Ordering number: EN3987B

Monolithic Linear IC

LA1826

Single-chip AM/FM Tuner with MPX Tuner System

Overview

The LA1826 is a single chip AM/FM tuner system IC with MPX stereo demodulator. An AM/FM stereo radio can be easily configured with a minimum number of external parts.

Functions

- FM: RF amplifier, MIX, OSC, IF amplifier, quadrature detector, S meter
- AM: RF amplifier, MIX, OSC (ALC), IF amplifier, detector, AGC
- MPX: PLL stereo decoder, stereo indicator

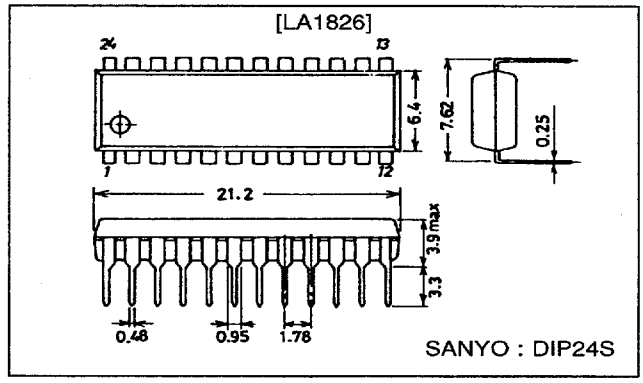
Features

- FM turner AM tuner, MPX functions contained on a single chip
- Few external components
- Low voltage operation
- Low current drain
- High stability
- Receives AM short wave broadcasts (7.2 to 24 MHz)
- Low carrier leakage MPX (during no input, and monaural input)

Package Dimensions

unit : mm

3067-DIP24S



Specifications

Absolute Maximum Ratings at Ta = 25°C, see specified Test Circuit

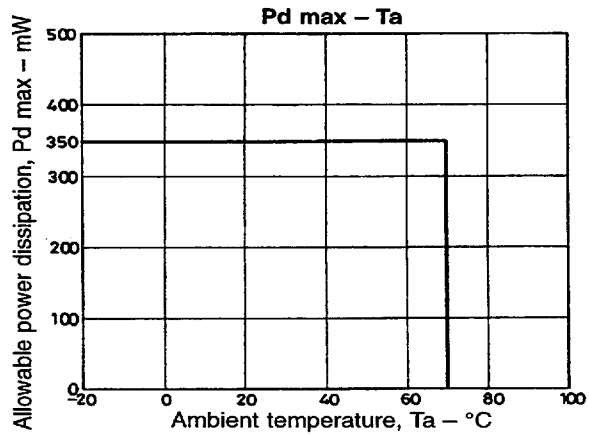
Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max	Pins 2, 3, 8, 9, 10, 19, 21, 22	7	V
Maximum supply current	I_{CC} max	Pins 2 + 3 + 8 + 9 + 19 + 21 + 22	50	mA
Flow-in current (Indicator driven current)	I_{LED}	Pin 10	10	mA
Flow-out current	I_4	Pin 4	0.1	mA
Allowable power dissipation	Pd max	Ta ≦ 70°C	350	mW
Operating temperature range	Topr		−20 to +70	°C
Storage temperature range	Tstg		−40 to +125	°C

Operating Conditions at Ta = 25°C

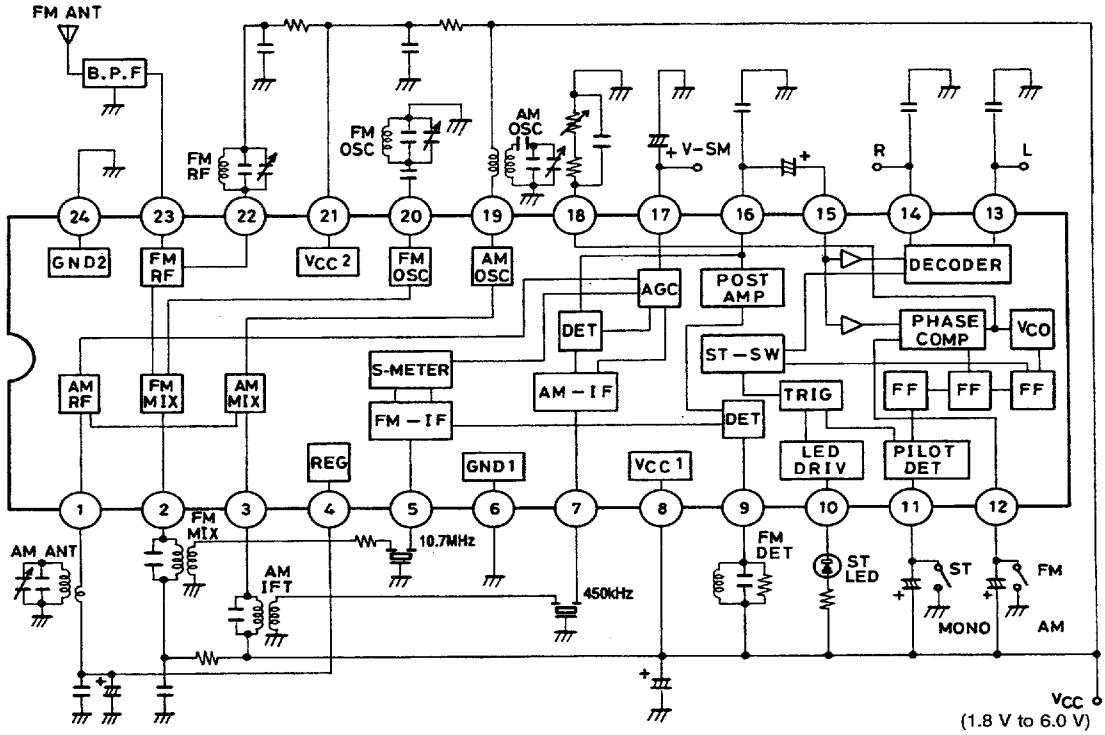
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3	V
Recommended supply voltage range	V_{CC} op		1.8 to 6.0	V

Operating Characteristics at Ta = 25°C, V_{CC} = 3 V, see specified Test Circuit

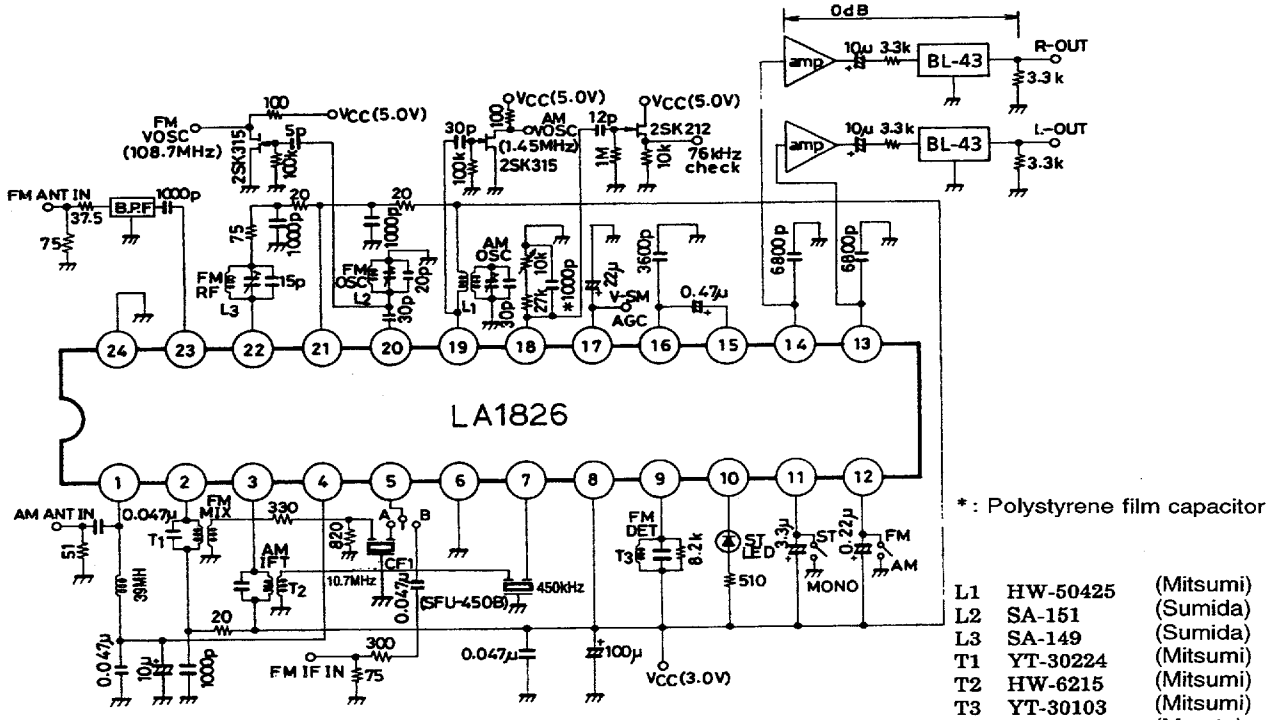
Parameter	Symbol	Conditions	min	typ	max	Unit
Quiescent current	I_{CCO}(FM)	V_{IN} = 0 during FM		13	22	mA
	I_{CCO}(AM)	V_{IN} = 0 during AM		5.0	9.0	mA
[AM characteristics]: f_C = 1000 kHz, fm = 1 kHz						
Detector output	Vo1	V_{IN} = 23 dBμ, 30% modulation	16	36	64	mV
	Vo2	V_{IN} = 80 dBμ, 30% modulation	38	60	95	mV
Signal-to-noise ratio	S/N1	V_{IN} = 23 dBμ, 30% modulation	14	18		dB
	SN/2	V_{IN} = 80 dBμ, 30% modulation	38	46		dB
Total harmonic distortion	THD1	V_{IN} = 80 dBμ, 30% modulation		0.5	1.3	%
	THD2	V_{IN} = 107 dBμ, 30% modulation		0.8	3.5	%
[FM characteristics] (IF amplifier and MPX, mono): f_C = 10.7 MHz, fm = 1 kHz						
–3 dB sensitivity	–3dBL.S.	Referenced to V_{IN} = 100 dBμ, 100% modulation, 3 dB down		32	41	dBμ
Demodulation output	Vo	V_{IN} = 100 dBμ, 100% modulation	80	115	160	mV
Channel balance	C.B.	V_{IN} = 100 dBμ, 100% modulation		0	2	dB
Total harmonic distortion	THD (mono)	V_{IN} = 100 dBμ, 100% modulation		0.6	1.2	%
Signal-to-noise ratio	S/N	V_{IN} = 100 dBμ, 100% modulation	66	71		dB
[FM characteristics] (IF amplifier and MPX, stereo): f_C = 10.7 MHz, fm = 1 kHz, L + R = 90%, pilot = 10%, V_{IN} = 100 dBμ						
Sepatation	Sep		25	35		dB
Total harmonic distortion	THD (main)			0.5	1.2	%
LED ON sensitivity	V_{LED-on}	Pilot	1.7	3.5	6.3	%
[FM front-end (reference characteristics)] : f_C = 98 MHz, fm = 1 kHz, see Application Circuit and specified Test Circuit						
–3 dB sensitivity	–3dBL.S.	Referenced to V_{IN}= 80 dBμ, 30% modulation, 3 dB down		7		dBμ
Local oscillator voltage	V_{OSC}	f_{OSC} = 108.7 MHz		150		mV



Equivalent Circuit Block Diagram



Test Circuit



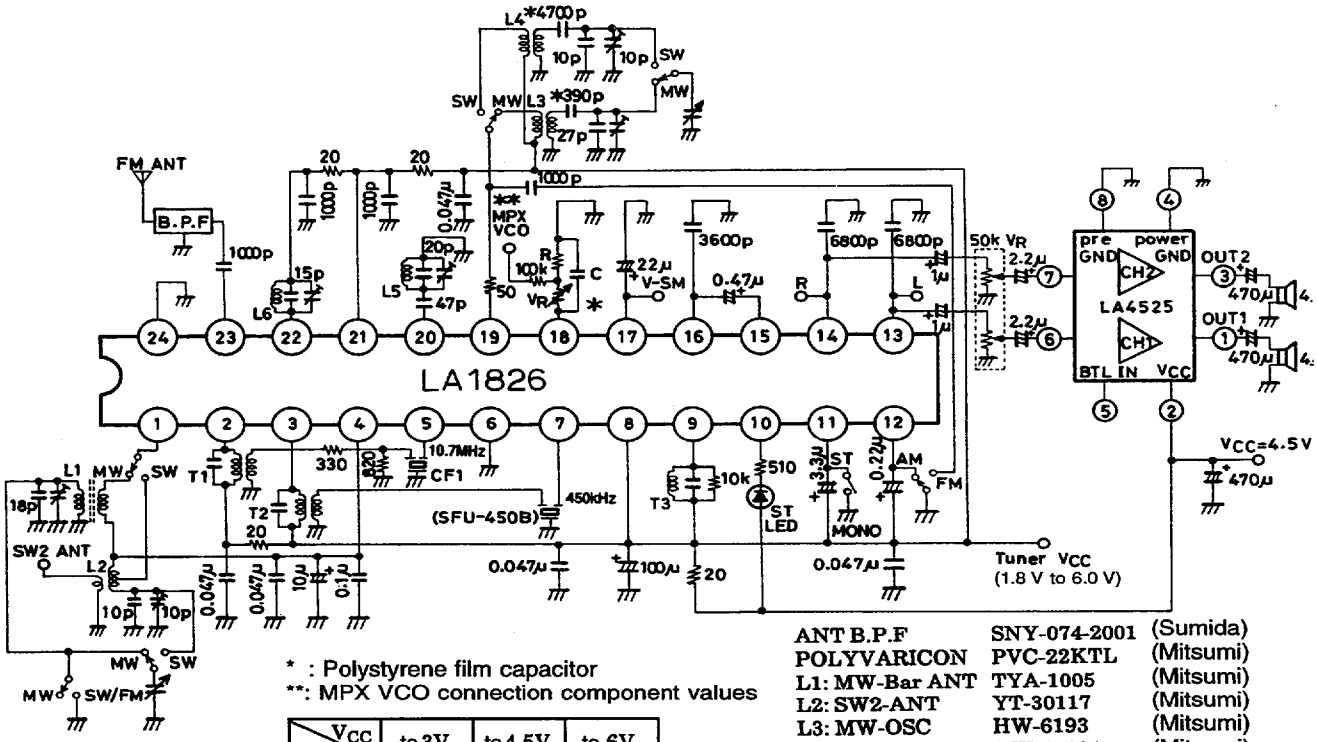
*: Polystyrene film capacitor

L1	HW-50425	(Mitsumi)
L2	SA-151	(Sumida)
L3	SA-149	(Sumida)
T1	YT-30224	(Mitsumi)
T2	HW-6215	(Mitsumi)
T3	YT-30103	(Mitsumi)
CF1	SFE10.7MS2	(Murata)

Unit (resistance: Ω, capacitance: F)

Sample Application Circuit

LA1826 + LA4525
FM, MW, SW (3 Band) Radio



* : Polystyrene film capacitor
**: MPX VCO connection component values

V_{CC}	to 3V	to 4.5V	to 6V
C	1000pF	820pF	620pF
R	27kΩ	33kΩ	51kΩ
VR	10kΩ	20kΩ	30kΩ

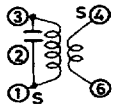
ANT B.P.F	SNY-074-2001	(Sumida)
POLYVARICON	PVC-22KTL	(Mitsumi)
L1: MW-Bar ANT	TYA-1005	(Mitsumi)
L2: SW2-ANT	YT-30117	(Mitsumi)
L3: MW-OSC	HW-6193	(Mitsumi)
L4: SW2-OSC	HW-40184	(Mitsumi)
L5: FM-OSC	SA-151	(Sumida)
L6: FM-RF	SA-149	(Sumida)
T1: FM-MIX	YT-30224	(Mitsumi)
T2: AM-IFT	HW-6215	(Mitsumi)
T3: FM-DET	SA-179	(Sumida)
CF1: FM-IF C.F	SFE10.7MS2	(Murata)

Unit (resistance: Ω, capacitance: F)

Coil Specifications

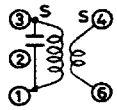
[FM]

- Antenna bandpass filter
  Sumida SNY-074-2001
- RF
  Sumida SA-149
  3.6 mm diameter air-core inductor with 4 1/2 turns of 0.6 mm wire
- Oscillator
  Sumida SA-151
  3.6 mm diameter air-core inductor with 3 1/2 turns of 0.6 mm wire
- Mixer
  Mitsumi YT-30224.
  When f_O = 10.7 MHz, Q_O = 80 and C =100 pF.



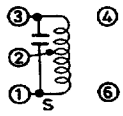
Winding	Turns
1 to 3	8
4 to 6	2

Sumida SA-165.
When f_O = 10.7 MHz, $Q_O \geqq 50$ and C = 100 pF.



Winding	Turns
3 to 1	12
4 to 6	2

- Detector
  Sumida SA-179.
  When f_O = 10.7 MHz, $Q_O \geqq 70$ and C = 82 pF.

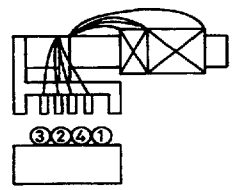


Winding	Turns
1 to 3	10

- IF filter
  Murata SFE10.7MS2

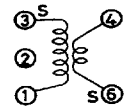
[MW]

- Poly-varicon
  Mitsumi PVC-22KTL
- Bar antenna
  Mitsumi TYA-1005.
  Pin 1 to pin 2 inductance is 260 μH and Q_O = 360.



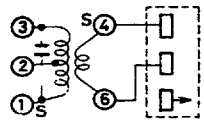
Winding	Turns
1 to 2	68
3 to 4	9

- Oscillator
  Mitsumi HW-6193 or Sumida SA-181.
  For the HW-6193, Q_O = 140 and L = 140 μH, and for the SA-181, Q_O = 80 and L = 140 μH.



Winding	Turns	
	HW-6193	SA-181
6 to 4	32	37
3 to 1	64	74

- IF tank
  Mitsumi HW-6215 or Sumida SA-164.
  For the HW-6215, when f_O = 445 kHz, Q_O = 110 and C = 180 pF (with SFU450B). For the SA-164, when f_O = 450 kHz, $Q_O \geqq 65$ and C = 180 pF.

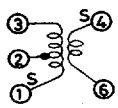


Winding	Turns	
	HW-6215	SA-164
1 to 2	94	122
4 to 6	7	9
2 to 3	58	62

- IF filter
  Murata SFU450B

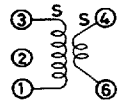
[SW]

- Antenna
  Mitsumi YT-30117.
  Note that Q_O = 95 and L = 1.4 μH.



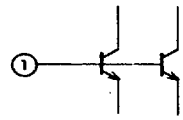
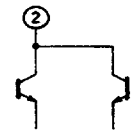
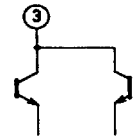
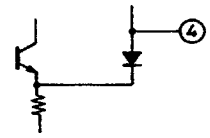
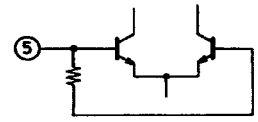
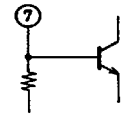
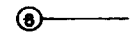
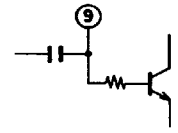
Winding	Turns
1 to 2	4
4 to 6	2
2 to 3	4

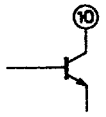
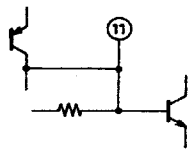
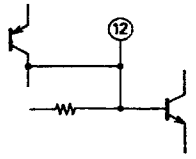
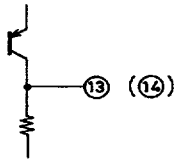
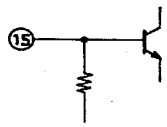
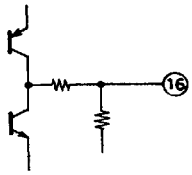
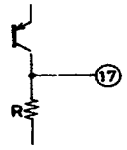
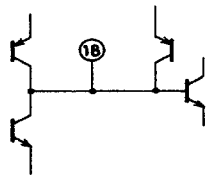
- Oscillator
  Mitsumi HW-40184.
  Note that $Q_O \geqq 28$ and L = 1.31 μH.

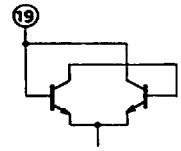
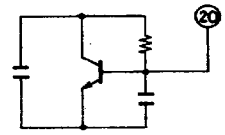
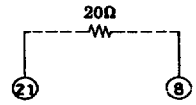
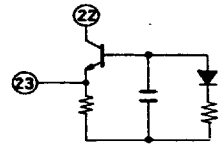


Winding	Turns
4 to 6	8
3 to 1	12

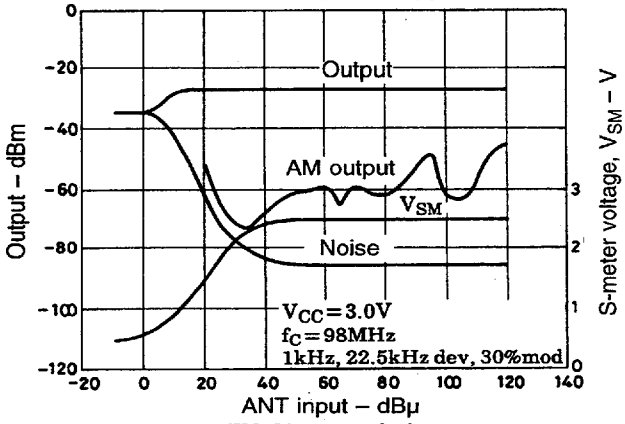
Pin Description and Quiescent Voltage (V_{CC} = 3.0 V)

Pin No.	Function	Internal equivalent circuit	Description	Quiescent voltage (V)	
				AM	FM
1	AM RF input		AM antenna coil between pins 1 and 4 (regulator voltage)	1.2	1.2
2	FM mixer output		FM mixer coil between pins 2 and 8 (V_{CC} supply)	3.0	3.0
3	AM mixer output		AM IFT coil between pins 3 and 8 (V_{CC} supply)	3.0	3.0
4	Regulator voltage		V_{Reg} = 1.2 V regulator voltage	1.2	1.2
5	FM IF input		r_i = 330 Ω input impedance	1.2	1.2
6	AM/FM IF/MPX ground			0	0
7	AM IF input		r_i = 2 kΩ input impedance	1.2	1.2
8	AM/FM IF/MPX supply (V_{CC})			3.0	3.0
9	FM detector		FM detector coil between pins 9 and 8 (V_{CC} supply)	3.0	3.0

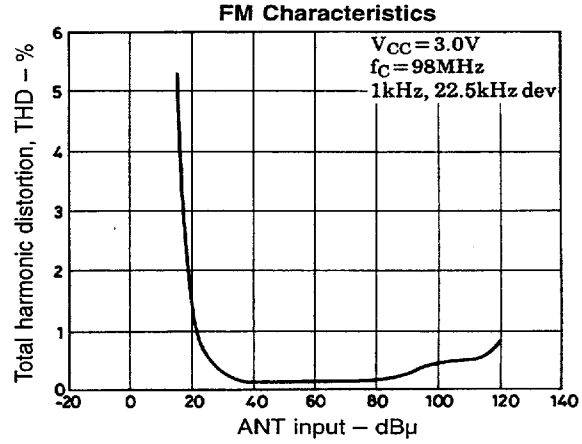
Pin No.	Function	Internal equivalent circuit	Description	Quiescent voltage (V)	
				AM	FM
10	Stereo LED		Active-Low open collector	3.0	3.0
11	Pilot detector		Forced monaural mode when pin 11 is connected to ground	1.7	2.3
12	Phase detector		FM when pin 12 is open, and AM when connected to ground	0	2.3
13	Left-channel output		r_o = 7.5 kΩ output impedance	1.4	1.4
14	Right-channel output				
15	MPX input		r_i = 50 kΩ input impedance	1.2	1.2
16	AM/FM demodulator output		r_o= 20 kΩ (AM) and r_o = 480 Ω (FM) output impedance	0.3	0.7
17	AM AGC output FM S-meter output		R = 14.6 kΩ internal load resistor	0.7	0.3
18	MPX VCO		The fixed components (R and C) vary depending on the supply voltage.	0	2.3

Pin No.	Function	Internal equivalent circuit	Description	Quiescent voltage (V)	
				AM	FM
19	AM oscillator		AM oscillator coil between pins 19 and 8 (V_{CC} supply)	3.0	3.0
20	FM oscillator		FM oscillator coil connection used for pin 20	3.0	2.7
21	FM front-end supply (V_{CC})		20 Ω external resistor connection	3.0	2.9
22	FM RF output		FM RF coil between pins 22 and 21 (front-end V_{CC} supply)	3.0	2.8
23	FM RF input		r_i = 430 Ω input impedance		
24	FM front-end ground			0	0

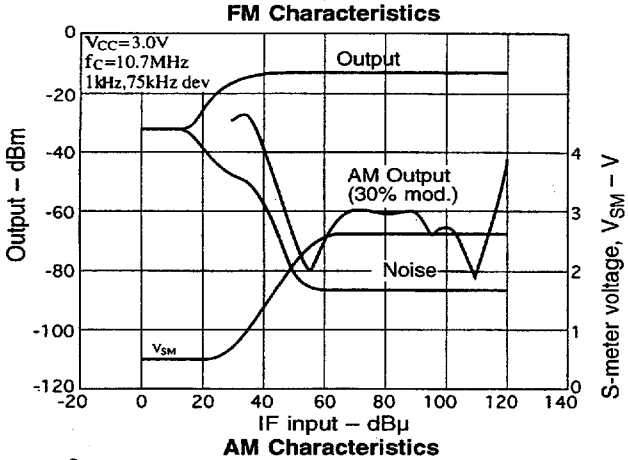
FM Characteristics



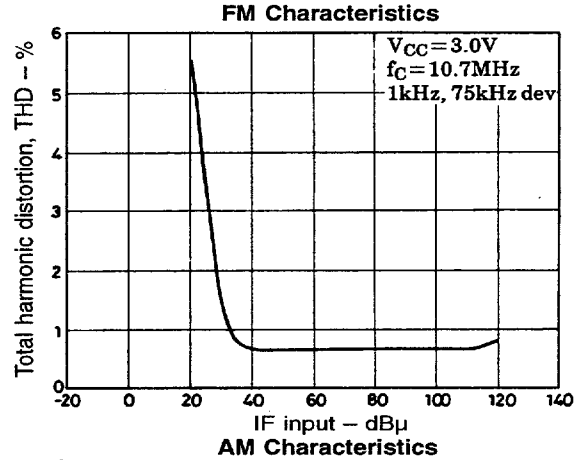
FM Characteristics



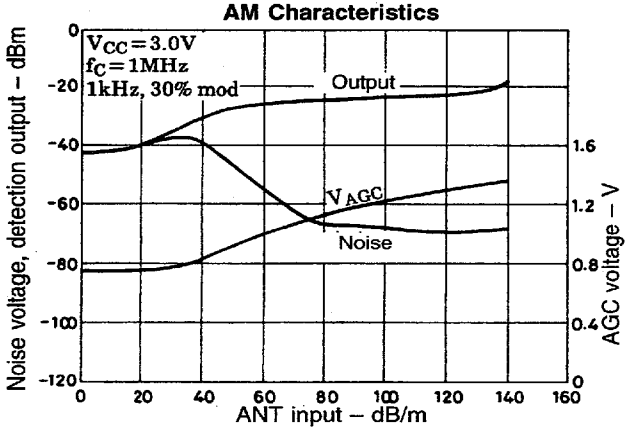
FM Characteristics



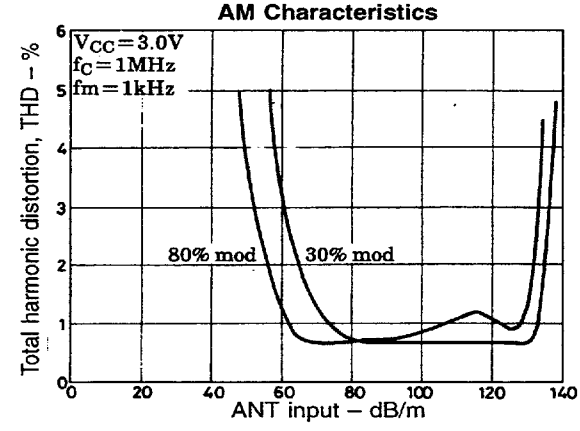
FM Characteristics



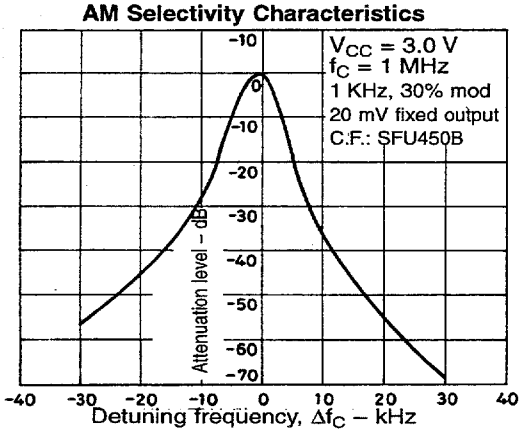
AM Characteristics



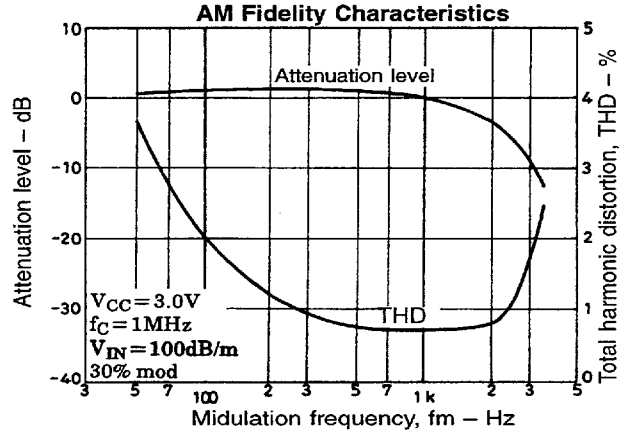
AM Characteristics



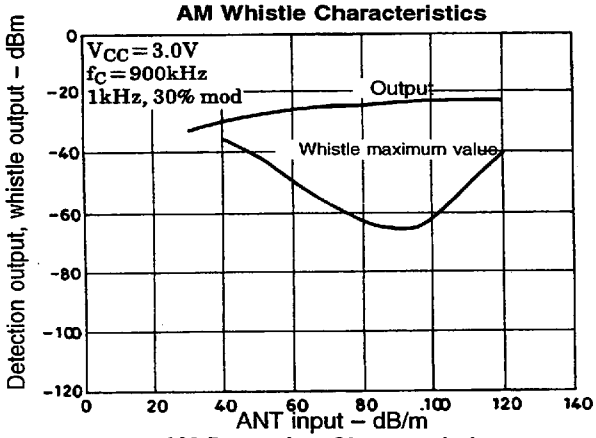
AM Selectivity Characteristics



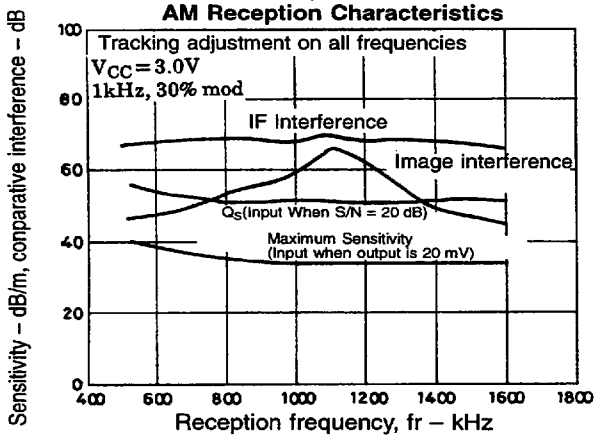
AM Fidelity Characteristics



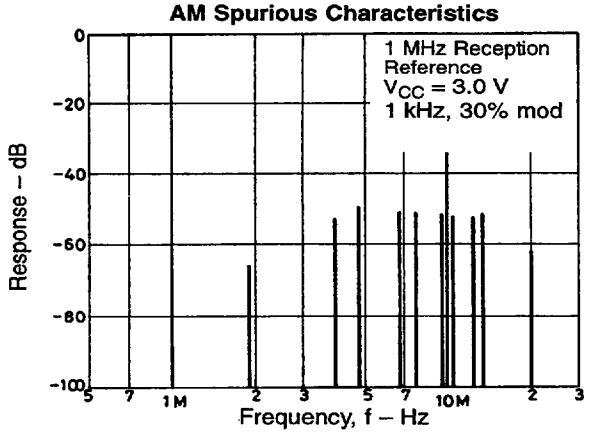
AM Whistle Characteristics



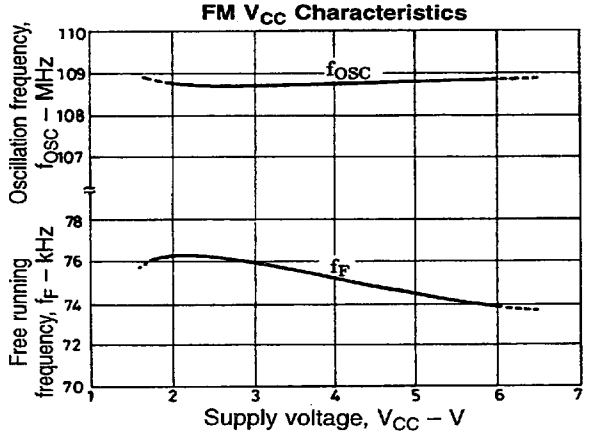
AM Reception Characteristics



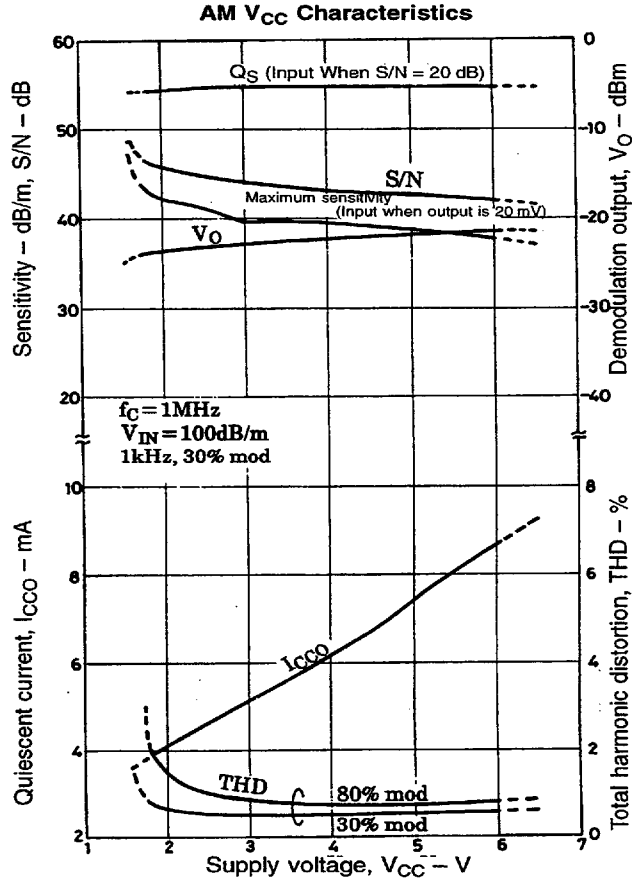
AM Spurious Characteristics



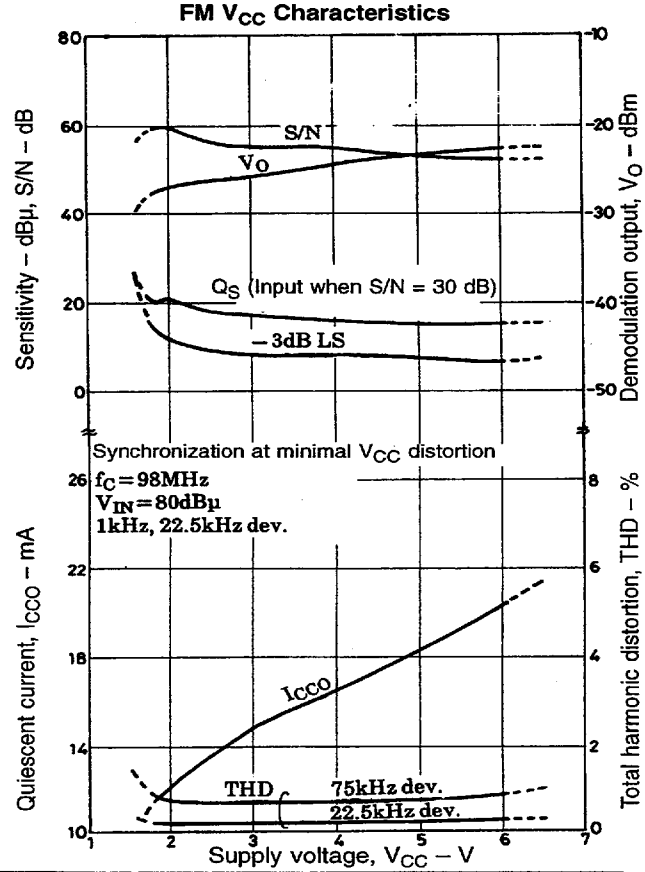
FM V_{CC} Characteristics



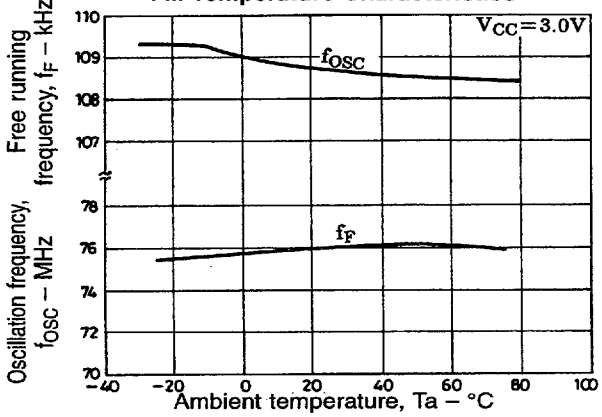
AM V_{CC} Characteristics



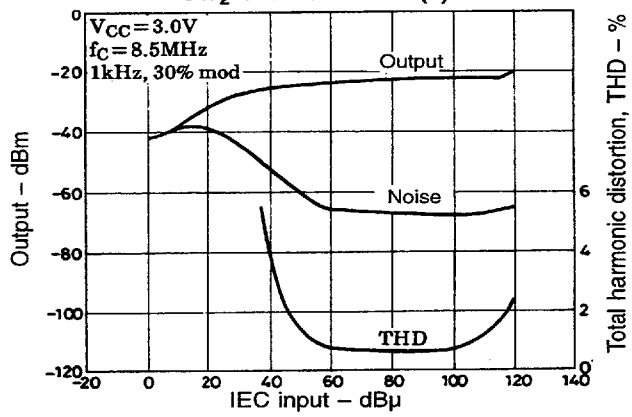
FM V_{CC} Characteristics



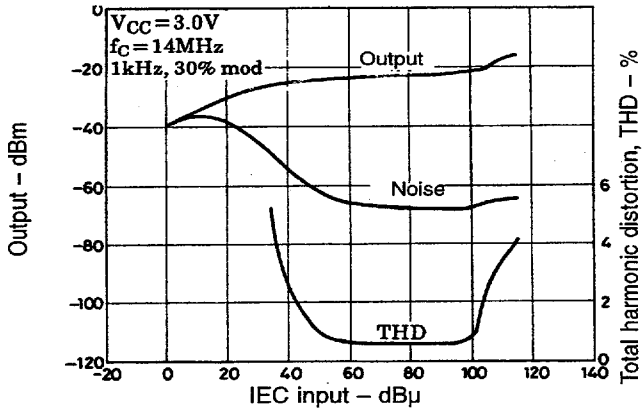
FM Temperature Characteristics



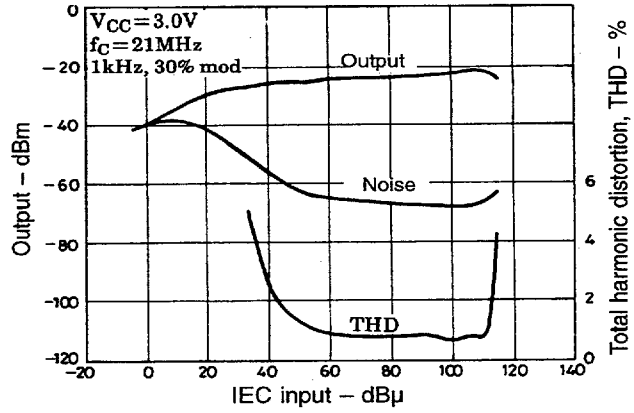
SW_2 Characteristics (1)



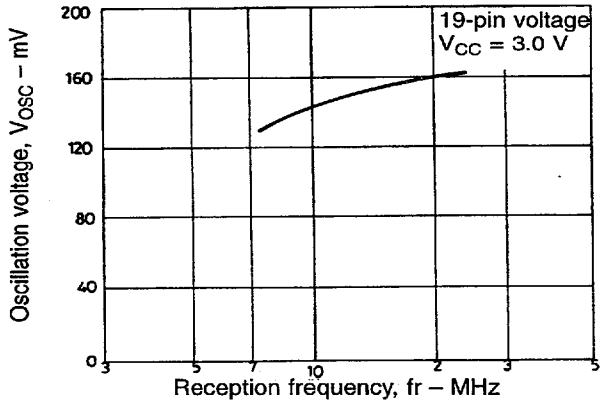
SW_2 Characteristics (2)



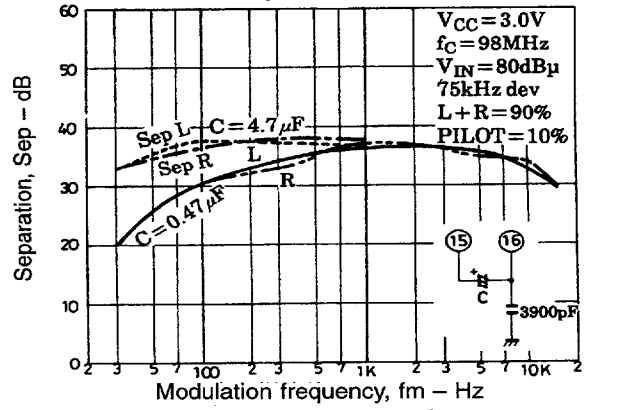
SW_2 Characteristics (3)



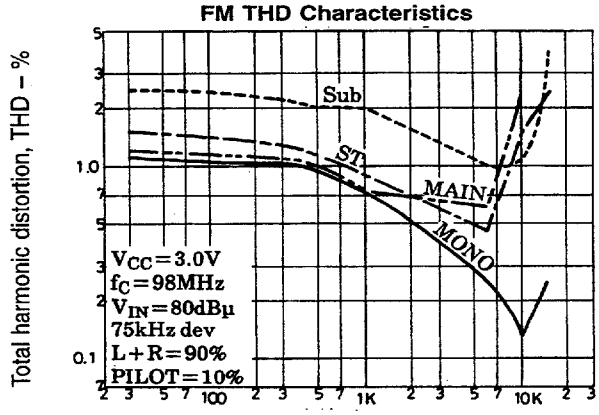
SW_2 Characteristics



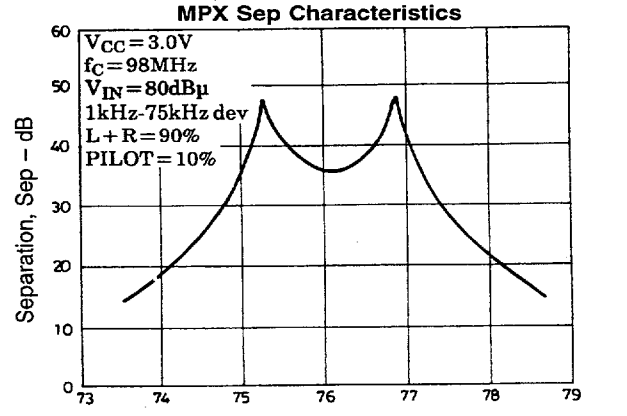
MPX Sep Characteristics



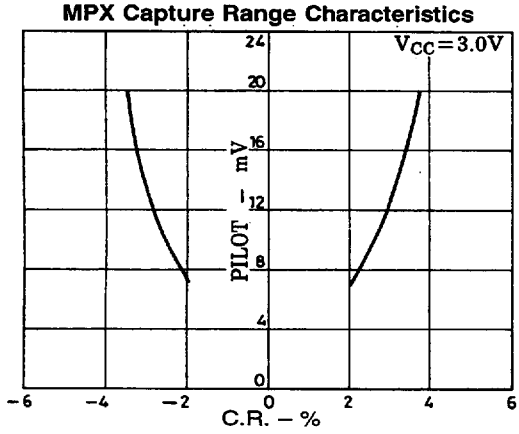
FM THD Characteristics



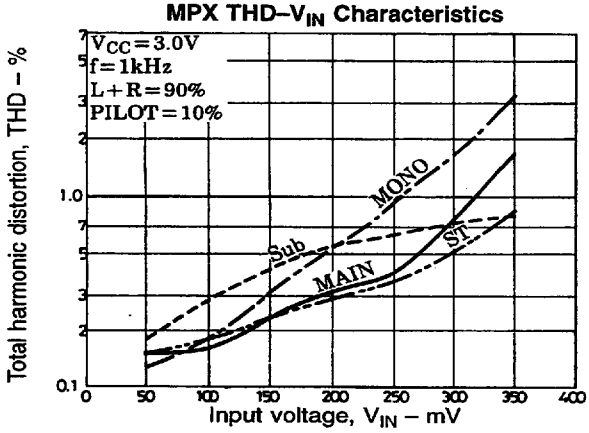
MPX Sep Characteristics



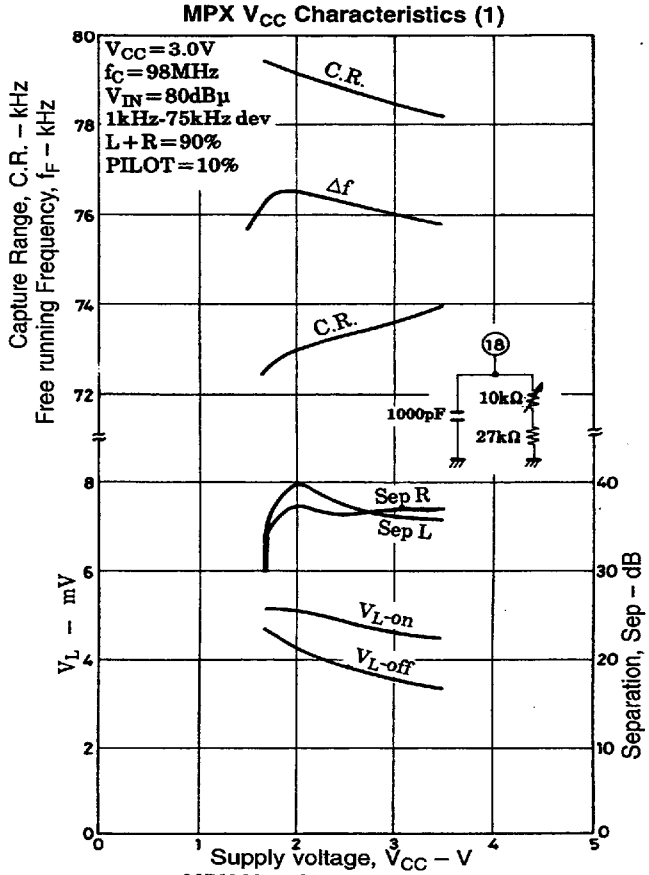
MPX Capture Range Characteristics



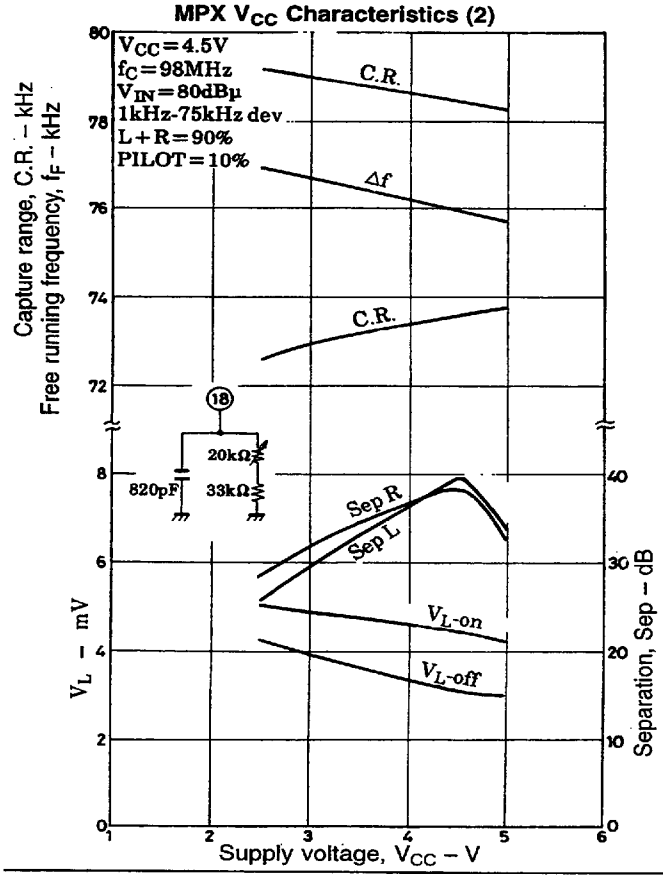
MPX THD–V_{IN} Characteristics



MPX V_{CC} Characteristics (1)



MPX V_{CC} Characteristics (2)



MPX V_{CC} Characteristics (3)