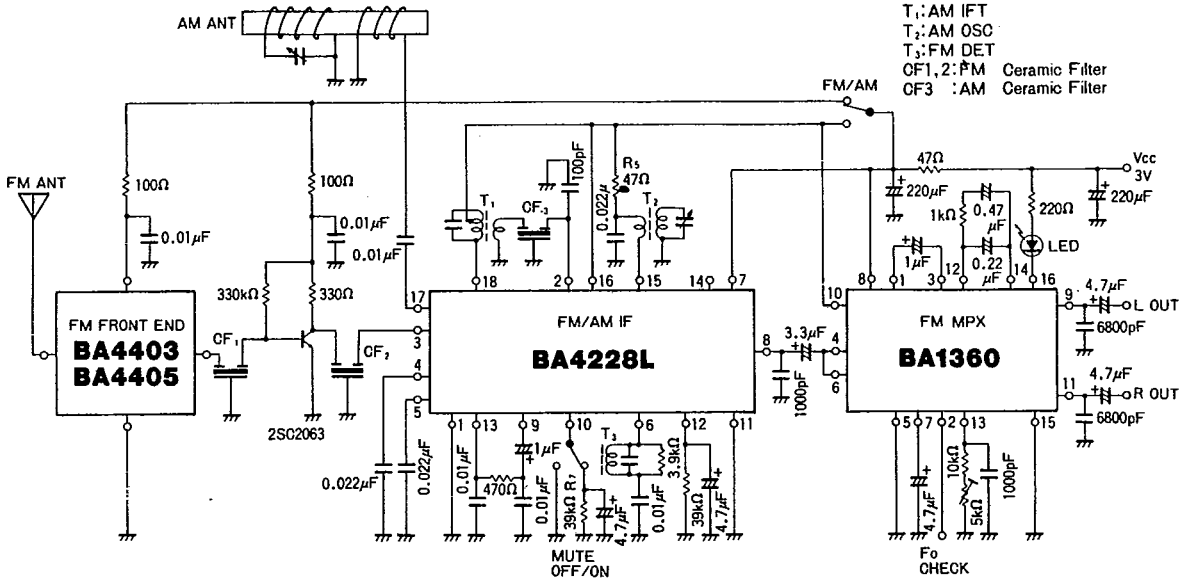


Fig. 5

Electrical Characteristic Curves

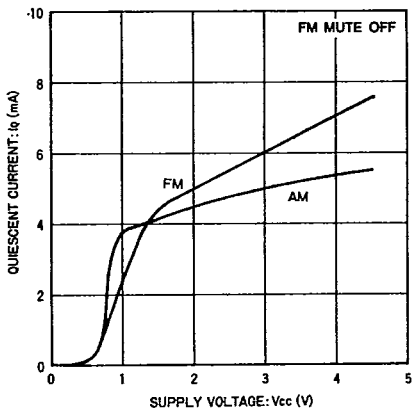


Fig. 6 Quiescent current vs. supply voltage

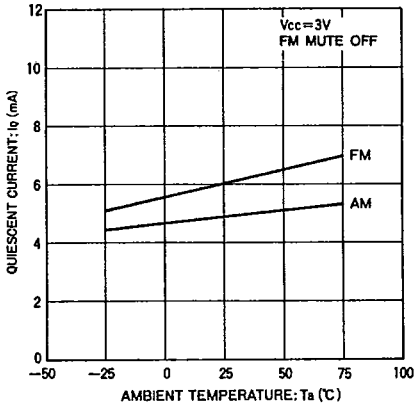


Fig. 7 Quiescent current vs. ambient temperature

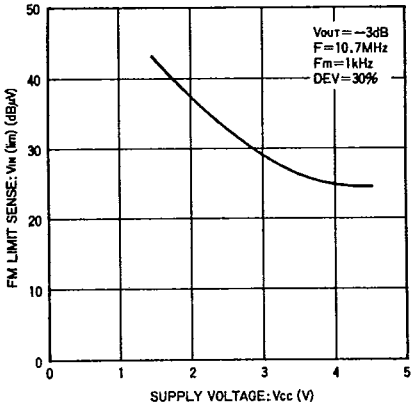


Fig. 8 FM limiting sensitivity vs. supply voltage

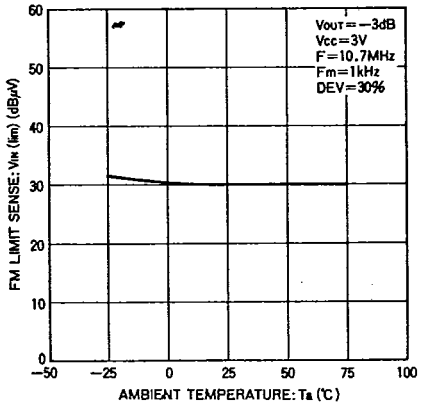


Fig. 9 FM limiting sensitivity vs. ambient temperature

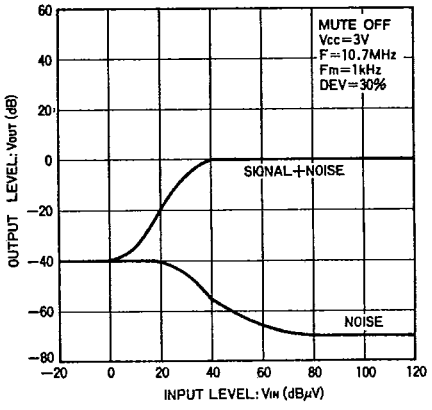


Fig. 10 FM output level vs. input level

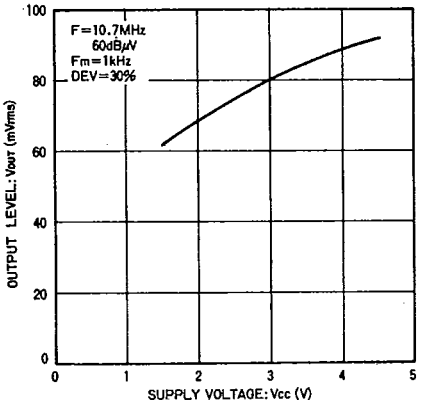


Fig. 11 FM output level vs. supply voltage

Electrical Characteristic Curves

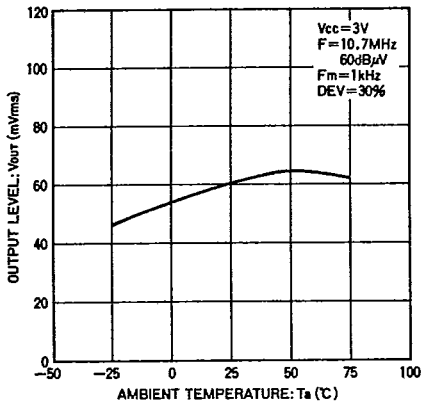


Fig. 12 FM output level vs. ambient temperature

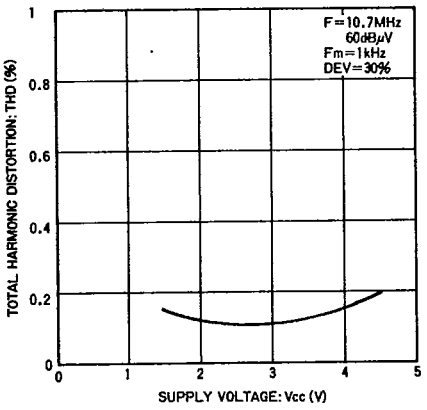


Fig. 13 FM total harmonic distortion vs. supply voltage

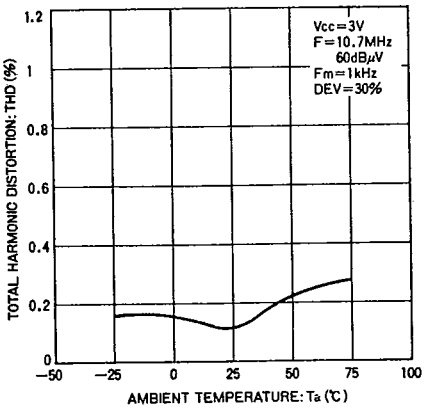


Fig. 14 FM total harmonic distortion vs. ambient temperature

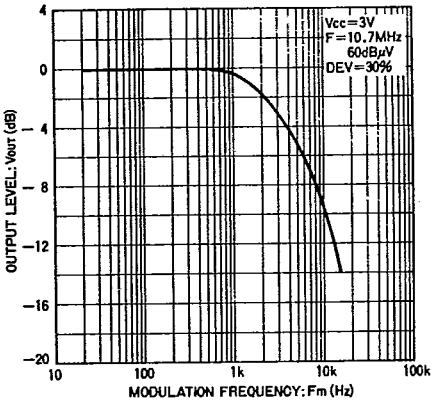


Fig. 15 FM output level vs. modulation frequency

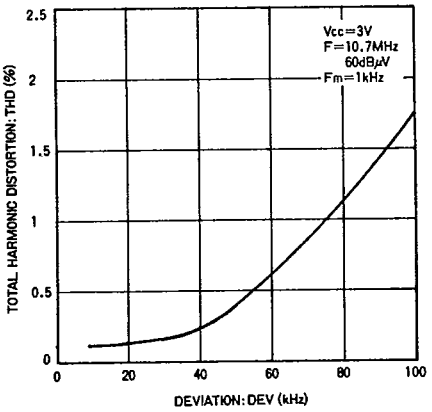


Fig. 16 FM total harmonic distortion vs. frequency deviation

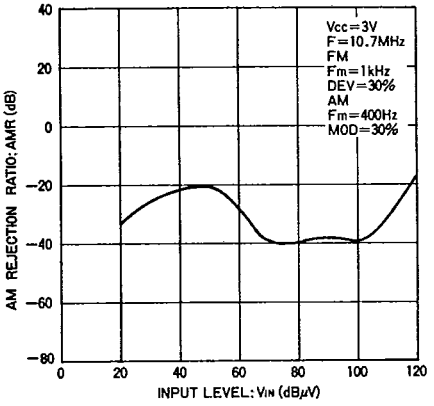


Fig. 17 AM rejection ratio vs. input level

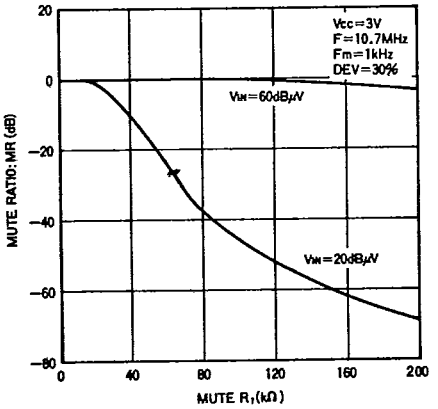


Fig. 18 FM muting ratio vs. resistance R_7

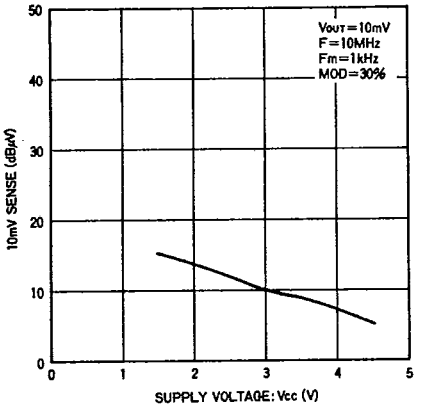


Fig. 19 AM 10 mV sensitivity vs. supply voltage

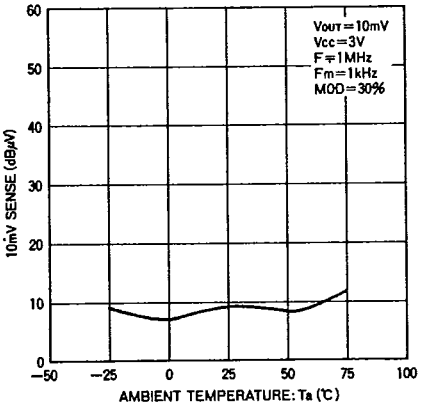


Fig. 20 AM 10 mV sensitivity vs. ambient temperature

Electrical Characteristic Curves

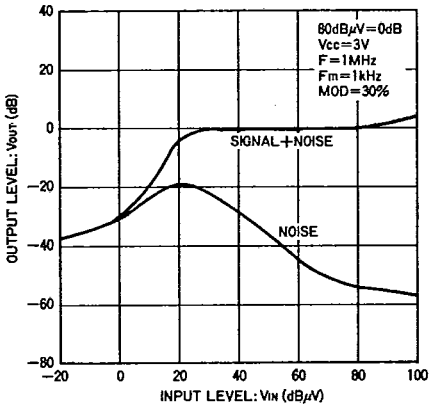


Fig. 21 AM output level vs. input level

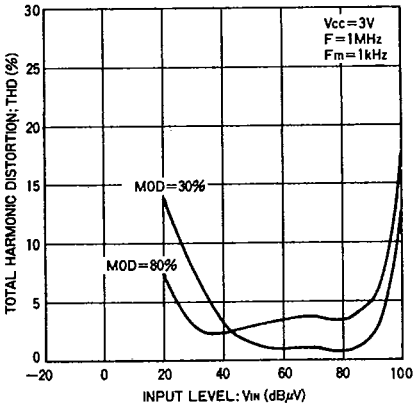


Fig. 22 AM total harmonic distortion vs. input level

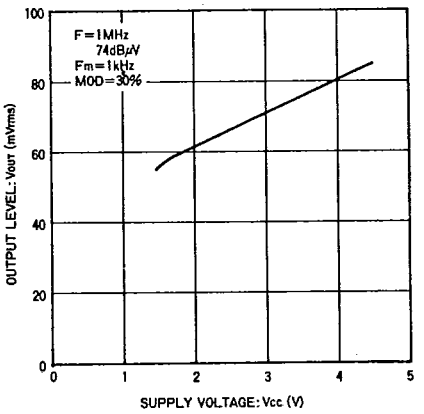


Fig. 23 AM output level vs. supply voltage

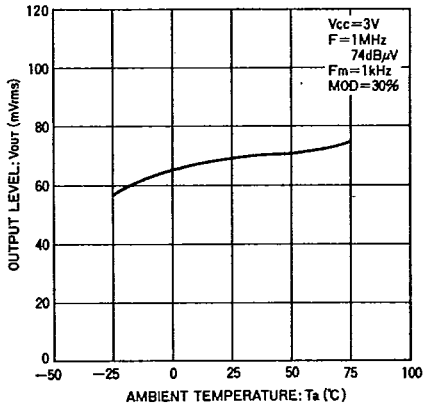


Fig. 24 AM output level vs. ambient temperature

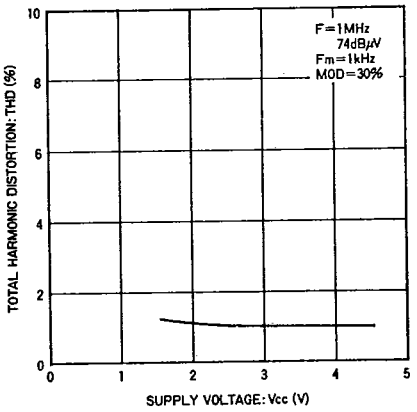


Fig. 25 AM total harmonic distortion vs. supply voltage

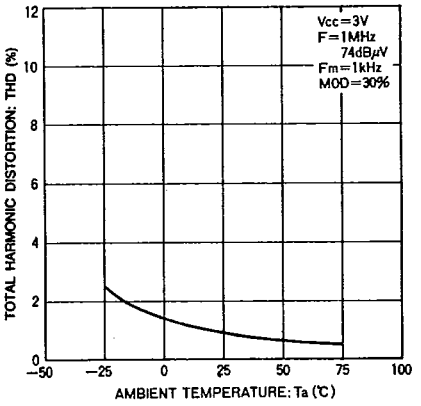


Fig. 26 AM total harmonic distortion vs. ambient temperature

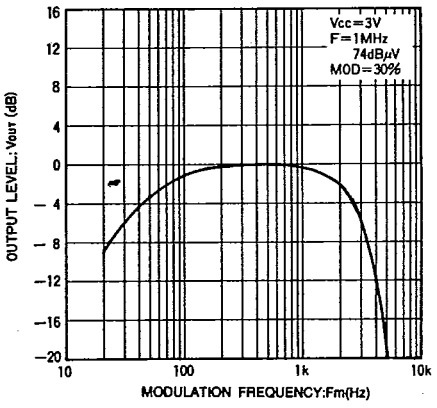


Fig. 27 AM output level vs. modulation frequency

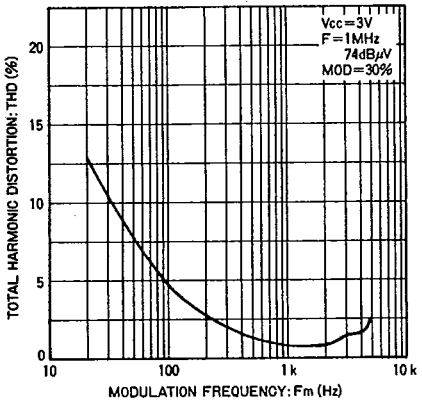


Fig. 28 AM total harmonic distortion vs. modulation frequency